BODY

SERVICE TOOLS

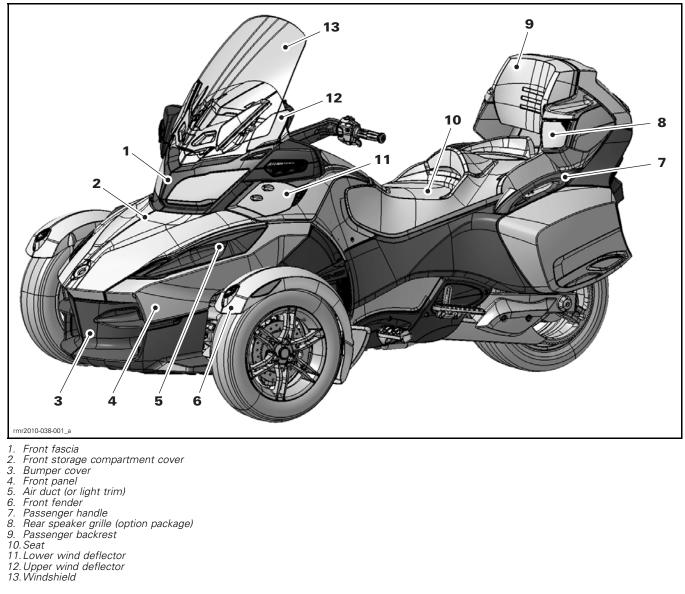
Description	Part Number	Page
FLUKE 115 MULTIMETER	529 035 868	29

SERVICE PRODUCTS

Description	Part Number	Pag	36
BRP PLASTIC & VINYL CLEANER	413 711 200		1

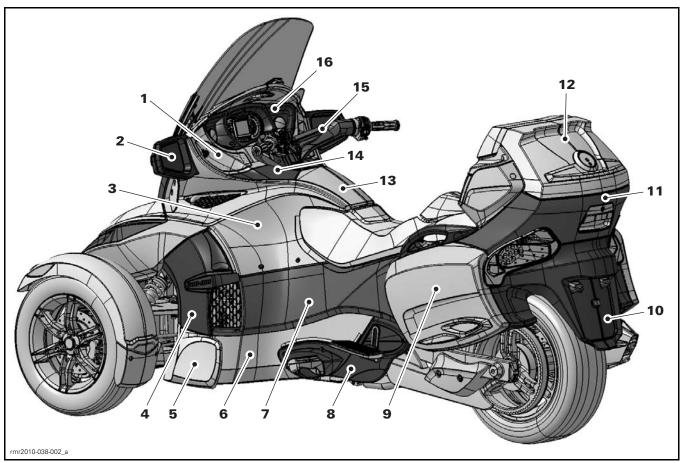
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BODY PARTS NOMENCLATURE (VEHICLE FRONT VIEW)



3

BODY PARTS NOMENCLATURE (VEHICLE REAR VIEW)

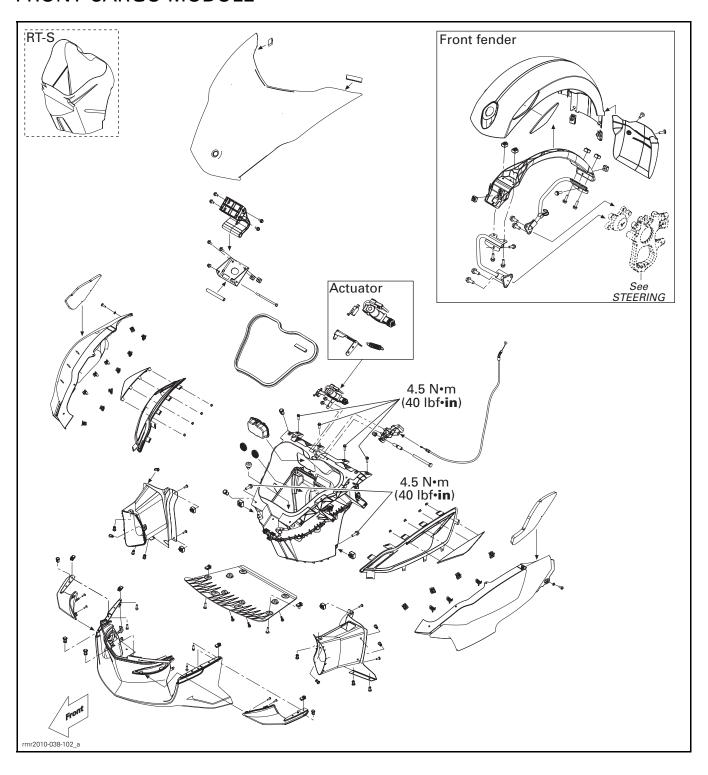


- Front speaker grille (option package)

- Front speaker grille (option package)
 Mirror
 Top side panel
 Middle side panel
 Bottom front side panel
 Bottom rear side panel
 Rear side panel
 Footrest support
 Side storage compartment cover
 Rear panel
 Rear panel

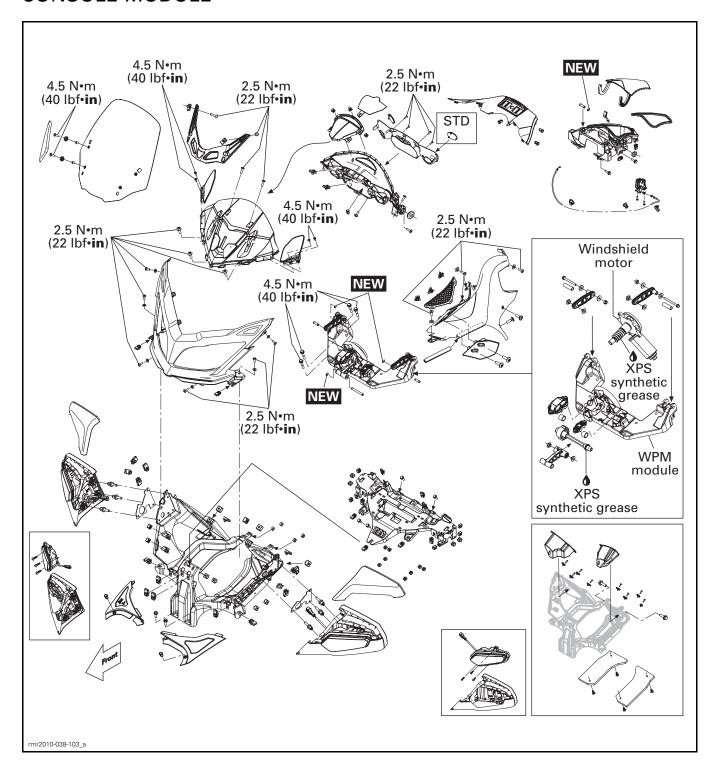
- 10. Rear render
 11. Rear panel
 12. Top storage compartment cover
 13. Glove box
 14. Central panel
 15. Ignition switch cover
 16. Gauge trim

FRONT CARGO MODULE

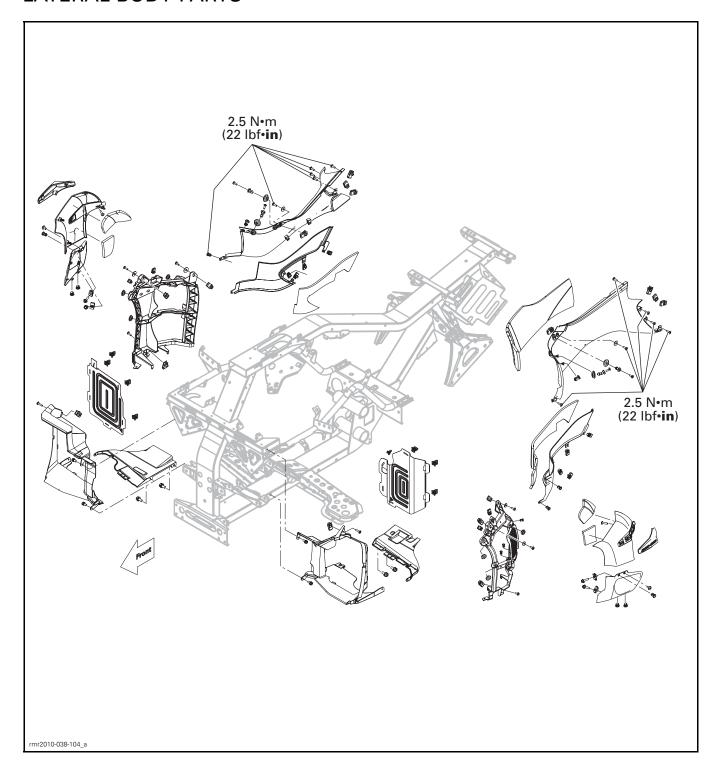


5

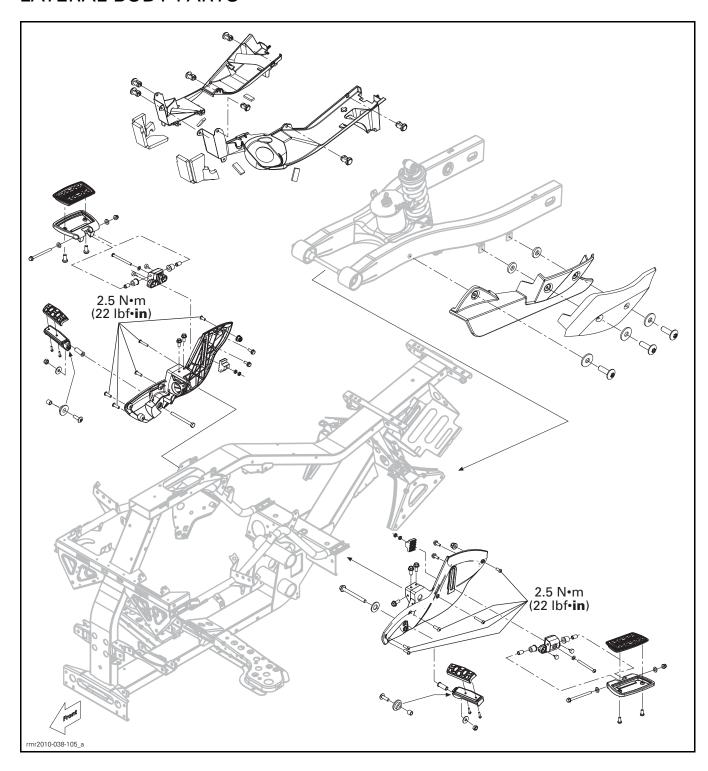
CONSOLE MODULE



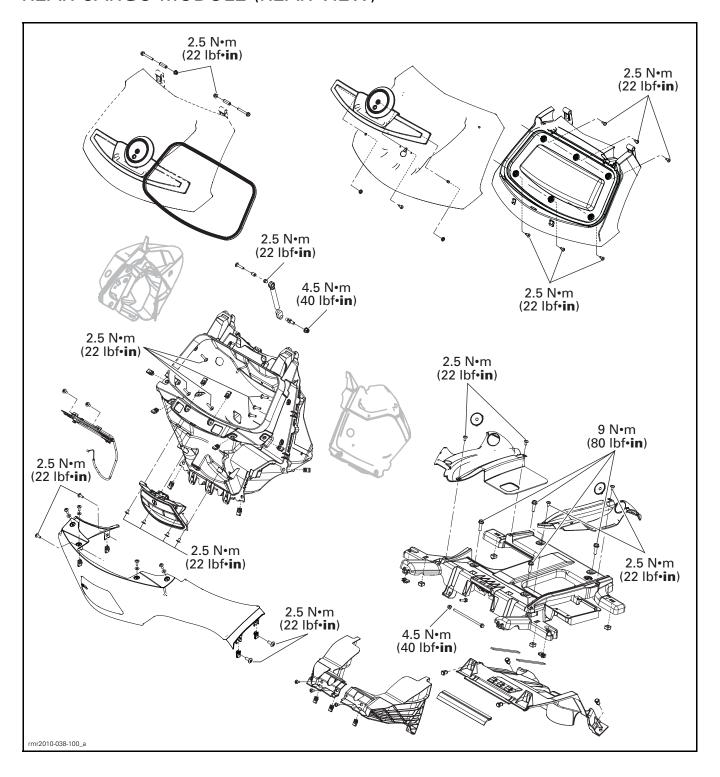
LATERAL BODY PARTS



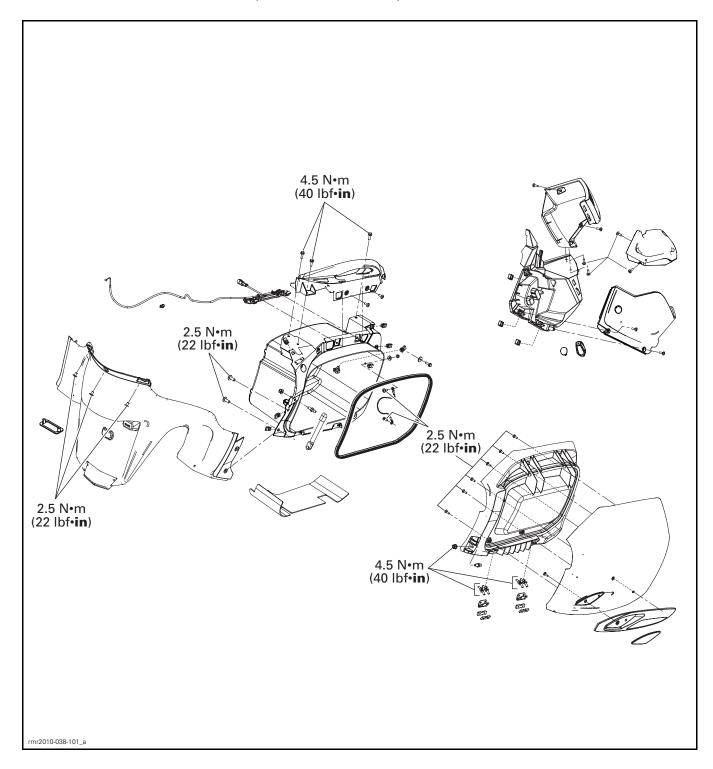
LATERAL BODY PARTS



REAR CARGO MODULE (REAR VIEW)

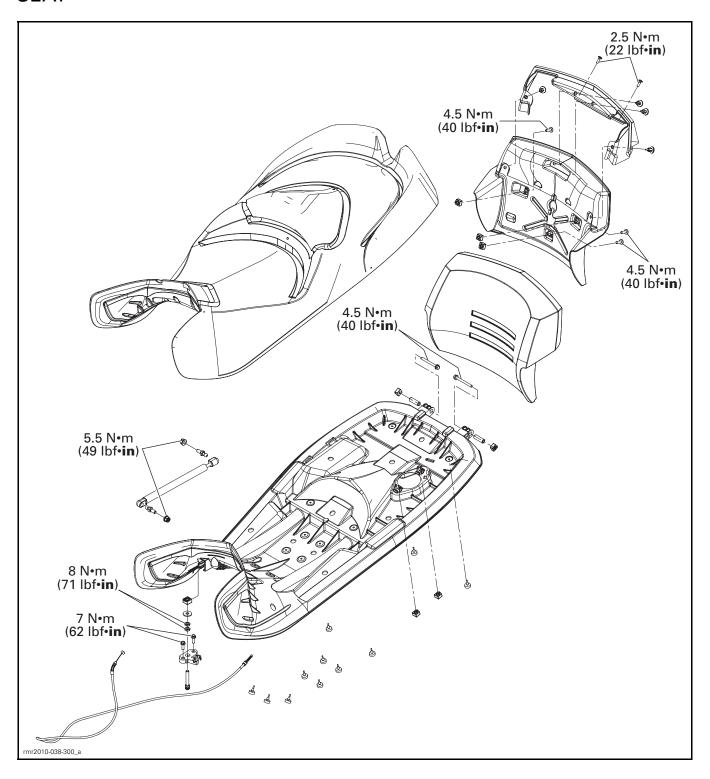


REAR CARGO MODULE (RH SIDE VIEW)



Subsection XX (BODY)

SEAT



GENERAL

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

A WARNING

Torque wrench tightening specifications must be strictly adhered to.

Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced.

NOTICE Hoses, cables and locking ties removed during a procedure must be reinstalled as per factory standards.

NOTICE Be careful when tightening plastic panels. Any deformation on the panel around the screw is an indication that it is too tight. Do not over torque panels in order to avoid to damage them.

NOTE: 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.

VEHICLE CARE

Vehicle Cleaning

To clean the vehicle, do not use high-pressure washers (like the ones found in car washes) as they may damage certain parts of the vehicle.

NOTICE Do not clean the windshield with alkaline or acid cleaner, gasoline or solvent to avoid windshield damage.

To clean the vehicle:

- Rinse the vehicle thoroughly with water to remove loose dirt.
- Using a soft, clean cloth, wash the vehicle with water mixed with a mild detergent, such as soap specially formulated for motorcycles or automobiles.
- While washing the vehicle, check for grease or oil. You can use BRP PLASTIC & VINYL CLEANER (P/N 413 711 200) or a mild automotive degreaser. Thoroughly follow the manufacturer's instructions.
- Dry the vehicle with a chamois or a soft towel.

Vehicle Waxing

Apply only nonabrasive wax safe for clearcoat paints on glossy finishes.

Avoid applying wax on matte surfaces.

NOTICE Do not polish windshield with any plastic cleaner/polisher.

A WARNING

Do not apply a vinyl or plastic protector on the seat as the surface will become slippery and the operator or the passenger may slip off the vehicle.

PROCEDURES

DECALS

Decal Removal

Using a heat gun (low heat setting) warm up one end of decal for a few seconds until decal can roll off when rubbing with your finger.

Pull decal slowly and when necessary apply more heat to ease removal on the area that has to be peeled off.

If decal tears while pulling off, it has to be heated for a few seconds longer. If decal tends to stretch while pulling off, stop heating and wait a few seconds to let it cool, then peel it off.

Decal Installation

Using isopropyl alcohol, clean the surface and dry thoroughly.

Apply a soapy water solution to new decal and carefully position it. Using a sponge or a squeegee, remove the air bubbles and water working from the center toward the edges. Allow to air dry.

NOTICE Do not apply isopropyl alcohol or solvent directly on decals.

MIRRORS

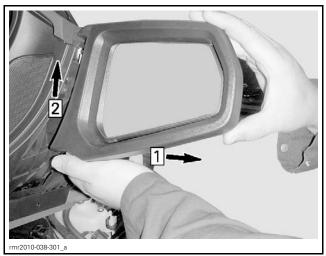
NOTE: The procedures are the same for LH and RH mirrors.

Mirror Removal

- 1. Pull lower part of mirror toward the outside to unlock it.
- 2. Slide mirror upwards to unhook it from upper slot.

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Subsection XX (BODY)



Step 1: Pull toward the outside Step 2: Slide upwards

Mirror Installation

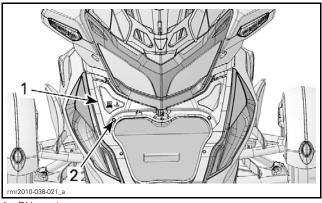
The installation is the reverse of the removal procedure.

SERVICE COVERS

NOTE: The procedures are the same for LH and RH service covers.

Service Cover Removal

- 1. Open front storage compartment cover.
- 2. Remove plastic rivet from service cover.



1. RH service cover

- 2. Plastic rivet
- 3. Lift lower portion of service cover then pull it toward the front.

NOTE: The installation is the reverse of the removal procedure.

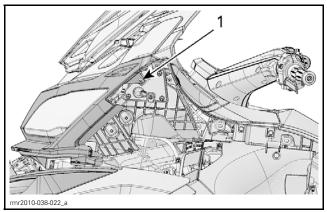
Service Cover Installation

The installation is the reverse of the removal procedure.

FRONT FASCIA

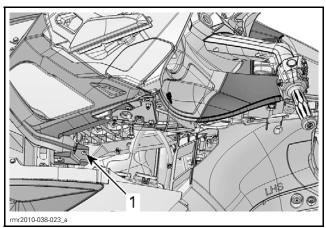
Front Fascia Removal

- 1. Remove mirrors. Refer to *MIRRORS* in this subsection.
- 2. Remove service covers. Refer to *SERVICE COVERS* in this subsection.
- 3. Remove middle side panels. Refer to *MIDDLE SIDE PANELS* in this subsection.
- 4. Remove top side panels. Refer to *TOP SIDE PANELS* in this subsection.
- 5. Remove upper retaining screws from front fas-



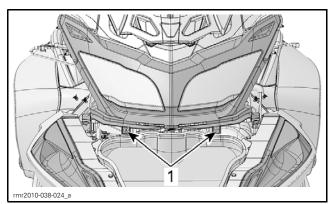
1. Upper retaining screw

6. Remove middle retaining screws from front fascia.



1. Middle retaining screw

7. Remove lower retaining screws and washers from front fascia.



1. Lower retaining screw

8. Remove front fascia from vehicle.

Front Fascia Installation

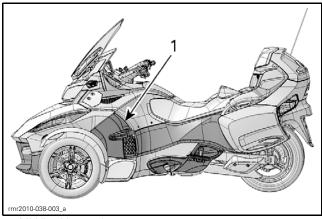
The installation is the reverse of the removal procedure. However, pay attention to the following. Torque front fascia retaining screws to 2.5 N•m (22 lbf•in).

MIDDLE SIDE PANELS

NOTE: The procedures are the same for LH and RH middle side panels.

Middle Side Panel Removal

1. Pull panel toward the outside to remove it from grommets at the front then unhook the rear.



1. Middle side panel

Middle Side Panel Installation

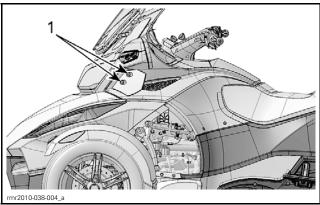
The installation is the reverse of the removal procedure.

TOP SIDE PANELS

NOTE: The procedures are the same for LH and RH service covers.

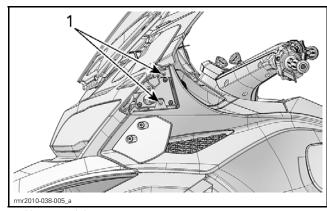
Top Side Panel Removal

- 1. Lift seat.
- 2. Open front storage compartment.
- 3. Remove middle side panel. Refer to *MIDDLE SIDE PANELS* in this subsection.
- 4. Remove retaining screws from lower wind deflector.



1. Retaining screws of wind deflector

- 5. Remove mirror. Refer to *MIRRORS* in this subsection.
- 6. Remove upper retaining screws from top side panel.

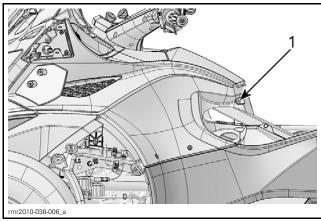


1. Upper retaining screws

7. Remove rear retaining screw from top side panel.

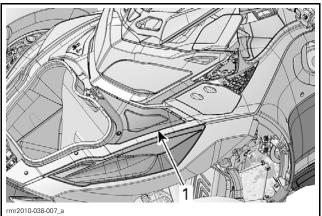
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Subsection XX (BODY)



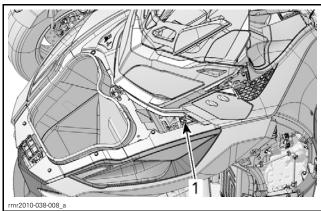
1. Rear retaining screw

8. Remove LH service cover. Refer to SERVICE COVERS in this subsection.



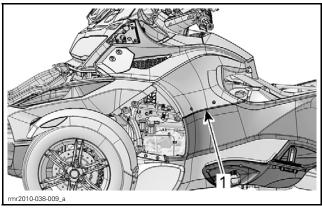
LH service cover

9. Remove front retaining screw from top side panel.



1. Front retaining screw

- 10. Remove lower retaining screws of top side panel.
- 11. Remove top side panel by lifting it upwards.



1. Top side panel

Top Side Panel Installation

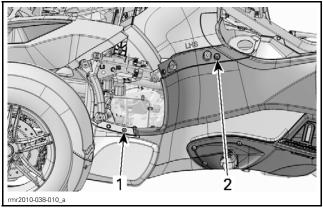
The installation is the reverse of the removal procedure. However, pay attention to the following. Torque top side panel retaining screws to 2.5 N•m (22 lbf•in).

REAR SIDE PANELS

NOTE: The procedures are the same for LH and RH rear side panels.

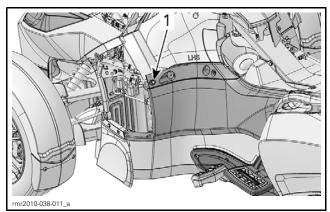
Rear Side Panel Removal

- 1. Remove middle side panel. Refer to MIDDLE SIDE PANELS in this subsection.
- 2. Remove top side panel. Refer to TOP SIDE PANELS in this subsection.
- 3. Remove front retaining screw of rear side panel.
- 4. Remove upper retaining screw and washer from rear side panel.



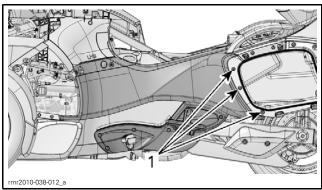
Front retaining screw
 Upper retaining screw

5. Remove front plastic rivet from rear side panel.



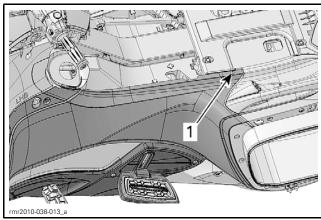
1. Front plastic rivet

- 6. Open side storage compartment cover.
- 7. Remove rear retaining screws from rear side panel.



1. Rear retaining screws

8. Remove top retaining screw of rear side panel.



1. Top retaining screw

9. Remove rear side panel from vehicle.

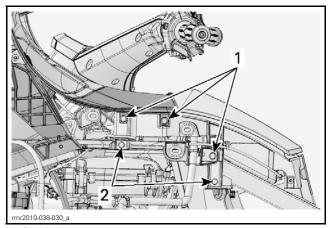
Rear Side Panel Installation

The installation is the reverse of the removal procedure. However, pay attention to the following. Torque rear side panel retaining screws to 2.5 N•m (22 lbf•in).

GLOVE BOX

Glove Box Removal

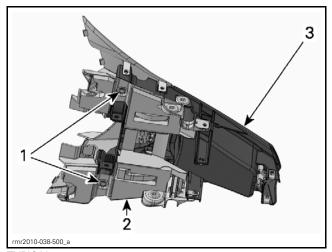
- 1. Remove middle side panel. Refer to MIDDLE SIDE PANELS in this subsection.
- 2. Remove top side panel. Refer to TOP SIDE PANELS in this subsection.
- 3. Remove rear side panel. Refer to REAR SIDE PANELS in this subsection.
- 4. Remove lateral acoustic panels. Refer to ACOUSTIC PANELS in this subsection.
- 5. Disconnect glove box cable from glove box.
- 6. Remove locking ties securing glove box cable.
- 7. Remove locking ties securing central panel switches.
- 8. Remove 3 plastic rivets from glove box on both
- 9. Remove 2 retaining screws from glove box on both side.



Plastic rivets
 Retaining screws

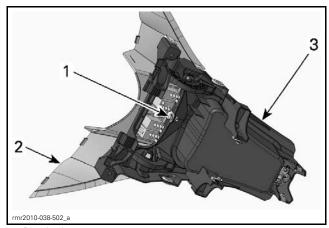
- 10. Slightly lift glove box.
- 11. Disconnect central panel switches connec-
- 12. Remove glove box from vehicle by lifting it upwards.
- 13. Remove plastic rivets securing acoustic panel to glove box.

Subsection XX (BODY)



TYPICAL

- 1. Plastic rivets
- 2. Top acoustic panel
- 3. Glove box
- 14. Remove plastic rivet securing central panel to glove box.



- Plastic rivet
- 2. Central panel
- 3. Glove box
- 15. Remove all the remaining components from glove box.

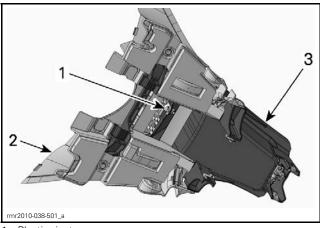
Glove Box Installation

The installation is the reverse of the removal procedure.

CENTRAL PANEL

Central Panel Removal

- 1. Remove glove box from vehicle, refer to *GLOVE BOX REMOVAL* in this subsection.
- 2. Remove plastic rivet securing central panel to glove box.



- 1. Plastic rivet
- 2. Central panel
- 3. Glove box
- 3. Remove central panel from glove box.

Central Panel Installation

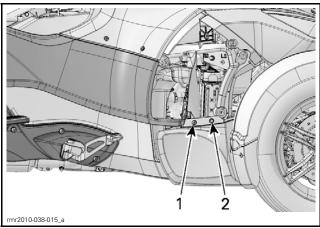
The installation is the reverse of the removal procedure.

BOTTOM FRONT SIDE PANELS

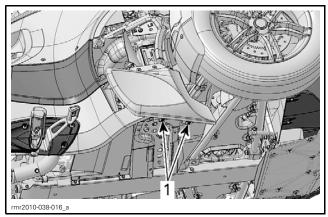
NOTE: The procedures are the same for LH and RH bottom front side panels.

Bottom Front Side Panel Removal

- 1. Remove middle side panel. Refer to *MIDDLE SIDE PANELS* in this subsection.
- 2. Remove upper retaining screw from panel.
- 3. Remove upper plastic rivet from panel.



- 1. Upper retaining screw
- 2. Upper plastic rivet
- 4. From underneath panel, remove lower plastic rivets.



1. Lower plastic rivets

5. Remove bottom front side panel from vehicle.

Bottom Front Side Panel Installation

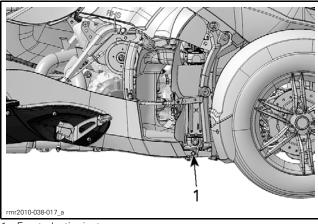
The installation is the reverse of the removal procedure.

BOTTOM REAR SIDE PANELS

NOTE: The procedures are the same for LH and RH bottom rear side panels.

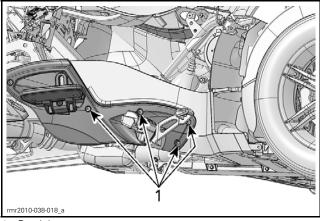
Bottom Rear Side Panel Removal

- 1. Remove middle side panel. Refer to *MIDDLE* SIDE PANELS in this subsection.
- 2. Remove top side panel. Refer to *TOP SIDE PANELS* in this subsection.
- 3. Remove rear side panel. Refer to *REAR SIDE PANELS* in this subsection.
- 4. Remove bottom front side panel. Refer to *BOT-TOM FRONT SIDE PANELS* in this subsection.
- 5. Remove front plastic rivet from bottom rear side panel.



1. Front plastic rivet

6. Remove retaining screws from bottom rear side panel.



1. Retaining screws

7. Remove bottom rear side panel from vehicle.

Bottom Rear Side Panel Installation

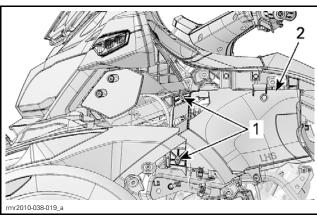
The installation is the reverse of the removal procedure. However, pay attention to the following. Torque bottom side panel retaining screws to 2.5 N•m (22 lbf•in).

ACOUSTIC PANELS

Acoustic Panel Replacement

Lateral

- 1. Remove middle side panel. Refer to *MIDDLE SIDE PANELS* in this subsection.
- 2. Remove top side panel. Refer to *TOP SIDE PANELS* in this subsection.
- 3. Remove rear side panel. Refer to *REAR SIDE PANELS* in this subsection.
- 4. Remove retaining screws from acoustic panel.



1. LH lateral acoustic panel

- 2. Retaining screws
- 5. Replace acoustic panel on vehicle.
- 6. Torque acoustic panel retaining screws to 6 N•m (53 lbf•in).

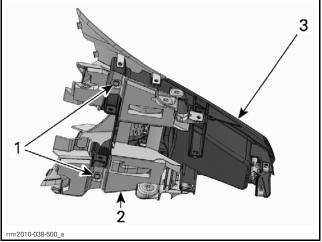
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Subsection XX (BODY)

7. Reinstall all removed panels.

Top

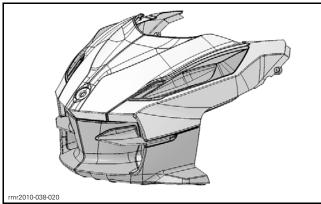
- 1. Remove glove box from vehicle, refer to *GLOVE BOX REMOVAL* in this subsection.
- 2. Remove plastic rivets securing acoustic panel to glove box.



TYPICAL

- 1. Plastic rivets
- 2. Top acoustic panel
- 3. Glove box
- 3. Replace acoustic panel on glove box.
- 4. Reinstall all removed panels and components.

FRONT CARGO MODULE

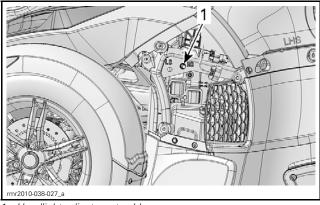


FRONT CARGO MODULE

Front Cargo Module Removal

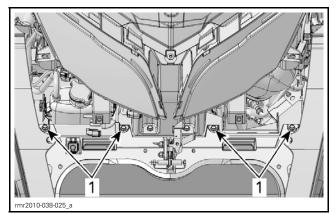
- 1. Remove mirrors. Refer to *MIRRORS* in this subsection.
- 2. Remove service covers. Refer to *SERVICE COVERS* in this subsection.
- 3. Remove middle side panels. Refer to *MIDDLE SIDE PANELS* in this subsection.

- 4. Remove top side panels. Refer to *TOP SIDE PANELS* in this subsection.
- 5. Remove front fascia. Refer to *FRONT FASCIA* in this subsection.
- 6. Remove nuts securing headlight adjustment cable on both side.



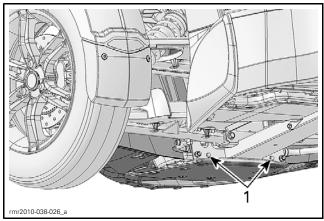
1. Headlight adjustment cable

- 7. Disconnect the following components from vehicle.
 - AAPTS sensor connector
 - Horn connector
 - Low beam light connectors (CE vehicle)
 - Fog light connectors (if equipped)
 - B.U.D.S. connector
 - Storage cover actuator connector
 - Storage cover switch connector
 - Storage cover cable.
- 8. Remove upper retaining screws from cargo module.



SOME PARTS REMOVED FOR CLARITY PURPOSE
1. Upper retaining screws

9. From underneath bumper cover, remove lower retaining screws from cargo module.



1. Lower retaining screws

10. Carefully pull cargo module toward front of vehicle.

Front Cargo Module Disassembly Sequence

To disassemble the front cargo module, carry out the following steps in this specific order. Refer to the exploded view at the beginning of this subsection for details.

- 1. Remove front storage compartment cover.
 - 1.1 Remove 4 screws at the front of cover.
- 2. Remove bumper cover air ducts.
 - 2.1 Remove 2 screws at the rear on both side.
 - 2.2 Remove 4 plastic rivets from inside air ducts on both side.
 - 2.3 Remove 2 plastic rivets from underneath bumper cover on both side.
- 3. Remove front panels.
 - 3.1 Remove 1 retaining washer from inside front panel on both side.
 - 3.2 Remove 3 screws from inside front panel on both side.
 - 3.3 Remove 3 plastic rivets on the top of front panel on both side.
- 4. Remove front bumper.

Front Cargo Module Assembly and Installation

Assemble front cargo module as the reverse of disassembly.

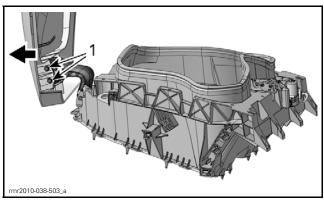
Install front cargo module as the reverse of removal procedure, however, pay attention to the following.

Adjust front storage compartment cover, refer to FRONT STORAGE COMPARTMENT COVER ADJUSTMENT in this subsection.

Torque storage compartment screws to 4.5 N•m (40 lbf•in).

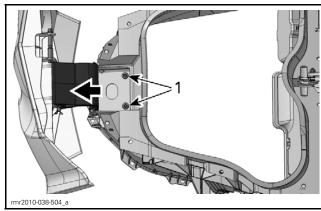
Front Storage Compartment Cover Adjustment

- 1. Open front storage compartment cover.
- 2. Loosen 4 retaining screws at the front of cover.
- 3. Completely move cover toward the outside then hold it in place.
- 4. Tighten 4 retaining screws at the front of cover.



1. Retaining screws at the front of cover

- 5. Loosen 2 retaining screws of cover hinge.
- 6. Completely move cover hinge toward the front.
- 7. Tighten 2 retaining screws of cover hinge.

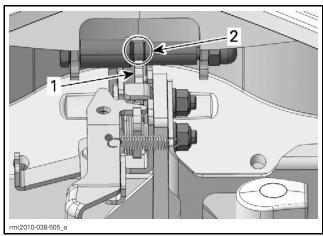


1. Retaining screws of cover hinge

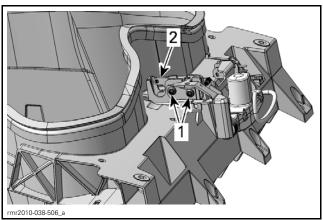
- 8. Verify alignment between the latch and the slot of the sleeve.
 - 8.1 If an alignment is required, loosen cover hinge screws and rotate hinge accordingly.

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Subsection XX (BODY)

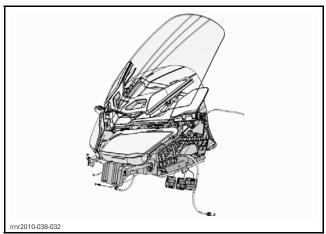


- 1. Latch
- 2. Slot of the sleeve
- 9. Lift cover 30 cm (12 in), let it fall, then verify if cover latch properly.
 - 9.1 If cover does not latch, loosen latch retaining screws and adjust latch accordingly.



- 1. Latch retaining screws
- 2. Latch
- 10. Ensure cover height fits with front panels height when cover is closed.

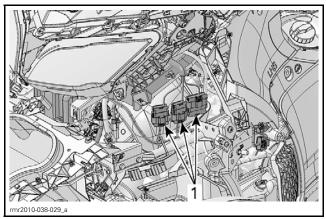
CONSOLE MODULE



CONSOLE MODULE

Console Module Removal

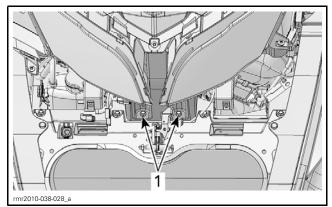
- 1. Lift seat.
- 2. Open front storage compartment.
- 3. Remove mirrors. Refer to *MIRRORS* in this subsection.
- 4. Remove both service covers. Refer to *SER-VICE COVERS* in this subsection.
- 5. Remove middle side panels. Refer to *MIDDLE SIDE PANELS* in this subsection.
- 6. Remove top side panels. Refer to *TOP SIDE PANELS* in this subsection.
- 7. Remove lateral acoustic panels. Refer to *ACOUSTIC PANELS* in this subsection.
- 8. Remove front fascia. Refer to *FRONT FASCIA* in this subsection.
- 9. Disconnect module harness connectors located on the LH side of vehicle.



SOME PARTS REMOVED FOR CLARITY PURPOSE

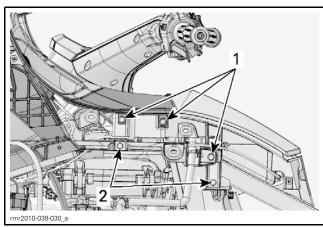
1. Module harness connectors

10. Remove front retaining screws from console module.



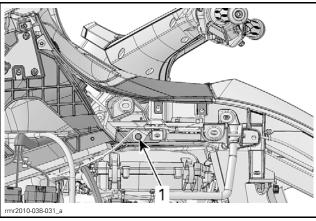
SOME PARTS REMOVED FOR CLARITY PURPOSE
1. Front retaining screws

- 11. Remove 3 plastic rivets from glove box on both side.
- 12. Remove 2 retaining screws from glove box on both side.



Plastic rivets

- 2. Retaining screws
- 13. Slightly lift glove box upwards.
- 14. Remove side retaining screws from console module.



1. Side retaining screw

 Carefully pull console module toward front of vehicle.

Console Module Disassembly Sequence

To disassemble the console module, carry out the following steps. Refer to the exploded view at the beginning of this subsection for details.

- 1. Remove multifunction gauge.
 - 1.1 Remove 4 screws securing gauge trim.
 - 1.2 Pull down both upper tabs.
 - 1.3 Move top of gauge toward rear.
 - 1.4 Disconnect gauge connector.
- 2. Remove headlights.
 - 2.1 Remove 4 retaining screws from headlight.
 - 2.2 Pull apart the tabs to unlock cover.
 - 2.3 Pull cover out.
 - 2.4 Disconnect the bulb connector.
- 3. Remove windshield. Refer to *WINDSHIELD* in this subsection.

Console Module Installation

Assemble console module as the reverse of disassembly, however, pay attention to the following.

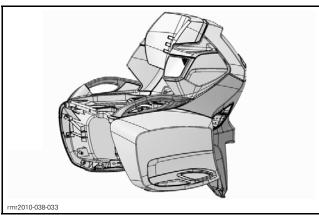
Torque gauge trim screws to 2.5 N•m (22 lbf•in). Install console module as the reverse of removal procedure, however, pay attention to the following

Torque console module front retaining screws to 7 N•m (62 lbf•in).

Torque console module side retaining screws to $7 \, \text{N} \cdot \text{m}$ (62 lbf $\cdot \text{in}$).

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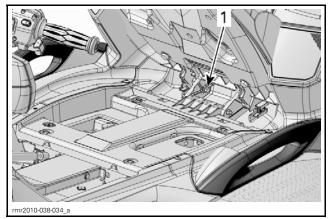
REAR CARGO MODULE



REAR CARGO MODULE

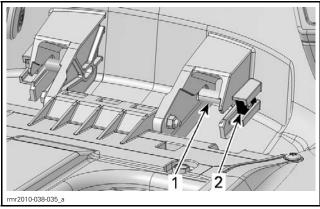
Rear Cargo Module Removal

- 1. Remove middle side panel. Refer to *MIDDLE SIDE PANELS* in this subsection.
- 2. Remove top side panel. Refer to *TOP SIDE PANELS* in this subsection.
- 3. Remove rear side panel. Refer to *REAR SIDE PANELS* in this subsection.
- 4. Remove seat from vehicle as follows:
 - 4.1 Disconnect shock absorber from seat base.
 - 4.2 Unplug pillion rider (passenger) switch.
 - 4.3 Remove seat base retaining bolts.

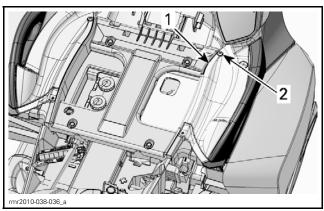


1. Seat base retaining bolt

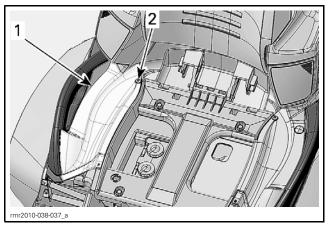
4.4 Remove spacer and caged nuts.



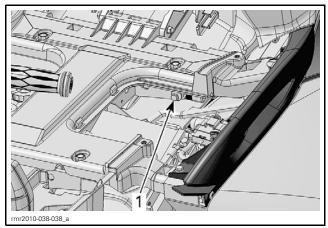
- 1. Spacer
- 2. Caged nut
- 5. Remove rear retaining screw from battery access panel (LH side).
- 6. Disconnect passenger heated grip switch.
- 7. Remove battery access panel from vehicle.



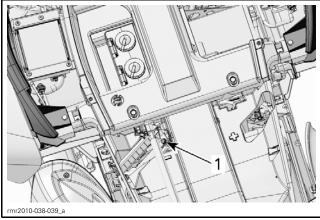
- 1. Battery access panel
- 2. Rear retaining screw
- 8. Remove rear retaining screw from audio player access panel (RH side).
- 9. Disconnect passenger audio control switch (option package).
- Remove audio player access panel from vehicle.



- Audio player access panel
 Rear retaining screw
- 11. Disconnect LH and RH ground straps by unscrewing each retaining screw.

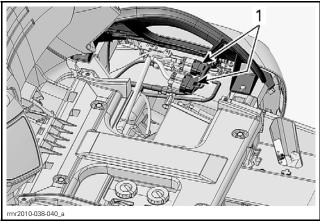


1. LH ground strap retaining screw



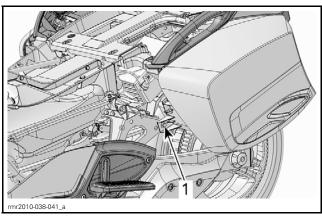
1. RH ground strap retaining screw

12. Disconnect both cargo harness connectors located on the LH side of the vehicle near passenger grab handle.



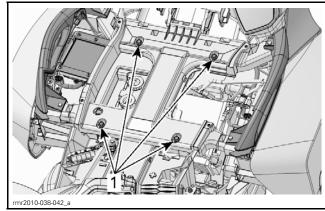
1. Cargo harness connectors

13. Remove lateral retaining screws and washers (on both side) of rear cargo module.



1. Lateral retaining screw

14. Remove top retaining screws of rear cargo module.



1. Top retaining screws

15. Carefully pull rear cargo module toward rear.

Rear Cargo Module Disassembly Sequence

To disassemble the rear cargo module, carry out the following steps in this specific order. Refer to the exploded view at the beginning of this subsection for details.

- 1. Remove rear panel.
 - 1.1 Open top and side storage compartment covers.
 - 1.2 Remove 2 screws on the top of each side storage compartment.
 - 1.3 Remove 4 screws on the rear of top storage compartment.
- 2. Remove rear fender.
 - 2.1 Remove 3 screws on the upper portion of rear fender.
 - 2.2 Remove 2 screws on the rear of each side storage compartment.
 - 2.3 Disconnect licence plate connector.
- 3. Remove passenger backrest.
 - 3.1 Remove 3 screws inside top storage compartment.
 - 3.2 Remove 2 screws on the top of passenger backrest.
- 4. Remove taillight.
 - 4.1 Remove 3 screws on the taillight housing.
 - 4.2 Disconnect taillight connector.

Rear Cargo Module Installation

Assemble cargo module as the reverse of disassembly, however, pay attention to the following.

Torque taillight screws to 2.5 Nom (22 lbfoin).

Torque passenger backrest screws

- To 4.5 N•m (40 lbf•in) for the ones inside storage compartment.
- To 2.5 N•m (22 lbf•in) for upper screws.

Torque rear fender screws to 2.5 N•m (22 lbf•in). Torque rear panel screws to 2.5 N•m (22 lbf•in).

Install cargo module as the reverse of removal procedure, however, pay attention to the following.

Torque rear cargo top retaining screws to 9 N•m (80 lbf•in).

Torque rear cargo lateral retaining screws to 4.5 N•m (40 lbf•in).

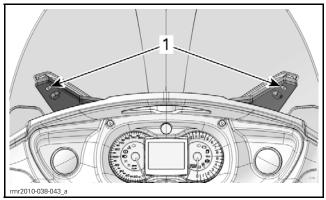
Torque battery and audio player access panels retaining screws to 2.5 N•m (22 lbf•in).

Torque seat base retaining bolts to 4.5 N•m (40 lbf•in).

WINDSHIELD

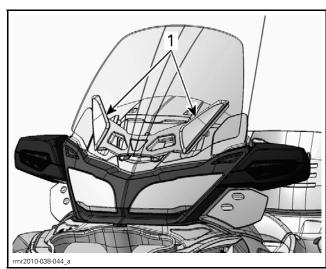
Windshield Removal

1. From inside windshield, remove retaining screws from windshield trim panels.



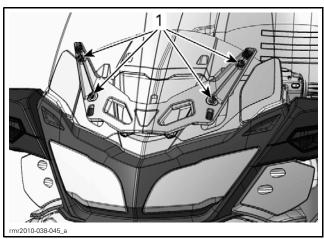
1. Windshield trim panels retaining screws

2. Remove windshield trim panels from vehicle.



1. Windshield trim panels

3. Remove windshield retaining screws and sleeves from support.



1. Windshield retaining screws

2.5 N•m (22 lbf•in).

4. Carefully remove windshield from vehicle.

Windshield Installation

The installation is the reverse of the removal procedure. However, pay attention to the following. Torque windshield retaining screws to 4.5 Nom

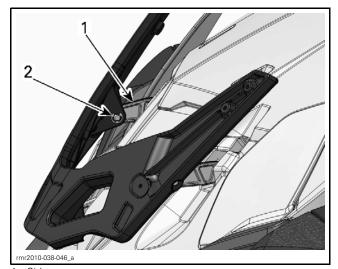
(40 lbf•in). Torque windshield trim panels retaining screws to

WINDSHIELD SUPPORT

Windshield Support Removal

NOTE: To access directly to windshield motor, it is not necessary to remove windshield from windshield support (step 1).

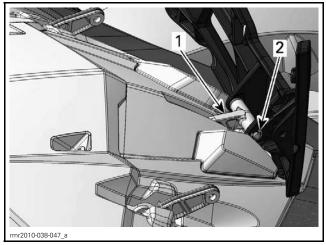
- 1. Remove windshield. Refer to WINDSHIELD in this subsection.
- 2. Remove C-clips from side arm pins.



Side arm

2. C-clip

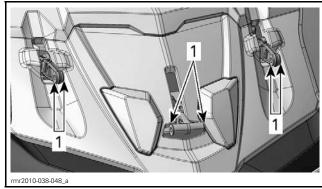
- 3. Remove side arm pins.
- 4. Rotate windshield support toward front.
- 5. Remove C-clip from center arm pin.



- 1. Center arm 2. C-clip
- 6. Remove center arm pin.
- 7. Remove windshield support from vehicle.

Windshield Support Installation

The installation is the reverse of the removal procedure. However, pay attention to the following. Make sure that arm bushings are installed as per the following illustration.



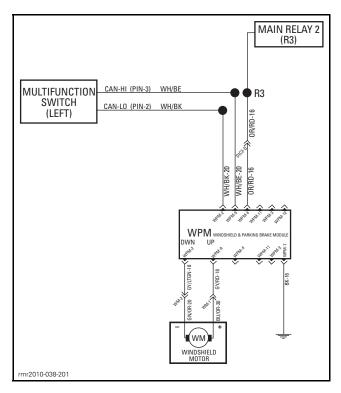
1. Bushings

Install NEW C-clip on arm pins.

WINDSHIELD MOTOR

NOTICE Do not remove windshield motor from windshield base. Both are calibrated at the factory. If windshield motor needs to be changed, replace windshield base with WPM module and windshield motor as an assembly.

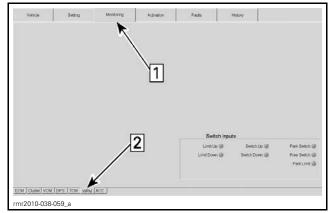
Windshield Wiring Diagram



Windshield Motor Monitoring (With B.U.D.S.)

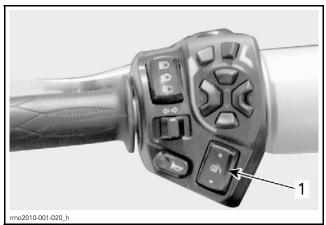
To monitor windshield motor during troubleshooting operation, proceed as follows:

- 1. Connect vehicle to B.U.D.S.. Refer to *COM-MUNICATION TOOLS AND B.U.D.S. SOFT-WARE* subsection.
- 2. Select Monitoring page.
- 3. Select WPM tab.



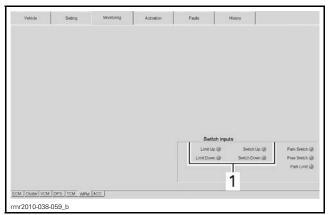
Step 1: Select monitoring Step 2: Select WPM

4. Press windshield adjustment switch on vehicle.



WINDSHIELD ADJUSTMENT SWITCH

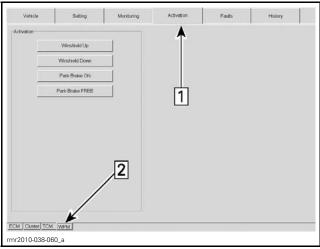
5. Check proper operation in B.U.D.S.



1. Windshield operation monitoring lights

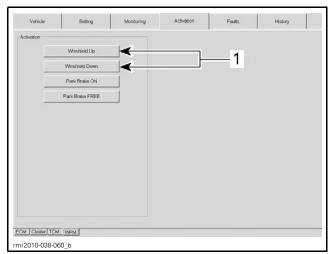
Windshield Motor Operation Test

- 1. Connect vehicle to B.U.D.S. Refer to *COMMU-NICATION TOOLS AND B.U.D.S. SOFTWARE* subsection.
- 2. Select **ACTIVATION** page.
- 3. Select WPM tab.



Step 1: Activation page Step 2: WPM folder

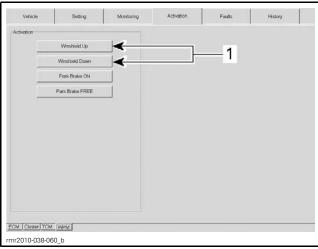
4. Press WINDSHIELD UP button.



- 1. Windshield UP and DOWN button
- 5. Verify if windshield motor works to raise windshield.

If windshield motor does not work:

- Check input voltage at motor (PIN-1), refer to the WIRING DIAGRAM.
- Check ground circuit continuity at motor (PIN-2), refer to the WIRING DIAGRAM.
- Check connector and terminal condition.
- 6. Press WINDSHIELD DOWN button.



- 1. Windshield UP and DOWN button
- 7. Verify if windshield motor works to lower windshield.

If windshield motor does not work:

- Check input voltage at motor (PIN-2), refer to the WIRING DIAGRAM.
- Check ground circuit continuity at motor (PIN-1), refer to the WIRING DIAGRAM.
- Check connector and terminal condition.

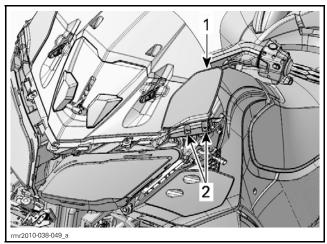
If the fault is not found after having carried out the previous tests:

- Test motor operation by connecting it directly to the battery posts.
 - If motor works properly, test module, refer to WINDSHIELD MODULE (WPM) in this subsection.
 - If motor does not work properly, replace windshield base with WPM module and windshield motor as an assembly.

NOTICE Do not power motor directly with the battery for a long period. Apply voltage quickly to ensure that the motor will not overheat at the end of its stroke.

Windshield Motor Removal

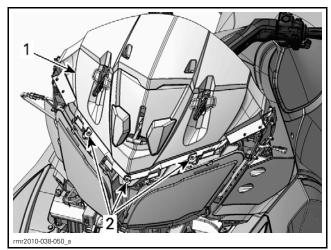
- 1. Remove windshield and windshield support together. Refer to *WINDSHIELD SUPPORT* in this subsection.
- 2. Remove front fascia. Refer to *FRONT FASCIA* in this subsection.
- Remove retaining screws of upper wind deflectors.
- 4. Remove upper wind deflectors from vehicle.



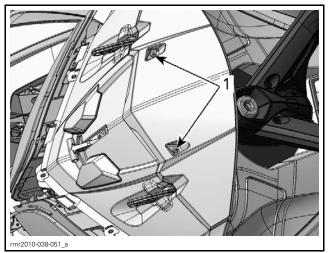
- 1. Upper wind deflector
- 2. Retaining screws
- 5. Remove lower retaining screws from console panel.

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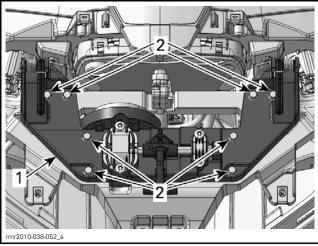
Subsection XX (BODY)



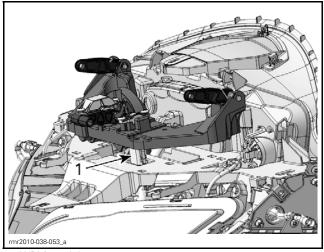
- 1. Console panel
- 2. Lower retaining screws
- 6. Remove upper retaining screws from console panel.



- 1. Upper retaining screws
- 7. Remove console panel by lifting it toward front.
- 8. Remove retaining screws from WPM module.



- 1. WPM module
- 2. Retaining screws
- 9. Slightly lift WPM module upwards.
- 10. Disconnect WPM module connector.



1. WPM module connector

- 11. Disconnect windshield motor wires.
- 12. Remove windshield base (WPM module) from vehicle.
- 13. Remove both side arms as follows:
 - 13.1 Remove retaining nut and washer.
 - 13.2 Remove retaining bolt and washer.
 - 13.3 Remove sleeve.
 - 13.4 Remove side arm.

NOTICE Do not remove windshield motor from windshield base. Both are calibrated at the factory. If windshield motor needs to be changed, replace windshield base with WPM module and windshield motor as an assembly.

Windshield Motor Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

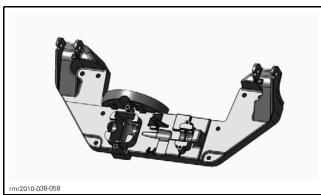
Torque WPM module retaining screws to 4.5 N•m (40 lbf•in).

Torque console panel retaining screws to 2.5 N•m (22 lbf•in).

Torque upper wind deflector retaining screws to $4.5 \,\mathrm{Nem}$ (40 lbf•in).

WINDSHIELD MODULE (WPM)

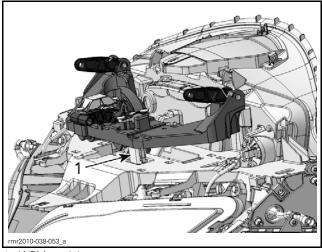
NOTE: WPM module has 2 functions, it controls windshield and parking brake. The WPM module is integrated into the windshield base.



WPM MODULE AND WINDSHIELD BASE

WPM Module Signal Circuit Continuity Test

- 1. Remove body parts as required to access to the WPM module. Refer to WPM MODULE RE-MOVAL in this subsection.
- 2. Disconnect WPM module connector.



1. WPM module connector

- 3. Disconnect LH multi-switch (MSL) connector. Refer to *LIGHTS*, *GAUGE AND ACCESSORIES* subsection.
- 4. Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to Ω .
- 5. Measure resistance as per the following table.

TEST PROBES	RESISTANCE
MSL switch connector pin 2 (WH/BK)	Close to 0 Ω
WPM module connector pin 8 (WH/BK)	Close to 0 11

TEST PROBES	RESISTANCE
MSL switch connector pin 3 (WH/BE)	
WPM module connector pin 6 (WH/BE)	Close to 0 Ω

If results are not as per the previous tables:

- Test MSL switch, refer to LIGHTS, GAUGE AND ACCESSORIES.
- Check connector and terminal condition.
- Repair open circuit in wiring.

If the fault is not found after having carried out the previous operations:

- Check input voltage at WPM module (PIN-5), refer to the WIRING DIAGRAM.
- Check ground circuit continuity at WPM module (PIN-7), refer to the WIRING DIAGRAM.

If the fault is still not found:

- Replace WPM module.

WPM Module Removal

1. Remove windshield base with WPM module and windshield motor as an assembly. Refer to WINDSHIELD MOTOR REMOVAL in this subsection.

NOTICE Do not remove windshield motor from windshield base. Both are calibrated at the factory. If WPM module needs to be changed, replace windshield base with WPM module and windshield motor as an assembly.

WPM Module Installation

The installation is the reverse of the removal procedure.

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BRAKES

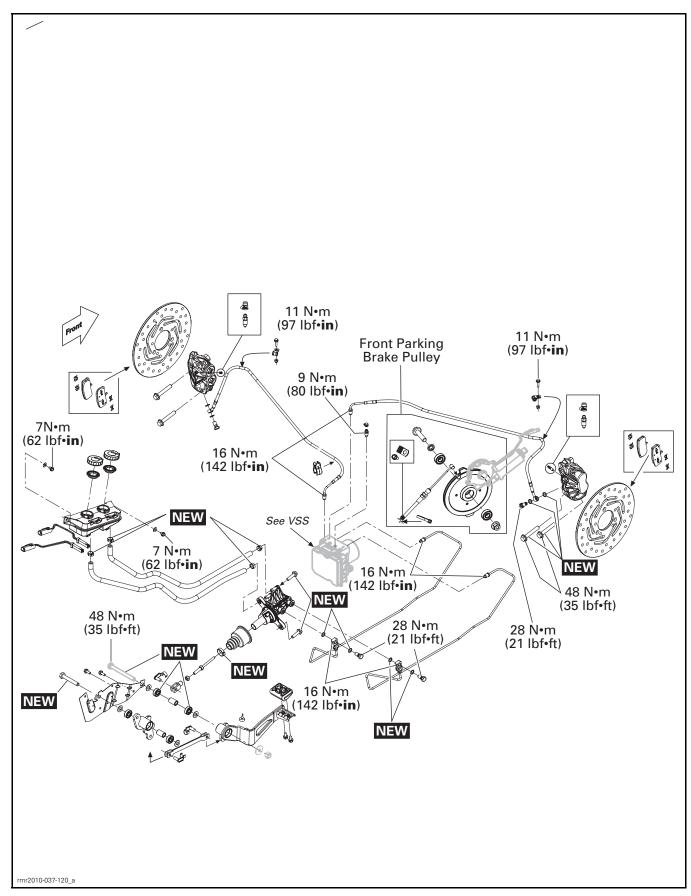
SERVICE TOOLS

Description	Part Number	Page
BLIND HOLE BEARING PULLER SET	529 036 117	21
FLUKE 115 MULTIMETER	529 035 868	30
MASTER CYLINDER ROD ADJUSTER	529 036 119	24

SERVICE PRODUCTS

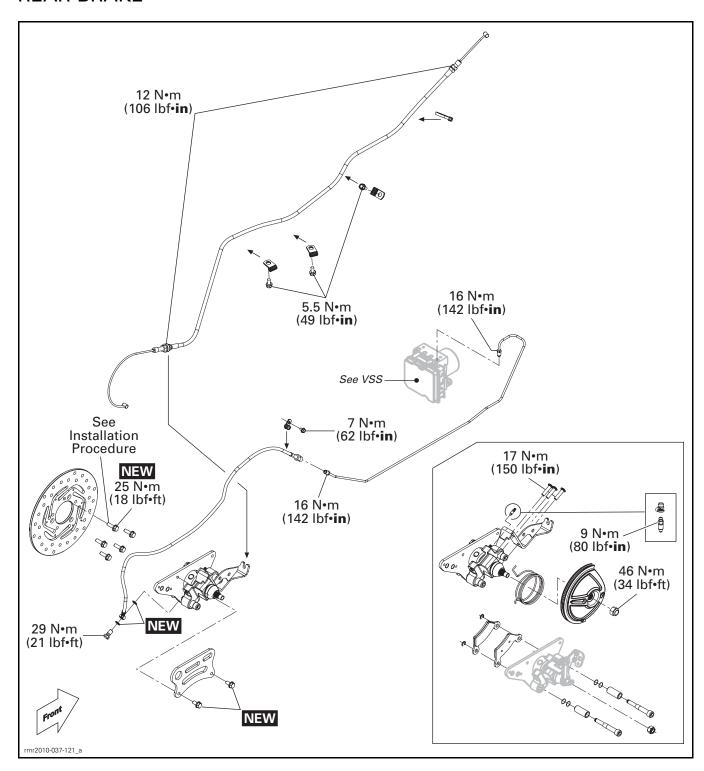
Description	Part Number	Page
BRAKE FLUID GTLMA (DOT 4)	293 600 062	4–5
LOCTITE 243 (BLUE)	293 800 060	

FRONT BRAKES



3

REAR BRAKE



GENERAL

This subsection covers the maintenance and procedures related to the braking system mechanical components. For ABS related components, refer to *VEHICLE STABILITY SYSTEM (VSS)* subsection.

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

A WARNING

Torque wrench tightening specifications must be strictly adhered to.

Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced.

A WARNING

Never apply anything to the brake fittings. The use of thread sealant or Teflon tape could cause brake system failure and cause severe damages to components.

NOTICE Avoid spilling brake fluid on plastic, rubber or painted parts. Protect these parts with a rag when servicing brake system.

NOTICE To avoid serious damage to the brake system, use only DOT 4 brake fluid from a sealed container. Do not use brake fluid taken from old or already opened containers, nor mix different fluids for topping off.

NOTICE Sealing washers must be discarded and replaced with new ones every time a Banjo fitting is unscrewed.

NOTICE Before opening or working near bleeders, reservoir or fittings, clean the part and its area to avoid system contamination.

NOTICE Hoses, cables and locking ties removed during a procedure must be reinstalled as per factory standards.

NOTE: Dispose brake fluid as per your local environmental regulations.

NOTE: 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.

FAULT CODES

If any bleeding is performed on the braking system, it is important to reset the fault codes. Refer to *MONITORING SYSTEM AND FAULT CODES* subsection.

NOTE: B.U.D.S. software is used to perform the reset.

TASK	WHAT TO DO
Any brake part replacement that involved bleeding	 Check/clear fault codes Clear LPS fault

MAINTENANCE

BRAKE FLUID

Recommended Brake Fluid

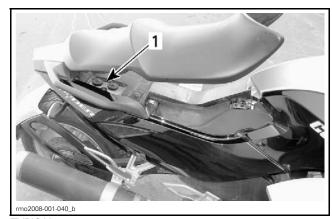
Always use brake fluid meeting the specification DOT 4 only such as BRAKE FLUID GTLMA (DOT 4) (P/N 293 600 062).

Brake Fluid Level Verification

Park the vehicle on a firm level surface.

Unlatch and lift seat.

Check brake fluid level in each reservoir, near the back of the seat. They should both be above the MIN. mark.

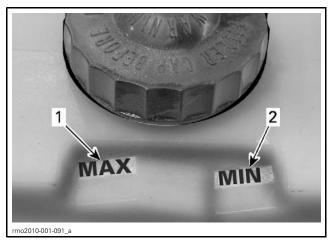


TYPICAL

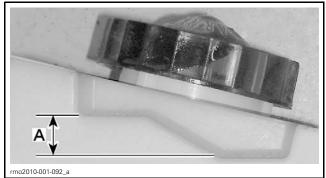
1. Brake fluid reservoir

Clean filler caps before removing.

Add fluid as required. Do not overfill.



Brake fluid MAX. level mark
 Brake fluid MIN. level mark



A. Operating range

Immediately wipe out any spills.

Reinstall cap on each reservoir.

Close seat and ensure it is fully latched.

Brake Fluid Replacement

To replace brake fluid, perform the complete brake bleeding sequence. Refer to *BRAKE FLUID BLEEDING PROCEDURE (COMPLETE SYSTEM)* below.

Brake Fluid Bleeding Procedure (Complete System)

General Guidelines

This procedure is divided in multiple tasks that must be completed in a specific order according to the following table.

STEP	TASK
1	Perform manual bleeding procedure (left caliper, right caliper, rear caliper and VCM)
2	Perform B.U.D.S. bleeding procedure (front circuit and rear circuit)
3	Validate the system pressure

Requirements for Task Completion

DESCRIPTION	QTY
BRAKE FLUID GTLMA (DOT 4) (P/N 293 600 062) (or equivalent)	1.75 L (1.85 quarts)
40 cm (16 in) clear hose (3/16)	3
80 cm (31 in) clear hose (3/16)	1
Small locking ties	4
Locking ties	4

Use a computer with the latest version of B.U.D.S. software, the MPI-2 and a diagnostic cable.

NOTE: Assistance is required to accomplish some actions.

Vehicle Preparation

NOTE: Vehicle battery must be fully charge prior to bleed brake system.

Remove body parts as required to access to the following components. Refer to *BODY* subsection

- Front left and right calipers
- Rear caliper
- VCM
- Brake fluid reservoir

NOTICE Protect plastic, rubber or painted parts with rags when servicing brake system.



TYPICAL

Place vehicle on a level surface.

Loosen front wheel lug nuts.

Lift the front of the vehicle.

Secure front of vehicle on jack stands.

Level the vehicle by using a jack underneath the rear shock absorber.

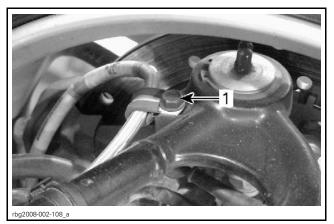
5

Subsection XX (BRAKES)

NOTE: To ensure that the vehicle is level, use the bottom vehicle frame as a reference.

Remove front wheels.

Remove clip retaining hose on suspension arm (one on each side).



TYPICAL

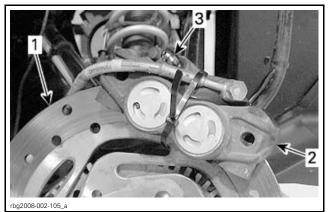
1. Clip retaining hose

Remove caliper mounting bolts from both front calipers.

NOTICE Do not let caliper hang by the hose and do not stretch or twist the hose.

Install each caliper horizontally on the top of its brake disc with bleeder to the highest point.

Secure caliper with locking tie.



TYPICAL

- 1. Brake disc
- 2. Caliper
- 3. Bleeder to the highest point

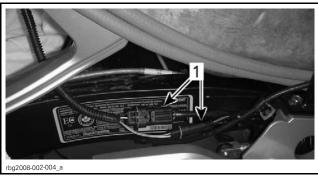
Open seat.

Detach lift cylinder from seat.

Lift seat and unplug the pillion rider (passenger) switch connector.

Cut locking ties securing brake hoses between reservoir and master cylinder.

Unplug low pressure switch connector and brake light connector.



TYPICAL

1. Low pressure switch connector and brake light connector

Detach brake fluid reservoir from vehicle.

Move reservoir down and outside the footrest and then reinstall at its location as per the following picture.

Place brake hoses alongside rear passenger footrest support.

Attach brake hoses to frame using locking tie.



TYPICAL

1. Rear passenger footrest support

NOTE: The previous steps are required for the hoses to run completely down toward the master cylinder.

Replug low pressure switch connector and brake light connector.

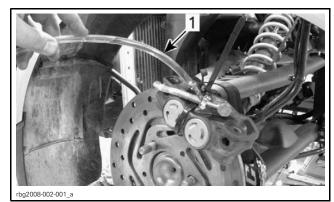
Remove reservoir caps.

Install a 40 cm (16 in) long clear hose onto:

- Left caliper bleeder
- Right caliper bleeder
- Rear caliper bleeder.

Secure all clear hose with small locking ties.

Fill clear hoses with brake fluid using a funnel (approximately 60 mm (2-1/2 in) long).

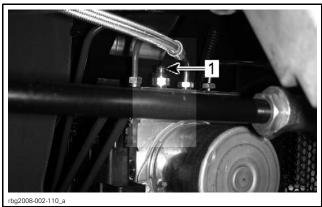


TYPICAL

1. Brake fluid

Locate VCM at the front of vehicle.

Install 80 cm (31 in) long clear hose onto VCM bleeder.



1. VCM bleeder

Secure VCM clear hose with small locking tie. Fill VCM clear hose with brake fluid using a funnel (approximately 60 mm (2-1/2 in) long).

Manual Bleeding Procedure (Preliminary Bleeding)

NOTE: Brake fluid reservoir must be kept full to prevent air from being pumped into the system. If a sequence is interrupted or a lack of fluid occurs, start the sequence again.

- 1. Start bleeding system with left front caliper.
- Open bleeder and slowly depress then slowly release brake pedal at least 25 times (full stroke) until fluid freely flows out of the bleeder without any air bubbles.

NOTE: It may be necessary to pump brake pedal more than 25 times, as a result, it is important to pump brake pedal until fluid flows out **without** any air bubbles.

3. When there is no more air bubbles in clear hose, close the bleeder while brake pedal is depressed.

NOTE: Do not release brake pedal until bleeder has been closed.

- 4. Pump up system pressure with brake pedal until pedal resistance is felt.
- 5. Depress and hold brake pedal.
- 6. Re-open bleeder and then re-close it.
- 7. Release brake pedal slowly.
- 8. Repeat manual bleeding procedure for the other bleeders in this order:
 - Right front caliper
 - Rear caliper
 - VCM.

B.U.D.S. Bleeding Procedure (Final Bleeding)

NOTE: The bleeding procedure is accomplished FIRST by completing the manual bleeding procedure as explained above.

Brake bleeding is completed using B.U.D.S. software. To properly bleed the complete braking system, use the bleeding sequence according to this table.

B.U.D.S. BLEEDING SEQUENCE		
OPERATION	BLEEDING CIRCUIT	
Complete brake system bleeding	Front circuit and rear circuit	

B.U.D.S. BLEEDING CIRCUIT	BLEEDER LOCATION
Front circuit	1: Left front caliper
Front circuit	2: Right front caliper
Rear circuit	3: Rear caliper
	4: VCM

NOTE: Each sequence must be carried out without interruption. Furthermore, brake fluid reservoir must be kept full to prevent air from being pumped into the system. If a sequence is interrupted or a lack of fluid occurs, start the sequence again.

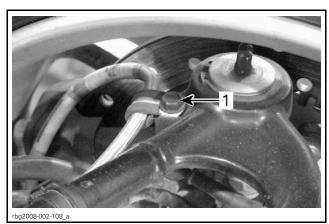
- 1. Connect B.U.D.S. Refer to *COMMUNICATION TOOLS AND B.U.D.S. SOFTWARE*.
- 2. In B.U.D.S., select Read Data.
- 3. Select **Setting** folder then the **VCM** page.
- 4. Read and understand the procedure on screen before beginning it.
- 5. Perform FRONT CIRCUIT BLEEDING and REAR CIRCUIT BLEEDING inclusively. Follow the instruction in B.U.D.S.

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Reinstall caliper. Refer to *CALIPER* in this subsection.

Reinstall clip retaining hose on suspension arm (one on each side).

Secure bolt to 11 Nom (97 lbfoin).



TYPICAL

1. Clip retaining hose

Reinstall wheels on vehicle. Refer to *STEERING/FRONT WHEELS* subsection for procedure.

Carry out the *BRAKE SYSTEM PRESSURE VALI-DATION* as detailed in this subsection.

NOTICE Do not pump up the brake pedal repeatedly before doing the validation.

Vehicle Reassembly

Reinstall brake fluid reservoir on vehicle with the hoses at their original location.

Secure brake fluid reservoir to 7 N•m (62 lbf•in).

Secure hoses with locking ties.

Install all removed *BODY* parts as the reverse of the removal procedure.

Ride the vehicle and apply the brake a few times to ensure the normal behavior of the vehicle.

Brake Fluid Bleeding Procedure (Rear Brake Only)

General Guidelines

This procedure is divided in multiple tasks that must be completed in a specific order according to the following table.

STEP	TASK
1	Perform manual bleeding procedure (rear caliper and VCM)
2	Perform B.U.D.S. bleeding procedure (rear circuit)
3	Validate the system pressure

Requirements for Task Completion

Requirements are the same as for bleeding the complete braking system. Refer to *BRAKE FLUID BLEEDING PROCEDURE (COMPLETE SYSTEM)*.

Vehicle Preparation

Remove body parts as required to access to the following components. Refer to *BODY* subsection

- Rear caliper
- VCM
- Brake fluid reservoir.

Level the vehicle.

NOTE: To ensure that the vehicle is level, use the bottom vehicle frame as a reference.

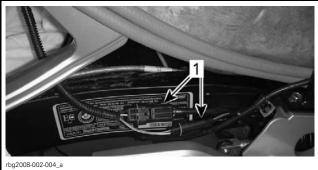
Open seat.

Detach lift cylinder from seat.

Lift seat and unplug the pillion rider (passenger) switch connector.

Cut locking ties securing brake hoses between reservoir and master cylinder.

Unplug low pressure switch connector and brake light connector.



TYPICAL

1. Low pressure switch connector and brake light connector

Detach brake fluid reservoir from vehicle.

Move reservoir down and outside the footrest and then reinstall at its location as per the following picture.

Place brake hoses alongside rear passenger footrest support.

Attach hoses to frame using locking tie.



TYPICAL

1. Rear passenger footrest support

NOTE: The previous steps are required for the hoses to run completely down toward the master cylinder.

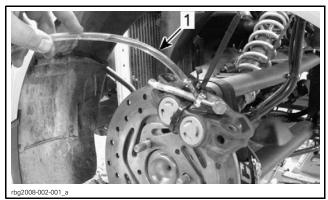
Replug low pressure switch connector and brake light connector.

Remove reservoir caps.

Install a 40 cm (16 in) long clear hose onto rear caliper bleeder.

Secure all clear hose with small locking ties.

Fill clear hoses with brake fluid using a funnel (approximately 60 mm (2-1/2 in) long).

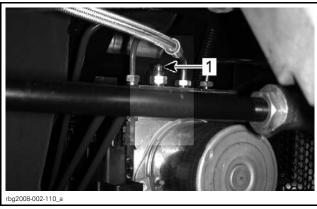


TYPICAL

1. Brake fluid

Locate VCM at the front of vehicle.

Install 80 cm (31 in) long clear hose onto VCM bleeder.



1. VCM bleeder

Secure VCM clear hose with small locking tie.

Fill VCM clear hose with brake fluid using a fund

Fill VCM clear hose with brake fluid using a funnel (approximately 60 mm (2-1/2 in) long).

Manual Bleeding Procedure (Preliminary Bleeding)

NOTE: Brake fluid reservoir must be kept full to prevent air from being pumped into the system. If a sequence is interrupted or a lack of fluid occurs, start the sequence again.

- 1. Start bleeding system with rear caliper.
- Open bleeder and slowly depress then slowly release brake pedal at least 25 times (full stroke) until fluid freely flows out of the bleeder without any air bubbles.

NOTE: It may be necessary to pump brake pedal more than 25 times, as a result, it is important to pump brake pedal until fluid flows out **without any air bubbles**.

3. When there is no more air bubbles in clear hose, close the bleeder while brake pedal is depressed.

NOTE: Do not release brake pedal until bleeder has been closed.

- 4. Pump up system pressure with brake pedal until pedal resistance is felt.
- 5. Depress and hold brake pedal.
- 6. Re-open bleeder and then re-close it.
- 7. Release brake pedal slowly.
- 8. Repeat manual bleeding procedure for VCM bleeder.

B.U.D.S. Bleeding Procedure (Final Bleeding)

NOTE: The bleeding procedure is accomplished FIRST by completing the manual bleeding procedure as explained above.

9

Brake bleeding is completed using B.U.D.S. software. To properly bleed the complete braking system, use the bleeding sequence according to this table.

B.U.D.S. BLEEDING SEQUENCE			
OPERATION	BLEEDING CIRCUIT		
Rear brake system bleeding	Rear circuit		
B.U.D.S. BLEEDING CIRCUIT	BLEEDER LOCATION		
De en einenit	3: Rear caliper		
Rear circuit	4: VCM		

NOTE: Each sequence must be carried out without interruption. Furthermore, brake fluid reservoir must be kept full to prevent air from being pumped into the system. If a sequence is interrupted or a lack of fluid occurs, start the sequence again.

- 1. Connect B.U.D.S. Refer to *COMMUNICATION TOOLS AND B.U.D.S. SOFTWARE*.
- 2. In B.U.D.S., select Read Data.
- 3. Select **Setting** folder then the **VCM** page.
- 4. Read and understand the procedure on screen before beginning it.
- 5. Perform **REAR CIRCUIT BLEEDING**. Follow the instruction in B.U.D.S.

Carry out the *BRAKE SYSTEM PRESSURE VALI-DATION* as detailed in this subsection.

NOTICE Do not pump up the brake pedal repeatedly before doing the validation.

Vehicle Reassembly

Reinstall brake fluid reservoir on vehicle with the hoses at their original location.

Secure brake fluid reservoir to 7 Nom (62 lbfoin).

Secure hoses with locking ties.

Install all removed *BODY* parts as the reverse of the removal procedure.

Ride the vehicle and apply the brake a few times to ensure the normal behavior of the vehicle.

Brake Fluid Bleeding Procedure (Front Brakes Only)

General Guidelines

This procedure is divided in multiple tasks that must be completed in a specific order according to the following table.

STEP	TASK
1	Perform manual bleeding procedure (left caliper and right caliper)
2	Perform B.U.D.S. bleeding procedure (front circuit)
3	Validate the system pressure

Requirements for Task Completion

Requirements are the same as for bleeding the complete braking system. Refer to *BRAKE FLUID BLEEDING PROCEDURE (COMPLETE SYSTEM)*.

Vehicle Preparation

Remove body parts as required to access to the following components. Refer to *BODY* subsection.

- Front left and right calipers
- Brake fluid reservoir

Place vehicle on a level surface.

Apply parking brake.

Loosen front wheel lug nuts.

Secure front of vehicle on jack stands.

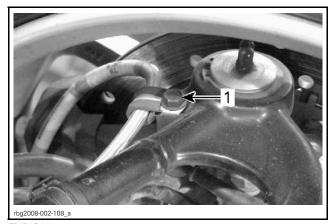
Level the vehicle by using a jack underneath the rear shock absorber.

NOTE: To ensure that the vehicle is level, use the bottom vehicle frame as a reference.

Remove front wheels.

NOTICE Never use any type of impact wrench for lug nut removal and installation. The use of impact wrench could damage the bolts threads and nuts.

Remove clip retaining hose on suspension arm (one on each side).



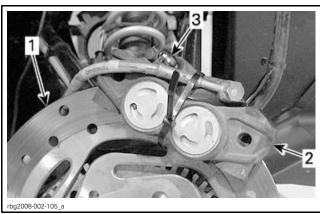
TYPICAL
1. Clip retaining hose

Remove caliper mounting bolts from both front calipers.

NOTICE Do not let caliper hang by the hose and do not stretch or twist the hose.

Install each caliper horizontally on the top of its brake disc with bleeder to the highest point.

Secure caliper with locking tie.



TYPICAL

- 1. Brake disc
- 2. Caliper
- 3. Bleeder to the highest point

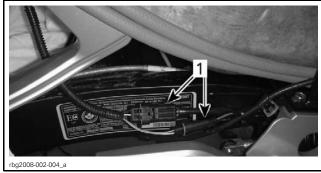
Open seat.

Detach lift cylinder from seat.

Lift seat and unplug the pillion rider (passenger) switch connector.

Cut locking ties securing brake hoses between reservoir and master cylinder.

Unplug low pressure switch connector and brake light connector.



TYPICAL

1. Low pressure switch connector and brake light connector

Detach brake fluid reservoir from vehicle.

Move reservoir down and outside the footrest and then reinstall at its location as per the following picture.

Place brake hoses alongside rear passenger footrest support.

Attach brake hoses to frame using locking tie.



TYPICAL

1. Rear passenger footrest support

NOTE: The previous steps are required for the hoses to run completely down toward the master cylinder.

Replug low pressure switch connector and brake light connector.

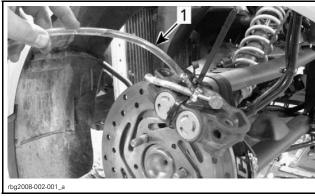
Remove reservoir caps.

Install a 40 cm (16 in) long clear hose onto:

- Left caliper bleeder
- Right caliper bleeder.

Secure all clear hose with small locking ties.

Fill clear hoses with brake fluid using a funnel (approximately 60 mm (2-1/2 in) long).



TYPICAL

1. Brake fluid

Manual Bleeding Procedure (Preliminary Bleeding)

NOTE: Brake fluid reservoir must be kept full to prevent air from being pumped into the system. If a sequence is interrupted or a lack of fluid occurs, start the sequence again.

- 1. Start bleeding system with:
 - Left front caliper
 - Right front caliper.

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 Open bleeder and slowly depress then slowly release brake pedal at least 25 times (full stroke) until fluid freely flows out of the bleeder without any air bubbles.

NOTE: It may be necessary to pump brake pedal more than 25 times, as a result, it is important to pump brake pedal until fluid flows out **without** any air bubbles.

3. When there is no more air bubbles in clear hose, close the bleeder while brake pedal is depressed.

NOTE: Do not release brake pedal until bleeder has been closed.

- 4. Pump up system pressure with brake pedal until pedal resistance is felt.
- 5. Depress and hold brake pedal.
- 6. Re-open bleeder and then re-close it.
- 7. Release brake pedal slowly.

B.U.D.S. Bleeding Procedure (Final Bleeding)

NOTE: The bleeding procedure is accomplished FIRST by completing the manual bleeding procedure as explained above.

Brake bleeding is completed using B.U.D.S. software. To properly bleed the complete braking system, use the bleeding sequence according to this table.

B.U.D.S. BLEEDING SEQUENCE			
OPERATION	BLEEDING CIRCUIT		
Front brake system bleeding	Front circuit		
B.U.D.S. BLEEDING CIRCUIT	BLEEDER LOCATION		
Format vincenta	1: Left front caliper		
Front circuit	2: Right front caliper		

NOTE: Each sequence must be carried out without interruption. Futhermore, brake fluid reservoir must be kept full to prevent air from being pumped into the system. If a sequence is interrupted or a lack of fluid occurs, start the sequence again.

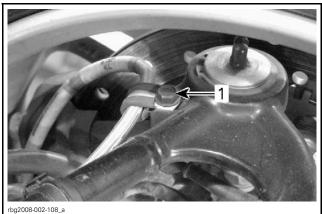
- 1. Connect B.U.D.S. Refer to *COMMUNICATION TOOLS AND B.U.D.S. SOFTWARE*.
- 2. In B.U.D.S., select Read Data.
- 3. Select **Setting** folder then the **VCM** page.
- 4. Read and understand the procedure on screen before beginning it.

5. Perform **FRONT CIRCUIT BLEEDING**. Follow the instruction in B.U.D.S.

Reinstall caliper. Refer to *CALIPER* in this subsection.

Reinstall clip retaining hose on suspension arm (one on each side).

Secure bolt to 11 N•m (97 lbf•in).



TYPICAL

1. Clip retaining hose

Reinstall wheels on vehicle. Refer to *STEERING* (DPS) AND WHEELS for procedure.

Carry out the *BRAKE SYSTEM PRESSURE VALI-DATION* as detailed in this subsection.

NOTICE Do not pump up the brake pedal repeatedly before doing the validation.

Vehicle Reassembly

Reinstall brake fluid reservoir on vehicle with the hoses at their original location.

Secure brake fluid reservoir to 7 Nom (62 lbfoin).

Secure hoses with locking ties.

Install all removed *BODY* parts as the reverse of the removal procedure.

Ride the vehicle and apply the brake a few times to ensure the normal behavior of the vehicle.

INSPECTION

BRAKE SYSTEM PRESSURE VALIDATION

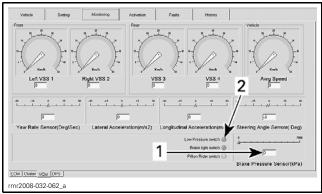
NOTICE Do not pump up the brake pedal repeatedly before doing the validation.

In B.U.D.S., select **Monitoring** folder then the **VCM** page.

Slowly depress the brake pedal (only once) until you reach **3500 kPa (508 PSI)** at the brake pressure sensor.

Maintain the brake pedal in position.

Check the **Low Pressure Switch** button value on the computer screen.



- 1. Brake Pressure Sensor (PSI) value
- 2. Low Pressure Switch button

If Low Pressure Switch button is still off when you reached the required pressure the validation is successful.

If Low Pressure Switch button turns on before reaching 3500 kPa (508 PSI), perform the following additional steps:

Perform equivalent of 3 complete wheels rotation (for the 3 wheels).

Slowly depress the brake pedal until Low Pressure Switch button turns on.

Take note of the Brake Pressure Sensor (PSI) value.

Perform equivalent of 3 complete wheels rotation (for the 3 wheels).

Slowly depress the brake pedal until Low Pressure Switch button turns on.

Take note of the **Brake Pressure Sensor (PSI)** value.

Perform equivalent of 3 complete wheels rotation (for the 3 wheels).

Slowly depress the brake pedal until Low Pressure Switch button turns on.

Take note of the Brake Pressure Sensor (PSI) value.

Calculate the average of the 3 Brake Pressure Sensor (PSI) values previously noted.

If the average is **EQUAL OR ABOVE 3500 kPa (508 PSI)**, the brake system pressure is conform. Clear fault codes.

If the average is **BELOW 3500 kPa (508 PSI)**, repeat *BRAKE FLUID BLEEDING PROCEDURE* with the following deviation:

Lift the rear of vehicle and adjust master cylinder on level.

PROCEDURES

CALIPER

Caliper Removal

Front Caliper

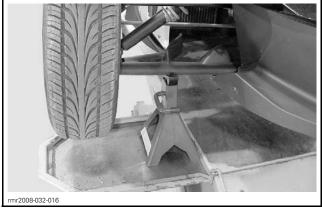
Place the vehicle on a level surface.

Apply parking brake.

Loosen wheel lug nuts.

Lift the front of vehicle.

Support the vehicle securely on jack stands.

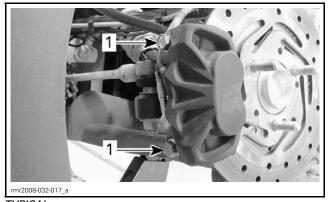


TYPICAL

Remove wheel.

Remove and discard caliper screws.

NOTE: If the caliper is replaced, loosen brake hose first. See procedure below. Otherwise, omit the next steps concerning the brake hose.



TYPICAL

1. Caliper screws

NOTICE Do not let caliper hangs by the hose and do not stretch or twist the hose.

Install a drain pan under caliper to catch brake fluid.

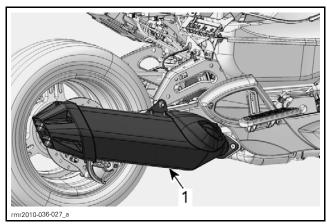
Loosen the Banjo fitting. Disconnect brake hose and discard sealing washers.

Remove the caliper from the vehicle.

Rear Caliper

Place vehicle on a level surface.

Remove muffler from swing arm.

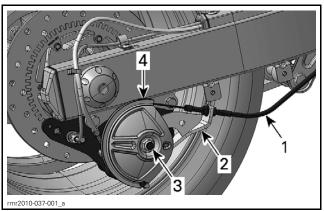


1. Muffler

Remove parking brake cable from parking brake support.

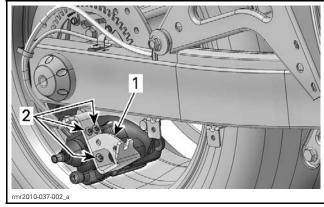
Remove retaining nut from parking brake rear pul-

Remove parking brake rear pulley and its spring.



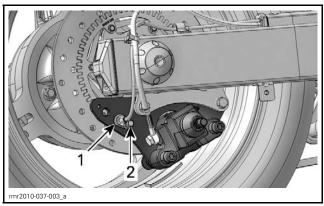
- Parking brake cable
- Parking brake support Parking brake rear pulley nut Parking brake rear pulley

Remove parking brake support from caliper bracket.



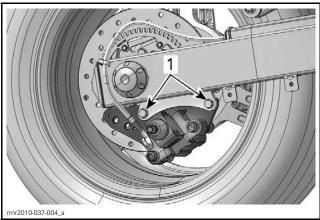
Parking brake support Retaining screws

Remove wheel speed sensor from caliper bracket.



 Wheel speed se
 Retaining screw Wheel speed sensor

Remove and discard caliper screws.



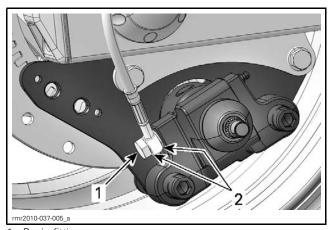
Caliper screws

NOTE: If the caliper is replaced, loosen brake hose first. See procedure below. Otherwise, omit the next steps concerning the brake hose.

NOTICE Do not let caliper hangs by the hose and do not stretch or twist the hose.

Install a drain pan under caliper to catch brake fluid.

Loosen the Banjo fitting. Disconnect brake hose and discard sealing washers.



Banjo fitting
 Sealing washers

Remove caliper.

Caliper Inspection

Check piston(s) for scratches, rust or other damages. If so, replace caliper.

Caliper Installation

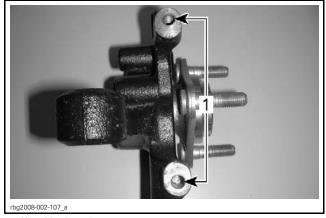
The installation is the reverse of the removal procedure. However, pay attention to the following. Install **NEW** caliper screws.

Install **NEW** sealing washers on banjo fitting if hoses were disconnected.

Torque banjo fitting to 29 N•m (21 lbf•ft).

Front Caliper

NOTICE To ensure good clamping of calipers screws, it is imperative to clean knuckle threads using a metric tap M10 x 1.5.



1. Knuckle threads

Secure caliper screws to 48 N•m (35 lbf•ft).

Rear Caliper

Torque parking brake support screws to 17 N•m (150 lbf•in).

Torque parking brake pulley nut to 46 N•m (34 lbf•ft).

Check wheel speed sensor adjustment. Refer to VEHICLE STABILITY SYSTEM subsection.

Adjust parking brake cable, refer to *PARKING BRAKE CABLE ADJUSTMENT* in this subsection.

BRAKE PAD

Brake Pad Inspection

Measure brake pad lining thickness.

BRAKE PAD THICKNESS			
Service Limit	1 mm (.04 in)		

NOTICE Brake pads must always be replaced in pairs.

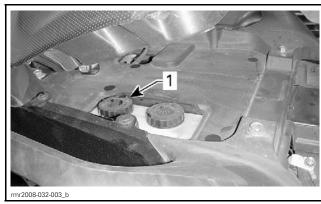
Front Brake Pad Replacement

Place the vehicle on a level surface.

Apply parking brake.

Lift seat.

Clean and remove the rear reservoir cap.



TYPICAL

1. Remove this cap

Loosen wheel lug nuts.

Lift the front of vehicle.

Support the vehicle securely on jack stands.

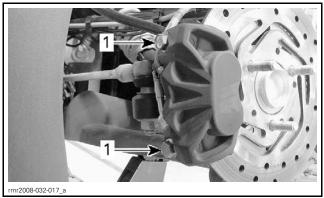
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TYPICAL

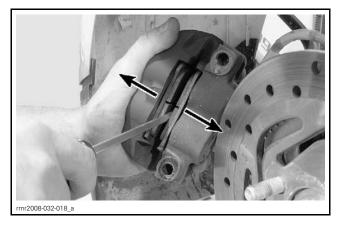
Remove wheel.

Remove and discard caliper screws.

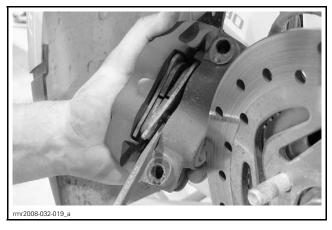


TYPICAL
1. Caliper screws

Using a flat screwdriver, depress pistons into their bores.

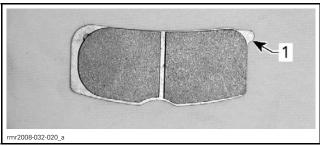


Remove brake pads.



Check the condition of pistons pins. Replace caliper as required.

Install **NEW** brake pads with tabs downward.



1. Brake pad tab

Install caliper. Refer to ${\it CALIPER}$ in this subsection.

Install wheel.

Ride the vehicle a few minutes to make sure the repair is successful.

A WARNING

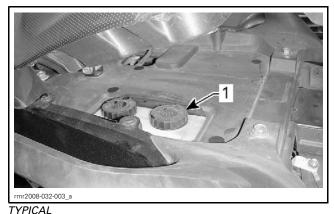
When installing new brake pads, always observe a break-in period of 300 km (200 mi). During this time, the brakes and the VSS will not operate at their maximum efficiency. You could lose control and crash – use extra caution.

Rear Brake Pad Replacement

Place vehicle on a level surface.

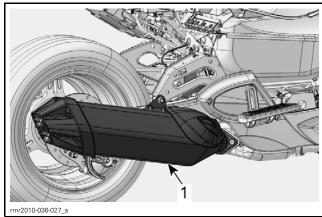
Lift seat.

Clean and remove the front reservoir cap.



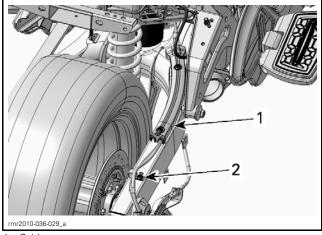
1. Remove this cap

Remove muffler from swing arm.



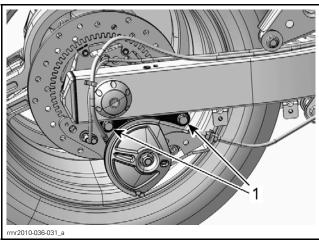
1. Muffler

Remove cables protector and cables fastener from swing arm.



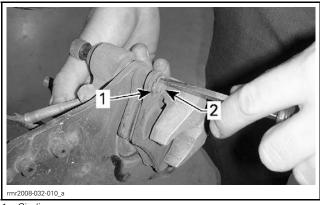
Cables protector Cables fastener

Remove and discard both caliper screws.



1. Caliper screws

Remove and discard circlips securing both brake pad pins.



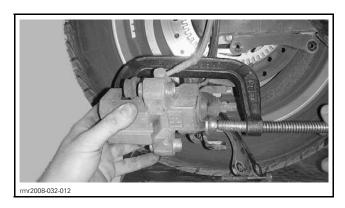
Circlip
 Brake pad pin

Unscrew and remove brake pad pins.

Check brake pad pins for wear, replace as required.

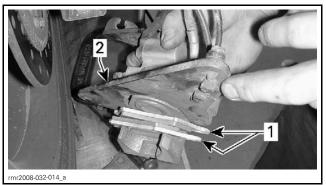
Remove wheel speed sensor bracket.

Use a C-clamp to push the piston into its bore to ease pad installation.



Remove and discard brake pads.

Install brake pads with the wheel speed sensor support.



1. New brake pads

Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on threads of brake pad pins.

NOTE: If new brake pad pins are used, the threads are coated with a self-locking product, do not apply Loctite 243 on threads.

Install brake pad pins. Do not tighten yet.

Install **NEW** circlips.

Install caliper with **NEW** screws.

Torque caliper screws to 25 N•m (18 lbf•ft).

Torque brake pad pins to 46 N•m (34 lbf•ft).

Apply brake a few times.

Check wheel speed sensor adjustment. Refer to VEHICLE STABILITY SYSTEM subsection.

Adjust parking brake cable, refer to *PARKING BRAKE CABLE ADJUSTMENT* in this subsection.

Ride the vehicle a few minutes to make sure the repair is successful.

WARNING

When installing new brake pads, always observe a break-in period of 300 km (200 mi). During this time, the brakes and the VSS will not operate at their maximum efficiency. You could lose control and crash – use extra caution.

BRAKE DISC

Brake Disc Inspection

Measure the brake disc thickness.



FRONT BRAKE DISC



REAR BRAKE DISC

MINIMUM BRAKE DISC THICKNESS			
Front and rear	5.5 mm (.22 in)		

Using a dial gauge, verify the brake disc warpage.

MAXIMUM BRAKE DISC WARPAGE			
Front and rear	0.12 mm (.004 in)		

Brake Disc Removal

Front Brake Disc

Place vehicle on a level surface.

Loosen wheel lug nuts.

Lift the front of vehicle.

Support the vehicle securely on jack stands.

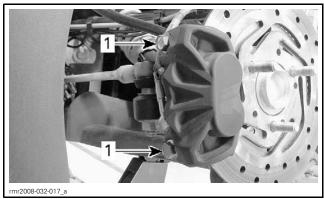
^{2.} Wheel speed sensor support



TYPICAL

Remove wheel.

Remove caliper screws.



TYPICAL

1. Caliper screws

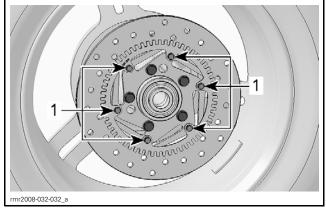
NOTICE Do not let caliper hangs by the hose and do not stretch or twist the hose.

Remove brake disc.

Rear Brake Disc

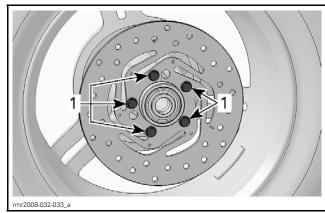
Remove rear wheel. Refer to *DRIVE BELT AND REAR WHEEL* subsection.

Remove encoder wheel by unscrewing encoder wheel screws. Discard screws.



1. Encoder wheel screws

Remove and discard brake disc screws.



1. Brake disc screws

Remove brake disc.

Brake Disc Installation

The installation is the reverse of the removal procedure. However, pay attention to the following. Position the brake disk so that directional arrow points forward.



Front Brake Disc

Install the encoder wheel before installing the brake disc.

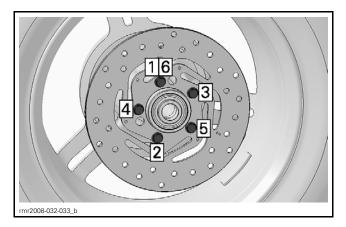
NOTICE Ensure encoder wheel is leaned against hub.

Install all other removed parts.

Rear Brake Disc

Install and torque **NEW** brake disc screws to 25 N•m (18 lbf•ft) as per the following sequence.

