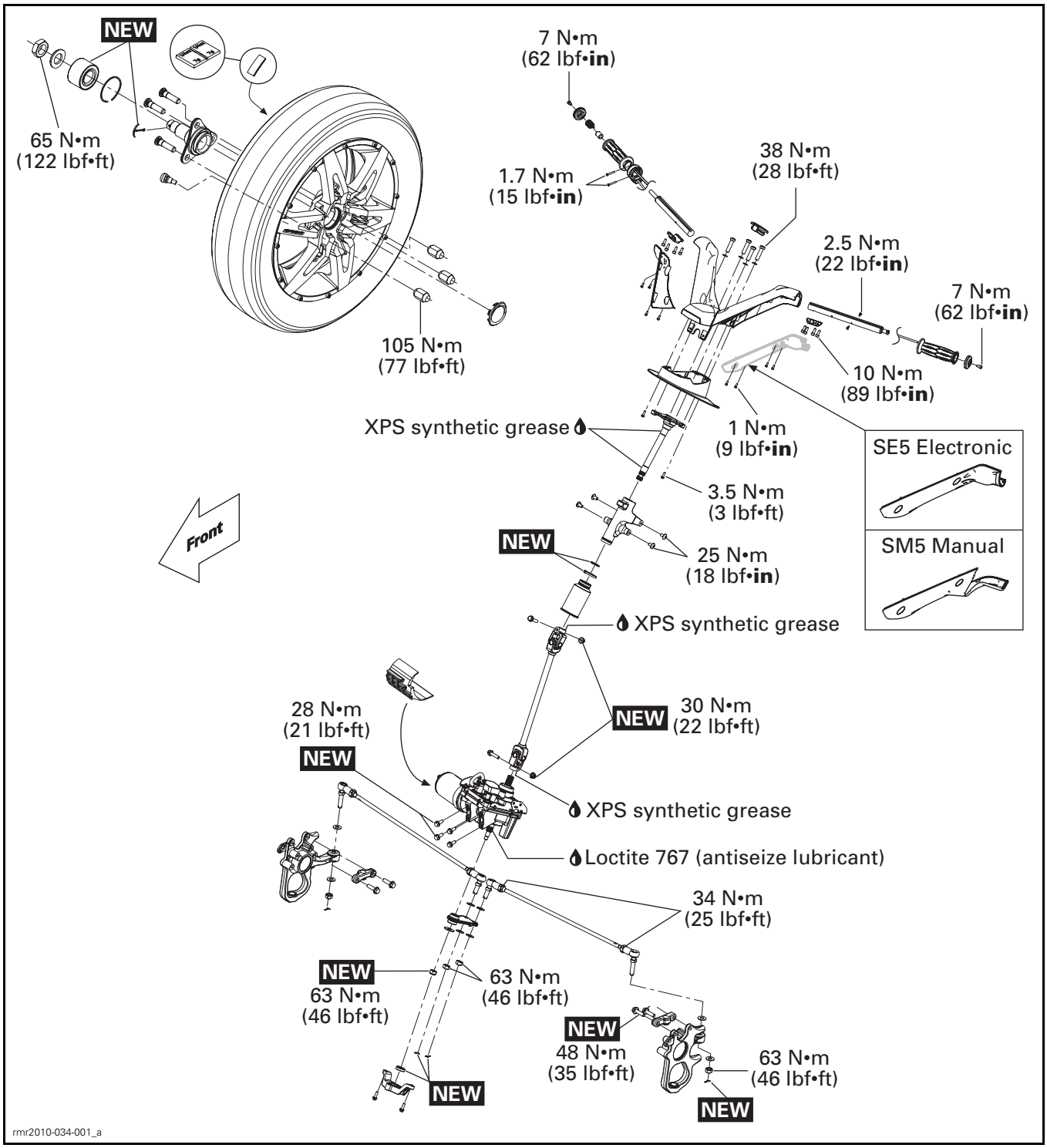
STEERING (DPS) AND WHEELS

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	26, 30–31

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


NEW
65 N•m
(122 lbf•ft)
7 N•m
(62 lbf•in)
1.7 N•m
(15 lbf•in)
38 N•m
(28 lbf•ft)
2.5 N•m
(22 lbf•in)
7 N•m
(62 lbf•in)
105 N•m
(77 lbf•ft)
10 N•m
(89 lbf•in)
XPS synthetic grease
1 N•m
(9 lbf•in)
SE5 Electronic
3.5 N•m
(3 lbf•ft)
SM5 Manual
Front
NEW
25 N•m
(18 lbf•in)
XPS synthetic grease
28 N•m
(21 lbf•ft)
NEW
30 N•m
(22 lbf•ft)
NEW
XPS synthetic grease
Loctite 767 (antiseize lubricant)
34 N•m
(25 lbf•ft)
NEW
63 N•m
(46 lbf•ft)
63 N•m
(46 lbf•ft)
NEW
48 N•m
(35 lbf•ft)
63 N•m
(46 lbf•ft)
NEW
NEW
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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.

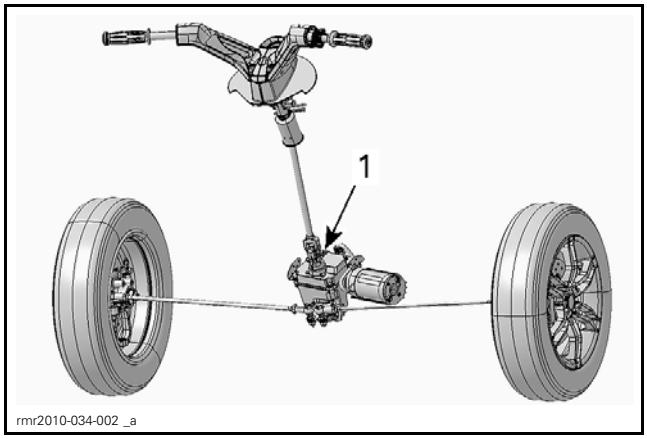
⚠ WARNING

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.

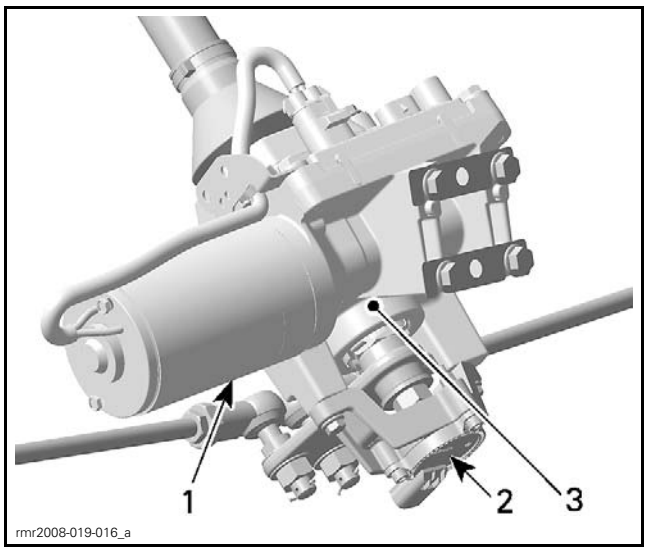
When the vehicle is operated in reverse, power steering assist will decrease as vehicle speed increases.

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
1. DPS motor
2. Steering angle sensor
3. 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

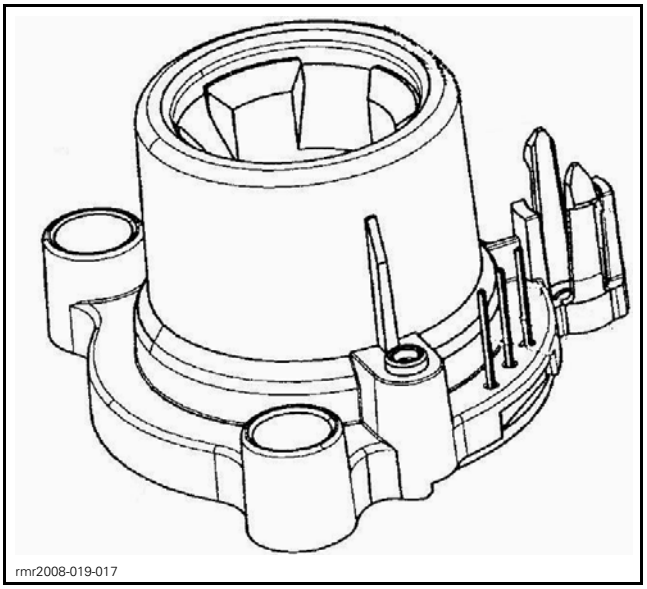
To protect the DPS electronic components, the steering assist behavior will change as follows.

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 decrease.
DPS internal board temperature is above 75°C (167°F)	
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



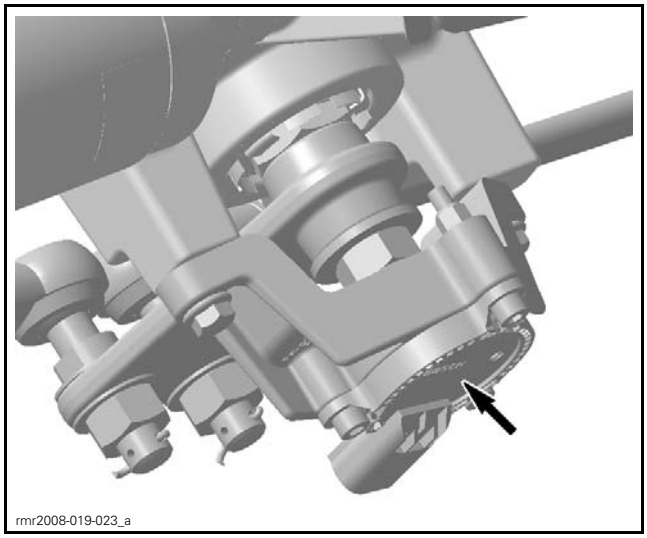
TYPICAL - STEERING TORQUE SENSOR

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.

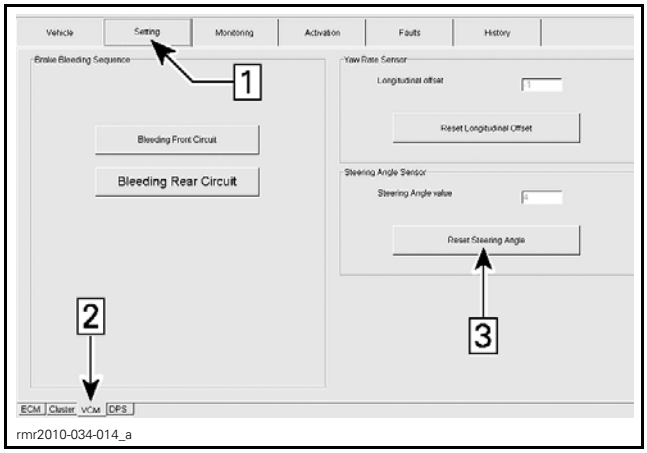
PART ADJUSTED OR REPLACED	WHAT TO DO
– DPS unit – Steering column support – Upper or lower steering column shaft – Pitman arm – Tie rod – Tie rod end – Knuckle – Wheel bearing – Ball joint – Front suspension arm (lower/upper) – Steering alignment	1. Perform a *STEERING ALIGNMENT* 2. Carry out an *SAS RESET* 3. Carry out a *TORQUE SENSOR RESET*
– Steering Angle Sensor (SAS)	Carry out an *SAS RESET*

SAS RESET

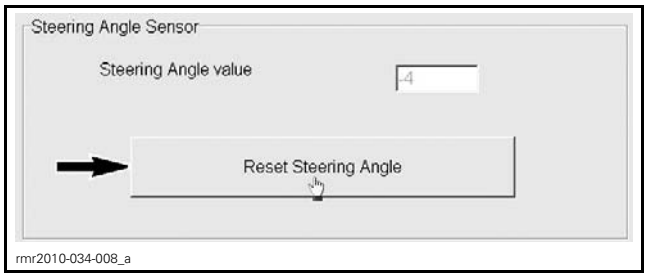
1. Perform a steering alignment to position handlebar in a straight ahead position. Refer to *STEERING ADJUSTMENT* in this subsection.
2. Connect vehicle to the latest B.U.D.S. software, refer to *COMMUNICATION TOOLS AND B.U.D.S. SOFTWARE* subsection.
3. In B.U.D.S., click on the **Read Data** button.
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

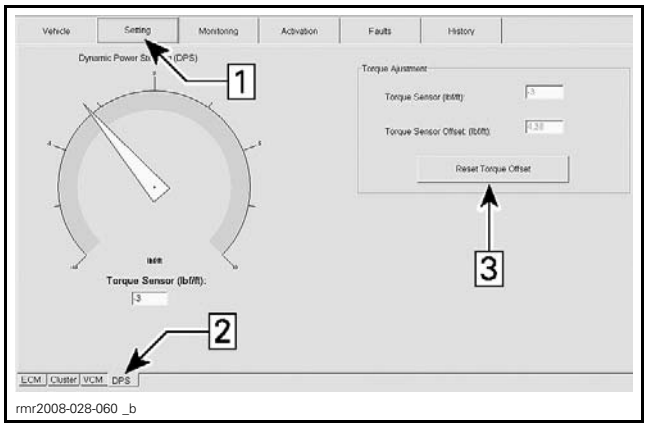
TORQUE SENSOR RESET

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 input.

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.
5. 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

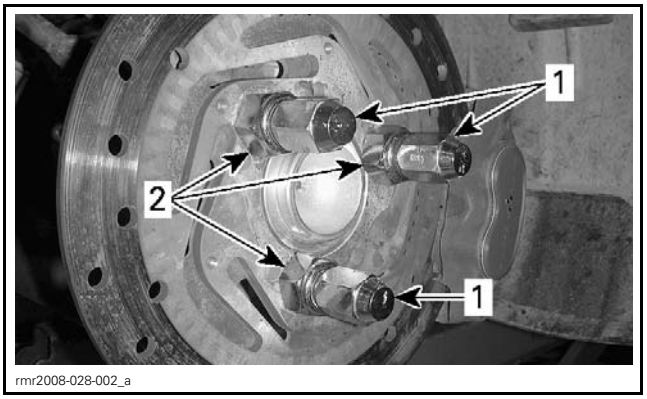
1. To perform the steering alignment procedure, ensure you have the following items close at hand:
   – An assistant
   – A 2.44 m (8 ft) aluminum angle (alignment bar)

- 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.

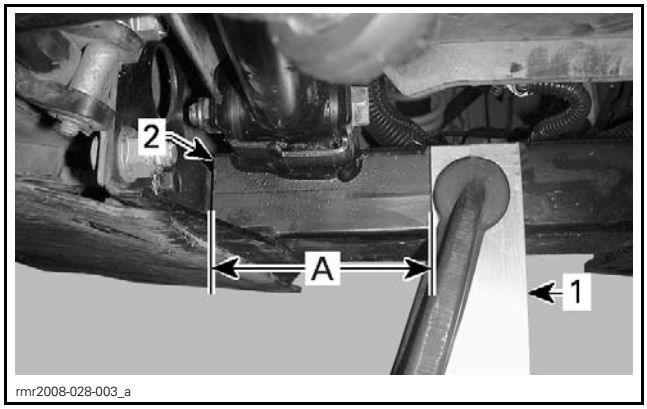
NOTE: Jack stands must be located as close to frame as possible to prevent front suspension compression or steering alignment will not be to specification.

