

SAFETY NOTICE

This manual has been prepared as a guide to correctly service and repair 2016 Sea-Doo® watercraft as described in the model list in the *INTRODUCTION*.

This edition was primarily published to be used by technicians who are already familiar with all service procedures relating to BRP products. Mechanical technicians should attend training courses given by BRPTI.

Please note that the instructions will apply only if proper hand tools and special service tools are used.

The contents of this manual depicts parts and procedures applicable to the particular product at the time of writing. Service and Warranty Bulletins may be published to update the content of this manual. Dealer modifications that were carried out after manufacturing of the product, whether or not authorized by BRP, are not included.

In addition, the sole purpose of the illustrations throughout the manual, is to assist identification of the general configuration of the parts. They are not to be interpreted as technical drawings or exact replicas of the parts.

The use of BRP parts is most strongly recommended when considering replacement of any component. Dealer and/or distributor assistance should be sought in case of doubt.

The engines and the corresponding components identified in this document should not be utilized on product(s) other than those mentioned in this document.

It is understood that certain modifications may render use of the watercraft illegal under existing federal, provincial and state regulations.

This manual emphasizes particular information denoted by the following wording and symbols:

WARNING

Indicates a potential hazard that, if not avoided, could result in serious injury or death.

 **CAUTION** Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE Indicates an instruction which, if not followed, could result in severe damage to vehicle components or other property.

NOTE: Indicates supplementary information required to fully complete an instruction.

Although the mere reading of such information does not eliminate the hazard, your understanding of the information will promote its correct use.

Always observe common shop safety practice.

Unless otherwise noted, the engine must be stopped and the tether cord must be removed prior to perform any services.

Before carrying out any inspection or maintenance procedure on the watercraft, wait until the engine and exhaust have cooled down to avoid potential burns.

Torque wrench tightening specifications must be strictly adhered to. Use the torque values and service products as in the exploded views or in the procedures when noted.

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

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

When ordering parts always refer to the specific model *PARTS CATALOG*.

We strongly recommend that any services be carried out and/or verified by a highly skilled professional mechanic.

It is understood that this manual may be translated into another language. In the event of any discrepancy, the English version shall prevail.

BRP disclaims liability for all damages and/or injuries resulting from the improper use of the contents.

INTRODUCTION

This shop manual covers the following BRP made 2016 Sea-Doo watercraft models.

MODEL
GTX ⁺ Series
GTX LIMITED 300
RXP™ Series
RXP-X 300
RXP-X 300 RS
RXT™ Series
RXT X 300
RXT X 300 RS
WAKE Series
WAKE PRO 215

The information and component/system descriptions contained in this manual are correct at time of writing. BRP however, maintains a policy of continuous improvement of its products without imposing upon itself any obligation to install them on products previously manufactured.

Due to late changes, there may be some differences between the manufactured product and the description and/or specifications in this document. BRP reserves the right at any time to discontinue or change specifications, designs, features, models or equipment without incurring obligation.

VEHICLE INFORMATION

HULL IDENTIFICATION NUMBER (HIN)

The hull identification number is composed of 12 digits:

YDV	12345	L	4	95
				Model year
				Year of production
				Month of production
				Serial number (a letter may also be used as a digit)
				Manufacturer

It is located on the deck at the rear of watercraft.



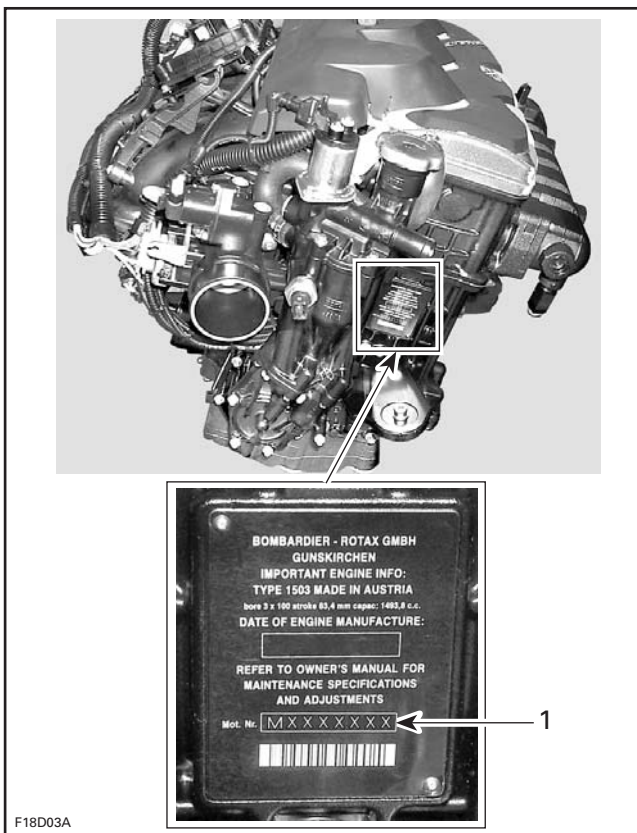
TYPICAL
1. Hull Identification Number (HIN) - aS and iS models



TYPICAL
1. Hull Identification Number (HIN) - models without aS and iS

ENGINE IDENTIFICATION NUMBER (EIN)

The Engine Identification Number is located on front end of the engine.



TYPICAL

1. Engine Identification Number (EIN)

HOISTING A WATERCRAFT

To work on a watercraft, you should mount it securely on a stand.

The LIFTING STRAP (P/N 529 036 189) MUST be used to hoist and mount the watercraft on a stand.

NOTICE Using any other lifting strap kit than the one recommended may cause damage to the vehicle. Bumpers could be torn off.



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TYPICAL

ENGINE EMISSIONS INFORMATION

Manufacturer's Responsibility

Manufacturers of engines must determine the exhaust emission levels for each engine horsepower family and certify these engines with the United States of America Environmental Protection Agency (EPA). An emissions control information label, showing emission levels and engine specifications, must be placed on each vehicle at the time of manufacture.

Dealer Responsibility

When servicing any vehicle that carry an emissions control information label, adjustments must be kept within published factory specifications.

Replacement or repair of any emission related component must be executed in a manner that maintains emission levels within the prescribed certification standards.

Dealers are not to modify the engine in any manner that would alter the horsepower or allow emission levels to exceed their predetermined factory specifications.

Exceptions include manufacturers' prescribed changes, such as altitude adjustments.

Owner Responsibility

The owner/operator is required to have engine maintenance performed to maintain emission levels within prescribed certification standards.

INTRODUCTION

The owner/operator is not to, and should not allow anyone else to modify the engine in any manner that would alter the horsepower or allow emissions levels to exceed their predetermined factory specifications.

Emission Regulations

The vehicle you are servicing may have been certified to applicable emission regulations in your country or state. Not as an exhaustive list; this may include standards for engine exhaust emissions, crankcase emissions, permeation emissions and evaporative emissions. Servicing procedures in this manual must be strictly followed in order to keep the vehicle within the factory specifications. Failure to follow servicing procedures in this manual may lead a vehicle to be out of compliance with applicable emission regulations.

When servicing any vehicle; adjustments must be kept within published factory specifications. Replacement or repair of any emission related component must be executed in a manner that maintains emission levels within the applicable certification standards. Nobody is allowed to modify the engine in any manner that would alter the horsepower or allow emission levels to exceed their predetermined factory specifications. Exceptions include manufacturer's prescribed changes.

The owner/operator is required to have engine maintenance performed to maintain emission levels within the prescribed certification standards. The owner/operator is allowed and should not allow anyone else to modify the engine in any manner that would alter the horsepower or allow emissions levels to exceed their predetermined factory specifications.

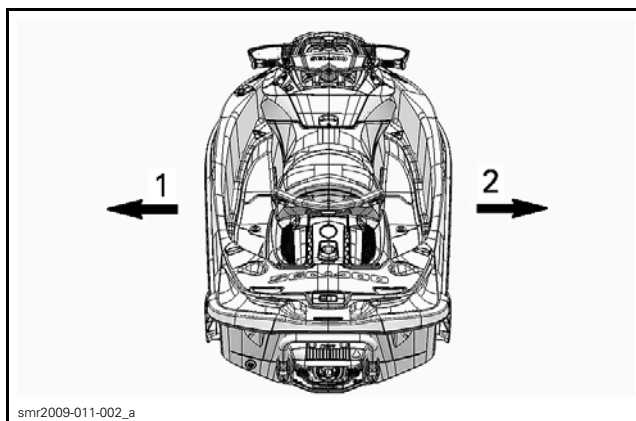
MANUAL INFORMATION

MANUAL PROCEDURES

Many of the procedures in this manual are inter-related. Before undertaking any task, you should read and thoroughly understand the entire section or subsection in which the procedure is contained.

A number of procedures throughout the book require the use of special tools. Before commencing any procedure, be sure that you have on hand all the tools required, or their approved equivalents.

The use of RIGHT (starboard) and LEFT (port) indications in the text are always referenced to the driving position (when sitting on the watercraft).



- smr2009-011-002_a
1. Left (port)
 2. Right (starboard)

Other common terms used in the marine industry are the BOW (front of the watercraft), and the STERN (rear of the watercraft).

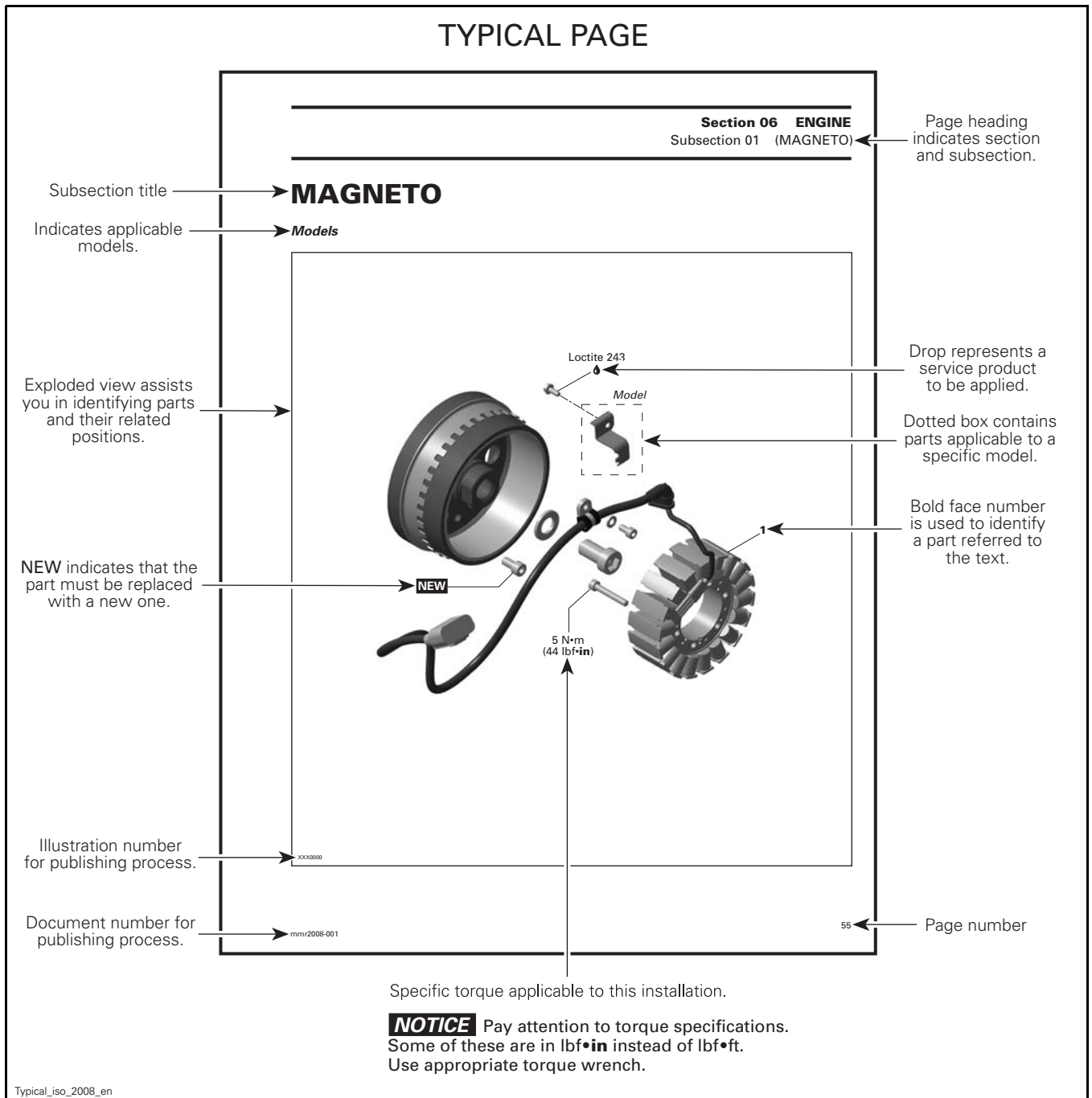
This manual uses technical terms which may be different from the ones in the *PARTS CATALOGS*.

MANUAL LAYOUT

This manual is divided into many major sections as can be seen in the main table of contents at the beginning of the manual.

Each section is divided into various subsections, and again, each subsection has one or more divisions.

Illustrations and photos show the typical construction of various assemblies and, in all cases, may not reproduce the full detail or exact shape of the parts used in a particular model vehicle. However, they represent parts which have the same or a similar function.



TYPICAL PAGE

Title in bold indicates category of information to be carried out.

Reference to a specific section or subsection.

Indicates component
procedures apply to.

Indicates specific procedure to be carried out.

► GENERAL

NOTE: The following procedures can be done without removing the engine.

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** sections 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, self-locking fasteners, etc.) must be replaced with new ones.

PROCEDURES

► MAGNETO FLYWHEEL

Magneto Flywheel Cleaning
Clean all metal components in a non-ferrous metal cleaner.

CAUTION: Clean magneto flywheel using only a clean cloth.

► Magneto Flywheel Removal

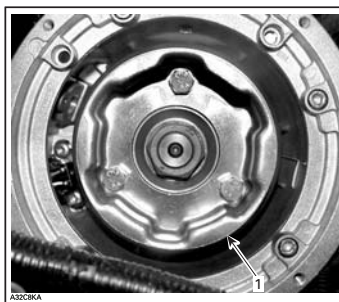
Remove muffler, refer to the *EXHAUST SYSTEM* section.

Remove acoustic panel.

Remove rewind starter.

Remove starting pulley **no. 2**.

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TYPICAL ←

1. Starting pulley

NOTE: To remove starting pulley bolts, hold magneto flywheel with a socket as shown.



TYPICAL

Models

Remove the connecting flange retaining the rewind starter to the engine housing.

"TYPICAL"
indicates a general
view which may
not represent exact
details.

Call-outs pertaining
to above illustration.

Illustration always follows text to which it applies.

Italic bold face type setting indicates a procedure applicable to a specific model(s).

Bold face number following part name refers to exploded view at beginning of subsection.

TIGHTENING TORQUE

Tighten fasteners to the torque specified in the exploded view(s) and/or in the written procedure. When a torque is not specified, the torque normally recommended for a specific fastener should be used. Refer to the following table.

WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices must be replaced when removed (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.).

In order to avoid a poor assembly, tighten screws, bolts, or nuts in accordance with the following procedure:

1. Manually screw all screws, bolts and/or nuts.
2. Apply half the recommended torque value.

NOTICE Be sure to use the recommended tightening torque for the specified fastener used.

NOTE: Whenever possible, always apply torque on the nut.

3. Tighten fastener to the recommended torque value.

NOTE: Always torque screws, bolts and/or nuts using a crisscross pattern when multiple fasteners are used to secure a part (e.g. a cylinder head). Some parts must be torqued according to a specific sequence and torque pattern as detailed in the installation procedure.

Property class and head markings	4.8   	8.8  	9.8  	10.9  	12.9  
Property class and nut markings	5   	8   	10   	12   	

A00A8BS

FASTENER SIZE	FASTENER GRADE/TORQUE			
	5.8 Grade	8.8 Grade	10.9 Grade	12.9 Grade
M4	1.5 N•m - 2 N•m (13 lbf•in - 18 lbf•in)	2.5 N•m - 3 N•m (22 lbf•in - 27 lbf•in)	3.5 N•m - 4 N•m (31 lbf•in - 35 lbf•in)	4 N•m - 5 N•m (35 lbf•in - 44 lbf•in)
M5	3 N•m - 3.5 N•m (27 lbf•in - 31 lbf•in)	4.5 N•m - 5.5 N•m (40 lbf•in - 49 lbf•in)	7 N•m - 8.5 N•m (62 lbf•in - 75 lbf•in)	8 N•m - 10 N•m (71 lbf•in - 89 lbf•in)
M6	6.5 N•m - 8.5 N•m (58 lbf•in - 75 lbf•in)	8 N•m - 12 N•m (71 lbf•in - 106 lbf•in)	10.5 N•m - 15 N•m (93 lbf•in - 133 lbf•in)	16 N•m (142 lbf•in)
M8	15 N•m (133 lbf•in)	25 N•m (18 lbf•ft)	32 N•m (24 lbf•ft)	40 N•m (30 lbf•ft)
M10	29 N•m (21 lbf•ft)	48 N•m (35 lbf•ft)	61 N•m (45 lbf•ft)	73 N•m (54 lbf•ft)
M12	52 N•m (38 lbf•ft)	85 N•m (63 lbf•ft)	105 N•m (77 lbf•ft)	128 N•m (94 lbf•ft)
M14	85 N•m (63 lbf•ft)	135 N•m (100 lbf•ft)	170 N•m (125 lbf•ft)	200 N•m (148 lbf•ft)

INTRODUCTION

FASTENER INFORMATION

NOTICE Most fasteners are metric. Mismatched or incorrect fasteners could cause damage to the vehicle.

SELF-LOCKING FASTENER PROCEDURE



TYPICAL — SELF-LOCKING FASTENER

The following describes common procedures used when working with self-locking fasteners.

Use a metal brush or a tap to clean the hole properly, then use a solvent. Allow the solvent time to act, approximately 30 minutes, then wipe off. Solvent utilization is to ensure proper adhesion of the product used for locking the fastener.

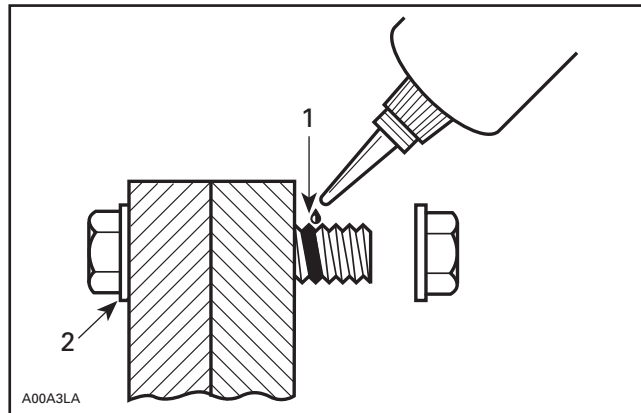
LOCTITE® APPLICATION PROCEDURE

The following describes common procedures used when working with Loctite products.

NOTE: Always use proper strength Loctite product as recommended in this Shop Manual.

NOTICE When applying threadlocker products (anaerobic products), pay attention to prevent the product from coming into contact with ABS plastic parts (painted parts).

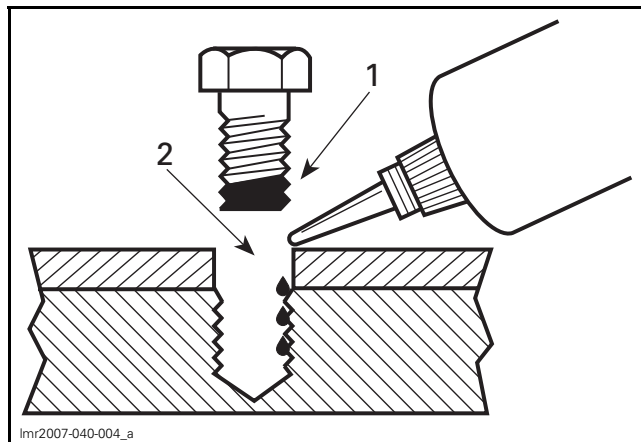
Threadlocker Application for Uncovered Holes (Bolts and Nuts)



1. Apply here
2. Do not apply

1. Clean threads (bolt and nut) with solvent.
2. Apply LOCTITE 7649 (PRIMER) (P/N 293 800 041) on threads and allow to dry.
3. Choose proper strength Loctite threadlocker.
4. Fit bolt in the hole.
5. Apply a few drops of threadlocker at proposed tightened nut engagement area.
6. Position nut and tighten as required.

Threadlocker Application for Blind Holes

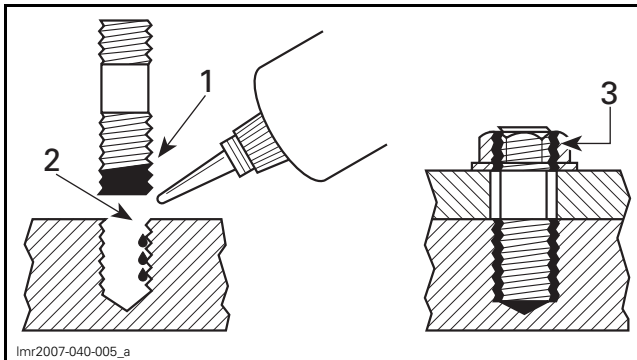


1. On fastener threads
2. On threads and at the bottom of hole

1. Clean threads (bolt and hole) with solvent.
2. Apply LOCTITE 7649 (PRIMER) (P/N 293 800 041) on threads (bolt and nut) and allow to dry for 30 seconds.
3. Choose proper strength Loctite threadlocker.

4. Apply several drops along the threaded hole and at the bottom of the hole.
5. Apply several drops on bolt threads.
6. Tighten as required.

Threadlocker Application for Stud Installation in Blind Holes



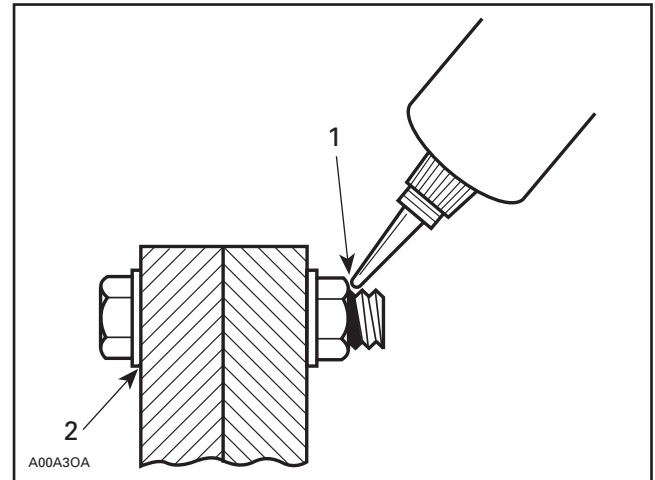
1. On stud threads
2. On threads and in the hole
3. On retaining nut threads

1. Clean threads (stud and hole) with solvent.
2. Apply LOCTITE 7649 (PRIMER) (P/N 293 800 041) on threads and allow to dry.
3. Put 2 or 3 drops of proper strength Loctite threadlocker on female threads and in hole.

NOTE: To avoid a hydro lock situation, do not apply too much Loctite.

4. Apply several drops of proper strength Loctite on stud threads.
5. Install stud.
6. Install cover, part, etc.
7. Apply a few drops of proper strength Loctite on uncovered stud threads.
8. Install and tighten retaining nut(s) as required.

Threadlocker Application for Pre-Assembled Parts

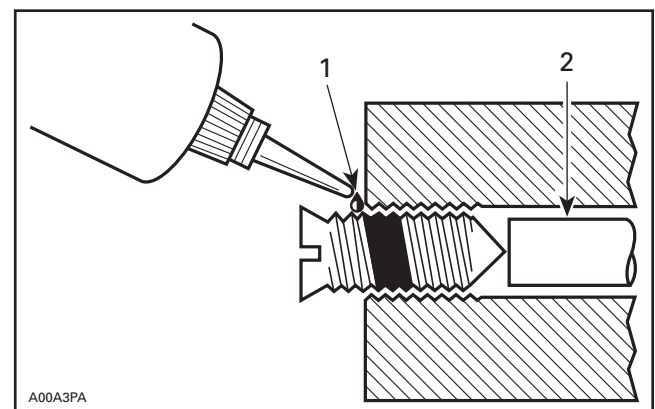


1. Apply here
2. Do not apply

1. Clean bolts and nuts with solvent.
2. Assemble components.
3. Tighten nuts.
4. Apply a few drops of proper strength Loctite on bolt/nut contact surfaces.
5. Avoid touching metal with tip of flask.

NOTE: For preventive maintenance on existing equipment, retighten nuts and apply proper strength Loctite on bolt/nut contact surfaces.

Threadlocker Application for an Adjustment Screw



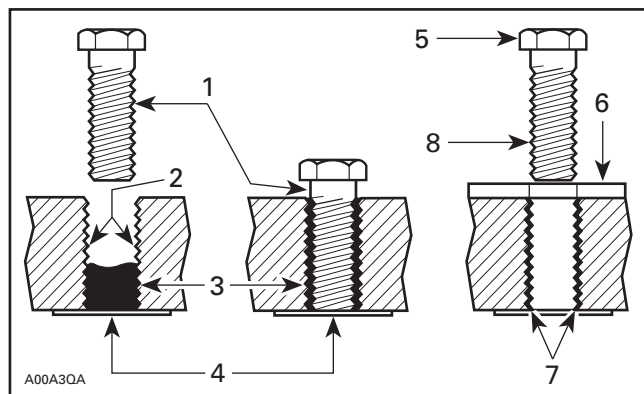
1. Apply here
2. Plunger

1. Adjust screw to proper setting.
2. Apply a few drops of proper strength Loctite threadlocker on screw/body contact surfaces.
3. Avoid touching metal with tip of flask.

INTRODUCTION

NOTE: If it is difficult to readjust, heat screw with a soldering iron (232°C (450°F)).

Application for Stripped Thread Repair



1. Release agent
2. Stripped threads
3. Form-A-Thread
4. Tape
5. Cleaned bolt
6. Plate
7. New threads
8. Threadlocker

Standard Thread Repair

Follow instructions on Loctite FORM-A-THREAD 81668 package.

If a plate is used to align bolt:

1. Apply release agent on mating surfaces.
2. Put waxed paper or similar film on the surfaces.
3. Twist bolt when inserting it to improve thread conformation.

NOTE: NOT intended for engine stud repairs.

Repair of Small Holes/Fine Threads

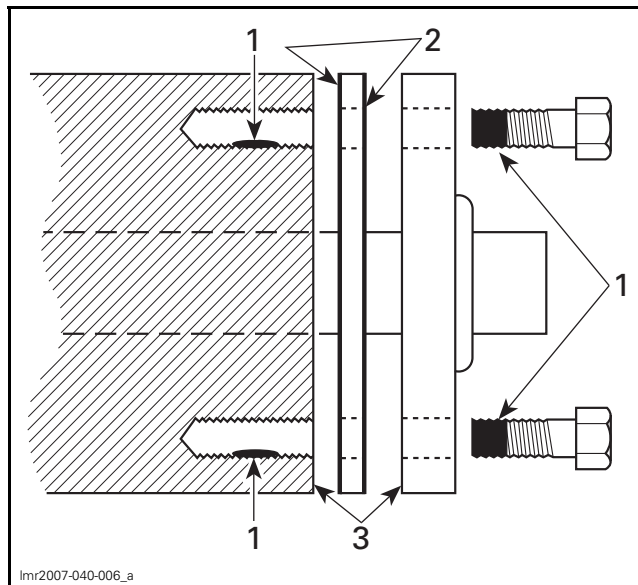
Option 1: Enlarge damaged hole, then follow *STANDARD THREAD REPAIR* procedure.

Option 2: Apply FORM-A-THREAD on the screw and insert in damaged hole.

Permanent Stud Installation (Light Duty)

1. Use a stud of the desired thread length.
2. DO NOT apply release agent on stud.
3. Follow Standard Thread Repair procedure.
4. Allow 30 minutes for Loctite FORM-A-THREAD to cure.
5. Complete part assembly.

Gasket Compound Application



1. Proper strength Loctite
2. Loctite Primer N (P/N 293 800 041) and Gasket Eliminator 518 (P/N 293 800 038) on both sides of gasket
3. Loctite Primer N only

1. Remove old gasket and other contaminants using LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500). Use a mechanical means only if necessary.

NOTE: Avoid grinding.

2. Clean both mating surfaces with solvent.
3. Spray Loctite Primer N on both mating surfaces and on both sides of gasket and allow to dry 1 or 2 minutes.
4. Apply LOCTITE 518 (P/N 293 800 038) on both sides of gasket, using a clean applicator.
5. Place gasket on mating surfaces and assemble parts immediately.

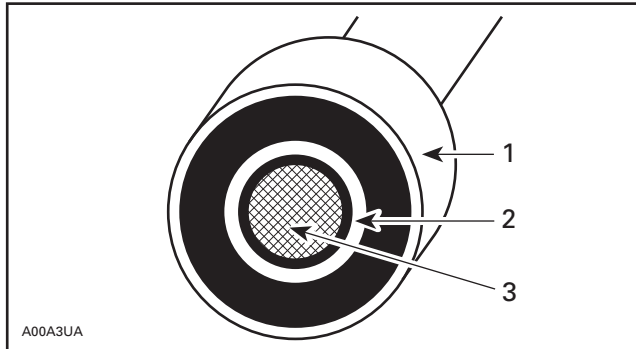
NOTE: If the cover is bolted to blind holes, apply proper strength Loctite in the hole and on threads. Tighten fastener.

If holes are sunken, apply proper strength Loctite on bolt threads.

6. Tighten as usual.

Threadlocker Application for Mounting on a Shaft

Mounting with a Press



1. Bearing
2. Proper strength Loctite
3. Shaft

1. Clean shaft external contact surface.
2. Clean internal contact surface of part to be installed on shaft.
3. Apply a strip of proper strength Loctite on circumference of shaft contact surface at insertion or engagement point.

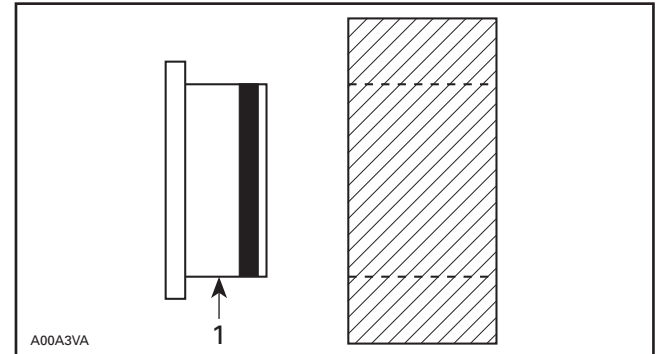
NOTE: Retaining compound is always forced out when applied on shaft.

4. DO NOT use antiseize Loctite or any similar product.
5. No curing period is required.

Mounting in Tandem

1. Apply retaining compound on internal contact surface (bore) of parts to be installed.
2. Continue parts assembly as per previous illustration.

Threadlocker Application for Case-In Components (Metallic Gaskets)



1. Proper strength Loctite

1. Clean inner housing diameter and outer gasket diameter.
2. Spray housing and gasket with LOCTITE 7649 (PRIMER) (P/N 293 800 041).
3. Apply a strip of proper strength Loctite on leading edge of outer metallic gasket diameter.

NOTE: Any Loctite product can be used here. A low strength liquid is recommended as normal strength and gap are required.

4. Install according to standard procedure.
5. Wipe off excess product.
6. Allow 30 minutes for product to cure.

NOTE: Normally used on worn-out housings to prevent leaking or sliding.

It is generally not necessary to remove gasket compound applied on outer gasket diameter.

MAINTENANCE SCHEDULE

Maintenance is very important for keeping the watercraft in a safe operating condition. The watercraft should be serviced as per the maintenance schedule.

A repair shop or person of the owner's choosing may maintain, replace, or repair emission control devices and systems. These instructions do not require components or service by BRP or authorized Sea-Doo dealers. Although an authorized Sea-Doo dealer has an in-depth technical knowledge and tools to service the Sea-Doo personal watercraft, the emission-related warranty is not conditioned on the use of an authorized Sea-Doo dealer or any other establishment with which BRP has a commercial relationship. For emission-related warranty claims, BRP is limiting the diagnosis and repair of emission-related parts to the authorized Sea-Doo dealers. For more information, please refer to the *US EPA EMISSION-RELATED WARRANTY* contained herein. Proper maintenance is the owner's responsibility. A warranty claim may be denied if, among other things, the owner or operator caused the problem through improper maintenance or use.

You must follow the instructions for fuel requirements in the fueling section of this manual. Even if gasoline containing greater than ten volume percent ethanol is readily available, the US EPA issued a prohibition against the use of gasoline containing greater than 10 vol% ethanol that applies to this vehicle. The use of gasoline containing greater than 10 vol% ethanol with this engine may harm the emission control system.

Disregard the information pertaining to the following systems if the watercraft is not equipped with these features:

- iBR (intelligent Brake and Reverse)
- iS (intelligent Suspension) (GTX LTD iS only)
- aS (adjustable Suspension) (RXT-X aS only)

Carry out all maintenance as listed in the schedule whenever the hours or time is reached.

NOTE: As an example, at 200 hours or 2 years, complete all items in this table and ALSO all items in the EVERY 100 hours or 1 year table.

WARNING

Failure to properly maintain the watercraft according to the maintenance schedule and procedures can make it unsafe to operate.

The maintenance schedule does not exempt the pre-ride inspection.

Subsection XX (MAINTENANCE SCHEDULE)

FIRST 50 HOURS OR 1 YEAR
Replace engine oil and filter
Inspect the exhaust system (daily flushing in salt water or dirty water use)
Inspect fuel cap, filler neck, fuel tank, fuel tank straps, fuel lines and connections
Test the fuel system for leaks
Inspect the throttle body
Check for fault codes
Inspect spark plugs
Inspect electrical connections and fastening (ignition system, starting system, fuel injectors, fuse boxes etc.)
Test the engine cut-off switch and the monitoring beeper
Verify the steering cable and connections
Verify steering nozzle bushings
Verify O.T.A.S. operation
Inspect carbon ring and drive shaft rubber boot (more frequently when using PWC in foul or dirt water)
Inspect impeller, impeller boot and wear ring condition
Verify iBR gate backlash
Inspect iBR protective guard
The following must be performed each month:
Inspect battery condition
Verify battery connections
Inspect sacrificial anode (more often in salt water use) and change when necessary
EVERY 100 HOURS OR 1 YEAR
Replace engine oil and filter
Inspect engine rubber mounts
Spray an anticorrosion lubricant to metallic components in engine compartment (every 10 hours in salt water use)
Inspect and flush the exhaust system
Inspect the cooling system (coolant level, hoses and fasteners for leaks)
Lubricate and verify the iTC lever for proper operation (Depress and release the lever to check for freedom of movement. If any friction is felt, the lever must be taken apart, cleaned, inspected for wear and lubricated)
Inspect fuel cap, filler neck, fuel tank, fuel tank straps, fuel lines and connections (At storage period or after 100 hours of use whichever comes first)
Test the fuel system for leaks
Inspect the throttle body
Inspect the air intake silencer
Check for fault codes
Inspect and lubricate ignition coils (1503 4-TEC engines)
Inspect ignition coils (1630 ACE HO engines)
Inspect electrical connections and fastening (ignition system, starting system, fuel injectors, fuse boxes etc.)

EVERY 100 HOURS OR 1 YEAR
Test the engine cut-off switch and the monitoring beeper
Verify the steering cable and connections
Verify steering nozzle bushings
Verify O.T.A.S. operation
Inspect carbon ring and drive shaft rubber boot (more frequently when using PWC in foul or dirt water)
Inspect impeller, impeller boot and wear ring condition
Verify the impeller shaft radial play
Inspect the jet pump housing
Verify and lubricate splines of the drive shaft and impeller
Measure impeller and impeller wear ring clearance
Lubricate and verify the iBR lever for proper operation (Depress and release the lever to check for freedom of movement. If any friction is felt, the lever must be taken apart, cleaned, inspected for wear and lubricated)
Verify iBR gate backlash
Verify iVTS trim ring, reverse support and iBR gate
Inspect iBR protective guard
Inspect iS system (leaks, pump reservoir oil level and position sensor operation)
Inspect aS system (leaks, remote reservoir (mounts, adjustment knob tightening)
Inspect hull, ride plate and water inlet grate for damages
The following must be performed every 100 hours (irrespective of the number of years):
Replace spark plugs (1630 ACE HO engines)
The following must be performed every 100 hours or at storage period (whichever comes first):
Impeller shaft seal, sleeve, O-ring and impeller cover
EVERY 200 HOURS OR 2 YEARS
Replace spark plugs (1503 4-TEC engines)
The following must be performed every 200 hours (irrespective of the number of years):
Replace the supercharger clutch (1503 4-TEC engines)
Inspect the clutch slipping torque of the supercharger (1630 ACE HO engines) - This supercharger is MAINTENANCE FREE . However, inspect supercharger at the same time when vehicle is used in intense conditions such as off-shore riding, continuous operation at wide open throttle, etc.
NOTICE Do not attempt to replace components of the supercharger assembly as the unit is factory-balanced to precise specifications. Failure to follow this recommendation may lead to supercharger and / or engine damage.
EVERY 300 HOURS OR 5 YEARS
Replace the coolant

STORAGE PROCEDURE

SERVICE PRODUCTS

Description	Part Number	Page
ANTICORROSION SPRAY	219 700 304	4
DOW CORNING 111	413 707 000	4
LOCTITE 767 (ANTISEIZE LUBRICANT)	293 800 070	4
XPS FUEL STABILIZER.....	413 408 601	1
XPS LUBE.....	293 600 016	1, 3-4

PROCEDURES

PROPULSION SYSTEM

Cleaning and Protecting the Propulsion System

Clean jet pump by spraying water in its inlet and outlet and then apply a coating of XPS LUBE (P/N 293 600 016) or equivalent.

Inspecting the Jet Pump

Remove impeller cover and check if jet pump is water contaminated; if so, refer to *JET PUMP* subsection for the repair procedure.

FUEL SYSTEM

Inspecting the Fuel System

Verify fuel system. Check fuel hoses for leaks. Replace damaged hoses or clamps if necessary.

Protecting the Fuel System

XPS FUEL STABILIZER (P/N 413 408 601) (or equivalent) should be added in the fuel tank to prevent fuel deterioration and fuel system gumming. Follow manufacturer's instructions for proper use.

NOTICE Fuel stabilizer should be added prior to engine lubrication to ensure fuel system component protection against varnish deposits.

Fill up fuel tank completely. Ensure there is no water inside fuel tank.

NOTICE Should any water be trapped inside fuel tank, severe internal damage will occur to the fuel injection system.

ENGINE

Replacing the Engine Oil and the Filter

Change engine oil and filter. Refer to *LUBRICATION SYSTEM* subsection.

Flushing the Exhaust System

Flush the exhaust system. Refer to *EXHAUST SYSTEM* subsection.

Draining the Intercooler

It is important to expel any trapped water that may have accumulated from condensation in the external intercooler.

NOTICE Failure to drain the intercooler may cause severe damage to this component.

260 Engines

Models With Suspension

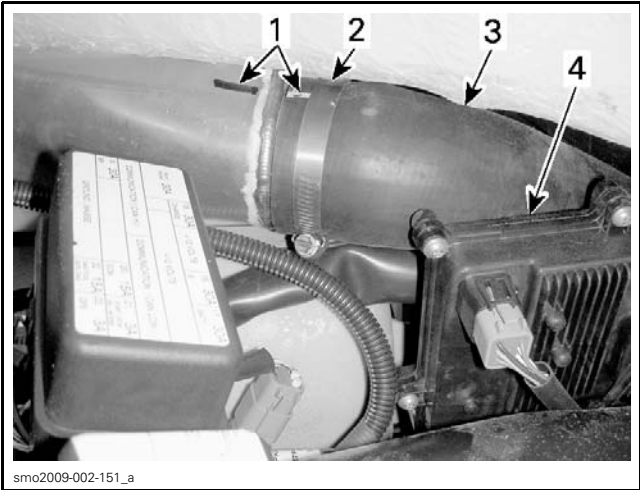
1. Open the boarding platform and remove the RH storage bin.
2. Ensure there is an alignment line drawn on the intercooler outlet hose. This will ensure the hose is not twisted or kinked on reinstallation.
3. Loosen the clamp retaining the intercooler outlet hose.
4. Remove the intercooler outlet hose from the intercooler.

NOTE: This hose feeds the inlet of the throttle body.

iS Models

5. Drape a couple of shop rags over the iS module to protect it from any expelled water from the intercooler.

Subsection XX (STORAGE PROCEDURE)



TYPICAL
1. Hose alignment lines
2. Hose clamp
3. Intercooler outlet hose
4. iS module

All Models

6. Start engine and rev up to 4000 RPM several times. Water will be expelled from the intercooler.

NOTE: Prevent air intake system from aspirating foreign objects which may cause severe engine or damage.

- 7. Stop engine.
- 8. Properly align and reinstall hose on intercooler.
- 9. Torque intercooler hose clamp as specified.

TIGHTENING TORQUE	
Intercooler hose clamp	4 N•m ± 1 N•m (35 lbf•in ± 9 lbf•in)

Models Without Suspension

- 1. Open the seat.
- 2. Ensure there is an alignment line drawn on the throttle body inlet hose. This will ensure the hose is not twisted or kinked on reinstallation.
- 3. Loosen the clamp retaining the hose to the throttle body.
- 4. Remove the hose from the throttle body and direct it away from the throttle body and other components.
- 5. Start engine and rev up to 4000 RPM several times. Water will be expelled from the intercooler.

NOTE: Prevent air intake system from aspirating foreign objects which may cause severe engine or damage.

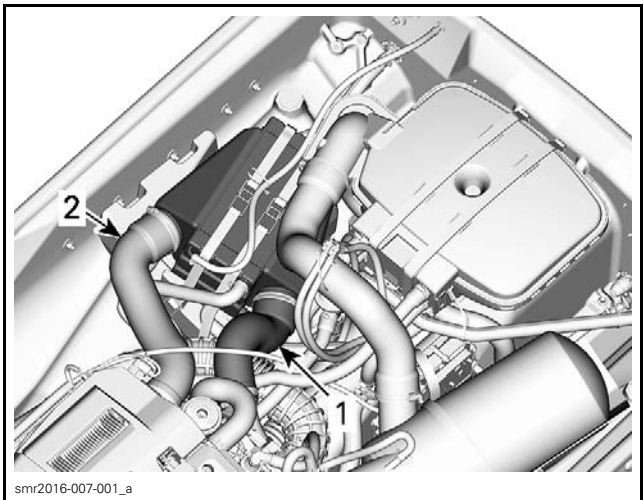
6. Stop engine.

- 7. Properly align and reinstall hose on throttle body.
- 8. Torque intercooler hose clamp as specified.

TIGHTENING TORQUE	
Intercooler hose clamp	4 N•m ± 1 N•m (35 lbf•in ± 9 lbf•in)

300 Engines

- 1. Ensure there is an alignment line drawn on the intercooler inlet hose. This will ensure the hose is not twisted or kinked on reinstallation.



1. Air inlet hose
2. Air outlet hose

- 2. Loosen the clamp retaining the intercooler inlet hose.
- 3. Remove the intercooler inlet hose from the intercooler.

NOTE: This hose feeds the hot, compressed air from the supercharger to the intercooler inlet.

The air side of the intercooler is self-draining into the inlet manifold of the intercooler. By disconnecting the air inlet hose from the intercooler, the presence of condensate water can be visually assessed and properly drained off without running the engine.

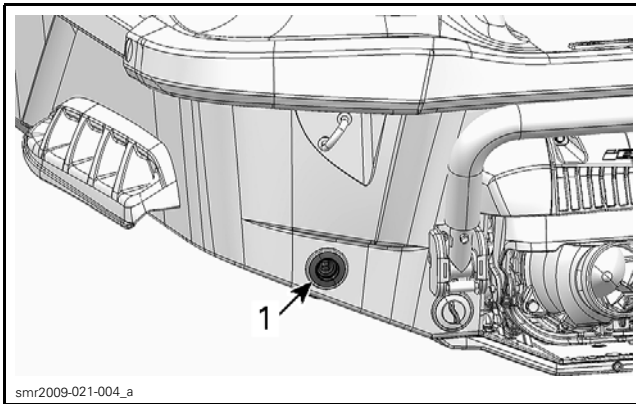
- 4. Reinstall the intercooler air inlet hose, ensure it is properly aligned as prior to removal to ensure proper engine operation.

TIGHTENING TORQUE	
Intercooler hose clamp	4 N•m ± 1 N•m (35 lbf•in ± 9 lbf•in)

Draining the Exhaust System

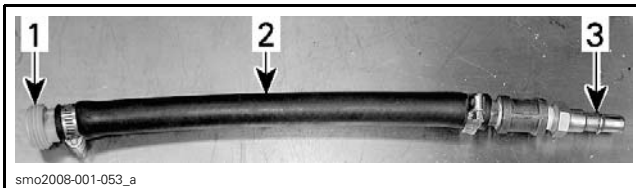
The exhaust system is self draining, but the exhaust manifold and intercooler need to be drained to avoid damages should the watercraft be stored in an area where the temperature attains the freezing point of water.

Using the flushing connector located at the rear of vehicle, inject pressurized air (at 380 kPa (55 PSI)) in the system until there is no more water flowing from jet pump.



1. Flushing connector

The following hose can be fabricated to ease draining procedure.



TYPICAL

1. Flushing adaptor (P/N 295 500 473)
2. Hose 13 mm (1/2 in)
3. Air hose male adapter

NOTICE Failure to drain the exhaust manifold may cause severe damage to components.

Replacing the Engine Coolant

Antifreeze should be replaced every 300 hours or every 5 years (whichever comes first) to prevent antifreeze deterioration.

NOTICE Failure to replace the antifreeze as recommended may allow its degradation that could result in poor engine cooling.

If coolant is not replaced, test the coolant density using an antifreeze hydrometer.

Replace coolant if necessary. For the coolant replacement procedure, refer to *COOLING SYSTEM* subsection.

NOTICE Improper antifreeze density may result in coolant freezing should the vehicle be stored in area where the freezing point is attained. This could seriously damage the engine.

Lubricating the Internal Parts of the Engine

Engine must be lubricated to prevent corrosion on internal parts.

Lubrication of the engine is recommended at the end of the season and before any extended storage period to provide additional corrosion protection. This will lubricate the engine intake valves, the cylinders and the exhaust valves.

To lubricate the engine, proceed as follows:

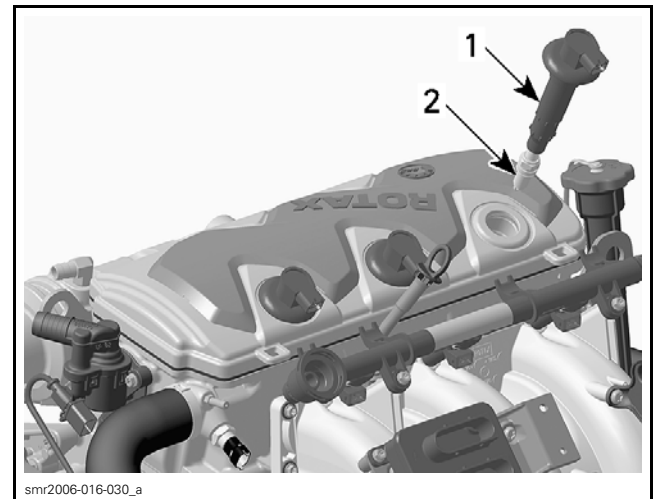
1. Open seat.

Models With Suspension

2. Remove the rear ventilation box.

All Models

3. Disconnect ignition coil connectors.
4. Clean the area around the ignition coils to avoid dirt falling into a cylinder.
5. Remove ignition coils.
6. Unscrew spark plugs.
7. Using an ignition coil as a puller, remove spark plugs.



TYPICAL - 1503 4-TEC ENGINE SHOWN

1. Ignition coil
2. Spark plug

8. Spray XPS LUBE (P/N 293 600 016) into each spark plug hole.
9. Crank the engine a few turns to distribute the oil on cylinder wall.

Subsection XX (STORAGE PROCEDURE)

NOTE: To crank engine, use the drowned mode to avoid injecting fuel. Fully depress throttle lever and hold for cranking engine.

10. Apply a small amount of LOCTITE 767 (ANTI-SEIZE LUBRICANT) (P/N 293 800 070) on spark plug threads then reinstall them.

NOTE: Refer to *IGNITION SYSTEM* subsection for details on installing the spark plugs and ignition coils.

11. On 155/215/260 engines, prior to inserting the ignition coil onto its spark plug, apply some DOW CORNING 111 (P/N 413 707 000) around the seal area that touches the spark plug hole.
12. Reinstall ignition coils.
13. On 155/215/260 engines, ensure the seal seats properly with the engine top surface.
14. Reconnect ignition coil connectors.
15. Install all other removed parts.

ELECTRICAL SYSTEM

Removing the Battery

For battery removal, cleaning and storage, refer to *CHARGING SYSTEM* subsection.

ENGINE COMPARTMENT

Cleaning the Engine Compartment

1. Clean the bilge with hot water and a mild detergent, or using bilge cleaner.
2. Rinse thoroughly.
3. Lift front end of watercraft to completely drain bilge. Refer to appropriate *HULL* subsection for bilge drain plug removal.

Applying an Anticorrosion Treatment

Wipe off any residual water in the engine compartment.

Spray XPS LUBE (P/N 293 600 016) or ANTICORROSION SPRAY (P/N 219 700 304) or an equivalent product over all metallic components only in engine compartment while minimizing overspray..

NOTE: The seat should be left partially open during storage. This will prevent engine compartment condensation and possible corrosion.

BODY AND HULL

Cleaning the Body and the Hull

Wash the body with a soap and water solution (only use a mild detergent). Rinse thoroughly with fresh water. Remove marine organisms from the hull.

NOTICE Never clean body parts or hull with strong detergent, degreasing agent, paint thinner, acetone, etc.

Replace damaged labels/decals.

Repairing the Body

If any repair is required, refer to appropriate *BODY* subsection.

Repairing the Hull

If any repair is required, refer to appropriate *HULL* subsection.

Protecting the Body and the Hull

Apply a good quality marine wax on body and hull.

If the watercraft is to be stored outside, cover it with an opaque tarpaulin to prevent sun rays and grime from affecting the plastic components, watercraft finish as well as preventing dust accumulation.

NOTICE The watercraft should never be left in water for storage, stored in direct sunlight or stored in a plastic bag.

PRESEASON PREPARATION

Proper vehicle preparation is necessary after the winter months or when a watercraft has not been used during 4 months.

Any worn, broken or damaged parts found must be replaced.

Using the *MAINTENANCE SCHEDULE*, perform the items titled *EVERY 100 HOURS OR 1 YEAR*.

EVERY 100 HOURS OR 1 YEAR
Replace engine oil and filter
Inspect engine rubber mounts
Spray an anticorrosion lubricant to metallic components in engine compartment (every 10 hours in salt water use)
Inspect and flush the exhaust system
Inspect the cooling system (coolant level, hoses and fasteners for leaks)
Lubricate and verify the ITC lever for proper operation (Depress and release the lever to check for freedom of movement. If any friction is felt, the lever must be taken apart, cleaned, inspected for wear and lubricated)
Inspect fuel cap, filler neck, fuel tank, fuel tank straps, fuel lines and connections (At storage period or after 100 hours of use whichever comes first)
Test the fuel system for leaks
smr2016-008-001

Furthermore, proceed with the following:

Watercraft Prepared as per Storage Procedure

- Ensure battery is fully charged.
- Reinstall the battery.
- Test ride watercraft to confirm proper operation.

Watercraft Not Prepared as per Storage Procedure

- Ensure battery is fully charged.
- Replace engine oil and filter.
- Drain fuel tank and fill with fresh fuel.
- Reinstall the battery.
- Test ride watercraft to confirm proper operation.

SPECIAL PROCEDURES

SERVICE TOOLS

Description	Part Number	Page
LARGE HOSE PINCHER.....	529 032 500	2
SUCTION PUMP	529 035 880	2

GENERAL

Refer to the following special procedures according to the specific event. Procedures described may not be applicable to every watercraft model.

PROCEDURES

TOWING THE WATERCRAFT IN WATER

Special precautions should be taken when towing a Sea-Doo watercraft in water.

The maximum recommended towing speed is 24 km/h (15 MPH).

This will prevent the exhaust system from filling with water, which may lead to water being injected into and filling the engine. Without the engine running, there isn't any exhaust pressure to push the water out the exhaust outlet.

NOTICE Failure to follow these instructions may result in damage to the engine. If you must tow a stranded watercraft in water, be sure not to exceed the maximum towing speed of 24 km/h (15 MPH).

SUBMERGED WATERCRAFT

NOTICE Never try to crank or start engine. Water trapped in the intake manifold would flow towards the engine and possible cause severe engine damage.

1. Drain bilge.
2. If the watercraft was submerged in salt water, rinse the bilge and all components thoroughly with fresh water using a garden hose to stop the salt corroding effect.
3. Check for water in the intake system. If water found in the intake system, refer to *WATER-FLOODED ENGINE* in this subsection.

Lubricating the Engine

Refer to *WATER-FLOODED ENGINE* in this subsection.

Inspecting the Fuel

Check fuel tank for water contamination. If necessary, siphon and refill with fresh fuel.

WATER-FLOODED ENGINE

If the engine is flooded with water, it must be serviced within a few hours after the event. Otherwise, the engine will have to be overhauled.

NOTICE

- Never try to crank or start the engine. Water trapped in the intake manifold would enter the combustion chamber through the intake valves and may cause damage to the engine.
- An engine flooded with water must be properly drained, lubricant replaced (oil change), operated (boil out procedure), then lubricant replaced again, otherwise parts will be seriously damaged.

Draining the Exhaust System

If water is suspected to be in the exhaust system, remove the exhaust pipe and the muffler. Drain them or siphon the water out of them. Refer to *EXHAUST SYSTEM* subsection.

Draining the Intake System

1. If water is present in the air intake silencer, empty it. Refer to *AIR INTAKE SYSTEM* subsection.
2. Remove the air intake silencer and check for water in the supercharger inlet hose. Remove hose to empty it.
3. Remove the water from blow-by valve hose.
4. If water is suspected in the intake manifold, remove the intake manifold and drain it. Then siphon the water out from the intake valve ports. Refer to *INTAKE MANIFOLD* subsection.

Subsection XX (SPECIAL PROCEDURES)

Servicing the Supercharger

If there is water in the oil or in the supercharger inlet hose, the supercharger should be taken apart, all the components dried, and the slip clutch needle bearings and shaft ball bearings replaced. Refer to appropriate *SUPERCHARGER* subsection.

1630 ACE HO Engines

Inspect the supercharger.

NOTICE Do not attempt to replace components of the supercharger assembly as the unit is factory balanced to precise specifications. Failure to follow this recommendation may lead to supercharger and/or engine damage.

Replacing the Engine Oil and the Filter

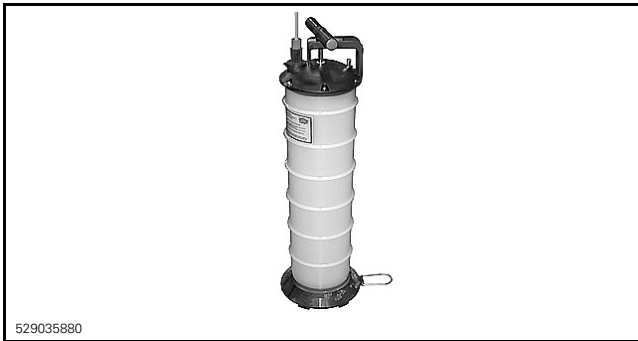
If the engine oil is contaminated with water (oil will be milky), change the engine oil and filter as per following procedure.

Models with Suspension

Remove the deck extension. Refer to *BODY (GTX, RXT AND WAKE PRO SERIES)* subsection.

All Models

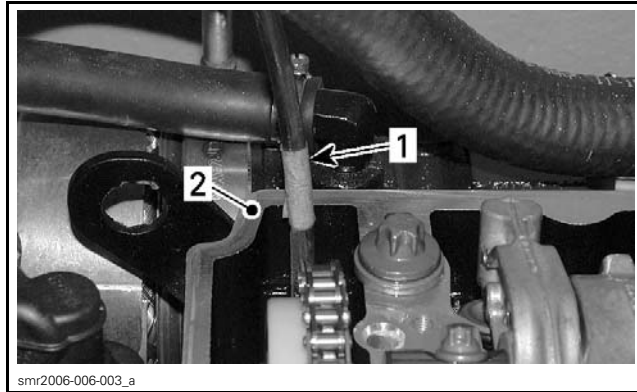
1. Using the SUCTION PUMP (P/N 529 035 880), siphon the contaminated oil from the engine reservoir through the dipstick hole.



NOTICE Never crank or start engine when siphon tube is in dipstick hole. Never start engine when there is no oil in engine.

2. Remove the suction pump tube from the dipstick hole.
3. Fully depress throttle lever and HOLD it for cranking.
4. Crank the engine for 5 seconds.
5. Remove the oil filter cap and the oil filter. Refer to appropriate *LUBRICATION SYSTEM* subsection.
6. Again, siphon the contaminated oil from the oil filter reservoir.

7. Remove valve cover. Refer to appropriate *CYLINDER HEAD* subsection.
8. Wrap a piece of tape around the suction pump tube 400 mm (16 in) from the end of the tube.
9. Insert the tube in the PTO area until the tape is even with the cylinder-block edge.
10. Siphon contaminated oil out.



TYPICAL

1. Suction pump tube with tape
2. Edge of cylinder-block

11. Remove the suction pump tube.
12. Reinstall valve cover.
13. Install a **NEW** oil filter and reinstall the oil filter cap.
14. Replenish the engine with appropriate amount of the recommended engine oil. Refer to appropriate *LUBRICATION SYSTEM* subsection.
15. Proceed with the *BOIL OUT PROCEDURE* that follows.

NOTE: The boil out procedure is intended to evaporate a small quantity of water contained in the oil system.

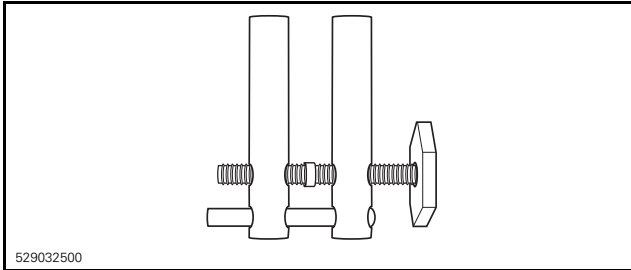
Boil Out Procedure in a Test Tank or Tied to a Trailer with Watercraft in Water

1. Connect the vehicle to latest applicable B.U.D.S. version to monitor the coolant temperature. Coolant temperature must exceed 100°C (212°F) in order for the water to boil out. Once the boiling point is attained, the water will evaporate quickly.
2. Run the engine for 5 minutes at 3500 RPM.

WARNING

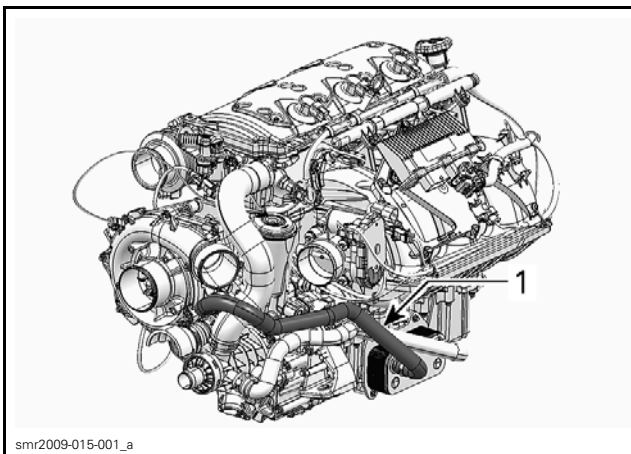
Be sure to safely secure the watercraft.

3. With the engine still running at 3500 RPM, install a LARGE HOSE PINCHER (P/N 529 032 500) on the coolant line going to the oil cooler.



⚠ WARNING

Certain components in the engine compartment may be very hot. Direct contact may result in skin burn. Do not touch any electrical parts or jet pump area when the engine is running.



TYPICAL

1. Oil cooler coolant inlet hose

4. Continue to run the engine at 3500 RPM for 15 more minutes (20 minute total run time).
5. Shut the engine off.
6. Remove the hose pincher from coolant line going to the oil cooler.

NOTICE Hose pincher must be removed prior to operating the watercraft. Failure to do this will result in damage to the engine.

7. Change the oil and filter again.
8. Procedure is now complete.

CAPSIZED WATERCRAFT

Capsized for More than 5 Minutes

Refer to *WATER-FLOODED ENGINE* in this subsection.



WATERCRAFT
SERVICE
Bulletin



October 29, 2010 Subject: **Storage Procedure**

No. **2010-7**

YEAR	MODEL	MODEL NUMBER	SERIAL NUMBER
2010	All	All	All

NOTE: Carry out the following tasks in the same order as detailed in this bulletin.

PROCEDURES

Propulsion System

Jet Pump Cleaning

Clean jet pump by spraying water in its inlet and outlet and then apply a coating of XPS LUBE (P/N 293 600 016) or equivalent.

WARNING

Always remove safety lanyard cap from post to prevent unexpected engine starting before cleaning the jet pump area. Engine must not be running for this operation.

Jet Pump Inspection

Remove impeller cover and check if jet pump is water contaminated; if so, refer to *JET PUMP* subsection in the appropriate *SHOP MANUAL* for the repair procedure.

Drive Shaft Corrosion Protection

No protection against corrosion is required since the drive shaft is rubber-coated.

Fuel System

Fuel System Inspection

Verify fuel system. Check fuel hoses for leaks. Replace damaged hoses or clamps if necessary.

NOTICE Salt water use may cause clamps to prematurely corrode. Therefore, they would require a closer look and a more frequent preventive replacement.

Fuel System Protection

The BRP FUEL STABILIZER (P/N 413 408 600) or equivalent should be added in fuel tank to prevent fuel deterioration and fuel system gumming. Follow manufacturer's instructions for proper use.

NOTICE Fuel stabilizer should be added prior to engine lubrication to ensure fuel system components protection against varnish deposits.

Engine

Engine Oil and Filter Replacement

Change engine oil and filter. Refer to *LUBRICATION SYSTEM* subsection in the appropriate *SHOP MANUAL*.

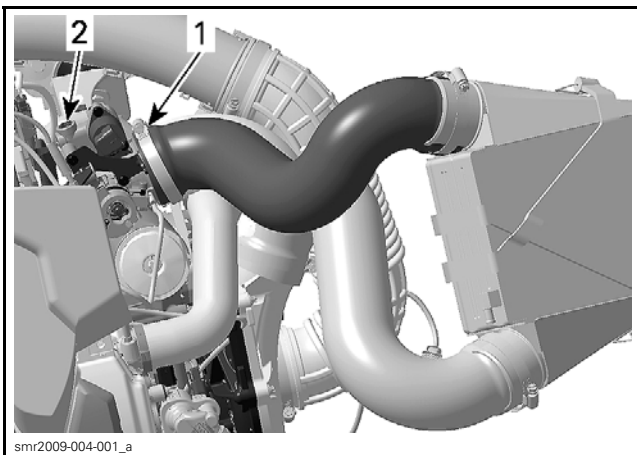
Intercooler Draining

It is important to expel any trapped water that may have accumulated from condensation in the external intercooler.

NOTICE Failure to drain the intercooler may cause severe damage to this components.

All 255 Engine Models except iS Series

1. Removed the intake hose from throttle body.



1. Intake hose
2. Throttle body

2. Start engine and rev up to 4000 RPMs several times. Water will be expelled from intercooler.



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WATER EXPELLED FROM INTERCOOLER

3. Stop engine.
4. Liberally lubricate throttle body inside and out.
5. Clean off any lubrication on the throttle body intake hose flange.
6. Install air intake hose to the throttle body.

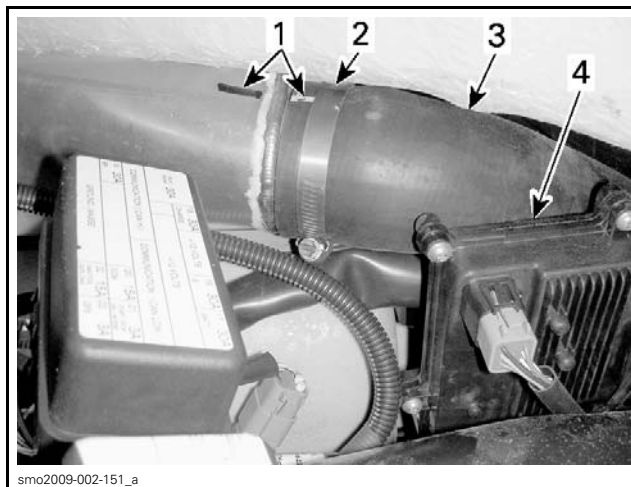
iS Series

Proceed as follows:

1. Loosen the clamp retaining the intercooler outlet hose.
2. Remove the intercooler outlet hose from the intercooler.

NOTE: This hose feeds the inlet of the throttle body.

3. Drape a couple of shop rags over the iS module to protect it from any expelled water from the intercooler.



1. Hose alignment lines
2. Hose clamp
3. Intercooler outlet hose
4. iS module

4. Start engine and rev up to 4000 RPMs several times. Water will be expelled from intercooler.

NOTE: Prevent air intake system from aspirating foreign objects which may cause severe engine or damage.

5. Stop engine.

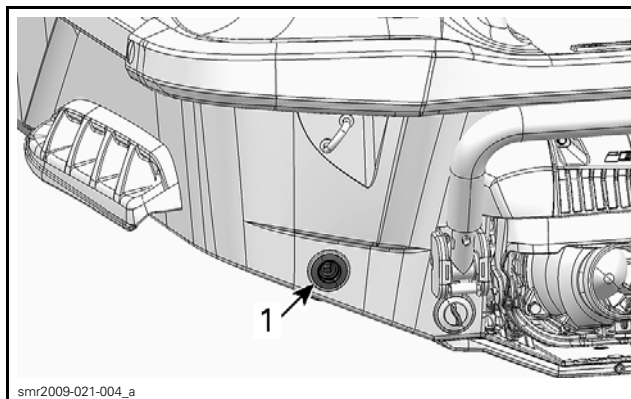
6. Install intercooler outlet hose.

Exhaust System Protection

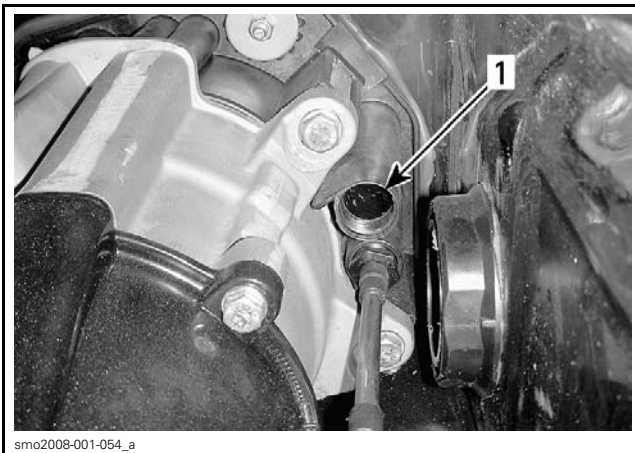
The exhaust system is self draining, but the exhaust manifold needs to be drained to avoid damages if watercraft is stored in area where freezing weather is present.

Using the flushing connector located at the rear of vehicle, inject pressurized air into system until there is no more water flowing from jet pump.

MODEL	AIR PRESSURE
iS Series	380 kPa (55 PSI)
All other models	689 kPa (100 PSI)



TYPICAL – iS SERIES
1. Flushing connector

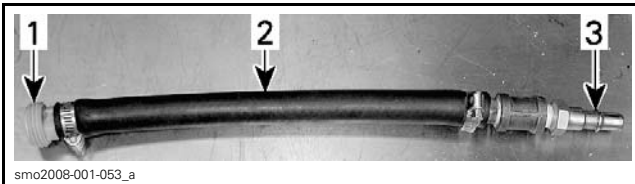


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TYPICAL – ALL OTHER MODELS

1. Flushing connector — location may differ

The following hose can be fabricated to ease draining procedure.



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TYPICAL

1. Flushing adaptor (P/N 295 500 473)
2. Hose 13 mm (1/2 in)
3. Air hose male adapter

NOTICE Failure to drain the exhaust manifold may cause severe damage to this components.

Engine Coolant Replacement

Antifreeze should be replaced every 200 hours or every two years to prevent antifreeze deterioration.

NOTICE Failure to replace the antifreeze as recommended may allow its degradation that could result in poor engine cooling.

If coolant is not replaced, test the coolant density using an antifreeze hydrometer.

Replace coolant if necessary. For the coolant replacement procedure, refer to *COOLING SYSTEM* subsection in the appropriate *SHOP MANUAL*.

NOTICE Improper antifreeze density might lead coolant to freeze if vehicle is stored in area where freezing point is reached. This would seriously damage the engine.

Engine Internal Lubrication

Engine must be lubricated to prevent corrosion on internal parts.

Lubrication of the engine is recommended at the end of the season and before any extended storage period to provide additional corrosion protection. This will lubricate the engine intake valves, the cylinders and the exhaust valves.

To lubricate the engine, proceed as follows:

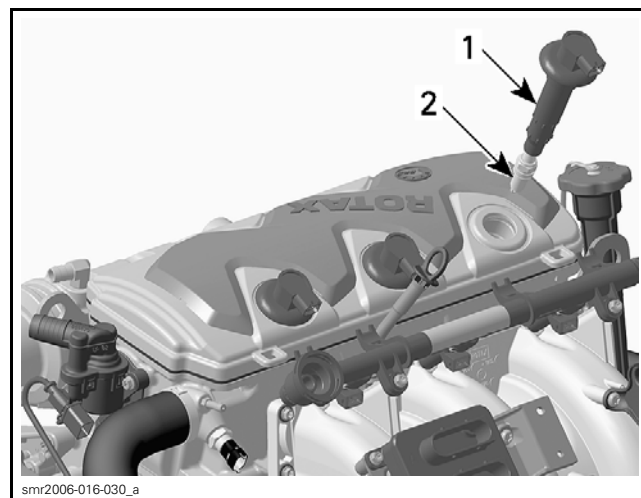
1. Open seat and remove the rear ventilation box.
2. On **iS series**, remove the rear ventilation box. For all other models, pull engine cover upward and remove it.
3. Disconnect ignition coil connectors.

WARNING

When disconnecting coil from spark plug, always disconnect coil from main harness first. Never check for engine ignition spark from an open coil and/or spark plug in the engine compartment as spark may cause fuel vapor to ignite.

NOTICE Never cut the locking ties of ignition coil connectors. This would allow mixing the wires between cylinders.

4. Clean ignition coil areas to avoid falling dirt into cylinder.
5. Remove ignition coils.
6. Unscrew spark plugs.
7. Using an ignition coil as a puller, remove spark plugs.



1. Ignition coil
2. Spark plug

8. Spray XPS LUBE (P/N 293 600 016) into each spark plug hole.
9. Crank the engine a few turns to distribute the oil on cylinder wall.

NOTE: To crank engine, use the drowned mode to avoid injecting fuel. Fully depress throttle lever and hold for cranking engine.

10. Apply LOCTITE 767 (ANTISEIZE LUBRICANT) (P/N 293 800 070) on spark plug threads then reinstall them.
11. Prior to inserting the ignition coil to its location, apply some DOW CORNING 111 (P/N 413 707 000) around the seal area that touches the spark plug hole.
12. Reinstall ignition coils.
13. Ensure the seal seats properly with the engine top surface.
14. Reconnect ignition coil connectors.
15. Install all other removed parts.

Electrical System

Battery Removal

For battery removal, cleaning and storage, refer to *CHARGING SYSTEM* subsection in the appropriate *SHOP MANUAL*.

Vehicle

Bilge Cleaning

Clean the bilge with hot water and mild detergent or with bilge cleaner.

Rinse thoroughly.

Lift front end of watercraft to completely drain bilge.

Body and Hull Cleaning

Wash the body with soap and water solution (only use mild detergent). Rinse thoroughly with fresh water. Remove marine organisms from the hull.

NOTICE Never clean body parts or hull with strong detergent, degreasing agent, paint thinner, acetone, etc.

Replace damaged labels/decals.

Body Repair

If any repair is needed, refer to *BODY* subsection in the appropriate *SHOP MANUAL*.

Anticorrosion Treatment

Wipe off any residual water in the engine compartment.

Spray XPS LUBE (P/N 293 600 016) over all metallic components in engine compartment.

Vehicle Protection

Apply a good quality marine wax on body and hull.

The seat should be left partially open during storage. This will prevent engine compartment condensation and possible corrosion.

If the watercraft is to be stored outside, cover it with an opaque tarpaulin to prevent sun rays and grime from affecting the plastic components, watercraft finish as well as preventing dust accumulation.

NOTICE The watercraft should never be left in water for storage, stored in direct sunlight or stored in a plastic bag.

ENGINE REMOVAL AND INSTALLATION

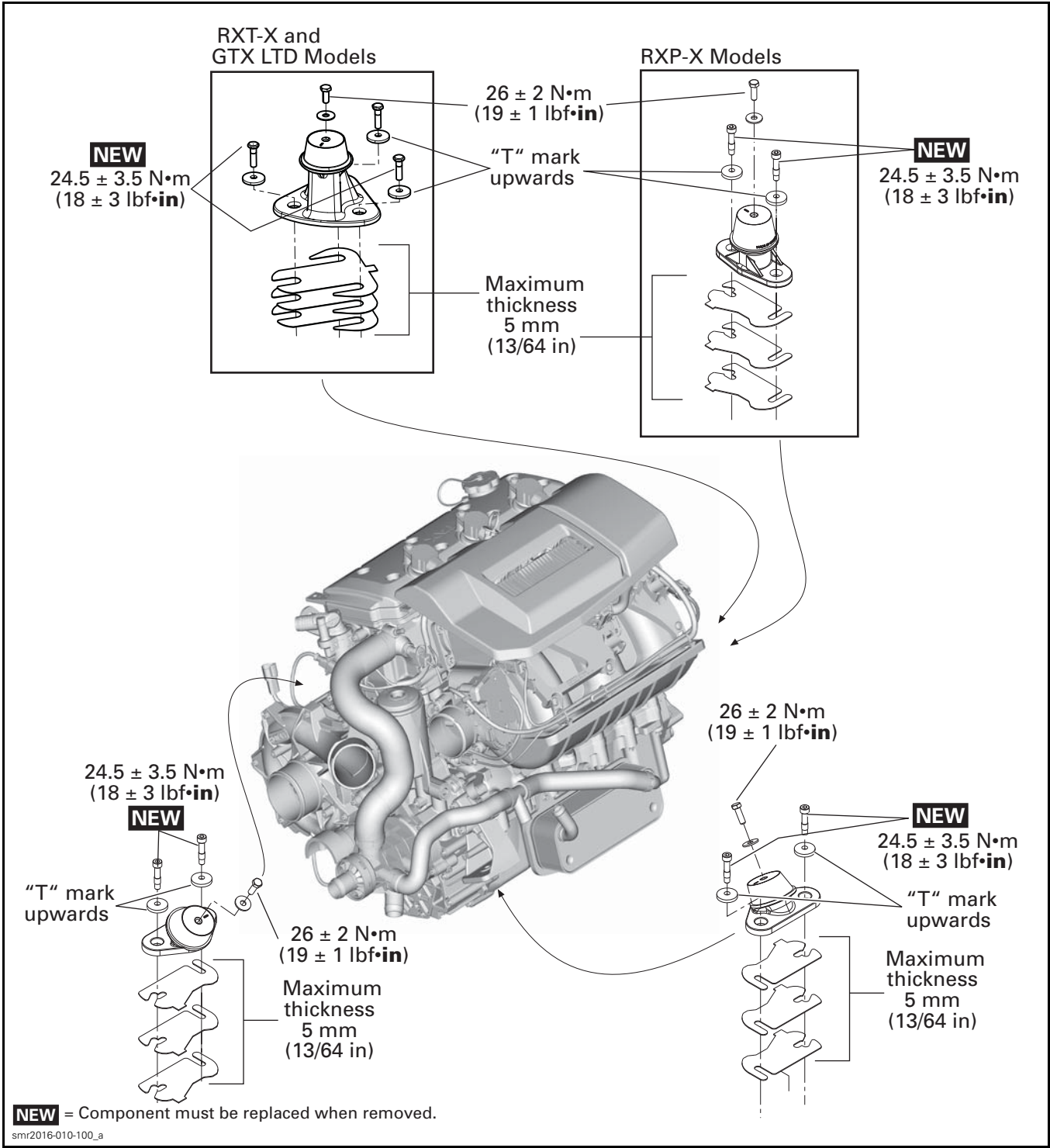
SERVICE TOOLS

Description	Part Number	Page
ALIGNMENT SHAFT ADAPTER	529 035 719	6-7
ALIGNMENT SHAFT SUPPORT	529 035 506	6
ALIGNMENT SHAFT	295 000 141	6-7
PUMP PLATE.....	529 036 224	6

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE).....	293 800 060	6, 8
PULLEY FLANGE CLEANER	413 711 809	5

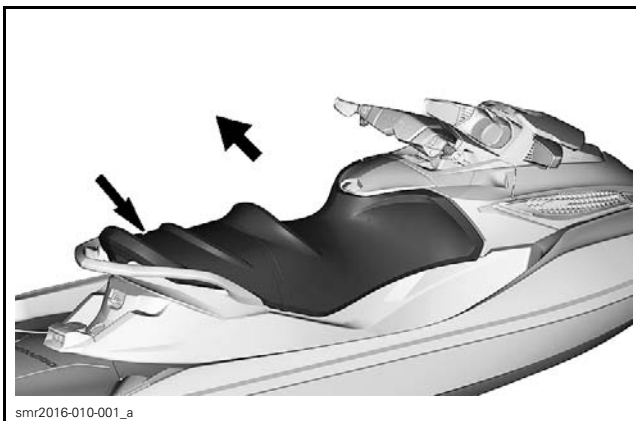
ENGINE SUPPORTS



PROCEDURES

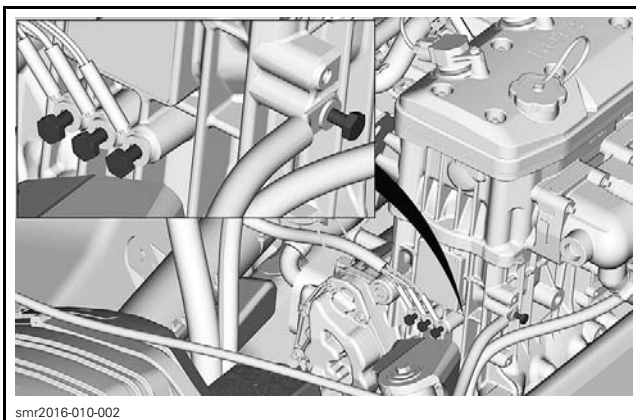
ENGINE

Removing the Engine

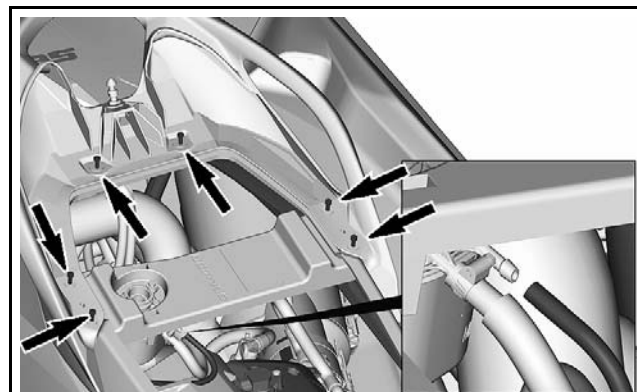
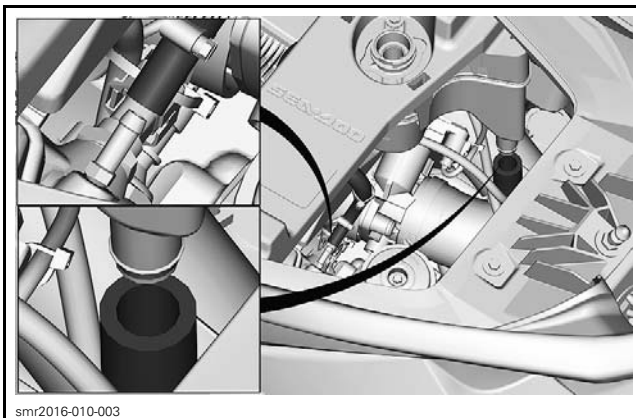


GTX LTD SHOWN

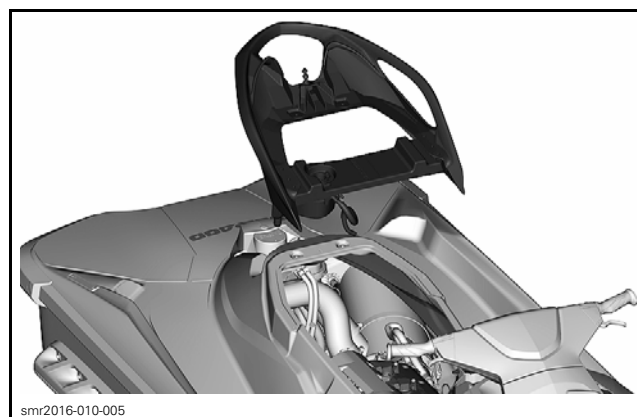
Disconnect the battery. Refer to *CHARGING SYSTEM* subsection.



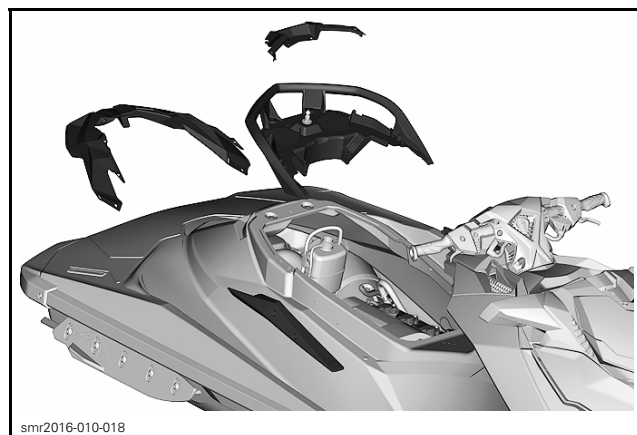
Drain coolant. Refer to *COOLING SYSTEM* subsection.



GTX LTD SHOWN

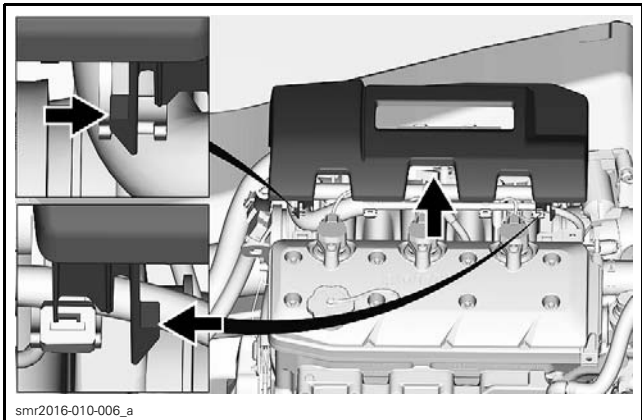


GTX LTD AND RXT-X MODELS

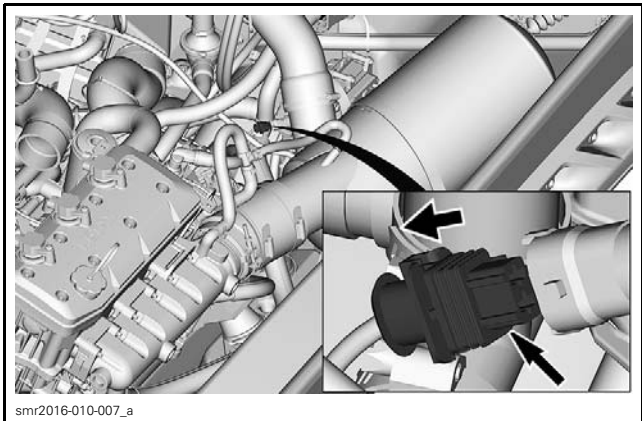


RXP X MODELS

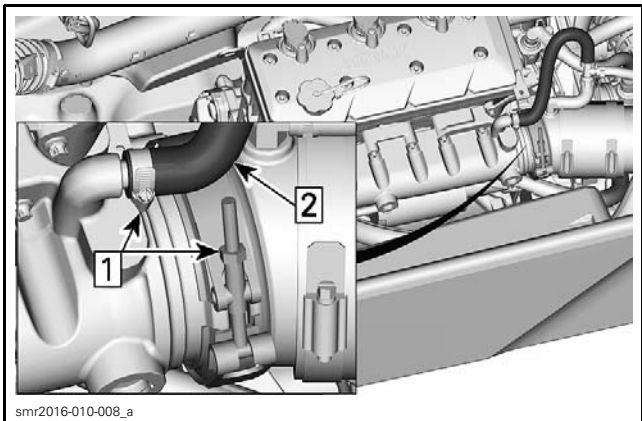
Subsection XX (ENGINE REMOVAL AND INSTALLATION)



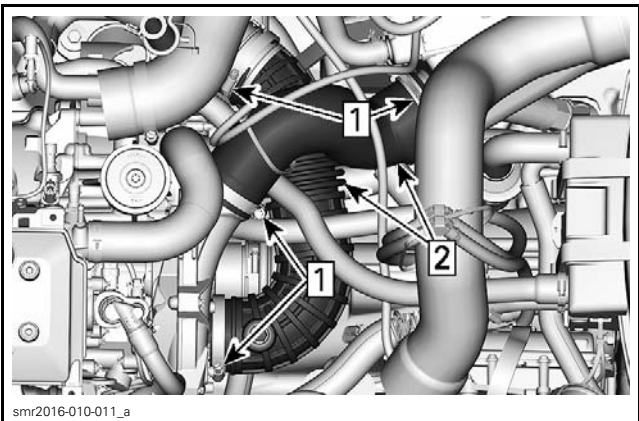
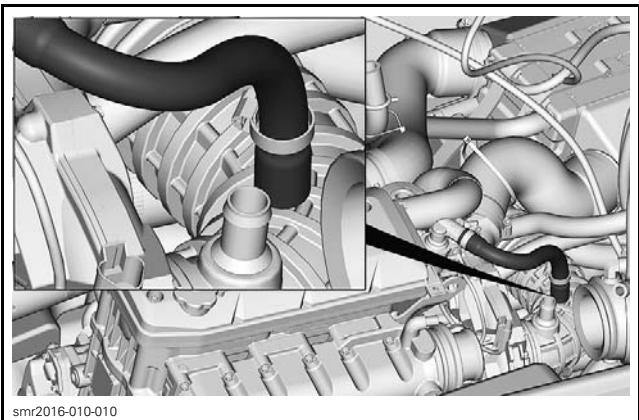
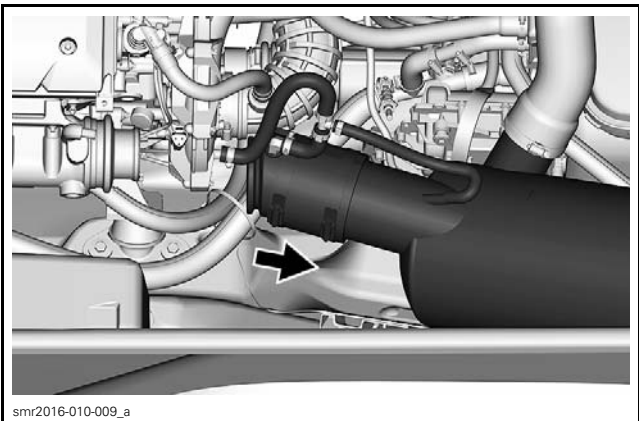
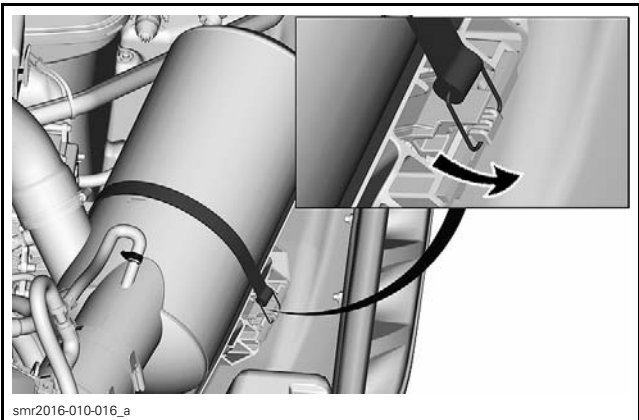
Remove the intake manifold. Refer to *INTAKE MANIFOLD* subsection.



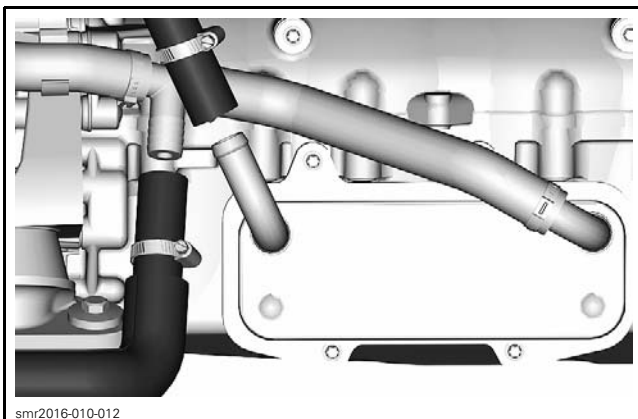
NOTICE Do not use pneumatic or electrical tool as seizure may occur.



Step 1: Loosen
Step 2: Disconnect

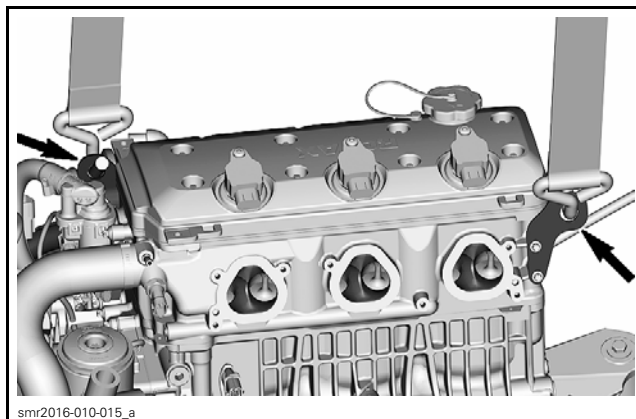


Step 1: Loosen
Step 2: Remove

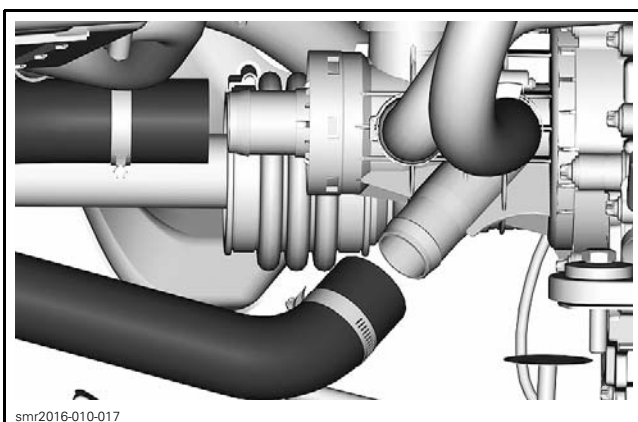


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ENGINE OIL COOLER

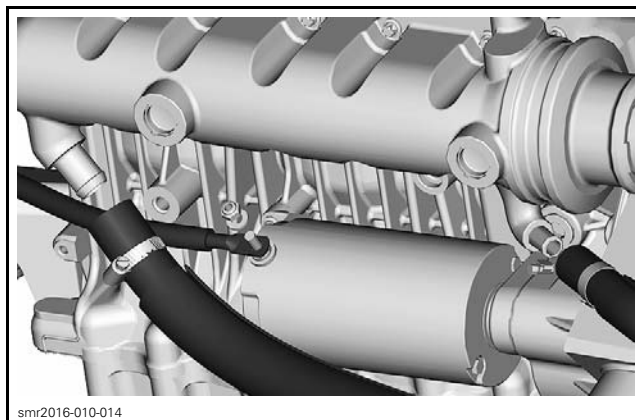


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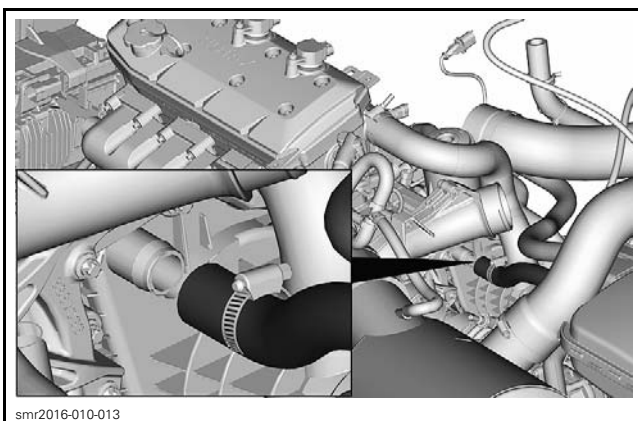


smr2016-010-017

WATER PUMP COVER



smr2016-010-014



smr2016-010-013

Remove the drive shaft. Refer to *DRIVE SHAFT* subsection.

Remove the engine mounting screws.

Cut any locking ties from hoses or wiring harness that prevent engine removal.

Slightly lift the engine using a suitable lifting device.

Carry on engine lifting to remove it from the body opening.

NOTICE Be careful not to scratch body or to hit any engine component during engine removal.

Installing the Engine

Installation of engine in watercraft is essentially the reverse of removal procedures. However pay particular attention to the following.

NOTICE Whenever engine is removed from watercraft, engine alignment must be performed at reinstallation.

Wipe off any spillage in bilge. Clean with the PULLEY FLANGE CLEANER (P/N 413 711 809).

Check tightness and condition of engine rubber mounts. Refer to *ENGINE MOUNTS* in this subsection.

Before completely lowering engine, install ground cable, starter cable and water hoses on exhaust manifold.

Ensure contact surface is perfectly clean when re-connecting ground cable to engine.

Subsection XX (ENGINE REMOVAL AND INSTALLATION)

TIGHTENING TORQUE	
Ground cable screw	10 N•m ± 2 N•m (89 lbf•in ± 18 lbf•in) + LOCTITE 243 (BLUE) (P/N 293 800 060)
Starter cable nut	10 N•m ± 1 N•m (89 lbf•in ± 9 lbf•in)
Exhaust manifold water hose clamps	1.7 N•m ± 0.2 N•m (15 lbf•in ± 2 lbf•in)

Place engine into vehicle.

Install engine support screws. Do not apply threadlocker to engine support screws and do not torque yet.

Align engine. Refer to *ENGINE ALIGNMENT* in this subsection for complete procedure.

NOTICE The engine alignment must be completed before finalizing the engine installation.

Install and properly align exhaust pipe. Refer to *EXHAUST SYSTEM* subsection.

Reinstall all other removed parts.

TIGHTENING TORQUE	
Air intake hose clamps	4 N•m ± 1 N•m (35 lbf•in ± 9 lbf•in)
Ride plate hose clamps	
Expansion coolant tank	
Coolant hose clamps	1.7 N•m ± 0.2 N•m (15 lbf•in ± 2 lbf•in)
Blow-by hose clamps	

Install protective cap over the starter cable end.

Check hose condition and pressure test fuel system, refer to *FUEL SYSTEM* section.

WARNING

Whenever doing any type of repair on watercraft or if any components of the fuel system are disconnected, a pressure test must be done before starting engine.

Verify all electrical connections (ground wires and battery).

Run engine and ensure there is no leakage.

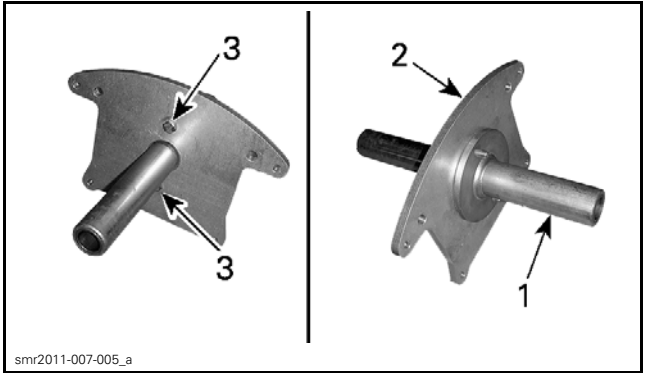
NOTICE If watercraft is out of water, exhaust system must be cooled using the flush kit.

Aligning the Engine

REQUIRED TOOLS	
PUMP PLATE (P/N 529 036 224)	
ALIGNMENT SHAFT SUPPORT (P/N 529 035 506)	
ALIGNMENT SHAFT ADAPTER (P/N 529 035 719)	
ALIGNMENT SHAFT (P/N 295 000 141)	

To verify alignment of engine proceed as follows:

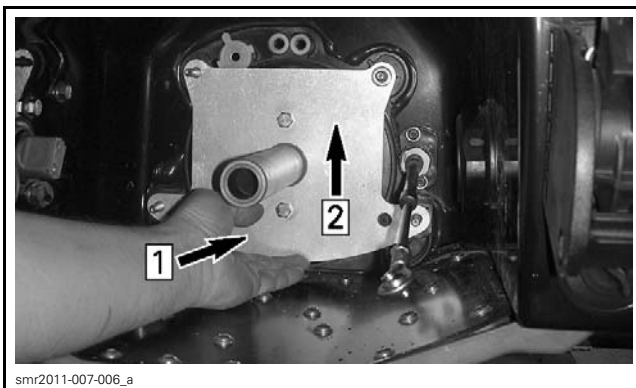
- 1. Remove jet pump and drive shaft. Refer to *STEERING AND PROPULSION* section.
- 2. Remove drive shaft boot.
- 3. Assemble alignment tool.
 - 3.1 Install the alignment shaft support on pump plate.
 - 3.2 Secure using M8 x 25 x 1.25 hexagonal screws.



- 1. Alignment shaft support (P/N 529 035 506)
- 2. Support plate (P/N 529 036 224)
- 3. M8 x 25 x 1.25 hexagonal screws

TIGHTENING TORQUE	
Alignment tool screws	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

- 4. Install the alignment tool as follows.
 - 4.1 Position the alignment tool against the pump support.
 - 4.2 Push the alignment tool upward and hold it in this position.



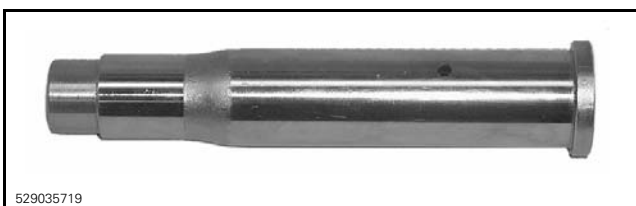
Step 1: Place alignment tool against pump support
Step 2: Push alignment tool upward

TIGHTENING TORQUE

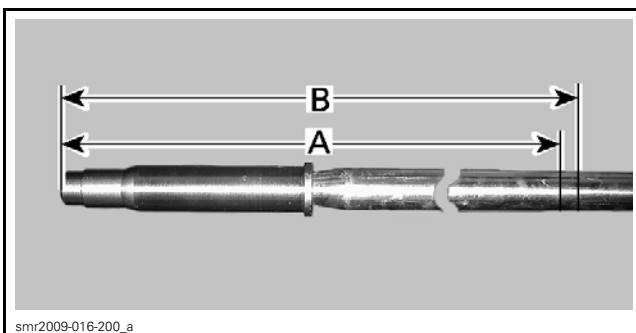
Alignment tool nuts

24.5 N•m ± 3.5 N•m
(18 lbf•ft ± 3 lbf•ft)

Install the ALIGNMENT SHAFT ADAPTER (P/N 529 035 719) on the end of the ALIGNMENT SHAFT (P/N 295 000 141).



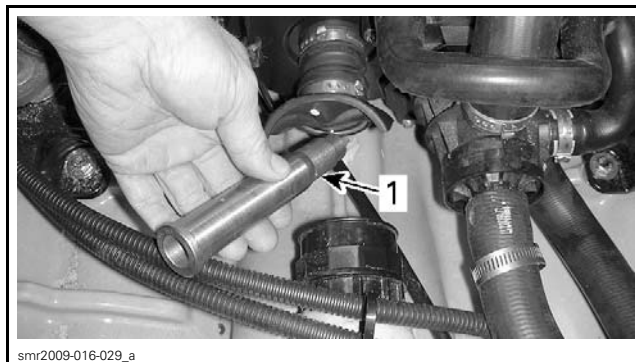
Trace two thin lines on alignment shaft.



LINES	DISTANCE
Line A	at 739.5 mm (29.114 in)
Line B	at 742.5 mm (29.232 in)

5. Remove the ALIGNMENT SHAFT ADAPTER (P/N 529 035 719) from the end of the alignment shaft and install it in engine PTO housing.

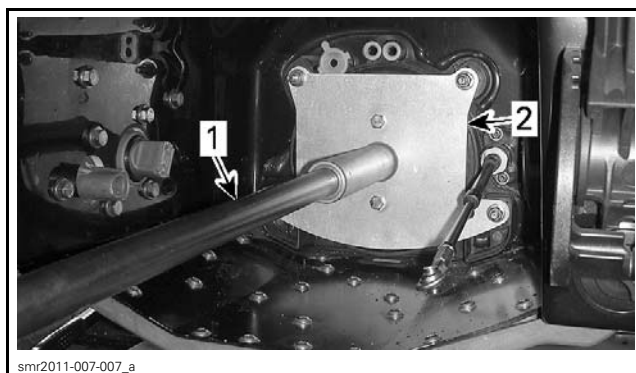
NOTICE Ensure alignment shaft adapter is fully inserted into the engine PTO housing.



TYPICAL

1. Alignment shaft adapter

6. Carefully slide the ALIGNMENT SHAFT (P/N 295 000 141) through the engine alignment tool.



1. Alignment shaft (P/N 295 000 141)

2. Alignment tool

7. Insert alignment shaft end into alignment shaft adapter. If the alignment is correct, the alignment shaft end should slide through the adapter.

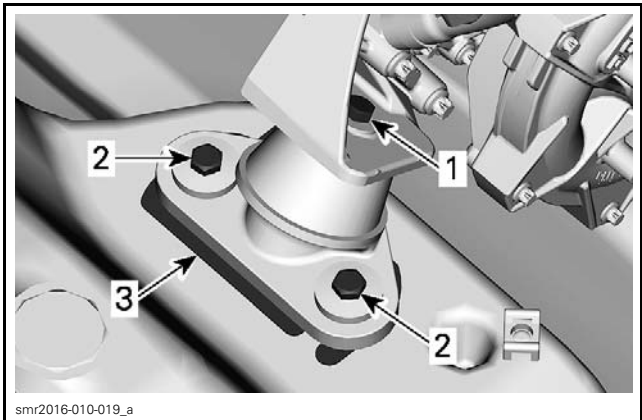
NOTE: A small resistance during shaft insertion is normal.

8. If the alignment is incorrect, loosen engine mount retaining screws (Allen socket screws).

9. Add or remove shims as required.

NOTE: Shims location is between engine mount and Hull.

NOTICE Whenever shims are used to correct alignment, never install more than 5 mm (13/64 in) of shims.



REAR LH ENGINE MOUNT SHOWN
1. Engine mounting screw
2. Engine mount retaining screws
3. Shim(s)

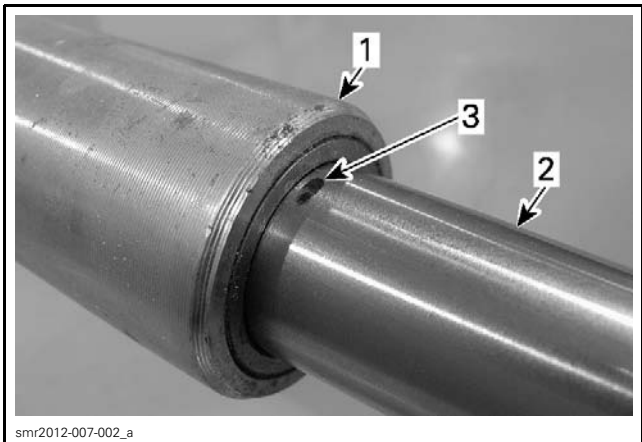
10. When engine alignment is correct, check the longitudinal position of engine.

Verifying the Engine Longitudinal Position

With alignment shaft installed, check the location of the marks (previously drawn at the beginning of the engine alignment procedure).

Engine is properly positioned longitudinally when the engine alignment tool is between both shaft marks.

- If **one** mark is visible, the engine is properly positioned.
- If **both** marks are visible, the engine must be moved forward.
- If **no** mark is visible, the engine must be moved rearward.



PROPER POSITION
1. Engine alignment tool
2. Alignment shaft
3. Mark at 742.5 mm (29.232 in)

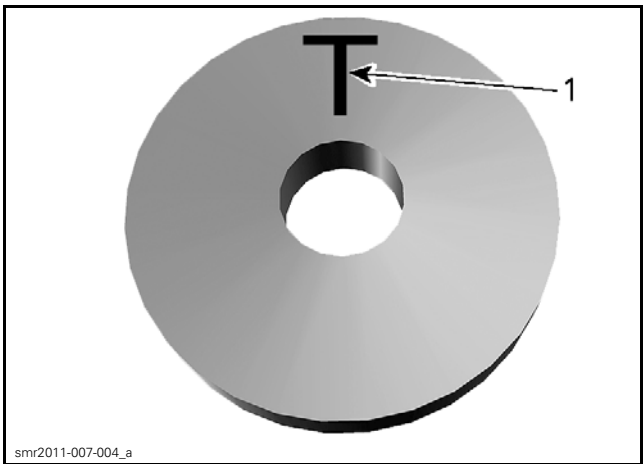
When alignment and longitudinal position of engine are correct, tighten engine mount screws. Refer to *ENGINE MOUNTS* in this subsection.

Recheck engine alignment.

ENGINE MOUNTS

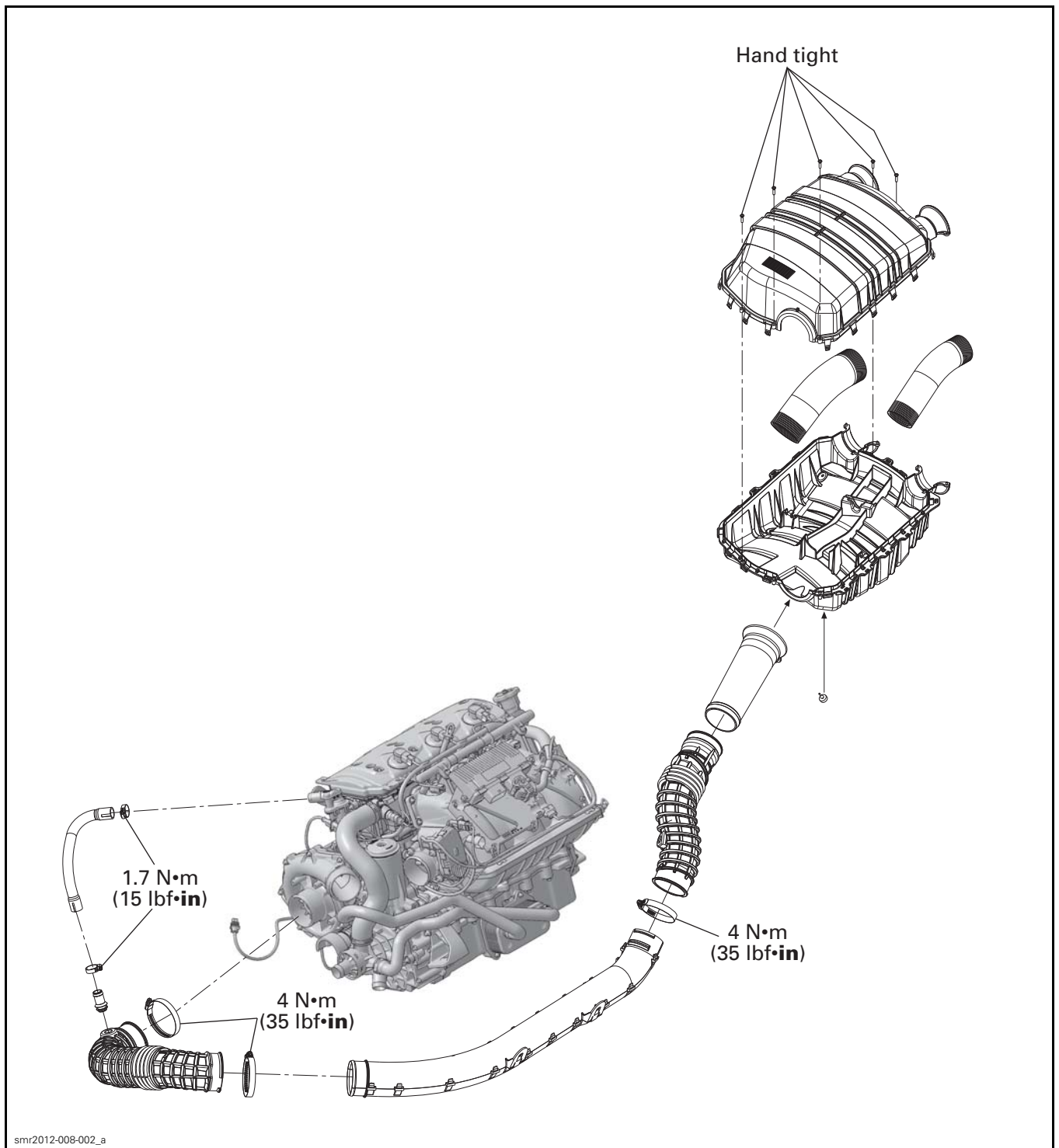
TIGHTENING TORQUE	
Service product	New screw with self-locking product or LOCTITE 243 (BLUE) (P/N 293 800 060)
Engine mount screw	26 N•m ± 2 N•m (19 lbf•ft ± 1 lbf•ft)

NOTE: Position conical spring washer with the "T" mark upwards.



1. T mark

AIR INTAKE SYSTEM



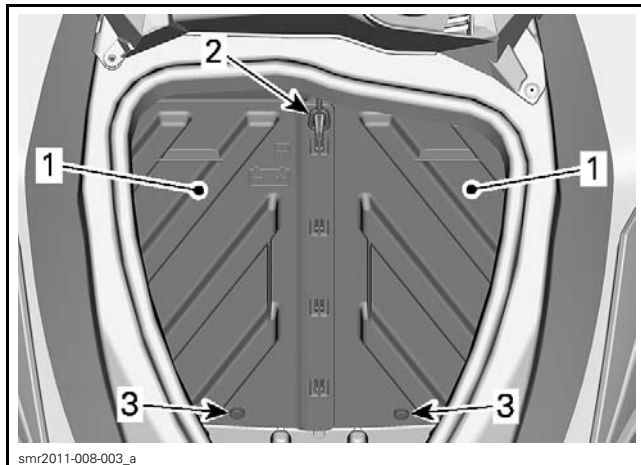
PROCEDURES

AIR INTAKE SILENCER

Accessing the Air Intake Silencer

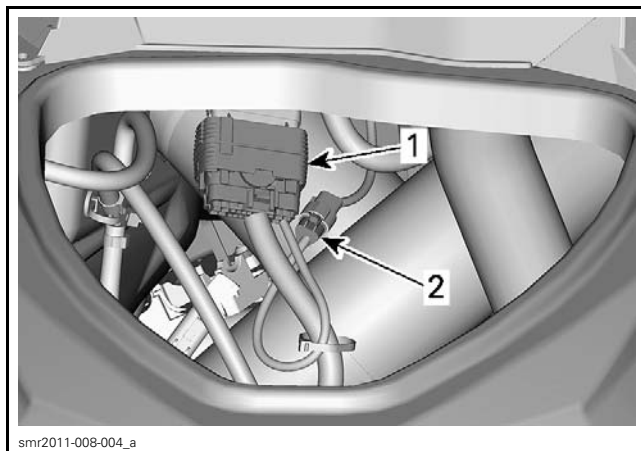
RXP Model

1. Open the front storage compartment cover.
2. Remove partitions. Refer to *BODY* subsection.



1. Partitions
2. Retaining strap
3. Plastic rivets

3. Disconnect gauge and OTAS connectors.

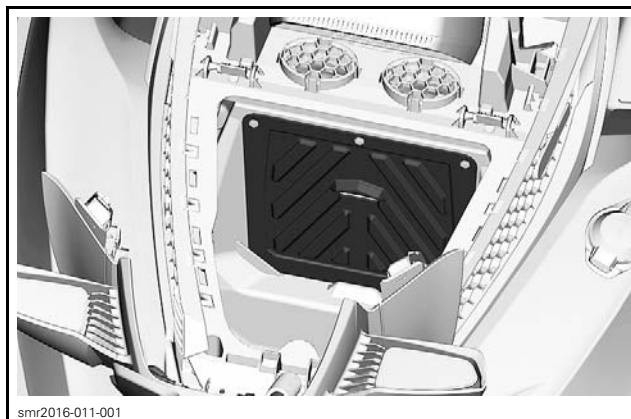


1. Gauge connector
2. OTAS connector

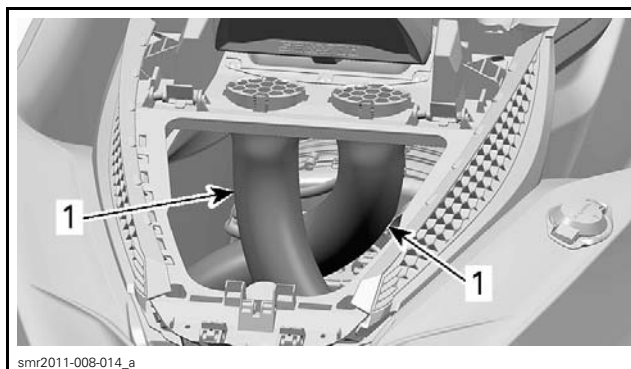
4. Remove plastic darts securing the top of the ventilation tubes.
5. Unplug ventilations tubes and place them lower in hull.

RXT and GTX Models

1. Open the front storage compartment cover.
2. Remove the storage bin.
3. Remove partitions. Refer to *BODY* subsection.

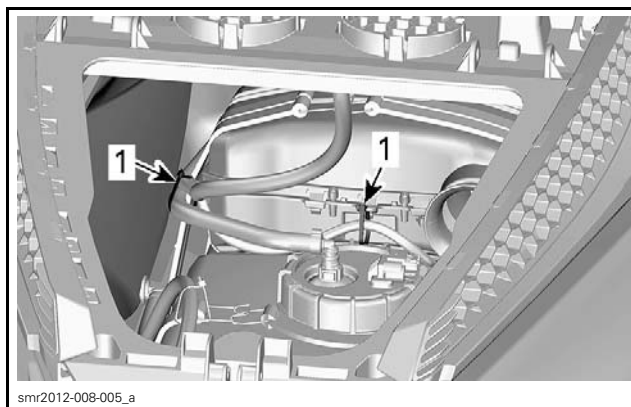


4. Unplug the top of ventilations tubes and place them lower in hull.



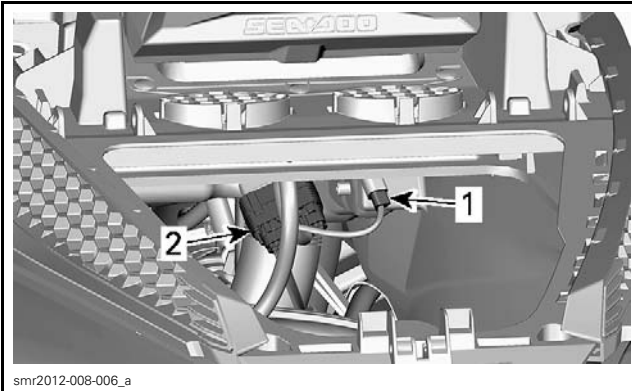
1. Ventilation tubes

5. Cut locking ties securing wiring harness and fuel hoses to air intake silencer.



1. Cut these locking ties

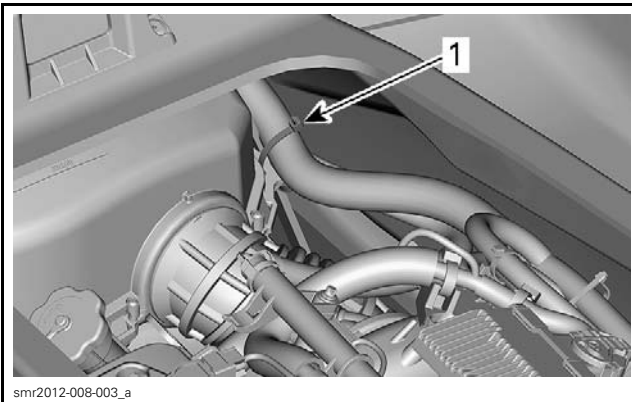
6. Disconnect gauge and OTAS connectors.



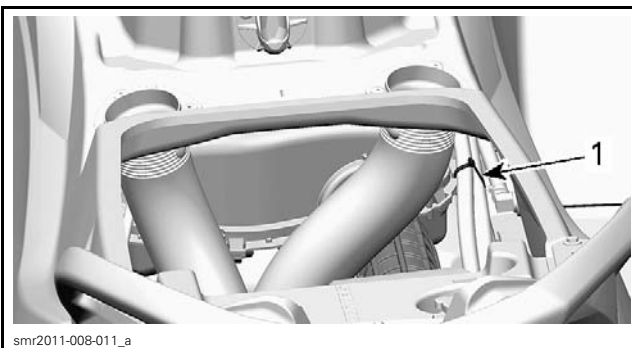
1. Disconnect the OTAS connector
2. Disconnect the gauge connector

Removing the Air Intake Silencer

1. Open or remove the seat.
2. From seat opening, cut locking tie securing the wiring harness and the fuel supply hose to air intake silencer.

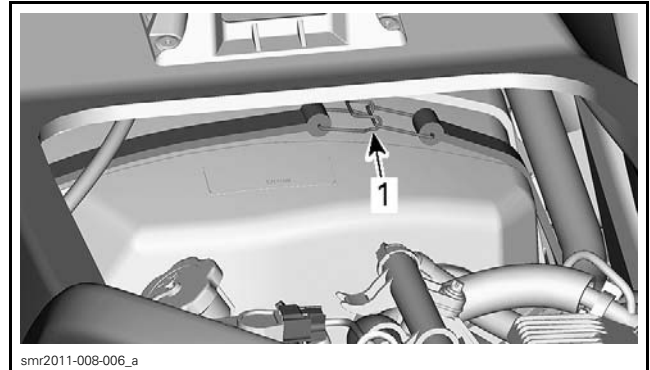


- RXP MODEL**
1. Cut this locking tie

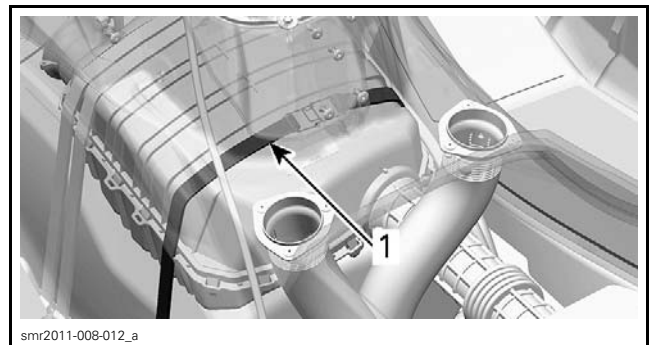


- RXT AND GTX MODELS**
1. Cut this locking tie

3. Detach rear retaining strap retaining air intake silencer and fuel tank.

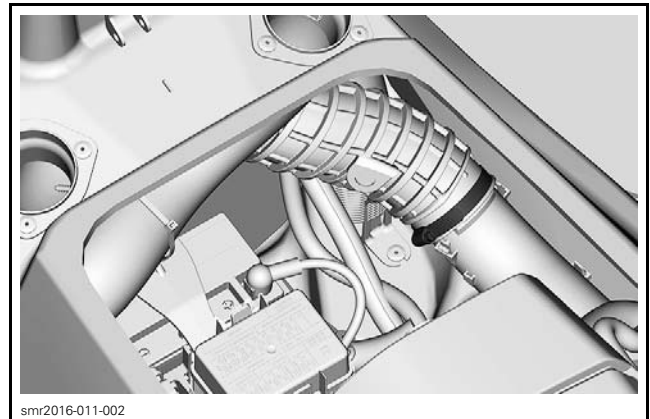


- RXP MODEL**
1. Rear retaining strap



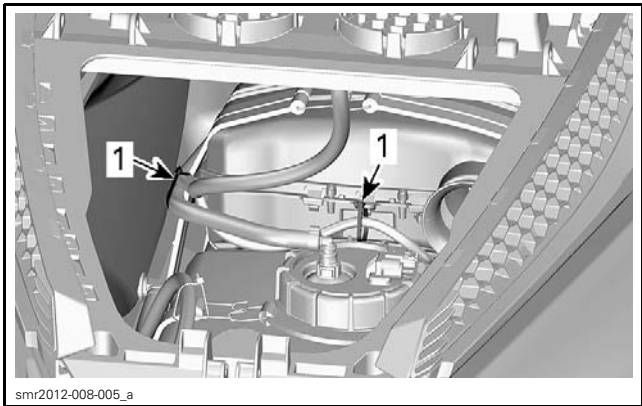
- RXT AND GTX MODELS**
1. Rear retaining strap – under glove box

4. Loosen clamp securing the air intake silencer outlet hose to air intake tube.



5. From the front storage compartment, cut locking ties securing the wiring harness and the fuel hose to air intake silencer.

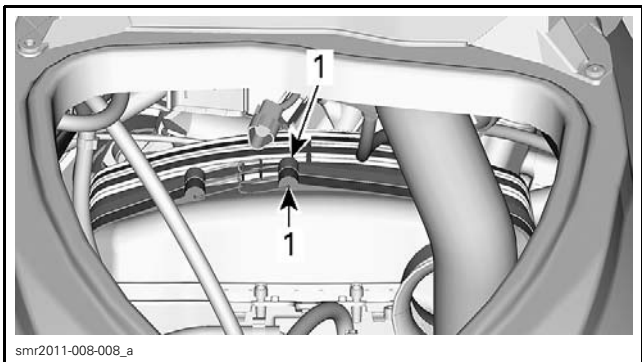
Subsection XX (AIR INTAKE SYSTEM)



TYPICAL - GTX LTD SHOWN

1. Cut these locking ties

6. Detach the front retaining straps.

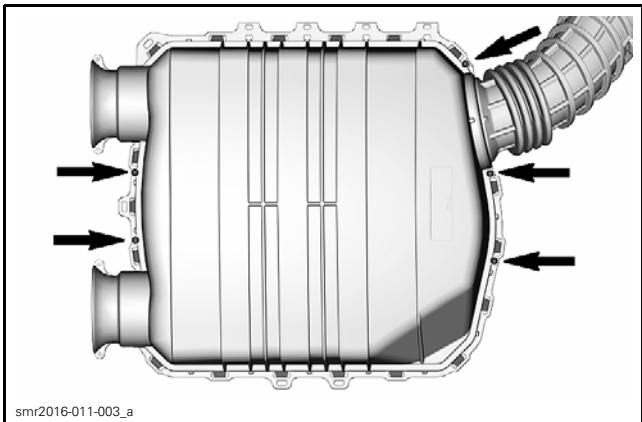


1. Front retaining straps

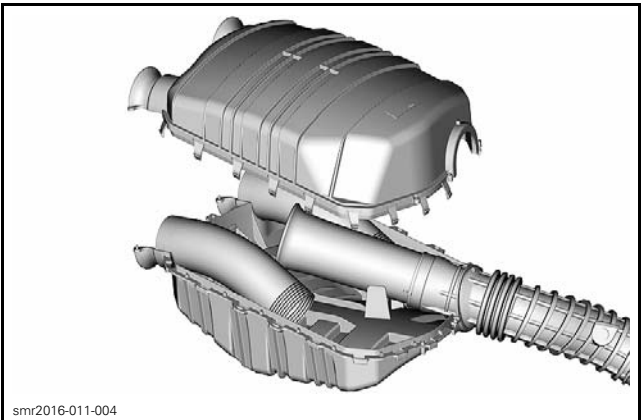
7. Carefully pull the air intake silencer forward to remove it from the vehicle.

Disassembling the Air Intake Silencer

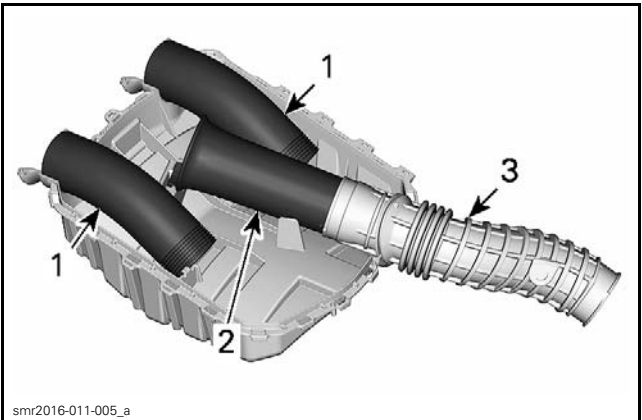
1. Remove screws retaining both parts of air intake silencer together.



2. Unlatch air intake silencer and remove the upper section.



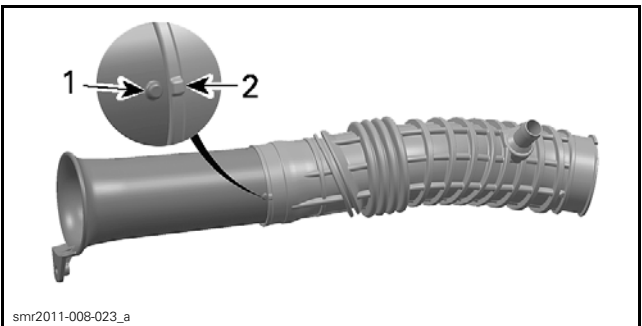
3. Remove the inlet tubes, the baffle and the outlet hose from the air intake silencer.



1. Inlet tubes
2. Baffle
3. Outlet hose

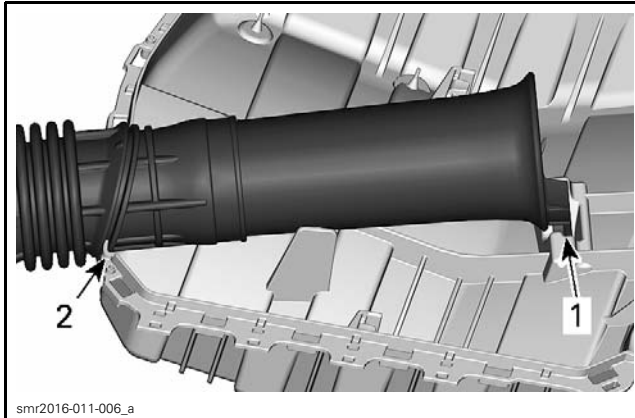
Assembling the Air Intake Silencer

Install the baffle into the outlet hose. Ensure marks are aligned.



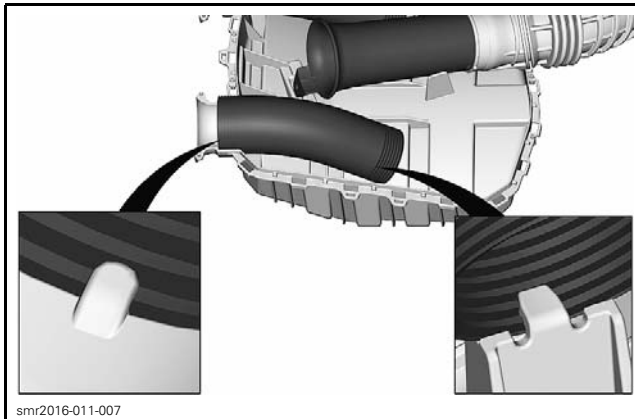
TYPICAL - GTX SHOWN
1. Baffle mark
2. Outlet hose mark

Install the assembly in the air intake silencer.



1. Baffle tab into air intake silencer slot
2. Air intake silencer rib into the outlet hose groove

Install the inlet tubes. Ensure each end is properly attached.



Press both halves of the air intake silencer together until all tabs are locked. Do not force, make sure all tubes are properly installed.

TIGHTENING TORQUE	
Air intake silencer screws	Hand tight

Installing the Air Intake Silencer

The installation is the reverse of the removal procedure. However, pay attention to the following. Ensure wiring harness and fuel hoses are properly routed.

Install new locking ties

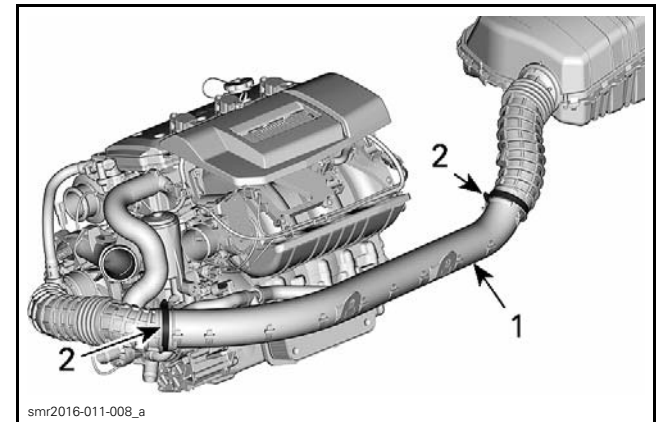
Make sure hoses are perfectly inserted into air intake tube before tightening the clamps.

TIGHTENING TORQUE	
Retaining clamps	4 N•m ± 1 N•m (35 lbf•in ± 9 lbf•in)

AIR INTAKE TUBE

Removing the Air Intake Tube

1. Open seat.
2. Detach the seat bridge from the body and move it aside to make room.
3. Loosen clamps retaining the air intake tube.



1. Air intake tube
2. Retaining clamps

4. Detach the air intake tube from both hoses.
5. Open the front compartment storage cover and remove the storage bin.
6. Remove compartment panel. Refer to *BODY* subsection.
7. Slide the air intake tube over the air intake silencer and through the front compartment opening.

Installing the Air Intake Tube

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

Make sure air intake tube is perfectly inserted into air intake hoses before tightening the clamps.

TIGHTENING TORQUE	
Retaining clamps	4 N•m ± 1 N•m (35 lbf•in ± 9 lbf•in)

EXHAUST SYSTEM

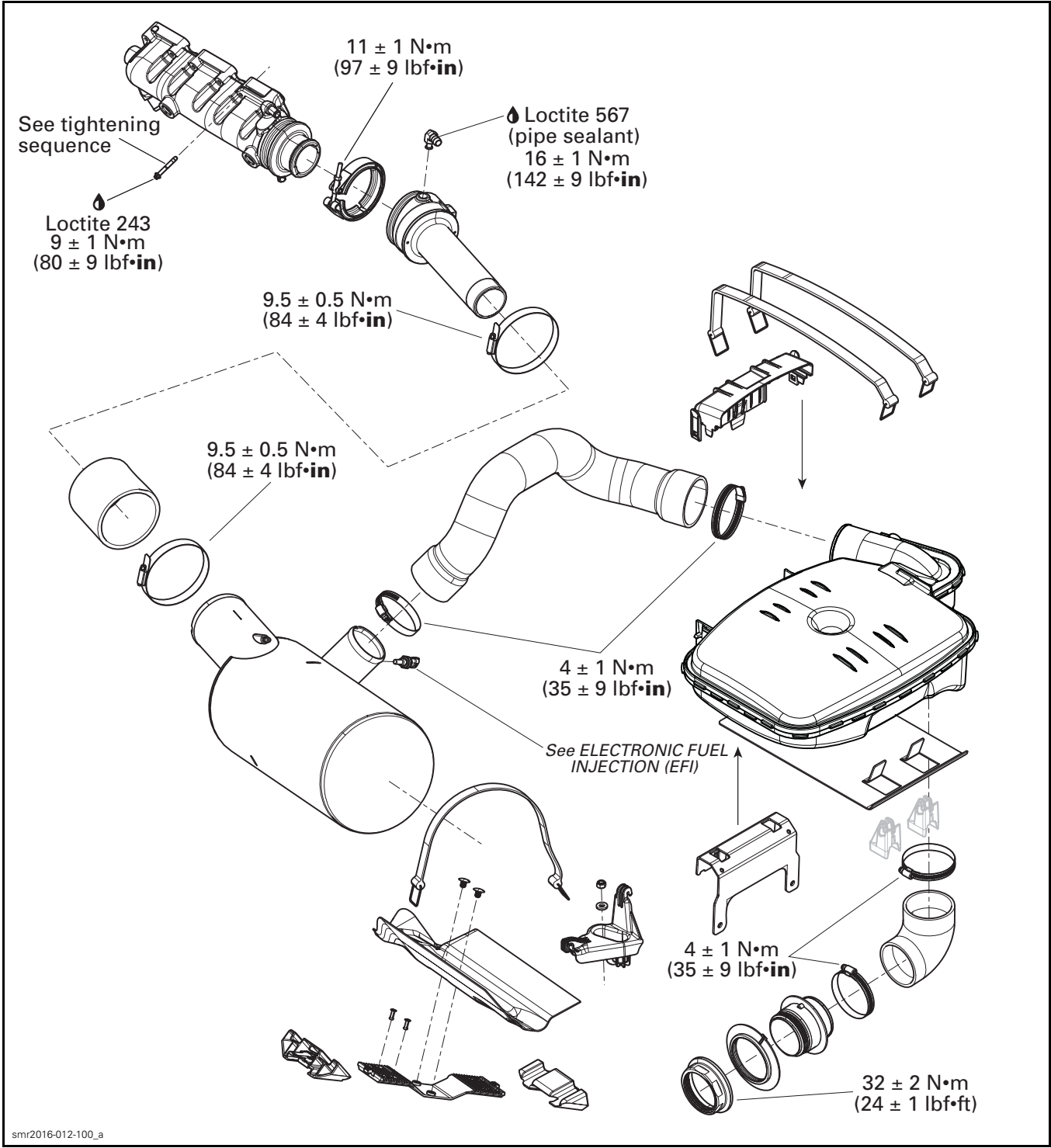
SERVICE TOOLS

Description	Part Number	Page
FLUSHING CONNECTOR ADAPTER	295 500 473	6

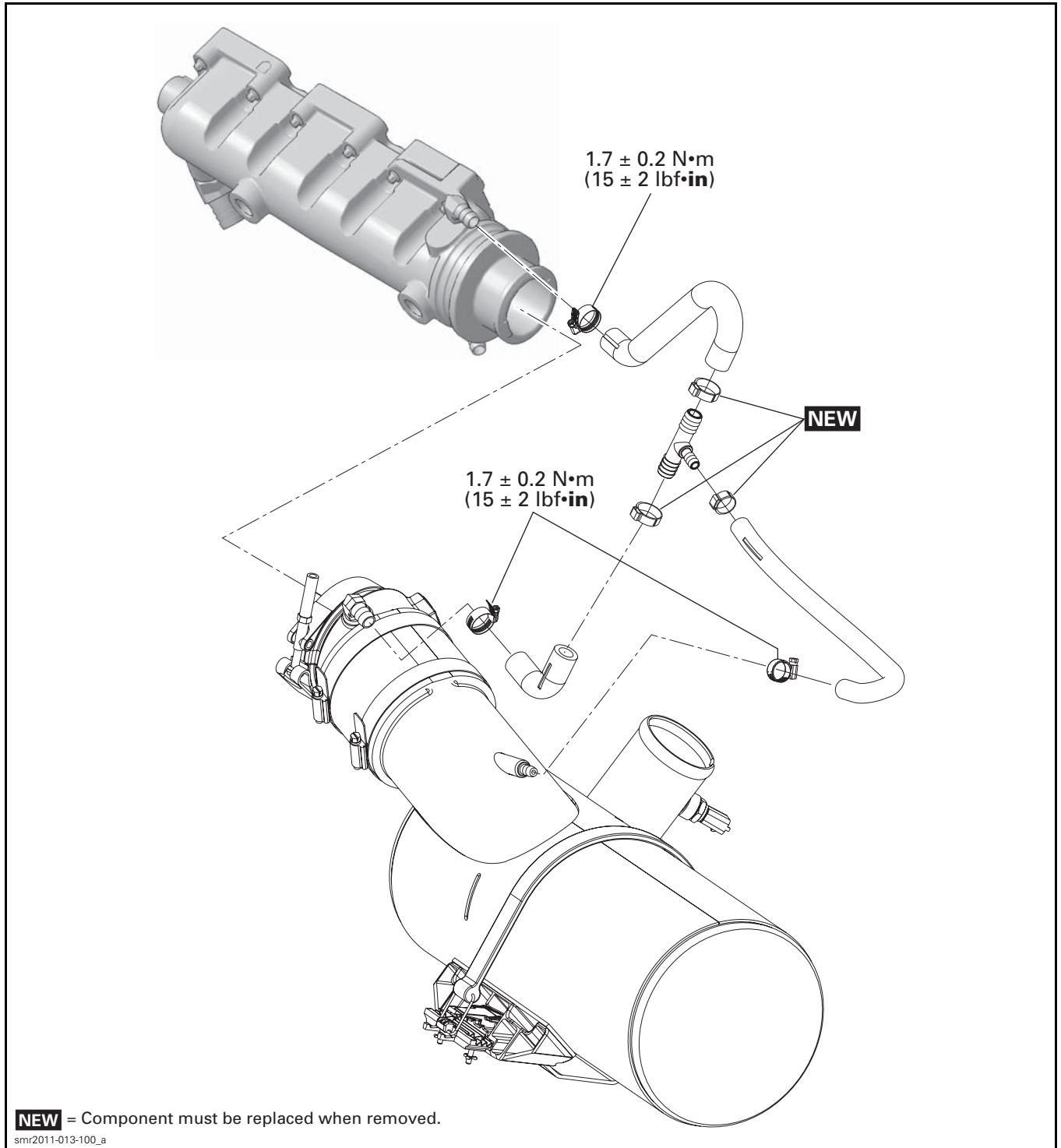
SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE).....	293 800 060	12
P80 GRIP-IT	296 000 406	14

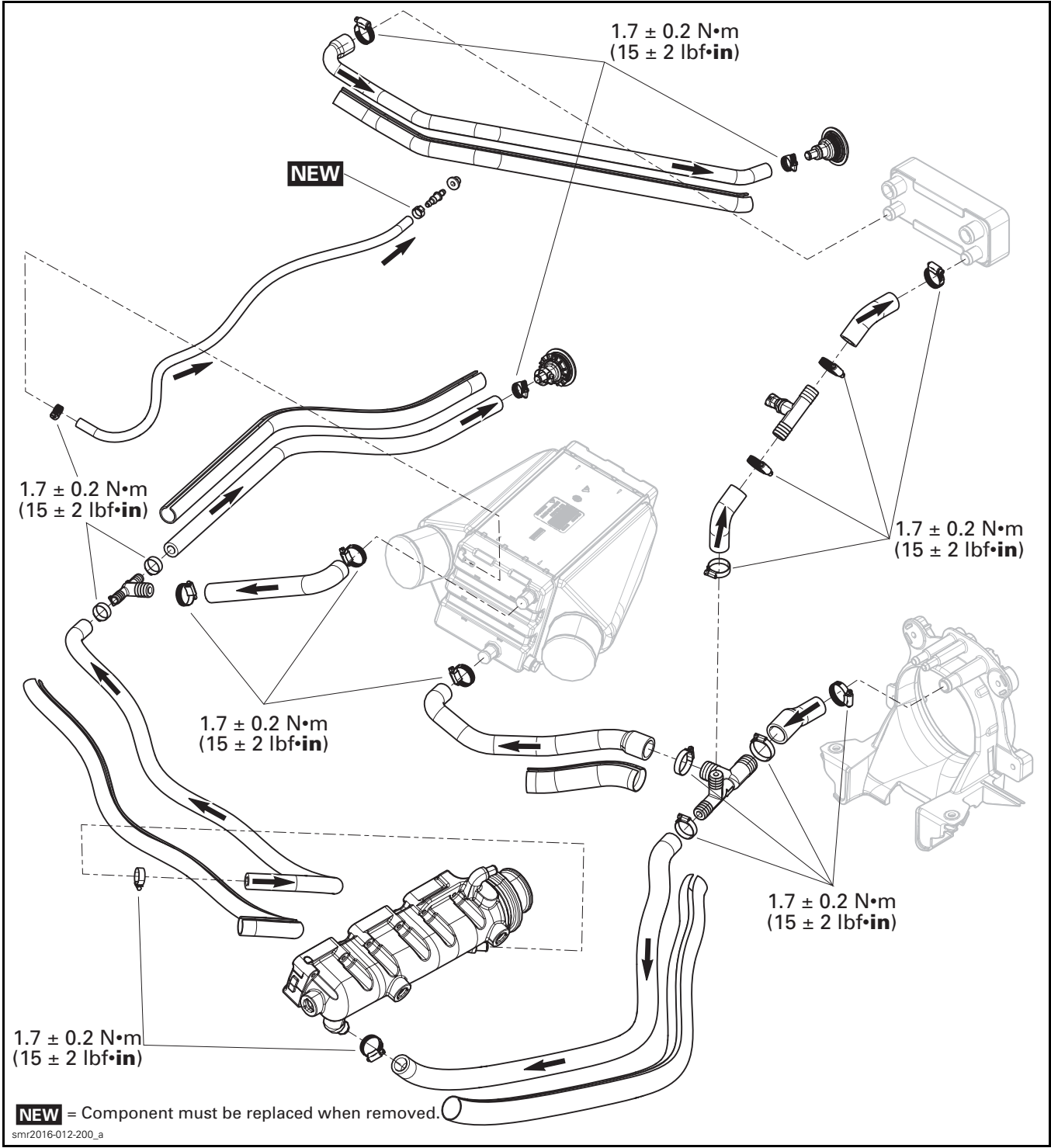
Subsection XX (EXHAUST SYSTEM)



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Subsection XX (EXHAUST SYSTEM)

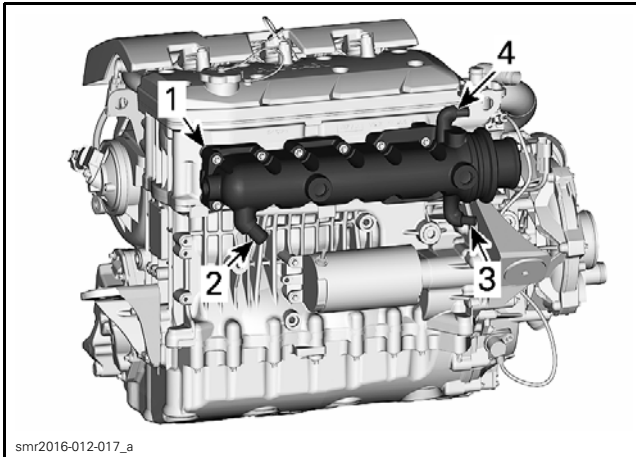


GENERAL

SYSTEM DESCRIPTION

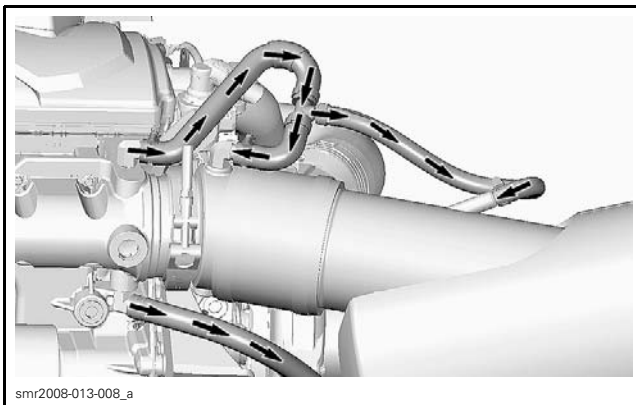
The exhaust system is cooled by water provided by a pressurized area in the jet pump (open loop system).

The same water is also used to cool the inter-cooler.

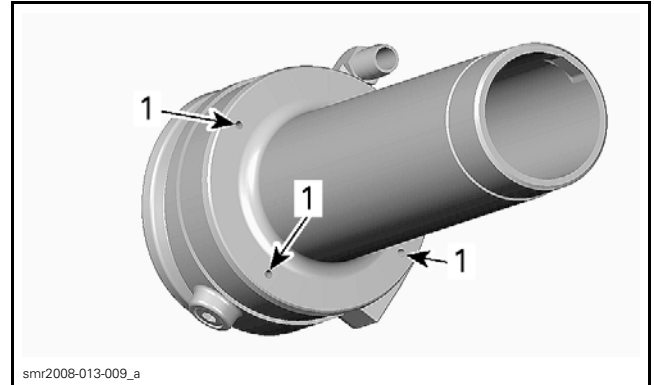


- smr2016-012-017_a
1. Exhaust manifold
 2. Exhaust manifold water inlet
 3. Exhaust manifold water outlet (to hull)
 4. Exhaust manifold water outlet (to exhaust pipe and muffler)

Water from the exhaust manifold jacket is directed to the exhaust pipe via 2 hoses.



Water exits exhaust pipe water jacket through holes to inject water in muffler and resonator.



smr2008-013-009_a

1. Water packet holes

Water is evacuated through the exhaust outlet in transom area.

Exhaust System Technical Specifications

TYPE	Total Loss Cooling System (TLCS)
WATER FLOW	Flow from jet pump (no water pump)
TEMPERATURE CONTROL	Calibrated outlet fittings (no thermostat)
SYSTEM BLEEDING	Self-bleed type
SYSTEM DRAINING	Self-drain type

MAINTENANCE

EXHAUST SYSTEM FLUSHING

Flushing the exhaust system with fresh water is essential to neutralize corroding effects of salt or other chemical products present in water. It will help to clean up sand, salt, shells or other particles in water jackets (exhaust system, intercooler and hoses).

Exhaust system flushing should be performed when the watercraft is not expected to be used further the same day or when the watercraft is stored for any extended time.

NOTICE Failure to flush the system, when necessary, will severely damage intercooler and exhaust system. Make sure engine operates during entire procedure.

Subsection XX (EXHAUST SYSTEM)

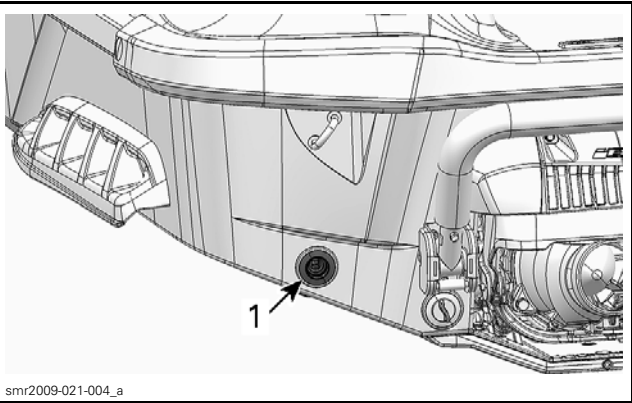
⚠ WARNING

Perform these operations in a well ventilated area. Certain components in the engine compartment may be very hot. Direct contact may result in skin burn. Do not touch any electrical part or jet pump area when engine is running.

⚠ WARNING

When operating the engine while the watercraft is out of the water, the heat exchanger in the ride plate may become very hot. Avoid any contact with ride plate as burns may occur.

Connect a garden hose to connector located at the rear of watercraft. Do not open water tap yet.

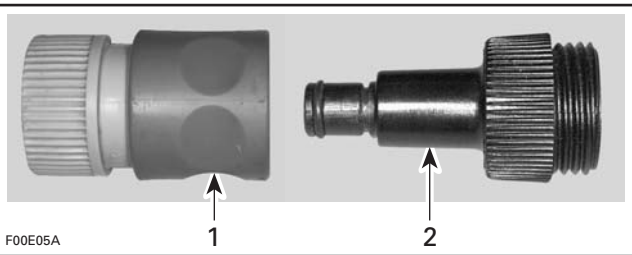


1. Water inlet connector

NOTE: The following tool is recommended when a quick connect adapter is used to ease garden hose installation.

RECOMMENDED TOOL

FLUSHING CONNECTOR
ADAPTER (P/N 295 500 473)



1. Quick connect adapter
2. Flushing connector adapter

To flush the exhaust system, start the engine then immediately open the water tap.

NOTICE Always start the engine before opening the water tap. Open water tap immediately after engine is started to prevent overheating. Never run engine without supplying water to the exhaust system when watercraft is out of water.

Run the engine about 20 seconds at a fast idle between 4000 - 5000 RPM.

NOTICE Never run engine longer than 2 minutes. Drive line seal has no cooling when watercraft is out of water.

Ensure water flows out of jet pump while flushing. Close the water tap, then stop the engine.

NOTICE Always close the water tap before stopping the engine.

Disconnect the garden hose.

NOTICE Remove flushing connector adapter after operation (if used).

PROCEDURES

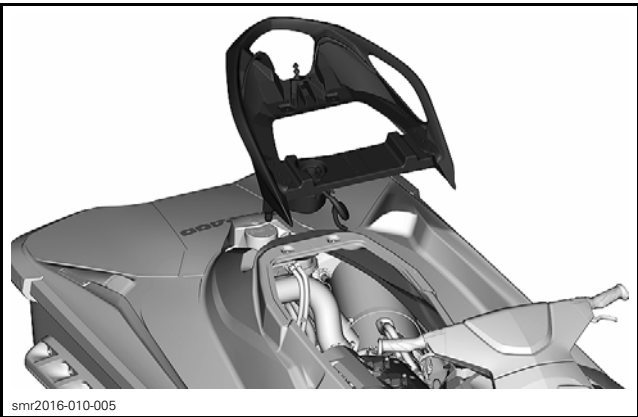
MUFFLER

⚠ CAUTION Certain components in the engine compartment may be very hot. Let exhaust system cool down prior to removing parts.

Muffler Access

Remove or open seat.

Removing the Muffler

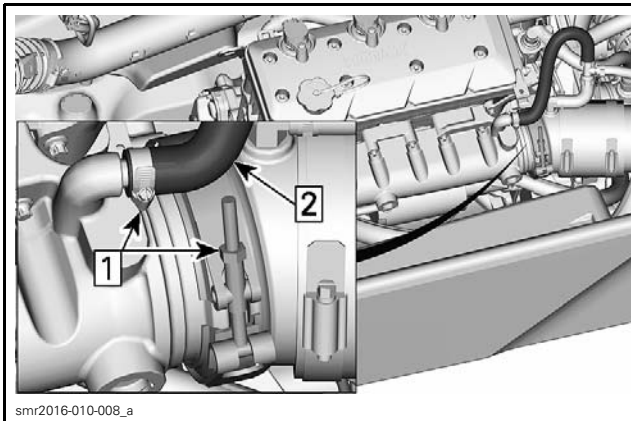


GTx LTD AND RXT-X MODELS

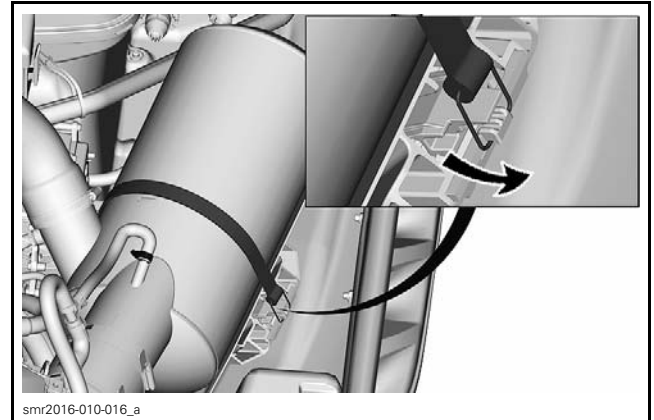
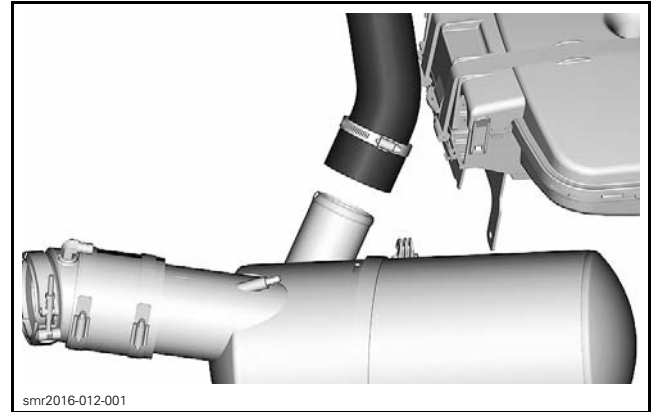
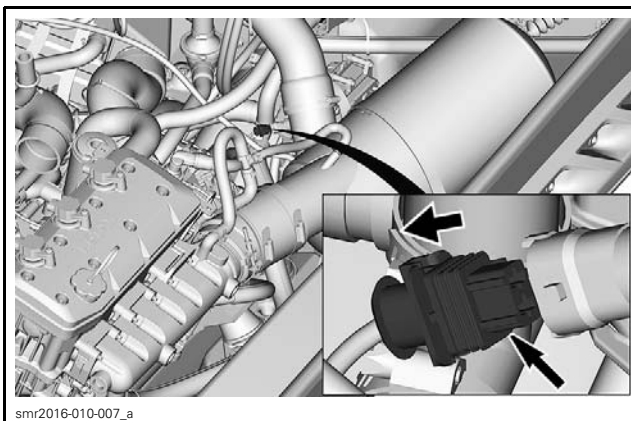


RXP X MODELS

NOTICE Do not use pneumatic or electrical tools as seizure may occur.



Step 1: Loosen
Step 2: Disconnect



Remove the muffler.

Inspecting the Muffler

Check muffler for:

- Cracks
- Corrosion
- Other damages.

Check if exhaust hose is:

- Brittle
- Hard
- Cracked
- Otherwise damaged.

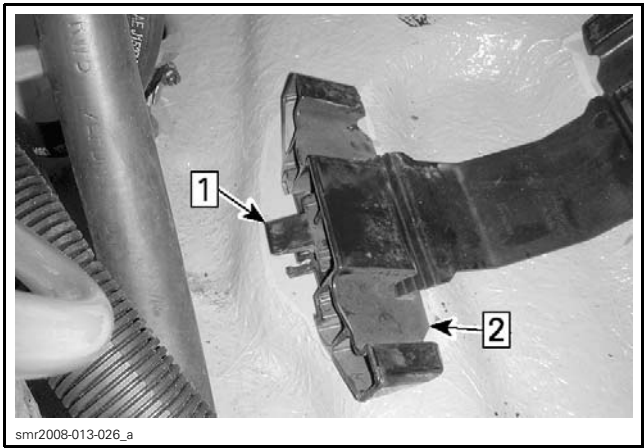
Replace any defective part.

Installing the Muffler

With a new muffler, install the EGTS sensor. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.

Open muffler adjusters by sliding adjuster blocks.

Subsection XX (EXHAUST SYSTEM)



TYPICAL – RUBBER PAD REMOVED FOR CLARITY PURPOSE
Step 1: Lift adjuster tab
Step 2: Move adjuster outward

Insert the muffler in hull.

Align the exhaust pipe flange with the exhaust manifold. Rotate and move muffler so that the exhaust pipe flange makes perfect contact with exhaust manifold.

Slide both adjuster blocks against muffler to support it in position.

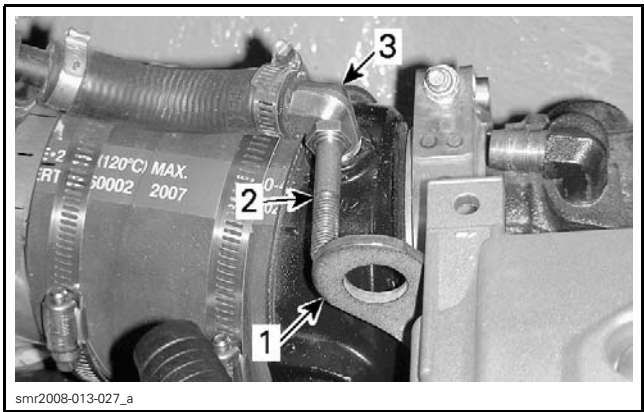
NOTE: Ensure muffler is in contact with both adjuster blocks. Readjust as required.

Install exhaust clamp with the nut upward.

Tighten clamp loosely.

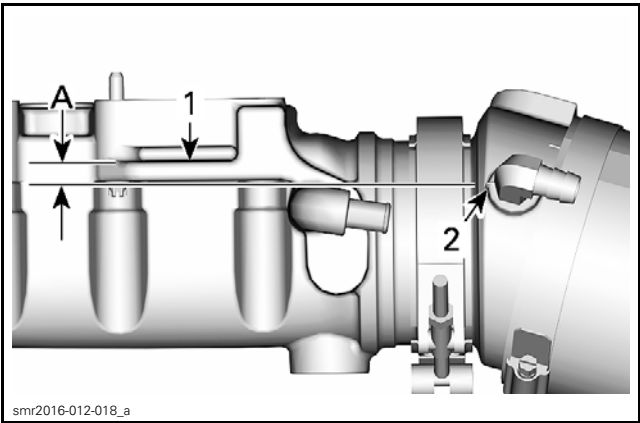
Using a spacer, position the exhaust pipe.

REQUIRED SPACER	
	20 mm (1-1/4 in)



TYPICAL
1. Engine lifting ring
2. Spacer (in this case a bolt)
3. Exhaust pipe fitting

Confirm that the exhaust pipe mark is aligned with the mark on the exhaust manifold.



1. Exhaust manifold rib wall facing the engine
2. Exhaust pipe mark
A. 10 mm (13/32 in)

Tighten exhaust clamp to specification.

TIGHTENING TORQUE	
Exhaust clamp	11 N•m ± 1 N•m (97 lbf•in ± 9 lbf•in)

NOTICE Do not use pneumatic or electric tools as seizure may occur.

Install the muffler strap.

NOTICE Ensure not to rotate muffler during strap installation. The use of a soapy water solution on inner side of muffler strap is recommended.

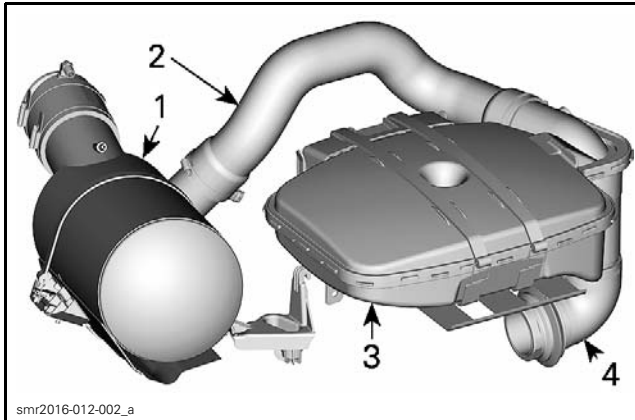
Install all other removed parts.

After installation, ensure there is no water or exhaust gas leak when engine is running.

Test run the engine while supplying water to the exhaust system.

NOTICE Never run engine without supplying water to the exhaust system when watercraft is out of water.

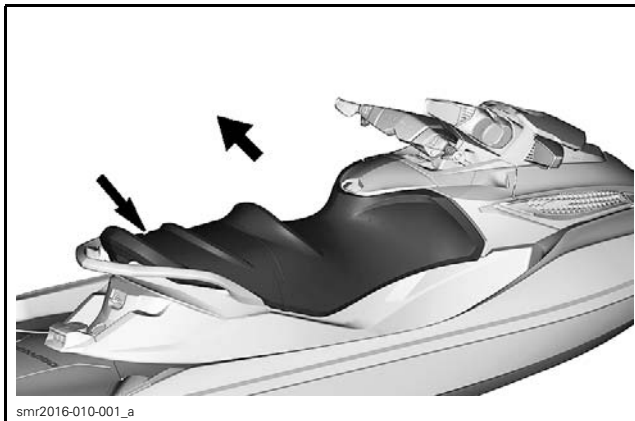
EXHAUST HOSES



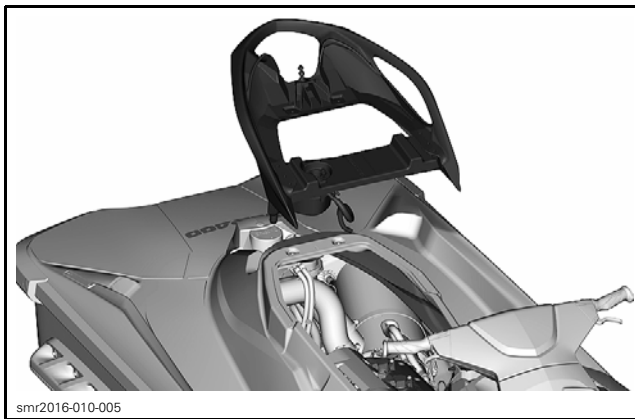
1. Muffler
2. Front exhaust hose
3. Resonator
4. Rear exhaust hose

Front Exhaust Hose

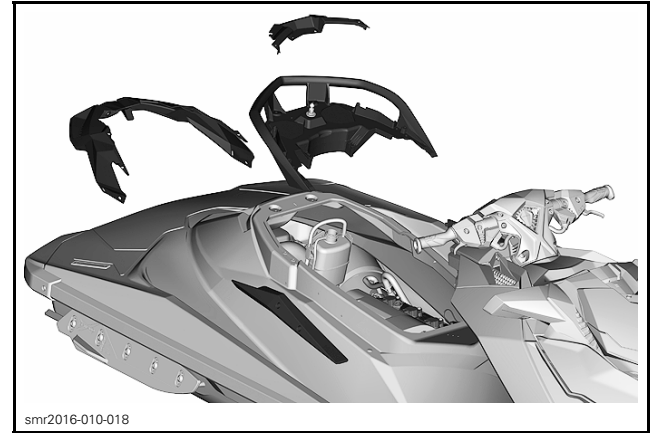
Removing the Front Exhaust Hose



GTX LTD SHOWN

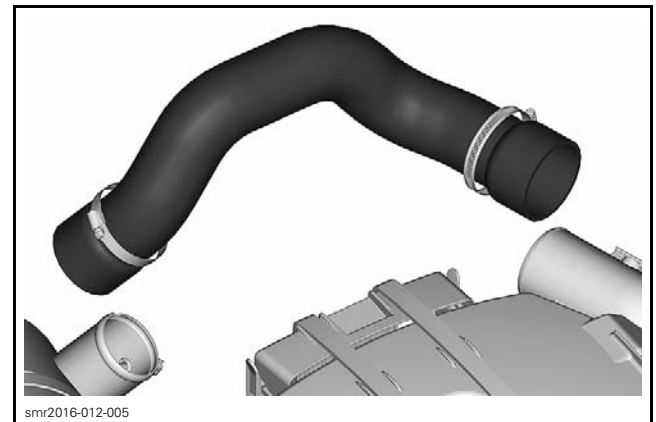
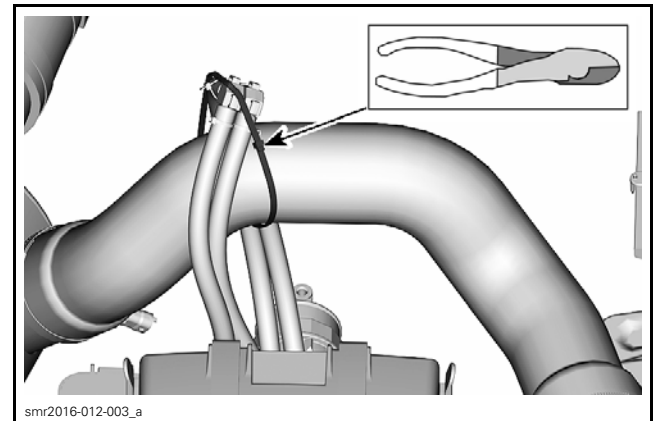


GTX LTD AND RXT-X MODELS



RXP X MODELS

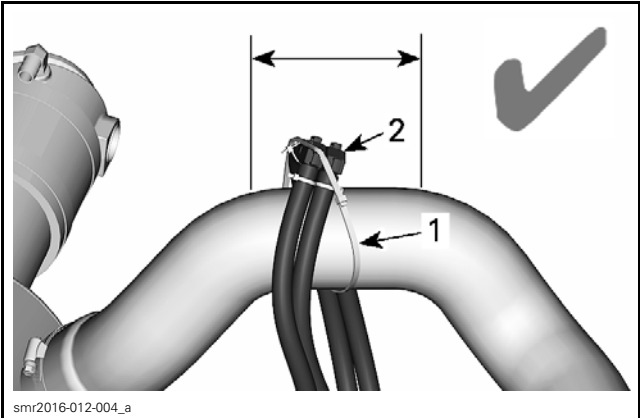
All Models



Installing the Front Exhaust Hose

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

Subsection XX (EXHAUST SYSTEM)



- 1. New locking tie
- 2. Elbow fittings tied on highest part of hose

TIGHTENING TORQUE	
Front exhaust hose clamp	4 N•m ± 1 N•m (35 lbf•in ± 9 lbf•in)

After installation, ensure there is no water or exhaust gas leak when the engine is running. Test run the engine while supplying water to the exhaust system.

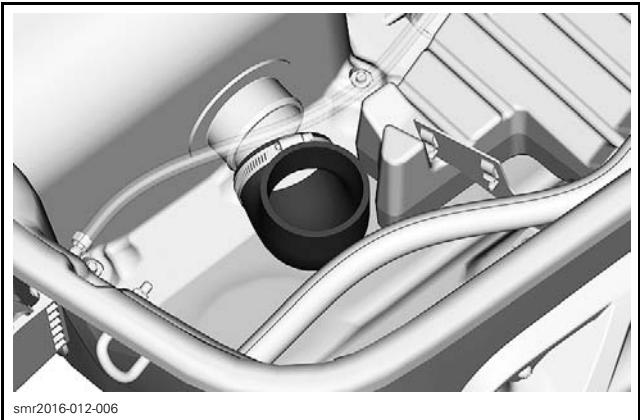
NOTICE Never run engine without supplying water to the exhaust system when watercraft is out of water.

Rear Exhaust Hose

Removing the Rear Exhaust Hose

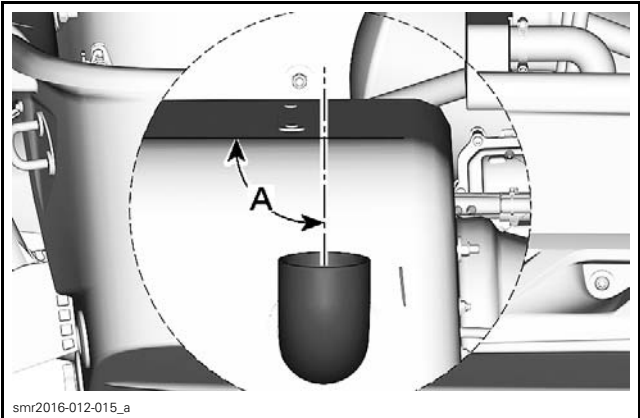
Remove the resonator. See procedure in this subsection.

Loosen clamp securing the rear exhaust hose to RH fixing plate.



Installing the Rear Exhaust Hose

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



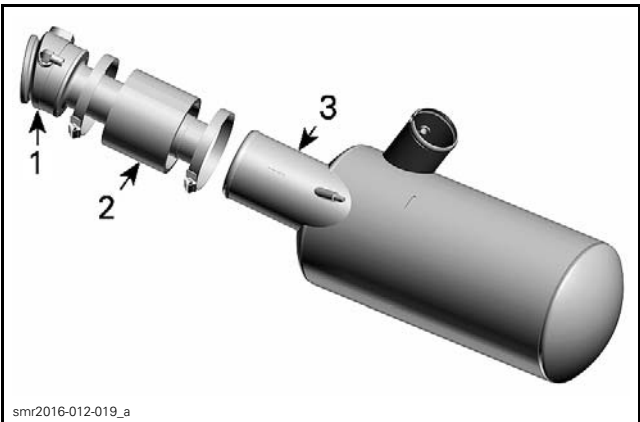
A. 90°

TIGHTENING TORQUE	
Rear exhaust hose clamp	4 N•m ± 1 N•m (35 lbf•in ± 9 lbf•in)

After installation, ensure there is no water or exhaust gas leak when the engine is running. Test run the engine while supplying water to the exhaust system.

NOTICE Never run engine without supplying water to the exhaust system when watercraft is out of water.

EXHAUST PIPE

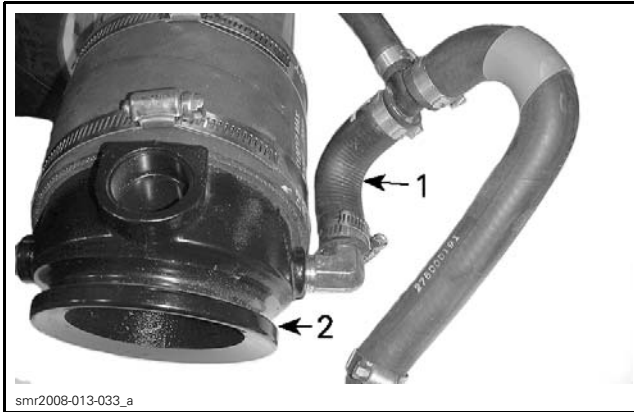


- 1. Exhaust pipe
- 2. Rubber adapter
- 3. Muffler

Removing the Exhaust Pipe

Remove *MUFFLER*, see procedure in this subsection.

Disconnect water inlet hose from exhaust pipe fitting.



1. Water inlet hose
2. Exhaust pipe

Loosen rubber adapter clamps.

Remove exhaust pipe and the rubber adapter.

Inspecting the Exhaust Pipe

Inspect exhaust pipe for:

- Cracks
- Flange damages
- Other damages.

Replace exhaust pipe as required.

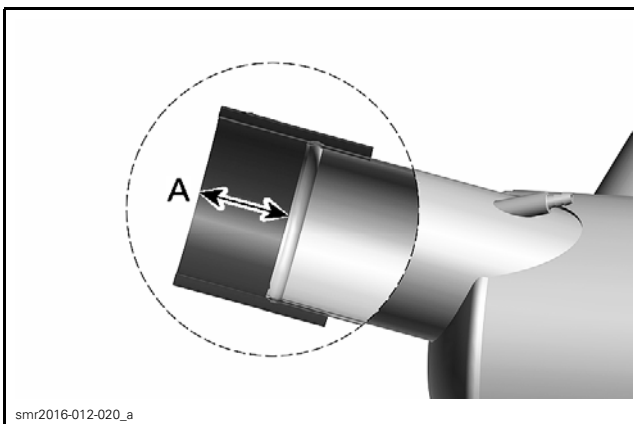
Check if the rubber adapter is:

- Brittle
- Hard
- Otherwise damaged.

Replace rubber adapter if necessary.

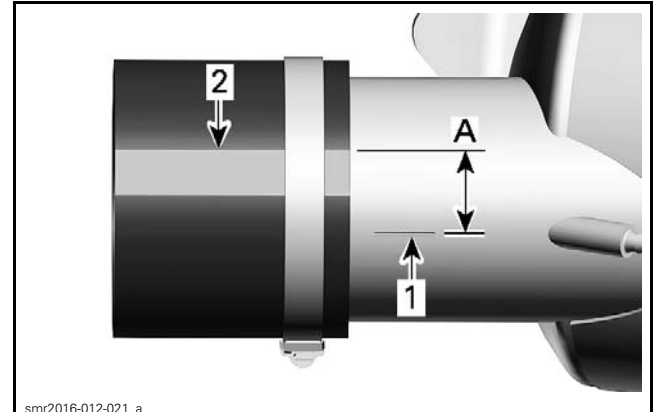
Installing the Exhaust Pipe

Install rubber adapter on muffler.



SECTION VIEW

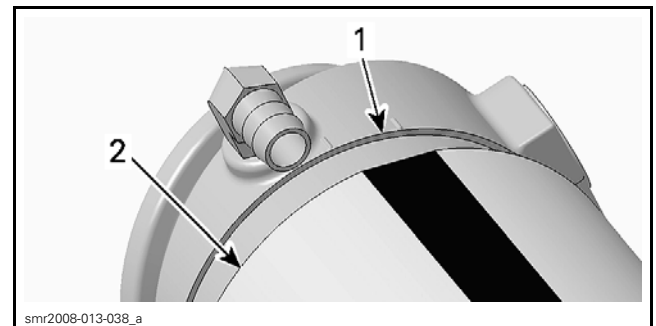
1. 57 mm $\pm$ 2 mm (2-1/4 in $\pm$ 5/64 in)



1. Muffler pre-mark
2. Blue strip on rubber adapter
- A. 23 mm (29/32 in)

TIGHTENING TORQUE	
Rubber adapter retaining clamp	9.5 N•m $\pm$ 0.5 N•m (84 lbf•in $\pm$ 4 lbf•in)

Install the exhaust pipe in rubber adapter. Ensure rubber adapter is properly seats against exhaust pipe shoulder.

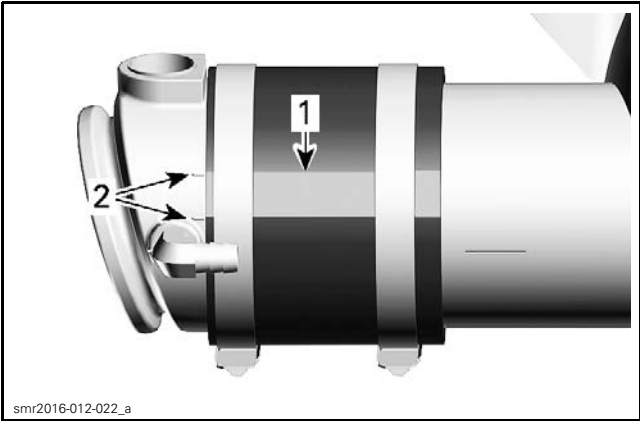


1. Exhaust pipe shoulder
2. Rubber adapter

Center the rubber adapter strip of the rubber adapter between both exhaust pipe marks.

Tighten retaining clamp.

TIGHTENING TORQUE	
Rubber adapter retaining clamp	9.5 N•m $\pm$ 0.5 N•m (84 lbf•in $\pm$ 4 lbf•in)



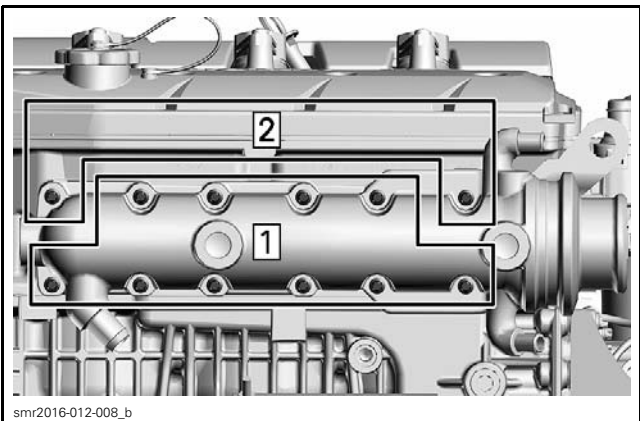
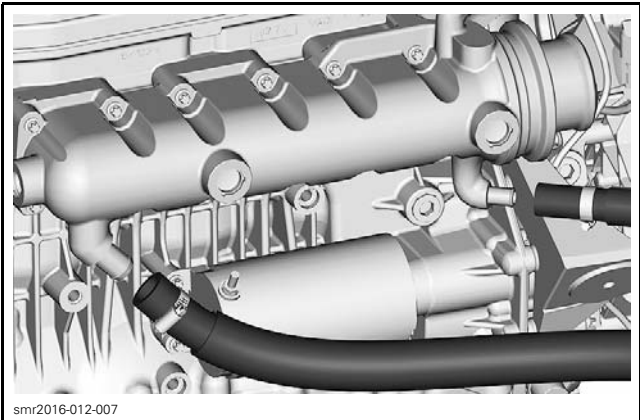
1. Rubber adapter strip
2. Exhaust pipe marks

Install muffler in vehicle. Refer to *INSTALLING THE MUFFLER* in this subsection for complete procedure.

EXHAUST MANIFOLD

Removing the Exhaust Manifold

1. Move muffler rearwards to make room. Refer to *REMOVING THE MUFFLER* in this subsection.



Step 1: Remove first
Step 2: Remove last

2. Remove the exhaust manifold from vehicle.

Inspecting the Exhaust Manifold

Inspect exhaust manifold condition paying attention for cracks or other damage. Check contact surfaces and hose. Replace any defective part.

Inspect plane surfaces for warpage. Small deformation can be corrected by grinding surface with a fine sand paper. Install sand paper on a surface plate and rub part against oiled sand paper.

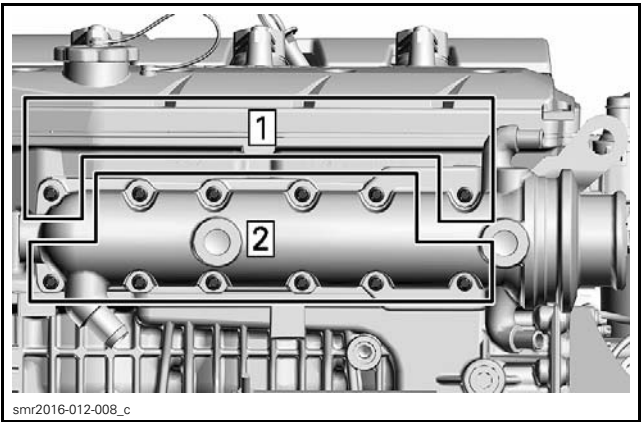
Clean all metal components in a solvent.

Installing the Exhaust Manifold

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

NOTE: There is no gasket between cylinder block and exhaust manifold.

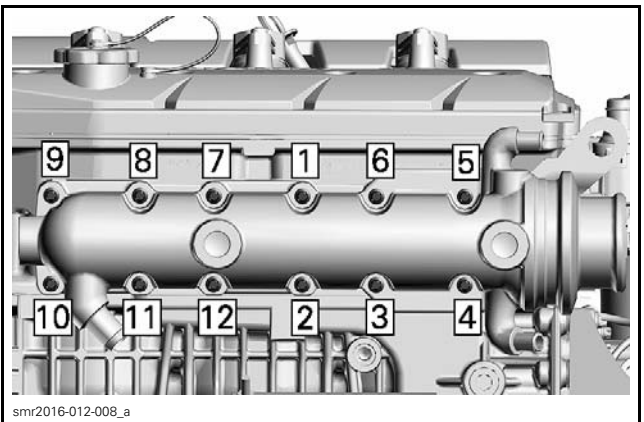
Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on threads of screws.



Step 1: Install first
Step 2: Install last

Tighten screws to specification as per following illustrated sequence. Repeat the procedure twice.

TIGHTENING TORQUE	
Exhaust manifold screw	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



TIGHTENING TORQUE

Exhaust manifold hose clamp	1.7 N•m ± 0.2 N•m (15 lbf•in ± 2 lbf•in)
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After installation, ensure there is no water or exhaust gas leak when the engine is running. Test run the engine while supplying water to the flushing connector.

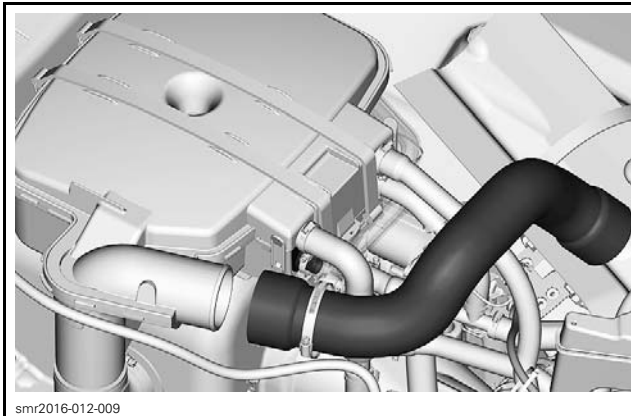
NOTICE Never run engine without supplying water to the exhaust system when watercraft is out of water.

RESONATOR

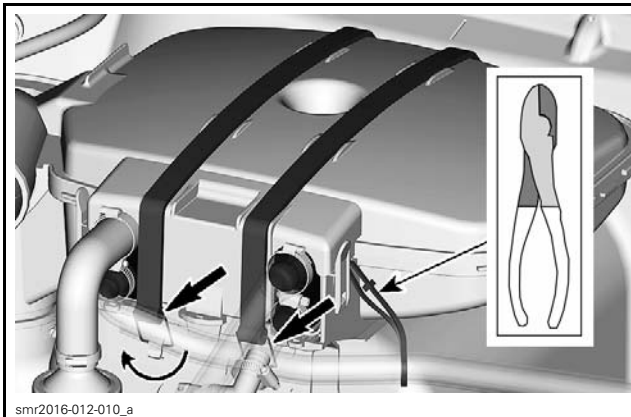
Removing the Resonator

Remove the muffler. See the procedure in this subsection.

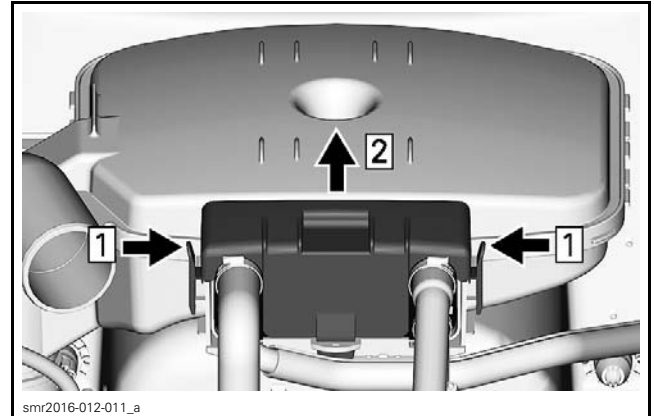
Remove the intercooler. Refer to *INTERCOOLER* subsection.



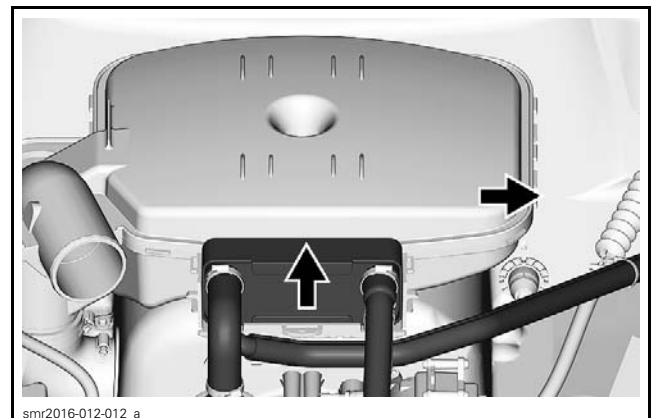
smr2016-012-009



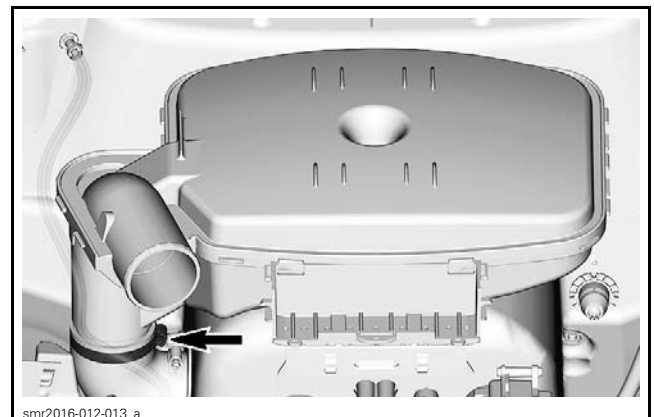
smr2016-012-010_a



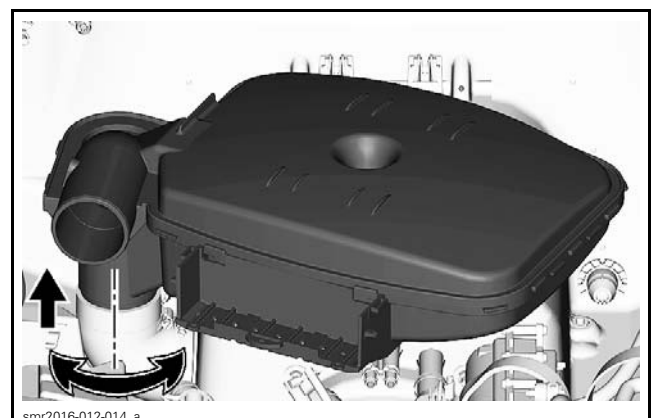
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smr2016-012-013_a



smr2016-012-014_a

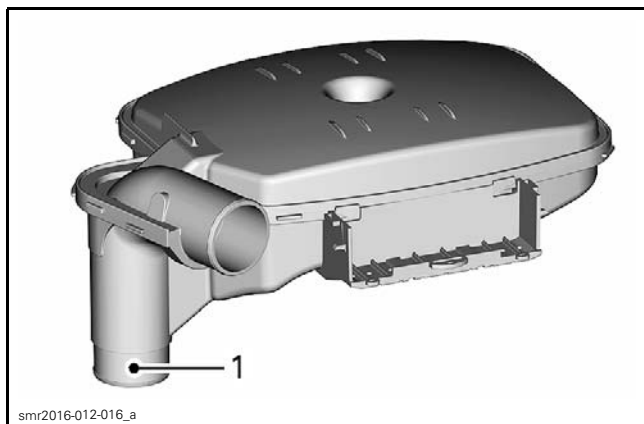
Subsection XX (EXHAUST SYSTEM)

Inspecting the Resonator

Inspect parts condition paying attention for deformation, cracks or other damage. Check hoses. Replace any defective part.

Installing the Resonator

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



1. Spray P80 GRIP-IT (P/N 296 000 406)

After installation, ensure there is no water or exhaust gas leak when the engine is running. Test run the engine while supplying water to the exhaust system.

NOTICE Never run engine without supplying water to the exhaust system when watercraft is out of water.

LUBRICATION SYSTEM

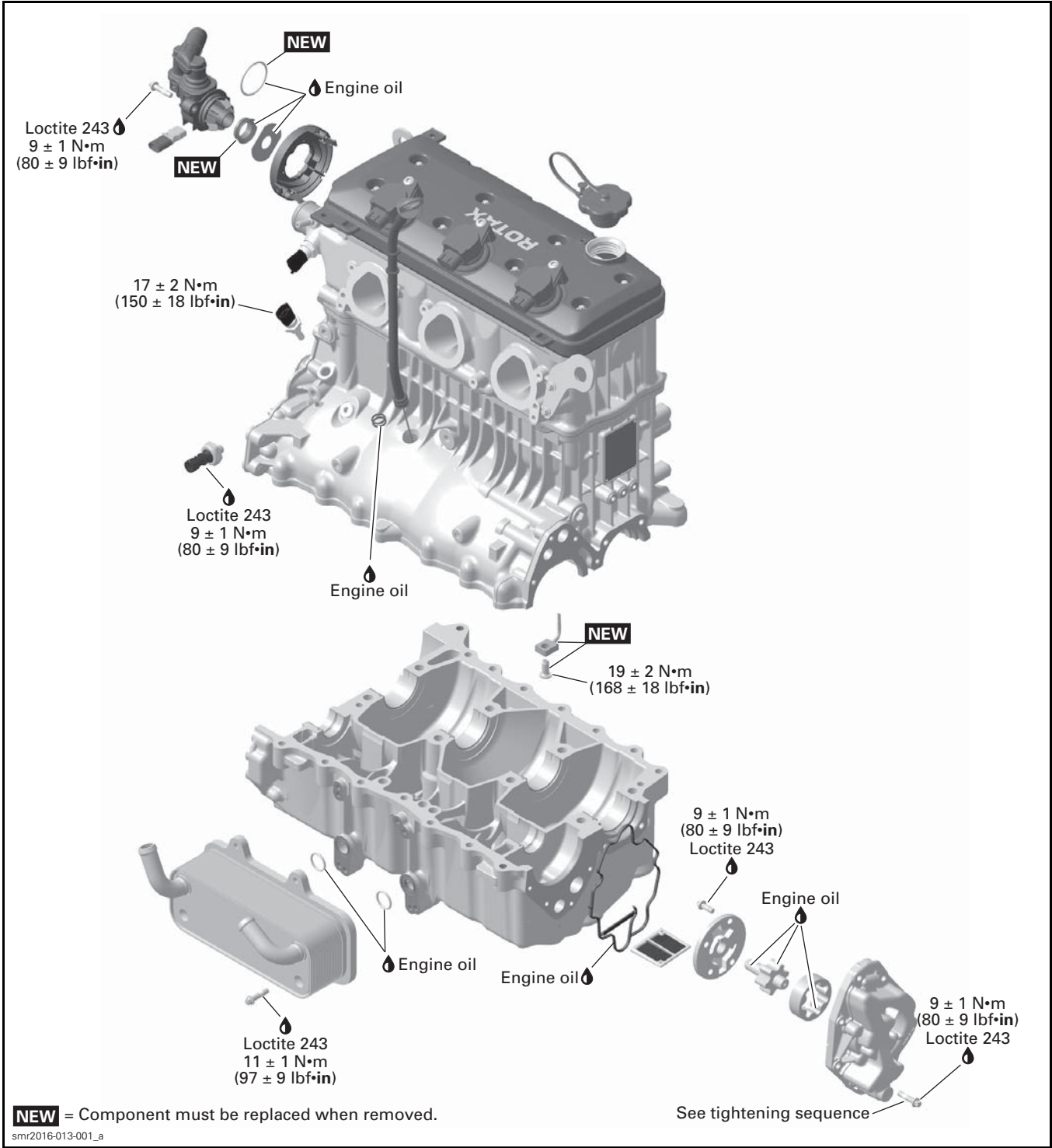
SERVICE TOOLS

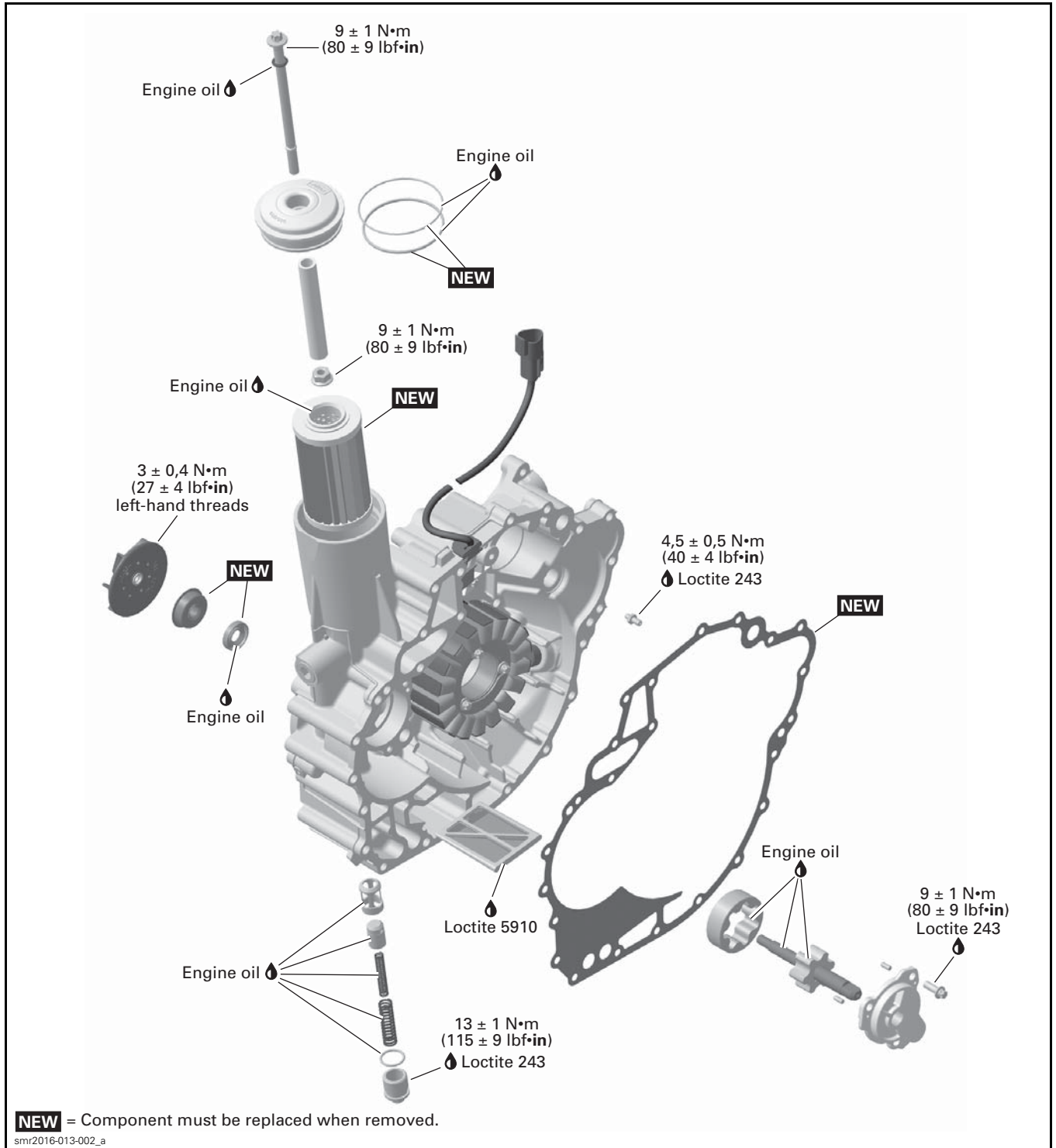
Description	Part Number	Page
ADAPTER HOSE	529 035 652	8
CERAMIC SEAL PULLER	529 036 365	16
ECM ADAPTER TOOL.....	529 036 166	10
FLUKE 115 MULTIMETER	529 035 868	10
HANDLE	420 877 650	17
OIL SEAL GUIDE.....	529 035 822	15
OIL SEAL PUSHER.....	529 035 757	17
PRESSURE GAUGE.....	529 035 709	8
SUCTION PUMP	529 035 880	7
WATER PUMP SEAL PUSHER.....	529 035 823	15, 17

SERVICE PRODUCTS

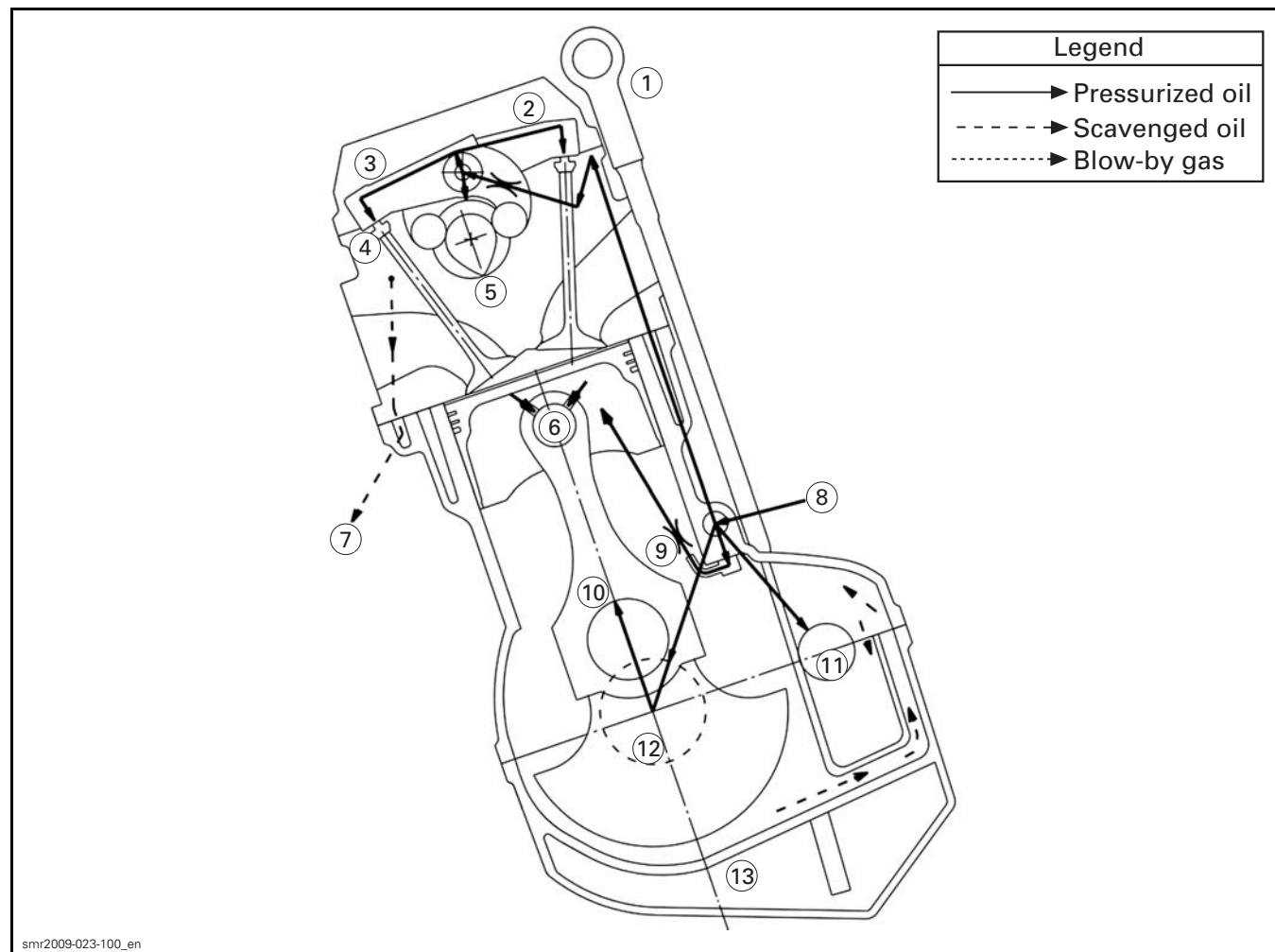
Description	Part Number	Page
LOCTITE 243 (BLUE).....	293 800 060	11, 13, 16, 20–21, 25, 28
PULLEY FLANGE CLEANER	413 711 809	7, 18
SUPER LUBE GREASE.....	293 550 030	8
XPS 4-STROKE SYNTH. BLEND OIL.....	293 600 121	6

Subsection XX (LUBRICATION SYSTEM)



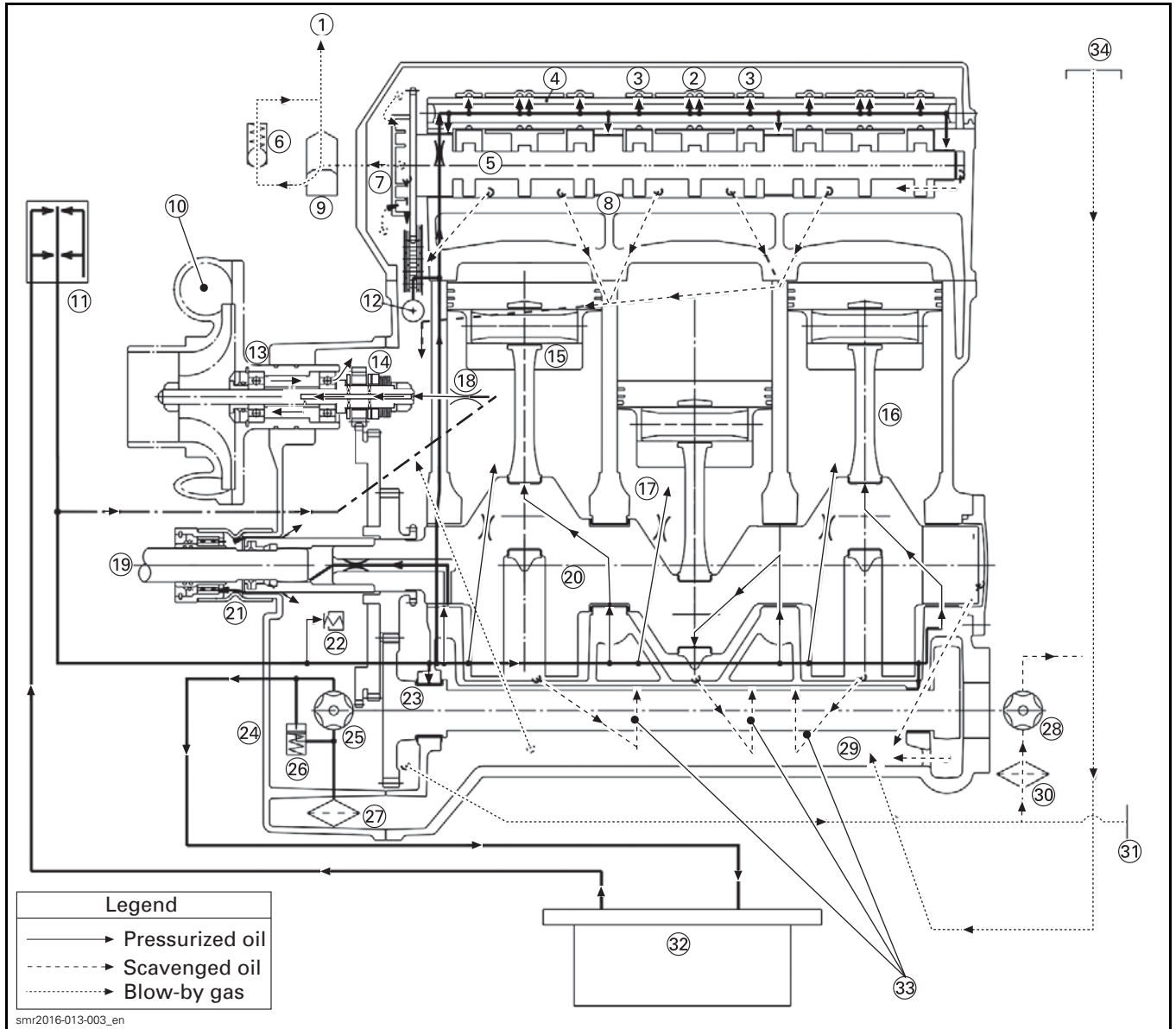


ENGINE LUBRICATION CIRCUIT



1. Oil dipstick
2. Rocker arm (intake)
3. Rocker arm (exhaust)
4. Hydraulic valve lifter
5. Camshaft
6. Piston pin
7. Into PTO housing
8. From oil filter
9. Piston cooling
10. Connecting rod
11. Balance shaft
12. Crankshaft
13. Oil tank

ENGINE LUBRICATION CIRCUIT (CONT'D)



1. To air intake silencer
2. Rocker arm (intake)
3. Rocker arm (exhaust)
4. Rocker arm axle
5. Camshaft
6. Pressure relief valve
7. Oil separator
8. Cylinder head
9. Blow-by valve
10. Supercharger
11. Oil filter
12. Hydraulic chain tensioner
13. Supercharger bearing
14. Friction clutch
15. Piston pin
16. Connecting rod
17. Piston cooling

18. Oil spray nozzle
19. Drive shaft
20. Crankshaft
21. PTO seal
22. Oil pressure switch
23. Balance shaft
24. PTO housing
25. Pressure pump
26. Pressure relief valve
27. Oil strainer (pressure pump)
28. Scavenge pump
29. Oil tank
30. Oil strainer (scavenge pump)
31. Oil drainage (PTO housing)
32. Oil cooler
33. Scavenge of oil and blow-by gas
34. Oil filler cap

MAINTENANCE

ENGINE OIL

Recommended Oil

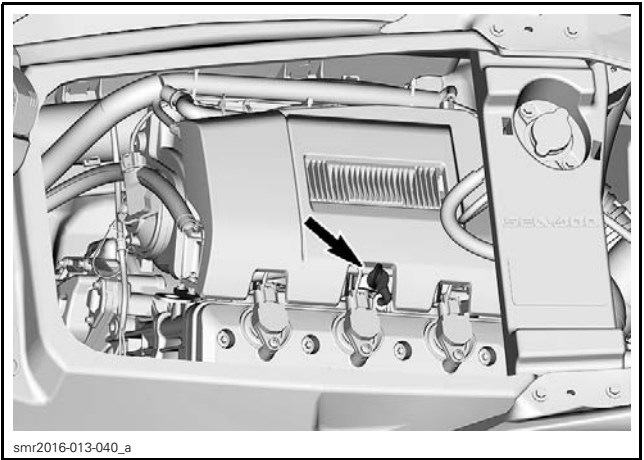
ENGINE OIL	
BRP RECOMMENDED PRODUCT	XPS 4-STROKE SYNTH. BLEND OIL (P/N 293 600 121)
ALTERNATIVE, OR IF NOT AVAILABLE	10W40 mineral engine oil compatible with wet clutches (JASO MA certified oils)

NOTE: The XPS engine oil has been thoroughly tested to be free of any additives that could impair the functionality of the supercharger clutch.

NOTICE NEVER use synthetic oil. This would impair the proper operation of the supercharger clutch. Do not add any additives to the recommended oil. Mineral oils not recommended by BRP may also contain additives (friction modifiers) that may cause inappropriate slippage of the supercharger and eventually lead to premature wear. For this reason, XPS Synthetic Blend oil (Summer Grade) or a BRP approved equivalent are the only recommended oils. Use of any oil not recommended by BRP may void BRP's limited warranty.

Verifying the Oil Level

NOTICE Check level frequently and refill if necessary. Do not overfill — it would make the engine smoke and reduce its power. Operating the engine with an improper level may severely damage engine. Wipe off any spillage.



Check the oil level as follows:

NOTE: It is of the utmost importance to follow this procedure in order to obtain an accurate reading of the engine oil level.

- 1. Watercraft must be level. Check oil level either with watercraft in water or out of water.

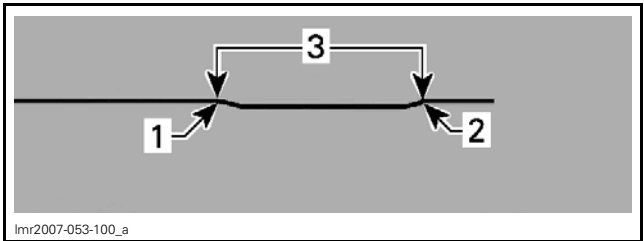
NOTE: If the watercraft is out of water, link a garden hose to the hose adapter. Refer to *EXHAUST SYSTEM FLUSHING* in the *EXHAUST SYSTEM* subsection.

- NOTICE** When watercraft is out of water:
- Never run engine without supplying water to the exhaust system.
 - Never run engine longer than 2 minutes. Drive line seal has no cooling when watercraft is out of water.

- 2. Warm-up engine then let idle for 30 seconds before stopping.
- 3. Stop engine.
- 4. Open or remove seat.
- 5. Wait at least 30 seconds for the oil to settle in the engine, then pull dipstick out and wipe clean.

CAUTION Engine oil may be hot. Certain components in the engine compartment may be very hot. Direct contact may result in skin burn.

- 6. Reinstall dipstick, push in completely.
- 7. Remove dipstick and read oil level. It should be between the FULL and ADD marks.



- 1. Full
- 2. Add
- 3. Operating range

Otherwise, add oil until its level is between marks as required.

NOTICE The oil quantity between FULL and ADD marks is 1 L (1.06 qt (U.S. liq.)).

To add oil, unscrew oil cap. Place a funnel into the valve cover opening and add the recommended oil to the proper level. Do not overfill.

Reinstall oil filler cap.

NOTICE Ensure that oil filler cap is properly closed. Otherwise big quantities of oil can spill out the oil filler cap.

Oil Change

NOTE: Oil and oil filter must be replaced at the same time. Oil change and oil filter replacement should be done with a warm engine.

Bring engine to its normal operating temperature.

NOTICE When watercraft is out of water:

- Never run engine without supplying water to the exhaust system.
- Never run engine longer than 2 minutes. Drive line seal has no cooling when watercraft is out of water.

Run engine for 10 seconds at 4000 RPM and shut it off at this RPM. This will move oil from PTO housing to oil tank to allow maximum oil draining.

Remove oil filler cap and dipstick.

⚠ CAUTION Engine oil may be hot. Certain components in the engine compartment may be very hot. Direct contact may result in skin burn.

Siphon oil through the dipstick tube.

REQUIRED TOOL	
SUCTION PUMP (P/N 529 035 880)	

NOTICE Never crank or start engine when suction pump hose is in the dipstick tube. Never start engine when there is no oil in engine.

NOTE: To properly position the suction pump hose is located at the proper height to siphon oil, it is suggested to put some electrical tape on hose at 475 mm (18-11/16 in) from its end. Then, insert the hose until you reach the tape.

Pull suction pump hose out of dipstick tube.

Fully depress the throttle lever and HOLD it while cranking engine for 10 seconds. Siphon oil again. Repeat the crank-siphon cycle 2 - 3 times.

Refill engine with the recommended oil, see *RECOMMENDED OIL* in this subsection.

Reinstall oil filler cap and dipstick.

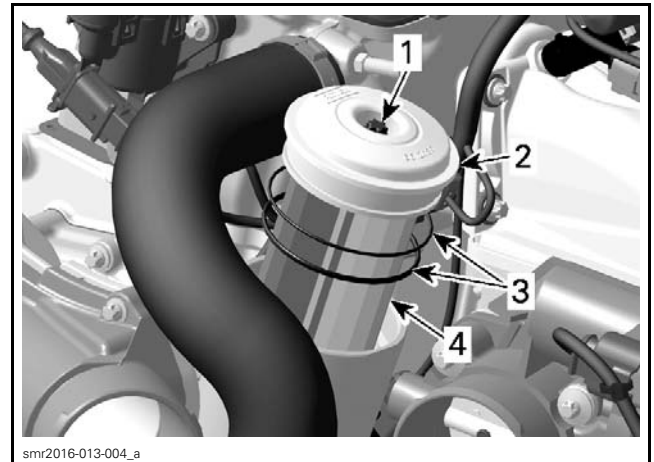
Replace *OIL FILTER*, see procedure in this subsection.

OIL FILTER

Removing the Oil Filter

Remove:

- Oil filter screw
- Oil filter cover
- Oil filter.



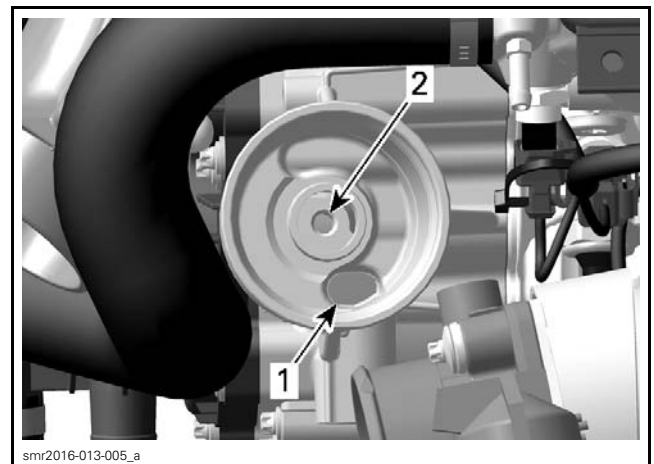
1. Oil filter screw
2. Oil filter cover
3. O-rings
4. Oil filter

Place rags in filler area to prevent spillage. If spillage occurs, clean immediately with the PULLEY FLANGE CLEANER (P/N 413 711 809) to prevent stains.

Inspecting the Oil Filter

Check oil filter screw O-ring, change if necessary.

Check and clean the oil filter inlet and outlet area for dirt and other contaminations.



1. Inlet bore from the oil pump to the oil filter
2. Outlet bore to the engine oil providing system

Subsection XX (LUBRICATION SYSTEM)

Installing the Oil Filter

For installation, reverse the removal procedure. Pay attention to the following details.

Install a **NEW** oil filter.

Install **NEW** O-rings on oil filter cover.

Apply engine oil on:

- Oil filter ring
- Filter cover O-rings
- Oil filter screw O-ring.

NOTE: In salt water area, it is recommended to coat mating surface of cover with SUPER LUBE GREASE (P/N 293 550 030).

Torque oil filter screw to specification.

TIGHTENING TORQUE	
Oil filter screw	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

INSPECTION

ENGINE OIL PRESSURE

Oil Pressure Test Requirement

Bring engine to its normal operating temperature.

CAUTION Certain components in the engine compartment may be very hot. Direct contact may result in skin burn.

NOTICE When watercraft is out of water:

- Never run engine without supplying water to the exhaust system.
- Never run engine longer than 2 minutes. Drive line seal has no cooling when watercraft is out of water.

Required Tools for Oil Pressure Test

REQUIRED TOOLS	
PRESSURE GAUGE (P/N 529 035 709)	
ADAPTER HOSE (P/N 529 035 652)	

NOTE: A 1/8 NPT pipe extension may ease the installation.

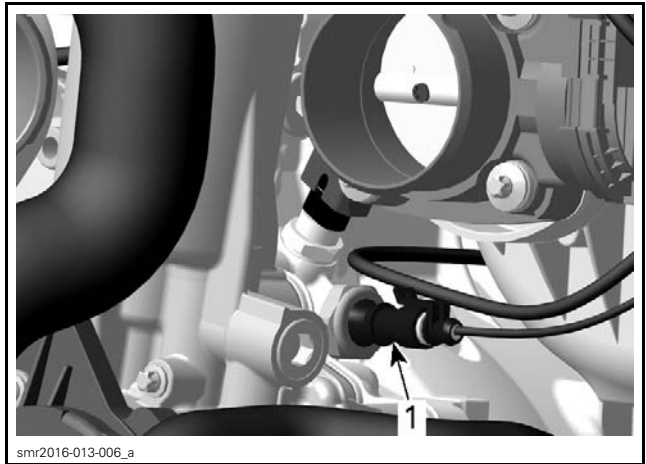
Oil Pressure Specifications

Use the following table to compare the oil pressure at different RPM.

OIL PRESSURE	
Idle (cold)	400 kPa - 600 kPa (58 PSI - 87 PSI)
Idle (at 80°C (176°F))	Min. 150 kPa (22 PSI)
4000 - 8000 (at 100°C (212°F))	350 kPa - 500 kPa (51 PSI - 73 PSI)

Test at the Oil Pressure Switch Location

Remove oil pressure switch and install gauge.



INSTALLATION AT PRESSURE SWITCH LOCATION
1. Oil pressure switch

To prevent the EMS to go in limp home mode (at 2500 RPM) or to generate a fault code, do the following:

1. Ground OPS to engine.
2. Plug OPS to harness.
3. Start engine.
4. While engine is running, unplug OPS from harness.

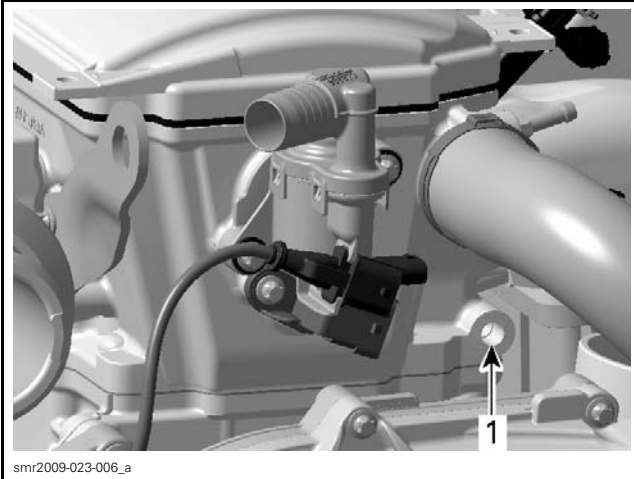
Read oil pressure at different RPM as per table above.

Reinstall oil pressure switch.

Test at the Cylinder Head Location

The oil pressure may be measured from cylinder head if desired.

Remove plug located on cylinder head and install gauge.



smr2009-023-006_a
INSTALLATION AT CYLINDER HEAD
 1. Remove plug and install gauge here

Start engine and read pressure at different RPM as per table above.

Reinstall plug.

TROUBLESHOOTING

The following is provided to help in diagnosing the probable source of troubles. It is a guideline and it should not be assumed to list all possible problems.

Always check for fault codes. If a fault code is detected, service the fault code first. Refer to *ENGINE MANAGEMENT* section.

LOW OR NO ENGINE OIL PRESSURE

1. **Oil level too low.**
 - Refill engine oil.
 - Check for high oil consumption. See below.
 - Check for oil leaks (oil leaking out of leak indicator hole, gaskets, oil seal or O-rings). Repair or replace.
2. **Oil pressure switch defective.**
 - Check and replace if necessary.
3. **Oil filter clogged.**
 - Replace engine oil and oil filter at the same time.
4. **Oil pressure regulator valve sticks open, or spring load is too small.**
 - Clean oil regulator piston and its bore. Replace if necessary.
 - Measure spring free length. Replace if too small.
5. **Oil pump(s) worn or damaged.**
 - Check oil pump rotors and its bore for wear limits. Replace if out of specification.
6. **Engine oil strainers are clogged.**
 - Remove and clean engine oil strainers.

7. **Heavy wear on plain bearings.**
 - Check radial clearance of plain bearings. Replace if out of specification.

HIGH OIL CONSUMPTION

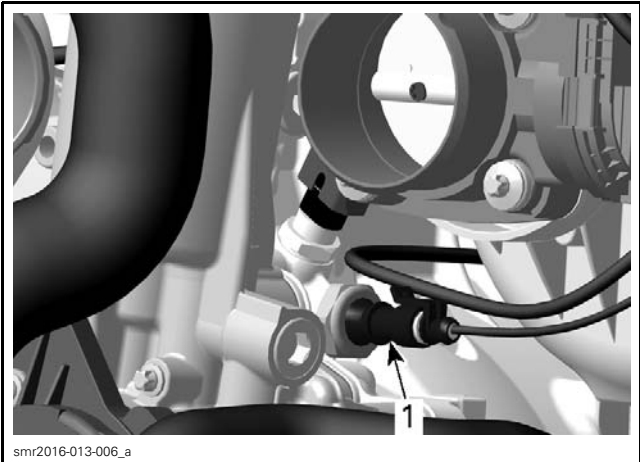
1. **Oil in breathing system.**
 - Check if breather V-ring is brittle, hard or damaged. Replace V-ring.
2. **Valve stem seals worn or damaged.**
 - Replace valve stem seals.
3. **Piston rings worn out (blue colored exhaust smoke).**
 - Replace piston rings.

OIL CONTAMINATION (WHITE APPEARANCE)

1. **Water ingestion through drive shaft and floating ring**
 - Check if water is leaking between drive shaft and floating ring. Repair or replace defective parts. Refer to *PTO HOUSING AND MAGNETO* subsection.
 - Change engine oil and filter.
2. **Oil seal and rotary seal on water pump shaft leaking.**
 - Replace oil seal and water pump shaft assembly.
 - Change engine oil and oil filter.
3. **Cylinder head gasket leaking.**
 - Replace cylinder head gasket and tighten cylinder head with recommended torque.
 - Change engine oil and oil filter.
4. **Cylinder head screws not properly tightened.**
 - Retighten screws with recommended torque.
 - Change engine oil.
5. **Oil cooler O-rings are leaking.**
 - Replace O-rings.
 - Change engine oil and oil filter.
6. **Cylinder block or cylinder head casting is leaking.**
 - Check for internal cracks in casting. Replace damaged components.
 - Change engine oil and oil filter.

PROCEDURES

OIL PRESSURE SWITCH (OPS)



1. OPS

Oil Pressure Switch Access

Remove the throttle body. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.

Oil Pressure Switch Operation

The oil pressure switch activates when the engine oil pressure is lower than following specified pressure range.

OIL PRESSURE SWITCH ACTIVATION RANGE
180 kPa to 220 kPa (26.11 PSI to 31.91 PSI)

Inspecting the Oil Pressure Switch

First, carefully check the condition of the connector terminals. Clean to remove dirt and corrosion that could affect proper operation of the OPS.

IMPORTANT: Do not apply dielectric grease on terminal.

Before checking the function of the OPS, an oil pressure test has to be performed to be sure the oil pressure is not in fault. Refer to *INSPECTION* in this subsection.

When the engine oil pressure tests good but the OIL message in the information center is present and the beeper sounds:

- Ensure OPS connector is plugged to the switch.
- Check the resistance of the OPS while engine is off and while engine is running.

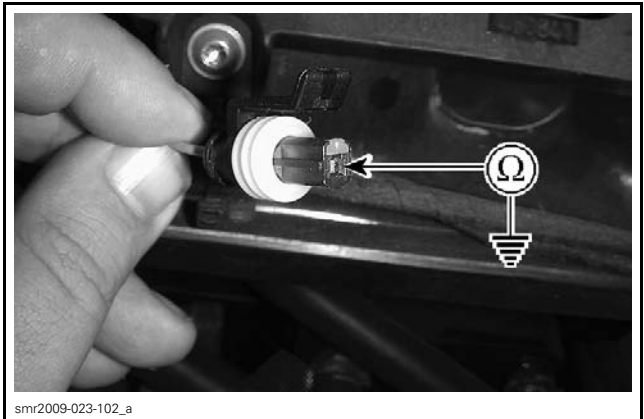
Testing the Oil Pressure Switch Resistance

Disconnect the connector from the OPS.

Use a multimeter to check the resistance as shown.

ENGINE NOT RUNNING		
TEST PROBES		RESISTANCE (Ω)
OPS connector (pin 1)	Engine ground	Close to 0 (normally closed switch)

ENGINE RUNNING		
TEST PROBES		RESISTANCE (Ω)
OPS connector (pin 1)	Engine ground	Infinitely high (OL) when pressure reaches 180 kPa (26.11 PSI) and 220 kPa (32 PSI)



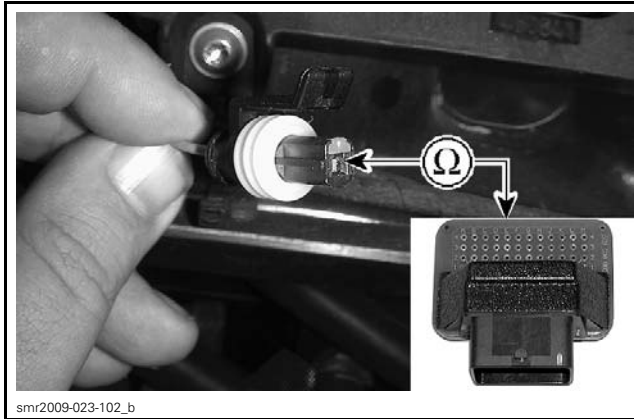
If resistance values are incorrect, replace OPS.
If the values are correct, check the continuity of the wiring harness.

Testing the Oil Pressure Switch Circuit Continuity

Disconnect the ECM connector "A" from the ECM.
Check continuity of OPS circuit as per following table.

REQUIRED TOOL	
ECM ADAPTER TOOL (P/N 529 036 166)	
FLUKE 115 MULTIMETER (P/N 529 035 868)	

OPS CONNECTOR	ECM ADAPTER	RESISTANCE
Pin 1	Pin E3	Close to 0 Ω (continuity)



If continuity test failed, repair or replace the connector and wiring between ECM connector and OPS.

If continuity test succeeded, check the ECM. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.

Removing the Oil Pressure Switch

Unplug the OPS connector.

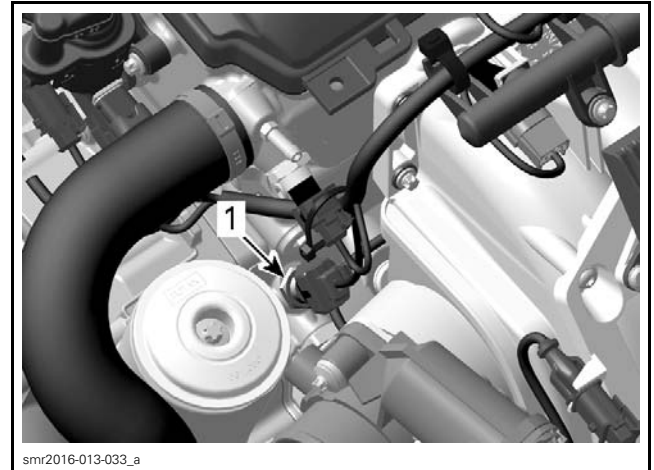
Unscrew and remove the oil pressure switch.

Installing the Oil Pressure Switch

Torque oil pressure switch to specification.

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Oil pressure switch	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

OIL TEMPERATURE SENSOR (OTS)



1. Oil temperature sensor (OTS)

NOTE: Engine will be set to limp home mode and an overheat indication will come on in the information center when the oil temperature reaches:

OVERHEAT TEMPERATURE
95°C (203°F)

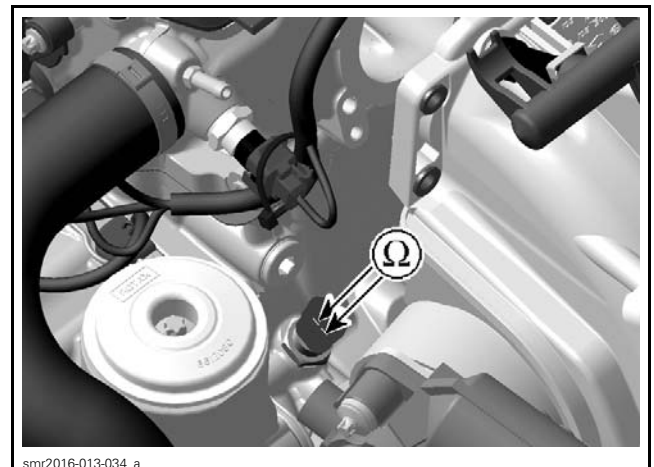
Check for debris or blockage in lubrication system.

OTS Access

Remove the throttle body. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.

Testing the OTS Resistance

1. Disconnect the connector from the OTS and test the resistance of the sensor. Refer to the *OTS RESISTANCE CHART* in this subsection.



If resistance measured is not as specified, replace the OTS.

Subsection XX (LUBRICATION SYSTEM)

If the resistance measured is as specified, proceed with the following steps.

- 2. Reconnect the OTS connector and disconnect ECM connector "A" from the ECM.
- 3. Check the OTS circuit resistance as per table.

OTS RESISTANCE TEST		
ECM ADAPTER PIN		RESISTANCE Ω
A-H4	A-J4	See <i>OTS RESISTANCE CHART</i>

OTS RESISTANCE CHART				
TEMPERATURE		RESISTANCE (OHMS)		
°C	°F	NOMINAL	LOW	HIGH
- 30	- 22	12600	11800	13400
- 20	- 4	11400	11000	11800
- 10	14	9500	8000	11,000
0	32	5900	4900	6900
10	50	3800	3100	4500
20	68	2500	2200	2800
30	86	1700	1500	1900
40	104	1200	1080	1320
50	122	840	750	930
60	140	630	510	750
70	158	440	370	510
80	176	325	280	370
90	194	245	210	280
100	212	195	160	210
110	230	145	125	160
120	248	115	100	125

If the resistance value measured is as specified, check ECM. Refer to *ECM* in the *ELECTRONNIC FUEL INJECTION (EFI)* subsection.

If the resistance value is not within specification, repair or replace wiring and connectors between ECM connector and the OTS.

OTS Replacement

- 1. Disconnect OTS connector and remove OTS.
- 2. Install the new OTS.

TIGHTENING TORQUE	
Oil temperature switch	17 N•m ± 2 N•m (150 lbf•in ± 18 lbf•in)

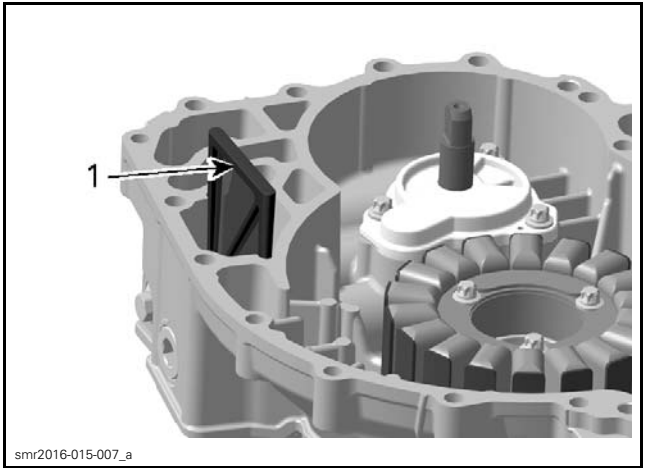
- 3. Reinstall remaining removed parts.

PTO OIL STRAINER

Removing the PTO Oil Strainer

Remove the PTO housing. Refer to *PTO HOUSING AND MAGNETO* subsection.

Remove the oil strainer.



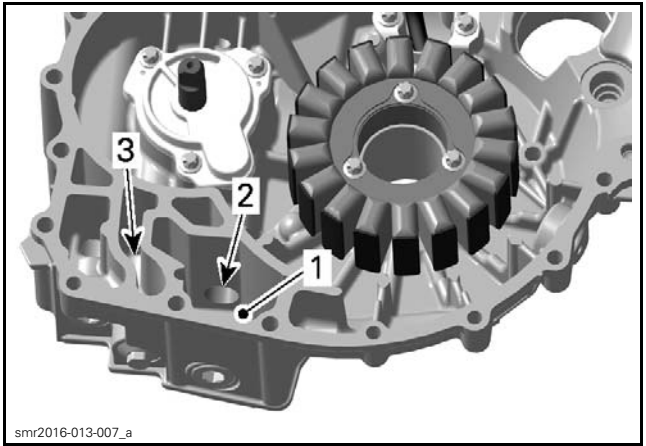
1. PTO oil strainer

Cleaning and Inspecting the PTO Oil Strainer

Clean oil strainer with a part cleaner then use compressed air to dry it.

Check oil strainer for damage, replace if necessary.

Check and clean the oil strainer compartment and oil bores for dirt and other contaminations.



1. Oil strainer compartment
2. Oil bore to the oil pump
3. Oil bore from the oil pump

Installing the PTO Oil Strainer

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

Clean PTO oil strainer to remove all remaining silicone residues in oil strainer area.

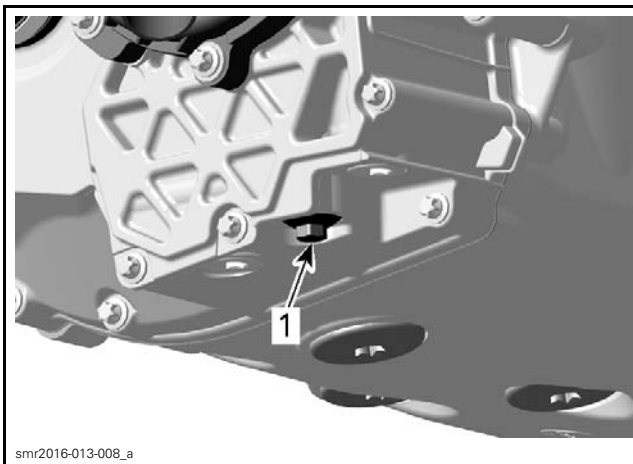
Install oil strainer in the PTO housing.

Install the PTO housing, Refer to *PTO HOUSING AND MAGNETO* subsection.

Refill engine at the proper level with the recommended oil. Refer to *ENGINE OIL* for the procedure.

ENGINE OIL PRESSURE REGULATOR

The oil pressure regulator is located on the bottom of the PTO housing.



1. Oil pressure regulator

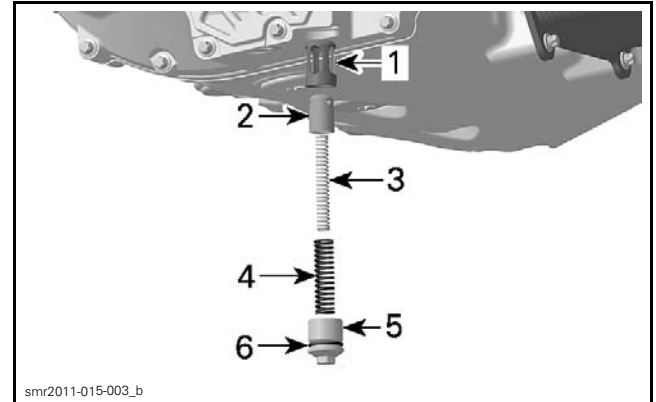
NOTE: The oil pressure regulator system opens when the oil pressure exceeds 400 kPa (58 PSI).

Removing the Oil Pressure Regulator

Remove engine oil. See procedure in *OIL CHANGE* in this subsection.

Remove:

- Oil pressure regulator plug
- Compression springs
- Valve piston
- Valve piston guide.



1. Valve piston guide
2. Valve piston
3. Inner compression spring
4. Outer compression spring
5. Oil pressure regulator plug
6. O-ring

NOTE: Oil pressure regulator plug on oil pump housing is spring loaded.

Inspecting the Oil Pressure Regulator

Inspect valve piston and valve piston guide for scoring or other damages.

Check outer compression spring for free length.

OUTER COMPRESSION SPRING FREE LENGTH	
NEW NOMINAL	60.0 mm (2.362 in)
SERVICE LIMIT	57.0 mm (2.244 in)

Replace inner and outer compression spring as an assembly.

Replace parts if important wear or damage are present.

Clean bore and threads in the PTO housing from metal shavings and other contaminations.

Installing the Oil Pressure Regulator

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

Make sure that the O-ring is on the plug screw.

Torque plug screw to specification.

NOTICE Make sure not over tighten the plug. Damages to springs may cause oil pressure regulator malfunction.

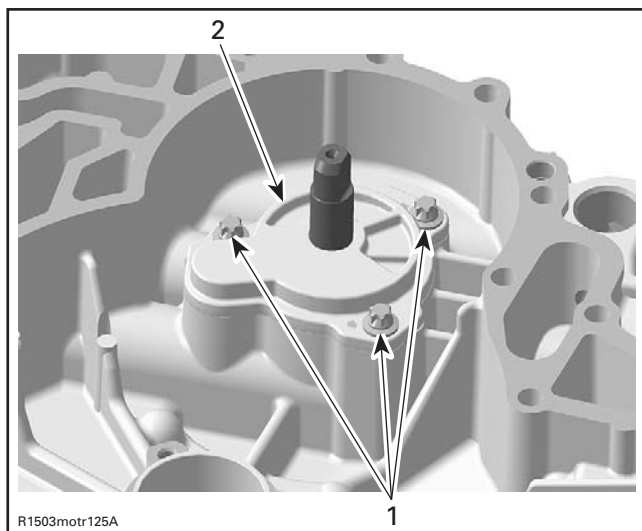
TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Oil pressure regulator plug	13 N•m ± 1 N•m (115 lbf•in ± 9 lbf•in)

OIL PRESSURE PUMP

The oil pressure pump is located in the PTO housing and is driven by the balance shaft.

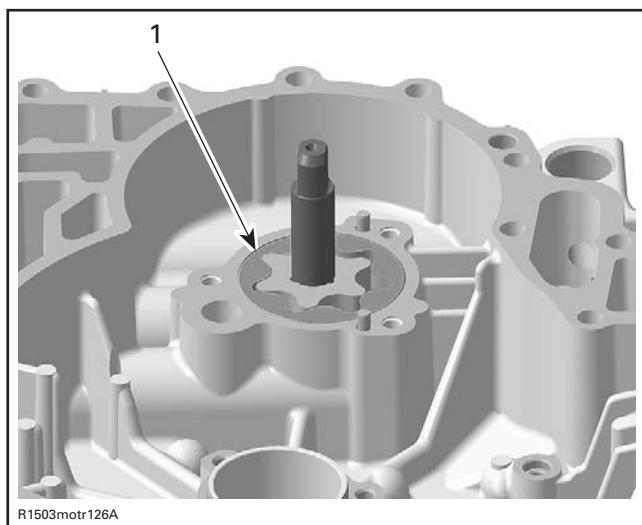
Removing the Oil Pressure Pump

1. Remove the PTO housing. Refer to *PTO HOUSING AND MAGNETO* subsection.
2. Remove water pump housing and the impeller. Refer to *COOLING SYSTEM* subsection.
3. Remove screws securing the oil pump cover.



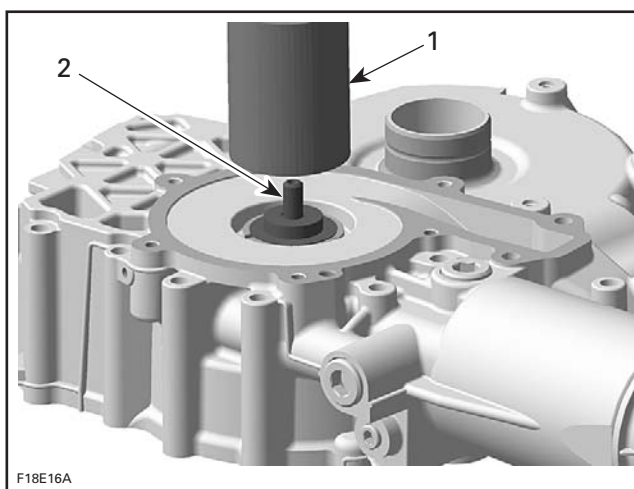
1. Screws
2. Oil pump cover

4. Pull and remove the outer oil pump rotor.



1. Outer oil pump rotor

5. Extract the coolant/oil pump shaft by pushing it from outside PTO housing cover.



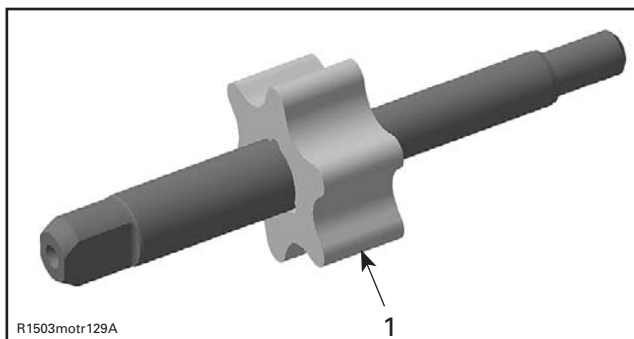
1. Pusher
2. Coolant/oil pump shaft

6. Remove rotary seal and oil seal. Refer to *ROTARY SEAL* further in this subsection.

Inspecting the Oil Pressure Pump

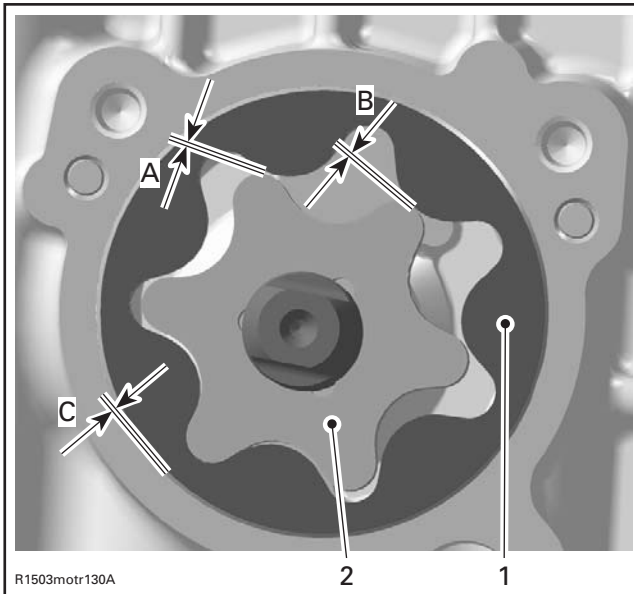
Inspect coolant/oil pump shaft, housing and cover for marks or other damages.

Check inner rotor for corrosion pin-holes or other damages. If so, replace coolant/oil pump shaft. Ensure to also check oil pump housing and cover and replace if damaged.



1. Pittings on the teeth

Using a feeler gauge, measure the clearance between inner and outer rotors.



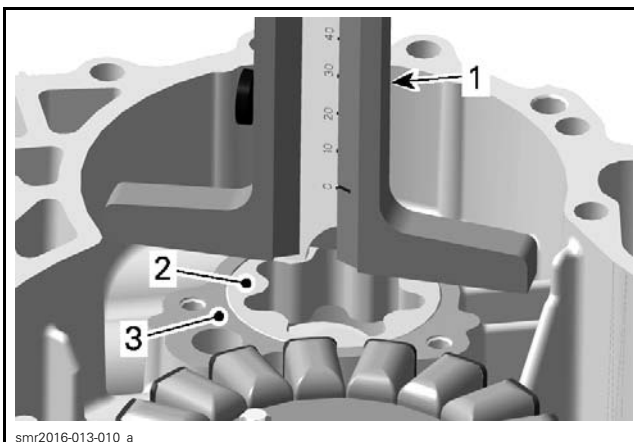
1. Outer rotor
2. Inner rotor

OIL PUMP RADIAL CLEARANCE	
SERVICE LIMIT	
A	0.25 mm (.0098 in)
B	
C	

If clearance between inner and outer rotors exceeds the tolerance, replace coolant/oil pump shaft. Ensure to also check oil pump housing and cover and replace if damaged.

If clearance between outer rotor and its bore in oil pump exceeds the tolerance, replace the complete oil pump and the PTO housing.

Using a depth gauge, measure axial clearance as shown.



1. Depth gauge
2. Oil pump outer rotor surface
3. PTO housing surface

Clearance between pump housing and outer rotor should not exceed the following specification. If so, replace the complete oil pump assembly.

OIL PUMP AXIAL CLEARANCE
0.1 mm (.004 in)

NOTE: When the axial clearance of the coolant/oil pump shaft increases, the oil pressure decreases. Check the inside of oil pump housing and its cover for scoring or other damages and replace if damaged.

Installing the Oil Pressure Pump

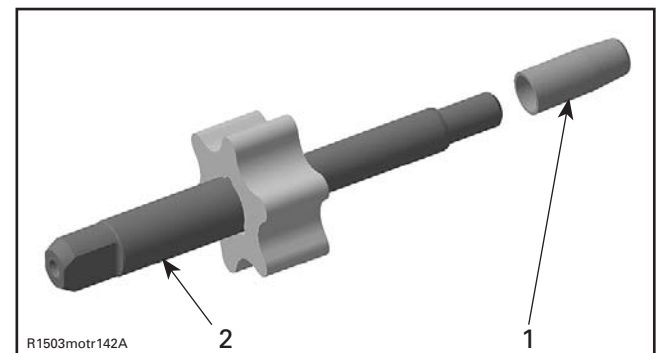
The installation is the reverse of the removal procedure. However, pay attention to the following details.