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Install *ENCODER WHEEL*, see procedure further in this subsection.

Install all other removed parts.

ENCODER WHEEL

Encoder Wheel Removal

Front Encoder Wheel

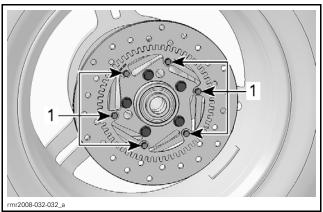
Remove appropriate *BRAKE DISC*, see procedure above in this subsection.

Pull encoder wheel to remove it.

Rear Encoder Wheel

Remove rear wheel. Refer to *DRIVE BELT AND REAR WHEEL* subsection.

Remove and discard encoder wheel screws.



1. Encoder wheel screws

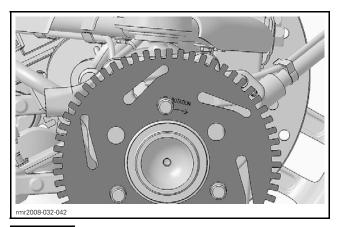
Encoder Wheel Inspection

Check if encoder wheel teeth are bent or otherwise damaged. Replace encoder wheel if necessary.

Encoder Wheel Installation

Front Encoder Wheels

Position the encoder wheel so that directional arrow points forward.

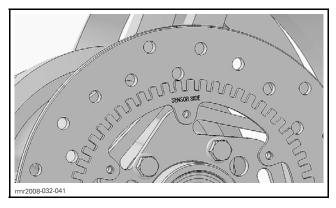


NOTICE Ensure encoder wheel is leaned against hub.

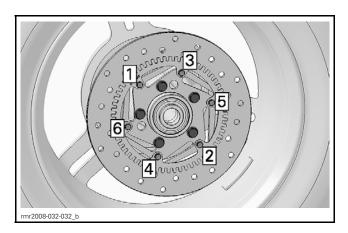
Install all other removed parts.

Rear Encoder Wheel

Position the encoder wheel with the inscription SENSOR SIDE facing outward.



Install and torque **NEW** encoder wheel screws to 5 N•m (44 lbf•in) as per the following sequence.



Install rear wheel.

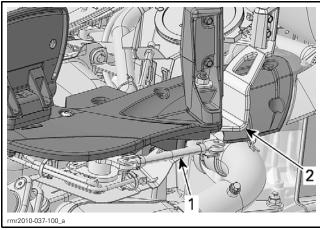
BRAKE PEDAL

Brake Pedal Removal

Remove body parts as required to access to the following components. Refer to BODY subsection.

- Brake pedal
- Master cylinder.

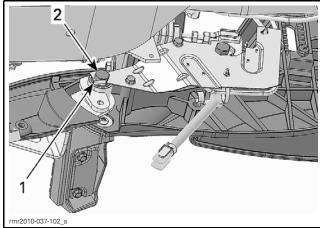
Unhook connecting rod from brake pedal.



Connecting rod Brake pedal

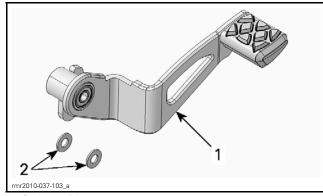
From the LH side, underneath vehicle:

- Unfold tab
- Remove and discard brake pedal bolt.



- Tab
- 2. Brake pedal bolt

Remove brake pedal and both washers.



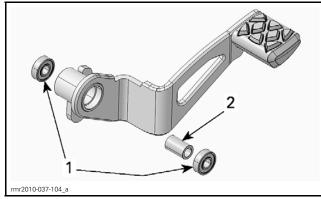
- Brake pedal
 Both washers

Brake Pedal Disassembly

Remove and discard brake pedal bearings using the BLIND HOLE BEARING PULLER SET (P/N 529 036 117).

Remove brake pedal sleeve.





 Brake pedal bearing
 Brake pedal sleeve Brake pedal bearings

Brake Pedal Assembly

Assembly is the reverse of the disassembly procedure.

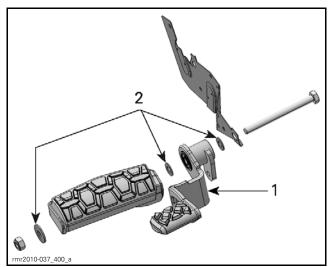
21

NOTE: When assembly brake pedal, always use **NEW** bearings.

Brake Pedal Installation

The installation is the reverse of the removal procedure. However, pay particular attention to the following.

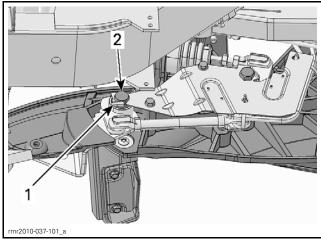
Install brake pedal using a **NEW** brake pedal bolt. Make sure to install washers as per the following illustration.



Brake pedal
 Washers

Tighten brake pedal bolt to 48 N•m (35 lbf•ft).

Fold either tabs against a flat side of brake pedal bolt head.



Folded Tab
 Brake pedal bolt

Each time brake pedal is re-installed, the adjustment of the master cylinder rod is necessary. Refer to *MASTER CYLINDER ROD*.

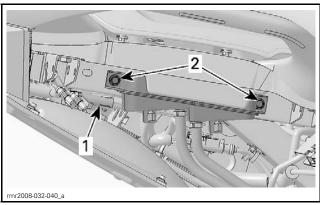
BRAKE FLUID RESERVOIR

Brake Fluid Reservoir Removal

Remove body parts as required to access to the brake fluid reservoir. Refer to *BODY* subsection.

Unplug brake fluid level sensor connectors.

Remove reservoir screws.



TYPICAL

- 1. Sensors connector
- 2. Reservoir screws

Remove reservoir caps.

Empty reservoir as much as possible.

Cut Oetiker clamps and disconnect hoses.

Brake Fluid Reservoir Installation

Connect hoses with NEW Oetiker clamps.

Install reservoir on frame.

Plug brake fluid level sensors.

Fill up reservoir with recommended brake fluid and bleed brake system. Refer to *BRAKE FLUID* in this subsection.

Install all other removed parts.

DUAL MASTER CYLINDER

Dual Master Cylinder Removal

Remove body parts as required to access to the following components. Refer to *BODY* subsection.

- Master cylinder
- Brake fluid reservoir.

Cut locking ties securing brake fluid reservoir hoses to frame.

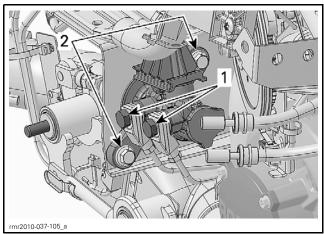
Place a container under master cylinder to catch brake fluid.

Loosen Banjo fittings retaining metal brake lines to master cylinder.

Apply on brake pedal to empty the brake fluid reservoir and the dual master cylinder.

Remove Banjo fittings and discard sealing washers.

Remove and discard master cylinder screws.



SOME PARTS REMOVED FOR CLARITY

- 1. Banjo fittings
- 2. Master cylinder screws

Unscrew brake fluid reservoir screws.

Unplug brake fluid level sensor connectors.

Remove master cylinder by moving it toward the front.

Cut Oetiker clamps and remove reservoir hoses from master cylinder.

Dual Master Cylinder Inspection

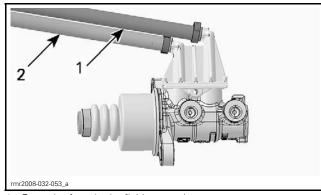
Check bellows for cracks or other damages. Replace bellows as necessary.

Check if the master cylinder plunger is not stuck by pushing it on. Replace master cylinder if necessary.

Dual Master Cylinder Installation

NOTICE During installation, ensure all parts are cleaned to avoid brake system contamination.

Install reservoir hoses with NEW Oetiker clamps.



From the front brake fluid reservoir
 From the rear brake fluid reservoir

Install dual master cylinder using 2 **NEW** master cylinder screws.

Torque master cylinder screws to 25 N•m (18 lbf•ft).

Install metal brake lines on master cylinder with **NEW** sealing washers.

Tighten Banjo fitting to 28 N•m (21 lbf•ft).

Install brake fluid reservoir.

Plug brake fluid level sensors.

Bleed complete brake system. Refer to *BRAKE FLUID BLEEDING PROCEDURE (COMPLETE SYSTEM)* at the beginning of this subsection.

Install all other removed parts.

MASTER CYLINDER ROD

Master Cylinder Rod Adjustment

A WARNING

This adjustment is necessary to calibrate the dual master cylinder and avoid braking system malfunction.

The adjustment of master cylinder rod must be performed when one of the following items is replaced or removed:

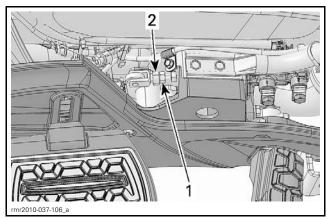
- Brake pedal
- Brake pedal stop
- RH footrest support
- Master cylinder rod
- Hook at the end of master cylinder rod
- Connecting rod.

Remove dual master cylinder. Refer to *DUAL MASTER CYLINDER* in this subsection.

Unscrew the nut locking the master cylinder rod.

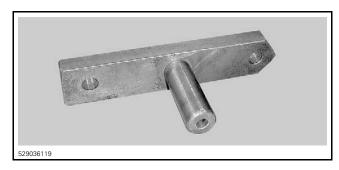
23

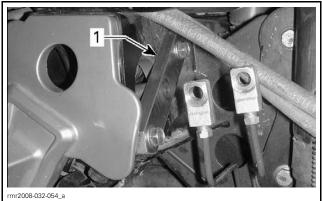
Tighten master cylinder rod into hook.



Locking nut
 Hook

Install the MASTER CYLINDER ROD ADJUSTER (P/N 529 036 119) instead of dual master cylinder. Position the end of rod inside tool.





TYPICAL

1. Master cylinder rod adjuster

Ensure brake pedal leans against its rubber stop. Hold brake pedal in this position.

Adjust the rod position until it just touches the inside of the adjuster hole without compressing rubber stop.



TYPICAL

Using two wrenches, hold the master cylinder rod and tighten lock nut. Ensure rod does not turn.



TYPICAL

Remove tool and install the dual master cylinder. Refer to *DUAL MASTER CYLINDER* in this subsection.

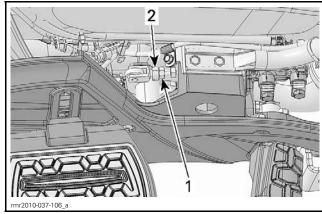
Attach reservoir hoses with new locking ties.

Master Cylinder Rod Removal

Remove body parts as required to access to the master cylinder. Refer to *BODY* subsection.

Loosen lock nut.

Remove hook lock.

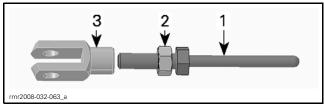


Lock nut
 Hook lock

Remove master cylinder rod from vehicle by moving it toward the rear.

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Unscrew clevis from master cylinder rod.



- Master cylinder rod
- Lock nut

Master Cylinder Rod Installation

Completely screw the clevis on master cylinder rod.

Secure clevis to brake pedal using the clevis lock. Adjust master cylinder rod, refer to MASTER CYLINDER ROD ADJUSTMENT.

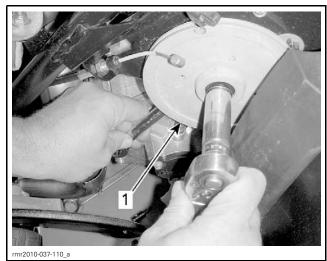
PARKING BRAKE FRONT PULLEY

Parking Brake Front Pulley Removal

Remove body parts as required to access to the parking brake front pulley. Refer to BODY subsection.

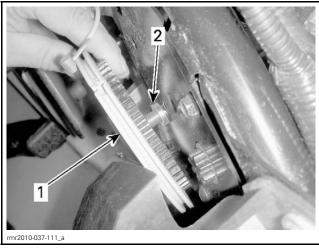
Detach parking brake cable from pulleys, refer to PARKING BRAKE CABLE REMOVAL in this subsection.

Remove front pulley retaining nut.



1. Front pulley

Carefully pull front pulley toward the outside then remove spacer.

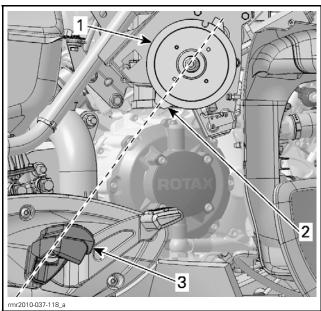


1. Front p 2. Spacer Front pulley

Parking Brake Front Pulley Installation

Install spacer on front pulley retaining bolt.

Install front pulley with the lower pulley stopper positioned toward driver footpeg, refer to illustration.



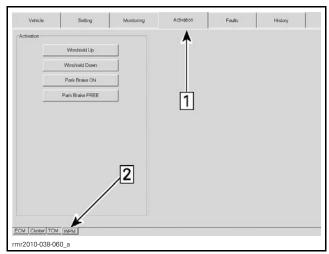
- Front pulley
- Lower pulley stopper
 Driver footpeg

Install and tighten retaining nut to secure front pul-

Connect vehicle to B.U.D.S. Refer to COMMUNI-CATION TOOLS AND B.U.D.S. SOFTWARE subsection.

Select Activation page.

Select WPM folder.



Step 1: Activation page Step 2: WPM folder

Press Park Brake FREE button to set pulley at its reference position.

Attach parking brake cable on front pulley.

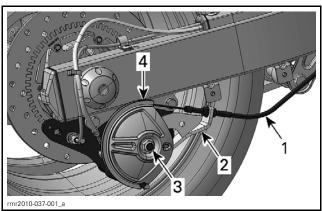
Adjust parking brake cable, refer to PARKING BRAKE CABLE ADJUSTMENT in this subsection.

PARKING BRAKE REAR PULLEY

Parking Brake Rear Pulley Removal

Detach parking brake cable from pulleys, refer to PARKING BRAKE CABLE REMOVAL in this subsection.

Remove parking brake rear pulley and its spring by unscrewing the retaining nut.



- Parking brake cable
- Parking brake support
- Parking brake rear pulley nut Parking brake rear pulley

Parking Brake Rear Pulley Installation

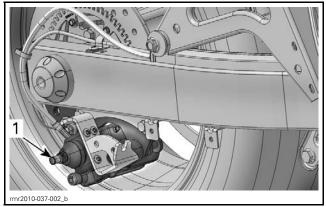
The installation is the reverse of the removal procedure. However, pay attention to the following. Adjust parking brake cable, refer to PARKING BRAKE CABLE ADJUSTMENT in this subsection.

PARKING BRAKE CABLE

Parking Brake Cable Adjustment

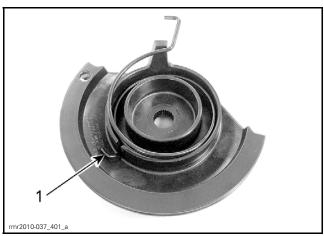
Remove parking brake rear pulley. Refer to PARK-ING BRAKE REAR PULLEY in this subsection.

Turn actuator clockwise to lean piston against pad, do not force the actuator.



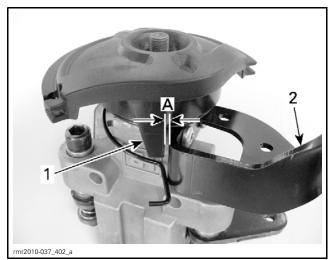
1. Actuator

Install spring in rear pulley groove.



1. Spring installed in groove

Install rear pulley with its stopper positioned against parking brake support.



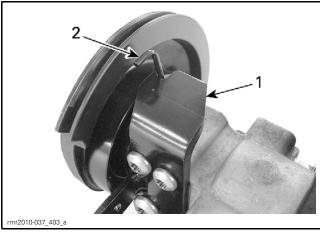
SOME PARTS REMOVED FOR CLARITY PURPOSE

- Rear pulley stopper
- 2. Parking brake support
- A. 1 mm to 3 mm (.039 in to .118 in)

NOTE: If adjustment cannot be obtained, remove rear pulley and move it one spline at a time until proper adjustment is obtained.

Install rear pulley retaining nut by hand, do not torque it for the moment.

Load rear pulley spring in the upper groove of parking brake support.



SOME PARTS REMOVED FOR CLARITY PURPOSE

- Parking brake support
 Spring

Torque rear pulley retaining nut to 46 N•m (34 lbf•ft).

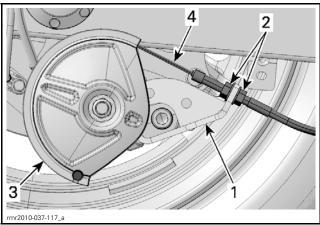
Hook cable on rear pulley.

Attach cable on parking brake support.

Adjust cable retaining nuts in order to generate a tension on the cable.

NOTE: The rear pulley rotates slightly clockwise when the proper adjustment is obtained.

Torque retaining nuts on the parking brake support to 12 N•m (106 lbf•in).



- Parking brake support
- Retaining nuts
- Rear pulley
 Must be tensioned

WARNING

Ensure parking brake cable is properly tensioned between both pulleys.

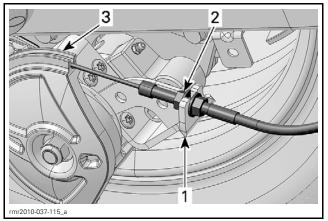
Apply and release the parking brake a few times to ensure normal operation of the mechanism.

Parking Brake Cable Removal

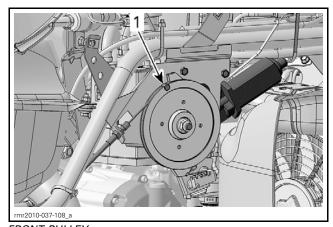
Remove body parts as required to access to the parking brake cable. Refer to BODY subsection.

Detach parking brake cable from pulleys as follows:

- Ensure parking brake is released.
- Unscrew nut securing parking brake cable on parking brake support.
- Remove cable from parking brake support.
- Unhook cable from rear pulley.
- Unhook cable from front pulley.

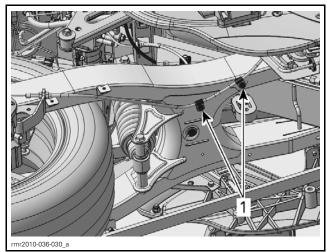


- Parking brake support
- Nut securing cable to parking brake support



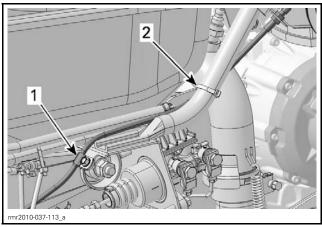
FRONT PULLEY 1. Parking brake cable

From underneath swing arm, remove parking brake cable fasteners.



SOME PARTS REMOVED FOR CLARITY 1. Parking brake cable fasteners

From RH side of vehicle, remove cable fastener and locking tie securing parking brake cable.

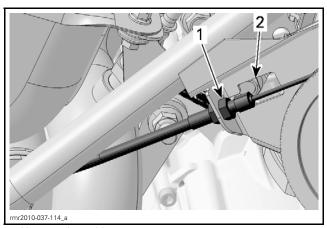


SOME PARTS REMOVED FOR CLARITY

- Parking bra
 Locking tie Parking brake cable fastener

Unscrew nut securing parking brake cable on the upper support.

Remove cable from the upper support by passing it through the hole.



- Nut securing cable to support
- 2. Hole to remove cable

Remove cable from vehicle.

Parking Brake Cable Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Align white lines on the cable with cable fasteners on swing arm.

Adjust parking brake cable, refer to PARKING BRAKE CABLE ADJUSTMENT in this subsection.

PARKING BRAKE MOTOR

Parking Brake Operation

To apply parking brake, press parking brake switch (PBS) down.

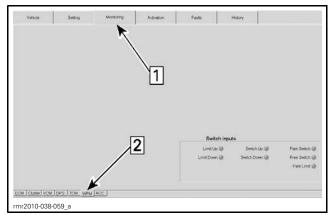
To release parking brake, press PBS switch down until brake indicator lamp turns OFF.

The parking brake cannot be activated while the vehicle is moving faster than 10 km/h (6 MPH).

Parking Brake Motor Monitoring (With B.U.D.S.)

To monitor parking brake motor during troubleshooting operation, proceed as follows:

- 1. Connect vehicle to B.U.D.S.. Refer to COM-MUNICATION TOOLS AND B.U.D.S. SOFT-WARE subsection.
- 2. Select Monitoring page.
- 3. Select WPM folder.



Step 1: Select monitoring Step 2: Select WPM

4. Press parking brake switch (PBS) on vehicle.

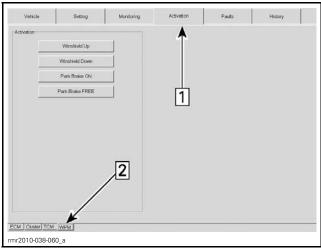


PARKING BRAKE SWITCH (PBS)

5. Check proper operation in B.U.D.S.

Parking Brake Motor Operation Test

- 1. Connect vehicle to B.U.D.S.. Refer to *COM-MUNICATION TOOLS AND B.U.D.S. SOFT-WARE* subsection.
- 2. Select **Activation** page.
- 3. Select WPM folder.



Step 1: Activation page Step 2: WPM folder

- 4. Press Park Brake ON button.
- 5. Verify if parking brake motor works properly to apply parking brake.

If parking brake works, go to step 6.

If parking brake motor does not work:

- Check input voltage at motor (PIN-1), refer to the WIRING DIAGRAM.
- Check ground circuit continuity at motor (PIN-2), refer to the WIRING DIAGRAM.
- Check connector and terminal condition.
- 6. Press Park Brake FREE button.
- 7. Verify if parking brake motor works properly to release parking brake.

If parking brake motor does not work:

- Check input voltage at motor (PIN-2), refer to the WIRING DIAGRAM.
- Check ground circuit continuity at motor (PIN-1), refer to the WIRING DIAGRAM.
- Check connector and terminal condition.

If the fault is not found after having carried out the previous tests:

- Test motor operation by connecting it directly to the battery posts.
 - If motor works properly, test module, refer to PARKING BRAKE MODULE (WPM) in this subsection.
 - If motor does not work properly, replace motor.

NOTICE Do not power motor directly with the battery for a long period. Apply voltage quickly to ensure that the motor will not overheat at the end of its stroke.

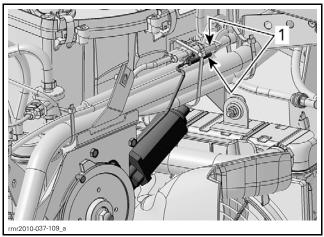
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Parking Brake Motor Removal

Remove body parts as required to access to the parking brake motor. Refer to *BODY* subsection.

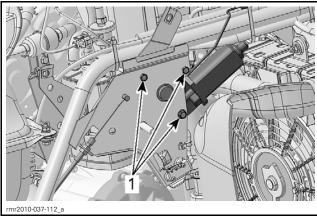
Remove parking brake front pulley, refer to *PARK-ING BRAKE FRONT PULLEY REMOVAL* in this subsection.

Disconnect parking brake motor connectors.



1. Parking brake motor connectors

Remove retaining bolts and nuts of parking brake motor.



1. Motor retaining bolts

Remove motor from vehicle by pulling it upwards.

Parking Brake Motor Installation

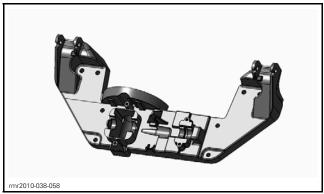
The installation is the reverse of the removal procedure. However, pay attention to the following. Install parking brake front pulley, refer to *PARK-ING BRAKE FRONT PULLEY INSTALLATION* in this subsection.

Adjust parking brake cable, refer to *PARKING BRAKE CABLE ADJUSTMENT* in this subsection.

PARKING BRAKE MODULE (WPM)

NOTE: WPM module has 2 functions, it controls windshield and parking brake. The WPM module is integrated into the windshield base.

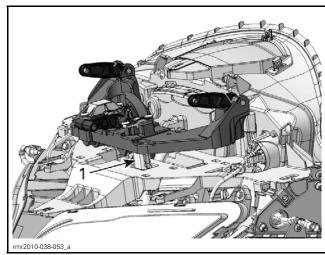
For troubleshooting and removal procedures relating to the WPM module, refer to *WINDSHIELD MODULE (WPM)* in *BODY* subsection.



WPM MODULE AND WINDSHIELD BASE

WPM Module Signal Circuit Continuity Test

- Remove body parts as required to access to the WPM module. Refer to WPM MODULE RE-MOVAL in BODY subsection.
- 2. Disconnect WPM module connector.



1. WPM module connector

- 3. Disconnect parking brake switch (PBS) connector. Refer to *PARKING BRAKE SWITCH (PBS)* in this subsection.
- 4. Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to $\Omega.$
- 5. Measure resistance as per the following tables.

TEST PROBES	RESISTANCE
PBS switch connector pin 2 (YL/LT GN)	Close to 0 Ω
WPM module connector pin 10 (YL/LT GN)	Close to 0 12
TEST PROBES	RESISTANCE
PBS switch connector	

TEST PROBES	RESISTANCE
PBS switch connector pin 3 (LT BU/GN)	Close to 0 Ω
WPM module connector pin 1 (LT BU/GN)	Close to 0 12

TEST PROBES	RESISTANCE
PBS switch connector pin 1 (GY/OR)	
WPM module connector pin 12 (GY/OR)	Close to 0 Ω

If results are not as per the previous tables:

- Check connector and terminal condition.
- Repair open circuit in wiring.

If the fault is not found after having carried out the previous operations:

- Test PBS switch, refer to PARKING BRAKE SWITCH (PBS) in this subsection.
- Check input voltage at WPM module (PIN-5), refer to the WIRING DIAGRAM.
- Check ground circuit continuity at WPM module (PIN-7), refer to the WIRING DIAGRAM.
- Test HBS switch, refer to PARKING BRAKE LIGHT SWITCH (HBS) in this subsection.
- Check wiring continuity between HBS switch (PIN-1) and WPM module (PIN-3), refer to the WIRING DIAGRAM.

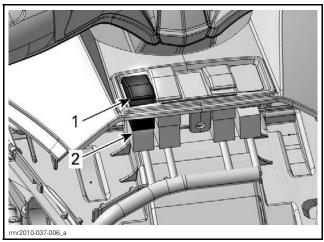
If the fault is still not found:

- Replace WPM module.

PARKING BRAKE SWITCH (PBS)

Parking Brake Switch Test

Remove central panel. Refer to BODY subsection.



- Parking brake switch
 Parking brake switch connector

Check switch operation as follows.

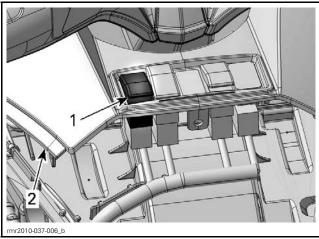
PARKING BRAKE SWITCH POSITION	PIN		RESISTANCE
Firmly pushed	c	2 3	Close to 0 Ω
Released (FREE)	Z		Infinite (OL)
	PIN		
PARKING BRAKE SWITCH POSITION	PI	N	RESISTANCE
	PI	N 2	RESISTANCE Infinite (OL)

If switch is defective, replace it with a new one.

Parking Brake Switch Replacement

Remove central panel. Refer to BODY subsec-

Remove parking brake switch from central panel by pushing tabs.



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- Parking brake switch
- 2. Central panel

Install a NEW switch on console.

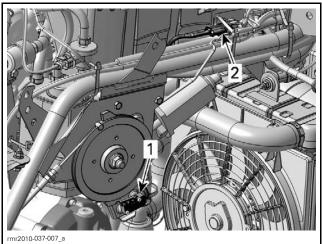
Re-install central panel as the reverse of removal procedure.

PARKING BRAKE LIGHT SWITCH (HBS)

Parking Brake Light Switch Test

Remove body parts as required to access to the parking brake light switch. Refer to BODY subsection.

Unplug parking brake light switch connector.



- Parking brake light switch
- 2. Parking brake light switch connector

Check switch operation as follows.

PARKING BRAKE LIGHT SWITCH POSITION	PIN		RESISTANCE @ 20°C (68°F)
Firmly pushed	1	ď	0.2 Ω max.
Released	ı	3	Infinite (OL)

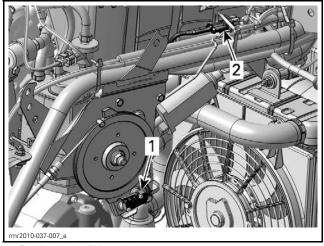
If switch is defective, replace it with a new one. If the switch tests good, verify wire continuity between harness connector and multifunction gauge.

MULTIFUNCTION GAUGE CONNECTOR PIN	HARNESS WIRES	RESISTANCE @ 20°C (68°F)
17	GREEN/WHITE	Close to 0 Ω

Parking Brake Light Switch Removal

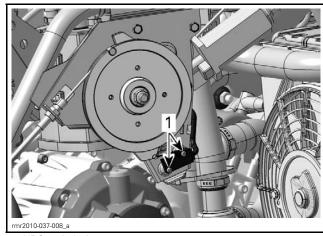
Remove body parts as required to access to the parking brake light switch. Refer to BODY subsec-

Unplug parking brake light switch connector.



- Parking brake light switch
 Parking brake light switch connector

Cut locking ties retaining the switch harness. Drill switch rivets.



1. HBS switch rivets

Remove parking brake light switch.

Parking Brake Light Switch Installation

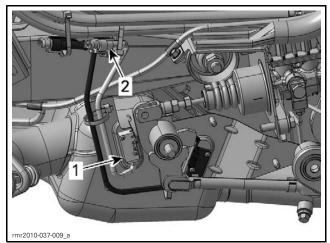
The installation is the reverse of the removal procedure.

BRAKE LIGHT SWITCH (BLS)

Brake Light Switch Test

Remove body parts as required to access to the brake light switch. Refer to BODY subsection.

Unplug brake light switch connector.



RH SIDE OF VEHICLE

- 1. Brake light switch
- 2. Brake light switch connector

Check switch operation as follows.

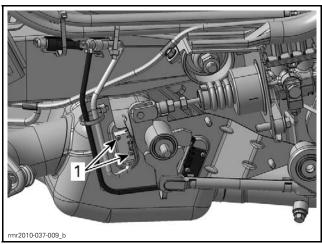
BRAKE LIGHT SWITCH POSITION	PIN		RESISTANCE @ 20°C (68°F)
Firmly pushed	1 0		0.2 Ω max.
Released	ļ		Infinite (OL)

If switch is defective, replace it with a new one. If the switch tests good, verify wire continuity between harness connector and ECM-B connector.

ECM-B CONNECTOR PIN	HARNESS WIRES	RESISTANCE @ 20°C (68°F)
C3	WHITE	Close to 0 Ω

Brake Light Switch Removal

Remove body parts as required to access to the brake light switch. Refer to *BODY* subsection. Cut locking ties retaining the switch harness. Drill brake light switch rivets.



RH SIDE OF VEHICLE

1. BLS switch rivets

Remove switch.

Brake Light Switch Installation

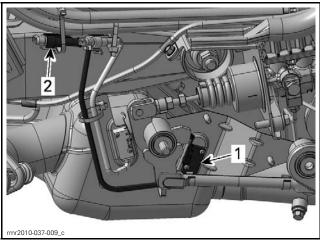
The installation is the reverse of the removal procedure.

LOW PRESSURE SWITCH (LPS)

NOTE: After a low pressure switch (LPS) problem has been solved, it is necessary to clear the occurred fault in the VCM. Refer to *LPS FAULT (BRAKING SYSTEM)* below.

Low Pressure Switch Test

Remove body parts as required to access to the brake light switch. Refer to *BODY* subsection. Unplug LPS connector.



RH SIDE OF VEHICLE

- LPS switch
- 2. LPS switch connector

Check switch operation as follows.

LOW PRESSURE SWITCH POSITION	PIN		RESISTANCE @ 20°C (68°F)		
Firmly pushed	2	2	2	٥	Infinite (OL)
Released	2	2 3	0.2 Ω max.		

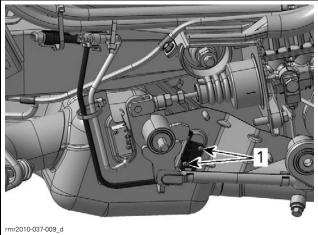
If switch is defective, replace it with a new one. If the switch tests good, verify wire continuity between harness connector and VCM.

VCM CONNECTOR PIN	HARNESS WIRES	RESISTANCE @ 20°C (68°F)
8	WHITE/VIOLET	Close to 0 Ω

LPS Removal

Remove body parts as required to access to the brake light switch. Refer to *BODY* subsection. Drill LPS rivets.

Cut locking ties retaining the switch harness.



RH SIDE OF VEHICLE

1 I PS switch rivets

Remove switch.

LPS Installation

The installation is the reverse of the removal procedure.

LPS Fault (Braking System)

After a low pressure switch (LPS) problem has been solved, it is necessary to clear the occurred fault in the VCM as follows:

- 1. Turn ignition switch OFF.
- 2. Wait 30 seconds.
- 3. Turn ignition switch ON.

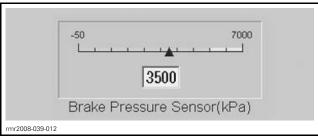
4. Firmly press brake pedal until you hear a "click" from the LPS switch or until braking pressure reaches 3500 kPa (508 PSI).

NOTE: The 1st click will come from the brake light switch. Continue to strongly press pedal to hear a 2nd click. This one will come from the low pressure switch.



TYPICAL

NOTE: Use B.U.D.S. to monitor brake pressure if desired.



MONITORING TAB, VCM MODULE

- 5. Turn ignition switch OFF.
- 6. Wait 30 seconds.
- 7. Turn ignition switch ON.
- 8. Validate fault was cleared.

COMMUNICATION TOOLS AND B.U.D.S. SOFTWARE

SERVICE TOOLS

Description	Part Number	Pa	ge
MPI-2 DIAGNOSTIC CABLE	710 000 851		3
MPI-2 INTERFACE CARD	529 036 018		3

SERVICE TOOLS - OTHER SUPPLIER

Description	Part Number	Page	ļ
MALE-FEMALE EXTENSION SERIAL CABLE	DB9	3	,

GENERAL

Refer to *PROCEDURES* in this subsection for instructions on using the communication tools.

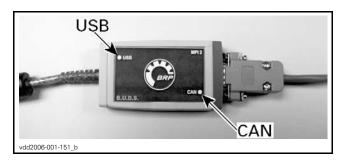
If communication problems occur, refer to *TROU-BLESHOOTING* in this subsection.

TROUBLESHOOTING

DIAGNOSTIC TIPS

MPI-2 Connection Troubleshooting

The MPI-2 includes 2 status lights to indicate the connection condition: USB and CAN. **Both lights must be GREEN** for the MPI-2 to function properly. Otherwise, refer to the following charts.



Prerequisite for USB Communication:

- PC Computer turned on.
- MPI-2 connected to PC computer.

COMMUNICATION PROBLEM (USB)		
status	what to do	
Light is OFF	 Check USB connection between MPI-2 and PC computer. Check USB operation on PC computer (hardware or Windows drivers). 	

Prerequisite for CAN Communication:

- 1. MPI-2 connected to the vehicle communication connector.
- 2. Ignition key turned on.
- 3. B.U.D.S. started and logged.

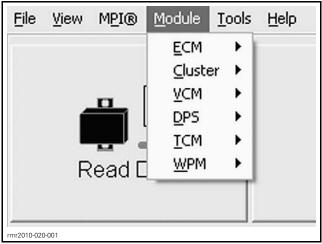
COMMUNICATION PROBLEM (CAN)		
status	what to do	
Light is OFF	 Check connection between MPI-2 and diagnostic cable connector. Check connection between diagnostic cable connector and vehicle communication connector. 	
Light is RED	 Check CAN wires/connectors on vehicle. 	

Communication Problems when using B.U.D.S.

Missing Module

If one or more "ECU" is (are) not communicating with the MPI, the module(s) may not be powered or may be defective.

- 1. To see which module is missing using B.U.D.S.; first select the **Read Data** button at the top of the B.U.D.S. page.
- 2. Then click on **Module** in the menu bar to expand its submenu.
- 3. Look at the list of modules in the submenu. If a module is not visible in the submenu list, then it is not communicating with the MPI.



TYPICAL - MODULE SUBMENU LIST SE5 MODELS

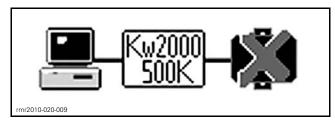
NOTE: The TCM listed in the Module submenu illustrated is ONLY AVAILABLE with the SE5 model

- 4. Ensure the missing module is properly connected.
- 5. If the module is connected, remove the connector from the module and test for the following:
 - Proper input voltage to the module
 - Ground circuit continuity
 - CAN bus continuity.

Refer to the *WIRING DIAGRAM* or appropriate subsection for details.

No Vehicle is Detected

If an "X" is shown in the status bar and the protocol indication is blinking between Kw2000 500K and KW2000, it means that no "ECU" is communicating with the MPI.



Check the following:

- Connections between the PC computer and the vehicle
- The vehicle is powered up.

If B.U.D.S. is trapped in a loop that continually displays the following message box, press on the **Try active detection mode** button in the message box. This will test if there is communication with the vehicle.



PROCEDURES

MULTI-PURPOSE INTERFACE-2 (MPI-2)

The MPI-2 (Multi-Purpose Interface-2) in conjunction with the MPI-2 diagnostic cable is used with the B.U.D.S. software to communicate with the Electronic Control Units (ECU).

MPI-2 Power

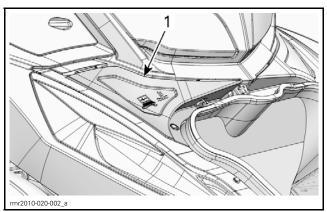
The MPI-2 interface card uses the power from the PC computer's USB port.

Connecting the PC to the Vehicle

A WARNING

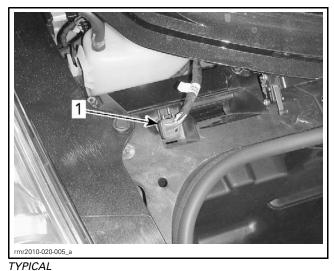
If the computer you are using is connected to a power outlet, there is a potential risk of electrocution when working in contact with water. Be careful not to touch water while working with the computer.

- 1. Open front storage compartment cover.
- 2. Remove the RH service cover.



1. Service cover

3. Locate the vehicle communication connector.



1. Vehicle communication connector location

Remove the communication connector from it's holder (protective cap).

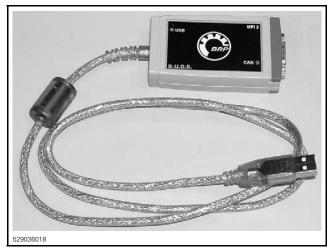
Connect one end of the MPI-2 DIAGNOSTIC CABLE (P/N 710 000 851) to the vehicle communication connector.





TYPICAL - MPI-2 CONNECTION TO VEHICLE COMMUNICATION CONNECTOR

Connect the other end of the diagnostic cable to to the MPI-2 INTERFACE CARD (P/N 529 036 018) connector.





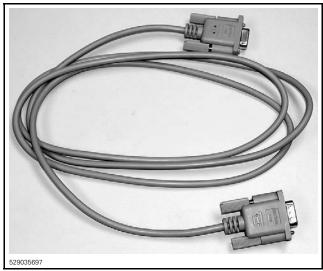
Connect the MPI-2 USB connector to the USB port on the PC (personal computer).



Use B.U.D.S. software as described further in *B.U.D.S. SOFTWARE*.

NOTE: An optional MALE-FEMALE EXTENSION SERIAL CABLE (P/N DB9) available at electronic retail outlets can be used between diagnostic cable and MPI-2 interface. Do not exceed 7.6 m (25 ft) or communication between the vehicle and the PC computer may be lost.

3



OPTIONAL MALE-FEMALE EXTENSION SERIAL CABLE

B.U.D.S. SOFTWARE

B.U.D.S. (BRP Utility and Diagnostic Software) is designed to allow electrical and electronic component monitoring, activation of certain components for testing and diagnostic purposes, and to carry out setting changes

Always use the latest applicable B.U.D.S. software version available on BOSSWeb.

For more information pertaining to the use of the B.U.D.S. software, use its **Help** menu which contains detailed information on its various functions.

Reading the Electronic Control Units using the B.U.D.S. Software

IMPORTANT: Ensure all connections are made **before starting B.U.D.S.** to allow proper operation. Refer to *CONNECTING THE PC TO THE VEHICLE* in this subsection.

- 1. Turn ignition key to ON.
- 2. Start the B.U.D.S. software.

NOTE: B.U.D.S. will automatically choose the appropriate MPI 2 protocol.

SM5 Model

3. Ensure the status bar shows the Kw2000 (500k) and the number 5 to its right.



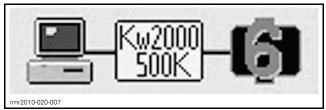
CONNECTION SUCCESSFUL — ALL "ECU" ARE CONNECTED

NOTE: Number 5 means that 5 "ECU" (Electronic Control Unit) are connected (ECM, VCM, DPS, WPM and multifunction gauge).

If a number less than 5 is indicated, refer to *TROU-BLESHOOTING* in this subsection.

SE5 Model

4. Ensure the status bar shows the Kw2000 (500k) and the number 6 to its right...



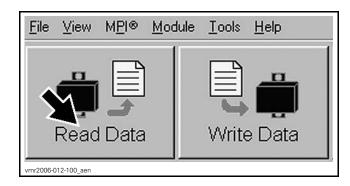
CONNECTION SUCCESSFUL — ALL "ECU" ARE CONNECTED

NOTE: Number 6 signifies that 6 "ECU" are connected (ECM, VCM, TCM, DPS, WPM and multifunction gauge (cluster).

If a number less than 6 is indicated, refer to *TROU-BLESHOOTING* in this subsection.

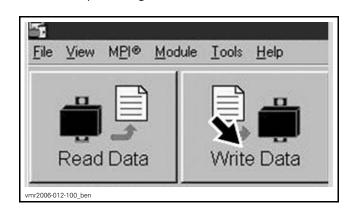
SM5 and SE5 Model

Read the ECUs by clicking the Read Data button.



Writing Changes in an ECU

When making a data or setting change in an ECU using B.U.D.S., save the new data (or setting) in the ECU by clicking the **Write Data** button.



NOTE: If the word Modified appears in the vehicle file identification number at the top of the B.U.D.S. page, then a change has been made that requires selecting the Write Data for the change to be saved.



When a change is made in the ECM using B.U.D.S., an ECM Tracking box that will say "Remove key from the vehicle..." may appear on the computer monitor.



When this occurs, turn the ignition key OFF and wait until the message disappears (approximately 20 seconds after key removal).

Disconnect the MPI connections and store the communication connector in its protective cap.

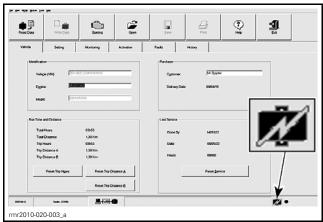


Communication connector stored in protective cap

NOTICE Failure to secure the diagnostic connector in its protective cap may result in corrosion or other damage to the terminals.

Electronic Modules ("ECU") Update

Whenever B.U.D.S. is first connected to a vehicle, check for an update icon in the B.U.D.S. status bar at the bottom of the Vehicle page.

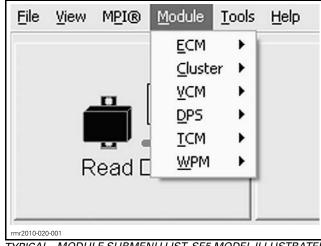


TYPICAL - UPDATE ICON

If the update icon is visible, B.U.D.S. indicates that a file is available to update at least one of the electronic modules.

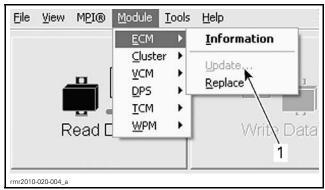
NOTE: If an update file is available on BOSSWeb but the B.U.D.S. software being used is not up to date, the update icon will not appear. Refer to the service bulletins to see if there is an update available.

Use the Module submenu and check all modules one at a time to see which module(s) can be updated.



TYPICAL - MODULE SUBMENU LIST, SE5 MODEL ILLUSTRATED

- 1. If the **Update** option is **greyed out**, no update file is available for this module.
- 2. If the **Update** option is **black**, an update file is available for this module. Select the update option and load the proper file.



Greyed out: No update to perform Black: Update file available

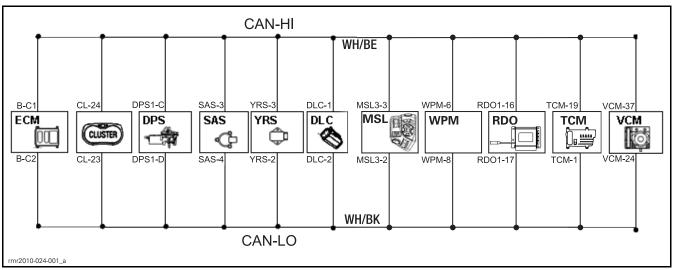
CONTROLLER AREA NETWORK (CAN) GENERAL

SYSTEM DESCRIPTION

The CAN (Controller Area Network) protocol is an ISO standard for serial data communication. The CAN bus links several electronic modules (ECU's) and sensors together so that they communicate to interact as required. 2 wires connect each component and they are in constant communication with each other at a rate of about every 20 milliseconds. CAN lines consist of a pair of wires (WHITE/BEIGE and WHITE/BLACK).

All modules monitor each other. If a component or system malfunction is detected, a module may generate a fault code, which it transmits through the CAN bus as a signal. The fault signal may be used for various functions such as triggering the display of an error message in the multifunction gauge cluster, turning on a fault indicator light, limiting or inhibiting vehicle or engine operation, or viewed using the B.U.D.S. software for troubleshooting.

Fault codes are broadcast to the CAN bus and can be displayed in the multifunction gauge or in B.U.D.S. The CAN is monitored by the ECM, VCM, DPS, TCM and WPM. See *MONITORING AND FAULT CODES* for fault codes information.



CLUSTER: Multifunction Gauge DPS: Dynamic Power Steering

SAS: Steering Angle Sensor YRS: Yaw Bate Sensor

YRS: Yaw Rate Sensor DLC: Diagnostic Link Connector VCM: Vehicle Control Module ECM: Engine Control Module

MSL: Multi Switch Left (RECC) WPM: Windshield and Parking Brake Module

RDO: Radio

TCM: Transmission Control Module (SE5 model)

WH/BE: White/Beige WH/BK: White/Black

rmr2010-024 1

CLUTCH (SE5)

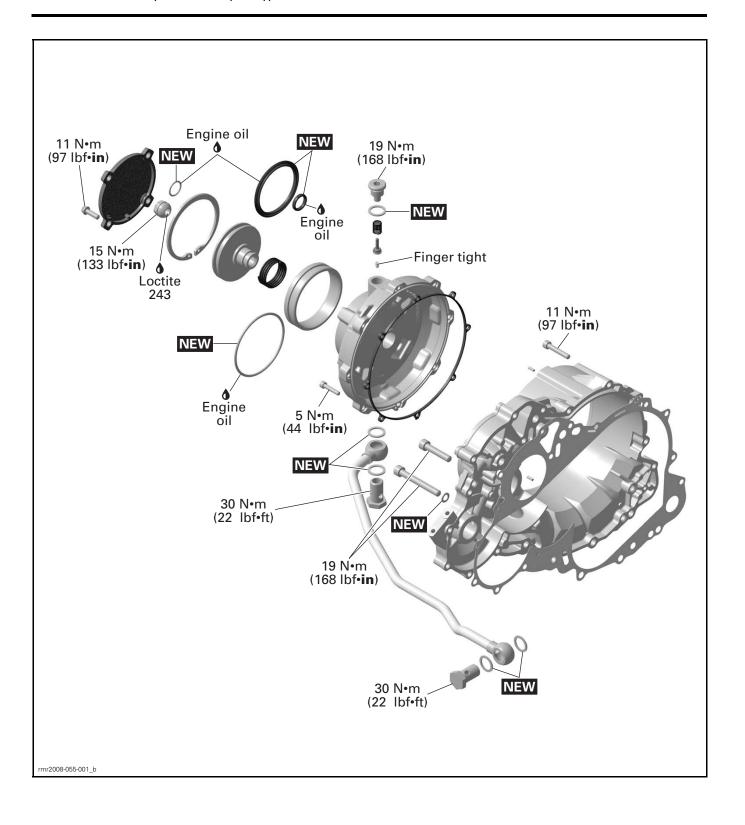
SERVICE TOOLS

Description	Part Number	Page
BLIND HOLE BEARING PULLER SET	529 036 117	16
CLUTCH ASSEMBLY HOLDER	529 036 133	18
CLUTCH PACK COMPRESSION TOOL	529 036 144	12

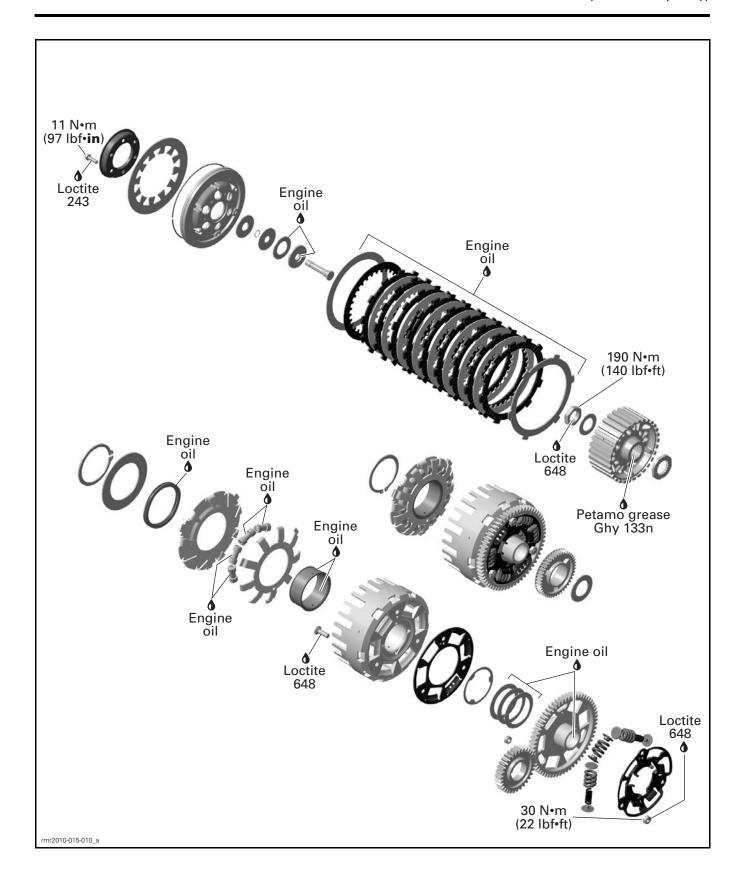
SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	6
LOCTITE 648 (GREEN)	413 711 400	19, 26
PETAMO GREASE GHY 133N	420 899 271	
PULLEY FLANGE CLEANER		·

Subsection XX (CLUTCH (SE5))



3



GENERAL

NOTE: For a better understanding, many of the following illustrations are produced with the engine out of vehicle. To carry out the instructions, it is not necessary to remove the engine from vehicle.

Always disconnect the battery negative cable before working the engine.

A WARNING

Always disconnect BLACK (-) cable first and reconnect last.

During assembly/installation, use torque values and service products as specified in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

A WARNING

Torque wrench tightening specifications must be strictly adhered to.

Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced with new ones.

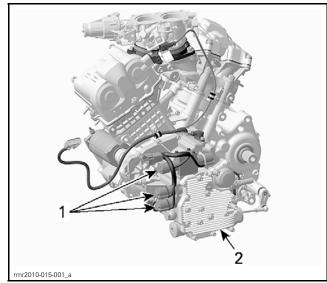
NOTICE Sealing washers must be discarded and replaced with new ones every time a Banjo fitting is unscrewed.

Periodically check the oil hoses for damages or leaks. Repair any leaks and replace damaged hose.

SYSTEM DESCRIPTION

The engine on the SE5 model features a sequential electronically controlled mechanical 5-speed transmission with a hydraulic type clutch system.

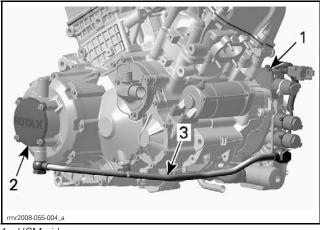
The clutch is disengaged and engaged by 2 valves in the hydraulic control module (HCM) that are controlled by the transmission control module (TCM).



- 1. Solenoid valves
- 2. Hydraulic control module (HCM)

One valve engages/disengages the clutch and the other valve modulates the clutch to control the speed of the clutch engagement for smooth operation.

Depending on which solenoid valve is activated, oil flows either from the HCM to the hydraulic clutch piston or from the hydraulic clutch piston to HCM.



- 1. HCM side
- 2. Hydraulic clutch side
- 3. Oil hose between hydraulic clutch and HCM

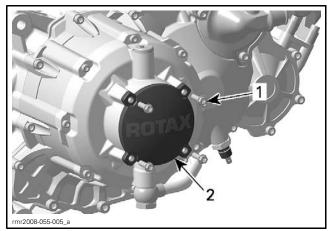
The SE5 clutch system uses the same oil as the engine.

PROCEDURES

HYDRAULIC PISTON

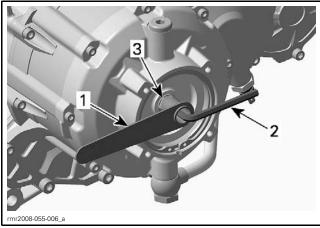
Hydraulic Piston Removal

Remove hydraulic piston cover screws.



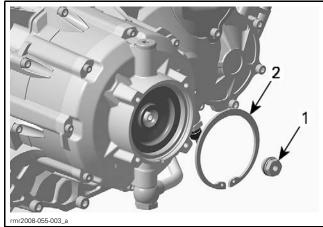
- 1. Screws (x4)
 2. Hydraulic piston cover

Using a 17 mm deep offset wrench, unscrew the hydraulic piston nut while holding the clutch release shaft with a 5 mm Allen wrench.



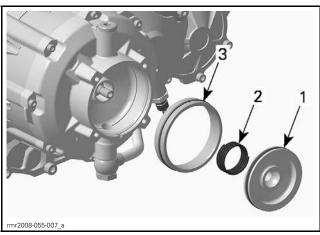
- Deep offset wrench
- Allen wrench
 Hydraulic piston nut

Remove retaining ring and hydraulic piston nut.



- Hydraulic piston nut
- 2. Retaining ring

Remove the hydraulic piston, compression spring and hydraulic cylinder sleeve.

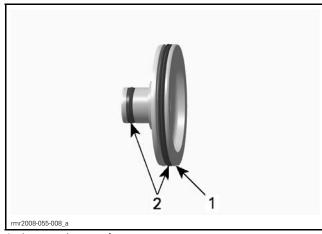


- Hydraulic piston
 Compression spring
 Hydraulic cylinder sleeve

Hydraulic Piston Inspection

Clean piston and visually inspect piston surface for scoring, scratches or abnormal wear. Replace if necessary.

Remove and discard piston seals.



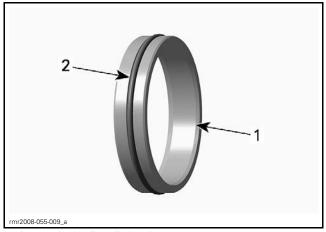
- Inspect piston surface
- 2. Inspect piston seals

Hydraulic cylinder sleeve inspection

Clean hydraulic cylinder sleeve and visually inspect sleeve surface for scoring, scratches or abnormal wear. Replace if necessary.

5

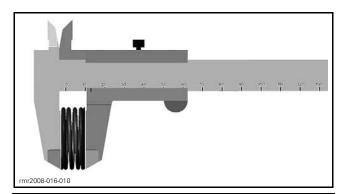
Remove and discard sleeve O-ring.



- Inspect hydraulic cylinder sleeve Discard O-ring

Compression Spring

Check free length of compression spring.

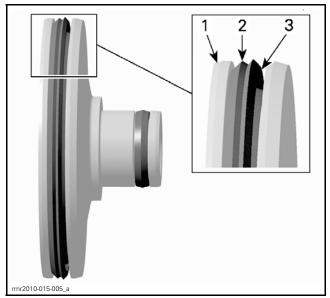


COMPRESSION SPRING FREE LENGTH	
NEW	32.50 mm to 33.50 mm (1.28 in to 1.319 in)
SERVICE LIMIT	32.00 mm (1.26 in)

If the compression spring is out of specifications, replace it.

Hydraulic Piston and Hydraulic Cylinder Sleeve Installation

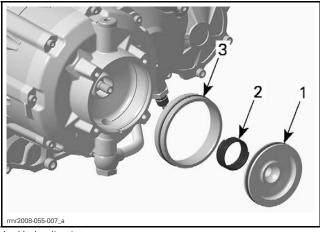
Installation is the reverse of the removal procedure. However, pay attention to following details. Install **NEW** hydraulic piston seals and hydraulic cylinder sleeve O-ring.



LARGE SEAL POSITIONING

- Piston
 Large seal
- 3. Open side of seal

Coat hydraulic piston, seals, hydraulic cylinder sleeve and O-ring with engine oil before installing them in the clutch cover.



- Hydraulic piston
- Compression spring
- Hydraulic cylinder sleeve

Apply LOCTITE 243 (BLUE) (P/N 293 800 060) to the hydraulic piston nut and torque to 15 Nom (133 lbf•in).

Install hydraulic piston cover.

CLUTCH COVER

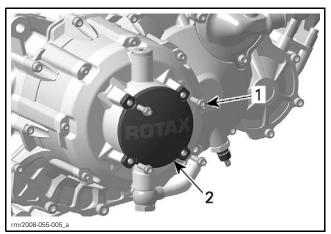
Clutch Cover Removal

Remove RH bottom rear side panel. Refer to the BODY subsection.

Lift and safely block RH front of vehicle to prevent engine oil leakage when removing components (if servicing clutch cover in vehicle).

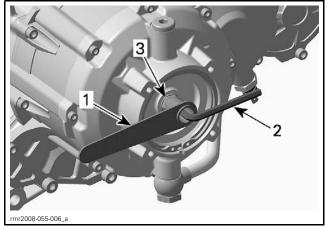
NOTE: Install a drain pan under the clutch cover and oil line to catch engine oil spillage.

Remove hydraulic piston cover screws.



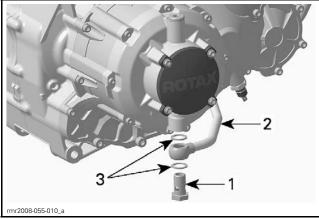
- Screws (x4)
- 2. Hydraulic piston cover

Using a 17 mm deep offset wrench, unscrew the hydraulic piston nut while holding the clutch release shaft with a 5 mm Allen wrench.



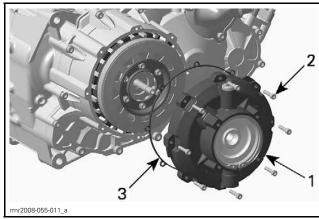
- Deep offset wrench
- Allen wrench
- 3. Hydraulic piston nut

Remove oil hose from clutch cover.



- Banjo bo
 Oil hose
 Gaskets Banjo bolt Oil hose

Remove clutch cover retaining screws.



- Clutch cover
- Retaining screws
- Gasket

Remove clutch cover from the engine.

Clutch Cover Inspection

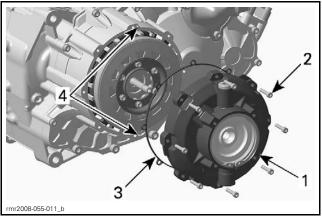
Clean clutch cover and inspect for cracks or other damages.

Clutch Cover Installation

Installation is the reverse of the removal procedure. However, pay attention to following details.

Ensure clutch cover gasket is in good condition and positioned correctly. Replace if necessary.

Ensure the clutch cover is properly positioned on the two alignment pins on the clutch housing.



- 1. Clutch cover
- 2. Retaining screws (x8)
- 3. Gasket
- 4. Alignment pins

NOTE: Install oil line with NEW gasket rings.

PRESSURE RETAINING VALVE

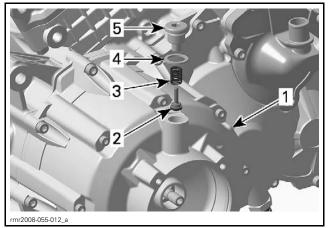
Pressure Retaining Valve Removal

Remove RH bottom rear side panel. Refer to *BODY*.

NOTE: Install a drain pan under clutch cover to catch engine oil.

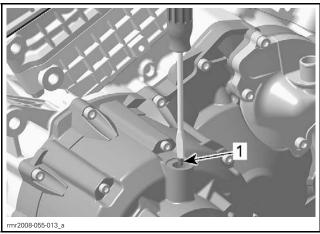
Remove plug screw on top of clutch cover.

Remove pressure retaining valve from clutch cover.



- 1. Clutch cover
- 2. Pressure retaining valve
- 3. Compression spring
- 4. Gasket ring
- 5. Plug screw

Using a flat screw driver, remove air nozzle from clutch cover.



1. Air nozzle

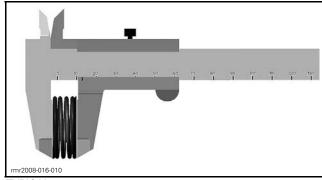
Pressure retaining valve Inspection

Clean all parts and inspect for damage.

NOTE: Ensure the port in the air nozzle is not clogged or dirty. Clean as required.

Compression Spring

Check free length of compression spring.



TYPICAL

COMPRESSION SPRING FREE LENGTH	
NEW	38.00 mm to 39.00 mm (1.496 in to 1.535 in)
SERVICE LIMIT	36.00 mm (1.417 in)

If the compression spring is out of specification, replace it.

Pressure retaining valve Installation

Installation is the reverse of the removal procedure. However, pay attention to following details.

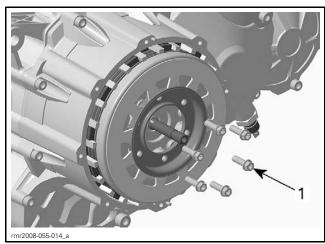
NOTE: Install the plug screw with a NEW gasket.

PRESSURE PLATE AND CLUTCH **DISK SPRING**

Pressure Plate and Clutch Disk Spring Removal

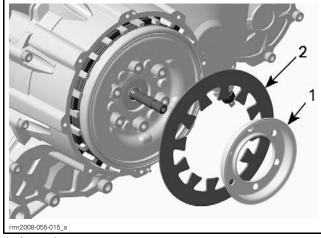
Remove CLUTCH COVER, see procedure in this subsection.

Loosen the inner plate retaining screws using a crisscross pattern, then remove them.



1. Inner plate retaining screws (x6)

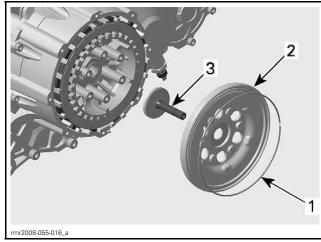
Remove inner plate and disk spring.



Inner plate

Remove pressure plate with retaining ring and clutch release pin.

Remove retaining ring from pressure plate only if necessary.



- Retaining ring
 Pressure plate
- 3. Clutch release pin

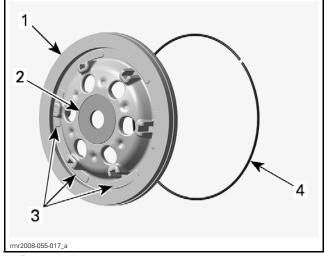
Pressure Plate, Disk Spring and Clutch Release Pin Inspection

Pressure Plate

Inspect pressure plate for cracks or other damages. Replace if necessary.

Inspect pressure plate thrust washer for cracks, wear or other damages. Thrust washer must fit tightly in pressure plate. Replace if necessary.

Inspect retaining ring for damage or wear. Replace if necessary.



- Pressure plate Thrust washer
- Trust surfaces
- 4. Retaining ring

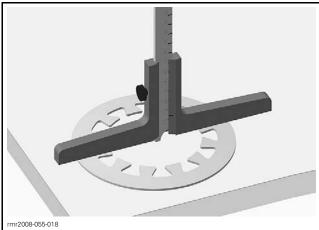
Disk Spring

Inspect disk spring for cracks, wear or other damages. Replace if necessary.

9

Place disk spring on a flat surface so that the outer circumference of the disk is flat on the surface. Measure the height of the spring in a crosswise direction, with reference to the flat surface.

DISK SPRING FREE LENGTH	
MINIMUM SERVICE LIMIT	7.00 mm (.2756 in)

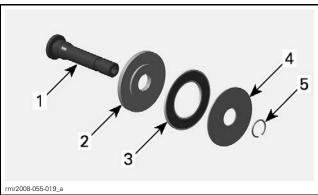


MEASURING DISK SPRING FREE LENGTH

Rotate tool and measure spring free length across several of the disk fingers. Replace disk spring if out of specification.

Clutch Release Pin

Visually inspect clutch release pin, thrust washers and axial needle bearing for wear or other damages. Replace if necessary.

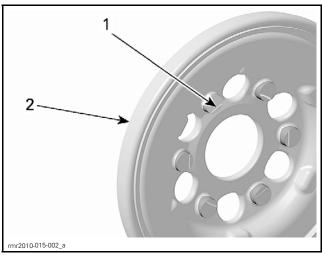


- 1. Clutch release pin
- 2. Trust washer
- 3. Axial needle bearing
- 4. Thrust washer
- 5. Retaining ring

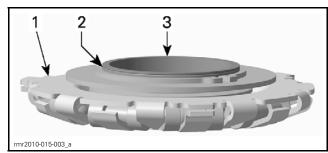
Pressure Plate, Disk Spring and Clutch Release Pin Installation

For installation, reverse the removal procedure. However, pay attention to the following:

NOTE: The pressure plate must show an identification groove and must be installed with the proper centrifugal clutch assembly equipped with bushing also showing an identification groove.



- 1. Identification groove
- 2. Pressure plate



- 1. Centrifugal clutch assy
- 2. Identification groove
- 3. Bushing

NOTE: Disk spring must be installed with the concave side towards the pressure plate.

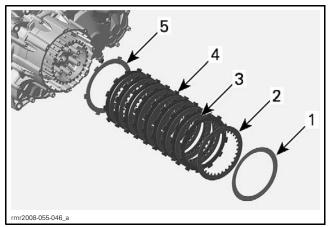
Tighten retaining screws to 11 N•m (97 lbf•in) using a crisscross pattern.

CLUTCH PLATES

Clutch Plate Removal

Remove pressure plate. See *PRESSURE PLATE AND CLUTCH DISK SPRING* in this subsection.

Remove friction plates and steel driven plates.



- Disk spring
- Adjustment plate
- 3. Steel driven plates
- Friction plates
- 5. Steel driven plate (2.5 mm (.098 in) thick)

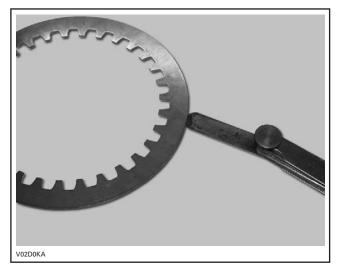
Clutch Plate Inspection

Inspect each plate for cracks, bent or broken teeth, missing or excessively worn friction material and any other damage.

Check friction and steel driven plates for warpage.

Place plates on a flat surface. Use a feeler gauge to measure warpage between plates and flat surface.

FRICTION AND STEEL D	RIVEN PLATE WARPAGE
MAXIMUM SERVICE LIMIT	0.15 mm (.006 in)



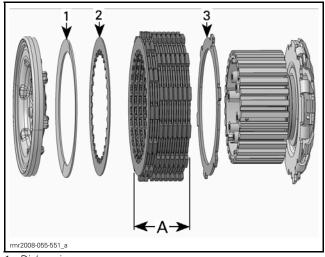
TYPICAL

Plate warpage must not exceed service limit.

Measure the thickness of the clutch plate assembly (friction and steel driven plates).

NOTE: Thickness of the clutch plate assembly is measured without the disk spring, the adjustment plate and the 2.5 mm (.098 in) thick plate.

CLUTCH PLATES ASSEMBLY THICKNESS	
MINIMUM SERVICE LIMIT	42.50 mm (1.673 in)



- Disk spring
- Disk spring
 Adjustment plate
 2.5 mm (.098 in) thick plate
- A. Minimum service limit

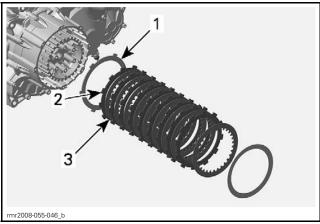
If plates are warped, damaged, or worn out of tolerance, replace all clutch plates.

Clutch Plate Installation and Adjustment

For installation, reverse the removal procedure. However, pay attention to the following.

Soak the **NEW** clutch plates in engine oil for 30 minutes before assembly to prevent clutch plate burning during break-in period.

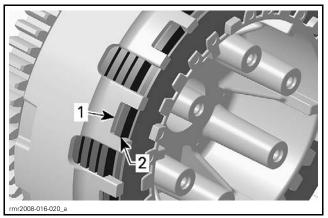
First, install the 2.5 mm (.098 in) thick steel driven plate.



- Steel driven plate
 Friction plate
 Steel driven plate Steel driven plate (2.5 mm (.098 in) thick)

Beginning with a friction plate, install friction plates and steel driven plates in alternate order.

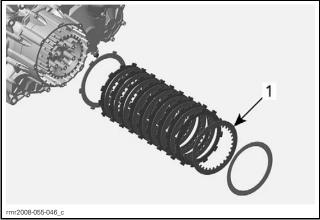
Place the tabs of the last friction plate into the shorter slots of clutch drum.



Shorter slot
 Last friction plate

Clutch Free-Play Adjustment

NOTE: The clutch free play is adjusted by installing an adjustment plate of the appropriate thickness. Adjustment plates of a variety of thicknesses are available for this purpose. The adjustment plates come in a kit of 11 plates. They range in thickness from 1 mm to 2 mm (.039 in to .079 in) in 0.1 mm (.004 in) increments.



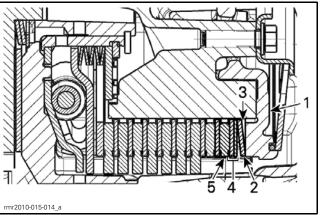
1. Adjustment plate

The thickness of the adjustment plate needs to be determined using the following procedure.

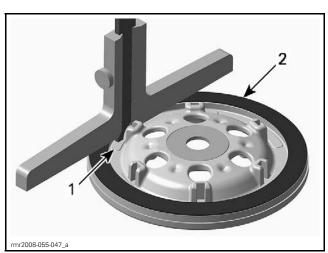
Measurement A

Install the disk spring on the pressure plate and measure the distance from the top of the disk spring to the machined surface of the pressure plate.

A CAUTION Disk spring must be installed with the concave side towards the pressure plate. Incorrectly assembled disk spring can cause a clutch malfunction. Clutch will not disengage.



- 1. Pressure plate
- 2. Disk spring
- 3. Assembly direction of disk spring
- 4. Adjustment plates
- 5. Friction plate

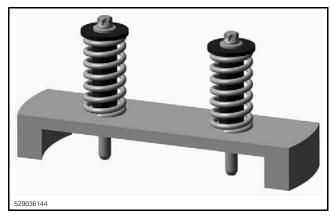


MEASUREMENT A

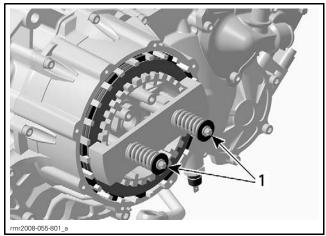
- 1. Machined surface on pressure plate
- 2. Disk spring

Measurement B

Use the CLUTCH PACK COMPRESSION TOOL (P/N 529 036 144).



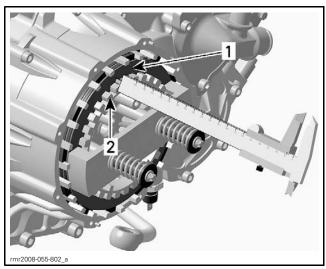
Install the tool on top of the plate assembly.



1. Tool installed

Alternately tighten tool screws to eliminate unevenness and to recover all play between plates.

Measure the distance from the top of the clutch hub to the top of the last friction plate.



MEASUREMENT B
1. Top of friction plate
2. Top of clutch hub

Use the following course of calculation to determine the thickness of the adjustment plate.

Adjustment plate thickness = B - A - 1 mm (.039 in)

For example: B $10.3 \,\text{mm} (4.055 \,\text{in}) - A 7 \,\text{mm} (.276 \,\text{in}) - 1 \,\text{mm} (.039 \,\text{in}) = 2.3 \,\text{mm} (.906 \,\text{in})$

Install a 2.3 mm (.906 in) thick adjustment plate.

EXAMPLE	
B=	10.3 mm
A=	- 7.0 mm
Subtract B from A	= 3.3 mm
Subtract 1mm	- 1 mm
Adjustment plate thickness equals	= 2.3 mm

NOTE: If necessary 2 plates of the adjustment plate kit can be installed to achieve the proper thickness of the adjustment plate.

For example: To get a 2.3 mm (.906 in) thick adjustment plate install a1.0 mm (.033 ft) plus a 1.3 mm (.043 ft) thick adjustment plate.

Reinstall remaining parts, refer to the appropriate instructions.

CLUTCH HOUSING

Clutch Housing Removal

Engine Installed in Vehicle

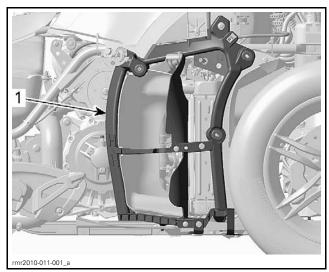
Refer to *BODY* and remove the following panels on the RH side:

- Middle Side Panel
- Top Side Panel
- Bottom Rear Side Panel
- Bottom Front Side Panel
- Rear Side Panel

Remove headlight adjustment cable from LH middle side panel support.

Remove RH middle side panel support.

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1. Middle side panel support

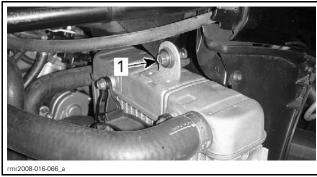
Drain engine oil, refer to *LUBRICATION SYSTEM*.

Drain engine coolant. Refer to *COOLING SYSTEM*.

Disconnect coolant hose from top of thermostat. Disconnect coolant hose from top of radiator.

Disconnect the top coolant hose of the water pump cover.

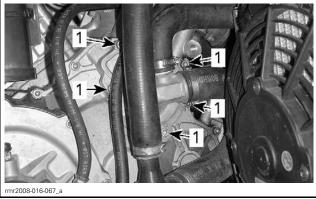
Remove the radiator retaining bolt.



TYPICAL - TOP OF RADIATOR

1. Radiator retaining bolt

Remove water pump cover screws.

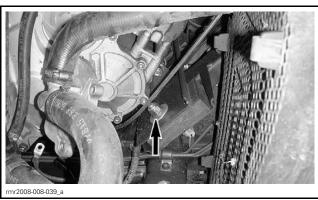


TYPICAL

1. Water pump cover screws

Disconnect cooling fan connector.

Remove the front engine mount bolt.

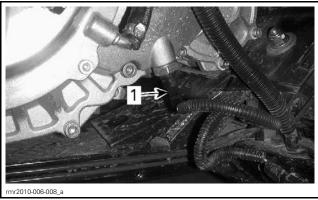


TYPICAL

Remove radiator, thermostat and water pump cover as an assembly.

Remove *CLUTCH COVER*. See procedure in this subsection.

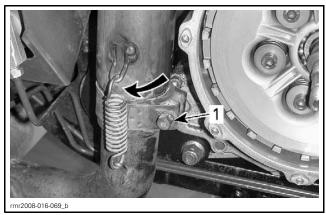
Disconnect the oil pressure switch connector.



1. Oil pressure switch connector

Remove exhaust spring.

Loosen exhaust clamp and turn it in order to the screw clutch housing screw behind.



TYPICAL

1. Exhaust clamp

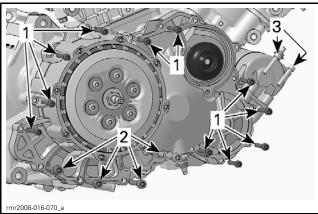
Complete the clutch housing removal by following the steps detailed in *ENGINE REMOVED FROM VEHICLE*.

Engine Removed from Vehicle

Place a drain pan under the clutch housing to catch oil spillage.

Remove starter screws.

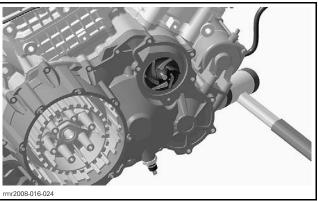
Remove all clutch housing screws.



TYPICAL

- 1. M6 retaining screws (11)
- 2. M8 retaining screws (4)
- 3. M6 Starter retaining screws (2)

Remove the clutch housing. Gently tap on clutch housing using a soft rubber mallet to separate it the from the crankcase.



TYPICAL

Clutch Housing Inspection

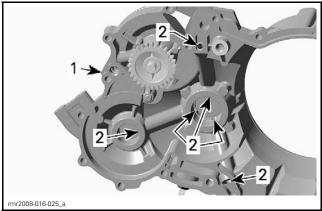
Inspect the clutch housing for cracks or other damages. Replace if necessary.

Check sealing surface for flatness.

Clean oil orifices in clutch housing from contaminants using PULLEY FLANGE CLEANER (P/N 413 711 809), then use an air gun to dry it.

WARNING

Always wear skin and eye protection. Chemicals can cause skin rash, skin burns and severe eye injury.



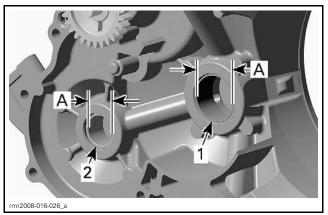
TYPICAL

Clutch housing
 Clean oil bores

Inspect plain bearings for scoring or other damages.

Measure plain bearing inside diameters and compare to the crankshaft and balance shaft journal diameters (support bearings). Refer to *BOTTOM END* subsection. Replace if measurement is out of specification.

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TYPICAL

- Plain bearing (crankshaft support)
- Plain bearing (balance shaft support)
- A. Measure plain bearing inside diameter

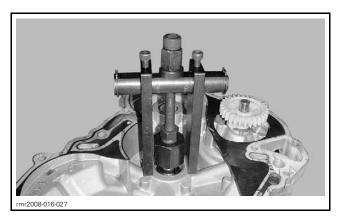
SERVICE LIMIT OF PLAIN BEARING INSIDE DIAMETER	
Crankshaft support bearing	30.040 mm (1.1827 in)
Balance shaft support bearing	20.060 mm (.7898 in)

Plain Bearing Replacement in Clutch Housing

Plain Bearing Removal

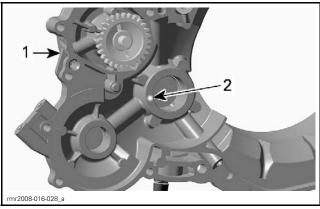
Mark the joint locations of the plain bearing segments on the clutch housing, prior to removing the plain bearings.

Pull out the plain bearings using the BLIND HOLE BEARING PULLER SET (P/N 529 036 117).



Plain Bearing Installation

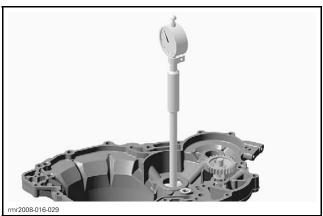
Crankshaft support plain bearings are available in 3 tolerance groups (red, blue and yellow). The proper tolerance group is marked with paint on the clutch housing.



TYPICAL

- Clutch housing
 Marking of tolerance group

If paint marking is not visible anymore, measure inside diameter of clutch housing bore where plain bearings are inserted.



MEASURE CLUTCH HOUSING BORE DIAMETER

Use the following table to find proper tolerance group of plain bearing.

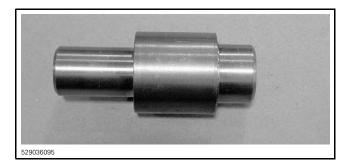
CLUTCH HOUSING BORE DIAMETER	PLAIN BEARING TOLERANCE GROUP
32.921 mm to 32.930 mm (1.2961 in to 1.2965 in)	Red
32.930 mm to 32.940 mm (1.2965 in to 1.2969 in)	Blue
32.940 mm to 32.951 mm (1.2969 in to 1.2973 in)	Yellow

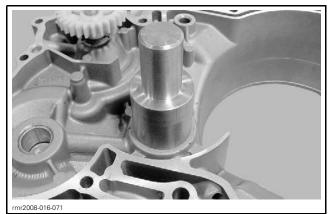
NOTICE Unless otherwise instructed, never use a hammer to install plain bearings. Plain bearings should only be installed using a press.

Heat clutch housing up to 100°C (212°F) before installing plain bearings.

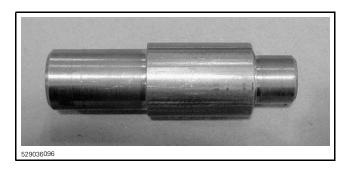
Install plain bearings using the appropriate plain bearing installer.

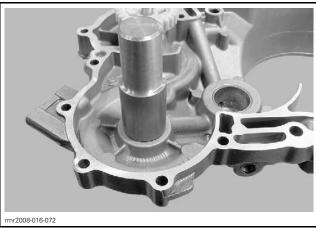
PLAIN BEARING	SERVICE TOOL PART NUMBER
Crankshaft support bearing	529 036 095
Balance shaft support bearing	529 036 096





PLAIN BEARING INSTALLER — CRANKSHAFT SUPPORT BEARING





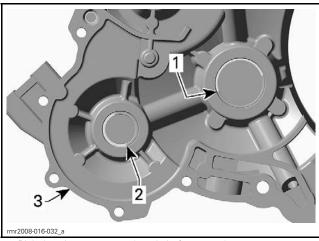
PLAIN BEARING INSTALLER — BALANCE SHAFT SUPPORT BEARING

Fit the plain bearings with PETAMO GREASE GHY 133N (P/N 420 899 271).

Support the clutch housing with a suitable support under the bearing seat. Use an O-ring to hold the plain bearings together during installation. Then carefully press-in the plain bearings.

NOTE: Remove O-ring just before plain bearings are completely pressed in.

NOTICE The plain bearing segments must be positioned as marked during removal.



- 1. Plain bearing segments (crankshaft support)
- 2. Plain bearing segments (balance shaft support)
- . Clutch housing

Clutch Housing Installation

For installation, reverse the removal procedure. However, pay attention to the following.

Install a **NEW** clutch housing gasket and **NEW** sealing washers.

Lubricate plain bearings with PETAMO GREASE GHY 133N (P/N 420 899 271), before installing clutch housing.

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Torque clutch housing screws using a crisscross pattern.

Reinstall remaining parts, refer to the appropriate instructions.

CLUTCH HUB

Clutch Hub Removal

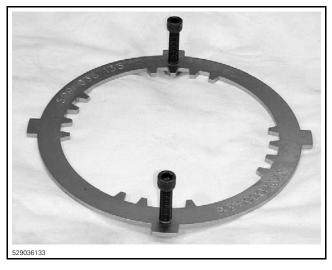
Remove:

- Clutch cover
- Pressure plate
- Clutch plates.

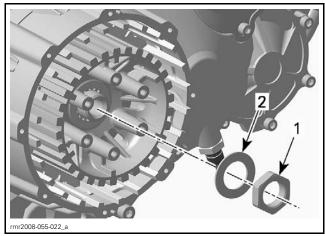
See procedures in this subsection.

Lock crankshaft in TDC position, refer to CRANKCASE AND CRANKSHAFT.

Install CLUTCH ASSEMBLY HOLDER (P/N 529 036 133).



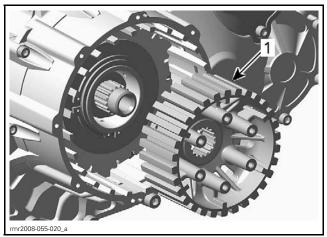
Remove the clutch hub retaining nut and spring washer.



1. Clutch hub retaining nut

Spring washer

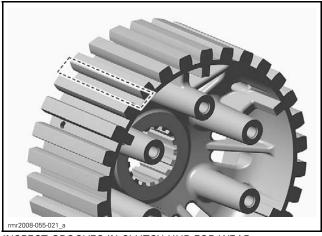
Remove clutch hub.



1. Clutch hub

Clutch Hub Inspection

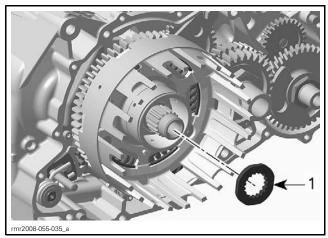
Inspect grooves in clutch hub for damages or wear caused by steel driven plates. Replace if necessary.



INSPECT GROOVES IN CLUTCH HUB FOR WEAR

Clutch Hub Installation

Ensure thrust washer is installed on clutch shaft ahead of clutch drum assembly before installing the clutch hub.

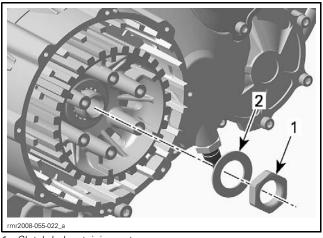


1. Clutch drum thrust washer

Apply PETAMO GREASE GHY 133N (P/N 420 899 271) on clutch hub teeth.

Insert clutch hub.

Reinstall spring washer and hub retaining nut.



Clutch hub retaining nut
 Spring washer

Apply LOCTITE 648 (GREEN) (P/N 413 711 400) on hub retaining nut threads.

Torque nut to 190 N•m (140 lbf•ft).

Reinstall remaining parts, refer to the appropriate instructions in this subsection.

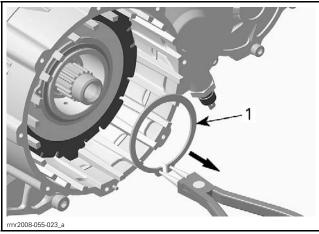
CENTRIFUGAL CLUTCH

Centrifugal Clutch Removal

Remove the following components, see procedure in this subsection.

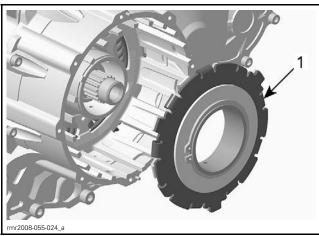
- Clutch cover
- Pressure plate
- Clutch plates
- Clutch hub.

Remove retaining ring.



1. Retaining ring

Remove centrifugal clutch assembly.



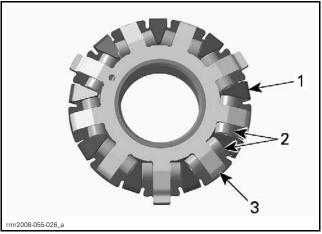
1. Centrifugal clutch assembly

Centrifugal Clutch Disassembly

Clean and thoroughly dry the centrifugal clutch assembly to remove all lubricating oil.

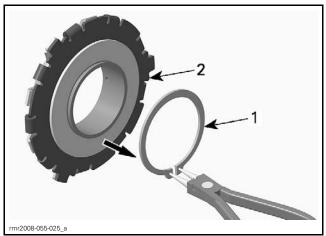
Using a permanent marker to number the position of the pressure plate, cam and centrifugal weights (rollers), so they may be reassembled in the same position.

NOTE: Mark the position of the pressure plate, cam and centrifugal weights, prior to disassembling them.



- Pressure plate
- Centrifugal weights (rollers)

Remove retaining ring.



- Retaining ring
 Centrifugal clutch assembly

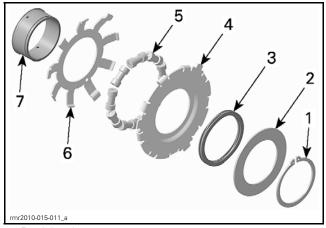
Remove stop plate.

Remove wave spring.

Remove pressure plate.

Remove centrifugal weights.

Remove cam.



- Retaining ring
- Stop plate
- Wave spring
- Pressure plate
- Centrifugal weights
- Bushing

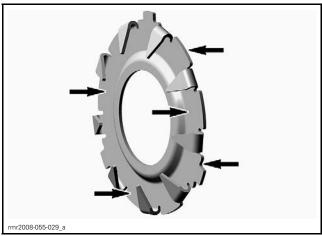
Centrifugal Clutch Inspection

Inspect stop plate for cracks or abnormal wear. Replace if necessary.

Pressure Plate

Inspect pressure plate for cracks, deformation or abnormal wear. Replace if necessary.

Inspect the thrust surfaces on both sides of the pressure plate for abnormal wear or grooves.



INSPECT THRUST SURFACE OF PRESSURE PLATE

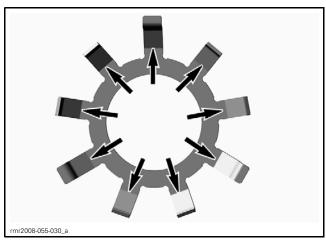
Centrifugal Weights

Inspect centrifugal weights for scoring and wear. Check if needle bearings of centrifugal weights move freely. Replace if necessary.

Cam

Inspect cam for cracks, deformation or abnormal wear. Replace if necessary.

Inspect the cam thrust surfaces for grooves or abnormal wear.

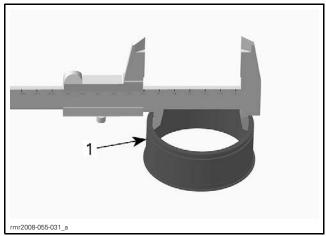


INSPECT THE CAM THRUST SURFACES

Bushing

Inspect bushing for cracks, grooves, or abnormal wear. Replace if necessary.

Measure inner diameter of bushing.



INNER DIAMETER MEASUREMENT

Bushing

BUSHING INNER DIAMETER	
MAXIMUM SERVICE LIMIT	63.10 mm (2.484 in)

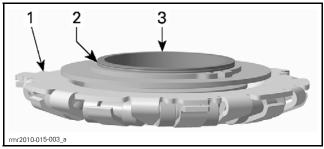
Replace bushing if inner diameter is worn beyond specification.

Centrifugal Clutch Assembly

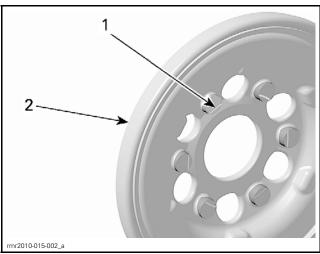
NOTICE Assemble the centrifugal clutch with the utmost care. Failure to strictly follow procedures may cause parts to loosen and/or malfunction of clutch, and may lead to serious engine damage.

Centrifugal clutch assembly is the reverse of disassembly. However, pay attention to the following details.

NOTE: Centrifugal clutch assembly must be equipped with bushing showing a identification groove and must be installed together with the proper pressure plate also showing an identification groove.

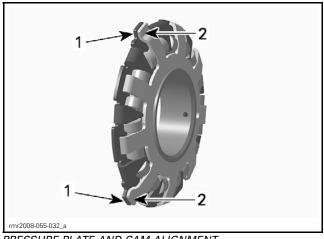


- Centrifug
 Identifica
 Bushing Centrifugal clutch assembly
- Identification groove



- Identification groove
- 2. Pressure plate

Assemble cam and pressure plate so the longer fingers are facing each other.



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PRESSURE PLATE AND CAM ALIGNMENT

- 1. Pressure plate long fingers
- 2. Cam long fingers

NOTE: Be sure to align corresponding numbers on cam, pressure plate and centrifugal weights (rollers) as marked prior to disassembly.

Insert the assembled clutch pressure plate, cam and weights over the bushing with the clutch pressure plate on top.

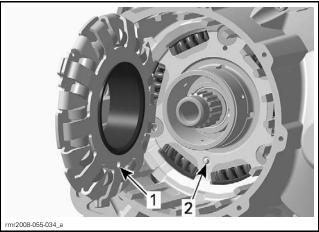
Install wave spring, stop plate and retaining ring.

Centrifugal Clutch Installation

For installation, reverse the removal procedure. However, pay attention to the following.

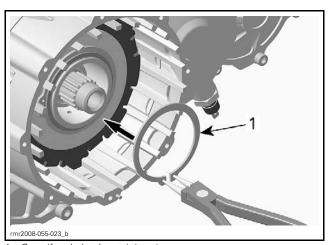
Install centrifugal clutch with cam alignment hole in line with clutch drum alignment pin.

NOTICE Make sure to correctly position centrifugal clutch in the clutch drum.



- 1. Alignment hole in centrifugal clutch
- 2. Alignment pin on clutch drum

Install centrifugal clutch retaining ring.



1. Centrifugal clutch retaining ring

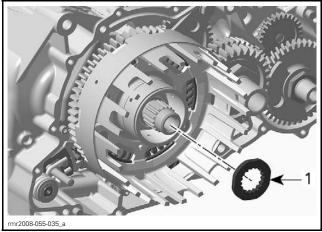
CLUTCH DRUM

Clutch Drum Removal

Remove the following items, see procedures in this subsection.

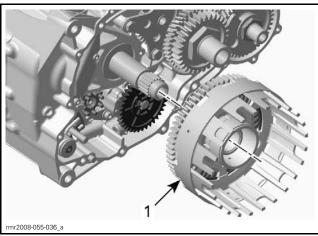
- Clutch cover
- Clutch disk assembly
- Clutch hub
- Centrifugal clutch assembly.

Remove the clutch drum thrust washer.



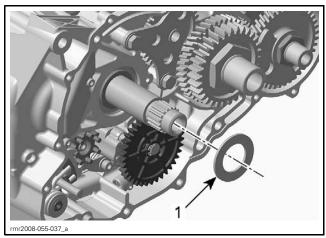
1. Clutch drum thrust washer

Remove the clutch drum.



1. Clutch drum

Remove the thrust washer.



1. Thrust washer

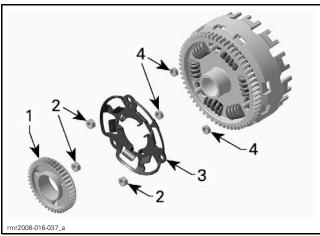
Clutch Drum Disassembly

Remove the oil pump drive gear.

Remove retaining nuts.

Remove the outer support plate.

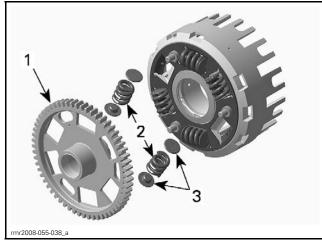
Remove distance sleeves.



- Oil pump drive gear
- Retaining nuts
- Outer support plate
- Distance sleeves

NOTE: Mark the position of springs and retainers, prior to removing them.

Remove clutch drum and gear together as well as both white marked springs and their spring retainers.



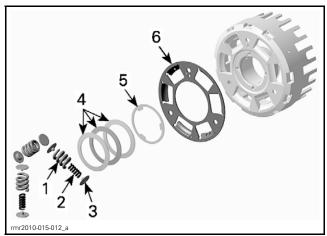
- Clutch drum gear
 Springs with white marks
 Spring retainers

Remove all other springs with their spring retain-

Remove the disc springs.

Remove the thrust washer.

Remove the inner support plate.



- Outer compression springs
- Inner compression springs
- Spring retainers
- Disc springs
- Thrust washer Inner support plate

Clutch Drum Inspection

Compression Springs and Retainers

Measure free length of each compression spring, refer to the following table.

COMPRESSION SPRING FREE LENGTH	
SERVICE LIMIT	
Outer springs and white marked springs	26.75 mm (1.053 in)
Inner springs	25.65 mm (1.01 in)

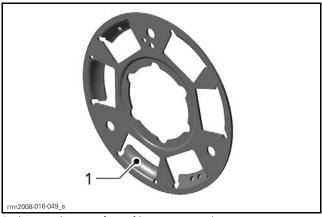
If a spring is out of specification, replace all springs as well as all spring retainers.

Inspect spring retainers for wear, cracks or scoring. Replace all springs and all spring retainers as an assembly.

Support Plates

Inspect support plates for cracks or abnormal wear. Replace if necessary.

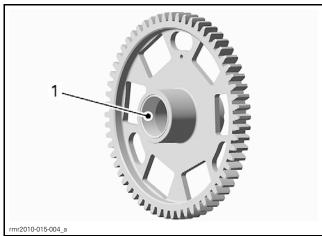
Inspect the thrust surface of inner support plate for abnormal wear or grooves. If necessary, replace inner support plate, thrust washer and disc spring as an assembly.



1. Inspect thrust surface of inner support plate

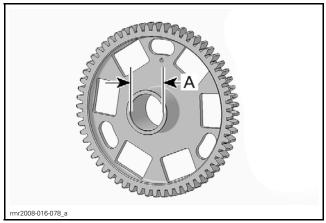
Clutch Drum Gear

Inspect bearing sleeve surface for scoring and wear.



1. Bearing sleeve surface

Measure inner diameter of bearing sleeve.



A. Inner diameter

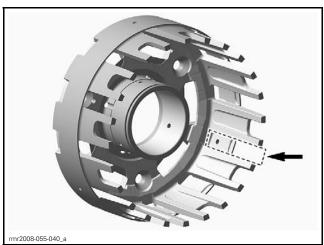
BEARING SLEEVE INNER DIAMETER	
SERVICE LIMIT	30.060 mm (1.183 in)

Inspect teeth condition for pitting or other damage.

Replace clutch drum drive gear if necessary.

Clutch Drum

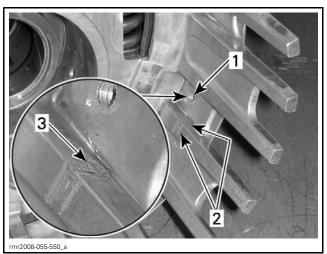
Inspect slots in clutch drum for damages or wear caused by friction plates. Replace if necessary.



INSPECT SLOTS IN CLUTCH DRUM FOR WEAR

Inspect the slots where there is a small hole.

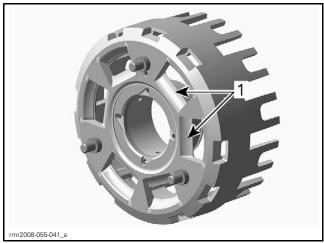
Slight markings or grooves caused by the centrifugal clutch are normal. If grooves on the side of the rib are deeper than 0.5 mm (.02 in), replace clutch drum.



- Slot with a small hole
- Slight markings or grooves here are normal
- 3. Maximum groove depth allowable here is 0.5 mm (.02 in)

Inspect spring cavities for deep grooves, caused by springs. Replace clutch drum if necessary.

NOTE: Slight markings caused by the springs are normal. Do not replace clutch drum needlessly.



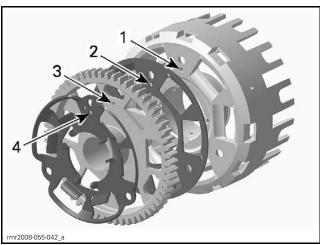
1. Inspect spring cavities

Clutch Drum Assembly

NOTICE Assembly of the clutch drum must be carried out with utmost care. Failure to strictly follow the procedures may cause parts to loosen and/or malfunction of the clutch drum and may lead to serious engine damage.

Assemble the clutch drum in the reverse order of disassembly. However, pay attention to the following details.

NOTICE The position of the clutch drum, support plates and clutch drum gear for assembly is clearly indicated with location holes in each part. During assembly ensure that all location holes are aligned with each other.

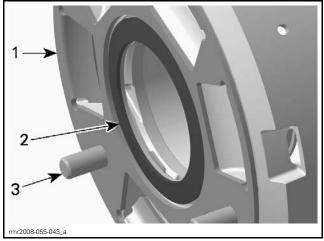


ALIGNMENT OF LOCATION HOLES FOR CLUTCH DRUM **ASSEMBLY**

- Hole in clutch drum
- 2. Hole in inner support plate
- Hole in clutch drum gear
 Hole in outer support plate

Insert the three M8 x 25 flat head screws from the inside of the drum. Hold the screws in position as you install the remaining parts.

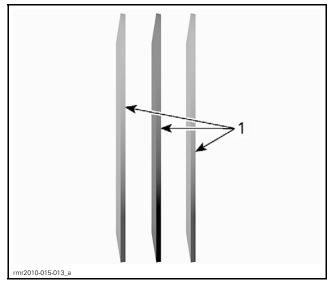
Install inner support plate on clutch drum, ensure the location holes are aligned with each other.



- Support plate Disc springs
- Drum assembly screw

NOTE: Assemble the disk springs in the right or-

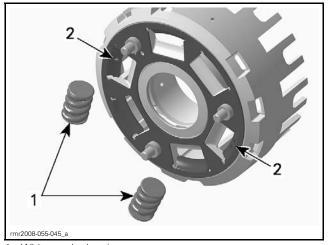
The concave side of the disk springs must face towards the clutch drum.



1. Concave side of disk springs

Install the clutch drum gear, ensure the location holes are aligned with each other.

