

2022 Service Manual

GTI™ Series, GTR™ Series
WAKE™ 170
Fish Pro Scout



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SAFETY NOTICE

This manual has been prepared as a guide to correctly service and repair GTI Series (except Rental), GTR and WAKE 170 Sea-Doo® watercraft.

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 of this publication.

IMPORTANT SAFETY PRECAUTIONS

We do not provide warnings about many basic shop safety practices (e.g.: Use Grinding Wheel – wear safety glasses). If you have not received shop safety training or do not feel confident about your knowledge of safe servicing practices, we recommend that you do not attempt to perform the procedures described in BRP shop manuals.

You should have a clear understanding of all basic shop safety practices. You should be wearing the appropriate clothing, using appropriate safety

SAFETY NOTICE

equipment and taking all necessary safety precautions. Please be especially careful of the following:

- Read and understand all instructions before you begin a procedure or repair.
- Ensure you have the proper tools, any necessary replacement parts and the skills to perform the tasks safely and completely.
- Protect your eyes by using approved and properly fitted safety glasses.
- Use other protective wear when necessary, for example safety shoes and gloves.
- Unless the service procedure requires that the engine remain running, make sure the engine is off **before** beginning service.
- Be sure there is adequate ventilation whenever you run the engine, to avoid the risk of Carbon Monoxide poisoning.
- To avoid injury from moving parts, make sure your hands, fingers and clothing are out of the way when the engine is running.
- Gasoline vapors and hydrogen gases from batteries are explosive. Keep all cigarettes, sparks and flames away from the battery, fuel-related components and other enclosed compartments.
- Never use gasoline to clean parts, always use an approved nonflammable solvent.
- Never drain or store gasoline in an open container.

WARNING

The foregoing list represents general safety practices. For details on workplace health and safety requirements in your area, consult your local workplace health and safety agency or association.

We have provided you with some of the most important general service safety precautions, above. We cannot, however, warn you of every conceivable hazard that can arise in performing the service and repair procedures depicted in BRP manuals. Only you can decide whether or not you should perform a given task.

INTRODUCTION

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.

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.

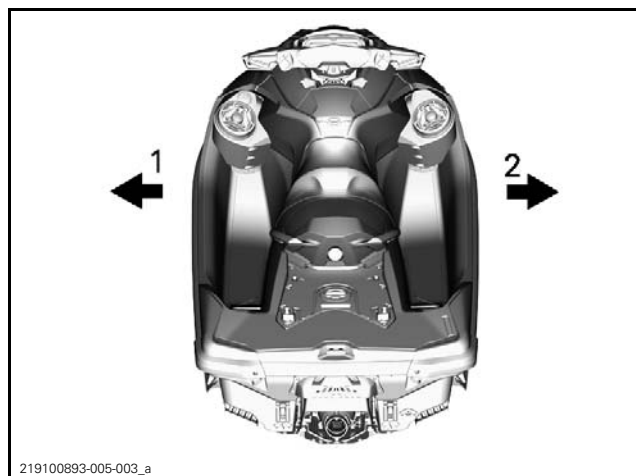
MANUAL INFORMATION

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).



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).

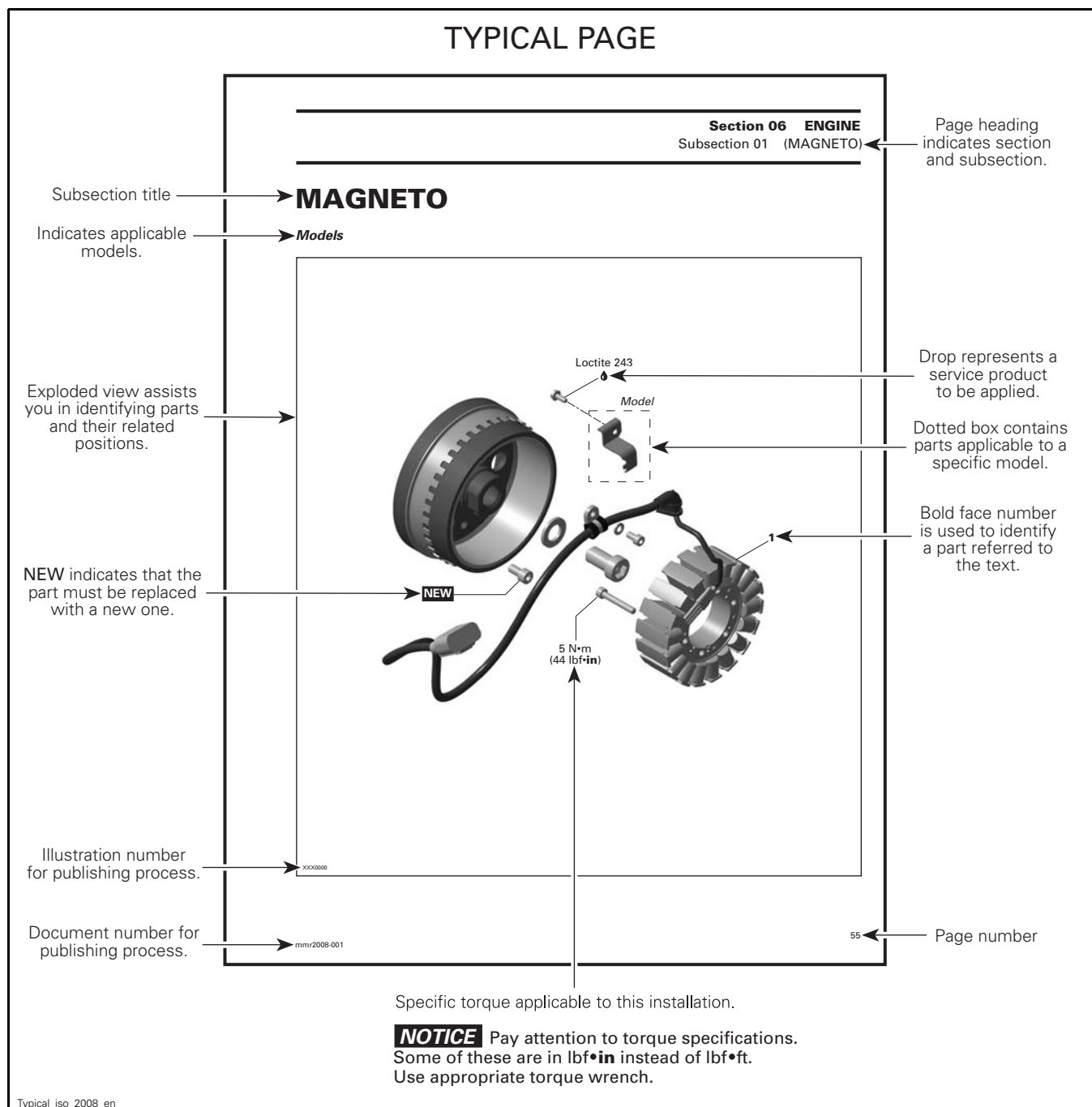
This manual uses technical terms which may be different from the ones in the *PARTS CATALOGS*.

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.

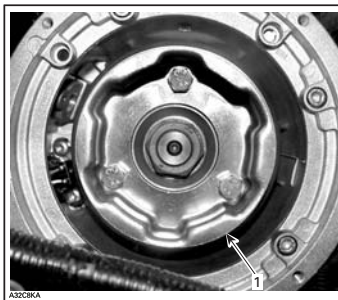
► Magneto Flywheel Removal

Remove muffler, refer to the *EXHAUST SYSTEM* section

Remove acoustic panel

Remove rewind starter.

Remove starting pulley no. 2.



TYPICAL ←

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	<p>4.8</p>	<p>8.8 9.8</p>	<p>10.9</p>	<p>12.9</p>
Property class and nut markings	<p>5</p>	<p>8</p>	<p>10</p>	<p>12</p>

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.

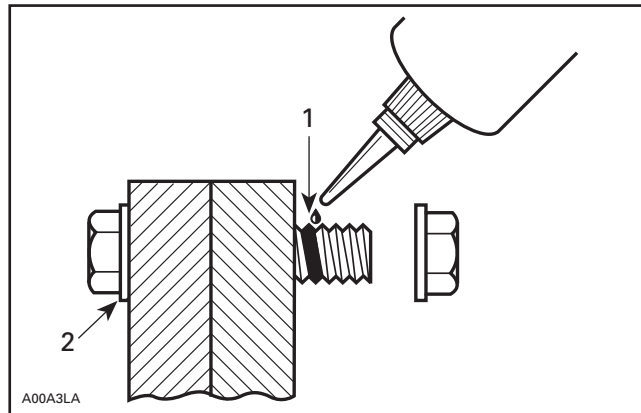
Use a metal brush or a tap to clean the hole properly, then use a solvent. Allow the solvent time to act, approximately 30 minutes, then wipe off. Solvent utilization is to ensure proper adhesion of the product used for locking the fastener.

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.

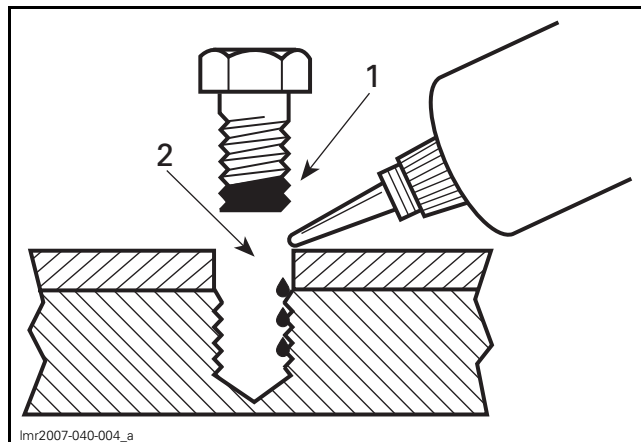
Threadlocker Application for Uncovered Holes (Bolts and Nuts)



1. Apply here
2. Do not apply

1. Clean threads (bolt and nut) with solvent.
2. Apply *LOCTITE 7649 (PRIMER)* 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

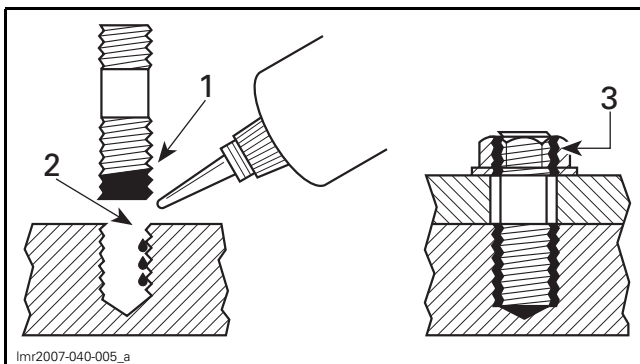


1. On fastener threads
2. On threads and at the bottom of hole

1. Clean threads (bolt and hole) with solvent.
2. Apply *LOCTITE 7649 (PRIMER)* 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



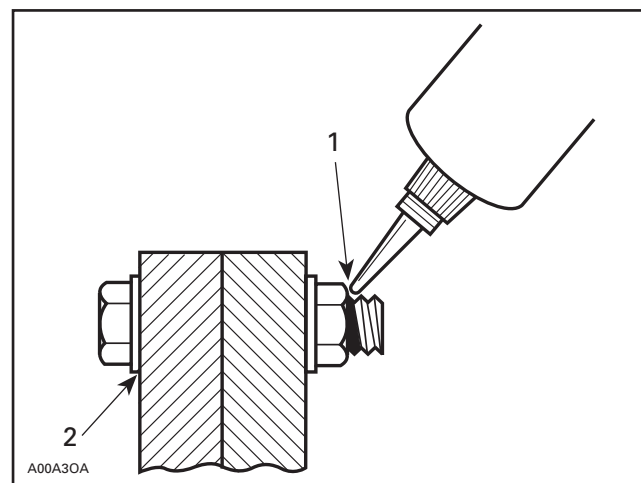
1. On stud threads
2. On threads and in the hole
3. On retaining nut threads

1. Clean threads (stud and hole) with solvent.
2. Apply *LOCTITE 7649 (PRIMER)* 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

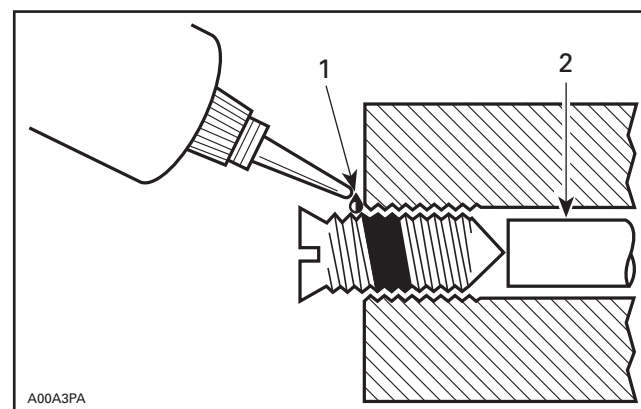


1. Apply here
2. Do not apply

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



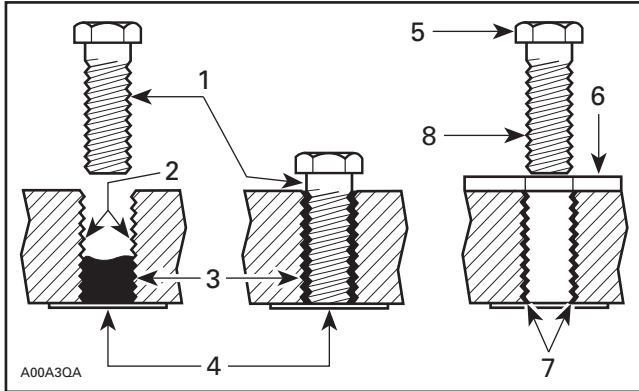
1. Apply here
2. Plunger

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. Tapes
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

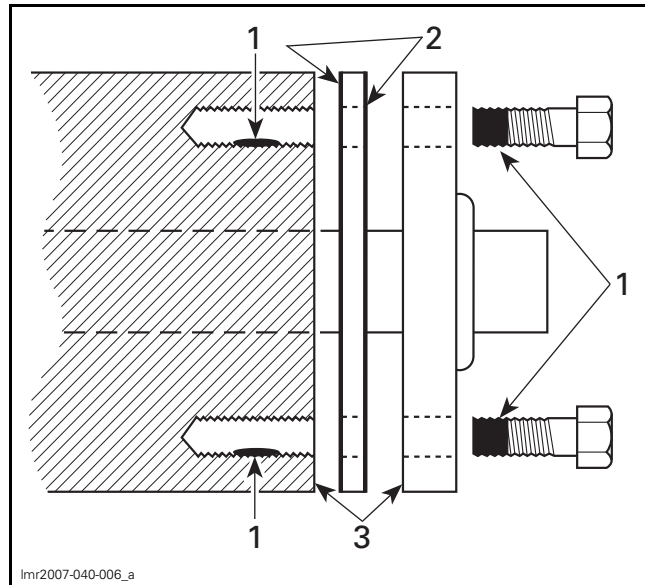
Option 1: Enlarge damaged hole, then follow *STANDARD THREAD REPAIR* procedure.

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 and Gasket Eliminator 518 on both sides of gasket
3. Loctite Primer N only

1. Remove old gasket and other contaminants using *LOCTITE CHISEL (GASKET REMOVER)*. 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* on both sides of gasket, using a clean applicator.
5. Place gasket on mating surfaces and assemble parts immediately.

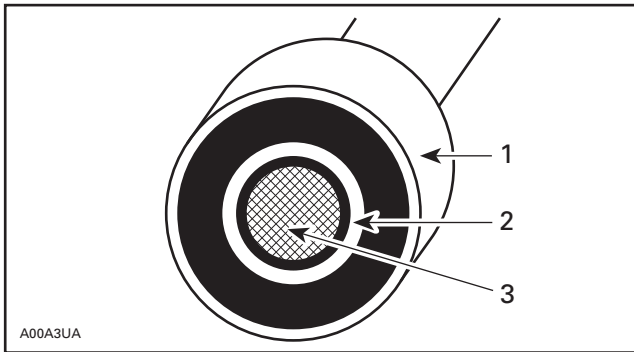
NOTE: If the cover is bolted to blind holes, apply proper strength Loctite in the hole and on threads. Tighten fastener.

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.

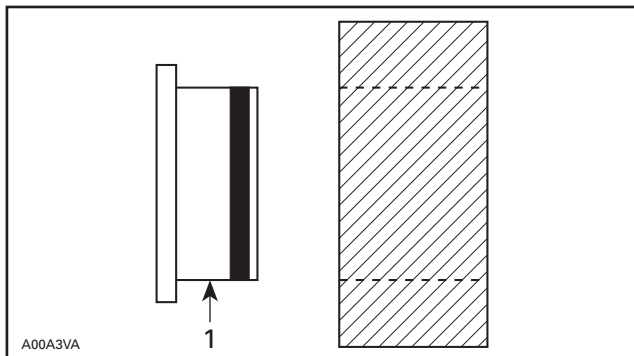
NOTE: Retaining compound is always forced out when applied on shaft.

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)*.

3. Apply a strip of proper strength Loctite on leading edge of outer metallic gasket diameter.

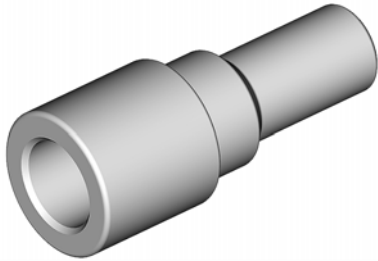
NOTE: Any Loctite product can be used here. A low strength liquid is recommended as normal strength and gap are required.

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.

ALIGNMENT SHAFT ADAPTER (900 ACE)
(P/N 529 036 454)



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ALIGNMENT SHAFT ADAPTER
(P/N 529 035 719)



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ALIGNMENT SHAFT SUPPORT
(P/N 529 035 506)



Page: 23, 53

ALIGNMENT SHAFT
(P/N 295 000 141)



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D.E.S.S. POST REMOVER
(P/N 529 035 943)



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DIAGNOSTIC HARNESS
(P/N 529 036 188)



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DIAGNOSTIC HARNESS
(P/N 529 036 384)



Page: 112, 128, 152, 167, 214

DRIVE SHAFT C-CLIP REMOVER
(P/N 529 036 026)



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ECM ADAPTER TOOL
(P/N 529 036 166)



Page: 36, 118, 150, 167

ECM TERMINAL REMOVER 2.25
(P/N 529 036 175)



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ECM TERMINAL REMOVER 3.36
(P/N 529 036 174)



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ENGINE LIFTING TOOL
(P/N 529 036 217)



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FLOATING RING TOOL (TYPE II)
(P/N 529 036 116)



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SERVICE TOOLS INDEX

FLUKE 115 MULTIMETER
(P/N 529 035 868)



Page: 35, 114, 118, 167, 175, 177

FLUSHING CONNECTOR ADAPTER
(P/N 295 500 473)



Page: 34, 66

FUEL HOSE ADAPTER
(P/N 529 036 396)



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FUEL HOSE DISCONNECT TOOL
(P/N 529 036 037)



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FUEL PUMP MODULE SOCKET
(P/N 529 036 125)




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FUEL TANK TEST CAP
(P/N 529 036 242)



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IBR NUT SOCKET
(P/N 529 036 379)



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IMPELLER REMOVER/INSTALLER
(P/N 529 035 956)



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IMPELLER SHAFT BEARING TOOL
(P/N 529 036 168)



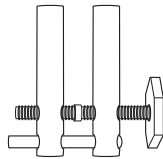
Page: 219

IMPELLER SHAFT PUSHER
(P/N 529 035 955)



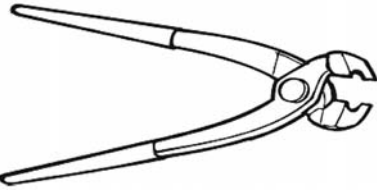
Page: 219

LARGE HOSE PINCHER
(P/N 529 032 500)



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OETIKER PLIER
(P/N 295 000 070)




Page: 47, 82, 124, 239

PRESSURE CAP
(P/N 529 036 283)



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PRESSURE GAUGE
(P/N 529 036 395)



Page: 122

PTO SHAFT ADAPTER
(P/N 529 036 401)



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TEST CAP
(P/N 529 035 991)



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PTO SUPPORT TOOL
(P/N 529 035 842)



Page: 243, 246

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



Page: 46, 81, 87, 118, 220

PUMP PLATE
(P/N 529 036 224)



Page: 23, 53, 222

VENTED CAP TEST ADAPTER
(THREADED)
(P/N 529 036 243)



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SPRING INSTALLER/REMOVER
(P/N 529 035 983)



Page: 162

SUCTION PUMP
(P/N 529 035 880)



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PERIODIC 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.

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.

Perform periodic checks and follow the maintenance schedule. **The maintenance schedule does not exempt the pre-ride inspection.**

Verifying fault codes, as first maintenance step, is a good practice and is highly recommended.

WARNING

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

EPA Regulation - Canadian and USA Vehicles

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 your vehicle, 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.

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.

The maintenance schedule does not exempt the pre-ride inspection. Refer to *OPERATOR'S GUIDE*.

AFTER EACH RIDE IN SALT, OR DIRTY WATER
Rinse engine compartment with fresh water and drain salt water
Flush the exhaust system
EVERY MONTH IN SALT, OR DIRTY WATER
Spray an anticorrosion lubricant to metallic components in engine compartment (every 10 hours in salt water use)
Inspect sacrificial anodes
AFTER FIRST 6 MONTHS OR 50 HOURS (WHICHEVER COMES FIRST)
Replace engine oil and filter (Rotax 1630 ACE - 300 engines)
EVERY YEAR AT PRESEASON OR 100 HOURS OF OPERATION (WHICHEVER COMES FIRST)
Inspect sacrificial anodes
Check for fault codes
Perform all items indicated in the Pre-Ride Inspection and Post-Operation Care
Replace engine oil and filter
Inspect engine rubber mounts
Inspect the cooling system (coolant level, hoses and fasteners for leaks)
Visually inspect connection between throttle body and intake manifold
Inspect the air intake for damage on hoses and clamps.
Inspect electrical connections and fastening (ignition system, starting system, fuel injectors, fuse boxes etc.)

Section 01 MAINTENANCE

Subsection 01 (PERIODIC MAINTENANCE SCHEDULE)

EVERY YEAR AT PRESEASON OR 100 HOURS OF OPERATION (WHICHEVER COMES FIRST)
Visually inspect area around carbon ring and drive shaft rubber boot for the following signs of failure: black carbon dust and water sprays (more frequently when using PWC in dirty water)
Inspect impeller and boot
Visually inspect impeller and wear ring for deep scratches, nicks and grooves
Remove impeller cover and inspect for signs of water intrusion
Visually inspect reverse gate bushing for excessive play
Inspect fuel cap, filler neck, fuel tank, straps, fuel lines and connections
Visually inspect coolant level in transducer support, top-off if necessary.
EVERY 2 YEARS OR 200 HOURS OF OPERATION (WHICHEVER COMES FIRST)
Replace spark plugs
Validate condition of bearing by manually spinning impeller checking for radial shaft play or noise
Verify and lubricate splines of the drive shaft and impeller
MAINTENANCE FREE
230 engines and 300 engines: The supercharger is maintenance free *. *Inspect supercharger every 200 hours (irrespective of the number of years) 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 5 YEARS OR 300 HOURS OF OPERATION (WHICHEVER COMES FIRST)
Replace the coolant

STORAGE PROCEDURE

SERVICE PRODUCTS

Description	Part Number	Page
ANTICORROSION SPRAY	219 700 304	8-9
FUEL STABILIZER (EUR)	779183	7
FUEL STABILIZER	779171	7
LUBRICANT AND ANTI-CORROSIVE (EUR)	779224	7-9
LUBRICANT AND ANTI-CORROSIVE.....	779168	7-9

PROCEDURES

PROPULSION SYSTEM

WARNING

Always remove tether cord from the engine cut-off switch to prevent unexpected engine starting before cleaning or servicing the propulsion system components.

Cleaning and Protecting the Propulsion System

Clean jet pump by spraying water in its inlet and outlet and then apply a coating of anticorrosion spray or equivalent.

SERVICE PRODUCT	
Scandinavia	LUBRICANT AND ANTI-CORROSIVE (EUR) (P/N 779224)
All other countries	LUBRICANT AND ANTI-CORROSIVE (P/N 779168)

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

With the new fuel additives, it is critical to use a fuel stabilizer to prevent fuel deterioration and fuel system gumming. Follow the manufacturer's instructions for proper use.

Fuel stabilizer 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.

SERVICE PRODUCT	
Scandinavia	FUEL STABILIZER (EUR) (P/N 779183)
All other countries	FUEL STABILIZER (P/N 779171)

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 Filter

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

Flushing the Exhaust System

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

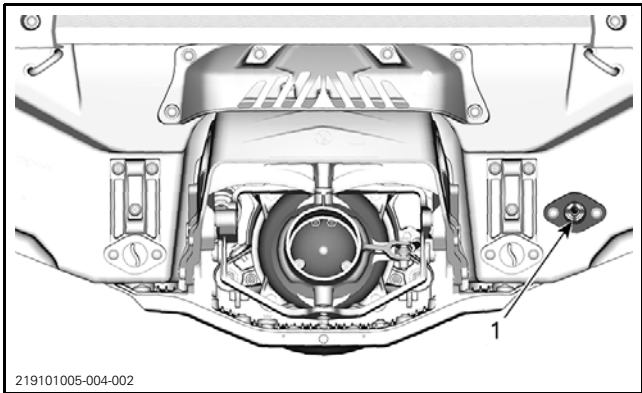
Draining the Exhaust System

The exhaust system is self draining, but the exhaust manifold needs 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.

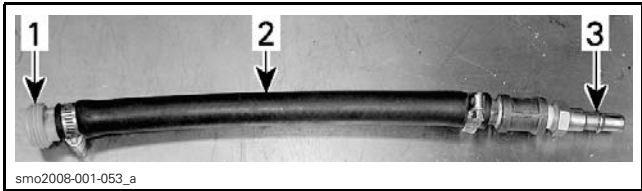
Section 01 MAINTENANCE

Subsection 02 (STORAGE PROCEDURE)



1. Flushing connector

The following hose can be fabricated to ease draining procedure.



TYPICAL

1. Flushing adaptor (P/N 295500473)

2. Hose 13 mm (1/2 in)

3. Air hose male adapter

NOTICE Failure to drain the exhaust manifold may cause severe damage to the inter-cooler (supercharged models) and exhaust manifold.

Remove special tools.

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.

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

Lubricating the Engine Internals

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 the seat.

2. Remove ignition coils and spark plugs. Refer to *IGNITION SYSTEM* subsection for details on removing the spark plugs and ignition coils.
3. Spray anti-corrosive lubricant or an equivalent product into each spark plug hole.

SERVICE PRODUCT	
Scandinavia	LUBRICANT AND ANTI-CORROSIVE (EUR) (P/N 779224)
All other countries	LUBRICANT AND ANTI-CORROSIVE (P/N 779168)
All countries	ANTICORROSION SPRAY (P/N 219 700 304)

4. Crank the engine a few turns to distribute the oil on cylinder walls.

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

5. Refer to *IGNITION SYSTEM* subsection for details on installing the spark plugs and ignition coils.
6. 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 *HULL* subsection for bilge drain plug removal.

Applying an Anticorrosion Treatment

Wipe off any residual water in the engine compartment.

Spray anti-corrosive lubricant or an equivalent product over all metallic components in engine compartment while minimizing overspray.

SERVICE PRODUCT	
Scandinavia	LUBRICANT AND ANTI-CORROSIVE (EUR) (P/N 779224)
All other countries	LUBRICANT AND ANTI-CORROSIVE (P/N 779168)
All countries	ANTICORROSION SPRAY (P/N 219 700 304)

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 Hull

Refer to appropriate *CARE AND REPAIR ONLINE BOOKLET* on www.operatorsguides.brp.com.

Replace damaged labels/decals.

Repairing the Body or Hull

If any repair are required, refer to appropriate *CARE AND REPAIR ONLINE BOOKLET* on www.operatorsguides.brp.com.

Protecting the Body and Hull

Refer to appropriate *CARE AND REPAIR ONLINE BOOKLET* on www.operatorsguides.brp.com.

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 YEAR AT PRESEASON OR 100 HOURS OF OPERATION (WHICHEVER COMES FIRST)
Check for fault codes
Perform all items indicated in the Pre-Ride Inspection and Post Care Inspection
Replace engine oil and filter
Inspect engine rubber mounts
Inspect the cooling system (coolant level, hoses and fasteners for leaks)
Test the fuel system for leaks
Inspect and lubricate throttle body
Inspect the air intake for damage on hoses and clamps.
Inspect electrical connections and fastening ignition system, starting system, fuel injectors, fuse boxes etc.)

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- 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
SUCTION PUMP	529 035 880	15

SERVICE PRODUCTS

Description	Part Number	Page
ANTICORROSION SPRAY	219 700 304	14-15
DIELECTRIC GREASE	293 550 004	14
LUBRICANT AND ANTI-CORROSIVE (EUR)	779224	14-15
LUBRICANT AND ANTI-CORROSIVE.....	779168	14-15

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.

1630 Engines

The maximum recommended towing speed is 32 km/h (20 MPH).

NOTE: Clamping the water supply hose is not required.

900 Engines

The maximum recommended towing speed is 21 km/h (13 MPH).

If you have to tow the watercraft, clamp the water supply hose in the engine compartment.

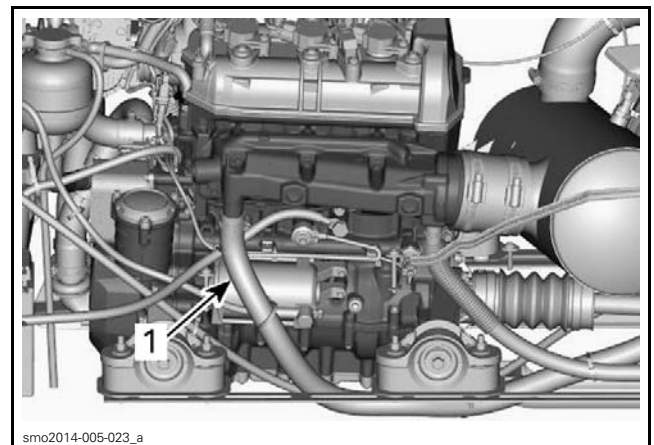
To access the water supply hose, pull out the LH access cover below the LH side of the seat and slide rearward to remove.

⚠ WARNING

Some components in the engine compartment may be hot. To avoid injury, wait for engine to cool down.

⚠ CAUTION Make sure the hose is properly clamped before towing the watercraft. If hose is not properly clamped when engine is not running, water will accumulate in the exhaust system, will enter the engine and cause damages.

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.



1. Water supply hose

Reinstall the LH access cover.

SUBMERGED WATERCRAFT

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

1. Drain bilge.
2. Remove the central body. Refer to *BODY* subsection.
3. 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.
4. Check for water inside:

– Air intake system

– Exhaust system

– Combustion chambers.

If water is found, refer to *WATER-FLOODED ENGINE* in this subsection.

5. Inspect all electrical connectors (harness and part side) for trace of corrosion.

– If any corrosion is found, repair terminals and connectors.

– Reapply dielectric grease if needed in all connectors except the ECM and starter relay.

SERVICE PRODUCT
DIELECTRIC GREASE (P/N 293 550 004)

If terminals and connectors are not corroded, re-install the central body, as per procedure done in the *BODY* 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 or inside air intake silencer 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 (cranking of engine), 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 and drain the resonator, muffler and exhaust manifold. Refer to *EXHAUST SYSTEM* subsection.

Draining the Intake System

1. If water is present in the air intake silencer, empty it and check for water in the inlet hose. Refer to *AIR INTAKE SYSTEM* subsection.
2. Remove the water from blow-by hose.
3. 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 *AIR INTAKE SYSTEM* subsection.

Draining and Lubricating the Combustion Chamber


Remove spark plugs.
Drain any water from combustion chambers and spray lub. & anti-corrosive in each spark plug hole.
Do not crank engine yet.

SERVICE PRODUCT	
Scandinavia	LUBRICANT AND ANTI-CORROSIVE (EUR) (P/N 779224)
All other countries	LUBRICANT AND ANTI-CORROSIVE (P/N 779168)
All countries	ANTICORROSION SPRAY (P/N 219 700 304)

Replacing the Engine Oil and Filter

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

1. Using the suction pump, siphon the contaminated oil from the engine reservoir through the dipstick tube.

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

2. Remove the suction pump tube from the dipstick tube.
3. Remove the oil filter. Refer to *LUBRICATION SYSTEM* subsection.
4. Siphon the contaminated oil from the oil filter reservoir.
5. Fully depress throttle lever and HOLD it for cranking. Crank the engine for 10 seconds.
6. Again, siphon the contaminated oil from the oil filter reservoir and dipstick tube.
7. Continue cranking and siphoning oil until no more oil coming into the oil filter reservoir.
8. Install a **NEW** oil filter and reinstall the oil filter cap.
9. Fill the engine with appropriate amount of the recommended engine oil. Refer to *LUBRICATION SYSTEM* subsection.
10. Reinstall spark plugs and ignition coils. Refer to *IGNITION SYSTEM* subsection.

NOTE: The installation of new spark plugs should be necessary.

11. Proceed with the *BOIL OUT PROCEDURE* that follows.

Boil Out Procedure in Water

NOTICE This procedure may be performed in water only. Performing this procedure out of water, using a garden hose, may seriously damaged the PTO sealing system and the cooling system.

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

1. Run the engine for 20 minutes at 4500 RPM.
2. Shut the engine off.
3. Change the oil and filter again.

Anticorrosion Treatment

NOTICE It is important to apply an anticorrosion treatment, especially if the vehicle was submerged in salt waters.

Wipe off any residual water in the engine compartment.

Spray lub. & anti-corrosive or anticorrosion spray over all metallic components in engine compartment.

SERVICE PRODUCT	
Scandinavia	LUBRICANT AND ANTI-CORROSIVE (EUR) (P/N 779224)
All other countries	LUBRICANT AND ANTI-CORROSIVE (P/N 779168)
All countries	ANTICORROSION SPRAY (P/N 219 700 304)

NOTICE Never spray lub. & anti-corrosive on any plastic parts or any electrical connector. For these parts always use ANTICORROSION SPRAY (P/N 219 700 304).

DROWNED MODE

If the engine is flooded with fuel 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.

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.

Section 01 MAINTENANCE

Subsection 04 (SPECIAL PROCEDURES)

CAPSIZED WATERCRAFT

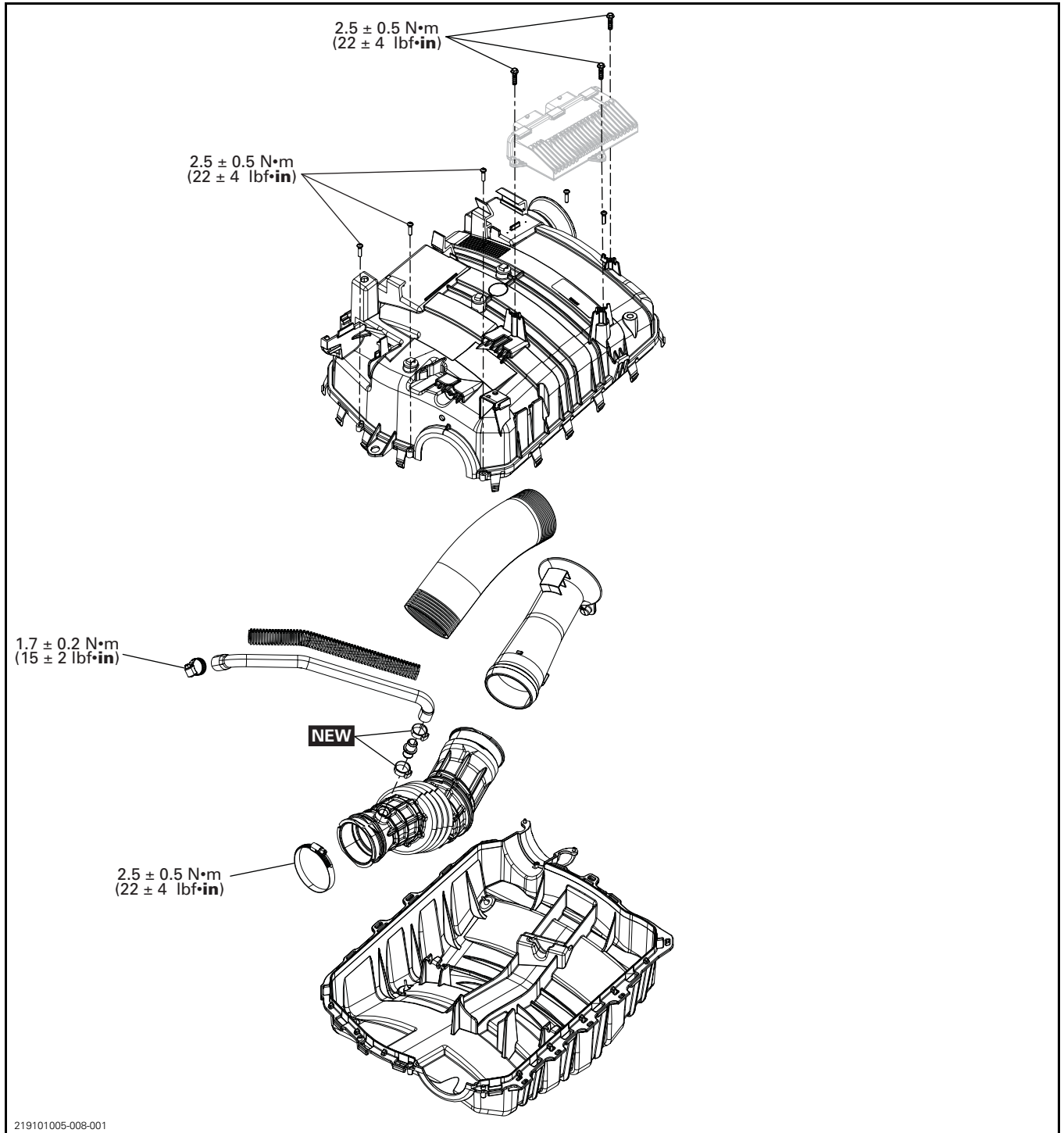
Capsized for More than 5 Minutes

Refer to *SUBMERGED WATERCRAFT* in this subsection.

**REFER TO ENGINE REMOVAL
AND INSTALLATION**

AIR INTAKE SYSTEM

AIR INTAKE SILENCER

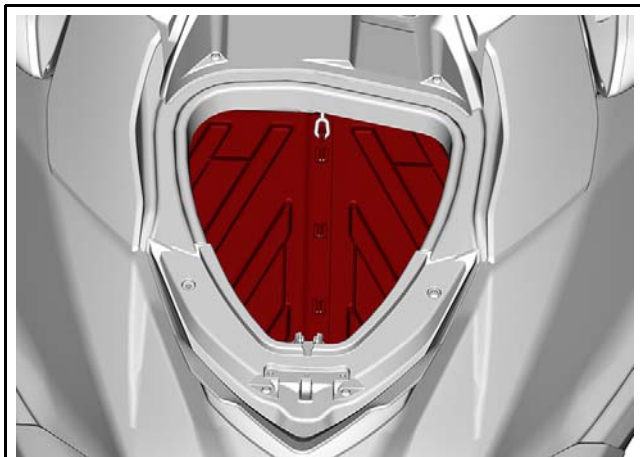


PROCEDURES

AIR INTAKE SILENCER

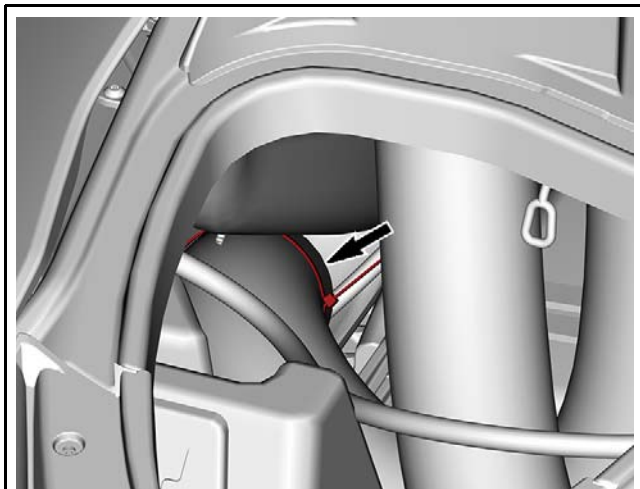
Removing the Air Intake Silencer

1. Remove the seats, storage compartment cover and engine service cover. Refer to *BODY* subsection.
2. Remove partitions.

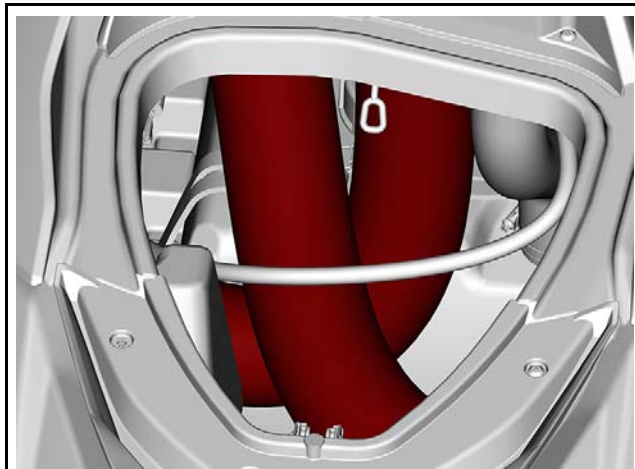


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3. Cut locking tie and unplug the top of ventilations tubes and place them lower in hull.



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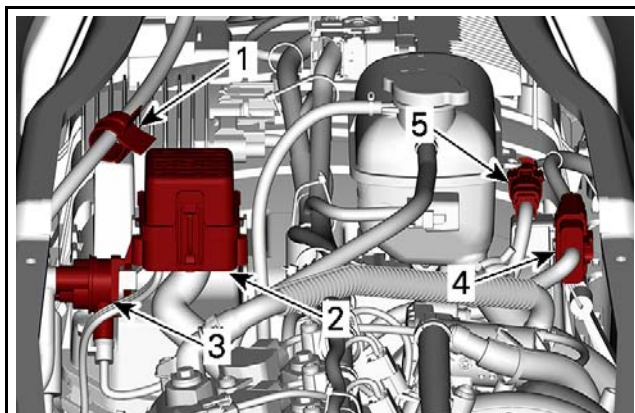


219101005-009-004

4. Disconnect the battery.

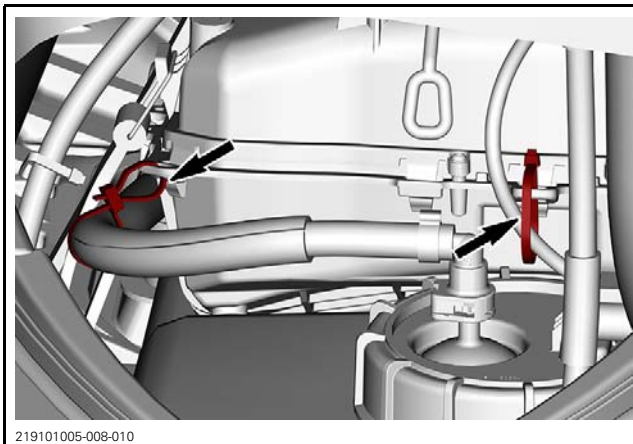
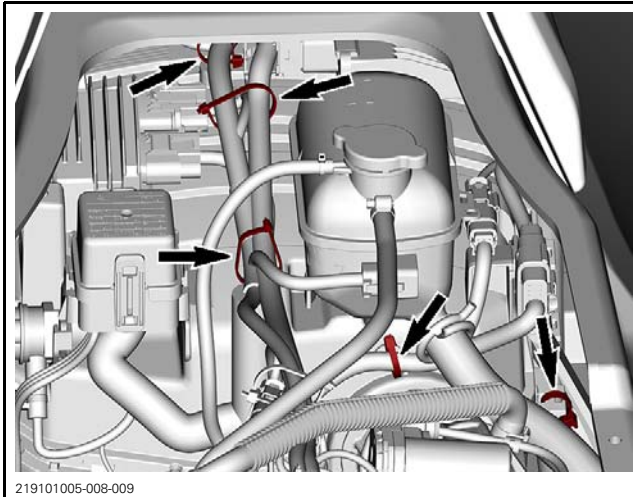
NOTICE Always disconnect the BLACK (-) cable first and reconnect last.

5. Separate from air intake silencer and set aside the following components.

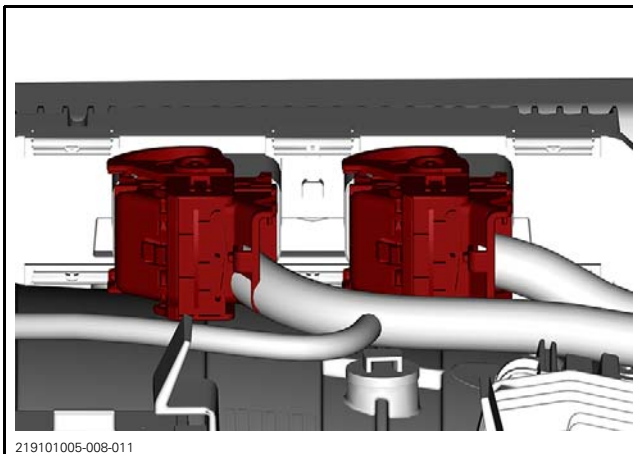


219101005-008-008

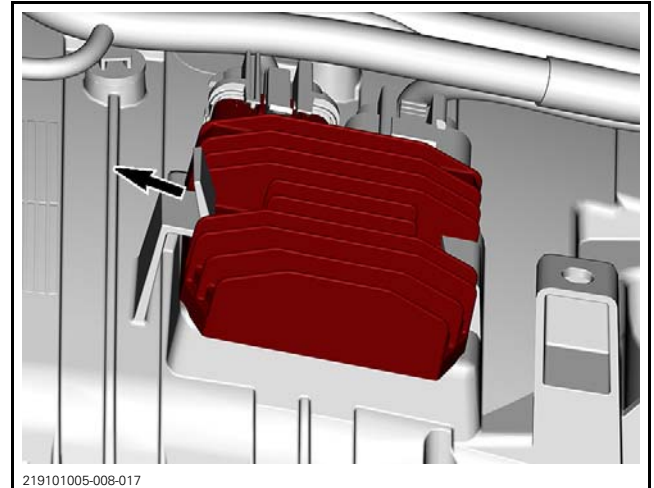
1. *Steering cable retainer*
 2. *Fuse box*
 3. *Starter solenoid*
 4. *HIC1 connector*
 5. *HIC2 connector*
6. Cut locking ties securing wiring harness and fuel hose to the air intake silencer.