Install a **NEW** rotary seal and a **NEW** oil seal. Refer to *ROTARY SEAL* in this subsection.

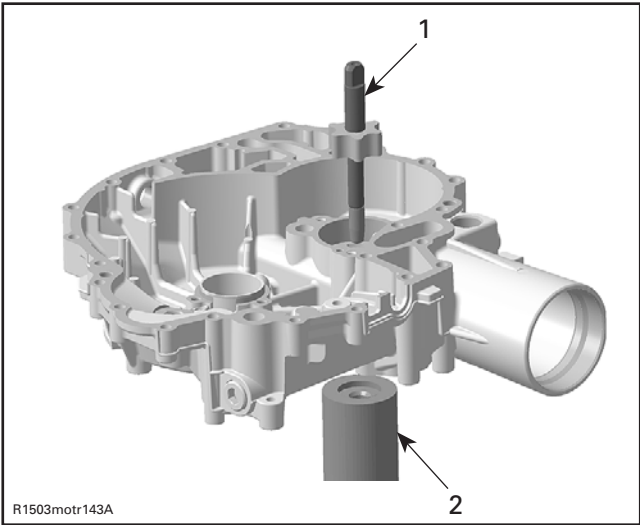
Install the coolant/oil pump shaft.

NOTICE Never use a hammer for the coolant/oil pump shaft installation. Only use a press to avoid damaging the ceramic component of the rotary seal.

REQUIRED TOOL	
OIL SEAL GUIDE (P/N 529 035 822)	
WATER PUMP SEAL PUSHER (P/N 529 035 823)	



1. Oil seal guide
2. Coolant/oil pump shaft



- 1. Coolant/oil pump shaft with oil seal guide
- 2. Rotary seal pusher to support PTO housing

Tighten oil pump cover screws to specification.

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Oil pump cover screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

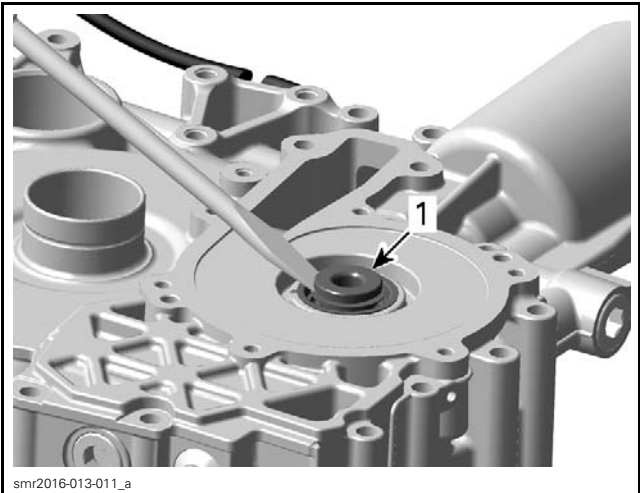
After engine is completely reassembled, start engine and make sure oil pressure is within specifications.

ROTARY SEAL

Removing the Rotary Seal

Remove the coolant/oil pump shaft. Refer to *OIL PRESSURE PUMP* in this subsection.

Carefully remove the inner ring of the rotary seal with a screwdriver.

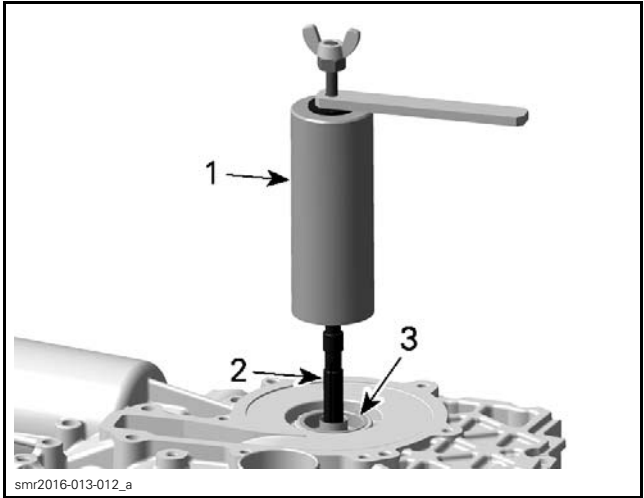


- 1. Inner ring of rotary seal

NOTICE Be careful not to damage the surface of the rotary seal bore or the sealing surface of the water pump housing in PTO housing.

REQUIRED TOOL	
CERAMIC SEAL PULLER (P/N 529 036 365)	

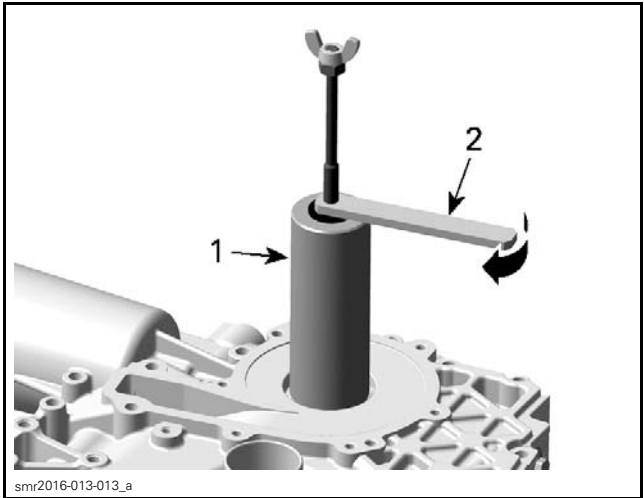
Put ceramic seal puller into the ceramic seal and turn the bearing puller until it's clamping.



- 1. Ceramic seal puller
- 2. Bearing puller
- 3. Ceramic seal

NOTE: Take care that the bearing puller end is exactly positioned between the oil seal and the ceramic seal.

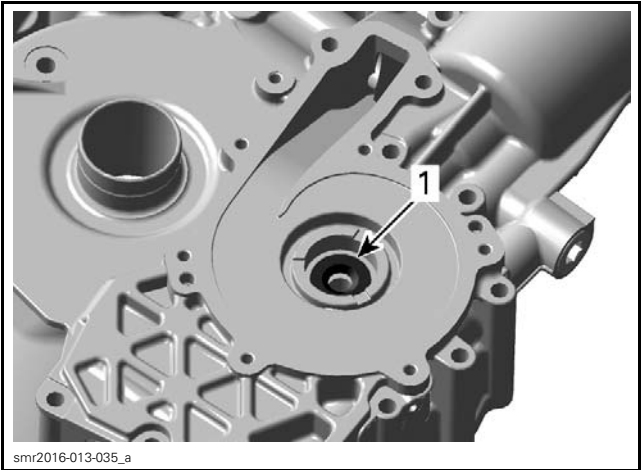
Start turning the lever clockwise until the ceramic seal is completely pulled out the PTO housing.



- 1. Ceramic seal puller
- 2. Bearing puller lever

Remove ceramic seal from bearing puller and discard it.

Remove oil seal behind the rotary seal.



1. Oil seal

Discard rotary seal and oil seal.

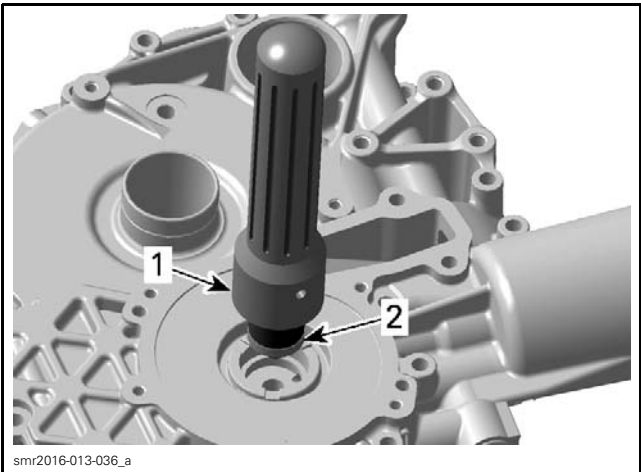
Installing the Rotary Seal

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

NOTE: Never use oil in the press fit area of the oil seal and rotary seal.

Install **NEW** oil seal.

REQUIRED TOOL	
OIL SEAL PUSHER (P/N 529 035 757)	
HANDLE (P/N 420 877 650)	



1. Handle with oil seal pusher
2. Oil seal

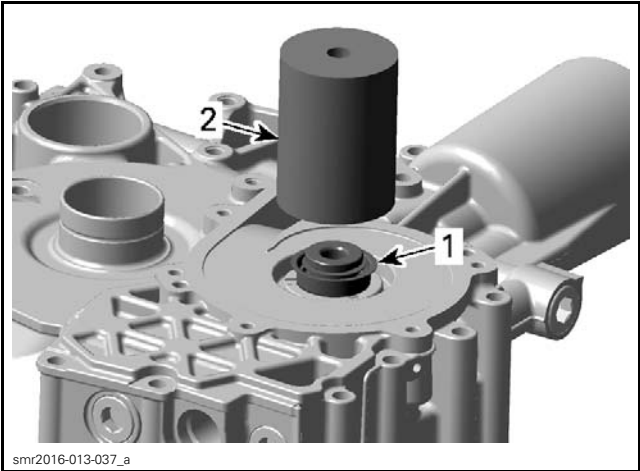
Install **NEW** rotary seal.

REQUIRED TOOL

WATER PUMP SEAL PUSHER
(P/N 529 035 823)



NOTICE Never use a hammer for the rotary seal installation. Only use a press to avoid damaging the ceramic component.

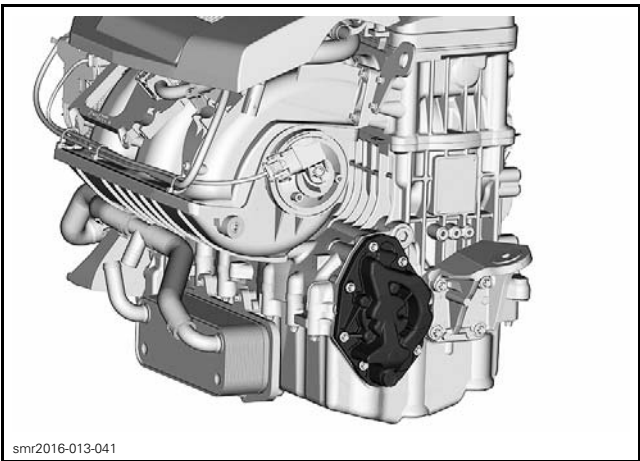


1. Rotary seal
2. Rotary seal installer

Install the coolant/oil pump shaft. Refer to *OIL PRESSURE PUMP* in this subsection.

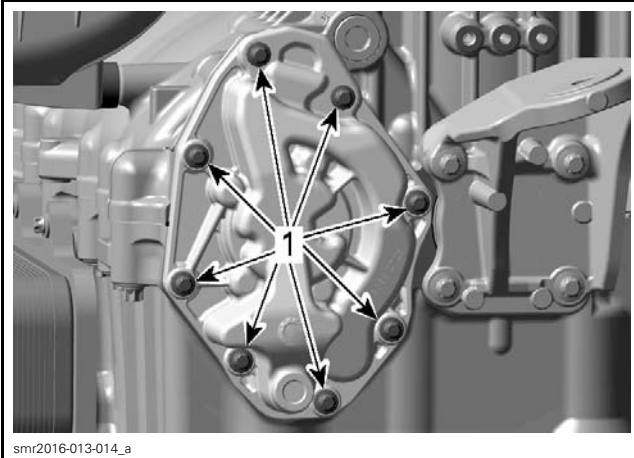
OIL SUCTION PUMP

Oil Suction Pump Location



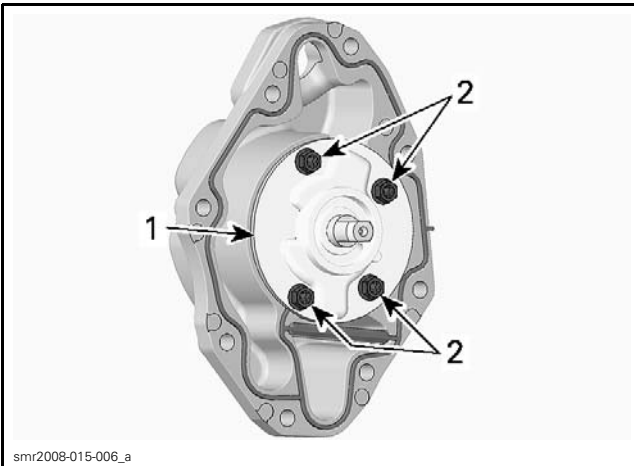
Removing the Oil Suction Pump

1. Remove retaining screws.



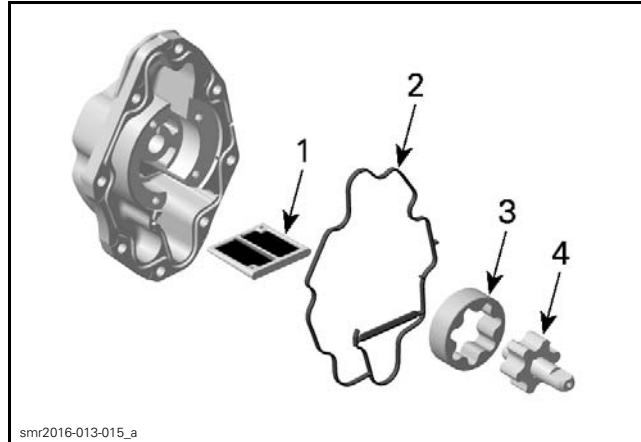
1. Suction pump cover screws

2. Place rags under cover to prevent spillage. If spillage occurs, clean with the PULLEY FLANGE CLEANER (P/N 413 711 809).
3. Remove the oil suction pump housing.
4. Remove:
 - Oil pump screws
 - Cover.



1. Oil pump cover
2. Oil pump screws

5. Remove:
 - Oil strainer
 - Cover gasket
 - Outer rotor
 - Oil pump shaft.

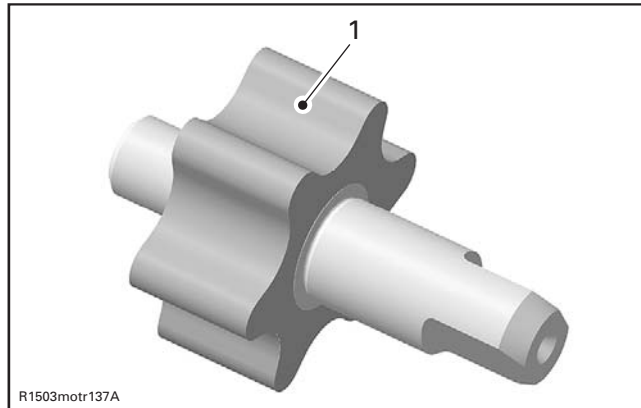


1. Oil strainer
2. Cover gasket
3. Outer rotor
4. Oil pump shaft

Inspecting the Oil Suction Pump

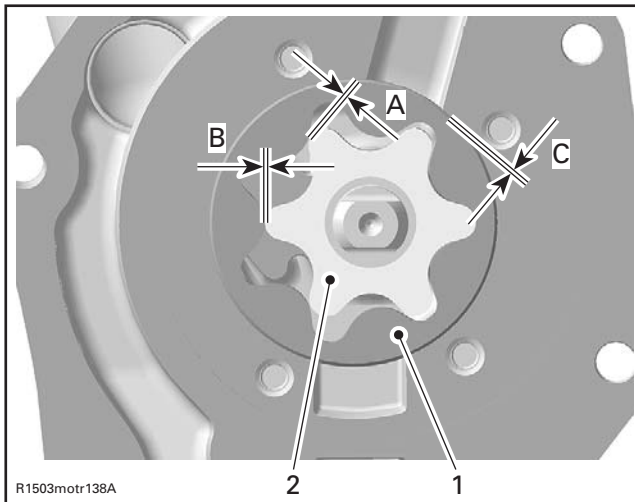
Inspect oil pump shaft, housing and cover for marks or other damages.

Check inner rotor for corrosion, pin-holes or other damages. If so, replace oil pump shaft. Ensure to also check oil pump housing and cover and replace if damaged.



1. Pittings on the teeth

Using a feeler gauge, measure the clearance between inner and outer rotors.



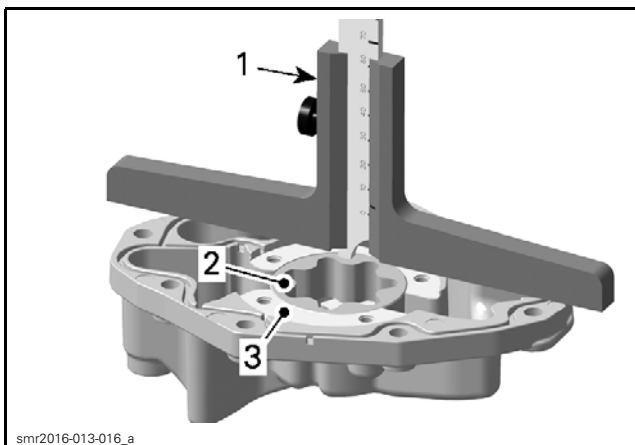
1. Outer rotor
2. Inner rotor

OIL PUMP RADIAL CLEARANCE	
SERVICE LIMIT	
A	0.25 mm (.0098 in)
B	
C	

If clearance between inner and outer rotors exceeds the tolerance, replace oil pump shaft. Ensure to also check oil pump housing and cover and replace if damaged.

If clearance between outer rotor and its bore in oil pump exceeds the tolerance, replace the complete oil pump and the PTO housing.

Using a depth gage, measure side wear as shown.



1. Depth gage
2. Oil pump outer rotor surface
3. Oil pump housing surface

Clearance between pump housing and outer rotor should not exceed the following specification. If so, replace the complete oil pump assembly.

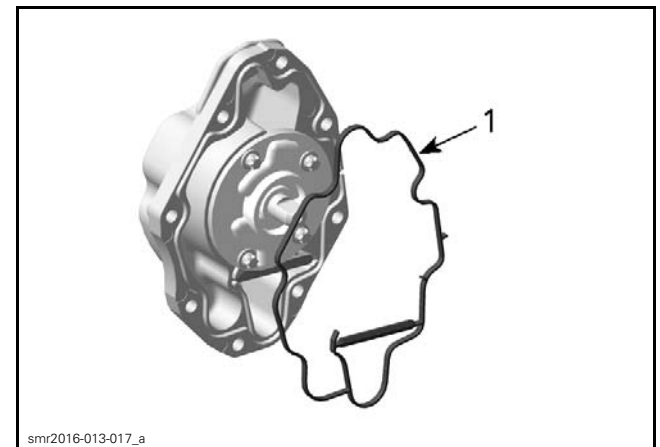
OIL PUMP AXIAL CLEARANCE

0.1 mm (.004 in)

NOTE: When the axial clearance of the oil pump shaft assembly increases, the oil pressure decreases.

Check the inside of oil pump housing and its cover for scoring or other damages and replace if damaged.

Inspect suction pump cover gasket.



1. Cover gasket

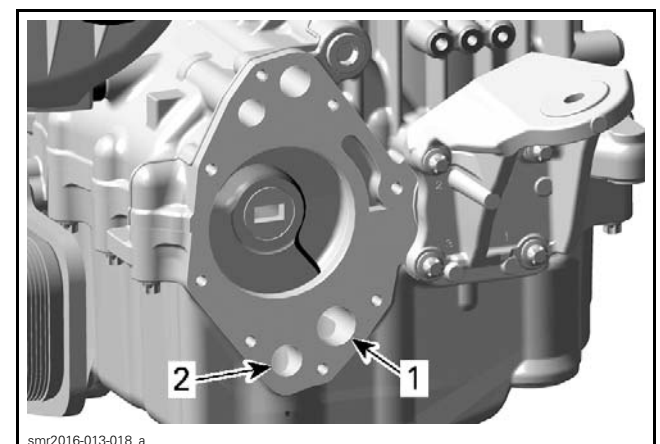
If gasket is brittle, cracked or hard, replace it.

Installing the Oil Suction Pump

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

Clean both contact surfaces of oil suction pump cover.

Check and clean the oil inlet and outlet area for dirt and other contaminations.



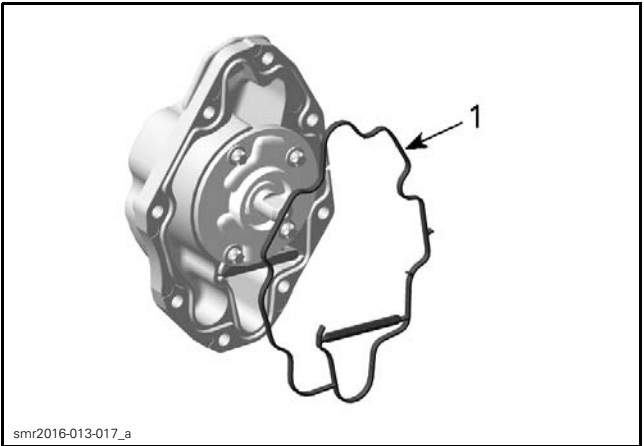
1. Oil inlet
2. Oil outlet

Tighten oil pump screws to specification.

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Oil pump screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

Make sure oil strainer is properly installed in the oil suction pump cover.

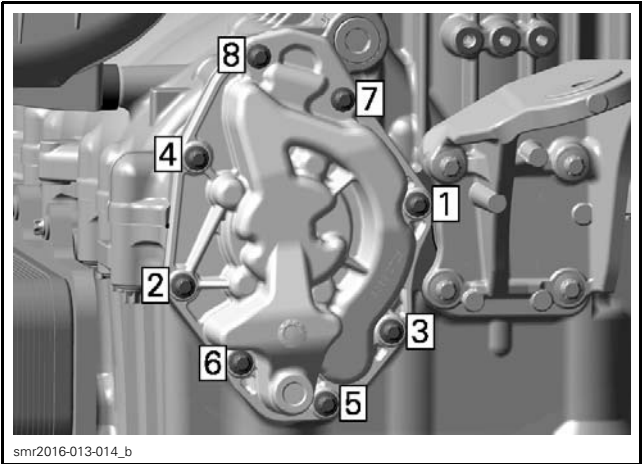
Apply engine oil on rubber ring gasket.



1. Cover gasket

Tighten suction pump cover screws to specification as per following sequence.

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Suction pump cover screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



TIGHTENING SEQUENCE

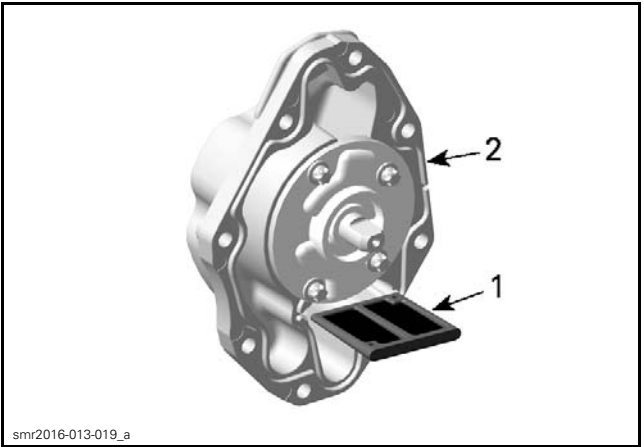
Refer to the appropriate procedures and install all other removed parts.

SUCTION PUMP OIL STRAINER

NOTE: The oil strainer does not need to be cleaned at every oil change. Clean it during other inspections, especially when the engine is disassembled.

Removing the Suction Pump Oil Strainer

Remove oil strainer from the suction pump cover, refer to *REMOVING THE OIL SUCTION PUMP* in this subsection.



1. Oil strainer
2. Suction pump cover

Inspecting the Suction Pump Oil Strainer

Clean oil strainer with a part cleaner then use compressed air to dry it.

Check oil strainer for tear or other damages. Replace it if necessary.

Installing the Suction Pump Oil Strainer

For installation of the suction pump cover, refer to *OIL SUCTION PUMP* in this subsection.

SUPERCHARGER OIL SPRAY NOZZLE

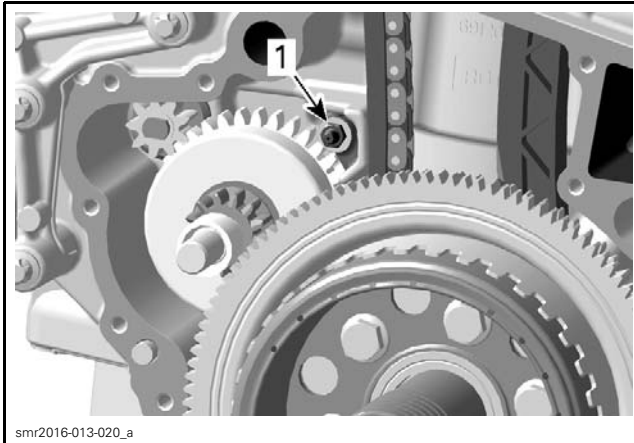
Supercharger Oil Spray Nozzle Location

The supercharger oil spray nozzle is located in the cylinder block right hand side above the sprag clutch

Removing the Supercharger Oil Spray Nozzle

Remove the PTO housing. Refer to *PTO HOUSING AND MAGNETO* subsection.

Unscrew the oil spray nozzle.



1. Oil spray nozzle

Inspecting the Supercharger Oil Spray Nozzle

Check oil spray nozzle for dirt or other damages.
Replace if necessary.

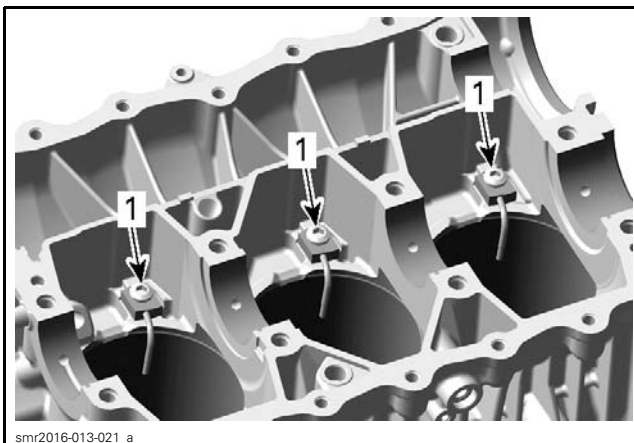
Installing the Supercharger Oil Spray Nozzle

The installation is the reverse of the removal procedure. However, pay attention to the following.
Install oil spray nozzle.

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Oil spray nozzle	4.5 N•m ± 0.5 N•m (40 lbf•in ± 4 lbf•in)

PISTON OIL SPRAY NOZZLES

The piston oil spray nozzles are located on the upper half of cylinder block.



1. Piston oil spray nozzles

NOTE: When the scope of repair work obligates you to split the cylinder block, take this opportunity to clean the oil spray nozzles.

Inspecting the Piston Oil Spray Nozzle

Check if the oil spray nozzle is damaged or bent.
Check for cracks at soldering.

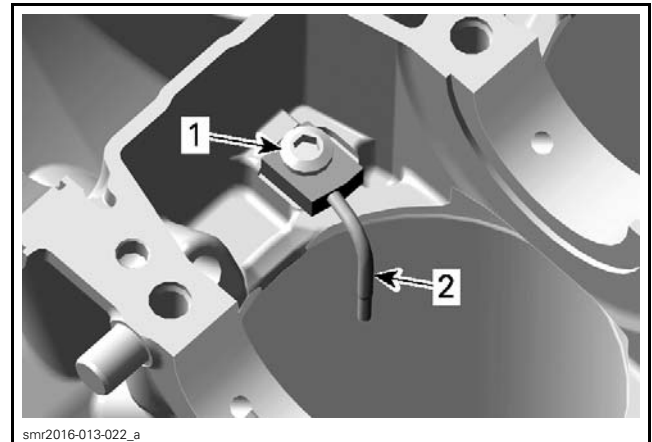
Replace as necessary.

If damaged replace immediately.

Removing the Piston Oil Spray Nozzle

Remove cylinder block lower half. Refer to *CYLINDER BLOCK* subsection.

Remove oil spray nozzle and Banjo fitting and discard it.

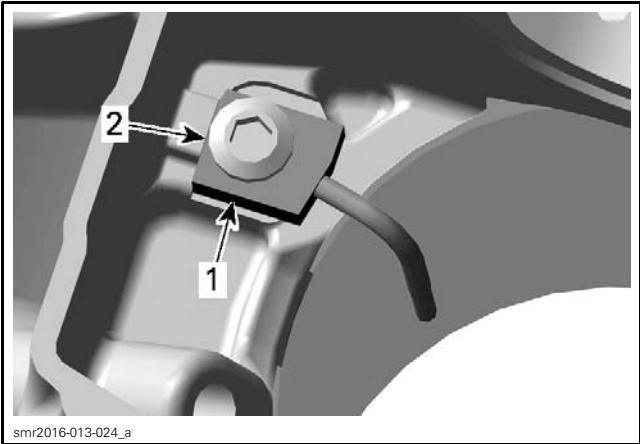


1. Banjo fitting
2. Oil spray nozzle

Installing the Piston Oil Spray Nozzle

Install **NEW** oil spray nozzle and Banjo fitting.

NOTICE At assembly make sure the contact surface of the oil spray nozzle is well fitted onto the cylinder block. If this is not ensured, the oil spray direction will change, causing potential engine damage.



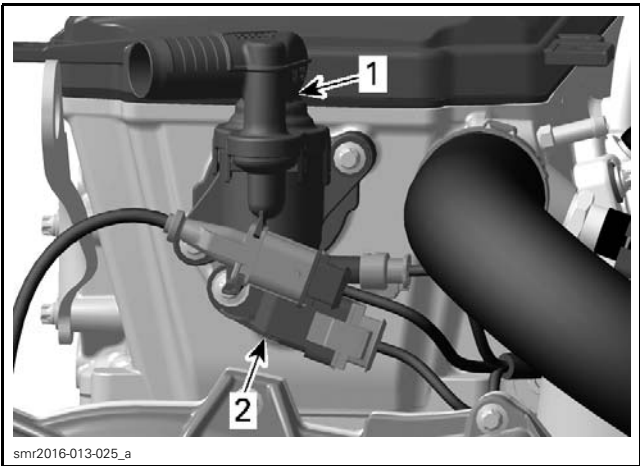
1. Oil spray nozzle
2. Contact surface

TIGHTENING TORQUE	
Piston oil spray nozzle banjo bolt	19 N•m ± 2 N•m (168 lbf•in ± 18 lbf•in)

OIL SEPARATOR COVER

Removing the Oil Separator Cover

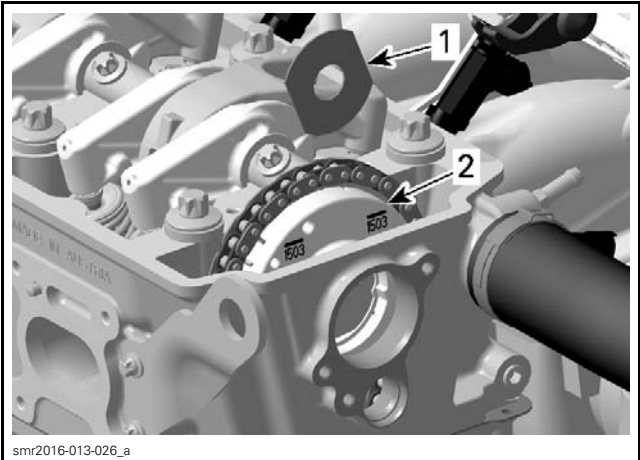
1. Remove the blow-by valve. See procedure in this subsection.
2. Remove camshaft position sensor, refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.



1. Blow-by valve
2. Camshaft position sensor

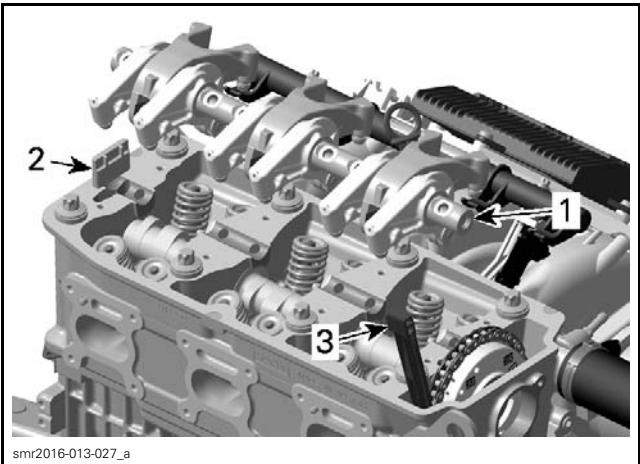
3. Remove valve cover, refer to *CYLINDER HEAD* subsection.
4. Remove thrust washer from oil separator cover.

NOTE: Make sure not to loose thrust washer when removing it from oil separator cover, otherwise thrust washer would fall into the PTO housing.



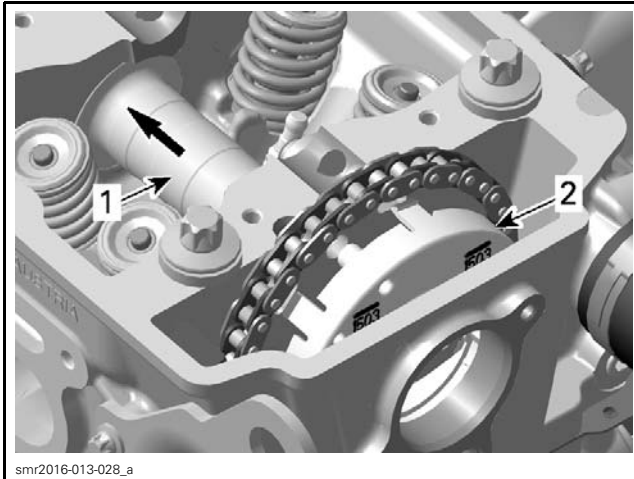
1. Thrust washer
2. Oil separator cover

5. Refer to *CYLINDER HEAD* subsection and remove:
 - Spark plug tube
 - Rocker arm shaft together with rocker arms
 - Chain guide
 - Camshaft lock.



1. Rocker arm shaft with rocker arms
2. Camshaft lock
3. Chain guide

6. Move camshaft backwards as far as possible.
7. Remove oil separator cover from timing gear by releasing the holding clips.

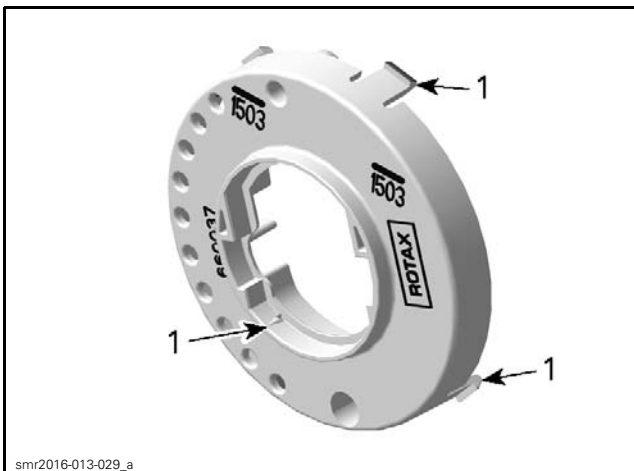


1. Camshaft
2. Oil separator cover

NOTE: Be careful not to break the holding clips from oil separator cover when its removed from the timing gear.

Inspecting the Oil Separator Cover

Inspect oil separator cover for marks or other damages. Ensure to check also the holding clips of oil separator cover and for thrust washer. If any damage is visible replace oil separator cover.



1. Holding clips

Installing the Oil Separator Cover

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

Properly install oil separator cover and thrust washer. They need to be in a perfect even position with timing gear.

NOTE: Make sure not to lose thrust washer when installed on oil separator cover.

Install all other removed parts.

BLOW-BY VALVE

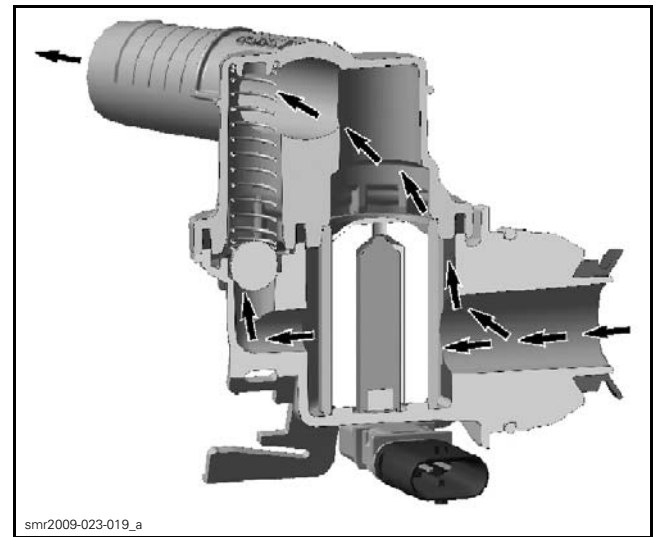
Blow-By Valve Description

The function of the blow-by valve is the circulation of the oil vapors.

Blow-By Valve Operation

Normal Operation

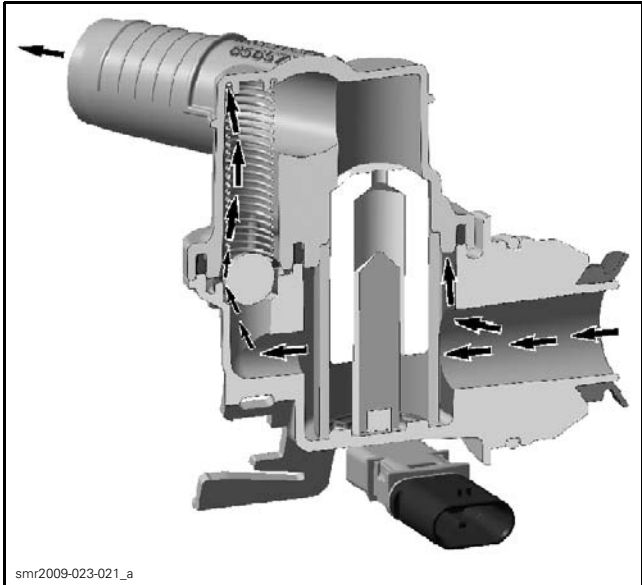
During its normal operation, the blow-by valve allows crankcase vapors to return in the intake system where they are harmlessly burned.



NORMAL OPERATION

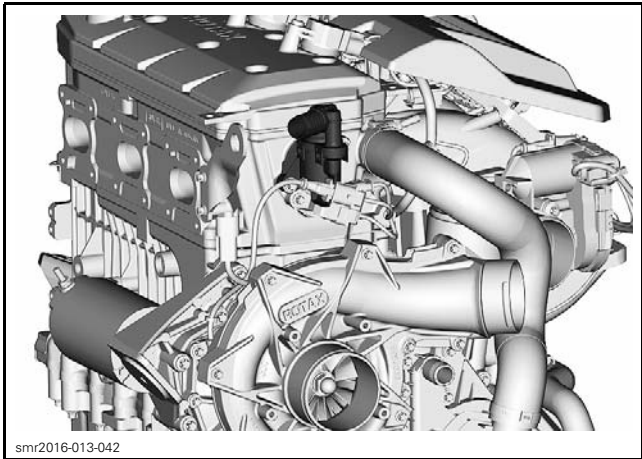
By-Pass Function

If, for any reason, the valve piston gets stuck at normal operation and the crankcase pressure exceeds 40 kPa (6 PSI), the pressure unseats a check ball and crankcase vapors can bypass the valve piston.



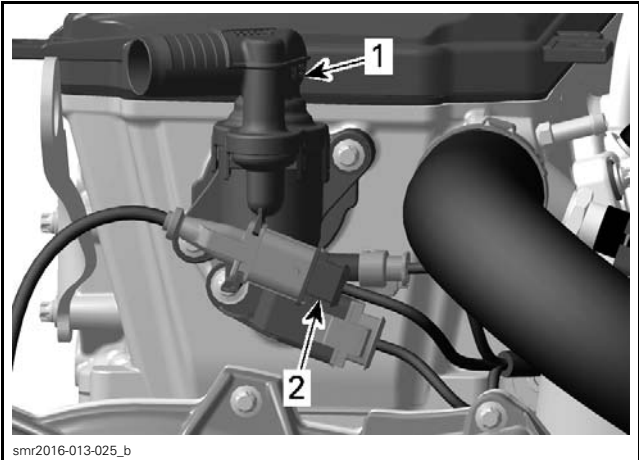
BY-PASS FUNCTION

Blow-By Valve Location



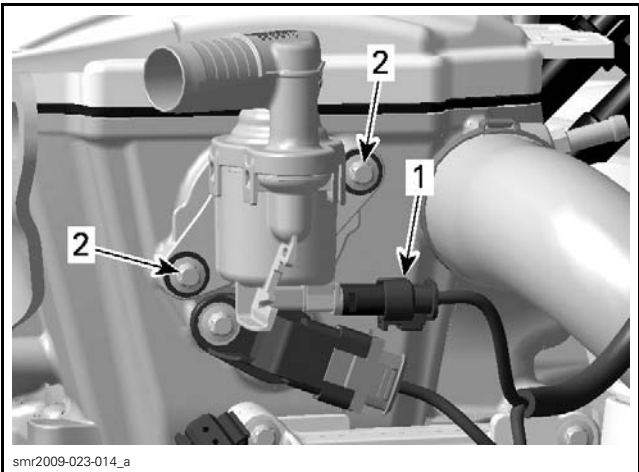
Removing the Blow-By Valve

Remove ventilation hose from blow-by valve.
Remove the CPS connector from its support on blow-by valve.



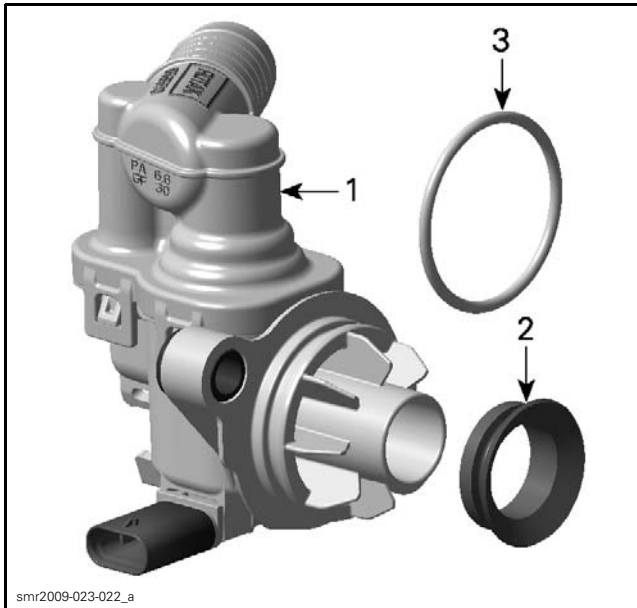
- 1. Blow-by valve
- 2. CPS connector

Disconnect the TOPS switch connector of the blow-by valve.
Unscrew and remove the blow-by valve.



- 1. TOPS switch connector
- 2. Retaining screws

Remove and discard O-ring and V-ring.
NOTE: The blow-by valve can not be disassembled.



1. Blow-by valve
2. V-ring
3. O-ring

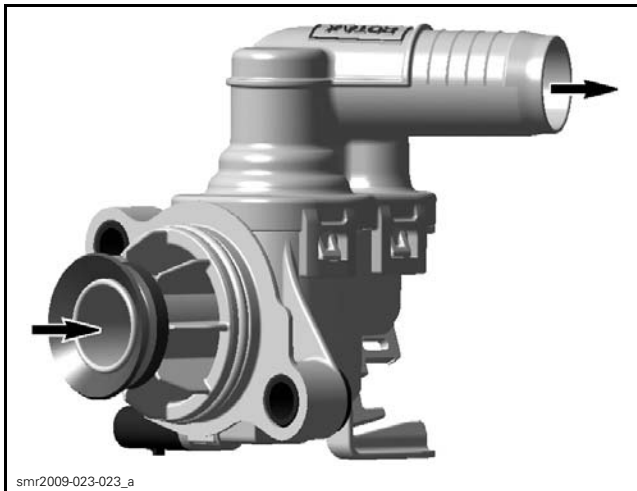
Inspecting the Blow-By Valve

If blow-by valve is damaged, replace it.

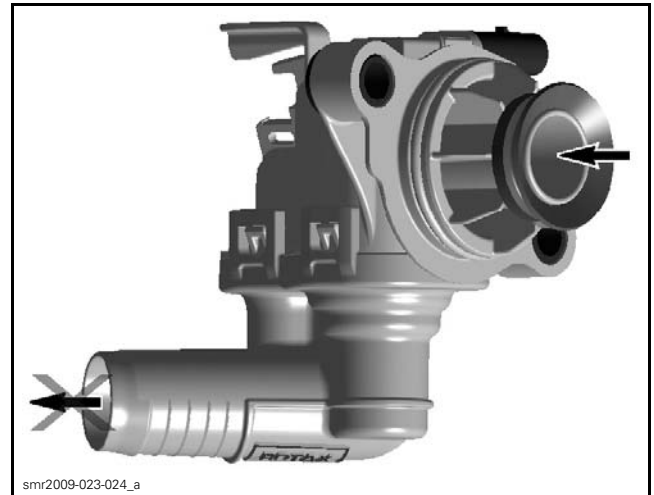
Clean all contact surfaces of blow-by valve.

Place a clean rag on valve inlet.

Blow air through inlet port. Air must flow freely to the outlet port.



Turn valve upside down and blow air again. Air must not flow out.



If test fails, replace blow-by valve.

Installing the Blow-By Valve

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

Install the blow-by valve with **NEW** O-ring and V-ring.

Tighten blow-by valve screws to specification.

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Blow-by valve screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

Reinstall remaining removed parts.

TOPS SWITCH

Tip Over Protection Switch (TOPS Switch) Function

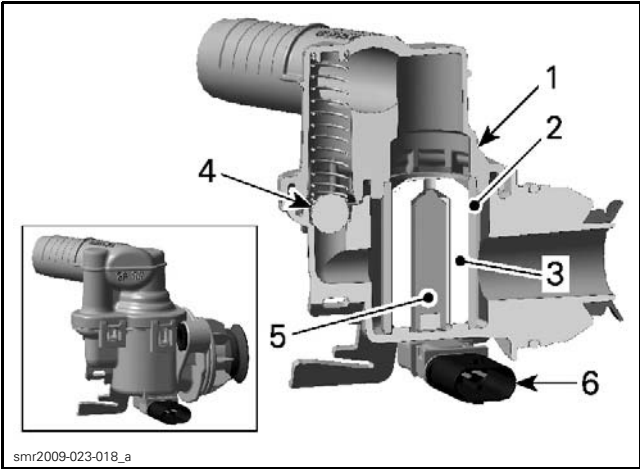
The function of the TOPS switch is the engine protection in the event the watercraft tip over.

During normal operation the TOPS switch state is OFF, no signal to the ECM.

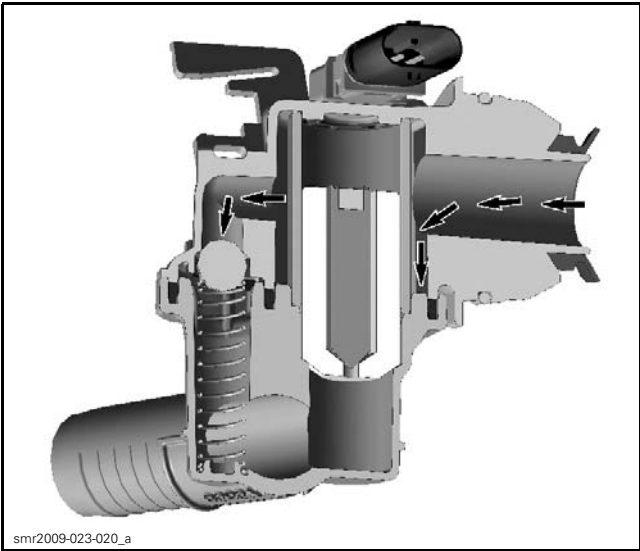
If the watercraft tips over, gravity causes a valve piston to close and no engine oil will leak out of the blow-by valve.

In this event, a pin (with magnet) opens a gap to the TOPS switch (Hall effect sensor) and the TOPS changes its state to ON and sends a signal to the ECM.

The ECM will shut down the engine by cutting the ignition and the fuel injection.



BLOW-BY VALVE CUT-AWAY
1. Valve housing
2. Valve sleeve
3. Valve piston
4. Check ball
5. Valve pin (with magnet)
6. TOPS switch of the blow-by valve



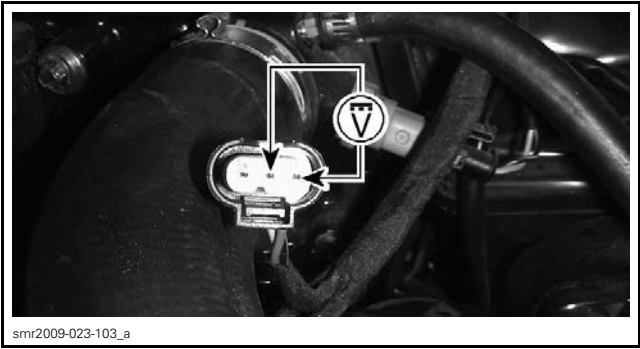
TIP OVER FUNCTION

Testing the TOPS Switch Input Voltage

Disconnect the TOPS switch connector of the blow-by valve.
Briefly press the START/STOP button to wake-up the ECM.

Probe terminals as shown to check the voltage output from the ECM.

TOPS SWITCH CONNECTOR	VOLTAGE
Pins 2 and 3	Approximately 5 Vdc



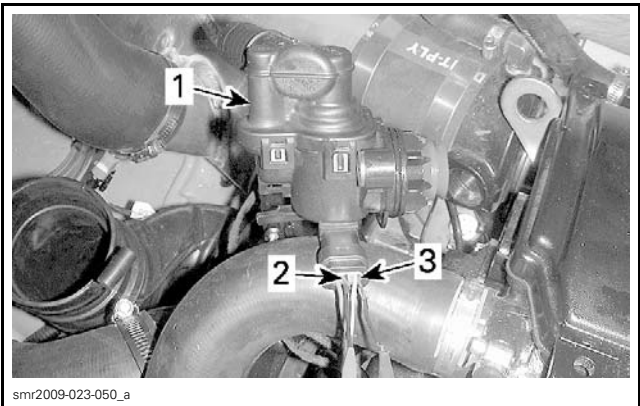
If voltage test is good, check the TOPS switch output voltage.

If voltage test is not good, check the continuity of the blow-by valve TOPS switch circuit.

NOTE: After voltage test, clear the fault codes in the ECM using the B.U.D.S. software.

Testing the TOPS Switch Output Voltage

Remove the blow-by valve.
Back-probe TOPS connector and check voltage.



BLOW-BY VALVE IN NORMAL POSITION
1. Blow-by valve
2. RED probe into pin 2
3. BLACK probe into pin 1

TOPS SWITCH CONNECTOR	BLOW-BY VALVE POSITION	VOLTAGE
Pin 1 and pin 2	Normal position	0.4 ± 0.1 Vdc
Pin 1 and pin 2	Upside down	4.4 ± 0.2 Vdc
Pin 2 and pin 3	Normal position or upside down	Approximately 5 Vdc

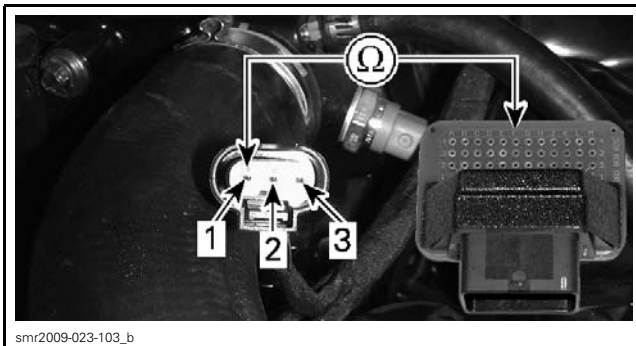
Replace TOPS switch if not within specification.

Testing the TOPS Switch Circuit Continuity

Disconnect the TOPS switch connector of the blow-by valve.

Disconnect the connector "A" from the ECM.
Check continuity of the blow-by valve TOPS switch circuit as per following table.

TOPS SWITCH CONNECTOR	ECM ADAPTER	RESISTANCE
Pin 1	Pin F4	Close to 0 Ω (continuity)
Pin 2	Pin G1	
Pin 3	Pin C4	

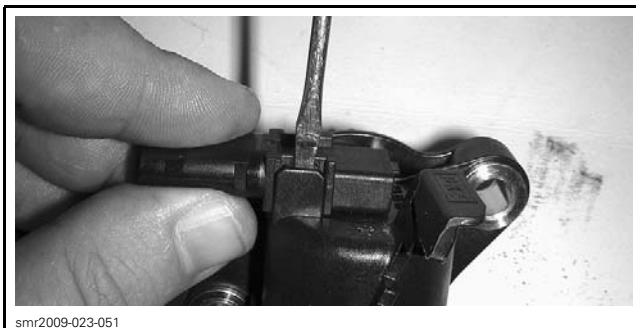


1. Pin 1
2. Pin 2
3. Pin 3

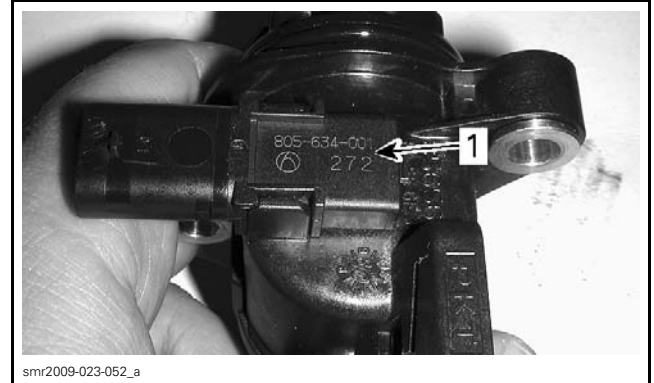
If continuity test is good, check ECM. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.
If continuity test is not good, repair or replace defective wires or connectors.

TOPS Switch Replacement

Remove blow-by valve and turn it upside down.
Insert a small screwdriver between TOPS switch and its retaining tab. Twist and hold the TOPS switch then release the other retaining tab.

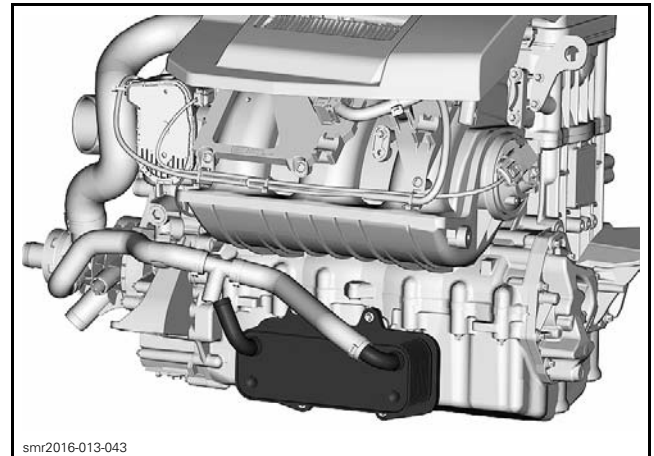


When installing the TOPS switch, make sure printed information is visible.



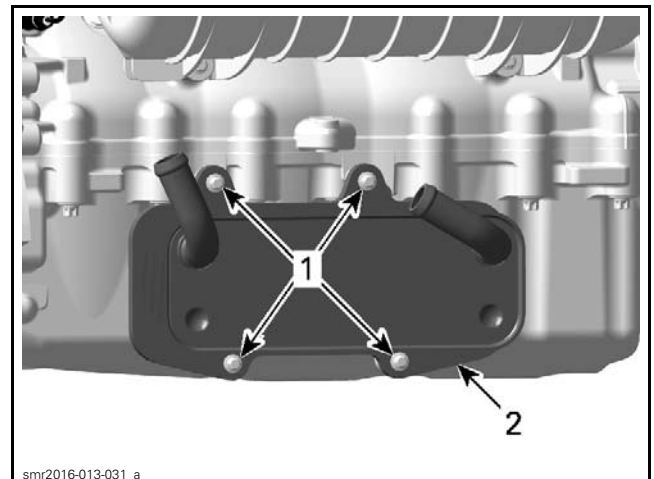
1. TOPS valve inscriptions

OIL COOLER



Removing the Oil Cooler

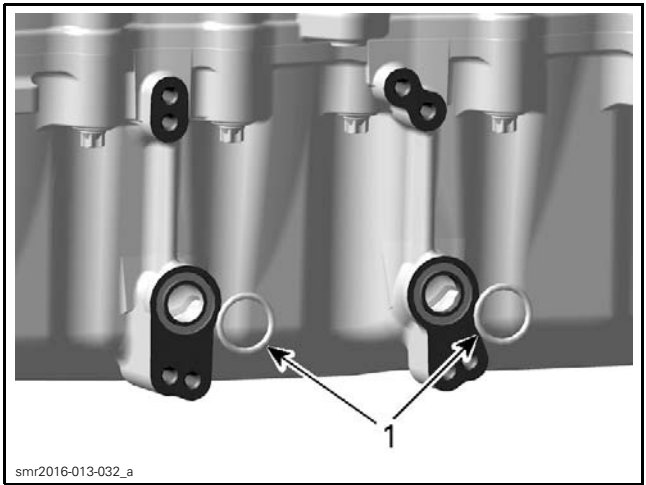
Remove engine from vehicle. Refer to *REMOVING AND INSTALLING THE ENGINE* subsection.
Disconnect cooling hoses from oil cooler.
Remove oil cooler screws.



1. Oil cooler screws
2. Oil cooler

Subsection XX (LUBRICATION SYSTEM)

Ensure not to lose O-rings located between oil cooler and engine.



1. O-rings

Inspecting the Oil Cooler

If O-rings are brittle, cracked or hard, replace them.

Clean both contact surfaces of oil cooler.

Check and clean the oil inlet and outlet area for dirt and other contaminations.

Installing the Oil Cooler

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

Apply engine oil on O-rings.

Tighten oil cooler screws to specification.

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Oil cooler screws	11 N•m ± 1 N•m (97 lbf•in ± 9 lbf•in)

COOLING SYSTEM

SERVICE TOOLS

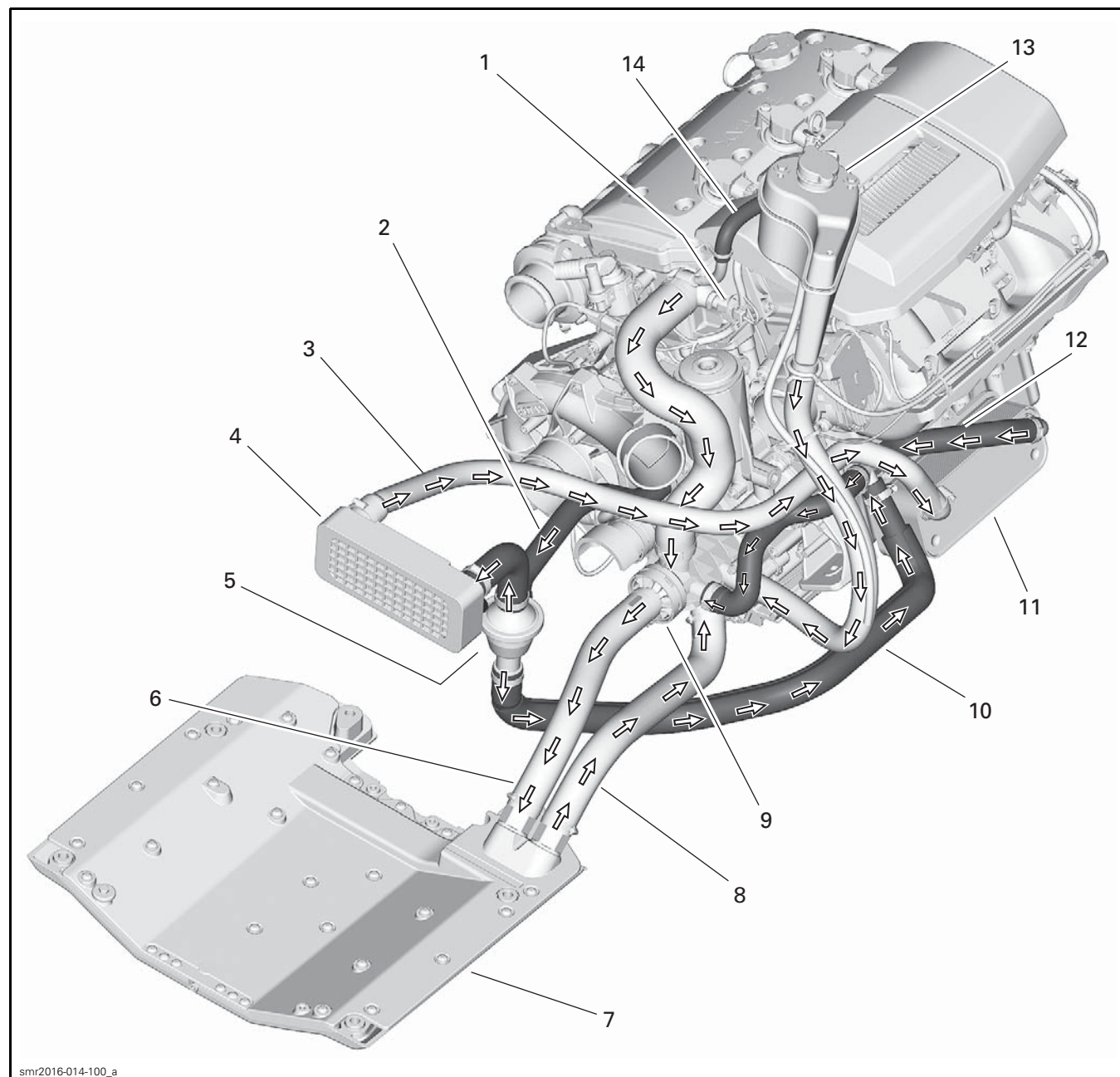
Description	Part Number	Page
OETIKER PLIERS.....	295 000 070	8
TEST CAP.....	529 035 991	7
VACUUM/PRESSURE PUMP	529 021 800	7

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE).....	293 800 060	11
LOCTITE 567 (PIPE SEALANT)	293 800 013	6
LONG LIFE ANTIFREEZE(F)	619 590 204	6
LONG LIFE ANTIFREEZE	219 702 685	6

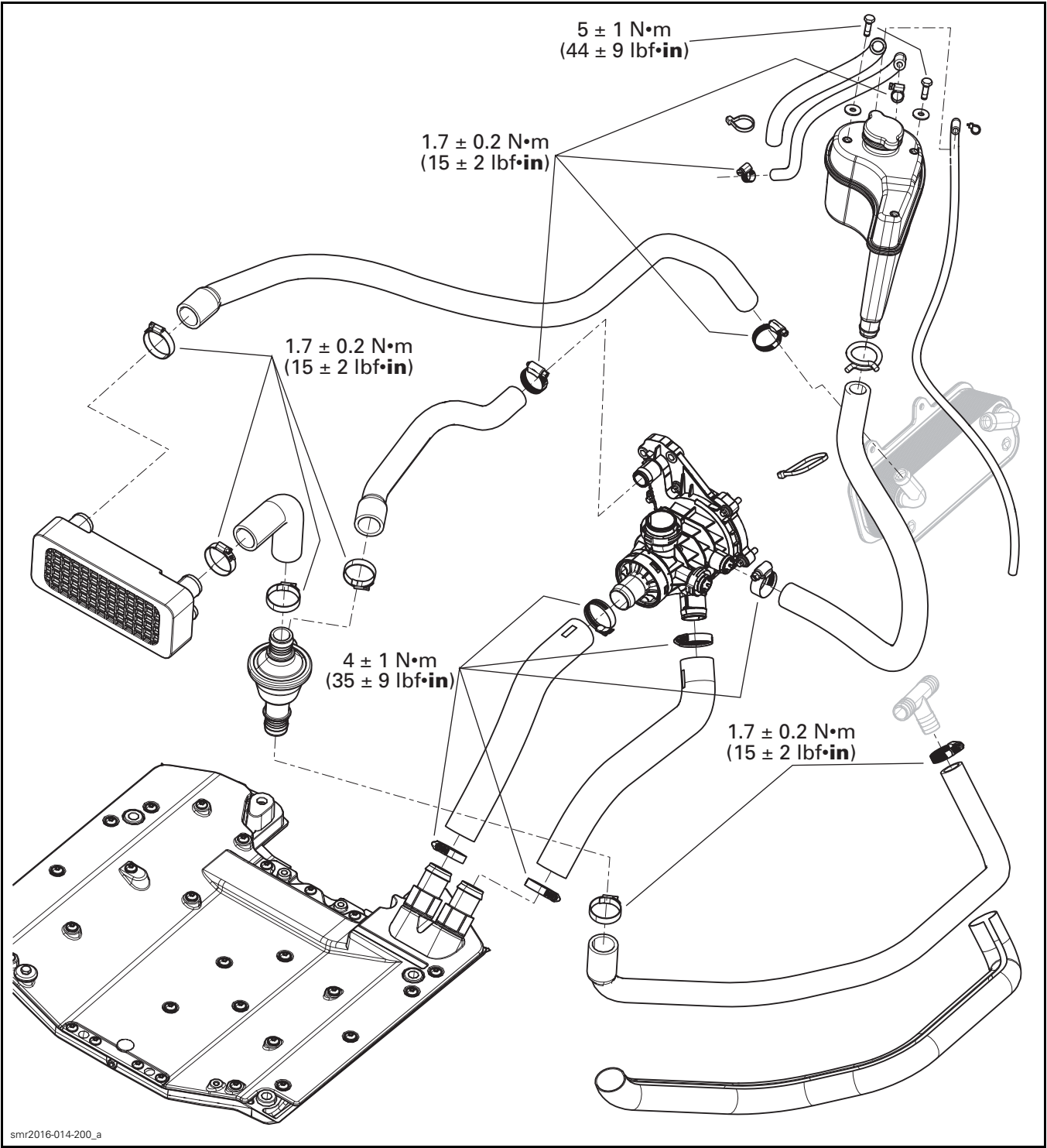
Subsection XX (COOLING SYSTEM)

Cooling System (Closed loop)



- | | |
|--|---|
| 1. Coolant temperature sensor (CTS) activates when monitoring beeper turns on at 110°C (230°F) | 8. Coolant returns from ride plate |
| 2. Coolant flows to thermostat housing | 9. Water pump cover / thermostat housing - Thermostat opens at 87°C (189°F) |
| 3. Coolant flows from intermediate cooler to oil cooler | 10. Intermediate cooler bypass hose |
| 4. Intermediate cooler | 11. Oil cooler |
| 5. Intermediate cooler bypass / thermostat housing - Thermostat opens at 65°C (149°F) | 12. Coolant returns from oil cooler |
| 6. Coolant flows to ride plate | 13. Expansion coolant tank |
| 7. Ride plate (operates as heat exchanger) | 14. Bleed hose from cylinder head to expansion coolant tank |

COOLING SYSTEM COMPONENTS





GENERAL

SYSTEM DESCRIPTION

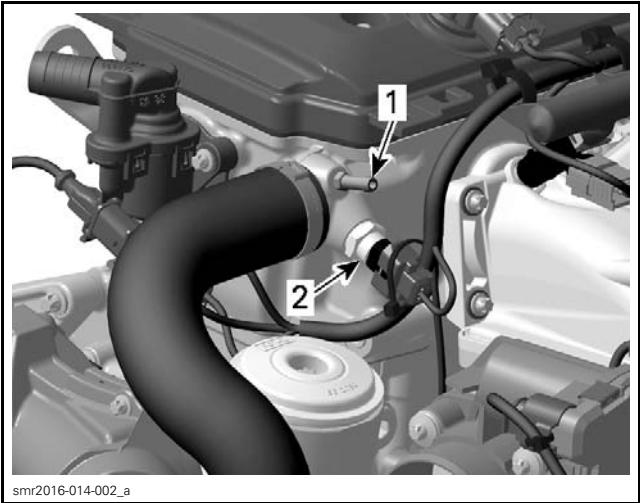
A closed loop cooling system is utilized on the 1603 XHO 4-TEC engine, which offers an efficient engine cooling while keeping dirt and salt water out of the cooling system. This system keeps the temperature constant and prevents internal engine corrosion.

A separate coolant tank ensures that enough engine coolant is in the circuit during any operating condition.

The coolant flow comes from the water pump impeller into the cylinder block. It goes around the cylinders and straight up to the cylinder head. A smaller quantity of engine coolant enters the cylinder block on the exhaust side for a better cooling. In the cylinder head the water channels flow around the exhaust and then the intake valves and leave the engine through a large hose. From there the coolant goes back to the water pump housing and depending on the engine temperature, it flows directly back to the water pump impeller, or it takes its way through the thermostat and then, through the heat exchanger.

From the water pump housing upper nozzle, the engine coolant is directed towards a second thermostat. If this thermostat is open, the coolant flows through it and reach a intermediate cooler which act as a heat exchanger using the open loop cooling system. From the intermediate cooler, the coolant flows through the oil cooler and goes back to the water pump. If the thermostat is closed, the coolant flows back to the water pump.

Coolant temperature sensor and bleed hose fitting are located on the cylinder head.



1. Bleed hose fitting
2. Coolant temperature sensor (CTS)

NOTICE Never modify cooling system arrangement, otherwise serious engine damage could occur.

Technical Specifications

TYPE	Closed loop cooling system.
COOLANT FLOW	Flow from water pump.
TEMPERATURE CONTROL	Thermostat.
SYSTEM BLEEDING	Self-bleed type through coolant tank (hose at uppermost point of circuit).
MONITORING BEEPER	Turns on at 102°C (216°F).

MAINTENANCE

ENGINE COOLANT

 **WARNING**

To avoid potential burns, do not remove the coolant tank cap or loosen the ride plate drain plug if the engine is hot.

Subsection XX (COOLING SYSTEM)

Recommended Coolant

COOLANT		
BRP recommended product	Finland, Norway and Sweden	LONG LIFE ANTIFREEZE(F) (P/N 619 590 204)
	All Other Countries	LONG LIFE ANTIFREEZE (P/N 219 702 685)
Alternative, or if not available	—	Distilled water and antifreeze solution (50% distilled water, 50% antifreeze)

Always use LONG LIFE ANTIFREEZE (P/N 219 702 685) or equivalent. If the recommended coolant is not available, use a low silicate, extended life ethylene-glycol premixed coolant (50%-50%) specifically formulated for internal combustion aluminum engines.

To prevent antifreeze deterioration, always use the same brand and grade. Never mix different brands or grades unless cooling system is completely flushed and refilled.

Draining the System

 **WARNING**

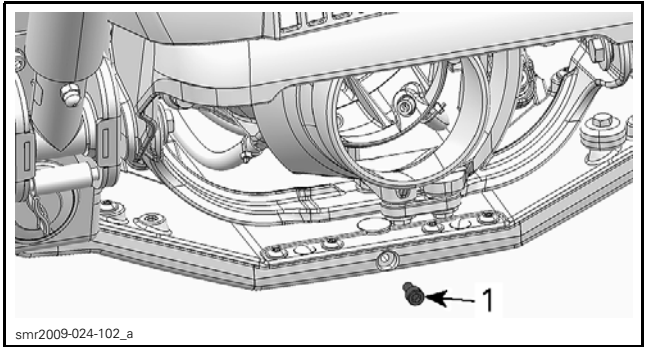
Never drain or refill cooling system when engine is hot.

Open or remove seat.

Install a drain pan underneath the ride plate.

Unscrew the drain plug on ride plate.

NOTE: Raising the front of the watercraft will contribute to drain the cooling system.



1. Cooling drain plug

Remove the coolant tank cap.

Dispose coolant as per local regulations.

Do not reinstall drain plug at this time.

Cleaning the System

NOTICE Cleaning the cooling system as per the following procedure is required when engine overheats (assuming everything else is operating normally) or each time coolant is replaced.

Drain the cooling system.

Add a cleaning product such as the Zerex® Super Cleaner by Valvoline (or an equivalent) in coolant tank then fill cooling system with demineralized water.

Reinstall cap on coolant tank.

Install watercraft in a test basin or ride on a water plane. Start engine and run for approximately 15 minutes.

IMPORTANT: Ensure thermostat opens so that the cleaning product flows in ride plate properly.

Stop engine and let the cleaning product work for 12 to 16 hours.

Thereafter, engine can be run one last time to soak off deposits.

Drain and thoroughly rinse the cooling system with clean fresh water.

Refill cooling system as described below.

Refilling the System

Watercraft should be level, engine cold and drain plug removed for refilling.

Place a container under drain plug to collect antifreeze.

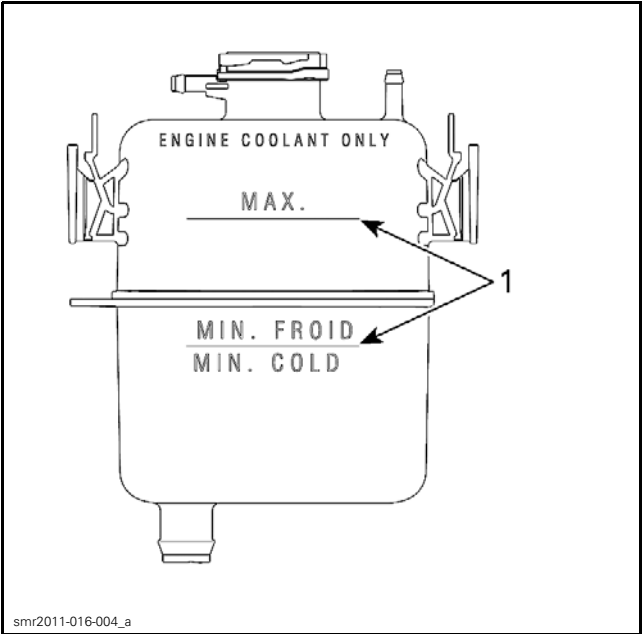
Apply LOCTITE 567 (PIPE SEALANT) (P/N 293 800 013) on drain plug threads.

Ask someone to pour recommended antifreeze in coolant tank.

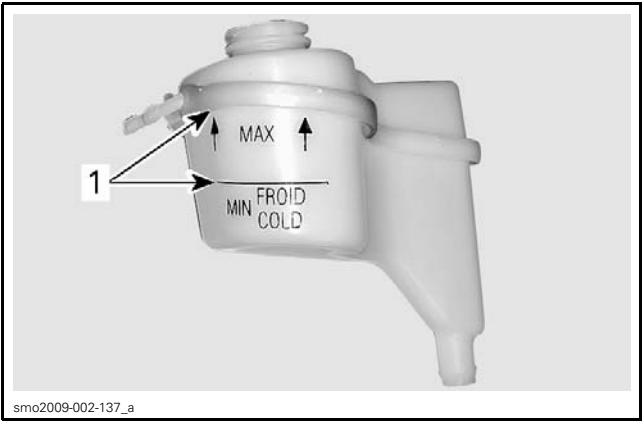
When antifreeze flows out from the ride plate drain hole, reinstall drain plug. Torque drain plug to specification.

TIGHTENING TORQUE	
Drain plug	8.3 N•m ± 0.7 N•m (73 lbf•in ± 6 lbf•in)

Continue to pour and fill coolant tank between marks.



RXP-X
1. Level between marks when engine is cold



GTX AND RXT-X
1. Level between marks when engine is cold

Do not install pressure cap at this time.
Link a garden hose to the hose adapter at the back of the watercraft. Refer to *EXHAUST SYSTEM FLUSHING* in the *EXHAUST SYSTEM* subsection.

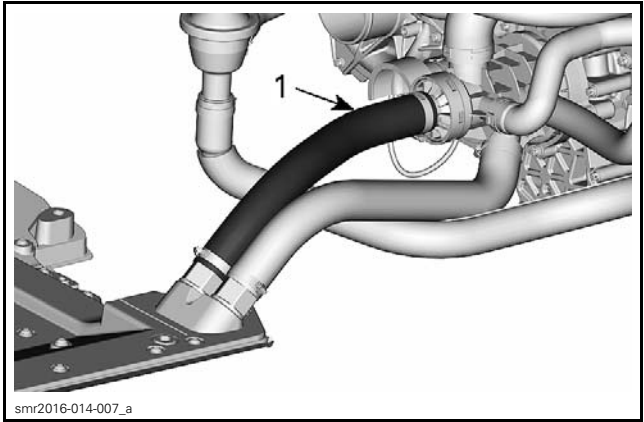
NOTICE Never run engine without supplying water to the exhaust system.

Start engine and let run for a maximum of 2 minutes. Stop engine and wait 15 minutes to cool down. Refill tank as necessary.

NOTICE Never run engine longer than 2 minutes. Drive line seal has no cooling when watercraft is out of water.

NOTE: Properly cool exhaust system by installing a garden hose. Refer to *EXHAUST SYSTEM* subsection.

Repeat this run-stop cycle 2-3 times until thermostat opens and stop engine.



1. This hose becomes hot when thermostat opens

Last, refill coolant tank and install pressure cap.
When engine has completely cooled down, recheck coolant level coolant tank and top up if necessary.

INSPECTION

COOLING SYSTEM LEAK TEST

 **WARNING**

To avoid potential burns, do not remove the coolant tank cap or loosen the ride plate drain plug if the engine is hot.

Open or remove seat.
Install test cap on the coolant tank.

REQUIRED TOOL	
TEST CAP (P/N 529 035 991)	

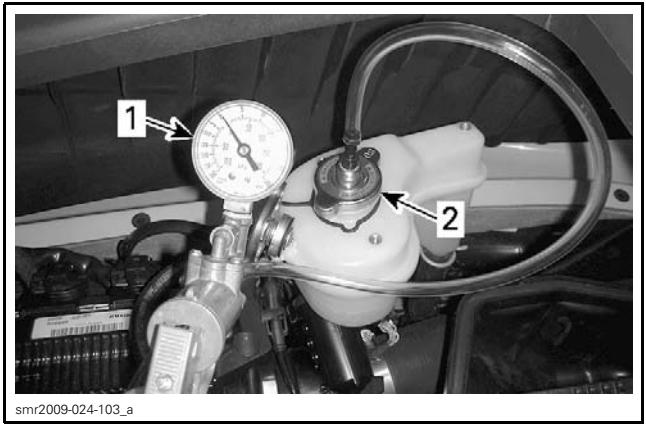
NOTE: It is not necessary to install a hose pincher on overflow hose.

Pressurize system through coolant tank.

REQUIRED TOOL	
VACUUM/PRESSURE PUMP (P/N 529 021 800)	

Subsection XX (COOLING SYSTEM)

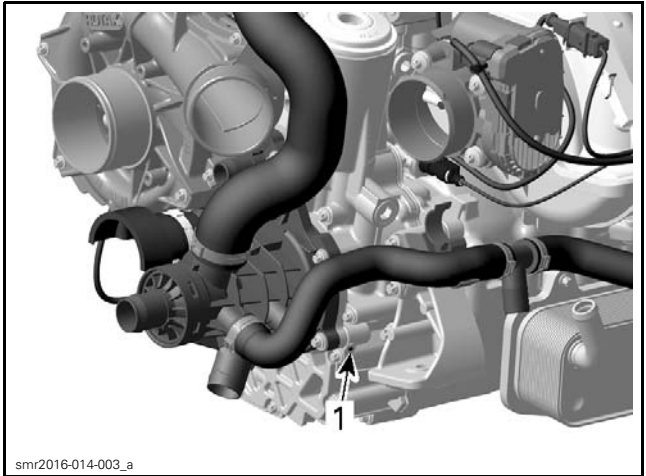
COOLING SYSTEM LEAK TEST
90 kPa (13 PSI)



TYPICAL
1. Vacuum/pressure pump
2. Test cap

Check all hoses, ride plate, engine, intermediate cooler and oil cooler for coolant leaks. Spray a soap and water solution and look for air bubbles.

Check the leak indicator hole if there is oil or coolant. If so, replace appropriate water pump shaft seal.



1. Leak indicator hole

After the leak test, rinse with water to remove soap residue.

TROUBLESHOOTING

The following is provided to help in diagnosing the probable source of troubles. It is a guideline and it should not be assumed to list all possible problems.

Always check for fault codes. If a fault code is detected, service the fault code first. Refer to *DIAGNOSTIC AND FAULT CODES* subsection.

ENGINE OVERHEATING

- 1. Low coolant level.
- Refill and check for leaks (coolant leaking out of engine leak indicator hole, hoses or clamps missing/defective, cylinder head gaskets leaks, ride plate leaking, etc.). Repair or replace.
- 2. Air in cooling system
- Refill and bleed cooling system.
- 3. Thermostat defective (does not open when engine gets hot)
- Replace thermostat housing.
- 4. Water pump failure
- Inspect and replace defective components.
- 5. Water temperature sensor defective
- Check or replace. Refer to ELECTRONIC FUEL INJECTION (EFI).
- 6. Ride plate, intermediate cooler, oil cooler or hoses damaged
- Check or replace damaged components.
- 7. Exhaust system clogged
- Flush exhaust system.
- 8. Internal passage blocked in cooling system
- Inspect and clean.

PROCEDURES

PRESSURE CAP

Inspecting the Pressure Cap

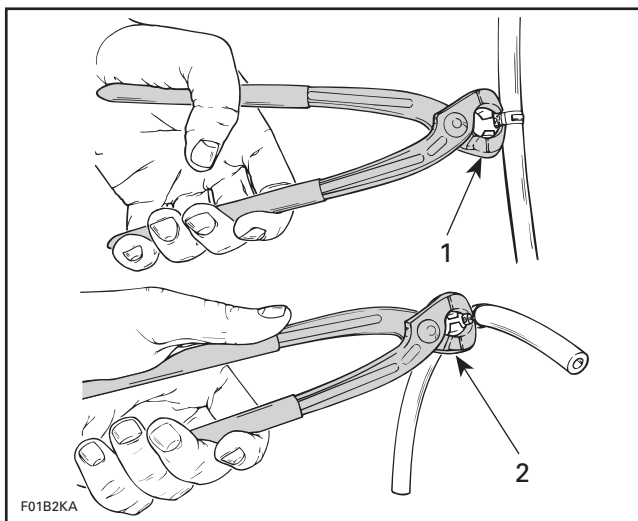
Using a pressure cap tester, check cap opening pressure. If opening pressure is out of range, install a new pressure cap.

CAP OPENING PRESSURE	
Opening range	90 kPa ± 10 kPa (13 PSI ± 1.5 PSI)

CLAMPS

Clamp Replacement

REQUIRED TOOL	
OETIKER PLIERS (P/N 295 000 070)	



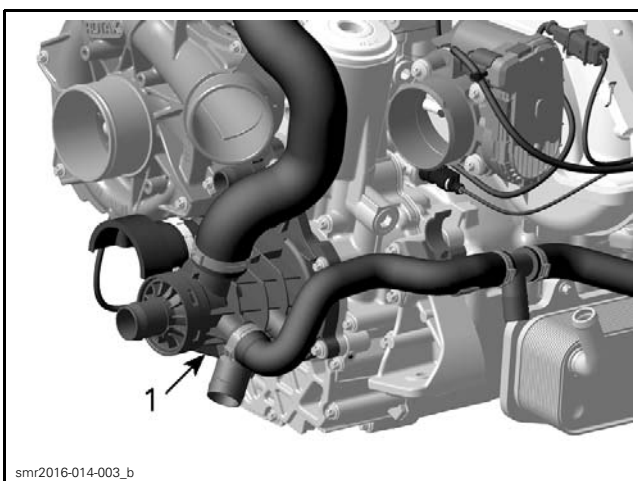
1. Cutting clamp
2. Securing clamp

NOTE: Always check general condition of hoses and clamp tightness.

COOLANT TEMPERATURE SENSOR (CTS)

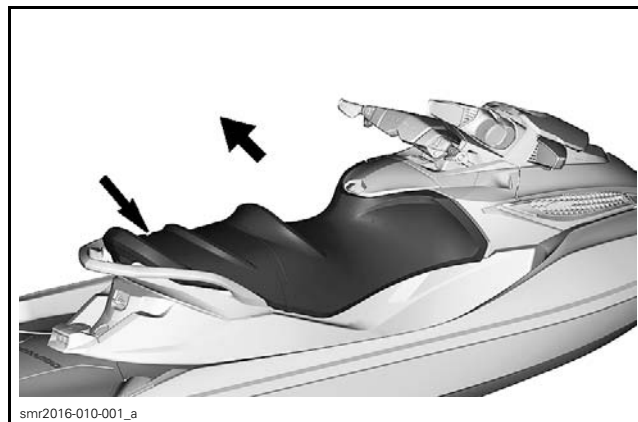
Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.

WATER PUMP HOUSING

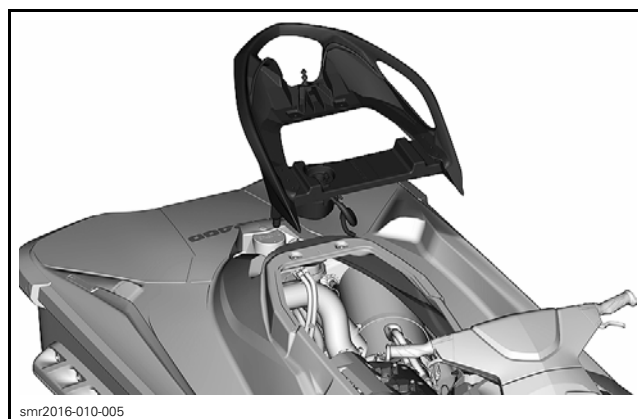


1. Water pump housing

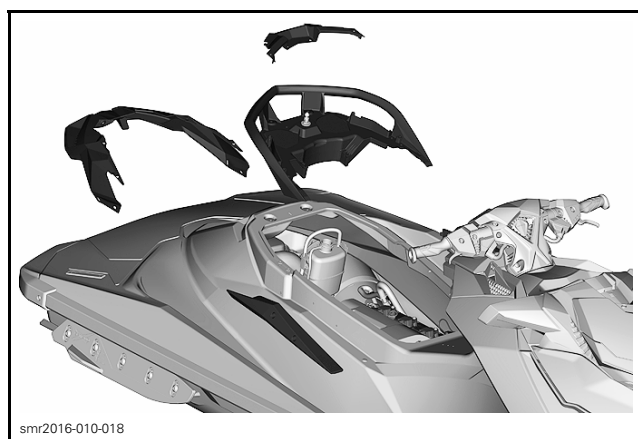
Water Pump Housing Access



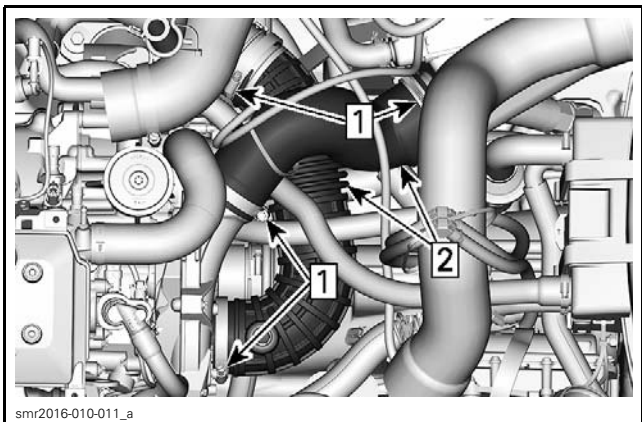
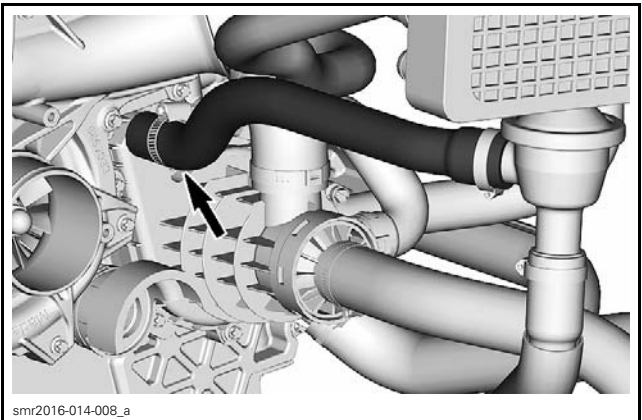
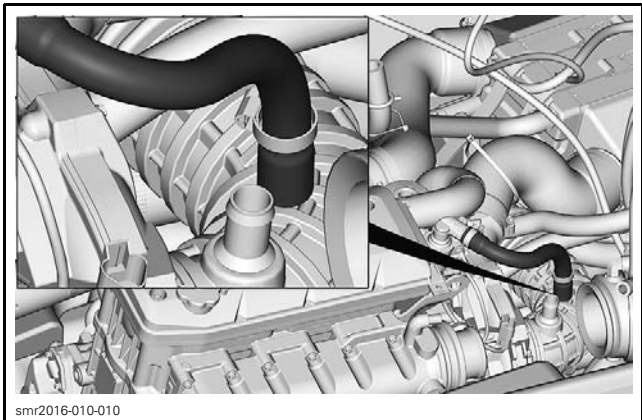
GTX LTD SHOWN



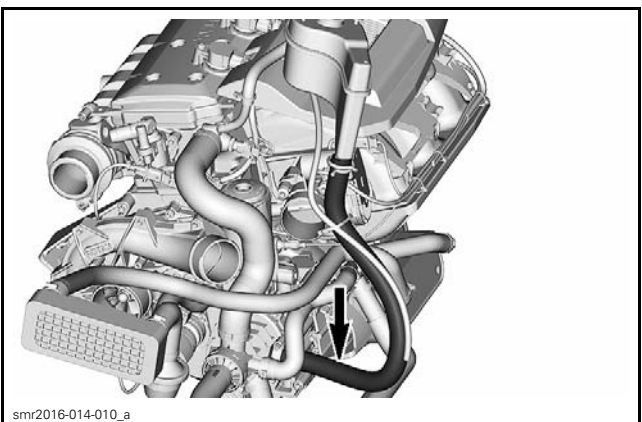
GTX LTD AND RXT-X MODELS



RXP X MODELS



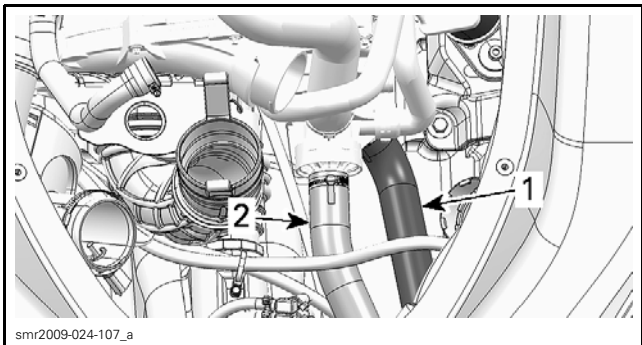
Step 1: Loosen
Step 2: Remove



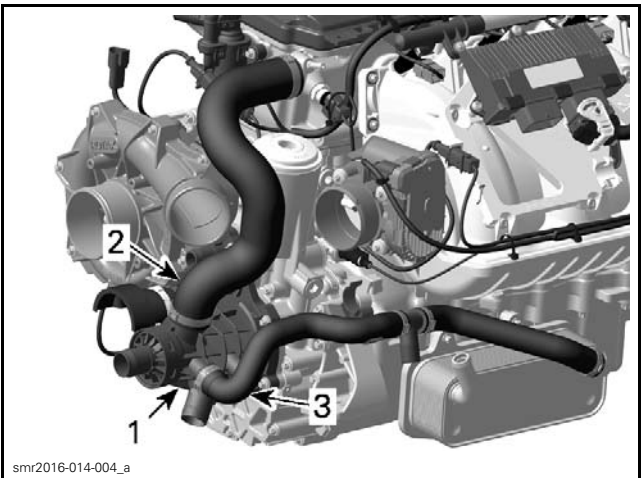
Disconnect the cylinder head outlet hose and oil cooler outlet hose.

Removing the Water Pump Housing

Drain cooling system and engine oil.
Disconnect ride plate, thermostat housing and coolant tank hoses from water pump housing.

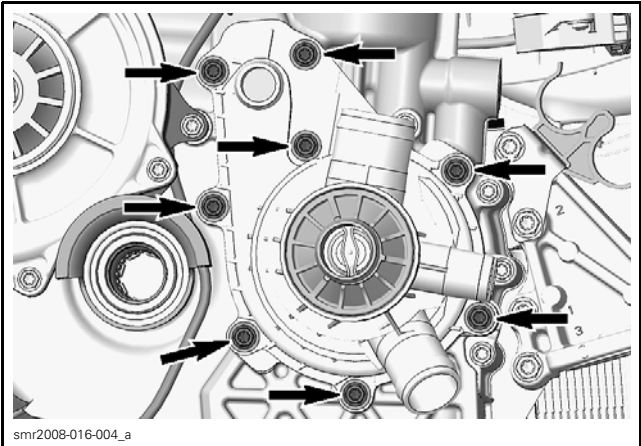


TYPICAL
1. Ride plate outlet hose
2. Ride plate inlet hose



1. Water pump housing
2. Cylinder head hose
3. Oil cooler outlet hose

Remove water pump housing screws.

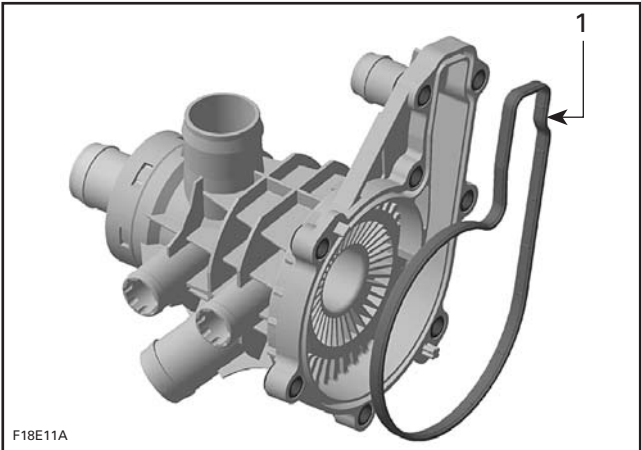


TYPICAL

Pull the water pump housing to remove it.

Inspecting the Water Pump Housing

Check if gasket is brittle, hard or damaged and replace as necessary.



1. Water pump housing gasket

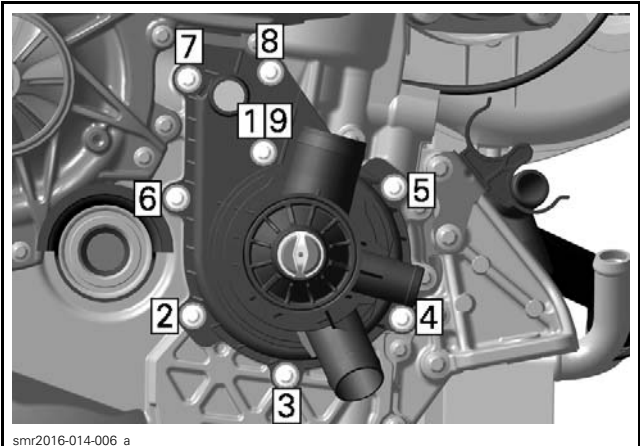
Check if thermostat is in good condition. Refer to *THERMOSTAT* in this subsection.

Installing the Water Pump Housing

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

NOTICE Take care that the gaskets are exactly in groove when reinstalling the water pump housing.

Tighten screws to specification using the following sequence.



TIGHTENING SEQUENCE

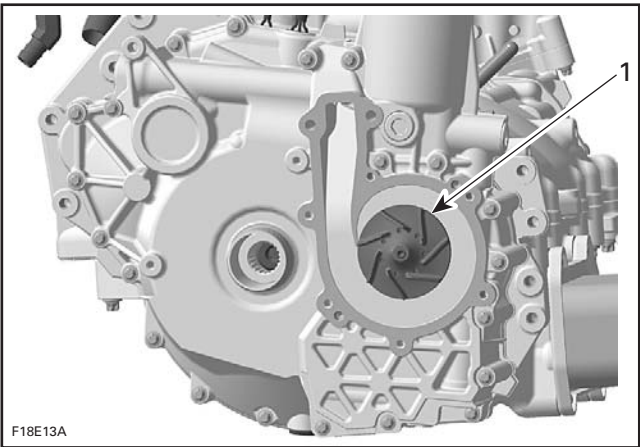
TIGHTENING TORQUE	
Water pump housing screws	$9\text{ N}\cdot\text{m} \pm 1\text{ N}\cdot\text{m}$ (80 lbf•in $\pm$ 9 lbf•in) + LOCTITE 243 (BLUE) (P/N 293 800 060)

WATER PUMP IMPELLER

Removing the Water Pump Impeller

Remove the *WATER PUMP HOUSING*, see procedure in this subsection.

Unscrew the impeller clockwise.



1. Impeller

NOTICE Coolant/oil pump shaft and impeller have left-hand threads.

Inspecting the Water Pump Impeller

Check impeller for cracks or other damage. Replace impeller if damaged.

Subsection XX (COOLING SYSTEM)

Installing the Water Pump Impeller

The installation is the reverse of the removal procedure. Pay attention to the following details.

NOTICE Be careful not to damage impeller wings during installation.

Torque impeller to specification.

TIGHTENING TORQUE	
Water pump impeller (left hand threads)	3 N•m ± 0.4 N•m (27 lbf•in ± 4 lbf•in)

THERMOSTAT

Both thermostats are single action type.

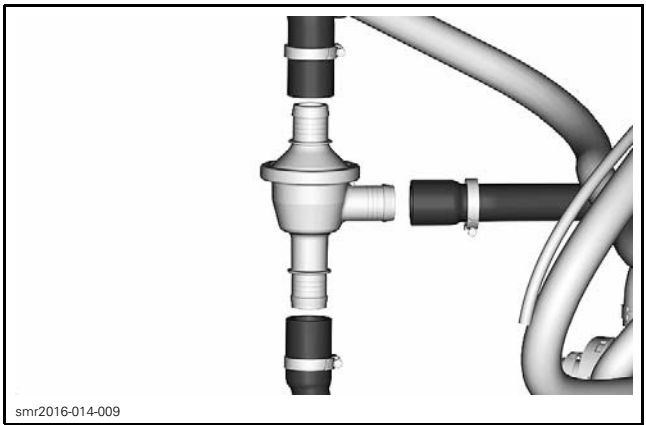
Removing the Thermostat

Water Pump Housing Thermostat

Remove the *WATER PUMP HOUSING*, see procedure in this subsection.

NOTE: The thermostat is located inside the water pump housing.

Secondary Thermostat



Testing the Thermostat

To check the operation of the thermostat, put it in water and heat water.

Water Pump Housing Thermostat

Look inside the cylinder head return hose connection to see the movement of the thermostat.

Intermediate Cooler Bypass Thermostat

Look inside the middle nozzle to see the movement of the thermostat.

THERMOSTAT OPENING TEMPERATURE	
Water pump housing thermostat	87°C (189°F)
Intermediate cooler bypass thermostat	65°C (149°F)

If there is no operation, replace the thermostat with its housing.

Installing the Thermostat

Water Pump Housing Thermostat

Refer to *WATER PUMP HOUSING* in this subsection.

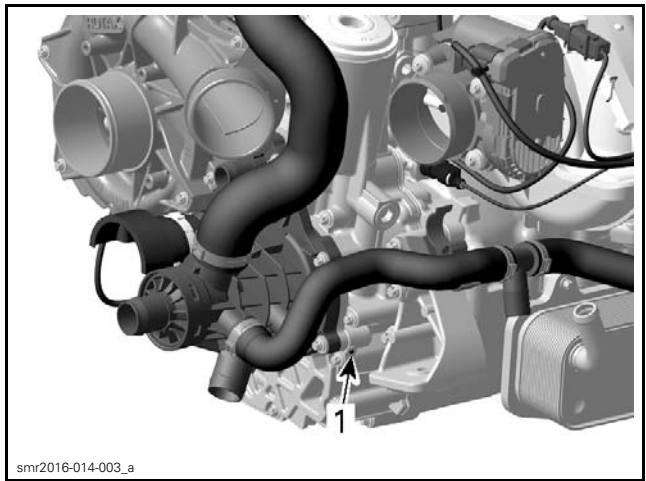
Intermediate Cooler Bypass Thermostat

TIGHTENING TORQUE	
Thermostat housing clamps	1.7 N•m ± 0.2 N•m (15 lbf•in ± 2 lbf•in)

ROTARY SEAL

Inspecting the Rotary Seal

- Check leak indicator hole for oil or coolant leak:
- Leaking coolant indicates a defective rotary seal
 - Leaking oil indicates a faulty oil seal.



1. Leak indicator hole

Rotary seal and oil seal must be replaced together.

Rotary Seal Replacement

Refer to *LUBRICATION SYSTEM* subsection.

PTO HOUSING, MAGNETO AND STARTER

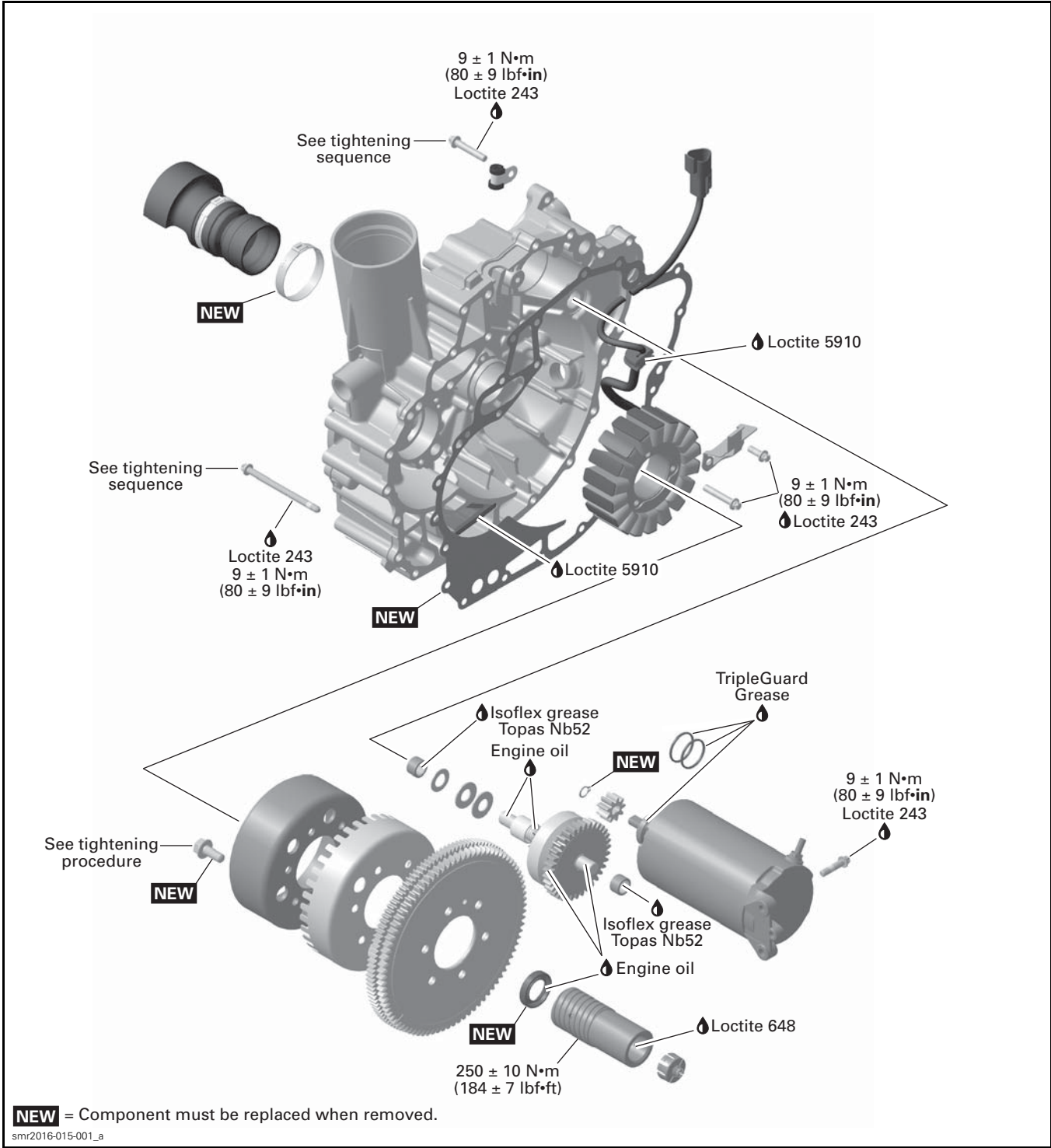
SERVICE TOOLS

Description	Part Number	Page
3-PIN MAGNETO HARNESS ADAPTER.....	529 036 016	8-9
HANDLE	420 877 650	13
IMPELLER REMOVER/INSTALLER.....	529 035 820	7
OETIKER PLIERS.....	295 000 070	7
STARTER DRIVE SEAL PUSHER.....	420 876 502	13
SUCTION PUMP	529 035 880	3

SERVICE PRODUCTS

Description	Part Number	Page
DIELECTRIC GREASE	293 550 004	16
ISOFLEX GREASE TOPAS NB 52	293 550 021	13
LOCTITE 243 (BLUE).....	293 800 060	5-6, 10, 16
LOCTITE 5910	293 800 081	5
LOCTITE 648 (GREEN)	413 711 400	8
PULLEY FLANGE CLEANER	413 711 809	6-7
TRIPLE-GUARD GREASE	296 000 329	16

Subsection XX (PTO HOUSING, MAGNETO AND STARTER)



GENERAL

NOTE: It is good practice to check for fault codes using the B.U.D.S. software as a first troubleshooting step. Refer to the *DIAGNOSTIC AND FAULT CODES* subsection.

Always carry out electrical tests on components before removing or installing them.

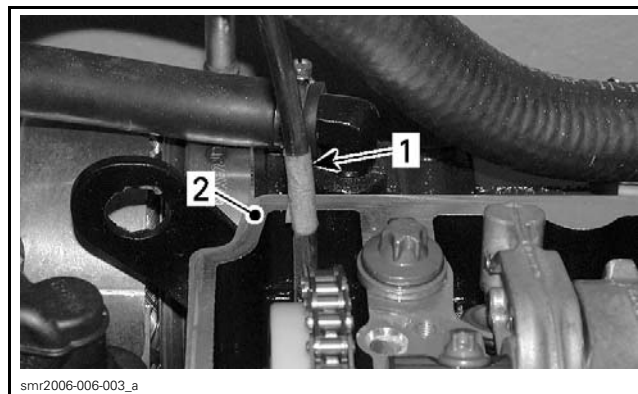
PROCEDURES

PTO HOUSING

Removing the PTO Housing

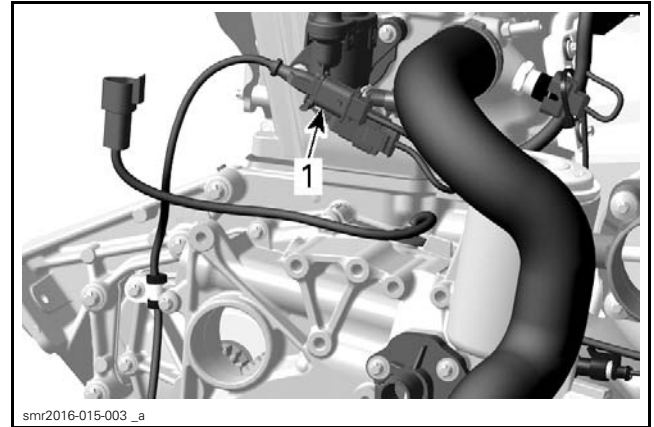
1. Remove the engine from the watercraft. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
2. Drain the engine oil. Refer to *LUBRICATION SYSTEM* subsection.
3. Remove the supercharger. Refer to *SUPERCHARGER* subsection.
4. Remove the valve cover. Refer to *CYLINDER HEAD* subsection.
5. Insert the tube of the suction pump in the lower area of the timing chain and syphon remaining oil out of the lower timing chain case.

REQUIRED TOOL	
SUCTION PUMP (P/N 529 035 880)	



1. Suction pump tube
2. Edge of cylinder block

6. Disconnect CPS connector from wiring harness.



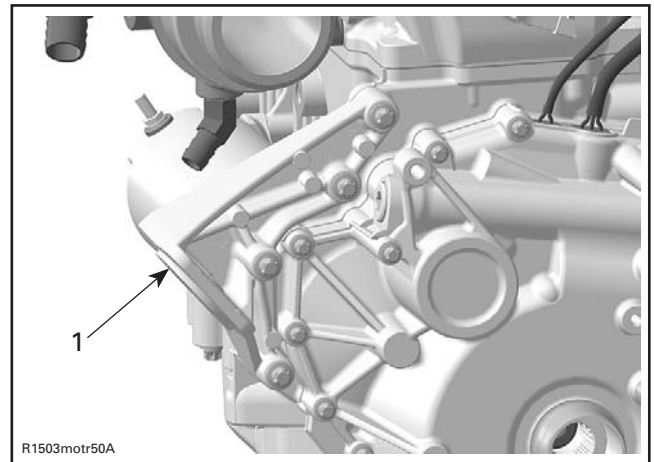
1. CPS connector

7. Disconnect the stator connector, refer to *STATOR CONNECTOR ACCESS* in this subsection.

8. Place rags under PTO housing to prevent oil spillage.

NOTE: Up to 250 ml (8 U.S. oz) of oil could flow out when removing PTO housing.

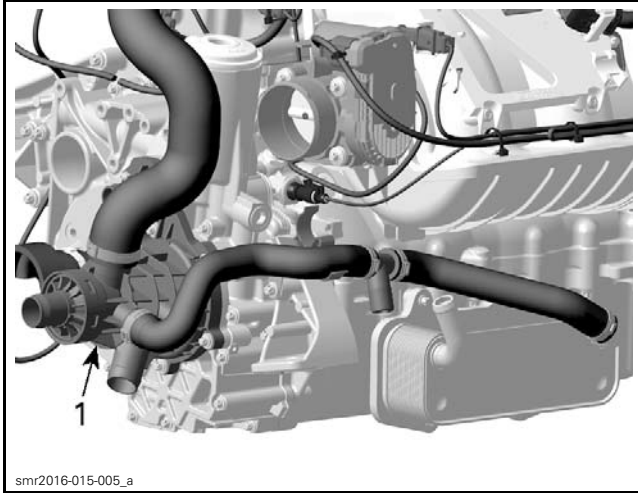
9. Remove LH rear engine support.



1. Engine support

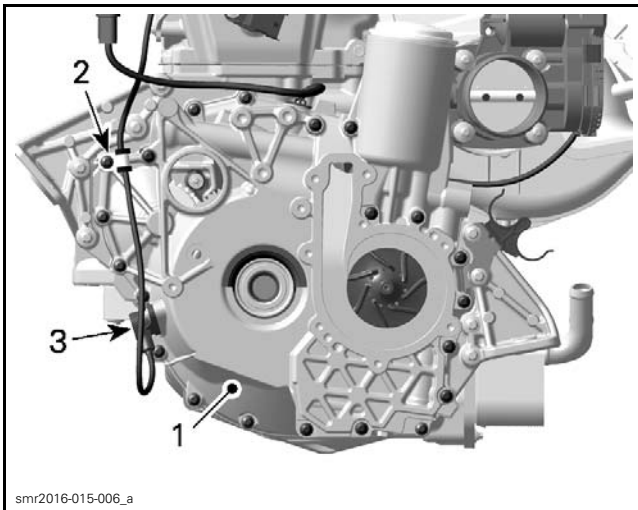
10. Remove water pump housing, refer to *COOLING SYSTEM* subsection.

Subsection XX (PTO HOUSING, MAGNETO AND STARTER)



1. Water pump housing

11. Remove PTO housing retaining screws and CPS harness retaining clamp.

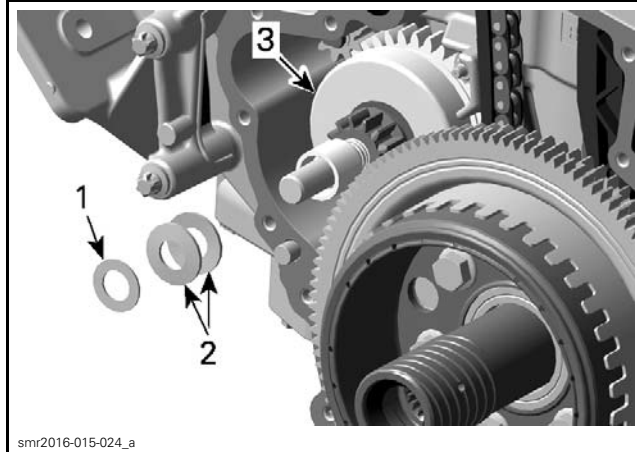


1. PTO housing
2. CPS harness retaining clamp
3. CPS

12. Pry off PTO housing from engine using two flat screwdrivers.

NOTICE Avoid scoring or damaging contact surfaces.

NOTICE Be careful not to lose the disc springs and thrust washer located on the starter drive shaft.



1. Thrust washer
2. Disc springs
3. Starter drive

13. Remove PTO housing gasket and discard it.

14. If necessary remove following parts from PTO housing:

- Stator, refer to procedure in this subsection
- Oil filter, refer to *LUBRICATION SYSTEM*
- Oil pressure pump, refer to *LUBRICATION SYSTEM*
- Engine oil pressure regulator, refer to *LUBRICATION SYSTEM*
- Crank position sensor (CPS).

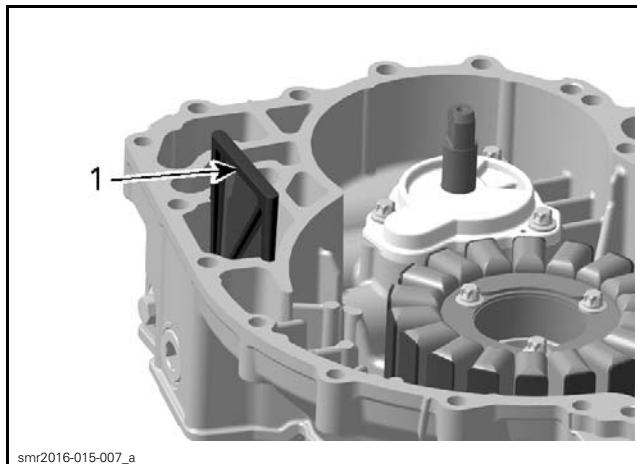
Inspecting the PTO Housing

Inspect PTO housing for cracks or any other damages. Replace if necessary.

Inspect starter drive needle bearing in the PTO housing.

NOTE: Clean all disassembled metal components in a non-ferrous metal cleaner.

Inspect oil strainer for contaminants, debris or other particles. Clean as required.



1. PTO oil strainer

Installing the PTO Housing

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

Install disc springs and thrust washer of starter drive, see *INSTALLING THE STARTER DRIVE* in this subsection.

Install a **NEW** PTO housing gasket.

Clean stator cable grommet and cylinder block to remove all remaining silicone residues in oil strainer area.

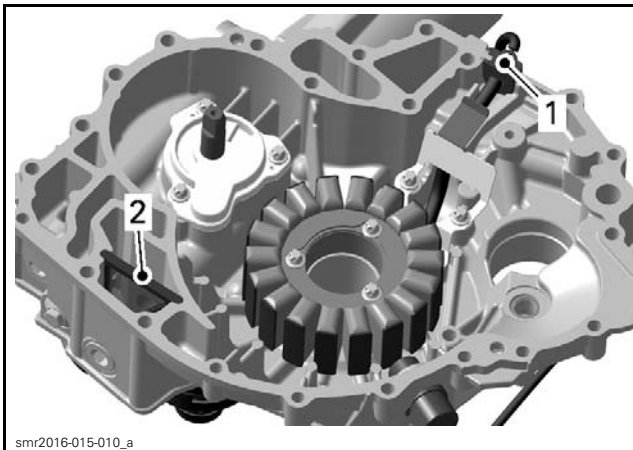
Apply sealing compound on:

- Stator cable grommet
- PTO oil strainer.

STATOR CABLE GROMMET AND PTO OIL STRAINER SEALING

Service product

LOCTITE 5910 (P/N 293 800 081)



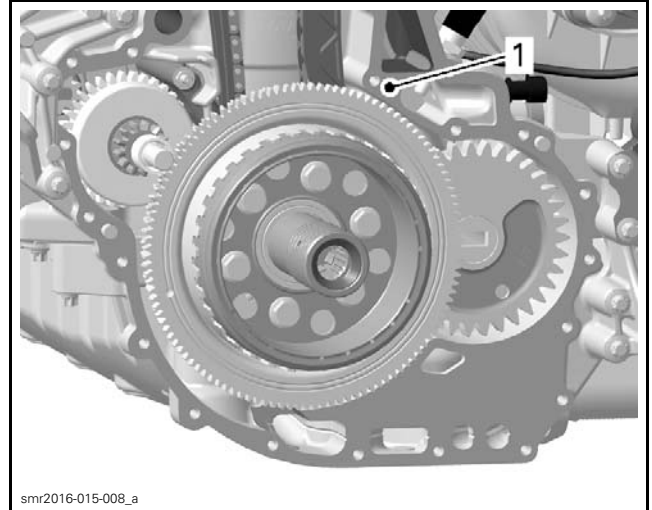
APPLY SEALING COMPOUND

1. Stator cable grommet
2. PTO oil strainer

Install PTO housing.

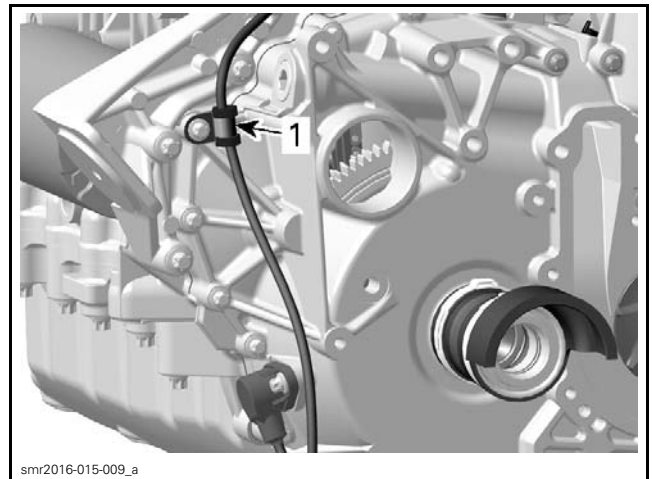
NOTICE During installation ensure:

- that thrust washer and spring discs are placed on starter drive shaft
- oil/water pump shaft alignment with balance shaft (rotate shaft slightly)
- starter drive gear alignment with the needle bearing
- proper PTO housing gasket alignment.



1. Pay attention that gasket remains properly positioned on this surface

Install the CPS harness retaining clamp.



1. CPS harness retaining clamp

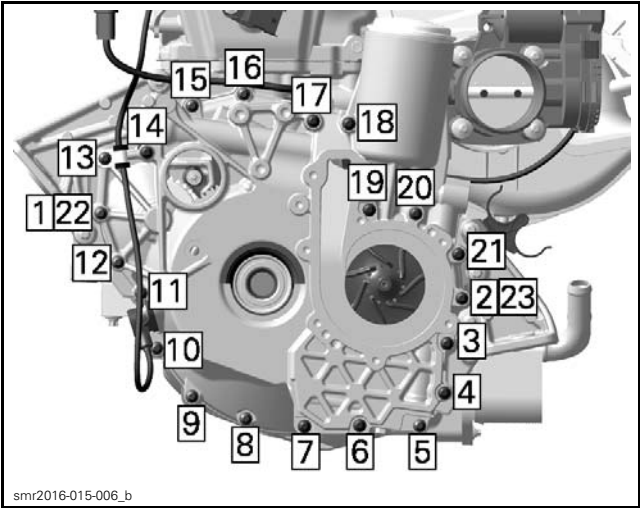
Tighten PTO housing screws as per following sequence.

TIGHTENING TORQUE

PTO housing screws

9 N•m ± 1 N•m
(80 lbf•in ± 9 lbf•in)
+
LOCTITE 243 (BLUE)
(P/N 293 800 060)

Subsection XX (PTO HOUSING, MAGNETO AND STARTER)



TIGHTENING SEQUENCE

Reinstall LH engine support as per following table.

TIGHTENING TORQUE	
Engine support screw	23 N•m ± 3 N•m (17 lbf•ft ± 2 lbf•ft)
	+ LOCTITE 243 (BLUE) (P/N 293 800 060)

Carry out an engine alignment, refer to the *ENGINE REMOVAL AND INSTALLATION* subsection.

NOTICE An engine alignment procedure must be carried, otherwise severe component damage may occur.

Install all remaining parts, reconnect hoses and electrical connectors. Refer to applicable subsections for procedures.

Refill engine oil and coolant. Refer to *LUBRICATION SYSTEM* and *COOLING SYSTEM* subsections.

PTO SEAL

PTO Seal Access

Place rags under PTO housing to prevent spillage. If spillage occurs, clean immediately with PULLEY FLANGE CLEANER (P/N 413 711 809) to prevent oil stains.

Remove drive shaft, refer to *STEERING AND PROPULSION* subsection.

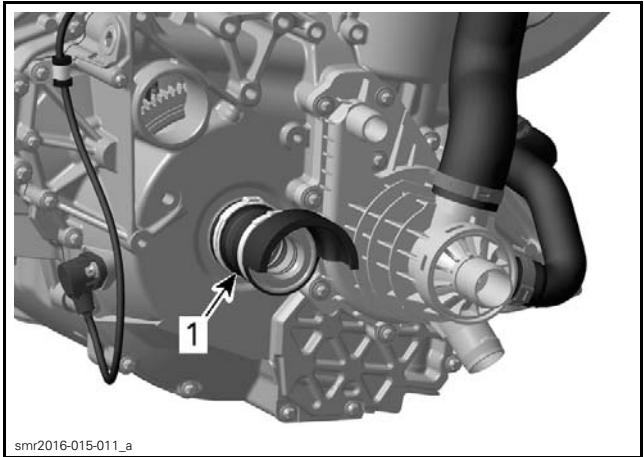
Remove supercharger, refer to *SUPERCHARGER* subsection.

Inspecting the PTO Seal

Inspect the PTO seal on the PTO housing. If brittle, hard, damaged or leaking, replace it.

Inspect ball bearing within PTO seal for excessive play and smooth operation.

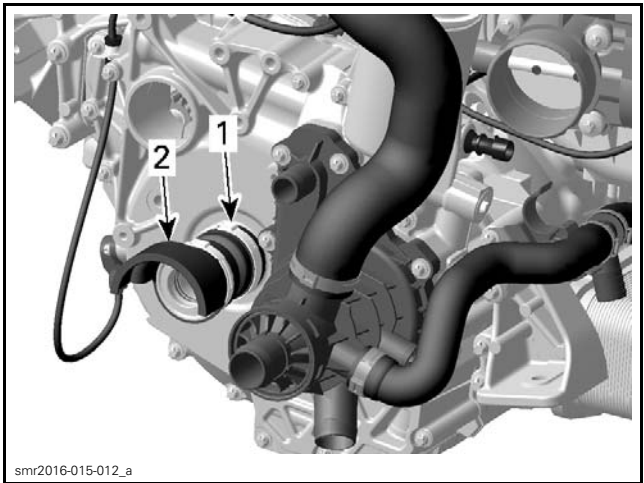
Replace PTO seal if oil seal or ball bearing is damaged.



1. PTO seal

Removing the PTO Seal

Remove the Oetiker clamp retaining the seal to the PTO housing.



1. Oetiker clamp
2. PTO seal

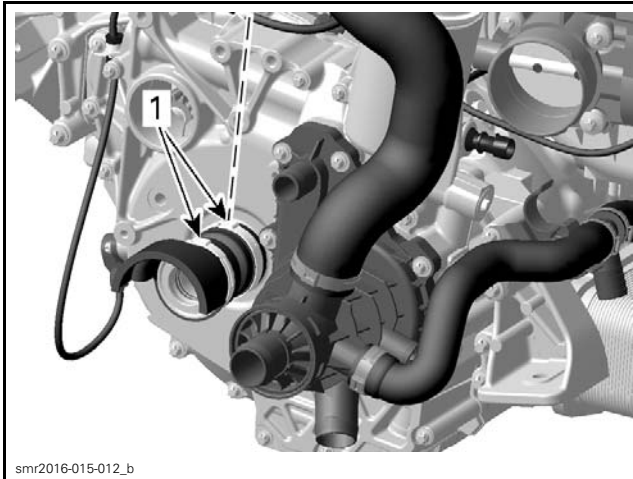
Pull seal from PTO housing.

Installing the PTO Seal

Insert a **NEW** Oetiker clamp over the seal.

Push seal onto PTO housing. Be sure to align seal and clamp as noted at removal.

NOTICE Ensure to position the Oetiker clamps facing to the cylinder head.



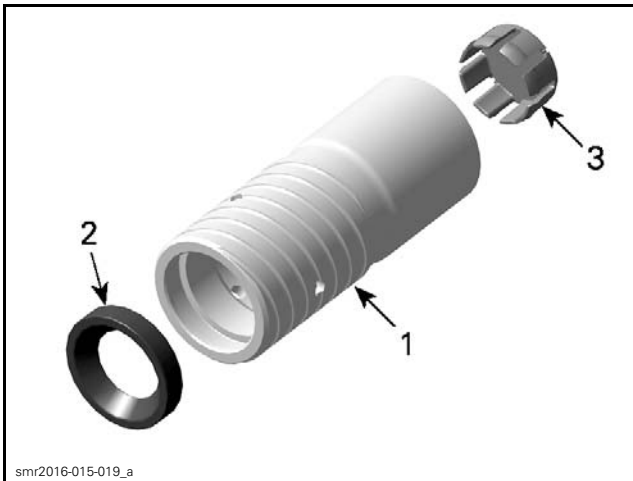
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1. Oetiker clamps

Crimp Oetiker clamp.

REQUIRED TOOL	
OETIKER PLIERS (P/N 295 000 070)	

PTO COUPLING



smr2016-015-019_a

1. PTO coupling
2. Oil seal
3. Stop sleeve

PTO Coupling Access

Remove drive shaft, refer to *STEERING AND PROPULSION* subsection.

Inspecting the PTO Coupling

Inspect seal within coupling, if it is brittle, cracked or hard, replace it.

Check coupling for worn or damaged splines. Replace as required.

Removing the PTO Coupling

Remove engine from vehicle, refer to the *ENGINE REMOVAL AND INSTALLATION* subsection.

Lock crankshaft. Refer to *CYLINDER BLOCK* subsection for the procedure.

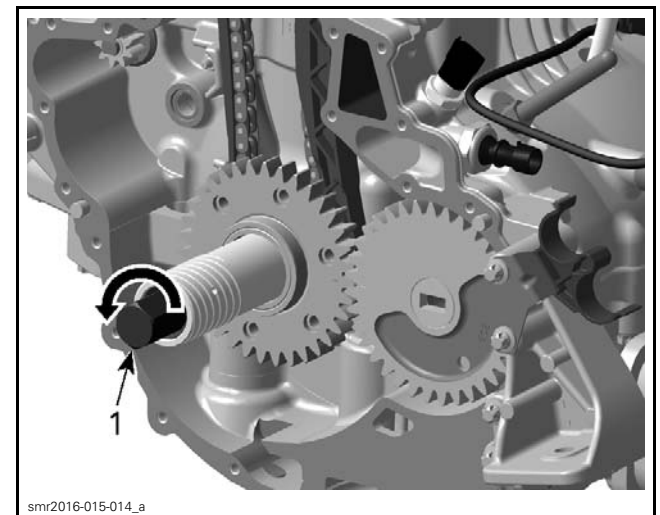
Refer to procedures in this subsection and remove:

- PTO housing
- Rotor and trigger wheel
- Ring gear
- Starter drive.

Heat up PTO coupling with a heat gun to break threadlocker.

Unscrew coupling from crankshaft.

REQUIRED TOOL	
IMPELLER REMOVER/INSTALLER (P/N 529 035 820)	



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TURN COUNTERCLOCKWISE TO REMOVE

1. Impeller removal tool

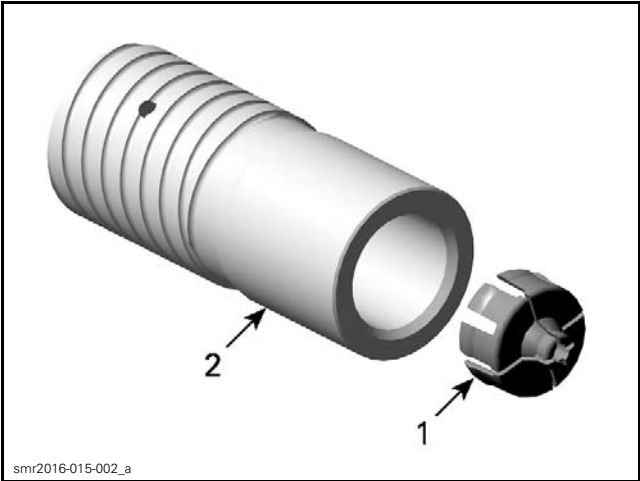
Installing the PTO Coupling

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

Use PULLEY FLANGE CLEANER (P/N 413 711 809) to clean following:

- Thread inside PTO coupling
- Thread on crankshaft.

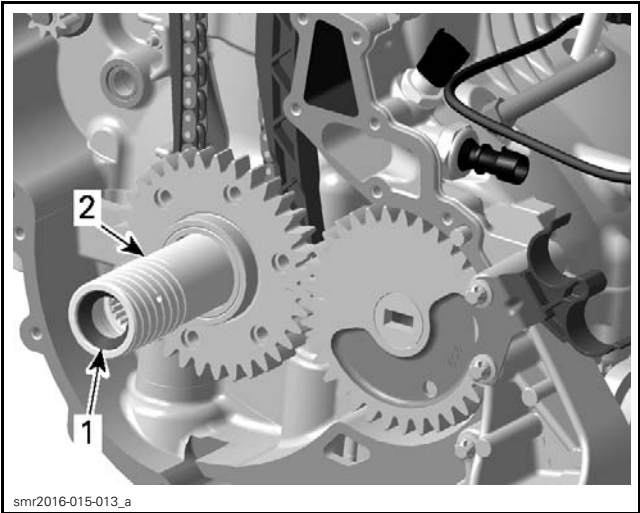
Install stop sleeve in PTO coupling.



- 1. Stop sleeve
- 2. PTO coupling

TIGHTENING TORQUE	
PTO coupling	250 N•m ± 10 N•m (184 lbf•ft ± 7 lbf•ft) + LOCTITE 648 (GREEN) (P/N 413 711 400)

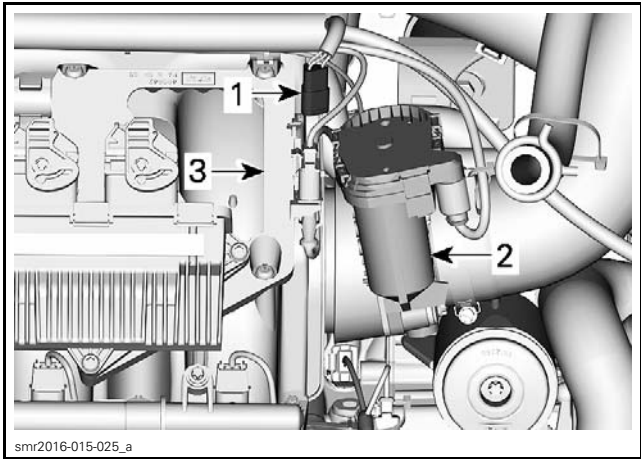
Always install **NEW** oil seal in PTO coupling.



- 1. Oil seal
- 2. PTO coupling

STATOR

Stator Connector Location



- 1. Magneto connector
- 2. Throttle body
- 3. ECM support

Testing the Stator Continuity

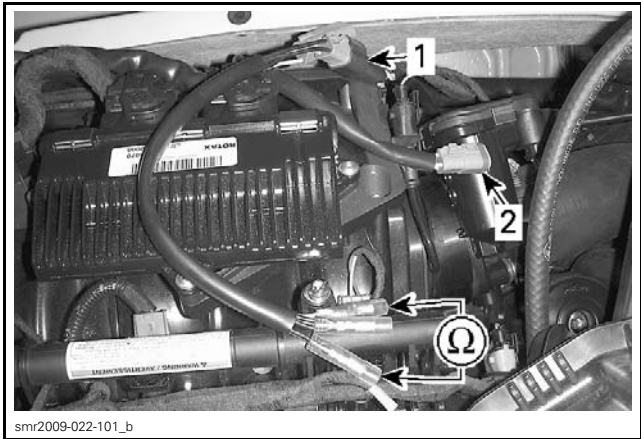
Disconnect the stator connector, refer to *STATOR CONNECTOR ACCESS* in this subsection.

Install harness adapter onto the stator connector.

NOTE: Do not connect the magneto harness adapter to the vehicle harness connector.

REQUIRED TOOL	
3-PIN MAGNETO HARNESS ADAPTER (P/N 529 036 016)	

Connect multimeter between each pair of YELLOW wires.



STATOR CONTINUITY TEST

- 1. Connect adapter to stator connector
- 2. Leave vehicle harness disconnected

Read resistance.

STATOR CONTINUITY TEST	
TERMINAL	RESISTANCE @ 20°C (68°F)
1 and 2	0.1 - 1 Ω
1 and 3	
2 and 3	

If any result is out of specification, replace stator.

Testing the Stator Insulation

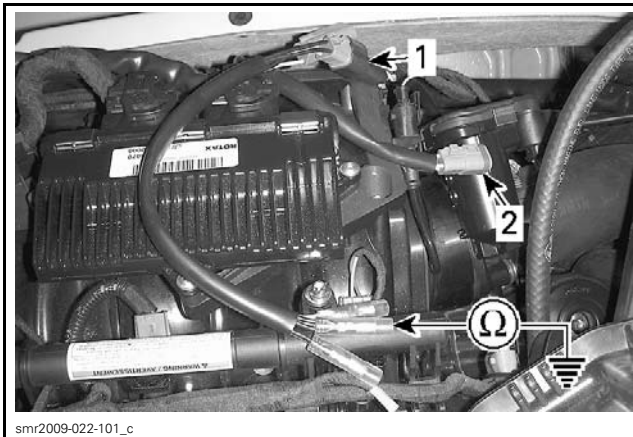
Disconnect the stator connector, refer to *STATOR CONNECTOR ACCESS* in this subsection.

Install harness adapter onto the stator connector.

NOTE: Do not connect the magneto harness adapter to the vehicle harness connector.

REQUIRED TOOL	
3-PIN MAGNETO HARNESS ADAPTER (P/N 529 036 016)	

Connect multimeter between any YELLOW wire and engine ground.



STATOR INSULATION TEST

1. Connect adapter to stator connector
2. Leave vehicle harness disconnected

Read resistance.

STATOR INSULATION TEST	
TERMINAL	RESISTANCE @ 20°C (68°F)
Any YELLOW wire and engine ground	Infinity (open circuit)

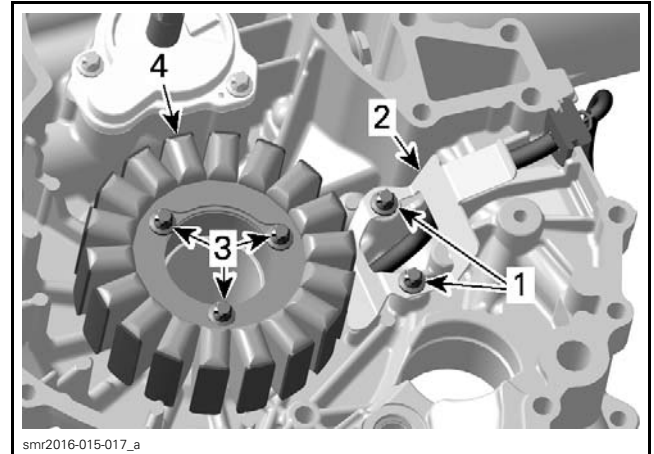
If there is a resistance or continuity to engine ground, the stator coils and/or the wiring is grounded and need to be repaired or replaced.

Removing the Stator

Remove PTO housing, see procedure in this subsection.

Remove:

- Retaining screws
- Stator cable holding plate
- Stator retaining screws
- Stator.



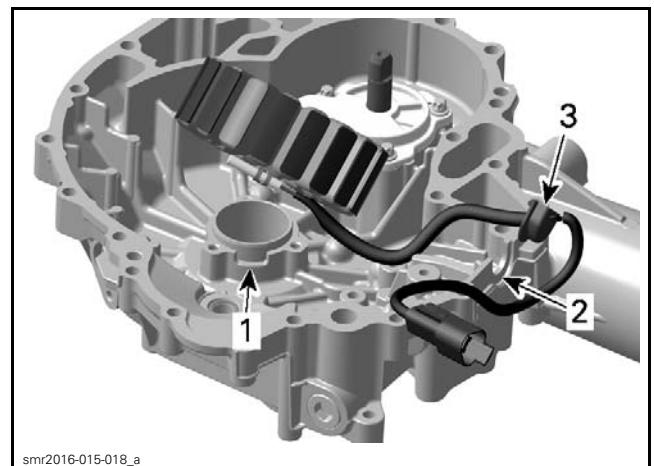
1. Screws
2. Holding plate
3. Stator screws
4. Stator

Clean cable grommet from sealing compound.

Installing the Stator

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

NOTE: There is only one position for the stator (notch in the PTO housing).



1. Notch for stator
2. PTO housing notch
3. Stator cable grommet

TIGHTENING TORQUE	
Stator retaining screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)
Cable holding screws	+ LOCTITE 243 (BLUE) (P/N 293 800 060)

Install PTO housing as per procedures in this sub-section.

ROTOR AND TRIGGER WHEEL

Rotor and Trigger Wheel Access

Remove PTO housing, see procedure in this sub-section.

Inspecting the Rotor and Trigger Wheel

Inspect rotor and trigger wheel condition. Pay particular attention to the inside of the rotor for:

- Cracks
- Rub marks
- Discoloration.

If damaged, replace faulty part.

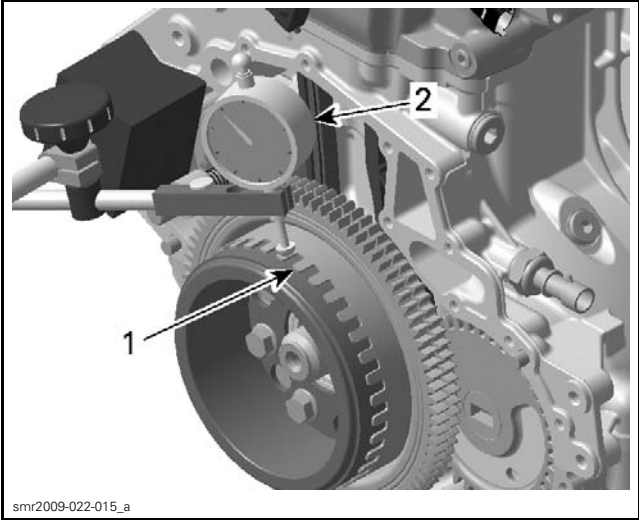
Check the trigger wheel for bent teeth using the following procedure.

1. Install a dial indicator on crankcase casting.
2. Position the gauge on a tooth and set it to zero (0). Be sure to lock the indicator dial to prevent movement of the dial during the remainder of the procedure.
3. Mark the first measured tooth (reference tooth).
4. Gently lift the gauge contact point off the tooth and rotate the rotor to the next tooth.

NOTE: When lifting contact point off the tooth for rotor rotation, be careful not to move gauge position or test readings taken on next tooth will not be accurate with reference to the reference tooth.

5. Gently set the gauge contact point on the next tooth and read the dial indicator.
6. Repeat this procedure taking a reading at each tooth.
7. Recheck reading on reference tooth to ensure gauge has not changed position (gauge should still read zero).

TRIGGER WHEEL TEETH INSPECTION
MAXIMUM ALLOWABLE DIFFERENCE
0.15 mm (.006 in)



1. Trigger wheel
2. Dial indicator

If the reading exceeds the maximum allowable tolerance, straighten the tooth or replace the trigger wheel.

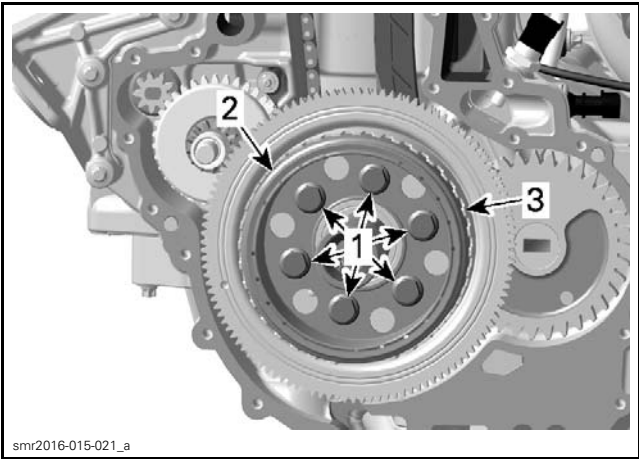
8. Properly reinstall PTO housing.

Removing the Rotor and Trigger Wheel

Lock crankshaft, refer to *CYLINDER BLOCK* sub-section for procedure.

Remove:

- Rotor retaining screws (discard them)
- Rotor
- Trigger wheel.

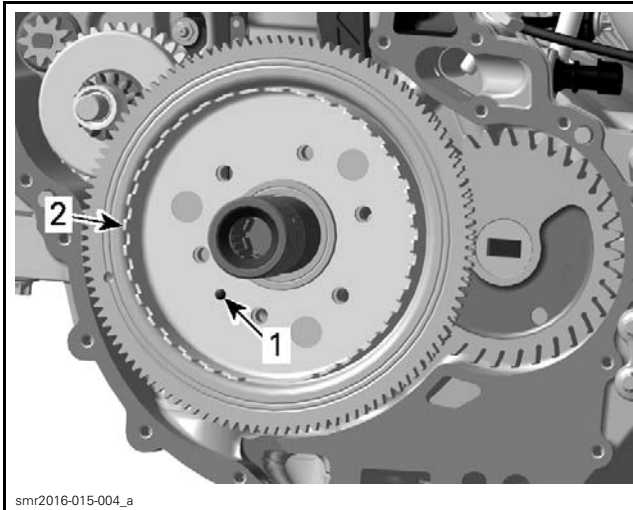


1. Rotor retaining screws
2. Rotor
3. Trigger wheel

Installing the Rotor and Trigger Wheel

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

1. Align the trigger wheel with the location pin on the crankshaft end.



1. Location pin
2. Trigger wheel

2. Install **NEW** OEM rotor screws and tighten them in a crisscross pattern as per following procedure.

NOTE: Always perform step A on all rotor screws before going to the step B.

ROTOR SCREWS TIGHTENING PROCEDURE	
STEP A	15 N•m ± 1 N•m (133 lbf•in ± 9 lbf•in)
STEP B	Additional 50° ± 5°

NOTICE This assembly uses stretch screws with pre-applied threadlocker. Always use **NEW** screws and strictly adhere to the tightening procedure.

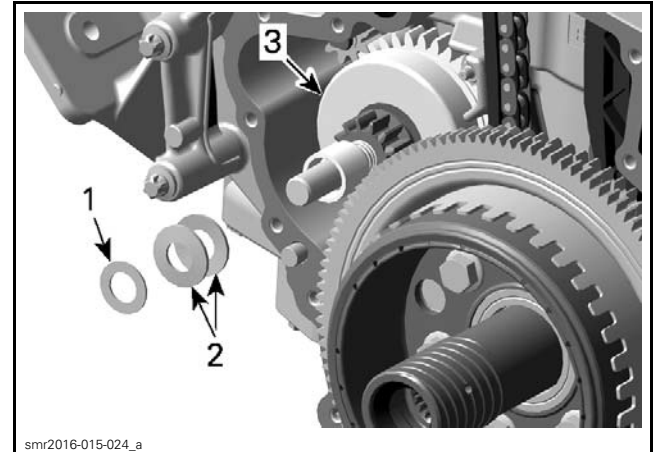
RING GEAR

Removing the Ring Gear

Lock crankshaft. Refer to *CYLINDER BLOCK* subsection for procedure.

Remove the PTO housing, see procedure in this subsection.

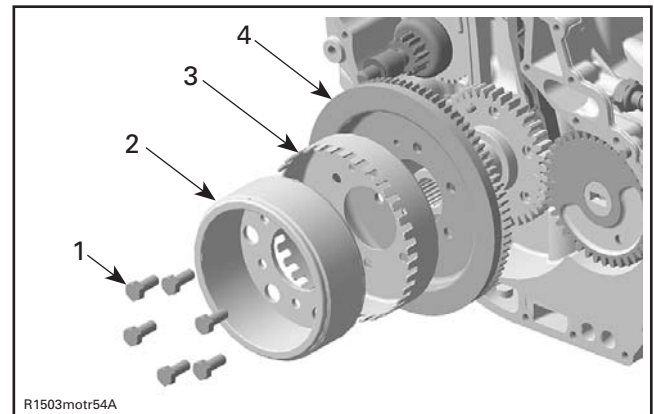
Remove thrust washer disc springs from starter drive shaft.



1. Thrust washer
2. Disc springs
3. Starter drive

Remove:

- Rotor retaining screws (discard them)
- Rotor
- Trigger wheel
- Ring gear.



1. Rotor retaining screws
2. Rotor
3. Trigger wheel
4. Ring gear

Inspecting the Ring Gear

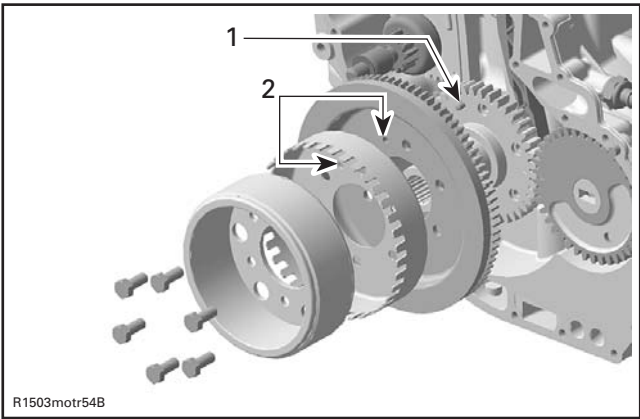
Inspect ring gear for damages. Pay particular attention to teeth condition. If badly worn, cracked, or broken teeth are found, replace ring gear.

Installing the Ring Gear

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

Align the ring gear with the location pin on the crankshaft end.

Subsection XX (PTO HOUSING, MAGNETO AND STARTER)



- 1. Location pin
- 2. Location pin holes

Install rotor and trigger wheel, refer to procedures in this subsection.

Install disc springs and thrust washer of starter drive, see *INSTALLING THE STARTER DRIVE* in this subsection.

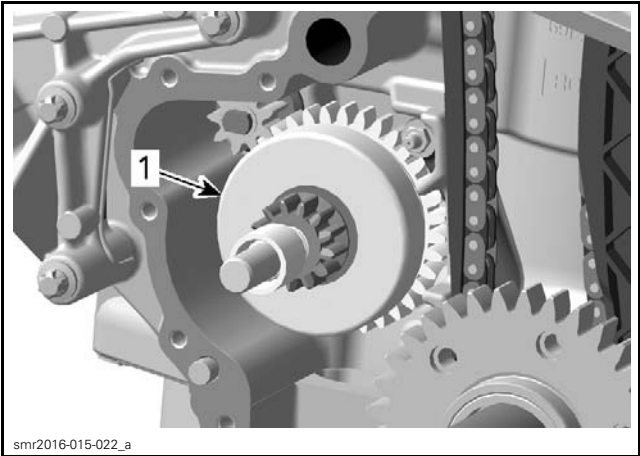
STARTER DRIVE

Starter Drive Removal

Refer to procedures in this subsection and remove:

- PTO housing
- Rotor and trigger wheel
- Ring gear.

Remove starter drive.



- 1. Starter drive

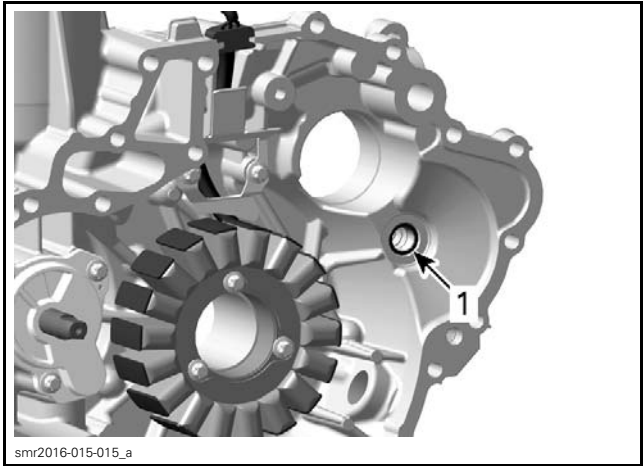
Inspecting the Starter Drive

Inspect all starter drive parts for excessive wear, cracks and other defects. Pay attention to the condition of the drive gear teeth.

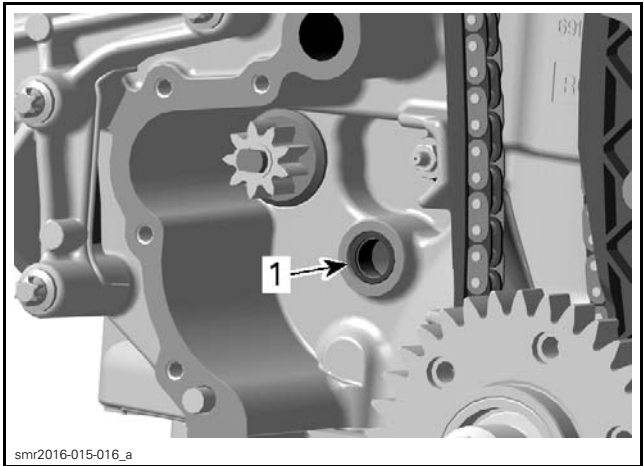
Ensure proper operation of the starter drive sprag clutch.

If any part of the assembly shows signs of abnormal wear, cracks, broken teeth or malfunction (sprag clutch), replace the faulty part.

Check needle bearings for excessive play and smooth operation. If damaged see *STARTER DRIVE BEARING REPLACEMENT* in this subsection.



- PTO HOUSING**
- 1. Starter drive bearing



- CYLINDER BLOCK**
- 1. Starter drive bearing

STARTER DRIVE BEARING REPLACEMENT

Remove starter drive bearing from PTO housing and/or cylinder block.

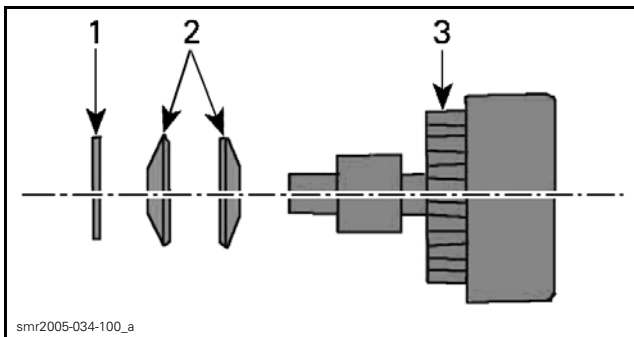
REQUIRED TOOL
Blind hole bearing puller set

Install starter drive bearing in the PTO housing or in the cylinder block.

REQUIRED TOOLS	
STARTER DRIVE SEAL PUSHER (P/N 420 876 502)	
HANDLE (P/N 420 877 650)	

Installing the Starter Drive

The installation is the reverse of the removal procedure. However, pay attention to the following.
Position the spring discs and thrust washer onto the starter drive shaft as per following illustration.



TYPICAL
1. Thrust washer
2. Spring discs
3. Starter drive

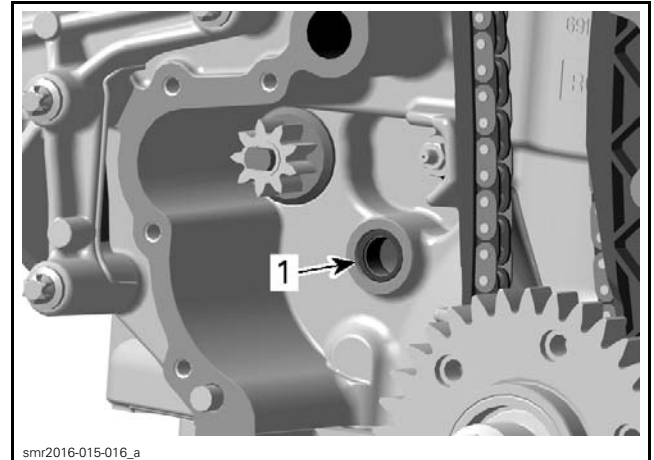
When installing a new starter drive lubricate:

- Shaft
- Gear teeth
- Splines.

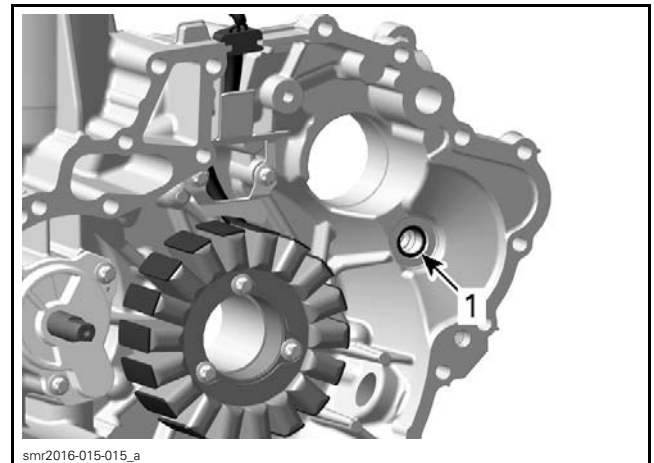
STARTER DRIVE	
Service product	Engine oil

Lubricate starter drive needle bearings.

STARTER DRIVE NEEDLE BEARINGS	
Service product	ISOFLEX GREASE TOPAS NB 52 (P/N 293 550 021)



CYLINDER BLOCK
1. Starter drive bearing



PTO HOUSING
1. Starter drive bearing

STARTER

Starter Quick Test

To easily bypass the starter solenoid and the start control circuits, proceed as follows.

- Use a fully charged 12 V battery with a capacity of at least 30 A-h.
- Use a set of booster cables to power the starter.

This procedure tests the following:

- Electric starter
- Starter power cable
- Battery to engine ground cable.

Subsection XX (PTO HOUSING, MAGNETO AND STARTER)

WARNING

Fuel, oil, or electrolyte vapors are flammable and may become explosive if certain conditions are met. These vapors may collect near the bottom of the hull when present. All types of ignition including electrical sparks are to be avoided when maintaining or testing vehicle.

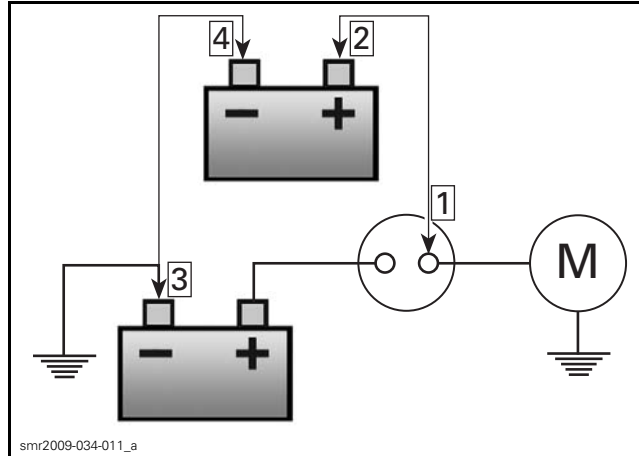
WARNING

Always wear safety glasses when working with or around batteries. Be sure to leave the booster battery out of the watercraft.

1. Connect booster cables in this strict order:
2. **RED booster cable:**
3. Connect one clip to the starter post on the starter solenoid.
4. Connect the other clip to the positive (+) terminal on the external battery.
5. **BLACK booster cable:**
6. Connect one clip to the negative (-) battery terminal in the **vehicle**.
7. Momentarily apply the second clip to the negative (-) terminal of the **external** battery.

WARNING

Always use an **external** battery for this test to prevent any electrical sparks from occurring within the hull. Always make the final connection to the external battery negative (-) terminal using the **BLACK** booster cable clip. Do not short starter solenoid contacts across the main power connections on the relay with a tool that would cause electrical sparks. Failure to follow this procedure may result in an explosion.



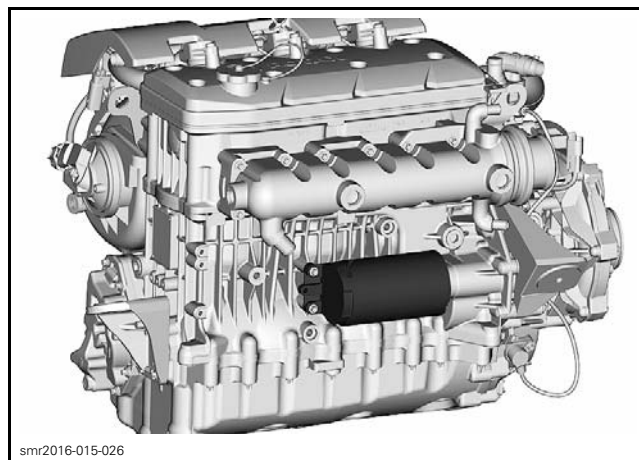
Step 1: Connect cable to solenoid starter post
Step 2: Connect cable to external battery positive post
Step 3: Connect cable to vehicle battery negative post
Step 4: Make a momentary contact

If engine does not crank (or cranks slowly), check the following:

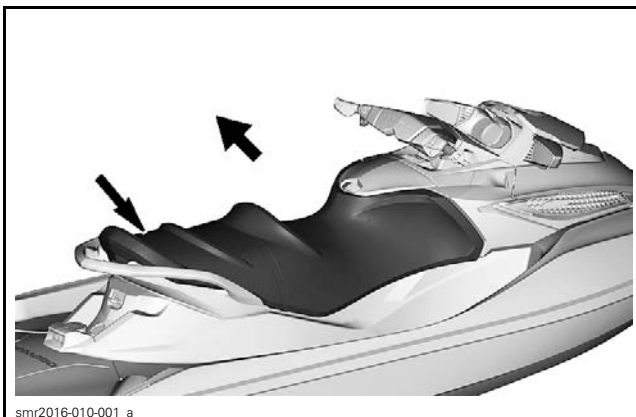
- Booster cable connections
- Vehicle battery ground cable connections to engine
- Starter power cable/connections from solenoid to starter
- Carry out a *SOLENOID DYNAMIC TEST*.

If the above items all test good, replace the starter.

Starter Location

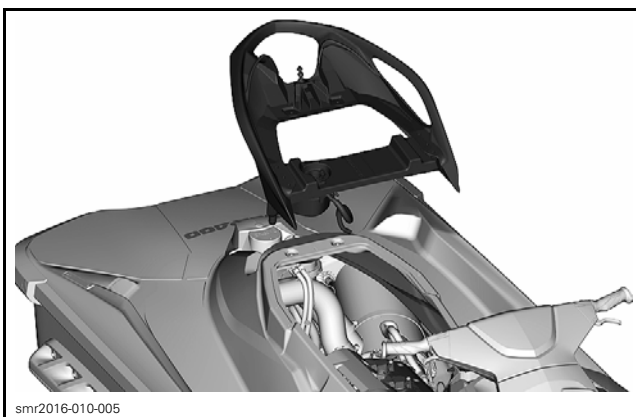


Removing the Starter



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GTX LTD SHOWN



smr2016-010-005

GTX LTD AND RXT-X MODELS

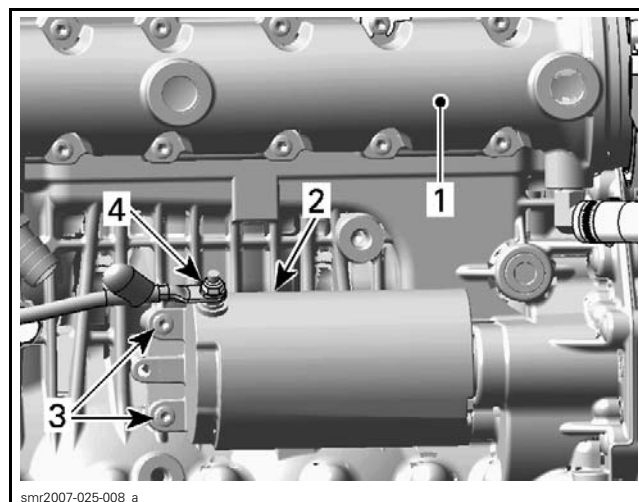
1. Disconnect battery. Refer to *CHARGING SYSTEM* subsection.

⚠ WARNING

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

NOTE: For better access to the starter, work from RH side and lay across the watercraft.

2. Disconnect starter power cable.
3. Remove starter retaining screws.

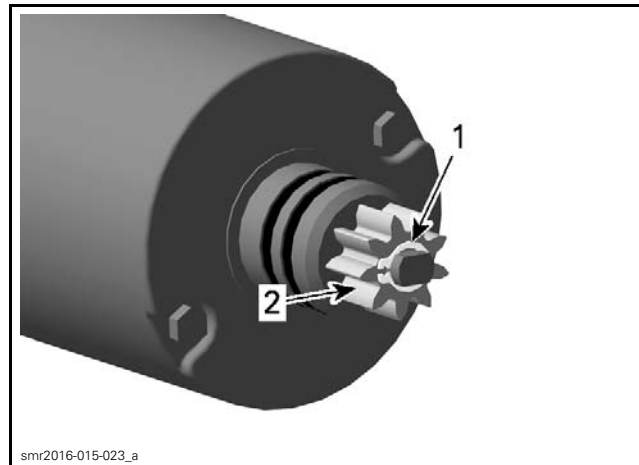


smr2007-025-008_a

1. Exhaust manifold
2. Starter
3. Starter retaining screws
4. Starter power cable retaining nut

Removing the Starter Gear

1. Remove starter.
2. Remove:
 - Circlip
 - Starter gear.



smr2016-015-023_a

1. Circlip
2. Starter gear

Installing the Starter Gear

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

Install a **NEW** circlip.

Installing the Starter

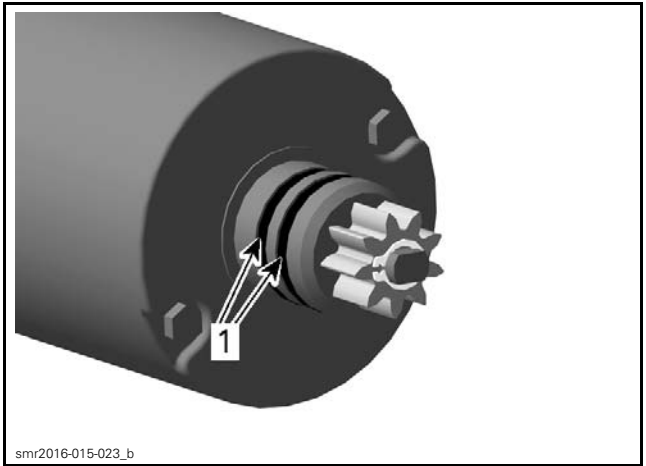
The installation is the reverse of the removal procedure. However, pay attention to the following.

1. Ensure starter and engine mating surfaces are free of debris. Serious problems may arise if starter is not properly aligned.

Subsection XX (PTO HOUSING, MAGNETO AND STARTER)

2. Lubricate starter O-rings.

STARTER O-RINGS	
Service product	TRIPLE-GUARD GREASE (P/N 296 000 329)



1. Lubricate starter O-rings

3. Install starter.

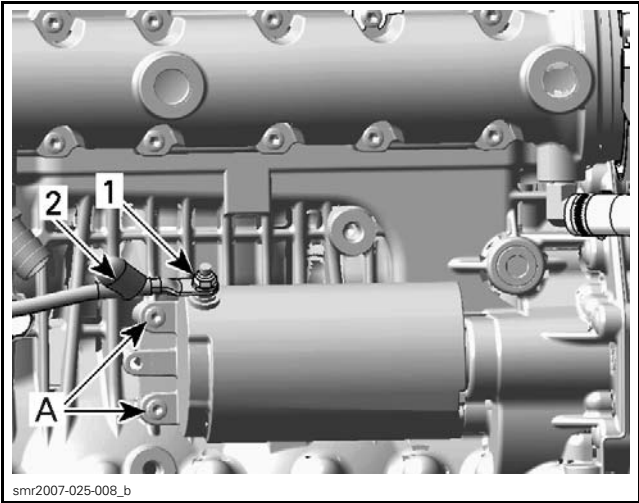
TIGHTENING TORQUE	
Starter retaining screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in) + LOCTITE 243 (BLUE) (P/N 293 800 060)

TIGHTENING TORQUE	
Starter cable retaining nut	7 N•m ± 1 N•m (62 lbf•in ± 9 lbf•in)

 **WARNING**

To prevent electric shock whenever connecting the RED power cable to the starter motor, ensure the BLACK (-) battery cable is disconnected.

- 4. Apply DIELECTRIC GREASE (P/N 293 550 004) on terminal and nut.
- 5. Install rubber protector over starter power cable retaining nut.



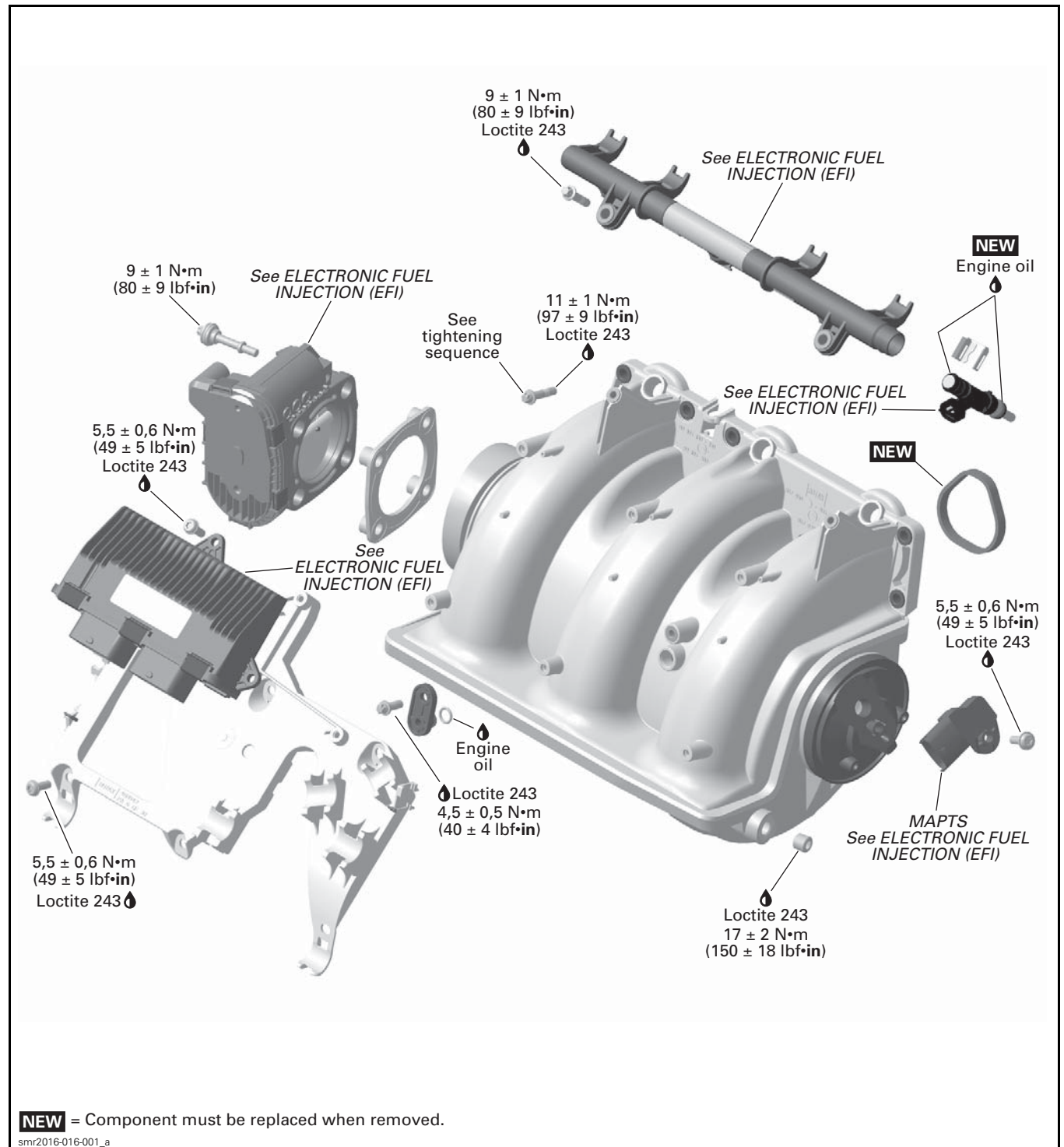
- 1. Cable retaining nut
- 2. Rubber protector

6. Reinstall all remaining removed parts.

INTAKE MANIFOLD

SERVICE PRODUCTS

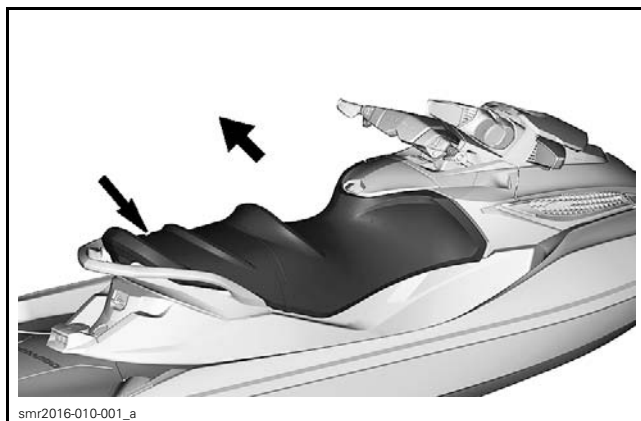
Description	Part Number	Page
LOCTITE 243 (BLUE).....	293 800 060	5-6



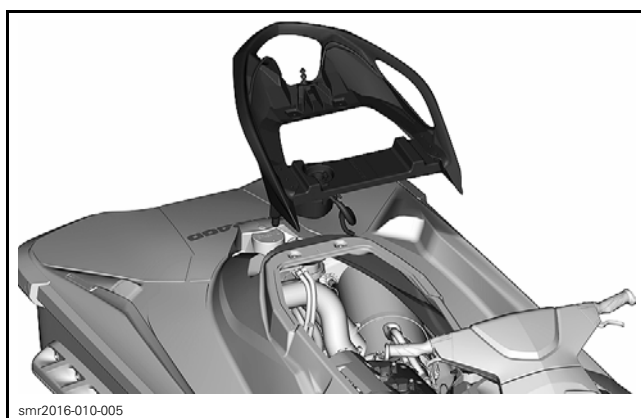
PROCEDURES

INTAKE MANIFOLD

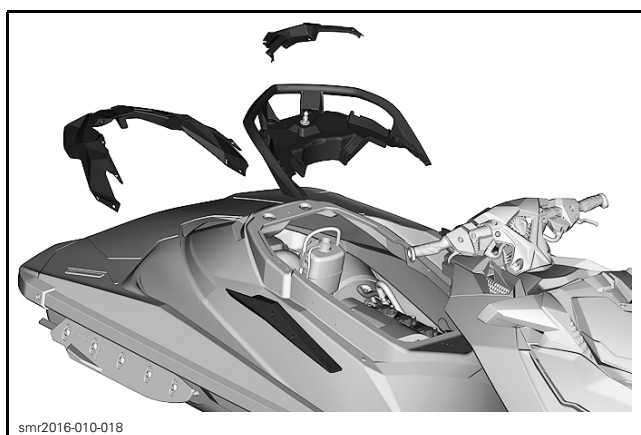
Intake Manifold Access



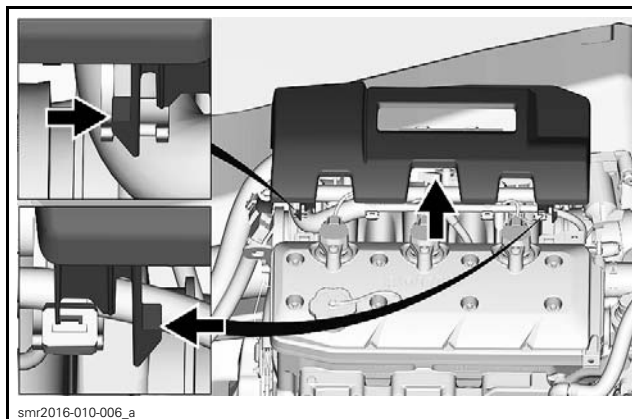
GTX LTD SHOWN



GTX LTD AND RXT-X MODELS

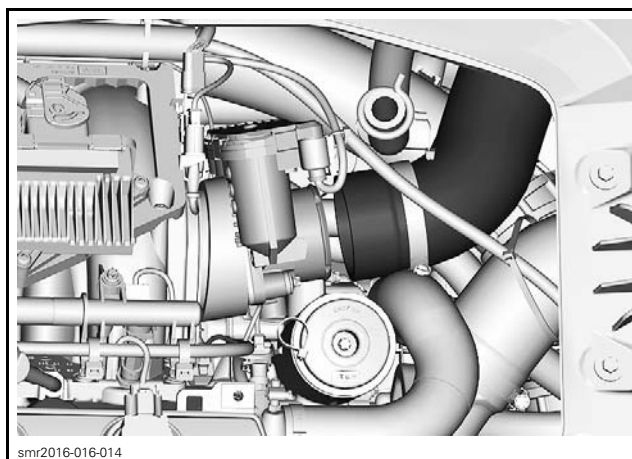


RXP X MODELS



Move the coolant expansion tank aside to make room.

Removing the Intake Manifold

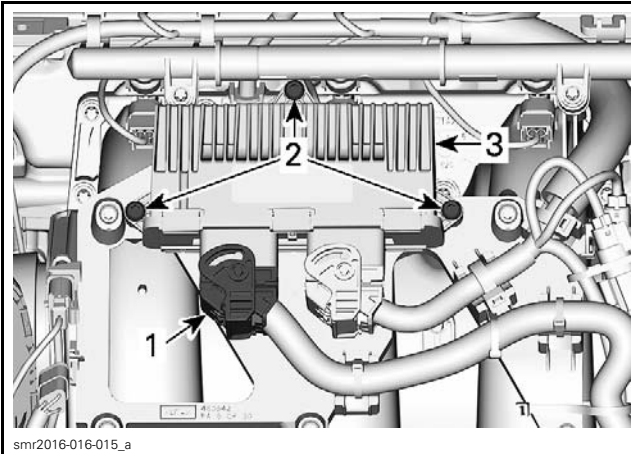


Remove the oil dipstick.

Disconnect fuel hose connector at fuel rail. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.

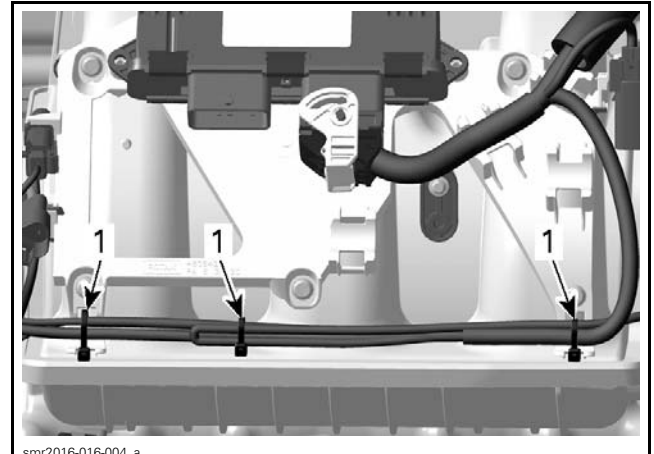
Unplug the "B" connector from the ECM. Refer to *CONNECTOR INFORMATION* subsection for procedure.

Unscrew ECM retaining screws.



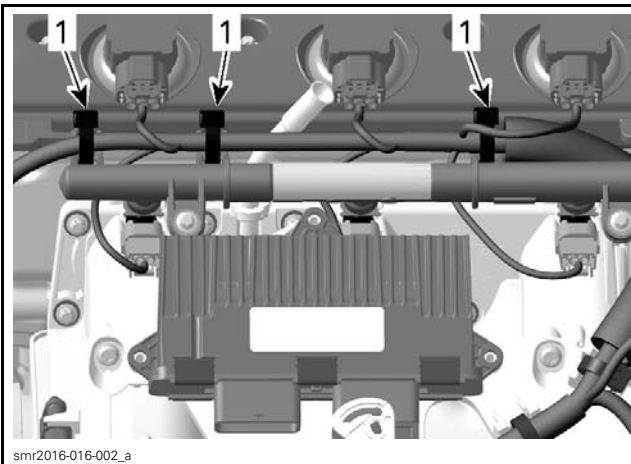
1. Connector "B"
2. Retaining screws
3. ECM

Cut locking ties securing the wiring harnesses to the intake manifold.

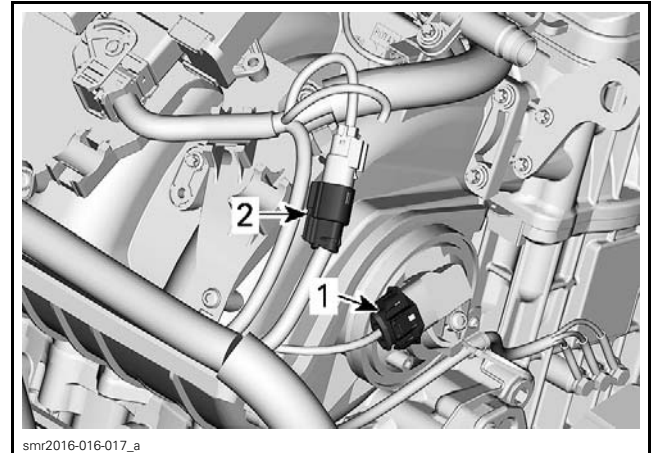


1. Locking ties (3x)

Unplug the manifold absolute pressure and temperature sensor (MAPTS) and the engine connector.



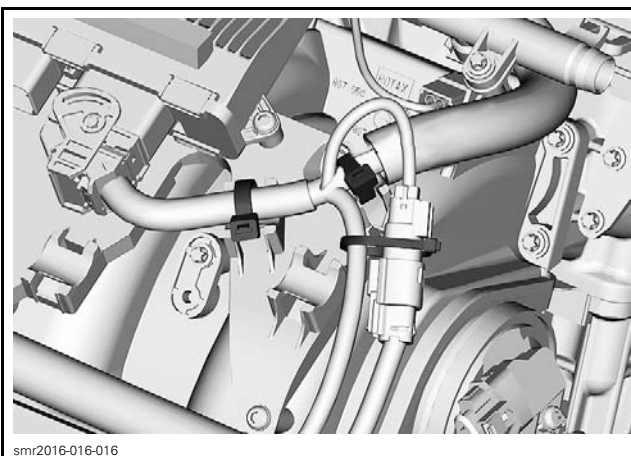
1. Locking ties (3x)



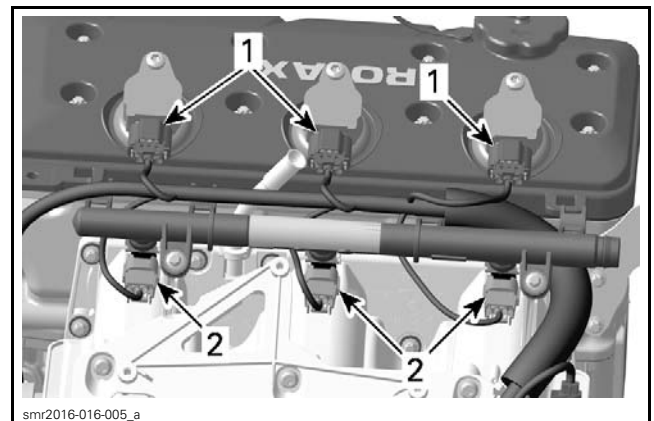
1. MAPTS connector
2. Engine connector location

Remove ECM from its support.

Unplug the ignition coil and fuel injector connectors.



LOCKING TIES (3X)



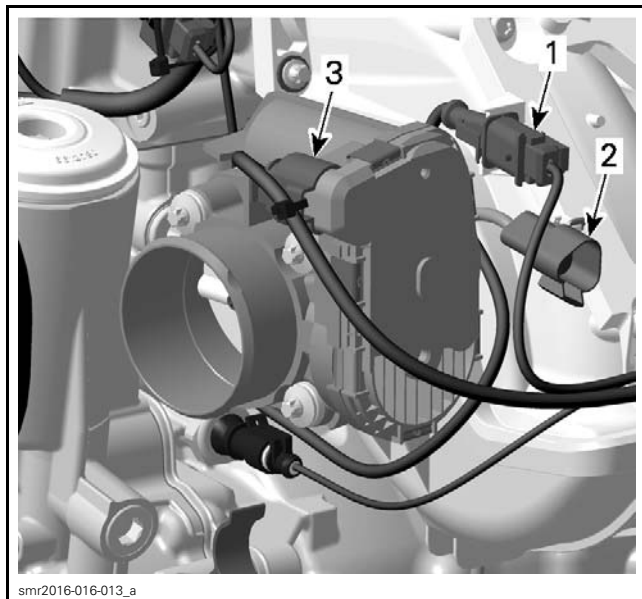
1. Ignition coil connectors
2. Fuel injector connectors

Cut locking tie from throttle body connector.

Subsection XX (INTAKE MANIFOLD)

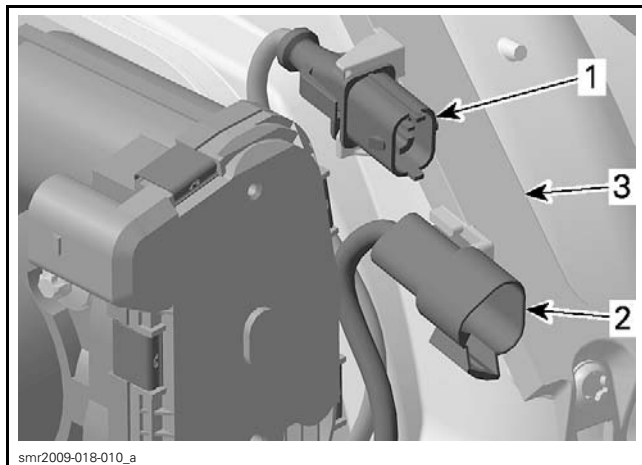
Unplug:

- Knock sensor (KS)
- Stator connector
- Throttle body connector.



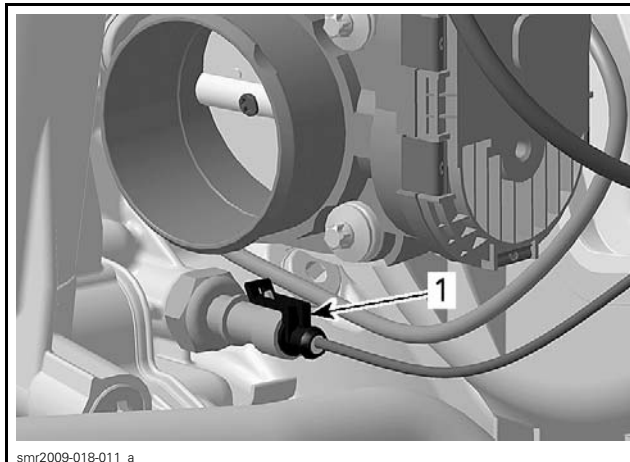
1. KS connector
2. Stator connector location
3. Throttle body connector

Detach the knock sensor (KS) and stator connector housings from the ECM support. For more details, refer to *CONNECTOR INFORMATION* subsection.



1. KS connector
2. Stator connector
3. ECM support

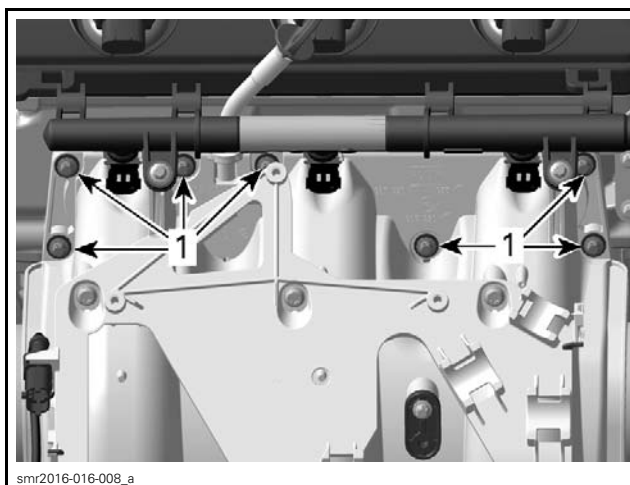
Unplug the oil pressure switch (OPS).



1. Oil pressure switch (OPS)

Pull the engine wiring harness with the ECM plugged away from intake manifold.

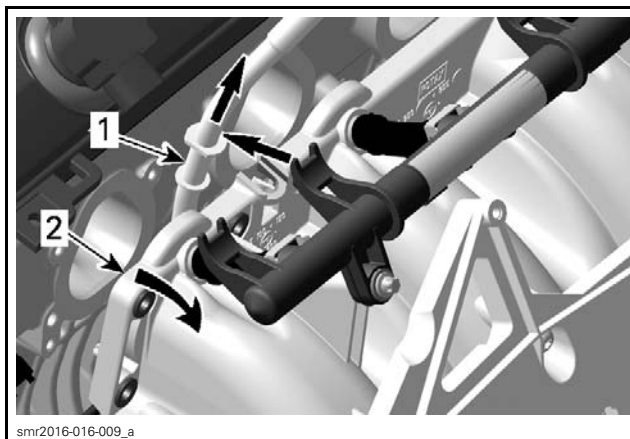
Remove manifold retaining screws.



1. Manifold retaining screws

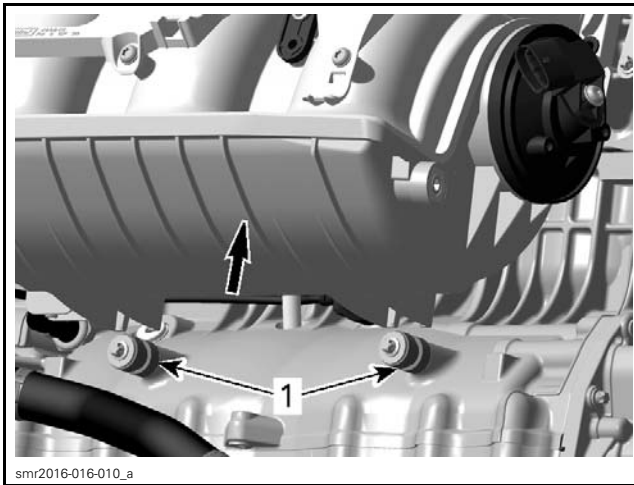
Carefully tilt intake manifold.

Then push the oil dipstick tube out of the manifold slot and pull it out of its bore in the cylinder block.



1. Oil dipstick tube
2. Intake manifold

Lift intake manifold up to pull it out of the mounting brackets.



1. Mounting brackets

Pull intake manifold out.

Remove and discard intake manifold gaskets.

Inspecting the Intake Manifold

Check intake manifold for cracks, warping at flanges or any other visible damage.

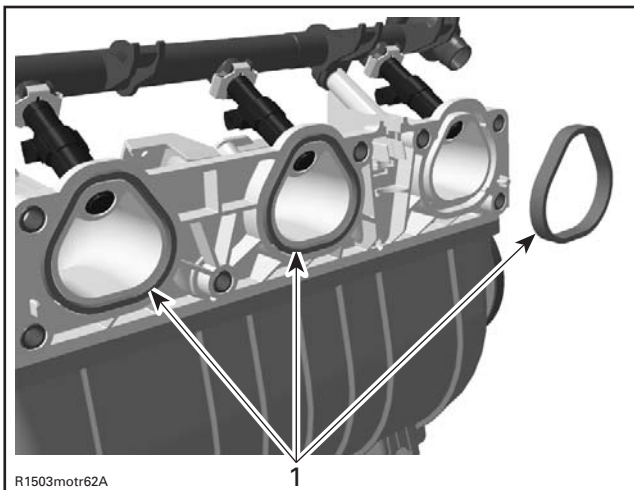
Check if intake manifold gaskets are cracked, brittle or otherwise damaged.

Replace damaged parts as necessary.

Installing the Intake Manifold

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

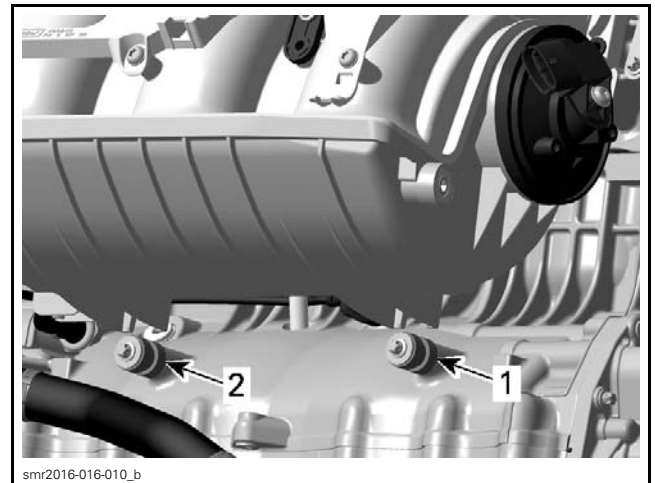
Properly install **NEW** gaskets.



INTAKE MANIFOLD

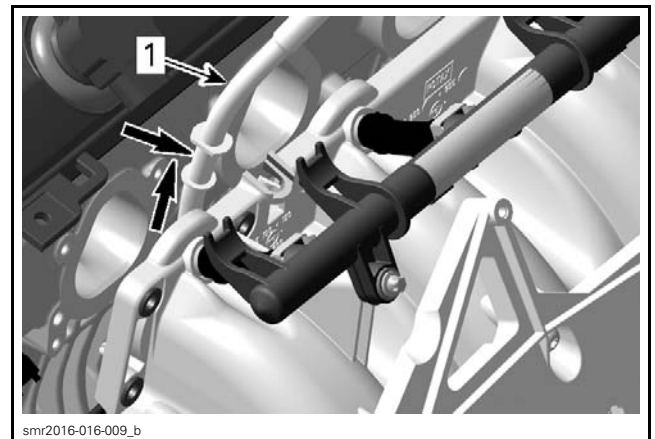
1. Gaskets

First, position intake manifold on front mounting bracket then push manifold toward engine, then proceed with rear mounting bracket.



1. Front mounting bracket
2. Rear mounting bracket

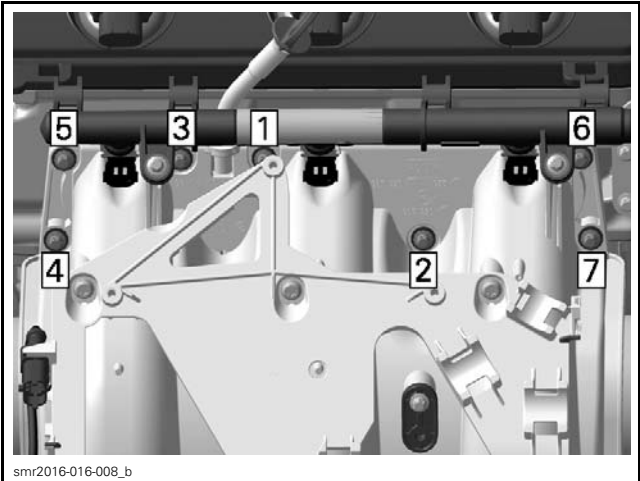
When installing the intake manifold, lift up the oil dipstick tube a little bit to fit in the slot of the manifold.



1. Oil dipstick tube

Tighten intake manifold to specification using the following sequence.

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Intake manifold screws	11 N•m ± 1 N•m (97 lbf•in ± 9 lbf•in)



TIGHTENING SEQUENCE

Ensure to properly route and secure wiring harness with locking ties.

Install the ECM on its support.

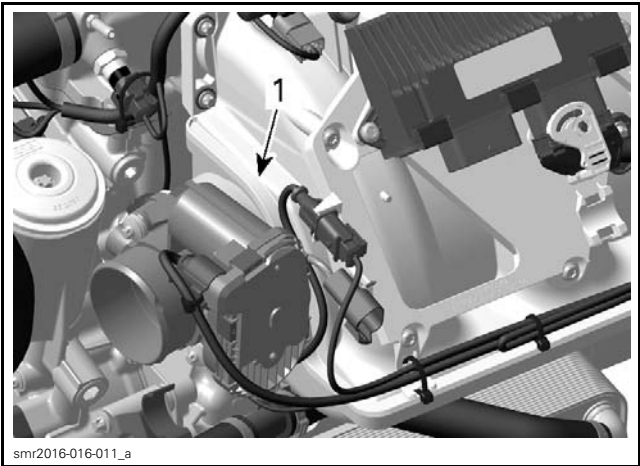
TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
ECM retaining screws	5.5 N•m ± 0.6 N•m (49 lbf•in ± 5 lbf•in)

Install all other removed parts.

FLAME ARRESTER

Flame Arrester Location

The flame arrester is integrated in the intake manifold.



1. Flame arrester inside intake manifold

Inspecting the Flame Arrester

The flame arrester in the intake manifold is maintenance free.

Flame Arrester Replacement

NOTE: The flame arrester can not be removed from the intake manifold.

Replace intake manifold if necessary. Refer to *INTAKE MANIFOLD* in this subsection.

CYLINDER HEAD

SERVICE TOOLS

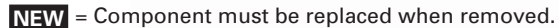
Description	Part Number	Page
CAMSHAFT LOCKING TOOL.....	529 035 839	11
DRIVE SHAFT ADAPTER.....	529 035 985	3
ENGINE LEAK DOWN TEST KIT	529 035 661	4
VALVE GUIDE PUSHER (6 MM).....	529 036 087	19
VALVE GUIDE REMOVER (6 MM)	529 036 086	19
VALVE SPRING COMPRESSOR CUP.....	529 036 073	15
VALVE SPRING COMPRESSOR	529 035 724	15

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
SNAP-ON VALVE STEM SEAL PLIERS	YA8230	16

SERVICE PRODUCTS

Description	Part Number	Page
ISOFLEX GREASE TOPAS NB 52	293 550 021	12
LOCTITE 243 (BLUE).....	293 800 060	10, 14
MOLYKOTE G-N.....	420 297 433	19



smr2016-017-001_a

GENERAL

NOTE: When diagnosing an engine problem, always perform an engine leak test. This will help pin-point a problem. Refer to *ENGINE LEAK TEST* in this subsection for procedures.

When disassembling parts that are duplicated in the engine, (e.g.: valves, bushings), it is strongly recommended to note their position and to keep them as a “group”. If you find a defective component, it will be much easier to find the cause of the failure. Since parts were break-in together during the engine operation, they will keep their matched fit when parts are reassemble together within their “group”.

INSPECTION

ENGINE LEAK TEST

The procedure has to be done when engine operating temperature of approximately 70°C (158°F) is reached.



WARNING

Be careful to burns when working on a hot engine.

Preparation

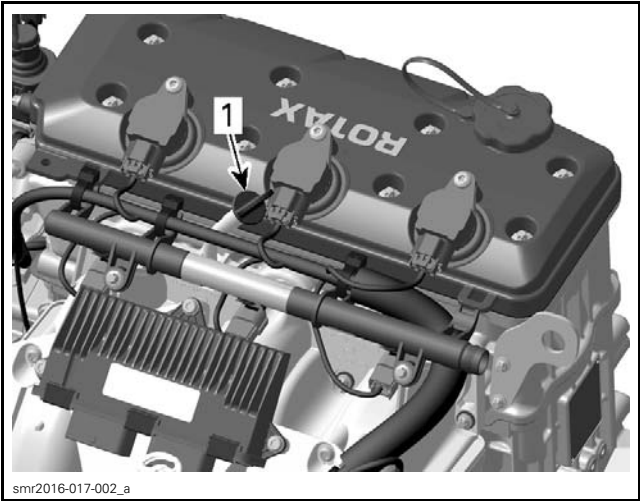
- 1. Remove any required parts to give access to engine.
- 2. Remove the tether cord.
- 3. Remove jet pump (refer to *JET PUMP* subsection).
- 4. Remove coolant pressure cap.



WARNING

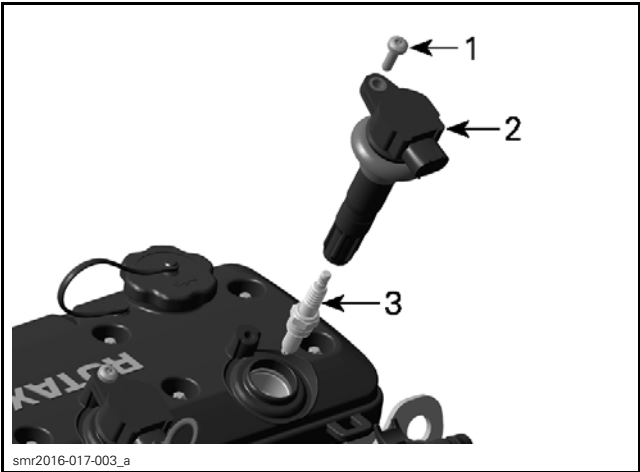
To avoid potential burns, only remove the coolant pressure cap by wearing the appropriate safety equipment.

- 5. Remove oil dipstick.



1. Oil dipstick

- 6. Unplug and remove ignition coils.
- 7. Remove spark plugs.



1. Retaining screw
2. Ignition coil
3. Spark plug

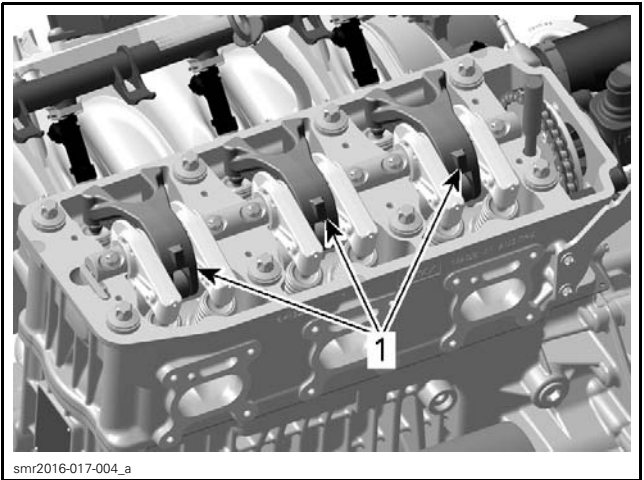
- 8. Remove *VALVE COVER*, see procedure in this subsection.
- 9. Install the drive shaft adapter and an appropriate wrench lever on drive shaft end.

REQUIRED TOOL	
DRIVE SHAFT ADAPTER (P/N 529 035 985)	

Leak Test Procedure

NOTE: Cylinder numbers are molded on valve cover.

- 1. Rotate engine crankshaft counterclockwise until the cylinder 1 is at Top Dead Center (TDC) compression stroke.
 - 1.1 As the engine crankshaft is turned over, observe the movement of intake rocker arm of the cylinder to be checked.
 - 1.2 After piston completes its cycle and the intake valve closes, observe the piston.
 - 1.3 When it reaches its uppermost position this is TDC compression stroke.



1. Intake rocker arms

- 2. Secure the wrench lever, at the end of the drive shaft, against hull to prevent further crankshaft rotation.
- 3. Install the leak down test tool.

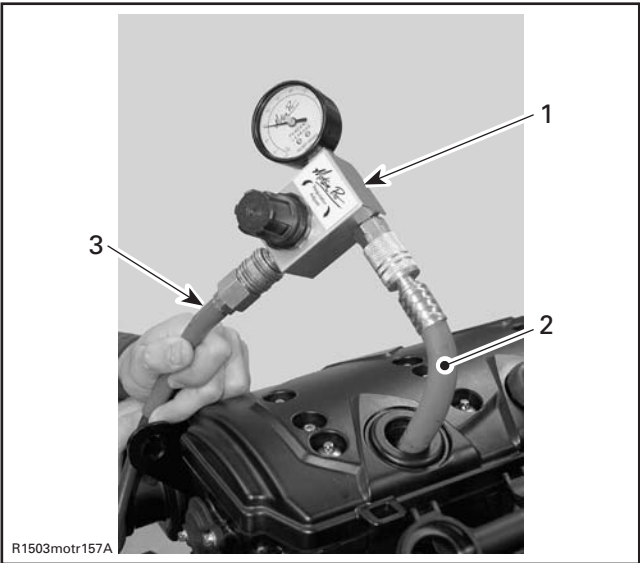
REQUIRED TOOL

ENGINE LEAK DOWN TEST KIT
(P/N 529 035 661)

- 3.1 Install the appropriate gauge adapter into spark plug hole.
- 3.2 Connect the leak down tester gauge to the gauge adapter.
- 3.3 Connect to an adequate pressurized air supply.
- 3.4 Set needle of measuring gauge to zero (0).

NOTE: Each tester will have specific instruction on the gauge operation and required pressure. Refer to manufacturer's instructions.

- 4. Supply combustion chamber with air.



TYPICAL
1. Leak down tester gauge
2. Gauge adapter
3. Air supply hose

- 5. Note the amount of leaking or percentage (depending on tester).

LEAKAGE PERCENTAGE	ENGINE CONDITION
Up to 15%	Excellent condition
16% to 25%	Good condition
26% to 40%	Fair condition; engine will run and performance might be down in some cases
41% and higher	Poor condition, diagnose and repair engine

- 6. Proceed the same way with remaining cylinders.

Diagnostic

Pressurize area to be tested, spray soap/water solution at the indicated location and look and/or listen for air bubbles.

OBSERVATION	CAUSE
Air escaping on intake port	Leaking intake valve(s)
Air escaping on exhaust port	Leaking exhaust valve(s)
Air escaping into crankcase	Excessively worn and/or broken piston rings
Air bubbles out of coolant tank	Leaking cylinder head gasket

OBSERVATION	CAUSE
Air/water escaping from cylinder-block/head	Damaged gasket and/or loosened screws
Coolant escaping from water pump housing	Damaged gasket and/or loosened screws (refer to <i>COOLING SYSTEM</i>)
Coolant escaping from leak indicator hole	Damaged rotary seal on water pump shaft (refer to <i>COOLING SYSTEM</i>)
Oily contamination on leak indicator hole	Damaged oil seal on water pump shaft

Reassembly

For reassembly, reverse the preparation procedure. Use torque values and service products from the exploded views (refer to proper *ENGINE* subsections).

Properly install ignition coils. Refer to *IGNITION SYSTEM* subsection.

TROUBLESHOOTING

The following is provided to help in diagnosing the probable source of problems. It is a guideline and it should not be assumed to list all possible problems.

Always check for fault codes. If a fault code is detected, service the fault code first. Refer to *DIAGNOSTIC AND FAULT CODES* section.

UNUSUAL ENGINE NOISE OR VIBRATIONS

1. **Incorrect camshaft timing adjustment**
- Replace damaged components and readjust camshaft timing.
2. **Camshaft timing gear screws got loose**
- Retighten screws with the recommended torque.
3. **Rocker arm(s) hydraulic element is broken or worn out (improper valve adjustment).**
- Replace faulty rocker arm(s).
4. **Rocker arm screw not properly tightened**
- Retighten screws with recommended torquing procedure.
5. **Faulty chain tensioner**
- Replace chain tensioner.
6. **Chain guide is worn out**
- Replace chain guide.

7. **Stretched timing chain or worn out sprocket**
- Replace timing chain and sprocket.
8. **Camshaft is worn out**
- Check if camshaft radial clearance is out of specification.

OIL LEAKAGE FROM CYLINDER HEAD

1. **Valve cover gasket is leaking**
- Replace valve cover gasket and retighten screws with recommended torque.
- Check valve cover for cracks or other damage. Replace if necessary.
2. **Valve cover screws are leaking**
- Replace valve cover screws.
3. **Spark plug tube gasket is leaking**
- Remove valve cover and replace spark plug tube gasket.
- Clean spark plug area from oil spillage.
4. **Blow by valve is leaking**
- Replace blow by valve O-ring.
5. **Camshaft sensor O-ring is leaking**
- Replace camshaft sensor O-ring.
6. **Cylinder head gasket is leaking**
- Remove cylinder head and check for damage.
- Replace cylinder head gasket and retighten screws with recommended torquing procedure.

ENGINE LACKS ACCELERATION OR POWER

1. **Incorrect camshaft timing adjustment**
- Replace damaged components and readjust camshaft timing.
2. **Intake or exhaust valves are leaking**
- Perform *ENGINE LEAK TEST*.
- Check if valve seats properly in valve seat.
- Repair or replace damaged components.
3. **Broken valve spring(s)**
- Replace defective parts.
4. **Broken rocker arm(s)**
- Replace defective parts.

PROCEDURES

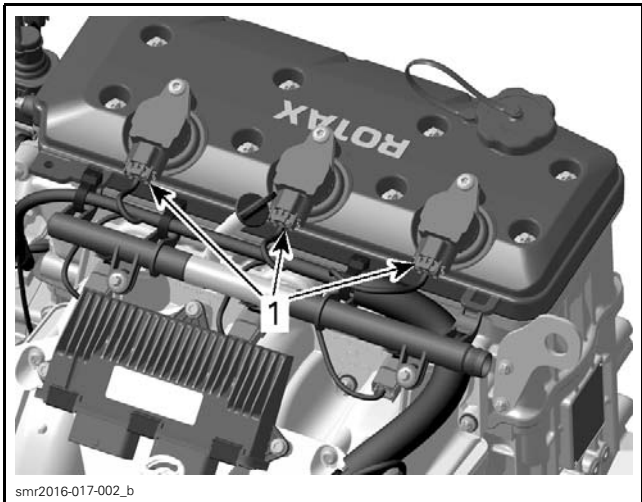
VALVE COVER

Valve Cover Access

Open or remove seat.

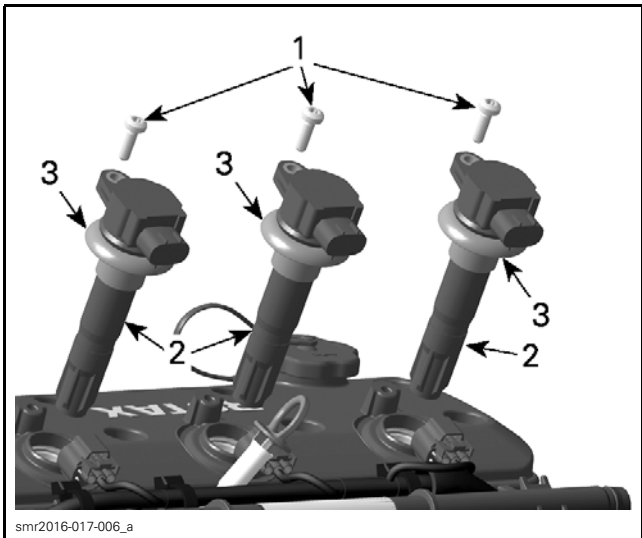
Removing the Valve Cover

1. Unplug ignition coils.



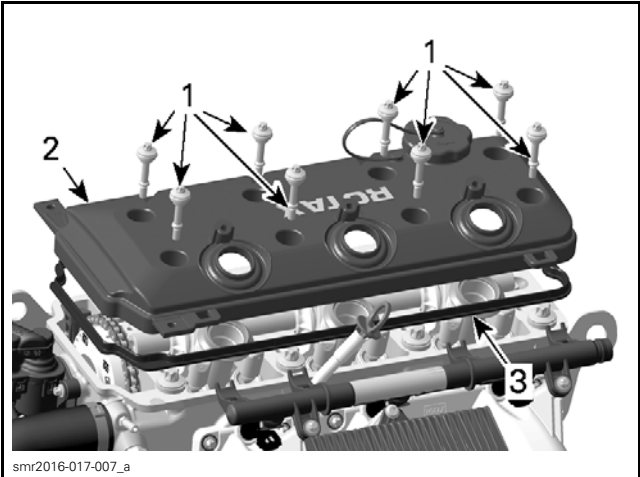
1. Ignition coil connectors

2. Remove:
- Retaining screws
 - Ignition coils
 - Gaskets.



1. Retaining screws
2. Ignition coils
3. Gaskets

3. Remove:
- Valve cover screws
 - Valve cover
 - Gasket (discard it).



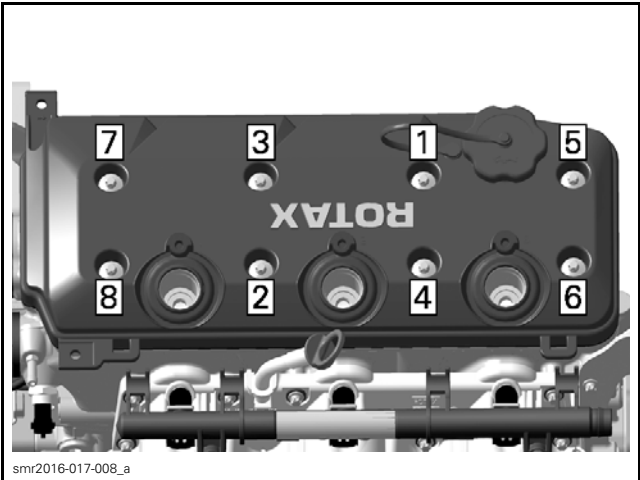
1. Valve cover screws
2. Valve cover
3. Gasket

Inspecting the Valve Cover

Check the valve cover for cracks or other damage. Check if rubber bushing on the valve cover screws are brittle, cracked or hard. If so, replace valve cover screw accordingly.

Installing the Valve Cover

The installation is the reverse of the removal procedure. However, pay attention to the following. Properly seat **NEW** gasket in the cover groove. Install the valve cover screws according to following sequence.



TIGHTENING SEQUENCE

NOTICE Repeat tightening procedure twice.

TIGHTENING TORQUE	
Valve cover screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

Install ignition coils, refer to *IGNITION SYSTEM* subsection.

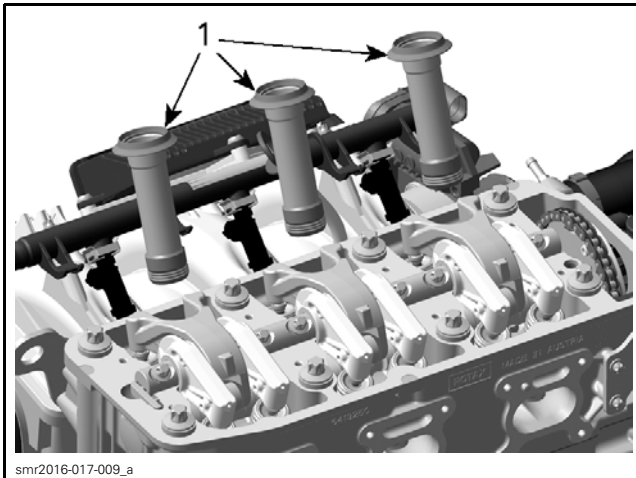
Install all other removed parts. Refer to proper subsection for procedure.

SPARK PLUG TUBES

Removing the Spark Plug Tube

Remove the *VALVE COVER*, see procedure in this subsection.

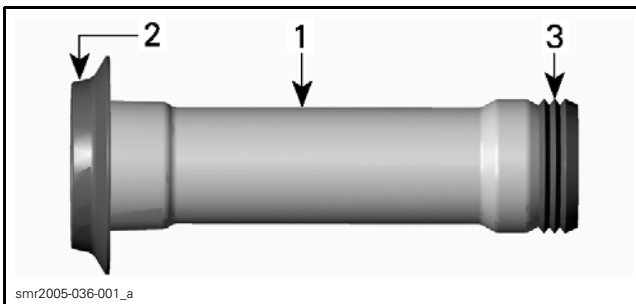
Pull spark plug tubes to remove them.



1. Spark plug tubes

Inspecting the Spark Plug Tube

Check seals on spark plug tube. If seals are brittle, cracked or hard, replace spark plug tube.



TYPICAL

1. Spark plug tube
2. Seal to the valve cover
3. Seal to the cylinder head

Installing the Spark Plug Tube

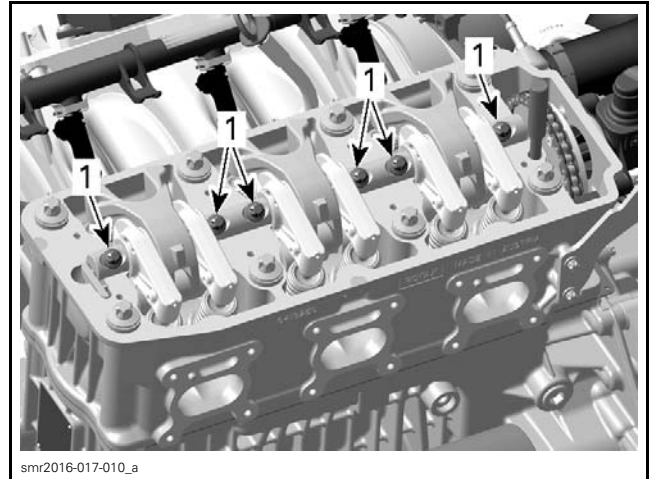
The installation is the reverse the removal procedure. However, pay attention to the following detail.

Apply engine oil on seals.

ROCKER ARMS

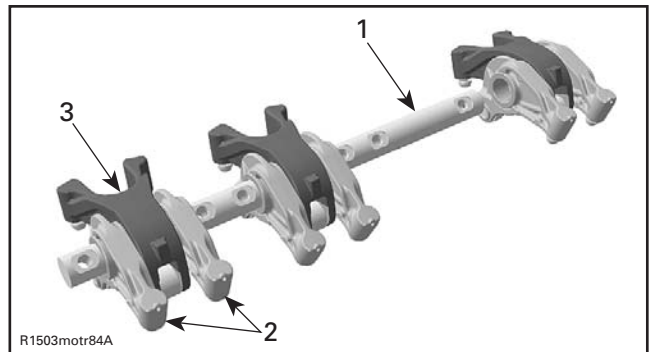
Removing the Rocker Arm

1. See procedure in this subsection to remove:
 - Valve cover
 - Spark plug tubes.
2. Remove and discard rocker arm shaft screws.



1. Rocker arm shaft screws

3. Remove rocker arm shaft with rocker arms.



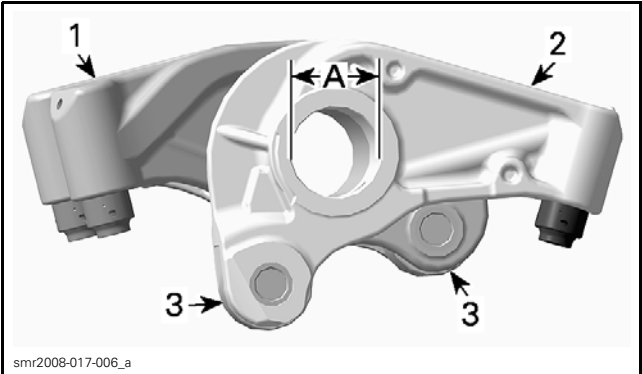
1. Rocker arm shaft
2. Rocker arms (exhaust side)
3. Rocker arm (intake side)

Inspecting the Rocker Arm

Inspect each rocker arm for cracks and scored friction surfaces. If so, replace rocker arm assembly.

Check the rocker arm rollers for free movement, wear and excessive radial play. Replace rocker arm assembly as necessary.

Subsection XX (CYLINDER HEAD)



- 1. Rocker arm (intake side)
- 2. Rocker arm (exhaust side)
- 3. Rollers
- A. Rocker arm inside diameter

Measure rocker arm inside diameter. If diameter is out of specification, change the rocker arm assembly.

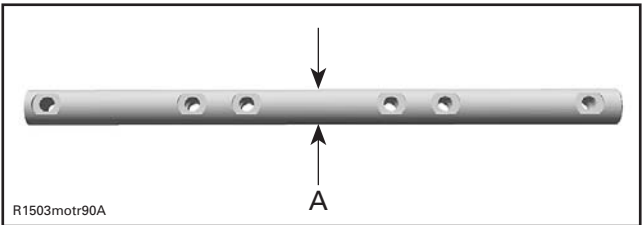
ROCKER ARM INSIDE DIAMETER	
NEW	20.007 mm to 20.020 mm (.7877 in to .7882 in)
SERVICE LIMIT	20.050 mm (.7894 in)

Press the hydraulic lifter with your thumb. If the hydraulic lifter can be fully pressed in, replace rocker arm. Lifter must turn freely in rocker arm bore. Otherwise, replace.

Rocker Arm Shaft

Check for scored friction surfaces, if so, replace parts.

Measure rocker arm shaft diameter.

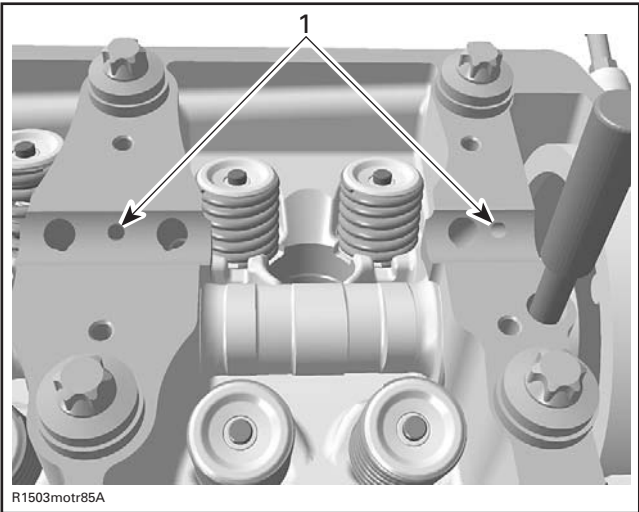


- A. Measure rocker arm shaft diameter here

ROCKER ARM SHAFT DIAMETER	
NEW	19.980 mm to 19.993 mm (.7866 in to .7871 in)
SERVICE LIMIT	19.970 mm (.7862 in)

Any area worn excessively will require parts replacement.

Verify and clean oil orifices to ensure a good rocker arm shaft lubrication.



- 1. Oil orifices from the camshaft to the rocker arm shaft, then to the rocker arms and finally to the valve adjustment

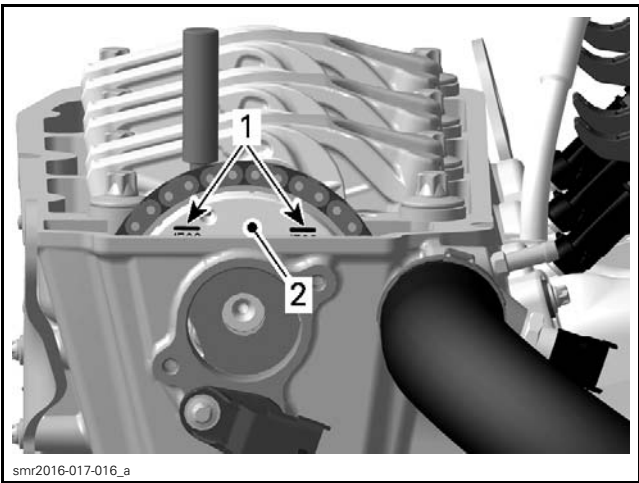
Installing the Rocker Arm

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

NOTE: The rocker arm shaft can only be installed in one specific position. Therefore strictly adhere to following procedure.

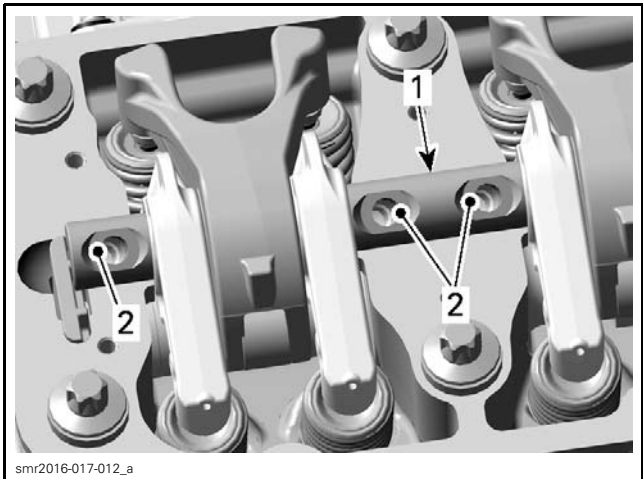
- 1. Lock camshaft. Refer to CAMSHAFT in this subsection.

NOTICE Make sure the printed marks on oil separator cover are parallel to the cylinder head base.



- 1. Printed marks
- 2. Oil separator cover

- 2. Apply engine oil on rocker arm shaft.
- 3. Position the rocker arm shaft with the notches on top.



1. Rocker arm shaft
2. Rocker arm shaft notches

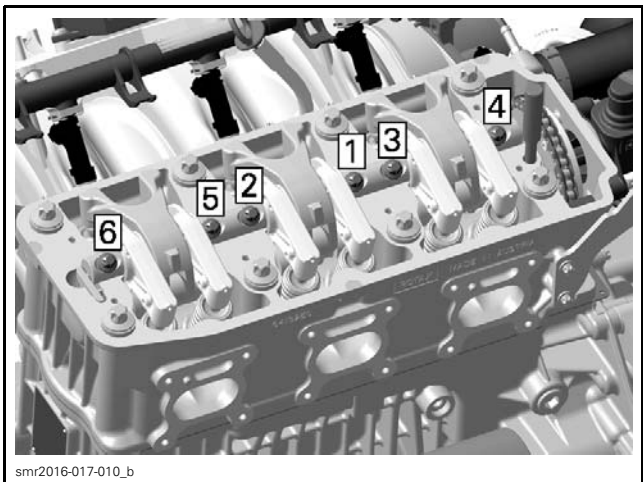
4. Install **NEW** rocker arm shaft screws.

NOTICE This assembly uses stretch screws. Always use **NEW** screws and strictly adhere to the tightening procedure.

5. Tighten screws according to following sequence.

NOTE: Always perform a step on **ALL** rocker arm shaft screws before going to the next step.

TIGHTENING PROCEDURE		
Rocker arm shaft screws	Step A	20 N•m ± 2 N•m (15 lbf•ft ± 1 lbf•ft)
	Step B	Additional 90° ± 5°



TIGHTENING SEQUENCE

CAMSHAFT TIMING GEAR

Removing the Camshaft Timing Gear

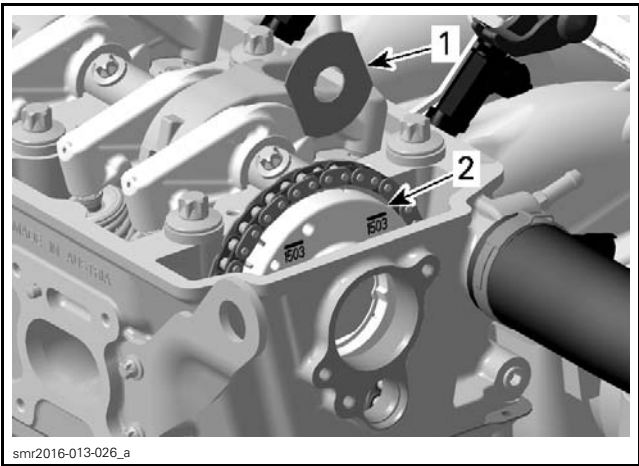
Lock crankshaft, refer to *CYLINDER BLOCK* subsection.

Remove *VALVE COVER*, see procedure in this subsection.

Remove camshaft position sensor. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.

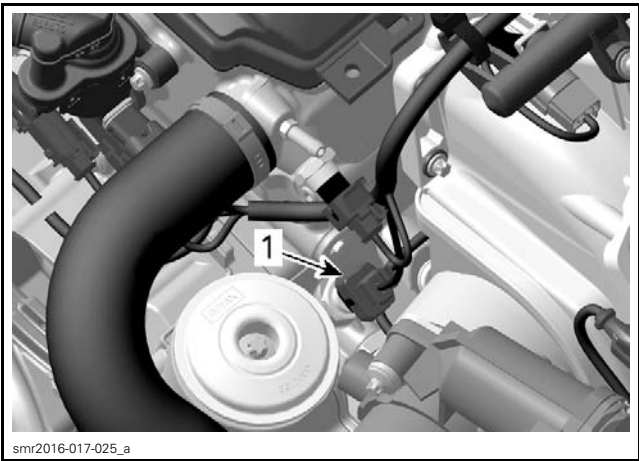
Lock camshaft. Refer to *CAMSHAFT* in this subsection.

Remove thrust washer from oil separator cover.



1. Thrust washer
2. Oil separator cover

Unplug oil temperature sensor.

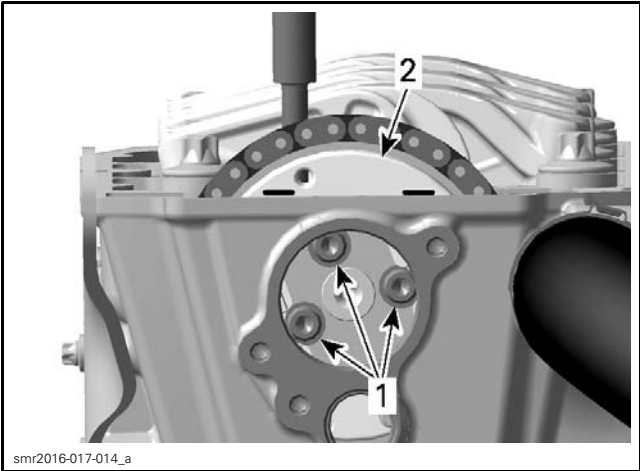


1. Oil temperature sensor connector

Remove the chain tensioner. Refer to *CYLINDER BLOCK* subsection.

Remove:

- Chain guide
- Camshaft timing gear with oil separator cover.



1. Timing gear screws
2. Camshaft timing gear with oil separator cover

NOTE: Secure timing chain with a retaining wire.

Inspecting the Camshaft Timing Gear

Check camshaft timing gear for wear or deterioration.

If gear is worn or damaged, replace it as a set (camshaft timing gear and timing chain).

NOTE: For crankshaft timing gear replacement, refer to *CYLINDER BLOCK* subsection.

Installing the Camshaft Timing Gear

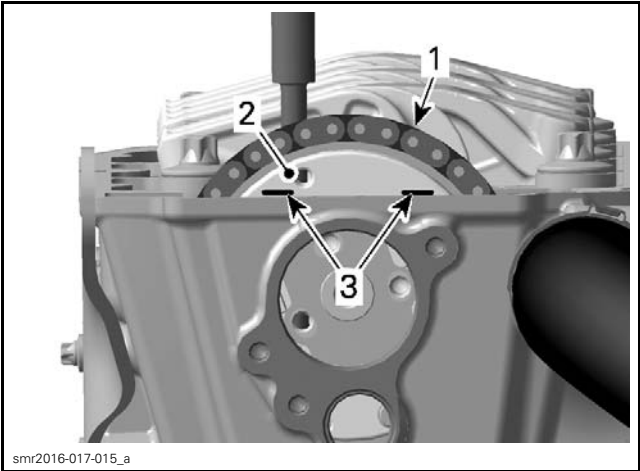
The installation is reverse of the removal procedure. However, pay attention to the following details.

Install oil separator cover on camshaft timing gear.

NOTICE Crankshaft and camshaft must be locked on TDC position.

Place camshaft timing gear along with timing chain on the camshaft.

NOTE: The printed marks on the oil separator cover must be parallel to the cylinder head base.



1. Timing chain
2. Oil separator cover
3. Printed marks

Ensure chain guides are properly installed.

Loosely install timing gear gear screws.

Install chain tensioner.

NOTE: There can be 2 different positions to install the timing gear on the camshaft. To find best position strictly follow the procedure.

Check if timing gear screws are still loose. If screws are squeezed by the timing gear, remove the chain tensioner again and rotate timing gear by one tooth clockwise.

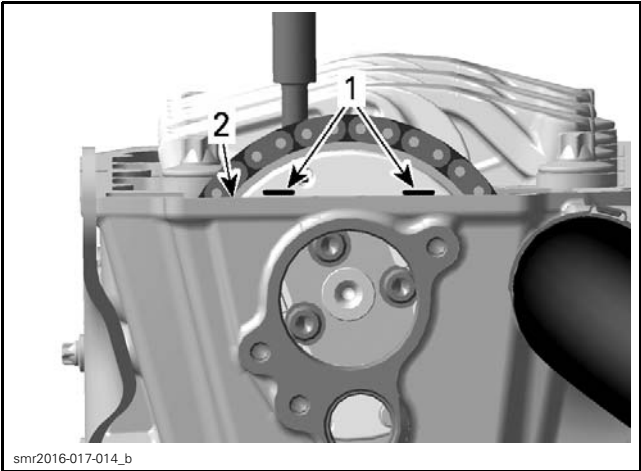
Install the chain tensioner again.

Remove timing gear screws and apply thread locker on threads.

Tighten timing gear screws to specification.

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Camshaft timing gear screws	16 N•m ± 2 N•m (142 lbf•in ± 18 lbf•in)

NOTICE Printed marks on the oil separator cover must be parallel to the cylinder head surface.



1. Printed marks
2. Cylinder head surface

Remove crankshaft and camshaft locking tools.
Install all other removed parts.

CAMSHAFT

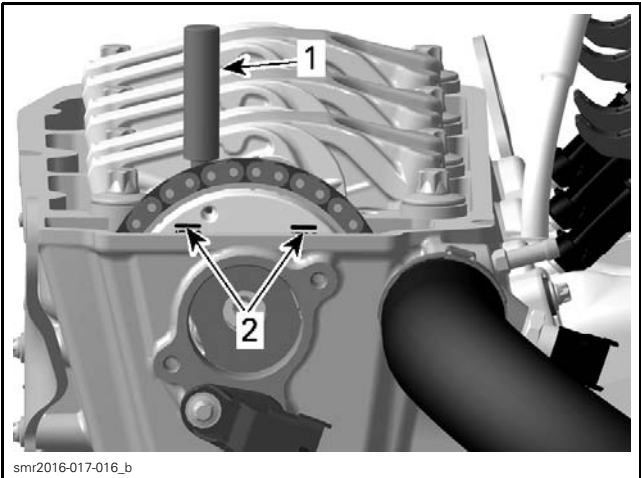
Camshaft Locking Procedure

1. Remove *VALVE COVER*, see procedure in this subsection.
2. Lock crankshaft, refer to procedure in *CYLINDER BLOCK* subsection.

NOTE: Make sure that printed marks on oil separator cover are parallel to the cylinder head base.

3. Insert the camshaft locking tool into the hole behind the camshaft timing gear to lock camshaft.

REQUIRED TOOL	
CAMSHAFT LOCKING TOOL (P/N 529 035 839)	



1. Camshaft locking tool
2. Printed marks

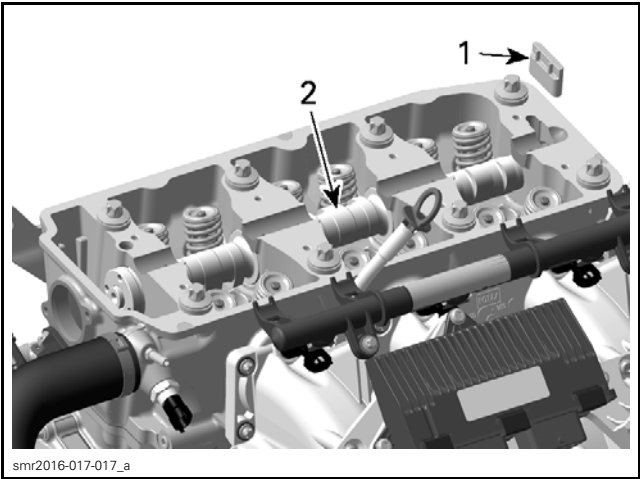
Removing the Camshaft

See procedure in this subsection and remove:

- Camshaft timing gear
- Rocker arm.

Remove:

- Camshaft lock
- Camshaft.



1. Camshaft lock
2. Camshaft

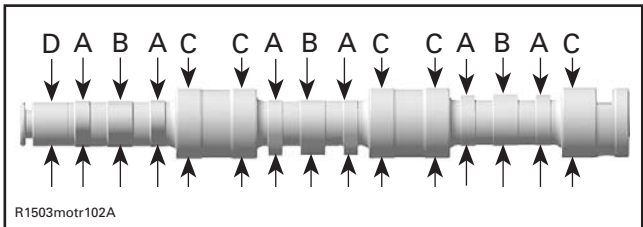
Inspecting the Camshaft

Check each lobe and bearing journal of camshaft for:

- Scoring
- Scuffing
- Cracks
- Other signs of wear.

Measure camshaft bearing journal and lobe height using a micrometer.

Measure clearance between both ends of camshaft and cylinder head.



A. Camshaft lobe (exhaust valves)
B. Camshaft lobe (intake valves)
C. Camshaft bearing journal
D. Camshaft bearing journal — engine front

CAMSHAFT LOBE HEIGHT — EXHAUST VALVE	
NEW	31.430 mm to 31.630 mm (1.2374 in to 1.2453 in)
SERVICE LIMIT	31.380 mm (1.2354 in)

Subsection XX (CYLINDER HEAD)

CAMSHAFT LOBE HEIGHT — INTAKE VALVE	
NEW	31.540 mm to 31.740 mm (1.2417 in to 1.2496 in)
SERVICE LIMIT	31.500 mm (1.2402 in)
CAMSHAFT BEARING JOURNAL	
NEW	39.892 mm to 39.905 mm (1.5706 in to 1.5711 in)
SERVICE LIMIT	39.880 mm (1.5701 in)
CAMSHAFT BEARING JOURNAL (ENGINE FRONT)	
NEW	24.939 mm to 24.960 mm (.9819 in to .9827 in)
SERVICE LIMIT	24.910 mm (.9807 in)
CAMSHAFT BEARING INNER DIAMETER	
NEW	40.000 mm to 40.020 mm (1.5748 in to 1.5756 in)
SERVICE LIMIT	40.050 mm (1.5768 in)
CAMSHAFT BEARING INNER DIAMETER (ENGINE FRONT)	
NEW	25.000 mm to 25.013 mm (.9843 in to .9848 in)
SERVICE LIMIT	25.050 mm (.9862 in)

Replace parts that are not within specifications.

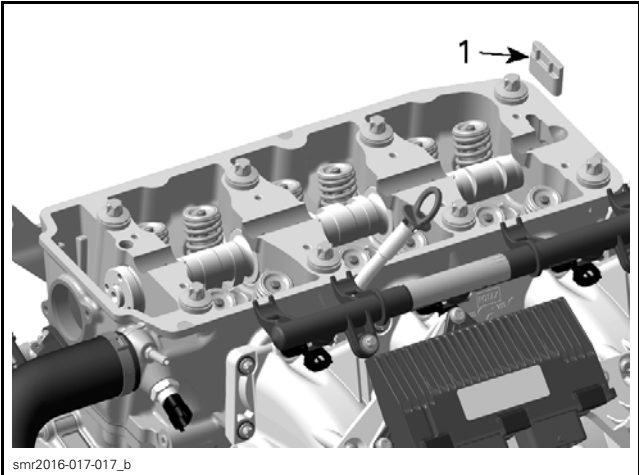
Installing the Camshaft

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

Lubricate the camshaft bearing journals.

CAMSHAFT BEARING JOURNALS	
Service product	ISOFLEX GREASE TOPAS NB 52 (P/N 293 550 021)

Install camshaft then place the camshaft lock in its slot.



1. Camshaft lock

For other parts, refer to the proper installation procedures in this subsection.

CYLINDER HEAD

Removing the Cylinder Head

Lock crankshaft, refer to *CYLINDER BLOCK* subsection.

Drain coolant, refer to *COOLING SYSTEM* subsection.

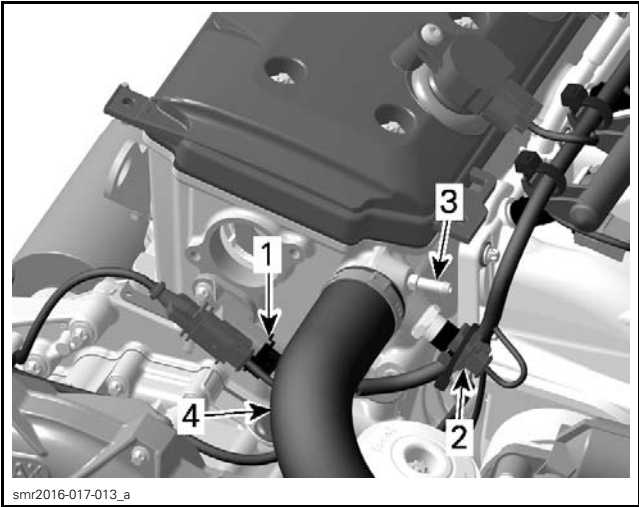
Remove blow-by valve from cylinder head. Refer to *LUBRICATION SYSTEM* subsection.

Unplug:

- Camshaft position sensors (CAPS)
- Coolant temperature sensor (CTS).

Disconnect:

- Bleeding hose
- Cylinder head outlet hose.



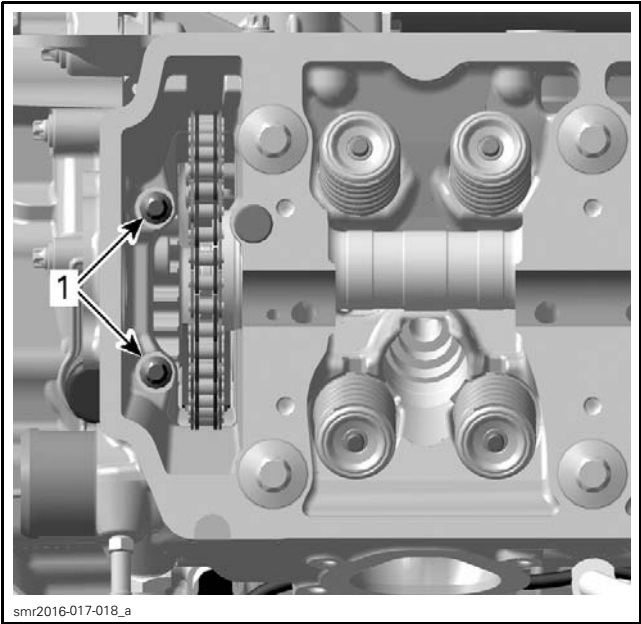
1. Camshaft position sensors (CAPS) connector
2. Coolant temperature sensor (CTS) connector
3. Bleeding nipple
4. Cylinder head outlet hose

Remove the intake manifold. Refer to *INTAKE MANIFOLD* subsection.

Remove the exhaust manifold. Refer to *EX-HAUST SYSTEM* subsection.

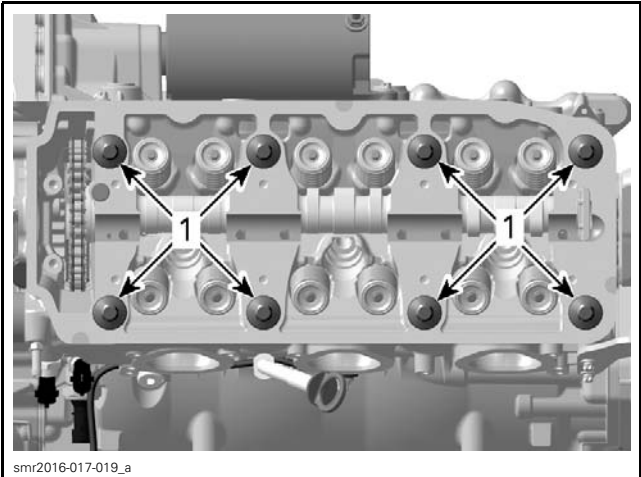
Remove the *CAMSHAFT TIMING GEAR*, see procedure in this subsection.

Remove the M6 cylinder head screws.



1. M6 cylinder head screws

Remove and discard the M11 cylinder head screws.



1. M11 cylinder head screws

Remove:

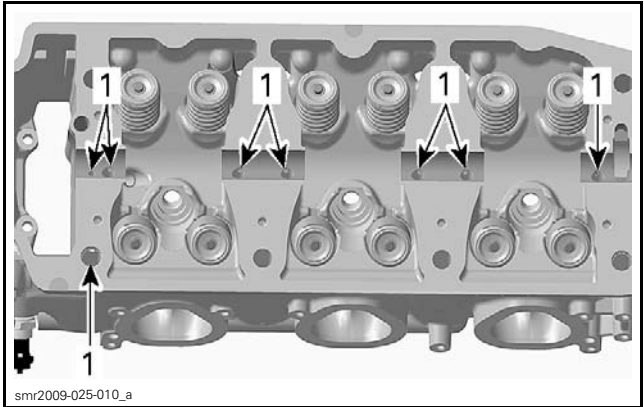
- Cylinder head
- Cylinder head gasket (discard it).

Cleaning the Cylinder Head

Remove carbon deposits from combustion chamber, exhaust port and piston top.

Clean cylinder head, especially cylinder head screw surface from oil spillage.

Blow out the oil orifices and check if they are not clogged.

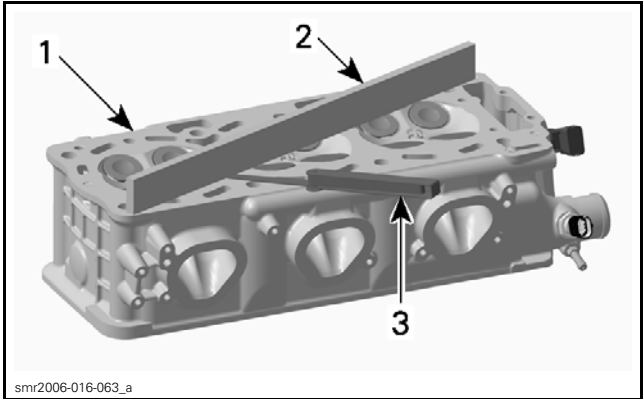


1. Oil orifices

Inspecting the Cylinder Head

Check for cracks between valve seats or other damages, if so, replace cylinder head.

Check cylinder head mating surface for flatness, using a straight edge.



1. Cylinder head
2. Flat bar
3. Feeler gauge

Check cylinder head warpage.