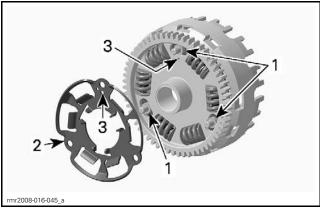
Install both white marked springs with spring retainers into the corresponding spring cavities which are marked with punched holes inside the inner support plate.



White marked springs
 Spring cavities marked with punched holes

Install remaining springs and retainers into spring cavities.

Install distance sleeves on clutch drum screws. then outer support plate. Ensure that the location holes aligned with each other.



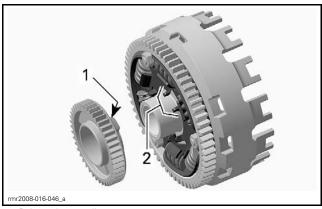
- Distance sleeves
- Outer support plate
- Location holes

Install retaining nuts on clutch drum screws.

Apply LOCTITE 648 (GREEN) (P/N 413 711 400) on threads of retaining nuts.

Torque nuts to 30 N•m (22 lbf•ft).

Finally, install the oil pump gear. Ensure the drive tabs on the oil pump gear engage in the drive tabs on the outer support plate.



- Drive tabs on oil pump gear
- Drive tabs on outer support plate

Functional Test

After assembly of the clutch drum is complete, check for torsion of the clutch drum on clutch drum gear. Proceed as follows.

- Reinstall clutch drum on clutch shaft.
- Ensure crankshaft is locked at piston TDC.
- Try to turn clutch drum.

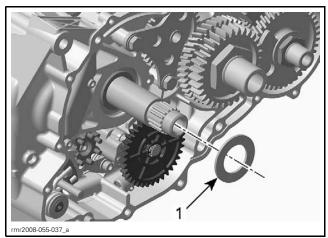
There must be no free-play between clutch drum and clutch drum gear.

If free-play has been detected, inspect all clutch drum components (e.g. disk spring, thrust washer, inner support plate). Refer to CLUTCH DRUM INSPECTION in this subsection.

Clutch Drum Installation

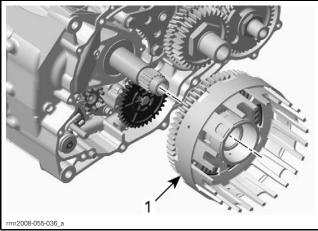
For installation, reverse the removal procedure. However, pay attention to the following.

Insert the first thrust washer on the clutch shaft before installing clutch drum.



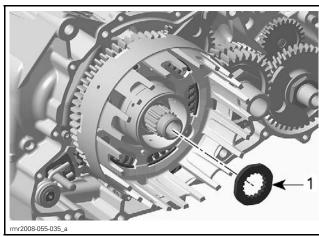
1. Thrust washer

Insert clutch drum on the clutch shaft.



1. Clutch drum

Install the other thrust washer on clutch shaft.



1. Thrust washer

Install clutch hub and all remaining parts. See procedures in this subsection.

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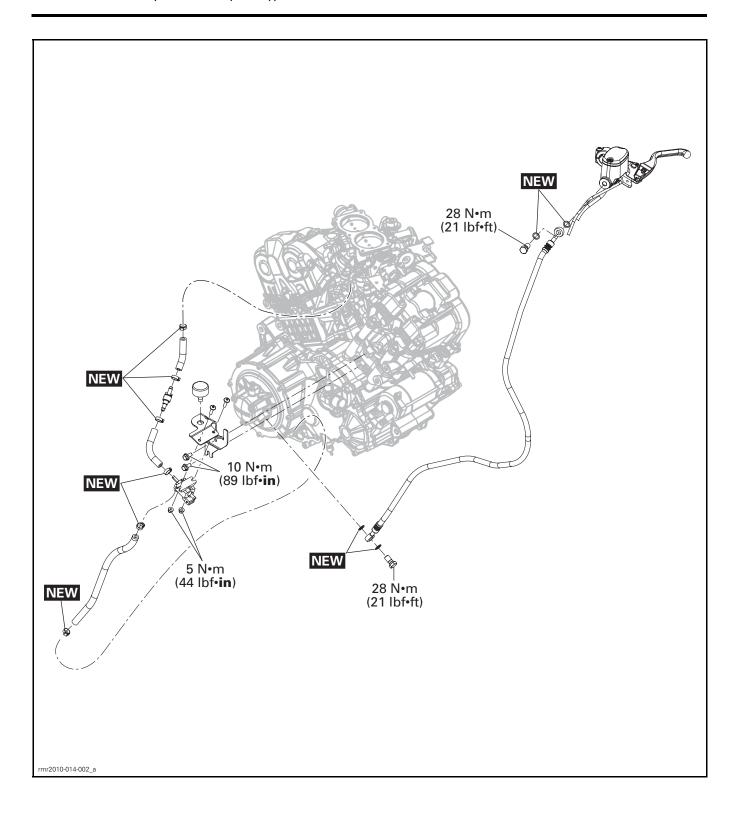
CLUTCH (SM5)

SERVICE TOOLS

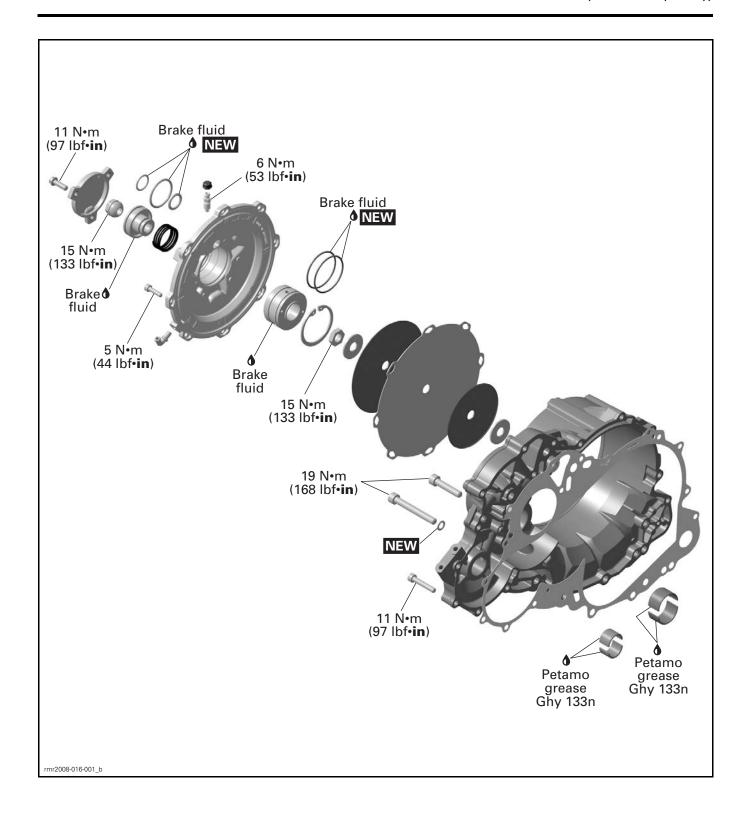
Description	Part Number	Page
BLIND HOLE BEARING PULLER SET	529 036 117	29
CLUTCH ASSEMBLY HOLDER	529 035 618	31
ECM ADAPTER TOOL	420 277 010	
FLUKE 115 MULTIMETER	529 035 868	
VACUUM/PRESSURE PUMP	529 021 800	8–9, 12, 17

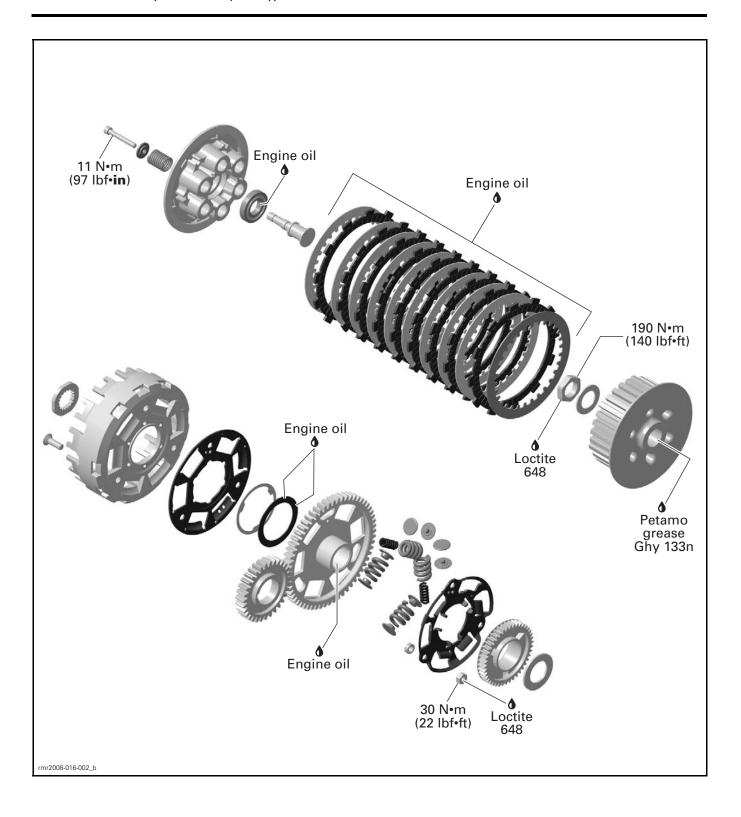
SERVICE PRODUCTS

Description	Part Number	Page
BRAKE FLUID GTLMA (DOT 4)	293 600 062	
LOCTITE 243 (BLUE)	293 800 060	24
LOCTITE 648 (GREEN)	413 711 400	32, 35
PETAMO GREASE GHY 133N	420 899 271	30–31
PULLEY FLANGE CLEANER	413 711 809	28



3





GENERAL

NOTE: For a better understanding, many of the following illustrations are produced with the engine out of vehicle. To carry out the instructions, it is not necessary to remove the engine from vehicle.

Always disconnect the battery negative cable before working the engine.

A WARNING

Always disconnect BLACK (-) cable first and reconnect last.

During assembly/installation, use torque values and service products as specified in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

A WARNING

Torque wrench tightening specifications must be strictly adhered to.

Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced with new ones.

NOTICE Hoses, cables or locking ties removed during a procedure must be reinstalled as per factory standards.

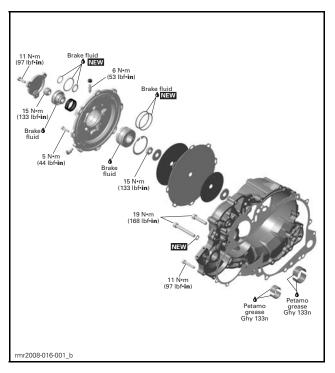
NOTICE Avoid spilling brake fluid on plastic, rubber or painted parts. Protect these parts with a rag when servicing the hydraulic clutch system.

NOTICE Sealing washers must be discarded and replaced with new ones every time a Banjo fitting is unscrewed.

Periodically check the clutch hoses for damages or leaks. Repair any damages or leaks.

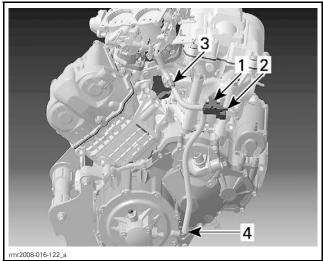
SYSTEM DESCRIPTION

The engine on the SM5 model features a hydraulically operated pneumatically assisted type clutch system.



A diaphragm assists the hydraulic system in displacing the pressure plate to disengage the clutch.

The diaphragm is activated by vacuum applied through an electronically controlled solenoid valve (controlled by the ECM).



- TYPICAL
- 1. Solenoid
- 2. Vent to atmosphere
- 3. Check valve
- 4. Vacuum to clutch release servo

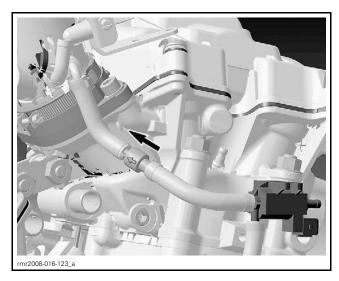
When the clutch lever is depressed and the engine is running, the ECM modulates the clutch solenoid valve to provide a variable assist to the clutch.

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The pneumatic assist will vary according to throttle position and to the engine RPM up to approximately 4000 RPM. Beyond that, there will not be any pneumatic assist.

- The lower the engine RPM, the greater the assist will be.
- The lesser the throttle opening, the greater the assist will be.

A check valve is used to allow only vacuum pulses to go towards diaphragm. Therefore, its orientation is important for proper operation.



When the clutch solenoid is not activated, the diaphragm vacuum hose is opened to atmospheric pressure which allows the diaphragm to return to its free position.

NOTE: A damaged diaphragm will cause engine oil to be drawn into the air intake from the clutch area. The burning engine oil will produce blue smoke out of the exhaust system.

MAINTENANCE

CLUTCH FLUID

Recommended Clutch Fluid

Use only DOT 4 BRAKE FLUID GTLMA (DOT 4) (P/N 293 600 062) or equivalent.

NOTICE To avoid serious damage to the hydraulic clutch system, use only brake fluid of the recommended type from a sealed container. Do not use fluid from an old or already opened container, nor mix different fluids for topping up the system.

Clutch Fluid Level Verification

Ensure vehicle is on a level surface.

Set the handlebar in the straight ahead position.

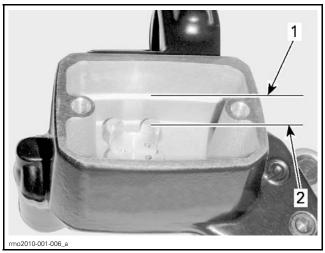
Wipe clean the reservoir cap area.

Unscrew retaining screws of reservoir cap using a Phillips screwdriver.



Carefully remove reservoir cap. Pay attention not to drop the seal.

Look inside the the reservoir to see the fluid level. The fluid should be within the maximum level and the minimum level.



FLUID REMOVED FOR CLARITY PURPOSE

- . Maximum level (line)
- 2. Minimum level (top of protuberance)

If the fluid level is lower than specified, add fluid to the reservoir up to the maximum level line. Do not overfill.

A WARNING

Avoid getting brake fluid on skin or in eyes, it may cause severe burns. In case of contact with the skin, wash thoroughly. In case of contact with the eyes, immediately rinse with plenty of water for at least 10 minutes and then consult a doctor immediately.

NOTE: A low level may indicate leaks or worn clutch discs.

Reinstall the reservoir cover.

NOTE: Ensure seal is located inside reservoir cap and the seal is completely collapsed.

Clutch Fluid Replacement

Clutch Fluid Draining

Remove the following RH body panels, refer to *BODY* subsection:

- Top side panel
- Rear side panel

Remove clutch reservoir cover screws. Do not remove cover at this time.



NOTICE Leave cover on reservoir to avoid spillage during the following procedure.

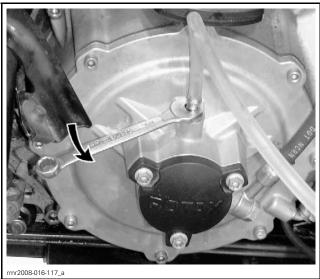
Connect a clear hose to the clutch bleeder on the clutch cover.

Insert the other end of the hose in an appropriate container (such as an empty break fluid bottle).



TYPICAL

Loosen the clutch bleeder.



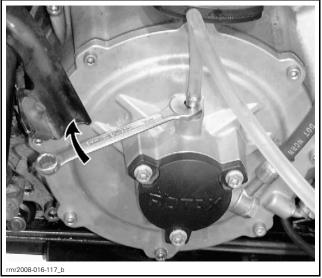
TYPICAL

Depress and release the clutch lever several times until no more fluid flows out of bleeder.



TYPICAL

Tighten bleeder.



TYPICAL

Clutch Fluid Filling

Remove reservoir cover.

Turn handlebar fully on right side.

NOTE: Turning the handlebar will help the bleeding process.

Fill reservoir with the recommended fluid.

Bleed systemusing the *CLUTCH FLUID BLEED-ING USING A PUMP (SYSTEM COMPLETELY EMPTY)* procedure.

NOTE: If a pump is not available, use the *CLUTCH FLUID BLEEDING WITHOUT A PUMP* procedure.

Clutch Bleeding Procedures

Clutch Fluid Bleeding using a Pump (System Completely Empty)

NOTE: If the system is completely empty, it is easier to bleed the system by pushing the fluid from the bleeder to the reservoir. Use the following procedure.

Install the VACUUM/PRESSURE PUMP (P/N 529 021 800) and the remote reservoir onto the clutch bleeder with a clear hose. See following illustration.



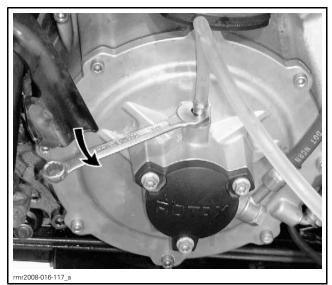


TYPICAL - PUMP AND REMOTE RESERVOIR INSTALLATION

Add recommended fluid in the pump remote reservoir.

Set pump to the PRESSURE position.

Loosen clutch bleeder.

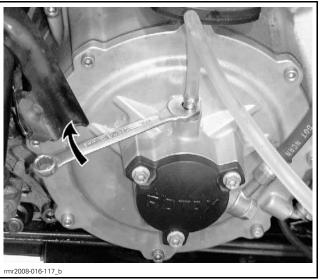


TYPICAL - LOOSEN CLUTCH BLEEDER

Activate the pump lever several times until fluid reaches the clutch reservoir. Then, tighten bleeder.



ACTIVATE PUMP UNTIL FLUID REACHES CLUTCH RESERVOIR



TYPICAL - TIGHTEN CLUTCH BLEEDER

Depress clutch lever several times. If it feels spongy, bleed system again using the *CLUTCH FLUID BLEEDING USING A PUMP (SYSTEM NOT COMPLETELY EMPTY)* procedure.

Top up fluid reservoir.

Install cover on reservoir.

Clutch Fluid Bleeding using a Pump (System Not Completely Empty)

Install the VACUUM/PRESSURE PUMP (P/N 529 021 800) and the remote reservoir onto the clutch bleeder with a clear hose. See following illustration.

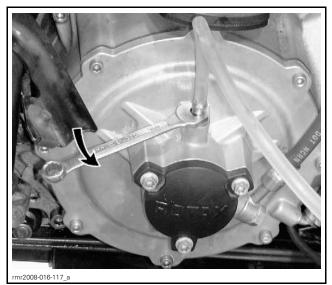


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TYPICAL - PUMP AND REMOTE RESERVOIR INSTALLATION

Set pump to the VACUUM position. Loosen clutch bleeder.



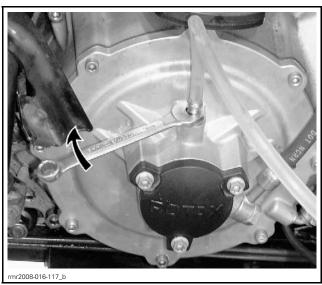
TYPICAL - LOOSEN CLUTCH BLEEDER

Depress and release the pump lever several times until no more air bubbles flow out of bleeder. Then, tighten bleeder.

NOTE: Check the clutch fluid level in reservoir often to prevent air from being drawn into the system.



ACTIVATE PUMP UNTIL NO MORE AIR COMES OUT



TYPICAL - TIGHTEN CLUTCH BLEEDER

Depress clutch lever several times. If it feels spongy, repeat procedure until system is entirely bled of trapped air.

Top up fluid reservoir.

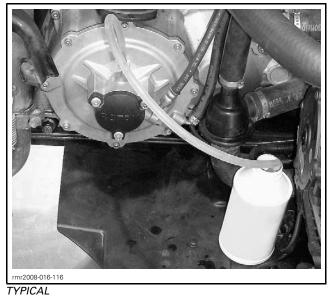
Install cover on reservoir.

Clutch Fluid Bleeding without a Pump

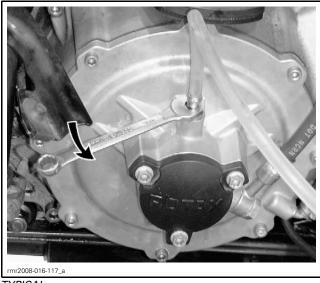
If a pump is not available, use the following procedure.

Connect a clear hose to the clutch bleeder.

Insert the other end of the hose into a **clean** container containing enough new brake fluid for the end of the hose to be submerged.



Loosen the clutch bleeder.



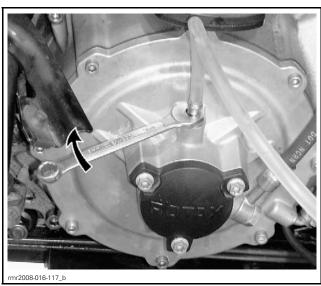
TYPICAL

Depress the clutch lever until it reaches the end of its stroke.



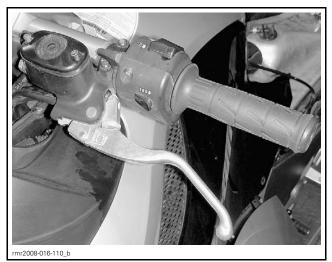
TYPICAL

Tighten the clutch bleeder.



TYPICAL

Release the clutch lever.



TYPICAL

IMPORTANT: Do not release clutch lever until bleeder has been tightened.

Repeat this sequence of depressing lever and loosening/tightening bleeder screw until no more air bubbles appear in hose.

NOTE: Check fluid level often to prevent air from being pumped into the system.

Depress clutch lever several times. If it feels spongy, repeat the procedure until system is entirely bled of trapped air.

Top up reservoir.

Install cover on reservoir.

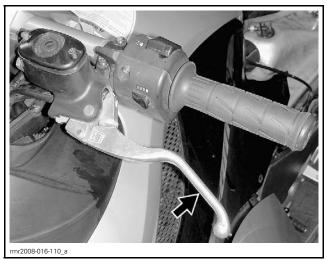
TROUBLESHOOTING

CLUTCH OPERATION TEST

Pneumatic Assist Quick Test

With the engine **not** running, depress the clutch lever a few times.

Note clutch lever resistance.



TYPICAL

Start engine and let run at idle.

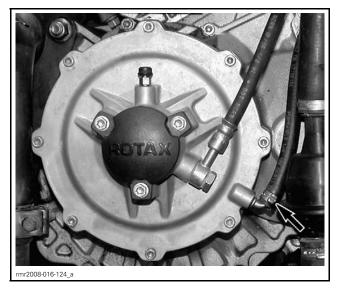
Depress clutch lever a few times.

Compare lever resistance with and without engine running.

Lever must be easier to depress when the engine is running. Otherwise, carry out a VACUUM LEAK TEST.

Vacuum Leak Test

Disconnect vacuum hose from clutch cover fitting.



Install the VACUUM/PRESSURE PUMP (P/N 529 021 800) onto the clutch cover vacuum hose fitting.





TYPICAL

Set the pump to vacuum and activate its lever several times until vacuum specified in the following table is obtained.

VACUUM LEAK TEST	
VACUUM	TIME WITHOUT LEAK
25 in Hg	30 seconds

If vacuum leaks, check the following:

- Clutch cover screws for tightness
- Tightness of diaphragm nut
- Diaphragm.

If the vacuum leak test was good, check the vacuum-assist components.

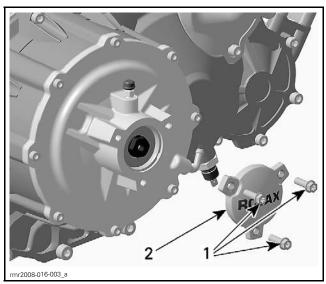
NOTE: If their is no clutch assist or only partial assist, the check valve should be suspected.

Remove the vacuum/pressure test pump and hose.

Install the system vacuum hose on the clutch cover and secure it as specified in the exploded view.

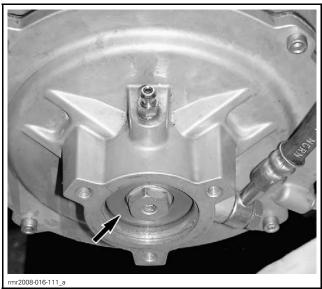
Hydraulic Operation Test

Remove hydraulic clutch piston cover.



- 1. Screws
- 2. Clutch piston over

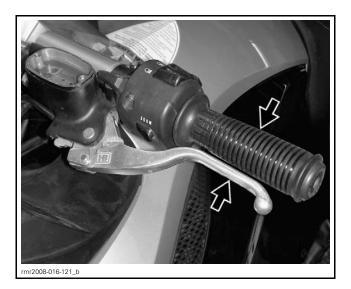
Observe the hydraulic piston position.



CLUTCH HYDRAULIC PISTON

Fully depress clutch lever and hold.

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Again, observe the hydraulic piston position.



MOVEMENT OF CLUTCH HYDRAULIC PISTON

It should move outwards approximately 2 mm (.079 in).

NOTE: Ensure clutch lever adjustment is set to allow maximum piston stroke. Also, piston must maintain its position as long as clutch lever is held depressed.

If clutch piston does not maintain its position while clutch lever is depressed, check the hydraulic components.

PROCEDURES

CLUTCH LEVER

Clutch Lever Inspection

Check clutch lever for cracks or other damages.

Replace as required.

Clutch Lever Replacement

Remove screw and nut retaining the clutch lever. Remove clutch lever.

Installation is the reverse of the removal.

MASTER-CYLINDER

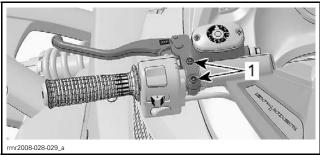
Master-Cylinder Removal

Drain fluid from clutch system. Refer to *CLUTCH FLUID REPLACEMENT* procedure in this subsection.

Loosen torque on screw retaining clutch fluid hose to reservoir.

NOTE: Do not remove screw at this time to avoid spillage.

Remove screws retaining master-cylinder to handlebar.



TYPICAL

1 Screws

Place master-cylinder reservoir over a drain pan. Remove the retaining screw and clutch fluid hose from the master cylinder.



TYPICAL

1. Remove screw

Empty reservoir into drain pan.

Tie off clutch hose to handlebar to avoid spillage.

NOTICE Be sure to protect all parts from the brake fluid as it will strip the finish off parts. Clean off any spillage immediately.

Discard sealing washers.

Remove clutch switch. Refer to *STARTING SYS-TEM* subsection.

Remove master-cylinder.

Master-Cylinder Installation

Installation is the reverse of the removal procedure, however pay attention to the following.

If clutch fluid hose was disconnected:

- Replace both sealing washers on clutch hose fitting.
- Bleed clutch system. Refer to CLUTCH BLEED-ING PROCEDURES in this subsection.

CLUTCH SOLENOID VALVE

Clutch Solenoid Valve Test with B.U.D.S.

Connect to the lastest B.U.D.S. software, refer to COMMUNICATION TOOLS AND B.U.D.S. SOFT-WARE.

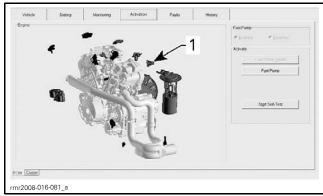
Select the Read Data button.

Select the **Faults** page tab.

Check for fault codes.

To test the solenoid valve operation, select the **Activation** page tab and confirm you are on the **ECM** page.

Activate the clutch solenoid valve by selecting the solenoid symbol.



1. Activate here

This will validate the clutch solenoid mechanical and electrical operation.

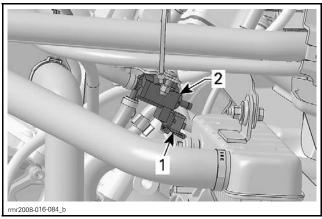
If the solenoid valve works, check clutch components.

If the solenoid valve does not work, proceed with a voltage test.

Input Voltage Test (Clutch Solenoid Valve)

Remove the RH upper side panel, refer to the *BODY* subsection.

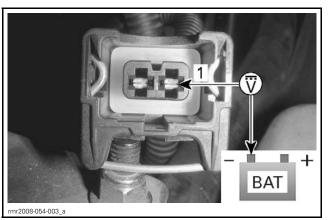
Disconnect the solenoid valve connector and turn ignition switch to ON.



- 1. Clutch solenoid valve connector
- 2. Clutch solenoid valve

Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to Vdc setting.

INPUT VOLTAGE TEST (CLUTCH SOLENOID VALVE)		
TEST PROBES VOLTAG		VOLTAGE
Clutch solenoid valve connector Pin 2	Battery ground	Battery voltage



INPUT VOLTAGE TEST (CLUTCH SOLENOID VALVE)

If you do not measure battery voltage, check fuse F2. If F2 is good, test the circuit continuity from the fuse to the clutch valve solenoid.

NOTE: If F2 is blown, the horn will not function.

If battery voltage is measured, test clutch solenoid valve resistance.

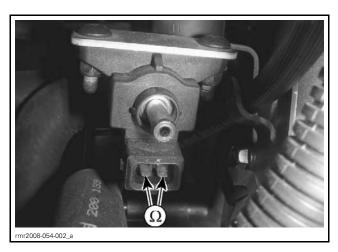
Clutch Solenoid Valve Resistance Test

Disconnect clutch solenoid connector.

Set the multimeter to Ω setting.

Measure the clutch solenoid resistance as per following table.

CLUTCH SOLENOID VALVE RESISTANCE TEST		
TEST PROBES	RESISTANCE @ 20°C (68°F)	
Solenoid pins 1 and 2	23 ± 1.2 Ω	



If resistance is out of specification, replace the solenoid.

If solenoid resistance is good, carry out a circuit continuity test.

Circuit Continuity Test (Clutch Solenoid Valve)

Ensure ignition switch is OFF.

Remove fuse F2.

Remove ECM connector "B" and install it on the ECM ADAPTER TOOL (P/N 420 277 010).

Set multimeter to Ω setting and measure the circuit continuity as per following table.

CIRCUIT CONTINUITY TEST (CLUTCH SOLENOID VALVE)		
TEST PROBES		RESISTANCE @ 20°C (68°F)
Clutch solenoid connector pin 2	Fuse F2 (contact E7)	Class to 0.0
Clutch solenoid connector pin 1	ECM adapter B-4	Close to 0 Ω

If resistance is out of specification, repair or replace wiring/connectors.

If solenoid resistance, input voltage and circuit continuity all tested good, check for the following:

- An obstructed vacuum hose
- A stuck solenoid valve plunger
- A malfunctioning clutch solenoid check valve.

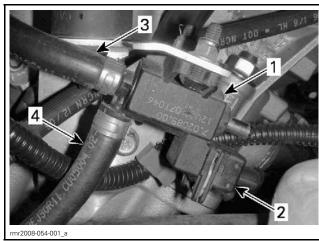
Repair or replace as applicable.

Clutch Solenoid Valve Removal

Remove the RH top side panel. Refer to the BODY subsection.

Disconnect clutch valve solenoid connector.

Remove screws securing clutch solenoid valve to support bracket.



- 1. Solenoid valve
 - Solenoid connector
- 3. Vacuum hose from throttle body
- 4. Vacuum hose to clutch housing

Cut Oetiker clamps and remove hoses from clutch valve solenoid.

NOTE: Mark hoses location for reinstallation.

Clutch Solenoid Valve Installation

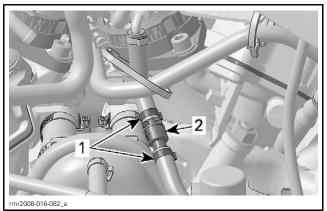
For installation, reverse the removal procedure.

CHECK VALVE (CLUTCH SOLENOID VALVE)

Check Valve Removal

Remove the air filter housing. Refer to AIR IN-TAKE SYSTEM.

Cut Oetiker clamps retaining the check valve.

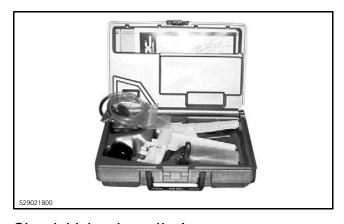


Oetiker clamps
 Check valve

Remove the check valve.

Check Valve Inspection

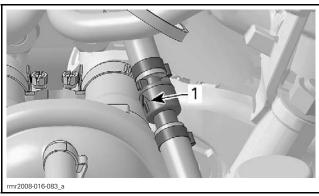
Using the VACUUM/PRESSURE PUMP (P/N 529 021 800), test the check valve operation.



Check Valve Installation

Install the check valve with the flow arrow pointing towards the throttle body.

Install **NEW** Oetiker clamps.



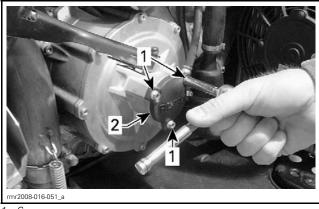
1. Flow arrow towards throttle body

Install all other removed parts.

HYDRAULIC PISTON

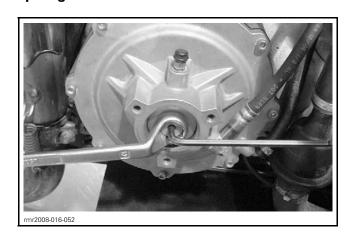
Hydraulic Piston Removal

Remove hydraulic piston cover screws.



1. Screws

Using a 17 mm deep offset wrench, unscrew the hydraulic piston nut while holding the clutch release shaft with a 5 mm Allen wrench. The diaphragm must not twist.



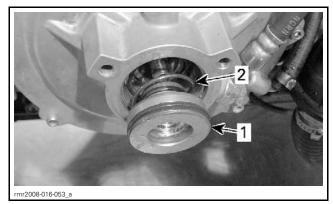
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^{2.} Hydraulic piston cover

NOTICE Hold the clutch release shaft with the Allen wrench to avoid twisting and damaging the diaphragm.

Squeeze clutch lever a few times to push hydraulic piston out of the clutch cover.

Remove compression spring.

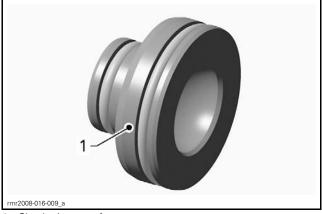


Hydraulic piston
 Compression spring

Hydraulic Piston Inspection

Clean piston with new brake fluid.

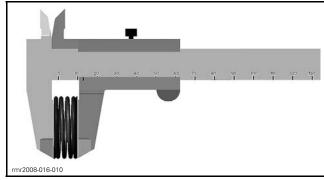
Visually inspect piston surface for scoring, scratches or abnormal wear. Replace if necessary.



1. Check piston surface

Compression Spring

Check free length of compression spring.



COMPRESSION SPRING FREE LENGTH	
NEW	37.10 mm to 42.90 mm (1.461 in to 1.689 in)
SERVICE LIMIT	35.00 mm (1.378 in)

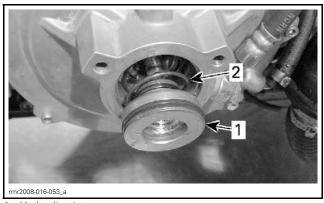
If the compression spring is out of specifications, replace it.

Hydraulic Piston Installation

Replace piston O-rings with NEW ones.

Coat hydraulic piston and O-rings with new brake fluid.

Install piston with compression spring into hydraulic cylinder.



Hydraulic piston
 Compression spring

Install hydraulic piston cover.

CLUTCH COVER

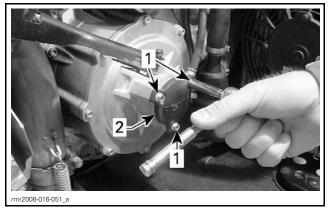
Clutch Cover Removal

Refer to *BODY* subsection and remove the following:

- Bottom rear side panel
- Rear side panel.

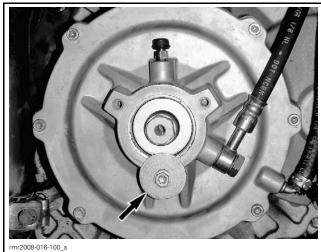
Lift and safely block RH front of vehicle to prevent engine oil leakage when removing components (if servicing clutch cover in vehicle).

Remove hydraulic piston cover screws.



- Screws
- 2. Hydraulic piston cover

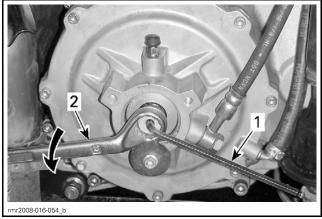
Secure hydraulic piston with a large washer and a piston cover screw to retain the piston in the cylinder and avoid clutch fluid leakage.



PISTON SECURED WITH A LARGE WASHER AND SCREW

Using a 17 mm deep offset wrench, unscrew the hydraulic piston nut while holding the clutch release shaft with a 5 mm Allen wrench. The diaphragm must not twist.

NOTICE Hold the clutch release shaft with the Allen wrench to avoid twisting and damaging the diaphragm.



- Hold Allen key
- Turn wrench counterclockwise

Remove clutch cover retaining screws.

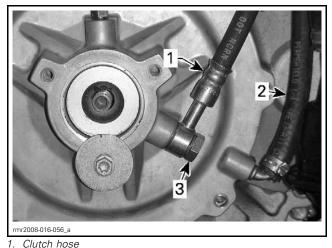
NOTE: Disconnect clutch fluid hose and vacuum hose ONLY if cover must be removed from the vehicle. Otherwise, omit these steps.

Loosen screw retaining clutch hose.

Disconnect hose and discard sealing washers.

NOTE: Install a drain pan under clutch hose to catch the clutch fluid.

Remove vacuum hose from clutch cover.



- Vacuum hose

Remove the clutch cover from the engine.

NOTICE Do not let the clutch cover hang from the hose and do not stretch or twist the hose.

Clutch Cover Inspection

Clean cover and check for cracks or other damage.

Clutch Cover Installation

Installation is the reverse of the removal procedure. However, pay attention to following details.

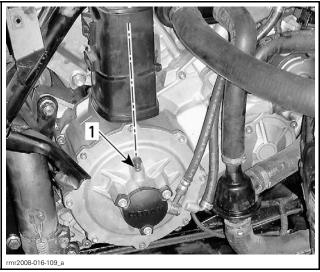
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Ensure slots in diaphragm are properly positioned on mounting lugs.



- Mounting lug
 Diaphragm slot inserted on lug
- Install clutch cover.

Position cover so that clutch bleeder screw is pointing upwards (when engine is on vehicle).



1. Bleeder approximately vertical

Torque clutch cover screws in a criss-cross pattern.

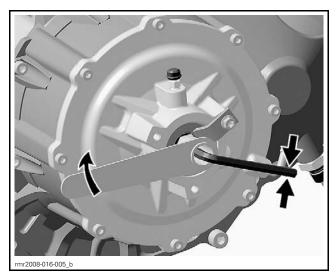
Install clutch fluid hose with **NEW** sealing washers.

Bleed clutch, refer to *CLUTCH BLEEDING PRO-CEDURES*.

Carry out a vacuum leak test. Refer to *CLUTCH OPERATION TEST.*

Screw the hydraulic piston nut while holding release shaft with a 5 mm Allen wrench. The diaphragm must not twist.

NOTICE Hold the clutch release shaft in its position using the Allen wrench to avoid twisting and damaging the diaphragm.



Torque the hydraulic piston nut to 15 N•m (133 lbf•in).

Test clutch operation.

Install hydraulic piston cover and torque screws.

NOTE: If clutch fluid leak occurred during cover removal, bleed and refill system as necessary.

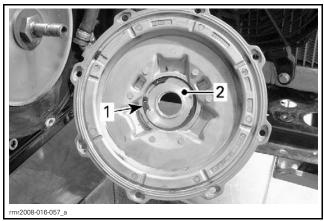
HYDRAULIC CYLINDER

Hydraulic Cylinder Removal

Remove the *HYDRAULIC PISTON*. See procedure in this subsection.

Remove the *CLUTCH COVER*. See procedure in this subsection.

Remove the circlip retaining the hydraulic cylinder.



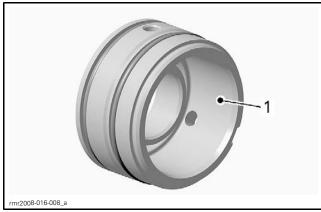
- 1. Circlip
- 2. Hydraulic cylinder

Remove hydraulic cylinder from clutch cover.

Hydraulic Cylinder Inspection

Clean parts with new brake fluid.

Visually inspect cylinder surface for scoring, scratches or abnormal wear. Replace if necessary.



1. Inspect cylinder surface

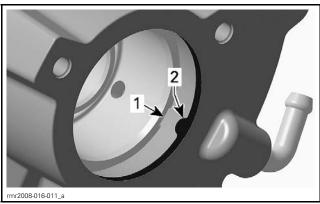
Replace O-rings with **NEW** ones.

Also inspect the clutch cover bore for scoring, scratches or other damages.

Hydraulic Cylinder Installation

Coat hydraulic cylinder and O-rings with new brake fluid and install the cylinder into the clutch cover bore.

Ensure the notch in the cylinder is aligned with the embossment on the clutch cover. See next illustration.



Hydraulic cylinder notch
 Clutch cover embossment

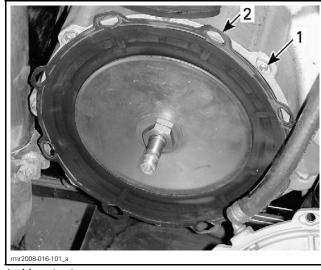
Install cylinder retaining circlip.

CLUTCH DIAPHRAGM

Diaphragm Removal

Remove the *CLUTCH COVER*. See procedure in this subsection.

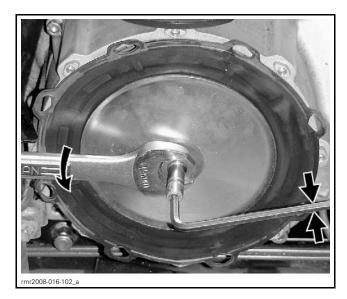
Pull diaphragm out of its mounting lugs, then rotate it away from the lugs to avoid damaging the diaphragm when removing retaining nut.



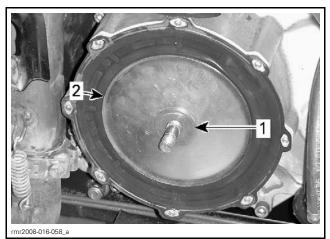
Mounting lugs
 Diaphragm rotated out of lugs

Unscrew retaining nut while holding release shaft with a 5 mm Allen wrench.

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Remove thrust washer. Remove disc plate.

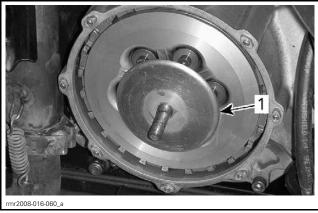


Thrust washer
 Disc plate

Remove diaphragm.

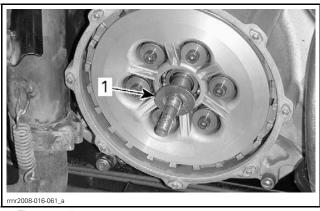


Remove support disc.



1. Support disc

Remove thrust washer.



1. Thrust washer

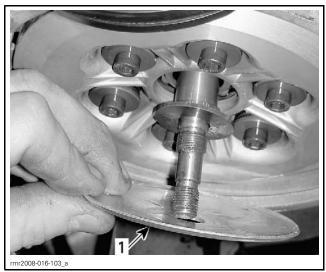
Diaphragm Inspection

Inspect rubber diaphragm for wear, tears, or other damages. Replace if necessary.

Diaphragm Installation

Installation is the reverse of the removal procedure. However, pay attention to following details.

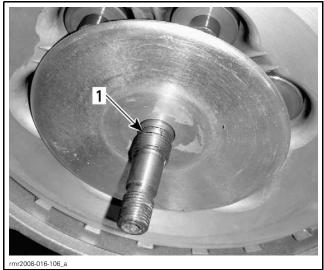
NOTICE Install support disc so that its rounded edge will be against diaphragm.



1. Rounded edge here

Ensure support disc is inserted past the groove in the shaft.

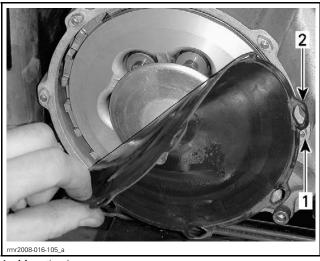
NOTE: Ensure to install the small support disc on the clutch side. The large disc plate goes on the outside of the diaphragm (clutch cover side).



1. Groove

Install diaphragm.

NOTICE Do not install diaphragm into its mounting lugs yet.



Mounting lug
 Diaphragm out of lug

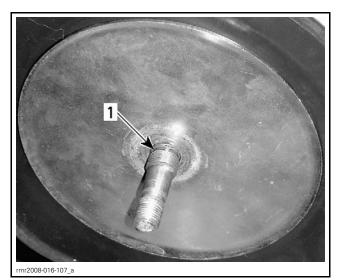
NOTICE Install disc plate so that its rounded edge will be against diaphragm.



1. Rounded edge here

Ensure diaphragm and disc plate are inserted past the groove in the shaft.

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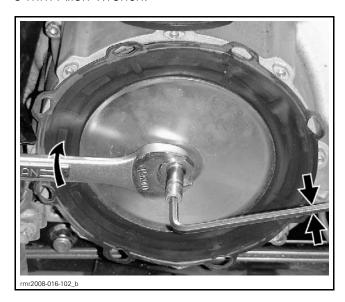


1. Groove

Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on the retaining nut threads.

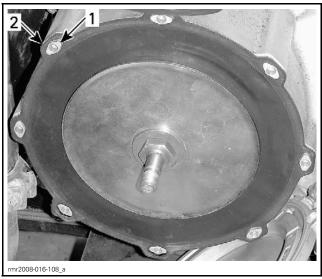
Install nut.

Tighten nut while holding release shaft with a 5 mm Allen wrench.



Torque nut to 15 N•m (133 lbf•in).

Position the slots in diaphragm onto the mounting lugs.



Mounting lug Diaphragm slot inserted on lugs

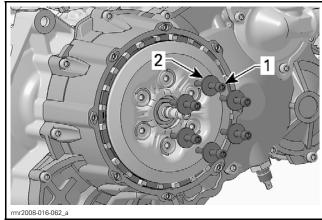
Install clutch cover. Refer to CLUTCH COVER.

PRESSURE PLATE AND CLUTCH **SPRINGS**

Pressure Plate and Clutch Spring Removal

Remove DIAPHRAGM, see procedure in this subsection.

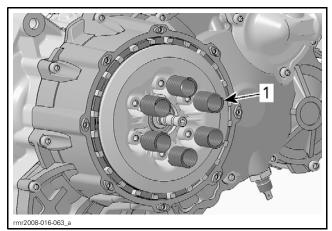
Loosen the retaining screws in a crisscross pattern, then remove them with the step washers.



Retaining screw

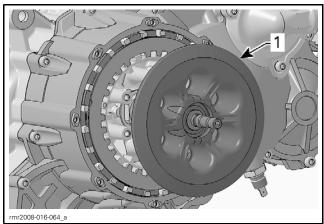
Step washer

Remove clutch springs.



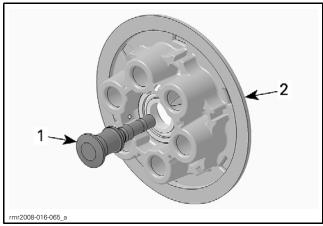
1. Clutch spring

Remove pressure plate.



1. Pressure plate

Remove clutch release pin from pressure plate.



Clutch release pin
 Pressure plate

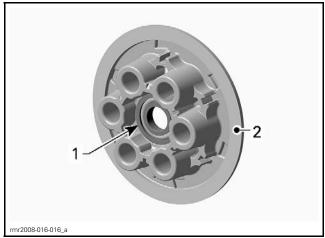
Pressure Plate and Clutch Spring Inspection

Pressure Plate

Inspect pressure plate for cracks or other damages. Replace if necessary.

Check if bearing in pressure plate turns smoothly and freely. Replace if necessary.

Inspect thrust surface for wear or other damages.

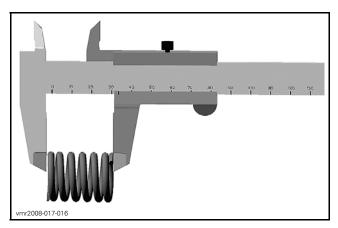


Bearing Trust surface

Clutch Spring

Measure each clutch spring free length. Replace every clutch spring if one is out of specifications.

CLUTCH SPRING	G FREE LENGTH
SERVICE LIMIT	58.50 mm (2.303 in)



Clutch Release Pin

Visually inspect clutch release pin for wear or other damage. Replace if necessary.

Pressure Plate and Clutch Spring Installation

For installation, reverse the removal procedure. However, pay attention to the following.

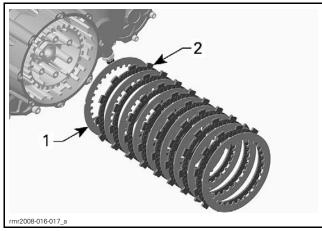
Tighten retaining screws in a crisscross pattern to 11 N•m (97 lbf•in).

CLUTCH PLATES

Clutch Plate Removal

Remove pressure plate. Refer to *PRESSURE PLATE AND CLUTCH SPRING* in this subsection.

Remove friction plates and steel driven plates.



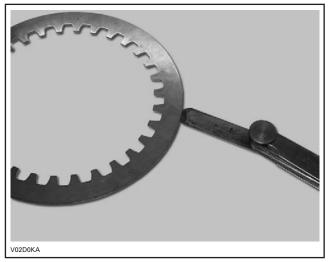
Friction plates
 Steel driven plates

Clutch Plate Inspection

Inspect each plate for cracks, bent or broken teeth, missing or excessively worn friction material and any other damage.

Check friction and steel driven plates for warpage. Place plates on a flat surface. Use a feeler gauge to measure warpage.

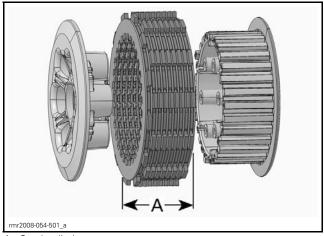
FRICTION AND STEEL D	RIVEN PLATE WARPAGE
SERVICE LIMIT	0.15 mm (.006 in)



TYPICAL

Measure the thickness of the clutch plates assembly (friction and steel driven plates).

CLUTCH PLATES ASSEMBLY THICKNESS		
SERVICE LIMIT	45.00 mm (1.772 in)	



A. Service limit

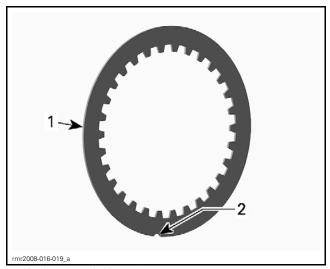
If plates are warped, damaged, or worn out of tolerance, replace all clutch plates.

Clutch Plate Installation

For installation, reverse the removal procedure. However, pay attention to the following.

Thoroughly lubricate **NEW** clutch plates with engine oil before assembly to prevent clutch plates burning during break-in period.

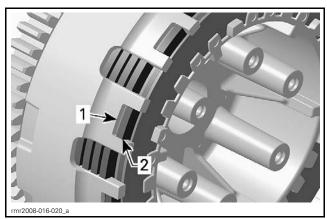
First, install a hardened steel driven plate marked with a notch.



- Hardened steel driven plate
 Marked with notch

Then install friction plates and steel driven plates in alternate order.

Place the tabs of the last friction plate into the shorter slots in the clutch drum.



- Shorter slot
- 2. Last friction plate

Reinstall remaining parts, refer to the applicable instructions.

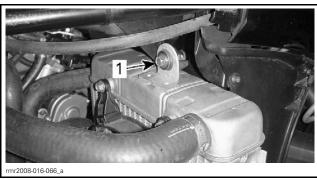
CLUTCH HOUSING

Clutch Housing Removal

Engine Installed in Vehicle

Drain engine oil, refer to LUBRICATION SYSTEM. Drain engine coolant. Refer to COOLING SYS-TEM.

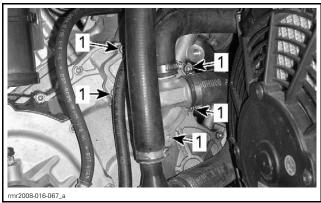
Remove the bolt securing the top of the coolant radiator.



TYPICAL

1. Radiator mounting bolt

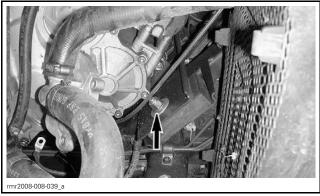
Remove water pump cover screws.



TYPICAL

1. Water pump cover screws

Move radiator rearward and unscrew the front engine mount bolt.



TYPICAL

Remove DIAPHRAGM. See procedure in this subsection.

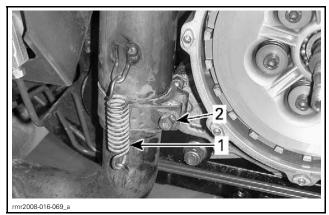
Disconnect the oil pressure switch connector.



1. Oil pressure switch connector

Remove exhaust spring.

Unscrew exhaust clamp and turn it in order to access the clutch housing screw behind.



TYPICAL

- 1. Exhaust spring
- 2. Exhaust clamp

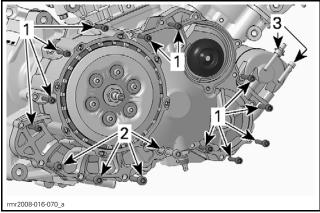
Complete the clutch housing removal by following the steps detailed in *ENGINE REMOVED FROM VEHICLE*.

Engine Removed from Vehicle

Place a drain pan under the clutch housing to catch oil spillage.

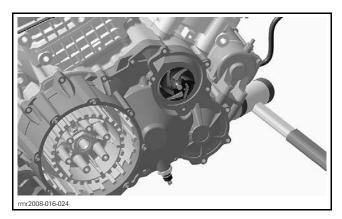
Remove starter screws.

Remove all clutch housing screws.



- 1. M6 retaining screws (11)
- 2. M8 retaining screws (4)
- 3. Starter screws

Remove the clutch housing. Gently tap on clutch housing using a soft hammer to separate it from the crankcase.

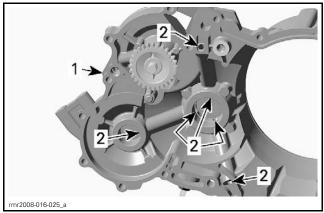


Clutch Housing Inspection

Inspect the clutch housing for cracks or other damages. Replace if necessary.

Check sealing surface for flatness.

Clean oil orifices in clutch housing from contaminants using PULLEY FLANGE CLEANER (P/N 413 711 809), then use an air gun to dry it.

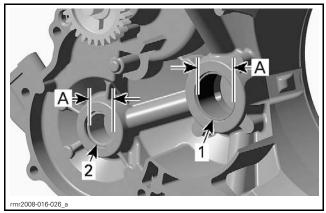


- 1. Clutch housing
- Clean oil bores

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Inspect plain bearings for scoring or other damages.

Measure plain bearing inside diameters and compare to the crankshaft and balance shaft journal diameters (support bearings). Refer to *BOTTOM END* subsection. Replace if measurement is out of specification.



- 1. Plain bearing (crankshaft support)
- 2. Plain bearing (balance shaft support)
- A. Measure plain bearing inside diameter

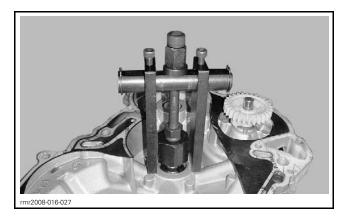
SERVICE LIMIT OF PLAIN BEARING INSIDE DIAMETER	
Crankshaft support bearing	30.040 mm (1.1827 in)
Balance shaft support bearing	20.060 mm (.7898 in)

Plain Bearing Replacement in Clutch Housing

Plain Bearing Removal

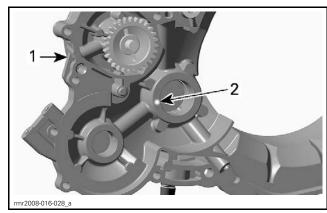
Mark the joint locations of the plain bearing segments on the clutch housing, prior to removing the plain bearings.

Pull out the plain bearings using the BLIND HOLE BEARING PULLER SET (P/N 529 036 117).



Plain Bearing Installation

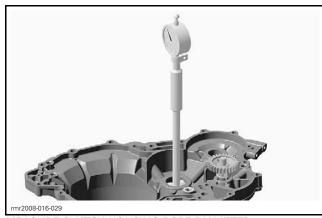
Crankshaft support plain bearings are available in 3 tolerance groups (red, blue and yellow). The proper tolerance group is marked with paint on the clutch housing.



1. Clutch housing

2. Paint marking of tolerance group

If paint marking is not visible anymore, measure inside diameter of clutch housing bore where plain bearings are inserted.



MEASURE CLUTCH HOUSING BORE DIAMETER

Use the following table to find proper tolerance group of plain bearing.

CLUTCH HOUSING BORE DIAMETER	PLAIN BEARING TOLERANCE GROUP
32.921 mm to 32.930 mm (1.2961 in to 1.2965 in)	Red
32.930 mm to 32.940 mm (1.2965 in to 1.2969 in)	Blue
32.940 mm to 32.951 mm (1.2969 in to 1.2973 in)	Yellow

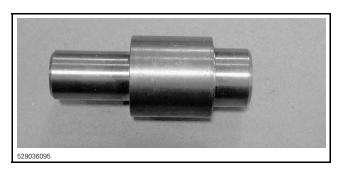
NOTICE Unless otherwise instructed, never use a hammer to install plain bearings. Plain bearings should only be installed using a press.

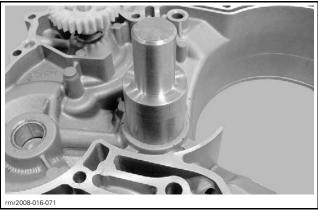
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Heat clutch housing up to 100°C (212°F) before installing plain bearings.

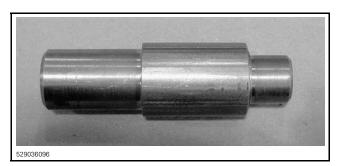
Install plain bearings using the appropriate plain bearing installer.

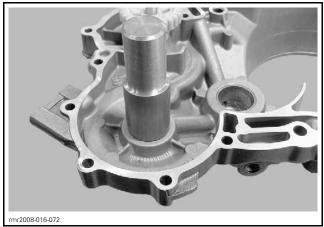
PLAIN BEARING	SERVICE TOOL PART NUMBER
Crankshaft support bearing	529 036 095
Balance shaft support bearing	529 036 096





PLAIN BEARING INSTALLER — CRANKSHAFT SUPPORT **BEARING**





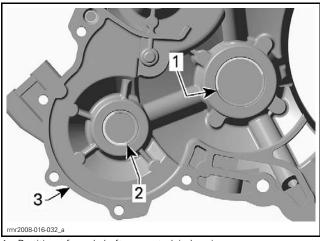
PLAIN BEARING INSTALLER — BALANCE SHAFT SUPPORT

Fit the plain bearings with PETAMO GREASE GHY 133N (P/N 420 899 271).

Support the clutch housing with a suitable support under the bearing seat. Use an O-ring to hold the plain bearings together during installation. Then carefully press-in the plain bearings.

NOTE: Remove O-ring just before plain bearings are completely pressed in.

NOTICE The plain bearing segments must be positioned as marked during removal.



- Partition of crankshaft support plain bearing
 Partition of balance shaft support plain bearing
 Clutch housing

Clutch Housing Installation

For installation, reverse the removal procedure. However, pay attention to the following.

Install a NEW clutch housing gasket and NEW sealing washers.

Lubricate plain bearings with PETAMO GREASE GHY 133N (P/N 420 899 271), before installing clutch housing.

Torque clutch housing screws using crisscross pattern.

Reinstall remaining parts, refer to the appropriate instructions.

CLUTCH HUB

Clutch Hub Removal

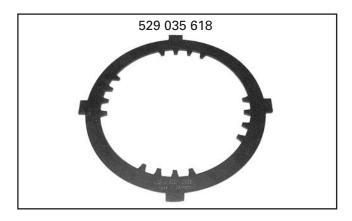
Remove:

- Clutch cover
- Clutch plates.

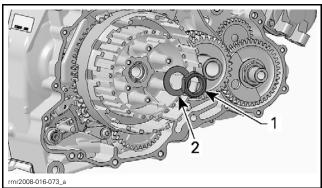
See procedures in this subsection.

Lock crankshaft in TDC position, refer to CRANKCASE AND CRANKSHAFT.

Install CLUTCH ASSEMBLY HOLDER (P/N 529 035 618).

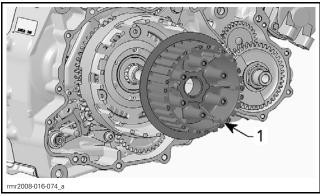


Remove the clutch hub locking nut and spring washer.



Clutch hub locking nut
 Spring washer

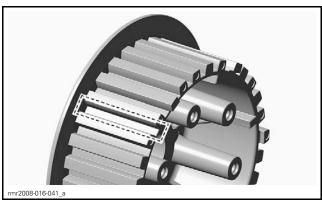
Remove clutch hub.



1. Clutch hub

Clutch Hub Inspection

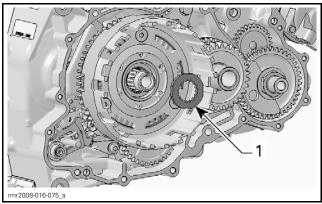
Inspect grooves in clutch hub for damages or wear caused by steel driven plates. Replace if necessary.



INSPECT GROOVES IN CLUTCH HUB FOR WEAR

Clutch Hub Installation

Ensure clutch drum thrust washer is installed on clutch shaft ahead of clutch drum assembly before installing the clutchhub.



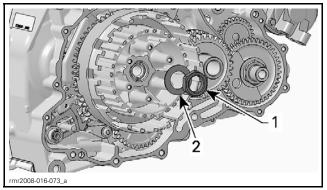
1. Clutch drum thrust washer

Apply PETAMO GREASE GHY 133N (P/N 420 899 271) on clutch hub teeth.

Insert clutch hub.

Reinstall spring washer and hub retaining nut.

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Clutch hub retaining nut Spring washer

Apply LOCTITE 648 (GREEN) (P/N 413 711 400) on hub retaining nut threads.

Torque nut to 190 N•m (140 lbf•ft).

Reinstall remaining parts, refer to the appropriate instructions in this subsection.

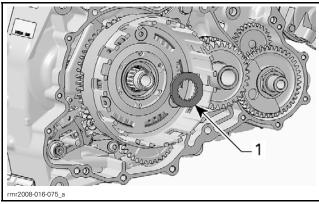
CLUTCH DRUM

Clutch Drum Removal

Remove the following items, see procedures in this subsection.

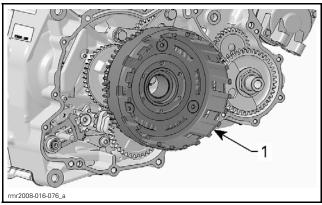
- Clutch cover
- Clutch disk assembly
- Clutch hub
- Clutch housing.

Remove the clutch drum thrust washer.



Clutch drum thrust washer

Remove the clutch drum.



1. Clutch drum

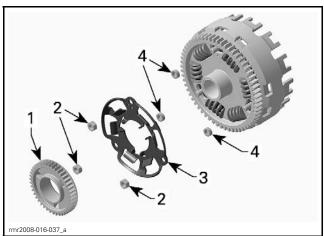
Clutch Drum Disassembly

Remove the oil pump drive gear.

Remove retaining nuts.

Remove the outer support plate.

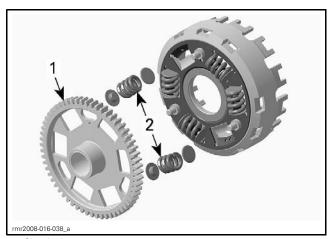
Remove distance sleeves.



- Oil pump drive gear
- Retaining nuts Outer support plate Distance sleeves

NOTE: Mark the position of springs and retainers, prior to removing them.

Remove clutch drum and gear together as well as both white marked springs and their spring retainers.



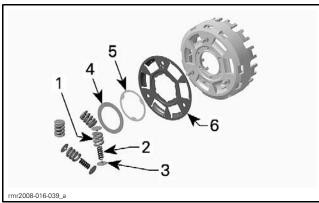
- 1. Clutch drum gear
- 2. Springs with white marks

Remove all other springs with their spring retainers.

Remove the disc spring.

Remove the thrust washer.

Remove the inner support plate.



- 1. Outer compression springs
- 2. Inner compression springs
- 3. Spring retainers
- 4. Disc spring
- 5. Thrust washer
- 6. Inner support plate

Clutch Drum Inspection

Compression Springs and Retainers

Measure free length of each compression spring, refer to the following table.

COMPRESSION SPRING FREE LENGTH		
SERVICE LIMIT		
Outer springs and white marked springs	26.75 mm (1.053 in)	
Inner springs	25.65 mm (1.01 in)	

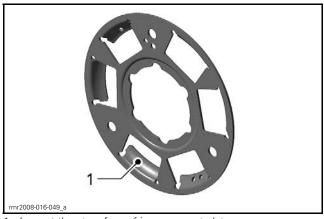
If a spring is out of specification, replace all springs as well as all spring retainers.

Inspect spring retainers for wear, cracks or scoring. Replace all springs and all spring retainers as an assembly.

Support Plates

Inspect support plates for cracks or abnormal wear. Replace if necessary.

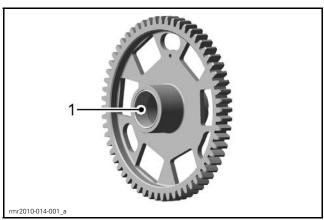
Inspect the thrust surface of inner support plate for abnormal wear or grooves. If necessary, replace inner support plate, thrust washer and disc spring as an assembly.



1. Inspect thrust surface of inner support plate

Clutch Drum Gear

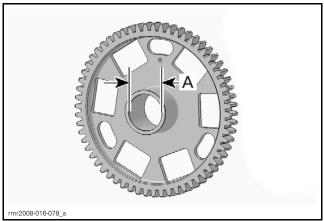
Inspect bearing sleeve for scoring and wear.



1. Bearing sleeve surface

Measure inner diameter of bearing sleeve.

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A. Inner diameter

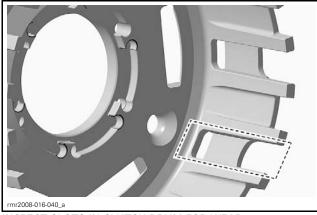
BEARING SLEEVE INNER DIAMETER		
SERVICE LIMIT	30.060 mm (1.183 in)	

Inspect teeth condition for pitting or other damage.

Replace clutch drum gear with drive gear if necessary.

Clutch Drum

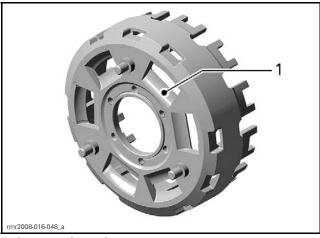
Inspect slots in clutch drum for damages or wear caused by friction plates. Replace if necessary.



INSPECT SLOTS IN CLUTCH DRUM FOR WEAR

Inspect spring cavities for deep grooves caused by springs. Replace clutch drum if necessary.

NOTE: Slight markings caused by the springs are normal. Do not replace clutch drum needlessly.



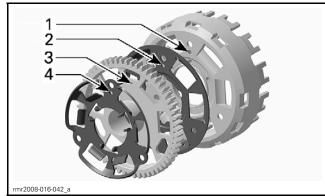
1. Inspect spring cavity

Clutch Drum Assembly

NOTICE Assembly of the clutch drum must be carried out with the utmost care. Failure to strictly follow procedures may cause parts to loosen and/or malfunction of the clutch drum and may lead to serious engine damage.

Assemble the clutch drum in the reverse order of disassembly. However, pay attention to the following details.

NOTICE The position of the clutch drum, support plates and clutch drum gear for assembly is clearly indicated with location holes in each part. During assembly, ensure that all location holes are aligned with each other.



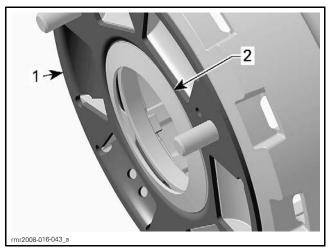
ALIGNMENT OF LOCATION HOLES OF CLUTCH DRUM PARTS

- 1. Hole in clutch drum
- 2. Hole in inner support plate
- 3. Hole in clutch drum gear
- 4. Hole in outer support plate

Insert the three M8 X 25 flat head screws from the inside of the drum. Hold the screws in position as you install the remaining parts.

Install inner support plate on clutch drum, ensure the location holes are aligned with each other.

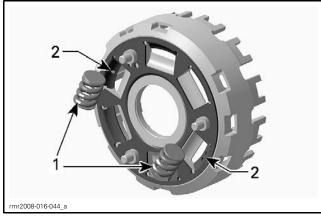
Install **NEW** disc spring with the concave side facing the inner support plate.



Support plate
 Disc spring

Install the clutch drum gear, ensure the location holes are aligned with each other.

Install both white marked springs with spring retainers into the corresponding spring cavities which are marked with punched holes inside the inner support plate.

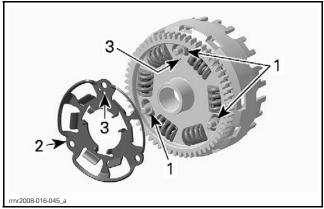


1. White marked springs

2. Spring cavities marked with punched holes

Install remaining springs and retainers into spring cavities.

Install distance sleeves on clutch drum screws, then outer support plate. Ensure that the location holes are aligned with each other.



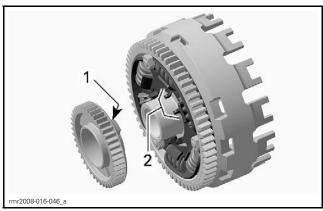
- 1. Distance sleeves
- 2. Outer support plate
- 3. Location holes

Install retaining nuts on clutch drum screws.

Apply LOCTITE 648 (GREEN) (P/N 413 711 400) on threads of retaining nuts.

Torque nuts to 30 N•m (22 lbf•ft).

Finally install oil pump gear. Ensure that tabs of oil pump gear engage in cavities of outer support plate.



- 1. Tabs of oil pump gear
- 2. Cavities of outer support plate

Functional Test

After assembly of the clutch drum is complete, check for torsion of the clutch drum on clutch drum gear by doing the following.

- Reinstall clutch drum on clutch shaft.
- Ensure crankshaft is locked at piston TDC.
- Try to turn clutch drum.

There must be no free-play between clutch drum and clutch drum gear.

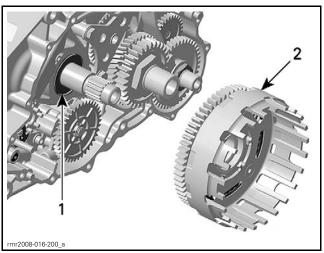
If free-play has been detected, inspect all clutch drum components (e.g. disk spring, thrust washer, inner support plate). Refer to *CLUTCH DRUM INSPECTION* in this subsection.

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Clutch Drum Installation

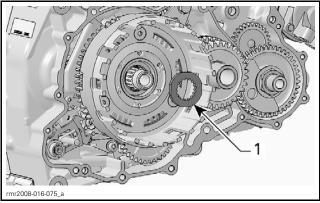
For installation, reverse the removal procedure. However, pay attention to the following.

Insert the first thrust washer on the clutch shaft. Insert clutch drum on the clutch shaft.



1. Thrust washer 2. Clutch drum

Install the other thrust washer on clutch shaft.



1. Thrust washer

Install clutch hub and all remaining parts. See procedures in this subsection.

COOLING SYSTEM

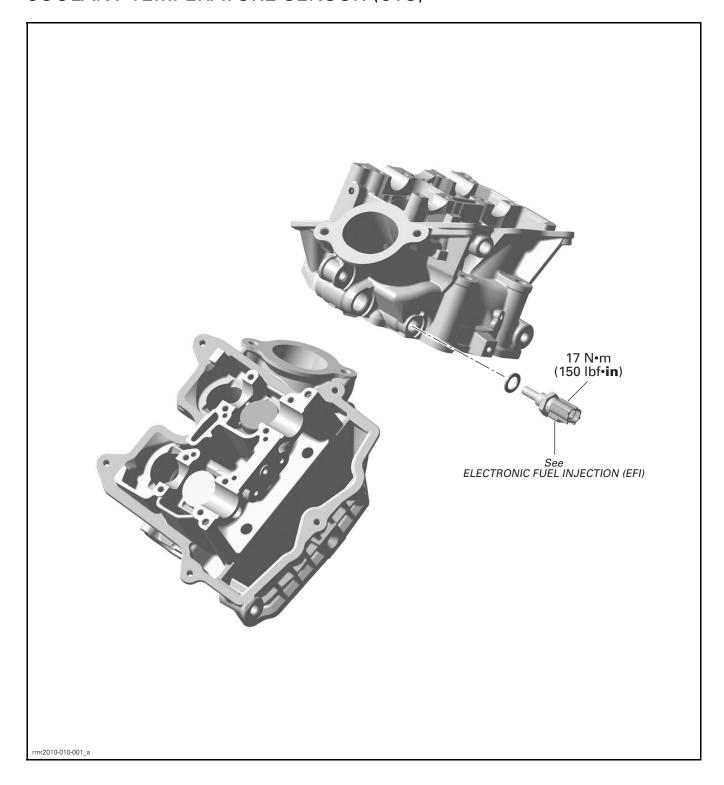
SERVICE TOOLS

Description	Part Number	Page
HANDLE	420 877 650	12
LARGE HOSE PINCHER	529 032 500	9
OETIKER PLIERS	295 000 070	7–9
OIL SEAL PUSHER	529 035 757	12
TEST CAP	529 035 991	6
VACUUM/PRESSURE PUMP	529 021 800	6
WATER PUMP CERAMIC SEAL INSTALLER	529 035 766	12

SERVICE PRODUCTS

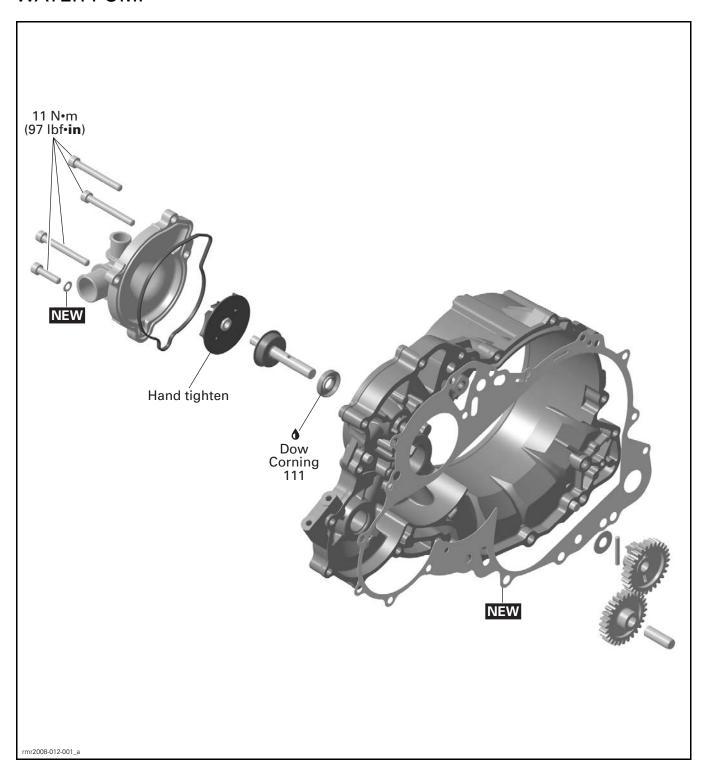
Description	Part Number	Page
BRP PREMIXED COOLANT	219 700 362	5
DOW CORNING 111	413 707 000	12

COOLANT TEMPERATURE SENSOR (CTS)

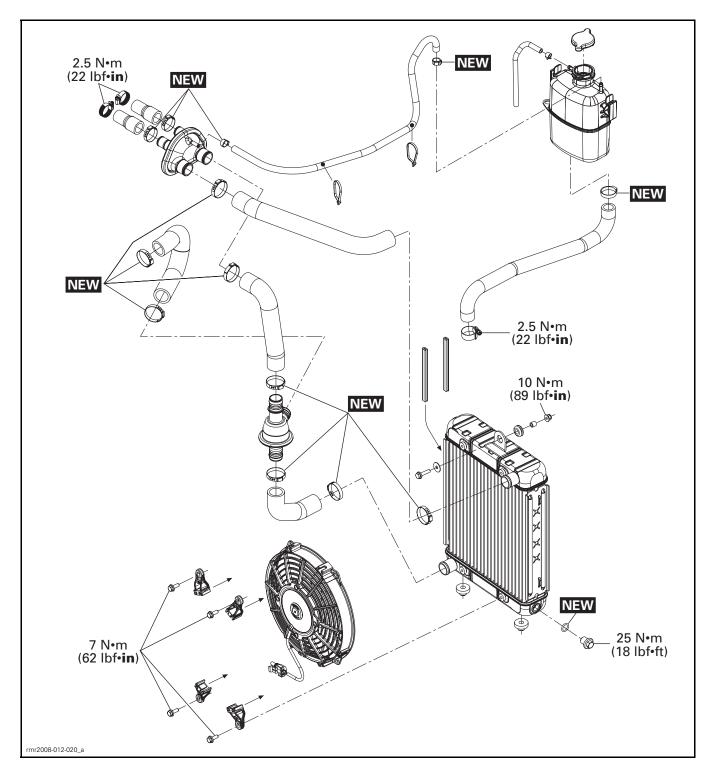


3

WATER PUMP



RADIATOR, COOLING FAN, THERMOSTAT AND COOLANT TANK



GENERAL

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

A WARNING

Torque wrench tightening specifications must be strictly adhered to.

Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pin, etc.) must be replaced with new ones.

NOTICE Hoses, cables or locking ties removed during a procedure must be reinstalled as per factory standards.

MAINTENANCE

ENGINE COOLANT

WARNING

To avoid potential burns, do not remove the coolant tank cap or loosen the cooling drain plug if the engine is hot.

Recommended Coolant

Use BRP PREMIXED COOLANT (P/N 219 700 362) or a blend of 50% antifreeze with 50% distilled water.

To prevent antifreeze deterioration, always use the same brand. Never mix different brands unless cooling system is completely flushed and refilled.

NOTICE To prevent rust formation or freezing condition, always replenish the system with the BRP premixed coolant or with 50% antifreeze and 50% distilled water. Do not use tap water, straight antifreeze or straight water in the system. Tap water contains minerals and impurities which build up in the system. During cold weather, straight water causes the system to freeze while straight antifreeze thickens and does not have the same efficiency. Always use ethylene glycol antifreeze containing corrosion inhibitors specifically recommended for aluminum engines.

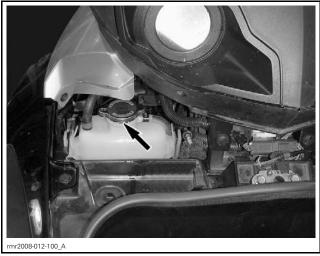
Draining Engine Coolant

Open the front storage compartment cover.

Refer to *BODY* subsection and remove on the RH side of vehicle:

- Service cover
- Middle side panel
- Bottom front side panel.

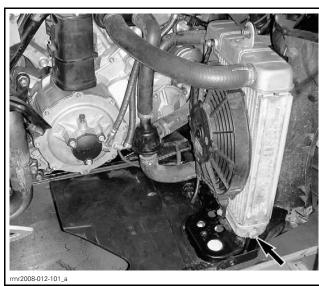
Remove coolant tank pressure cap.



TYPICAL

Place a drain pan under radiator drain plug.

Drain engine coolant by removing the drain plug from radiator.



TYPICAL

Discard the O-ring on drain plug.

Adding Engine Coolant

Ensure vehicle is on a flat surface and engine is cold.

5

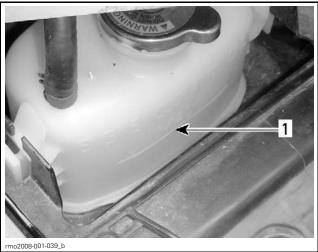
Subsection XX (COOLING SYSTEM)

Install a **NEW** O-ring on drain plug.

Torque drain plug to 25 N•m (18 lbf•ft).

Using a long reach funnel, fill cooling system until coolant reaches upper level mark of coolant tank.

NOTE: Filling requires approximately 3.2 L (3.4 qt (U.S. liq.)) of coolant.



TYPICAL

1. Upper level mark

Do not install coolant tank pressure cap yet.

Run engine until thermostat opens, then stop engine.

NOTE: Use B.U.D.S. to monitoring engine temperature. The thermostat opening begins at 75°C (167°F). The coolant tank should be hot.

Let engine cool down.

Recheck coolant level and top up if necessary.

Test the density of the coolant using an antifreeze hydrometer. Follow the hydrometer manufacturer instruction for proper use.

NOTICE Ensure the coolant density is adequate to avoid any damages from freezing.

Reinstall pressure cap.

Reinstall removed parts.

INSPECTION

COOLING SYSTEM LEAK TEST

A WARNING

In order to avoid getting burned, do not remove the coolant tank cap or loosen the engine drain plug if the engine is hot.

Open the front storage compartment cover.

Remove the service cover on the RH side. Refer to *BODY* subsection.

Remove coolant tank cap.

Install the TEST CAP (P/N 529 035 991) on filler neck of coolant tank.

Pressurize the system through coolant tank to 90 kPa (13 PSI) by using the pump included in the VACUUM/PRESSURE PUMP (P/N 529 021 800).



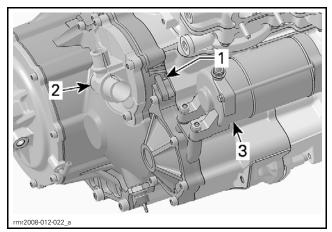




TYPICAL

If pressure drops, check all hoses, radiator and cylinder/base for coolant leaks. Spray a soap/water solution and look for air bubbles.

Inspect the engine leak indicator hole.



TYPICAL

- Leak indicator hole Water pump housing
- 3. Starter

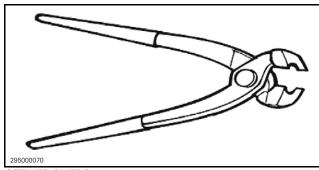
NOTE: Leaking coolant indicates a damaged rotary seal on water pump side. Refer to WATER PUMP SHAFT AND SEALS in this subsection.

PROCEDURES

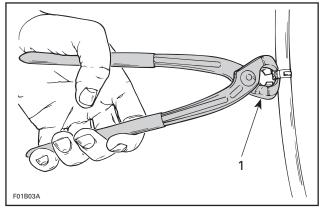
OETIKER CLAMPS

Oetiker Clamp Replacement

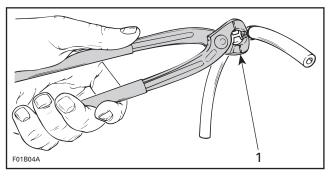
To secure or cut Oetiker clamps, use OETIKER PLI-ERS (P/N 295 000 070).



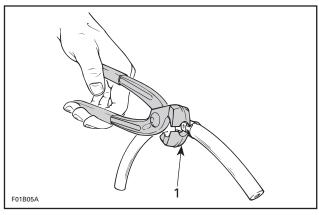
OETIKER PLIERS



1. Cutting clamp



1. Securing clamp



1. Securing clamp in limited access

COOLING FAN

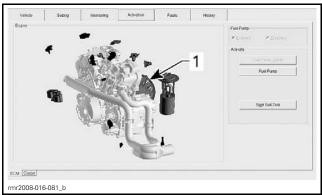
The cooling fan turns on when engine coolant temperature reaches 102°C (216°F).

Coolant Fan Test with B.U.D.S.

Connect B.U.D.S. Refer to COMMUNICATION TOOLS AND B.U.D.S. SOFTWARE.

In B.U.D.S., select Activation folder then the ECM page.

Press on the cooling fan to activate it.



1. Activate fan here

If cooling fan works, check coolant temperature sensor (CTS).

Subsection XX (COOLING SYSTEM)

If the cooling fan does not work, check the 10 A fuse. If fuse is good, check the cooling fan relay.

Cooling Fan Relay Test

Remove the cooling fan relay (R4). Refer to POWER DISTRIBUTION subsection.

Install a jumper wire end between pins D8 and C7. If the fan works correctly by jumping the relay, replace the relay.

If the fan does not work, check the wiring harness and connectors between fuse box and cooling fan.

If the fan does not work after all tests, replace it.

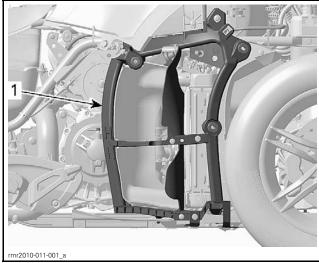
Cooling Fan Removal

Refer to BODY and remove the following panels on the RH side:

- Middle Side Panel
- Top Side Panel
- Bottom Rear Side Panel
- Bottom Front Side Panel
- Rear Side Panel

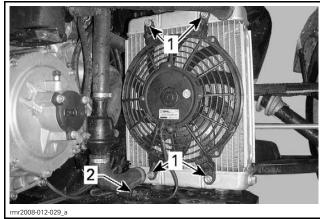
Remove headlight adjustment cable from LH middle side panel support.

Remove RH middle side panel support.



1. Middle side panel support

Remove screws securing cooling fan to radiator. Unplug fan connector.



TYPICAL

- Cooling fan screws Cooling fan connector

Cooling Fan Installation

For the installation, reverse the removal procedure.

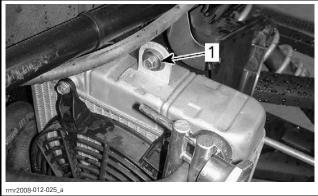
RADIATOR

Radiator Removal

For access, refer to COOLING FAN REMOVAL in this subsection.

Drain the engine coolant. Refer to ENGINE COOLANT in this subsection.

Unscrew bolt on the top of radiator.



TYPICAL 1. Radiator bolt

Unplug the cooling fan connector.

Cut the Oetiker clamps securing hoses to radiator using the OETIKER PLIERS (P/N 295 000 070). Refer to OETIKER CLAMPS in this subsection for instructions

Disconnect radiator hoses.

Lift radiator and remove it from vehicle.

Unscrew cooling fan from radiator.

Radiator Inspection

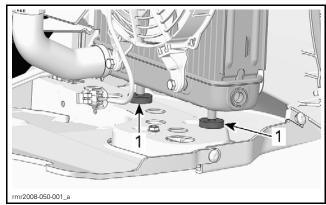
Check radiator fins for clogging or damage.

Remove insects, mud or other obstructions with low pressure water.

Radiator Installation

For installation, reverse the removal procedure. However, pay attention to the following.

Make sure the rubber mounts between bottom of radiator and frame are not missing.



TYPICAL

1. Radiator rubber mounts

Install a **NEW** radiator drain plug O-ring.

Add engine coolant and bleed cooling system. Refer to *ENGINE COOLANT* in this subsection.

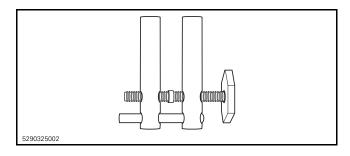
THERMOSTAT

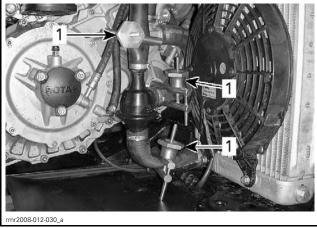
The thermostat is a single action type mounted externally to the engine on the RH side. The thermostat starts opening when engine coolant reaches 75°C (167°F).

Thermostat Removal

For access, refer to *COOLING FAN REMOVAL* in this subsection.

Install a LARGE HOSE PINCHER (P/N 529 032 500) on each cooling hoses from thermostat housing.





TYPICAL

1. Hose pinchers

NOTE: As an alternative method, drain the engine coolant. Refer to *ENGINE COOLANT* in this subsection for the procedure.

Using the OETIKER PLIERS (P/N 295 000 070), cut hose clamps. Refer to *OETIKER CLAMPS* in this subsection for instructions.

Pull out thermostat housing. Catch spilled coolant.

Thermostat Test

To check thermostat, put housing in water and heat water. Thermostat should begin to open when water temperature reaches 75°C (167°F).

Thermostat Installation

For installation, reverse the removal procedure. Pay attention to the following.

Thermostat must be installed with its wider section toward the bottom.

Install NEW clamps using Oetiker pliers.

Refill coolant tank and bleed cooling system.

COOLANT TANK CAP

Coolant Tank Cap Inspection

Using a pressure cap tester, check opening pressure 90 kPa (13 PSI).

COOLANT TANK

The coolant expands as the temperature and pressure rise in the system. If the limiting system working pressure cap is reached 90 kPa (13 PSI), the pressure relief valve in the pressure cap is lifted from its seat and allows coolant to flow through the overflow hose into the coolant tank.

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Subsection XX (COOLING SYSTEM)

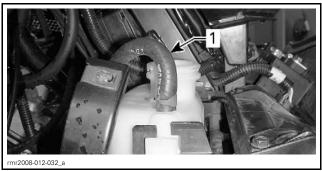
Coolant Tank Removal

Drain the engine coolant. Refer to ENGINE COOLANT in this subsection.

Remove the front fascia. Refer to BODY subsection.

Remove the RH side headlight. Refer to LIGHTS, GAUGE AND ACCESSORIES subsection.

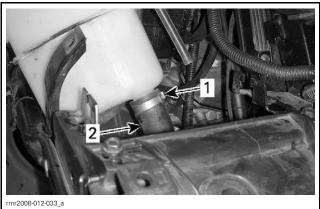
Disconnect the overflow hose on the top of coolant tank.



TYPICAL 1. Overflow hose

Unlatch coolant tank and lift it.

Cut the Oetiker clamp securing coolant tank hose.



TYPICAL

- 1. Oetiker clamp
- 2. Coolant hose

Remove hose from coolant tank.

Coolant Tank Installation

The installation is the reverse of the removal procedure.

WATER PUMP HOUSING

Water Pump Housing Removal

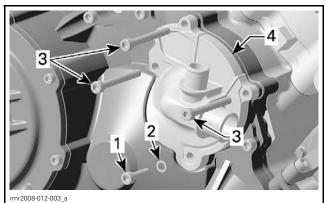
For access, refer to COOLING FAN REMOVAL in this subsection.

WARNING

To avoid potential burns, do not remove the coolant tank cap or loosen the cooling drain plug if the engine is hot.

ENGINE Drain cooling system. Refer to COOLANT in this subsection.

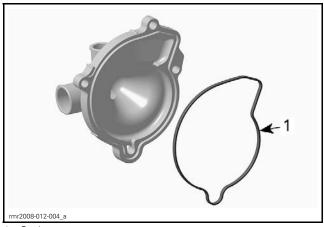
Remove water hoses from water pump housing. Remove screws retaining water pump housing.



- Cooling drain plug
- Sealing ring
- Water pump cover

Water Pump Housing Inspection

Check if gasket is brittle, hard or damaged and replace as necessary.



1. Gasket

Water Pump Housing Installation

The installation is the opposite of the removal procedure.

NOTICE To prevent leaking, take care that the gasket is exactly in groove when you reinstall the water pump housing.

Tighten screws of water pump housing in a crisscross sequence.

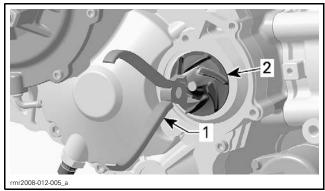
WATER PUMP IMPELLER

Water Pump Impeller Removal

Remove water pump housing. See procedure in this subsection.

Use proper snap ring pliers to unscrew water pump impeller.

NOTE: Water pump shaft and impeller have righthand threads. Remove by turning counterclockwise and install by turning clockwise.



TYPICAL

- Snap ring pliers
- 2. Water pump impeller

Remove impeller from water pump shaft.

Water Pump Impeller Inspection

Check impeller for cracks or other damage. Replace impeller if damaged.

Water Pump Impeller Installation

The installation is the opposite of the removal procedure. Pay attention to the following detail.

Tighten water pump impeller by hand. To not overtighten.

WATER PUMP SHAFT AND **SEALS**

Water Pump Shaft/Seal Removal

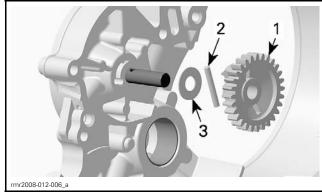
Remove clutch cover. Refer to the appropriate clutch subsection.

Remove water pump housing and impeller, see procedures in this subsection.

Pull water pump gear to remove it.

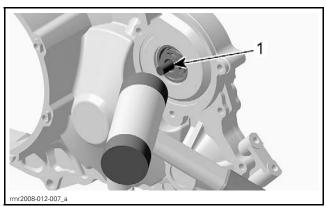
Remove needle pin.

Remove thrust washer.



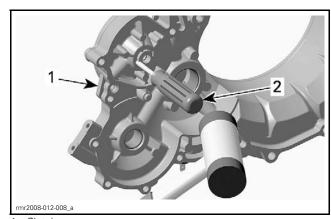
- Water pump gear
- Needle pin
 Thrust washer

Sharply strike out water pump shaft from the outside towards the inside, using a plastic hammer.



1. Water pump shaft

Use a suitable 4 mm (.157 in) punch and strike out oil seal and rotary seal together from inside towards the outside.

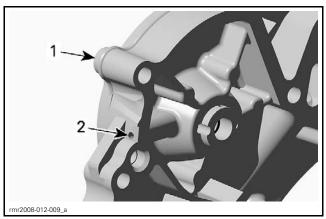


- 1. Clutch cover 2. Punch

Water Pump Shaft/Seal Inspection

Clean leak indicator hole in clutch cover from contamination.

Subsection XX (COOLING SYSTEM)



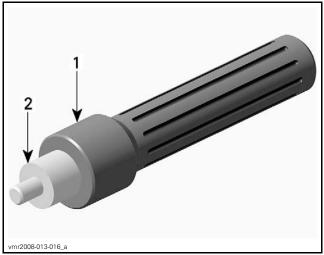
- Clutch cover
 Leak indicator hole
- Water Pump Shaft/Seal Installation

For installation, reverse the removal procedure.

NOTICE Always replace rotary seal and water pump shaft together. Also, install a NEW oil seal (behind rotary seal) at the same time.

NOTE: Never use oil in the press fit area of the oil seal.

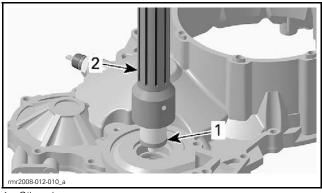
Use the OIL SEAL PUSHER (P/N 529 035 757) and the HANDLE (P/N 420 877 650) to install oil seal.



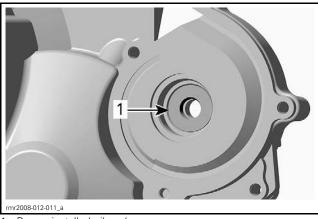
Handle
 Oil seal pusher

Apply DOW CORNING 111 (P/N 413 707 000) on sealing lip and push oil seal in place.

NOTE: Sealing lip must face towards the inside of clutch cover.

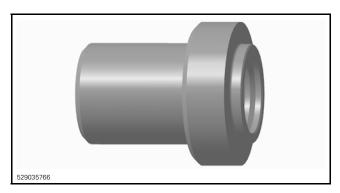


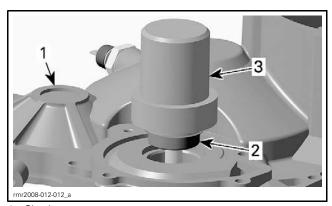
1. Oil seal 2. Installer handle with oil seal pusher



1. Proper installed oil seal

Carefully press-in water pump shaft assembly into clutch cover, using the WATER PUMP CERAMIC SEAL INSTALLER (P/N 529 035 766).

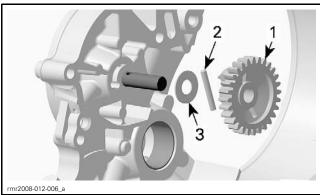




- Clutch cover
 Water pump shaft assembly
 Rotary seal installer

NOTICE Never use a hammer for water pump shaft assembly installation. Use press only.

Reinstall thrust washer, needle pin and water pump gear.



- Water pump gear
 Needle pin
 Thrust washer

Reinstall water pump impeller and check if water pump turns smooth after installation.

Properly reinstall remaining parts. Refer to appropriate sections.

CRANKCASE AND CRANKSHAFT

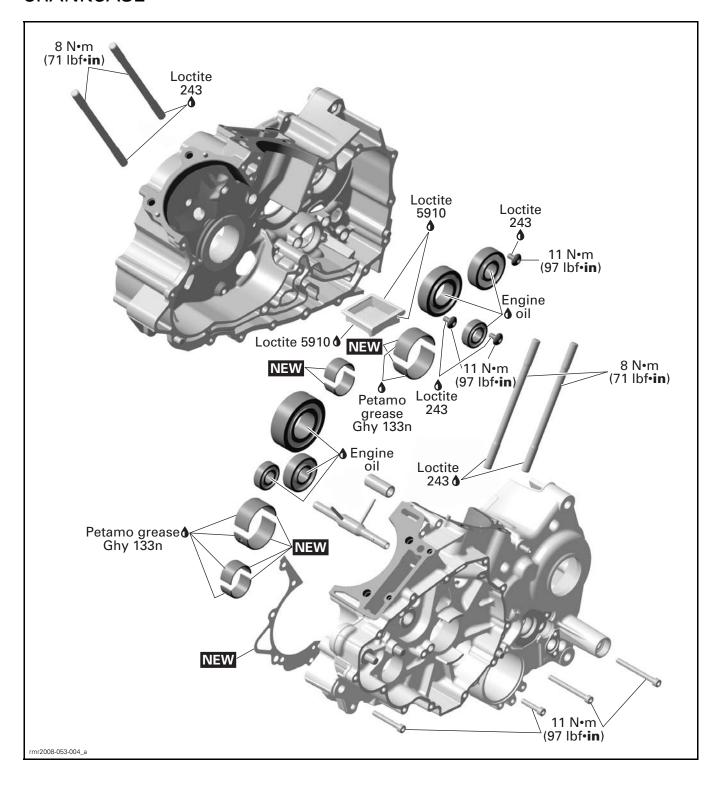
SERVICE TOOLS

Description	Part Number	Page
BALANCE SHAFT PLAIN BEARING REM/INST	529 036 094	
BLIND HOLE BEARING PULLER SET	529 036 117	
CRANKCASE PLAIN BEARING REM/INST	529 036 093	
PULLER/LOCKING TOOL	529 036 098	4–5. 19

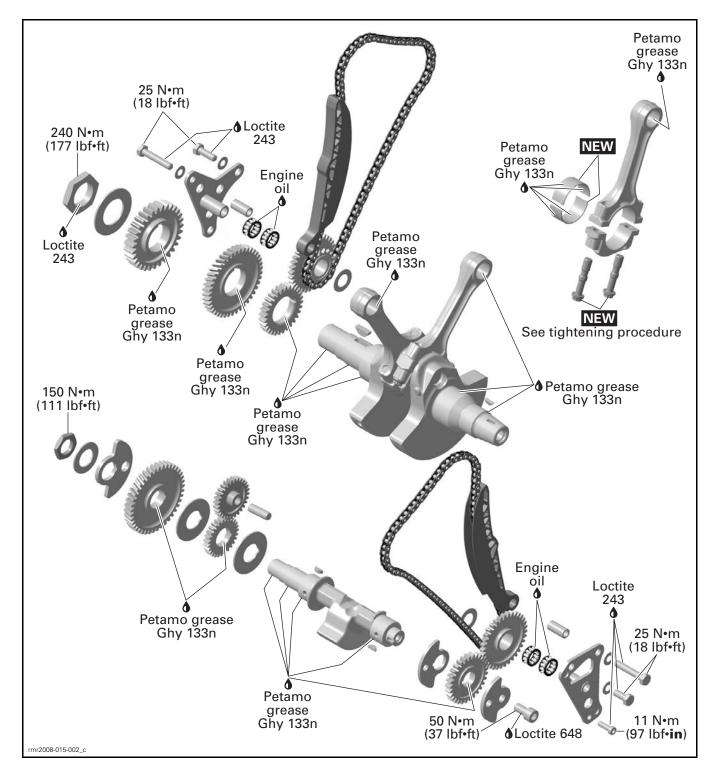
SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	15
LOCTITE 5910	293 800 081	17
PETAMO GREASE GHY 133N	420 899 271	16–17

CRANKCASE



CRANKSHAFT AND BALANCE SHAFT



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3

GENERAL

Always disconnect battery before working on the engine.

Even though many parts do not need to be removed to reach other parts, it is recommended to remove these parts anyway in order to inspect them.

When disassembling parts that are duplicated in the engine, (e.g.: timing chain, drive gears), it is strongly recommended to note their position (front/rear cylinder) and to store them as a "group".

During assembly/installation, use the torque values and service products as specified in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for procedure.

NOTICE Torque wrench tightening specifications must be strictly adhered to.

Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pin, etc.) must be replaced with new ones.

ENGINE REASSEMBLY SEQUENCE

NOTE: This procedure describes only the reassembly sequence of critical components, which are important to achieve the proper camshaft timing for both cylinders. Refer to appropriate topic in this manual for complete instructions.

NOTICE After a complete engine tear down, in order to achieve proper camshaft timing, the following engine reassembly sequence must be strictly followed.