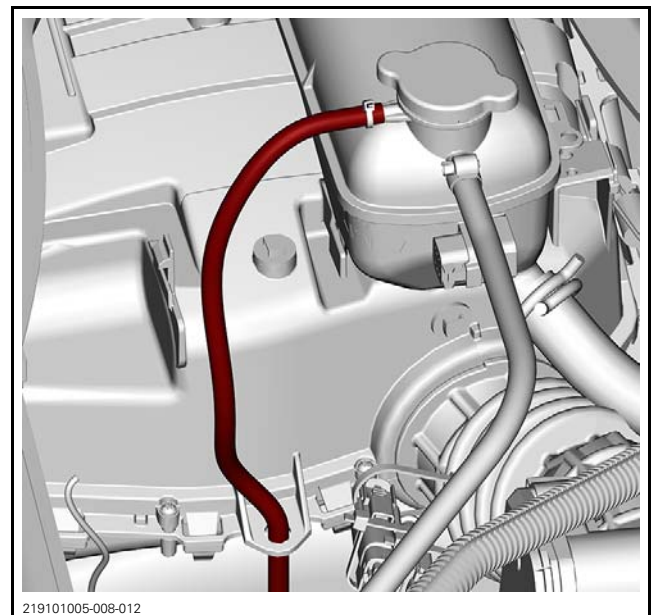
7. Disconnect both ECM connectors.



8. Unclip rectifier from air intake silencer and set aside.

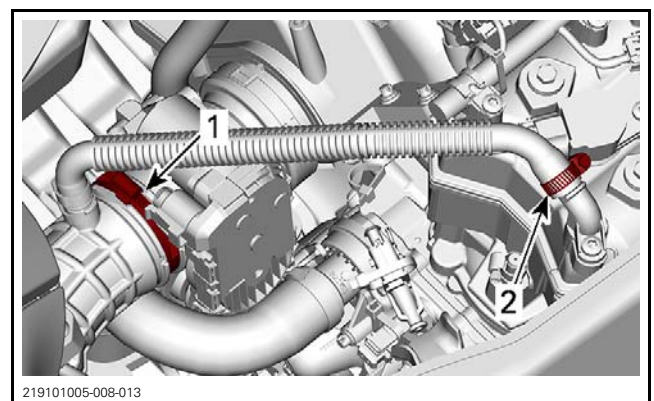


9. Remove coolant hose from coolant reservoir.



10. Unclip coolant reservoir and set aside.

11. Loosen outlet hose clamp and vent hose clamp to separate air intake silencer from engine.

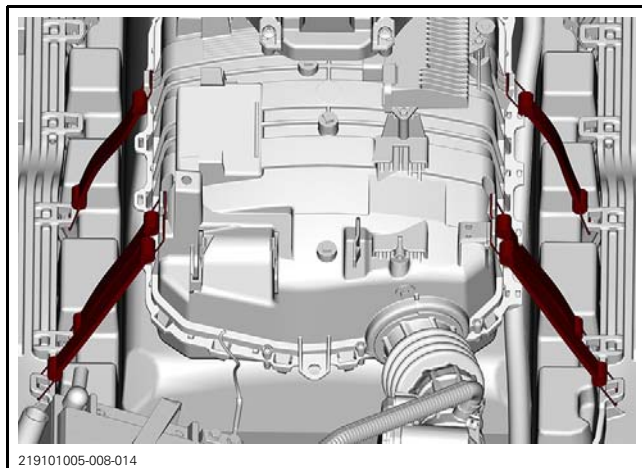


1. Outlet hose clamp
2. Vent hose clamp

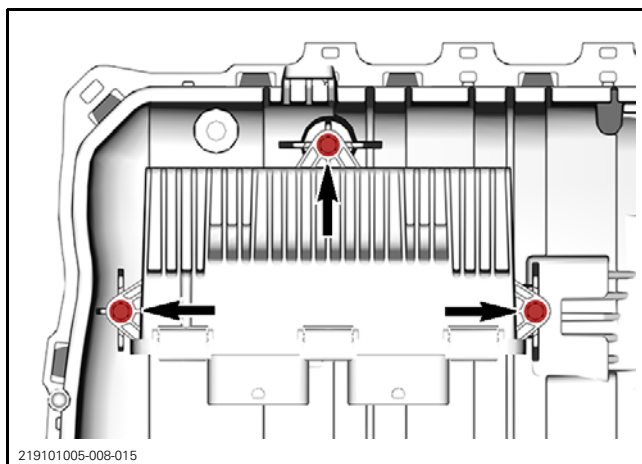
Section 02 ENGINE - 900 ACE

Subsection 02 (AIR INTAKE SYSTEM)

12. From seat opening, detach the retaining straps.



13. Pull air intake silencer forward to remove it from the vehicle.
14. Remove ECM holding screws to remove ECM.



Disassembling the Air Intake Silencer

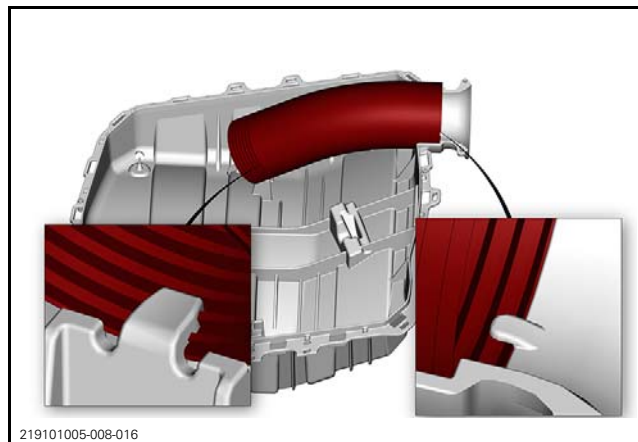
Remove screws securing upper section of air intake silencer to the lower section.

Release all retaining tabs.

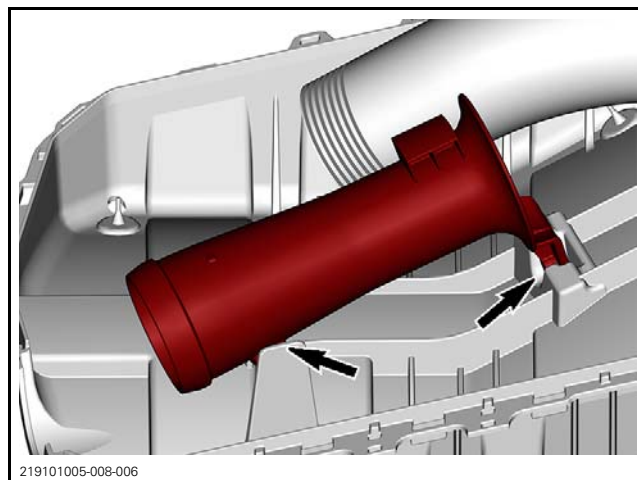
Separate upper and lower sections.

Assembling the Air Intake Silencer

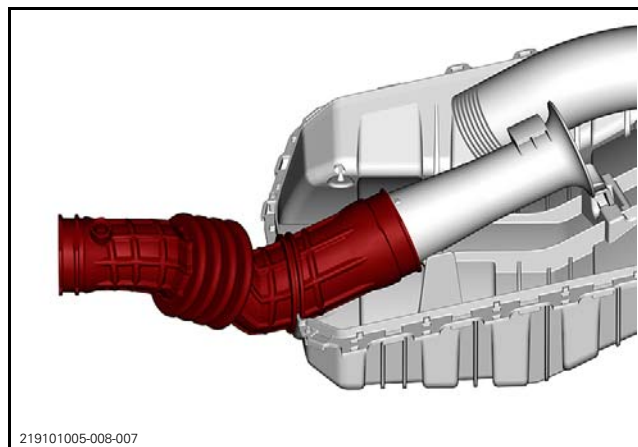
Install the inlet tube. Ensure each end is properly attached.

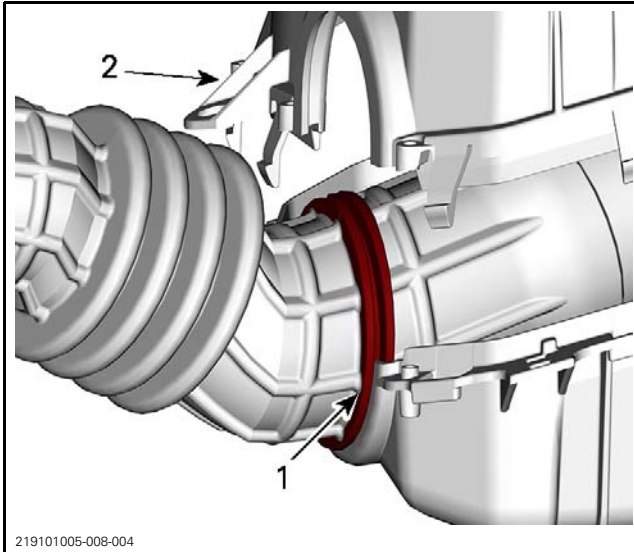


Install baffle tab into air intake silencer slots.

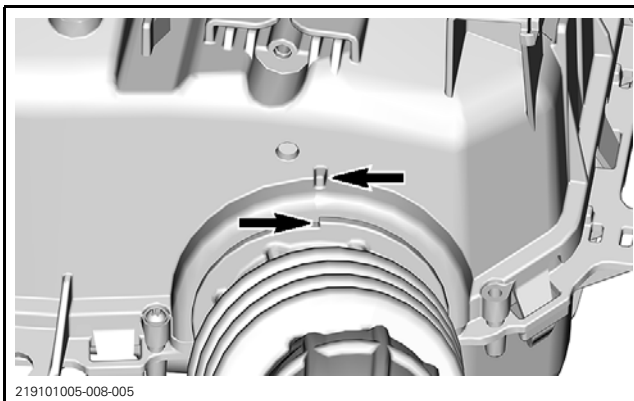


Install the outlet hose into the baffle. Ensure air intake silencer rib goes into the outlet hose groove and that marks are aligned.





1. Outlet hose groove.
2. Air intake silencer upper section.



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

Secure the upper section to lower section using previously removed K40 x 16 Torx screws. Refer to exploded view for tightening torque specifications.

Installing the Air Intake Silencer

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

Refer to exploded view for tightening torque specifications.

Ensure wiring harness and fuel hoses are properly routed.

Install new locking ties.

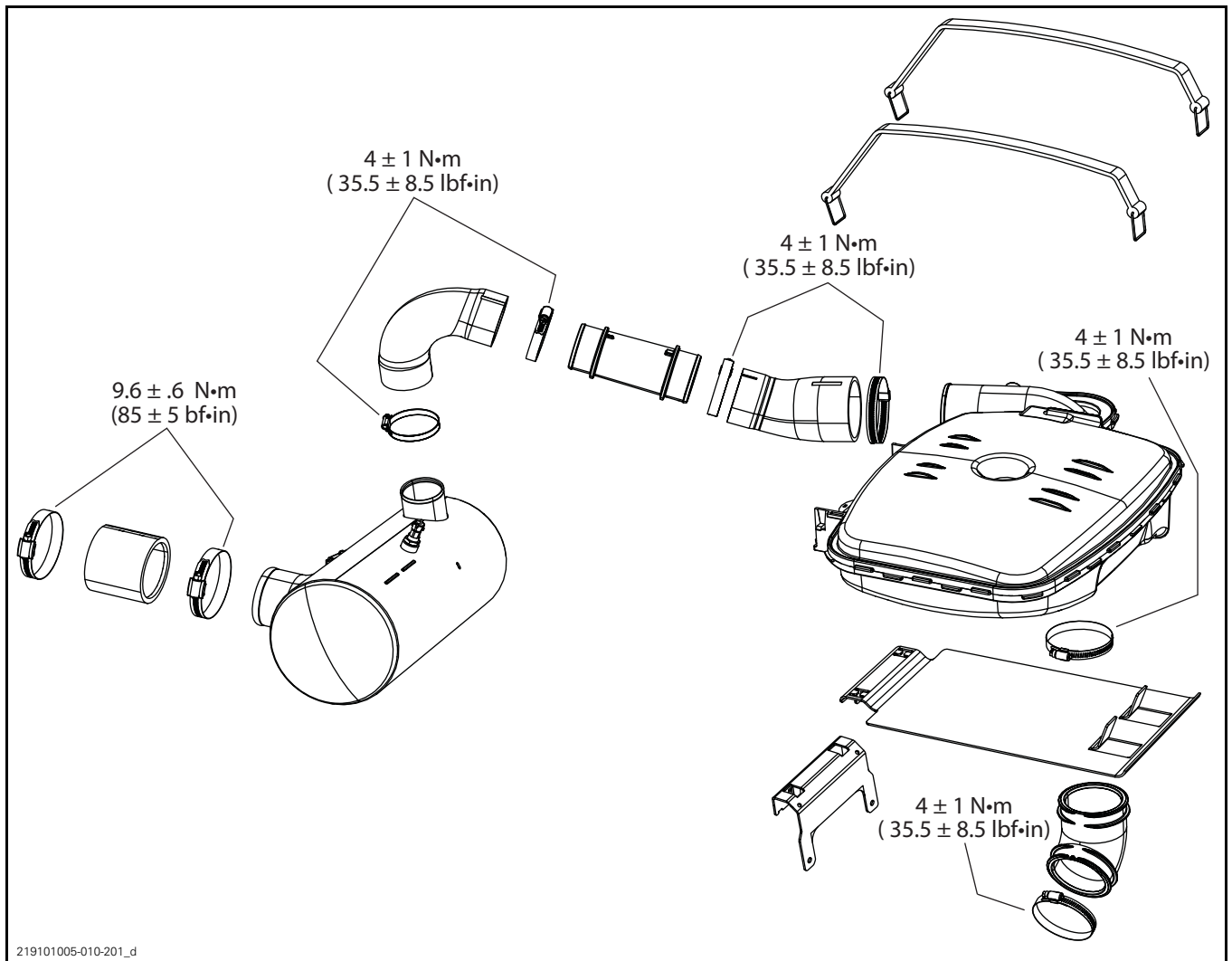
EXHAUST SYSTEM

SERVICE TOOLS

Description	Part Number	Page
ECM ADAPTER TOOL.....	529 036 166	36
FLUKE 115 MULTIMETER	529 035 868	35
FLUSHING CONNECTOR ADAPTER	295 500 473	34

SERVICE PRODUCTS

Description	Part Number	Page
DIELECTRIC GREASE	293 550 004	36
LOCTITE 518	293 800 038	36
P80 GRIP-IT	296 000 406	39



GENERAL

SYSTEM DESCRIPTION

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

Water exits exhaust manifold through holes to inject water in muffler.

NOTE: For more information on the exhaust manifold, refer to *EXHAUST MANIFOLD* subsection.

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.

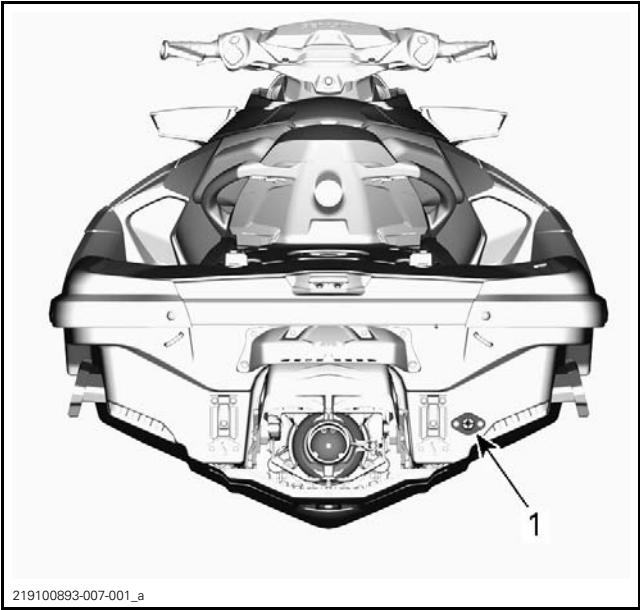
⚠ WARNING

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.



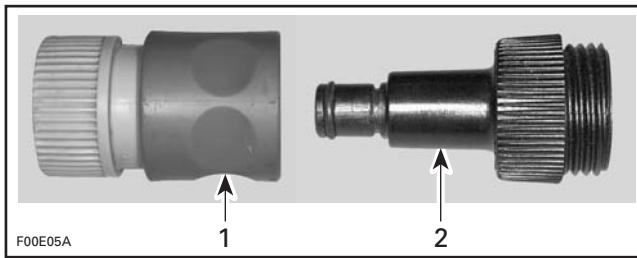
1. Water inlet connector

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.

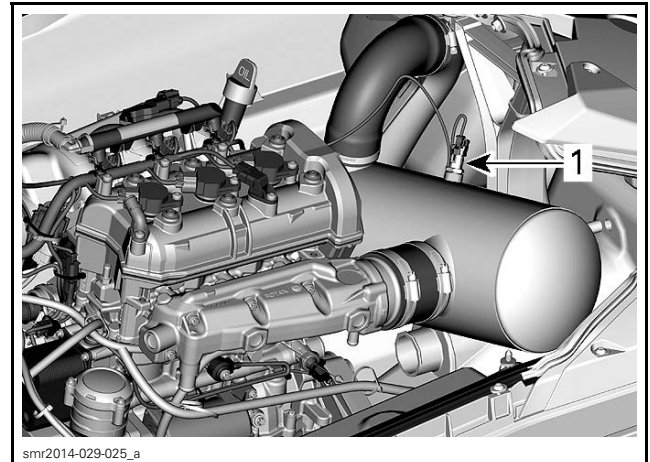
NOTICE Always close the water tap before stopping the engine.

Disconnect the garden hose.

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

PROCEDURES

EXHAUST GAS TEMPERATURE SENSOR (EGTS)



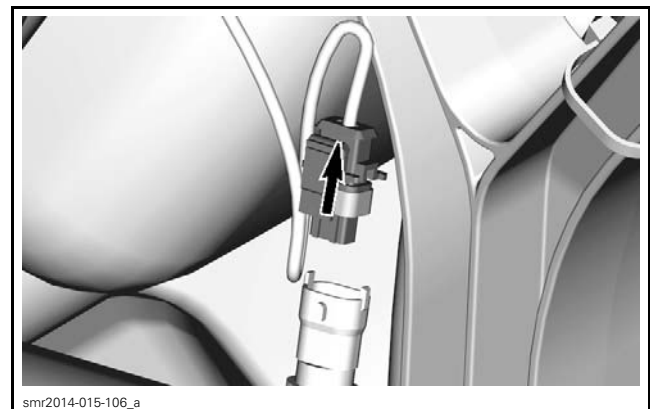
1. Exhaust gas temperature sensor (EGTS)

An overheat signal will come on in the multifunction gauge when the exhaust gases reach the following temperature.

OVERHEAT TEMPERATURE
95°C (203°F)

Testing the EGTS Resistance

1. Remove the parts required to access the EGTS.
2. Disconnect the EGTS connector.



EGTS

3. Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to Ω selection and measure the resistance of the sensor.

Section 02 ENGINE - 900 ACE

Subsection 03 (EXHAUST SYSTEM)



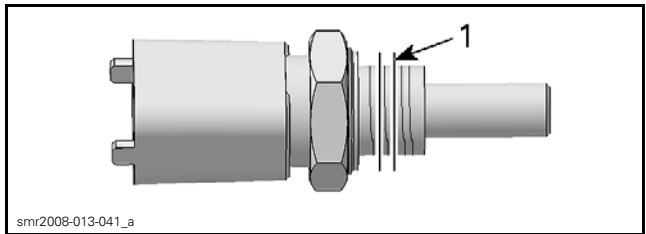
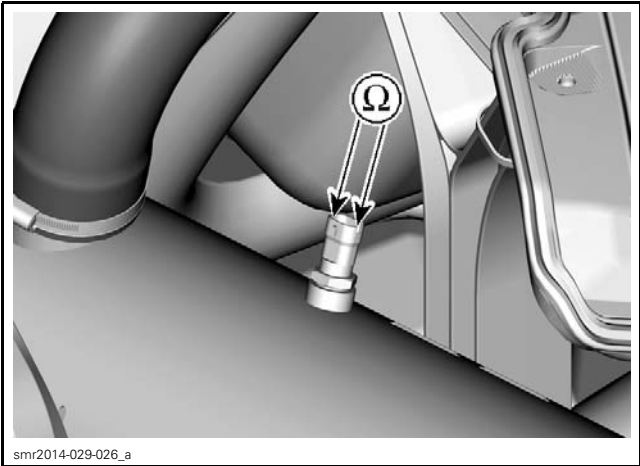
ECM ADAPTER		MEASUREMENT
J4	H4	See <i>EGTS RESISTANCE CHART</i>

If resistance value is as specified, check ECM. Refer to *ENGINE CONTROL MODULE (ECM)* 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 treads of new EGTS.
4. Install new EGTS.



The resistance should be as per the *EGTS RESISTANCE CHART* that follows. Otherwise, replace the EGTS.

EGTS TEMPERATURE SENSOR TABLE			
TEMPERATURE		RESISTANCE (OHMS)	
°C	°F	LOW	HIGH
- 40	- 40	38457	52630
- 10	14	8208	10,656
20	68	2233	2780
80	176	297	349
120	248	105	122

If the EGTS resistance is within specifications, proceed with the following steps.

1. Reconnect the EGTS.
2. Disconnect ECM-A connector.
3. Using a multimeter and the ECM adapter tool, check the circuit resistance as per following table.

REQUIRED TOOL	
ECM ADAPTER TOOL (P/N 529 036 166)	

1. Apply Loctite 518 in this area

TIGHTENING TORQUE	
EGTS	16 N•m ± 2 N•m (142 lbf•in ± 18 lbf•in)

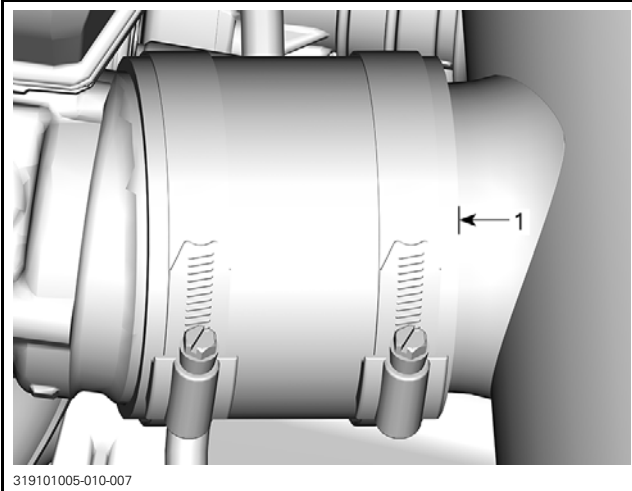
5. Apply DIELECTRIC GREASE (P/N 293 550 004) on EGTS connector before reinstall it.
6. Install all other removed parts, refer to applicable subsections.

MUFFLER

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

Removing the Muffler

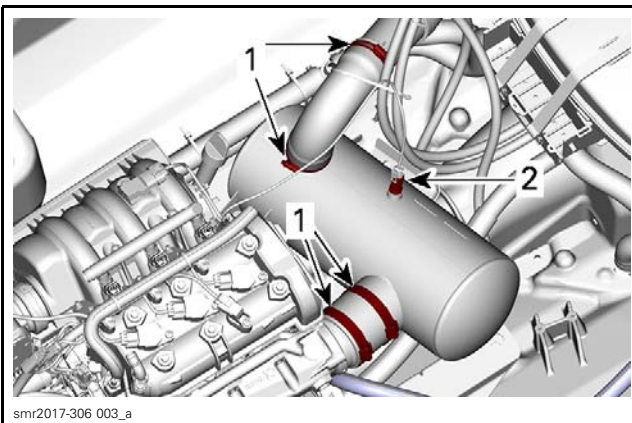
1. Remove or open seat.
2. Set aside the coolant reservoir.
3. Mark manifold to muffler hose location on muffler.



1. Trace a mark here

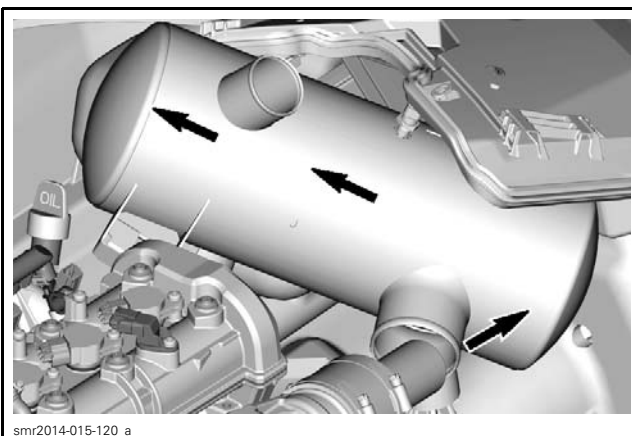
NOTICE Do not use pneumatic or electrical tools as seizure may occur.

4. Loosen muffler hose clamps and disconnect EGTS.



1. Muffler hose clamps
2. EGTS

5. 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.

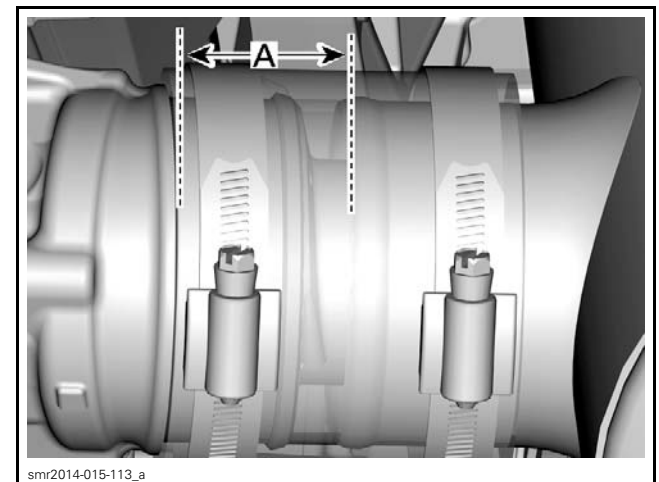
Installing the Muffler

With a new muffler, install the EGTS sensor. Refer to this subsection.

With a new muffler, mark muffler as per specification in step 1.

1. Ensure mark on muffler, inscribed during removal, provides correct engagement length into manifold to muffler exhaust hose.

NOTE: Because of manufacturing tolerances, the measurement must be taken as illustrated. From the muffler to the end of the hose.

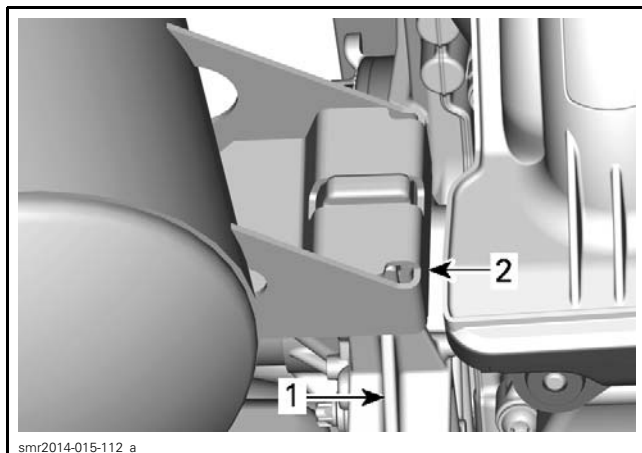


MANIFOLD TO MUFFLER EXHAUST HOSE - PORT SIDE VIEW
A. Muffler engagement length 40 mm ± 2 mm (1.57 in ± .08 in)

2. Install muffler.
3. Position muffler support on rear starboard engine mount.

Section 02 ENGINE - 900 ACE

Subsection 03 (EXHAUST SYSTEM)



MUFFLER SUPPORT - STARBOARD SIDE VIEW

1. Rear starboard engine mount
2. Muffler support

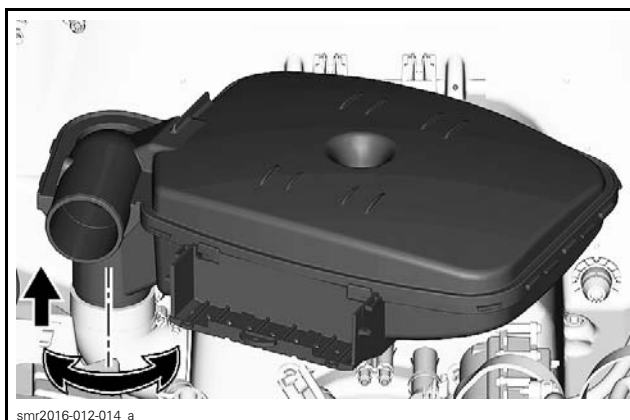
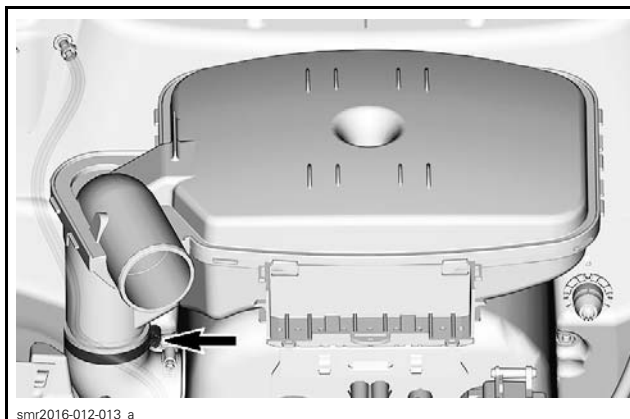
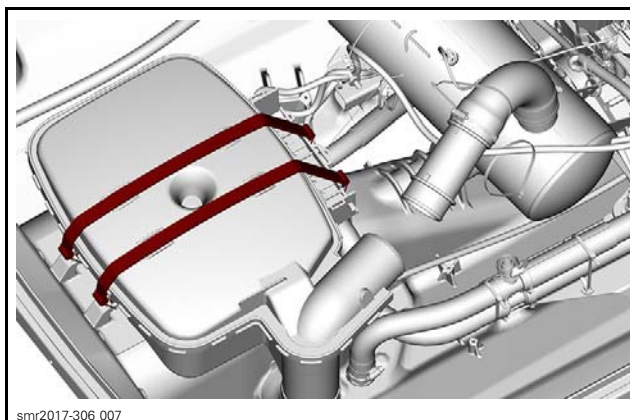
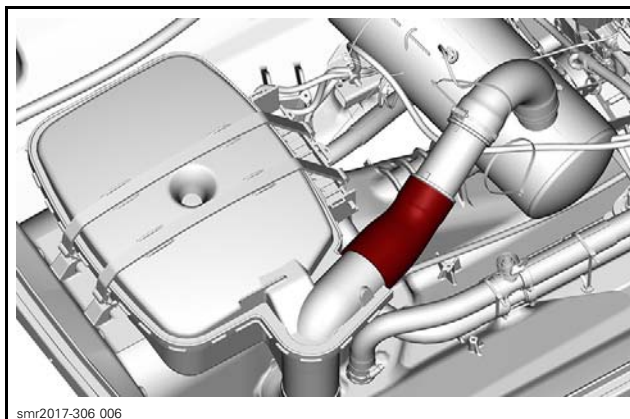
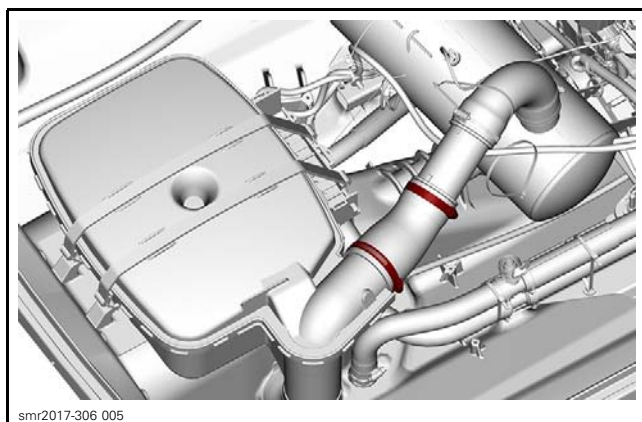
NOTE: Ensure muffler support is properly seated on rear starboard engine mount.
Ensure manifold to muffler exhaust hose is aligned with mark on inscribed muffler.

4. Reposition rear support.
5. Install all other removed parts.
6. Test run the engine while supplying water to the exhaust system.
7. After installation, ensure there is no water or exhaust gas leak when engine is running.

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

RESONATOR

Removing the Resonator



Inspecting the Resonator

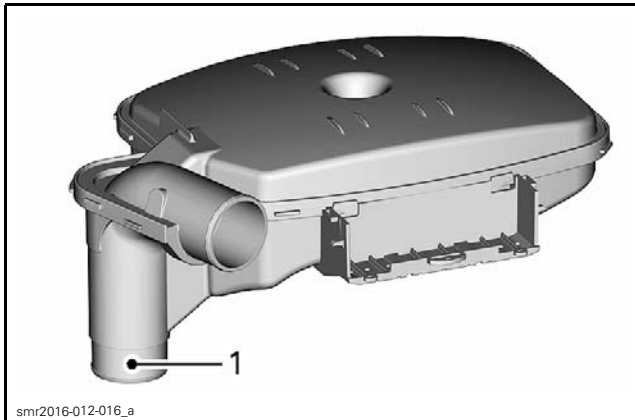
Inspect parts condition paying attention for deformation, cracks or other damage. Check hoses. Replace any defective part.

Installing the Resonator

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

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.



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.

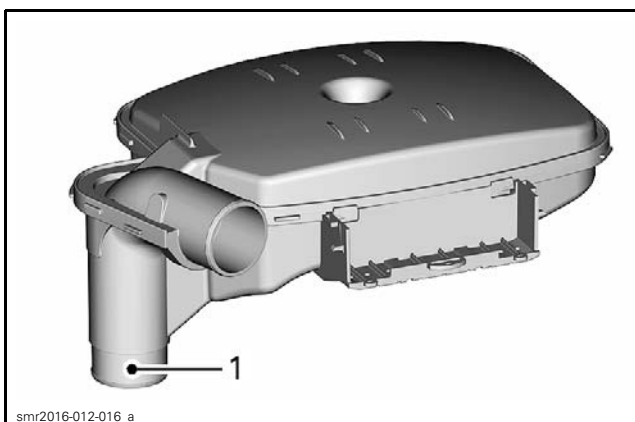
NOTICE Never run engine without supplying water to the exhaust system when watercraft is out of water.

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)

VEHICLE COOLING SYSTEM

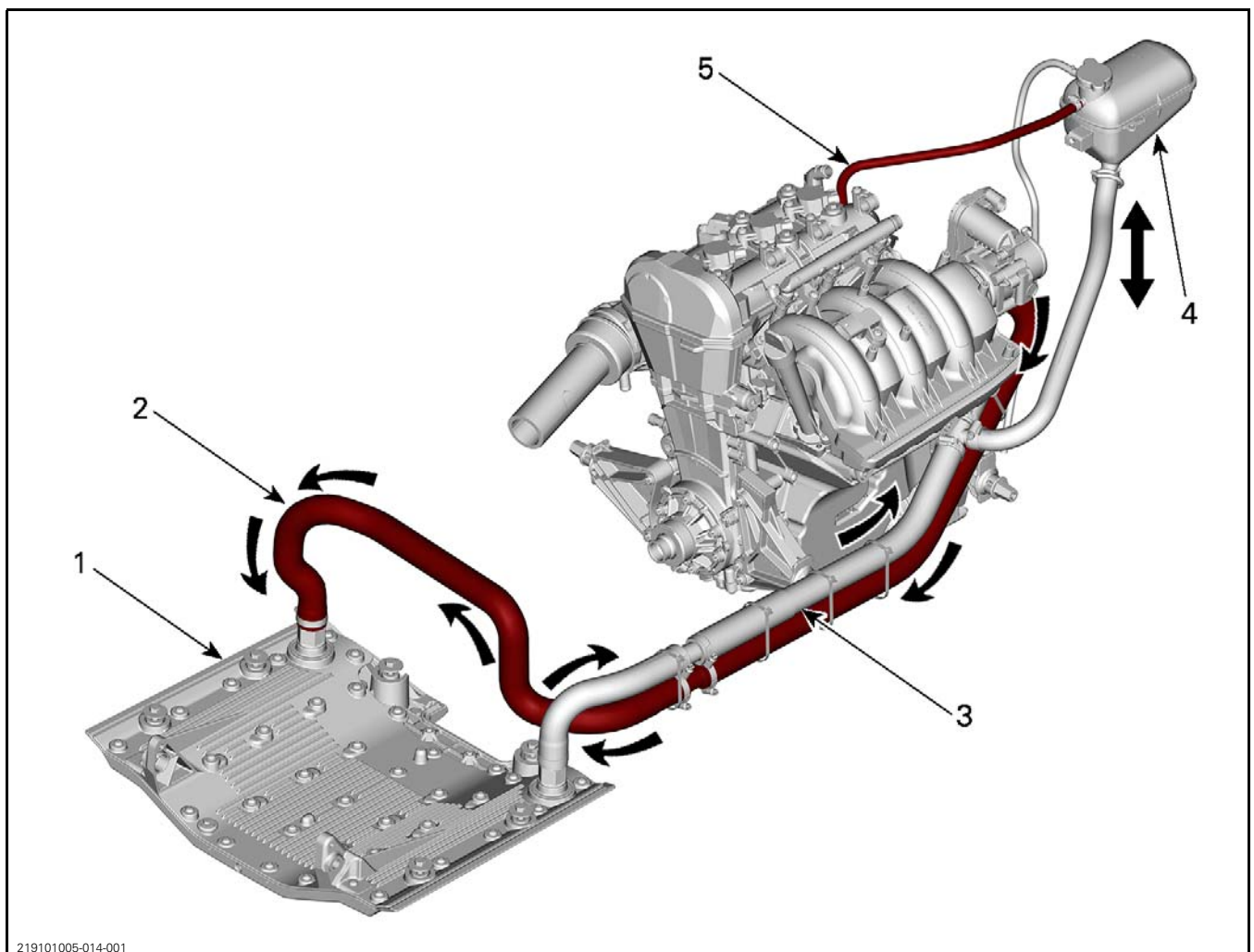
SERVICE TOOLS

Description	Part Number	Page
OETIKER PLIER.....	295 000 070	47
TEST CAP.....	529 035 991	46
VACUUM/PRESSURE PUMP	529 021 800	46

SERVICE PRODUCTS

Description	Part Number	Page
EXTENDED LIFE PRE-MIXED COOLANT (EUR)	779223	44
EXTENDED LIFE PRE-MIXED COOLANT	779150	44
LOCTITE 567 (PIPE SEALANT)	293 800 013	45

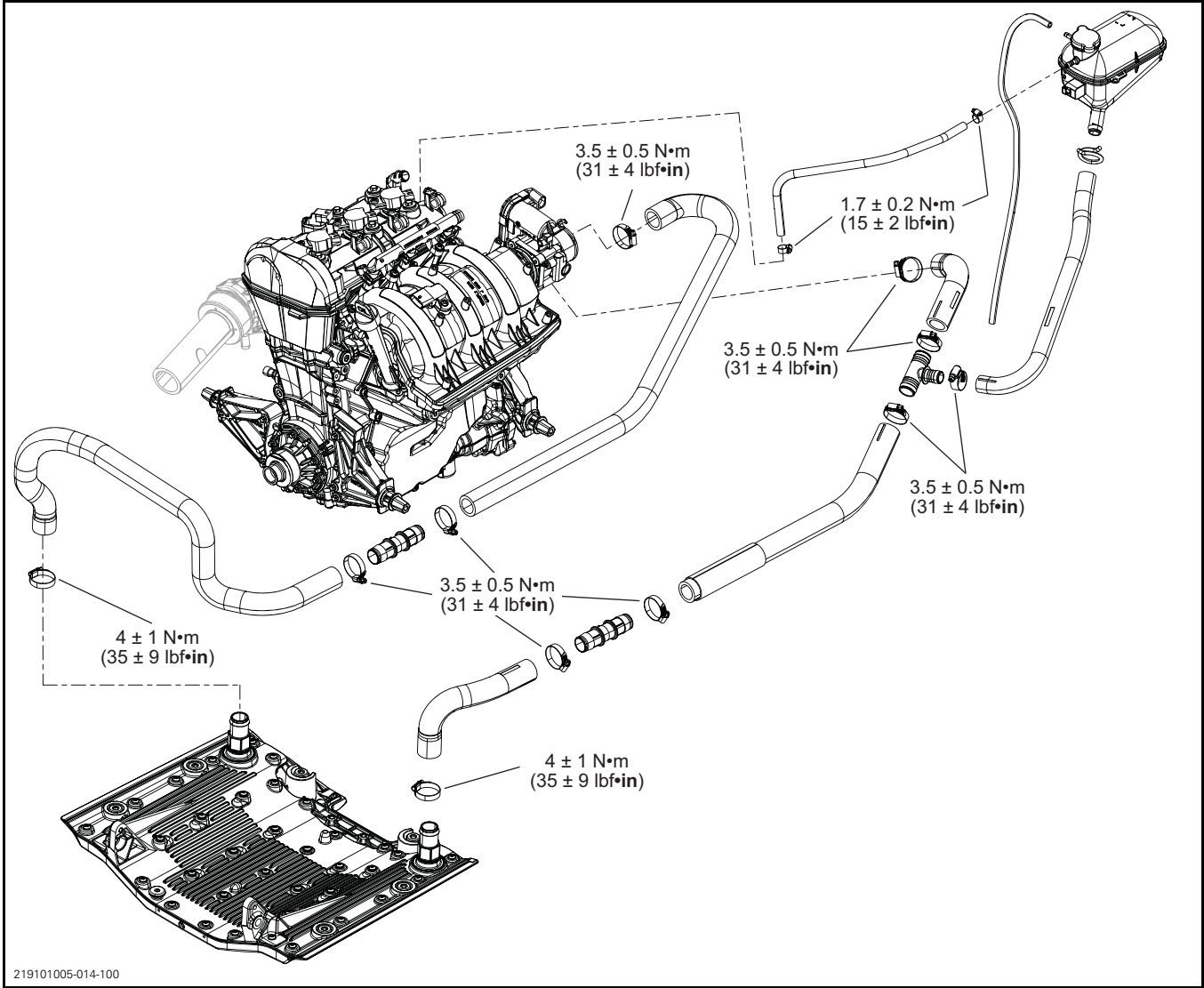
Cooling System (Closed loop)



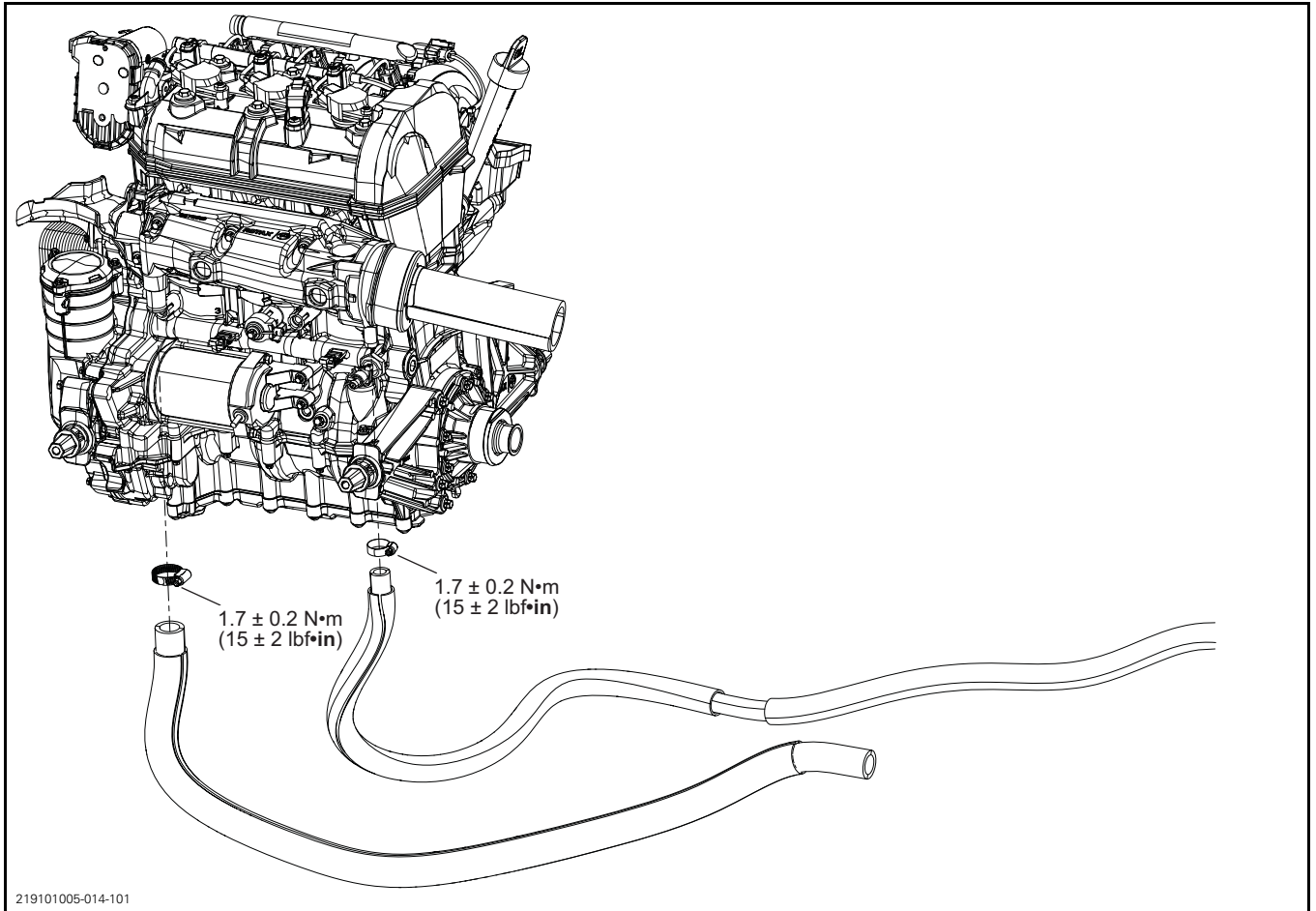
1. Ride plate (operates as heat exchanger)
2. Coolant flows to ride plate
3. Coolant returns from ride plate
4. Expansion coolant tank
5. Bleed hose from cylinder head to expansion coolant tank

Section 02 ENGINE - 900 ACE
Subsection 04 (VEHICLE COOLING SYSTEM)

Cooling System (Closed loop)



Cooling System (Open loop)



GENERAL

SYSTEM DESCRIPTION

A closed loop cooling system is utilized on all BRP watercraft engines, 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 through the thermostat directly back to the water pump impeller, or it takes its way through the heat exchanger.