5. Remove front wheels.
6. Secure brake disc to wheel hub with lug nuts and spacers (M18 elastic stop nuts).



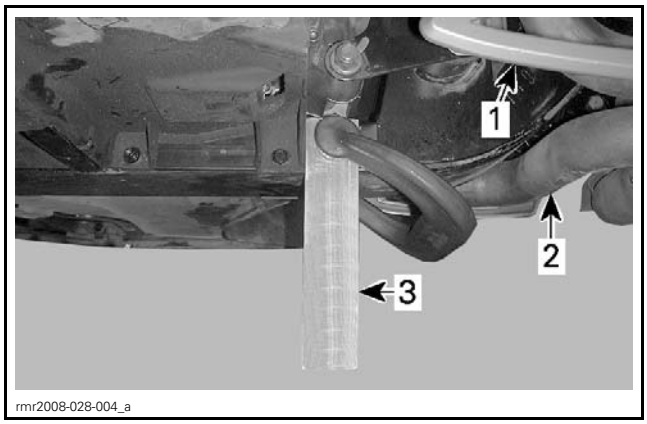
TYPICAL
1. Lug nuts
2. M18 elastic stop nuts

7. Using a C-clamp, position the front spacer bar at 100 mm (4 in) from the end of frame.



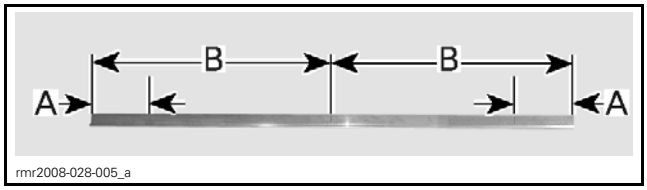
TYPICAL
1. Front spacer bar secured by a C-clamp
2. Frame front end
A. 100 mm (4 in)

8. Using C-clamp, secure the other spacer near the rear portion of the frame.



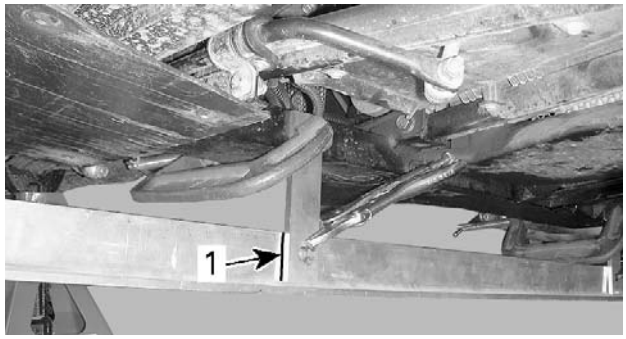
TYPICAL
1. Driver footrest
2. "Y" pipe
3. Rear spacer secured by a C-clamp

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.



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TYPICAL
1. Alignment bar center mark

NOTE: Ensure alignment bar is parallel with the frame.

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.

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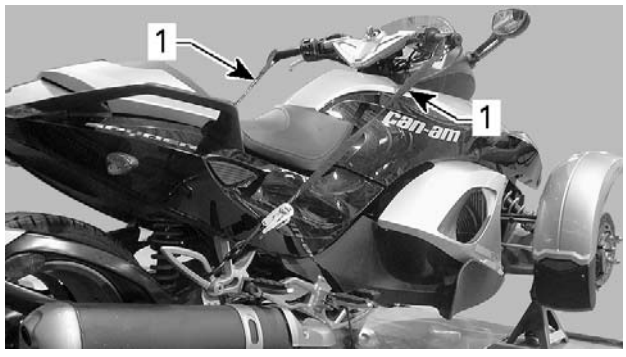
TYPICAL

NOTE: The reference point must be the same on each side.

12. Tie handlebar to passenger footrests to prevent movement of the steering during alignment.



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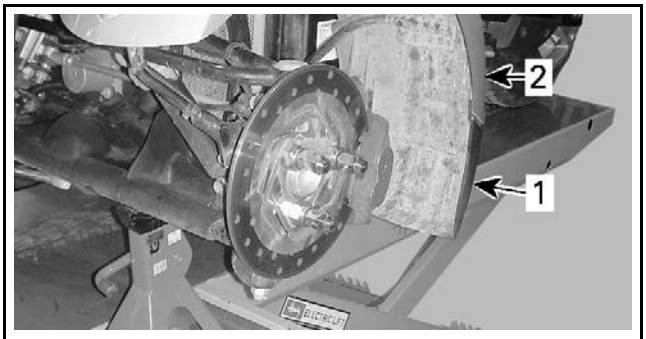
TYPICAL
1. Tie downs

13. Remove each front fender mudguard.



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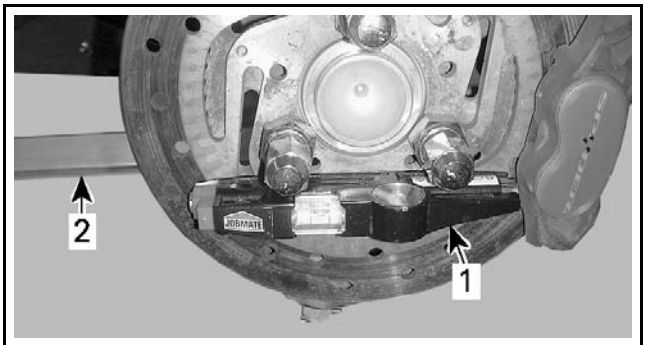
TYPICAL - LH SIDE SHOWN
1. Mudguard
2. Front fender

14. Install the magnetic laser level on a brake disc.



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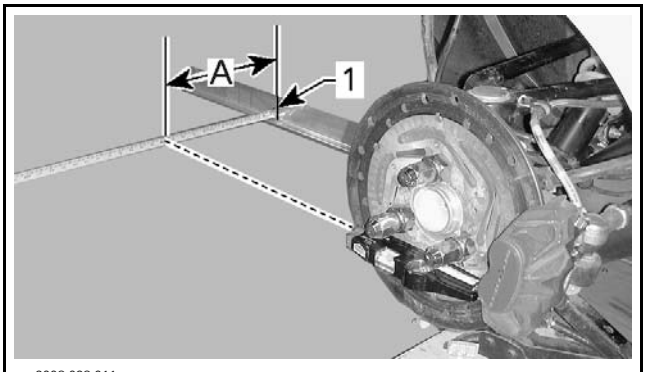
TYPICAL
1. Magnetic laser level
2. Alignment bar

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.



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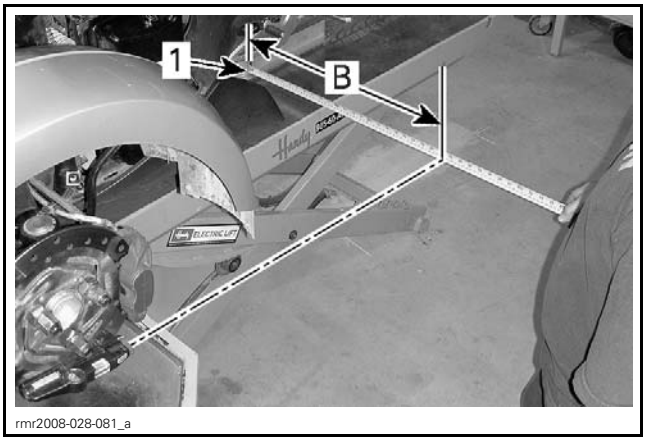
TYPICAL - FRONT MEASUREMENT SHOWN
1. Front mark on alignment bar
A. Front distance



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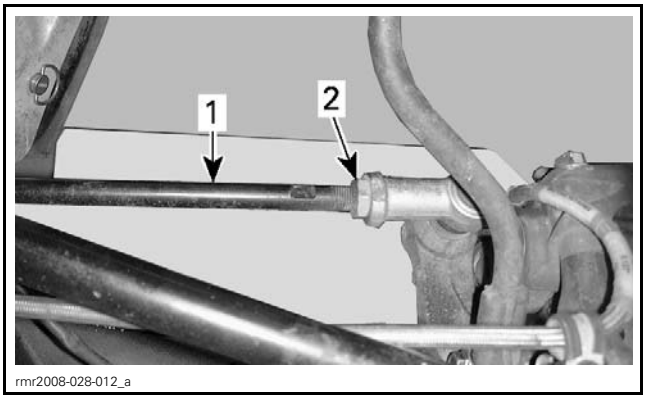
TYPICAL - REAR MEASUREMENT SHOWN
1. Rear mark on alignment bar
B. Rear distance

16. Refer to the following chart for alignment specification.

MODEL	TOE-IN
Spyder RT	-10.5 mm ± 0.5 mm (-.4134 in ± .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).



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1. Tie-rod
2. Tie-rod lock nut (one per tie-rod end)

18. Recheck the measurement after torquing tie-rod 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)	Limp home mode is set.
YRS (yaw rate sensor)	
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 gradually decrease. If battery voltage is below 8 Vdc, no steering assist will be 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

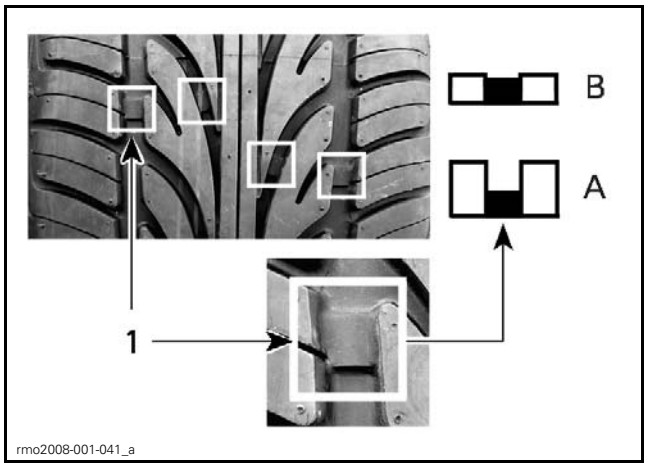
1. The installation is the reverse of the removal procedure.
2. Tighten wheel lug nuts to 105 N•m (77 lbf•ft).

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.

⚠ 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*.
2. Using an automotive tire changer (rim clamp type), remove the old tire and install the new one.

⚠ 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*.

⚠ WARNING

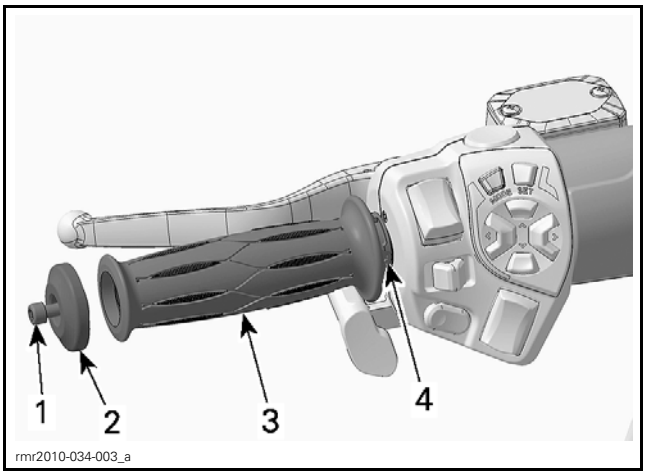
When installing new tires, always observe a break-in period of 300 km (200 mi). During this time, the tires and the VSS will not operate at their maximum efficiency. You could lose control and crash – use extra caution.

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).

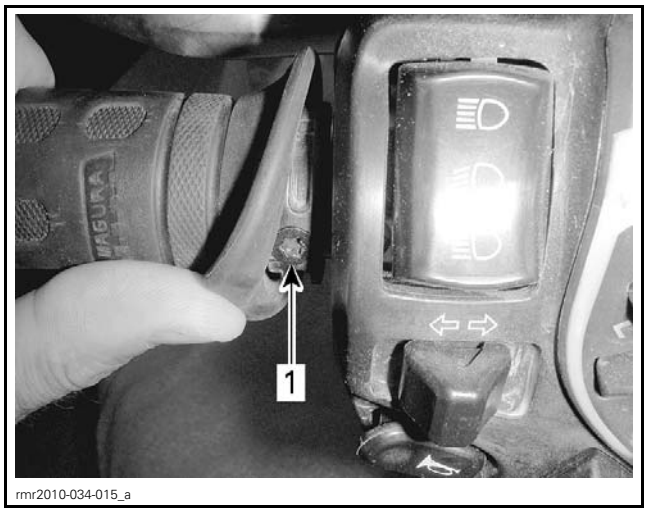
LH Handlebar Grip Removal

1. Remove handlebar end cap retaining screw, and remove end cap from handlebar.



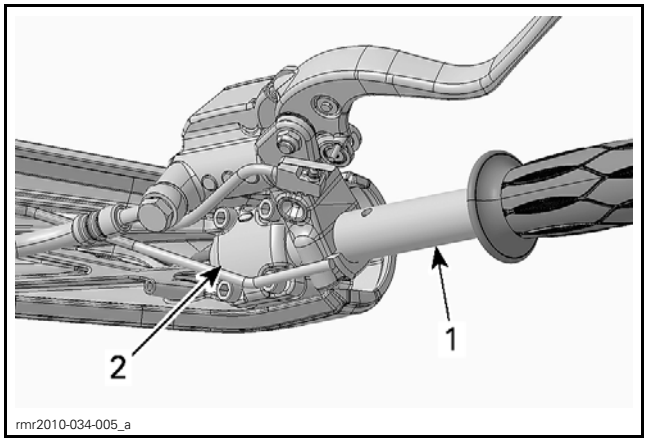
TYPICAL
1. *End cap retaining screw*
2. *Handlebar end cap*
3. *Heated grip*
4. *Grip retaining screws (2)*

2. Slightly pull back the raised shoulder of the rubber grip near LH multifunction switch, and remove the two grip retaining screws.



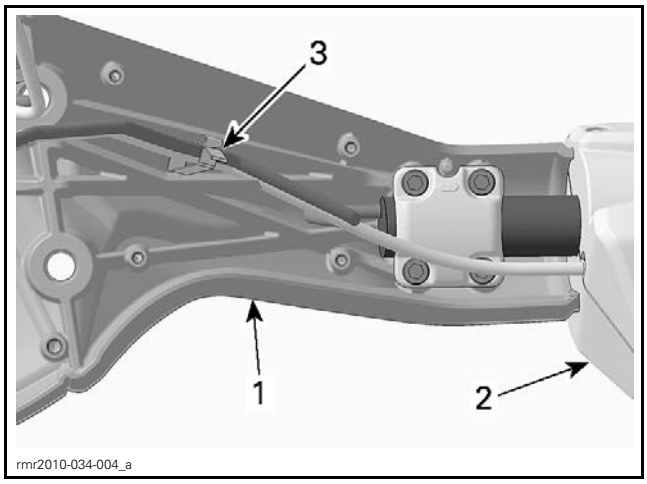
1. *Grip retaining screws (2)*

3. Remove the lower cover under the LH handlebar.
4. Remove the handlebar tube clamp and remove the tube from the handlebar.