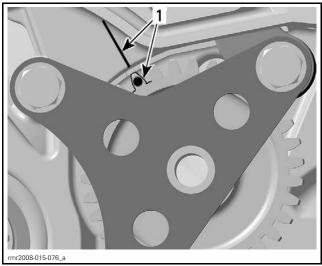
Rear Cylinder Reassembly

Lock crankshaft when connecting rod of rear cylinder is at TDC, using the PULLER/LOCKING TOOL (P/N 529 036 098).



Install timing chain and timing chain drive gears of rear cylinder, refer to *TIMING CHAIN* in this subsection.

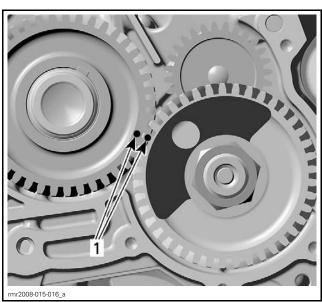
NOTE: Ensure to align mark on timing chain intermediate gear with mark on crankcase, then install mating gear on crankshaft.



1. Align marks

Install water pump drive gears, then balance shaft drive gears.

NOTE: Ensure to align both dots on balance shaft drive gears.



1. Align dots of balance shaft drive gears

Install and torque locking nuts of crankshaft and balance shaft.

Refer to CYLINDER HEAD AND CYLINDER to reinstall the following components of rear cylinder:

- Piston
- Cylinder
- Cylinder head
- Camshaft timing gears

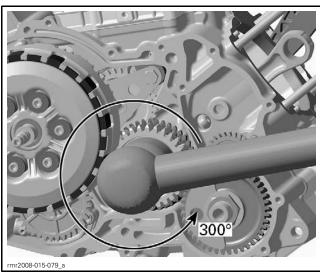
- Timing chain guide and chain tensioner
- Balance shaft drive gears of upper balance shaft.

Reinstall remaining parts of rear cylinder.

Front Cylinder Reassembly

NOTICE Rear cylinder reassembly must be completed FIRST as explained above.

Unscrew the PULLER/LOCKING TOOL (P/N 529 036 098), turn crankshaft on clutch side 300° counterclockwise and lock crankshaft when connecting rod of front cylinder is at TDC.

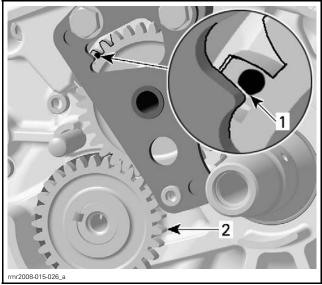


TYPICAL – TURN CRANKSHAFT 300° COUNTERCLOCKWISE

NOTICE Keep connecting rod of front cylinder in central position when turning the crankshaft, to avoid it getting tilted in crankcase.

Install timing chain and timing chain drive gears of front cylinder, refer to *TIMING CHAIN* in this subsection.

NOTE: Ensure to align mark on timing chain intermediate gear with mark on the bearing flange, then install mating gear on balance shaft.



- 1. Align marks
- 2. Timing chain drive gear

Refer to *CYLINDER HEAD AND CYLINDER* to reinstall the following components of front cylinder:

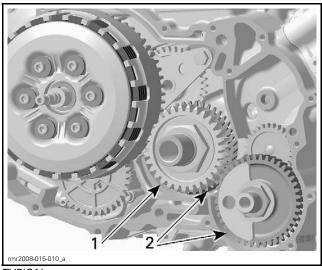
- Piston
- Cylinder
- Cylinder head
- Camshaft timing gears
- Timing chain guide and chain tensioner.

Reinstall remaining parts of front cylinder.

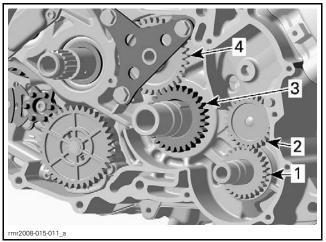
PROCEDURES

DRIVE GEARS

The drive gears are located on the engine clutch side behind the clutch housing.



- TYPICAL
- Primary drive gear
 Balance shaft drive gears



- 1. Water pump gear
- 2. Water pump intermediate gear
- 3. Timing chain drive gears, rear cylinder
- 4. Timing chain intermediate gear, rear cylinder

Drive Gear Removal

Lock crankshaft at ignition TDC of rear cylinder, refer to *CRANKSHAFT* in this subsection.

Remove chain tensioner of rear cylinder.

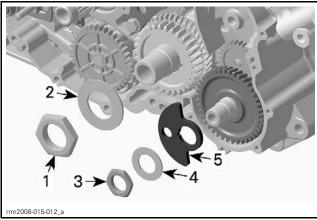
Remove clutch housing and clutch drum assembly. Refer to *CLUTCH* subsection.

Unscrew crankshaft locking nut.

Remove spring washer.

Unscrew balancer shaft locking nut.

Remove spring washer and balancing mass.



- 1. Crankshaft locking nut
- 2. Crankshaft spring washer
- 3. Balance shaft locking nut
- 4. Balance shaft spring washer
- 5. Balancing mass

Remove primary drive gear.

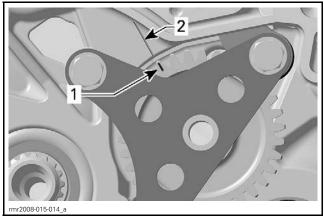
Remove balance shaft drive gears.

Remove thrust washer.

Remove water pump drive gear.

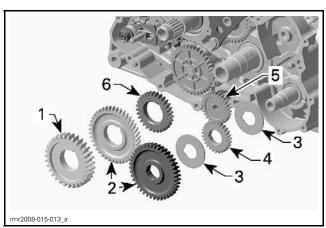
Remove water pump intermediate gear.

Scribe a mark on timing chain intermediate gear aligned with the crankcase molded mark, prior removing timing chain drive gear.



- 1. Scribe a mark on timing chain intermediate gear
- 2. Molded crankcase mark

Remove timing chain drive gear.



- 1. Primary drive gear
- 2. Balance shaft drive gears
- 2. Baiance snan u 3. Thrust washers
- 4. Water pump drive gear
- 5. Water pump intermediate gear
- 6. Timing chain drive gear

Drive Gear Inspection

Inspect gear tooth for wear or other damage. If gears are pitted, scored, rounded, cracked or chipped, they should be replaced.

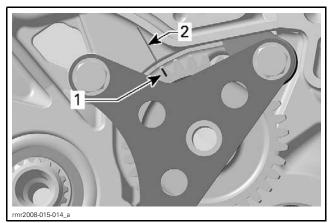
NOTE: Balance shaft drive gears and timing chain drive gears are paired. Replace balance shaft drive gears and timing chain drive gears as a set.

Drive Gear Installation

The installation is essentially the reverse of the removal procedure, but pay attention to the following details.

NOTE: Crankshaft must still be locked at ignition TDC of rear cylinder.

Ensure mark (scribed during removal) of timing chain intermediate gear (rear cylinder) matches with the molded mark on crankcase.



- 1. Mark on timing chain intermediate gear
- 2. Crankcase molded mark

NOTICE Wrong position of timing chain drive gears will lead to wrong camshaft timing and cause severe engine damage.

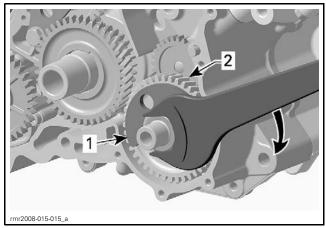
Balance Shaft Drive Gears

NOTICE The following instruction is only valid if camshaft timing gears of front cylinder have not been removed before. In this case, the camshaft of front cylinder is spring loaded and will turn the balance shaft counterclockwise.

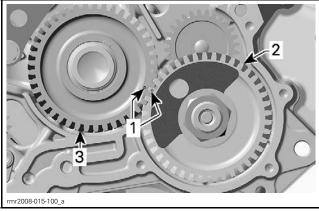
Temporarily install balance shaft drive gears in any position.

Install balancing mass, spring washer and torque locking nut to 150 N•m (111 lbf•ft).

Temporary pull up drive gear from crankshaft and turn balance shaft **clockwise** until marks of drive gears can be aligned. Then install balance drive gear on crankshaft to its final position.



- Balancing mass
- 2. Balance shaft gear



- 1. Align marks balance shaft drive gears
- 2. Balance shaft gear
- 3. Balance shaft drive gear

NOTICE Wrong position of balance shaft drive gears will lead to wrong camshaft timing of front cylinder and cause severe engine damage.

Reinstall remaining parts, use service products and torque values as described in the exploded view.

NOTICE After a complete tear down of the engine, to achieve proper camshaft timing, the *ENGINE REASSEMBLY SEQUENCE* detailed at the beginning of this subsection must be strictly followed.

TIMING CHAIN

The engine is equipped with two timing chains. The front cylinder timing chain is located on the engine MAG side behind the magneto cover. The rear cylinder timing chain is located on the engine clutch side behind the clutch housing.

Timing Chain Removal (Front Cylinder)

Lock crankshaft at ignition TDC of front cylinder, refer to *CRANKSHAFT* in this subsection.

Refer to *CYLINDER HEAD AND CYLINDER* subsection and remove the following parts:

- Valve cover
- Chain tensioner
- Timing chain guide
- Camshaft timing gears.

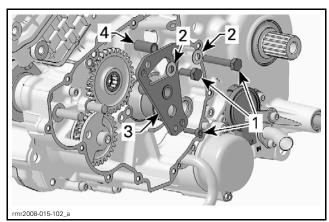
Refer to *MAGNETO AND STARTER* subsection and remove:

- 1. Magneto cover
- 2. Rotor
- 3. Starter drive gears.

Remove screws and spring washers securing the bearing flange.

Remove the bearing flange.

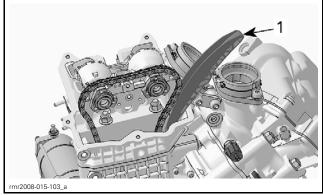
Remove distance sleeve.



TYPICAL

- Retaining screws
- Spring washers Bearing flange
- 4. Distance sleeve

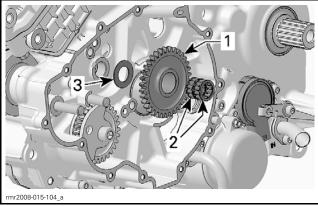
Remove chain tensioner guide.



1. Chain tension guide

Remove timing chain intermediate gear and needle bearings.

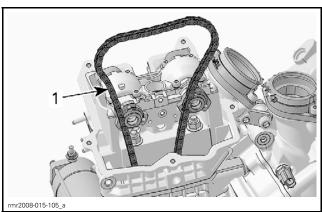
Remove thrust washer.



TYPICAL

- Timing chain intermediate gear
- Needle bearings
- Thrust washer

Remove timing chain.



Timina chain

NOTE: Mark the operating direction of the timing chain before removal.

Timing Chain Removal (Rear Cylinder)

Lock crankshaft at ignition TDC of rear cylinder, refer to CRANKSHAFT in this subsection.

Refer to CYLINDER HEAD AND CYLINDER subsection and remove the following parts:

- Valve cover
- Chain tensioner
- Timing chain guide
- Camshaft timing gears.

Refer to *CLUTCH* subsection and remove:

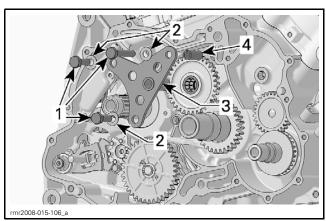
- 1. Clutch housing
- 2. Clutch drum assembly.

Remove primary drive gear and balance shaft gear. See *DRIVE GEARS* in this subsection.

Remove screws and spring washers securing the bearing flange.

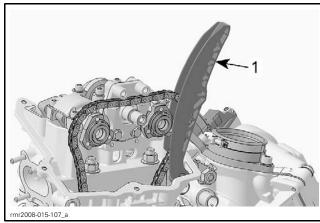
Remove the bearing flange.

Remove distance sleeve.



- Retaining screws
- Spring washers Bearing flange Distance sleeve

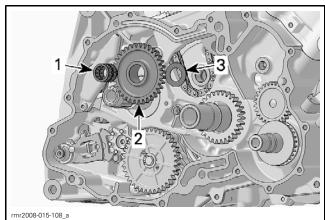
Remove chain tension guide.



1. Chain tension guide

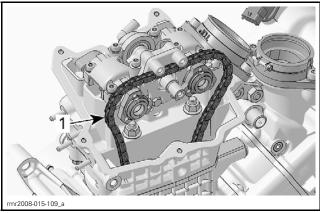
Remove timing chain intermediate gear and needle bearings.

Remove thrust washer.



- Needle bearings
- Timing chain intermediate gear
- 3. Thrust washer

Remove timing chain.



Timing chain

NOTE: Mark the operating direction of the timing chain before removal.

Timing Chain and Drive Gear Inspection

Inspection is the same for both timing chains and timing chain drive gears.

NOTE: Always keep the parts of each cylinder as a group.

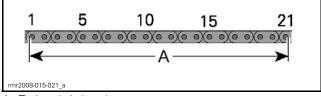
Timing Chain

NOTE: Check timing chain on camshaft timing gear for excessive radial play.

Check chain links condition for wear or other damage.

Measure timing chain length. Mark 21 pins on chain and measure the distance at the outer diameter of pins.

NOTE: Ensure to eliminate play in chain while measuring.



A. Timing chain length

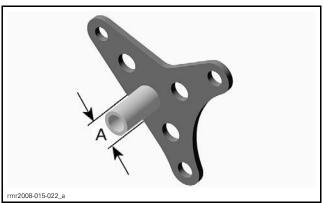
TIMING CHAIN LENGTH (DISTANCE OF 21 PINS)		
SERVICE LIMIT	165.2 mm (6.504 in)	

If chain is excessively worn or damaged, replace it as a set (camshaft timing gears and timing chain).

Bearing Flange

Inspect bearing flange pin for scoring, pitting or other damages.

Measure pin diameter at the running surface of the needle bearings.



A. Pin diameter

BEARING FLANGE PIN DIAMETER		
SERVICE LIMIT	15.980 mm (.6291 in)	

Replace bearing flange if pin is out of specification.

Needle Bearings

Check needles for wear or pitting.

Check needle cage for cracks or other damage. Replace if necessary.

Timing Chain Intermediate Gear

Inspect gear teeth for wear or other damage. If gear is pitted, scored, rounded, cracked or chipped, it should be replaced.

Measure inside diameter of intermediate gear.

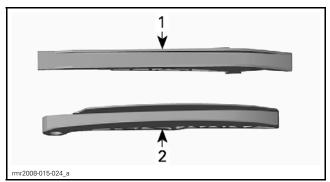


INTERMEDIATE GEA	R INSIDE DIAMETER
SERVICE LIMIT	22.015 mm (.8667 in)

Replace timing chain intermediate gear if out of specification.

NOTE: Timing chain intermediate gear and timing chain drive gear are paired. Replace as a set.

Timing Chain Guide and Chain Tension Guide



Timing chain guide
 Chain tension guide

Check timing chain guide and chain tension guide for wear, cracks, deforming or grooves caused by timing chain.

If groove depth exceed 1.2 mm (.0472 in), replace timing chain guide and/or chain tension guide.

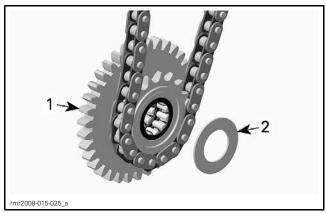
Timing Chain Installation (Front Cylinder)

The installation is essentially the reverse of the removal procedure, but pay attention to the following details.

NOTE: Crankshaft must be still locked at ignition TDC of front cylinder, prior installing timing chain and timing chain drive.

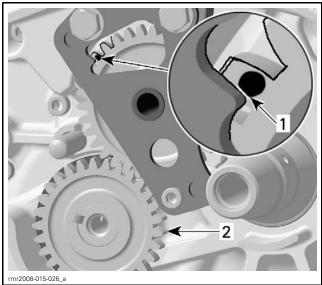
NOTICE After a complete tear down of the engine, to achieve proper camshaft timing, the *ENGINE REASSEMBLY SEQUENCE* detailed at the beginning of this subsection must be strictly followed.

Fit thrust washer with grease onto timing chain intermediate gear, to avoid dropping it into crankcase.



- Timing chain intermediate gear
- 2. Thrust washer

Ensure to align mark on timing chain intermediate gear with mark on bearing flange during installation.



- Align marks
- 2. Timing chain drive gear

NOTICE Wrong position of timing chain drive gears will lead to wrong camshaft timing and cause severe engine damage.

Properly reinstall camshaft timing gears, refer to CAMSHAFT TIMING GEAR in CYLINDER/CYLIN-DER HEAD subsection.

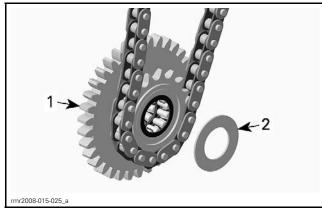
Timing Chain Installation (Rear Cylinder)

The installation is essentially the reverse of the removal procedure, but pay attention to the following details.

NOTE: Crankshaft must be still locked at ignition TDC of rear cylinder, prior installing timing chain and timing chain drive.

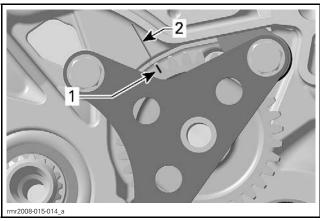
NOTICE After a complete tear down of the engine, to achieve proper camshaft timing, the ENGINE REASSEMBLY SEQUENCE detailed at the beginning of this subsection must be strictly followed.

Fit thrust washer with grease onto timing chain intermediate gear, to avoid dropping it into crankcase.



- Timing chain in
 Thrust washer Timing chain intermediate gear

NOTE: Ensure to align mark on timing chain intermediate gear with mark on crankcase during installation.



- Align mark on timing chain intermediate gear
- Crankcase mark

NOTICE Wrong position of timing chain drive gears will lead to wrong camshaft timing and cause severe engine damage.

Properly reinstall camshaft timing gears, refer to CAMSHAFT TIMING GEAR in CYLINDER/CYLIN-DER HEAD subsection.

CRANKCASE

Remove engine from vehicle, refer to ENGINE RE-MOVAL AND INSTALLATION.

Crankcase Disassembly

Lock crankshaft at ignition TDC of front cylinder, refer to *CRANKSHAFT* in this subsection.

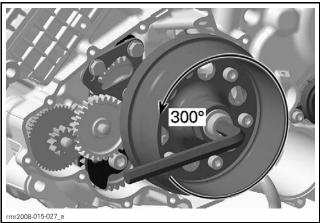
Remove electric starter from engine.

Refer to *CYLINDER/CYLINDER HEAD* subsection to remove the following parts:

- Front cylinder head
- Cylinder
- Piston.

Unscrew crankshaft locking bolt.

Use a 14 mm Allen wrench and turn crankshaft on magneto side 300° counterclockwise, then lock it at ignition TDC of rear cylinder.



TURN CRANKSHAFT 300° COUNTERCLOCKWISE

Refer to *CYLINDER/CYLINDER HEAD* subsection and remove the following parts:

- 1. Rear cylinder head
- 2. Cylinder
- 3. Piston.

Refer to *CLUTCH* subsection to remove the following parts:

- 4. Clutch housing
- 5. Clutch plates
- 6. Clutch hub
- 7. Clutch drum.

Remove *DRIVE GEARS*, see procedure in this subsection.

NOTE: Oil pump removal from crankcase is not necessary, but recommended to see condition of oil pump (refer to *LUBRICATION SYSTEM* subsection).

Remove the oil filter cover and the oil filter.

Refer to *MAGNETO AND STARTER* subsection and remove the following parts:

- 8. Magneto cover
- 9. Rotor
- 10. Starter drive gears.

Refer to *TIMING CHAIN* in this subsection to remove timing chains and timing chain drive gears.

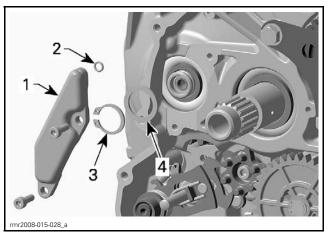
Refer to *GEARBOX* subsection and remove the following parts:

- 11. Front sprocket
- 12. Gearbox position sensor (GBPS)
- 13. Shifting mechanism.

Remove the oil duct cover. Discard O-ring.

Remove the snap ring.

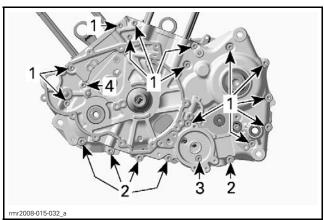
Remove the thrust washer.



- 1. Oil duct cover
- 2. O-ring
- 3. Snap ring
- 4. Thrust washer

NOTE: Before splitting the crankcase, measure crankshaft axial play. Refer to *CRANKSHAFT* in this subsection.

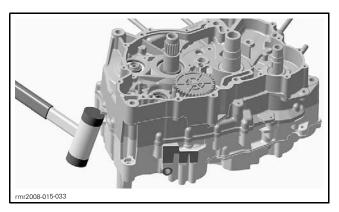
Remove crankcase screws.



- 1. Screws M6 x 65 (qty 13)
- 2. Screws M6 x 45 (qty 5)
- 3. Screw M6 x 30
- 4. Screw M6 x 80

Carefully split crankcase halves by using a soft hammer.

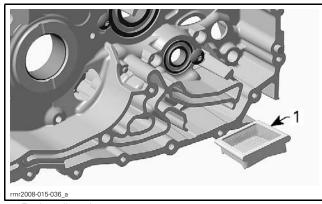
NOTE: During disassembly, do not damage the sealing surfaces of the crankcase halves.



Pull crankshaft and balance shaft out of crankcase. Refer to *GEARBOX* and remove:

- 14. Gearbox
- 15. Reverse intermediate gear.

Remove engine oil strainer from crankcase halve (clutch side).



1. Engine oil strainer

NOTE: For oil strainer inspection, refer to *LUBRI-CATION SYSTEM* subsection.

Crankcase Inspection and Cleaning

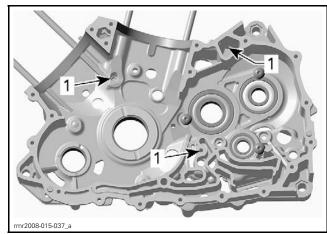
Clean crankcase using a part cleaner.

Dry crankcase using compressed air.

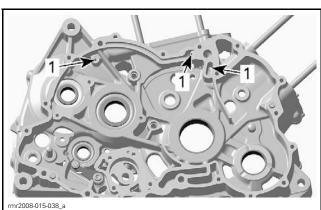
Blow out the oil supply orifices and check if they are not clogged.

A WARNING

Always wear skin and eye protection. Chemicals can cause skin rash, skin burns and severe eye injury.

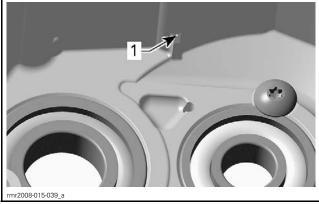


CRANKCASE HALVE — CLUTCH SIDE 1. Check oil supply orifices



CRANKCASE HALVE — CLUTCH SIDE

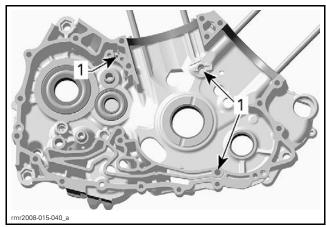
1. Check oil supply orifices



CRANKCASE HALVE — CLUTCH SIDE

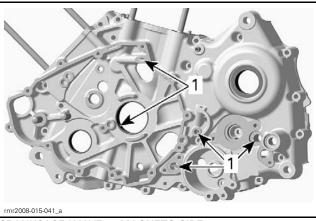
1. Check oil supply hole

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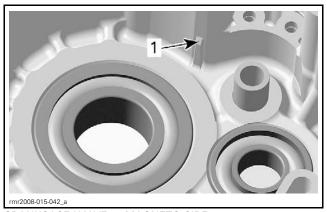
CRANKCASE HALVE — MAGNETO SIDE

1. Check oil supply orifices



CRANKCASE HALVE — MAGNETO SIDE

1. Check oil supply orifices



CRANKCASE HALVE — MAGNETO SIDE

1. Check oil supply hole

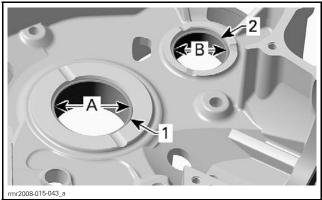
Check crankcase halves for cracks or other damage. Replace if damaged.

Check if oil hose connectors are bent or otherwise damaged. Refer to OIL HOSE CONNECTORS in LUBRICATION SYSTEM subsection if replacement is necessary.

Oil ball bearings and check for smooth operation. Check for excessive play and/or pitting. Replace if necessary.

Check plain bearings for scoring or other dam-

Measure plain bearing inside diameter and compare with crankshaft/balance shaft bearing journal diameters (refer to CRANKSHAFT and BALANCE SHAFT). Replace if the measurements are out of specification.



TYPICAL — CRANKCASE HALVE

- Crankshaft plain bearing
- Balance shaft plain bearing
- A. Measure plain bearing inside diameter crankshaft B. Measure plain bearing inside diameter balance shaft

PLAIN BEARING INSIDE DIAMETER (SERVICE LIMIT)	
CRANKSHAFT	46.035 mm (1.8124 in)
BALANCE SHAFT	32.060 mm (1.2622 in)

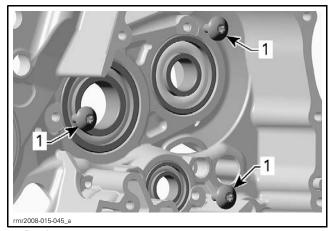
Crankcase Bearing Replacement

Always heat crankcase halves up to 140°C (284°F) for removal and installation of bearings.

NOTICE Always support crankcase halves properly when ball bearings and/or plain bearings are removed and installed. Damages to crankcase halves may occur if this procedure is not performed correctly.

Ball Bearing Removal

Remove screws securing bearings.



1. Bearing screws

Notice the assembly direction of the ball bearings during removal.

Remove clutch shaft ball bearing from magneto side crankcase half, by using the BLIND HOLE BEARING PULLER SET (P/N 529 036 117).

Press out remaining ball bearings with suitable punch.

Ball Bearing Installation

NOTE: As a rule, disassembled ball bearings must be replaced by new ones.

NOTICE Unless otherwise instructed, never use hammer to install ball bearings. Use press only.

Install **NEW** ball bearings in the same direction as during removal, using suitable punch.

Slightly oil ball bearings at the outer race to ease installation.

NOTE: Sealing ring of clutch shaft ball bearing (on magneto side) must face outside the crankcase (bearing balls visible from inside).



A. Sealing ring

Reinstall bearing screws, apply LOCTITE 243 (BLUE) (P/N 293 800 060) and torque to 11 N•m (97 lbf•in).

Plain Bearing Removal

Mark the partition of the plain bearings on crankcase halves, prior removing the plain bearings.

Remove plain bearings with the proper plain bearing remover/installer.

PLAIN BEARING REMOVER/INSTALLER		
CRANKSHAFT	CRANKCASE PLAIN BEARING REM/INST (P/N 529 036 093)	
BALANCE SHAFT	BALANCE SHAFT PLAIN BEARING REM/INST (P/N 529 036 094)	



CRANKSHAFT PLAIN BEARING REMOVER/INSTALLER



BALANCE SHAFT PLAIN BEARING REMOVER/INSTALLER

Place suitable support sleeve underneath the proper bearing seat before removing plain bearings.

Using a press, carefully push the plain bearings out from the crankcase half inside towards the outside.

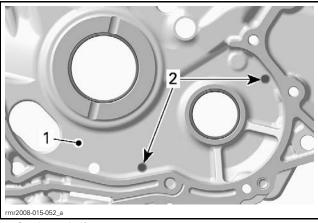
NOTE: During disassembly, make sure not to damage the sealing surfaces of the crankcase halves.

Plain Bearing Installation

NOTE: Plain bearings are available in 3 tolerance groups (red, blue and yellow).

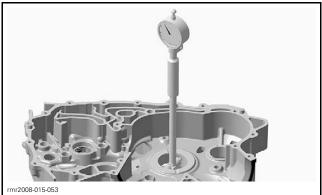
The proper tolerance group is marked with paint on the crankcase.

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- 1. Crankcase half
- 2. Marking of tolerance group

If marking is not visible anymore, measure inside diameter of crankcase where plain bearing fits.



MEASURE INSIDE DIAMETER OF CRANKCASE

Use the following table to find proper tolerance group of plain bearing.

CRANKCASE INSIDE DIAMETER (CRANKSHAFT)	PLAIN BEARING TOLERANCE GROUP
49.899 mm to 49.908 mm (1.9645 in to 1.9649 in)	RED
49.908 mm to 49.918 mm (1.9649 in to 1.9653 in)	BLUE
49.918 mm to 49.929 mm (1.9653 in to 1.9657 in)	YELLOW

CRANKCASE INSIDE DIAMETER (BALANCE SHAFT)	PLAIN BEARING TOLERANCE GROUP
35.909 mm to 35.918 mm (1.4137 in to 1.4141 in)	RED
35.918 mm to 35.928 mm (1.4141 in to 1.4145 in)	BLUE
35.928 mm to 35.939 mm (1.4145 in to 1.4149 in)	YELLOW

NOTICE Unless otherwise instructed, never use hammer to install plain bearings. Use press only.

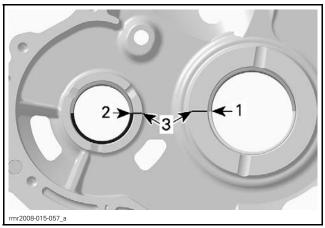
Install plain bearings with the same tools as per removal.

Fit the plain bearings with PETAMO GREASE GHY 133N (P/N 420 899 271).

Use an O-ring to hold the plain bearings in place during installation.

Place suitable support sleeve underneath the proper bearing seat before installing plain bearings.

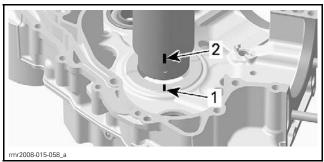
NOTICE The partition of the plain bearings must be positioned in the same direction as marked on crankcase halves during removal.



TYPICAL

- 1. Partition of crankshaft plain bearings
- 2. Partition of balance shaft plain bearings
- 3. Mark

Mark position of oil orifice on crankcase half (magneto side) and on plain bearing installer. Align mark on plain bearing installer with mark on crankcase half.



- 1. Oil orifice position marked on crankcase
- 2. Oil orifice position marked on plain bearing installer

NOTICE Wrong oil orifice position will stop oil supply to plain bearings and will cause engine damage.

Carefully press-in the plain bearings in the same direction as during disassembly.

NOTE: Remove O-ring before completely press-in plain bearings.

During installation, make sure not to damage the sealing surfaces of the crankcase halves.

Crankcase Assembly

The assembly of crankcase is essentially the reverse of removal procedure. However, pay attention to the following details.

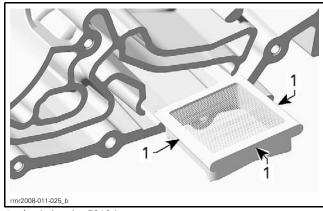
Install a new crankcase gasket.

Coat the plain bearings with PETAMO GREASE GHY 133N (P/N 420 899 271) before mounting crankshaft and balance shaft.

NOTE: Correctly reinstall crankshaft (refer to *CRANKSHAFT*).

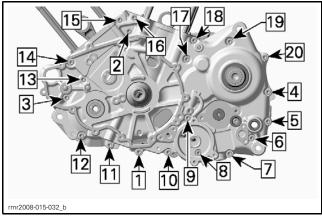
For reinstallation of gearbox and oil seals, refer to *GEARBOX* subsection.

Apply a seam of LOCTITE 5910 (P/N 293 800 081) on the oil strainer to fit into crankcase.



1. Apply Loctite 5910 here

Tighten crankcase screws as per the following sequence.

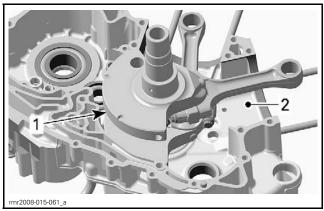


TIGHTENING SEQUENCE

Install all other removed parts.

NOTICE After a complete tear down of the engine, to achieve proper camshaft timing, the *ENGINE REASSEMBLY SEQUENCE* detailed at the beginning of this subsection must be strictly followed.

CRANKSHAFT



1. Crankshaft 2. Crankcase MAG

Crankshaft Locking Procedure

NOTICE The crankshaft must be locked at the ignition TDC of the respective cylinder for removal and installation work on crankshaft, balance shaft and camshaft.

NOTE: Crankshaft can be locked at ignition TDC for each cylinder separately.

The following procedure is valid for both cylinders.

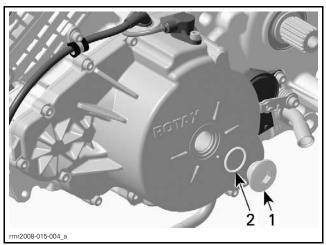
Remove upper side panels. Refer to BODY.

Remove spark plugs.

Remove valve covers. Refer to *CYLINDER HEAD/CYLINDER*.

On **SM5** model, remove magneto cover plug screw.

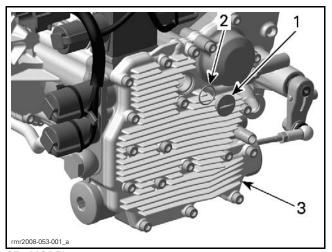
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SM5 MODEL

- Plug screw
 O-ring

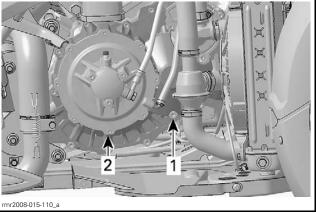
On SE5 model, remove plug screw on the hydraulic control module (HCM) housing.



SE5 MODEL

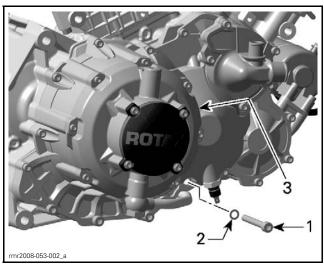
- Plug screw
 O-ring
 HCM housing

Remove M8 screw with sealing ring blocking access hole.



SM5 MODEL

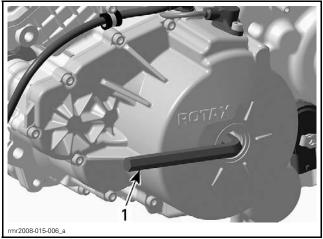
- Access screw Clutch cover



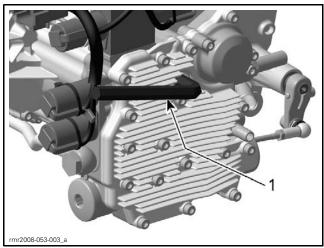
SE5 MODEL

- Access screw
 Sealing ring
 Clutch cover

Use a 14 mm Allen wrench to turn the crankshaft until the piston is at the ignition TDC of the respective cylinder.

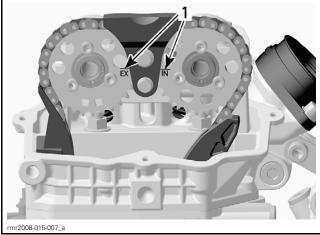


SM5 MODEL 1. Allen wrench



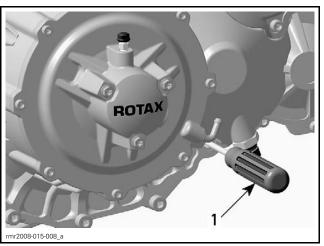
SE5 MODEL
1. Allen wrench

NOTE: When piston is at ignition TDC, the printed marks ("IN" and "EX") on the camshaft timing gears must be aligned, as shown in the next illustration.



TYPICAL 1. Align marks

Use a small screwdriver to check if the groove in the crankshaft is aligned with the hole.

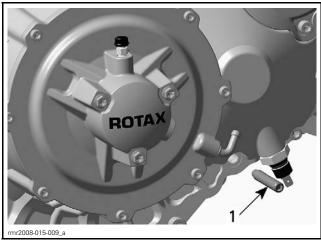


TYPICAL

1. Screwdriver

Lock crankshaft with the PULLER/LOCKING TOOL (P/N 529 036 098).





TYPICAL

1. Crankshaft locking bolt

Crankshaft Removal

Refer to CRANKCASE in this subsection.

Crankshaft Inspection

NOTE: Check each bearing journal of crankshaft for scoring, scuffing, cracks or other signs of wear.

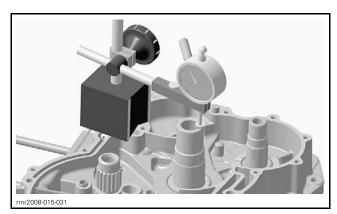
NOTICE Components with less than the service limit always have to be replaced. If this is not observed, severe damage may be caused to the engine.

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Crankshaft Axial Play

NOTE: Axial play needs to be measured before splitting the crankcase.

Measure play on PTO end, using a dial indicator.



CRANKSHAFT AXIAL PLAY		
SERVICE LIMIT	0.7 mm (.0276 in)	

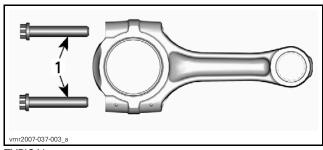
If play is out of specification, replace crankcase and/or crankshaft.

Connecting Rod Big End Radial Play

NOTE: Prior to remove connecting rods from the crankshaft, mark assembly direction (front cylinder and rear cylinder, magneto and clutch side) and big end halves together to ensure a correct reinstallation.

Remove connecting rods from crankshaft.

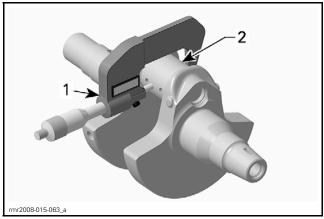
NOTICE Always replace connecting rod screws if removing the connecting rod. It is also recommended to replace plain bearings, within an overhaul of the engine.



TYPICAL
1. Connecting rod screws

Clean crankshaft oil orifices and make sure they are not clogged.

Measure crankshaft pin. Compare to inside diameter of connecting rod big end.



1. Micrometer

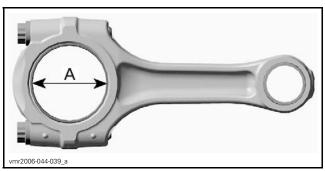
Crankshaft pin area for plain bearing

To measure the connecting rod big end diameter, leave the OLD plain bearings in place.

Install the connecting rod cap and follow the torque procedure as described in *CRANKSHAFT ASSEMBLY* further using the **OLD** connecting rod screws.

NOTE: Secure the connecting rod in a vise with aluminum jaws.

Measure connecting rod big end diameter.



TYPICAL

A. Connecting rod big end diameter (plain bearing in place)

CRANKSHAFT PIN DIAMETER		
SERVICE LIMIT	41.960 mm (1.652 in)	
CONNECTING ROD BIG END DIAMETER		
SERVICE LIMIT	42.080 mm (1.6567 in)	
CONNECTING ROD BIG END RADIAL PLAY (WITH USED PLAIN BEARING)		
SERVICE LIMIT	0.07 mm (.0028 in)	

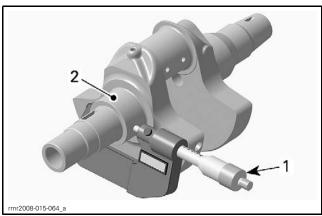
NOTE: Use **NEW** plain bearings, when connecting rod big end radial play is out of specification.

Connecting Rod/Piston Pin Clearance

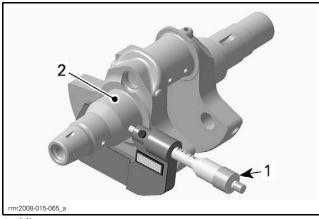
Refer to CYLINDER HEAD/CYLINDER subsection.

Crankshaft Radial Play (MAG/Clutch Side)

Measure crankshaft journal on MAG/clutch side. Compare to inside diameter of MAG/clutch side plain bearings in crankcase (refer to *CRANKCASE* in this subsection).



- 1. Micrometer
- 2. Crankshaft area for MAG side plain bearing



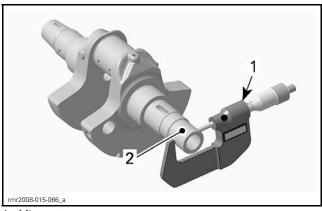
- 1. Micrometer
- 2. Crankshaft area for clutch side plain bearing

CRANKSHAFT BEARING JOURNAL (MAG/CLUTCH SIDE)		
SERVICE LIMIT	45.955 mm (1.8093 in)	
CRANKSHAFT RADIAL PLAY		

CRANKSHAFT RADIAL PLAY (MAG/CLUTCH SIDE)		
SERVICE LIMIT	0.06 mm (.0024 in)	

Crankshaft Radial Play (Clutch Support Bearing Side)

Measure the crankshaft bearing journal that inserts in the clutch support bearing. Compare to inside diameter of plain bearing in clutch housing (refer to *CLUTCH HOUSING* in *CLUTCH* subsection).



- 1. Micrometer
- 2. Crankshaft journal (clutch support bearing)

CRANKSHAFT BEARING JOURNAL (CLUTCH SUPPORT BEARING)		
SERVICE LIMIT	29.970 mm (1.1799 in)	

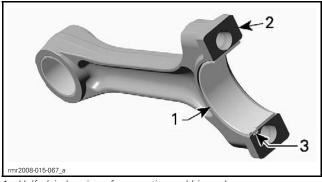
CRANKSHAFT RADIAL PLAY (CLUTCH SUPPORT BEARING)

SERVICE LIMIT 0.065 mm (.0026 in)

Crankshaft Assembly

For assembly, reverse the disassembly procedure. Pay attention to following details.

Put **NEW** plain bearings correctly in place and clean the split surface on both sides carefully with a clean rag.



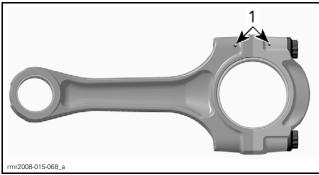
- 1. Half plain bearing of connecting rod big end
- 2. Split surface of the connecting rod
- 3. Nose of plain bearing in line with connecting rod groove

Oil the plain bearing surface of the connecting rod and crank pin before installation.

NOTICE Properly reinstall connecting rods in the same assembly direction as marked during removal.

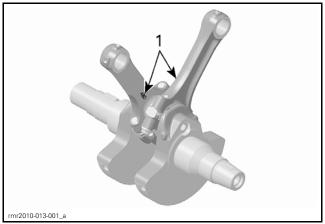
Printed marks on connecting rod and cap must point together.

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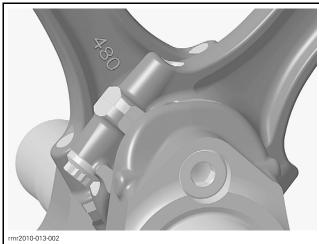


1. Printed marks

Install connecting rods on crankshaft in a way that stamped part numbers face together.



1. Stamped marks on connecting rods facing together



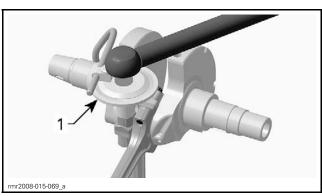
TYPICAL - STAMPED MARK

NOTICE Always use NEW connecting rod screws for the final assembly of the crankshaft.

Apply oil on head of **NEW** connecting rod screws and torque as per following procedure:

 First, torque screws to 2 N•m (18 lbf•in). Do not apply any thread locker.

- Secondly, torque screws to 30 N•m (22 lbf•ft).
- Finish tightening the screws with an additional 75° turn using an angle torque wrench.



1. Angle torque wrench

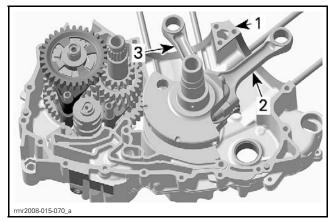
NOTICE Failure to strictly follow this procedure may cause screw to loosen and lead to engine damage. The plain bearing tapered end must be against the counterweight.

Crankshaft Installation

For installation of crankshaft in crankcase reverse the removal procedure. Pay attention to the following details.

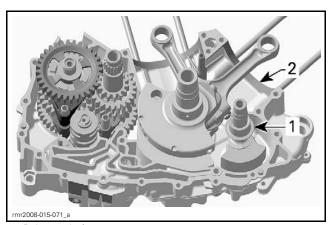
Do not mix up the connecting rods of front and rear cylinders during installation.

NOTICE Observe the correct installation position when fitting the crankshaft with the connecting rods. The connecting rod clutch side must to face to front cylinder.



- 1. Crankcase half MAG side
- 2. Connecting rod front cylinder
- 3. Connecting rod rear cylinder

BALANCE SHAFT



Balance shaft
 Crankcase MAG

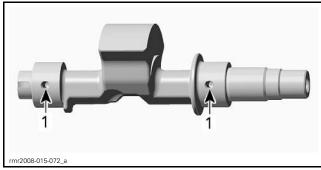
Balance Shaft Removal

Refer to CRANKCASE in this subsection.

Balance Shaft Inspection

NOTE: Check each bearing journal of balance shaft for scoring, scuffing, cracks or other signs of wear.

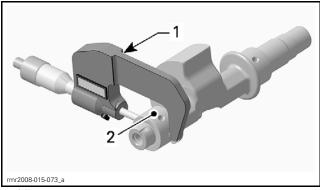
Clean balance shaft oil orifices and make sure they are not clogged.



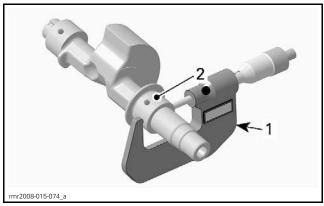
1. Clean oil orifices

Balance Shaft Radial Play (MAG/CLUTCH Side)

Measure balance shaft bearing journals on MAG/CLUTCH side. Compare to inside diameter of plain bearings in crankcase (refer to *CRANKCASE* in this subsection).



- 1. Micrometer
- 2. Bearing journal MAG side



- 1. Micrometer
- 2. Bearing journal clutch side

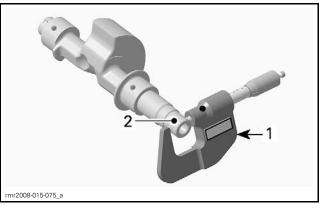
BALANCE SHAFT BEARING JOURNAL (MAG/CLUTCH SIDE)		
SERVICE LIMIT 31.980 mm (1.2591 in)		

BALANCE SHAFT RADIAL PLAY (MAG/CLUTCH SIDE)		
SERVICE LIMIT	0.06 mm (.0024 in)	

Balance Shaft Radial Play (Clutch Support Bearing Side)

Measure balance shaft bearing journal on clutch side (support bearing). Compare to inside diameter of plain bearing in clutch housing (refer to *CLUTCH HOUSING* in *CLUTCH* subsection).

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- Micrometer
 Bearing journal clutch support bearing

BALANCE SHAFT BEARING JOURNAL (CLUTCH SUPPORT BEARING)			
SERVICE LIMIT 19.990 mm (.787 in			

BALANCE SHAFT RADIAL PLAY (CLUTCH SUPPORT BEARING)		
SERVICE LIMIT	0.06 mm (.0024 in)	

Balance Shaft Installation

The installation is the reverse of the removal procedure.

DIGITALLY ENCODED SECURITY SYSTEM (D.E.S.S.)

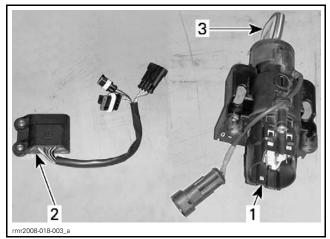
SERVICE TOOLS

Description	Part Number	Page
MASTER KEY	529 036 106	2–3

GENERAL

SYSTEM DESCRIPTION

The D.E.S.S. system is an electronic anti-start system that allows engine starting only with a programmed key.



- 1. Ignition switch 2. D.E.S.S. module
- 3. Ignition key with a ROM chip

The ignition key contains a ROM chip that includes a digital type code.

The 2 keys that come with the Roadster have been programmed at the factory. Up to 4 keys can be programmed on the Roadster.

SYSTEM OPERATION

When the ignition switch is turned to the ON position, the D.E.S.S. module is energized and a signal is sent by radio wave to an antenna located on the ignition switch. If the D.E.S.S. module recognizes the ignition key code, it sends a run signal to the ECM which allows engine cranking to take place. If the D.E.S.S. module does not recognize the code, the cluster will display "BAD KEY" (it can take up to 40 seconds before the message displays).

If all vehicle keys have been lost, the ignition switch AND D.E.S.S. module must be replaced.

PROCEDURES

KEYS

General Information on Programming Keys

The D.E.S.S. module is programmed to recognize the digital code in the key.

A master key is used to program keys.

The cluster will display guiding tips during key programming.

During the programming process, all keys will be erased (the first key installed after removal of the master key will erase the previous key(s) and this key will be the first newly programmed key).

If you want to reuse previously programmed keys, you must reprogram them.

A minimum of 2 keys **MUST** be programmed.

The second key must be programmed within 2 minutes. Otherwise, the D.E.S.S. module will remain in programming mode and the following conditions will occur:

- Engine will start, then stop after 2 minutes.
- When the ignition is turned OFF, current drain will be higher than usual and the battery will completely discharge within 1-2 weeks if the vehicle is not used.

If key programming was successful, the cluster will display a "SUCCESS" message. If the cluster does not display this message, the new key programming will not be stored. The entire procedure must be repeated from the beginning.

If the programming session is not correctly completed, no changes are saved in the D.E.S.S. module.

Adding/Reprogramming Keys

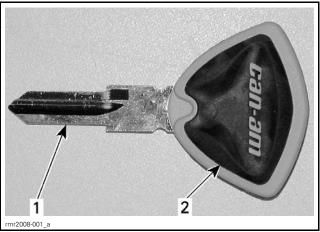
The following procedures describe how to program keys on a vehicle that has already at least one programmed functional key.

NOTE: Additional keys to program must be precut to the ignition switch.

To add or reprogram a key, carry out the following steps:

- 1. Insert an already programmed functional key into the ignition switch.
- 2. Turn the ignition key to "ON".
- 3. Turn the ignition key to "OFF".
- 4. Wait five (5) seconds.
- 5. Remove programmed key.
- 6. Insert MASTER KEY (P/N 529 036 106).

NOTE: The master key is purposely "not cut" and will not turn in the ignition switch.



MASTER KEY
1. No notches
2. RED colored

- 7. Wait until the cluster displays "MASTER".
- 8. Remove the master key.
- 9. Insert a key to program.
- 10. Turn ignition switch to "ON".
- 11. Wait until cluster displays "NEXT KEY".
- 12. Turn ignition switch to "OFF".
- 13. Remove key.
- 14. Insert next key to program.
- 15. Turn ignition switch to "ON".
- 16. Wait until cluster displays "NEXT KEY".

NOTE: If there are at least two keys programmed and you do not wish to program more keys (4 maximum), leave the last programmed key in the ignition switch. If you wish to program another key, repeat the previous five steps.

- 17. Wait until cluster displays "SUCCESS".
- 18. Turn ignition switch to "OFF".
- 19. Remove key.

Key programming procedure is complete.

NOTE: When the maximum of four keys are programmed, the cluster will display "SUCCESS".

Start engine and let run for more than 2 minutes. If engine does not stop on its own after 2 minutes, programming mode is complete.

Programming Keys with a New D.E.S.S. Module

The following procedures describe how to program keys on a vehicle when the D.E.S.S. module has been replaced.

After installation of a new D.E.S.S. module (with or without a new ignition switch), the module will automatically go into programming mode when the ignition switch is first turned ON.

NOTE: No master key is required.

To program the ignition keys into the new D.E.S.S. module, carry out the following steps:

- 1. Insert first key to program into the ignition switch.
- 2. Turn the ignition key to "ON".
- 3. Wait until cluster displays "NEXT KEY".
- 4. Turn ignition switch to "OFF".
- 5. Remove key.
- 6. Insert the second key to program.

NOTE: A new D.E.S.S. module will allow programming of two keys initially. If you wish to program more than two keys, refer to *ADDING/REPROGRAMMING KEYS* after this procedure is completed.

- 7. Turn ignition switch to "ON".
- 8. Wait until cluster displays "SUCCESS".
- 9. Turn ignition switch to "OFF".
- 10. Remove key.

Key programming procedure is complete.

Start engine and let run for more than 2 minutes. If engine does not stop on its own after 2 minutes, programming mode is complete.

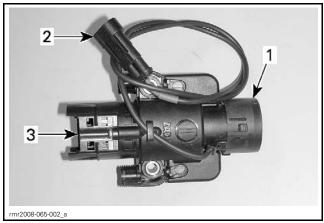
Programming Keys with a New Ignition Switch

The following procedure describes how to program keys when **only** the ignition switch has been replaced.

NOTE: You must have at least the top portion of an ignition key containing the electronic chip programmed to the vehicle and in good working order to carry out this procedure. If not, both the ignition switch and D.E.S.S. module must be replaced.

Replace the ignition switch according to the removal and installation procedures in the IGNITION SYSTEM subsection. However, do not install the upper console assembly or other panels removed for access.

Connect only the large ignition switch connector to the new switch at this time. The old ignition switch D.E.S.S. antenna must remain connected to the D.E.S.S. module.

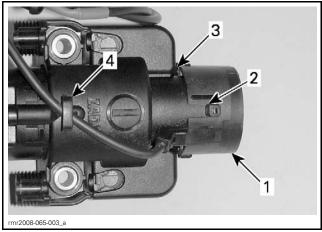


IGNITION SWITCH ASSEMBLY

- 1. D.E.S.S. antenna ring
- D.E.S.S. antenna connector
- Ignition switch connector

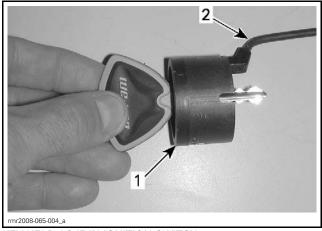
NOTE: The new ignition switch will be used to power ON the vehicle but the old ignition key and antenna must be used for recognition by the D.E.S.S. module.

NOTE: If a key cannot be inserted in the old ignition switch, carefully pry off the D.E.S.S. antenna from the top of the old switch assembly. It will be used during the key programming procedure.



- Antenna ring
- Antenna locking pin (one each side)
- Carefully pry here (each side)
- 4. Squeeze this clip in to remove from switch assembly

The following illustration shows how to use the old D.E.S.S. antenna for recognition of the old ignition key and master key to put the D.E.S.S. module into programming mode.

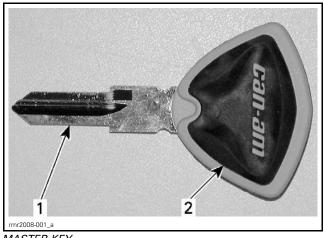


KEY HELD AS IF IN IGNITION SWITCH

- Antenna ring
 Antenna wire connected to D.E.S.S. module connector

To program the ignition keys from the new switch into the old D.E.S.S. module, carry out the following steps:

- 1. Insert the OLD programmed key into the OLD ignition switch (or old antenna).
- 2. Insert a **NEW** key in the **NEW** ignition switch.
- 3. Turn the **NEW** ignition key to "ON" to power the system.
- 4. Turn the **NEW** ignition key to "**OFF**".
- 5. Wait five (5) seconds.
- 6. Remove the **OLD** programmed key and insert the MASTER KEY (P/N 529 036 106) in its place.



3

MASTER KEY

- No notches
- 2. RED colored

- 7. Wait until the cluster displays "MASTER" indicating that the module enters the key programming mode.
- 8. Remove the master key.
- 9. Quickly disconnect the **OLD** D.E.S.S. antenna and connect the **NEW** D.E.S.S. antenna to the D.E.S.S. module.

NOTE: If too much time is used to switch the antenna connectors, the programming may fail and the procedure will have to be repeated from the beginning.

- 10. Turn **NEW** ignition switch to "ON".
- 11. Wait until cluster displays "NEXT KEY".
- 12. Turn ignition switch to "OFF".
- 13. Remove key.
- 14. Insert next key to program.
- 15. Turn ignition switch to "ON".
- 16. Wait until cluster displays "NEXT KEY".

NOTE: If there are at least two keys programmed and you do not wish to program more keys (4 maximum), leave the last programmed key in the ignition switch.

- 17. Wait until cluster displays "SUCCESS".
- 18. Turn ignition switch to "OFF".
- 19. Remove key.

Key programming procedure is complete.

Start engine and let run for more than 2 minutes. If engine does not stop on its own after 2 minutes, programming mode is complete.

Ensure wiring is properly routed and all connectors properly connected to new switch and D.E.S.S. module.

NOTE: Do not apply dielectric grease in the D.E.S.S. module connectors.

Install the remaining parts, refer to applicable sections.

D.E.S.S. MODULE

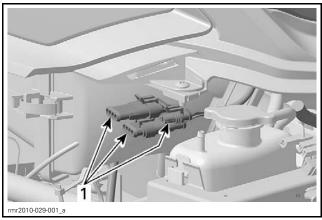


The D.E.S.S. module is located behind the front frame member.

D.E.S.S. Module Replacement

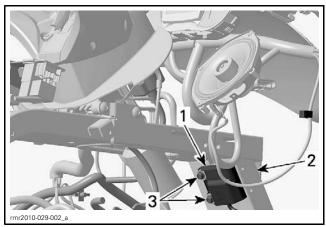
1. Refer to *BODY* and remove console module and service cover.

Disconnect the D.E.S.S. module connectors.



PARTS REMOVED FOR CLARITY
1. D.E.S.S. module connectors

Remove the D.E.S.S. module retaining screws.



PARTS REMOVED FOR CLARITY

- D.E.S.S. module
 Front frame member
- 3. Retaining screws

Remove the D.E.S.S. module.

For installation, reverse the removal procedures. Tighten retaining screws to 7 N•m (62 lbf•in).

NOTICE Do not apply any dielectric grease in the D.E.S.S. module connectors.

Program a minimum of 2 keys into the new module. See PROGRAMMING KEYS WITH A NEW D.E.S.S. MODULE in this subsection.

DRIVE BELT AND REAR WHEEL

SERVICE TOOLS

Description	Part Number	Page
BELT TENSION METER	529 036 115	
BLIND HOLE BEARING PULLER SET	529 036 117	11–12, 15
SOCKET SPANNER	529 036 113	

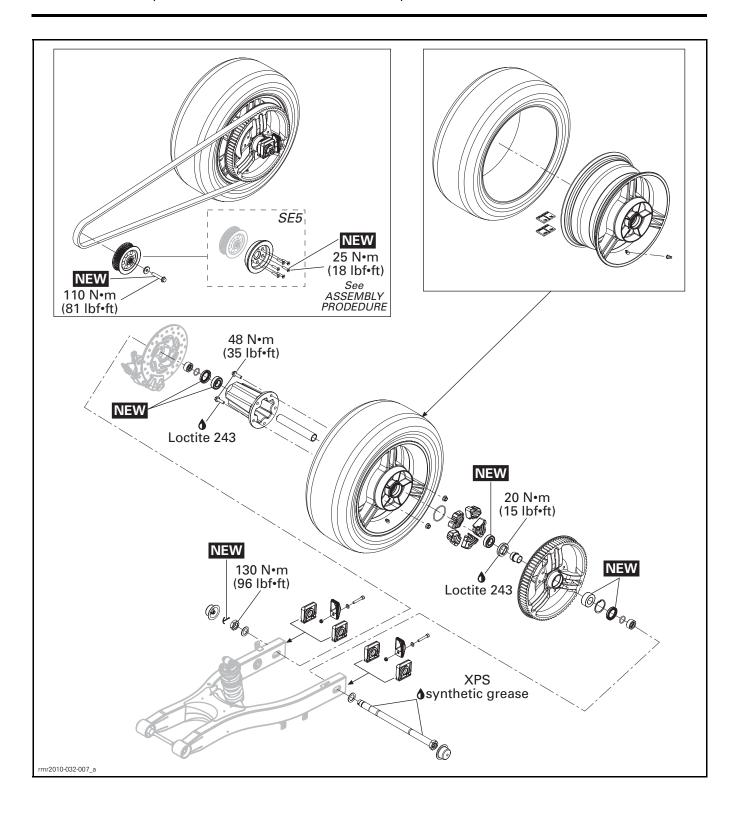
SERVICE TOOLS - OTHER SUPPLIER

Description	Part Number	Page
SNAP-ON SEAL PULLER	YA105	15

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	11
XPS SYNTHETIC GREASE	293 550 010	11

Subsection XX (DRIVE BELT AND REAR WHEEL)



GENERAL

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

A WARNING

Torque wrench tightening specifications must be strictly adhered to.

Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced.

NOTICE During installation, make sure every part is free from old grease and dirt. This allows for a clean reassembly and will avoid premature wear caused by dirt contamination.

NOTICE Hoses, cables and locking ties removed during a procedure must be reinstalled as per factory standards.

Road test vehicle at moderate speeds a few minutes to ensure normal operation following maintenance or repair (proper drive belt tension and alignment, rear brake operates correctly, etc.).

PROCEDURES

DRIVE BELT

Drive Belt Inspection

Lift the rear of vehicle and install a jack under the frame to support the rear of vehicle off the ground.

Remove the belt guard.

Inspect the full length of the belt. Inspect for the following conditions:

WEAR CONDITION		REQUIRED ACTION	
₹	Good condition	None	
₹	Hairline cracks	Monitor condition	
	Minor chipping	Monitor condition	
700	Opened cracks	Replace belt	
	Hook wear	Replace belt	
777	Missing teeth	Replace belt	
shiman in and a second	Belt fabric worn, exposing internal components	Replace belt	
	Stone damage	Replace belt	

NOTE: Hairline cracks do not require the replacement of the belt, but must be monitored closely – they may lead to opened cracks or missing teeth, requiring belt replacement. Damage to the center of belt will eventually require belt replacement, but when cracks extend to the edge of belt, belt failure is imminent.

When a drive belt is replaced, also replace the sprockets to increase the longevity of the new drive belt.

Drive Belt Tension Verification

NOTICE Always verify drive belt tension with the rear wheel lifted of the ground.

Place vehicle on a level surface.

NOTE: The area must be protected against wind and must have a low background noise.

Set transmission to NEUTRAL.

Lift rear of vehicle by the frame until rear wheel is off the ground.

NOTICE Do not lift under rear shock absorber. Always lift by the frame. Refer to illustration.

rmr2010-032 3

Subsection XX (DRIVE BELT AND REAR WHEEL)



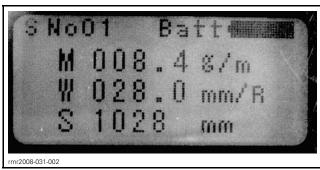
TYPICAL - LIFT BY THE FRAME

To check the drive belt tension use the BELT TEN-SION METER (P/N 529 036 115).



Enter the following specifications to program the meter.

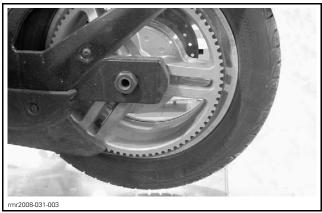
MASS	WIDTH	SPAN
8.4 g/m	28.0 mm/R	1028 mm



SONIC TENSION METER DISPLAY

NOTE: Refer to the manufacturer's instructions to set the informations into the device.

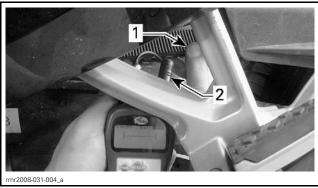
Turn rear wheel to align a wheel spoke with the swing arm.



TYPICAL - SWING ARM ALIGNS WITH A SPOKE

Behind the LH passenger footrest, hold the sonic tension meter sensor approximately 1 cm (1/2 in) from the top run of belt or closer without touching the belt.

Tap the belt to make the belt vibrate.



TYPICAL

- 1. Tap the belt
- 2. Sonic tension meter sensor

Read the measurement.

Repeat measurement at every spokes and at midway of every spokes (6 measurements total).



TYPICAL - SWING ARM ALIGNS AT MIDWAY OF SPOKES

Obtained values (lowest and highest) must be in the following range:

DRIVE BELT TENSION (REAR WHEEL LIFTED)

750N ± 250N

If the tension of drive belt is out of specification, adjust drive belt as per DRIVE BELT TENSION AD-JUSTMENT.

Drive Belt Tension Adjustment

Lift rear of vehicle by the frame until rear wheel is off the ground.

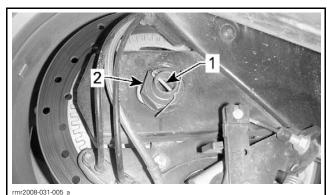
NOTICE Do not lift under rear shock absorber. Always lift by the frame. Refer to illustration.



TYPICAL - LIFT BY THE FRAME

Remove both rear axle caps.

From RH side of vehicle, remove and discard cotter pin locking the rear axle nut.



REAR RH SIDE OF VEHICLE

Cotter pin
 Rear axle nut

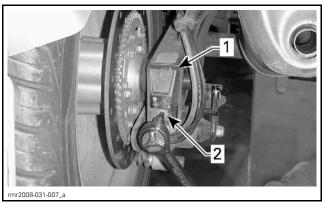
Using a 36 mm socket, loosen rear axle nut.



Adjust tensioner screws as following:

- Tighten screws 1/4 turn to increase belt tension.
- Loosen screws 1/4 turn to decrease belt tension.

NOTE: Always turn both tensioner screws evenly to keep drive belt aligned.



- Rear axle tensioner

Tighten rear axle nut enough to avoid rear axle movement.

Adjust drive belt tension as per specification, refer to DRIVE BELT TENSION VERIFICATION.

When recommended tension is obtained, torque rear axle nut to 130 Nom (96 lbfoft).

Install a **NEW** cotter pin and both axle caps.

WARNING

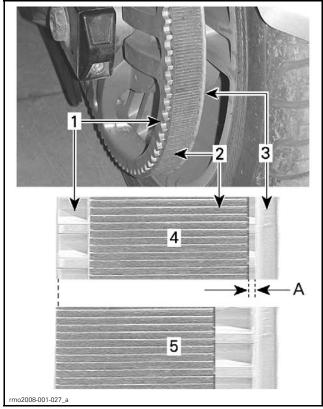
Always install a NEW cotter pin on rear axle.

Drive Belt Alignment

Drive Belt Alignment Verification

The gap between drive belt and rear sprocket internal flange should be a minimum of 1 mm (1/32 in) and a maximum of 5 mm (3/16 in).

5



BELT ALIGNMENT

- 1. Rear sprocket
- 2. Belt
- 3. Sprocket internal flange
- 4. Proper belt alignment
- 5. Belt exceeding external edge realign belt
- A. MIN. 1 mm (1/32 in) MAX. 5 mm (3/16 in)

Drive Belt Alignment Procedure

If drive belt needs to be aligned, proceed as follows.

Lift rear of vehicle by the frame until rear wheel is off the ground.

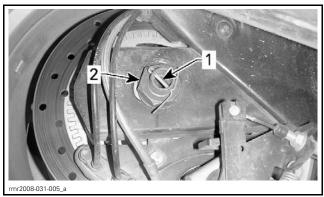
NOTICE Do not lift under rear shock absorber. Always lift by the frame. Refer to illustration.



TYPICAL - LIFT BY THE FRAME

Remove both axle caps.

From RH side of vehicle, remove and discard cotter pin locking the rear axle nut.



TYPICAL - REAR RH SIDE OF VEHICLE

- 1. Cotter pin
- 2. Rear axle nut

Using a 36 mm socket, loosen rear axle nut.

NOTE: Loosen axle nut just enough to slide wheel using axle tensioner screws.



Adjust tensioner screws as follows:

- If drive belt is on the outside edge of rear sprocket, tighten the LH tensioner screw.
- If drive belt is on the rear sprocket flange, tighten the RH tensioner screw.

Clear rear wheel area.

Ask somebody to start engine and select the first gear.

Carefully release clutch lever and check drive belt alignment.

Stop rear wheel and repeat in reverse.

Stop engine.

If an adjustment is necessary, tighten the appropriate axle tensioner screw and recheck the alignment.

When alignment is good, check drive belt tension. Refer to *DRIVE BELT TENSION VERIFICATION*.

Torque rear axle nut to 130 N•m (96 lbf•ft) when proper tension is reached.

Install a **NEW** cotter pin and the both axle caps.

Check wheel speed sensor adjustment. Refer to VEHICLE STABILITY SYSTEM subsection.

A WARNING

Always install a NEW cotter pin on rear axle.

Drive Belt Removal

NOTE: If drive belt is removed but not replaced, mark the direction of rotation. Drive belt must be reinstalled in the same direction to obtain the maximum drive belt life span.

Lift rear of vehicle by the frame until rear wheel is off the ground.

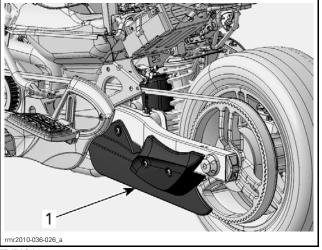
NOTICE Do not lift under rear shock absorber. Always lift by the frame. Refer to illustration.



TYPICAL - LIFT BY THE FRAME

Remove body parts as required to access to the front sprocket. Refer to *BODY* subsection.

Remove belt guard from swing arm.

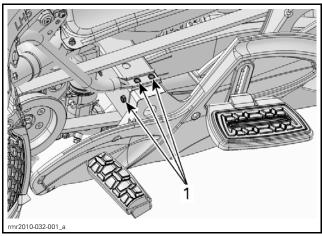


TYPICAL

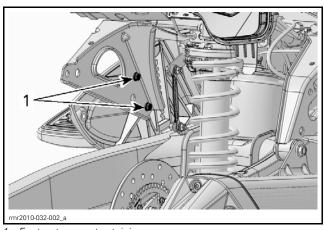
1. Belt guard

Remove belt tension, refer to *DRIVE BELT TEN-SION ADJUSTMENT* and completely loosen tensioner screws to remove belt from rear sprocket.

Remove LH footrest support from vehicle by unscrewing retaining screws.



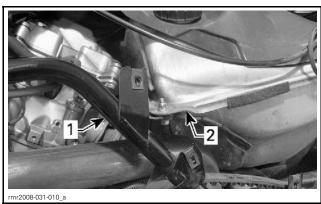
1. Footrest support retaining screws.



1. Footrest support retaining screws.

NOTE: For SM5 model, detach shifter lever before removing LH footrest support.

Unscrew bolt securing LH lateral support to fuel tank.



TYPICAL

- Lateral support Fuel tank

Lift end of lateral support.

Slide drive belt between lateral support and the footrest support bracket.

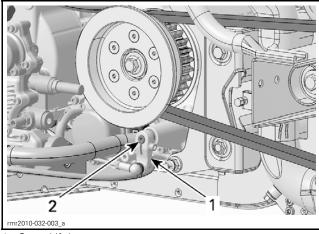
SM5 Model

Remove drive belt from front sprocket.

SE5 Model

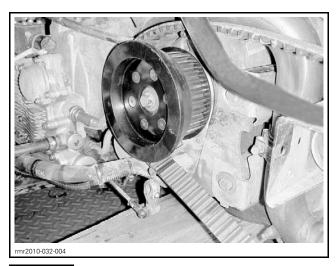
Remove Allen screw securing gear shift lever to shifter shaft.

Detach gear shift lever from shifter shaft.



Gear shift lever Shifter shaft

Carefully slide drive belt between sprocket flywheel and shifter shaft.



NOTICE Do not remove flywheel from front sprocket for the drive belt removal.

Drive Belt Installation

Installation is the reverse of the removal. However, pay attention to the following.

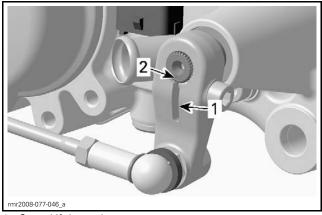
When using the same drive belt, reinstall it in the same direction of rotation. For a new drive belt, no specific direction is required.

Align drive belt. Refer to DRIVE BELT ALIGN-MENT.

Adjust drive belt tension. Refer to DRIVE BELT TENSION ADJUSTMENT.

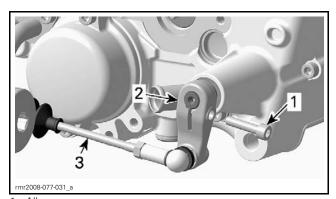
SE5 Model

Install the gear shift lever and align its slot with the dot on the end of shifter shaft.



- Gear shift lever slot
- Shifter shaft dot

Torque Allen screw securing gear shift lever on shifter shaft to 11 Nom (97 lbfoin).



- Allen screw Gear shift lever
- Gear shift lev
 Shift linkage

Make sure that gear shift lever works properly.

REAR WHEEL

Rear Wheel Removal

Place vehicle on a level surface.

Lift rear of vehicle by the frame until rear wheel is off the ground.

NOTICE Do not lift under rear shock absorber. Always lift by the frame. Refer to illustration.



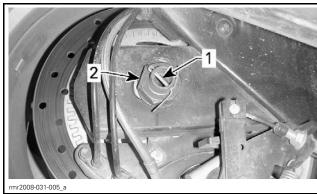
TYPICAL - LIFT BY THE FRAME

Remove the following body panels, refer to REAR CARGO MODULE DISASSEMBLY in BODY subsection.

- Rear panel
- Rear fender.

Remove both axle caps.

From RH side of vehicle, remove and discard cotter pin locking the rear axle nut.



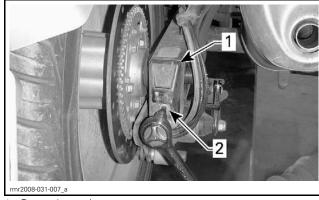
TYPICAL - REAR RH SIDE OF VEHICLE

- Cotter pin
 Rear axle nut

Using a 36 mm socket, loosen rear axle nut.

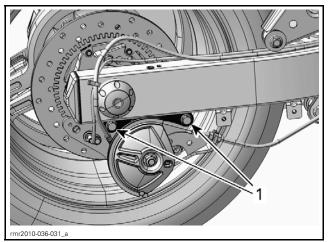


Loosen rear axle tensioner screws. Be careful not to unscrew tensioner screws completely.



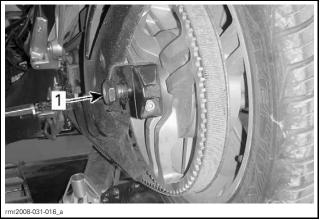
- 1. Rear ax 2. Screw Rear axle tensioner

Remove and discard both caliper screws.



1. Caliper screws

From the LH side of vehicle, support rear wheel and remove the rear axle.

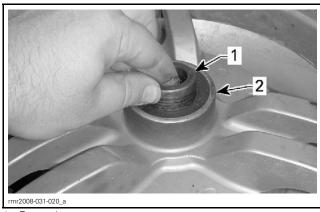


1. Rear axle

Remove drive belt from rear sprocket. Remove wheel from vehicle.

Rear Wheel Disassembly

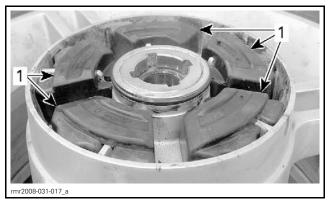
Remove the external spacer.



1. External spacer

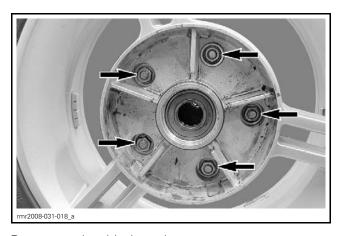
Remove *REAR SPROCKET*, see procedure in this subsection.

Remove rear sprocket dampers.



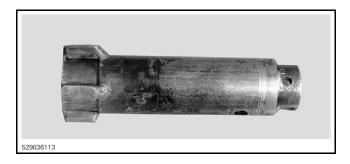
1. Rear sprocket damper

Unscrew wheel hub bolts.



Remove wheel hub and spacer.

Using the SOCKET SPANNER (P/N 529 036 113), unscrew the wheel bearing nut.

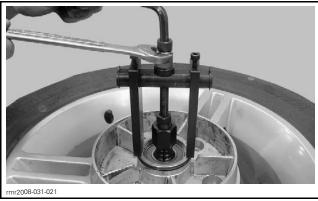


^{2.} Rear sprocket



Using the BLIND HOLE BEARING PULLER SET (P/N 529 036 117), remove and discard wheel bearing.





Rear Wheel Inspection

Verify condition and wear of the following wheel components:

- External spacer
- Seals
- O-ring (inside external spacer)
- O-ring (around nave)
- Rim.

Replace any components as required.

Rear Wheel Assembly

The assembly is the reverse of the disassembly procedure. However, pay attention to the following.

Install a NEW wheel bearing.

Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on threads of wheel bearing nut.

Torque wheel bearing nut to 20 Nom (15 lbfoft).

Install the rear sprocket and wheel hub on rear wheel. Refer to *REAR SPROCKET* and *WHEEL HUB*.

Make sure rear sprocket spokes are aligned along with rear wheel spokes.

Rear Wheel Installation

Install caliper bracket with NEW caliper screws.

Torque caliper screws to 25 Nom (18 lbfoft).

Apply XPS SYNTHETIC GREASE (P/N 293 550 010) on rear axle.

Install the drive belt on rear sprocket.

Align holes of the following components:

- Swing arm
- Rear adjusters
- Caliper support
- Wheel.

Insert the rear axle from the LH side.

On RH side, install a washer and the rear axle nut. Pull rear wheel backward and tighten rear axle nut slightly.

Using a ruler, measure the distance between washer and the swing arm end.



Tighten rear adjuster screws to same length on both sides of swing arm.

Align drive belt. Refer to DRIVE BELT ALIGN-MENT.

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A WARNING

Always install a NEW cotter pin on rear axle.

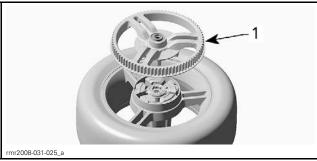
NOTE: The Spyder RT uses a heavy duty rim with a load rating of 400 kg (882 lb) to match with the tire. Always check the load rating on rim spoke to ensure that the rim meets the proper specification.

REAR SPROCKET

Rear Sprocket Removal

Remove rear wheel. Refer to *REAR WHEEL* in this subsection.

Pull rear sprocket.

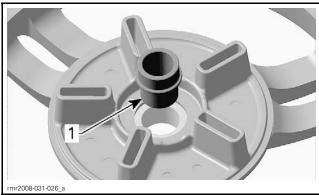


1. Rear sprocket

Rear Sprocket Inspection

Verify sprocket as follows:

- Sprocket teeth for wear.
- Sprocket bearing turns smoothly and freely.
- Bearing spacer for wear.

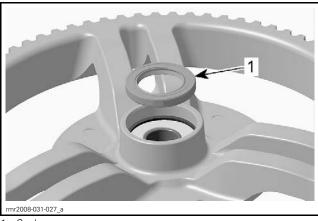


1. Bearing spacer

Replace components as required.

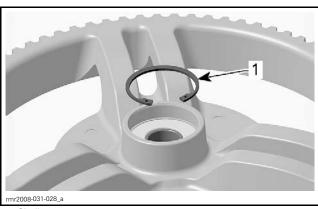
Rear Sprocket Disassembly

Remove seal.



1. Seal

Remove circlip.



1. Circlip

Using the BLIND HOLE BEARING PULLER SET (P/N 529 036 117), remove and discard sprocket bearing.

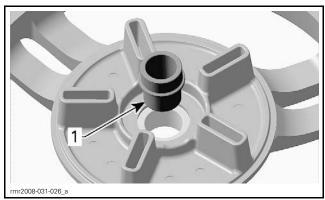


Rear Sprocket Assembly

The assembly is the reverse of the disassembly procedure. However, pay attention to the following.

When installing the sprocket bearing, make sure to insert the bearing very straight to avoid damaging sprocket hub and to press the bearing from its outer race.

Install the long side of bearing spacer inside rear sprocket bearing.



1. Long side of bearing spacer

Rear Sprocket Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

An approximate gap of 1.6 mm (1/16 in) between rear sprocket and rear wheel is normal. If the gap is higher, remove the rear sprocket and check the condition of the nave O-ring.

Make sure rear sprocket spokes are aligned along with rear wheel spokes.

FRONT SPROCKET

Front Sprocket Removal

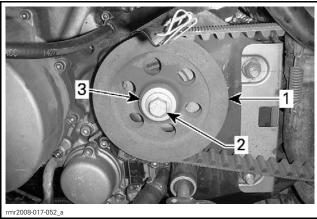
A CAUTION Apply parking brake before removing front sprocket to avoid vehicle movement.

Remove body parts as required to access to the front sprocket. Refer to *BODY* subsection.

Loosen drive belt tension. Refer to *DRIVE BELT* in this subsection.

Remove and discard the front sprocket screw.

NOTICE For SE5 model, do not remove flywheel from front sprocket for its removal.



TYPICAL

- Front sprocket
- Sprocket screw
- Washer

Remove front sprocket from main shaft.

Front Sprocket Inspection

NOTICE For SE5 model, do not remove flywheel from front sprocket for the inspection.

Inspect splines of main shaft for wear or other damages. If necessary replace main shaft (gear-box disassembly is required).

Check inner splines and teeth of sprocket for wear or other damages. Replace sprocket as required.

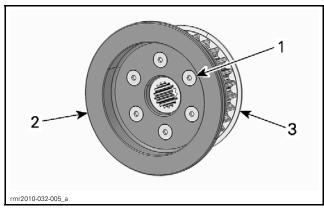
Check inner flange of sprocket to ensure it is not warped or worn out.

Front Sprocket Disassembly (SE5 Model)

NOTICE Remove flywheel from front sprocket only if the sprocket needs to be changed. If disassembly is required, make sure to strictly follow assembly procedure. Refer to FRONT SPROCKET ASSEMBLY (SE5 MODEL).

Unscrew flywheel retaining screws from front sprocket.

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- 1. Flywheel retaining screws
- 2. Flywheel
- 3. Front sprocket

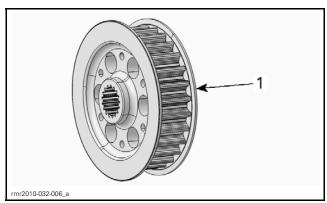
Front Sprocket Assembly (SE5 Model)

Clean front sprocket threads using a metric tap M8 x 1.25.

A WARNING

To ensure good clamping of flywheel screws, it is imperative to clean front sprocket threads using a metric tap M8 x 1.25.

Use a **NEW** front sprocket (with an internal flange).

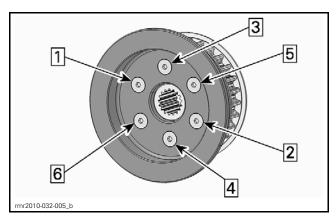


1. Internal flange

Install flywheel on front sprocket.

Install **NEW** flywheel retaining screws (with scotch grip on threads).

Tighten flywheel retaining screws as per the following sequence.



Torque flywheel retaining screws to 25 N•m (18 lbf•ft).

WARNING

Make sure to install NEW flywheel screws with scotch grip on threads.

Front Sprocket Installation

The installation is the reverse of the removal procedure. However, pay attention to the following. Install a **NEW** front sprocket screw.

Torque front sprocket screw to 110 N•m (81 lbf•ft).

A WARNING

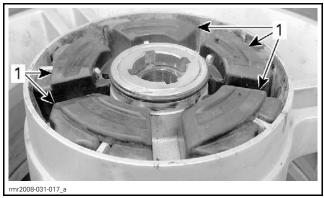
Make sure to install a NEW sprocket screw with scotch grip on threads. Screw must be torqued as specified.

WHEEL HUB

Wheel Hub Removal

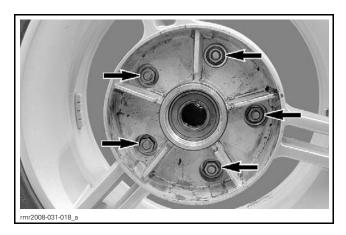
Remove rear wheel. Refer to *REAR WHEEL* in this subsection.

Remove rear sprocket dampers.



1. Rear sprocket damper

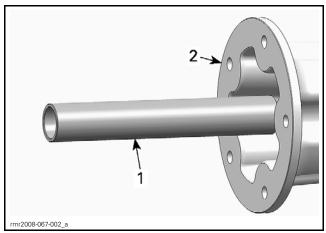
Unscrew wheel hub bolts.



Remove wheel hub and spacer.

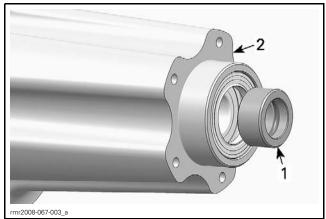
Wheel Hub Bearing Replacement

Remove the wheel hub inner spacer.



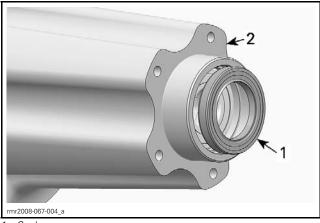
Inner spacer
 Wheel hub

Remove the outer spacer.



Outer spacer
 Wheel hub

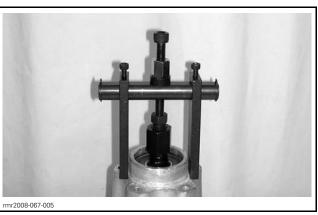
Using a seal puller such as the SNAP-ON SEAL PULLER (P/N YA105) or a screwdriver, drive the seal out of the wheel hub.



1. Seal 2. Wheel hub

Using the BLIND HOLE BEARING PULLER SET (P/N 529 036 117), remove and discard sprocket bearing.





Clean bearing area.

Install the **NEW** bearing, make sure to insert the bearing very straight to avoid damaging wheel hub and to press bearing from its outer race.

Install a NEW seal.

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Wheel Hub Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

When installing wheel hub, ensure inner spacer is properly seated against both inner races (wheel bearing and wheel hub bearing).

REAR TIRE

Rear Tire Inspection

Check tire pressure. Check for air leaks (hissing sound) caused by an ill-fitting rim or a faulty tire valve.

Check tire for:

- Cuts
- Slits
- Cracks.

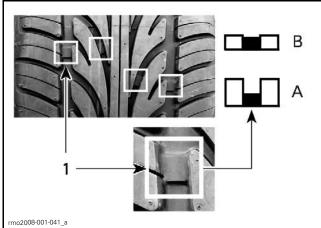
Check sides of tire for:

- Bumps
- Bulaes
- Nails
- Other foreign objects.

Check minimum tread depth by using the treadwear indicators. Check in three locations across the tire tread:

- Outer edge
- Center
- Inside edge.

The tread-wear indicators will appear across the treads that have been worn down to the minimum tread depth. When at least one tread-wear indicator appears across the tread, have the tire replaced as soon as possible.



- 1. Tread-wear indicator
- A. Appropriate tread depth
- B. Minimum tread depth, replace tire

It is normal to see uneven wear on tire depending on how the vehicle is driven and road conditions. The rear tire center tread will wear unevenly depending on if the vehicle is driven smoothly or aggressively.

Recommended Tire

A WARNING

It is imperative to follow the proper *MAX LOAD RATING* of the tire relating to the model of vehicle serviced. Always check on the tire sidewall to ensure that the load rating is in accordance with the following table.

REAR TIRE LOAD RATING			
MODEL	MAX LOAD RATING	DESIGNATION	
Spyder RT	400 kg (882 lb)	MC 225/50R15 76H	

NOTE: The Spyder RT uses a heavy duty rim with a load rating of 400 kg (882 lb) to match with the tire. Always check the load rating on rim spoke to ensure that the rim meets the proper specification.

Rear Tire Replacement

WARNING

The VSS on the vehicle has been calibrated to perform best with a tire of a specific size, material, and tread pattern. Replacing the tire with one not approved by BRP can cause the VSS to be ineffective.

To replace the rear tire, do the following:

Remove rear wheel from vehicle. Refer to *REAR WHEEL* in this subsection.

Using an automotive tire changer (rim clamp type), remove the old tire and install the new one.

A WARNING

The tire is only designed to rotate in one direction. If a tire is mounted on the incorrect side, you will have less traction and could lose control.

A WARNING

It is imperative to follow the proper *MAX LOAD RATING* of the tire relating to the model of vehicle serviced. Always check on the tire sidewall to ensure that the load rating is in accordance with the specification. Refer to *RECOMMENDED TIRE*.

NOTE: Refer to manufacturer's instructions for tire changer operation.

Remove the old balancing masses from rim.

Clean inner side of wheel with alcohol to remove grease and dust.

Balance wheel using a wheel balancer.

See directive in table below depending which wheel balancer type is used.

WHEEL BALANCER		
Motorcycle type balancer	Do not remove wheel hub or wheel bearing	
Automotive type balancer	Remove wheel hub and wheel bearing	

NOTE: Refer to manufacturer's instructions for wheel balancer operation.

Install the new balancing masses inside wheel. Position them in the center of the flat inner surface of the rim.

NOTICE Improperly positioned weights can cause interference.

Install a **NEW** wheel bearing if it has been removed.

Reinstall wheel. Refer to *REAR WHEEL* in this subsection.

WARNING

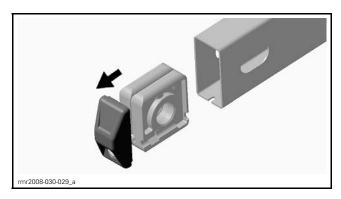
When installing a new tire, always observe a break-in period of 300 km (200 mi). During this time, the tire and the VSS will not operate at their maximum efficiency. You could lose control and crash – use extra caution.

REAR WHEEL TENSIONER

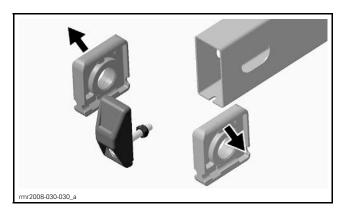
Rear Wheel Tensioner Removal

Remove rear wheel. Refer to *REAR WHEEL* in this subsection.

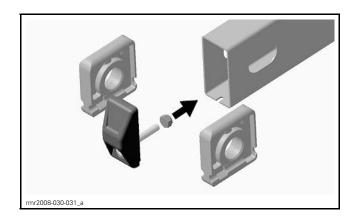
Pull tensioner out of swing arm end.



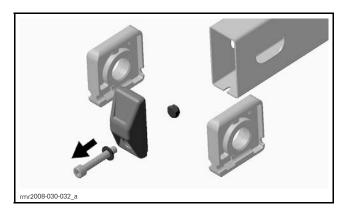
Separate both sliding blocks.



Unscrew nut completely.



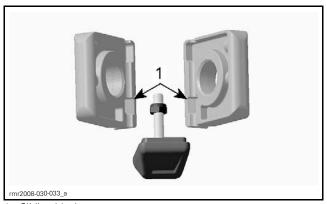
Remove tensioner bolt with its washer.



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Rear Wheel Tensioner Installation

Install nut into sliding blocks recesses.



1. Sliding blocks recesses

Insert tensioner into swing arm end.
Install and adjust all other removed parts.

ELECTRONIC SHIFT SYSTEM (SE5)

SERVICE TOOLS

Description	Part Number	Page
FLUKE 115 MULTIMETER	529 035 868	6

SERVICE TOOLS - OTHER SUPPLIER

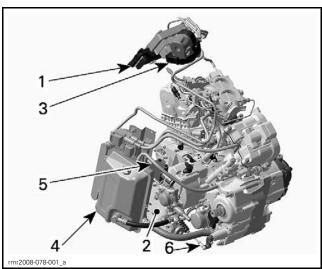
Description	Part Number	Page
FLUKE RIGID BACK PROBES	TP88	6

GENERAL

SYSTEM DESCRIPTION

The engine features a sequential electronically controlled mechanical 5-speed gearbox (SE5) with a hydraulically-actuated type clutch system.

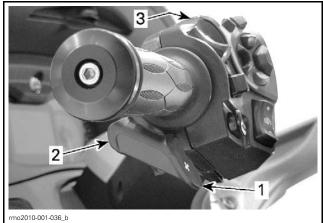
NOTE: The SE5 is an electronically controlled version of a sequential manual gearbox.



TYPICAL

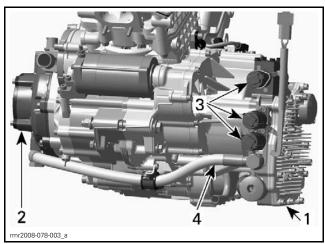
- 1. Transmission control module (TCM)
- 2. Hydraulic control module (HCM)
- 3. SE5 switches (upshift, downshift, reverse)
- 4. Oil tank
- 5. Solenoid valves
- 6. Link rod between HCM and shifter

The transmission control module (TCM) manages 4 solenoid valves located on the hydraulic control module (HCM) that control and activate the gear shifting process.



SE5 SWITCHES

- 1. Upshift
- 2. Downshift
- 3. Reverse

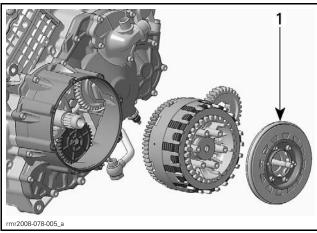


TYPICAL

- 1. HCM
- Clutch servo
 Solenoid valves
- 4. Pressure hose from HCM to clutch servo

The SE5 uses a centrifugal clutch system that engages automatically at approximately 2000 RPM as the rider increases engine RPM, and disengages when the engine falls below that RPM.

Subsection XX (ELECTRONIC SHIFT SYSTEM (SE5))



1. Centrifugal clutch

Auto Neutral

When engine is started and running, the gearbox is automatically set to the neutral position.

The gearbox is not linked with the engine until the engine speed is above approximately 2000 RPM to engage the centrifugal clutch.

Shift from Neutral

The following conditions must be met so that a gearshift can take place:

- Engine RPM is lower than 1800 RPM.
- Vehicle speed is lower than 3 km/h (2 MPH).

Upshift

When the gearshift selector is pushed (upshift) and the vehicle is stopped, the TCM will immediately signal the corresponding solenoid valves on the HCM to shift the gearbox up one gear if the gearbox is in neutral or reverse.

When the vehicle is moving and the gearbox is in 1st gear or above, a minimum RPM and speed must be met to permit an upshift to take place. Otherwise, no upshift is allowed until the required RPM is reached.

If desired, the gearbox can remain in this gear until engine reaches its rev-limited RPM.

If the gearbox is in 5th gear and the gearshift selector is pushed (upshift), nothing will happen.

Downshift

When the gearshift selector is pulled (downshift), the TCM will signal the corresponding solenoid valves on the HCM to shift the gearbox down one gear as long as it does not cause the engine RPM to exceed preset parameters.

Reverse

To shift in reverse gear:

- Engine must be running.
- Vehicle must not be moving.
- Push the reverse button.
- Pull the gearshift selector (downshift).

If gearbox is in reverse gear and the gearshift selector is pulled (downshift), nothing will happen.

Double Shift from 1st Gear or Reverse

When the gearshift selector is held for more than 1/3 second, a double shift will take place as follows:

- If gearbox is in 1st gear, the gearbox will shift to the reverse gear (reverse button must be held also).
- If gearbox is in reverse gear, the gearbox will shift to the 1st gear.

Auto Downshift

When the following conditions are met, a downshift will automatically take place:

- Throttle is released.
- Vehicle decelerates.
- A predetermined RPM is reached.
- A predetermined vehicle speed is reached.

RPM Increase on Downshift

When a downshift is commanded, the TCM will transmit a downshift signal through the CAN BUS that is used by the engine control module (ECM) to command the electric throttle actuator (ETA) to momentarily "slightly" open the throttle plates to increase engine RPM. This assists the synchronization of engine RPM and rear wheel speed without any required action by the operator. This also prevents the RPM from dropping below centrifugal clutch engagement speed.

Vehicle Stop

When coming to a complete stop, after the gearbox has shifted into first gear, the centrifugal clutch will automatically disengage the engine from the gearbox. This prevents stalling and leaves the vehicle ready for its next acceleration event.

TROUBLESHOOTING

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.

TROUBLESHOOTING GUIDELINES

This troubleshooting guideline should be used jointly with the flow chart available in the pocket located on the last page of this manual.

For any problem, start troubleshooting by:

- Checking fault codes using B.U.D.S. Communication problems should be checked first.
- Checking oil level and condition. Engine and clutch share the same oil. Oil type, level and condition are very important. Refer to LUBRI-CATION SYSTEM subsection for details.

Gearbox Does Not Shift Into Gear (Up or Down)

- Carry out the TCM STATUS VALIDATION. Refer to TRANSMISSION CONTROL MODULE (TCM) in this subsection.
- Using B.U.D.S., check shifting system components (shift switches, solenoid valves, TCM, etc.).
- Check hydraulic and mechanical components.

Erratic or Harsh Shifting

Carry out a *CLUTCH ACTIVATION TEST*, refer to *TEST WITH B.U.D.S.* in this subsection.

Gearbox Does Not Shift Into Reverse

Refer to *REVERSE BUTTON TEST WITH B.U.D.S.* in the *GEARBOX* subsection.

TROUBLESHOOTING WITH B.U.D.S.

B.U.D.S. provides useful features to troubleshoot the gear shift system. Most are obvious. The others are described here.

NOTE: Some items need the engine to be running to be monitored in B.U.D.S. In this case, follow the displayed instructions carefully.

Monitoring Page in B.U.D.S.

Clutch mod (%) is useful to acknowledge the clutch modulation while shifting.

Outputs Section

Clutch/Shift Up/Shift Down sol

 When ON, it indicates that the TCM sent the command to activate the related solenoid.

Check TCM

 When ON, it indicates that a fault relative to the TCM is active.

TCM Active

- When ON, it indicates that the TCM is working to carry out the gear shifting.
- When OFF, it indicates that the TCM is OFF because of a TCM malfunction. No gear shift will take place. Refer to TCM STATUS VERIFICATION in this subsection.

BLS/Reverse (R) / Neutral (N):

- They indicate their status as seen by the TCM.

Switch Inputs Section

When a LED is on, it indicates that the switch sends the signal.

Activation Page in B.U.D.S.

Activation section allows the activation of the different solenoids.

Routine section allows to force an action such as an upshift or downshift. For example, the **Shift up** button will activate all the necessary solenoids, in the proper sequence, required to carry out an upshift.

Test with B.U.D.S.

Connect vehicle to B.U.D.S.

NOTE: Make sure you have checked fault codes and engine oil level prior to carrying the following tests.

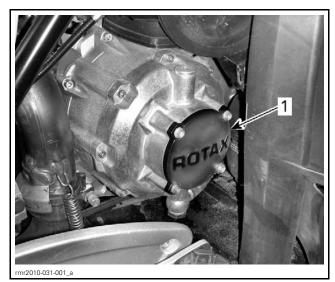
Clutch Activation Test

Refer to *BODY* and Remove RH bottom rear side panel.

Remove clutch cover cap.

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Subsection XX (ELECTRONIC SHIFT SYSTEM (SE5))



1. Clutch cover cap

NOTE: If oil is present when removing cap, check the O-ring on the clutch piston nut and the clutch piston seal. Replace as required.

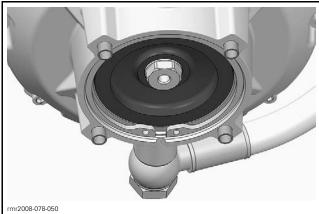
Make sure TCM is operational. Refer to *TCM STA-TUS VERIFICATION* in this subsection.

Select the **TCM** tab on the **Activation** page. Look at the **Routine** section.

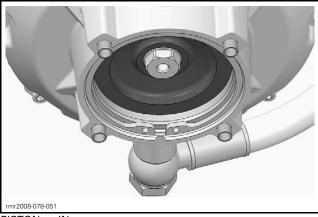
Start engine and let run at idle.

In B.U.D.S., click the Clutch activation button.

Clutch piston should move outwards then return approximately at the same speed.



PISTON — OUT



PISTON — IN

If test is successful, carry out a *CLUTCH ACTIVA-TION AND MODULATION TEST* below.

If test failed, check the HCM oil pressure and the clutch solenoids operation. Refer to *HY-DRAULIC CONTROL MODULE (SE5)* subsection. If the HCM oil pressure and solenoids test good, check for clutch mechanical problems. Refer to *CLUTCH (SE5)* subsection.

Clutch Activation and Modulation Test

In B.U.D.S., click the Clutch activ + mod button.

Clutch piston should move outwards then return slower than when it moved outwards. Otherwise, check the clutch modulation solenoid operation. Refer to *HYDRAULIC CONTROL MODULE* (SE5) subsection.

Shifting Test

If shift switches DELs turn ON in B.U.D.S. when switches are pressed in but gearbox does not shift gears, carry out the following:

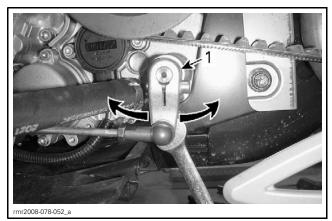
Start engine

Go in **TCM** under **Activation**. Look at the **Routine** section.

Click on the **Upshift** or **Downshift** button.

Gearbox should shift into selected gear. If not, try to manually shift gearbox through all gears as follows:

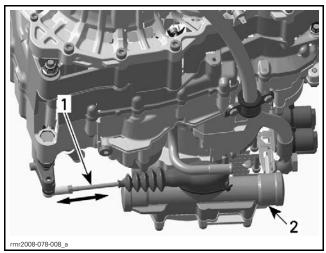
Install a 13 mm wrench on the flat edges of the shift shaft lever and use it to turn shift shaft.