Engine coolant is also directed towards the oil cooler (coolant type).


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

Technical Specifications

TYPE	Closed loop cooling system.
COOLANT FLOW	Flow from water pump.
TEMPERATURE CONTROL	Thermostat. (opens at 80°C (176°F))
SYSTEM BLEEDING	Self-bleed type through coolant tank (hose at uppermost point of circuit).
MONITORING BEEPER	Turns on at 110°C (230°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.

Recommended Coolant

COOLANT	
Scandinavia	EXTENDED LIFE PRE-MIXED COOLANT (EUR) (P/N 779223)
All Other Countries	EXTENDED LIFE PRE-MIXED COOLANT (P/N 779150)
Alternative, or if not available	Distilled water and antifreeze solution (50% distilled water, 50% antifreeze)

If the recommended coolant is not available, use a low silicate, extended life ethylene-glycol pre-mixed coolant (50%-50%) specifically formulated for internal combustion aluminum engines.

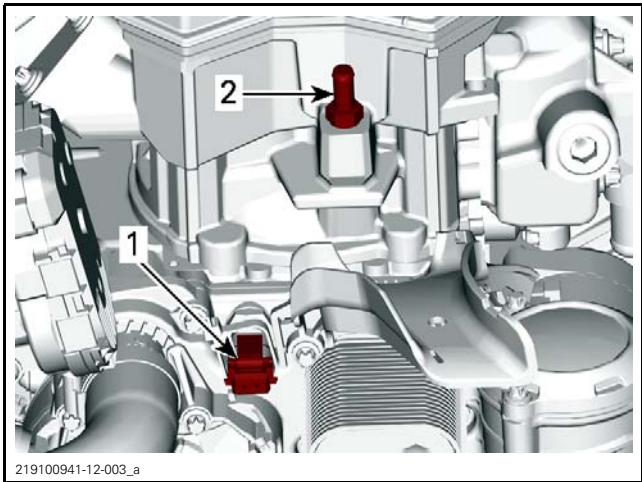
To prevent antifreeze deterioration, always use the same brand and grade. Never mix different brands or grades unless cooling system is completely flushed and refilled.

Draining the System

 **WARNING**

Never drain or refill cooling system when engine is hot.

- Remove seats.
- Remove engine service cover.



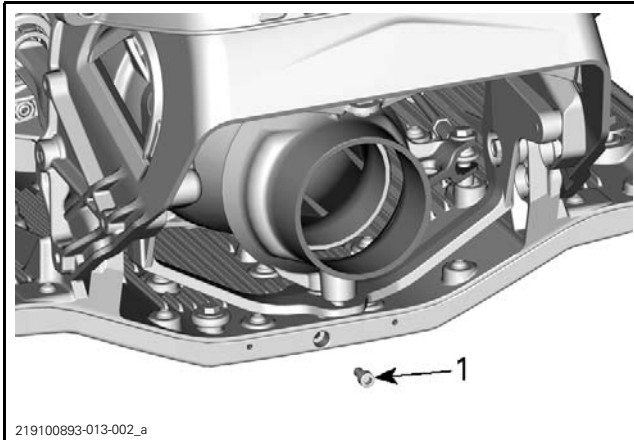
1. Coolant temperature sensor (CTS)
2. Bleed hose nipple

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

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.



TYPICAL
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 pipe sealant on drain plug threads.

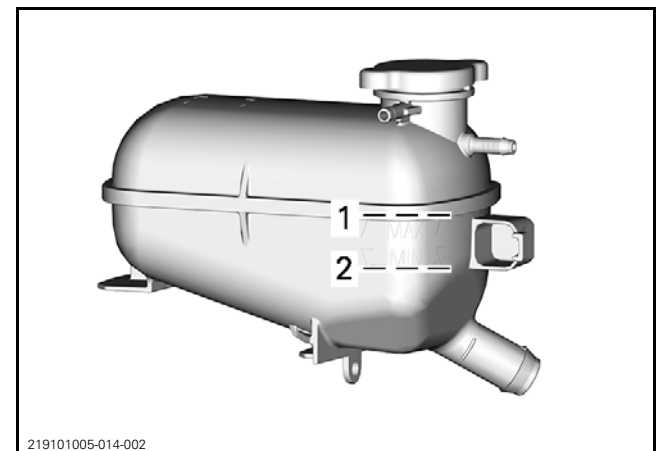
SERVICE PRODUCT
LOCTITE 567 (PIPE SEALANT) (P/N 293 800 013)

Ask someone to pour recommended antifreeze in coolant tank.

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

TIGHTENING TORQUE	
Drain plug	8.5 N•m ± 0.5 N•m (75 lbf•in ± 4 lbf•in)

Continue to pour and fill coolant tank between marks.



LEVEL BETWEEN MARKS WHEN ENGINE IS COLD

1. MAX
2. MIN

Do not install pressure cap at this time.

Link a garden hose to the hose adapter at the back of the watercraft. Refer to *FLUSHING THE EXHAUST SYSTEM* in the *EXHAUST SYSTEM* sub-section.

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

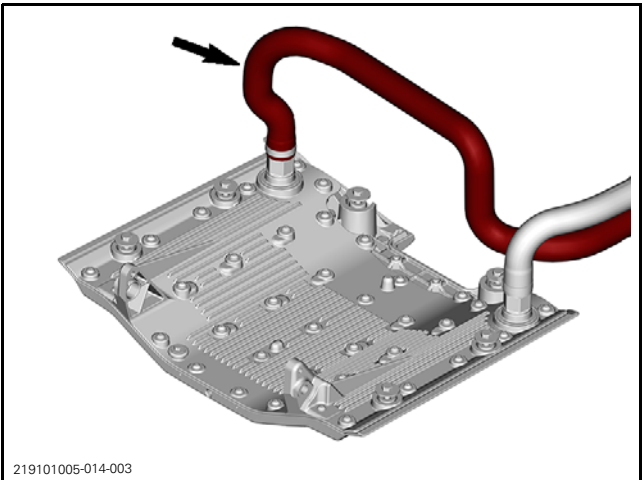
Start engine and let run for a maximum of 2 minutes. Stop engine and wait 15 minutes to cool down. Refill tank as necessary.

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

Section 02 ENGINE - 900 ACE

Subsection 04 (VEHICLE COOLING SYSTEM)

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



HOSE HOT WHEN THERMOSTAT OPENS

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

INSPECTION

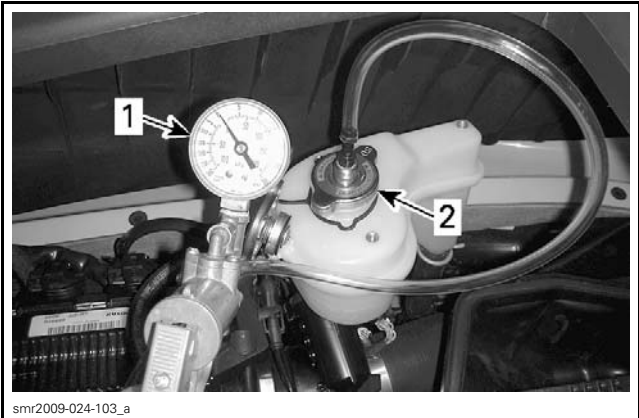
COOLING SYSTEM LEAK TEST

WARNING

To avoid potential burns, do not remove the
coolant tank cap if the engine is hot.

NOTE: This test confirms if there is a leak in the
cooling system, including the engine.
Pressurize cooling system through coolant reser-
voir.

REQUIRED TOOLS	
TEST CAP (P/N 529 035 991)	
VACUUM/PRESSURE PUMP (P/N 529 021 800)	
COOLING SYSTEM LEAK TEST	
110 kPa (16 PSI)	

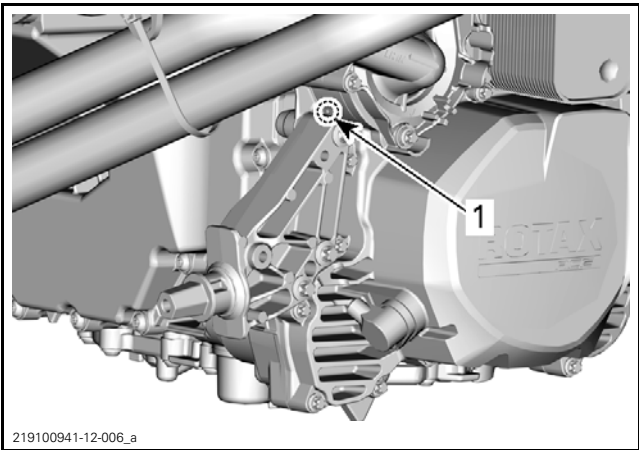


TYPICAL
1. Vacuum/pressure pump
2. Test cap

If pressure drops, check all hoses, heat exchanger
and engine for coolant leaks. Spray a soap/water
solution and look for air bubbles.

Check the leak indicator hole if there is oil or
coolant leaking.

NOTE: In general, leaking coolant indicates a
damaged rotary seal. Leaking oil indicates a dam-
aged oil seal. If either seal is leaking, both seals
must be replaced at the same time. Refer to
WATER PUMP in COOLING SYSTEM - ENGINE
in the appropriate engine shop manual.



1. Leak indicator hole

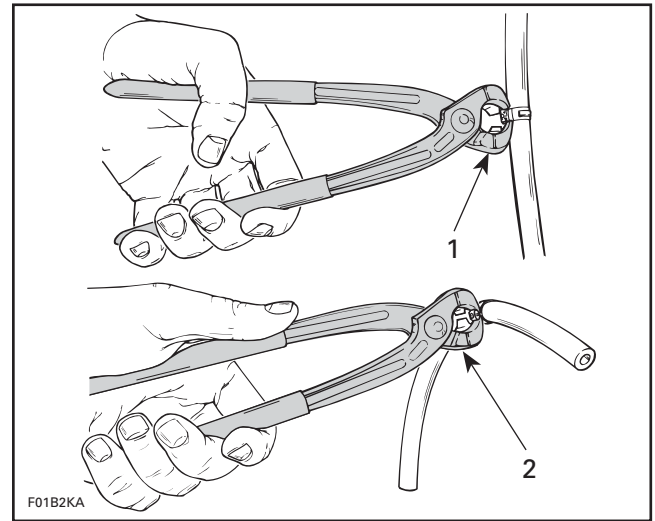
TROUBLESHOOTING

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 prob-
lems.

Always check for fault codes. If a fault code is de-
tected, service the fault code first. Refer to *DIAG-
NOSTIC 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 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.



1. Cutting clamp
2. Securing clamp

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

PROCEDURES

PRESSURE CAP

Testing 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 \pm 10 kPa (13 PSI \pm 1.5 PSI)

CLAMPS

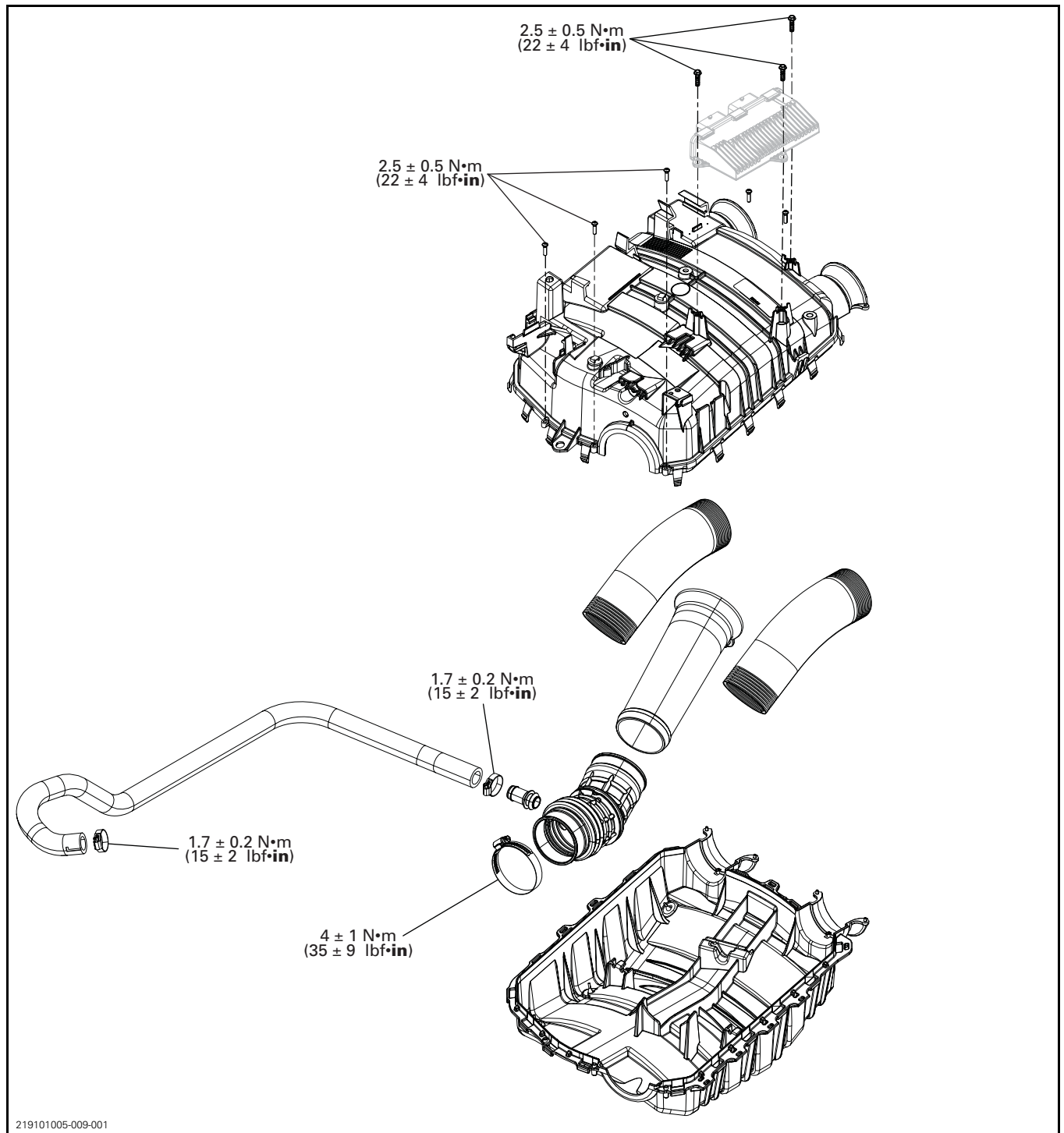
Replacing the Oetiker Clamp

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

**REFER TO ENGINE REMOVAL
AND INSTALLATION**

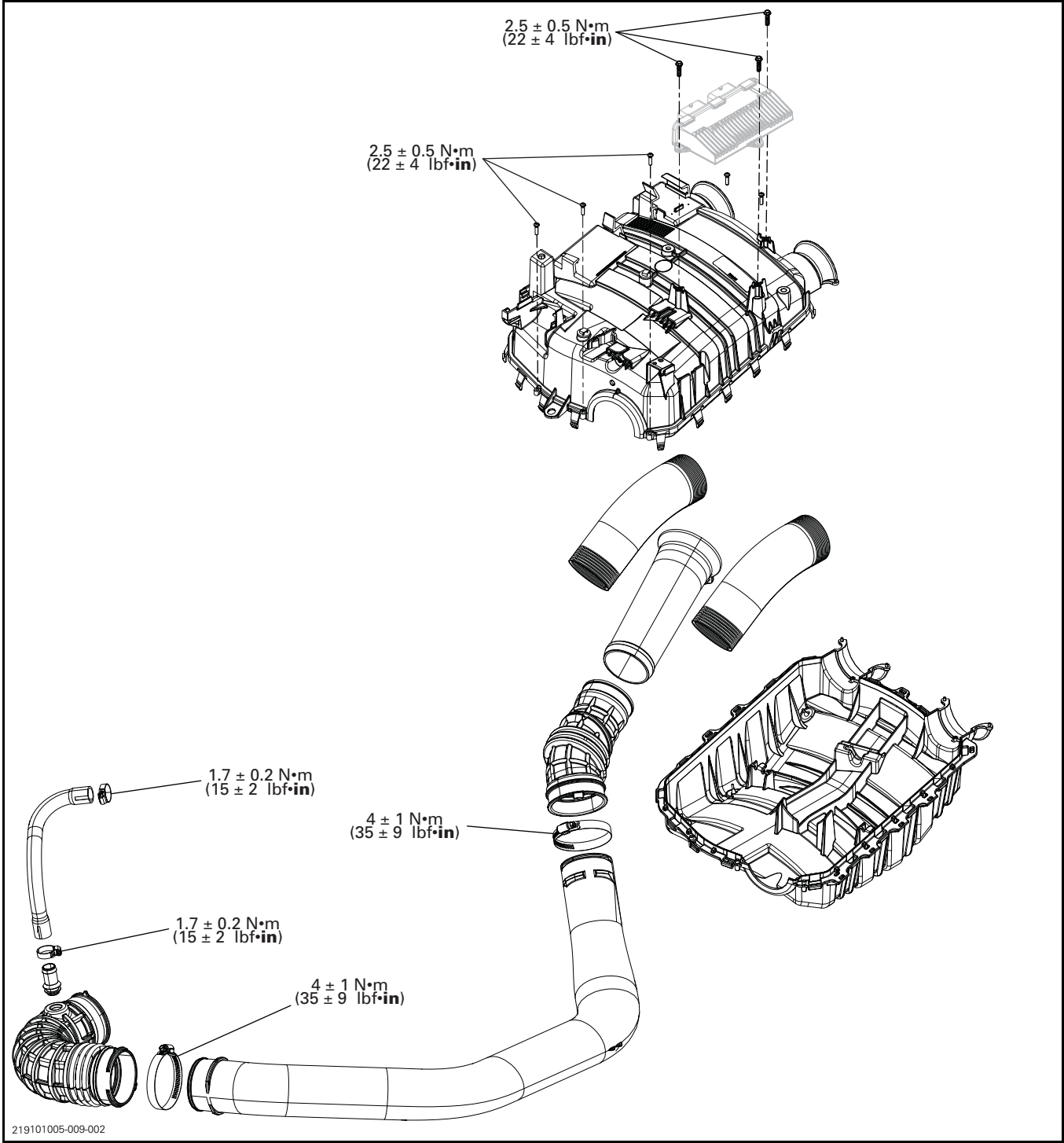
AIR INTAKE SYSTEM

130 and 170 Engines



Section 03 ENGINE - 1630 ACE
Subsection 02 (AIR INTAKE SYSTEM)

230 Engines

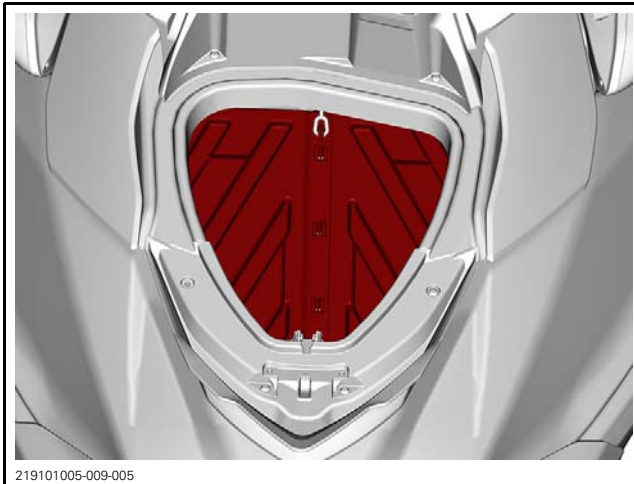


PROCEDURES

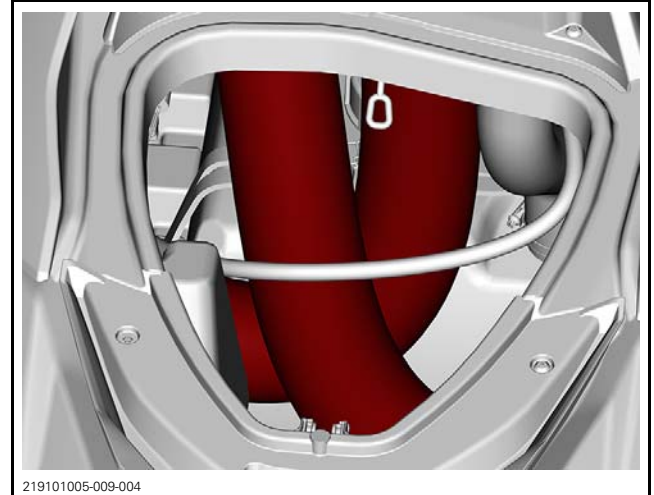
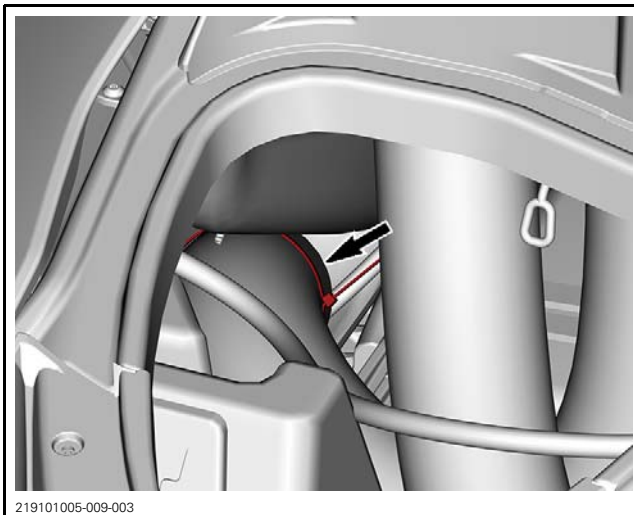
AIR INTAKE SILENCER

Removing the Air Intake Silencer

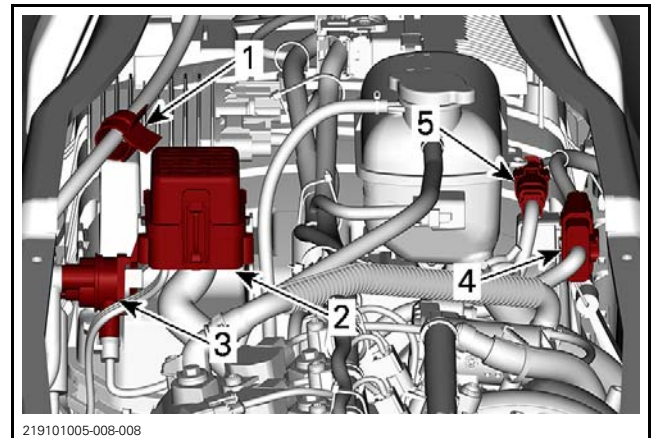
1. Remove the seats, storage compartment cover and engine service cover. Refer to *BODY* sub-section.
2. Remove partitions.



3. Cut locking tie and unplug the top of ventilations tubes. Place them lower in hull.



4. Separate from air intake silencer and set aside the following components.



1. *Steering cable retainer*
2. *Fuse box*
3. *Starter solenoid*
4. *HIC1 connector*
5. *HIC2 connector*

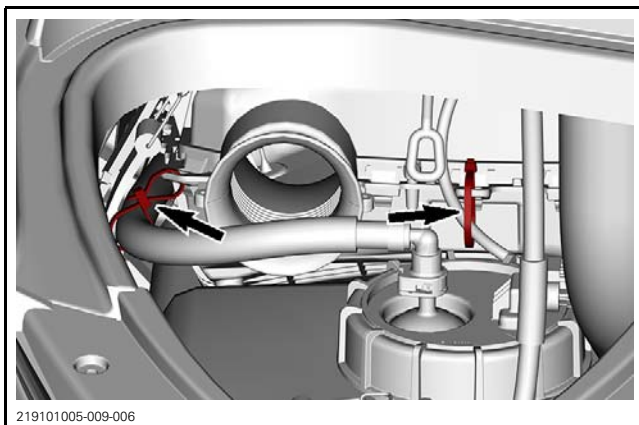
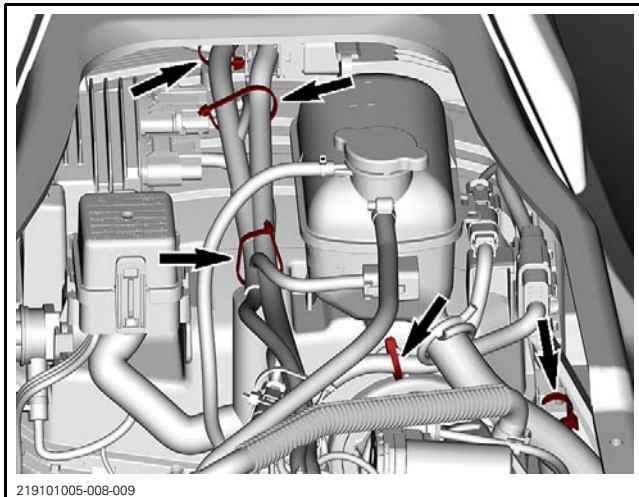
5. Disconnect the battery.

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

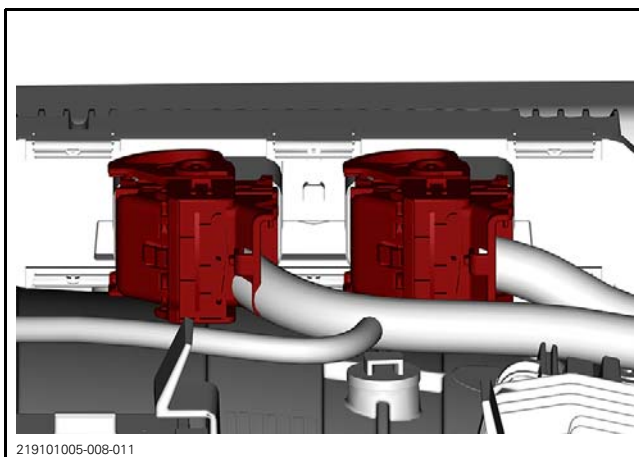
6. Cut locking ties securing wiring harness and fuel hose to air intake silencer.

Section 03 ENGINE - 1630 ACE

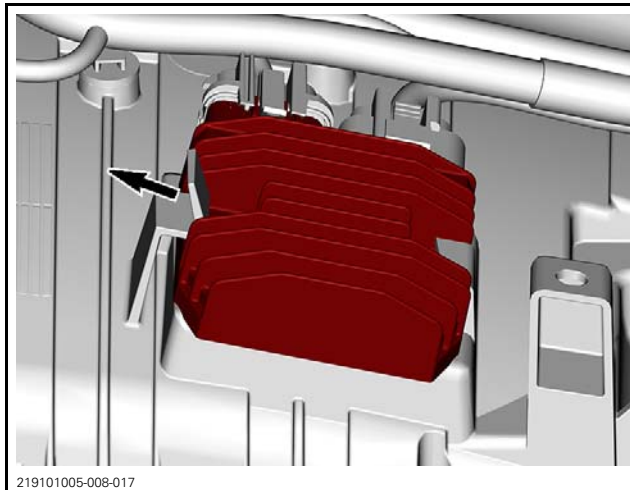
Subsection 02 (AIR INTAKE SYSTEM)



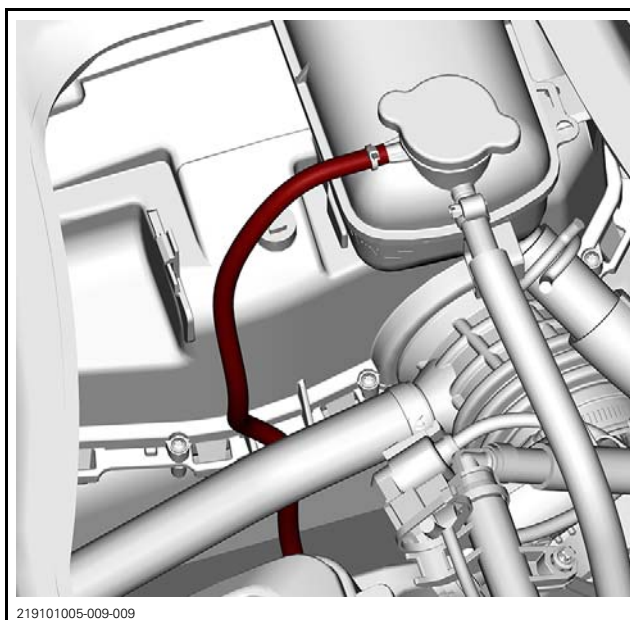
7. Disconnect both ECM connectors.



8. Unclip rectifier from air intake silencer and set aside.

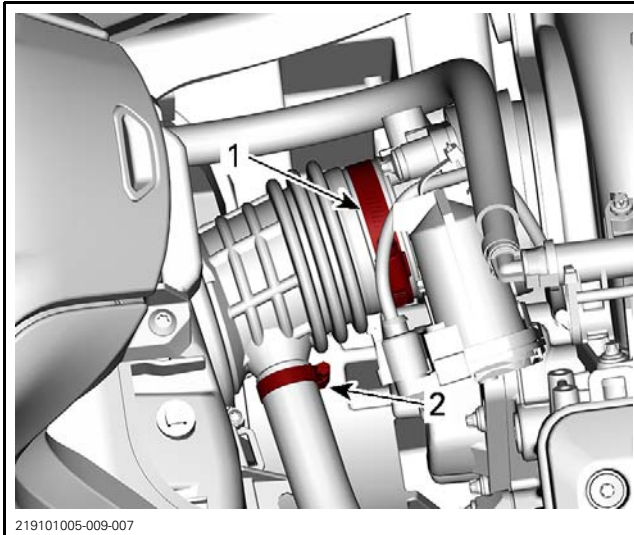


9. Remove coolant hose from coolant reservoir.

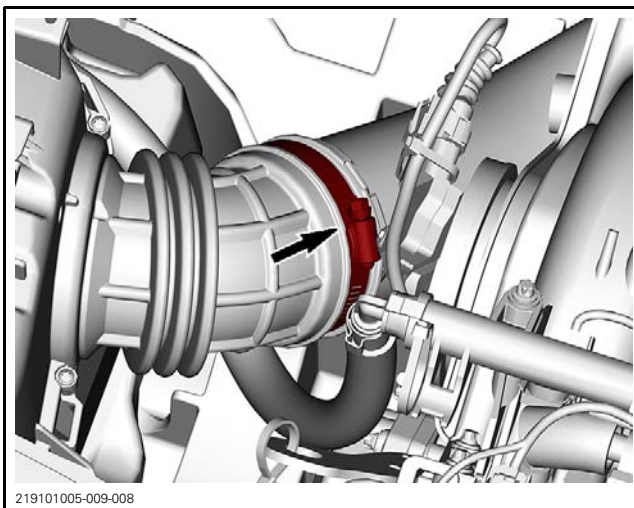


10. Unclip coolant reservoir and set aside.

11. Loosen clamps to separate air intake silencer from engine.

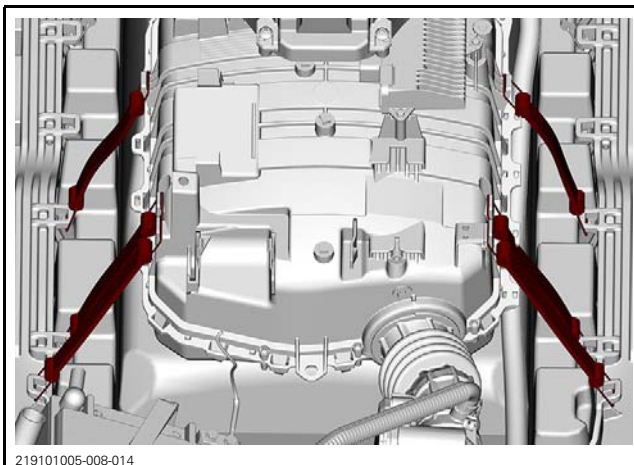


130 AND 170 ENGINES
1. Outlet hose clamp
2. Vent hose clamp



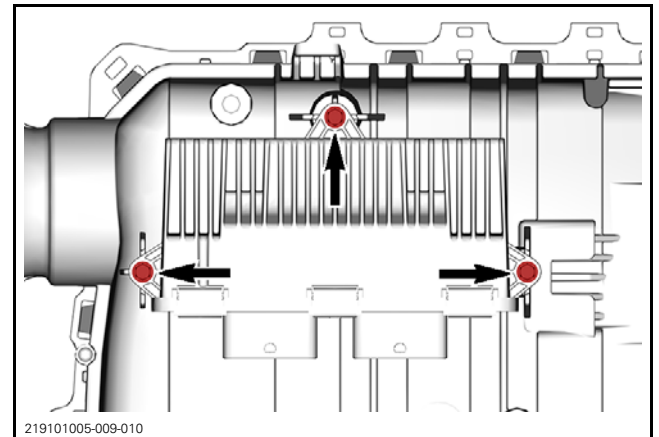
230 ENGINES

12. Detach the retaining straps.



13. Pull air intake silencer forward to remove it from the vehicle.

14. Remove ECM holding screws to remove ECM.



Disassembling the Air Intake Silencer

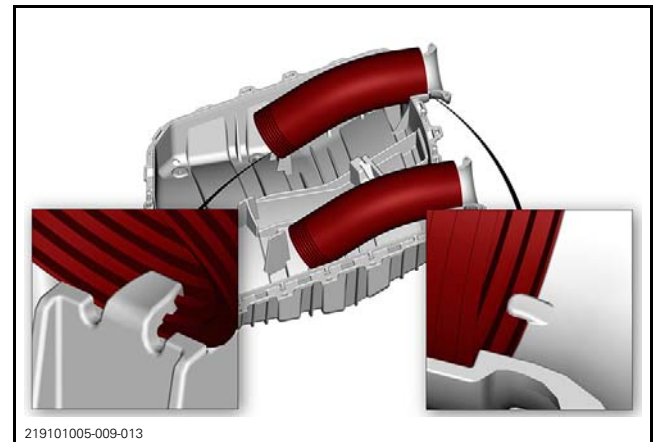
Remove screws securing upper section of air intake silencer to the lower section.

Release all retaining tabs.

Separate upper and lower sections.

Assembling the Air Intake Silencer

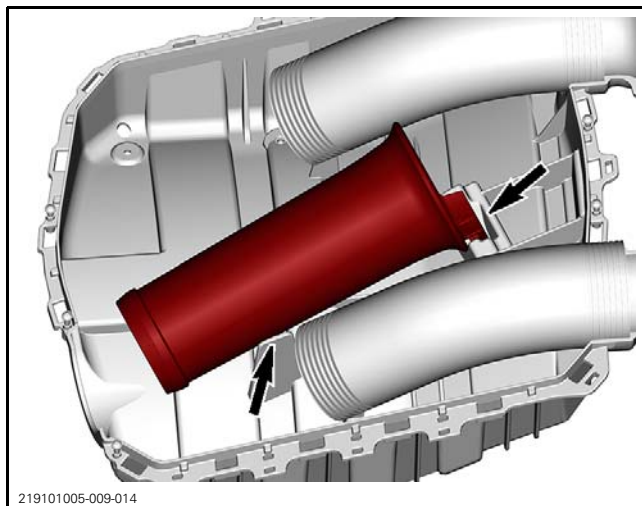
Install the inlet tubes. Ensure each end is properly attached.



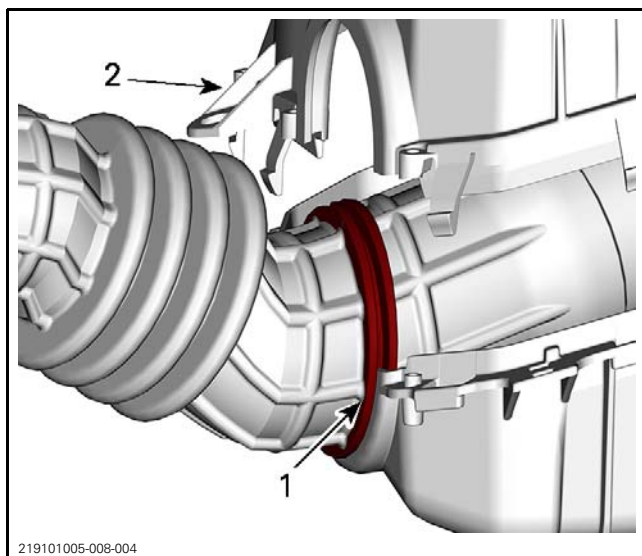
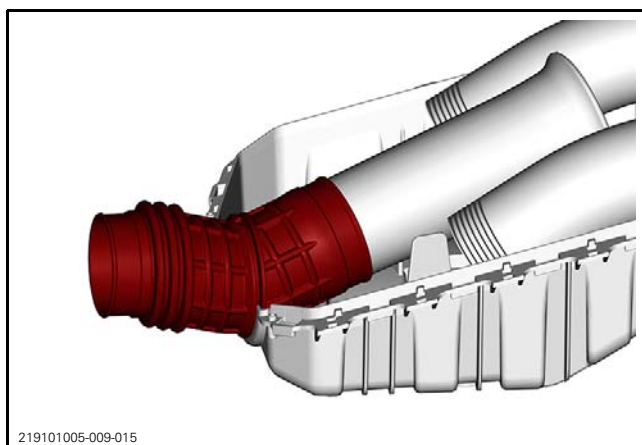
Install baffle tab into air intake silencer slots.

Section 03 ENGINE - 1630 ACE

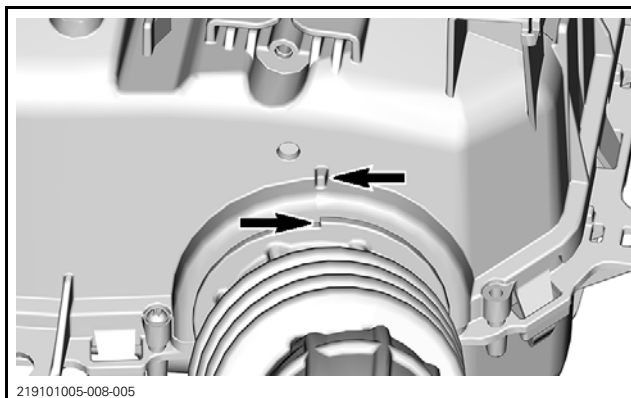
Subsection 02 (AIR INTAKE SYSTEM)



Install the outlet hose into the baffle. Ensure air intake silencer rib goes into the outlet hose groove and that marks are aligned.



1. Outlet hose groove.
2. Air intake silencer upper section.



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

Secure the upper section to lower section using previously removed K40 x 16 Torx screws. Refer to exploded view for tightening torque specifications.

Installing the Air Intake Silencer

The installation is the reverse of the removal procedure. However, pay attention to the following. Refer to exploded view for tightening torque specifications.

Ensure wiring harness and fuel hoses are properly routed.

Install new locking ties

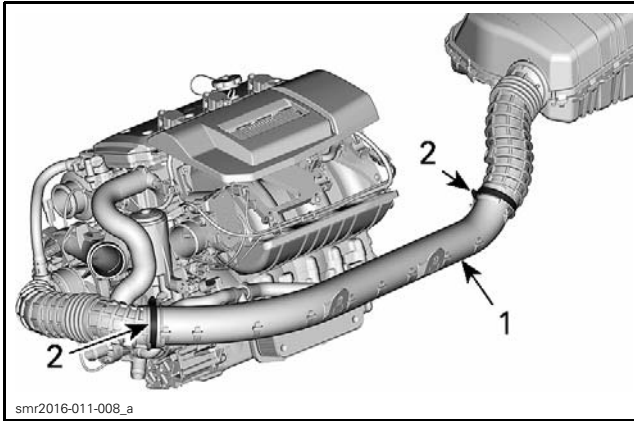
Make sure hoses are perfectly inserted into air intake tube before tightening the clamps.

AIR INTAKE TUBE

Removing the Air Intake Tube

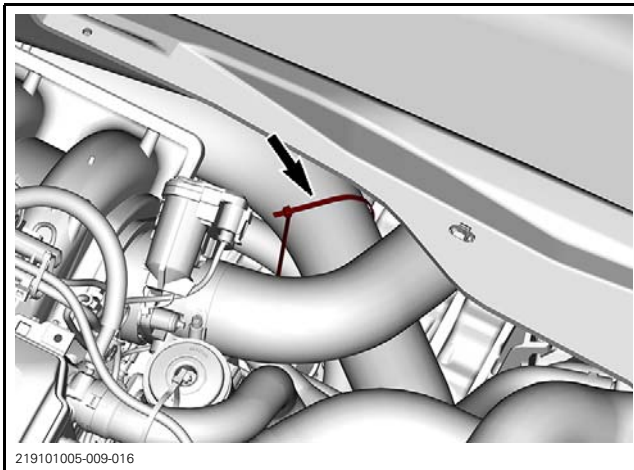
Supercharged Engine

1. Remove the seats and engine service cover. Refer to *BODY* subsection.
2. Loosen clamps to detach the air intake tube from both hoses.



- 1. Air intake tube
- 2. Retaining clamps

- 3. Cut locking tie securing air intake tube to coolant hose.



- 4. Slide the air intake tube through the engine access opening.

Installing the Air Intake Tube

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

Refer to exploded view for tightening torque specifications.

Install new locking ties.

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

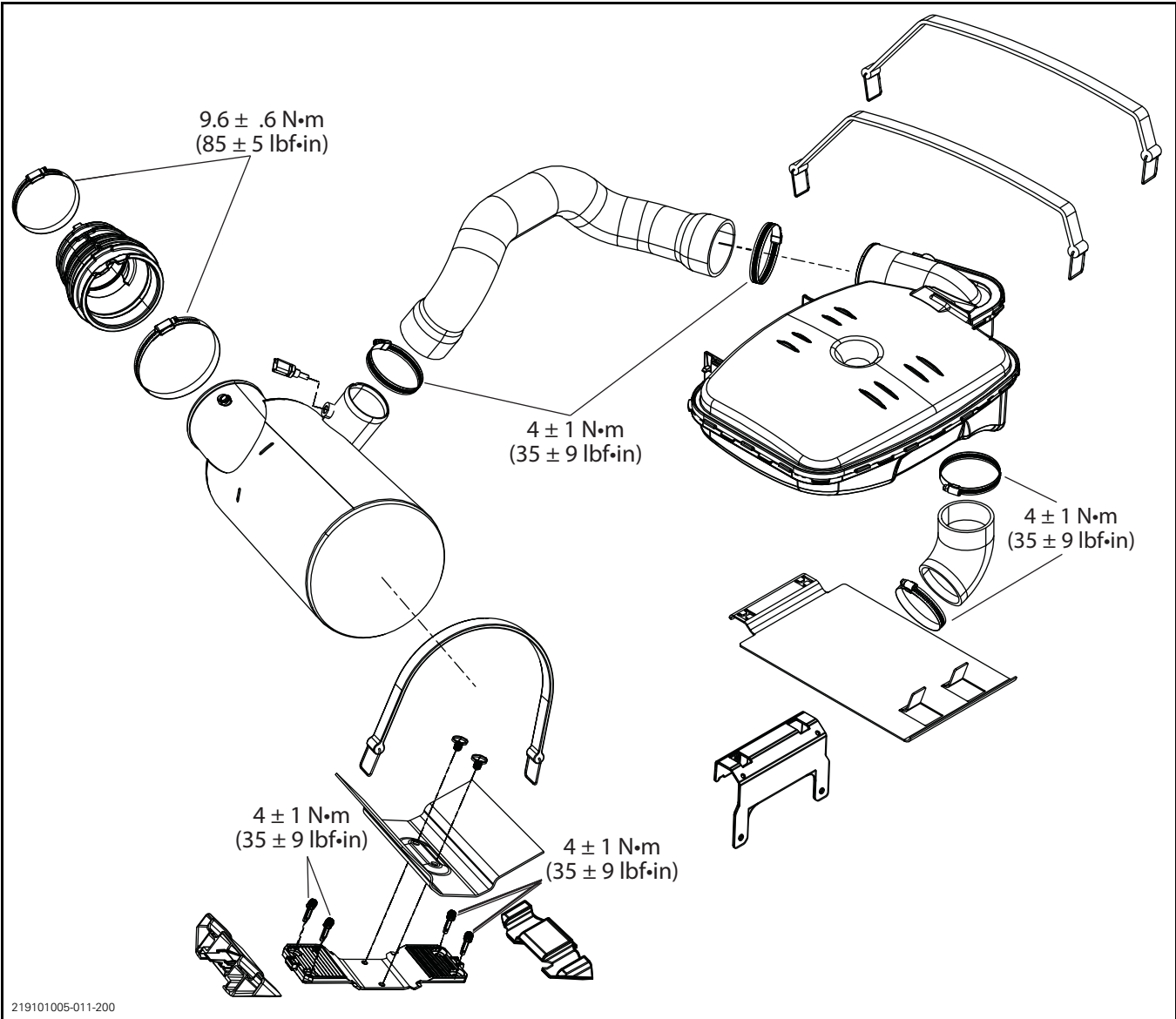
EXHAUST SYSTEM

SERVICE TOOLS

Description	Part Number	Page
FLUSHING CONNECTOR ADAPTER	295 500 473	66

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 518	293 800 038	68
P80 GRIP-IT	296 000 406	72



GENERAL

SYSTEM DESCRIPTION

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

Water exits exhaust manifold through holes to inject water in muffler.

NOTE: For more information on the exhaust manifold, refer to *EXHAUST MANIFOLD* subsection.

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.

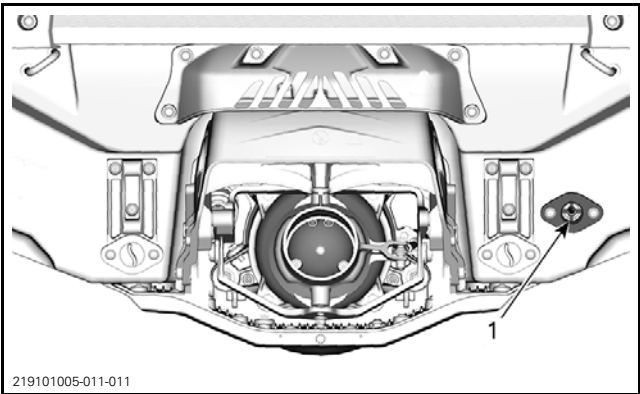
⚠ WARNING

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.