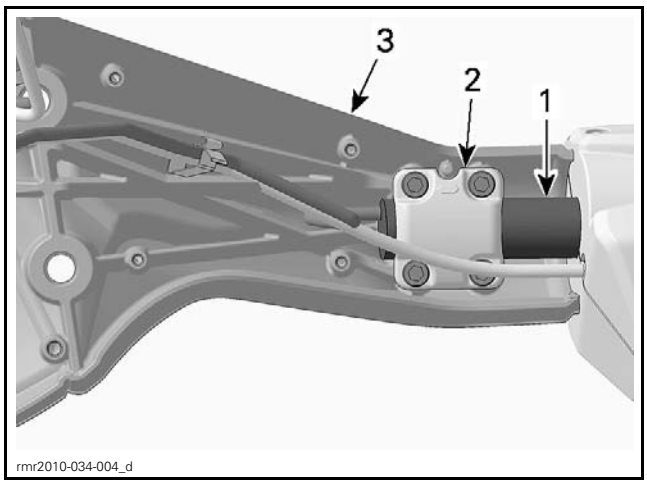
TYPICAL
1. *Handlebar tube*
2. *Tube retaining clamp*

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.

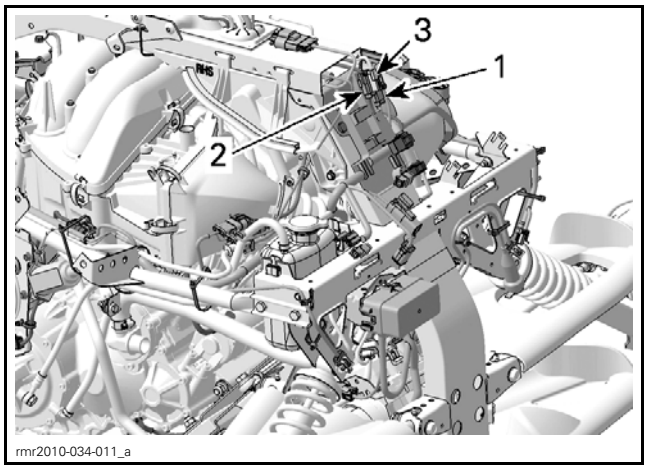


1. *Handlebar tube*
2. *Tube retaining clamp*
3. *Handlebar*

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.

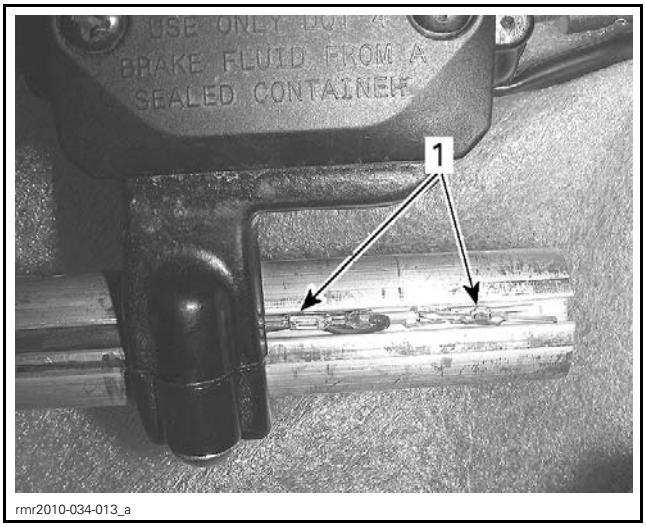
8. Disconnect the LH heated grip connector.



1. *LH heated grip connector*
2. *RH heated grip connector*
3. *Clutch lever switch connector (SM5 only)*

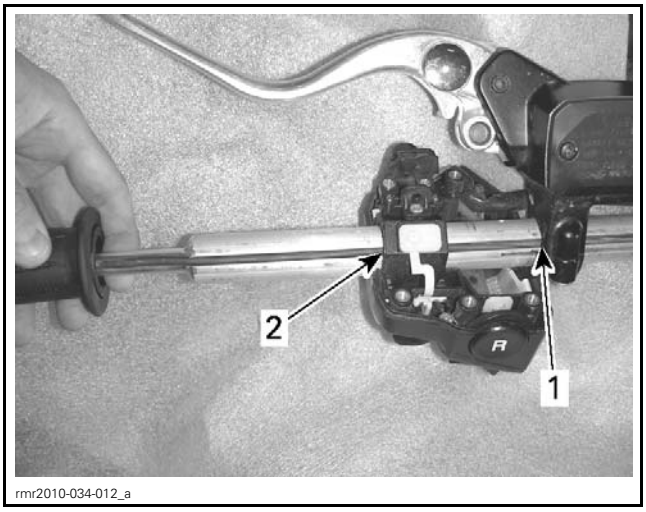
9. Cut the locking-tie that secures the wire harness at the front of the upper frame member.
10. Attach a string of approximately 1.25 m (4 ft) to the wire harness to help feed the wires on the new grip through the upper frame member, and rubber seal under handlebar.
11. Pull the wire harness up to the handlebar.
12. Untie 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.



rmr2010-034-013_a

1. Connector pins end to end



rmr2010-034-012_a

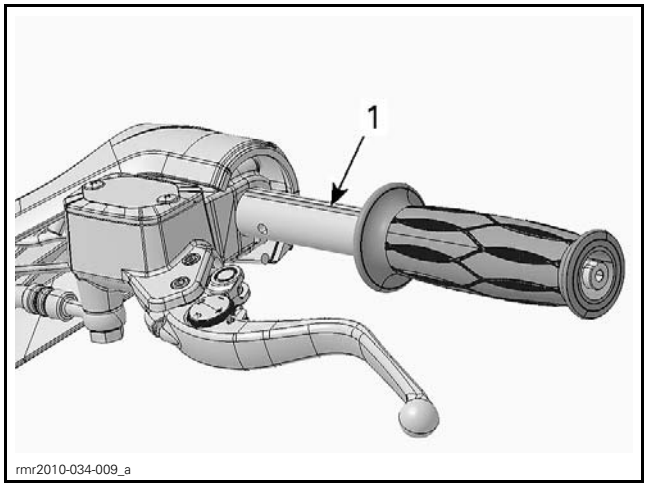
TYPICAL - LH HEATED GRIP WIRE ROUTING
1. LH multifunction switch (cover removed)
2. Brake lever housing (SM5 only)

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).

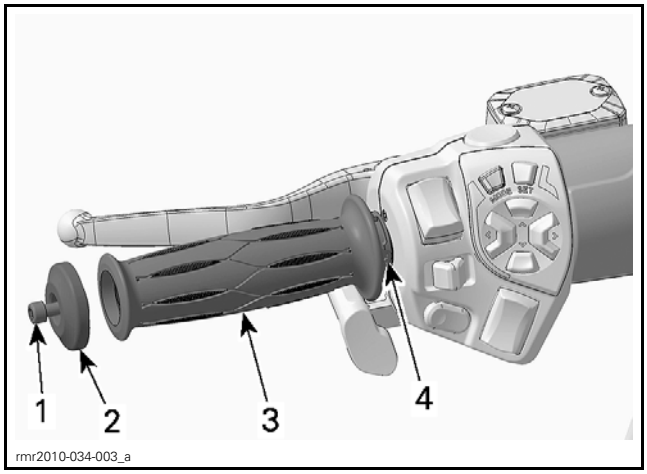
2. Position the grip on the handlebar tube with the heater wires properly aligned with the groove in the handlebar tube.



rmr2010-034-009_a

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**).

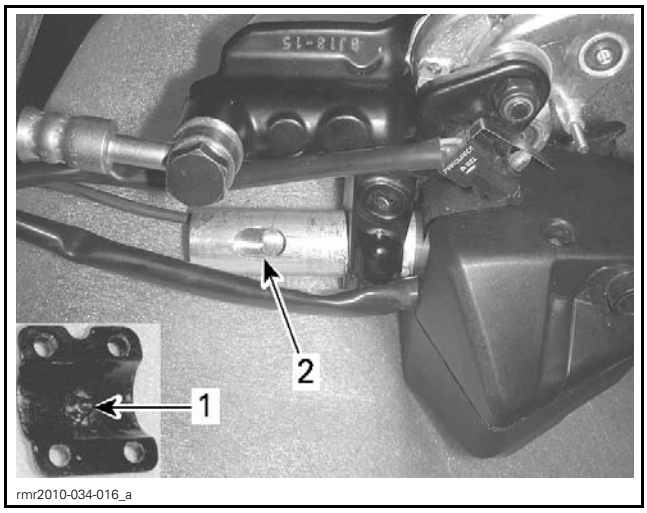


rmr2010-034-003_a

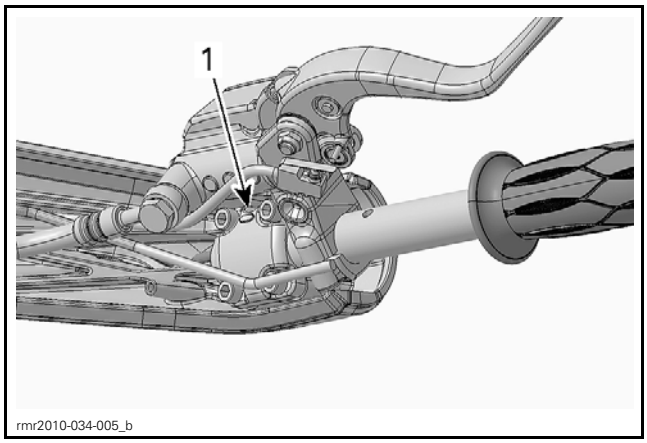
1. Cap retaining screw
2. Handlebar end cap
3. Heated grip
4. Grip retaining screws (2)

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.

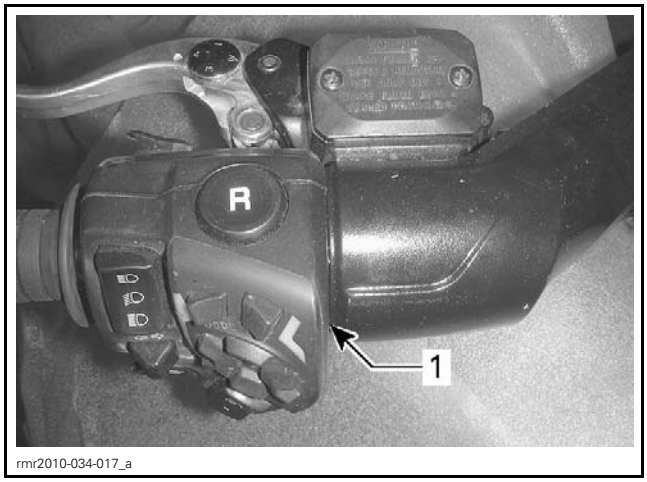


1. *Location pin in retaining clamp*
2. *Oblong location hole in handlebar tube*



1. *Notch facing alignment pin*

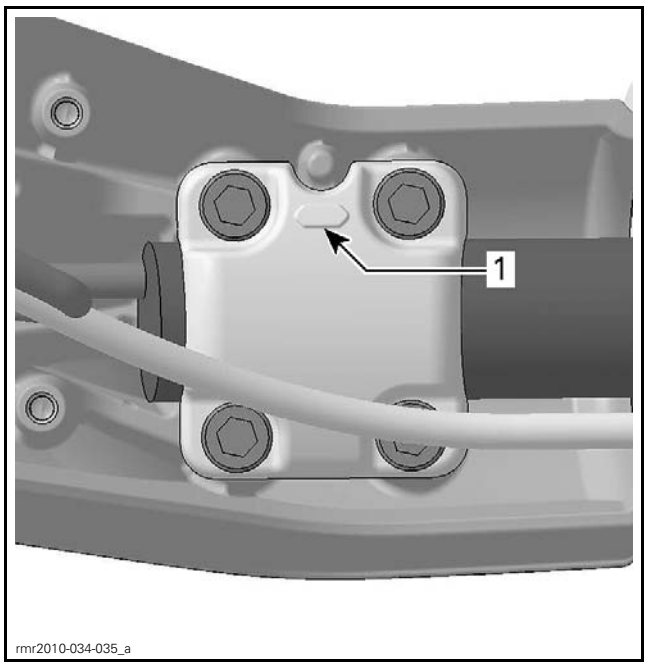
8. Push the handlebar tube in until the multifunction switch makes contact with the handlebar.



1. *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)

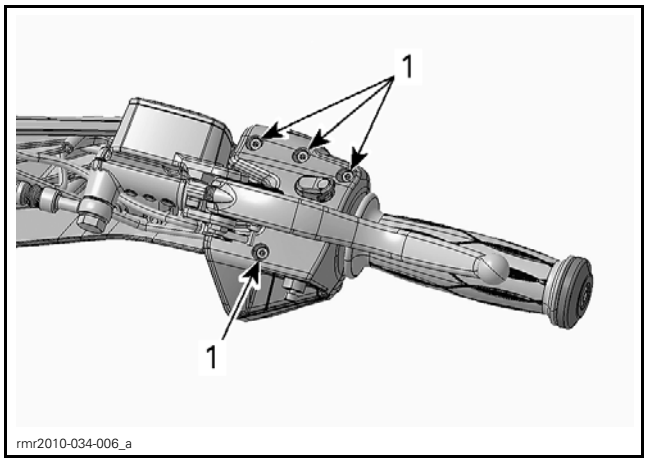
13. Ensure connector pins are properly locked in, then reconnect the heated grip connector to the vehicle harness connector.
14. Insert the heated grip and multifunction switch harnesses in the retaining clip provided in the handlebar.
15. Install the LH handlebar cover. Apply 1 N•m (9 lbf•**in**) to 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)

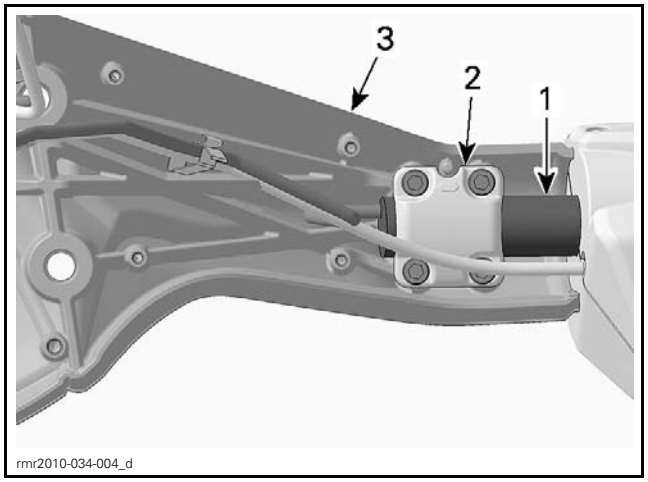
LH Multifunction Switch Removal

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.