1. Shift shaft lever

If the shift shaft does not turn, disconnect its linkage and try again to turn the shift shaft.

- If the shift shaft does not turn, proceed with gearbox repair.
- If the shift shaft turns, inspect the shift linkage and the HCM hydraulic piston.



VIEW FROM BACK SIDE OF HCM

- Shift linkage
 Hydraulic piston in HCM

PROCEDURES

GEAR SHIFTING SWITCHES

Gear Shifting Switches Test with B.U.D.S.

Connect vehicle to B.U.D.S...

Make sure that both clutch and clutch modulation solenoids and valves work.

Select the **TCM** tab in the **Monitoring** page. Look at the Switch Inputs.

The LEDs in B.U.D.S. should be OFF when no switch is activated and should turn ON while pressing on the corresponding switch.

If both LEDs turn ON at the appropriate moment, carry out the SHIFTING TEST. Refer to TROUBLESHOOTING WITH B.U.D.S. in this subsection.

If LEDs do not turn ON when switches are pressed in, check left multifunction switch (MSL), refer to LIGHTS, GAUGE AND ACCESSORIES subsection.

TRANSMISSION CONTROL MODULE (TCM)

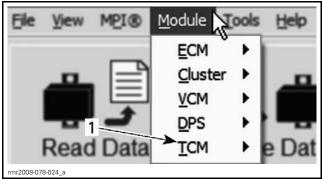
TCM Status Validation

Turn ignition key to ON.

Ensure that fuel pump turns on a few seconds. Otherwise, check ECM power supply.

Connect B.U.D.S. and logon.

Look in the Module menu if the TCM module is visible. Otherwise, the module is not powered, defective or cannot communicate via CAN.



1. TCM is visible

If TCM module is visible, select Monitoring page and TCM tab.

Make sure TCM active LED is turned on. Otherwise, turn ignition switch (key) OFF, wait 30 seconds, then turn it ON. If LED still does not turn on, try a new TCM.

NOTE: Make sure there is no communication problem code.

If TCM module is visible and active, carry out GEAR SHIFTING SWITCHES TEST WITH B.U.D.S..

If TCM module is not visible or active, carry out TCM INPUT VOLTAGE TEST.

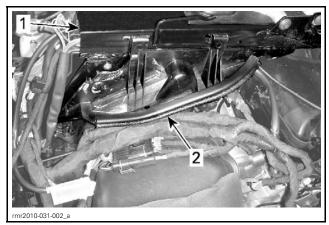
TCM Input Voltage Test

Check fuse MF2 in rear fuse box.

Refer to BODY and remove console module.

Remove acoustic panel.

Subsection XX (ELECTRONIC SHIFT SYSTEM (SE5))



Frame
 Acoustic panel

Disconnect TCM connector.

Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and FLUKE RIGID BACK PROBES (P/N TP88).

Set multimeter to Vdc.

Read voltage as follows.

NOTICE To avoid damaging the connector, probe only the terminal tip.

TCM CONNECTOR	BATTERY	VOLTAGE	
Pin 17	Ground	Pattory voltage	
Pin 35	Ground	Battery voltage	

Turn ignition switch (key) ON.

TCM CONNECTOR	BATTERY	VOLTAGE (KEY ON)
Pin 4	Ground	Battery voltage



If voltage is not good, check wiring/connectors between TCM and main relay 2. Refer to *WIRING DIAGRAM*.

If voltage is good, carry out a *TCM GROUND TEST*.

Clear fault codes.

TCM Ground Test

Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and FLUKE RIGID BACK PROBES (P/N TP88).

Set multimeter to VDC.

Check ground as follows:

Connect multimeter red probe to a positive source such as the battery terminal of the starter solenoid.

Probe pin 10, then pin 28 of TCM connector with the black (COM) probe of the multimeter. If ground is good, multimeter will show battery voltage.

NOTICE To avoid damaging the connector, probe only the terminal tip.

TCM CONNECTOR	BATTERY	RESULT	
Pin 10	Positive source	Pattonyvaltaga	
Pin 28	Positive source	Battery voltage	



If ground circuits are not good, check wiring and connections between TCM and battery ground.

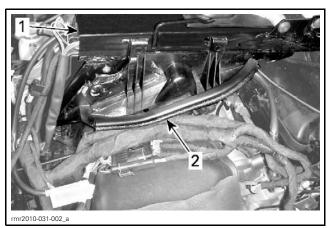
If ground circuits are good, try a new TCM.

Clear fault codes.

TCM Replacement

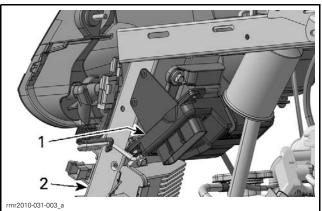
Removal

Refer to *BODY* and remove console module. Remove acoustic panel.

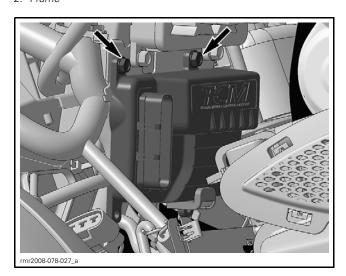


Frame
 Acoustic panel

Disconnect TCM connector.
Remove TCM retaining screws.



1. TCM 2. Frame



Pull out TCM.

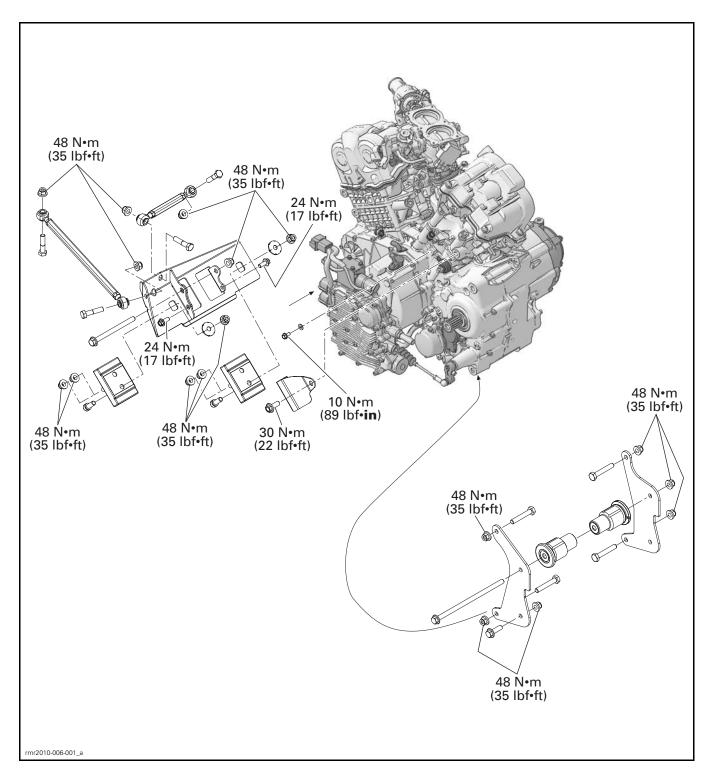
Installation

Reverse removal procedures.

ENGINE REMOVAL AND INSTALLATION

SERVICE TOOLS

Description	Part Number	Page
BLIND HOLE BEARING PULLER SET	529 036 117	11
ENGINE LIFTING TOOL	529 036 181	



GENERAL

A CAUTION To avoid potential burns, let engine and exhaust system cool down.

During assembly/installation, use the torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

WARNING

Torque wrench tightening specifications must be strictly adhered to.

Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced with new ones.

NOTICE Hoses, cables or locking ties removed during the procedure must be reinstalled as per factory standard.

PROCEDURES

ENGINE

Preparation for Engine Removal

Place vehicle on a workstation that will have access to an engine-lifting hoist.

Disconnect the BLACK (-) cable from battery, then the RED (+) cable.

WARNING

Always disconnect battery cables exactly in the specified order, the BLACK (-) cable first. It is recommended to disconnect electrical connections prior to disconnecting fuel lines.

Remove the following panels (refer to *BODY* for procedure):

- Both top side panels
- Both rear panels
- Both middle side panels
- Both bottom side panels (rear and front)
- Front storage compartment
- Glove box
- Central panel.

Drain oil (engine and oil tank). Refer to *LUBRICA-TION SYSTEM* subsection.

Drain engine coolant. Refer to *COOLING SYS-TEM* subsection.

Remove muffler and catalytic converter. Refer to *EXHAUST SYSTEM* subsection.

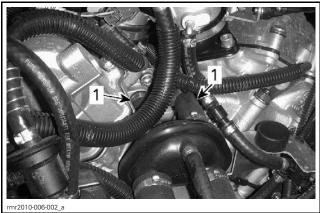
Remove both lateral supports. Refer to *FRAME* subsection.

Remove the air filter housing and the resonator. Refer to *AIR INTAKE SYSTEM* subsection.

Release drive belt tension. Refer to *DRIVE BELT AND REAR WHEEL* subsection.

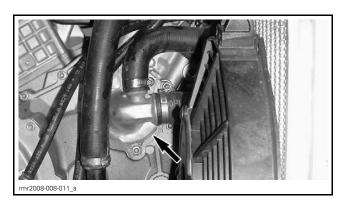
On Right Side of Vehicle:

1. Disconnect the coolant hoses from cylinder heads.

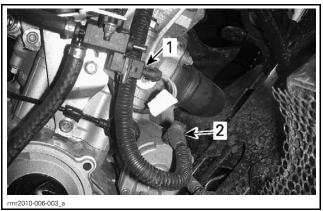


1. Coolant hoses

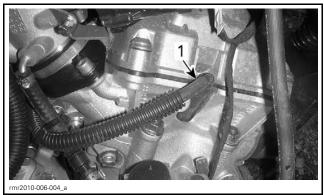
2. Remove screws retaining water pump cover.



- 3. Unplug the clutch actuation valve connector.
- 4. Remove the starter cable from the starter.



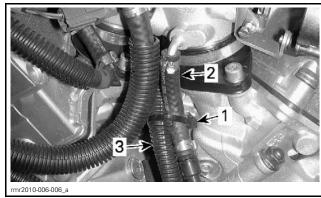
- Clutch actuation valve connector
 Starter cable
- 5. Unplug spark plug cable from the front cylinder head.



- 1. Spark plug cable
- 6. Unplug the electric throttle actuator (ETA) connector.



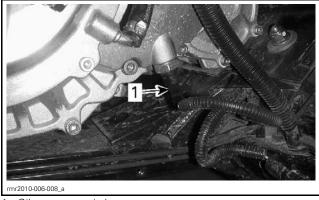
- 1. ETA connector
- 7. Cut locking tie attaching spark plug cable and clutch actuation valve hose.



- Cut this locking tie Clutch activation valve hose Spark plug cable
- 8. Disconnect the clutch actuation valve hose from throttle body.

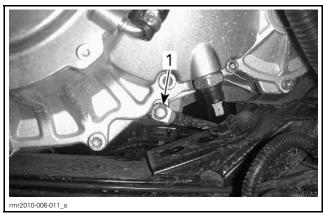


- 1. Cut this Oetiker clamp
- 9. Unplug the oil pressure switch



3

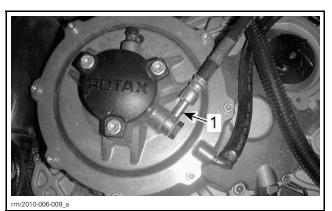
- 1. Oil pressure switch
- 10. Remove ground wire from engine.



1. Ground wire screw

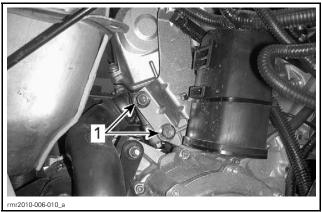
11. On **SM5 models**, disconnect clutch hose and discard sealing washers.

NOTE: Place a container under clutch hose to recover the clutch fluid.



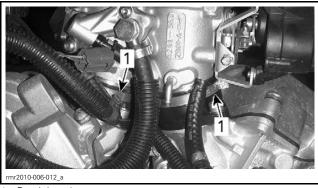
1. Clutch hose

12. Remove screws retaining the EVAP canister to cylinder.



1. EVAP canister support screws

13. Loosen clamps securing throttle body to intake adapters.

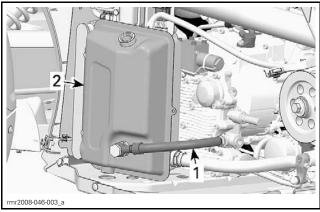


1. Retaining clamps

14. Lift throttle body and attach it against the top frame member.

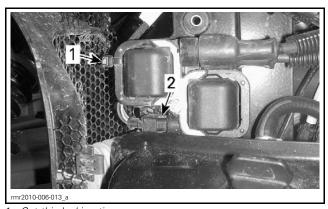
On left side of vehicle:

1. On **SE5 models**, detach the clutch servo hose from the bottom of oil tank.



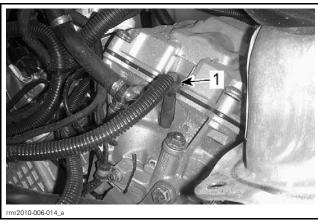
1. Clutch servo hose

- 2. Oil tanl
- 2. Cut locking tie retaining ignition coil wire and unplug ignition coil connector.

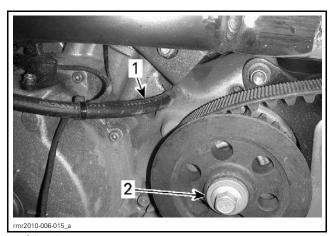


Cut this locking tie
 Ignition coil connector

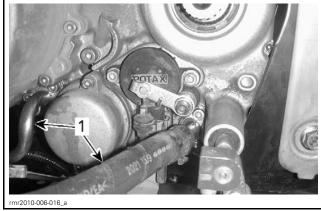
3. Unplug spark plug cable from the front cylinder head.



- 1. Spark plug cable
- 4. Disconnect the oil tank vent from crankcase.
- 5. Remove the front sprocket and move drive belt rearward. Refer to GEARBOX subsection for procedure.

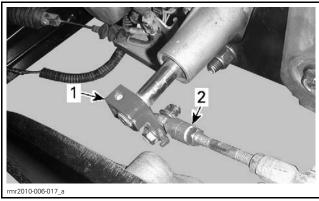


- Oil tank vent
 Front sprocket screw
- 6. Remove both oil hose connectors from crankcase.

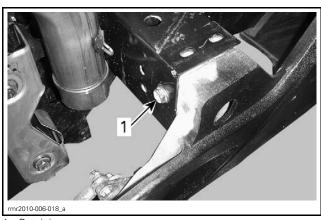


7. Remove the oil tank and oil cooler with the ignition coil.

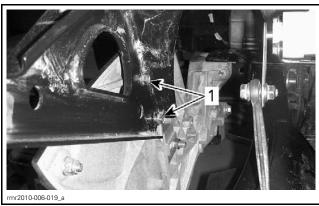
- 8. Remove the LH footrest.
 - 8.1 Remove bolt retaining shifting link to shifting block.



- Shifting block
 Shifting link
- - 8.2 Remove screw securing the middle of the footrest to frame.

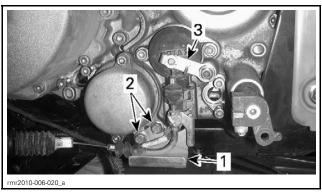


- 1. Retaining screw
 - 8.3 Remove both screws securing the rear of footrest to footrest support.



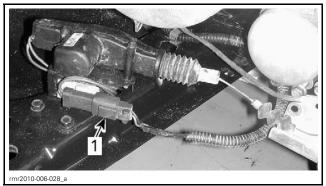
- 1. Rear retaining screws
- 9. Remove screws retaining reverse cable support to engine and detach the end of the cable from the reverse lever.

5



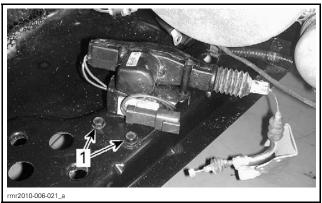
- Reverse cable support
 Retaining screws
 Reverse lever

- 10. Unplug the reverse actuator.



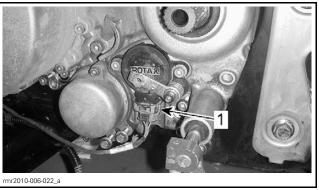
1. Reverse actuator connector

11. Remove screws retaining the reverse actuator to frame.

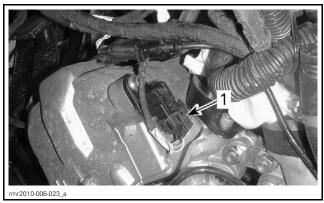


1. Reverse actuator screws

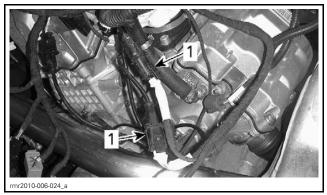
12. Unplug the following sensors.



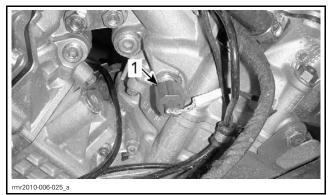
1. Gearbox position sensor (GBPS)



Camshaft position sensor (CAPS)



1. Both knock sensors (KS)

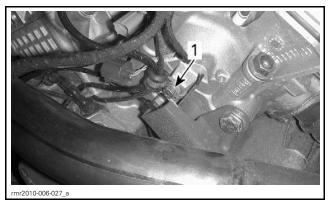


Coolant temperature sensor (CTS)



1. Crankshaft position sensor (CPS)

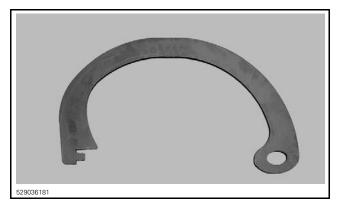
13. Detach clamp retaining knock sensor wires to engine.



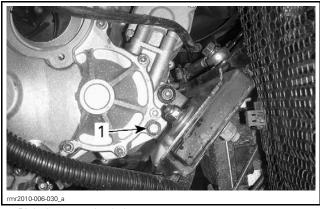
1. Clamp retaining screw

Lifting Engine

- 1. Install the lifting tool.
 - 1.1 Turn the handlebar fully LH to avoid damaging it with lifting tool.
 - 1.2 Install the hook of the ENGINE LIFTING TOOL (P/N 529 036 181) between cylinder heads.

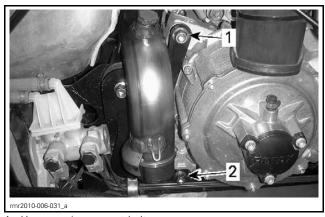


2. On RH side of the vehicle, remove the front lower engine bolt.



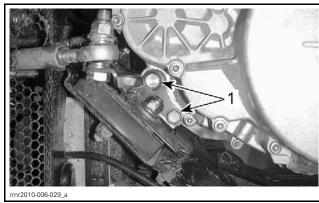
1. Right lower engine bolt

3. Remove engine support bolts.



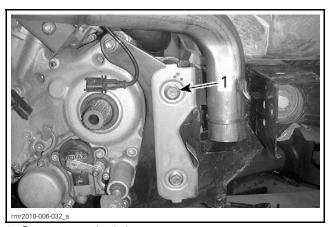
Upper engine support bolt
 Lower engine support bolt

4. On the LH side of engine, remove both front engine bolts.



1. Left front engine bolts

5. Remove the rear upper engine bolt.



1. Rear upper engine bolt

- 6. Remove the rear engine support on the RH side of vehicle.
- 7. Lift engine slowly and remove it from vehicle.

Engine Installation

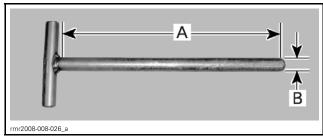
The installation is the reverse of the removal procedure. However, pay attention to the following.

NOTE: Prior to install engine, inspect condition of engine mounts.

Position engine in chassis.

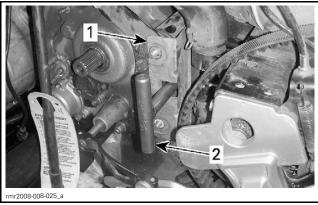
Install the engine mounts shield.

Install an alignment pin (homemade tool) through engine supports and chassis to align the engine.



ALIGNMENT PIN — HOMEMADE TOOL

A. Approximately 400 mm (16 in) B. 19 mm (3/4 in)



TYPICAL

- Engine mounts shield
- Alignment pin

Lean engine against alignment pin.

Install all mounting bolts and mounting nuts.

Torque mounting bolts and mounting nuts to 48 N•m (35 lbf•ft).

Remove alignment pin.

Install all other removed parts.

Final Assembly

Make sure coolant and oil drain plugs are reinstalled and tight.

Fill cooling system. Refer to COOLING SYSTEM subsection.

Fill engine with the recommended oil and required quantity. Refer to LUBRICATION SYSTEM subsection.

Reconnect battery.

WARNING

Connect RED (+) cable then BLACK (-) cable. Always connect RED (+) cable in first.

Start engine and let it reach its operating temperature.

Stop engine and check coolant and oil levels. Refill as necessary.

Align and adjust tension of drive belt. Refer to DRIVE BELT AND REAR WHEEL subsection.

Test drive vehicle to confirm proper operation.

ENGINE MOUNTS

Engine Mounts Removal

Front Rubber Mounts

Refer to BODY subsection to remove the following parts:

Both top side panels

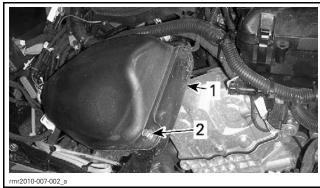
- Both middle side panels
- Both bottom side panels (rear and front)
- Glove box
- Central panel.

Release drive belt tension. Refer to *DRIVE BELT AND REAR WHEEL* subsection.

Move oil tank and oil cooler (for LH side) or radiator (for RH side) aside to make room.

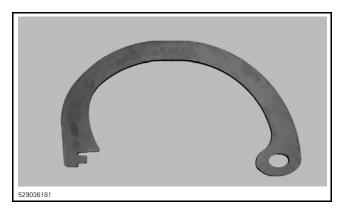
Remove the air filter housing cover.

On left side, remove retaining bolt securing resonator.



- 1. Resonator
- 2. Resonator retaining bolt

Install the ENGINE LIFTING TOOL (P/N 529 036 181).

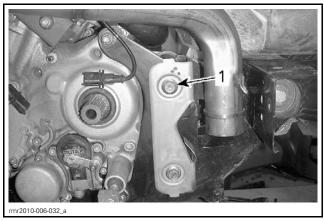


On RH side of the vehicle, remove engine support bolts.



- 1. Upper engine support bolt
- 2. Lower engine support bolt

On the LH side of engine, remove the rear upper engine bolt.

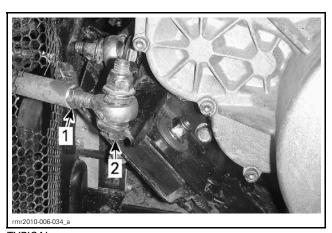


1. Rear upper engine bolt

Loosen both jam nuts of longitudinal tie rod. Remove bolt securing the longitudinal tie-rod to front engine support.



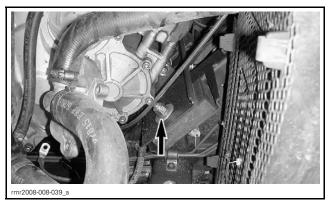
1. Front jam nut



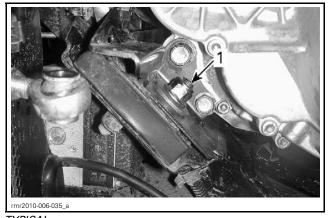
TYPICAL

- 1. Rear jam nut
- 2. Tie-rod retaining bolt

Remove nuts securing the front engine support.



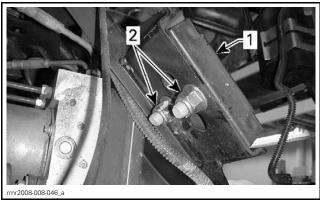
RH SIDE OF VEHICLE



TYPICAL
1. Left front engine support bolt

Lift the engine just enough to free the front of enaine.

Unscrew nuts retaining front rubber mount on frame.



Front rubber mount
 Remove these nuts

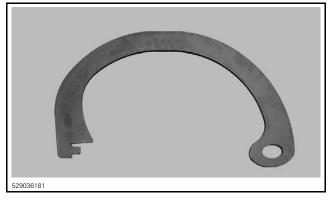
Rear Rubber Mounts

Refer to *BODY* subsection to remove the following parts:

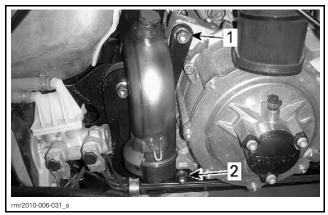
- Both top side panels
- Both middle side panels
- Both bottom side panels
- Glove box
- Central panel.

Release drive belt tension. Refer to *DRIVE BELT AND REAR WHEEL* subsection.

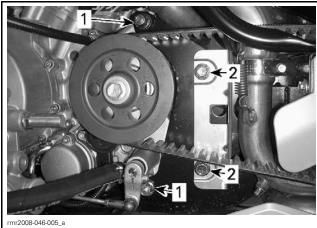
Install the ENGINE LIFTING TOOL (P/N 529 036 181).



1. Remove engine support bolts.



- Upper engine support bolt
- 2. Lower engine support bolt



TYPICAL – LH REAR ENGINE SUPPORT

- Engine support nuts
 Engine support bolts

Using the BLIND HOLE BEARING PULLER SET (P/N 529 036 117), remove rear rubber mounts.





TYPICAL

Engine Mounts Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Front Rubber Mounts

Install rubber mount.

Tighten nuts to 48 N•m (35 lbf•ft).

Tighten all engine bolts.

Fingertight longitudinal tie-rod until any play is removed, Hold tie-rod and torque both jam nuts.

Rear Rubber Mounts

Insert rubber mount into tube and align the tab with the recess on tube.

Using a plastic hammer, insert rubber mount into tube.

EXHAUST SYSTEM

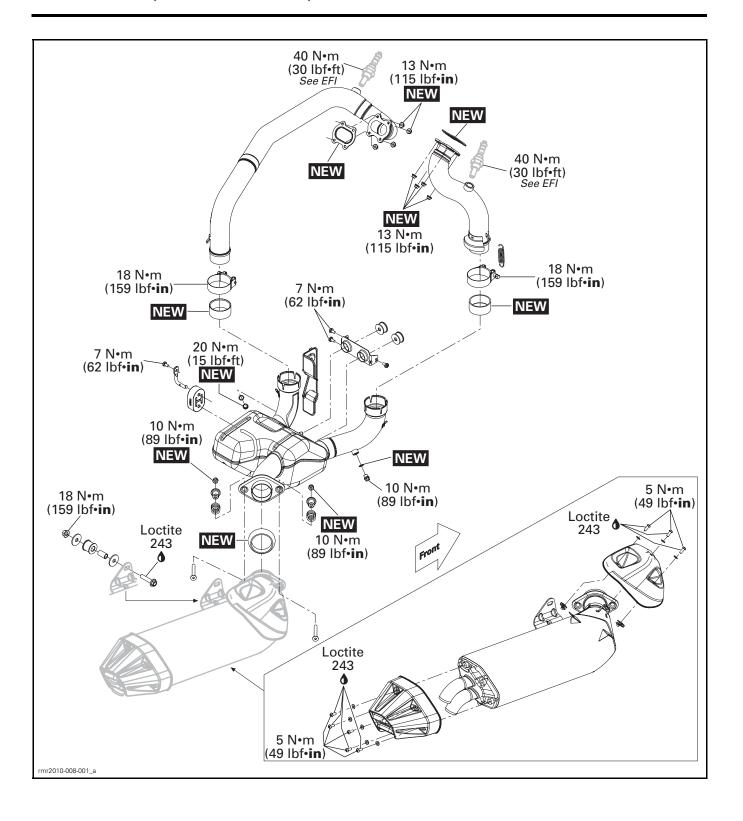
SERVICE TOOLS

Description	Part Number	Page
SPRING INSTALLER/REMOVER	529 035 983	6

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	5

Subsection XX (EXHAUST SYSTEM)



GENERAL

A WARNING

To avoid potential burns, never touch exhaust system components immediately after the engine has been run as these components are very hot. Let engine and exhaust system cool down before performing any servicing.

During assembly/installation, use the torque values and service products as specified in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

A WARNING

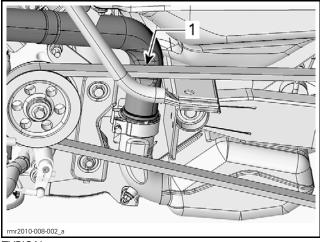
Torque wrench tightening specifications must be strictly adhered to. Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be replaced.

Hoses, cables or locking ties removed during a procedure must be reinstalled as per factory standards.

EXHAUST SYSTEM INSTALLATION SEQUENCE

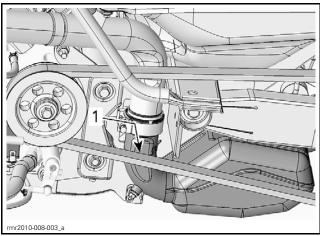
NOTE: When installing exhaust system components, use new gaskets and new hardware as applicable. Apply specified torques. Refer to the exploded view.

- 1. Install all exhaust system components loosely to ease adjustment of components.
- 2. Check exhaust system clearance gaps as component fasteners are torqued:
 - 2.1 Ensure clearance between the LH forward head pipe and the drive belt is at least 8 mm (5/16 in).



TYPICAL

- 1. Head pipe to drive belt clearance
 - 2.2 Ensure clearance between the LH forward pipe on the catalytic converter and the drive belt is at least 8 mm (5/16 in).

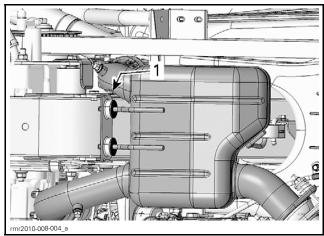


TYPICAL

- 1. Catalytic converter pipe to drive belt clearance
 - 2.3 Ensure clearance between the LH forward pipe on the catalytic converter and the frame is at least 3 mm (1/8 in).

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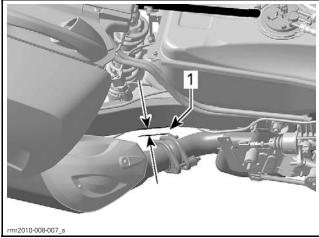
Subsection XX (EXHAUST SYSTEM)



TYPICAL

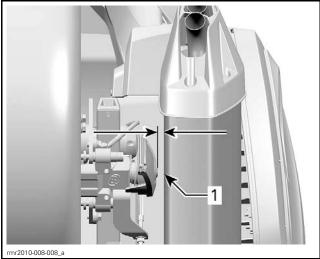
- 1. Catalytic converter pipe to frame clearance
 - 2.4 Ensure clearance between the flange on the catalytic converter exit pipe and the swing arm is at least 4 mm (5/32 ft).

NOTE: This measurement is taken at a slight angle with the suspension fully extended.



TYPICAL

- 1. Converter flange to swing arm clearance
 - 2.5 Ensure clearance between the park brake pulley nut/bolt on the rear wheel and the muffler is at least 10 mm (13/32 in)



TYPICAL

- 1. Park brake pulley nut/bolt to muffler clearance
- Torque exhaust system components in the following order. Adjust sequence as required according to parts removal and installation to ensure proper clearances are obtained.
 - Rear head pipe (RH) to cylinder head
 - Front head pipe (LH) to cylinder head
 - Catalytic converter support bracket to frame mounts
 - Rear head pipe to catalytic converter (clamp)
 - Front head pipe to catalytic converter (clamp)
 - Muffler mounting bolt.
 - Muffler to catalytic converter flange bolts
- 4. Recheck clearances when all components are torqued. Adjust as required.

MAINTENANCE

CATALYTIC CONVERTER FRONT GASKET REPLACEMENT

- 1. Open the seat and both side rear cargo compartments.
- 2. Remove both mirrors, refer to *BODY* subsection.
- 3. Remove the following body panels, refer to *BODY* subsection:
 - LH and RH middle side panels
 - LH and RH wind deflectors
 - LH and RH top side panels
 - LH and RH acoustic panels
 - LH and RH rear side panels

- 4. Remove spring (right head pipe to catalytic converter) and clamps retaining catalytic converter to both head pipes, refer to *CATALYTIC CONVERTER REMOVAL*.
- 5. Remove the screws that secure to the frame the forward support bracket for the catalytic converter.
- 6. With the assistance of a coworker, support the muffler and remove the muffler retaining bolt.

NOTICE Insert padding between muffler and park brake pulley on rear wheel axel to prevent contact between parts and damage to the muffler.

- 7. As you support the catalytic converter, unhook the upper rubber support from the catalytic converter.
- 8. Carefully pull the catalytic converter off both head pipes.

NOTICE Do not let the muffler contact any part of the vehicle to avoid damaging the finish on the muffler or any part it may contact. Wrap the muffler with a thick cloth or blanket to protect it during removal, installation.

- 9. Remove exhaust gasket from each head pipe.
- 10. Install a **NEW** exhaust gasket on each pipe.
- 11. Install the muffler and catalytic converter in the reverse order of the removal however, pay attention to the following:
 - Clean muffler retaining bolt threads and apply LOCTITE 243 (BLUE) (P/N 293 800 060), or install a new bolt.
 - Torque muffler retaining bolt and converter exhaust clamps to 18 N•m (159 lbf•in).
 - Torque the screws that secure the catalytic converter support bracket to 7 N•m (62 lbf•in).

INSPECTION

Always inspect exhaust system parts for the following defects or damages:

- Cracks
- Tearing
- Bending
- Dents
- Corrosion
- Leaks
- And any other damage or defect which could affect system performance.

Replace as required.

PROCEDURES

MUFFLER HEAT SHIELD

Heat Shield Removal

Remove the three screws mounting the heat shield to the forward end of the muffler.

Heat Shield Installation

- 1. Apply LOCTITE 243 (BLUE) (P/N 293 800 060) to the threads of the mounting screws.
- 2. Position heat shield on muffler, install and torque the three mounting screws to 5.5 N•m (49 lbf•ft).

MUFFLER

Muffler Removal

- 1. Position vehicle for ease of access to muffler retaining bolt and muffler flange screws under the vehicle.
- 2. Remove the nuts and springs that secure the muffler flange to the catalytic converter flange.

NOTE: The socket head screws may be left in the flanges at this time.

3. While supporting muffler, remove the muffler mounting hex screw from the muffler support.

NOTICE Insert padding between muffler and park brake pulley on rear wheel axel to prevent contact between parts and damage to the muffler.

- 4. Remove the two socket head screws from the muffler flange and carefully remove the muffler from the catalytic converter.
- 5. Discard old muffler gasket.

Muffler Installation

1. Install a **NEW** muffler gasket on the muffler end of the catalytic converter exhaust pipe.

NOTICE Insert padding between muffler and park brake pulley on rear wheel axel to prevent contact between parts and damage to the muffler.

- 2. Insert muffler pipe over catalytic converter pipe and insert the two socket head screws through the flanges.
- 3. Install muffler retaining bolt on muffler support and tighten nut until it bottoms out loosely.

5

Subsection XX (EXHAUST SYSTEM)

- 4. Position a wooden spacer block of 80 mm (3.15 in)in thickness between the muffler and rear swing arm, close to the muffler retaining bolt.
- 5. Install springs and retaining nuts on the muffler flange screws and tighten nuts slightly. Do not torque them at this time.
- 6. Torque the muffler retaining nut to 18 N•m (159 lbf•in).
- 7. After torquing the muffler retaining nut, torque the inner muffler flange nut until a torque of 11 N•m (97 lbf•in) is obtained, then torque the outer flange nut to same torque.

NOTE: Ensure clearance between the flange on the catalytic converter exit pipe and the swing arm is at least 4 mm (5/32 ft) with full swing arm extension. Refer to *EXHAUST SYSTEM INSTALLATION SEQUENCE* for illustration.

NOTICE When compressing the rear suspension, ensure the muffler clears the park brake pulley on the rear caliper by at least 10 mm (.394 in). If clearance is not obtained, loosen then re-torque the flange nuts until proper clearance is obtained. Refer to *EXHAUST SYSTEM INSTALLATION SEQUENCE* for illustration.

- 8. Ensure the wooden spacer block between the muffler and swing arm is removed.
- 9. Start engine and ensure the muffler gasket ring is not leaking.

CATALYTIC CONVERTER

Catalytic Converter Removal

- 1. Open the seat and both rear side cargo compartments.
- 2. Remove both mirrors, refer to *BODY* subsection.
- 3. Remove the following body panels, refer to *BODY* subsection:
 - LH and RH middle side panels
 - LH and RH wind deflectors
 - LH and RH top side panels
 - LH and RH acoustic panels
 - LH and RH rear side panels
- 4. Remove the *MUFFLER*, see procedure in this subsection.
- 5. Remove the spring retaining the catalytic converter to the rear head pipe (RH side) using SPRING INSTALLER/REMOVER (P/N 529 035 983).



6. Loosen the exhaust clamps securing the catalytic converter to both head pipes sufficiently to slide the clamps down the pipes.

NOTE: Note the position of each clamp for installation.

- 7. Remove the screws that secure the forward support bracket for the catalytic converter to the frame.
- 8. As you support the catalytic converter, unhook the rubber support above the converter.
- 9. Carefully pull down on catalytic converter exhaust pipes to disconnect them from the head pipes.

Catalytic Converter Installation

- 1. Install **NEW** gaskets on the head pipes.
- 2. Assure both exhaust clamps are positioned loosely on catalytic converter pipes prior to insertion on front head pipes.
- 3. Insert the catalytic converter support bracket onto the converter support hooks. Ensure the grommets are in good condition.
- 4. Insert the catalytic converter pipes over the head pipes.
- 5. Insert the support hook above the catalytic converter into its rubber support.
- 6. Slide exhaust clamps over each converter to head pipe joint and tighten them just enough for them to remain in position.
- 7. Install the RH head pipe spring using same tool as removal.

NOTE: Make sure pipe joints are bottomed out to prevent leakage which could affect system efficiency.

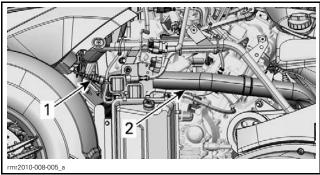
- 8. Install screws that secure the forward converter support bracket. Torque screws to 7 N•m (62 lbf•in).
- 9. Properly position exhaust clamps at converter to head pipe joints and torque them to 18 N•m (159 lbf•in).
- Ensure proper exhaust system clearance gaps are obtained. Refer to EXHAUST SYSTEM IN-STALLATION SEQUENCE at the beginning of this subsection.
- 11. Install muffler, refer to *MUFFLER INSTALLA-TION*.

12. Install all remaining removed parts and panels.

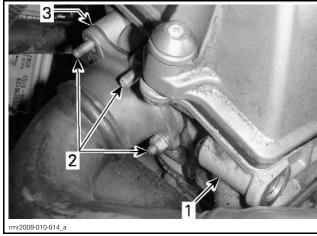
HEAD PIPE (FRONT CYLINDER)

Head Pipe Removal (Front Cylinder)

- 1. Open the seat and both rear side cargo compartments.
- 2. Remove both mirrors, refer to *BODY* subsection.
- 3. Remove the following body panels, refer to *BODY* subsection:
 - LH and RH middle side panels
 - LH and RH wind deflectors
 - LH and RH top side panels
 - LH and RH rear side panels
 - LH middle side panel
 - LH bottom front side panel
 - Oil cooler duct.
- 4. Remove the muffler. Refer to MUFFLER RE-MOVAL in this subsection.
- 5. Remove the catalytic converter. Refer to *CAT-ALYTIC CONVERTER REMOVAL* in this subsection.
- 6. Remove the oxygen sensor from the head pipe.



- Oxygen sensor
- 2. Front head pipe
- 7. Remove and discard the four nuts retaining head pipe to front cylinder head.



TYPICAL

- . Front cylinder head
- 2. Nut locations (one is not visible)
- 3. Gasket, head pipe to cylinder head
- 8. Head pipe is removed by carefully moving the pipe forward off the studs, rotating it so that it can be pulled out under the rear portion of the LH lateral support.

Head Pipe Installation (Front Cylinder)

- 1. Install **NEW** head pipe gaskets.
- 2. Install head pipe loosely on cylinder head using four **NEW** retaining nuts.
- 3. Install oxygen sensor. Torque sensor to 40 N•m (30 lbf•ft).
- 4. Install remaining exhaust system components loosely.
- 5. Torque exhaust system fasteners and ensure proper exhaust system clearance gaps are obtained. Refer to *EXHAUST SYSTEM INSTALLATION SEQUENCE* in the beginning of this subsection.

Install all remaining removed parts and panels including oil cooler duct. Refer to *BODY* subsection.

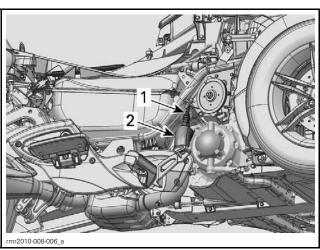
HEAD PIPE (REAR CYLINDER)

Head Pipe Removal (Rear Cylinder)

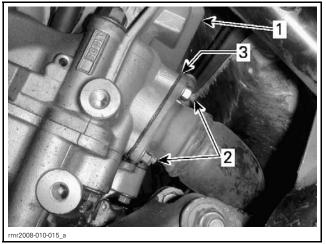
- 1. Open the seat and both rear side cargo compartments.
- 2. Remove both mirrors, refer to *BODY* subsection.
- 3. Remove the following body panels, refer to *BODY* subsection:
 - LH and RH middle side panels
 - LH and RH wind deflectors
 - LH and RH top side panels
 - LH and RH acoustic panels
 - LH and RH rear side panels

Subsection XX (EXHAUST SYSTEM)

- 4. Remove the muffler and catalytic converter, refer to *MUFFLER REMOVAL* and *CATALYTIC CONVERTER REMOVAL* procedures in this subsection.
- 5. Remove the oxygen sensor from the head pipe.



- Oxygen sensor
- 2. Rear head pipe
- 6. Remove and discard the four nuts retaining head pipe to rear cylinder head.



TYPICAL

- 1. Right cylinder head
- 2. Nut locations (two are not visible)
- 3. Gasket, head pipe to cylinder head

Head Pipe Installation (Rear Cylinder)

- 1. Install **NEW** head pipe gaskets.
- 2. Install head pipe loosely on cylinder head using four **NEW** retaining nuts.
- 3. Install oxygen sensor. Torque sensor to 40 N•m (30 lbf•ft).
- 4. Install remaining exhaust system loosely.

5. Torque exhaust system fasteners and ensure proper exhaust system clearance gaps are obtained. Refer to *EXHAUST SYSTEM INSTALLATION SEQUENCE* in the beginning of this subsection.

Install all removed panels, refer to BODY subsection.

FRONT SUSPENSION

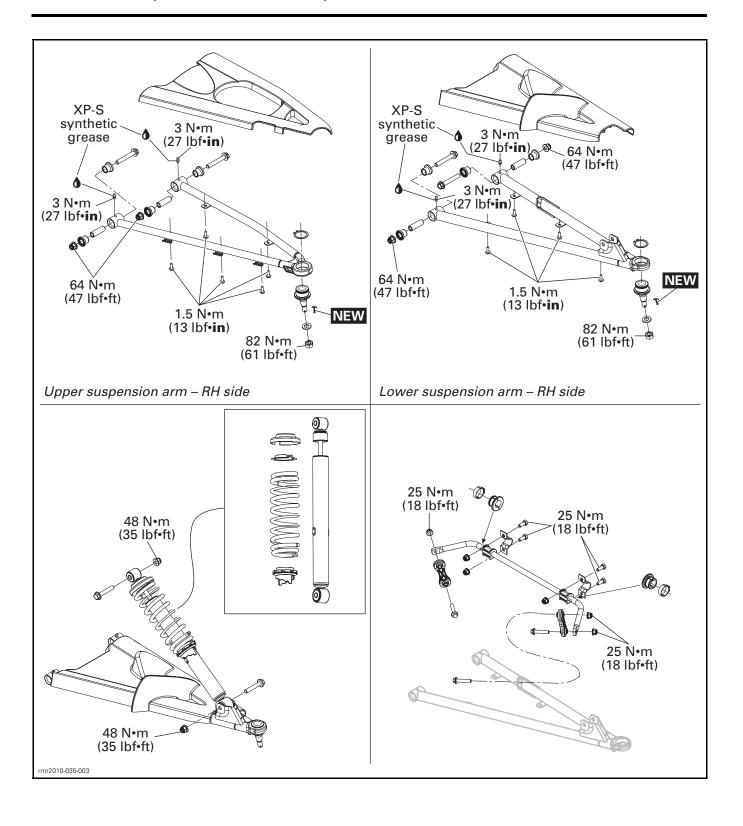
SERVICE TOOLS

Description	Part Number	Page
BALL JOINT EXTRACTOR	529 035 827	
BALL JOINT INSTALLER	529 035 975	7, 9
BALL JOINT REMOVER SUPPORT	529 036 121	7, 9
SPRING REMOVER	529 036 007	

SERVICE PRODUCTS

Description	Part Number	Page
XPS SYNTHETIC GREASE	293 550 010	4, 7, 9

Subsection XX (FRONT SUSPENSION)



GENERAL

During assembly/installation, use the torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

A WARNING

Torque wrench tightening specifications must be strictly adhered to.

Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced.

NOTICE Hoses, cables and locking ties removed during a procedure must be reinstalled as per factory standards.

ADJUSTMENT

SPRING PRELOAD

Place vehicle on a level surface.

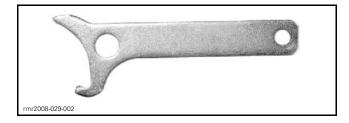
Install a jack under the front portion of frame.

Lift the front of vehicle until shock absorbers are fully extended.

A WARNING

Adjust both springs to the same load. Uneven adjustment can cause poor handling and loss of stability, and/or control, and increase the risk of an accident.

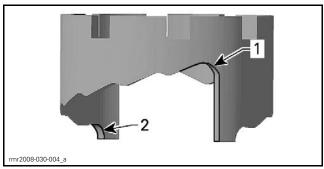
Adjust spring preload by turning adjusting cam accordingly, with the adjusting wrench in vehicle tool kit.





Turn the adjusting cams clockwise to increase spring preload.

Turn the adjusting cams counterclockwise to decrease spring preload.



- 1. Softest adjustment (position 1)
- 2. Hardest adjustment (position 5)

RECOMMENDED SPRING PRELOAD	
LOAD	CAM POSITION
68 kg (150 lb) rider	1, 2
91 kg (200 lb) rider	3
68 kg (150 lb) rider with cargo	3
91 kg (200 lb) rider with cargo	4
Rider with passenger and cargo	5

MAINTENANCE

SUSPENSION LUBRICATION

3

Place vehicle on a level surface.

Apply parking brake.

Loosen wheel lug nuts.

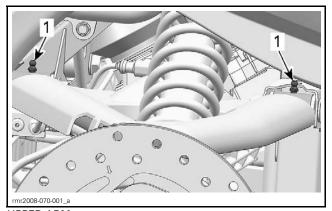
Lift the front of the vehicle.

Secure vehicle on jack stands.

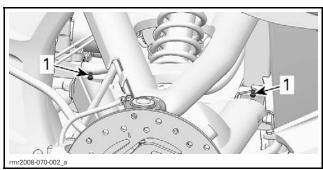
Remove wheel.

Subsection XX (FRONT SUSPENSION)

Use XPS SYNTHETIC GREASE (P/N 293 550 010) to lubricate suspension arms. There are two grease fittings per arm.



UPPER ARM
1. Grease fittings



LOWER ARM
1. Grease fittings

PROCEDURES

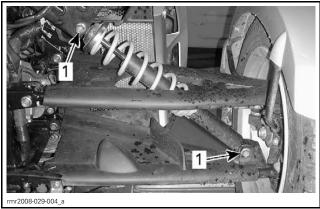
SHOCK ABSORBER

Shock Absorber Removal

Remove body parts as required to access to the shock absorber. Refer to *BODY* subsection.

Lift the front of vehicle.

Unscrew shock absorber bolts.



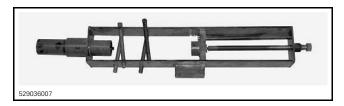
FRONT CARGO MODULE REMOVED FOR CLARITY

1. Shock absorber bolts

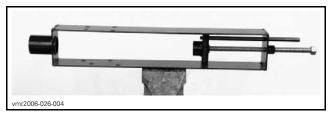
Remove shock absorber from vehicle.

Shock Absorber Disassembly

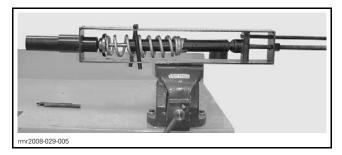
To remove spring from the shock absorber, use the SPRING REMOVER (P/N 529 036 007).



Place the tool in a vise.



Position the shock absorber in the tool and install the spring compressor pins.



Tighten the spring compressor tool screw until the spring is sufficiently compressed to remove spring locking devices.

Remove spring stopper then release the spring compressor tool screw.



TYPICAL

Shock Absorber Inspection

Examine shock for leaks.

Extend and compress the piston at least 5 complete strokes with its rod upward.

Check that rod moves smoothly and with uniform resistance over its entire stroke.

NOTE: During compression motion, it is normal to feel a small resistance only.

Pay attention to the following conditions that will denote a defective shock:

- A very weak rebound.
- A skip or a hang back when reversing stroke at mid travel.
- Seizing or binding condition except at extreme end of either stroke.
- Oil leakage.
- A gurgling noise, after completing one full compression and extension stroke.

Check piston rod for excessive wear or pitting.

Inspect the spring for damage. Replace if necessary.

On both ends, check the bushings for excessive wear or other damages.

Replace shock absorber or spring if any faults are present.

Shock Absorber Assembly and Installation

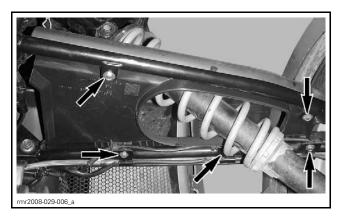
For assembly and installation, reverse the disassembly and removal procedures.

AIR DEFLECTOR (UPPER ARM)

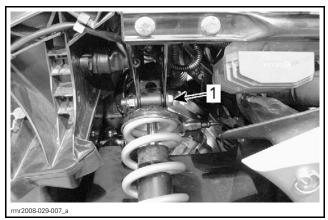
Air Deflector Removal

Remove body parts as required to access to the air deflector. Refer to *BODY* subsection.

Underneath suspension arm, remove air deflector screws.



Remove the upper shock absorber bolt.



1. Upper shock absorber bolt

Detach flexible brake hose and speed sensor wire from air deflector.

Remove the air deflector.

Air Deflector Installation

The installation is the reverse of the removal procedure.

UPPER SUSPENSION ARM

Upper Suspension Arm Inspection

Check upper suspension arms for bending or other damage. Replace suspension arms if necessary.

Move upper suspension arm from side to side and up and down. There should be no noticeable play in bushings.

If necessary, remove suspension arm and inspect pivot bushings and sleeves for wear or damages. Replace bushings and/or sleeves if necessary.

5

Subsection XX (FRONT SUSPENSION)

Upper Suspension Arm Removal

Place vehicle on a level surface.

Apply parking brake.

Remove front cargo module. Refer to *BODY* subsection.

Loosen wheel lug nuts.

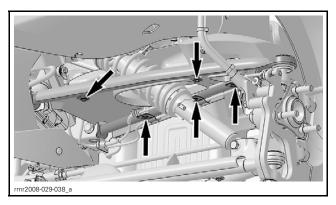
Lift the front of the vehicle.

Secure vehicle on jack stands.

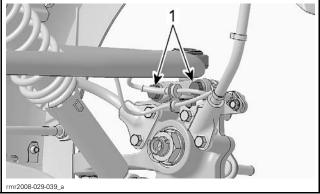
Remove wheel.

Remove brake disc and encoder wheel. Refer to *BRAKES* subsection.

Remove screws securing the air deflector on upper suspension arm.

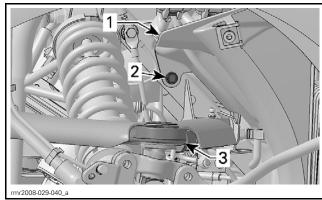


Remove screws securing the upper ball joint support.



1. Ball joint support screws

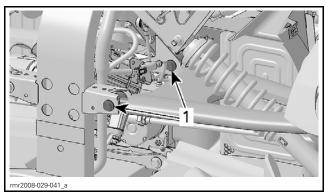
Remove upper screw retaining oil cooler air duct (LH side) or radiator air duct (RH side).



LH SIDE SHOWN

- 1. Oil cooler air duct
- 2. Screw to remove
- 3. Upper suspension arm

Unscrew upper suspension arm bolts.

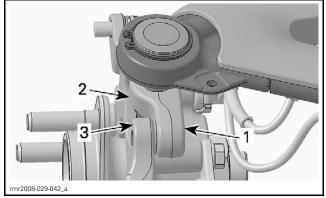


1. Upper suspension arm bolts

Remove the upper suspension arm without its air deflector.

Upper Suspension Arm Installation

The installation is the reverse of the removal procedure. However, pay attention to the following. Position the rounded side of the upper ball joint support toward knuckle.



- 1. Ball joint support
- 2. Rounded side of ball joint support

3. Knuckle

Use XPS SYNTHETIC GREASE (P/N 293 550 010) to lubricate upper suspension arm. There are two grease fittings per arm.

Perform the steering angle reset. Refer to STEER-ING ANGLE SENSOR in STEERING (DPS) AND WHEELS subsection.

Perform the torque offset reset. Refer to TORQUE OFFSET RESET in STEERING (DPS) AND WHFFI S subsection.

UPPER BALL JOINT

Upper Ball Joint Inspection

Inspect ball joint end for damage. Ensure it is moving freely without play. Replace ball joints as required.

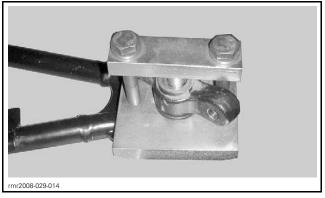
Upper Ball Joint Removal

Remove the UPPER SUSPENSION ARM, see procedure in this subsection.

Remove and discard the cotter pin from ball joint. Unscrew the ball joint nut.

Install the BALL JOINT EXTRACTOR (P/N 529 035 827) and detach ball joint support from ball joint.

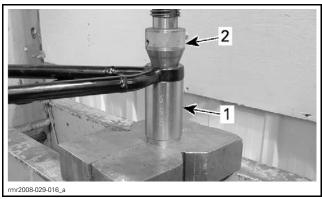




Remove circlip securing ball joint to suspension arm.



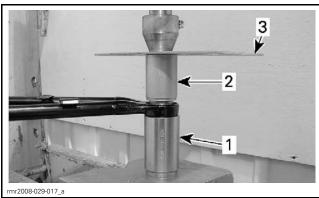
Using a press and the BALL JOINT REMOVER SUP-PORT (P/N 529 036 121), press ball joint out of the upper suspension arm.



Ball joint remover

Upper Ball Joint Installation

Using a press, the BALL JOINT REMOVER SUP-PORT (P/N 529 036 121) and the BALL JOINT IN-STALLER (P/N 529 035 975), press ball joint into the suspension arm.



- Ball joint remover
- Ball joint in
 Steel plate Ball joint installer

Install suspension arm on vehicle. Refer to UP-PER SUSPENSION ARM in this subsection.

7

Subsection XX (FRONT SUSPENSION)

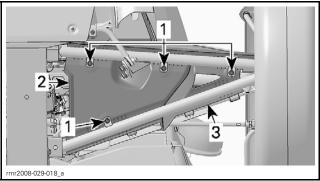
Perform the steering angle reset. Refer to STEER-ING ANGLE SENSOR in STEERING (DPS) AND WHEELS subsection.

Perform the torque offset reset. Refer to TORQUE OFFSET RESET in STEERING (DPS) AND WHEELS subsection.

AIR DEFLECTOR (LOWER ARM)

Air Deflector Removal

Underneath suspension arm, remove air deflector screws.



UNDERNEATH LH LOWER SUSPENSION ARM

- Air deflector screws
- Air deflector
 Suspension arm

Remove the air deflector.

Air Deflector Installation

The installation is the reverse of the removal procedure.

LOWER SUSPENSION ARM

Lower Suspension Arm Inspection

Check lower suspension arms for bending or other damage. Replace suspension arms if necessary.

Move lower suspension arm from side to side and up and down. There should be no noticeable play in bushings.

If necessary, remove suspension arm and inspect pivot bushings and sleeves for wear or damages. Replace bushings and/or sleeves if necessary.

Lower Suspension Arm Removal

Place vehicle on a level surface.

Apply parking brake.

Remove front cargo module. Refer to BODY subsection.

Loosen wheel lug nuts.

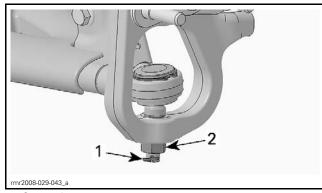
Lift the front of the vehicle.

Remove wheel.

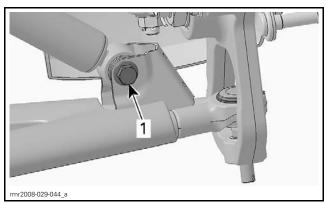
Remove brake disc and encoder wheel. Refer to BRAKES subsection.

Remove and discard cotter pin from ball joint.

Unscrew ball joint nut.

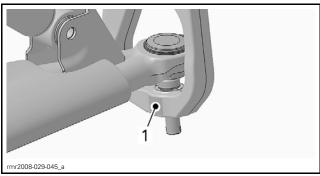


- Cotter pm
 Ball joint nut Cotter pin
- Remove the lower shock absorber bolt.



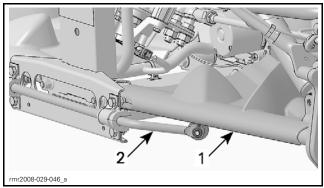
Lower shock absorber bolt

Hit the bottom of knuckle to separate ball joint.



Hit here

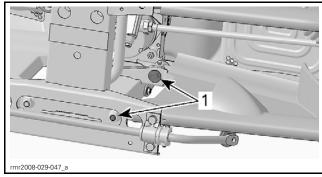
Underneath lower suspension arm, remove stabilizer bar bolt.



1. Lower suspension arm

2. Stabilizer bar

Unscrew lower suspension arm bolts.



1. Lower suspension arm bolts

Remove the lower suspension arm with its air deflector.

Turn suspension arm upside down and remove the air deflector.

Lower Suspension Arm Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Use XPS SYNTHETIC GREASE (P/N $\,$ 293 550 010) to lubricate lower suspension arm. There are two grease fittings per arm.

Perform the steering angle reset. Refer to *STEER-ING ANGLE SENSOR* in *STEERING (DPS) AND WHEELS* subsection.

Perform the torque offset reset. Refer to TORQUE OFFSET RESET in STEERING (DPS) AND WHEELS subsection.

LOWER BALL JOINT

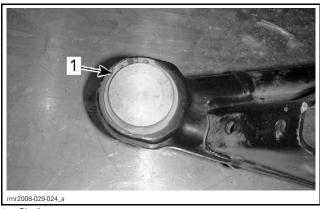
Lower Ball Joint Inspection

Inspect ball joint end for damage. Ensure it is moving freely without play. Replace ball joints as required.

Lower Ball Joint Removal

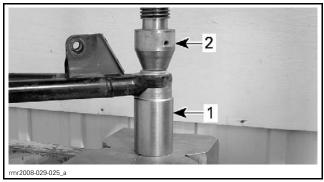
Remove the LOWER SUSPENSION ARM, see procedure in this subsection.

Remove circlip securing ball joint to suspension arm.



1. Circlip

Using a press and the BALL JOINT REMOVER SUP-PORT (P/N 529 036 121), press ball joint out of the lower suspension arm.



1. Ball joint remover

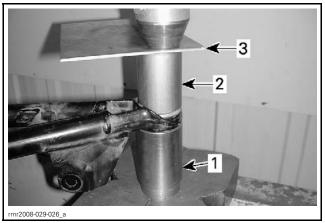
2. Pres

Lower Ball Joint Installation

Using a press, the BALL JOINT REMOVER SUPPORT (P/N 529 036 121) and the BALL JOINT INSTALLER (P/N 529 035 975), press ball joint into the suspension arm end.

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Subsection XX (FRONT SUSPENSION)



- Ball joint remover support
- Ball joint installer
 Steel plate

Install suspension arm on vehicle. Refer to LOWER SUSPENSION ARM.

Perform the steering angle reset. Refer to STEER-ING ANGLE SENSOR in STEERING (DPS) AND WHEELS subsection.

Perform the torque offset reset. Refer to TORQUE OFFSET RESET in STEERING (DPS) AND WHEELS subsection.

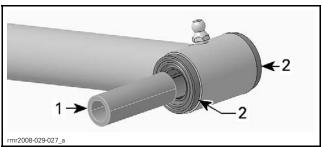
PIVOT BUSHINGS

NOTE: The following procedure is the same for all suspension arms.

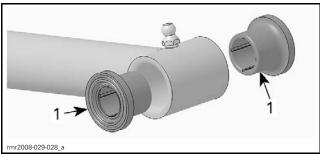
Pivot Bushings Removal

Remove appropriate suspension arm. Refer to UPPER SUSPENSION ARM or LOWER SUSPEN-SION ARM in this subsection.

Remove sleeve from pivot bushings.



- Sleeve 2. Pivot bushings
- Using a punch, remove pivot bushings.



1. Pivot bushings

Pivot Bushings Installation

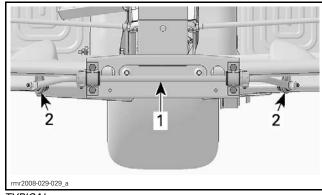
The installation is the reverse of the removal procedure.

STABILIZER BAR

Stabilizer Bar Removal

Remove front cargo module. Refer to BODY subsection.

Unscrew stabilizer bar from link rods.

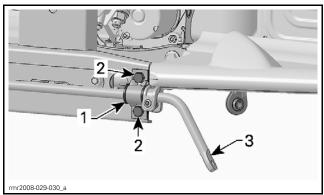


TYPICAL

- Stabilizer bar
- Link rods

Turn stabilizer bar downward.

Remove stabilizer bar bushings.

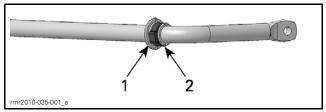


TYPICAL

- Stabilizer bar bushing
- Remove these bolts
- 3. Stabilizer bar

Remove stabilizer bar from vehicle.

Remove oetiker clamps and stabilizer bar stoppers.



- Stopper
- 2. Oetiker clamp

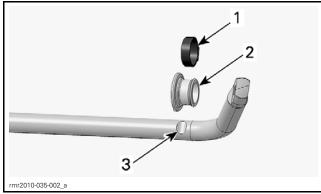
Stabilizer Bar Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

Before installing stabilizer bar, verify if all ball joints of link rods move smoothly and freely. Replace link rod if necessary.

Check stabilizer bar bushings for cracks or other damages. Replace if necessary.

Install stoppers. Align stopper with stabilizer bar groove.



- Oetiker clamp Stabilizer bar stopper Stabilizer bar groove

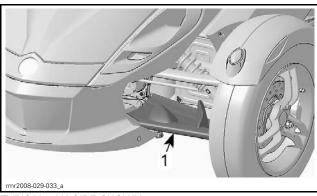
Install all other removed parts.

LINK ROD

Link Rod Removal

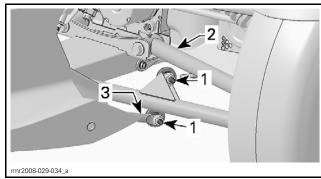
Lift the front of vehicle.

Remove the air deflector from lower suspension arm.



TYPICAL - LH SIDE SHOWN 1. Air deflector

Unscrew the bolts securing link rods.



LH SIDE SHOWN

- 1. Link rod bolts
- Lower suspension arm
 Stabilizer bar

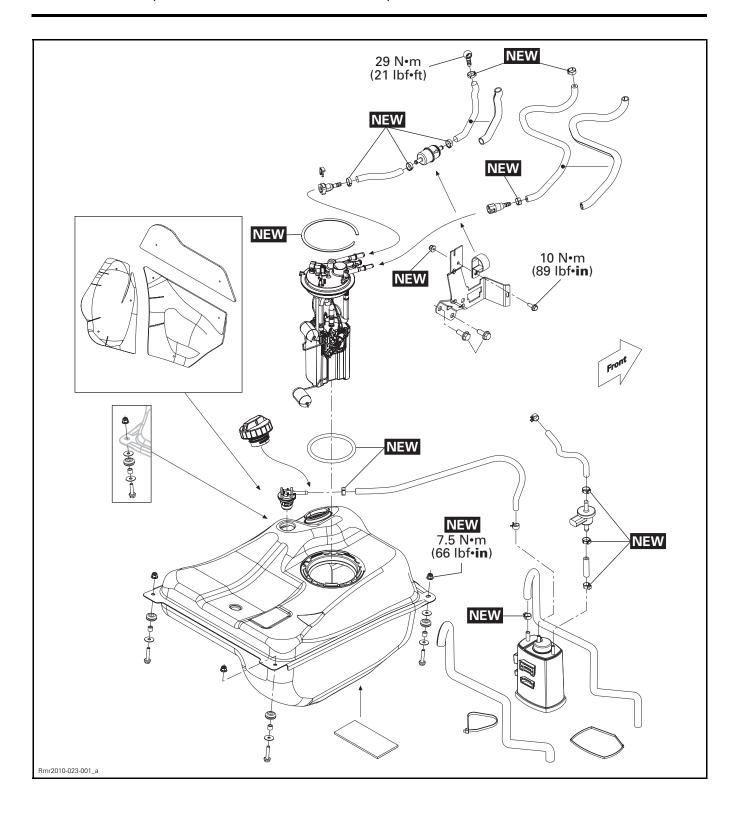
Link Rod Installation

The installation is the reverse of the removal procedure.

FUEL TANK AND FUEL PUMP

SERVICE TOOLS

Description	Part Number	Page
ECM ADAPTER TOOL		
FLUKE 115 MULTIMETER	529 035 868	17, 20
FUEL HOSE ADAPTER	529 036 023	6
OETIKER PLIERS	295 000 070	
PRESSURE GAUGE	529 035 709	6
VACUUM/PRESSURE PUMP	529 021 800	4, 19, 22



GENERAL

WARNING

Torque wrench tightening specifications must be strictly adhered to. Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced.

WARNING

Always disconnect battery prior to working on the fuel system.

WARNING

Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area.

WARNING

Do not allow fuel to spill on hot engine parts and/or on electrical connectors.

WARNING

Always proceed with care and use appropriate safety equipment when working on pressurized fuel system. Wear safety glasses.

Fuel lines remain under pressure at all times. Proceed with care when removing/installing high pressure test equipment.

Use B.U.D.S. software to disable fuel pump and crank engine to release fuel pressure prior to removing a hose.

Cover the fuel hose connections with an absorbent shop rag and carefully disconnect them to minimize spilling.

Wipe off any fuel spillage.

Hoses, cables or locking ties removed during a procedure must be reinstalled as per factory standards.

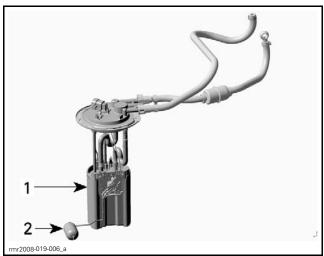
SYSTEM DESCRIPTION

The fuel tank and fuel pump system main components are:

- A fuel tank
- An electric fuel pump module
- An in line fuel filter
- An evaporative emission system
- A purge valve.

Fuel Pump Module

The fuel pump module is inserted through the top of the fuel tank. It includes an electric fuel pump and a float type fuel level sensor that varies in resistance according to fuel level.



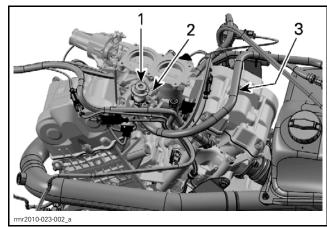
TYPICAL

- Fuel pump
- 2. Fuel level sensor

Fuel Pressure Regulator

The fuel pressure regulator is mounted on the LH side of the throttle body. It controls the fuel pressure in the system and allows excess fuel to return to the fuel tank.

The fuel pressure regulator is referenced to atmospheric pressure. A small filter is attached to the atmospheric pressure port.

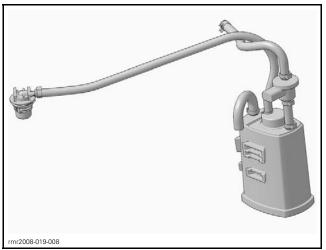


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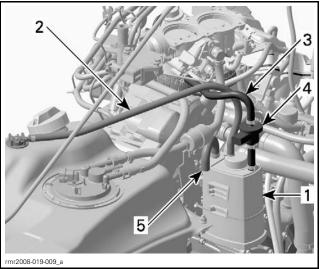
TYPICAL

- Fuel pressure regulator
- Filter
 Fuel return line to fuel tank

Evaporative Emission System (EVAP)



TYPICAL - EVAP CANISTER



TYPICAL

- EVAP canister
- Vent hose from fuel tank
- Vacuum hose from throttle body
- EVAP purge solenoid valve Overflow hose

As the vehicle is sitting and not running, fuel evaporates within the fuel tank.

The fuel tank vent is connected to an EVAP canister (charcoal) that is used to trap any hydrocarbon emissions from the evaporated fuel preventing them from escaping to the atmosphere. The fuel vapors are absorbed by a charcoal medium inside the canister.

An EVAP purge valve is used in conjunction with the EVAP canister. A hose connects the solenoid operated valve to a vacuum port on the throttle body.

Once the engine is running and reaches a predetermined engine RPM, the ECM energizes the solenoid valve open. Thus, vacuum from the

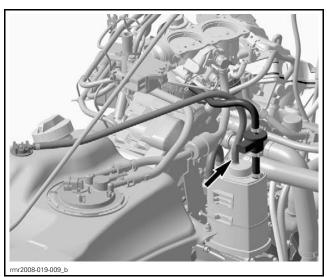
engine draws (or purges) the hydrocarbon emissions from the canister and burns them during the combustion process. The ECM cycles the solenoid ON and OFF as necessary.

Should the canister overfill with liquid fuel, an overflow hose is provided to direct the fuel under the vehicle.

INSPECTION

FUEL SYSTEM LEAK TEST

- 1. Remove body parts on the RH side of the vehicle as required to access fuel system components. Refer to the BODY subsection.
- 2. Fill up fuel tank (recommended).
- 3. Disconnect vent line from EVAP canister.



TYPICAL - EVAP CANISTER VENT LINE

4. Install VACUUM/PRESSURE PUMP (P/N 529 021 800) onto EVAP canister vent line.





TYPICAL

5. Set hand pump to pressure and pressurize fuel tank as per following table.

FUEL SYSTEM LEAK TEST		
PRESSURE	TIME WITHOUT PRESSURE DROP	
28 kPa (4 PSI)	10 minutes	

If pressure drops, locate fuel leak(s) and repair/replace leaking component(s).

NOTE: To ease locating leak(s), spray a solution of soapy water on hoses and components. Bubbles will indicate leak location(s). When testing is complete, thoroughly rinse off the soapy water solution with clear water to prevent premature deterioration of components.

- 6. Reinstall fuel tank vent hose on EVAP canister.
- 7. Reinstall all removed body parts, refer to *BODY* subsection.

FUEL PUMP PRESSURE TEST

The fuel pump pressure test provides an indication of the available pressure at the fuel pump outlet. It validates the pressure regulator, the fuel pump and allows checking for leaks in the fuel system (high pressure side).

Fuel Pump Pressure Test (Static)

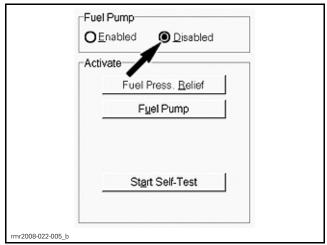
This test allows the following fuel system checks:

- Internal component and external fuel system leak checks (high pressure system)
- Static fuel pressure test (engine not running).

Proceed as follows to conduct test:

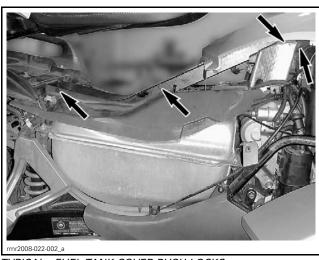
1. Ensure the battery is fully charged. Battery voltage must be over 12 volts.

- 2. Ensure there is enough gas in fuel tank.
- 3. Connect to the latest B.U.D.S. software, refer to *COMMUNICATION TOOLS AND B.U.D.S. SOFTWARE* subsection.
- 4. Select the **Read Data** button.
- 5. Select the **Activation** tab.
- 6. On the RH side of the activation page in the **Fuel Pump** field, select the **Disabled** button to disable the fuel pump.



TYPICAL - FUEL PUMP DISABLED IN B.U.D.S.

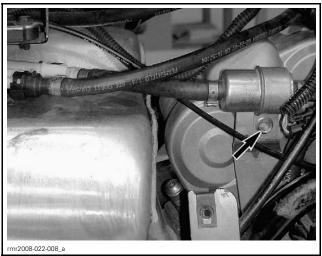
- 7. Release fuel pressure in system by running the engine until it runs out of gas.
- 8. Remove body parts on the RH side of the vehicle as required to access fuel system components. Refer to *BODY* subsection.
- 9. Remove RH fuel tank cover.



5

TYPICAL - FUEL TANK COVER PUSH LOCKS

10. Remove fuel filter retaining screw.



TYPICAL - FUEL FILTER RETAINING SCREW

11. Disconnect the pressure hose from the fuel pump module.

A WARNING

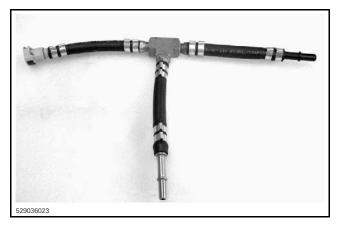
Cover the fuel hose connection with an absorbent shop rag. Slowly disconnect the fuel hose to minimize spilling. Wipe off any fuel spillage.



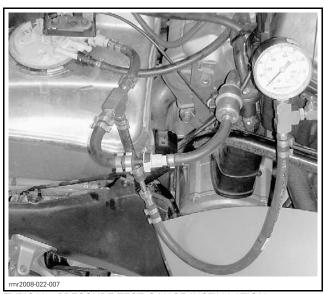
TYPICAL - PUMP MODULE PRESSURE HOSE

12. Connect a fuel PRESSURE GAUGE (P/N 529 035 709) to the FUEL HOSE ADAPTER (P/N 529 036 023).



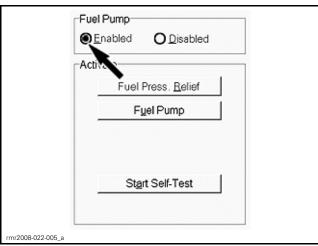


13. Install gauge T-fitting between disconnected fuel system hoses (in-line installation).



TYPICAL - PRESSURE TEST GAUGE INSTALLATION

14. In B.U.D.S., reactivate fuel pump by selecting the **Enabled** button in the fuel pump field on the activation page.



TYPICAL - ENABLE FUEL PUMP

- 15. Set engine stop switch to RUN.
- 16. Turn ignition key ON. Do not crank engine.
- 17. Observe fuel pressure on test gauge.
- 18. Turn ignition key OFF.
- 19. Repeat the test 3 4 times to ensure a consistent pressure reading.

FUEL PRESSURE TEST (STATIC)		
FUEL PRESSURE	350 ± 20 kPa (51 ± 3 PSI)	

If pressure is not within specifications, refer to *DIAGNOSTIC FLOW CHART (FUEL PUMP)* in *TROUBLESHOOTING* in this subsection.

If pressure is within specifications, carry out the FUEL PUMP PRESSURE TEST (DYNAMIC).

Fuel Pump Pressure Test (Dynamic)

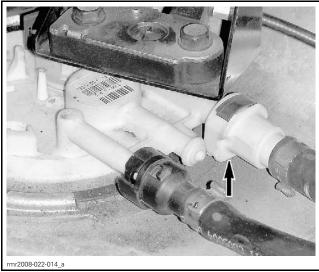
This test validates the following components in the fuel system:

- Fuel filter (if badly cloqged)
- Fuel supply and return hoses
- Fuel pump (under partial load)
- Pressure regulator.
- 1. Follow the instructions in the *FUEL PUMP PRESSURE TEST (STATIC)* procedure to disconnect the fuel pump pressure hose and install the pressure gauge.
- 2. Start engine.
- 3. Increase and vary engine RPM.
- 4. Observe fuel pressure.

FUEL PRESSURE TEST (DYNAMIC)	
FUEL PRESSURE	350 ± 20 kPa (51 ± 3 PSI)

- 5. If pressure is not within specifications, refer to DIAGNOSTIC FLOW CHART (FUEL PUMP) in TROUBLESHOOTING in this subsection.
- 6. Release fuel system pressure using B.U.D.S.
- 7. Remove all test equipment.
- 8. Reconnect fuel hoses.

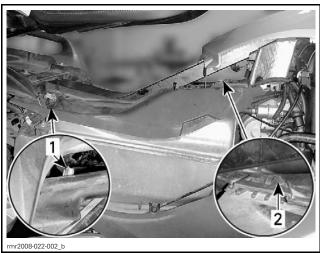
NOTE: Be sure to reconnect the quick connect fitting on the fuel pump pressure hose with the flat portion facing down.



TYPICAL - FLAT SIDE FACING DOWN

- 9. Reinstall fuel filter retaining screw.
- 10. Reinstall all removed body parts, refer to *BODY* subsection.

When reinstalling fuel tank covers, pay attention to the following.



TYPICAL

- 1. Align locating pin
- 2. Align locking tab

Use locking ties to secure wiring and hoses as per factory specifications.

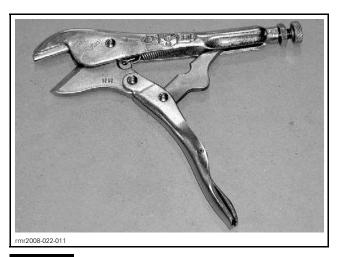
TROUBLESHOOTING

DIAGNOSTIC FLOW CHART (FUEL PUMP)

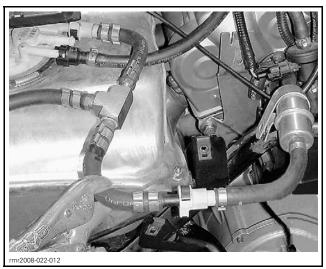
Special Procedures using Flow Chart

Follow these recommendations and procedures to block fuel hoses as described in the flow chart. Use hose pinching pliers to momentarily pinch hose.

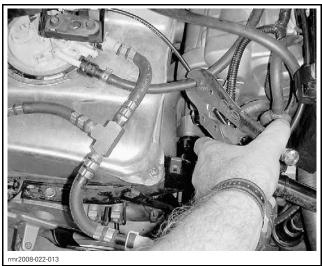
NOTICE Do not use regular pliers. Use only appropriate hose pincher pliers.



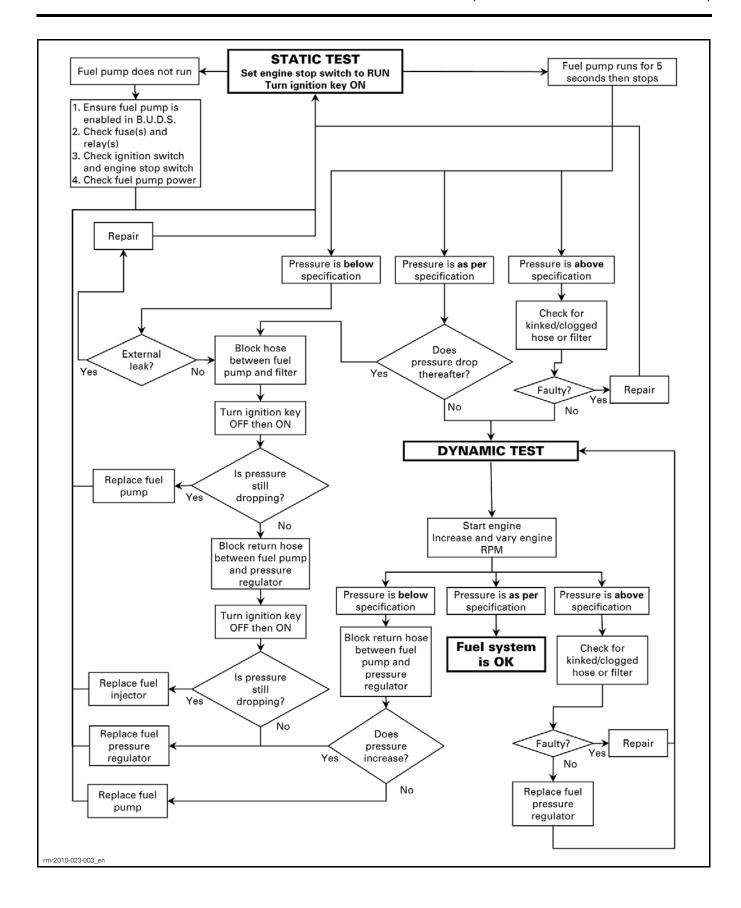
NOTICE Do not pinch hose too hard and no more than 10 seconds.



TYPICAL - HOSE BETWEEN PUMP AND FILTER



TYPICAL - HOSE BETWEEN FUEL PUMP AND PRESSURE REGULATOR

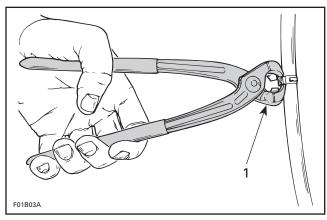


PROCEDURES

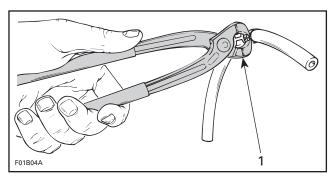
FUEL LINES

When replacing a fuel line, be sure to use BRP approved fuel hoses as available from the BRP parts department. This will ensure continued proper and safe operation.

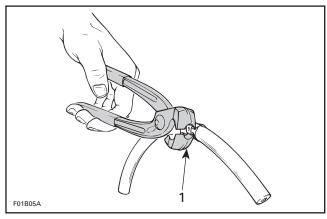
To secure or cut Oetiker clamps on fuel lines, use OETIKER PLIERS (P/N 295 000 070).



1. Cutting clamp



1. Securing clamp



1. Securing clamp in limited access

A WARNING

Replace any damaged, leaking or deteriorated fuel line. Use of damaged fuel lines, or fuel lines not approved by BRP, could compromise fuel system integrity.

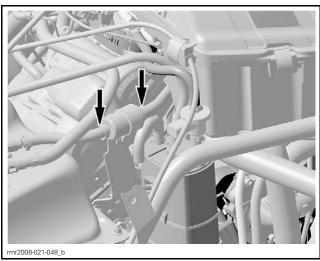
WARNING

Always disconnect battery exactly in the specified order, BLACK (-) cable first. It is recommended to disconnect electrical connections prior to disconnecting fuel lines.

FUEL FILTER

Fuel Filter Removal

- 1. Remove body parts on the RH side of the vehicle as required to access fuel system components. Refer to the *BODY* subsection.
- 2. Release fuel pressure. Refer to *FUEL PUMP PRESSURE TEST (STATIC)* in this subsection.
- 3. Cut the Oetiker clamps retaining the fuel hoses on each side of the fuel filter.



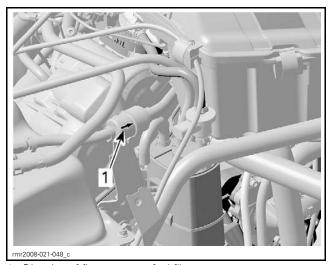
TYPICAL - FUEL FILTER OETIKER CLAMPS

- 4. Remove the fuel hoses from the fuel filter.
- 5. Remove the fuel filter support retaining screw.

Fuel Filter Installation

1. Install fuel filter.

NOTE: Be sure to position the arrow on the fuel filter in the direction of fuel flow; from fuel pump towards throttle body.



1. Direction of flow arrow on fuel filter

2. Install new Oetiker clamps on fuel filter hoses using OETIKER PLIERS (P/N 295 000 070).

A WARNING

Always install new Oetiker clamps. Only use the Oetiker clamps recommended in the *PARTS CATALOG*.

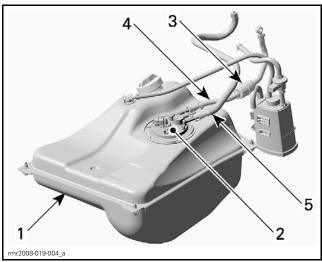
- 3. Secure filter to chassis. Torque screw on filter retaining clamp to 10 N•m (89 lbf•in).
- 4. Re-enable fuel pump in B.U.D.S. as described in the *FUEL PUMP PRESSURE TEST (STATIC)* procedure in this subsection.
- 5. Turn ignition switch ON to activate fuel pump and check for leaks in the system. Pay particular attention to the hose connections that were disconnected for the procedure.
- 6. Reinstall all removed body parts, refer to *BODY* section.

FUEL TANK

Fuel Tank Draining

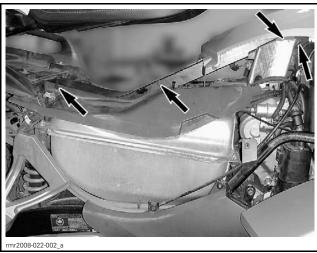
Siphon fuel from tank into an approved fuel storage container.

Fuel Tank Removal



TYPICAL

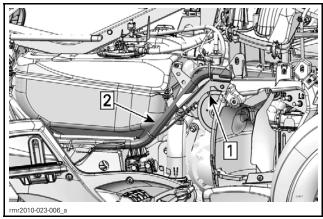
- 1. Fuel tank
- 2. Fuel pump
- 3. In-line fuel filter
- 4. Fuel supply hose
- 5. Fuel return hose
- 1. Siphon fuel tank.
- 2. Remove body parts on both sides of the vehicle as required to access the fuel tank, refer to *BODY* subsection.
- 3. Remove fuel tank covers above fuel tank.



TYPICAL - FUEL TANK COVER PLASTIC RIVETS (RH SIDE ILLUSTRATED)

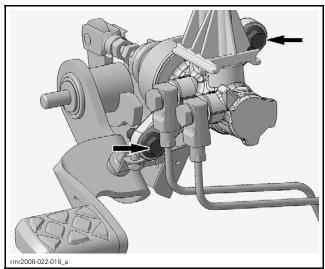
- 4. Remove the rear cargo compartment assembly, refer to *BODY* subsection.
- 5. Disconnect parking brake cable from actuator pulley, refer to *BRAKES* subsection.
- 6. Remove the RH lateral frame support, refer to *FRAME* subsection.

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Step 1: Disconnect parking brake cable here Step 2: Remove lateral frame support

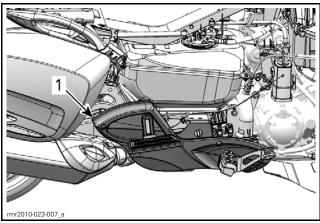
7. Remove 2 retaining screws from the master cylinder.



TYPICAL - MASTER CYLINDER RETAINING SCREWS

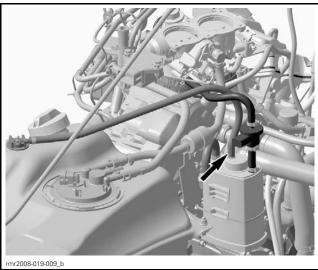
8. Remove the remaining screws that secure the RH foot peg support to the frame, and remove the support from the vehicle.

NOTE: The remaining screws are screwed into the rear face of the foot peg support.



1. RH foot peg support

- 9. Cut locking ties securing master cylinder hoses coming from brake oil reservoirs (as required).
- 10. Remove the two brake oil reservoir retaining screws, refer to the *BRAKES* subsection.
- 11. Remove fuel tank retaining bolts.
- 12. Remove the bushing and grommet from the LH aft fuel tank mounting bracket.
- 13. Disconnect fuel pump connector.
- 14. Disconnect fuel supply and return hoses from fuel tank.
- Disconnect fuel tank vent hose from EVAP canister.



TYPICAL - EVAP CANISTER VENT HOSE

16. Pull fuel tank up and out from RH side of vehicle.

NOTE: Move master cylinder from side to side as necessary to allow removal of fuel tank. Be specially careful not to damage brake oil hoses and fittings.

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TYPICAL - LIFT AND PULL OUT OVER BRAKE OIL HOSES

Fuel Tank Inspection

Inspect fuel tank for any damage or cracks which may result in fuel leaks. Replace fuel tank as required.

Fuel Tank Installation

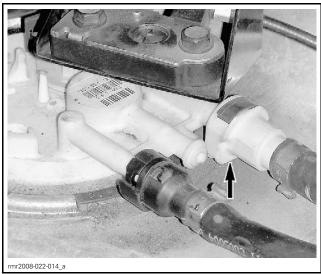
Reverse the removal procedure. However, pay attention to the following:

- 1. Reinstall fuel tank. Install hardware as illustrated in exploded view at the beginning of this subsection.
- 2. Torque fuel tank mounting screws to 7.5 N•m (66 lbf•in).
- 3. Reinstall foot peg support. Refer to the *BODY* subsection.
- 4. Properly reinstall brake system master cylinder and reservoir. Refer to the *BRAKES* subsection.

WARNING

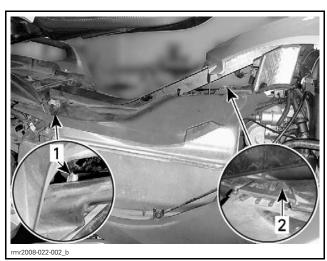
Be sure to carry out a leak test and an operational test of the brake system as indicated in the *BRAKES* subsection.

- 5. Use locking ties to secure wiring and hoses as per factory specification.
- 6. Connect fuel supply hose and fuel return hose quick connects. Flat section of quick connect must face down towards fuel tank.



TYPICAL - FLAT SIDE DOWN

- 7. Install the fuel tank vent hose on the EVAP canister fitting.
- 8. Install the fuel pump electrical connector after all fuel hoses have been connected.
- 9. Install fuel tank covers. Ensure proper insertion of alignment pins.

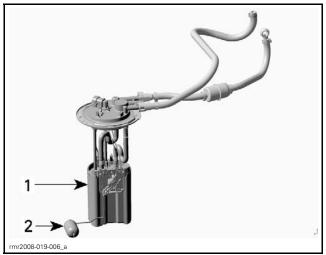


TYPICAL

- Align locating pin
 Align locking tab
- 10. Refill fuel tank.
- 11. Pressurize fuel system by turning ignition key ON, and check for leaks. Refer to *FUEL SYS-TEM LEAK TEST* in this subsection.
- 12. Reinstall lateral frame support, refer to *FRAME* subsection.
- 13. Reinstall rear cargo assembly and all other removed body parts, refer to *BODY* subsection.

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FUEL PUMP



TYPICAL - FUEL PUMP MODULE

- 1. Fuel pump (in pump reservoir)
- 2. Fuel level sensor

Fuel Pump Quick Test

Open the seat for access to top of fuel tank.

Apply the metal end of a screwdriver to the top of the fuel pump module and, the other end against your ear.

When turning ignition switch to ON, listen for the fuel pump. It should run for a few seconds to build up pressure in the fuel system, and then shut off.

If you do not hear the fuel pump function for a few seconds, check fuse F12 (front fuse box). If fuse is good, carry out a *FUEL PUMP CIRCUIT TEST*.

NOTE: If fuse F12 is blown, the PRE-STARTING RELAY (R2) will NOT be energized closed and the starter solenoid will not function when the start button is pressed, even if all cranking conditions are met.

Fuel Pump Circuit Continuity Test

Remove fuse F12 in front fuse box.

Disconnect ECM connector "B" and install it on the ECM ADAPTER TOOL (P/N 529 036 166).

Set multimeter to Ω and test for circuit continuity through the fuel pump as per following table.

FUEL PUMP CIRCUIT TEST		
FUSE BOX	ECM ADAPTER	RESISTANCE @ 20°C (68°F)
Pin A-9	Pin M-1	Approx. 2 Ω

If you obtained a resistance close to 2 ohms (or slightly higher), the fuel pump and its circuit wiring is good.

NOTE: The fuel pump motor winding resistance should be slightly less than 2 ohms when measured at the pump connector.

If you obtained a high resistance or an open circuit, disconnect the fuel pump connector and carry out the *FUEL PUMP INPUT CIRCUIT CONTI-NUITY* and the *FUEL PUMP CONTROL CIRCUIT CONTINUITY* tests separately as per following tables. Refer to *WIRING DIAGRAM* for circuit detail.

FUEL PUMP CIRCUIT CONTINUITY (POWER WIRE)		
FUSE BOX PUMP HARNESS CONNECTOR RESISTANCE @ 20°C (68°F)		RESISTANCE @ 20°C (68°F)
Pin A-9	Pin B	Close to 0 Ω

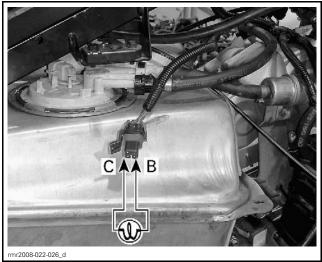
FUEL PUMP CIRCUIT CONTINUITY (CONTROL WIRE)		
ECM CONNECTOR "B"	PUMP HARNESS CONNECTOR	RESISTANCE @ 20°C (68°F)
Pin M-1	Pin C	Close to 0 Ω

If you do not obtain close to 0 ohms (continuity), repair applicable wiring/connectors.

If you obtained close to 0 ohms, carry out a *FUEL PUMP INPUT VOLTAGE TEST*.

Fuel Pump Circuit Test Using a Test Light

- 1. Connect a 12 Vdc test light between the fuel pump harness connector pins B and C.
- 2. Turn the ignition switch ON. The test light should turn on for a few seconds, then turn off.



TYPICAL

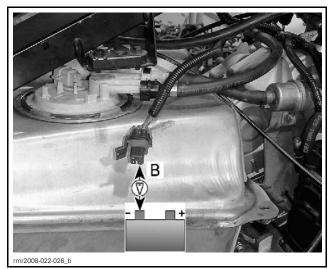
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If test light came ON for a few seconds and then turned OFF, the fuel pump circuit and ECM are functioning normally. Replace fuel pump.

If the test came on dim or not at all, carry out the FUEL PUMP INPUT VOLTAGE TEST.

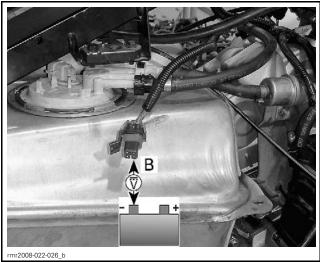
Fuel Pump Input Voltage Test

Probe fuel pump harness connector as illustrated using a multimeter set to 12 Vdc. When turning ignition switch ON, you should read close to battery voltage.



TYPICAL

If battery voltage is not read, carry out a *FUEL PUMP CIRCUIT CONTINUITY TEST* for the pump power wire.



TYPICAL

If battery voltage is read to ground, the pump input circuit is good. Carry out a *FUEL PUMP CIRCUIT CONTINUITY TEST* for the control wire (ground circuit) from the ECM.

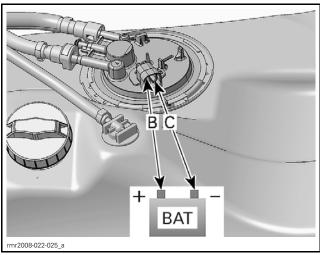
If voltage is low to battery ground, test for a short or partial short circuit to ground with the pump circuit isolated from parallel circuits, refer to the WIRING DIAGRAM.

NOTE: A fault in the ECM or in a parallel circuit may prevent fuel pump operation. Use B.U.D.S. to check for fault codes.

Fuel Pump Operational Test

Install small insulated jumper wires between the fuel pump module connector and a known good 12 volt battery as in following illustration.

Ensure normal pump circuit polarity is respected as illustrated.



TYPICAL

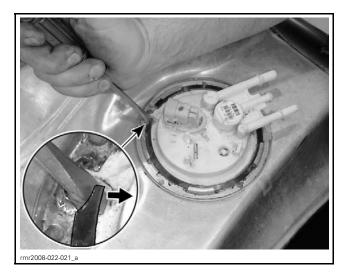
NOTICE Running the fuel pump connected in reverse polarity for a few minutes can damage the pump motor.

If pump does not function, replace it.

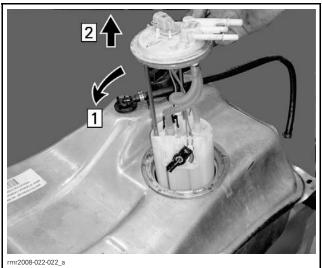
Fuel Pump Removal

- 1. Remove fuel tank, see *FUEL TANK REMOVAL* in this subsection.
- 2. Use an appropriate screwdriver to carefully pry out the tapered end of fuel pump retainer ring.

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- 3. Remove and discard retainer ring.
- 4. Carefully pull out fuel pump paying attention to float arm.



Step 1: Rotate pump backward Step 2: Pull out pump

5. Discard O-ring seal on pump module.

Fuel Pump Installation

Reverse removal procedure. However, pay attention to the following:

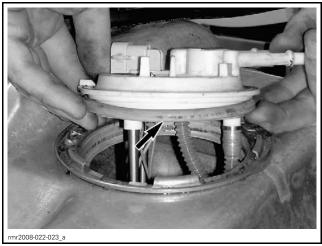
A WARNING

Install a new fuel pump ring seal and retainer ring.

1. Install and hold a NEW ring seal against fuel pump flange.

NOTE: Apply some oil on ring seal to ease installation

2. Carefully insert pump in fuel tank; be careful not to damage fuel level float arm.



TYPICAL - PUMP RING SEAL INSTALLATION

3. Index fuel pump tab with notch in fuel tank and ensure pump and O ring seal are properly seated.



TYPICAL - PUMP INDEXING

1. Index tab with notch

4. Install a new fuel pump retaining ring.

A WARNING

Ensure retainer ring is properly seated and locked.

5. Pressurize fuel system and check for leaks. Refer to *FUEL SYSTEM LEAK TEST.*

FUEL LEVEL SENSOR

Fuel Level Sensor Resistance Test

With Digital Fuel Indication in Multifunction Gauge

- 1. Remove the multifunction gauge (cluster), refer to the *LIGHTS*, *GAUGE AND ACCESSORIES* subsection.
- 2. Disconnect the multifunction gauge connector.
- 3. Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to Ω selection.
- 4. Alternately fill and empty fuel tank, and measure the fuel sensor resistance through the wiring harness as per following table.

FUEL LEVEL SENSOR RESISTANCE TEST		
FUEL LEVEL	CLUSTER CONNECTOR	RESISTANCE READING AT 21°C (70°F)
Empty	Pin 15 to	Approx. 290 Ω
Full	chassis ground	Approx. 80 Ω



CLUSTER CONNECTOR PIN OUT

If you did not obtain readings as specified, carry out the *CONTINUITY TEST OF FUEL LEVEL SEN-SOR WIRING*.

If you obtained resistance readings as specified, fuel level sensor and harness wiring are good. Carry out a WOW test of the multifunction gauge using the B.U.D.S. software. See *MULTI-FUNCTION GAUGE TEST USING B.U.D.S* in the *LIGHTS, GAUGE AND ACCESSORIES* subsection. Check for proper operation of the fuel level indication during the WOW test.

With Analog Fuel Gauge

- 1. Remove the analog fuel gauge connector (FG1).
- 2. Carry out a fuel level sensor resistance test as per following table.

TEST PROBES		
FG1 pin S	Chassis ground	

FUEL LEVEL SENSOR RESISTANCE TEST		
FUEL LEVEL	RESISTANCE READING AT 21°C (70°F)	
Empty	Approx. 290 Ω	
Full	Approx. 80 Ω	

If you obtain resistance readings as specified, the fuel level sensor and it's wiring harness are good. Refer to the *LIGHTS*, *GAUGE AND AC-CESSORIES* subsection.

If you do not obtain readings as specified, carry out the *CONTINUITY TEST OF FUEL LEVEL SEN-SOR WIRING*.

Continuity Test of Fuel Level Sensor Wiring

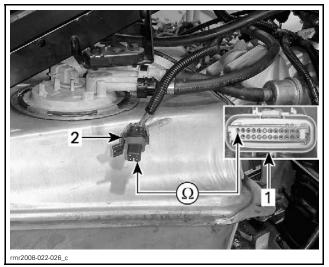
Disconnect the fuel pump module electrical connector.

With Digital Fuel Indication in Multifunction Gauge

Measure for continuity of the wiring from the fuel pump connector (FP) and the multifunction gauge cluster connector (CL) as per following table. Refer to *WIRING DIAGRAM* for details.

CONTINUITY TEST OF FUEL LEVEL SENSOR WIRING			
PROBE CONNECTORS		RESISTANCE READING AT 21°C (70°F)	
FP-A (BU wire)	CL-15	Close to 0 Ω	
	Chassis ground	OL (infinite)	
FP-D (BK)	Chassis ground	Close to 0 Ω	

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TYPICAL - CONTINUITY TEST OF FUEL LEVEL SENSOR WIRING

- 1. Cluster connector
- 2. Fuel pump module connector

If resistance readings are as specified, remove the fuel pump module and replace the fuel level sensor. Refer to the *FUEL TANK AND FUEL PUMP* subsection.