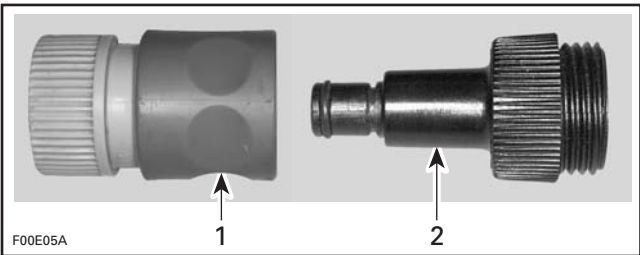
1. Water inlet connector

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.

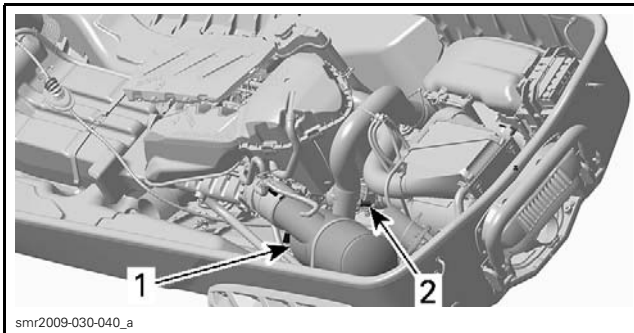
NOTICE Always close the water tap before stopping the engine.

Disconnect the garden hose.

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

PROCEDURES

EXHAUST GAS TEMPERATURE SENSOR (EGTS)



1. Muffler
2. Exhaust gas temperature sensor (EGTS)

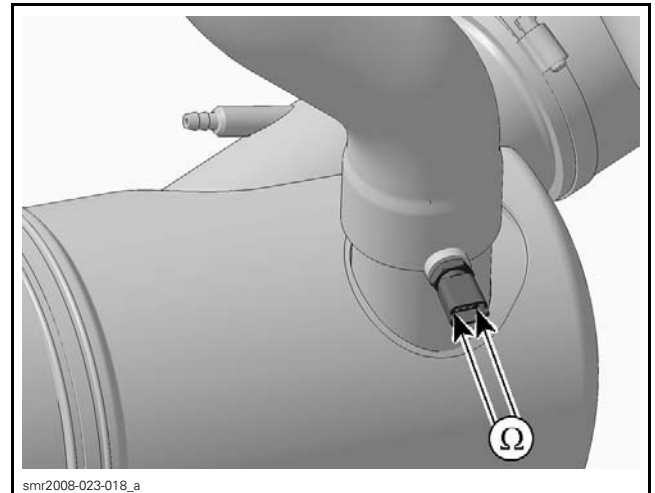
NOTE: An overheat signal will come on in the information center when the exhaust temperature reaches.

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.

EGTS RESISTANCE TEST		
EGTS PIN		MEASUREMENT
1	2	Refer to <i>EGTS RESISTANCE CHART</i>

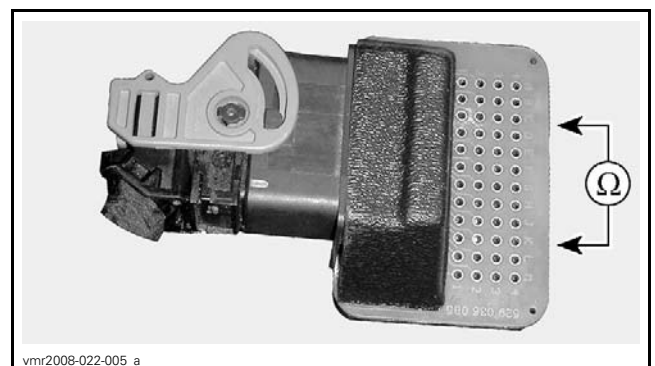


The resistance should be as per the *EGTS RESISTANCE CHART* that follows. Otherwise, replace the EGTS.

If the EGTS resistance is within specifications, proceed with the following steps.

4. Reconnect the EGTS.
5. Disconnect ECM-B connector from the ECM and install it on the ECM adapter tool.
6. Check the circuit resistance as per following table.

EGTS RESISTANCE TEST AT ECM		
ECM ADAPTOR PIN		MEASUREMENT
B-F3	B-G4	Refer to <i>EGTS RESISTANCE CHART</i>



Section 03 ENGINE - 1630 ACE

Subsection 03 (EXHAUST SYSTEM)

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

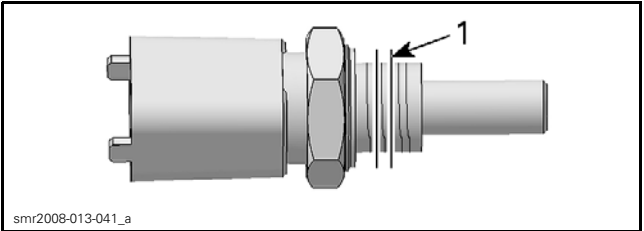
If resistance value is as specified, check ECM. Refer to *ENGINE CONTROL MODULE (ECM)* subsection.

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 on the middle threads of the new EGTS.

SERVICE PRODUCT
LOCTITE 518 (P/N 293 800 038)



1. Apply Loctite 518 in this area

- 4. Install the EGTS.

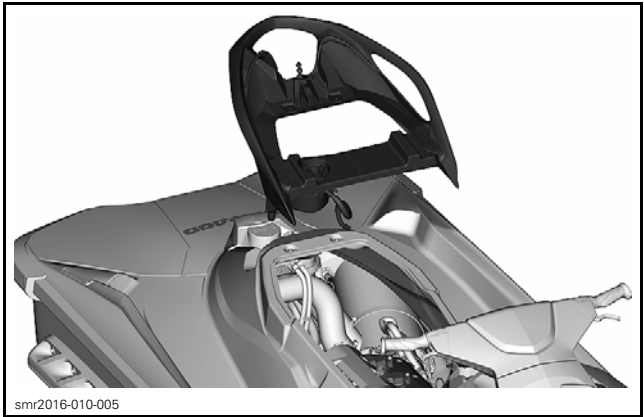
TIGHTENING TORQUE	
EGTS	16 N•m ± 2 N•m (142 lbf•in ± 18 lbf•in)

- 5. Install the EGTS connector.
- 6. Install all other removed parts, refer to applicable subsections.

MUFFLER

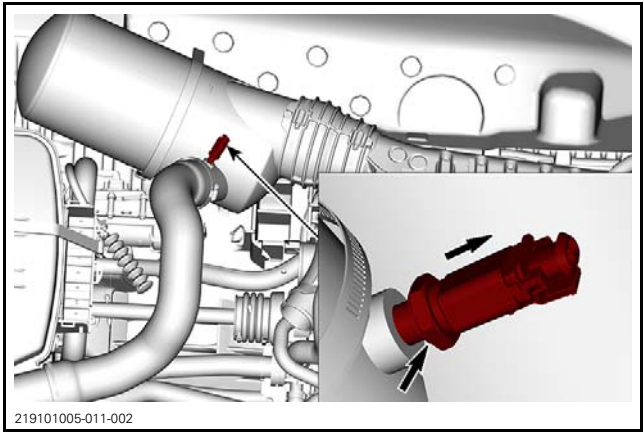
CAUTION Certain components in the engine compartment may be very hot. Let exhaust system cool down prior to removing parts.

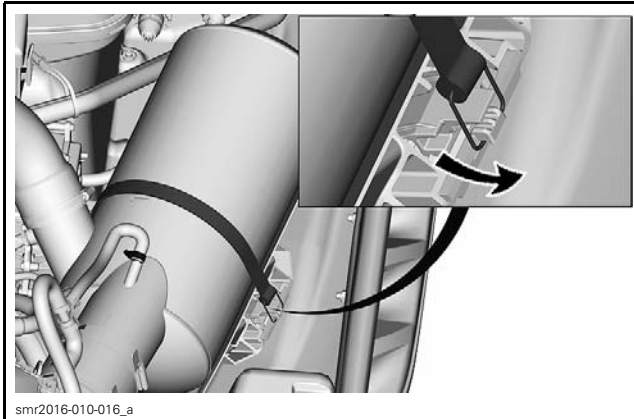
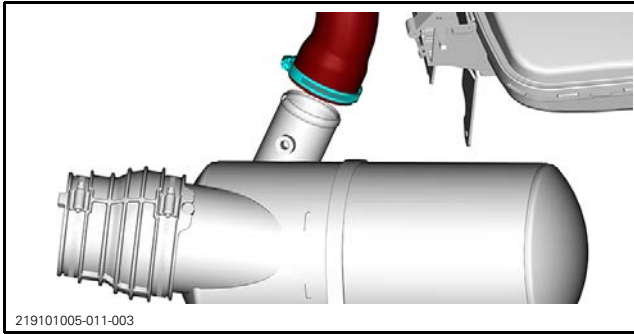
Removing the Muffler



Set aside the coolant reservoir.

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





Remove the muffler.

Inspecting the Muffler

Check muffler for:

- Cracks
- Corrosion
- Other damages.

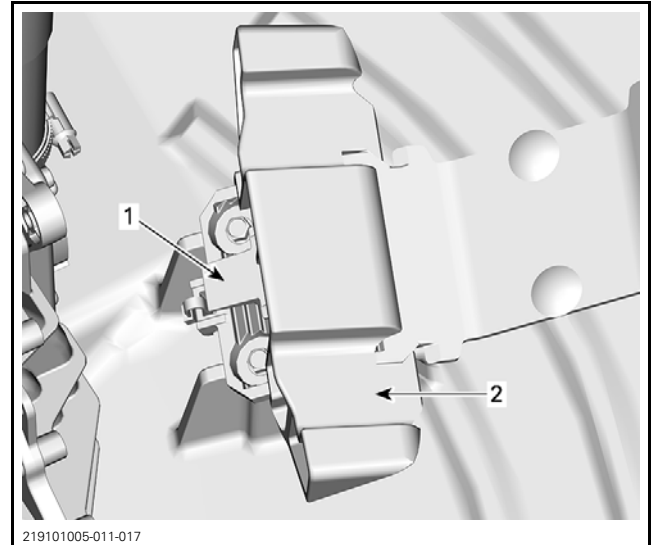
Check if exhaust hose is:

- Brittle
- Hard
- Cracked
- Otherwise damaged.

Replace any defective part.

Installing the Muffler

1. With a new muffler, install the EGTS sensor. Refer to this subsection.
2. Open muffler adjusters by sliding adjuster blocks.

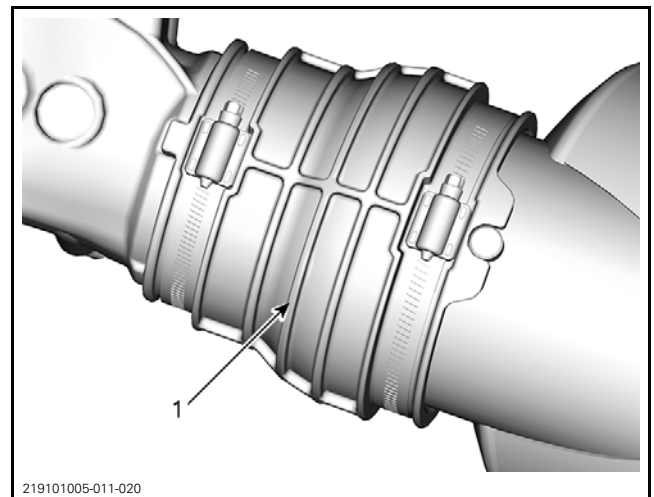


TYPICAL – RUBBER PAD REMOVED FOR CLARITY PURPOSE

Step 1: Lift adjuster tab

Step 2: Move adjuster outward

3. Insert the muffler in hull.
4. Align the rubber adaptor flange with the exhaust manifold. Rotate and move muffler so that the rubber adaptor notch fits into the exhaust manifold slot.
5. Install exhaust clamp exactly as shown in the figure below.



1. Rubber adaptor

6. Tighten exhaust clamp to specification.

TIGHTENING TORQUE	
Exhaust clamp	9.6 N•m and .6 N•m (85 lbf•in and 5 lbf•in)

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

7. Install the muffler strap.

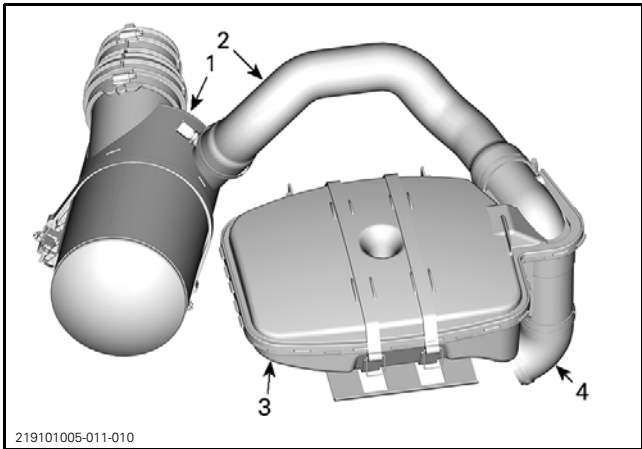
Section 03 ENGINE - 1630 ACE
Subsection 03 (EXHAUST SYSTEM)

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

- 8. Install all other removed parts.
 - 9. 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.

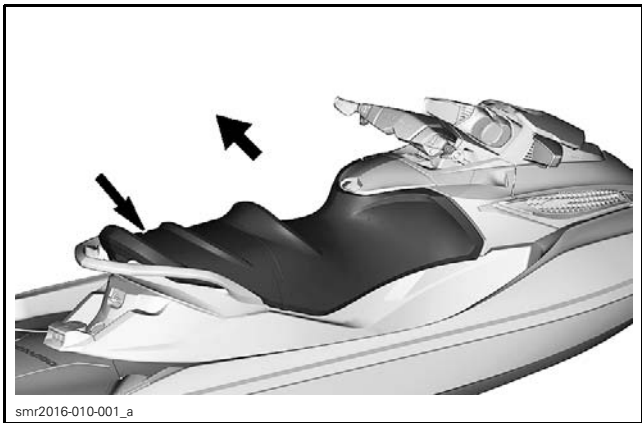
EXHAUST HOSES



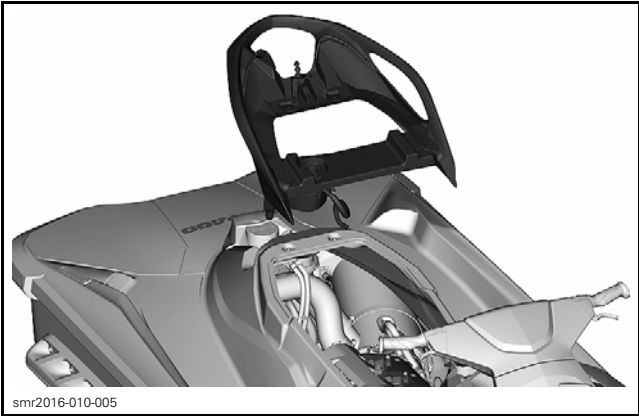
- 1. Muffler
- 2. Front exhaust hose
- 3. Resonator
- 4. Rear exhaust hose

Front Exhaust Hose

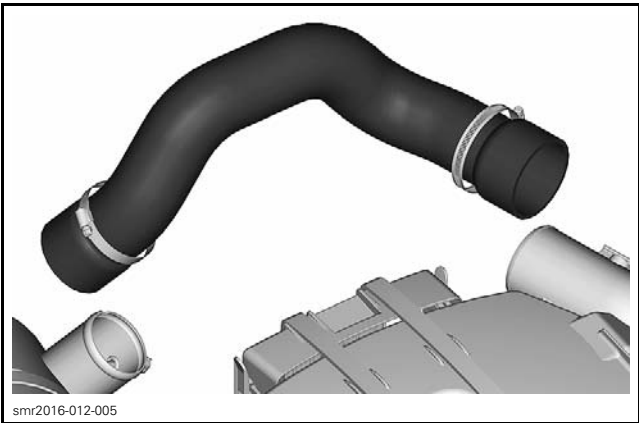
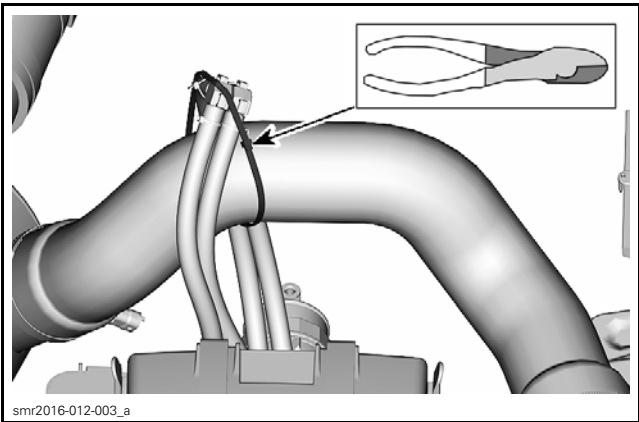
Removing the Front Exhaust Hose



GTx LTD SHOWN

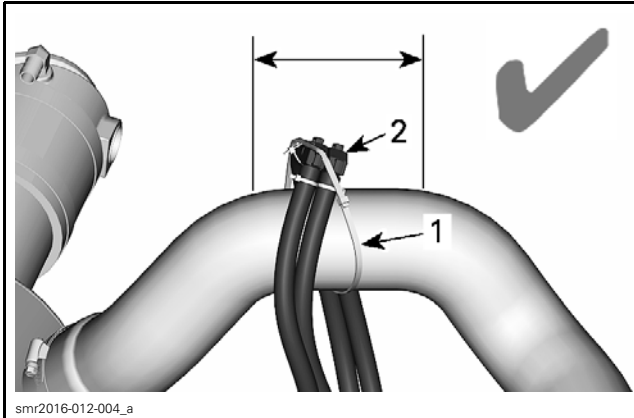


All Models



Installing the Front Exhaust Hose

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



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

TIGHTENING TORQUE	
Front exhaust hose clamp	$4 \text{ N}\cdot\text{m} \pm 1 \text{ N}\cdot\text{m}$ (35 lbf•in \pm 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.

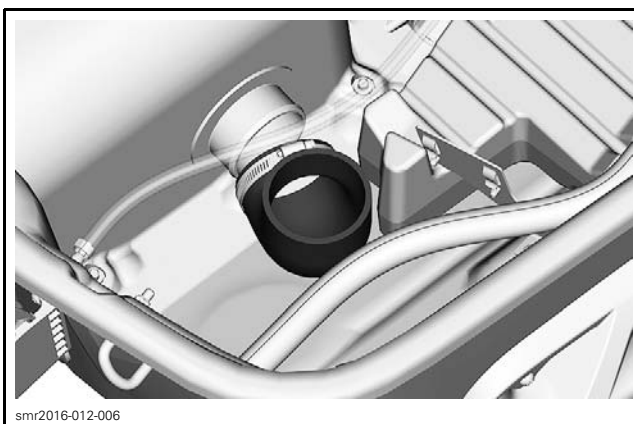
NOTICE Never run engine without supplying water to the exhaust system when watercraft is out of water.

Rear Exhaust Hose

Removing the Rear Exhaust Hose

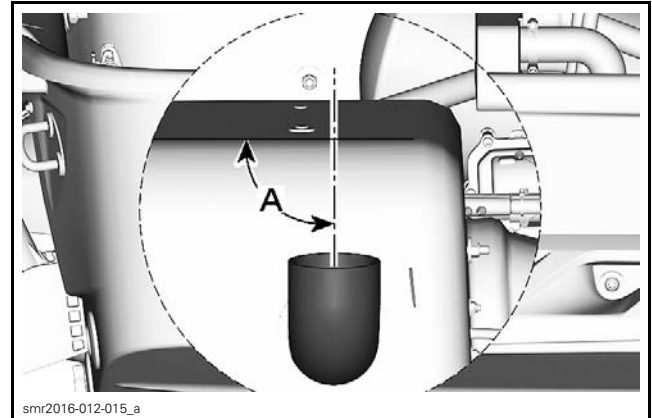
Remove the resonator. See procedure in this subsection.

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	$4 \text{ N}\cdot\text{m} \pm 1 \text{ N}\cdot\text{m}$ (35 lbf•in \pm 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.

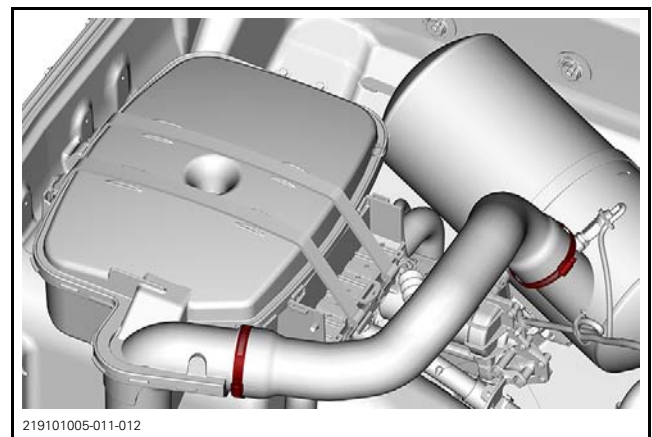
NOTICE Never run engine without supplying water to the exhaust system when watercraft is out of water.

RESONATOR

Removing the Resonator

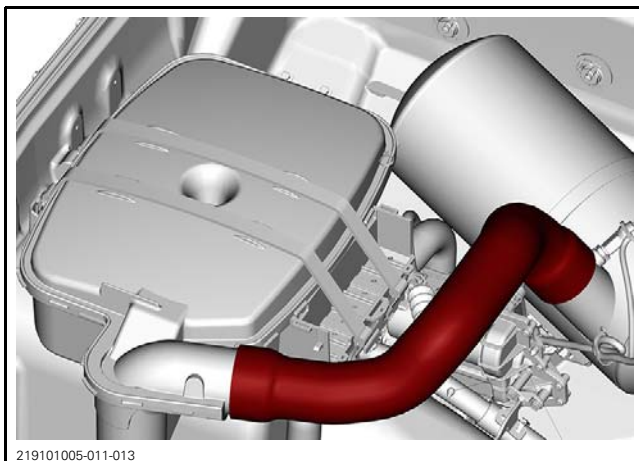
Remove the muffler. See the procedure in this subsection.

Remove the intercooler. Refer to *INTERCOOLER* subsection.



Section 03 ENGINE - 1630 ACE

Subsection 03 (EXHAUST SYSTEM)

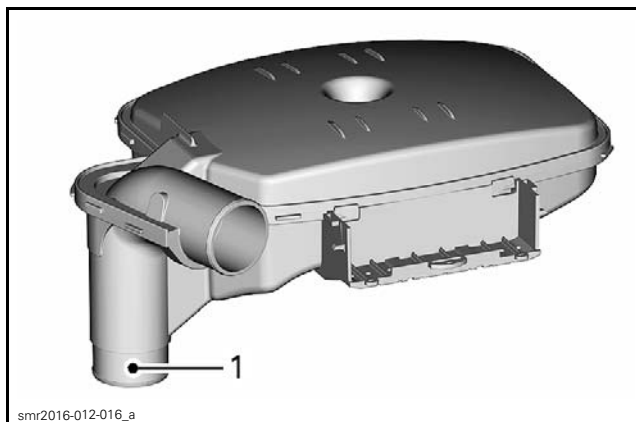
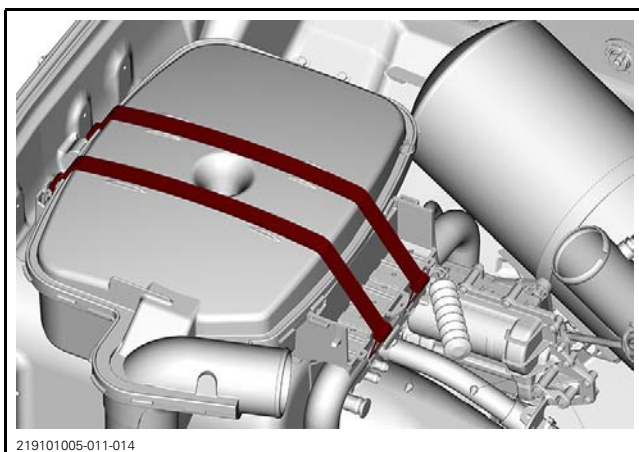


Inspecting the Resonator

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

Installing the Resonator

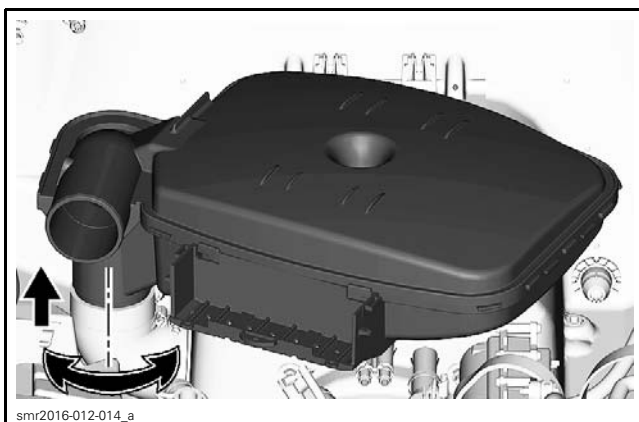
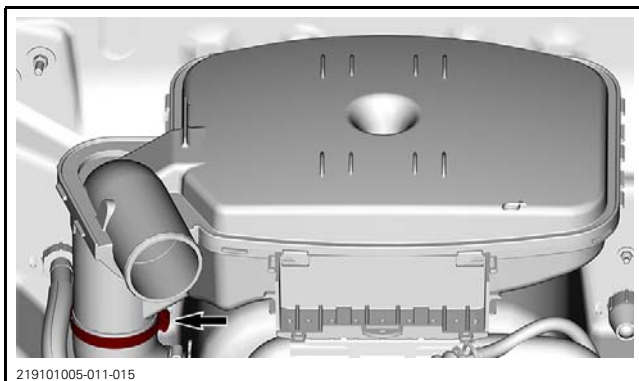
The installation is the reverse of the removal procedure. However, pay attention to the following.



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.



VEHICLE COOLING SYSTEM

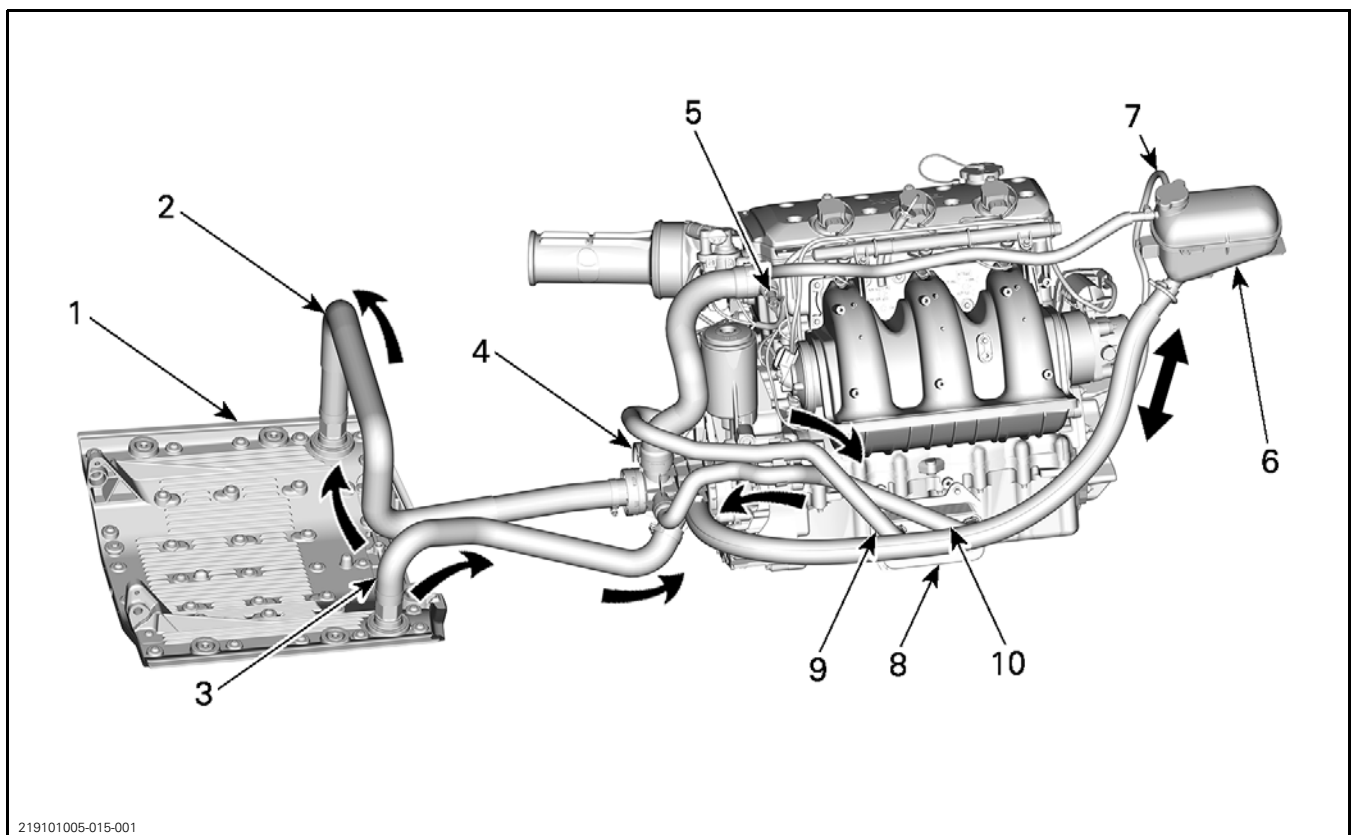
SERVICE TOOLS

Description	Part Number	Page
OETIKER PLIER.....	295 000 070	82
TEST CAP.....	529 035 991	81
VACUUM/PRESSURE PUMP	529 021 800	81

SERVICE PRODUCTS

Description	Part Number	Page
EXTENDED LIFE PRE-MIXED COOLANT (EUR)	779223	79
EXTENDED LIFE PRE-MIXED COOLANT	779150	79
LOCTITE 567 (PIPE SEALANT)	293 800 013	80

Cooling System (Closed loop)



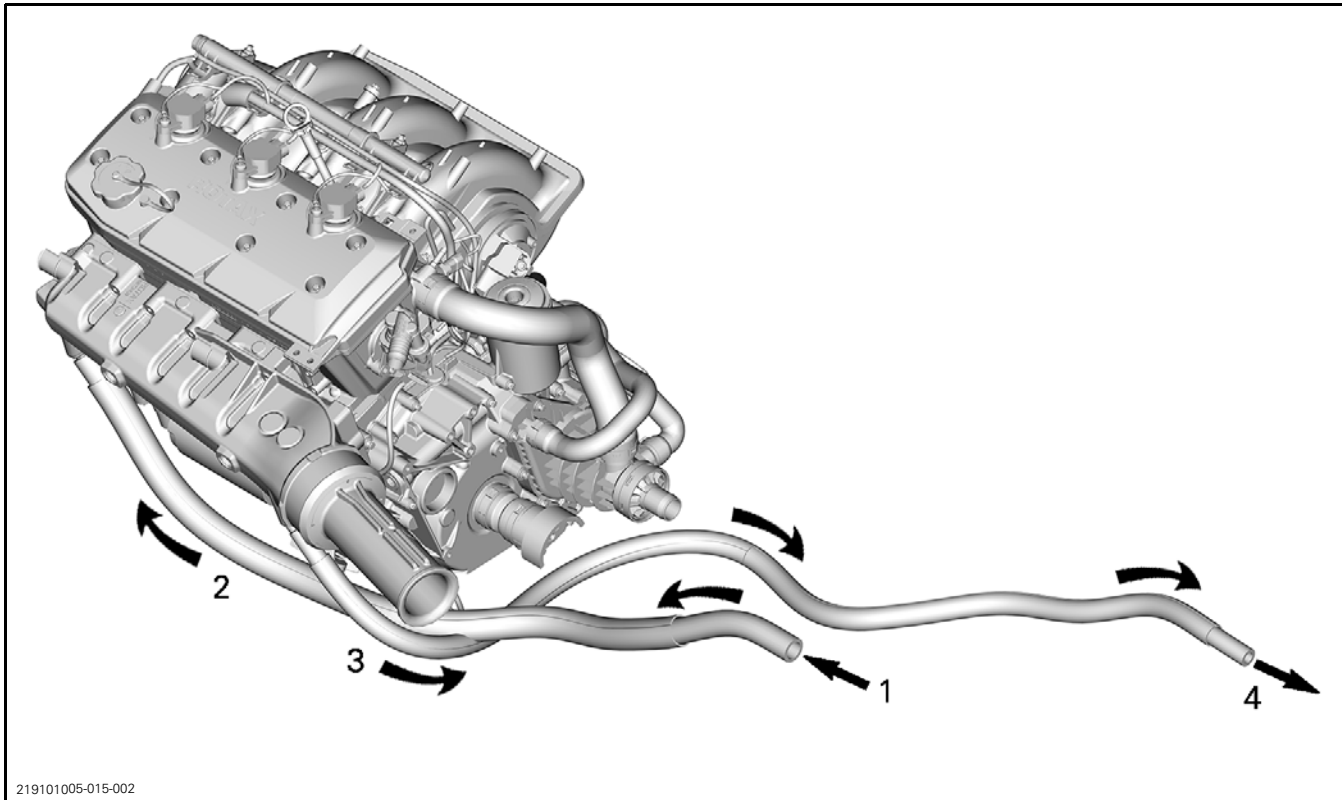
TYPICAL

1. Ride plate (operates as heat exchanger)
2. Coolant flows to ride plate
3. Coolant returns from ride plate
4. Water pump cover / thermostat housing - Thermostat opens at 80°C (176°F)
5. Coolant temperature sensor (CTS) - Monitoring beeper turns on at 102°C (216°F) for 130/155/230 engines and 97.5°C (208°F) for 300 engines
6. Expansion coolant tank
7. Bleed hose from cylinder head to expansion coolant tank
8. Oil cooler
9. Coolant flows to oil cooler
10. Coolant returns from oil cooler

Section 03 ENGINE - 1630 ACE

Subsection 04 (VEHICLE COOLING SYSTEM)

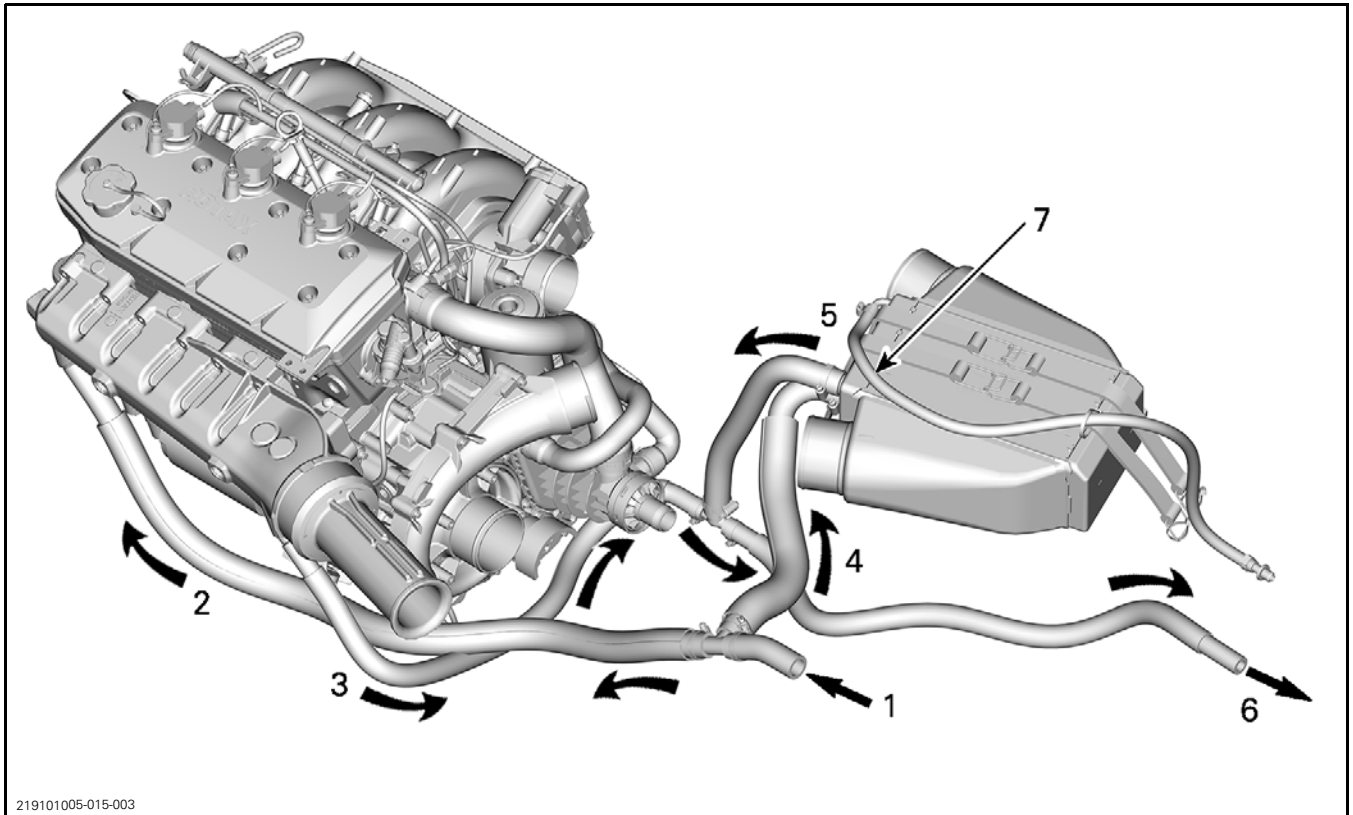
Cooling system (Open loop without intercooler)



TYPICAL

1. Water enters system
2. Water enters the exhaust manifold
3. Water exits the exhaust manifold
4. Water exits system

Cooling system (Open loop with intercooler)



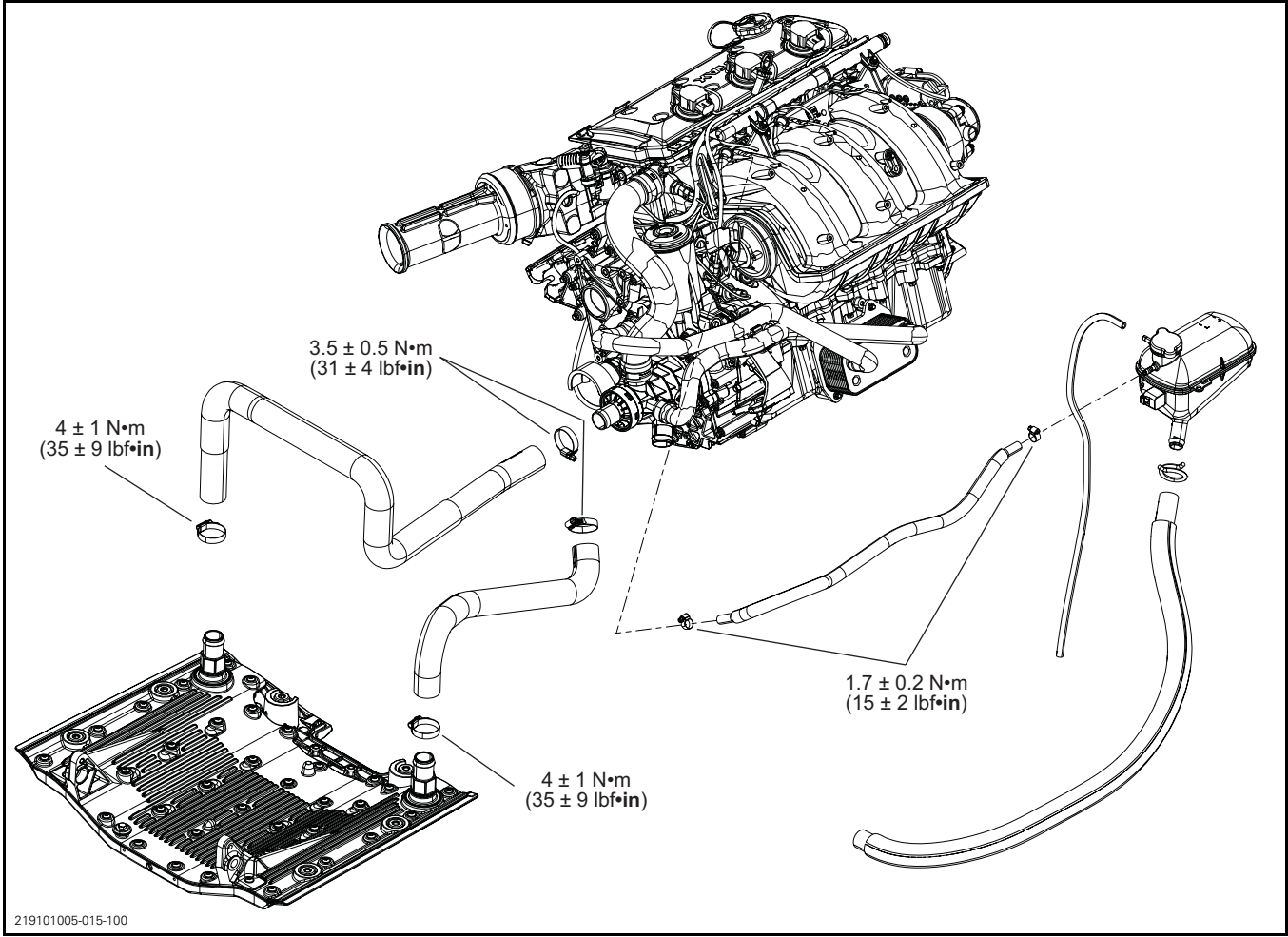
TYPICAL

1. Water enters system
2. Water enters the exhaust manifold
3. Water exits the exhaust manifold
4. Water enters intercooler

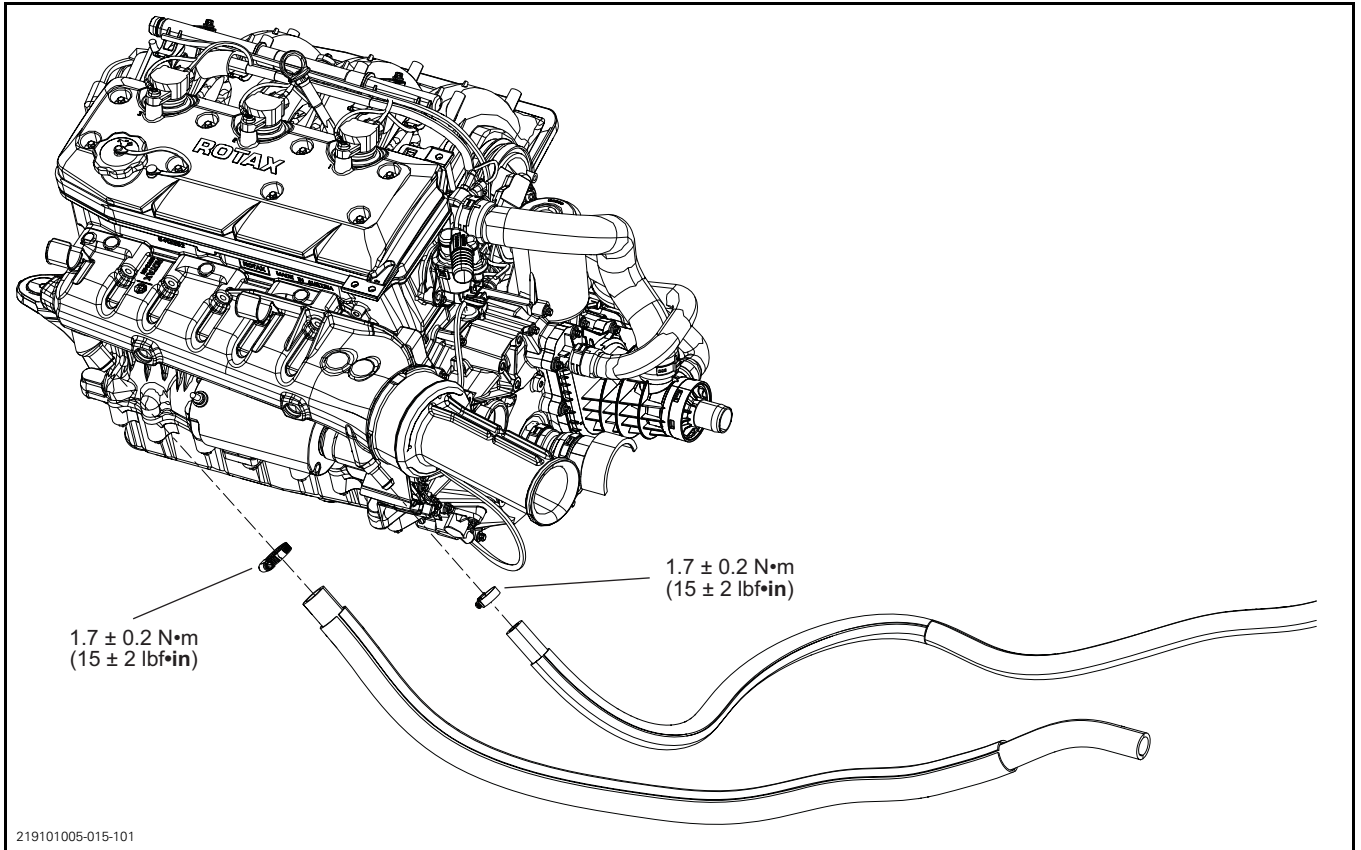
5. Water exits the intercooler
6. Water exits system
7. Bleed hose from intercooler

Section 03 ENGINE - 1630 ACE
Subsection 04 (VEHICLE COOLING SYSTEM)

Cooling System (Closed loop)

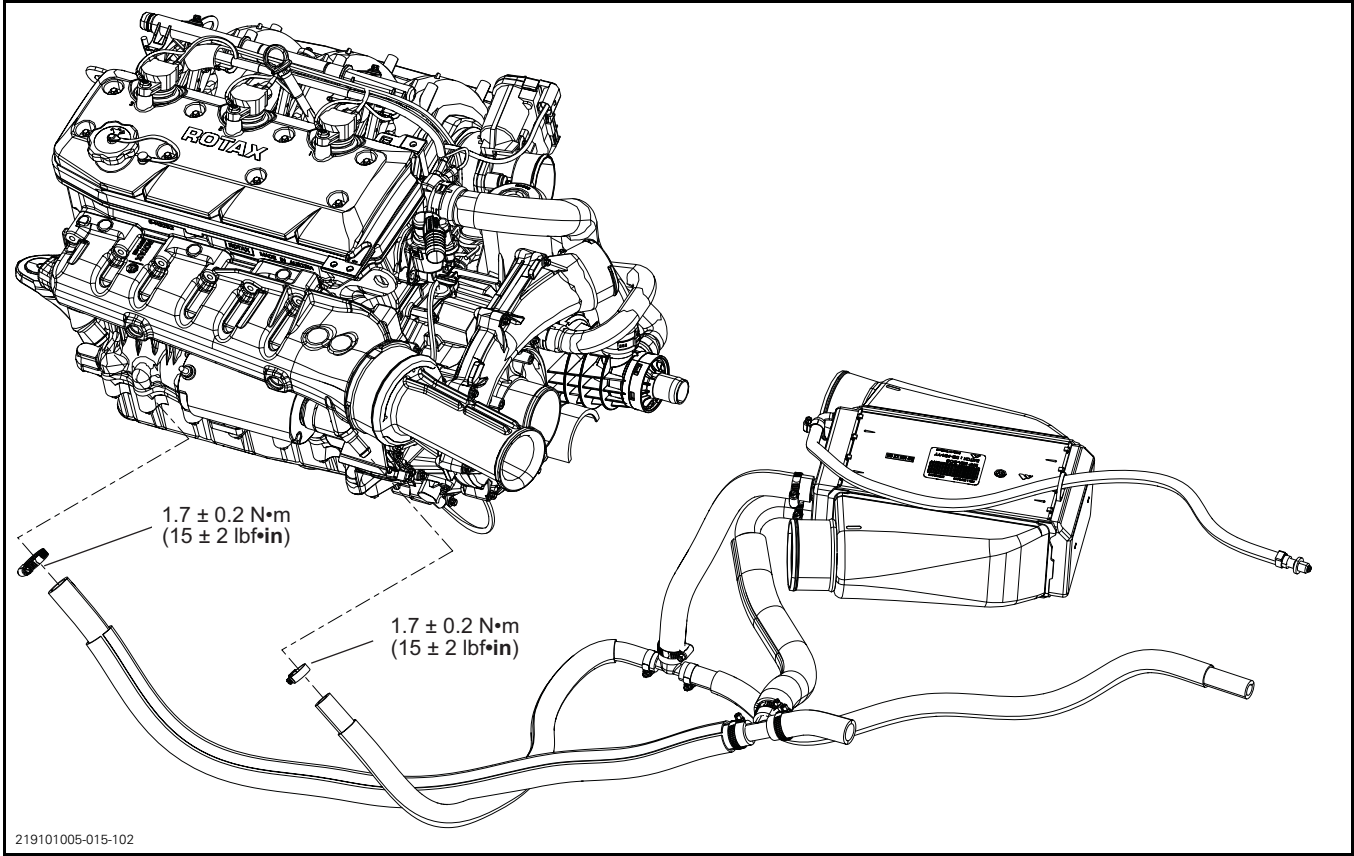


Cooling System (Open loop without intercooler)



Section 03 ENGINE - 1630 ACE
Subsection 04 (VEHICLE COOLING SYSTEM)

Cooling System (Open loop with intercooler)



GENERAL

NOTICE Never start the engine without coolant in the cooling system, some engine parts can be damaged.