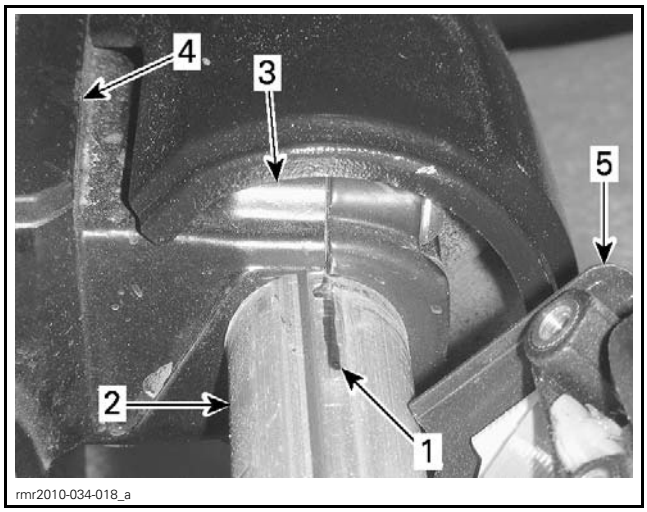


1. Handlebar tube
2. Retaining clamp
3. Handlebar

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

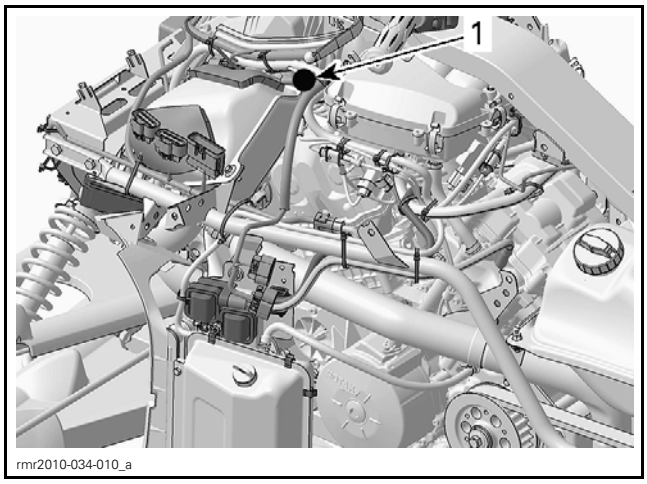
7. Remove the clutch housing from the handlebar tube.

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.
10. 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.

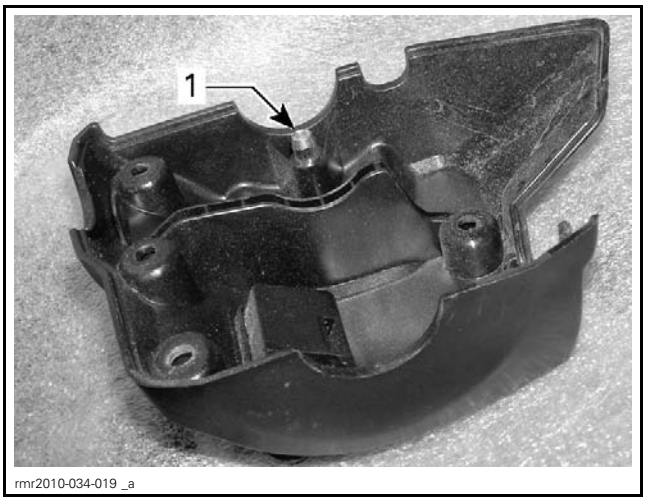
1. Slide the multifunction switch housing onto the handlebar tube.

SM5 Model

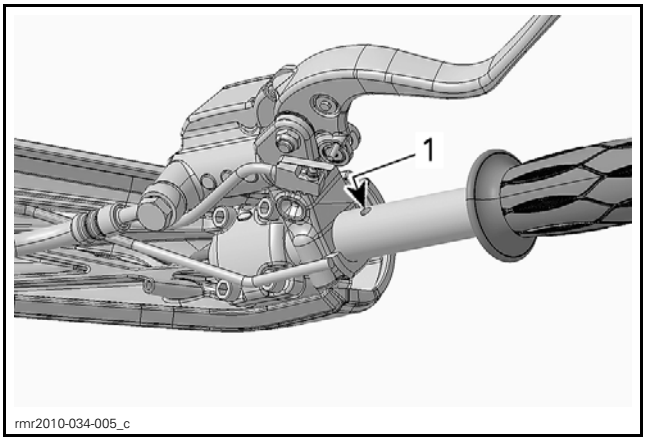
2. Position clutch lever housing on the handlebar tube using the reference line, and install its retaining clamp.

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

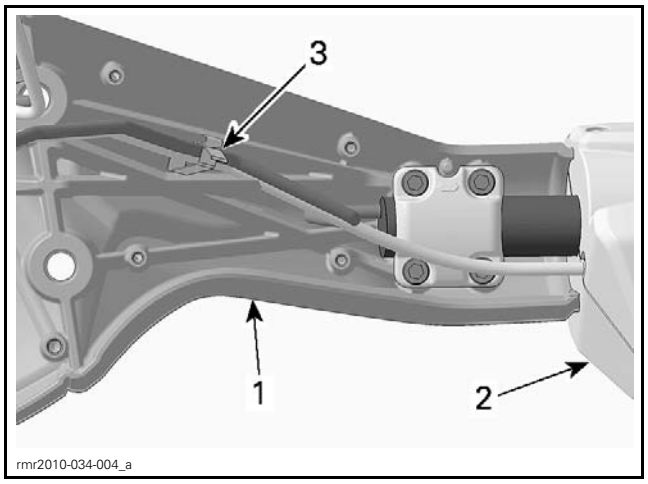
4. Install the multifunction switch cover. Torque retaining screws to 1 N•m (9 lbf•**in**)

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.



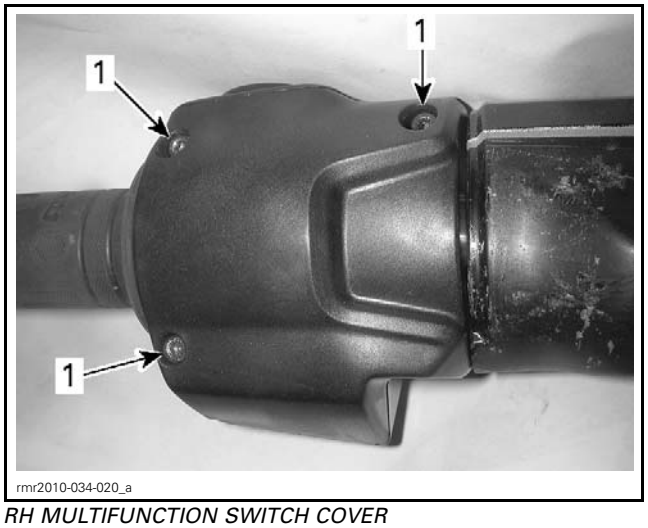
1. Handlebar
2. LH multifunction switch
3. Harness retaining clip

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)

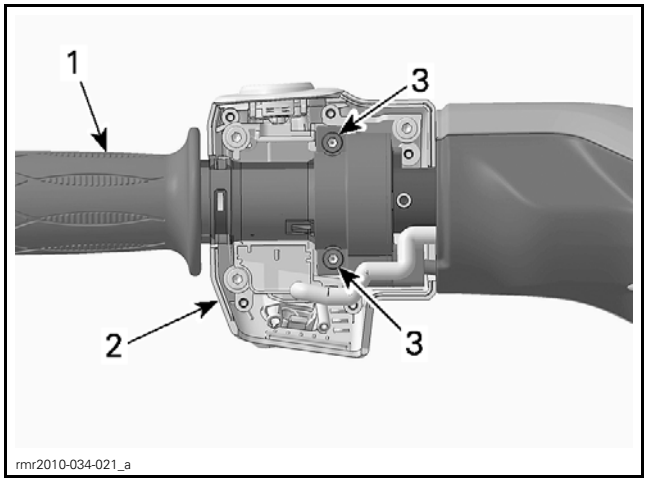
RH Multifunction Switch Removal

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.

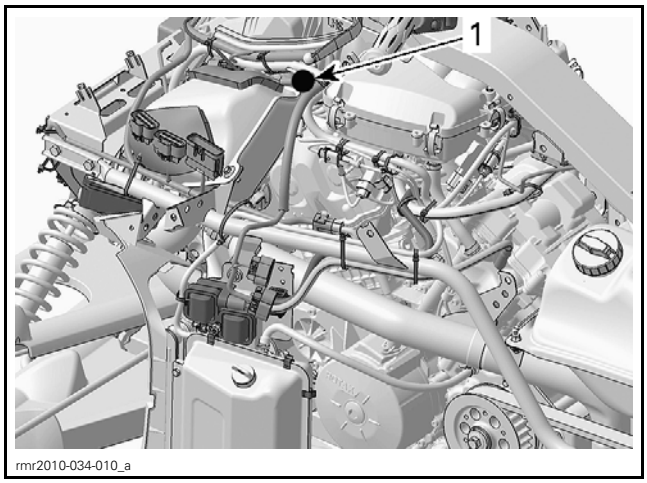


1. Throttle handle
2. RH multifunction switch housing
3. Retaining screws (2) for the multifunction switch housing

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.

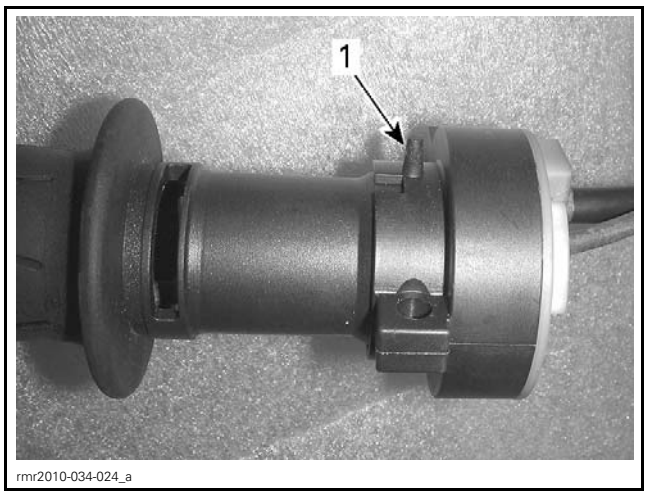
10. Remove the harness from the frame and handlebar leaving the feed string in its place.

RH Multifunction Switch Installation

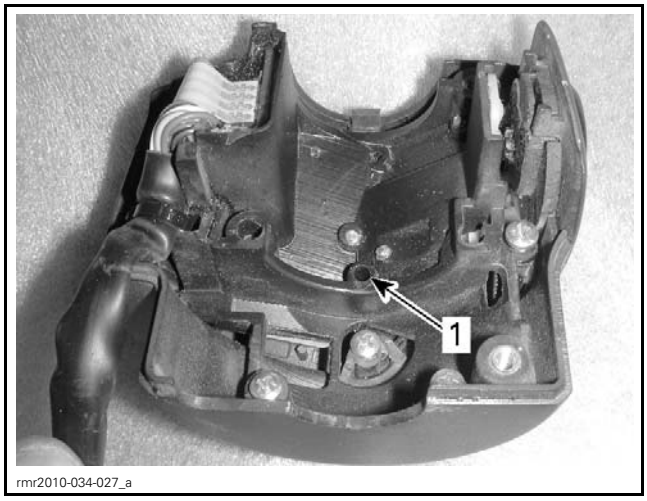
Installation is the reverse of the removal procedure. However, pay attention to the following.

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.

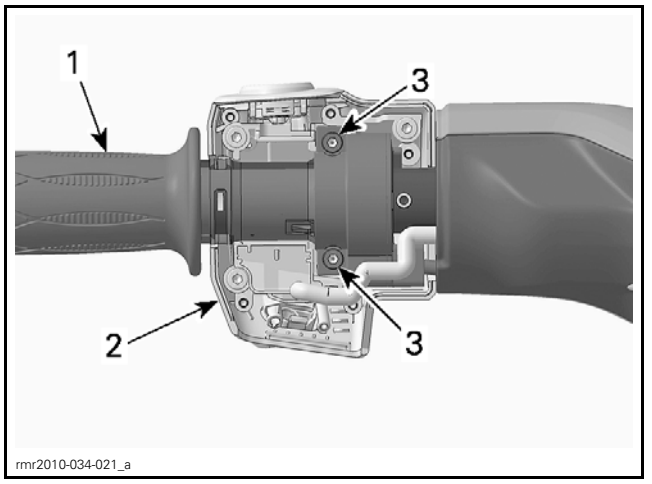


1. Throttle handle location pin



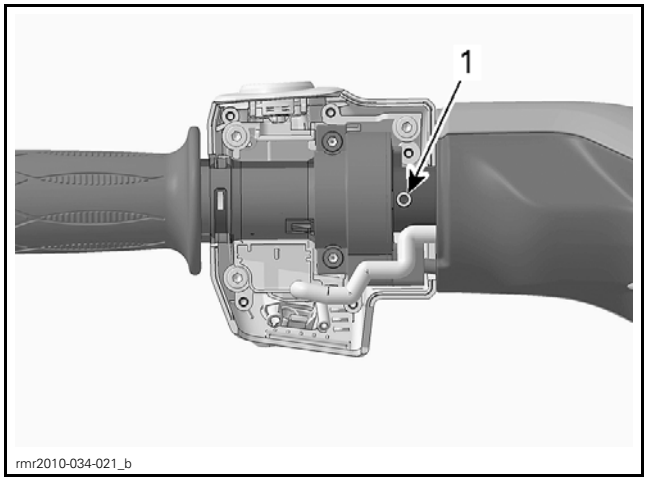
1. Location hole in multifunction switch housing

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.

1. 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.**

6. Carefully rotate throttle handle through its full range of motion, then release to ensure proper operation.

⚠ 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.

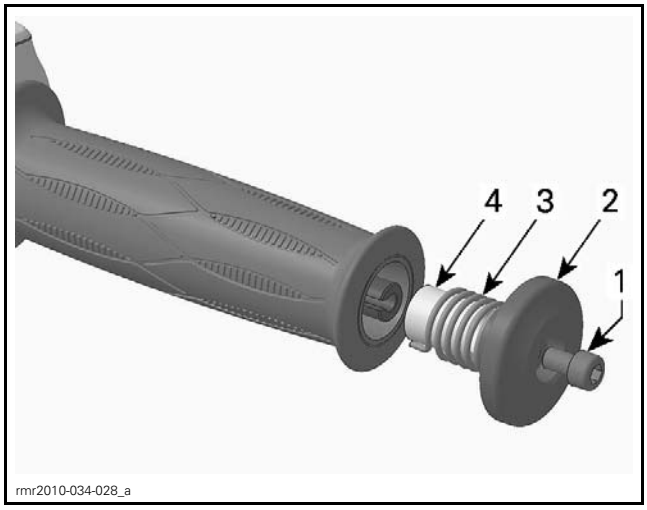
NOTICE **Ensure wiring harness is properly routed through the handlebar and upper frame member to prevent pinching, chaffing or other wire damage.**

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

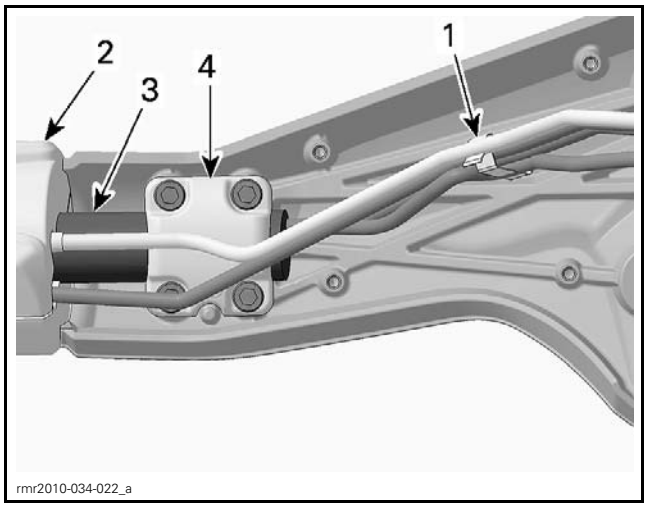
Throttle Handle Removal

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.