If resistance readings are not as specified, carry out continuity test at D1C1-D connector pin. Repair or replace wiring and connectors as required.

With Analog Fuel Gauge

Measure for continuity of the wiring from the fuel pump connector (FP) and the analog fuel gauge connector (FG) as per following table. Refer to *WIRING DIAGRAM* for details.

CONTINUITY TEST OF FUEL LEVEL SENSOR WIRING			
PROBE CONNECTORS		RESISTANCE READING AT 21°C (70°F)	
FG1-S (BU wire)	FP-A (BU wire)	Close to 0 Ω	
	Chassis ground	OL (infinite)	
FP-D (BK)	Chassis ground	Close to 0 Ω	

If resistance readings are as specified, remove the fuel pump module and replace the fuel level sensor. Refer to the *FUEL TANK AND FUEL PUMP* subsection.

If resistance readings are not as specified, carry out continuity test at DIC1-D connector pin. Repair or replace wiring/connectors as required.

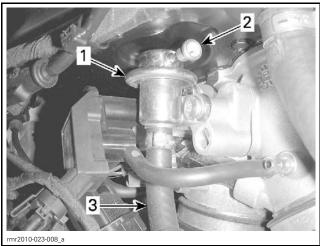
NOTE: The DIC1 connector is located between the air inlet resonator and the instrument console.

FUEL PRESSURE REGULATOR

The fuel pressure regulator is mounted to the fuel rail on the LH side of the throttle body.

The fuel pump pressure hose is connected to the fuel rail on the RH side of the throttle body. It provides the full fuel pump pressure to both injector fuel rails through an interconnecting port within the throttle body.

The pressure regulator regulates the pressure from the pump by bleeding away excess pressure in the fuel rails and returning it to the fuel pump.



TYPICAL

- 1. Fuel pressure regulator
- 2. Filt
- 3. Fuel return hose to fuel pump

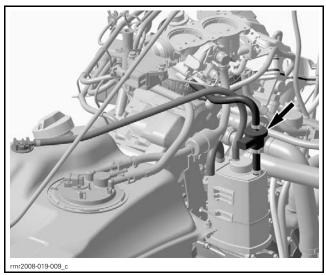
Fuel Pressure Regulator Test

Refer to *FUEL PRESSURE TEST* in this subsection for testing procedure.

Fuel Pressure Regulator Replacement

For replacement of the fuel pressure regulator, refer to *FUEL RAIL REPLACEMENT* in the *ELECTRONIC FUEL INJECTION (EFI)* subsection.

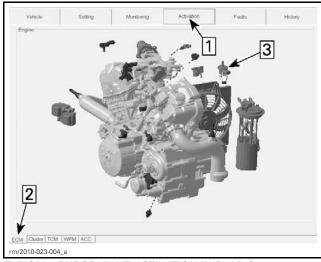
EVAP PURGE VALVE



TYPICAL - EVAP PURGE VALVE

Purge Valve Test using B.U.D.S.

- 1. Remove RH side panels as required to access the purge valve. Refer to the *BODY* subsection.
- 2. Turn ignition key ON.
- 3. Using B.U.D.S. software, activate the purge valve as per following illustration.



TYPICAL - PURGE VALVE ACTIVATION IN B.U.D.S.

Step 1: Select activation page tab Step 2: Choose ECM page

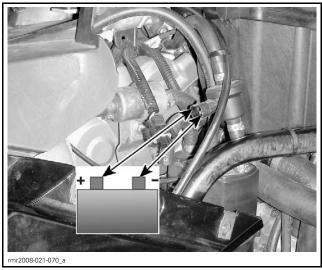
Step 3: Click on purge valve icon

You should feel the solenoid within the purge valve operating.

If operation of the solenoid is felt when activated, carry out the *PURGE VALVE OPERATION TEST*. If solenoid does not function, carry out the *PURGE VALVE SOLENOID TEST*.

Purge Valve Solenoid Test

- 1. Disconnect the purge valve connector.
- 2. Connect small jumper wires to the purge valve solenoid.
- 3. Momentarily connect the jumper wires to a remote 12 Vdc battery.



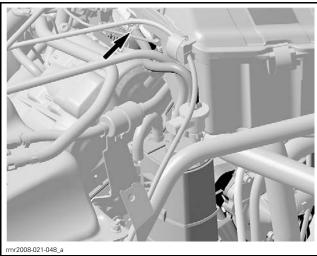
TYPICAL

If the solenoid does not function, replace it.

If the solenoid functions, carry out the *PURGE VALVE INPUT VOLTAGE TEST*.

Purge Valve Operational Test

1. Disconnect purge valve vacuum hose from the throttle body.

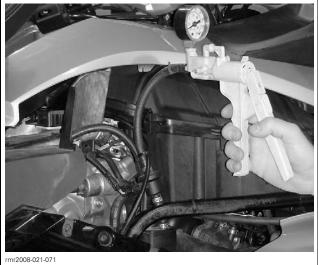


TYPICAL

2. Install the VACUUM/PRESSURE PUMP (P/N 529 021 800) on the vacuum hose.

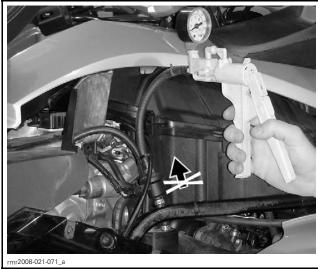
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TYPICAL

- 3. Set pump to vacuum function.
- 4. Activate pump lever several times. Air should not come through the purge valve. Otherwise, replace the purge valve.

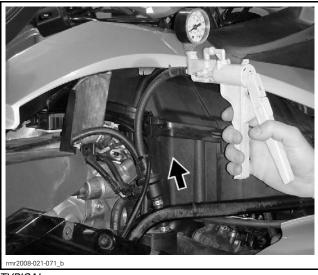


TYPICAL

5. Turn ignition key ON.

6. Using B.U.D.S. software, activate the purge valve as illustrated in *PURGE VALVE TEST US-ING B.U.D.S.*

Air should now flow through purge valve when you apply vacuum with the hand pump. Otherwise, replace the valve as it does not open when the valve solenoid is activated.



TYPICAL

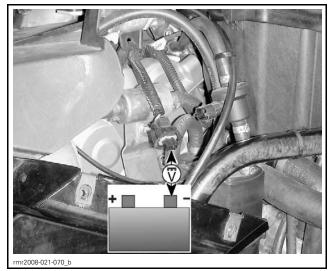
- 7. Remove the hand pump and reconnect the vacuum hose on the throttle body.
- 8. Install all removed parts in the reverse order of removal.

Purge Valve Input Voltage Test

- 1. Disconnect the purge valve connector.
- 2. Turn ignition switch to ON.
- 3. Using a FLUKE 115 MULTIMETER (P/N 529 035 868) set to Vdc, measure for input voltage at the purge valve connector (EVAP) as per following table.



PURGE VALVE INPUT VOLTAGE TEST			
PURGE VALVE SOLENOID (HARNESS SIDE)		MEASUREMENT	
PROBE			
Pin 2 (ORANGE/GREEN)	Battery ground	Battery voltage	



TYPICAL

If input voltage is as specified, carry out the PURGE VALVE CONTROL CIRCUIT TEST.

If input voltage is not as specified, check fuse F12.

NOTE: If fuse F12 is open, the starter solenoid will not function either.

If fuse is good, carry out a *PURGE VALVE INPUT CIRCUIT TEST (CONTINUITY)* in this subsection.

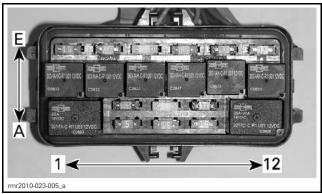
Purge Valve Input Circuit Test (Continuity)

Remove fuse F12 in front fuse box.

Disconnect the purge valve connector.

Set multimeter to Ω and test for continuity of the purge valve input circuit (12 Vdc) as per following table.

PURGE VALVE INPUT CIRCUIT TEST (CONTINUITY)			
PURGE VALVE HARNESS CONNECTOR	FRONT FUSE BOX	RESISTANCE @ 20°C (68°F)	
Pin 2	Pin A9	Close to 0 Ω (continuity)	



TYPICAL - FRONT FUSE BOX PIN-OUT

If continuity is not good, repair or replace wiring and connectors between fuse box and valve connector.

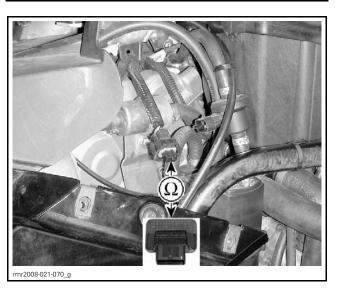
If continuity is good, carry out the *PURGE VALVE CONTROL CIRCUIT TEST* in this subsection.

Purge Valve Control Circuit Test (Continuity)

Disconnect "A" connector from the ECM and connect it to the ECM ADAPTER TOOL (P/N 529 036 166).

Set multimeter to Ω and test for continuity of the purge valve control circuit (ground) as per following table.

PURGE VALVE CONTROL CIRCUIT TEST			
PURGE VALVE HARNESS CONNECTOR	ECM CONNECTOR "A"	RESISTANCE @ 20°C (68°F)	
Pin 1	M3	Close to 0 Ω (continuity)	



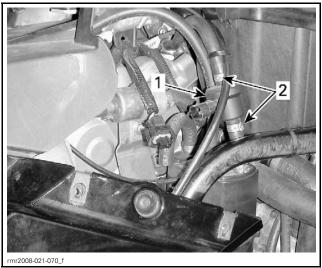
If ground circuit is faulty, repair/replace wiring/connector.

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Purge Valve Replacement

Removal

- 1. Disconnect purge valve connector.
- 2. Cut Oetiker clamps securing hoses to purge valve.



EVAP purge valve
 Oetiker clamps

NOTE: To secure or cut Oetiker clamps, use OETIKER PLIERS (P/N 295 000 070).

3. Pull hoses off valve.

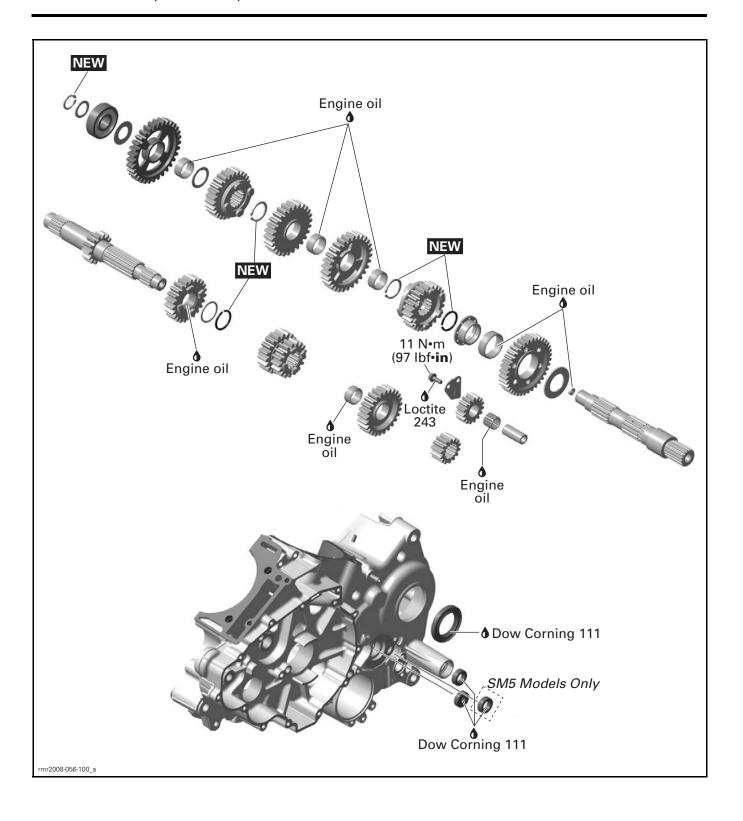
Installation

- 1. Carry out a functional test of the purge valve prior to installation using a remote 12 Vdc battery and the VACUUM/PRESSURE PUMP (P/N 529 021 800) as described in *PURGE VALVE OPER-ATIONAL TEST* in this subsection.
- 2. Secure hoses to the purge valve using NEW Oetiker clamps.
- 3. Reconnect purge valve connector.

GEARBOX

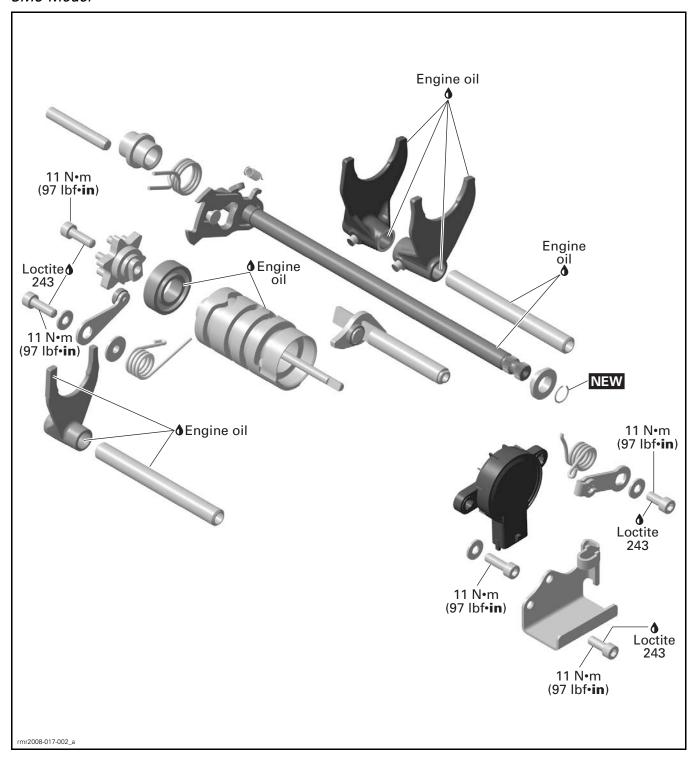
SERVICE TOOLS

Description	Part Number	Page
CRANKCASE SEAL PUSHER	529 036 092	9
ECM ADAPTER TOOL	529 036 166	6
FLUKE 115 MULTIMETER	529 035 868	10
HANDLE	420 877 650	8–9
MAIN SHAFT PROTECTOR	529 036 123	
MAIN SHAFT SEAL INSTALLER	529 036 088	8
MAIN SHAFT SEAL PUSHER	529 036 124	9
OIL SEAL INSTALLER	529 036 070	8–9
PROTECTION SLEEVE	529 036 071	8–9
SERVICE TOOLS – OTHER SUPPLIER		
Description	Part Number	Page
SNAP-ON SNAP RING PLIERS	SRP3	14
SERVICE PRODUCTS		
Description	Part Number	Page

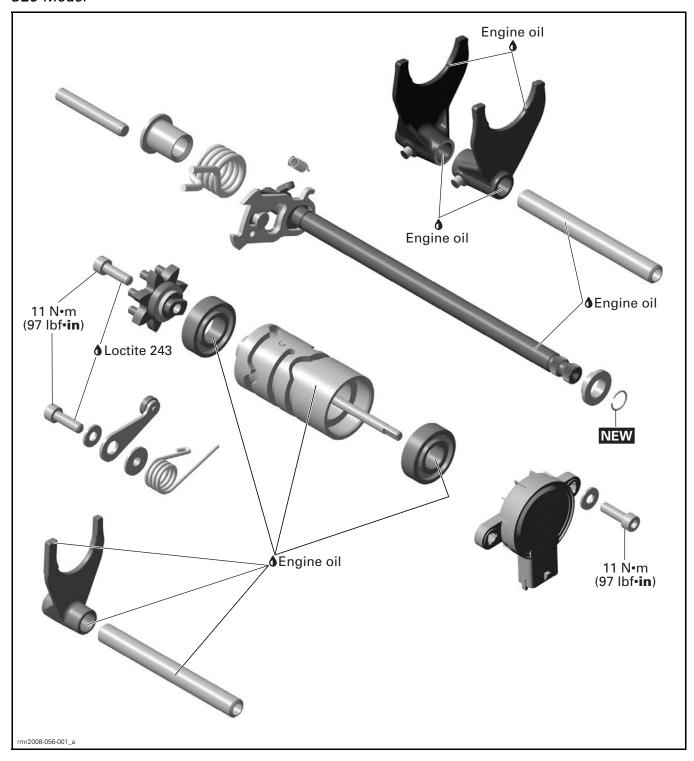


3

SM5 Model



SE5 Model



GENERAL

NOTE: For a better understanding, the following illustrations are taken with engine out of vehicle. However, it is not always necessary to remove engine from vehicle to perform some instructions.

Always disconnect the BLACK (-) cable from the battery before working on the engine.

A WARNING

Always disconnect BLACK (-) cable first and reconnect last.

During assembly/installation, use torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

NOTICE Hoses, cables or locking ties removed during a procedure must be reinstalled as per factory standards.

A WARNING

Torque wrench tightening specifications must be strictly adhered to.

Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced.

GEARBOX POSITION SENSOR (GBPS) RESET

When replacing the gearbox position sensor (GBPS), it is required to reset (re-zero) its values for proper operation.

NOTE: B.U.D.S. software is used to perform the reset.

PART REPLACED	WHAT TO DO
GBPS	Reset Closed Throttle and Gear Position Sensor in Setting , ECM

TROUBLESHOOTING

TROUBLESHOOTING GUIDELINES

Gearbox Does Not Shift Into Reverse

Check fuse F7 of the front fuse box.

Make sure the actuator cable is properly adjusted and aligned. Refer to *REVERSE ACTUATOR CA-BLE ADJUSTMENT* in this subsection.

Carry out a *REVERSE BUTTON TEST WITH B.U.D.S.* in this subsection.

PROCEDURES

REVERSE BUTTON TEST WITH B.U.D.S.

Connect vehicle to B.U.D.S.

Select the **TCM** tab in the **Monitoring** page. Look at the **Switch Inputs**.

If LED turns ON when the reverse button is pressed in, it indicates that the button sends the message.

- On SM5 model, carry out the REVERSE ACTU-ATOR ACTIVATION WITH B.U.D.S. in this subsection.
- On SE5 model, verify the shift system operation. Refer to ELECTRONIC SHIFT SYSTEM (SE5) and HYDRAULIC CONTROL MODULE (SE5) subsections.

If LED does not turn ON when reverse button is pressed in, check left multifunction switch (MSL), refer to *LIGHTS*, *GAUGE AND ACCESSORIES* subsection.

GEARBOX POSITION SENSOR (GBPS)

Gearbox Position Sensor Test

First, check fault codes in B.U.D.S. software.

Before beginning the test, ensure vehicle is on NEUTRAL.

On left side, remove the bottom rear side panel and the rear side panel. Refer to *BODY* subsection.

Unplug the GBPS connector.

Before replacing the GBPS, check the following.

5

GBPS Input Voltage Test

MULTIMETER PROBE POSITIONS	VOLTAGE
GBPS connector (pin 1) and GBPS connector (pin 3)	
	5 volts

If voltage is adequate, check GBPS communication link (CAN).

If there is no voltage, check each GBPS input as follows

10110475.	
MULTIMETER PROBE POSITIONS	VOLTAGE
GBPS connector (pin 1) and battery ground	
	5 volts
GBPS connector (pin 3) and battery + terminal	
	Battery voltage

If there is no voltage, check wires and connector pins. Replace or repair defective parts and reset fault codes.

GBPS Communication Link Continuity Test

Unplug "A" connector from ECM and connect it to the ECM ADAPTER TOOL (P/N 529 036 166).



MULTIMETER PROBE POSITIONS	RESISTANCE @ 20°C (68°F)
GBPS connector (pin 2) and ECM adapter tool on ECM A (pin C4)	
	Below 1 Ω

If resistance is out of specification, check wires and connector pins. Repair and reset fault codes. If resistance is good, replace the GBPS and reset fault codes.

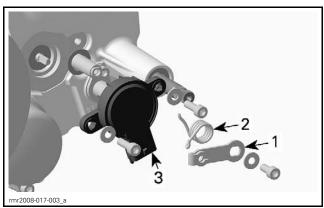
Gearbox Position Sensor Removal

Make sure that gearbox is in neutral position.

On SM5 model, remove the control lever and the control lever spring.

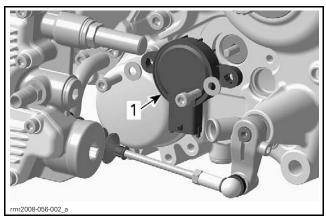
Remove GBPS screws.

Remove the GBPS.



SM5 MODEL

- Control lever
- Control lever
 Control lever spring
 Gearbox position sensor (GBPS)

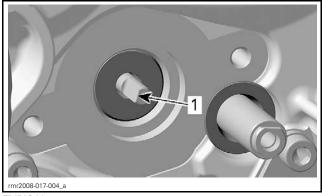


SE5 MODEL

1. Gearbox position sensor (GBPS)

Gearbox Position Sensor Installation

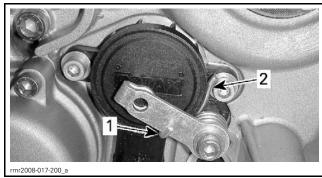
For installation reverse the removal procedure. Align GBPS with the flat on the shift drum shaft.



TYPICAL

1. Flat on shift drum shaft

On SM5 model, install the control lever spring as shown in the next illustration.



Spring hook
 Straight end of spring

After installation, refer to CLOSED THROTTLE AND GEARBOX POSITION SENSOR RESET in the ELECTRONIC FUEL INJECTION (EFI) subsection to perform the GBPS reset.

OIL SEALS

Oil Seals Removal

A small flat screwdriver can be used to remove these oil seals.

NOTICE Avoid scoring surfaces when replacing oil seals.

Main Shaft Oil Seal

To access this seal, remove the FRONT SPROCKET. See procedure in this subsection.

Gear Locking Shaft Oil Seal (SM5)

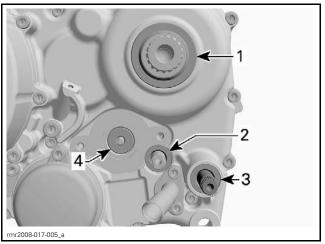
To access this seal, remove the GEARBOX POSI-TION SENSOR. See procedure in this subsection.

Shift Shaft Oil Seal

To access this seal, remove gearshift lever.

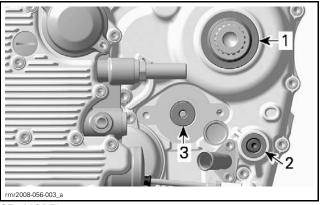
Shift Drum Shaft Oil Seal

To access this seal, remove gear position sensor the GEARBOX POSITION SENSOR. See procedure in this subsection.



SM5 MODEL

- 1. Main shaft oil seal
- Gear locking shaft oil seal
- Shift shaft oil seal
- Shift drum shaft oil seal

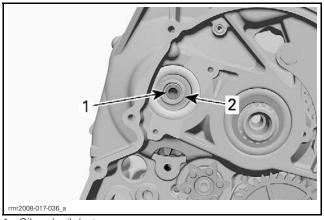


SE5 MODEL

- Main shaft oil seal
- Shift shaft oil seal
 Shift drum shaft oil seal

Oil Duct Cover Oil Seal

To access this seal, remove the OIL DUCT COVER as in the LUBRICATION SYSTEM subsection.



- Oil seal, oil duct cover
- 2. Main shaft, clutch side

Oil Seals Inspection

Replace oil seals if they are brittle, hard or damaged.

Check running surface of shafts for scratches. Replace if necessary, refer to SHIFTING SYSTEM or GEARBOX in this subsection.

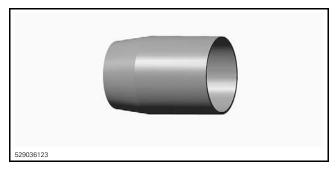
Oil Seals Installation

NOTICE All oil seals must be installed with sealing lip towards gearbox.

Apply DOW CORNING 111 (P/N 413 707 000) inside each seal.

Main Shaft Oil Seal

Put the MAIN SHAFT PROTECTOR (P/N 529 036 123) on main shaft and move oil seal on shaft.



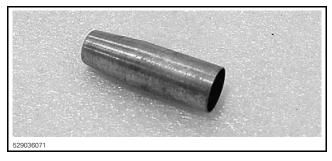
Assemble the MAIN SHAFT SEAL INSTALLER (P/N 529 036 088) and the HANDLE (P/N 420 877 650) then use the assembly to push oil seal in place.





Gear Locking Shaft Oil Seal

Put the PROTECTION SLEEVE (P/N 529 036 071) on gear locking shaft and move oil seal on shaft.

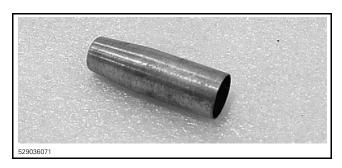


Then use the OIL SEAL INSTALLER (P/N 529 036 070) and push oil seal into place.



Shift Shaft Oil Seal

Put the PROTECTION SLEEVE (P/N 529 036 071) on gear locking shaft and move oil seal on shaft.



Then use the OIL SEAL INSTALLER (P/N 529 036 070) and push oil seal into place.



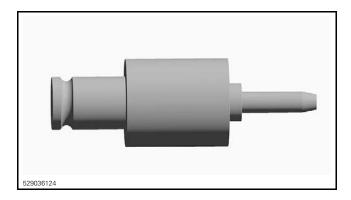
Shift Drum Shaft Oil Seal

Put oil seal on shift drum shaft and use the CRANKCASE SEAL PUSHER (P/N 529 036 092) to push oil seal into place.

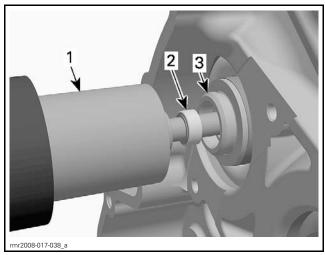


Oil Duct Cover Oil Seal

Use the MAIN SHAFT SEAL PUSHER (P/N 529 036 124) and the HANDLE (P/N 420 877 650) to push oil seal into main shaft.





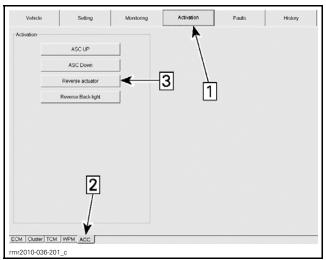


- Oil seal installer with handle 1.
- Oil seal
 Main shaft

REVERSE ACTUATOR (SM5 MODEL)

Reverse Actuator Activation with B.U.D.S..

- 1. On left side, remove the bottom rear side panel and the rear side panel. Refer to BODY subsection.
- 2. Connect vehicle to B.U.D.S..
- 3. Select the Activation and ACC tabs.
- 4. Keep an eye on the reverse actuator.
- 5. Click on the Reverse actuator button.



Step 1: Activation tab

Step 2: ACC tab

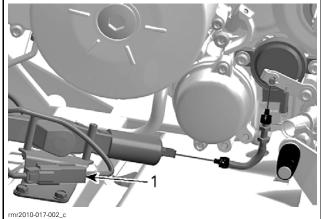
Step 3: Reverse actuator button

If actuator operates, check the lever, cable and bracket condition and make sure the cable is properly adjusted and aligned.

If actuator does not operate, carry out a *REVERSE* ACTUATOR INPUT VOLTAGE TEST.

Reverse Actuator Input Voltage Test

- 1. Make sure fuse F7 is good.
- 2. On left side, remove the bottom rear side panel and the rear side panel. Refer to *BODY* subsection.
- 3. Disconnect the reverse actuator connector.



1. Reverse actuator connector

- 4. Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to Vdc.
- 5. Place the RED multimeter probe on pin 2 (OR/VI wire) of the actuator connector.
- 6. Pace the BLACK (COM) probe on a good ground.
- 7. Measure voltage.

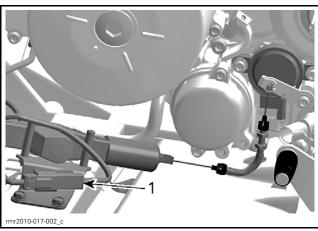
REVERSE ACTUATOR INPUT VOLTAGE TEST		
TEST P	ROBES	RESULT
Actuator connector pin 2	Ground	Battery voltage

If voltage is as specified, carry out a REVERSE ACTUATOR CONTROL CIRCUIT TEST.

If voltage is not as specified, look for an open circuit between fuse F7 and reverse actuator connector.

Reverse Actuator Control Circuit Test

- 1. On left side, remove the bottom rear side panel and the rear side panel. Refer to *BODY* subsection.
- 2. Disconnect the reverse actuator connector.



1. Reverse actuator connector

- 3. Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to Vdc.
- 4. Place the RED probe on a positive source such as the starter solenoid battery input.
- 5. Place the multimeter BLACK (COM) probe on pin 1 of the actuator connector.
- 6. Have an assistant:
 - Taking place on the vehicle.
 - Holding the clutch and selecting the first gear with the engine running.
 - Pressing the reverse button.
 selecting

NOTE: Vehicle must not be moving and engine speed must be below 1800 RPM.

7. Measure voltage while button is pressed.

NOTE: Once reverse button is pressed, the ground signal (control) will be held for 2 to 3 seconds wether the button is held or not. After a few attempts, it is normal for the system to shut down the reverse function for a few minutes.

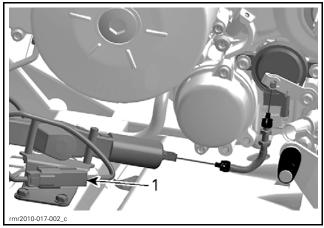
REVERSE ACTUATOR CONTROL CIRCUIT TEST		
TEST P	ROBES	RESULT (REVERSE BUTTON PRESSED)
Actuator connector pin 1	Positive source	Battery voltage

If voltage is as specified, try a new reverse actuator.

If voltage is not as specified, look for an open circuit between reverse actuator connector and cluster connector pin 3.

Reverse Actuator Replacement

- 1. On left side, remove the bottom rear side panel and the rear side panel. Refer to BODY subsection.
- 2. Disconnect the reverse actuator connector.



1. Reverse actuator connector

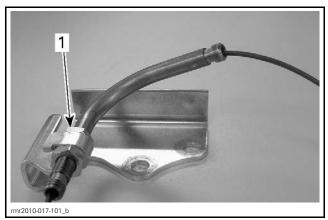
- 3. Remove reverse actuator mounting screws.
- 4. Remove cable guide bracket mounting screws.
- 5. Detach actuator cable from control lever.
- 6. Installation is the reverse of removal however, it is critical to carry out the REVERSE ACTUATOR CABLE ADJUSTMENT.

NOTE: Start adjustment procedure before installing the new actuator on the vehicle.

Reverse Actuator Cable Adjustment

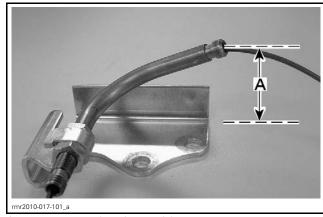
1. Lay the cable guide bracket on a workbench and loosen the adjusting nuts.

2. Set the lower adjusting nut against the bottom of the cable guide threads.



1. Lower nut against bottom of threads.

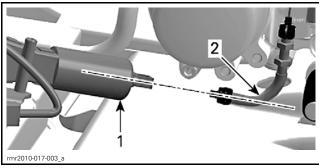
3. Set the distance between the workbench surface and the cable guide center line to $37 \, \text{mm} \pm 1 \, \text{mm} \, (1.46 \, \text{in} \pm .04 \, \text{in})$ as shown, then tighten the upper adjustment screw.



A. $37 \, \text{mm} \pm 1 \, \text{mm} \, (1.46 \, \text{in} \pm .04 \, \text{in})$

- 4. Install the cable guide bracket on the engine.
- 5. Position actuator on the frame member, then loosely thread the rear mounting bolt.

The actuator center axis must be in line with the cable guide vertically.

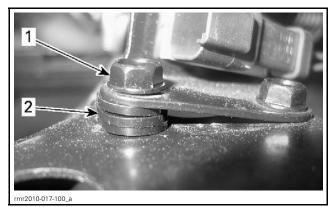


11

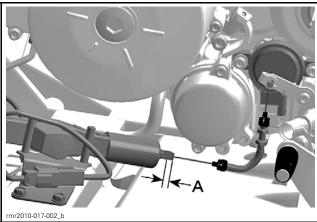
ACTUATOR AND CABLE GUIDE IN LINE

- Actuator
 Cable guide

- 6. Place enough shims (P/N 710 002 024) underneath the actuator mounting plate front hole to obtain alignment.
- 7. Once parts are aligned, thread the front mounting screw through the shims.



- 1. Front mounting screw
- 2. Shims
- 8. Tighten mounting screws.
- 9. Make sure that there is an axial free play of 2 mm (1/16 in) minimum at actuator rod.



A. Free play at the actuator rod

10. Validate that gearbox engages in reverse.

SHIFTING MECHANISM

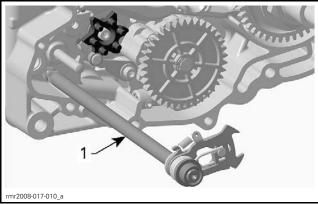
Parts of the shifting mechanism can be replaced without removing the engine:

- Shift shaft
- Index lever
- Index shim
- Index spring.

Shifting Mechanism Removal

Remove clutch cover and clutch drum. Refer to the appropriate clutch subsection.

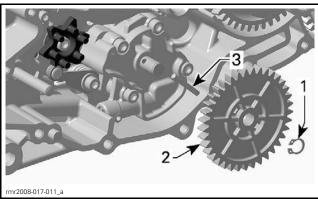
Pull out shift shaft assembly from crankcase.



TYPICAL

1. Shift shaft assembly

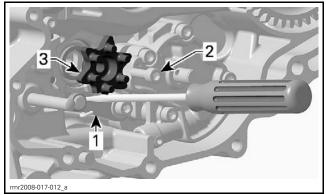
Remove oil pump gear.



TYPICAL

- 1. Retaining ring
- Oil pump gear
- 3. Needle pin

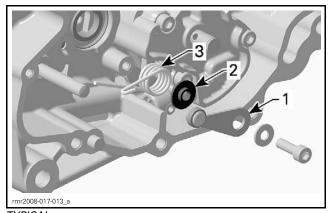
Use a flat screwdriver to turn index lever counterclockwise while removing index shim.



TYPICAL

- 1. Index lever
- 2. Screw
- 3. Index shim

Remove index lever and index spring.



TYPICAL

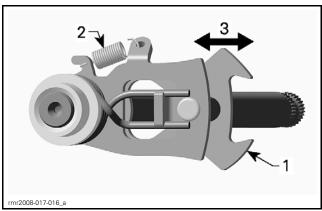
- Index lever
- Step ring
 Index spring

Shifting Mechanism Inspection

Shift Shaft

Check shift shaft for worn splines or other damages.

Check pawl and pawl spring for wear and proper operation.



TYPICAL

- 3. Check for free movement

Index Lever

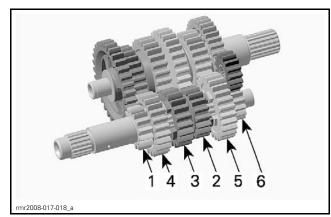
Roller of index lever must move freely. Replace as necessary.

Shifting Mechanism Installation

The Installation is the reverse of the removal procedure.

When installation of shifting mechanism is finished check if gears engage exactly and shifting system works properly.

GEARBOX



- 1st speed
- 2nd speed
- 3rd speed
- 4th speed
- 5th speed
- Reverse speed

Gearbox Disassembly

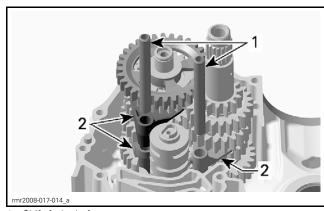
Remove engine from vehicle. Refer to ENGINE REMOVAL AND INSTALLATION subsection.

Remove FRONT SPROCKET. See procedure in this subsection.

Remove the SHIFTING MECHANISM. See procedure in this subsection.

Separate both crankcase housings. Refer to CRANKCASE AND CRANKSHAFT subsection.

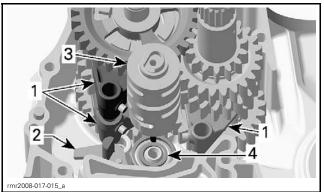
Remove both shift fork shafts from shift forks.



- Shift fork shafts
- Shift forks

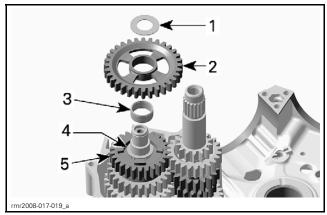
On SM5 model, disengage shift forks and gear locking shaft from shift drum.

Remove shift drum and bearing.



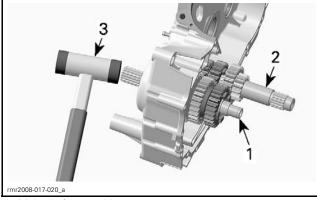
- Shift forks
- Gear locking shaft (SM5 Model only)
- Shift drum
- Bearing

Before removing the gearbox from crankcase withdraw the following separate parts from main shaft.



- Thrust washer
- Free pinion (1st gear)
- Needle bearing
- Thrust washer
- Shifting gear (4th gear)

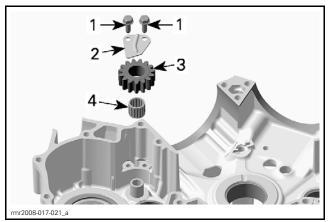
Using a soft hammer, tap main shaft to assist withdrawing main shaft assembly together with clutch shaft assembly.



- Main shaft assembly
- Clutch shaft assembly
- 3. Soft hammer

Reverse Intermediate Gear

Remove screws and retaining plate and withdraw intermediate gear and needle bearing.



- Screws
- Retaining plate
- Intermediate gear
- Needle bearing

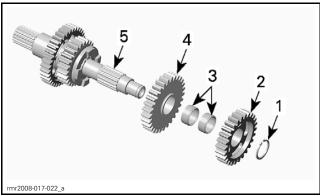
Ball Bearings

When gearbox is removed check gearbox ball bearings for contamination and/or metal shavings. Check if bearings turn freely and smoothly. Replace if necessary, refer to CRANKCASE AND CRANKSHAFT.

Main Shaft

Remove and discard the snap ring using special pliers as such the SNAP-ON SNAP RING PLIERS (P/N SRP3).

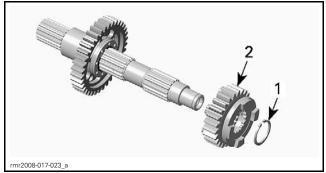
Remove free pinions and needle bearings.



- Snap ring
- Stap ting
 Free pinion (3rd gear)
 Needle bearings
 Free pinion (2nd gear)
 Main shaft assembly

Remove and discard snap ring retaining the shifting gear (5th gear).

Withdraw shifting gear.

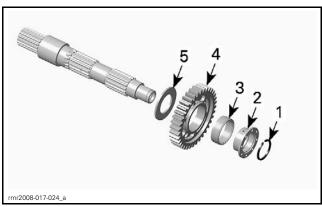


- Snap ring
- 2. Shifting gear (5th gear)

Remove and discard snap ring securing the reverse gear.

Withdraw free pinion with needle bearing and bearing sleeve.

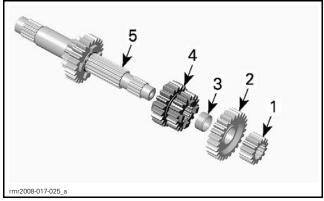
Then remove thrust washer.



- Snap ring
- Bearing sleeve
- Needle bearing
- Free pinion (reverse gear)
- 5. Thrust washer

Clutch Shaft

Remove fixed gear, free pinion, needle bearing and thrust washer and shifting gear from clutch shaft.

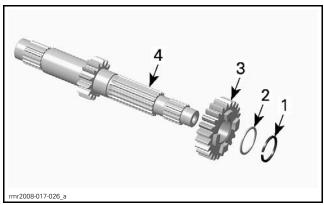


- Fixed gear (reverse gear)

- Free pinion (5th gear) Free pinion (5th gear) Needle bearing Shifting gear (2nd and 3rd gear) Clutch shaft assembly

Remove and discard snap ring the free pinion (4th

Withdraw thrust washer and free pinion from clutch shaft.



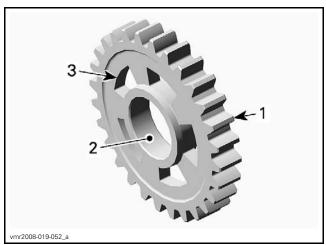
- Snap ring

- Thrust washer
 Free pinion (4th gear)
 Clutch shaft (1st gear)

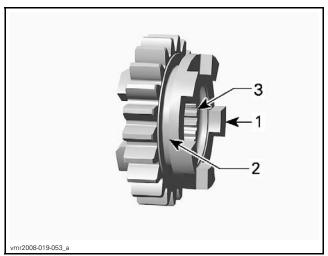
Gearbox Inspection

Always verify for the following when inspecting gearbox components:

- Gear teeth damage
- Worn or scored bearing surfaces
- Rounded engagement dogs and slots
- Worn shift fork engagement groove
- Worn tracks on shift drum
- Worn shift fork engagement pins
- Worn splines on shafts and gears
- Bent, worn or scored shift fork shafts
- Bent, worn or scored shift fork.



- TYPICAL FREE PINION
- Teeth
- Bearing surface
- 3. Engagement slot

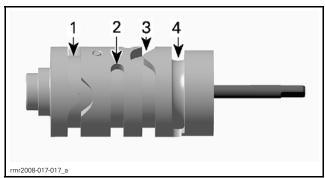


TYPICAL — SHIFTING GEAR

- Engagement dog
- Shift fork engagement groove
- Inner splines

Shift Drum

Check shift drum tracks for scouring or heavy wear, like rounded engagement slots.



- Track for 1st / 3rd gear shift fork
 Track for 4th / 5th gear shift fork
 Track for 2nd / Reverse gear shift fork
 Track for gear locking shaft (SM5 model only)

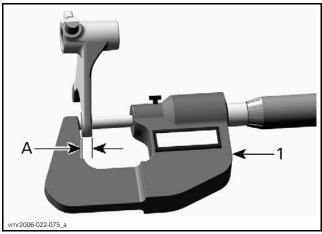
Gear Locking Shaft (SM5)

Roller of gear locking shaft must move freely. Replace as necessary.

Shift Fork

Check shift forks for visible damage, wear or bent shift fork claws.

Measure the shift fork claw thickness.

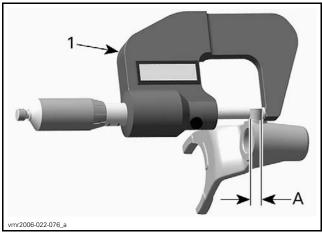


TYPICAL

- 1. Micrometer
- A. Shift fork claw thickness

SHIFT FORK CLAW THICKNESS		
New	4.00 mm to 4.10 mm (.1575 in to .1614 in)	
Service limit	3.90 mm (.1535 in)	

Measure the shift fork engagement pin diameter.



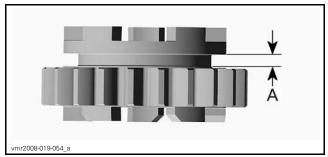
TYPICAL

- 1. Micrometer
- A. Shift fork engagement pin diameter

SHIFT FORK ENGAGEMENT PIN DIAMETER	
New	5.92 mm to 5.97 mm (.2331 in to .235 in)
Service limit	5.850 mm (.2303 in)

Gears

Measure the width of shift fork engagement groove.

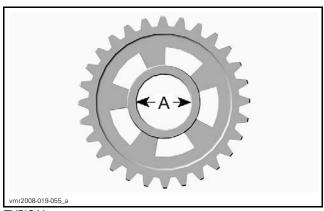


TYPICAL — SHIFTING GEAR
A. Width of shift fork engagement groove

WIDTH OF SHIFT FORK ENGAGEMENT GROOVE	
New	4.20 mm to 4.30 mm (.1654 in to .1693 in)
Service limit	4.50 mm (.1772 in)

Check free pinions for wear.

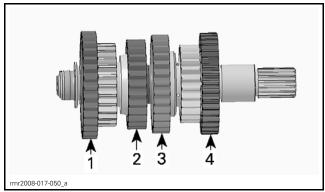
Measure the inside diameter of free pinion.



TYPICAL

A. Diameter free pinion bearing

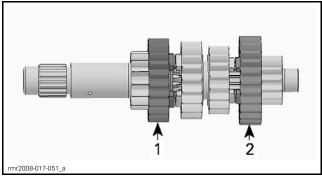
MAIN SHAFT FREE PINIONS		
NEW		
1 st gear		
2 nd gear	29.007 mm to 29.020 mm (1.142 in to 1.1425 in)	
3 rd gear	(11111211110311111123111)	
Reverse gear	40.009 mm to 40.025 mm (1.5752 in to 1.5758 in)	
SERVICE LIMIT		
1 st gear		
2 nd gear	29.035 mm (1.143 in)	
3 rd gear		
Reverse gear	40.040 mm (1.5764 in)	



MAIN SHAFT — FREE PINION

- 1. 1st gear
 2. 3rd gear
 3. 2nd gear
 4. Reverse gear

CLUTCH SHAFT FREE PINIONS		
NE	EW	
4 th gear	29.080 mm - 29.100 mm (1.1449 in - 1.1457 in)	
5 th gear	26.000 mm - 26.013 mm (1.0236 in - 1.0241 in)	
SERVICE LIMIT		
4 th gear	29.125 mm (1.1467 in)	
5 th gear	26.025 mm (1.0246 in)	



CLUTCH SHAFT — FREE PINION

4th gear
 5th gear

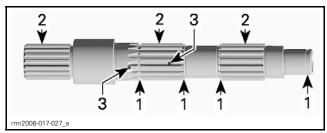
Main Shaft

Check main shaft for wear.

Check retaining ring grooves.

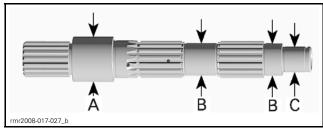
Check splines for wear and/or damages.

Blow out the oil orifices and check if they are not clogged.



- Retaining ring grooves
- Splines Oil orifices

Measure diameters of main shaft bearing journals.

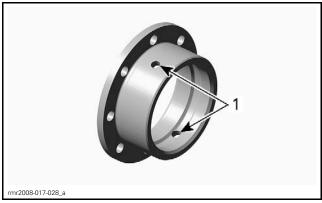


- A. Magneto side bearing journal B. Free pinion bearing journal C. Clutch side bearing journal

MAIN SHAFT BEARING JOURNAL			
NE	NEW		
Magneto side bearing journal	34.989 mm - 35.000 mm (1.3775 in - 1.378 in)		
Free pinion bearing journal	24.980 mm - 24.993 mm (.9835 in984 in)		
Clutch side bearing journal	19.987 mm - 20.000 mm (.7869 in7874 in)		
SERVIC	SERVICE LIMIT		
Magneto side bearing journal	34.975 mm (1.377 in)		
Free pinion bearing journal	24.970 mm (.9831 in)		
Clutch side bearing journal	19.970 mm (.7862 in)		

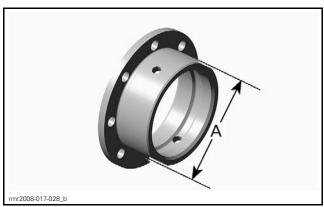
Bearing Sleeve

Check if oil orifices are free. Clean if required.



1. Oil orifices

Measure external diameter of reverse gear free pinion bearing.



A. External diameter

FREE PINION BEARING EXTERNAL DIAMETER		
New	34.984 mm - 35.000 mm (1.3773 in - 1.378 in)	
Service limit	34.970 mm (1.3768 in)	

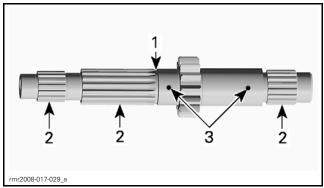
Clutch Shaft

Check clutch shaft for wear.

Check retaining ring groove.

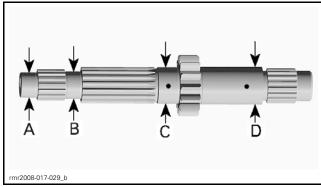
Check splines for wear and/or damages.

Blow out the oil orifices and check if they are not clogged.



- Retaining ring groove
- Splines
 Oil orifices

Measure diameters of clutch shaft bearing journals.



- A. Magneto side bearing journal B. Free pinion bearing journal (5th gear)
- Free pinion bearing journal (4th gear)
- C. Free pinion bearing journal D. Clutch side bearing journal

CLUTCH SHAFT BEARING JOURNAL			
NEW			
Magneto side bearing journal	19.987 mm - 20.000 mm (.7869 in7874 in)		
Free pinion bearing journal (5 th gear)	21.987 mm - 22.000 mm (.8656 in8661 in)		
Free pinion bearing journal (4 th gear)	29.041 mm - 29.054 mm (1.1433 in - 1.1439 in)		
Clutch side bearing journal	29.980 mm - 29.993 mm (1.1803 in - 1.1808 in)		
SERVIC	SERVICE LIMIT		
Magneto side bearing journal	19.970 mm (.7862 in)		
Free pinion bearing journal (5 th gear)	21.970 mm (.865 in)		
Free pinion bearing journal (4 th gear)	29.030 mm (1.1429 in)		
Clutch side bearing journal	29.965 mm (1.1797 in)		

Reverse Intermediate Gear

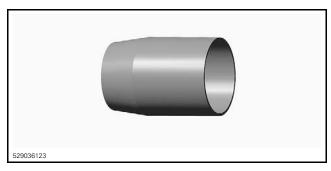
Check reverse intermediate gear, needle bearing and bearing pin visually for wear, pitting and/or scoring. Replace parts if necessary.

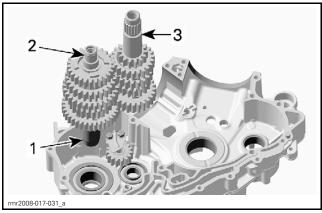
Gearbox Assembly and Installation

For assembly and installation, reverse the disassembly and removal procedures. Pay attention to the following details.

NOTICE Always install NEW snap rings.

For gearbox installation put the MAIN SHAFT PRO-TECTOR (P/N 529 036 123) on main shaft in order not to damage main shaft oil seal.





- Main shaft protector
- Main shaft
- Clutch shaft

Seat shafts fully home by tapping them into place with a plastic hammer.

Install the shifting mechanism.

Install all other removed parts.

HYDRAULIC CONTROL MODULE (SE5)

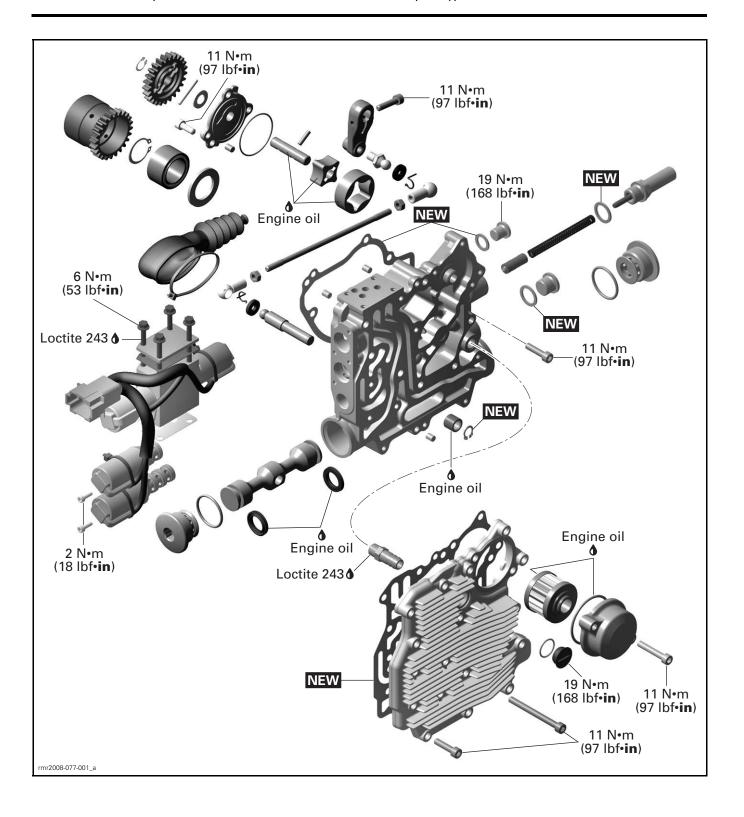
SERVICE TOOLS

Description	Part Number	Page
FLUKE 115 MULTIMETER	529 035 868	12
OIL PRESSURE GAUGE	529 036 142	

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	14–15

rm:2010-016



GENERAL

Always disconnect the negative battery cable before working on the engine.

WARNING

Always disconnect the BLACK (-) cable first and reconnect last.

Always carry out electrical tests on components before removing or installing them to ensure their state of operation.

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a thread locker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

A WARNING

Torque wrench tightening specifications must be strictly adhered to.

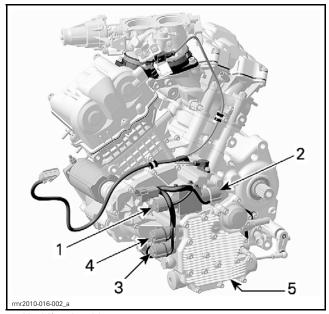
Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced with new ones.

NOTICE Hoses, cables and locking ties removed during a procedure must be reinstalled as per factory standards.

SYSTEM DESCRIPTION (COMPONENTS)

The transmission control module (TCM) manages 4 solenoid valves located on the hydraulic control module (HCM) which control and activate the gear shifting process.

NOTE: Consult also the *ELECTRONIC SHIFT SYSTEM (SE5)* subsection for an overview of the gearshift operation and troubleshooting.



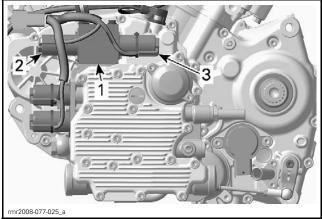
- 1. Upshift solenoid
- 2. Downshift solenoid
- Clutch solenoid
- 4. Clutch modulation solenoid
- 5. Hydraulic control module (HCM)

Shift Solenoids

The shift solenoids are located on top of the HCM module.

The LH side solenoid function is to upshift to a higher gear.

The RH side solenoid function is to downshift to a lower gear.



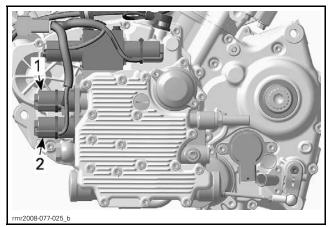
- 1. Shifting valve
- Upshift solenoid
 Downshift solenoid

Clutch Solenoids

The clutch solenoid function is to disengage and engage the clutch when shifting occurs by allowing HCM oil pressure to reach the clutch piston (for disengagement only).

3

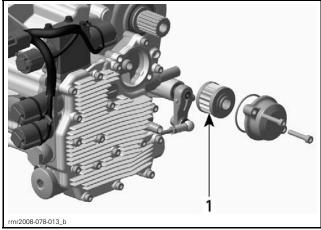
The clutch modulation solenoid function is to bleed the oil pressure from the clutch piston (through the clutch solenoid) to control the clutch engagement speed. For this reason, it is the clutch modulation solenoid.



- 1. Clutch modulation solenoid
- 2. Clutch solenoid

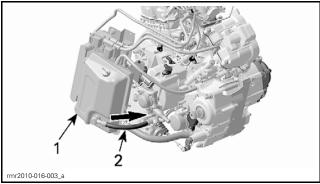
Hydraulic Control Module (HCM)

The HCM shares its oil with the engine. The HCM uses its own oil filter to protect the hydraulic components.



1. Oil filter

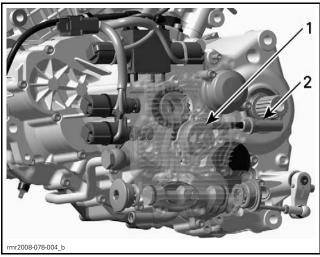
The oil tank supplies oil to the hydraulic control module (HCM).



TYPICAL

- 1. Oil tank
- 2. Oil supply line to HCM

The HCM includes its own oil pump specifically used for the clutching and gear shifting.

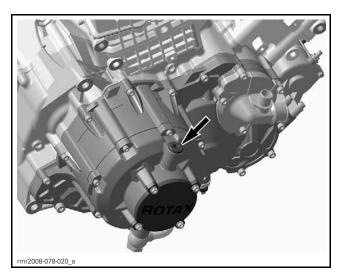


- 1. Oil pump
- 2. Oil pressure regulator

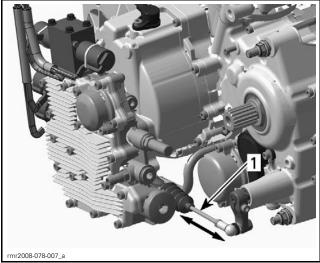
The mechanically-driven pump continuously turn, when engine is running, to feed the oil in the system.

The hydraulic system works at approximately 1 200 kPa (174 PSI) when shifting. An oil pressure regulator is used to stabilize the pressure.

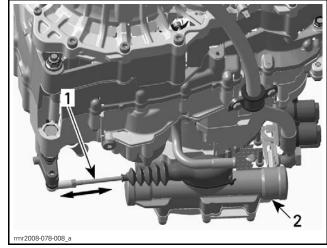
A self bleeding regulator valve, located at the highest point of the shifting system, is used to bleed away air trapped in the system back the to crankcase.



The shift shaft is attached by a mechanical link to the HCM. A hydraulic piston moves the link rod to either upshift or downshift. The piston moves when oil is sent through shift solenoids when energized by the TCM.



1. Link rod between HCM and shift shaft



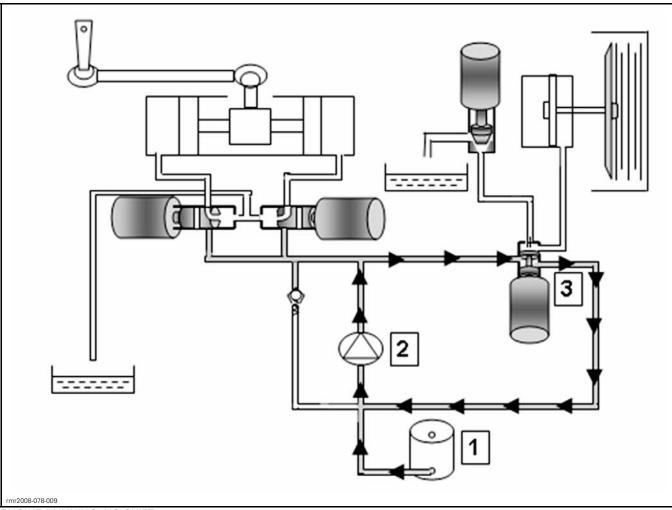
Link rod
 Hydraulic piston location

SYSTEM DESCRIPTION (PRINCIPLE OF OPERATION)

Hydraulic Operation When No Shifting Occurs

When the engine is running and there is no shift selected, oil is supplied from the oil tank to the HCM oil pump.

Oil is then circulated through a passageway in the clutch solenoid back through the HCM oil pump in a continuous loop to maintain the oil flow ready for any upcoming shift request.



ENGINE RUNNING, NO SHIFT

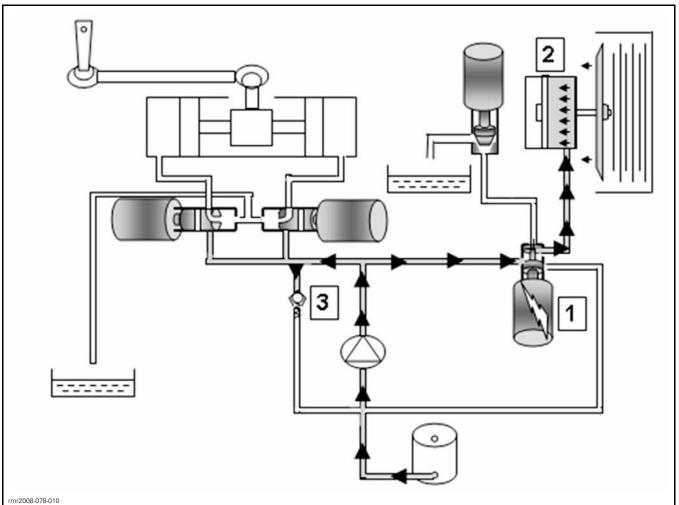
- Oil tank
 HCM oil pump
- 3. Clutch solenoid

Hydraulic Operation When Shifting Occurs

When a shift is selected, the clutch solenoid is activated by the TCM and oil from the pressure line is directed to the clutch servo.

At the same time oil pressure builds and is limited to 1 200 kPa (174 PSI) by the HCM oil pressure regulator.

That oil, under the same pressure is also available at the shift solenoid valves.



CLUTCH DISENGAGEMENT

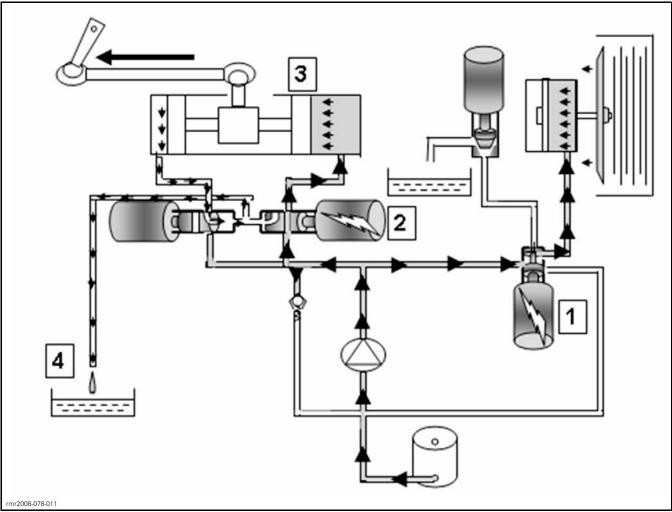
- 1. Clutch solenoid
- 2. Clutch servo
- 3. HCM oil pressure regulator

After the clutch solenoid is activated and the clutch is disengaged, one of the shift solenoid is then activated by the TCM.

Pressurized oil can then pass through the solenoid valve to one side of the shift hydraulic piston.

The hydraulic piston moves the linkage and a shift is initiated.

As the hydraulic piston moves, oil on the opposite side of the piston is pushed out through the shift solenoid to the crankcase sump.



SHIFTING

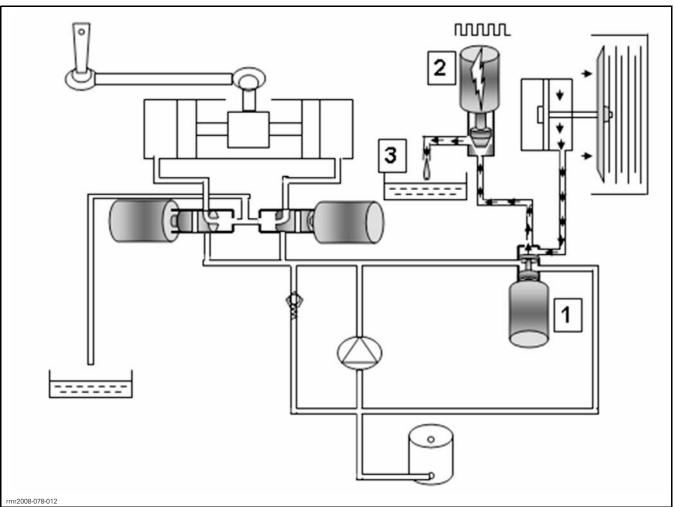
- Clutch solenoid Shift solenoid
- Hydraulic piston
 Crankcase sump

When the TCM determines that the shift has been initiated by the position of the gearbox position sensor (GBPS), it turns off the shift solenoid and the clutch solenoid.

The TCM then sends a pulse width modulated (PWM) signal to the clutch modulation solenoid.

Oil is then bled off of the clutch servo through a passageway in the clutch solenoid and the clutch modulation solenoid to the crankcase sump.

The clutch is then smoothly engaged.



CLUTCH ENGAGEMENT MODULATION

- 1. Clutch solenoid
- Clutch modulation solenoid
 Crankcase sump

9

MAINTENANCE

HCM OIL FILTER

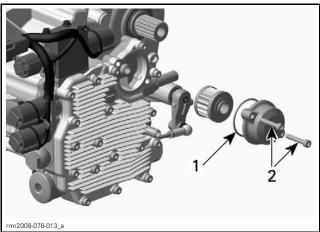
NOTE: The HCM uses the same oil as the engine, but has its own oil filter.

HCM Oil Filter Removal

NOTE: Replace HCM oil filter and engine oil filter at the same time. Refer to *MAINTENANCE SCHEDULE* for frequency.

Drain engine oil. Refer to *LUBRICATION SYSTEM* subsection.

Remove oil filter cover screws.



Oil filter cover
 Cover screws

Remove oil filter cover with O-ring. Discard O-ring.

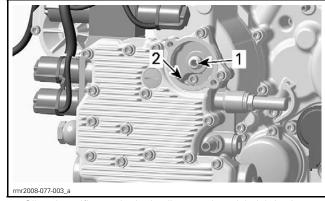
Remove oil filter.

Dispose filter as per your local environmental regulations.

HCM Oil Filter Installation

The installation is the reverse of the removal procedure. Pay attention to the following.

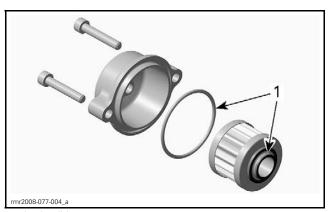
Check and clean the oil inlet and outlet orifices in hydraulic control module for dirt and contaminations.



- Oil outlet orifice to the hydraulic control module lubrication system
- 2. Oil inlet orifice to the oil pump

Install a NEW O-ring on oil filter cover.

To ease assembly and prevent displacement of the O-ring during installation, slightly oil filter and O-ring, refer to following illustration.



1. Apply oil here

INSPECTION

HCM OIL PRESSURE TEST

Oil pressure test prerequisite:

- Warm engine (80°C (176°F))
- The recommend oil in engine
- The proper oil level.

Remove the following LH body panels, refer to *BODY* subsection:

- Top side panel
- Rear side panel.

Remove plug screw located behind HCM oil filter housing.



TYPICAL

Install the OIL PRESSURE GAUGE (P/N 529 036 142) in HCM oil pressure threaded tap hole.

Connect the latest version of B.U.D.S. and logon.

Make sure TCM is operational. Refer to *TCM STATUS VALIDATION* in the *ELECTRONIC SHIFT SYSTEM (SE5)* subsection.

Select the **Activation** page and **TCM** folder. Look at the **Routine** section of the page.



ACTIVATION PAGE, TCM FOLDER

Start engine.

Let engine idle.

NOTE: If more than 400 kPa (58 PSI) is read when the engine is idling, check for blockage in clutch solenoid valve and in HCM passageways.

Select **Clutch activation** on the **Routine** section of the B.U.D.S. **Activation** page.

While clutch is activating, watch pressure gauge and note the value.



TYPICAL

NOTE: The nominal oil pressure is only achieved during clutch activation or shifting



TYPICAL

The oil pressure should be within the following values.

OIL PRESSURE	IDLE SPEED, WHILE SHIFTING
MINIMUM	900 kPa (131 PSI)
NOMINAL	1 200 kPa (174 PSI)
MAXIMUM	1 600 kPa (232 PSI)

If oil pressure is not within the specifications, check the following:

- Oil leaks (internal or external)
- HCM oil filter
- HCM oil pressure regulator
- HCM self bleeding valve
- Hydraulic valve(s) and solenoid(s)

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- HCM oil pump
- HCM.

Drain pressure gauge into oil tank.

Reinstall removed parts.

Disconnect B.U.D.S.

PROCEDURES

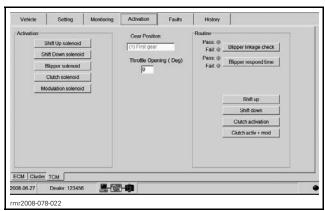
SHIFT AND CLUTCH SOLENOIDS

Solenoid Activation Test with B.U.D.S

Connect the latest version of B.U.D.S. and logon.

Make sure TCM is operational. Refer to *TCM STATUS VALIDATION* in the *ELECTRONIC SHIFT SYSTEM (SE5)* subsection.

Select the **Activation** page and **TCM** folder. Look at the **Routine** section of the page.



ACTIVATION PAGE, TCM FOLDER

Clutch to activate each solenoids on the **Activation** section of the B.U.D.S. **Activation** page. Activate the solenoids in the following order while listening and feeling the solenoids

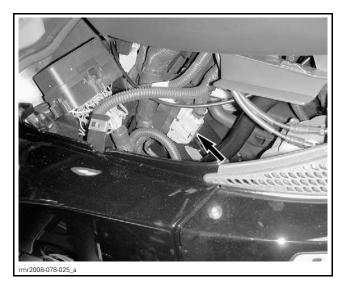
- Upshift solenoid
- Downshift solenoid
- Clutch solenoid
- Modulation solenoid.

Use the following electrical tests if any solenoids did not activated.

Solenoid Test

Remove LH upper side panel. Refer to *BODY* subsection.

Disconnect TCM connector.



Disconnect the 8-pin solenoid connector.



Solenoid Resistance

Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and select the position $\Omega.$

Measure the resistance between the following pins.

SOLENOID	SOLENOID CONNECTOR PIN (WIRE COLOR)		RESISTANCE AT 20°C (68°F)
Upshift	1 (RED)	8 (WHITE)	2.50 – 2.80 Ω
Downshift	2 (RED)	7 (WHITE)	2.50 – 2.80 Ω
Clutch	3 (RED)	6 (WHITE)	2.50 – 2.80 Ω
Clutch modulation	4 (ORANGE)	5 (WHITE)	1.00 – 1.50 Ω

If the resistance measuring is not within the specification replace faulty parts.

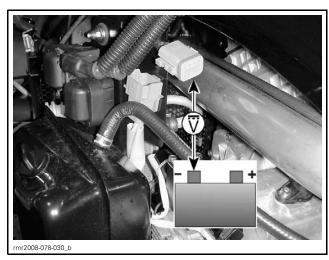
Power Circuit

Turn ignition switch ON.

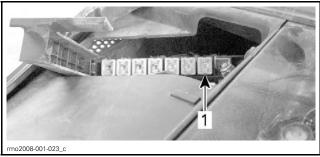
Set multimeter to Vdc.

Read voltage as follows.

SWITCH	SOLENOID CONNECTOR PIN	VOLTAGE
l lo obift	8 and battery ground	No voltage
Upshift	1 and battery ground	Battery voltage
Downshift	7 and battery ground	No voltage
DOWNSHIIT	2 and battery ground	Battery voltage
Clutch	3 and battery ground	Battery Voltage
Clutch	6 and battery ground	No voltage
Clutch	4 and battery ground	Battery voltage
modulation	5 and battery ground	No voltage



If a solenoid test failed, check sol + TCM fuse (2) in rear fuse box. If it is good, check wiring and connectors between TCM and battery.



REAR FUSE BOX 1. Sol + TCM fuse

If solenoid test succeeded, continue testing.

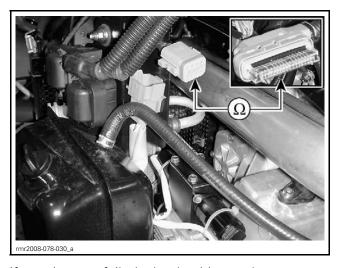
Contact Circuit

Turn ignition switch OFF.

Set multimeter to Ω .

Check continuity as follows.

SWITCH	TCM CONNECTOR PIN	SOLENOID CONNECTOR PIN	RESISTANCE
Upshift	32	8	
Downshift	33	7	
Clutch	34	6	Close to 0 Ω
Clutch modulation	30	5	



If a resistance failed, check wiring and connectors between TCM and solenoid connector.

Solenoid Removal

Remove body panels, refer to the *BODY* subsection.

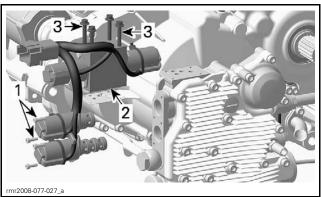
Disconnect solenoid connector from wiring harness.

Remove screws retaining solenoid valve body to HCM.

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Remove Allen screws securing the modulation and the clutch solenoids from the side of HCM.

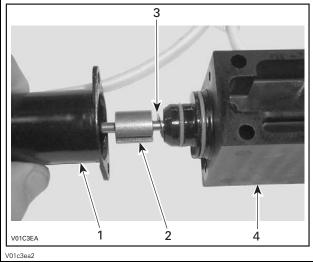
NOTE: Solenoids are available as single parts, replace complete solenoid valve set only if necessary. For removing pins of the connector refer to *CONNECTOR INFORMATION* subsection.



- 1. Allen screws
- 2. Solenoid valve body
- 3. Solenoid valve screws

Remove solenoids from HCM.

NOTE: Use caution when pulling the shifting solenoid from the body as engagement pin and washer may fall out.



TYPICAL

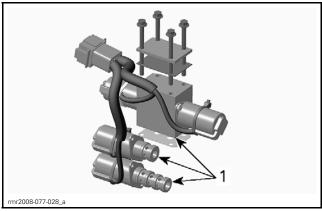
- 1. Shifting solenoid
- 2. Engagement pin
- 3. Washer
- 4. Valve body

Solenoid Inspection

Check solenoids and gaskets for any damage. Replace if necessary.

Solenoid Cleaning

Clean tip of clutch and modulation solenoids with a contact cleaner.



1. Clean this area with contact cleaner

Solenoid Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on threads of solenoid valve screws.

Torque solenoid valve body screws to 6 N•m (53 lbf•in).

Torque Allen screw to 2 N•m (18 lbf•in).

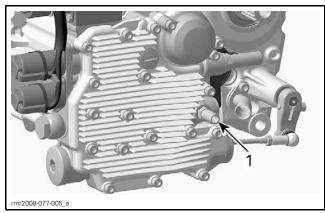
Check oil level in oil tank and refill with recommended oil if necessary. Refer to *LUBRICATION SYSTEM* subsection.

Install pins of the solenoid valves in the correct place of the connector, refer to following table:

•	•	J
SOLENOID	WIRE IDENTIFICATION NUMBER AT CONNECTOR (WIRE COLOR)	
Upshift	1 (RED)	8 (WHITE)
Downshift	2 (RED)	7 (WHITE)
Clutch	3 (RED)	6 (WHITE)
Clutch modulation	4 (ORANGE)	5 (WHITE)

OIL HOSE NIPPLE

The oil hose nipple is located on the front of the HCM.



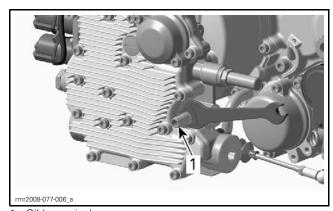
1. Oil hose nipple "IN"

Oil Hose Nipple Removal

Drain engine oil, refer to *LUBRICATION SYSTEM* subsection.

Remove oil hose from nipple.

Unscrew oil hose nipple.



1. Oil hose nipple

Oil Hose Nipple Inspection

Clean oil hose nipple with a part cleaner, then use air pressure to dry it.

WARNING

Always wear skin and eye protection. Chemicals can cause skin rash, skin burns and severe eye injury.

Check if threads of the oil hose nipple is damaged. Replace if necessary.

Check oil hose nipple for cracks. Replace if necessary.

Oil Hose Nipple Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on hose nipple threads.

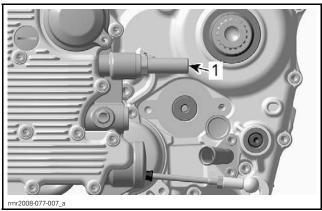
Torque oil hose nipple to 11 N•m (97 lbf•in).

Install oil hose.

Refill oil tank with recommended oil and check engine oil level. Refer to *LUBRICATION SYSTEM* subsection.

HCM OIL PRESSURE REGULATOR

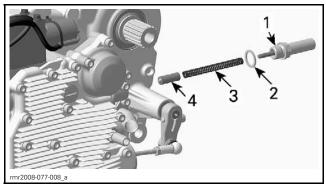
The HCM oil pressure regulator is located inside the hydraulic control module.



1. HCM oil pressure regulator location

HCM Oil Pressure Regulator Removal

Remove oil pressure regulator from HCM.



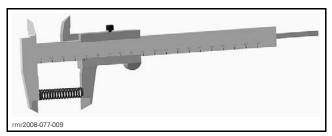
- 1. Plug screw
- 2. Sealing washer
- 3. Spring
- 4. Pressure regulator piston

HCM Oil Pressure Regulator Inspection

Inspect oil pressure regulator bore (where the regulator piston fits) and regulator piston for scoring or other damages. Check if piston moves easily in hydraulic control module bore.

Inspect compression spring for any deformation and free length.

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SPRING FREE LENGTH		
SERVICE LIMIT	110 mm (4.331 in)	

Replace worn or damaged components.

Clean bore and thread in the hydraulic control unit from metal shavings and other contaminations.

HCM Oil Pressure Regulator Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Always install a NEW sealing washer.

Torque plug screw to 19 N•m (168 lbf•in).

Refill oil tank with recommended oil and check engine oil level. Refer to LUBRICATION SYSTEM subsection.

HYDRAULIC CONTROL MODULE (HCM)

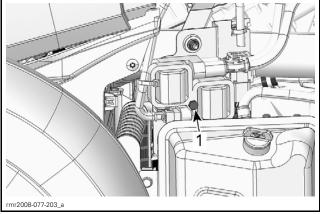
HCM Removal

Make sure gearbox is on N position.

Remove the LH lower side panel. Refer to BODY subsection.

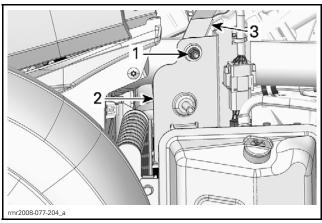
Drain engine oil. Refer to LUBRICATION SYSTEM subsection.

Unscrew bolt securing the ignition coil.



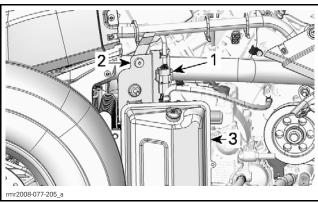
Ignition coils bolt

Remove bolt retaining ignition coil support to lateral support.



- Remove this bolt
- Ignition coils support
- Lateral support

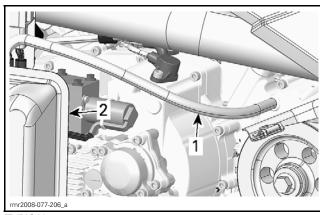
Unplug the solenoids connector and remove connector housing from the ignition coils support.



TYPICAL

- Solenoid connector
- Ignition coils support Oil tank

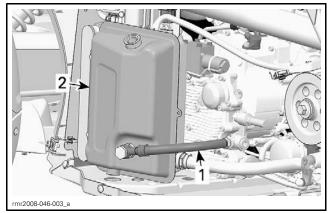
Disconnect the oil tank vent from crankcase.



TYPICAL

- Oil tank vent
- 2. Oil tank

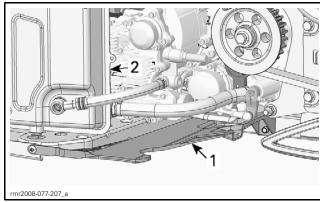
Detach the clutch servo hose from the bottom of oil tank.



TYPICAL

- 1. Clutch servo hose 2. Oil tank

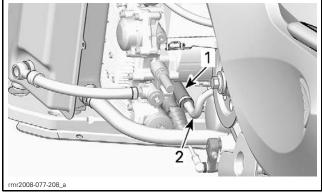
Remove the bottom plate under oil tank.



TYPICAL

- Bottom plate Oil tank

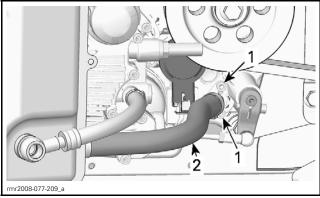
Disconnect oil cooler inlet hose from engine outlet connector tube.



TYPICAL

- Oil cooler inlet hose
 Engine outlet connector tube

Remove engine inlet connector tube from crankcase. Discard O-rings.

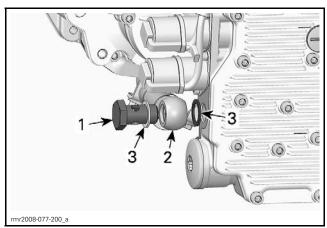


TYPICAL

- Engine inlet connector tube bolts
 Oil cooler outlet hose

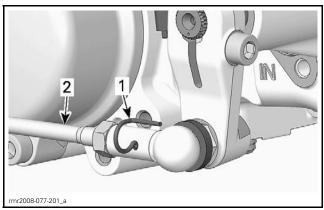
Move oil tank and oil cooler aside to make room. Remove HCM OIL FILTER, see procedure above in this subsection.

Unscrew the Banjo fitting securing the clutch hose to HCM. Discard sealing washers.



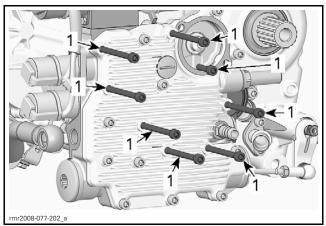
- Banjo fitting
 Clutch hose
 Sealing washers

Remove circlip of shift linkage.



- 1. Circlip 2. Shift linkage

NOTE: For easier removal of plug screws, loosen them before removing the HCM from the engine. Remove screws retaining the HCM to the magneto cover.



1. HCM screws

Pull the HCM and discard its gasket.

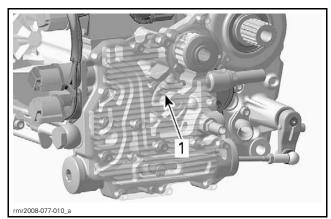
HCM Installation

The installation is the reverse of the removal procedure.

OIL PUMP

The oil pump is located inside the hydraulic control module (HCM).

The HCM is equipped with its own oil pump.

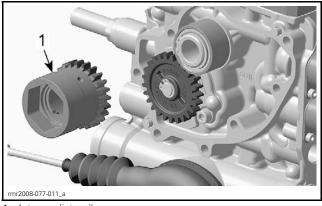


1. Oil pump

Oil Pump Removal

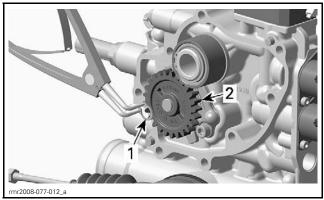
Remove the HCM from the engine, refer to HY-DRAULIC CONTROL MODULE (HCM) in this subsection.

Remove intermediate oil pump gear.



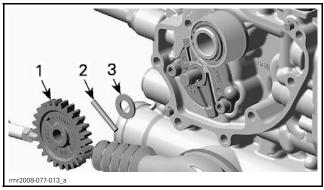
1. Intermediate oil pump gear

Remove retaining ring.



Retaining ring
 Oil pump gear

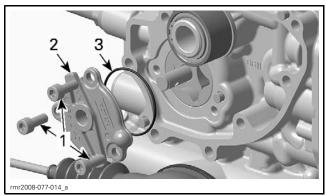
Remove oil pump gear, needle pin and thrust washer.



1. Oil pump gear

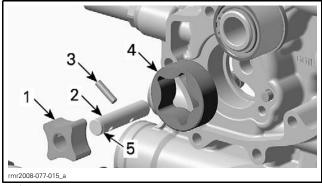
Remove oil pump cover. Discard the O-ring.

Needle pin
 Thrust washer



- 1. Oil pump cover screws
- 2. Oil pump cover
- 3. O-ring

Remove oil pump shaft with rotor set.



- 1. Inner rotor
- 2. Oil pump shaft
- 3. Needle pin
- Outer rotor
 Groove

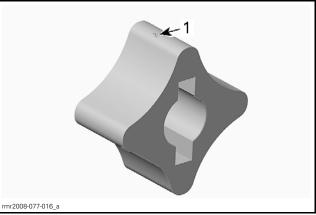
Oil Pump Inspection

Check oil pump cover and hydraulic control module surface (where the oil pump cover fits) for damage.

Inspect rotor set and oil pump bore for serious marks, scratches or other damages. If so, replace damaged parts.

NOTE: Minimal imperfections or scratches are allowed.

Check inner rotor for corrosion pin holes, pitting or other damages. If defects or damages are found, replace oil pump inner and outer rotor.

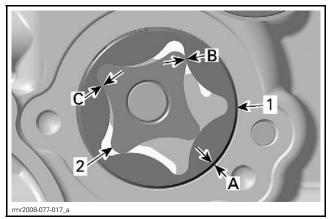


TYPICAL

1. Pitting on the teeth

Radial Clearance

Using a feeler gauge, measure the radial clearance as illustrated. Refer to table following illustration for service limits.



TYPICAL

- 1. Outer rotor
- 2. Inner rotor

OUTER AND INNER ROTOR CLEARANCE		
SERVICE LIMIT		
А		
В	0.25 mm (.0098 in)	
С		

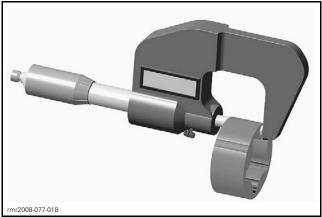
If clearance between inner and outer rotors exceeds the tolerance, replace the oil pump.

If clearance between outer rotor and its bore in hydraulic control module exceeds the tolerance, replace the complete oil pump assembly and/or the hydraulic control module.

Axial Clearance

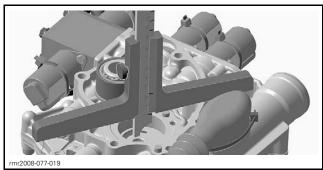
Measure outer rotor thickness with micrometer.

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OUTER ROTOR THICKNESS

Using a depth gauge, measure the depth of the oil pump bore as shown.



OIL PUMP BORE DEPTH (HYDRAULIC CONTROL MODULE)

Difference between measurements should not exceed 0.15 mm (.0059 in). If the clearance is out of tolerance, replace the complete oil pump assembly.

NOTE: When the axial clearance of the oil pump assembly increases, the oil pressure decreases.

Check oil pump gear for serious marks and damage. If so, replace damaged part.

NOTE: Minimal imperfections or scratches are allowed.

Oil Pump Installation

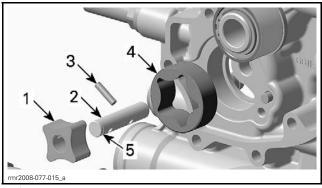
For installation, reverse the removal procedure. Pay attention to the following details.

Clean all metal components in a solvent.

Coat inner and outer rotors with oil.

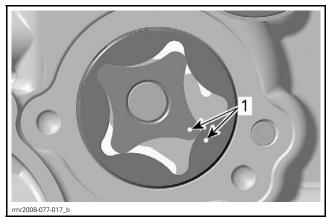
Install oil pump shaft.

NOTE: The groove must face outwards and be visible when installing oil pump cover.



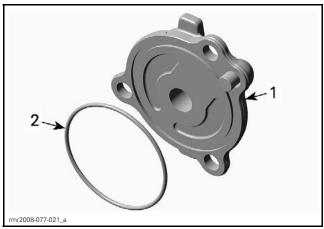
- 1. Inner rotor
- 2. Oil pump shaft
- 3. Needle pin
- 4. Outer rotor
- 5. Groove

Assemble oil pump into hydraulic control module. Markings on inner and outer rotor must face toward oil pump cover and aligned.



MARKINGS ON INNER AND OUTER ROTOR
1. Markings

Install oil pump cover with a NEW O-ring.



1. Oil pump cover

2. New O-ring

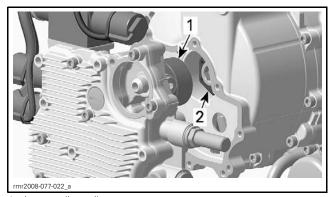
HCM Oil Pressure Test

After assembly, start engine and make sure HCM oil pressure is within specifications (refer to HCM OIL PRESSURE TEST in this subsection).

INTERMEDIATE OIL PUMP GEAR

The intermediate oil pump gear is located on the backside of the hydraulic control module.

The intermediate oil pump gear is driven by the hexagonal nut of the crankshaft and drives the oil pump gear.



Intermediate oil pump gear
 Hexagonal nut of crankshaft

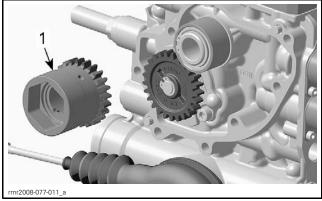
Intermediate Oil Pump Gear Removal

Drain engine oil, refer to *LUBRICATION SYSTEM* subsection.

Disconnect solenoid connector from wiring harness.

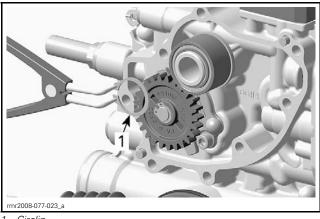
Remove oil hose from hydraulic control module nipple.

Remove hydraulic control module from engine. Remove intermediate oil pump gear.



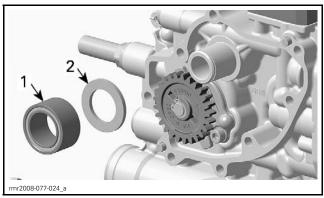
1. Intermediate oil pump gear

Remove circlip of needle bearing



1. Circlip

Remove needle bearing from hydraulic control module.



Needle bearing
 Thrust washer

Intermediate Oil Pump Gear Inspection

Check if teeth and internal hexagon of intermediate oil pump gear are damaged, check intermediate oil pump gear for cracks. Replace if necessary.

Clean needle bearing with a part cleaner and check for any damage. Replace if necessary.

Check needle bearing journal for any damage or abnormal wear. Replace hydraulic control module if necessary.

Intermediate Oil Pump Gear Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Apply engine oil on needle bearing.

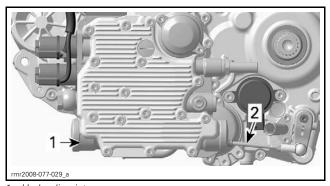
Refill oil tank with recommended oil and check engine oil level. Refer to *LUBRICATION SYSTEM* subsection.

HYDRAULIC PISTON

The hydraulic piston is located on the lower side of the HCM.

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The hydraulic piston is activated by the solenoid valves and is shifting the gears via the shifting linkage.



Hydraulic piston
 Shifting linkage

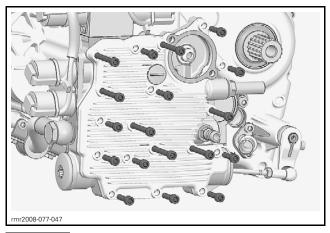
NOTE: Before dissembling the hydraulic piston, check if there is any oil contamination in the area of the bellow. If there is a leakage it is a indication for worn out or damaged piston linings, if necessary replace faulty parts.

Hydraulic Piston Removal

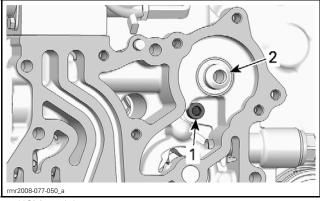
Drain engine oil, refer to *LUBRICATION SYSTEM* subsection.

Remove *HCM OIL FILTER*, see procedure above in this subsection.

Remove the HCM cover by removing the following screws.

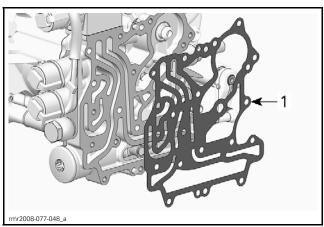


NOTICE The HCM is still retained by one screw. This screw is located below oil filter adaptor. Do not force the HCM to avoid damages.



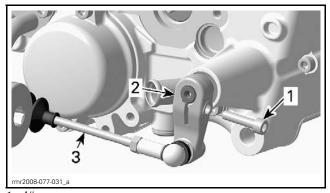
HCM retaining screw
 Oil filter adaptor

Remove and discard the HCM cover gasket.



1. HCM cover gasket

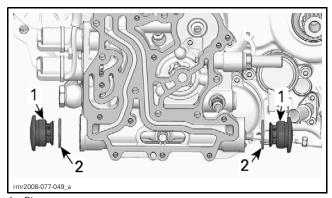
Unscrew Allen screw from gear shift lever and remove shift linkage together with gear shift lever from the shift shaft.



Allen screw
 Gear shift lever

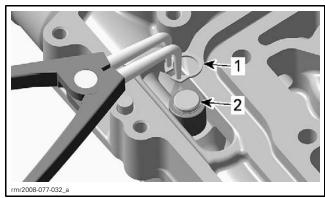
3. Shift linkage

Remove hydraulic piston plug screws.



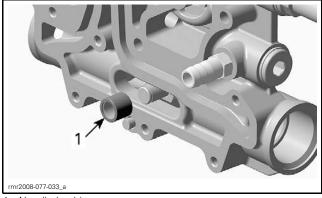
Plug screws
 Plug screw O-rings

Remove retaining ring from guide pin.



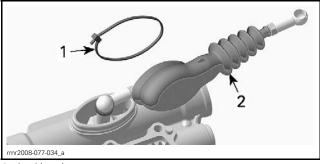
Retaining ring
 Guide pin

Remove needle bushing from guide pin.



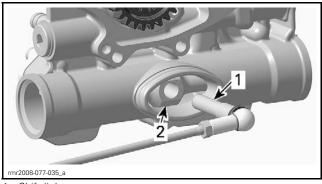
1. Needle bushing

Remove locking tie from bellow and slide bellow backwards.



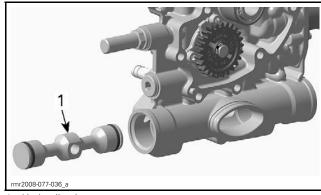
Locking tie
 Bellow

Remove shift linkage from hydraulic piston.



Shift linkage
 Hydraulic piston

Remove hydraulic piston by sliding it out to either side of the hydraulic module.

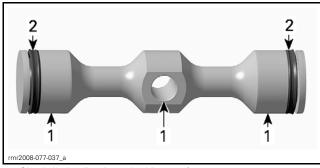


1. Hydraulic piston

Hydraulic Piston Inspection

Check hydraulic piston and piston linings for any damage, scores or abnormal wear. Replace parts if necessary.

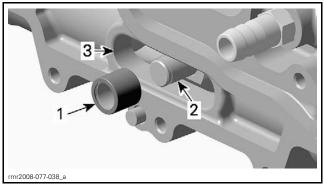
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Check hydraulic piston in this area for wear
 Piston linings

Check hydraulic piston bore inside the hydraulic control module for any damage, scores or abnormal wear. Replace parts if necessary.

Check needle bushing, guide pin and sliding slot of needle bushing inside hydraulic control module for wear, scores and abnormal damage. Replace parts if necessary.

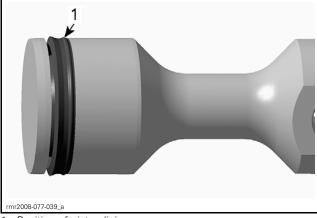


- Needle bushing
- Sliding slot

Hydraulic Piston Installation

For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: Sealing lip of piston linings must face away of each other.



1. Position of piston linings

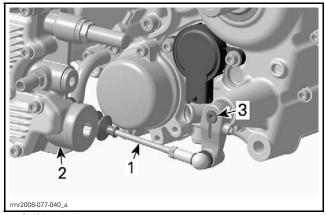
Oil hydraulic piston and piston linings prior of installation.

NOTE: Make sure not to damage the piston linings when installing the hydraulic piston.

After completing the installation check oil level in oil tank and refill with recommended oil if necessary. Refer to LUBRICATION SYSTEM subsection.

SHIFT LINKAGE

The shift linkage is the link between the hydraulic piston and the shift shaft.



- Shifting linkage
- Hydraulic piston
- Shift shaft

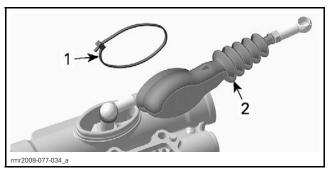
Shift Linkage Removal

NOTE: To carry out the following instruction, it is not necessary to remove the HCM from the engine. For better understanding, many of the following illustrations are taken with the HCM removed from the engine.

Select NEUTRAL position.

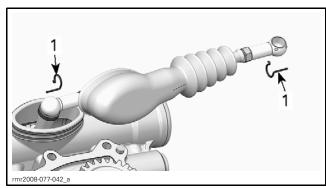
Remove body panels, refer to the BODY subsec-

Remove locking tie from bellow and slide bellow backwards.



- Locking tie 1. 2.
- Bellow

Remove both circlips from shift linkage.



1. Circlips

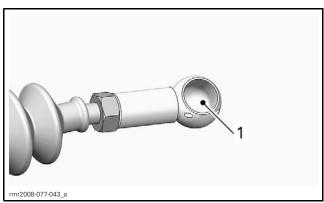
Shift Linkage Inspection

Check shift linkage rod for bending or any other damage.

Check both ball joints for abnormal wear.

Check bellow for brittle and cracks.

Replace parts if necessary.

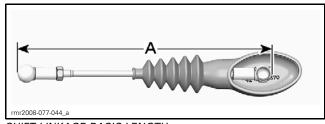


1. Check both ball joints in this area for wear

Shift Linkage Installation

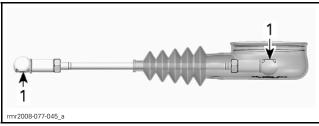
For installation, reverse the removal procedure. Pay attention to the following details.

For basic adjustment assemble the shift linkage to approximately 210 mm (8.268 in).



SHIFT LINKAGE BASIC LENGTH A. 210 mm (8.268 in)

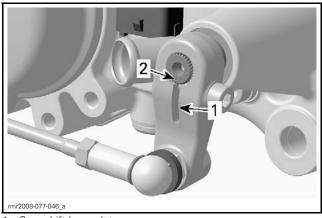
Ball joints must face in opposite direction.



1. Position of ball joints

Install NEW locking tie on bellow.

Install the gear shift lever. Align its slot with the dot on the end of shift shaft.



Gear shift lever slot
 Shift shaft dot

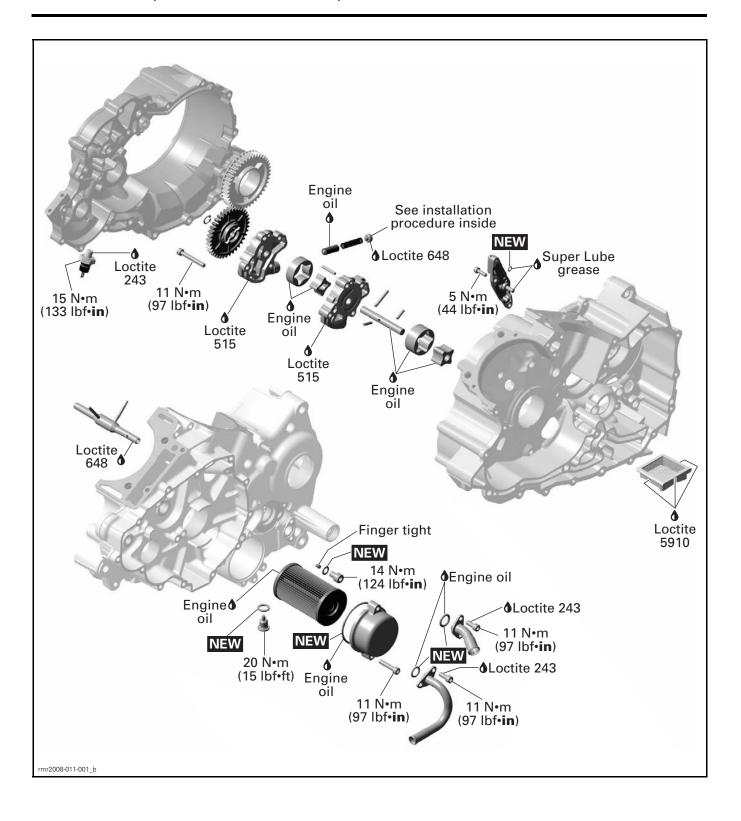
LUBRICATION SYSTEM

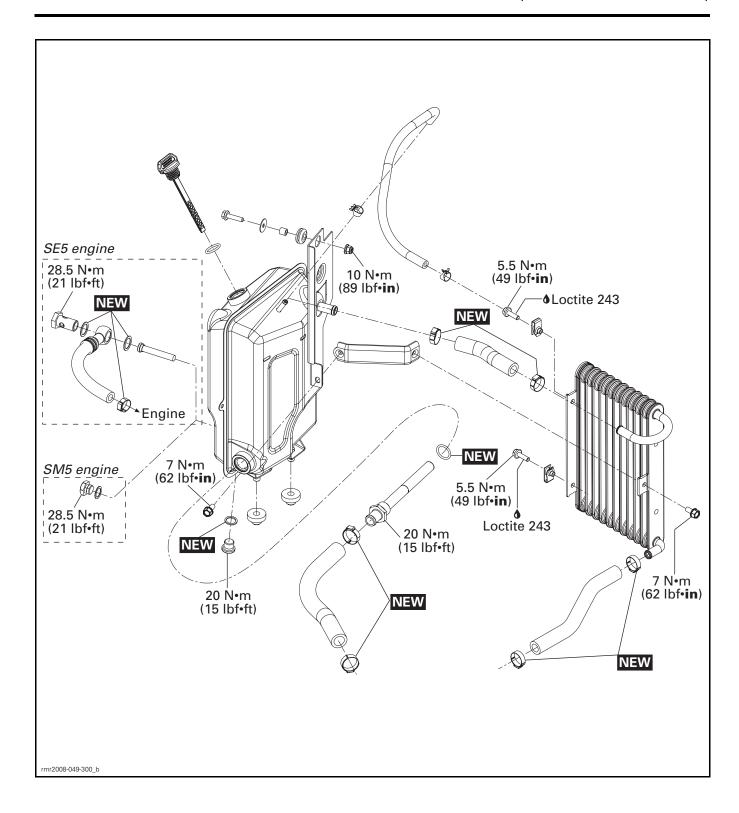
SERVICE TOOLS

Description	Part Number	Page
ADAPTER HOSE	529 035 652	
ECM ADAPTER TOOL	529 036 166	8
FLUKE 115 MULTIMETER	529 035 868	8
OETIKER PLIERS	295 000 070	12
PRESSURE GAUGE	529 035 709	7

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)		
LOCTITE 515	413 702 700	17
LOCTITE 648 (GREEN)	413 711 400	18, 20
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	17
SUPER LUBE GREASE	293 550 030	19
XPS SYNTHETIC BLEND OIL (SUMMER GRADE)	293 600 121	4





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3

GENERAL

During assembly/installation, use the torque values and service products as specified in the exploded views.

Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

A WARNING

Torque wrench tightening specifications must be strictly adhered to.

Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced with new ones.

NOTICE Hoses, cables or locking ties removed during a procedure must be reinstalled as per factory standards.

MAINTENANCE

ENGINE OIL

Recommended Engine Oil

The same oil is used for the engine, gearbox, clutch and the hydraulic control module (SE5 model).

Use XPS SYNTHETIC BLEND OIL (SUMMER GRADE) (P/N 293 600 121) or a 5W 40 semi-synthetic or synthetic motorcycle oil meeting the requirements for API service SL, SJ, SH or SG classification. Always check the API service label on the oil container.

NOTICE To avoid damaging the clutch, do not use a motor oil meeting the API service SM or ILSAC GF-4 classification. Clutch slippage will occur.

Engine Oil Level Verification

NOTICE To obtain a precise reading of the engine oil level, follow this procedure and make sure engine is at normal operating temperature.

Park the vehicle on a level surface.

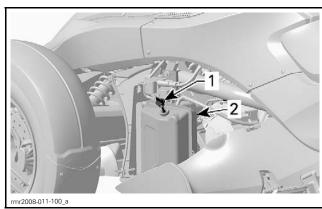
Remove the LH middle side panel. Refer to *BODY* subsection.

With the engine already at normal operating temperature, start engine and let it run for at least 30 seconds.

NOTE: Running engine for at least 30 seconds allows the suction oil pump to drain the oil from the engine crankcase back into the oil tank. Not carrying out this step could result in overfilling the enaine oil.

Stop engine.

Unscrew and remove the oil dipstick.



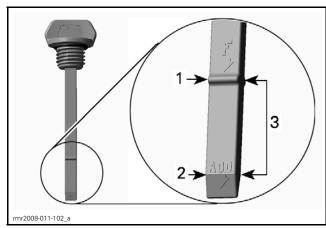
- Oil dipstick
- Oil tank

Wipe off the dipstick.

Reinsert and completely screw in the dipstick to assure an accurate reading.

Unscrew and remove the dipstick again.

Check the oil level on the dipstick. It should be near or equal to the upper mark.



- 1. Full 2. Add 3. Operating range

Oil Level is at or Near Upper Mark

Properly insert and tighten dipstick.

Install the LH middle side panel, refer to BODY subsection.

Oil Level Under Operating Range

Add a small amount of recommended oil.

NOTE: The oil quantity between ADD mark and F mark is 0.5 L (.5 gt (U.S. lig.)).

Recheck oil level.

Repeat the above steps until oil level reaches the dipsticks upper (F) mark. Do not overfill.

Properly insert and tighten dipstick.

Install the LH middle side panel, refer to BODY subsection.

Engine Oil Change

Prior to changing the oil, ensure vehicle is on a level surface.

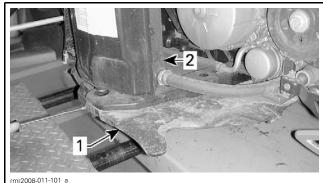
NOTICE Oil and engine oil filter must be replaced at the same time. Oil change should be carried out with a warm engine.

A CAUTION Engine oil can be very hot.

Remove the following LH body panels, refer to BODY subsection:

- Middle side panel
- Top side panel
- Rear side panel
- Bottom front side panel
- Bottom rear side panel.

Remove the bottom plate under oil tank.



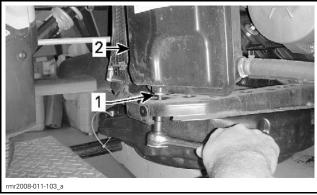
TYPICAL

1. Bottom plate 2. Oil tank

Clean area around drain plug under oil tank.

Place an appropriate drain pan under oil tank.

Remove the reservoir drain plug and discard the sealing washer.



TYPICAL

- 1. Reservoir drain plug
- 2. Oil tank

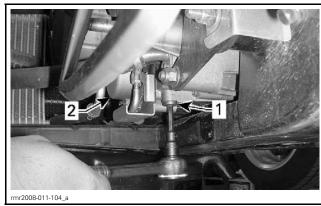
Remove the dipstick.

Allow sufficient time for oil to completely drain out of reservoir.

Clean area around engine drain plug.

Place an appropriate drain pan under the engine.

Remove the engine oil drain plug and discard the sealing washer.



TYPICAL

- Engine oil drain plug
 Oil filter cover

Allow sufficient time for oil to completely drain from crankcase.

Clean the magnet on the engine drain plug.

Using **NEW** sealing washers, install engine and oil tank drain plugs.

NOTICE Never reuse the drain plug sealing washer. Always replace it with a new one.

Torque drain plugs (engine and oil tank) 20 N•m (15 lbf•ft).

Replace engine oil filter. Refer to ENGINE OIL FIL-TER further in this subsection.

Pour 3 L (3.2 gt (U.S. lig.)) of the recommended oil into oil tank.

5

Start engine and let idle for two minutes.

NOTICE Do not rev up engine during idling period as this may cause permanent engine damage.

NOTICE Ensure oil pressure warning lamp goes out within 5 seconds from engine start. If oil pressure warning lamp stays ON for more than 5 seconds, STOP ENGINE and recheck oil level.

Ensure oil filter cover, engine drain plug and oil tank drain plug are not leaking.

Stop engine.

NOTE: The oil level dipstick is accurate when the oil temperature is at 80°C (176°F). If the oil level is checked when the oil is at room temperature (20°C (68°F)), the proper oil level indication is half way between the lower (ADD) and upper (F) marks on the dipstick. This must be considered to prevent overfilling the oil tank.

SM5 Model

Add 0.9 L (1 qt (U.S. liq.)) of the recommended oil in the oil tank (3.9 L (4.1 qt (U.S. liq.)) total quantity).

Check oil level immediately and adjust if required. Reinstall all removed body panels.

Dispose of used oil as per your local environmental regulations.

SE5 Model

Add 1.2 L (1.3 qt (U.S. liq.)) of the recommended oil in the oil tank (4.2 L (4.4 qt (U.S. liq.))) total quantity).

Check oil level immediately and adjust if required.

NOTE: If both the engine oil filter and the HCM oil filter are replaced, the total oil quantity to add will be 4.3 L (4.5 qt (U.S. liq.)).

Reinstall all removed body panels.

Dispose of used oil as per your local environmental regulations.

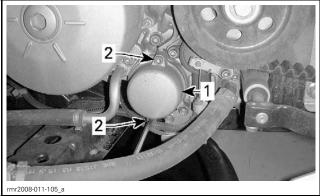
ENGINE OIL FILTER

NOTE: For the HCM oil filter replacement procedure, refer to the *HYDRAULIC CONTROL MOD-ULE (SE5)* subsection.

Engine Oil Filter Removal

Refer to *OIL CHANGE* for the list of required body panels to be removed.

Remove oil filter cover screws.



TYPICAL

- 1. Oil filter cover
- 2. Cover screws

Remove oil filter cover with O-ring. Discard O-ring.

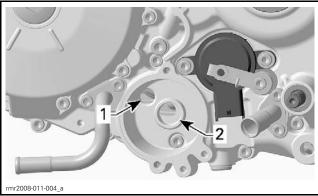
Remove oil filter.

Dispose filter as per your local environmental regulations.

Engine Oil Filter Installation

Installation is the reverse of the removal procedure. However, pay attention to the following.

Check and clean the oil inlet and outlet orifices in crankcase for dirt and contaminants.

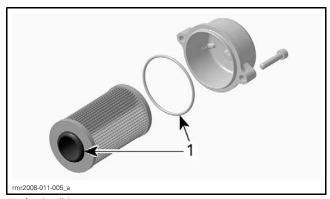


TYPICAL

- 1. Oil inlet orifice from oil pressure pump
- 2. Oil outlet orifice to engine lubrication system

Install a NEW O-ring on the oil filter cover.

To ease assembly and prevent displacement of the O-ring during installation, slightly oil filter and O-ring, refer to following illustration.



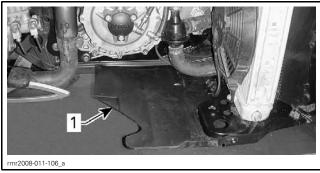
1. Apply oil here

INSPECTION

ENGINE OIL PRESSURE TEST

NOTE: The engine oil pressure test should be carried out with a warm engine (80°C (176°F) engine oil temperature) and with the recommended oil at the appropriate level.

Remove the bottom plate behind radiator. Refer to BODY subsection.



TYPICAL 1. Bottom plate

Connect the ADAPTER HOSE (P/N 529 035 652) to the PRESSURE GAUGE (P/N 529 035 709).



OIL PRESSURE GAUGE

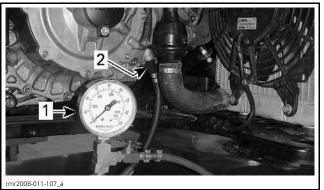


HOSE ADAPTER

Remove the OIL PRESSURE SWITCH, see the procedure in this subsection.

NOTE: Place a container to retrieve engine oil that will flow out of engine.

Screw the the hose adapter into the oil pressure switch location.



TYPICAL

- Oil pressure gauge
 Hose adapter

Measured engine oil pressure should be within the following values.

3		
OIL PRESSURE	1400 RPM	5000 RPM
MINIMUM	70 kPa (10 PSI)	350 kPa (51 PSI)
NOMINAL	150 kPa (22 PSI)	420 kPa (61 PSI)
MAXIMUM	300 kPa (44 PSI)	550 kPa (80 PSI)

After engine oil pressure test, reinstall oil pressure switch, see procedure in this subsection.

Reinstall body panels.

PROCEDURES

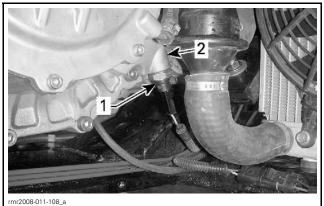
ENGINE OIL PRESSURE SWITCH (EOP)

Engine Oil Pressure Switch Access

Remove the following RH body panels, refer to *BODY* subsection:

- Middle side panel
- Top side panel
- Rear side panel
- Bottom front side panel
- Bottom rear side panel.

The engine oil pressure switch is located on the RH side of the engine on the clutch housing.



TYPICAL

- 1. Oil pressure switch
- 2. Clutch housing

Engine Oil Pressure Switch Activation

The engine oil pressure switch activates if engine the oil pressure is in the range of 30 kPa to 60 kPa (4.4 PSI to 8.7 PSI).

Engine Oil Pressure Switch Inspection

First ensure engine oil pressure is within specifications. Refer to *ENGINE OIL PRESSURE TEST* in this subsection.

If the engine oil pressure is good, carry out an *OIL* PRESSURE SWITCH RESISTANCE TEST.

Engine Oil Pressure Switch Resistance Test

NOTE: The engine must be warm to test the oil pressure switch properly.

Disconnect the oil pressure switch connector.

Use a FLUKE 115 MULTIMETER (P/N 529 035 868) set to Ω setting and test the resistance of the EOP switch as follows.

EOP SWITCH RESISTANCE TEST (Ω)		
Engine Not Running		
EOP Engine switch pin ground		Close to 0 Ω (normally closed switch)

If resistance is incorrect, replace the oil pressure switch.

If the resistance is correct, retest the EOP switch with engine running. Read result and compare to table.

EOP SWITCH RESISTANCE TEST (Ω)		
Engine Running		
EOP switch pin	Engine ground	Infinite (OL)

If resistance is incorrect, replace the oil pressure switch.

If the resistance is correct, test the oil pressure switch wiring circuit.

Engine Oil Pressure Switch Circuit Test EOP Switch Circuit Dynamic Test

First, ensure an engine oil pressure test has been performed and that engine oil pressure is within specifications.

Start the engine.

Disconnect the EOP switch connector.

Ground the EOP switch connector. The low oil pressure pilot lamp should turn on.

Unground the EOP switch connector. Oil pilot lamp should turn off.

If the test succeeded and the low oil pressure pilot lamp stays ON when engine is running, try a new EOP switch.

If the low oil pressure pilot lamp does not come on with the circuit grounded, test continuity of EOP switch circuit wiring.

EOP Switch Circuit Continuity Test

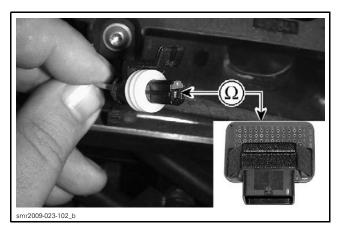
Disconnect the connector "A" from the ECM. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection for the procedure.

Use the ECM ADAPTER TOOL (P/N 529 036 166) and the FLUKE 115 MULTIMETER (P/N 529 035 868).



Check continuity of OPS circuit as per following table.

TEST PROBES		RESISTANCE
OPS connector	ECM adapter pin E3	Close to 0 Ω (continuity)



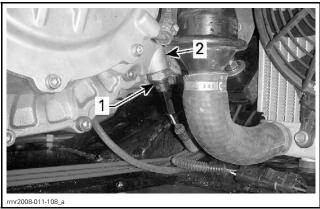
If circuit continuity is not measured, repeat test at the engine disconnect (HIC) connector. Repair wiring/connectors as required.

Engine Oil Pressure Switch Removal

Start vehicle and let engine run approximately 5 minutes.

NOTE: This is recommended to avoid oil drainage from engine when removing switch.

Disconnect the oil pressure switch connector. Unscrew and remove the oil pressure switch.



TYPICAL

- 1. Oil pressure switch
- 2. Clutch housing

Engine Oil Pressure Switch Installation

Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on threads of oil pressure switch.

NOTICE Do not apply Loctite 243 to the first thread. If Loctite seeps into pressure switch, oil pressure switch may malfunction.

Torque oil pressure switch to 15 N•m (133 lbf•in).

OIL TANK

Oil Tank Access

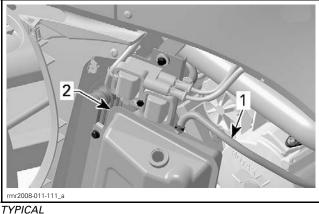
Remove the following LH body panels, refer to *BODY* subsection:

- Middle side panel
- Bottom front side panel.

Oil Tank Removal

Drain oil tank. Follow the procedure in *OIL CHANGE*.

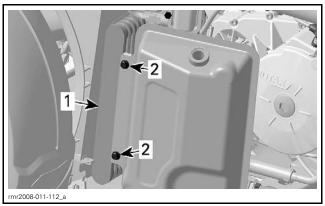
Disconnect vent hose from top of oil tank.



1. Vent hose

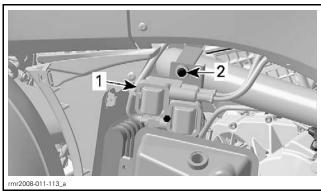
2. Oil tank

Remove screws retaining oil tank and oil cooler.



- TYPICAL
 1. Oil cooler
 2. Remove these screws

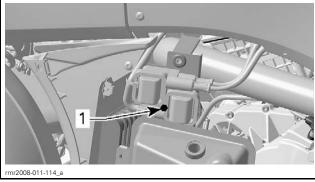
Unscrew bolt above ignition coil securing oil tank to frame.



TYPICAL

- Ignition coil
 Remove this bolt

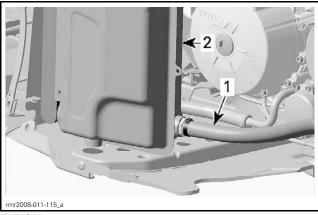
Remove ignition coil retaining bolt.



TYPICAL

1. Ignition coil bolt

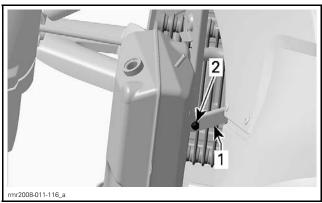
At the bottom of oil tank, disconnect the oil tank return hose.



TYPICAL

- Return hose
 Oil tank

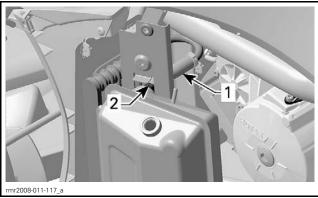
Behind oil tank, unscrew bolt securing oil tank to support.



TYPICAL

- Oil tank support
 Support bolt

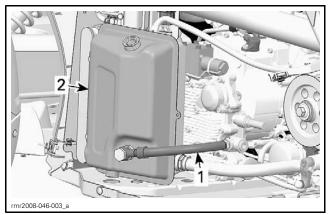
Disconnect the oil cooler outlet hose.



TYPICAL

- Oil cooler outlet hose
 Remove this Oetiker clamp

On SE5 Model, remove the HCM clutch servo hose in the front of the tank.



TYPICAL

- Clutch servo hose
 Oil tank

Remove oil tank.

Oil Tank Installation

The installation is the reverse of the removal procedure. However, pay attention to the following. Install NEW Oetiker clamps.

Using a NEW sealing washer, install oil tank drain plug.

NOTICE Never reuse a sealing washer a second time. Always replace it with a new one.

Torque drain plug to 20 N•m (15 lbf•ft).

Refill oil tank with recommended oil. Refer to EN-GINE OIL at the beginning of this subsection.

OIL TANK STRAINER

Oil Tank Strainer Access

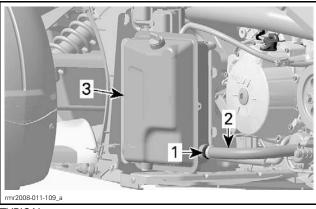
Remove the following LH body panels, refer to BODY subsection:

- Middle side panel
- Bottom front side panel.

Oil Tank Strainer Removal

Drain oil tank. See OIL CHANGE procedure in this subsection.

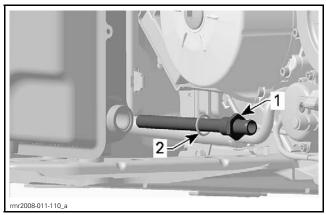
Disconnect oil tank return hose.



TYPICAL

- Strainer end Oil tank return hose
- Oil tank

Unscrew and remove oil tank strainer with its O-ring. Discard the O-ring.



- Oil tank strainer

Oil Tank Strainer Cleaning

Clean oil tank strainer with a parts cleaner then use air pressure to dry it.

Oil Tank Strainer Inspection

Check condition of strainer mesh. Replace strainer as required.

Oil Tank Strainer Installation

For installation, reverse the removal procedure. However, pay attention to the following.

Wipe off any oil spillage on oil tank.

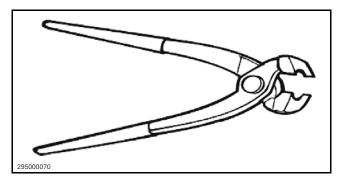
Install a new O-ring on the oil strainer.

Apply engine oil on O-ring.

Install strainer in oil tank and torque to 20 N•m (15 lbf•ft).

NOTICE Take care not to damage O-ring while inserting strainer into oil tank. Apply oil on O-ring to ease installation.

Using OETIKER PLIERS (P/N 295 000 070), install a **NEW** Oetiker clamp on oil return hose.



Refill oil tank with recommended oil. Refer to EN-GINE OIL at the beginning of this subsection.

Install all other removed parts.

OIL COOLER

Oil Cooler Access

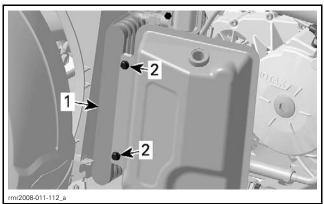
Remove the following LH body panels, refer to BODY subsection:

- Middle side panel
- Bottom front side panel.

Oil Cooler Removal

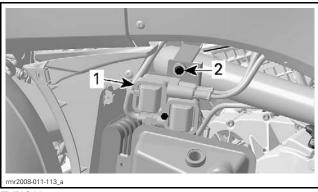
Drain oil tank. See OIL CHANGE procedure in this subsection.

Remove screws retaining oil tank and oil cooler.



- Oil cooler
- Remove these screws

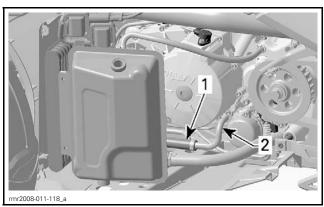
Unscrew bolt above ignition coil securing oil tank to frame.



TYPICAL

- Ignition coil
 Remove this bolt

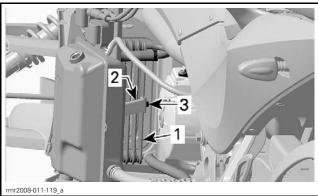
Disconnect oil cooler inlet hose from engine outlet connector tube.



TYPICAL

- Oil cooler inlet hose
- 2. Engine outlet connector tube

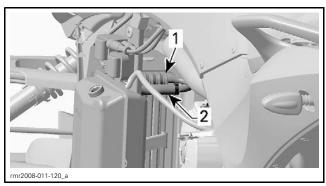
Behind oil tank, remove screw securing oil cooler to support.



TYPICAL

- Oil cooler
- Support
- 3. Remove this screw

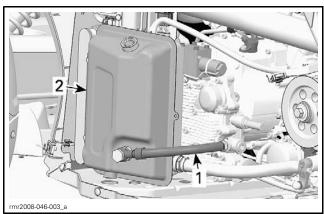
Remove and discard Oetiker clamp securing oil cooler outlet hose.



- Oil cooler
- 2. Oil cooler outlet hose

Disconnect oil cooler outlet hose. Be careful to avoid breaking oil cooler outlet tube.

On SE5 Model, remove the HCM clutch servo hose from the front of the tank.



- **TYPICAL**
- Clutch servo hose
 Oil tank

Move oil tank rearward to remove oil cooler.

Oil Cooler Installation

For installation, reverse the removal procedure.

Refill oil tank with recommended oil and check engine oil level. Refer to ENGINE OIL at the beginning of this subsection.

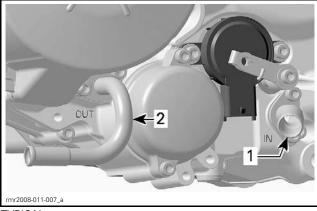
OIL HOSE CONNECTOR TUBES

Oil Hose Connector Tube Access

Remove the following LH body panels, refer to BODY subsection:

- Middle side panel
- Top side panel
- Rear side panel
- Bottom front side panel
- Bottom rear side panel.

The oil hose connector tubes are located on the crankcase, magneto side.



TYPICAL

- Oil hose connector tube "IN"
 Oil hose connector tube "OUT"

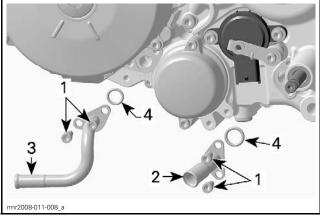
Oil Hose Connector Tube Removal

Drain engine oil, refer to OIL CHANGE in this subsection.

Remove oil hoses from connectors tubes.

Loosen connector tube retaining screws.

Remove connector tubes and O-rings. Discard O-rings.



TYPICAL

- Screws
- Oil hose connector tube "IN"
- Oil hose connector tube "OUT"

Oil Hose Connector Tube Inspection

Clean oil hose connector tubes with a parts cleaner, then use air pressure to dry the parts.

WARNING

Always wear skin and eye protection. Chemicals can cause skin rash, skin burns and severe eye injury.

Check connector tubes for cracks or other damages. Replace if necessary.

Oil Hose Connector Tube Installation

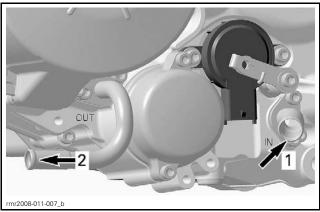
For installation, reverse the removal procedure. However, pay attention to the following details.

Always replace connector tube O-rings with NEW ones.

Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on connector tube retaining screws.

Torque screws to 11 Nom (97 lbfoin).

Install hoses as shown.



TYPICAL

- From oil tank
- 2. To oil cooler

Refill oil tank with recommended oil and check engine oil level. Refer to ENGINE OIL at the beginning of this subsection.

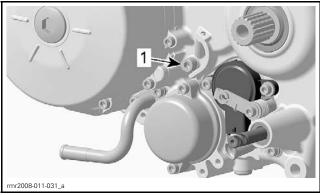
OIL JET

Oil Jet Access

Remove the following LH body panels, refer to BODY subsection:

- Middle side panel
- Top side panel
- Rear side panel
- Bottom front side panel
- Bottom rear side panel.

The oil jet is located on the magneto side, screwed inside crankcase. It supplies oil to the wet clutch.



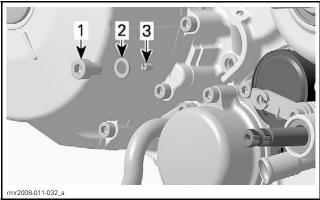
TYPICAL

Oil Jet Removal

Remove plug screw.

Remove and discard gasket ring.

Unscrew oil jet.



TYPICAL

- Plug screw
- Gasket ring
- Gasket
 Oil jet

Oil Jet Cleaning

Clean oil jet with a parts cleaner, then use air pressure to dry it.

WARNING

Always wear skin and eye protection. Chemicals can cause skin rash, skin burns and severe eye injury.

Oil Jet Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Fasten oil jet finger tight.

Install a new gasket ring on the plug screw.

Wipe off any oil spillage.

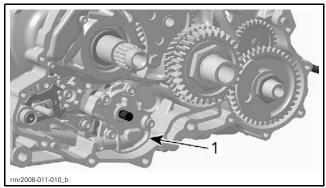
OIL PUMP MODULE

The engine is equipped with two oil pumps, an oil pressure pump and an oil suction pump. Both pumps are integrated into one oil pump module.

Oil Pump Module Access

Remove clutch and centrifugal clutch (SE5 model). Refer to appropriate clutch subsection.

The oil pump module is located behind the clutch on the crankcase.



1. Oil pump module

Oil Pump Module Removal

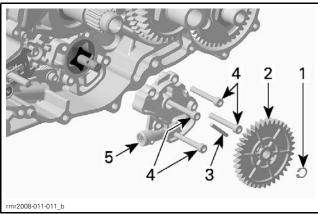
Remove snap ring.

Remove oil pump gear.

Remove needle pin retaining oil pump gear.

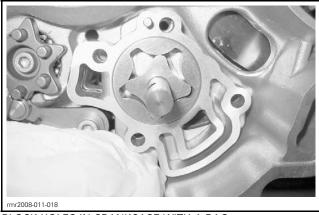
Remove oil pump module screws.

Remove oil pump module cover.



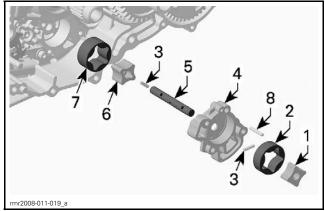
- 1. Snap ring
- Oil pump gear
- 3. Needle pin
- 4. Oil pump screws
- 5. Oil pump module cover

Using a rag, block the oil passages to prevent the needle pin from falling into the crankcase.



BLOCK HOLES IN CRANKCASE WITH A RAG

Remove the remaining oil pump module parts:



- 1. Inner rotor (pressure pump)
- 2. Outer rotor (pressure pump)
- 3. Needle pins
- Oil pump housing
- 5. Oil pump shaft
- 6. Inner rotor (suction pump)
- 7. Outer rotor (suction pump)
- 8. Dowel pin

Oil Pump Module Inspection

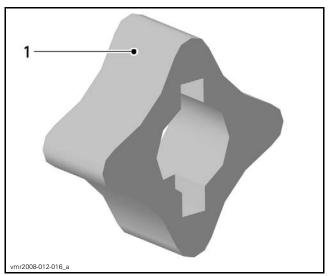
NOTE: The inspection procedure is the same for both oil pumps.

Check oil pump module housing and crankcase surface (where the oil pump module housing fits) for flatness with a straight edge.

Inspect oil pumps and oil pump bores for wear marks, scratches, cracks or other damages. Replace damaged parts.

Check inner rotor for corrosion pin holes, pitting or other damages. If defects or damages are found, replace oil pump inner and outer rotor.

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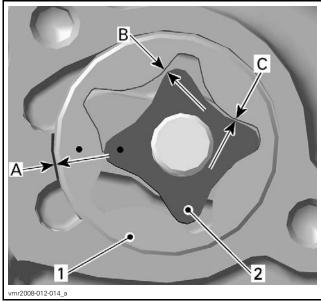


TYPICAL

1. Pitting on the teeth

Radial Clearance

Using a feeler gauge, measure the radial clearance as illustrated. Refer to table following illustration for service limits.



TYPICAL

1. Outer rotor

2. Inner rotor

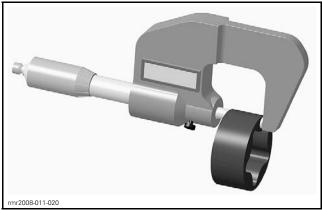
OUTER AND INNER ROTOR CLEARANCE		
SERVICE LIMIT		
А		
В	0.25 mm (.0098 in)	
С		

If clearance between inner and outer rotors exceeds the tolerance, replace the respective oil pump.

If clearance between outer rotor and its bore in crankcase or if oil pump module housing exceeds the tolerance, replace the oil pump module and the crankcase if required.

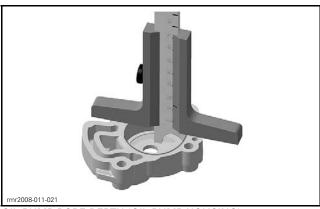
Axial Clearance

Measure outer rotor thickness with micrometer.

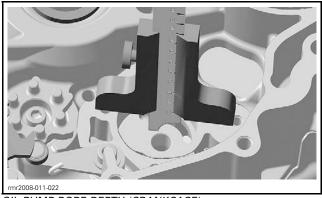


OUTER ROTOR THICKNESS

Using a depth gauge, measure the depth of the corresponding oil pump bore as illustrated.



OIL PUMP BORE DEPTH (OIL PUMP HOUSING)



OIL PUMP BORE DEPTH (CRANKCASE)

The difference between measurements should not exceed 0.15 mm (.0059 in). If the oil pump axial clearance is out of tolerance, replace the complete oil pump assembly.

NOTE: When the axial clearance of the oil pump assembly increases, the oil pressure decreases.

Oil Pump Module Installation

For installation, reverse the removal procedure. However, pay attention to the following details.

Clean all metal components in a solvent.

Remove old sealant from mating surfaces of crankcase, oil pump module housing and oil pump module cover, using LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500) and scotch-bride (if necessary).

Apply a thin film of LOCTITE 515 (P/N 413 702 700) on crankcase and oil pump housing surface.

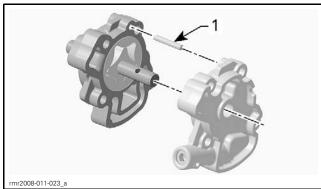
IMPORTANT: When beginning the application of sealant, the assembly and the first torquing should be carried out within 10 minutes. It is suggested to have all required parts, tools and products on hand to save time.

NOTE: Coat inner and outer rotors with oil.

First, assemble oil pressure pump rotors into the oil pump module housing. Markings on inner and outer rotors must face outwards and be visible when holding the housing.

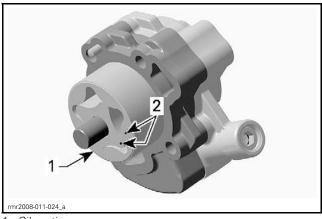
Install oil pump module cover on oil pump module housing.

Install the dowel pin into oil pump module housing.



1. Dowel pin

Next, assemble oil suction pump onto oil pump shaft. Markings on inner and outer rotor must be visible.



- 1. Oil suction pump
- 2. Markings on inner and outer rotor

Finally, install complete oil pump module into crankcase.

NOTICE At installation take care not to lose needle pin and drop it in the crankcase.

Torque oil pump retaining screws in a criss-cross pattern to 11 N•m (97 lbf•in).

After installation, check for smooth operation of the oil pump assembly.

Install all other removed parts.

Final Test

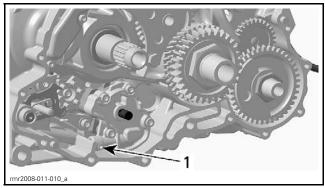
After engine is completely reassembled, start engine and make sure oil pressure is within specifications (refer to *ENGINE OIL PRESSURE TEST* in this subsection).

ENGINE OIL PRESSURE REGULATOR

Engine Oil Pressure Regulator Access

Remove clutch and centrifugal clutch (SE5 model). Refer to appropriate clutch subsection.

The engine oil pressure regulator is located inside the oil pump module cover.

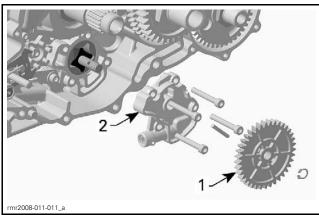


1. Engine oil pressure regulator

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Oil Pressure Regulator Removal

Remove oil pump module cover. Refer to *OIL PUMP MODULE* above.



- 1. Oil pump gear
- 2. Oil pump module cover

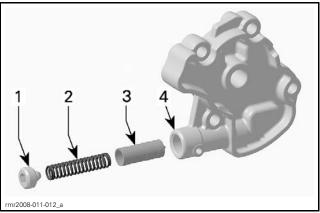
NOTE: Check the pressure regulator piston for freedom of movement. If piston moves freely and oil pressure is within specification, there is no need to remove the plug screw.

Using a vise with aluminium jaws, lightly clamp oil pump module cover.

Unscrew the plug screw.

Remove the regulator spring.

Remove the regulator piston.



- 1. Plug screw
- 2. Regulator spring
- 3. Regulator piston
- 4. Oil pump module cover

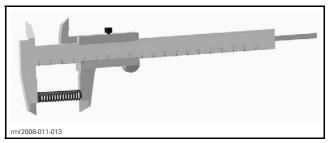
Oil Pressure Regulator Inspection

Inspect the regulator piston for scoring or other damages. Check also the bore of the oil pump module cover.

Check if piston moves easily in oil pump module

Check compression spring for any deformation.

Check compression spring free length.



SPRING FREE LENGTH	
NEW NOMINAL	37.6 mm (1.48 in)
SERVICE LIMIT	36.6 mm (1.441 in)

Replace worn or damaged components.

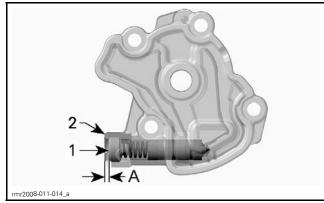
Clean bore and screw threads in the oil pump module cover of metal shavings and other contaminants.

Oil Pressure Regulator Installation

For installation, reverse the removal procedure. However, pay attention to the following details.

Apply LOCTITE 648 (GREEN) (P/N 413 711 400) on the plug screw threads.

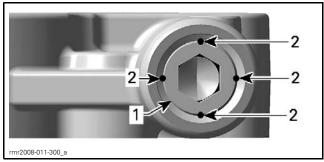
Install plug screw until its position is 2 mm (.0787 in) deeper than the collar of the oil pump module cover, see next illustration.



- 1. Plug screw
- 2. Collar of oil pump module cover
- A. 2 mm (.0787 in)

Check if oil pressure regulator works by pushing on regulator piston.

Secure plug screw with four (4) center punch marks.



1. Plug screw

OIL DUCT COVER

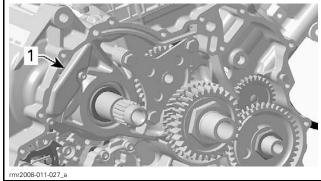
The oil duct cover supplies additional oil to the main shaft in the gearbox.

Oil Duct Cover Access

Refer to the *CLUTCH* subsection and remove the following parts:

- Clutch cover
- Clutch plates
- Clutch housing
- Clutch drum assembly.

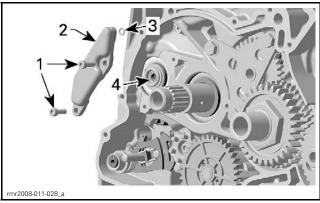
The oil duct cover is located on the crankcase behind the clutch.



1. Oil duct cover

Oil Duct Cover Removal

Remove two (2) retaining screws and pull oil duct cover from the crankcase.



- 1. Retaining screws
- Oil duct cover
- 3. O-ring (discard)
- 4. Oil seal

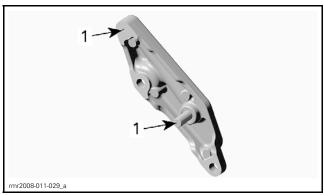
Oil Duct Cover Inspection

Check oil duct cover for cracks or other damages. Replace if necessary.

Clean oil passage in cover with a parts cleaner, then use an air gun to dry it.

WARNING

Always wear skin and eye protection. Chemicals can cause skin rash, skin burns and severe eye injury.



1. Clean oil passage

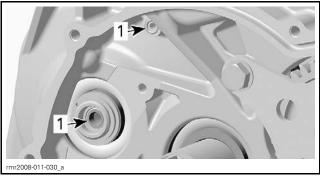
Oil Duct Cover Installation

For installation, reverse the removal procedure. However, pay attention to the following details.

Install a **NEW** O-ring.

Apply SUPER LUBE GREASE (P/N 293 550 030) on O-ring and oil seal, as shown.

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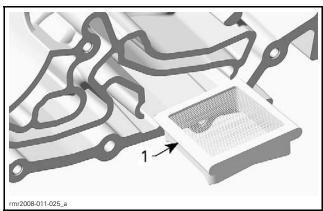
1. Apply Super Lube grease here

Reinstall remaining parts, refer to the appropriate sections in this manual.

ENGINE OIL STRAINER

Engine Oil Strainer Access

The engine oil strainer (sieve) is located between both crankcase halves.



1. Engine oil strainer

Engine Oil Strainer Removal

Separate both crankcase halves. Refer to CRANKCASE AND CRANKSHAFT subsection.

Engine Oil Strainer Inspection

Clean engine oil strainer with a parts cleaner then use air pressure to dry it.

Check engine oil strainer for damage and change if necessary.

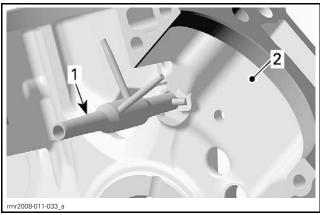
Engine Oil Strainer Installation

Refer to *CRANKCASE* in *CRANKCASE AND CRANKSHAFT* subsection.

OII TUBE

Oil Tube Access

The oil tube is located inside crankcase, between both crankcase halves.



- 1. Oil tube
- 2. Crankcase halve- magneto side

NOTE: If the engine has to be dismantled within the scope of repair work, take this opportunity to clean the oil tube.

Oil Tube Removal

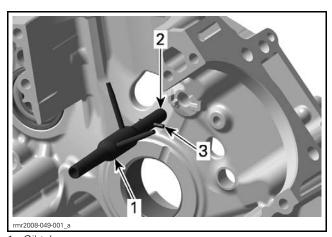
Separate both crankcase halves, refer to CRANKCASE AND CRANKSHAFT subsection.

Oil Tube Inspection

Clean oil tube with a parts cleaner, then use air pressure to dry the parts.

Oil Tube Installation

NOTE: If the oil tube is damaged or bent during work in the crankcase, it must be replaced immediately.



- 7. Oil tube 2. LOCTITE 648 (GREEN) (P/N 413 711 400) 3. Needle pin
- **NOTE:** Make sure not to apply too much LOCTITE 648 (GREEN) (P/N 413 711 400) on oil tube, otherwise oil passage may be clogged.

NOTICE At assembly, ensure the needle pin in the oil tube is correctly fitted into the crankcase. If this is not ensured, the oil spray direction will change, causing potential engine damage.

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OVERVIEW

GENERAL

The vehicle senses its surroundings utilizing multiple on-board electronic control modules and sensors. These sophisticated systems monitor and control a broad range of functions.

The various electronic modules used in the vehicle transmit data about their system's operation to all other modules through a CAN bus (CONTROLLER AREA NETWORK). The information transmitted on CAN bus can be used by all modules simultaneously as applicable to their system's operation.

Refer to *CONTROLLER AREA NETWORK (CAN)* subsection for more details.

The vehicle features the following main electronic systems:

ENGINE MANAGEMENT SYSTEM (EMS)

A highly advanced engine management system (EMS) has been used to ensure a high power output from the engine with a cleaner more efficient combustion.

Many systems are controlled by the engine management system (EMS). Refer to the *ENGINE MANAGEMENT SYSTEM (EMS)* subsection for more details.

VEHICLE STABILITY SYSTEM (VSS)

The VSS helps to maintain vehicle control in normal riding conditions as well as in emergency avoidance maneuvers.

To maintain vehicle stability, the VSS interacts with the several other subsystems as well as with the engine management system. Refer to the *VEHICLE STABILITY SYSTEM (VSS)* subsection for more details.

DYNAMIC POWER STEERING (DPS)

The Dynamic Power Steering (DPS) system provides a computer controlled, variable steering assist achieved by an electric motor to optimize the amount of steering input required by the rider.

Refer to the *(DYNAMIC POWER STEERING (DPS)* subsection for more details.

ELECTRONIC SHIFT SYSTEM (SE5)

The SE5 engine features a sequential electronically controlled mechanical 5-speed gearbox with a hydraulically-actuated type clutch system.

NOTE: The SE5 is an electronically controlled version of a sequential manual gearbox.

Refer to the *(ELECTRONIC SHIFT SYSTEM (SE5)* subsection for more details.

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POWER DISTRIBUTION

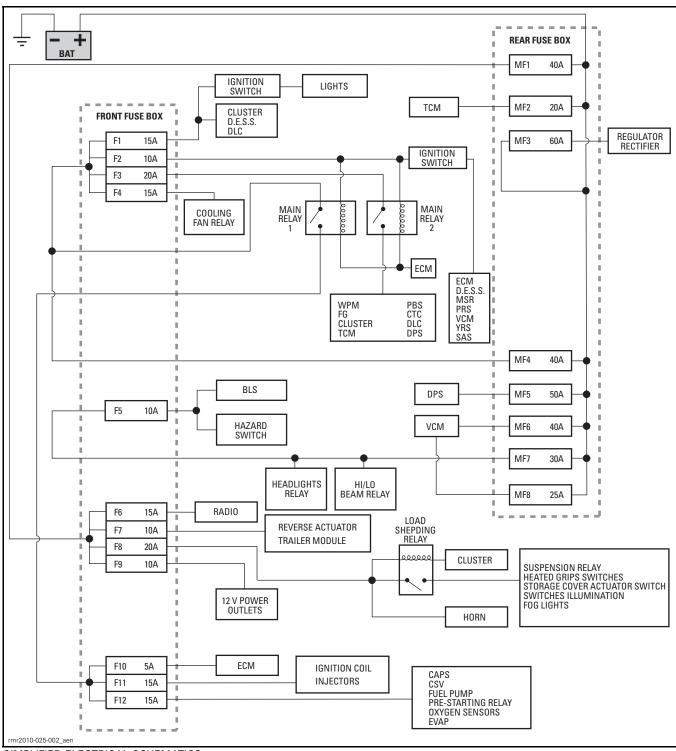
SERVICE TOOLS

Description	Part Number	Pag	ge
FLUKE 115 MULTIMETER	529 035 868		Ç

SERVICE PRODUCTS

Description	Part Number	Page
DIELECTRIC GREASE	293 550 004	6

Subsection XX (POWER DISTRIBUTION)



SIMPLIFIED ELECTRICAL SCHEMATICS

BLS	Brake lights switch	
CAPS	Camshaft position sensor	
CSV	Clutch valve solenoid	
CTG	Coolant temperature gauge	
DLC	Diagnostic link connector	
DPS	Dynamic power steering	
ECM	Engine control module	
FG	Fuel gauge	
MSR	Multifunction switch right	
PBS	Parking brake switch	
PRS	Pillion rider (Passenger) switch	
SAS	Steering angle sensor	
TCM	Transmission control module	
VCM	Vehicle control module	
WPM	Windshield and parking brake module	
YRS	Yaw rate sensor	

GENERAL

It is highly recommended to disconnect the battery when replacing any electric or electronic component.

A WARNING

Always disconnect battery exactly in the specified order, BLACK (-) cable first, RED (+) cable last. Always reconnect BLACK (-) cable last. Do not place tools on battery.

COMPONENT DESCRIPTION

Rear Fuse Box

The rear fuse box contains the main fuses.

Rear Fuse Box Location

The rear fuse box is located under the seat on the right side of the vehicle.



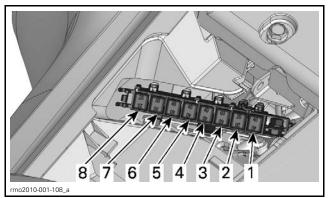
1. Rear fuse box (master)

Fuse Description

The rear fuse box contains the main fuses. They protect the beginning of the circuits or high amperage components.

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Subsection XX (POWER DISTRIBUTION)



UNDER SEAT- PARTS REMOVED FOR MORE CLARITY

NO.	DESCRIPTION	
MF1	Accessories (supplies fuses F6, F7, F8, F9)	40 A
MF2	TCM valves (SE5 model)	20 A
MF3	Rectifier/regulator	60 A
MF4	Main fuse (supplies fuses F1, F2, F3, F4)	40 A
MF5	Dynamic Power Steering (DPS) motor	50 A
MF6	VCM pump	40 A
MF7	Lights (supplies relays R6, fuse F5 and relay R8 control)	30 A
MF8	VCM valves	25 A

The fuse box is a single bus bar type which feeds power to each fuse through its lower contact. Power comes either directly from the battery, or from the voltage regulator/rectifier through MFB34 rectifier fuse (F3).

The top contact receives power through the fuse and distributes it to the subsystem, or component.

Front Fuse Box

The front fuse box contains the following items:

- The subsystem fuses
- Relays
- Spare fuses of various ratings (in the cover)
- A fuse removal tool.

Front Fuse Box Location

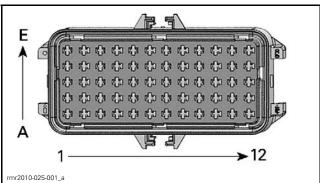
The front fuse box is located under the RH plastic cover inside the front storage compartment.



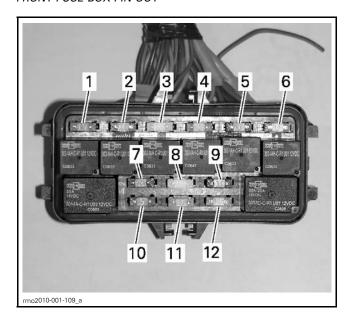
INSIDE FRONT STORAGE COMPARTMENT

1. Front fuse box

Fuse Description



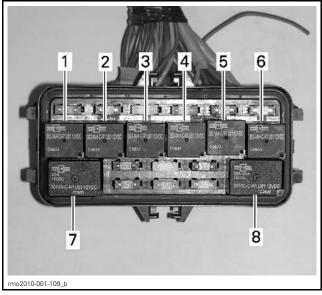
FRONT FUSE BOX PIN-OUT



NO.	DESCRIPTION	
F1	Direct battery power: Cluster D.E.S.S. Diagnostic link connector (DLC) Through ignition switch: Lights	15 A
F2	Direct battery power: Main relays control Through ignition switch: Steering angle sensor (SAS) Yaw rate sensor (YRS) Vehicle control module (VCM) Engine control module (ECM) D.E.S.S. Pillion rider switch (PRS) Multifunction switch, right (MSR)	10 A
F3	Direct battery power: Main relay 2 power Through main relay 2: Windshield and parking brake module (WPM) Cluster Fuel level gauge Coolant temperature gauge Parking brake switch illumination Transmission control module (TCM) Dynamic Power Steering control (DPS)	20 A
F4	Direct battery power: Cooling fan relay	15 A
F5	Direct battery power: Hazard switch Brake light switch	10 A
F6	Direct battery power: Radio	15 A
F7	Direct battery power: Reverse actuator Trailer module	10 A
F8	Direct battery power: Horn Load shedding relay Through load shedding relay: Suspension relay Heated grips Front storage compartment light Storage cover actuator Switches illumination Fog lights	20 A
F9	Direct battery power: 12 volt power outlets	10 A
F10	Through main relay 1: Engine control module (ECM)	5 A

NO.	DESCRIPTION	
F11	Through main relay 1: Ignition coil Fuel injectors	15A
F12	Through main relay 1: Fuel pump motor H2OS (oxygen sensors) heaters Pre-starting relay EVAP purge valve Clutch valve Camshaft position sensor (CAPS)	15 A

Relay Description



NO.	DESCRIPTION	
R1	Air controlled suspension	
R2	Pre-starting	
R3	Main relay 2	
R4	Cooling fan	
R5	Load shedding relay	
R6	Headlights relay	
R7	Main relay 1	
R8	Headlights high beam/low beam relay	

TROUBLESHOOTING

DIAGNOSTIC TIPS

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

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Subsection XX (POWER DISTRIBUTION)

IMPORTANT: When troubleshooting an electrical system fault, check battery condition, cables and connections first.

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.

Before interchanging relays for troubleshooting, ensure relays are identical by comparing information written on the relay outer casing.

4- pin relays may be inverted 180° at installation and work correctly. Make sure that the relay tabs are properly aligned with the fuse holder terminals at installation.

Circuit Testing

Check the related-circuit fuse condition with a test lamp, multimeter, fuse tester or ohmmeter. A visual inspection on its own could lead to an incorrect conclusion.

If a group of fuses or components are not supplied in voltage check the related main fuse (in rear fuse box) first.

Electrical Connection Inspection

When replacing an electric or electronic component, always check electrical connections. Make sure they are tight, make good contact, and are corrosion-free. Dirty, loose or corroded contacts are poor conductors and are often the source of a system or component malfunction.

Pay particular attention to ensure that pins are not bent or pushed out of their connectors.

Ensure all wire terminals are properly crimped on wires, and connector housings are properly fastened.

Check for signs of moisture, corrosion or dullness. Clean pins properly and coat them with DIELECTRIC GREASE (P/N 293 550 004) or other appropriate lubricant (except if otherwise specified) when reassembling them.

Pay attention to ground wires.

TESTING SEQUENCE

Electrical Power Does Not Come ON

Electrical system power up is normally identified by the gauge powering up and cycling through its self-test function.

If gauge do not come ON, check the following:

- Battery and connections condition, refer to CHARGING SYSTEM subsection.
- Main relays and circuits, refer to RELAYS in this subsection.
- Ignition switch and circuits, refer to IGNITION SYSTEM subsection.

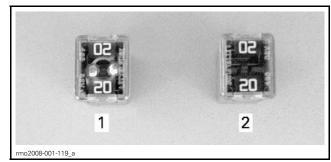
PROCEDURES

FUSES

Fuse Inspection

If an electrical system fault occurs, check the fuses. If a fuse is burnt, replace it with a fuse of the same rating.

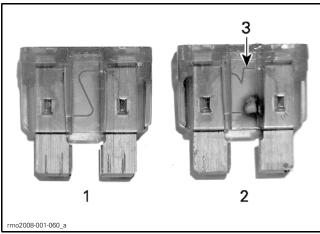
Keep in mind that an electrical component may require more than one fuse, one low amperage rated fuse for its control circuit, and another higher rated fuse for the main component power. These two fuses may not be in the same fuse box.



REAR FUSE BOX FUSES

1. Good fuse

2. Blown fuse



FRONT FUSE BOX FUSES

- 1. Good fuse
- Blown fuse
 Melted filament

A visual inspection of a fuse may not be conclu-

Two metal contacts are visible on top of the front fuse box fuses. They can be used for testing the fuse using a test lamp, fuse tester or a multimeter. They can also be used for testing the circuit the fuse protects without removing the fuse.

However, when testing a fuse using an ohmmeter, the fuse must always be removed from the fuse box.

NOTE: A good fuse will show battery voltage on both sides. Battery voltage read on one side only indicates a blown fuse. No voltage on either side indicates a circuit problem.

Fuse Replacement

WARNING

When replacing a fuse, do not use a higher rated fuse than recommended. Use of a higher rated fuse can lead to severe component or circuit damage, an overheat condition, and possibly and electrical fire. If a fuse has burnt out, the source of the malfunction should be identified and corrected before applying power to the vehicle.

NOTICE Do not apply a silicone-based dielectric grease or similar product on fuse or relay plug-in terminals in front fuse box. Use of such a product will cause premature failure of the relay contacts.

Front Fuse Box

- 1. Open front storage compartment.
- 2. Remove RH plastic cover.

- Remove fuse box cover.
- 4. Identify and replace blown fuse with a fuse of the same rating.

Rear Fuse Box

- 1. Open seat.
- 2. Open fuse box cover.
- 3. Identify and replace blown fuse with a fuse of the same rating.

RFI AYS

Main Relay 1 (R7) Operational Test

NOTE: A defective ignition switch or ECM will not allow main relays control.

If no voltage is supplied to fuses F10, F11 and F12 in front fuse box with the ignition switch (key) ON, test main relay 1 (R7) as follows:

Check fuse F2 in front fuse box.

If F2 is good, carry out a MAIN RELAY 1 (R7) OUICK TEST.

If F2 is blown, refer to the WIRING DIAGRAM and look for a short circuit or component.

If input voltage, control circuit and relay are good, the circuits supplied by the relay may be defective.

Main Relay 1 (R7) Quick Test

Refer to FRONT FUSE BOX in this subsection for pinout information.

- 1. Locate main relay 1 relay in the front fuse box.
- 2. While touching the relay, turn ignition switch (key) ON. You should feel it "click".

NOTE: Main relay 2 (R3) also clicks with key ON. Make sure not to be mistaken between R3 and R7. Main relays remain "ON" for a while once activated by the ECM.

If relay clicks when key is turned ON, check voltage input at pin A1 of front fuse box. If voltage is read at pin A1, test relay, refer to RELAY BENCH TEST in this subsection.

If relay does not click when key is turned ON, check voltage input at pin B1 of front fuse box. If voltage is read at pin B1, carry out a MAIN RELAY 1 (R7) CONTROL CIRCUIT TEST. If there is no voltage at pin B1, look for an open circuit.

Main Relay 1 (R7) Control Circuit Test

Refer to FRONT FUSE BOX in this subsection for pinout information.

7

1. Remove main relay 1.

Subsection XX (POWER DISTRIBUTION)

- 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 A3 of front fuse box.

MAIN RELAY 1 CONTROL CIRCUIT TEST		
TEST P	ROBES	RESULT (WITH KEY ON)
Front fuse box pin A3	Positive source	Battery voltage

If ground signal is good, test relay, refer to *RELAY BENCH TEST* in this subsection.

If ground signal is not good, refer to WIRING DI-AGRAM and look for an open circuit.

Main Relay 2 (R3) Operational Test

NOTE: A defective ignition switch or ECM will not allow main relays control.

If no voltage is supplied to cluster connector pin 8 with ignition switch (key) ON (cluster does not turn on), test relay 2 (R3) as follows:

Check fuses F2 and F3 in front fuse box.

If F2 and F3 are good, carry out a MAIN RELAY 2 (R3) QUICK TEST.

If F2 or F3 are blown, refer to the WIRING DIA-GRAM and look for a short circuit or component.

If input voltage, control circuit and relay are good, the circuits supplied by the relay may be defective

Main Relay 2 (R3) Quick Test

Refer to *FRONT FUSE BOX* in this subsection for pinout information.

- 1. Locate main relay 2 in the front fuse box.
- 2. While touching the relay, turn ignition switch (key) ON. You should feel it "click".

NOTE: Main relay 1 (R7) also clicks with key ON. Make sure not to be mistaken between R3 and R7. Main relays remain "ON" for a while once activated by the ECM.

If relay clicks when key is turned ON, check voltage input at pin C5 of front fuse box. If voltage is read at pin C5, test relay, refer to *RELAY BENCH TEST* in this subsection.

If relay does not click when key is turned ON, check voltage input at pin D5 of front fuse box. If voltage is read at pin D5, carry out a *MAIN RELAY 2 (R3) CONTROL CIRCUIT TEST*. If there is no voltage at pin D5, look for an open circuit.

Main Relay 2 (R3) Control Circuit Test

Refer to *FRONT FUSE BOX* in this subsection for pinout information.

- 1. Remove main relay 2.
- 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 C6 of front fuse box.

MAIN RELAY 1 CONTROL CIRCUIT TEST		
TEST P	ROBES	RESULT (WITH KEY ON)
Front fuse box pin C6	Positive source	Battery voltage

If ground signal is good, test relay, refer to *RELAY BENCH TEST* in this subsection.

If ground signal is not good, refer to WIRING DI-AGRAM and look for an open circuit.

Load Shedding Relay (R5) Operational Test

The load shedding relay will cut off power to the following components if the battery voltage is too low:

- Console switches illumination (except the parking brake switch)
- Front and rear heated grips
- Air controlled suspension
- Front storage cover actuator
- Fog lights.

If battery and charging system are within specifications and the above components are not functional, check fuse F8.

If fuse F8 is good, check the relay input voltage at pins C9 and D9 of front fuse box. If voltage is good at pins C9 and D9, carry out a *LOAD SHED-DING RELAY CONTROL CIRCUIT TEST*. If there is no voltage at pins C9 and D9, look for an open circuit between fuse F8 and relay.

If F8 is blown, refer to the WIRING DIAGRAM and look for a short circuit or component.

Load Shedding Relay (R5) Control Circuit Test

Refer to *FRONT FUSE BOX* in this subsection for pinout information.

- 1. Remove load shedding relay.
- 2. Set multimeter to Vdc.
- 3. Start engine.
- 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 D10 of front fuse box.

LOAD SHEDDING RELAY CONTROL CIRCUIT TEST		
PRO	BES	RESULT (WITH ENGINE RUNNING)
Front fuse box pin D10	Positive source	Battery voltage

If ground signal is good, check voltage input at pin C1 (suspension relay input) of front fuse box. If voltage does not reach pin C1, test relay, refer to *RELAY BENCH TEST*. If voltage reaches pin C1, check other accessories wiring for an open circuit.

If ground signal is not good, refer to WIRING DIA-GRAM and look for an open circuit between relay and gauge. If circuit is not open, the gauge may be defective.

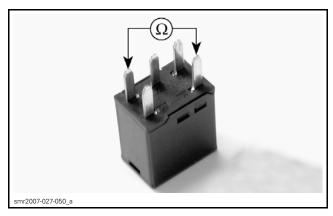
Relay Bench Test

Remove relay.

Use the FLUKE 115 MULTIMETER (P/N 529 035 868), and select the Ω position.

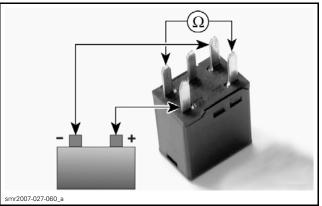
Probe relay as follows.

TERM	INAL	RESISTANCE	
	87	Open circuit (OL)	
30	87a (if applicable)	Close to 0 Ω	



Connect battery between terminals 85 and 86 as shown and probe relay again as follows.

TERMI	NAL	RESISTANCE	
	87	Close to 0 Ω	
30	87a (if applicable)	Open circuit (OL)	



BATTERY CONNECTED BETWEEN TERMINALS 85 AND 86

If the relay failed a test, replace it.

NOTE: Use the same method to test 4-pin relays. On some 5-pin relays, the 87a is unused, see *WIRING DIAGRAM* for details.

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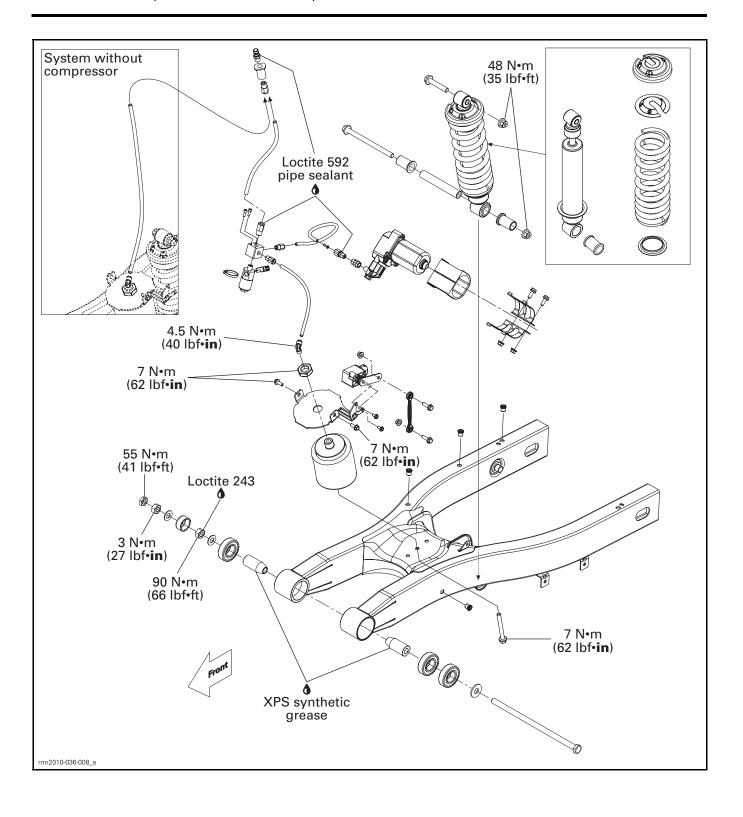
REAR SUSPENSION

SERVICE TOOLS

Description	Part Number	Page
BLIND HOLE BEARING PULLER SET	529 036 117	18
FLUKE 115 MULTIMETER	529 035 868	6, 9–10
SPRING REMOVER	529 036 007	15

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	19
LOCTITE 592 (PIPE SEALANT)	293 800 018	12
XPS SYNTHETIC GREASE	293 550 010	19



GENERAL

During assembly/installation, use the torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

A WARNING

Torque wrench tightening specifications must be strictly adhered to.

Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced.

A CAUTION The ACS suspension system may be under high pressure (up to 7 bar (100 PSI)). Release air pressure prior to working on the system. Refer to RELEASING AIR PRESSURE IN SYSTEM FOR SERVICING.

A CAUTION Always wear safety goggles when working with pressurized air system.

NOTICE Do not exceed 7 bar (100 PSI) in the system. This might damage the air suspension system.

NOTICE Hoses, cables and locking ties removed during a procedure must be reinstalled as per factory standards.

NOTE: 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.

SYSTEM DESCRIPTION

System Without Compressor (Manual Adjustment)

The ACS suspension without an integrated compressor is adjustable manually using a conventional air compressor and a pressure gauge. This system is equipped with an air spring mounted on the swing arm and located in front of the shock absorber.

The air spring is connected directly to an air hose with a pneumatic valve, as a result, adjusting the air pressure is as easy as inflating a tire.

NOTE: When adjusting the pressure, do not put your weight on the vehicle and do not load cargo in the storage compartment.

System With Compressor (Remote Adjustment)

This system works the same way as the manual one except that the adjustment is done electronically using a dedicated button. The compressor is integrated in the vehicle so the system can be adjusted on the fly to suit rider preferences and automatically keeps vehicle level constant with changing rider weight or load applied.

The requested setting is sent to the multifunction gauge and a position sensor mounted on the swing arm monitors the vehicle level to ensure proper ride height. Depending on the rider adjustment, the multifunction gauge will increase pressure in the air spring using the compressor or release pressure using the solenoid valve.

The highlighted bar on the multifunction gauge indicates the actual setting. Pressing the switch will move the bar up or down one at a time.

The multifunction gauge indicates suspension setting as follows.

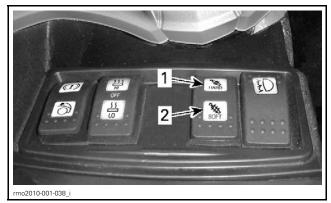


1. Actual setting

NOTE: On models without separate analog gauges, the temperature bar gauge will be replaced by the suspension bar in the multifunction gauge.

To change the ACS setting, press ACS switch until the requested setting is displayed in the multifunction gauge.

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- 1. Press here to stiffen
- 2. Press here to soften

ACS Suspension Settings

On both systems, the ACS suspension is adjustable from 0.7 bar (10 PSI) to 7 bar (100 PSI). Refer to the table below to know the air pressure setting relating to the recommended loading capacity of the vehicle.

System Without Compressor

RECOMMENDED REAR SUSPENSION PRESSURE		
CONDITION	PRESSURE	
Rider alone	2 bar (30 PSI)	
Rider and fully loaded side storage compartments and top storage compartment	3 bar (40 PSI)	
Rider and a passenger	5 bar (75 PSI)	
Rider, a passenger and fully loaded side storage compartments and top storage compartment	6 bar (85 PSI)	

System With Compressor

ACS SUSPENSION SETTINGS		
SETTING BAR	RIDING COMFORT	
1 (top)	Softest	
2	Soft	
3	Factory setting	
4	Stiff	
5 (bottom)	Stiffest	

Releasing Air Pressure in System for Servicing

Before working on the air system, always release air pressure as follows.

1. Open seat.

- 2. Push and hold pneumatic valve plunger using a small screwdriver.
- 3. Wait until the system is completely empty of air.

NOTE: Make sure to wait enough time in order to let the system expel the air. (no more pressurized air sound from the valve).

TROUBLESHOOTING

DIAGNOSTIC TIPS

Error Code (AIR FAULT) Displayed in Gauge

The error code AIR FAULT can appear on the multifunction gauge for different reasons that are not necessarily related to a failure of the ACS system.

If the error code appears on the multifunction gauge, it indicates a disparity between the requested and the actual suspension settings.

If the error code remains active for a long period, it may indicates a major leak in the system. In this case, the multifunction gauge will automatically shut down the compressor to prevent it from overheating.

If there is a major leak in the system, check the system for leakage as follows:

- Start vehicle and adjust the ACS setting to ACS
 6.
- Inspect all hoses and fittings with soapy water to detect leaks.

Error Code Displayed and Suspension Setting Can Not Be Adjusted

If there is no leak, it is probably an electrical problem. In this case, an electrical failure of the compressor or the solenoid valve will result the impossibility to change the actual suspension setting.

After multiple attempts to change suspension setting, the multifunction gauge will activate error code **AIR FAULT**. Refer to *TROUBLESHOOTING GUIDELINES* for further troubleshooting procedure.

TROUBLESHOOTING GUIDELINES

Requested Setting Display Does Not Change in Gauge

- 1. Check the ACS SWITCH (CSS).
- 2. Check fuse F8, refer to *POWER DISTRIBU-TION*.

3. Check relay R8, refer to *POWER DISTRIBU-TION*.

Suspension Setting Can Not Be Changed

- 1. Check the ACS SWITCH (CSS).
- 2. Check the ACS RELAY (R1).
- 3. Test the ACS POSITION SENSOR.
- 4. Check multifunction gauge control circuit continuity (to compressor PIN-19 and to solenoid valve PIN-18).

Suspension Setting Can Be Reached to Decrease Pressure Only

- 1. Check the ACS RELAY (R1).
- 2. Check the ACS COMPRESSOR.

Suspension Setting Can Be Reached To Increase Pressure Only

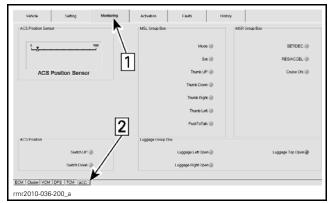
1. Check the ACS SOLENOID VALVE.

TROUBLESHOOTING WITH B.U.D.S.

ACS Position Sensor Monitoring

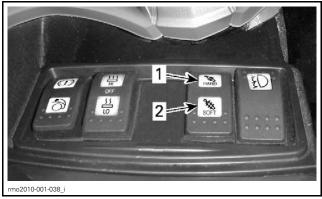
To monitor the position sensor during troubleshooting operation, proceed as follows:

- 1. Connect vehicle to B.U.D.S.. Refer to *COM-MUNICATION TOOLS AND B.U.D.S. SOFT-WARE* subsection.
- 2. Select Monitoring page.
- 3. Select ACC folder.



Step 1: Select Monitoring Step 2: Select ACC

- 4. Start engine and let it run at idle.
- 5. Press ACS adjustment switch on vehicle.



ACS ADJUSTMENT SWITCH

- 1. Press here to stiffen
- 2. Press here to soften
- 6. Check proper operation in B.U.D.S.

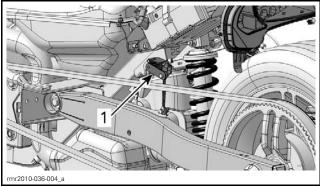
PROCEDURES

NOTE: Refer to the exploded view for service product, torque and assembly details.

ACS POSITION SENSOR

ACS Position Sensor Location

The ACS position sensor is located on the LH side of the vehicle near the shock absorber.



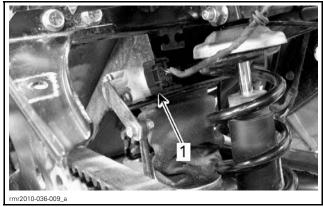
SOME PARTS REMOVED FOR CLARITY PURPOSE

1. ACS position sensor

ACS Position Sensor Signal Circuit Continuity Test

- 1. Remove rear cargo module. Refer to *BODY* subsection.
- 2. Disconnect position sensor connector.

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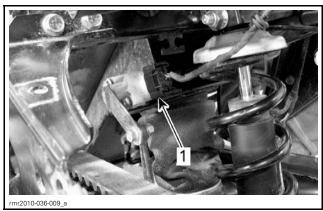
1. Position sensor connector

- 3. Remove multifunction gauge from vehicle. Refer to *LIGHTS*, *GAUGE AND ACCESSORIES* subsection.
- 4. Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to $\Omega.$
- 5. Measure resistance as per the following table.

TEST PROBES	RESISTANCE
Gauge connector pin 13 (LT BU/YL)	Close to 0 Ω
Position sensor connector pin 4 (LT BU/YL)	Close to 0 12

ACS Position Sensor Input Voltage Test

- 1. Remove rear cargo module. Refer to *BODY* subsection.
- 2. Disconnect position sensor connector.



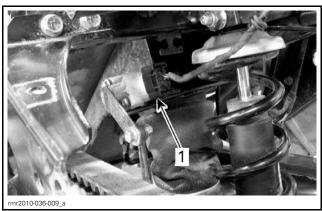
1. Position sensor connector

- 3. Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to Vdc.
- 4. Start engine and let it run at idle.
- 5. Measure voltage as per the following table.

TEST PROBES	VOLTAGE
Pin 5 (YL/WH)	Battery voltage
Battery negative (-) post	(± 12 Vdc)

ACS Position Sensor Ground Circuit Continuity Test

- 1. Remove rear cargo module. Refer to *BODY* subsection.
- 2. Disconnect position sensor connector.



1. Position sensor connector

- 3. Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to Vdc.
- 4. Start engine and let it run at idle.
- 5. Measure voltage as per the following table.

TEST PROBES	VOLTAGE	
Pin 1 (BK)	Battery voltage	
Battery positive (+) post	(± 12 Vdc)	

ACS Position Sensor Reset (With B.U.D.S.)

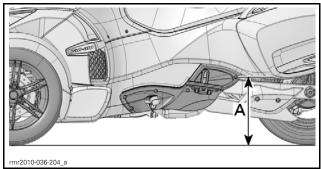
- 1. Connect vehicle to B.U.D.S.. Refer to *COM-MUNICATION TOOLS AND B.U.D.S. SOFT-WARE* subsection.
- 2. Select **Setting** page.
- 3. Select ACC folder.
- 4. Park vehicle straight on a level surface.
- 5. Release air pressure, refer to *RELEASING AIR PRESSURE IN SYSTEM FOR SERVICING* in this subsection.
- 6. Check rear tire pressure and make sure that tire is inflated at 193 kPa (28 PSI).
- 7. Place 14 kg (30 lb) inside rear cargo module.
- 8. Install a jack under the rear portion of frame.



TYPICAL

9. Lift vehicle until rear screw of the footrest support is at 348 mm (13.701 in) of the ground.

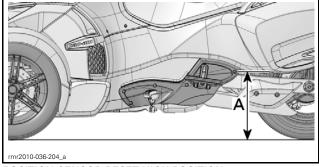
POSITION SENSOR RESET				
LOW position 348 mm (13.701 in)				



POSITION SENSOR RESET LOW POSITION
A. 348 mm (13.701 in)

- 10. Place ignition switch to ON position.
- 11. Press Position Sensor Reset LOW Position in B.U.D.S.
- 12. Lift vehicle until rear screw of the footrest support is at 403 mm (15.866 in) of the ground.

POSITION SENSOR RESET			
HIGH position 403 mm (15.866 in)			

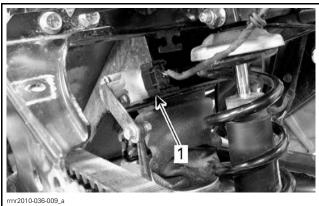


POSITION SENSOR RESET HIGH POSITION A. 403 mm (15.866 in)

- 13. Press Position Sensor Reset HIGH Position in B.U.D.S.
- 14. Place ignition switch to OFF position for 30 seconds.
- 15. Lower vehicle at the ground.
- 16. Start engine and let it run at idle then check if ACS suspension works properly.

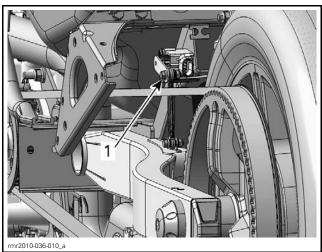
ACS Position Sensor Replacement

- 1. Release air pressure, refer to *RELEASING AIR PRESSURE IN SYSTEM FOR SERVICING* in this subsection.
- 2. Remove body parts as required to access to the position sensor. Refer to *BODY* subsection.
- 3. Disconnect position sensor connector.



1. Position sensor connector

4. Detach link rod from position sensor by removing upper bolt and nut.

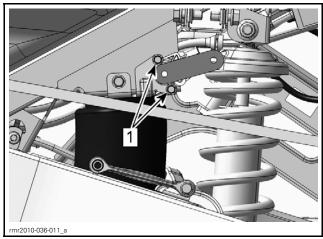


1. Link rod upper bolt

5. Move position sensor arm to access to retaining screws.

7

6. Remove position sensor retaining screws.



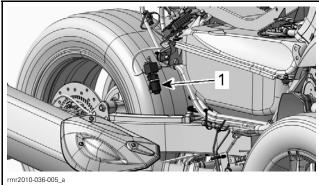
1. Position sensor retaining screws

- 7. Remove position sensor from vehicle.
- 8. Install a new position sensor on vehicle as the reverse of removal.
- 9. Perform the initialization of the position sensor, refer to ACS POSITION SENSOR RESET (WITH B.U.D.S.).

ACS SOLENOID VALVE

ACS Solenoid Valve Location

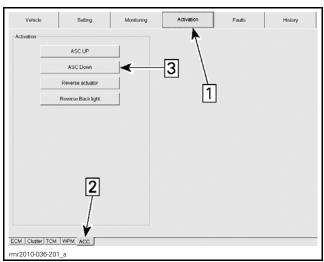
The ACS solenoid valve is located on the RH side of the vehicle near the shock absorber.



SOME PARTS REMOVED FOR CLARITY PURPOSE

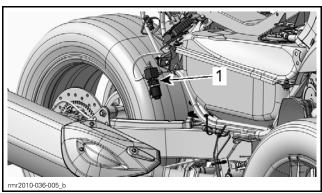
ACS Solenoid Valve Operation Test

- 1. Connect vehicle to B.U.D.S.. Refer to COM-MUNICATION TOOLS AND B.U.D.S. SOFT-WARE subsection.
- 2. Select Activation page.
- 3. Select ACC folder.
- 4. Press ASC Down button to proceed.



Step 1: Select Activation Step 2: Select ACC Step 3: Press ASC Down

5. Verify that air exits from side port to confirm proper solenoid operation.



SOME PARTS REMOVED FOR CLARITY PURPOSE

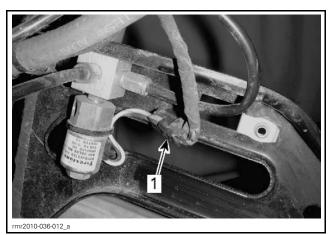
1. Side port

If no air exits from side port:

- Check input voltage at solenoid valve (PIN-1), refer to the WIRING DIAGRAM.
- Check ground circuit continuity at solenoid valve (PIN-2), refer to the WIRING DIAGRAM.
- Check connector and terminal condition.

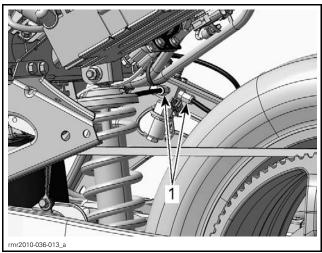
ACS Solenoid Valve Replacement

- 1. Release air pressure, refer to *RELEASING AIR PRESSURE IN SYSTEM FOR SERVICING* in this subsection.
- 2. Remove body parts as required to access to the ACS solenoid valve. Refer to *BODY* subsection.
- 3. Disconnect solenoid valve connector.



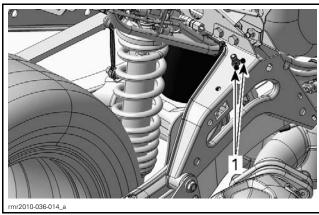
1. Solenoid valve connector

- 4. Disconnect pneumatic hoses from air fittings as follows:
 - 4.1 Push fitting ring toward ACS manifold.
 - 4.2 Hold ring in place.
 - 4.3 Pull air hose.



1. Air fittings

5. Remove ACS manifold retaining screws.



1. ACS manifold retaining screws

6. Remove ACS manifold from vehicle.

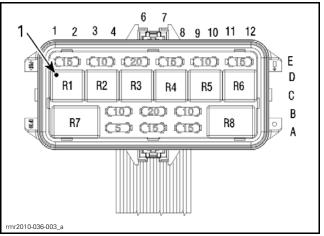
- 7. Unscrew ACS solenoid valve from ACS manifold
- 8. Install a new solenoid valve as the reverse of removal procedure.
- 9. Check the air system for leakage, to do so, start vehicle and adjust the ACS setting to ACS 6, then inspect all hoses and fittings with soapy water to detect leaks.

ACS RELAY (R1)

ACS Relay Location

ACS relay (R1) is located in the front fuse block, under the front storage compartment cover.

ACS SUSPENSION RELAY (R1)			
RELAY TERMINAL FUSE BLOCK PIN			
86	D1		
85	C2		
30	C1		
87	D2		



FRONT FUSES BLOCK

1. ACS suspension relay

ACS Relay Continuity Test

- 1. Remove relay (R1), refer to ACS RELAY LOCA-TION.
- 2. Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to Ω .
- 3. Measure resistance as per the following table.

TEST PROBES	RESISTANCE	
Terminal 30	Open (OL)	
Terminal 87	Open (OL)	

- 4. Apply 12 volts on terminals 86 and 85.
- 5. Measure resistance again as per the following table.

TEST PROBES	PROBES RESISTANCE	
Terminal 30	Class to 0.0	
Terminal 87	Close to 0 Ω	

If results are not as per the previous tables, replace relay.

ACS Relay Input Voltage Test

- 1. Remove relay (R1), refer to ACS RELAY LOCA-TION.
- 2. Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to Vdc.
- 3. Start engine and let it run at idle.
- 4. Measure voltage as per the following tables.

TEST PROBES	VOLTAGE
Fuse box pin C1 (LT GN/GY)	Battery voltage
Battery negative (-) post	(± 12 Vdc)

TEST PROBES	VOLTAGE
Fuse box pin D1 (LT GN/GY)	Battery voltage
Battery negative (-) post	(± 12 Vdc)

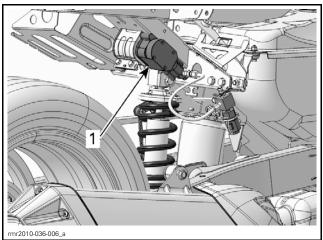
If voltage is not as specified:

- Check fuse F8, refer to POWER DISTRIBU-TION.
- Check relay R8, refer to POWER DISTRIBU-TION.
- Check wiring continuity, refer to the WIRING DIAGRAM.
- Check connector and terminal condition.

ACS COMPRESSOR

ACS Compressor Location

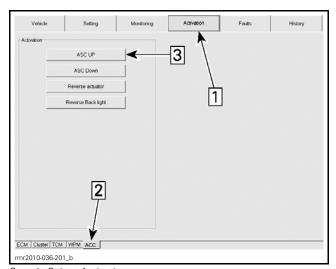
The ACS compressor is located on the RH side of the vehicle near the shock absorber.



SOME PARTS REMOVED FOR CLARITY PURPOSE 1. ACS compressor

ACS Compressor Operation Test

- 1. Connect vehicle to B.U.D.S.. Refer to COM-MUNICATION TOOLS AND B.U.D.S. SOFT-WARE subsection.
- 2. Select **Activation** page.
- 3. Select ACC folder.
- 4. Press ASC UP button to proceed.



Step 1: Select Activation Step 2: Select ACC Step 3: Press ASC UP

5. Verify if compressor works properly.

NOTICE Do not power compressor for a long period (30 seconds maximum) to prevent overheating.

If compressor does not work:

- Check input voltage at compressor (PIN-2), refer to the WIRING DIAGRAM.

- Check ground circuit continuity at compressor (PIN-1), refer to the WIRING DIAGRAM.
- Check connector and terminal condition.

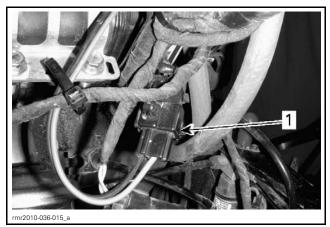
If the fault is not found after having carried out the previous tests:

- Test compressor operation by connecting it directly to the battery posts.
 - If compressor works properly, check relay R1, refer to ACS RELAY (R1) in this subsection
 - If compressor does not work properly, replace compressor.

NOTICE Do not power compressor directly with the battery for a long period. Apply voltage quickly to ensure that the compressor will not over pressurize the air system or overheating.

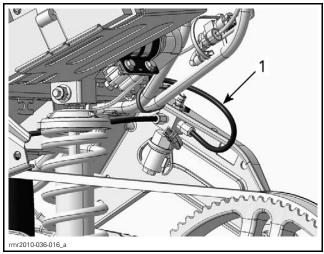
ACS Compressor Removal

- 1. Release air pressure, refer to *RELEASING AIR PRESSURE IN SYSTEM FOR SERVICING* in this subsection.
- 2. Remove body parts as required to access to the compressor. Refer to *BODY* subsection.
- 3. Disconnect compressor connector.



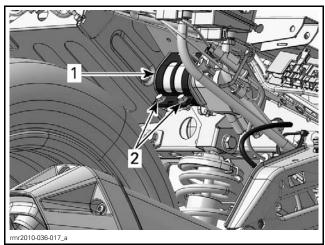
1. Compressor connector

- 4. Disconnect compressor pneumatic hose from manifold as follows:
 - 4.1 Push fitting ring toward ACS manifold.
 - 4.2 Hold ring in place.
 - 4.3 Pull air hose.

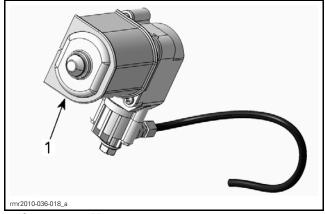


1. Compressor pneumatic hose

5. Remove bolts and nuts from compressor retaining collar.



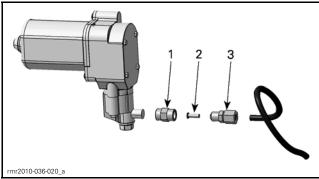
- 1. Retaining collar
- 2. Bolts
- 6. Open retaining collar then remove compressor.
- 7. Remove compressor rubber.



1. Compressor rubber

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8. Unscrew check valve and fitting from compres-



- 1. NPT nipple
- Inner sleeve
- 3. Check valve

ACS Compressor Installation

The installation procedure is the reverse of removal procedure, however pay attention to the following.

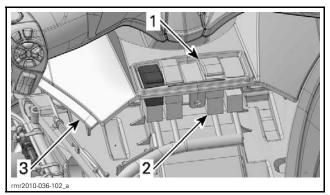
Apply LOCTITE 592 (PIPE SEALANT) (P/N 293 800 018) on check valve male threads.

Check the air system for leakage, to do so, start vehicle and adjust the ACS setting to ACS 6, then inspect all hoses and fittings with soapy water to detect leaks.

ACS SWITCH (CSS)

ACS Switch Test

Remove central panel. Refer to BODY subsection.



- ACS switch ACS switch connector

Check switch continuity as follows.

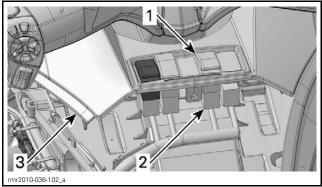
ACS SWITCH POSITION	PIN		RESISTANCE	
Firmly pushed to UP	2	5		
Released (FREE)	2	3	Close to 0 Ω	
Firmly pushed to DWN	2	1	- 0.000 10 0 11	

If switch is defective, replace it with a new one.

ACS Switch Replacement

Remove central panel. Refer to BODY subsection.

Remove ACS switch from console by pushing retaining tabs.



- ACS switch
- ACS switch connector
- 3. Central panel

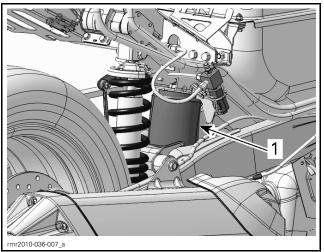
Install a NEW switch on console.

Re-install central panel as the reverse of removal procedure.

ACS AIR SPRING

ACS Air Spring Location

The ACS air spring is located on the swing arm in front of the shock absorber.



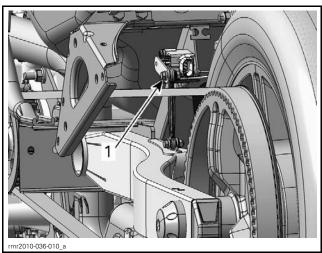
SOME PARTS REMOVED FOR CLARITY PURPOSE

1. ACS air spring

ACS Air Spring Removal

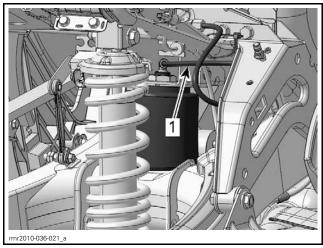
NOTICE Always detach link rod from position sensor before servicing the rear suspension (on applicable models).

- 1. Release air pressure, refer to *RELEASING AIR PRESSURE IN SYSTEM FOR SERVICING* in this subsection.
- 2. Remove body parts as required to access to the ACS air spring. Refer to *BODY* subsection.
- 3. Detach link rod from position sensor by removing upper bolt and nut (on applicable models).



1. Link rod upper bolt

- 4. Disconnect pneumatic hose from air spring as follows:
 - 4.1 Push fitting ring toward air spring.
 - 4.2 Hold ring in place.
 - 4.3 Pull air hose.



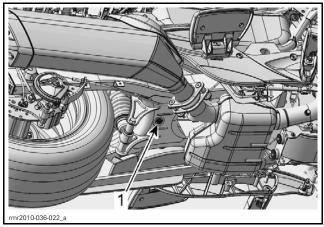
1. Air spring hose

- 5. Install a jack under the rear portion of frame.
- 6. Slightly lift the vehicle to extend the air spring.



TYPICAL

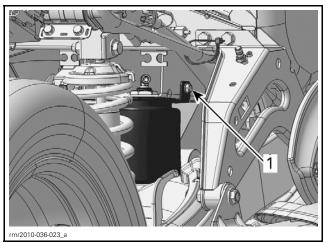
7. From underneath swing arm, remove air spring lower retaining screw.



1. Lower retaining screw

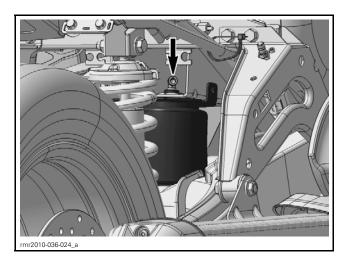
8. Remove air spring upper retaining screws on both side.

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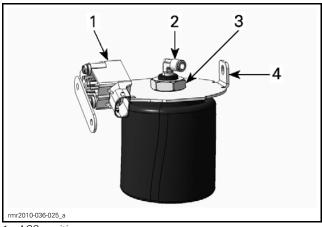
1. Upper retaining screw

9. Carefully push down air spring then remove it from vehicle frame.



10. Remove the following components from air spring:

- ACS position sensor
- Pneumatic fitting
- Air spring plate retaining nut
- Air spring plate.



- 1. ACS position sensor
- 2. Pneumatic fitting
- 3. Air spring plate retaining nut

4. Air spring plate

ACS Air Spring Installation

The installation procedure is the reverse of removal procedure, however pay attention to the following.

Torque air spring retaining screws to 7 N•m (62 lbf•in).

Torque air spring retaining nut to 7 N•m (62 lbf•in).

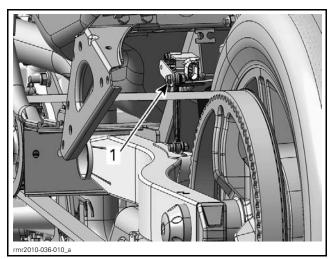
Check the air system for leakage, to do so, start vehicle and adjust the ACS setting to ACS 6, then inspect all hoses and fittings with soapy water to detect leaks.

SHOCK ABSORBER

Shock Absorber Removal

NOTICE Always detach link rod from position sensor before servicing the rear suspension (on applicable models).

- 1. Release air pressure, refer to *RELEASING AIR PRESSURE IN SYSTEM FOR SERVICING* in this subsection.
- 2. Remove body parts as required to access to the shock absorber. Refer to *BODY* subsection.
- 3. Detach link rod from position sensor by removing upper bolt and nut (on applicable models).



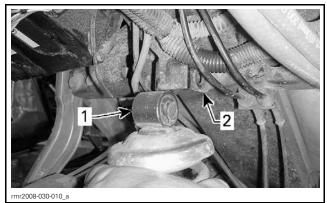
1. Link rod upper bolt

- 4. Remove the shock absorber upper bolt.
- 5. Install a jack under the rear portion of frame.



TYPICAL

6. Lift the vehicle until the shock absorber can be removed from upper bracket.

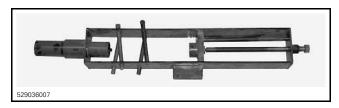


TYPICAL

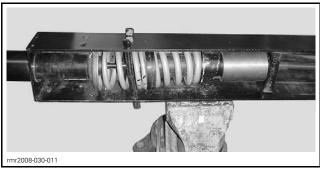
- Shock absorber
 Upper bracket
- 7. Remove the shock absorber lower bolt.
- 8. Remove rear shock absorber from vehicle.

Shock Absorber Disassembly

1. Use the SPRING REMOVER (P/N 529 036 007).

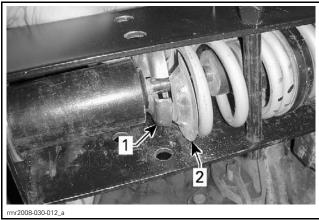


- 2. Place the tool in a vise.
- 3. Position the shock absorber in the tool as shown.



TYPICAL

- 4. Tighten the shock spring remover screw until the spring is sufficiently compressed to remove spring locking devices.
- 5. Remove spring stopper and its cap then release the shock spring remover screw.



TYPICAL

- Cap
 Spring stopper
- 6. Remove spring from shock.

Shock Absorber Inspection

Examine shock for leaks.

Extend and compress the piston at least 5 complete strokes with its rod upward.

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Check that rod moves smoothly and with uniform resistance over its entire stroke.

NOTE: During compression motion, it is normal to feel a small resistance only.

Pay attention to the following conditions that will denote a defective shock:

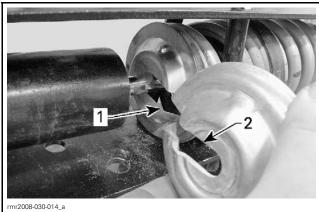
- A very weak rebound.
- A skip or a hang back when reversing stroke at mid travel.
- Seizing or binding condition except at extreme end of either stroke.
- Oil leakage.
- A gurgling noise, after completing one full compression and extension stroke.

Replace if any faults are present.

Shock Absorber Assembly

The assembly is the reverse of the disassembly procedure. However, pay attention to the following.

When installing spring stopper and cap, make sure to install opening at 180°.



TYPICAL

- Stopper opening Cap opening

Shock Absorber Installation

The installation is the reverse of the removal procedure.

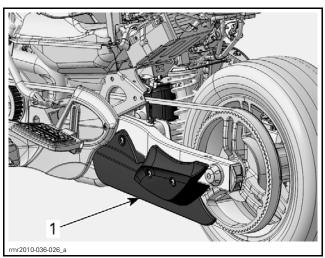
SWING ARM

Swing Arm Removal

NOTICE Always detach link rod from position sensor before servicing the rear suspension (on applicable models).

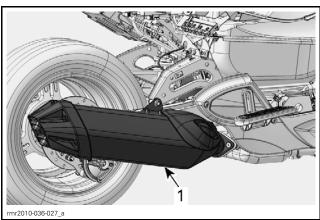
1. Release air pressure, refer to RELEASING AIR PRESSURE IN SYSTEM FOR SERVICING in this subsection.

- 2. Remove rear cargo module. Refer to BODY subsection.
- 3. Remove belt guard from swing arm.



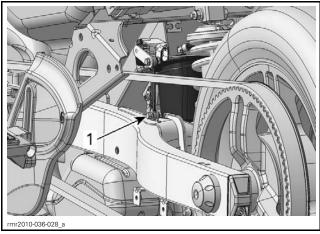
Belt guard

4. Remove muffler from swing arm.



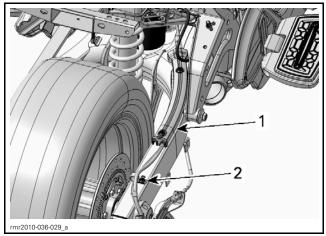
Muffler

5. Detach ACS position sensor link rod from swing arm by removing lower bolt and nut (on applicable models).

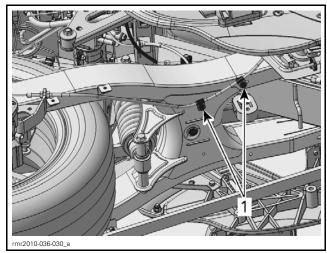


1. Link rod lower bolt

6. Remove cables protector and cables fastener from swing arm.

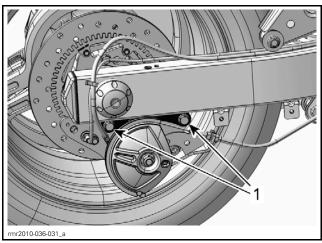


- Cables protector
 Cables fastener
- 7. From underneath swing arm, remove parking brake cable fasteners.



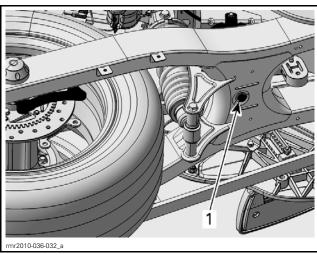
1. Parking brake cable fasteners

8. Remove and discard both caliper screws.



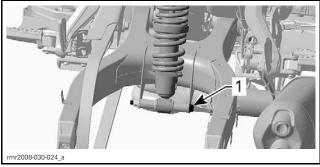
1. Caliper screws

9. From underneath swing arm, remove air spring lower retaining screw.



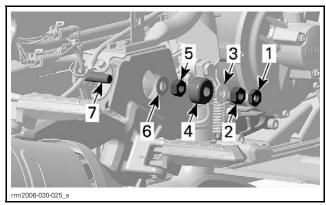
1. Lower retaining screw

- 10. Place vehicle on a level surface.
- 11. Lift the rear of the vehicle.
- 12. Install a jack stand under frame.
- 13. Remove rear wheel. Refer to DRIVE BELT AND REAR WHEEL subsection.
- 14. Unscrew shock absorber lower bolt.

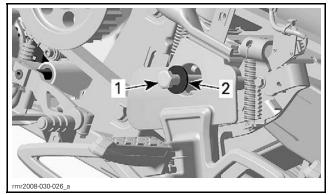


1. Shock absorber lower bolt

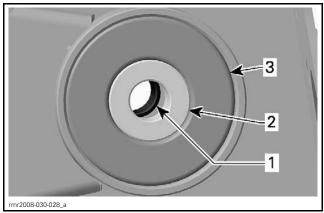
- 15. Through the RH driver's footrest hole, remove:
 - The lock nut
 - The positioning nut
 - The washer
 - The spacer
 - The swing arm nut and its washer.



- Lock nut
- Positioning nut
- Washer
- Spacer
- Swing arm nut
- Washer
- 7. Swing arm bolt
- 16. Remove swing arm bolt with its washer.

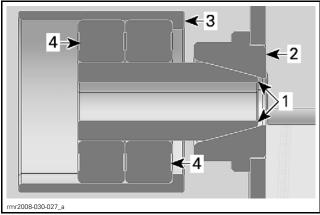


- Swing arm bolt
- 17. Insert a long punch through RH inner sleeve and push out the LH inner sleeve from swing arm.



VIEW FROM RIGHT SIDE OF SWING ARM

- LH inner sleeve
- RH inner sleeve
- RH bearing



CROSS SECTION OF FRAME AND SWING ARM (LEFT SIDE)

- Push inner sleeve here
- Frame
- Swing arm
 Swing arm bearings
- 18. Insert a long punch through LH bearing and push out the RH inner sleeve.
- 19. Discard inner sleeves.
- 20. Remove the swing arm.

Swing Arm Inspection

Check swing arm for cracks, bending or other damages.

Check if bearings turn smoothly and freely.

Replace all damaged parts.

Swing Arm Disassembly

Using the BLIND HOLE BEARING PULLER SET (P/N 529 036 117), remove swing arm bearings.



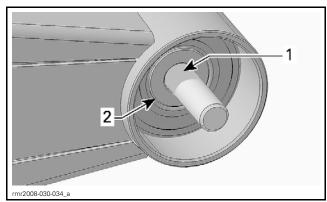
Discard them.

Swing Arm Assembly

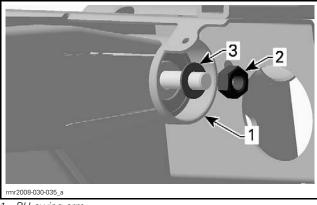
Using a press and an appropriate bearing installer, install **NEW** bearings.

Swing Arm Installation

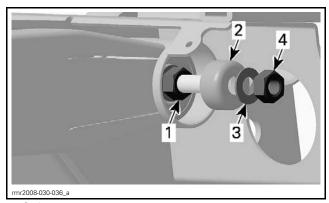
- 1. Apply XPS SYNTHETIC GREASE (P/N 293 550 010) on inner sleeves.
- 2. Insert **NEW** inner sleeves into bearings, the tapered side first. Do not push sleeves completely.
- 3. Align swing arm bores with tapered openings in
- 4. Push inner sleeves completely to retain swing arm to frame.
- 5. From the LH side, insert the swing arm bolt with its washer.
- 6. Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on threads of swing arm bolt.



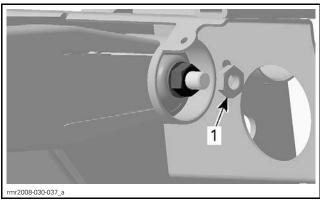
- Apply threadlocker here (shaded portion)
- 7. Install a washer and the swing arm nut.



- 1. RH swing arm
- Swing arm nut Washer
- 8. Torque swing arm nut to 90 N•m (66 lbf•ft).
- 9. Move swing arm up and down. The swing arm must move freely and smoothly.
- 10. Install the spacer, the washer and the positioning nut.



- Swing arm nut
- Spacer
- Washer
- 4. Positioning nut
- 11. Torque positioning nut to 3 N•m (27 lbf•in).
- 12. Install the lock nut.



- 1. Lock nut
- 13. Secure positioning nut with a wrench and tighten lock nut to 55 Nom (41 lbfoft).

19

- 14. Install **NEW** caliper screws.
- 15. Install all other removed parts.

STARTING SYSTEM

SERVICE TOOLS

Description	Part Number	Pa	ge
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.

1

Subsection XX (STARTING SYSTEM)

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).

A 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*.