CYLINDER HEAD WARPAGE	
Maximum	0.15 mm (.006 in)

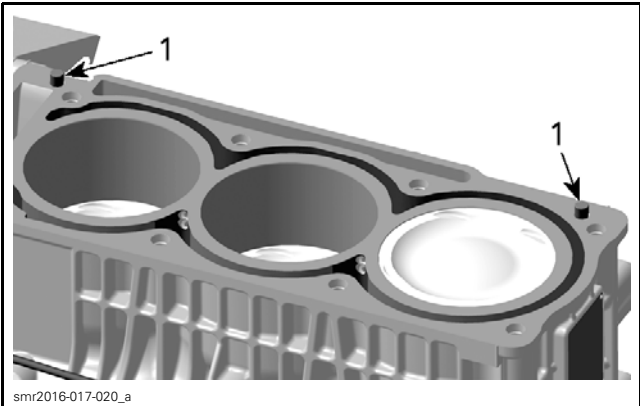
If warpage exceeds specification, replace cylinder.

Subsection XX (CYLINDER HEAD)

Installing the Cylinder Head

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

Ensure dowel pins are in place.



1. Dowel pins

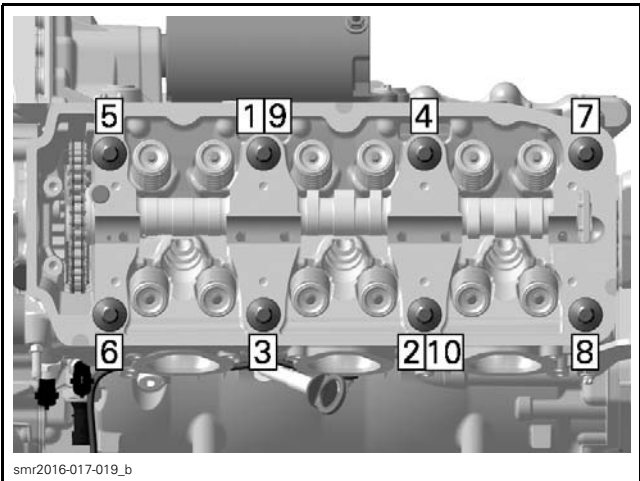
Install NEW cylinder head gasket.

NOTICE Each installation of the cylinder head requires a new cylinder head gasket. Using a gasket twice will cause engine damage.

Install NEW M11 cylinder head screws and tighten as per following procedure.

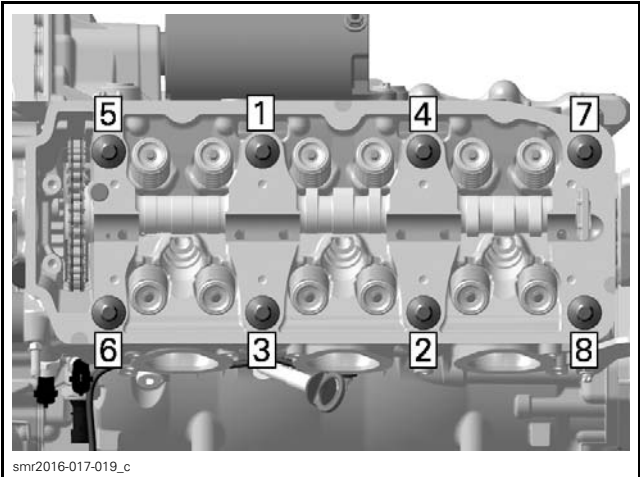
NOTICE This assembly uses stretch screws. Always use NEW screws and strictly adhere to the tightening procedure.

NOTE: Always perform a step on ALL M11 cylinder head screws before going to the next step.



TIGHTENING SEQUENCE - STEP A

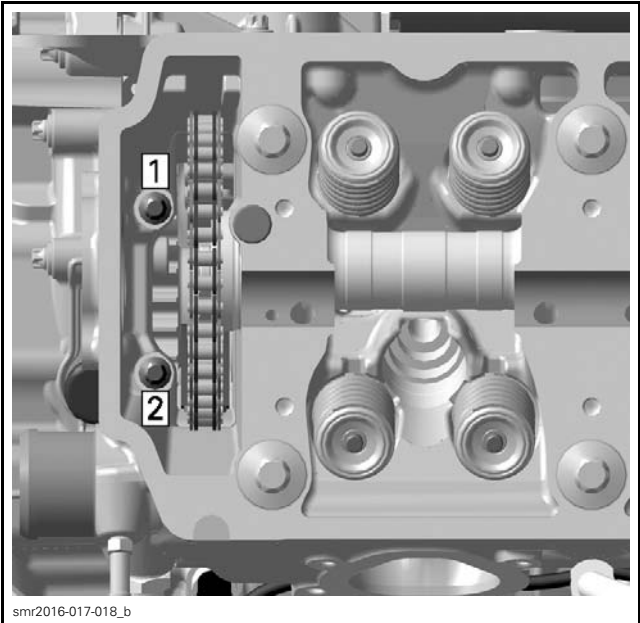
TIGHTENING PROCEDURE		
M11 cylinder head screws	Step A	40 N•m ± 3 N•m (30 lbf•ft ± 2 lbf•ft)



TIGHTENING SEQUENCE - STEP B AND C

TIGHTENING PROCEDURE		
M11 cylinder head screws	Step B	Additional 120° ± 5°
	Step C	Additional 120° ± 5°

Tighten M6 cylinder head screws to specification.



TIGHTENING SEQUENCE

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
M6 cylinder head screws	11 N•m ± 1 N•m (97 lbf•in ± 9 lbf•in)

Remove crankshaft and camshaft locking tools.
Install all removed parts.

VALVE SPRINGS

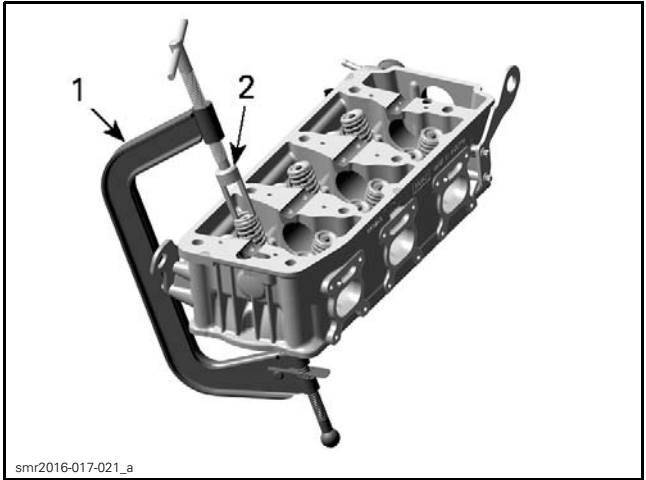
Removing the Valve Spring

See procedures in this subsection to remove:

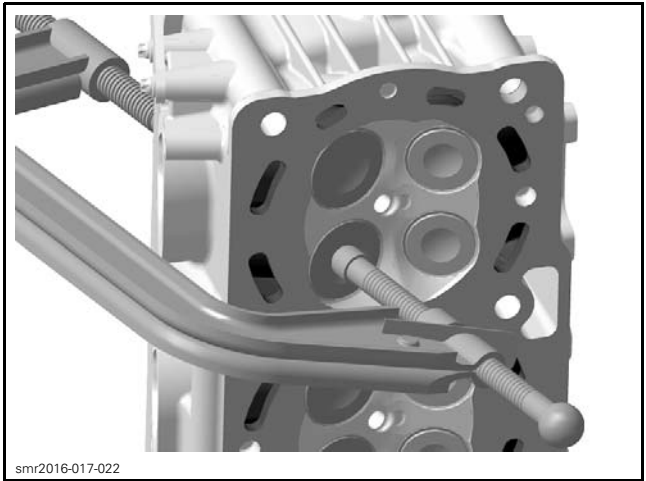
- *ROCKER ARM*
- *CYLINDER HEAD.*

Compress valve springs.

REQUIRED TOOL	
VALVE SPRING COMPRESSOR (P/N 529 035 724)	
VALVE SPRING COMPRESSOR CUP (P/N 529 036 073)	



1. Valve spring compressor clamp
2. Valve spring compressor cup



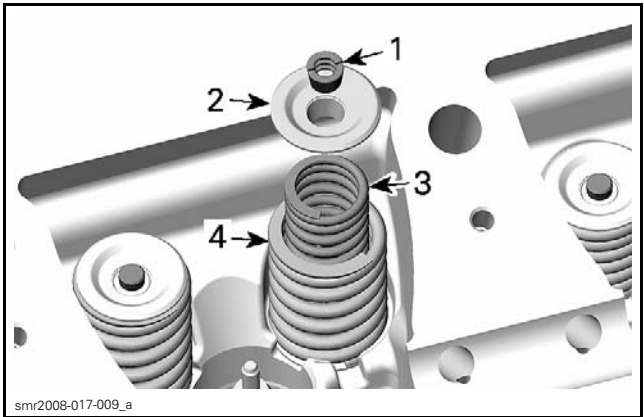
LOCATE VALVE SPRING COMPRESSOR CLAMP IN CENTER OF THE VALVE

Remove valve cotters.

Withdraw valve spring compressor tools.

Remove:

- Valve spring retainer
- Outer valve springs
- Inner valve springs.



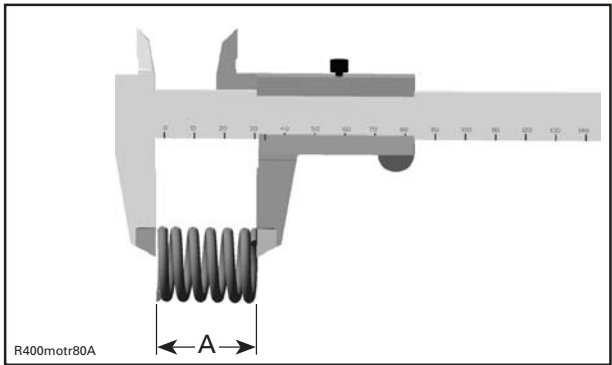
1. Valve cotters
2. Valve spring retainer
3. Inner valve spring
4. Outer valve spring

Inspecting the Valve Spring

Check valve springs for rust, corrosion or other visible damages. If so, replace faulty valve springs.

Check valve springs for free length and straightness.

Replace valve springs if not within specifications.



A. Valve spring length

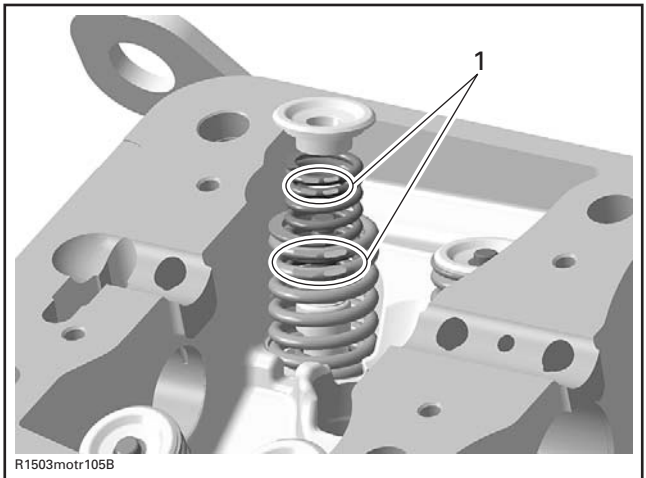
OUTER VALVE SPRING FREE LENGTH	
NEW NOMINAL	45.45 mm (1.789 in)
SERVICE LIMIT	43.00 mm (1.693 in)
INNER VALVE SPRING FREE LENGTH	
NEW NOMINAL	41.02 mm (1.615 in)
SERVICE LIMIT	38.80 mm (1.528 in)

Installing the Valve Spring

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

Colored area of the valve spring must be placed on top.

NOTE: Valve cotters must be properly engaged in valve stem grooves.



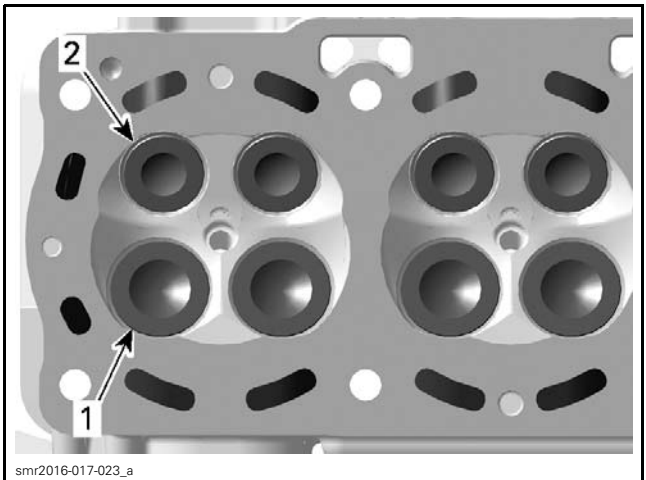
1. Position of the valve spring

VALVES

Removing the Valve

Remove valve spring.

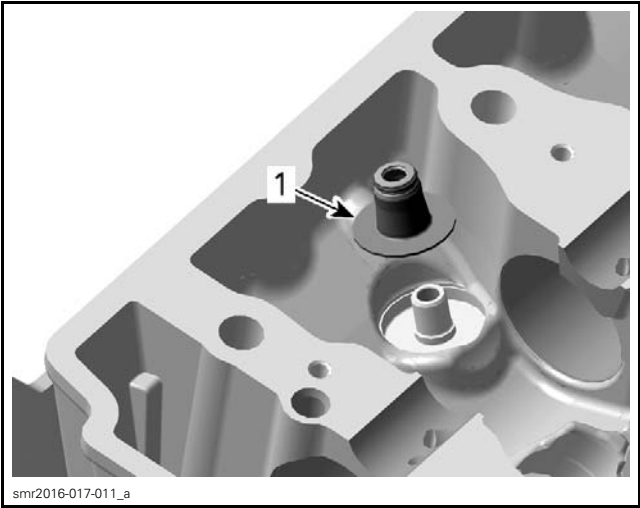
Push valve stem then pull valves out of valve guides.



1. Intake valve 38 mm
2. Exhaust valve 31 mm

Remove and discard valve stem seal.

REQUIRED TOOL
SNAP-ON VALVE STEM SEAL PLIERS (P/N YA8230)



1. Valve stem seal

Inspecting the Valve

Valve Stem Seal

Always install **NEW** seals whenever valves are removed.

Inspection of valve stem seals is not needed because **NEW** seals should always be installed whenever cylinder head is removed.

Valve

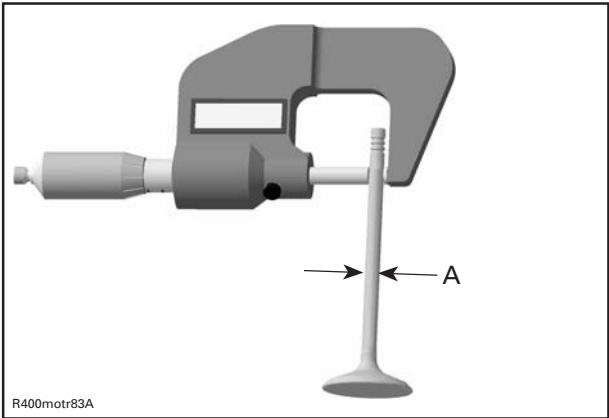
Inspect valve surface, check for abnormal stem wear and bending. If so, replace by a new one.

Valve Stem and Valve Guide Clearance

Measure valve stem and valve guide in three places, using a micrometer and a small bore gauge.

NOTE: Clean valve guide to remove carbon deposits before measuring.

Change valve if valve stem is out of specification or has other damages such as wear or friction surface.



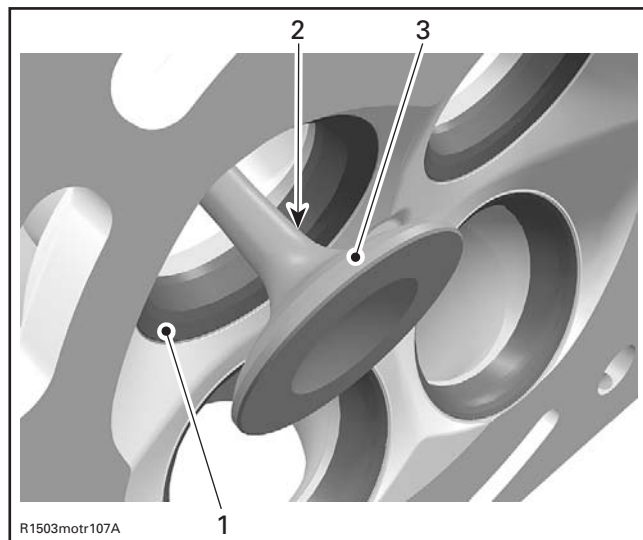
A. Valve stem diameter

VALVE STEM DIAMETER	
INTAKE VALVE	
NEW	5.961 mm to 5.975 mm (.2347 in to .2352 in)
SERVICE LIMIT	5.930 mm (.2335 in)
EXHAUST VALVE	
NEW	5.946 mm to 5.960 mm (.2341 in to .2346 in)
SERVICE LIMIT	5.930 mm (.2335 in)

Replace valve guide if it is out of specification or has other damages such as wear or friction surface. Refer to *VALVE GUIDE* in this subsection.

VALVE GUIDE INNER DIAMETER	
INTAKE AND EXHAUST VALVE	
NEW	5.994 mm to 6.018 mm (.236 in to .2369 in)
SERVICE LIMIT	6.060 mm (.2386 in)

Valve Face and Seat



1. Valve seat
2. Exhaust valve contaminated area
3. Valve face (contact surface to valve seat)

Check valve face and seat for burning or pittings and replace valve or cylinder head if there are signs of damage.

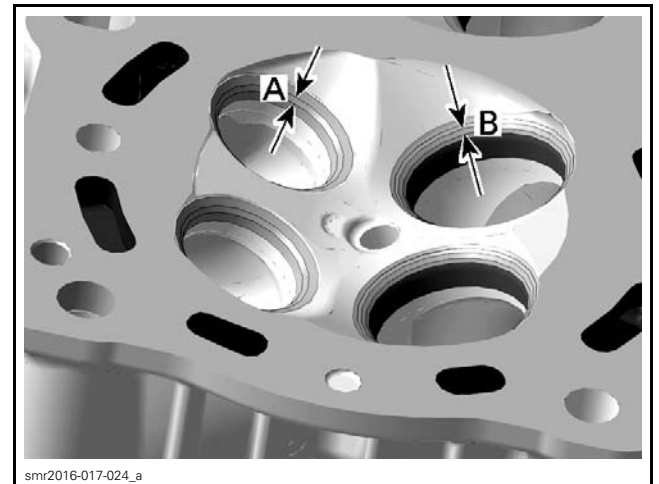
Ensure to seat valves properly. Apply some lapping compound on valve face and work valve on its seat with a lapping tool.

NOTE: The location of contact area should be in center of valve seat.

Measure valve seat width, using a caliper.

VALVE SEAT CONTACT WIDTH	
INTAKE VALVE	
NEW	1.10 mm to 1.30 mm (.043 in to .051 in)
SERVICE LIMIT	1.60 mm (.063 in)
EXHAUST VALVE	
NEW	1.25 mm to 1.55 mm (.049 in to .061 in)
SERVICE LIMIT	1.80 mm (.071 in)

If valve seat contact width is too wide or has dark spots, replace the cylinder head.



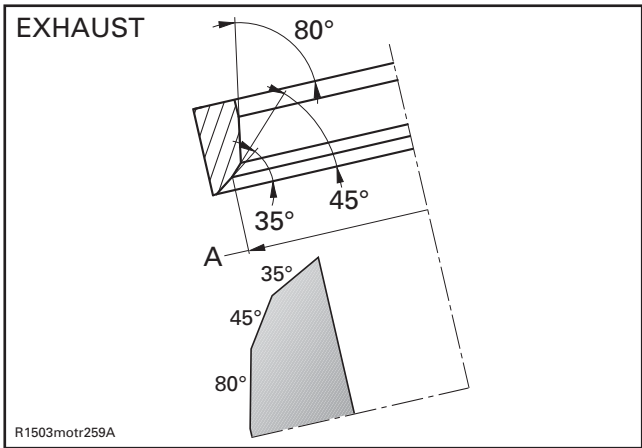
- A. Valve seat contact width - Exhaust valve
- B. Valve seat contact width - Intake valve

Valve Seat Grinding

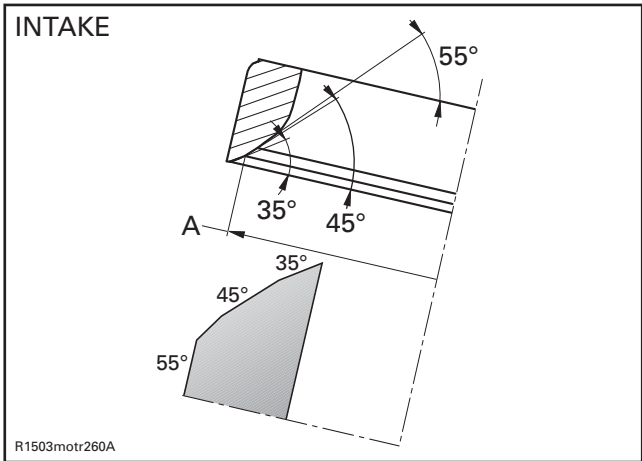
NOTE: The valve seats may be reground with a valve seat grinder which centers on the valve guide.

1. Grind the valve seat at 45°. Remove no more material than absolutely necessary to clean the seat up.
2. Using a 35° stone, narrow the valve seat until the appropriate outer diameter is obtained.

Subsection XX (CYLINDER HEAD)



A. Valve seat outer diameter EXHAUST



A. Valve seat outer diameter INTAKE

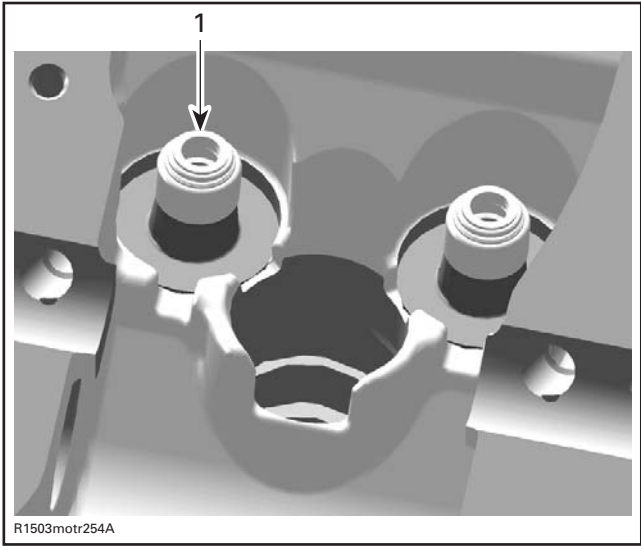
VALVE SEAT OUTER DIAMETER	
INTAKE	37.35 mm (1.4705 in)
EXHAUST	30.30 mm (1.1929 in)

- Using a 55° stone for the intake and an 80° stone for the exhaust valve, reduce the valve seat contact width to the appropriate value mentioned above.
- Finally, coat the valve seating surface with a fine paste of valve grinding compound using a manual valve grinding mandrel. Lightly grind the valves until a smooth, even, uniform sealing surface of the appropriate inside and outside diameter is obtained on both the valve and the seat. Use only a hand held valve grinding mandrel with a suction cup, rotating the valve back and forth through about 45°, and then advancing the valve 45° before repeating this operation.

Installing the Valve

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

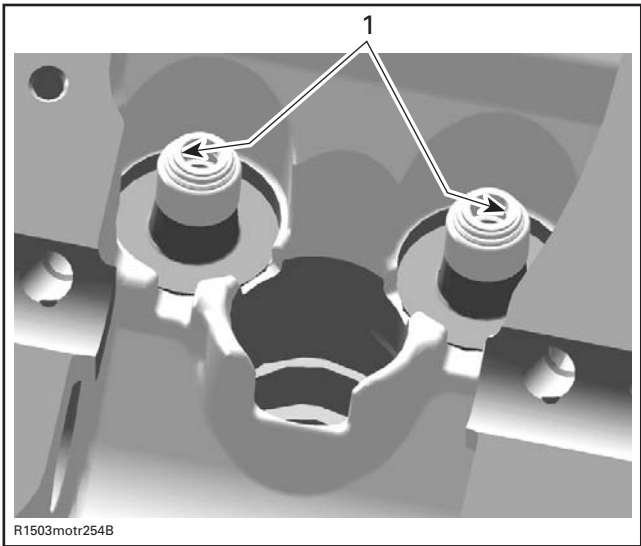
Install **NEW** valve stem seal.



1. Valve stem seal

Apply engine oil on valve stem and install valve.

NOTICE Be careful when valve stem is passed through sealing lips of valve stem seal.



1. Sealing lips of valve stem seal

To ease installation of cotters, apply oil or grease on them so that they remain in place while releasing the spring.

After springs are installed, ensure valve springs and valve spring retainer are properly locked by tapping on valve stem end with a soft hammer so that valve opens and closes a few times.

NOTICE An improperly locked valve spring will cause engine damage.

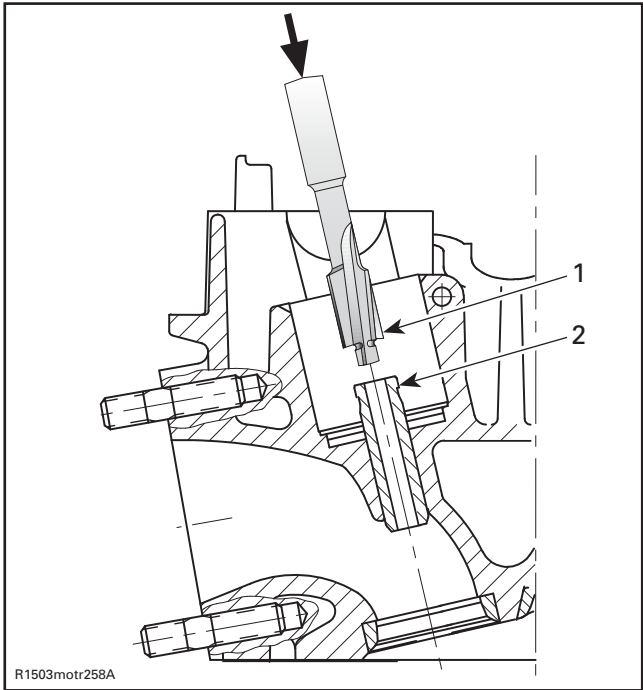
VALVE GUIDE

Valve Guide Replacement

NOTICE Do not heat cylinder head for this procedure.

NOTICE The sharp edge near the top of the valve guide must be machined away. Otherwise it will foul the valve guide hole in the cylinder head and destroy the cylinder head, as the valve guide is removed.

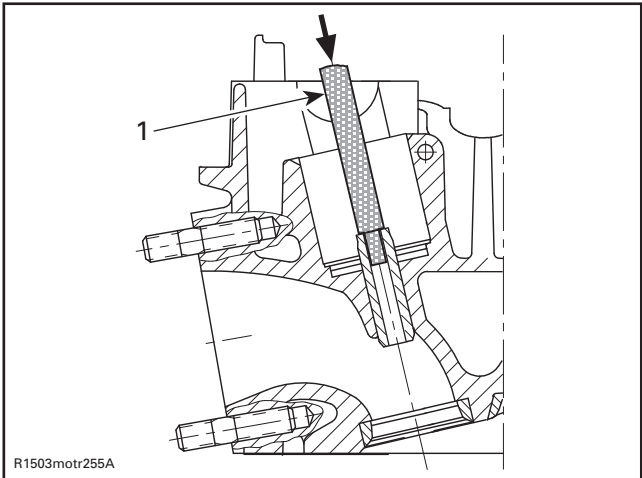
Use a special reamer as far as the top of the notch.



TYPICAL
1. Special reamer
2. Notch

Chase valve guide out of the cylinder head towards combustion chamber.

REQUIRED TOOL	
VALVE GUIDE REMOVER (6 MM) (P/N 529 036 086)	



TYPICAL
1. Punch

Check valve guide bore for abraded material. The inlet and exhaust valve guides have the same length and are interchangeable.

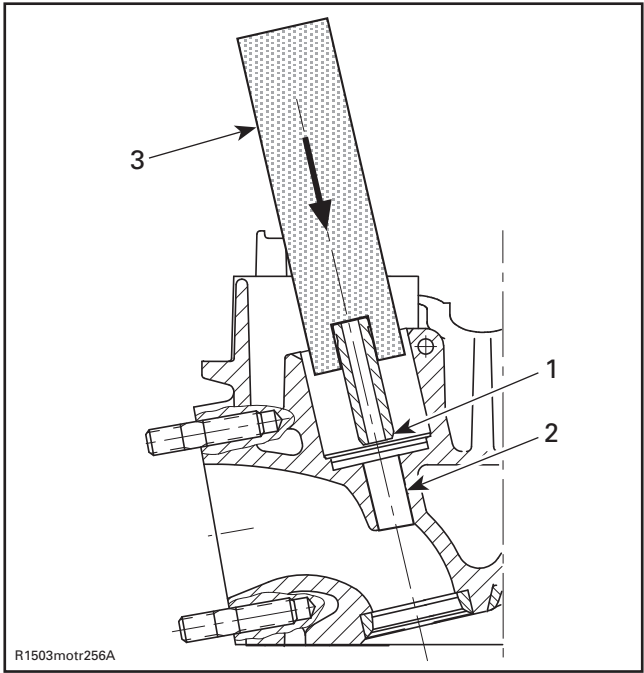
NOTE: If valve guide has caused scoring during extraction, replace the cylinder head.

Grease the bore in cylinder head and the leading end of valve guide with MOLYKOTE G-N (P/N 420 297 433).

Press the valve guide into the **COLD** cylinder head as shown.

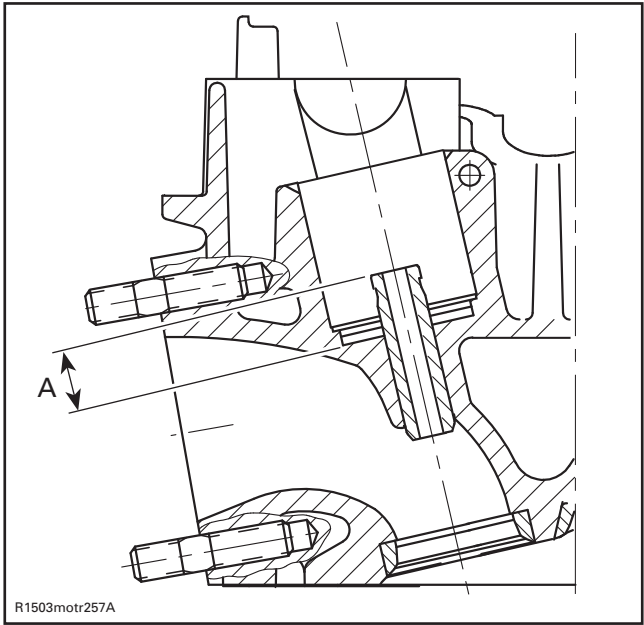
REQUIRED TOOL	
VALVE GUIDE PUSHER (6 MM) (P/N 529 036 087)	

Subsection XX (CYLINDER HEAD)



Clean cylinder head carefully. Check that the valve seat is concentric with the new guide axis (check contact surface with engineer's blue).

TYPICAL
1. Valve guide leading end
2. Cylinder head bore
3. Jig



TYPICAL
A. Protrusion

VALVE GUIDE PROTRUSION (MEASUREMENT "A")
12.4 MM TO 12.8 MM (.488 IN TO .504 IN)

NOTE: After installing new guides, they must be reamed with a standard 6 mm reamer tool. These are available from various tool suppliers.

CYLINDER BLOCK

SERVICE TOOLS

Description	Part Number	Page
CRANKSHAFT LOCKING TOOL	529 035 821	13, 17, 24
PISTON CIRCLIP INSTALLER.....	529 036 368	9

SERVICE TOOLS – OTHER SUPPLIER

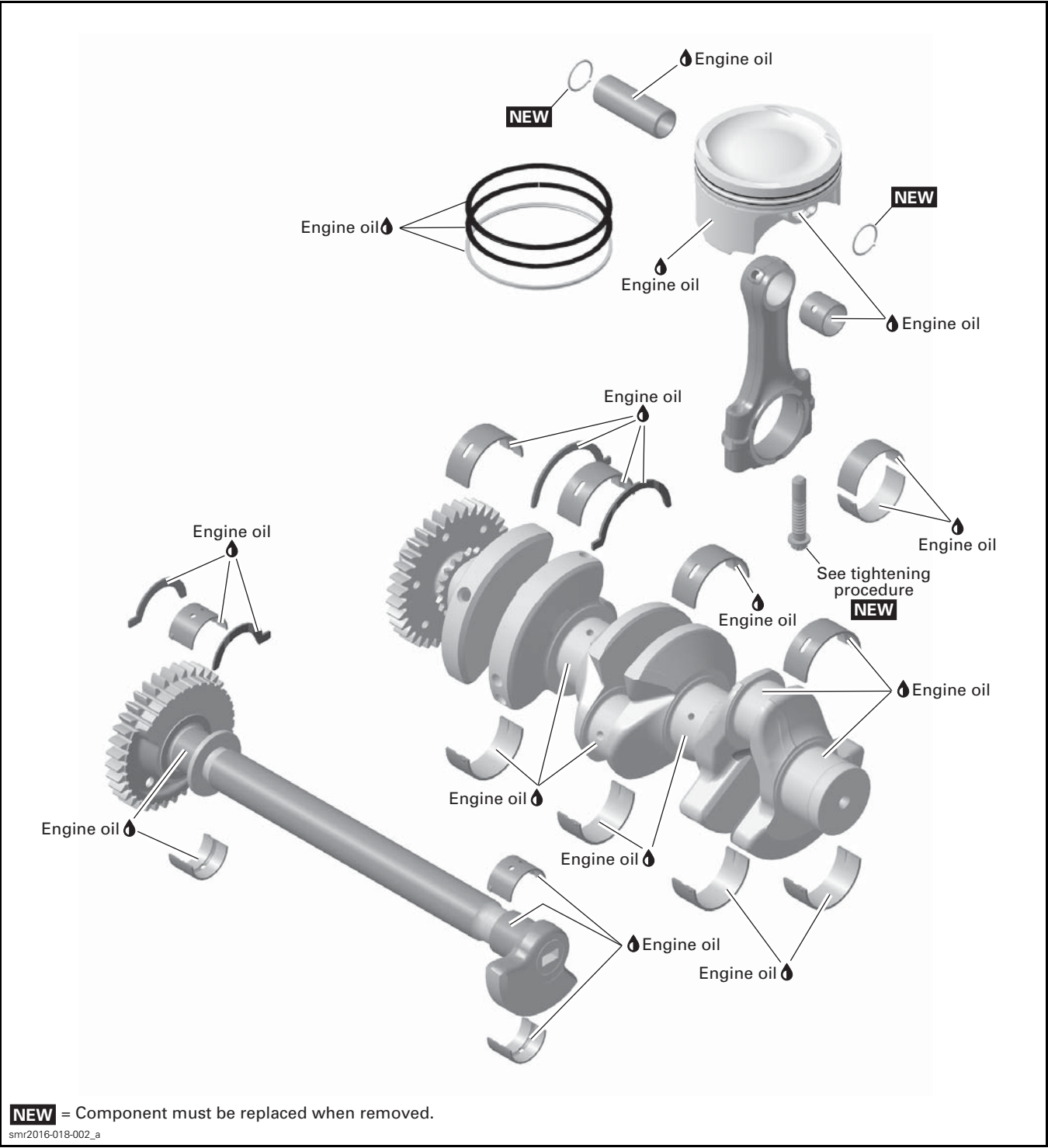
Description	Part Number	Page
SNAP-ON PISTON RING COMPRESSOR PLIERS	RC980	10

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	23–24
LOCTITE 5910	293 800 081	22
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	20



smr2016-018-001_a



GENERAL

When disassembling parts that are duplicated in the engine, (e.g.: pistons, connecting rods etc.), it is strongly recommended to note their position and to keep them as a "group". If you find a defective component, it will be much easier to find the cause of the failure. Since parts were break-in together during the engine operation, they will keep their matched fit when parts are reassemble together within their "group".

TROUBLESHOOTING

The following is provided to help in diagnosing the probable source of troubles. It is a guideline and it should not be assumed to list all possible problems.

Always check for fault codes. If a fault code is detected, service the fault code first. Refer to *DIAGNOSTIC AND FAULT CODES* subsection.

UNUSUAL ENGINE NOISE OR VIBRATIONS

1. Heavy wear on plain bearings
 - Check radial play of plain bearings.
 - Replace plain bearings if out of specification.
2. Crankshaft and balancer shaft are not properly aligned
 - Disassemble cylinder block and check if marks are properly aligned.
3. Crankshaft or balancer shaft axial play out of specification
 - Measure crankshaft and balancer shaft axial play.
 - If axial play is out of specification, replace thrust washers.
4. Connecting rod axial play out of specification
 - Measure connecting rod axial play on crankshaft.
 - Replace connecting rod or crankshaft if out of specification.
5. Connecting rod screws got loose
 - Replace damaged components and retighten screws with the recommended torque.

BLUE SMOKE IN THE EXHAUST

1. Oil scrapper rings worn out
 - Replace piston rings.

ENGINE SUDDENLY TURNS OFF (POOR IDLING)

1. Piston rings worn out
 - Replace piston rings.

2. Piston/cylinder wall clearance out of specification
 - Check piston/cylinder wall clearance.
 - Replace if out of specification.
3. Melted or broken piston
 - Check if oil spray nozzle is not clogged. Refer to *LUBRICATION SYSTEM* subsection.
 - Replace piston and cylinder block if necessary.

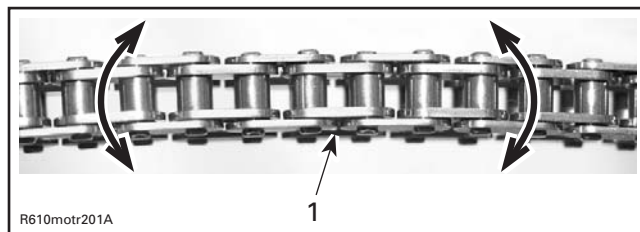
PROCEDURES

TIMING CHAIN

Inspecting the Timing Chain

Check timing chain on camshaft gear for excessive radial play.

Check chain condition for wear and rollers condition.



1. Timing chain

If chain is excessively worn or damaged, replace it as a set (camshaft timing gear and timing chain).

Removing the Timing Chain

Remove:

- Engine from vehicle (refer to *ENGINE REMOVAL AND INSTALLATION* subsection)
- Cylinder head (refer to *CYLINDER HEAD* subsection)
- PTO housing (refer to *PTO HOUSING AND MAGNETO* subsection)
- Crankshaft (refer to *CRANKSHAFT* in this subsection)
- Timing chain.

Installing the Timing Chain

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

Ensure to perform proper valve timing.

NOTICE Improper valve timing will damage engine components.

Lock crankshaft and camshaft at TDC (refer to *CYLINDER HEAD* subsection for the camshaft locking procedure).

Install chain, then install chain tensioner.

CHAIN TENSIONER

Chain Tensioner Access

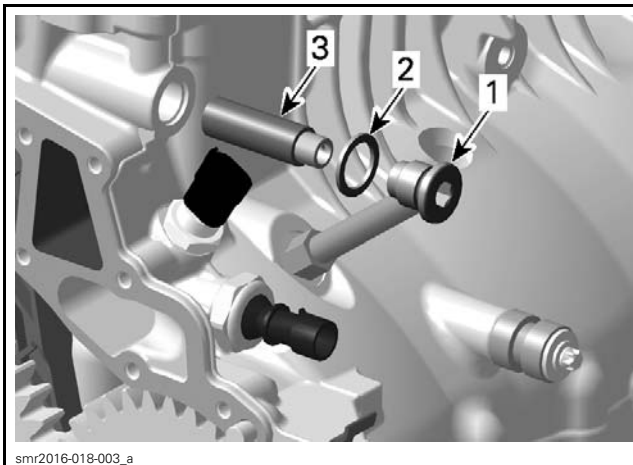
NOTE: Removal of the intake manifold allows easier access to the chain tensioner, but is not necessary. Refer to *INTAKE MANIFOLD* subsection.

Removing the Chain Tensioner

Lock crankshaft, refer to *CRANKSHAFT LOCKING PROCEDURE* in this subsection.

Remove:

- Chain tensioner plug screw
- Gasket ring (discard it)
- Chain tensioner.



1. Plug screw
2. Gasket ring
3. Chain tensioner

Inspecting the Chain Tensioner

Check chain tensioner for:

- excessive wear
- cracks
- free movement of the chain tensioner piston.

Installing the Chain Tensioner

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

Install plug screw with a **NEW** gasket ring .

Tighten the chain tensioner plug screw to specification.

TIGHTENING TORQUE

Chain tensioner plug
screw

17 N•m ± 2 N•m
(150 lbf•in ± 18 lbf•in)

PISTONS AND CONNECTING RODS

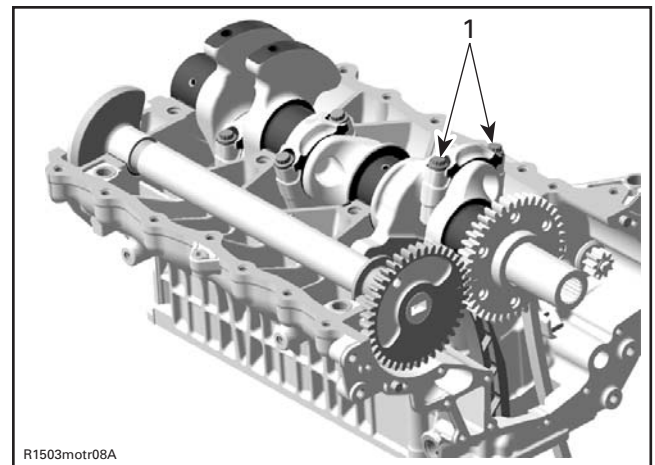
Removing the Piston and Connecting Rod

1. Disassemble *CYLINDER BLOCK* as per procedure in this subsection.

NOTE: It is recommended to measure connecting rod big end axial play prior to remove connecting rod. Refer to *INSPECTION* below.

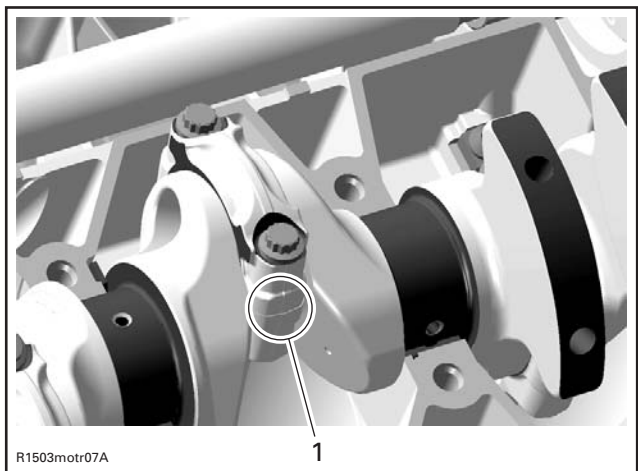
2. Remove:

- Connecting rod screws
- Connecting rod caps.



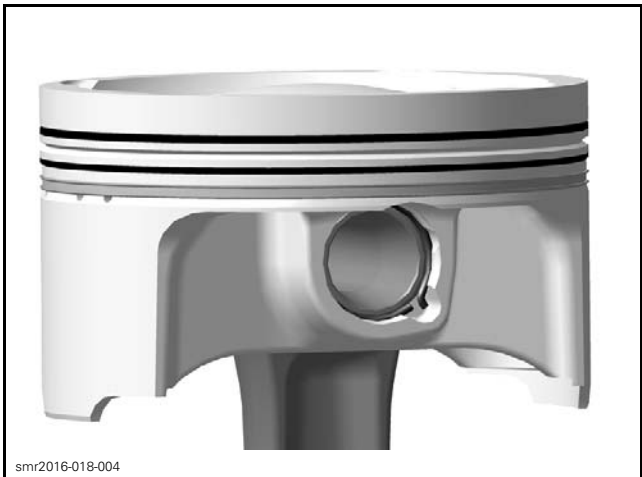
1. Connecting rod screws

NOTE: Before removing the connecting rod caps, mark them to remember the right position when reassembling.



1. Connecting rod mark

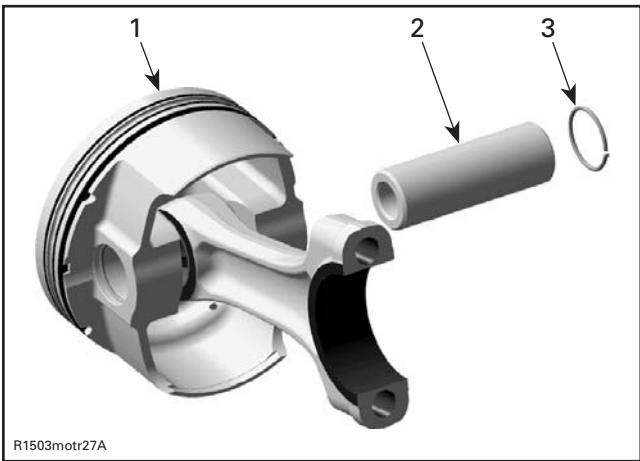
- 3. Pull piston with connecting rod out of the cylinders.
- 4. Remove one piston circlip and discard it.



1. Piston circlip

NOTE: The removal of both piston circlips is not necessary to remove piston pin.

- 5. Push piston pin out of piston.



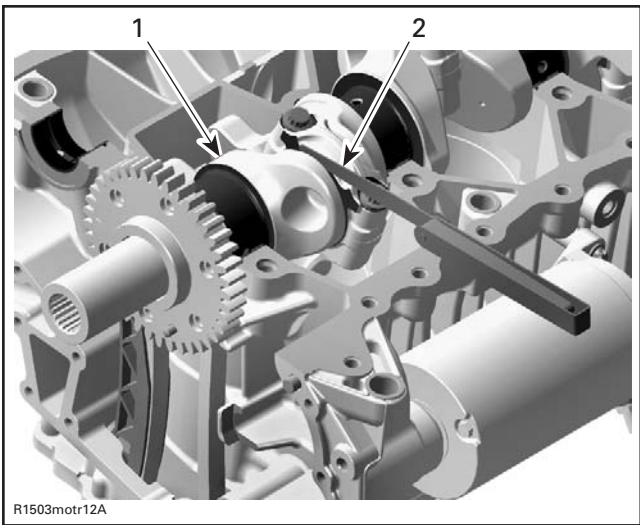
1. Piston
2. Piston pin
3. Circlip

- 6. Detach piston from connecting rod.

Inspecting the Connecting Rod

Connecting Rod Big End Axial Play

Using a feeler gauge, measure distance between butting face of connecting rod and crankshaft counterweight. If the distance exceeds specified tolerance, replace the worn part.

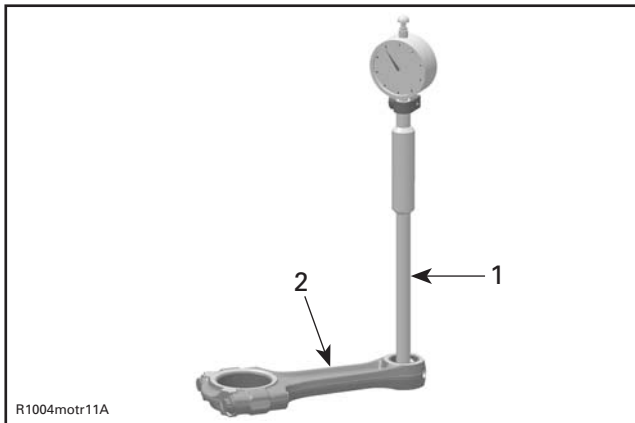


1. Crankshaft
2. Feeler gauge

CONNECTING ROD BIG END AXIAL PLAY	
NEW	0.100 mm to 0.352 mm (.004 in to .014 in)
SERVICE LIMIT	0.500 mm (.02 in)

Connecting Rod Small End Radial Play

Measure connecting rod small end.



TYPICAL
1. Bore gauge
2. Connecting rod

CONNECTING ROD SMALL END DIAMETER	
NEW	22.01 mm to 22.02 mm (.8665 in to .8669 in)
SERVICE LIMIT	22.07 mm (.8689 in)

If the connecting rod small end diameter is out of specification, replace small end bearing sleeve.

NOTE: For small end bearing sleeve replacement contact a machine shop. After installing a **NEW** small end bearing sleeve on the connecting rod, the inner diameter and the oil holes need to be machined to specification.

Measure piston pins, refer to *INSPECTING THE PISTON PIN* in this subsection. Compare to inside diameter of connecting rod to obtain connecting rod small end radial play.

CONNECTING ROD SMALL END RADIAL PLAY	
SERVICE LIMIT	0.080 mm (.003 in)

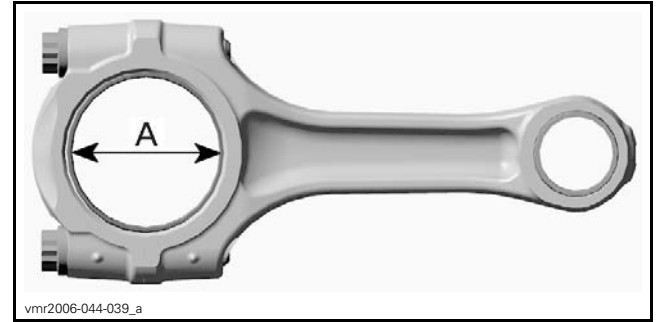
Connecting Rod Big End Radial Play

Measure inside diameter of connecting rod big end. Compare to crankshaft pin.

To measure the connecting rod big end diameter, use the **OLD** screws.

Install the **OLD** bearings as they were mounted initially.

Tighten connecting rod screws, refer to *INSTALLING THE PISTON AND CONNECTING ROD* in this subsection.



TYPICAL
A. Connecting rod big end bearing

CONNECTING ROD BIG END DIAMETER	
SERVICE LIMIT	45.080 mm (1.7748 in)

CONNECTING ROD BIG END RADIAL PLAY	
SERVICE LIMIT	0.09 mm (.0035 in)

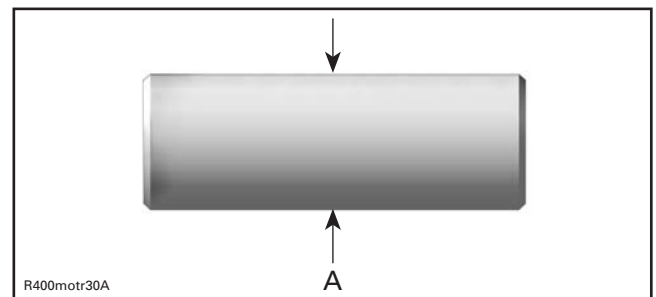
Use **NEW** bearings, when connecting rod big end diameter is out of specification.

Inspecting the Piston Pin

Using synthetic abrasive woven, clean piston pin from deposits.

Inspect piston pin for scoring, cracking or other damages.

Measure piston pin. See the following illustration for the proper measurement position.



TYPICAL
A. Piston pin diameter here

PISTON PIN DIAMETER	
NEW	21.996 mm to 22.000 mm (.866 in to .8661 in)
SERVICE LIMIT	+21.990 mm (.8657 in)

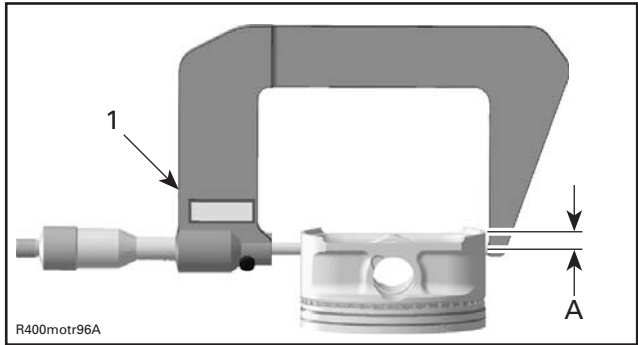
Measure connecting rod small end diameter, refer to *CONNECTING RODS INSPECTION* in this subsection to check connecting rod small end radial play.

Subsection XX (CYLINDER BLOCK)

Inspecting the Piston

Inspect piston for scoring, cracking or other damages. Replace piston and piston rings if necessary.

Using a micrometer, measure piston at 18 mm (.709 in) perpendicularly (90°) to piston pin axis.



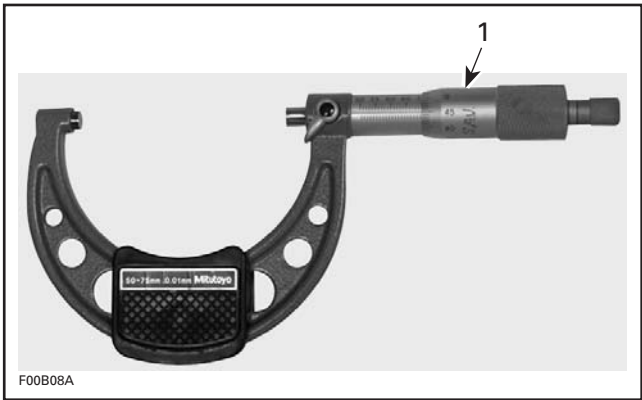
TYPICAL
1. Measuring perpendicularly (90°) to piston pin axis
A. 18 mm (.709 in)

The measured dimension should be as described in the subsequent table. If not, replace piston.

PISTON MEASUREMENT	
NEW	99.931 mm to 99.949 mm (3.9343 in to 3.935 in)
SERVICE LIMIT	99.900 mm (3.9331 in)

Piston/Cylinder Wall Clearance

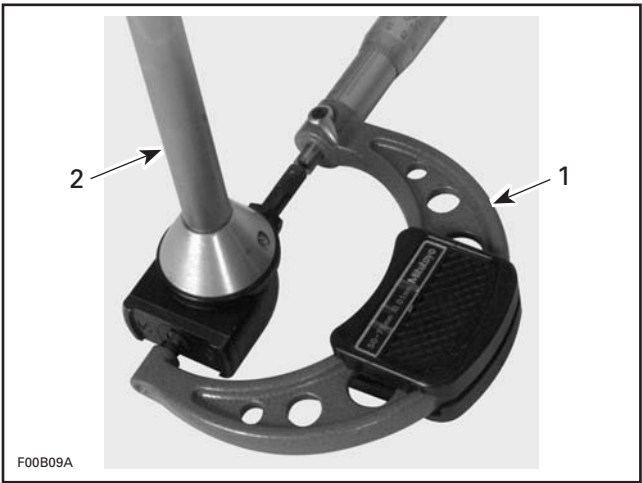
Adjust and lock a micrometer to the piston dimension.



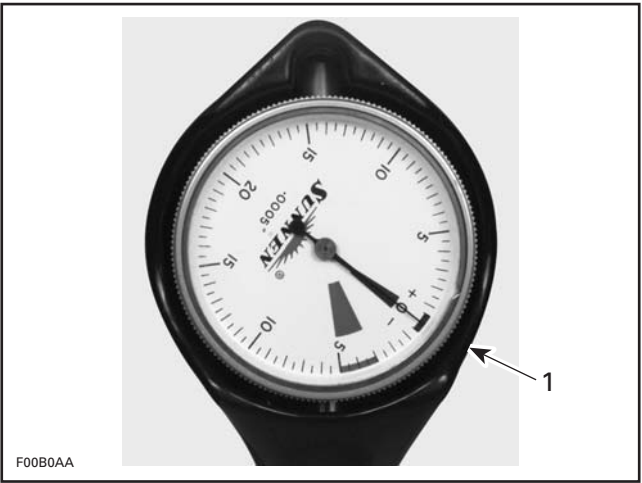
1. Micrometer set to the piston dimension

NOTE: Make sure used piston is not worn.

With the micrometer set to the dimension, adjust a cylinder bore gauge to the micrometer dimension and set the indicator to 0 (zero).



1. Use the micrometer to set the cylinder bore gauge
2. Dial bore gauge



TYPICAL
1. Indicator set to 0 (zero)

NOTE: Make sure the cylinder bore gauge indicator is set exactly at the same position as with the micrometer, otherwise the reading will be false.

Position the dial bore gauge 62 mm (2.44 in) above cylinder base, measuring perpendicularly (90°) to piston pin axis.

Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder wall clearance.

PISTON/CYLINDER CLEARANCE	
NEW NOMINAL	0.044 mm to 0.076 mm (.0017 in to .003 in)
SERVICE LIMIT	0.100 mm (.0039 in)

If clearance exceeds specified tolerance, re-hone cylinder sleeve and replace piston by an oversize one.

NOTE: It is not necessary to have all pistons replaced with an oversize if they are not all out of specification. Mixed standard size and oversize piston are allowed.

Piston and Connecting Rod Assembly

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

1. Apply engine oil on the piston pin.
2. Insert piston pin into piston and connecting rod.

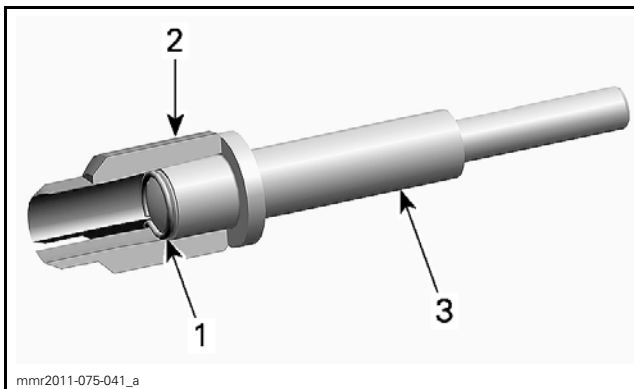
NOTE: Be sure to reinstall all parts in their original position as marked during removal.

3. Install **NEW** piston circlip.

REQUIRED TOOL	
PISTON CIRCLIP INSTALLER (P/N 529 036 368)	

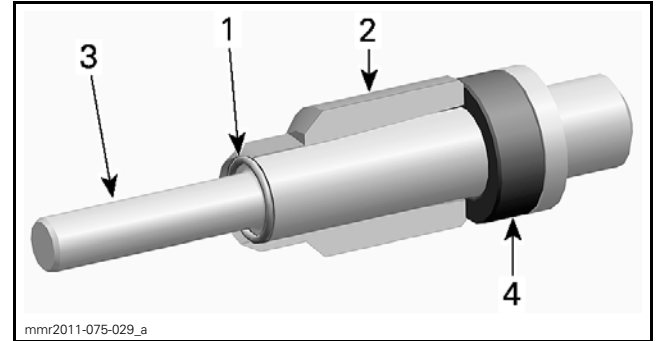
NOTICE Always replace removed piston pin circlips by **NEW** ones.

- 3.1 Place the circlip in the sleeve and push piston circlip installer handle until circlip reaches the mid position in the sleeve.



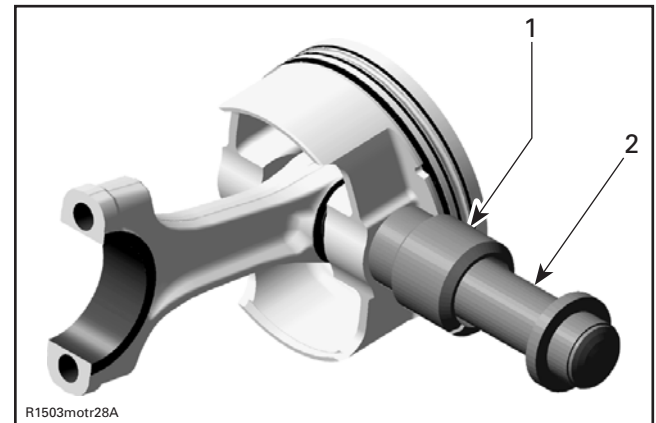
TYPICAL
1. Circlip
2. Sleeve
3. Installer handle

- 3.2 Put the distance sleeve on the installer handle.
- 3.3 Push piston circlip installer handle until distance sleeve makes contact with the sleeve.



TYPICAL
1. Circlip
2. Sleeve
3. Installer handle
4. Distance sleeve

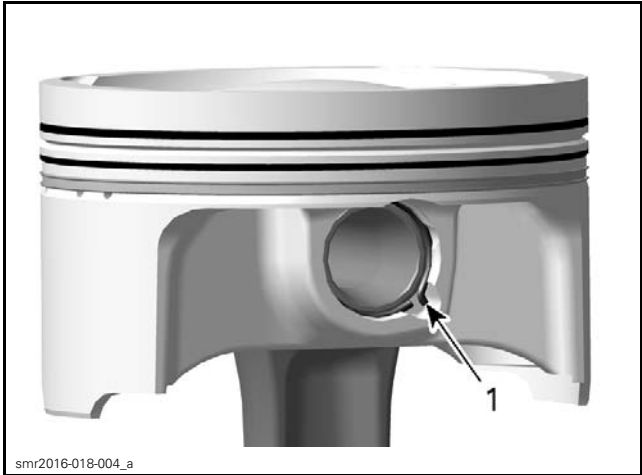
- 3.4 Remove distance sleeve and insert installer handle into the sleeve.
- 3.5 Insert the end of the handle into the piston pin, then push to engage the circlip in the piston groove.



TYPICAL
1. Sleeve with piston circlip inside
2. Assembly jig from piston clip installer

NOTICE If piston pin circlip installation fails, repeat step 3 by using a **NEW** circlip.

NOTE: Ensure that hook of the piston circlip is positioned properly.

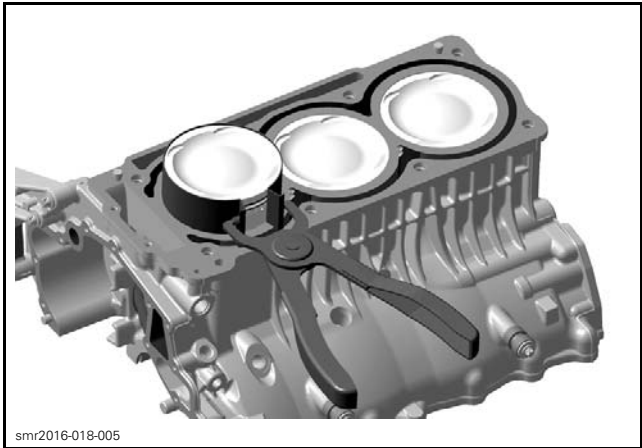


CORRECT POSITION OF THE PISTON CIRCLIP

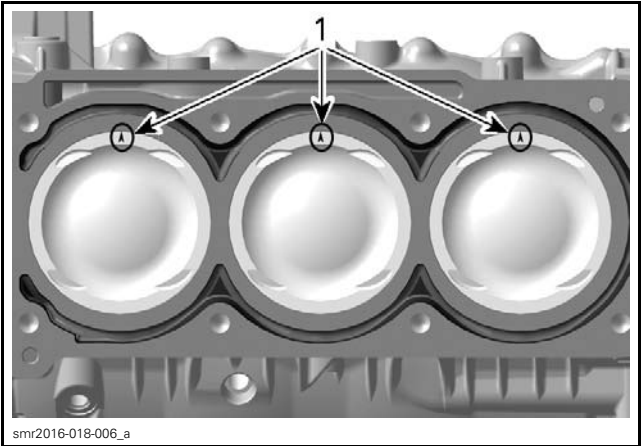
Installing the Piston and Connecting Rod

- 1. Use engine oil and lubricate:
 - Piston
 - Piston rings
 - Band of the piston ring compressor tool
 - Connecting rod bearings.
 - Cylinder bore
- 2. Slide piston into cylinder.

RECOMMENDED TOOL
SNAP-ON PISTON RING COMPRESSOR PLIERS (P/N RC980)

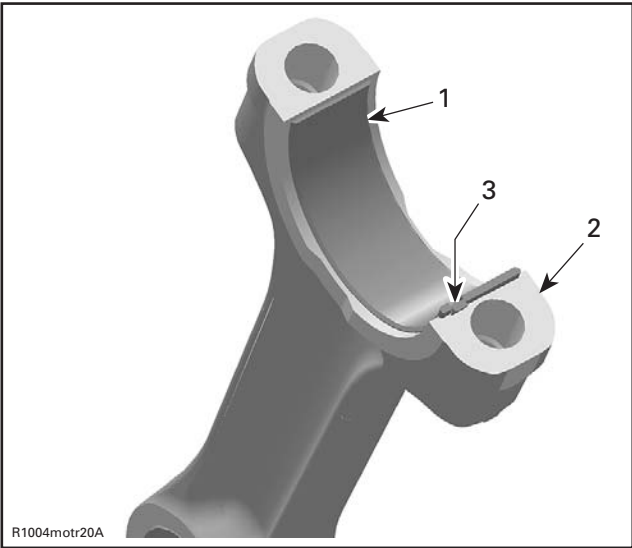


NOTICE Install piston with punched arrow to-ward exhaust side.



1. Arrows toward exhaust side

- 3. Correctly install bearings and carefully clean split surface on both sides (cracked area).



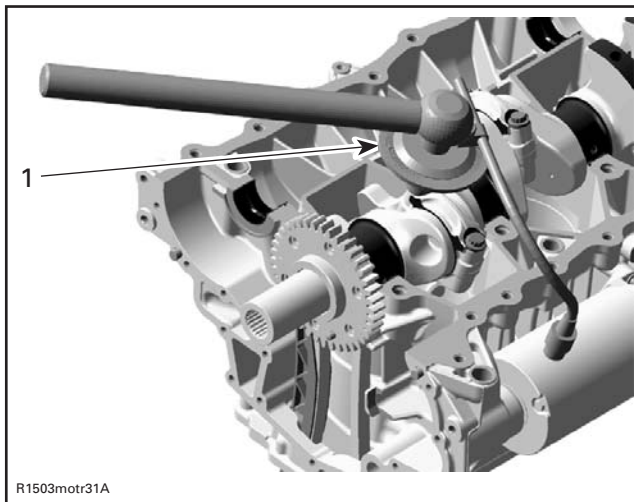
- TYPICAL**
- 1. Half bearing of connecting rod big end
 - 2. Split surface of the connecting rod
 - 3. Protrusion of bearing in line with connecting rod groove

- 4. Tighten **NEW** connecting rod screws as per fol-lowing procedure:

NOTICE This assembly uses stretch screws. Always use **NEW** screws and strictly adhere to the tightening procedure.

NOTICE All connecting rod screws must be torque **FIRST** according to step A before per-forming the step B.

TIGHTENING PROCEDURE		
Connecting rod screws	Step A	45 N•m ± 3 N•m (33 lbf•ft ± 2 lbf•ft)
	Step B	Additional 90° ± 5°



1. Angle torque wrench

PISTON RINGS

Removing the Piston Ring

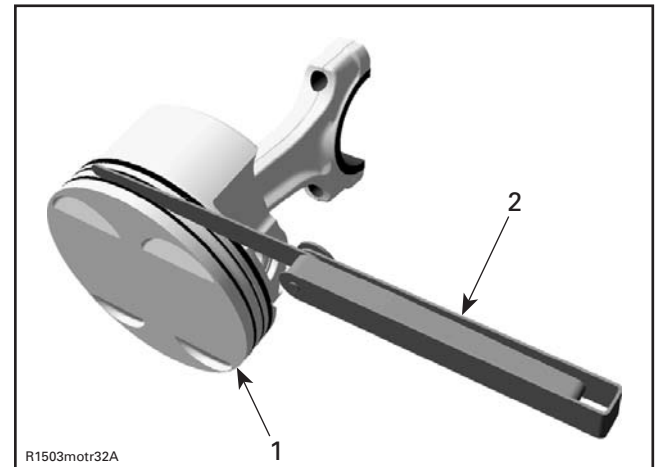
Remove piston, see procedure in this subsection.
Remove piston rings.

Inspecting the Piston Ring Inspection

Ring/Piston Groove Clearance

Using a feeler gauge measure each ring/piston groove clearance. If the clearance is too large, the piston and the piston rings should be replaced.

RING/PISTON GROOVE CLEARANCE	
RECTANGULAR	
NEW	0.025 mm to 0.070 mm (.001 in to .0028 in)
SERVICE LIMIT	0.150 mm (.0059 in)
TAPER-FACE	
NEW	0.015 mm to 0.060 mm (.0006 in to .0024 in)
SERVICE LIMIT	0.150 mm (.0059 in)
OIL SCRAPER RING	
NEW	0.010 mm to 0.180 mm (.0004 in to .0071 in)
SERVICE LIMIT	0.200 mm (.0079 in)



1. Piston
2. Filler gauge

Ring End Gap

RING END GAP	
NEW	
RECTANGULAR	0.30 mm to 0.50 mm (.012 in to .02 in)
TAPER-FACE	0.35 mm to 0.55 mm (.014 in to .022 in)
OIL SCRAPER RING	0.20 mm to 0.70 mm (.008 in to .028 in)
SERVICE LIMIT	
ALL	1.20 mm (.047 in)

Measure position for ring end gap in the area of 8 mm to 16 mm (.315 in to .63 in) from top of cylinder.

NOTE: In order to correctly position the ring in the cylinder, use piston as a pusher.

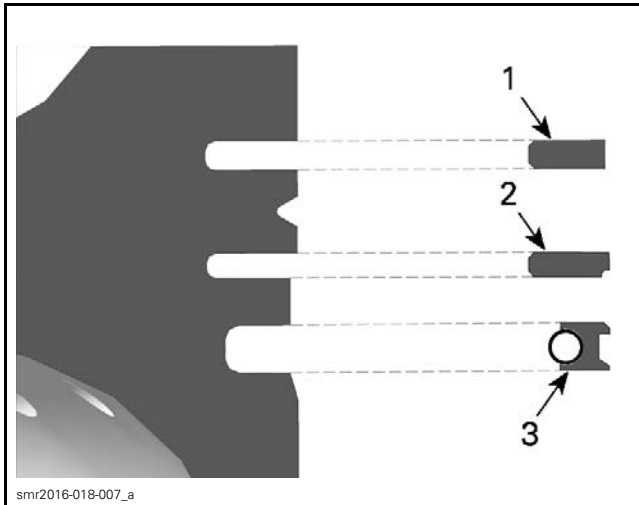
Using a feeler gauge, check ring end gap. Replace ring if gap exceeds service limit.

Installing the Piston Ring

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

Install rings in the following order and layout:

PISTON RING INSTALLATION		
ORDER	RING	POSITION
FIRST STEP	Oil scraper ring	equal
SECOND STEP	Taper-face ring	Stamped "E" and "TOP" facing UP
THIRD STEP	Rectangular ring	Stamped "E" and "TOP" facing UP



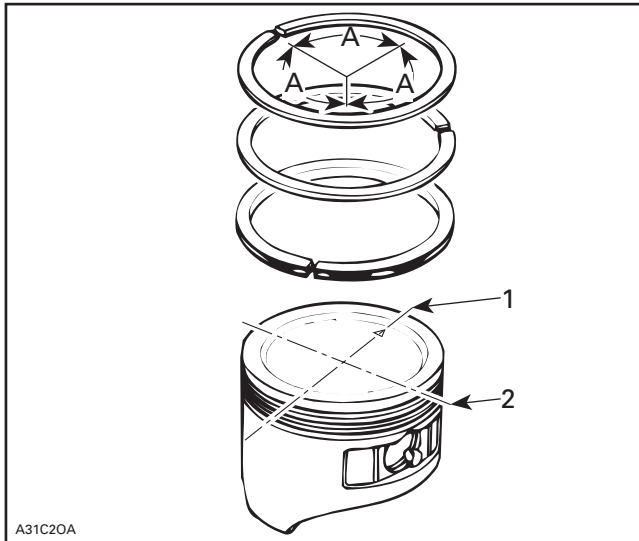
- smr2016-018-007_a
1. Rectangular ring
 2. Taper-face ring
 3. Oil scraper ring

NOTICE Ensure that top and second rings are not interchanged.

NOTE: Use a ring expander to prevent breakage during installation. The oil ring must be installed by hand.

Check that rings rotate smoothly after installation.

Space the piston ring end gaps 120° apart and do not align the gaps with the piston pin bore or the thrust side axis.



- A31C20A
1. DO NOT align ring gap with piston thrust side axis
 2. DO NOT align ring gap with piston pin bore axis
 - A. 120°

CRANKSHAFT

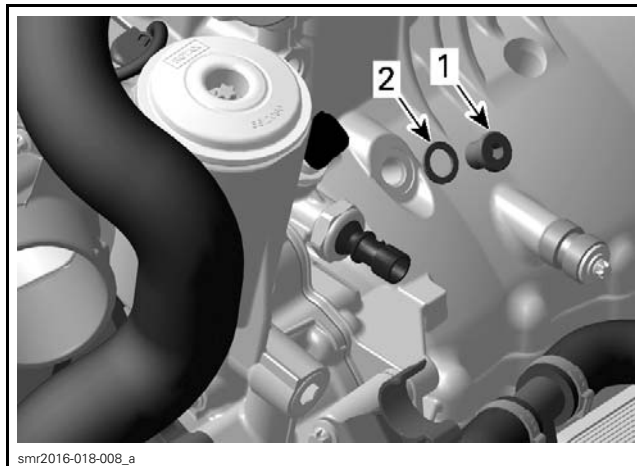
Crankshaft Locking Procedure

NOTICE The crankshaft must be locked at TDC for removal and installation of crankshaft, balancer shaft and camshaft.

NOTE: When the crankshaft is locked, the piston of cylinder 3 is at ignition TDC.

Remove:

- Intake manifold (refer to *INTAKE MANIFOLD* subsection)
- Spark plugs
- Valve cover (refer to *CYLINDER HEAD* subsection)
- Crankshaft access plug screw.

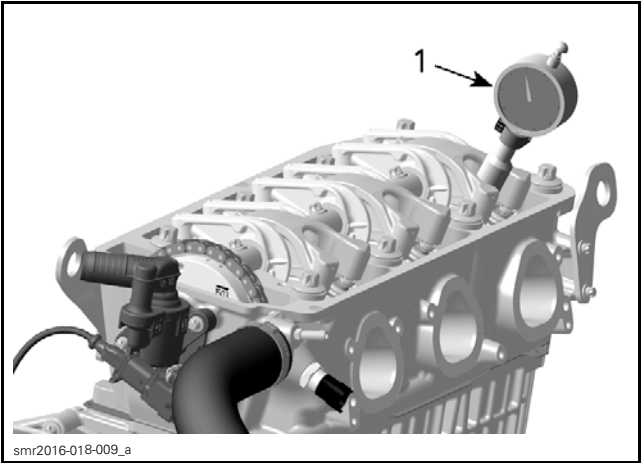


- smr2016-018-008_a
1. Crankshaft access plug screw
 2. Gasket ring

Turn engine counterclockwise.

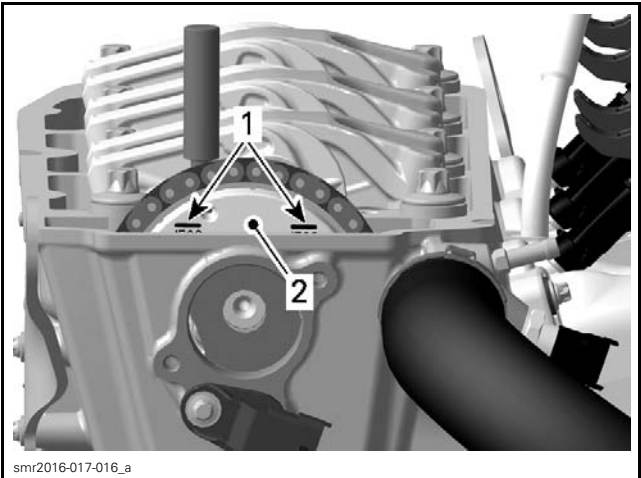
Bring piston of cylinder 3 to ignition TDC, using a dial gauge or another similarly suitable tool.

NOTICE Do not scratch or damage piston and cylinder surface.



1. Dial gauge

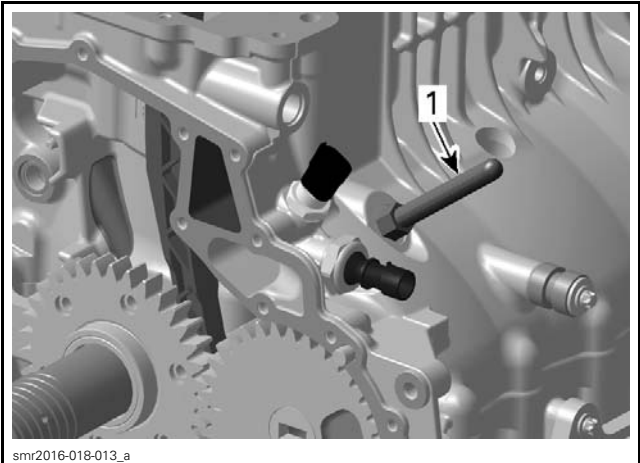
NOTE: When the piston of cylinder 3 is at ignition TDC, the position lines on oil separator cover must be lined up as shown in the following illustration.



1. Position lines
2. Oil separator cover

Use a small screwdriver to check if the groove in the crankshaft is aligned with the hole.
In this position, lock the crankshaft.

REQUIRED TOOL	
CRANKSHAFT LOCKING TOOL (P/N 529 035 821)	



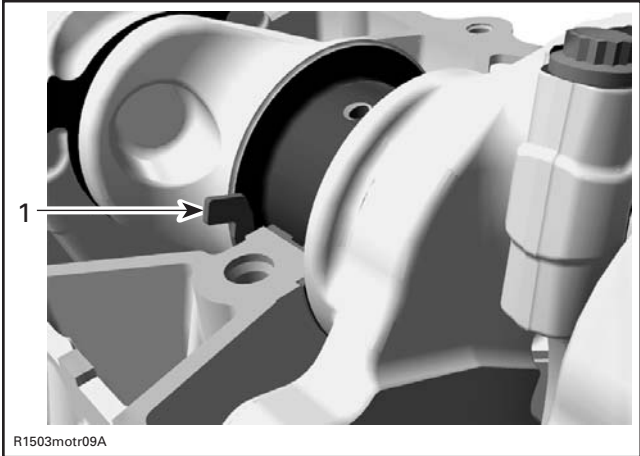
1. Crankshaft locking tool

After removing the crankshaft locking tool install plug screw with a **NEW** gasket ring.

TIGHTENING TORQUE	
Plug screw	17 N•m ± 2 N•m (150 lbf•in ± 18 lbf•in)

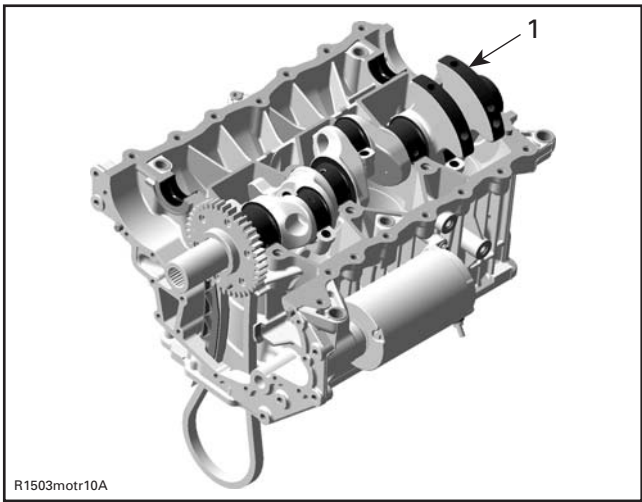
Removing the Crankshaft

1. Disassemble *CYLINDER BLOCK* as per procedure described in this subsection.
2. Remove connecting rod screws. Refer to *PISTONS AND CONNECTING RODS* in this subsection.
3. Remove thrust washers.



1. Thrust washer

4. Remove crankshaft.

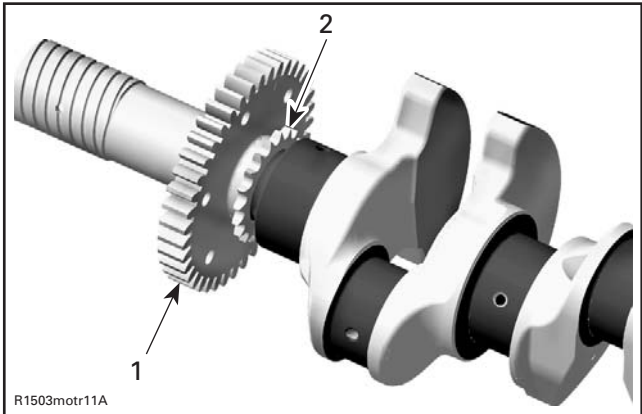


1. Crankshaft

Inspecting the Crankshaft

Inspecting the Crankshaft Gear

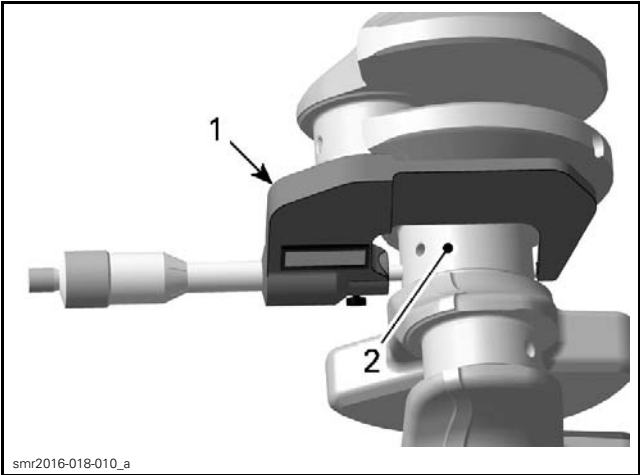
Replace crankshaft if the gears are worn or otherwise damaged.



1. Balancer gear
2. Crankshaft timing gear

Crankshaft Radial Play

Measure all crankshaft journals. Compare to inside diameter of crankshaft bearings, refer to *CYLINDER BLOCK* in this subsection.



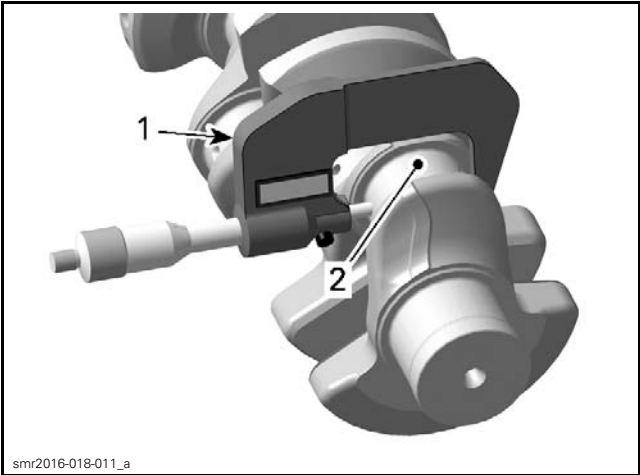
1. Micrometer
2. Crankshaft area for bearing

CRANKSHAFT JOURNAL DIAMETER	
NEW	49.991 mm to 50.010 mm (1.9681 in to 1.9689 in)
SERVICE LIMIT	49.950 mm (1.9665 in)

CRANKSHAFT JOURNAL RADIAL CLEARANCE	
SERVICE LIMIT	0.07 mm (.0028 in)

Crankshaft Pin

Measure all crankshaft pin diameters. Compare to inside diameter of connecting rod bearings, refer to *PISTONS AND CONNECTING RODS* in this subsection.

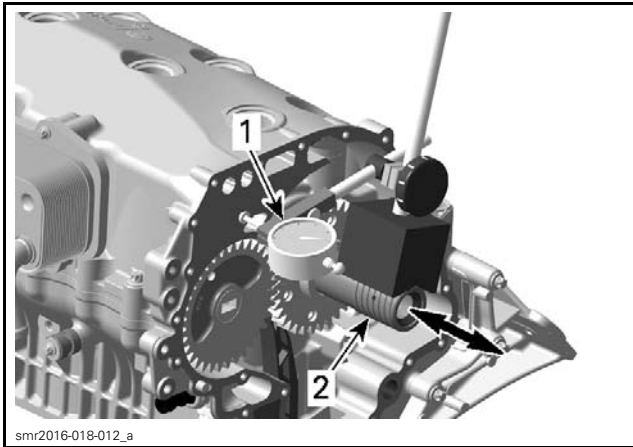


1. Micrometer
2. Crankshaft pin area for bearing

CRANKSHAFT PIN DIAMETER	
NEW	45.032 mm to 45.048 mm (1.7729 in to 1.7735 in)
SERVICE LIMIT	45.025 mm (1.7726 in)

Crankshaft Axial Clearance

When assembling the cylinder-block, measure the crankshaft axial clearance.



1. Dial gauge
2. Crankshaft

CRANKSHAFT AXIAL CLEARANCE	
NEW	0.08 mm to 0.22 mm (.003 in to .009 in)
SERVICE LIMIT	0.35 mm (.014 in)

Installing the Crankshaft

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

NOTE: Be careful that connecting rods do not hit the cylinder block.

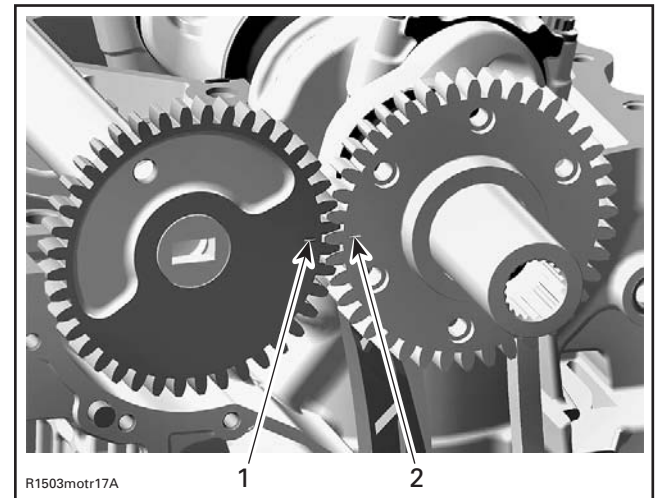
NOTICE Before installing the crankshaft, ensure that:

- chain guide is already installed
- timing chain is installed on crankshaft timing gear.

Those parts cannot be installed when the crankshaft is in place.

Install crankshaft with the timing chain.

NOTICE Crankshaft and balancer shaft marks must be aligned.

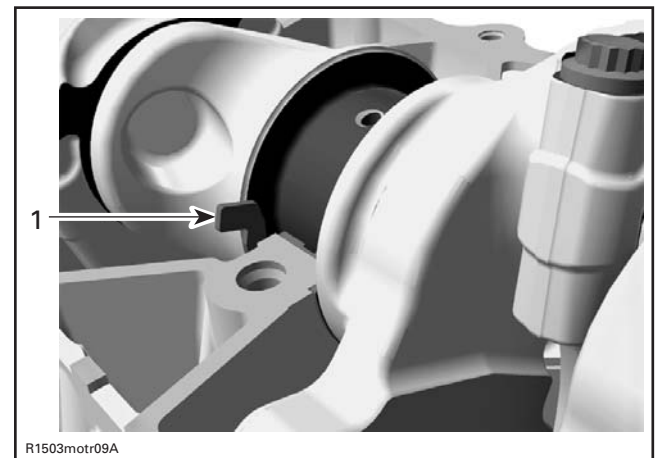


1. Mark on balancer shaft
2. Mark on crankshaft

Install connecting rod caps, refer to *PISTONS AND CONNECTING RODS* in this subsection.

NOTICE It is absolutely necessary to follow this procedure. Otherwise severe engine damage can occur.

Insert thrust washers as soon as crankshaft is in place as per following illustration.

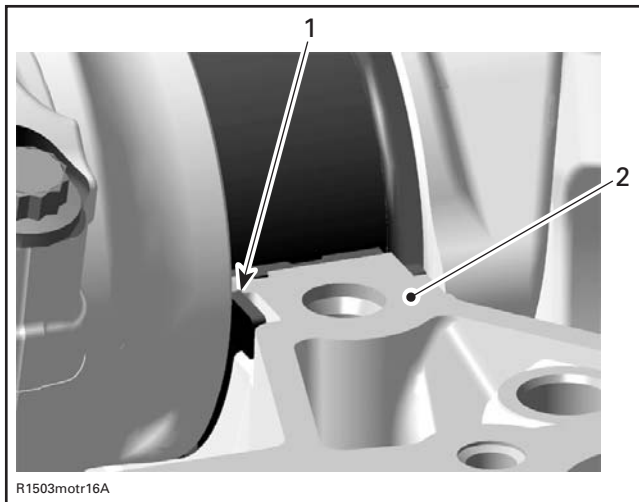


THRUST WASHER INSERT DIRECTION

1. Thrust washer

NOTICE Thrust washers have to be flush with the cylinder block sealing surface.

Subsection XX (CYLINDER BLOCK)



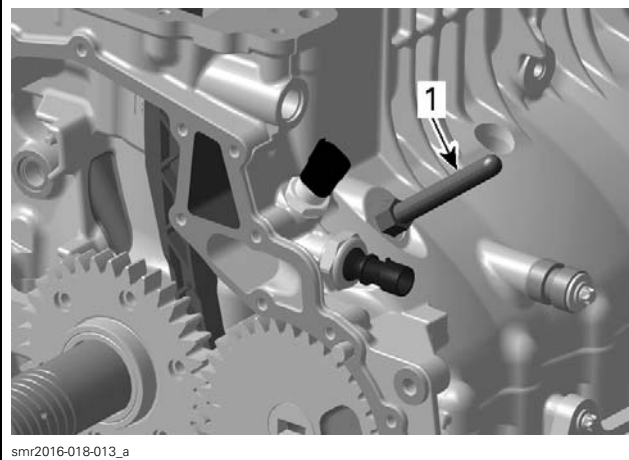
- 1. Thrust washer
- 2. Sealing surface

Install cylinder block lower half. Refer to *CYLINDER BLOCK* in this subsection.

Lock crankshaft at TDC before installing the camshaft and the rocker arms (refer to *CYLINDER HEAD* subsection).

REQUIRED TOOL

CRANKSHAFT LOCKING TOOL
(P/N 529 035 821)

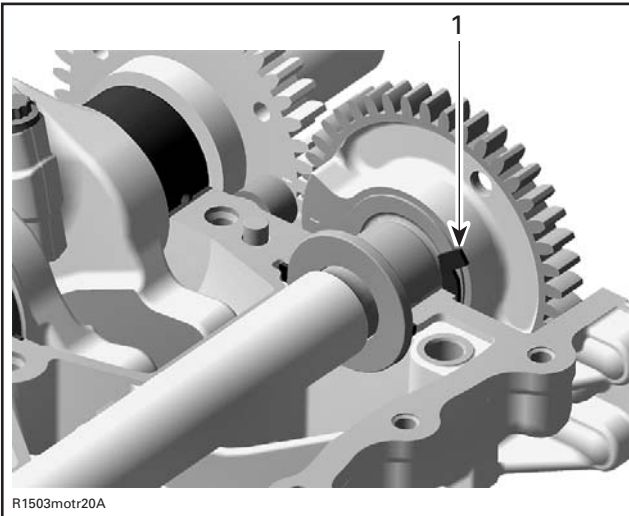


1. Crankshaft locking tool

BALANCER SHAFT

Removing the Balancer Shaft

1. Disassemble *CYLINDER BLOCK*, see procedure in this subsection.
2. Remove thrust washers.



1. Thrust washer

3. Remove balancer shaft.

Inspecting the Balancer Shaft

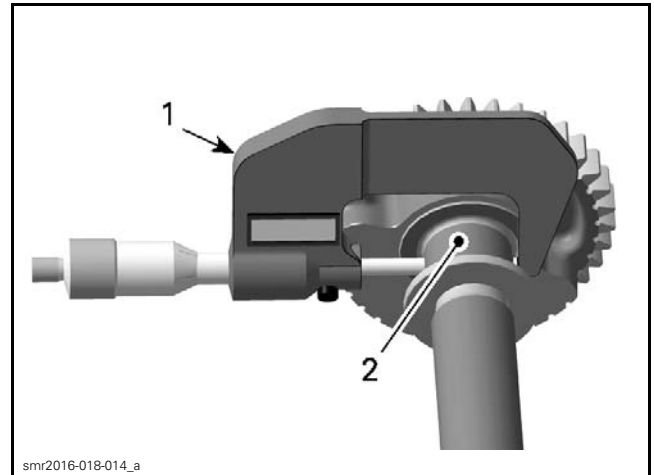
Check balancer shaft and replace if damaged.

If the gear on the balancer shaft is damaged, replace balancer shaft.

Check gear on the crankshaft at the same time and replace crankshaft if necessary (refer to *CRANKSHAFT* in this subsection).

Balancer Shaft Bearing Seat Play

Measure all balancer shaft bearing journals. Compare to inside diameter of balancer shaft bearings (see *INSPECTING THE CYLINDER BLOCK* in this subsection).



1. Micrometer
2. Balancer shaft area for bearing

BALANCER SHAFT JOURNAL DIAMETER

NEW	31.984 mm to 32.000 mm (1.2592 in to 1.2598 in)
SERVICE LIMIT	31.950 mm (1.2579 in)

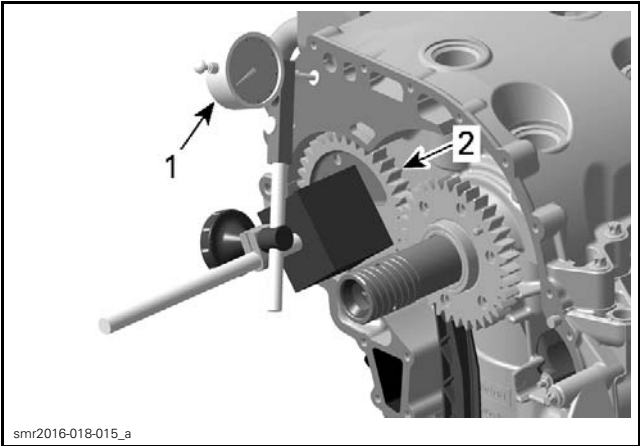
BALANCER SHAFT JOURNAL RADIAL CLEARANCE

SERVICE LIMIT	0.07 mm (.0028 in)
---------------	--------------------

Balancer Shaft Axial Clearance

When assembling the cylinder-block, measure the balance shaft axial play.

Subsection XX (CYLINDER BLOCK)



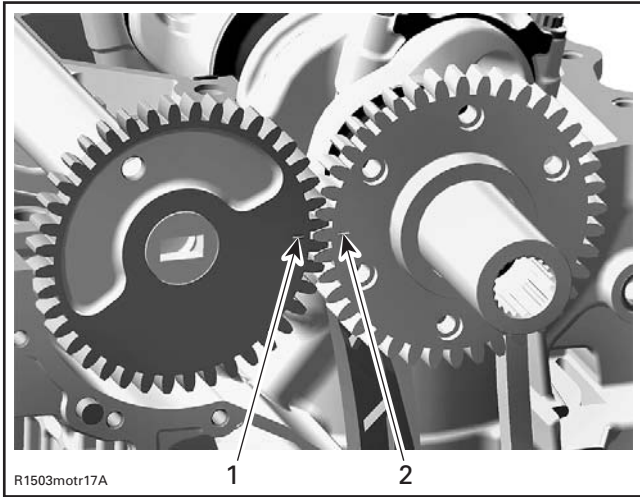
1. Dial gauge
2. Balancer shaft

BALANCER SHAFT AXIAL CLEARANCE	
NEW	0.02 mm to 0.25 mm (.001 in to .01 in)
SERVICE LIMIT	0.35 mm (.014 in)

Installing the Balancer Shaft

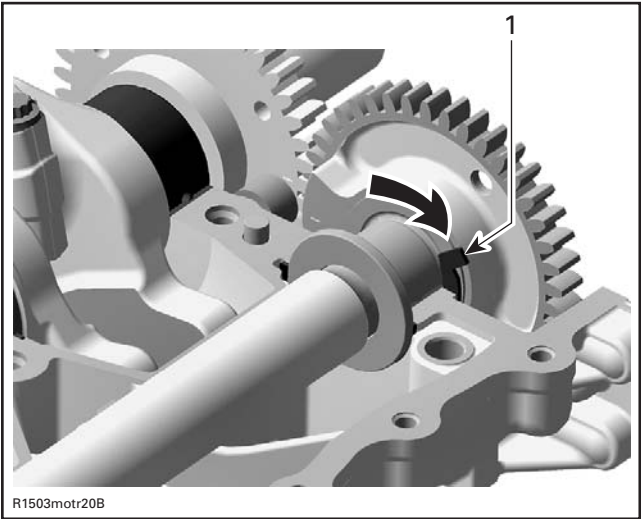
The installation is the reverse of the removal procedure. However, pay attention to following details.

NOTICE Balancer shaft and crankshaft marks have to be aligned.



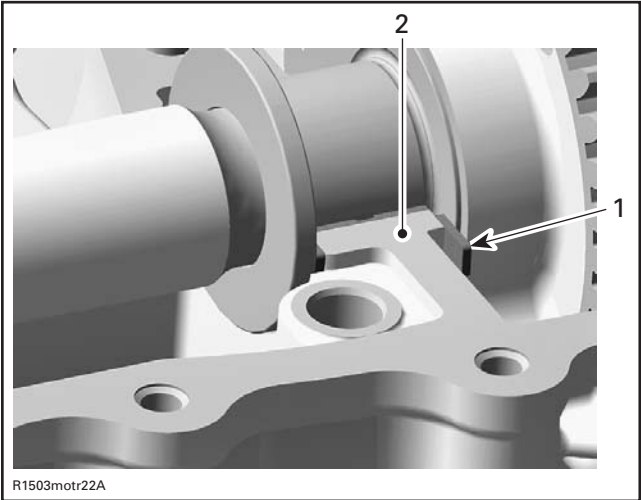
1. Mark on balancer shaft
2. Mark on crankshaft

Install thrust washers in place as per following illustration.



THRUST WASHER INSERT DIRECTION
1. Thrust washer

NOTICE Thrust washers must be flush with the cylinder block sealing surface.



1. Thrust washer
2. Sealing surface

Install cylinder block lower half. Refer to *CYLINDER BLOCK* in this subsection.

Reassemble engine in accordance with the proper assembly procedures.

CYLINDER BLOCK

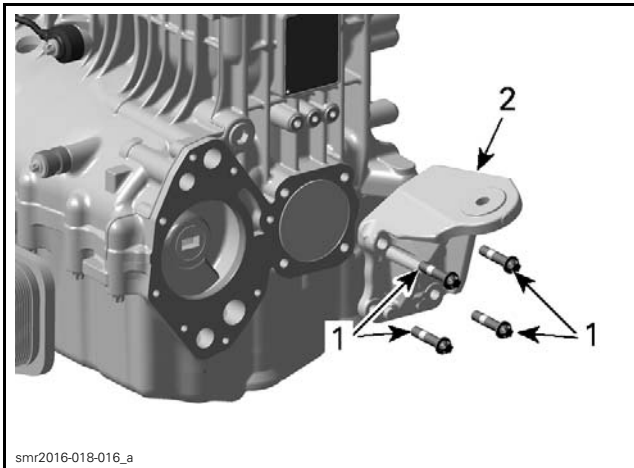
Disassembling the Cylinder Block

Refer to *PTO HOUSING AND MAGNETO* subsection and remove:

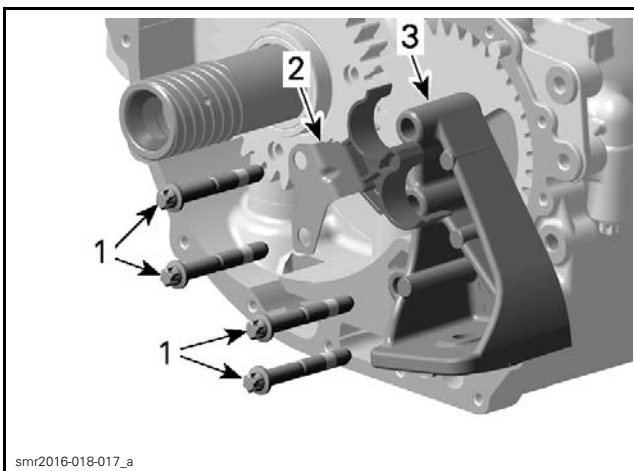
- PTO housing
- Starter gear
- Starter drive.

Remove engine mounting brackets.

Refer to *LUBRICATION SYSTEM* subsection and remove oil suction pump.



1. Retaining screws
2. Engine mounting bracket

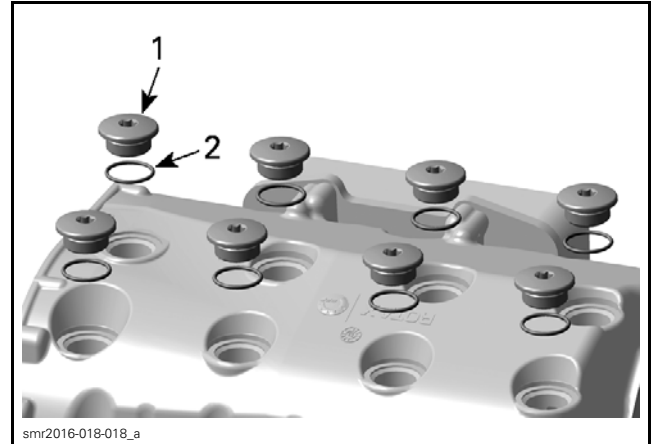


1. Retaining screws
2. Engine mounting bracket

Refer to *CYLINDER HEAD* subsection and remove cylinder head.

NOTE: Before splitting the cylinder block, measure crankshaft axial play. Refer to *CRANKSHAFT* in this subsection.

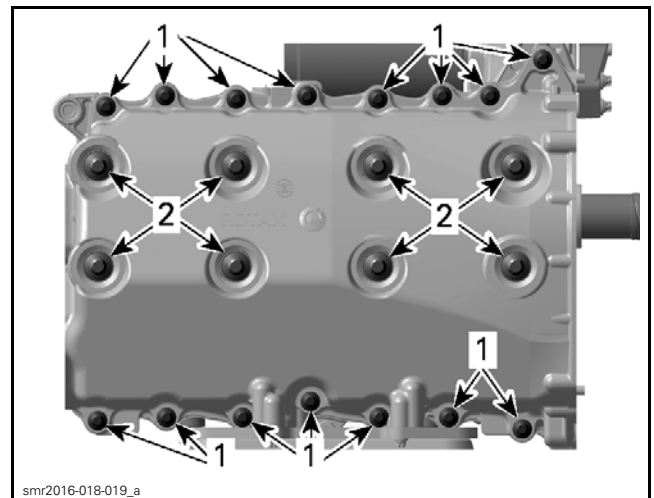
Remove oil reservoir plug screws with O-rings.



1. Oil reservoir plug screw
2. O-ring

Remove cylinder block screws:

1. Start removing the M8 screws.
2. Then remove the M10 screws.

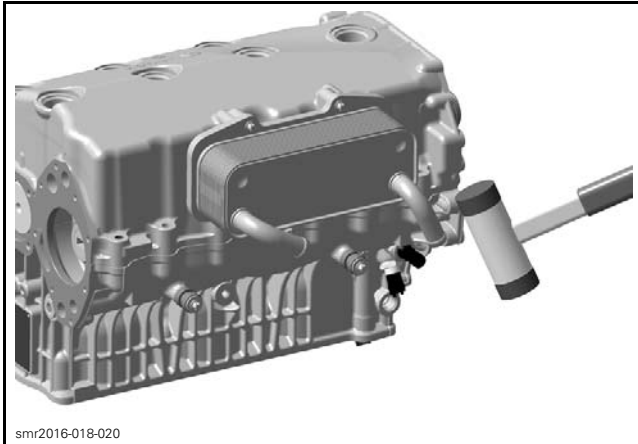


1. M8 screws
2. M10 screws

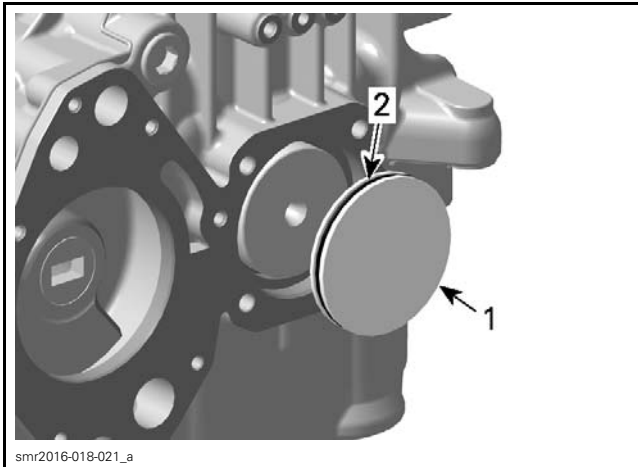
Carefully remove cylinder block lower half by using a soft hammer.

NOTE: Take care not to damage the sealing surfaces of the cylinder block halves.

Subsection XX (CYLINDER BLOCK)



Remove crankshaft cover with O-ring.



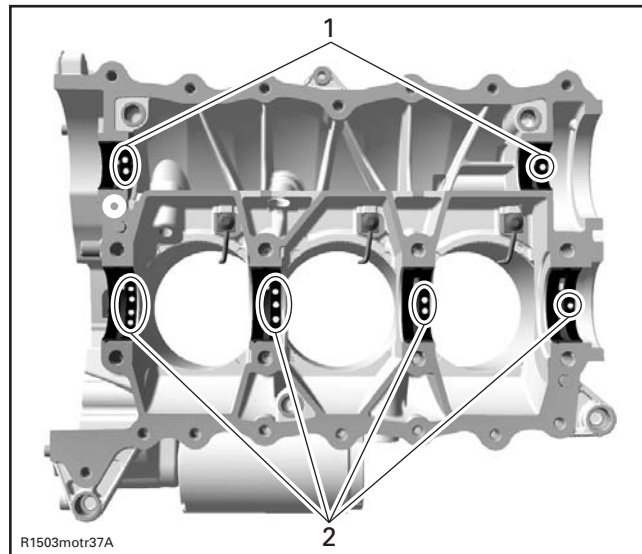
1. Crankshaft cover
2. O-ring

Refer to procedures in this subsection and remove:

- Balancer shaft
- Crankshaft
- Piston with connecting rod.

Removing the Plain Bearings

When the plain bearings of crankshaft and balancer shaft need to be removed from the cylinder block, mark them to identify the correct position at installation. See the following illustration for an example:



1. Marks on balancer shaft bearings
2. Marks on crankshaft bearings

Cleaning the Cylinder Block

Clean cylinder block using a part cleaner, then use compressed air to dry it.

Blow out the oil orifices using compressed air and make sure they are not clogged.

Clean all metal components in a solvent.

Cylinder block mating surfaces are best cleaned using a combination of the LOCTITE CHISEL (GAS-KET REMOVER) (P/N 413 708 500) and a brass brush. Brush a first pass in one direction then make the final brushing perpendicularly (90°) to the first pass (cross hatch).

NOTICE Do not wipe with rags. Use a new clean hand towel only.

Inspecting the Cylinder Block

Cylinder Block and Cylinder Bores

Check cylinder block for cracks or other damage.

Check cylinder block mating surfaces for flatness using a straight edge.

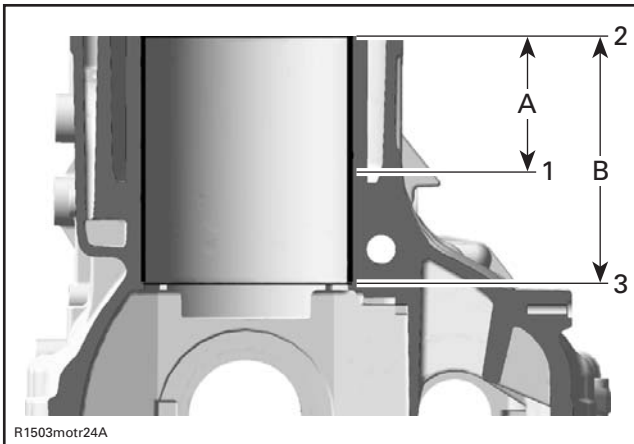
Check cylinder bores for cracks, scoring and wear ridges on the top and bottom of the cylinder.

Replace cylinder block if necessary.

Cylinder Taper

Measure cylinder bore and if it is out of specifications.

Measure cylinder bore at 3 recommended positions. See the following illustration.



1. First measuring diameter
2. Second measuring diameter
3. Third measuring diameter
- A. 60 mm (2.362 in)
- B. 110 mm (4.331 in)

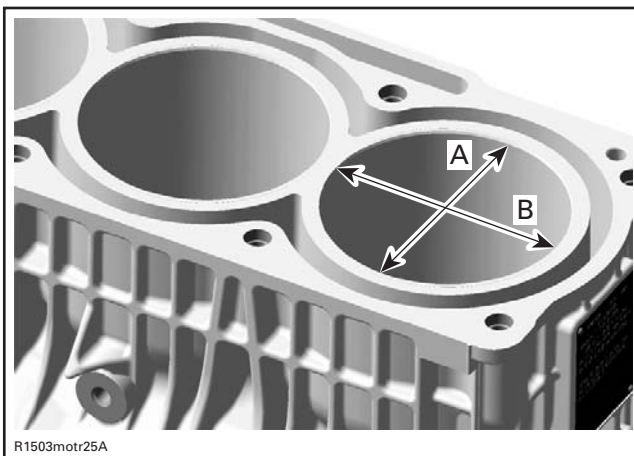
CYLINDER TAPER IN DIAMETER	
NEW MAXIMUM	0.036 mm (.0014 in)
SERVICE LIMIT	0.100 mm (.0039 in)

If a cylinder bore is out of specification, please replace cylinder block assembly.

Cylinder Out of Round

Measure cylinder diameter in piston axis direction from top of cylinder. Take an other measurement 90° from first one and compare.

NOTE: Take the same measuring points as described in *CYLINDER TAPER*.



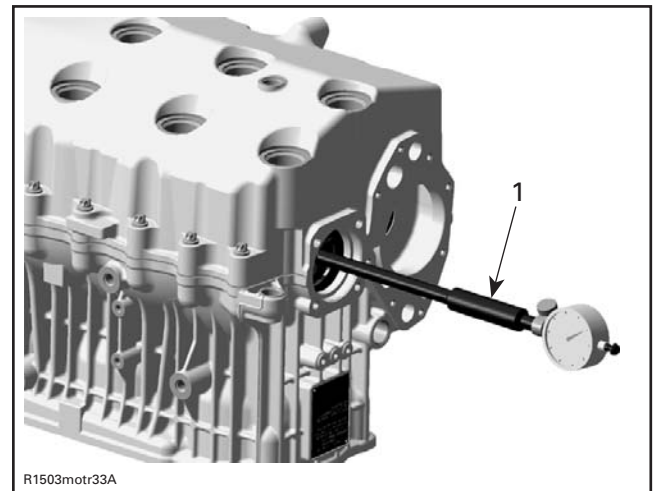
- A. Perpendicular to crankshaft axis
- B. Parallel to crankshaft axis

CYLINDER OUT OF ROUND	
NEW MAXIMUM	0.008 mm (.0003 in)
SERVICE LIMIT	0.020 mm (.0008 in)

Bearings

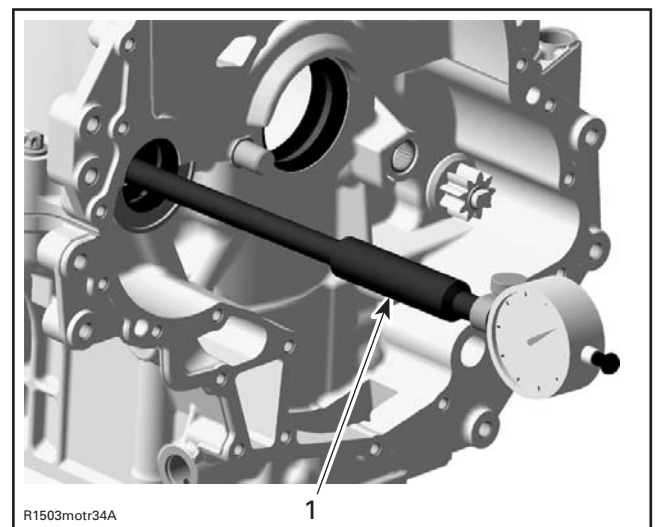
Measure plain bearing inside diameter and compare with crankshaft bearing journal diameter (refer to *CRANKSHAFT* in this subsection). Proceed as follows:

- Use the **OLD** plain bearings and put both cylinder block halves together.
- Tighten screws as described in *ASSEMBLING THE CYLINDER BLOCK*.
- Measure the inside diameter of the crankshaft plain bearings using a bore gauge



ENGINE UPSIDE DOWN
1. Bore gauge

CRANKSHAFT BEARING INSIDE DIAMETER	
SERVICE LIMIT	50.10 mm (1.9724 in)



ENGINE UPSIDE DOWN
1. Bore gauge

Subsection XX (CYLINDER BLOCK)

BALANCER SHAFT BEARING INSIDE DIAMETER	
SERVICE LIMIT	32.11 mm (1.2642 in)

Replace plain bearings if they are out of specifications.

Assembling the Cylinder Block

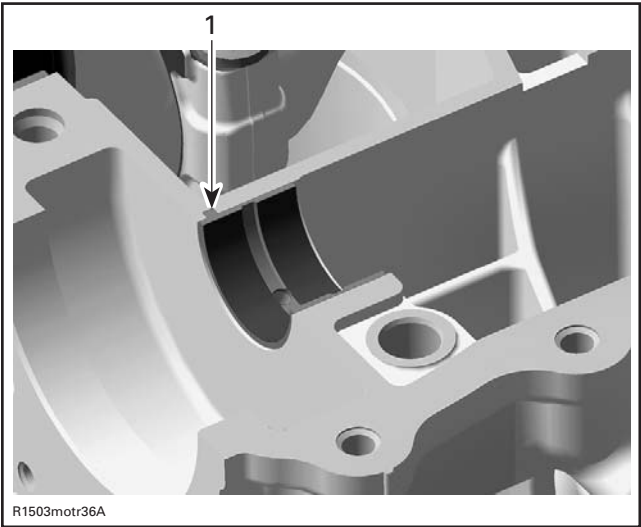
The assembly is the reverse of the disassembly procedure. However, pay attention to the following details.

Install the following components:

- Piston oil nozzles, refer to *LUBRICATION SYSTEM* subsection
- Oil cooler, refer to *LUBRICATION SYSTEM* subsection
- Supercharger oil spray nozzle, refer to *LUBRICATION SYSTEM* subsection
- Electric starter, refer to *PTO HOUSING AND MAGNETO* subsection
- Chain tensioner guide.

If **OLD** bearings will be used again, reinstall them at the same position as they were before.

Correctly install bearings. Top crankshaft bearing halves have a bore which has to be placed in the upper cylinder block.



1. Bearing protrusion in cylinder block notch

Apply engine oil on all plain bearings.

For proper installation of pistons, refer to *PISTONS AND CONNECTING RODS* in this subsection.

NOTICE Before installing the crankshaft, ensure that:

- chain guide is already installed
- timing chain is installed on crankshaft timing gear.

Those parts cannot be installed after as the crankshaft is in place.

IMPORTANT: When beginning the application of the crankcase sealant, the assembly and the first torquing should be done within 10 minutes. It is suggested to have all you need on hand to save time.

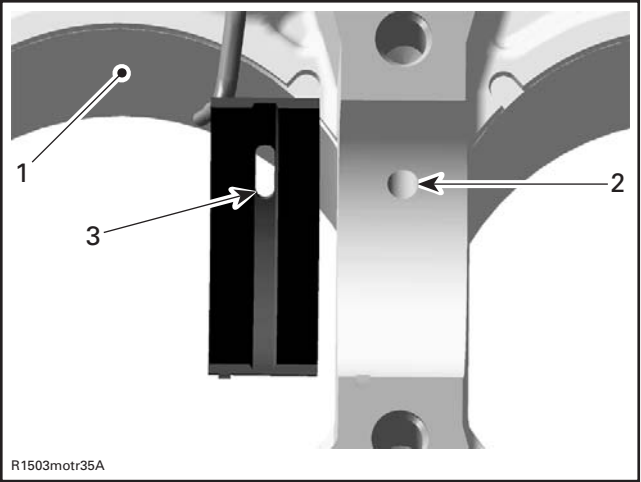
Apply sealant on mating surfaces.

CYLINDER BLOCK SEALANT	
Service product	LOCTITE 5910 (P/N 293 800 081)

NOTE: When beginning the application of the gear housing sealant, the assembly and the first torquing should be done within 10 minutes. It is suggested to have all you need on hand to save time.

REQUIRED TOOL
Plexiglas plate
Soft rubber roller

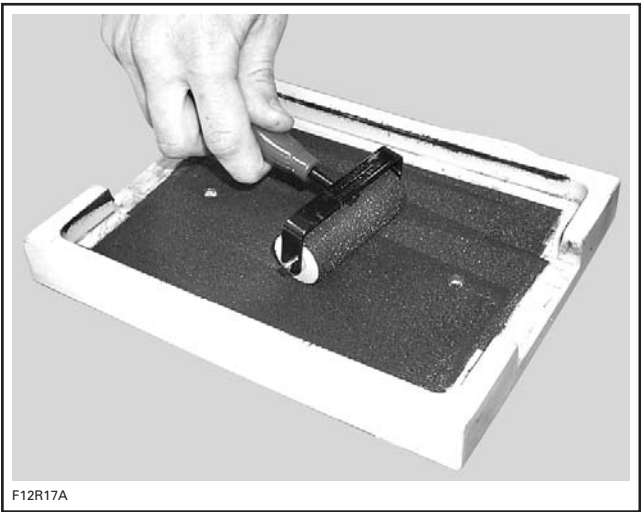
Apply some sealant on the plate and get a thin uniform coat (spread as necessary).



1. Cylinder block upper half
2. Oil bore in cylinder block
3. Oil bore in bearing

Bearings have to be flush with the cylinder block split surface and their protrusions have to fit in the notched areas in the cylinder block seat.

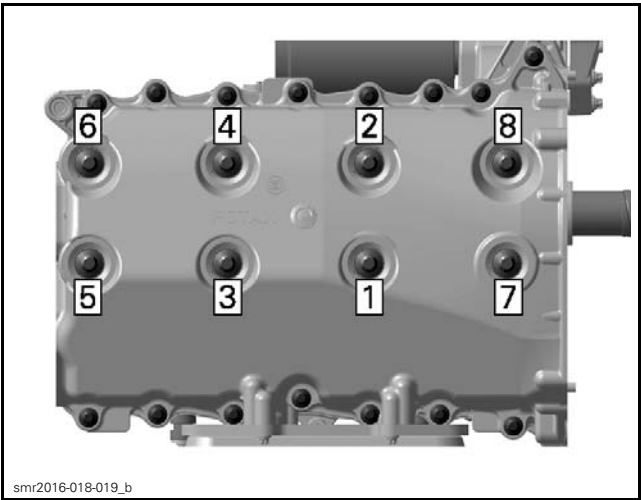
Then apply the sealant on supercharger housing sealing surface.



NOTE: If you do not use the roller method, you may use your finger to uniformly distribute this sealant.

Do not apply in excess as it will spread out inside crankcase.

Tighten M10 cylinder block screws as per following sequence.

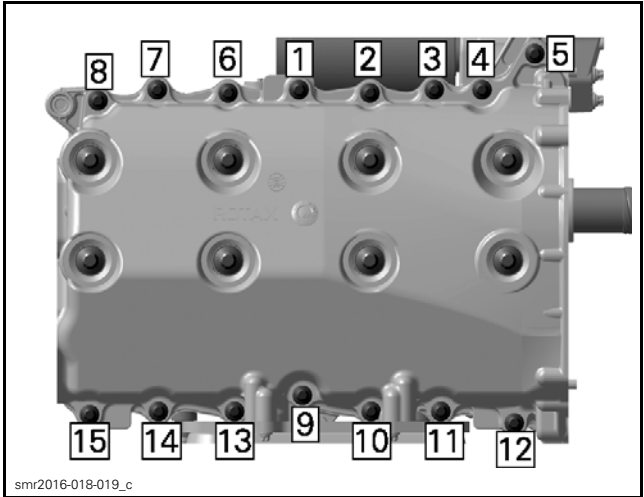


M10 SCREWS TIGHTENING SEQUENCE

NOTICE All M10 cylinder block screws must be torque **FIRST** according to step A before performing to step B.

TIGHTENING PROCEDURE		
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)	
M10 cylinder block screws	Step A	40 N•m ± 3 N•m (30 lbf•ft ± 2 lbf•ft)
	Step B	55 N•m ± 4 N•m (41 lbf•ft ± 3 lbf•ft)

Tighten M8 cylinder block screws as per following sequence.

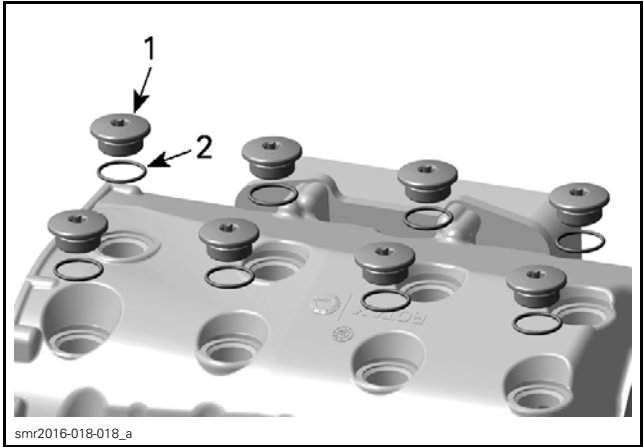


M8 SCREWS TIGHTENING SEQUENCE

TIGHTENING TORQUE	
M8 cylinder block screws	30 N•m ± 3 N•m (22 lbf•ft ± 2 lbf•ft)

NOTE: Check axial clearance of balancer shaft and crankshaft before continuing the assembly. Refer to *CRANKSHAFT* and *BALANCER SHAFT* in this subsection for the procedure.

Install oil reservoir plug screws with O-rings.

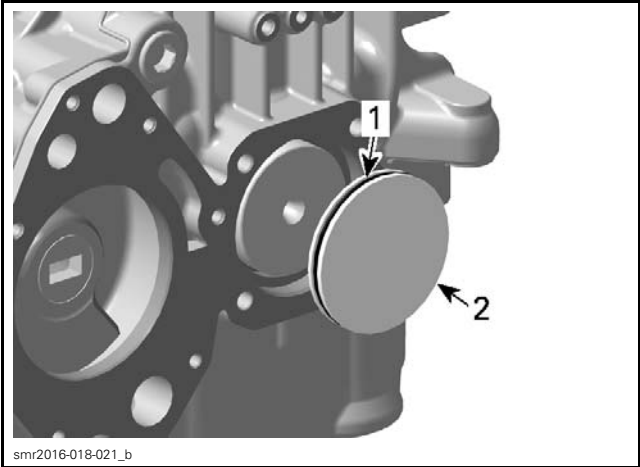


1. Oil reservoir plug screw
2. O-ring

Subsection XX (CYLINDER BLOCK)

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Oil reservoir plug screw	23 N•m ± 3 N•m (17 lbf•ft ± 2 lbf•ft)

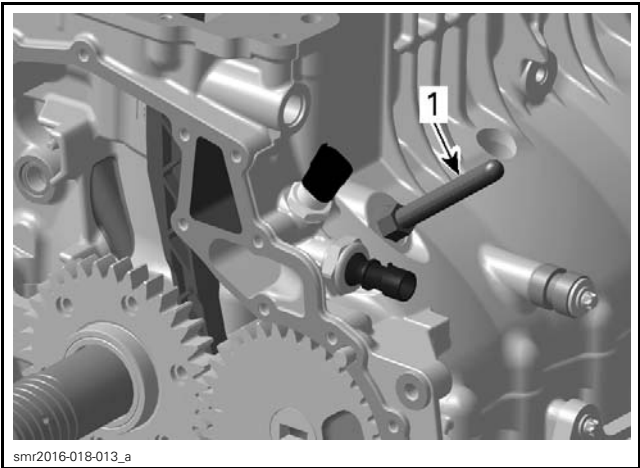
Apply engine oil on O-ring and press in crankshaft cover.



- 1. O-ring
- 2. Crankshaft cover

Position crankshaft at TDC before installing the camshaft and the rocker arms (refer to *CYLINDER HEAD* subsection).

REQUIRED TOOL	
CRANKSHAFT LOCKING TOOL (P/N 529 035 821)	



- 1. Crankshaft locking tool

Reassemble engine in accordance with the proper assembly procedures.

SUPERCHARGER

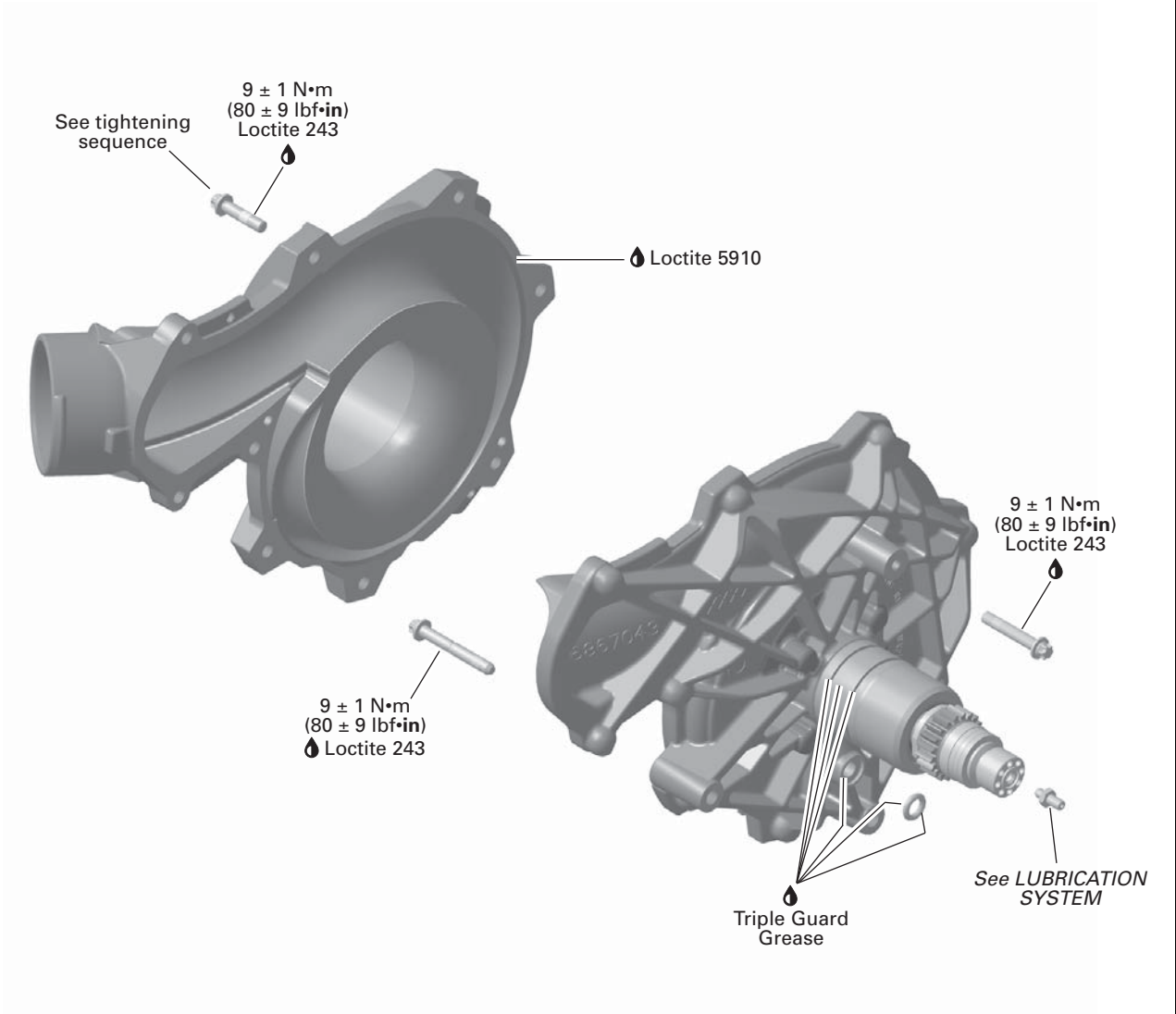
SERVICE TOOLS

Description	Part Number	Page
CAMSHAFT LOCKING TOOL.....	529 035 839	3
SUPERCHARGED GEAR HOLDER	529 036 364	4
SUPPORT PLATE.....	529 035 947	4, 7
TORX ADAPTER.....	529 035 938	7, 9

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE).....	293 800 060	8-9
LOCTITE 5910	293 800 081	8
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	8
TRIPLE-GUARD GREASE	296 000 329	9

Subsection XX (SUPERCHARGER)



NEW = Component must be replaced when removed.

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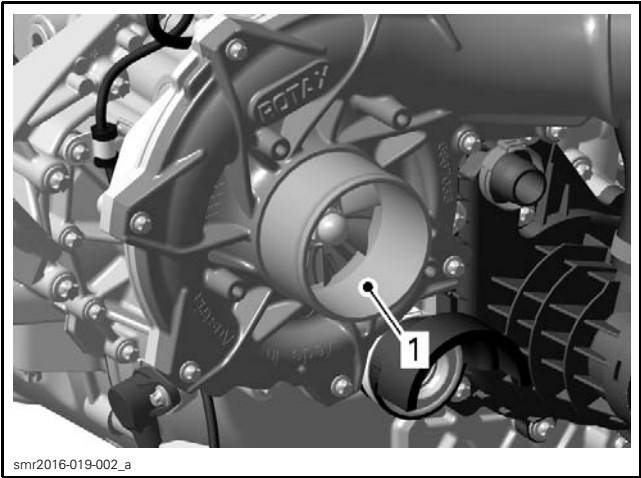
INSPECTION

SUPERCHARGER INLET
CLEANLINESS

NOTE: A lower than usual maximum RPM at full throttle might be caused by a dirty supercharger inlet.

Remove supercharger air inlet hose.

Visually inspect supercharger inlet side for oil, salt or any other deposits.



1. Supercharger inlet

If dirt is found, proceed as follows.

1. Separate supercharger housing.

NOTE: Since supercharger is disassembled, it is recommended to completely inspect it.

2. Clean internal housing and turbine using a brass brush and cleaning solvent to get rid of oil deposits.

3. Blow dry with compressed air.

NOTICE Do not let turbine spin when using compressed air.

4. Complete usual assembly procedures as described in this subsection.

SUPERCHARGER CLUTCH
SLIPPING MOMENT
(ON ENGINE)

Remove supercharger air inlet hose.

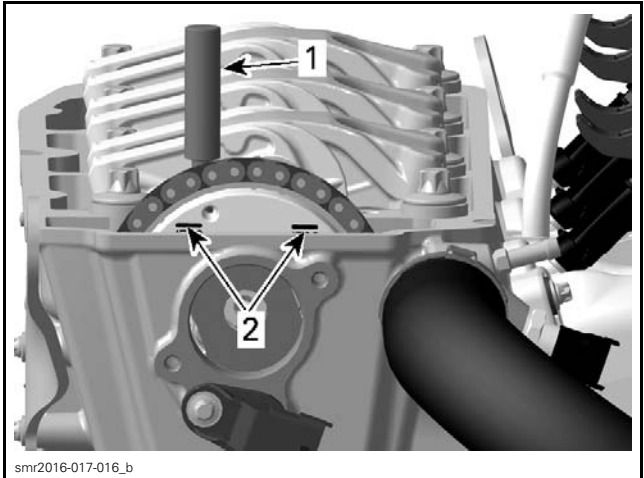
Remove valve cover, refer to *CYLINDER HEAD* subsection.

Remove spark plugs, refer to *IGNITION SYSTEM* subsection.

Turn engine by rotating the supercharger nut counterclockwise until the position lines on oil separator cover are lined up as shown in the following illustration.

Lock camshaft.

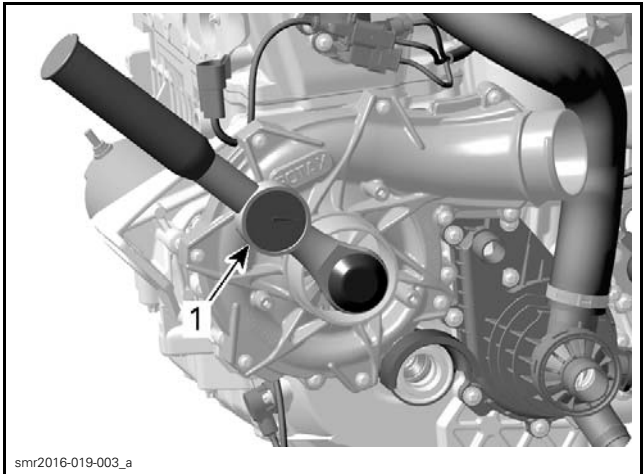
REQUIRED TOOL	
CAMSHAFT LOCKING TOOL (P/N 529 035 839)	



1. Camshaft locking tool
2. Position lines

Check slipping moment counterclockwise.

REQUIRED TOOL	
Torque wrench with actual torque viewer	
A mirror is useful to see the viewer	



1. Torque wrench

NOTE: Before checking the supercharger slipping moment turn the clutch for a minimum of 3 complete revolutions. This will dissipate grease or oil on the friction shims for a precise reading.

Subsection XX (SUPERCHARGER)

Supercharger should start to turn at a torque within the specified values.

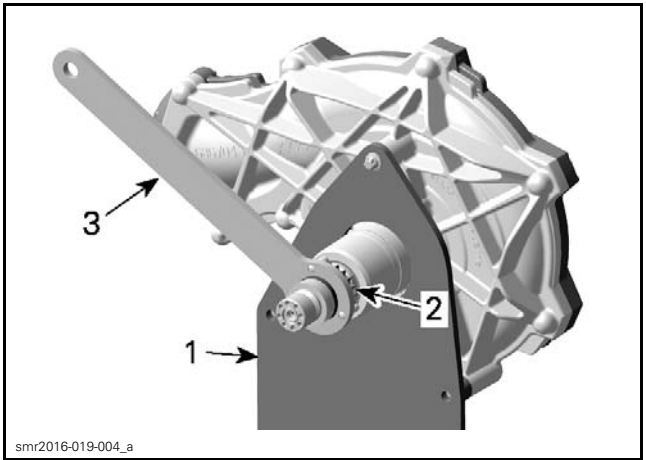
SLIPPING MOMENT (NEW SUPERCHARGER)
14 N•m to 17 N•m (124 lbf•in to 150 lbf•in)
SLIPPING MOMENT (BREAK-IN SUPERCHARGER)
Minimum 11 N•m (97 lbf•in)

If the torque is not within specifications, replace supercharger assembly.

SUPERCHARGER CLUTCH
SLIPPING MOMENT
(BENCH TEST)

Mount supercharger on support plate.
Hold supercharger gear.

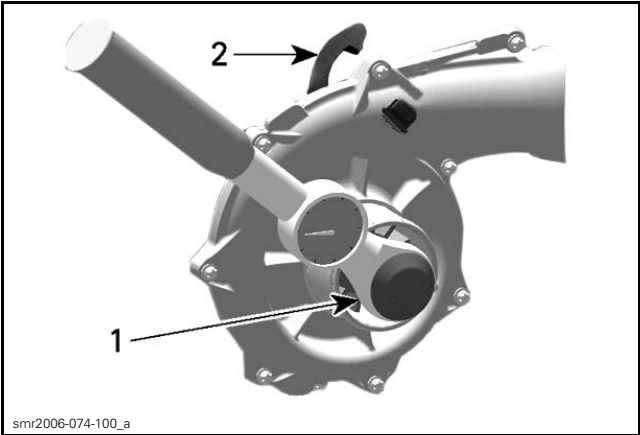
REQUIRED TOOLS
SUPPORT PLATE (P/N 529 035 947)
2x screw M6x25
SUPERCHARGED GEAR HOLDER (P/N 529 036 364)



- 1. Support plate
- 2. Supercharger gear
- 3. Supercharger gear holder

Check slipping moment counterclockwise.

REQUIRED TOOL
Torque wrench with a viewer



- 1. Torque wrench
- 2. Gear holder

NOTE: Before checking the supercharger slipping moment to turn the clutch for a minimum of 3 complete revolutions. This will dissipate grease or oil on the friction shims for a proper reading.

Supercharger should start to turn at a torque within the specified values.

SLIPPING MOMENT (NEW SUPERCHARGER)
14 N•m to 17 N•m (124 lbf•in to 150 lbf•in)
SLIPPING MOMENT (BREAK-IN SUPERCHARGER)
Minimum 11 N•m (97 lbf•in)

If the torque is not within specification, replace supercharger assembly.

TROUBLESHOOTING

The following is provided to help in diagnosing the probable source of troubles. It is a guideline and it should not be assumed to list all possible problems.

Always check for fault codes. If a fault code is detected, service the fault code first. Refer to *DIAGNOSTIC AND FAULT CODES* subsection.

ENGINE WILL NOT START (ENGINE DOES NOT TURN OVER)

- 1. Supercharger seized or obstructed
 - Inspect and replace supercharger assembly if necessary.
 - Inspect supercharger oil spray nozzle, refer to *LUBRICATION SYSTEM* subsection.

ENGINE LACKS ACCELERATION OR POWER (DOES NOT REACH MAXIMUM RPM)

1. Supercharger inlet is dirty
 - Check and clean supercharger inlet.
 - Check engine oil. Siphon excess of oil.
2. Supercharger slipping clutch defective
 - Check slipping clutch moment.
 - Replace supercharger assembly if out of specification.
3. Check intercooler for oil contamination.
 - Clean intercooler.

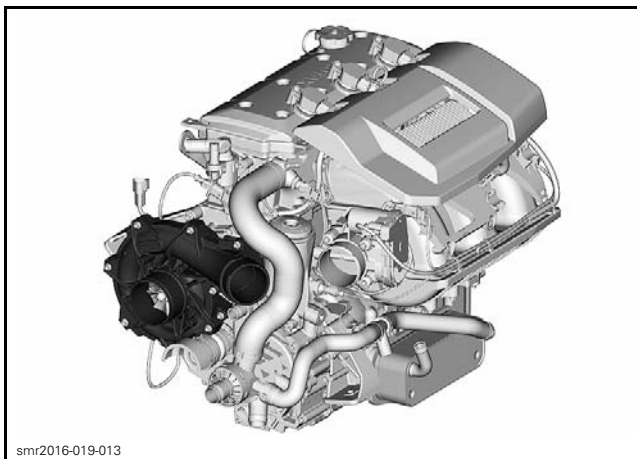
PROCEDURES

SUPERCHARGER OIL SPRAY NOZZLE

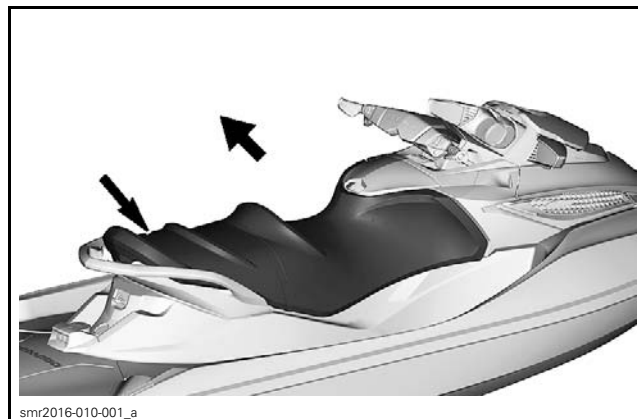
Refer to *LUBRICATION SYSTEM* subsection.

SUPERCHARGER

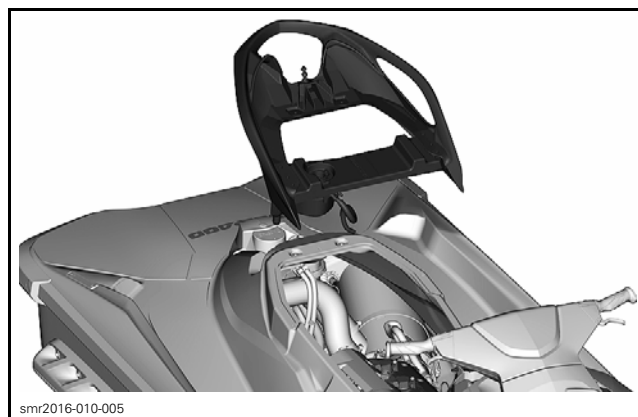
Supercharger Location



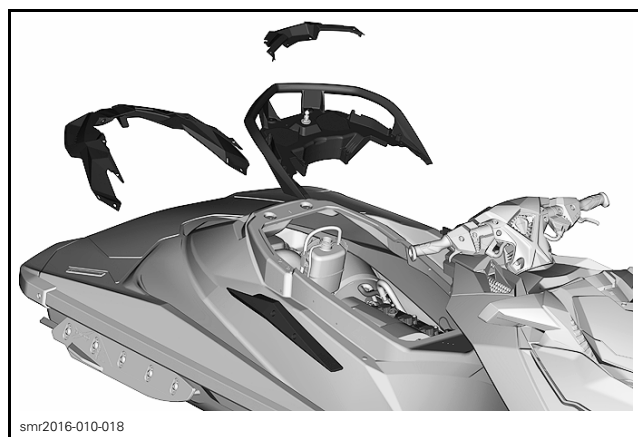
Removing the Supercharger



GTX LTD SHOWN

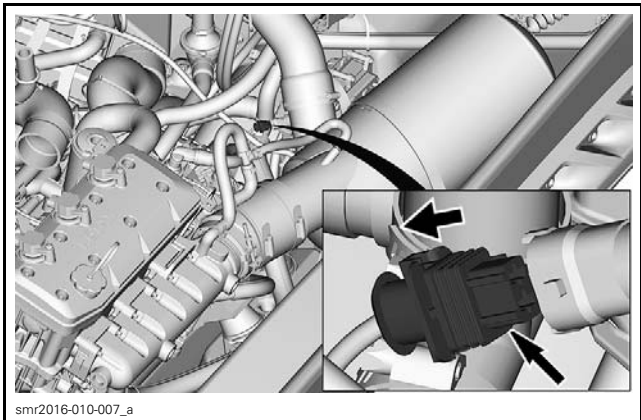


GTX LTD AND RXT-X MODELS

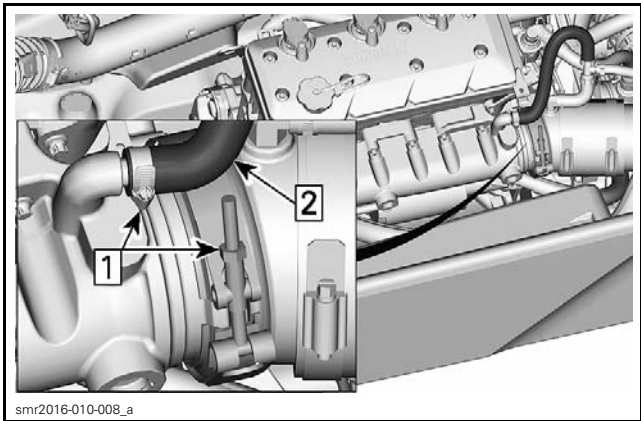


RXP X MODELS

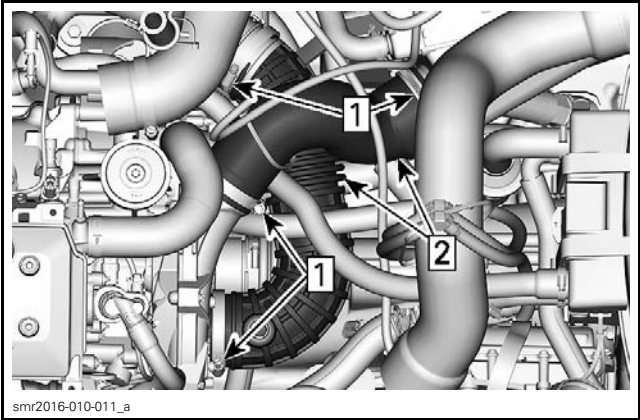
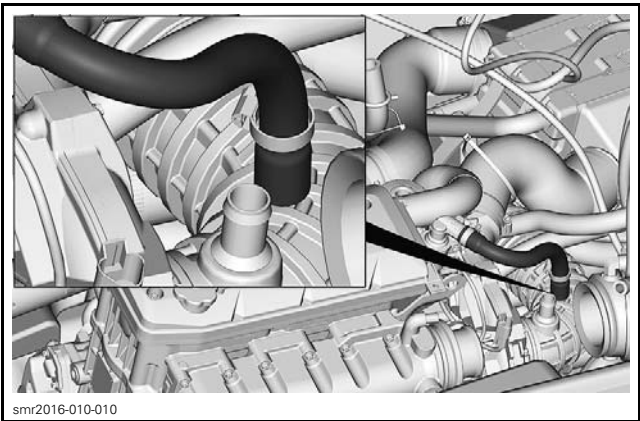
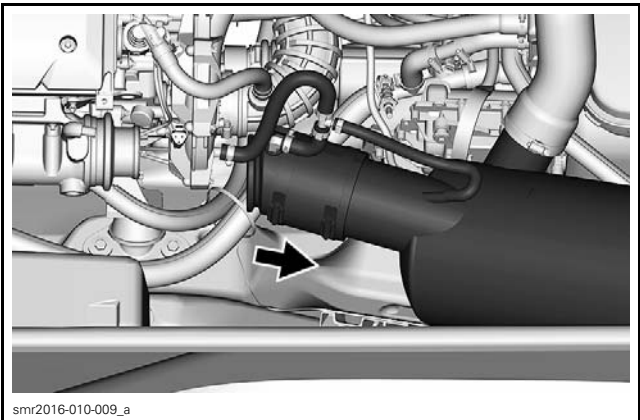
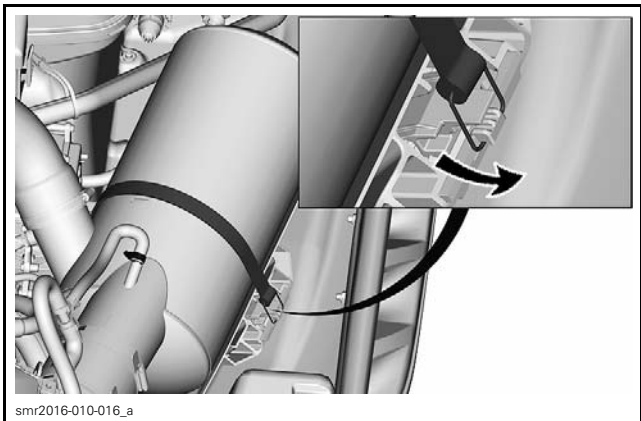
Subsection XX (SUPERCHARGER)



NOTICE Do not use pneumatic or electrical tool as seizure may occur.



Step 1: Loosen
Step 2: Disconnect

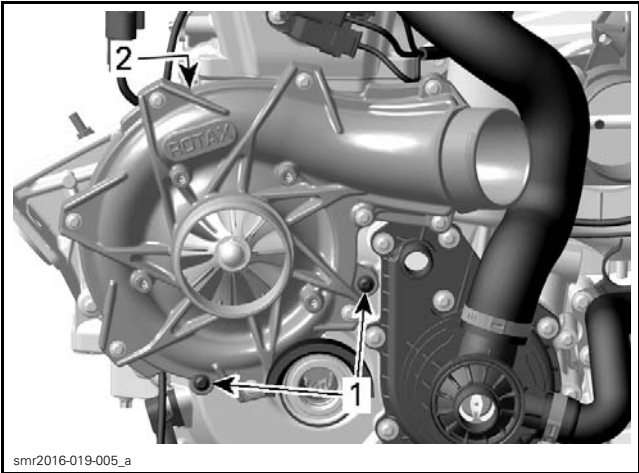


Step 1: Loosen
Step 2: Remove

Remove jet pump. Refer to *JET PUMP* subsection.

NOTE: Removing the jet pump allows the drive shaft to drop just enough so that the floating ring clears the supercharger.

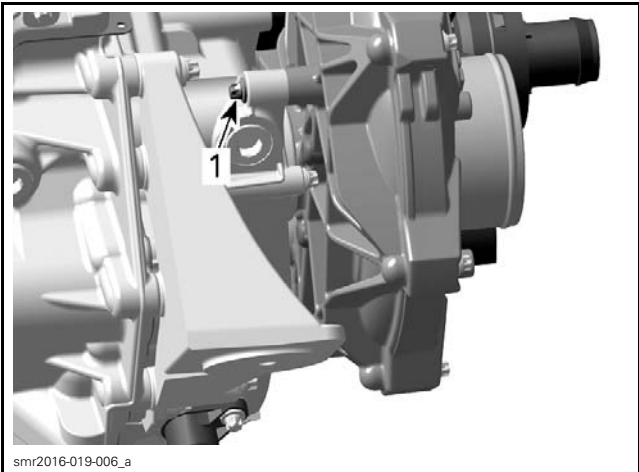
Remove retaining screws.



- 1. Supercharger retaining screws
- 2. Upper supercharger retaining screw (hidden behind the supercharger)

NOTE: Use the following tool to remove the upper retaining screw.

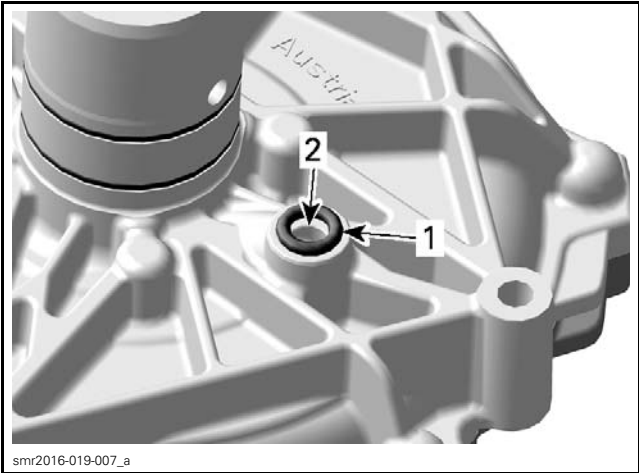
REQUIRED TOOL	
TORX ADAPTER (P/N 529 035 938)	



- 1. Upper retaining screw

Remove supercharger from engine.

NOTE: Take care not to lose the O-ring of oil return bore.



- 1. O-ring
- 2. Oil return bore

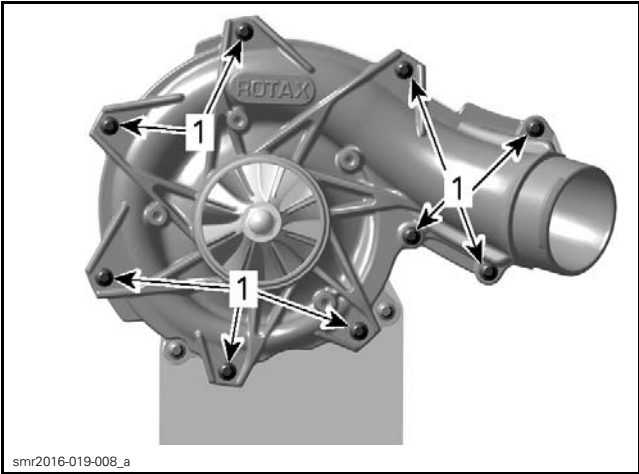
Disassembling the Supercharger

NOTICE Be scrupulous when working on supercharger parts. Supercharger rotation reaches 46800 RPM. Any modification, improper handling or damage on the parts, may result in damage of the supercharger. Strictly follow the described procedures.

- 1. Secure the supercharger on its support plate.

REQUIRED TOOL	
SUPPORT PLATE (P/N 529 035 947)	
2x screw M6x25	

- 2. Remove supercharger housing screws.



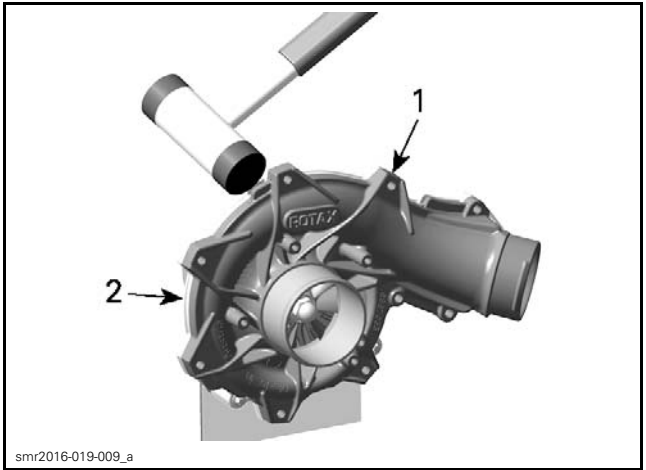
- 1. Supercharger housing screws

- 3. Separate supercharger housing.

NOTE: Take care not damaging the sealing surfaces of the supercharger housings.

Subsection XX (SUPERCHARGER)

REQUIRED TOOL
Soft hammer



- 1. Housing half (intake side)
- 2. Housing half (engine side)

NOTICE To grant the optimal performance and smooth operation the supercharger assembly is balanced. Consequently it is not possible to perform any repairs on the supercharger assembly.

Assembling the Supercharger

- 1. Clean supercharger housing halves using a part cleaner, then use compressed air to dry it. Take care that deposits do not get into the bearing area.

NOTICE Do not let turbine spin when using compressed air.

- 2. Clean supercharger housing mating surfaces. Brush in one direction then make the final brushing perpendicularly (90°) to the first pass.

SUPERCHARGER HOUSING MATING SURFACES CLEANING	
Service product	LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500)

REQUIRED TOOL
Brass brush

- 3. Apply sealant on supercharger housing sealing surface.

SUPERCHARGER HOUSING SEALING SURFACE	
Service product	LOCTITE 5910 (P/N 293 800 081)

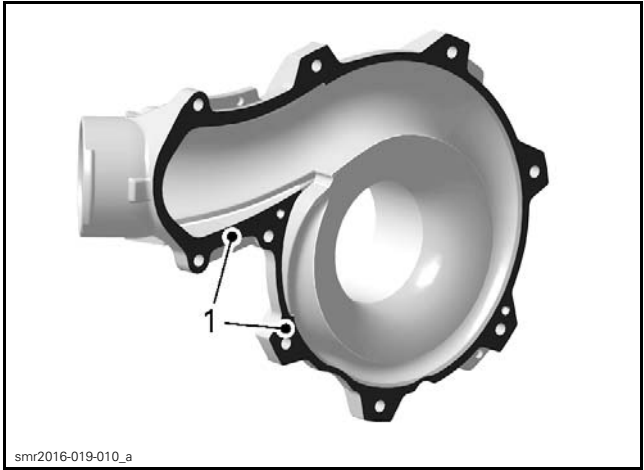
NOTICE When beginning the application of the gear housing sealant, the assembly and the first torquing should be done within 10 minutes. It is suggested to have all you need on hand to save time.

Apply some sealant on the plate and get a thin uniform coat (spread as necessary).

Then apply the sealant on supercharger housing sealing surface.

REQUIRED TOOL
Plexiglas plate
Soft rubber roller

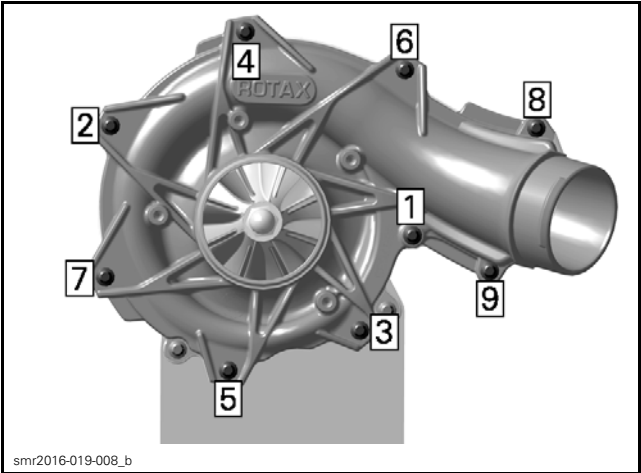
NOTE: Ensure not to apply too much sealant, as it will spread out inside supercharger housing.



HOUSING HALF (INTAKE SIDE)
1. Apply Loctite 5910 on sealing surface

- 4. Assemble supercharger housing halves.
- 5. Tighten supercharger housing screws according to the following sequence.

TIGHTENING TORQUE	
Supercharger housing screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in) + LOCTITE 243 (BLUE) (P/N 293 800 060)



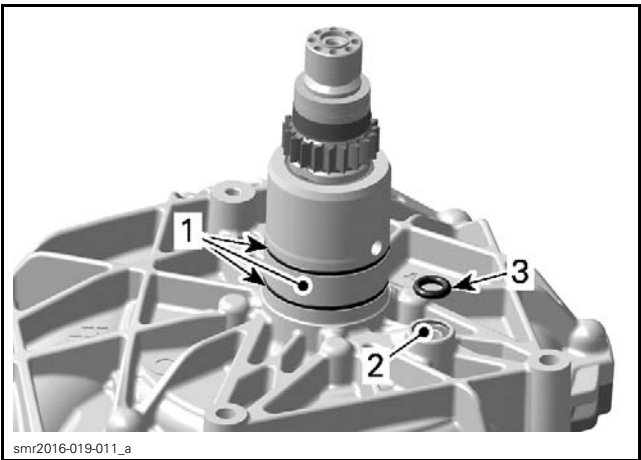
TIGHTENING SEQUENCE

Installing the Supercharger

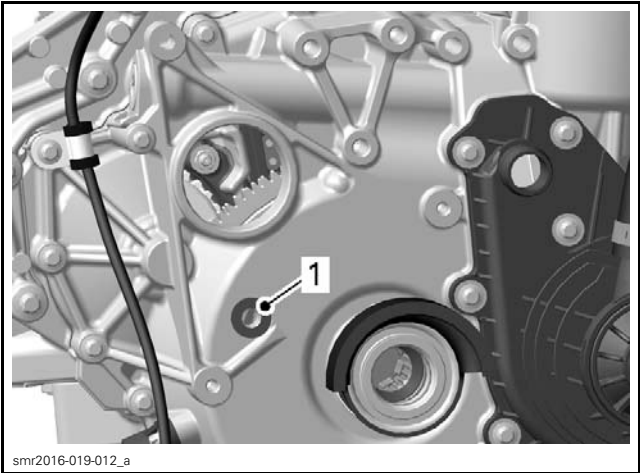
1. Grease:
- Mounting surface of the supercharger with O-rings.
 - Sealing surface of oil return bore on super-charger housing
 - O-ring
 - Sealing surface of oil return bore on PTO housing.

SUPERCHARGER JOURNAL AND OIL RETURN BORE SEALING	
Service product	TRIPLE-GUARD GREASE (P/N 296 000 329)

NOTE: Ensure O-rings are installed.



- LUBRICATE
1. Mounting surface with O-rings
2. Oil return bore sealing surface
3. O-ring



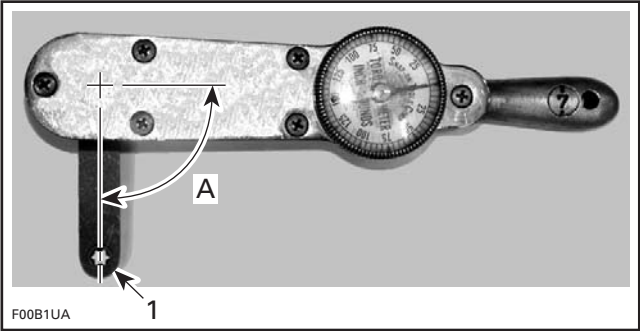
- LUBRICATE
1. Oil return bore sealing surface

2. Install supercharger on PTO housing.
3. Tighten supercharger retaining screws to specifications.

TIGHTENING TORQUE	
Supercharger retaining screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in) + LOCTITE 243 (BLUE) (P/N 293 800 060)

NOTE: For the upper retaining screw the following tool must be used mounted 90° to torque wrench.

REQUIRED TOOL	
TORX ADAPTER (P/N 529 035 938)	



1. Torx adapter perpendicular to torque wrench
A. 90°

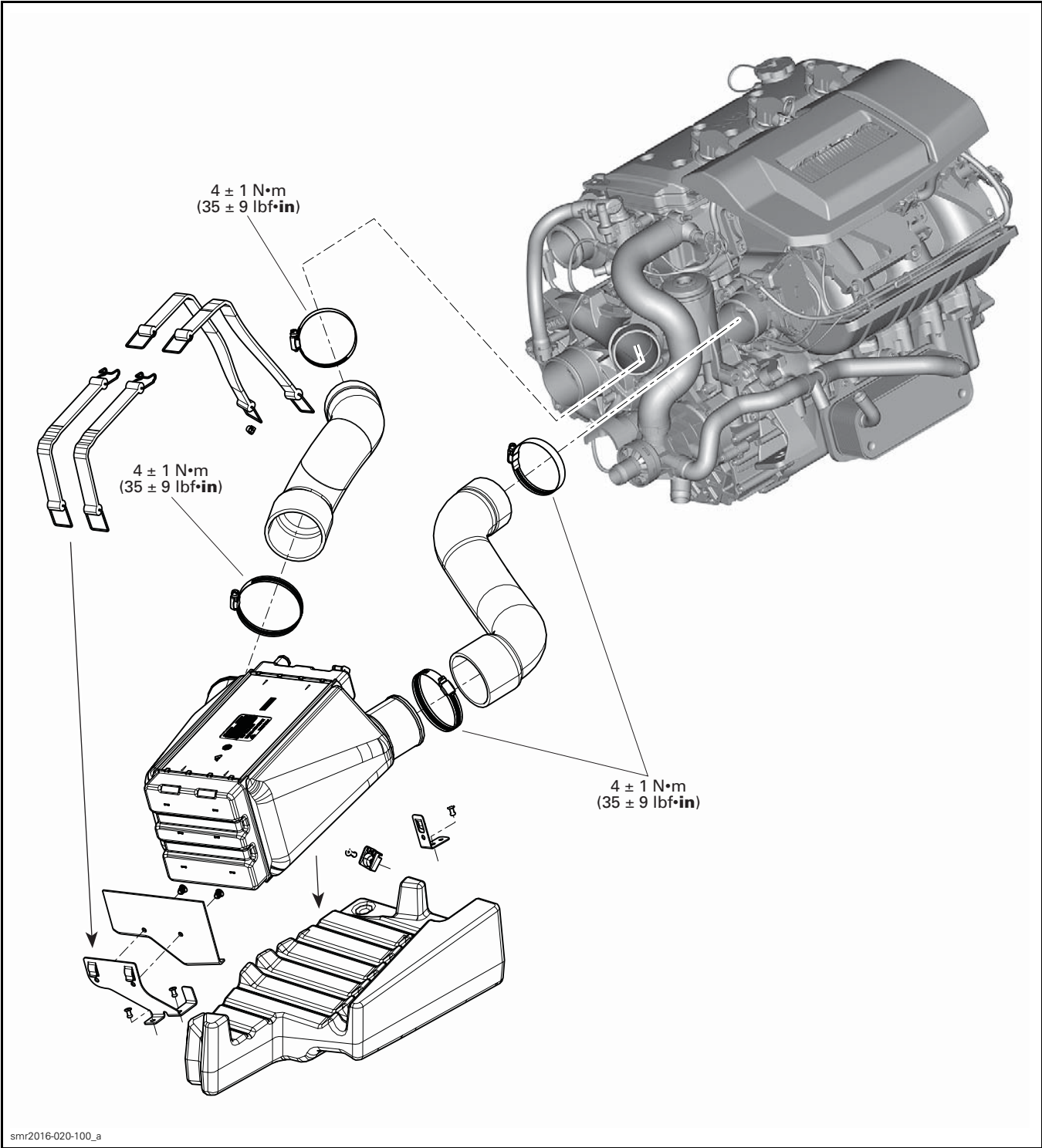
NOTICE Not installing the tool as shown will change the torque applied to the screw.

4. After complete installation of the supercharger, the slipping moment has to be rechecked. Refer to *SUPERCHARGER CLUTCH SLIPPING MOMENT (ON ENGINE)* at the beginning of this subsection.

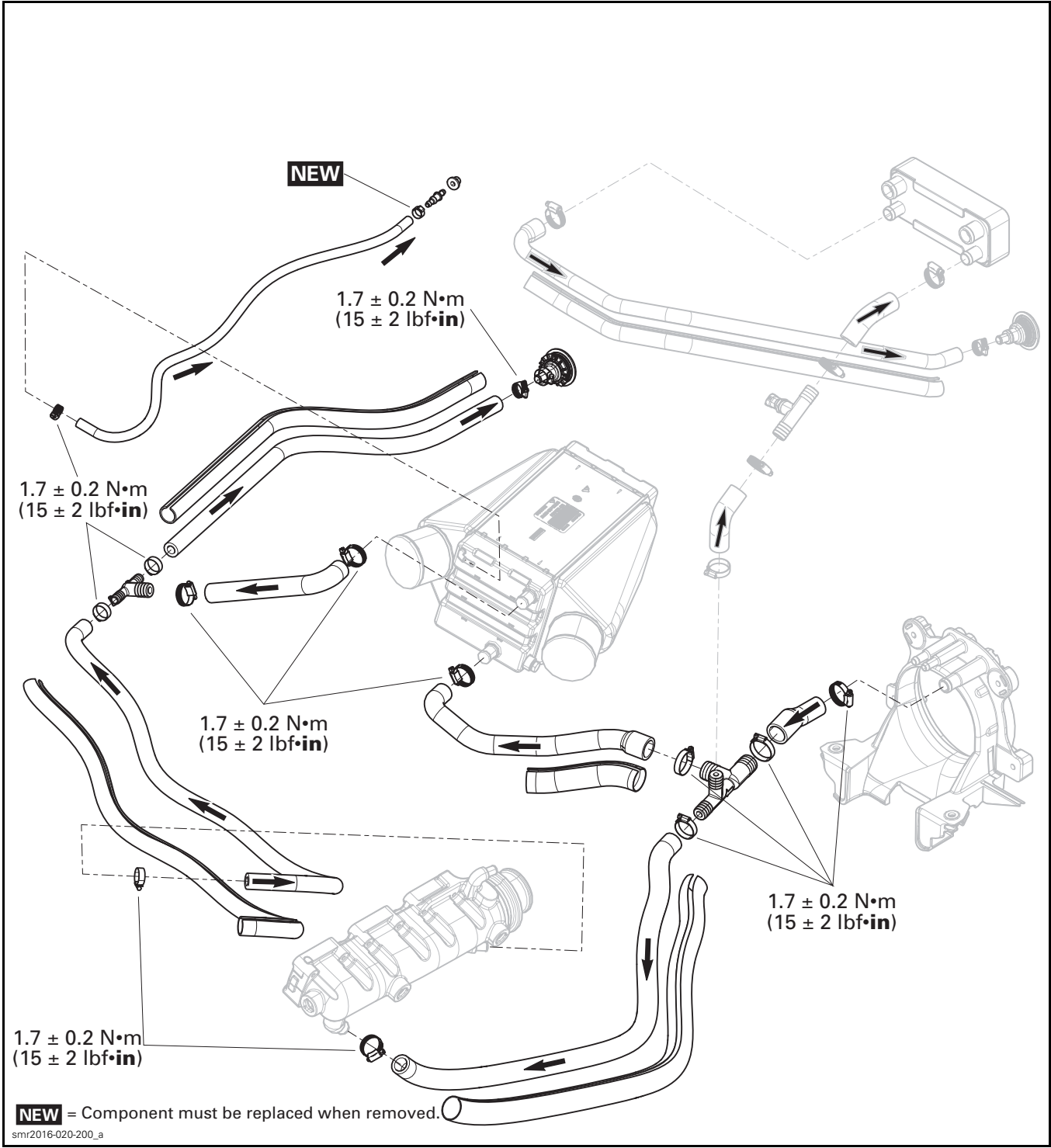
INTERCOOLER

SERVICE TOOLS

Description	Part Number	Page
LARGE HOSE PINCHER.....	529 032 500	4
VACUUM/PRESSURE PUMP	529 021 800	4



Subsection XX (INTERCOOLER)



MAINTENANCE

INTERCOOLER FLUSHING

Flushing the intercooler with fresh water is essential to neutralize corroding effects of salt or other chemical products present in water. It will help to clean up sand, salt, shells or other particles in intercooler.

NOTE: Intercooler is flushed with the exhaust system, as they are on the same circuit.

Exhaust system and intercooler should be flushed each time:

- Watercraft is used in salt water and is not expected to be used further the same day.
- Watercraft is used in foul water.
- Watercraft is stored for any extended time.

Refer to *EXHAUST SYSTEM* subsection for flushing procedure.

NOTICE Failure to flush the system, when necessary, will severely damage engine intercooler and/or exhaust system.

PROCEDURES

INTERCOOLER

 **WARNING**

Let engine cool down prior to work on or near intercooler.

Cleaning the Intercooler

If temperature in intake manifold is too high or if engine is down in performance, intercooler may require to be cleaned.

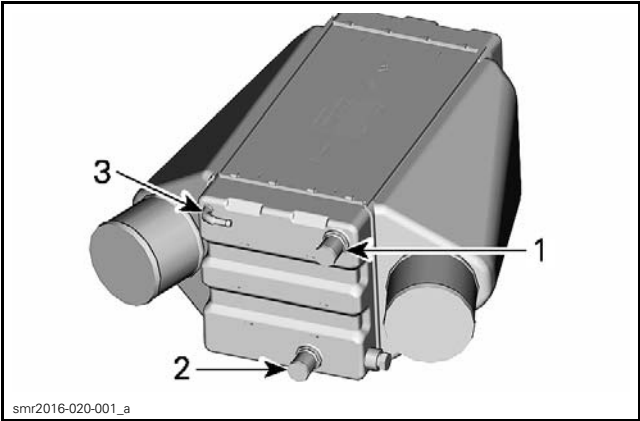
The exhaust system should be flushed first, as it may unclogged the intercooler. If not, then proceed with the intercooler cleaning procedure as detailed here.

NOTE: The exhaust temperature will decrease when the intercooler is clogged because more water is rerouted through the exhaust system.

To clean the intercooler, do the following:

NOTICE Never try to clean the intercooler with chemical products. Only use fresh water. Chemical products will permanently damage the internal parts of intercooler.

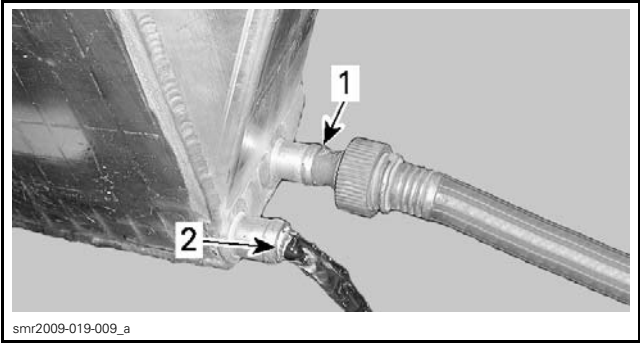
1. Remove the intercooler from the watercraft.
See procedure further in this subsection.
2. Pour fresh water into the water outlet fitting.



1. Intercooler water outlet fitting
2. Intercooler water inlet fitting
3. Intercooler bleeding hose fitting

3. Let water soak in intercooler for a couple of hours. Occasionally, shake the intercooler to soak off deposits.
4. Rinse the intercooler using a garden hose installed on water outlet.
5. Let water flow out of intercooler a few minutes to evacuate internal deposits.
6. Check water flow.

WATER FLOW	
LOW OR ERRATIC	1. Repeat cleaning procedure.
	2. Replace the intercooler.
HIGH AND REGULAR	Intercooler is not clogged.



- TYPICAL**
1. Garden hose installed on water outlet
2. High and regular water flow

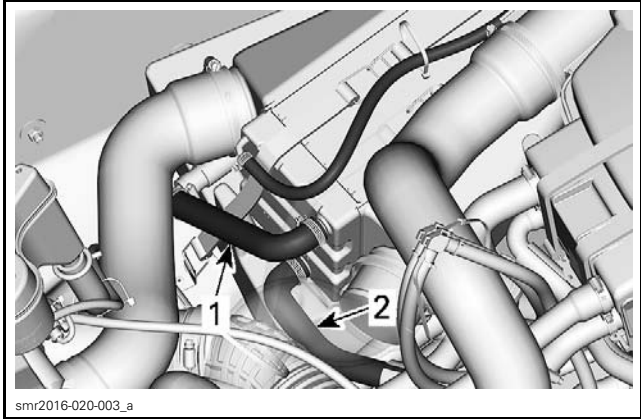
7. Perform a leak test before installing the intercooler in the watercraft.

Intercooler Leak Test

Block intercooler water outlet hose.

Subsection XX (INTERCOOLER)

REQUIRED TOOL	
LARGE HOSE PINCHER (P/N 529 032 500)	



MANY PARTS REMOVED FOR CLARITY PURPOSE
1. Intercooler water outlet hose
2. Intercooler water inlet hose

Unplug the intercooler water inlet hose from the intercooler.
Install the VACUUM/PRESSURE PUMP (P/N 529 021 800) on intercooler water inlet fitting.



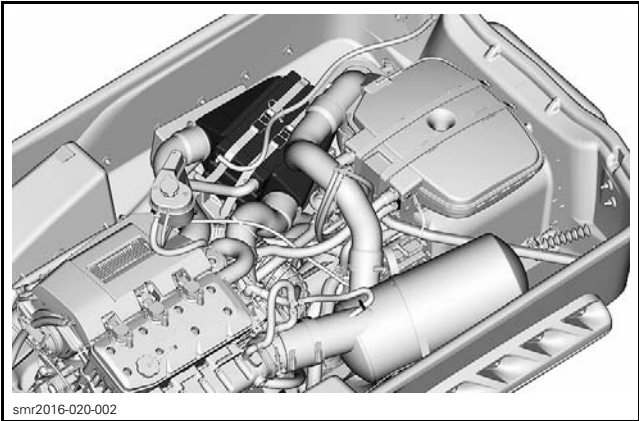
VACUUM/PRESSURE PUMP

Pressurize the intercooler.

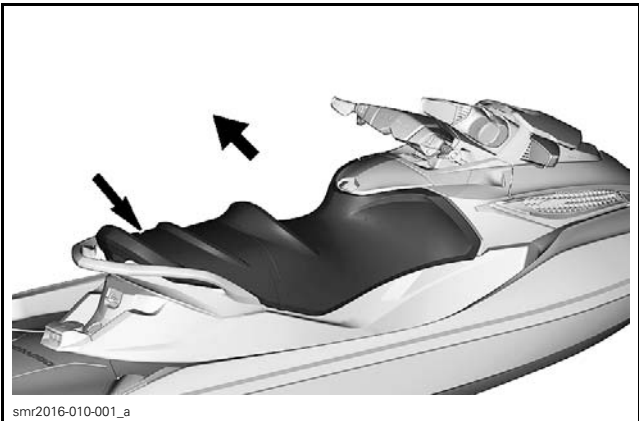
PRESSURE TEST
69 kPa (10 PSI) for 10 minutes minimum

If there is a pressure drop, first spray tool, hoses and adapters with a soapy water solution to ensure they are not leaking. If they are not leaking, replace the intercooler.

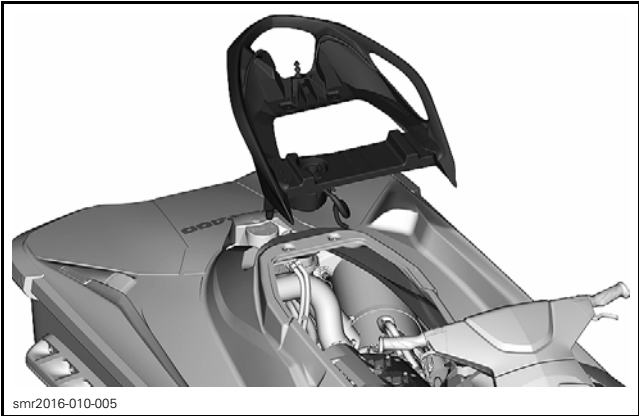
Intercooler Location



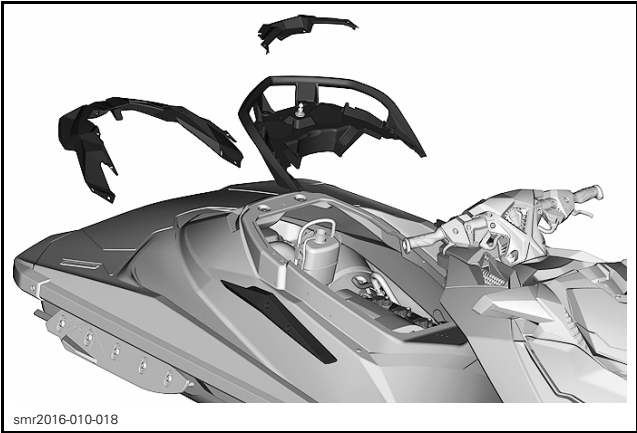
Removing the Intercooler



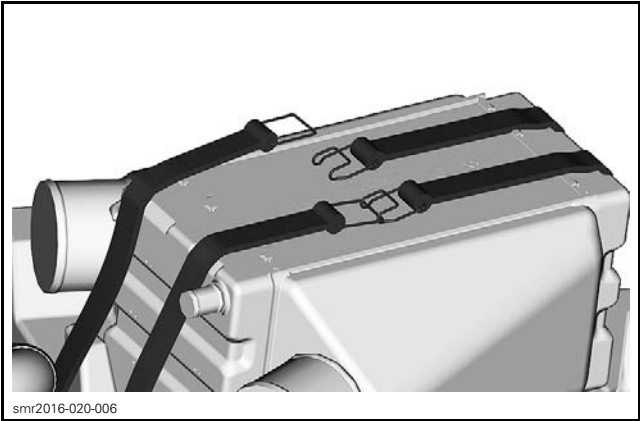
GTX LTD SHOWN



GTX LTD AND RXT-X MODELS



RXP X MODELS



Pull intercooler out of vehicle.

Installing the Intercooler

The installation is the reverse of the removal procedure.

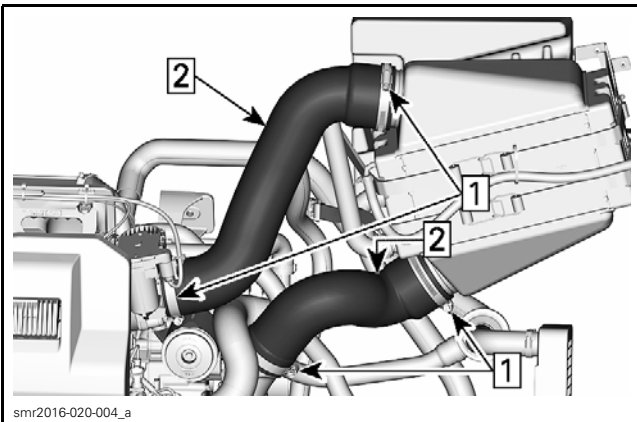
NOTE: Ensure hoses are routed correctly and locking ties are positioned at proper locations.

REPLACING INTERCOOLER ATTACHMENTS

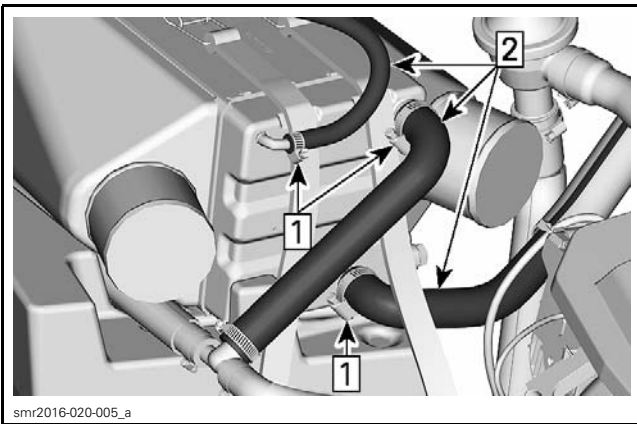
Remove the intercooler.

Drill the head of the rivets.

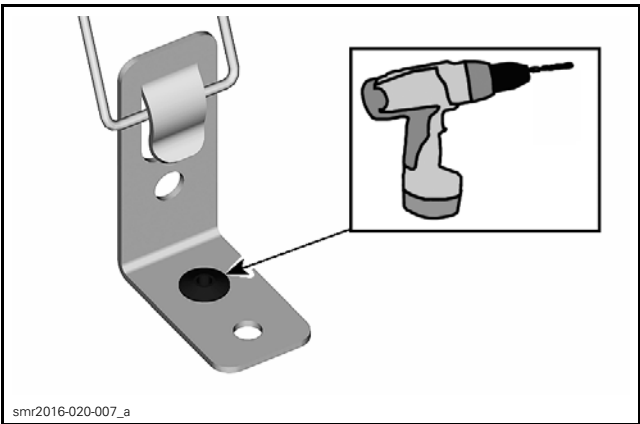
NOTICE Drilling rivets too deep may leads to hull damage.



Step 1: Loosen
Step 2: Remove

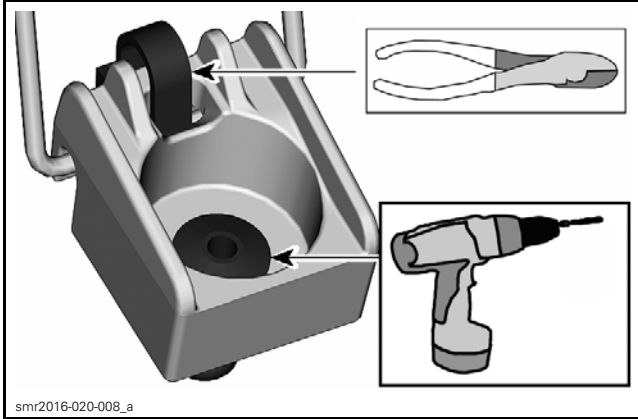


Step 1: Loosen
Step 2: Disconnect

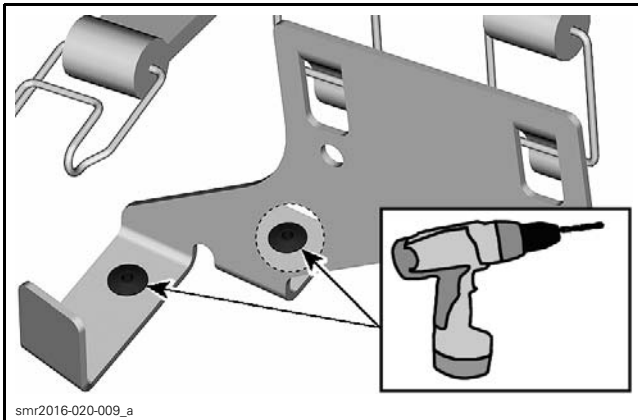


FRONT RH SIDE ATTACHMENT

Subsection XX (INTERCOOLER)



FRONT LH SIDE ATTACHMENT



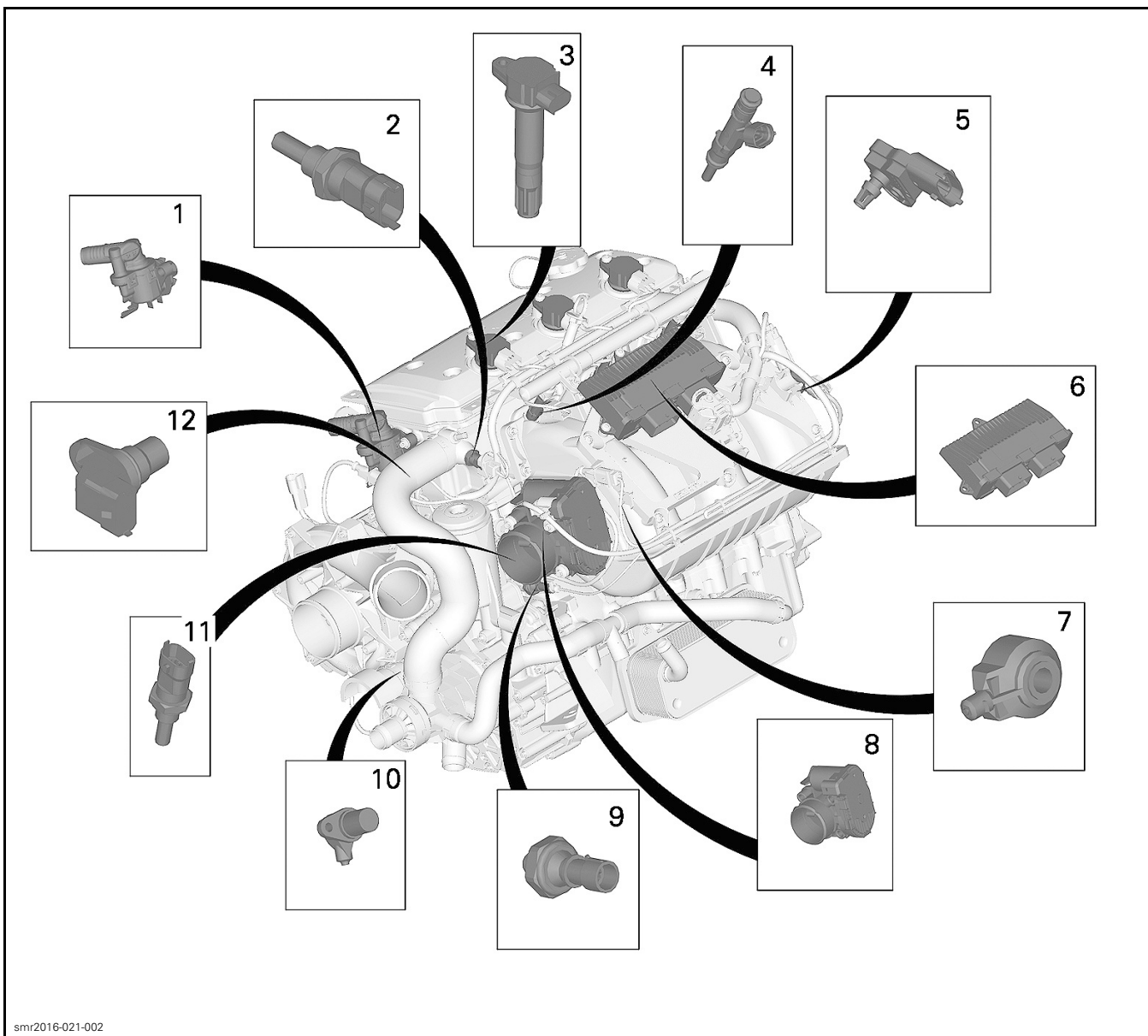
REAR ATTACHMENT

Install the attachment with new rivets and new locking tie if required.

ENGINE MANAGEMENT SYSTEM

GENERAL

1630 ACE HO



smr2016-021-002

1. Blow-by Valve
2. Coolant temperature sensor (CTS)
3. Coil #1
4. Injector #1
5. Manifold absolute pressure and temperature sensor (MAPTS)
6. Electronic control module (ECM)
7. Knock Sensor (KS)
8. Electronic throttle actuator (ETA)
9. Oil pressure sensor (OPS)
10. Crankshaft position sensor (CPS)
11. Oil temperature sensor (OTS)
12. Camshaft position sensor (CAPS)

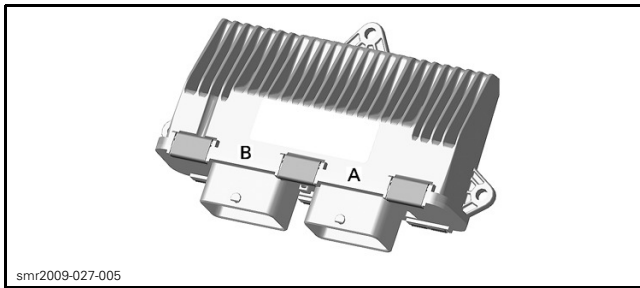
SYSTEM DESCRIPTION

An engine management system (EMS) is used to ensure a high power output with cleaner combustion.

There are 7 main systems that interact with the engine management system:

1. Electronic fuel injection
2. D.E.S.S. System
3. Ignition System
4. Starting System
5. O.T.A.S.
(Off-Throttle Assisted Steering)
6. T.O.P.S.
(Tip-Over Protection System)
7. iControl System

Engine Control Module (ECM)



ECM

The ECM is the main component of the engine management system. It controls the electrical system and the engine management functions by processing the information obtained from various switches, controls and sensors that it compares to predetermined parameters stored in the ECM.

It also interacts with the other electronic systems through the CAN bus (information center and iControl System) for various functions that affect engine management.

It features a permanent memory that will store fault codes, customer information and other engine information, even when the battery is removed from the vehicle.

The ECM controls the following engine management functions:

Engine RPM Limiter

The ECM limits maximum engine speed. It monitors engine RPM through the CPS and varies fuel injection, ignition and throttle plate opening as necessary.

Engine Speed Control

The ECM controls the engine idle RPM. In addition, it can vary the engine speed by commanding the electronic throttle actuator (ETA) to open or close based on throttle position and various other inputs. The ETA also allows for other functions of the iControl system.

Drowned Mode

If the engine is flooded and does not start, this special mode can be activated to prevent fuel injection and ignition while cranking in order to ventilate the engine to dry the cylinder walls.

NOTE: This mode can also be used if the engine is water-flooded.

To activate DROWNED MODE, proceed as per following steps.

1. Install the tether cord cap on the engine cut out switch.
2. While the engine is stopped, fully pull and HOLD the throttle lever.
3. Press the START/STOP button. DROWNED MODE is now on.

Releasing the throttle lever will allow the ECM to revert back to normal mode.

If the engine does not start, it may be necessary to remove the spark plugs and crank the engine with rags over the spark plug holes. Refer to *IGNITION SYSTEM* subsection.

Monitoring System

The ECM monitors:

- The electrical and electronic components of the engine system
- The iControl system
- The information center (gauge)
- Some components of the electrical system
- Signals from other electronic modules

For more information, refer to *DIAGNOSTIC AND FAULT CODES*.

Limp Home Mode

The ECM may automatically set the engine in LIMP HOME MODE using default parameters when certain major faults are detected. For more information, refer to *DIAGNOSTIC AND FAULT CODES*.

Diagnostic Mode

The ECM features a self-diagnostic mode that is initiated on system power up for certain systems and components (when pressing the START but-

ton), and when the engine is running for others.
Refer to *DIAGNOSTIC AND FAULT CODES* subsection for more information.

iCONTROL SYSTEM

GENERAL

The iControl (intelligent Control) system may consist of the following systems depending on the PWC model:

- Intelligent Throttle Control (iTC)
- Intelligent Brake and Reverse (iBR)
- Intelligent Suspension (iS).

The information center (gauge) and handlebar switches are used to navigate through and select several functions, modes of operation and change certain settings and system parameters using the appropriate handlebar controls.

Each control is electronic and provides a command signal to an electronic module whose function is to assure proper operation of its system within set parameters.

For a comprehensive and complete description of the information center, refer to *INFORMATION CENTER (GAUGE)* subsection.

iTC (INTELLIGENT THROTTLE CONTROL)

The iTC is an electronic throttle control system (ETC) that includes a cable-less throttle control (TAS) located on the RH side of handlebar and an electric throttle actuator (ETA) located on the throttle body.

The iTC allows functions such as touring/sport mode, cruise control, slow speed mode, ski mode and O.T.A.S.™ as well as a more precise control of the engine power.

For a comprehensive and complete description of this system, refer to *INTELLIGENT THROTTLE CONTROL (ITC)* subsection.

iBR (INTELLIGENT BRAKE AND REVERSE)

The iBR is a brake and reverse system used to avoid obstacles, gradually slow down or stop the watercraft, or drive backwards by lowering the iBR gate that redirects the water flow at the outlet of the jet pump nozzle.

For a comprehensive and complete description of this system, refer to *IBR AND VTS* subsection.

iS (INTELLIGENT SUSPENSION)

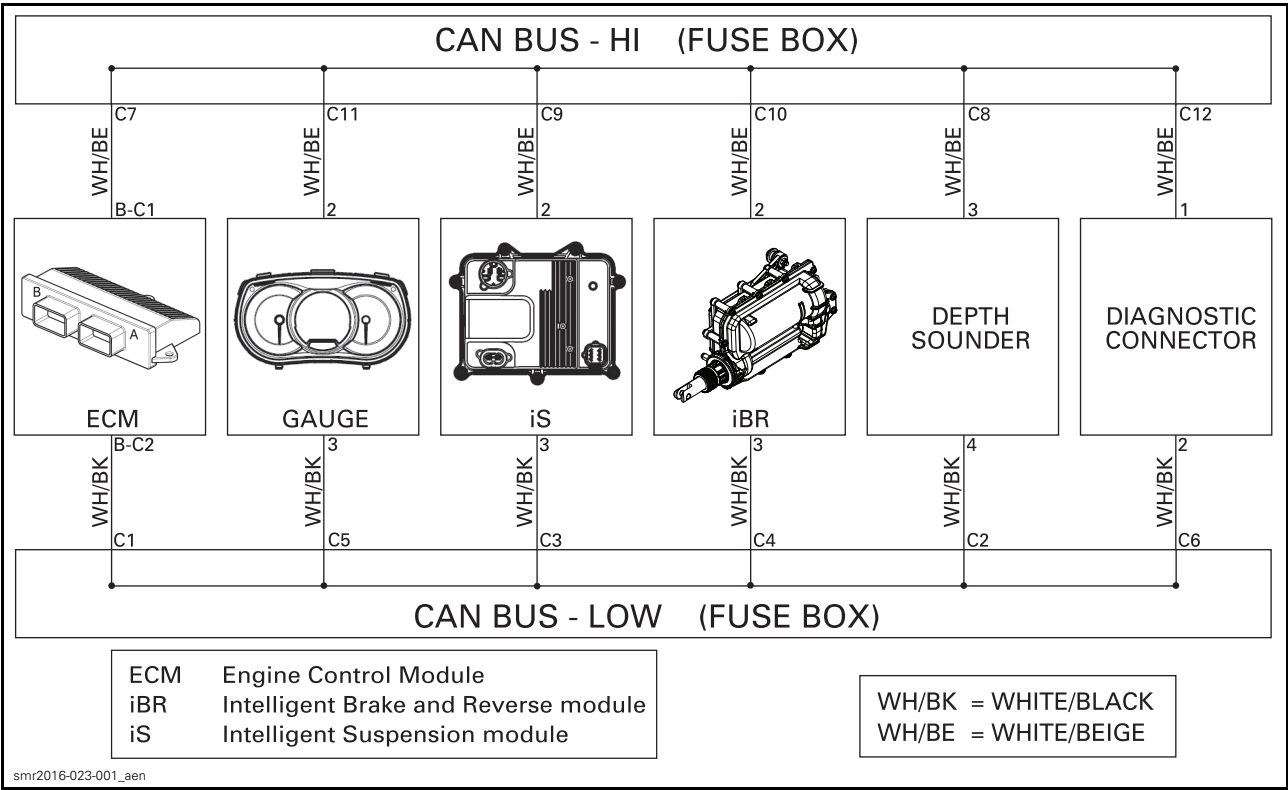
The intelligent suspension is an electronically controlled hydro/mechanical system consisting of a hydraulic pump, an actuator, suspension arms, springs and one shock absorber. They are installed in the hull and connected to the moving deck. The suspension system is used to isolate the riders from the rough water.

CONTROLLER AREA NETWORK (CAN)

GENERAL

SYSTEM DESCRIPTION

The CAN (Controller Area Network) protocol is an ISO standard for serial data communication. The CAN bus is the nervous system of the iControl system and the engine management system (EMS). It links the electronic modules (ECMs) together so that they communicate to interact as required. Two wires connect each component and they are in constant communication with each other at a rate of about every 10 or 100 milliseconds depending on the component. CAN lines consist of a pair of twisted wires (WHITE/BLACK and WHITE/BEIGE).



CAN BUS DIAGRAM

TROUBLESHOOTING

DIAGNOSTIC TIPS

Check the fault codes using B.U.D.S. as a first troubleshooting step. Refer to *DIAGNOSTIC AND FAULT CODES* subsection.

Make sure the modules are powered before testing CAN.

CAN Communication Problems

The following chart gives some symptoms and behaviors relative to the CAN component in cause. The list is not exhaustive, only the most significant items are given to help in troubleshooting.

CAN FAULTY WIRES (no communication)	VEHICLE BEHAVIOR OR OBSERVATION IN INFORMATION CENTER	OBSERVATION IN B.U.D.S.
Diagnostic connector not secured in its holder (holder contains a 120Ω resistor)	CAN intermittent problems. NOTE: Occurs more frequently on watercraft equipped with 2 electronic modules.	Nothing
Water in holder of diagnostic connector (particularly with salt water)	Communication problems and strange behavior of information center. Inoperative electronic systems in watercraft.	Nothing
Short circuit in CAN wires	Engine is set to limp home mode. iBR gate will not move. "Locked" in neutral. iBR light is ON. Check engine light is ON.	B.U.D.S. will not be able to communicate with any electronic module. "No vehicle detected" message will be displayed in B.U.D.S.
Information center (cluster)	Check engine light is ON. iBR light is ON. Some functions not displayed such as: Engine hours, iS, VTS and RPM.	3 modules instead of 4 will be active. "Cluster" tab and its data will not be available in B.U.D.S. ECM, iBR and iS will report a cluster CAN problem.
ECM (Engine Control Module)	Engine is set to limp home mode. Check engine light is ON. iBR light is ON. iBR gate "locked" in neutral. Some functions not displayed such as: Engine hours and RPM.	3 modules instead of 4 will be active. ECM tab and its data will not be available in B.U.D.S. iBR and iS will report an ECM CAN problem.
iBR (intelligent Brake and Reverse)	Engine is set to limp home mode. iBR gate will not move. "Locked" in neutral. iBR light is ON. Check engine light is ON. Some functions not displayed such as: Lake water temperature, no VTS, no F, N and R indication.	3 modules instead of 4 will be active. iBR tab and its data will not be available in B.U.D.S. ECM and iS will report an iBR CAN problem.

Subsection XX (CONTROLLER AREA NETWORK (CAN))

CAN FAULTY WIRES (no communication)	VEHICLE BEHAVIOR OR OBSERVATION IN INFORMATION CENTER	OBSERVATION IN B.U.D.S.
iS (intelligent Suspension)	iS handlebar controls have no effect. No DOCK mode. Suspension will remain to its last position before the CAN problem. iS position is not displayed.	3 modules instead of 4 will be active. iS tab and its data will not be available in B.U.D.S.
Depth sounder	The menu Depth Sounder Indicator will not be visible. The Depth menu will not be available.	Nothing will be observable.
Diagnostic connector	Nothing will be observable.	B.U.D.S. will not be able to communicate with any electronic module. "No vehicle detected" message will be displayed in B.U.D.S.

NOTE: If the gauge cannot communicate with an optional module (iS module or depth sounder) during the initial power up, the gauge will interpret this as if the vehicle is not equipped with it. No further test of the system occurs and no indication or fault message will be visible. If communication is interrupted after the gauge has already detected them, then the gauge will indicate that there is a communication fault.

COMMUNICATION TOOLS AND B.U.D.S.

SERVICE TOOLS

Description	Part Number	Page
DIAGNOSTIC CABLE	710 000 851	2, 4
MPI-2 INTERFACE CARD	529 036 018	2
MPI-3 INTERFACE CARD	529 036 353	2

GENERAL

Refer to *PROCEDURES* for instructions on the communication tools.

If communication problems occur, refer to *TROUBLESHOOTING* in this subsection.

REQUIRED TOOLS

MANDATORY TOOLS	
A personal computer (laptop or desktop)	
MPI-2 INTERFACE CARD (P/N 529 036 018)	
OR	
MPI-3 INTERFACE CARD (P/N 529 036 353)	
DIAGNOSTIC CABLE (P/N 710 000 851)	
OPTIONAL TOOL	
Extension cable available at electronic retail outlets. Do not exceed 7.5 m (25 ft)	

TROUBLESHOOTING

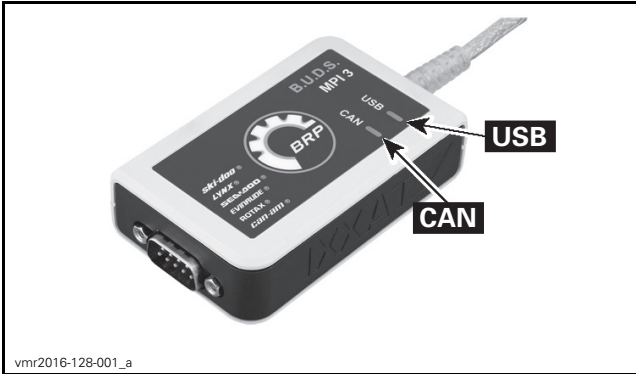
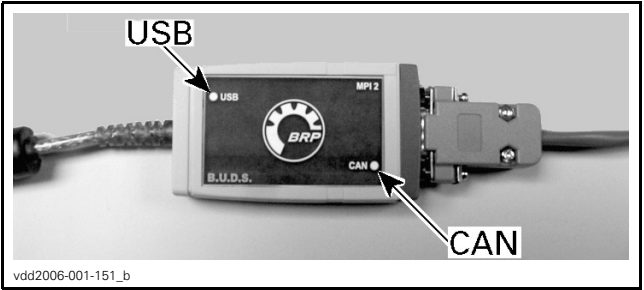
DIAGNOSTIC TIPS

IMPORTANT: Make sure all connections are made and vehicle is powered up **before starting B.U.D.S.** to allow proper communication between the vehicle and B.U.D.S. software.

Troubleshooting the MPI Connection

MPI Status Lights

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



MPI-3 CARD

Prerequisite for USB communication:

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

USB LIGHT	
STATUS	WHAT TO DO
Light is OFF	Check USB connection between MPI card and PC computer. Check USB operation on PC computer (hardware or USB drivers)
Light is GREEN	Connections are GOOD. Communication can take place on USB side

Prerequisite for CAN Communication:

- MPI card connected to diagnostic connector on vehicle.
- Ignition key installed and turned to ON (electrical system powered up without engine started).
- B.U.D.S. started and logged on.

CAN LIGHT	
STATUS	WHAT TO DO
Light is OFF	Check connection between MPI card and diagnostic connector on vehicle
Light is RED	Check CAN wires/connectors on vehicle
Light is GREEN	Connections are GOOD. Communication can take place on CAN side

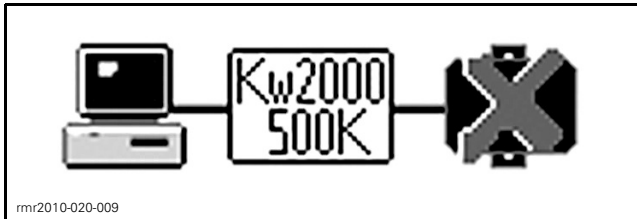
Communication Problems when Using B.U.D.S.

Missing Module

If one or more ECM is not communicating with the MPI, refer to *DIAGNOSTIC AND FAULT CODES* subsection.

No Vehicle Detected

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

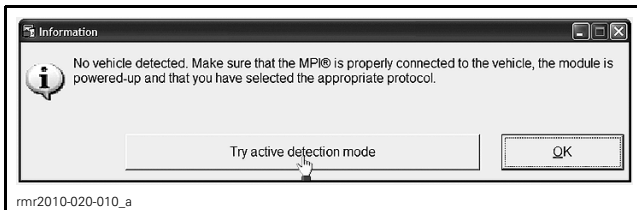


1. Check connections between the PC computer and the vehicle.
2. Ensure the electrical system is powered up.

NOTE: The **tether cord** must be installed.

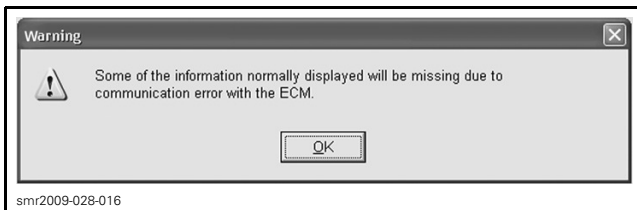
3. Ensure both USB and CAN lights on the MPI are GREEN. Refer to *TROUBLESHOOTING THE MPI CONNECTION* subsection.

If B.U.D.S. does not automatically exit the following message box, click the **Try active detection mode** button. This will manually establish the communication with the ECUs.



Message Box: "Some of the Information Normally Displayed..."

If the following message box is displayed in B.U.D.S.:



1. Click on the **OK** button in the box.
2. Ensure the tether cord is properly installed.
3. **Briefly** press the vehicle **START** button to activate the ECM. **Do not hold START button to avoid engine starting.**
4. Click on the **Read Data** button in B.U.D.S.

Message Box: "Engine must be Stopped..."

If the following message box is displayed in B.U.D.S.:



1. Click on the **Cancel** button in B.U.D.S.
2. Ensure the tether cord is properly installed.
3. **Briefly** press the vehicle **START** button to activate the ECM. **Do not hold START button to avoid engine starting.**
4. Continue with the procedure undertaken prior to the appearance of the message box.

PROCEDURES

MULTI-PURPOSE INTERFACE CARD (MPI-2 OR MPI-3)

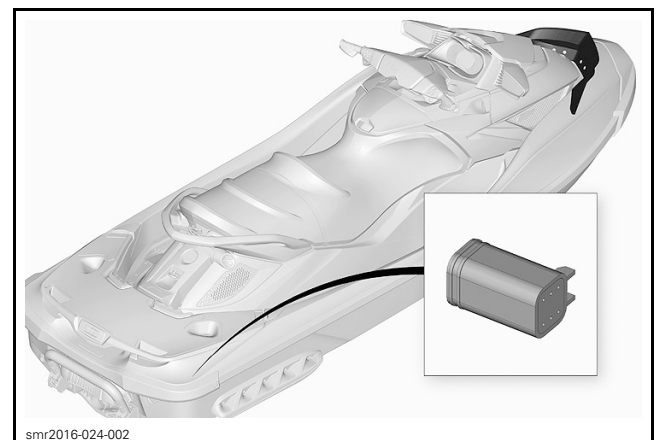
The MPI (Multi-Purpose Interface) in conjunction with the diagnostic cable is used with B.U.D.S. to communicate with the ECM (engine control module) and other modules.

MPI Card Power

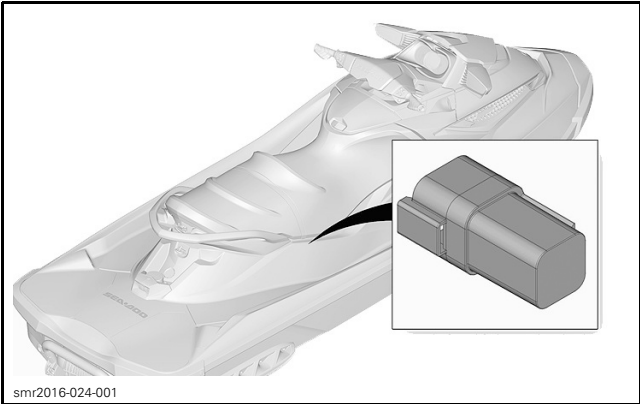
The MPI card uses the power from the PC computer's USB port.

Diagnostic Connector Location

The 6-pin diagnostic connector is located beside the battery, stored in its protective cap.



MODELS WITH SUSPENSION



MODELS WITHOUT SUSPENSION

Connecting the PC to the Vehicle

**WARNING**

If the computer you are using is connected to the 110 Vac 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 VCK.

1. Locate the 6-pin diagnostic connector, refer to *DIAGNOSTIC CONNECTOR LOCATION* in this subsection.
2. Disconnect the 6-pin diagnostic connector from it's holder (protective cap).
3. Connect one end of the DIAGNOSTIC CABLE (P/N 710 000 851) to the vehicle connector.



DIAGNOSTIC CABLE CONNECTED TO VEHICLE

4. Connect the other end of diagnostic cable to the MPI card.
5. Connect the MPI card to the USB port of a PC (personal computer).



MPI CARD CABLE CONNECTED TO USB PORT

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

B.U.D.S. SOFTWARE

B.U.D.S. (BRP Utility and Diagnostic Software) is designed to allow programming key(s) to the vehicle, allow electrical and electronic component monitoring, activation of certain components for diagnostic purposes, and to carry out settings changes.

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

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

Reading Electronic Control Units Using B.U.D.S.

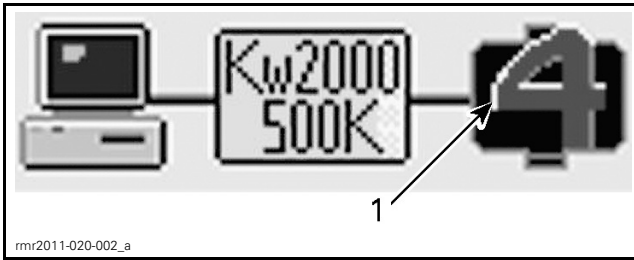
IMPORTANT: Ensure all connections have been made **before starting B.U.D.S.** to allow proper operation. Refer to *MPI* in this subsection.

1. Press the START button to wake up the electrical system.
2. Install the tether cord on the engine cut-off switch.
3. Start B.U.D.S. and login.

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

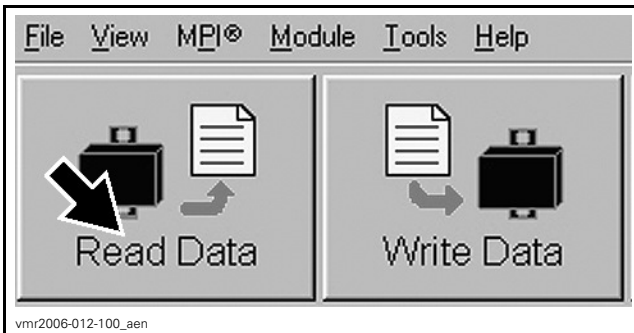
4. Ensure the appropriate number of modules is shown in the status bar.

NUMBER OF MODULES	MODULES
2	ECM and cluster
3	ECM, cluster and iBR
4	ECM, cluster, iBR and iS



1. Number of modules

5. Read electronic modules by clicking the Read Data button.

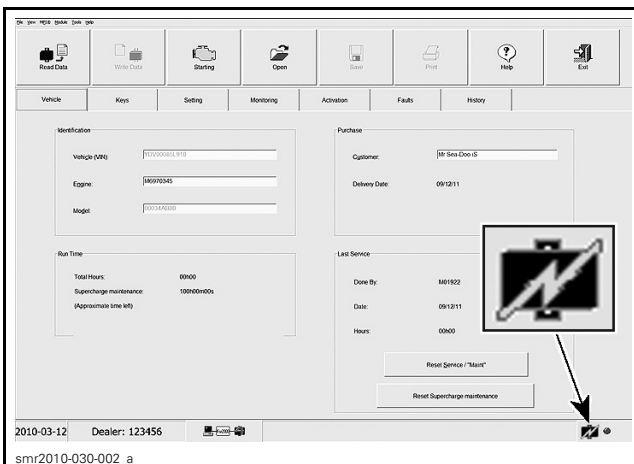


B.U.D.S. is now ready to use.

Updating Electronic Control Module (ECM) Software

NOTICE Failure to strictly follow a procedure to update a module may permanently damage the module.

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

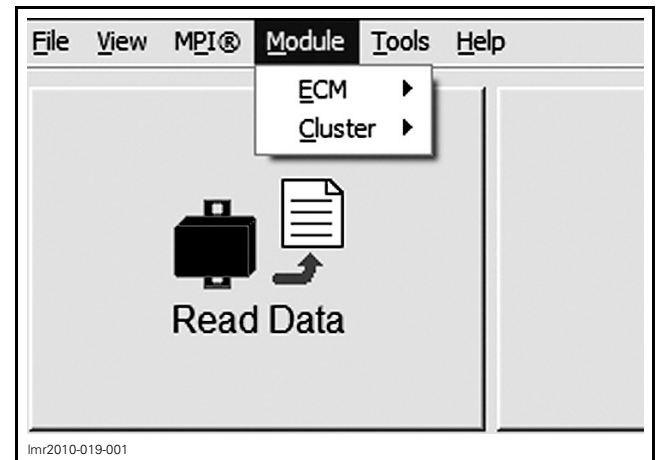


TYPICAL

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:

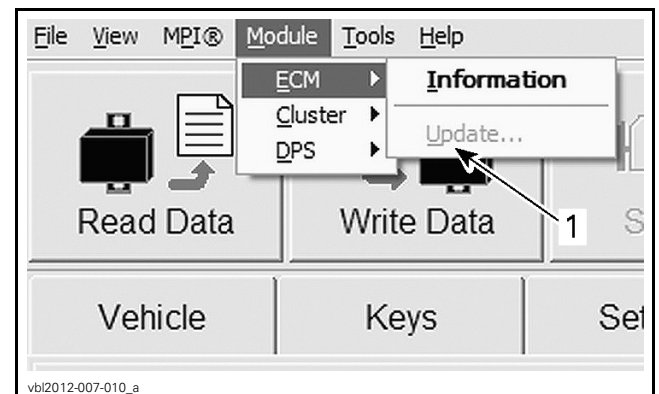
NOTE: If an update file is available on *KNOWLEDGE CENTER* but the B.U.D.S. software being used is not up to date, the update icon will not appear. Refer to the *SERVICE BULLETINS* to see if there is an update available.

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



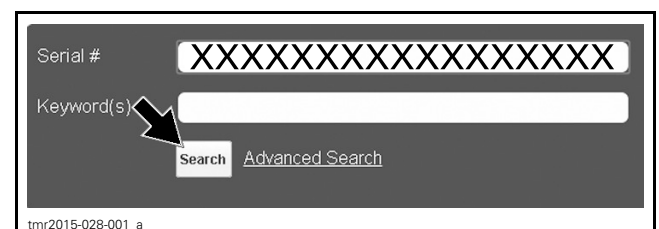
TYPICAL - MODULE SUBMENU LIST

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.



1. **Greyed out:** No update to perform
Black: Update file available

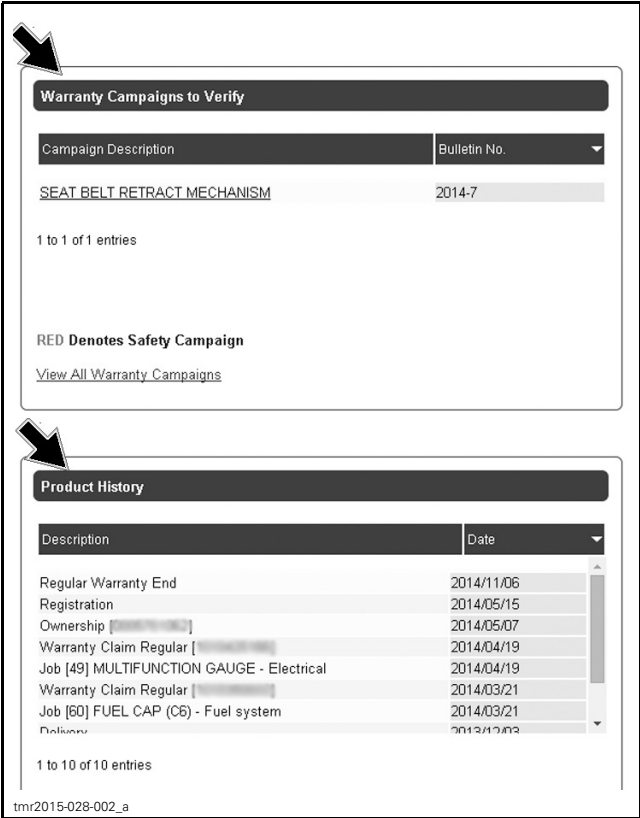
Before applying an update, log onto *KNOWLEDGE CENTER* and search the vehicle's VIN to find the unit's history.



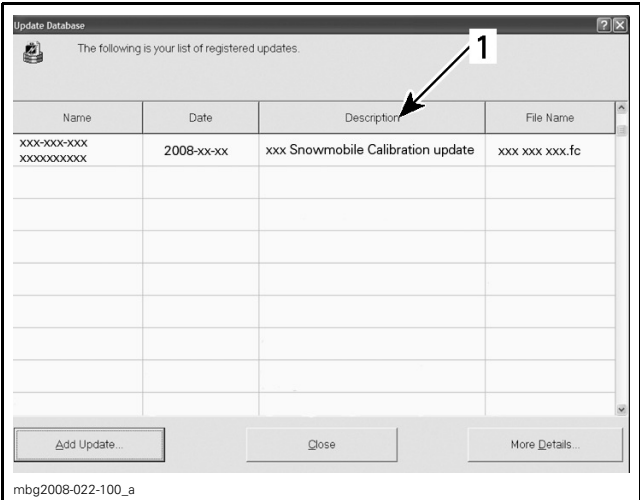
Subsection XX (COMMUNICATION TOOLS AND B.U.D.S.)

Complete all *WARRANTY CAMPAIGNS TO VERIFY*.

NOTE: *PRODUCT HISTORY* will show all repairs performed and claimed under warranty.



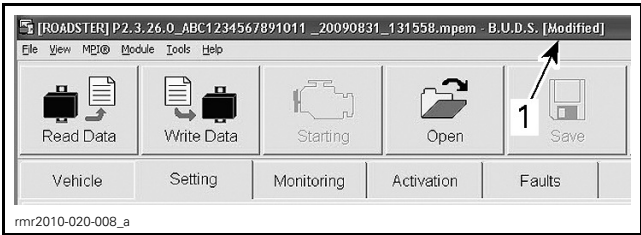
NOTE: When selecting the update menu in B.U.D.S., a dialog box will appear and the update file description may give some clue to finding the vehicle-related information on *KNOWLEDGE CENTER*.



TYPICAL
1. File description

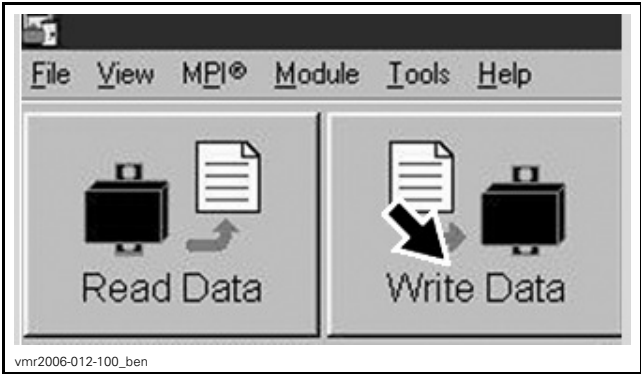
Writing Changes in an ECM

If the word **Modified** appears at the end of the vehicle file name at the top of the B.U.D.S. page, then a change has been made that requires it to be saved to the proper electronic module.



TYPICAL
1. Indicate setting or data modified; Write Data to save

Click the **Write Data** button.



NOTE: A message box will confirm a successful operation.

In such a case, turn ignition switch OFF, then wait for the message to disappear before disconnecting the MPI.

Disconnect MPI card and store the vehicle diagnostic connector in its protective cap.

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

DIAGNOSTIC AND FAULT CODES

GENERAL

MONITORING SYSTEM

This system monitors the electronic components of the EMS (engine management system), iBR, information center, iS and other components of the electrical system to detect if they are faulty or defective. The monitoring system becomes active when the START button is pressed.

NOTE: Some components need the engine to be running to be monitored (fuel injectors for example).

The following components or functions are monitored.

EMS MONITORING
Battery voltage
EMS sensors (TAS, TPS, CPS, CAPS, MAPS, MATS, CTS, OPS, EGTS, TOPS, knock sensor). Throttle actuator, ignition coils and fuel injectors
ECM
Engine RPM
CAN
D.E.S.S. system
START switch and starter solenoid
Fuel pump
O.T.A.S.
Information center
iBR module

iBR MONITORING
iBR module and motor
BRLS
Engine RPM
Vehicle speed
iBR gate position
CAN
Lake temperature sensor
Information center
ECM

INFORMATION CENTER MONITORING
Information center
VTS, Sport and ECO switch
MODE and SET switch
Cruise switch
CAN
GPS
Fuel level sensor
Depth sounder
ECM
iBR module
iS module

iS MONITORING
iS module and motor
Vehicle speed
Suspension position
CAN
TOPS
Information center
iBR module

When a malfunction is currently detected, the related electronic module:

- Sets an active fault code.
- Adapts the proper protection strategy according to the failure.
- Sends out warning signals to the information center/beeper codes to inform the rider of a particular condition.

When a minor or transient fault occurs, the fault message and beeper will cease automatically if the condition that caused the fault does not exist anymore.

If a minor fault is active, the engine will operate without a noticeable loss of performance.

Releasing the throttle and letting the engine return to idle speed may allow normal operation to resume. If this does not work, try the following:

- Remove tether cord from the engine cut-off switch.
- Wait 3 minutes to allow the ECM to shut down.
- Start engine.
- Check if the fault code is still active.

Subsection XX (DIAGNOSTIC AND FAULT CODES)

The electronic system will react differently depending on the fault type. If a severe failure occurs, the engine may not be allowed to be started. In other cases, the engine may operate in limp home mode (reduced speed) or not be affected at all.

These strategies are used to protect the engine system from damage and to maintain safe operation of the vehicle.

Limp Home Mode

When a major component of the EMS or the iBR is not operating properly, limp home mode will be set. Engine speed will be limited and therefore vehicle speed.

This mode allows the rider to return home which would otherwise not be possible.

When this mode is active, LIMP HOME MODE will be displayed in the information center.

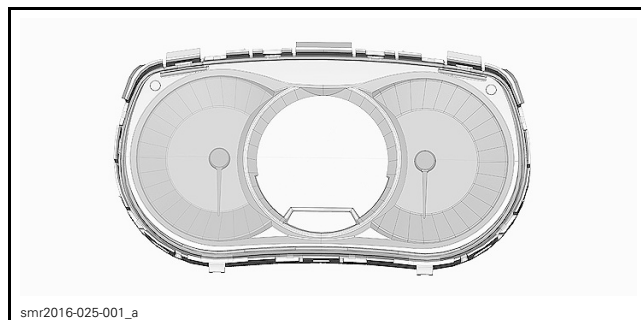
Indicator Lights and Message Display Information

The fault indicators and messages displayed in the information center will inform you of a particular condition or if an anomaly occurs.

Standard Gauge

FAULT INDICATOR (ON)	MESSAGE DISPLAY	DESCRIPTION
	HIGH TEMPERATURE	Engine or exhaust system overheating
	CHECK ENGINE or LIMP HOME MODE	Check engine (minor fault req. maint.) or iBR system fault or LIMP HOME MODE (major eng. fault)
	LOW or HIGH BATTERY VOLTAGE	Low/high battery voltage
	LOW OIL PRESSURE	Low engine oil pressure detected
	iBR MODULE ERROR	iBR system fault

X Gauge



PILOT LAMPS (ON)	MESSAGE DISPLAY	DESCRIPTION
	LOW or HIGH BATTERY VOLTAGE	Low/high battery voltage
	HIGH TEMPERATURE	Engine or exhaust system overheating
	CHECK ENGINE or LIMP HOME MODE	Check engine (minor fault req. maint.) or LIMP HOME MODE (major eng. fault)
	LOW OIL PRESSURE	Low oil pressure
	—	iBR system fault
	—	OTAS system fault

Subsection XX (DIAGNOSTIC AND FAULT CODES)

FAULT MESSAGES	
RIGHT KEYPAD ERROR	Gauge control button malfunction
LOW OIL PRESSURE	Engine low oil pressure detected
HIGH EXHAUST TEMPERATURE	High exhaust temperature detected
HIGH TEMPERATURE	High engine temperature detected
CHECK ENGINE	Engine management system malfunction or maintenance required
HIGH BATTERY VOLTAGE	High battery voltage detected
LOW BATTERY VOLTAGE	Low battery voltage detected
LIMP HOME MODE	Major fault detected, engine power limited
FUEL SENSOR DEFECTIVE	Fuel level sensor fault
WATER TEMP SENSOR DEFECTIVE	Problem in iBR, not sending water temperature info
CALIBRATION CHECKSUM ERROR	Information center programming corrupted
MAINTENANCE REQUIRED	Watercraft maintenance required
DEPTH SOUNDER MODULE COMMUNICATION PROBLEM	Error message if depth sounder is disconnected while riding
IS MODULE COMMUNICATION PROBLEM	Error message if communication with the suspension module is lost while riding
iBR MODULE ERROR	Error message if communication with the iBR module is lost while riding
FUNCTION CANNOT BE ACTIVATED	Message when a function is not or cannot be properly activated
WRONG KEY	Key not programmed for this watercraft
O.T.A.S. MAINTENANCE REQUIRED	Maintenance on O.T.A.S. required

Beeper Signals

When one of the below conditions occurs, the monitoring system emits the following beep signals.

BEEPER CODES	DESCRIPTION
A 1 second beep every 5 second interval (while installing D.E.S.S. key on engine cut-off switch if ECM is on)	Bad D.E.S.S. system connection. Reinstall tether cord correctly over engine cut-off switch.
	Wrong D.E.S.S. key. Use a tether cord with a D.E.S.S. key that has been programmed for the watercraft.
	Defective D.E.S.S. key. Use another programmed D.E.S.S. key.
	Defective engine cut-off switch. Check. Refer to <i>IGNITION SYSTEM</i> subsection.
	Improper operation of ECM or defective wiring harness. Check. Refer to <i>ELECTRONIC FUEL INJECTION (EFI)</i> subsection.
A 2 second beep every 5 minute interval	Low fuel level. Refill fuel tank. If problem persists, check sensor and circuit. Refer to <i>FUEL TANK AND FUEL PUMP</i> subsection.
	Fuel tank level sensor or circuit malfunction. Check sensor and circuit. Refer to <i>FUEL TANK AND FUEL PUMP</i> subsection.
Continuously beeps	High engine coolant temperature. Refer to <i>COOLING SYSTEM</i> subsection.
	High exhaust temperature. Refer to <i>ELECTRONIC FUEL INJECTION (EFI)</i> subsection.
	Low oil pressure. Turn off engine as soon as possible. Check oil level and refill. Refer to <i>LUBRICATION</i> subsection.

FAULT CODES

A fault code is an indication that a malfunction is detected by the monitoring system of the vehicle.

Fault Code Categories

A fault code consists of an alphanumeric designa- tor followed by a hexadecimal number of 3 digits. The alphanumeric designator defines the category of the fault code while the hexadecimal number refers to a unique fault.

FAULT CODE CATEGORIES		
ALPHANUMERIC DESIGNATOR	MODULE/ SYSTEM	EXAMPLE OF FAULT CODE
From B0 to B3	Body (include information center and switch faults)	B2211
From C0 to C3	iBR and iS	C007B
From P0 to P3	Power train and related system faults (includes ECM)	P062F
From U0 to U3	Communication between modules and sensors	U0179

RELATED MODULE AND FAULTS	
MODULE	FAULT CODE CATEGORY
ECM (engine control module)	Stores mainly "P" codes and some "U" codes
iBR (intelligent brake and reverse)	Stores mainly "C" codes and a few "U" codes
iS (intelligent suspension)	Stores mainly "C" codes and a few "U" codes
Cluster	Stores mainly "C" codes and a few "U" codes

Reading Fault Codes Using the Information Center

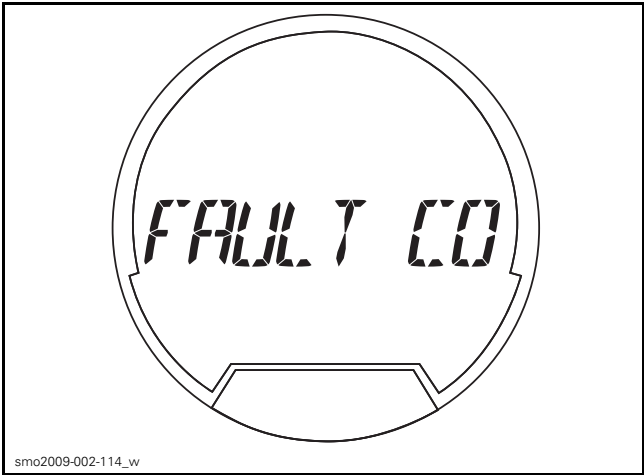
NOTE: A fault code must have the "Active" state to be displayed in the multifunction gauge.

1. Press the MODE button repeatedly until the FAULT CODE function is visible in the multi- function display.
2. Press the SET button or the UP or DOWN arrow button to enter the function and display the first fault code.

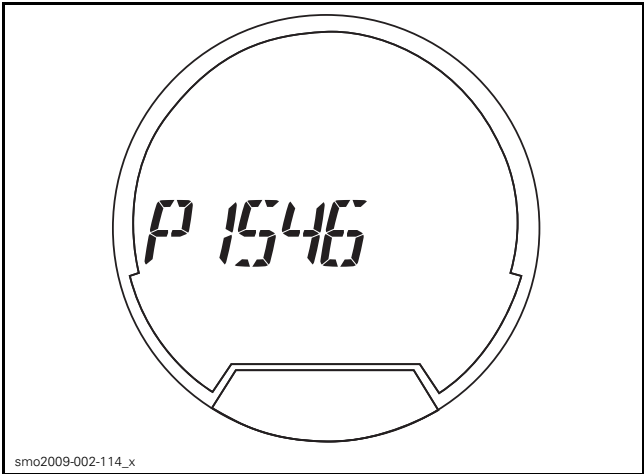
3. Press the UP or DOWN arrow button repeat- edly to display each subsequent code.

NOTE: When the last fault code has been dis- played and the button is pressed again, the sys- tem loops back to the first fault code displayed, and all fault codes can again be displayed. If there was one active fault code when entering FAULT CODE mode, and it becomes occurred (no longer active), a NO ACTIVE FAULT CODE message will scroll in the display.

4. To exit the FAULT CODE display function, the MODE or SET button must be pressed once. There is no time-out on this function.



FAULT CODE DISPLAY FUNCTION



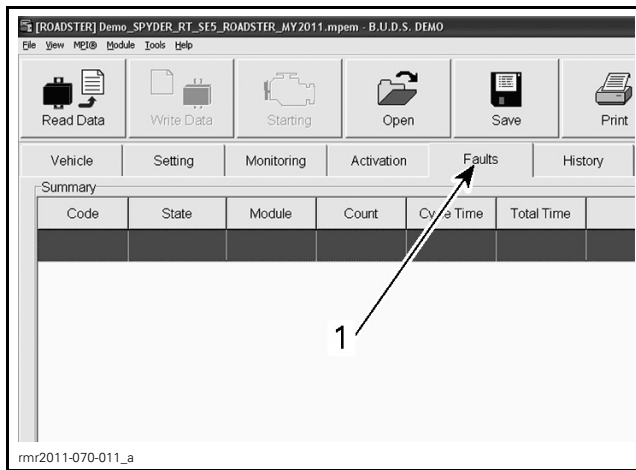
TYPICAL - ENGINE FAULT CODE EXAMPLE

Reading Fault Codes Using B.U.D.S. Software

NOTE: All fault code types can be read with B.U.D.S.

1. Connect vehicle to the latest applicable B.U.D.S. software. Refer to *COMMUNICA- TION TOOLS AND B.U.D.S.* subsection.

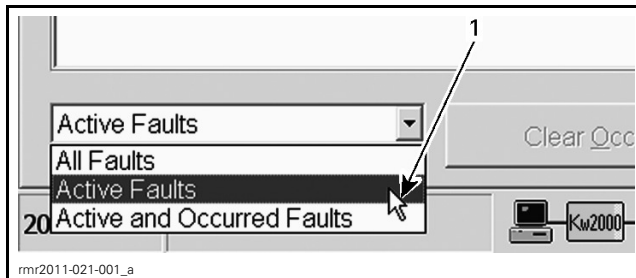
2. Click on the **Read Data** button.
3. Click on the **Faults** tab.



TYPICAL

1. Fault tab

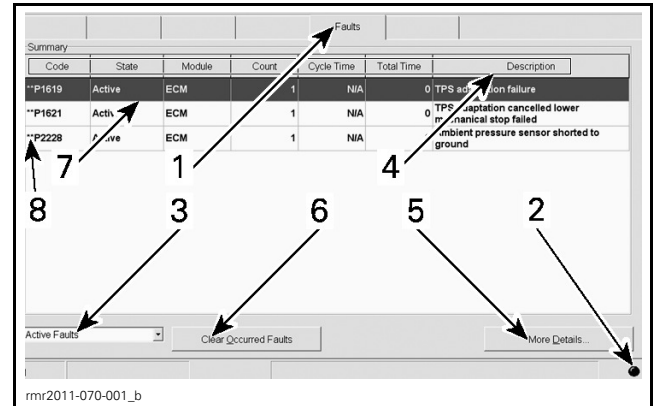
4. Click on the drop-down list on the LH lower corner.
5. Choose the fault state to display.



TYPICAL

1. Drop down list

FAULT STATE	INFORMATION
All faults	Display all possible faults regardless of state
Active faults	Display only faults matching this state. Empty area if there is no active fault
Active and occurred faults	Display only faults that have either state. Empty area if there is neither active nor occurred fault



TYPICAL FAULT PAGE

1. Fault tab
2. Fault indicator light
3. Fault code state drop box
4. Fault nomenclature
5. More details button
6. Clear occurred faults button
7. Selected fault
8. More information indicator

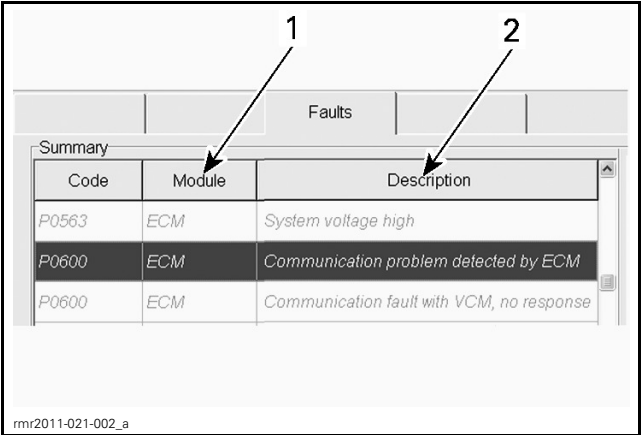
FAULT PAGE DESCRIPTION	
ITEM	INFORMATION
Fault tab	Click tab to display the fault page
Fault indicator light	When flashing, it indicates there is active fault(s)
Fault code state drop box	Click drop box to select the type of faults to display
Fault nomenclature	Display specific information and statistics related to the fault (see fault nomenclature table)
More details button	To display possible causes and service actions related to the selected fault
Clear occurred faults button	To clear all occurred faults in related ECU(s)
Selected fault	When a fault is selected, additional information pertaining to that fault will be displayed when clicking the "More details" button. To select a fault, click on the fault with the mouse or use the cursor up or down to scroll to the desired fault

Subsection XX (DIAGNOSTIC AND FAULT CODES)

FAULT NOMENCLATURE	
COLUMN	INFORMATION
Code	Fault code number. When 2 stars (**) precedes the code, detailed conditions when the fault occurred, can be displayed by clicking the "More details" button
State	Display the fault state (active, occurred, inactive)
Module	Displays the module that reports the fault code. This is the module that detects or has received a message of an anomaly and reports it. List of modules: Multifunction gauge ECM (engine control module) iBR (intelligent brake and reverse) iS (intelligent suspension)
Count	Number of times this fault occurred within the driving cycle Value: From 0 to 255
Cycle time	Not to be used Value: From 0 to 255 minutes
Total time	Not to be used Value: From 0 to 64 255 minutes
Description	Provides a short description of the fault

When reading a fault code in B.U.D.S., pay particular attention to which module reports a fault. It is indicated in the **Module** column.

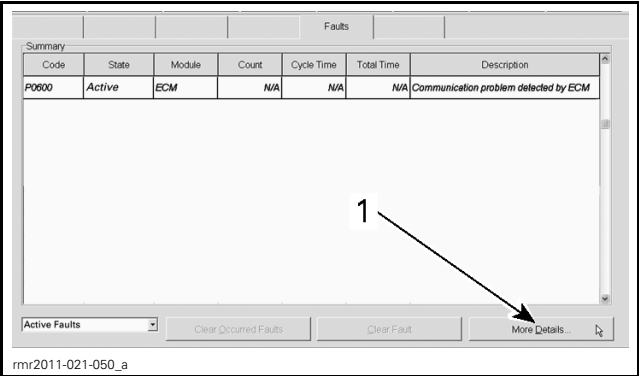
The **Description** column gives a short description of the fault.



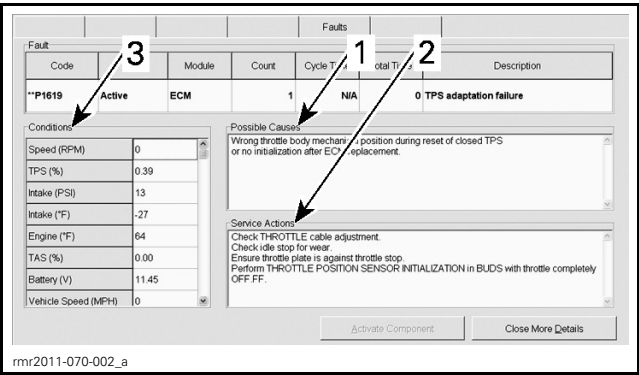
SOME COLUMNS REMOVED FOR CLARITY PURPOSE

- 1. Module that reports a fault
- 2. Fault description

Click on the **More Details** button, on the RH lower corner, to display the "Possible Causes" and the "Service Actions" to step further in the diagnosis.



TYPICAL
1. Click here



TYPICAL — MORE DETAILS PAGE
1. Possible causes related to the selected fault
2. Service actions
3. Operating conditions when fault occurred

MORE DETAILS PAGE DESCRIPTION	
ITEM	INFORMATION
Possible causes	List the possible causes that triggered the fault
Service actions	List the possible actions to perform to solve the fault
Conditions when fault occurred	List the operating conditions of the engine and/or vehicle when the fault was triggered

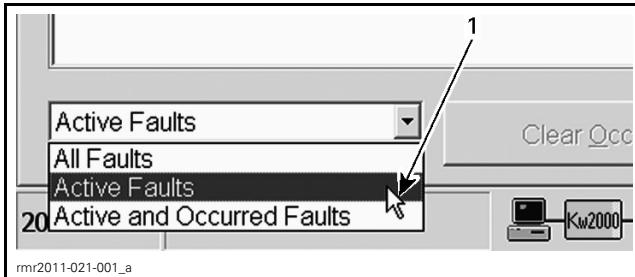
Fault Code States

The various electronic control units (ECUs) used in the vehicle can generate a variety of fault codes depending on the level of monitoring they are capable of. Fault codes have 3 possible states:

- Active
- Occurred
- Inactive.

Click the **Fault** tab then click on the drop-down list on the LH lower corner.

Choose the fault code state you want to display.



TYPICAL

1. Drop down list

FAULT STATE	INFORMATION
All faults	Display all possible faults regardless of state
Active faults	Display only faults matching this state. Empty area if there is no active fault
Active and occurred faults	Display only faults that have either state. Empty area if there is neither active nor occurred fault

Active Fault Codes

An active fault code is an indication of a fault that is **currently triggered**.

The active fault may or may not compromise normal operation of the related system(s). Service action in B.U.D.S. should be used to correct the problem that caused the fault code.

Once the fault condition(s) of the active fault is no longer present, its state will change to "occurred".

Occurred Fault Codes

An occurred fault code indicates a fault that was active, but **no longer** is.

The occurred fault does not presently affect system or component operation but is retained as a history of the faults that were detected.

Inactive Fault Codes

An inactive fault code represents a fault code that is neither active, nor occurred. It is simply part of a list of all possible faults which may be monitored by the various ECUs, which may become active or occurred if the monitoring system detects an applicable fault.

Clearing Fault Codes

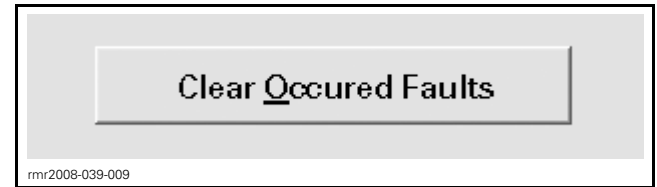
Connect vehicle to the latest applicable B.U.D.S. software. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

Click on the **Read Data** button.

Click on the **Faults** tab.

NOTE: Only the **Occurred** state faults can be cleared.

Click the **Clear Occurred Faults** button.



CLEAR OCCURED FAULTS

This will reset the appropriate counter(s) and will also record that the problem has been fixed in the related module memory.

Observe the "Occurred" fault(s). They should all disappear. Otherwise, follow this procedure.

- Remove tether cord cap from engine cut-off switch.
- Wait 3 minutes.
- Repeat procedure to clear faults again.

FAULT CODE DIAGNOSTIC

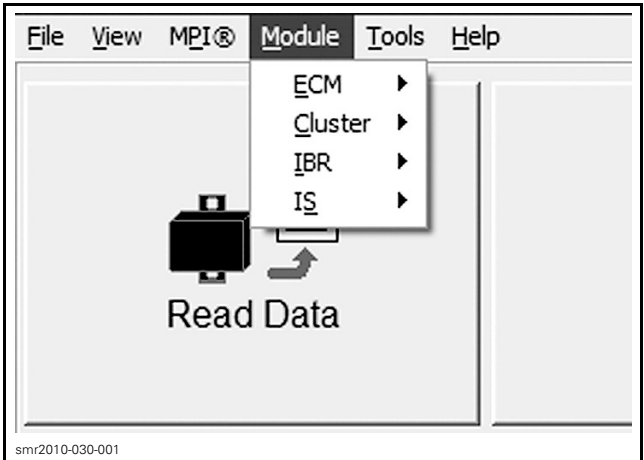
Missing Module

If a module is missing, several fault codes will appear.

To quickly find which module is missing, perform the following:

1. Connect vehicle to the latest applicable B.U.D.S. software. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Click on the **Read Data** button.
3. Click **Module** in the menu bar.
4. Look at the list of modules.
5. If a module is not visible, then it is not communicating through the CAN bus (controller area network).

Subsection XX (DIAGNOSTIC AND FAULT CODES)



TYPICAL — MODULE SUBMENU LIST (MODELS WITH iBR AND iS)

6. Refer to the following table to find the appropriate subsection in this manual to diagnose the missing module.

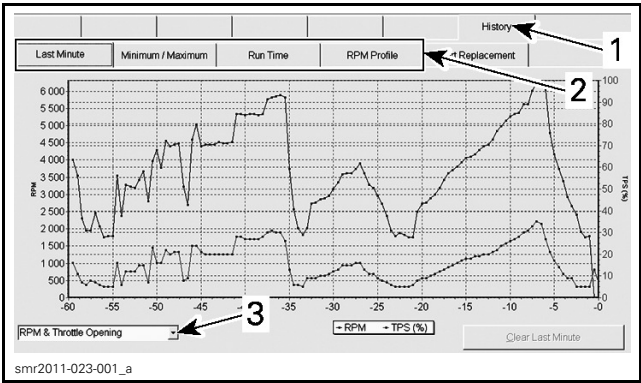
MISSING MODULE	SECTION TO REFER TO
ECM	ELECTRONIC FUEL INJECTION (EFI)
Cluster	INFORMATION CENTER (GAUGE)
iBR	iBR AND VTS
iS	SUSPENSION (iS)

Diagnostic Tips Using B.U.D.S.