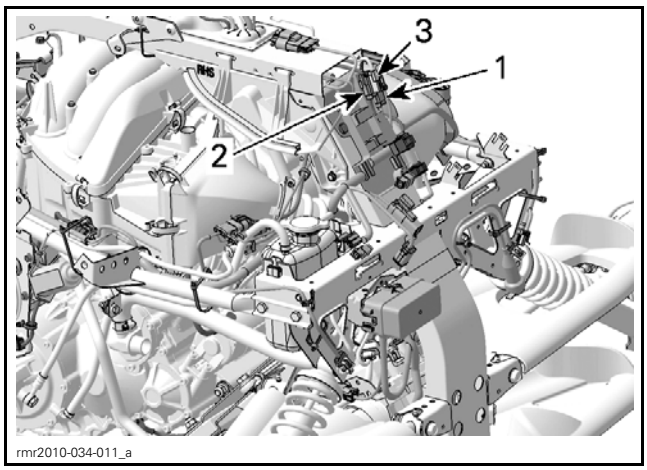


1. Harness retaining clip
2. RH multifunction switch
3. RH handlebar tube
4. Handlebar tube clamp

4. Pull the heated grip wiring from the groove in the handlebar tube as you remove the throttle handle from the handlebar tube.

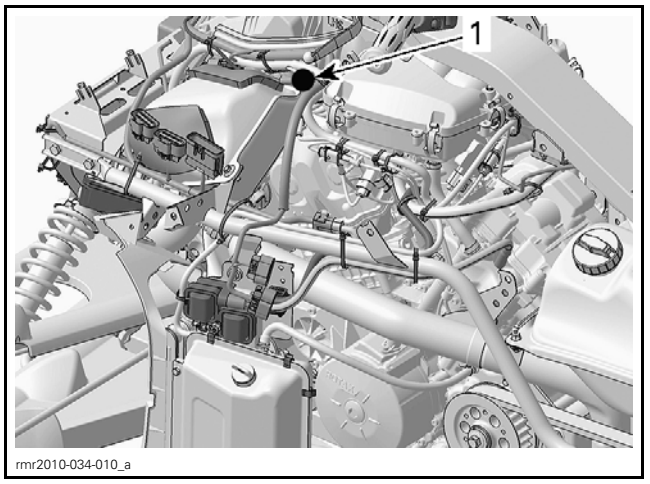
NOTE: If replacing throttle handle, carry on with the following steps.

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

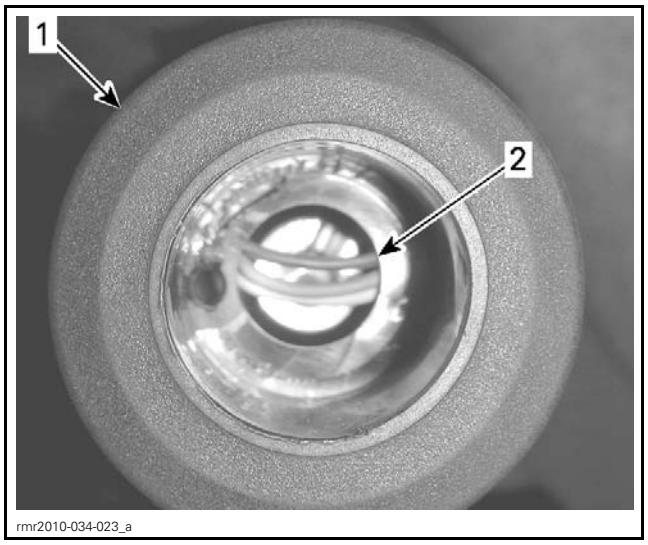
8. Cut the locking-tie that secures the wiring harness at the front of the upper frame member.
9. Attach a string of approximately 1.25 m (4 ft) to the wire harness to help feed the new wires though.
10. Remove the harness from the handlebar and frame leaving the feed string in its place.

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.

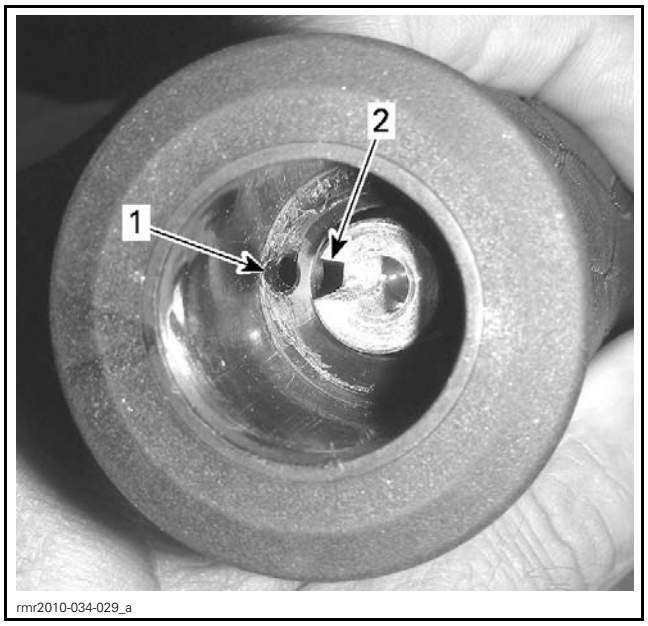
⚠ WARNING

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.

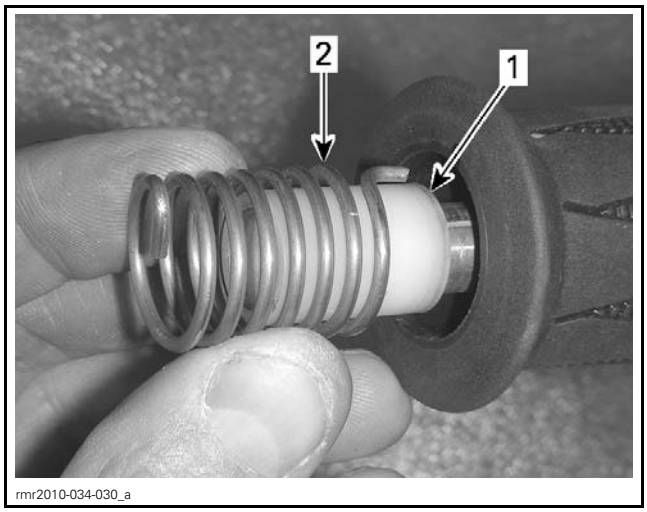


IMPROPER INSTALLATION
1. *Throttle handle*
2. *Heated grip wires* NOT PROPERLY ROUTED

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.

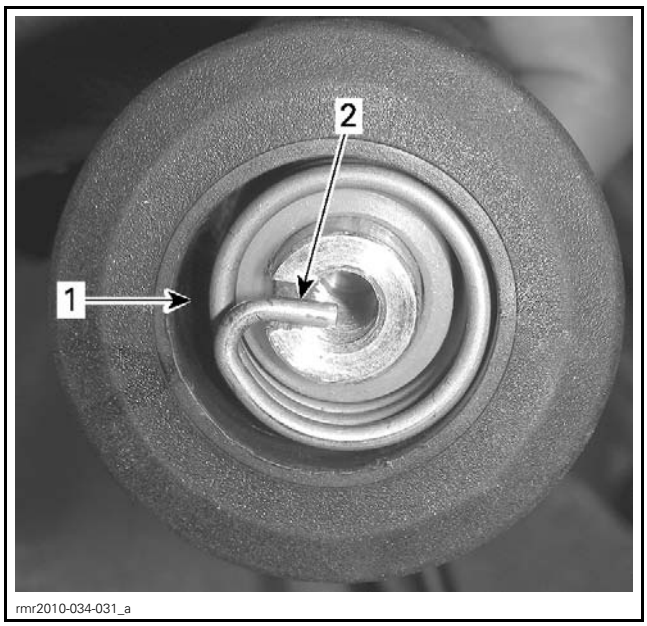


6. Insert the plastic sleeve in the throttle return spring, then insert the spring and sleeve in the throttle handle.



1. *Plastic sleeve*
2. *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 hole (not visible)*
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 INSTALLATION* 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.

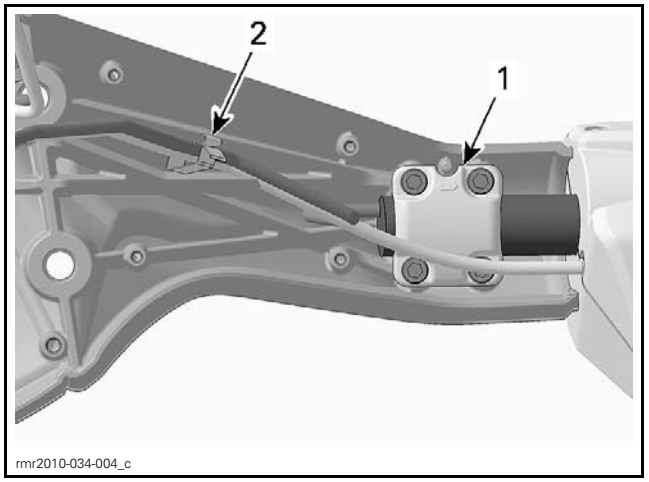
12. Secure harness in the retaining clip within the handlebar, and at the front of the upper frame using a locking-tie.
13. Reconnect the heated grip and TAS connectors to the vehicle harness.
14. Install the handlebar cover and torque screws to 1 N•m (9 lbf•**in**).
15. Ensure wire harness does not 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

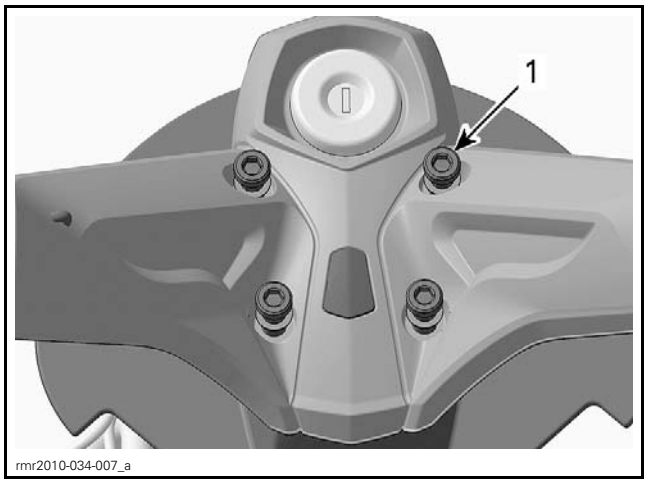
1. Remove the LH and RH handlebar covers.
2. Remove the clamps that secure both LH and RH handlebar tubes to the handlebar, and remove the wiring harnesses (LH and RH) from the retaining clips.

NOTE: This removes all controls from the handlebar without disassembling or disconnecting them.



TYPICAL - LH SE5 MODEL ILLUSTRATED
1. *Handlebar tube retaining clamp*
2. *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.



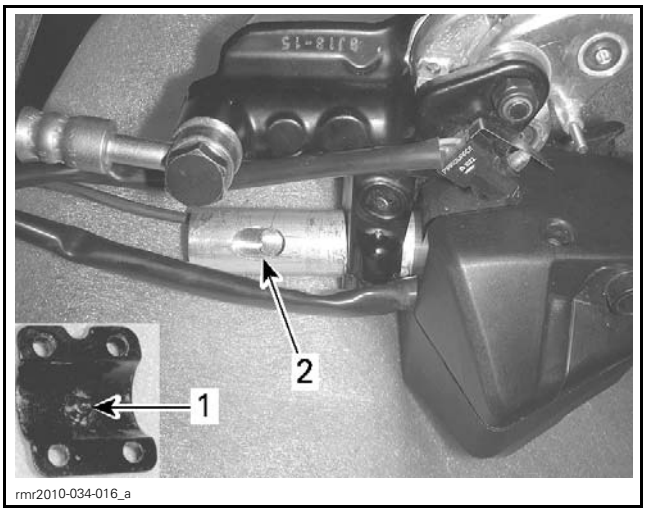
1. *Handlebar retaining screws*

Handlebar Installation

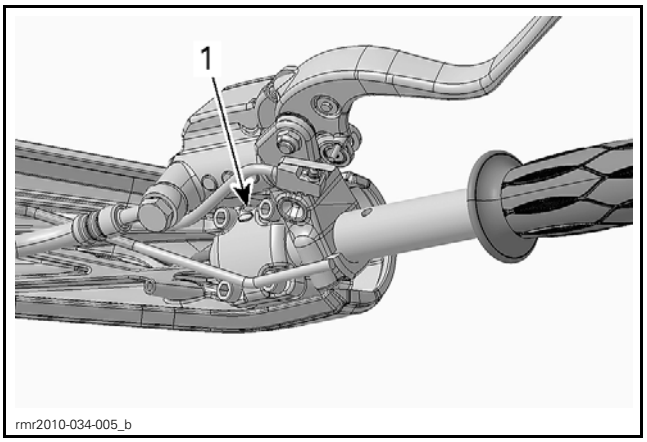
Installation is the reverse of the removal procedure however, pay attention to the following.

1. Install handlebar using NEW retaining screws. Torque screws to 38 N•m (28 lbf•ft).
2. Install ignition switch, refer to *IGNITION SYSTEM* subsection.
3. Torque the screws retaining the central handlebar cover to 3.5 N•m (31 lbf•**in**).
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).