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.

Recommended Coolant

COOLANT	
Scandinavia	EXTENDED LIFE PRE-MIXED COOLANT (EUR) (P/N 779223)
All Other Countries	EXTENDED LIFE PRE-MIXED COOLANT (P/N 779150)
IF THE RECOMMENDED ENGINE COOLANT IS NOT AVAILABLE	
Use a blend of 50% distilled water and 50% antifreeze (especially formulated for 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.

Engine Coolant Level

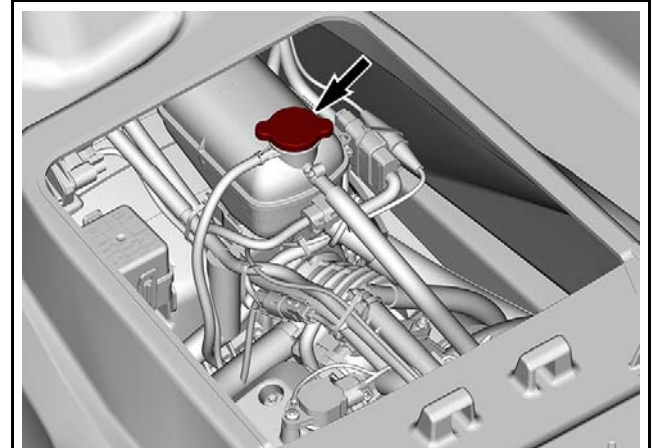
⚠ WARNING

Check coolant level with engine cold. Never add coolant when engine is hot.

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

Remove seats.

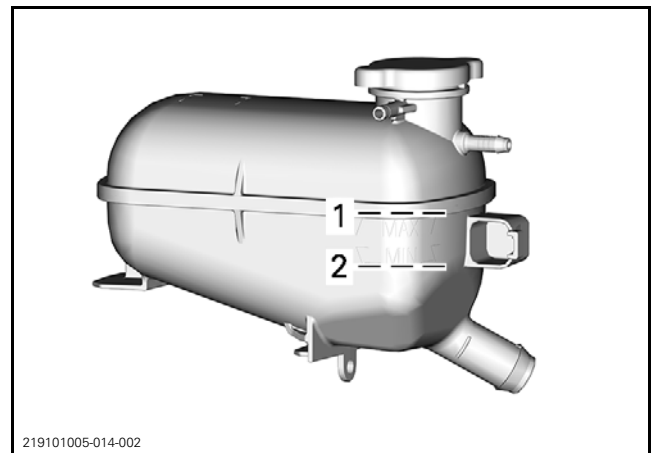
Locate the expansion tank cap.



219002053-003

TYPICAL

With watercraft on a level surface, coolant level should be between MIN. and MAX. marks on coolant reservoir when engine is cold.



219101005-014-002

LEVEL BETWEEN MARKS WHEN ENGINE IS COLD

1. MAX
2. MIN

NOTE: The watercraft is level when it is in water. When on a trailer, raise trailer tow pole and block in this position when bumper rail is level.

Add coolant, see *RECOMMENDED ENGINE COOLANT* for specification, to adjust coolant level between marks as required. Use a funnel to avoid spillage. Do not overfill.

Properly tighten the expansion tank cap. Reinstall seats.

NOTE: A cooling system that frequently requires coolant is an indication of leaks or engine problems. See an authorized Sea-Doo dealer.

Draining the System

⚠ WARNING

Never drain or refill cooling system when engine is hot.

Section 03 ENGINE - 1630 ACE

Subsection 04 (VEHICLE COOLING SYSTEM)

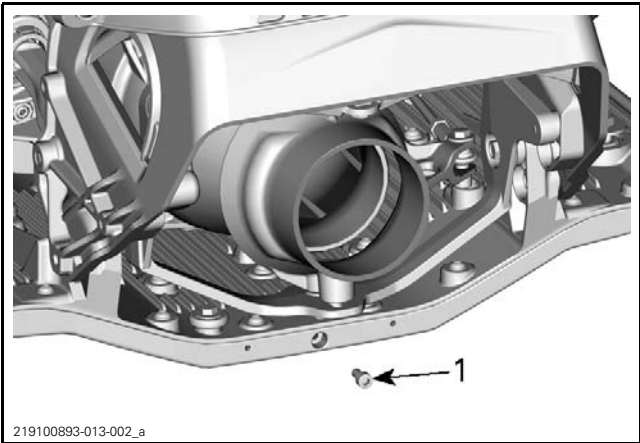
Remove seats.

Remove engine service cover.

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.



TYPICAL

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 pipe sealant on drain plug threads.

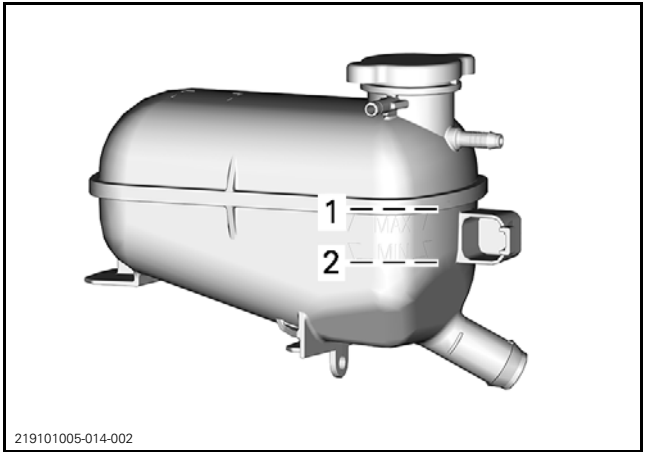
SERVICE PRODUCT
LOCTITE 567 (PIPE SEALANT) (P/N 293 800 013)

Ask someone to pour recommended antifreeze in coolant tank.

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

TIGHTENING TORQUE	
Drain plug	8.5 N•m ± 0.5 N•m (75 lbf•in ± 4 lbf•in)

Continue to pour and fill coolant tank between marks.



LEVEL BETWEEN MARKS WHEN ENGINE IS COLD

1. MAX

2. MIN

Do not install pressure cap at this time.

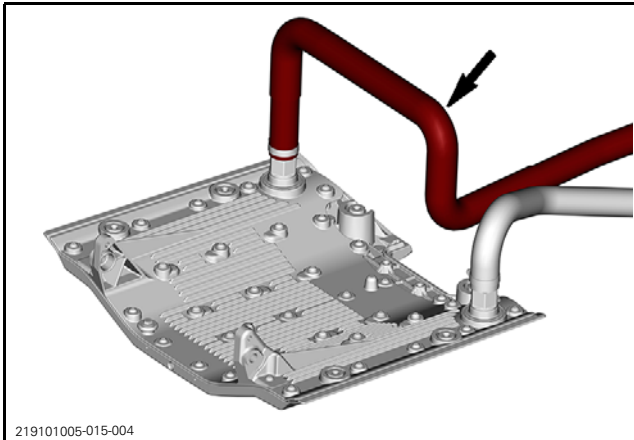
Link a garden hose to the hose adapter at the back of the watercraft. Refer to *FLUSHING THE EXHAUST SYSTEM* in the *EXHAUST SYSTEM* sub-section.

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.

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



HOSE HOT WHEN THERMOSTAT OPENS

Last, refill coolant tank and install pressure cap.

When engine has completely cooled down, recheck coolant level in the coolant tank and top up if necessary.

INSPECTION



COOLING SYSTEM LEAK TEST

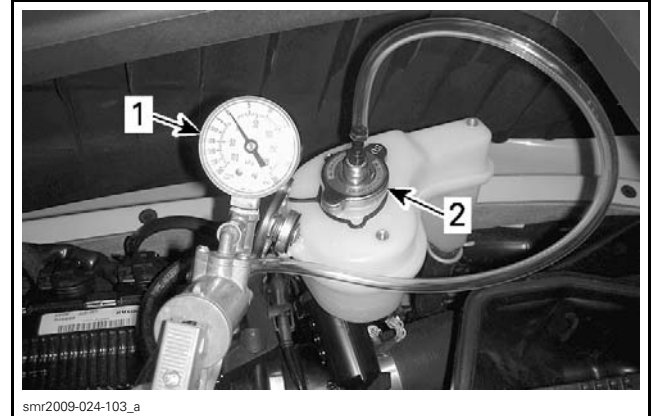
⚠ WARNING

To avoid potential burns, do not remove the coolant tank cap if the engine is hot.

NOTE: This test confirms if there is a leak in the cooling system, including the engine.

Pressurize cooling system through coolant reservoir.

REQUIRED TOOLS	
TEST CAP (P/N 529 035 991)	
VACUUM/PRESSURE PUMP (P/N 529 021 800)	
COOLING SYSTEM LEAK TEST	
110 kPa (16 PSI)	



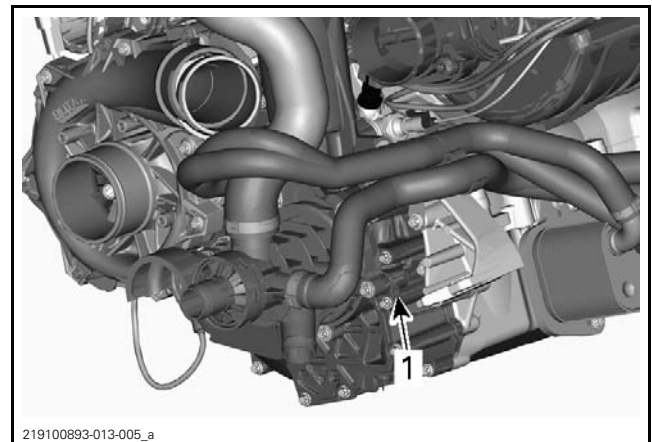
TYPICAL

1. Vacuum/pressure pump
2. Test cap

If pressure drops, check all hoses, heat exchanger and engine for coolant leaks. Spray a soap/water solution and look for air bubbles.

Check the leak indicator hole if there is oil or coolant leaking.

NOTE: In general leaking coolant indicates a damaged rotary seal. Leaking oil indicates a damaged oil seal. If either seal is leaking, both seals must be replaced at the same time. Refer to *WATER PUMP* in *COOLING SYSTEM - ENGINE* in the appropriate engine shop manual.



1. Leak indicator hole

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 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


Testing the Pressure Cap

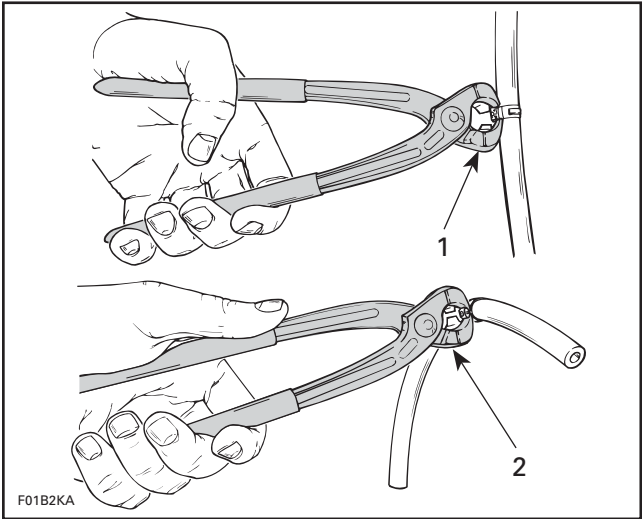
Using a pressure cap tester, check cap opening pressure. If opening pressure is out of range, install a new pressure cap.

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

CLAMPS

Replacing the Oetiker Clamp

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

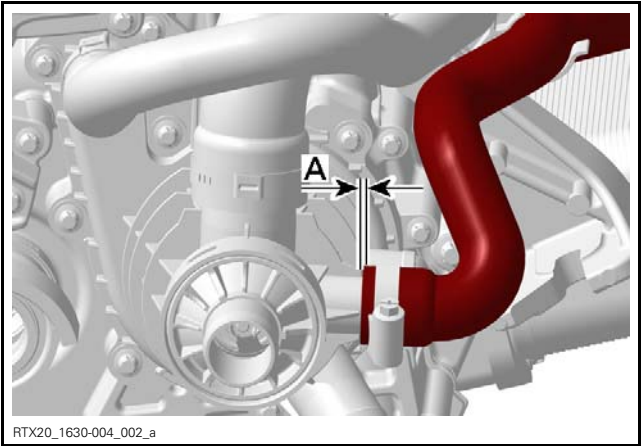


1. Cutting clamp
2. Securing clamp

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

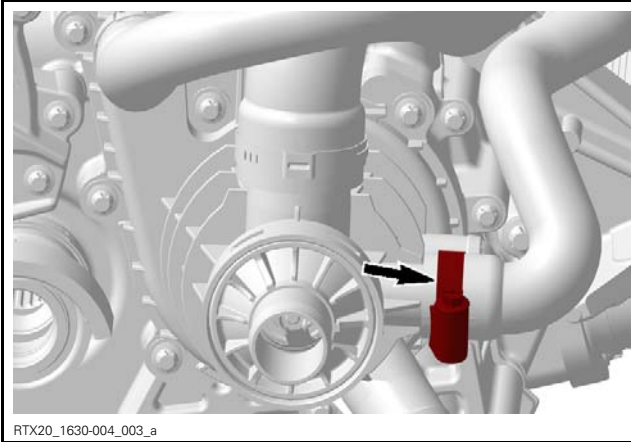
Gear Clamp

Ensure that the gap between the water pump housing and the edge of the hose equals to 0 mm - 2 mm (0 in - .08 in).



A. 0 mm - 2 mm (0 in - .08 in)

Tighten gear clamp to specification.

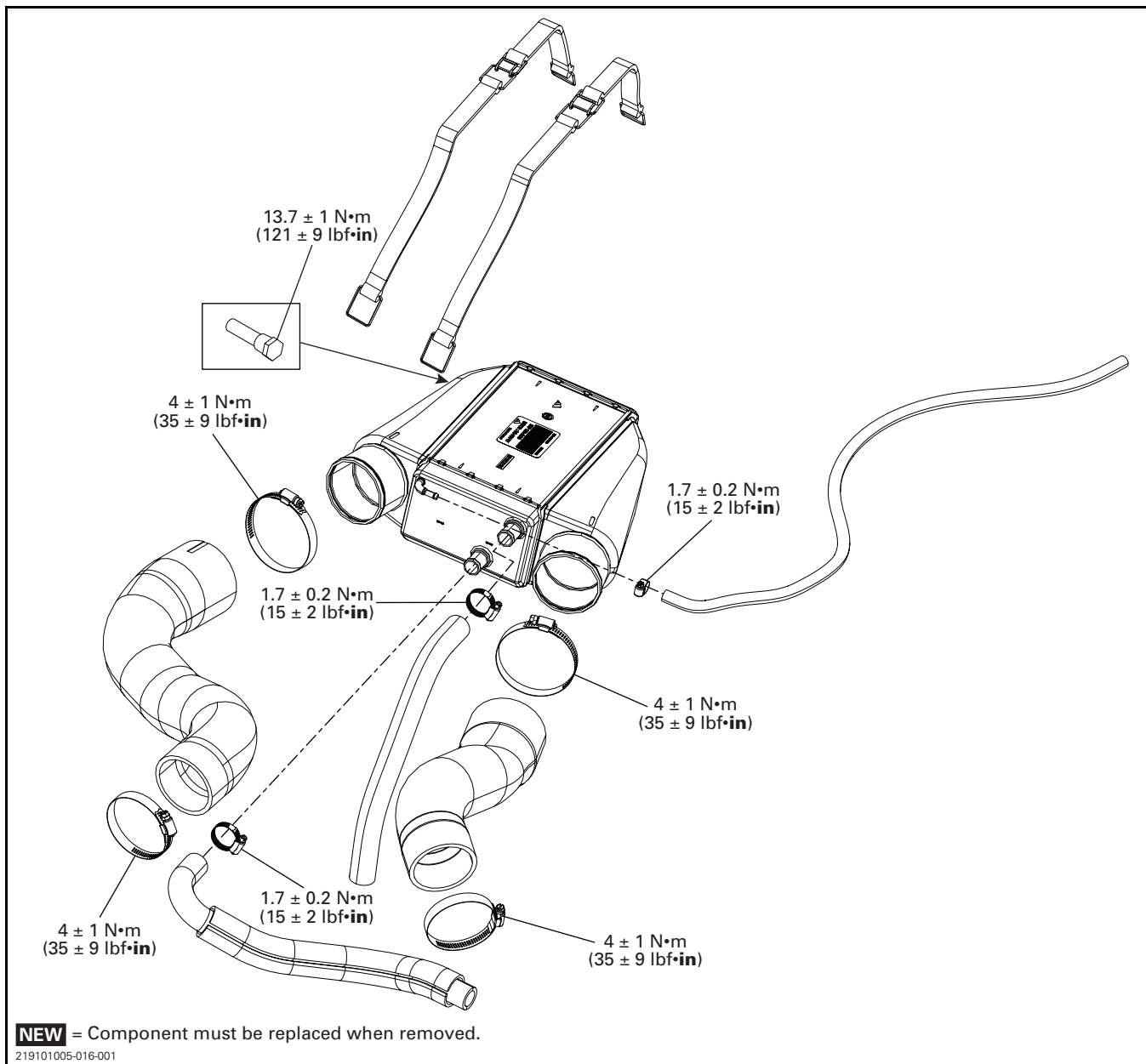


TIGHTENING TORQUE	
Gear clamp	3.5 N•m ± 0.5 N•m (31 lbf•in ± 4 lbf•in)

INTERCOOLER

SERVICE TOOLS

Description	Part Number	Page
LARGE HOSE PINCHER.....	529 032 500	87
VACUUM/PRESSURE PUMP	529 021 800	87



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 (1630 ACE)* subsection for flushing procedure.

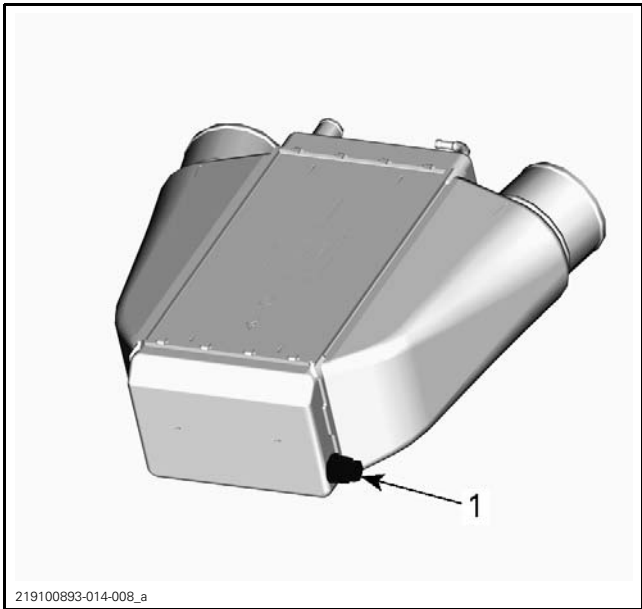
NOTICE Failure to flush the system, when necessary, will severely damage engine intercooler and/or exhaust system.

PROCEDURES

SACRIFICIAL ANODE

Sacrificial Anode location

Sacrificial Anode is located on the back of the intercooler.



Sacrificial Anode maintenance

Inspect and replace sacrificial anode according to *MAINTENANCE SCHEDULE* subsection.

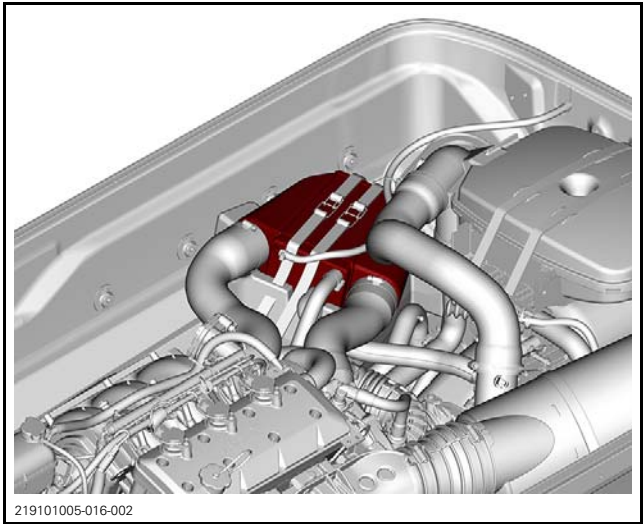
INTERCOOLER

 **WARNING**

Let engine cool down prior to work on or near intercooler.

Locating the Intercooler

Intercooler is located on the rear right side of the watercraft.



PARTS REMOVED FOR CLARITY

Cleaning the Intercooler

If temperature in intake manifold is too high or if engine is down in performance, intercooler may require to be cleaned.

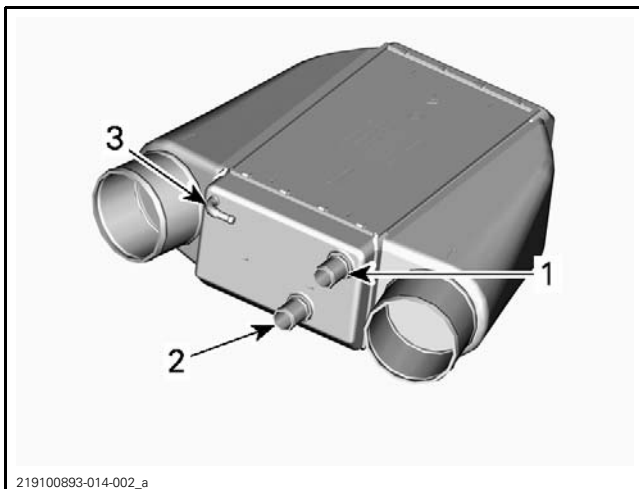
The exhaust system should be flushed first, as it may unclog the intercooler. If not, then proceed with the intercooler cleaning procedure as detailed here.

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.

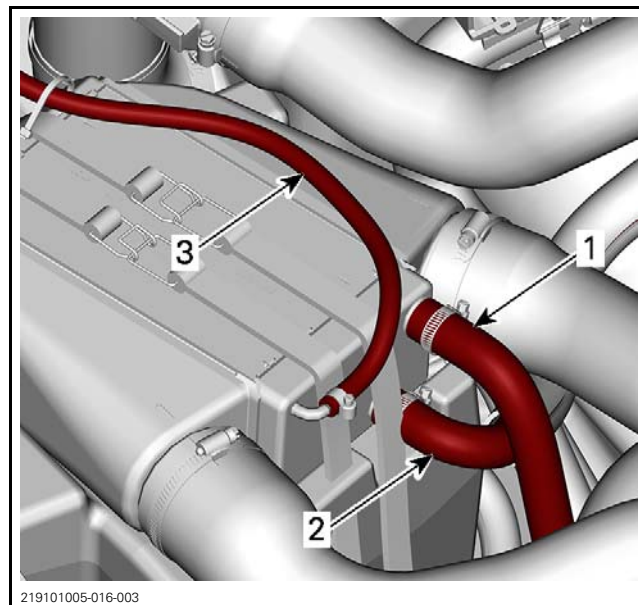
WATER FLOW	
LOW OR ERRATIC	1. Repeat cleaning procedure.
	2. Replace the intercooler.
HIGH AND REGULAR	Intercooler is not clogged.

7. Perform a leak test before installing the intercooler in the watercraft.

Intercooler Leak Test

Block intercooler water outlet hose.

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
 3. Intercooler bleed hose

Block intercooler bleed fitting.

Unplug the intercooler water inlet hose from the intercooler.

Install the vacuum/pressure pump on intercooler water inlet fitting.

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

Pressurize the intercooler.

PRESSURE TEST
69 kPa (10 PSI) for 10 minutes minimum

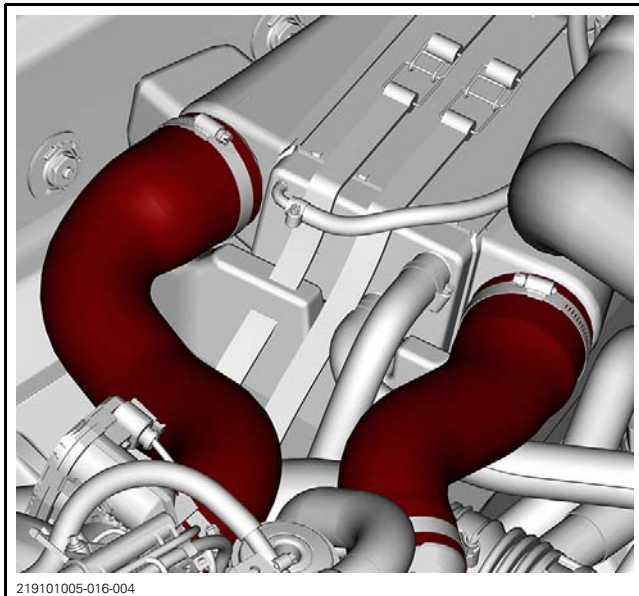
If there is a pressure drop, first spray tool, hoses and adapters with a soapy water solution to ensure they are not leaking. If they are not leaking, replace the intercooler.

Removing the Intercooler

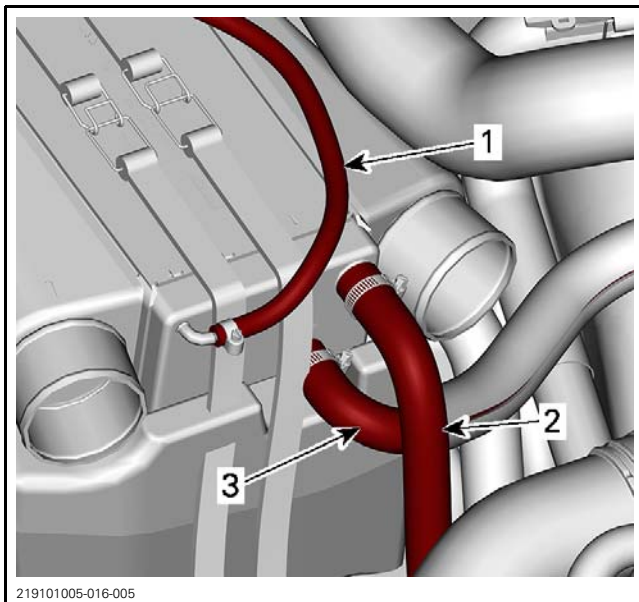
1. Remove seats. Refer to *BODY* subsection.
2. Remove engine service cover. Refer to *BODY* subsection.
3. Remove front exhaust hose. Refer to *EX-HAUST SYSTEM* subsection.
4. Disconnect and remove intercooler air hoses.

Section 03 ENGINE - 1630 ACE

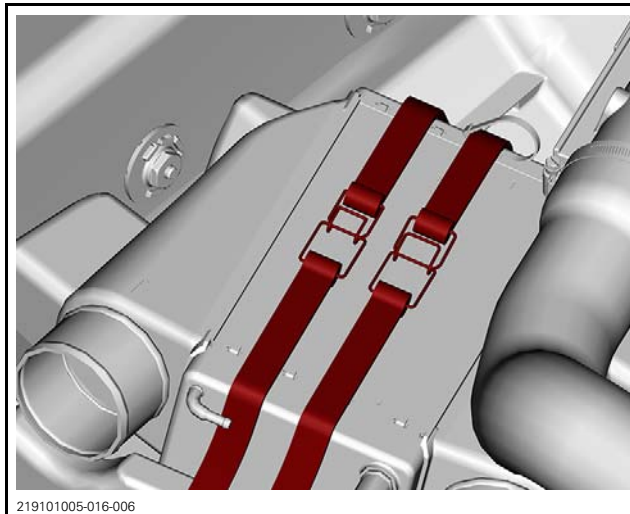
Subsection 05 (INTERCOOLER)



5. Disconnect intercooler water hoses and intercooler bleed hose.



6. Untie intercooler straps.



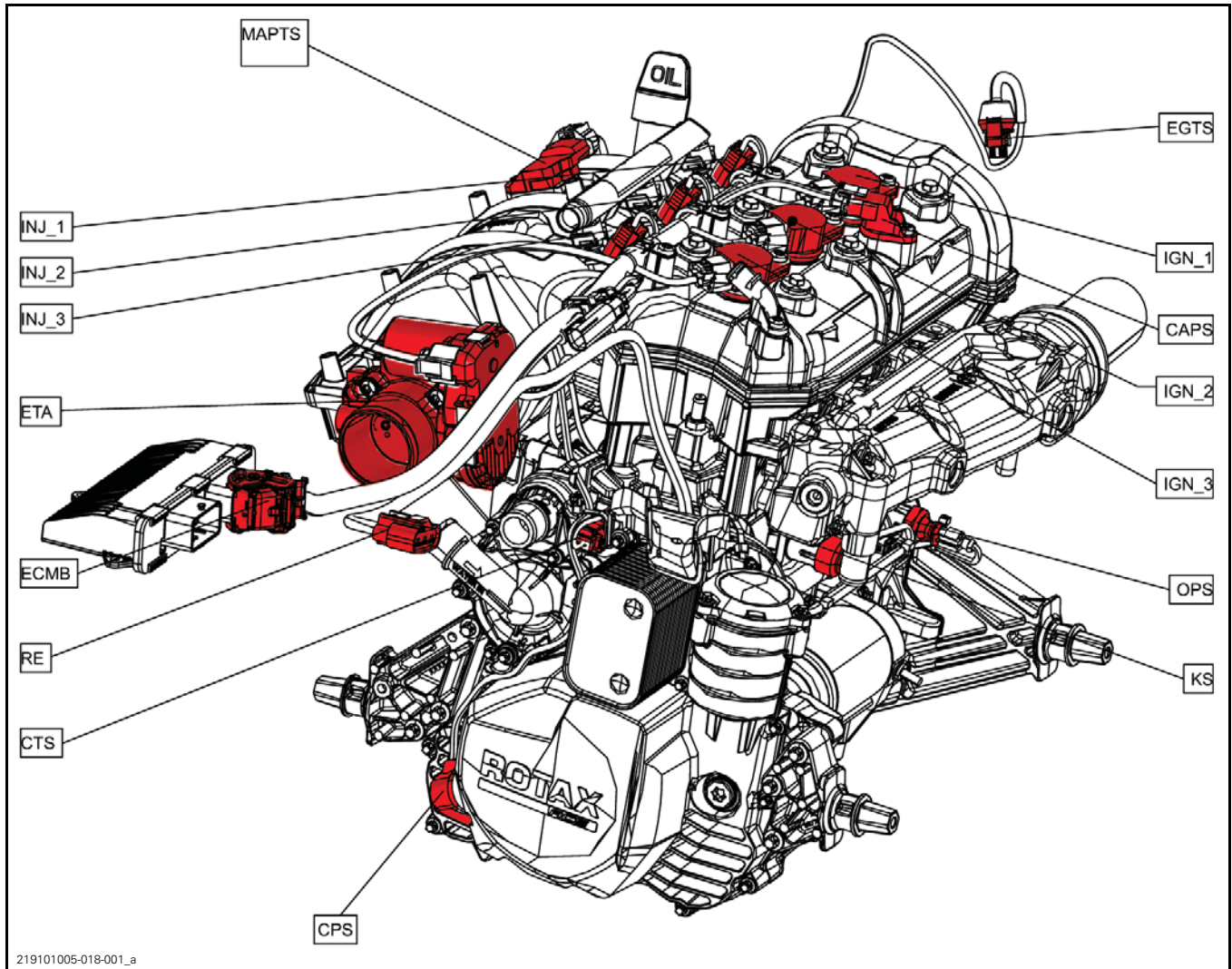
Installing the Intercooler

The installation is the reverse of the removal procedure. However, pay attention to the following. Refer to exploded view for tightening torque specifications.

NOTE: Ensure hoses are routed correctly and locking ties are positioned at proper locations.

ENGINE MANAGEMENT SYSTEM (EMS) (900 ACE)

900 ACE - 90



Section 04 ELECTRONIC MANAGEMENT SYSTEMS

Subsection 01 (ENGINE MANAGEMENT SYSTEM (EMS) (900 ACE))

GENERAL

SYSTEM DESCRIPTION

An engine management system (EMS) is used to ensure a high power output with cleaner combustion.

There are 6 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. T.O.P.S.
(Tip-Over Protection System)
6. iControl System

Air management

The quantity of air admitted into the engine is calculated by the throttle angle (TPS), the intake air temperature (IAT) and the manifold pressure/vacuum sensor (MAP) on the intake manifold.

NOTE: the MAPTS combines the pressure and temperature sensors into one sensor.

The operator's demands on the throttle lever are captured by the throttle accelerator sensor (TAS) and result in the movement of the electronic throttle actuator (ETA).

Fuel management

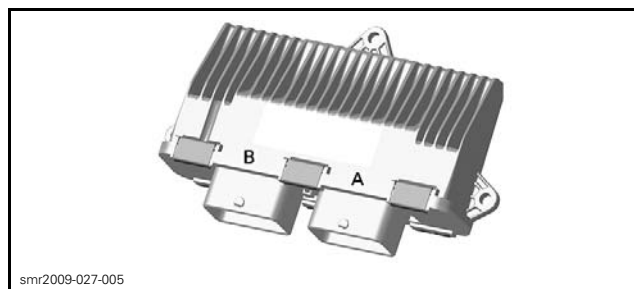
The coolant temperature sensor (CTS) is used to determine engine temperature. The ECM will slightly lean out the fuel mixture to bring a cold engine to operating temperature faster. Once the engine is at operating temperature, this stops.

NOTE: On some engines the oil temperature sensor is also used to calculate engine temperature.

In response to changes in air management, the ECM will adjust the quantity of fuel injected to optimize combustion.

The ECM will vary injection duration and timing to minimize emissions and maximize power.

Engine Control Module (ECM)

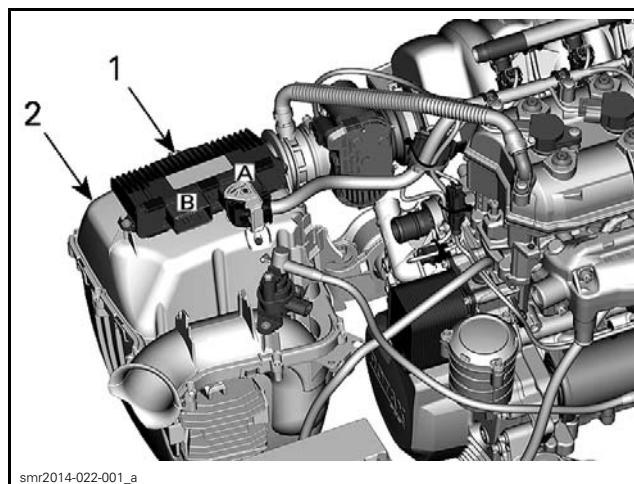


ECM

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 (multifunction gauge and iControl System) for various functions that affect engine management.

The ECM is mounted on the air intake silencer.



TYPICAL

1. ECM

2. Air intake silencer

A. Connector "A" (Engine harness)

B. Connector "B" (Vehicle harness)

It features a permanent memory that will store fault codes, customer information and other engine information, even when the engine is stopped and the battery is removed from the vehicle.

The ECM controls the following engine management functions:

Throttle Protection

If the throttle is not completely closed during engine startup, the engine will not start.

To revert to normal operation, completely release the throttle lever.

Engine RPM Limiter

The ECM monitors engine RPM through the CPS and CAPS. It then varies fuel injection, ignition and throttle plate opening as necessary to limit maximum engine speed.

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.

Monitoring System

The ECM monitors:

- The electrical and electronic components of the engine system
- The iControl system
- The multifunction gauge
- Some components of the electrical system
- Signals from other electronic modules

For more information, refer to *DIAGNOSTIC AND FAULT CODES*.

Limp Home Mode

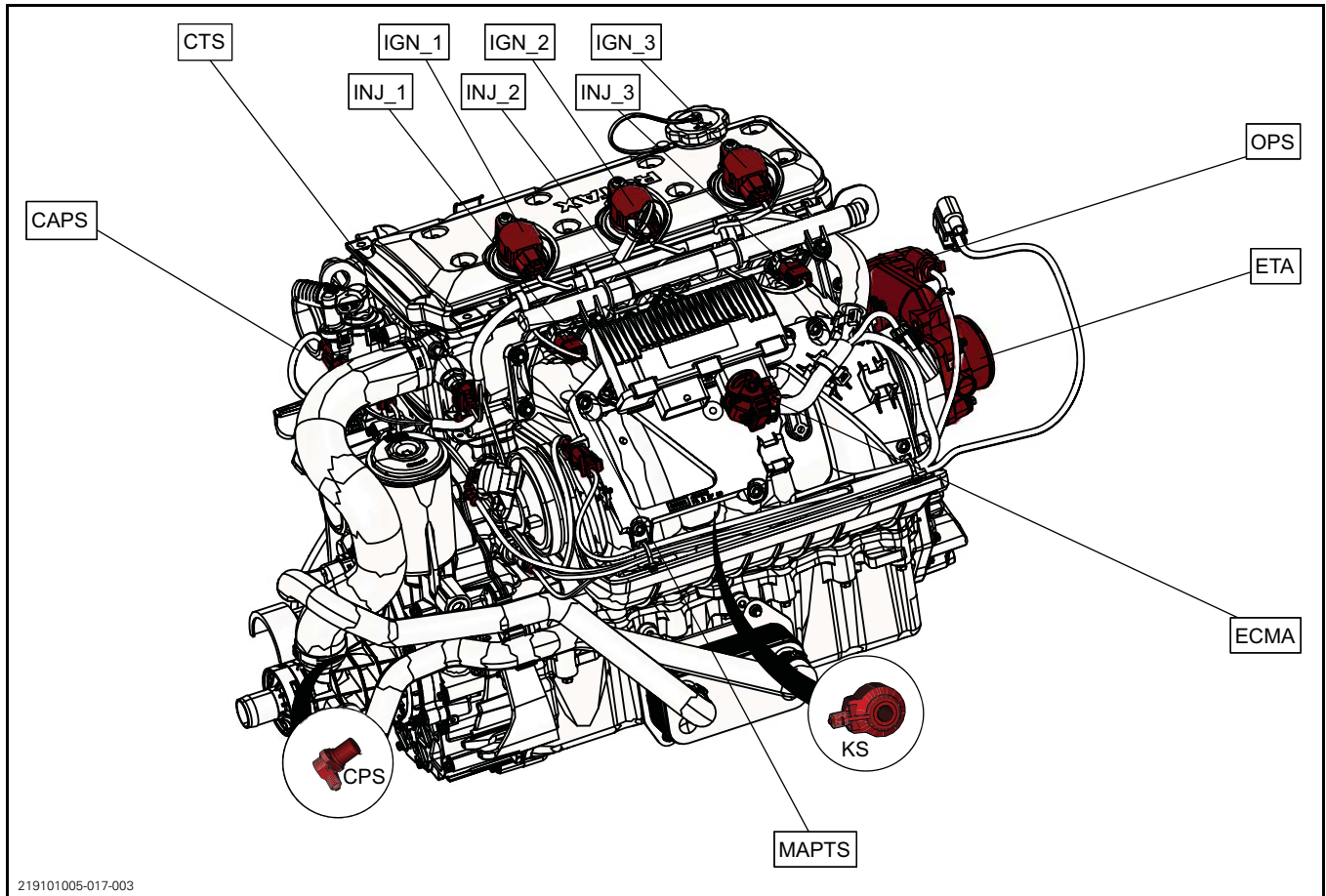
The ECM may automatically set the engine in LIMP HOME MODE using default parameters when certain major faults are detected. For more information, refer to *DIAGNOSTIC AND FAULT CODES* subsection.

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 button), and when the engine is running for others. Refer to *DIAGNOSTIC AND FAULT CODES* subsection for more information.

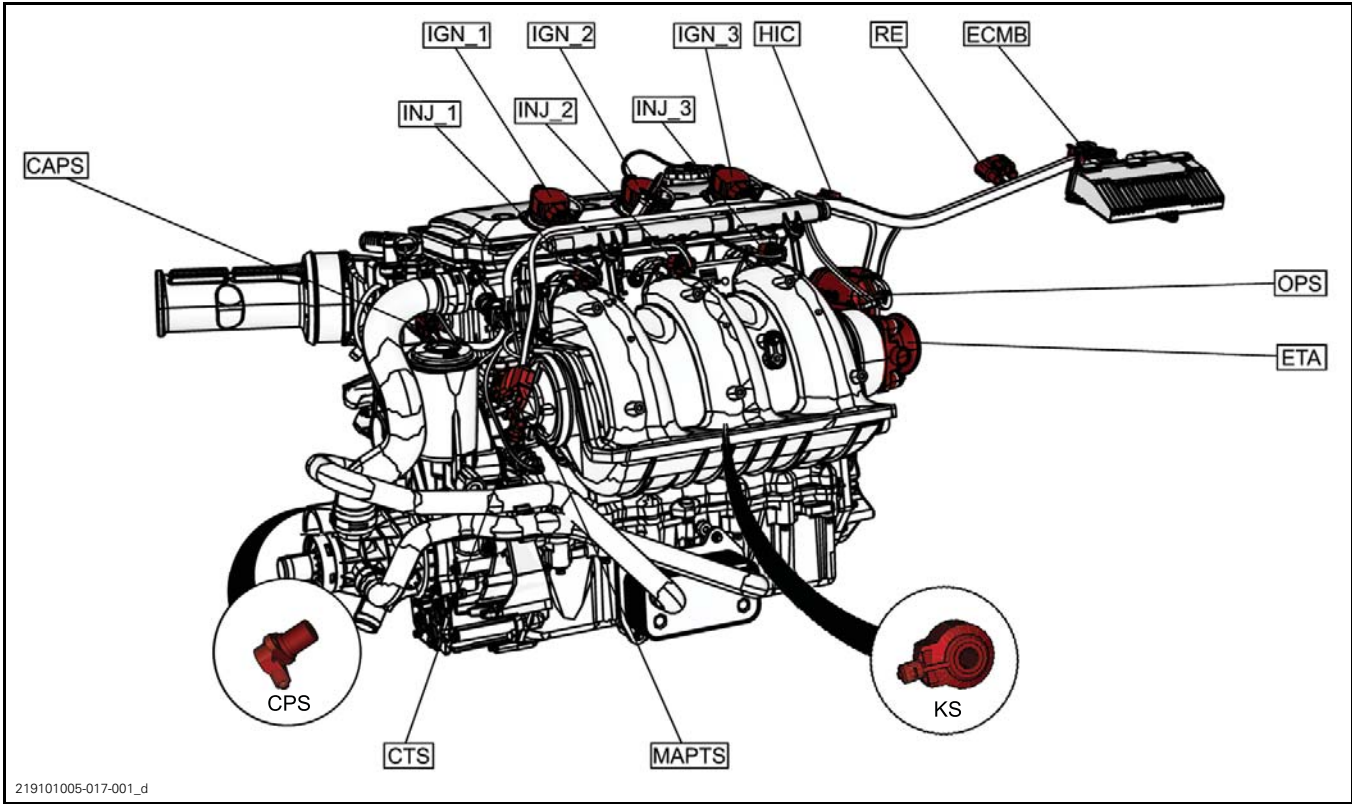
ENGINE MANAGEMENT SYSTEM (EMS) (1630 ACE)

1630 ACE - 130



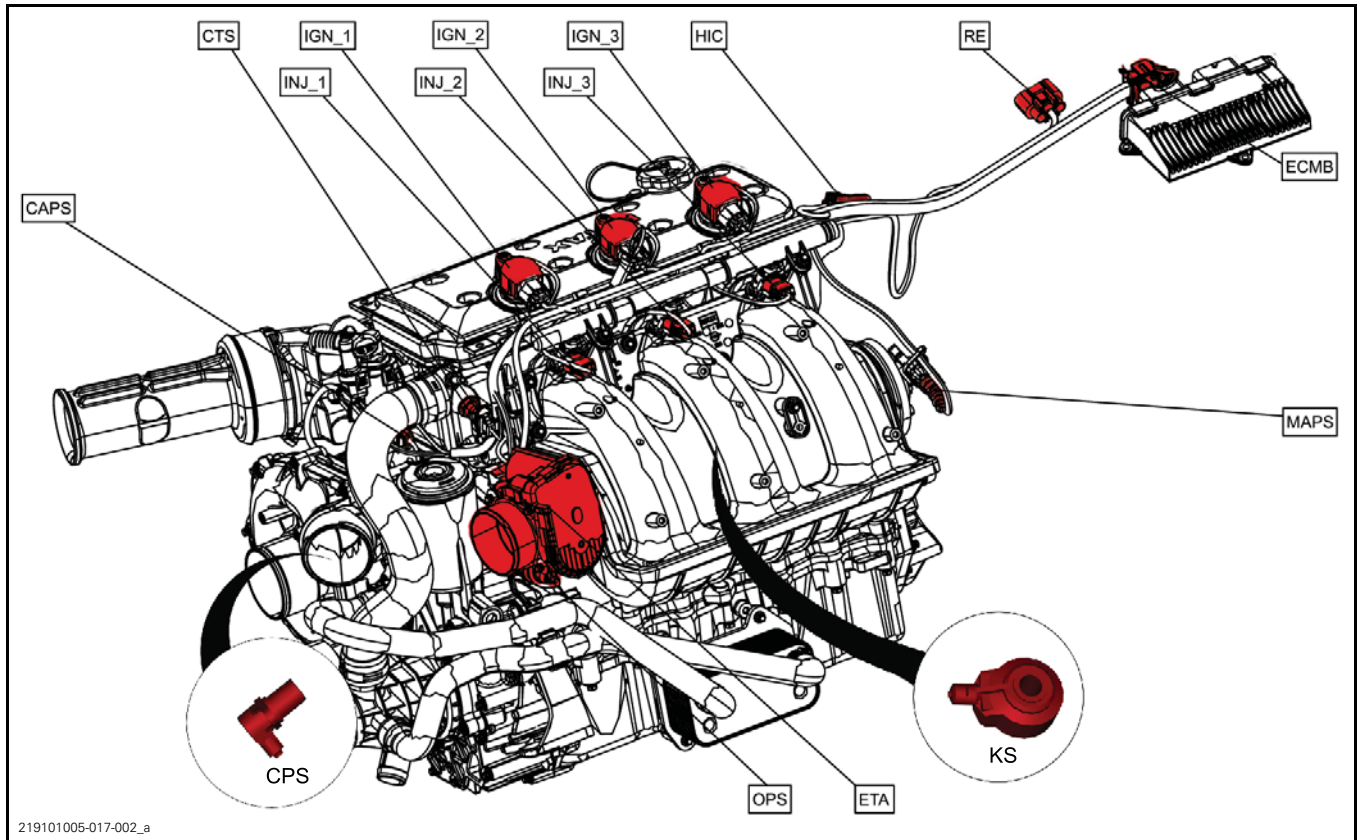
Section 04 ELECTRONIC MANAGEMENT SYSTEMS
Subsection 02 (ENGINE MANAGEMENT SYSTEM (EMS) (1630 ACE))

1630 ACE - 170



Section 04 ELECTRONIC MANAGEMENT SYSTEMS
Subsection 02 (ENGINE MANAGEMENT SYSTEM (EMS) (1630 ACE))

1630 ACE - 230



Section 04 ELECTRONIC MANAGEMENT SYSTEMS

Subsection 02 (ENGINE MANAGEMENT SYSTEM (EMS) (1630 ACE))

GENERAL

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. T.O.P.S.
(Tip-Over Protection System)
6. iControl System

Air management

The quantity of air admitted into the engine is calculated by the throttle angle (TPS), the intake air temperature (IAT) and the manifold pressure/vacuum sensor (MAP) on the intake manifold.