History Page

HISTORY PAGE DESCRIPTION	
ITEM	INFORMATION
Last minute	Displays several parameters recorded in the last minute of engine operation
Minimum/Maximum	Display the minimum and maximum values encountered. Click "Clear Min/Max" to reset the values
Run time	Display the time proportion in what mode the engine was running in
RPM profile	Display the RPM range proportion in which the engine was running in

To see the last minute of operating conditions, click on the **History** tab in B.U.D.S.

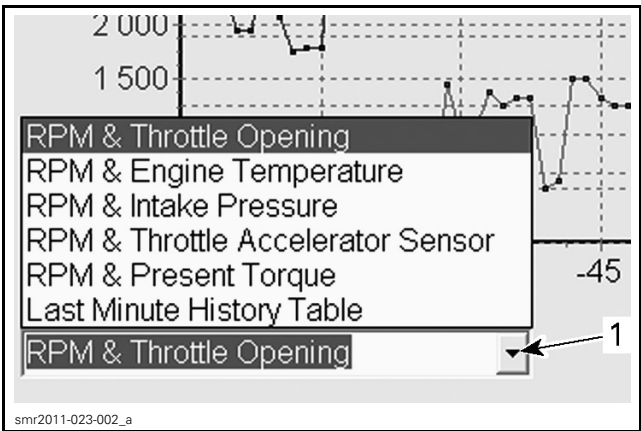


- 1. History tab
- 2. Additional history pages
- 3. Drop-down list in Last Minute page

Last Minute Drop-Down List:

From the **Last Minute** page, click on the drop-down list on the LH lower corner.

Choose the values to display.



- 1. Drop down list

Guidelines to Solve Fault Codes

CONDITION	ACTION
Troubleshooting vehicle	Use B.U.D.S. to: Read fault codes. Display "Active" faults to see components currently not operating normally. Display "Occurred" faults to troubleshoot intermittent problems. Monitor system(s), sensor(s), switches and actual conditions. Activate component(s) for troubleshooting. Set components etc. Know the last minute of operating conditions by using the "History" page. Know the operating conditions, if available, when a fault code occurred by using the "More details" button in the fault page.
New fault(s) appear after a vehicle maintenance or repair	Check sensor connections or mixed up connections. Before vehicle maintenance: Read the electronic modules with B.U.D.S. Save and print the B.U.D.S. file (keep faults option only). After vehicle maintenance: Read the electronic modules with B.U.D.S. Compare the fault code(s) before and after the maintenance using the printed copy and the current B.U.D.S. reading. Investigate only the newly fault codes. Clear all occurred faults in B.U.D.S.
Communication faults displayed as "Occurred" after module flashing	Normal behavior when flashing a module. Clear all occurred faults and check again.
Sensor "Active" fault	Read the fault description in B.U.D.S. Click on the "More Details" button. Look at the "Conditions" when available. Read the "Possible Causes". Apply the "Service Actions".
Several fault codes active at the same time	Likely to be caused by burnt fuse(s) or bad bus bar connection(s).
Low system voltage on one module Power problem on sensor(s)	Check related fuse(s) and relay. Check related power and ground wires. Check for common power supply to several sensors/modules (refer to <i>POWER DISTRIBUTION AND GROUNDS</i>). NOTE: Some sensors are supplied by the battery while others are supplied by a module.
Low system voltage on several modules (several communication faults will also appear)	Check battery condition and connections. Check related fuse(s) and relay. Check voltage regulator/rectifier.
High system voltage on several modules	A battery charger has likely been used to substitute the vehicle battery. Clear all occurred faults and check again. Check voltage regulator/rectifier.
When all modules report that a module is missing	Check the module that is reported as missing. Check related fuse(s) and relay. Check related power and ground wires.
When several modules are in fault	Search for a common problem such as a faulty sensor.

Subsection XX (DIAGNOSTIC AND FAULT CODES)

CONDITION	ACTION
CAN bus failure, CAN buss OFF	When several modules and sensors report that a module is missing. The missing module may report CAN bus failure, CAN bus off. Check related CAN wires (continuity, short to ground, short between CAN low and high). Check module pins and wiring terminals. Then, the other modules should stop reporting that module is missing.
Occurred fault(s)	May have been generated due to a system or component that was momentarily operating outside normal parameters.
	May be generated when disconnecting and reconnecting a component, replacing a burnt fuse, or may be due to a momentary high or low voltage.
	Before being "Occurred", a fault has always been "Active" for a certain time, indicating that an unexpected condition or problem has been present during the driving cycle. A frequent momentarily fault or an intermittent fault may never be seen as "Active" in B.U.D.S. while there is still a pending problem. This type of malfunctions can be discovered by looking at the "Occurred" faults and then by evaluating the fault count. As long as a fault is present, it is displayed as "Active".
Fault count (0 - 255)	Low value: Suggests handling problems (connections, terminal contact/shape etc.). High value: Suggests a frequent and unsolved problem. The problem should be investigated.
Fault conditions (More details button)	Look for abnormal, excessive values.
Hard to find problems	When the basic troubleshooting has been done and the fault code(s) persists, often the problem is related to the wiring harness, connections or electromechanical components. Short to ground, to battery or between wires. Wire splices, chafing, terminal problems (pulled out, bent, out of shape, corroded etc.). Bad contacts in switch or relay.

GUIDELINES TO SOLVE SPECIFIC FAULT CODES

Refer to the fault code table available on *KNOWL-
EDGE CENTER*.

INTELLIGENT THROTTLE CONTROL (iTC)

SERVICE TOOLS

Description	Part Number	Page
DIAGNOSTIC HARNESS	529 036 188	11
FLUKE 115 MULTIMETER	529 035 868	12, 15

SERVICE PRODUCTS

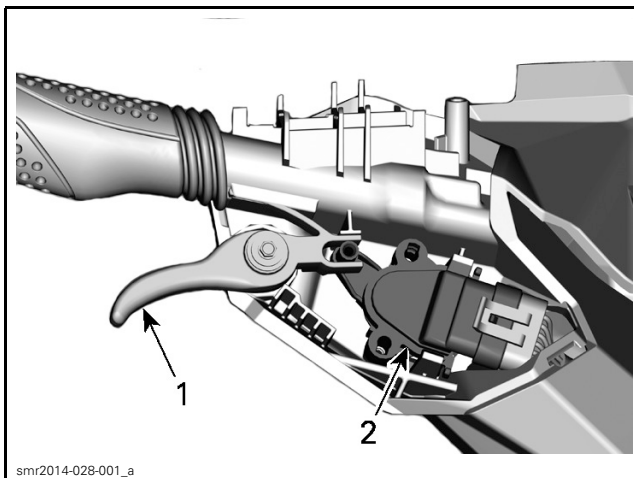
Description	Part Number	Page
DIELECTRIC GREASE	293 550 004	13

GENERAL

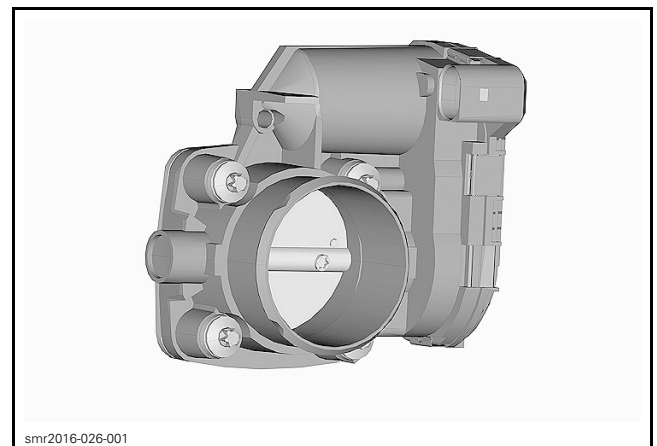
SYSTEM DESCRIPTION

NOTE: Some functions or features described in this section may not apply to every PWC model, or may be available as an option.

The iTC is an electronic throttle control system that includes a cableless throttle control located on the RH side of handlebar, an electric throttle actuator (ETA) located on the throttle body and the engine control module (ECM). The iTC is often referred to as a "throttle by wire" system.



TYPICAL
 1. Throttle lever
 2. Throttle accelerator sensor (TAS)



The throttle lever operates the throttle accelerator sensor (TAS). It is a double output hall effect sensor. The redundancy is used for security purposes.

The throttle actuator (ETA) is a DC motor on the throttle body that regulates the throttle plate via a drive gear. Pulse width modulation (PWM) is used to control the motor. In the throttle body, there is a double throttle position sensor (TPS). The redundancy is used for security purposes. The TPS is a potentiometer that supplies the ECM the actual angle position of the throttle plate.

According to the torque demand from the TAS, the ECM powers the ETA motor to rotate towards open or close the throttle plate. When the ECM detects through the TPS that the throttle plate has reached the targeted opening, the ECM stops the throttle actuator.

The iTC allows the throttle actuator to be moved irrespective of the accelerator sensor position since it is not directly linked by a throttle cable.

Subsection XX (INTELLIGENT THROTTLE CONTROL (iTC))

While the throttle lever might be fully pulled in and held, the ECM could close the throttle plate instead of opening it if the iBR lever were pulled in. Then, the ECM could open the throttle plate to accelerate the engine to increase the braking effect. These different throttle plate movements could be achieved while the throttle lever was still fully pulled in. This is one of the great flexibility of the iTC.

The use of the iTC allows the following additional engine modes of operation.

Touring Mode

Touring mode allows the operator to choose for progressive throttle response at certain engine speed.

Available engine power and acceleration is reduced when accelerating from a complete stop and when operating in the low engine power range under certain conditions.

When throttle is applied, the engine will progressively accelerate to an operating range whereby full power eventually becomes available. If the engine is throttled down sufficiently and for a long enough period of time, engine power and acceleration will again be reduced.

Sport Mode

Sport mode allows the operator for instant throttle response.

Maximum engine power is available throughout the engine operational range.

ECO Mode

When ECO mode is selected (fuel economy mode), engine RPM is limited whereby an optimal cruising speed is maintained in order to reduce fuel consumption.

Cruise Control

Cruise mode is a function of iTC (intelligent Throttle Control) system that allows the operator to set the desired maximum watercraft speed.

This is useful when cruising for long distances, operating in limited speed zones, or towing a tuber, skier or wake boarder.

Cruise mode only limits forward speed, the operator must keep the throttle depressed to maintain forward speed.

Once the maximum cruise speed is set, the operator can vary the watercraft speed from idle speed up to the set cruise speed using the throttle lever. The set cruise speed will not be exceeded even if the throttle lever is fully depressed.

As you proceed under a constant cruising speed setting, keep your attention level up to maintain good situational awareness.

Slowing down is a matter of releasing the throttle lever further than the set point, or by pulling the iBR lever in or decrease speed with the DOWN button.

If the iBR lever is pulled in for braking, CRUISE mode is overridden but **not deactivated**.

Once the iBR lever is released and the throttle is pulled in to engage forward position, the cruise function will reengage to limit the watercraft speed as it was set before iBR lever activation.

Slow Speed Mode

The Intelligent Throttle Control also allows for a Slow Speed Mode where the driver can adjust and set idle speed. This is useful when operating in slow speed zones where the driver must be especially attentive to possible obstacle avoidance.

The throttle plate will open and close as necessary to maintain the set speed.

Ski Mode

Ski mode allows for repeated and precisely controlled launches and a set towing speed, designed specifically for towing a skier or wake boarder.

RAMP Function

The RAMP function available in ski mode is a pre-programmed function used for launching and accelerating the PWC when towing a skier or wakeboarder.

TARGET SPEED Function

The TARGET SPEED function limits the maximum towing speed.

Learning and Rental Keys

Learning and Rental keys limit the watercraft maximum speed. The full stroke of the throttle lever is used while only a partial stroke of the throttle plate is achieved. Therefore, greater throttle lever movement is used while a smaller engine speed and torque variation is applied through the throttle actuator. This permits a more accurate and easier throttle operation to control the engine within a specified torque curve and maximum speed setting for a learner.

O.T.A.S.™ System (Off-Throttle Assisted Steering)

The O.T.A.S. (Off-Throttle Assisted Steering) system provides additional maneuverability in off-throttle situations. The O.T.A.S. system is electronically activated and slightly increases engine speed under a pre-defined RPM when the driver initiates a full turn. When the handlebar is brought back to its center position, the throttle reverts to idle.

The throttle plate will open and close as necessary to assist the steering.

Limitations

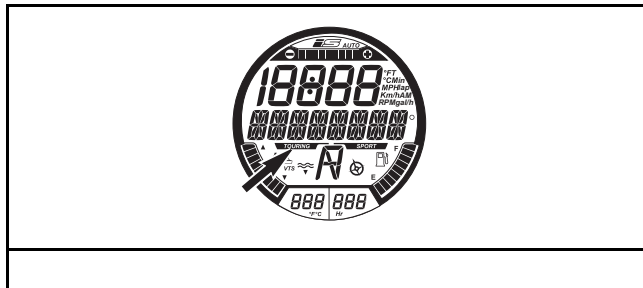
The O.T.A.S. system cannot help maintaining control or prevent collisions in all situations.

OPERATING MODES

Touring Mode

By default, the watercraft is set to TOURING mode of operation when started.

A TOURING mode indicator is ON in the multi-function gauge to confirm the active mode of operation.



Sport Mode

When selected, SPORT MODE provides for instant throttle response and more rapid accelerations than TOURING MODE.

NOTE: Sport mode is not available if using a LEARNING key.

Once activated, SPORT MODE will remain active until it is deactivated by the operator, or the engine is shut down whereby it defaults back to TOURING MODE.

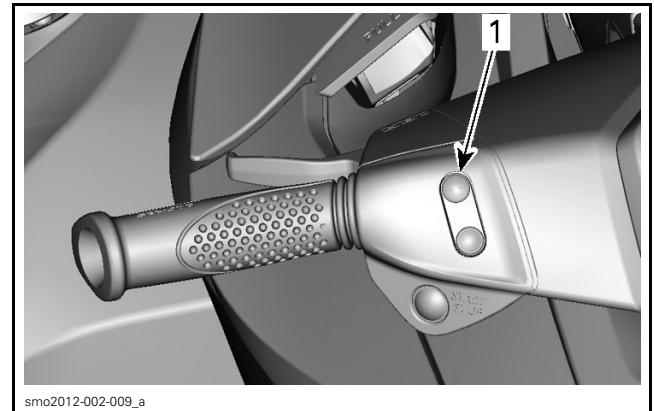
Activating Sport Mode

To quickly activate sport mode while riding at speed, carry out the following:

⚠ WARNING

When activating sport mode, be sure to maintain situational awareness of other watercrafts, obstacles, or persons in the water.

1. Depress and hold the SPORT button for at least 1 seconds.



TYPICAL
1. Sport button

The following message will be displayed:

MESSAGE DISPLAYED

ENTERING SPORT MODE - INCREASED ACCELERATION - INSTRUCT PASSENGERS TO HOLD - PRESS_SPORT_BUTTON

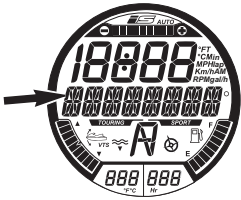
⚠ WARNING

Ensure passengers are advised that sport mode provides for increased accelerations and that they are to hold on tightly.

2. Press the SET button again to activate sport mode.

A scrolling SPORT MODE ACTIVATED message will momentarily confirm that sport mode has been activated.

Subsection XX (INTELLIGENT THROTTLE CONTROL (iTC))

The image shows a circular gauge with a digital display at the top showing '18888'. Below the display are several rows of smaller digital numbers. A needle points to the 'SPORT' indicator on the right side of the gauge. The gauge also shows '888 888' at the bottom.

MESSAGE DISPLAYED

SPORT MODE ACTIVATED

NOTE: After a few seconds, the gauge will revert to its normal display.

3. Ensure the SPORT mode indicator is turned on.

The image shows a circular gauge with a digital display at the top showing '18888'. Below the display are several rows of smaller digital numbers. A needle points to the 'SPORT' indicator on the right side of the gauge. The gauge also shows '888 888' at the bottom.

SPORT MODE INDICATOR (ALL MODELS EXCEPT RXT-X)

NOTE: The SPORT mode indicator will come on and stay on as long as sport mode is active.

There is no SPORT mode indicator in the multifunction display, but only a SPORT MODE indicator light in the tachometer.

Deactivating Sport Mode

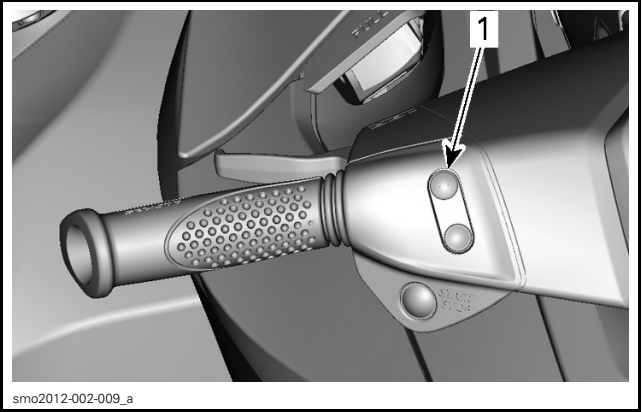
To quickly deactivate sport mode while riding at speed, carry out the following:

A black triangle with a white exclamation mark inside.

WARNING

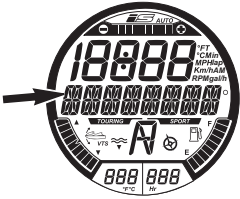
When deactivating sport mode, be sure to maintain situational awareness of other watercrafts, obstacles, or persons in the water.

1. Depress and hold the SPORT button for at least 1 seconds.



TYPICAL
1. Sport button

NOTE: The following message will scroll in the multifunction display: SPORT MODE DEACTIVATED.

The image shows a circular gauge with a digital display at the top showing '18888'. Below the display are several rows of smaller digital numbers. A needle points to the 'SPORT' indicator on the right side of the gauge. The gauge also shows '888 888' at the bottom.

MESSAGE DISPLAYED

SPORT MODE DEACTIVATED

NOTE: After a few seconds, the gauge will revert to its normal display.

2. Ensure the TOURING mode indicator is on.

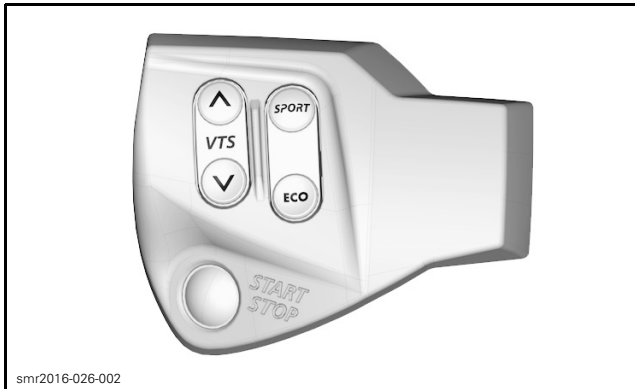
The image shows a circular gauge with a digital display at the top showing '18888'. Below the display are several rows of smaller digital numbers. A needle points to the 'TOURING' indicator on the right side of the gauge. The gauge also shows '888 888' at the bottom.

TOURING MODE INDICATOR (ALL MODELS EXCEPT RXT-X/RXT-X aS)

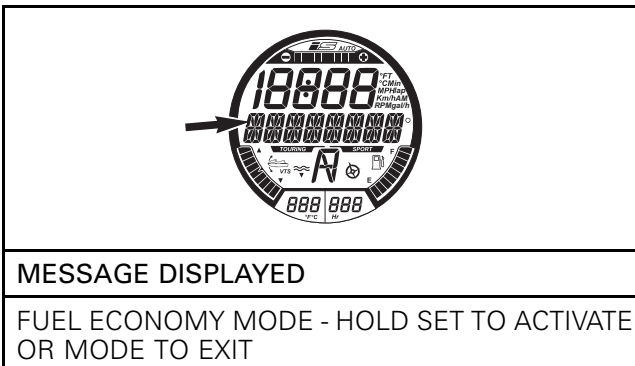
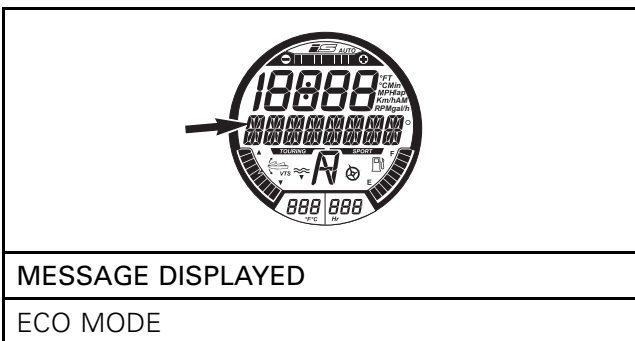
ECO Mode
(Fuel Economy Mode)

Activating ECO Mode

1. Depress the ECO button for at least 1 seconds.



The following message will be displayed on the multifunction display:



The ECO mode indicator will also be activated.

Deactivating ECO Mode

1. Depress the ECO button for at least 1 seconds. The ECO mode indicator will be deactivated.

Cruise Mode

Activating Cruise Mode at Idle Speed

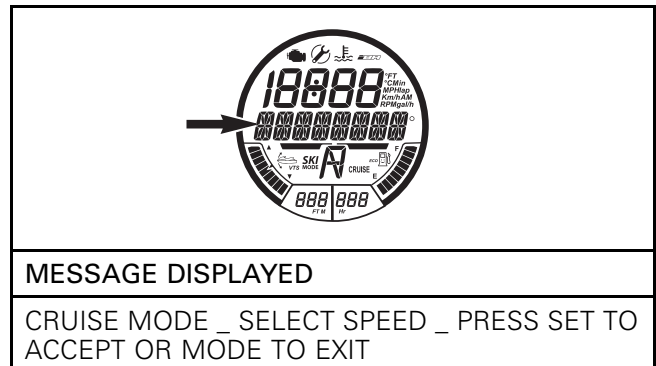
NOTE: This function is available up to approximately 10 km/h (6 MPH).

To activate and preset CRUISE MODE at idle speed, carry out the following:

1. Tap the throttle lever to move the iBR to the forward position.
2. Press and hold the cruise button.

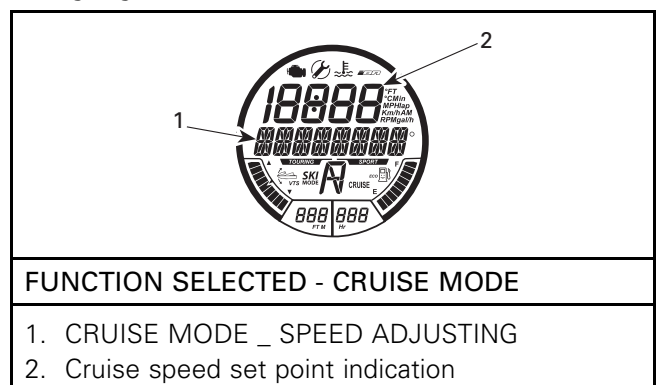


The following message will appear in the multifunction display.

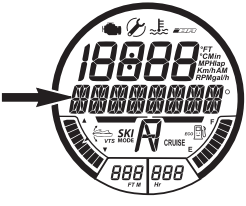


3. Press the UP button until the desired cruise speed is indicated in the numerical display.

The following will be displayed in the multifunction gauge.



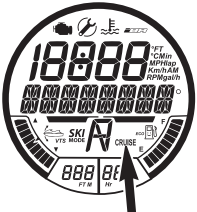
4. Press the SET button to save the cruise speed selected and engage cruise mode. The following scrolling message will appear in the multifunction display.



MESSAGE DISPLAYED

CRUISE MODE ACTIVE

A beep indicating that you are now in cruise mode will sound, and a CRUISE indicator will come on in the multifunction gauge.



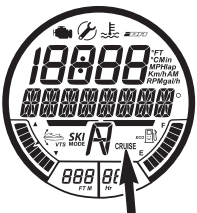
CRUISE MODE INDICATOR

Activating Cruise Mode Above Idle Speed

To activate cruise mode above idle speed (10 km/h (6 MPH)):

1. Accelerate to the desired watercraft speed and hold throttle lever steady.
2. Press and hold the cruise button for approximately 1 second.

A beep indicating that you are now in cruise mode will sound, and a CRUISE indicator will come on in the multifunction gauge.



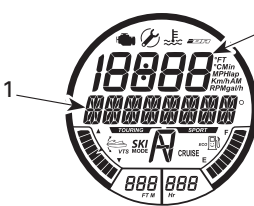
CRUISE MODE INDICATOR

Changing Set Cruise Speed

To **increase** or **decrease** the set cruise speed:

1. Hold the throttle lever all the way in to the handlebar.
2. On the RH handlebar, press UP/DOWN button.

While the UP/Down is being pressed to change the speed setting, the following will appear in the multifunction gauge.



FUNCTION SELECTED - CRUISE MODE

1. CRUISE MODE _ SPEED ADJUSTING
2. Cruise speed set point indication

NOTE: Pressing the UP/DOWN button repeatedly will change the cruise set speed in single increments. Pressing and holding the button will increase or decrease the speed until the button is released.

Deactivating Cruise Mode

To deactivate cruise mode:

1. Release the throttle lever.
2. Press the cruise button.

Deactivation of cruise mode is indicated by:

- The CRUISE indicator will turn off.
- A BEEP will be heard.

NOTE: If the throttle lever is not fully released when the cruise button is pressed to deactivate cruise mode, the BEEP will not be heard and the cruise indicator will remain on. The speed limiting function of cruise mode will stay active until the throttle is fully released, then the BEEP will be heard and the cruise indicator will go out.

Slow Speed Mode

The Intelligent Throttle Control also allows for a Slow Speed Mode where the driver can adjust and set idle speed. This is usefull when operating in slow speed zones where the driver must be especially attentive to possible obstacle avoidance.

The operator can set idle speed between 1.6 km/h to 11 km/h (1 MPH to 7 MPH).

If you accelerate above approximately 14 km/h (9 MPH) , Slow Speed Mode will be deactivated and the engine will return to idle RPM when the throttle is released.

Should a situation arise where the operator must stop or accelerate quickly away from a hazardous situation, pulling in the iBR lever, or pulling in on the throttle lever will deactivate slow speed mode and normal control of the watercraft will be returned to the operator.

Activating Slow Speed Mode

To activate slow speed mode of operation:

1. Release the throttle lever to idle RPM.
2. Pull in and release the iBR lever to engage neutral.
3. Press and hold the cruise button for approximately 1 second.

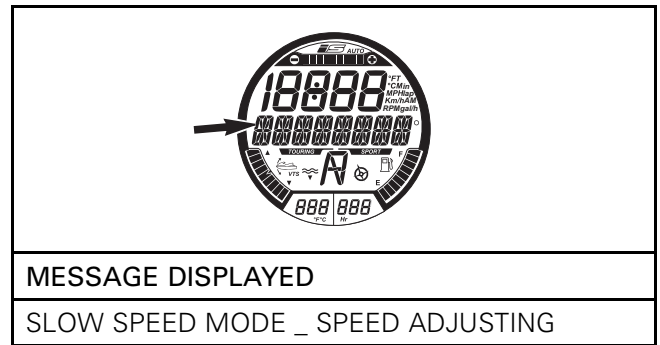


The CRUISE indicator will come on in the speedometer or multifunction display to indicate cruise activation.

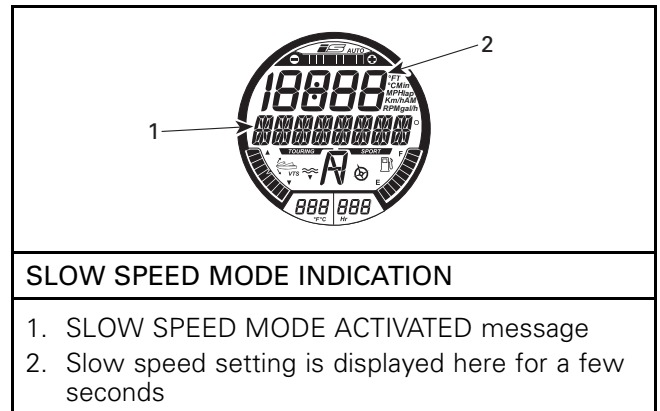


TYPICAL - CRUISE MODE INDICATOR LIGHT IN SPEEDOMETER

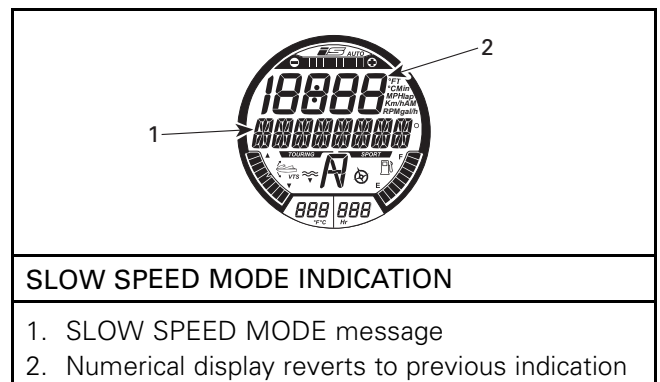
A message will scroll in the multifunction display to specify that you are now in slow speed mode.



The default slow speed setting of 1 will also come on for a few seconds in the numerical display.

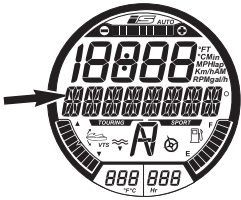


NOTE: The scrolling SLOW SPEED MODE message repeats itself as long as slow speed mode is activated. The numerical display reverts back to the previous indication after a few seconds.



Changing Set Slow Speed

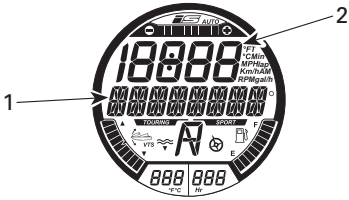
To **increase** or **decrease** the set slow speed, press the UP/DOWN button on the RH handlebar once, or repeatedly.



MESSAGE DISPLAYED

SLOW SPEED MODE _ SPEED ADJUSTING

The setting point indication in the digital screen will come back on to indicate the slow speed setting change.



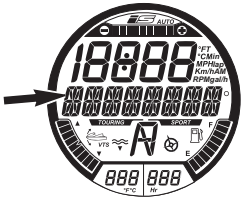
SLOW SPEED MODE INDICATION

1. SLOW SPEED MODE message
2. Numerical display reverts to previous indication

The displays will revert back to their previous indication a few seconds after the last activation of the UP or DOWN button.

NOTE: There are 5 slow speed settings available (1 through 5). Adjust slow speed mode to desired speed.

The following message will scroll across the multifunction display periodically as a reminder.



MESSAGE DISPLAYED

SLOW SPEED MODE ACTIVE

The displays will revert back to their previous indication a few seconds after the last activation of the UP or DOWN button.

Deactivating Slow Speed Mode

The slow speed mode can be deactivated using any of the following methods:

- Pressing the cruise button.

- Depressing the iBR lever.
 - Accelerating past the set slow speed.
- When deactivating SLOW SPEED MODE by pressing the cruise button, or accelerating using the throttle lever, the iBR gate stays in the forward position.
- When using the iBR lever, the iBR gate will move towards the reverse position, then neutral when the lever is released.
- SLOW SPEED MODE deactivation will be indicated in the following manner:
- The CRUISE indicator will go out.
 - The scrolling SLOW SPEED MODE ACTIVE message will cease.

Ski Mode

Ski mode allows for repeated and precisely controlled launches, and a set towing speed, specifically for towing a skier or wake boarder.

Ski mode is not available if using a LEARNING key.

RAMP Function

The RAMP function offers a pre-programmed setting for launching and accelerating the PWC.

RAMP 1 provides:

- Slowest launch (smoothest)
- Slowest acceleration rate
- Slowest TARGET SPEED range.

RAMP 5 provides:

- Quickest launch
- Quickest acceleration rate
- Highest TARGET SPEED range.

TARGET SPEED Function

The TARGET SPEED function limits the maximum towing speed.

Once the RAMP has been selected, an average PWC target speed for that RAMP will be visible in the numerical display.

The average speed displayed and the speed range available is dependent on the RAMP selected. The higher the RAMP number, the higher the speed range.

The operator may increase or decrease the target speed to any value within the selected RAMP speed range.

NOTE: If the desired target speed cannot be set in the selected RAMP, you must exit then reengage SKI MODE, and select a different RAMP.

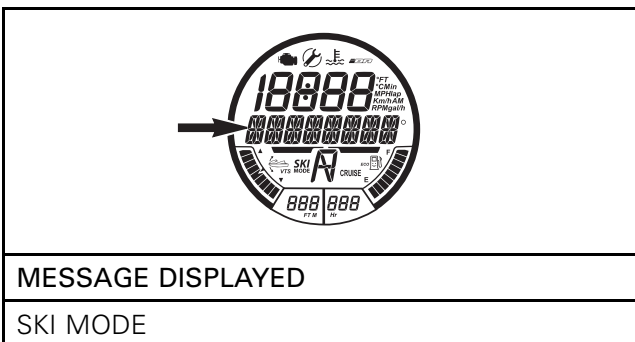
Activating and Using Ski Mode

To engage ski mode, carry out the following steps:

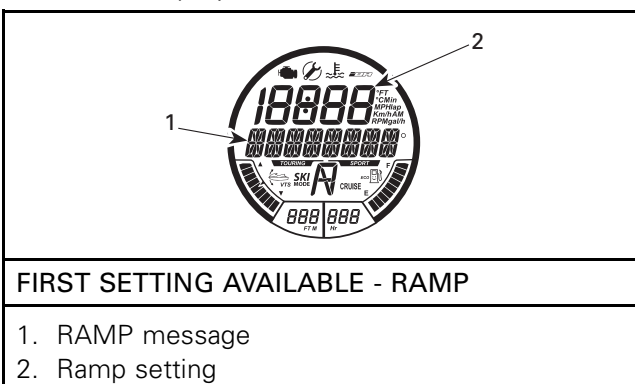
1. Release throttle lever.

NOTE: Ski mode cannot be engaged if the throttle lever is not fully released, and if CRUISE or SLOW SPEED mode is engaged. A message will appear in the multifunction display advising you of the situation. Follow the instructions in the display.

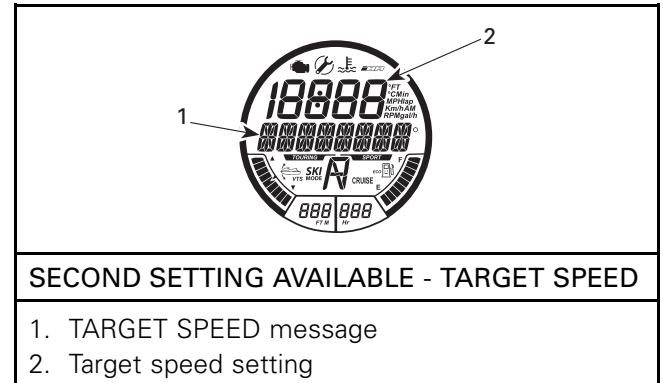
2. Press the MODE button repeatedly until SKI MODE is visible in the multifunction display.



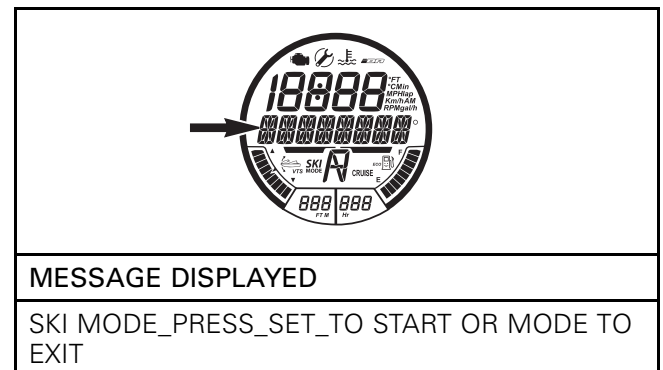
3. Press SET to enter the function. The multifunction gauge message will change to RAMP. The RAMP setting number will be visible in the numerical display.



4. To change the RAMP setting, press the UP/DOWN button until the desired ramp number is visible in the numerical display.
5. Press SET to lock in the ramp setting; the multifunction display will change to the TARGET SPEED setting function.

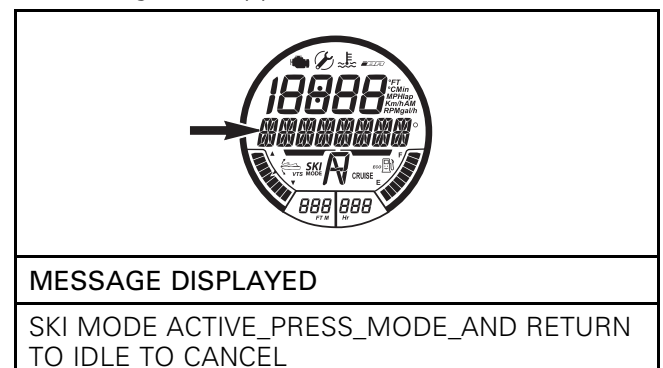


6. Press the UP/DOWN button to increase or decrease the target speed.
7. Press SET to lock in the target speed; the display will switch to the following scrolling message.



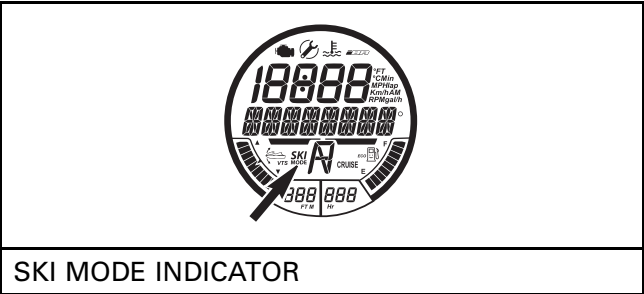
NOTE: A BEEP will be heard every 5 seconds as a SKI MODE engaged reminder.

8. Press SET again; the following confirmation message will appear.



Subsection XX (INTELLIGENT THROTTLE CONTROL (iTC))

NOTE: The SKI MODE indicator will also come ON and blink when ski mode becomes active. It will be ON steady when the operator pulls and holds the throttle lever all the way in to the handlebar.



9. To launch the PWC in ski mode, pull in and hold the throttle lever all the way to the handlebar grip. The PWC will accelerate to the set TARGET SPEED and the SKI MODE indicator will be on steady.

10. To increase or decrease the TARGET SPEED during a ski run, press the UP/DOWN button, **do not** release the throttle lever.

NOTE: If the throttle is partly released during a ski run, the SKI MODE indicator light will start to blink and the speed adjust function using the UP/DOWN arrow button will be deactivated.

11. To end a ski run or to pick up a fallen skier or wakeboarder, fully release the throttle to regain normal throttle control.

NOTE: When the throttle is fully released during ski mode operation, the system returns to ski mode engaged status. The SKI MODE indicator light will go out but, ski mode will remain engaged and a message to that effect will reappear in the multifunction display.

12. Press SET to reactivate ski mode and fully pull in the throttle lever to start another ski run.

Deactivating Ski Mode

To exit ski mode at any given point during the ski mode setting process, press the MODE button.

To end a ski run and completely deactivate ski mode, release the throttle to idle, then press the MODE button.

Learning Key Mode

There are 5 speed settings available.

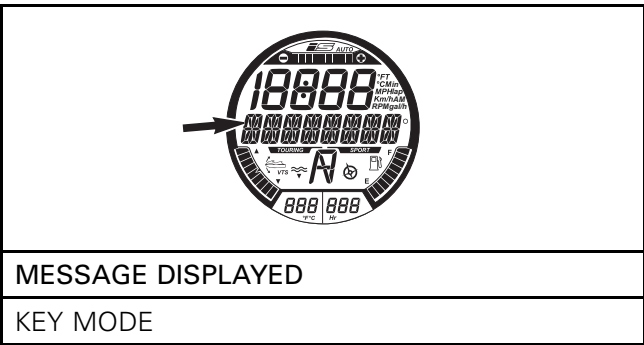
By default, the speed setting is no 3.

Changing Learning Key Speed Settings

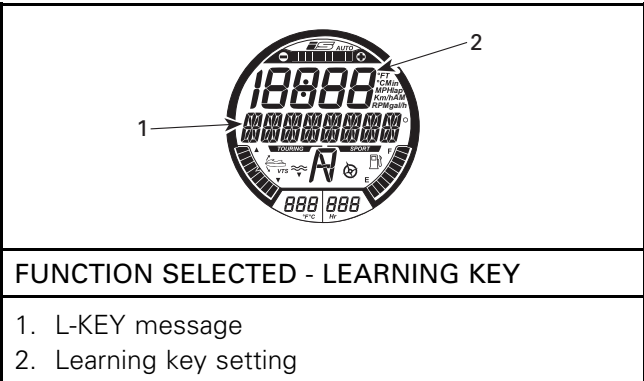
NOTE: Changing key settings is only available when the engine is not running.

To change learning key settings, carry out the following:

1. Press the START/STOP button to wake up the electrical system and install the NORMAL key on the engine cut-off switch.
2. Wait for the information center to complete its self-test and display the key recognition message.
3. Press the MODE button repeatedly until KEY MODE is visible in the digital screen of the information center.



4. Press the SET button once to enable learning key mode setting function. The display will change to L-Key.



5. Press the UP or DOWN button to toggle the key setting between 1 and 5. See table for speed limitations according to setting.
6. Press the SET button once to save the setting, twice to exit the function, or simply wait for the function to time-out. The change in key setting will automatically be saved.

NOTE: The key speed setting is applicable to any key of the same type used on a specific watercraft. The same key type used on a different watercraft may therefore have a different key speed setting.

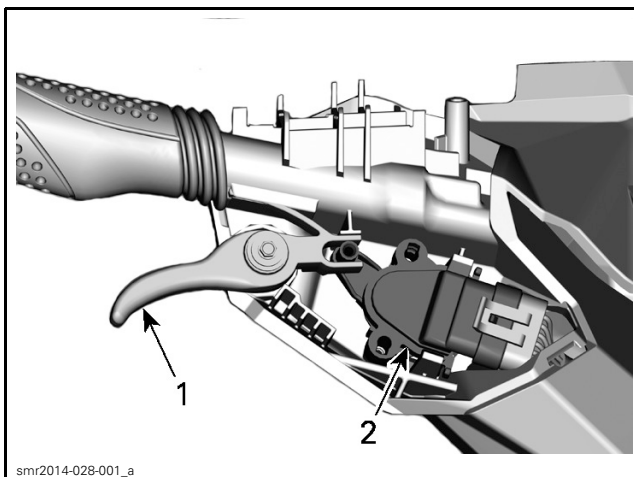
D.E.S.S. KEY TYPE	KEY SPEED SETTING	APPROX. MAX. SPEED
LEARNING KEY	5	80 km/h (50 MPH)
	4	74 km/h (46 MPH)
	3	68 km/h (42 MPH)
	2	60 km/h (37 MPH)
	1	51 km/h (32 MPH)

PROCEDURES

THROTTLE ACCELERATOR SENSOR (TAS)

General

The throttle accelerator sensor (TAS) is a double hall effect sensor that sends a signal to the ECM which is proportional to the throttle lever angle.

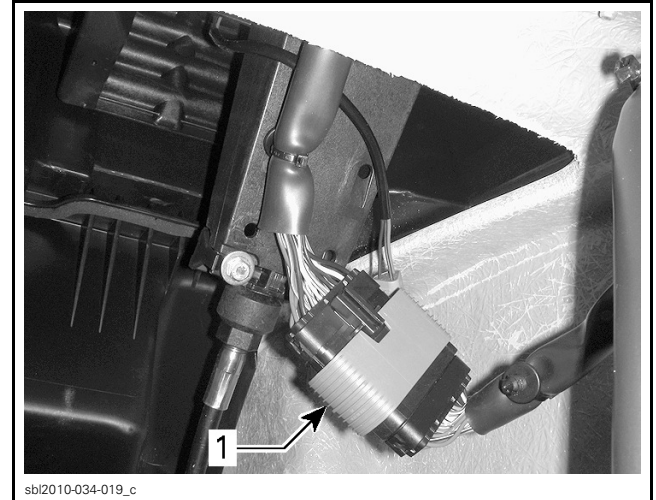


1. Throttle lever
2. Throttle accelerator sensor (TAS)

First ensure the throttle lever functions adequately. Pull the throttle lever fully in towards the handlebar, then release it. It must reach the wide open position and return to the idle position freely when released. Otherwise, refer to *STEERING SYSTEM* for an inspection.

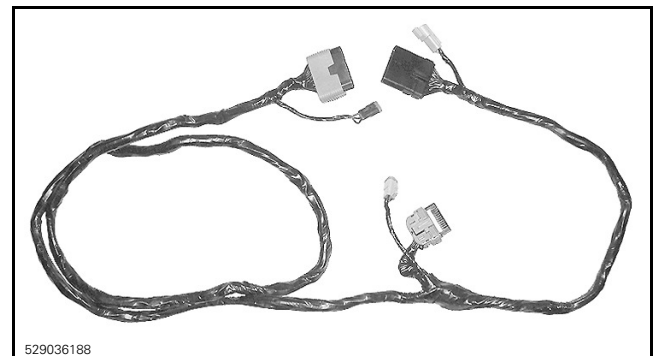
Testing TAS Voltage

1. Disconnect the 24-pin steering connector.



1. 24-pin connector

2. Connect the DIAGNOSTIC HARNESS (P/N 529 036 188) to make an in-line connection between the disconnected connectors.



NOTE: Use only the 24 pin connectors.

3. Install the tether cord on the engine cut-off switch.
4. Briefly press the START button to wake up the ECM.
5. Measure the voltage readings on the installed diagnostic harness connector as follows. Refer to wiring diagram for details.

Subsection XX (INTELLIGENT THROTTLE CONTROL (iTC))

24-PIN CONNECTOR		IDLE POSITION	WIDE OPEN POSITION
PIN		VOLTAGE (VDC)	
9 (VI/BU)	3 (BK)	4.9 - 5.1	
3 (BK)	6 (YL/BU)	0.15 - 0.35	1.4 - 1.6
10 (VI/GN)	4 (BK)	4.9 - 5.1	
4 (BK)	7 (YL/GY)	0.4 - 0.6	2.9 - 3.1

If voltage is as per specification, the TAS sensor is functional.

If voltage is out of specification, check continuity of wires between the ECM and the sensor. If continuity is good, replace sensor.

6. Reinstall removed components.

Replacing the TAS

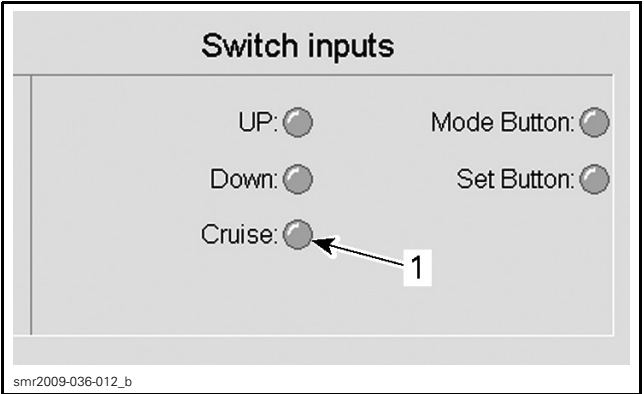
Refer to BRLS in iBR subsection.

CRUISE SWITCH

Testing Cruise Switch

If pressing the cruise switch does not engage the CRUISE or SLOW SPEED modes, test the cruise switch as per following procedure.

- 1. Connect the watercraft to the latest B.U.D.S. software. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection for details.
- 2. In B.U.D.S., click the **Monitoring** tab then the **Cluster** tab.
- 3. Press the cruise button on the RH handlebar and look for the **Cruise** indicator light to come on in the **Switch inputs** area.



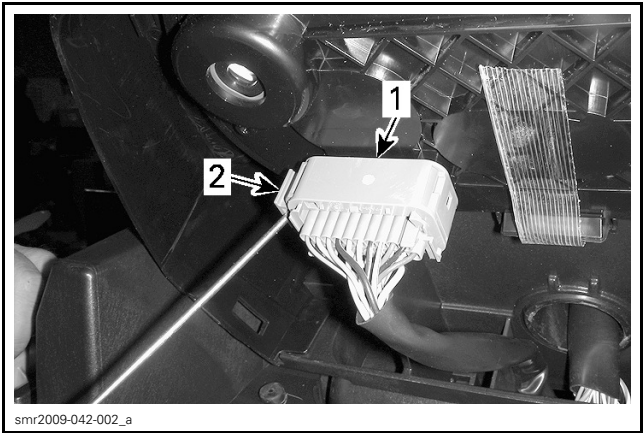
TYPICAL
1. Cruise indicator light

If the test succeeded, the switch and wiring are good and the problem may be related to the information center or ECM. Check for related fault codes. Refer to *DIAGNOSTIC AND FAULT CODES*.

If the test failed, test the switch and wiring as described in the following steps.

- 4. Remove the gauge support cover. Refer to *GAUGE* subsection.
- 5. Disconnect the gauge connector.

NOTICE Pull connector lock out sideways. Do not twist the screwdriver.



1. Gauge connector
2. Pull out to unlock connector

- 6. Use the FLUKE 115 MULTIMETER (P/N 529 035 868).
- 7. Select the Ω (ohm) function.
- 8. Test the cruise switch as per following table.

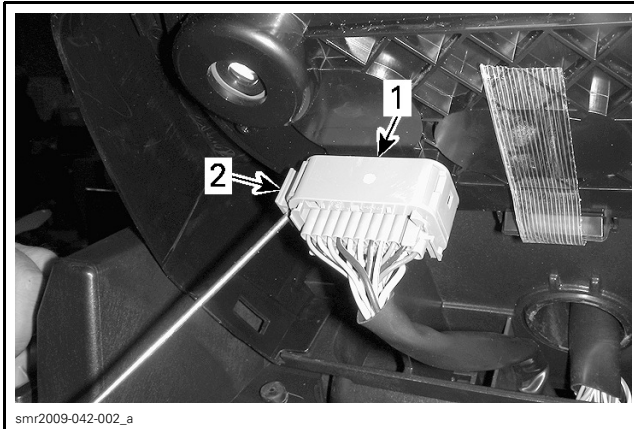
CRUISE SWITCH TEST			
GAUGE CONNECTOR		SWITCH POSITION	RESISTANCE
Pin 7	Pin 10	Switch released	OL
		Switch depressed	Close to 0 Ω

If the test failed, replace the cruise switch.

If the test succeeded, the problem may be internal to the information center. Try a new one.

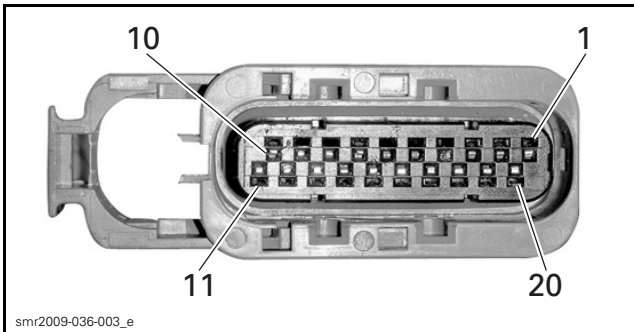
Replacing the Cruise Switch

- 1. Disconnect information center connector.



1. Gauge connector
2. Pull out to unlock connector

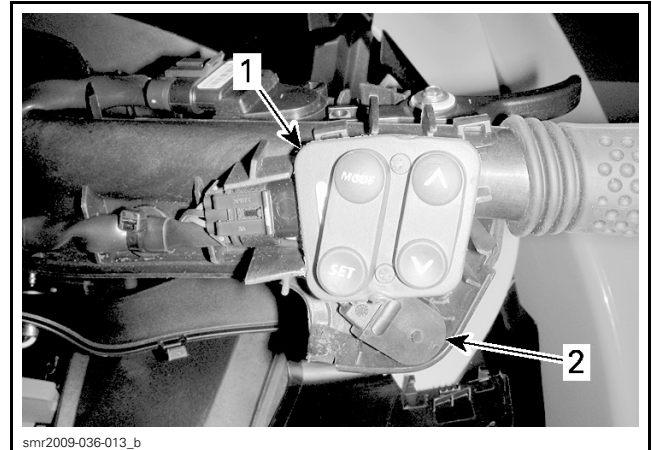
2. Remove terminal 7 (GRAY wire) and 10 (BLACK wire) from the gauge connector.



GUAGE CONNECTOR PIN-OUT

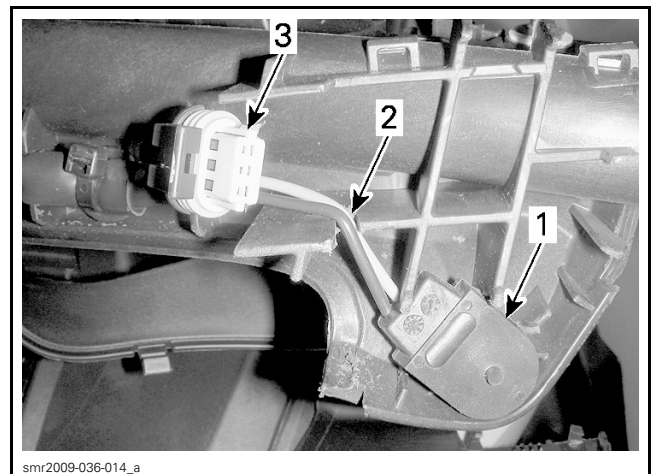
3. Attach a string approximately 1.2 m (4 ft) to the end of the wires which will be used for drawing the new switch wires through the harness protective sheath.
4. Remove steering cover. Refer to *STEERING AND O.T.A.S.* subsection.
5. Remove the MODE/SET and UP/DOWN arrow switches from its support.

NOTE: It is not necessary to disconnect switches.



1. MODE/SET and UP/DOWN arrow switches
2. Cruise switch

6. Remove the cruise switch by lifting it off its support.
7. Cut the locking ties from the harness sheath as necessary.
8. Carefully pull the wires out of the harness. Ensure the string draws through the harness sheath.
9. Tie the string to the new cruise switch wire ends and pull the new wires through the harness.
10. Install new switch terminals in the gauge connector.
11. Apply a small amount of DIELECTRIC GREASE (P/N 293 550 004) on switch terminals.
12. Reconnect gauge connector.
13. Properly insert cruise switch wiring in slot in switch support before installing MODE/SET and UP/DOWN arrow switches.



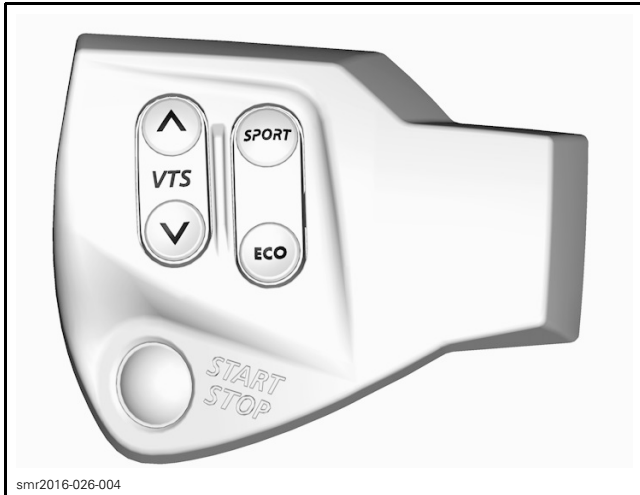
SOME PARTS REMOVED FOR CLARITY

1. Cruise switch
2. Wiring in slot
3. MODE/SET and UP/DOWN arrow switch connector

14. Complete installation in reverse order of removal.

SPORT/ECO SWITCH

Sport/ECO Switch Overview



TYPICAL

The Sport/ECO switch contain a series of 4 diodes for the Sport and ECO switches.

The center wire to the switches (pin C), is common for Sport/ECO switch and VTS switch. The other two wires (pins A and B), act as signal wires for each set of switches to the gauge. They actually each form one branch of an electronic circuit within the gauge.

Each diode (in circuit) drops a nominal 0.6 Vdc when conducting electricity. If the circuit current passes through all four diodes (if the Sport/ECO switch is open), a drop of 2.4 Vdc would be measured across the 4 the diodes (pin B to pin C). This 2.4 Vdc at pin B tells the gauge the Sport/ECO switch is open.

If the Sport button is pressed, 2 diodes are bypassed. The remaining two diodes in the circuit drop 1.2 Vdc (at pin B).

If the ECO button is pressed, 1 diode is bypassed. The remaining three diodes in the circuit drop 1.8 Vdc (at pin B).

The gauge senses these voltages through pin 14 of its connector, and interprets them as signals that tell it which switch is activated.

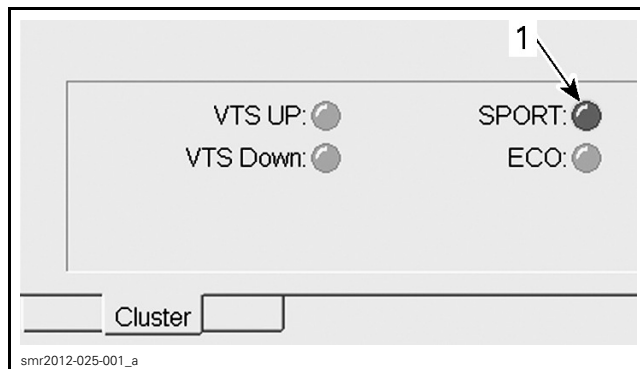
When Sport or ECO button is pressed, a circuit within the gauge will translate it to CAN protocol and transmit it through the CAN bus. The ECM (engine control module) will react to the command and carry out the function.

NOTE: The above stated voltages vary slightly depending on the actual voltage applied to the circuit and the current flow through the diodes. When using a Fluke 115 multimeter for testing in diode test mode, the voltage and current applied by the multimeter are lower than in circuit. The quality of probe contact, the actual probes and leads, and the precision of the meter calibration will all affect the results, which will most likely be slightly lower than nominal values stated.

Testing the Sport/ECO Switch

If Sport/ECO switches do not allow the selection, test the switches as follows:

- Check the Sport/ECO switch operation using B.U.D.S. software. Refer to *COMMUNICATION TOOLS AND B.U.D.S. SOFTWARE* subsection to connect B.U.D.S.
- Check if there is any occurred or active fault code(s). If not, proceed with the following test.
- Depress the Sport button on steering and check if the **Sport** light turn on in B.U.D.S.
- Repeat with the ECO switch. **ECO** light should turn on in B.U.D.S.



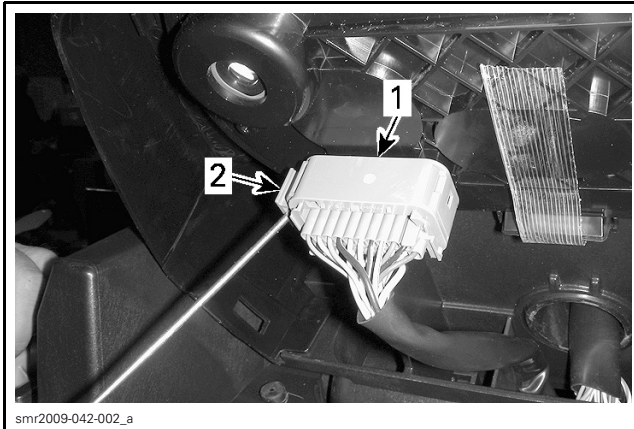
MONITORING AND CLUSTER TABS

1. Sport light

If one switch does not function, replace Sport/ECO switch.

If both switches stay off, do the following to verify the circuit.

1. Remove the gauge support cover.
2. Disconnect the gauge connector.



1. Gauge connector
2. Slide out gauge connector tab to unlock

3. Using the FLUKE 115 MULTIMETER (P/N 529 035 868) set to the diode test function, test the Sport or ECO switches as per following tables.

NOTE: In diode test mode, the multimeter will test the voltage drop through the diodes.



iS SWITCH TEST		
SWITCH POSITION	MULTIMETER LEAD/GAUGE CONNECTOR	VOLTAGE
Switch released	BLACK/WHITE lead/Pin 14 WHITE/GN lead/Pin 15	Approx. 2 Vdc
	WHITE/GN lead/Pin 14 BLACK/WHITE lead/Pin 15	OL
UP depressed	BLACK/WHITE lead/Pin 14 WHITE/GN lead/Pin 15	Approx. 1.1 Vdc
	WHITE/GN lead/Pin 14 BLACK/WHITE lead/Pin 15	OL
DOWN depressed	BLACK/WHITE lead/Pin 14 WHITE/GN lead/Pin 15	Approx. 1.6 Vdc
	WHITE/GN lead/Pin 14 BLACK/WHITE lead/Pin 15	OL

NOTE: Remember that each diode should drop approximately 0.6 Vdc when positively biased, and read as an OL (open circuit) when negatively biased (leads reversed).

If, when measuring between pins 14 and 15 an OL is obtained with both positive and negative diode biasing, test the wiring harness continuity between the gauge and switch assembly. If harness continuity is good, replace the switch assembly.

If any reading is significantly different than listed, carry out the same test at the switch connector, refer to the wiring diagram. If you obtain the same results, replace the switch assembly.

If voltages measured on every switch are as listed in the previous tables (or very close to it), the switches and the wiring harness are good. The fault may be within the gauge, or in the circuit or component the function applies to.

ELECTRONIC FUEL INJECTION (EFI)

SERVICE TOOLS

Description	Part Number	Page
ECM ADAPTER TOOL.....	529 036 166	4, 6, 16, 23, 25, 29, 32–33, 35–36
FLUKE 115 MULTIMETER	529 035 868	4–6, 15–16, 23, 25, 27, 29, 32–33, 36
FUEL HOSE DISCONNECT TOOL	529 036 037	10

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
FLUKE AUTOMOTIVE BACK PROBE PIN.....	TP40	27
FLUKE SUREGRIP INSULATED TEST LEADS.....	TL224	27

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE).....	293 800 060	7, 11, 25, 28, 34, 37
LOCTITE 518.....	293 800 038	35

GENERAL

WARNING

Always disconnect battery prior to working on the fuel system. Always disconnect battery exactly in the specified order, BLACK (-) cable first. Electrical connections should be disconnected prior to disconnecting fuel lines.

WARNING

Fuel vapors are flammable and explosive under certain conditions. Ensure work area is well ventilated. Do not smoke or allow open flames or sparks in the vicinity.

Use B.U.D.S. software to release the fuel pressure in the system prior to disconnecting a fuel line. Refer to *FUEL TANK AND FUEL PUMP* subsection.

Cover the fuel line connection with an absorbent shop rag before disconnecting them. Slowly disconnect the fuel hose to minimize spilling.

WARNING

Fuel lines remain under pressure at all times. Always proceed with care and use appropriate safety equipment when working on a pressurized fuel system. Wear safety glasses. Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Proceed with care when removing or installing high pressure test equipment, or disconnecting fuel line connections. Wipe off any fuel spillage in the bilge. Never use a hose pincher on high pressure hoses.

When the repair is completed, ensure the hose from the fuel rail to the fuel pump is properly connected and secured in its support. Test for fuel leaks as described in *FUEL TANK AND FUEL PUMP* subsection.

WARNING

Always perform the fuel system high pressure leak test if any component has been removed or disconnected.

WARNING

If a gasoline leak and/or odor is present, do not start the engine. Repair the leak.

SYSTEM DESCRIPTION

The electronic fuel injection system (EFI) is comprised of various sensors used for detecting ongoing operating conditions of the engine and watercraft, and includes all the actuators that perform the required adjustment to the engine.

This system also introduces torque management functions.

Electrical System

ECM (Electronic Control Module)

From input signals (e.g. throttle lever, iBR lever), the ECM acknowledges driver demands and converts them to an engine torque requirement through calculation of several variables. Then, the ECM controls the iTC (intelligent Throttle Control), the injection system and the ignition system to meet the torque requirement.

The ECM manages the engine torque requirements and controls engine operation to ensure it is delivering optimum performance, fuel economy and meeting emission regulations. The ECM also controls idle speed and limits maximum engine speed.

Since the ECM manages several torque requirements at the same time including contradictory demands (such as the throttle lever and the iBR lever being fully pulled in at the same time), it must prioritize the most important requirement according to predefined conditions and apply the proper action.

EFI Sensors

The ECM reads the inputs from the sensors which it compares to predetermined parameters stored in the ECM, makes computations, and activates the outputs accordingly (injectors, ignition coils etc.).

Signals from sensors are used by the ECM to determine the injection and ignition parameters (referenced to fuel and ignition maps) as required to maintain the optimum air-fuel ratio.

Air Induction

Throttle Body

A 60 mm throttle body is mounted on the intake manifold.

Air for combustion is drawn in by a mechanically-driven supercharger. The air flows through the throttle body and is controlled by a throttle plate.

Fitted on the throttle body, an electronic throttle actuator (ETA) allows the ECM to electronically control the throttle plate opening which regulates the amount of air that enters the engine, and therefore engine speed.

There is no idle air control valve (IACV).

Fuel System

Fuel Rail

A single fuel rail is mounted on the intake manifold. The fuel rail ensures that enough fuel can be delivered to the fuel injectors throughout the engine operating range.

The fuel rail is fed by the fuel pump. The fuel pressure applied to the fuel rail is regulated by the fuel pressure regulator located in the fuel pump module.

Fuel Injectors

One injector per cylinder is used to inject fuel into the intake ports of the cylinder head.

Fuel Pump

An electric fuel pump with an integrated pressure regulator is used. Refer to *FUEL TANK AND FUEL PUMP* subsection.

ADJUSTMENT

IDLE SPEED

Idle speed is not adjustable. The ECM controls the idle speed of the engine through the iTC system by controlling throttle plate opening using the ETA (electronic throttle actuator).

Idle speed can be monitored in B.U.D.S.

CLOSED THROTTLE RESET

General Information

This operation performs a reset of the TPS values of the throttle body in the ECM.

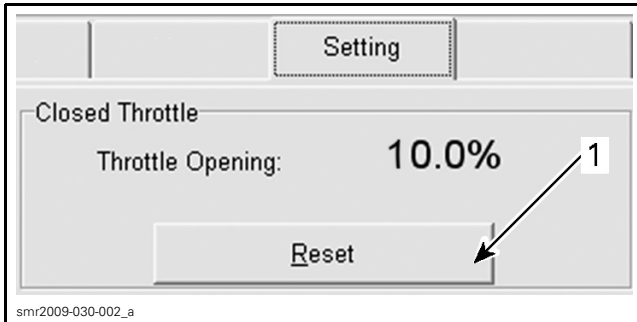
Closed throttle reset must be carried out only when:

- Replacing the throttle body.
- Replacing the ECM.

Closed Throttle Reset Procedure

1. Use the B.U.D.S. software to perform this setting. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Press the START button to wake up the ECM.

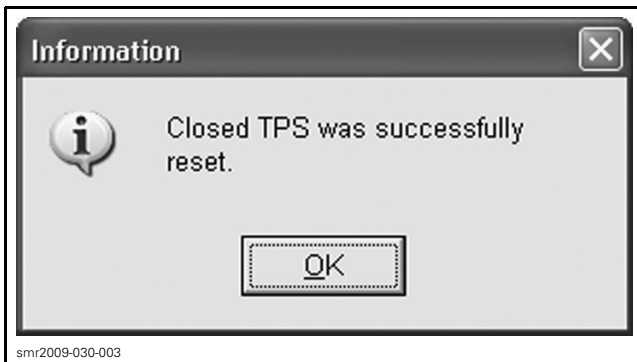
3. Install the tether cord on the engine cut-off switch.
4. Ensure throttle lever is completely released.
5. In B.U.D.S., click the ECM **Setting** tab, then click on the **Reset** button.



ECM SETTING PAGE IN B.U.D.S.

1. Click Reset button

The following message will confirm the operation.



Reset is completed.

NOTE: It is not necessary to click on the Write button in B.U.D.S.

Exit B.U.D.S.

NOTE: If the throttle valve was not within the allowed range when the **Closed Throttle** reset was carried out, no error message would be displayed. However, a fault code would be set when the engine is started.

6. Start engine and make sure it operates normally through its full engine RPM range.
7. Check for fault codes using B.U.D.S. If a fault code related to the throttle actuator appears, clear it, then carry out another **Closed Throttle** reset procedure. To clear faults, refer to *DIAGNOSTIC AND FAULT CODES* subsection.

TROUBLESHOOTING

DIAGNOSTIC TIPS

Engine problems are not necessarily related to the fuel injection system.

It is important to ensure that the engine/propulsion system, fuel delivery and electrical systems are functioning normally.

For diagnostics purposes, use B.U.D.S. software. See *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

After a problem has been solved, be sure to clear the fault(s) in the ECM using the B.U.D.S. software.

⚠ WARNING

All electrical actuators and electronic modules are powered as soon as the START button is pressed. Always disconnect the battery prior to disconnecting any electrical or electronic parts.

Never use a battery charger to temporarily substitute the battery as it may cause the ECM to function erratically, or not at all.

Check related-circuit fuse solidity and condition with an ohmmeter. A visual inspection could lead to a false diagnosis.

Electrical Related Problems

It is important to check the following in the electrical system:

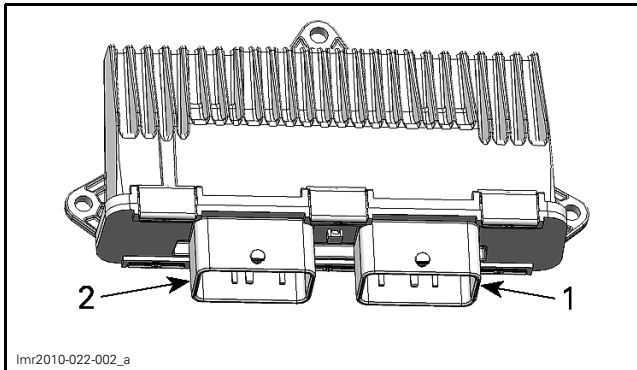
- Battery voltage
- Fuses
- Bus bar condition in fuse box
- Ground connections
- Wiring and connectors.

Ensure that all electronic components are genuine OEM. Any modification to the wiring harness may lead to poor system operation or generate fault codes.

Electrical Connections

Pay particular attention to ensure that terminals and pins are not out of their connectors, corroded, or out of shape.

When probing terminals, pay attention not to deform the terminals as this could cause a loose or intermittent connection that would be difficult to troubleshoot.



ECM CONNECTOR IDENTIFICATION

1. Connector A
2. Connector B

NOTE: For connector information, cleaning and probing, refer to *WIRING DIAGRAM* subsection.

ECM Wake Up Validation

Press the START button.

NOTE: Do not install the tether cord.

QUICK INDICATION THAT ECM IS POWERED (assuming the observed component is working)

Information center turns on.

Fuel pump turns on for approximately 5 seconds.

NOTE: Since the tether cord is not installed, the information center will turn off a few seconds after the self-test, but the ECM and electrical system will stay powered for approximately 3 minutes longer.

If the ECM does not turn on, check the following:

- Fuses F8, F19 and F3 in fuse box
- Battery voltage. Refer to *CHARGING SYSTEM*
- The 12 Vdc power bus bars in fuse box
- The ground bus bar in fuse box
- Relay and wiring. Refer to *POWER DISTRIBUTION*
- ECM power supply wires and ground wires. See following procedure.

ECM Wake Up Logic

With Tether Cord Installed

When the START button is pressed to start engine:

- ECM pin B-D1 receives current from battery via the START switch. ECM is woken up.
- ECM pin B-H2 provides a ground to the relay coil in fuse box.
- The relay contacts close and provides main 12 Vdc power to the ECM at pin B-M4.

- The relay also powers the other components in the electrical system.
- ECM pin B-E4 monitors for a tether cord installed on the engine cut-off switch.
- When a tether cord is installed, the magnet in the tether cord cap closes the reed switches in the engine cut-off switch and the ECM pin B-F2 provides a ground. This tells the ECM the tether cord is installed.
- ECM pin B-B2 reads the D.E.S.S. key in the tether cap and determines if it is valid. If so, the engine can be started.

Without a Tether Cord Installed

When the START button is pressed:

- The information center turns on, goes through the self-test function, displays applicable messages and turns off a few seconds later.
- The engine cannot be cranked.
- The ECM stays powered up until it removes the ground to the relay coil after 3 minutes (pin B-H2).
- Relay contacts open and power to the ECM is removed.
- Power is also removed on all other electrical systems except the GPS supply to the information center.

ECM Shut Down Logic

When the engine is stopped by using the STOP button or by removing the tether cord from the engine cut-off switch, the following occurs:

- ECM stops the engine.
- After 5 seconds, the information center turns off.
- After 60 seconds, ECM (pin B-H2) removes the ground to the relay coil.
- Relay contacts open and power to the ECM is removed.
- Power is also removed on all other electrical systems except the GPS supply to the information center.

Testing ECM Power Supply

1. Remove cover from fuse box. Refer to *POWER DISTRIBUTION* subsection.

2. Press the START button to wake up the ECM.

NOTE: Do not install the tether cord.

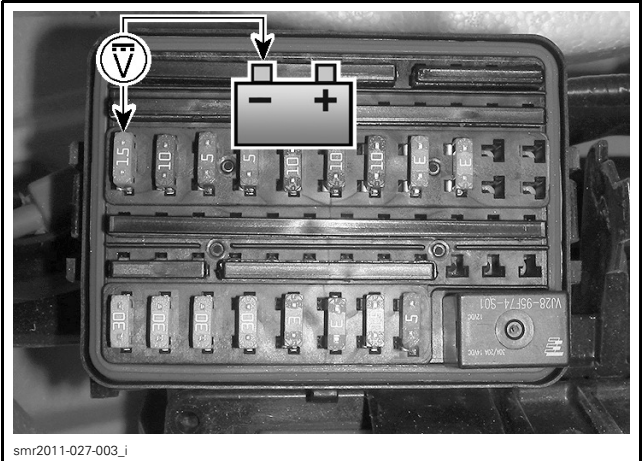
3. Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and select Vdc.

4. Probe fuse F19 as illustrated.

Subsection XX (ELECTRONIC FUEL INJECTION (EFI))

NOTE: This will validate the fuse at the same time.

FUSE BOX	BATTERY POST	VOLTAGE
Fuse F19 terminal at F1	Ground	Battery voltage
Fuse F19 terminal at E1		



If battery voltage is measured at E1 but not at F1, replace the fuse.

If voltage is not measured at E1, check the wiring and connections between the relay output and F19 output. Refer to *WIRING DIAGRAM*.

If voltage is as per specification, carry out the *CONTINUITY TEST OF ECM POWER CIRCUIT*.

Testing Continuity of ECM Power Circuit

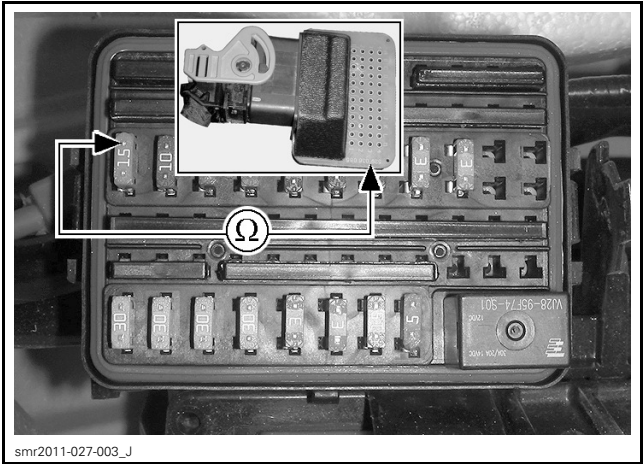
1. Wait for electrical power to go off (approximately 3 minutes).
2. Disconnect "B" connector from ECM.
3. Install ECM ADAPTER TOOL (P/N 529 036 166) on ECM connector.



4. Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and select Ω .

5. Probe terminals as per following table.

FUSE BOX	ECM ADAPTER	RESISTANCE
Terminal F1	Pin B-M4	Close to 0 Ω



If an open circuit is measured, repair or replace wiring and connectors.

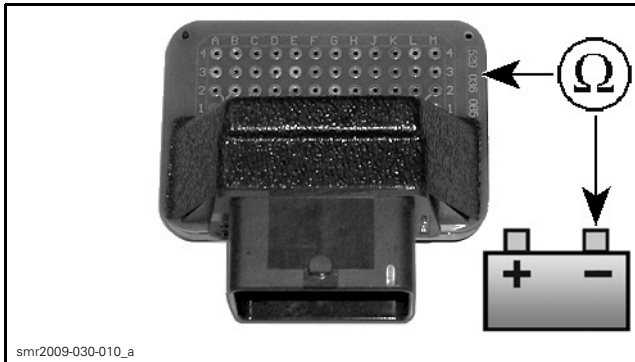
If the ECM power circuit tests good, the problem may be one of the following:

- Start switch circuit open to ECM, refer to *STARTING SYSTEM* subsection.
- ECM not providing a ground to relay in fuse box, refer to *POWER DISTRIBUTION* subsection.
- ECM ground wire open circuit, refer to *CONTINUITY TEST OF ECM GROUND CIRCUITS* in this subsection.
- ECM internal problem.

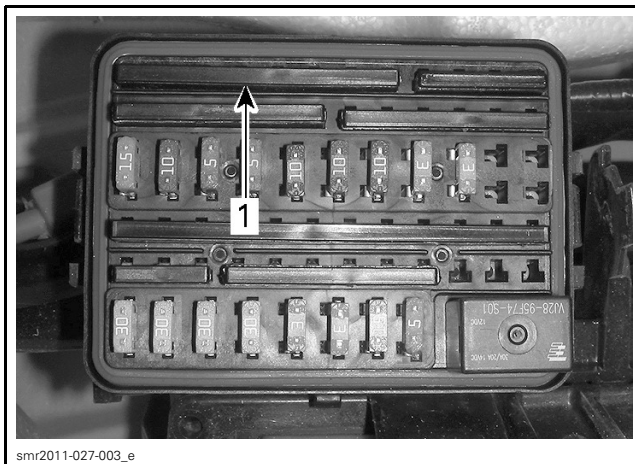
Testing Continuity of ECM Ground Circuits

1. Disconnect "B" connector from ECM.
2. Install ECM ADAPTER TOOL (P/N 529 036 166) on ECM connector.
3. Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and select Ω .
4. Probe adapter terminals as per following table.

ECM ADAPTER	BATTERY POST	RESISTANCE
Pins B-L1, B-M2 and B-M3	Ground	Close to 0 Ω (continuity)



If measurement is out of specification, check ground bus bar in fuse box and continuity of its wires and connections with the engine grounds. Also check battery ground and engine grounds. Refer to *POWER DISTRIBUTION AND GROUNDS*.



TYPICAL

1. Ground bus bar in fuse box

If everything tests good and ECM does not power up, try a new ECM. Refer to *ECM REPLACEMENT*.

Removing the ECM

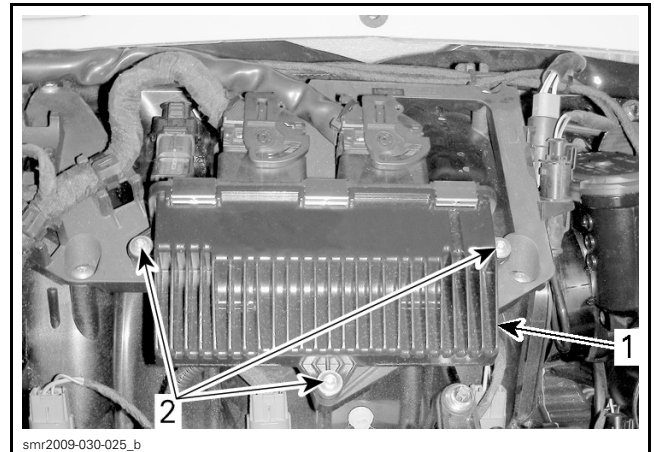
NOTE: If a new ECM is to be installed, first read the procedures in *ECM REPLACEMENT* in this subsection.

1. Disconnect battery cables.

⚠ WARNING

Always disconnect the **BLACK** negative (-) battery cable first, then disconnect **RED** positive (+) cable.

2. Disconnect both ECM connectors from ECM.
3. Unscrew all retaining screws and remove the engine ECM from its support on the intake manifold.



1. ECM
2. Retaining screws

Installing the ECM

Reverse removal procedure however, pay attention to the following.

1. Install ECM.

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
ECM retaining screws	5.5 N•m ± 0.6 N•m (49 lbf•in ± 5 lbf•in)

NOTICE Always replace ECM by the same part number or by a BRP approved equivalent.

2. Reconnect ECM connectors.
3. Reconnect battery cables.

⚠ WARNING

Always reconnect the **RED** positive (+) battery cable first, then reconnect **BLACK** negative (-) cable.

4. If a new ECM is installed, refer to *ECM REPLACEMENT* in this subsection.

ECM Replacement

Prior to replacing a suspected ECM, ensure that all the recommendations in the general introduction of this section have been followed.

When installing a new ECM, data must be entered and a reset is required.

ECM Manual Data Entry

There are 2 possible methods to collect the required information. The 1st being the easiest:

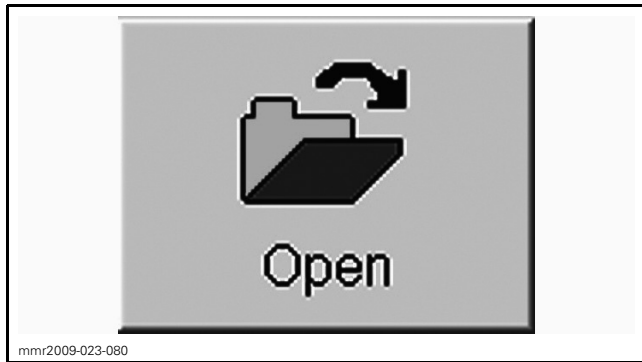
1. Use B.U.D.S. software and obtain the data from a saved **.mpem** file on your PC computer.
2. Collect the information from the vehicle and BOSSWeb.

1st Collecting Method: Obtaining the Data from a Saved **.mpem** File

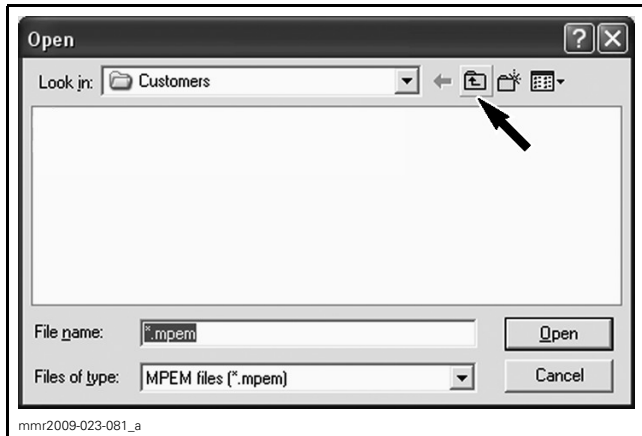
1. Use the B.U.D.S. software.

NOTE: It is not necessary to perform any connection. The PC computer can be used alone.

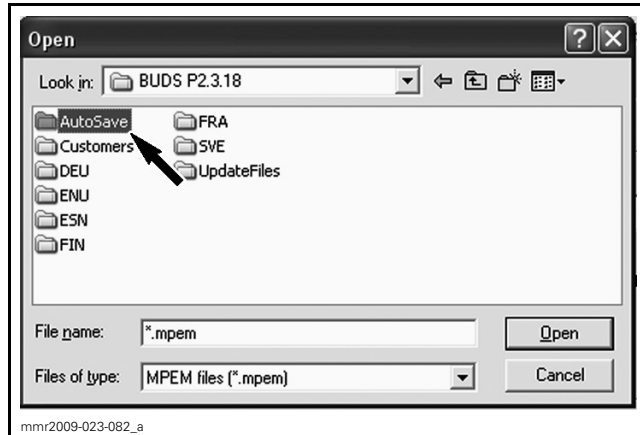
2. In B.U.D.S., click on the **Open** button.



3. Click once on the **Folder Up** button in the **Open** box.

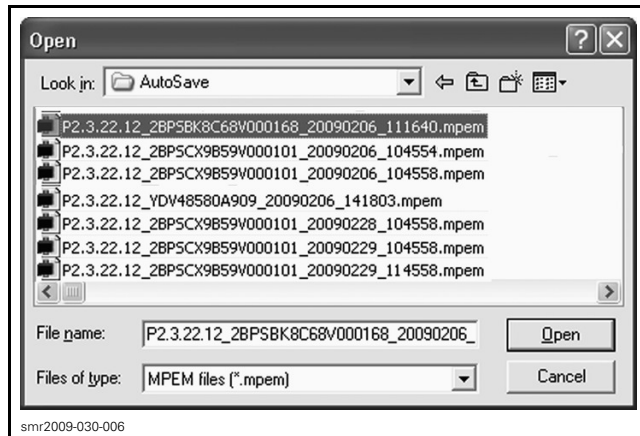


Double click on the **AutoSave** folder.



NOTE: You may have to go to another **AutoSave** folder from a previous version of B.U.D.S.

4. Choose the latest file saved for this specific vehicle.



TYPICAL

IMPORTANT: Be sure to use the file that specifically matches the vehicle you are servicing.

NOTE: The file name structure is as follows:

BUDS version_VIN_date read (yyyymmdd)_hour read (hhmmss).mpem

Example:

P2.3.22.12_2BPSBK8C68V000168_20090206_111640.mpem

Hence:

B.U.D.S. version: P2.3.22.12

VIN: 2BPSBK8C68V000168

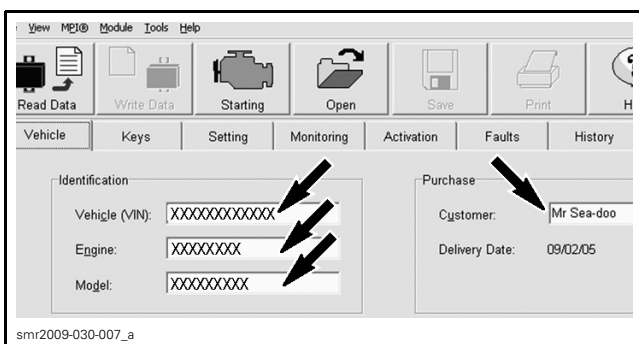
Date: 2009 02 06

Hour: 11h 16m 40s

5. Go in the **Vehicle** tab and record the following information.

1. Vehicle serial number
2. Engine serial number (without the leading "M")

3. Vehicle model number
4. Customer name.

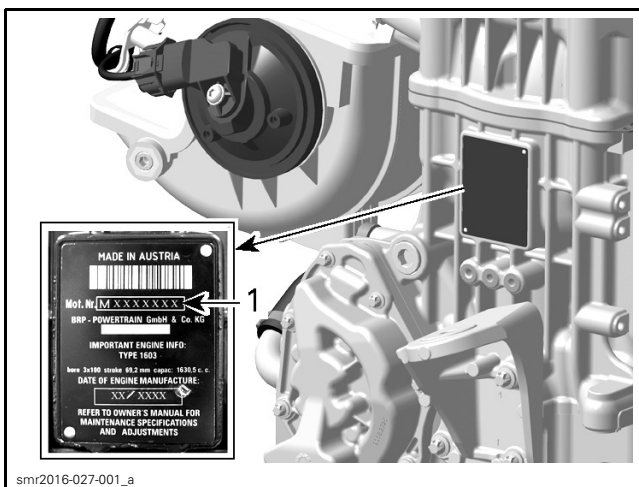


VEHICLE TAB

6. Enter recorded data in ECM as detailed in *ENTERING THE COLLECTED INFORMATION INTO THE ECM*.

2nd Collecting Method: Collect the Information from the Vehicle and Knowledge Center

1. Record engine serial number.



1. Engine serial number

2. Record the following numbers using *KNOWLEDGE CENTER*, enter the unit's serial # in the search..

1. Vehicle model number
2. Customer name.

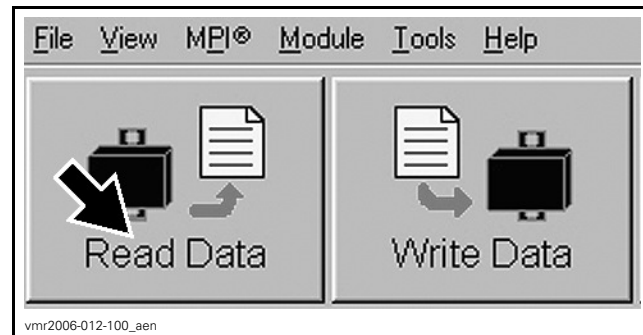
3. Enter the recorded data in the new ECM as detailed in *ENTERING THE COLLECTED INFORMATION INTO THE ECM*.

Entering the Collected Information into the ECM

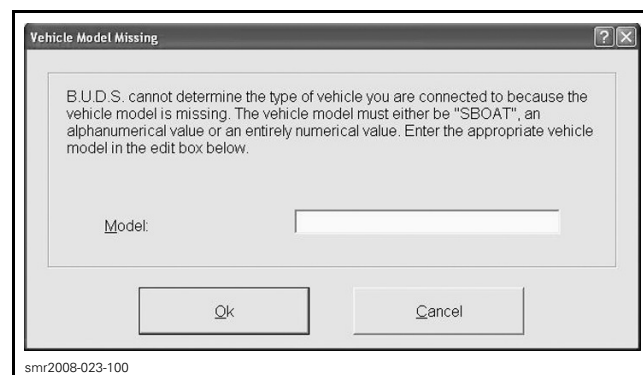
1. Use the latest applicable B.U.D.S. software. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Press the START button to wake up the ECM.

3. Install the tether cord on the engine cut-off switch.

4. In B.U.D.S., click the **Read Data** button to read the new ECM.

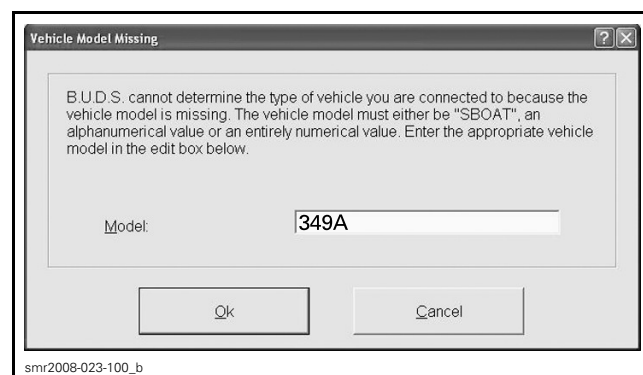


The following window will pop up.



5. Enter the vehicle model number.

NOTICE Do not enter SBOAT for a PWC. Enter only the appropriate model number as obtained when gathering the information.

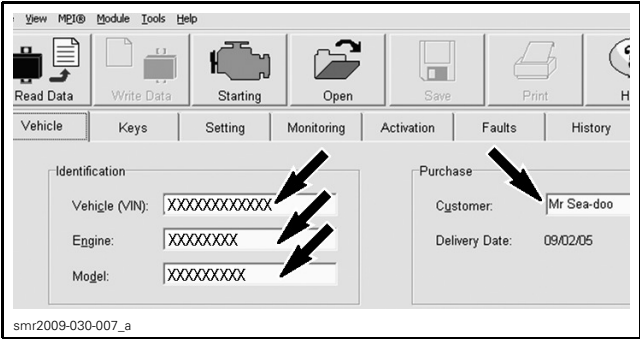


TYPICAL

6. Click the **Vehicle** tab and enter the information you recorded previously.

1. Vehicle serial number
2. Engine number (do not enter the "M" at the beginning of the engine number)
3. Customer name.

Subsection XX (ELECTRONIC FUEL INJECTION (EFI))

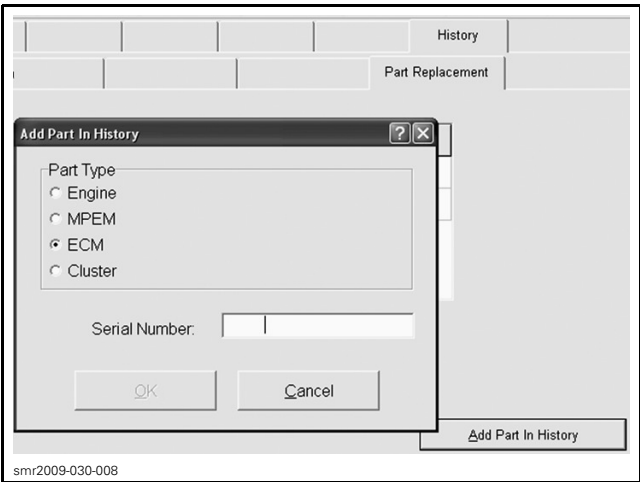


VEHI-030-007_a

7. Click on the following tabs:

- History
- Part Replacement
- Add Part in History.

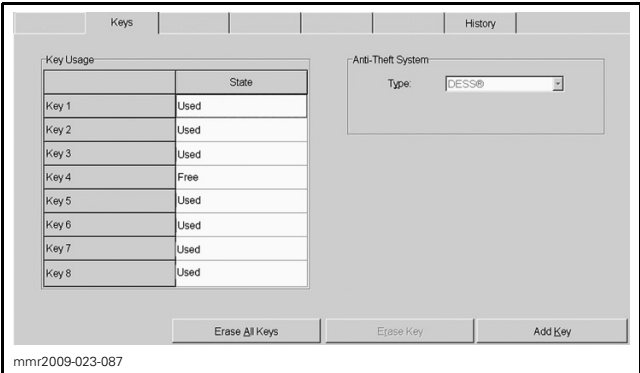
8. Enter the old ECM serial number in the Add Part In History window.



smr2009-030-008

NOTE: The ECM serial number can be found on the ECM sticker that also identifies the part number.

9. Click the **Keys** tab and click on the **Erase All Keys** button.

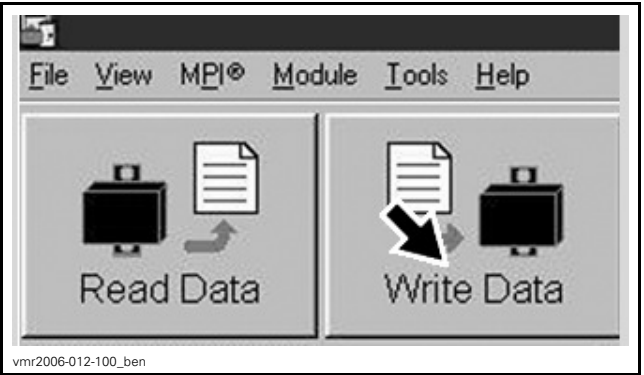


10. Program the desired D.E.S.S. key(s) to the watercraft. Refer to *D.E.S.S. SYSTEM* subsection.

NOTE: If you do not program at least one D.E.S.S. key to the watercraft, you will not be able to write the data to the new ECM, and will be prompted to do so.

11. Briefly press the vehicle **START** button to wake up the ECM. **Engine must not crank.**

12. Click on the **Write Data** button.



13. Perform the **Closed throttle** reset. Refer to **Closed Throttle Reset (TPS)** in *ADJUSTMENTS* in this subsection.

14. Reinstall remaining removed parts.

FUEL RAIL

Fuel Rail Location

Fuel rail is located above intake manifold.

Removing the Fuel Rail

Fuel Rail Hose Disconnection

1. Release fuel pressure. Refer to *FUEL PUMP* in *FUEL TANK AND FUEL PUMP* subsection.
2. Place an absorbent shop rag under the fuel supply hose fitting at the fuel rail to catch any fuel leakage.
3. Disconnect fuel hose from fuel rail.

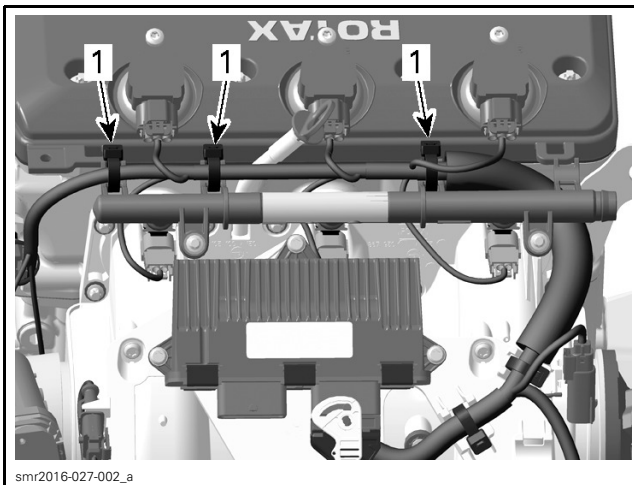
REQUIRED TOOL	
FUEL HOSE DISCONNECT TOOL (P/N 529 036 037)	



NOTE: It may be necessary to rotate fuel hose fitting to align the tool ends with the openings of the locking mechanism.

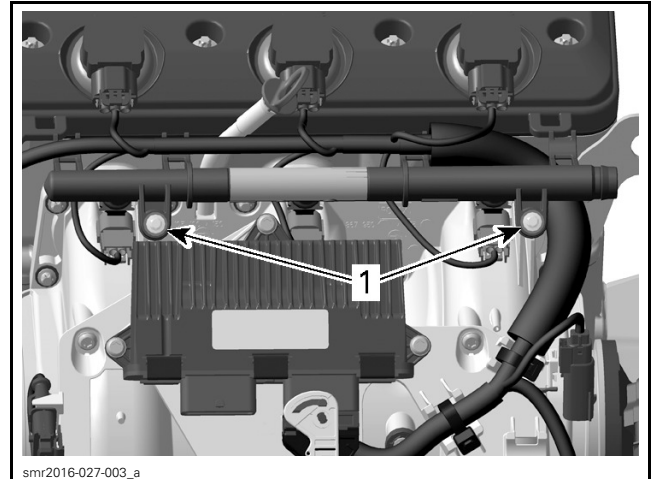
Removing the Fuel Rail

1. Cut locking ties retaining engine harness to fuel rail.



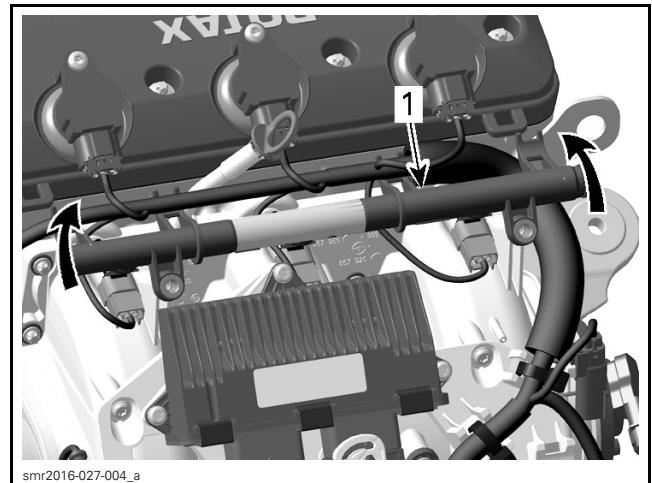
1. Cut locking ties

2. Remove screws retaining the fuel rail.



1. Retaining screws

3. Gently pull fuel rail side to side (wiggle).



1. Fuel rail

4. Disconnect all injector connectors.
5. Pull fuel rail out with fuel injectors.

Installing the Fuel Rail

Reverse the removal procedure. However, pay attention to the following.

1. Install fuel rail with injectors.

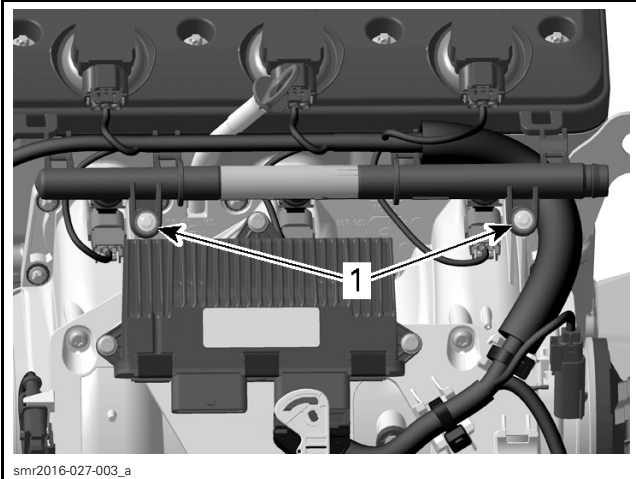
Lubricate O-rings of fuel injectors.

FUEL INJECTOR O-RINGS	
Service product	Engine oil

2. Tighten fuel rail retaining screws to specification.

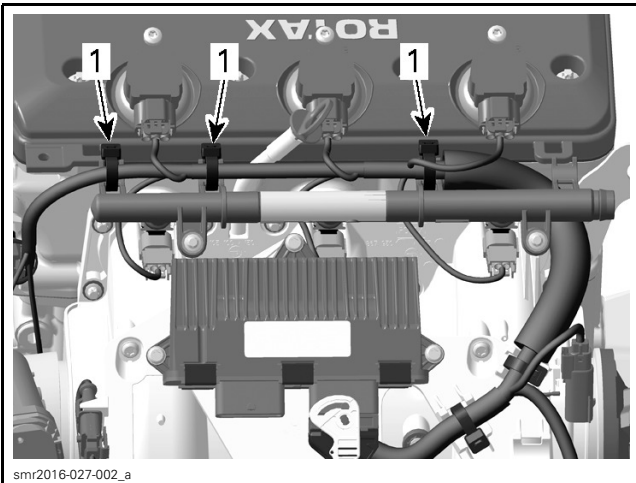
TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Fuel rail retaining screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

Subsection XX (ELECTRONIC FUEL INJECTION (EFI))



1. Retaining screws

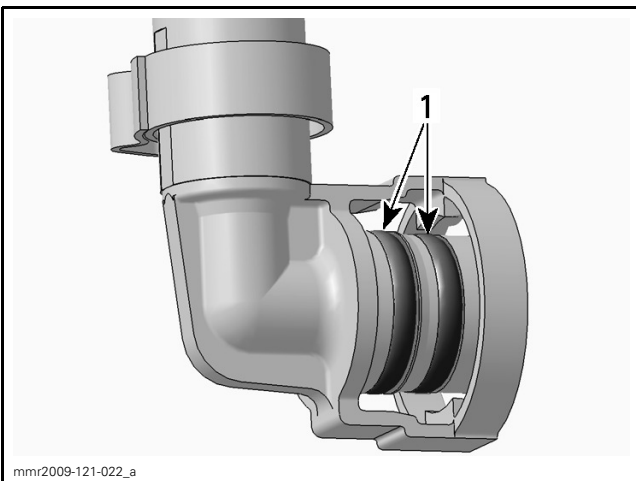
3. Properly install new locking ties to secure engine harness to fuel rail.



1. New locking ties

Fuel Rail Hose Connection

1. Apply engine oil on O-rings of fitting.



1. Apply oil on O-rings

2. Connect fuel hose to fuel rail.

IMPORTANT: Push fuel hose fitting on fuel rail until you hear a "click". Try pulling fuel hose off fuel rail to ensure fitting is properly locked.

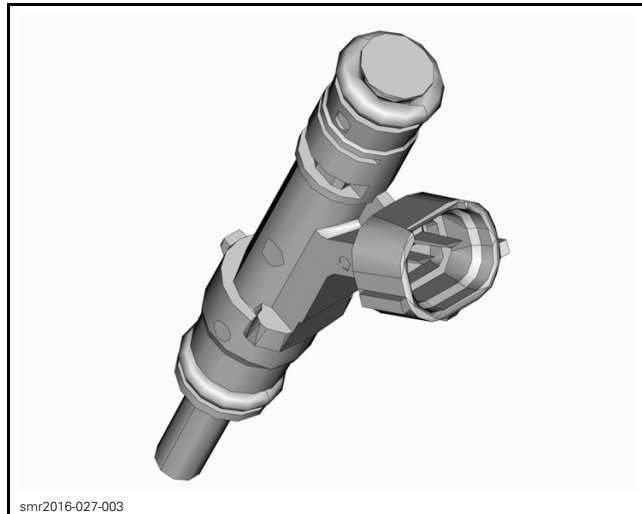
3. Pressurize the fuel system and check for a fuel leak. Refer to *FUEL TANK AND FUEL PUMP* subsection.

⚠ WARNING

Failure to pressurize the fuel system may result in severe injury or a life threatening situation should a leak occur.

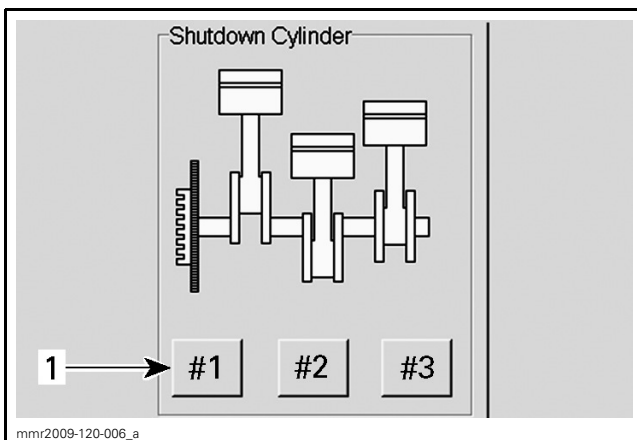
4. Reinstall all remaining removed parts.

FUEL INJECTOR



Testing the Fuel Injector Operation with B.U.D.S. (Dynamic)

1. Connect watercraft to B.U.D.S. software. Refer to *COMMUNICATION TOOLS AND B.U.D.S.*
2. Start engine.
3. In B.U.D.S., click the following:
 - Read Data button
 - Monitoring tab.
4. Using the B.U.D.S. software, shut down each engine cylinder one at a time by clicking on the button under the applicable cylinder.



MONITORING AND ECM TABS

1. Click on cylinder number to be tested

If the engine RPM drops when clicking on a cylinder, the injector and the ignition of this cylinder are functioning normally.

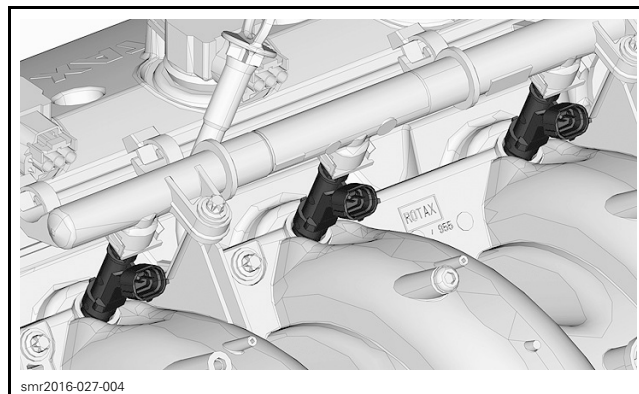
If the engine RPM does not drop when clicking on a cylinder, this cylinder is not functioning properly. Check the following:

- Fuel injector operation. Refer to *TESTING THE FUEL INJECTOR OPERATION* in this subsection.
- Spark plug and ignition coil. Refer to *IGNITION SYSTEM* subsection.
- Engine condition.

Testing the Fuel Injector Operation with B.U.D.S. (Static)

NOTICE After fuel injector activation using B.U.D.S., always crank engine in drowned mode to ventilate engine and prevent a potential backfire due to fuel accumulation in the engine.

1. Connect watercraft to B.U.D.S. software. Refer to *COMMUNICATION TOOLS AND B.U.D.S.*
2. Press the START button to wake up the ECM.
3. Install the tether cord on the engine cut-off switch.
4. In B.U.D.S., click the following:
 - **Read Data** button
 - **Activation** tab.
5. On the ECM Activation page, energize the fuel injector to be tested by clicking on it in B.U.D.S.



ACTIVATION AND ECM TABS

6. Listen to the injector.

If you can hear the injector, it validates its operation. Carry out *TESTING THE FUEL INJECTOR BALANCE*.

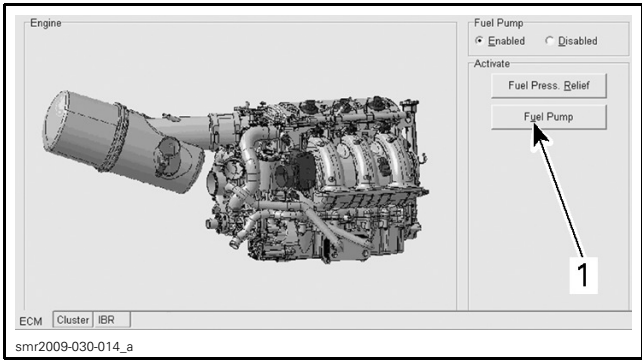
If you do not hear the injector, carry out *TESTING THE INJECTOR INPUT VOLTAGE*.

Testing the Fuel Injector Balance with B.U.D.S.

NOTICE After fuel injector activation using B.U.D.S., always crank engine in drowned mode to ventilate engine and prevent a potential backfire due to fuel accumulation in engine.

1. Install a fuel pressure gauge as described in *FUEL TANK AND FUEL PUMP* subsection.
2. Connect watercraft to B.U.D.S. software. Refer to *COMMUNICATION TOOLS AND B.U.D.S.*
3. Press the START button to wake up the ECM.
4. Install tether cord on engine cut-off switch.
5. In B.U.D.S., click the following:
 - **Read Data** button
 - **Activation** tab.
6. In B.U.D.S., click the **Fuel Pump** button to activate fuel pump.

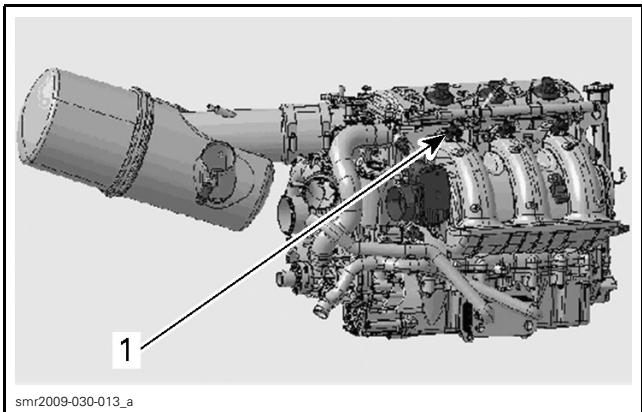
Subsection XX (ELECTRONIC FUEL INJECTION (EFI))



TYPICAL ACTIVATION AND ECM TABS

1. Fuel Pump activation button

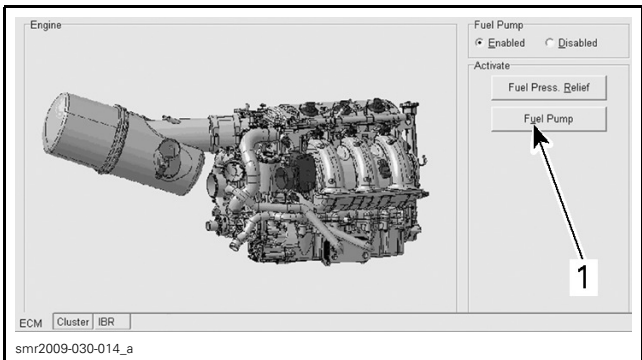
7. Fuel pressure must be within specification. Refer to *FUEL TANK AND FUEL PUMP* subsection. Re-activate fuel pump as necessary.
8. In B.U.D.S., energize fuel injector **no. 1**.



TYPICAL ACTIVATION AND ECM TABS

1. Injector of cylinder no. 1 shown

9. Record the fuel pressure drop for injector **no. 1**.
10. In B.U.D.S., click the **Fuel Pump** button to activate fuel pump.



ACTIVATION AND ECM TABS

1. Fuel pump

11. Repeat the procedure for fuel injectors **no. 2** and **no. 3** and record the pressure drop for each injector.

12. The maximum fuel pressure drop between injectors should not exceed the following specification:

MAXIMUM FUEL PRESSURE DROP ALLOWED BETWEEN FUEL INJECTORS
10 kPa (1.5 PSI)

If pressure drop of any fuel injector is greater than the specification, replace that injector then repeat the test.

13. Using the valve on the fuel pressure gauge, release the pressure in the system (if so equipped).
14. Remove fuel pressure gauge and reinstall removed parts.

Testing the Fuel Injector Input Voltage

1. Open/remove seat.

Models with Suspension

2. Remove rear ventilation box. Refer to *BODY*.

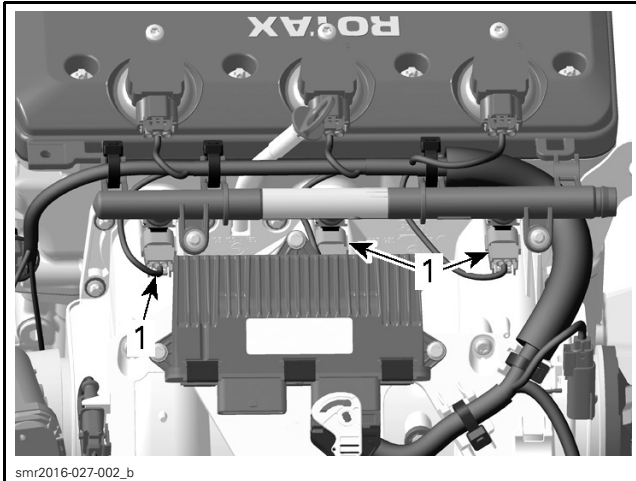
All Models

3. Remove ECM from its support.
4. Disconnect fuel injector connectors.

NOTE: Push against tab underneath connector as illustrated to unlock it.



PUSH HERE TO UNLOCK



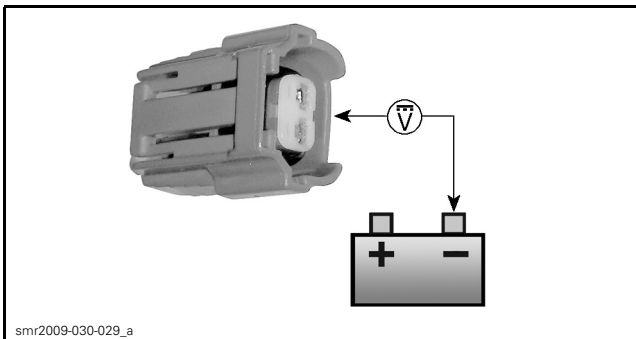
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1. Fuel injector connectors

5. Press the START button to wake up the ECM.
 6. Install tether cord on engine cut-off switch.
 7. Read input voltage to the applicable injector as per following table.
- Set multimeter to Vdc.

REQUIRED TOOL	
FLUKE 115 MULTIMETER (P/N 529 035 868)	

PROBE INJECTOR CONNECTOR	MEASUREMENT
VIOLET wire with a tracer to battery ground	Battery voltage



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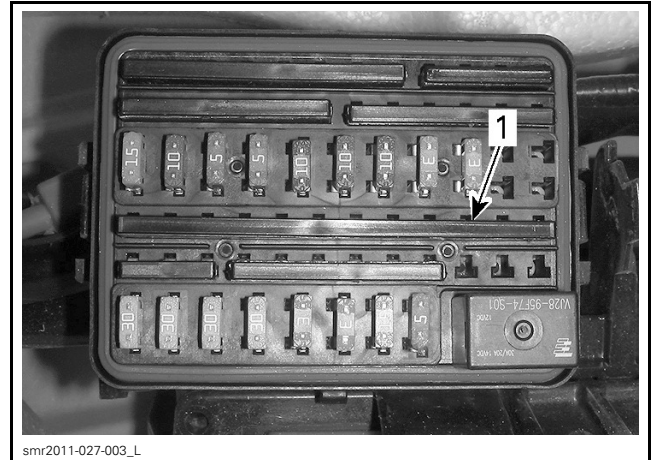
If battery voltage is measured, carry out *TESTING THE INJECTOR CONTROL CIRCUIT*.

If battery voltage is not measured, check continuity between fuse box and injector as follows.

Testing the Continuity of Injector Power Circuit

1. Remove cover of fuse box. Refer to *POWER DISTRIBUTION* subsection.

2. Remove the long bus bar.



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TYPICAL

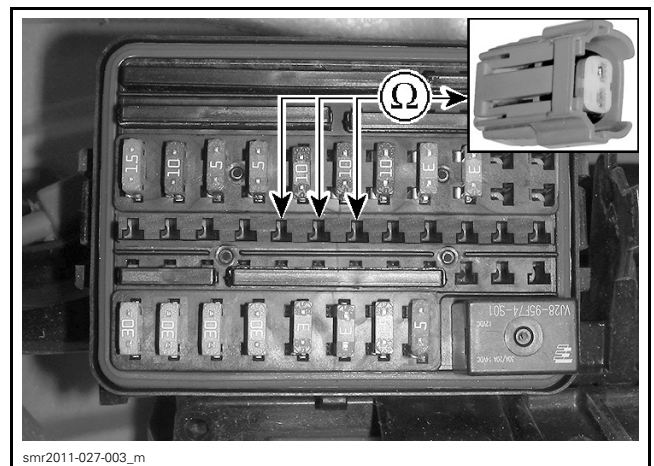
1. Long bus bar

3. Read resistance of the applicable injector circuit as per following table.

Set multimeter to Ω .

REQUIRED TOOL	
FLUKE 115 MULTIMETER (P/N 529 035 868)	

INJECTOR	INJECTOR CONNECTOR	FUSE BOX	MEASUREMENT
1 (rear)	VIOLET wire with a tracer	Terminal F7	Close to 0 Ω
2		Terminal F6	
3		Terminal F5	



smr2011-027-003_m

If continuity is good, the fuse, wiring and connectors are functional.

If continuity is not obtained, first check the fuse and replace as required.

Subsection XX (ELECTRONIC FUEL INJECTION (EFI))

- 4. If fuse is good, repair/replace wiring and connectors from fuse box to injector. Refer to *WIRING DIAGRAM* subsection.
- 5. Reinstall bus bar and cover.

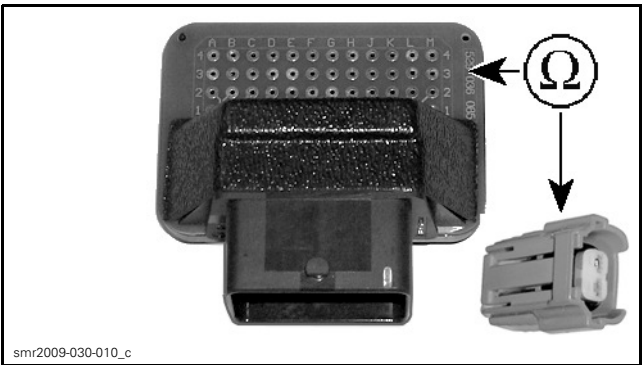
Testing the Fuel Injector Control Circuit

- 1. Disconnect ECM-A connector.
- 2. Probe terminals as per following table.

REQUIRED TOOL	
ECM ADAPTER TOOL (P/N 529 036 166)	
FLUKE 115 MULTIMETER (P/N 529 035 868)	

Install ECM connector on ECM adapter.
Set multimeter to Ω .

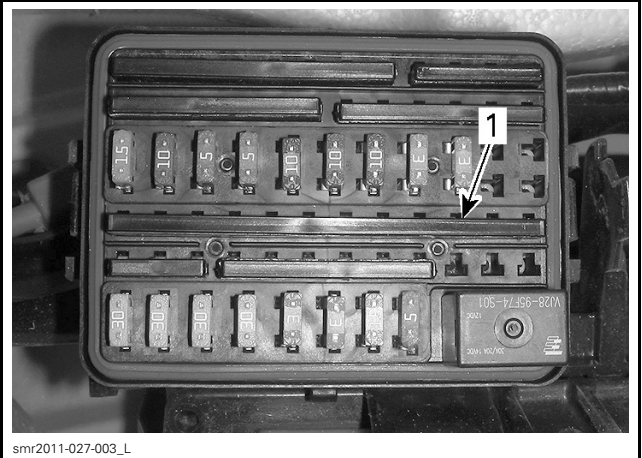
INJECTOR	ECM ADAPTER	INJECTOR	MEASUREMENT
1 (rear)	Pin A-B3	BROWN wire with a tracer	Close to 0 Ω
2	Pin A-K1		
3	Pin A-J1		



If control circuit is at fault, repair or replace wiring and connectors.
If control circuit and all tests applicable to the injector are good, try a new ECM. Refer to *ECM*.

Testing the Fuel Injector Resistance (at ECM Connector)

- 1. **Reconnect** the injector connector.
- 2. Disconnect the ECM-A connector.
- 3. Remove the long bus bar from fuse box.



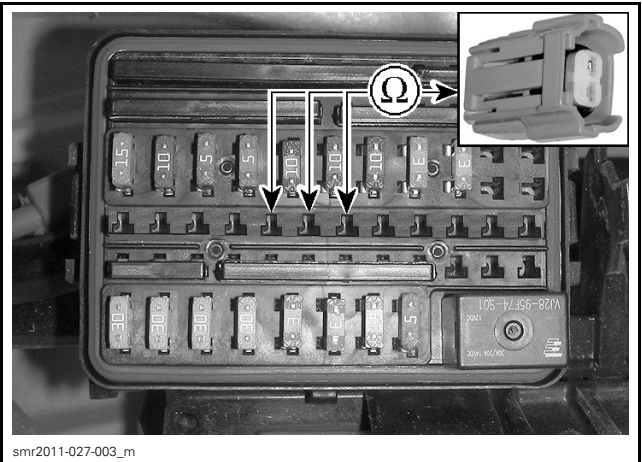
TYPICAL
1. Long bus bar

- 4. Measure resistance value between terminals as follows.

REQUIRED TOOL	
ECM ADAPTER TOOL (P/N 529 036 166)	
FLUKE 115 MULTIMETER (P/N 529 035 868)	

Install ECM connector on ECM adapter.
Set multimeter to Ω .

INJECTOR	FUSE BOX TERMINAL	ECM ADAPTER PIN	RESISTANCE @ 20°C (68°F)
1	F7	A-B3	11.4 - 12.6 Ω
2	F6	A-K1	
3	F5	A-J1	



If resistance values are as specified, injector coil is in good condition.

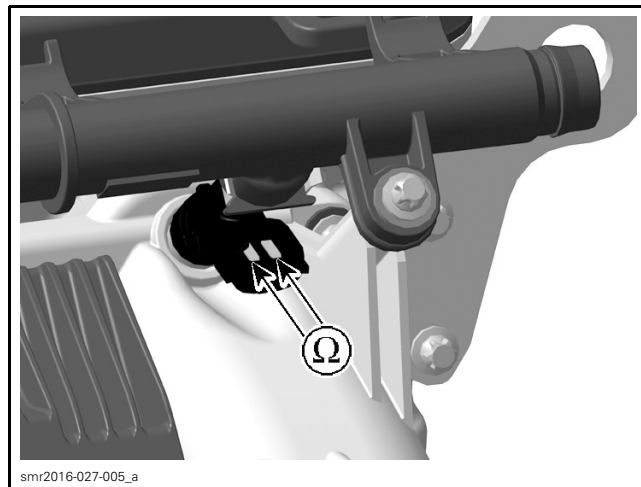
If resistance value are not as specified, repeat test at injector connector.

5. Reinstall bus bar and fuse box cover.

Testing the Fuel Injector Resistance (at Component)

1. Remove injector connector.
2. Check resistance value between injector pins as per followings table.

INJECTOR PIN		RESISTANCE @ 20°C (68°F)
1	2	11.4 - 12.6 Ω

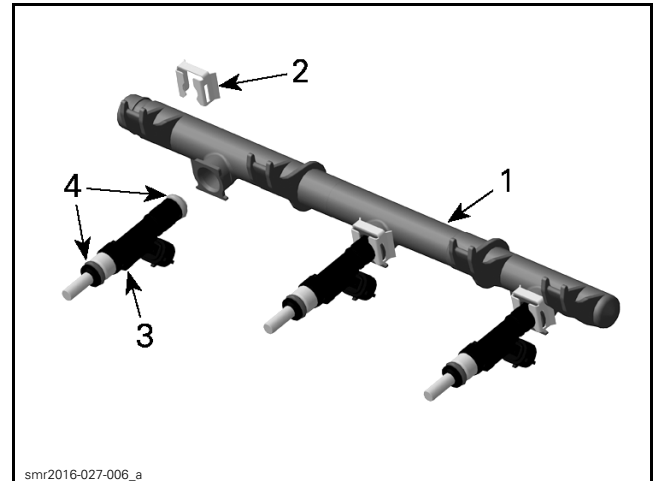


If readings are not as specified, replace injector.

If readings are as specified, repair or replace wiring and connectors from ECM to injector.

Removing the Fuel Injector

1. Remove fuel rail. Refer to *FUEL RAIL* in this subsection.
2. Remove the injector clip.



FUEL RAIL ASSEMBLY

1. Fuel rail
2. Injector clip
3. Fuel injector
4. O-rings

3. Pull the fuel injector out of the fuel rail.

Installing the Fuel Injector

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

FUEL INJECTOR IDENTIFICATION	
ENGINE	INJECTOR COLOR CODE
1603	Yellow green

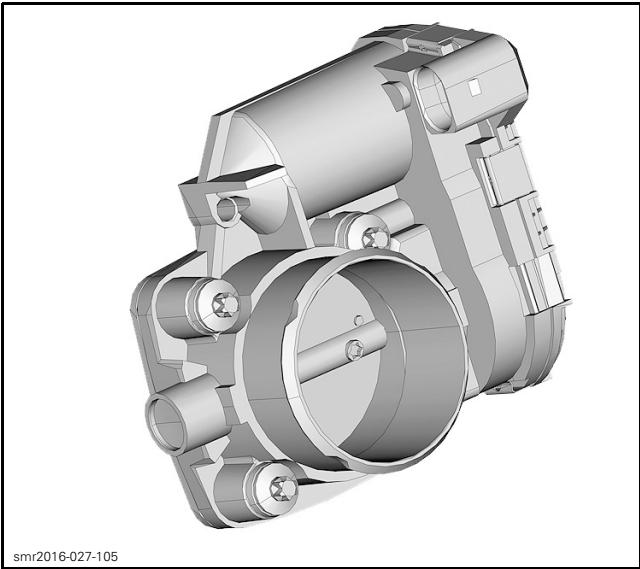
1. If you reinstall a used injector replace O-rings with **NEW** ones.
2. Apply a thin film of engine oil to O-rings.
3. Insert the fuel injector in the fuel rail.
4. Secure injector to fuel rail with a retaining clip.
5. Install fuel rail on engine. Refer to *FUEL RAIL* in this subsection.
6. Pressurize the fuel system and check for a fuel leak. Refer to *FUEL TANK AND FUEL PUMP* subsection.

⚠ WARNING

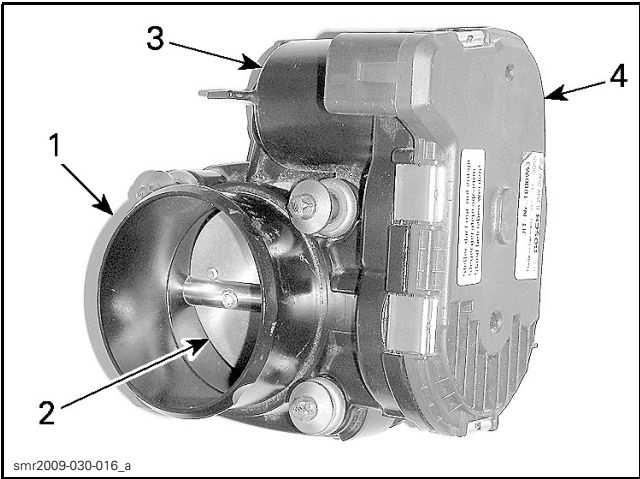
Always carry out a fuel system high pressure leak test after working on the fuel system.

7. Reinstall all remaining removed parts, refer to applicable subsections.

THROTTLE BODY



Throttle Body Description



- 1. Throttle body
- 2. Throttle plate
- 3. Throttle actuator (electric motor inside)
- 4. Throttle position sensor (TPS) (inside)

Electronic Throttle Actuator (ETA)

The electronic throttle actuator (ETA) is a DC motor on the throttle body that regulates the throttle plate via a drive gear. Pulse width modulation (PWM) is used to control the motor.

Throttle Plate Operating Positions

Two torsional springs are connected to the throttle plate. A main spring and another one in a plunger mechanism.

When there is no power to the throttle actuator (ETA), the plunger mechanism maintains the throttle plate at a rest position. This also serves as the limp home position.

When the throttle plate is opened by the ETA as commanded by the ECM, it acts against the main spring. If the ETA failed, the return spring would bring the throttle plate back to the limp home position.

ECM	ENGINE	THROTTLE BODY
OFF	Stopped	Throttle actuator: Off. Throttle plate: Rest position, maintained opened at approximately 8° (1). This is also the limp home position.
ON	Not started	Throttle actuator: On. Throttle plate: Moves from the rest position to approximately 14°. It then moves back to the rest position. This is the diagnostic mode where the rest position, actuator opening force to overcome the return springs and the motor return rate are monitored. If any of these parameters are out of range, a fault code is initiated.
ON	Started. Normal operation at idle	Throttle actuator: On. Throttle plate: Moves from the rest position to idle position (approximately 1-3°) according to ECM injection and ignition maps. Throttle plate is opened and closed as necessary to control the idle speed.
ON	Started. Normal operation at various RPM	Throttle actuator: On. Throttle plate: Opens and closes according to ECM torque management priorities.
(1) Degree values are given from the fully closed position.		

Throttle-Body Faults and Effects

NOTE: Among other things, a weak or broken spring and a sticky throttle plate (carbon build-up, dried salt water etc) are validated by the throttle body diagnostic mode.

FAULT	EFFECT
Partial failure of TAS sensor (one internal sensor only)	Limp home mode. Engine speed limited to idle. ECM will use the remaining TAS sensor. Fault code set and beeper activated to emit warning signals. Check engine light is turned ON. Driveability could be reset by releasing and reapplying the throttle.
Complete failure of TAS sensor (both internal sensors)	Limp home mode. Engine speed limited to 2500 RPM. Fault code set and beeper activated to emit warning signals. Check engine light is turned ON.
Any throttle body failure	Limp home mode. Engine speed limited to 2500 RPM. Engine speed can still be increased up to 3200 RPM using the throttle lever. Fault code set and beeper activated to emit warning signals. Check engine light is turned ON.
NOTE: When one of these faults is active, O.T.A.S. and iBR will continue to monitor their input signals. However, since the engine speed is limited, the O.T.A.S. will not be activated. Also, since the ECM cannot control the throttle body, the iBR may produce a fault since the ECM does not react to its specific torque requests. It all depends on the circumstances when the iBR is applied. (vehicle and engine speed will be a factor).	

Lubricating the Throttle Body

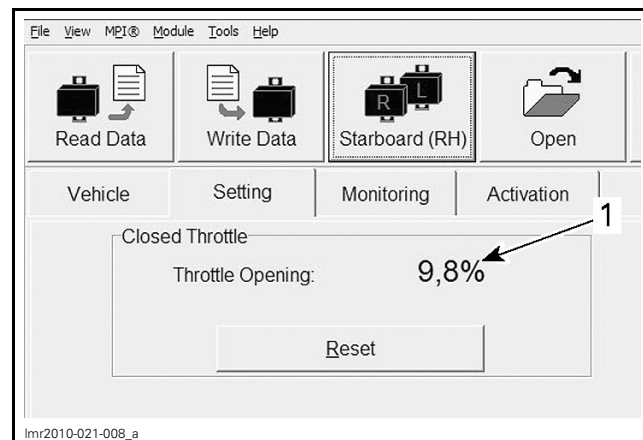
No lubrication is required.

Testing the ETA

Testing the Throttle Body Actuator (ETA) with B.U.D.S.

NOTE: Use the **Setting** page, to confirm ETA movement. The **Monitoring** page will not read the actual ETA movement.

1. Enable electrical system.
2. Connect vehicle to the latest B.U.D.S. version.
3. Select the **Setting**, then **ECM** tabs.
4. Slowly depress the throttle lever from the idle to WOT. The ETA should go from 0% to 100%.



TYPICAL

1. ETA position

If result is out of specification, carry out a **CLOSED THROTTLE RESET**. Refer to **ADJUSTMENT** in this subsection.

NOTE: The ETA is reset at the same time as the TPS.

After the reset, test ETA again.

If the result is still out of specification, check wire continuity between ECM and throttle body before assuming the ETA is at fault.

Inspecting the ETA

Always check for corroded terminals or damaged wiring when diagnosing throttle body problems.

Testing the ETA (Dynamic)

1. Remove the parts required to access the throttle body.
2. Remove the air inlet hose from the throttle body.
3. Observe the throttle plate with the engine stopped.

NOTE: The throttle plate should be in the rest position (slightly opened).

WARNING

Keep your fingers out of the throttle plate area while the ECM turns on. The throttle actuator will cycle. This could cause serious finger injuries as throttle plate quickly moves.

4. As you observe the throttle plate, have someone press the START button to wake up the ECM.

NOTE: The throttle plate should cycle quickly from the rest position to a partially open position (approximately 14°), then back to the rest position.

Subsection XX (ELECTRONIC FUEL INJECTION (EFI))

5. Install the tether cord on the engine cut-off switch.

NOTE: The throttle plate should cycle again.

6. As you observe the throttle plate, have someone gradually and evenly pull in the throttle lever, then release it in the same way.

NOTE: The throttle plate should open then close according to throttle lever position. However, the movement of the throttle plate may not be linear with the displacement of the throttle lever.

If any test failed, proceed with the *TESTING THE THROTTLE BODY (STATIC)*.

Testing the ETA (Static)

⚠ WARNING

First ensure the ECM is off. Do not move the throttle plate using your fingers. Otherwise, if the START button is pressed the ECM turn on and quickly cycle the throttle plate which could cause serious finger injury.

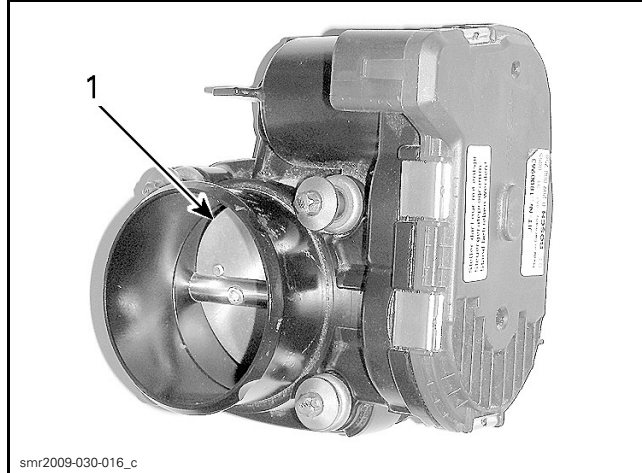
1. Using a blunt tool, push in on the throttle plate and ensure it opens smoothly within the throttle body.



1. Push here to open

NOTE: The throttle plate must open fully and return freely to the rest position (slightly opened) when released.

2. Push throttle plate closed as indicated in following illustration. It must close completely and return freely to the rest position (slightly opened) when released.



1. Push here to close

If the throttle plate does not move smoothly or does not return freely to the rest position, the problem is mechanical. Check for salt accumulation on throttle plate shaft. It may also be an actuator or gear problem. Replace throttle body as necessary.

If throttle plate operates normally, the problem is electrical. Check throttle actuator (ETA) wiring continuity, throttle position sensor (TPS) and throttle accelerator sensor (TAS).

⚠ WARNING

If the throttle plate does not return properly after a proper cleaning, replace the throttle body.

Cleaning the Throttle Body

Remove the parts required to access the throttle body.

Check throttle body cleanliness using a flashlight. Fully open throttle plate and verify:

- Throttle body bore
- Throttle plate edge.

Look for:

- Dirt
- Oily surfaces
- Carbon and salt deposits on throttle plate and the surrounding bore.

Clean as necessary.

NOTICE Only use an appropriate throttle body cleaner that will not damage O-rings and EFI sensors.

⚠ WARNING

Use the product in well ventilated area. Refer to product manufacturer's warnings. Wipe off any product leakage in bilge.

To avoid getting dirt into engine, spray cleaner on a clean rag (outside the bilge) then rub rag against throttle plate and bore. A toothbrush works well too.

⚠ WARNING

First ensure ECM is off. Otherwise, if ECM should suddenly turn off, it would quickly close the throttle plate which could cause serious finger injury.

Manually open throttle and hold fully open to reach all surfaces.

⚠ WARNING

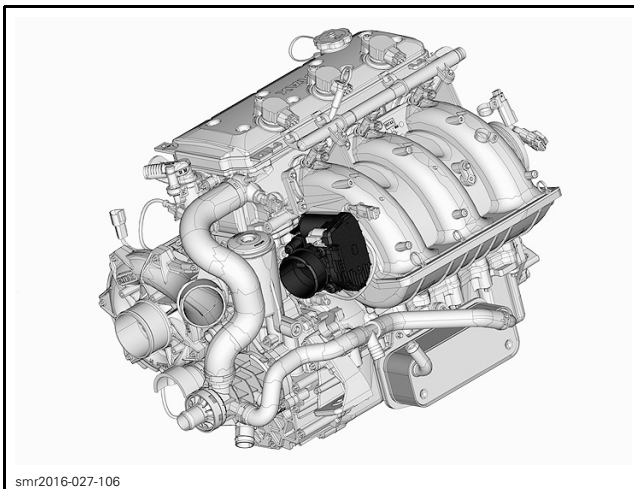
Ensure nobody presses the START button. The ECM would turn on and the throttle actuator (ETA) would cycle. This could cause serious finger injury as the throttle plate moves quickly.

To remove residual dirt, spray cleaner on throttle plate and on bore.

Reinstall removed parts.

Throttle Body Replacement

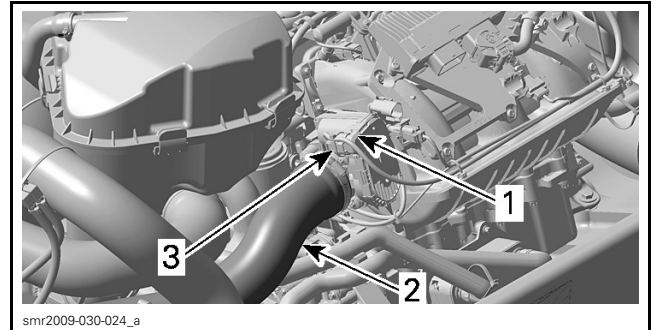
Throttle Body Location



Removing the Throttle Body

1. Disconnect inlet hose from throttle body.
2. Disconnect throttle body connector.

To remove connector from throttle body, press connector locking tab illustrated.

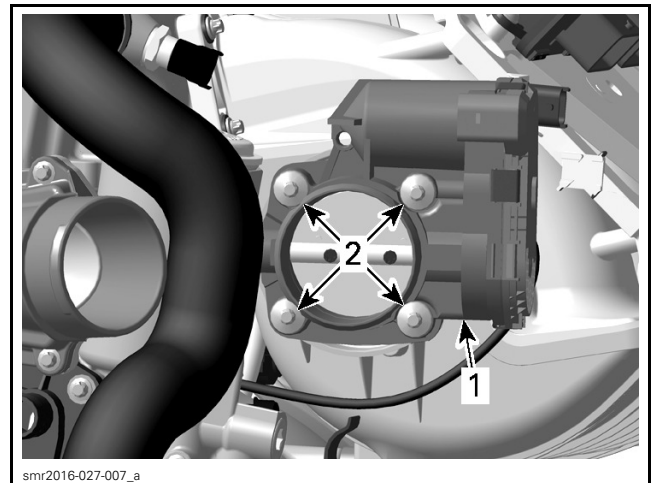


1. Throttle body
2. Inlet hose
3. Connector



PRESS HERE TO UNLOCK

3. Remove retaining screws from throttle body.



1. Throttle body
2. Retaining screws

4. Pull throttle body off intake manifold.

Installing the Throttle Body

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

- 1. Tighten retaining screws in a criss-cross sequence.

TIGHTENING TORQUE	
Throttle body retaining screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

- 2. Perform the **Closed Throttle** reset. See procedure in *ADJUSTMENTS* in this subsection.

TPS (THROTTLE POSITION SENSOR)

General

NOTE: The TPS is part of the throttle body.

The throttle position sensor (TPS) is a double potentiometer that sends signals to the ECM that are proportional to the throttle plate angle. The TPS is located inside the throttle body.

Testing the TPS Wear

- 1. With the engine turned off, slowly pull in throttle lever and pay attention for smooth operation without physical stops.
- 2. Press the START button to wake up the ECM.
- 3. Install the tether cord on the engine cut-off switch.
- 4. Connect watercraft to B.U.D.S. software. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
- 5. In B.U.D.S., click the following:
 - **Monitoring** tab
 - **ECM** tab.
- 6. Slowly and regularly depress the throttle lever.
- 7. Observe the **Throttle Opening** needle movement in B.U.D.S.



MONITORING AND ECM TABS

NOTE: The needle should move gradually and regularly as you move the throttle lever. If the needle “sticks”, bounces or suddenly drops, it may indicate a worn TPS that needs to be replaced. An initial slight delay after the throttle lever is pulled and before the needle starts to move is normal.

If the needle behavior is not as expected, proceed with the following steps.

- 8. Manually move the throttle plate in throttle body using a blunt tool (without sharp tip).

**WARNING**

Do not move throttle plate with your fingers. Otherwise, if ECM should turn off, it would quickly close the throttle plate which could cause serious finger injury.



1. Push here

9. Check needle movement again.
 - If needle moves as expected, check the throttle accelerator sensor (TAS). Refer to *INTELLIGENT THROTTLE CONTROL (ITC)* subsection.
 - If needle does not move as expected, perform *TESTING THE TPS RESISTANCE* in this subsection.

Testing the TPS Resistance

1. Remove the parts required to access the throttle body.
2. Ensure the throttle body connector is properly connected.
3. Disconnect ECM-A connector from the ECM, refer to *ECM ACCESS* in this subsection.
4. Probe circuit as per following table while using a finger to manually move throttle plate.

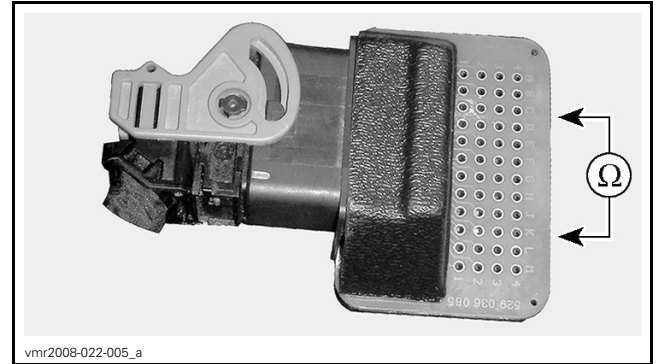
REQUIRED TOOL	
ECM ADAPTER TOOL (P/N 529 036 166)	
FLUKE 115 MULTIMETER (P/N 529 035 868)	

Install ECM connector on ECM adapter.

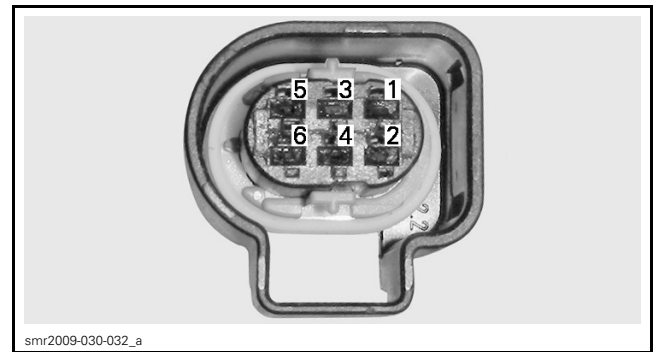
Set multimeter to Ω .

ECM ADAPTER		FULLY CLOSED THROTTLE PLATE ⁽¹⁾		FULLY OPEN THROTTLE PLATE	
		RESISTANCE (Ω)			
PIN		MIN.	MAX.	MIN.	MAX.
A-A2	A-K4	875	1625	875	1625
A-A2	A-K3	954	1934	228	585
A-A2	A-F3	254	634	980	1983
A-K3	A-K4	228	585	954	1934
A-K3	A-F3	1385	2315	1385	2315
A-K4	A-F3	980	1983	254	634

⁽¹⁾ To obtain the fully closed position, it is necessary to push against the throttle plate in the throttle body with a finger and hold it in this position for the measurement.



If any resistance value is incorrect, check wire continuity between ECM and throttle body before assuming the TPS is at fault. Refer to *WIRING DIAGRAM* subsection.



TPS CONNECTOR PIN-OUT

If the TPS resistance values are correct, try a new ECM. Refer to *ENGINE CONTROL MODULE (ECM)* in this subsection.

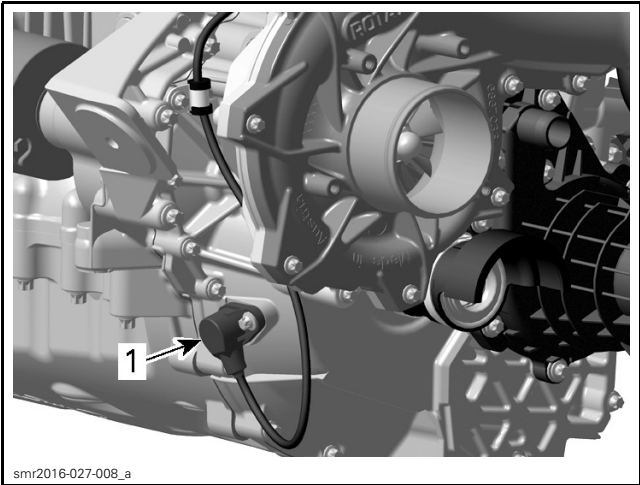
CRANKSHAFT POSITION SENSOR (CPS)

Troubleshooting the CPS

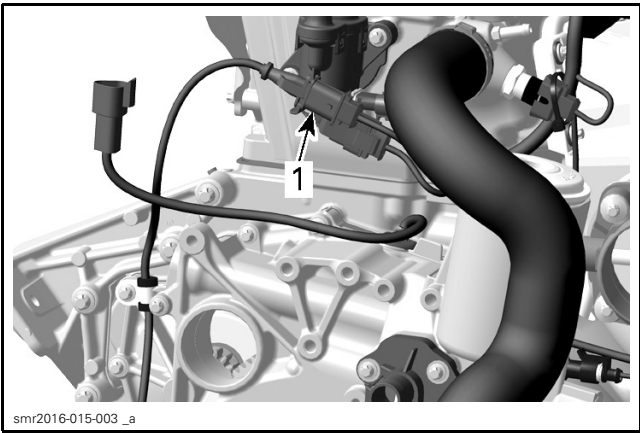
NOTICE Take into account that a CPS fault can be triggered by electronic or mechanical fault:

1. Check for fault codes
2. Test the CPS as per following procedure
3. If it tests good, check trigger wheel teeth condition. Refer to *PTO HOUSING AND MAGNETO* subsection.

CPS and CPS Connector Location



1. Crankshaft Position Sensor (CPS)



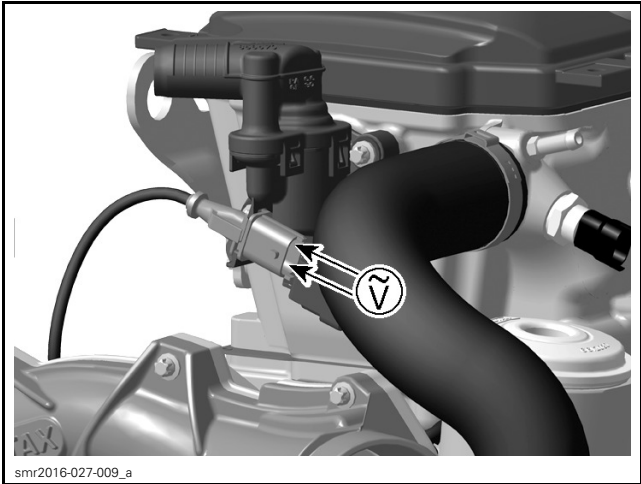
SUPERCHARGER REMOVED FOR CLARITY

1. CPS connector

Testing the CPS Voltage

- 1. Disconnect CPS wiring harness connector.
- 2. Press the START button to wake up the ECM.
- 3. Install the tether cord on the engine cut-off switch.
- 4. Pull the throttle lever completely in to the handlebar and hold (drowned mode).
- 5. While cranking the engine, probe CPS terminals.

CPS CONNECTOR		MEASUREMENT
PIN		VOLTAGE
1	2	Approximately 3.7 Vac



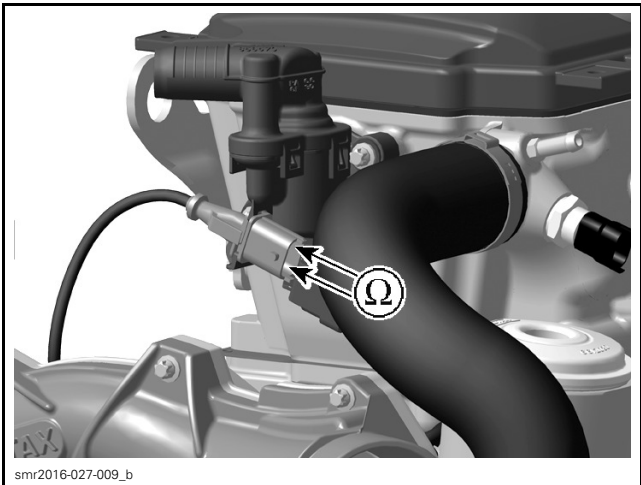
If voltage is not as specified, carry out *TESTING THE CPS RESISTANCE AT CPS CONNECTOR*.

If voltage is as specified, check continuity of wiring between CPS connector and ECM connector. Refer to *TESTING THE CPS RESISTANCE AT ECM CONNECTOR*.

Testing the CPS Resistance at CPS Connector

- 1. Probe CPS connector terminals as per following table.

CPS CONNECTOR		MEASUREMENT
PIN		RESISTANCE Ω @ 20°C (68°F)
1	2	775 - 950 Ω



If resistance is not within specifications, replace the CPS.

If resistance tests good carry out *TESTING THE CPS RESISTANCE AT ECM CONNECTOR*.

Testing the CPS Resistance at ECM Connector

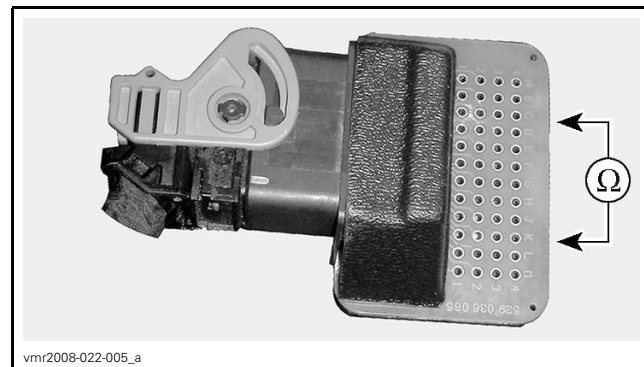
1. Remove parts required to access ECM-A connector.
2. Disconnect ECM-A connector from the ECM.
3. Probe CPS terminals as per following table.

REQUIRED TOOL	
FLUKE 115 MULTIMETER (P/N 529 035 868)	
ECM ADAPTER TOOL (P/N 529 036 166)	

Set multimeter to Ω .

Install ECM connector on ECM adapter.

ECM-A CONNECTOR		MEASUREMENT
PIN		RESISTANCE Ω @ 20°C (68°F)
A-H1	A-K2	775 - 950 Ω



If resistance measured is as specified, check ECM. Refer to *ENGINE CONTROL MODULE (ECM)* in this subsection.

If resistance measured is not as specified, repair or replace wiring and connectors between ECM and the CPS.

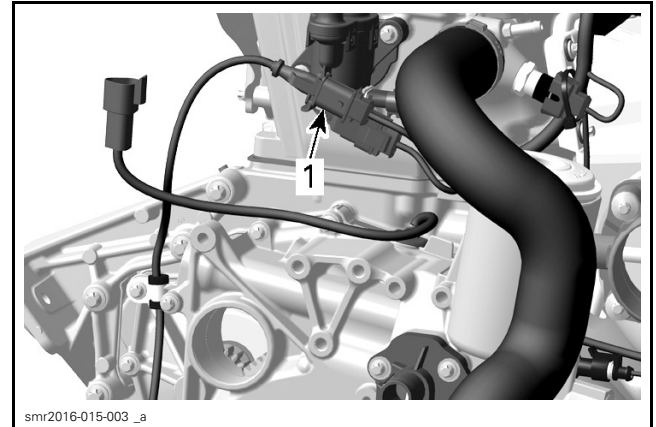
CPS Replacement

CPS Replacement

1. Drain oil from PTO housing. Refer to *PTO HOUSING, MAGNETO AND STARTER*.

NOTE: It is not necessary to drain oil from engine.

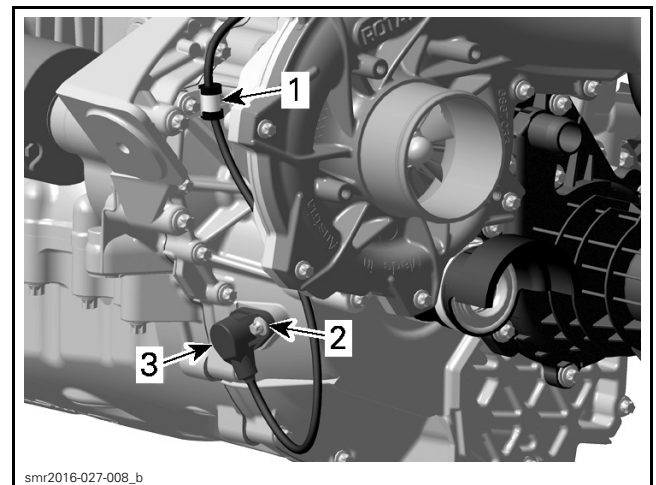
2. Disconnect CPS connector.



SUPERCHARGER REMOVED FOR CLARITY

1. CPS connector

3. Remove CPS harness retaining clamp.
4. Remove CPS retaining screw.



1. CPS harness retaining clamp

2. CPS retaining screw

3. CPS

5. Pull out CPS.

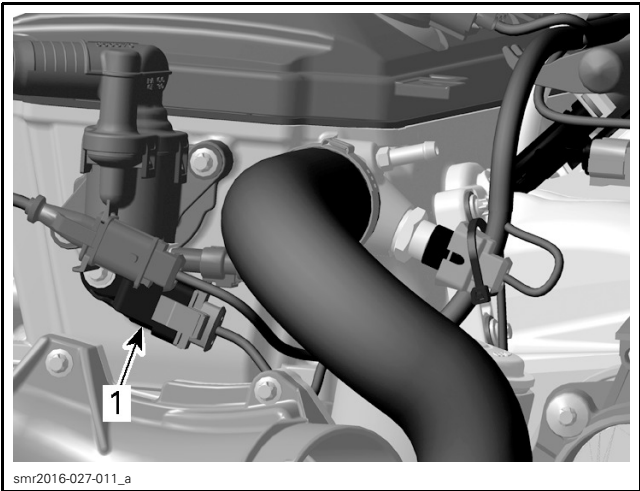
Installation is the reverse removal procedure. However, pay attention to the following.

6. Tighten CPS retaining screw to specification.

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
CPS retaining screw	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

7. Refill engine oil and check oil level, refer to *LUBRICATION SYSTEM* subsection.

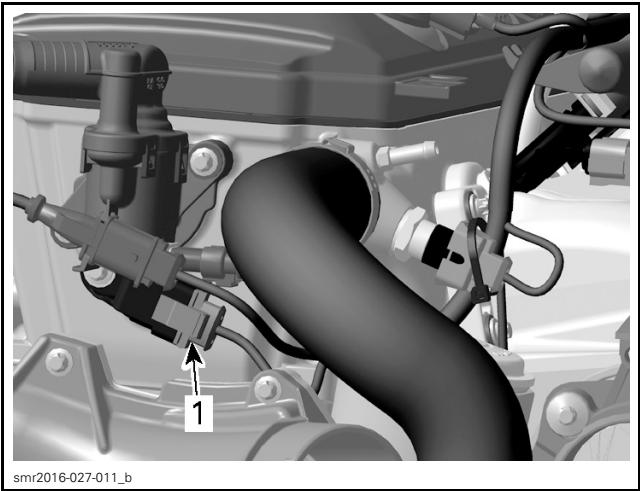
CAMSHAFT POSITION SENSOR (CAPS)



1. CAPS

Testing the CAPS Voltage (Harness Side)

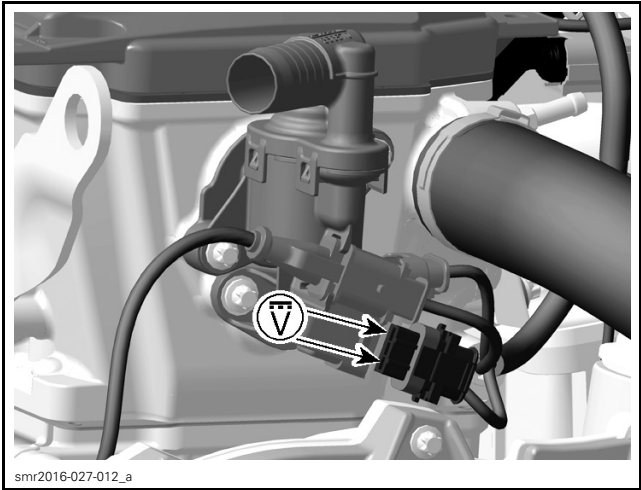
- 1. First check fuse F12 in fuse box. Replace as required.
- 2. Remove the parts required to access the CAPS.
- 3. Disconnect CAPS connector.



1. CAPS connector

- 4. Press the START button to wake up the ECM.
- 5. Install tether cord on engine cut-off switch.
- 6. Probe harness connector terminals as per following table.

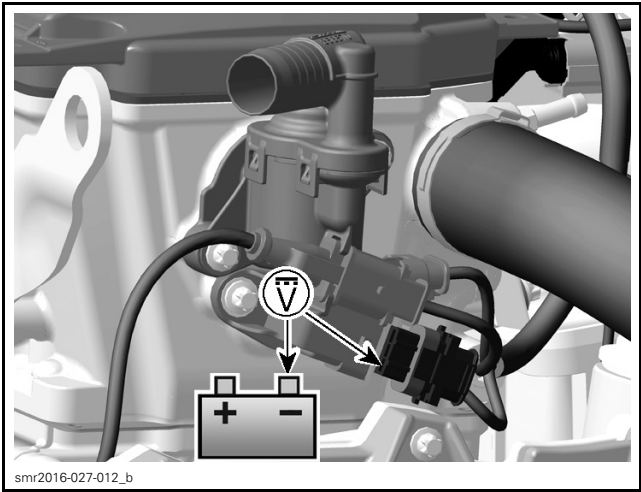
CAPS CONNECTOR		MEASUREMENT
PIN		VOLTAGE
3	1	Battery voltage



If battery voltage is read, proceed with *TESTING THE CAPS (DYNAMIC)* in this subsection.

If battery voltage is not read, probe circuit as per following table.

MEASUREMENT		VOLTAGE
CAPS connector pin 3	Battery ground	Battery voltage

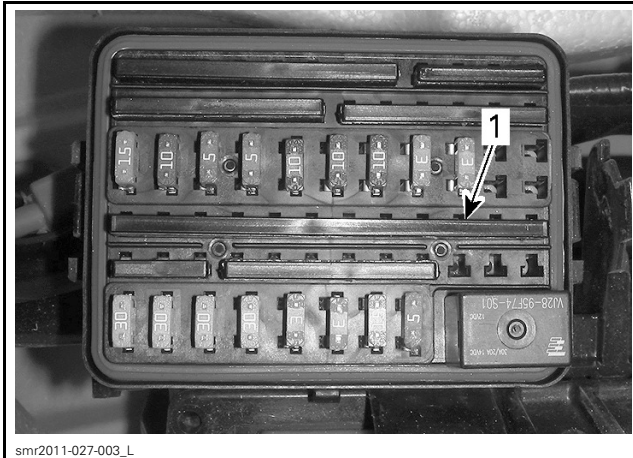


If voltage is read to battery ground, check continuity of ground circuit between CAPS pin 1 and ECM-A connector pin D4. Repair or replace wiring and connectors.

If voltage is not read to battery ground, carry out *TESTING THE CONTINUITY OF CAPS POWER CIRCUIT*.

Testing the Continuity of CAPS Power Circuit

- 1. Remove cover from fuse box. Refer to *POWER DISTRIBUTION*.
- 2. Remove the long bus bar.



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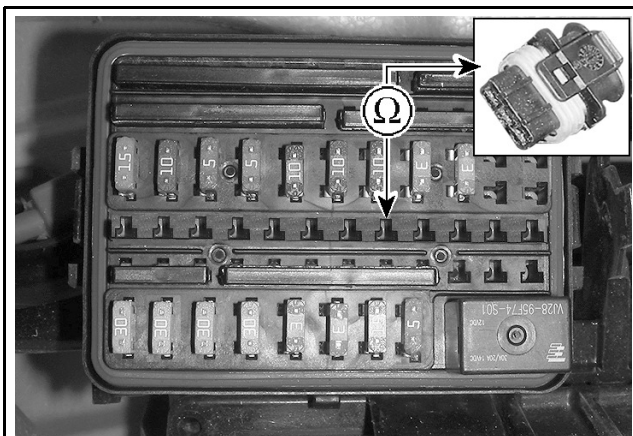
1. Pull out

3. Read resistance of the CAPS circuit as per following table.

REQUIRED TOOL	
FLUKE 115 MULTIMETER (P/N 529 035 868)	

Set multimeter to Ω .

FUSE BOX	CAPS CONNECTOR	RESISTANCE
TERMINAL	PIN	Ω
H10	3	Close to 0 Ω (continuity)



smr2011-027-003_o

If continuity is good, wiring and connectors are functional.

If a high resistance or an open circuit is measured, check the short bus bar in fuse box, repair or replace wiring and connectors from fuse box terminal to CAPS connector.

4. Reinstall bus bar and cover.

Testing the CAPS (Dynamic)

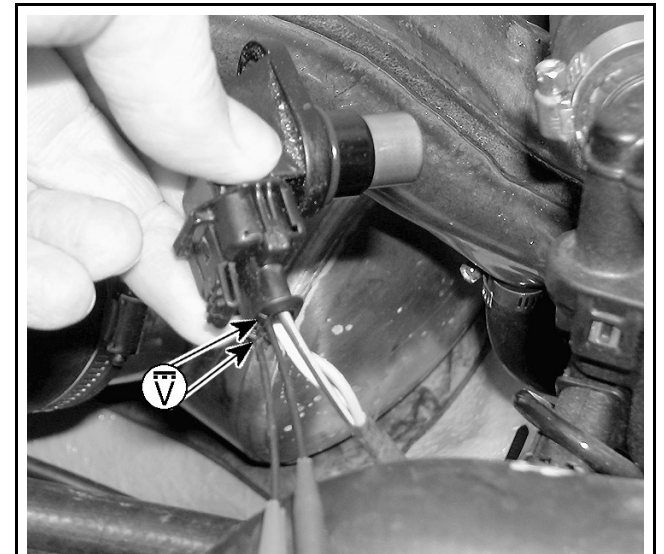
1. Remove the parts required to access the CAPS.
2. Remove CAPS sensor from engine.
3. Back-probe connector and read voltage as follows.

NOTE: To safely probe wire terminals through the back of the connector, using following tools or equivalent. Care must be taken not to damage connector seals.

REQUIRED TOOL	
FLUKE AUTOMOTIVE BACK PROBE PIN (P/N TP40)	
FLUKE SUREGRIP INSULATED TEST LEADS (P/N TL224)	

NOTICE Do not use sharp end probes. They could damage the connector seal.

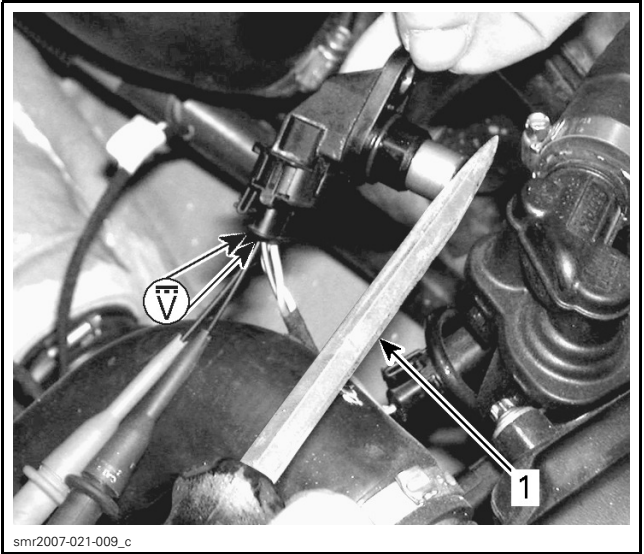
CAPS CONDITION	CAPS CONNECTOR		VOLTAGE
Free	2	1	Close to 12 Vdc



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TYPICAL

CAPS CONDITION	CAPS CONNECTOR		VOLTAGE
Metallic object on sensor just for a few seconds	2	1	Close to 0 Vdc



1. Metallic object

NOTE: Check several times if voltage follows the placement of the metallic object. Voltage must change each time.

If voltage is as specified, repair or replace wiring and connectors between sensor and ECM.

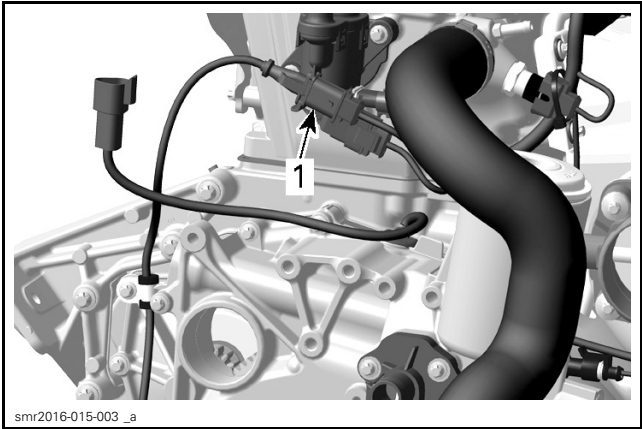
If wiring is good, check ECM. Refer to *ENGINE CONTROL MODULE (ECM)*.

If voltage is not measured as specified, try a new CAPS.

CAPS Replacement

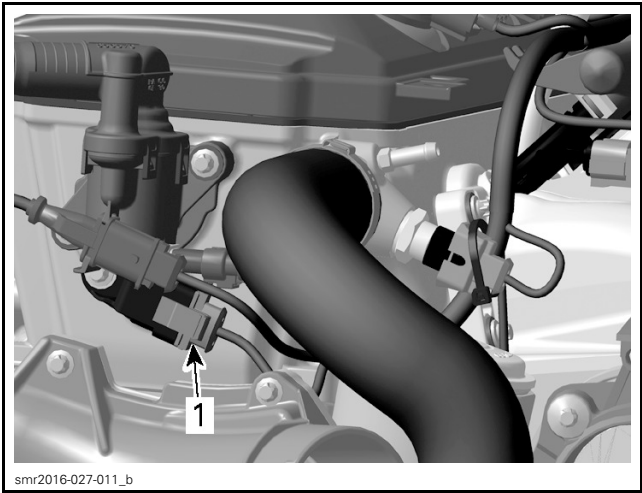
CAPS Replacement

1. Detach CPS connector from its holder.



SUPERCHARGER REMOVED FOR CLARITY
1. CPS connector

2. Disconnect CAPS connector.



1. CAPS connector

3. Unscrew the CAPS retaining screw.
4. Pull CAPS from engine.
5. Install the CAPS.

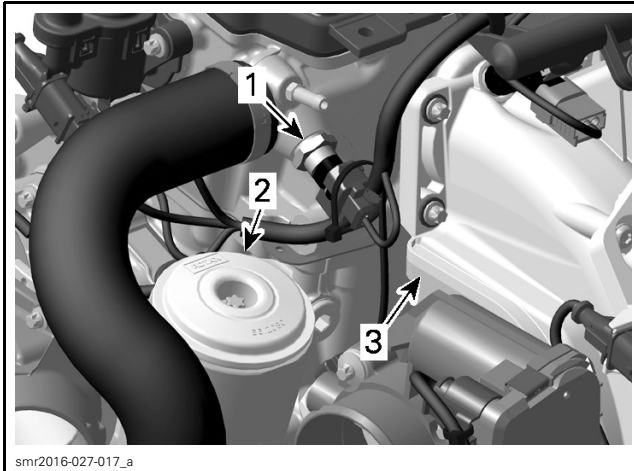
NOTICE Be sure to install new O-ring on a reused CAPS.

6. Tighten CAPS retaining screw to specification.

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
CAPS retaining screw	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

COOLANT TEMPERATURE
SENSOR (CTS)

The CTS is located between the intake manifold and the oil filter cover.



1. Coolant temperature sensor (CTS)
2. Oil filter cover
3. Intake manifold

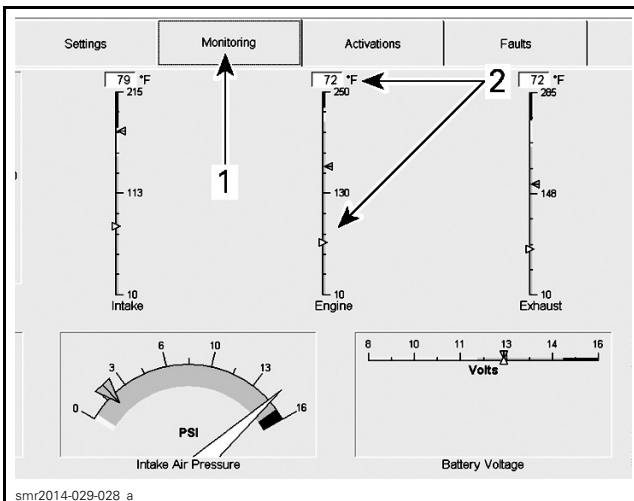
NOTE: The CTS will cause the engine overheat warning to come on when the coolant temperature is above:

OVERHEAT TEMPERATURE
110°C (230°F)

Check for debris or blockage in cooling system.

CTS Quick Test

1. Connect the vehicle B.U.D.S. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. In B.U.D.S., select the following:
 - Read Data button
 - Monitoring page tab
 - ECM page.
3. Look for the engine temperature indication.



- TYPICAL**
1. Monitoring tab
 2. Engine temperature

The engine temperature gauge in B.U.D.S. should provide an indication of the actual engine coolant temperature. Otherwise, test the *CTS RESISTANCE*.

Testing the CTS Resistance

1. Remove parts required to access ECM connectors.
2. Disconnect the ECM-A connector.
3. Check the CTS circuit resistance as per table.

REQUIRED TOOL	
FLUKE 115 MULTIMETER (P/N 529 035 868)	
ECM ADAPTER TOOL (P/N 529 036 166)	

Set multimeter to Ω .

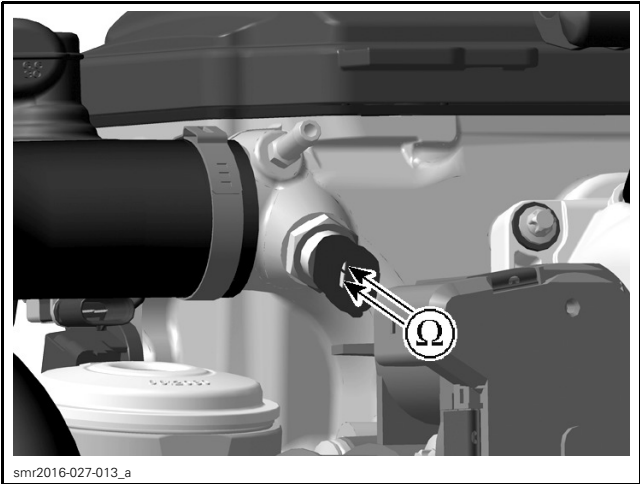
Install ECM connector on ECM adapter.

CTS RESISTANCE TEST		
ECM ADAPTER PIN		RESISTANCE Ω
A-A1	A-J2	See <i>CTS TEMPERATURE SENSOR TABLE</i>

If resistance test is good, replace the ECM.

If resistance is out of specification, proceed with the following steps.

4. Remove the parts required to access the CTS.
5. Disconnect the CTS connector.
6. Check continuity of wiring between ECM and CTS connector, refer to *WIRING DIAGRAM*. If there is an open circuit, repair or replace wiring and connectors.
7. If continuity of wiring is good, test the resistance of the sensor as per following tables.



CTS RESISTANCE TEST		
CTS SENSOR PIN		RESISTANCE Ω
1	2	See <i>CTS TEMPERATURE SENSOR TABLE</i>

CTS TEMPERATURE SENSOR TABLE			
TEMPERATURE		RESISTANCE (OHMS)	
°C	°F	LOW	HIGH
- 40	- 40	38457	52630
- 10	14	8208	10656
20	68	2233	2780
80	176	297	349
120	248	105	122

NOTE: To test sensor at various temperatures, remove sensor and use a heat gun, ice and a thermometer. Refer to *REPLACING THE CTS*.

If the resistance value measured is as specified, repair the connectors or replace the wiring harness between ECM connector and CTS connector.

If the resistance value is not within specification replace CTS.

Replacing the CTS

CTS Replacement

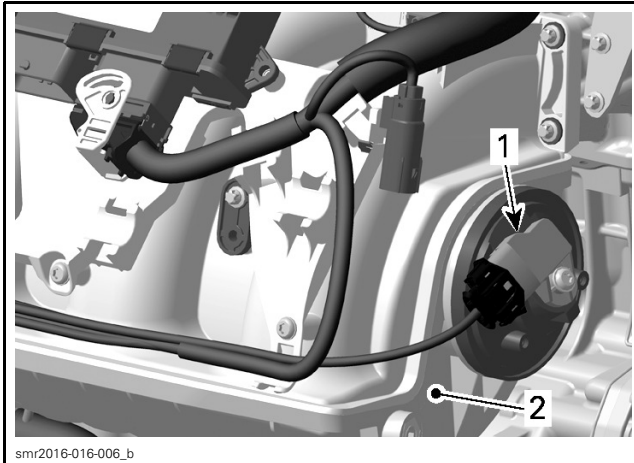
- 1. Drain engine coolant to below CTS level, refer to *COOLING SYSTEM* subsection.
- 2. Cut locking tie on wiring harness and move wiring aside for access. Be sure to take note of their position.
- 3. Disconnect CTS connector and remove CTS.
- 4. Install the new CTS and tighten to specification.

TIGHTENING TORQUE	
Coolant temperature switch	17 N•m ± 2 N•m (150 lbf•in ± 18 lbf•in)

- 5. Reinstall remaining removed parts. Be sure to secure wiring harness as noted prior to removal.
- 6. Refill and bleed the cooling system, refer to *COOLING SYSTEM* subsection.
- 7. Reinstall remaining removed parts.

MANIFOLD ABSOLUTE PRESSURE AND TEMPERATURE SENSOR (MAPTS)

NOTE: This sensor is a multifunction device. It measures manifold absolute pressure and intake air temperature for air flow calculations.



FRONT SIDE OF ENGINE

1. Manifold absolute pressure and temperature sensor (MAPTS)
2. Intake manifold

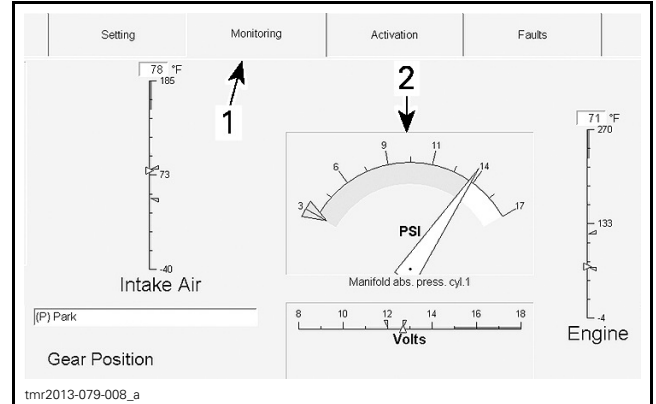
MAPTS Pressure Function

NOTE: This sensor is a dual function device. Before the engine is started, when power is applied to the system, the sensor measures the ambient atmospheric pressure and stores it in the ECM. Thereafter, once the engine is started, it measures the air pressure in the intake manifold at operating RPMs.

Ensure sensor is correctly installed on intake manifold. Otherwise, the MAPTS could generate a fault code for an unexpected sensor range at idle when it reads an erroneous intake manifold pressure. Remove sensor and check for oil or dirt on its end and if problem persists, check throttle plate condition/position and the wiring harness. Perform the following tests.

MAPTS Pressure Function Quick Test

1. Connect vehicle to the applicable B.U.D.S. software version.
2. In B.U.D.S., select the following:
 - Read Data
 - Monitoring tab
 - ECM tab.



1. Monitoring tab
2. MAPTS pressure reading

3. Look for and take note of the MAPTS pressure reading while the engine is stopped.

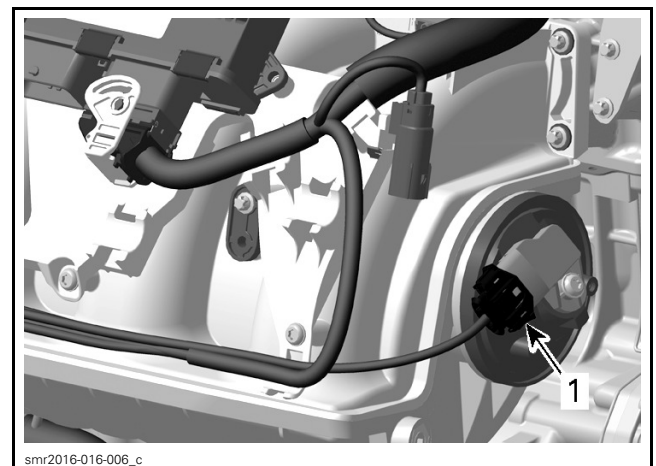
Values have to be within ± 3.4 kPa (.5 PSI).

MAPTS PRESSURE FUNCTION QUICK TEST			
RESULT	SERVICE ACTION		
NO READING	Circuit Continuity Test of MAPTS Pressure Function	MAPTS Input Voltage Test	Repair or replace wiring
VALUE IS OUT OF RANGE	Replace MAPTS		

4. Perform the same test with a new MAPTS and compare both readings.

Testing the MAPTS Input Voltage (Pressure Function)

1. Remove the parts required to access the MAPTS.
2. Disconnect connector from MAPTS.



1. MAPTS connector

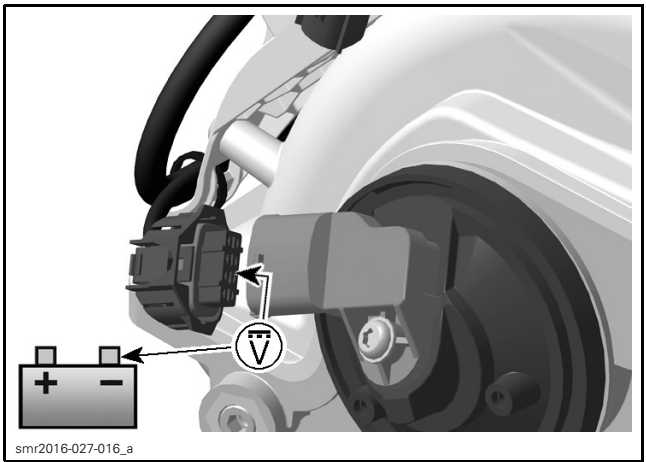
Subsection XX (ELECTRONIC FUEL INJECTION (EFI))

- 3. Press the START button to wake up the ECM.
- 4. Install the tether cord on the engine cut-off switch.
- 5. Read voltage as per following table.

REQUIRED TOOL	
FLUKE 115 MULTIMETER (P/N 529 035 868)	

Set multimeter to Vdc.

MAPTS CONNECTOR	VOLTAGE
Terminal 3 to battery ground	Approx. 5 V
Terminal 4 to battery ground	Approx. 0 V
Terminal 1 to battery ground	Approx. 0 V



If voltage measured is as specified, replace the MAPTS.

If voltage measured is not as specified, refer to *TESTING THE CONTINUITY OF MAPTS WIRING HARNESS (PRESSURE FUNCTION)*.

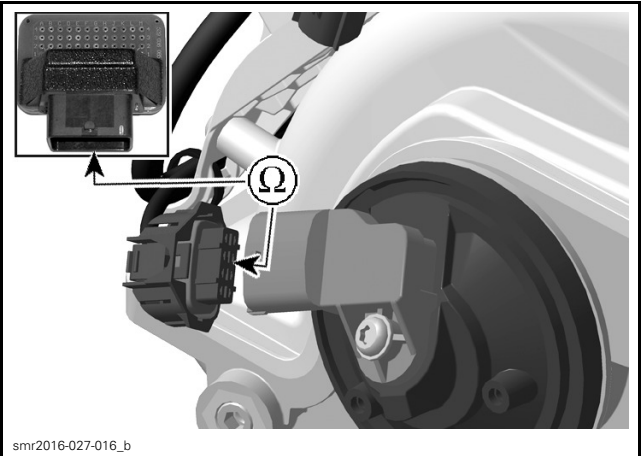
Testing the Continuity of MAPTS Wiring Harness (Pressure Function)

- 1. Disconnect ECM-A connector from the ECM.
- 2. Test for circuit continuity as per following table.

REQUIRED TOOL	
ECM ADAPTER TOOL (P/N 529 036 166)	
FLUKE 115 MULTIMETER (P/N 529 035 868)	

Install ECM connector on ECM adapter.
Set multimeter to Ω .

MAPTS CONNECTOR	ECM CONNECTOR	RESISTANCE
Pin 1	A-H2	Close to 0 Ω continuity
Pin 3	A-B4	
Pin 4	A-G4	



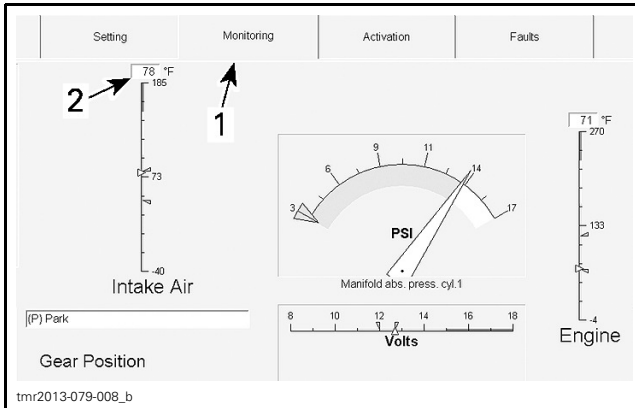
If resistance is not within specification, repair or replace the wiring harness between ECM connector and the MAPTS. Refer to *WIRING DIAGRAM*.

MAPTS Temperature Function

The sensor monitors the air temperature inside the intake manifold.

MAPTS Quick Test (Temperature Function)

- 1. Connect vehicle to the applicable B.U.D.S. software version.
- 2. In B.U.D.S., select the following:
 - Read Data
 - Monitoring tab
 - ECM tab.
- 3. Look for the **Intake Air** temperature reading while the engine is stopped.



1. Monitoring tab
2. MAPTS temperature reading

NOTE: If the complete vehicle is at room temperature, B.U.D.S. should display the ambient air temperature at the intake manifold.

4. Perform the same test with a new MAPTS and compare both readings.

If the engine's MAPTS temperature reading is significantly different than the new MAPTS, replace it.

NOTE: Both sensors must measure the same ambient air temperature.

If there is no reading, carry out *TESTING THE MAPTS RESISTANCE (TEMPERATURE FUNCTION)*.

Testing the MAPTS Resistance (Temperature Function)

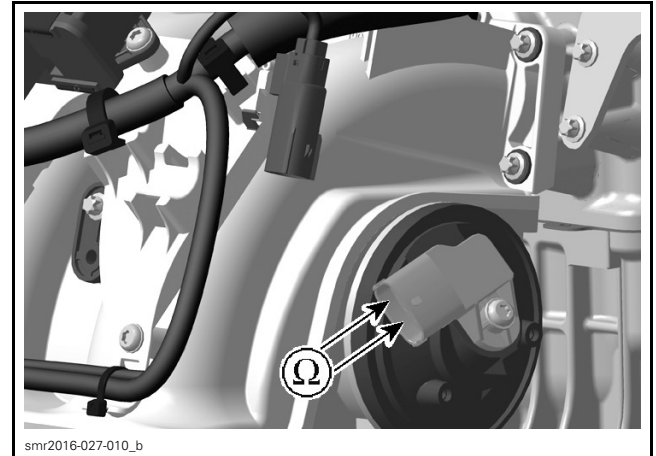
Disconnect the connector from the MAPTS.

Check the resistance of the sensor itself as shown.

REQUIRED TOOL	
FLUKE 115 MULTIMETER (P/N 529 035 868)	

Set multimeter to Ω .

MAPTS		MEASUREMENT
PIN		
1	2	Refer to MAPTS TEMPERATURE SENSOR TABLE



MAPTS TEMPERATURE SENSOR TABLE			
TEMPERATURE		RESISTANCE (OHMS)	
°C	°F	LOW	HIGH
- 40	- 40	40528	56935
- 10	14	8103	10919
20	68	2193	2863
80	176	294	368
120	248	98	122

If resistance is not within specification, replace the MAPTS.

If resistance tests good, **reconnect** the MAPTS and disconnect the ECM-A connector.

Using a multimeter, recheck resistance value as per following table.

REQUIRED TOOL	
ECM ADAPTER TOOL (P/N 529 036 166)	

Install ECM connector on ECM adapter.

ECM CONNECTOR		MEASUREMENT
PIN		
A-H2	A-H3	Refer to MAPTS TEMPERATURE SENSOR TABLE

MAPTS TEMPERATURE SENSOR TEST RESULTS			
RESULT	SERVICE ACTION		
NO READING	Circuit Continuity Test of MAPTS Temperature Function	MAPTS Input Voltage Test	Repair or replace wiring
INCORRECT RESISTANCE VALUE	Replace MAPTS		
CORRECT RESISTANCE VALUE	Try a new ECM		

Testing the MAPTS Circuit Continuity (Temperature Function)

MAPTS CIRCUIT CONTINUITY TEST (TEMPERATURE FUNCTION)		
ECM-A	MAPTS CONNECTOR	RESISTANCE VALUE
Pin H2	Pin 1	Close to 0 Ω
Pin H3	Pin 2	

MAPTS Replacement

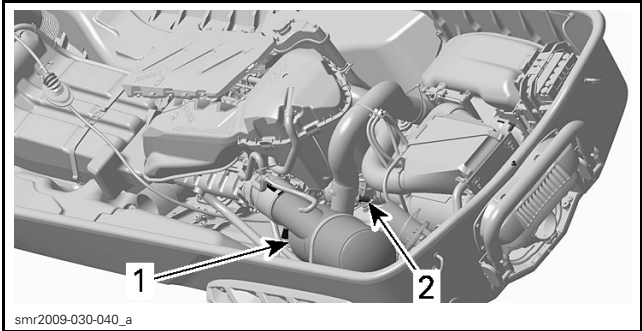
MAPTS Replacement

1. Disconnect MAPTS connector and remove the MAPTS.
2. Install the new MAPTS paying attention to index its tab into the adaptor notch.
3. Tighten retaining screw to specification.

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
MAPTS retaining screw	5.5 N•m ± 0.6 N•m (49 lbf•in ± 5 lbf•in)

4. Reinstall remaining parts removed, refer to applicable subsections.

EXHAUST GAS TEMPERATURE SENSOR (EGTS)



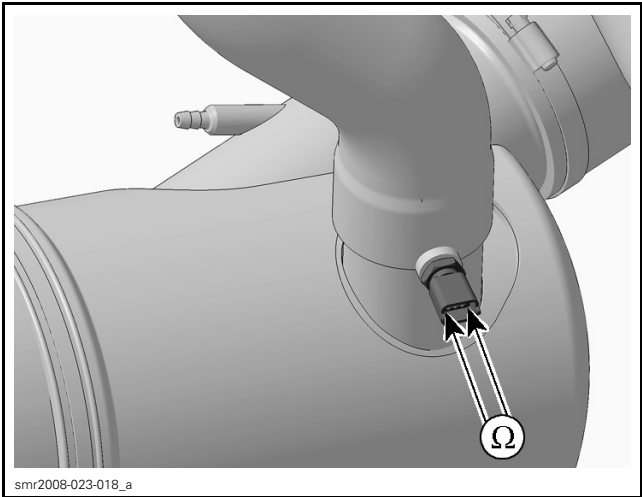
1. Muffler
2. Exhaust gas temperature sensor (EGTS)

NOTE: An overheat signal will come on in the information center when the exhaust temperature reaches.

OVERHEAT TEMPERATURE
110°C (230°F)

Testing the EGTS Resistance

1. Remove the parts required to access the EGTS.
2. Disconnect the connector from the EGTS.
3. Measure the resistance of the sensor.



The resistance should be as per the *EGTS RESISTANCE CHART* that follows. Otherwise, replace the EGTS.

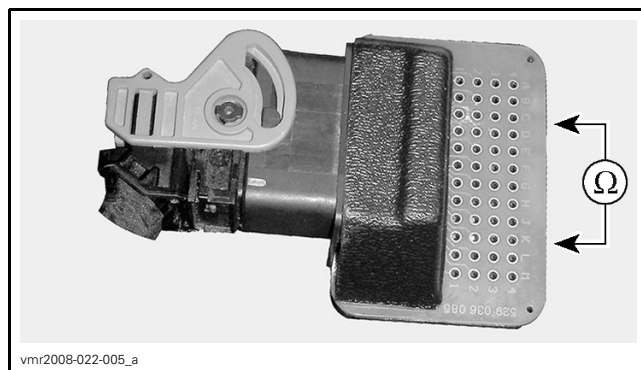
If the EGTS resistance is within specifications, proceed with the following steps.

4. Reconnect the EGTS and disconnect ECM-A connector from the ECM.

5. Using a multimeter and the ECM ADAPTER TOOL (P/N 529 036 166), check the circuit resistance as per following table.

ECM ADAPTER		MEASUREMENT
PIN		RESISTANCE Ω
B-F3	B-G4	See <i>EGTS RESISTANCE CHART</i>

EGTS RESISTANCE CHART				
TEMPERATURE		RESISTANCE (OHMS)		
°C	°F	NOMINAL	LOW	HIGH
- 30	- 22	12600	11800	13400
- 20	- 4	11400	11000	11800
- 10	14	9500	8000	11,000
0	32	5900	4900	6900
10	50	3800	3100	4500
20	68	2500	2200	2800
30	86	1700	1500	1900
40	104	1200	1080	1320
50	122	840	750	930
60	140	630	510	750
70	158	440	370	510
80	176	325	280	370
90	194	245	210	280
100	212	195	160	210
110	230	145	125	160
120	248	115	100	125

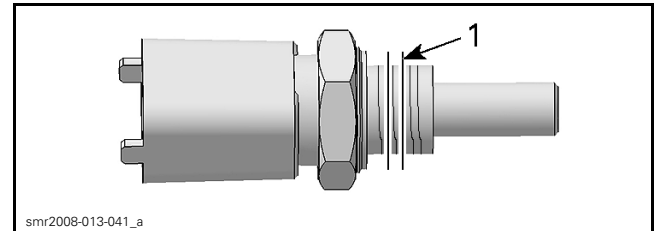


If resistance value is as specified, check ECM. Refer to *ENGINE CONTROL MODULE (ECM)* in this subsection.

If resistance value is not within specifications, repair or replace wiring and connectors between the ECM and the EGTS.

Replacing the EGTS

1. Disconnect the EGTS connector.
2. Unscrew EGTS from muffler.
3. Apply LOCTITE 518 (P/N 293 800 038) on the middle threads of the new EGTS.



1. Apply Loctite 518 in this area

4. Install the EGTS.

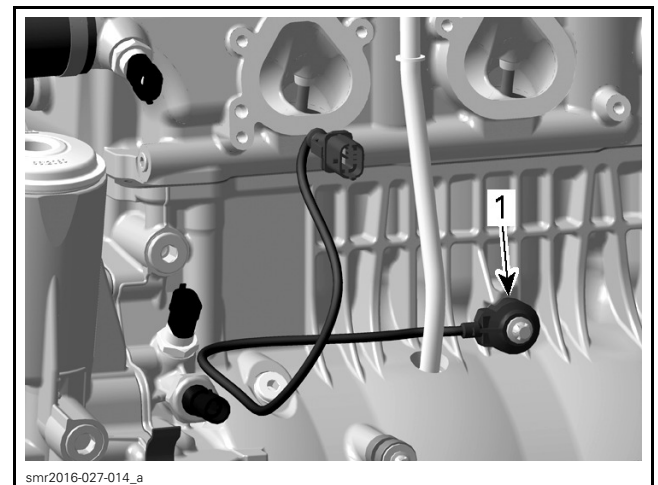
TIGHTENING TORQUE	
EGTS	16 N•m (142 lbf•in)

5. Install the EGTS connector.
6. Install all other removed parts, refer to applicable subsections.

KNOCK SENSOR (KS)

Knock Sensor Location

The KS is located in the cylinderblock behind the intake manifold



1. Knock sensor (KS)

Testing the KS (Dynamic)

1. Connect watercraft to B.U.D.S. software, refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. In B.U.D.S., click the **Faults** tab and look for a **Knock sensor fault**.
3. Start engine and throttle it to above 5000 RPM.

Subsection XX (ELECTRONIC FUEL INJECTION (EFI))

NOTE: The engine must not run out of the water without providing proper cooling to the exhaust system. Maximum engine run time out of water is 2 minutes. Failure to do so may result in damage to the exhaust system and engine. Refer to *EXHAUST SYSTEM* subsection.

4. Using the B.U.D.S. software, monitor the knock sensor for a fault code.

If no fault occurs, the knock sensor is good.

If a fault occurs, carry out the following steps.

5. Ensure sensor and cylinder block contact surfaces are clean.

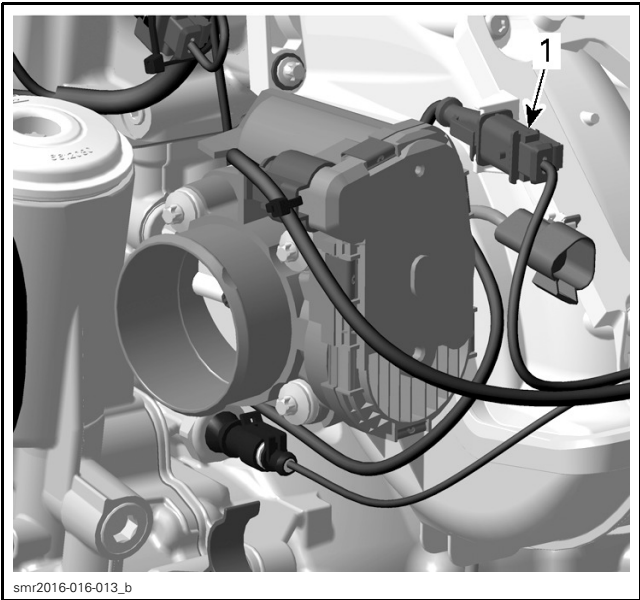
6. Ensure the correct mounting bolt and washer are used and are properly torqued.

NOTE: It is necessary to remove the intake manifold to inspect the contact surfaces. Refer to *IN-TAKE MANIFOLD* subsection.

7. Check the knock sensor resistance, refer to *TESTING THE KS RESISTANCE*.

Testing the KS Resistance

- 1. Remove parts required to access knock sensor,
- 2. Disconnect the knock sensor connector.

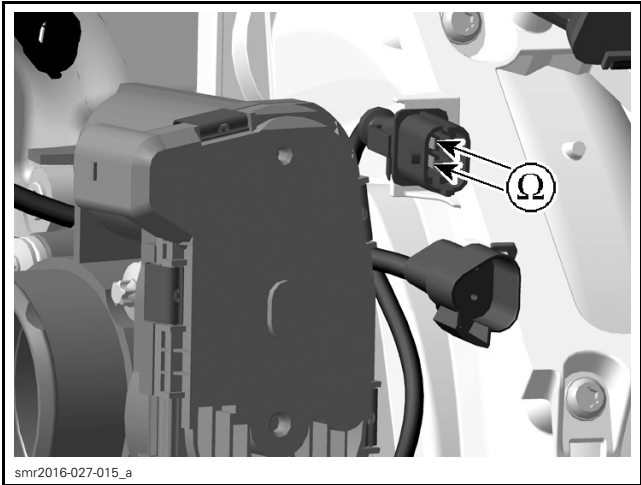


1. KS connector

3. Measure the resistance between the knock sensor terminals.

REQUIRED TOOL	
FLUKE 115 MULTIMETER (P/N 529 035 868)	

Set multimeter to Ω .



KNOCK SENSOR RESISTANCE @ 20°C (68°F)
Approximately 5 M Ω

If resistance is not as specified, replace knock sensor.

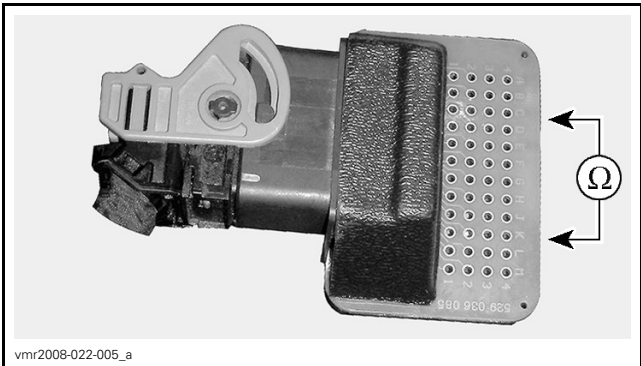
If resistance is as specified, carry on with the following steps.

- 4. Reconnect the knock sensor connector.
- 5. Disconnect ECM-A connector.
- 6. Check circuit resistance through the knock sensor as per following table.

REQUIRED TOOL	
ECM ADAPTER TOOL (P/N 529 036 166)	

Install ECM connector on ECM adapter.

ECM ADAPTER		MEASUREMENT
PIN		RESISTANCE @ 20°C (68°F)
A-C3	A-G2	Approximately 5 M Ω



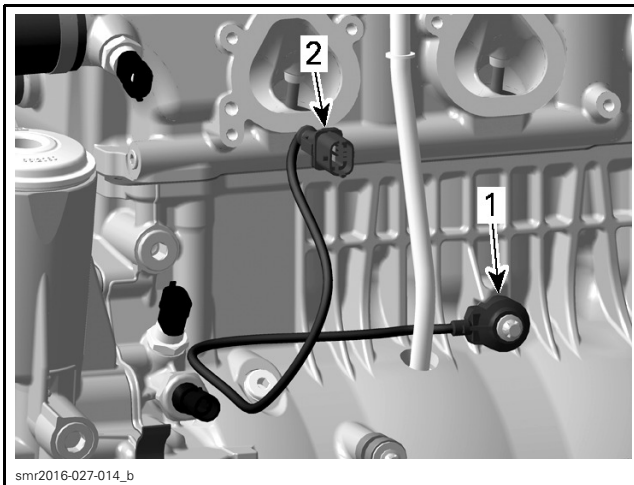
If wiring harness is good, check ECM. Refer to *ENGINE CONTROL MODULE (ECM)* in this section.

If an open circuit is measured, repair or replace wiring and connectors between ECM and knock sensor.

KS Replacement

KS Replacement

1. Disconnect KS sensor connector.



TYPICAL - INTAKE MANIFOLD REMOVED

1. Knock sensor
2. Knock sensor connector

2. Unscrew and remove knock sensor from engine.
3. Clean contact surfaces.
4. Apply thread locker in threaded hole.
5. Install the new knock sensor and tighten retaining screw to specification.

NOTICE Improper torque may interfere with knock sensor operation and lead to severe internal engine damage.

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
KS retaining screw	23 N•m ± 3 N•m (17 lbf•ft ± 2 lbf•ft)

6. Reconnect knock sensor connector.
7. Reinstall remaining removed parts, refer to applicable subsections.

FUEL TANK AND FUEL PUMP

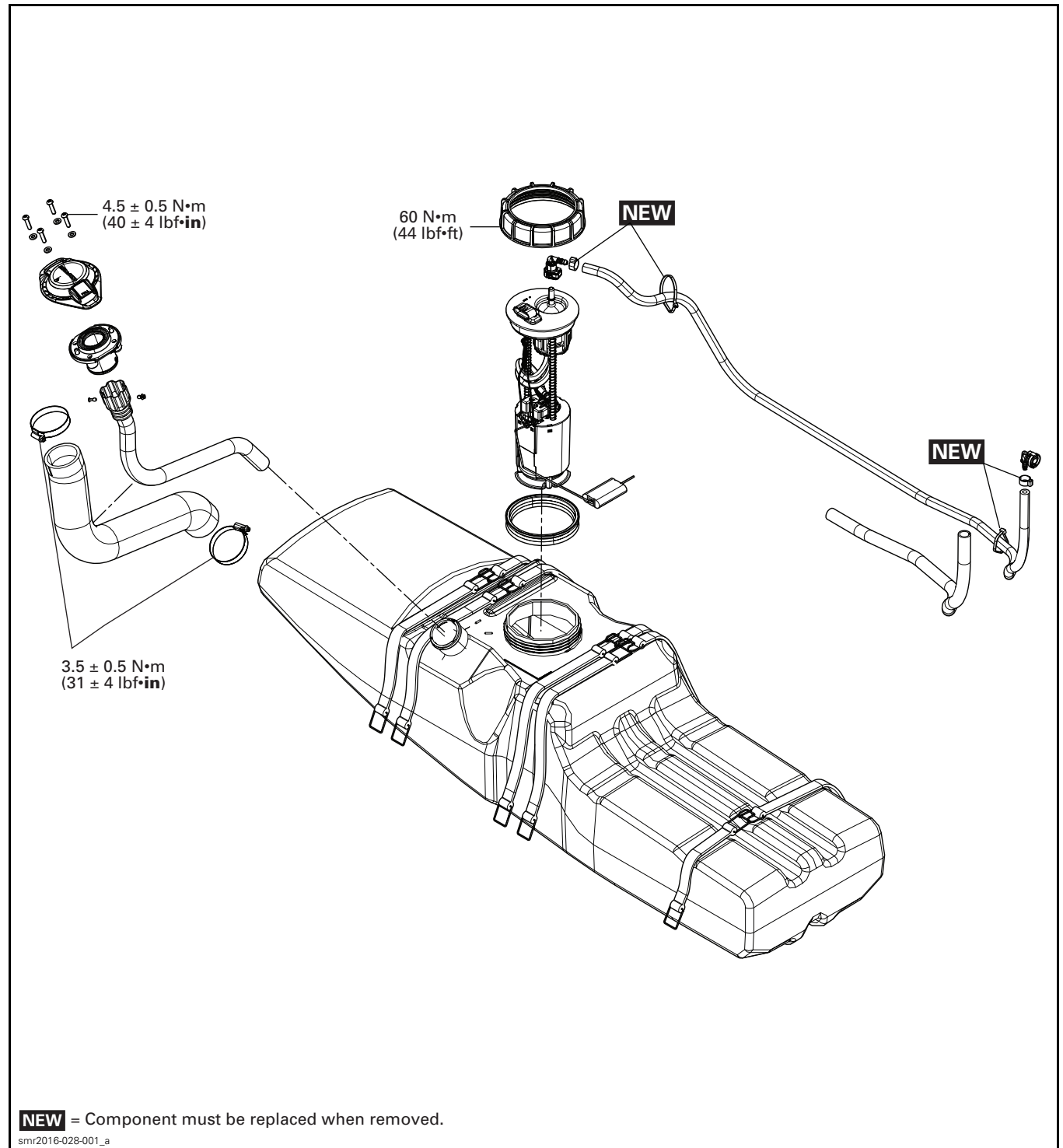
SERVICE TOOLS

Description	Part Number	Page
DIAGNOSTIC HARNESS	529 036 188	13
ECM ADAPTER TOOL.....	529 036 166	9
FLUKE 115 MULTIMETER	529 035 868	8, 14
FUEL HOSE ADAPTER.....	529 036 023	7
FUEL PUMP MODULE SOCKET.....	529 036 125	11
FUEL TANK TEST CAP	529 036 242	5
FUEL TANK TEST CAP (FLIP)	529 036 244	5
OETIKER PLIERS.....	295 000 070	8
PRESSURE GAUGE.....	529 035 709	7
VACUUM/PRESSURE PUMP	529 021 800	5

[illegible]

FUEL TANK AND FUEL PUMP

Models With Suspension



GENERAL

⚠ WARNING

Fuel lines remain under pressure at all times. Always proceed with care and use appropriate safety equipment when working on a pressurized fuel system. Wear safety glasses.

⚠ WARNING

Always disconnect battery prior to working on the fuel system. Fuel vapors are flammable and explosive under certain conditions. Always work in a well ventilated area. Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Proceed with care when removing/installing high pressure test equipment or disconnecting fuel line connections. Cover the fuel line connection with an absorbent shop rag. Wipe off any fuel spillage in the bilge.

⚠ WARNING

When the repair is completed, ensure that hoses and connections from fuel rail to the fuel pump are properly secured. Then, pressurize the fuel system. After carrying out a fuel pump pressure test, use the valve on the fuel pressure gauge to release the pressure (if so equipped).

⚠ WARNING

The fuel pump is energized for a few seconds each time the START button is depressed. It builds fuel system pressure very quickly. Prior to pressing the START button, ensure there are no disconnected or damaged fuel lines that may leak fuel. A high pressure leak test must be carried out whenever a fuel system component has been disconnected.

⚠ WARNING

Ensure wires and hoses are routed and secured away from any vibrating, rotating, moving or hot components or sharp edges. Use appropriate shields and fastening devices as per factory standards.

NOTICE Whenever repairing the fuel system, always check for water infiltration in the fuel tank. Replace any damaged, leaking or deteriorated fuel line.

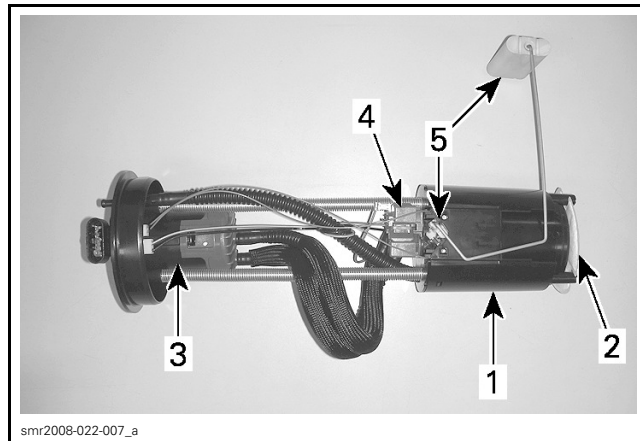
SYSTEM DESCRIPTION

The fuel system is comprised of:

- A fuel tank
- A vented fuel tank cap
- A fuel pump module mounted inside the fuel tank
- A fuel vent system, and
- A variety of hoses.

The fuel pump module is basically comprised of:

- An electric fuel pump mounted inside a canister type pump reservoir
- A lower inlet filter
- An upper outlet filter
- A pressure regulator
- A float type fuel level sensor.



FUEL PUMP MODULE

1. Fuel pump reservoir
2. Lower inlet filter
3. Upper outlet filter
4. Fuel pressure regulator
5. Float type fuel level sensor

Fuel Pump Operation

When the pump is in operation, it draws fuel into the canister through a lower inlet filter and a disk type valve.

The pressurized fuel is pushed through an upper outlet filter to the fuel rail.

Excess fuel pressure generated by the pump is routed from the upper filter back to the pump canister reservoir by a pressure regulator mounted on the pump reservoir cover.

When the START button is pressed, the electrical system is powered. The fuel pump will come on for approximately 2 seconds to pressurize the fuel rail in preparation for the engine start.

The ECM supplies the ground signal to turn on the fuel pump motor.

The pressure regulator will ensure appropriate fuel pressure is supplied to the injectors.

When the ECM receives a signal to shut down the engine (START/STOP switch, engine cut-off switch, or T.O.P.S. switch) it removes the fuel pump ground signal.

Fuel Level Indication

An electric float type fuel level sensor is mounted on the side of the fuel pump reservoir. As the float moves with changing fuel levels, it varies a resistance that changes the voltage signal coming from the information center (multifunction gauge). This signal is representative of the fuel level.

The information center interprets the fuel level voltage signal that comes back from the fuel level sensor. It then displays the proper fuel level in the information center and a low fuel warning message when required.

The information center will also trigger the beeper which produces the appropriate beep signal to warn the driver of a low fuel condition.

The fuel level sensor resistance is at its lowest value when the fuel tank is full, and at its highest value when the tank is empty.

Refer to the *FUEL LEVEL SENSOR* in this subsection for fuel level sensor testing procedures.

Fuel Tank Venting

The entire vent system is incorporated within the fuel tank cap.

⚠ WARNING

If the cap requires replacement, it must be replaced with an approved vented cap of the same type supplied by BRP. Use of any other cap, or use of a non-vented cap will not allow proper venting of the fuel tank. The result may be engine fuel starvation, fuel tank overpressure, or fuel leaks which could lead to a fire or an explosion.

INSPECTION

TESTING FUEL TANK FOR LEAKS

1. Visually inspect condition of hoses and clamps.
2. Remove/open fuel tank cap.
3. Fill up fuel tank.
4. Install test cap on filler neck.
5. Use the following tool to pressurize fuel tank.

REQUIRED TOOL

VACUUM/PRESSURE PUMP
(P/N 529 021 800)



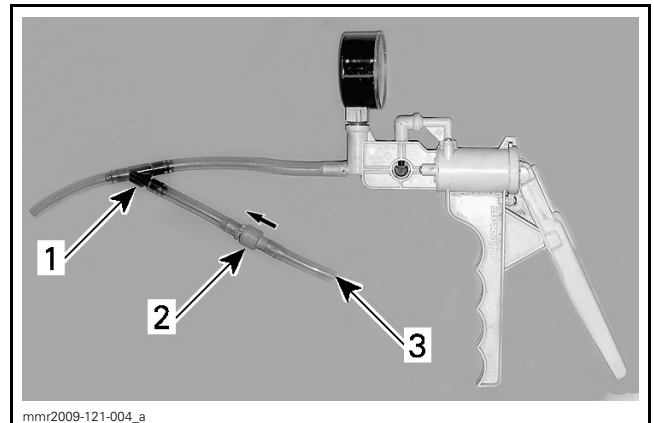
FUEL TANK TEST CAP
(P/N 529 036 242)



FUEL TANK TEST CAP (FLIP)
(P/N 529 036 244)

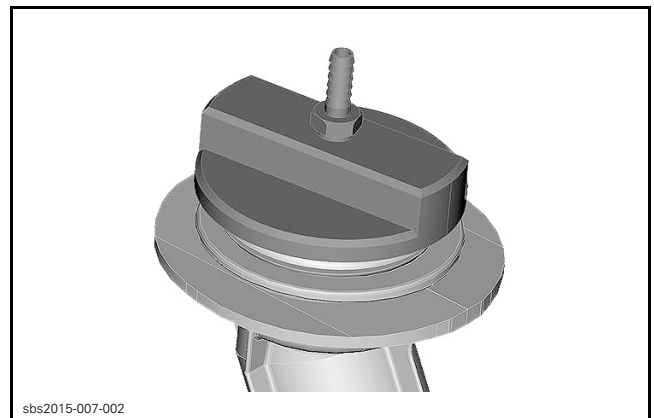


NOTE: A Y-fitting and a check valve can be installed to use compressed air for quick pressure build-up when the fuel tank is not full.



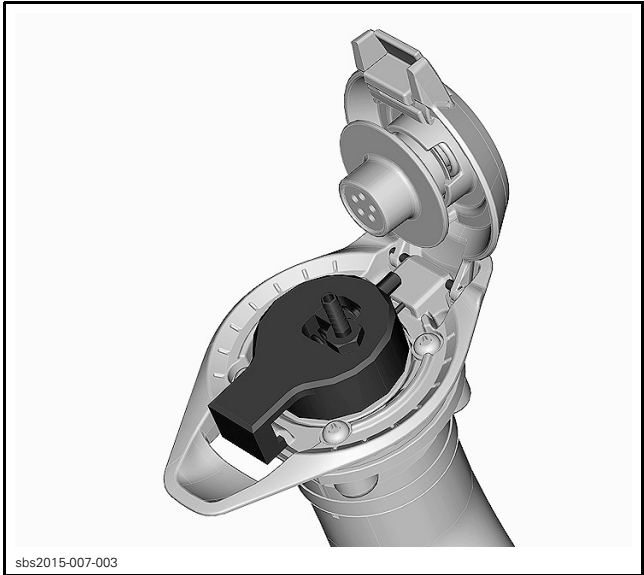
1. Y-fitting (P/N 293 710 059)
2. Check valve (P/N 275 500 505)
3. Apply compressed air here

6. Install the applicable fuel tank test cap.



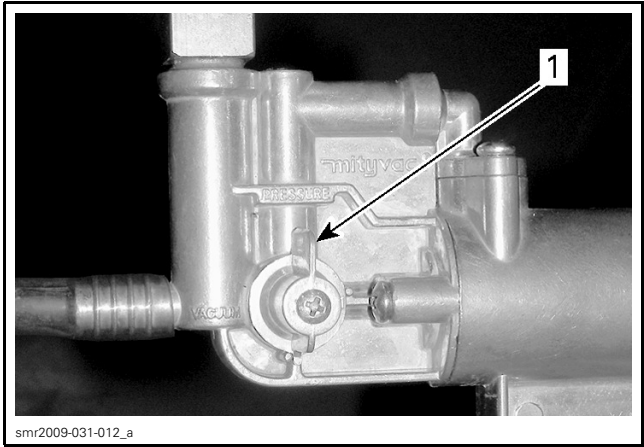
SCREW TYPE TEST CAP

Subsection XX (FUEL TANK AND FUEL PUMP)



FLIP TYPE TEST CAP

- 7. Connect the vacuum/pressure pump to the nipple of fuel tank test cap.
- 8. Set vacuum/pressure pump to PRESSURE.



1. Pressure selected

- 9. Pressurize fuel tank to specification.

NOTICE Do not exceed the specification when pressurizing the fuel tank.

FUEL TANK LEAK TEST	
PRESSURE	TIME WITHOUT PRESSURE DROP
21 kPa (3 PSI)	10 minutes

If the pressure drops, locate fuel leak(s), repair/replace leaking component(s) and retest.

Possible leak areas are:

- Filler neck, hose and connections
- Fuel tank
- Fuel tank neck

- Fuel pump gasket
- Fuel pump check valve (unlikely)

To locate a leak, check for a fuel smell or leaking fuel.

If a leak is not visible, spray a soapy water solution on components to ease locating the leak(s); bubbles will indicate the leak location(s).

NOTE: If the pressure drops and no leak has been found, it is possibly fuel pump check valve.

NOTICE When the fuel system leak test is completed, thoroughly rinse all components of the soapy water solution with clear water. A soapy water residue may cause premature deterioration and must be rinsed away.

⚠ WARNING

If a leak is found, do not start the engine. Wipe off any fuel that leaked and ventilate the hull thoroughly to remove any accumulated fuel vapors. Do not use electric powered tools on watercraft unless system has passed the leak test.

- 10. Remove test cap.

TESTING FUEL PUMP PRESSURE

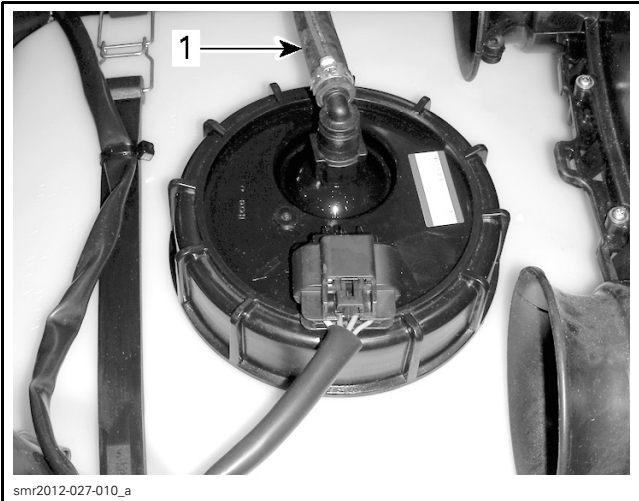
Preparation

The pressure test will show the available pressure at the fuel pump outlet. It validates the pressure regulator, the fuel pump and check valve and it tests for leaks in the system.

- 1. Ensure the battery is fully charged, refer to *CHARGING SYSTEM*.
- 2. Ensure hoses and fittings are not leaking. Repair any leaks.
- 3. Ensure there is enough gas in the fuel tank.
- 4. Disconnect the pressure outlet hose from the fuel pump.

⚠ WARNING

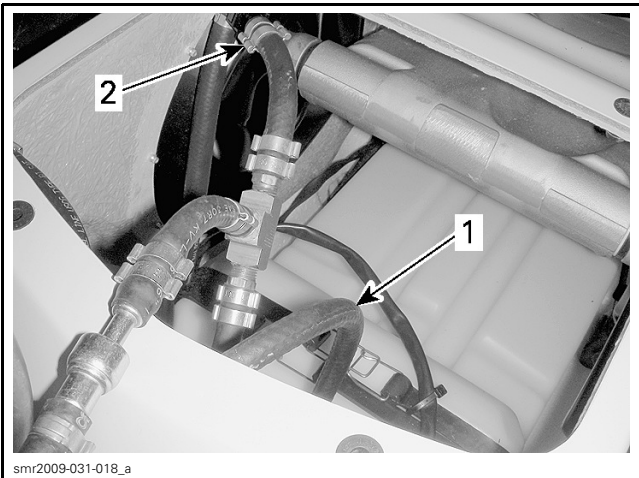
Cover the fuel line connection with an absorbent shop rag. Wipe off any fuel spillage inside the bilge.



1. Outlet hose

5. Install pressure test tools between disconnected hose and fuel pump fitting (in line installation).

REQUIRED TOOLS	
PRESSURE GAUGE (P/N 529 035 709)	
FUEL HOSE ADAPTER (P/N 529 036 023)	

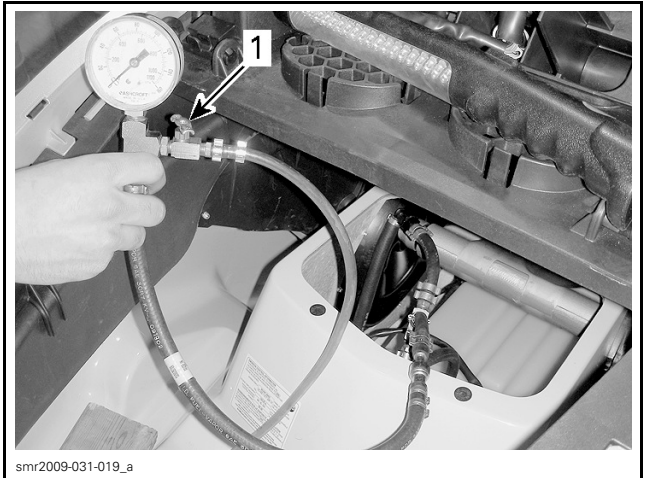


TYPICAL
1. Connect to fuel pump
2. Connect to outlet hose

Test when Engine Is Stopped

1. Remove tether cord from the engine cut-off switch to prevent engine starting.
2. Press the START button and observe fuel pressure.

3. Release pressure in system using the valve on the pressure gauge between each test so that the reading returns to zero (0).
4. Repeat test twice and compare readings to specifications in following table.



FUEL PUMP PRESSURE TEST

1. Valve on gauge

MODELS	FUEL PRESSURE (WHEN PRESSING THE START BUTTON)
All	386 kPa - 414 kPa (56 PSI - 60 PSI)

Test when Cranking or Starting Engine

1. Crank or start engine and observe fuel pressure. The fuel pressure should be the same as in previous test.

If pressure is good, fuel pump and pressure regulator are functioning correctly.

2. Stop the engine.

A rapid pressure drop indicates leakage either from the fuel rail or from the fuel pump check valve. Check fuel rail for leaks.

If a pressure drop occurs when pressing the START button and the fuel rail is not leaking, then replace the fuel pump module.

A slow pressure drop indicates leakage either from a fuel injector or from the fuel pressure regulator in the fuel pump module. To check fuel injectors for leaks, refer to the *ELECTRONIC FUEL INJECTION (EFI)* subsection. If injectors are not leaking, then replace fuel pump.

3. Release fuel pressure in system using the valve on the pressure gauge.
4. Remove pressure gauge and reinstall fuel hose on fuel pump module.

 **WARNING**

Wipe off any fuel spillage in the bilge. Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area.

5. Reinstall all other removed parts, refer to applicable subsections.

PROCEDURES

FUEL HOSES AND OETIKER CLAMPS

Inspecting Fuel Hoses

- 1. Inspect all fuel hoses for wear, kinks, cracks or any other types of damages.
- 2. Inspect all clamps for tightness.

Replacing Fuel Hoses

When replacing fuel hoses, be sure to use hoses and clamps as available from BRP parts department. This will ensure continued proper and safe operation.

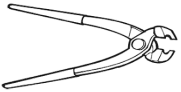
 **WARNING**

Use of fuel lines other than those recommended by BRP may compromise fuel system integrity.

 **WARNING**

- Never use a hose pincher on high pressure hoses.
- Never change the routing of a fuel hose.
- Always reinstall the corrugated protective tubing on fuel hoses.
- Secure fuel hoses using the appropriate locking tie or fastener to prevent contact with sharp edges or hot, rotating and moving parts.
- After connecting a hose or a quick connect fitting, pull on the hose near the fitting to make sure it is securely locked.
- Always validate fuel system tightness by testing fuel tank for leaks.

Replacing Oetiker Clamps

REQUIRED TOOL	
OETIKER PLIERS (P/N 295 000 070)	

 **WARNING**

Whenever removing a hose in the fuel system, always use new Oetiker clamps at assembly.

FUEL PUMP

Testing the Fuel Pump

- 1. Remove tether cord from the engine cut-off switch to prevent engine starting.
- 2. Press START button.
- 3. The fuel pump should run for 2 seconds to build up fuel system pressure.
- 4. If fuel pump runs, test the *FUEL PUMP PRESSURE* as described in this subsection.
- 5. If the fuel pump does not run:
 - Ensure ECM is powered. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.
 - Check fuse F18. If fuse is faulty, replace it and repeat test. If fuse is good, test the *FUEL PUMP INPUT VOLTAGE* in this subsection.

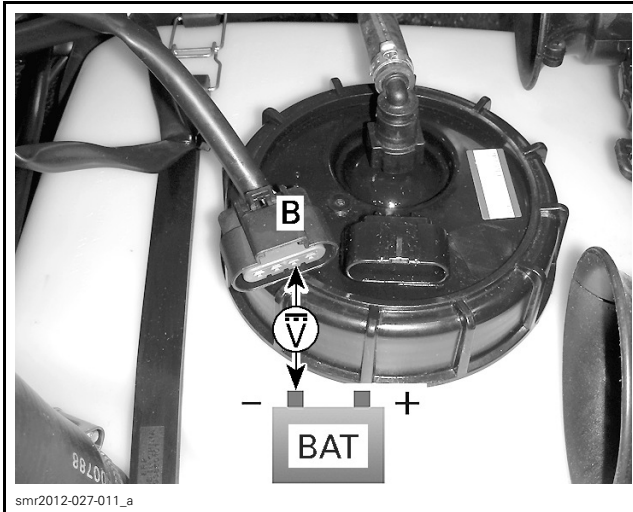
Testing Fuel Pump Pressure

Refer to *INSPECTION* in this subsection.

Testing Fuel Pump Input Voltage

- 1. Ensure the fuel pump fuse (F18) is in good condition.
- 2. Disconnect fuel pump harness connector. Refer to *FUEL PUMP REMOVAL*.
- 3. Use the FLUKE 115 MULTIMETER (P/N 529 035 868).
- 4. Select Vdc.
- 5. Press the START button.
- 6. Read voltage at fuel pump harness connector as per following table.

INPUT VOLTAGE TEST		
TEST PROBES		VOLTAGE
Pin B (+ probe)	Battery ground (- probe)	Battery voltage



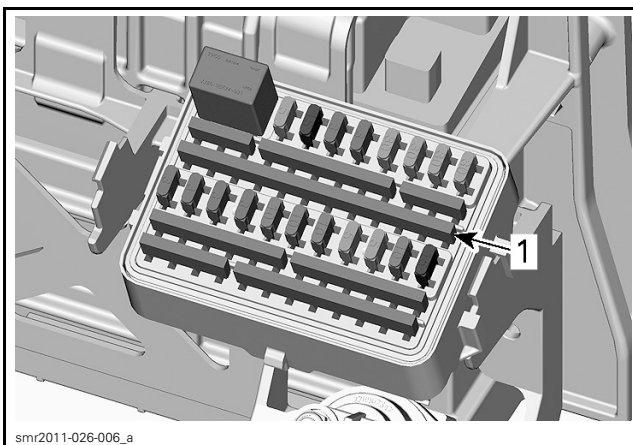
FUEL PUMP INPUT VOLTAGE TEST

If battery voltage is read, power circuit is good. Test the *FUEL PUMP CIRCUIT*.

If battery voltage is not read, power circuit is faulty. Test continuity of power circuit wiring between fuse box and fuel pump. Test the *FUEL PUMP CIRCUIT* in this subsection.

Testing Fuel Pump Circuit

1. Reconnect the fuel pump harness connector.
2. Remove cover of fuse box.
3. Remove the long bus bar.



1. Long bus bar

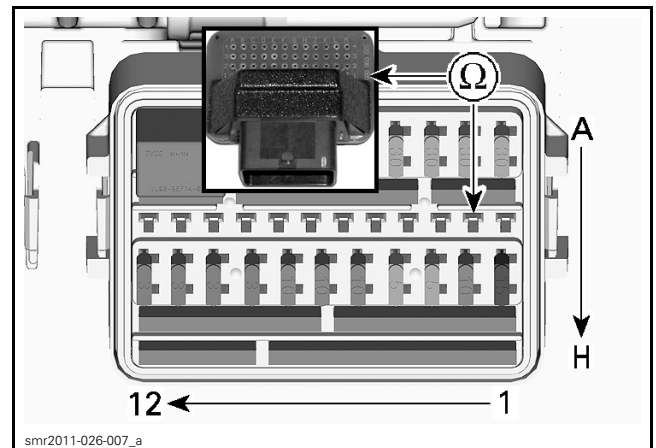
4. Remove ECM connector "B" and install it on the ECM ADAPTER TOOL (P/N 529 036 166).



5. Set multimeter to Ω and test pump circuit as per following table.

PUMP CIRCUIT TEST THROUGH FUEL PUMP

TEST PROBES		RESISTANCE @ 20°C (68°F)
Fuse box terminal D2	ECM connector B pin B-M1	Approx. 12 Ω

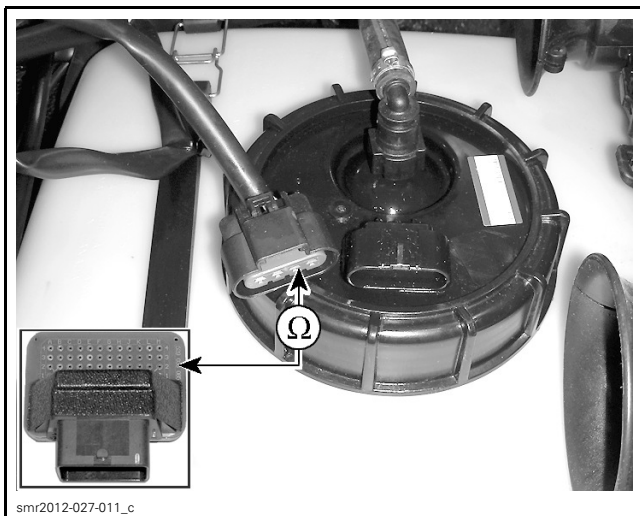
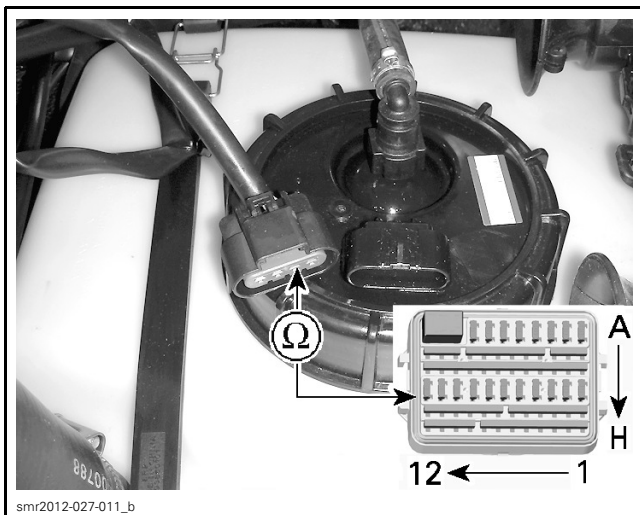


6. If test succeeded, the fuel pump, its fuse and its wiring harness are good.
7. If test failed, test wiring continuity as per table.

FUEL PUMP HARNESS CONTINUITY TEST (WIRING ONLY)

TEST PROBES		RESISTANCE @ 20°C (68°F)
Pump harness connector pin B	Fuse box terminal F2	Close to 0 Ω (continuity)
Pump harness connector pin A	ECM connector B pin B-M1	

Subsection XX (FUEL TANK AND FUEL PUMP)



If there is an open circuit to FB-F2, repair wiring/connector between fuel pump and fuse box.

If there is good continuity to FB-F2 and fuel pump fuse (F18) is good, check continuity of the wire jumper between D2 and E2. Repair or replace wiring as required.

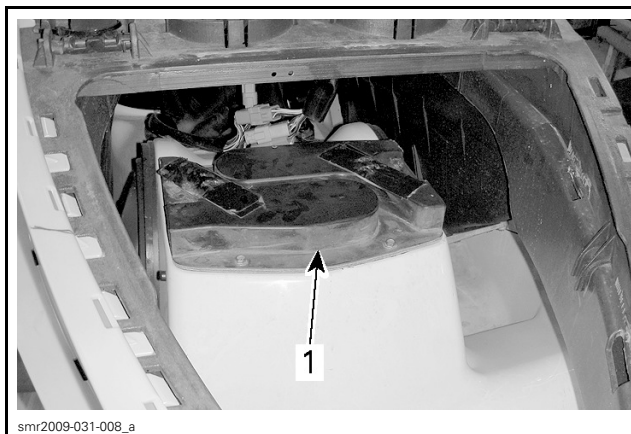
If every test succeeded and fuel pump still does not work, try a new ECM. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.

Removing the Fuel Pump

1. Open front storage compartment cover.
2. Remove storage bin or partitions. Refer to *BODY* subsection.

Models with Suspension

3. Remove front ventilation box.



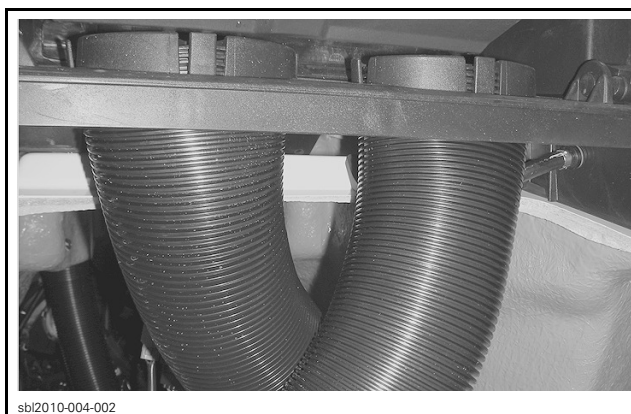
1. Ventilation box

4. Lift suspension to gain access.

NOTE: If more height is required or if the suspension cannot be used, manually lift suspension by the anchor points close to handlebar and safely lock in this position. Do not lift the watercraft from the anchor points.

Models Without Suspension

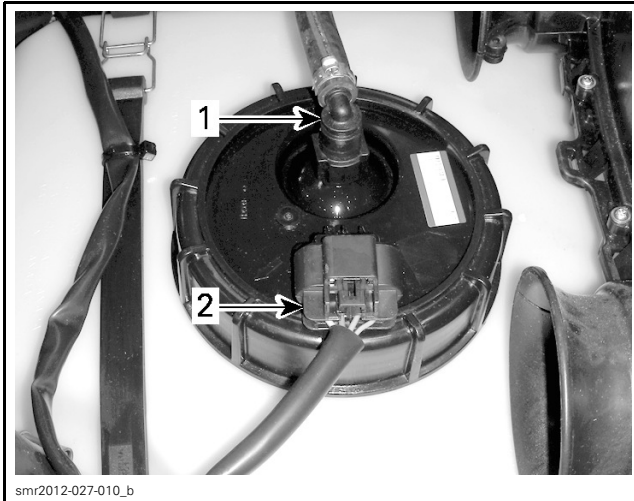
5. Disconnect the top of the two front air ventilation hoses, refer to *BODY* subsection.



FRONT AIR VENTILATION HOSES

All Models

6. Disconnect the negative battery terminal, refer to *CHARGING SYSTEM* subsection.
7. Disconnect fuel pump electrical connector.
8. Disconnect the vent tube from the fuel pump.
9. Wrap shop rags around the high pressure fuel hose fitting, then press on the release button of the quick connect fitting and disconnect the hose.

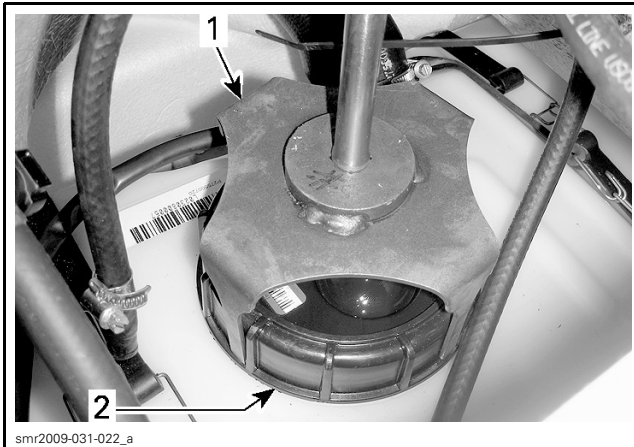


1. Quick connect fitting (high pressure fuel hose)
2. Harness connector

10. Unscrew the fuel pump retaining nut.

REQUIRED TOOL

FUEL PUMP MODULE SOCKET
(P/N 529 036 125)



1. Fuel pump module socket
2. Fuel pump retaining nut

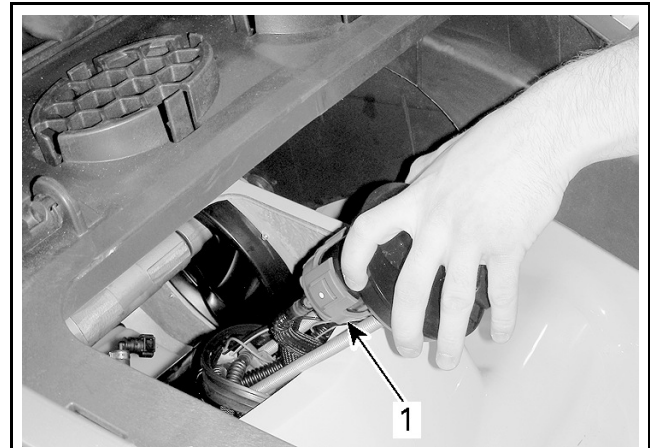
NOTICE While pulling out the fuel pump module, pay attention to the corrugated tubes and fuel sensor float arm. Float arm can get caught up and bend which will reduce fuel sensor accuracy. If fuel pump module is dropped or damaged, it must be replaced.

11. Slowly pull fuel pump module up through opening until corrugated tubes contact sides of opening. Tilt the fuel pump module as you slowly pull the pump upwards.

⚠ WARNING

The upper filter and fuel pump reservoir on the fuel pump module contain fuel which will drain out when fuel pump module is not in an upright position.

12. Carefully pull fuel pump module out.



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IS MODEL SHOWN

1. Pull out fuel pump module

⚠ WARNING

Always wipe off any fuel spillage from the watercraft. When working with fuel or fuel system and its components, always work in a well ventilated area.

Installing the Fuel Pump

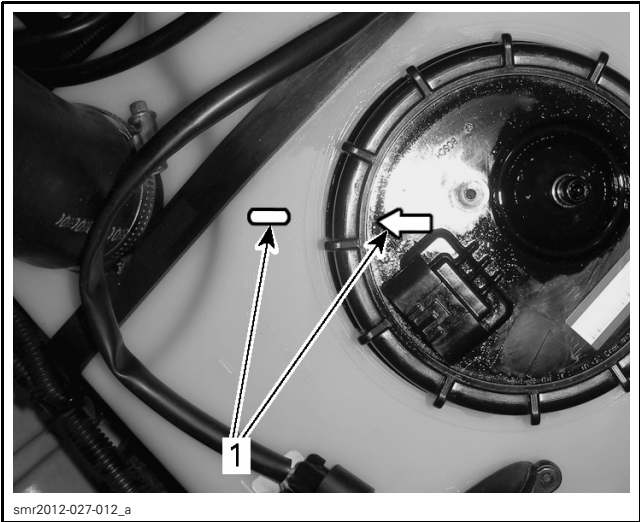
Reverse the removal procedure however, pay attention to the following.

1. Carefully insert fuel pump module in fuel tank so as not to bend float arm.
2. Install a NEW fuel pump module gasket each time the module is reinstalled.

NOTE: Wipe off parts to prevent fuel pump from turning while torquing fuel pump nut.

3. Align arrow on top of fuel pump module with index mark on top of fuel tank or fuel sensor accuracy will be affected.

NOTE: Index mark and arrow locations are highlighted for clarity in following illustration.



FUEL PUMP MODULE INDEXING

1. Align marks

4. Tighten fuel pump nut.

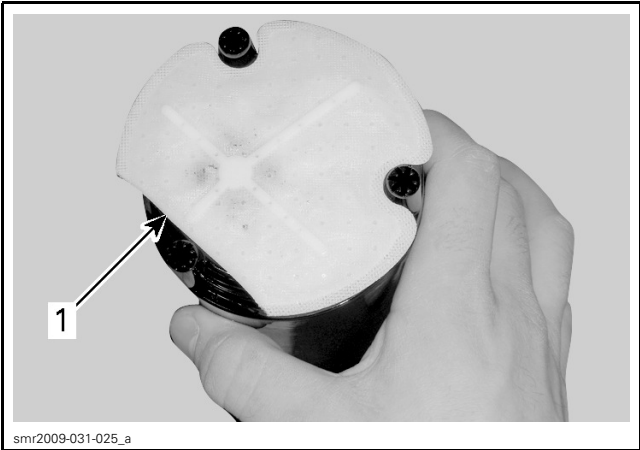
TORQUE	
Fuel pump nut	60 N•m (44 lbf•ft)

5. Test the fuel tank for leaks. Refer to *TESTING FUEL TANK FOR LEAKS*.

FUEL FILTER

Inspecting the Fuel Filter

Inspect fuel filter. If dirty, partially clogged or damaged, replace it.



1. Fuel filter

Removing the Fuel Filter

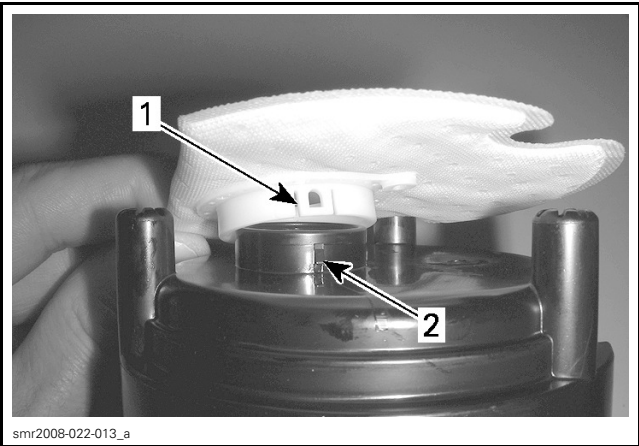
NOTE: The lower fuel filter on the fuel pump module does not require replacement under normal operating conditions. Replace only if permanently clogged or damaged.

1. Remove fuel pump. Refer to *FUEL PUMP* in this subsection.

⚠ WARNING

The upper filter and fuel pump reservoir on the fuel pump module contain fuel which will drain out when fuel pump module is not in an upright position.

2. Turn fuel pump upside down.
3. Using a small flat screwdriver, pry up the filter locking tabs.



1. Fuel filter locking tab (x2)
2. Filter locking pin (x2)

4. Pull filter off fuel pump reservoir housing.

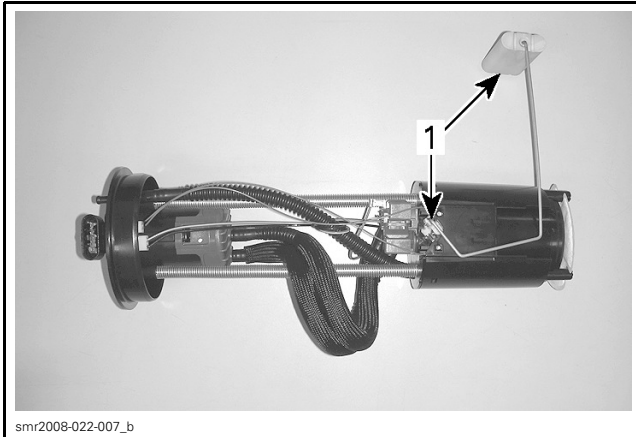
Installing the Fuel Filter

1. Align new filter with pump reservoir housing.
2. Press new filter on by hand. Ensure it is fully seated and locked onto the pump reservoir housing.
3. Reinstall fuel pump as per procedure in this subsection.
4. Test the fuel tank for leaks. Refer to *TESTING FUEL TANK FOR LEAKS*.
5. Install all other removed parts, refer to applicable subsection.

FUEL LEVEL SENSOR

Fuel Level System Overview

A float type fuel level sensor mounted on the fuel pump module sends a signal to the information center.



TYPICAL — FUEL PUMP MODULE
1. Fuel level sensor

The information center interprets this signal and turns on the appropriate number of segments of a bar type fuel level indication in the lower RH side of the digital screen in the information center.