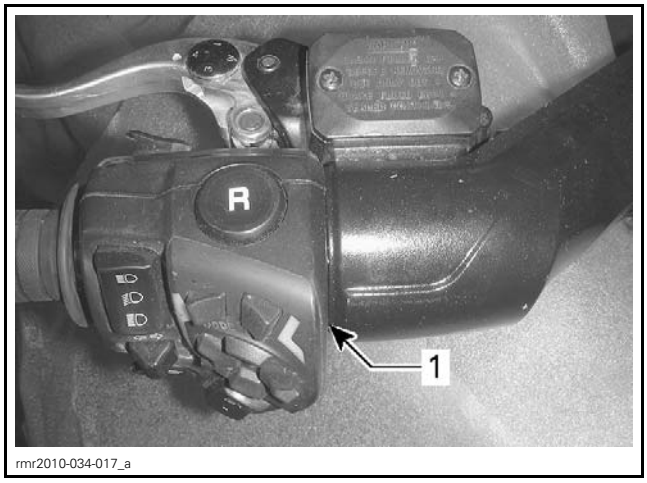


TYPICAL - LH SIDE ILLUSTRATED
1. Location pin in retaining clamp
2. Oblong location hole in handlebar tube



TYPICAL - LH SIDE ILLUSTRATED
1. Notch facing alignment pin

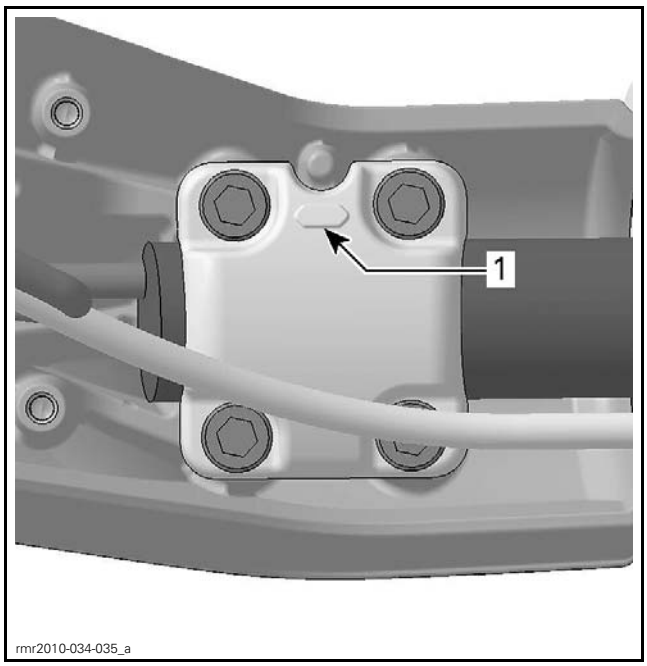
5. Push handlebar grip inwards until the multifunction switch housing touches the handlebar..



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.



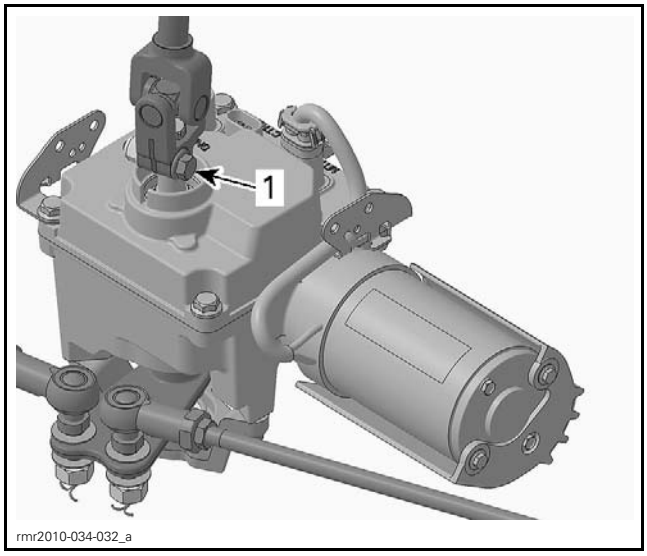
TYPICAL - LH HANDLEBAR TUBE CLAMP, RH SIMILAR BUT UPSIDE DOWN
1. Torque screws indicated by this arrow first

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

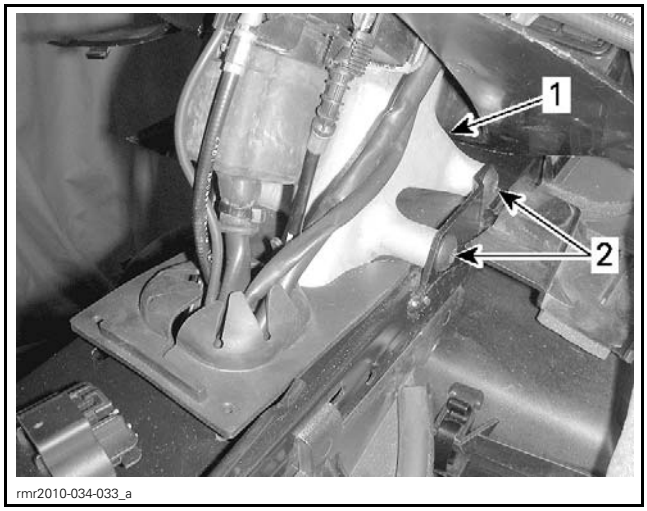
Steering Column Removal

1. Remove handlebar, refer to *HANDLEBAR REMOVAL* 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.



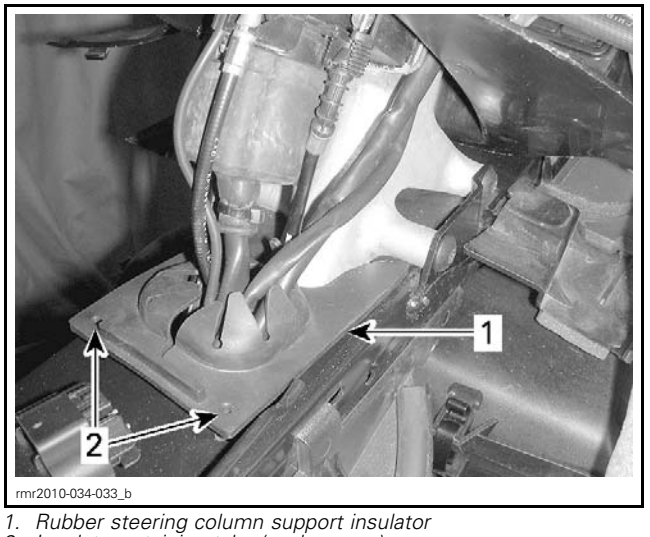
5. Pull the steering column out through top of frame.

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.
4. 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.

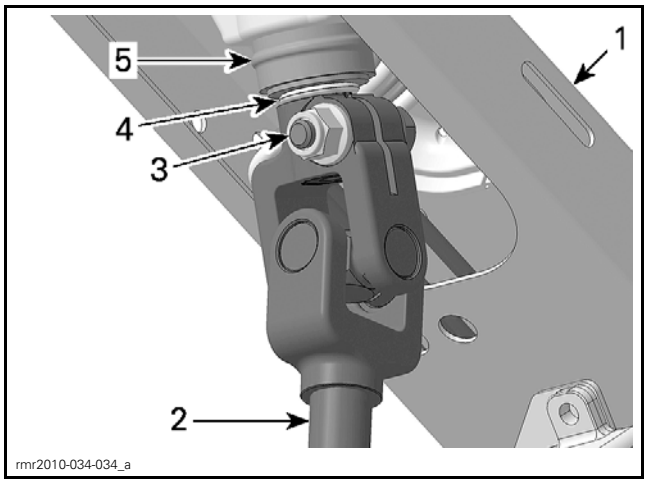
Steering Column Support Removal

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 N•m (23 lbf•ft).
7. Position the bellows with the raised shoulder on the steering column support inside the groove provided within the small end of the bellows.



1. Upper frame member
2. Lower steering column shaft
3. Upper U-joint pinch bolt
4. O ring
5. 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 subsection.
14. Perform the torque offset reset. Refer to *TORQUE OFFSET RESET* in this subsection.

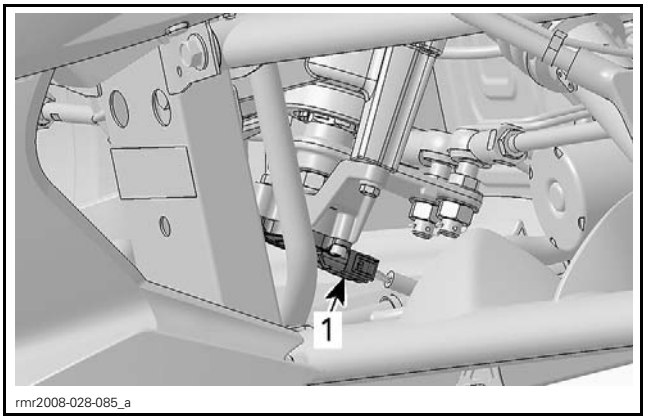
STEERING ANGLE SENSOR (SAS)

First, check for fault codes using the latest applicable B.U.D.S. software.

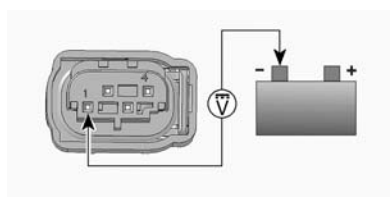
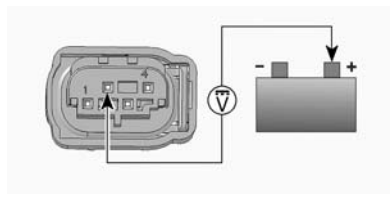
Before replacing the SAS, check the following.

SAS Input Voltage Test

Disconnect SAS connector and turn ignition switch ON.



TYPICAL - BOTTOM OF DPS UNIT
1. SAS connector

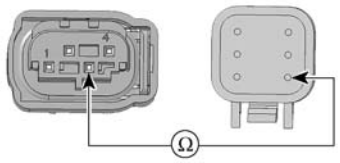
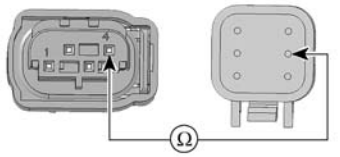
MULTIMETER PROBE POSITIONS	VOLTAGE
SAS connector (pin 1) and battery ground	Battery voltage
	
SAS connector (pin 2) and battery + terminal	
	

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.

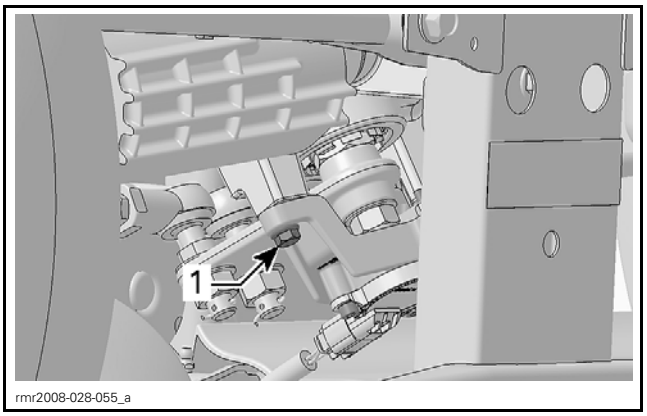
MULTIMETER PROBE POSITIONS	RESISTANCE @ 20°C (68°F)
SAS connector (pin 3) and diagnostic connector (pin 1)	Less than 1 Ω
	
SAS connector (pin 4) and diagnostic connector (pin 2)	
	

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.

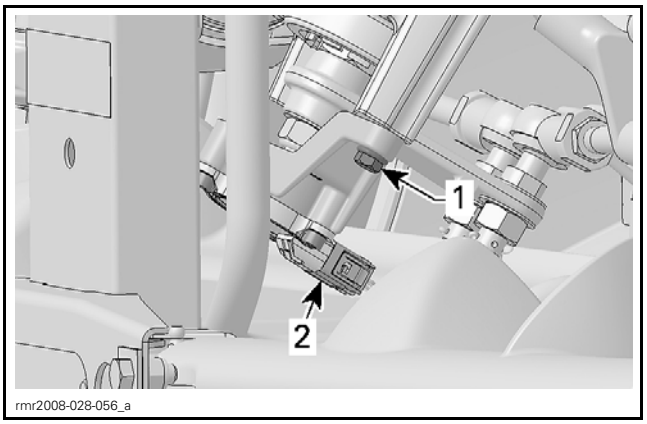
SAS Removal

1. Remove the front storage compartment. Refer to *BODY* subsection.
2. Remove screws retaining the SAS support to DPS.



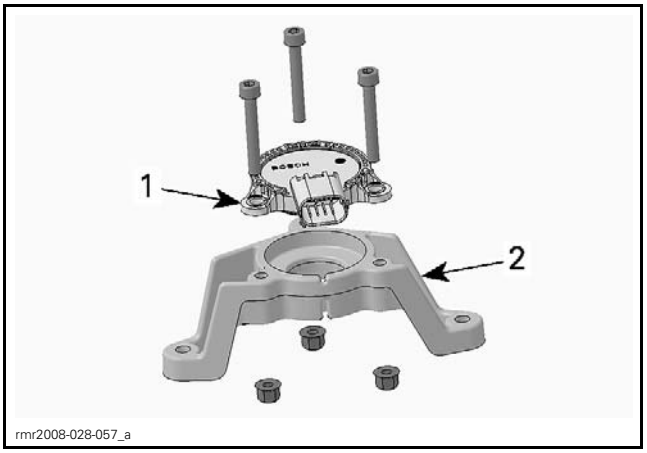
TYPICAL
1. *RH SAS support screw*

3. Disconnect the SAS connector.



TYPICAL
1. *LH SAS support screw*
2. *SAS connector*

4. Remove SAS from its support.

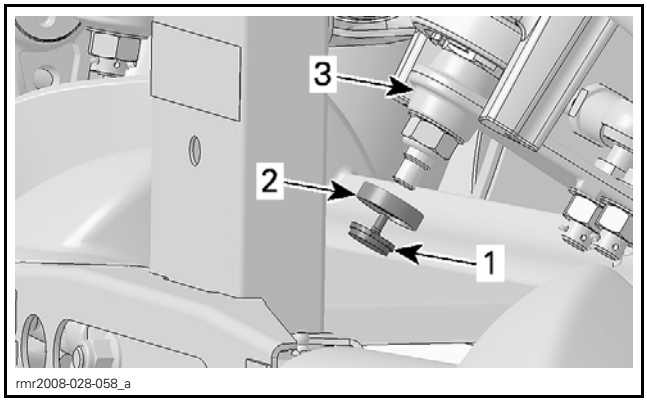


1. *SAS*
2. *SAS support*

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.



1. *Magnet*
2. *Seal*
3. *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 N•m (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

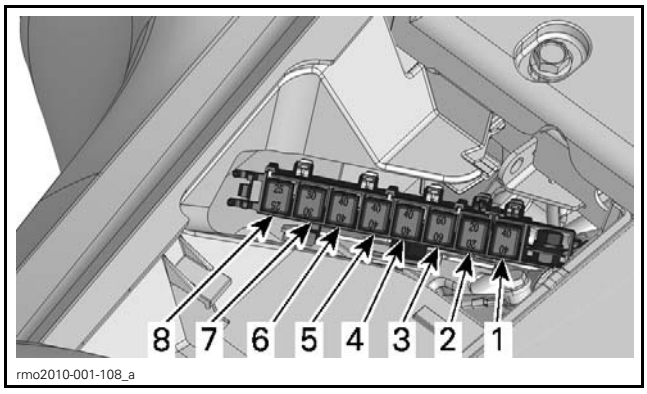
DPS Unit Troubleshooting

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.