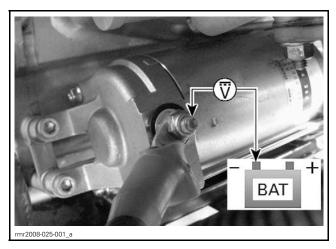
Starter Input Voltage Test

- 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).

A 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.



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.

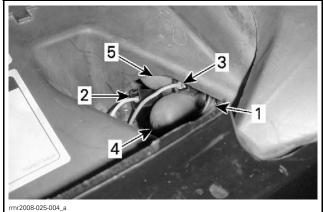
D2 DIODE (STARTER SOLENOID)

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.

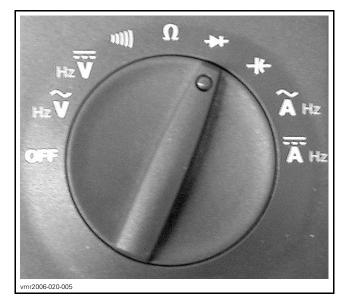


- Starter solenoid
- STS1 (YELLOW/PINK wire) STS2 (VIOLET/BEIGE wire)
- STS3 from battery
- STS4 to starter

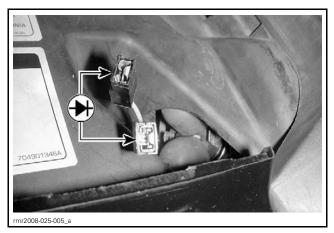
Set multimeter as shown.

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.

Subsection XX (STARTING SYSTEM)



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



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

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

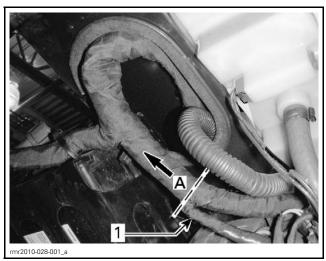
NOTE: If the diode is damaged and short circuits, fuse F12 will probably blow and open the circuit. If the diode blows and open circuits, it will not provide protection to the sensitive electronics. These components will be damaged, may function intermittently, or completely fail.

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.

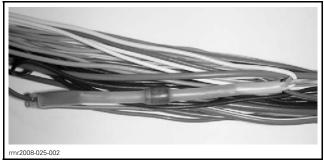
The diode is located within a 500 mm (18 in) distance from the small harness junction.



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.



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 DIA-GRAM*.

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

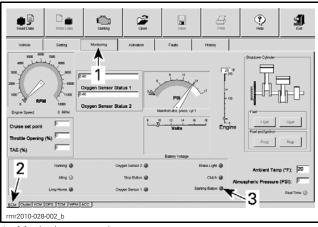
NOTE: The engine stop switch is located on the RH multifunction switch housing.

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.



- Monitoring page 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-START-ING 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.

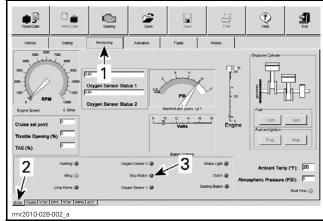
START BUTTON

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.



- Monitoring page tab
 ECM tab
 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 RE-LAY 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.

Subsection XX (STARTING SYSTEM)

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 VOLT-AGE 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	Dottoryvaltage
Front fuse box pin D3	Ground	Battery voltage

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-START-ING 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.



STARTER SOLENOID (RH FUEL TANK COVER REMOVED)

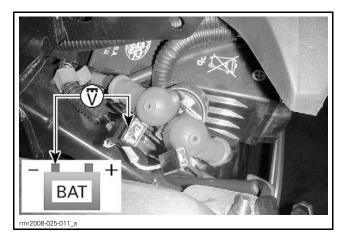
Inspect connections and clean as necessary.

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.

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



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 SO-LENOID 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 SO-LENOID STATIC TEST: CONTINUITY*.

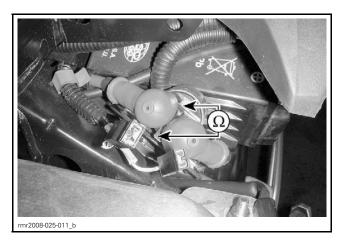
Starter Solenoid Static Test: Continuity

Disconnect battery.

Disconnect small terminals from solenoid.

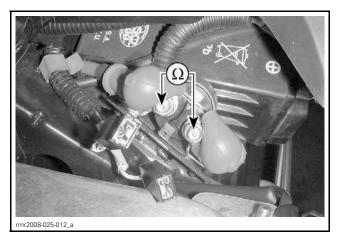
With a multimeter, test the primary winding resistance as follows.

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



Test for a stuck solenoid plunger as follows.

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



If any measurement is out of specification, replace solenoid.

Reconnect battery and starter terminals.

Subsection XX (STARTING SYSTEM)

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.



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.



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.

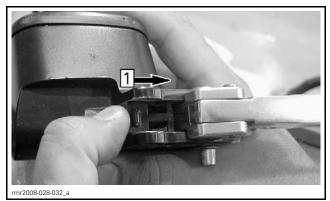
CLUTCH SWITCH CONTINUITY TEST			
CLUTCH SWITCH POSITION	PIN		RESISTANCE @ 20°C (68°F)
Firmly depressed	1	2	Below 3Ω
Released	Į	Z	Infinite (OL)

If switch is defective, replace with a new one.

Clutch Switch Removal

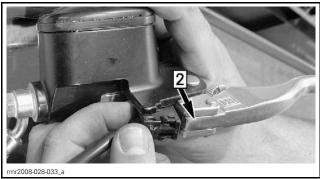
Remove clutch lever from handlebar, refer to *CLUTCH* subsection.

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.

STEERING (DPS) AND WHEELS

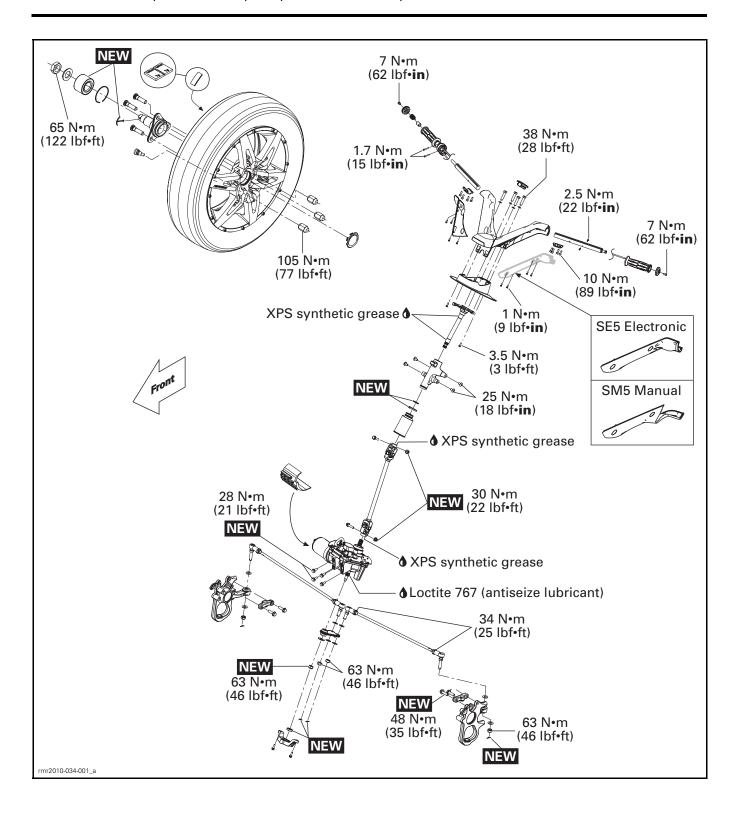
SERVICE TOOLS

Description	Part Number	Page
BALL JOINT INSTALLER	529 035 975	34
CLUTCH COVER BEARING INSTALLER	529 036 095	34
FLUKE 115 MULTIMETER	529 035 868	25
MAGNET SOCKET	529 036 178	

SERVICE PRODUCTS

Description	Part Number	Page
CABLE LUBRICANT	293 600 041	11–12, 19
LOCTITE 243 (BLUE)	293 800 060	27
LOCTITE 767 (ANTISEIZE LUBRICANT)	293 800 070	30
XPS SYNTHETIC GREASE	293 550 010	23–24, 29

Subsection XX (STEERING (DPS) AND WHEELS)



GENERAL

During assembly/installation, use the torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

WARNING

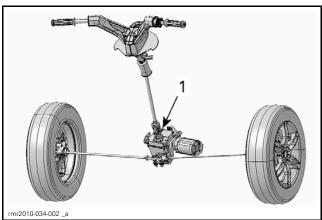
Torque wrench tightening specifications must be strictly adhered to.

Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced.

NOTICE Hoses, cables, or locking ties removed during procedure must be reinstalled as per factory standards.

SYSTEM DESCRIPTION (FEATURES)

The Dynamic Power Steering (DPS) provides a computer controlled, variable power assist, achieved by an electric motor to optimize the amount of steering input required by the rider.



1. Dynamic power steering (DPS)

The DPS uses the following parameters:

- Battery voltage
- Engine RPM
- Vehicle speed
- Torque sensor
- Steering angle.

The amount of steering assist provided is dependent on the handlebar effort (steering torque), steering angle and the vehicle speed.

The greater the handlebar effort (steering torque), the greater the assist will be.

The slower the vehicle speed, the greater the assist will be.

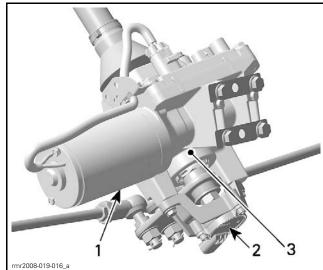
When the vehicle is operated in reverse, power steering assist will decrease as vehicle speed increases.

NOTE: If available electrical power is limited due to low battery voltage or excessive electrical system loads that reduce available voltage to the DPS, steering assist will be reduced.

SYSTEM DESCRIPTION (COMPONENTS)

DPS Unit

The DPS unit is a self contained unit that includes the steering gear, the DPS module, the DPS motor, the steering angle sensor and the torque sensor.



TYPICAL - DPS UNIT

- DPS motor
- Steering angle sensor
 DPS module and torque angle sensor (internal)

The DPS module provides amperage to the motor. The amount and duration of that amperage is determined by the inputs to the DPS module.

The direction in which the motor turns is changed by reversing the polarity of the electrical power applied to the motor.

The DPS motor does not "spin", but rather turns in very small increments based on the amount, duration, and polarity of the DC power delivered by the DPS module.

DPS Unit Protection

To protect the DPS electronic components, the steering assist behavior will change as follows.

Subsection XX (STEERING (DPS) AND WHEELS)

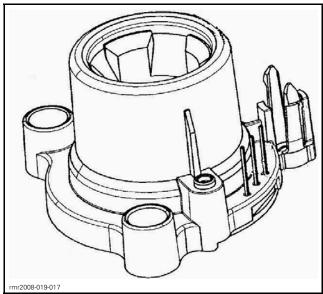
CONDITION	DPS BEHAVIOR	
DPS internal board temperature is below -10°C (14°F)	Steering assist is stopped.	
When motor internal temperature reaches a certain temperature (DPS continuously estimates it)	Steering assist will gradually	
DPS internal board temperature is above 75°C (167°F)	decrease.	
DPS internal board temperature is above 85°C (185°F)	Steering assist is stopped.	

When the DPS unit temperature is back within normal operating temperature range:

- Turn ignition key OFF.
- Wait 30 seconds.
- Turn ignition key ON.

Steering assist should resume normal operation.

Steering Torque Sensor



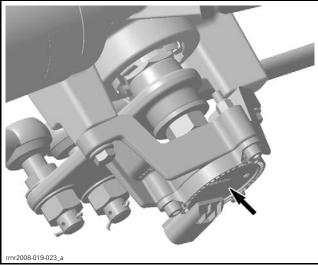
TYPICAL - STEERING TORQUE SENSOR

The steering column is connected to the shaft on the DPS unit. A small area of the shaft is magnetized. Inside the DPS unit, the sensor surrounds the magnetized area of the DPS shaft.

When the handlebar is turned, torque is applied to the shaft which tends to twist the shaft slightly, deforming the magnetic field. The sensor detects the torque by measuring the deviation of the magnetic field.

The torque sensor is very sensitive and can detect very small changes in the magnetic field. The harder the handlebar is turned, the greater the magnetic deviation, the greater the power steering assist.

Steering Angle Sensor (SAS)



TYPICAL - STEERING ANGLE SENSOR

The SAS determines the angle of the front wheels in relation to the fore and aft centerline of the vehicle. It gives a direct reading to the DPS and VCM of the handlebar position in relation to the vehicle.

ADJUSTMENT

When adjusting or replacing the following parts or sensor, a reset (re-zero) of the sensor values and a steering alignment is required for proper system operation.

B.U.D.S. software is used to perform the sensor(s) reset.

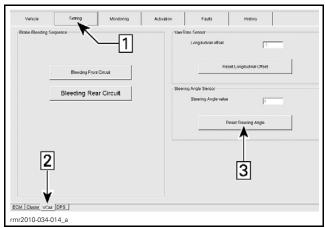
PART ADJUSTED OR REPLACED	WHAT TO DO
 DPS unit Steering column support Upper or lower steering column shaft Pitman arm Tie rod Tie rod end Knuckle Wheel bearing Ball joint Front suspension arm (lower/upper) Steering alignment 	 Perform a STEERING ALIGNMENT Carry out an SAS RESET Carry out a TORQUE SENSOR RESET
Steering Angle Sensor (SAS)	Carry out an SAS RESET

SAS RESET

- 1. Perform a steering alignment to position handlebar in a straight ahead position. Refer to STEERING ADJUSTMENT in this subsection.
- 2. Connect vehicle to the latest B.U.D.S. software, refer to COMMUNICATION TOOLS AND B.U.D.S. SOFTWARE subsection.
- 3. In B.U.D.S., click on the Read Data button.
- 4. Choose the **Setting** page tab, then select **VCM** tab.

NOTICE Ensure handlebar is free.

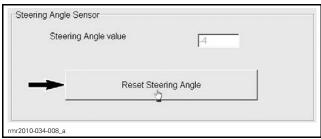
5. Press Reset Steering Angle button.



STEERING ANGLE SENSOR RESET

Step 1: Choose Setting page tab Step 2: Select VCM tab

Step 3: Press on Reset Steering Angle button



RESET STEERING ANGLE BUTTON

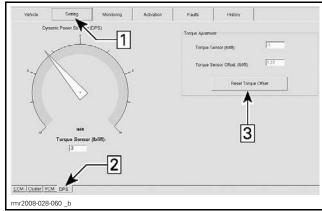
TOROUE SENSOR RESET

NOTE: If the steering NULL position is difficult to obtain and there isn't an indication of a DPS fault, check for excessive friction in the tie-rod ends. The NULL position should be obtained when the steering is centered with no torque applied to the DPS from the steering components or driver in-

- 1. Perform a steering alignment to position handlebar in a straight ahead position. Refer to STEERING ADJUSTMENT in this subsection.
- 2. In B.U.D.S., click on Read Data button.
- 3. Choose the **Setting** page tab, then select **VCM** tab.

NOTICE Ensure handlebar is free.

- 4. Choose the **DPS** tab.
- Press Reset Torque Offset button.



TORQUE SENSOR OFFSET RESET

Step 1: Choose Setting page tab Step 2: Select DPS tab

Step 3: Press on Reset Torque Offset button

STEERING ALIGNMENT

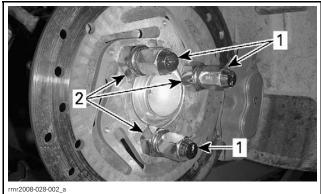
- 1. To perform the steering alignment procedure, ensure you have the following items close at hand:
 - An assistant
 - A 2.44 m (8 ft) aluminum angle (alignment bar)

5

- 2 spacer bars of 178 mm (7 in) x 25 mm (1 in)
- 2 C-clamps
- 2 locking pliers
- 6 M18 elastic stop nuts
- A magnetic laser level
- A tape measure or a meter
- 2 open end wrenches (10 mm and 19 mm (7/16 in and 7/8 in))
- A computer with the latest version of the applicable B.U.D.S. software.
- 2. Place vehicle on level surface.
- 3. Apply the parking brake.
- 4. Lift the front of vehicle and support it with 2 jack stands under "A" arms, as close to frame as possible.

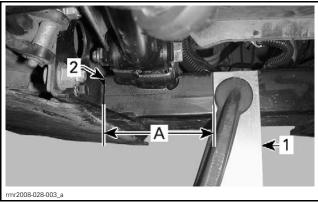
NOTE: Jack stands must be located as close to frame as possible to prevent front suspension compression or steering alignment will not be to specification.

- 5. Remove front wheels.
- 6. Secure brake disc to wheel hub with lug nuts and spacers (M18 elastic stop nuts).



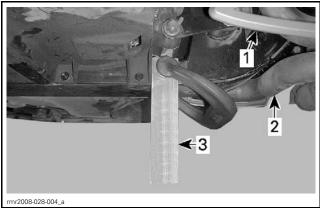
TYPICAL

- 1. Lug nuts
- 2. M18 elastic stop nuts
- 7. Using a C-clamp, position the front spacer bar at 100 mm (4 in) from the end of frame.



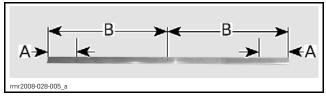
TYPICAL

- 1. Front spacer bar secured by a C-clamp
- 2. Frame front end
- A. 100 mm (4 in)
- 8. Using C-clamp, secure the other spacer near the rear portion of the frame.

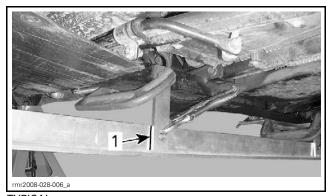


TYPICAL

- 1. Driver footrest
- 2. "Y" pipe
- 3. Rear spacer secured by a C-clamp
- 9. Mark the alignment bar at three places, in the center, and at 30 cm (12 in) from each end.



- A. 30 cm (12 in) B. 1.22 m (4 ft)
- 10. Attach the alignment bar to the spacers using the locking pliers. Position center mark of the alignment bar against the forward edge of the front spacer.



TYPICAL

1. Alignment bar center mark

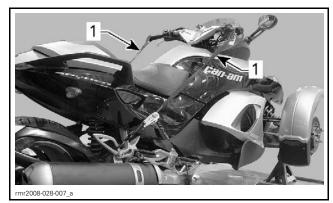
NOTE: Ensure alignment bar is parallel with the

11. Position the handlebar so that it is in straight ahead position by measuring from the extremities of the handlebar to a rear fixed point.



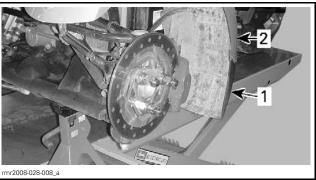
NOTE: The reference point must be the same on each side.

12. Tie handlebar to passenger footrests to prevent movement of the steering during align-



TYPICAL

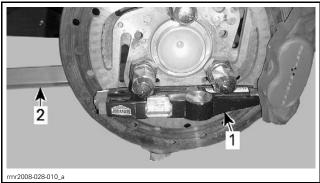
13. Remove each front fender mudguard.



TYPICAL - LH SIDE SHOWN

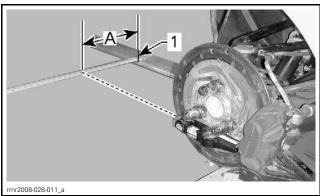
- Mudguard
 Front fender

14. Install the magnetic laser level on a brake disc.



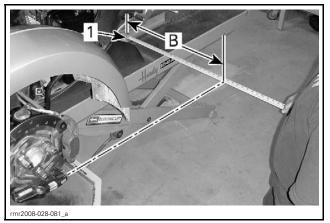
- TYPICAL
 1. Magnetic laser level
 2. Alignment bar
- 15. Using the tape measure (or meter), measure front and rear distances between alignment bar and laser level line at the marks on the alignment bar.

NOTE: Tape measure must be held perpendicular to alignment bar to obtain a precise measurement.



TYPICAL - FRONT MEASUREMENT SHOWN

- 1. Front mark on alignment bar
- A. Front distance



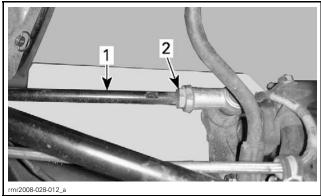
TYPICAL - REAR MEASUREMENT SHOWN

- 1. Rear mark on alignment bar
- B. Rear distance
- 16. Refer to the following chart for alignment specification.

MODEL	TOE-IN	
Spyder RT	$-10.5 \mathrm{mm} \pm 0.5 \mathrm{mm}$ (4134 in \pm .0197 in)	
Front distance (A) – rear distance (B) = toe-in		

NOTE: When subtracting distance B from A, the result must be **negative** (-) to obtain a toe-in alignment with no suspension compression.

- 17. To set alignment of each wheel:
 - 17.1 Hold the tie-rod with an open end wrench (on flat portions of tie rod) and loosen the lock nut at each tie-rod end.
 - 17.2 Adjust the tie-rod length by turning it until proper alignment specification is obtained.
 - 17.3 Torque tie-rod lock nuts to 34 N•m (25 lbf•ft).



- 1. Tie-rod
- 2. Tie-rod lock nut (one per tie-rod end)
- 18. Recheck the measurement after torquing tierod lock nuts.

- 19. Ensure both tie-rod ends on the same tie-rod are centered on their ball and not hard over in opposite directions.
- 20. Perform the steering angle reset. Refer to *SAS RESET* in this subsection.
- 21. Perform the torque offset reset. Refer to *TORQUE SENSOR RESET* in this subsection.

TROUBLESHOOTING

DPS FAULTS

FAULT	DPS BEHAVIOR			
SAS (steering angle sensor)				
YRS (yaw rate sensor)	Limp home mode is set.			
VSS				
ECM fault (GBPS)	Limp home mode is set.			
DPS				
Low battery voltage	When battery voltage is lower than 11.5 V, steering assist will gradual decrease. If battery voltage is below 8 Vdc, no steering assist who available.			

NOTE: When a fault is no longer active or has been repaired, turn ignition key OFF, then start engine to restart steering assist.

PROCEDURES

FRONT WHEEL

Front Wheel Removal

- 1. Place the vehicle on a level surface.
- 2. Apply parking brake.
- 3. Loosen wheel lug nuts.
- 4. Lift the front of vehicle.
- 5. Secure vehicle on jack stands. Position jack stands under lower suspension arms.

Remove lug nuts and wheel.

Front Wheel Installation

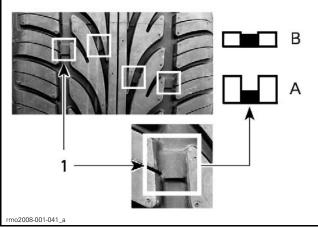
- 1. The installation is the reverse of the removal procedure.
- 2. Tighten wheel lug nuts to 105 N•m (77 lbf•ft).

FRONT TIRE

Front Tire Inspection

- 1. Check tire pressure. Check for air leaks (hissing sound) caused by a puncture, an ill-fitting rim, or a faulty tire valve.
- 2. Check tire for:
 - Cuts
 - Slits
 - Cracks.
- 3. Check sides of tire for:
 - Bumps
 - Bulges
 - Nails
 - Other foreign objects.
- 4. Check for minimum tread depth by using the tread-wear indicators. Check in three locations across the tire's tread:
 - Outer edge
 - Center
 - Inside edge.

The tread-wear indicators will appear across the treads that have been worn down to the minimum tread depth. When at least one tread-wear indicator appears across the tread, have the tire replaced as soon as possible.



- 1. Tread-wear indicator
- A. Appropriate tread depth
- B. Minimum tread depth, replace tire

It is normal to see uneven wear on tires depending on how the vehicle is driven and road conditions. The front tires outer or inner tread edges will wear unevenly depending on if the vehicle is driven smoothly or aggressively.

A WARNING

Do not hold the front wheel spoke while attempting to spin the front wheel as your fingers may be caught between the wheel and the brake caliper.

Front Tire Replacement

WARNING

The VSS on the vehicle has been calibrated to perform best with a tire of a specific size, material, and tread pattern. Replacing a tire with one not approved by BRP can cause the VSS to be ineffective.

To replace a front tire, carry out the following steps:

- 1. Remove front wheel from vehicle. Refer to *FRONT WHEEL*.
- Using an automotive tire changer (rim clamp type), remove the old tire and install the new one.

A WARNING

Tires used on this vehicle are only designed to rotate in one direction. Do not switch the left and right front wheels or tire direction of rotation will be reversed.

NOTE: Refer to manufacturer's instructions for tire changer operation.

- 3. Remove the old balancing weight(s) from the rim.
- 4. Clean inner side of wheel with alcohol to remove grease and dust.
- 5. Balance wheel using a wheel balancer.

NOTE: Refer to manufacturer's instructions for wheel balancer operation.

6. Install new balancing weight(s) inside wheel. Position them in the center of the flat inner surface of the rim.

NOTICE Improperly positioned weights can cause interference with the lower ball joint stud.

7. Reinstall wheel. Refer to FRONT WHEEL.

A WARNING

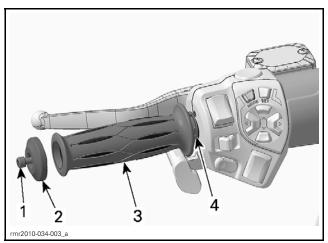
When installing new tires, always observe a break-in period of 300 km (200 mi). During this time, the tires and the VSS will not operate at their maximum efficiency. You could lose control and crash – use extra caution.

HANDLEBAR GRIP

NOTE: This vehicle uses heated handlebar grips. The LH grip may be replaced on its own however, the RH grip must be replaced with the throttle handle assembly, that includes the TAS (throttle accelerator sensor).

LH Handlebar Grip Removal

1. Remove handlebar end cap retaining screw, and remove end cap from handlebar.



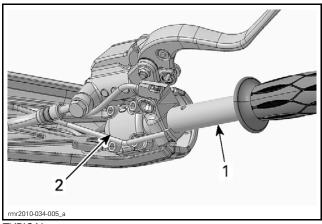
TYPICAL

- 1. End cap retaining screw
- 2. Handlebar end cap
- 3. Heated grip
- 4. Grip retaining screws (2)
- 2. Slightly pull back the raised shoulder of the rubber grip near LH multifunction switch, and remove the two grip retaining screws.



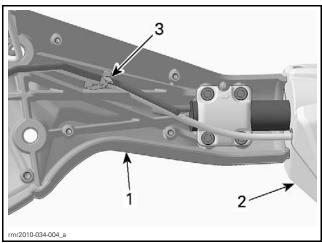
1. Grip retaining screws (2)

- 3. Remove the lower cover under the LH handlebar.
- 4. Remove the handlebar tube clamp and remove the tube from the handlebar.



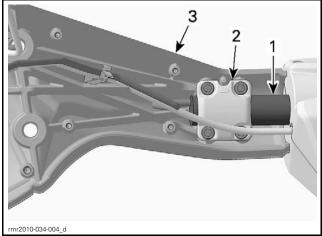
TYPICAL

- 1. Handlebar tube
- 2. Tube retaining clamp
- 5. Remove the heated grip wire harness from the retaining clip in the handlebar.



LH HANDLEBAR, LOWER COVER REMOVED

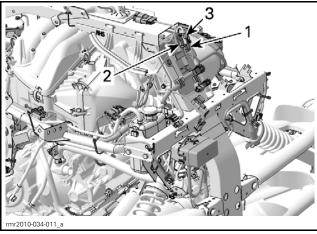
- 1. Handlebar
- 2. Multifunction switch
- 3. Retaining clip
- 6. Remove the handlebar tube from the handlebar by removing the screws that secure the tube retaining clamp.



- 1. Handlebar tube
- 2. Tube retaining clamp
- 3. Handlebar
- 7. Remove the required body parts to access electrical connectors for the heated grip. Refer to *BODY* subsection.

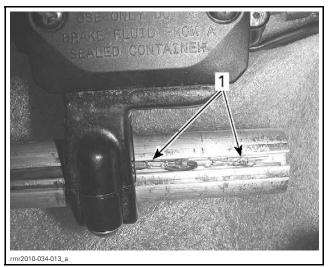
NOTE: The heated grip connectors are located under the instrument console at the end of the front frame member. Connectors may be accessed by removing the LH headlight or the console assembly.

8. Disconnect the LH heated grip connector.

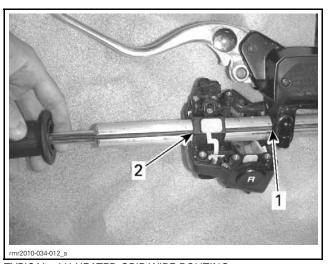


- 1. LH heated grip connector
- P. RH heated grip connector
- 3. Clutch lever switch connector (SM5 only)
- 9. Cut the locking-tie that secures the wire harness at the front of the upper frame member.
- 10. Attach a string of approximately 1.25 m (4 ft) to the wire harness to help feed the wires on the new grip through the upper frame member, and rubber seal under handlebar.
- 11. Pull the wire harness up to the handlebar.
- 12. Until the feed string from the wire harness.
- 13. Remove the connector housing from the heated grip wiring.
- 14. As you pull the grip off the handlebar, feed the grip electrical wires through the handlebar tube.

NOTE: To facilitate removal of the wire harness from handlebar tube, spray a light coat of CABLE LUBRICANT (P/N 293 600 041) in the groove provided in the handlebar tube. Align the connector pins end to end to route them through the multifunction switch housing and clutch lever housing (SM5 only). It is not necessary to remove the multifunction switch and clutch lever housings from the handlebar tube.



1. Connector pins end to end



TYPICAL - LH HEATED GRIP WIRE ROUTING
1. LH multifunction switch (cover removed)

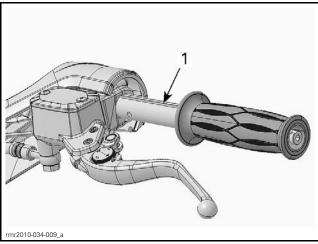
2. Brake lever housing (SM5 only)

LH Handlebar Grip Installation

1. Insert the heated grip wires in the handlebar.

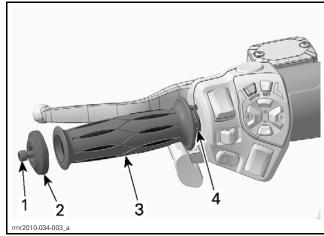
NOTE: To facilitate installation of the wire harness in the handlebar tube, spray a light coat of CABLE LUBRICANT (P/N 293 600 041) in the groove provided in the handlebar tube. Align the connector pins end to end to route them through the multifunction switch housing and clutch lever housing (SM5 only).

2. Position the grip on the handlebar tube with the heater wires properly aligned with the groove in the handlebar tube.



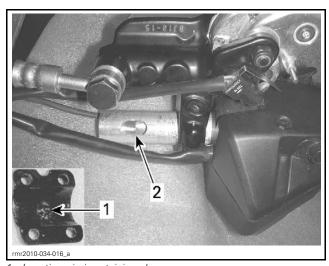
SM5 MODEL ILLUSTRATED, CLUTCH LEVER INSTALLED
1. Groove for heater wiring

- 3. Carefully insert the heated grip over the tube and simultaneously pull the wire harness through the groove provided in the tube.
- 4. Push the heated grip in until the retaining screw holes in the grip align with the holes in the handlebar tube.
- 5. Install the two grip retaining screws. Torque screws to 2.5 N•m (22 lbf•in).
- 6. Install the handlebar grip cap and torque retaining screw to 7 N•m (62 lbf•in).



- 1. Cap retaining screw
- 2. Handlebar end cap
- 3. Heated grip
- 4. Grip retaining screws (2)
- 7. Install the handlebar tube on the handlebar and **finger tighten** retaining screws at this time.

NOTE: A pin inside the tube retaining clamp inserts in a hole provided in the handlebar tube for proper location. The tube clamp is installed with the notch on its perimeter in line with a pin on the handlebar.

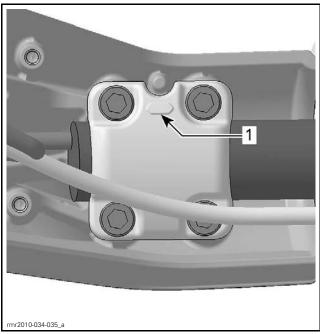


- Location pin in retaining clamp
 Oblong location hole in handlebar tube
- rm/2010-034-005_b
- 1. Notch facing alignment pin
- 8. Push the handlebar tube in until the multifunction switch makes contact with the handlebar.



- Multifunction switch to handlebar contact
- 9. Torque the tube retaining clamp to 10 N•m (89 lbf•in).

NOTE: Torque the clamp retaining screws indicated by an arrow on the clamp first (notch side), then torque the other screws. See following illustration.



TYPICAL - HANDLEBAR TUBE CLAMP

1. Torque screws indicated by this arrow first

- 10. Attach the feed string to the heated grip wire harness.
- 11. Using the feed string, pull the wires through the upper frame member.
- 12. Install heater wires in the connector housing as per following table.

LH FRONT HEATED GRIP WIRE CONNECTIONS				
WIRE	PIN NUMBER			
Light green/white	pin 1 (FLH-1)			
Light green/blue	pin 2 (FLH-2)			
Black	pin 3 (FLH-3)			

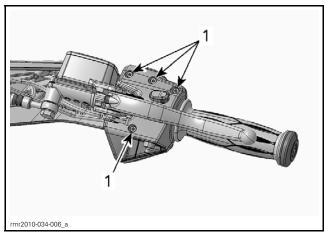
- 13. Ensure connector pins are properly locked in, then reconnect the heated grip connector to the vehicle harness connector.
- 14. Insert the heated grip and multifunction switch harnesses in the retaining clip provided in the handlebar.
- 15. Install the LH handlebar cover. Apply 1 N•m (9 lbf•in) to the 4 retaining screws.
- 16. Install a new locking-tie to secure wire harness at front of upper frame member.
- 17. Install console, refer to BODY subsection.

- 18. Start engine and test heated grip for proper operation.
- 19. Install all removed body parts, refer to *BODY* subsection.

MULTIFUNCTION SWITCH (LH)

LH Multifunction Switch Removal

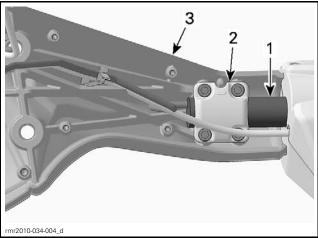
1. Remove the screws that secure the multifunction switch cover.



SM5 MODEL ILLUSTRATED

1. LH multifunction switch screws

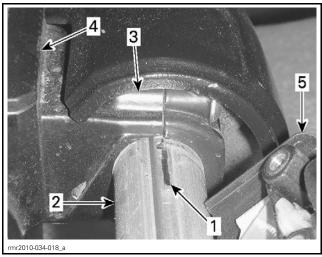
- 2. Separate the cover from the multifunction switch housing.
- 3. Remove the lower cover on the LH handlebar.
- 4. Remove the handlebar tube from the handlebar by removing its retaining clamp.



- 1. Handlebar tube
- 2. Retaining clamp
- 3. Handlebar
- 5. Remove the multifunction switch wire harness from the retaining clip within the handlebar.

SM5 Model

6. Using an ink marker, draw a reference line on the handlebar tube to mark the position of the clutch lever housing. It will be used to properly reposition the clutch lever housing on the handlebar tube for installation.



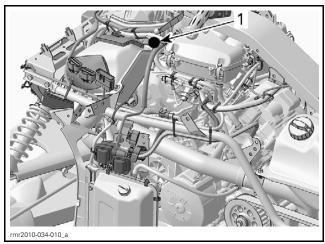
- 1. Ink reference line (clutch housing position)
- 2. Handlebar tube
- 3. Clutch housing
- 4. Clutch master cylinder
- 5. LH multifunction switch
- 7. Remove the clutch housing from the handlebar tube.

All Models

8. Remove the multifunction switch housing from the handlebar tube.

NOTE: If replacing multifunction switch assembly, continue with the following steps.

- 9. Remove the console assembly for access to the multifunction switch connectors. Refer to *BODY* subsection.
- Disconnect the LH multifunction switch connector and cut the locking-tie that secures the wire harness at the front of the upper frame member.



1. Connector location for LH multifunction switch

- 11. Attach a string of approximately 1.25 m (4 ft) to the wire harness to help feed the new wires though.
- 12. Remove the multifunction switch wire harness from the upper frame member leaving the feed string in its place.

LH Multifunction Switch Installation

The installation is the reverse of the removal procedure. However, pay attention to the following items.

1. Slide the multifunction switch housing onto the handlebar tube.

SM5 Model

2. Position clutch lever housing on the handlebar tube using the reference line, and install its retaining clamp.

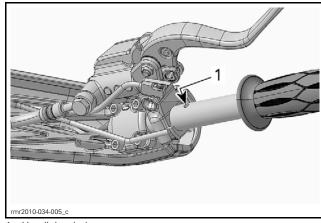
All Models

3. Align the locating pin in the multifunction switch cover with the hole provided in the handlebar tube.



LH MULTIFUNCTION SWITCH COVER

1. Alignment pin



1. Handlebar hole

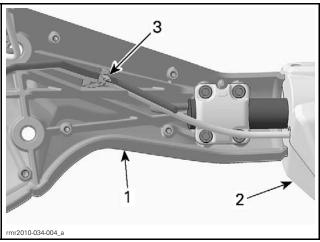
4. Install the multifunction switch cover. Torque retaining screws to 1 N•m (9 lbf•in)

NOTICE When installing the multifunction switch cover, ensure its alignment pin is inserted in the hole provided in the handlebar tube. Ensure wire harness exits the switch housing through the opening provided in the cover. Torque the lower retaining screw first.

5. Attach the feed string to the wire harness and carefully pull the wires though the upper frame member.

NOTICE Ensure proper routing of wire harness through the handlebar and upper frame member to prevent pinching, chaffing or other wire damage.

6. Secured harness in the retaining clip within the handlebar.

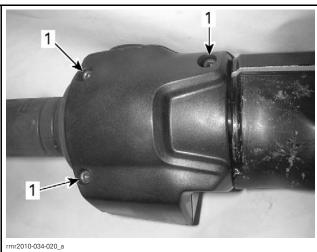


- 1. Handlebar
- 2. LH multifunction switch
- 3. Harness retaining clip
- 7. Secure wiring harness to the front frame member using a locking-tie as per factory specification.
- 8. Ensure wire harness does not hinder handlebar movement by turning handlebar in both directions.
- 9. Install console, refer to BODY section.
- 10. Test multifunction switch controls for proper operation of applicable systems.
- 11. Install all removed body parts, refer to the *BODY* subsection.

MULTIFUNCTION SWITCH (RH)

RH Multifunction Switch Removal

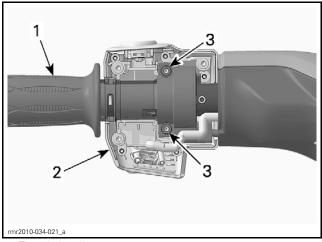
1. Remove the retaining screws from the LH multifunction switch cover.



RH MULTIFUNCTION SWITCH COVER
1. Retaining screws (x3)

2. Remove the multifunction switch cover.

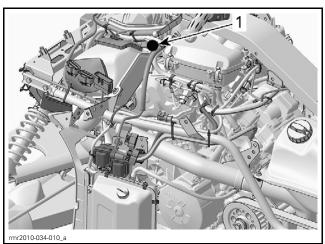
- 3. Remove the RH handlebar cover.
- 4. Remove the 2 screws that secure the multifunction switch housing to the throttle handle.



- 1. Throttle handle
- 2. RH multifunction switch housing
- 3. Retaining screws (2) for the multifunction switch housing
- 5. Remove the multifunction switch housing from the throttle handle, and its wiring harness from the retaining clip within the handlebar.

NOTE: If replacing multifunction switch assembly, carry on with following steps.

- 6. Remove the console assembly for access to the multifunction switch connector. Refer to *BODY* subsection.
- 7. Disconnect the RH multifunction switch connector.



- 1. Connector location for RH multifunction switch
- 8. Cut the locking-tie that secures the wiring harness at the front of the upper frame member.
- 9. Attach a string of approximately 1.25 m (4 ft) to the wire harness to help feed the new wires though the upper frame member.

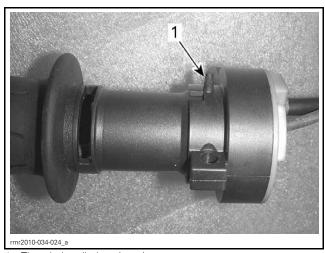
10. Remove the harness from the frame and handlebar leaving the feed string in its place.

RH Multifunction Switch Installation

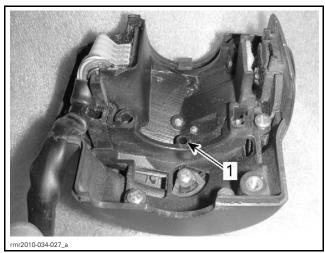
Installation is the reverse of the removal procedure. However, pay attention to the following.

1. Position multifunction switch over throttle handle

NOTE: For proper positioning of the multifunction switch housing with the throttle handle, a location pin is provided on the throttle handle that must insert in a hole provided in the multifunction switch housing.

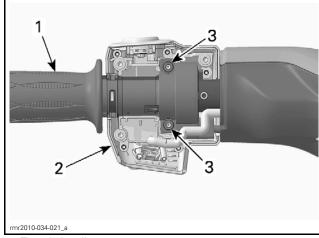


1. Throttle handle location pin

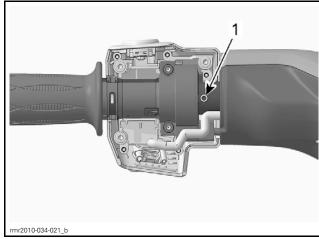


1. Location hole in multifunction switch housing

2. Install the two screws that retain the multifunction switch housing to the throttle handle. Torque screws to 1 N•m (9 lbf•in).

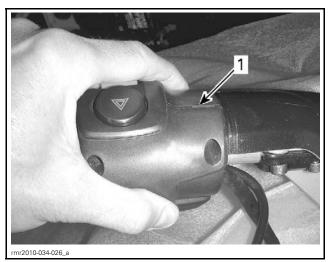


- 1. Throttle handle
- 2. RH multifunction switch housing
- 3. Switch housing retaining screws (2)
- 3. Hold multifunction switch cover over the switch housing.
- 4. Rotate the multifunction switch housing **counterclockwise** (approximately 1/4 turn) until its location pin can be inserted in the hole provided in the handlebar tube.



1. Location hole for multifunction switch in handlebar tube

NOTE: When the multifunction switch housing is rotated **counterclockwise** so the location pin inserts in the hole provided in the handlebar tube, the switch housing and its cover will properly mate together.



 Multifunction switch cover properly closed after switch housing rotation

5. Install cover retaining screws. Torque screws to 1 N•m (9 lbf•in).

NOTICE When installing the multifunction switch cover, torque the lower retaining screw first. Ensure wire harness exits the switch housing through the opening provided.

Carefully rotate throttle handle through its full range of motion, then release to ensure proper operation.

A WARNING

Always test throttle handle operation. Throttle handle must rotate smoothly and without restriction through it full range of motion, and return freely to its idle position when released.

If throttle does operate smoothly without restriction, or does not return freely to idle position, refer to *THROTTLE HANDLE INSTALLATION* in this subsection.

NOTE: If replacing multifunction switch assembly, carry on with following steps.

7. Attach the feed string to the wire harness and carefully pull the harness through.

NOTICE Ensure wiring harness is properly routed through the handlebar and upper frame member to prevent pinching, chaffing or other wire damage.

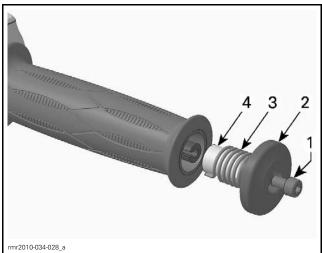
- 8. Secure harness in the retaining clip within the handlebar, and at the front of the upper frame using a locking-tie.
- 9. Reconnect the multifunction switch connector.

- 10. Install the handlebar cover and torque screws to 1 N•m (9 lbf•in).
- 11. Ensure wiring harness does not hinder handlebar movement by turning handlebar in both directions.
- 12. Install the console, refer to BODY subsection.
- 13. Test multifunction switch controls for proper operation of applicable systems.
- 14. Install all removed body parts, refer to the *BODY* subsection.

THROTTLE HANDLE

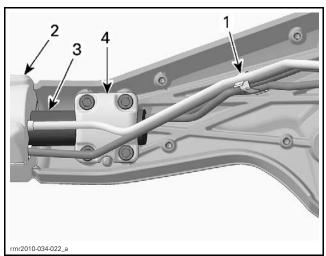
Throttle Handle Removal

- 1. Remove the RH multifunction switch from the throttle handle. Refer to *RH MULTIFUNCTION SWITCH REMOVAL* in this subsection.
- 2. To remove throttle handle, remove the items listed in the following illustration.



RH THROTTLE HANDLE REMOVAL

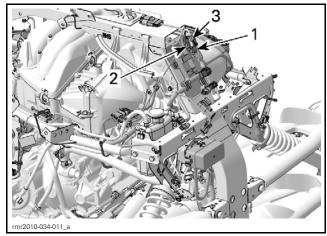
- 1. End cap screw
- 2. throttle handle return spring
- 3. Return spring sleeve
- 4. End cap
- 3. Remove the RH handlebar tube retaining clamp and remove the tube from the handlebar.



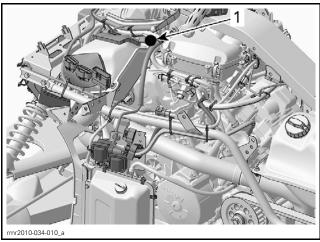
- 1. Harness retaining clip
- 2. RH multifunction switch
- 3. RH handlebar tube
- 4. Handlebar tube clamp
- 4. Pull the heated grip wiring from the groove in the handlebar tube as you remove the throttle handle from the handlebar tube.

NOTE: If replacing throttle handle, carry on with the following steps.

- 5. Remove the console assembly for access to the heated grip connector and the TAS connector (throttle accelerator sensor). Refer to *BODY* subsection.
- 6. Disconnect the RH heated grip.



- 1. LH heated grip connector
- 2. RH heated grip connector
- 3. Clutch lever switch connector (SM5 only)
- 7. Disconnect the TAS connector.



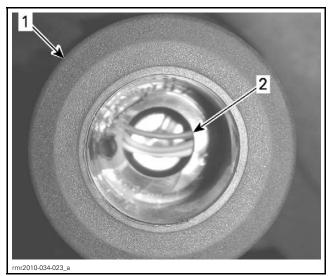
- 1. TAS connector location
- 8. Cut the locking-tie that secures the wiring harness at the front of the upper frame member.
- 9. Attach a string of approximately 1.25 m (4 ft) to the wire harness to help feed the new wires though.
- 10. Remove the harness from the handlebar and frame leaving the feed string in its place.

Throttle Handle Installation

- 1. Spray a light coat of CABLE LUBRICANT (P/N 293 600 041) in the groove provided in the handlebar tube for the heated grip wiring harness.
- 2. Align the throttle handle and heated grip wire harness with the groove in the handlebar tube.
- 3. As you slide the throttle handle on the handlebar tube, **carefully** pull the wire harness through the groove in the handlebar tube.
- 4. Ensure heated grip wiring is properly positioned in line and in the groove provided in the handlebar tube.

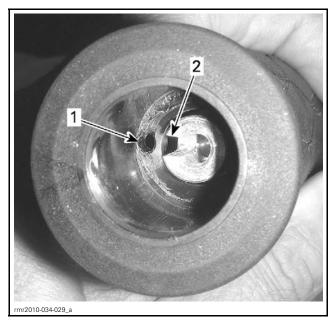
WARNING

Ensure heated grip wiring is not wrapped around handlebar tube, or caught on the end of the tube. Improper routing of heated grip wires will damage wires and prevent proper operation of the throttle handle.

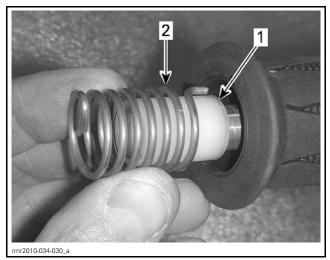


IMPROPER INSTALLATION

- Throttle handle
 Heated grip wires NOT PROPERLY ROUTED
- 5. Rotate the throttle handle forward (clockwise) to align the hole in the throttle handle with the slot at the end of the handlebar tube.

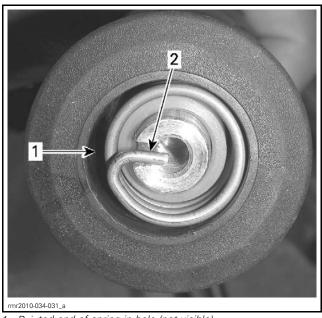


6. Insert the plastic sleeve in the throttle return spring, then insert the spring and sleeve in the throttle handle.



Plastic sleeve Return spring

NOTE: A small hole inside the throttle handle is provided for inserting the pointed end of the return spring, and a slot is provided in the handlebar tube for anchoring the folded end of the spring.



1. Pointed end of spring in handlebar tube slot
2. Folded end of spring in handlebar tube slot

- 7. As you hold the throttle handle steady, install the handlebar end cap, torque retaining screw to 1 N•m (9 lbf•in).
- 8. Slightly rotate throttle handle to ensure return spring is properly engaged.

NOTE: If no spring tension is felt, repeat previous steps to ensure proper engagement of return spring. If throttle is difficult to turn, the heated grip wiring may not be properly positioned, or is wrapped around the handlebar tube.

- 9. Install multifunction switch over throttle handle as described in RH MULTIFUNCTION SWITCH /NSTALLAT/ON in this subsection.
- 10. Carefully rotate the throttle handle a few times through its full range of motion to ensure it turns freely.

WARNING

Always test throttle handle operation. Throttle handle must rotate smoothly and without restriction through it full range of motion, and return freely to its idle position when released.

If throttle does not operate smoothly, freely, and without restriction, ensure heated grip wire harness is properly routed in throttle handle, and ensure multifunction switch is properly installed.

If throttle does not return freely to idle position, also check for proper engagement of throttle handle return spring.

NOTE: If replacing throttle handle, also carry out the following steps.

11. Attach the feed string to the throttle handle wiring harnesses and carefully route them through the handlebar and upper front frame member.

WARNING

Ensure wiring harness is properly routed through multifunction switch housing, handlebar, and upper frame member to prevent pinching, chaffing or other wire damage.

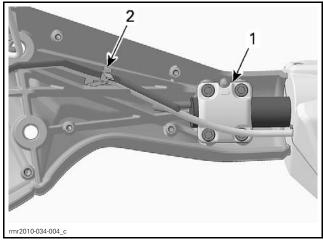
- 12. Secure harness in the retaining clip within the handlebar, and at the front of the upper frame using a locking-tie.
- 13. Reconnect the heated grip and TAS connectors to the vehicle harness.
- 14. Install the handlebar cover and torque screws to 1 N•m (9 lbf•in).
- 15. Ensure wire harness does not hinder handlebar movement by turning handlebar in both directions.
- 16. Install the console, refer to BODY subsection.
- 17. Install all removed body parts, refer to the BODY subsection.
- 18. Start vehicle and test for proper operation of throttle and heated grip.

HANDLEBAR

Handlebar Removal

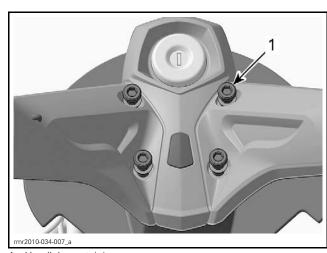
- 1. Remove the LH and RH handlebar covers.
- 2. Remove the clamps that secure both LH and RH handlebar tubes to the handlebar, and remove the wiring harnesses (LH and RH) from the retaining clips.

NOTE: This removes all controls from the handlebar without disassembling or disconnecting them.



TYPICAL - LH SE5 MODEL ILLUSTRATED

- Handlebar tube retaining clamp
- Handlebar tube retaining claim
 Wiring harness retaining clip
- 3. Remove the ignition switch from the handlebar, refer to IGNITION SYSTEM subsection.
- 4. Remove and discard the 4 handlebar retaining screws.



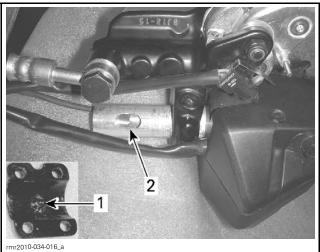
1. Handlebar retaining screws

Handlebar Installation

Installation is the reverse of the removal procedure however, pay attention to the following.

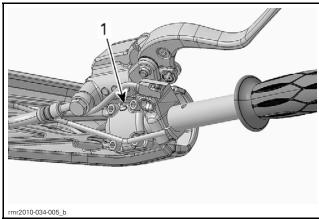
- 1. Install handlebar using **NEW** retaining screws. Torque screws to 38 N•m (28 lbf•ft).
- 2. Install ignition switch, refer to *IGNITION SYS-TEM* subsection.
- 3. Torque the screws retaining the central handlebar cover to 3.5 Nom (31 lbfoin).
- 4. Install the LH and RH handlebar tubes loosely.

NOTE: A pin in the handlebar tube retaining clamp inserts in an oblong location hole provided in the handlebar tube. The tube clamp is installed with the notch on its perimeter in line with a pin on the handlebar (LH and RH are opposite).



TYPICAL - LH SIDE ILLUSTRATED

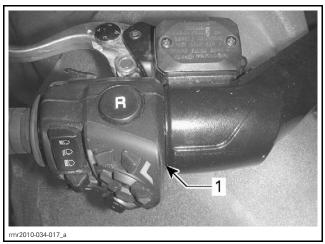
- 1. Location pin in retaining clamp
- 2. Oblong location hole in handlebar tube



TYPICAL - LH SIDE ILLUSTRATED

1. Notch facing alignment pin

5. Push handlebar grip inwards until the multifunction switch housing touches the handlebar..

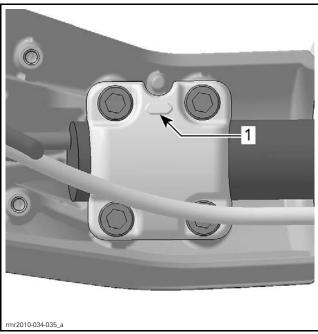


TYPICAL - LH SIDE ILLUSTRATED RH SIMILAR

1. Multifunction switch to handlebar contact

6. Torque the tube retaining clamp screws to 10 N•m (89 lbf•in).

NOTE: Torque the clamp retaining screws indicated by an arrow on the clamp first (notch side), then torque the other screws. See following illustration.



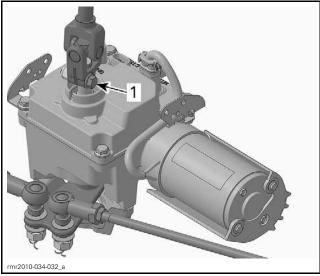
TYPICAL - LH HANDLEBAR TUBE CLAMP, RH SIMILAR BUT UPSIDE DOWN

- 1. Torque screws indicated by this arrow first
- 7. Properly route the wiring harnesses from the controls on the handlebars and insert them in the retaining clips provided in the handlebar.
- 8. Install the handlebar covers and torque retaining screws to 1 N•m (9 lbf•in)
- 9. Install all other removed parts, refer to applicable subsection.

STEERING COLUMN

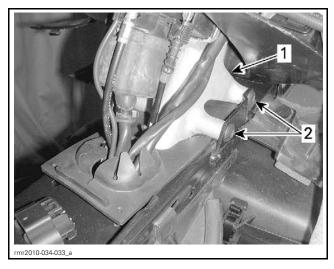
Steering Column Removal

- 1. Remove handlebar, refer to *HANDLEBAR RE-MOVAL* procedure in this subsection.
- 2. Remove body parts required to access DPS unit.
- 3. Remove the pinch bolt that secures the lower steering column U-joint to the DPS unit shaft, and discard elastic nut.



DPS UNIT

- 1. Lower steering column pinch bolt
- 4. Remove the 4 screws that secure the steering column support assembly to the frame.



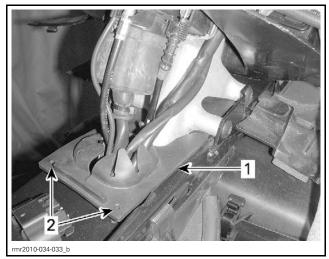
5. Pull the steering column out through top of frame.

Steering Column Installation

Installation is the reverse of the removal however, pay attention to the following.

- 1. Apply XPS SYNTHETIC GREASE (P/N 293 550 010) on steering column splines at lower U-joint.
- 2. Insert steering column in frame.
- 3. Index and insert the steering column splines onto the DPS shaft splines.
- Install lower steering column pinch bolt using a NEW elastic nut. Torque nut to 31 N•m (23 lbf•ft).
- 5. Align the steering column support with the bracket on the frame, and install its retaining screws. Tighten the front screws first, then tighten the rear screws. Toque screws to 24 N•m (18 lbf•ft).

NOTE: Ensure the rubber insulator under the steering support is properly positioned and that its retaining tabs are inserted in the frame before torquing support retaining screws.



- 1. Rubber steering column support insulator
- 2. Insulator retaining tabs (each corner)
- 6. Install all other removed parts, refer to applicable subsection.

STEERING COLUMN BUSHINGS

The steering column bushings must be replaced with the steering column support.

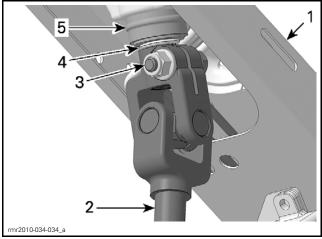
Steering Column Support Removal

1. Remove the steering column assembly from the vehicle. Refer to *STEERING COLUMN REMOVAL* procedure in this subsection.

- 2. Push up on the bellows just bellow the steering column support to expose the upper steering column pinch bolt.
- 3. Remove the pinch bolt that secures the lower steering column shaft to the upper steering column shaft.
- 4. Remove the bellows from the steering column support.
- 5. Remove the O-ring from the splines of the upper steering column. Discard the O-ring.
- 6. Pull the upper steering column shaft out of the column support.

Steering Column Support Installation

- 1. Apply XPS SYNTHETIC GREASE (P/N 293 550 010) to the bushing contact points on the upper steering column shaft and on the splines of the lower steering column U-joints.
- 2. Insert the upper steering column shaft in the column support.
- 3. Insert a **NEW** O-ring at the top of the splines on the upper steering column shaft.
- 4. Insert the bellows over the bottom end of the steering support, **Do not** install the locking-tie at this time.
- 5. Index and push the lower steering column onto the splines of the upper steering column shaft until the pinch bolt can be inserted through the grooved portion of the shaft.
- 6. Install a NEW elastic nut on the pinch bolt and torque nut to 31 Nom (23 lbfoft).
- 7. Position the bellows with the raised shoulder on the steering column support inside the groove provided within the small end of the bellows.



- Upper frame member
- 2. 3. Lower steering column shaft
- Upper U-joint pinch bolt
- Raised shoulder on steering column (bellows not illustrated)
- 8. Install a locking-tie on the grooved portion to properly secure the bellows.
- 9. Install the steering column, refer to STEERING COLUMN INSTALLATION in this subsection.
- 10. Install the handlebar and controls, refer to HANDLEBAR in this subsection.
- 11. Install the ignition switch, refer to IGNITION system subsection.
- 12. Install all other removed parts, refer to applicable subsection.
- 13. Perform the steering angle reset. Refer to STEERING ANGLE SENSOR in this subsec-
- 14. Perform the torque offset reset. Refer to TORQUE OFFSET RESET in this subsection.

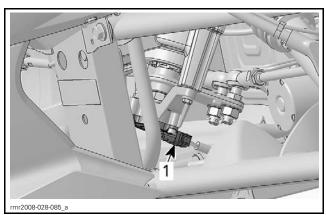
STEERING ANGLE SENSOR (SAS)

First, check for fault codes using the latest applicable B.U.D.S. software.

Before replacing the SAS, check the following.

SAS Input Voltage Test

Disconnect SAS connector and turn ignition switch ON.



TYPICAL - BOTTOM OF DPS UNIT 1. SAS connector

MULTIMETER PROBE POSITIONS	VOLTAGE
SAS connector (pin 1) and battery ground	
	Pottony voltogo
SAS connector (pin 2) and battery + terminal	Battery voltage

No voltage — Check wires and connector pins. Replace or repair defective parts and reset fault codes.

Battery Voltage measured — Check SAS communication link (CAN).

SAS CAN Communication Link (CAN) Continuity Test

- 1. Disconnect steering angle sensor connector.
- 2. Disconnect the vehicle diagnostic connector.
- 3. Set a FLUKE 115 MULTIMETER (P/N 529 035 868) to Ω selection and test SAS CAN bus wire continuity as per following table.

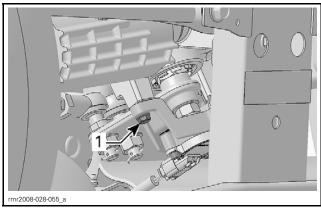


MULTIMETER PROBE POSITIONS	RESISTANCE @ 20°C (68°F)
SAS connector (pin 3) and diagnostic connector (pin 1)	
	Less than 1 Ω
SAS connector (pin 4) and diagnostic connector (pin 2)	Less than 1 12

Resistance is out of specification — Check wires and connector pins. Repair and reset fault codes. Resistance is good — Replace the steering angle sensor and reset fault codes.

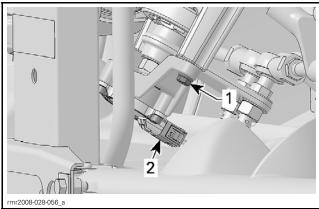
SAS Removal

- 1. Remove the front storage compartment. Refer to *BODY* subsection.
- 2. Remove screws retaining the SAS support to DPS.



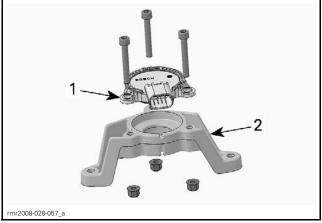
TYPICAL

- 1. RH SAS support screw
- 3. Disconnect the SAS connector.



TYPICAL

- LH SAS support screw
- 2. SAS connector
- 4. Remove SAS from its support.

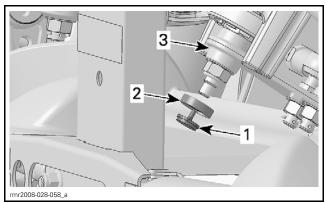


- 2. SAS support
- 5. Unscrew magnet from the DPS shaft using the MAGNET SOCKET (P/N 529 036 178).



NOTICE The SAS magnet is a sensitive and fragile part. Do not to drop it on a hard surface. Do not place it directly on metal parts. If the SAS magnet is dropped, knocked, or place on a metallic surface, replace it with a new one even if it appears in a good condition.

6. Remove and discard the seal.



- Magnet
- Magnet
 Seal
 Pitman arm

SAS Inspection

Inspect SAS support for cracks or other damages. Replace if necessary.

Inspect the magnet for cracks or other damages. Replace as required.

SAS Installation

- 1. Install a NEW seal.
- 2. Install the magnet and tighten it to 2 Nom (18 lbf•in) using the MAGNET SOCKET (P/N 529 036 178).



3. Clean the magnet using a clean rag to remove any metallic particle.

- 4. Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on threads of sensor support screws.
- 5. Tighten SAS support screws to 10 N•m (89 lbf•in).
- 6. Install all other parts removed, refer to applicable subsection.
- 7. Carry out the following SAS reset procedure.

DPS UNIT

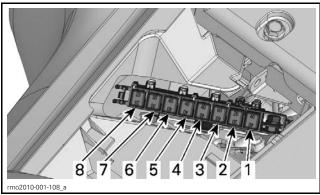
DPS Unit Troubleshooting

A diagnostic flow chart is inserted in the pocket of the back cover page of this manual.

Check for fault codes using the latest applicable B.U.D.S. software.

DPS Unit Fuse Inspection

Check the 40 A DPS motor fuse located in the rear fuse box under seat. Replace as required.

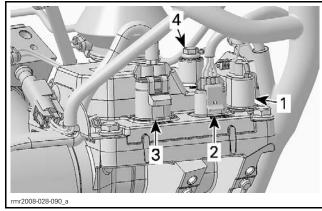


FUSE LOCATIONS, REAR FUSE BOX DPS motor fuse (F5

The 12 Vdc DPS control power comes from a 20 A fuse through MAIN Relay 2 (R3), both located in the front fuse box. This fuse supplies power to several systems including the multifunction gauge (cluster). If the cluster is powered, the fuse is good.

DPS Unit Circuit Test (Main Power)

1. Disconnect DPS main power connector.



- 1. DPS main power connector
- 2. DPS control connector
- B. DPS motor connector
- 4. DPS ground
- 2. Set multimeter to Vdc.
- 3. Turn ignition switch to ON.
- 4. Test for DPS motor circuit as per following table.

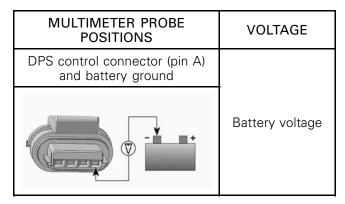
MULTIMETER PROBE POSITIONS	VOLTAGE
DPS power connector (pin A) and battery ground	
	Battery voltage
DPS ground and battery + terminal	
V	

No voltage — Check fuse 5 (40 A). If good, check wires and connector pins. Replace or repair defective parts and reset fault codes.

Voltage — Carry out a *DPS CIRCUIT TEST (CONTROL POWER)*.

DPS Unit Circuit Test (Control Power)

- 1. Disconnect DPS control power connector and turn ignition switch ON.
- 2. Test for DPS control power as per following table.



If there is no voltage. Check fuse F4 (5 A). If good, check wires and connector pins. Replace or repair defective parts and reset fault codes.

If there is voltage. Carry out a CONTINUITY TEST OF DPS UNIT COMMUNICATION LINK (CAN).

Continuity Test of DPS Unit Communication Link (CAN)

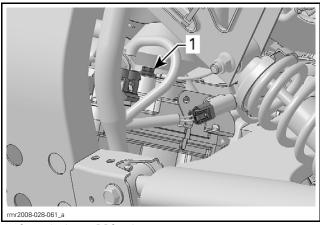
- 1. Set multimeter to Ω selection.
- 2. Disconnect DPS control connector.
- 3. Disconnect the vehicle diagnostic connector.
- 4. Test DPS CAN bus wire continuity as per following table.

ing table.	
MULTIMETER PROBE POSITIONS	RESISTANCE @ 20°C (68°F)
DPS control connector (pin C) and diagnostic connector (pin 1)	
	Polovy 1 O
DPS control connector (pin D) and diagnostic connector (pin 2)	Below 1 Ω

If resistance is out of specification. Check wires and connector pins. Repair and reset fault codes. If resistance is good. Replace the DPS unit and reset fault codes using the latest B.U.D.S. software.

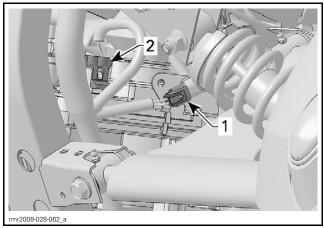
DPS Unit Removal

- 1. Remove the front storage compartment and console. Refer to the *BODY* subsection.
- 2. Remove the steering support mounting screws.
- 3. Remove the DPS unit ground wire.

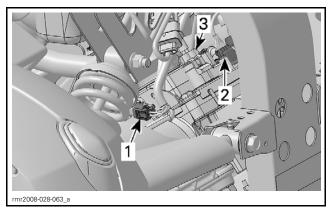


1. Ground wire on DPS unit

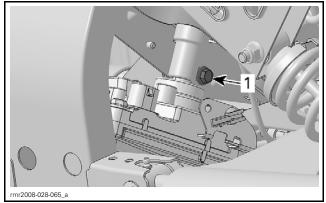
- 4. Remove the LH speed sensor connector c
- 5. Disconnect the DPS unit power connector.



- 1. LH speed sensor connector
- 2. DPS unit power connector
- 6. Remove the RH speed sensor connector from its mounting bracket.
- 7. Disconnect the DPS unit control and motor connectors.

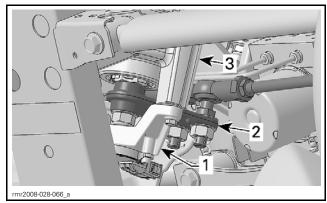


- RH speed sensor connector
- DPS unit control connector
- 3. DPS unit motor connector
- 8. Remove the pinch bolt securing the lower steering column to the DPS unit shaft.

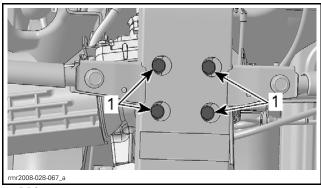


TYPICAL

- 1. Steering column bolt
- 9. Remove steering angle sensor (SAS) support from DPS unit.
- 10. Remove tie-rod ends from pitman arm.



- Steering angle sensor support
- Pitman arm
 DPS unit
- 11. Pull up on the steering column sufficiently to disconnect it from the DPS unit shaft.
- 12. Remove screws securing DPS unit to frame.



DPS screws

- 13. Pull upwards on the DPS unit toremove it from the frame.
- 14. If replacing the DPS unit, remove the SAS magnet from the DPS shaft, refer to SAS REMOVAL in this subsection.

DPS Unit Installation

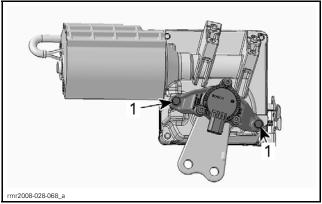
- 1. Install DPS unit on frame. Torque retaining screws to 28 Nom (21 lbfoft)
- 2. Apply XPS SYNTHETIC GREASE (P/N 293 550 010) on DPS unit splines.
- 3. Index and insert steering column splines on DPS shaft splines.
- 4. Install pinch bolt at lower end of steering column using a new elastic nut, and torque nut to 31 N•m (23 lbf•ft).
- 5. Install steering column support retaining screws, torque to 24 Nom (18 lbfoft).
- 6. Reconnect the DPS unit connectors.
- 7. Reconnect the DPS ground wire.
- 8. Install the LH and RH speed sensor connectors on their mounting brackets.
- 9. Install the SAS sensor and magnet, refer to SAS INSTALLATION in this subsection.
- 10. Install all other removed parts, refer to applicable subsection.
- 11. Perform a steering alignment to position handlebar in a straight ahead position. Refer to ADJUSTMENT at the beginning of this subsection.
- 12. Perform the steering angle reset. Refer to AD-JUSTMENT in this subsection.
- 13. Perform the torque offset reset. Refer to AD-JUSTMENT in this subsection.

PITMAN ARM

Pitman Arm Removal

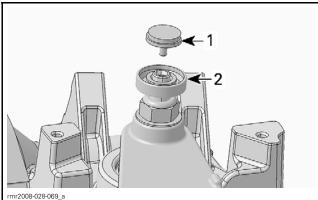
1. Remove DPS unit. Refer to DPS UNIT.

2. Remove the steering angle sensor (SAS) support from DPS unit.



- 1. SAS support screws
- 3. Remove magnet from the DPS shaft using MAGNET SOCKET (P/N 529 036 178).

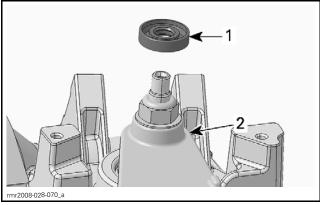




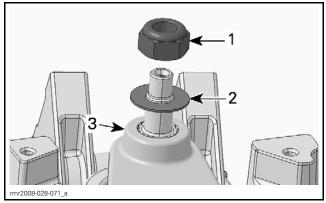
1. Magnet 2. Seal

NOTICE The magnet is a sensitive and fragile part. Do not to drop it on a hard surface and do not place it directly on metal parts. If magnet is dropped, knocked, or placed on a metallic surface, replace it with a new one even if it appears in a good condition.

4. Remove and discard the seal.



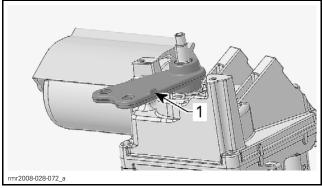
- Pitman arm
- 5. Remove pitman arm nut and washer.



- Pitman arm nut
- Pitman arm
 Washer
 Pitman arm
- 6. Using a puller, remove the pitman arm from DPS unit.

Pitman Arm Installation

- 1. Apply LOCTITE 767 (ANTISEIZE LUBRICANT) (P/N 293 800 070) on DSP shaft splines.
- 2. Install pitman arm on DPS shaft.



- 1. Pitman arm bump
- 3. Install washer and retaining nut.
- 4. Tighten nut to 63 N•m (46 lbf•ft).

- 5. Install a NEW seal.
- 6. Install the magnet using the MAGNET SOCKET (P/N 529 036 178) and tighten it to 2 N•m (18 lbf•in).

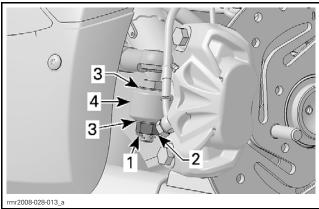


- 7. Clean the magnet using a clean rag to remove any metallic particle.
- 8. Install all other removed parts, refer to applicable subsection.
- 9. Perform steering alignment. Refer to ADJUST-MENT at the beginning of this subsection.
- 10. Perform the steering angle reset. Refer to STEERING ANGLE SENSOR in this subsection.
- 11. Perform the torque offset reset. Refer to TORQUE OFFSET RESET in this subsection.

TIE-ROD

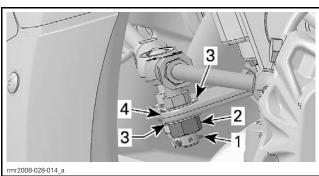
Tie-Rod Removal

- 1. Place vehicle on a level surface.
- 2. Apply parking brake.
- 3. Loosen wheel lug nuts.
- 4. Lift the front of vehicle on jack-stands.
- 5. Remove wheel.
- 6. From pitman arm and knuckle, remove:
 - Cotter pin (discard)
 - Tie-rod end nut
 - Hardened washers.



FROM KNUCKLE

- Cotter pin Tie-rod end nut
- Hardened washers
- Knuckle



FROM PITMAN ARM

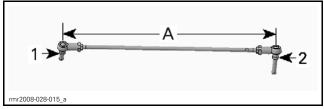
- Cotter pin
 Tie-rod nut
- Hardened washers
- 4. Steering column lever
- 7. Remove tie-rod from vehicle.

Tie-Rod Inspection

Inspect tie-rod ends for wear or excess play. If excessive, replace tie-rod end.

Tie-Rod Installation

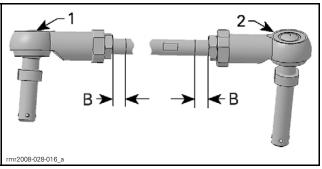
1. For the installation, reverse the removal procedure. However, pay attention to the following.



MAXIMUM LENGTH

- 1. Pitman arm side
- 2. Knuckle side
- A. $620 \, \text{mm} \pm 50 \, \text{mm} \, (24.5 \, \text{in} \pm 2 \, \text{in})$

TIE-l	ROD
Maximum length — dimension "A"	$620 \text{mm} \pm 50 \text{mm}$ (24.5 in ± 2 in)



UNENGAGED THREADS

- 1. Pitman arm side
- 2. Knuckle side

Step 1: B. 12 mm (.47 in)

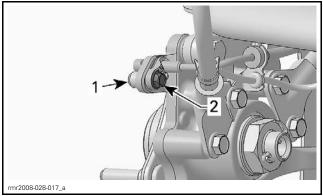
TIE-ROD				
Unengaged threads — dimension "B" *	12 mm (.47 in)			

- * Dimension "B" to be approximately equal upon assembly.
- 2. Tighten tie-rod lock nuts finger tight.
- 3. Install tie-rod on steering knuckle. Follow installation sequence as depicted in exploded view.
- 4. Torque tie-rod retaining nut to 63 N•m (46 lbf•ft).
- 5. Install **NEW** cotter pins. Both ends of cotter pins must be folded around nut.
- 6. Perform steering alignment. Refer to *ADJUST-MENT* at the beginning of this subsection.
- 7. Perform the steering angle reset. Refer to *STEERING ANGLE SENSOR* in this subsection.
- 8. Perform the torque offset reset. Refer to *TORQUE OFFSET RESET* in this subsection.

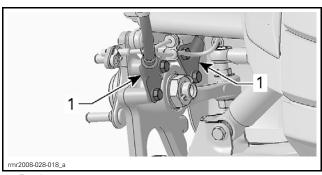
KNUCKLE

Knuckle Removal

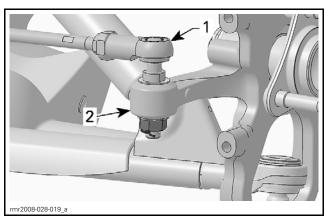
- 1. Place vehicle on a level surface.
- 2. Apply parking brake.
- 3. Loosen wheel lug nuts.
- 4. Lift the front of vehicle on jack-stands.
- 5. Remove wheel.
- 6. Remove brake disc and encoder wheel. Refer to *BRAKES* subsection.
- 7. Remove wheel speed sensor retaining screw.



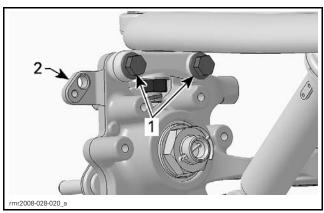
- 1. Wheel speed sensor
- 2. Wheel speed sensor screw
- 8. Unscrew fender supports.



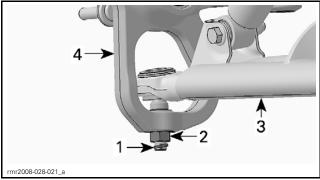
- 1. Fender supports
- 9. Remove tie-rod end from knuckle, refer to *TIE-ROD* in this subsection.



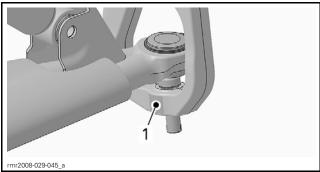
- 1. Tie-rod end
- 2. Knuckle
- 10. Remove upper ball joint support screws.



- 1. Ball joint support screws
- 2. Knuckle
- 11. Remove cotter pin and lower ball joint nut.



- 1. Cotter pin
- 2. Lower ball joint nut
- 3. Lower suspension arm
- 4. Knuckle
- 12. Separate lower ball joint from knuckle.



- 1. Hit here
- 13. Remove wheel hub and wheel bearing only if necessary.

Knuckle Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

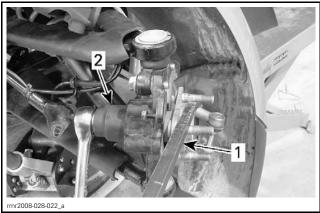
- 1. Tighten upper and lower ball joint nuts to 82 N•m (60 lbf•ft).
- 2. Install **NEW** cotter pins. Both ends of cotter pins must be folded around nut.

- 3. Install tie-rod ends as described in *TIE-ROD* in this subsection.
- 4. Perform steering alignment. Refer to *ADJUST-MENT* at the beginning of this subsection.
- 5. Perform the steering angle reset. Refer to *STEERING ANGLE SENSOR* in this subsection.
- 6. Perform the torque offset reset. Refer to *TORQUE OFFSET RESET* in this subsection.

WHEEL HUB

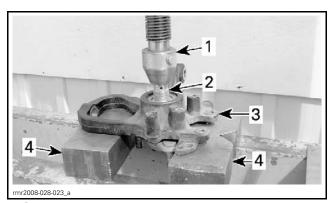
Wheel Hub Removal

1. Remove knuckle however, unscrew the wheel hub nut before removing ball joints from knuckle. Refer to *KNUCKLE* in this subsection for knuckle removal procedure.



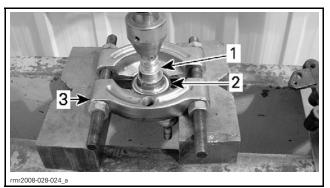
WHEEL HUB NUT REMOVAL

- 1. Prvba
- 2. 36 mm socket
- Using a press, remove wheel hub from knuckle. Support the knuckle properly to avoid damaging it.



- . Press
- 2. Wheel hub
- 3. Knuckle
- 4. Blocks to support knuckle
- 3. Wheel bearing must be replaced every time wheel hub is removed. Refer to WHEEL BEAR-ING further in this subsection.

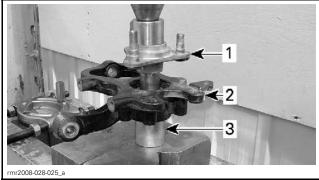
4. If the bearing inner race remains on the wheel hub shaft, use a press and a bearing separator to remove inner race.



- 1. Wheel hub
- 2. Bearing inner race
- Bearing separator

Wheel Hub Installation

1. Press wheel hub into bearing using the BALL JOINT INSTALLER (P/N 529 035 975) as a support. This tool will support the bearing inner race during wheel hub installation.



- 1. Wheel hub
- 2. Knuckle
- 3. Bearing inner race support
- 2. Before pressing wheel hub, ensure it is perfectly aligned.

NOTICE If the wheel hub is not aligned, wheel bearing will be damaged and its replacement necessary.

3. Install the knuckle and all other removed parts.

WHEEL BEARING

Wheel Bearing Inspection

- 1. Lift the front of vehicle on jack-stands.
- 2. Hold the wheel at the top and bottom and attempt to move it back and forth to check for looseness and lateral play in the bearing.

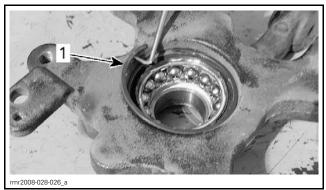
3. Rotate wheel and check for smoothness of rotation.

If there is any play or roughness of rotation, replace the wheel bearing.

NOTE: First, check if ball joints are loose. If necessary repair all defective parts before checking the wheel bearing condition. Be careful not to mistake play in a ball joint for a bad wheel bearing.

Wheel Bearing Removal

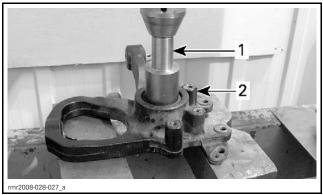
- 1. Remove *WHEEL HUB*. See procedure in this subsection.
- 2. Remove the circlip retaining the wheel bearing in the knuckle.



1. Circlip

3. Using a press and the CLUTCH COVER BEARING INSTALLER (P/N 529 036 095), remove the wheel bearing.

NOTICE Support the knuckle properly to avoid damaging it.



- 1. Clutch bearing installer
- 2. Knuckle

Wheel Bearing Installation

- 1. Place the **NEW** bearing in a freezer for 30 minutes before installing.
- 2. Clean all grease from outer and inner surfaces of knuckle.

- 3. Place knuckle in an oven at 100°C (212°F) for 30 minutes maximum to ease its installation.
- 4. Install the wheel bearing in the knuckle. Use a press if necessary.
- 5. When the knuckle is cold, install the circlip.
- 6. Install the other removed parts in the reverse order of removal, refer to applicable procedure in this subsection.
- 7. Perform the steering angle reset. Refer to *STEERING ANGLE SENSOR* in this subsection.
- 8. Perform the torque offset reset. Refer to *TORQUE OFFSET RESET* in this subsection.

SPYDER RT (SM5/SE5)

MODEL -			SPYDER RT		
			SM5	SE5	
ENGINE					
Engine type			ROTAX® 991, 4-stroke, 60° V-twin, Dual Over Head Camshaft (DOHC), liquid cooled		
Number of cylinders				2	
Number of valves				8	
Bore			97 mm	(3.82 in)	
Stroke			68 mm	(2.68 in)	
Displacement			998 cm ³	³ (60.9 in ³)	
Compression ratio			12	2.2:1	
	Type		Dry sump with separate	oil reservoir and oil cooler	
	Oil filter (eng transmission)	ine and	BRP Rotax papel	r type, replaceable	
	Engine oil pressure	Minimum	350 kPa (51 PSI) @ 5000 RPM	I / 80°C (176°F) oil temperature	
Lubrication		Capacity (oil change with engine filter)	3.9 L (4.1 qt (U.S. liq.))	4.2 L (4.4 qt (U.S. liq.))	
	Engine oil	Capacity (oil change with engine and HCM filters)	N.A.	4.3 L (4.5 qt (U.S. liq.))	
		Recommended	XPS synthetic blend oil (summer grade) (P/N 293 600 121) or a 40 semi-synthetic (minimum) or synthetic motorcycle oil meeting requirements for API service SL, SJ, SH or SG classification		
Exhaust system			2 into 1 with catalytic converter		
Air filter			Paper	element	
Intake valve opening			20° BTDC @ 1 mm (.04 in)		
Intake valve closing			40° ABDC @ 1 mm (.04 in)		
Exhaust valve opening			45° BBDC @ 1 mm (.04 in)		
Exhaust valve closing			5° ATDC @ 1 mm (.04 in)		
Valve clearance	Intake		0.11 mm to 0.18 mm (.0043 in to .0071 in)		
varvo dicaranco	Exhaust		0.22 mm to 0.29 mm (.0087 in to .0114 in)		
	Intake	New	5.961 mm to 5.975 mm (.2347 in to .2352 in)		
Valve stem diameter	iiitake	Service limit	5.950 mm (.2343 in)		
vaive steili ulailletei	Exhaust	New	5.946 mm to 5.960 mm (.2341 in to .2346 in)		
LXIIduSt		Service limit	5.935 mm (.2337 in)		
Valve out of round	Intake and	New	0.005 mr	n (.0002 in)	
vaive out of fourid	exhaust	Service limit	0.06 mm (.0024 in)		
Valve guide diameter			6.006 mm to 6.018 mm (.2365 in to .2369 in)		
varvo garao arameter		Service limit	6.050 mm (.2382 in)		

Subsection 01 (SPYDER RT (SM5/SE5))

MODEL			SPYDER RT	
MODEL			SM5	SE5
ENGINE (cont'd)				
		New	1.00 mm to 1.40 mm (.0394 in to .0551 in)	
V I	Intake	Service limit	1.60 mm (.063 in)
Valve seat contact width	E. I	New	1.25 mm to 1.55 mm (.0492 in to .061 in)	
	Exhaust	Service limit	1.80 mm (.0709 in)	
V 1 - PC - 1 - 1 - 1 - P	•	New	33.459 mm to 33.475 mm	(1.3173 in to 1.3179 in)
Valve lifter bucket diameter		Service limit	33.440 mm (1.3165 in)	
Valve lifter bucket radial cleara	ince	Service limit	0.08 mm (.	0031 in)
		New	39.24 mm (1.5449 in)
	Inner spring	Service limit	38.00 mm (·
Valve springs free length		New	41.97 mm (•
	Outer spring	Service limit	40.50 mm (·
-		New	96.940 mm to 96.950 mm	(3.8165 in to 3.8169 in)
	Size "1" / "A"	Service limit	96.920 mm (
Piston measurement		New	96.950 mm to 96.960 mm	•
	Size "2" / "B"	Service limit	96.930 mm (
		New	0.050 mm to 0.075 mn	•
Piston/cylinder clearance		Service limit	0.090 mm (
		1st	Upper compression ring, L-section	
Piston ring type		2 nd	Lower compression ring, taper-face	
5 /1		3rd	Oil scraper ring	
	All	New	0.15 mm to 0.35 mm (.0059 in to .0138 in)	
Ring end gap	All	Service limit	0.100 mm (.0039 in)	
	Upper compression ring	Service limit	0.120 mm (.0047 in)	
Ring/piston groove clearance	Lower compression ring	Service limit	0.120 mm (.0047 in)
	Oil scraper ring	Service limit	0.100 mm (.0039 in)
Cylinder bore	Size "1" / "A"	New	97.000 mm to 97.012 mm	(3.8189 in to 3.8194 in)
Cylinder bore	Size "2" / "B"	New	97.012 mm to 97.025 mm	(3.8194 in to 3.8199 in)
Camshaft bearing journal		New	23.967 mm to 23.980 mm (.9436 in to .9441 in)	
Callistrate Dearling Journal		Service limit	23.950 mm	(.9429 in)
Complete booring journal bara		New	24.007 mm to 24.020 mm (.9452 in to .9457 in)	
Camshaft bearing journal bore		Service limit	24.040 mm (.9465 in)	
Camshaft radial clearance		Service limit	0.060 mm (.0024 in)	
0	MAG side	Service limit	0.070 mm (.0028 in)
Crankshaft deflection	Clutch side	Service limit	0.040 mm (.0016 in)	
0 1 1 6 1 1 1		New	41.979 mm to 42.010 mm	
Crankshaft pin diameter		Service limit	41.960 mm (1.652 in)	

Subsection 01 (SPYDER RT (SM5/SE5))

MODEL			SPYDER RT	
			SM5	SE5
ENGINE (cont'd)				
Connecting rod big end diamet (with plain bearings)	er	Service limit	42.080 mm (1.6567 in)	
Connecting rod big end radial pl	av	New	0.020 mm to 0.045 mm (.0008 in to .0018 in)	
connecting for big end radial pi	lay	Service limit	0.070 mm	(.0028 in)
Connecting rod small end diame	otor	New	22.010 mm to 22.020 mm (.8665 in to .8669 in)	
oomiceting roa sman ona alamo	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Service limit	22.030 mm (.8673 in)	
Piston pin diameter		New	21.997 mm to 22.000 r	nm (.866 in to .8661 in)
Tioton pin diamotor		Service limit	21.990 mn	n (.8657 in)
CLUTCH				
Туре			Wet clutch, multi-plate, hydraulic operation (pneumatic assist)	Centrifugal clutch + wet multi-plate clutch, automatically controlled by the TCM
Clutch fluid	Recommended		Brake fluid DOT 4	Use engine oil for lubrication
Ciuteii iiuiu	Capacity		60 ml (2 U.S. oz)	Ose engine on for tubrication
Clutch spring free length		Service limit	58.00 mm (2.283 in)	
Clutch plate assembly (friction and steel driven plates)	thickness	Service limit	44.90 mm (1.768 in)	
Friction and steel driven plate w	/arpage	Service limit	0.15 mm (.0059 in)	
Centrifugal clutch speed		Engagement	N.A.	2000 ± 200 RPM
ochtmagar cratori spoca		Stall	N.A.	3200 ± 200 RPM
GEARBOX				
Туре			Sequential manual 5-speed (SM5) with reverse	Sequential electronic 5-speed (SE5) with reverse
Primary reduction gear ratio			60	/31
		1 st	32/14	
		2 nd	29/17	
Gear ratio		3rd	26/19	
dodi Tatio		4th	26/23	
		5 th	24/25	
		Reverse	36/14	
Shift fork claw thickness		Service limit	3.90 mm (.1535 in)	
Width of shift fork engagement		Service limit		(.1772 in)
	1st, 2nd and 3rd	Service limit	29.035 mm (1.143 in)	
Free pinion bore diameter	4 th	Service limit	29.125 mm (1.1467 in)	
5 th Reverse		Service limit	26.025 mm (1.0246 in)	
		Service limit	40.040 mm (1.5764 in)	
MAG side		↓ ↓	34.975 mn	n (1.377 in)
Main shaft journal diameter	Free pinion bearing	Service limit 24.970 mm (.9831 in)		n (.9831 in)
	Clutch side		19.970 mm (.7862 in)	

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Subsection 01 (SPYDER RT (SM5/SE5))

MODEL		SPYDER RT			
MODEL		SM5	SE5		
ENGINE (cont'd)					
Clutch shaft journal diameter	MAG side	Service limit	19.970 m	m (.7862 in)	
	Free pinion bearing 4 th	Service limit	29.030 mm (1.1429 in)		
	Free pinion bearing 5 th	Service limit	21.970 mm (.865 in)		
	Clutch side Service limit		29.965 mm (1.1797 in)		
COOLING SYSTEM					
Туре			·	radiator with cooling fan	
Coolant	Туре		Ethyl glycol/water mix (50% coolant, 50% water). Use premixed coolant sold by BRP (P/N 219 700 362) or coolant specifically designed for aluminum engines		
	Capacity		3.2 L (3.4 qt (U.S. liq.))		
Thermostat	Opening temperature	Opening		75°C (167°F)	
Radiator fan			102°C (216°F)		
Radiator cap opening pressure			90 kPa (13 PSI)		
ELECTRICAL SYSTEM					
Magneto generator output			650 W @ 6000 RPM		
Ignition system type			Electronic ignition with dual output coil		
Ignition timing			Electronically controlled, not adjustable		
	Quantity		2		
Spark plug	Make and type		NGK DCPR9E (apply heat-sink paste P12 (P/N 420 897 186) on spark plug thread)		
	Gap		0.7 mm to 0.8 mm (.028 in to .031 in)		
Engine RPM limiter setting	Forward		9500 RPM		
	Туре		Maintenance free		
Battery	Model		Yuasa YTX24HL-BS		
Dattery	Voltage		12 V		
	Nominal rating		21A∙h		
Headlight			Halogen, 2 x 55 W CE Models: Halogen, 4 x 60 W		
Fog light (Spyder RTS)		Halogen, 2 x 35 W			
Taillight/brake light		2 x 2.25 W			
Turn signal lights	Front		2 x 4.5 W		
Turn signal lights	Rear		2 x 20 W		
Position lights		2 x 5 W			
License plate light		5 W			
Backup light		2 x 20 W			
Day light (Spyder RTS)		0.5 W			
Front storage compartment ligh	nt (Spyder RTS)		0.2 W		

Subsection 01 (SPYDER RT (SM5/SE5))

MODEL		SPYDER RT		
		SM5	SE5	
ELECTRICAL SYSTEM (cont'd)				
Fuses (under seat)	Accessories	40	A	
	TCM valves	N.A.	20 A	
	Rectifier 60 A		A	
	Main fuse	40	A	
	Dynamic Power Steering (DPS) motor	40	А	
	VSS pump	40	40 A	
	leadlights 30 A		Α	
	VSS valves	25	25 A	
	Lights: tail, position, plate & day Vbat: Cluster, VIM & DLC	15	А	
	Vbat Control: main relays Vkey: SAS, YRS, VCM, ECM, D.E.S.S., PRS & MSR	10	А	
	Vbat: Main relay Vrelayed: WPM, CL, FG, CTG, PBS pilot light, TCM, DPS		A	
	Vbat: Cooling fan relay	15	15 A	
	Vbat: Hazard, brake light switch	10	А	
Fuses (under the service center behind	Vbat: radio (XM, CB, GPS, iPOD)	15	Α	
the front storage compartment)	Vbat: Backup actuator & trailer module	10	A	
	Vbat: Horn, shedding relay Vrelayed: suspension relay, heated grips, HA, LED Pilot lights: CSS, FHS, FGS	20	А	
	Vbat: Accessory plugs	10	A	
	Vrelayed: ECM	5	5 A	
	Vrelayed: Injectors & ignition coils	15	А	
	Vrelayed: HO2S1 & 2, EVAP, CAPS, fuel pump motor, CSV, pre-starting relay	15	15 A	
FUEL SYSTEM				
Fuel delivery	Type Multi-point Electronic Fuel Injunction With ETC (Electronic Throttle Dual throttle body (51 mm) with		ic Throttle Control)	
Fuel pump	Туре	Electrical modu	Electrical module in fuel tank	
ruer pump	Operating pressure	350 kPa	(51 PSI)	
Idle speed		1400 RPM ± 100	1400 RPM ± 100 (not adjustable)	

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Subsection 01 (SPYDER RT (SM5/SE5))

MODEL		SPYDER RT			
MODEL		SM5	SE5		
FUEL SYSTEM (cont'd)					
		MINIMUM OCTANE RATING			
Fuel	Туре		Regular unleaded gasoline		
		Inside North America	87 (R+M)/2		
	Octane rating	Outside North America	92 RON		
			TANE RATING (OPTIMUM PERFORMANCE)		
	Туре		Premium unleaded gasoline		
		Inside North America	91 (R	+M)/2	
	Octane rating	Outside North America	95 RON		
Fuel tank capacity	l	7 unoriou	25 L (6.6	U.S. gal.)	
DRIVE SYSTEM				_	
F	Туре		Drive belt		
Final drive	Ratio		28,	28/79	
D: 1.1	Material		Carbon reinforced		
Drive belt	Tension (with re	ear wheel lifted)	750 N ± 250 N (169 lbf ± 56 lbf)		
Final drive ratio		2.8:1			
STEERING					
Turning radius			4.84 m (15.9 ft)		
Total toe-in (vehicle on gro	und)		$-10 \text{ mm} \pm 0.5 \text{ mm} (394 \text{ in} \pm .02 \text{ in})$		
Camber angle		0° ± 0.5°			
Tie-rod maximum length unengaged threads		12 mm (.4724 in) maximum			
Tie-rod maximum length		595 mm (23.43 in)			
SUSPENSION					
FRONT					
Suspension type			Double suspension arm with anti-roll bar		
Suspension travel			151 mm (5.9 in)		
Shock absorber	Oty		2		
	Туре		Oil damper		
Spring free length		250.5 mm ± 3 mm (9.9 in ± .1 in)			
Spring preload adjustment		5 position cam adjustment			
REAR					
Suspension type	Suspension type		Air pressure Swing arm with single shock		
	Spyder RT/Aud Convenience Pa		Adjustable air pressure: 69 kPa to 689 kPa (10 PSI to 100 PSI)		
Preload adjustment	Spyder RTS		Air Controlled Suspension (ACS) Compressor-controlled air suspension with 5 customized positions		

Subsection 01 (SPYDER RT (SM5/SE5))

	ADE!	SPYDER RT		
MODEL		SM5	SE5	
SUSPENSION (cont'd)				
Suspension travel		145 mm	n (5.7 in)	
Charle shoothar	Oty	1		
Shock absorber	Туре	Oil damper		
Spring free length		100 mm (3.9 in)		
Spring color code		Gold/Black/Gold		
BRAKES				
Туре		Foot-actuated. Fully integrated hydraulic 3-wheel braking system with ABS and EBD		
Front brake		Dual discs of 250 mm (9.8 in) with 4 piston calipers		
Rear brake		Single disc of 250 mm (9.	8 in) with 1 piston caliper	
Brake fluid	Capacity	530 ml (17	7.9 U.S. oz)	
DIAKE HUIU	Туре	DO	T 4	
Parking brake		Mechanical, electrically a	ctuated to the rear caliper	
Caliper	Front	4 piston	s caliper	
Calipei	Rear	Single piston. SI	liding pins caliper	
Brake pad material	Front	Org	anic	
brake pau material	Rear	Organic		
linimum brake pad thickness		1 mm (.04 in)		
Minimum brake disc thickness	Front/rear	5.33 mm (.21 in)		
Maximum brake disc warpage		0.12 mm (.005 in)		
TIRES AND WHEELS				
TIRES				
Type (use BRP recommended	Front	MC 165/65R14 47H (special motorcycle type		
tires)	Rear	MC 225/50R15 76H (special motorcycle type)		
	Front	Minimum: 89 kPa (13 PSI) (0.89 bar)		
Pressure	TTOTIC	Maximum: 117 kPa (17 PSI) (1.17 bar)		
i i e a a ui e	Rear	Minimum: 179 kPa (26 PSI) (1.79 bar)		
	Heal	Maximum: 207 kPa (30 PSI) (2.07 bar)		
Minimum tire thread depth	Front	2.5 mm	(3/32 in)	
Trimmain the throad dopth	Rear	4.0 mm	(5/32 in)	
WHEELS				
Size	Front	14 in x 5 in		
	Rear	15 in x 7 in		
Front wheel nuts torque		105 N∙m (77 lbf∙ft)		
Rear drive axle nut torque		130 N•m	(96 lbf•ft)	
DIMENSION				
Overall length		2 667 mm (105 in)		
Overall width		1 572 m	m (62 in)	
Overall height	Windshield in upper position	1 600 mm (63 in)		
	Windshield in lower position	1 510 mm (59.5 in)		
Seat height		780 mm ± 10 mr	m (30.7 in ± .4 in)	

Subsection 01 (SPYDER RT (SM5/SE5))

MODEL		SPYDER RT		
		SM5	SE5	
DIMENSION (cont'd)	•			
Wheel base		1 708 mm (67 in)		
Front wheel track		1 384 mm (54.5 in)		
Ground clearance (front and ι	under engine)	115 mm (4.5 in)		
WEIGHT AND LOADING CA	APACITY			
	Spyder RT	400 kg (882 lb)		
Dry weight	Spyder RT Audio & Convenience Package	413 kg (911 lb)		
	Spyder RTS	422 kg (930 lb)		
Front storage compartment	Capacity	55 L (14.5 U.S. gal.)		
	Maximum load	16 kg (35 lb)		
Glove box	Capacity	1.8 L (.5 U.S. gal.)		
	Maximum load	2 kg (4 lb)		
Side storage compartment	Capacity	23.5 L (6.2 U.S. gal.)		
	Maximum load	7 kg (15 lb)		
Roar storago compartment	Capacity	40.5 L (10.7 U.S. gal.)		
Rear storage compartment	Maximum load	9 kg (20 lb)		
Total vehicle load allowed (in and added accessories)	cluding operator, passenger, cargo	240 kg (529	5 lb)	
Gross vehicle weight rating (0	GVWR)	663 kg (1,46	62 lb)	
Maximum weight on trailer tongue		18 kg (40 lb)		
Maximum towed weight (trailer and cargo)		180 kg (400 lb)		