Troubleshooting the Fuel Level Sensor

FUEL LEVEL TROUBLESHOOTING	
SYMPTOM	POSSIBLE CAUSE
Fuel gauge always display EMPTY	– Wiring/connectors – Fuel level sensor – Float stuck in low position
Fuel gauge always display FULL	– Water in fuel pump connector – Float stuck in full position
Fuel level sensor fault code	– Wiring/connectors – Fuel level sensor
Fuel gauge displays wrong level	– Low battery voltage – Fuel level sensor fault

Use B.U.D.S. to check for a fault code. Refer to *DIAGNOSTIC AND FAULT CODES*.

Testing Fuel Level Sensor Voltage

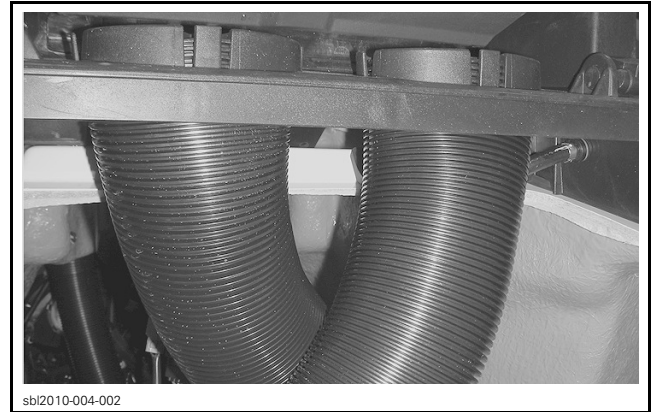
1. First ensure battery is fully charged.

Models with Suspension

2. Lift suspension to gain access.

Models Without Suspension

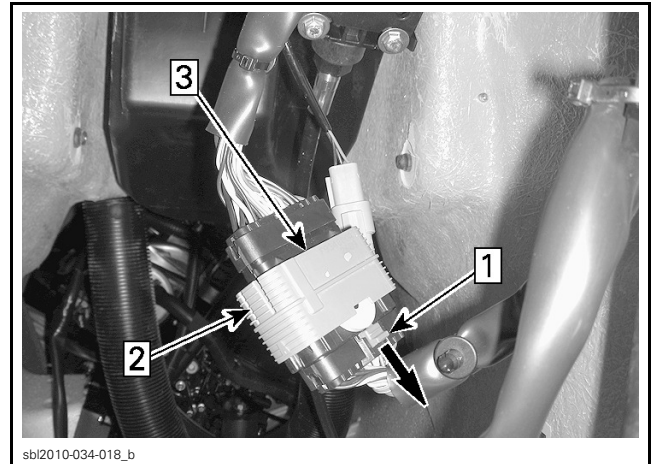
3. Disconnect the top of the two front air ventilation hoses, refer to *BODY* subsection.



FRONT AIR VENTILATION HOSES

All Models

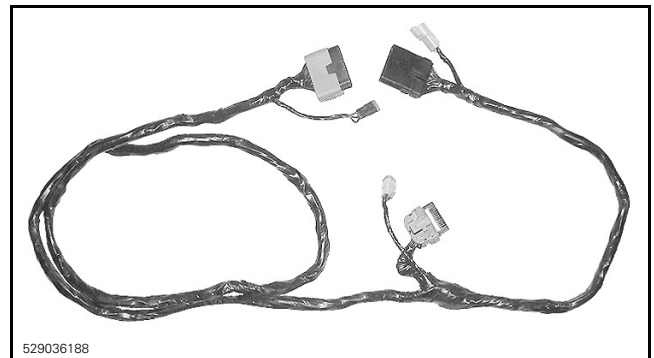
4. From under the steering support area, disconnect the 24-pin connector.



24-PIN STEERING CONNECTOR DISCONNECT

Step 1: Pull out safety lock
Step 2: Press in on release tab
Step 3: Pull locking collar down

5. Connect the DIAGNOSTIC HARNESS (P/N 529 036 188) to make an in-line connection between the disconnected connector.

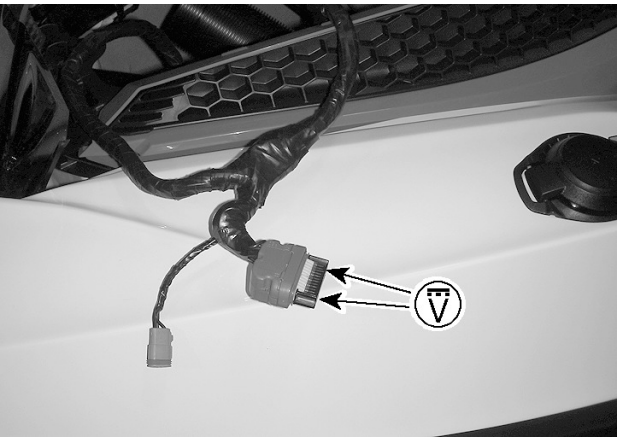


6. Briefly press the START button to wake up the ECM.
7. Install the tether cord on the engine cut-off switch.

Subsection XX (FUEL TANK AND FUEL PUMP)

- 8. Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and select Vdc.
- 9. Measure the voltage at the test connector of the diagnostic harness as follows.

FUEL TANK LEVEL	TEST CONNECTOR OF DIAGNOSTIC HARNESS	VOLTAGE
Full	Pins 5 and 17	0.14 Vdc
Empty		2.7 Vdc



TEST CONNECTOR OF DIAGNOSTIC HARNESS

NOTE: Voltage could be slightly different depending on battery voltage but should remain relatively close to this range. If fuel tank is not full or empty, the voltage value will be proportional to the fuel level (somewhere in-between).

If voltage is as per specifications the fuel level circuit and sensor are good. If fuel level does not work in information center, try a new one.

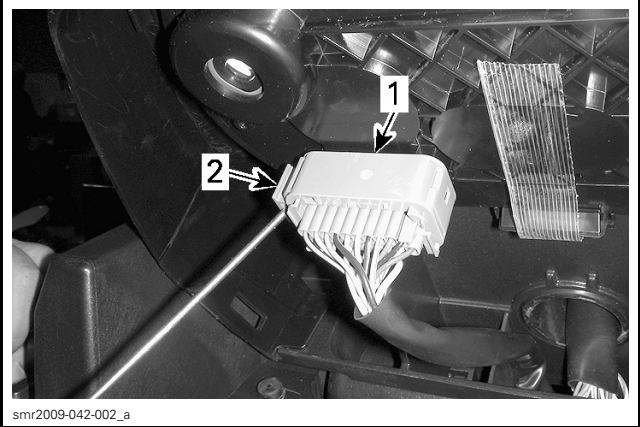
If voltage is out of specifications, test the *FUEL LEVEL SENSOR RESISTANCE AT INFORMATION CENTER* as described in this subsection.

Remove diagnostic harness and reconnect connector.

Testing Fuel Level Sensor Resistance at Information Center

- 1. Disconnect information center (multifunction gauge) connector. Refer to *GAUGE* subsection.

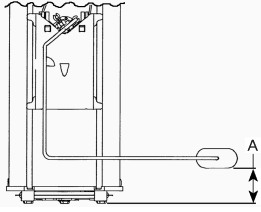
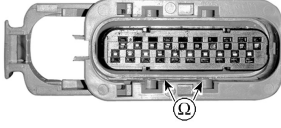
NOTICE Pull connector lock out. Do not twist the screwdriver.



- 1. Gauge connector
- 2. Pull out to unlock connector

- 2. Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and select Ω .
- 3. Alternately drain then fill fuel tank and measure the sensor resistance between pins 19 and 20 as follows.

RESISTANCE (Ω)	FLOAT HEIGHT
4.8 ± 2.2	Maximum (FULL)
47.8 ± 2.2	Middle (HALF)
89.8 ± 2.2	Minimum (EMPTY)



A. Float height

NOTE: If fuel tank is not full or empty, the resistance value will be proportional to the fuel level (somewhere in-between).

If readings are as per specifications, the fuel level circuit and sensor are good. If fuel level does not work in information center, try a new one.

If readings are out of specifications, test the *FUEL LEVEL SENSOR RESISTANCE AT FUEL PUMP*.

If an open circuit is measured, carry out a continuity test of the wiring from the information center to the 24-pin steering connector, and from the 24-pin steering connector to the fuel pump module connector. Refer to *WIRING DIAGRAM*.

If the wiring is good, test *FUEL LEVEL SENSOR RESISTANCE AT FUEL PUMP*.

- 4. Reconnect information center (multifunction gauge) connector.

Testing Fuel Level Sensor Resistance at Fuel Pump

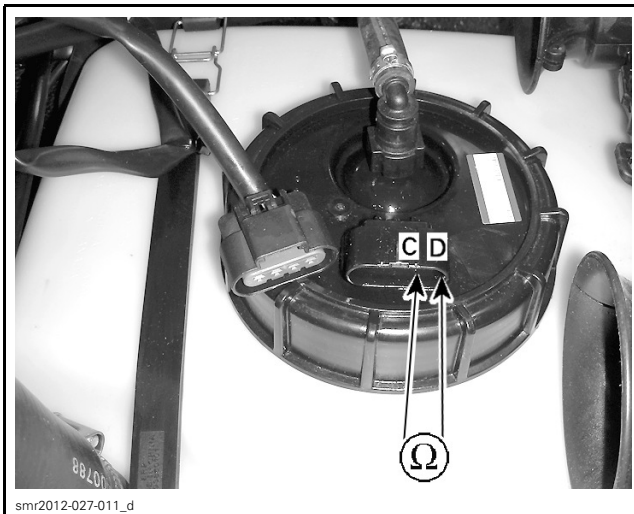
1. Disconnect fuel pump module connector.



FUEL PUMP MODULE

1. Fuel pump module connector

2. Alternately drain then fill fuel tank and measure the sensor resistance between pins "C" and "D" of the fuel pump connector. See table in *TESTING FUEL LEVEL SENSOR RESISTANCE AT INFORMATION CENTER*.

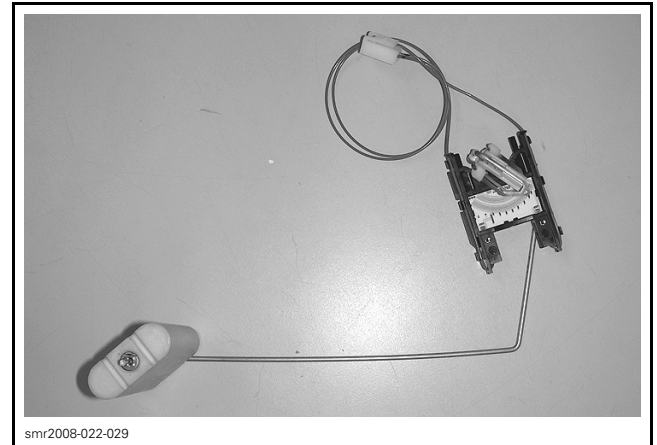


FUEL LEVEL SENSOR RESISTANCE TEST

If readings are out of specifications, replace sensor.

When everything else has been tested and fuel level is still not working, try a new information center.

Removing the Fuel Level Sensor



FUEL LEVEL SENSOR

1. Remove fuel pump module from fuel tank, see *FUEL PUMP REMOVAL* in this subsection.

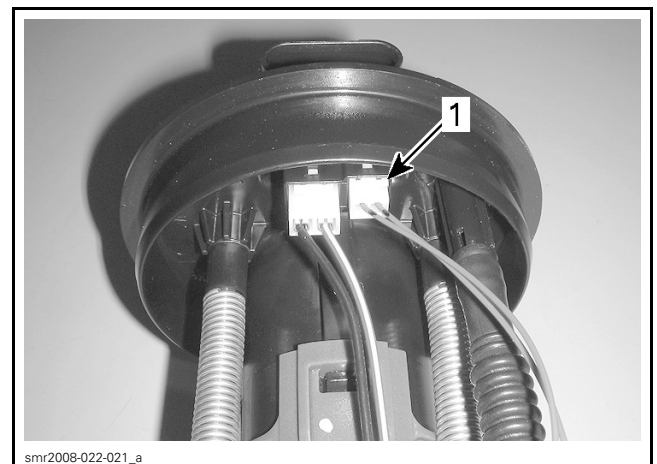
⚠ WARNING

The upper filter and fuel pump reservoir on the fuel pump module contain fuel which will drain out when fuel pump module is not in an upright position.

2. Drain all fuel from the upper fuel filter and fuel pump reservoir in an appropriate container.

NOTE: Note routing of fuel level sensor wires prior to disconnecting the sensor from the fuel pump module flange.

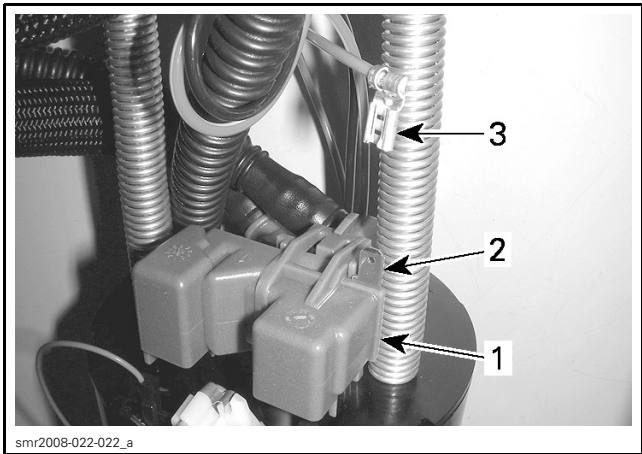
3. Disconnect the fuel level sensor connector from the fuel pump module upper flange.



1. Fuel level sensor connector

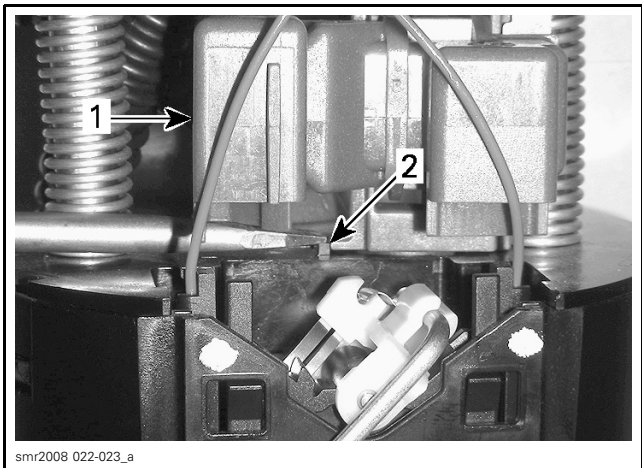
4. Disconnect the ground wire from the pressure regulator. Be careful not to bend the ground contact on the pressure regulator.

Subsection XX (FUEL TANK AND FUEL PUMP)

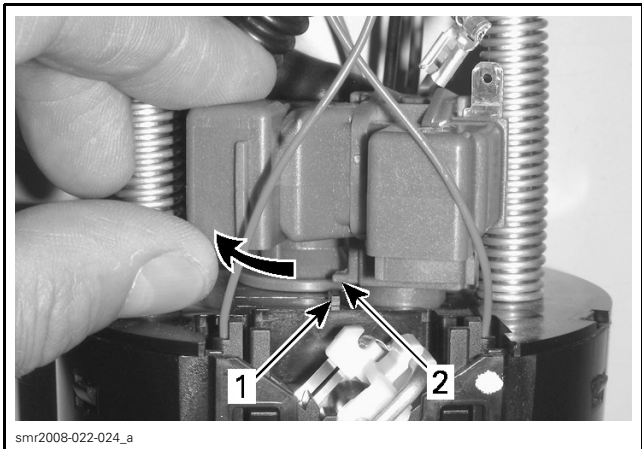


- 1. Pressure regulator
- 2. Ground wire contact on pressure regulator
- 3. Ground wire disconnected

5. Using a flat screwdriver, press down on the locking tab just below the pressure regulator to release it from the pump reservoir cover, and rotate it clockwise simultaneously so that it slips over the locking tab.

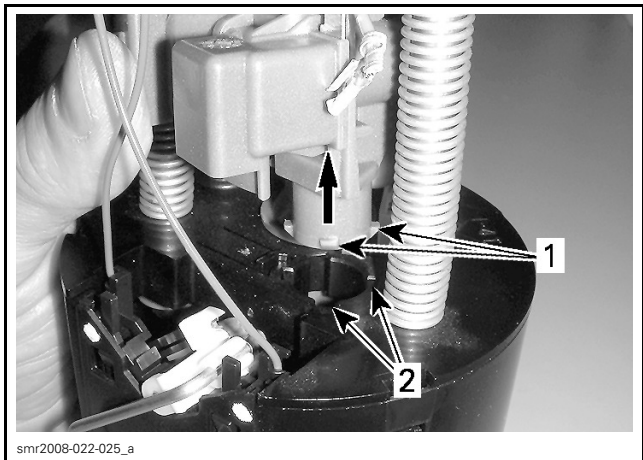


- 1. Pressure regulator
- 2. Pressure regulator locking tab



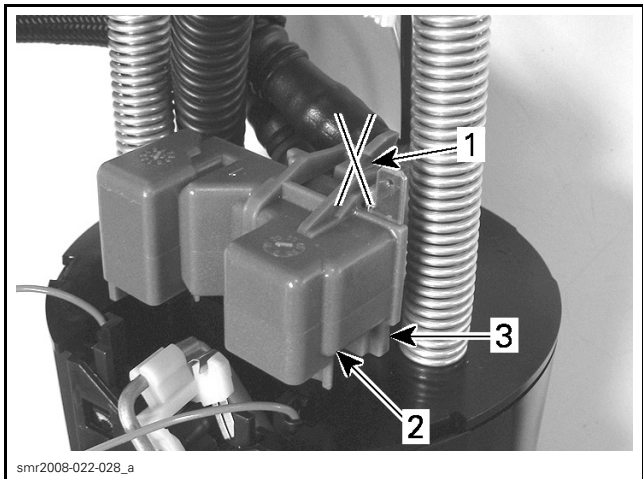
- 1. Pressure regulator locking tab
- 2. Pressure regulator rotated clockwise over locking tab

6. Once the pressure regulator is rotated over the locking tab, pull up on it to remove it from the pump reservoir cover.



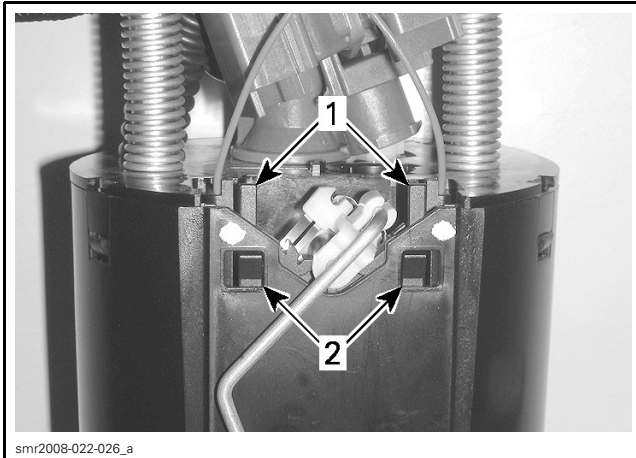
- 1. Pressure regulator alignment tabs
- 2. Fuel pump reservoir alignment tabs

NOTE: The pressure regulator cover must not be removed from the pressure regulator housing assembly.

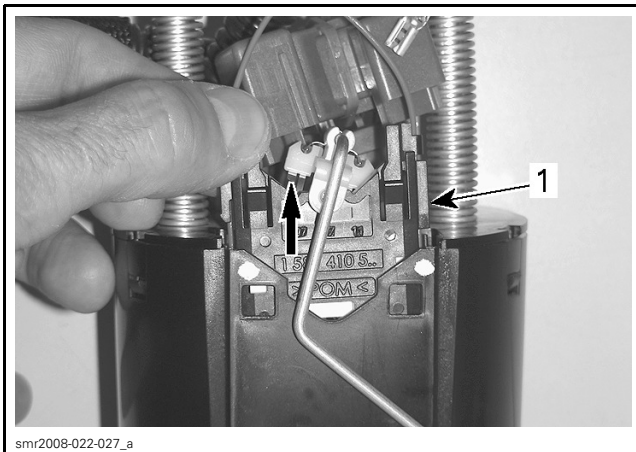


- 1. Do not remove pressure regulator cover at locking tabs
- 2. Pressure regulator cover
- 3. Pressure regulator housing

7. Push in on the release tabs at the top of the fuel level sensor to unlock it from the fuel pump reservoir housing, and simultaneously pull up on the fuel level sensor to remove it.



1. Fuel level sensor release tabs
2. Locking pins

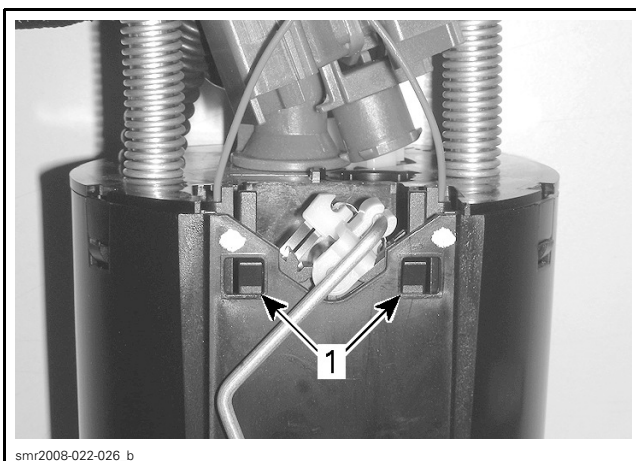


1. Pull up on fuel level sensor

Installing the Fuel Level Sensor

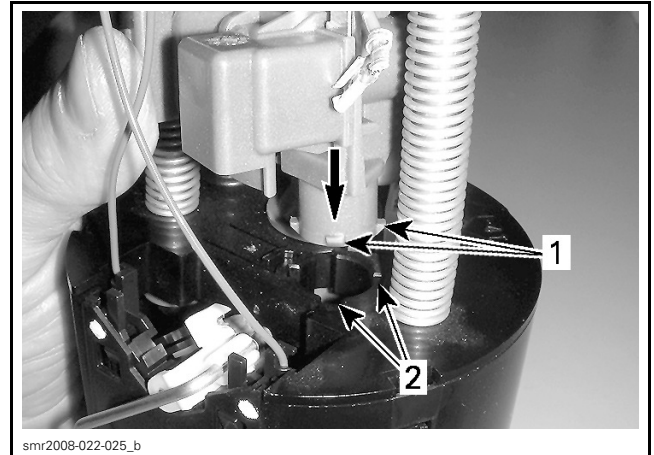
Installation is the reverse of the removal procedure however, pay attention to the following.

1. Ensure fuel level sensor locking pins are properly engaged into the fuel pump reservoir.



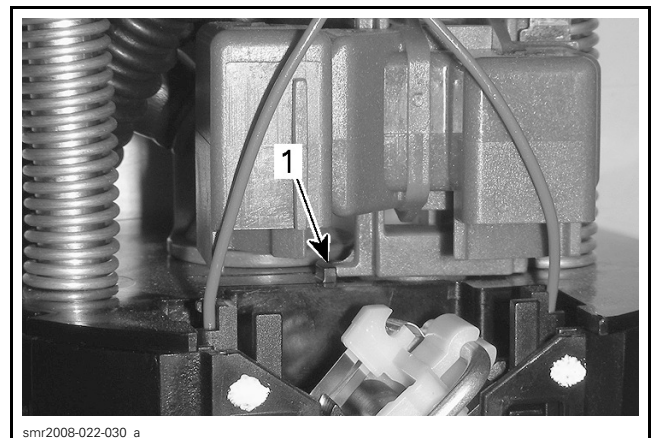
1. Ensure engagement of sensor locking pins

2. Align the fuel pressure regulator tabs into the pump reservoir cover and turn it counterclockwise until it locks properly.



PRESSURE REGULATOR INSERTION INTO PUMP RESERVOIR COVER

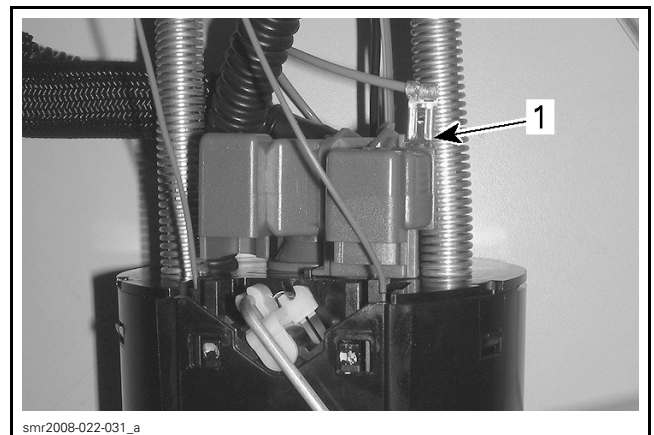
1. Pressure regulator alignment tabs
2. Fuel pump reservoir alignment tabs



TAB UP WHEN PRESSURE REGULATOR PROPERLY LOCKED

1. Pressure regulator locking tab

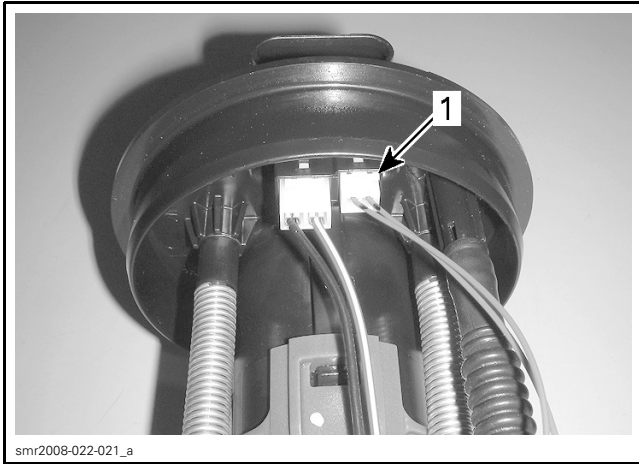
3. Reconnect the ground wire onto the pressure regulator.



1. Pressure regulator ground wire installed

Subsection XX (FUEL TANK AND FUEL PUMP)

4. Ensure fuel level sensor connector is locked into the module flange connector.



1. Fuel level sensor connector

5. Test fuel level sensor resistance as described in this subsection.
6. Reinstall the fuel pump module. Refer to *INSTALLING THE FUEL PUMP* in this subsection.

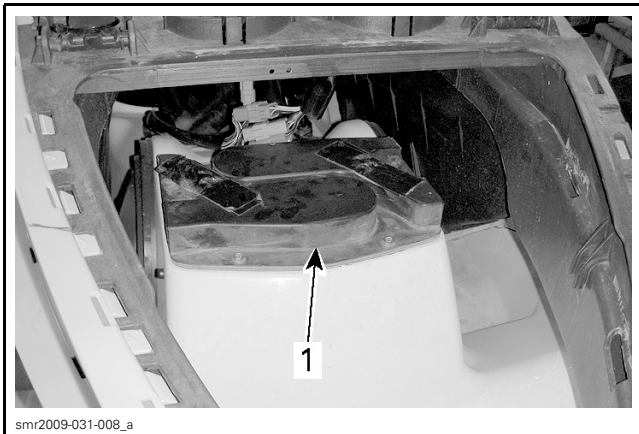
FUEL TANK

Inspecting the Fuel Tank

1. Open front storage compartment cover.
2. Remove storage bin or partitions. Refer to *BODY* subsection.

Models with Suspension

3. Remove front ventilation box.



1. Ventilation box

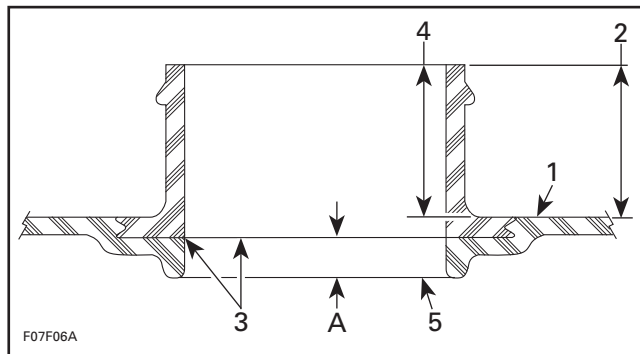
Models Without Suspension

4. Open or remove seat for access to aft end of fuel tank.

All Models

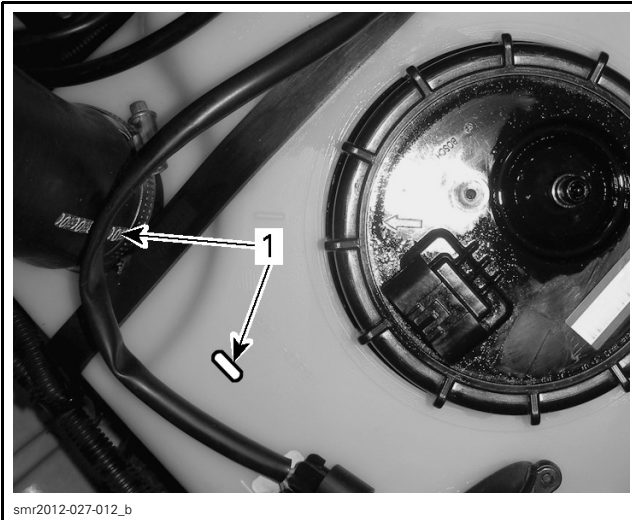
5. Inspect fuel tank retaining straps for wear, cracks or any other damages. Inspect strap clip anchors.
6. Inspect fuel tank for wear caused by any abnormal contact or rubbing with other component(s).
7. Disconnect fuel filler hose from fuel tank.
8. Inspect fuel tank filler hose for wear, cracks or other damages.
9. Visually inspect the inside and outside of the fuel tank filler necks for crack(s). If crack(s) are found, replace fuel tank.
10. With your fingers, feel the inside and outside surfaces of fuel tank, especially near the filler neck.
11. Flex fuel tank neck to ensure there are no hidden cracks.

NOTE: A fuel tank is comprised of 2 components: the tank and the filler neck. The filler neck is injection molded and the tank is then blow molded over the neck. During the molding process, a small molding seam may appear on the inner side of the neck at approximately 4 mm (5/32 in) from the base of the neck. It is normal to have a molding seam and it should not be confused with a crack.



1. Tank upper surface area
 2. Inspect outer upper surface at filler neck
 3. Normal molding seam
 4. Inspect upper surface area inside filler neck
 5. Base of filler neck
- A. Approx. 4 mm (5/32 in)

12. Install filler hose and torque retaining clamps.



INDEXING WITH FUEL TANK

1. Align mark with the writing on hose

TORQUE	
Filler hose retaining clamps	3.5 N•m (31 lbf•in)

13. Reinstall all other removed parts. Refer to appropriate subsection.

Removing the Fuel Tank

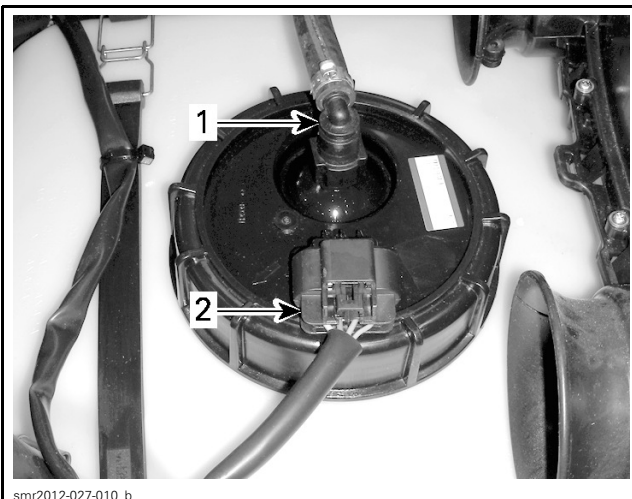
1. Remove engine. Refer to *ENGINE REMOVAL AND INSTALLATION*.

Models with Suspension

2. Remove suspension base. Refer to *SUSPENSION*.

All Models

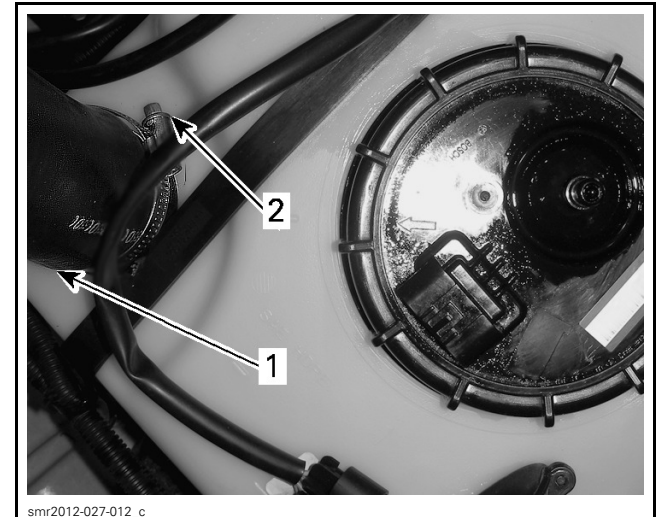
1. Siphon fuel tank.
2. Disconnect fuel pump connections.



1. Quick connect fitting (high pressure fuel hose)
2. Harness connector

3. Disconnect filler hose from fuel tank.

NOTE: Removing retaining screws of the filler neck may help to disconnect hose from fuel tank.



1. Filler hose
2. Retaining clamp

NOTE: Take note of wiring harness, hose and cable routing for proper reinstallation. Also note method used for securing with locking ties.

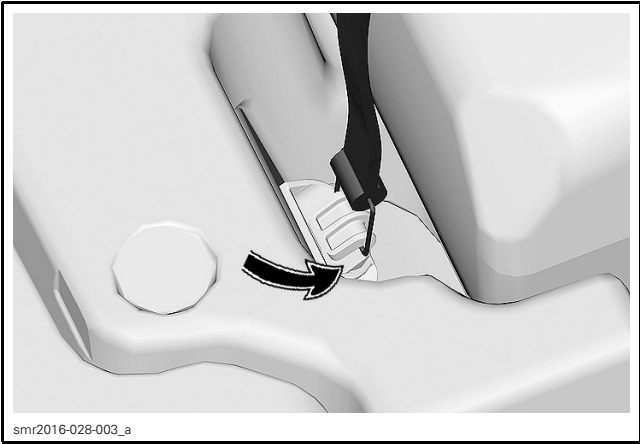
4. Detach fuel tank retaining straps.
5. Remove fuel tank from the vehicle.
6. Remove fuel pump as necessary. Refer to *FUEL PUMP* in this subsection.
7. Inspect hull and flotation foams for wear.

Installing the Fuel Tank

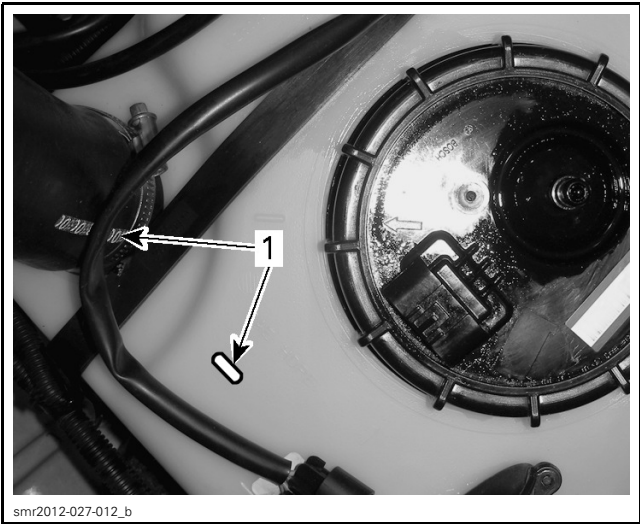
NOTE: Apply torque values as specified in the exploded view.

1. Reinstall fuel pump if it was removed. Refer to *FUEL PUMP* in this subsection.
2. Ensure flotation foams are properly positioned under fuel tank.
3. Insert fuel tank in hull.
4. Place fuel tank retaining strap ends in anchoring clips.

Subsection XX (FUEL TANK AND FUEL PUMP)



- 5. Secure retaining strap ends on top of fuel tank.
- 6. Properly secure wire harness, cables and hose as prior to removal using appropriate locking ties.
- 7. Install fuel tank filler hose as illustrated.



INDEXING WITH FUEL TANK
1. Align mark with the writing on hose

TORQUE	
Filler hose retaining clamps	3.5 N•m (31 lbf•in)

- 8. Reinstall all other removed parts. Refer to their subsections.
- 9. When vehicle reassembly is complete, test fuel tank for leaks as described in this subsection.

Subsection XX (POWER DISTRIBUTION AND GROUNDS)

NO.	DESCRIPTION	
F1	Through relay: – iS control	5 A
F2	Direct power (through F8): – Diagnostic connector	15 A
F3	Direct power (through F8): – START/STOP	3 A
F4	Direct power (through F8): – GPS ²	3 A
F5	Direct power: – iBR power ¹	30 A
F6	Direct power: – Voltage regulator/rectifier	30 A
F7	Direct power: – iS power	30 A
F8	– F2 – F3 – F4 – Relay	30 A
F11	Through relay: – Depth sounder	3 A
F12	Through relay: – O.T.A.S. – Gauge start up – CAPS	3 A
F13	Through relay: – Fuel injector cyl. 1 – Ignition coil cyl. 1	10 A
F14	Through relay: – Fuel injector cyl. 2 – Ignition coil cyl. 2	10 A
F15	Through relay: – Fuel injector cyl. 3 – Ignition coil cyl. 3	10 A
F16	Through relay: – Starter solenoid	5 A
F17	Through relay: – iBR control	5 A
F18	Through relay: – Fuel pump	10 A
F19	Through relay: – ECM power	15 A

Note 2: If so equipped.

RELAY

Relay Pin Identification

The relay is in the fuse box. Refer to *FUSE BOX LOCATION*.

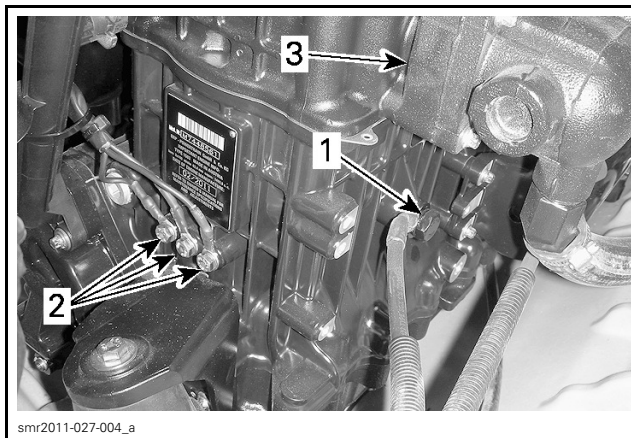
RELAY PIN IDENTIFICATION		
FUNCTION	FUSE BOX PIN	CONDITION
12-volt input at winding	B9	Direct battery power from fuse F8
Control	A11	Grounded by ECM B pin H2 once START/STOP is depressed
12-volt input at contacts	A9	Direct battery power from fuse F8
12-volt output	B11	-

GROUNDS

Ground Location

All the ground terminals are located on the front of engine.

There is no splice in the ground wiring, the inter-connections are made through a bus bar in the fuse box.



FRONT OF ENGINE

1. Battery ground
2. Electrical components grounds
3. Exhaust manifold

IGNITION SYSTEM (1630 ACE HO)

SERVICE TOOLS

Description	Part Number	Page
D.E.S.S. POST REMOVER	529 035 943	6

GENERAL

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to. Locking devices when removed (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.

⚠ WARNING

Never check for engine ignition spark from an open coil and/or spark plug as spark may cause potential fuel vapors to ignite. Always use an approved spark tester.

SYSTEM DESCRIPTION

The engine control module (ECM) controls the ignition system, as well as many other engine related functions.

The battery supplies power to the primary side of the ignition coils through a relay while the ECM completes the circuit to each coil primary winding by switching it to ground at the appropriate moment.

The ignition system is a digital inductive type system.

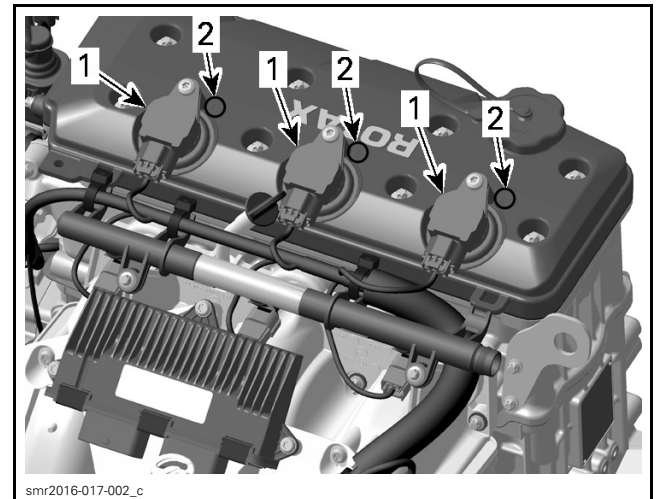
Ignition system parameters such as ignition timing, dwell time and firing order are controlled by the ECM in order to meet engine operational requirements.

Direct ignition coils (stick coils) are used for each cylinder.

Three separate ignition coils receive power from three separate fuses.

When a ground signal is provided by the ECM to an ignition coil primary winding, a high voltage is induced in the coil secondary winding that is used to produce a spark at the spark plug electrode.

Cylinder 1 is located on the PTO side of the engine. Each cylinder is identified by a number on the valve cover.



1. Ignition coils
2. Cylinder identification number on valve cover

Ignition Timing

Ignition timing is not adjustable.

The ECM is programmed with ignition maps that it uses along with data received from a variety of sensors to establish optimum ignition timing under all engine operating conditions.

The firing of each spark plug is independent of the others.

Engine RPM Limiter

The ECM will limit the maximum engine speed by cutting off ignition spark and fuel at a predetermined engine RPM.

RPM LIMITER
8300 RPM

Knock Sensor

A knock sensor is mounted on the cylinder block behind the intake manifold. It detects specific vibrations that would typically be generated by engine detonation.

Subsection XX (IGNITION SYSTEM (1630 ACE HO))

If detonation occurs, the knock sensor detects it and the ECM goes into a specific operating mode whereby it temporarily retards the ignition advance until detonation stops.

The ECM is able to identify in which cylinder the knocking occurs and modifies the ignition advance on that cylinder only.

Refer to the *ELECTRONIC FUEL INJECTION (EFI)* subsection for testing and replacement procedures.

TROUBLESHOOTING

It is good practice to check for fault codes using the B.U.D.S. as a first troubleshooting step. Refer to *DIAGNOSTIC AND FAULT CODES* subsection.

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

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

TESTING THE IGNITION SYSTEM

1. Ensure fuses F13, F14 and F15 are powered and in good condition.
2. If a fuse is burnt, test for a short circuit or faulty component on that fuse circuit before replacing the fuse.

WARNING

Due to the possibility of flammable vapors accumulating in the bilge, you should always test for a short circuit which may produce a spark and ignite the vapors before replacing a burnt fuse.

3. If there is no active fault code, start diagnostic by testing *IGNITION COIL USING B.U.D.S.*
4. If a primary winding of an ignition coil or a circuit is at fault, a fault code will be set. Refer to *DIAGNOSTIC AND FAULT CODES* subsection.

DIAGNOSTIC GUIDELINES

The following is provided to help in diagnosing the probable cause of a problem. It is a guideline and should not be assumed to list all possible causes.

ENGINE WILL NOT STOP WHEN REMOVING KEY FROM ENGINE CUT-OFF SWITCH

1. Defective engine cut-off switch
 - Check engine cut-off switch. Replace if necessary.

ENGINE WILL NOT START (ENGINE TURNS OVER)

1. Fouled or defective spark plug
 - Check spark plug condition. Replace if necessary.
2. Defective CPS
 - Test CPS, refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.
3. Defective trigger wheel
 - Check. Refer to *PTO HOUSING, MAGNETO AND STARTER* subsection.
4. Defective ignition circuit
 - Check fuses, ignition coils, wiring and connectors.

ENGINE HARD TO START

1. Faulty, fouled or worn out spark plug
 - Check spark plug condition. Replace if necessary.
2. Drowned engine
 - Check engine temperature value using B.U.D.S. monitoring page. If the temperature read is lower than the ambient temperature, CTS sensor may be defective or have a bad connection. Therefore, the ECM would erroneously set the engine in cold start mode and it could flood the spark plugs.

ENGINE MISFIRES, RUNS IRREGULARLY

1. Fouled, defective, worn spark plugs
 - Check spark plug condition. Replace if necessary.
2. Defective T.O.P.S. sensor
 - Test T.O.P.S. Refer to *LUBRICATION* subsection.
3. Damaged trigger wheel/loose CPS
 - Check. Refer to *PTO HOUSING, MAGNETO AND STARTER* subsection.
4. Defective ignition circuit
 - Check fuses, ignition coils, wiring and connectors.
5. Poor engine grounds
 - Check ground condition, refer to *POWER DISTRIBUTION AND GROUNDS* subsection.

ENGINE CONTINUALLY BACKFIRES

1. Fouled, defective spark plugs
 - Check spark plug condition. Replace if necessary.
2. Damaged trigger wheel/defective or loose CPS
 - Check, refer to *PTO HOUSING, MAGNETO AND STARTER* and *ELECTRONIC FUEL INJECTION (EFI)* subsections.

ENGINE DETONATION OR PINGING

1. Faulty or disconnected knock sensor
 - Check, refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.

ENGINE LACKS ACCELERATION OR POWER

1. Weak spark
 - Check spark plugs, coils, wiring and connections.

PROCEDURES

IGNITION COILS

⚠ WARNING

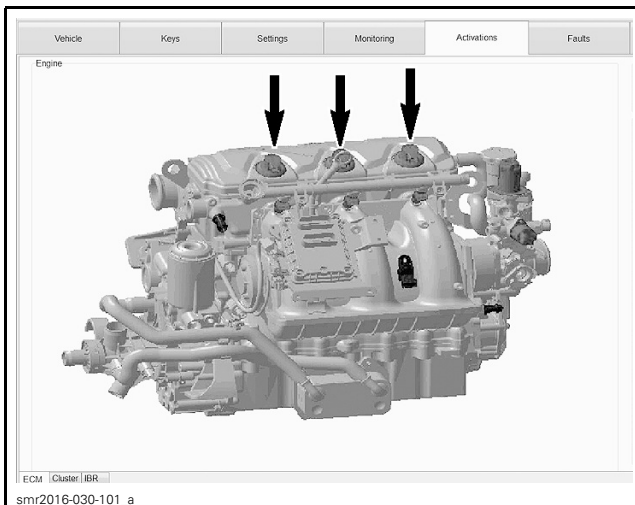
Never check for engine ignition spark from an open coil and/or spark plug in the engine compartment as a spark may cause fuel vapors which may have accumulated in the bilge to ignite.

Ignition Coil Location

1. Open or remove seat.
- Ignition coils are located on top of the valve cover.

Testing the Ignition Coil Using B.U.D.S.

1. Connect to the latest applicable B.U.D.S. software. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* section.
2. Select the **Activation** and **ECM** tabs.
3. Energize the ignition coil to be tested by clicking on the corresponding illustration.



You should hear the spark occurring. If in doubt, use a sealed **vapor proof** spark tester or an inductive spark tester as available from tool suppliers, to prevent a spark from occurring in the bilge.

If there is no ignition at one or more coils, carry out *TESTING THE IGNITION COIL INPUT VOLTAGE*.

If spark is weak, try a new spark plug. If spark is still weak, try a new ignition coil.

NOTE: The voltage required to produce a spark in the combustion chamber is higher when the engine is running.

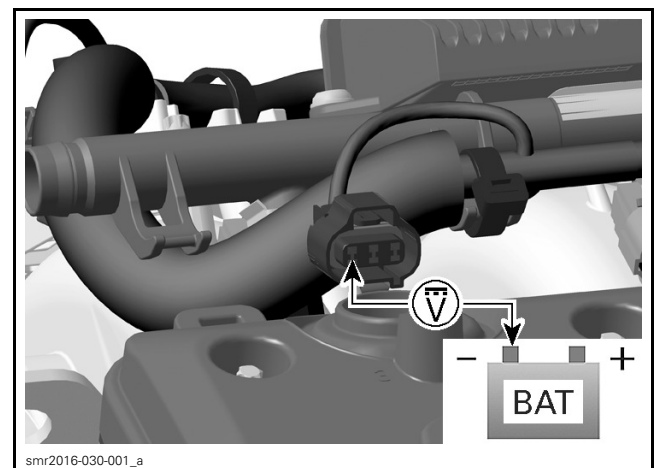
Testing the Ignition Coil Input Voltage

Make sure fuses F13, F14 and F15 are good before testing.

1. Disconnect the applicable ignition coil connector.
2. Remove tether cord from the engine cut-off switch.
3. Press the START button to activate the ECM.
4. Measure voltage within 3 minutes after depressing START/STOP button.

Set multimeter to Vdc.

TEST PROBES		VOLTAGE
VIOLET/BLUE wire (ignition coil no. 1)	Battery ground	Battery voltage
VIOLET/GREEN wire (ignition coil no. 2)		
VIOLET/ORANGE wire (ignition coil no. 3)		



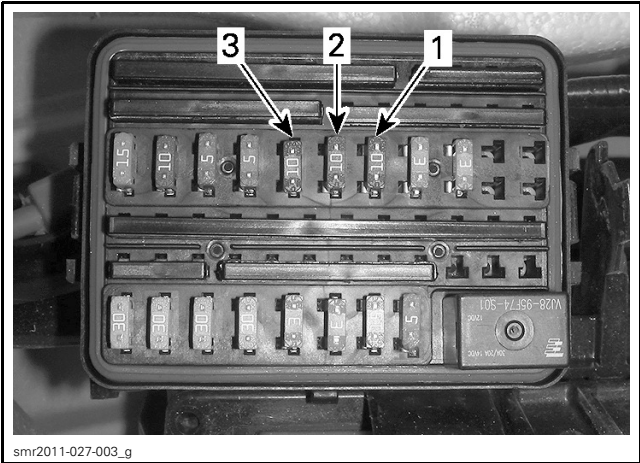
IGNITION COIL INPUT VOLTAGE TEST

If test succeeds, carry out *TESTING THE IGNITION COIL RESISTANCE*.

If test fails, carry out *TESTING THE IGNITION COIL POWER CIRCUIT CONTINUITY*.

Testing the Ignition Coil Power Circuit Continuity

1. Remove fuses F13, F14 and F15.

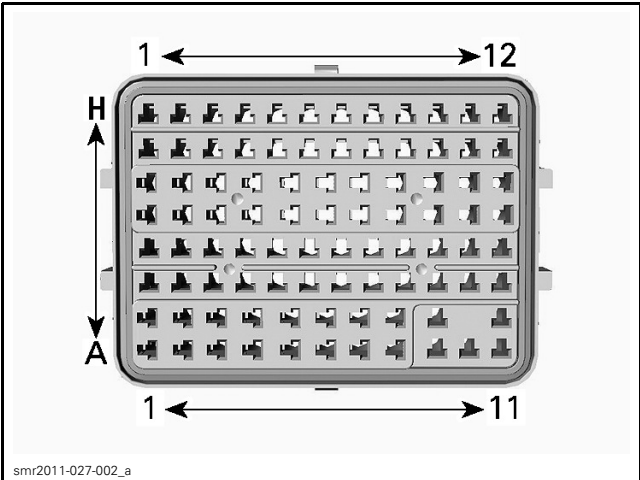


- 1. Fuse F13
- 2. Fuse F14
- 3. Fuse F15

2. Read resistance of the desired ignition coil circuit.

Set multimeter to Ω .

IGNITION COIL	IGNITION COIL WIRE	FUSE BOX	MEASUREMENT
1 (rear)	VT/BU	Terminal F7	Close to 0 Ω
2	VT/GN	Terminal F6	
3	VT/OR	Terminal F5	



FUSE BOX PIN IDENTIFICATION

If test fails at any ignition coil, test the following items separately and repair/replace wiring or terminals from fuse box to the applicable ignition coil.

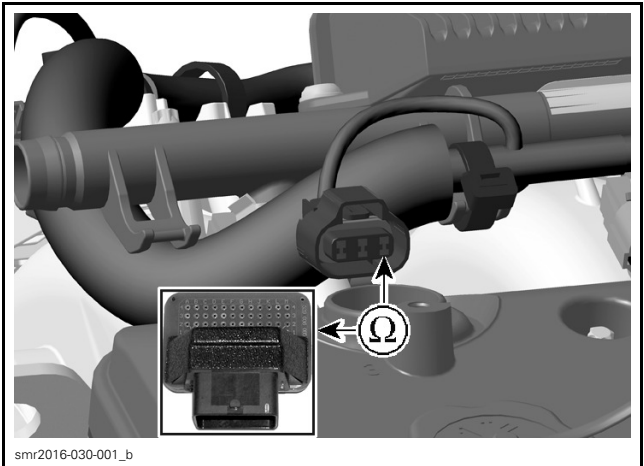
- Wiring from fuse box to engine C04-4POS connector
- Wiring from C04-4POS connector to ignition coil.

Refer to *WIRING DIAGRAM* for details.

Testing the Ignition Coil Control Circuit Continuity

1. Disconnect ECM connector "A". For connector identification, refer to *WIRING HARNESS AND CONNECTOR* subsection.
2. Connect ECM connector to the adapter.
3. Disconnect ignition coil connector.
4. Test for continuity of circuit as per following table.

COIL	IGNITION COIL WIRE	ECM ADAPTER	RESISTANCE
Cylinder 1 (rear)	BR/BK	A-M4	Close to 0 Ω (continuity)
Cylinder 2	BR/OR	A-M2	
Cylinder 3	BR/YL	A-M1	



IGNITION COIL CONTROL CIRCUIT TEST

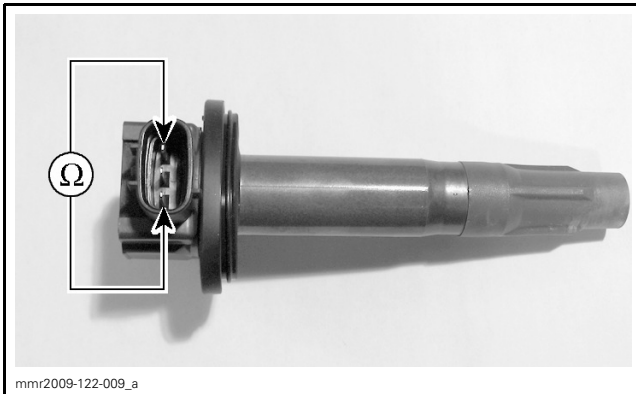
If test fails, repair the connector or replace the engine wiring harness.

Testing the Ignition Coil Resistance

An ignition coil with a good resistance measurement can still be faulty. Current leakage can occur at high voltage levels which is not detectable with an ohmmeter. Replacing the ignition coil may be necessary as a test.

Primary Winding

1. Remove ignition coil. Refer to *REMOVING THE IGNITION COIL* in this subsection.
2. Perform a visual inspection of the ignition coils. Check for corrosion, bent pins, loose or burnt contacts, and cracked or torn insulator.
3. Using a multimeter, measure the resistance of the primary winding.



PRIMARY WINDING

TERMINAL	RESISTANCE @ 20°C (68°F)
1 and 3	0.80 - 0.97 Ω

If test fails, replace ignition coil.

If test succeeds, carry out *TESTING THE IGNITION COIL CONTROL CIRCUIT CONTINUITY*.

Secondary Winding

The secondary winding on this type of ignition coil cannot be tested.

Removing the Ignition Coil

1. Disconnect ignition coil connector.

NOTICE Do not pry on ignition coil using any tool.

2. Remove ignition coil retaining screw.
3. Remove ignition coil from spark plug by rotating coil side to side as you pull up.

Installing the Ignition Coil

1. Install ignition coil on spark plug.
2. Align the retaining screw hole of the ignition coil with the threaded hole on the valve cover.
3. Push the ignition coil all the way down until it rests on the valve cover.
4. Install and tighten retaining screw.

TIGHTENING TORQUE

Ignition coil retaining screw	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)
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5. Reconnect ignition coil connector.

SPARK PLUGS

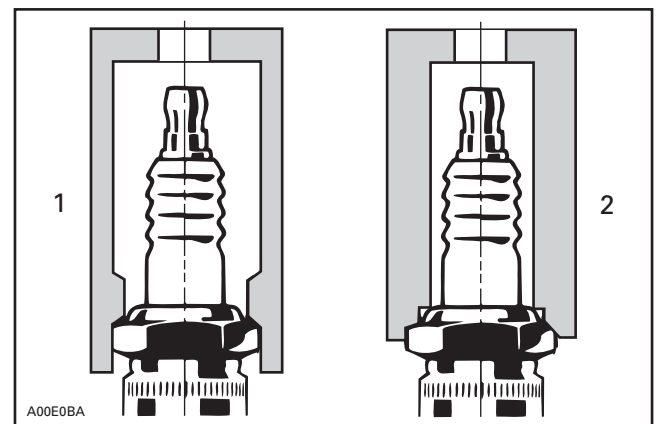
Removing the Spark Plug

1. Remove ignition coil. Refer to *IGNITION COIL REMOVAL* in this subsection.

WARNING

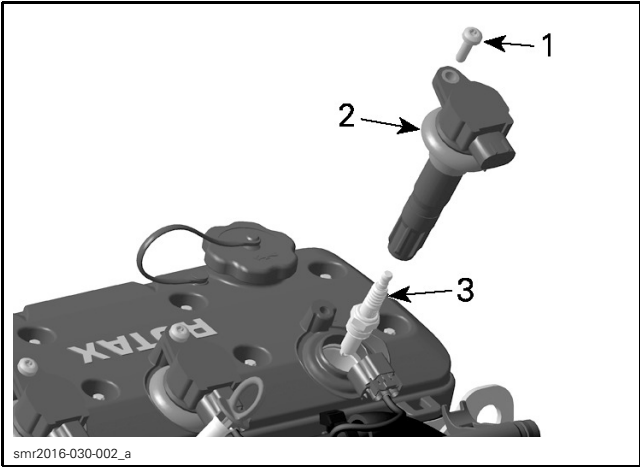
Never remove an ignition coil from a spark plug without disconnecting it from the wiring harness. Flammable vapors may be present in the bilge. Should the tether cord be installed on the engine cut-off switch, a spark could be generated at the spark plug end of the coil possibly resulting in an explosion.

2. Using a spark plug socket, release the torque applied to the spark plug.



1. Approved socket
2. Improper socket

3. Clean the spark plug and cylinder head with pressurized air.
4. Unscrew spark plug then use the ignition coil to take spark plug out of spark plug hole.



1. Retaining screw
2. Ignition coil
3. Spark plug

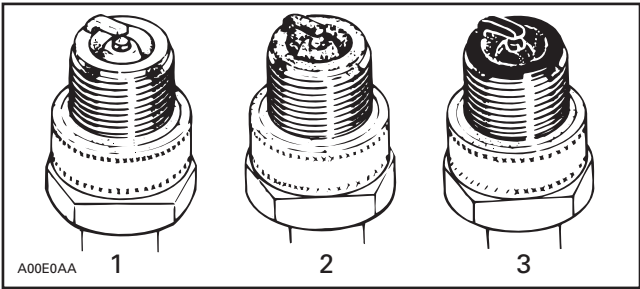
Troubleshooting a Fouled Spark Plug

Fouling of the spark plug is indicated by irregular running or misfiring of the engine, decreased engine speed due to misfiring, reduced performance, and increased fuel consumption.

Other possible causes are: use of an incorrect or bad fuel, defective ignition system, incorrect spark plug gap, loss of compression, or lubricating oil entering the combustion chamber.

The plug face of a fouled spark plug has either a wet or dry black carbon deposit. Such coatings form a conductive connection between the center electrode and the ground electrode.

Spark Plug Analysis



TYPICAL
1. Overheated (light gray, white)
2. Normal (light brown, brown)
3. Fouled (black, wet or dry, dark deposits, gray, melted coating)

The plug face reveals the condition of the engine, operating condition, method of driving and fuel mixture. For this reason it is advisable to inspect the spark plug at prescribed intervals, examining the plug face (i.e. the part of the plug projecting into the combustion chamber).

Installing the Spark Plug

Prior to installation, ensure the contact surfaces of the cylinder head and spark plug are free of grime.

- 1. Using a wire feeler gauge, set electrode gap as specified in the *TECHNICAL SPECIFICATIONS*.
- 2. Hand screw spark plug into cylinder head.
- 3. Then tighten the spark plug clockwise to specification using an approved spark plug socket.

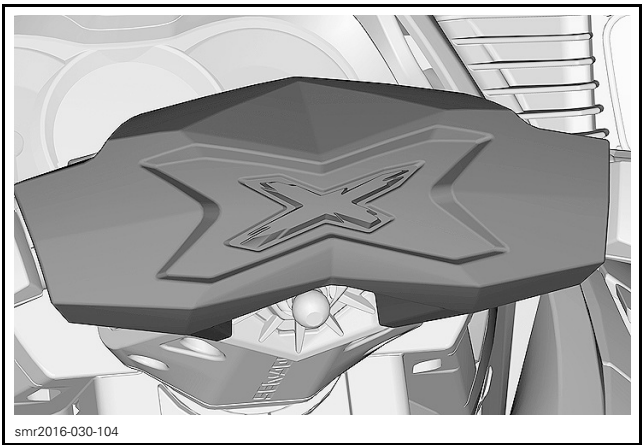
TIGHTENING TORQUE	
Spark plug	17 N•m ± 2 N•m (150 lbf•in ± 18 lbf•in)

- 4. Install ignition coil. Refer to *INSTALLING THE IGNITION COIL* in this subsection.
- 5. Complete the installation in the reverse order of the removal.

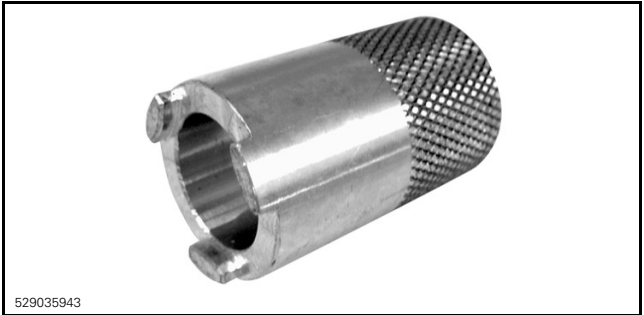
ENGINE CUT-OFF SWITCH

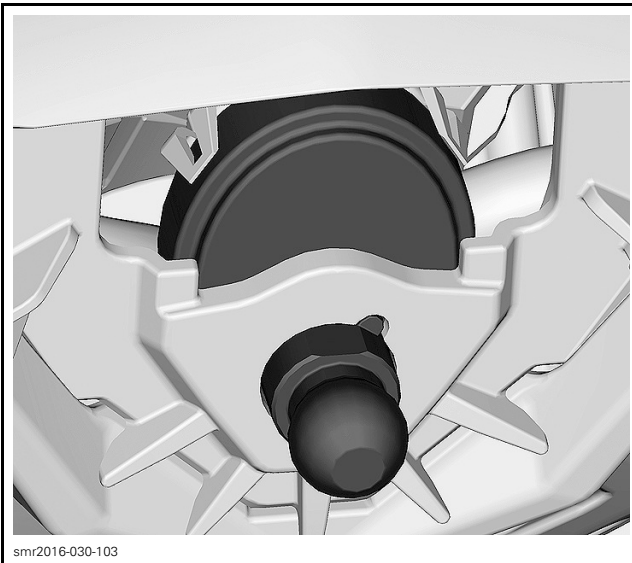
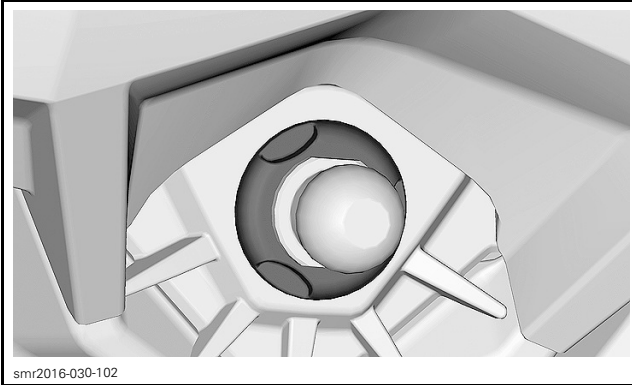
Refer to D.E.S.S. subsection for operation.

Replacing the Cut-Off Switch



REQUIRED TOOL
D.E.S.S. POST REMOVER (P/N 529 035 943)





CHARGING SYSTEM

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
ELECTRO SPECIALTIES BATTERY LOAD TESTER.....	710	7
EXTECH INDUCTIVE AMMETER	380941	2

GENERAL

NOTICE When performing a test on iS models with the engine running above approximately 4500 RPM for 3 seconds, be aware that the suspension will move to its predefined up position and then stop in that position. Wait until suspension is stopped before working on the watercraft. Keep away from moving parts.

SYSTEM DESCRIPTION

The purpose of the charging system is to maintain the battery at a full state of charge and to provide the electrical system with the required electrical power for normal vehicle operation.

Magneto

The magneto is the primary source of electrical energy. It transforms a magnetic field into an electric current (AC).

The magneto has a 3 phase, delta wound, 18 pole stator that is rated at 420 watts.



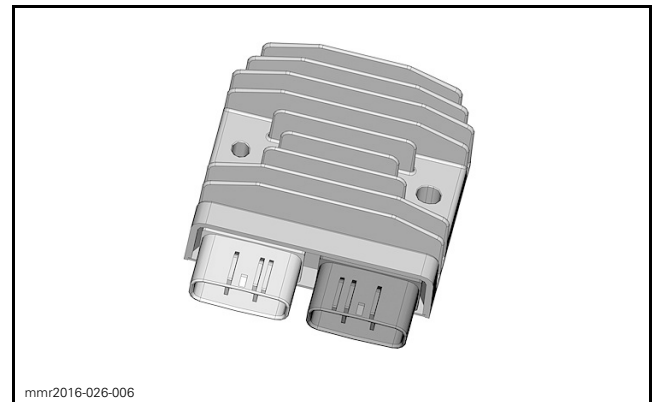
F18H1RA

TYPICAL

Voltage Regulator/Rectifier

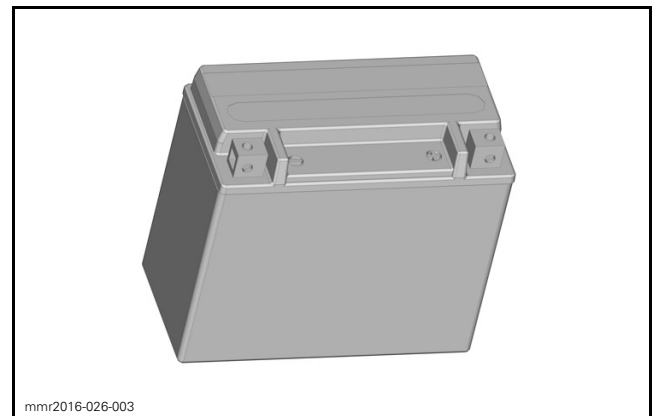
The rectifier receives AC current from the magneto and transforms it into direct current (DC).

The voltage regulator, included in the same unit, limits voltage to a maximum level to prevent any damage to electrical components.



mmr2016-026-006

Battery



mmr2016-026-003

The battery supplies DC power to the electric starter for cranking the engine. During engine starting, it also supplies DC power to every electrical and electronic system in the vehicle as well as all accessories.

At low engine RPM operation and high current load conditions, it supplements the magneto output and helps to maintain a steady system voltage.

2. Start engine.

NOTE: Connect a garden hose to cool exhaust system. Refer to *EXHAUST SYSTEM* subsection.

3. Increase engine RPM as specified in the following table and read current with the ammeter.

TEST ENGINE SPEED	CURRENT
5500 RPM	Approx. 10 A (while suspension does not move)

NOTE: Initial current reading will be higher than specified due to the battery drain from the engine start. This is an indication that the charging system is operating normally. Current load will come down as the battery recovers its charge.

If current reading is far below specification, test stator output and wiring harness prior to concluding the voltage regulator/rectifier is faulty.

NOTE: If the battery is in poor condition or is not at a full state of charge, current reading will be above specification. Refer to *BATTERY* in this subsection for battery testing.

TROUBLESHOOTING

DISCHARGED OR WEAK BATTERY

1. Battery posts and/or cable terminal oxidized.
 - Clean battery terminals, posts, and coat with dielectric grease.
2. Loose or bad connections.
 - Check for wiring and connector tightness, frayed or broken wires. Repair or replace cables or connectors.
3. Worn or faulty battery (sulfated, fretting, shorted plates or cell, damaged casing, loose post).
 - Test BATTERY VOLTAGE (LOAD APPLIED).
 - Replace battery.
4. Burnt fuse(s) or faulty rectifier.
 - First check fuse(s). If in good condition, check voltage regulator/rectifier.
5. Faulty stator.
 - Test stator and replace as required.

6. Parasitic or "Key Off" current loads.

- Isolate, reduce or eliminate such loads.
- Recharge battery as recommended if vehicle is not used for extended periods of time.

NOTE: "Key Off" or parasitic loads may be loads due to installed accessories. Parasitic loads may also be due to water infiltration in connectors, or partial short circuits that slowly drain a battery without causing a fuse to burn.

LOW OR NO CHARGING SYSTEM VOLTAGE

1. Blown F6 fuse.
 - Check F6 fuse.
2. Defective stator.
 - Test stator. Refer to PTO HOUSING, MAGNETO, AND STARTER subsection.
3. Defective charging system wiring or connections.
 - Check for damaged wiring.
 - Check for damaged or loose connections.

REPETITIVE BLOWN F6 FUSE

1. Voltage regulator/rectifier internal circuit shorted to ground.
 - Refer to TESTING VOLTAGE REGULATOR/RECTIFIER FOR BLOWN F6 FUSE in this subsection.

PROCEDURES

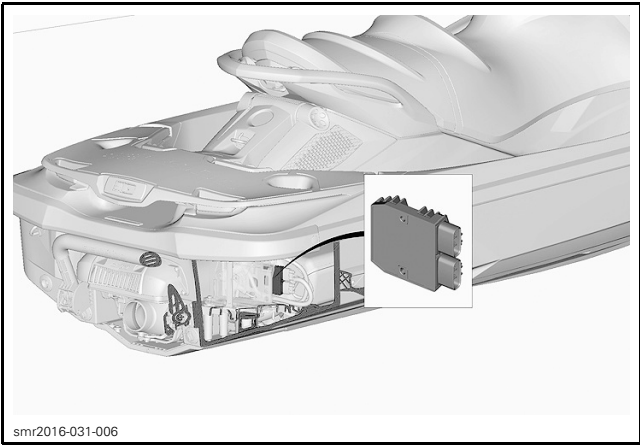
VOLTAGE REGULATOR/RECTIFIER

Testing the Voltage Regulator Continuity

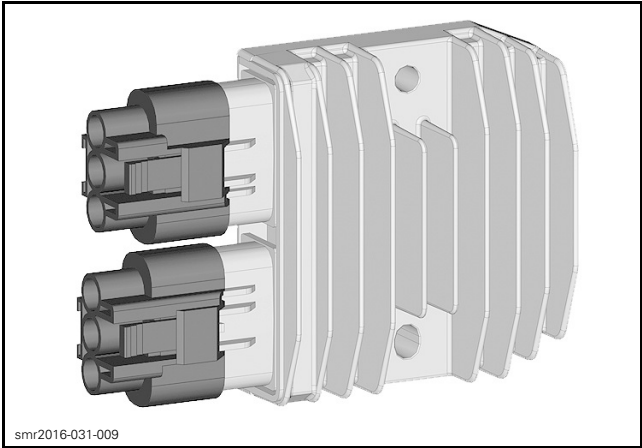
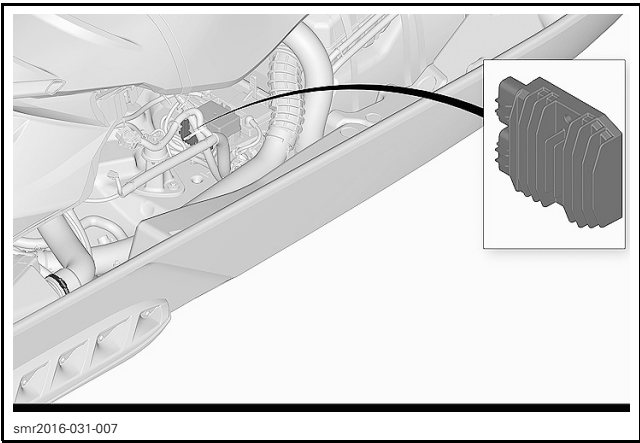
Due to internal circuitry, there is no static test available to check continuity.

Voltage Regulator/Rectifier Location

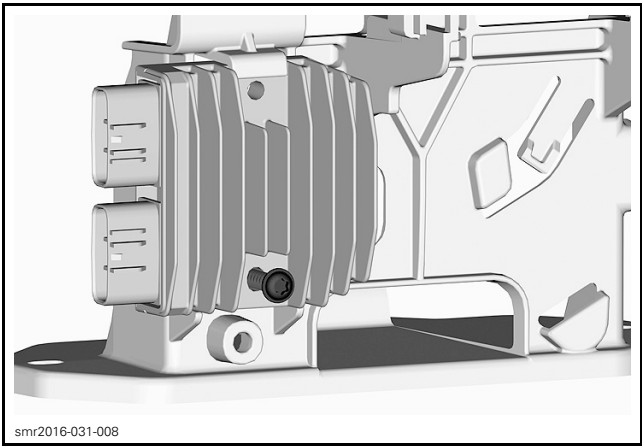
Models with suspension



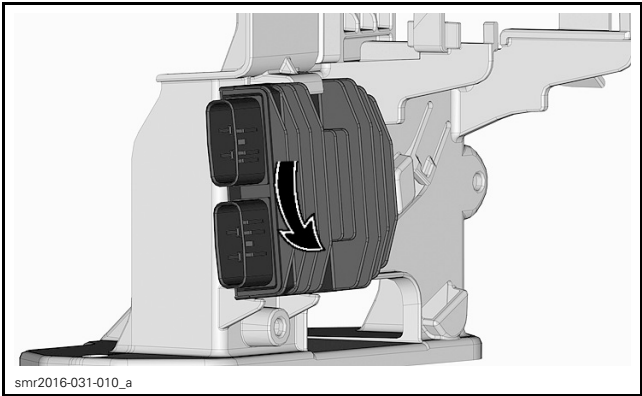
Models without suspension



2. Remove screw.



3. Rotate and remove regulator/rectifier.



Testing Voltage Regulator/Rectifier for Blown F6 Fuse

1. Detach the voltage regulator/rectifier from the electrical component support. Refer to *REMOVING THE VOLTAGE REGULATOR/RECTIFIER* in this subsection.
2. Disconnect the voltage regulator/rectifier 2-wire connector.
3. Install a new fuse.

If the fuse still burns, check for a shorted wire or connector pin.

If fuse does not burn, replace regulator/rectifier.

Removing the Voltage Regulator/Rectifier

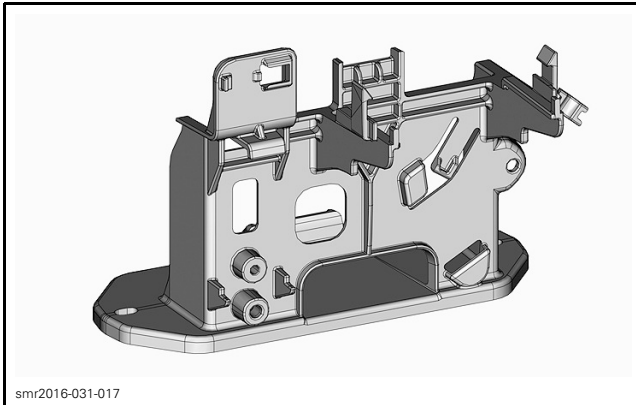
1. Disconnect both connectors from the voltage regulator/rectifier.

Installing the Voltage Regulator/Rectifier

Installation is the reverse of the removal procedure

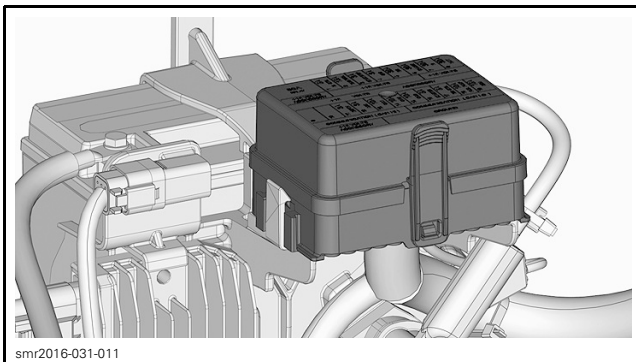
TIGHTENING TORQUE	
Regulator/Rectifier Screw	5 N•m ± 1 N•m (44 lbf•in ± 9 lbf•in)

ELECTRICAL COMPONENT SUPPORT

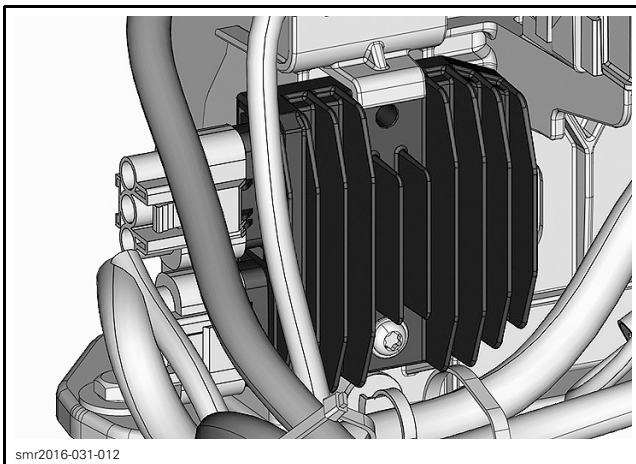


Removing the Electrical Component Support

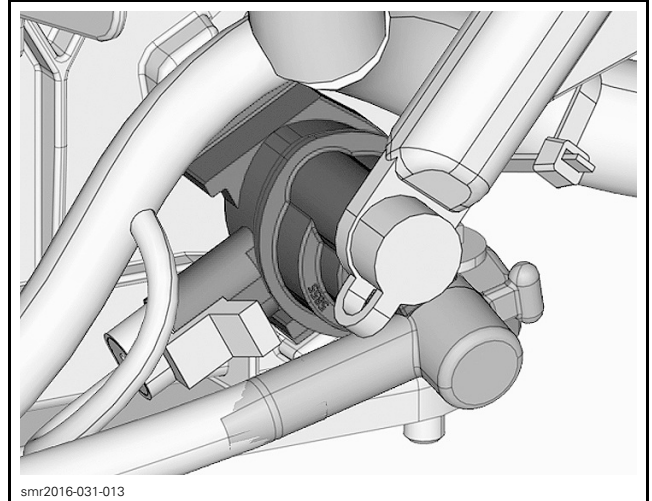
Remove the following components from the electrical component support.



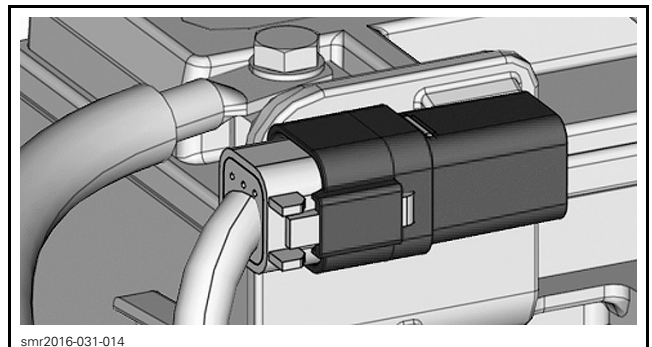
FUSE BOX



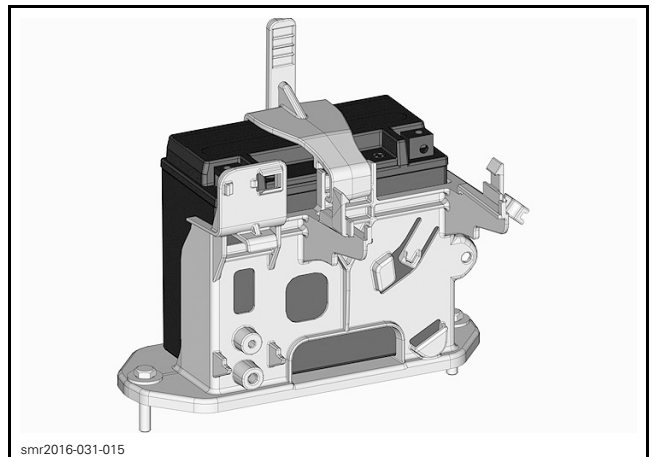
REGULATOR/RECTIFIER



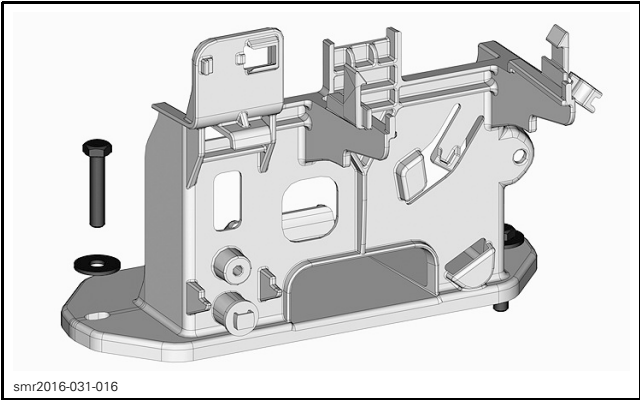
STARTER SOLENOID



DIAGNOSTIC CONNECTOR



BATTERY



RETAINING SCREWS

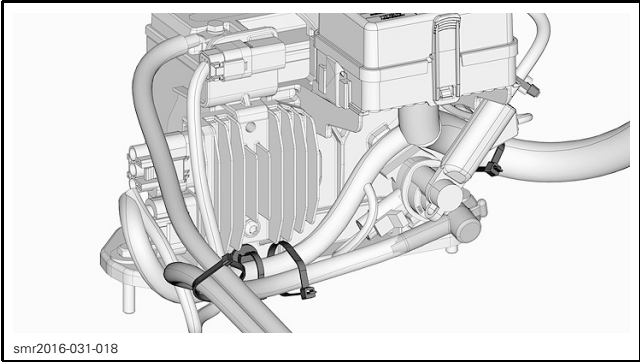
Installing the Electrical Component Support

Installation is the reverse of removal procedure.

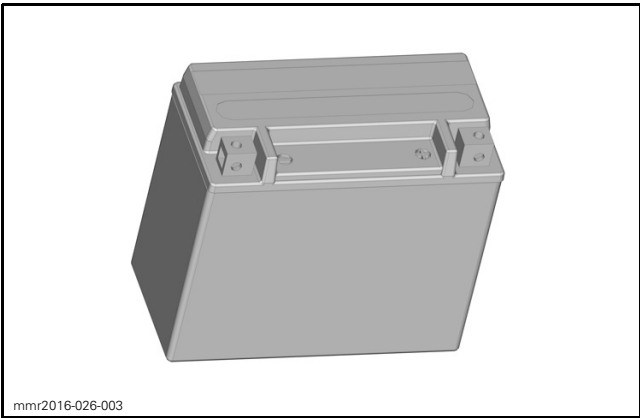
TIGHTENING TORQUE	
Retaining Screws	16 N•m ± 2 N•m (142 lbf•in ± 18 lbf•in)

**WARNING**

Replace all locking ties.

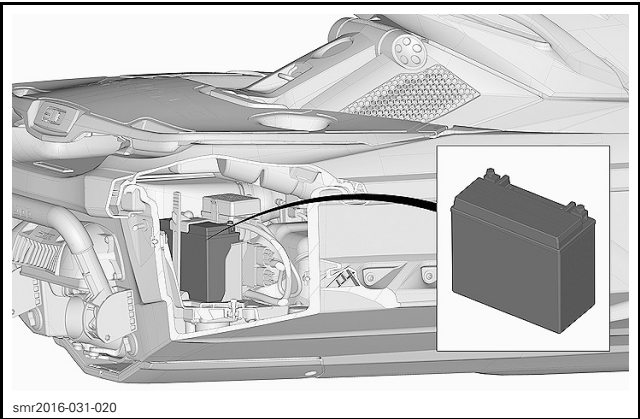


BATTERY

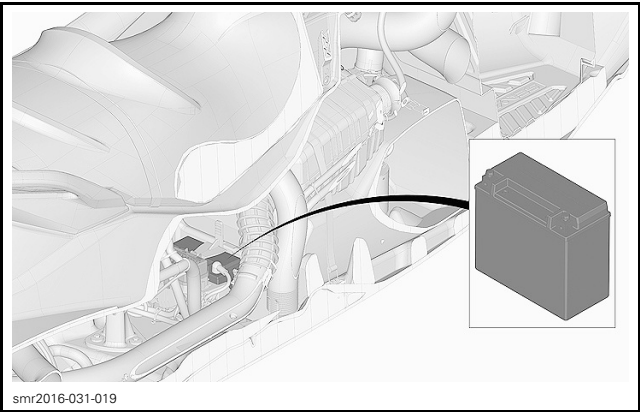


Battery Location

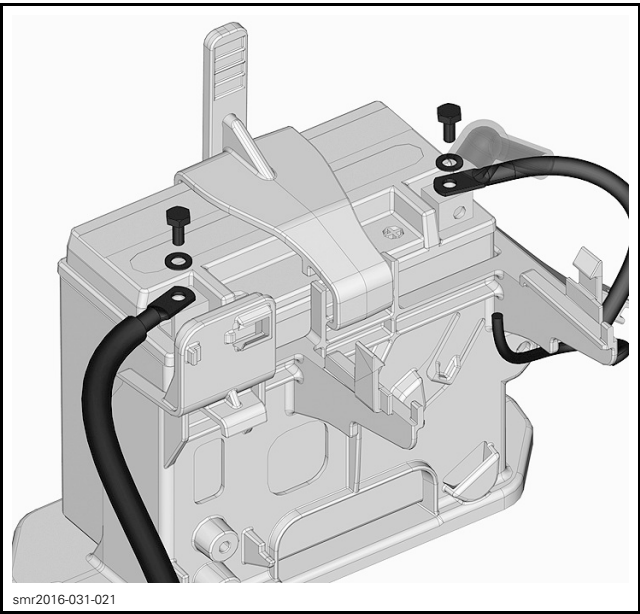
Models with suspension



Models without suspension



Removing the Battery



Cleaning the Battery

Clean the battery casing, caps, cables and battery posts using a solution of baking soda and water.

NOTICE Do not allow cleaning solution to enter battery.

Remove corrosion from battery cable terminals and battery posts using a firm wire brush. Rinse with clear water then dry well.

Inspecting the Battery

- Keep the top free of grime
- Check casing, cables, clamps, and case for obvious damage or loose connections.
- Clean terminals and connectors as necessary

Refer to battery manufacturer guidelines.

Battery Testing

There are 3 types of battery tests.

TEST METHOD	COMMENT
Testing voltage (load applied)	A dynamic voltage test with a load applied gives an accurate indication of the condition of the battery. This is the most recommended method.
Testing voltage (no load)	A static voltage test is carried out without discharging current. It is the simplest and most commonly used but the most likely to give false results.

Testing Battery Voltage(Load Applied)

Use a load testing device such as the ELECTRO SPECIALTIES BATTERY LOAD TESTER (P/N 710). It has a 500 A carbon pile adjustable load.

Follow battery load tester instructions.

Apply a load of 3 times the ampere-hour rating of the battery for 14 seconds, then check battery voltage.

BATTERY VOLTAGE TEST (LOAD APPLIED)	
TIME TO MEASURE INTO TEST	VOLTAGE (WITH LOAD APPLIED)
14 seconds	10.5 Vdc min.

If battery voltage has dropped below specification, the battery storage capacity has decreased appreciably and the battery should be replaced.

Testing Battery Voltage(No Load)

NOTE: Be aware that the voltage test can indicate that the battery is in good condition even though the battery does not have enough stored energy to crank the engine. A load test gives a more accurate indication of the condition of the battery.

If the battery has just received a charge, wait 1-2 hours before taking a voltage reading.

Set multimeter to Vdc and measure voltage at battery terminals.

FULLY CHARGED BATTERY VOLTAGE (NO LOAD)
12.6 Vdc minimum

Storing the Battery

Disconnect and remove battery from watercraft as explained in *BATTERY REMOVAL*.

NOTICE Battery storage is critical for battery life. Regularly charging the battery during storage will prevent cell sulfation. Keeping the battery in vehicle for storage may lead to contacts degradation/corrosion and case damage if freezing occurs. A discharged battery will freeze and crack in areas where freezing conditions are experienced. Electrolyte leakage will damage surrounding parts. Always remove battery from vehicle for storage and regularly recharge it to keep an optimal condition.

The battery must always be stored fully charged. If required, recharge until the recommended specific gravity is obtained prior to storage.

NOTICE Battery electrolyte temperature must not exceed 50°C (122°F) during charging. The battery casing should not feel hot to the touch.

Clean battery terminals and cable connections using a wire brush.

Apply a light coat of dielectric grease on terminals.

Clean battery casing and caps using a solution of baking soda and water.

Rinse battery with clear water and dry well using a clean cloth.

Store battery in a cool dry place. Such conditions reduce self-discharging and keep fluid evaporation to a minimum. Keep battery away from dew, high moisture and direct sunlight.

Subsection XX (CHARGING SYSTEM)

AMBIENT TEMPERATURE	CHARGING FREQUENCY
Below 16°C (60°F)	Every month
Above 16°C (60°F)	Every 2 weeks

 **WARNING**

Batteries must always be stored out of reach of children.

Activating a New Battery

YTX20-L batteries are factory activated. Test and charge battery as required before installing it.

Charging a Used Battery

To find the recommended charger current output in amps for a specific battery, divide the battery amp hour rating by 10. For example a 14 AH battery should be charged at 1.4 amps (14 AH ÷ 10 = 1.4 amp current).

 **WARNING**

Never charge battery while installed in watercraft.

For best results, battery should be charged when it is at room temperature. A battery that is cold may not accept current for several hours after charging has begun.

Do not charge a frozen battery. If the battery charge is very low, the battery may freeze. If you suspect the battery to be frozen, move it to a heated area for about 2 hours (or more if required) to let it thaw out before charging.

 **WARNING**

Always charge a battery in a well ventilated area.

The time required to charge a battery will vary depending on several factors, such as:

- Battery temperature: The charging time is increased for a cold battery as charging current accepted by a cold battery will be lower than for a warm battery. As the battery warms up, it will accept a higher rate of charge.
- State of charge: As a battery discharges, it gives up its stored energy. The greater the discharge, the longer it will take to fully recharge it.
- Type of charger: Battery chargers vary in the amount of voltage and current that they can supply.

Charging a Very Flat or Completely Discharged Battery

The battery charger used should have an adjustable charging rate. A unit which can be adjusted in small increments is acceptable.

The battery charger must be equipped with an ammeter capable of accurately measuring current of less than 1 ampere.

Unless this procedure is properly followed, a good battery may be needlessly replaced.

1. Measure the voltage at the battery posts with an accurate voltmeter. If it is below 10 volts, the battery will accept current at very low rate. It could be some time before the charging rate increases. Such low current flow may not be detectable on some charger ammeters and the battery will not seem to accept the charge.
2. Exceptionally for this particular case, set the charger to a high rate.

NOTE: Some chargers have a polarity protection feature which prevents charging unless the charger leads are connected to the correct battery terminals. A completely discharged battery may not have enough voltage to activate this circuitry, even though the leads are connected properly. This will make it appear that the battery will not accept a charge. Follow the charger manufacturer's instruction on how to bypass or override this circuitry so that the charger will turn on and charge a low-voltage battery.

3. Since battery chargers vary in the amount of voltage and current they provide, the time required for the battery to accept a measurable charger current may be up to 10 hours or more.
4. If the charging current is not up to a measurable amount after 10 hours, the battery should be replaced.
5. If the charging current is measurable before the end of the 10 hour period, the battery is good and charging should be completed at a lower rate.
6. It is recommended that any battery recharged using this procedure be tested under load prior to returning it to service.

Installing the Battery

Installation is the reverse of removal procedure.

 WARNING

Always connect battery cables in the specified order, RED positive cable first, BLACK negative cable last.

1. Connect RED (+) cable.
2. Connect BLACK (-) cable last.
3. Apply dielectric grease on battery posts.
4. Verify cable routing and attachments.

STARTING SYSTEM (1630 ACE HO)

SERVICE TOOLS

Description	Part Number	Page
DIAGNOSTIC HARNESS	529 036 188	3
ECM ADAPTER TOOL.....	529 036 166	2, 4
FLUKE 115 MULTIMETER	529 035 868	2-4

GENERAL

BASIC STARTING SYSTEM OPERATION

Engine Cranking Conditions

The following conditions must be met to allow engine cranking:

1. START/STOP button pressed and released to activate the ECM.
2. The tether cord securely installed on the engine cut-off switch and the D.E.S.S. key recognized by the ECM as valid (2 short beeps)
3. START/STOP button pressed and held.

Starting System Logic

If the ECM recognizes a valid D.E.S.S. key, it allows engine cranking by providing the ground to the starter solenoid when the START/STOP button is pressed and held.

If the START/STOP button is activated while the throttle lever is depressed more than 60%, the engine will crank but will not start (engine drowned mode).

If the START/STOP button is held after engine has started, the ECM automatically stops the starter if engine speed reaches at least 1400 RPM.

If the START/STOP button is pressed when the engine is running, the engine will shut down.

TROUBLESHOOTING

DIAGNOSTIC TIPS

NOTE: It is a good practice to check for fault codes using B.U.D.S. as a first troubleshooting step. Refer to *DIAGNOSTIC AND FAULT CODES* subsection.

Starting system failures are not necessarily related to the starter but may be due to one the following:

- Starter solenoid fuse F16

- Battery, refer to *CHARGING SYSTEM*
- START/STOP switch
- Starter solenoid
- Engine cut-off switch
- ECM
- Wiring/connections.

Check these components before removing the starter.

NOTE: This subsection assumes the problem is related to an electrical component of the starting system. If the starting system tests good, ensure engine and jet pump integrity. Refer to applicable subsection.

DIAGNOSTIC GUIDELINES

NOTHING HAPPENS WHEN START/STOP BUTTON PRESSED

1. **Battery not connected**
 - Connect battery.
2. **Burnt fuse**
 - F3 fuse: (START/STOP switch circuit).
 - F8 fuse: (main DC power fuses).
 - F19 fuse (ECM power fuse).
3. **Defective relay or related circuits**
 - Test relay and circuits.
4. **Defective START/STOP switch**
 - Test START/STOP switch, wiring and connections.

ENGINE DOES NOT CRANK

1. **D.E.S.S. not functional or wrong D.E.S.S. key**
 - If 2 short beeps are not heard when pressing the START/STOP button, refer to *DIGITALLY ENCODED SECURITY SYSTEM* subsection.
2. **Burnt fuse**
 - F16 fuse: (starter solenoid power) Test *SOLENOID INPUT VOLTAGE (Solenoid Coil)*.

Subsection XX (STARTING SYSTEM (1630 ACE HO))

3. Discharged battery

- Recharge and test. Refer to *CHARGING SYSTEM* subsection.

4. Battery connections

- Check/clean/tighten.

5. Poor/bad or corroded ground contacts (engine, battery ground cable, starter etc.)

- Check/clean/repair, refer to *POWER DISTRIBUTION AND GROUNDS* subsection.

6. Starter solenoid

- Test solenoid, wiring and connections.

7. Damaged starter or ground cables

- Test *SOLENOID (DYNAMIC)*.

8. Obstructed starter drive gear assembly

- Check/repair, refer to *PTO HOUSING, MAGNETO AND STARTER*.

9. No ground provided by ECM to starter solenoid

- Test *CONTINUITY OF START/STOP SWITCH CONTROL CIRCUIT* in this subsection.

10. Engine cannot be rotated (possibly seized or jet pump blocked)

- Refer to *ENGINE* subsection.

ENGINE CRANKS SLOWLY

1. Loose, corroded or dirty battery cable connections

- Check/clean/tighten.

2. Discharged/weak battery

- Recharge and test. Refer to *CHARGING SYSTEM* subsection.

3. Low voltage from starter solenoid

- Test *SOLENOID (DYNAMIC)*.

4. Damaged starter or ground cables

- Test *SOLENOID (DYNAMIC)*.

5. Worn starter

- Check.

STARTER TURNS, BUT STARTER DRIVE DOES NOT MESH WITH RING GEAR

1. Worn starter drive gear/starter gear/ring gear

- Replace worn parts. Refer to *STARTER GEAR* in this subsection and *PTO HOUSING, MAGNETO AND STARTER* subsection.

2. Defective drive

- Replace starter drive. Refer to *PTO HOUSING, MAGNETO AND STARTER* subsection.

STARTER KEEPS RUNNING

1. Shorted solenoid winding

- Replace solenoid.

2. Melted solenoid contacts

- Replace solenoid.

3. Sticking or defective starter drive

- Lubricate or replace. Refer to *PTO HOUSING, MAGNETO AND STARTER*.

PROCEDURES

⚠ WARNING

When carrying out any kind of maintenance on the starting system, always disconnect the battery ground cable. This will eliminate the possibility of shorting out a power cable, and generating a spark which could result in a fire or and explosion. Do not place any tool on the battery.

ENGINE START/STOP SWITCH

Testing START/STOP Switch Circuit Continuity

1. Remove START/STOP switch fuse (F3).

For fuse box access, refer to *POWER DISTRIBUTION AND GROUNDS* subsection.

Disconnect connector "B" from the ECM, refer to *WIRING HARNESS AND CONNECTOR* subsection.

Install ECM ADAPTER TOOL (P/N 529 036 166) on ECM harness connector "B".



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

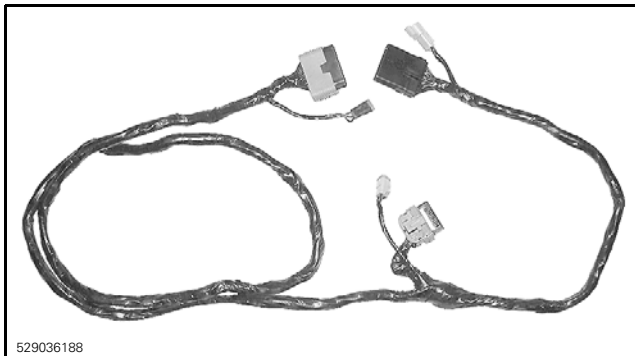
Press and hold the START/STOP switch and test for continuity of the switch circuit as per following table.

CONTINUITY TEST OF START/STOP SWITCH CIRCUIT (BUTTON PRESSED AND HELD)		
FUSE BOX	ECM CONNECTOR B	RESISTANCE
Pin A6	B-D1	Close to 0 Ω (continuity)

- If the reading is as specified, the START/STOP switch and its wiring are good.
- If a high resistance or an open circuit is measured, carry out *START/STOP SWITCH CONTINUITY TEST*.

Testing START/STOP Switch Continuity

- Remove START/STOP switch fuse (F3).
- Disconnect the 24-pin steering connector:
- Connect the DIAGNOSTIC HARNESS (P/N 529 036 188) to make an in-line connection between the disconnected connector.



NOTE: Use the 24 pin connectors only.

- Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and select Ω .
- Measure resistance through switch as per following table.

CONTINUITY TEST OF START/STOP SWITCH CIRCUIT		
SWITCH POSITION	DIAGNOSTIC HARNESS CONNECTOR	RESISTANCE
Released	Pins 2 and 23	Infinite (OL)
Pressed and held		Close to 0 Ω



If the switch does not test as specified, replace the engine START/STOP switch.

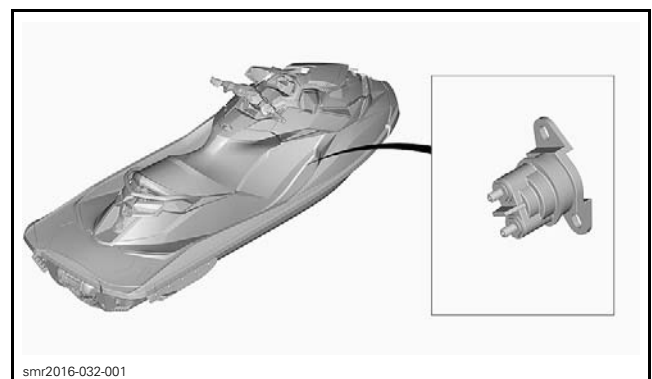
If the switch tests as specified, check for an open circuit between connections as per table:

OPEN CIRCUIT TEST		
CIRCUIT CONNECTIONS		RESISTANCE
Fuse box pin A6	Steering connector pin 23	Must be close to 0 Ω
Steering connector pin 2	ECM connector B, pin D1	

STARTER SOLENOID

Starter Solenoid Location

Models Without Suspension



Testing Solenoid Input Voltage

- Make sure F16 fuse is powered and in good condition before testing.
- Disconnect solenoid connector.
- Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to Vdc.
- Install tether cord on the engine cut-off switch.
- Press the START/STOP button to activate ECM.

Subsection XX (STARTING SYSTEM (1630 ACE HO))

6. Measure voltage within 3 minutes after START/STOP switch has been depressed.

SOLENOID INPUT VOLTAGE TEST (SOLENOID COIL)		
TEST PROBES		VOLTAGE READING
Pin A	Battery ground	Battery voltage

If test succeeded, carry out a *SOLENOID CONTROL CIRCUIT TEST*.

If test failed, carry out a *START/STOP SWITCH CIRCUIT CONTINUITY TEST*.

Testing Solenoid Control Circuit Continuity

- Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to Ω .
- Disconnect connector "B" from ECM.
- Install ECM ADAPTER TOOL (P/N 529 036 166) on ECM harness connector.
- Test continuity of wiring from solenoid to ECM as per following table.

SOLENOID CONTROL CIRCUIT TEST		
SOLENOID CONNECTOR	ECM CONNECTOR B	RESISTANCE
Pin B	B-L4	Close to 0 Ω (continuity)

If test failed, repair or replace wiring/connectors.
If test succeeded, carry out a *SOLENOID COIL RESISTANCE TEST*.

Testing Solenoid Coil Resistance

- Set multimeter to Ω .
- Disconnect solenoid connector.
- Measure solenoid coil resistance as per following table.

SOLENOID COIL RESISTANCE TEST		
SOLENOID CONNECTOR		RESISTANCE
Pin A	Pin B	4.5 to 5.5 Ω

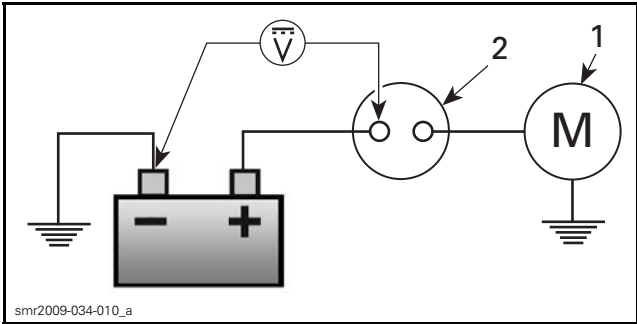
If test fails, replace solenoid.

Testing Solenoid (Dynamic)

- Ensure fuse F16, battery, and starter solenoid are properly connected.
- Make sure the battery ground cable is securely connected to the engine. Refer to *POWER DISTRIBUTION AND GROUNDS*.

- Set ECM in engine drowned mode:
 - Depress throttle lever.
 - Install a rubber band to hold lever in full throttle position.
- Set multimeter to Vdc.
- Crank engine.
- As engine is cranking**, measure the voltage as per following tables.

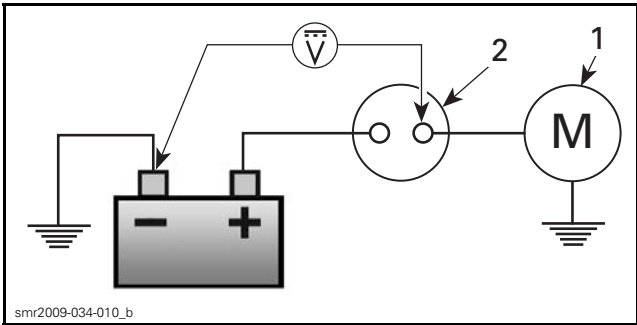
SOLENOID DYNAMIC TEST (ENGINE CRANKING)		
TEST PROBES		VOLTAGE (DC)
Solenoid battery post	Battery ground	Battery voltage



- Starter motor
- Starter solenoid

- If test failed, check battery positive cable (from battery to solenoid).
- If test succeeded, continue with next step.

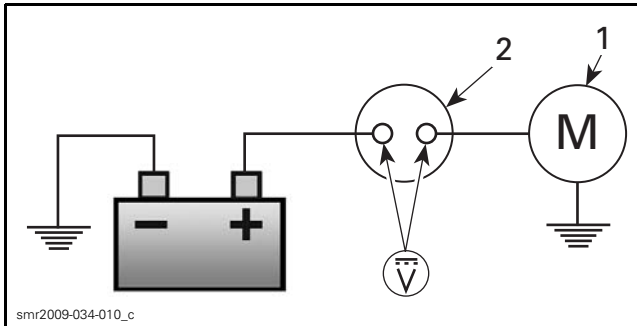
SOLENOID DYNAMIC TEST (ENGINE CRANKING)		
TEST PROBES		VOLTAGE (DC)
Solenoid starter post	Battery ground	Battery voltage



- Starter motor
- Starter solenoid

- If test failed, carry out a *SOLENOID INPUT VOLTAGE TEST (SOLENOID COIL)*.
- If test succeeded, continue with next step.

SOLENOID DYNAMIC TEST (ENGINE CRANKING)		
TEST PROBES		VOLTAGE (DC)
Solenoid battery post	Solenoid starter post	0.2 Vdc max.



1. Starter motor
2. Starter solenoid

If test failed, replace solenoid.

If all solenoid dynamic tests are as specified, replace starter.

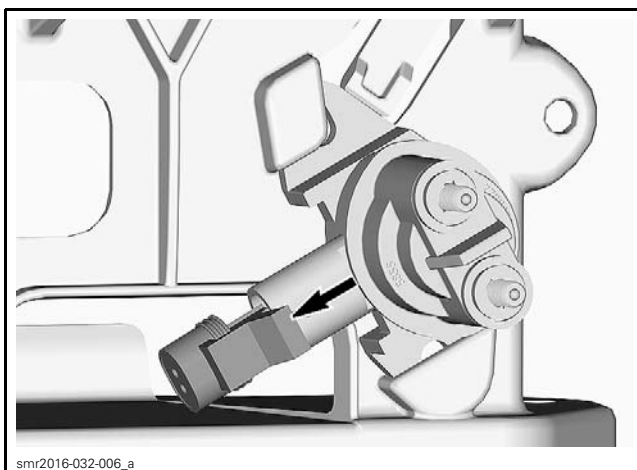
11. Remove rubber band from throttle lever.
12. Attach the electrical component support to the battery holder. Refer to *ELECTRICAL COMPONENT SUPPORT* in *CHARGING SYSTEM* subsection.
13. Reinstall removed parts.

Removing the Solenoid

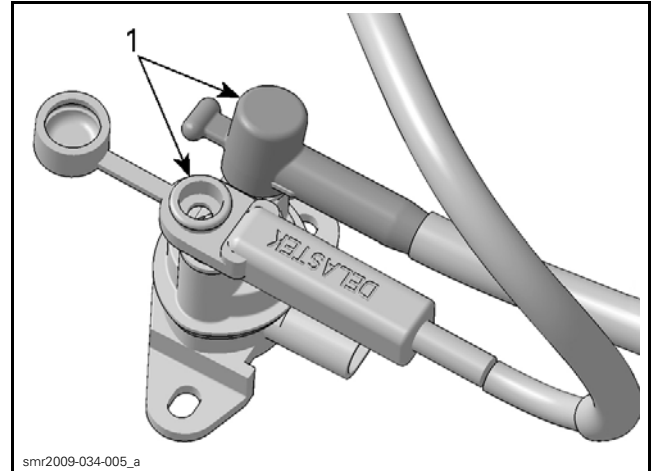
1. Disconnect battery. Refer to *CHARGING SYSTEM* subsection.

⚠ WARNING

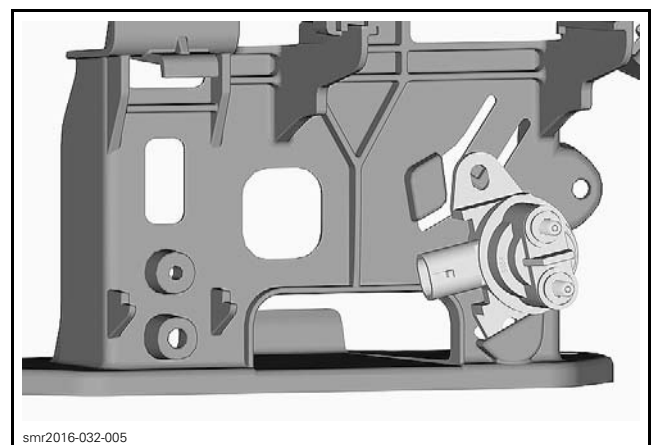
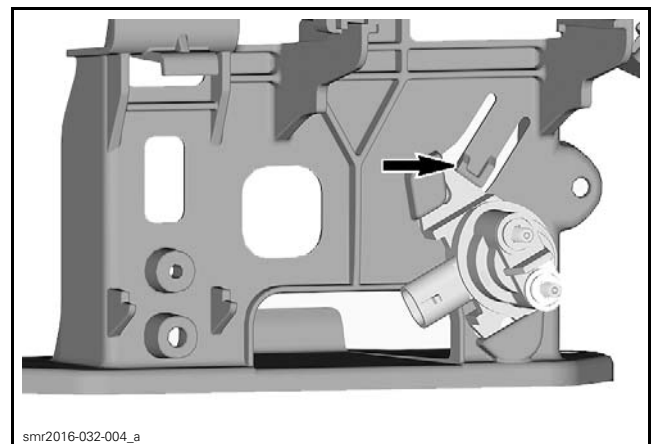
Always disconnect the BLACK (-) battery cable first and reconnect last.



2. Disconnect solenoid cables.



TYPICAL
1. Cables



Installing the Solenoid

Reverse the removal procedure and pay attention to the following.

STARTER

For starter information refer to *PTO HOUSING, MAGNETO AND STARTER* subsection.

RADIO FREQUENCY DIGITALLY ENCODED SECURITY SYSTEM (RF D.E.S.S.)

GENERAL

SYSTEM DESCRIPTION

The following components are specially designed for this system: ECM, D.E.S.S. key (inside tether cord cap) and engine cut-off switch.

The D.E.S.S. key contains a magnet and a RFID chip.

- The magnet closes the hall effect switch inside the engine cut-off switch.
- The RFID chip contains a unique digital code. It is the equivalent of the tooth-pattern cut on a conventional ignition key.

The D.E.S.S. system allows the engine to start only if a tether cord cap is installed on the engine cut-off switch and the D.E.S.S. key is recognized as valid by the ECM.

The D.E.S.S. key is quite flexible:

- Up to 8 D.E.S.S. keys may be programmed in the ECM memory using the B.U.D.S. The keys can also be erased individually.
- The same D.E.S.S. key can be used on another vehicle equipped with the D.E.S.S. system. It only needs to be programmed for that vehicle.

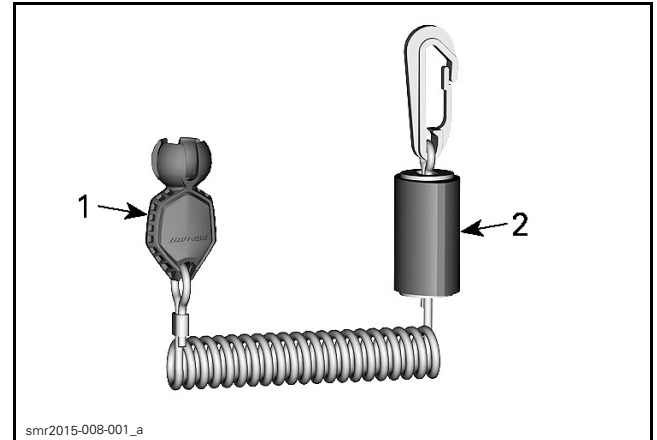
D.E.S.S. Key Types

Three types of keys can be used:

- Normal key
- Learning key
- Rental key.

To ease key type recognition, the tether cord float comes in different colors.

KEY TYPE	FLOAT COLOR
Normal	Yellow or Black
Learning	Green
Rental ⁽¹⁾	Orange
⁽¹⁾ Rental key can be programmed to a rental watercraft only.	



1. D.E.S.S. Key
2. Tether cord float

Upon tether cord installation, the key type used is momentarily displayed by the multifunction gauge.

Both learning and rental keys provide a mode of operation whereby engine power and speed is limited.

There are 5 speed settings available for the learning key mode. By default, the key modes are preset to the speed setting (3). Refer to *INTELLIGENT THROTTLE CONTROL (iTC)* subsection.

NOTE: Changing key settings is only available when the engine is not running.

D.E.S.S. Key Beeper Codes

BEEPER	SIGNIFICATION
A 0.5 second beep every 5 seconds	Indicates the D.E.S.S. is reading the key.
2 short beeps	Indicates the D.E.S.S. recognizes the key.
A 1 second beep every 5 seconds	Indicates the D.E.S.S. does not recognize the key.

NOTE: Other beeps not related to D.E.S.S. can be heard. Refer to *DIAGNOSTIC AND FAULT CODES*.

TROUBLESHOOTING

DIAGNOSTIC GUIDELINES

The following is provided to help in diagnosing the probable cause of a problem. It is a guideline and should not be assumed to list all possible causes.

NO BEEP CODE WHEN KEY IS INSTALLED ON ENGINE CUT-OFF SWITCH — ENGINE CAN NOT BE STARTED

- 1. Gauge shuts-down after its WOW test: Defective engine cut-off switch
 - Check engine cut-off switch. Refer to *IGNITION SYSTEM* subsection.

NO BEEP CODE WHEN KEY IS INSTALLED ON ENGINE CUT-OFF SWITCH — ENGINE CAN BE STARTED

- 1. Defective gauge beeper
 - Check gauge beeper. Refer to *INFORMATION CENTER (GAUGE)*.

GAUGE DISPLAYS "READING KEY" AND THERE IS NO KEY INSTALLED ON ENGINE CUT-OFF SWITCH

- 1. Gauge shuts-down after 3 minutes: Defective engine cut-off switch
 - Check engine cut-off switch.

PROCEDURES

D.E.S.S. KEY

D.E.S.S. Key Recognition

To allow key recognition, carry out the following steps:

- 1. Briefly press the START/STOP button to wake up the ECM.
- 2. Securely install the tether cord on watercraft engine cut-off switch.
- 3. Press and hold the START/STOP button to start engine.

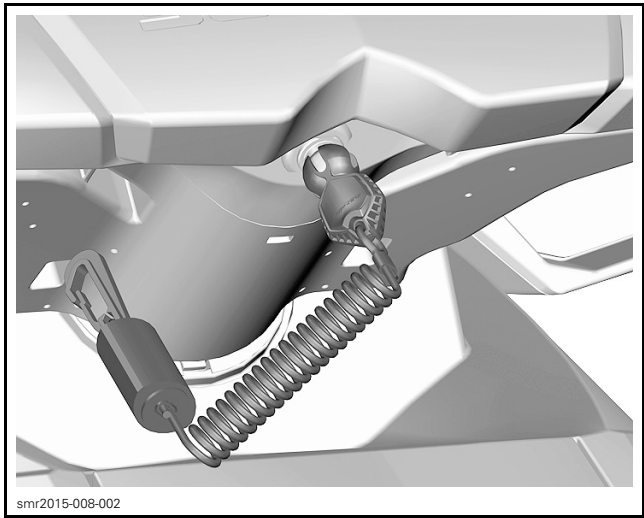
Programming D.E.S.S. Keys

- 1. Connect the watercraft to latest applicable B.U.D.S. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

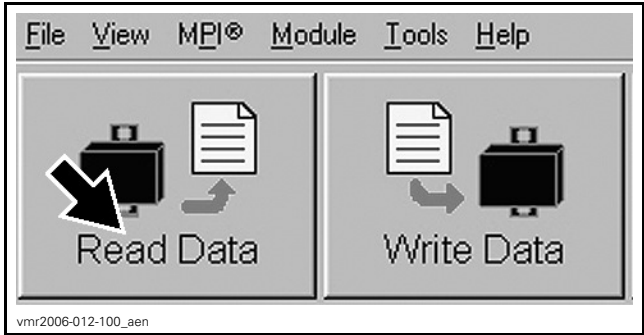
IMPORTANT: Ensure all connections have been made **before starting B.U.D.S.** to allow proper operation.

- 2. Briefly press START/STOP button to power the ECM.

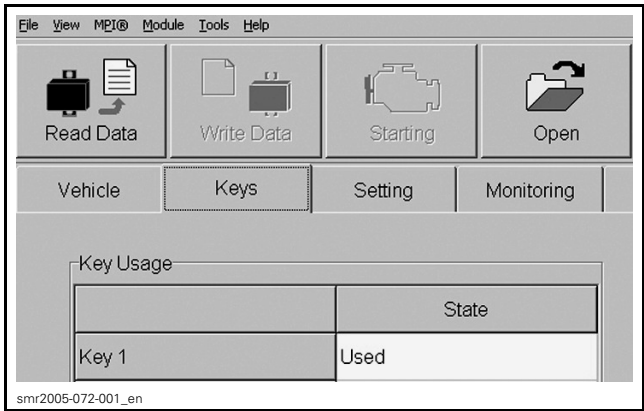
- 3. Install a tether cord on the engine cut-off switch to program a D.E.S.S. key.



- 4. Read ECM using **Read Data** button.



- 5. Click on **Keys** tab.



Adding a Key

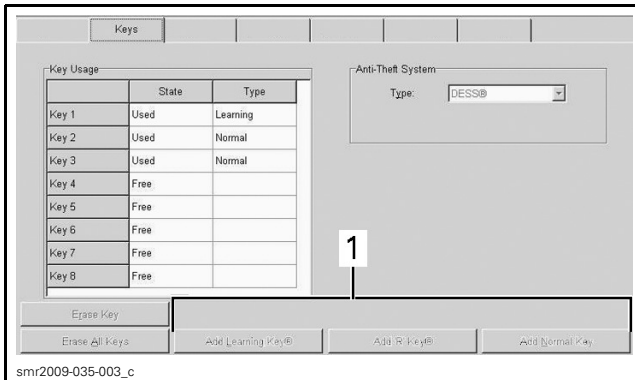
- 1. Click on the **Add Key** button at the bottom of the screen according to the key type you want to program.

Subsection XX (RADIO FREQUENCY DIGITALLY ENCODED SECURITY SYSTEM (RF D.E.S.S.))

WARNING

If programming a Learning or Rental key, be sure to use the proper key type (color) to avoid possible confusion.

NOTE: A rental key can be programmed to a rental watercraft only.



1. Add Key buttons

- After approximately 10 seconds, the following window will pop up confirming the new key has been saved in the PC computer.



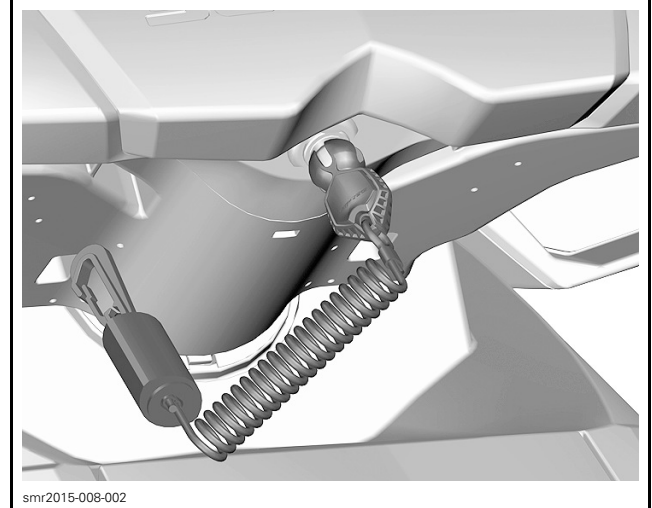
- If programming is complete, write the changes to the ECM. Refer to *WRITING CHANGES TO ECM* in this subsection.

Adding Another Key

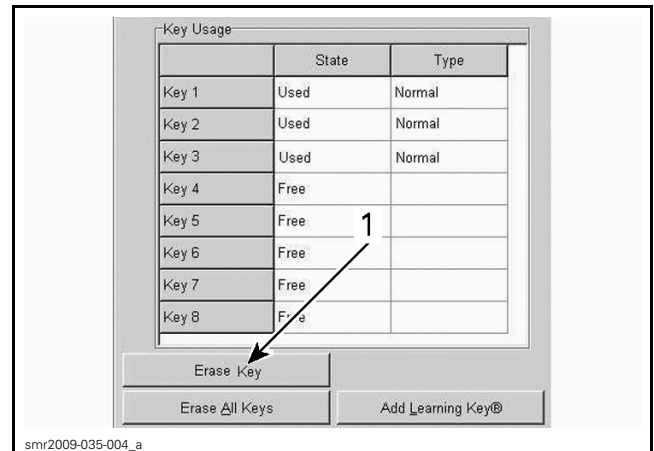
- Remove the tether cord from the engine cut-off switch.
- Install the next tether cord on the engine cut-off switch.
- Click on the **Add Key** button.
- If programming is complete, write the changes to the ECM. Refer to *WRITING CHANGES TO ECM* in this subsection.

Erasing Keys

- Install the tether cord on the engine cut-off switch.



- Click on **Erase Key** button at bottom of B.U.D.S. screen.



1. Click on this button

After approximately 10 seconds the following message will appear.



The key is now erased in the PC computer.

- If programming is complete, write the changes to the ECM. Refer to *WRITING CHANGES TO ECM* in this subsection.

Erasing Another Key

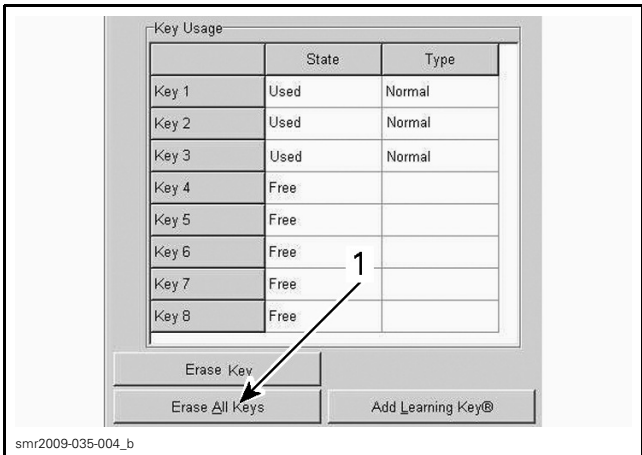
- Remove the tether cord from the engine cut-off switch.

Subsection XX (RADIO FREQUENCY DIGITALLY ENCODED SECURITY SYSTEM (RF D.E.S.S.))

- 2. Install the next tether cord to be erased on the engine cut-off switch.
- 3. Click on **Erase Key** button.
- 4. If programming is complete, write the changes to the ECM. Refer to *WRITING CHANGES TO ECM* in this subsection.

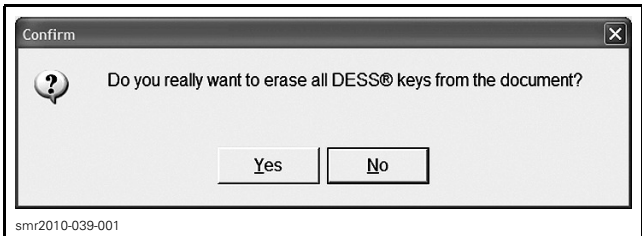
Erasing All Keys

- 1. Click on **Erase All Keys** button at bottom of screen.



- 1. Click on this button

NOTE: The following message will be displayed in B.U.D.S.



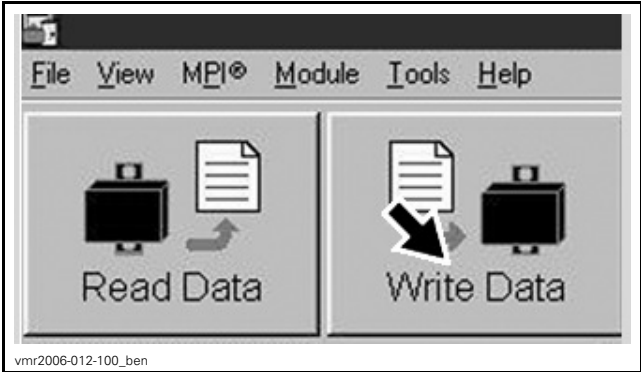
- 2. Click **Yes** to proceed with erasing all keys.
- 3. When done, program at least one new key to the vehicle. Refer to *ADDING A KEY* in this subsection.
- 4. When programming is complete, write the changes to the ECM. Refer to *WRITING CHANGES TO ECM* in this subsection.

NOTE: If there isn't at least one key programmed to the watercraft, B.U.D.S. will not allow you to write the changes to the ECM and will prompt you to add a key.

Writing Changes to ECM

Save the changes made in B.U.D.S. into the ECM as follows.

- 1. Click the **Write Data** button.



NOTE: If for some reason the writing operation fails, exit B.U.D.S. Restart B.U.D.S. and reenter all the previously lost information.

- 2. After the write operation, remove key from D.E.S.S. post.
- 3. Try the key(s) on the watercraft.

D.E.S.S. / Engine cut-off Operation

Normal Operation



MONITORING PAGE, ECM TAB

Refer to *WIRING DIAGRAM*.

RFID CONNECTOR PIN	SPECIFICATIONS
A	ECM ground
B	12 - 15 Vdc
C	5 Vdc
D	12 Vdc

Key Not Read

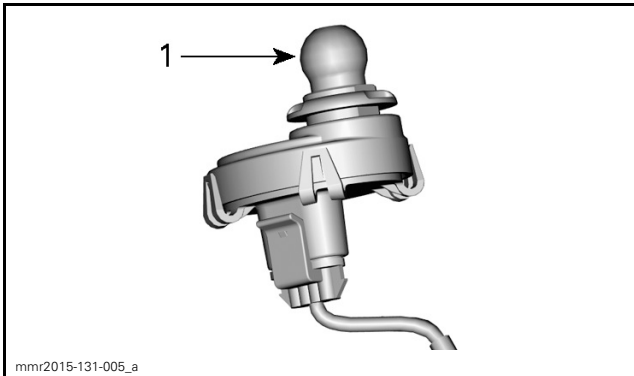


MONITORING PAGE, ECM TAB

Possible causes:

- Damaged RFID chip
- No voltage at RFID-D connector
- No voltage at RFID-C connector

Condition can be duplicated with a magnet on the D.E.S.S. post.



1. D.E.S.S. post

Key Not Present



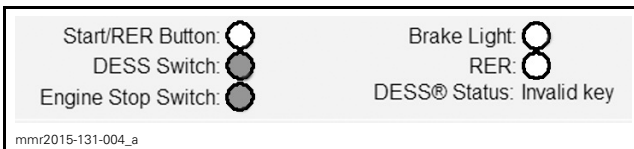
MONITORING PAGE, ECM TAB

Possible causes:

- No key installed
- No **ground** at RFID-A connector
- No voltage at RFID-B connector
- No voltage at RFID-C connector
- No voltage at RFID-D connector

Condition can be duplicated by unplugging the RFID connector.

Invalid Key



MONITORING PAGE, ECM TAB

Possible causes:

- Key not programmed to ECM

INFORMATION CENTER (GAUGE)

SERVICE PRODUCTS

Description	Part Number	Page
DIELECTRIC GREASE	293 550 004	12, 20

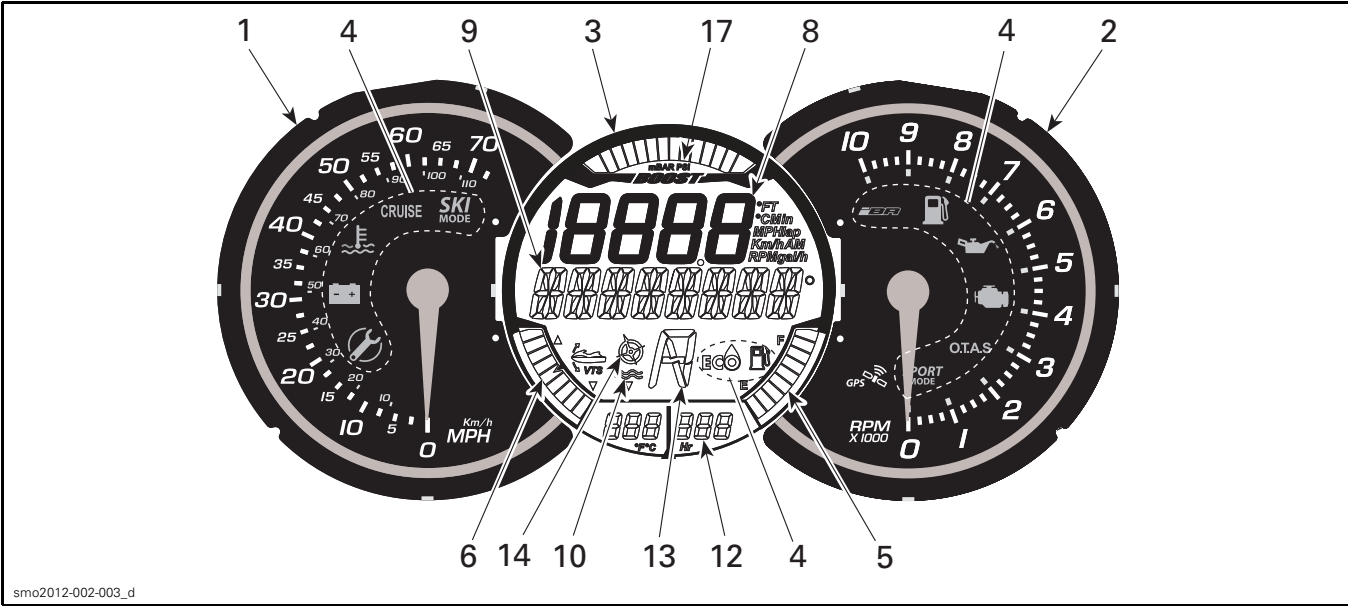
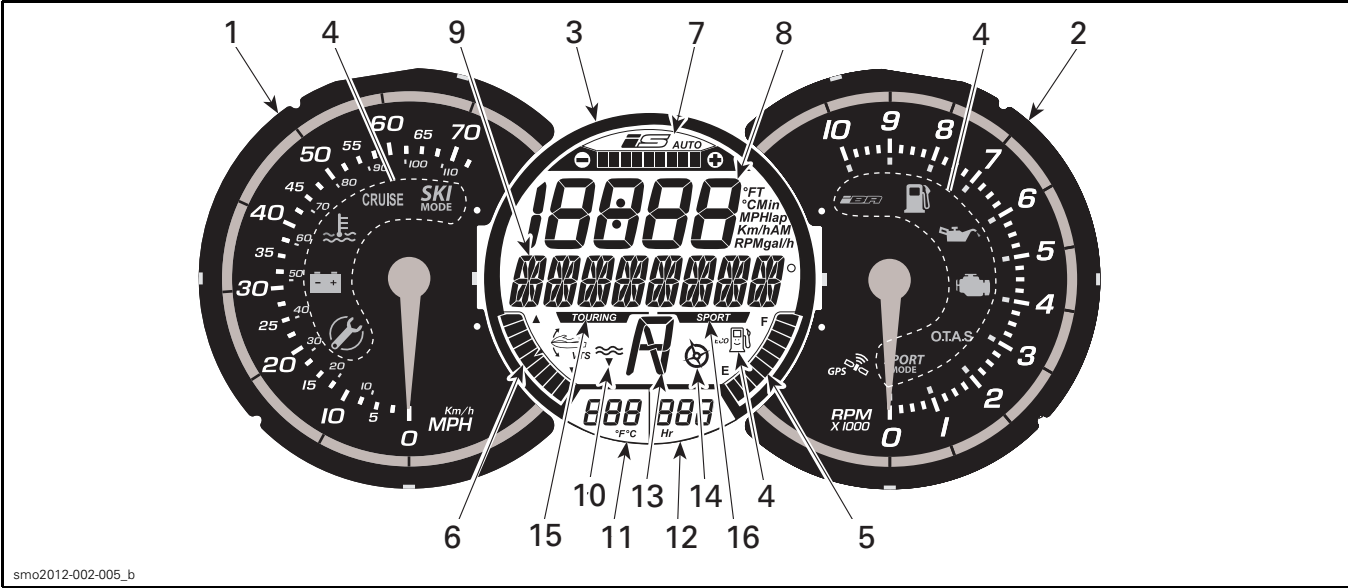
GENERAL

INFORMATION CENTER

WARNING

Do not adjust the display while riding, you could lose control.

Information Center Description



1) Speedometer

The speedometer, located in the LH side of the information center, provides an analog indication of the speed of the watercraft in miles per hour (MPH) and kilometers per hour (km/h).

The speed indication is based on a GPS (Global Positioning System) incorporated within the information center.

If for some reason the GPS signal is lost, a default mode is used whereby, the speed is calculated using information received from other systems to provide an estimated watercraft speed.

2) Tachometer

The tachometer provides an analog indication of the revolutions per minute (RPM) of the engine. Multiply the indicated number by 1000 to obtain the actual engine RPM.

3) Multifunction Gauge

The multifunction gauge, located in the center of the information center, is capable of displaying different indications simultaneously.

Numerical and multifunction displays in the digital screen indicator can be used to display various indications, or for selecting modes of operation and changing settings as explained in their respective sections.

4) Indicator Lights

Indicator lights (pilot lamps), inform you of a selected function or a system anomaly.

An indicator light may be accompanied by a scrolling message in the multifunction display.

See the following table for information on the usual pilot lamps. Refer to *MONITORING SYSTEM* for details on malfunction pilot lamps.

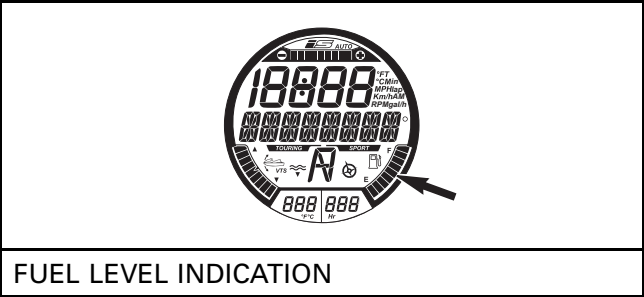
PILOT LAMPS (ON)	MESSAGE DISPLAY	DESCRIPTION
	MAINTENANCE REMINDER	Maintenance required.
	LOW-FUEL	Low fuel level, approx. 25% tank capacity, 14 L (3.7 U.S. gal.) or fuel level sensor disconnected.
	Scrolling SLOW SPEED MODE message	CRUISE mode or SLOW SPEED MODE engaged.
	Scrolling SKI MODE messages	Ski Mode activated.
	Scrolling SPORT MODE messages	Sport Mode activated.

Subsection XX (INFORMATION CENTER (GAUGE))

PILOT LAMPS (ON)	MESSAGE DISPLAY	DESCRIPTION
ALL MODELS EXCEPT RXT-X/RXT-X aS MODELS		
	FUEL ECO	Fuel Economy Mode
RXT-X/RXT-X aS		
	FUEL ECO	Fuel Economy Mode activated.

5) Fuel Level Indication

A bar gauge located in the bottom RH side of the multifunction display continuously indicates the amount of fuel in the fuel tank while riding.



When the fuel tank is full, 8 segments (bars) of the indicator are turned on. The top segment is not used.

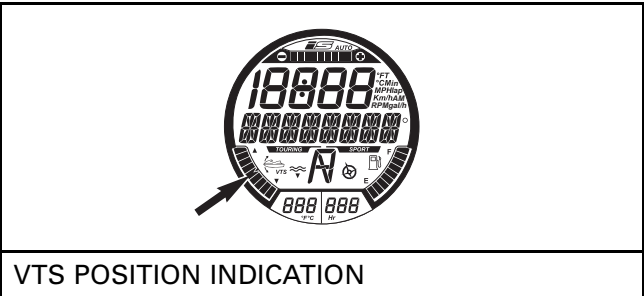
Low Fuel Level Warning

It is active when there is only 2 segments of fuel indicated (approximately 25% fuel tank capacity or 14 L (3.7 U.S. gal.).

6) VTS Position

The VTS position indication located in the bottom LH side of the digital screen shows the riding attitude of the watercraft.

A single segment of a bar gauge type indicator is turned on to indicate the relative position of the watercraft bow.



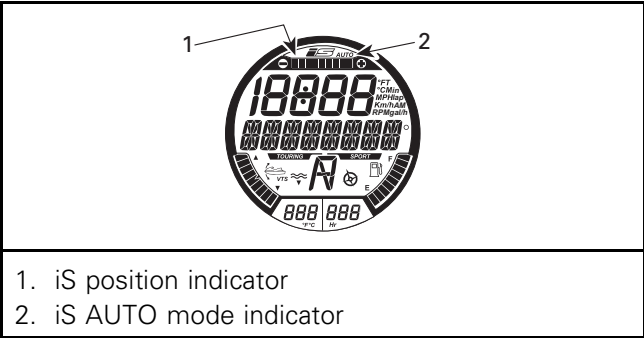
Refer to *OPERATING INSTRUCTIONS* for more details on using the VTS.

7) iS Position

GTX Ltd iS

The iS display (intelligent Suspension) provides a visual indication of the relative height of the suspension.

It also indicates if the suspension is in AUTO mode of operation.



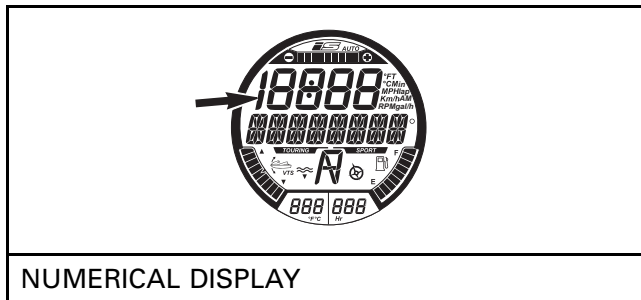
When the suspension system is operating in AUTO mode, the AUTO indicator and all bar segments of the position indicator will be on.

When the suspension height is adjusted manually using the UP/DOWN buttons (while in IS mode), the system switches to MANUAL mode of operation. The AUTO indication disappears and only one bar segment of the position indicator will be on.

Refer to *OPERATING INSTRUCTIONS* for more information on using the suspension.

8) Numerical Display

The numerical display is used to provide a variety of indications as selected by the operator using the DISPLAY function in the multifunction display.



The available indications are dependent on the watercraft model or option installed.

When the information center is first powered up, the numerical display defaults to the last selected indication.

9) Multifunction Display

The multifunction display is used to:

- Display the WELCOME message on power up.
- Display the KEY recognition message.
- Provide various indications as selected by the operator.
- Activating and setting various functions and modes of operation.
- Display scrolling messages of function activation or system faults.
- Display fault codes.

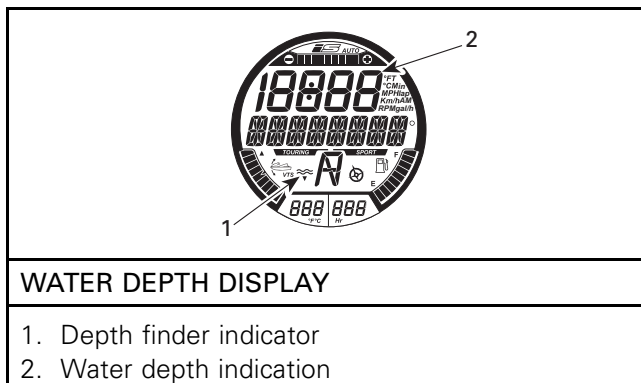
NOTE: The default indication in the multifunction display is the compass direction.

10) Water Depth Display

The water depth display provides an indication of the lake water depth.

The system is capable of indicating water depth under the hull in single increments up to 50 m (164 ft).

NOTE: Under certain conditions, the display may stop indicating. The display ability to provide an indication of the water depth depends on the conditions of use.



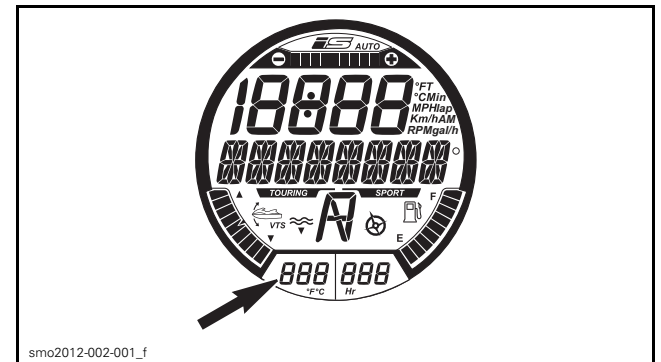
NOTE: The water depth indication is only available when a depth finder is installed and detected.

! WARNING
Never use the depth finder as a warning device to ride in shallow water.

11) Lake Water Temperature Display

GTX Limited Only

Continuously displays surface water temperature.

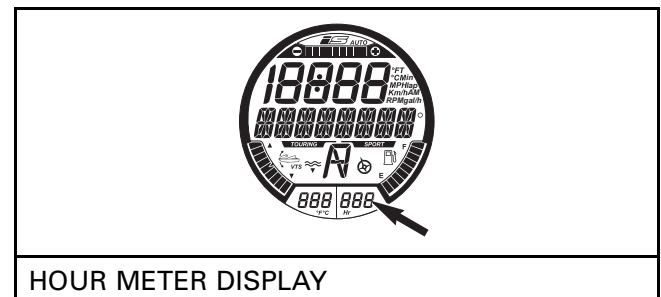


The numerical display may also be selected to display water temperature. See *NUMERICAL DISPLAY* in this section.

To change the unit of measurement, refer to *SETTING THE UNITS OF MEASUREMENT AND LANGUAGE* in this subsection.

12) Hour Meter Display (HR)

Continuously displays the accumulated engine hours.



13) iBR Position

Provides an indication of the iBR gate position.

- N (neutral)
- F (forward)
- R (reverse).



iBR POSITION INDICATOR

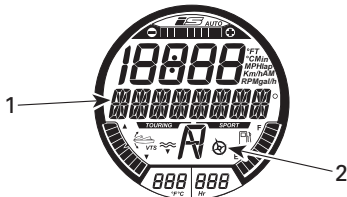
14) Compass

A GPS incorporated in the information center provides the indication in the multifunction display.

The cardinal points, intermediate cardinal points, as well as the azimuth the watercraft is travelling are displayed in the multifunction display by default when the watercraft is moving.

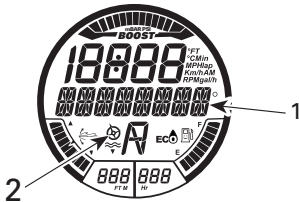
For a compass indication to be displayed, the GPS must have a good link with the navigation satellites.

This is confirmed when the COMPASS active indicator is visible in the digital screen.



COMPASS (GAUGE WITHOUT BOOST GAUGE)

- 1. Compass indication
- 2. Compass active indicator



COMPASS (GAUGE WITH BOOST GAUGE)

- 1. Compass indication
- 2. Compass active indicator

NOTE: The compass indication is only available above 5 km/h (3 MPH).

⚠ WARNING

Use the compass as a guide only. Not to be used for precision navigation purposes.

15) Touring Mode Indicator

All Models Except RXT-X/RXT-X aS/RXP-X.

When the TOURING mode indicator is ON, the default TOURING mode is active.



TOURING MODE INDICATOR

Refer to *OPERATOR'S GUIDE*.

16) Sport Mode Indicator



SPORT MODE INDICATOR (GAUGE WITHOUT BOOST GAUGE)

When sport mode of operation is selected, the sport mode indicator will come on and stay on until sport mode is deactivated, or the watercraft is shut down.

NOTE: The sport mode is not the default riding mode. To be active, it must be selected after starting the engine.

Refer to *OPERATOR'S GUIDE*.

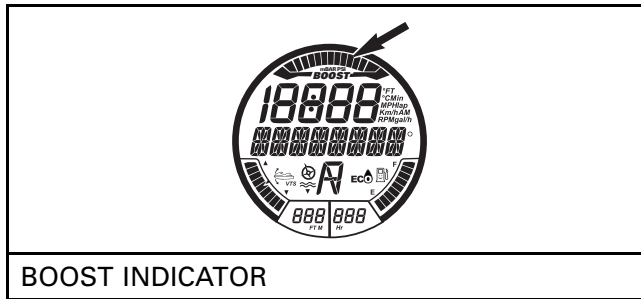
GTX LTD iS/RXT/WAKE PRO

In addition to the sport mode indicator in the multifunction display, a SPORT MODE indicator light turns ON in the tachometer.

RXT-X/RXT-X aS/RXP-X

There is no sport mode indicator in the multifunction display, only a SPORT MODE indicator light turns ON in the tachometer.

17) Boost Gauge



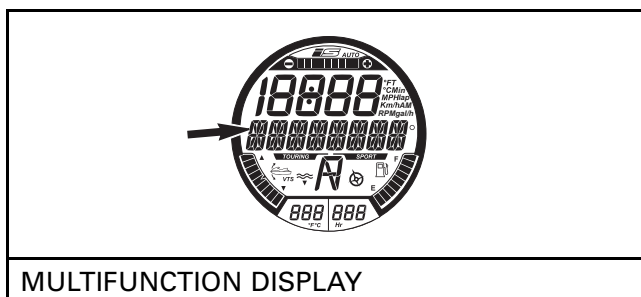
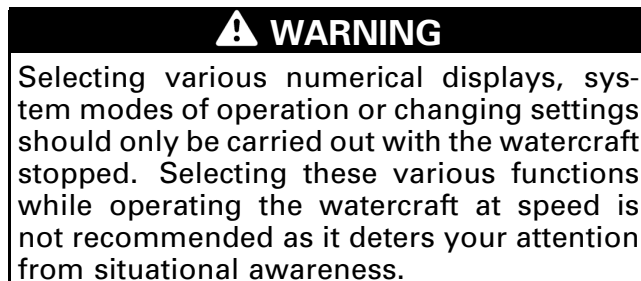
The boost gauge indicates the manifold pressure of the engine provided by the supercharger.

Navigating the Multifunction Display

When the electrical system is powered up and the cluster has completed its self test function, a WELCOME ABOARD SEA-DOO scrolling message will appear for a few seconds. After the welcome message, nothing will appear in the display until the watercraft is operated.

When the watercraft is being operated, the multifunction display provides an indication of compass heading or scrolling messages from the monitoring system.

The multifunction display is also used to display a menu for the selection of various functions which, permit changing the numerical display indication, system modes of operation, settings, active system fault codes, and a lap timer.



To change the unit of measurement, refer to *SETTING THE UNITS OF MEASUREMENT AND LANGUAGE* in this subsection.

Selecting Functions

When operating at speed, the multifunction display normally provides an indication of the compass direction and azimuth the watercraft is traveling.

To select the various functions available through the multifunction display, press the MODE button repeatedly until the desired function is visible:

- LAP TIME
- SKI MODE
- LAP TIME
- FUEL CONSUMPTION
- VTS MODE
- DISPLAY
- FAULT CODES
- KEY MODE
- SETTINGS.

Then press the SET button to enter that function.

NOTE: The fault code function is only available when there is an active fault. The settings and key mode functions are only available when the engine is shut off. The key mode function is only available with a normal key.

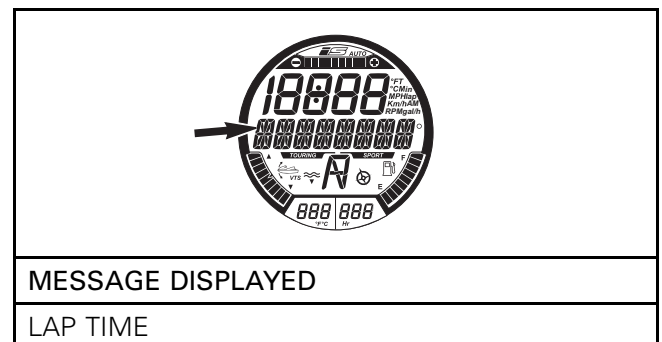
Function Description

Lap Timer

The lap timer can be used to record up to 50 individual lap times.

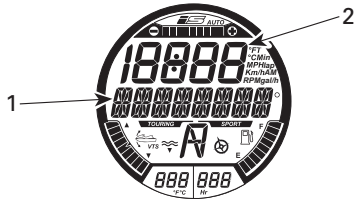
To activate and use the lap timer, carry out the following:

1. Press the MODE button repeatedly until LAP TIME is visible in the multifunction display.



2. Press the SET button to enter the function, the lap timer will be activated and visible in the display.

Subsection XX (INFORMATION CENTER (GAUGE))

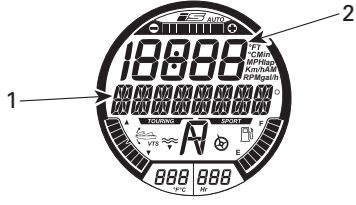


FUNCTION SELECTED: LAP TIMER
1. Lap time 2. Lap count

3. To start the timer, press the SET button.
- NOTE:** The timer starts immediately when pressing the SET button.
4. To record each lap time, press the SET button at the start of each lap.
- NOTE:** The lap time will be recorded, the lap counter in the numerical display will count the number of laps recorded, and the timer will continue to run.
5. To save the last lap and stop the timer, press the MODE button.

To view each lap time, use the UP or DOWN button. The lap counter will indicate which lap is indicated.

To view the cumulative lap time of all laps recorded, use the UP or DOWN button until ALL is visible in the lap counter.



MESSAGE DISPLAYED: LAP TIMER
1. Total time 2. ALL is displayed here

To reset the lap timer and lap counter, press and hold the SET button until the timer and counter are reset to 0 (zero).

Ski Mode

Ski mode is used for repeated controlled launches when towing a skier or wakeboarder. Refer to *OPERATOR'S GUIDE*.

Fuel Consumption

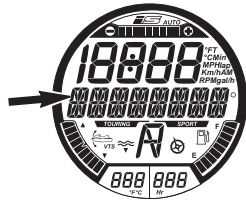
- The FUEL CONSUMPTION function is used to display the watercrafts fuel consumption in four different ways.
- Instant fuel flow per hour (gal/h or l/h)
 - Average fuel flow per hour (gal/h or l/h)
 - Distance to empty (Mi or Km)
 - Time to empty (h or min).

The fuel consumption functions are not continuously active.

A fuel consumption function becomes active only when selected as the indication in the numerical display.

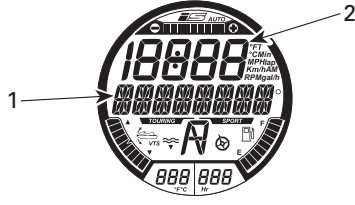
When the LOW FUEL indications come on in the multifunction gauge, the "TIME TO EMPTY" and "DISTANCE TO EMPTY" functions will indicate "0" (zero) if they are the selected indication.

- To display the watercraft fuel consumption, carry out the following:
1. Press the MODE button repeatedly until FUEL CONSUMPTION is visible in the multifunction display.



MESSAGE DISPLAYED
FUEL CONSUMPTION

2. Press the UP or DOWN button to toggle to the desired fuel consumption display mode.



FUEL CONSUMPTION DISPLAY MODE
1. INSTANT FUEL CONSUMPTION message 2. Fuel consumption value

3. Press the SET button to save the setting and return to the main display.

NOTE: The fuel consumption value will be displayed in the numerical display. Double click the SET button to reset the average fuel consumption indication. The display will momentarily indicate zero (0).

VTS Mode

The VTS MODE function is used to manually set the VTS or change VTS PRESET settings. Refer to *OPERATING INSTRUCTIONS* subsection in the *OPERATOR'S GUIDE* for details.

Display

The DISPLAY function is used to change the indication in the numerical display. Refer to *CHANGING NUMERICAL DISPLAY INDICATION*.

Fault Codes

The FAULT CODES function is used to display active fault codes. Refer to *MONITORING SYSTEM* subsection.

Key Mode

The KEY MODE function is used for changing LEARNING key settings. Refer to *OPERATING INSTRUCTIONS* subsection in the *OPERATOR'S GUIDE* for details.

Settings

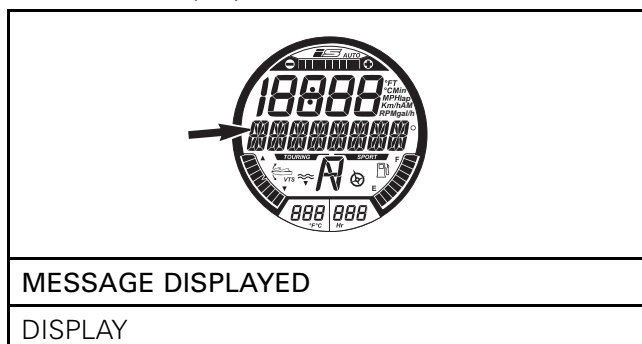
The SETTINGS function is used for:

- Clock setting. Refer to *MULTIFUNCTION GAUGE SETUP*
- Dock mode setting. Refer to iS (INTELLIGENT SUSPENSION) in the *SUSPENSIONS* subsection
- iBR override function for maintenance.

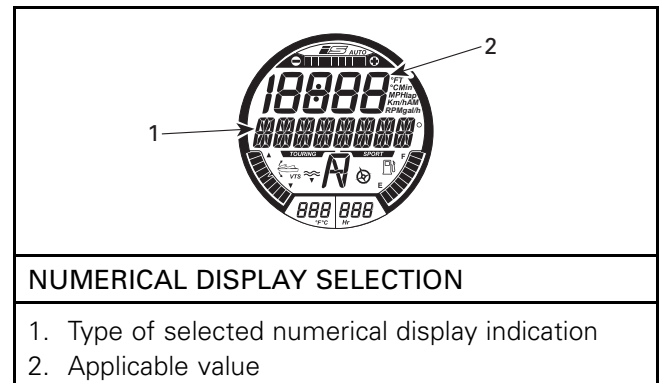
Changing Numerical Display Indication

To change the indication in the numerical display, carry out the following:

1. Press the MODE button on the RH handlebar repeatedly until DISPLAY is visible in the multifunction display.



2. Press the SET button to enter the DISPLAY function.
3. Press the UP or DOWN button until the preferred available indication appears.
 - RPM
 - SPEED
 - LAKE TEMPERATURE (only on model GTX Limited)
 - DEPTH
 - ENGINE TEMP
 - ALTITUDE (only on Limited models)
 - TOP SPEED
 - AVG SPEED
 - TOP RPM
 - AVG RPM
 - CLOCK.



4. Press the SET button to select and save the preferred indication, or wait for the display function to time out. The last indication visible will be automatically saved.

The following abbreviations are used in the numerical display:

- FT or M
- RPM
- MPH or Km/h
- °F or °C
- AM or PM
- Gal/h or l/h.

Resetting Numerical Display Indication

The following numerical display indications can be reset:

- Average fuel consumption
- Top speed
- Average speed
- Top RPM
- Average RPM.

Subsection XX (INFORMATION CENTER (GAUGE))

To reset indications, double click the SET button. The numerical display will momentarily indicate zero (0).

NOTE: Each of these functions become active ONLY when selected as the numerical display indication.

Multifunction Display Messages

For a list of usual messages that may be displayed in the multifunction display, refer to *MULTIFUNCTION DISPLAY MESSAGES* in this section.

OPERATING MODES

Refer to *OPERATOR'S GUIDE*.

Refer to *INTELLIGENT THROTTLE CONTROL (ITC)*.

MULTIFUNCTION DISPLAY MESSAGES

FAULT MESSAGES	
WRONG KEY	Wrong key selected for model
RIGHT KEYPAD ERROR	MODE/SET, UP/DOWN arrow button malfunction
LOW OIL PRESSURE	Engine low oil pressure detected
HIGH EXHAUST TEMPERATURE	High exhaust temperature detected
HIGH ENGINE TEMPERATURE	High engine temperature detected
CHECK ENGINE	Engine system malfunction or maintenance required
HIGH BATTERY VOLTAGE	High battery voltage detected
LOW BATTERY VOLTAGE	Low battery voltage detected
LIMP HOME MODE	Major fault detected, engine power limited
FUEL SENSOR DEFECTIVE	Fuel level sensor fault
CALIBRATION CHECKSUM ERROR	Cluster programming corrupted, need to be re-flashed using B.U.D.S.
MAINTENANCE REQUIRED	Watercraft maintenance required
DEPTH finder MODULE COMMUNICATION PROBLEM	Error message if depth finder is disconnected while riding
iS MODULE COMMUNICATION PROBLEM	Error message if communication with the suspension module is lost while riding
iBR MODULE ERROR	Error message if communication with the iBR module is lost while riding
OTAS DEFECTIVE – MAINTENANCE REQUIRED	OTAS is not correctly adjusted

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.* subsection.

IMPORTANT: When troubleshooting an electrical system fault, check battery condition, cables and connections first.

Electrical System Activation

1. Press the START/STOP button.

NOTE: Pressing the START/STOP button without the tether cord (D.E.S.S. key) installed on the engine cut-off switch will turn on electrical power without starting the engine; the information center will cycle through a self-test function and shut off its display after a few seconds. However, the electrical system will stay powered up for approximately three minutes after the START button was pressed.

2. Install the tether cord on the engine cut-off switch to activate ECM and Information Center when testing procedures require a component or system to be supplied with electrical power.

IMPORTANT: When B.U.D.S. is being used, the ECM will stop communicating with B.U.D.S. approximately 3 minutes after the START button is pressed. Therefore, operations with B.U.D.S. will be interrupted. To reestablish communication, briefly press the START button. **Do not hold** the START button to avoid engine starting.

Circuit Testing

Check the related-circuit fuse condition with a fuse tester or ohmmeter (a visual inspection could lead to a wrong conclusion).

Electrical Connection Inspection

When replacing an electric or electronic component, always check electrical connections. Make sure they are tight, make good contact, and are

Subsection XX (INFORMATION CENTER (GAUGE))

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 when reassembling them, except if otherwise specified such as for the ECM connectors.

Pay attention to ground wires.

TROUBLESHOOTING GUIDELINES

Press the START/STOP button and install the tether cord on the engine cut-off switch.

NOTE: Information center should come on, cycle through its self test function, and stay on for approximately 3 minutes after which all electrical power will turn off.

Briefly press the START/STOP button every 3 minutes to reenergize the electrical system. Do not hold the START/STOP button to avoid engine starting.

NOTE: When troubleshooting using the following guidelines, it is important to remember that some indications, functions and features described may not apply to every PWC model, or may be available as an option.

Information Center “Does Not Turn ON”

If the information center does not turn ON when the START/STOP button is pressed, the power circuit or ground circuit to the information center is probably open.

iS Models

Double click the iS button to move the suspension to the up position. If the suspension does not move to the up position, the problem is related to the electrical power system. Refer to *POWER DISTRIBUTION AND GROUNDS* subsection.

If the suspension moves to the up position, the electrical power system is functioning normally.

All Models

Test the 3 A GAUGE/OTAS/CAPS fuse (fuse 12) in fuse box 1 (FB1).

If the fuse tests good, test *INFORMATION CENTER INPUT VOLTAGE*.

If the information center input voltage test is good, test for continuity of the gauge ground circuit (gauge connector pin 11 (BLACK wire) to the ground bus-bar (pin H7) in FB1.

Refer to *WIRING DIAGRAM* for circuit details.

Information Center Turns ON with Some Indications Missing

1. Connect to the latest applicable B.U.D.S. version, refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Read the fault codes, refer to *DIAGNOSTIC AND FAULT CODES* subsection.

If a fault code is related to a communication problem, carry out a continuity test of the CAN bus wires between the applicable module and the CAN bus-bars in FB1. Refer to *WIRING DIAGRAM* and *CONTROLLER AREA NETWORK (CAN)* subsections.

NOTE: The information center, ECM, iS module, iBR module, and the diagnostic connector are linked together through CAN bus-bars in fuse box 1. If one wire of the two wire CAN bus system is open, communication will be slower than normal. Multiple fault codes may be generated and the ECM will put the watercraft in LIMP HOME mode.

If one module cannot be seen in B.U.D.S., the fault may be the wires that link the module to the CAN bus bars, or a problem internal to that module. Test the CAN bus wires from the faulty module to the CAN bus-bars in FB1 for continuity before assuming the problem is the module.

Information Center Goes Blank Except for:

- GPS indicator ON
- Compass ON (if watercraft moving)
- Fuel level ON
- iBR fault indicator light ON
- Indicated speed
- No other indications visible.

There is no communication between the information center and all other modules (ECM, iS, iBR).

Carry out a continuity check of the CAN bus wires from the CAN bus-bars in FB1 to the information center (pins 2 and 3). Refer to the *WIRING DIAGRAM* and *CONTROLLER AREA NETWORK (CAN)* subsections for details.

If an open circuit is detected, carry out same test from the pin steering connector (pins 8 and 20).

All Indications ON Except for:

- LAKE WATER TEMP indication
- VTS indication
- iBR position indication
- CHECK ENGINE light is on.

NOTE: The lake water temperature indication is only available for the GTX Limited model.

The iBR CAN bus circuit is open or the iBR module is at fault.

NOTE: The ECM will generate several fault codes and engage LIMP HOME mode.

Carry out a continuity check of the CAN bus wires from the CAN bus-bars in FB1 to the iBR module (pins 2 and 3). Refer to the *WIRING DIAGRAM* and *CONTROLLER AREA NETWORK (CAN)* subsections for details.

NO RPM Indication and NO Engine Hour Display

If there is NO RPM indication and NO engine hour display, and the watercraft is in LIMP HOME mode, the CAN bus to the ECM is open.

Carry out a continuity check of the CAN bus wires from the CAN bus-bars in FB1 to the ECM module, connector "B" pins C1 and C2 (B-C1 and B-C2). Refer to the *WIRING DIAGRAM* and *CONTROLLER AREA NETWORK (CAN)* subsections for details.

NO iS Position Display

If there is no iS position display (suspension position), the iS module is at fault, or its CAN bus circuit is open.

Carry out a continuity check of the CAN bus wires from the CAN bus-bars in FB1 to the iS module (pins 2 and 3). Refer to the *WIRING DIAGRAM* for details.

NOTE: If communication with the iS module cannot be established when electrical power is first applied, the monitoring system assumes this is a normal situation (PWC not equipped with iS) and will not display an error message.

NO Fuel Level Indication

If there is no fuel level indication, test the fuel level sensor and its wiring circuit to the information center. Refer to *FUEL TANK AND FUEL PUMP* subsection.

NO Depth Gauge Indication

If there is no depth gauge indication available and the depth finder active indicator is not on, refer to *DEPTH FINDER* in this subsection.

NOTE: If communication with the depth finder cannot be established when electrical power is first applied, the monitoring system assumes this is a normal situation (PWC not equipped with depth finder) and will not display an error message.

NO Speed or Compass Indication

To obtain a speed or compass reading and to turn on the GPS indicator, the GPS requires a good uplink to at least three navigation satellites.

If there is no speed or compass indication, look for the GPS indicator icon. If the GPS indicator is off, either the GPS cannot uplink with the satellites, or the GPS system in the information center is at fault.

If another watercraft nearby displays a good GPS uplink (GPS indicator light on in cluster), the information center may need to be replaced.

NOTE: If the GPS uplink is lost while navigating at speed, the speedometer will provide an estimated speed indication based on other parameters. The compass indication will not be available until a good satellite uplink is reestablished.

Speed and Compass Indication Slow to Come ON

When initially powering up the watercraft and driving away, the speed and compass indications may be slow to come on. This is normal as the GPS requires time to establish an uplink with the navigation satellites (cold start).

If the watercraft was run long enough to display the compass and speed indications, shut down for a short period of time and then restarted (hot start), the speed and compass indications should not take more than 30 seconds to come on.

If the speed and compass indications take more than 30 seconds to come on, test for the following:

- GPS fuse 4 in FB1
- Battery voltage at pin 1 of the information center
- Continuity of wire between information center (pin 1) and contact A5 of FB1.

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NOTE: This circuit provides 12 Vdc to the GPS in the information center so that it memorizes the satellites it was linked to for a period of two hours. This allows the indications to be available within a few seconds of restarting the watercraft (hot start). After a two hour period, the GPS will have to reestablish new satellite links.

Beeper Does Not Function

The beeper is incorporated within the information center.

If no beep code is heard when installing the tether cord, first ensure ECM is powered. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.

In B.U.D.S., carry out the following:

- **Cluster Buzzer Test** on the cluster activation page
- Check for fault codes. Carry out service actions as applicable.

If the **Cluster Buzzer Test** failed, the ECM is powered, and the ECM and information center are communicating properly through the CAN bus, replace the information center.

PROCEDURES

INFORMATION CENTER

Information Center Self Test Function

When the START/STOP button is pressed momentarily and the vehicle powers up, all LCD segments and indicator lights in the information center will turn **ON for 3 seconds** (self test function). This self test function allows the driver time to ensure that all indications are functioning properly.

It also validates the information centers internal circuits, however, this does not validate proper operation of the individual external circuits and sensors that provide inputs to the information center.

If a system fault is detected by the ECM, the applicable message and/or indicator light will be displayed, and a beep code may be heard.

If the tether cord is not installed, the indications in the information center will shut off a few seconds after the self test function, but the electrical system power stays on for approximately 3 minutes. Installing the tether cord on the engine cut-off switch will turn the indications back on.

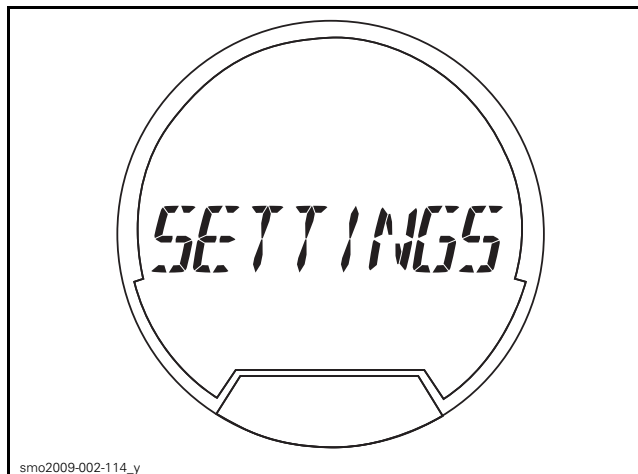
If the tether cord is installed, the cluster will stay on for approximately 3 minutes.

NOTE: If the START/STOP button is pressed and held without the tether cord installed, the information center will stay on as long as the START button is held.

Multifunction Gauge Setup

Setting the Clock

1. Press the MODE button repeatedly until SETTINGS is visible in the multifunction display.



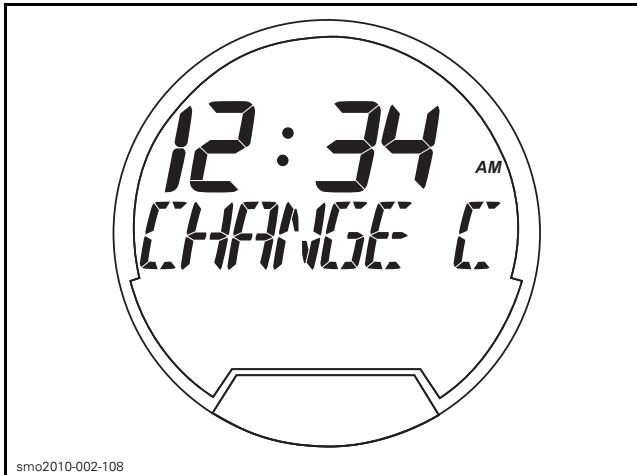
FUNCTION SELECTED: SETTINGS

2. Press the UP or DOWN arrow button repeatedly until CLOCK is visible.



FUNCTION SELECTED: CLOCK

3. Press the SET button to enter the function. CHANGE CLOCK OFFSET message will be displayed.



FUNCTION SELECTED: CHANGE CLOCK OFFSET

4. Press the UP or DOWN arrow button to adjust the clock to the correct local time.
5. Press the SET button to save the setting and return to the main display.

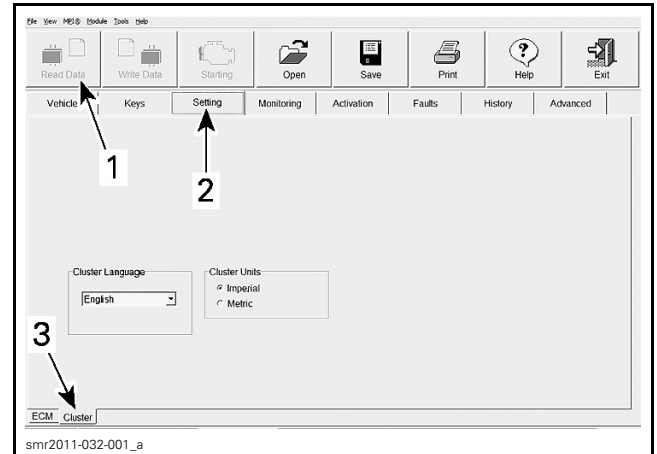
NOTE: The clock uses the GPS signal to maintain the appropriate time referenced to Greenwich Mean Time (GMT). When setting the clock, only the hour digits may be changed. For the clock to function, the GPS requires a good satellite uplink.

Setting the Units of Measurement and Language

1. Connect vehicle to the latest applicable B.U.D.S. version, refer to the *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Press the START/STOP button to energize the electrical system.

NOTE: You will need to press the START button every three minutes or the electrical system will shut off.

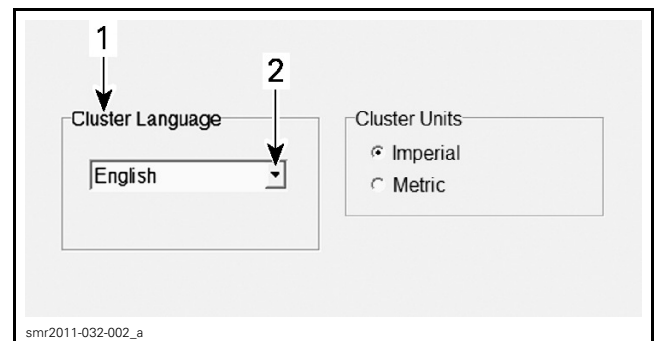
3. Select the **Read Data** button.
 4. Choose the **Setting** tab at the top of the page.
- At the bottom LH side of the setting page, select the **Cluster** tab.



TYPICAL

1. Read Data
2. Setting tab
3. Cluster tab

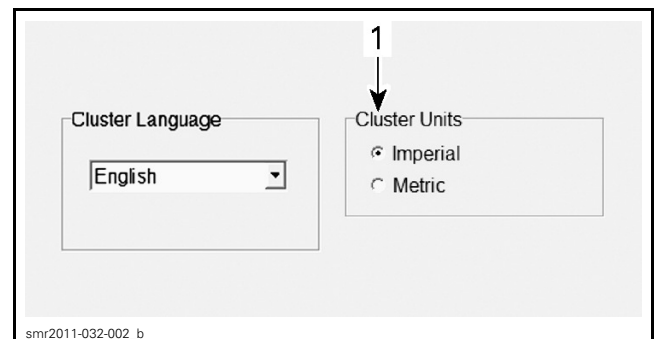
In the **Cluster Language** field, choose the desired unit of language.



TYPICAL

1. Cluster Language field
2. Click on this arrow to expand list of available languages

In the **Cluster Units** field, choose the desired unit of measurement, **Imperial** or **Metric**.



TYPICAL

1. Cluster Units field

Clearing the Maintenance Reminder Indicators

When the watercraft, engine or supercharger are due for maintenance, the maintenance reminder indicator will come on, and a scrolling **MAINTENANCE REQUIRED** or **SUPERCHARGER**

Subsection XX (INFORMATION CENTER (GAUGE))

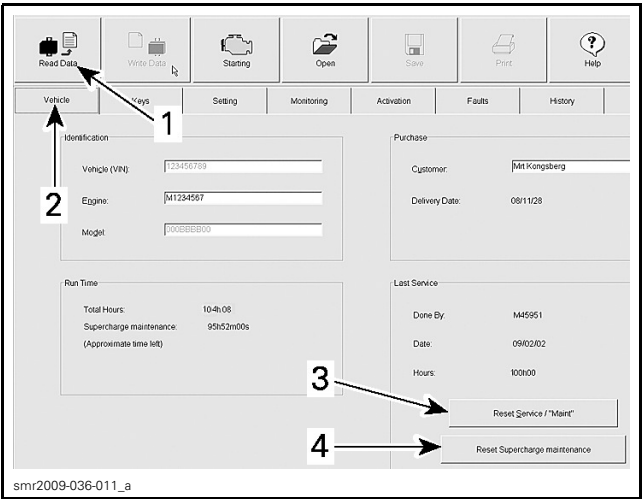
MAINTENANCE REQUIRED message will scroll in the digital screen. These maintenance reminders must be cleared using B.U.D.S.

- 1. Connect vehicle to the latest applicable B.U.D.S. version, refer to the *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
- 2. Press the START/STOP button to energize the electrical system.

NOTE: You will need to press the START button every three minutes or the electrical system will shut off.

- 3. Select the **Read Data** button.
- 4. Choose the **Vehicle** tab at the top of the page.
- 5. At the bottom RH side of the vehicle page in the **Last Service** field, choose **Reset Service/"Maint"** or **Reset Supercharger Maintenance** button as applicable.

NOTE: If the supercharger maintenance was carried out before the reminder appeared in the information center, the supercharger maintenance reminder must be reset in order to reset the supercharger maintenance hour counter and prevent the reminder from appearing prematurely.



- TYPICAL**
- 1. Read Data
 - 2. Vehicle tab
 - 3. Reset Service/"Maint" button
 - 4. Reset Supercharger Maintenance button

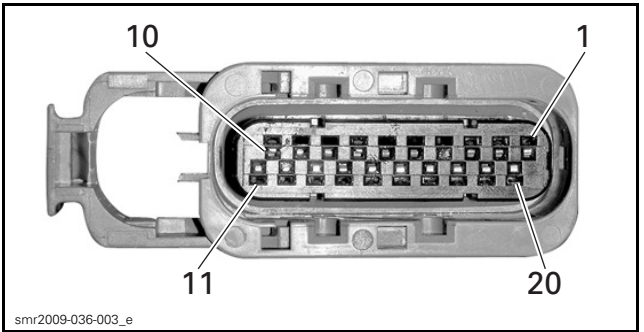
Information Center Pin-Out

NOTE: Depending on watercraft model and installed accessories, some multifunction gauge connector pins may not be used. Refer to *WIRING DIAGRAM*.

Testing Information Center Input Voltage

- 1. Disconnect the gauge connector.

- 2. Press the START button and install the tether cord on the engine cut-off switch.



GAUGE CONNECTOR PIN-OUT

INPUT VOLTAGE TEST AT GAUGE CONNECTOR		
PROBE		VOLTAGE
Pin 1 (Hot at all times)	Pin 11 (Permanent ground)	Battery voltage
Pin 12 (Hot with main relay on)		

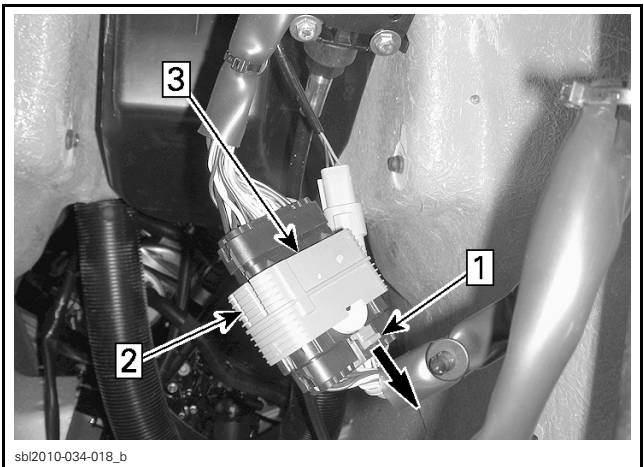
If battery voltage is measured as specified, replace the information center.

If battery voltage is measured to battery ground but not to pin 11, test *CONTINUITY OF GAUGE GROUND WIRE* circuit from the gauge connector to the ground bus-bar contact in FB1 as described further in this subsection.

- 3. If battery voltage is not measured at the gauge connector, check wiring. Refer to *WIRING DIAGRAM*.

Testing Gauge Ground Wire Continuity

- 1. Disconnect the 24-pin steering connector.

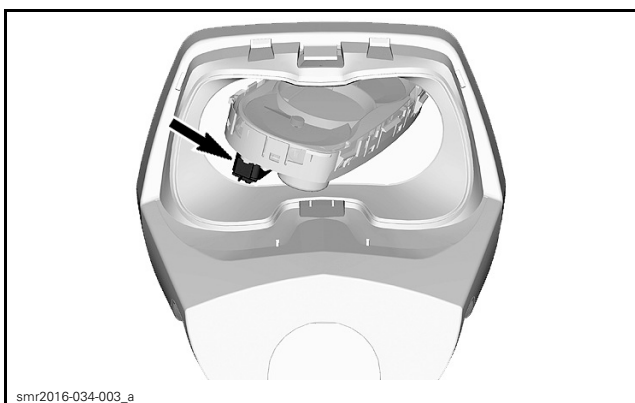
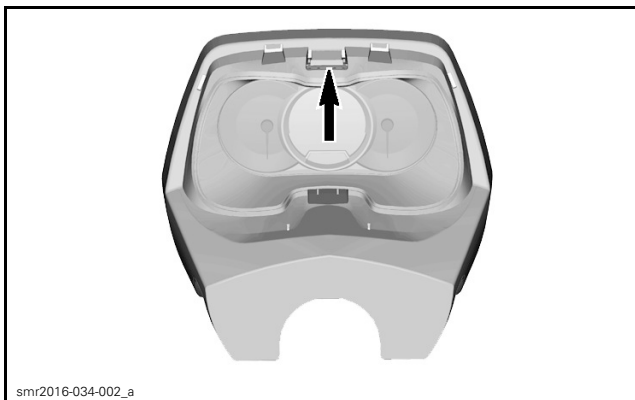


- TYPICAL - 24-PIN STEERING CONNECTOR DISCONNECT**
- Step 1: Pull out safety lock
 - Step 2: Press in on release tab
 - Step 3: Pull locking collar down

GROUND TEST AT STEERING CONNECTOR	
PROBE	VOLTAGE
Pin 11 (Permanent ground)	Battery voltage

2. Repair wiring and connectors as required.

Removing the Information Center



Installing the Information Center

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

NOTE: If you are installing a replacement information center, refer to *INFORMATION CENTER REPLACEMENT* in this subsection.

After the information center has been replaced, connect the watercraft to the latest applicable B.U.D.S. version and carry out any updates (if required). Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

Once the information center has been updated (if required), select the applicable settings as described in *SETTING LANGUAGE AND UNITS OF MEASUREMENT* in this subsection.

MODE/SET AND UP/DOWN ARROW BUTTONS

Overview

The MODE/SET and UP/DOWN arrow buttons assembly contains a series of 4 diodes for the MODE and SET switches, and another 4 diodes for the UP/DOWN arrow switches. Refer to *WIRING DIAGRAM* for simplified diagram of switches.

The center wire to the switches (pin C), is common to both sides of the switch assembly (somewhat like a ground wire). The other two wires (pins A and B), act as signal wires to the information center for each set of switches. They actually each form one branch of an electronic circuit within the information center.

Each diode (in circuit) drops a nominal 0.6 Vdc when conducting electricity. If the circuit current passes through all four diodes (say MODE and SET switches open), a drop of 2.4 Vdc would be measured across the 4 the diodes (pin B to pin C). This voltage drop of 2.4 Vdc measured at pin B tells the gauge the MODE and SET switches are open.

If the MODE switch is pressed, 2 diodes are bypassed. The remaining two diodes in the circuit drop 1.2 Vdc (at pin B).

If the SET switch is pressed, 1 diode is bypassed. The remaining three diodes in the circuit drop 1.8 Vdc (at pin B).

The gauge senses these voltages through pin 17 of the gauge connector, and interprets them as signals that tell it which switch is activated.

If the command signal generated by the closure of a switch concerns another module, a circuit within the gauge will translate it to CAN protocol and transmit it through the CAN bus. The applica-

Subsection XX (INFORMATION CENTER (GAUGE))

ble module will react to the command, carry out the function, and transmit the result back through the CAN bus.

The information center will use the signals from the switches and the transmitted information from the other modules, convert them to an indication, and cancel the command signal it sent out once the function has been carried out.

Command signals from the MODE and SET switches are used by the information center only.

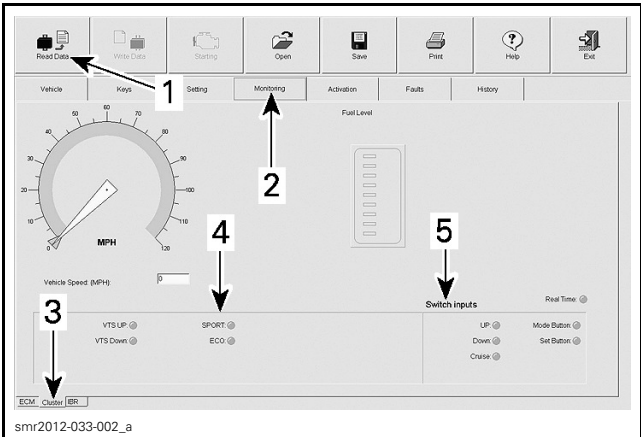
The UP/DOWN arrow switch commands are used by the gauge for certain functions and settings. They will also be translated and sent out through the CAN bus to be used by the ECM for the CRUISE, SKI mode and SLOW SPEED functions for increasing or decreasing speed when the functions are active, and by the iBR for iBR gate positioning in SLOW SPEED mode of operation.

The UP/DOWN switches are also used for VTS trim on models without VTS buttons.

NOTE: The voltages stated previously vary slightly depending on the actual voltage applied to the circuit and the current flow through the diodes. When using a Fluke 115 multimeter for testing in diode test mode, the voltage and current applied by the multimeter are lower than in circuit. The quality of probe contact, the actual probes and leads, and the precision of the meter calibration will all affect the results, which will most likely be slightly lower than nominal values stated.

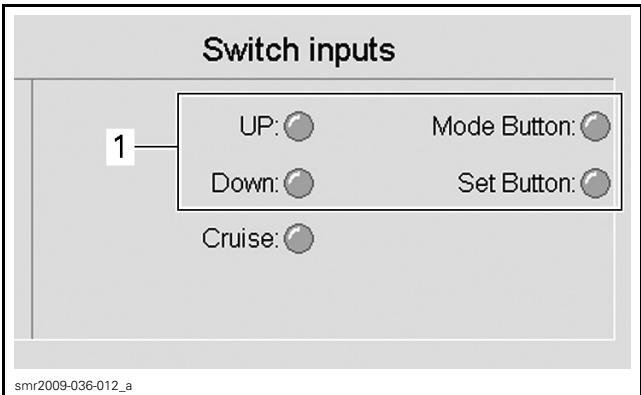
Testing MODE/SET and UP/DOWN Buttons Using B.U.D.S.

- 1. Connect the watercraft to the latest applicable B.U.D.S. version. Refer to *COMMUNICATION TOOLS AND B.U.D.S.*
 - 2. Press the START/STOP button to energize the electrical system.
- NOTE:** You will need to press the START button every three minutes or the electrical system will shut off.
- 3. Select the **Read Data** button.
 - 4. Choose the **Monitoring** tab at the top of the page.
 - 5. At the bottom LH side of the monitoring page, select the **Cluster** tab.



- 1. Read Data button
- 2. Monitoring tab
- 3. Cluster tab
- 4. LH switch inputs field
- 5. RH switch inputs field

- 6. Press each of the MODE/SET and UP/DOWN arrow buttons and look for the applicable indicator light to come on in the **Switch inputs** field on lower RH side of the cluster page (Mode, Set, Up or Down).



SWITCH INPUTS
1. MODE/SET and UP/DOWN arrow button indicator lights

If each of the gauge button indicator lights come on when the applicable switch is pressed, the problem may be related to the information center.

If one or all of the indicator lights does not come on, test *MODE/SET AND UP/DOWN ARROW SWITCH USING A MULTIMETER.*

Testing MODE/SET and UP/DOWN Switch

NOTE: It is important to set the multimeter to the diode check function when testing the MODE/SET and UP/DOWN arrow switches as it contain diodes.

- 1. Test the MODE/SET and UP/DOWN arrow switches as per following tables.

MODE/SET SWITCH TEST			
SWITCH POSITION	FLUKE 115	GAUGE CONNECTOR	VOLTAGE
Switch released	RED lead BLACK lead	Pin 17 Pin 18	Approx. 2 Vdc or OL (see note 1)
	BLACK lead RED lead	Pin 17 Pin 18	OL
MODE depressed	RED lead BLACK lead	Pin 17 Pin 18	Approx. 1.1 Vdc
	BLACK lead RED lead	Pin 17 Pin 18	OL
SET depressed	BLACK lead RED lead	Pin 17 Pin 18	Approx. 1.6 Vdc
	BLACK lead RED lead	Pin 17 Pin 18	OL

UP/DOWN ARROW SWITCH TEST			
SWITCH POSITION	FLUKE 115	GAUGE CONNECTOR	VOLTAGE
Switch released	RED lead BLACK lead	Pin 16 Pin 18	Approx. 2 Vdc or OL (see note 1)
	BLACK lead RED lead	Pin 16 Pin 18	OL
UP depressed	RED lead BLACK lead	Pin 16 Pin 18	Approx. 1.1 Vdc
	BLACK lead RED lead	Pin 16 Pin 18	OL
DOWN depressed	RED lead BLACK lead	Pin 16 Pin 18	Approx. 1.6 Vdc
	BLACK lead RED lead	Pin 16 Pin 18	OL

NOTE: Remember that each diode should drop approximately 0.6 Vdc when positively biased, and read as an OL (open circuit) when negatively biased (leads reversed).

Note 1: May be OL on some multimeters.

If the readings are correct when testing with the switch depressed UP and DOWN, while it was OL with the switch released, then the switch is functional.

When measuring between pins 17 and 18, or 16 and 18, if an OL is obtained with both positive and negative diode biasing, test the continuity of each wire between the gauge and switch assembly. If continuity is good, replace the switch assembly.

If any reading is significantly different than specified, carry out the same test at the switch connector, refer to the wiring diagram. If you obtain the same results, replace the switch assembly.

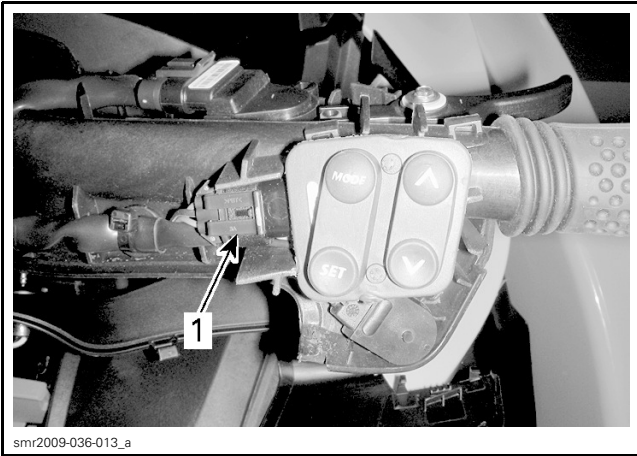
If voltages measured on every switch are as specified (or very close to it), the switches and the wiring harness are good. The fault may be within the gauge. Replace the gauge.

Replacing the MODE/SET and UP/DOWN Switch Assembly (Except X Package)

1. Remove steering cover, refer to *STEERING AND O.T.A.S.* subsection.

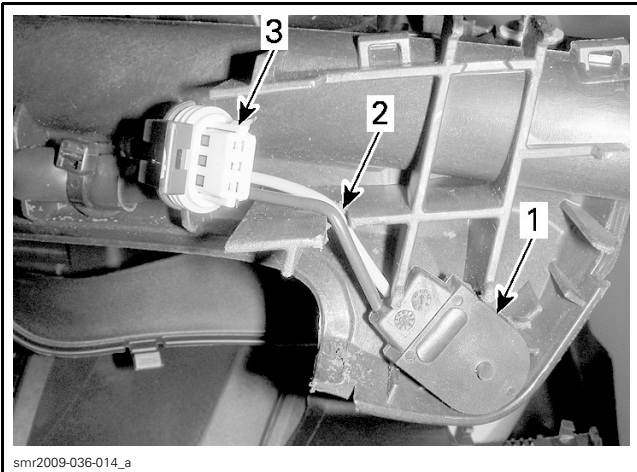
Subsection XX (INFORMATION CENTER (GAUGE))

2. Disconnect connector from switch assembly.



TYPICAL - GTX LIMITED IS ILLUSTRATED
1. MODE/SET and UP/DOWN switch connector

3. Remove switch assembly from support by lifting it off the support.
4. As applicable, ensure wiring from cruise switch is properly inserted in slot provided before installing MODE/SET and UP/DOWN arrow switch assembly.



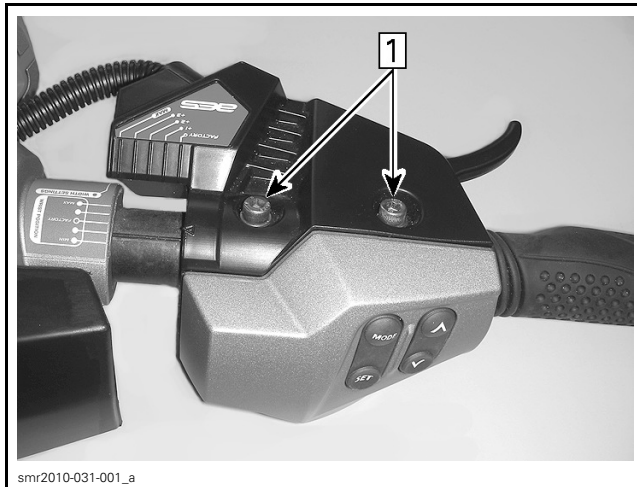
TYPICAL - GTX LIMITED IS ILLUSTRATED
1. Cruise switch
2. Wiring in slot provided in support
3. MODE/SET and UP/DOWN arrow switch connector

5. Apply a small amount of DIELECTRIC GREASE (P/N 293 550 004) on switch contact pins.
6. Install connector on new switch assembly.
7. Insert switch assembly in switch support.
8. Install steering cover, refer to *STEERING AND O.T.A.S.*

Replacing the MODE/SET and UP/DOWN Switch Assembly (X Package Only)

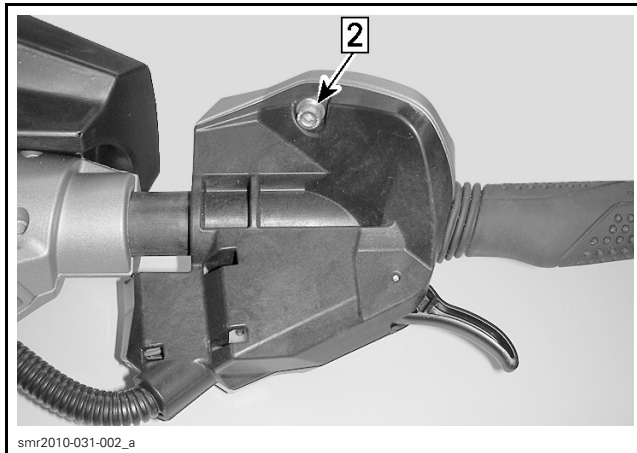
Removing the Switch

1. Remove the 2 screws in the front of the upper handlebar housing.



Step 1: Remove these two screws

2. Remove the screw at back of the handlebar.

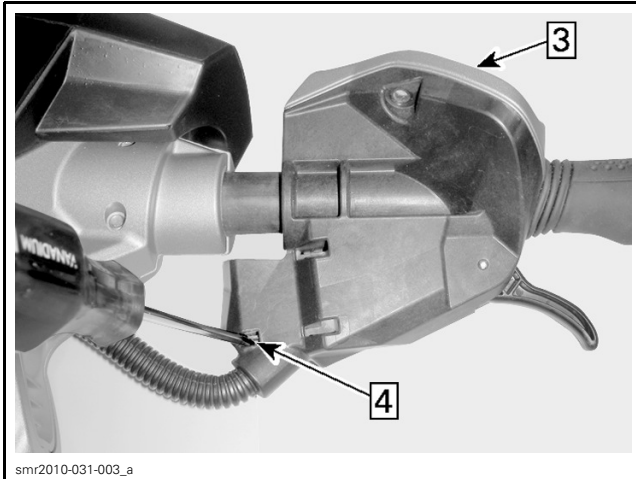


Step 2: Remove this screw

NOTICE Do not try to pull the cover off the housing at this time or damage to the cover will occur.

3. Take hold of the housing cover to prevent it from falling off the handlebar when unlocking the upper housing in the following step.
4. Using a small screwdriver, unlock the tab that retains the upper housing and pull the upper housing off.

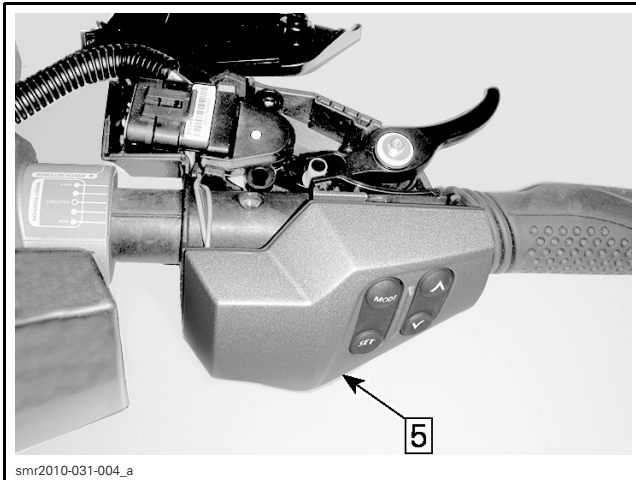
NOTICE As you remove the upper housing, hold on to the housing cover to prevent it from falling off the handlebar.



smr2010-031-003_a

Step 3: Hold on to this housing cover
Step 4: Unlock this tab

5. Remove the housing cover from the handlebar.

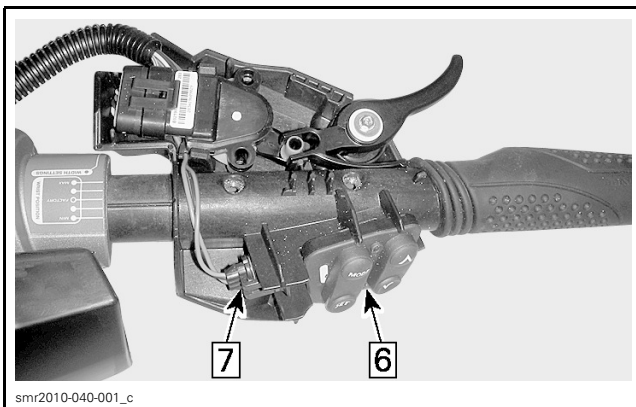


smr2010-031-004_a

Step 5: Remove housing cover

6. Remove switch from handlebar housing.

7. Remove connector from switch.



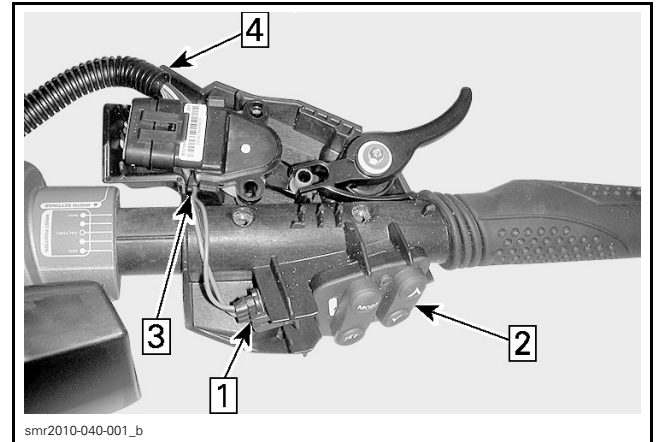
smr2010-040-001_c

Step 6: Remove switch
Step 7: Remove connector

Installing the Switch

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

1. Install connector on switch assembly.
2. Insert switch assembly in handlebar housing.
3. Ensure proper wire routing.
4. Ensure proper positioning of corrugated conduit.

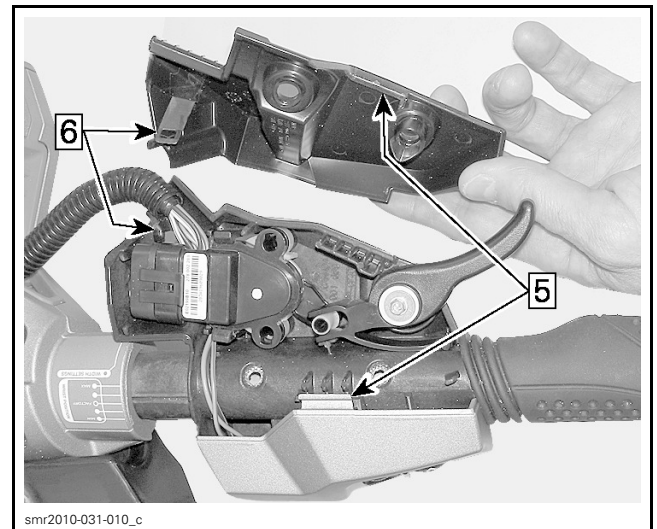


smr2010-040-001_b

Step 1: Install connector
Step 2: Insert switch in handlebar housing
Step 3: Ensure proper wire routing
Step 4: Ensure proper positioning of corrugated conduit

5. Ensure engagement of housing cover retaining tabs.

6. Ensure engagement of upper housing locking tabs.



smr2010-031-010_c

Step 5: Ensure engagement of housing cover retaining tabs
Step 6: Ensure engagement of upper housing locking tabs

7. Position the upper housing on the handlebar housing.

8. Ensure proper engagement of the upper housing and cover tabs.

9. Install the three retaining screws for the upper housing and tighten them as specified.

UPPER SWITCH HOUSING SCREW TORQUE
2 N•m (18 lbf•in)

10. Connect watercraft to the latest applicable B.U.D.S. version, refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

11. Ensure there are no fault codes, refer to *DIAGNOSTIC AND FAULT CODES* subsection.

12. Ensure proper operation of throttle lever and switch assembly.

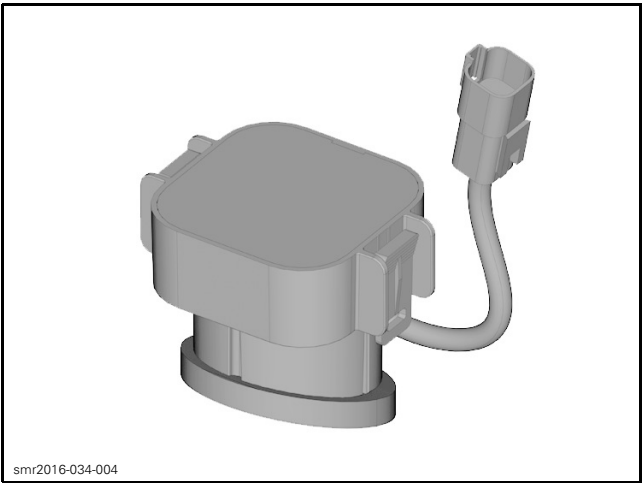
WATER TEMPERATURE SENSOR

The water temperature sensor is connected to the ECM.

Water from the jet pump passes through the intercooler inlet hose where the sensor measures its temperature, generating a signal that is interpreted by the ECM module. The ECM module then sends the information through the can-bus to the information center that translates it into a temperature indication.

If the temperature display is 0 degrees, water temperature sensor might be defective. Verify water temperature sensor and replace if necessary.

DEPTH FINDER



smr2016-034-004

WARNING

Never use the depth gauge as a warning device to ride in shallow water. Use it as a navigation guide only. Not to be used to get precise navigation data.

Depth Finder Troubleshooting

DEPTH FINDER TROUBLESHOOTING		
SYMPTOM	POSSIBLE CAUSE	REMEDY
Nothing is displayed in the information center	Depth finder not connected.	Properly connect depth finder.
	Depth finder not properly installed.	Make sure depth finder is properly installed in battery holder base. There must be no air gap between hull and silicone pad(s).
	12 Vdc wire or ground wire to depth finder open.	Check fuse and wiring harnesses.
	Problem with communication link wires.	Check wires to CAN bus-bars in FB1.
---- (ft or m) is displayed	Watercraft is not in water.	Launch watercraft in water and recheck.
	There is air between silicone pad and depth finder or between depth finder and battery holder base.	Remove depth finder. Replace silicone pad.
	Depth finder is defective.	Try a new depth finder.

Replacing the Depth Finder

Do not attempt remove the depth finder. Epoxy glue holds it in place.

Order a new depth finder from accessories (PAC) and follow the instructions provided with the kit.

Testing Depth Finder Operation

1. Press START/STOP button to activate gauge.
2. Confirm the depth finder icon is active in gauge.
3. If icon is not active, check in BUDS that icon box is checked.

NOTE: When watercraft is not in water, the icon is active but there is no reading. To verify proper operation, launch watercraft in water and compare depth indication with actual depth.

STEERING AND O.T.A.S.

SERVICE TOOLS

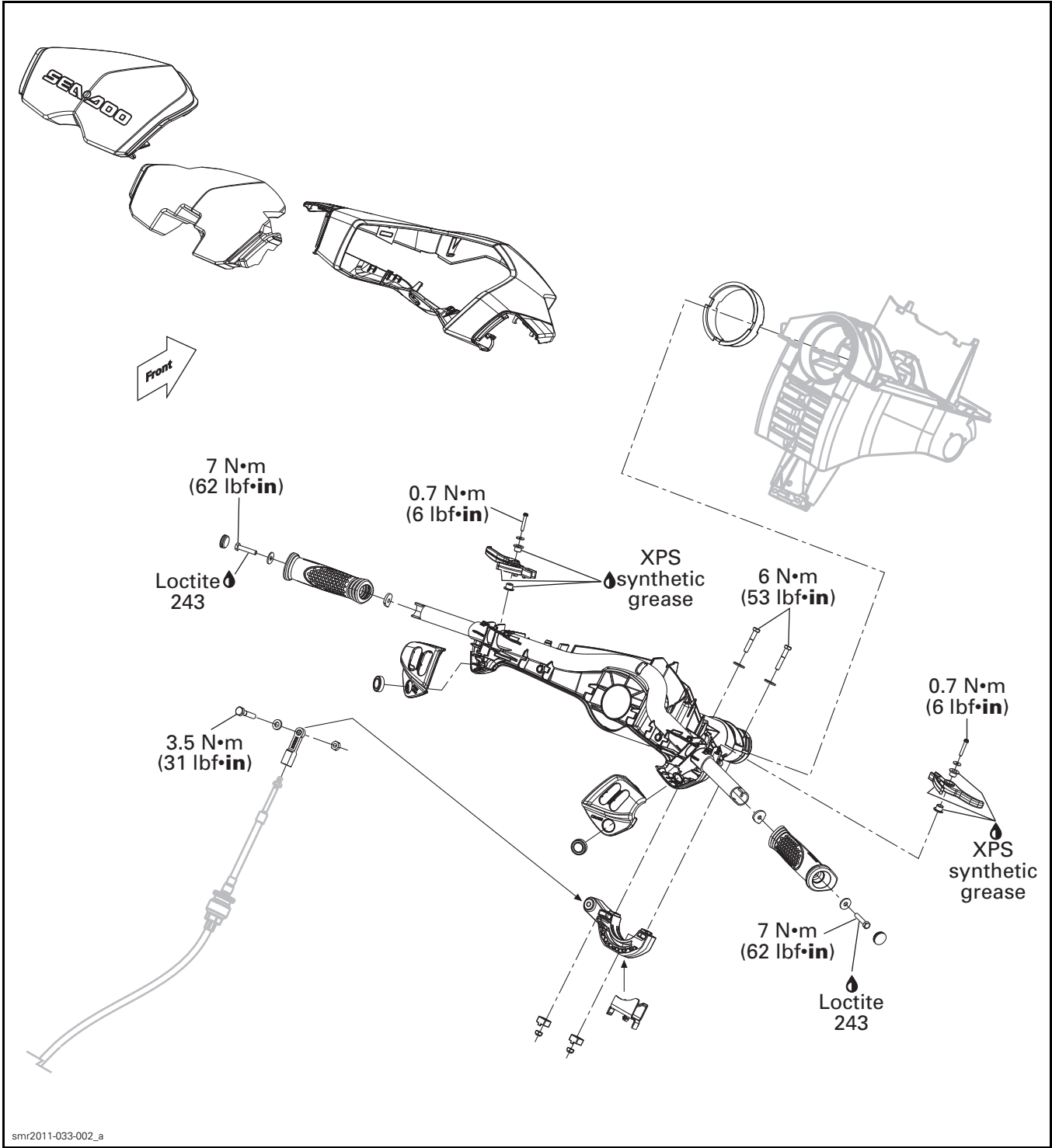
Description	Part Number	Page
DIAGNOSTIC HARNESS	529 036 188	22–23
FLUKE 115 MULTIMETER	529 035 868	22–23
STEERING CABLE TOOL	295 000 145	16

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	9, 12
LOCTITE 567 (PIPE SEALANT)	293 800 013	16
XPS SYNTHETIC GREASE.....	293 550 010	14

STEERING COLUMN

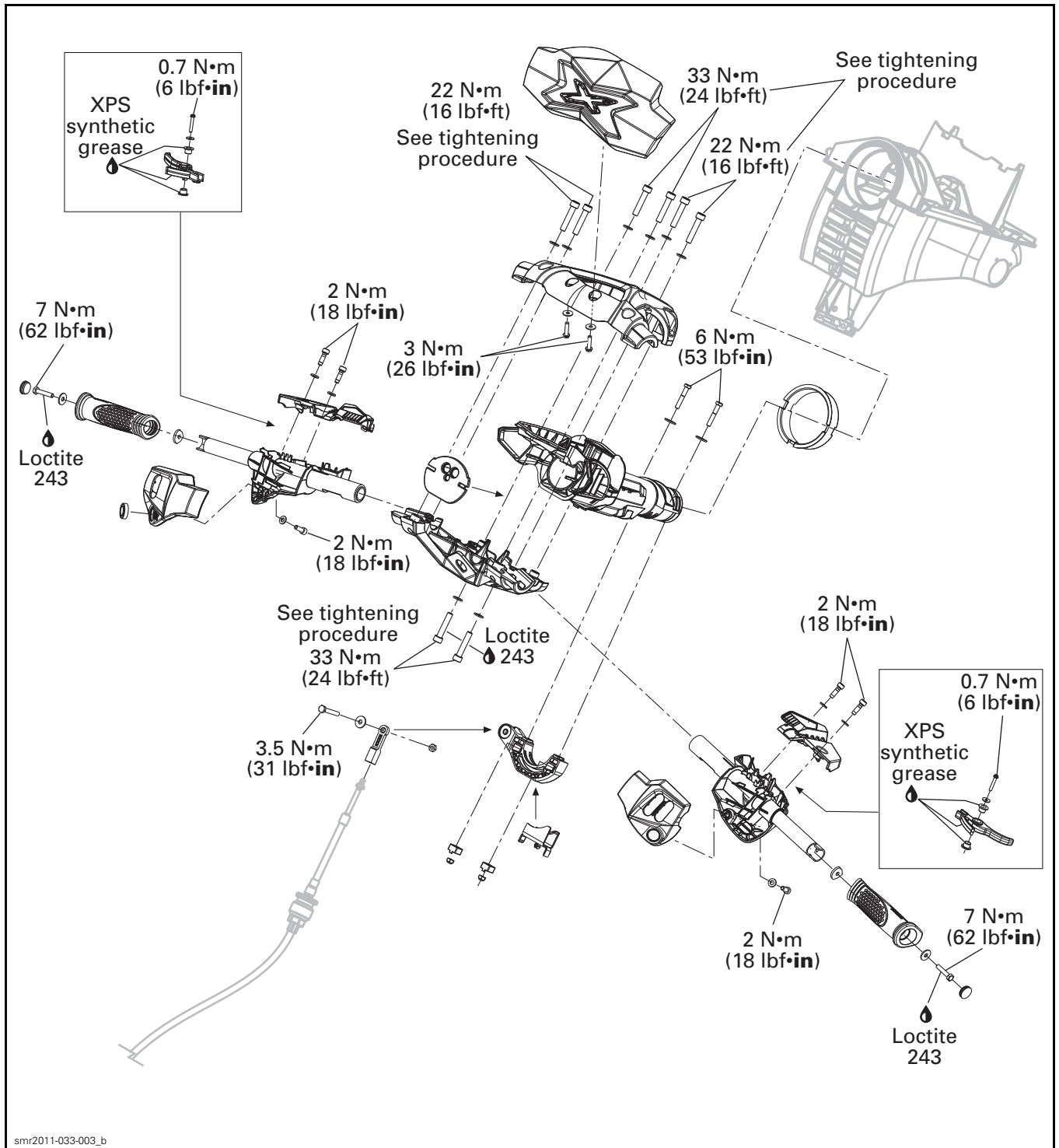
GTX, GTX iS, RXT and Wake Pro



smr2011-033-002_a

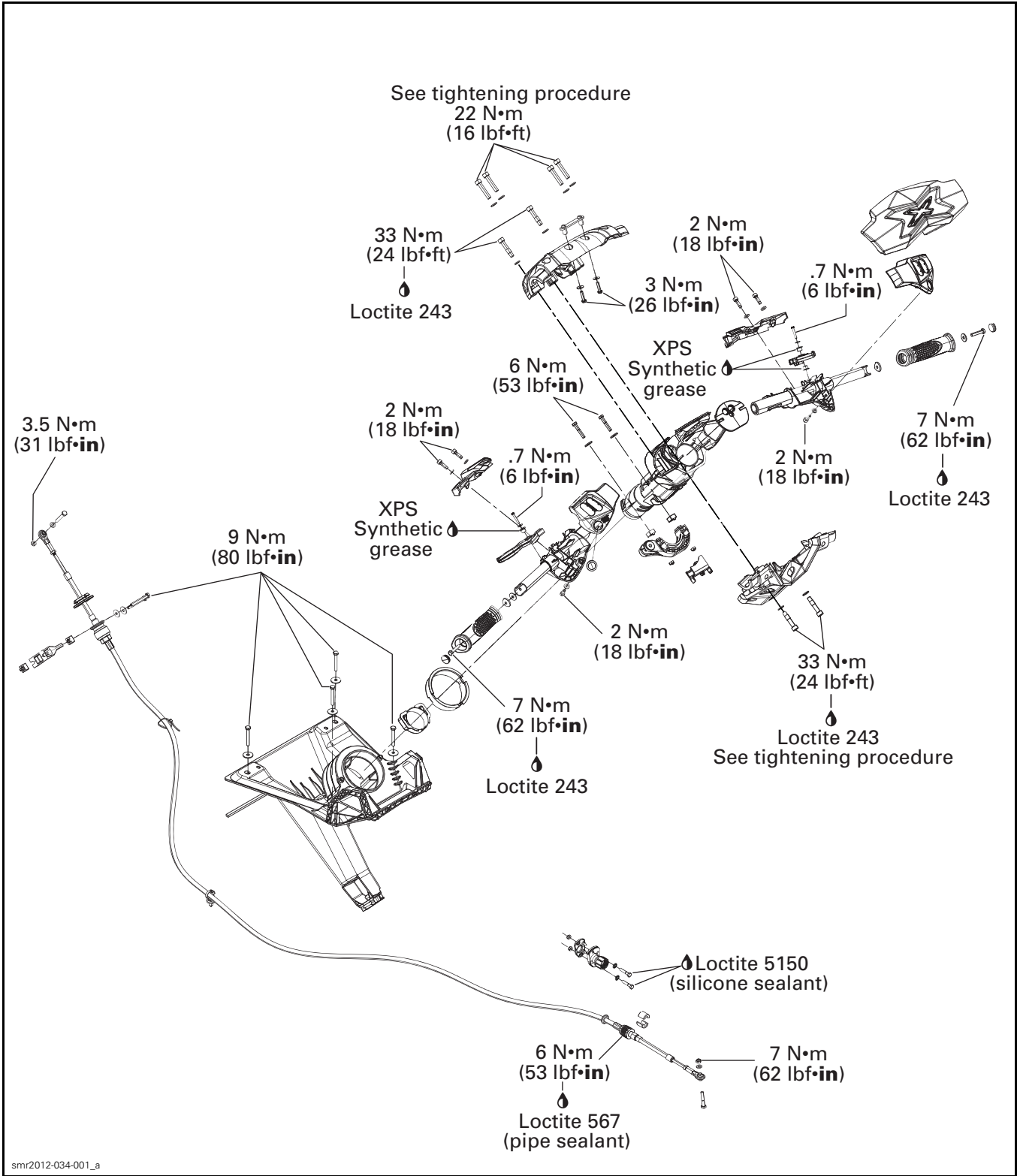
STEERING COLUMN

RXT-X, RXT-X aS and RXT-X rs



STEERING COLUMN AND CABLE

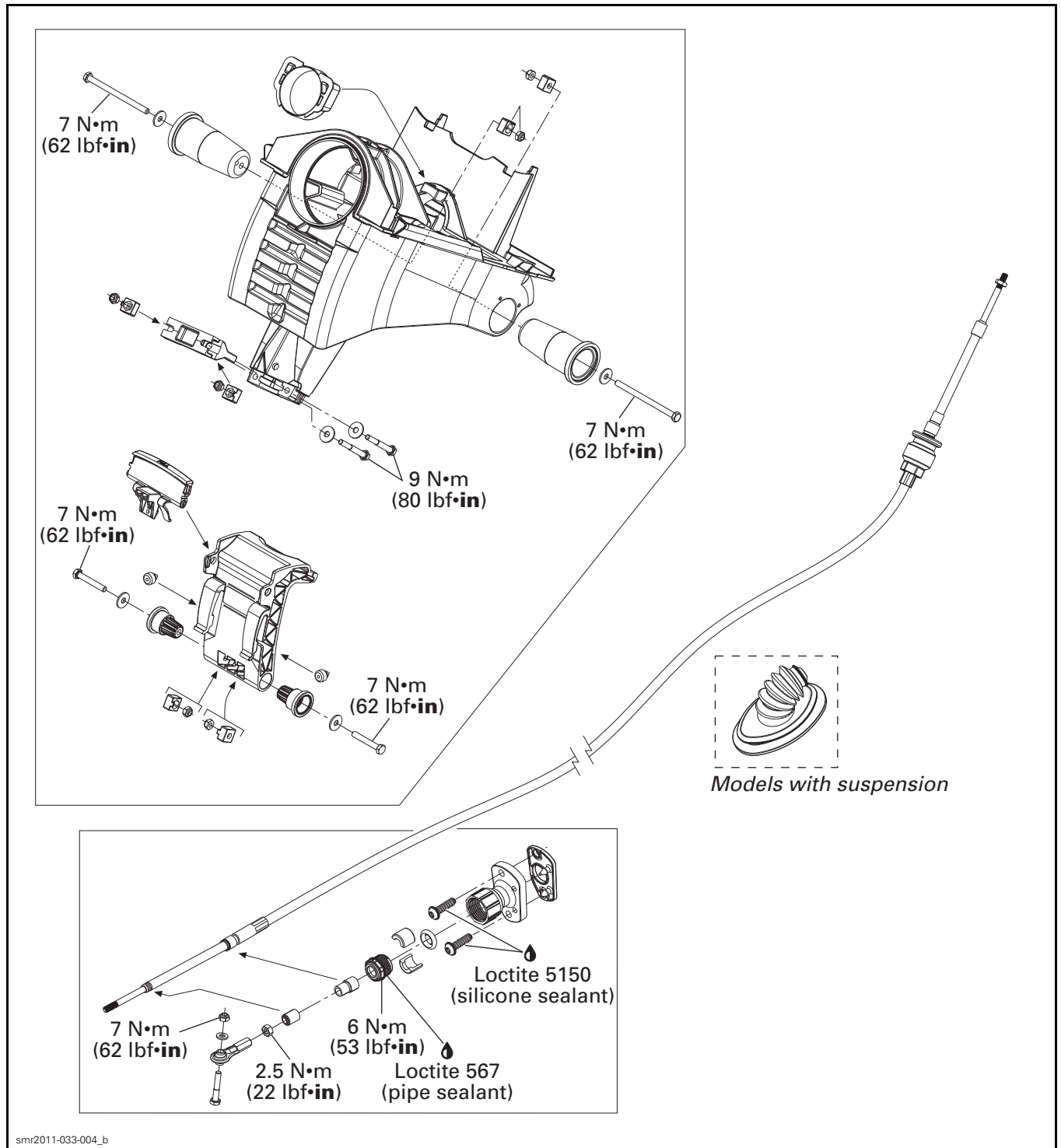
RXP-X Series



smr2012-034-001_a

STEERING COLUMN SUPPORT AND CABLE

GTX/RXT Series and WAKE PRO



GENERAL

SYSTEM DESCRIPTION (O.T.A.S.)

The O.T.A.S. (Off-Throttle Assisted Steering) provides additional maneuverability in off-throttle situations.

The system uses a pair of magnets attached to the steering column and a Hall effect switch attached to the steering column support.

When activated by a magnet, the O.T.A.S. switch sends a signal to the ECM.

The ECM activates a pre-programmed RPM setting when the driver initiates a full turn after releasing throttle lever. The engine RPM is controlled by the Intelligent Throttle Control (iTC).

The O.T.A.S. system is activated in the following conditions:

- The engine speed must be above 4000 RPM for at least 1.5 second (approximately).
- The throttle lever must be released completely.
- The steering must be fully turned within approximately 4 seconds after throttle release.

The O.T.A.S. will stay activated for a random period of time as long as the O.T.A.S. switch is closed.

O.T.A.S. will be deactivated if:

- The throttle is reapplied, or
- The steering is turned sufficiently to open the O.T.A.S. switch for more than one second.

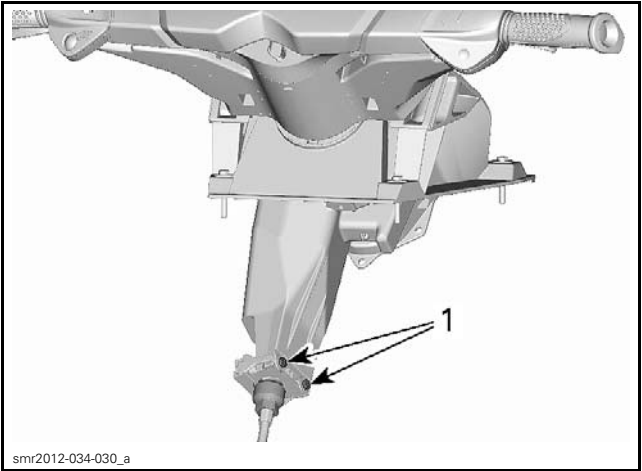
ADJUSTMENT

ADJUSTING THE ALIGNMENT OF THE STEERING

Models without Suspension

Work from engine compartment to reach adjustment nut.

1. Loosen steering cable clamp bolts. Do NOT remove bolts.

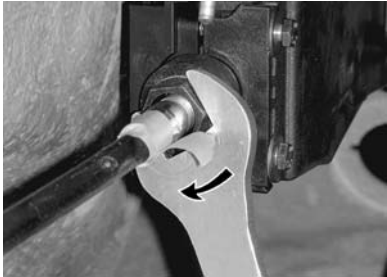


ACCESS FROM ENGINE COMPARTMENT

1. Loosen bolts

2. Turn adjustment nut 1 turn at a time in the direction shown in following table.

REQUIRED TOOL	
Cut a 22 mm (7/8 in) opened wrench to 100 mm (4 in) of length	

ACCESS FROM ENGINE COMPARTMENT	
WATERCRAFT BEHAVIOR	WHAT TO DO
Pulls on left side	Turn steering cable adjustment nut as shown 
Pulls on right side	Turn steering cable adjustment nut as shown 

3. Tighten steering cable clamp bolts to specification.

TIGHTENING TORQUE	
Steering cable adjustment nut	6 N•m (53 lbf•in)

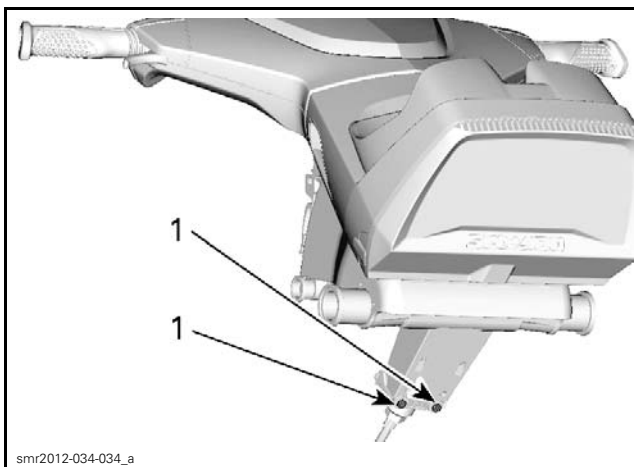
4. Test watercraft.
5. Readjust adjustment nut as necessary.

Models with Suspension

Set suspension to its maximum UP position or safely lift.

Work from front storage compartment to reach adjustment nut.

1. Loosen steering cable clamp bolts. Do NOT remove bolts.

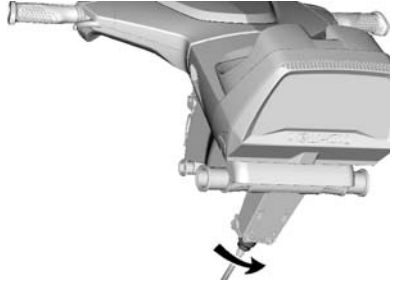
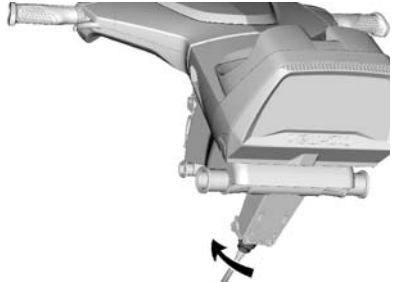


ACCESS FROM FRONT STORAGE COMPARTMENT

1. Loosen bolts

2. Turn adjustment nut 1 turn at a time in the direction shown in following table.

REQUIRED TOOL	
Cut a 22 mm (7/8 in) opened wrench to 100 mm (4 in) of length	

ACCESS FROM FRONT STORAGE COMPARTMENT	
WATERCRAFT BEHAVIOR	WHAT TO DO
Pulls on left side	Turn steering cable adjustment nut as shown 
Pulls on right side	Turn steering cable adjustment nut as shown 

3. Tighten steering cable clamp bolts to specification.

TIGHTENING TORQUE	
Steering cable adjustment nut	6 N•m (53 lbf•in)

4. Test watercraft.
5. Readjust adjustment nut as necessary.

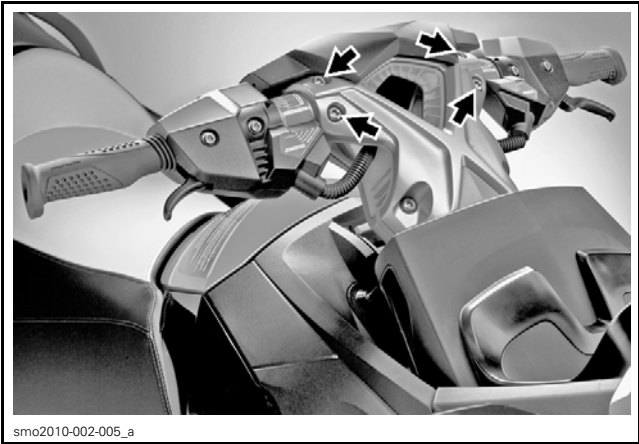
ADJUSTABLE ERGONOMIC STEERING (AES)

Models with AES Steering

The handlebar may be adjusted to driver preference by extending and rotating the handlebar extension tubes.

To adjust, carry out the following steps:

1. Loosen the screws (2 each side) that secure the handlebar extension tubes.



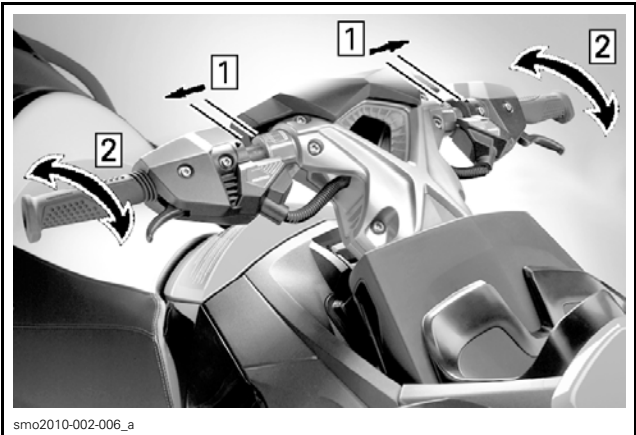
EXTENSION TUBE RETAINING SCREWS (4)

2. Pull out or push in the handlebar grips to adjust handlebar width.

NOTE: The handlebar width factory set position is fully closed. The handlebar width may be increased by 2.5 cm (1 in) each side.

3. Rotate the handlebar grips to the desired position of the controls.

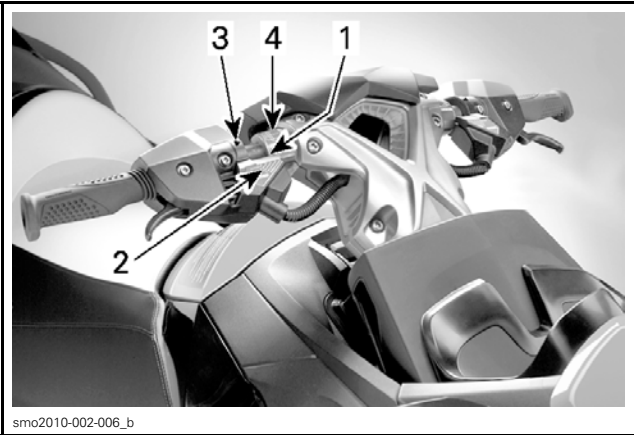
NOTE: Rotating the handlebar grips rotates the handlebar extension tubes and controls. The extension tubes may be rotated plus or minus 18° from the factory set position.



ERGONOMIC ADJUSTMENTS

Step 1: Adjust handlebar width
Step 2: Adjust angular position of controls

4. Using the index marks and scales on each side of the handlebar, ensure identical width and angular position of both handlebar extension tubes.



- 1. Width index
- 2. Width scale
- 3. Angular position index
- 4. Angular position scale

TIGHTENING TORQUE	
Handlebar retaining screws	22 N•m (16 lbf•ft)

INSPECTION

O.T.A.S. OPERATION

This test is to be performed with the watercraft in the water (test tank or on a trailer).

NOTICE If the test is performed on a trailer, ensure no debris or rocks can damage the jet pump.

Start engine.

Raise engine speed higher than 4000 RPM for more than 1 second.

Release throttle while steering is in the straight ahead position.

Within 1 to 3 seconds, turn handlebar all the way to one side.

The O.T.A.S. should come on by keeping or increasing engine speed to approximately 3000 RPM.

Then, engine speed will gradually decrease to idle speed within approximately 5 seconds.

Repeat test for the other side.

If the engine does not behave as described, carry out the *TESTING THE O.T.A.S. SWITCH WITH B.U.D.S.*

TROUBLESHOOTING

DIAGNOSTIC TIPS

Check fault codes as a first troubleshooting step.

If O.T.A.S. works when handlebar is turned on one side only, check:

- Magnets condition
- If magnets and switch are securely installed.

To confirm is O.T.A.S. is functional, carry out *O.T.A.S. OPERATION* in this subsection. If it is not possible, carry out *TESTING THE O.T.A.S. SWITCH WITH B.U.D.S.*

PROCEDURES

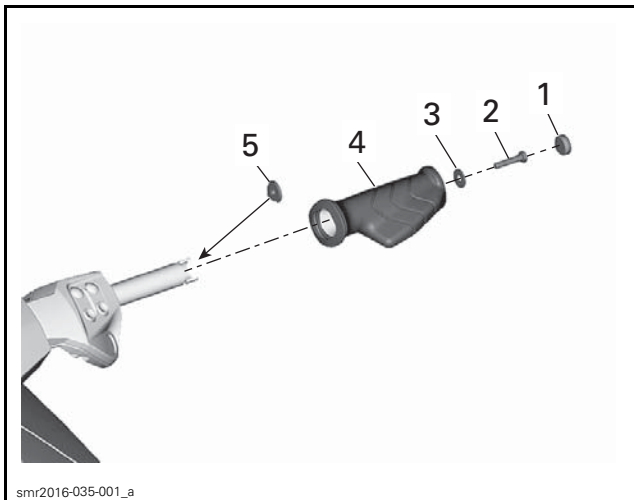
HANDLEBAR GRIP

Removing the Handlebar Grip

To remove handlebar grip, remove the cap, then the retaining screw.

Pull out handlebar grip and remove grip insert from handlebar.

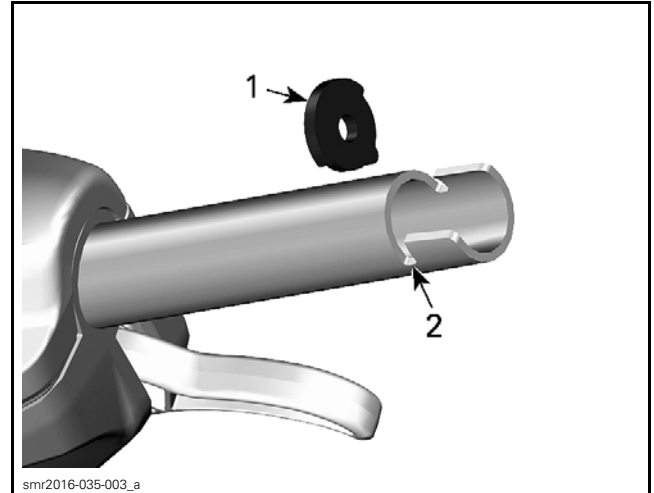
NOTE: Verify grip insert for damage.



1. Handlebar grip cap
2. Handlebar grip screw
3. Flat washer
4. Handlebar grip
5. Handlebar grip insert

Installing the Handlebar Grip

When installing the grip insert in the handlebar, ensure that it is properly inserted in the slot at the end of the handlebar tubing.



TYPICAL

1. Grip insert
2. Handlebar slot

Install handlebar grip on handlebar matching it to the notch in the handlebar.

Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on screw threads (or use new self-locking screws).

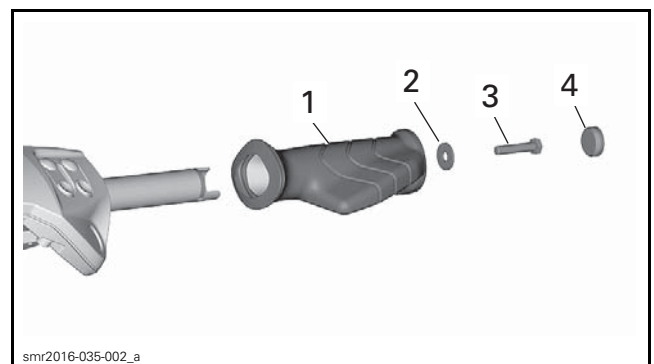
Install flat washer and handlebar grip screw.

NOTICE Ensure to install flat washer otherwise screw will damage the grip end.

Torque handlebar grip screw to specification.

TIGHTENING TORQUE	
Handlebar grip screw	7 N•m (62 lbf•in)

Install cap.



TYPICAL

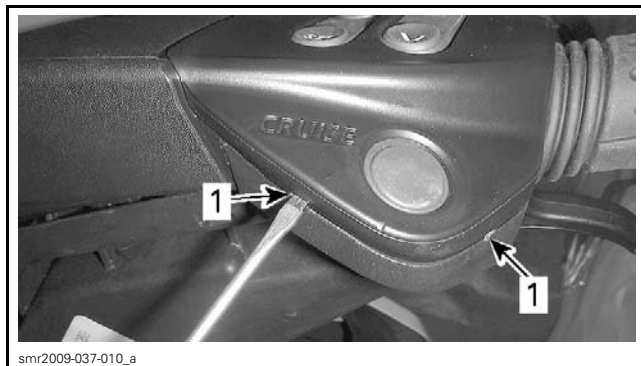
1. Grip
2. Flat washer
3. Screw
4. Cap

HANDLEBAR SWITCH COVER (LH OR RH)

Removing the Handlebar Switch Cover (LH or RH)

Models without AES Steering

1. Insert the end of a small screwdriver in one of cover slots.



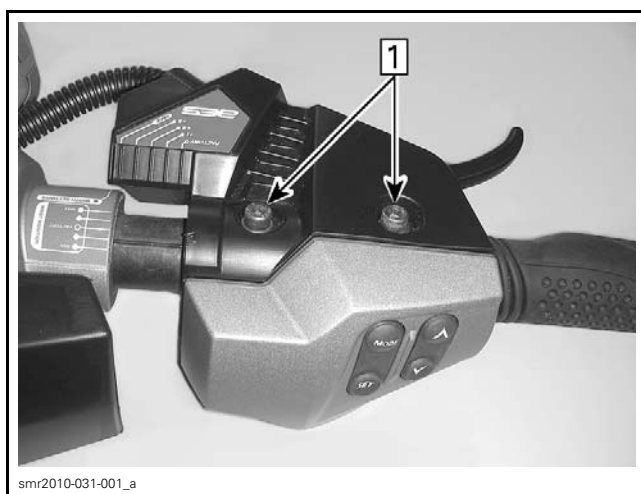
RH SIDE SHOWN

1. Cover slots

2. Twist screwdriver to open cover.
3. Remove the switch cover.

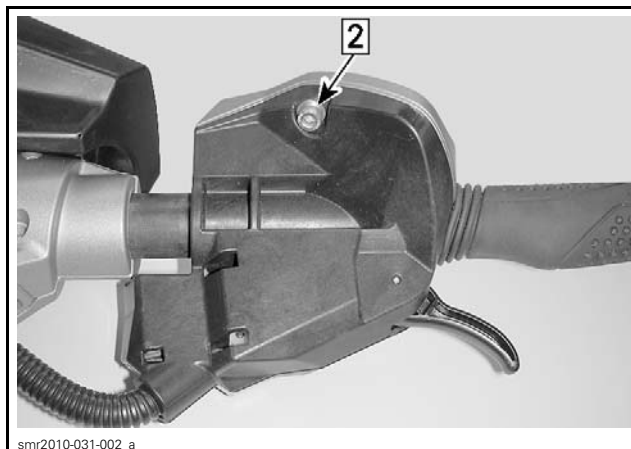
Models with AES Steering

1. Remove the 2 screws at front of the upper handlebar housing.



Step 1: Remove these two screws

2. Remove the screw at rear of the handlebar.

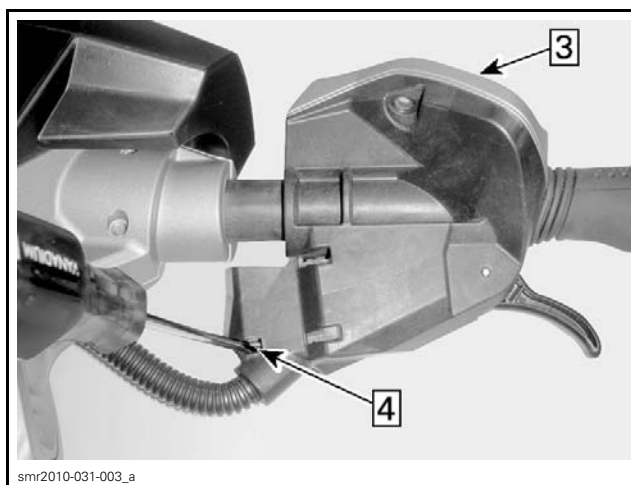


Step 2: Remove this screw

NOTICE Do not try to pull the cover off the housing at this time.

3. Hold the housing cover to prevent it from falling off the handlebar when unlocking the upper housing in the following step.
4. Using a small screwdriver, unlock the tab retaining the upper housing and pull the upper housing off.

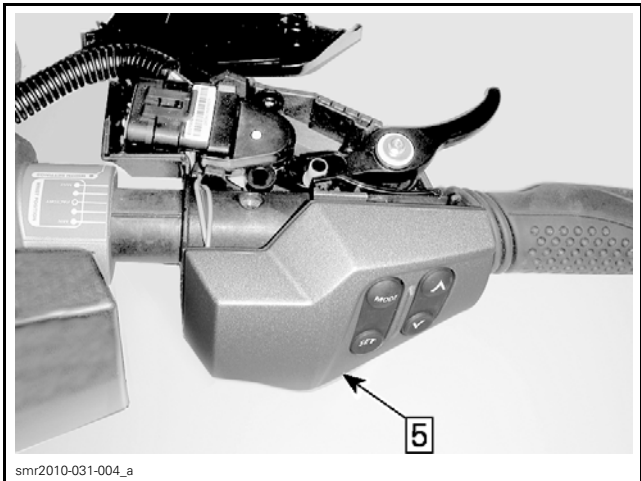
NOTICE As you remove the upper housing, hold the housing cover to prevent it from falling off the handlebar.



Step 3: Hold on to this housing cover

Step 4: Unlock this tab

5. Remove the housing cover from the handlebar.

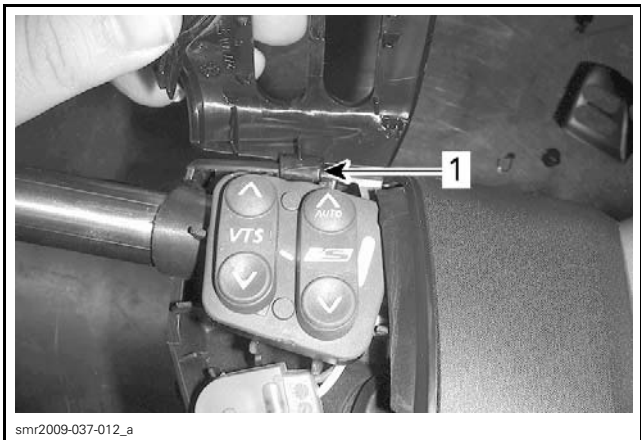


Step 5: Remove housing cover

Installing the Handlebar Switch Cover (LH or RH)

Models without AES Steering

- 1. Install the round rubber button in the cover.
- 2. Insert the front tab and tilt the cover over the switches (applicable models).



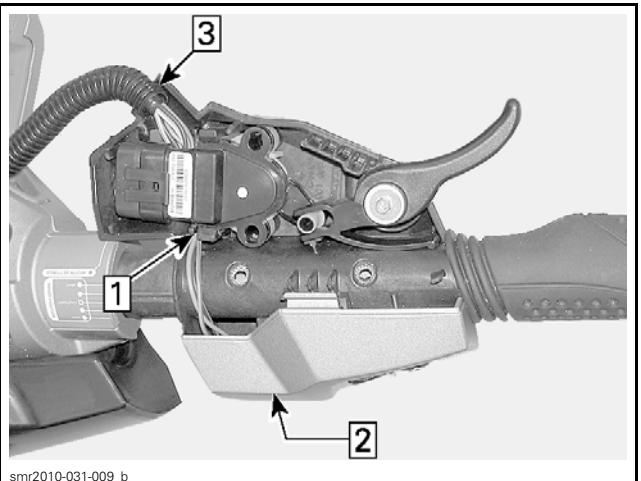
TYPICAL — RH SIDE SHOWN
1. Front tab

- 3. Press on the cover to lock it.

Models without AES Steering

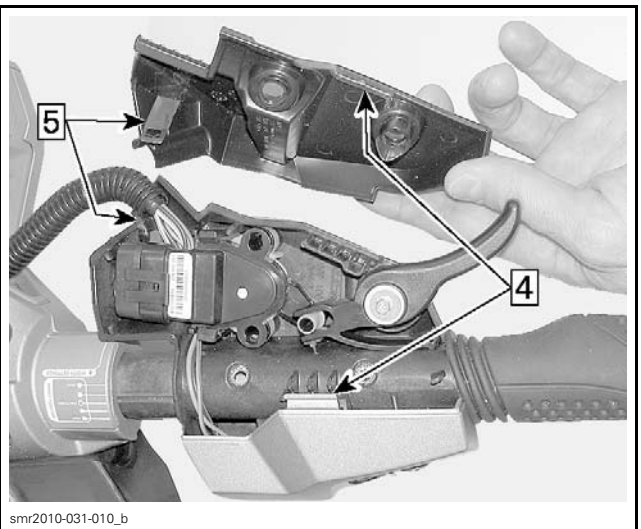
Installation is the reverse of the removal procedure however, pay attention to the following.

- 1. Route wires to avoid pinching them.
- 2. Position the housing cover onto the handlebar housing.
- 3. Ensure positioning of corrugated conduit



Step 1: Ensure wiring is properly routed
Step 2: Install housing cover
Step 3: Ensure proper corrugated conduit positioning

- 4. Position the upper housing on the handlebar housing.
- 5. Ensure proper engagement of the upper housing and cover tabs.



Step 4: Ensure engagement of housing cover retaining tabs
Step 5: Ensure engagement of upper housing locking tabs

- 6. Install the three retaining screws for the upper housing and torque them to specification.

TIGHTENING TORQUE	
Upper housing screws	2 N•m (18 lbf•in)

- 7. Ensure proper operation of throttle lever.

EXTENSION BLOCKS (AES STEERING)

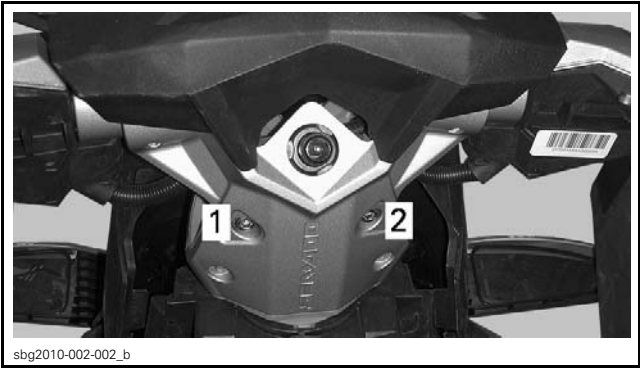
Extension Block Removal

- 1. Remove all socket screws (8x) that retain the front and the rear extension blocks.