NOTE: the MAPTS combines the pressure and temperature sensors into one sensor.

The operator's demands on the throttle lever are captured by the throttle accelerator sensor (TAS) and result in the movement of the electronic throttle actuator (ETA).

Fuel management

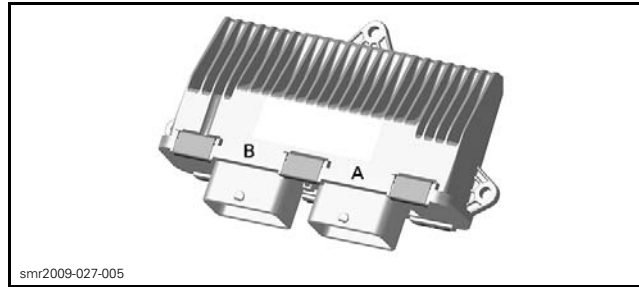
The coolant temperature sensor (CTS) is used to determine engine temperature. The ECM will slightly lean out the fuel mixture to bring a cold engine to operating temperature faster. Once the engine is at operating temperature, this stops.

NOTE: On some engines the oil temperature sensor is also used to calculate engine temperature.

In response to changes in air management, the ECM will adjust the quantity of fuel injected to optimize combustion.

The ECM will vary injection duration and timing to minimize emissions and maximize power.

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.

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*.

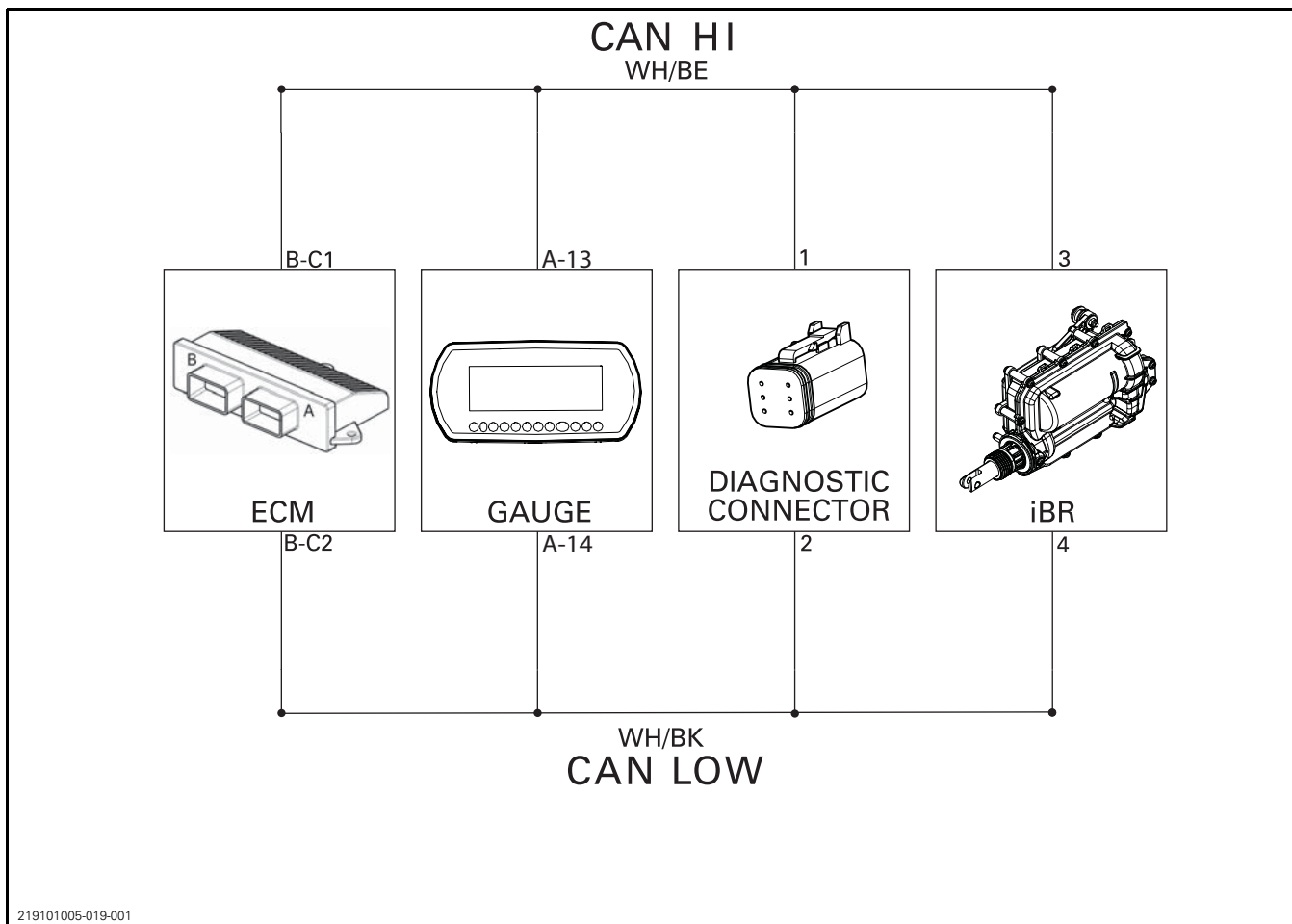
Limp Home Mode

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* subsection.

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 button), and when the engine is running for others. Refer to *DIAGNOSTIC AND FAULT CODES* subsection.

CONTROLLER AREA NETWORK (CAN)



CAN BUS DIAGRAM

GENERAL

CONTROLLER AREA NETWORK (CAN)

The CAN protocol is an ISO standard for serial data communication.

The ECM forms a network with other components linked with the CAN bus.

The CAN bus (or CAN lines) consist of a pair of wires (WHITE/BEIGE and WHITE/BLACK) that connect every component to each other. The electronic modules are in constant communication within the network.

There are resistors on the CAN lines in the ECM, multifunction gauge and the thermocouple module.

CAN network resistance can be measured from the COM connector pins.

Section 04 ELECTRONIC MANAGEMENT SYSTEMS

Subsection 03 (CONTROLLER AREA NETWORK (CAN))

TROUBLESHOOTING

DIAGNOSTIC TIPS

Check the fault codes using the BRP diagnostic software (BUDS2) as a first troubleshooting step.

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 BUDS2
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 return to VTS position. iBR light is ON. Check engine light is ON.	BUDS2 will not be able to communicate with any electronic module. "No vehicle detected" message will be displayed in BUDS2.
Information center (gauge)	Check engine light is ON. iBR light is ON. Some functions not displayed such as: Engine hours, VTS and RPM.	2 modules instead of 3 will be active. "Cluster" tab and its data will not be available in BUDS2 ECM and iBR 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 will return to VTS position. Some functions not displayed such as: Engine hours and RPM.	2 modules instead of 3 will be active. ECM tab and its data will not be available in BUDS2 iBR will report an ECM CAN problem.
iBR (Intelligent Brake and Reverse)	Engine is set to limp home mode. iBR gate will return to VTS position. 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.	2 modules instead of 3 will be active. iBR tab and its data will not be available in BUDS2 ECM will report an iBR CAN problem.
Diagnostic connector	Nothing will be observable.	BUDS2 will not be able to communicate with any electronic module. "No vehicle detected" message will be displayed in BUDS2.

If the gauge cannot communicate with an optional accessory (e.g.: 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.

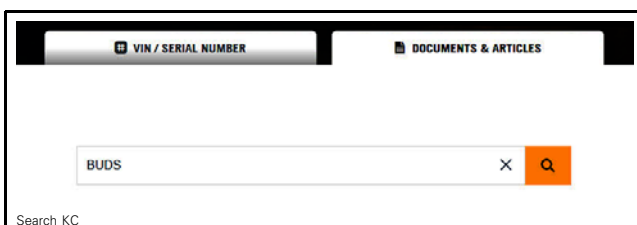
COMMUNICATION TOOLS

GENERAL

Refer to the **B.U.D.S. directory** on *KNOWLEDGE CENTER* for all BUDS2 related information, including:

- Download link
- User manual (programming keys, reading fault codes, writing data to modules etc.)
- Installation instructions
- BRP BUDS chart.

Search keyword: "BUDS".



TROUBLESHOOTING

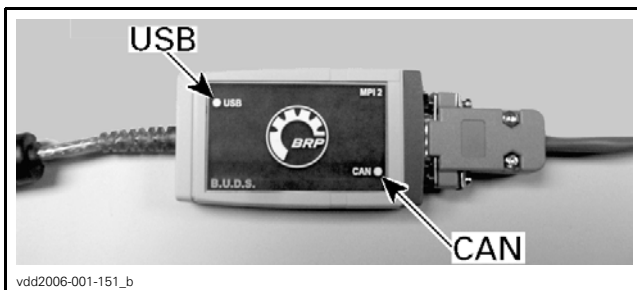
Refer to the BRP BUDS chart to ensure you are using the appropriate hardware and tools.

COMMUNICATION PROBLEMS

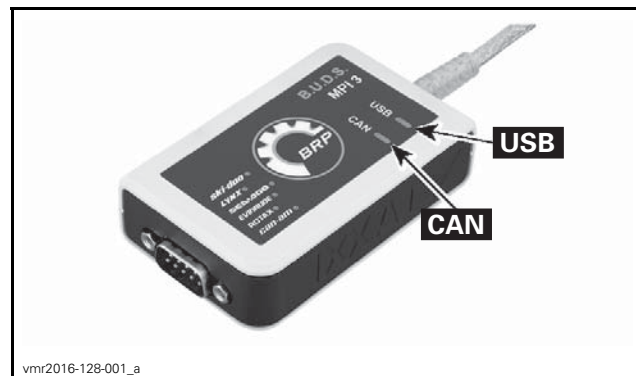
MPI Connection Troubleshooting

MPI Status Lights

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



MPI-2 CARD



MPI-3 CARD

Prerequisite for USB Communication:

- Computer turned ON
- MPI connected to PC computer.

COMMUNICATION PROBLEM (USB)	
STATUS	WHAT TO DO
USB Light is OFF	<ul style="list-style-type: none"> – Check USB connection between MPI card and PC computer. – Check USB operation on computer (hardware or Windows drivers).
USB Light is GREEN	<ul style="list-style-type: none"> – Connections are GOOD. Communication can take place on USB side.

Prerequisite for CAN Communication:

1. MPI card connected to diagnostic connector.
2. The tether cord cap (D.E.S.S. key) is installed on the engine cut-off switch.
3. BUDS2 started and logged.
4. ECM is powered.

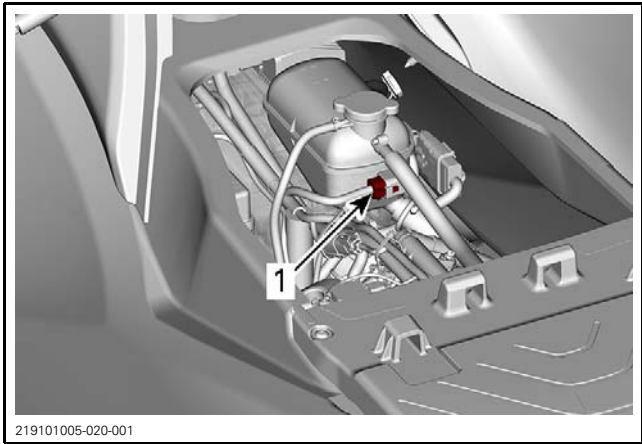
Section 04

ELECTRONIC MANAGEMENT SYSTEMS

Subsection 04 (COMMUNICATION TOOLS)

COMMUNICATION PROBLEM (CAN)	
STATUS	WHAT TO DO
CAN Light is OFF	<ul style="list-style-type: none">– BUDS2 does not communicate with the vehicle.– Check connections from computer to vehicle.– Check if BUDS2. is started.– Check if vehicle is powered: is cluster turned ON? If it is not ON, install the tether cord cap (D.E.S.S. key) on the engine cut-off switch.
CAN Light is RED	<p>This occurs when BUDS2 loses communication with vehicle.</p> <ul style="list-style-type: none">– Check connections from computer to vehicle.– Check if vehicle is powered: is cluster turned ON? If not, install the tether cord cap (D.E.S.S. key) on the engine cut-off switch.
CAN Light is GREEN	<ul style="list-style-type: none">– Connections are GOOD. BUDS2 communicates normally with the vehicle.

Connector Location



1. Connector location

DIAGNOSTIC AND FAULT CODES

GENERAL

MONITORING SYSTEM

This system monitors the electronic components of the EMS (engine management system), iBR, information center 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
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

INFORMATION CENTER MONITORING
MODE and SET switch
Cruise switch
CAN
GPS
Fuel level sensor
Depth sounder
ECM
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.

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.

Section 04 ELECTRONIC MANAGEMENT SYSTEMS

Subsection 05 (DIAGNOSTIC AND FAULT CODES)

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.

For information on usual indicator lights, refer to *INFORMATION CENTER (GAUGE)*.

4.5" Digital Display

INDICATOR LIGHT / ICON (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
N/A	IBR MODULE ERROR	Light is steady with a buzzer and a check engine light: iBR system fault (refer to an authorized Sea-Doo dealer)
	—	Light is flashing: iBR system fault (refer to an authorized Sea-Doo dealer)
	—	Light is steady with no buzzer: iBR system still functional but needs to be inspected by an authorized Sea-Doo dealer

MESSAGE DISPLAY INFORMATION	
HIGH EXHAUST TEMPERATURE	High exhaust temperature detected
HIGH ENGINE TEMPERATURE	High engine temperature detected
CHECK ENGINE	Engine system malfunction or maintenance required
LIMP HOME MODE	Major fault detected, engine power limited
FUEL SENSOR FAULT	Fuel level sensor fault
IBR MODULE ERROR	iBR system malfunction
MAINTENANCE REQUIRED	Watercraft maintenance required

NOTICE Running engine with low oil pressure may severely damage the engine.

Section 04 ELECTRONIC MANAGEMENT SYSTEMS

Subsection 05 (DIAGNOSTIC AND FAULT CODES)

Beeper Signals

When one of the below conditions occurs, the monitoring system emits the following beep signals.

BEEPER CODES	DESCRIPTION
1 long beep (while installing tether cord on watercraft engine cut-off switch)	Bad D.E.S.S. system connection. Reinstall tether cord cap correctly on the engine cut-off switch.
	Wrong D.E.S.S. key. Use a tether cord that has been programmed for the watercraft.
	Defective D.E.S.S. key. Use another tether cord with programmed D.E.S.S. key.
	Defective engine cut-off switch. Refer to an authorized Sea-Doo dealer.
	Improper operation of ECM or defective wiring harness. Seek service from an authorized Sea-Doo dealer, repair shop, or person of your own choosing for maintenance, repair, or replacement. Please refer to the <i>US EPA EMISSIONS-RELATED WARRANTY</i> contained herein for information about warranty claims.
A 2 seconds beep every 15 minutes interval	Engine management system fault. Seek service from an authorized Sea-Doo dealer, repair shop, or person of your own choosing for maintenance, repair, or replacement. Please refer to the <i>US EPA EMISSIONS-RELATED WARRANTY</i> contained herein for information about warranty claims.
	iBR system fault. Refer to an authorized Sea-Doo dealer.
A 2 seconds beep every 10 minutes interval	Low fuel level. Refill fuel tank. If problem persists, refer to an authorized Sea-Doo dealer.
2 second beeps	High engine temperature coolant. See <i>ENGINE OVERHEATING</i> .
	Low oil pressure. Turn off engine as soon as possible. Check oil level and refill. Seek service from an authorized Sea-Doo dealer, repair shop, or person of your own choosing for maintenance, repair, or replacement. Please refer to the <i>US EPA EMISSIONS-RELATED WARRANTY</i> contained herein for information about warranty claims.
Constant beep (Stops when vehicle is turned OFF)	High exhaust temperature. Seek service from an authorized Sea-Doo dealer, repair shop, or person of your own choosing for maintenance, repair, or replacement. Please refer to the <i>US EPA EMISSIONS-RELATED WARRANTY</i> contained herein for information about warranty claims.

NOTICE If the monitoring beeper continuously sounds, stop engine as soon as possible.

Section 04 ELECTRONIC MANAGEMENT SYSTEMS

Subsection 05 (DIAGNOSTIC AND FAULT CODES)

FAULT CODES

A fault code is an indication that a glitch or malfunction is detected by the monitoring system of the vehicle.

When there is a problem, the ECM can provide fault codes to ease troubleshooting.

The faults registered in the ECM are stored in memory.

IMPORTANT: After a problem has been solved, be sure to clear the fault(s) in the ECM using the BRP diagnostic software (BUDS2). This will properly reset their states.

How to Read Fault Codes

Refer to *COMMUNICATION TOOLS* subsection.

For more information pertaining to the faults code status and report, refer to BUDS2 online help.

How to Find Fault Code Descriptions

Connect the vehicle to the BRP diagnostic software (BUDS2). Refer to *COMMUNICATION TOOLS* subsection.

In BUDS2, go to **FAULTS** page.

Browse lists of active/ occurred and inactive fault codes.

INTELLIGENT THROTTLE CONTROL (iTC)

SERVICE TOOLS

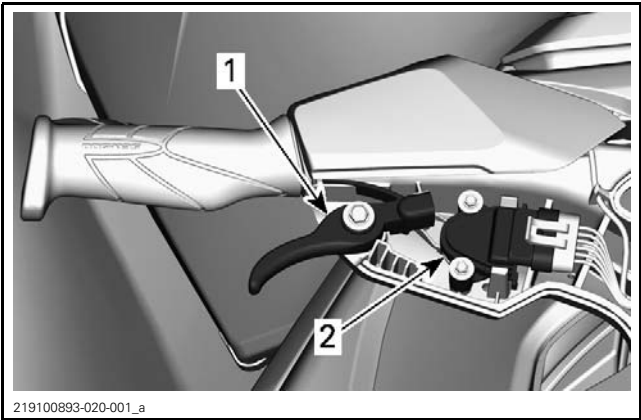
Description	Part Number	Page
DIAGNOSTIC HARNESS	529 036 384	112
FLUKE 115 MULTIMETER	529 035 868	114

GENERAL

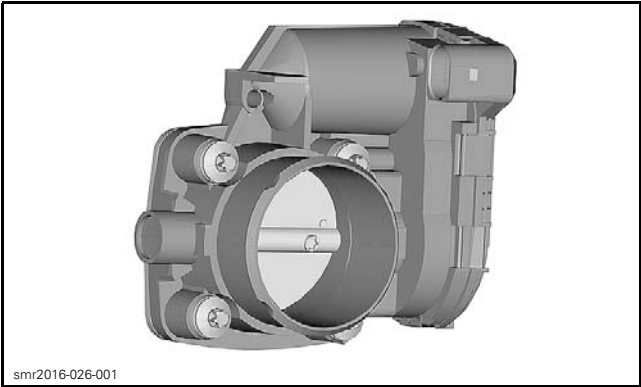
SYSTEM DESCRIPTION

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.



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.

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.

Default riding mode

Default riding 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.

Section 05 FUEL SYSTEM

Subsection 01 (INTELLIGENT THROTTLE CONTROL (iTC))

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.

Speed limiter mode

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 (If equipped)

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 wake boarder.

TARGET SPEED Function

The TARGET SPEED function limits the maximum towing speed.

Learning

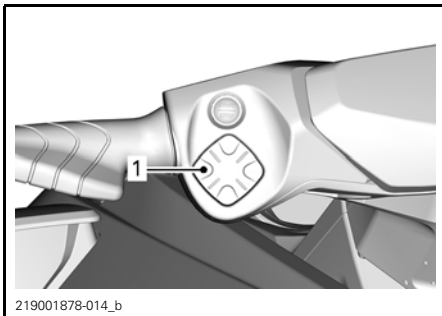
Learning limit the watercraft maximum speed. The full stroke of the throttle lever is used while only a partial stroke of the throttle plate is achieved. Therefore, greater throttle lever movement is used while a smaller engine speed and torque variation is applied through the throttle actuator. This permits a more accurate and easier throttle operation to control the engine within a specified torque curve and maximum speed setting for a learner.

OPERATING MODES

	GTI	GTI SE	GTR	WAKE
Default riding mode	X	X	X	X
Sport mode	X	X	X	X
ECO mode	X	X	X	X
Speed Limiter mode	N/A	X	X	X
Slow speed mode	N/A	X	X	X
Ski mode	N/A	-	-	X
Learning key modes	X	X	X	X
X = Indicates a standard feature - = See your Sea-Doo dealer for availability. N.A. = Not Applicable				

To change the operating mode;

- Press MODE button,
- Acknowledge the safety message by pressing and holding MODE button will get the SPORT mode,
- Pressing MODE button again will activate the SKI mode,
- Pressing the MODE button again will activate the ECO mode.



1. Mode button

Default riding Mode

By default, the watercraft is set to DEFAULT riding mode of operation when started.

Sport Mode

SPORT MODE provides for instant throttle response and more rapid accelerations than TOURING MODE.

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 activate the Sport mode, press once on the mode button while in touring mode. The sport icon will start to flash and a safety message will scroll. For safety reason, follow the instruction in the safety message to activate the sport mode. Once activated, the SPORT icon will turn ON.

Deactivating Sport Mode

A single press on mode button will take you to the SKI mode (if available) or ECO mode.

ECO Mode (Fuel Economy Mode)

ECO mode provides a smoother throttle application and increased fuel economy.

Speed Limiter Mode (if equipped)

Speed limiter 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.

The operator must keep the throttle depressed to maintain forward speed.

Once the maximum speed is set, the operator can vary the watercraft speed from idle speed up to the set speed using the throttle lever. The set speed will not be exceeded even if the throttle lever is fully depressed.

As you proceed under a constant speed setting, keep your attention level up to maintain good situational awareness.

Section05 FUEL SYSTEM

Subsection01 (INTELLIGENT THROTTLE CONTROL (iTC))

Slowing down is a matter of releasing the throttle lever further than the set point, or by pulling the iBR lever in.

If the iBR lever is pulled in for braking, Speed Limiter mode is overridden but **not deactivated**.

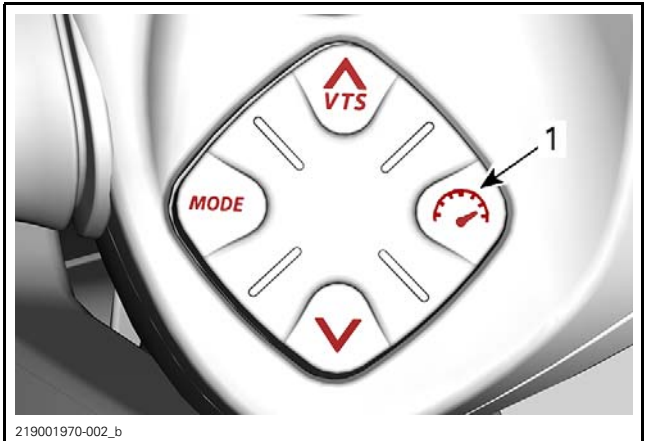
Once the iBR lever is released and the throttle is pulled in to engage forward thrust, the speed limiter function will reengage to limit the watercraft speed as it was set before.

Prerequisite for Speed Limiter Mode Activation

NOTE: Speed limiter mode is not available if slow speed mode or ski mode (if equipped) is engaged. Speed limiter MODE can be activated when the watercraft is going at more then 15m/h.

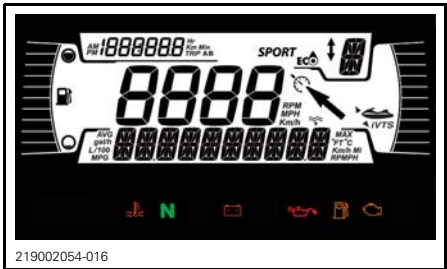
Activating Speed Limiter Mode

1. Maintain a constant speed.
2. Press the Speed Control button.



1. Speed Control button

You will hear a beep indicating that you are now in speed limiter mode, and a speed limiter MODE indicator will be lit.



TYPICAL

NOTE: Activating speed limiter mode of operation only limits the maximum speed available when depressing the throttle lever. The throttle lever must be held in to maintain forward speed. Watercraft speed can be varied from idle up to the set cruise speed using the throttle lever once the speed limiter function is activated. Watercraft speed may vary depending on water conditions during use.

To change the set speed; keep throttle lever fully depressed and press the UP or DOWN arrow button.

Deactivating Speed Limiter Mode

To deactivate speed limiter mode:

1. Release the throttle lever.
2. Long press the speed limiter button.

Deactivation of speed limiter mode is indicated by:

- The speed limiter indicator will go off.

NOTE: If the throttle lever is not fully released when the button is pressed to deactivate the speed limiter mode, the speed limiter MODE indicator will remain on. The speed limiting function will stay active until the throttle is fully released, then the speed limiter MODE 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).

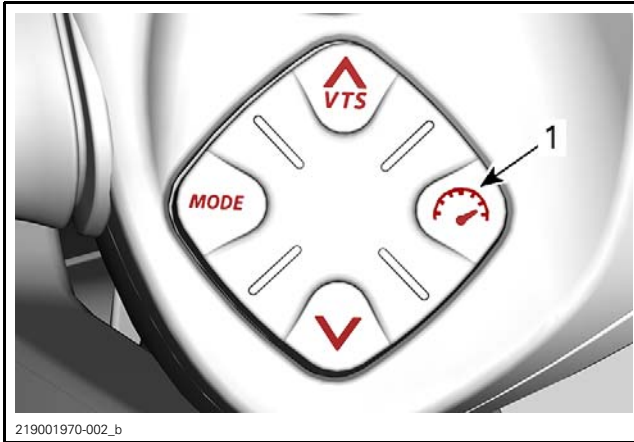
If you accelerate above approximately15 km/h (9 MPH) , Slow Speed Mode will be deactivated and the engine will return to idle RPM when the throttle is released.

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. Press the Speed Control button.



1. Speed Control button

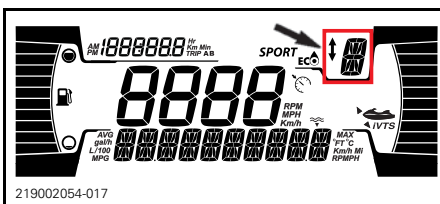
The Speed limiter/Slow Speed indicator will come on in the multifunction display to indicate activation.



TYPICAL

A message will scroll in the multifunction display to specify that you are now in slow speed mode.

The default slow speed setting of 5 will show in the numerical display.



Changing Set Slow Speed

To **increase** or **decrease** the set slow speed, press the UP/DOWN button on the RH handlebar once, or repeatedly.

NOTE: There are 9 slow speed settings available (1 through 9). Adjust slow speed mode to desired speed.

When pressing the up/down button, a message "SET LEVEL" will appear. You can select from one of the 9 slow speed setting (1 to 9).

Level 5 is the default and it correspond to the normal idle of the vehicle. By using level 1-4 you can slow down the vehicle and go as slow as 1.5 km/h (1 MPH). The slow speed mode can be used as a

trolling mode and is useful for fishing. Level 6-9 gives you the ability to go up to 12 km/h (7 MPH) without touching the throttle lever.

NOTE: Speed will vary depending on load, wind and waves conditions

Deactivating Slow Speed Mode

The slow speed mode can be deactivated using any of the following methods:

- Pressing the Speed Control button.
- Depressing the iBR lever.
- Accelerating past the set slow speed.

When deactivating SLOW SPEED MODE by 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 Speed Limiter indicator will go out

Ski Mode (If equipped)

Ski mode allows for repeated and precisely controlled launches, and a set towing speed, specifically for towing a skier or wake boarder.

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

RAMP 5 provides:

- Quickest launch
- Quickest acceleration rate

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 operator may increase or decrease the target speed to any value within the selected RAMP speed range.

Using Ski Mode

Press MODE button to select the SKI mode.

1. Press OK button when SKI icon flashes.

Section 05 FUEL SYSTEM
Subsection 01 (INTELLIGENT THROTTLE CONTROL (iTC))

2. Select ski ramp by using the UP or DOWN arrow button. Ramp 1 will give the slowest acceleration.

NOTE: Acceleration ramp will not behave the same depending on the vehicle type, vehicle load and water conditions. For safety reasons, always start using ramp # 1 to familiarize your skier with acceleration and then change the ramp as needed.

3. Press RIGHT arrow button to confirm acceleration ramp.

4. Select the maximum target speed by using the UP or DOWN arrow button.

5. Press RIGHT arrow button to confirm.

NOTE: At any moment you can use the left and right arrow to change the ramp and speed selection.

6. After your selection and when your are ready, press the OK button to activate the function.

The message **SKI READY** will display.

Keep throttle fully applied to ski.

Releasing the throttle or applying the brake will pause the SKI mode, simply press OK button to reactivate the SKI mode.

Deactivating Ski Mode

To end a ski run and completely deactivate ski mode, release the throttle to idle, then press the MODE button.

Learning Key Mode

The learning I key provides a mode of operation whereby engine power and speed is limited.

There are 5 speed settings available.

By default, the speed setting is no 1.

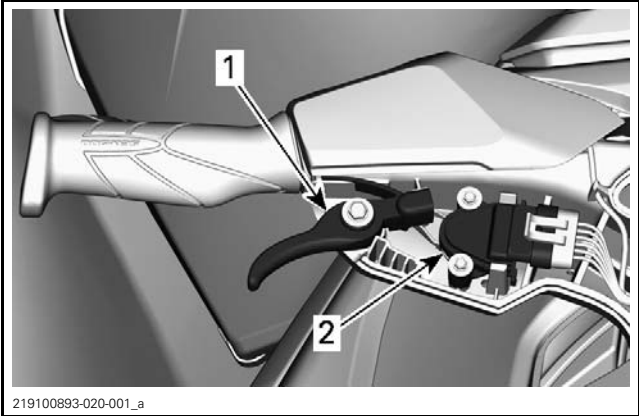
Refer to *4.5 DIGITAL DISPLAY* for adjustment.

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.

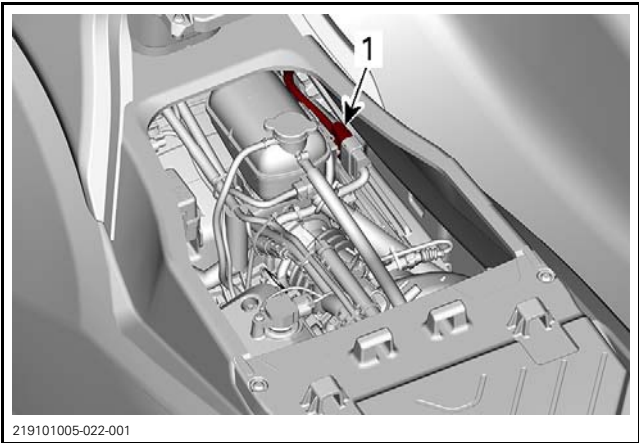


1. Throttle lever
2. Throttle accelerator sensor (TAS)

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 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 20-pin steering connector.



1. 20-pin connector

2. Connect the diagnostic harness to make an in-line connection between the disconnected connectors.

REQUIRED TOOL	
DIAGNOSTIC HARNESS (P/N 529 036 384)	

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.

20-PIN CONNECTOR		IDLE POSITION	WIDE OPEN POSITION
PIN		VOLTAGE (VDC)	
13 (VI/BU)	14 (BK)	4.9 - 5.1	
14 (BK)	15 (YL/BU)	0.15 - 0.35	1.4 - 1.6
16 (VI/GN)	17 (BK)	4.9 - 5.1	
17 (BK)	18 (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.

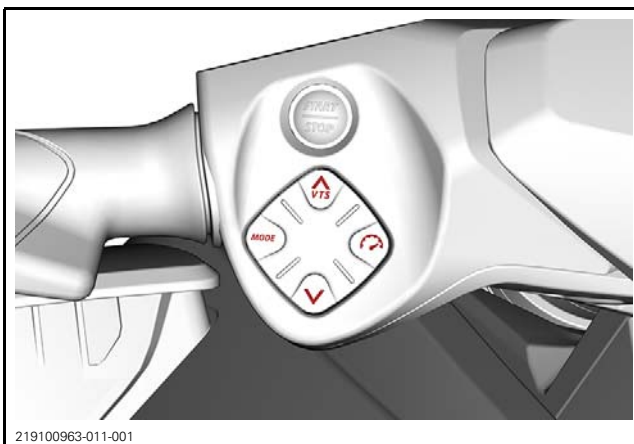
6. Reinstall removed components.

Replacing the TAS

Refer to BRLS in iBR subsection.

MODE/SPEED CONTROL SWITCH

Mode/Speed Control Switch Overview



The Mode/Speed Control switch contain a series of 4 diodes for the Mode and Speed Control switches.

The center wire to the switches (pin C), is common for Mode/Speed Control 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 Mode/Speed Control switch is open), a drop of 2.4 Vdc would be measured across the 4 the diodes (pin A to pin C). This 2.4 Vdc at pin A tells the gauge the Mode/Speed Control switch is open.

If the Mode button is pressed, 2 diodes are bypassed. The remaining two diodes in the circuit drop 1.2 Vdc (at pin A).

If the Speed Control button is pressed, 1 diode is bypassed. The remaining three diodes in the circuit drop 1.8 Vdc (at pin A).

The gauge senses these voltages and interprets them as signals that tell it which switch is activated.

When Mode or Speed Control 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 Mode/Speed Control Switch

If Mode/Speed Control switches do not allow the selection, test the switches as follows:

- Connect the vehicle to the BRP diagnostic software (BUDS2). Refer to *COMMUNICATION TOOLS* subsection.
- Check if there is any occurred or active fault code(s). If not, proceed with the following test.
- In BUDS2, go to:
 - **Measurements** page
 - **Cluster** button
 - **Cluster - Basic** tab
- Depress the Mode button on steering and check the **Mode** light status.
- Repeat with the Speed Control switch. **Speed Control** light status should change

If one switch does not function, replace Mode/Speed Control switch.

Section05 FUEL SYSTEM

Subsection01 (INTELLIGENT THROTTLE CONTROL (iTC))

If both switches stay off, do the following to verify the circuit.

1. Remove the gauge support cover.
2. Disconnect the gauge connector.
3. Using the multimeter set to the diode test function, test the Sport or ECO switches as per following tables.

REQUIRED TOOL
FLUKE 115 MULTIMETER (P/N 529 035 868)

NOTE: In diode test mode, the multimeter will test the voltage drop through the diodes.



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 16 and 2 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.

MULTIMETER LEAD/ GAUGE CONNECTOR	SWITCH POSITION	VOLTAGE
RED lead/Pin 16 BLACK lead/Pin 2	Both switches released	± 2.4 Vdc
	Speed Control switch depressed	OL
	Mode switch depressed	± 1.2 Vdc
RED lead/Pin 16 BLACK lead/Pin 2	Both switches released	OL
	Speed Control switch depressed	
	Mode switch depressed	

FUEL TANK AND FUEL PUMP

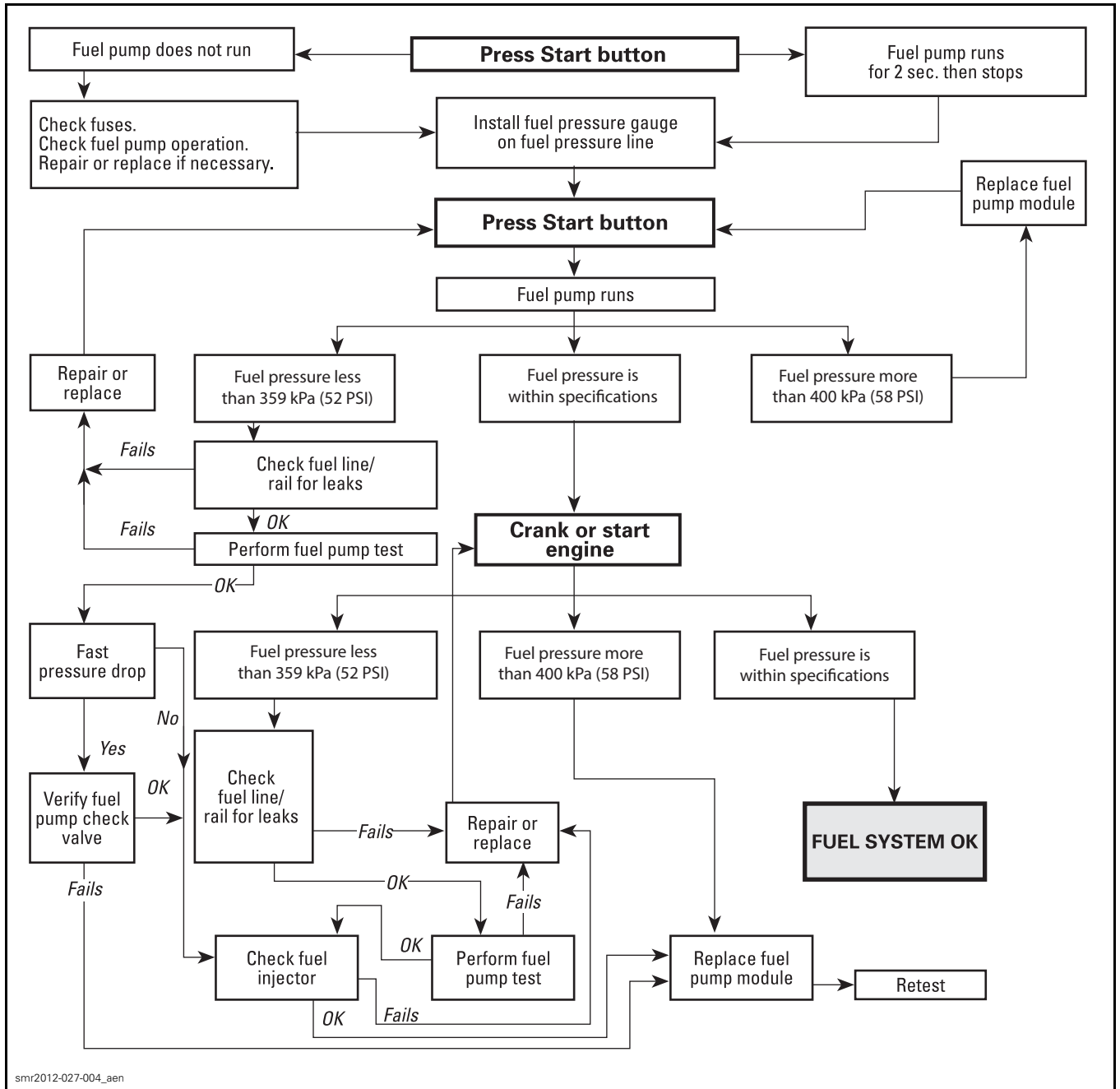
SERVICE TOOLS

Description	Part Number	Page
DIAGNOSTIC HARNESS	529 036 384	128
ECM ADAPTER TOOL.....	529 036 166	118
FLUKE 115 MULTIMETER	529 035 868	118
FUEL HOSE ADAPTER.....	529 036 396	122
FUEL PUMP MODULE SOCKET.....	529 036 125	118
FUEL TANK TEST CAP	529 036 242	120
OETIKER PLIER.....	295 000 070	124
PRESSURE GAUGE.....	529 036 395	122
VACUUM/PRESSURE PUMP	529 021 800	118
VENTED CAP TEST ADAPTER (THREADED).....	529 036 243	121

Subsection 02 (FUEL TANK AND FUEL PUMP)



FUEL SYSTEM DIAGNOSTIC FLOW CHART




Section05 FUEL SYSTEM


Subsection02 (FUEL TANK AND FUEL PUMP)

GENERAL


The following tools are required to test most of the electrical parts.

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

The following tool is required to perform most leak test.

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

The following tool is required to remove and install fuel pump locking ring.

REQUIRED TOOL	
FUEL PUMP MODULE SOCKET (P/N 529 036 125)	

⚠ 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

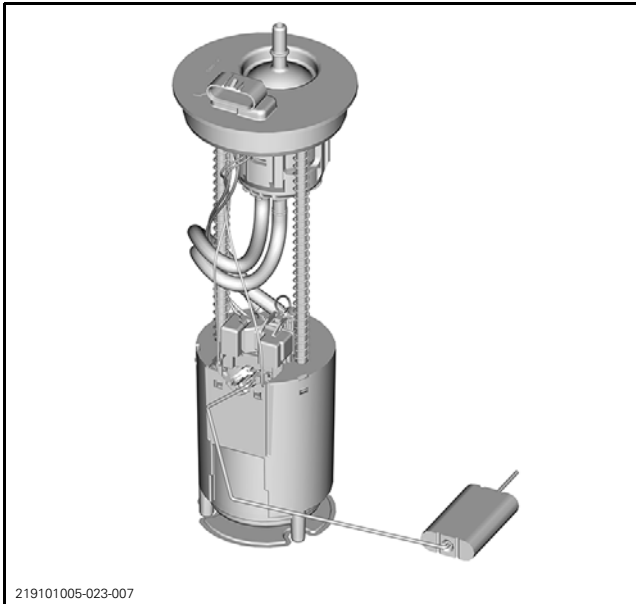
Ensure wires and hoses are routed and secured away from any vibrating, rotating, moving or hot components or sharp edges. Use appropriate shields and fastening devices as per factory standards.

NOTICE Whenever repairing the fuel system, always check for water infiltration in the fuel tank. Replace any damaged, leaking or deteriorated fuel line.

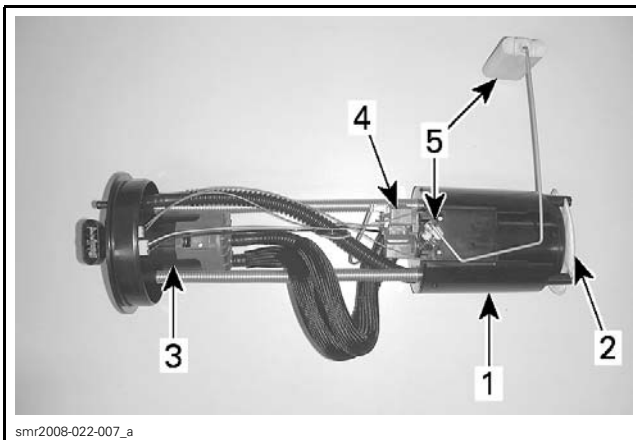
SYSTEM DESCRIPTION

- The fuel system is comprised of:
- A fuel tank
 - A vented fuel tank cap
 - A fuel pump module mounted inside the fuel tank
 - A 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



The fuel pump module is inserted in the fuel tank. It provides fuel delivery for the EFI system and includes the following components.



FUEL PUMP MODULE COMPONENTS

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 reservoir 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 turn on momentarily to pressurize the fuel rail in preparation for the engine start.