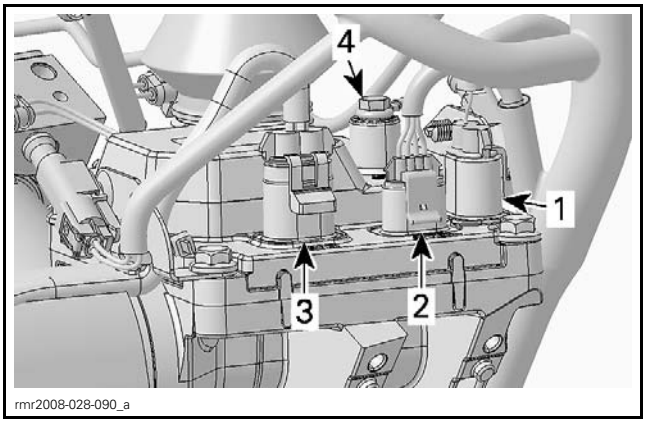


FUSE LOCATIONS, REAR FUSE BOX
DPS motor fuse (F5

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.

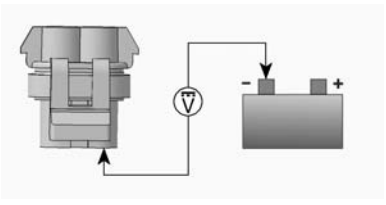
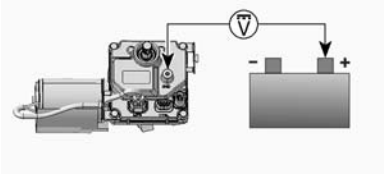
DPS Unit Circuit Test (Main Power)

1. Disconnect DPS main power connector.



1. DPS main power connector
2. DPS control connector
3. 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.

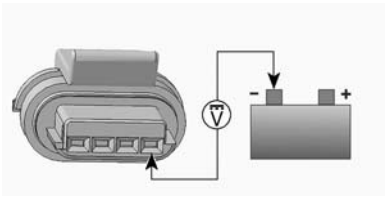
MULTIMETER PROBE POSITIONS	VOLTAGE
DPS power connector (pin A) and battery ground	Battery voltage
	
DPS ground and battery + terminal	
	

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.

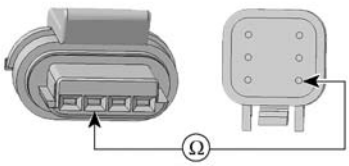
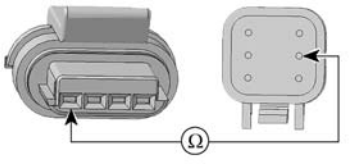
MULTIMETER PROBE POSITIONS	VOLTAGE
DPS control connector (pin A) and battery ground	Battery voltage
	

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.

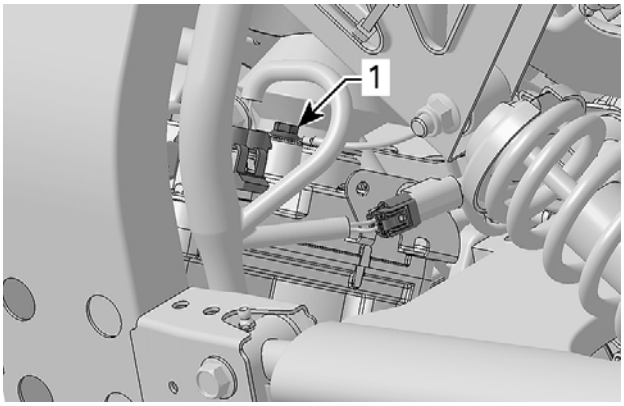
MULTIMETER PROBE POSITIONS	RESISTANCE @ 20°C (68°F)
DPS control connector (pin C) and diagnostic connector (pin 1)	Below 1 Ω
	
DPS control connector (pin D) and diagnostic connector (pin 2)	
	

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.

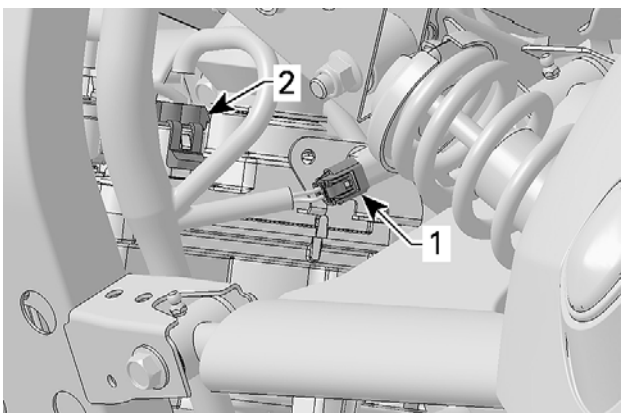
DPS Unit Removal

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.



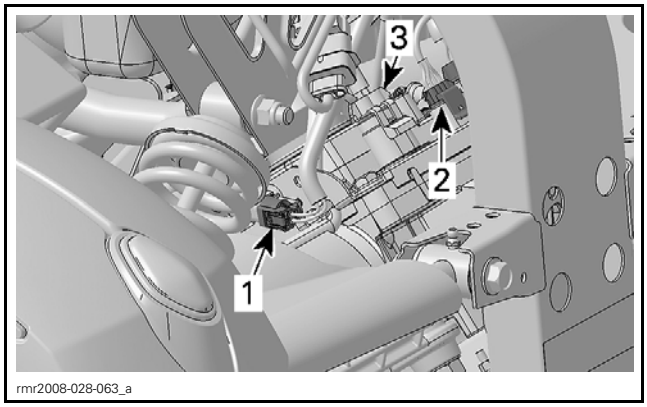
1. Ground wire on DPS unit

4. Remove the LH speed sensor connector c
5. Disconnect the DPS unit power connector.



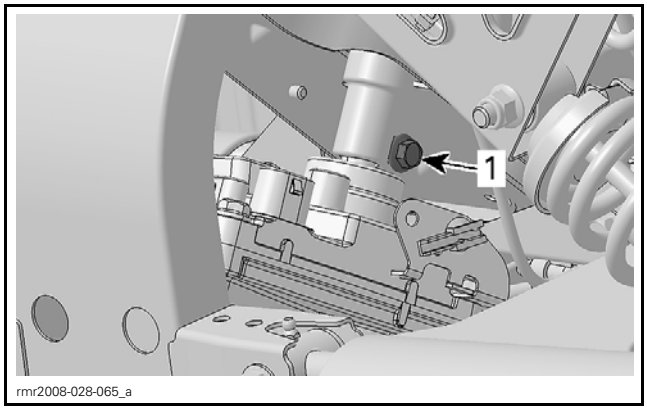
1. LH speed sensor connector
2. DPS unit power connector

6. Remove the RH speed sensor connector from its mounting bracket.
7. Disconnect the DPS unit control and motor connectors.



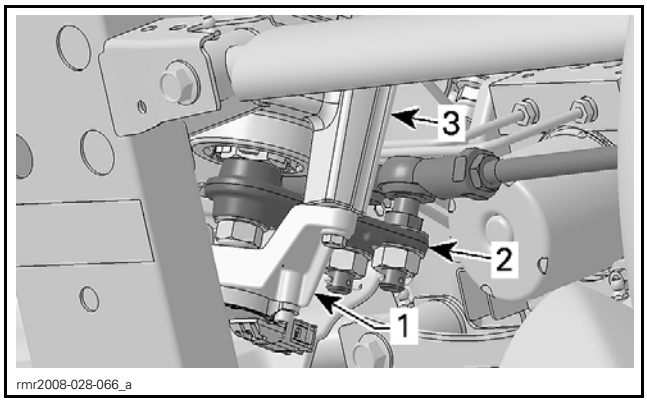
1. *RH speed sensor connector*
2. *DPS unit control connector*
3. *DPS unit motor connector*

8. Remove the pinch bolt securing the lower steering column to the DPS unit shaft.



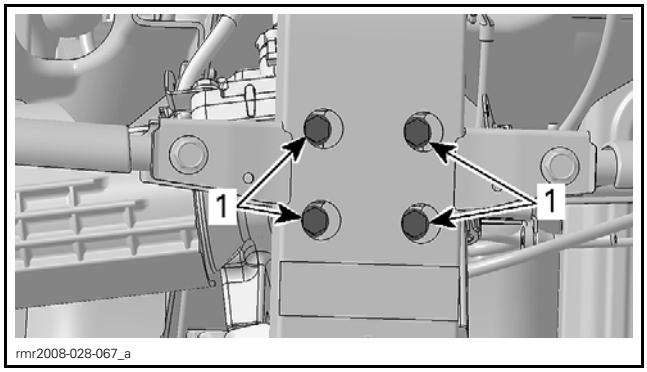
TYPICAL
1. *Steering column bolt*

9. Remove steering angle sensor (SAS) support from DPS unit.
10. Remove tie-rod ends from pitman arm.



1. *Steering angle sensor support*
2. *Pitman arm*
3. *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.



1. *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

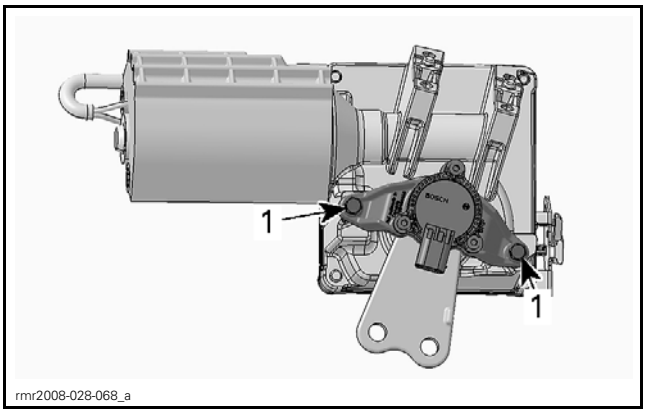
1. Install DPS unit on frame. Torque retaining screws to 28 N•m (21 lbf•ft)
2. Apply XPS SYNTHETIC GREASE (P/N 293 550 010) on DPS unit splines.
3. Index and insert steering column splines on DPS shaft splines.
4. Install pinch bolt at lower end of steering column using a new elastic nut, and torque nut to 31 N•m (23 lbf•ft).
5. Install steering column support retaining screws, torque to 24 N•m (18 lbf•ft).
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 *ADJUSTMENT* in this subsection.
13. Perform the torque offset reset. Refer to *ADJUSTMENT* in this subsection.

PITMAN ARM

Pitman Arm Removal

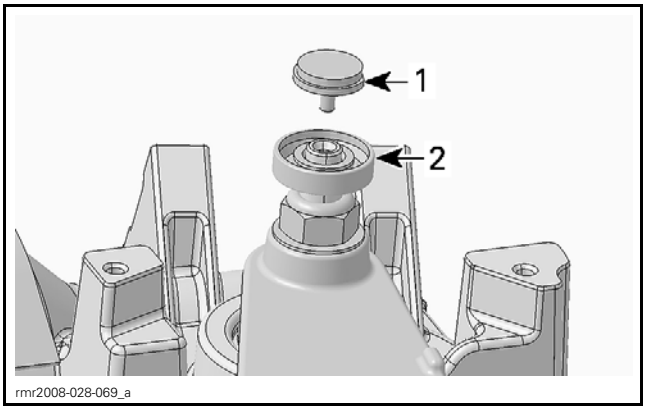
1. Remove DPS unit. Refer to *DPS UNIT*.

2. Remove the steering angle sensor (SAS) support from DPS unit.



1. SAS support screws

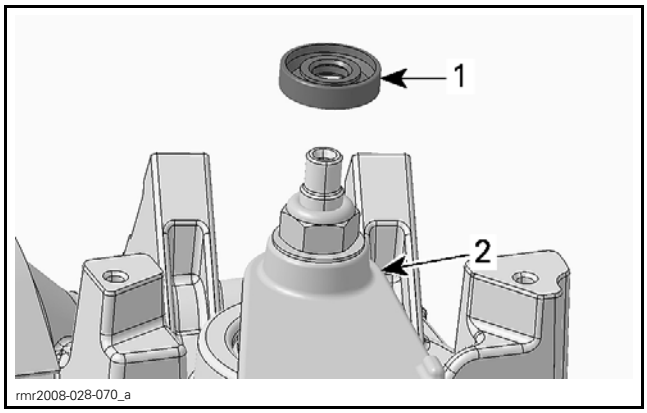
3. Remove magnet from the DPS shaft using MAGNET SOCKET (P/N 529 036 178).



1. Magnet
2. Seal

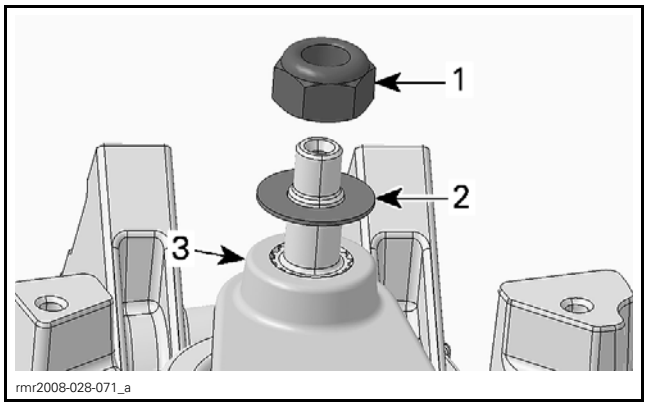
NOTICE The magnet is a sensitive and fragile part. Do not to drop it on a hard surface and do not place it directly on metal parts. If magnet is dropped, knocked, or placed on a metallic surface, replace it with a new one even if it appears in a good condition.

4. Remove and discard the seal.



1. Seal
2. Pitman arm

5. Remove pitman arm nut and washer.

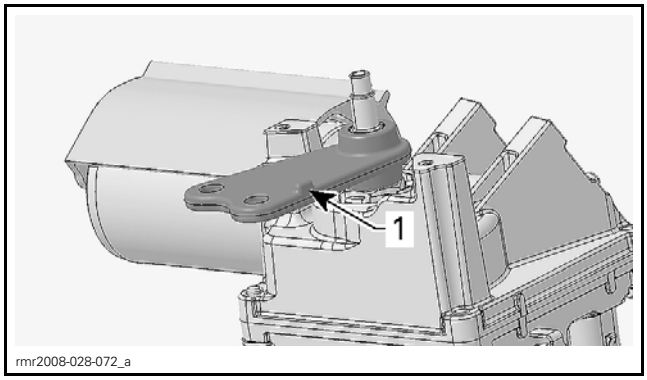


1. Pitman arm nut
2. Washer
3. Pitman arm

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).