- 2. Separate both extension blocks.
- 3. Remove the engine cut-off switch (D.E.S.S. post) retaining nut. Refer to *IGNITION SYSTEM*.

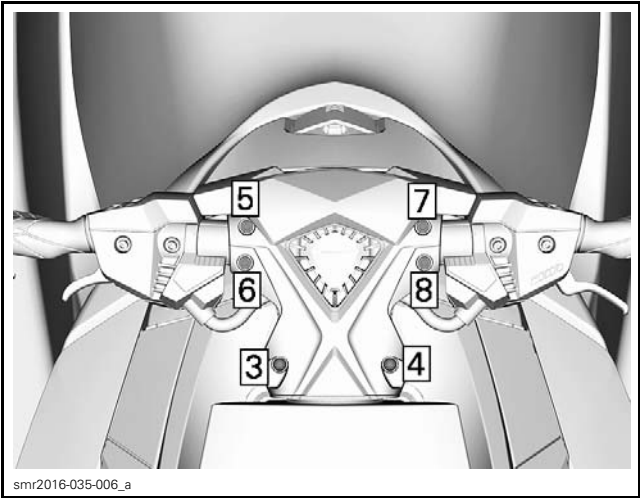
Extension Block Installation

Tighten screws to specification as per illustrated sequence.



REAR STEERING EXTENSION BLOCK

TIGHTENING TORQUE	
Rear steering extension block screws	33 N•m (24 lbf•ft)



FRONT STEERING EXTENSION BLOCK

TIGHTENING TORQUE		
Steps 3 and 4	Torx screw	33 N•m (24 lbf•ft) + LOCTITE 243 (BLUE) (P/N 293 800 060) or install new self-locking screws)
Step 5 to 8	Allen socket screws	22 N•m (16 lbf•ft)

Install engine cut-off switch (D.E.S.S. post) retaining nut. Refer to *IGNITION SYSTEM*.

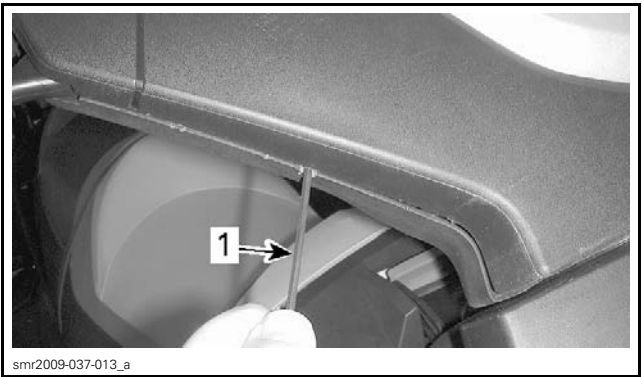
STEERING COVER

Removing the Steering Cover

Models without AES Steering

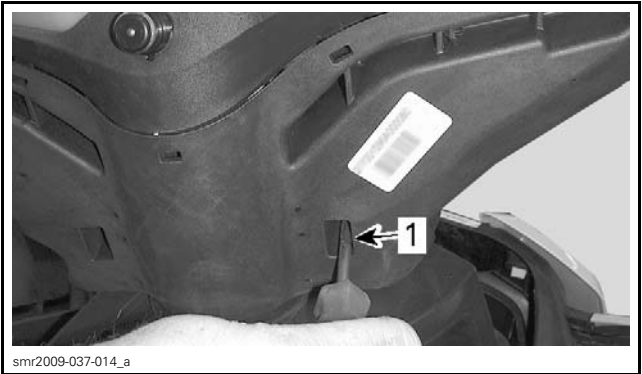
- 1. Remove the engine cut-off switch (D.E.S.S. post) retaining nut. Refer to *IGNITION SYSTEM*.
- 2. Remove both handlebar switch covers. See procedure in this subsection.
- 3. Unlock steering cover from steering.
 - 3.1 Insert a small tool, such as an Allen key, into a steering cover hole. Press the tool against the retaining tab to unlock it. Repeat for the other side.

NOTICE The tool must be inserted perfectly straight to avoid breaking the tab holder.



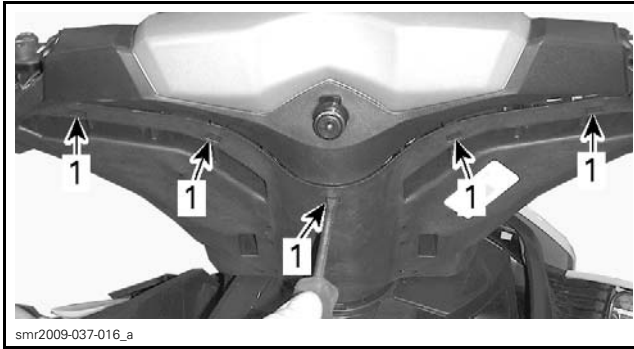
1. Allen key

- 3.2 In both cavities at the back of steering cover, release both inner retaining tabs using a long screwdriver.



1. Rear cavity

- 3.3 Release the five retaining tabs at the rear of steering cover.



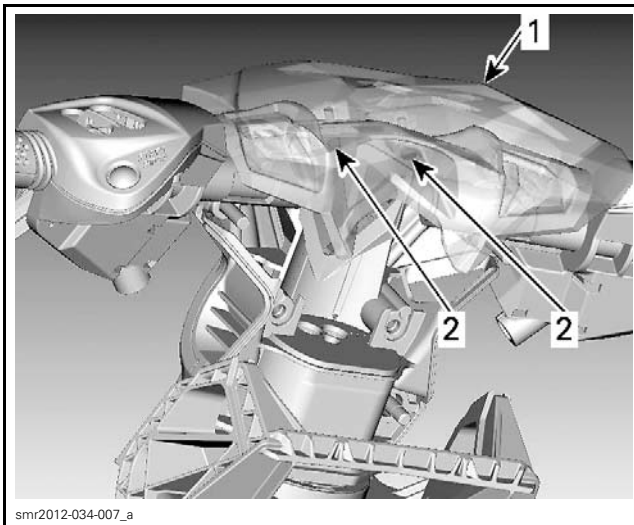
1. Retaining tabs

3.4 Remove the foam inside the steering cover.

3.5 Remove the engine cut-off switch from the steering cover.

RXT-X/RXP-X Series

1. Separate the extension blocks. See procedure in this subsection.
2. Remove screws securing the steering cover (underneath steering cover) to the front extension block.

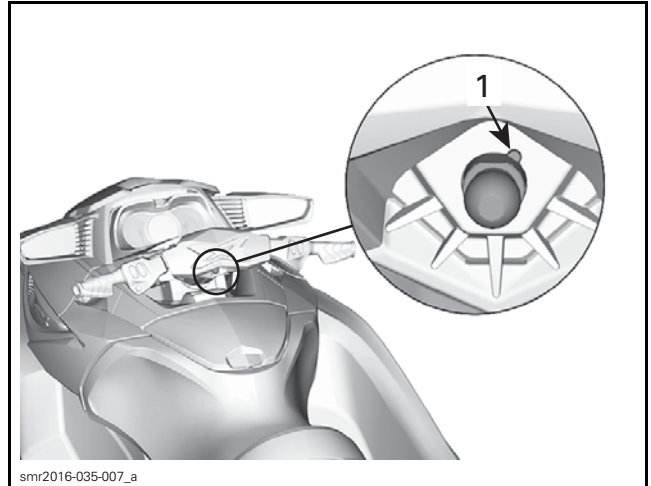


1. Steering cover
2. Retaining screws

Installing the Steering Cover

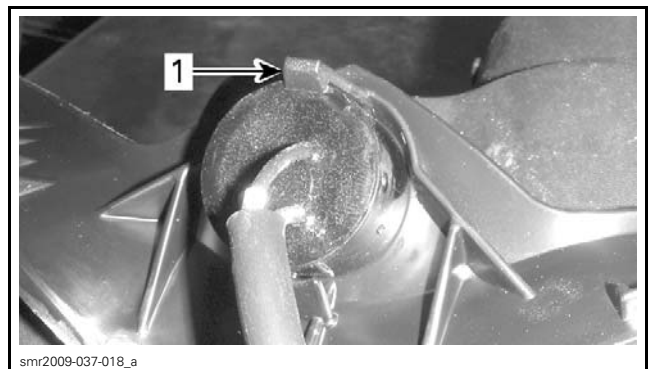
All Models Except RXT-X/RXP-X Series

1. Install the engine cut-off switch.
 - 1.1 Index the alignment pin of the engine cut-off switch with the notch of steering cover.



1. Steering cover notch

- 1.2 Press the engine cut-off switch until retaining tab is positioned correctly.

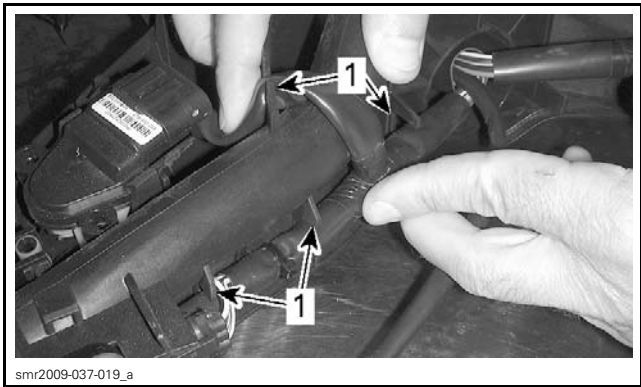


1. Retaining tab

2. Install the engine cut-off switch nut.

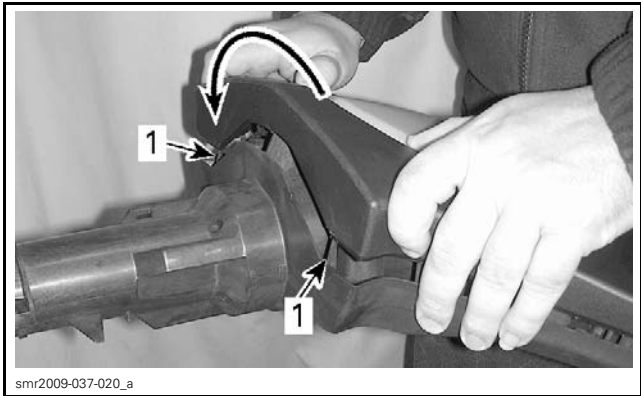
TIGHTENING TORQUE	
Engine cut-off switch nut	2 N•m (18 lbf•in)

3. Install the foam.
4. Place the engine cut-off switch harness in foam slot.
5. Install the steering cover.
 - 5.1 Check if all harnesses are route properly. All harness must be inserted in its slot.



1. Harness slots

- 5.2 Clip the top of the cover.
- 5.3 Stretch the bottom of the steering cover until the cover edge passes over the inner ribs.



STEERING REMOVED FOR CLARITY PURPOSE
1. Inner ribs

- 5.4 Push both side of the cover to lock it with the steering column.
- 5.5 Install switch covers.

RXT-X/RXP-X Series

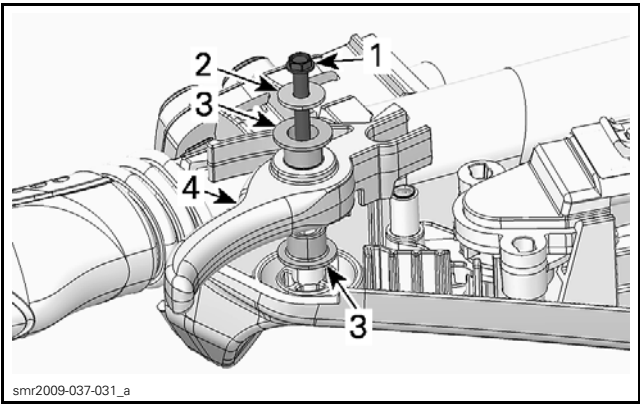
The installation is the reverse of the removal procedure.

THROTTLE AND iBR LEVERS

NOTE: The following procedure demonstrates the replacement of the throttle lever but the same procedure will be used for the iBR lever.

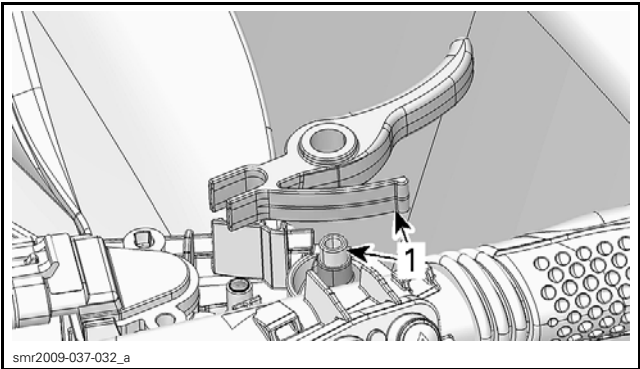
Replacing the Lever

- 1. Remove *HANDLEBAR SWITCH COVER*, see procedure in this subsection.
- 2. Remove the screw and washer securing throttle lever.
- 3. Remove throttle lever and its bushings.



1. Retaining screw
2. Washer
3. Bushings
4. Throttle lever

- 4. Clean throttle lever area from dust or any deposits.
- 5. Apply XPS SYNTHETIC GREASE (P/N 293 550 010) on bushings and on the outer surface of the return tab.



1. Apply grease here

- 6. Install the lever.
 - 6.1 Install both bushings in lever hole.
 - 6.2 Insert sensor lever end into throttle lever fork.
 - 6.3 Position the return tab against the handlebar.
 - 6.4 Secure the lever with washer and screw.

TIGHTENING TORQUE	
Lever screw	0.7 N•m (6 lbf•in)

- 7. Reinstall all removed parts using appropriate procedures.

STEERING CABLE
Replacing the Steering Cable

RXP-X Series
Remove seat.

Open the front storage compartment cover.

Remove access cover.

Remove the gauge trim. Refer to *BODY (RXP-X SERIES)* subsection.

RXT/GTX without Suspension

Open the seat and the front storage compartment cover.

Remove the storage basket.

Remove the gauge support. Refer to *INFORMATION CENTER (GAUGE)* subsection.

RXT/GTX with Suspension

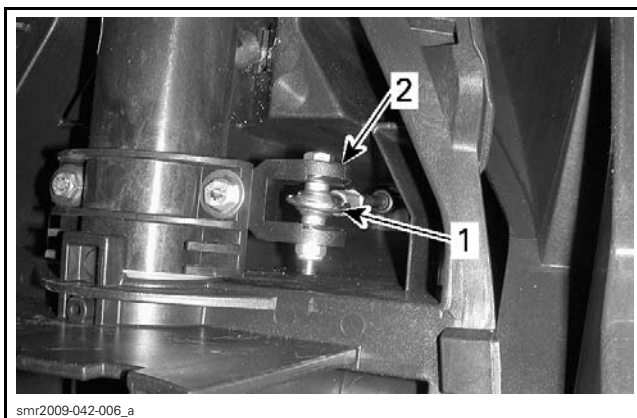
Remove the moving deck. Refer to *BODY (GTX, RXT AND WAKE PRO SERIES)* subsection.

Remove the adjusting nut from steering cable end.

All Models

1. Detach steering cable from steering column.

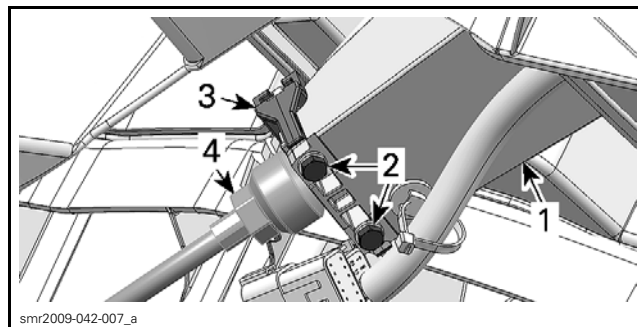
1.1 Remove the bolt securing the ball joint to the steering column arm.



1. Steering cable ball joint
2. Steering column arm

1.2 Remove the steering cable clamp bolts.

1.3 Unhook steering cable clamp.



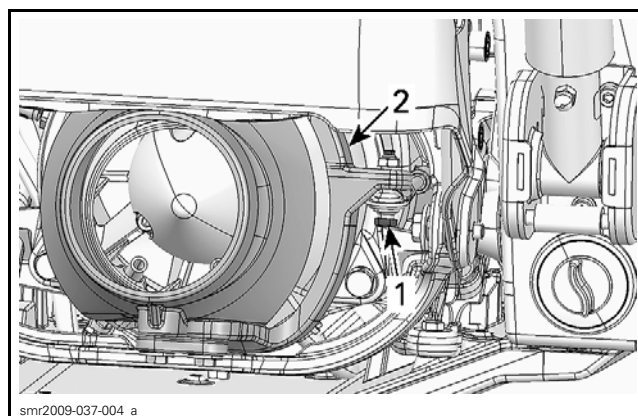
TYPICAL

1. Steering column
2. Steering column clamp bolts
3. Steering column clamp
4. Steering cable adjusting nut

1.4 Place steering in its lower position (models with tilt steering).

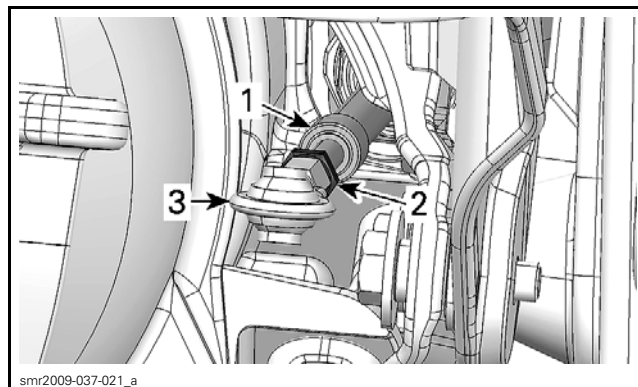
1.5 Free steering cable from the clamp.

2. At rear of the watercraft, disconnect ball joint from jet pump nozzle arm.



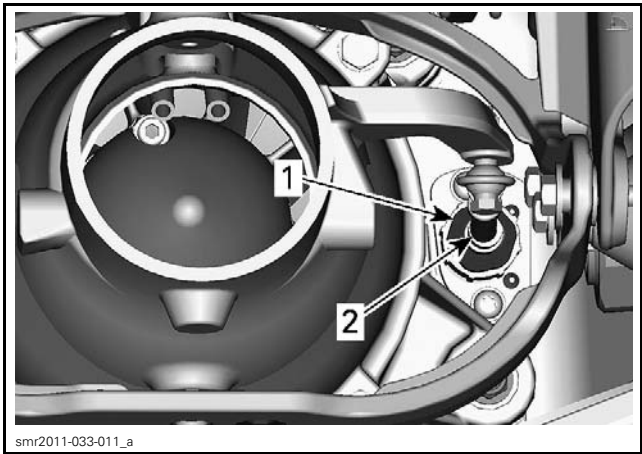
1. Steering cable bolt
2. Nozzle arm

3. Remove ball joint and jam nut from cable.



1. Steering cable
2. Jam nut
3. Ball joint

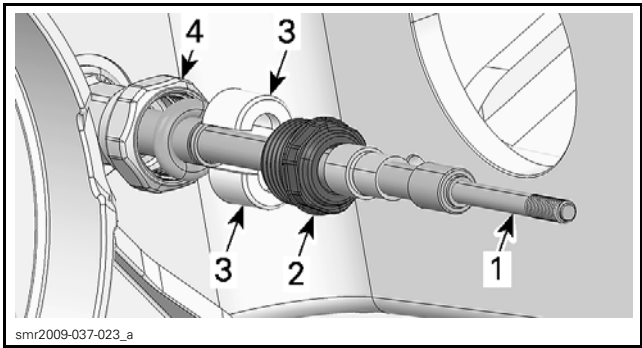
4. Loosen steering cable nut.



- 1. Steering cable nut
- 2. Steering cable

REQUIRED TOOL	
STEERING CABLE TOOL (P/N 295 000 145)	

5. Remove steering cable nut, half rings and O-ring.



TYPICAL - PUMP AND iBR SYSTEM REMOVED FOR CLARITY PURPOSE ONLY

- 1. Steering cable
- 2. Steering cable nut
- 3. Half rings
- 4. O-ring

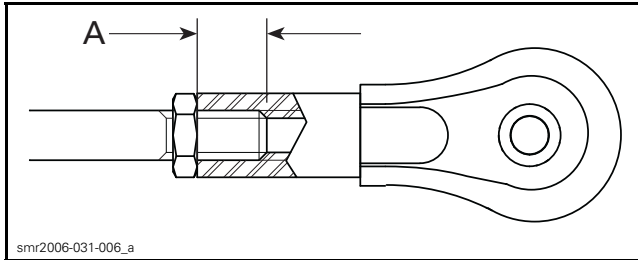
6. Remove the adjusting nut from the new steering cable.
7. From inside the hull, pull the aft end of the cable through the hull fitting.
8. Using a piece of hose, attach one end of the new cable to the opposite end of the old cable together.
9. Route the new cable in the hull by slowly pulling the old one, then separate cable ends.
10. From inside of the hull, pass the aft end of the cable through the hull fitting.
11. Secure the steering cable to the hull fitting.
- 11.1 Install O-ring and half rings.
- 11.2 Apply LOCTITE 567 (PIPE SEALANT) (P/N 293 800 013) on nut threads.

11.3 Secure steering cable with the steering cable nut.

TIGHTENING TORQUE	
Steering cable nut	6 N•m (53 lbf•in)

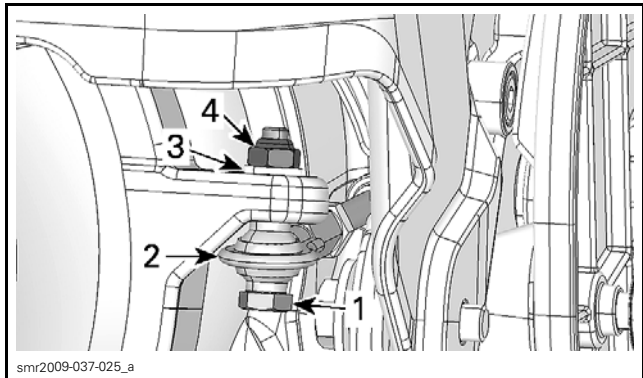
12. Install the ball joint on the end of the steering cable.

12.1 The threaded portion of steering cable inserted into ball joint should be within 9 mm ± 1 mm (.354 in ± .039 in).



A. 9 mm ± 1 mm (.354 in ± .039 in)

- 12.2 Tighten jam nut to specification.
- 12.3 Position the steering cable ball joint to the nozzle as per following illustration.



TYPICAL

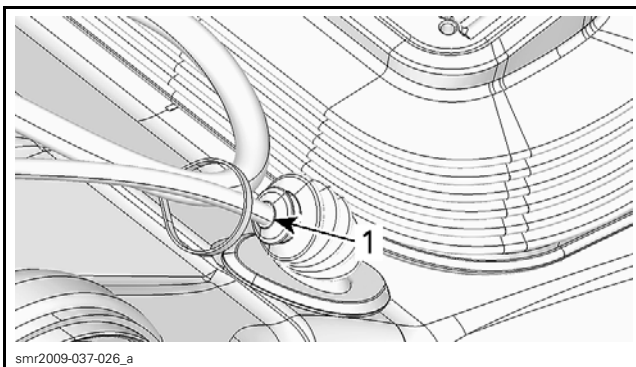
- 1. Ball joint bolt
- 2. Ball joint under nozzle arm
- 3. Washer
- 4. Nut

12.4 Tighten ball joint nut to specification.

TIGHTENING TORQUE	
Ball joint jam nut	2.5 N•m (22 lbf•in)
Ball joint nut	7 N•m (62 lbf•in)

RXT/GTX with Suspension

1. Check if the cable bellow is properly positioned all around steering cable.

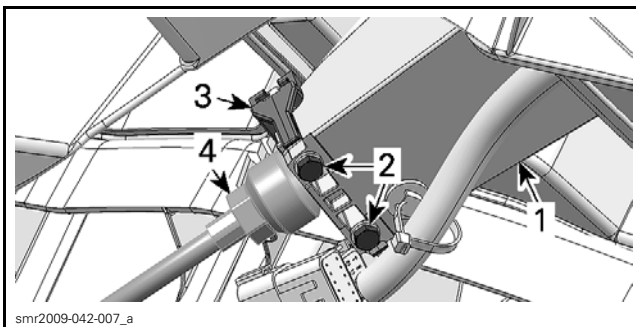


1. Check fit

2. Reinstall the moving deck. Refer to *BODY (GTX, RXT AND WAKE PRO SERIES)* subsection for complete procedure.

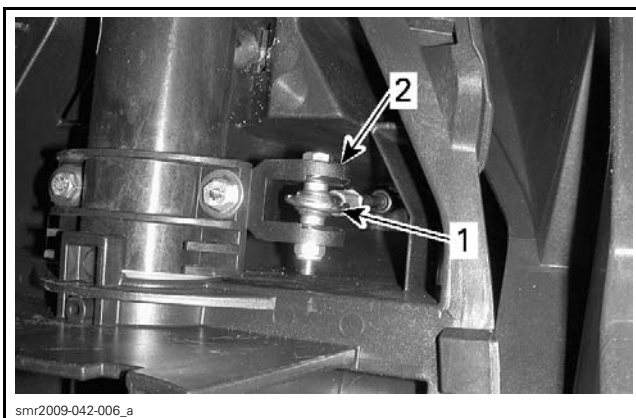
All Models

1. Carry out *ADJUSTING THE ALIGNMENT OF THE STEERING*. See procedure in this subsection.
2. Insert the steering cable through the bottom end of the steering column.
3. Install steering cable clamp and its bolts. Do not tighten bolts yet.



1. Steering column
2. Steering column clamp bolts
3. Steering column clamp
4. Steering cable adjusting nut

4. Attach steering cable to steering column arm.



1. Steering cable ball joint
2. Steering column arm

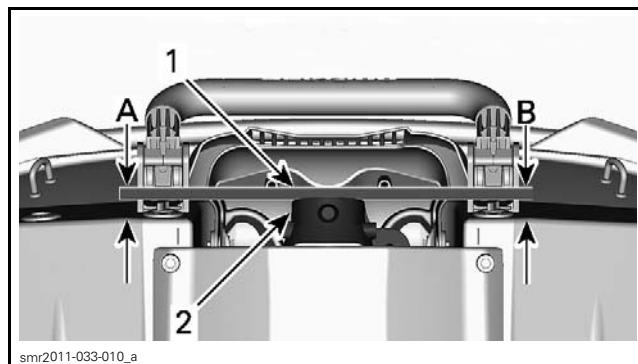
TIGHTENING TORQUE

Front steering cable screw	5 N•m (44 lbf•in)
----------------------------	-------------------

5. Install other removed parts.

Adjusting the Steering Cable

1. Steering cable adjustment is required only if:
 - A steering cable end ball joint has been replaced or loosened/tightened.
 - Steering cable adjustment nut has been loosened/tightened.
 - Steering cable has been replaced.
 - Steering column or support has been replaced.
2. Raise the iBR gate by activating the iBR override function. Refer to *iBR AND VTS* subsection.
3. Refer to *STEERING CABLE* in this subsection and:
 - Detach steering cable end from steering column.
 - Unhook steering cable from retaining clamp of steering column support.
4. Position jet pump nozzle as follows:
 - 4.1 Place a straight edge on the nozzle end.
 - 4.2 Measure the distance from the transom each side of the straight edge.



VIEW FROM UNDERNEATH THE HULL

1. Straight edge
2. Nozzle
- A. LH side measure
- B. RH side measure

- 4.3 Turn nozzle so that measures A and B are equal.

5. Adjust steering cable as follows:

- 5.1 Turn adjustment nut to reach specification.

STEERING ADJUSTMENT SPECIFICATION
187.7 mm (7.39 in)
NOTE: This specification gives the proper nozzle adjustment to offset the jet pump thrust.

NOTE: Be careful not to move inner rod as it would alter nozzle position.

NOTE: When handlebar is in straight position and steering cable is installed, steering nozzle may not be parallel to transom. This is to offset jet pump thrust.

6. Test ride watercraft.
- 6.1 If watercraft pull on one side, carry out *STEERING ALIGNMENT* in this subsection.

STEERING COLUMN

Removing the Steering Column

RXP-X Series

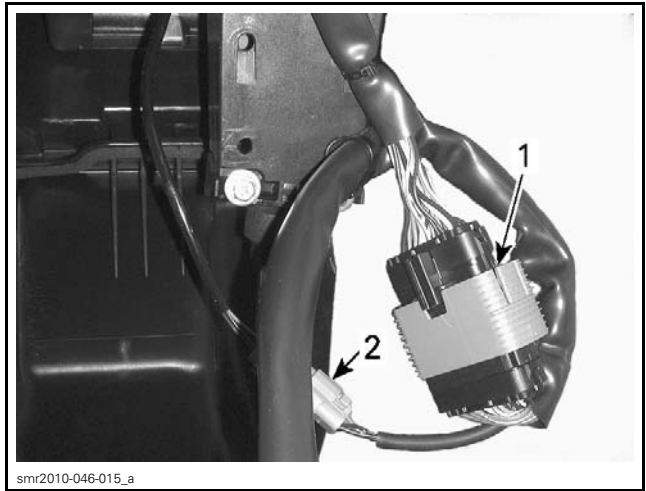
Open the front storage cover.
Remove the access cover.
Remove gauge trim, refer to *BODY (RXP-X SERIES)* subsection.

All Other Models

Open the front storage cover and remove the storage basket.
Remove the gauge support. Refer to *INFORMATION CENTER (GAUGE)* subsection.

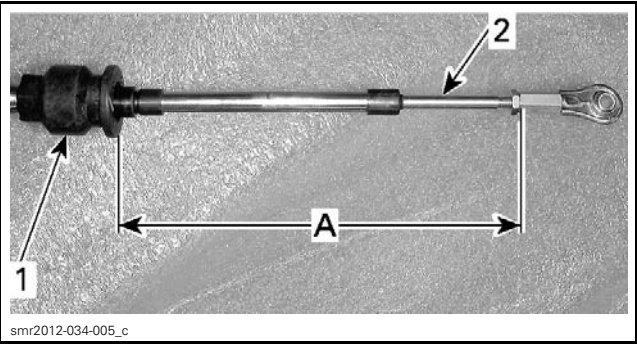
All Models

1. Disconnect both connectors under the steering column.



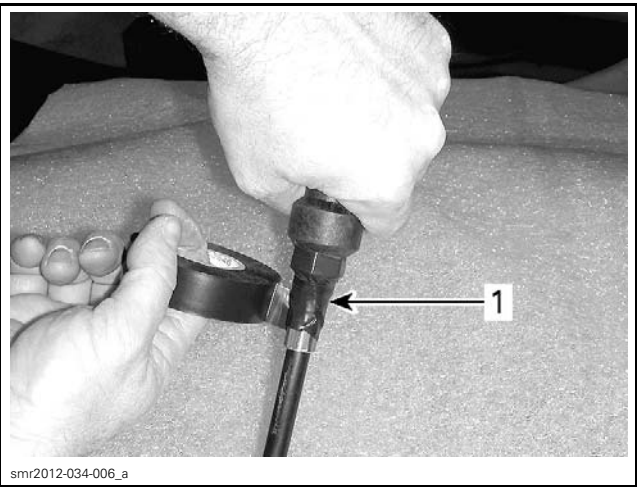
1. Steering connector
2. O.T.A.S. connector

2. Remove both screws securing the steering column.



1. Adjustment nut
2. Do NOT move inner rod
A. 187.7 mm (7.39 in)

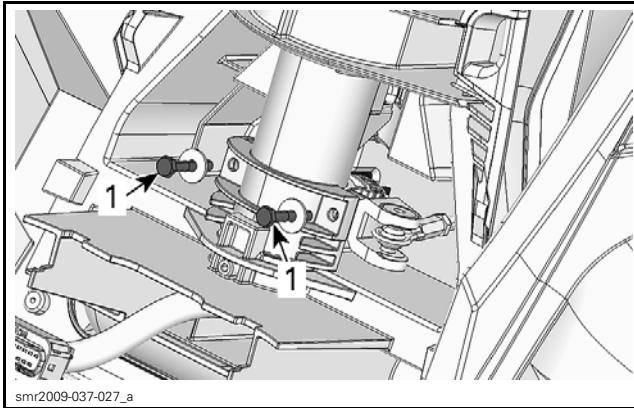
- 5.2 Recheck nozzle position. If it moved, reposition it and readjust cable nut.
- 5.3 Reinstall steering cable. Pay attention not to turn the adjustment nut as it would alter adjustment.
- NOTE:** Tape can be used over adjustment nut to prevent altering adjustment.



1. Tape adjustment nut to cable housing to prevent altering adjustment

- 5.4 Tighten steering cable clamp bolts to specification.

TIGHTENING TORQUE
6 N•m (53 lbf•in)



1. Steering column screws

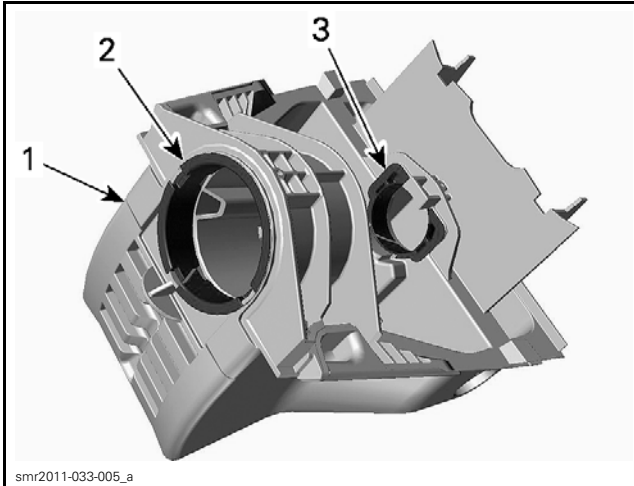
3. Pull steering column out of its support. Ensure to not damage wiring harness connectors and O.T.A.S. magnets.

Inspecting the Steering Column

Check steering column for:

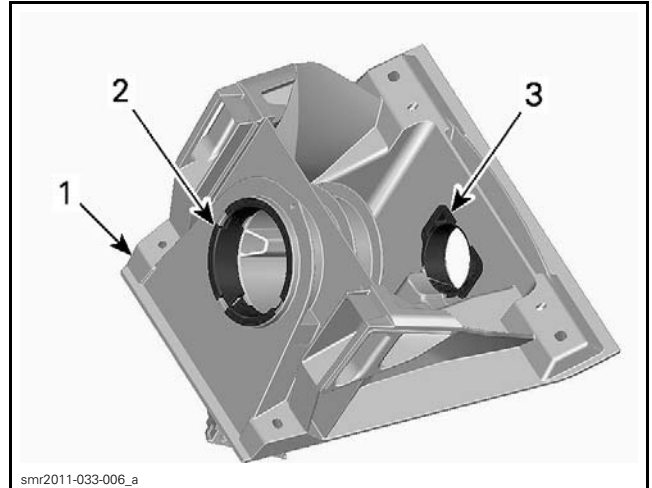
- Cracks
- Stress marks
- Signs of wear.

Check steering column support bushings.



MODELS WITH TILT STEERING

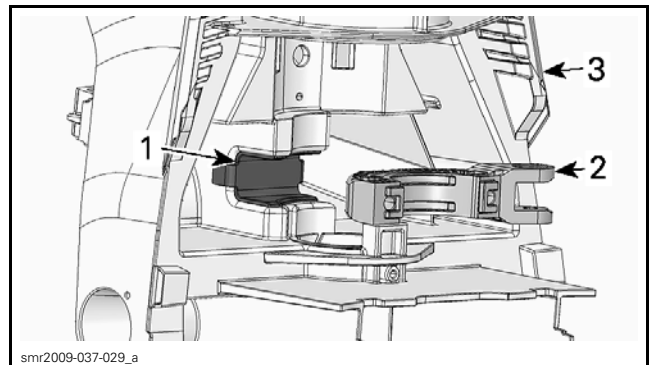
1. Steering column support
2. Upper bushing
3. Lower bushing



MODELS WITHOUT TILT STEERING

1. Steering column support
2. Upper bushing
3. Lower bushing

Check wear sleeve behind the steering column arm.



1. Wear sleeve
2. Steering column arm
3. Steering column support

Replace any damaged or worn parts.

Installing the Steering Column

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

Carefully, drive steering column through steering column support. Ensure not to hit the O.T.A.S. magnet during steering column installation.

Tighten steering column screws to specifications.

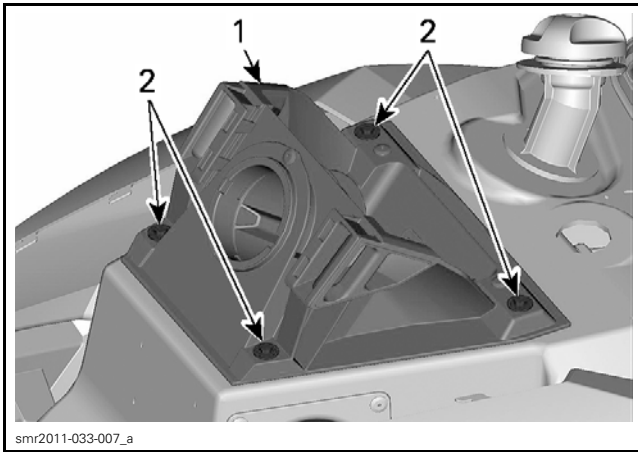
TIGHTENING TORQUE	
Steering column screws	6 N•m (53 lbf•in)

Reinstall all removed parts using appropriate procedure.

STEERING COLUMN SUPPORT

Removing the Steering Column Support (RXP-X Series)

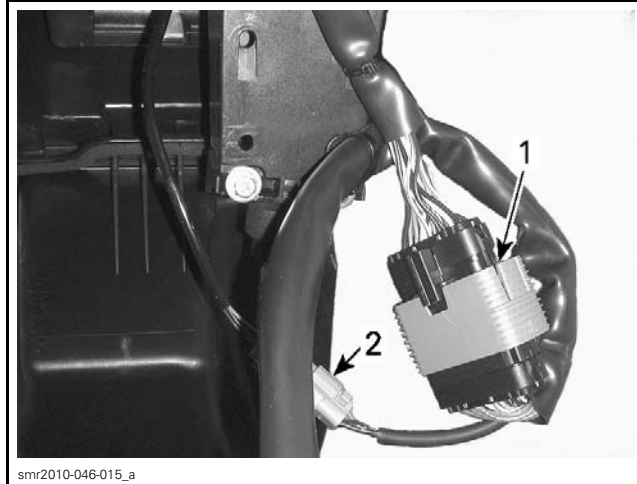
1. Remove steering column, see procedure in this subsection.
2. Remove console, refer to *BODY (RXP-X SERIES)* subsection.
3. Remove steering column support retaining screws.



1. Steering column support
2. Retaining screws

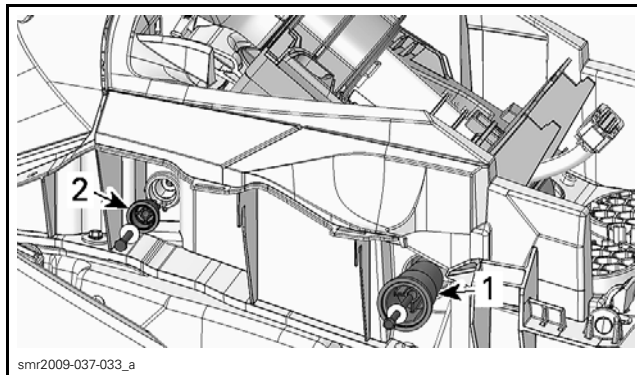
Removing the Steering Column Support (GTX, RXT and WAKE PRO Series)

1. Refer to *BODY (GTX, RXT AND WAKE PRO SERIES)* and remove the following parts:
 - Storage compartment cover
 - Front grille (**models with suspension**)
 - Body covers.
2. Remove storage basket.
3. Disconnect both connectors under the steering column.



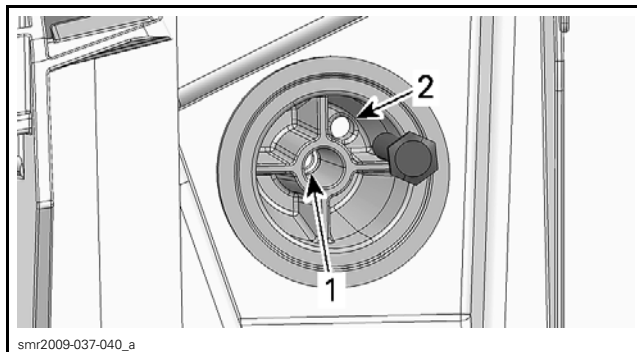
1. Steering connector
2. O.T.A.S. connector

4. Remove the gauge support. Refer to *INFORMATION CENTER (GAUGE)* subsection.
5. On both sides, remove both pivot bushings (steering column support and steering adjustment handle).



1. Pivot bushing of steering column support
2. Pivot bushing of steering adjustment handle

NOTE: If pivot bushings retaining steering column are hard to remove, remove the retaining screw from the center hole and tighten it into the offset hole. Tighten screw until the pivot bushing comes out of steering column support.



1. Center hole
2. Offset hole

6. Remove steering column support and steering adjustment handle from vehicle.
7. Remove *STEERING COLUMN* from its support. See the procedure in this subsection.

Installing the Steering Column Support

Installation is the reverse of the removal procedure.

STEERING TILT RELEASE HANDLE

Replacing the Steering Tilt Release Handle

Use the same procedure as for *STEERING COLUMN SUPPORT*.

O.T.A.S. SWITCH

Testing the O.T.A.S. Switch Using B.U.D.S.

Connect watercraft to B.U.D.S. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

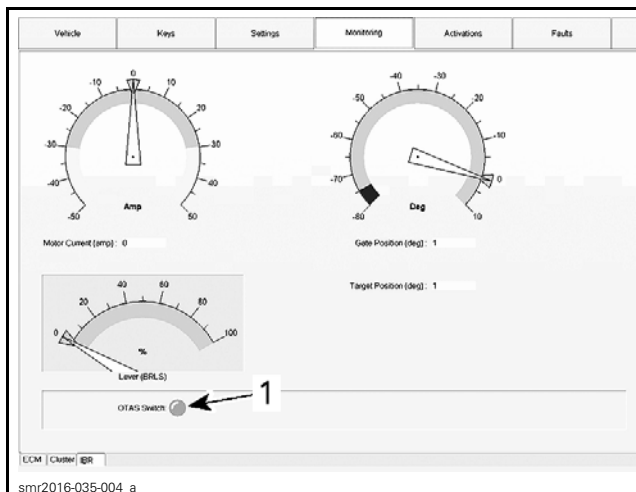
Select the **Monitoring** and **iBR** tabs.

Briefly press the START/STOP button to wake up the ECM.

Install the tether cord on the engine cut-off switch.

While monitoring the O.T.A.S. indicator in B.U.D.S., completely turn steering in one direction and keep it in this position.

The O.T.A.S. indicator should turn on when handlebar reaches the stopper.



MONITORING AND iBR TABS

1. O.T.A.S. indicator

Repeat test for the other side.

If O.T.A.S. indicator does not turn on, carry out the *TESTING THE O.T.A.S. SWITCH INPUT VOLTAGE*.

Testing the O.T.A.S. Switch Input Voltage

Access the O.T.A.S. connector as follows:

RXP-X Series

Open the front storage cover and remove the access panel.



TYPICAL

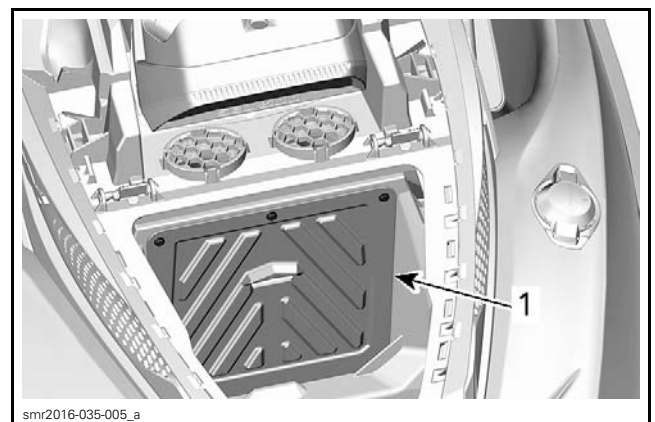
1. Access panel

GTX/RXT Series and WAKE PRO

Open front storage compartment cover.

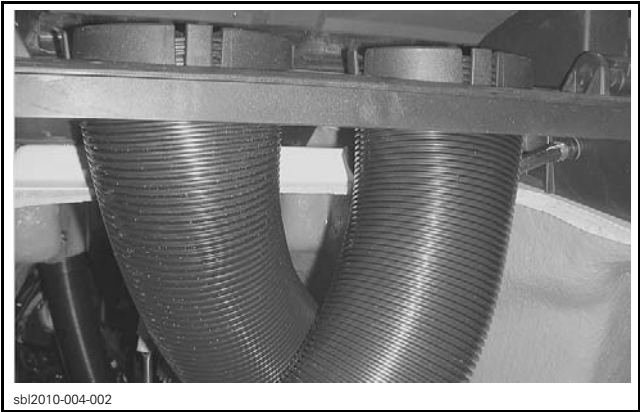
Remove front storage bin.

Remove the access panel.



1. Access panel

Disconnect the top of the front air ventilation hoses.



sb12010-004-002
FRONT AIR VENTILATION HOSES

GTX and RXT with Suspension

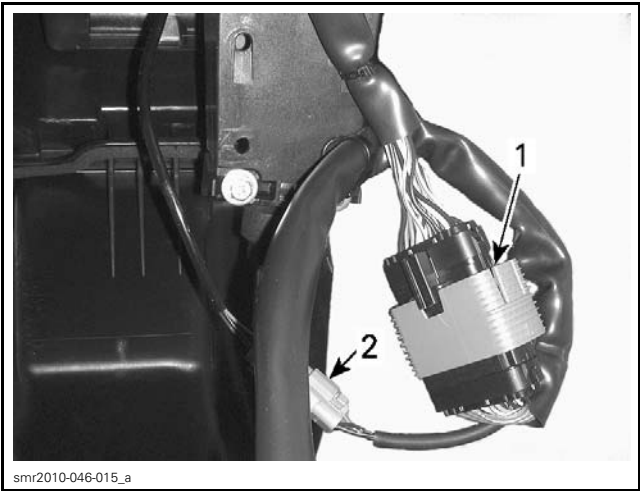
Open front storage compartment cover.

Remove front storage bin.

For easier access, rise the moving deck using the iS "up" button.

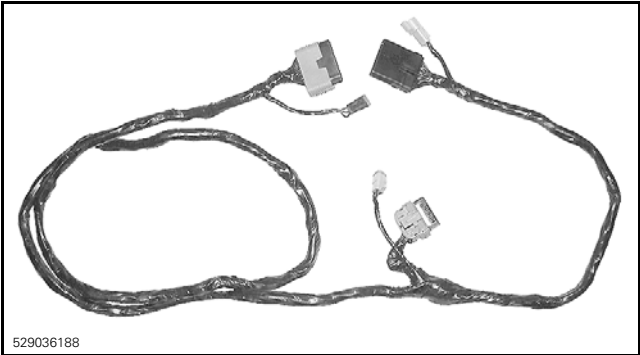
All Models

Disconnect the O.T.A.S. connector (keep the 24-pin steering harness connected).



smr2010-046-015_a
1. Steering connector
2. O.T.A.S. connector

Connect the DIAGNOSTIC HARNESS (P/N 529 036 188) in-line between the disconnected O.T.A.S. connectors.



Press the START/STOP button to activate the electrical system.

Using the FLUKE 115 MULTIMETER (P/N 529 035 868), measure voltage as follows.

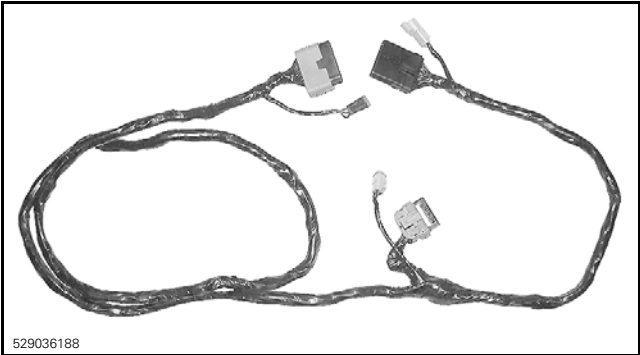
TEST PROBES		VOLTAGE (VDC)
PIN A (3-pin connector)	Battery negative post	Battery voltage

If voltage is not as specified, check wiring and connectors.

If voltage is as specified, carry out the *TESTING THE O.T.A.S. SWITCH GROUND*.

Testing the O.T.A.S. Switch Ground

Install the DIAGNOSTIC HARNESS (P/N 529 036 188) as described in *TESTING THE O.T.A.S. SWITCH INPUT VOLTAGE*.



Press the START/STOP button to activate the electrical system.

Using the FLUKE 115 MULTIMETER (P/N 529 035 868), check ground circuit as follows.

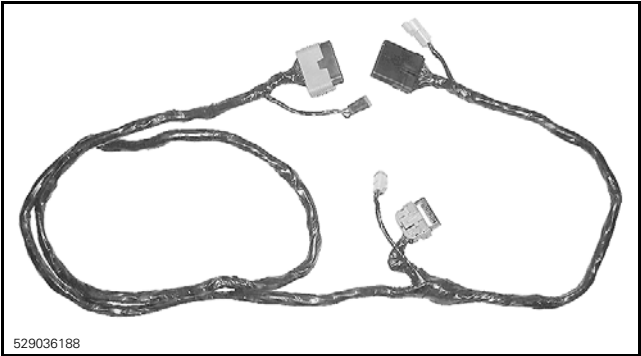
TEST PROBES		VOLTAGE (VDC)
PIN A (3-pin connector)	PIN B (3-pin connector)	Battery voltage

If voltage is not as specified, check wiring and connectors.

If voltage is as specified, carry out the *TESTING THE O.T.A.S. SWITCH SIGNAL*.

Testing the O.T.A.S. Switch Signal

Install the DIAGNOSTIC HARNESS (P/N 529 036 188) as described in *TESTING THE O.T.A.S. SWITCH INPUT VOLTAGE*.



Press the START/STOP button to activate the electrical system.

Using the FLUKE 115 MULTIMETER (P/N 529 035 868), check switch signal as follows.

TEST PROBES		HANDLEBAR POSITION	VOLTAGE
PIN C (3-pin connector)	PIN B (3-pin connector)	Straight ahead	0.6 to 0.8 Vdc
		Turned completely to the right	2.0 to 2.5 Vdc
		Turned completely to the left	

If voltage is not as specified, replace the switch.

NOTE: To avoid useless switch replacement, make sure magnets are in good condition. Also, make sure magnets and switch are securely clipped.

Replacing the O.T.A.S. Switch

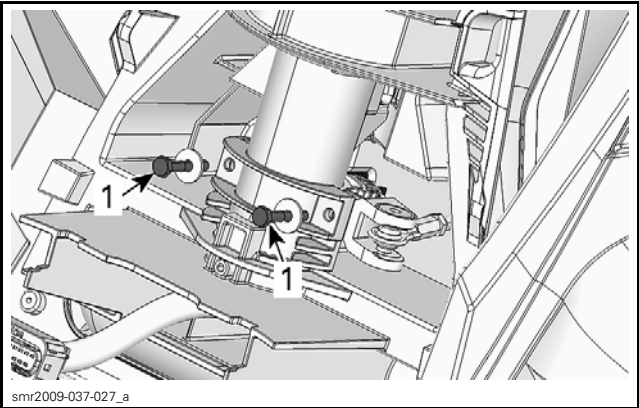
Models Without Tilt Steering

Remove steering column, see procedure in this subsection.

Models with Tilt Steering

Remove *STEERING COLUMN SUPPORT*, see procedure in this subsection.

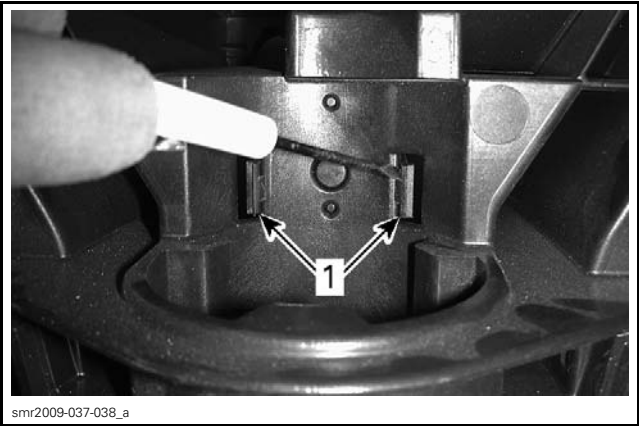
Remove steering column from its support by removing both retaining screws.



1. Steering column screws

All Models

- 1. Using a small screwdriver, unhook the switch from steering support.



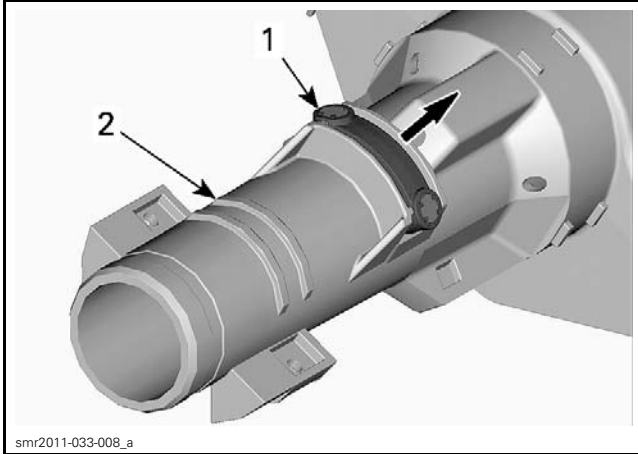
1. Switch retaining tabs

Reverse removal procedure to reinstall the O.T.A.S. switch.

O.T.A.S. MAGNETS

Replacing the Magnets

- 1. Remove *STEERING COLUMN*, see procedure in this subsection.
- 2. Pull magnets off the steering column.



1. Magnets
2. Steering column

Reverse removal procedure to reinstall the magnets.

iBR AND VTS

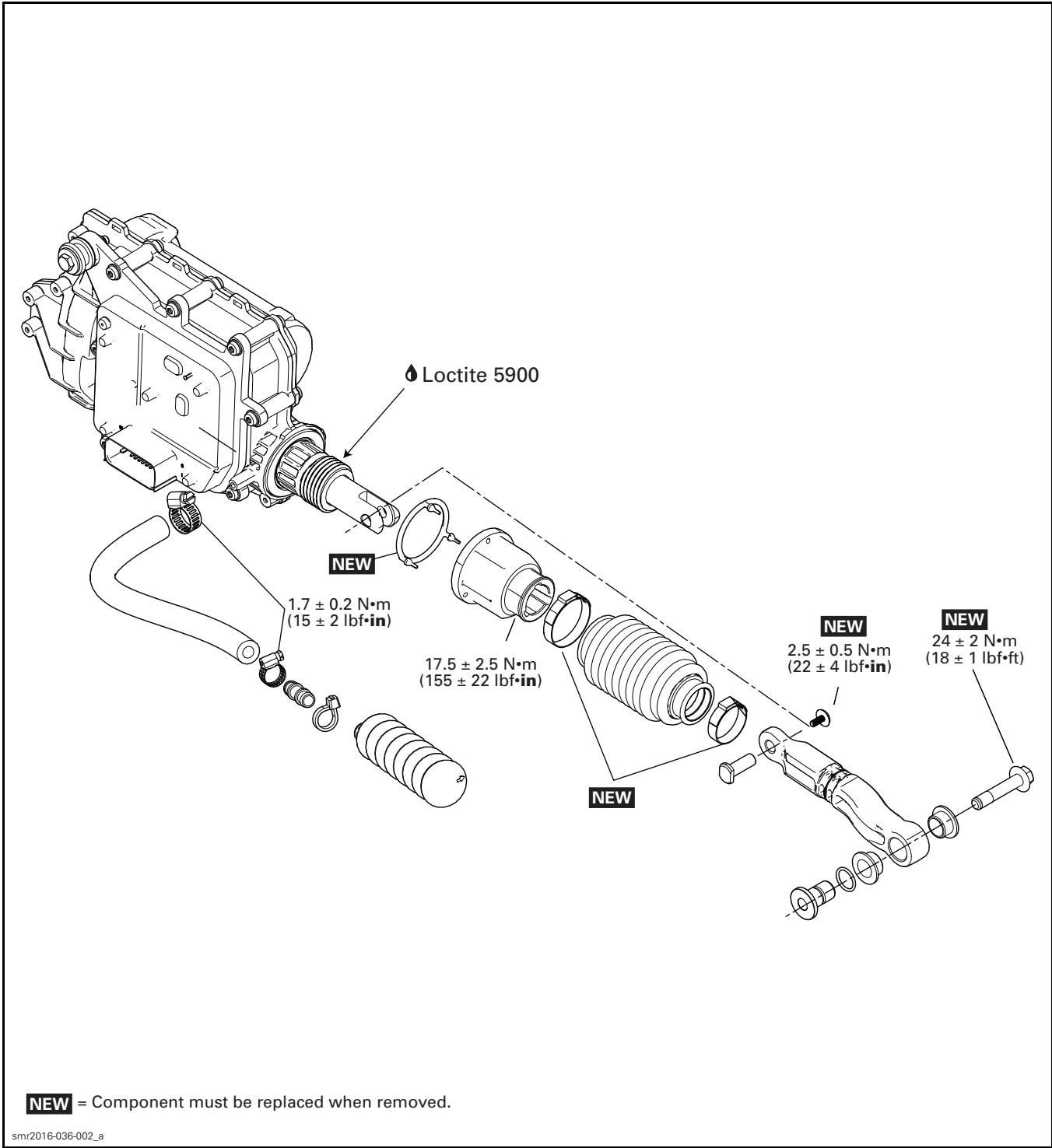
SERVICE TOOLS

Description	Part Number	Page
DIAGNOSTIC HARNESS	529 036 188	26
IBR NUT SOCKET.....	529 036 379	19

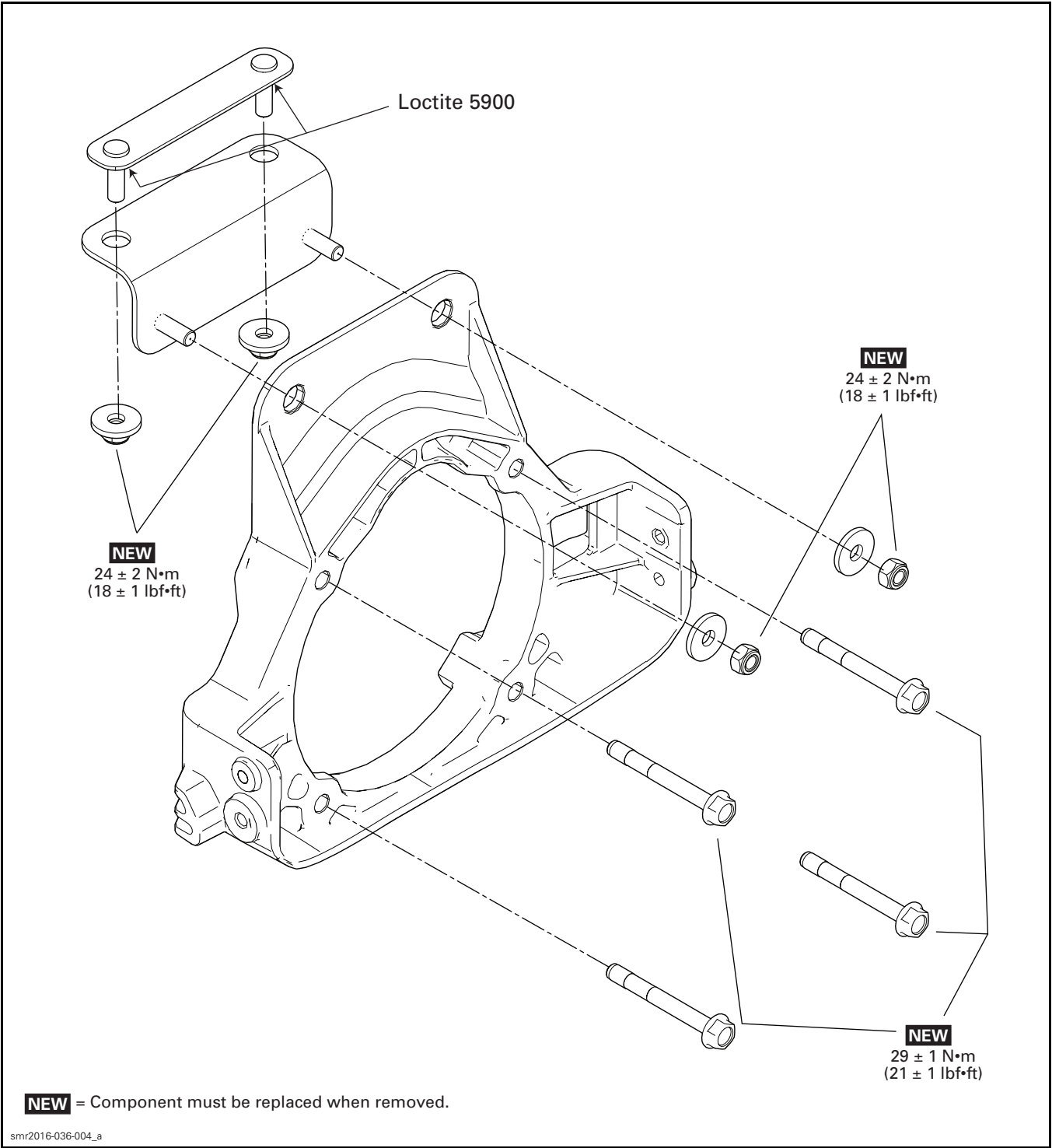
SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 5900	293 800 066	19, 24

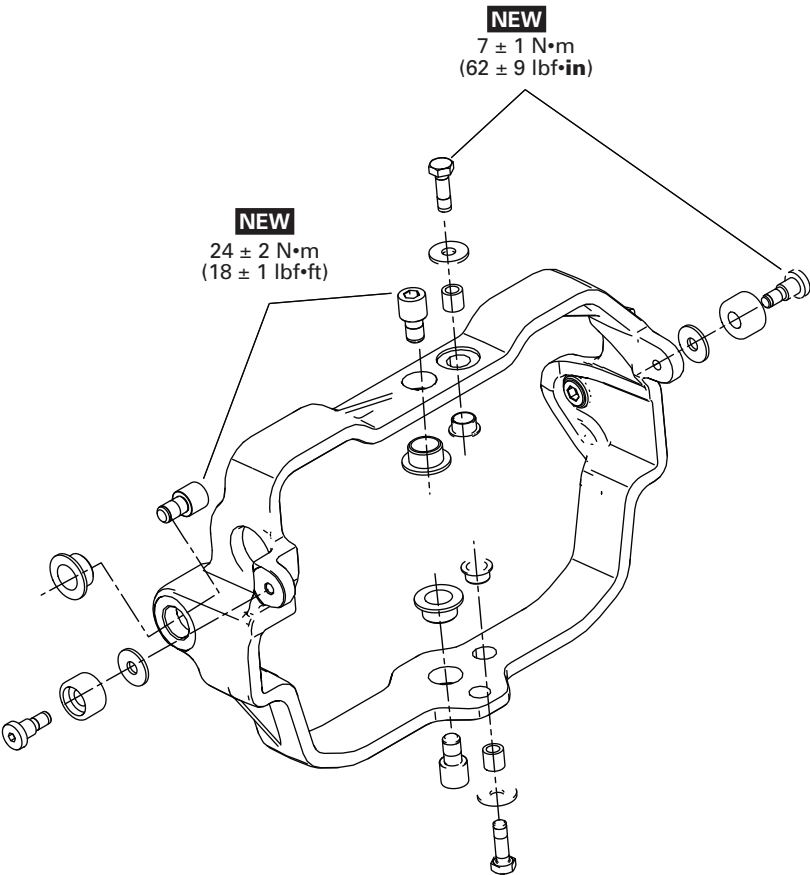
iBR ACTUATOR



iBR GATE SUPPORT BRACKET



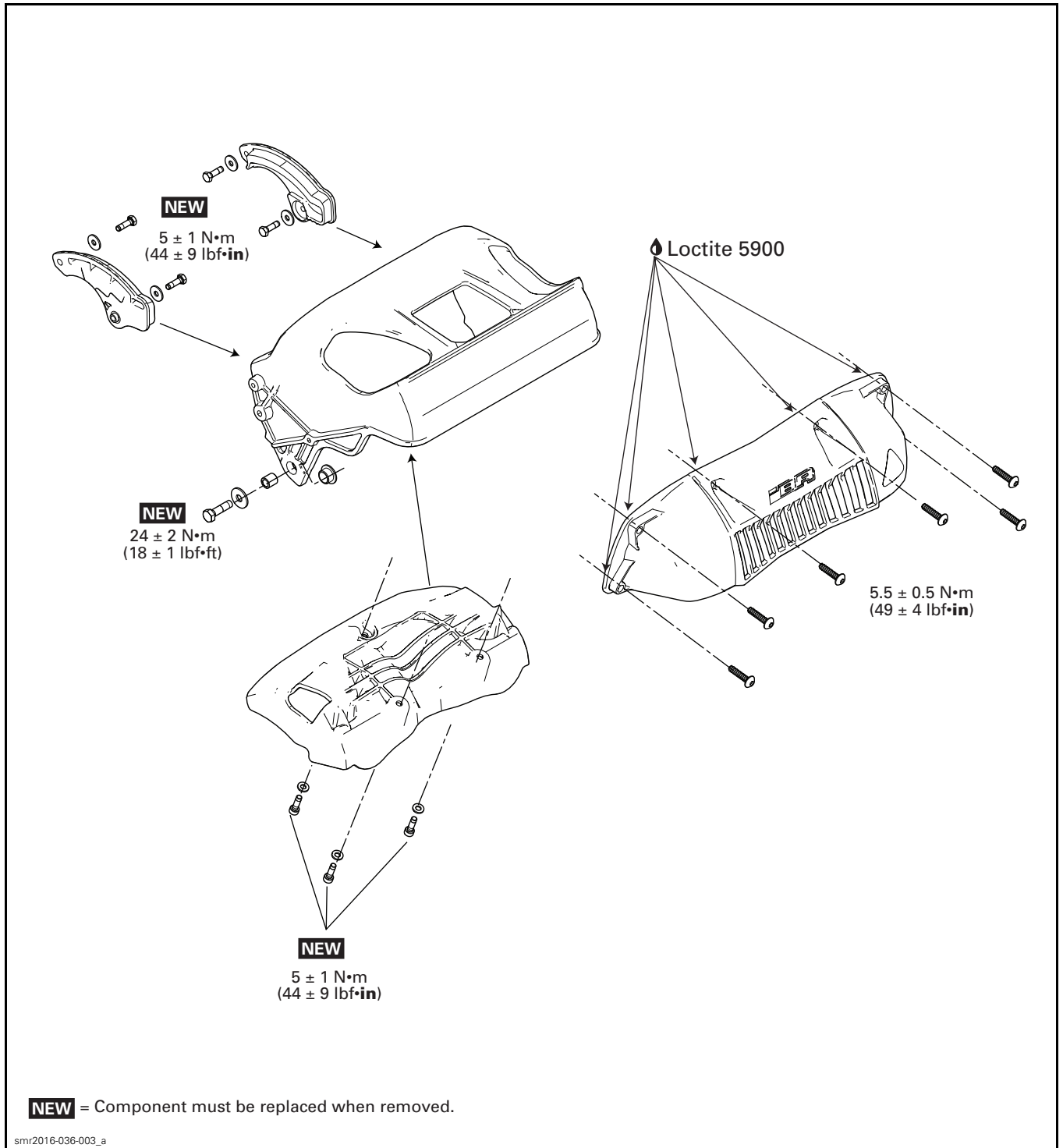
VTS TRIM RING



NEW = Component must be replaced when removed.

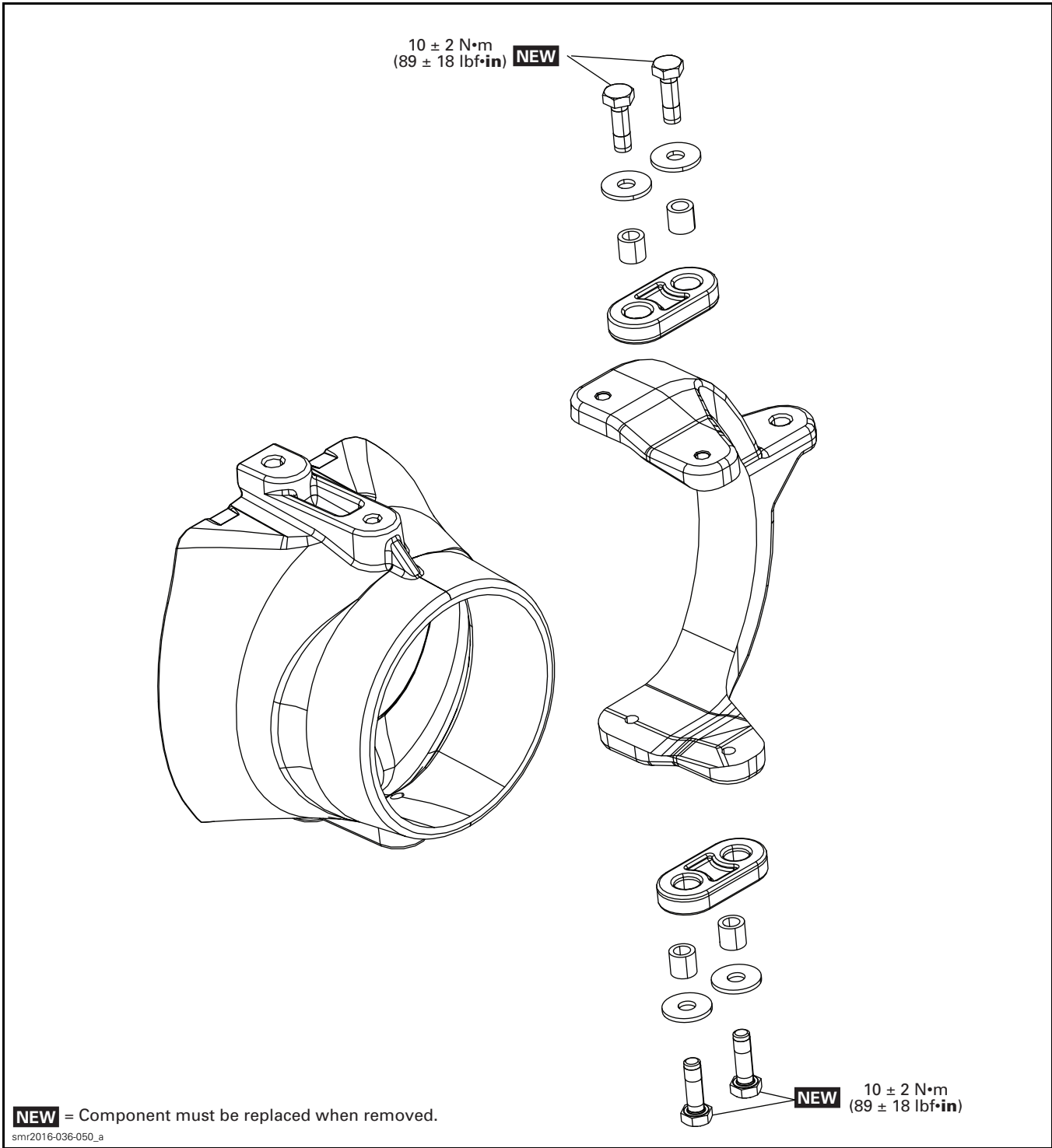
smr2016-036-001_a

iBR GATE



NOZZLE AND STEERING MULTIPLIER

Steering multiplier on applicable models



GENERAL

During assembly/installation, use torque values and service products as indicated 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, self-locking fasteners, cotter pins, etc.) must be replaced with new ones.

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

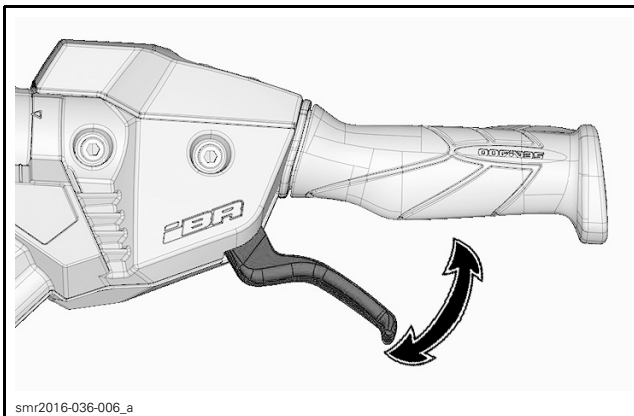
SYSTEM DESCRIPTION (iBR)

The iBR (intelligent Brake and Reverse) is an electronically controlled braking and reverse system.

The iBR module controls the position of the iBR gate to provide forward thrust, reverse thrust, braking thrust, and neutral.

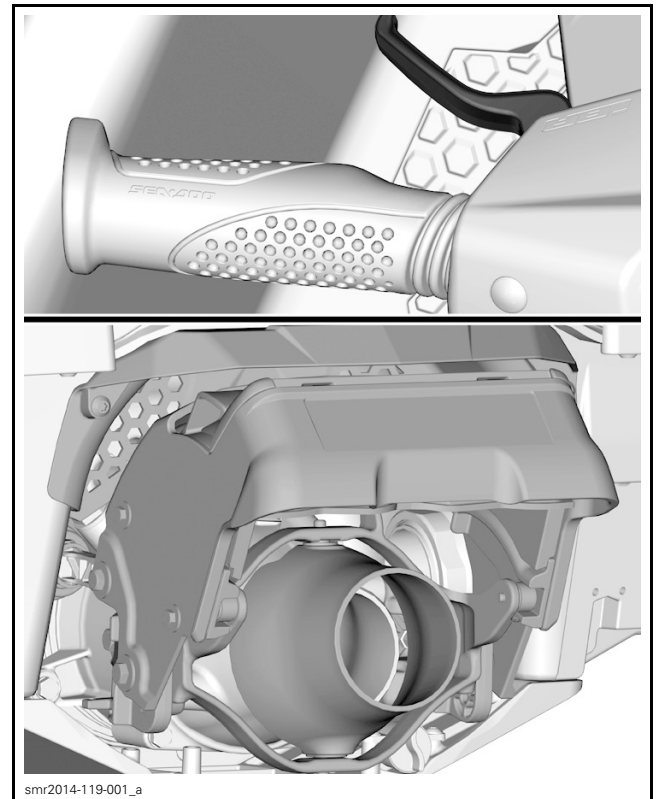
The operator commands the position of the iBR gate using either the throttle lever for forward thrust, or the iBR lever for neutral, reverse, and for the braking function.

The iBR lever is located on the LH side of the handlebar.

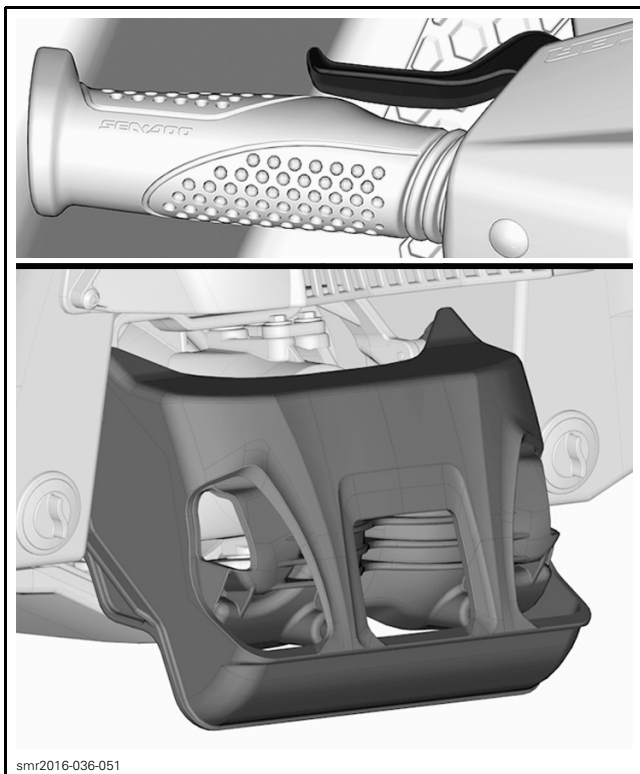


When the iBR lever is pulled in, it operates the brake and reverse lever sensor (BRLS). It is a double output hall effect sensor. The redundancy is used for security purposes.

The BRLS sends the signals to the iBR module. The iBR module controls an electric motor that in turn raises or lowers the iBR gate through a mechanical drive unit.



TYPICAL - FORWARD



TYPICAL - REVERSE

NOTE: The iBR gate will move when commanded by the iBR lever only if the engine is running. For maintenance purposes, the iBR OVERRIDE function available through the gauge can be used to electrically move the gate to the desired position.

Depending on vehicle speed and how far the iBR lever is pulled in, the iBR module will automatically adjust the iBR gate movement speed and stroke.

NOTE: The iBR lever must be pulled in at least 25% of its travel (approximately) before the iBR gate starts to move. The first 25% of iBR lever travel has no effect on the iBR gate.

Every time the iBR gate moves when commanded by the iBR lever, engine RPM is momentarily reduced to idle speed as the gate moves.

⚠ WARNING

If it is necessary to remove any foreign object catch in the iBR gate, nozzle or linkages, strictly observe the following before proceeding:

- Remove tether cord from engine cut-off switch.
- Wait at least 5 minutes or remove iBR fuses.
- Do not press on START/STOP button. If START/STOP button is pressed, wait another 5 minutes.

Forward Mode

To engage forward:

- Start engine
- Pull in the throttle lever.

The iBR gate will automatically move to the forward position (full up).

NOTE: The full up position of the iBR gate is dependent on the selected VTS trim position.

Reverse Mode

If the watercraft speed is below 14 km/h (9 MPH) when the iBR lever is pulled in, reverse mode is engaged.

When the iBR lever is pulled in to engage reverse, the following occurs:

- Engine RPM is reduced to idle.
- The iBR gate moves to the reverse position.
- Engine RPM ramps up to the engine power commanded by the throttle lever.

When operating in reverse mode, the iBR lever controls the iBR gate position and the engine RPM is controlled by the throttle lever.

Maximum engine RPM in reverse is 5000 RPM.

Braking Mode

If the watercraft speed is 14 km/h (9 MPH) per hour and above when the iBR lever is pulled in, braking mode is engaged.

When the iBR lever is pulled in to engage braking, the following occurs:

- Engine RPM is reduced to idle.
- The iBR gate moves to the maximum down position.
- Engine power is requested by the iBR module depending on inputs of vehicle speed and iBR lever position.

When operating in braking mode, the iBR gate always moves to the maximum down position. The throttle lever signal is overridden and engine RPM is now dependent on watercraft speed and how far the iBR lever is pulled in.

If watercraft speed is high when braking is applied, engine power will be initially low and then ramp up to the power commanded by the iBR module. The engine RPM may be increased, as necessary, to apply a stronger braking effect with the jet pump thrust when the conditions dictate.

As the watercraft slows to less than 8 km/h (5 MPH), the following occurs:

- Braking mode ceases.

- Reverse mode takes over if the iBR lever is not released.
- Throttle control reverts back to the throttle lever.

Neutral Mode

Every time the iBR lever is pulled in and released, the iBR gate will default to the **neutral** position, except if the throttle lever is still pulled in when the iBR lever is released. If the throttle lever is still pulled, the iBR gate will move to the forward position when the iBR lever is released and the watercraft will accelerate forward.

iBR Override Function

Refer to *iBR ACTUATOR*.

SYSTEM DESCRIPTION (VTS)

The VTS system is actually part of the iBR system. It provides watercraft pitch trim adjustments by adjusting the horizontal position of the jet nozzle.

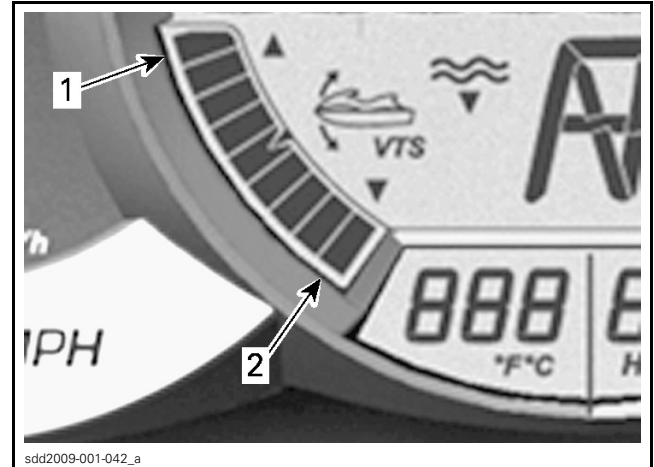
The VTS can be electrically trimmed to the desired attitude within the VTS range, or to one of 2 preset trim positions (on applicable models).

The VTS switch (or Up/Down switch) sends command signals to the gauge. The gauge converts them to CAN protocol and sends them through the CAN bus to the iBR module on the iBR actuator. The actuator then moves the iBR gate which moves the nozzle to the desired trim position.

NOTE: The nozzle and iBR gate move together in the VTS trim range up to the maximum nozzle down position. If NEUTRAL, BRAKING or REVERSE is engaged, the iBR gate moves past the VTS full down position. When FORWARD thrust is reengaged, the nozzle and iBR gate move up to the last selected VTS trim position.

The nozzle trim position can be seen on the VTS position indicator in the information center.

NOTE: Changing the VTS trim position only changes the indication. The nozzle will move to the selected VTS trim position when forward thrust is engaged.



INFORMATION CENTER — VTS POSITION INDICATOR

1. Bow up
2. Bow down

NOTE: Only the segment indicating the relative position of the VTS will be on. The illustration shows all segments on as can be seen during the self test function.

The VTS system provides the following features according to models

- Nozzle trimming
- Selection of 2 preset trim positions
- Recording of 2 preset trim positions.

Nozzle Trimming

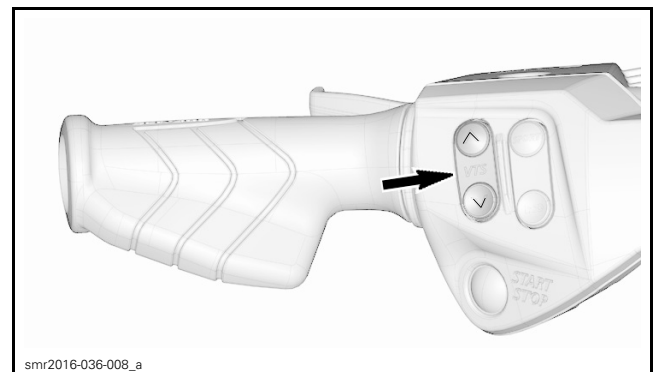
Watercraft must be operating in forward position.

Depending on the model, 5 or 9 trim positions are available.

Using the VTS Button (LH Side of Handlebar)

Models with VTS buttons

Press the UP or DOWN arrow button to change the VTS setting.



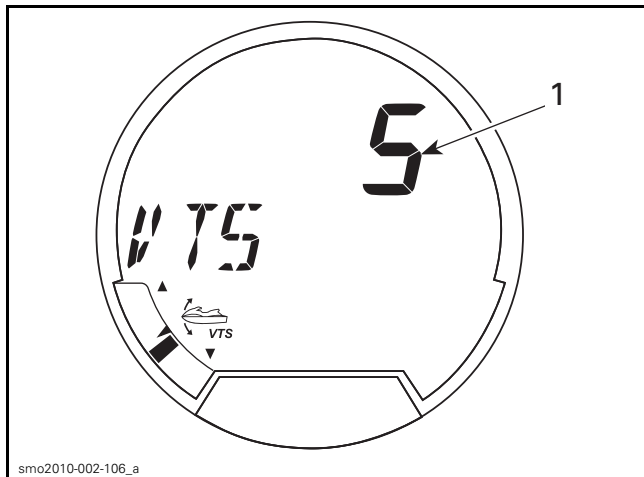
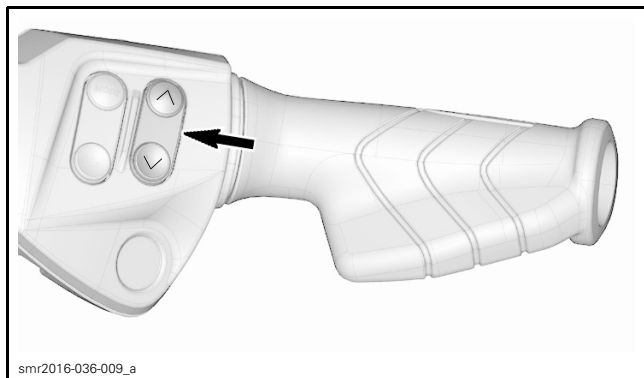
TYPICAL - VTS CONTROL BUTTON

Subsection XX (iBR AND VTS)

Using the Up/Down Button (RH Side of Handlebar)

Models without VTS buttons

1. Press the MODE button to display the VTS function in the gauge.
2. Press the UP or DOWN arrow button to change the VTS setting.



FUNCTION SELECTED - VTS
1. VTS setting

3. Press the SET button to save the desired setting.

Using Preset Trim Positions

Two preset trim positions can be selected.

To select the **highest** trim position recorded, double-click on the VTS UP arrow button (bow up).

To select the **lowest** trim position recorded, double-click on the VTS DOWN arrow button (bow down).

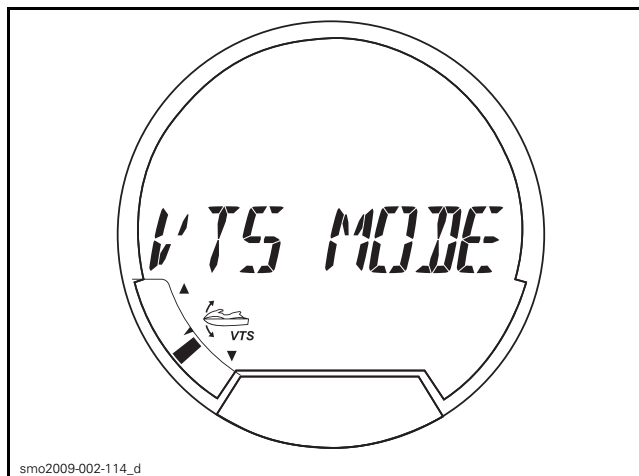
Recording Preset Trim Positions

Two different VTS trim positions may be recorded for quickly selecting the preferred watercraft trim attitude.

When the VTS PRESET trim positions are changed, the new settings will remain recorded in memory.

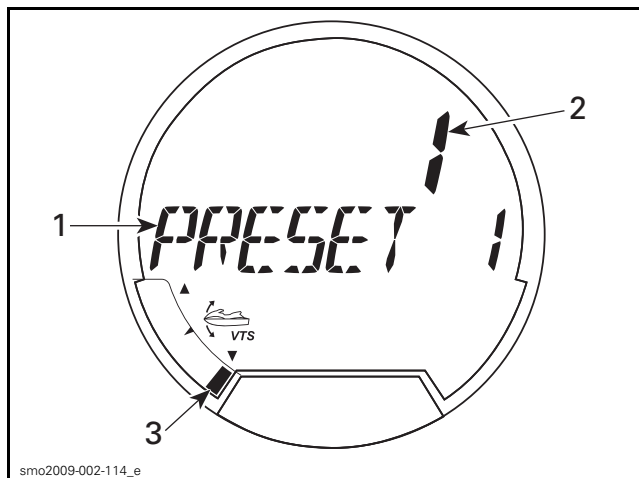
To record VTS preset trim positions:

1. Press the START/STOP button.
2. Install the tether cord on the engine cut-off switch.
3. Press the MODE button repeatedly until VTS MODE is displayed.



FUNCTION SELECTED - VTS MODE

4. Press the SET button to display PRESET 1.
5. Press the VTS UP/DOWN button to change the PRESET 1 VTS position.



FUNCTION SELECTED - PRESET 1

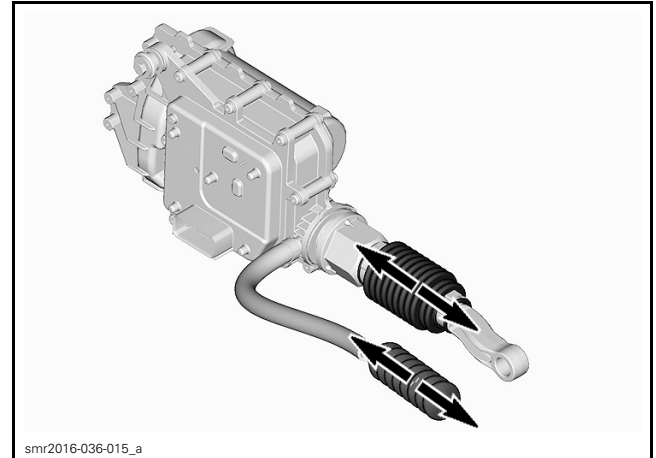
1. Preset 1 function
2. VTS setting selected to 1
3. VTS position indicator at setting 1 (bow down)

6. Press the SET button to save PRESET 1 and display PRESET 2.
7. Set PRESET 2
8. Press the SET button to save the settings.

NOTE: The VTS system will compare the preset trim settings recorded, the highest position will be assigned to the UP arrow (bow up), the lowest to the DOWN arrow.

iBR ACTUATOR

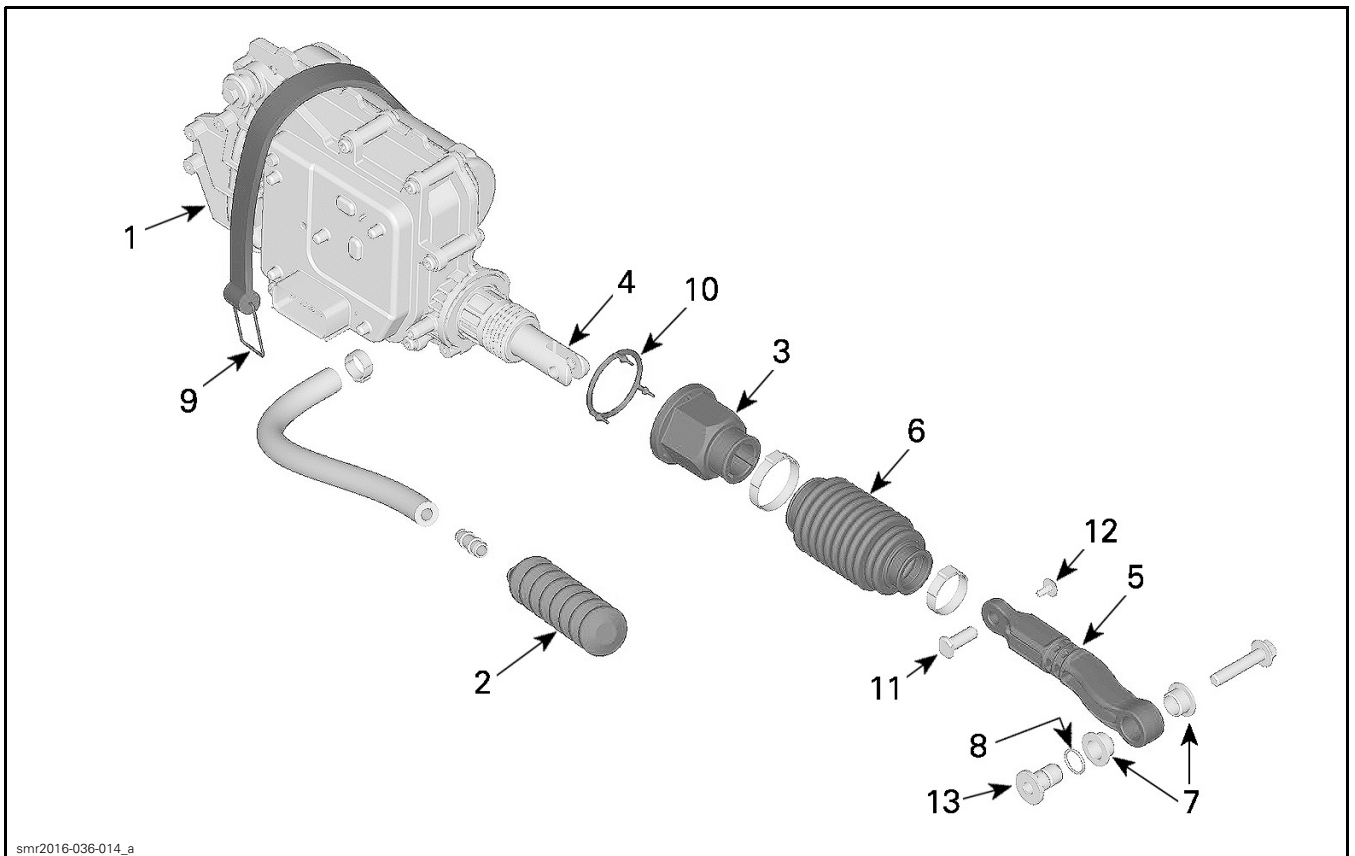
The iBR actuator is a sealed unit. As the actuator shaft moves, air is transferred between the boot and the air chamber.



smr2016-036-015_a

iBR ACTUATOR AIR CHAMBER MOVEMENT

Nomenclature



smr2016-036-014_a

iBR ACTUATOR COMPONENTS

1. Actuator
2. Air chamber
3. iBR nut
4. Actuator shaft
5. Connecting arm
6. Connecting arm boot
7. Plastic bushing
8. O-ring
9. Retaining strap
10. iBR nut o-ring
11. Connecting arm pin
12. Connecting arm pin screw
13. Shoulder sleeve

iBR Override Function

iBR override moves the iBR actuator through its full range of motion.

NOTICE Remove any foreign object that may obstruct iBR actuator movement.

Activating iBR Override Function

- 1. Press the START/STOP button.
- 2. Install the tether cord.

NOTE: Do not start the engine. The tether cord must be installed to ensure the information center will not shut off all indications after its self test function. Briefly press the START/STOP button to reactivate the electrical system when required.

- 3. Pull in the iBR lever;
 - 3.1 There will be a beep.

Models with a VTS Switch

- 4. Press the VTS UP or DOWN button to move the iBR gate.

Models Without a VTS Switch

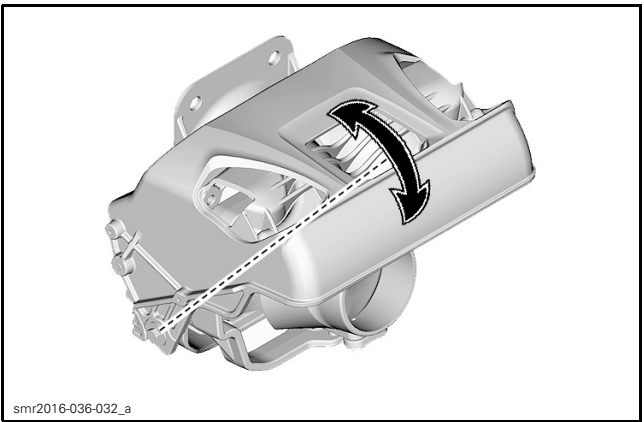
- 5. Press the UP/DOWN arrow button (RH handle-bar) to move the iBR gate.

IBR GATE SUPPORT BRACKET

The iBR gate support bracket secures the iBR gate and support assembly to the watercraft.

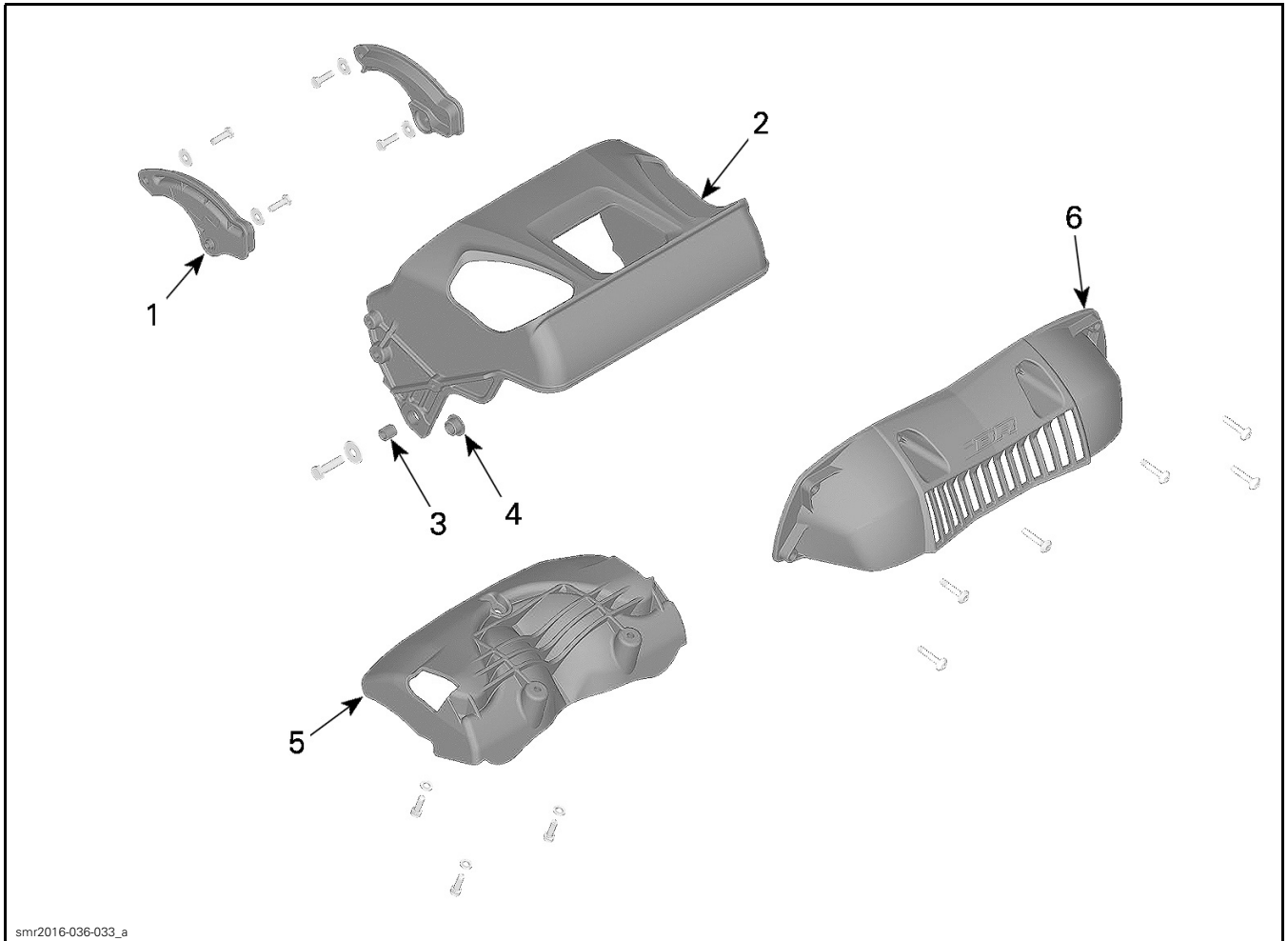
IBR GATE

The iBR gate can move up and down.



WATERCRAFT DIRECTION	GATE POSITION
Forward	UP
Neutral	Neutral
Reverse	Down

Nomenclature



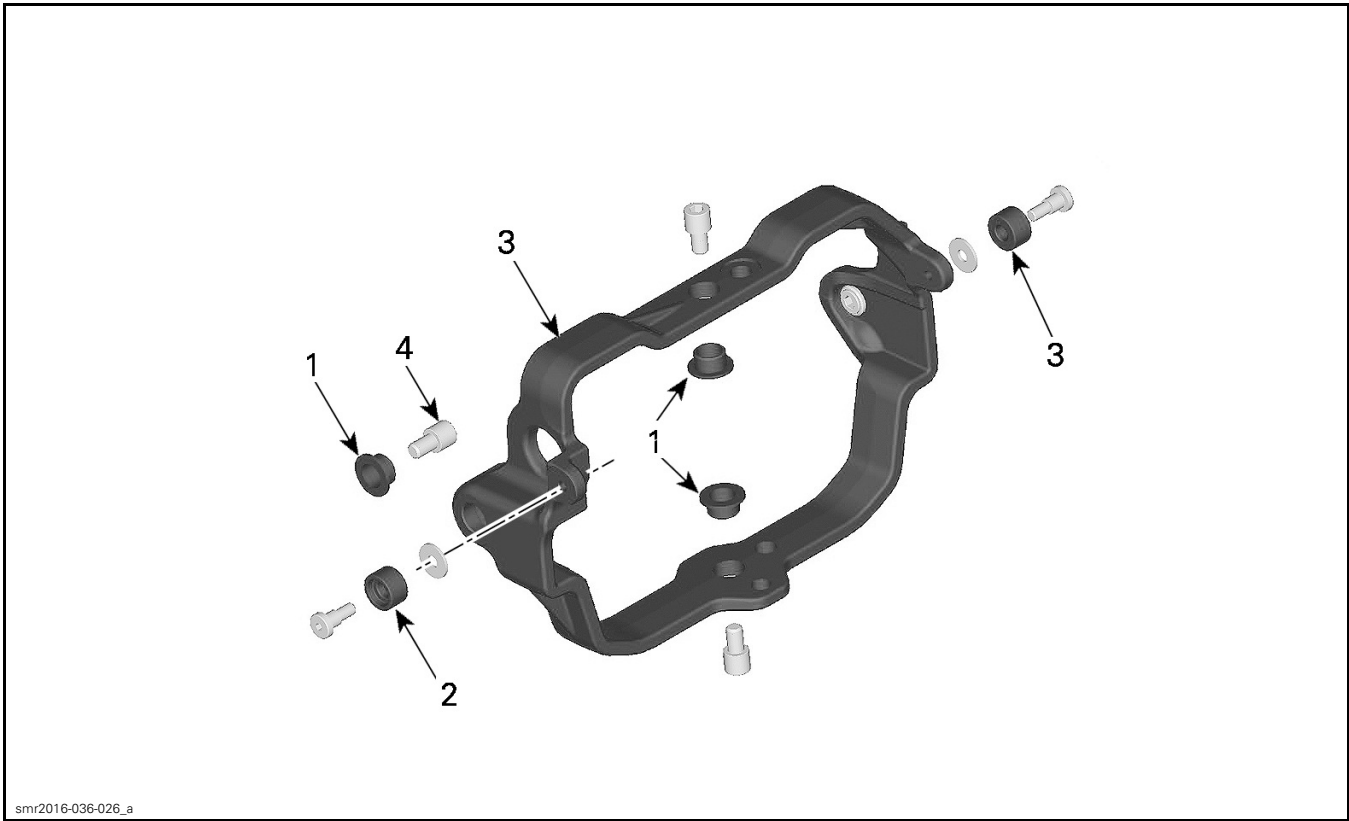
1. *iBR ramps*
2. *Gate*
3. *Sleeve*
4. *Plastic bushing*
5. *Inner gate*
6. *Guard*

VTS TRIM RING

The VTS trim ring supports the steering nozzle.

The VTS trim ring also allows VTS adjustment on applicable models.

Nomenclature



- 1. Plastic bushing
- 2. Roller bushing
- 3. VTS trim ring
- 4. Pivot screw

BRAKE AND REVERSE LEVER SWITCH (BRLS)

The BRLS is a double potentiometer type sensor. It produces 2 signals (redundancy) for self-monitoring.

ADJUSTMENT

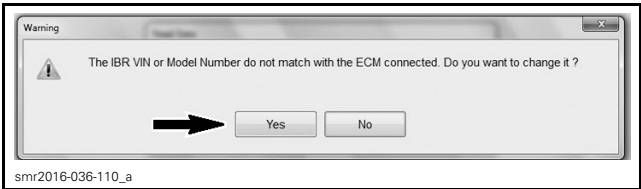
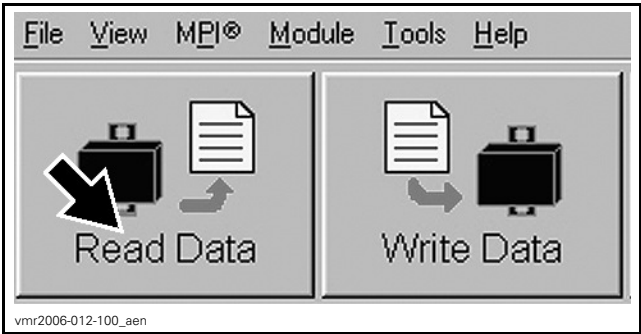
iBR AUTO CALIBRATION USING B.U.D.S.

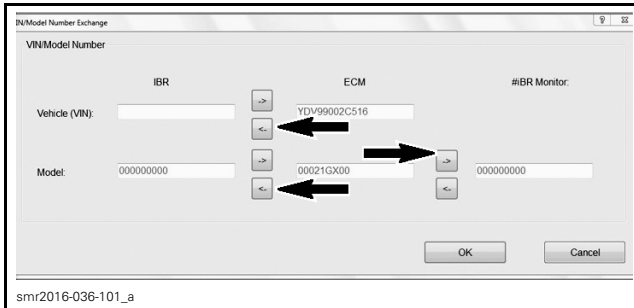
NOTICE iBR auto-calibration must be performed with the complete reverse gate assembly properly installed. Performing the auto-calibration procedure without the reverse gate assembly in place will damage the actuator.

Perform after repairing or removing the jet pump and/or iBR system components.

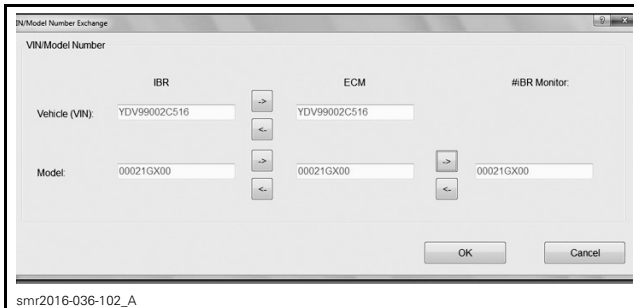
Connect B.U.D.S.

New iBR Actuators

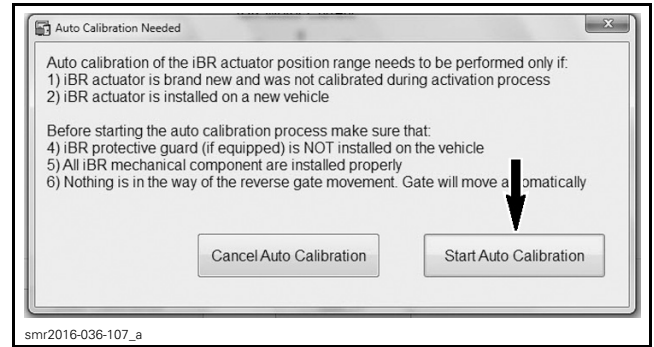
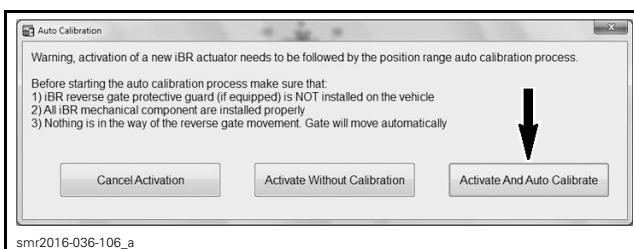
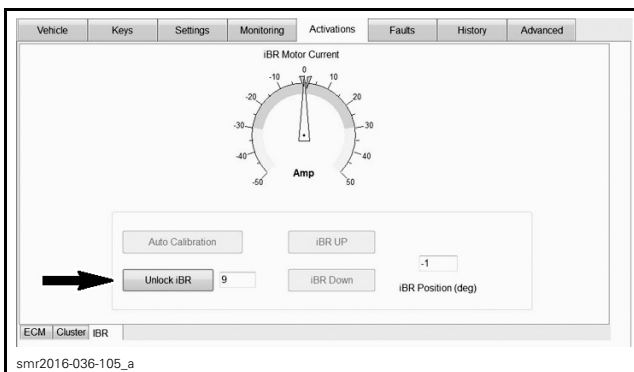
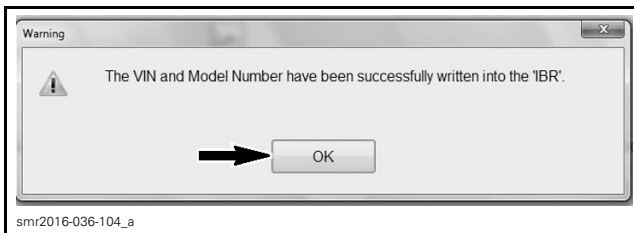




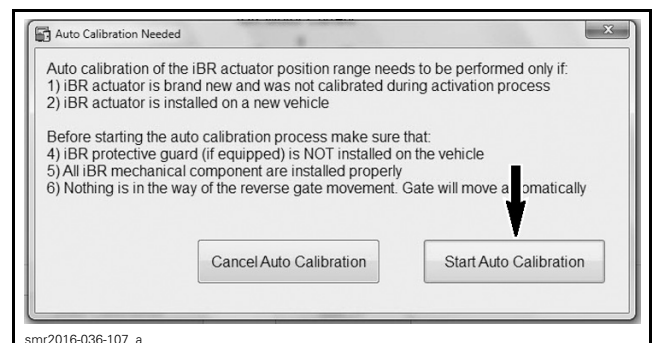
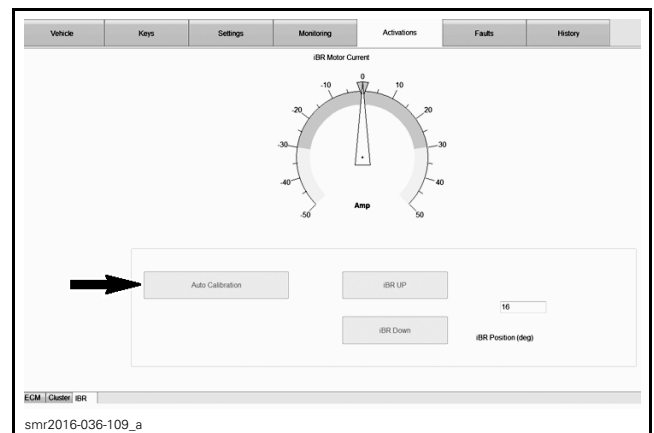
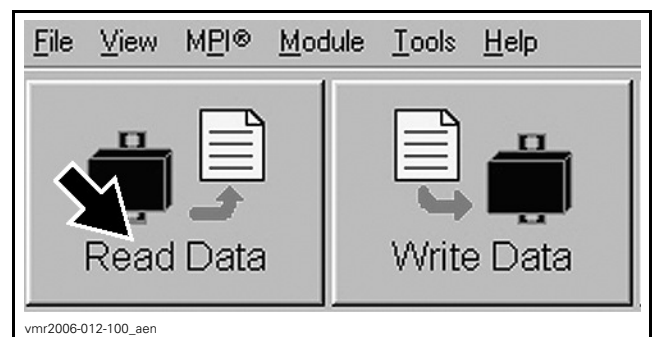
NUMBERS VARY BY UNIT



NUMBERS VARY BY UNIT



Previously Installed (Activated) iBR Actuators



INSPECTION

INSPECTION POINTS

Inspect:

- Inspect connecting arm boot condition
- Inspect roller bushings. They should not be deformed and must spin freely.
- Inspect plastic bushings. They should not be loose or deformed.
- Inspect iBR ramps for wear or cracking.

TESTING SEQUENCE

To troubleshoot the iBR system, carry out the following in this order:

- Ensure the iBR gate movement is not obstructed in any way.
- Ensure the iBR gate mechanism is in good condition and does not show signs of excessive wear or friction.
- Check system fuses.
- Check battery condition and state of charge.
- Make sure battery connections are clean and tight.
- Connect the watercraft to B.U.D.S. to check for iBR system or CAN bus related fault codes. Carry out service actions as indicated in B.U.D.S.
- If a CAN bus communication fault with the iBR actuator is indicated, or the iBR actuator is not visible in B.U.D.S., carry out a continuity test of the CAN bus wires.
- Try moving the iBR using the iBR UP and iBR DOWN buttons on the iBR activation page in B.U.D.S.
- Check for proper gate and actuator movement. Refer to *TESTING iBR SYSTEM*.
- Visually inspect system connectors for moisture ingress, corrosion, and proper contact.
- Remove the screw retaining the gate to the connecting arm. Move the gate up and down by hand to check for freedom of movement.

iBR SYSTEM FUNCTIONAL TEST

Test on Dry Land

NOTE: This test requires two persons. One person to start engine and operate controls, and one person to observe iBR gate movement.

1. Provide adequate ventilation of exhaust gases or move watercraft outside.

NOTICE Do not install an exhaust ventilation hose in the iBR gate area or damage may occur when the iBR gate moves downward during operation.

2. Connect a water hose to the watercraft to provide exhaust system cooling when operating engine. Refer to *EXHAUST SYSTEM* subsection for procedure.

NOTICE

- Ensure there are no tools or other object that may interfere with the iBR gate movement.
- Do not run engine for more than 2 minutes out of water or damage may occur.

WARNING

The person observing the iBR gate movement must stand to the side of the stern well clear of the iBR gate and pump nozzle in full view of the operator.

3. Start engine and let idle.

NOTE: If iBR gate was not in the neutral position, it will move to the neutral position on engine start up.

4. Depress the throttle lever slightly and visually confirm the iBR gate moves to the forward position (up to the VTS trim position), then release throttle. The iBR gate must remain in the forward position.
5. Depress the iBR lever fully and confirm the iBR gate moves to the full down position.
6. Release the iBR lever completely and confirm the iBR gate moves to the neutral position.
7. Disconnect water hose then shut engine off.

Test with Watercraft on a Waterway

1. Start engine and let idle.

NOTE: If iBR gate is not in the neutral position before the engine start, it will move to the neutral position on engine start up.

2. Depress the throttle lever slightly, then release it. Forward movement of the watercraft confirms the iBR gate has moved to the forward position.
3. Depress the iBR lever fully. Rearward movement of the watercraft confirms the iBR gate has moved to the reverse position.
4. Release the iBR lever completely. Reverse thrust should cease and the watercraft should continue to drift rearward on momentum.

5. Apply a small amount of forward thrust to stop rearward velocity, then tap the iBR lever to return the iBR gate to neutral.
6. Shut engine off.

TROUBLESHOOTING

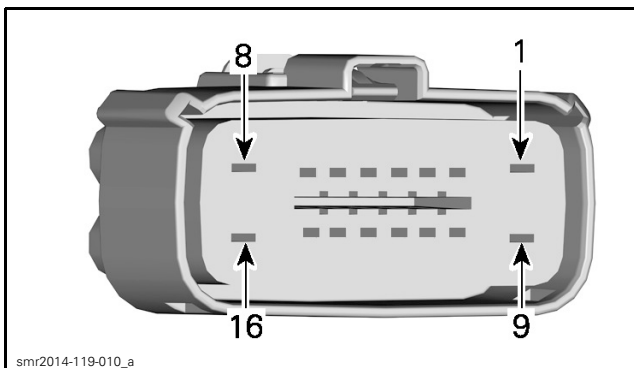
The iBR system is self monitoring. If a fault occurs in the iBR system, it will raise a fault code and communicate it to the information center through the CAN bus. The information center will turn on the iBR indicator light to advise the operator of the iBR system fault. If the fault remains active, it may be displayed in the gauge. If it is no longer active, B.U.D.S. must be used to read the fault.

PROCEDURES

iBR ACTUATOR

Specifications

Always refer to *WIRING DIAGRAM*.



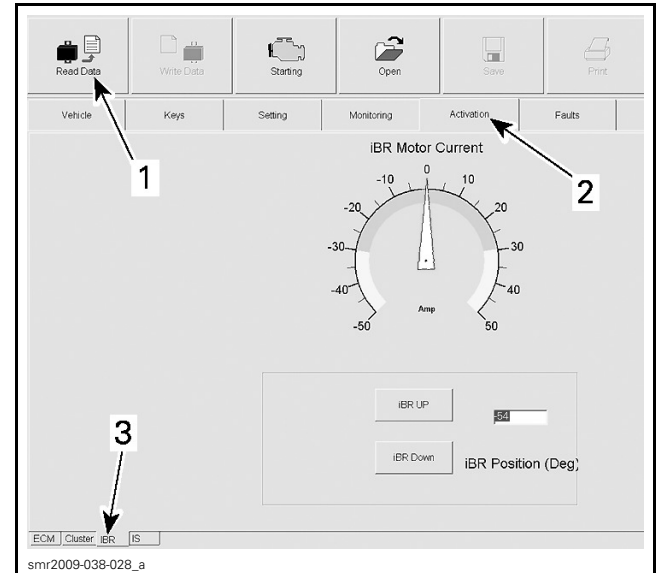
smr2014-119-010_a
iBR ACTUATOR CONNECTOR

iBR ACTUATOR CONNECTOR	
PIN	SIGNAL
iBR-1	Battery voltage (Hot at all times)
iBR-2	Battery voltage (Hot with main relay on)
iBR-8	Ground

iBR ACTUATOR CURRENT DRAW	
DOWN SELECTION	-5 to -15 A
UP SELECTION	+10 to +20 A

Testing iBR Actuator Operation Using B.U.D.S.

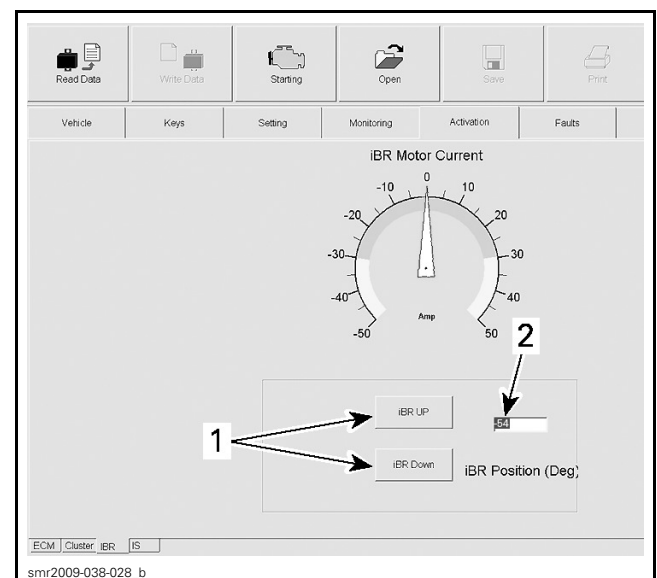
1. Click the **Activation** tab.
2. Click the **iBR** tab.



TYPICAL

1. Read Data
2. Activation page
3. iBR tab

3. Click **iBR UP** and **iBR DOWN** buttons alternately and look for a change in **iBR Position (Deg)**.



TYPICAL

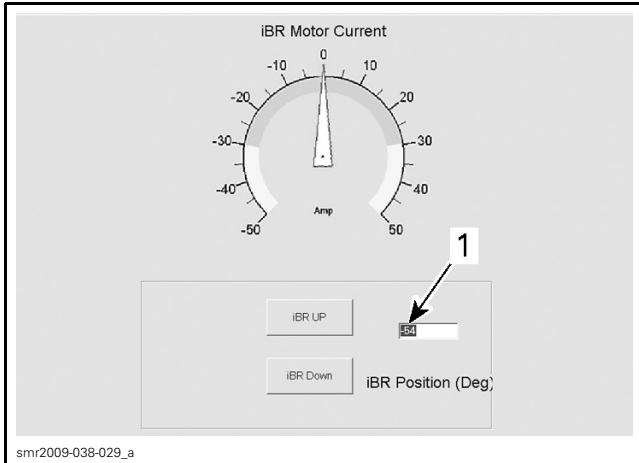
1. iBR UP/DOWN buttons
2. iBR position indication

If the iBR moves using these buttons but does not move using the iBR lever, test *BRLS VOLTAGE* in this subsection.

If the iBR does not move, check the iBR fuse(s) in fuse box. If fuse(s) are good, check power and ground circuits.

Testing iBR Actuator Motor Current Using B.U.D.S.

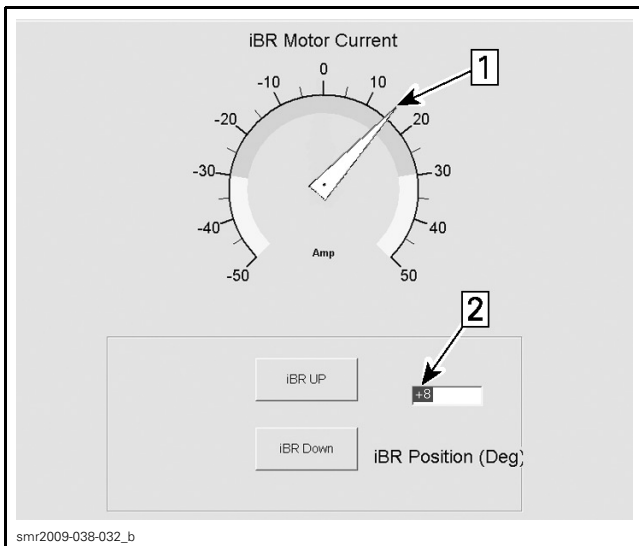
1. On the iBR activation page in B.U.D.S., note the **iBR Position (Deg)** indication.



1. iBR position indication

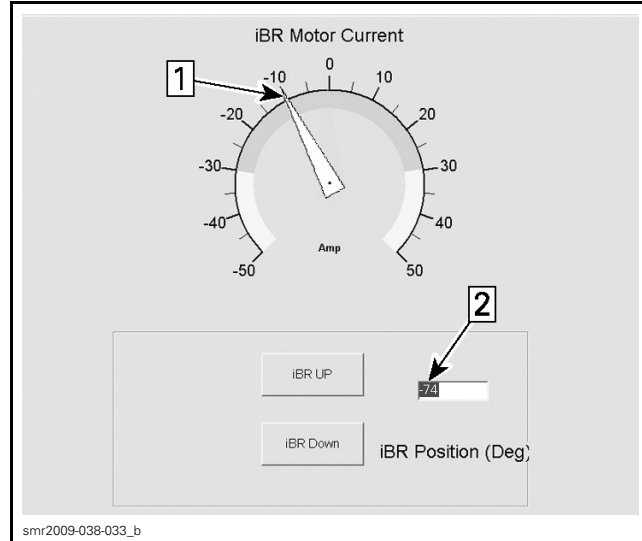
2. Activate the iBR override function.
3. Move the iBR to the full up position and look for the **iBR Motor Current** indication in B.U.D.S. Also look for a change of **iBR Position (Deg)** indication.

NOTE: Current draw indication will not be stable. High and low peaks will be observed. Look for the maximum average current draw.



- Step 1: Note iBR current draw
- Step 2: Note iBR position indication change

4. Move the iBR to the full down position and look for the **iBR Motor Current** draw indication. Also look for a change of **iBR Position (Deg)** indication.



- Step 1: Note iBR current draw
- Step 2: Note iBR position indication change

If current draw is abnormally high (between 20 and 30 A), check the following:

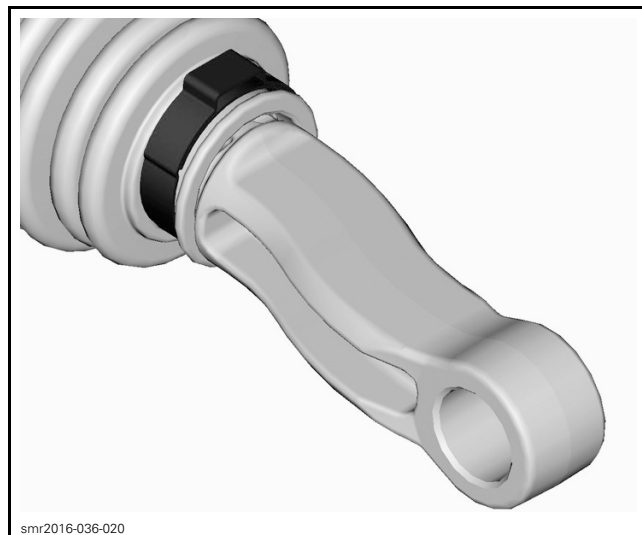
- Ensure iBR gate is free of debris.
- Check for excessive friction in gate movement.
- Check roller bushings, plastic bushings and iBR ramps.
- Check for proper voltage to the iBR actuator.
- Check for fault codes using B.U.D.S.

Remove debris, replace iBR gate components, or replace the iBR actuator as applicable.

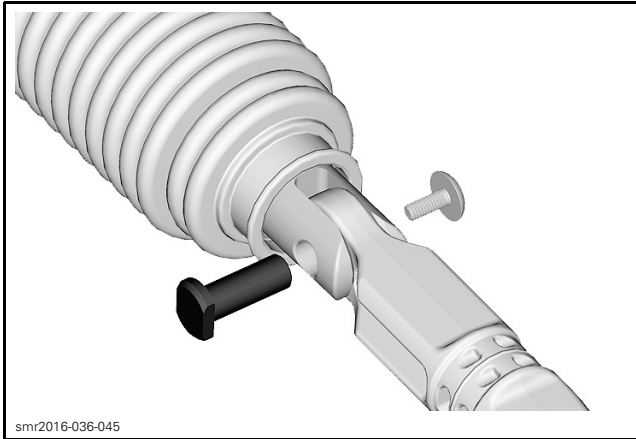
Removing the iBR Actuator

NOTICE Do not try to manually force the iBR gate when all components are installed.

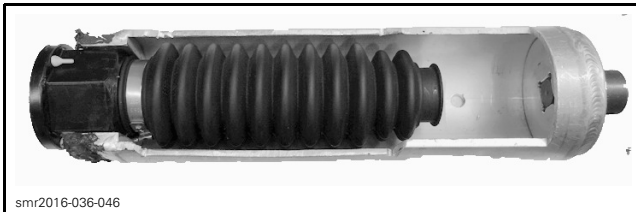
1. Remove iBR gate assembly.
2. Remove small connecting arm boot Oetiker clamp.



3. Remove connecting arm pin and screw.



4. Remove iBR nut and boot. IBR NUT SOCKET (P/N 529 036 379).

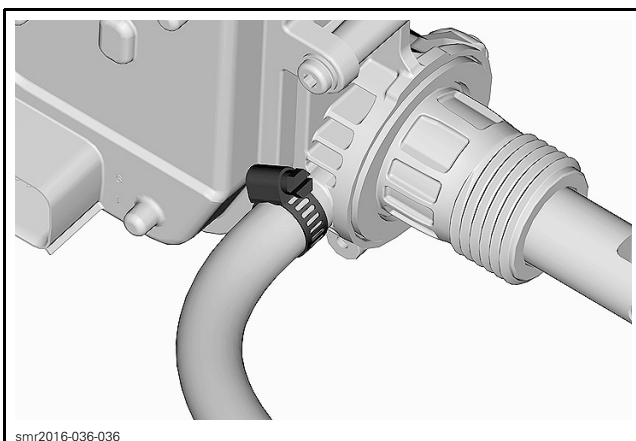


5. Move muffler. Refer to *EXHAUST SYSTEM*.
6. Unplug electrical connector.
7. Remove retaining strap.
8. Remove iBR actuator and air chamber.

Installing the iBR Actuator

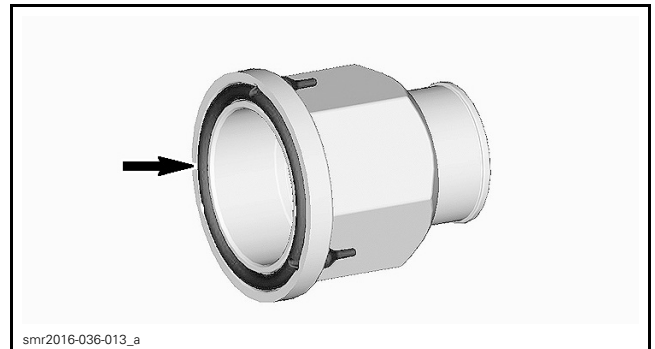
NOTICE Failure to adhere to the sequence in the following steps will cause the iBR air chamber to rupture or burst and cause premature failure of the iBR actuator.

1. Install the air chamber on the iBR actuator.
 - 1.1 Tighten the clamp.



2. Connect iBR actuator connector.
3. Install iBR actuator shaft through hull opening.
4. Slide the o-ring into position on iBR nut.

NOTICE Apply LOCTITE 5900 (P/N 293 800 066) to iBR actuator threads only. Wipe off any excess on iBR shaft immediately.

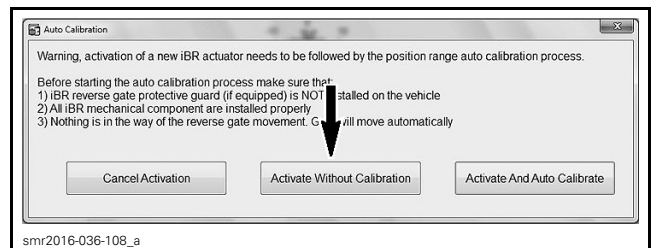


NOTICE Ensure no sealing agents contact the iBR shaft.

5. Torque iBR nut.
6. Install strap.

New iBR Actuators Only

7. Refer to *iBR AUTO CALIBRATION USING B.U.D.S.* in this subsection and **activate without calibration** in order to use the iBR override function.



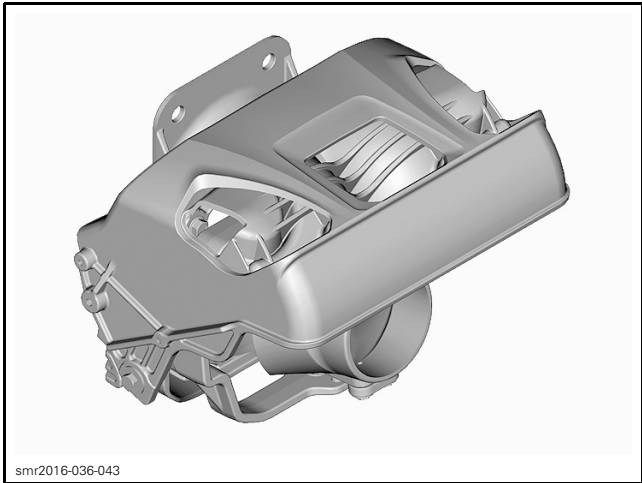
All iBR Actuators

8. Install connecting arm.
- Reverse removal procedure.

NOTICE Allow 24 hours for thread locker on retaining screws to cure.

Perform *iBR AUTO-CALIBRATION* procedure.

iBR GATE ASSEMBLY

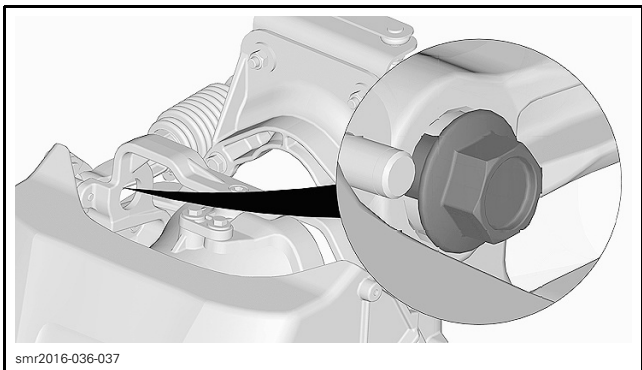


Removing the iBR Gate Assembly

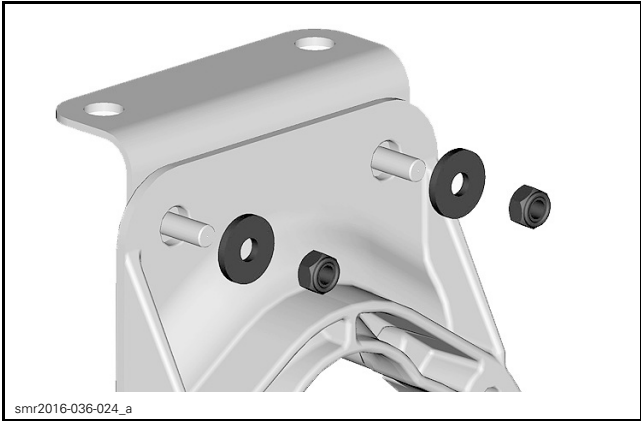
1. Remove the guard.



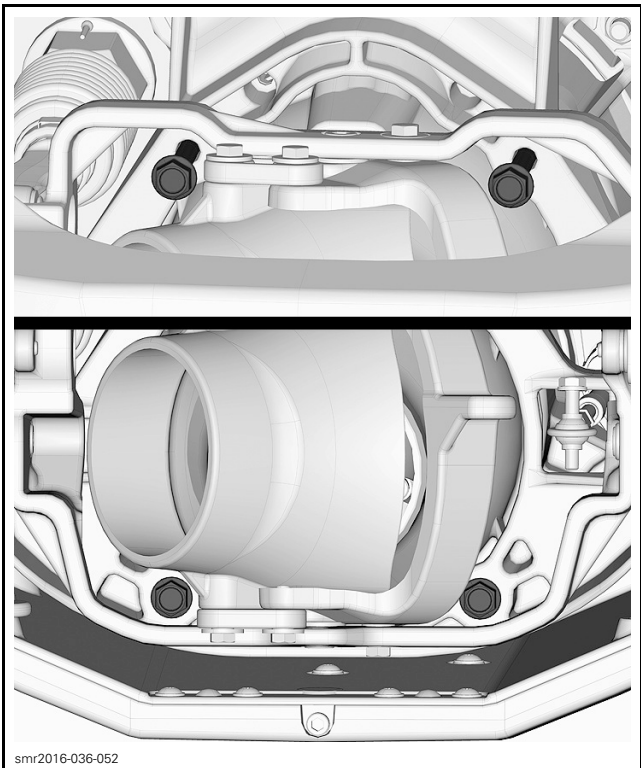
- 2. Use the iBR override function to lower the gate until the holes align.
- 3. Disconnect the connecting arm.



- 4. Disconnect the steering cable. Refer to *STEERING AND O.T.A.S.* subsection.
- 5. Remove L-plate retaining nuts.



6. Remove the iBR gate support bracket screws.

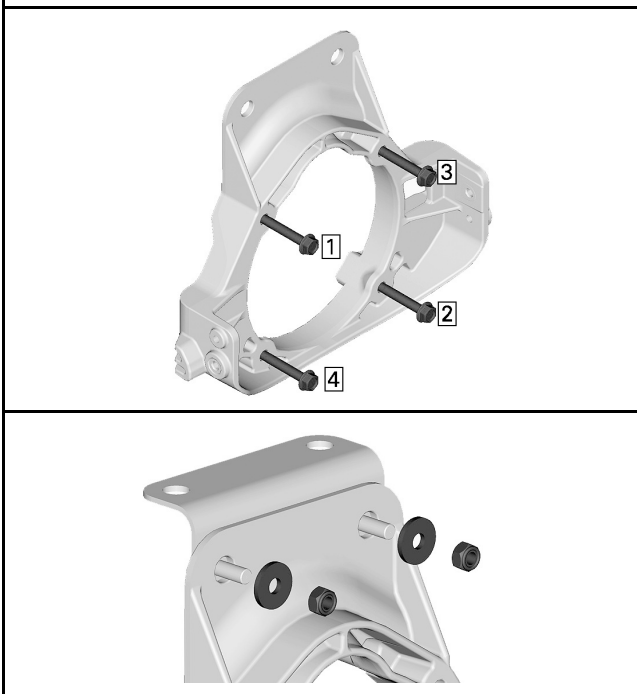


TOP: GATE LOWERED / BOTTOM: GATE RAISED (BY HAND)

NOTICE Do not drop the venturi when removing the iBR Gate Assembly.

Installing the iBR Gate Assembly

TIGHTENING SEQUENCE

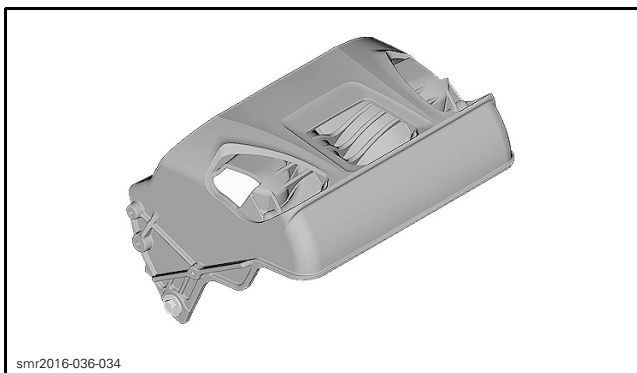


Reverse removal procedure.

NOTICE Allow 24 hours for thread locker on retaining screws to cure.

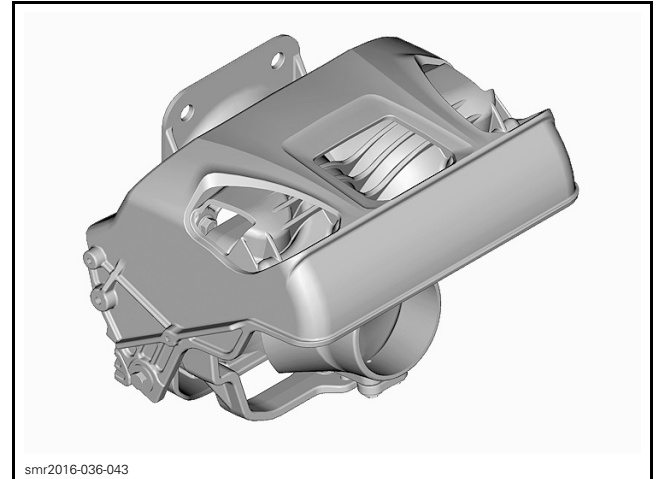
Perform *iBR AUTO-CALIBRATION* procedure.

iBR REVERSE GATE

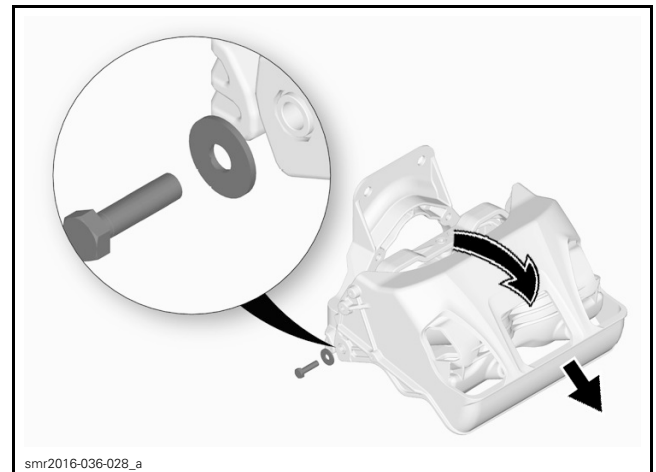


Removing the iBR Reverse Gate

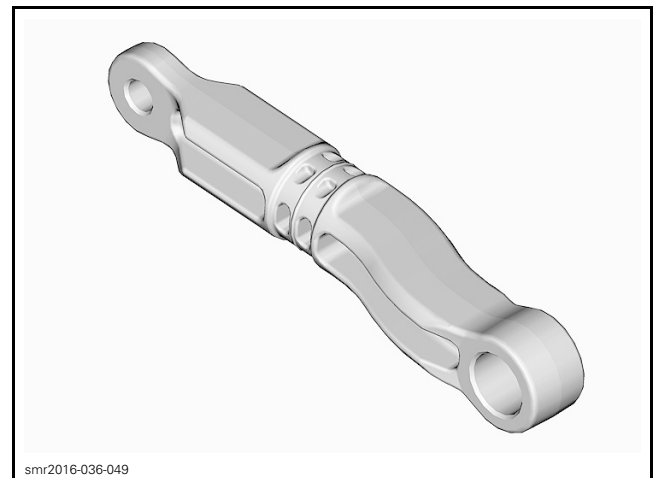
Remove the iBR gate assembly.



Remove the iBR reverse gate.

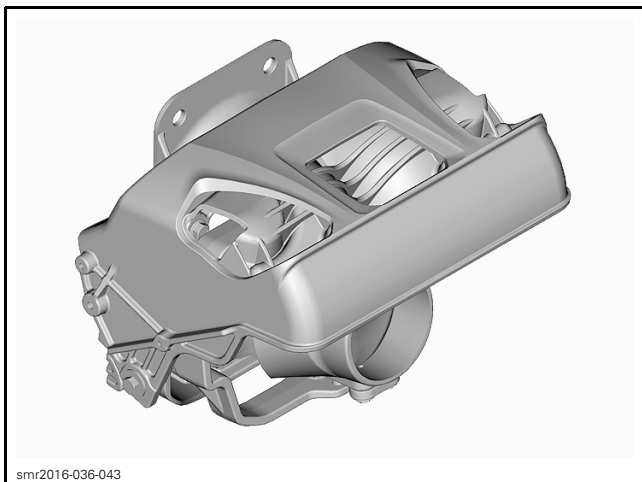


CONNECTING ARM

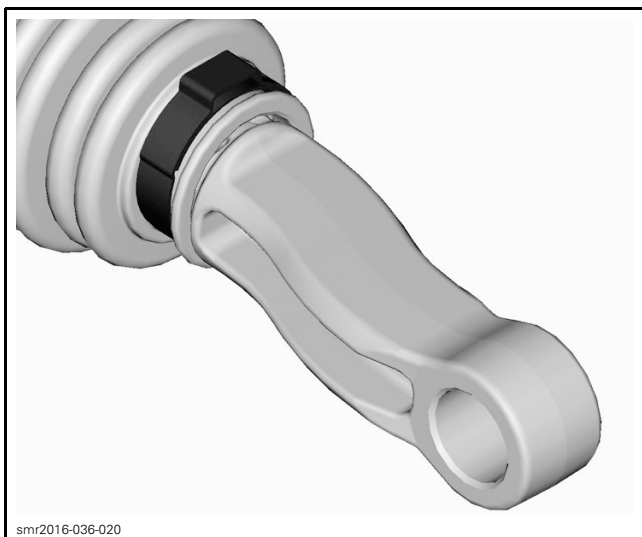


Removing the Connecting Arm

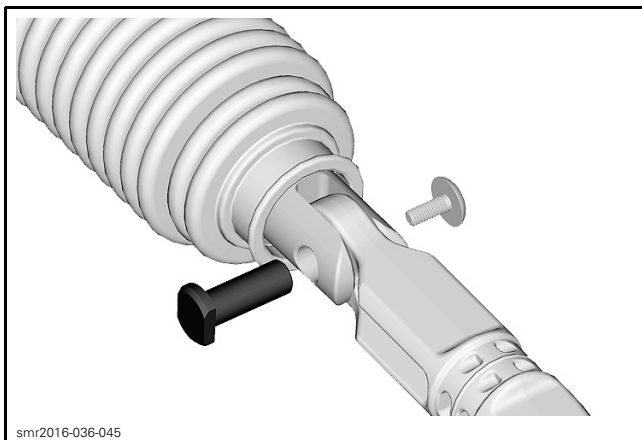
1. Remove the iBR gate assembly. Refer to *iBR GATE ASSEMBLY*.



2. Remove small connecting arm boot Oetiker clamp.



3. Remove connecting arm pin and screw.

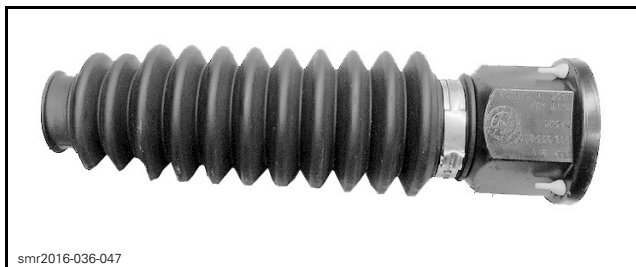


4. Remove connecting arm.

Installing the Connecting Arm

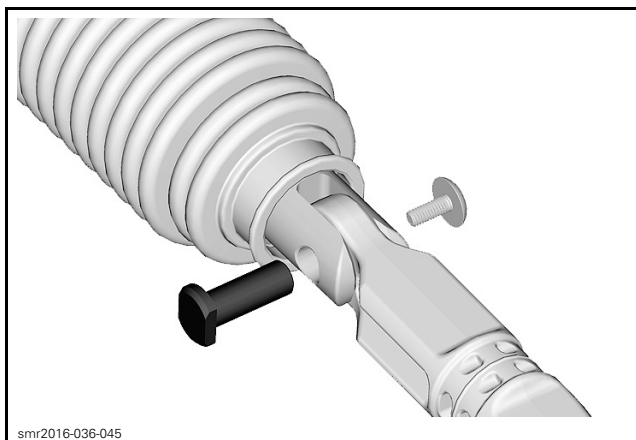
Use iBR override function to move iBR actuator to the full down setting.

NOTE: The boot should already be installed and clamped on the iBR nut.

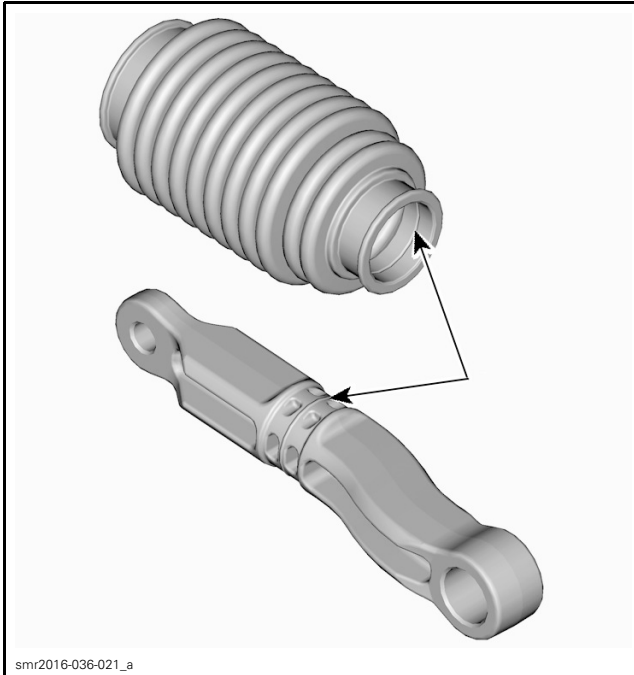


NOTICE Failure to adhere to the sequence in the following steps will cause the iBR air chamber to rupture or burst and cause premature failure of the iBR actuator.

1. Push boot back towards iBR actuator.
2. Install connecting arm pin and screw.
 - 2.1 Torque screw.

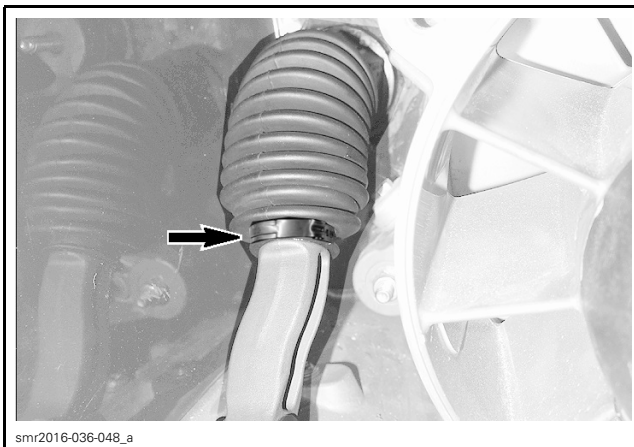


3. Position the boot over the connecting arm.



4. Compress the air chamber (attached to iBR actuator).

4.1 Clamp the Oetiker clamp on the connecting arm boot.

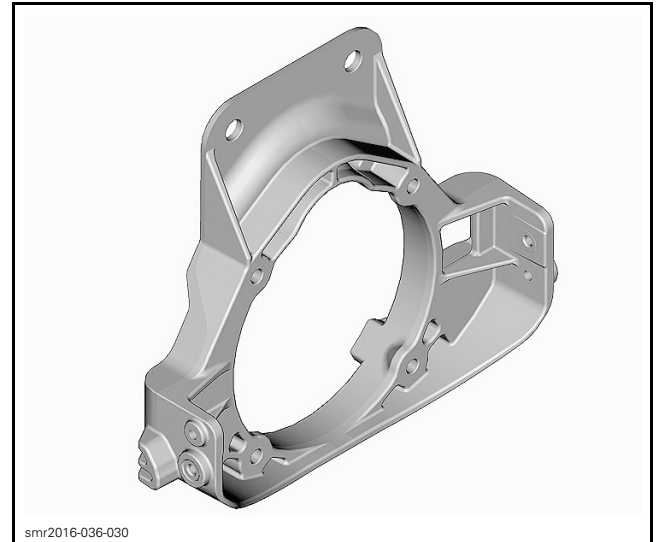


Reverse removal procedure.

NOTICE Allow 24 hours for thread locker on retaining screws to cure.

Perform *iBR AUTO-CALIBRATION* procedure.

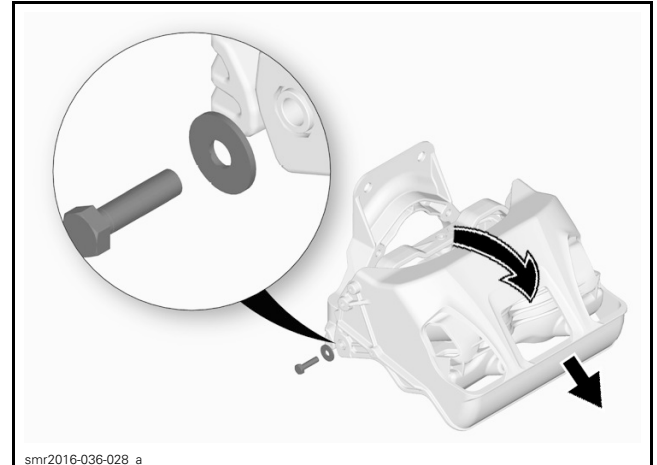
iBR GATE SUPPORT BRACKET



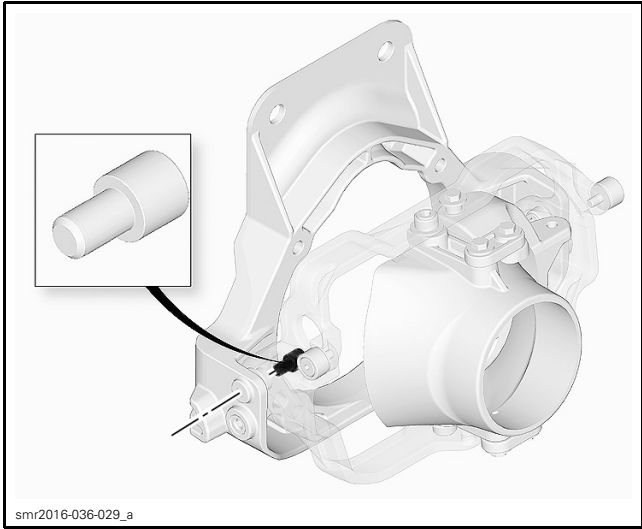
Removing the iBR Gate Support Bracket

Remove the iBR Gate Assembly.

1. Remove the iBR gate.



2. Remove the trim ring and nozzle assembly.



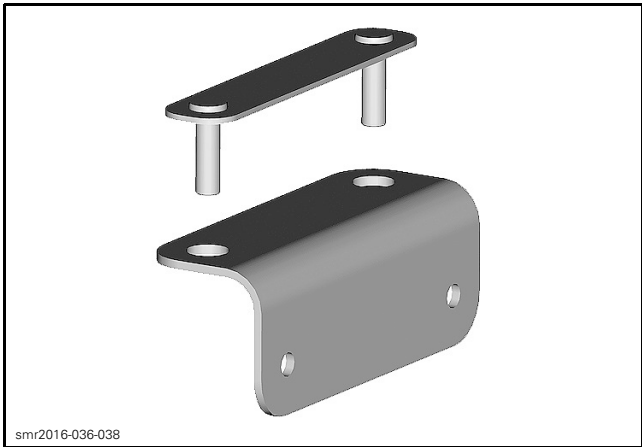
Installing the iBR Gate Support Bracket

Reverse removal procedure.

NOTICE Allow 24 hours for thread locker on retaining screws to cure.

Perform *iBR AUTO-CALIBRATION* procedure.

L-PLATE



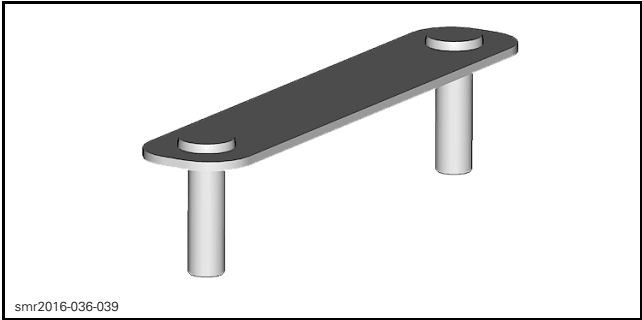
The L plate is pre-aligned from factory. It should not be removed unless it is damaged.

Removing the L-Plate

Remove iBR gate assembly.

Remove L-Plate retaining nuts.

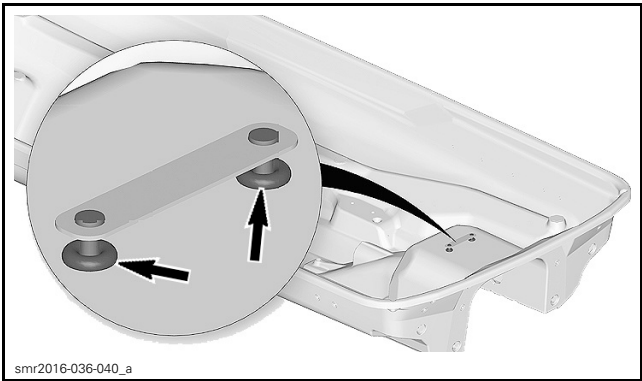
NOTE: The top studs and plate are sealed to the hull. If removed, they must be cleaned and sealed.



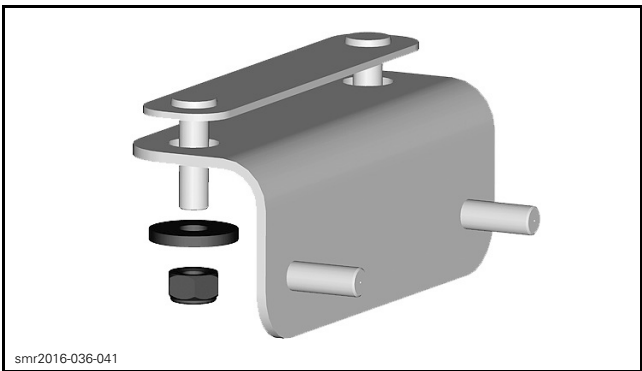
L-PLATE TOP STUDS AND PLATE

Installing the L-Plate

If removed, the top studs and plate must be sealed with LOCTITE 5900 (P/N 293 800 066).



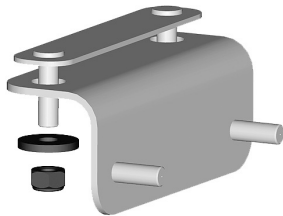
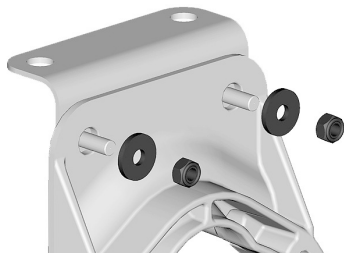
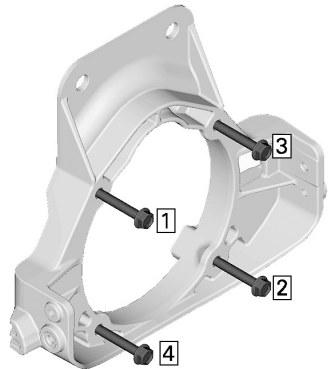
1. Loosely install L-plate nuts.



2. Install gate support bracket with the iBR gate assembly and tighten the 4 bolts and 2 nuts.

3. Tighten L-plate nuts.

TIGHTENING SEQUENCE

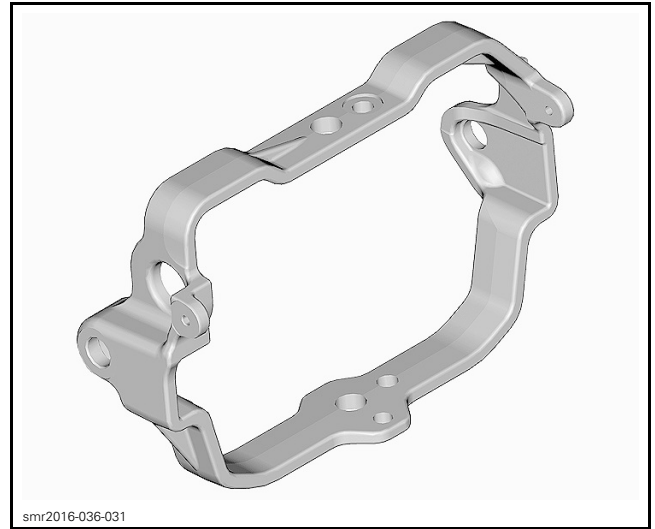


Reverse removal procedure.

NOTICE Allow 24 hours for thread locker on retaining screws to cure.

Perform *IBR AUTO-CALIBRATION* procedure.

VTS TRIM RING



Removing the VTS Trim Ring

1. Remove iBR gate assembly.
2. Remove iBR reverse gate.
3. Remove nozzle pivot screws.

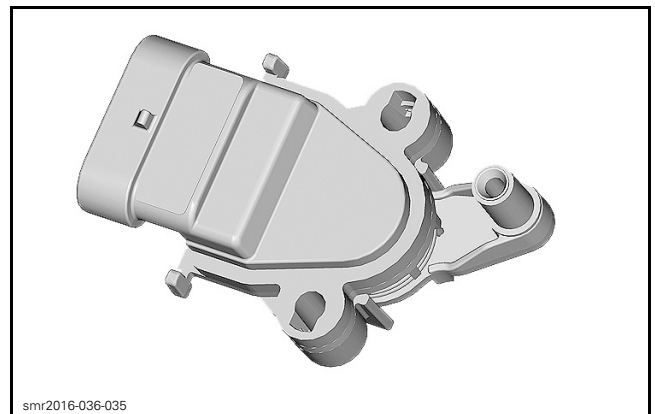
Installing the VTS Trim Ring

Reverse removal procedure.

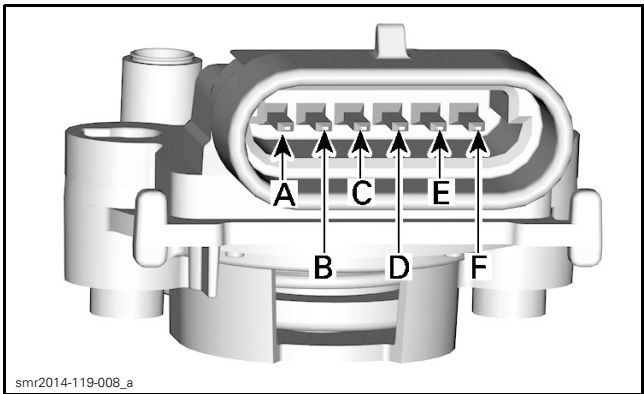
NOTICE Allow 24 hours for thread locker on retaining screws to cure.

Perform *IBR AUTO-CALIBRATION* procedure.

BRAKE AND REVERSE LEVER SWITCH (BRLS)



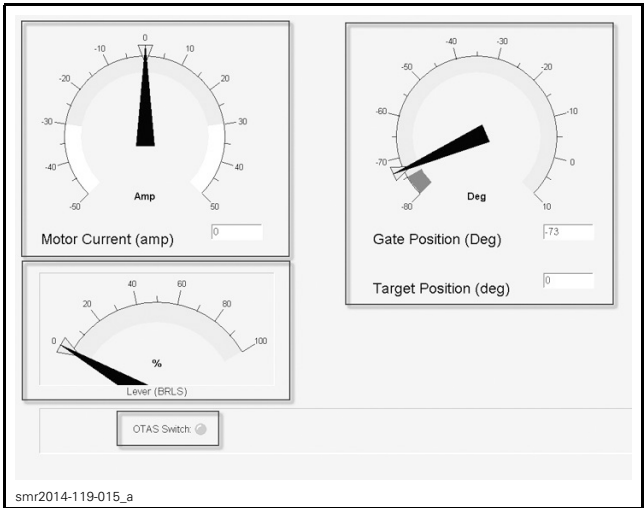
Testing and Specifications



BRLS PINOUT

BRLS PINOUT	
PIN	SIGNAL
BRLS-A	5 VDC
BRLS-B	GND
BRLS-C	View signal % in B.U.D.S.
BRLS-D	5VDC
BRLS-E	GND
BRLS-F	View signal % in B.U.D.S.

NOTE: When moving BRLS lever, the BRLS percentage should increase or decrease in a steady linear fashion.



MONITORING iBR IN B.U.D.S.

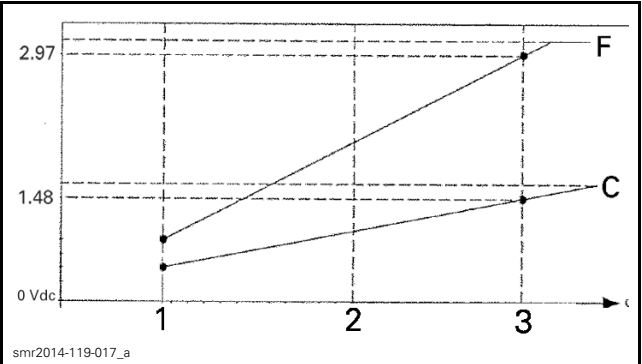
If B.U.D.S. does not show BRLS percentage moving or if reading is erratic:

- Check for BRLS reference voltage.

- Check for BRLS ground.
- Carry out a continuity test of the wiring between the iBR actuator and the BRLS.

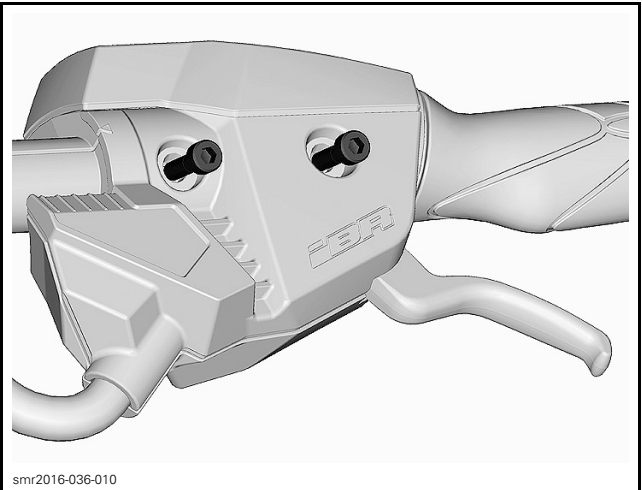
NOTE: When installed on vehicle the BRLS-C Vdc signal should always be half of the BRLS-F Vdc signal when testing with a multimeter.

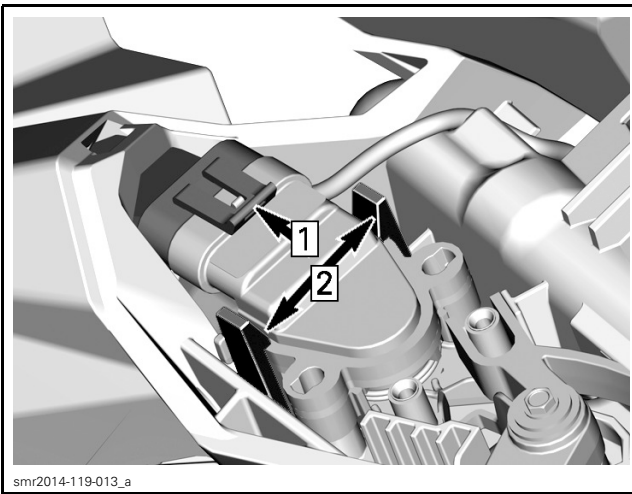
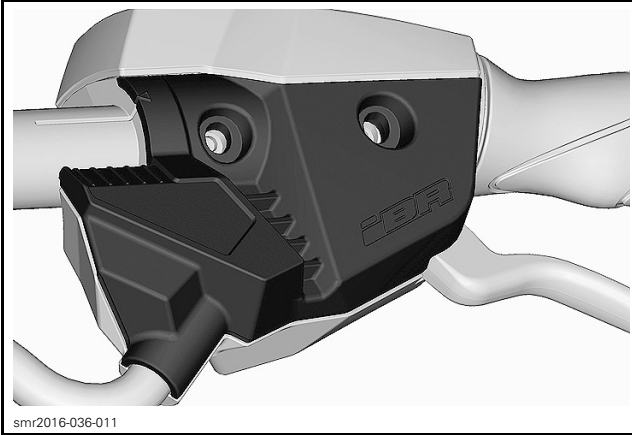
To test, install DIAGNOSTIC HARNESS (P/N 529 036 188) between steering harness connectors.



APPROXIMATE BRLS SIGNAL VOLTAGE CURVE PINS F AND C
1. BRLS released
2. BRLS at 50% pulled
3. BRLS fully pulled

Removing the BRLS





Installing the BRLS

Reverse removal procedure.

TIGHTENING TORQUE	
BRLS Switch Cover Screws	2 N•m ± 1 N•m (18 lbf•in ± 9 lbf•in)

JET PUMP

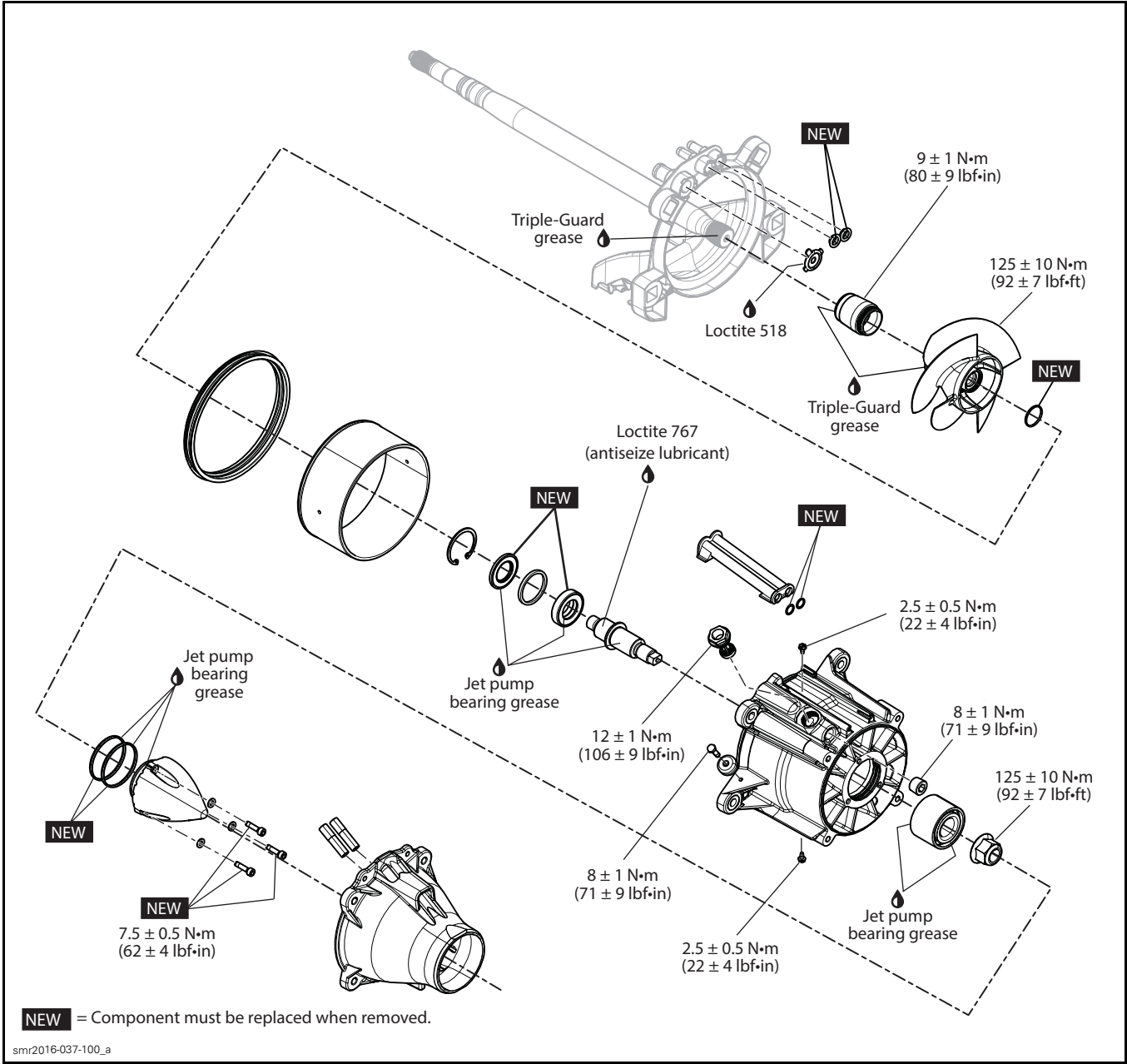
SERVICE TOOLS

Description	Part Number	Page
IMPELLER REMOVER/INSTALLER	529 035 956	10–11, 15
IMPELLER SHAFT BEARING TOOL	529 036 168	13–14
IMPELLER SHAFT PUSHER.....	529 035 955	12–13
PRESSURE CAP	529 036 172	4
PUMP PLATE.....	529 036 224	5
SEAL/BEARING PUSHER.....	529 035 819	14
VACUUM/PRESSURE PUMP	529 021 800	4

SERVICE PRODUCTS

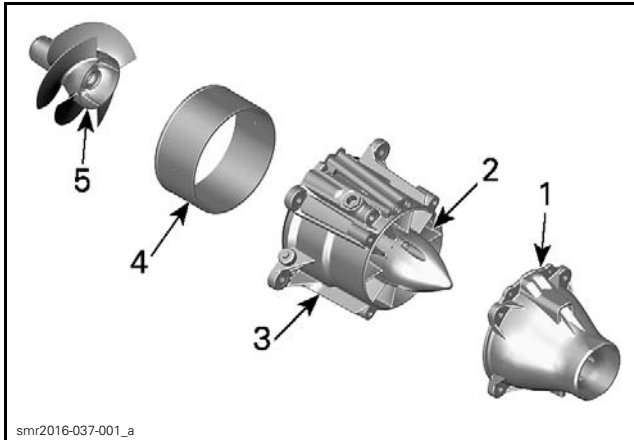
Description	Part Number	Page
JET PUMP BEARING GREASE	293 550 032	9, 14, 16
LOCTITE 243 (BLUE).....	293 800 060	12
LOCTITE 518.....	293 800 038	7
LOCTITE 577 (THREAD SEALANT)	293 800 050	11
LOCTITE 767 (ANTISEIZE LUBRICANT)	293 800 070	10
PULLEY FLANGE CLEANER	413 711 809	6
TRIPLE-GUARD GREASE	296 000 329	6–7, 11
XPS LUBE.....	293 600 016	7, 10

Subsection XX (JET PUMP)



GENERAL

JET PUMP MAIN COMPONENTS



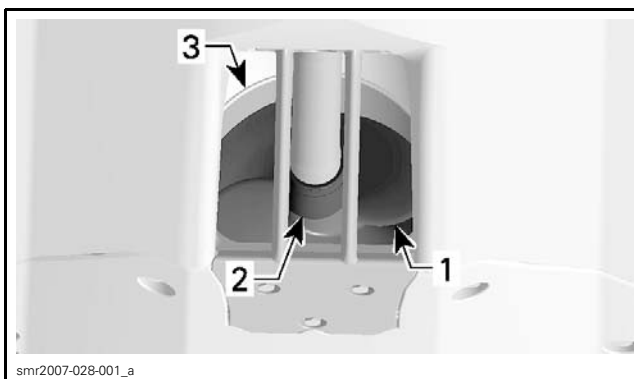
TYPICAL

1. Venturi
2. Stator
3. Jet pump housing
4. Wear ring
5. Impeller

INSPECTION

IMPELLER CONDITION

Condition of impeller, impeller boot and wear ring can be quickly checked from underneath the watercraft. With the vehicle on the trailer, use a flashlight to visually inspect them through the inlet grate.



TYPICAL — UNDERNEATH HULL

1. Impeller
2. Impeller boot
3. Wear ring

IMPELLER/WEAR RING CLEARANCE

This clearance is critical for jet pump performance. To check clearance, remove jet pump.

Using a feeler gauge, measure clearance between impeller blade tip and wear ring. Measure each blade at its center.



MODEL	MAXIMUM WEAR CLEARANCE
All models	0.35 mm (.014 in)

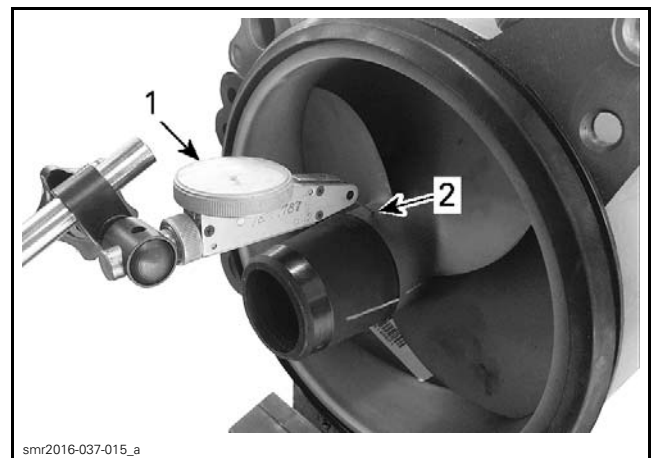
IMPELLER SHAFT RADIAL PLAY

Radial play is critical for jet pump life span.

To check radial play, remove jet pump.

Make sure impeller shaft turns freely and smoothly.

1. Retain housing in a soft jaw vise making sure not to damage housing lug.
2. Set a dial gauge and position its tip onto metal end, close to the end of the impeller hub.
3. Move shaft end up and down. Difference between highest and lowest dial gauge reading is radial play.



TYPICAL — MEASURING IMPELLER SHAFT RADIAL PLAY

1. Dial gauge
2. Measure close to impeller hub end

Subsection XX (JET PUMP)

RADIAL PLAY
0.5 mm (.02 in)

Excessive play can come either from worn bearing or damaged jet pump housing bearing surface.

LEAK TEST

Whenever performing any type of repair on the jet pump, a leak test should be carry out.

Proceed as follows:

- 1. Remove impeller cover. Refer to *IMPELLER COVER* in this subsection.
- 2. Install the PRESSURE CAP (P/N 529 036 172) on pump housing.



- 3. Connect the VACUUM/PRESSURE PUMP (P/N 529 021 800) to the pressure cap fitting.



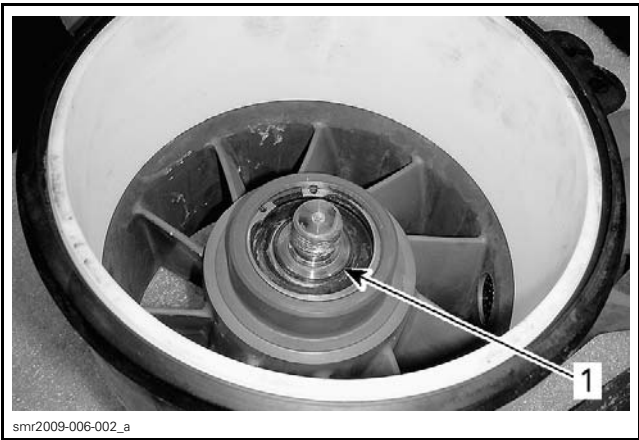
TYPICAL

- 4. Pressurize pump.

LEAK TEST PRESSURE
Maximum 70 kPa (10 PSI)

- 5. Pump must maintain this pressure for at least 5 minutes.

NOTE: If there is 2 or 3 bubbles coming out from the seal on the impeller side is acceptable. Leaks from other areas must be repaired.



TYPICAL

1. Small leak here is acceptable

NOTICE Repair any leak. Failure to correct a leak will lead to premature wear of pump components.

- 6. Disconnect pump and remove pressure cap.
- 7. Reinstall impeller cover. Refer to *IMPELLER COVER* in this subsection.

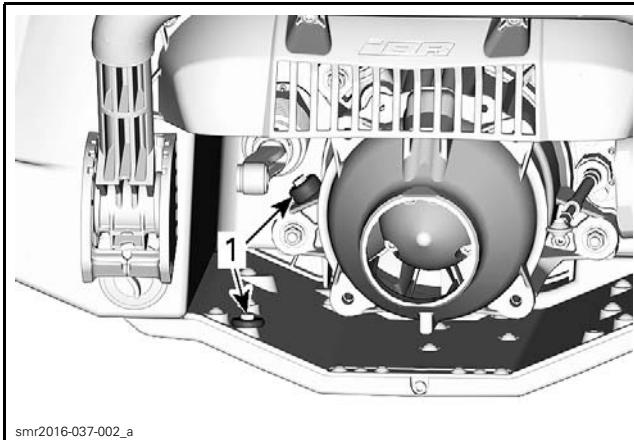
PROCEDURES

NOTE: Whenever removing a part, visually check for damage such as: corrosion, cracks, split, break, porosity, cavitation, deformation, distortion, heating discoloration, wear pattern, defective plating, missing or broken balls in ball bearing, water damage diagnosed by black-colored spots on metal parts, etc. Replace any damaged parts. As a quick check, manually feel clearance and end play, where applicable, to detect excessive wear.

SACRIFICIAL ANODE

Inspecting the Sacrificial Anode

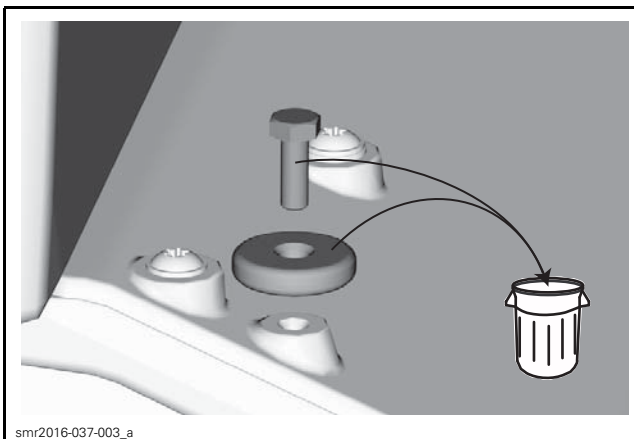
Check for wear. If worn more than half, replace anode.



1. Sacrificial anode location

Removing the Sacrificial Anode

Remove and discard screw and anode.



Installing the Sacrificial Anode

Installation is the reverse of the removal procedure.

TIGHTENING TORQUE

Sacrificial anode screw	8 N•m ± 1 N•m (71 lbf•in ± 9 lbf•in)
-------------------------	---

VENTURI

Removing the Venturi

1. Remove the iBR gate, VTS trim ring and nozzle. Refer to *iBR AND VTS* subsection.
2. Remove the venturi from the jet pump housing.

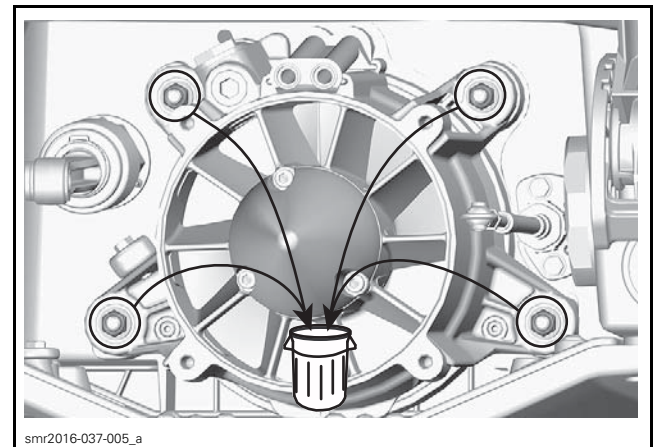
Installing the Venturi

The installation is the reverse of the removal procedure.

JET PUMP HOUSING

Removing the Jet Pump Housing

1. Remove the iBR gate, VTS trim ring and nozzle. Refer to *iBR AND VTS* subsection.
2. Remove the venturi.
3. Remove and discard the nuts that retain the jet pump to the pump support.



4. Pull back jet pump housing to remove it from the pump support. It may be necessary to wiggle it slightly as you pull back on the pump.

Temporarily fasten the PUMP PLATE (P/N 529 036 224) to pump support to support drive shaft and avoid PTO oil seal damage.

Subsection XX (JET PUMP)

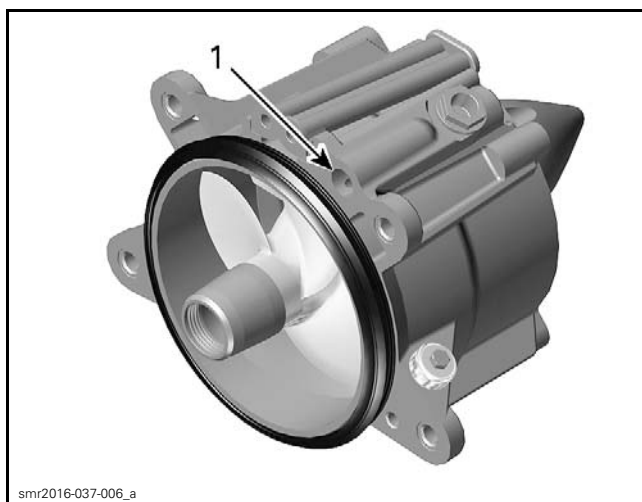


Inspecting and Cleaning the Jet Pump Housing

1. Visually inspect jet pump housing. Pay attention to the stator. Ensure the assembly is clean and free of any debris and defects.

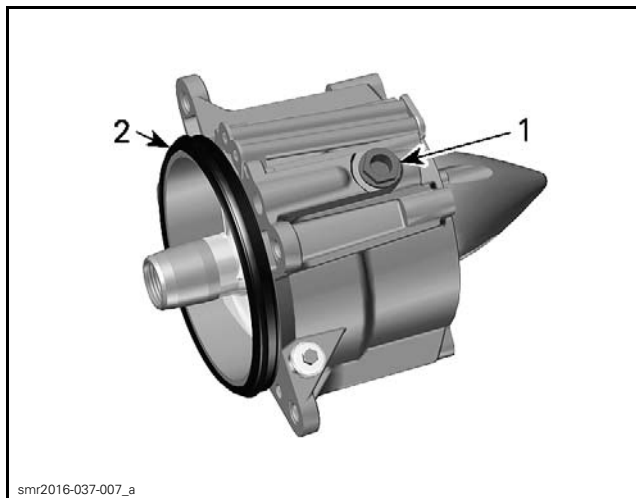
Do the following as applicable.

2. Blow low pressure compressed air through the pressure outlet fitting and make sure it is clear.



1. Pressure outlet

3. Ensure cap screw is tight.
4. Ensure the neoprene seal is in good condition. Replace as required.



1. Cap screw
2. Neoprene seal

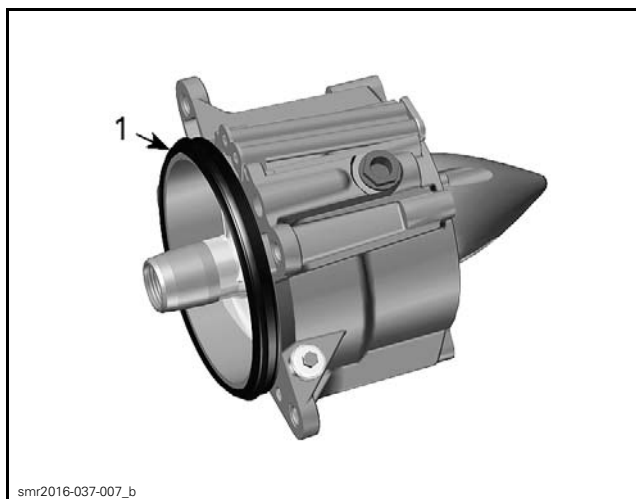
Installing the Jet Pump Housing

Clean impeller splines and drive shaft splines with PULLEY FLANGE CLEANER (P/N 413 711 809) or equivalent. Splines must be free of any residue.

NOTICE To avoid damaging the drive shaft finish, never use a metallic brush.

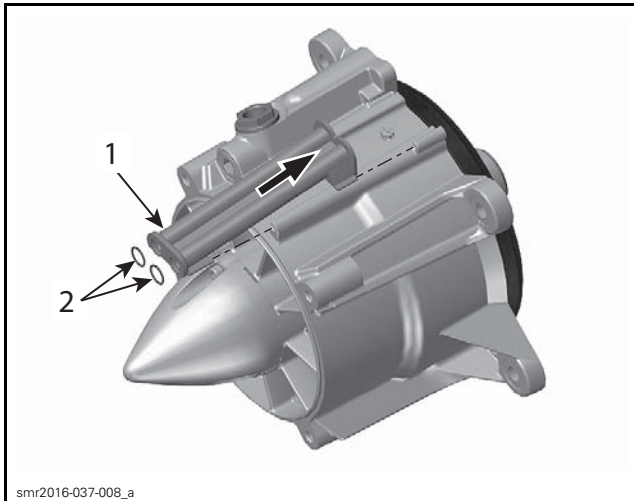
Lubricate drive shaft splines, impeller splines and the inside of the impeller boot with TRIPLE-GUARD GREASE (P/N 296 000 329).

Ensure the neoprene seal is properly installed on the jet pump.



1. Neoprene seal

Install new O-rings then slide water outlet adapter onto pump.



1. Slide adapter onto pump
2. New O-rings here

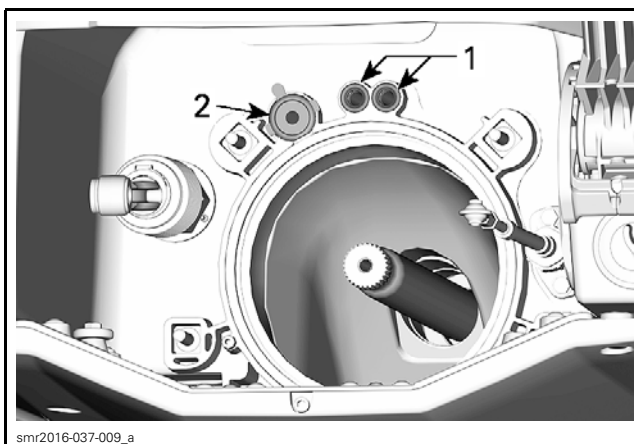
Install new O-rings on pump support.

The water flow is controlled by a calibrated reducer. Ensure to install the proper reducer.

Apply a thin layer of LOCTITE 518 (P/N 293 800 038) on the rounded portion of the reducer to hold it against the support.

REDUCER	
ENGINE	COLOR CODE
300	Pink
All other	Green

NOTICE Improper reducer can cause overheating and damage to exhaust system.



1. Install new O-rings
2. Calibrated reducer

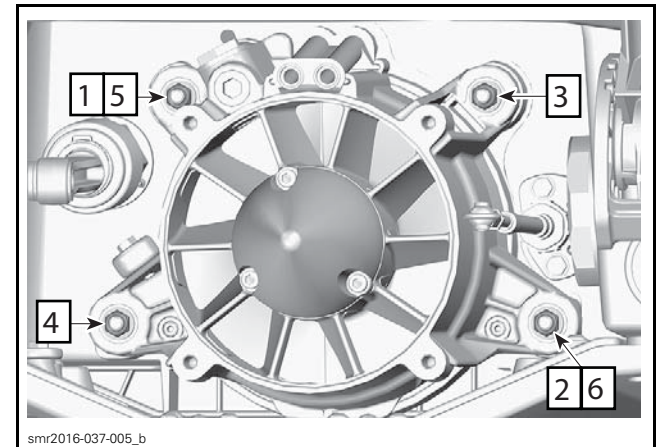
Generously apply TRIPLE-GUARD GREASE (P/N 296 000 329) on drive shaft splines.

Install jet pump.

NOTE: If necessary, wiggle jet pump to engage drive shaft splines in impeller.

Install new nuts and torque as per table and the illustrated sequence.

TIGHTENING TORQUE
26 N•m ± 2 N•m (19 lbf•ft ± 1 lbf•ft)

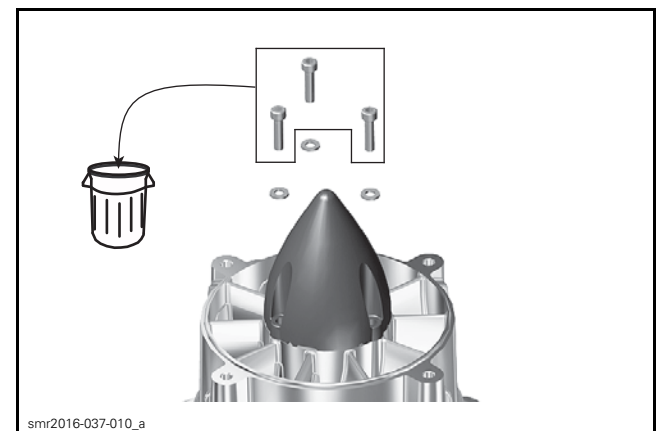


NOTE: Slightly lubricate wear ring with XPS LUBE (P/N 293 600 016) to minimize friction during initial impeller start.

IMPELLER COVER

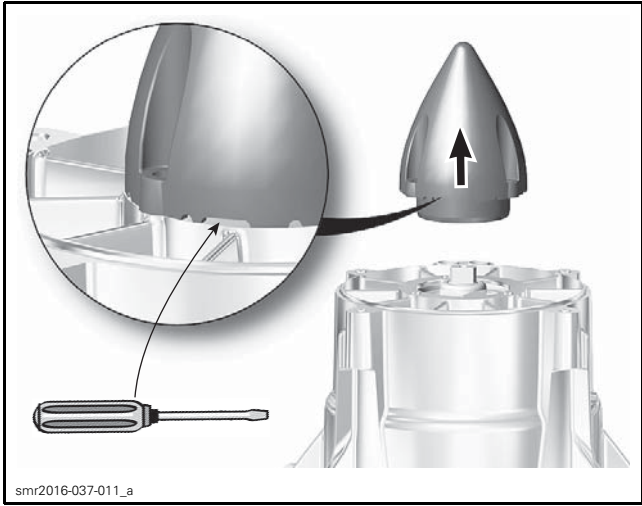
Removing the Impeller Cover

1. Remove the jet pump housing.
2. With pump housing in vertical position, remove and discard the 3 retaining screws.

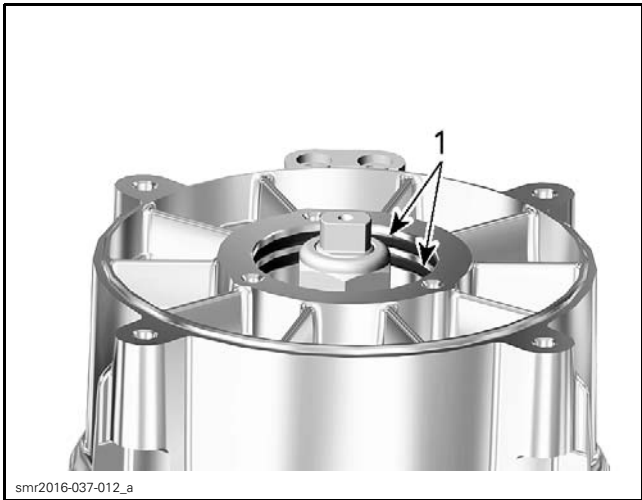


3. Using a fiber hammer, gently tap impeller cover to help release it from the jet pump housing.
4. Use a flat screwdriver in the slots provided as pry points to remove it from the jet pump housing.

Subsection XX (JET PUMP)



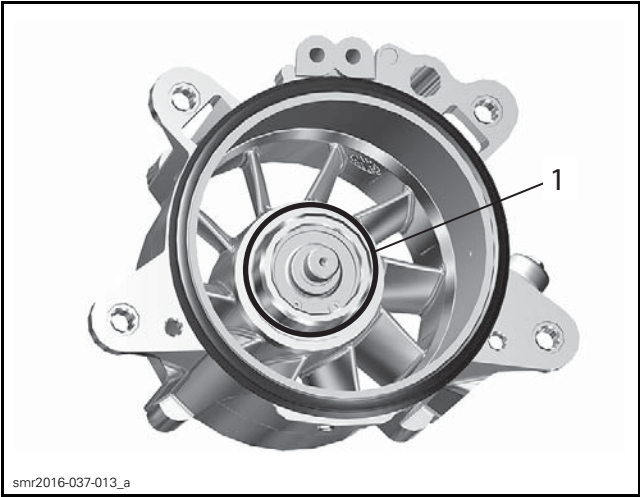
5. Remove both cover O-rings.



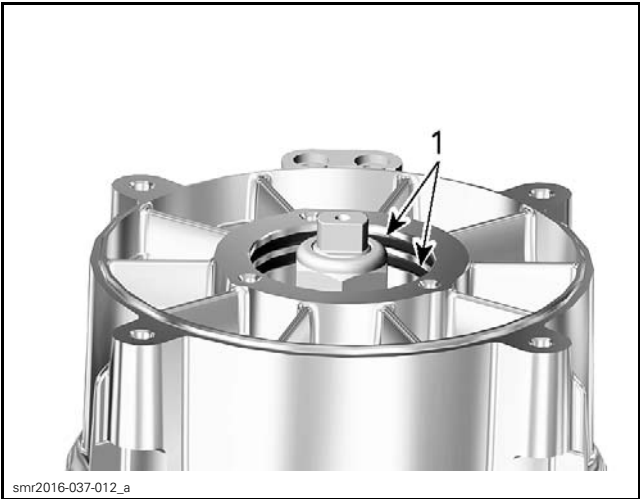
1. Cover O-rings

Inspecting the Impeller Cover

Check for presence of water in cover and bearing area. If water is found, replace seals on impeller side. Also replace O-rings and/or impeller cover.

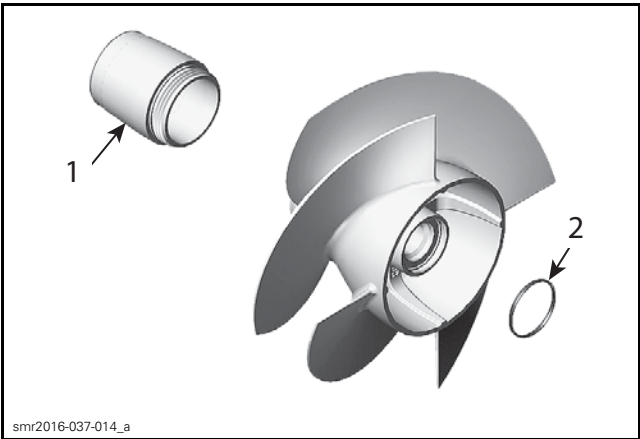


1. Seal on impeller side



1. Cover O-rings

Check impeller boot and O-rings condition on impeller. Replace as required.

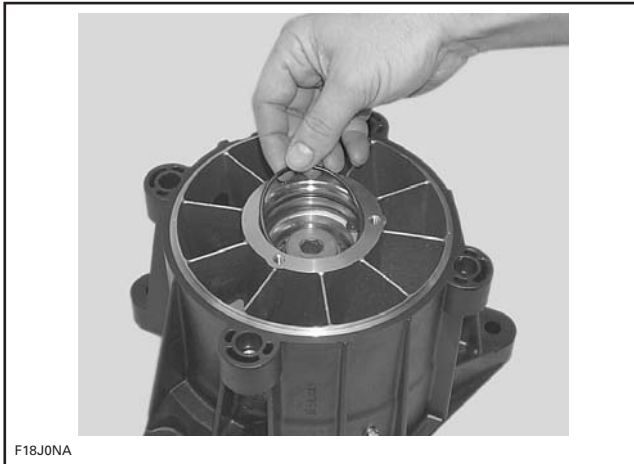


1. Impeller boot
2. Impeller O-ring

Perform a leak test. Refer to *LEAK TEST* in this subsection.

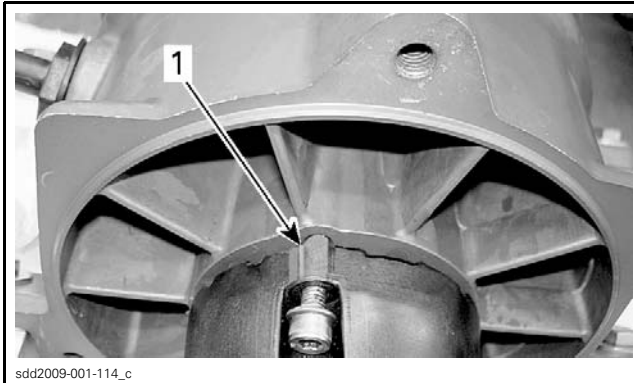
Installing the Impeller Cover

1. Apply a thin layer of JET PUMP BEARING GREASE (P/N 293 550 032) in O-ring grooves.
2. Install O-rings in their respective groove and make sure they are properly lubricate..



TYPICAL

3. Install impeller cover by aligning the cover index mark with the pump top fin as shown.



1. Align mark with top fin

NOTE: Cover can only be installed in one position as screw holes are not located symmetrically.

4. Secure cover with **NEW** self-locking screws.

NOTE: Push cover against pump housing while alternately tightening screws. Make sure O-rings are positioned correctly and they are not damaged when pushing the cover.

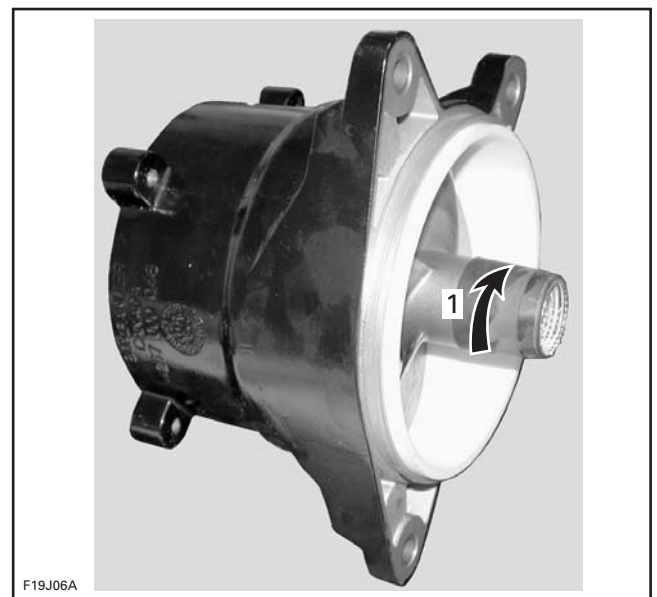
TIGHTENING TORQUE	
Cover screw	7.5 N•m ± 0.5 N•m (66 lbf•in ± 4 lbf•in)

IMPELLER

Removing the Impeller

NOTE: If impeller shaft is to be disassembled, loosen the impeller shaft nut prior to removing the impeller.

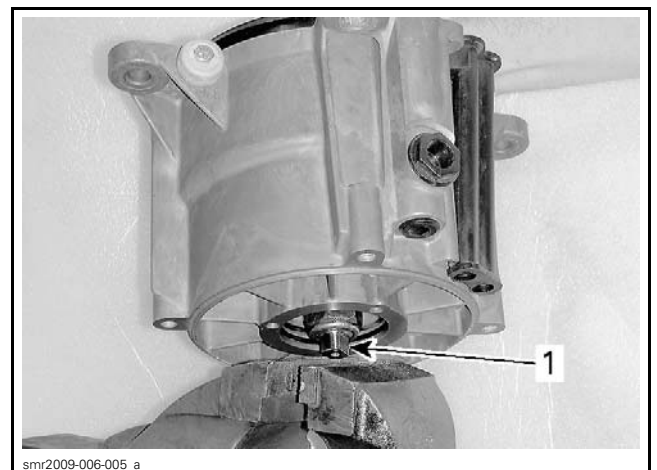
1. Remove jet pump housing. Refer to *JET PUMP HOUSING* in this subsection.
2. Remove impeller cover. Refer to *IMPELLER COVER* in this subsection.
3. Remove impeller boot by turning it **clockwise** (LH threads).



TYPICAL

1. Unscrew clockwise

4. Mount the flat sides of impeller shaft in a vise.



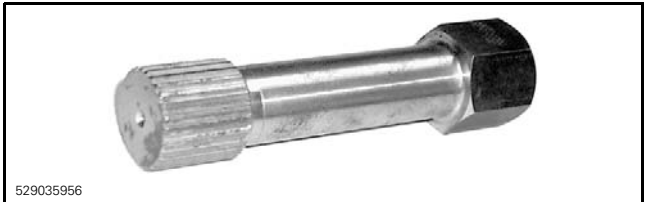
TYPICAL

1. Flat side

5. Unscrew the impeller counterclockwise using the required tool.

Subsection XX (JET PUMP)

REQUIRED TOOL
IMPELLER REMOVER/INSTALLER (P/N 529 035 956)



TYPICAL

NOTICE Never use an impact wrench to loosen impeller.

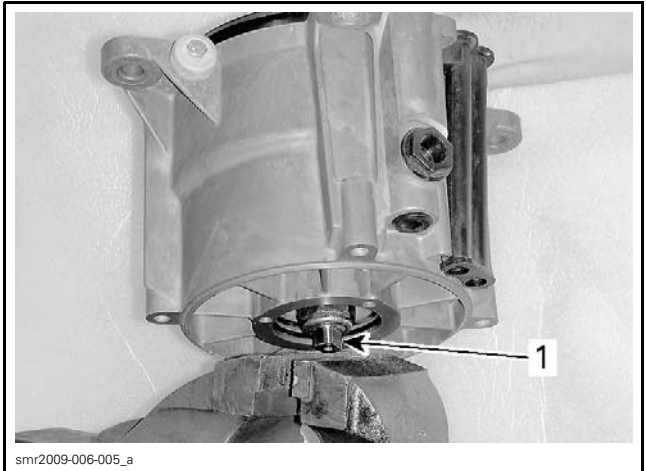


TYPICAL

6. To pull impeller out of the pump, apply a rotating movement as you pull on the impeller.

Installing the Impeller

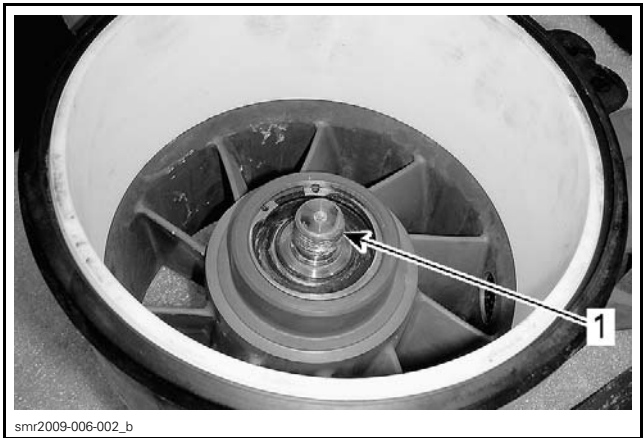
1. Mount the flat sides of the impeller shaft in a vise.



TYPICAL

1. Flat side

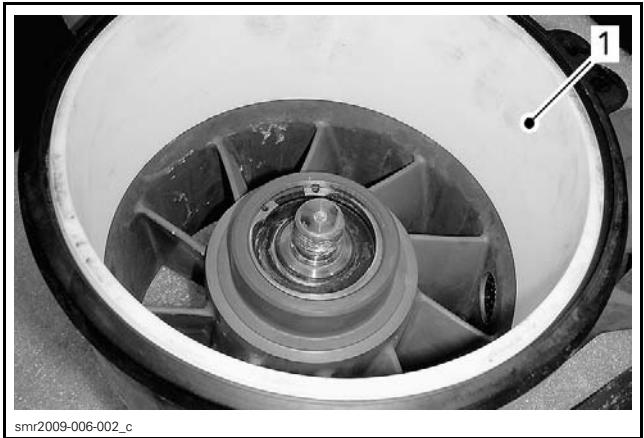
2. Apply LOCTITE 767 (ANTISEIZE LUBRICANT) (P/N 293 800 070) on threads of impeller shaft.



TYPICAL

1. Antiseize lubricant

3. Apply XPS LUBE (P/N 293 600 016) on the wear ring surface.



TYPICAL

1. Spray XPS lube on this surface

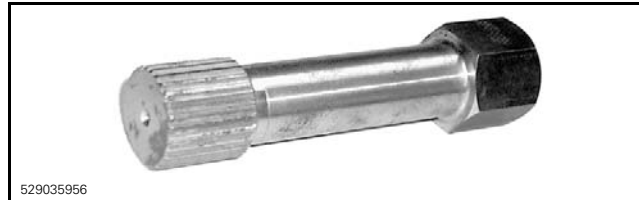
4. Start screwing the impeller on its shaft.



TYPICAL

5. Mount the required tool in impeller splines.

REQUIRED TOOL
IMPELLER REMOVER/INSTALLER (P/N 529 035 956)



TYPICAL

6. Torque impeller as per table.

NOTICE Never use an impact wrench to tighten impeller shaft.

TIGHTENING TORQUE
125 N•m ± 10 N•m (92 lbf•ft ± 7 lbf•ft)

Remove tool.

7. Apply LOCTITE 577 (THREAD SEALANT) (P/N 293 800 050) on impeller boot threads.
8. Apply TRIPLE-GUARD GREASE (P/N 296 000 329) inside impeller boot.
9. Install impeller boot on impeller and tighten counterclockwise.

WEAR RING

Inspecting the Wear Ring

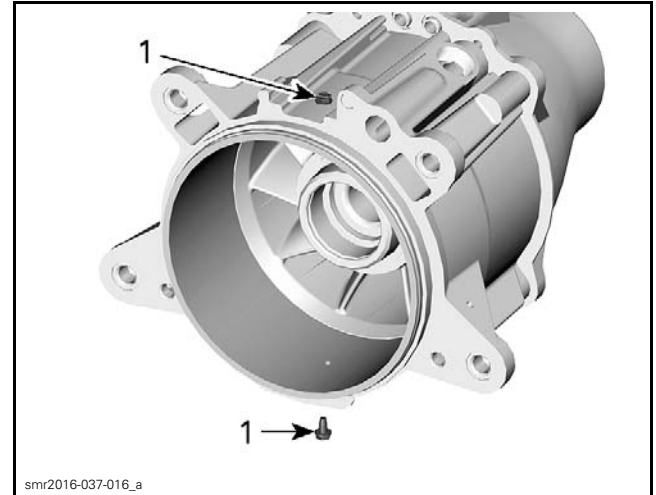
Check wear ring for:

- Deep scratches
- Irregular surface
- Any apparent damage.

Check *IMPELLER/WEAR RING CLEARANCE*, see procedure at the beginning of this subsection.

Removing the Wear Ring

1. Remove jet pump housing. Refer to *JET PUMP HOUSING* in this subsection.
2. Remove impeller, refer to *IMPELLER* in this subsection.
3. On models equipped with the 1600 4-TEC engine, remove screws securing the wear ring.



1. Wear ring screws

Two methods can be used to remove the wear ring, use the most appropriate as your situation.

Method Using a Freezer

1. Place the jet pump housing and the new wear ring in a freezer for approximately 1-1/2 hour at -10°C (14°F).
2. Remove the housing from the freezer and pull the wear ring out.

Method by Cutting the Wear Ring

1. Place jet pump housing in a vise with soft jaws. It is best to clamp housing using a lower ear.
2. Cut wear ring at two places.

NOTICE When cutting ring, be careful not to damage jet pump housing.

NOTE: Wear ring can be cut using a jigsaw, a small grinder or a low clearance hacksaw.

3. After cutting ring, insert a screwdriver blade between jet pump housing and ring outside diameter.
4. Push ring so that it can collapse internally.
5. Pull ring out.

Installing the Wear Ring

Like the removing procedure, two methods can be used to install the wear ring, use the most appropriate as your situation.

Method Using a Freezer

While the housing is still cold, insert the new wear ring (previously place in the freezer) in the housing.

Subsection XX (JET PUMP)

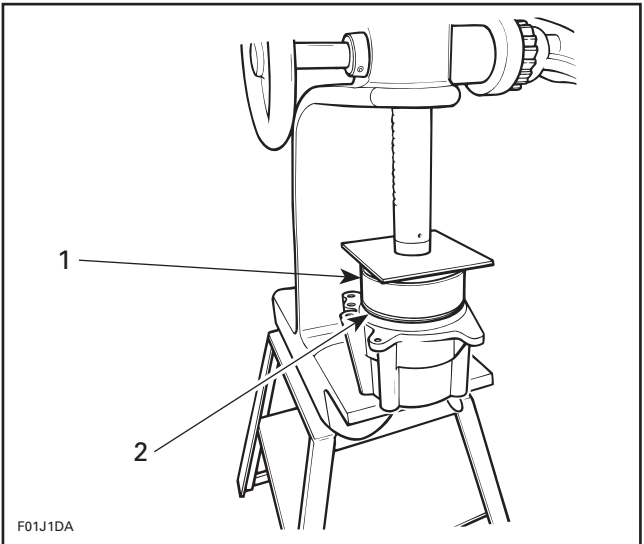
On models equipped with the 1600 4-TEC engine, the wear ring must be secured by screws. Drill pilot holes in the wear ring using a #24 drill bit (5/32 in) and apply LOCTITE 243 (BLUE) (P/N 293 800 060) on screw threads.

TIGHTENING TORQUE	
Wear ring screws	2.5 N•m ± 0.5 N•m (22 lbf•in ± 4 lbf•in)

Method Using a Press

To install wear ring in housing, use a square steel plate of approximately 180 x 180 mm x 6 mm thick (7 x 7 in x 1/4 in) and a press.

Manually engage ring in housing making sure it is equally inserted all around. Press ring until it seats into bottom of housing.



- 1. Rounded edge
- 2. Press wear ring

On models equipped with the 1600 4-TEC engine, the wear ring must be secured by screws. Drill pilot holes in the wear ring using a #24 drill bit (5/32 in) and apply LOCTITE 243 (BLUE) (P/N 293 800 060) on screw threads.

TIGHTENING TORQUE	
Wear ring screws	2.5 N•m ± 0.5 N•m (22 lbf•in ± 4 lbf•in)

IMPELLER SHAFT, BEARING AND SEALS

Removing the Impeller Shaft, Bearing and Seals

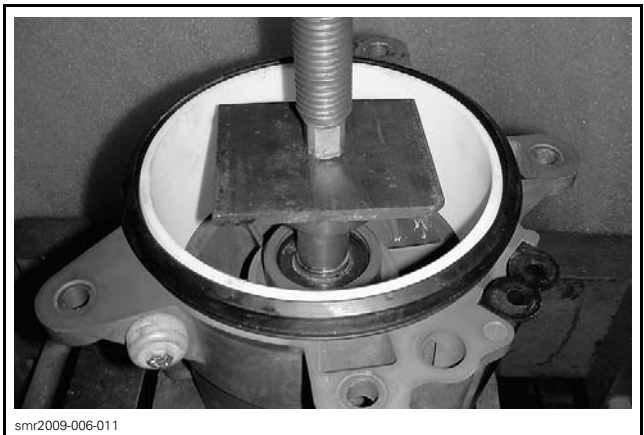
Removing the Shaft

1. Remove impeller. Refer to *IMPELLER* in this subsection.
2. Use the IMPELLER SHAFT PUSHER (P/N 529 035 955) to press impeller shaft out of pump housing.

NOTE: Bearing will come out with the impeller shaft.



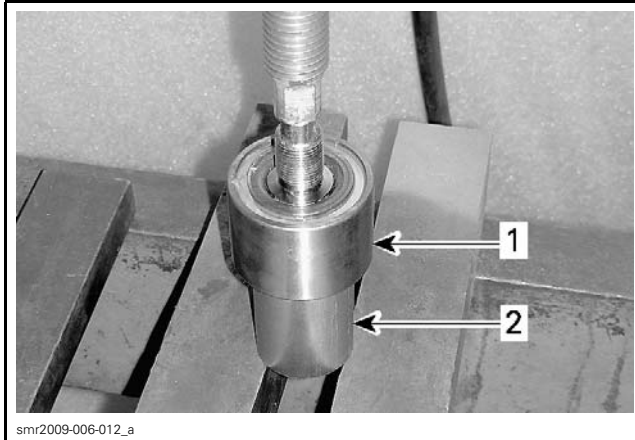
TYPICAL



TYPICAL

Removing the Bearing

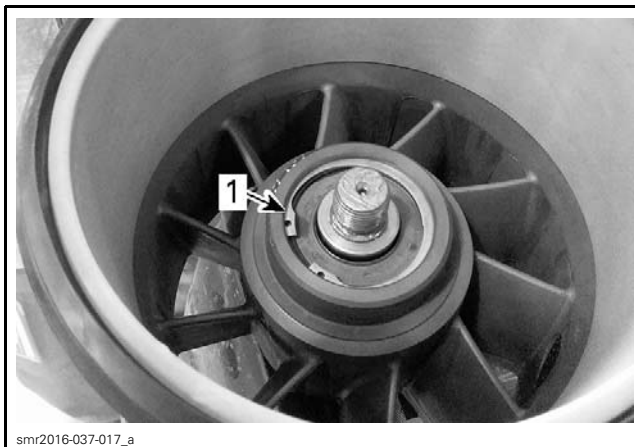
1. Use the IMPELLER SHAFT BEARING TOOL (P/N 529 036 168) to press bearing off impeller shaft.



TYPICAL
 1. Impeller shaft and bearing
 2. Bearing tool on INNER race

Removing The Seals

1. Remove and discard the circlip securing the seals.



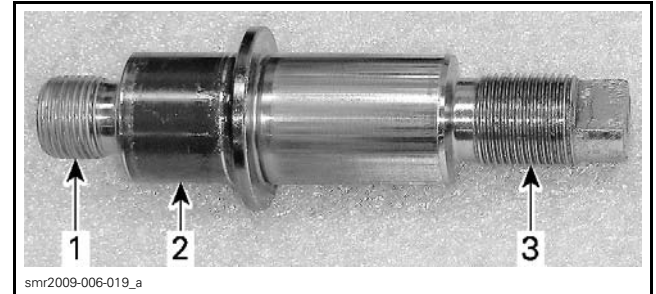
1. Circlip

2. Using an appropriate tool, press seals out of the housing.

Inspecting the Impeller Shaft and its Bearing

With your finger nail, feel seal lip contact surface on shaft. If any irregular surface is found, replace shaft and seals.

Check condition of shaft threads.



TYPICAL
 1. Threads
 2. Seal lip contact surface
 3. Threads

Inspect ball bearing for corrosion.

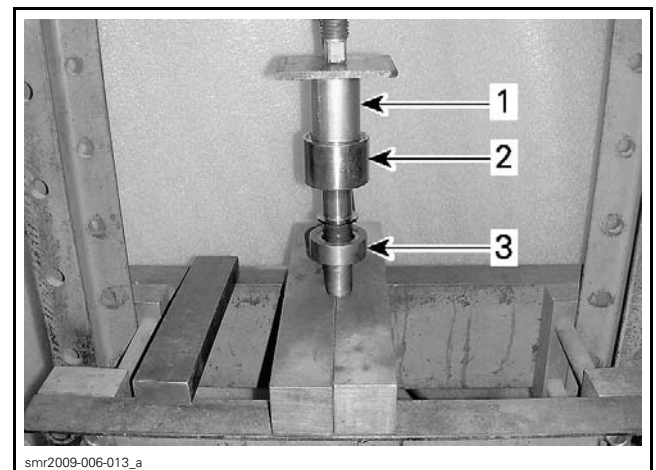
Installing the Impeller Shaft, Bearing and Seals

Installing the Bearing

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

1. Using the IMPELLER SHAFT BEARING TOOL (P/N 529 036 168) on the bearing inner race, press the bearing on the impeller shaft.
2. Use the IMPELLER SHAFT PUSHER (P/N 529 035 955) to protect the impeller shaft threads.

NOTE: The bearing can be installed in either direction.



TYPICAL
 1. Impeller shaft bearing tool on INNER race
 2. Impeller shaft and bearing
 3. Impeller shaft installer/pusher tool

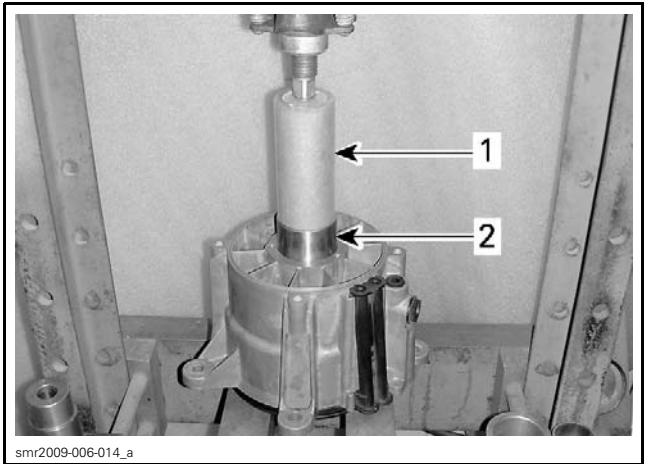
3. Press bearing until it bottoms.

Subsection XX (JET PUMP)

Installing the Impeller Shaft and Seals

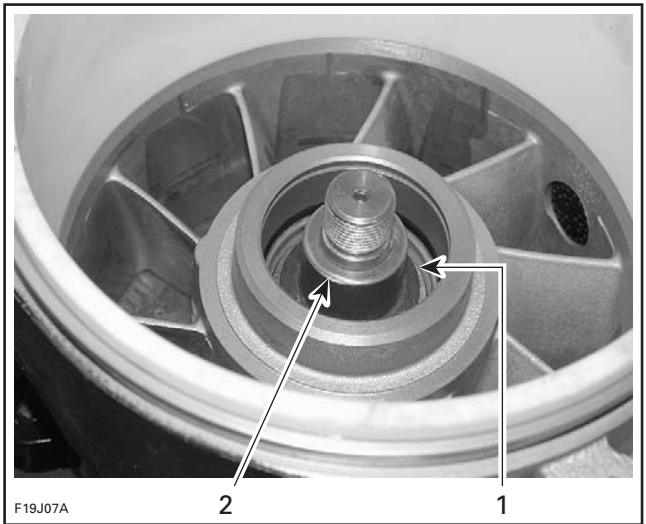
NOTE: Ensure there is no O-ring in pump housing on the cover side.

- 1. From the outlet side of pump, press impeller shaft assembly into housing using the IMPELLER SHAFT BEARING TOOL (P/N 529 036 168).



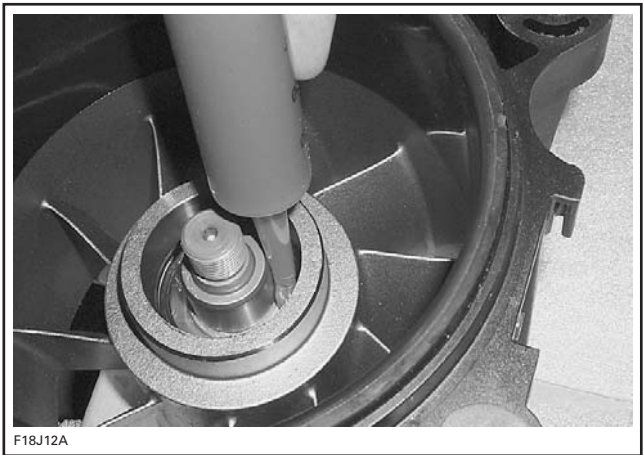
TYPICAL
1. Bearing tool
2. Impeller shaft and bearing

- 2. Press bearing until it bottoms.
- NOTE:** Ensure impeller shaft turns freely and smoothly.
- 3. Turn pump upside down.
 - 4. Coat shaft surface with JET PUMP BEARING GREASE (P/N 293 550 032).
 - 5. Install O-ring at bottom.



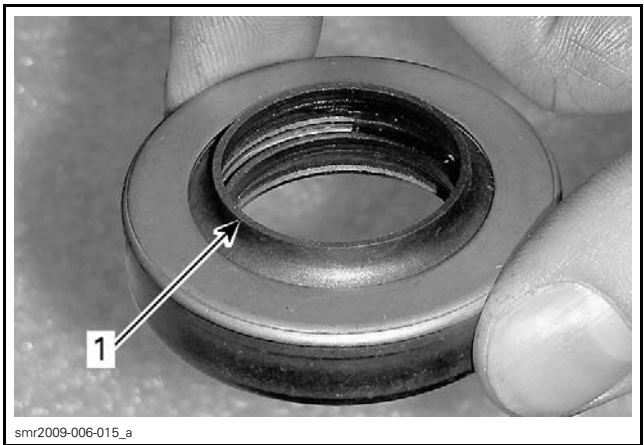
TYPICAL
1. O-ring at bottom
2. Coat surface

- 6. Apply 4 ml (.1 U.S. oz) of JET PUMP BEARING GREASE (P/N 293 550 032) on bearing.

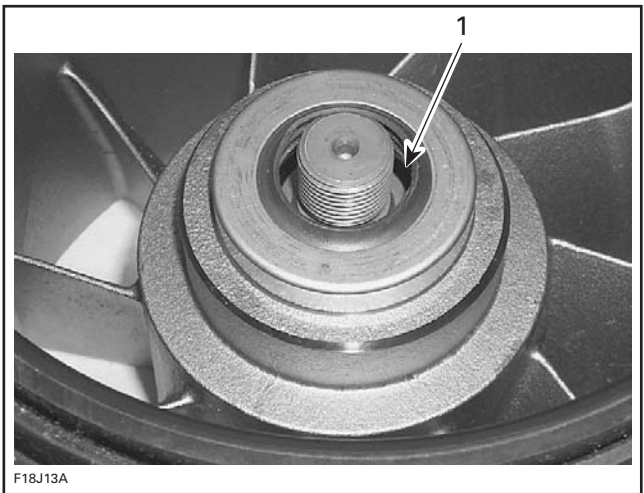


TYPICAL

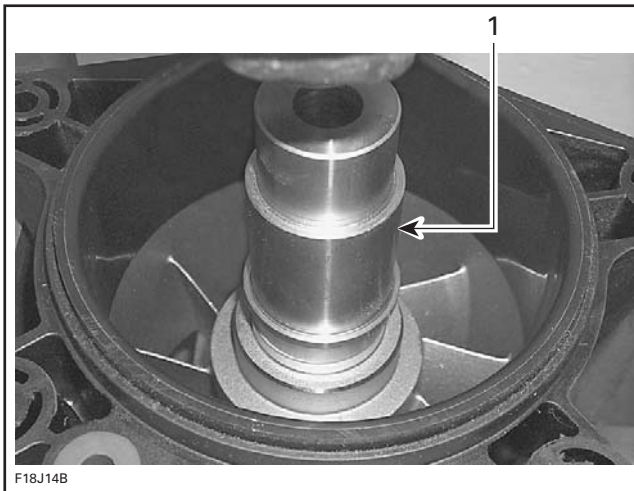
- 7. Press a **NEW** double lip seal using the SEAL/BEARING PUSHER (P/N 529 035 819) until seal bottoms. Make sure seal lip are facing upwards.



1. Seal lip up



1. Seal lip facing up

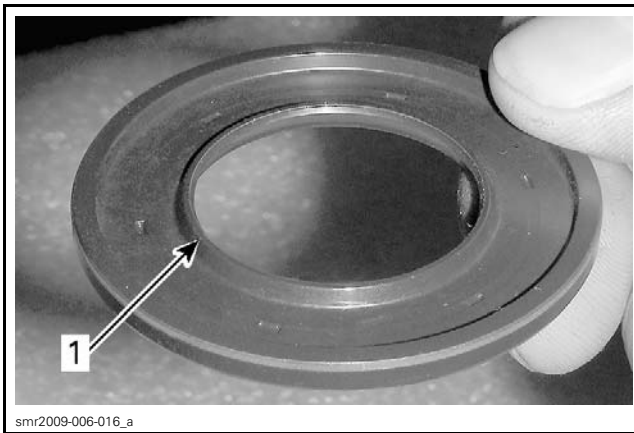


F18J14B

TYPICAL

1. Seal/bearing pusher

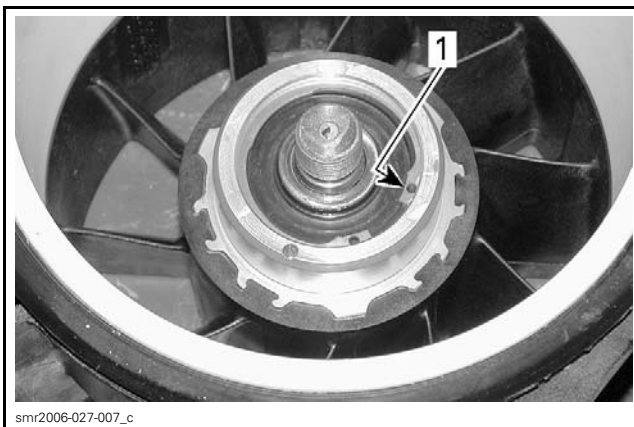
8. Install spacer and then the other seal (thin). Ensure seal lip is facing up.



smr2009-006-016_a

1. Seal lip facing up

9. Install circlip.



smr2006-027-007_c

TYPICAL

1. Circlip

10. Turn pump upside down.

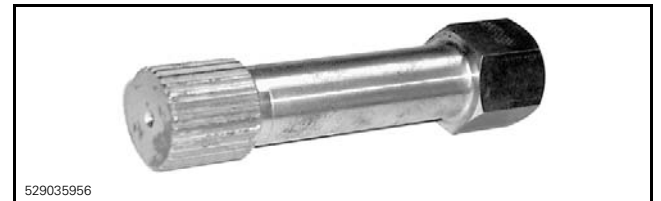
11. Before installing any other parts, pressurize jet pump to insure proper seal installation. Refer to *LEAK TEST* in this subsection.

12. Install impeller. Refer to *IMPELLER* in this subsection.

13. Mount in a vise the impeller remover/installer.

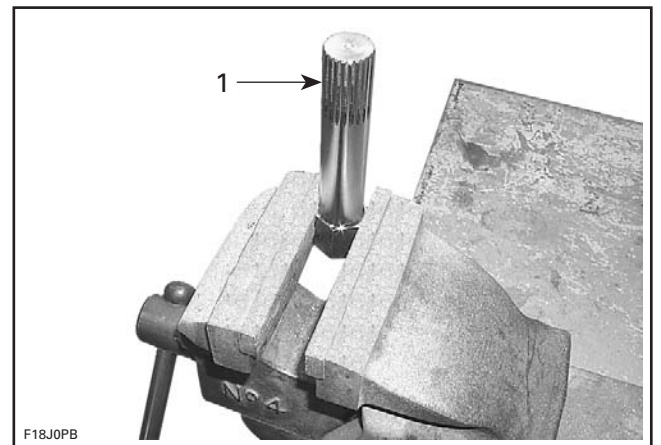
REQUIRED TOOL

IMPELLER REMOVER/INSTALLER (P/N 529 035 956)



529035956

TYPICAL



F18J0PB

1. Impeller remover/installer tool

14. Install jet pump housing over this tool.

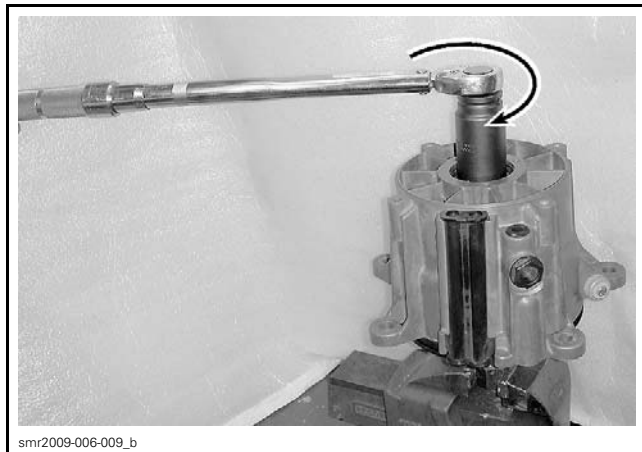


F18J0QA

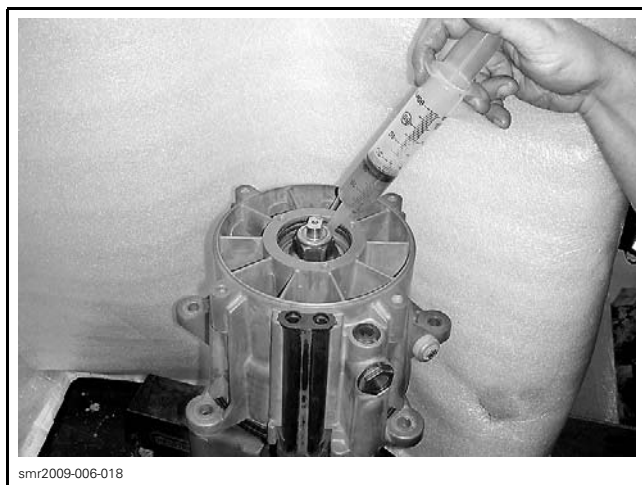
TYPICAL

Subsection XX (JET PUMP)

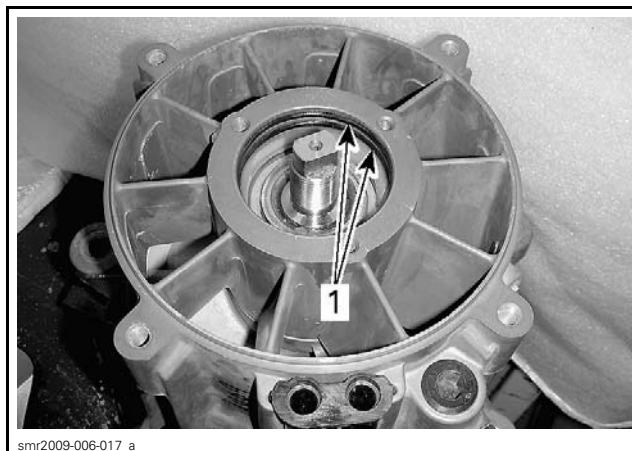
15. Using a 30 mm socket, screw the impeller shaft nut on clockwise.
16. Torque nut as specified in exploded view.



17. Apply 26 ml (.9 U.S. oz) of JET PUMP BEARING GREASE (P/N 293 550 032) on the bearing (nut side) and in O-ring grooves.



18. Install the two O-rings in pump housing and make sure they are properly lubricated..



TYPICAL
1. O-rings

19. Install the impeller cover. Refer to *IMPELLER COVER* in this subsection.

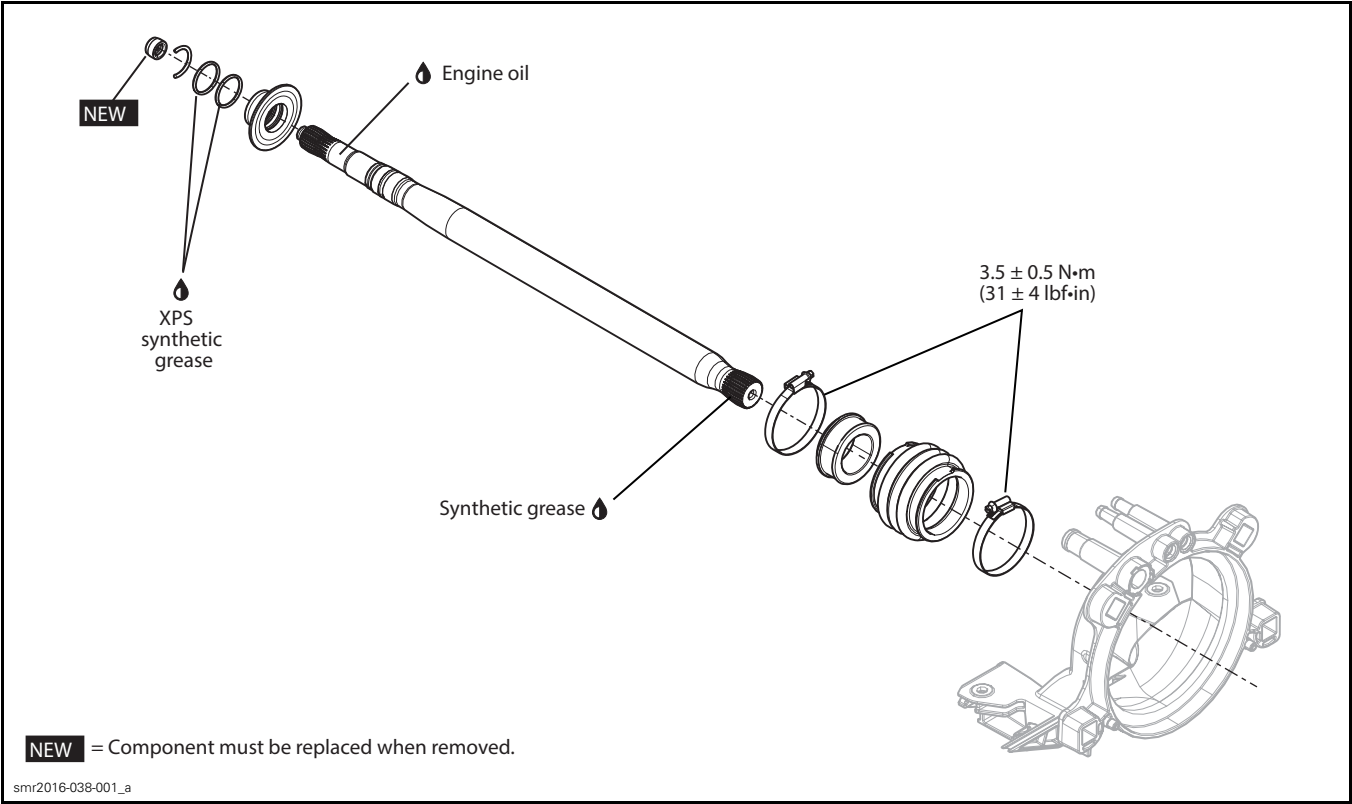
DRIVE SHAFT

SERVICE TOOLS

Description	Part Number	Page
DRIVE SHAFT C-CLIP REMOVER	529 036 026	2
FLOATING RING TOOL (TYPE II)	529 036 116	2
PTO SUPPORT TOOL	529 035 842	3, 6

SERVICE PRODUCTS

Description	Part Number	Page
PULLEY FLANGE CLEANER	413 711 809	4
XPS LUBE	293 600 016	3
XPS SYNTHETIC GREASE	293 550 010	6



PROCEDURES

DRIVE SHAFT

Drive Shaft Access

Models Without Suspension

If more information is required to remove the following parts, refer to *BODY* subsection.

- Seat bridge (GTX, RXT and Wake Pro models)
- Rear handle (RXP models)

Models With Suspension

1. Remove moving deck and deck extension. Refer to *BODY* subsection.
2. Remove the air intake silencer. Refer to *AIR INTAKE SYSTEM (MODELS WITH SUSPENSION)* subsection:

Removing the Drive Shaft

Preparation

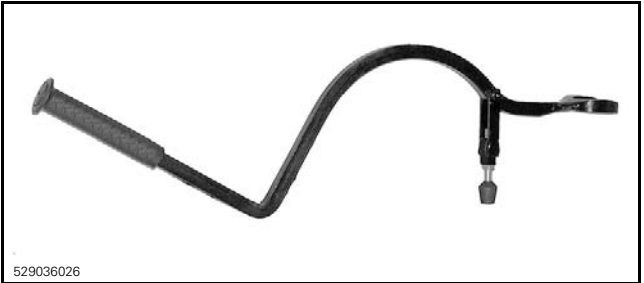
Refer to *DRIVE SHAFT ACCESS* to remove required parts according to model.

Procedures

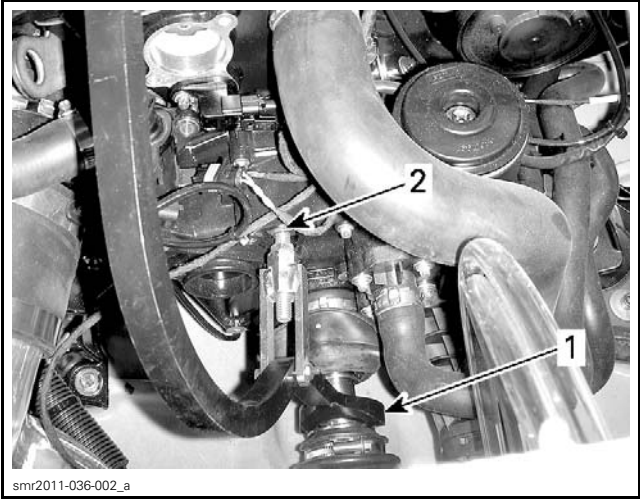
NOTE: Ensure jet pump is installed before beginning this procedure.

1. Lift rubber protector to expose PTO seal assembly.
2. Confirm the floating ring is not stuck on drive shaft as follows:

REQUIRED TOOL
DRIVE SHAFT C-CLIP REMOVER (P/N 529 036 026)

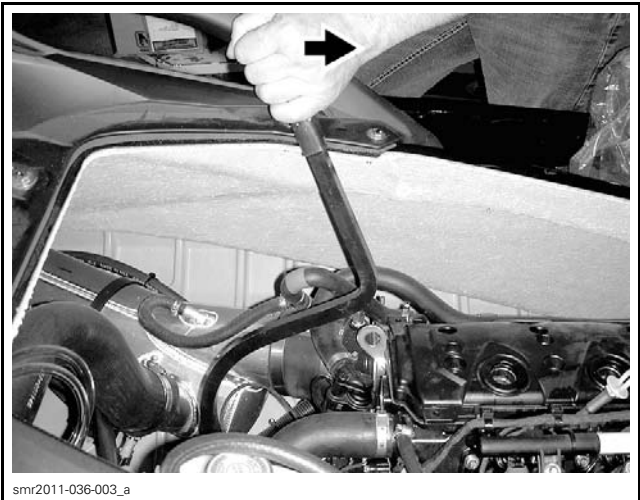


- 2.1 Place the fork of drive shaft C-clip remover against floating ring.
- 2.2 Place the adjustable arm against the engine or the arm of the tool against the supercharger.



1. Fork against floating ring
2. Adjustable arm

- 2.3 Move the tool handle toward the front of vehicle to push floating ring rearward.

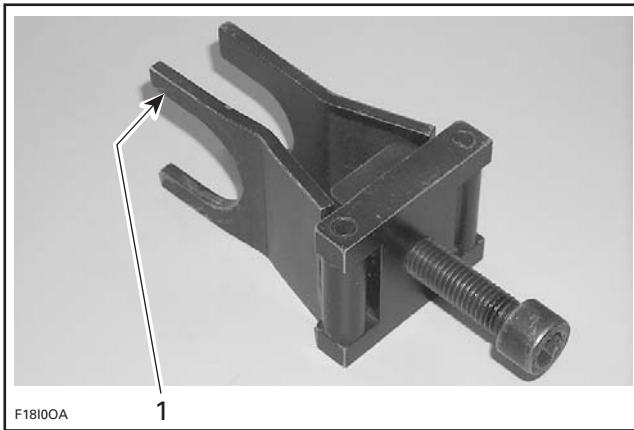


The next steps (3 to 11) should be performed only if the floating ring seems stuck or hard to move. Otherwise, go to the step 12.

NOTE: Do not remove circlip at this time.

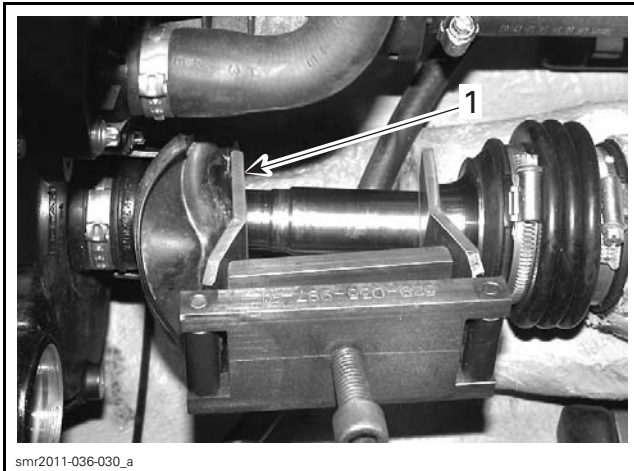
3. Remove the drive shaft C-clip remover.
4. Remove the supercharger. Refer to appropriate *SUPERCHARGER* subsection.
5. Install the following tool on drive shaft with its largest opening on PTO side.

REQUIRED TOOL
FLOATING RING TOOL (TYPE II) (P/N 529 036 116)



TYPICAL

1. Largest opening on PTO seal side



TYPICAL

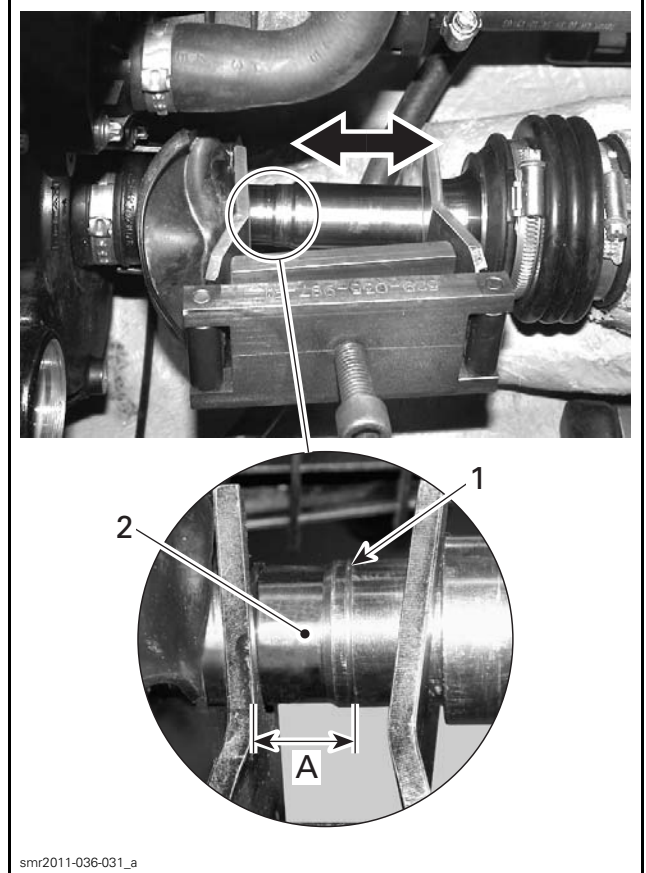
1. Largest opening here

6. To expose the O-ring contact area, tighten tool screw until the following gap is obtained.

GAP BETWEEN TELLTALE GROOVE AND TOOL EDGE
18 mm (11/16 in)

7. Lubricate O-ring contact area with XPS LUBE (P/N 293 600 016).

NOTE: This is necessary to ease drive shaft removal later in this procedure.