The ECM supplies the ground (power control 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 (digital display). 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

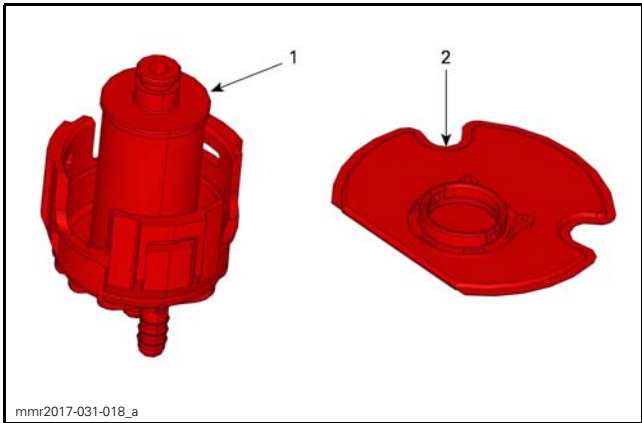
If the cap requires replacement, it must be replaced with an approved vented cap of the same type supplied by BRP. Use of any other cap, or use of a non-vented cap will not allow proper venting of the fuel tank. The result may be engine fuel starvation, fuel tank overpressure, or fuel leaks which could lead to a fire or an explosion.

NOTE: BRP is the only supplier of the vented fuel tank cap. There is no equivalent vented fuel tank cap available on the market today.

Section05 FUEL SYSTEM

Subsection02 (FUEL TANK AND FUEL PUMP)

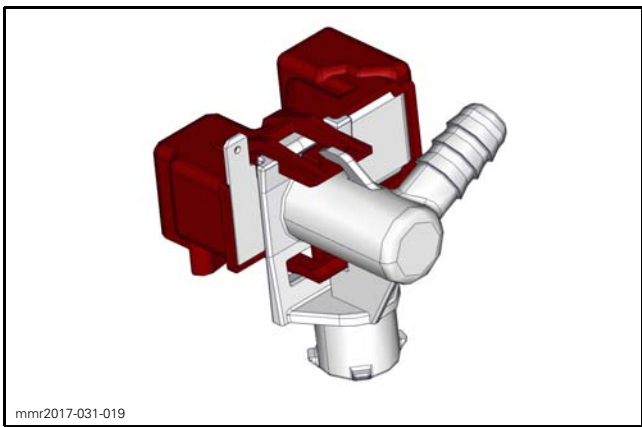
Fuel Filters



FUEL FILTERS
1. Upper outlet filter
2. Lower inlet filter

The system comprises two levels of filtration. A lower inlet filter (prefilter) attached to the bottom of the pump, and an upper outlet filter that is integral to the fuel pump module.

Fuel Pump Pressure Regulator



The fuel pressure regulator is integral to the fuel pump module. The pressure regulator maintains proper fuel pressure for the EFI system.

Fuel Tank Vent System

The fuel tank is equipped with a vent system that ensures the fuel tank remains at ambient pressure.

Air can enter and exit the fuel tank at all times through the fuel tank vent valve. This prevents negative pressure within the fuel tank which could cause fuel starvation.

The vent valve also prevents fuel from flowing out through the inlet of the vent system should the vehicle be overturned.

INSPECTION

FUEL TANK LEAK TEST

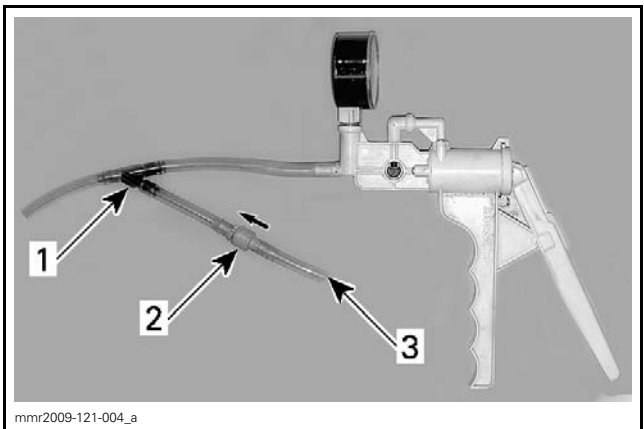
WARNING

Always carry out a fuel tank leak test whenever the fuel tank shows signs of wear or damage which may cause a leak, or when the fuel pump has been removed or replaced, or if you suspect a leak. If the fuel tank is damaged, the fuel tank should be replaced even if no leak is present. Do not attempt to repair the fuel tank.

1. Visually inspect condition of hoses and clamps.
2. Remove fuel tank cap.
3. Install test cap on filler neck.
4. Use the following tool and vacuum/pressure pump to pressurize fuel tank.

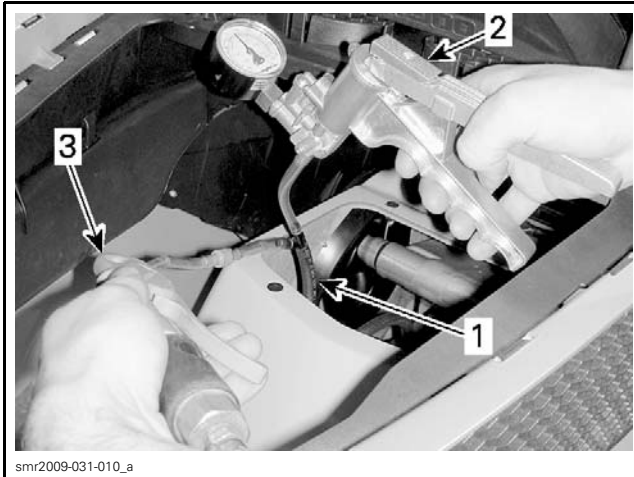
REQUIRED TOOL	
FUEL TANK TEST CAP (P/N 529 036 242)	

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

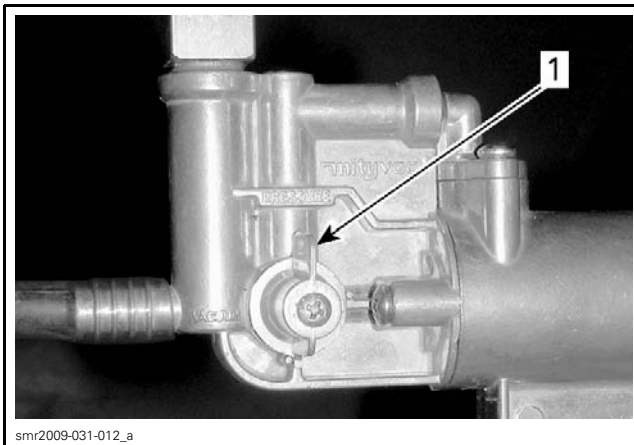
5. Connect the vacuum/pressure pump to the nipple of fuel tank test cap.



TYPICAL

1. Inlet valve end
2. Vacuum/pressure pump
3. Compressed air supply

6. Set vacuum/pressure pump to PRESSURE.



1. Pressure selected

7. 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.

NOTE: In case of fuel tank leak, do not attempt repair. Fuel tank must be replaced.

Possible leak areas are:

- Filler neck with cup, hose and connections
- Fuel tank
- Fuel tank neck
- Fuel pump gasket

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).

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.

8. Remove test cap.

FUEL TANK CAP LEAK TEST

To test the fuel tank cap, use the following tool and vacuum/pressure pump.

REQUIRED TOOL	
VENTED CAP TEST ADAPTER (THREADED) (P/N 529 036 243)	

Inlet Check Valve Function Test

Install the fuel tank cap onto the vented cap test adapter.

Set vacuum/pressure pump to the VACUUM function.

Connect vacuum/pressure pump to nipple of vented cap test adapter.

Squeeze the vacuum/pressure pump handle several times to draw air in through the check valve of fuel tank cap.

Air should be drawn in freely and vacuum indication on pump should remain at zero. If vacuum rises, replace the fuel tank cap.

Pressure Relief Valve Function Test

Set the vacuum/pressure pump to the PRESSURE function.

Section05 FUEL SYSTEM

Subsection02 (FUEL TANK AND FUEL PUMP)

Squeeze the vacuum/pressure pump handle to apply pressure to the check valve of fuel tank cap and observe the pressure rise. It should be as per specification.


PRESSURE RELIEF VALVE FUNCTION TEST	
PRESSURE	TEST RESULT
Up to 6.9 kPa (1 PSI)	Pressure must hold
Above 6.9 kPa (1 PSI) and below 13.8 kPa (2 PSI)	Pressure must release

If pressure holds above specification, replace the fuel tank cap.

Remove test adapter.

Reinstall/close fuel tank cap.

FUEL SYSTEM HIGH PRESSURE LEAK TEST

 **WARNING**

A high pressure leak test must be carried out before starting the engine anytime a fuel system component has been disconnected for maintenance or replacement.

1. Visually inspect fuel system to ensure all fuel system connections are properly made.
2. Lightly pull on hoses at each connection to ensure they are properly locked at the quick connect fittings.
3. Remove tether cord from the engine cut-off switch to prevent engine starting.
4. Press the START button to turn on the fuel pump for a few seconds and pressurize the fuel system.
5. Check for fuel odor and visually inspect hoses, fittings and components for leaking fuel.
6. If a leak is detected, repair or replace the leaking component and repeat leak test after the repair.
7. If no leak is found, engine can be started.


FUEL PUMP PRESSURE TEST

Preparation

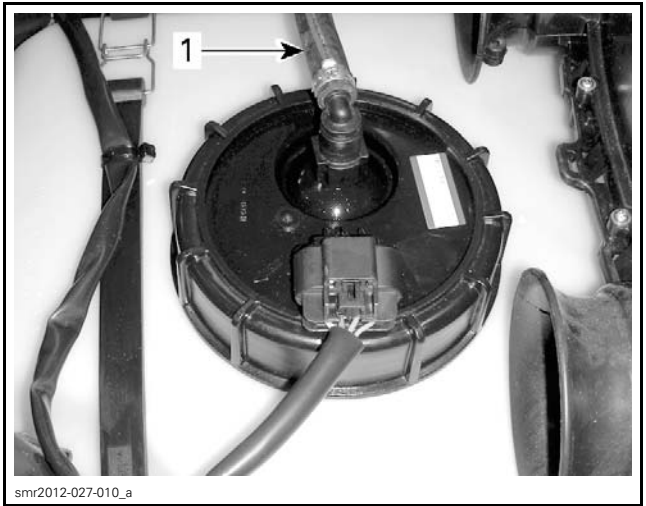
The pressure test will show the available pressure at the fuel pump outlet. It validates the pressure regulator, the fuel pump and check valve and it tests for leaks in the system.

1. Ensure the battery is fully charged, refer to *CHARGING SYSTEM* subsection.

2. Ensure hoses and fittings are not leaking. Repair any leak.
3. Ensure the fuel level in the fuel tank is sufficient.
4. Disconnect the pressure outlet hose from the fuel pump.



 **WARNING**

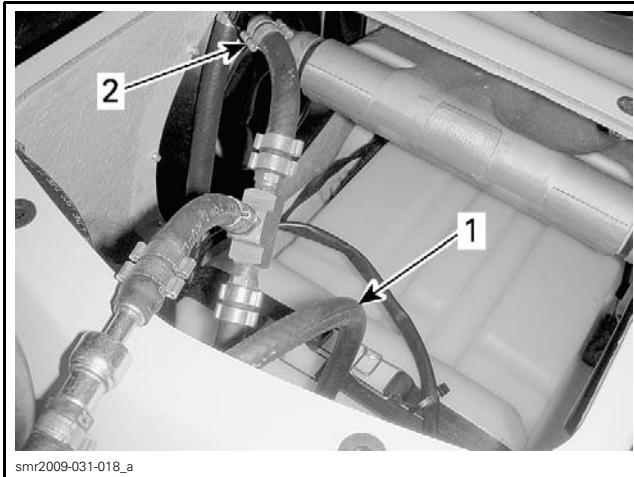
Cover the fuel line connection with an absorbent shop rag. Wipe off any fuel spillage inside the bilge.



1. Outlet hose

5. Install pressure test tools between disconnected hose and fuel pump fitting (in line installation).

REQUIRED TOOLS	
PRESSURE GAUGE (P/N 529 036 395)	
FUEL HOSE ADAPTER (P/N 529 036 396)	



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

FUEL PRESSURE (WHEN PRESSING THE START BUTTON)
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.

5. Reinstall all other removed parts, refer to applicable subsections.

PROCEDURES

FUEL HOSES AND OETIKER CLAMPS

Inspecting the Fuel Hose

1. Inspect all fuel hoses for wear, kinks, cracks or any other types of damages.
2. Inspect all clamps for tightness.

Replacing the Fuel Hose

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.

Section 05 FUEL SYSTEM

Subsection 02 (FUEL TANK AND FUEL PUMP)

⚠ WARNING

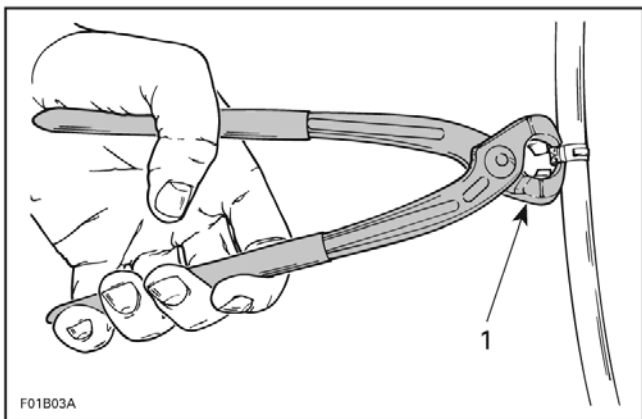
- Never use a hose pincher on high pressure hoses.
- Never change the routing of a fuel hose.
- Always reinstall the corrugated protective tubing on fuel hoses.
- Secure fuel hoses using the appropriate locking tie or fastener to prevent contact with sharp edges or hot, rotating and moving parts.
- After 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 performing a *FUEL PUMP PRESSURE TEST*.

Replacing the Oetiker Clamps

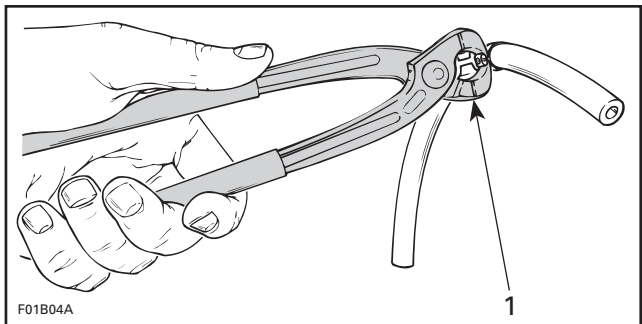
To secure or cut Oetiker clamps on fuel lines, use appropriate pliers.

REQUIRED TOOL

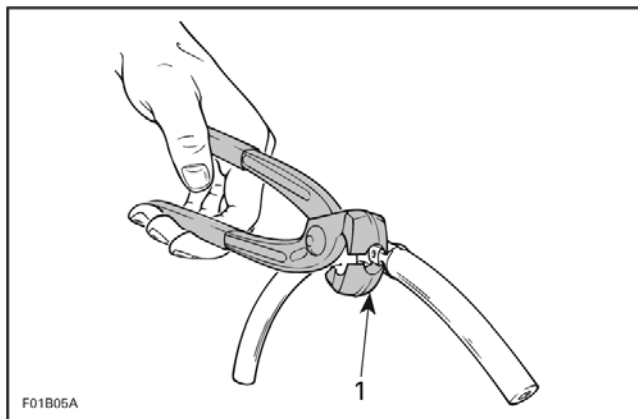
OETIKER PLIER
(P/N 295 000 070)



1. Cutting clamp



1. Securing clamp



1. Securing clamp in limited access

⚠ WARNING

Whenever removing a hose in the fuel system, always use new Oetiker clamps at assembly.

FUEL PUMP

Fuel Pump Operation Test

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, carry out the *FUEL PUMP PRESSURE TEST* as described in *INSPECTION* in this subsection.
5. If the fuel pump does not run:
 - Ensure ECM is powered. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.
 - Check fuse F2. If fuse is faulty, replace it and repeat test. If fuse is good, carry out the *FUEL PUMP INPUT VOLTAGE TEST* in this subsection.

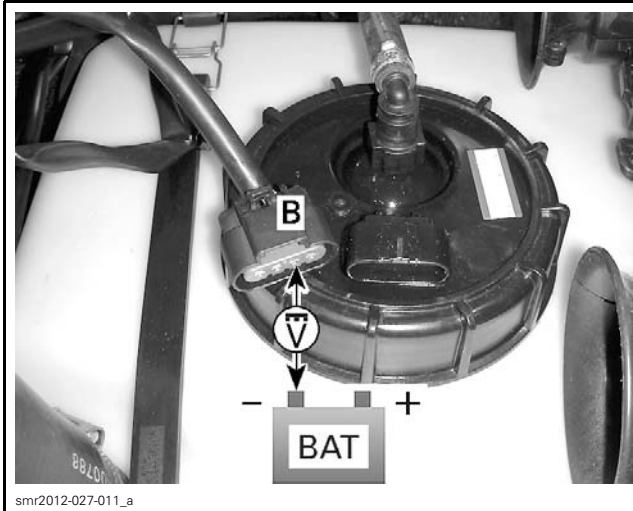
Fuel Pump Pressure Test

Refer to *INSPECTION* in this subsection.

Fuel Pump Input Voltage Test

1. Ensure the fuel pump fuse (F2) is in good condition.
2. Disconnect fuel pump harness connector. Refer to *FUEL PUMP REMOVAL* in this subsection.
3. Use multimeter and select Vdc.
4. Press the START button.
5. Read voltage at fuel pump harness connector as per following table.

FUEL PUMP INPUT VOLTAGE TEST		
TEST PROBES		VOLTAGE
Pin B (+ probe)	Battery ground (- probe)	Battery voltage



FUEL PUMP INPUT VOLTAGE TEST

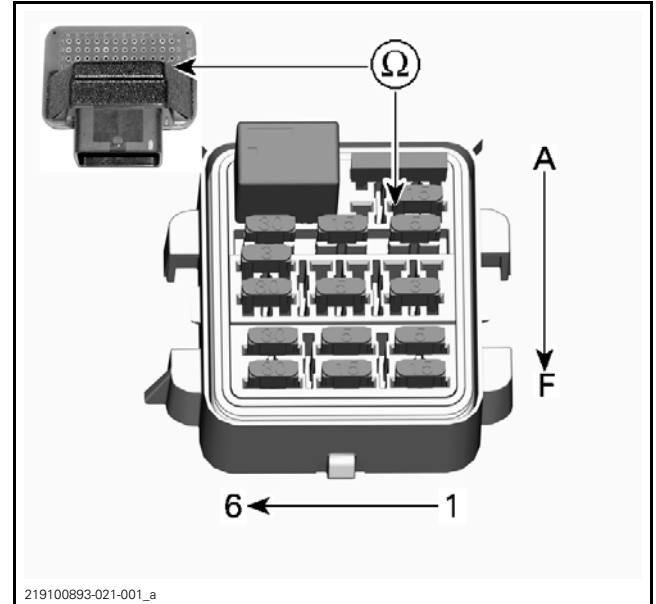
If battery voltage is read, power circuit is good. Test the fuel pump circuit. Refer to *FUEL PUMP CIRCUIT TEST* in this subsection.

If battery voltage is not read, power circuit is faulty. Test continuity of power circuit wiring between fuse box and fuel pump. Refer to *FUEL PUMP CIRCUIT TEST* in this subsection.

Fuel Pump Circuit Test

1. Reconnect the fuel pump harness connector.
2. Remove cover of fuse box.
3. Remove ECM connector "B" and install it on the ECM adapter.
4. Set multimeter to Ω and test pump circuit as per following table.

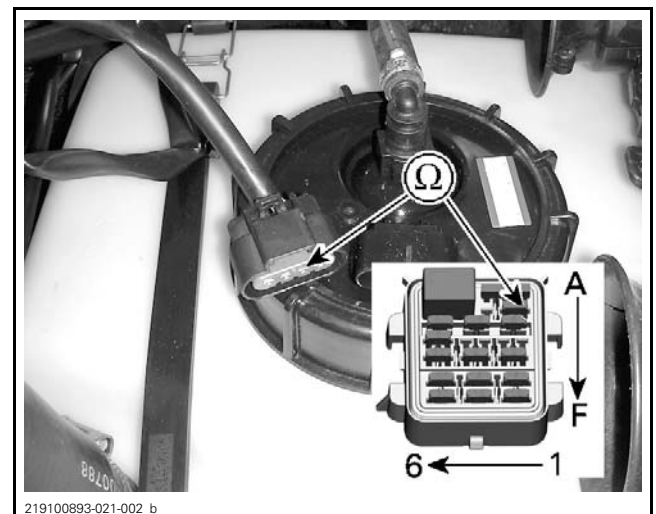
PUMP CIRCUIT TEST THROUGH FUEL PUMP		
TEST PROBES		RESISTANCE @ 20°C (68°F)
Fuse box terminal B2	ECM connector B pin B-M1	Approx. 12 Ω



5. If test succeeded, the fuel pump, its fuse and its wiring harness are good.

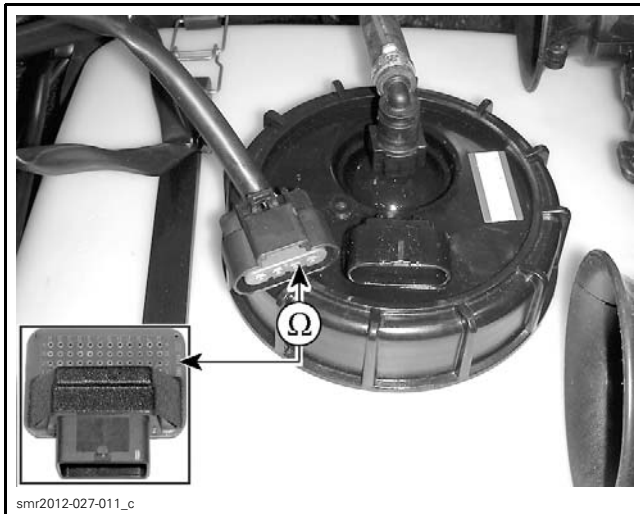
6. If test failed, test wiring continuity as per table.

FUEL PUMP HARNESS CONTINUITY TEST (WIRING ONLY)		
TEST PROBES		RESISTANCE @ 20°C (68°F)
Pump harness connector pin B	Fuse box terminal B1	Close to 0 Ω (continuity)
Pump harness connector pin A	ECM connector B pin B-M1	



Section 05 FUEL SYSTEM

Subsection 02 (FUEL TANK AND FUEL PUMP)



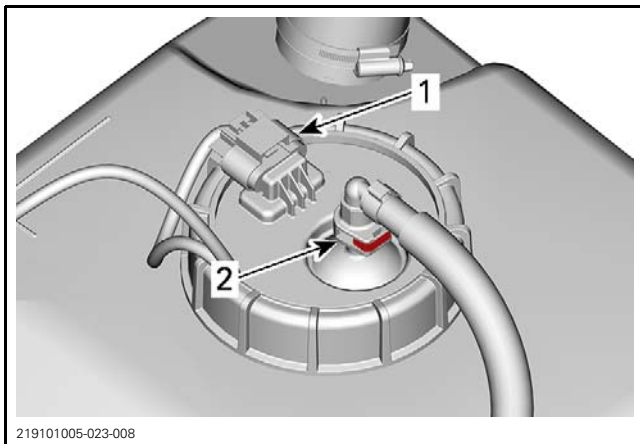
If there is an open circuit to FB-F2, repair wiring/connector between fuel pump and fuse box.

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, replace ECM. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.

Removing the Fuel Pump

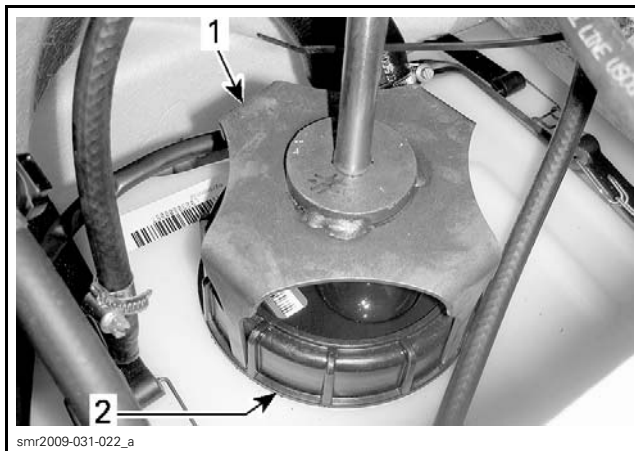
1. Disconnect the negative battery terminal, refer to *CHARGING SYSTEM* subsection.
2. Disconnect fuel pump electrical connector.
3. Wrap shop rags around the high pressure fuel hose fitting, push the red locking tab of the quick connect fitting out then push down to disconnect the hose.



1. Quick connect fitting (high pressure fuel hose)
2. Harness connector

4. Unscrew the fuel pump retaining nut using the fuel pump module socket.

NOTICE Ensure the fuel pump does not turn while unscrewing the retaining nut.



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.

5. 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.

6. Carefully pull fuel pump module out.

⚠ 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

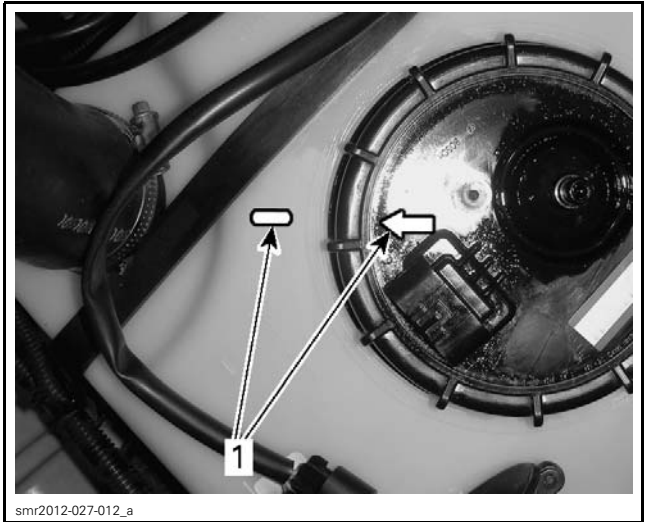
The installation is the reverse of the removal procedure. However, pay attention to the following.

1. Install a **NEW** fuel pump module gasket each time the module is reinstalled.
2. Carefully insert fuel pump module in fuel tank so as not to bend float arm.

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 to specification using the fuel pump module socket.

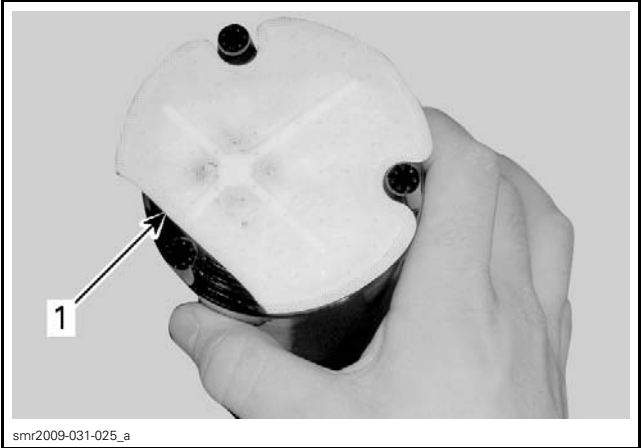
TIGHTENING TORQUE	
Fuel pump locking ring	60 N•m ± 7 N•m (44 lbf•ft ± 5 lbf•ft)

5. Refill fuel tank and ensure there are no leaks by performing a *FUEL TANK LEAK TEST* and a *FUEL SYSTEM HIGH PRESSURE LEAK TEST* as described in this subsection.

FUEL FILTER

Fuel Filter Inspection

Inspect fuel filter. If dirty, partially clogged or damaged, replace it.



1. Fuel filter

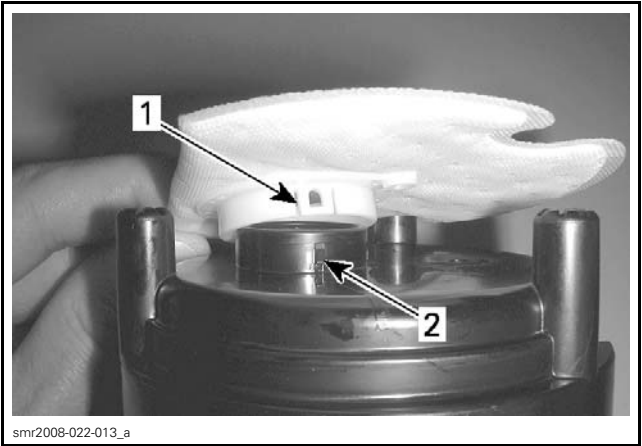
Removing the Fuel Filter

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.

NOTE: 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.

Section05 FUEL SYSTEM

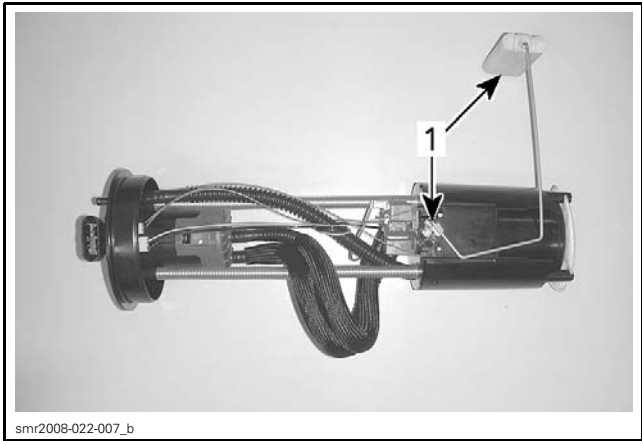
Subsection02 (FUEL TANK AND FUEL PUMP)

3. Reinstall fuel pump as per procedure in this subsection.
4. Carry out a *FUEL SYSTEM HIGH PRESSURE LEAK TEST* as described in this 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.

Fuel Level Troubleshooting

FUEL LEVEL TROUBLESHOOTING	
SYMPTOM	POSSIBLE CAUSE
Fuel gauge always display EMPTY	<div><div>– Wiring/connectors</div><div>– Fuel level sensor</div><div>– Float stuck in low position</div></div>
Fuel gauge always display FULL	<div><div>– Water in fuel pump connector</div><div>– Float stuck in full position</div></div>
Fuel level sensor fault code	<div><div>– Wiring/connectors</div><div>– Fuel level sensor</div></div>
Fuel gauge displays wrong level	<div><div>– Low battery voltage</div><div>– Fuel level sensor fault</div></div>

Connect vehicle to BRP diagnostic software (BUDS2). Refer to *DIAGNOSTIC AND FAULT CODES* subsection.

Fuel Level Sensor Voltage Test

1. Ensure battery is fully charged.
2. Disconnect the steering connector (HIC1). Refer to *WIRING HARNESS AND CONNECTORS* subsection.
3. Connect the diagnostic harness to make an in-line connection between the disconnected connectors.

REQUIRED TOOL	
DIAGNOSTIC HARNESS (P/N 529 036 384)	

4. Briefly press the START button to wake up the ECM.
5. Install the tether cord on the engine cut-off switch.
6. Use the multimeter and select Vdc.
7. Measure the voltage at the test connector of the diagnostic harness as follows.

FUEL LEVEL SENSOR VOLTAGE TEST		
FUEL TANK LEVEL	TEST CONNECTOR OF DIAGNOSTIC HARNESS	VOLTAGE
Full	Pins 12 and 19	0.14 Vdc
Empty		2.7 Vdc

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, replace fuel level sensor.

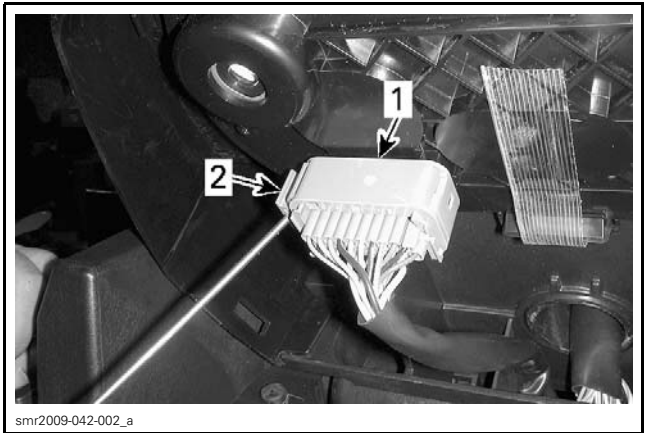
If voltage is out of specifications, carry out the *FUEL LEVEL SENSOR RESISTANCE TEST AT INFORMATION CENTER* as described in this subsection.

Remove diagnostic harness and reconnect connector.

Fuel Level Sensor Resistance Test at Information Center

1. Disconnect information center (digital display) connector. Refer to *INFORMATION CENTER* subsection.

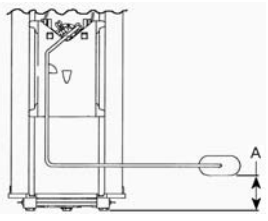

NOTICE Pull connector lock out. Do not twist the screwdriver.



1. Gauge connector
2. Pull out to unlock connector

2. Use the multimeter 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 (MM)
4.8 ± 2.2	268.9 ± 3.0 (FULL)
17.8 ± 2.2	240.6 ± 3.0
27.8 ± 2.2	219.1 ± 3.0
37.8 ± 2.2	193.8 ± 3.0
47.8 ± 2.2	161.9 ± 3.0 (HALF)
57.8 ± 2.2	128.3 ± 3.0
67.8 ± 2.2	94.1 ± 3.0
77.8 ± 2.2	60.6 ± 3.0
89.8 ± 2.2	28.8 ± 3.0 (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, perform the *FUEL LEVEL SENSOR RESISTANCE TEST AT FUEL PUMP*.

If an open circuit is measured, carry out a continuity test of the wiring from the information center to the 20-pin steering connector, and from the 20-pin steering connector to the fuel pump module connector. Refer to *WIRING DIAGRAM*.

If the wiring is good, carry out a *FUEL LEVEL SENSOR RESISTANCE TEST AT FUEL PUMP*.

4. Reconnect information center (digital display) connector.

Fuel Level Sensor Resistance Test 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 *FUEL LEVEL SENSOR RESISTANCE TEST AT INFORMATION CENTER*.

Section 05 FUEL SYSTEM

Subsection 02 (FUEL TANK AND FUEL PUMP)

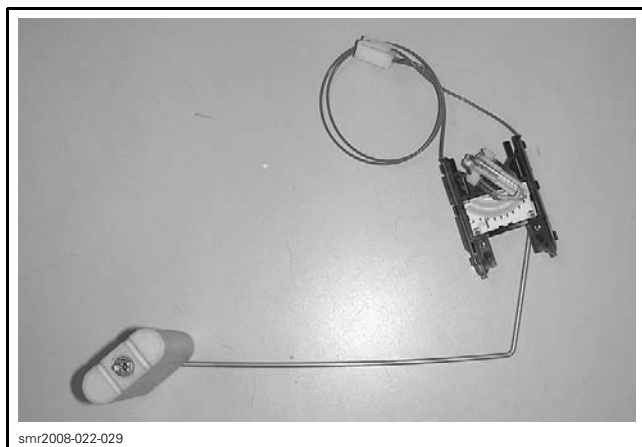


FUEL LEVEL SENSOR RESISTANCE TEST

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.

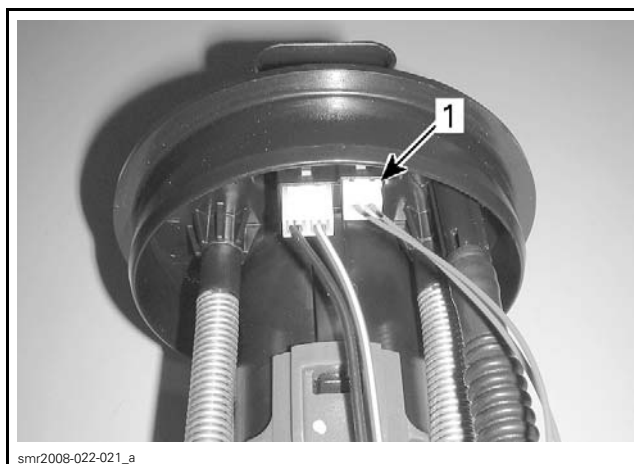
WARNING

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.

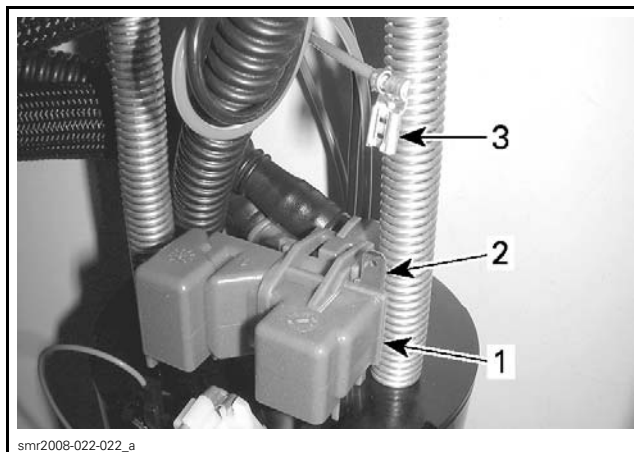
NOTE: Note routing of fuel level sensor wires prior to disconnecting the sensor from the fuel pump module flange.

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.

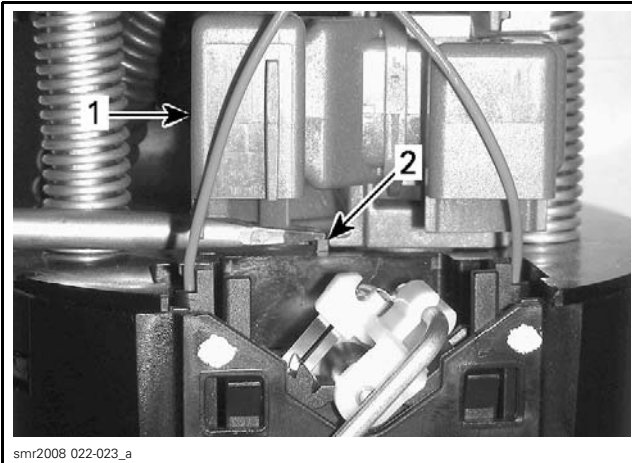


1. Pressure regulator
2. Ground wire contact on pressure regulator
3. Ground wire disconnected

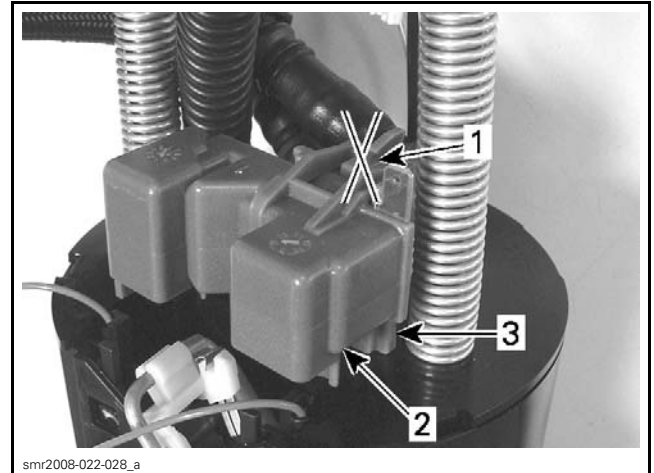
5. Using a flat screwdriver, press down on the locking tab just below the pressure regulator to release it from the pump reservoir cover, and rotate it clockwise simultaneously so that it slips over the locking tab.

Section 05 FUEL SYSTEM

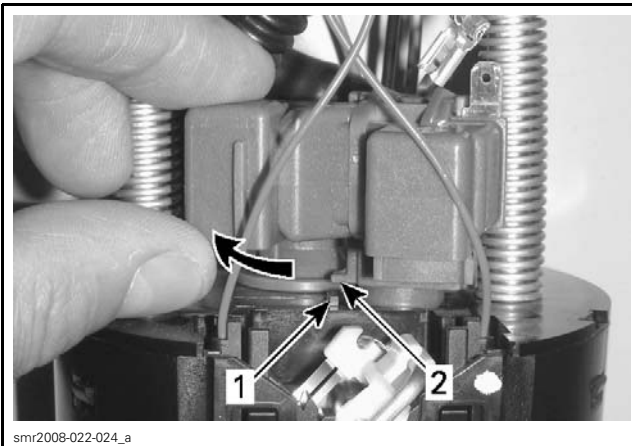
Subsection 02 (FUEL TANK AND FUEL PUMP)



1. Pressure regulator
2. Pressure regulator locking tab

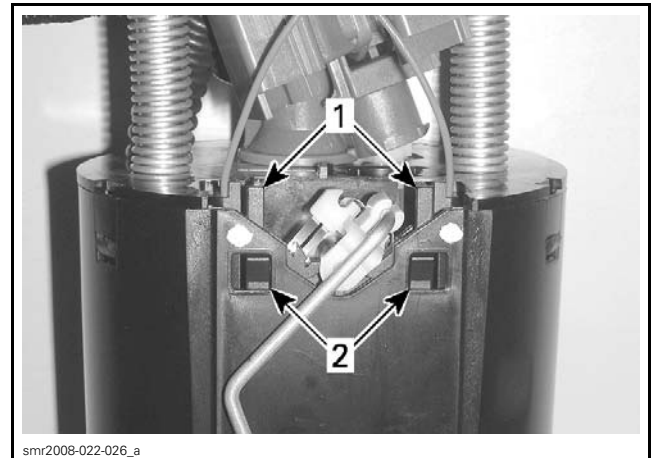


1. Do not remove pressure regulator cover at locking tabs
2. Pressure regulator cover
3. Pressure regulator housing

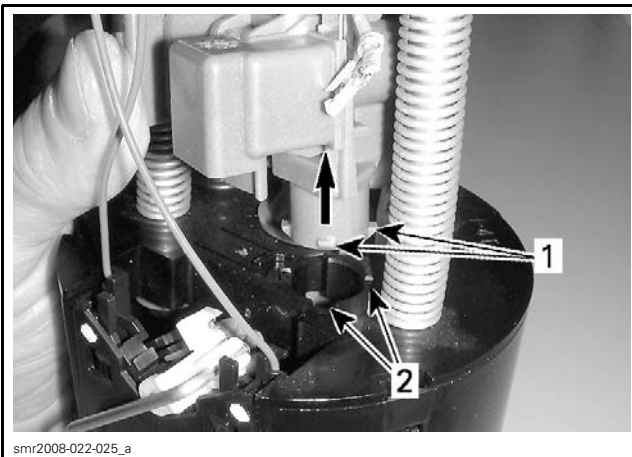


1. Pressure regulator locking tab
2. Pressure regulator rotated clockwise over locking tab

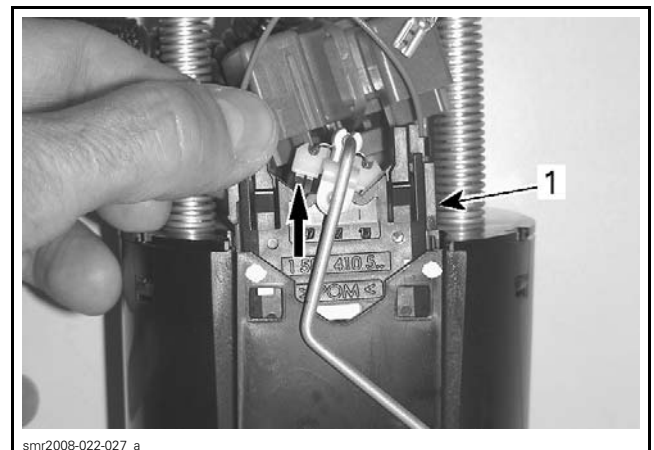
6. Once the pressure regulator is rotated over the locking tab, pull up on it to remove it from the pump reservoir cover.



1. Fuel level sensor release tabs
2. Locking pins



1. Pressure regulator alignment tabs
2. Fuel pump reservoir alignment tabs



1. Pull up on fuel level sensor

NOTE: The pressure regulator cover must not be removed from the pressure regulator housing assembly.

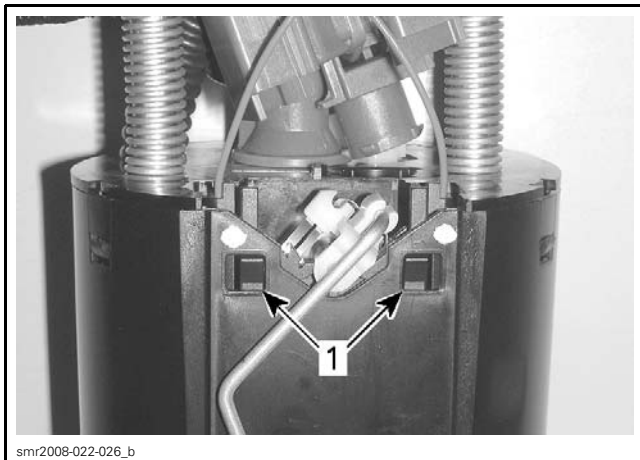
Section 05 FUEL SYSTEM

Subsection 02 (FUEL TANK AND FUEL PUMP)

Installing the Fuel Level Sensor

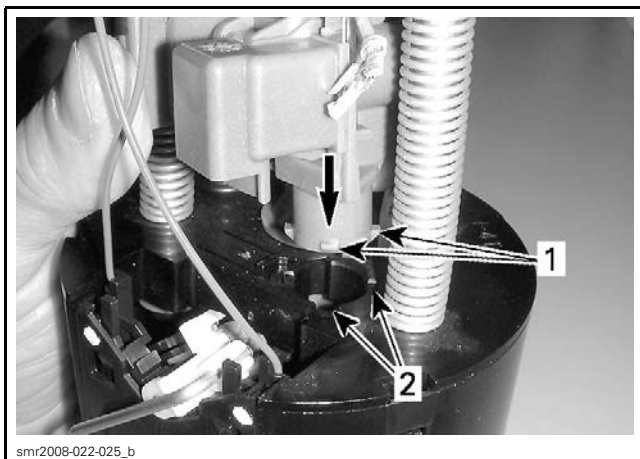
Installation is the reverse of the removal procedure however, pay attention to the following.