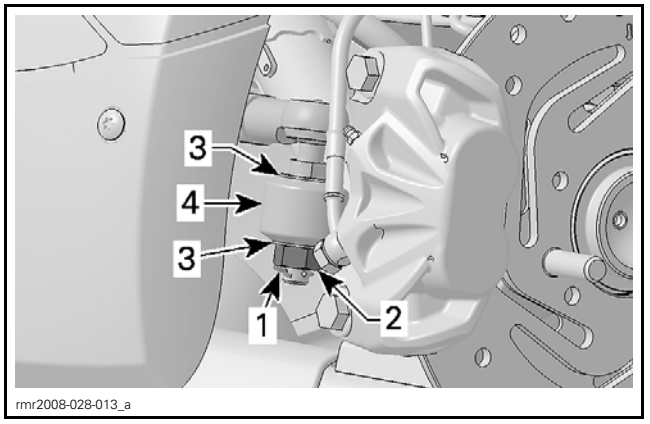
5. Install a **NEW** seal.
6. Install the magnet using the MAGNET SOCKET (P/N 529 036 178) and tighten it to 2 N•m (18 lbf•**in**).

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 *ADJUSTMENT* 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.

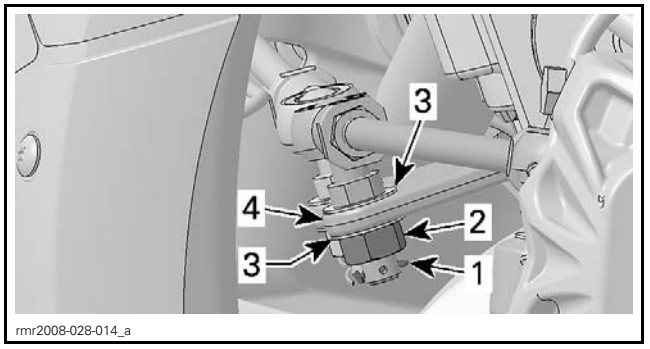
TIE-ROD

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
1. *Cotter pin*
2. *Tie-rod end nut*
3. *Hardened washers*
4. *Knuckle*



FROM PITMAN ARM
1. *Cotter pin*
2. *Tie-rod nut*
3. *Hardened washers*
4. *Steering column lever*

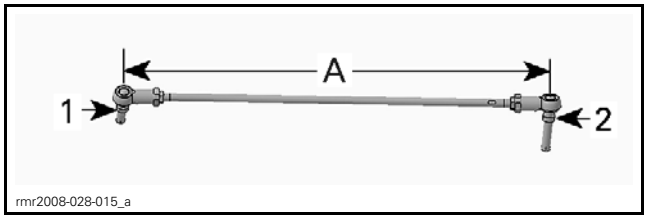
7. Remove tie-rod from vehicle.

Tie-Rod Inspection

Inspect tie-rod ends for wear or excess play. If excessive, replace tie-rod end.

Tie-Rod Installation

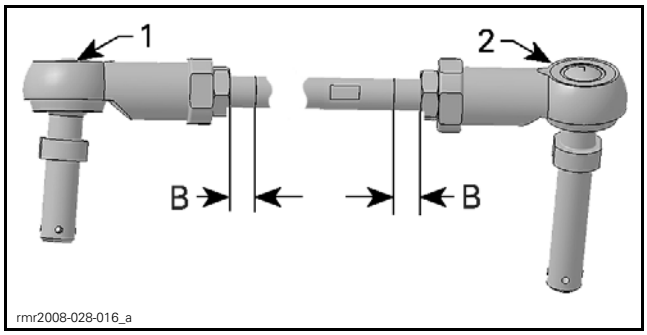
1. For the installation, reverse the removal procedure. However, pay attention to the following.



MAXIMUM LENGTH
1. *Pitman arm side*
2. *Knuckle side*

A. 620 mm ± 50 mm (24.5 in ± 2 in)

TIE-ROD	
Maximum length — dimension "A"	620 mm ± 50 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)

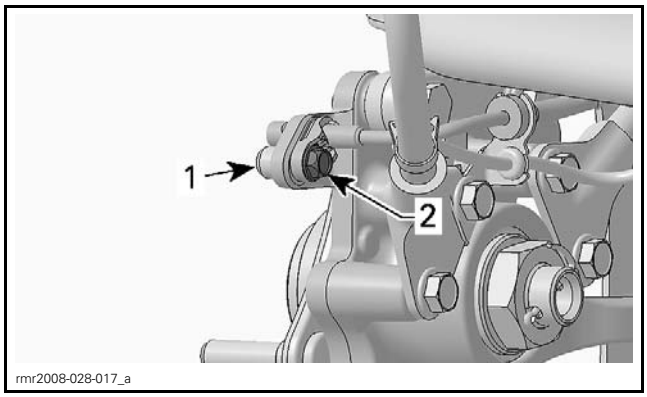
* Dimension "B" to be approximately equal upon assembly.

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 *ADJUSTMENT* 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

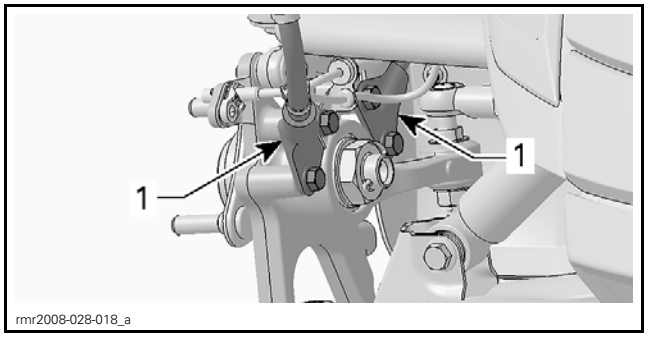
Knuckle Removal

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.



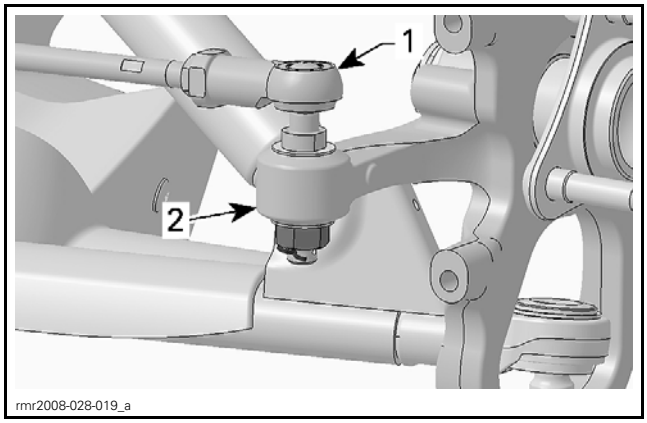
1. *Wheel speed sensor*
2. *Wheel speed sensor screw*

8. Unscrew fender supports.



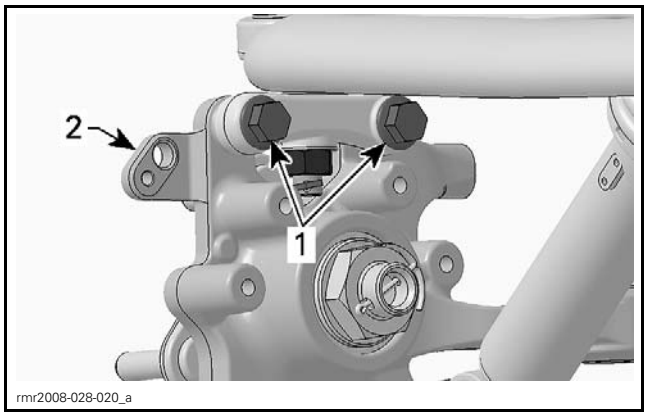
1. *Fender supports*

9. Remove tie-rod end from knuckle, refer to *TIE-ROD* in this subsection.



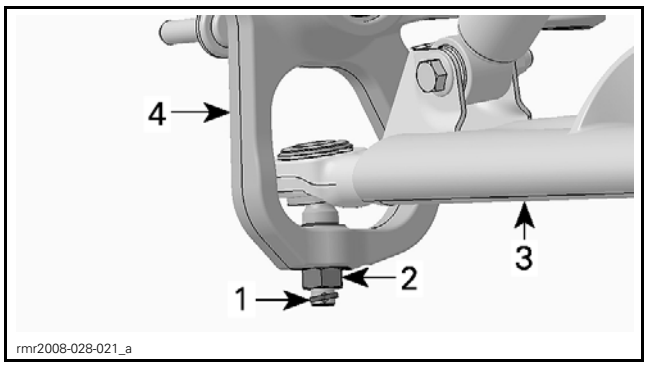
1. *Tie-rod end*
2. *Knuckle*

10. Remove upper ball joint support screws.



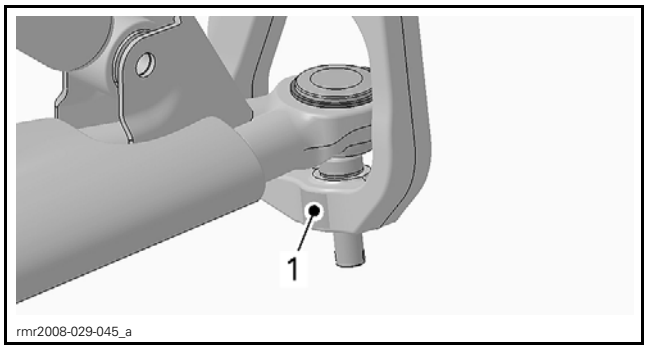
1. Ball joint support screws
2. Knuckle

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

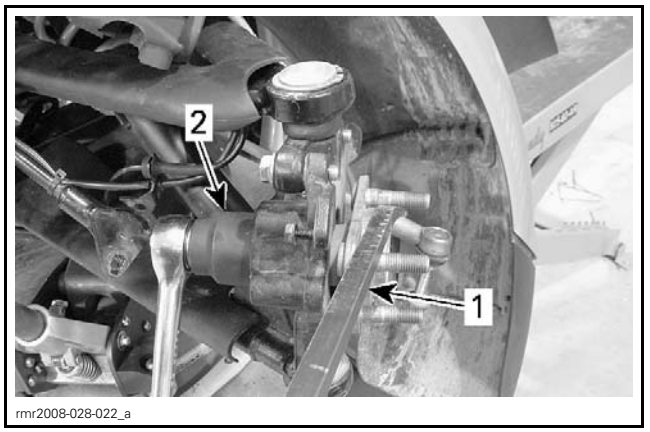
The installation is the reverse of the removal procedure. However, pay attention to the following.

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 *ADJUSTMENT* 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

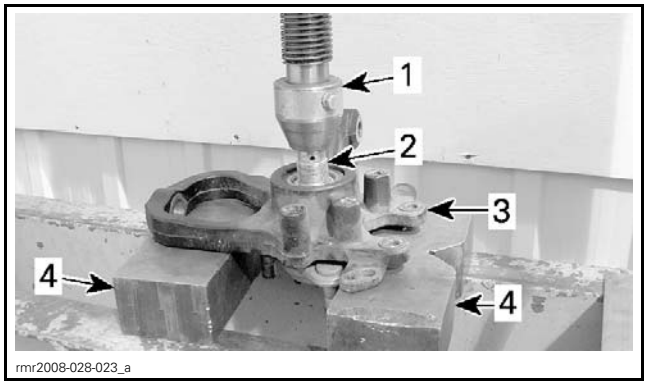
Wheel Hub Removal

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. Prybar
2. 36 mm socket

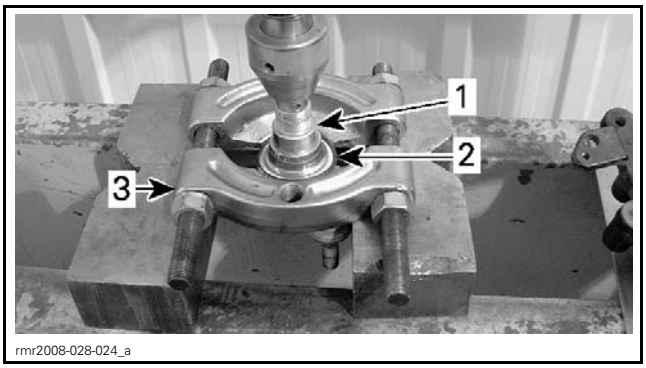
2. Using a press, remove wheel hub from knuckle. Support the knuckle properly to avoid damaging it.



1. 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 BEARING* further in this subsection.

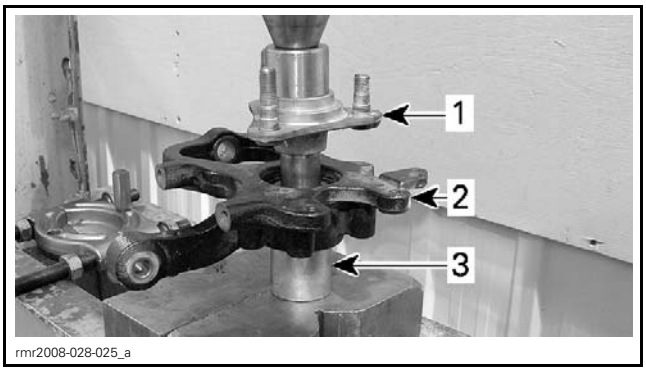
4. If the bearing inner race remains on the wheel hub shaft, use a press and a bearing separator to remove inner race.



1. Wheel hub
2. Bearing inner race
3. 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

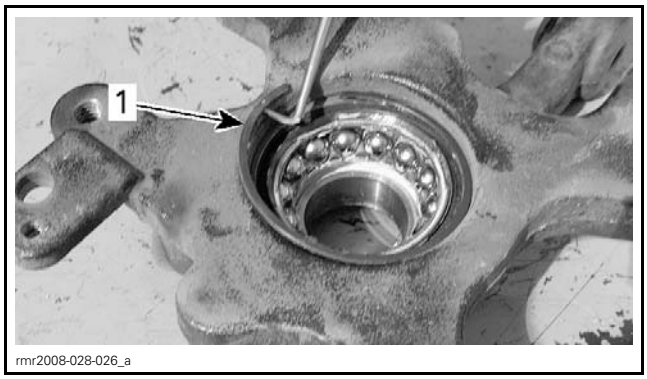
1. Lift the front of vehicle on jack-stands.
2. Hold the wheel at the top and bottom and attempt to move it back and forth to check for looseness and lateral play in the bearing.
3. Rotate wheel and check for smoothness of rotation.

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

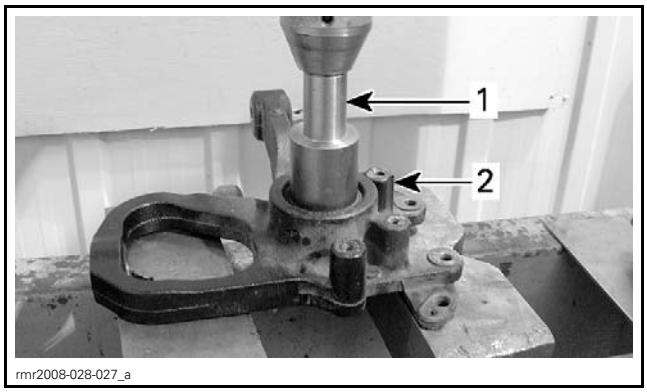
1. Remove *WHEEL HUB*. See procedure in this subsection.
2. Remove the circlip retaining the wheel bearing in the knuckle.



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.