TYPICAL

1. Telltale groove

2. Lubricate this area

A. 18 mm (11/16 in)

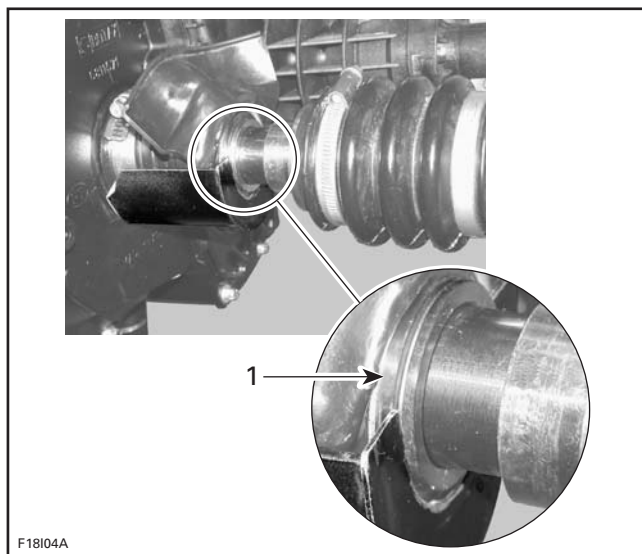
8. Remove the floating ring tool.

9. Install the following tool to PTO seal assembly.

REQUIRED TOOL
PTO SUPPORT TOOL (P/N 529 035 842)



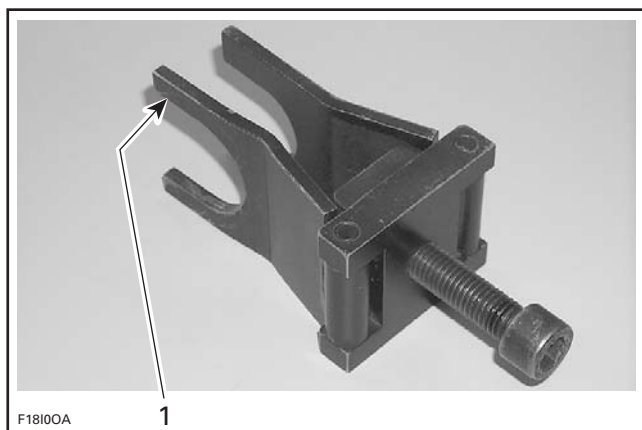
Subsection XX (DRIVE SHAFT)



1. Insert in groove of PTO seal assembly

NOTICE Strictly follow this procedure otherwise damage to component might occur.

10. Reinstall the floating ring tool as shown.

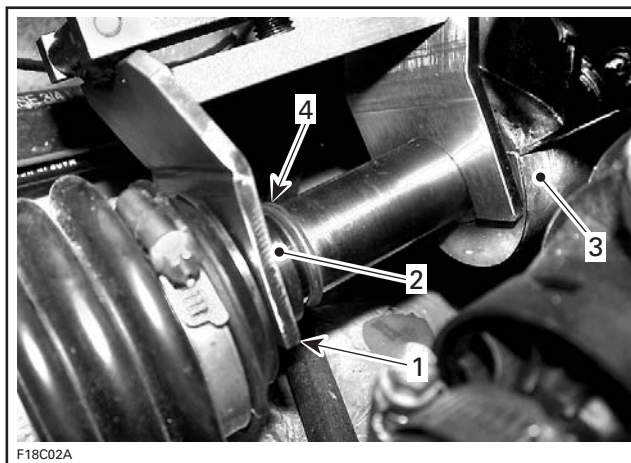


TYPICAL

1. Largest opening on PTO seal side

11. Tighten tool screw to push floating ring rearward and expose circlip.

12. Remove and discard circlip.



TYPICAL

1. Largest opening here

2. Floating ring

3. PTO seal support tool

4. Remove circlip

13. Remove the floating ring tool.

14. Place rags under PTO housing to prevent spillage. If spillage occurs, clean immediately with the PULLEY FLANGE CLEANER (P/N 413 711 809) to prevent oil stains.

15. Remove jet pump. Refer to *JET PUMP* subsection.

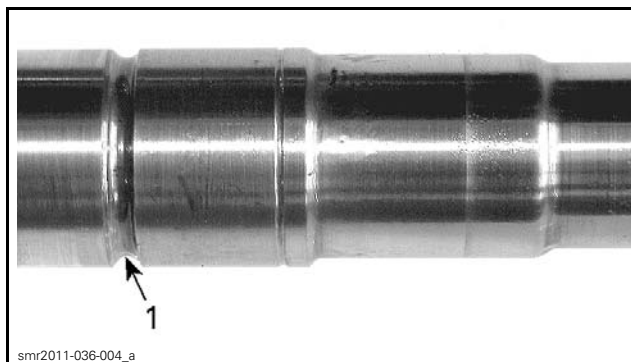
16. Remove drive shaft.

NOTE: A slight jerk to the rear may be required to remove the drive shaft from the PTO seal assembly.

Inspecting the Drive Shaft

Drive Shaft

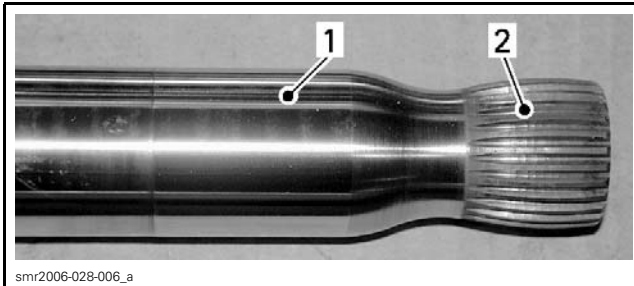
Inspect condition of circlip groove. If there is any damage or severe wear, replace drive shaft.



1. Circlip groove

Inspect condition of drive shaft splines. If splines are damaged, replace drive shaft and check splines of impeller and PTO housing.

With your finger nail, feel machined surface of drive shaft. If any irregular surface is found, re-new drive shaft.

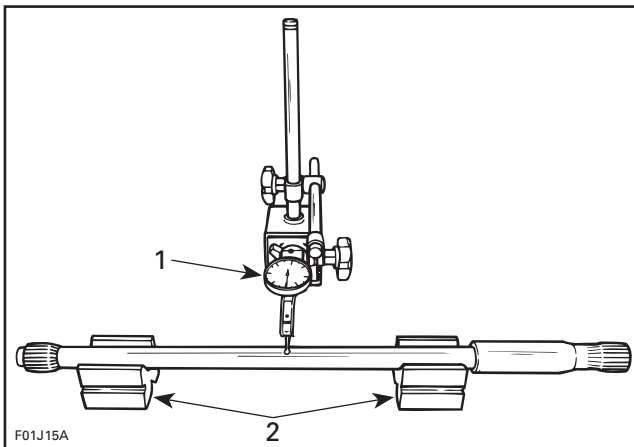


TYPICAL

1. Surface condition
2. Splines condition

Place drive shaft on V-blocks and set-up a dial gauge in center of shaft. Slowly rotate shaft; difference between highest and lowest dial gauge reading is deflection. Refer to the following illustration.

NOTE: Excessive deflection could cause vibration and damage to drive shaft splines, impeller or floating ring.



MEASURING DRIVE SHAFT DEFLECTION

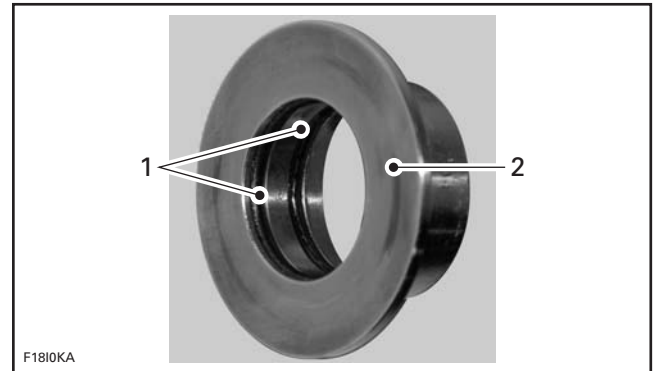
1. Dial gauge
2. V-blocks

Maximum permissible deflection is 0.5mm (.02 in).

Floating Ring

Inspect condition of O-rings and contact surface of floating ring.

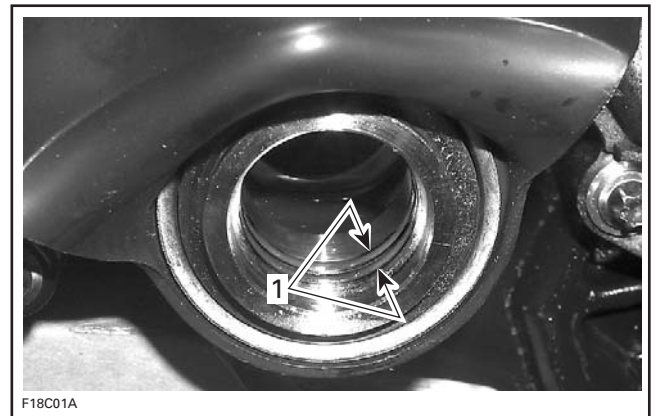
Replace as required.



1. O-rings
2. Contact surface

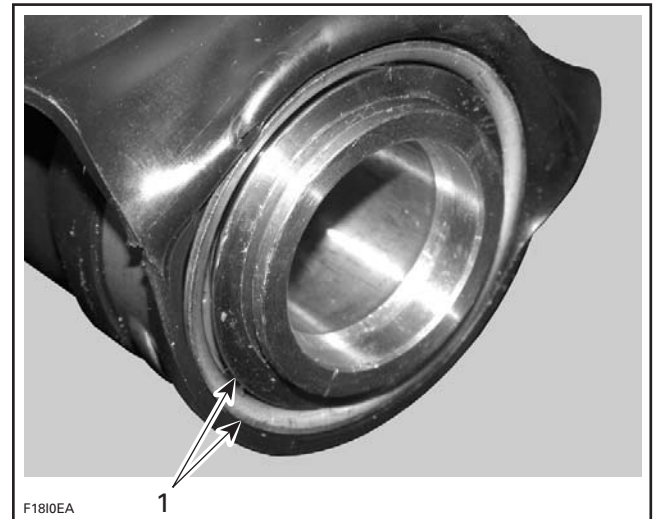
Installing the Drive Shaft

Before installing drive shaft, discard both O-rings inside PTO seal and install **NEW** ones.



1. O-rings

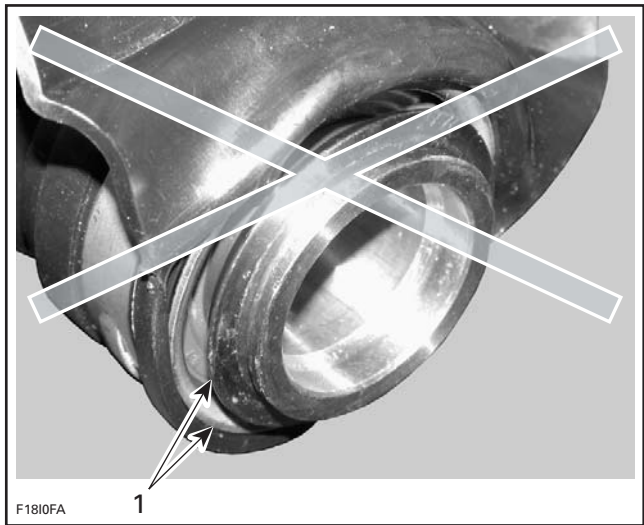
Inspect PTO seal assembly. The inner sleeve must be flush with outer circumference of the assembly. Otherwise, gently push or tap on inner sleeve until flush.



CORRECT POSITION

1. Inner sleeve flush with outer circumference

Subsection XX (DRIVE SHAFT)



INCORRECT POSITION
1. Inner sleeve not flush with outer circumference

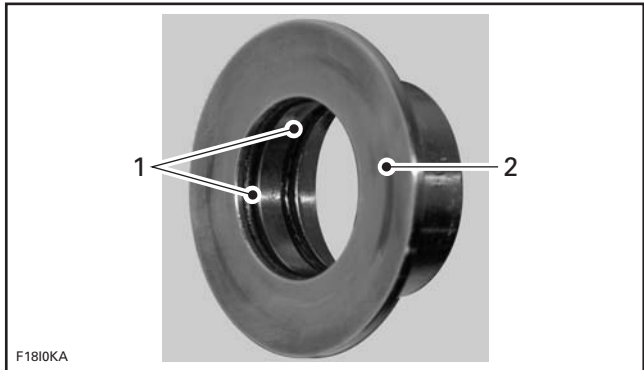
Remove the damper at the end of drive shaft and replace it with a **NEW** one.



1. Damper

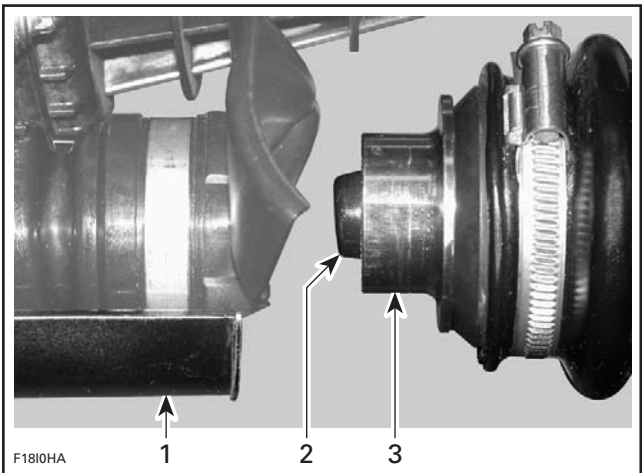
Install the PTO SUPPORT TOOL (P/N 529 035 842) on PTO seal assembly.

Apply a thin coat of XPS SYNTHETIC GREASE (P/N 293 550 010) on the floating ring O-rings. Do not get grease on floating ring contact surface.



1. XP-S synthetic grease on O-rings
2. No lubrication on contact surface

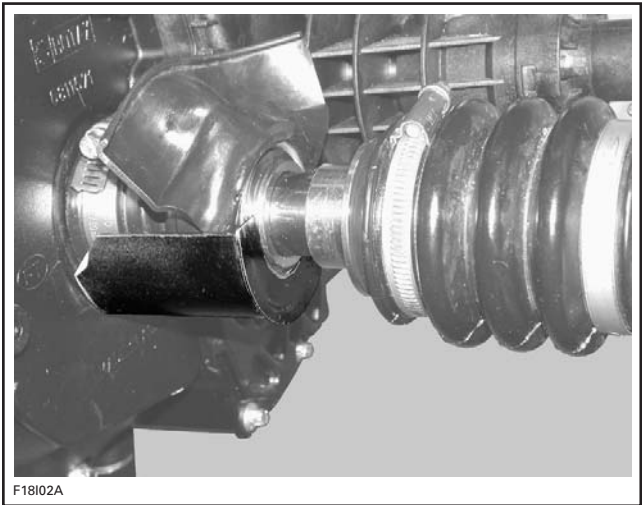
Slide drive shaft far enough to install floating ring.



1. PTO seal support
2. Drive shaft end
3. Insert floating ring on shaft end

Continue pushing drive shaft towards engine carefully guiding it in the PTO seal then in crankshaft splines. It may be necessary to move PTO seal assembly up and down to position it in the same axis as the drive shaft.

NOTE: If drive shaft does not enter into the PTO seal, check engine alignment.

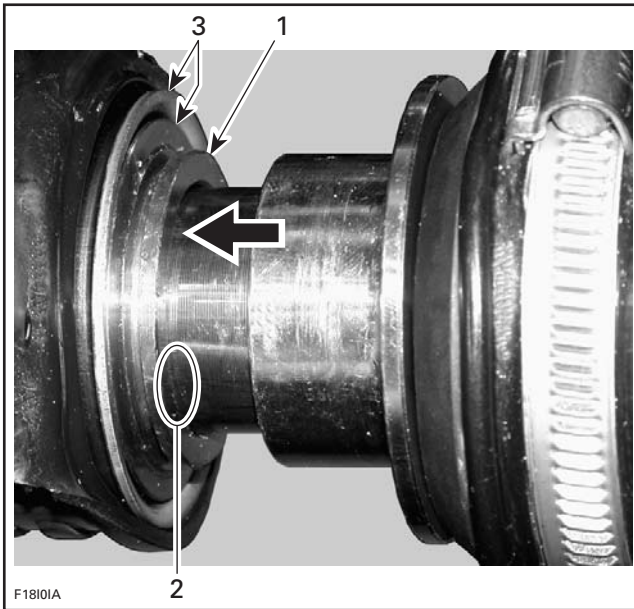


TYPICAL

Maintain PTO seal assembly in the proper position and tap shaft end until it bottoms against engine.

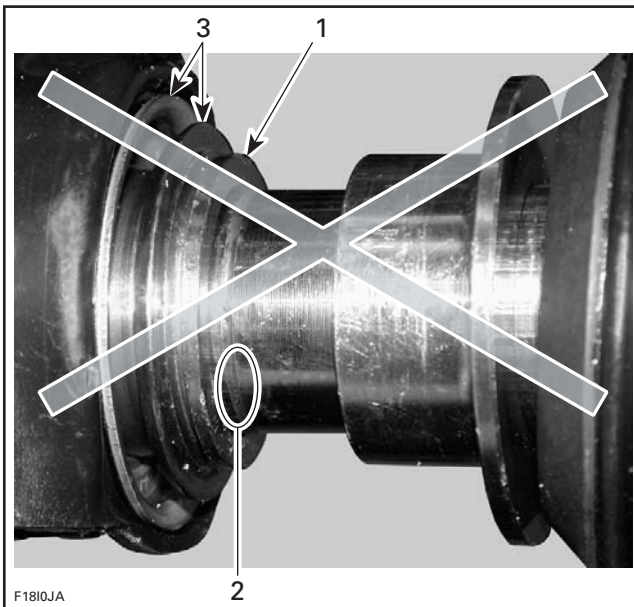
At this time, the telltale groove **MUST NOT** be visible. This validates the correct position.

NOTICE If the telltale groove is exposed, the installation is wrong and PTO seal assembly will be pressed into crankshaft splines which could rub a hole in seal thus creating an oil leak.



CORRECT INSTALLATION

1. PTO seal assembly
2. Shaft pushed in, hiding telltale groove
3. Inner sleeve flush with outer circumference



IMPROPER INSTALLATION

1. PTO seal assembly
2. Telltale groove visible
3. Inner sleeve NOT flush with outer circumference

Temporarily install the jet pump housing.
Push floating ring rearwards and install a **NEW** circlip.

Ensure everything is properly positioned:

- Telltale groove is not visible
- Inner sleeve is flush with outer circumference of PTO seal assembly
- Circlip is not exposed.

If telltale groove is visible, pull PTO seal assembly rearwards to fully extend it.

If inner sleeve is not flush, gently tap it until it is flush.

Reposition rubber protector.

Permanently install jet pump. Refer to *JET PUMP* subsection.

Test watercraft then ensure there is:

- No oil leak in PTO seal area
- No water intrusion by the thru-hull fitting area.

DRIVE SHAFT BOOT

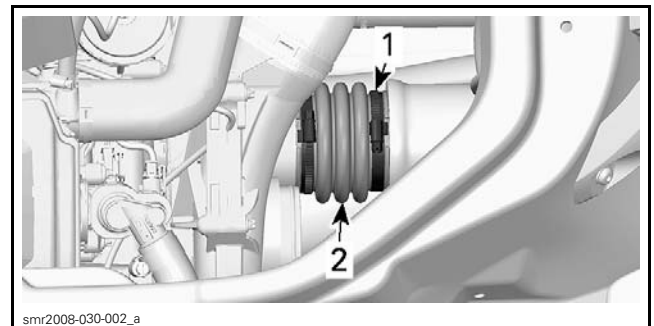
Inspecting the Drive Shaft Boot

Inspect the condition of boot. If there is any damage or evidence of wear, replace it.

Removing the Drive Shaft Boot

Remove drive shaft. Refer to *DRIVE SHAFT* in this subsection.

Loosen gear clamp holding boot, then carefully pull boot and carbon ring from hull insert.



TYPICAL

1. Loosen this clamp
2. Drive shaft boot

Installing the Drive Shaft Boot

The installation is the reverse of the removal procedure.

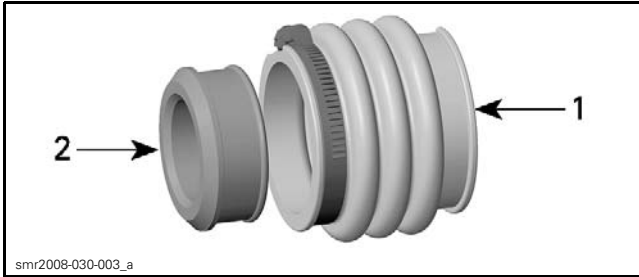
CARBON RING

Removing the Carbon Ring

Remove *DRIVE SHAFT BOOT*. See procedure in this subsection.

Loosen gear clamp then pull carbon ring from drive shaft boot.

Subsection XX (DRIVE SHAFT)



- 1. Drive shaft boot
- 2. Carbon ring

Installing the Carbon Ring

The installation is the reverse of the removal procedure.

BODY (GTX_RXT AND WAKE PRO SERIES)

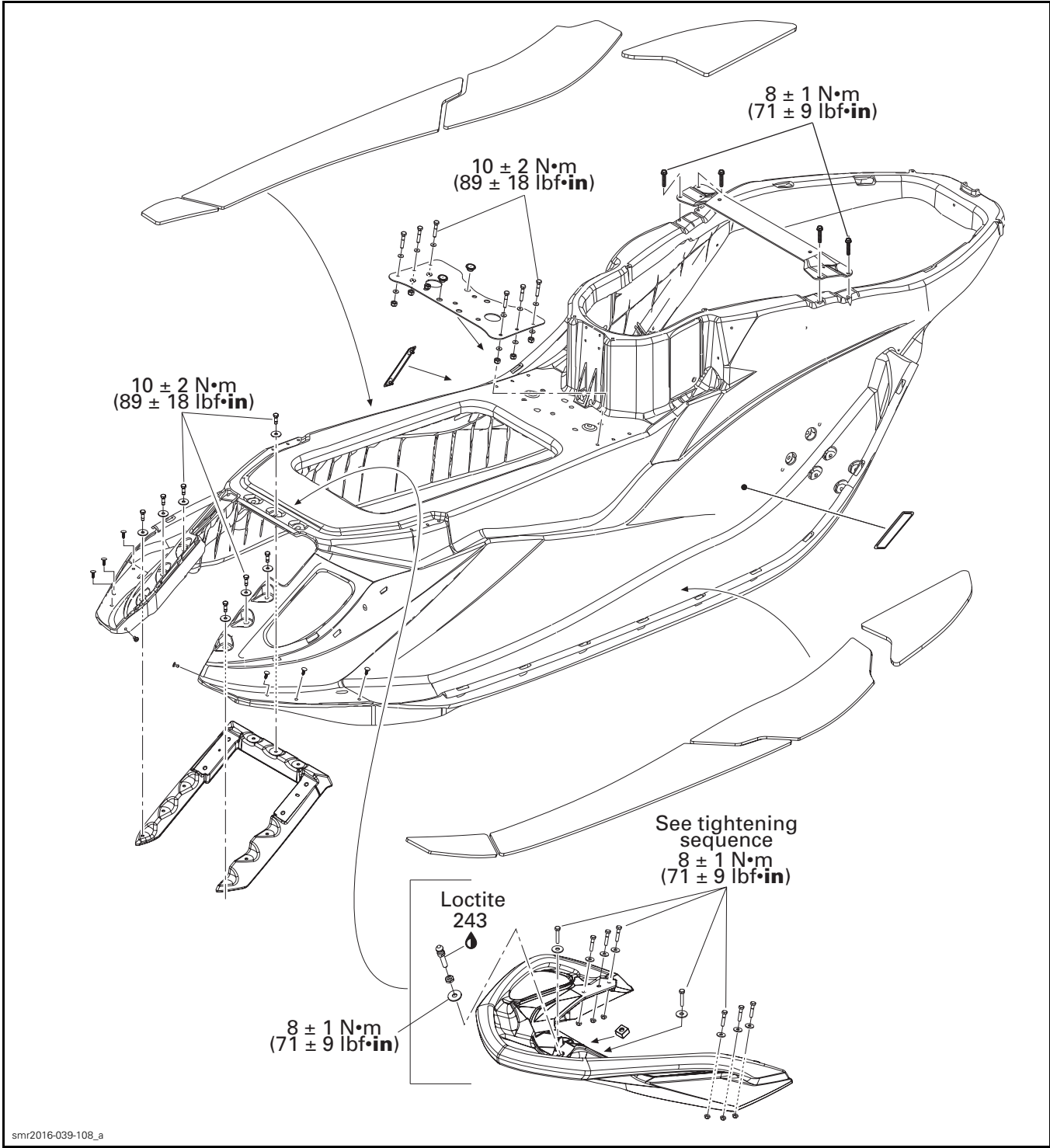
SERVICE TOOLS

Description	Part Number	Page
SUPERTANIUM DRILL BIT 3/16".....	529 031 800	23

SERVICE PRODUCTS

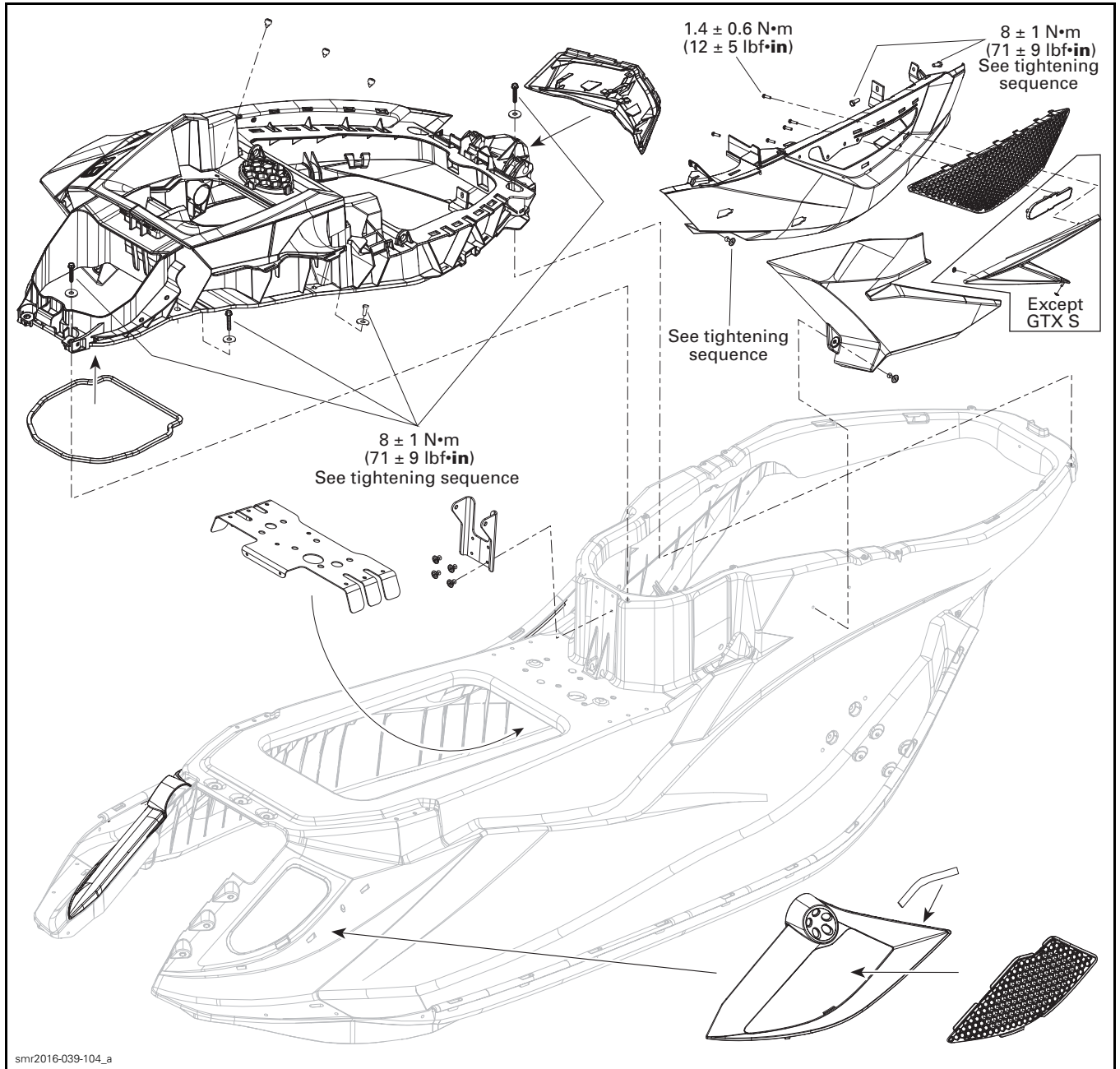
Description	Part Number	Page
CLEAR SILICONE SEALANT	296 000 309	28–29
LOCTITE 243 (BLUE).....	293 800 060	19
LOCTITE 414	413 705 800	17, 34
XPS ALL PURPOSE CLEANER	219 701 709	19
XPS SYNTHETIC GREASE.....	293 550 010	45

BODY (MODELS WITH SUSPENSION)

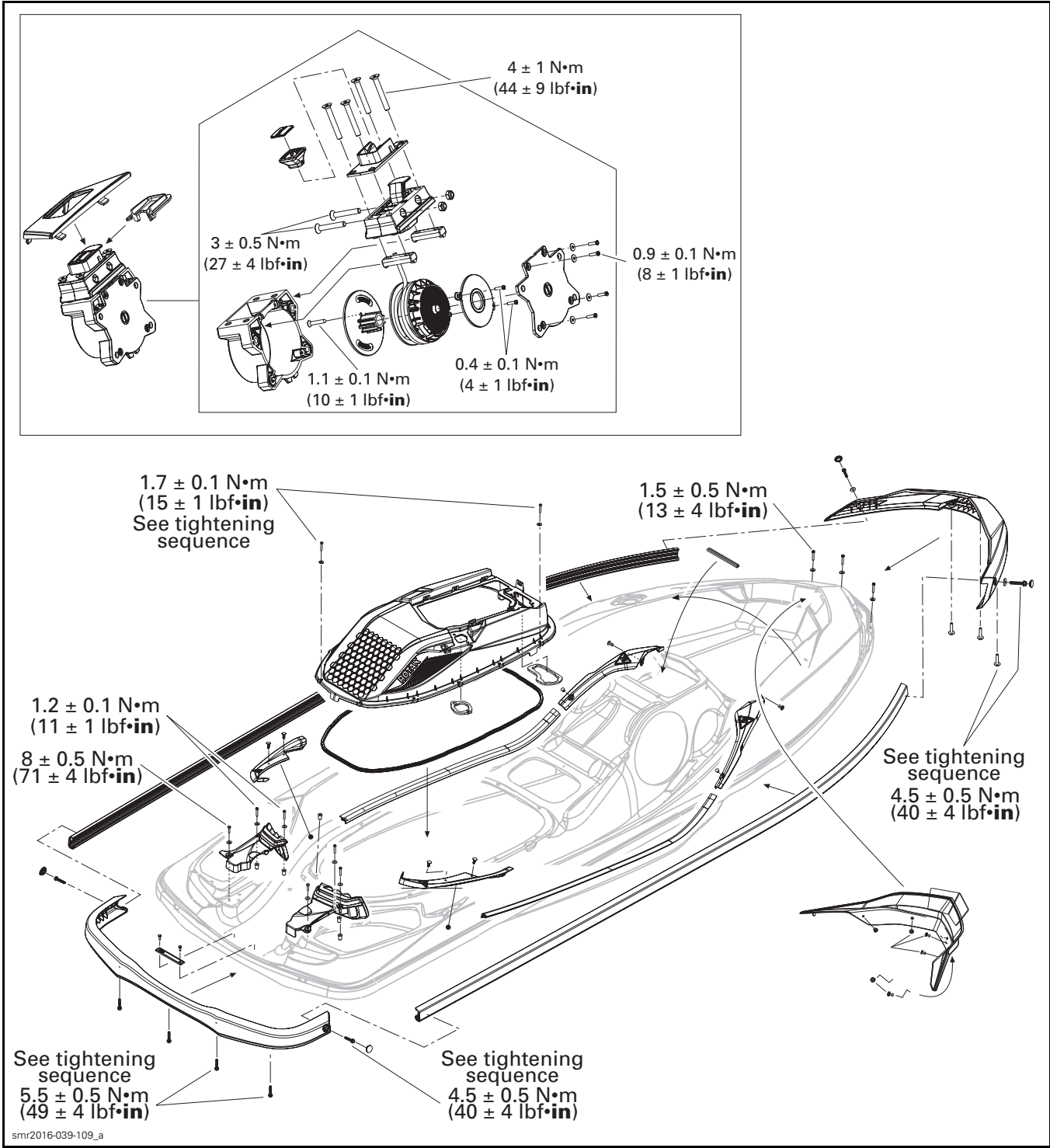


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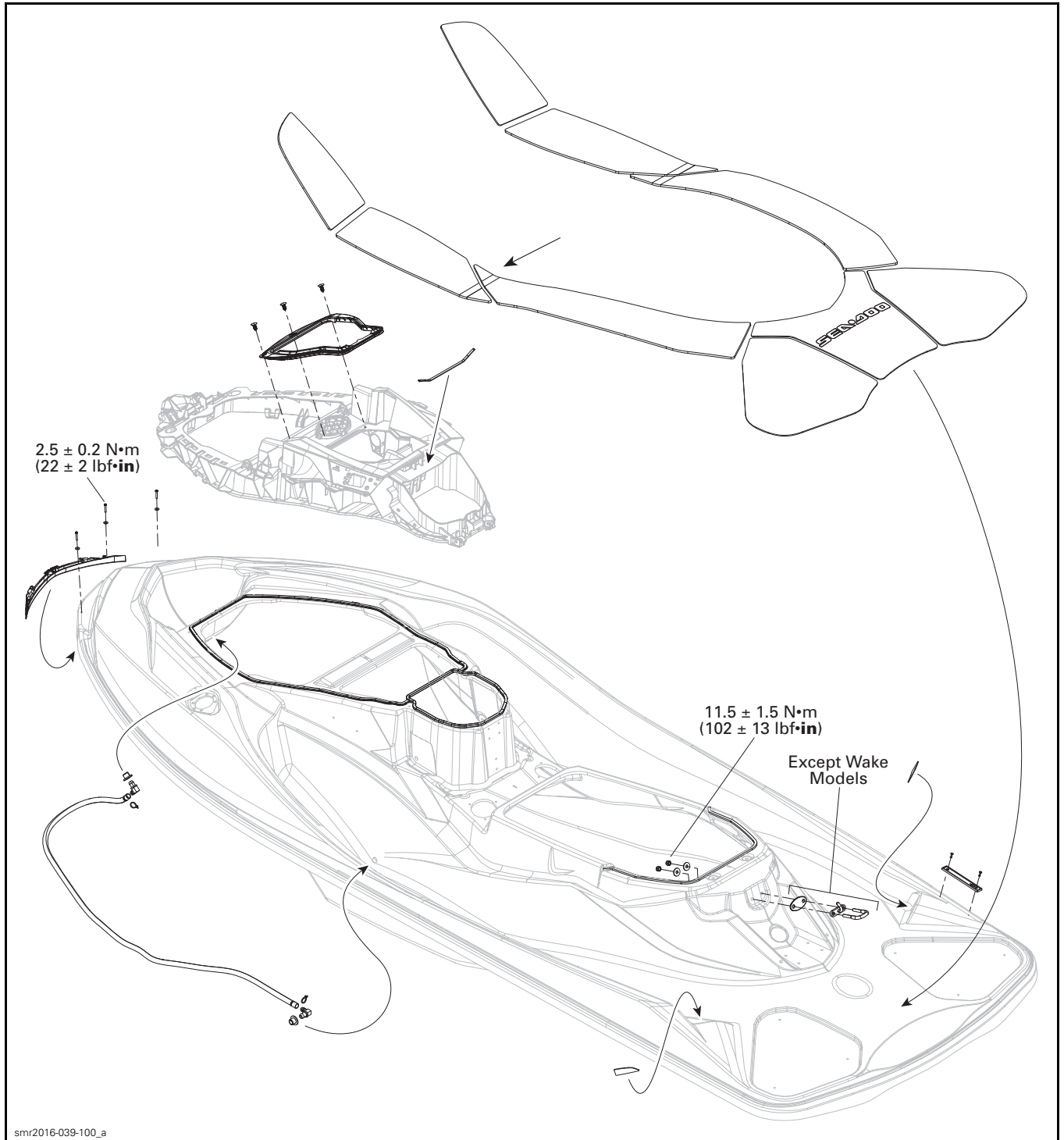
BODY (MODELS WITH SUSPENSION)



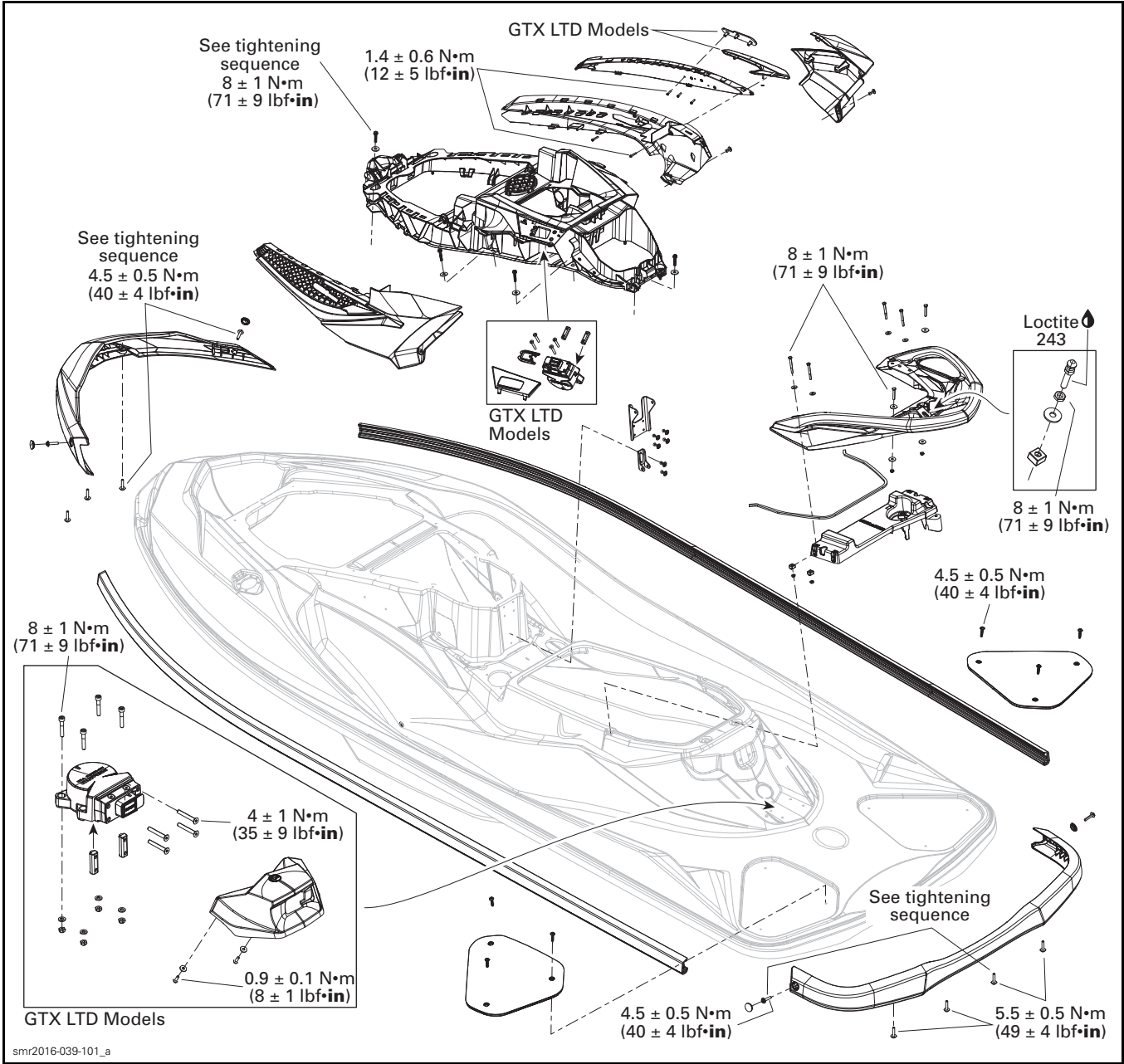
BODY (MODELS WITH SUSPENSION)



BODY (MODELS WITHOUT SUSPENSION)

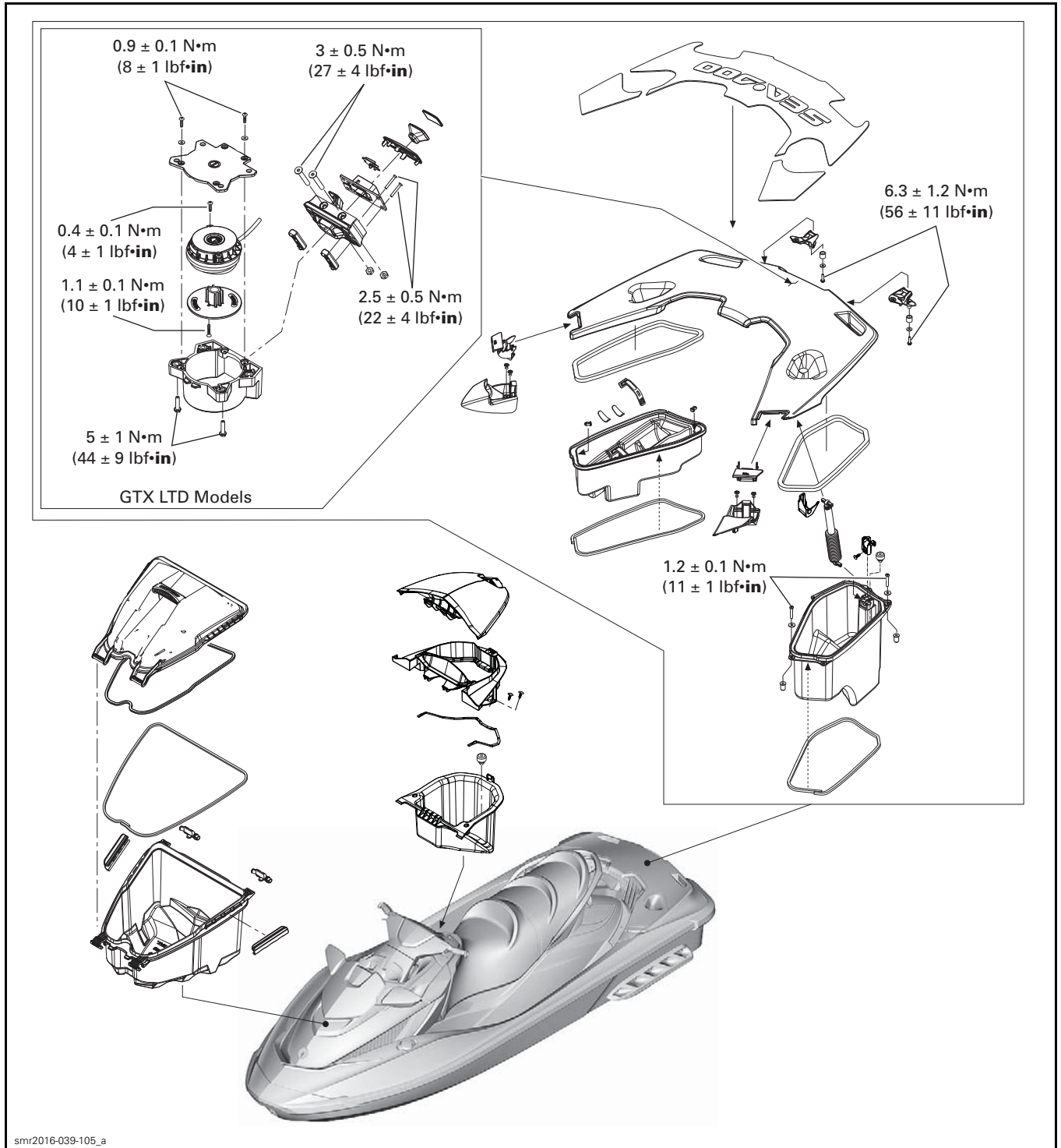


BODY (MODELS WITHOUT SUSPENSION)

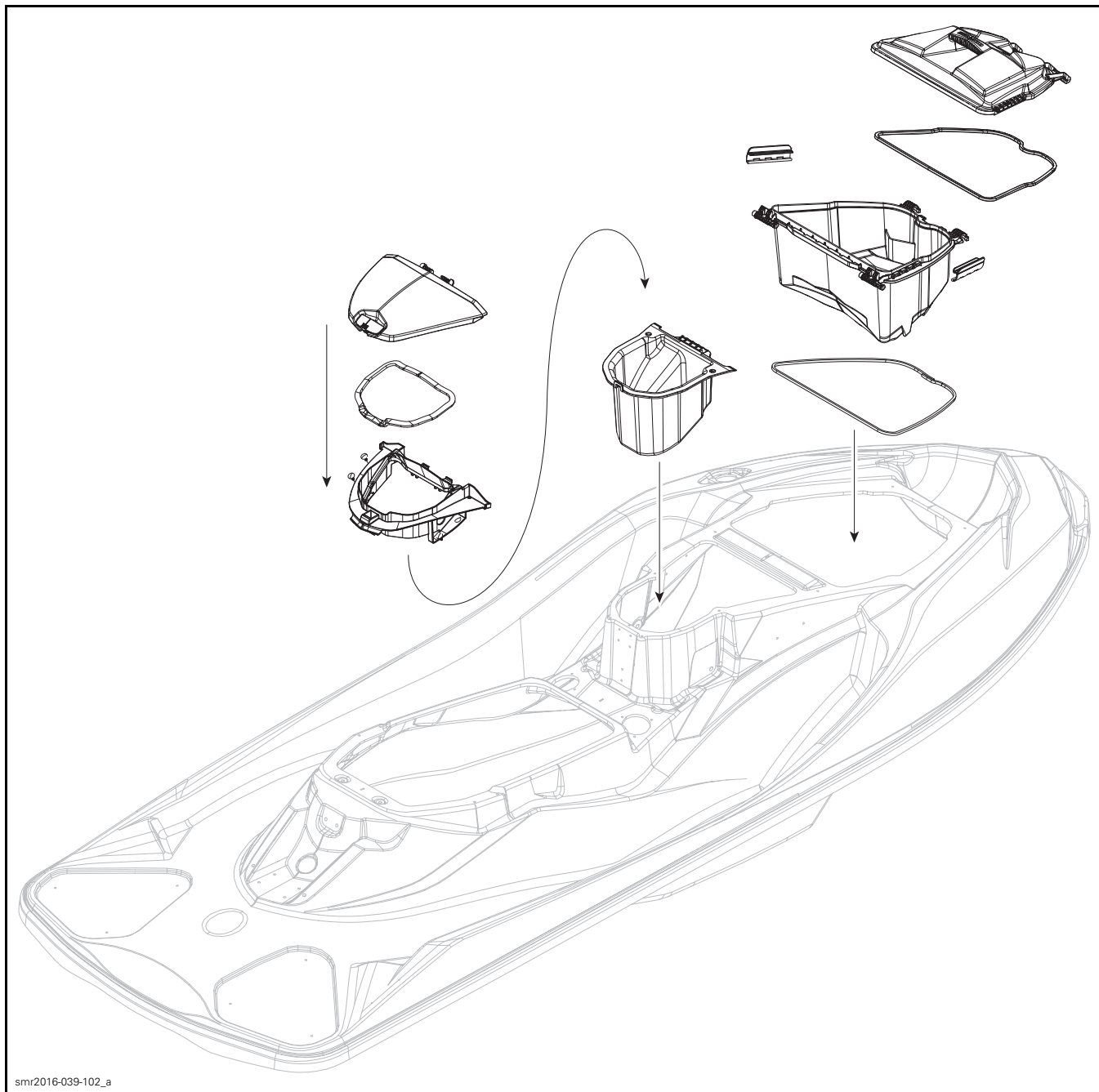


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STORAGE COMPARTMENT (MODELS WITH SUSPENSION)

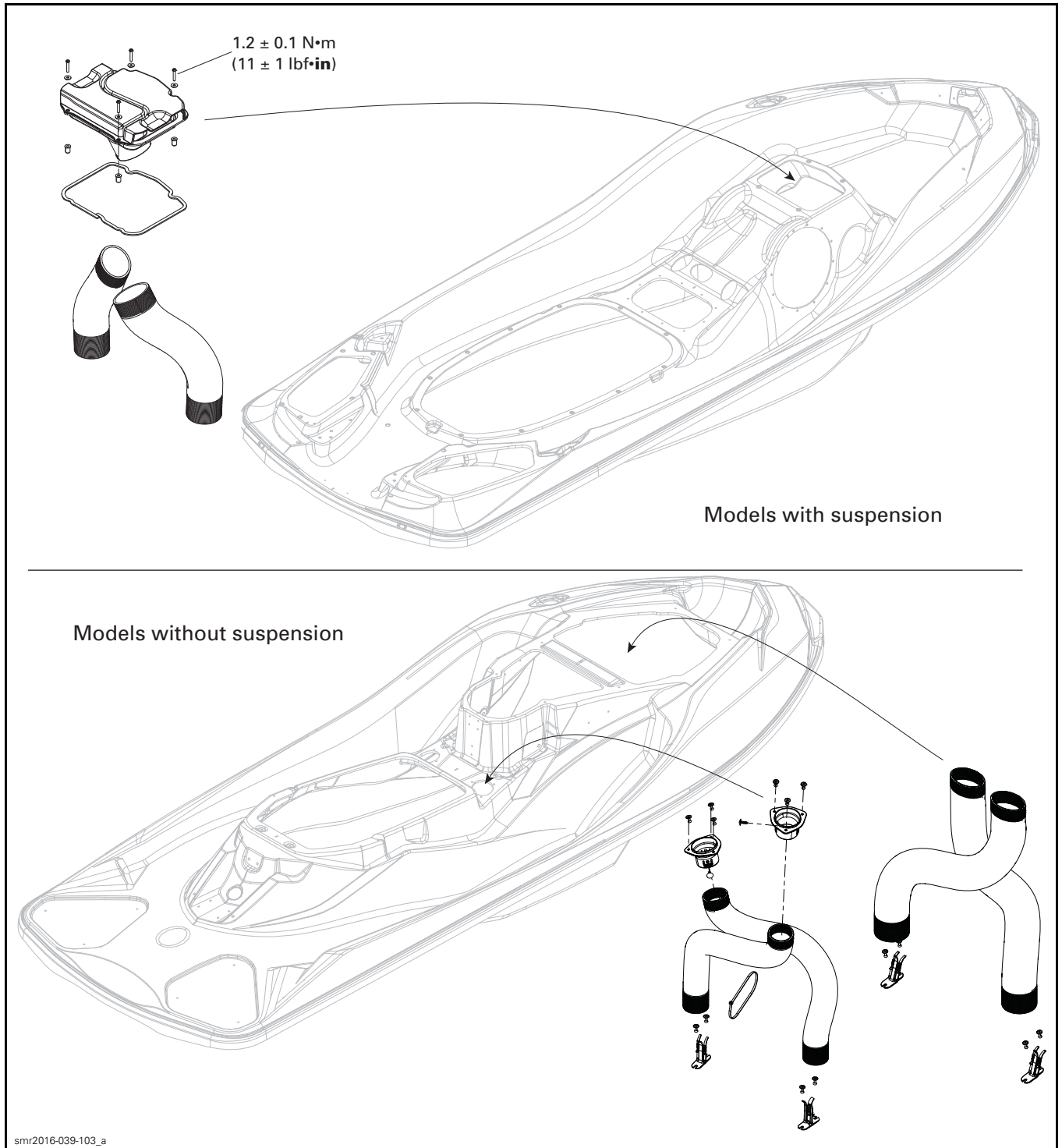


STORAGE COMPARTMENT (MODELS WITHOUT SUSPENSION)

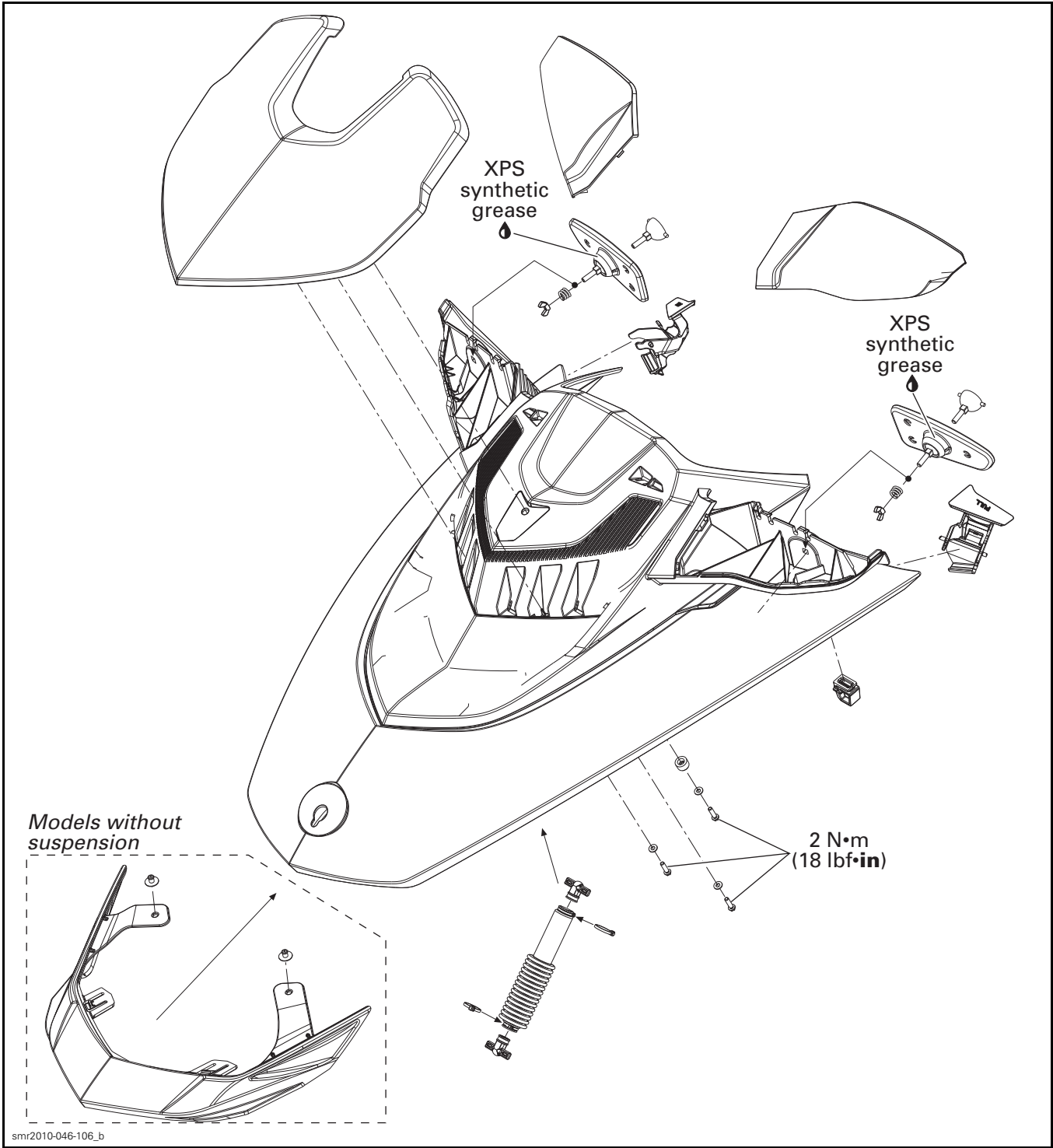


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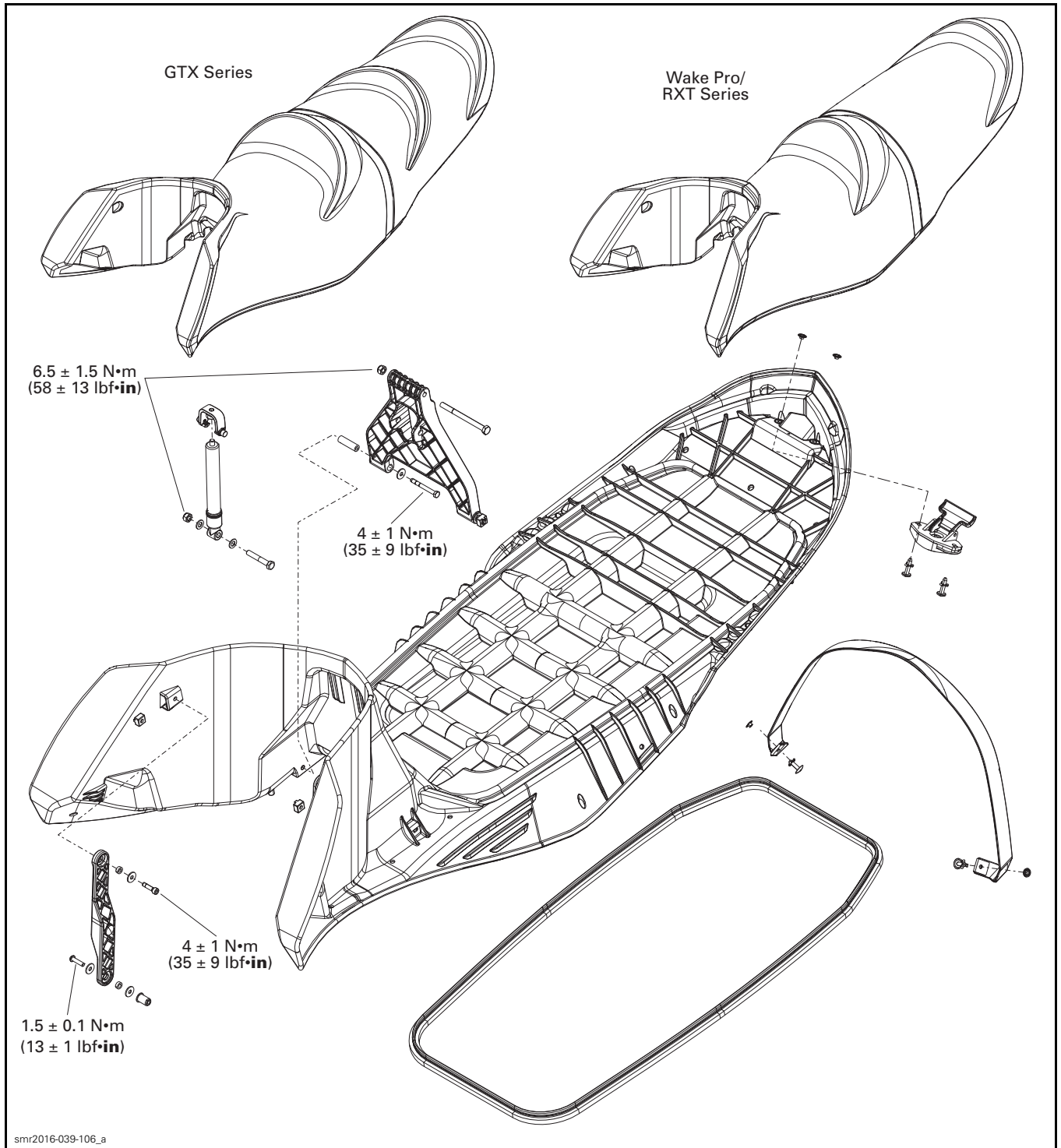
VENTILATION



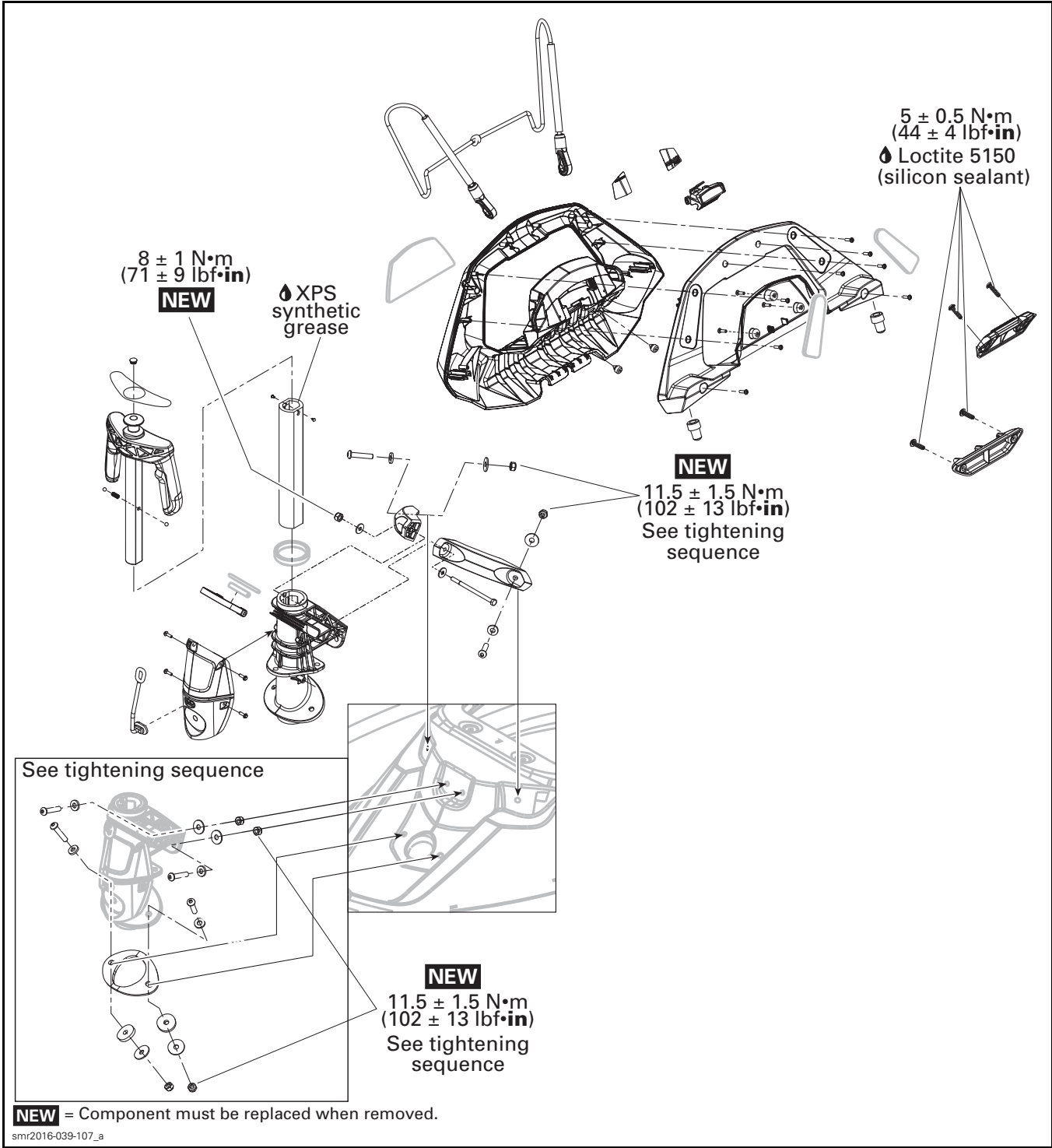
FRONT COVER



SEAT



WAKEBOARD RACK AND WAKE PYLON (WAKE PRO MODEL)



PROCEDURES

GELCOAT

The deck is constructed of chopped fiberglass, saturated with resin. It is sprayed on the layer of gelcoat along with pieces of fiberglass mat, cloth and woven roving which are added at required areas.

For the hull, a different material is used and a standard polyester based fiberglass repair kit **will not work**. Refer to *HULL* subsection for proper material and procedures.

Gelcoat Repair Information

All liquid gelcoat and repair kits can be purchased directly from Gelcote International Ltd. BRP does not distribute these products.

NOTE: Fiberglass repair kit is also available through automotive or marine suppliers.

Gelcote International Ltd web site has all the Sea-Doo personal watercraft and sport boat gelcoat colors.

You can order on the web site and get confirmation of your order within hours. Quick, reliable service is what is offered to all BRP dealers around the world.

There are many services on this web site to make your ordering quick and informative. Or you can call Gelcote International directly with any question pertaining to gelcoat. Service, value and knowledge is what you can expect when you call Gelcote International.

Gelcote International Ltd
174 Colonnade Road Suite 29
Ottawa, Ontario
Canada, K2E 7J5

Phone: (613) 225-2177
Phone: (877) 435-2683 (Toll Free)
Fax: (613) 225-5297

Web Site: www.gelcoat.ca
E-mail: info@gelcote.com

WARNING

Protect skin, wear gloves when in contact with resin, hardeners and gelcoat. A barrier skin cream may also be used. Do not expose area to open flame or lit cigarette. Some of the materials are flammable. Protect eyes, wear safety glasses when grinding, sanding or spraying. Use a dust mask when sanding or grinding. When spraying wear a respirator or paint mask. Always read warning labels on products.

TOOLS

Air mask	Power sander
Buffing pda	Putty knife
Cover sheets	Safety glasses
Heavy-duty polisher	Sanding block
Paint brush	Scissors
Plastic container (mixing)	Spray gun
Plastic film	Stirring stick
Plastic squeegee	White cloths

MATERIALS

Acetone	Epoxy filler
Cabosil	Masking tape
Cardboard	Liquid gelcoat
Fine compound (white)	Medium compound (white)
Fiberglass cloth	Polyester resin
Fiberglass mat	24-grit sanding disks
Gelcoat putty	Wax
Sandpaper (100-grit, 220-grit, 320-grit, 400-grit, 600-grit, 1000-grit)	

Air Bubbles Repair

Possible cause:

- Air pocket trapped between layers of laminate and gelcoat.

Preparation of Surface

Remove all of the damaged gelcoat surrounding the air bubble with a putty knife or preferably a carbide grinding tip. Make sure all loose and weak areas are completely removed. Sand a small area of the gelcoat surface with 220-grit sandpaper. If needed, sand the cavity itself. These areas must have a rough surface to allow the gelcoat putty to bond properly.

Filling the Cavity

The prepared surface must be cleaned with acetone on a cloth. Use a gelcoat repair kit. Follow the mixing instructions in the kit when preparing the gelcoat putty.

Carefully mix the required amount while making sure there are no air bubbles in the mixture. With a putty knife, fill the repair area and cover with plastic film. Curing time may depend on temperature, amount of putty and percentage of catalyst. After 2 hours, press lightly on the surface with fingers to test the hardness. When the area becomes hard, remove the plastic film.

Sanding

Begin block sanding the patch with 320-grit sandpaper until you come close to the original surface. Remove dust with a water soaked cloth and continue sanding with a 400-grit wet paper. Finish wet sanding with a 600-grit to remove deeper scratches. If needed you can wet sand with finer grit paper such as 1000-grit.

Buffing and Waxing

Buff the surface using a heavy duty polisher with a buffing pad. Make sure the pad is free of dirt or you may damage the gelcoat. Carefully begin buffing with a white medium compound. Finish off using a fine compound. While buffing, pay close attention to avoid overheating the surface.

Blisters Repair

Possible causes:

- Insert catalyst
- Improper catalyst/gelcoat ratio.

A blister is a visible bump on the watercraft surface that may not necessarily come right through the gelcoat layer. In the case of only a few blisters, follow the same repair procedure as for air bubbles. If they are numerous and in close concentration, spray liquid gelcoat to achieve proper repair. This procedure is covered in *MINOR GELCOAT FRACTURES*.

Minor Gelcoat Fractures Repair

Possible causes:

- Flexing of fiberglass laminate
- Gelcoat thickness
- Direct result of impact.

In case of fractures which have not penetrated past the gelcoat layer, the repair concerns the gelcoat only. If flex cracking or impact are evident,

then additional reinforcement may be necessary. This subject will be covered in *COMPOUND FRACTURES*.

Preparing the Surface

Small Fractures: Open the cracks up with a sharp triangular can opener or preferably a carbide tipped die grinder. The V groove will provide a good bonding area for the gelcoat. With 220-grit sandpaper, sand the sides of the notched out areas.

Numerous Fractures: Using a grinder with a 24-grit disk, remove the gelcoat. Sand the area edge with 220-grit sandpaper.

Filling the Repair Area

Small Fractures: Refer to the same procedure as in the *AIR BUBBLES*.

Numerous Fractures Over Large Surface: Prepare the area for spray application of liquid gelcoat. Wipe down the surface with acetone. Mask the area off to protect the watercraft from overspray.

Mix the needed quantity of gelcoat and catalyst according to suppliers recommendations. The gelcoat can be thinned with acetone up to 10%. If it needs more consistency you can add cabosil.

Make sure that the air supply is free of oil, dirt and water.

Test spray the gelcoat mixture on paper to verify its consistency and pattern. You may have to apply 5 or 6 coats to cover the area properly. Overlap each coat further than the last, leaving at least 30 seconds between passes. Avoid trying to coat the surface with only a few heavy coats, this will not allow the gelcoat to dry properly.

Apply a coat of polyvinyl alcohol (PVA) to seal off the air and protect the gelcoat surface from dust. PVA speeds up the curing process because gelcoat will not cure properly when exposed to air.

Sanding

Wash the polyvinyl alcohol off with water. Depending on the size of the area repaired, you can either block sand as per previous procedure or you may use an air sander. Sand the surface down with progressively finer grits of sandpaper until the desired finish is achieved.

Buffing and Waxing

Buff the surface using a heavy duty polisher with a buffing pad. Make sure the pad is free of dirt or you may damage the gelcoat. Carefully begin

buffing with a white medium compound. Finish off using a fine compound. While buffing, pay close attention to avoid overheating the surface.

Compound Fractures Repair

Possible causes:

- Thickness of fiberglass laminate
- Direct result of impact.

Compound fractures are those that have gone past the gelcoated surface and in through the layers of fiberglass laminate. Two types of repairs have to be performed. The first is to restore the structural integrity of the damaged area. Fracture types can vary from a simple crack to a large hole. Usually, fiberglass reinforcement becomes necessary, especially if the fracture can be attributed to weakness. The final part of the repair is the gelcoating, which cannot be done until the interior and exterior laminate surfaces have been repaired.

Outside: Remove the damaged gelcoat and fiberglass with a 24-grit disk using a power sander. Grind outward at least 2 inches from the fracture to allow the patch to bond to strong material. Cut enough pieces of fiberglass mat necessary to build up the area. The pieces should be cut so they overlap each other by at least a half inch. For a smoother finish, the last layer should be fiberglass cloth. If the fracture is small enough all you may have to do is fill the area with an epoxy filler.

Inside: For the interior repair, you can grind more. This will allow for more fiberglass material which will strengthen the area. If the fracture opening is too large after surface preparation, you may need a backing support to cover the opening. Cut alternating pieces of fiberglass mat and cloth in overlapping sizes.

Patching the Repair Area

Outside: The outside should be done first. Wipe clean the area with acetone on a cloth, then mask off area. For a small crack use an epoxy filler in the same way you would use gelcoat repair putty. When laying up a larger area you will use mat, cloth and fiberglass resin and catalyst. Use a clean container to mix the resin, mix only what you will need. Follow the recommended catalyst ratio.

Using a clean paintbrush, brush the mixed resin on the surface. Place the smallest piece of mat over the fracture and then wet out the mat. Follow with the remaining pieces of mat and final layer of cloth. While wetting the pieces make sure you work the air bubbles out and saturate all the

pieces evenly. Try to work quickly, you may only have 15 or 20 minutes. You may clean the brush with acetone.

Wait until the repair has hardened before moving on to the interior repair. If the size of the opening is too large for the pieces to maintain the proper shape, you will have to use a backing support. It is a shaped piece of cardboard that fits flush to the interior surface and has a plastic layer on the repair side. It is held in place by tape or a support.

Inside: Wipe down the area with acetone on a cloth. Apply the same procedure as for outside repair when laminating the alternating pieces of fiberglass material. If a backing support was used, remove it before starting the repair. After the area has hardened, remove sharp edges of material from surface. If required paint the surface.

Sanding

Outside: This surface will have to be prepared for application of gelcoat. The size of the area will determine the gelcoating procedure to be used. Refer to the *MINOR GELCOAT FRACTURES REPAIR*.

Buffing and Waxing

Refer to the *BUFFING AND WAXING* in *MINOR GELCOAT FRACTURES REPAIR*.

DECALS

Removing Decal

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

NOTE: When heating near light surfaces, duct tape should be applied to protect the surface. Otherwise the light color could become a yellowish color.

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.

Installing Decal (with a Protective Film on Back Side)

These decals usually contain written information (e.g.: warning) and are used on gelcoat or metal.

Using isopropyl alcohol, clean the surface and dry thoroughly.

Using a pencil and the decal as a template, mark the area where decal will be located.

Remove half of the decal back protective film and align decal with marks. Start sticking it from center and remove the other half of the film to stick it completely. Carefully squeegee decal beginning at center and working outward using, firm, short, overlapping strokes.

Installing Decal (with a Protective Film on Both Sides)

These decals usually contain graphics and are used on gelcoat or plastic.

Installation on Gelcoat

Using isopropyl alcohol, clean the surface and dry thoroughly.

Using a pencil and the decal as a template mark the area where decal will be located.

For better adhesion a dry application is recommended, however, to ease decal installation a mild solution of soapy water can be sprayed over surface where decal will be installed.

Remove back protective film from decal and align decal with marks. When well aligned squeegee decal beginning at center and working outward using firm, short, overlapping strokes.

Remove front protective film once decal has adhered to hull.

Installation on Plastic Surface (Storage Cover)

Clean surface with isopropyl alcohol and dry thoroughly.

Using a pencil and the decal as a template, mark the area where decal will be located.

NOTICE Do not use soapy water to locate decal on plastic parts.

Remove back protective film from decal and carefully align decal with marks. When well aligned squeegee decal beginning at center and working outward using firm, short, overlapping strokes.

Remove front protective film once decal has adhered.

CARPETS

Cleaning Carpet

To clean the carpets, use 3M™ Citrus Base Cleaner or the equivalent. See the manufacturer's instructions.

Removing the Carpet

Unstick a carpet corner.

Pull carpet vigorously to remove the carpet and its glue from body.

To remove the remaining glue from body, use a plastic or rubber spatula. Scrape remaining glue with spatula.

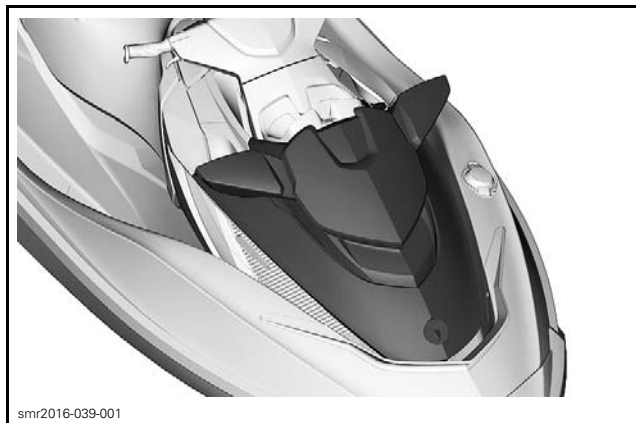
NOTE: Do not use any products (alcohol, acetone, thinner, etc.) or heat the remaining carpet glue. Chemical reactions make glue very hard to remove.

Installing Carpet

Clean body surface with isopropyl alcohol and dry thoroughly.

Install new carpet.

STORAGE COMPARTMENT COVER



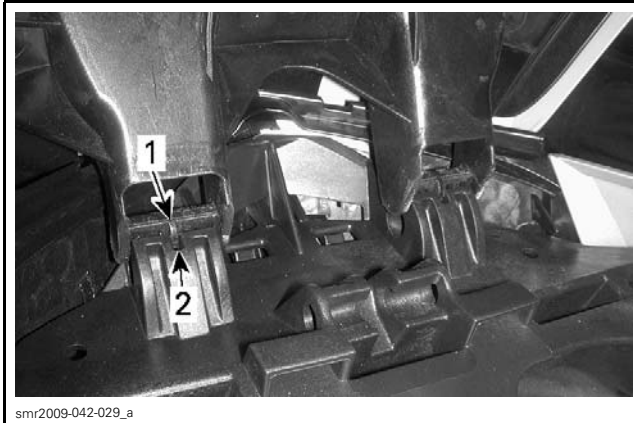
Removing the Storage Compartment Cover

1. Open cover.
2. Cut locking tie retaining the bellows of gas shock.



1. Cut this locking tie

3. Move bellows downward.
4. Unscrew gas shock from its upper attachment.
5. Remove gas shock from vehicle.
6. Open cover completely.
7. Align cover hinge keys with front body module slots.
8. Pull up cover to remove it.



1. Cover hinge key
2. Front body module slot

Installing Storage Compartment Cover

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

Remove gas shock attachment from cover.

Apply LOCTITE 414 (P/N 413 705 800) on threads of shock absorber body.

Tighten manually the attachment on gas shock.

Install the bellows and secure it using a locking tie.

Install the gas shock on cover.

NOTE: The corrugated section of bellows must point downward.



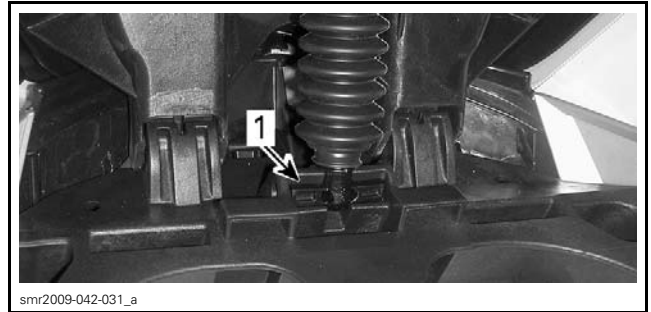
1. Corrugated section

Install cover on vehicle.

NOTICE Make sure to insert cover hinges completely. A click must be heard to indicate complete insertion.

Position the gas shock lower attachment on cavity opening.

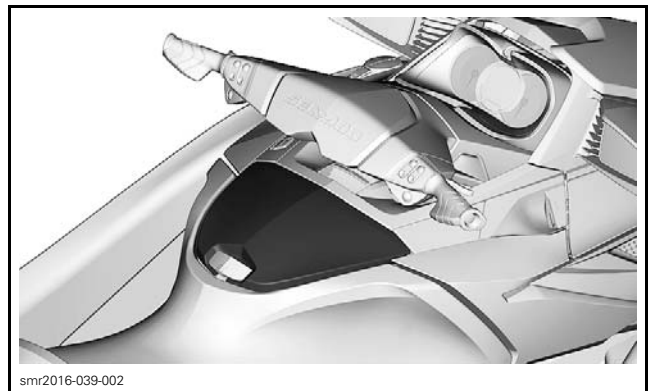
NOTICE To avoid breaking the attachment, do not force to insert it in cavity.



1. Lower attachment in its cavity

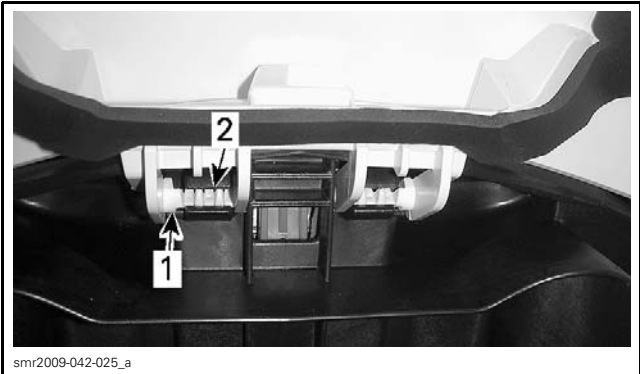
Close cover to lock the bottom of the gas shock.

GLOVE BOX COVER



Removing the Glove Box Cover

1. Move steering in its upper position.
2. Open glove box cover until cover hinges are aligned with front body module openings.



- 1. Glove box cover hinge
- 2. Front body module opening

3. Pull the bottom of cover gently to release hinges.

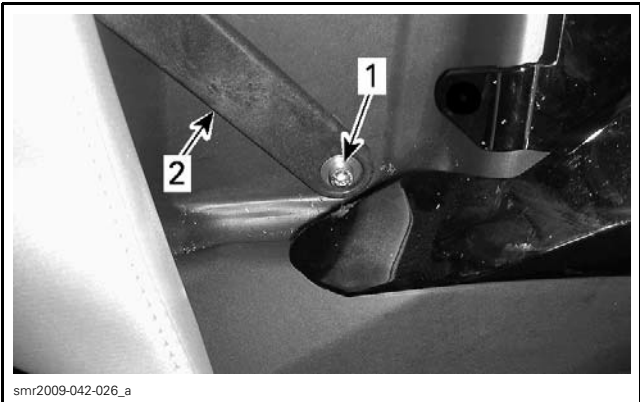
Installing the Glove Box Cover

Reverse the removal procedure.

SEAT

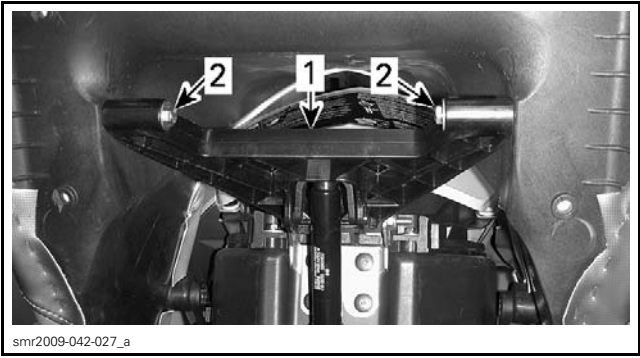
Removing the Seat

- 1. Open seat.
- 2. Attach the seat to support it during removal.
- 3. Remove Allen socket screw retaining the lateral arm to moving deck (one each side).



- 1. Allen socket screw
- 2. RH lateral arm

4. Remove bolts securing the central arm to seat.



- 1. Central arm
- 2. Retaining bolts

5. Remove seat from vehicle.

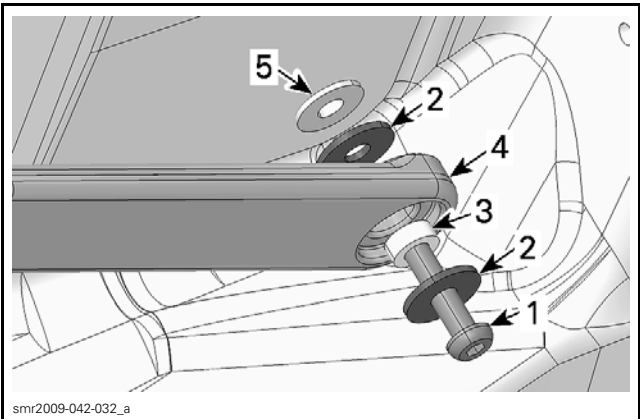
Installing the Seat

The installation is the reverse of the removal procedure. However, pay attention to the following. Install seat to central arm.

Tighten seat retaining bolts to specification.

TIGHTENING TORQUE	
Seat retaining bolt	4 N•m ± 1 N•m (35 lbf•in ± 9 lbf•in)

Secure lateral arms to moving deck. Install parts as shown.



- 1. Allen socket screw
- 2. Stainless steel flat washers
- 3. Sleeve
- 4. RH lateral arm
- 5. Rubber grommet in moving deck

Tighten lateral arm screws to specification.

TIGHTENING TORQUE	
Lateral arm screw	1.5 N•m ± 0.1 N•m (13 lbf•in ± 1 lbf•in)

NOTICE Do not tighten screws over this recommended torque. Otherwise, the rubber grommet could turn and screw will be hard to remove.

Cleaning the Seat

For general purpose cleaning, use XPS ALL PURPOSE CLEANER (P/N 219 701 709), Vinyl Finish Vinyl Cleaner, Fantastik or warm water with a mild dish soap such as Dawn or Ivory. Gently scrub with a small soft bristle brush.

For dirt build-up, use XPS ALL PURPOSE CLEANER (P/N 219 701 709), Vinyl Finish Vinyl Cleaner or an equivalent. Let soak for approximately 10 minutes, then gently scrub with a soft bristle brush. For specific stain removal, refer to your cleaning and care card.

Do not use any silicone-based protectants. They will extract the plasticizers, leaving the vinyl hard and brittle, and eventually cracking will occur.

RECOMMENDED PRODUCTS	
1.	XPS ALL PURPOSE CLEANER (P/N 219 701 709)
2.	Dish Soap (Dawn or Ivory)
3.	Fantastik
4.	3M Citrus Cleaner
5.	303 Protectant

Vinyl Cleaning Recommendations for Special Stains

TYPE OF STAIN	STEP 1	STEP 2	STEP 3	ACTION
Ballpoint ink*	E	B	A	A. Medium-soft brush, warm soapy water, rinse/dry.
Chewing gum	D	A	—	
Coffee, tea, chocolate	B	—	—	
Pen	D	B	—	B. Vinyl Finish Cleaner, rinse/dry.
Grease	D	B	—	
Household soil	A	B	—	
Ketchup	A	B	—	C. One (1) tablespoon of ammonia, one-fourth (1/4) cup of hydrogen peroxide, three-fourth (3/4) cup of water, rinse/dry.
Latex paint	A	B	—	
Lipstick	A	B	—	
Mildew or wet leaves*	C	B	A	D. Wipe or scrape off excess (chill gum with ice before hand).
Motor oil	B	—	—	
Oil-based paint	D	B	—	
Permanent marker*	E	B	C	
Spray paint	B	B	—	

Suntan lotion	A	B	—	E. Denatured alcohol, rinse/dry.
Tar/asphalt	D	B	—	
Yellow mustard	A	B	C	
*Suntan lotion, tree pollen, wet leaves and some other products can contain dyes that stain permanently.				

All cleaning methods must be followed by a thorough rinse with warm water.

Certain household cleaners, powdered abrasives, steel wool and industrial cleaners can cause damage and discoloration and are not recommended. Dry cleaning fluids and lacquer solvents should not be used as they will remove printed pattern and gloss. Waxes should be used with caution as many contain dyes or solvents that can permanently damage the protective coating.

SEAT LATCH

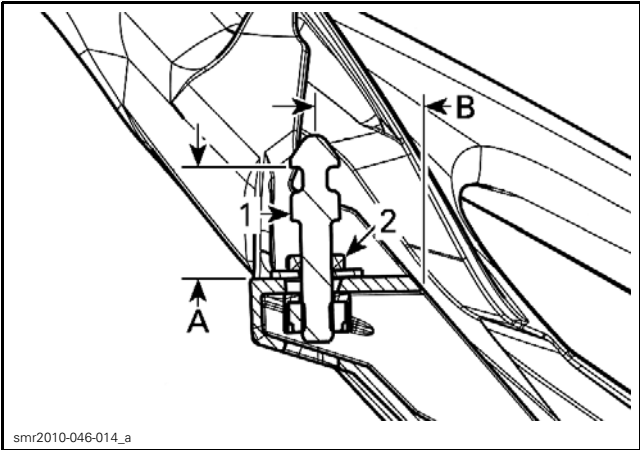
Adjusting the Seat Latch

NOTE: Apply Threadlocker on threads of lock pin when the adjustment is required or when the lock pin is removed. If a new lock pin is used, it is already coat with a threadlocker.

1. Loosen adjustment nut.
2. Adjust lock pin height. Do not torque yet.
3. Position the lock pin longitudinally into the rear handle slot.
4. Hold the lock pin in this position and tighten adjustment nut to specification.

TIGHTENING TORQUE	
Seat latch adjustment nut	$8\text{ N}\cdot\text{m} \pm 1\text{ N}\cdot\text{m}$ $(71\text{ lbf}\cdot\text{in} \pm 9\text{ lbf}\cdot\text{in})$ + LOCTITE 243 (BLUE) (P/N 293 800 060)

5. Close the seat and readjust as required.



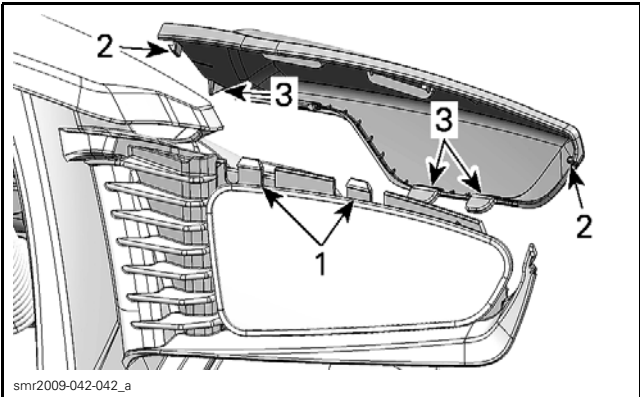
- 1. Lock pin
- 2. Adjustment nut

MODEL	MEASURE A	MEASURE B
Models with suspension	32.4 mm ± 1.0 mm (1.276 in ± .039 in)	34.4 mm ± 1.0 mm (1.354 in ± .039 in)
Models without suspension	36.4 mm ± 1.0 mm (1.433 in ± .039 in)	

MIRRORS

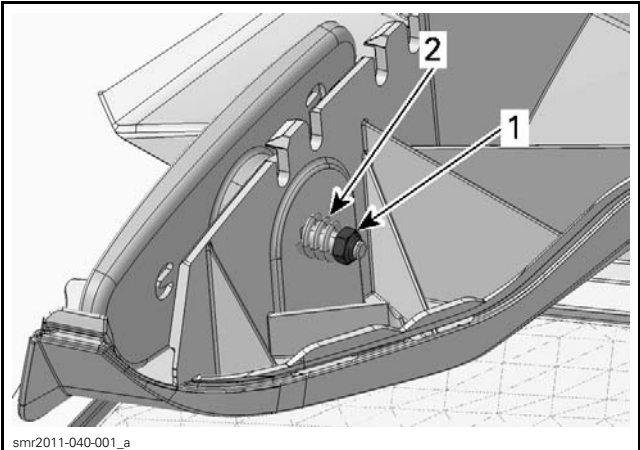
Replacing the Mirror

- 1. Remove mirror trim as follows.
 - 1.1 Using a small screwdriver, unlock both front tabs securing the front of mirror trim.
 - 1.2 Tilt the trim forward and remove it.



- 1. Front retaining tabs
- 2. Side retaining tabs
- 3. Locating tabs

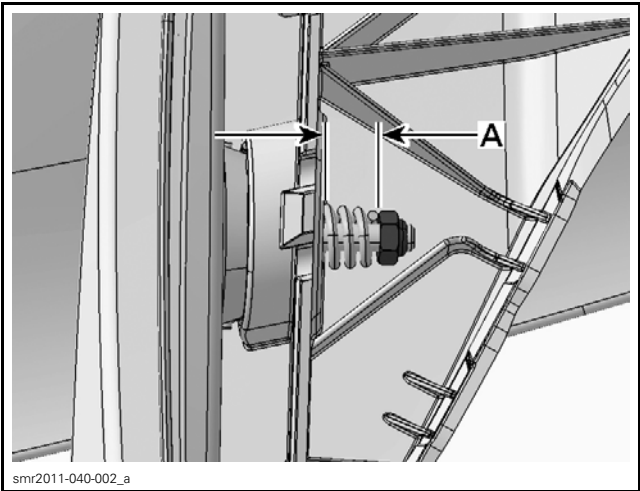
- 2. Remove nut and spring securing mirror.



- 1. Nut
- 2. Spring

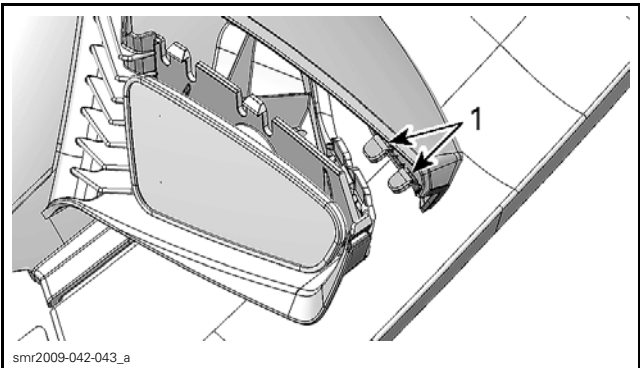
- 3. Install the new mirror and tighten nut to specification.

MIRROR SPRING LENGTH SPECIFICATION
10 mm to 12 mm (13/32 in to 15/32 in)



- A. 10 mm to 12 mm (13/32 in to 15/32 in)

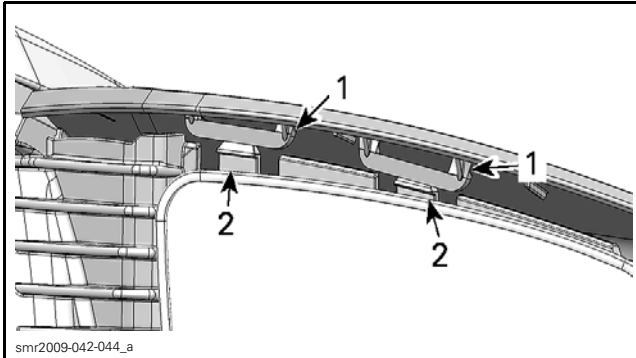
- 4. Install mirror trim as follows.
 - 4.1 Install the front locating tabs.



- 1. Front locating tabs

- 4.2 Lower rear part of trim.

- 4.3 Lift up the rear edge and press the center of trim to position retainers over front retaining tabs.



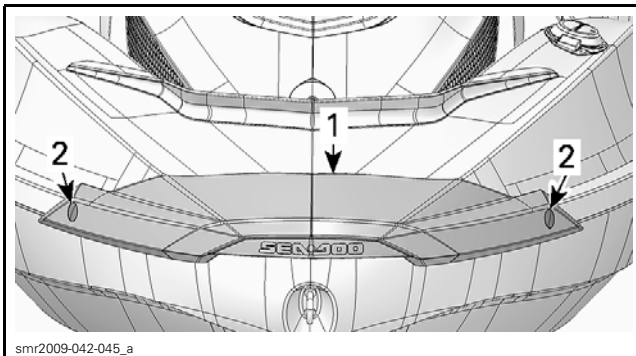
1. Trim retainers
2. Retaining tabs

BUMPERS

Removing the Bumper

Front Bumper

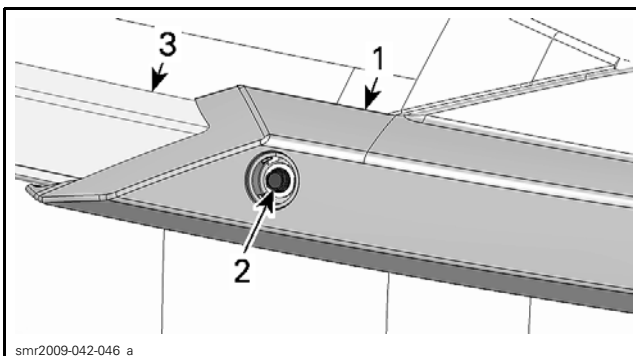
1. Remove both protective caps.



TYPICAL – iS MODEL SHOWN

1. Front bumper
2. Protective caps

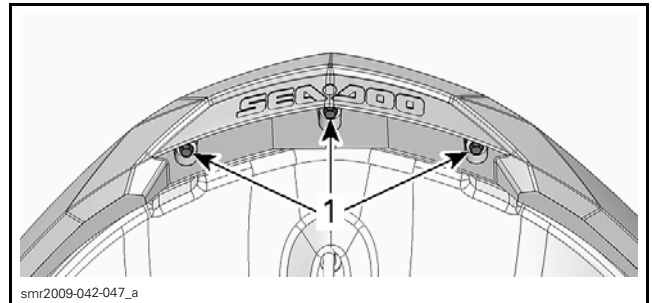
2. Remove side screws securing front bumper to body.



FROM RH SIDE OF VEHICLE

1. Front bumper
2. Retaining screw
3. Side bumper

3. Remove screws located under front bumper.



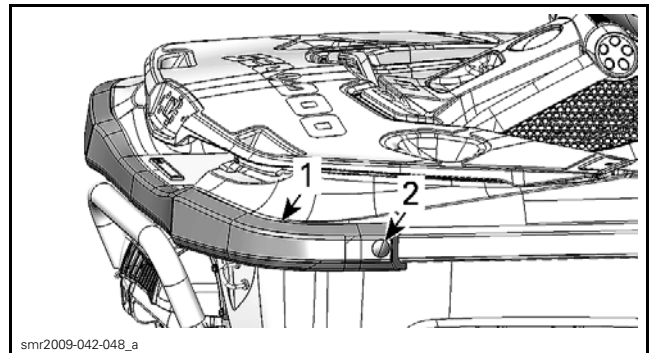
UNDERNEATH FRONT OF VEHICLE

1. Retaining screws

4. Remove front bumper from vehicle.

Rear Bumper

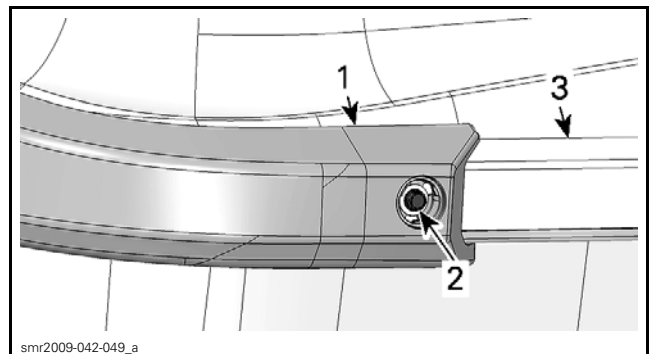
1. Remove both protective caps (one on each side).



TYPICAL – iS MODEL SHOWN

1. Rear bumper
2. Protective cap

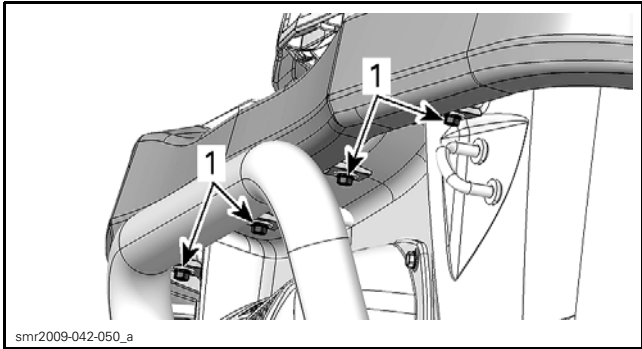
2. Remove side screws securing rear bumper to body.



FROM RH SIDE OF VEHICLE

1. Rear bumper
2. Retaining screw
3. Side bumper

3. Remove screws located under rear bumper.



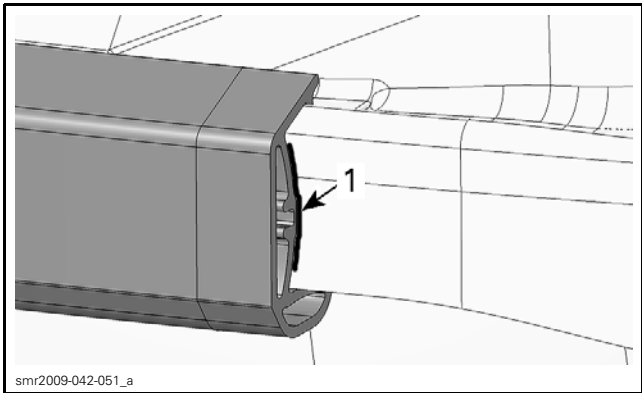
1. Retaining screws

4. Remove rear bumper from vehicle.

Side Bumpers

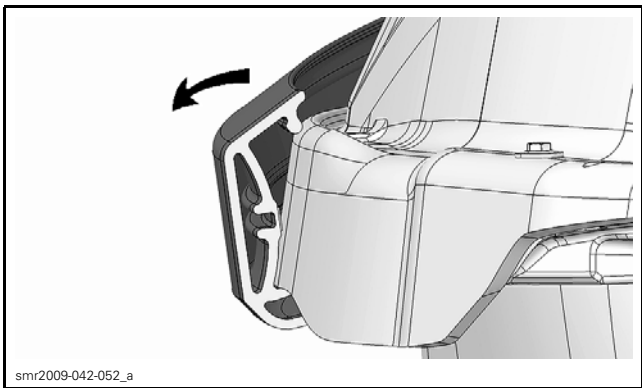
- 1. Remove front and rear bumpers.
- 2. Using a marker, trace a line at bumper end.

NOTE: These marks will be used during installation.



1. Trace a line here

- 3. Pull the top of bumper to unclip it from body.
- NOTE:** A heat gun can be used to soften side bumper.

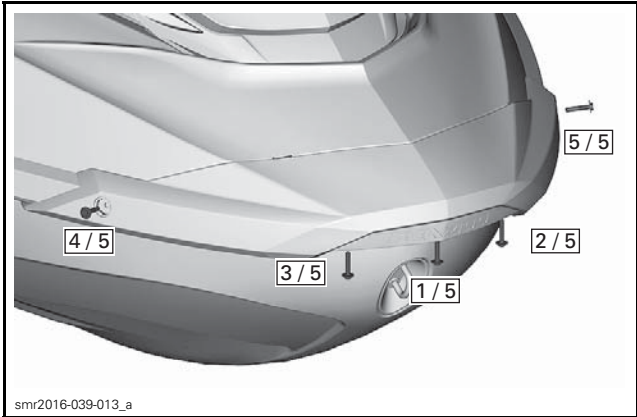


Installing the Bumper

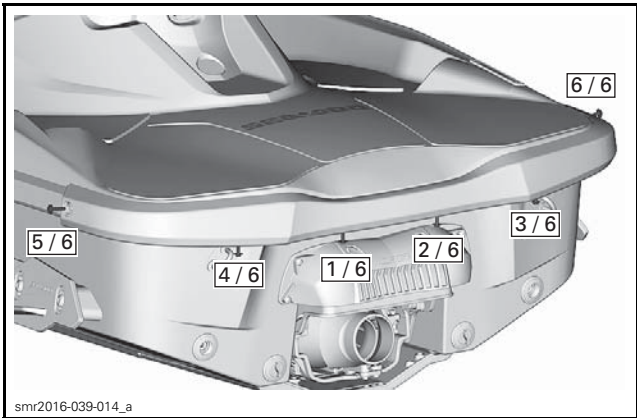
Front and Rear Bumper

The installation is the reverse of the removal procedure.

Tighten bumper screws as per following tightening sequence. Refer to exploded view for applicable tightening torque.



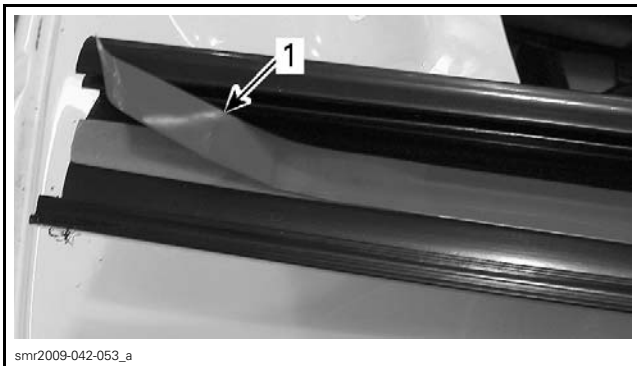
FRONT BUMPER



REAR BUMPER

Side Bumpers

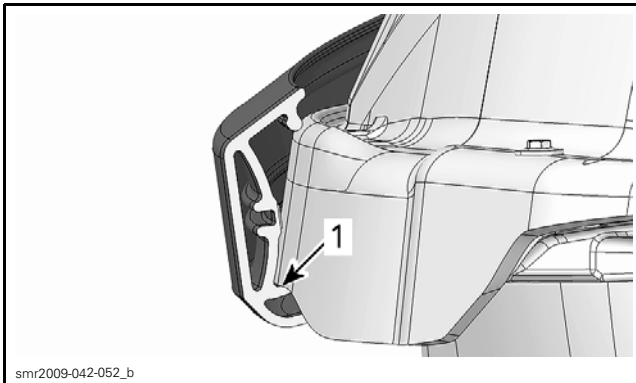
- 1. Remove all remaining residues of the mounting tape.
- 2. Clean bumper area using isopropyl alcohol.
- 3. Remove the protective skin on mounting tape.



1. Protective skin

- 4. Insert bumper over body lip.
 - 4.1 Insert lower section first.

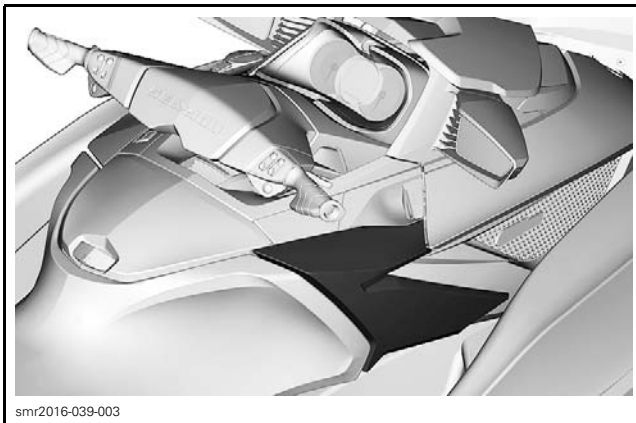
4.2 Insert upper section last.



1. Make sure bumper is positioned correctly

NOTE: A heat gun can be used to soften side bumper.

LATERAL COVER



Removing the Lateral Cover

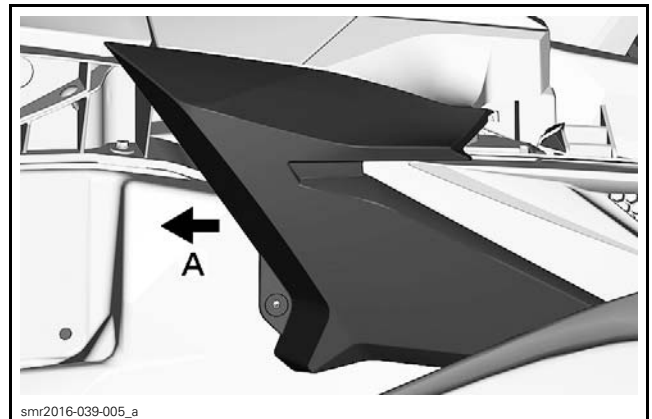
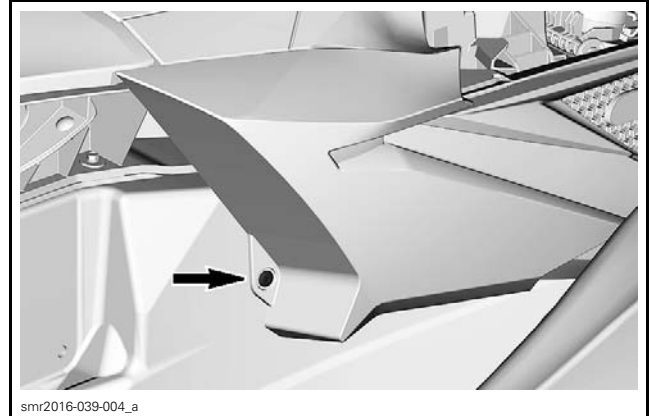
Open seat.

REQUIRED TOOL

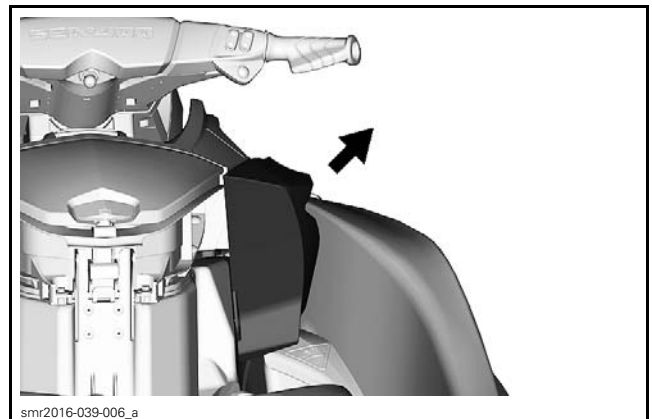
SUPERTANIUM DRILL BIT 3/16" (P/N 529 031 800)



529031800



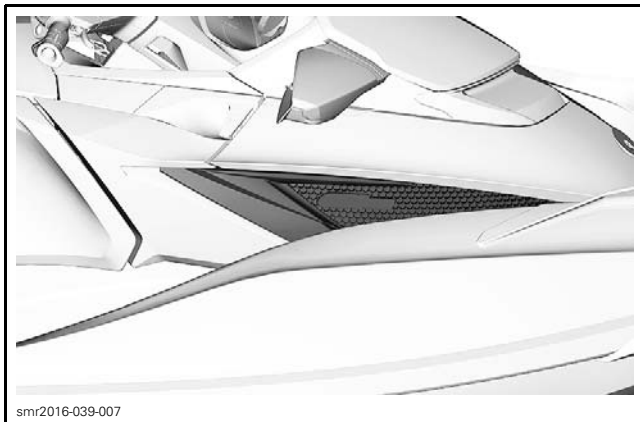
A. 12 mm (1/2 in)



Installing the Lateral Cover

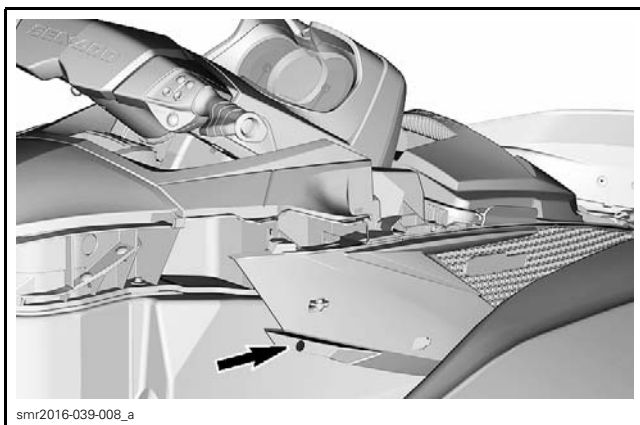
The installation is the reverse of the removal procedure.

LATERAL GRILLE ASSEMBLY



Removing the Lateral Grille Assembly

1. Remove the:
 - *STORAGE COMPARTMENT COVER*
 - Storage bin
 - *FRONT GRILLE*
 - *LATERAL PANEL*.See procedure in this subsection.
2. Drill the rivet securing the lateral grille assembly.

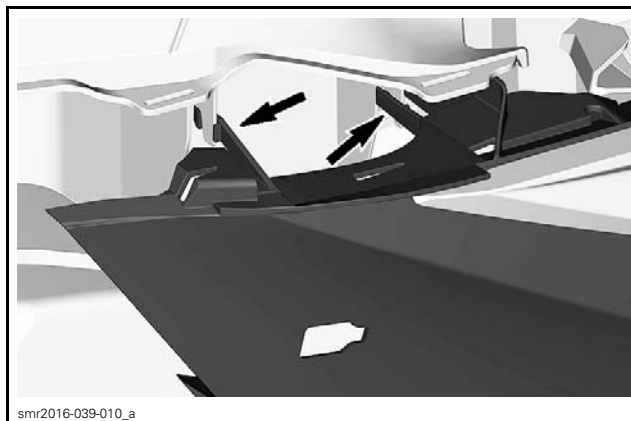


Models with Suspension

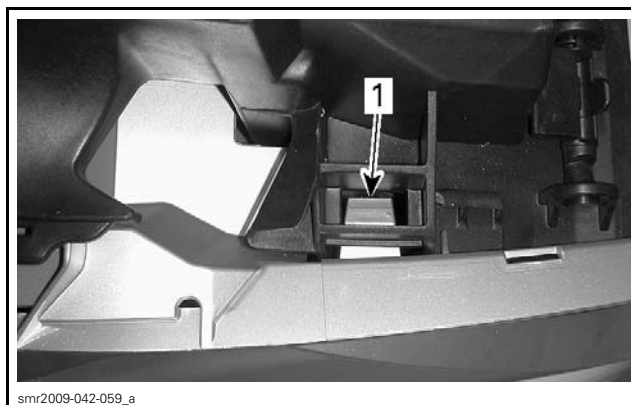
3. At the front of front body module, remove screws.

All models

4. Unlock rear and center retaining tabs.



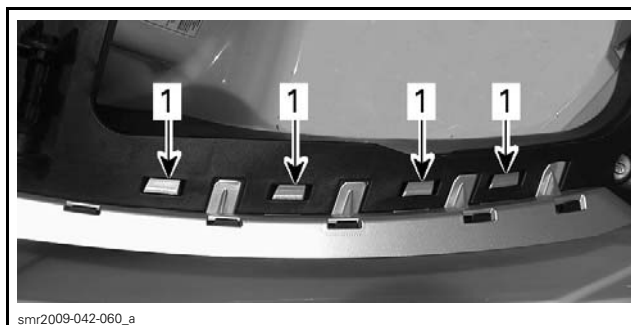
RH SIDE SHOWN



RH SIDE SHOWN

1. Center retaining tab

5. Unlock the four retaining tabs securing the front of the grille assembly.



RH SIDE SHOWN

1. Front retaining tab

6. Remove the grille assembly.

Installing Body Cover

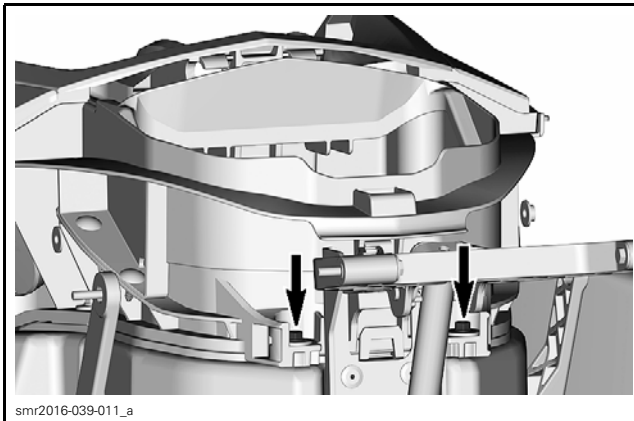
The installation is the reverse of the removal procedure.

FRONT BODY MODULE

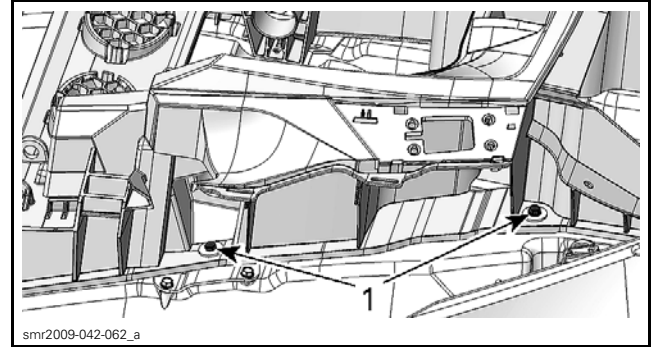


Removing the Front Body Module

1. Refer to appropriate procedures and remove the following parts:
 - Storage compartment cover
 - Storage bin
 - Glove box cover
 - Lateral grille assembly
 - Steering and steering lock
2. Remove both screws and washers located at rear end.

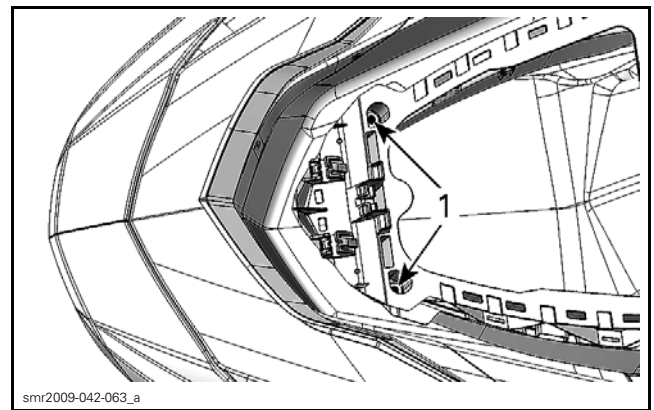


3. On each side of front body module, remove both retaining screws.



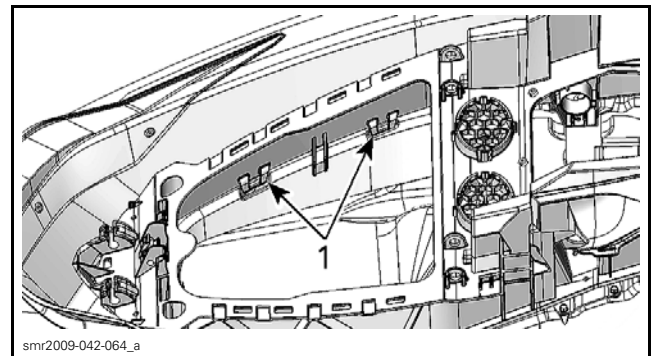
1. LH side retaining screws

4. At the front of body module, remove screws.



1. Front retaining screws

5. Unlock retaining tabs.



1. Front body module retaining tabs

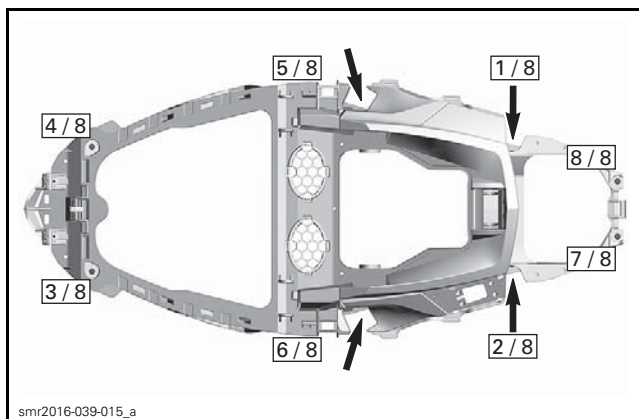
6. Remove front body module.

Installing the Front Body Module

The installation is the reverse of the removal procedure. However, pay attention to the following. Install all module screws.

Tighten screws to specification as per following tightening sequence.

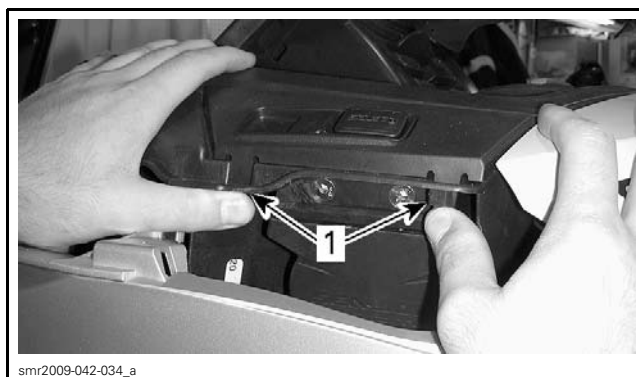
TIGHTENING TORQUE	
Front body module screw	8 N•m ± 1 N•m (71 lbf•in ± 9 lbf•in)



SPEED-TIE UNIT

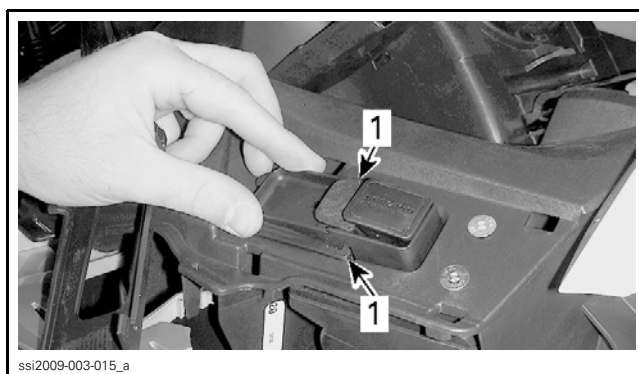
Removing the Front Speed-Tie Unit

1. Open seat and storage cover.
2. Remove the LH *LATERAL PANEL*.
3. Remove Speed-Tie trim by releasing both retaining tabs.



1. Retaining tabs

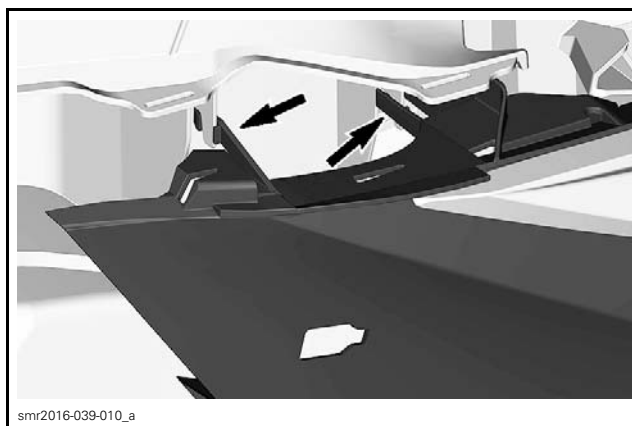
4. Using a small screwdriver, release both retaining hooks securing the cam trim on locking mechanism.



1. Retaining hooks

5. Remove screws retaining the Speed-Tie unit.
6. Position the reel of Speed-Tie unit to the bottom of its cavity.

7. Remove the locking mechanism from vehicle.
8. Unlatch the rear tabs.



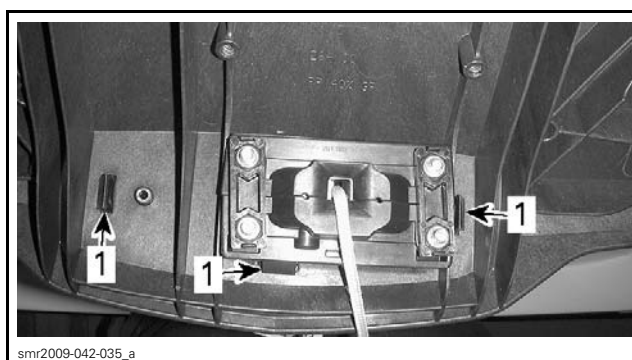
TYPICAL - RH SIDE SHOWN

9. Slightly pull on top of LH grille assembly and remove the Speed-Tie unit.

Removing the Rear Speed-Tie Unit

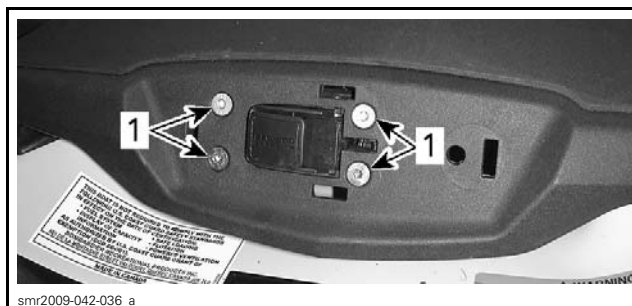
Models with Suspension

1. Remove screws securing the Speed-Tie unit to the boarding platform.
2. Remove rear trim by releasing retaining tabs.



1. Retaining tabs

3. Remove screws securing the locking mechanism to the boarding platform.



1. Retaining screws

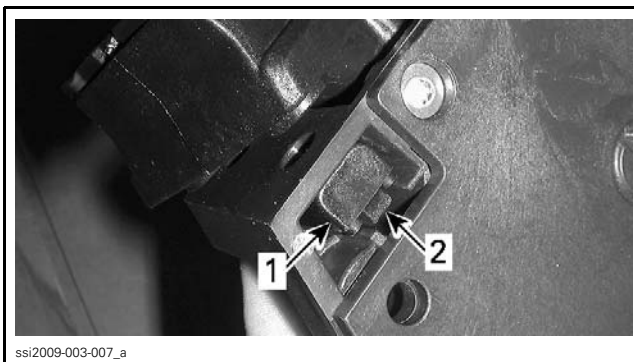
4. Remove the Speed-Tie unit from vehicle.

Models without Suspension

1. Open seat.
2. From underneath deck, remove screws retaining the Speed-Tie cover.
3. Remove bolts securing the Speed-Tie unit to deck.

Installing the Front Speed-Tie Unit

The installation is the reverse of the removal procedure. However, pay attention to the following. Ensure both double cage nuts are correctly inserted into Speed-Tie unit cavities.



1. Double cage nut
2. Positioning tab

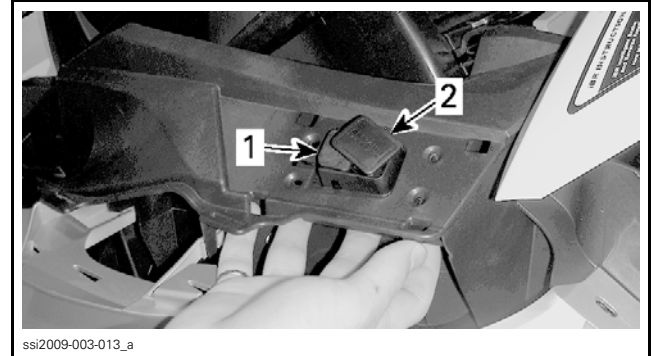
NOTE: To facilitate the locking mechanism insertion, temporarily pull approximately 200 mm (8 in) of rope between reel and locking mechanism.

1. Position the reel to the bottom of its cavity.



1. Push in the reel

2. Lift the lever and insert the locking mechanism so that the lever is pointing toward the front of vehicle.



1. Locking lever
2. Rope

3. Align the reel with the locking mechanism.
4. Tighten locking mechanism retaining screws to specification.

TIGHTENING TORQUE	
Locking mechanism screw	4 N•m ± 1 N•m (35 lbf•in ± 9 lbf•in)

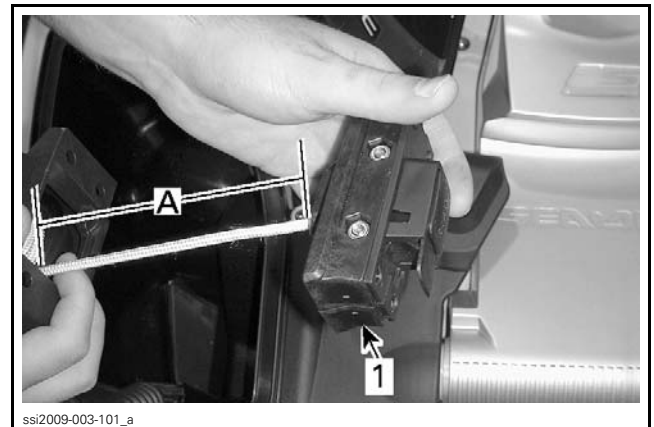
5. Test Speed-Tie operation.

Installing the Rear Speed-Tie Unit

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

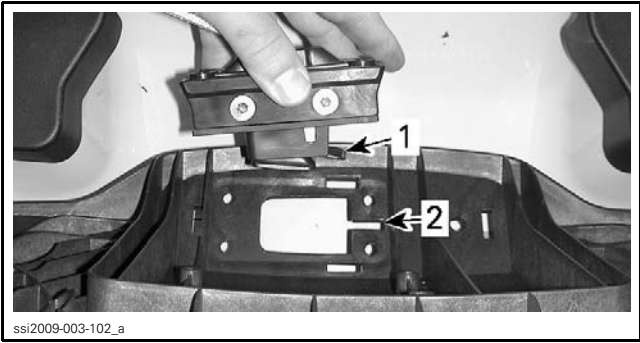
Models with Suspension

NOTE: To facilitate the locking mechanism insertion, temporarily pull approximately 200 mm (8 in) of rope.



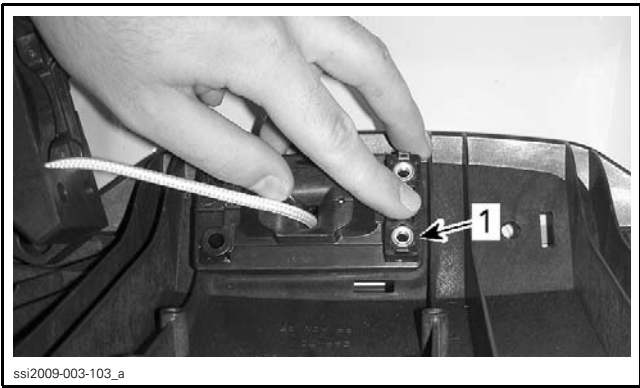
1. Locking mechanism
- A. 200 mm (8 in)

1. Insert the locking mechanism in boarding platform opening. Position the locking lever toward the slot.



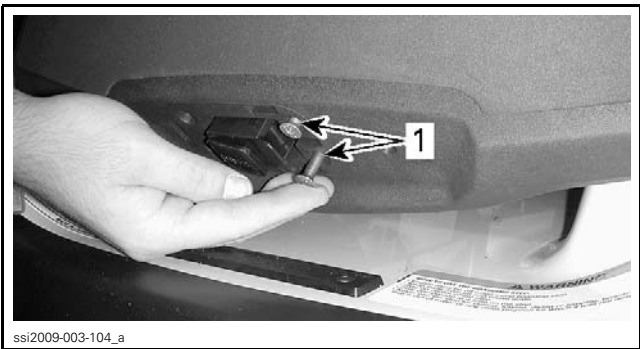
1. Locking lever
2. Boarding platform slot

2. Position a double cage nut on the locking mechanism.



1. Double cage nut

3. Secure it using retaining screws.



1. Retaining screws (M6 x 45)

4. Install the second double cage nut.
5. Secure the reel of the Speed-Tie unit on boarding platform.
6. Tighten all screws to specification.

TIGHTENING TORQUE	
Speed-Tie unit screw	5 N•m ± 1 N•m (44 lbf•in ± 9 lbf•in)
Locking mechanism screw	2.5 N•m ± 0.5 N•m (22 lbf•in ± 4 lbf•in)

7. Test Speed-Tie operation.

Models without Suspension

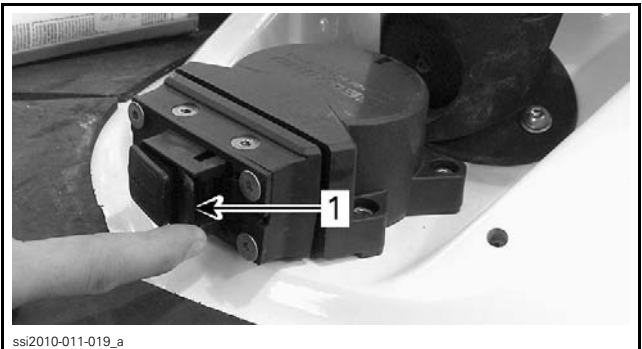
1. Clean all residues of silicone from deck and Speed-Tie cover.
2. Apply CLEAR SILICONE SEALANT (P/N 296 000 309) in the Speed-Tie unit holes.



3. Align Speed-Tie unit holes with body holes.
4. Install and tighten Speed-Tie unit retaining screws to specification.

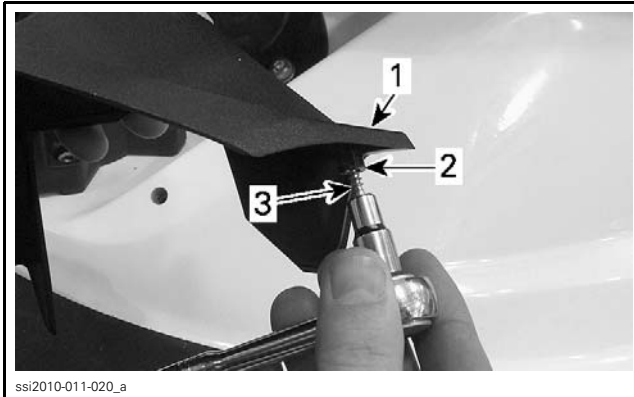
TIGHTENING TORQUE	
Speed-Tie unit screw	8 N•m ± 1 N•m (71 lbf•in ± 9 lbf•in)

5. Pull the locking lever to allow cover installation.



1. Locking lever

6. To facilitate new cover installation and avoid cross threading, install both Plastite screws in cover posts (approximately 3-4 turns). Then, remove screws.

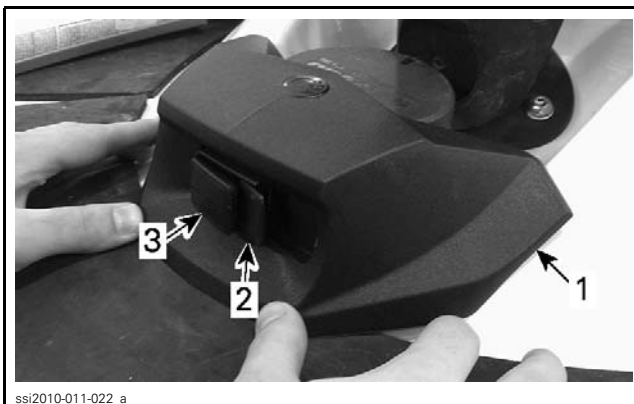


1. Cover
2. Cover posts
3. Plastite screws K40 x 13

7. Apply CLEAR SILICONE SEALANT (P/N 296 000 309) all around both cover holes.



8. Install the cover.
 - 8.1 Insert cover opening over the mooring rope stopper and the locking lever.



1. Cover
2. Locking lever
3. Mooring rope stopper

- 8.2 Insert cover posts into cover holes.

NOTE: Due to the drilling precision, it may be necessary to pry slightly the cover to insert cover posts into cover holes.

- 8.3 From underneath deck, secure the cover with Plastite screws and flat washers. To avoid damaging the cover, stop tightening as soon as the washers are against the deck.

TIGHTENING TORQUE	
Speed-Tie unit cover screw	0.9 N•m ± 0.1 N•m (8 lbf•in ± 1 lbf•in)

9. Test Speed-Tie operation.

Cleaning the Speed-Tie Unit

A minimum of maintenance is required to keep the Speed-Tie unit and the rope in serviceable condition.

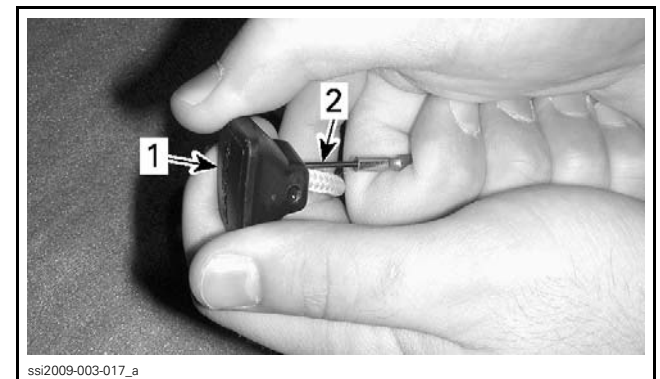
Clean the locking mechanism and rope with fresh water to remove salt, sand or other deposits.

NOTICE Do not use a high pressure washer to clean the Speed-Tie unit.

Let dry.

Replacing the Speed-Tie Rope

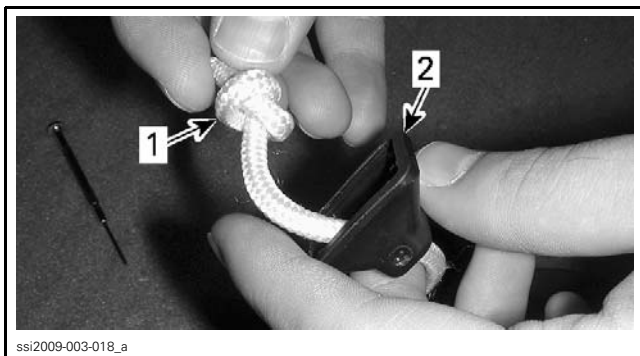
1. Remove the Speed-Tie unit from the vehicle.
2. Using a small tool, remove the rope cap.



1. Cap
2. Small screwdriver

3. Untie the knot and remove the button.

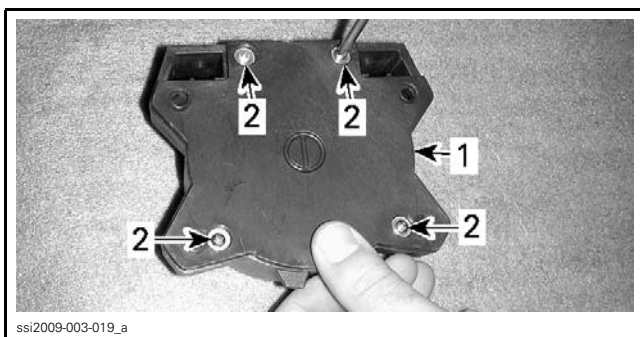
Subsection XX (BODY (GTX_RXT AND WAKE PRO SERIES))



1. Untie this knot
2. Button

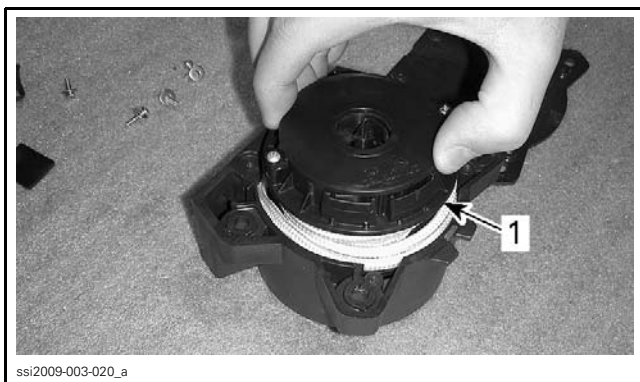
4. Remove the locking mechanism and let the rope retracts into housing.

5. Remove the back cover.



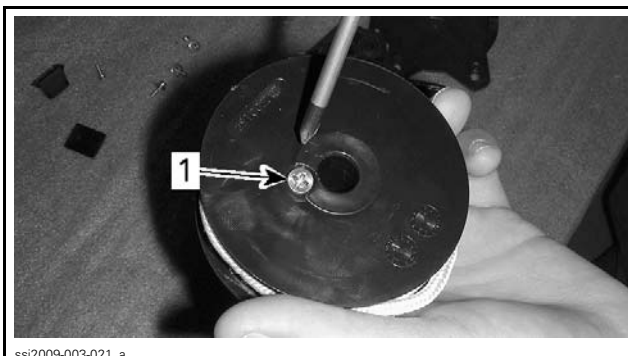
1. Back cover
2. Retaining screws

6. Remove the rewind unit.



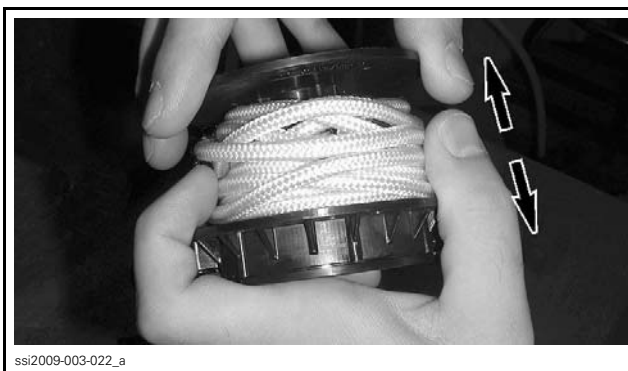
1. Rewind unit

7. Turn the unit upside down and remove the retaining screw.

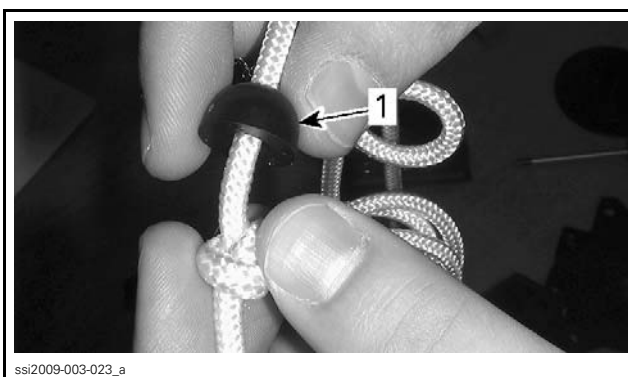


1. Retaining screw

8. Split the rewind unit and remove damaged rope.

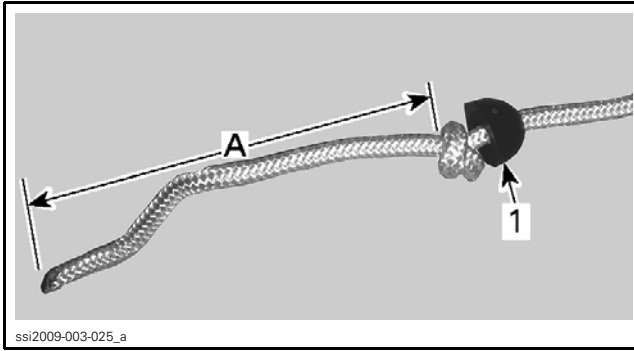


9. Before discarding rope, remove and keep the inner stopper.



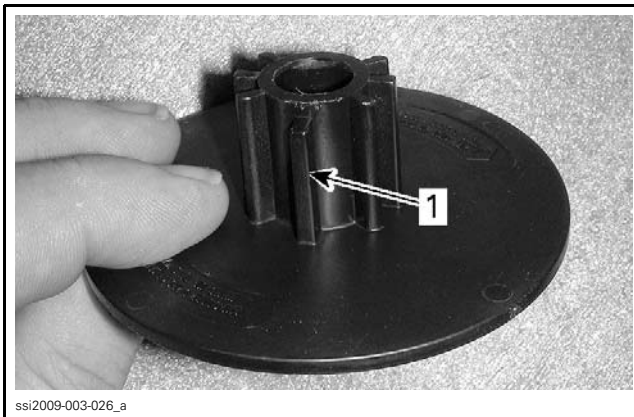
1. Inner stopper

10. Insert the inner stopper on new rope and tie a knot near the end of the line. Position the inner stopper in order to its flat side leans against the knot.



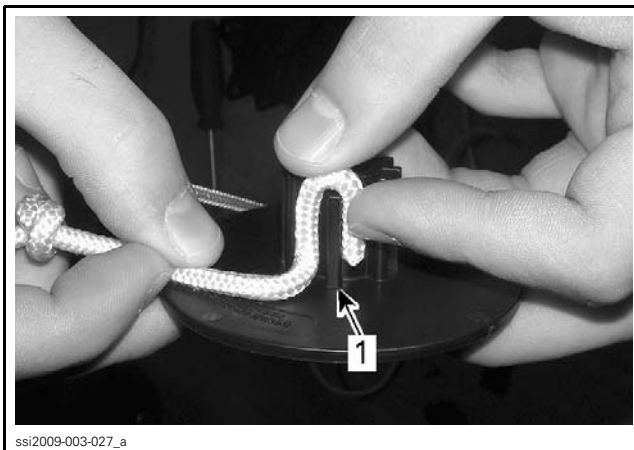
1. Inner stopper
A. 106 mm ± 6 mm (4-1/8 in ± 15/64 in)

11. On rewind unit base, identify the short tongue.



1. Short tongue

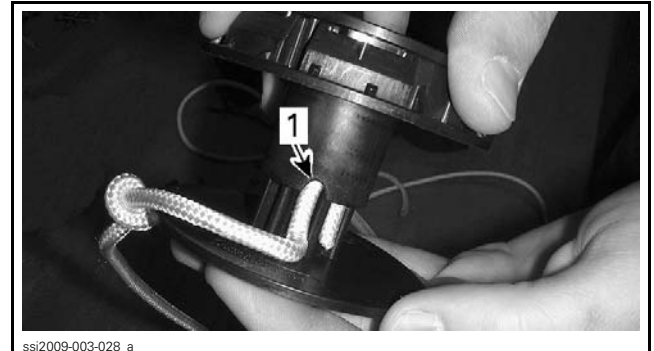
12. Install the rope end (with the knot) over the short tongue as shown.



1. Short tongue

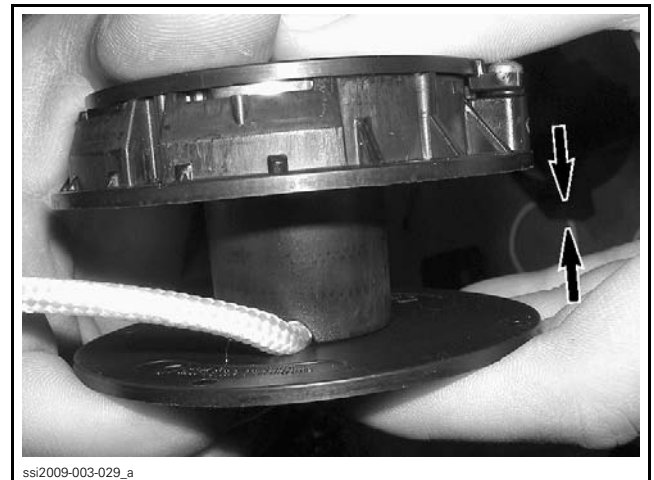
13. Install the rewind unit cover.

13.1 Align the cover notch and the rope.



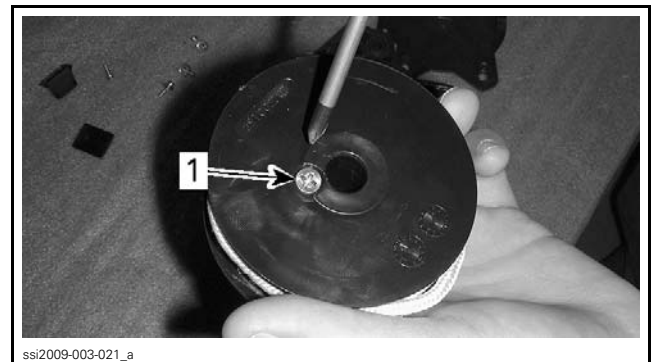
1. Cover notch

13.2 Press in the cover until both parts are completely pressed together.



13.3 Install and tighten retaining screw to specification.

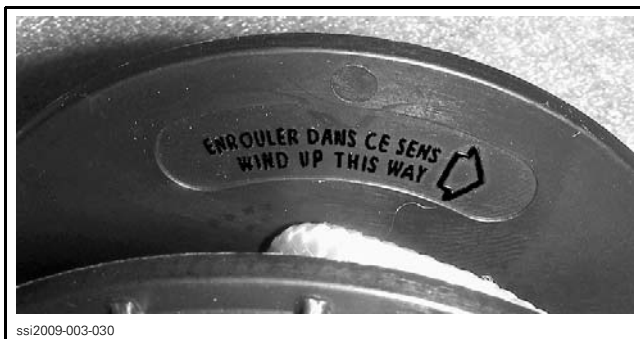
TIGHTENING TORQUE	
Rewind unit cover screw	1.1 N•m ± 0.1 N•m (10 lbf•in ± 1 lbf•in)



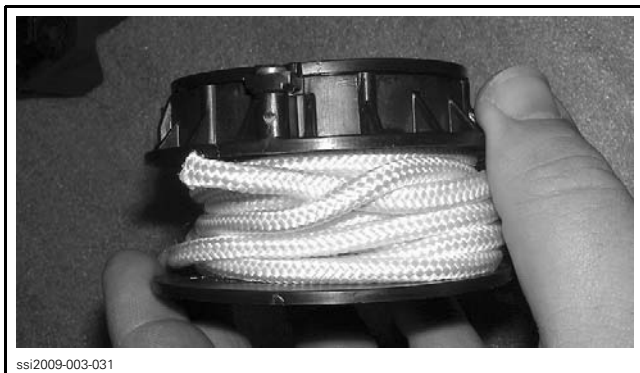
1. Rewind unit cover retaining screw

14. Turn rope clockwise. Check indications on inner side of rewind unit.

Subsection XX (BODY (GTX_RXT AND WAKE PRO SERIES))



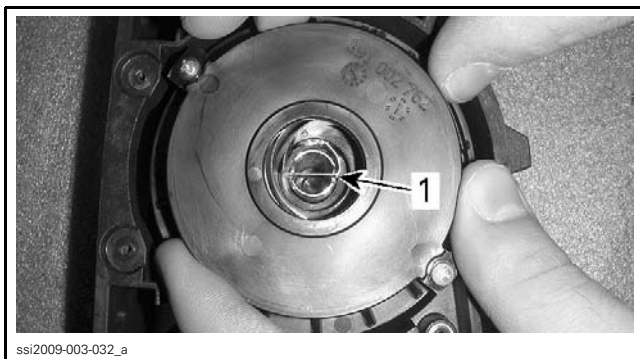
15. Lock the end of rope as shown.



16. Install rewind unit into housing.

16.1 Install the rewind unit with the retaining screw downward. The end of rope must be placed in front of the housing opening.

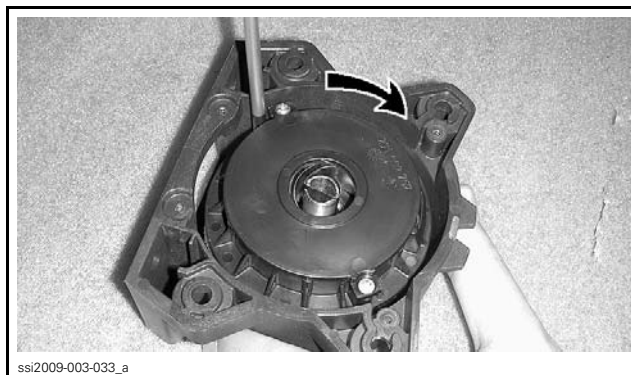
16.2 Insert spring in shaft notch.



1. Spring in notch

NOTE: Ensure spring is properly inserted in notch.

17. Using a screwdriver, crank rewind spring exactly 7 turns (clockwise).



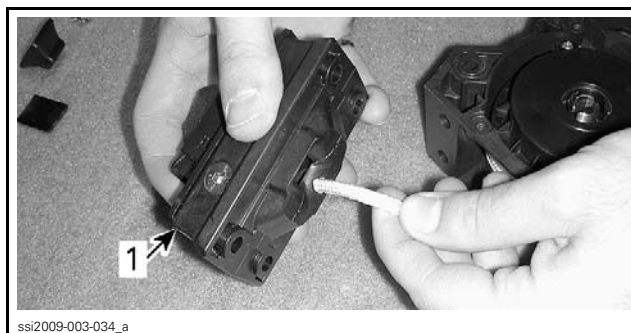
18. Unlock the end of the rope and pull it out by the housing opening.

NOTE: Be careful not to release the rope and the spring. Otherwise you will need to remove drum and repeat the cranking operation.

19. Install locking mechanism and rope.

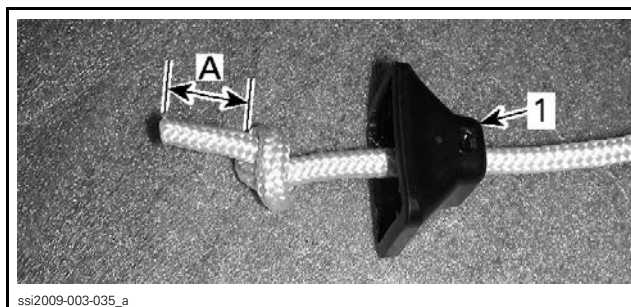
19.1 Pull out rope end.

19.2 Insert end of rope through locking mechanism.



1. Locking mechanism

19.3 Pass rope end through the rope button and tie a knot on the rope end, see picture.



1. Rope

A. $18\text{ mm} \pm 6\text{ mm}$ ($23/32\text{ in} \pm 15/64\text{ in}$)

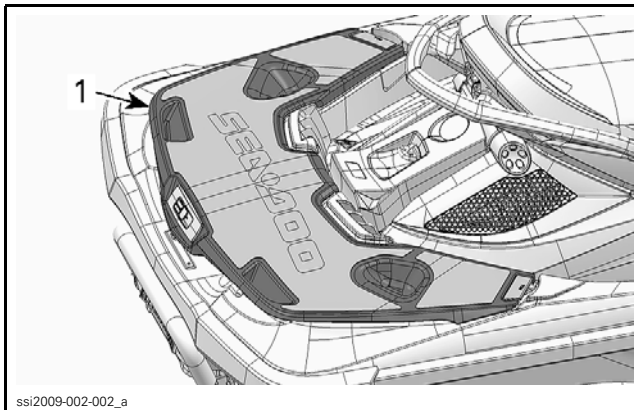
19.4 Pull knot in the button and install the button cap. Make sure cap is properly snapped.

20. Install and tighten Speed-Tie cover retaining screws to specification.

TIGHTENING TORQUE	
Speed-Tie cover screw	0.9 N•m ± 0.1 N•m (8 lbf•in ± 1 lbf•in)

21. Check Speed-Tie operation.
22. Reinstall the Speed-Tie unit on vehicle.

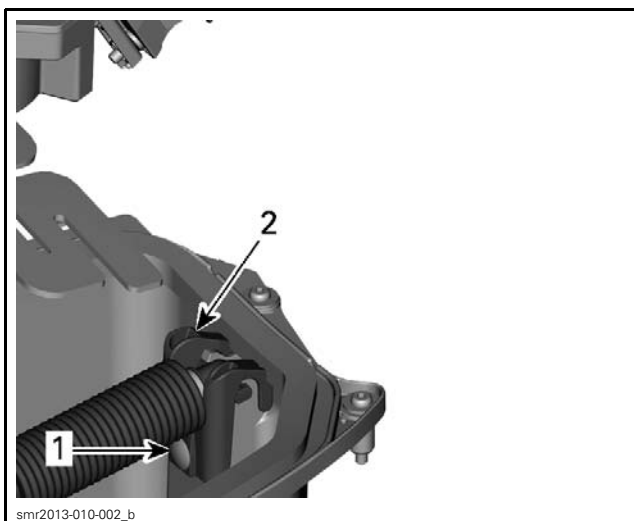
BOARDING PLATFORM (MODELS WITH SUSPENSION)



1. Boarding platform

Removing the Boarding Platform

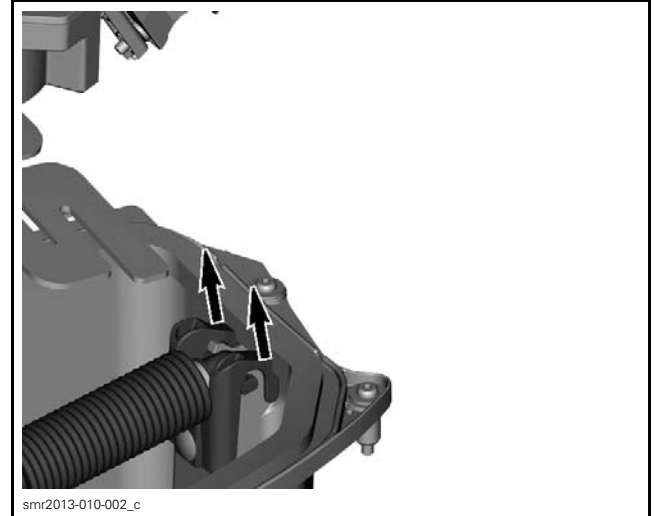
1. Unlatch the boarding platform.
2. Open boarding platform completely.
3. Remove plastic dart securing rear shock assembly support.



TYPICAL - PARTS REMOVED FOR CLARITY

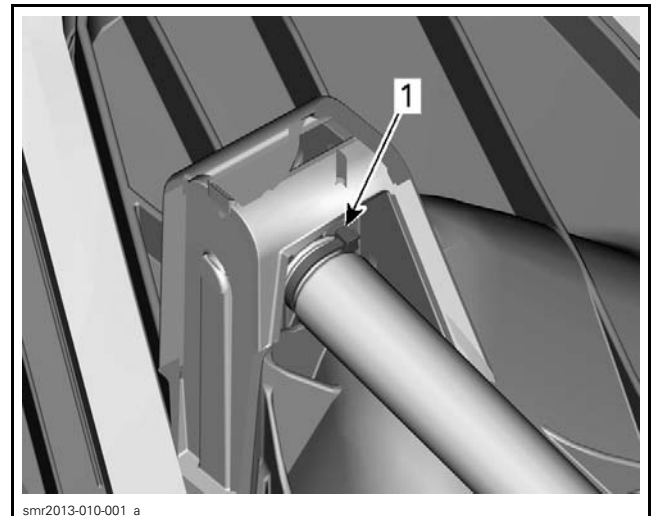
1. Plastic dart
2. Rear shock assembly support

4. Remove rear shock assembly support.



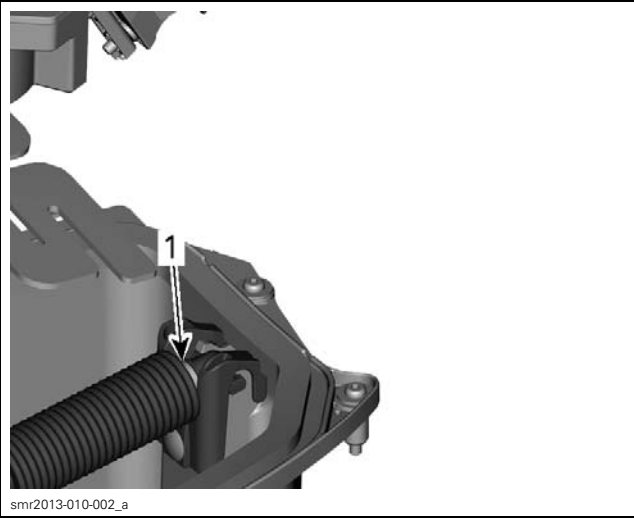
TYPICAL - PARTS REMOVED FOR CLARITY

5. Remove front shock assembly support.
6. Cut locking ties retaining the bellows of gas shock.



1. Cut this locking tie

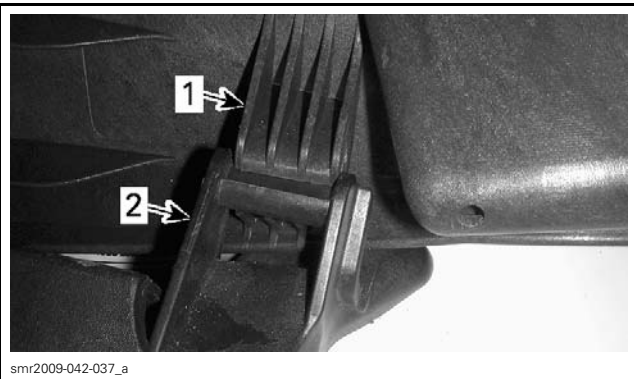
Subsection XX (BODY (GTX_RXT AND WAKE PRO SERIES))



TYPICAL

1. Cut this locking tie

7. Move bellows downward.
8. Unscrew gas shock from its upper attachment.
9. Remove gas shock from vehicle.
10. Align boarding platform hinge openings with flat sides of fixed hinges.



1. Boarding platform hinge
2. Fixed hinge

11. Remove boarding platform.

Installing the Boarding Platform

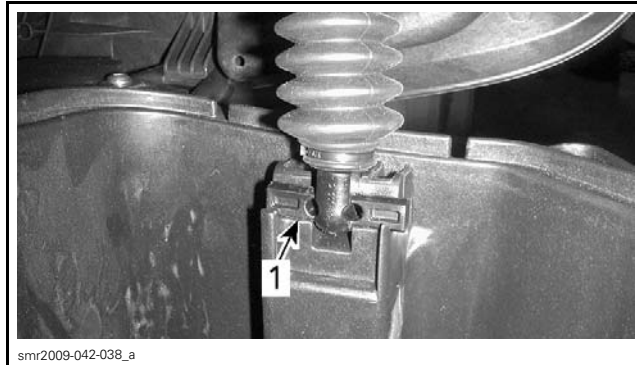
1. Remove gas shock attachment from boarding platform.
2. Apply LOCTITE 414 (P/N 413 705 800) on threads of shock absorber body.
3. Manually tighten the attachment on gas shock.
4. Install the bellows and secure it using a locking tie.
5. Install the gas shock on cover.

NOTE: The corrugated section of bellows must point downward.

6. Align boarding platform hinge openings with flat sides of fixed hinges.

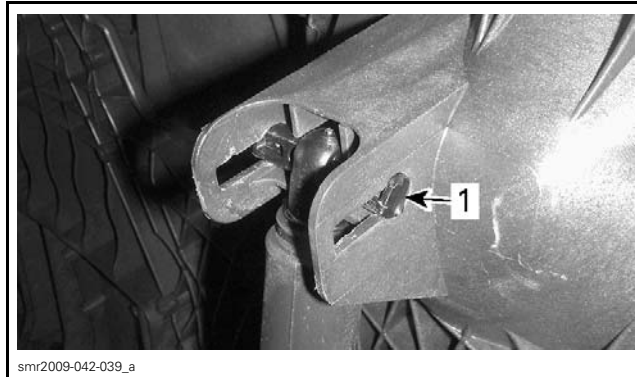
7. Push in the boarding platform to assemble hinges.
8. Position the bottom of the gas shock on cavity opening.

NOTICE To avoid breaking the attachment, do not force to insert it in cavity.



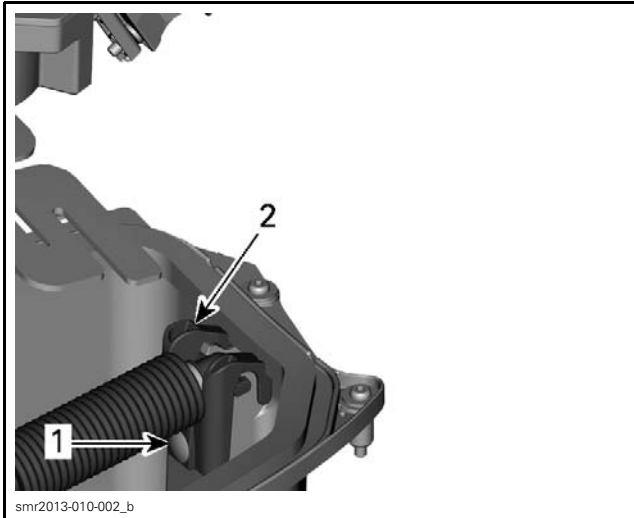
1. Lower attachment on cavity opening

NOTE: Make sure upper attachment is properly inserted in its slots.



1. Upper attachment

9. Install rear shock assembly support onto rear shock and securing in place using plastic dart.

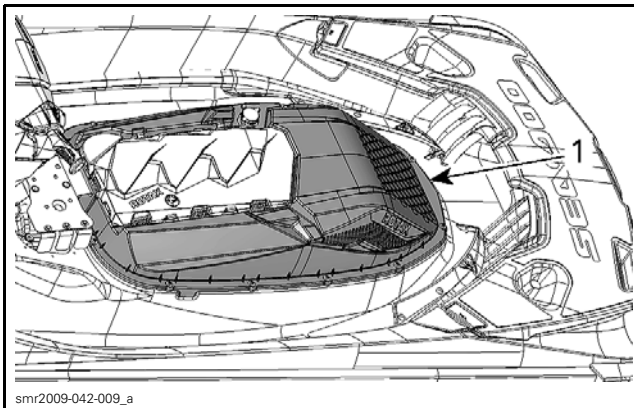


TYPICAL - PARTS REMOVED FOR CLARITY

1. Plastic dart
2. Rear shock assembly support

10. Close boarding platform to lock the bottom of the gas shock.
11. Lock boarding platform.

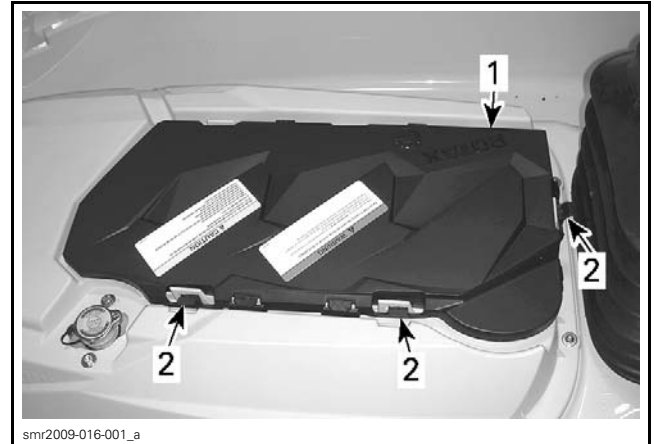
DECK EXTENSION (MODELS WITH SUSPENSION)



1. Deck extension

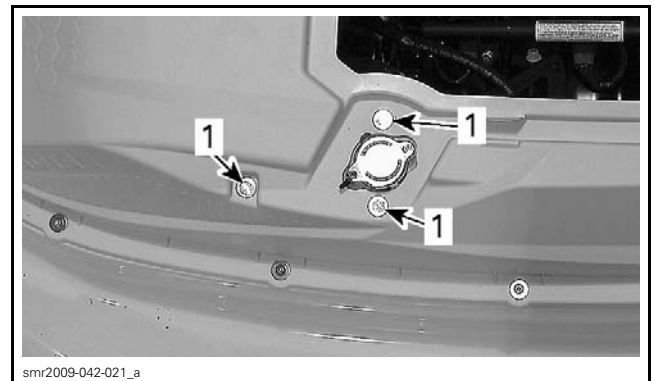
Removing the Deck Extension

1. Open seat.
2. Remove the rear ventilation box.



1. Rear ventilation box
2. Retaining latches

3. Close seat.
4. Tilt the *MOVING DECK*, see procedure in this subsection.
5. Remove coolant reservoir screws.



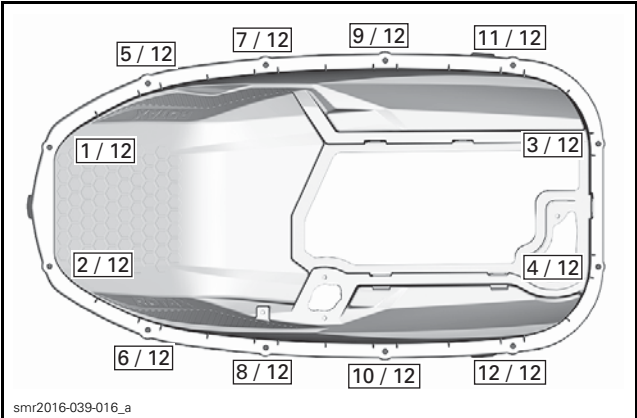
1. Coolant reservoir screws

6. Remove all screws retaining deck extension to fixed deck.
7. Remove the deck extension.

Installing the Deck Extension

1. Position the deck extension.
2. Install all screws retaining deck extension.
3. Tighten screws to specification as per following sequence.

TIGHTENING TORQUE	
Deck extension screw	1.7 N•m ± 0.1 N•m (15 lbf•in ± 1 lbf•in)



NOTICE Do not tighten screws over this recommended torque. Otherwise, the rubber grommet could turn and screw will be hard to remove.

4. Install and tighten coolant reservoir screws to specification.

TIGHTENING TORQUE	
Coolant reservoir screw	$5\text{ N}\cdot\text{m} \pm 1\text{ N}\cdot\text{m}$ (44 lbf·in $\pm$ 9 lbf·in)

5. Reposition moving deck. Refer to *MOVING DECK* in this subsection.

MOVING DECK (MODELS WITH SUSPENSION)



The moving deck is comprised of:

- Front storage cover
- Front body module
- Steering
- Seat
- Foot wells.

The moving deck is attached to the intelligent suspension and moves as a single unit.

The moving deck does not comprise the boarding platform and the rear storage bins.

It is possible to tilt the moving deck for servicing the watercraft, such as:

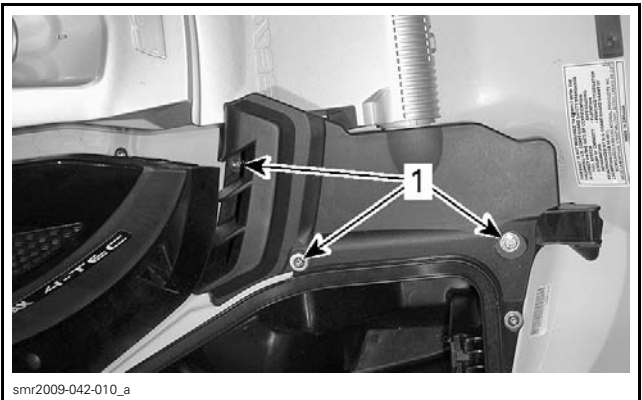
- Deck extension removal
- Working on air intake system
- Suspension position sensor replacement
- Suspension hydraulic pump replacement.

The moving deck removal is also required for major repairs, such as:

- Engine removal
- Suspension component removal (except suspension position sensor)
- Fuel tank removal.

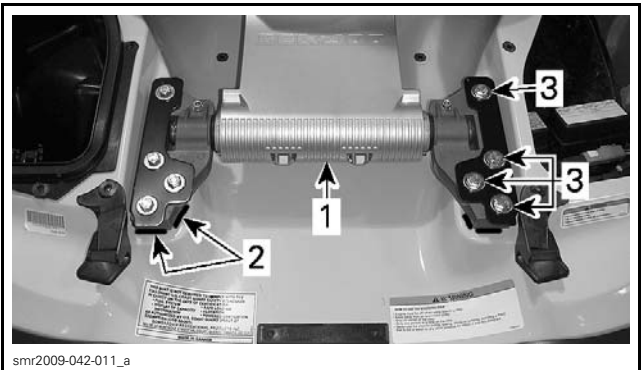
Tilting Moving Deck for Servicing Watercraft

1. Remove the *BOARDING PLATFORM*, see procedure in this subsection.
2. Remove bolts securing both rear suspension arm covers.



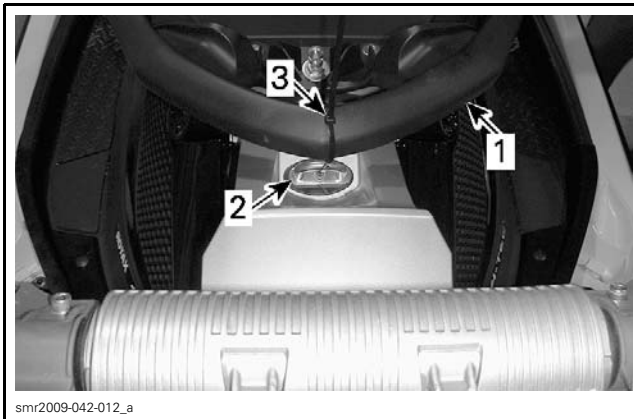
1. Cover screws

3. Mark position of rear suspension arm brackets for proper reinstallation.
4. Remove and discard screws securing rear suspension arm to fixed deck.



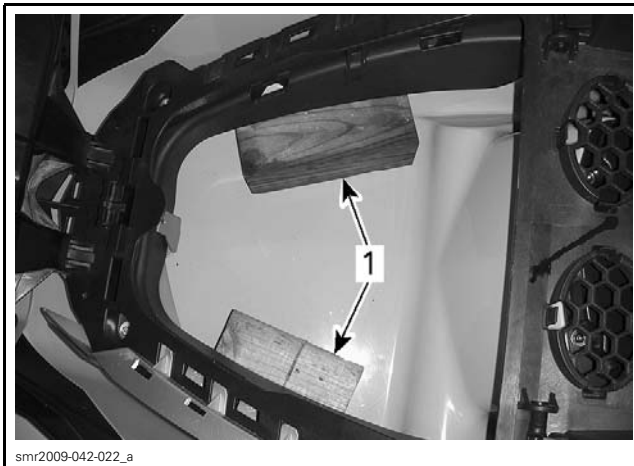
1. Rear suspension arm
2. Reinstallation marks
3. Screws (discard)

5. Lift the rear suspension arm against seat handle and attach it with locking tie or strap.



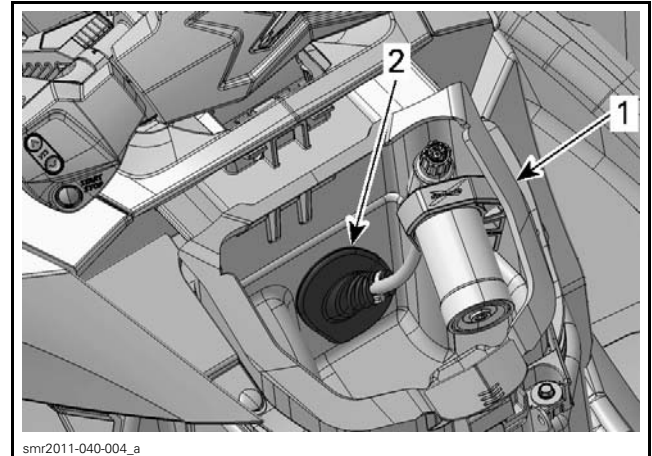
1. Seat handle
2. Ski/wakeboard attachment
3. Locking tie

6. Install two pieces of wood (4 x 4) under moving deck front area as shown to avoid potential damage when lifting the moving deck.



1. Pieces of wood

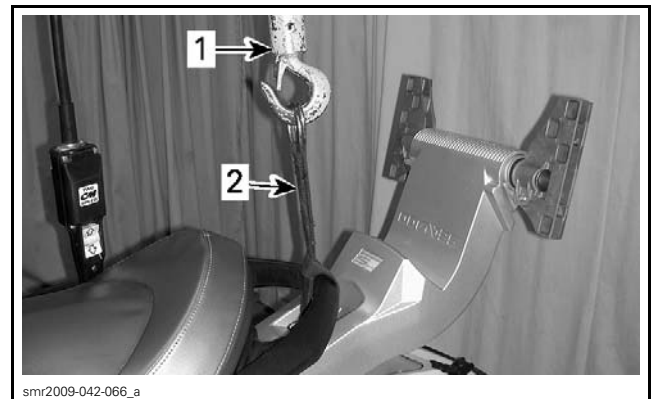
7. Place steering in its lower position.
8. On aS models, ensure that remote reservoir hose has enough free length before tilting the moving deck.
 - If hose is too tight, remove remote reservoir retaining screws then move hose inside deck.



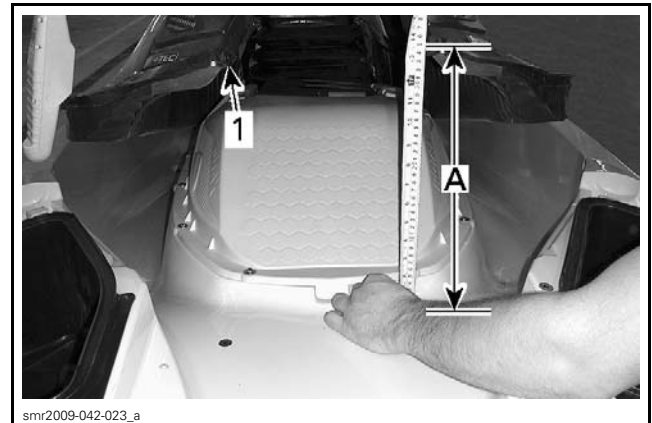
aS MODEL

1. Remote reservoir retaining screws (2x)
2. Hose bellows

9. Using suitable lifting devices, raise the rear of moving deck to 340 mm (13-1/2 in).



1. Hoist
2. Lifting strap



1. Use this rivet as reference point
- A. 340 mm (13-1/2 in)

NOTICE Lifting the rear of moving deck more than the recommended height can damage the steering cable and the remote reservoir hose.

Lowering Back Moving Deck

- 1. Carefully lower and secure the rear suspension arm to the fixed deck.
 - 1.1 Position the rear suspension arm brackets in accordance with the reference marks previously drew on fixed deck.
- 1.2 Install **NEW** screws to secure rear suspension arm brackets.
- 1.3 Tighten screws to specification.

NOTICE If no mark was trace, refer to *iS SUSPENSION* subsection for proper procedure to install and align the rear suspension arm.

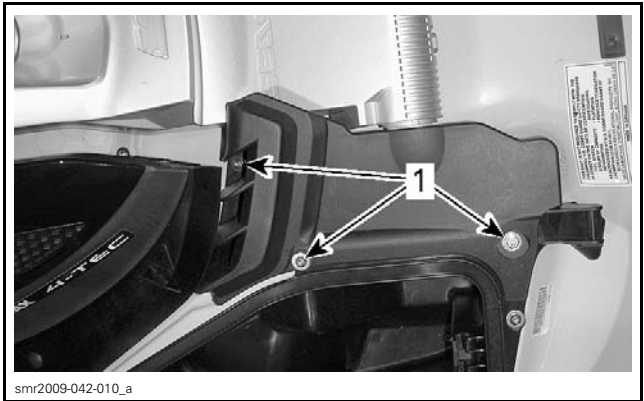
TIGHTENING TORQUE	
Rear suspension arm screw	25 N•m ± 3 N•m (18 lbf•ft ± 2 lbf•ft)

- 2. Detach lifting device.
- 3. Remove pieces of wood located under the front of moving deck.

Removing the Moving Deck for Servicing Watercraft

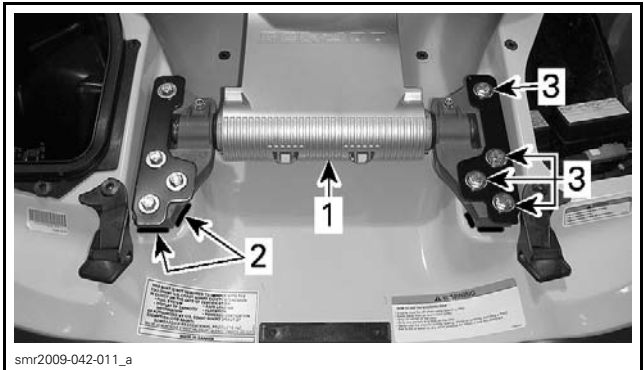
- 1. Open the front storage cover and remove the front basket.
- 2. On aS models, remove remote reservoir from moving deck as follows:
 - 2.1 Remove both retaining screws.
 - 2.2 Detach hose bellows from moving deck.
 - 2.3 Insert remote reservoir into moving deck hole.

- 4. Remove bolts securing both rear suspension arm covers.



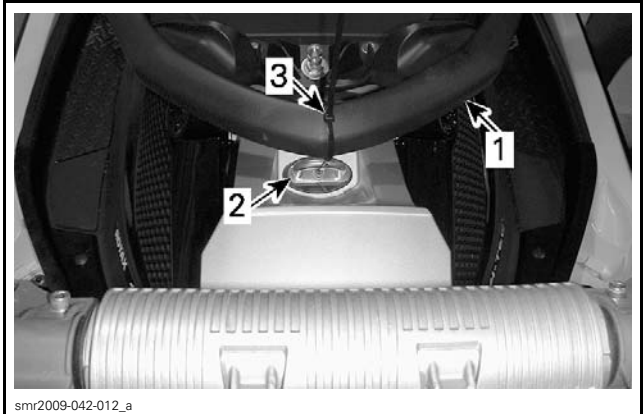
1. Cover screws

- 5. Mark position of rear suspension arm brackets for proper reinstallation.
- 6. Remove and discard screws securing rear suspension arm to fixed deck.

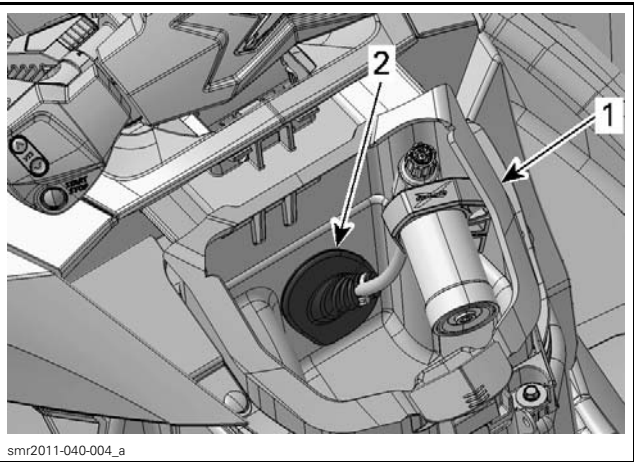


1. Rear suspension arm
2. Reinstallation marks
3. Screws (discard)

- 7. Lift and attach the rear suspension arm against seat handle.



1. Seat handle
2. Ski/wakeboard attachment
3. Locking tie



aS MODEL
1. Remote reservoir retaining screws (2x)
2. Hose bellows

- 3. Remove the *BOARDING PLATFORM*, see procedure in this subsection.

8. Manually tip up the front of moving deck and install a piece of wood (2 x 4) between fixed deck and each lateral supports.



FROM THE FRONT OF VEHICLE

1. RH lateral support
2. Piece of wood

9. Detach moving deck from lateral supports.

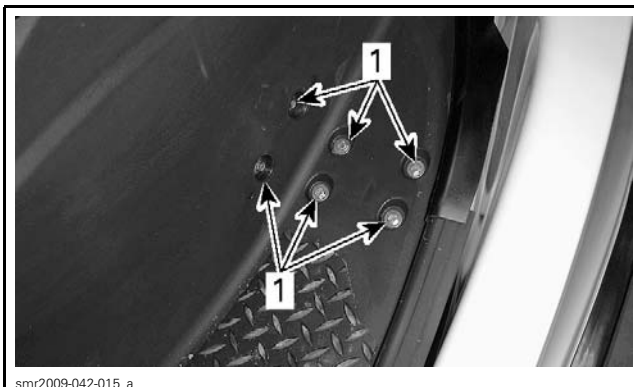
- 9.1 Remove front carpet of foot wells and protective caps on both sides of the moving deck. Discard the front carpets.



RH SIDE SHOWN

1. Front carpet (discard)
2. Protective cap

- 9.2 Remove and discard screws securing moving deck to lateral supports.

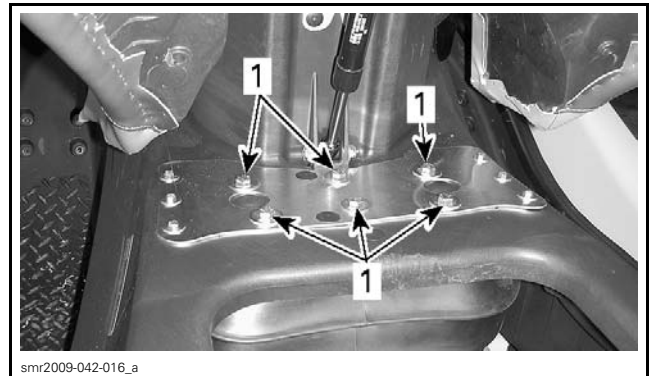


RH SIDE SHOWN

1. Retaining screws (discard)

10. Open seat.

11. Remove and discard M8 screws securing the suspension mounting plate and moving deck.

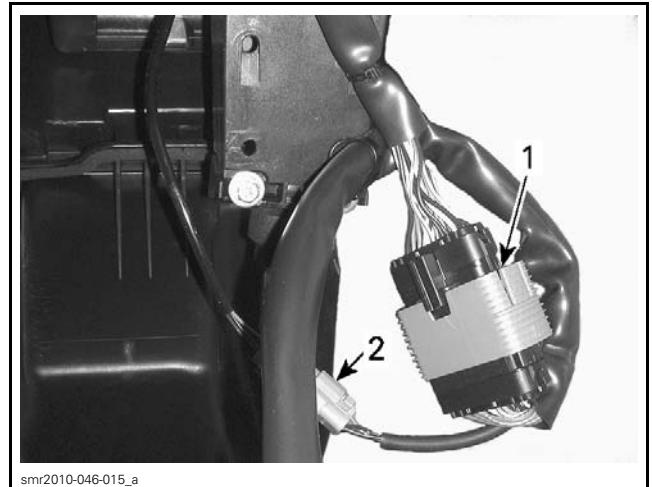


1. Moving deck central screws (to discard)

12. Close seat.

13. Remove the gauge support. Refer to *INFORMATION CENTER (GAUGE)* subsection.

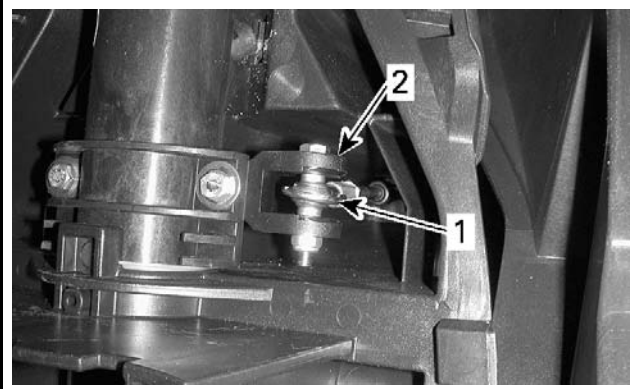
14. Disconnect both connectors under moving deck.



1. Steering connector
2. O.T.A.S. connector

15. Detach steering cable from steering column.

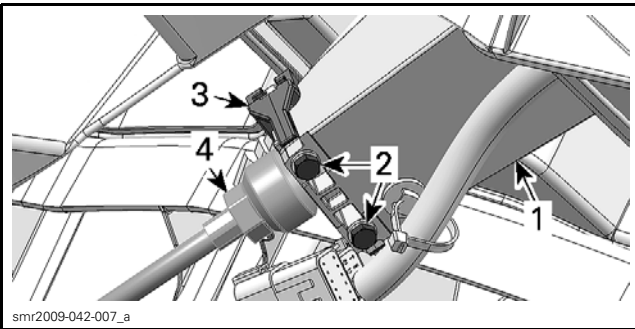
- 15.1 Remove bolt securing ball joint to steering column.



- smr2009-042-006_a
1. Steering cable ball joint
 2. Steering column

15.2 Remove bolts retaining steering cable clamp.

15.3 Unlatch steering cable clamp.



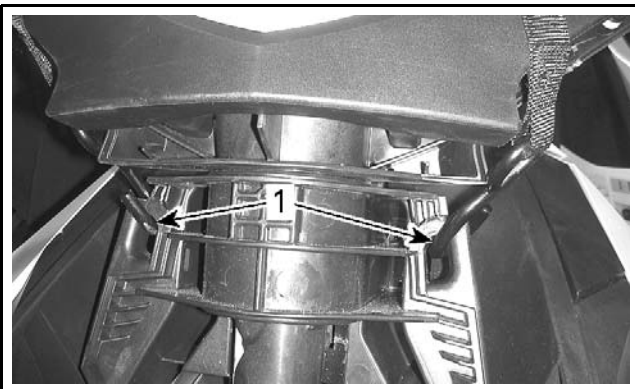
- smr2009-042-007_a
1. Steering column
 2. Steering column clamp bolts
 3. Steering column clamp
 4. Steering cable adjusting nut

15.4 Place steering in its lower position.

15.5 Free steering cable from fixed clamp.

16. Install lifting straps.

16.1 Using both mooring cleats under steering, install two lifting straps.



- smr2009-042-079_a
1. Front lifting strap hooks into steering mooring cleats

16.2 Install another lifting strap on seat handle.

17. Attach all lifting straps to an lifting device to lift the moving deck.

CAUTION Make sure lifting device is located at the center of the vehicle to rise moving deck horizontally.

18. Raise moving deck slowly and drive steering cable out of steering column.

19. Place the moving deck on a level surface.

Installing the Moving Deck

1. Install 2 pieces of wood under lateral supports.

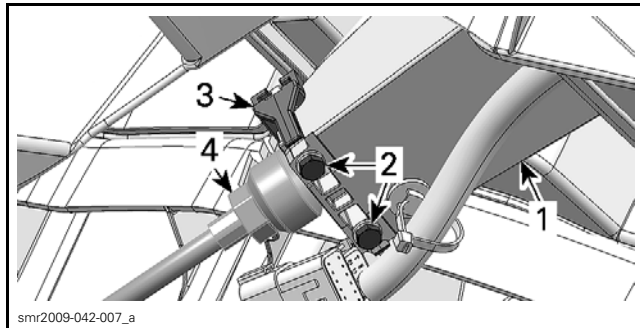


smr2009-042-071

2. Slowly, lower the moving deck just enough to be able to insert the end of steering cable in steering column.

NOTICE Make sure not to pinch electrical harness while lowering the moving deck.

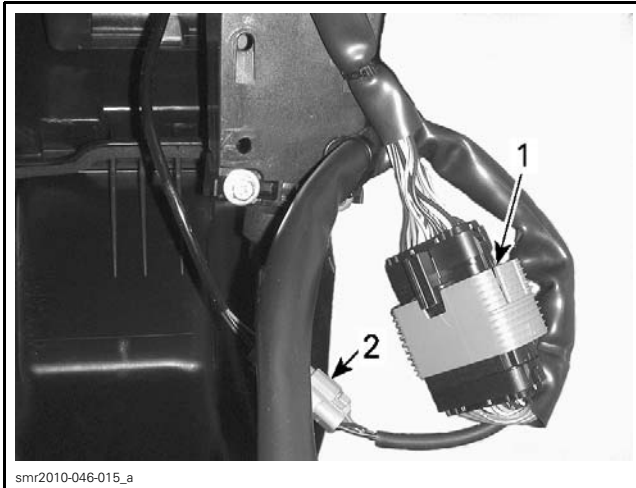
3. Install steering cable clamp and its bolts. Do not tighten bolts yet.



smr2009-042-007_a

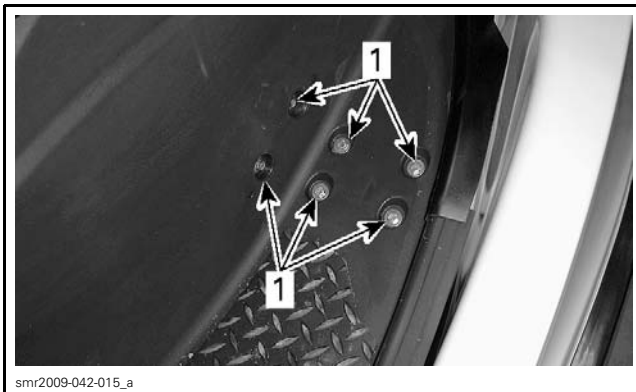
1. Steering column
2. Steering column clamp bolts
3. Steering column clamp
4. Steering cable adjusting nut

4. Connect both electrical connectors under moving deck.



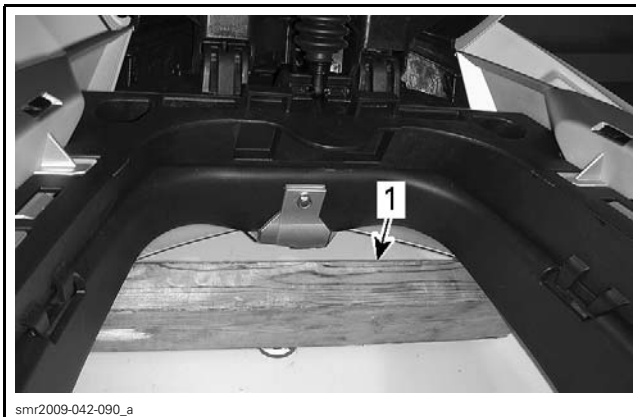
1. Steering connector
2. O.T.A.S. connector

5. Lower the front of moving deck and secure it on both lateral supports using **NEW** screws.



- RH SIDE SHOWN**
1. Retaining screws (new)

6. Remove pieces of wood located under lateral supports and reposition one under moving deck front area.

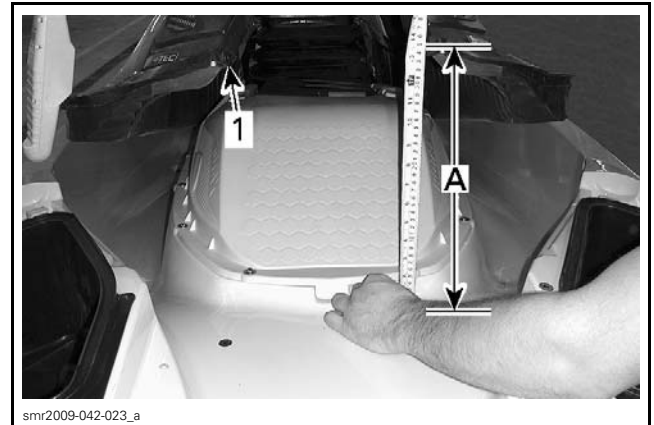


1. Install piece of wood here

7. Remove the front lifting straps.
8. Open seat.

9. Raise rear of moving deck until suspension is clear of moving deck.

NOTICE Do not raise the rear of moving deck more than 340 mm (13-1/2 in).

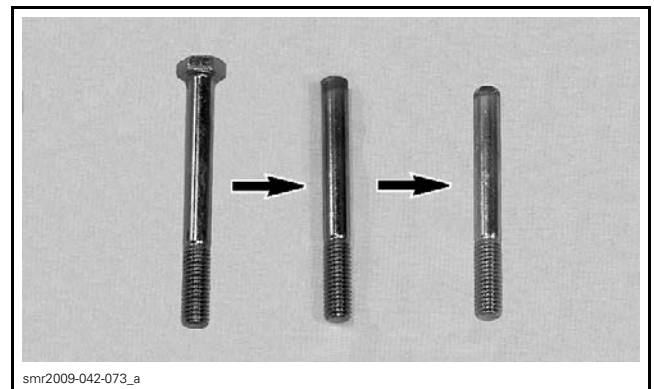


1. Use this rivet as reference point
- A. 340 mm (13-1/2 in)

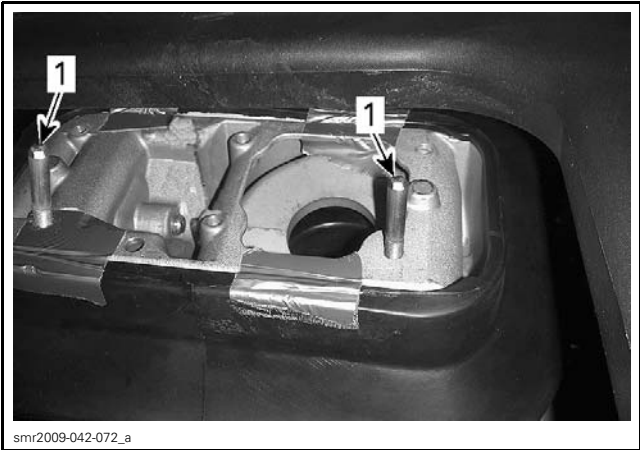
10. Install two homemade alignment pins on suspension mounting plate.

10.1 Take two M8 x 50 bolts and cut their heads.

10.2 Grind down the cut ends to make a rounded shape.



10.3 Install alignment pins into the 2 rear outside positions of suspension mounting plate.



1. Alignment pins

- 11. Position the moving deck so that alignment pins are aligned with suspension reinforcement plate holes.
 - 12. Lower the moving deck over alignment pins.
 - 13. Install **NEW** M8 screws to secure the moving deck to suspension mounting plate.
- NOTE:** Remove the alignment pins only when 2 screws are engaged in mounting plate.
- 14. Tighten screws to specification.

TIGHTENING TORQUE	
Moving deck screw	25 N•m ± 3 N•m (18 lbf•ft ± 2 lbf•ft)

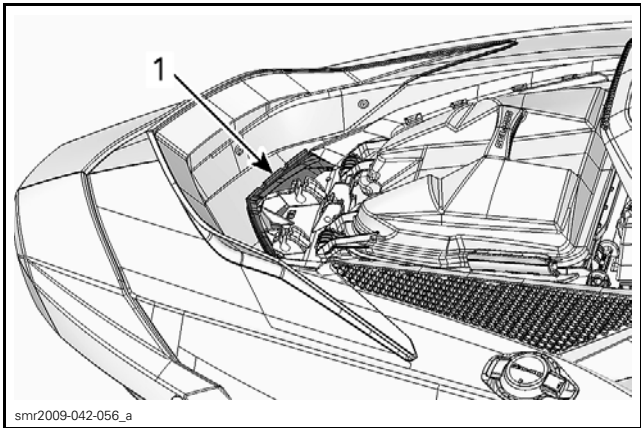
- 15. Close seat.
 - 16. Carefully lower and secure the rear suspension arm to the fixed deck.
 - 16.1 Position the rear suspension arm brackets in accordance with the reference marks previously drew on fixed deck.
- NOTICE** If no mark was trace, refer to *iS SUSPENSION* subsection for proper procedure to install and align the rear suspension arm.
- 16.2 Install **NEW** screws to secure rear suspension arm brackets.
 - 16.3 Tighten screws to specification.

TIGHTENING TORQUE	
Rear suspension arm screw	25 N•m ± 3 N•m (18 lbf•ft ± 2 lbf•ft)

- 17. Remove rear lifting strap.
- 18. Attach steering cable to steering column.
- 19. Install gauge support. Refer to *INFORMATION CENTER (GAUGE)* subsection.

- 20. On aS models, install remote reservoir on moving deck.
- 21. Install **NEW** front carpets on foot wells and protective caps on moving deck.
- 22. Check steering alignment then tighten steering clamp bolts. Refer to *STEERING* subsection.

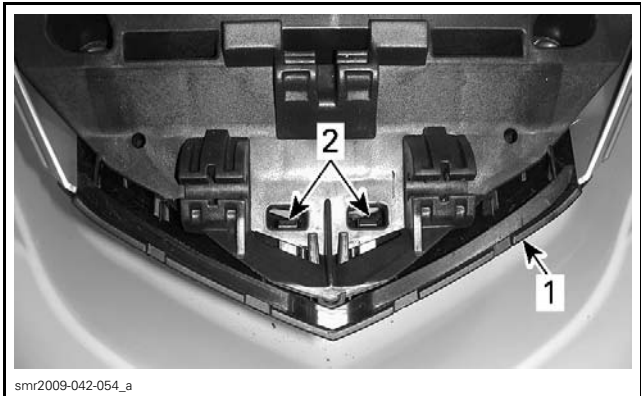
FRONT GRILLE
(MODELS WITH SUSPENSION)



LOCATED UNDER STORAGE COMPARTMENT COVER
1. Front grille

Removing the Front Grille

- 1. Remove the *STORAGE COMPARTMENT COVER*, see procedure in this subsection.
- 2. Press on both tabs securing front grille to front body module.



1. Front grille
2. Retaining tabs

- 3. Remove grille.

Installing the Front Grille

The installation is the reverse of the removal procedure.

SPLASH DEFLECTOR (MODELS WITH SUSPENSION)

Removing the Splash Deflector



1. To remove the splash deflector, drill out the 4 rivets securing the splash deflector to the fixed deck.
2. Pull the deflector from the fixed deck.

NOTICE A molded location pin at each end of the deflector are each inserted into the fixed deck. Be careful not to break them when removing the deflector.

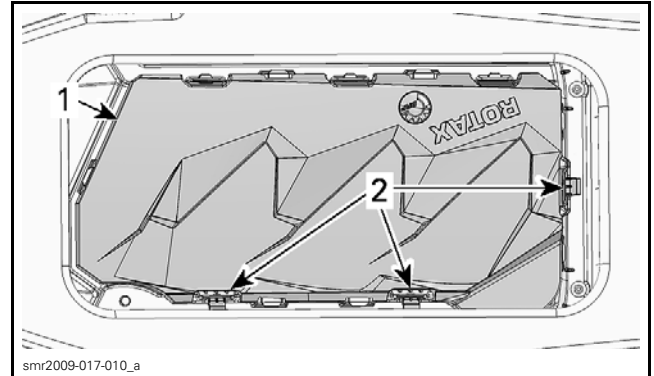
Installing the Splash Deflector

1. Position the splash deflector over the forward end of the fixed deck and press the guide pins into the holes provided in the deck.
2. Install four new rivets to secure the deflector to the deck.

REAR VENTILATION BOX (MODELS WITH SUSPENSION)

Removing the Rear Ventilation Box

1. Open seat.
2. Release all retaining latches.



1. Ventilation box
2. Retaining latches

3. Remove the ventilation box.

Installing the Rear Ventilation Box

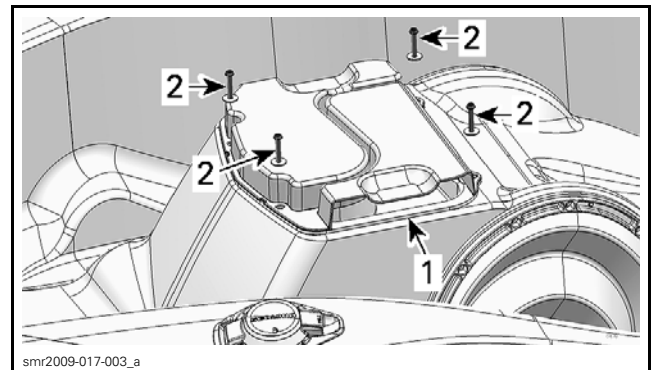
The installation is the reverse of the removal procedure. However, pay attention to the following. Before installing the ventilation box, check the condition of its seal.

If the seal is damaged, replace the ventilation box as an assembly.

FRONT VENTILATION BOX (MODELS WITH SUSPENSION)

Removing the Front Ventilation Box

1. Open the front storage cover and remove the storage basket.
2. Remove screws securing the ventilation box to fixed deck.



1. Front ventilation box
2. Retaining screws

3. Remove the ventilation box.

Installing the Front Ventilation Box

The installation is the reverse of the removal procedure. However, pay attention to the following. Before installing the ventilation box, check the condition of its seal.

Subsection XX (BODY (GTX_RXT AND WAKE PRO SERIES))

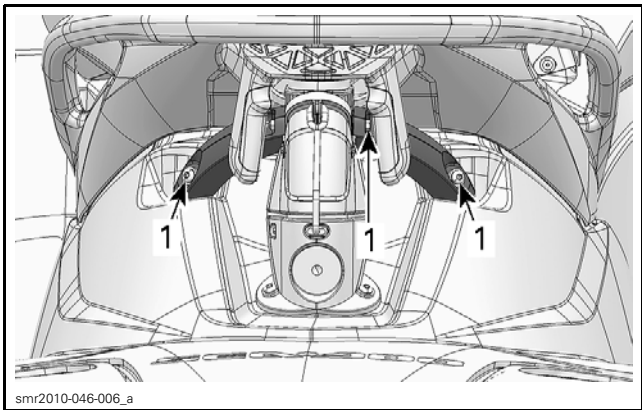
If the seal is damaged, replace the ventilation box.
Tighten ventilation box screws to specification.

TIGHTENING TORQUE	
Ventilation box screw	1.2 N•m ± 0.1 N•m (11 lbf•in ± 1 lbf•in)

WAKE PYLON (WAKE PRO 215)

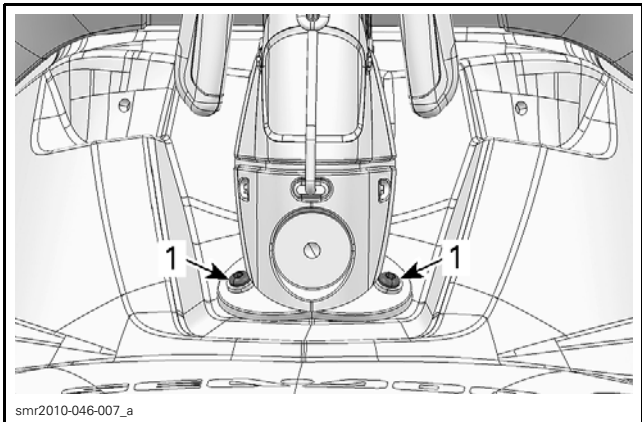
Removing the Wake Pylon

Open the seat.
Remove both lateral arms.



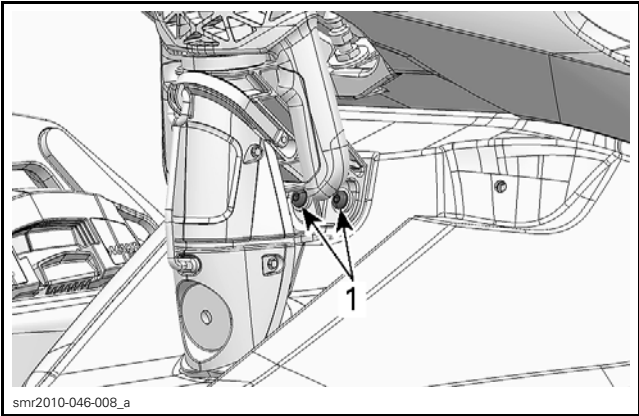
1. Lateral arms screws

Remove bolts and nuts at the bottom of wake pylon.



1. Wake pylon bottom bolts

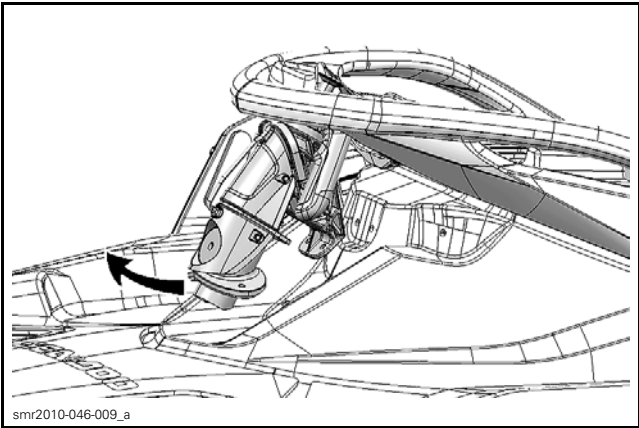
Remove bolts and nuts securing the wake pylon support to body.



1. Wake pylon support bolts

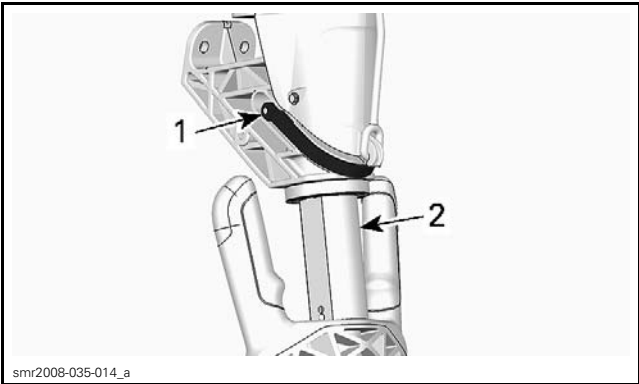
Lift the wake pylon to disengage its bottom from the body.

Slide the bottom of the wake pylon rearward to remove the wake pylon from vehicle.



Disassembling the Wake Pylon

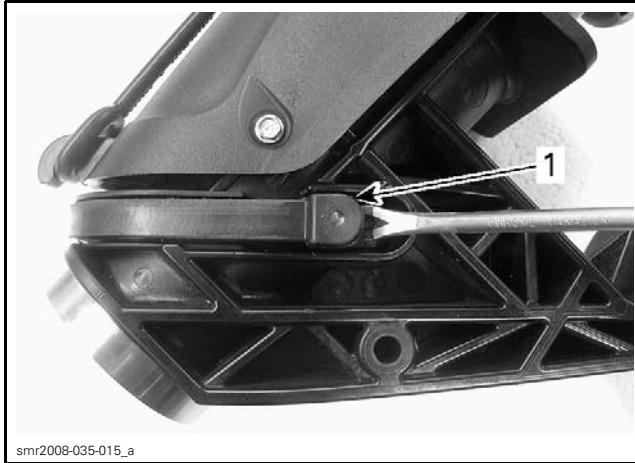
Extend the handle completely.
Turn the wake pylon upside down.
Move both ends of locking strap to disengage the inner lock and free the handle.



1. Locking strap end
2. Handle stem

Locking Strap

Using a screwdriver or any other suitable tool, detach a side of the locking strap from retaining pin.

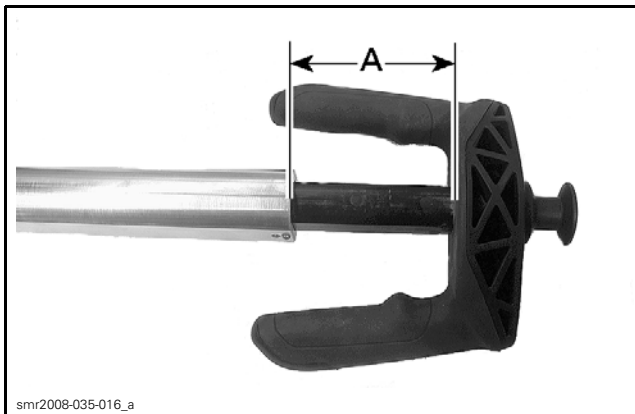


1. Locking strap

Remove locking strap and the inner lock.

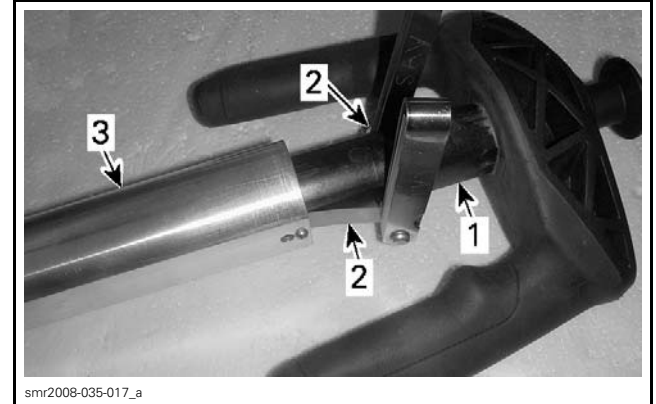
Handle

Extend handle approximately 75 mm to 90 mm (3 in to 3-1/2 in).



A. 75 mm to 90 mm (3 in to 3-1/2 in)

Insert two thin feeler gauges between handle stem and extension tube.



1. Handle stem
2. Feeler gauges
3. Extension tube

Place a rag around the joint to catch balls and spring.

Hold feeler gauges and pull the handle.

Assembling the Wake Pylon

Handle

Install a loose locking tie on handle stem.

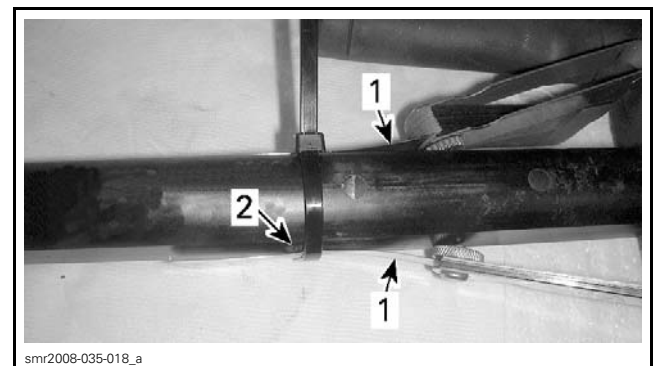
Apply XPS SYNTHETIC GREASE (P/N 293 550 010) on each ends of spring.

Insert the spring in the handle stem hole.

Position a ball on each ends of spring.

Install a feeler gauge over each balls.

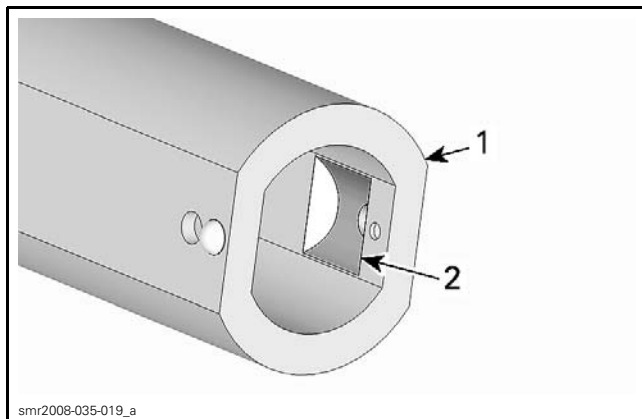
Tighten the locking tie in order to retain feeler gauges and balls.



1. Feeler gauges
2. Ball

Apply XPS SYNTHETIC GREASE (P/N 293 550 010) in both recesses of the extension tube.

Subsection XX (BODY (GTX_RXT AND WAKE PRO SERIES))



1. Extension tube
2. Recesses

Slide the handle stem into the extension tube.
Remove feeler gauges and locking tie.

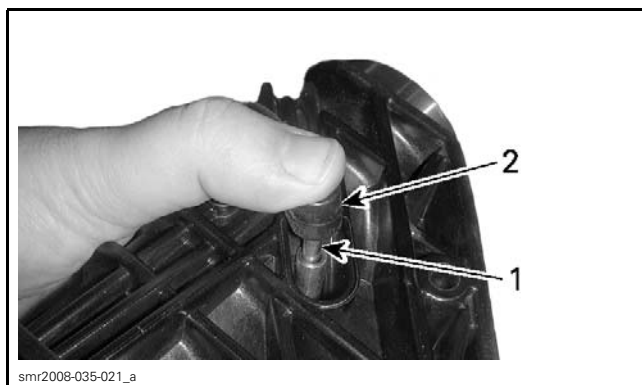
Locking Strap

Remove the wake pylon trim.



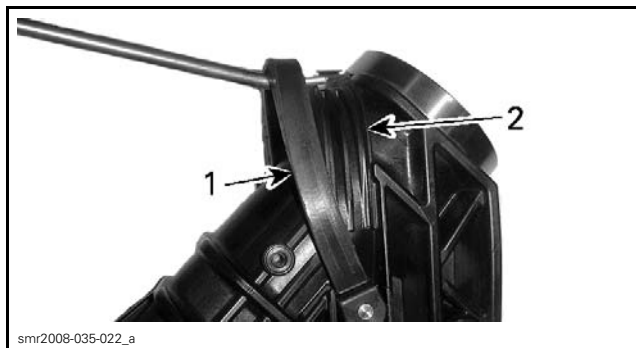
1. Wake pylon trim screws

Install lock and insert the end of the locking strap over the retaining pin.



1. Retaining pin
2. Locking strap

Using a suitable tool, position the locking strap in its groove.



1. Locking strap
2. Locking strap groove

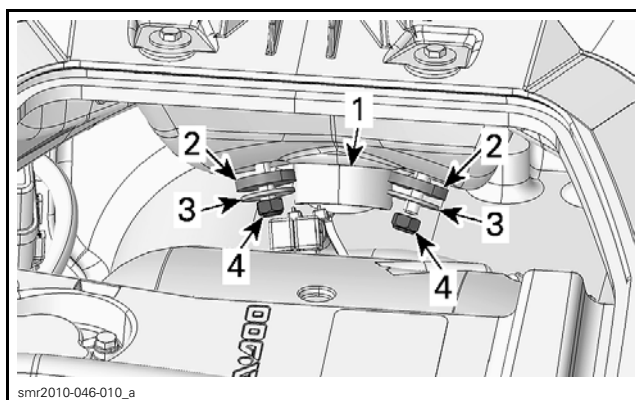
Reinstall the wake pylon trim.

Do not install the handle into wake pylon yet.

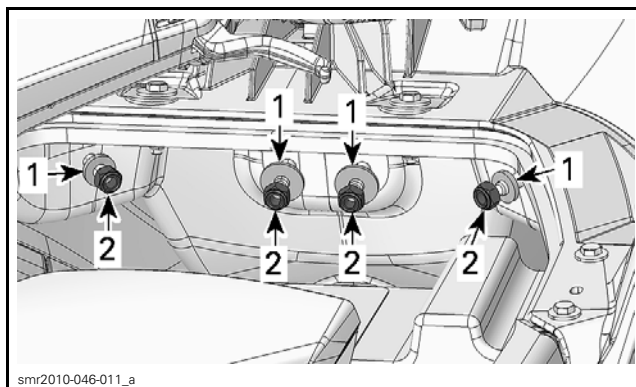
Installing the Wake Pylon

Position the wake pylon on vehicle.

Install and secure wake pylon and lateral arms using previously removed fasteners and new elastic stop nuts.



1. Bottom of wake pylon
2. Rubber washers
3. Flat washers
4. New elastic stop nuts



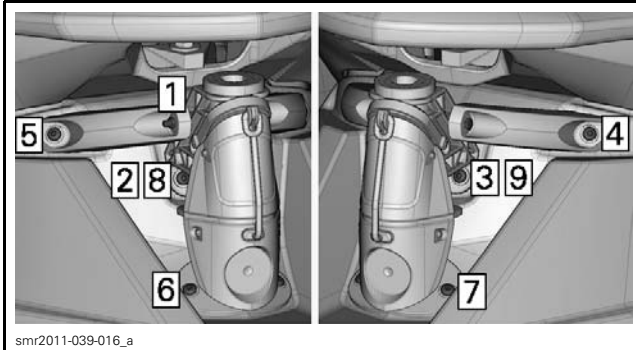
1. Flat washers
2. New elastic stop nuts

Tighten all nuts by hand.

Ensure base of wake pylon is well leaned against body.

Tighten all nuts to specification as per the following sequence.

TIGHTENING TORQUE	
Nut securing wake pylon to lateral arms	8 N•m ± 1 N•m (71 lbf•in ± 9 lbf•in)
Lateral arms and wake pylon nuts	11.5 N•m ± 1.5 N•m (102 lbf•in ± 13 lbf•in)



TIGHTENING SEQUENCE

Insert the handle into the wake pylon.

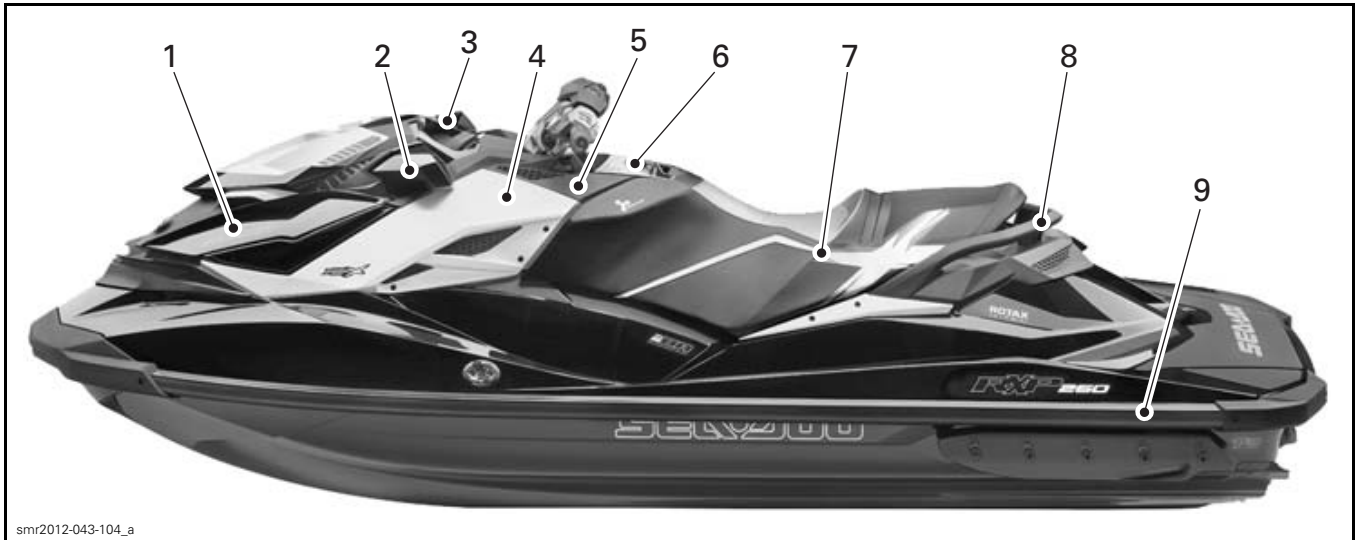
Move both ends of the locking strap forward to fully insert the handle.

BODY (RXP-X SERIES)

SERVICE TOOLS

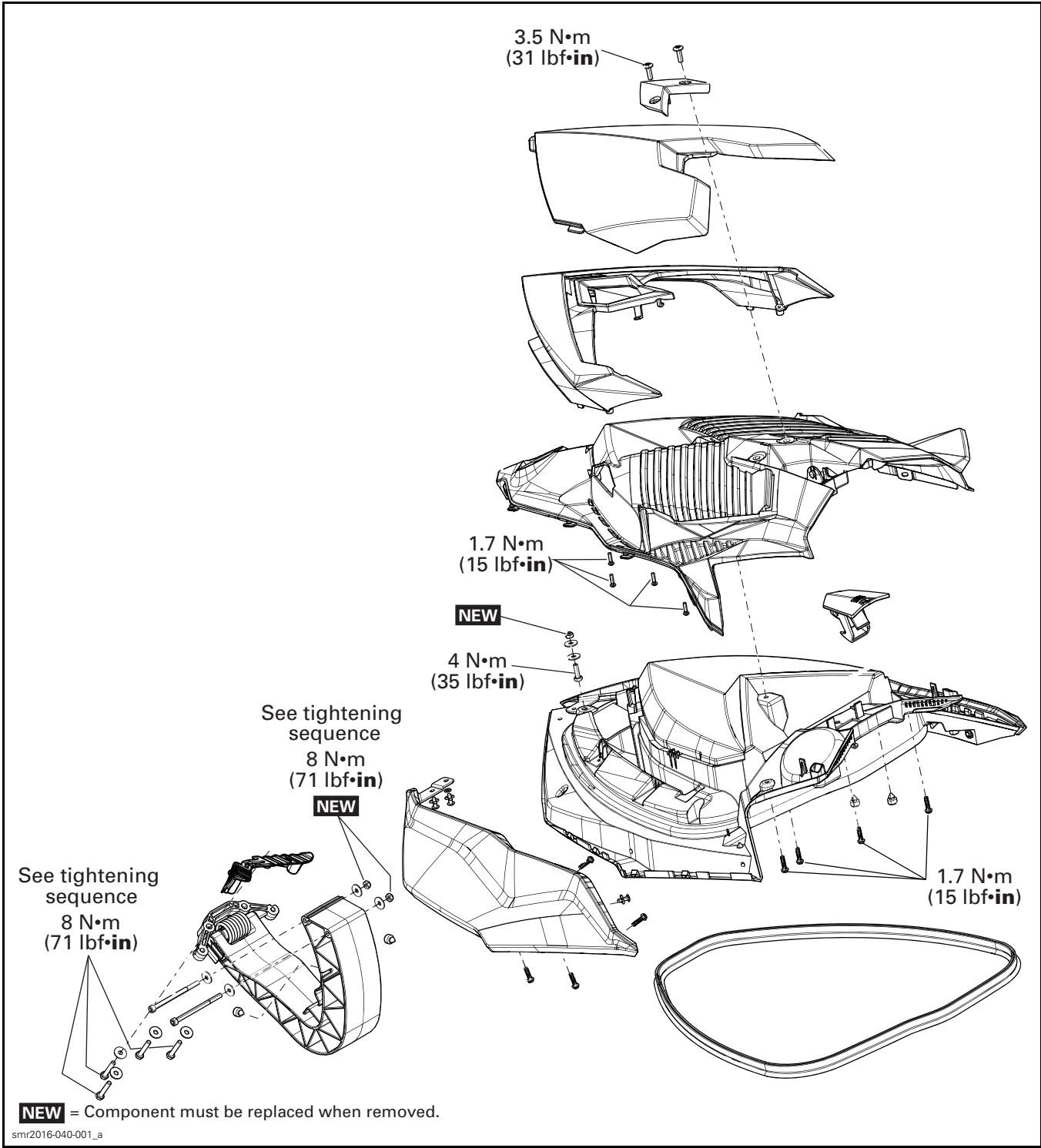
Description	Part Number	Page
SUPERTANIUM DRILL BIT 3/16".....	529 031 800	11-12, 14

BODY PARTS NOMENCLATURE

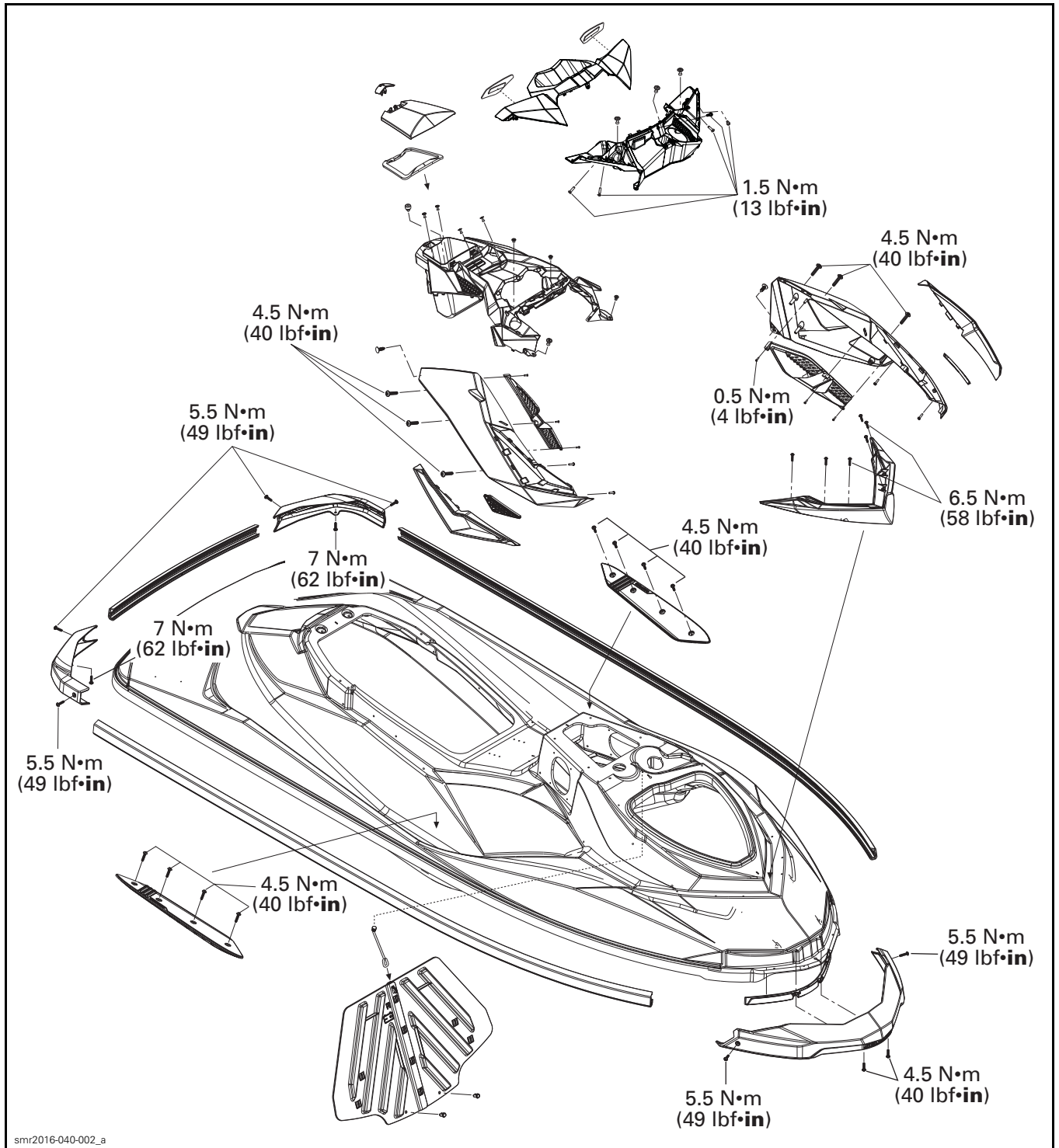


1. Storage compartment cover
2. Mirror support
3. Gauge trim
4. Lateral trim panel
5. Console
6. Glove box cover
7. Seat
8. Rear handle
9. Bumper

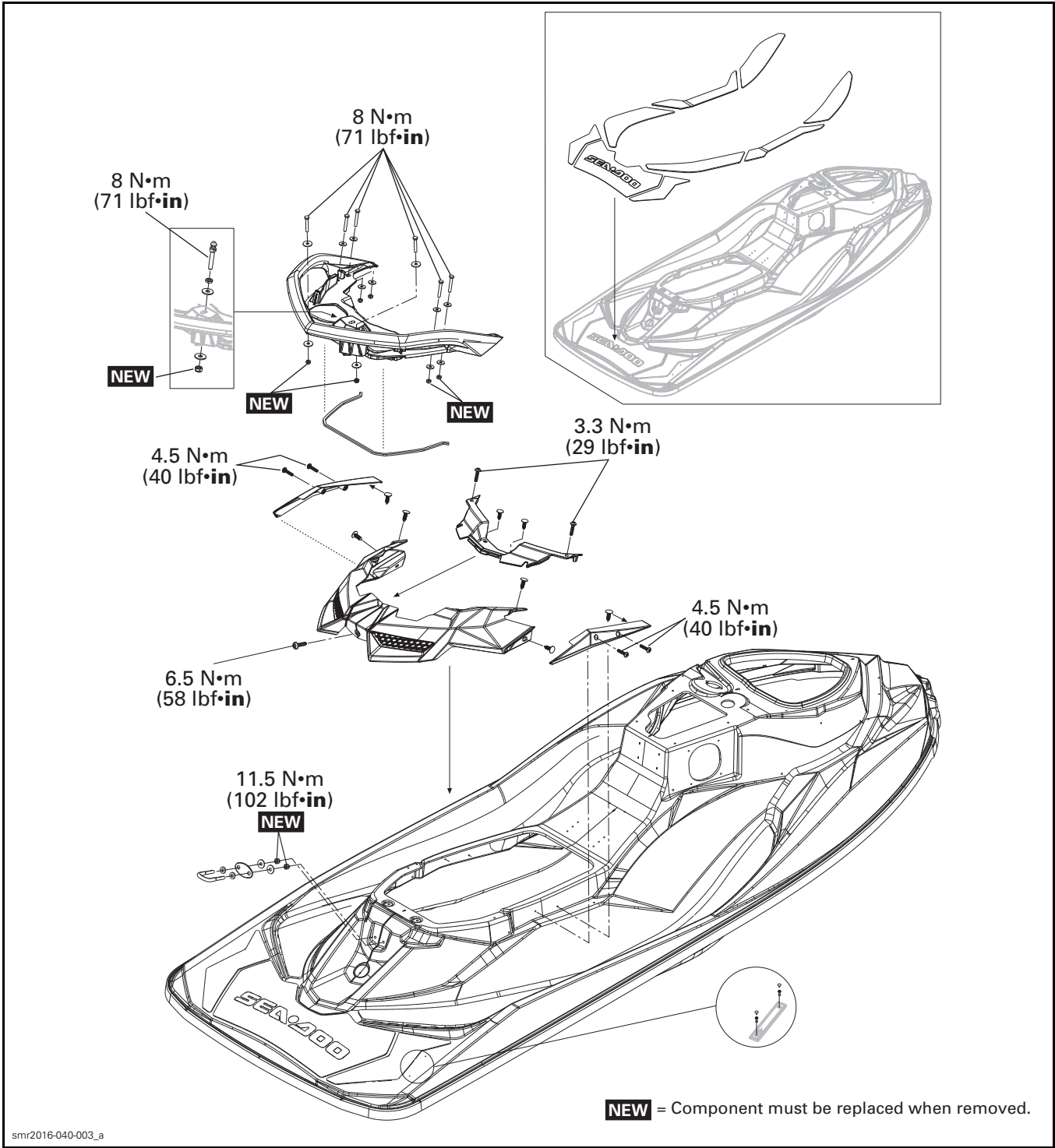
STORAGE COMPARTMENT COVER



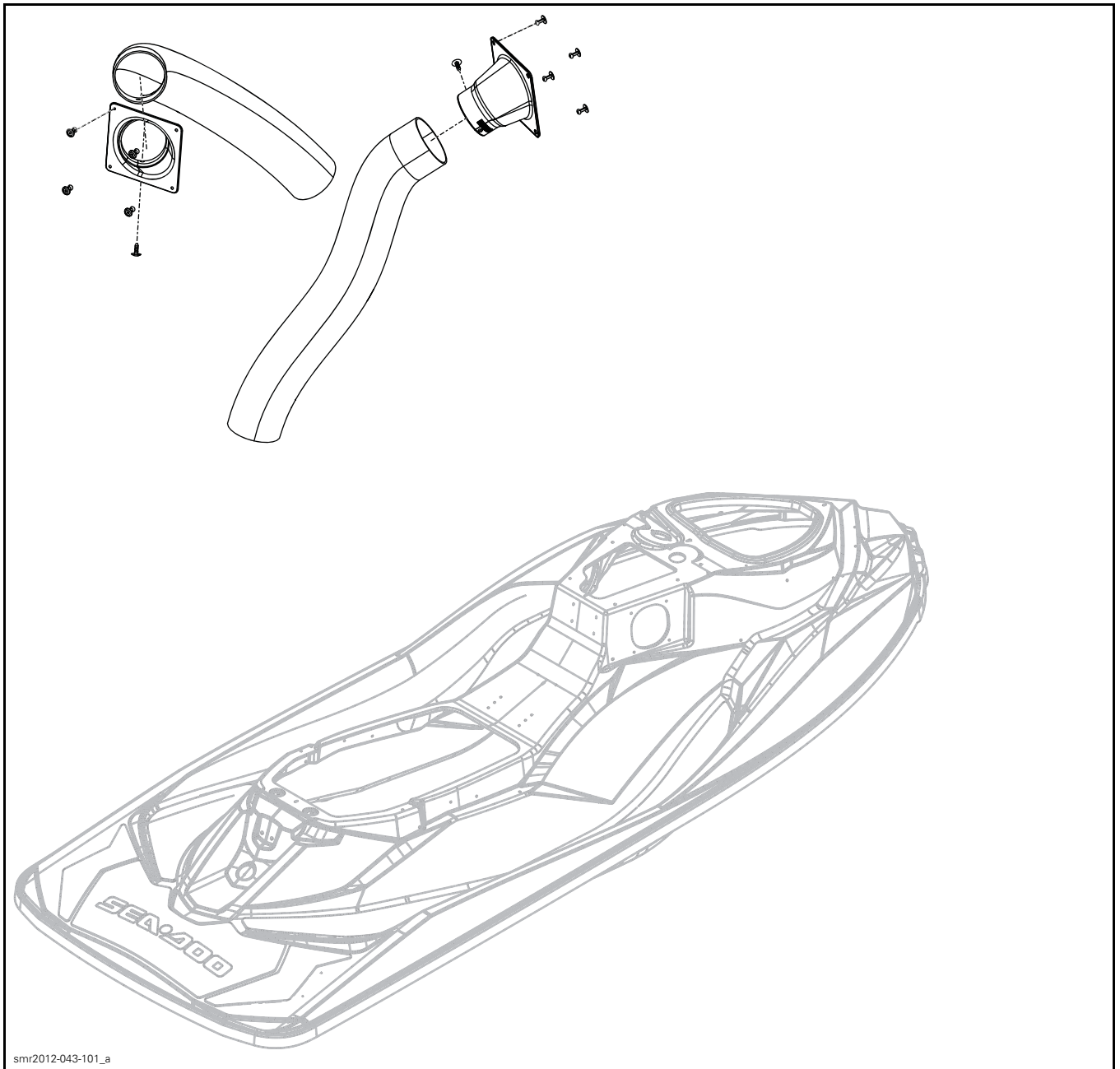
BODY PARTS



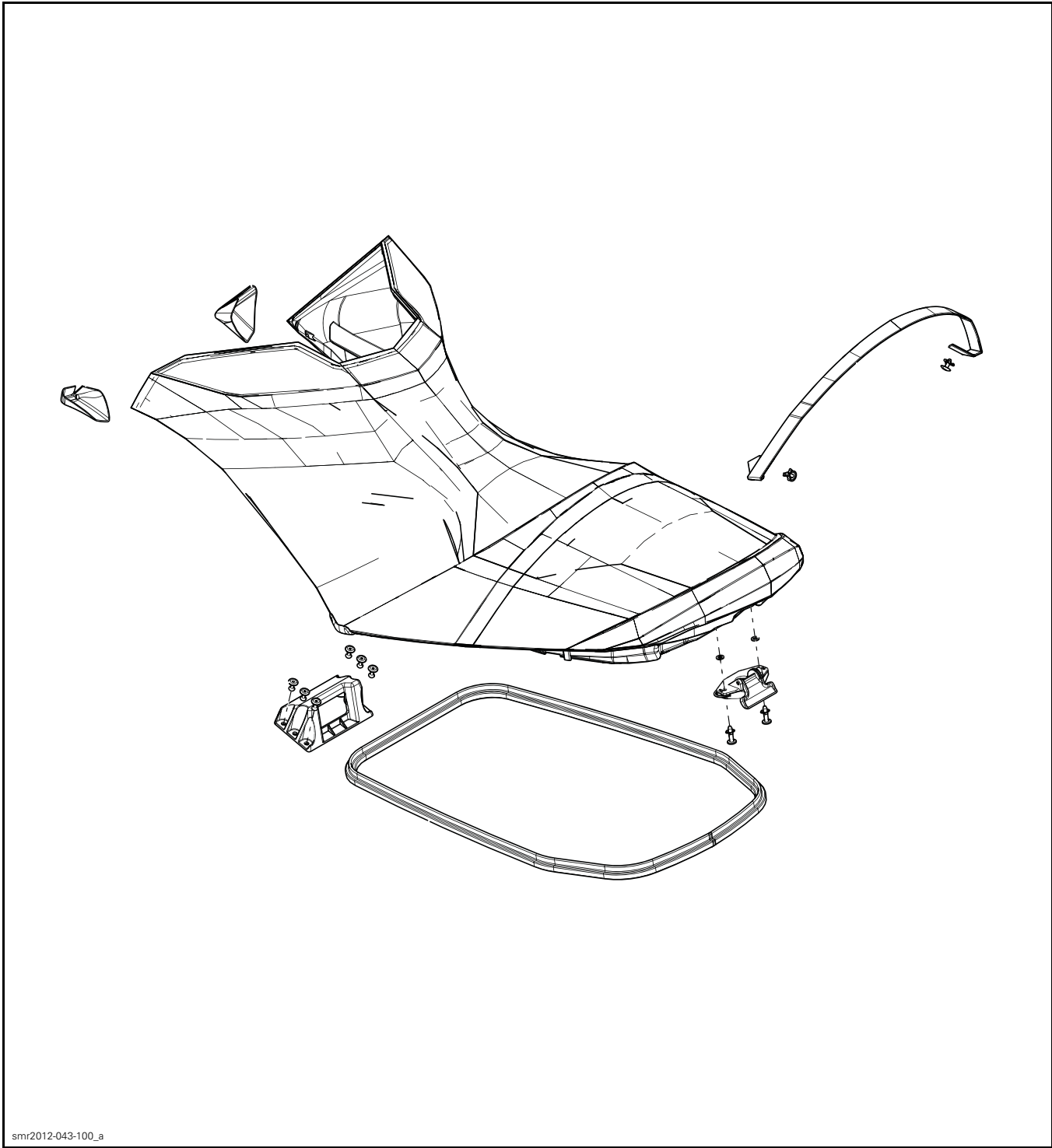
BODY PARTS



VENTILATION



SEAT



smr2012-043-100_a

PROCEDURES

GELCOAT, DECALS AND CARPETS

For information and repair, refer to *BODY (GTX, RXT SERIES AND WAKE PRO)* subsection.

STORAGE COMPARTMENT COVER

Removing the Storage Compartment Cover

1. Open storage compartment cover.
2. Remove nuts and bolts securing storage compartment cover to hinge.



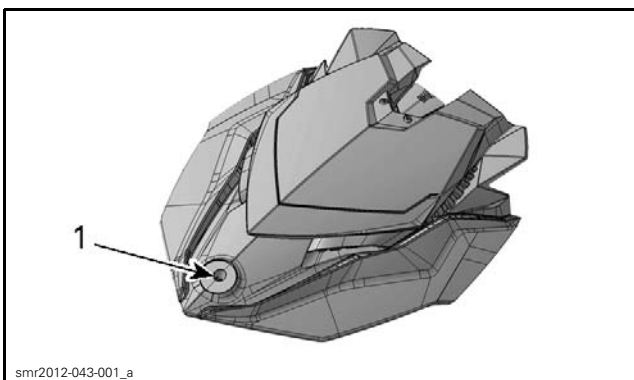
1. Retaining nuts

3. Remove storage compartment cover.

Disassembling the Storage Compartment Cover

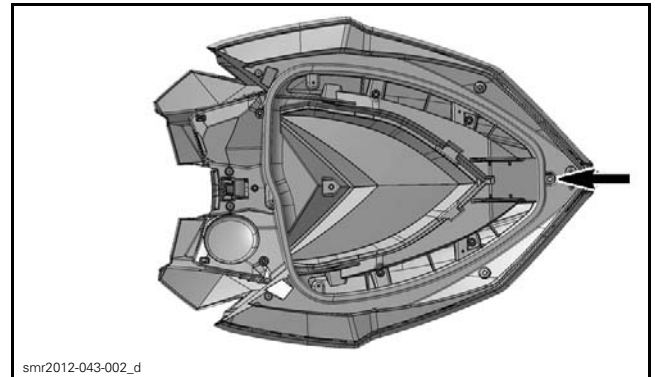
Storage Compartment Cover Inner Shell

1. Remove BRP logo located at the front of cover.



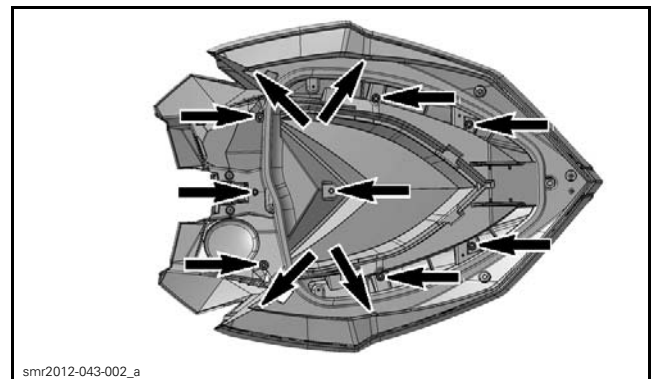
1. BRP logo

2. Remove inner shell retaining bolt.



INNER SHELL RETAINING BOLT

3. Remove inner shell retaining screws.



INNER SHELL RETAINING SCREWS

4. Unlatch retaining tabs on both sides using a screwdriver.

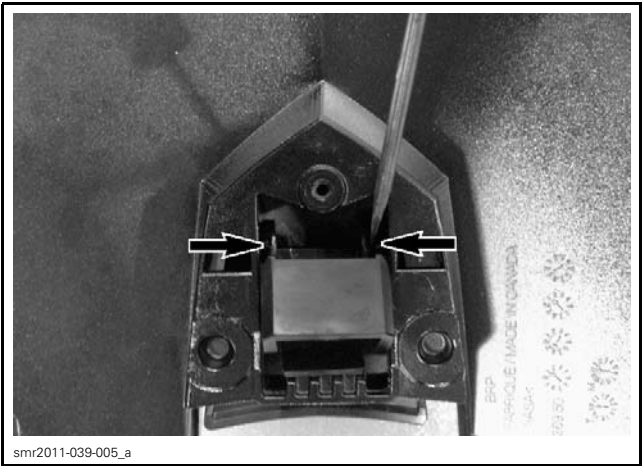


5. Disassemble inner shell from storage compartment cover.

Storage Compartment Cover Latch

1. Ensure that inner shell is removed.

2. Remove latch by slightly pushing both retaining holes toward the inside.

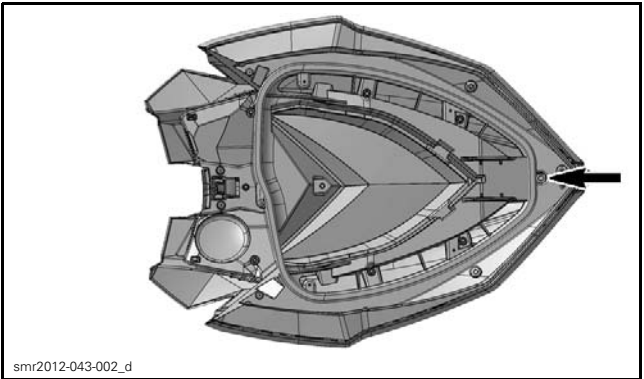


Assembling the Storage Compartment Cover

The assembly is the reverse of the disassembly procedure. However, pay attention to the following.

Tighten inner shell retaining bolt to specification.

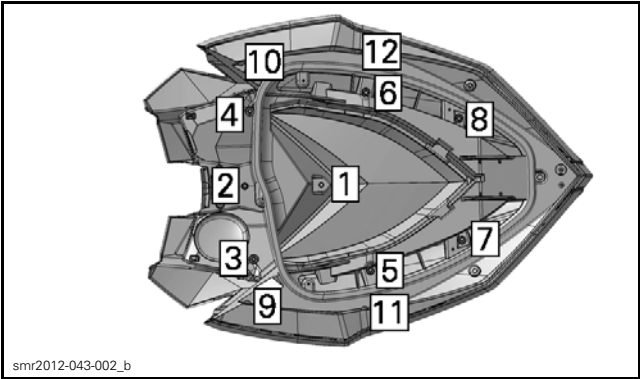
TIGHTENING TORQUE	
Inner shell retaining bolt	4 N•m (35 lbf•in)



INNER SHELL RETAINING BOLT

Tighten inner shell retaining screws to specification as per the following sequence.

TIGHTENING TORQUE		
Inner shell retaining screws	Steps 1 to 8	1.7 N•m (15 lbf•in)
	Steps 9 to 12	2.8 N•m (25 lbf•in)



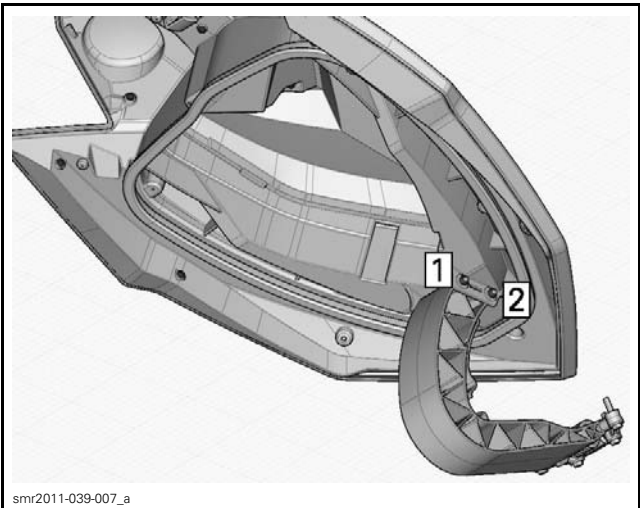
TIGHTENING SEQUENCE

Installing the Storage Compartment Cover

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

Tighten storage compartment cover retaining nuts to specification as per the following sequence.

TIGHTENING TORQUE	
Storage compartment cover retaining nuts	8.0 N•m (71 lbf•in)

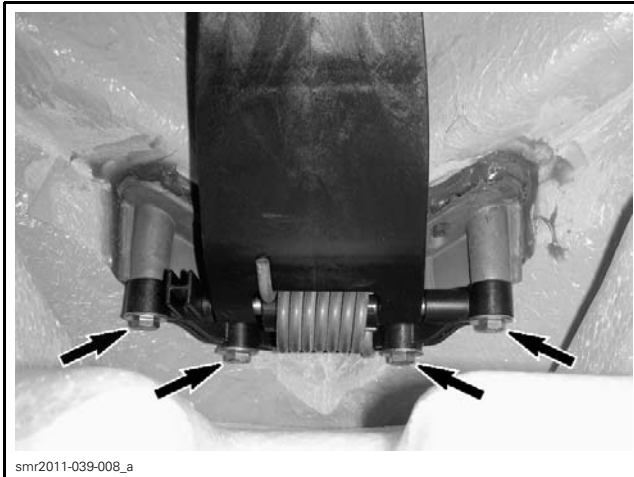


TIGHTENING SEQUENCE

STORAGE COMPARTMENT COVER HINGE

Removing the Storage Compartment Cover Hinge

1. Proceed with *REMOVING THE STORAGE COMPARTMENT COVER*.
2. Remove screws securing storage compartment cover hinge to deck.



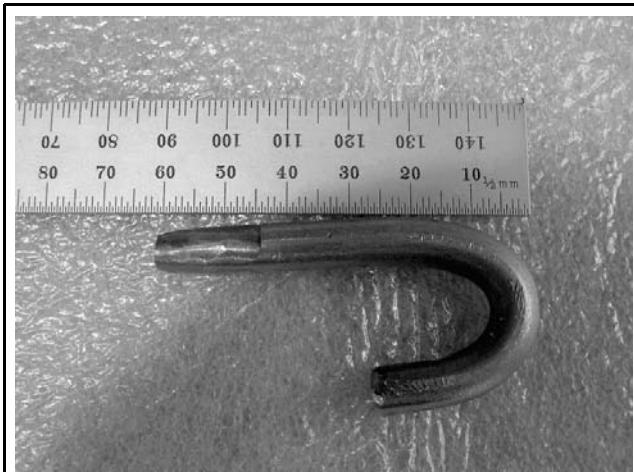
smr2011-039-008_a

HINGE RETAINING SCREWS

Installing the Storage Compartment Cover Hinge

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

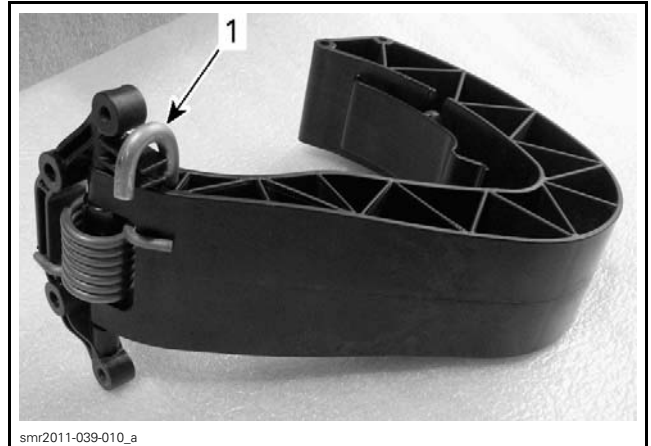
Use a $\varnothing$ 6.5 mm (1/4 in) steel rod to make a hook in order to lock the hinge.



smr2011-039-009

TYPICAL

Insert the steel hook on the lateral tab of hinge in order to slightly load the spring.

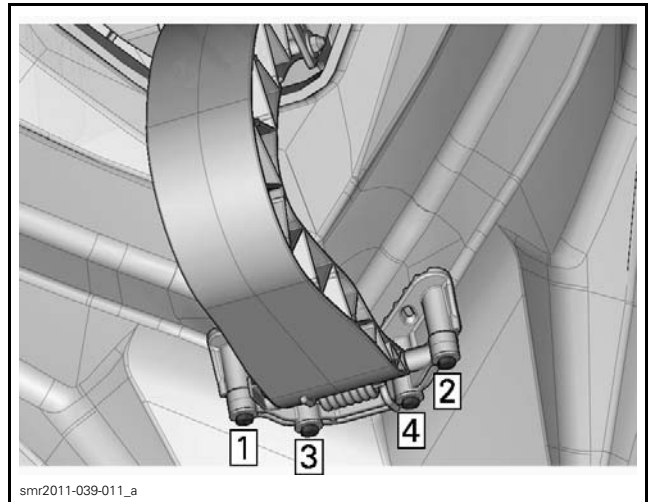


smr2011-039-010_a

1. Steel hook

Tighten hinge retaining screws to specification as per the following sequence.

TIGHTENING TORQUE	
Storage compartment cover hinge screws	8.0 N•m (71 lbf•in)



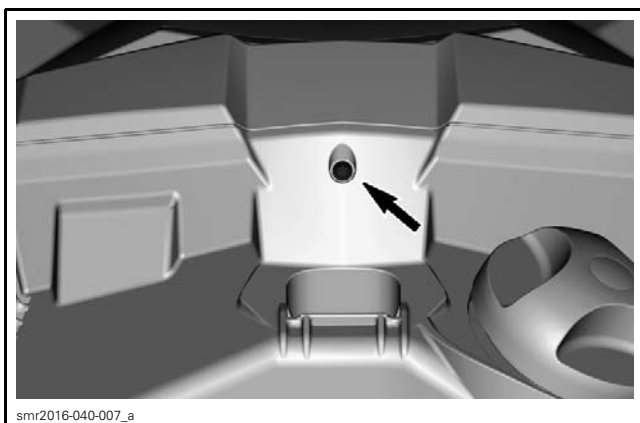
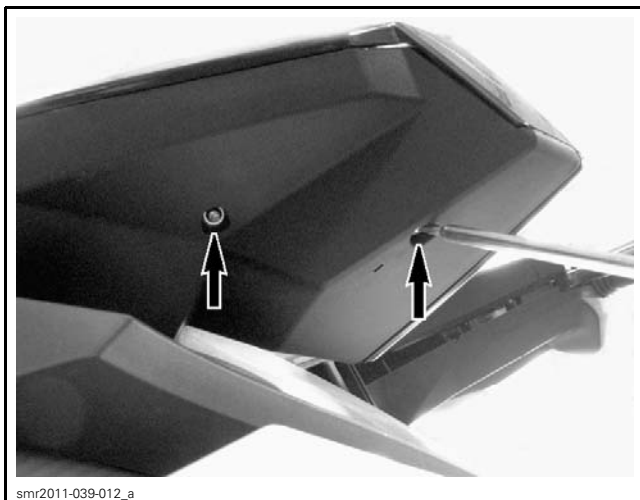
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TIGHTENING SEQUENCE

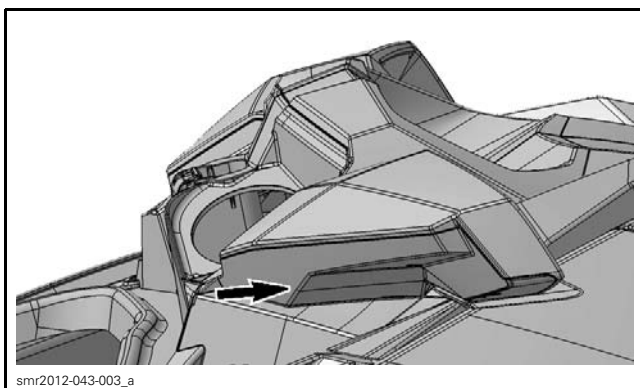
GAUGE TRIM

Removing the Gauge Trim

1. Open storage compartment cover.
2. From underneath mirror, remove retaining screws on both sides.



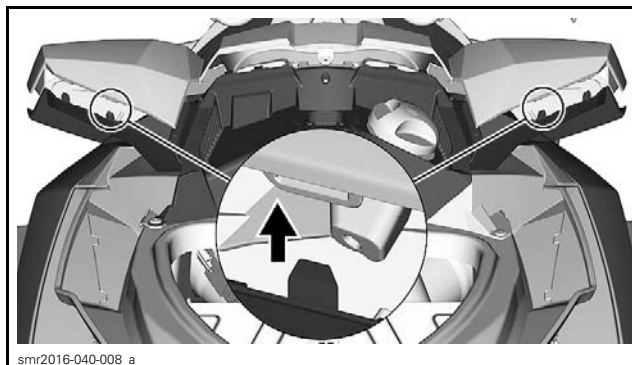
3. Hit with a sharp blow the front part of mirror toward the rear to unlock it.



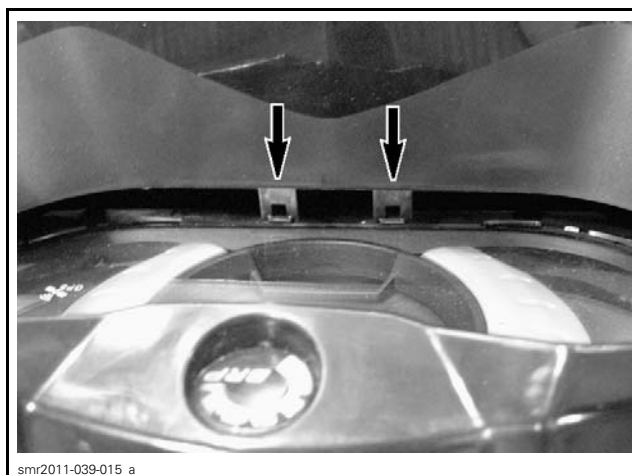
4. Remove gauge trim from mirror support.

Installing the Gauge Trim

The installation is the reverse of the removal procedure. However, pay attention to the following. Prior to inserting gauge trim into mirror support, ensure that all tabs are properly aligned.



TOP OF GAUGE TRIM

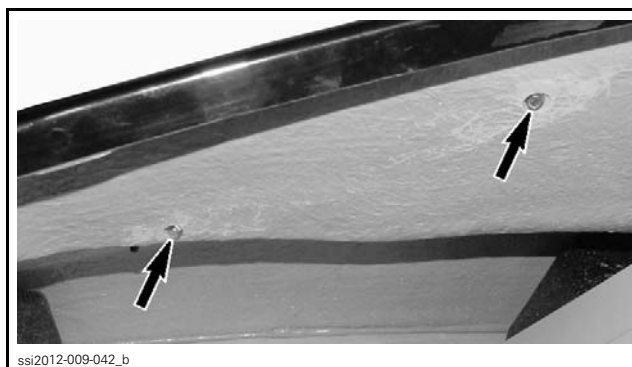


BOTTOM OF GAUGE TRIM

LATERAL TRIM PANEL

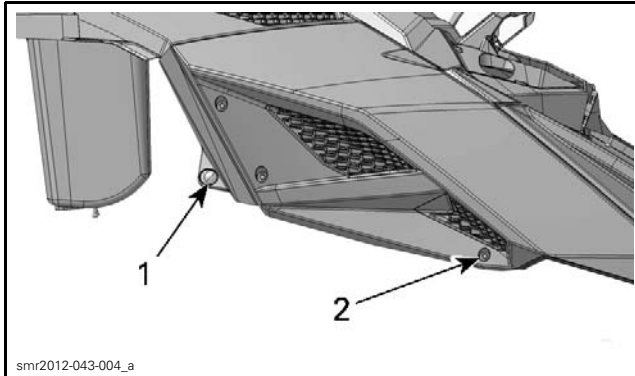
Removing the Lateral Trim Panel

1. Remove seat.
2. From inside storage compartment, remove screws securing lateral trim panel to deck.



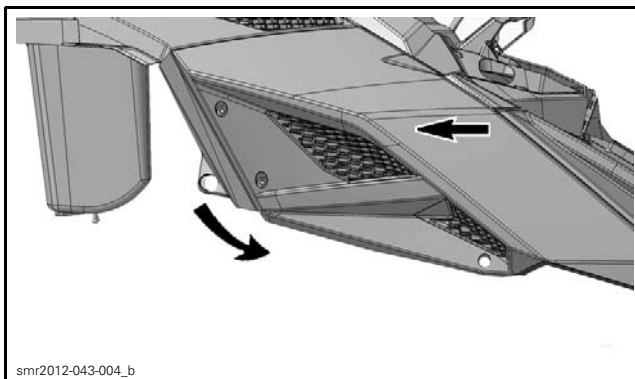
RETAINING SCREWS

3. From inside storage compartment, remove plastic rivet securing lateral trim panel to deck.
4. Remove plastic rivet and retaining screw securing the rear portion of lateral trim panel.



1. Plastic rivet
2. Retaining screw

5. Slide and rotate panel toward the front to unlock retaining tabs.



Installing the Lateral Trim Panel

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

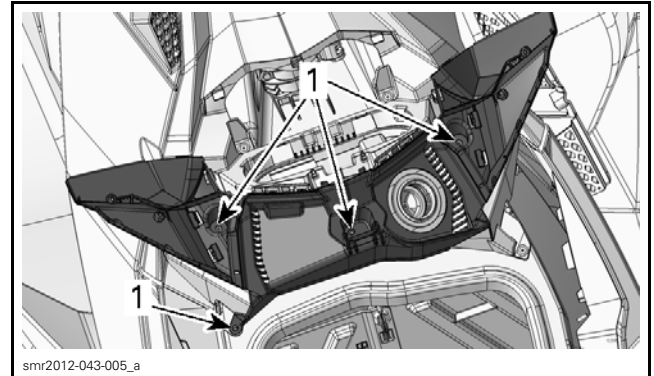
MIRROR SUPPORT

Removing the Mirror Support

1. Proceed with *REMOVING THE LATERAL TRIM PANEL*. See procedure in this subsection.
2. Remove the information center. Refer to *INFORMATION CENTER (GAUGE)* subsection.
3. Remove steering column, refer to *STEERING AND O.T.A.S.* subsection.
4. Remove the following rivets securing mirror support to deck.

REQUIRED TOOL

SUPERTANIUM DRILL BIT 3/16" (P/N 529 031 800)



1. Mirror support retaining rivets

5. Remove fuel tank cap.

6. Place a **clean** cloth rag onto fuel tank tube.

7. Unlatch retaining tabs on both sides using a screwdriver.

8. Unlatch retaining tabs on the top using a screwdriver.

9. Remove mirror support by pulling it upwards.

10. Remove cloth rag and reinstall fuel tank cap.

WARNING

Fuel vapors are flammable and explosive under certain conditions. Unless otherwise noted, the fuel tank cap must always be installed on watercraft.

Installing the Mirror Support

The installation is the reverse of the removal procedure. However, pay attention to the following. Prior to inserting mirror support into console, ensure that all tabs are properly aligned.

Install rivets upside down with washers on mirror support top surface.

MIRRORS

Replacing the Mirror

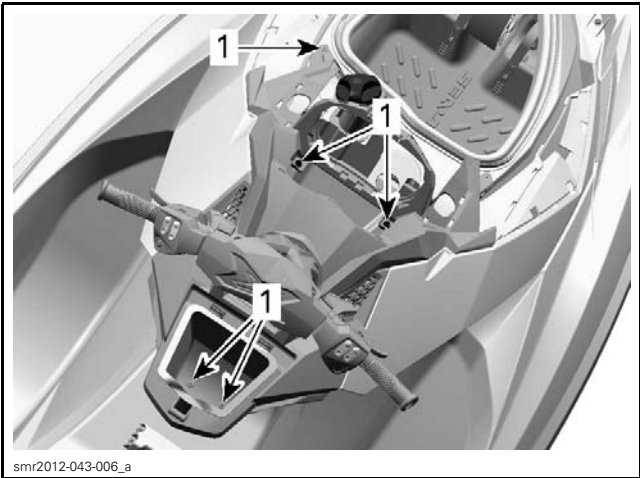
1. Proceed with *REMOVING THE GAUGE TRIM*, see procedure in this subsection.
2. From inside gauge trim, slightly heat mirror.
3. Push at the back of mirror to remove it.
4. Properly clean gauge trim surface of any glue residue.
5. Install mirror using adhesive tape at the back of mirror.
6. Reinstall gauge trim as the reverse of removal.

CONSOLE

Removing the Console

- 1. Proceed with *REMOVING THE MIRROR SUPPORT*. See procedure in this subsection.
- 2. Remove *GLOVE BOX COVER*, see procedure in this subsection.
- 3. Remove the following rivets securing console to deck.

REQUIRED TOOL
SUPERTANIUM DRILL BIT 3/16" (P/N 529 031 800)



1. Console retaining rivets

- 4. Remove console by pulling it upwards.

Installing the Console

The installation is the reverse of the removal procedure. However, pay attention to the following. To ease installation of rivets located in glove box, proceed as follows:

- Remove air intake silencer, refer to *AIR INTAKE SYSTEM (WITHOUT SUSPENSION)* subsection.
- Install rivets upside down with washers on console top surface.

GLOVE BOX COVER

Replacing the Glove Box Cover

- 1. Open glove box cover.
- 2. Pull glove box cover upwards to release it from console hinge.



- 3. Reinstall glove box cover as the reverse of removal.

SEAT

Cleaning the Seat

For information, refer to *BODY (GTX, RXT SERIES AND WAKE PRO)* subsection.

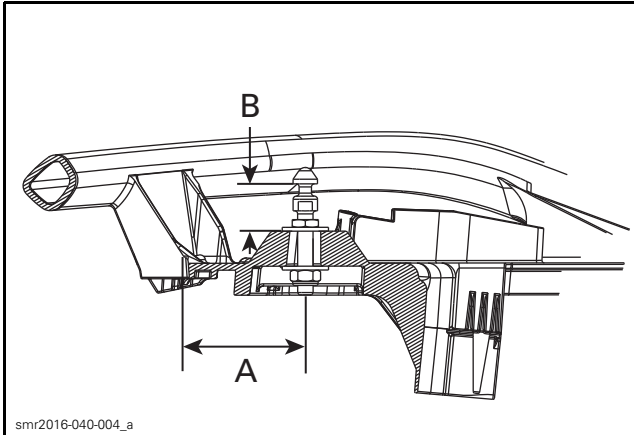
SEAT LATCH

Adjusting the Seat Latch

NOTE: Apply threadlocker on threads of lock pin when the adjustment is required or when the lock pin is removed. If a new lock pin is used, it is already coat with a threadlocker.

- 1. Loosen adjustment nut.
- 2. Adjust lock pin height. Do not torque yet.
- 3. Position the lock pin longitudinally into the rear handle slot.

LOCK PIN POSITIONING	
MEASURE A	76 mm (2.992 in)
MEASURE B	30.7 mm ± 1.0 mm (1.209 in ± .039 in)



A. 76 mm (2.992 in)
B. 30.7 mm ± 1.0 mm (1.209 in ± .039 in)

4. Hold the lock pin in this position and tighten as per the following specification.

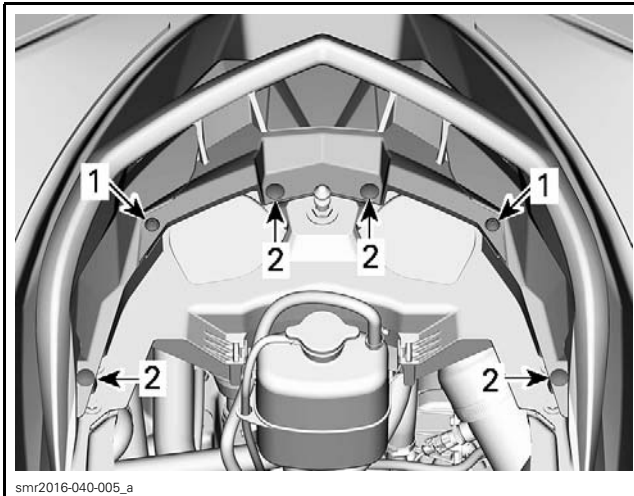
TIGHTENING TORQUE	
Lock pin	8.0 N•m (71 lbf•in)

5. Close the seat and readjust if required.

REAR HANDLE

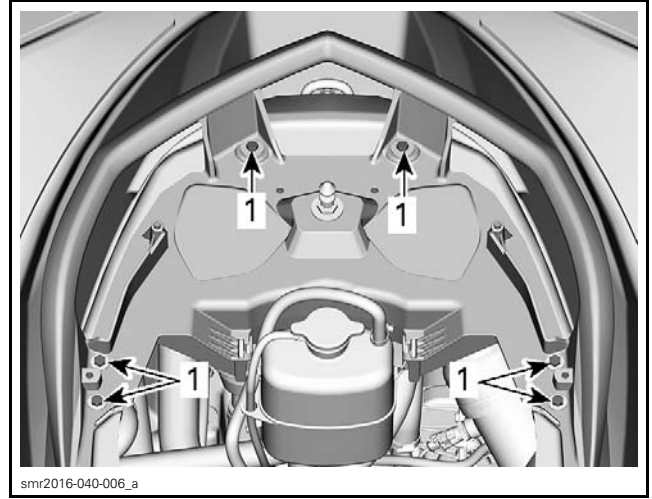
Replacing the Rear Handle

1. Remove seat.
2. Remove rear handle cover.



1. Rear handle cover retaining screws
2. Plastic darts

3. Remove screws securing rear handle to deck.



1. Rear handle retaining screws

4. Replace rear handle.

TIGHTENING TORQUE	
Rear handle screws	8.0 N•m (71 lbf•in)

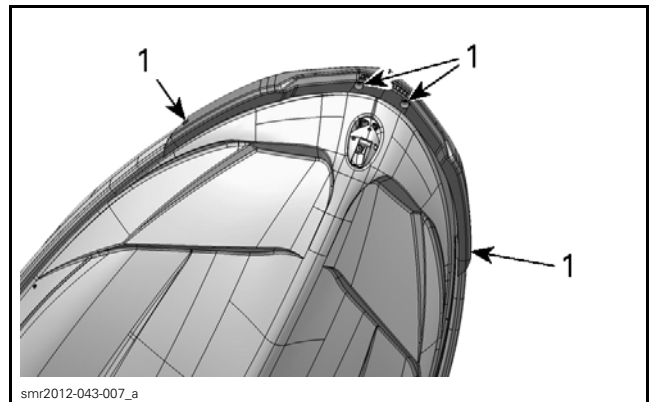
5. Reinstall rear handle cover.

TIGHTENING TORQUE	
Rear handle cover screws	3.3 N•m (29 lbf•in)

BUMPER

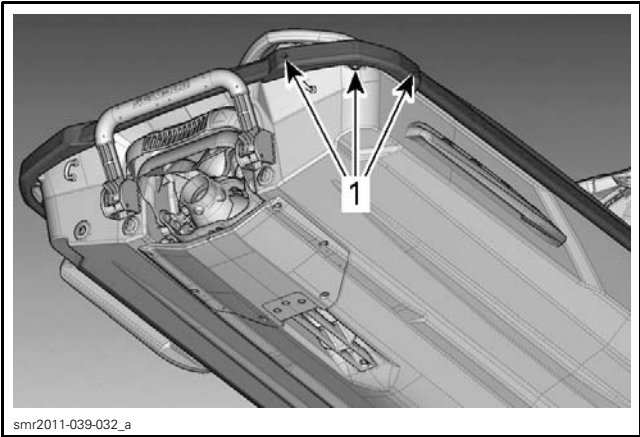
Replacing the Bumper

1. Remove screws securing front bumper.
2. Remove front bumper from deck.



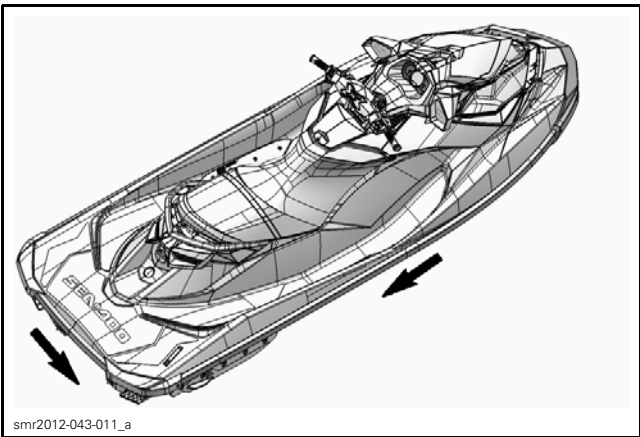
1. Front bumper retaining screws

3. Remove screws securing both rear corner bumpers.
4. Remove rear corner bumpers from deck.



1. Rear corner bumper retaining screws

5. Slide side bumpers toward the rear to remove them from deck.
6. Slide rear bumper toward the side to remove it from deck.

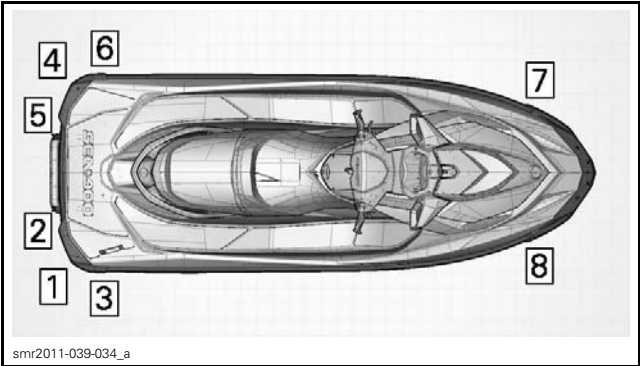


7. Install **new** bumpers as the reverse of removal.
- NOTE:** Use soapy water to ease bumper installation.
8. Tighten front bumper lower retaining screws to specification.

TIGHTENING TORQUE	
Front bumper lower screws	4.5 N•m (40 lbf•in)

9. Tighten bumper retaining screws to specification as per the following sequence.

TIGHTENING TORQUE		
Rear corner bumpers lower screws	Steps 1 and 4	7 N•m (62 lbf•in)
Bumper retaining screws	Steps 2-3 and 5 to 8	5.5 N•m (49 lbf•in)



TIGHTENING SEQUENCE

VENTILATION DUCT

Replacing the Ventilation Duct

1. Proceed with *REMOVING THE LATERAL TRIM PANEL*. See procedure in this subsection.
2. Remove plastic rivet securing ventilation duct to housing.



3. Remove the following rivets securing ventilation duct housing to deck.

REQUIRED TOOL
SUPERTANIUM DRILL BIT 3/16" (P/N 529 031 800)





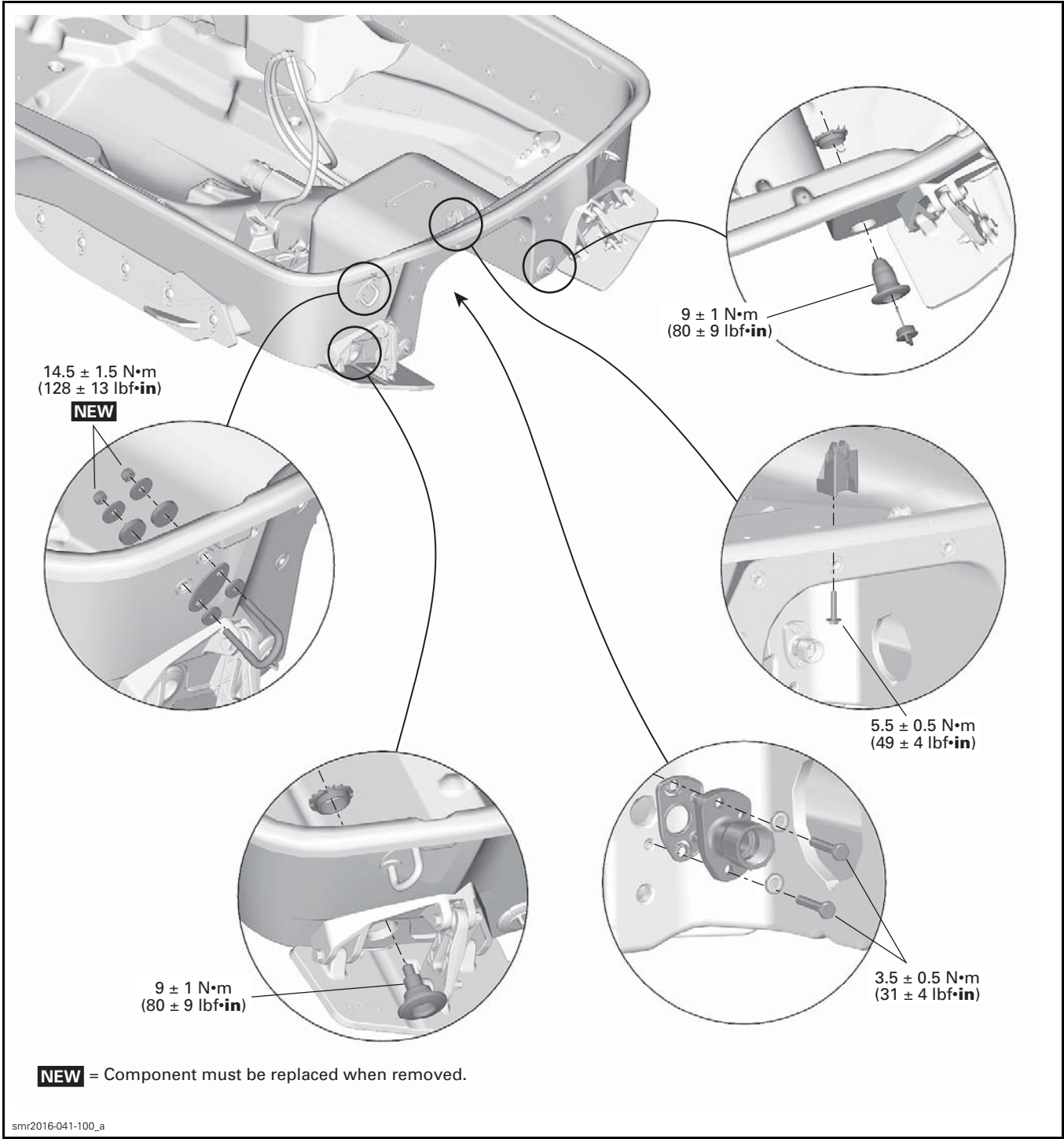
4. If applicable, remove locking tie securing wiring harness to ventilation duct.
5. Remove ventilation duct and its housing from watercraft.
6. Reinstall parts as the reverse of removal.

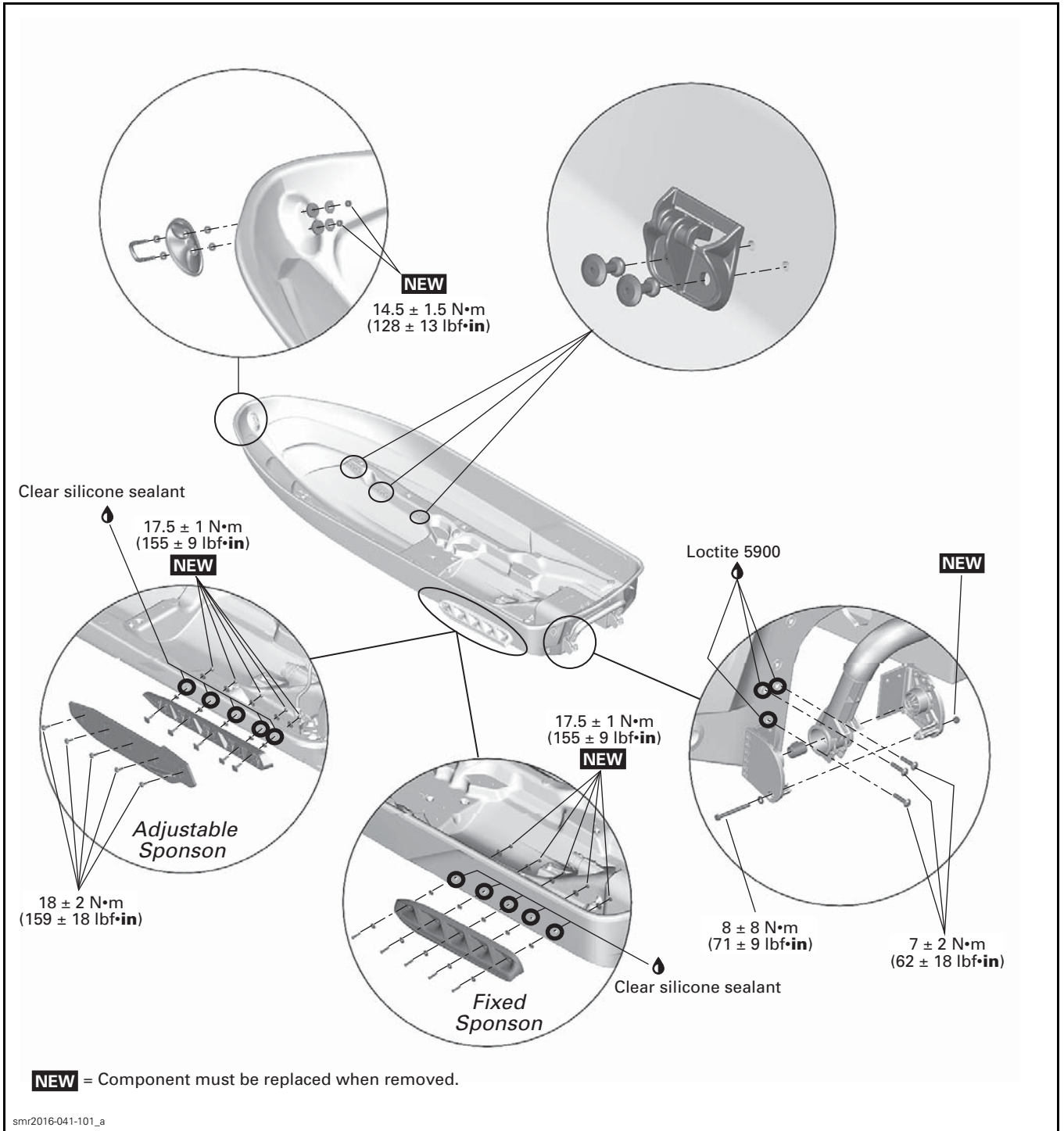
HULL (GTX_RXT AND WAKE PRO SERIES)

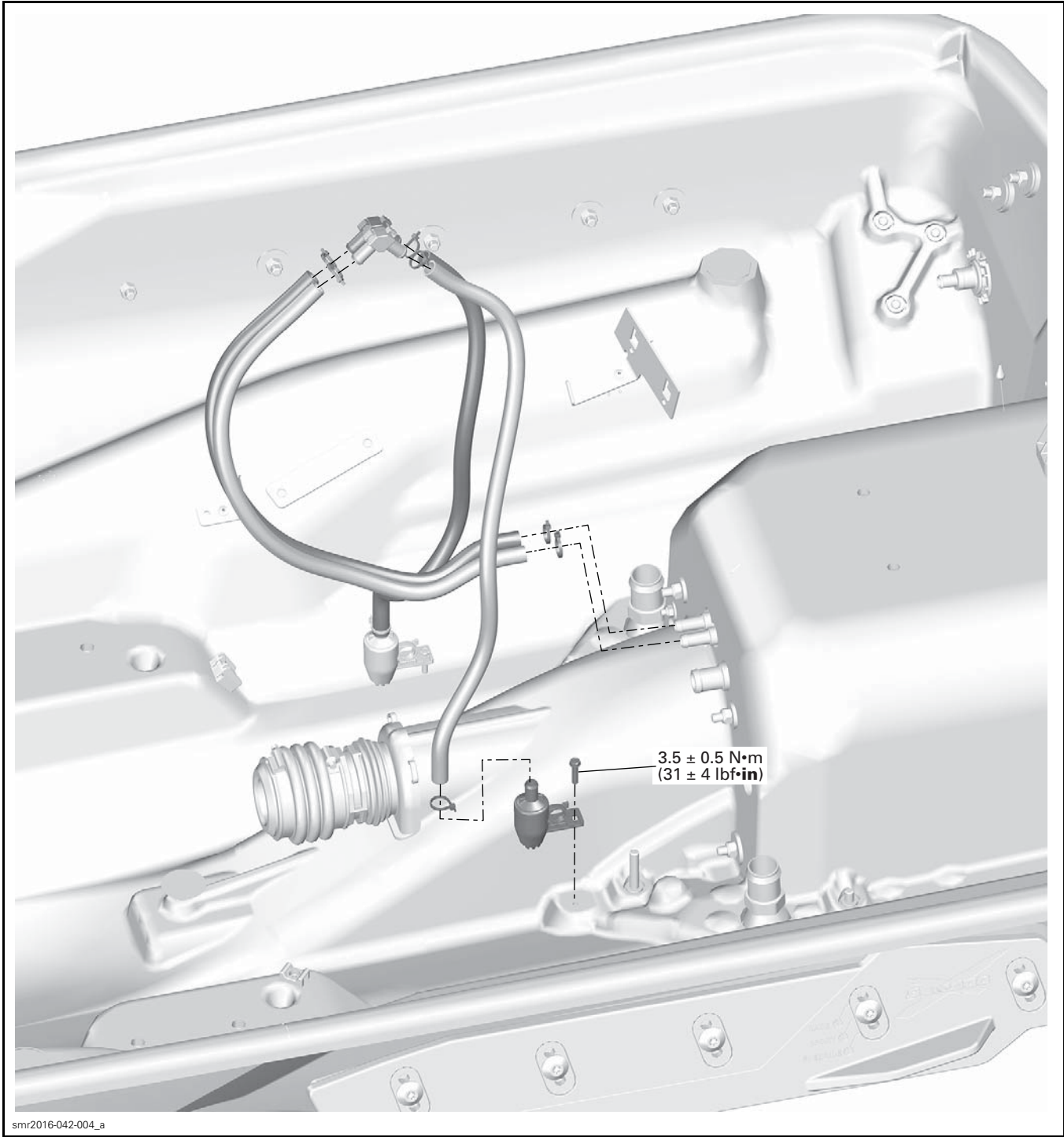
SERVICE PRODUCTS

Description	Part Number	Page
BRP HEAVY DUTY CLEANER	293 110 001	10-12, 15
CLEAR SILICONE SEALANT	296 000 309	13-14, 19
LOCTITE 5900	293 800 066	10-12, 15

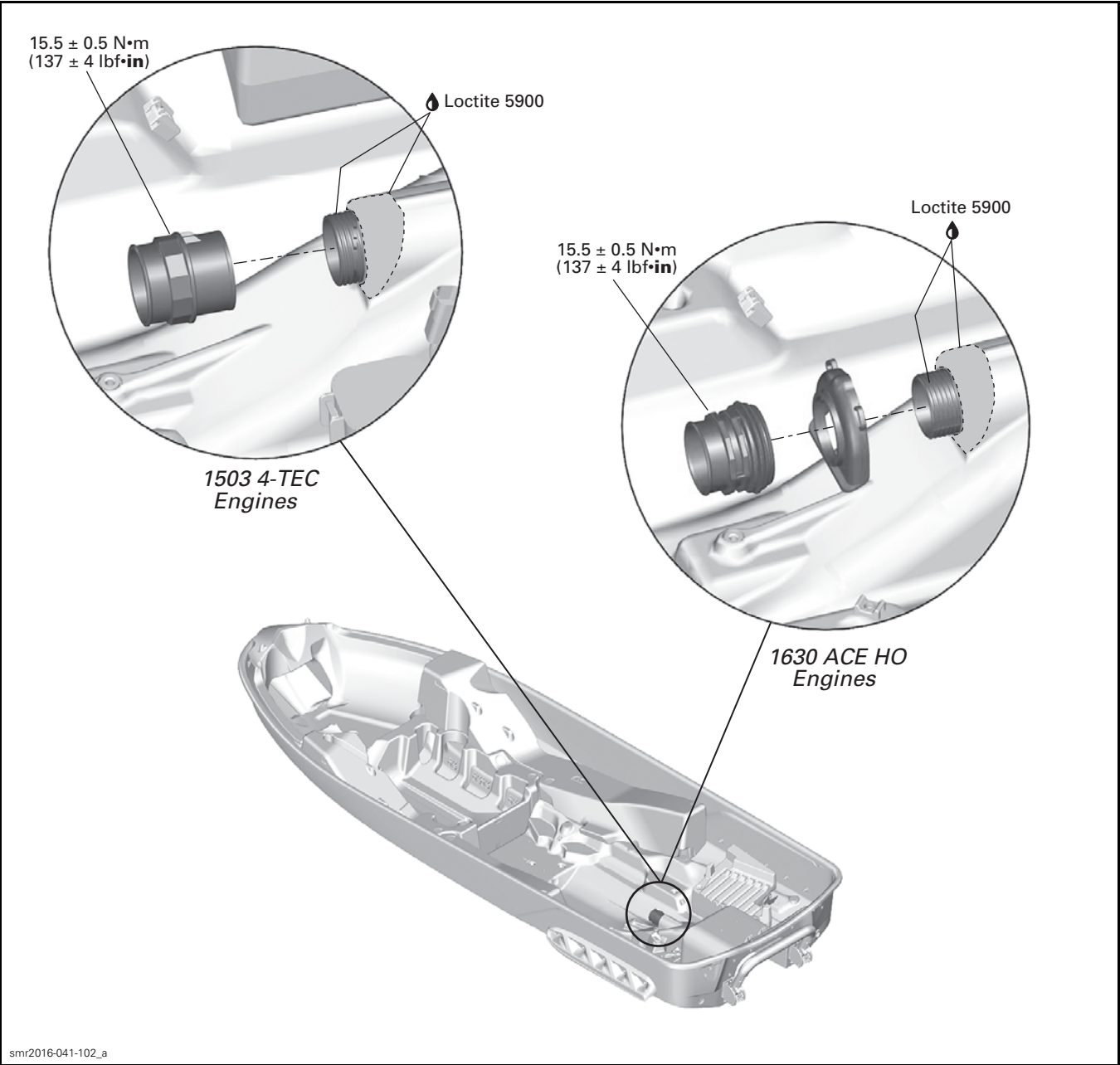
Subsection XX (HULL (GTX_RXT AND WAKE PRO SERIES))



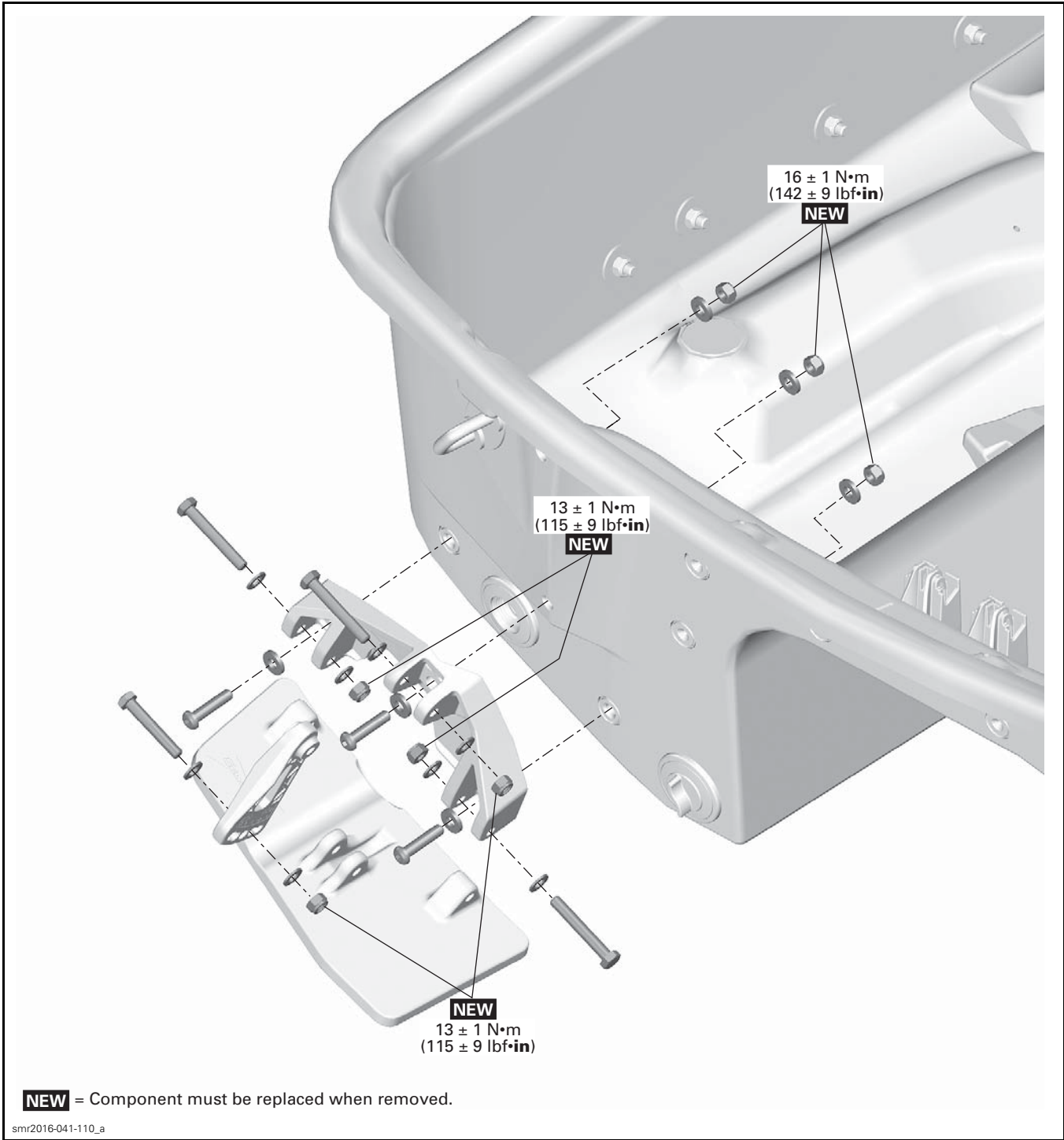


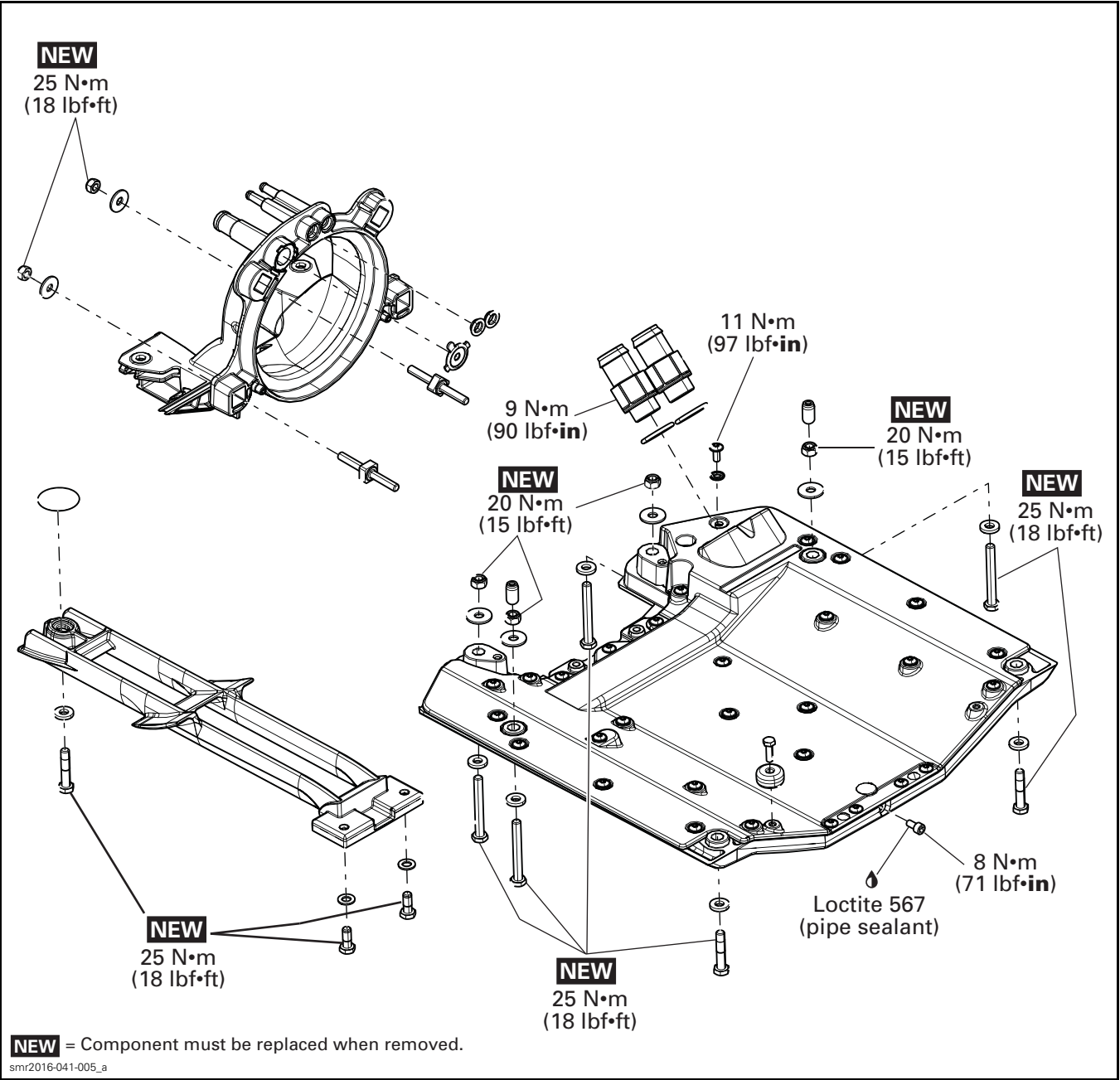


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RXT-X aS Models





PROCEDURES

HULL

Hull Repair

The repair procedures of the S³ hull is not the same as a fiberglass composite hull and deck. The standard polyester based fiberglass repair kits **will not work** with this type of hull. The polyester will not adhere to the S³ hull material. Only two-part epoxy repair material should be used.

To repair a S³ hull, the use of an Epoxy repair system, such as the WEST SYSTEM® or an other equivalent epoxy system, is mandatory.

However, the finish on the S³ hull is a polyester based gelcoat with a bonding layer between the hull and the gelcoat. Standard gelcoat refinishing can be performed if the damage is limited to the color surface. If damage requires the removal or the repair to structure material, the epoxy may also be used as a barrier coat before refinishing with gelcoat. Epoxy adheres to S³ hull material, and gelcoat adheres to epoxy.

An epoxy repair kit can be purchased directly from WEST SYSTEM.

Go to www.westsystem.com.

On this site you will find complete repair instructions, click on HOW TO USE.

Also training videos, tools and several products are available on the web site.

Consumer Assistance

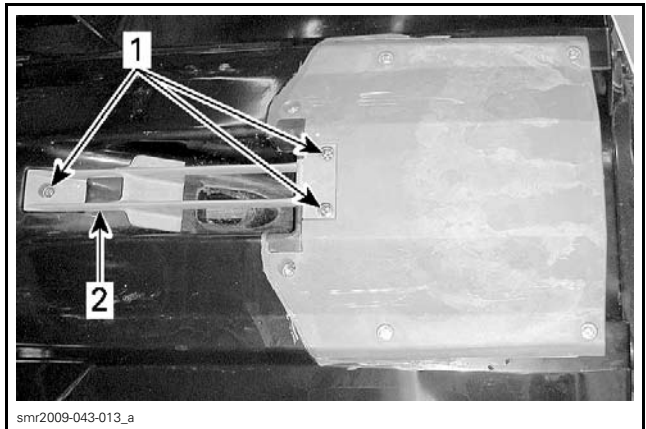
North and South America
WEST SYSTEM 102 Patterson Ave. P.O. Box 665 Bay City, MI 48707-0665 Phone: 989 684-7286 Toll free: 866 937-8797 Fax: 989 684-1374
Europe, Middle East, Africa and Asia
Wessex Resins and Adhesives Limited, Cupernham House, Cupernham Lane, Romsey, England SO51 7LF Phone: 44-1-794-521-111 Fax: 44-1-794-517-779 E-mail: info@wessex-resins.com

Australia, South Pacific and Asia
ATL Composites, P.O. Box 2349/Southport 4215, Queensland, Australia, Tel.: +61 7-5563-1222, Fax: +61 7-5563-1585 E-mail: info@atlcomposites.com
New Zealand, South Pacific and Asia
Adhesive Technologies Ltd., 17 Corbans Ave./Box 21-169, Henderson, Auckland, New Zealand, Phone: 64-9-838-6961, Fax: 64-9-836-4849 E-mail: enquiries@adhesivetechologies.co.nz

INLET GRATE

Removing the Inlet Grate

Remove inlet grate retaining screws using an impact tool. Discard screws.

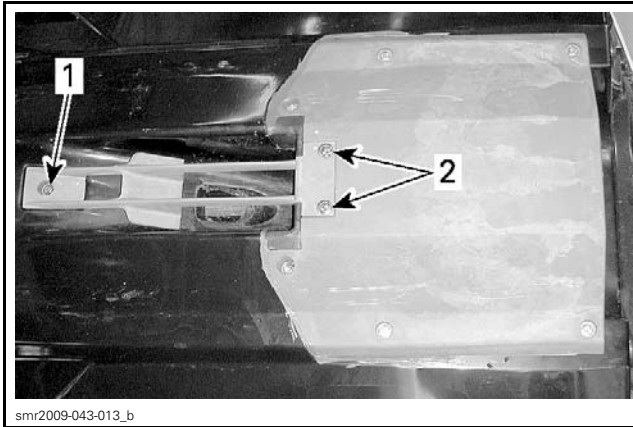


TYPICAL
1. Inlet grate screws
2. Inlet grate

Installing the Inlet Grate

1. Install **NEW** inlet grate retaining screws at the proper location.

INLET GRATE SCREWS	
LOCATION	SCREW SIZE
Front	M8 x 45
Rear	M8 x 20

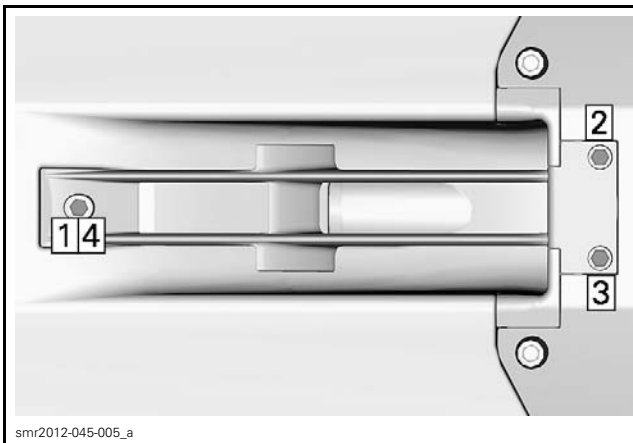


SCREW LOCATION

1. Front
2. Rear

2. Tighten screws to the specified torque and sequence.

TIGHTENING TORQUE		
INLET GRATE SCREWS	First step	Hand tighten
	Second step	25 N•m (18 lbf•ft)



TIGHTENING TORQUE SEQUENCE

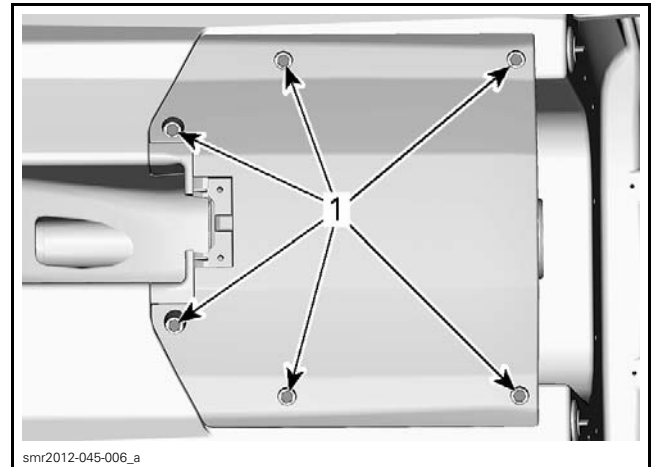
RIDE PLATE

Removing the Ride Plate

1. Remove inlet grate, see procedure in this subsection.
2. Remove jet pump. Refer to *JET PUMP*.
3. Drain cooling system. Refer to *COOLING SYSTEM*.
4. From inside the hull, disconnect coolant hoses from the ride plate.
5. Remove coolant hose fittings from the ride plate.

NOTICE If possible, remove the hose fittings from the ride plate before removing the ride plate. If fittings cannot be removed, proceed with care when removing the ride plate.

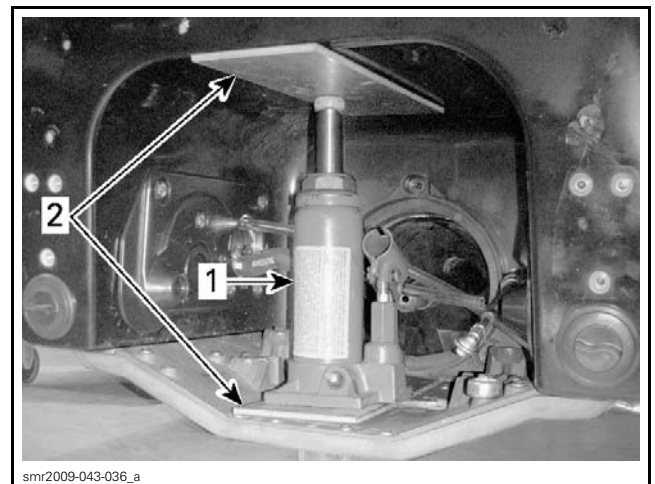
6. Heat ride plate retaining screws using a heat gun.
7. Using an impact tool, remove and discard retaining screws.



TYPICAL

1. Ride plate retaining screws

8. Install a low height hydraulic bottle jack and 2 steel plates between ride plate and hull as per following illustration.



TYPICAL

1. Hydraulic bottle jack
2. Steel plates

9. Heat the edge of the ride plate with a heat gun to soften the sealant.
10. Start pumping the hydraulic jack slowly.
11. Using a sharp knife, carefully cut the sealant around the ride plate edges.

12. Pump the hydraulic jack slowly to pry the ride plate from the hull.

Cleaning the Ride Plate

- 1. Carefully scrape off all excess sealant from ride plate and hull.
- 2. Clean hull surface with BRP HEAVY DUTY CLEANER (P/N 293 110 001) to eliminate grease, dust and sealant residue. Clean fitting threads.

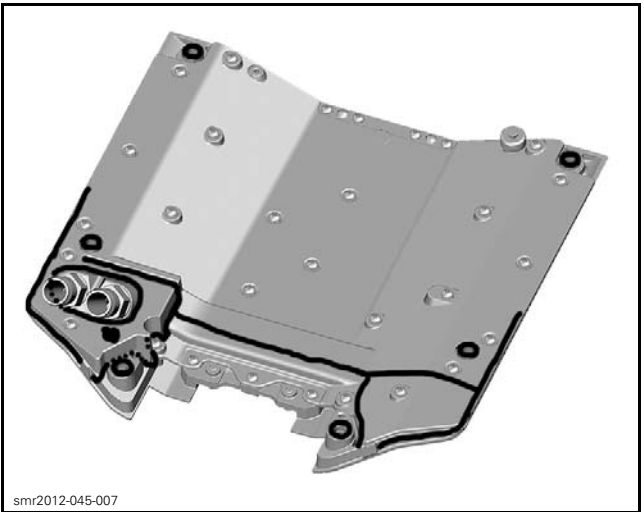
Installing the Ride Plate

- 1. Install both hose fittings on the ride plate. Tighten to the specified torque.

NOTE: Replace O-rings if necessary.

TIGHTENING TORQUE	
Hose fittings	9 N•m (80 lbf•in)

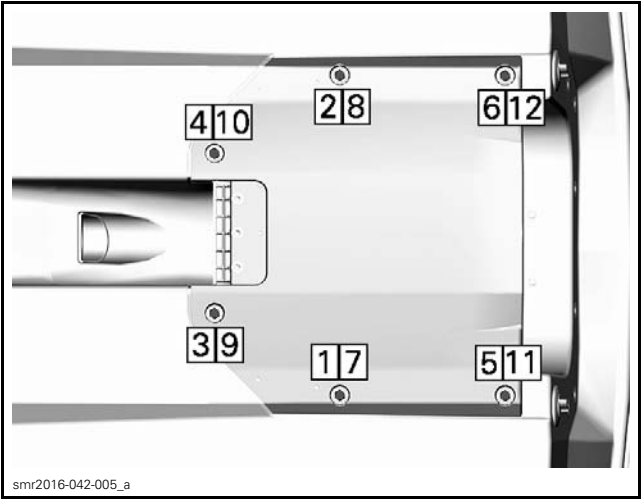
- 2. Apply LOCTITE 5900 (P/N 293 800 066) sealant as illustrated.



SEALANT APPLICATION

- 3. Position ride plate on hull and thread NEW screws 5 turns by hand.
- 4. Position inlet grate and thread NEW screws 5 turns by hand. Refer to INLET GRATE in this subsection.
- 5. Tighten screws to the specified torque and sequence.

TIGHTENING TORQUE		
RIDE PLATE RETAINING SCREWS	First step	Hand tighten
	Second step	25 N•m (18 lbf•ft)



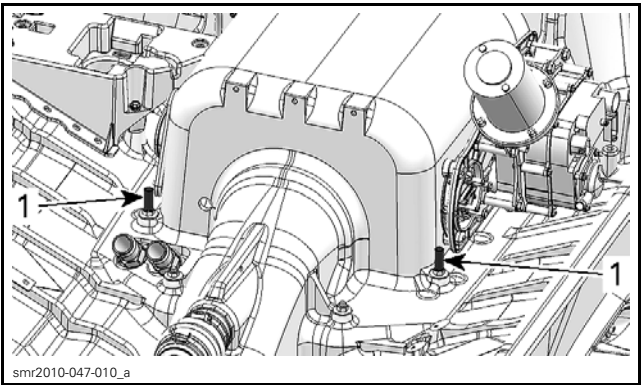
RIDE PLATE TIGHTENING SEQUENCE

- 6. Tighten inlet grate screws to the specified torque and sequence, refer to INSTALLING THE INLET GRATE in this subsection.
- 7. Reinstall coolant hoses on ride plate fittings.

NOTICE Make sure the coolant hose clamp screws do not rub on any component.

TIGHTENING TORQUE	
Coolant hose clamps	4 N•m (35 lbf•in)

- 8. Install jet pump, refer to the JET PUMP subsection.
- 9. Install iBR gate and VTS trim ring, refer to the iBR AND VTS subsection.
- 10. Install a piece of hose over the threaded end of the front ride plate screws.



TYPICAL
1. Hoses

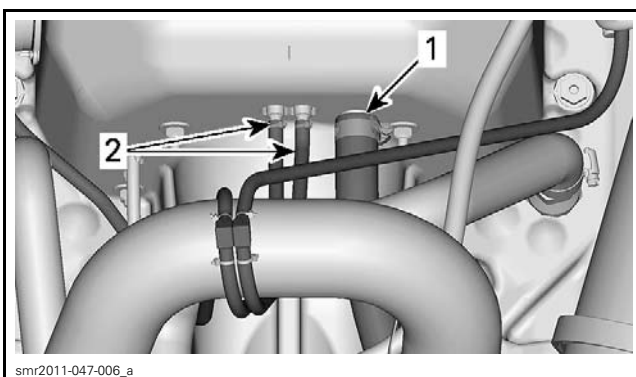
- 11. Install battery and electrical accessories support, refer to CHARGING SYSTEM subsection.
- 12. Fill and bleed cooling system and carry out a leak test. Refer to COOLING SYSTEM subsection.

13. Install all remaining parts. Refer to the applicable procedures.

JET PUMP SUPPORT

Removing the Jet Pump Support

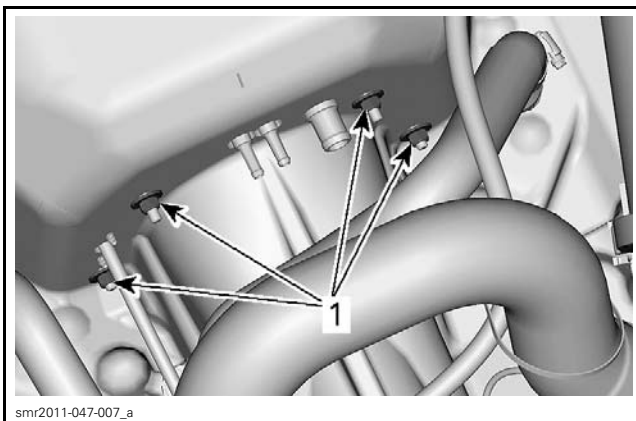
1. Remove the following parts:
 - Jet pump (refer to *JET PUMP* subsection)
 - Drive shaft (refer to *DRIVE SHAFT* subsection)
 - Ride plate (refer to *RIDE PLATE* in this subsection).
2. Disconnect hoses from jet pump support.



INSIDE THE HULL

1. Exhaust water supply hose
2. Bailer hoses

3. Remove jet pump support retaining nuts and washers.



INSIDE THE HULL

1. Jet pump support retaining nuts

4. Heat the jet pump support using a heat gun in order to soften the sealant.
5. Pull jet pump support off the hull.
6. Note the alignment shims location.

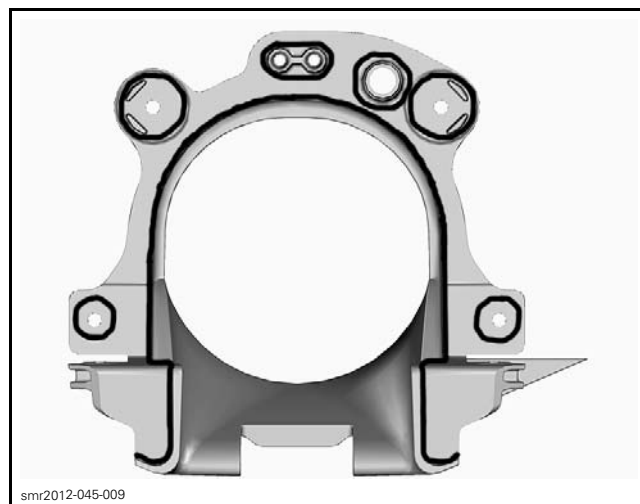
NOTICE Alignment shims have to be reinstalled at the same location.

Cleaning the Jet Pump Support

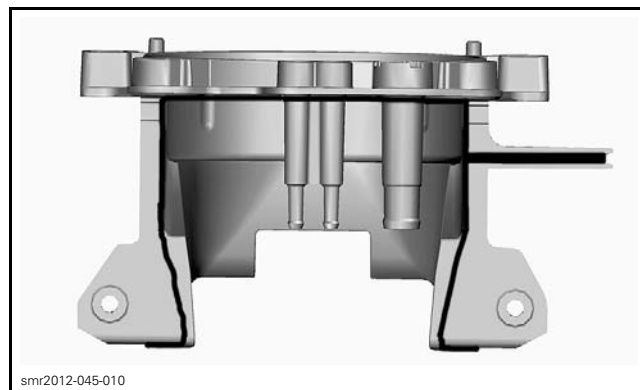
1. Scrape off all excess sealant from jet pump support, ride plate, and hull.
2. Inspect pump support for cracks or other damage.
3. Clean jet pump support and hull surface with BRP HEAVY DUTY CLEANER (P/N 293 110 001) to eliminate grease, dust, and sealant residue.

Installing the Jet Pump Support

1. Make sure sealant contact areas are clean and dry.
2. Apply LOCTITE 5900 (P/N 293 800 066) on the jet pump support as shown (thick black line).



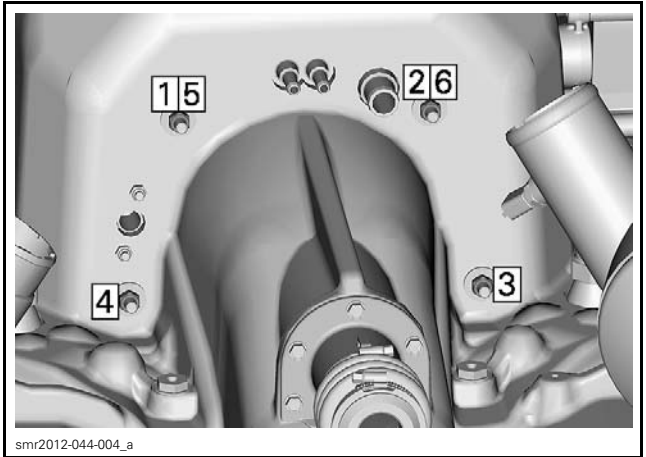
SEALANT APPLICATION



SEALANT APPLICATION

3. Insert the studs in the jet pump support square holes.
4. Slide the alignment shims on the studs.
5. Position the jet pump support against the hull.
6. Inside the hull, thread all 4 retaining nuts.
7. Tighten retaining nuts to the specified torque and sequence.

TIGHTENING TORQUE	
Jet pump support retaining nuts	25 N•m (18 lbf•ft)



JET PUMP SUPPORT TIGHTENING SEQUENCE

- 8. Remove excess sealant.
- 9. Reinstall other removed parts. Refer to appropriate subsections for procedures.

THRU-HULL FITTING

Removing the Thru-Hull Fitting

- 1. Remove drive shaft, refer to *DRIVE SHAFT* subsection.
- 2. Heat the thru-hull fitting nut with a heat gun to soften the sealer.
- 3. Unscrew the thru-hull fitting nut and remove the spacer.
- 4. From underneath of the vehicle, heat the thru-hull fitting with a heat gun to soften the sealer.
- 5. Pull thru-hull fitting off the hull.

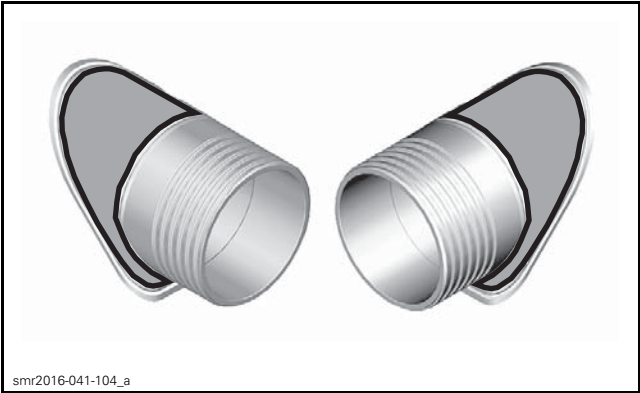
Cleaning the Thru-Hull Fitting Area

- 1. Scrape off all excess sealant from the hull.
- 2. Clean hull surface with BRP HEAVY DUTY CLEANER (P/N 293 110 001) to eliminate grease, dust, and sealant residue.

NOTE: Use only a clean, dry, oil free filtered air supply for dusting and drying parts or hull.

Installing the Thru-Hull Fitting

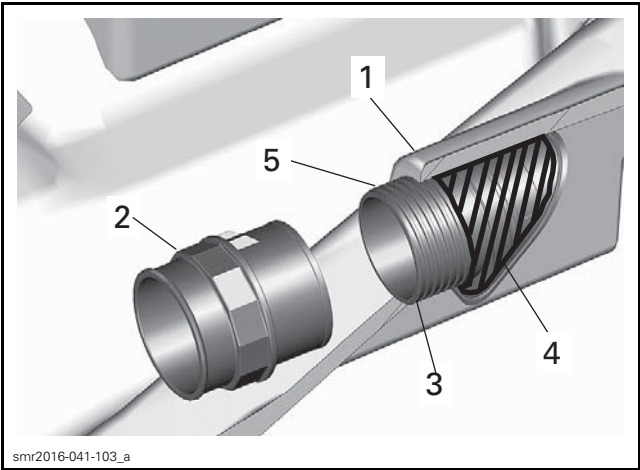
- 1. Make sure thru-hull fitting sealing surface is free of sealant residue, clean and dry before installation.
- 2. Apply LOCTITE 5900 (P/N 293 800 066) sealant all around on shaded surface.



SEALANT APPLICATION

- 3. Tighten nut to the specified torque.

TIGHTENING TORQUE	
Thru-hull fitting nut	15.5 N•m ± 0.5 N•m (137 lbf•in ± 4 lbf•in)



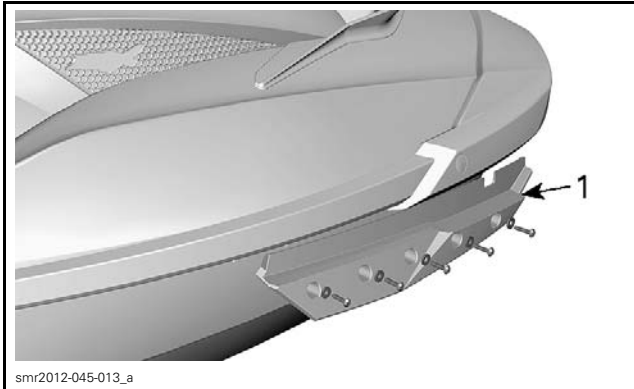
- 1. Hull (cut for clarity purpose)
- 2. Inner thru-hull fitting
- 3. Exterior thru-hull fitting
- 4. Sealant on exterior thru-hull fitting
- 5. Sealant over the threads

- 4. Install other removed parts, refer to the appropriate subsections.

BOW STABILIZER (RXT-X aS SERIES)

Removing the Bow Stabilizer

Remove retaining screws.



1. LH bow stabilizer

Installing the Bow Stabilizer

The installation is the reverse of the removal procedure.

TIGHTENING TORQUE	
Bow stabilizer screws	7 N•m ± 2 N•m (62 lbf•in ± 18 lbf•in)

FIXED REAR SPONSONS

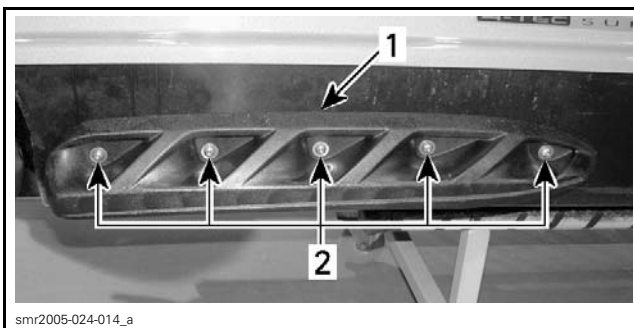
NOTE: Removal and installation procedure for RH and LH sponson is similar.

Removing the Fixed Rear Sponson

On models with a 1503 4-TEC engine, remove the muffler (on LH side) or the resonator (on RH side). Refer to the *EXHAUST SYSTEM* subsection.

On models with a 1630 ACE HO engine, remove the intercooler (on RH side) or the muffler (on LH side). Refer to *INTERCOOLER* or *EXHAUST SYSTEM* subsection.

From inside hull, hold sponson nuts while removing sponson retaining bolts and washers.



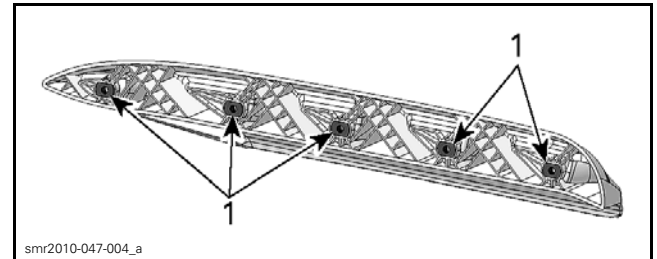
TYPICAL – RH SPONSON SHOWN

1. Sponson
2. Retaining bolts

Installing the Fixed Rear Sponson

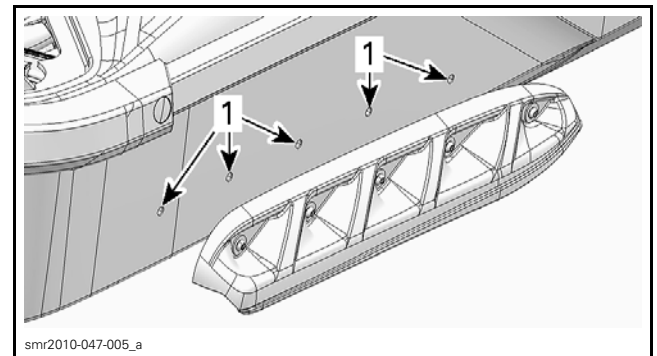
1. Clean any residues of silicone sealant on hull and sponsons.

2. Apply CLEAR SILICONE SEALANT (P/N 296 000 309) on back side of sponson spacers.



1. Apply silicone sealant here

3. Apply a small amount of CLEAR SILICONE SEALANT (P/N 296 000 309) into each hull hole.



1. Apply silicone sealant in these holes

4. Insert a bolt with washer through each hole and install the sponson against the hull.
5. From inside hull, secure each bolt with a washer and a NEW elastic stop nut.
6. Tighten nuts as specified.

TIGHTENING TORQUE	
Sponson retaining nuts	17.5 N•m ± 1 N•m (155 lbf•in ± 9 lbf•in)

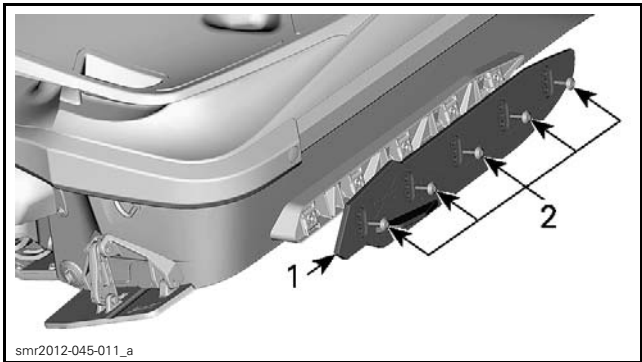
7. Reinstall muffler or resonator. Refer to *EXHAUST SYSTEM* for the procedure.

ADJUSTABLE REAR SPONSONS (RXT-X SERIES)

NOTE: The following procedures apply for RH and LH sides.

Removing the Adjustable Rear Sponson

Remove and discard all screws securing adjustable sponsons.



1. Adjustable sponson
2. Retaining screws

Installing the Adjustable Rear Sponson

WARNING

Both sponsons must be installed and adjusted at the same height. Missing sponsons or improper adjustment will affect handling and stability, which could cause a loss of control of the watercraft.

TIGHTENING TORQUE	
Sponson retaining screws	18 N•m ± 2 N•m (159 lbf•in ± 18 lbf•in)

ADJUSTABLE SPONSON SUPPORTS (RXT-X SERIES)

NOTE: Removal and installation procedure for RH and LH sponson is similar.

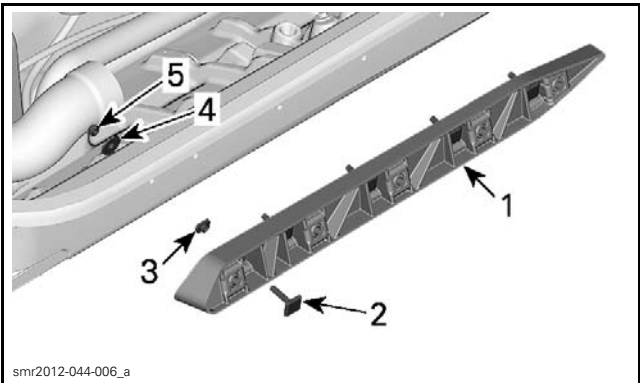
Removing the Adjustable Sponson Support

Remove the *ADJUSTABLE SPONSON*, see procedure in this subsection.

Remove the required parts:

- Muffler (on LH side)
- Resonator (on RH side - 1503 4-TEC engine)
- Intercooler (on RH side - 1630 ACE HO engine).

From inside hull, remove nuts and washers retaining the adjustable sponson support.

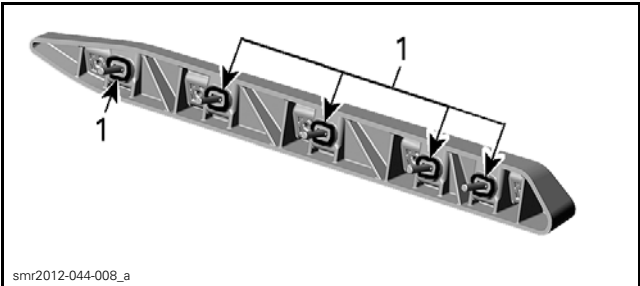


BODY NOT SHOWN FOR CLARITY PURPOSE
1. Sponson support
2. Square head stud
3. Push nut
4. Washer
5. Elastic stop nut

Installing the Adjustable Sponson Support

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

REQUIRED PRODUCT	LOCATION
CLEAR SILICONE SEALANT (P/N 296 000 309)	Around each hole of sponson support



1. Apply silicon sealant here

TIGHTENING TORQUE	
Sponson support nuts (NEW)	17.5 N•m ± 1 N•m (155 lbf•in ± 9 lbf•in)

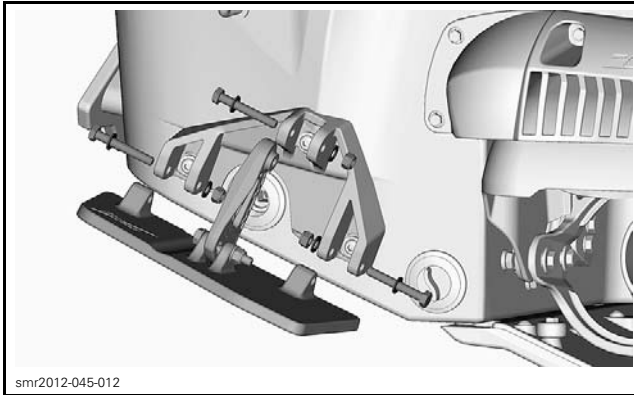
Reinstall adjustable sponson as described in *INSTALLING THE ADJUSTABLE SPONSON*.

ADJUSTABLE TRIM TABS (RXT-X aS MODEL)

NOTE: The following procedures apply for RH and LH sides.

Removing the Adjustable Trim Tab

1. Remove fasteners retaining trim tab and link rod to trim tab support.



2. Before removing trim tab support, trace line on hull around support to ensure alignment when reinstalling the support.
3. Remove trim tab support from hull.
4. Clean any residues of silicone sealant on hull and inside hull holes.

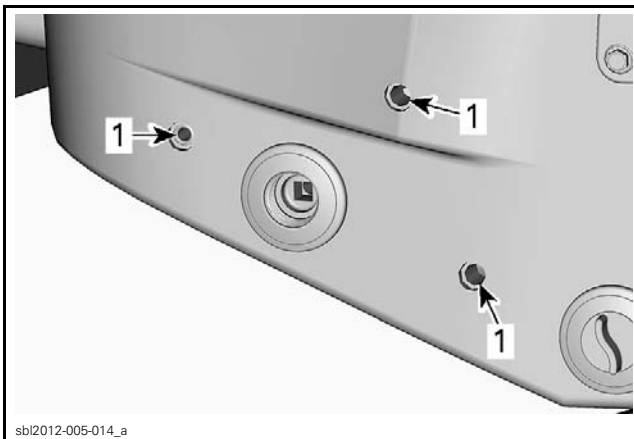
REQUIRED PRODUCT
BRP HEAVY DUTY CLEANER (P/N 293 110 001)

Installing the Adjustable Trim Tab

NOTICE Do not use pneumatic or electrical tools when stainless steel fasteners are used as seizure may occur.

1. Apply sealant in each hull holes.

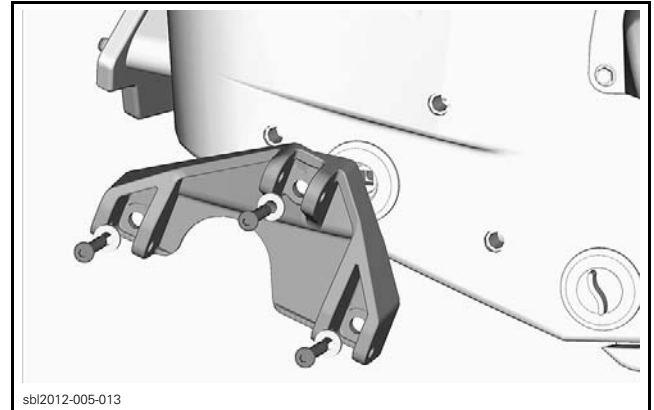
REQUIRED PRODUCT
LOCTITE 5900 (P/N 293 800 066)



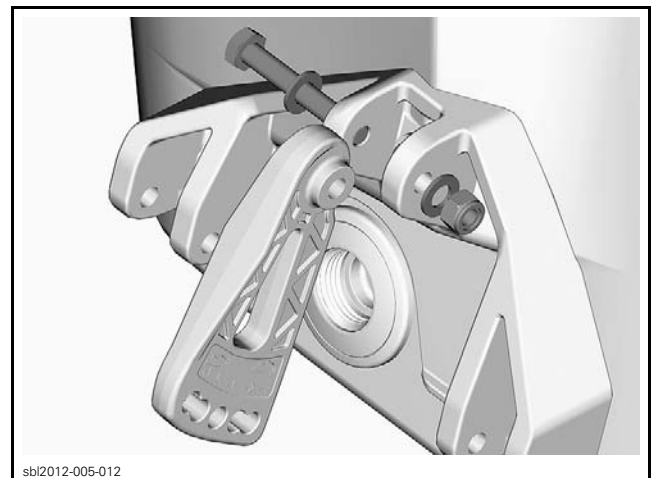
1. Apply sealant in these holes

2. Install the trim tab support using previously drawn marks.

TIGHTENING TORQUE	
Trim tab support screws	16 N•m (142 lbf•in)

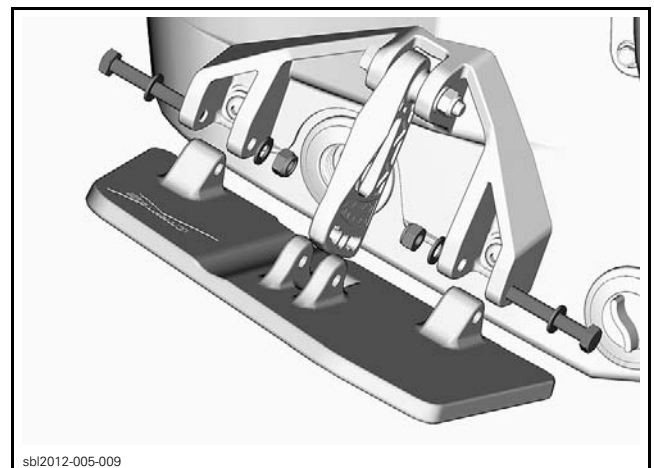


3. Install the link rod in the upper bracket of the support, as shown.



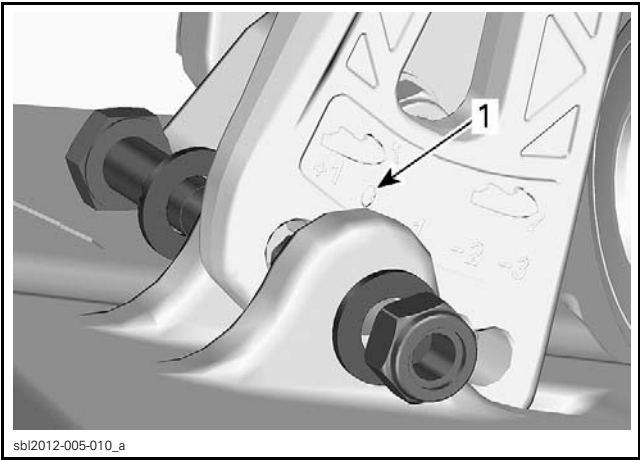
TIGHTENING TORQUE	
Link rod upper retaining nut	13 N•m (115 lbf•in)

4. Secure trim tab to support as shown.



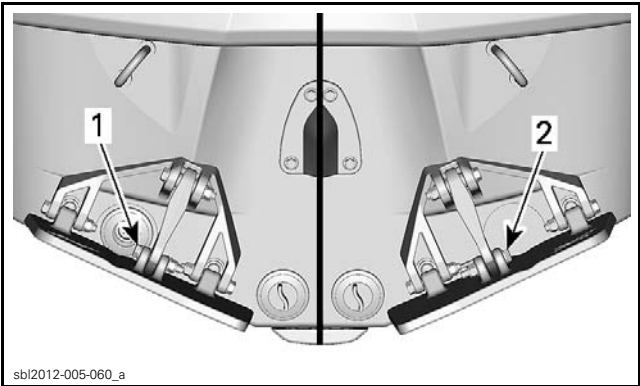
TIGHTENING TORQUE	
Trim tab retaining nuts	13 N•m (115 lbf•in)

5. Secure the bottom of the link rod. Position the link rod to the 0 (zero) position (factory setting).



1. 0 (zero) position (factory setting)

NOTE: Make sure to place the bolt head toward outside of watercraft.



1. Bolt head here – left link rod
2. Bolt head here – right link rod

TIGHTENING TORQUE	
Link rod lower retaining nut	13 N•m (115 lbf•in)

BAILERS

Two bailer pick ups (one each side), serve to drain the bilge of the watercraft when it is in operation. The bailer pick ups are connected through a hose system to two syphon tubes mounted in the jet pump venturi that draw the water out of the bilge through the bailer pick ups. The bailers are also connected to the bilge drain plugs in the stern.

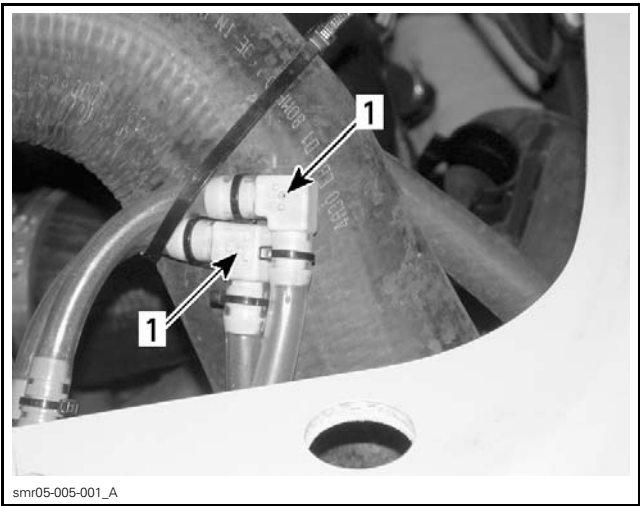
Bailer Pick-Up Access

Models with Suspension

Open the boarding platform.
Remove the storage bins.

Inspecting the Bailer Pick-Up

1. Inside hull, check holes in the bailer pick-ups to see if they are obstructed. Clean if necessary.
2. Check if the hole on each bailer hose elbow fitting is obstructed. Clean both elbow fittings if necessary.



1. Elbow fitting holes

NOTE: When repositioning the bailer hose elbows, attach them at the highest position that you can on the exhaust hose.

DRAIN PLUGS

Drain Plug Access

Models with Suspension

Open the boarding platform.
Remove the appropriate storage bin.

1503 4-TEC Engine

To reach the RH drain plug, remove the muffler.
For the LH drain plug, remove the resonator.

1630 ACE HO Engine

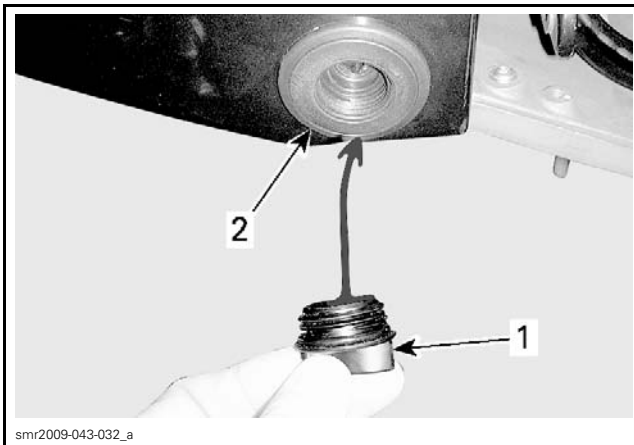
To reach the RH drain plug, remove the muffler and the resonator.
For the LH drain plug, remove the intercooler and the resonator.

Drain Plug Neck Removal

Remove the required parts:

- Muffler (on LH side)
- Resonator (on RH side - 1503 4-TEC engine)
- Intercooler (on RH side - 1630 ACE HO engine).

1. Unscrew the drain plug from the drain neck and pull the drain plug out of the neck.



DRAIN PLUG REMOVAL

1. Drain plug
2. Drain neck

2. Inside hull, hold the drain neck nut using adjustable pliers.
3. Using a ratchet handle and extension of appropriate size, unscrew the drain neck from the hull.



DRAIN NECK REMOVAL

Installing the Drain Plug Neck

1. Install drain neck and torque to specification.

TIGHTENING TORQUE	
Drain plug neck	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

2. Secure bailer hose to drain neck using a NEW locking tie.

3. Reinstall all removed parts in the reverse order of removal.

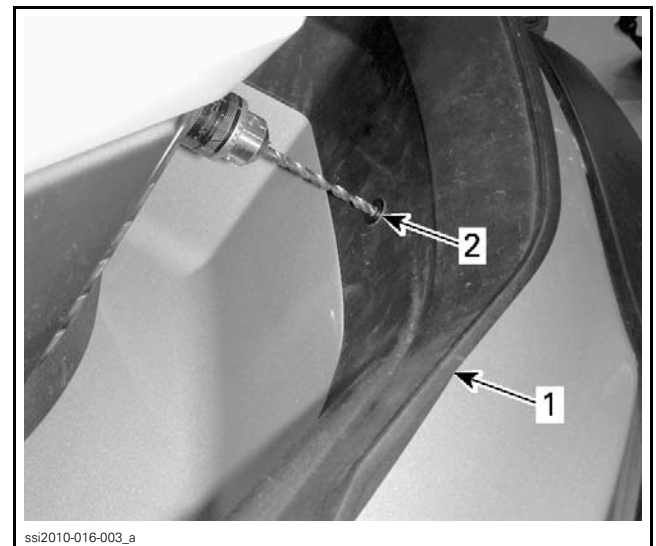
BOW EYELET

Removing the Bow Eyelet

Models with Suspension

To remove the retaining nuts on the bow mooring eyelet, an access hole must be cut in the neoprene sealing pad. Carry out the following steps.

1. Remove splash deflector.
 - 1.1 Drill all rivets holding the splash deflector.



1. Splash deflector
2. Rivet

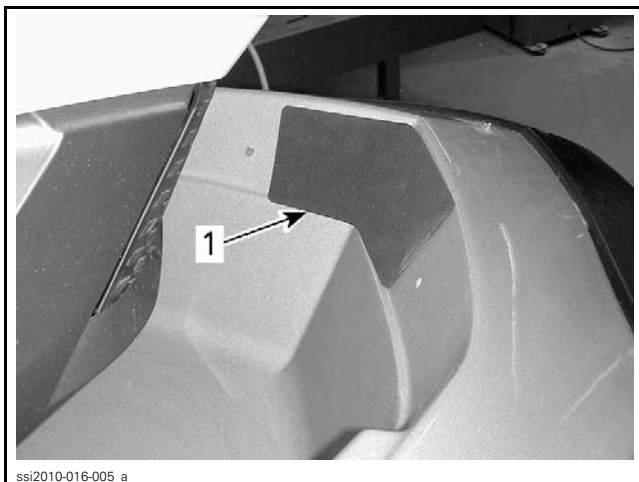
- 1.2 Remove splash deflector from vehicle.



- 1.3 Clean aluminum residues.

2. Using a cutting knife, make opening in the neoprene sealing pad.

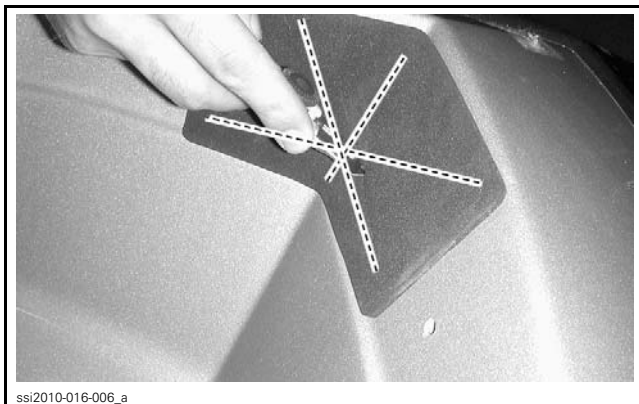
Subsection XX (HULL (GTX_RXT AND WAKE PRO SERIES))



1. Neoprene sealing pad

3. Make 3 cuts according to the following picture.

NOTICE Do not cut neoprene sealing pad too close to its edges to prevent tearing it off when folding and ensure proper sealing.



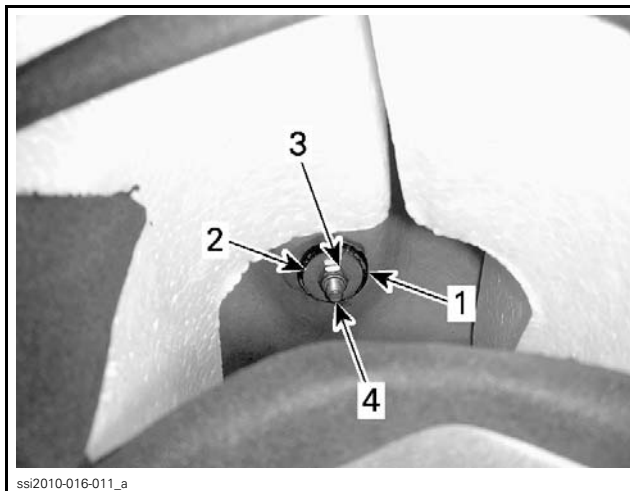
CUTTING PATTERN

4. Gently fold all flaps of the neoprene sealing pad towards the inside of the hull.



5. Unscrew and discard both elastic stop nuts holding the bow eyelet in place.

NOTE: The rubber washers and large washers should be kept for installation.



- 1. Rubber washer
- 2. Large washer
- 3. Elastic nut
- 4. Screw

6. From the outside of watercraft, pull bow eyelet to remove it from watercraft.

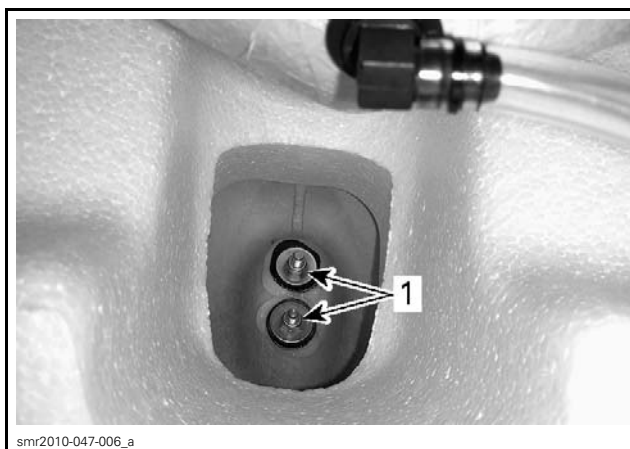
7. Clean any residue of silicone sealant on hull.

Models Without Suspension

1. Open the front storage cover.

2. Remove the storage bin.

3. Remove nuts and washers securing the bow eyelet or the iCATCH bow cup. Discard nuts.



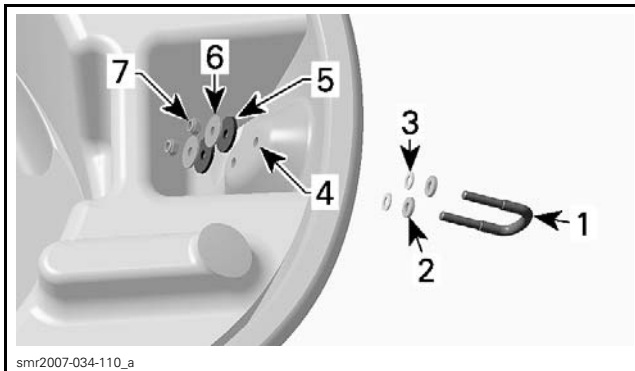
TYPICAL – INSIDE HULL

- 1. Eyelet retaining nuts

4. Remove the bow eyelet/iCATCH bow cup from the vehicle.

5. Clean any residue of silicone sealant from the hull.

Installing the Bow Eyelet



TYPICAL – BOW EYELET

1. Bow eyelet
2. Small washer
3. Nylon washer
4. Loctite 5150 (silicone sealant) here
5. Rubber washer
6. Large washer
7. Elastic stop nut

REQUIRED PRODUCT	LOCATION
CLEAR SILICONE SEALANT (P/N 296 000 309)	Inside hull, around holes
TIGHTENING TORQUE	
Retaining nuts	14.5 N•m (128 lbf•in)

Models with Suspension

Reinstall the splash deflector on the fixed deck using 6 rivets.

NOTICE Ensure neoprene gasket edges have not been damaged during the installation procedure before reinstalling the splash deflector. If gasket is damaged, replace by a new one.

STERN EYELETS

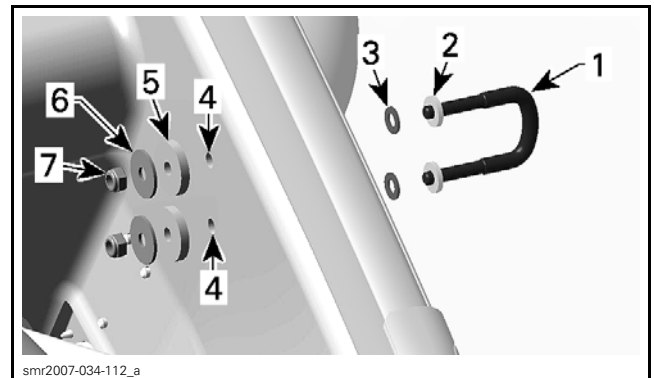
Removing the Stern Eyelet

1. On models with suspension, open the boarding platform and remove the applicable storage tray.
2. Inside hull, unscrew and discard elastic stop nuts securing the stern eyelet to hull.
3. Pull stern eyelet to remove it from watercraft.
4. Clean any residue of silicone sealant from the hull.

Installing the Stern Eyelet

1. Install small washers and nylon washers to stern eyelet and insert it through the hull.
2. Inside hull, apply CLEAR SILICONE SEALANT (P/N 296 000 309) all around holes.

3. Install eyelet and other parts using NEW elastic stop nuts as per following illustration.



TYPICAL

1. Stern eyelet
2. Small washer
3. Nylon washer
4. Loctite 5150 (silicone sealant) here
5. Rubber washer
6. Large washer
7. Elastic stop nut

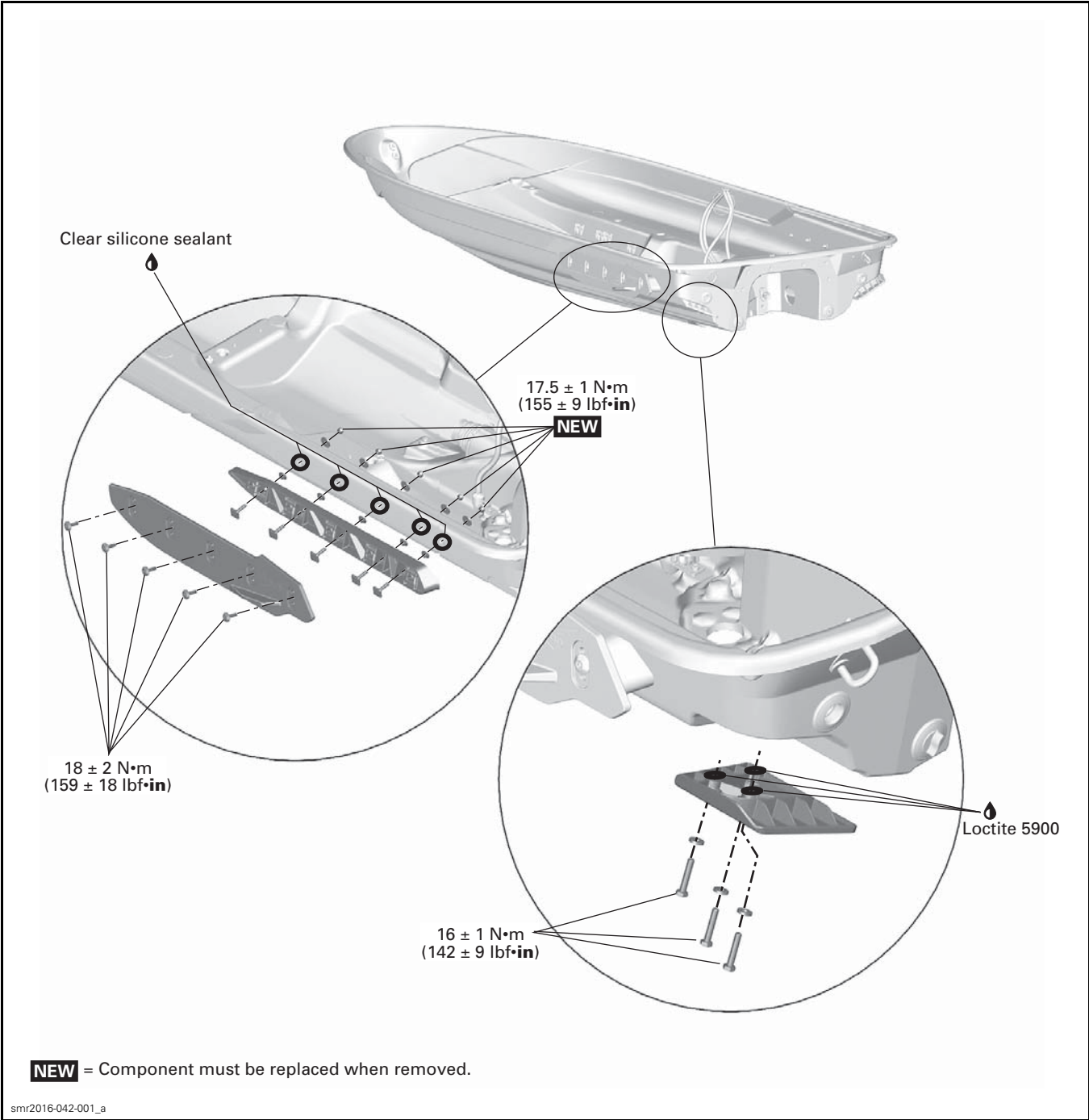
4. Tighten nuts to the specified torque.

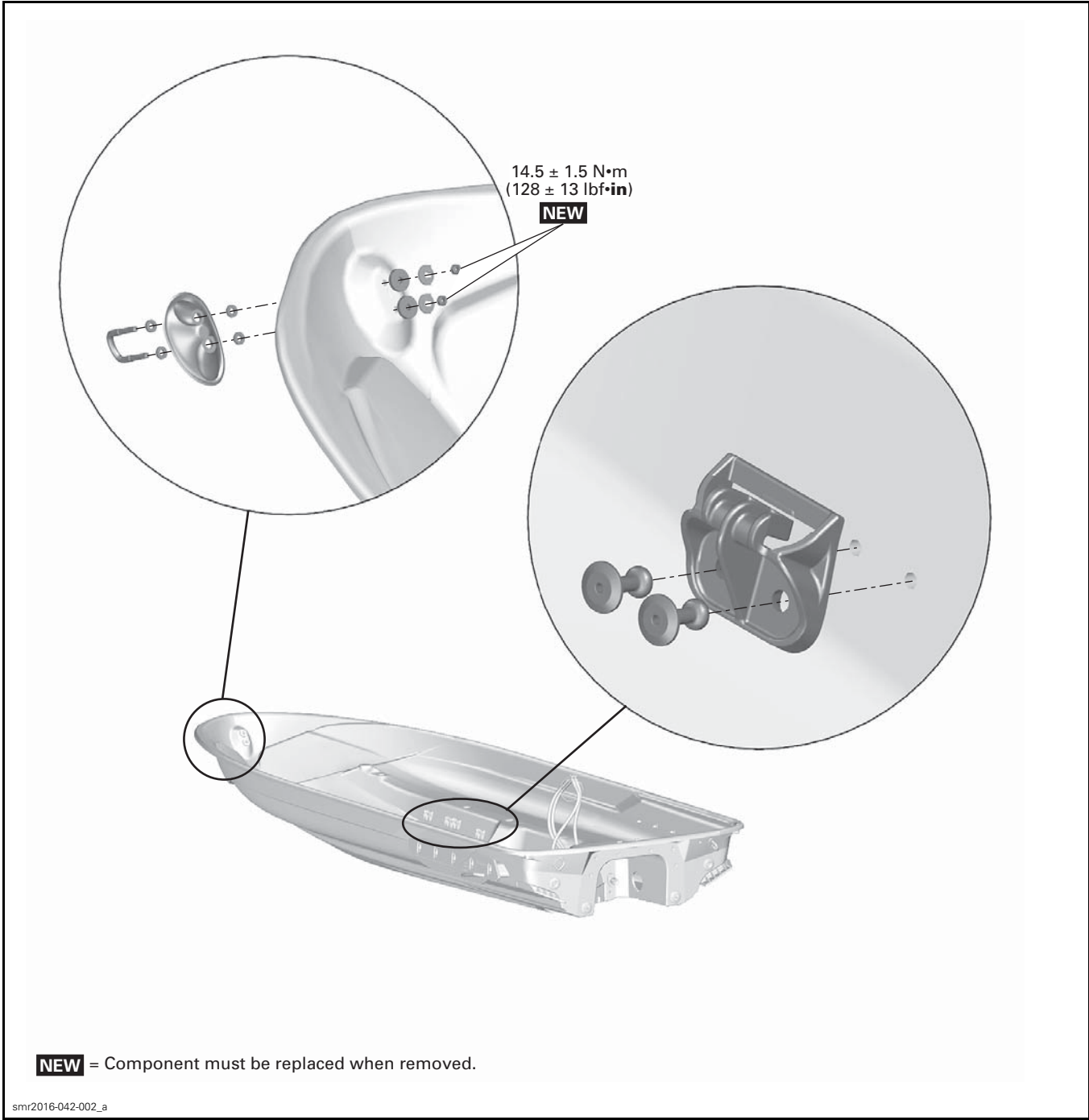
TIGHTENING TORQUE	
Eyelet retaining nuts	14.5 N•m ± 1.5 N•m (128 lbf•in ± 13 lbf•in)

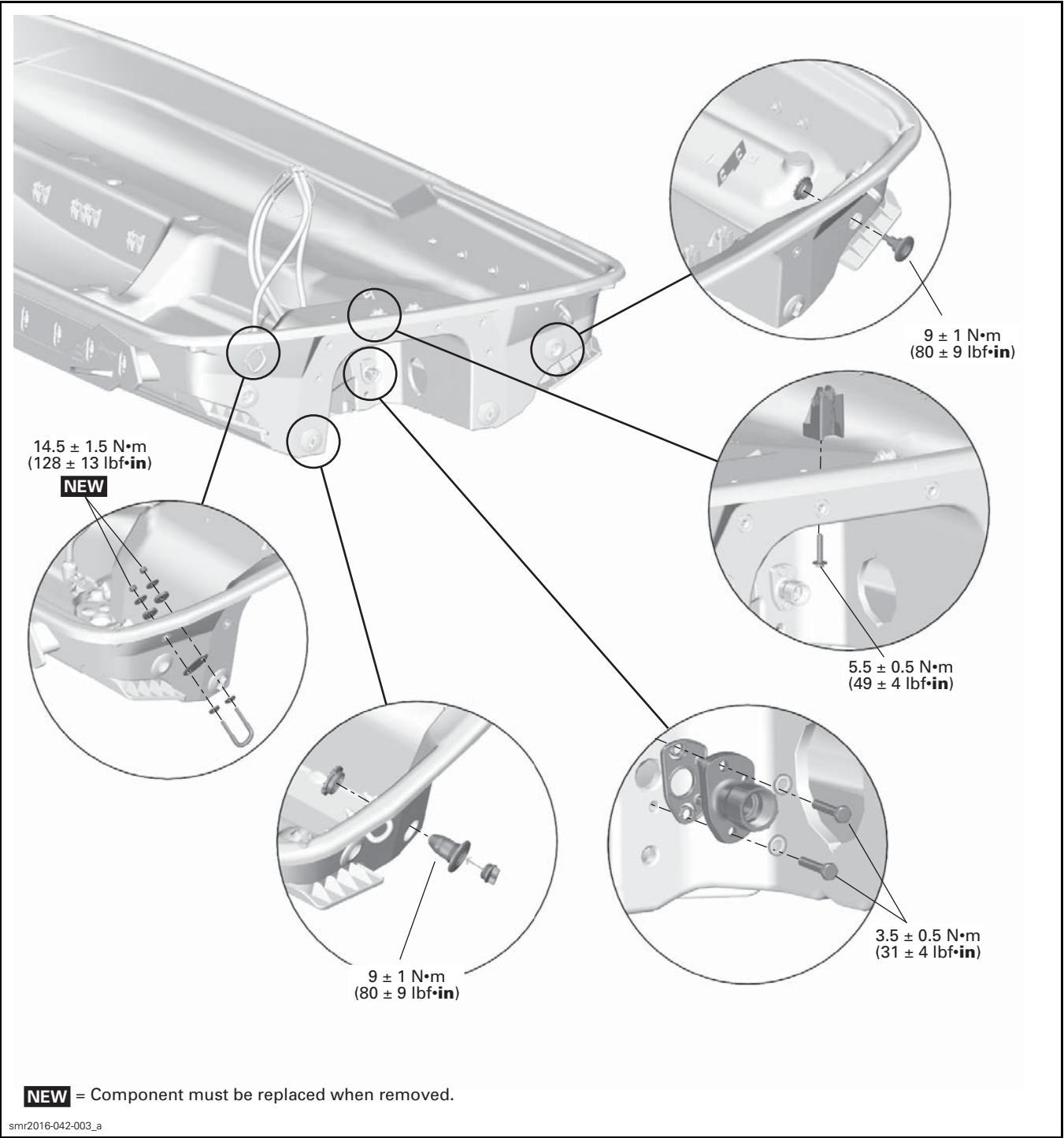
HULL (RXP-X SERIES)

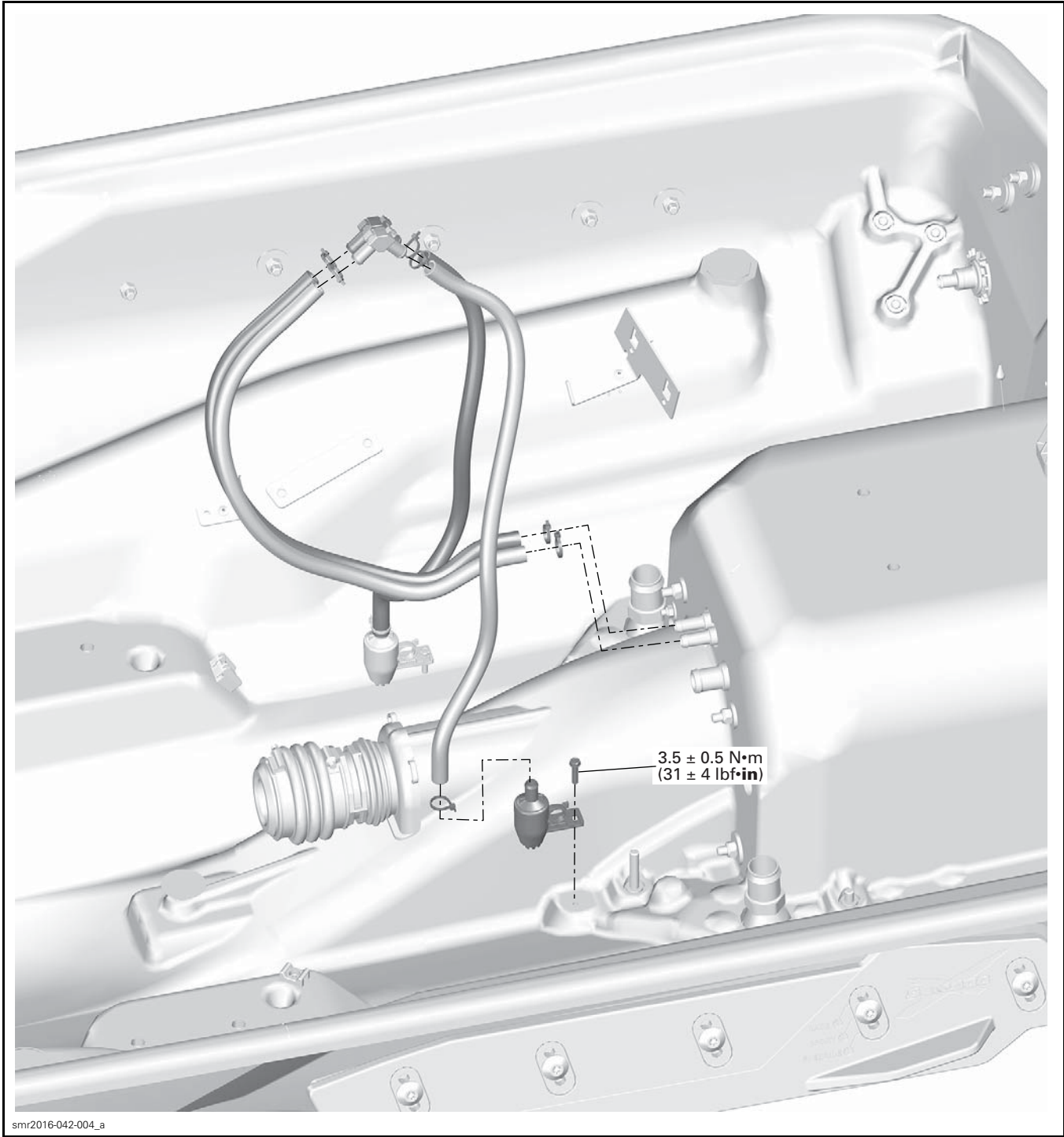
SERVICE PRODUCTS

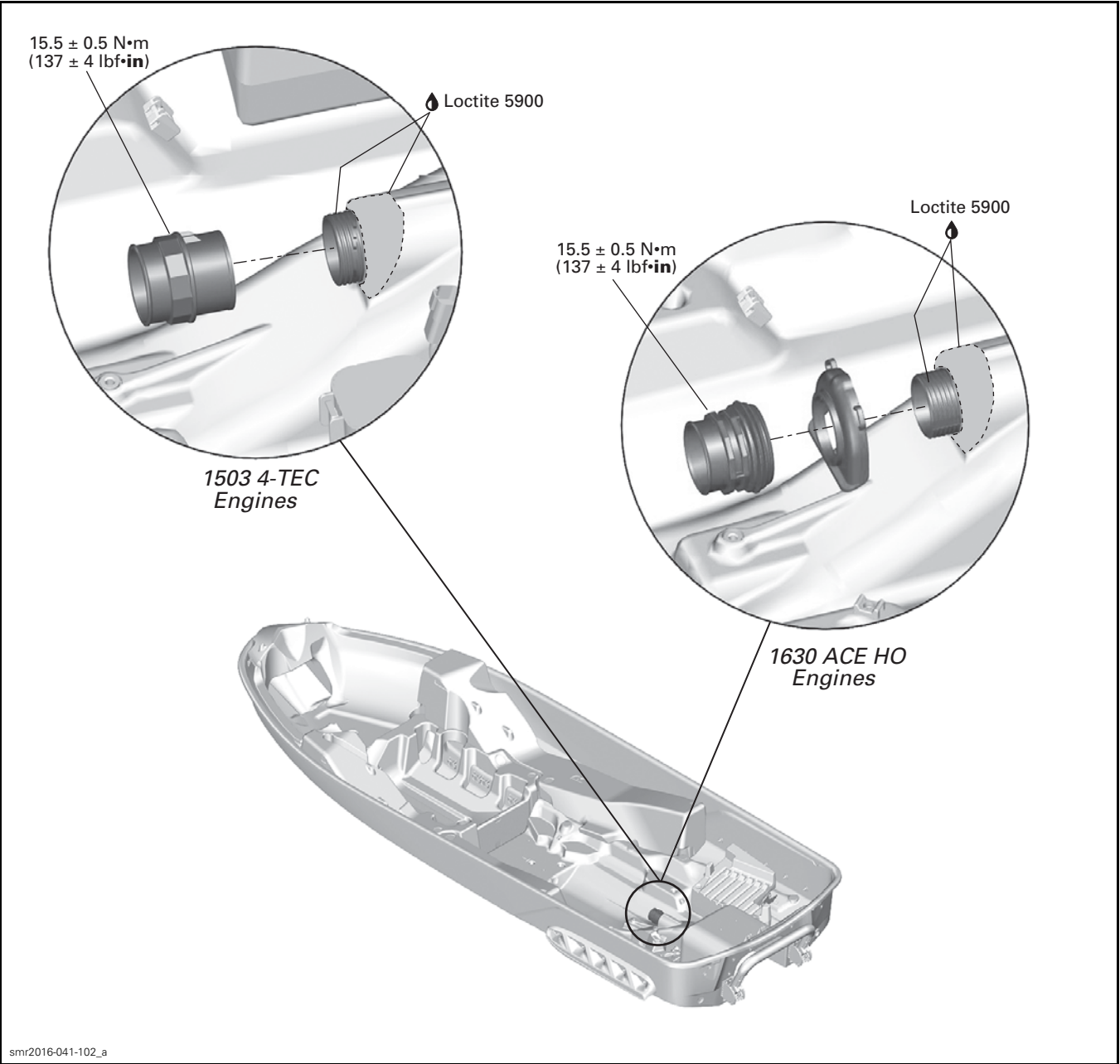
Description	Part Number	Page
BRP HEAVY DUTY CLEANER	293 110 001	9-11
CLEAR SILICONE SEALANT	296 000 309	12, 14
LOCTITE 5900	293 800 066	9-12



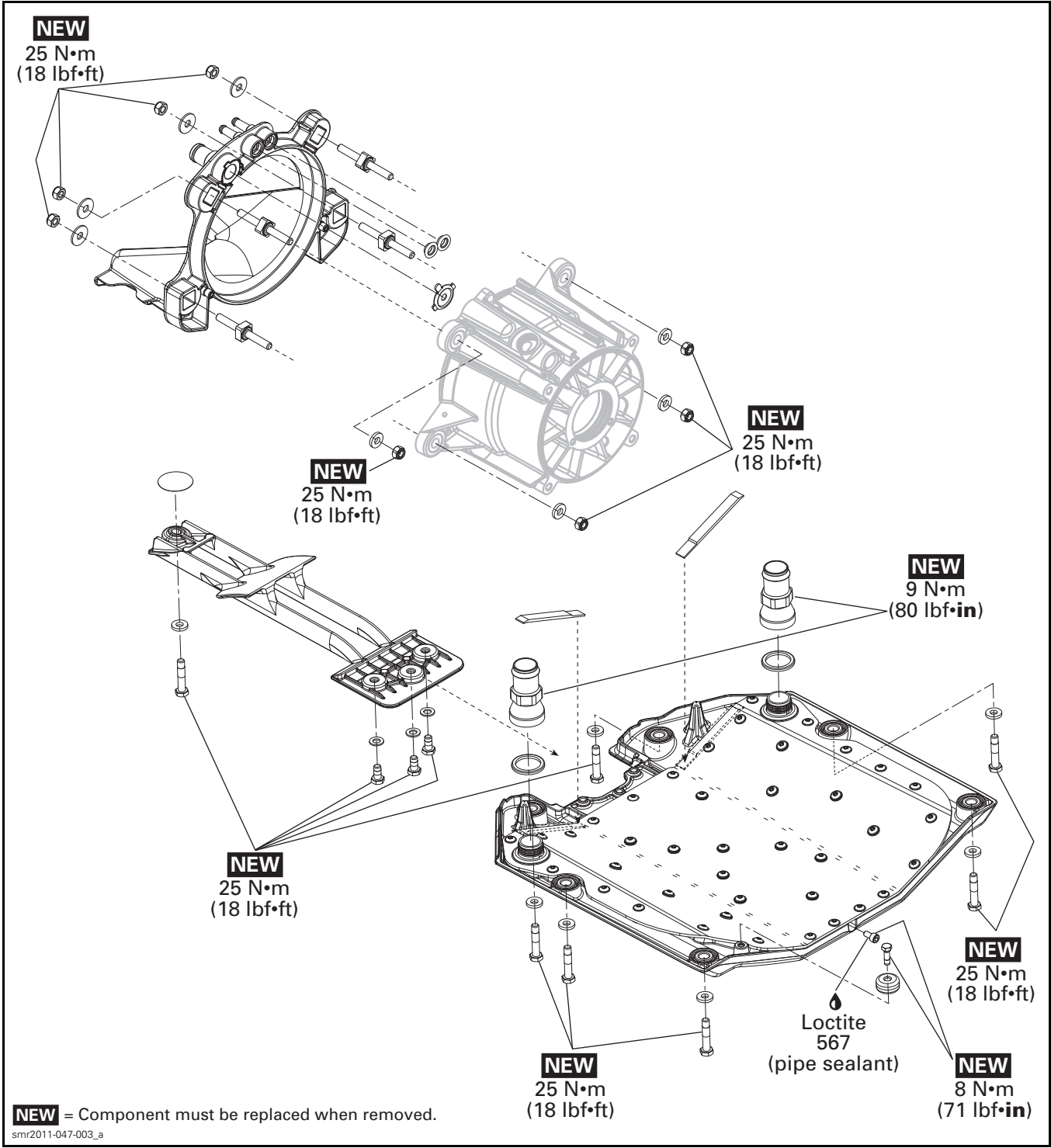








Subsection XX (HULL (RXP-X SERIES))



PROCEDURES

HULL

Hull Repair

The repair procedures of the hull is not the same as a fiberglass composite hull and deck. The standard polyester based fiberglass repair kits **will not work** with this type of hull. The polyester will not adhere to the hull material. Only two-part epoxy repair material should be used.

To repair a hull, the use of an Epoxy repair system, such as the WEST SYSTEM® or equivalent epoxy, is mandatory.

However, the finish on the ³ hull is a polyester based gelcoat with a bonding layer between the hull and the gelcoat. Standard gelcoat refinishing can be performed if the damage is limited to the color surface. If damage requires the removal or the repair to structure material, the epoxy may also be used as a barrier coat before refinishing with gelcoat. Epoxy adheres to hull material, and gelcoat adheres to epoxy.

An epoxy repair kit can be purchased directly from WEST SYSTEM.

Go to www.westsystem.com.

On this site you will find complete repair instructions, click on HOW TO USE.

Also training videos, tools and several products are available on the web site.

Consumer Assistance

North and South America

WEST SYSTEM

102 Patterson Ave.
P.O. Box 665 Bay City, MI 48707-0665

Phone: 989 684-7286
Toll free: 866 937-8797
Fax: 989 684-1374

Europe, Middle East, Africa and Asia

WESSEX RESINS AND ADHESIVES LIMITED
Cupernham House, Cupernham Lane, Romsey
England SO51 7LF

Phone: 44-1-794-521-111
Fax: 44-1-794-517-779
E-mail: info@wessex-resins.com

Australia, South Pacific and Asia

ATL COMPOSITES

P.O. Box 2349/Southport 4215
Queensland, Australia

Tel.: +61 7-5563-1222,
Fax: +61 7-5563-1585
E-mail: info@atlcomposites.com

New Zealand, South Pacific and Asia

ADHESIVE TECHNOLOGIES LTD.

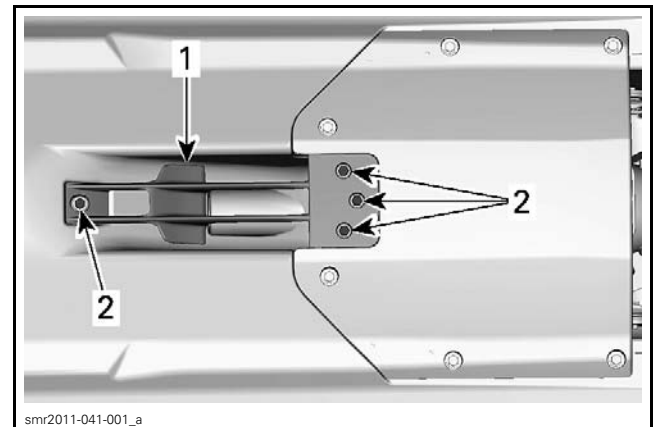
17 Corbans Ave./Box 21-169, Henderson
Auckland, New Zealand

Phone: 64-9-838-6961
Fax: 64-9-836-4849
E-mail: enquiries@adhesivetechologies.co.nz

INLET GRATE

Removing the Inlet Grate

1. Remove inlet grate retaining screws using an impact tool. Discard screws.



TYPICAL

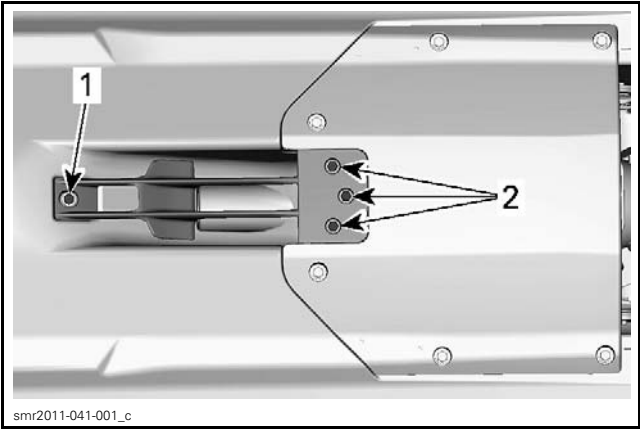
1. Inlet grate
2. Inlet grate screws

2. Remove inlet grate.

Installing the Inlet Grate

1. Install NEW inlet grate retaining screws at the proper location.

INLET GRATE SCREWS	
LOCATION	SCREW SIZE
Front	M8 x 45
Rear	M8 x 20

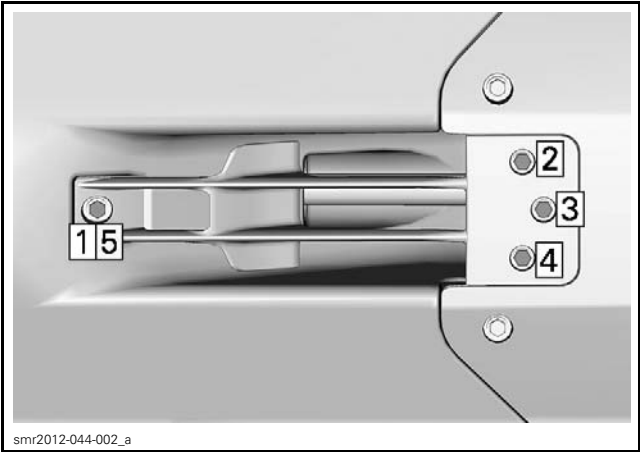


SCREW LOCATION

- 1. Front
- 2. Rear

- 2. Tighten screws to the specified torque and sequence.

TIGHTENING TORQUE		
INLET GRATE SCREWS	First step	Hand tighten
	Second step	25 N•m (18 lbf•ft)



TIGHTENING TORQUE SEQUENCE

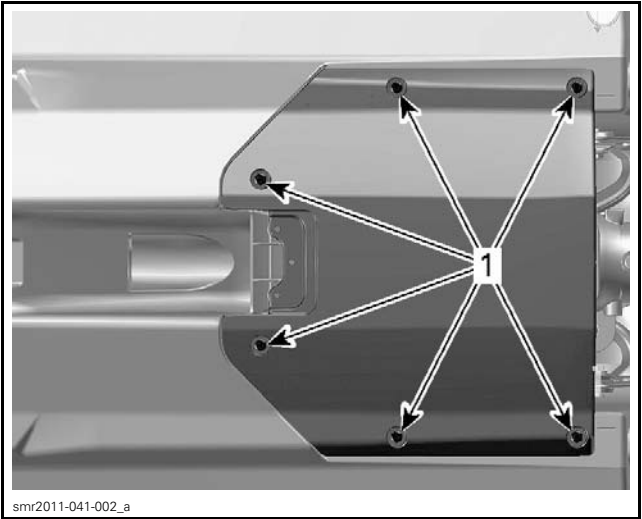
RIDE PLATE

Removing the Ride Plate

- 1. Remove inlet grate, see procedure in this sub-section.
- 2. Remove jet pump. Refer to *JET PUMP*.
- 3. Drain cooling system. Refer to *COOLING SYSTEM*.
- 4. From inside the hull, disconnect coolant hoses from the ride plate.
- 5. Remove coolant hose fittings from the ride plate.

NOTICE If possible, remove the hose fittings from the ride plate before removing the ride plate. If fittings cannot be removed, proceed with care when removing the ride plate.

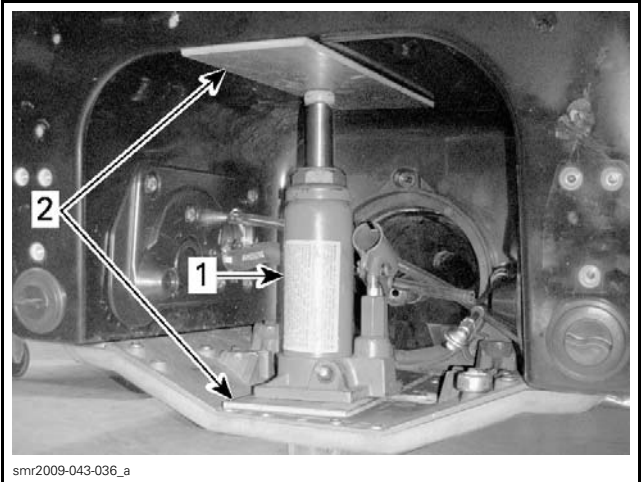
- 6. Heat ride plate retaining screws using a heat gun.
- 7. Using an impact tool, remove and discard retaining screws.



TYPICAL

- 1. Ride plate retaining screws

- 8. Install a low height hydraulic bottle jack and 2 steel plates between ride plate and hull as per following illustration.



TYPICAL

- 1. Hydraulic bottle jack
- 2. Steel plates

- 9. Heat the edge of the ride plate with a heat gun to soften the sealant.
- 10. Start pumping the hydraulic jack slowly.
- 11. Using a sharp knife, carefully cut the sealant around the ride plate edges.

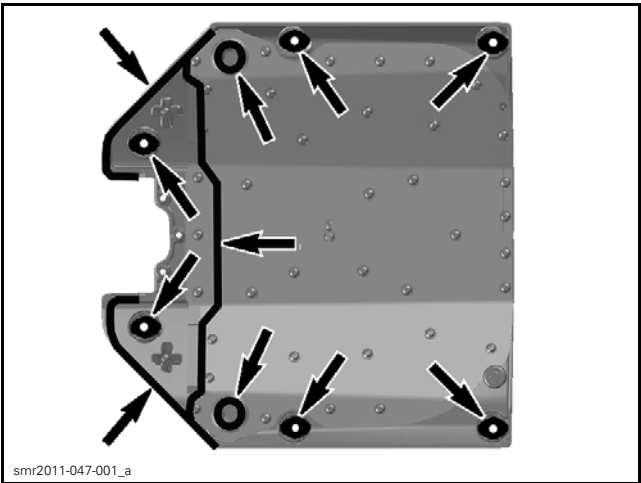
12. Pump the hydraulic jack slowly to pry the ride plate from the hull.

Cleaning the Ride Plate

1. Carefully scrape off all excess sealant from ride plate and hull.
2. Clean hull surface with BRP HEAVY DUTY CLEANER (P/N 293 110 001) to eliminate grease, dust and sealant residue. Clean fitting threads.

Installing the Ride Plate

1. Apply LOCTITE 5900 (P/N 293 800 066) sealant as illustrated.



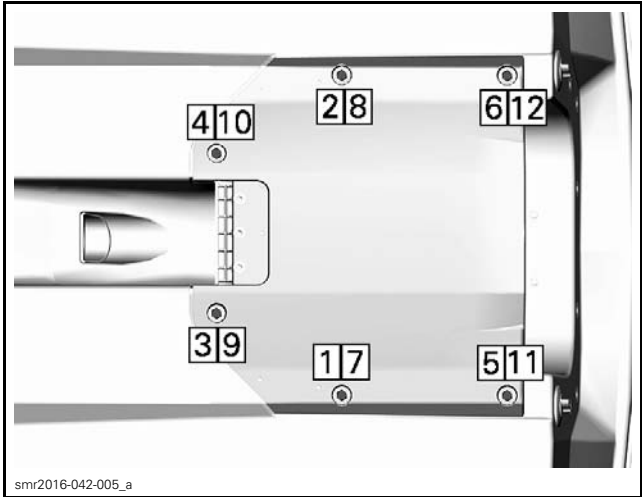
SEALANT APPLICATION

2. Install both hose fittings on the ride plate. Tighten to the specified torque.

TIGHTENING TORQUE	
Hose fittings	9 N•m (80 lbf•in)

3. Position ride plate on hull and thread **NEW** screws 5 turns by hand.
4. Position inlet grate and thread **NEW** screws 5 turns by hand. Refer to *INLET GRATE* in this subsection.
5. Tighten screws to the specified torque and sequence.

TIGHTENING TORQUE		
RIDE PLATE RETAINING SCREWS	First step	Hand tighten
	Second step	25 N•m (18 lbf•ft)



RIDE PLATE TIGHTENING SEQUENCE

6. Tighten inlet grate screws to the specified torque and sequence, refer to *INSTALLING THE INLET GRATE* in this subsection.
7. Reinstall coolant hoses on ride plate fittings.

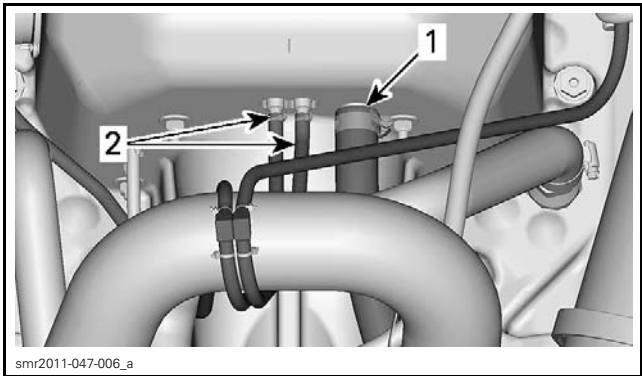
NOTICE Make sure the coolant hose clamp screws do not rub on any component.

8. Fill and bleed cooling system and carry out a leak test. Refer to *COOLING SYSTEM* subsection.
9. Install all remaining parts. Refer to the applicable procedures.

JET PUMP SUPPORT

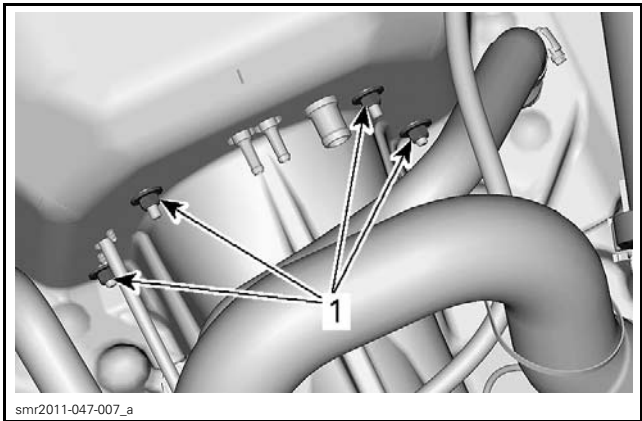
Removing the Jet Pump Support

1. Remove the following parts:
- Jet pump (refer to *JET PUMP* subsection)
 - Drive shaft (refer to *DRIVE SHAFT* subsection)
 - Ride plate (refer to *RIDE PLATE* in this subsection).
2. Disconnect hoses from jet pump support.



INSIDE THE HULL
1. Exhaust water supply hose
2. Bailer hoses

3. Remove jet pump support retaining nuts and washers.



INSIDE THE HULL
1. Jet pump support retaining nuts

4. Heat the jet pump support using a heat gun in order to soften the sealant.
5. Pull jet pump support off the hull.
6. Note the alignment shims location.

NOTICE Alignment shims have to be reinstalled at the same location.

Cleaning the Jet Pump Support

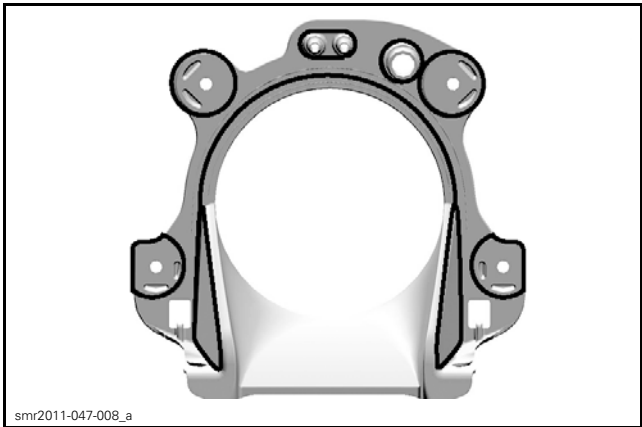
1. Scrape off all excess sealant from jet pump support, ride plate, and hull.
2. Inspect pump support for cracks or other damage.
3. Clean jet pump support and hull surface with BRP HEAVY DUTY CLEANER (P/N 293 110 001) to eliminate grease, dust, and sealant residue.

Installing the Jet Pump Support

1. Make sure sealant contact areas are clean and dry.

NOTE: If a new jet pump support is installed, perform a flame treat to increase the adhesion of the Loctite 5900.

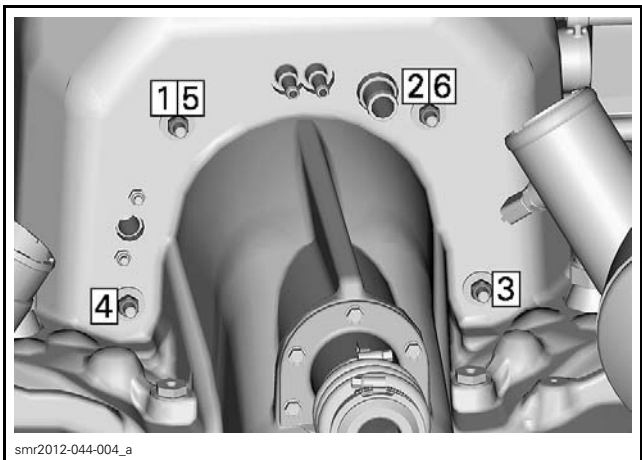
2. Apply LOCTITE 5900 (P/N 293 800 066) on the jet pump support as shown (thick black line).



SEALANT APPLICATION

3. Insert the studs in the jet pump support square holes.
4. Slide the alignment shims on the studs.
5. Position the jet pump support against the hull.
6. Inside the hull, thread all 4 retaining nuts.
7. Tighten retaining nuts to the specified torque and sequence.

TIGHTENING TORQUE	
Jet pump support retaining nuts	25 N•m (18 lbf•ft)



JET PUMP SUPPORT TIGHTENING SEQUENCE

8. Remove excess sealant.
9. Reinstall other removed parts. Refer to appropriate subsections for procedures.

THRU-HULL FITTING

Removing the Thru-Hull Fitting

1. Remove drive shaft, refer to *DRIVE SHAFT* subsection.
2. Heat the thru-hull fitting nut with a heat gun to soften the sealer.
3. Unscrew the thru-hull fitting nut and remove the spacer.
4. From underneath of the vehicle, heat the thru-hull fitting with a heat gun to soften the sealer.
5. Pull thru-hull fitting off the hull.

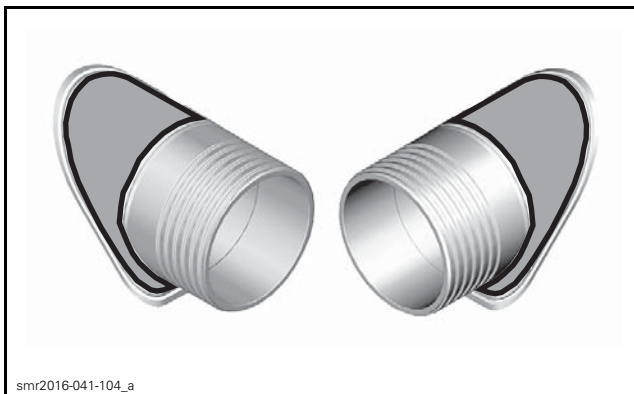
Cleaning the Thru-Hull Fitting Area

1. Scrape off all excess sealant from the hull.
2. Clean hull surface with BRP HEAVY DUTY CLEANER (P/N 293 110 001) to eliminate grease, dust, and sealant residue.

NOTE: Use only a clean, dry, oil free filtered air supply for dusting and drying parts or hull.

Installing the Thru-Hull Fitting

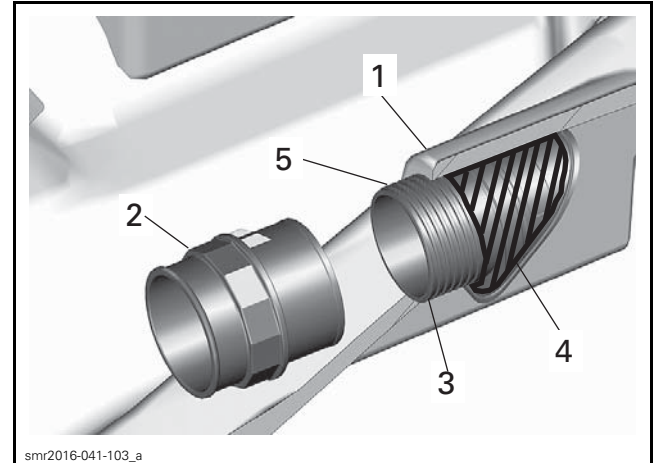
1. Make sure thru-hull fitting sealing surface is free of sealant residue, clean and dry before installation.
2. Apply LOCTITE 5900 (P/N 293 800 066) sealant all around on shaded surface.



SEALANT APPLICATION

3. Tighten screws to the specified torque and sequence.

TIGHTENING TORQUE	
Thru-hull fitting nut	15.5 N•m ± 0.5 N•m (137 lbf•in ± 4 lbf•in)



1. Hull (cut for clarity purpose)
2. Inner thru-hull fitting
3. Exterior thru-hull fitting
4. Sealant on exterior thru-hull fitting
5. Sealant over the threads

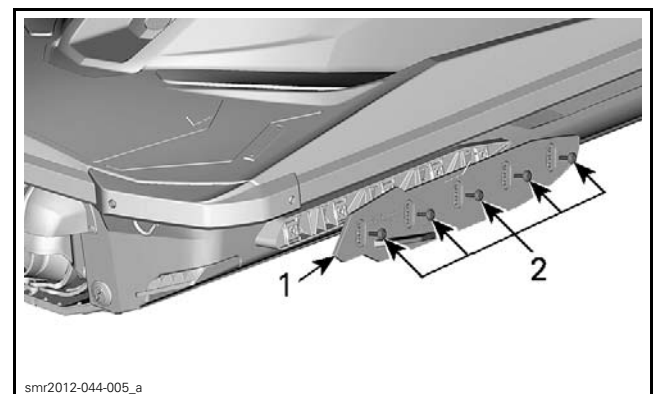
4. Install other removed parts, refer to the appropriate subsections.

ADJUSTABLE REAR SPONSONS

NOTE: The following procedures apply for RH and LH sides.

Removing the Adjustable Rear Sponson

Remove and discard all screws securing adjustable sponsons.



1. Adjustable sponson
2. Retaining screws

Installing the Adjustable Rear Sponson

⚠ WARNING

Both sponsons must be installed and adjusted at the same height. Missing sponsons or improper adjustment will affect handling and stability, which could cause a loss of control of the watercraft.

TIGHTENING TORQUE	
Sponson retaining screws	18 N•m ± 2 N•m (159 lbf•in ± 18 lbf•in)

ADJUSTABLE SPONSON SUPPORTS

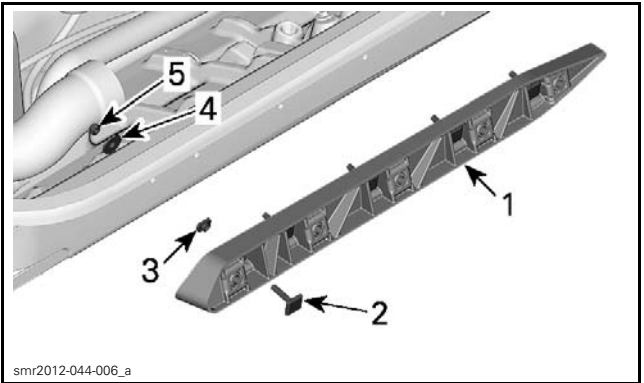
NOTE: Removal and installation procedure for RH and LH sponson is similar.

Removing the Adjustable Sponson Support

Remove the *ADJUSTABLE SPONSON*, see procedure in this subsection.

Remove the muffler (on LH side). Refer to *EX-HAUST SYSTEM* subsection.

From inside hull, remove nuts and washers retaining the adjustable sponson support.



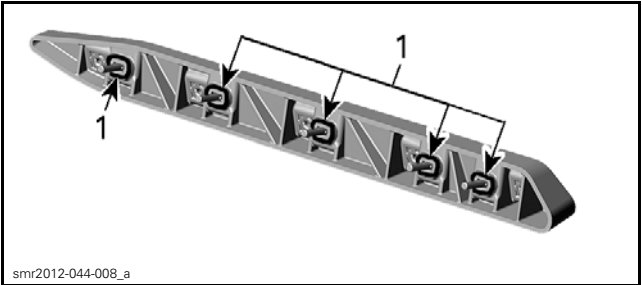
BODY NOT SHOWN FOR CLARITY PURPOSE

- 1. Sponson support
- 2. Square head stud
- 3. Push nut
- 4. Washer
- 5. Elastic stop nut

Installing the Adjustable Sponson Support

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

REQUIRED PRODUCT	LOCATION
CLEAR SILICONE SEALANT (P/N 296 000 309)	Around each hole of sponson support



- 1. Apply silicon sealant here

TIGHTENING TORQUE	
Sponson support nuts (NEW)	17.5 N•m ± 1 N•m (155 lbf•in ± 9 lbf•in)

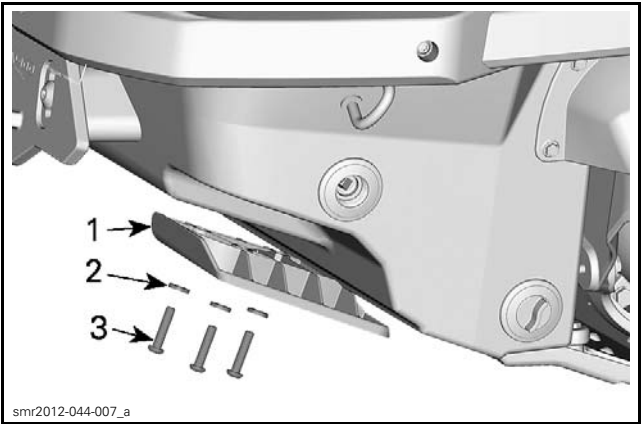
Reinstall adjustable sponson as described in *INSTALLING THE ADJUSTABLE SPONSON*.

FIXED TRIM TABS

NOTE: The following procedures apply to RH and LH sides.

Fixed Trim Tab Removal

Remove screws securing the fixed trim tab.



- 1. Trim tab
- 2. Washer
- 3. Trim tab retaining screws

Installing the Fixed Trim Tab

REQUIRED PRODUCT	LOCATION
LOCTITE 5900 (P/N 293 800 066)	Inside each hole of the hull

TIGHTENING TORQUE	
Fixed trim tab retaining screws	16 N•m ± 1 N•m (142 lbf•in ± 9 lbf•in)

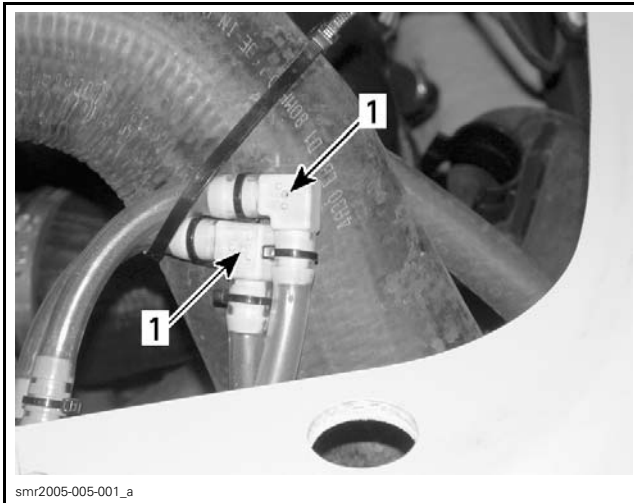
BAILERS

Two bailer pick ups (one each side), draw water from the bilge when watercraft is in operation.

The bailer pick ups are connected to syphon tubes mounted in the jet pump venturi that use the jet pump thrust to create a vacuum.

Inspecting the Bailer Pick-Up

1. Check holes in the bailer pick-ups to see if they are obstructed. Clean if necessary.
2. Check if the hole on each bailer hose elbow fitting is obstructed. Clean elbow fittings if necessary.



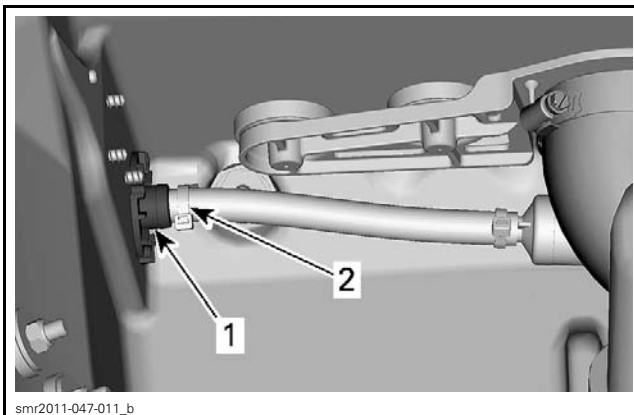
TYPICAL
1. Elbow fitting holes

NOTE: When repositioning the bailer hose elbows, attach them at the highest available point on the exhaust hose.

DRAIN PLUGS

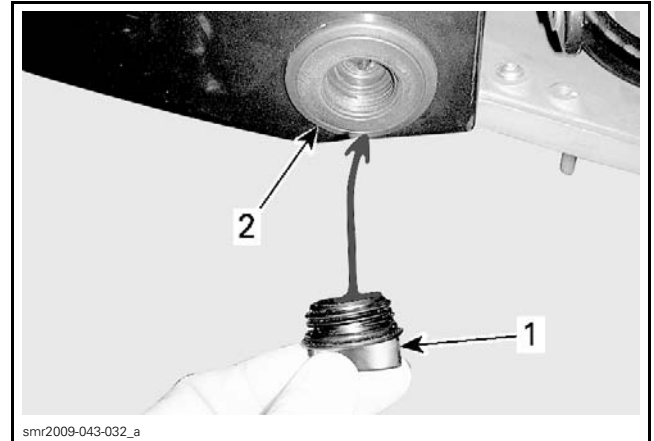
Removing the Drain Plug Neck

1. Cut locking tie securing bailer hose to the drain plug assembly.



RH SHOWN
1. Drain plug neck
2. Locking tie

2. Unscrew the drain plug from the drain neck and pull the drain plug out of the neck.



DRAIN PLUG REMOVAL
1. Drain plug
2. Drain neck

3. Inside the hull, hold drain neck nut using adjustable pliers.
4. Insert a ratchet extension in the square hole, then unscrew the drain neck from the hull.



DRAIN NECK REMOVAL

Installing the Drain Plug Neck

1. Install drain neck and torque to specification.

TIGHTENING TORQUE	
Drain plug neck	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

2. Secure bailer hose to drain neck using a NEW locking tie.
3. Reinstall all removed parts in the reverse order of removal.

BOW AND STERN EYELETS

Bow Eyelet Access

Open the front storage cover.

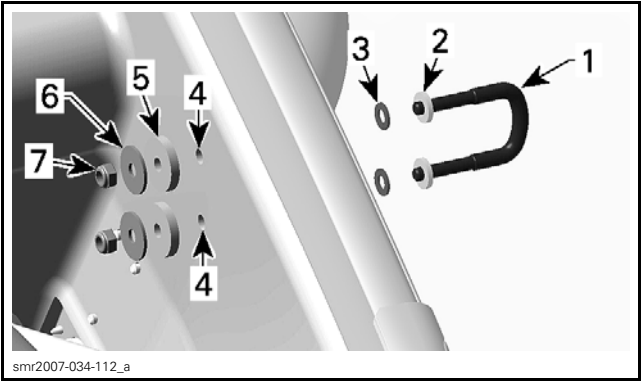
Stern Eyelet Access

Remove seat.

Removing the Eyelet

- 1. Unscrew and discard both bow eyelet retaining nuts.

NOTE: Keep all washers for installation. Bow and stern eyelets have the same hardware layout.

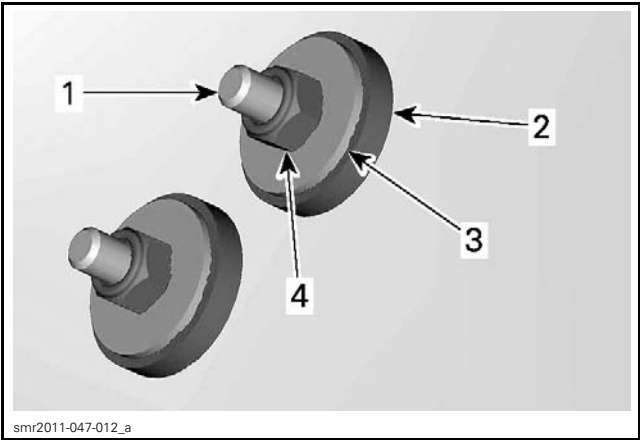


TYPICAL

- 1. Eyelet
- 2. Small stainless steel washer
- 3. Nylon washer
- 4. Loctite 5150 (silicone sealant) here
- 5. Rubber washer
- 6. Large stainless steel washer
- 7. Elastic stop nut

- 3. Tighten nuts to the specified torque.

TIGHTENING TORQUE	
Eyelet retaining nuts	14.5 N•m ± 1.5 N•m (128 lbf•in ± 13 lbf•in)



TYPICAL - INSIDE THE HULL

- 1. Threaded portion of the eyelet
- 2. Rubber washer
- 3. Large stainless steel washer
- 4. Elastic stop nut

- 2. Pull eyelet off the hull.
- 3. Clean any silicone sealant residue.

Installing the Eyelet

- 1. Inside the hull, apply CLEAR SILICONE SEALANT (P/N 296 000 309) around eyelet mounting holes.
- 2. Position eyelet and hardware as illustrated. Use **NEW** elastic stop nuts.

NOTE: Bow and stern eyelets have the same hardware layout.

1630 ACE HO ENGINE

ENGINE			
Engine type			ROTAX® 1630 ACE™ HO, 4-stroke, Single Over Head Camshaft (SOHC)
Declared Power			217 kW @ 8000 RPM
Induction			Supercharged intercooled
Number of cylinders			3
Number of valves			12 valves with hydraulic lifters (no adjustment)
Bore			100 mm (3.9 in)
Stroke			69.2 mm (2.7 in)
Displacement			1 630.5 cm³ (99.5 in³)
Compression ratio			8.4:1
Maximum HP RPM			8000 RPM
Intake valve opening			0° BTDC
Intake valve closing			50° ABDC
Exhaust valve opening			50° BBDC
Exhaust valve closing			0° ATDC
Valve stem diameter	Intake	New	5.961 mm to 5.975 mm (.2347 in to .2352 in)
		Service limit	5.930 mm (.2335 in)
	Exhaust	New	5.946 mm to 5.960 mm (.2341 in to .2346 in)
		Service limit	5.930 mm (.2335 in)
Valve guide diameter		New	5.994 mm to 6.018 mm (.236 in to .2369 in)
		Service limit	6.060 mm (.2386 in)
Valve spring free length	Inner	New	41.02 mm (1.615 in)
		Service limit	38.80 mm (1.528 in)
	Outer	New	45.45 mm (1.789 in)
		Service limit	43.00 mm (1.693 in)
Valve seat contact width	Intake	New	1.10 mm to 1.30 mm (.043 in to .051 in)
		Service limit	1.60 mm (.063 in)
	Exhaust	New	1.25 mm to 1.55 mm (.049 in to .061 in)
		Service limit	1.80 mm (.071 in)
Rocker arm inner diameter		New	20.007 mm to 20.020 mm (.7877 in to .7882 in)
		Service limit	20.050 mm (.7894 in)
Rocker arm shaft diameter		New	19.980 mm to 19.993 mm (.7866 in to .7871 in)
		Service limit	19.970 mm (.7862 in)
Cylinder head maximum warpage		Service limit	0.15 mm (.006 in)

Subsection XX (1630 ACE HO ENGINE)

ENGINE			
Piston ring type		1 st	Upper compression ring, rectangular
		2 nd	Lower compression ring, tapered face
		3 rd	Oil scraper ring
Ring end gap	Rectangular	New	0.30 mm to 0.50 mm (.012 in to .02 in)
	Taper-face	New	0.35 mm to 0.55 mm (.014 in to .022 in)
	Oil scraper ring	New	0.20 mm to 0.70 mm (.008 in to .028 in)
	All	Service limit	1.20 mm (.047 in)
Ring/piston groove clearance	Rectangular	New	0.025 mm to 0.070 mm (.001 in to .0028 in)
		Service limit	0.150 mm (.0059 in)
	Taper-face	New	0.015 mm to 0.060 mm (.0006 in to .0024 in)
		Service limit	0.150 mm (.0059 in)
	Oil scraper ring	New	0.010 mm to 0.180 mm (.0004 in to .0071 in)
		Service limit	0.200 mm (.0079 in)
Piston measurement		New	99.931 mm to 99.949 mm (3.9343 in to 3.935 in)
		Service limit	99.900 mm (3.9331 in)
Piston/cylinder wall clearance		New	0.044 mm to 0.076 mm (.0017 in to .003 in)
		Service limit	0.100 mm (.0039 in)
Cylinder taper		New Maximum	0.036 mm (.0014 in)
		Service limit	0.100 mm (.0039 in)
Cylinder out of round		New Maximum	0.008 mm (.0003 in)
		Service limit	0.020 mm (.0008 in)
Camshaft bearing journal diameter	Front	New	24.939 mm to 24.960 mm (.9819 in to .9827 in)
		Service limit	24.910 mm (.9807 in)
	PTO and center	New	39.892 mm to 39.905 mm (1.5706 in to 1.5711 in)
		Service limit	39.880 mm (1.5701 in)
Camshaft bearing inner diameter	Front	New	25.000 mm to 25.013 mm (.9843 in to .9848 in)
		Service limit	25.050 mm (.9862 in)
	PTO and center	New	40.000 mm to 40.020 mm (1.5748 in to 1.5756 in)
		Service limit	40.050 mm (1.5768 in)

ENGINE			
Cam lobe height	Intake	New	31.540 mm to 31.740 mm (1.2417 in to 1.2496 in)
		Service limit	31.500 mm (1.2402 in)
	Exhaust	New	31.430 mm to 31.630 mm (1.2374 in to 1.2453 in)
		Service limit	31.380 mm (1.2354 in)
Crankshaft deflection		Maximum	0.08 mm (.003 in)
Crankshaft axial clearance		New	0.08 mm to 0.22 mm (.003 in to .009 in)
		Service limit	0.35 mm (.014 in)
Crankshaft bearing journal diameter		New	49.991 mm to 50.010 mm (1.9681 in to 1.9689 in)
		Service limit	49.950 mm (1.9665 in)
Crankshaft radial clearance		Service limit	0.07 mm (.0028 in)
Crankshaft bearing inside diameter		Service limit	50.10 mm (1.9724 in)
Crankshaft pin diameter		New	45.032 mm to 45.048 mm (1.7729 in to 1.7735 in)
		Service limit	45.025 mm (1.7726 in)
Connecting rod big end diameter		Service limit	45.080 mm (1.7748 in)
Connecting rod big end radial play		Service limit	0.090 mm (.0035 in)
Connecting rod big end axial play		New	0.100 mm to 0.352 mm (.004 in to .014 in)
		Service limit	0.500 mm (.02 in)
Connecting rod small end diameter		New	22.01 mm to 22.02 mm (.8665 in to .8669 in)
		Service limit	22.07 mm (.8689 in)
Connecting rod small end radial play		Service limit	0.080 mm (.003 in)
Piston pin diameter		New	21.996 mm to 22.000 mm (.866 in to .8661 in)
		Service limit	21.990 mm (.8657 in)
Balance shaft journal diameter		New	31.984 mm to 32.000 mm (1.2592 in to 1.2598 in)
		Service limit	31.950 mm (1.2579 in)
Balance shaft radial clearance		Service limit	0.070 mm (.0028 in)
Balance shaft bearing inside diameter		Service limit	32.11 mm (1.2642 in)
Balance shaft axial clearance		New	0.02 mm to 0.25 mm (.001 in to .01 in)
		Service limit	0.35 mm (.014 in)
Supercharger clutch slipping moment		New supercharger	14 N•m to 17 N•m (124 lbf•in to 150 lbf•in)
		Break-in supercharger	Minimum 11 N•m (97 lbf•in)

Subsection XX (1630 ACE HO ENGINE)

AIR INTAKE SYSTEM		
Intake spark arrester		Tubular, wire screen
LUBRICATION SYSTEM		
Lubrication	Oil type	XPS 4-stroke synthetic blend oil) (P/N 293 600 121) or a 10W40 mineral engine oil compatible with wet clutches (JASO MA certified oils)
	Capacity	3 L (3.2 qt (U.S. liq.)) oil change w/filter 5 L (5.3 qt (U.S. liq.))total
	Type	Dry sump (2 oil pumps). Replaceable oil filter. Water-cooled oil cooler
Oil pressure	Idle (cold)	400 kPa - 600 kPa (58 PSI - 87 PSI)
	Idle (at 80°C (176°F))	Min. 150 kPa (22 PSI)
	4000 - 8000 (at 100°C (212°F))	350 kPa - 500 kPa (51 PSI - 73 PSI)
Oil pressure regulator outer compression spring free length	New	60.0 mm (2.362 in)
	Service limit	57.0 mm (2.244 in)
Oil temperature sensor	Limp home mode activation	Above 95°C (203°F)
Oil pump radial clearance	Service limit	0.25 mm (.0098 in)
Oil pump axial clearance	Service limit	0.1 mm (.004 in)
COOLING SYSTEM		
Type		Closed loop cooling system
Coolant		Ethylene-glycol / distilled water mix (50%/50%). Use premix coolant from BRP (Long life antifreeze) or a coolant specially formulated for aluminum engines
Cooling system capacity		5.5 L (5.8 qt (U.S. liq.)) total
Thermostat		87°C (189°F)
Monitoring beeper setting		102°C (216°F)
Radiator cap opening pressure		90 kPa (13 PSI)
EXHAUST SYSTEM		
Type		D-Sea-Bel sound reduction system. Water cooled/water injected (open loop). Direct flow from jet pump
Water injection in muffler		3 x 3.5 mm (.138 in) on exhaust pipe and 1 x 3.5 mm (.138 in) on muffler

VEHICLES SPECIFICATIONS

FUEL SYSTEM				
Fuel injection type			1503 4-TEC	Multipoint fuel injection with iTC (intelligent Throttle Control). Single throttle body (62 mm (2.44 in)) with an actuator
			1630 ACE HO	Multipoint fuel injection with iTC (intelligent Throttle Control). Single throttle body (60 mm (2.36 in)) with an actuator
Fuel pressure				386 kPa to 414 kPa (56 PSI to 60 PSI)
Fuel injector		Quantity		3
Fuel type	Inside North America ((RON + MON)/2)	Naturally-Aspirated engine	87 or higher	
		Supercharged engine	91 or higher	
	Outside North America (RON)	Naturally-Aspirated engine	91 or higher	
		Supercharged engine	95 or higher	
Fuel tank (including reserve)		With suspension	60 L (16 U.S. gal.)	
		Without suspension	70 L (18 U.S. gal.)	
Fuel tank reserve (from low level signal)				approx. 12 L (3.2 U.S. gal.)
Idle speed		1503 4-TEC	1800 ± 50 RPM (not adjustable)	
		1630 ACE HO	1700 ± 50 RPM (not adjustable)	
ELECTRICAL SYSTEM				
Ignition system type				IDI (Inductive Discharge Ignition)
Battery				Sealed, 12 V, 18 A•h
Spark plug	Make and type	1503 4-TEC	NGK DCPR8E or an equivalent	
		1630 ACE HO	KR9C-G or an equivalent	
	Gap		0.7 mm to 0.8 mm (.028 in to .031 in)	
Magneto generator output		1503 4-TEC	360 W @ 6000 RPM	
		1630 ACE HO	420 W @ 6000 RPM	
Stator				0.1 to 1.0 Ω
Anti-start system				RFDI D.E.S.S. (Radio Frequency Identification Digitally Encoded Security System) with selectable maximum vehicle speed settings for LK (learning key)
Ignition timing				Variable (electronically controlled)
Ignition coil	Primary	1503 4-TEC	0.85 to 1.15 Ω	
		1630 ACE HO	0.80 to 0.97 Ω	
	Secondary	1503 4-TEC	9.5 to 13.5 KΩ	
		1630 ACE HO	N.A.	

Subsection XX (VEHICLES SPECIFICATIONS)

ELECTRICAL SYSTEM		
Engine speed limiter setting	1503 4-TEC	8300 RPM
	1630 ACE HO	8400 RPM
Fuse box	#1: iS control	5 A
	#2: Diagnostic connector	15 A
	#3: START/STOP	3 A
	#4: GPS	3 A
	#5: iBR power	30 A
	#6: Voltage rectifier/regulator	30 A
	#7: iS power	30 A
	#8: Battery (Fuses 2, 3, 4 and relay)	30 A
	#11: Depth sounder	3 A
	#12 O.T.A.S., Gauge start up, CAPS	3 A
	#13: Inj/Ign cyl 1	10 A
	#14: Inj/Ign cyl 2	10 A
	#15: Inj/Ign cyl 3	10 A
	#16: Starter solenoid	5 A
	#17: iBR control	5 A
	#18: Fuel pump	10 A
	#19: ECM power	15 A
STEERING		
Steering	RXT-X Series	Adjustable Ergonomic Steering (AES), tilt at 4 positions
	RXP-X Series	Adjustable Ergonomic Steering (AES)
	GTX Series RXT 260 RXT 260 RS WAKE PRO	Tilt at 4 positions
Steering nozzle pivoting angle		26°
O.T.A.S. (Off-Throttle Assisted Steering)		Electronically-controlled. Achieved with the iBR gate and engine speed
PROPULSION		
Jet pump	Type	Axial flow single stage
	Grease type	Jet pump bearing grease (P/N 293 550 032)

Subsection XX (VEHICLES SPECIFICATIONS)

PROPULSION			
Impeller	Rotation (seen from rear)		Counterclockwise
	Pitch	GTX LTD iS RXT-X aS RXT-X aS RS	14°/25°
		GTX LTD 300 RXP-X RXP-X RS RXT-X 300 RXT-X 300 RS	13.6°/24°
		All Other	10°/21°
	Outside diameter	GTX LTD 300 RXP-X RXP-X RS RXT-X 300 RXT-X 300 RS	161 mm ± 0.06 mm (6.339 in ± .002 in)
		All Other	159 mm ± 0.06 mm (6.26 in ± .002 in)
Impeller/wear ring clearance		New	0 mm to 0.23 mm (0 in to .009 in)
		Service limit	0.35 mm (.0138 in)
Impeller shaft		End play (new)	0
		Side play	0
Drive shaft		Coupling type	Crowned splines, direct drive
		Deflection (max.)	0.5 mm (.02 in)
Minimum required water level for propulsion system			90 cm (3 ft) underneath the lowest rear portion of hull
IBR AND VTS			
Description			Intelligent Brake and Reverse activated by a LH lever. Electronically-controlled iBR gate to provide brake, reverse, neutral and forward position
Gate angle (from horizontal line of watercraft)		Forward	Approx. from +5° to -3°
		Neutral	Approx. -55°
		Braking	Approx. -70°
		Reverse	Approx. -70°
VTS system			Electronically-controlled through the VTS control button with 2 preset positions
VTS range angle			5° up, -3° down
Actuator			12 V, 75 A max. capacity. Reversible PWM (pulse-width modulation) motor

Subsection XX (VEHICLES SPECIFICATIONS)

WEIGHT AND LOADING CAPACITY		
Dry weight	GTX	399 kg (880 lb)
	GTX S	462 kg (1,019 lb)
	GTX LTD RXT RXT RS WAKE PRO	406 kg (895 lb)
	GTX LTD iS	471 kg (1,038 lb)
	GTX LTD 300	412 kg (908 lb)
	RXP-X RXP-X RS	386 kg (851 lb)
	RXT-X 300 RXT-X 300 RS	415 kg (915 lb)
	RXT-X aS RXT-X aS RS	466 kg (1,027 lb)
Number of passenger (driver incl.)	RXP-X RXP-X RS	2
	All Other	3
Load limit (passenger(s) and luggages)	RXP-X Series	182 kg (400 lb)
	Models with suspension	227 kg (500 lb)
	All Other	272 kg (600 lb)
Storage capacity	RXP-X Series	116.4 L (30.75 U.S. gal.)
	Models with suspension	63 L (16.64 U.S. gal.)
	All Other	162 L (42.8 U.S. gal.)

DIMENSIONS		
Overall length	RXP-X Series	331.6 cm (131 in)
	All Other	353.5 cm (139.2 in)
Overall width	RXP-X Series	122.7 cm (48.3 in)
	All Other	122.4 cm (48.2 in)
Overall height	GTX GTX LTD RXT RXT RS WAKE PRO	116.6 cm (45.9 in)
	GTX S GTX LTD iS	111.4 cm (43.9 in)
	RXP-X Series	114.7 cm (45.2 in)
	RXT-X Series	118.1 cm (46.5 in)

MATERIALS	
Impeller material	Stainless steel
Impeller housing/stator	Aluminum/aluminum

MATERIALS	
Hull	CM-TEC process, composite
Inlet grate	Aluminum
Steering cover	Thermoplastic
Venturi	Aluminum
Nozzle	Aluminum
Fuel tank	Polyethylene
Seat	Polyurethane/foam

WIRING DIAGRAM INFORMATION

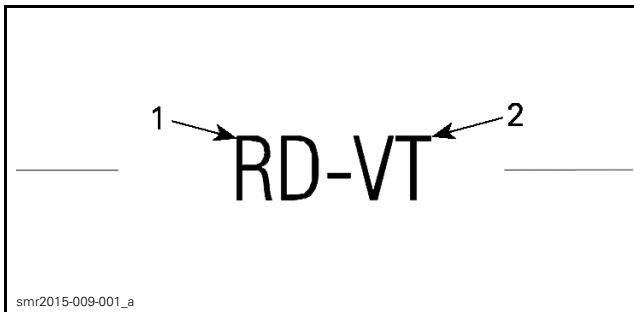
GENERAL

WIRING DIAGRAM LOCATION

The wiring diagrams are in the back cover pocket.

WIRING DIAGRAM CODES

Wire Color Codes



1. Wire main color
2. Tracer (thin colored line)

General Wire Color Use

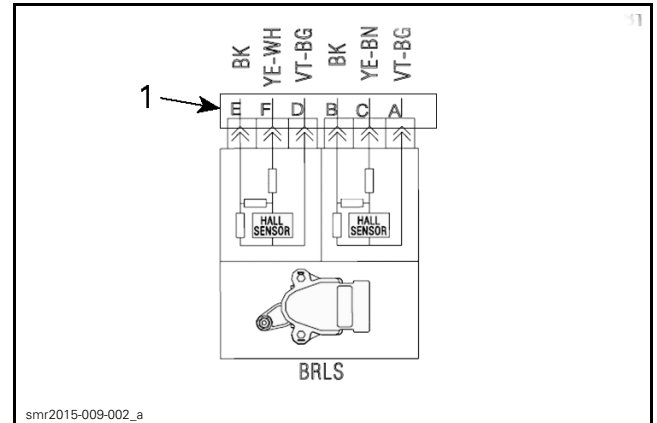
COLOR	USE
RED	Battery power (12 Vdc directly connected to battery)
RED + tracer	Fused 12 Vdc power or switched power from relay
VIOLET or VIOLET + tracer	Fused 12 Vdc accessory power from fuse box
YELLOW	Alternating current (AC) from magneto
BLACK	Ground
WHITE/BEIGE WHITE/BLACK	CAN HI wires, CAN LO wires

Color Codes

COLOR CODES			
CODE	COLOR	CODE	COLOR
BG	BEIGE (TAN)	OR / OG	ORANGE
BK	BLACK	PK	PINK
BN	BROWN	RD	RED
BU	BLUE	VT	VIOLET
GN	GREEN	WH	WHITE
GY	GRAY	YE	YELLOW

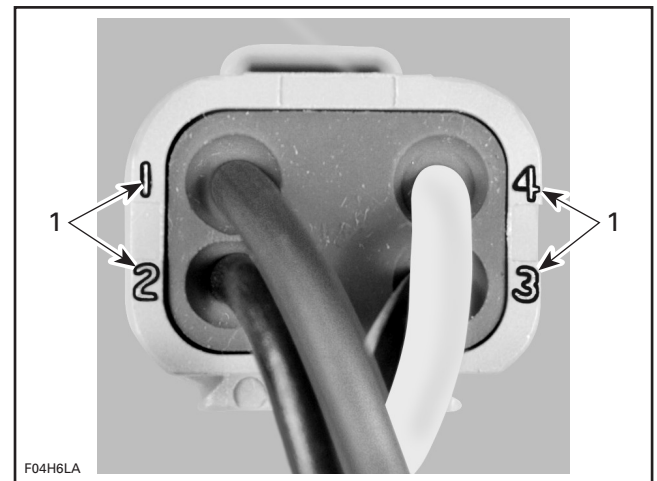
Terminal Identification on Connector

On the wiring diagram, a letter or a digit is used to identify the terminal position in a connector.



1. Terminal position

On a connector, a letter or a digit is usually molded on the connector to identify the terminal position.



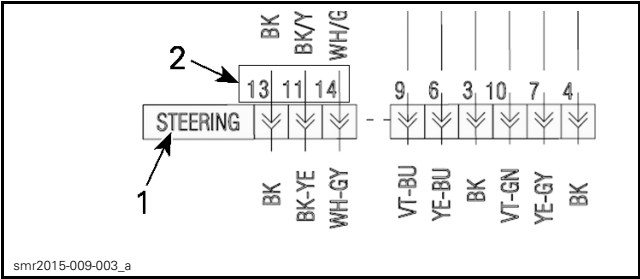
TYPICAL

1. Wire identification numbers

Terminal Identification on a Wiring Diagram

In-line connectors of wiring harnesses are identified on the wiring diagram with their approximate location and the following information.

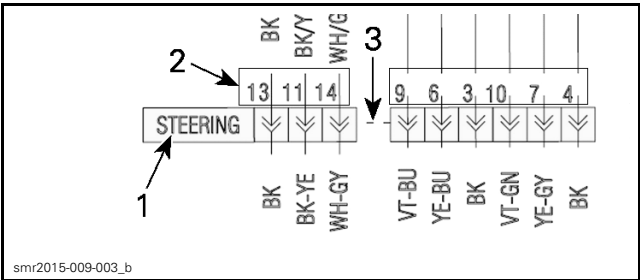
Subsection XX (WIRING DIAGRAM INFORMATION)



TYPICAL
1. Connector location
2. Wire pin location in connector

Connectors Linked by a Dashed Line

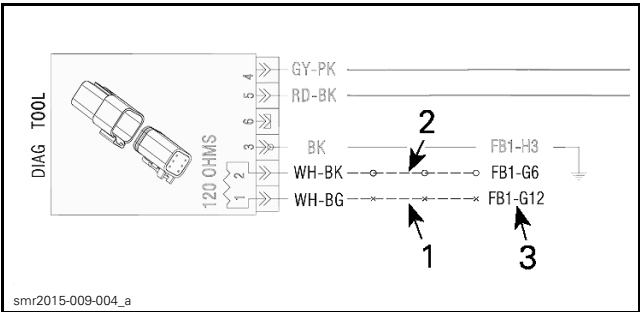
Connectors may be divided into segments linked by dashed lines, however, some segments of the same connector may be found elsewhere on the wiring diagram.



TYPICAL
1. Connector identification and location
2. Connector pin number
3. Dashed line links connector segments as one

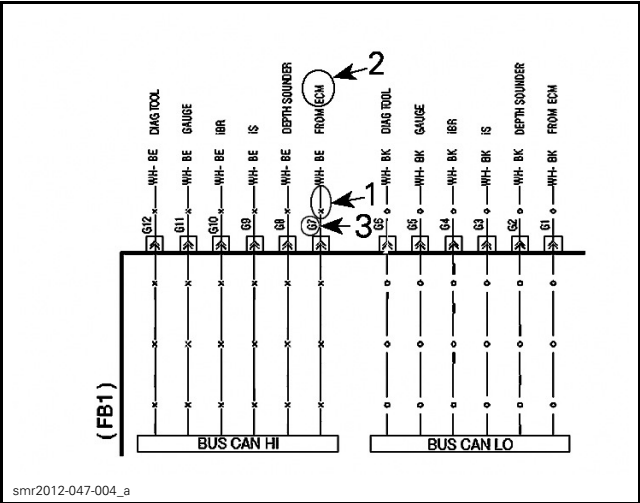
CAN Wire Circuit References

On the wiring diagram, CAN linked components use the following coding.



TYPICAL
1. CAN HI wire (x)
2. CAN LOW wire (o)
3. Wire destination
FB1 - G12 = : Terminal G12 in the fuse box no. 1

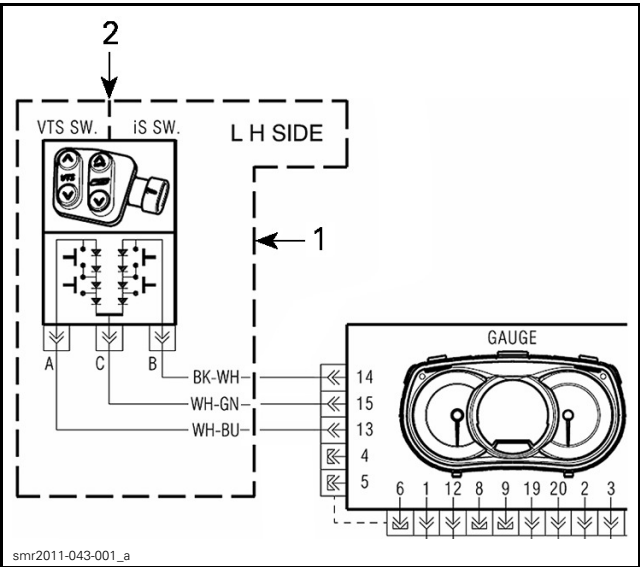
Corresponding CAN links are identified at fuse box using the following coding.



TYPICAL
1. CAN wire
2. Wire origin
3. Destination terminal (as referenced at ECM)

Component Application

If a component in the wiring diagram is not applicable to every vehicle model, or can be installed as an option or accessory on certain models, the component shall be enclosed in a dash line.



1. Component(s) optional or applicable to certain models
2. Indicates each switch is a separate component

WIRING HARNESS AND CONNECTORS

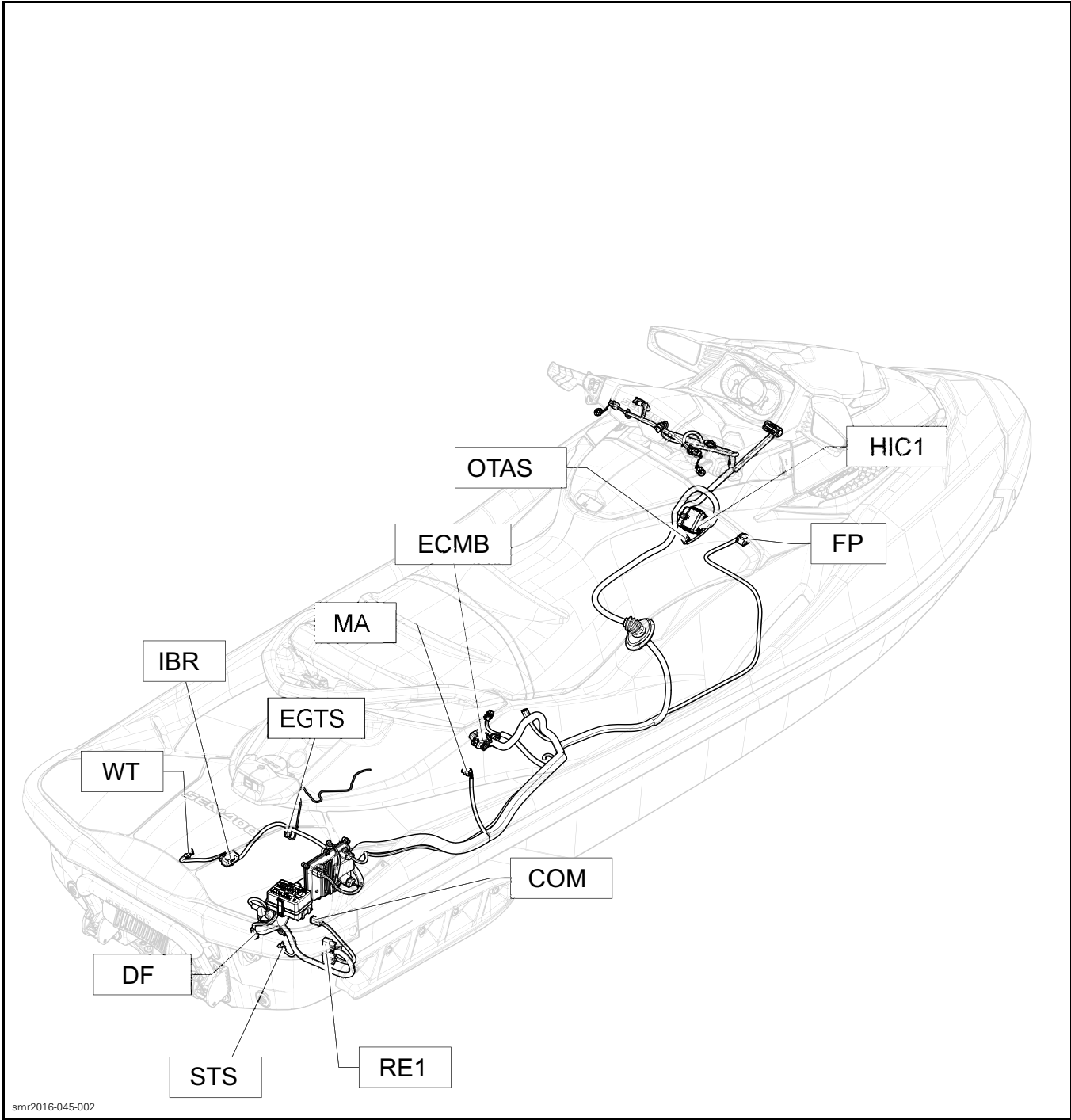
SERVICE TOOLS

Description	Part Number	Page
CRIMPING TOOL (HEAVY GAUGE WIRE)	529 035 730	13
ECM ADAPTER TOOL.....	529 036 166	8
ECM TERMINAL REMOVER 2.25.....	529 036 175	8
ECM TERMINAL REMOVER 3.36.....	529 036 174	8

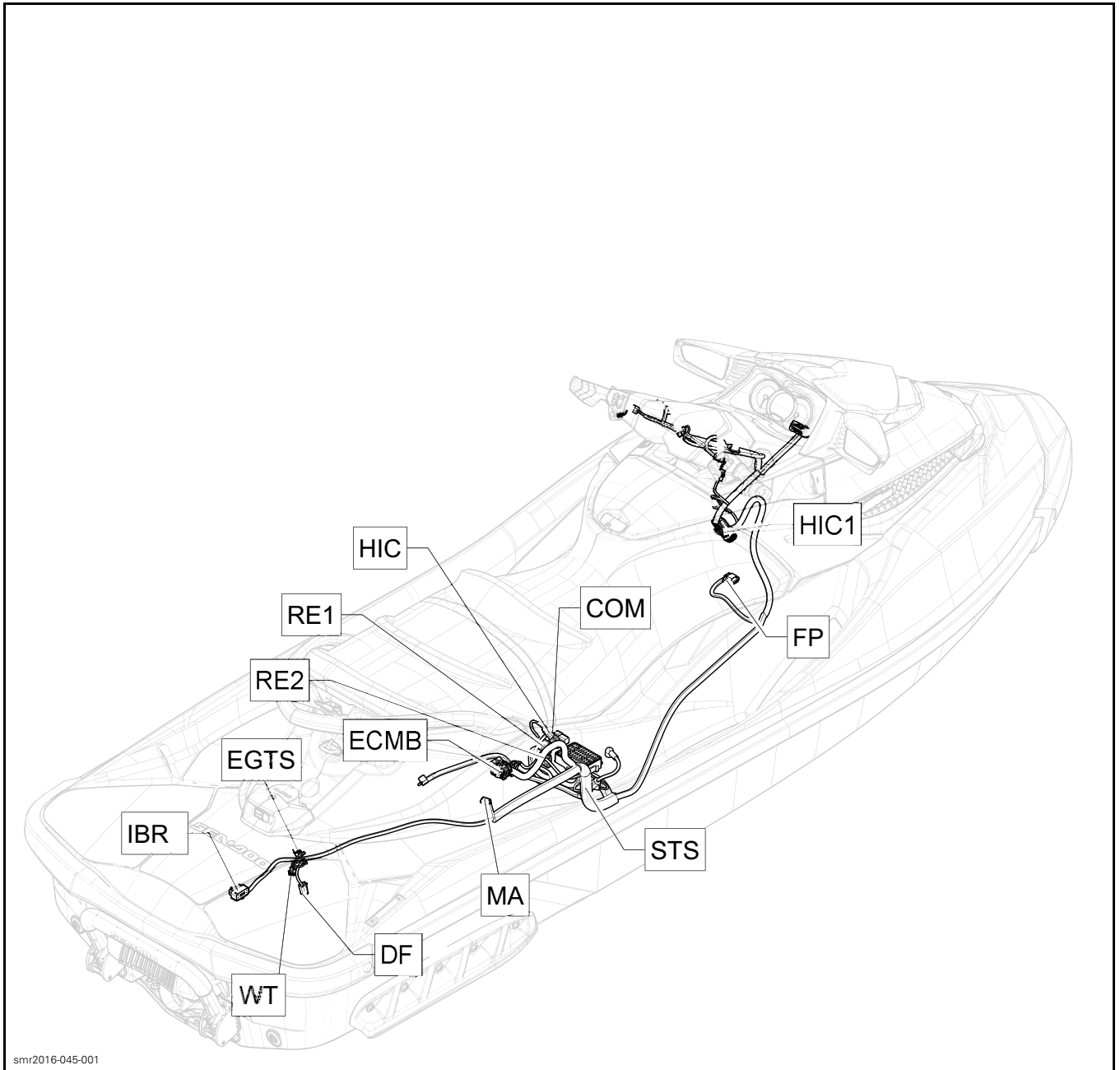
SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
DELPHI TERMINAL EXTRACTOR	12094429	9–10
FCI TERMINAL EXTRACTOR TOOL	54241678	11
GM TERMINAL EXTRACTOR.....	12094430	12
MOLEX 150 TERMINAL EXTRACTOR TOOL	63813 - 1500	11

MAIN HARNESS (WITH SUSPENSION)



MAIN HARNESS (WITHOUT SUSPENSION)



Subsection XX (WIRING HARNESS AND CONNECTORS)

GENERAL

ACRONYM	DEFINITION
ACC	ACCessory
ATS	Air Temperature Sensor
BAT+	Battery +
BP	Battery Post
BRLS	Brake and Reverse Lever Sensor
CAN	Controlled Area Network
CAPS	Camshaft Position Sensor
CL	Cluster
COM	Communication
CPS	Crankshaft Position Sensor
CS	Cruise Switch
CTRL	Control
CTS	Coolant Temperature Sensor
CYL	Cylinder
DESS	Digitally Encoded Security System
DIAG TOOL	Diagnostic connector
DF	Depth Finder
DS	DESS Post
ECMB	ECM connector B
ECMB_L	ECM connector B Large pin
ECMB_S	ECM connector B Small pin
ECO	ECO switch
EGTS	Engine Gas Temperature Sensor
ETC	Electronic Throttle Control
FB	Fusebox
FP	Fuel Pump
GND	Ground Engine
GND1	Ground iBR
GND2	Ground Fuse Box
GND3	Ground Regulator

ACRONYM	DEFINITION
HIC	Harness Inter Connector to Engine
HIC1	Harness Inter Connector to Steering
iBR	Intelligent Brake and Reverse
iS	Intelligent Suspension
KS	Knock Sensor
LTS	Lake Temperature Sensor
MA	Magneto
MAPS	Manifold Air Pressure Sensor
MATS	Manifold Air (intake) Temperature Sensor
MSL	Multi Switch Left
MSR	Multi Switch right
OPS	Oil Pressure Switch
OTAS	Off Throttle Assisted Steering
REG	REGulator
RE1	Reg/Rect connecteur 1
RE2	Reg/Rect connecteur 2
RFID	Radio Frequency Identification
SOL	Solenoid
SPS	Suspension Position Sensor
SSS	Start Stop Switch
STS	Starter Solenoid
SUP	Suspension Power
SUS	Suspension Signal
TAS	Throttle Accelerator Sensor
TOPS	Tip Over Position Sensor
TPS	Throttle Position Sensor
VTs	Variable Trim System
WT	Water Temperature
FLS	Fuel level sensor

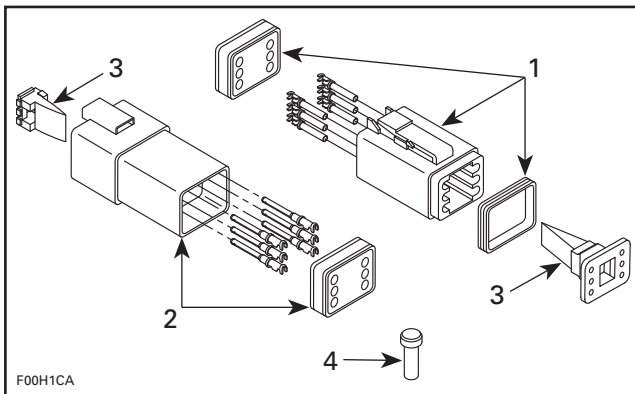
PROCEDURES

⚠ WARNING

When disassembling any connector for repair or replacement on the vehicle, always disconnect the battery to ensure all electrical power is removed and prevent any possibility of a short circuit. Refer to *CHARGING SYSTEM* subsection.

DIAGNOSTIC CONNECTOR (DEUTSCH)

Connector Disassembly and Reassembly



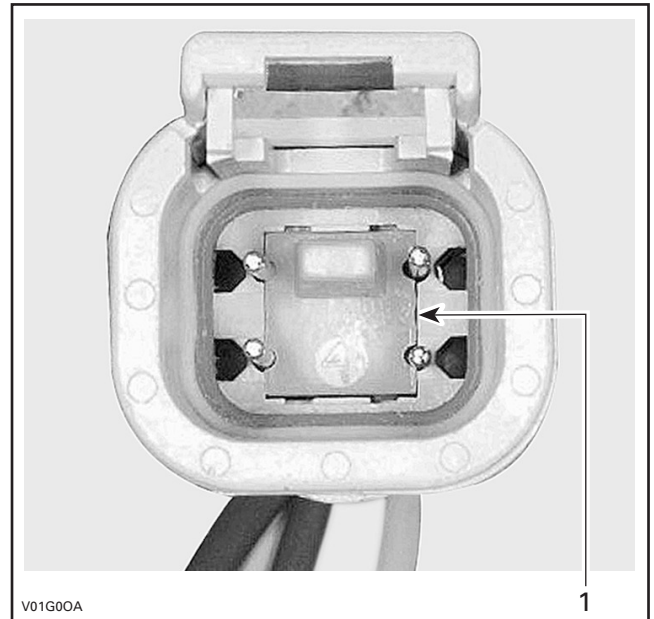
TYPICAL - DEUTSCH CONNECTOR

1. Male connector
2. Female connector
3. Secondary lock
4. Sealing cap

NOTICE Do not apply dielectric grease on terminal inside connector.

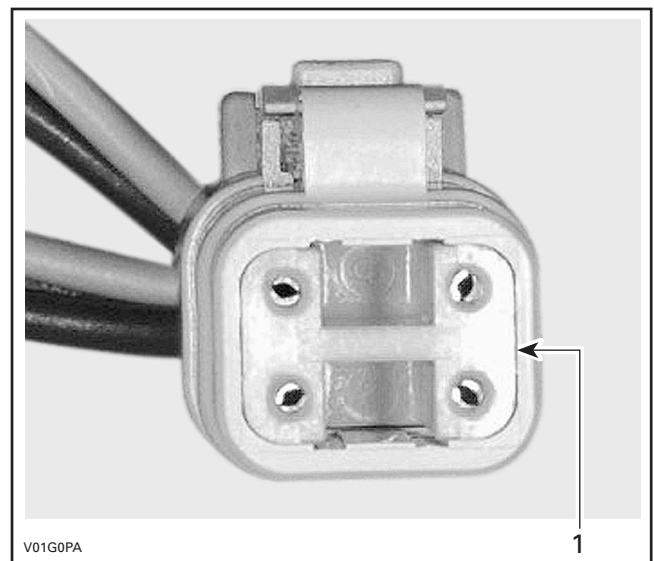
To remove terminals from connector, proceed as follows:

1. Using long nose pliers, pull out the plastic lock from between the terminals.



TYPICAL - FEMALE CONNECTOR

1. Female lock



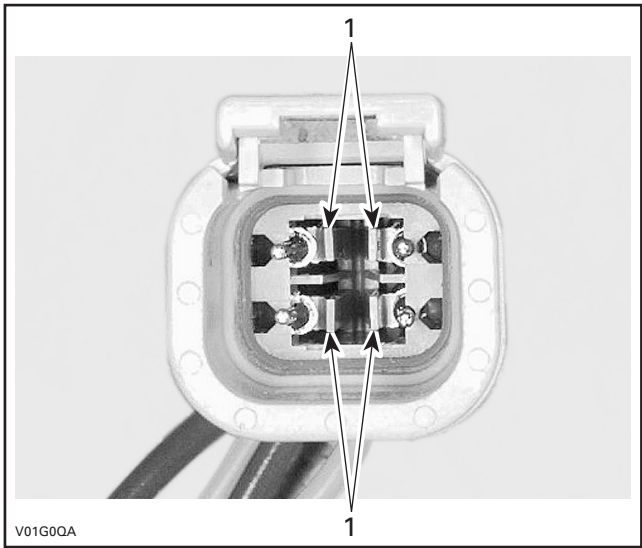
TYPICAL - MALE CONNECTOR

1. Male lock

NOTE: Before pin extraction, push wire forward to relieve pressure on retaining tab.

2. Insert a 4.8 mm (.189 in) wide screwdriver blade inside the front of the terminal cavity.
3. Pry the retaining tab away from the terminal while gently pulling the wire and terminal out of the back of the connector.

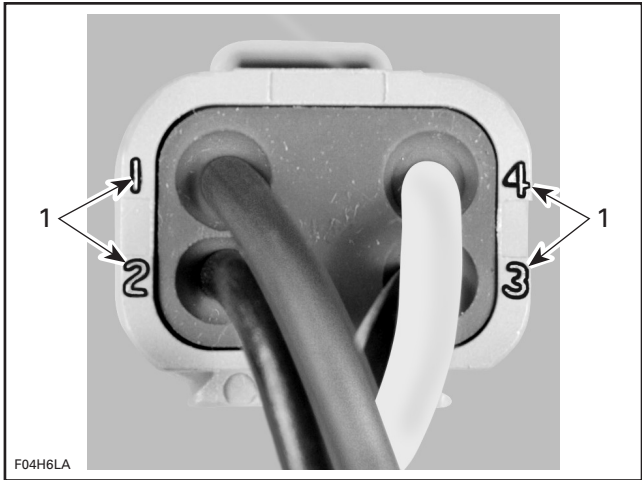
Subsection XX (WIRING HARNESS AND CONNECTORS)



TYPICAL - FEMALE CONNECTOR
1. Retaining tabs

To install:

1. For insertion of a terminal, ensure the plastic lock is removed.
2. Insert terminal through the back of the connector in the appropriate position, and push it in as far as it will go. You should feel or hear the terminal lock engage.
3. Pull back on the terminal wire to ensure the retention fingers are holding the terminal.
4. After all required terminals have been inserted, the lock must be installed.



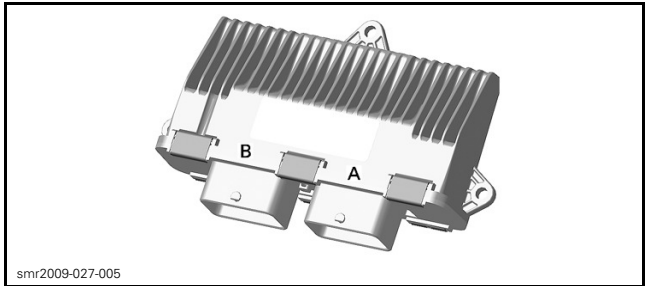
TYPICAL - CONNECTOR PIN-OUT
1. Terminal position identification numbers

ECM CONNECTOR (MOLEX)

There are 2 connectors on the ECM.

The engine wiring harness connector is connected to ECM connector "A". The vehicle wiring harness connector is connected to ECM connector "B".

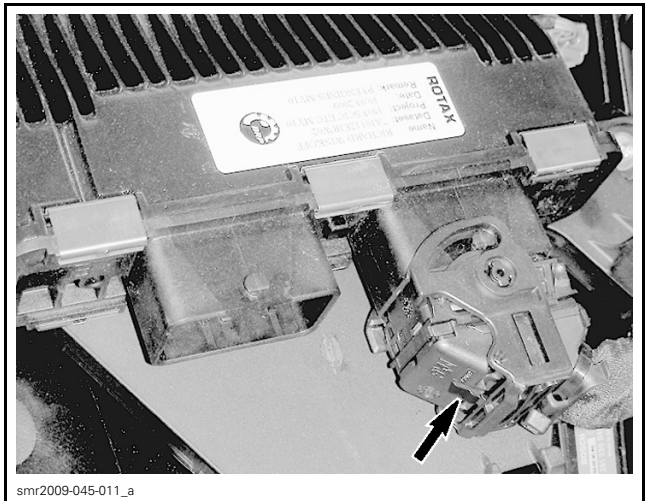
Each ECM connector has 48 pins however, connectors "A" and "B" are not interchangeable due to their specific keyways.



ECM CONNECTORS

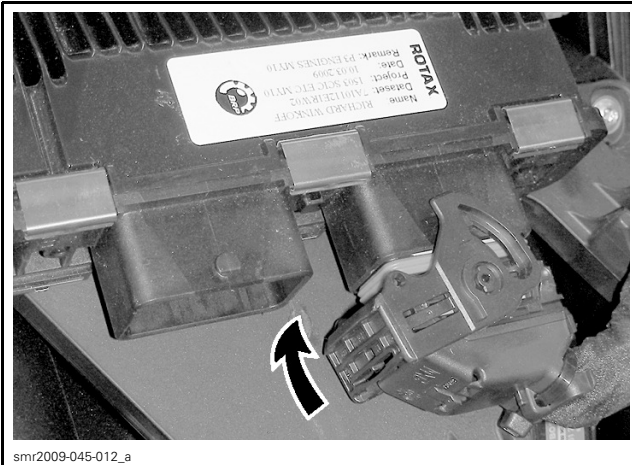
Connector Removal

1. To access the ECM, refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.
2. Press and hold the locking tab on the connector to be disconnected.



LOCKING TAB TO PRESS AND HOLD

3. As you hold the locking tab, rotate the connector locking cam until it stops.



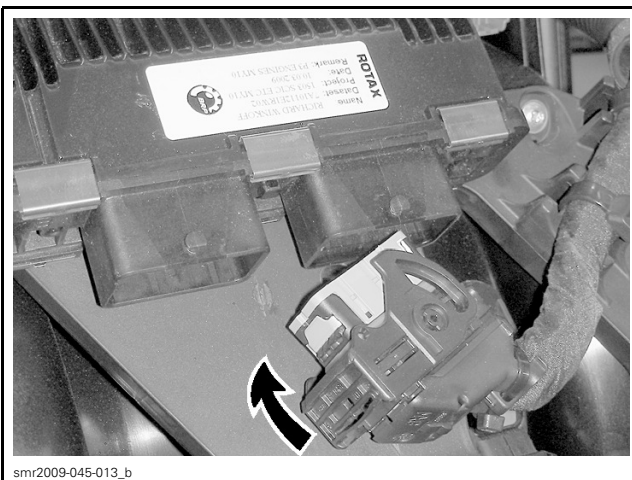
CONNECTOR LOCKING CAM ROTATION TO RELEASE

4. Pull connector off ECM.



Connector Installation

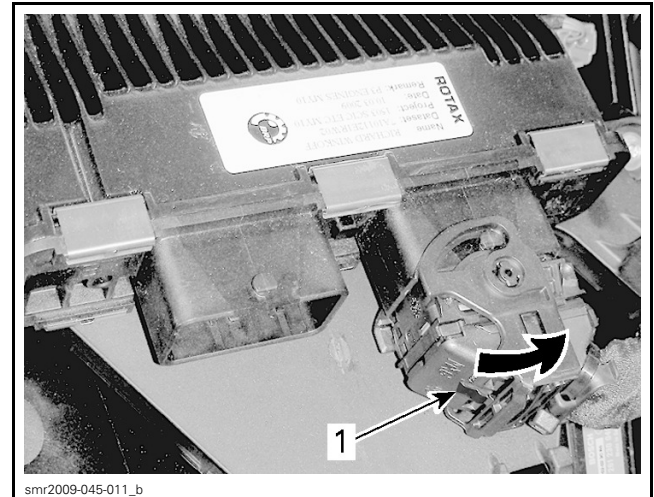
1. Fully open connector locking cam.



CONNECTOR LOCKING CAM IN RELEASE POSITION

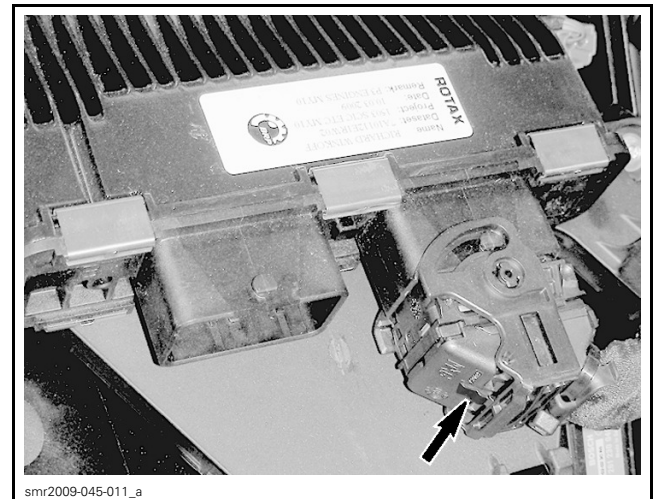
2. Insert connector on ECM.

3. As you push the connector onto the ECM, rotate the connector locking cam until it snaps locked.



1. Locked here

4. Ensure the locking tab is fully out.



LOCKING TAB FULLY OUT

Connector Inspection

Before replacing an ECM, always check electrical connections.

1. Ensure connector locking mechanism is functioning properly.
2. Ensure all wire terminals (pins) are properly locked in the connector.
3. Ensure they are very tight, make good contact with the pins in the ECM.
4. Ensure the pins in the harness connector and the ECM connector are clean, shiny and corrosion-free.
5. Check wiring harness for signs of scoring.

NOTE: A “defective ECM module” could possibly be repaired simply by disconnecting and reconnecting it.

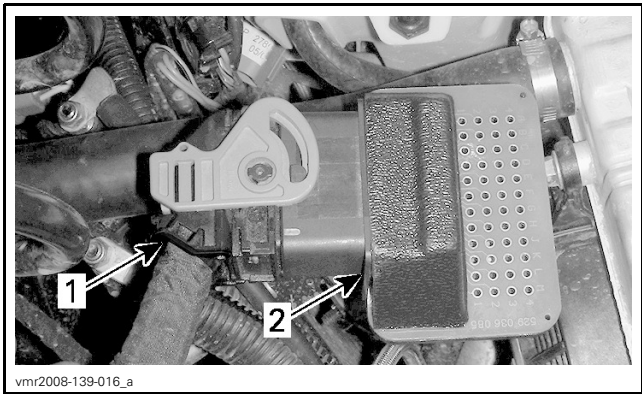
NOTICE Do not apply any lubricant product to the pins of the ECM connector.

Connector Probing

The most recommended and safest method to probe the MOLEX (ECM) connector terminals is to use the ECM ADAPTER TOOL (P/N 529 036 166). This tool will prevent deforming or enlarging of the terminals, which would lead to bad ECM terminal contact creating intermittent or permanent problems.



- 1. Disconnect the ECM connector to be probed, and reconnect it on the ECM adapter.
- 2. Probe wire terminals of the circuit to be tested directly in the adapter holes.



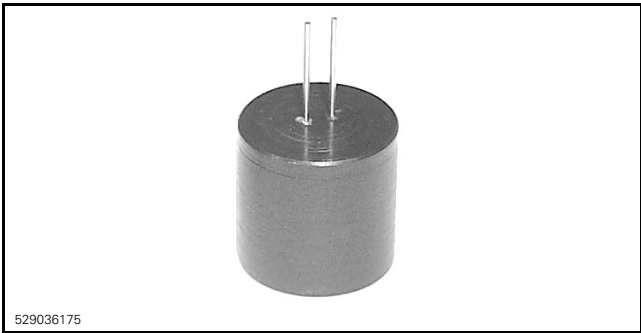
TYPICAL
1. ECM connector
2. ECM adapter

NOTICE Never probe directly on the ECM harness connector. This could change the shape or enlarge the terminals and create intermittent or permanent contact problems.

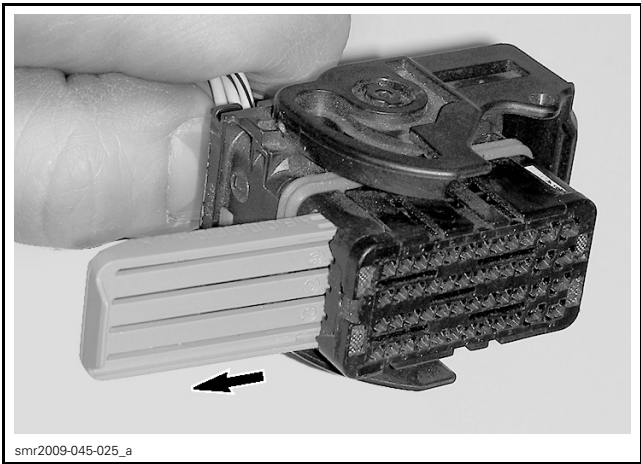
Connector Terminal Removal (Harness Connector)

To remove a signal terminal from the ECM harness connector, use the ECM TERMINAL REMOVER 2.25 (P/N 529 036 175).

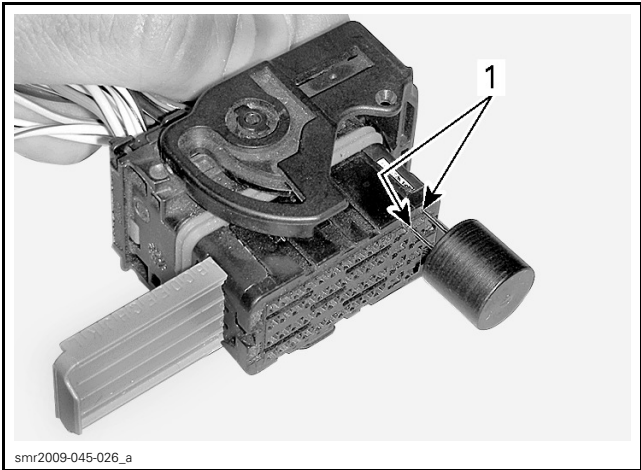
To remove a power terminal, use the ECM TERMINAL REMOVER 3.36 (P/N 529 036 174).



- 1. Remove rear protector from connector.
- 2. Pull out the connector lock.

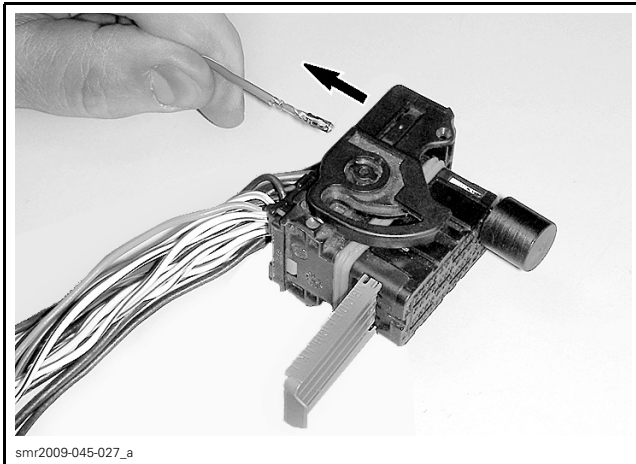


- 3. Insert tool to unlock terminal.



1. Unlock here

4. Gently pull on the wire to extract the terminal out the back of the connector.



NOTICE Before installing wire terminals in the connector, ensure all terminals are properly crimped on wires. After installation of wire terminals in the connectors, ensure they are properly locked by gently pulling on them as if to extract them.

TAS AND OTAS CONNECTORS (DELPHI/PACKARD)

Connector Terminal Removal

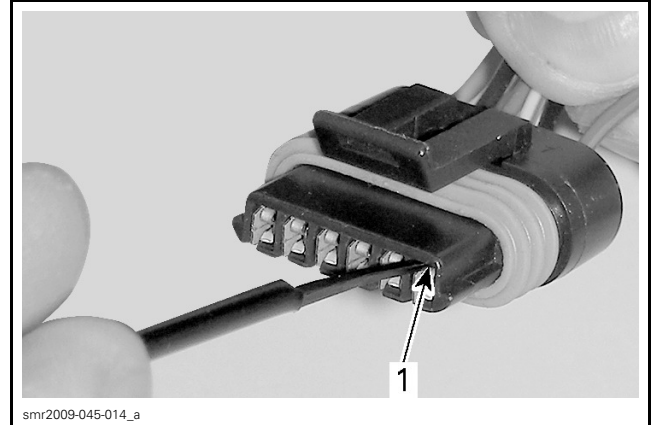
To remove a terminal (pin) from the connector, use a special tool such as the DELPHI TERMINAL EXTRACTOR (P/N 12094429).



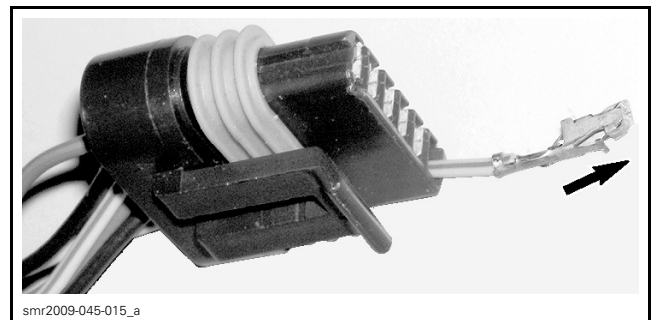
DELPHI TERMINAL EXTRACTOR (P/N 12094429)

NOTE: Grinding the tool end to a taper is required.

1. Carefully insert the tool in the space provided to release the pin lock.
2. Push the pin out the front of the connector by pushing on the wire.



1. Unlock terminal here

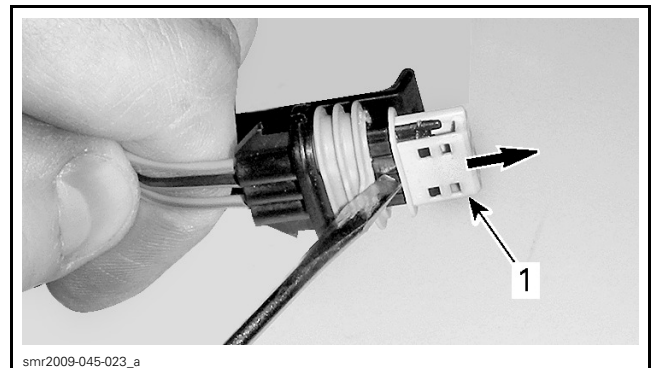


NOTICE Before installing terminals in the connectors, ensure all terminals are properly crimped on the wires. After installation of the wire terminals in the connectors, ensure they are properly locked by gently pushing on them as if to extract them.

FUEL PUMP AND STARTER SOLENOID CONNECTORS (DELPHI)

Terminal Removal

1. To remove a terminal from connector, first remove the locking cap.



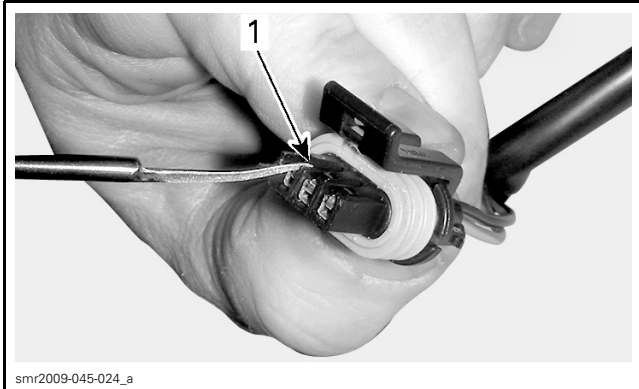
1. Pry out locking cap

Subsection XX (WIRING HARNESS AND CONNECTORS)

- Carefully insert the DELPHI TERMINAL EXTRACTOR (P/N 12094429) in the space provided to release the pin lock.

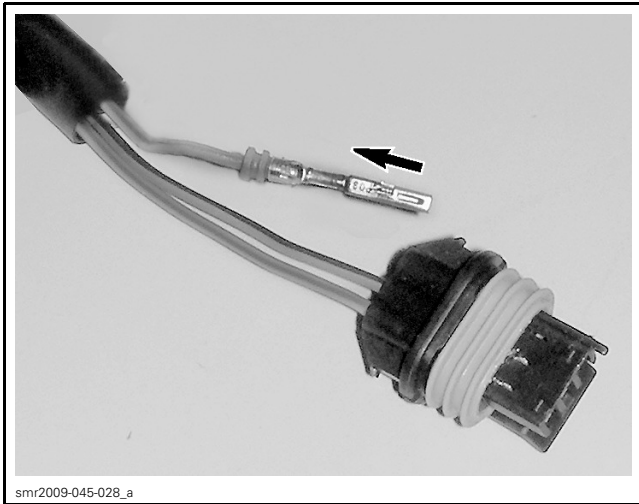


DELPHI TERMINAL EXTRACTOR (P/N 12094429)



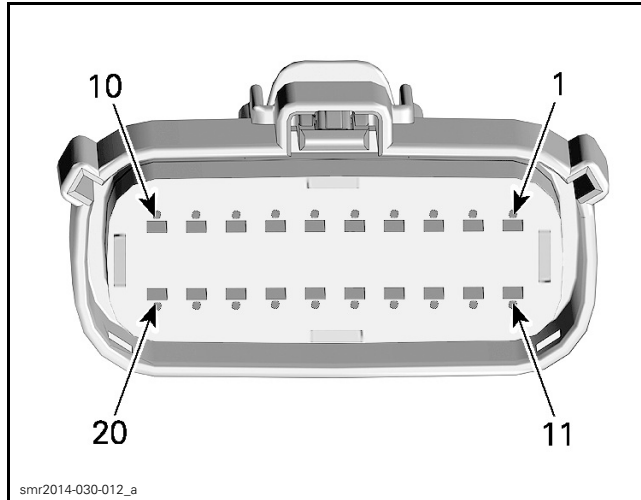
- Unlock here

- Gently pull on the wire to extract the pin out the back of the connector.



NOTICE Before installing terminals in the connectors, ensure all terminals are properly crimped on the wires. After installation of the wire terminals in the connectors, ensure they are properly locked by gently pushing on them as if to extract them.

STEERING CONNECTOR (20 PIN MOLEX 150)



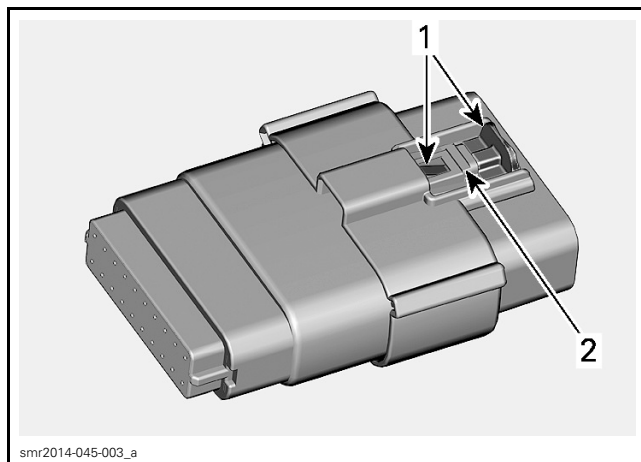
- Female connector pin-out (sockets)

Connector Disconnect

Pull back the red secondary lock from the connector latch lever. Do not remove it from the latch.

Push the two connector assemblies together to unload the latch.

Depress the latch lever and pull the two connector assemblies apart.



- Red secondary lock (shown out)
- Latch lever

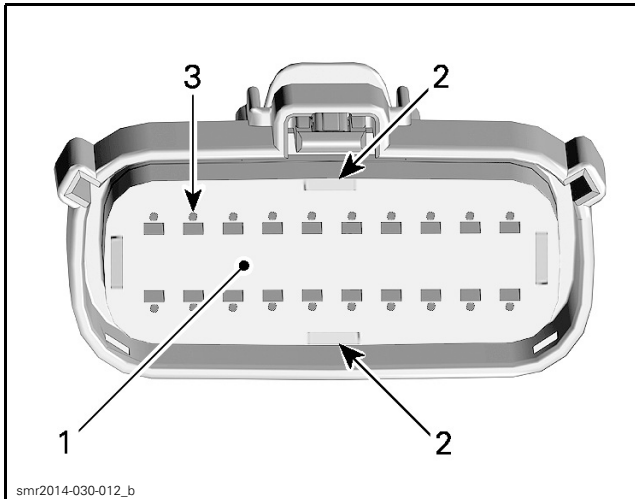
Connector Probing

- Disconnect the steering connector in the vehicle and connect it to the Diagnostic Harness (P/N 284560054).
- Probe the applicable circuit using the test connector on the diagnostic harness.

NOTICE Attempting to probe the connector without using the diagnostic connector may damage the connector pins, or even cause a short circuit if testing an energized circuit.

Socket Extraction (Female Connector)

1. Insert a small flat screwdriver in the pry holes of the socket locator, on the socket side of the connector.



1. Socket locator
2. Pry holes
3. Holes for inserting terminal extractor tool

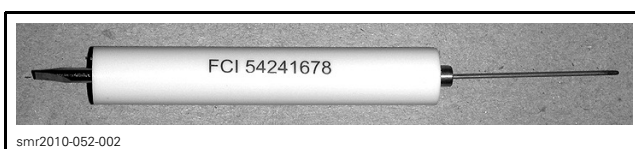
2. Carefully pull out the socket locator out to the detent position (approximately 5 mm).

NOTE: Do not remove the socket locator from the connector housing.

3. Insert the extractor tool in the small hole adjacent to the socket.

NOTE: Push the extractor tool in only as far as required to release the lock from the socket. The tool should slide along the socket and be inserted between the socket and the lock.

REQUIRED TOOL
FCI TERMINAL EXTRACTOR TOOL (P/N 54241678) or,
MOLEX 150 TERMINAL EXTRACTOR TOOL (P/N 63813 - 1500)



FCI TERMINAL EXTRACTOR TOOL (P/N 54241678)



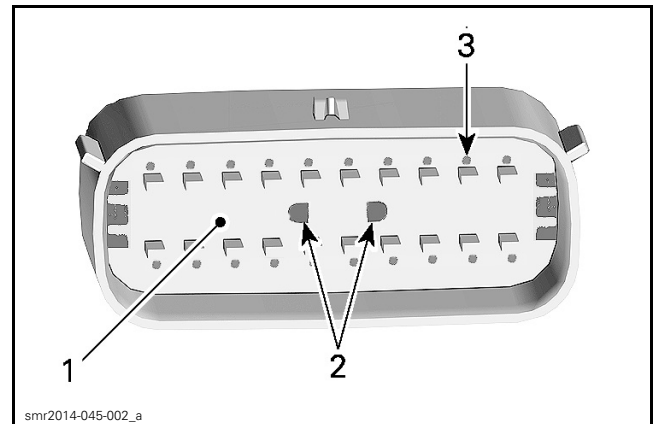
MOLEX 150 TERMINAL EXTRACTOR TOOL 6(P/N 3813 - 1500)

4. Gently pull on the wire to extract the socket out the back of the connector.

Pin Extraction (Male Connector)

1. Using a pair of thin long nose pliers, pull the pin locator out to the detent position (approximately 5 mm). This will allow unlocking of the pins.

NOTICE Do not attempt to remove the pin locator or damage will occur. Be careful not to bend the pins when using the pliers.

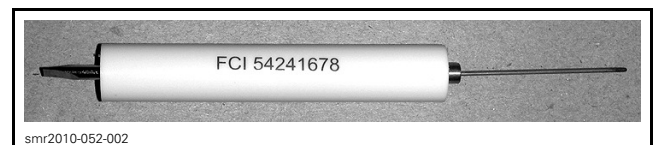


1. Pin locator
2. Insert long nose pliers here
3. Holes for inserting terminal extractor tool

2. Insert the extractor tool in the small hole adjacent to the pin.

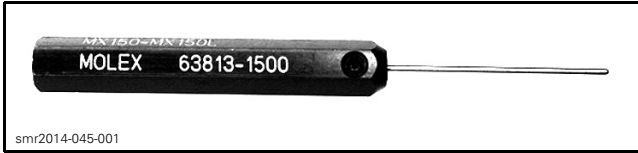
NOTE: Push the extractor tool in only as far as required to release the lock from the pin. The tool should slide along the pin and be inserted between the pin and the lock.

REQUIRED TOOL
FCI TERMINAL EXTRACTOR TOOL (P/N 54241678) or,
MOLEX 150 TERMINAL EXTRACTOR TOOL (P/N 63813 - 1500)



FCI TERMINAL EXTRACTOR TOOL (P/N 54241678)

Subsection XX (WIRING HARNESS AND CONNECTORS)



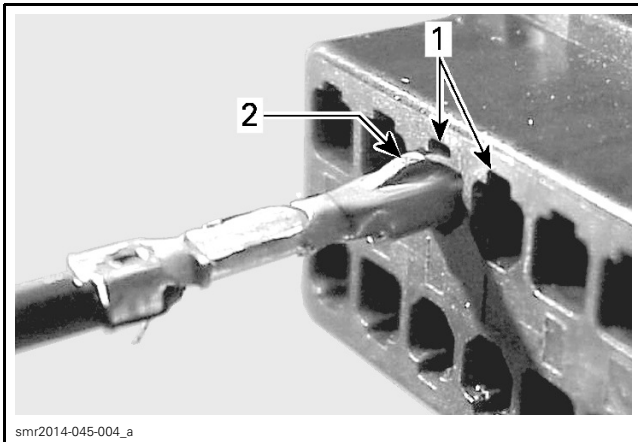
smr2014-045-001
MOLEX 150 TERMINAL EXTRACTOR TOOL 6(P/N 3813 - 1500)

3. Gently pull on the wire to extract the pin out the back of the connector.

Pin Insertion

1. Ensure the terminal (pin) is properly crimped onto the wire.
2. Ensure the pin locator (the white plastic insert in the connector) is out in the detent position.
3. Insert the pin in through the back of the connector.

NOTE: When inserting the pin, insert the stepped portion facing the notch in the connector pin hole.



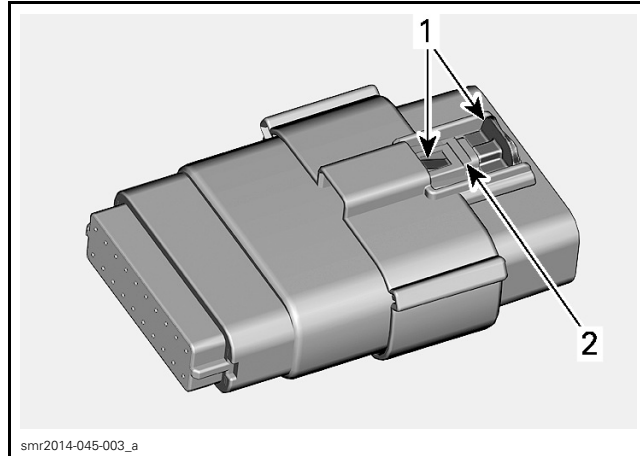
smr2014-045-004_a
TYPICAL - PIN INSERTION

1. Notch
2. Stepped portion towards notch

4. Push the pin in until the pin lock engages the pin.
5. Gently pull on the pin to ensure it is properly locked.
6. Repeat previous steps for each pin to be inserted.
7. Push the pin locator into the connector to the locked position.

Reconnecting the 20 pin MOLEX Connector

1. Insert the male connector into the female connector and push it in until the latch lever fully engages.
2. Push in the secondary lock (red tab) until it fully engages into the latch lever.



1. Red secondary lock (shown out)
2. Latch lever

ENGINE CONNECTOR (4 PIN MOLEX 150)

Refer to *STEERING CONNECTOR (20 PIN MOLEX 150)* for applicable procedures.

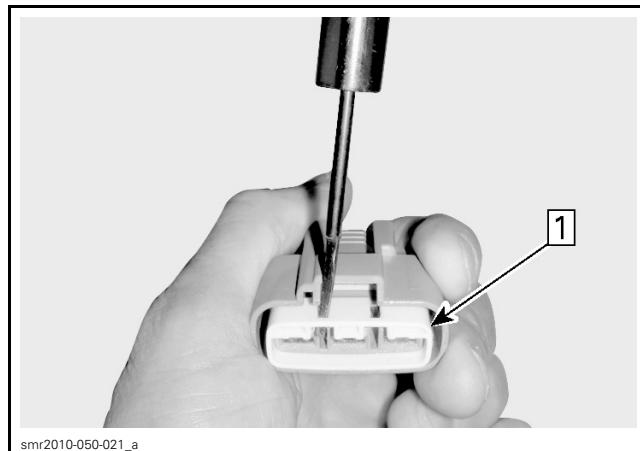
MULTIFUNCTION GAUGE CONNECTOR (6 PIN MOLEX 150)

Refer to *STEERING CONNECTOR (20 PIN MOLEX 150)* for applicable procedures.

VOLTAGE REGULATOR/RECTIFIER CONNECTOR (FURUKAWA)

Terminal Removal

1. Remove the secondary lock (plastic insert).

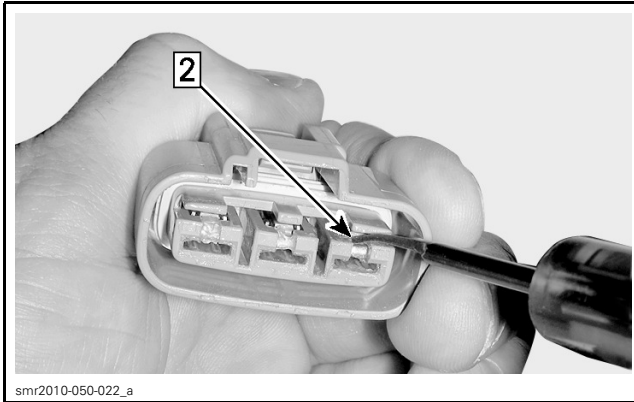


smr2010-050-021_a
Step 1: Remove the secondary lock

2. Carefully insert the GM TERMINAL EXTRACTOR (P/N 12094430) between the lock and the pin to release the pin.

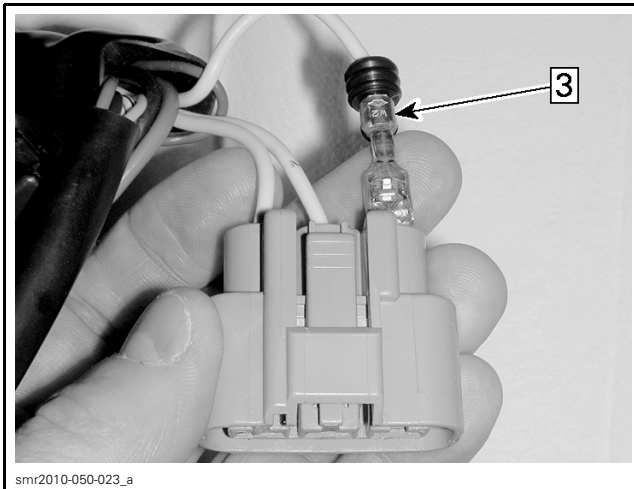


smr2010-052-003
GM TERMINAL EXTRACTOR (P/N 12094430)



smr2010-050-022_a
Step 2: Insert GM extractor tool (P/N 12094430)

3. Gently pull on the wire to extract the pin out the back of the connector.



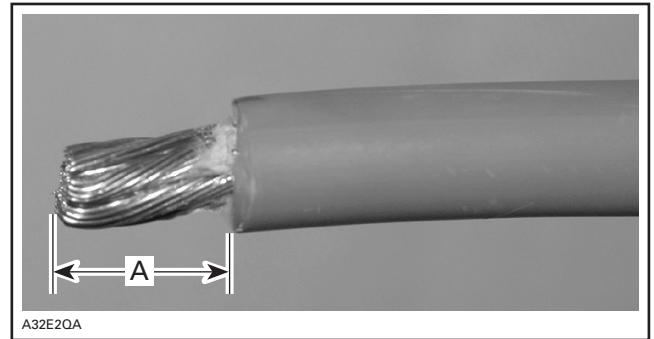
smr2010-050-023_a
Step 3: Pull wire to extract pin

NOTICE Before installing terminals in the connectors, ensure all terminals are properly crimped on the wires. After installation of the wire terminals in the connectors, ensure they are properly locked by gently pushing on them as if to extract them.

BATTERY CABLES

Battery Cable Crimping

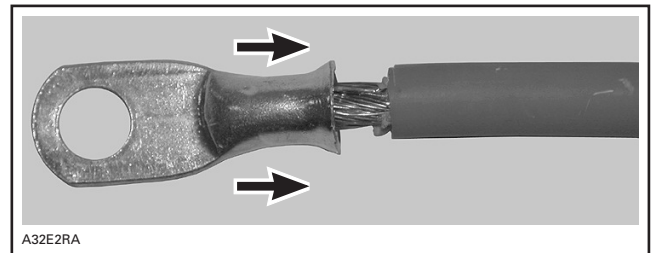
Carefully strip the wire approximately to 10 mm (3/8 in) in length, using a wire stripping tool or sharp blade/knife.



A. 10 mm (3/8 in)

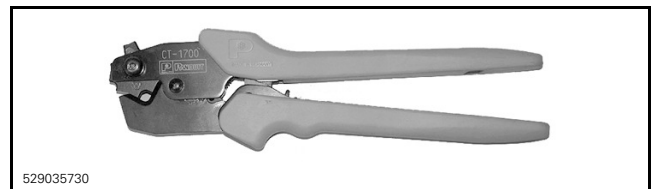
NOTE: Make sure not to cut wire strands while stripping the wire.

Install the appropriate terminal on the wire according to the requirement. Refer to appropriate *PARTS CATALOG*.



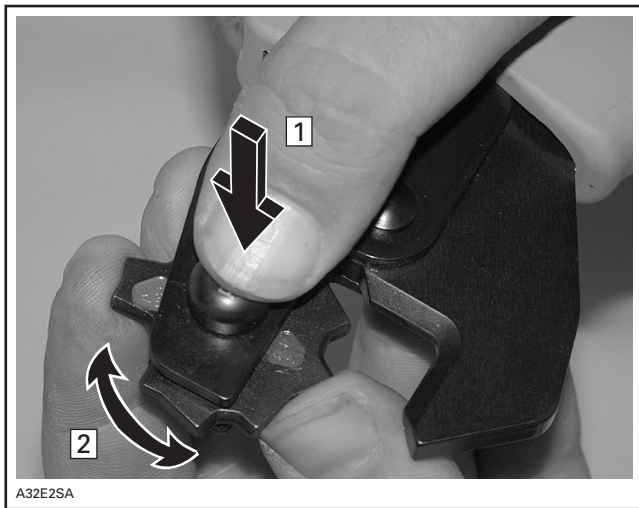
INSTALLATION OF TERMINAL

Follow the instructions provided with the CRIMPING TOOL (HEAVY GAUGE WIRE) (P/N 529 035 730) to select the proper position of the tool.



NOTE: Different wires require different crimping pliers settings, so make sure to follow the instruction supplied with the tool.

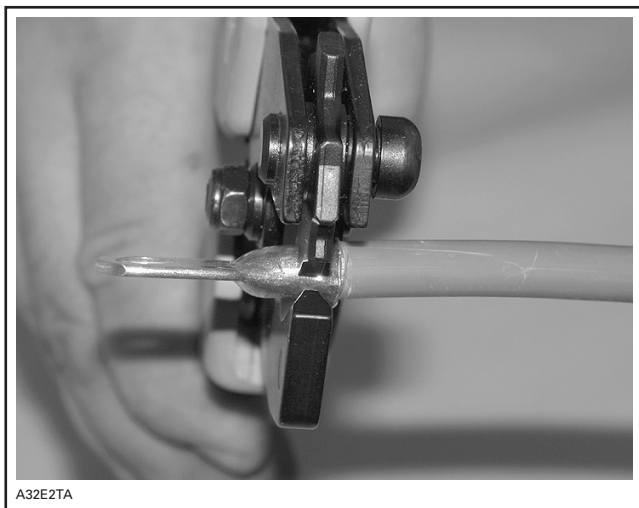
Subsection XX (WIRING HARNESS AND CONNECTORS)



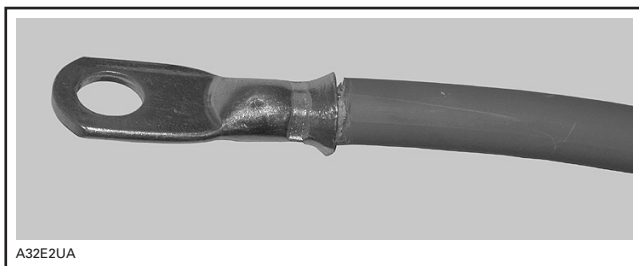
POSITIONING THE CRIMPING PLIERS

Step 1: Press
Step 2: Rotate

After positioning the crimping pliers, crimp the terminal already installed on wire.



CRIMPING OF WIRE



PROPERLY CRIMPED WIRE

To verify, if the wire is properly crimped, apply some pulling force on wire and the terminal at the same time from both directions.

NOTICE Never weld the wire to the terminal. Welding can change the property of the wire and it can become brittle and break.

Install the protective heat shrink rubber tube on the terminal. Heat the heat shrink rubber tube using the heat gun so that it grasps the wire and the terminal.

NOTICE Make sure that the protective heat shrink rubber tube has been properly installed and no part of wire is exposed.

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