1. Ensure fuel level sensor locking pins are properly engaged into the fuel pump reservoir.



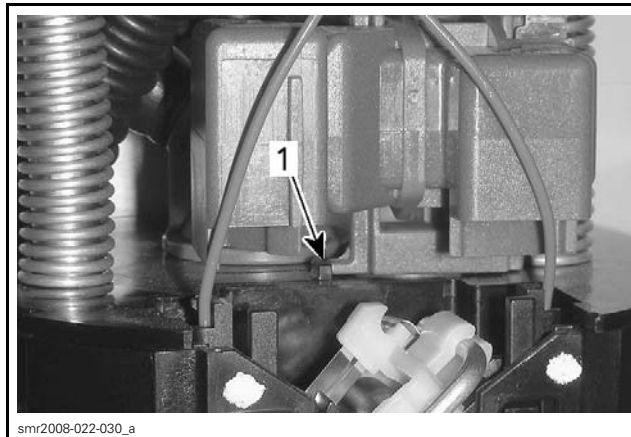
1. Ensure engagement of sensor locking pins

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

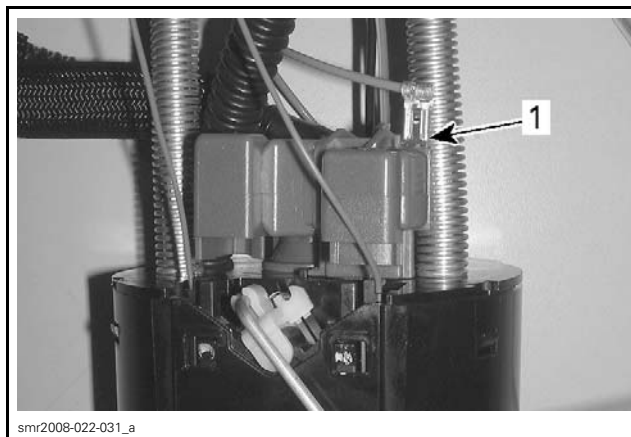
1. Pressure regulator alignment tabs
2. Fuel pump reservoir alignment tabs



TAB UP WHEN PRESSURE REGULATOR PROPERLY LOCKED

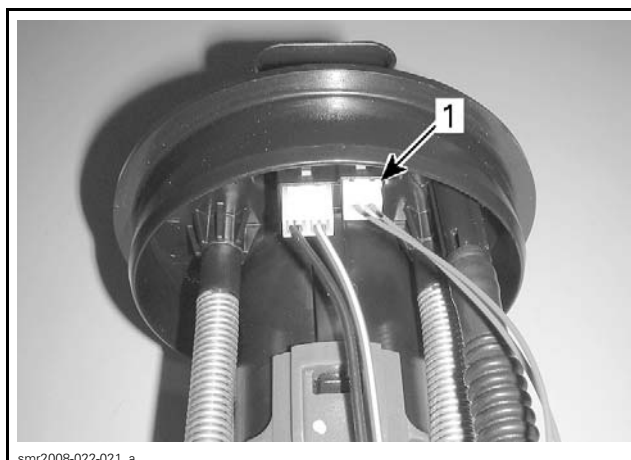
1. Pressure regulator locking tab

3. Reconnect the ground wire onto the pressure regulator.



1. Pressure regulator ground wire installed

4. Ensure fuel level sensor connector is locked into the module flange connector.



1. Fuel level sensor connector

5. Carry out a **FUEL LEVEL SENSOR RESISTANCE TEST** as described in this subsection.

6. Reinstall the fuel pump module. Refer to *FUEL PUMP INSTALLATION* in this subsection.

FUEL TANK

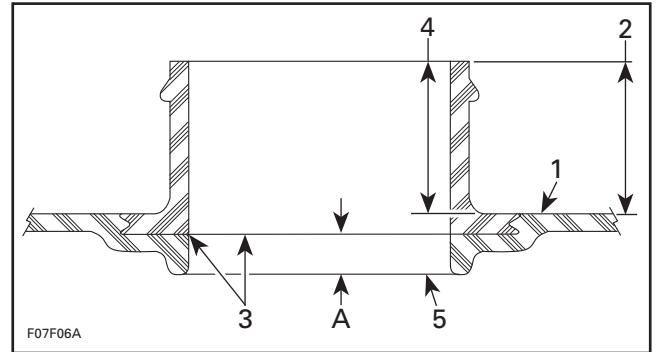
Draining the Fuel Tank

Remove fuel tank cap and siphon gas into an approved fuel container.

Fuel Tank Inspection

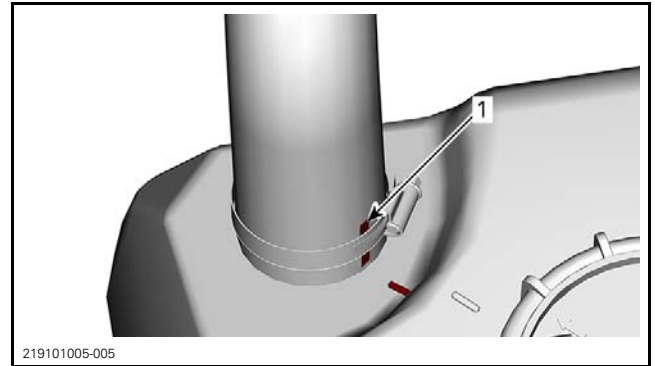
1. Drain fuel tank. Refer to *DRAINING THE FUEL TANK* above in this subsection.
2. Inspect fuel tank retaining straps for wear, cracks or any other damages. Inspect strap clip anchors and bolts.
3. Inspect fuel tank for wear caused by any abnormal contact or rubbing with other component(s).
4. Disconnect fuel filler hose from fuel tank.
5. Inspect fuel tank filler hose for wear, cracks or other damages.
6. Visually inspect the inside and outside of the fuel tank filler necks for crack(s). If crack(s) are found, replace fuel tank.
7. With your fingers, feel the inside and outside surfaces of fuel tank, especially near the filler neck.
8. Flex fuel tank neck to ensure there are no hidden cracks.

NOTE: The 60 liters 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)

9. Install filler hose and tighten the retaining clamps.



INDEXING WITH FUEL TANK

1. Align mark with the writing on hose

TIGHTENING TORQUE	
Filler hose retaining clamps	3.5 N•m ± 0.5 N•m (31 lbf•in ± 4 lbf•in)

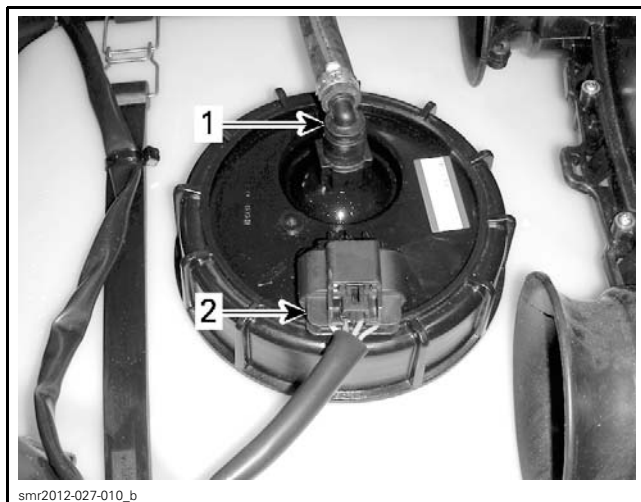
10. Reinstall all other removed parts. Refer to appropriate subsection.

Removing the Fuel Tank

1. Remove engine. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
2. Remove the air intake silencer. Refer to *AIR INTAKE SYSTEM* subsection.
3. Drain fuel tank. Refer to *DRAINING THE FUEL TANK* above in this subsection.
4. Disconnect fuel pump connections.

Section 05 FUEL SYSTEM

Subsection 02 (FUEL TANK AND FUEL PUMP)

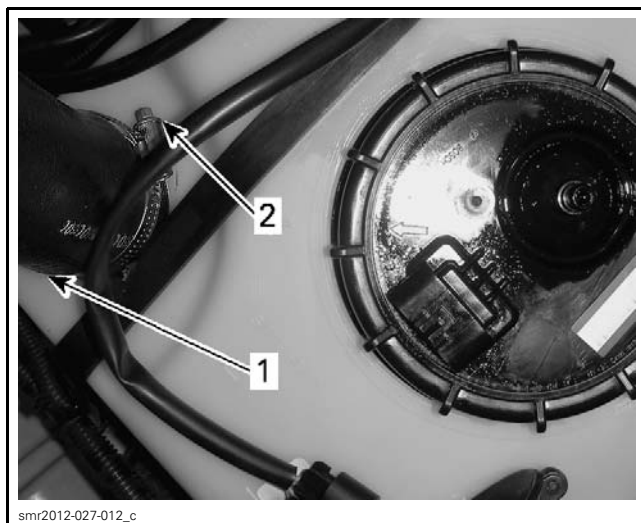


TYPICAL

1. Quick connect fitting (high pressure fuel hose)
2. Harness connector

5. Disconnect filler hose from fuel tank.

NOTE: Removing the hood and then removing retaining screws of the filler neck may help to disconnect hose from fuel tank.



1. Filler hose
2. Retaining clamp

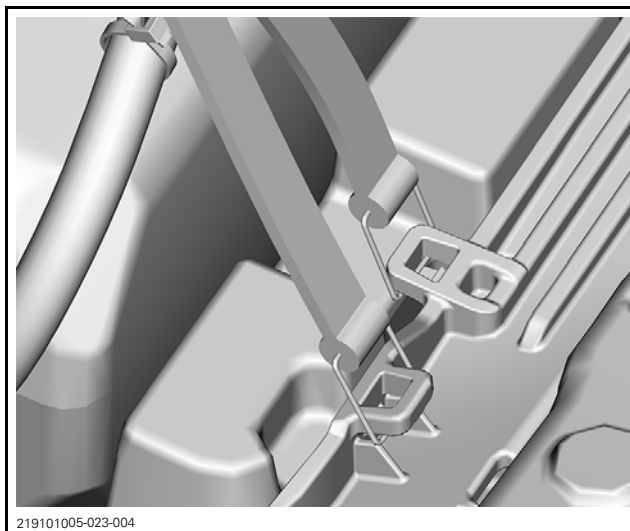
NOTE: Take note of wiring harness, hose and cable routing for proper reinstallation. Also note method used for securing with locking ties.

6. Detach fuel tank retaining straps.
7. Remove fuel tank from the vehicle.
8. Remove fuel pump as necessary. Refer to *FUEL PUMP* in this subsection.
9. Inspect hull and flotation foams for wear.

Installation the Fuel Tank

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

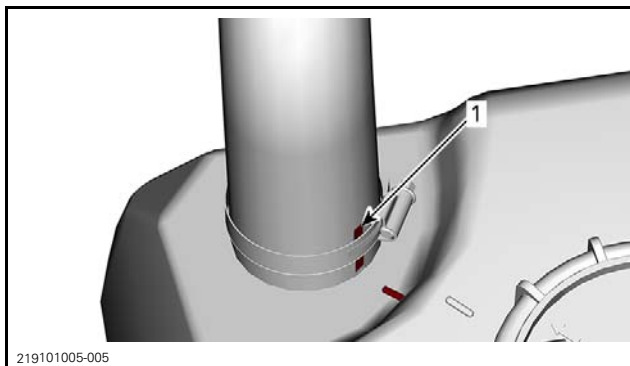
1. Reinstall fuel pump if it was removed. Refer to *FUEL PUMP* in this subsection.
2. Ensure flotation foams are properly positioned under fuel tank.
3. Insert fuel tank in hull.
4. Place fuel tank retaining strap ends in anchoring clips. Temporarily use tape to hold straps on the top of fuel tank.



TYPICAL

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.

NOTE: Reinstall retaining screws and hood. Tighten to specification.



INDEXING WITH FUEL TANK

1. Align mark with the writing on hose

TIGHTENING TORQUE	
Filler hose retaining clamps	3.5 N•m ± .5 N•m (31 lbf•in ± 4 lbf•in)
Retaining screw	5.5 N•m ± .5 N•m (49 lbf•in ± 4 lbf•in)

8. Reinstall all other removed parts. Refer to their subsections.
9. When vehicle reassembly is complete, carry out a *FUEL TANK LEAK TEST* and a *FUEL SYSTEM HIGH PRESSURE LEAK TEST* as described in this subsection.

POWER DISTRIBUTION AND GROUNDS

GENERAL

OVERVIEW

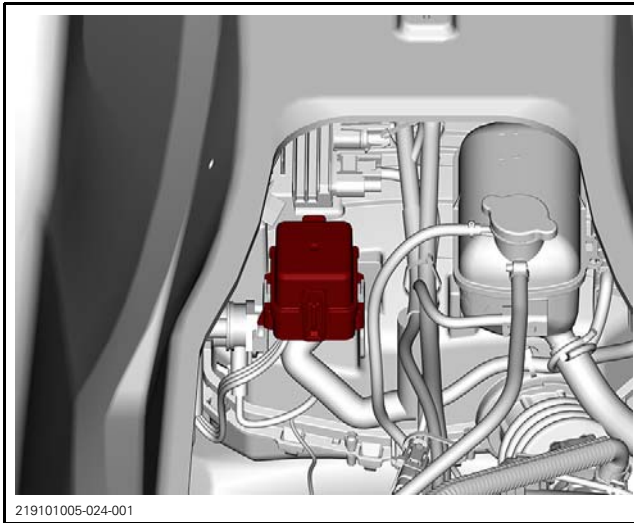
The battery is the primary source of power for the electrical system, it is recharged by the magneto.

Some components are permanently connected to the battery (unswitched) while some require a relay or switch to be closed (switched).

At high RPM if the magneto power is greater than the loads, the rectifier/regulator will regulate power as necessary.

The system uses an external voltage regulator/rectifier.

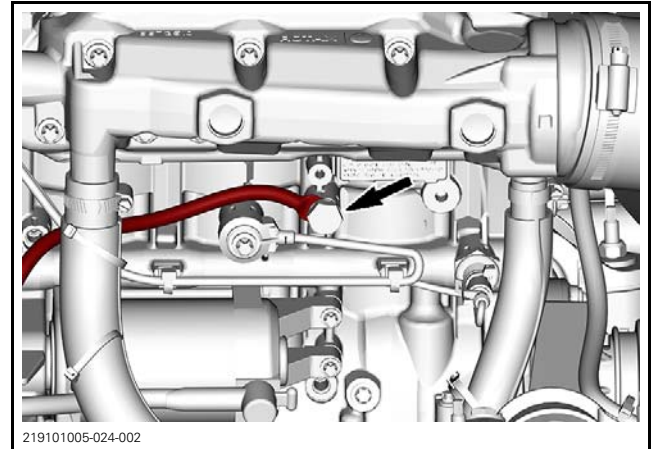
FUSE BOX (FB)



GROUND LOCATIONS

900 ACE Engine

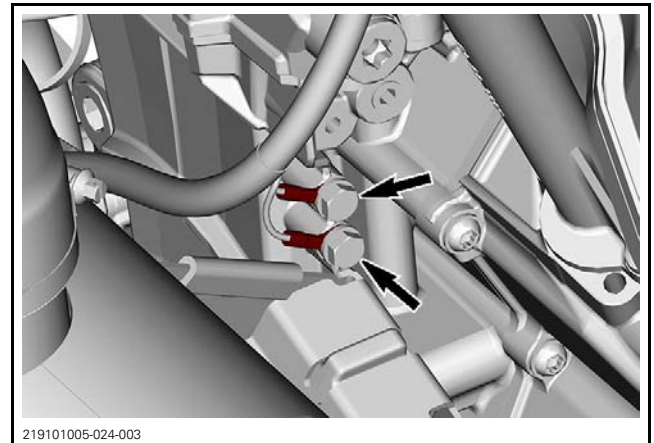
The battery ground is located under the exhaust manifold.



BATTERY GROUND

TIGHTENING TORQUE	
Battery ground terminal	23.5 N•m ± 1.5 N•m (17 lbf•ft ± 1 lbf•ft)

Electrical components grounds are located on rear of engine.



ELECTRICAL COMPONENTS GROUNDS

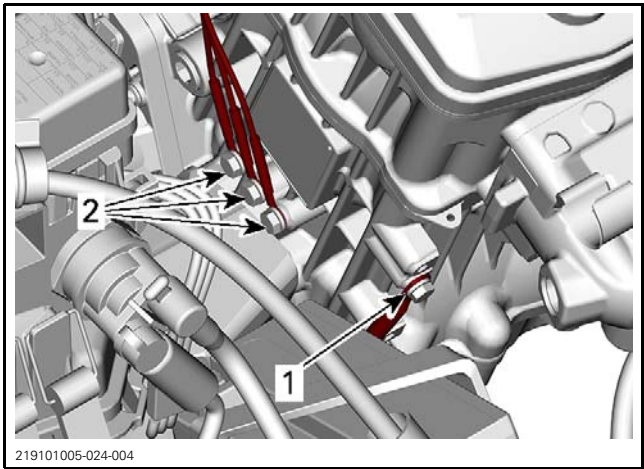
TIGHTENING TORQUE	
Electrical components ground terminals	10 N•m ± 2 N•m (89 lbf•in ± 18 lbf•in)

1630 ACE Engine

Battery and electrical components grounds are located on front of engine.

Section06 ELECTRICAL SYSTEM

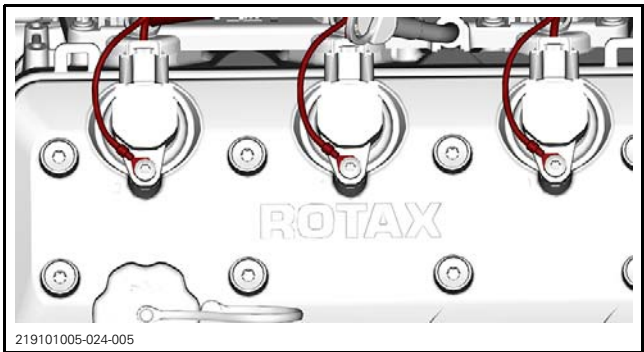
Subsection 01 (POWER DISTRIBUTION AND GROUNDS)



- 1. Battery ground
- 2. Electrical components grounds

TIGHTENING TORQUE	
Ground terminals	10 N•m ± 2 N•m (89 lbf•in ± 18 lbf•in)

Coil grounds are located on top of engine.



COIL GROUNDS

WIRING HARNESS AND CONNECTORS

SERVICE TOOLS

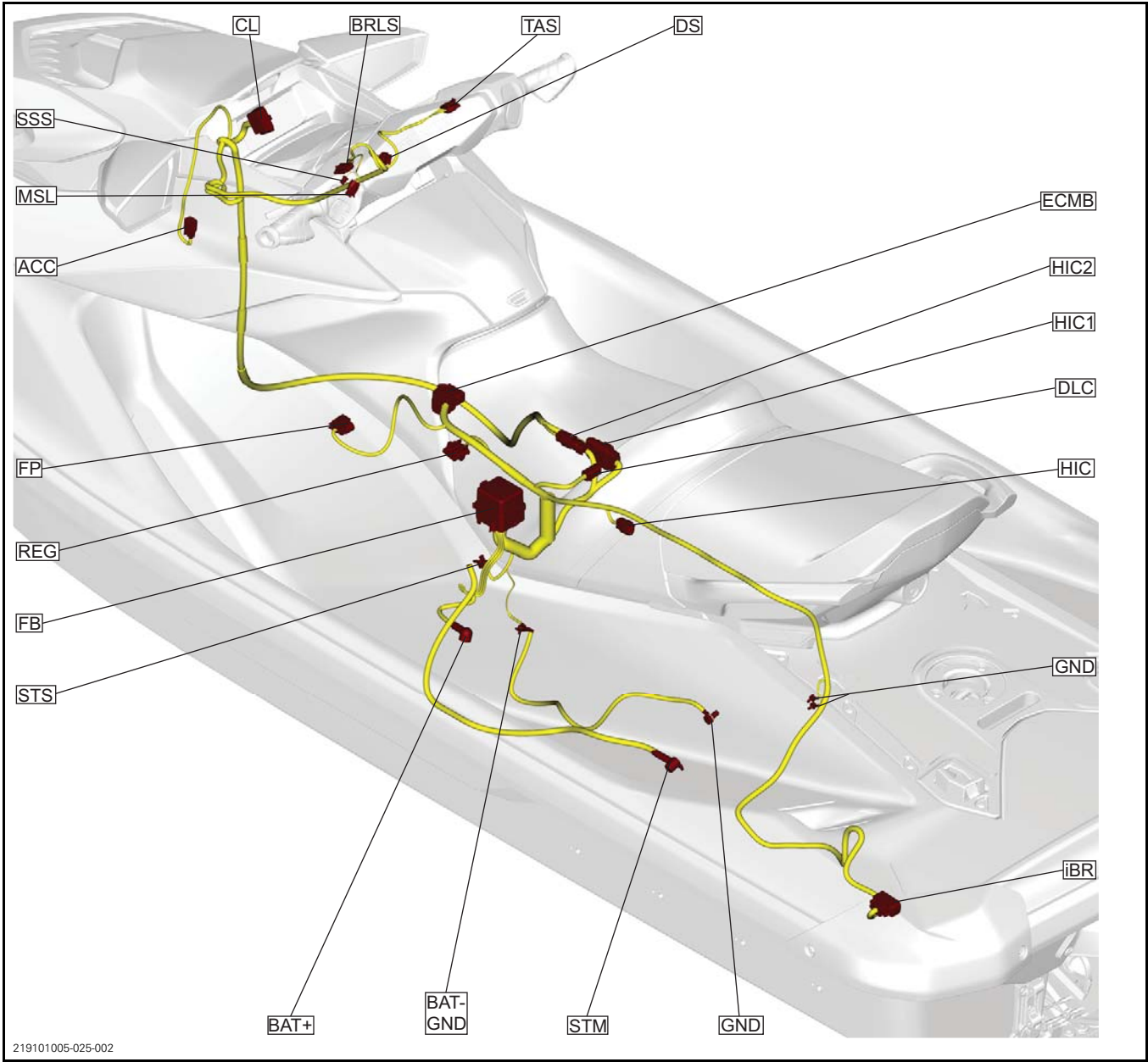
Description	Part Number	Page
DIAGNOSTIC HARNESS	529 036 384	152
ECM ADAPTER TOOL.....	529 036 166	150
ECM TERMINAL REMOVER 2.25.....	529 036 175	150
ECM TERMINAL REMOVER 3.36.....	529 036 174	150

SERVICE TOOLS – OTHER SUPPLIER

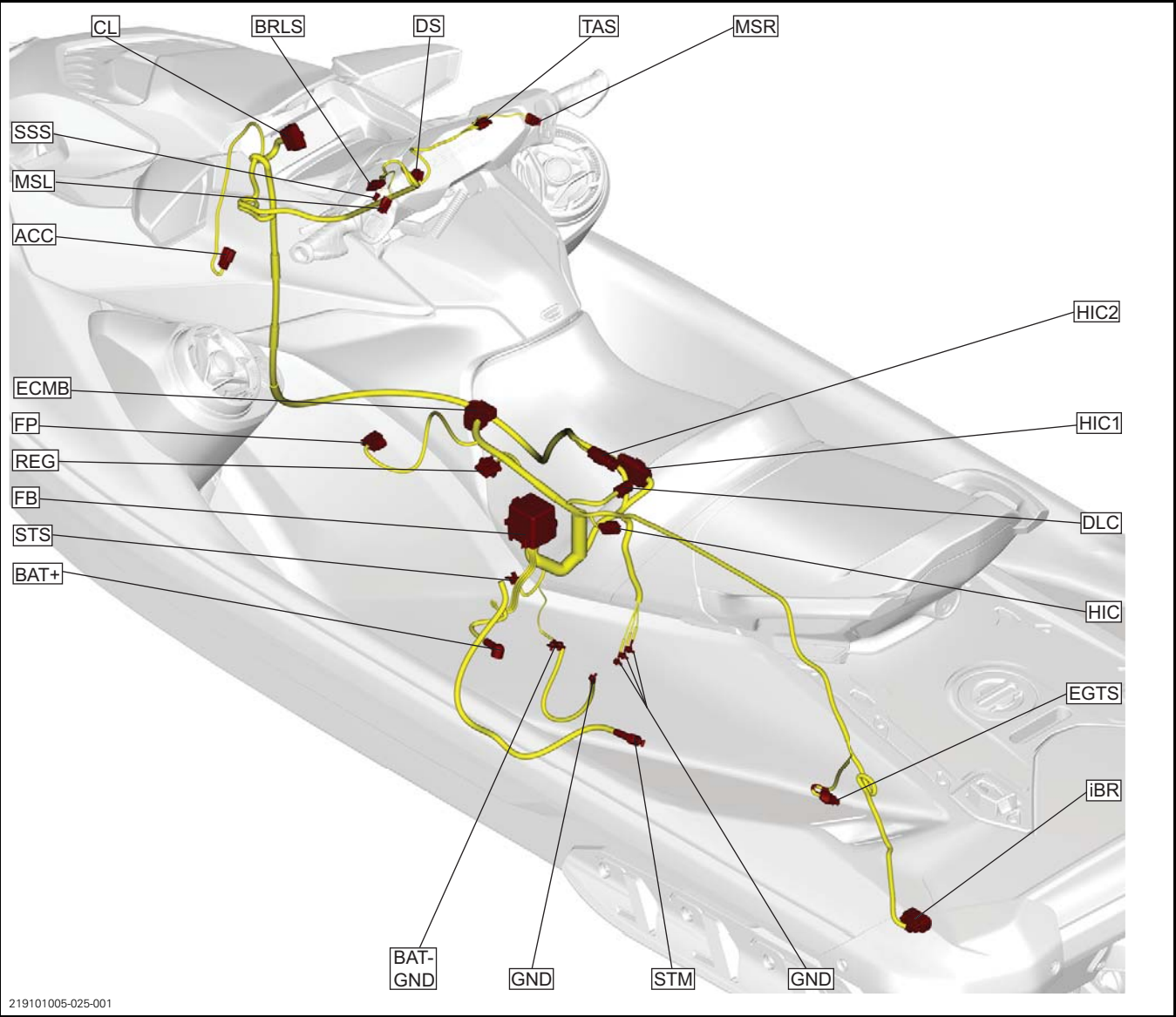
Description	Part Number	Page
DELPHI TERMINAL EXTRACTOR	12094429	151
FCI TERMINAL EXTRACTOR TOOL	54241678	153
GM TERMINAL EXTRACTOR.....	12094430	154
MOLEX 150 TERMINAL EXTRACTOR TOOL	63813 - 1500	153

Section 06 ELECTRICAL SYSTEM
Subsection 02 (WIRING HARNESS AND CONNECTORS)

900 ACE Engines

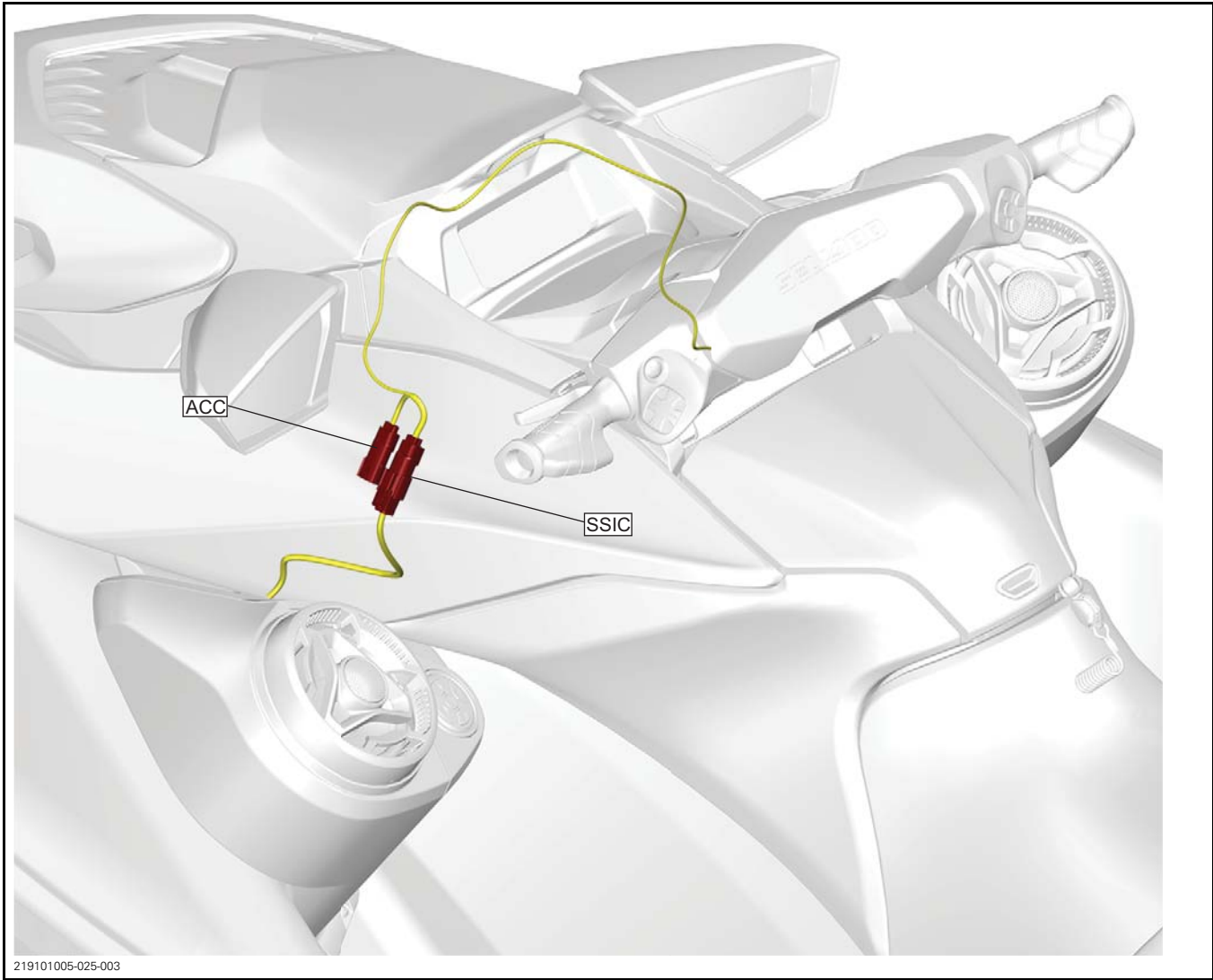


1630 ACE Engines

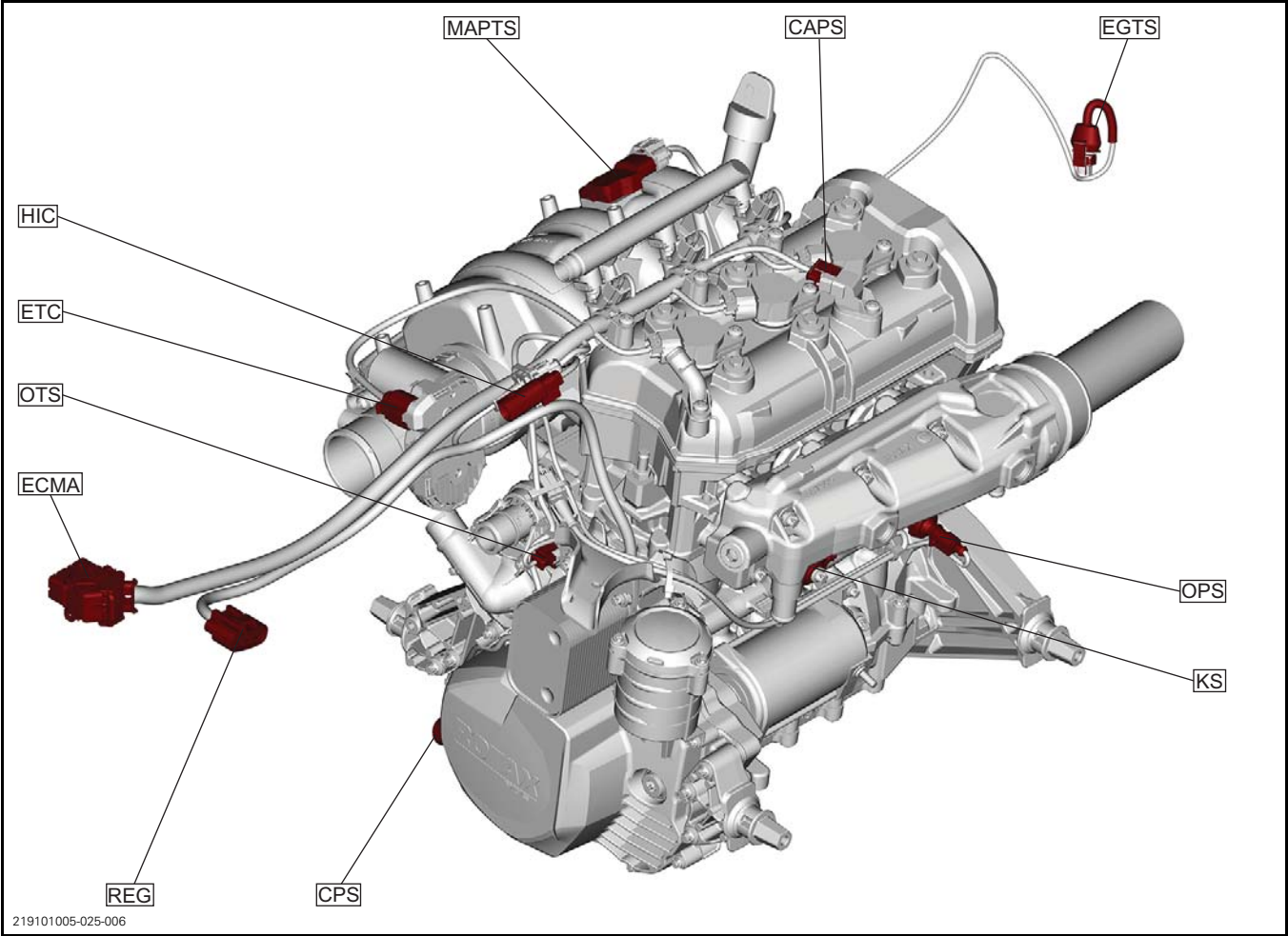


Section 06 ELECTRICAL SYSTEM
Subsection 02 (WIRING HARNESS AND CONNECTORS)

Sound System Option

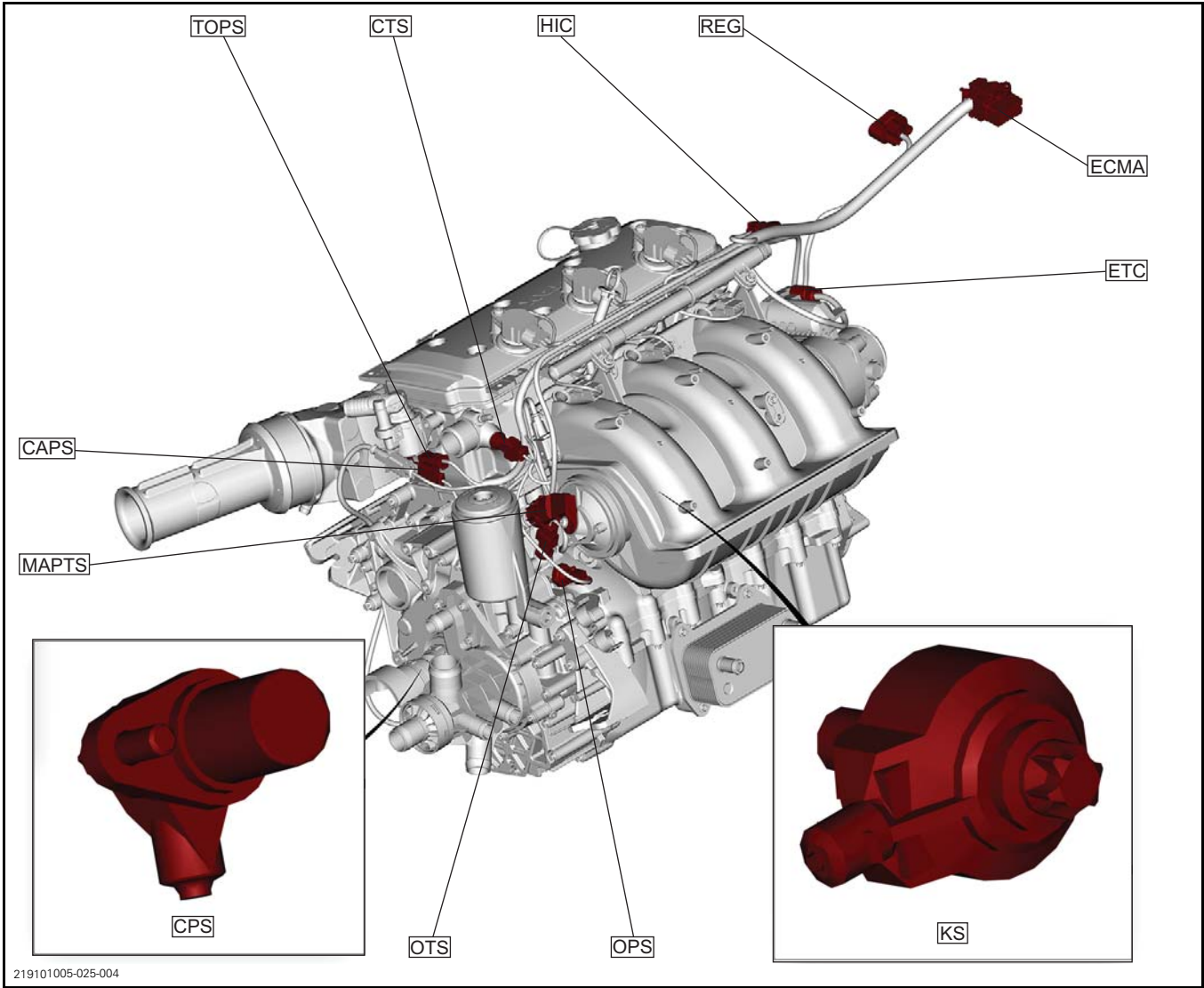


900 ACE engines



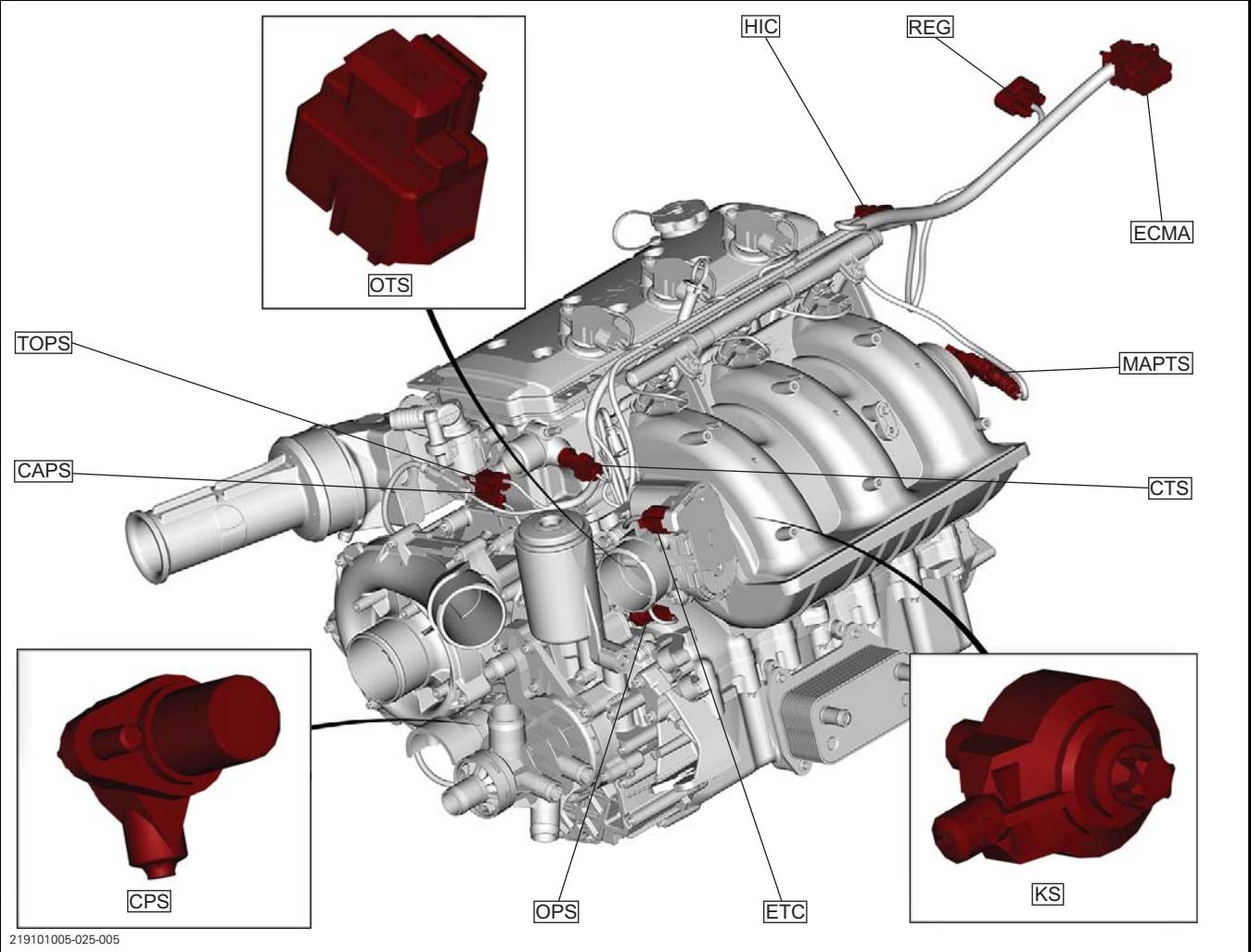
Section 06 ELECTRICAL SYSTEM
Subsection 02 (WIRING HARNESS AND CONNECTORS)

1630 ACE - 130 and 170 engines



219101005-025-004

1630 ACE - 230 engines



Section 06 ELECTRICAL SYSTEM

Subsection 02 (WIRING HARNESS AND CONNECTORS)

GENERAL

ACRONYM	DESCRIPTION	ACRONYM	DESCRIPTION
ACC	Accessories	HIC	Harness Inter Connector to Engine
BAT+	Battery +	HIC1	Harness Inter Connector to Steering 1
BAT-	Battery -	HIC2	Harness Inter Connector to Steering 2
BRLS	Brake and Reverse Lever Sensor	iBR	Intelligent Braking and Reverse
CAPS	Camshaft Position Sensor	KS	Knock Sensor
CL	Cluster	MAPTS	Manifold Air Pressure And Temperature Sensors
CPS	Crankshaft Position Sensor	MSL	Multi Function Switch Left
CTS	Coolant Temperature Sensor	MSR	Multi Function Switch Right
DLC	Data Link Connector	OPS	Oil Pressure Sensor
DS	DESS post	OTS	Oil Temperature Sensor
ECMA	ECM connector A	REG	Voltage Regulator/Rectifier connector
ECMB	ECM connector B	SSIC	Sound System Inter Connector
EGTS	Exhaust Gas Temperature Sensor	SSS	Start/Stop Switch
ETC	Electronic Throttle Control	STM	Starter Motor
FB	Fusebox	STS	Starter Solenoid
FP	Fuel Pump	TAS	Throttle Accelerator Sensor
GND	Ground	TOPS	Tip Over Position Sensor

NOTE: Multi Function Switch Right (MSR) only available on applicable models.

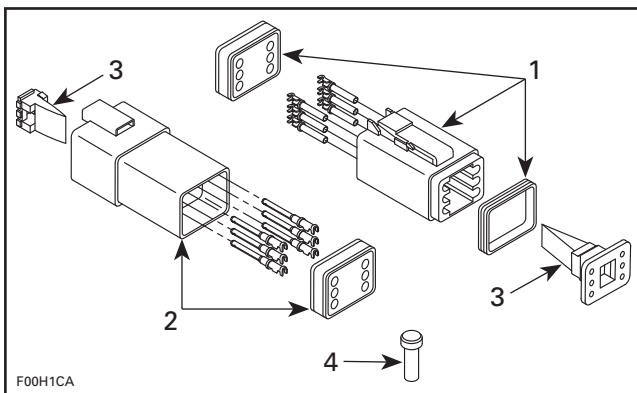
PROCEDURES

⚠ 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.

DATA LINK CONNECTOR (DEUTSCH)

Disassembling and reassembling the Connector



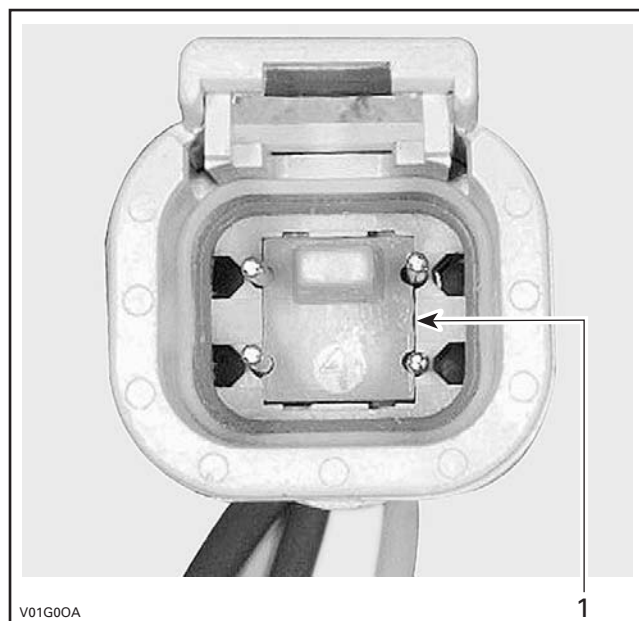
TYPICAL - DEUTSCH CONNECTOR

1. Male connector
2. Female connector
3. Secondary lock
4. Sealing cap

NOTICE Do not apply dielectric grease on terminal inside connector.

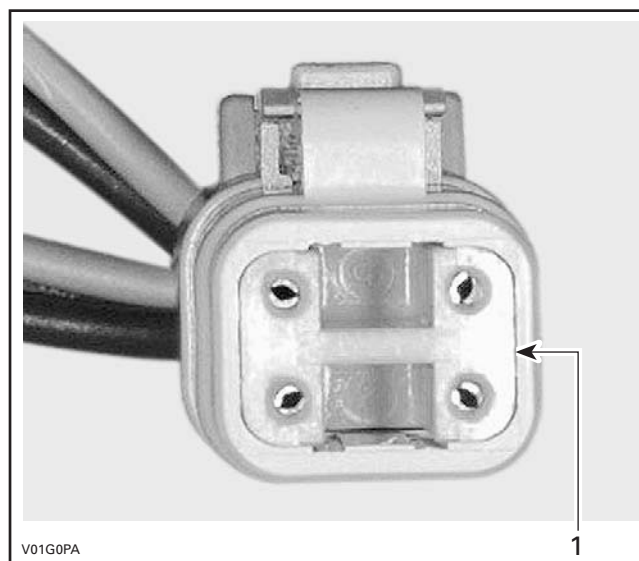
To remove terminals from connector, proceed as follows:

1. Using long nose pliers, pull out the plastic lock from between the terminals.



TYPICAL - FEMALE CONNECTOR

1. Female lock



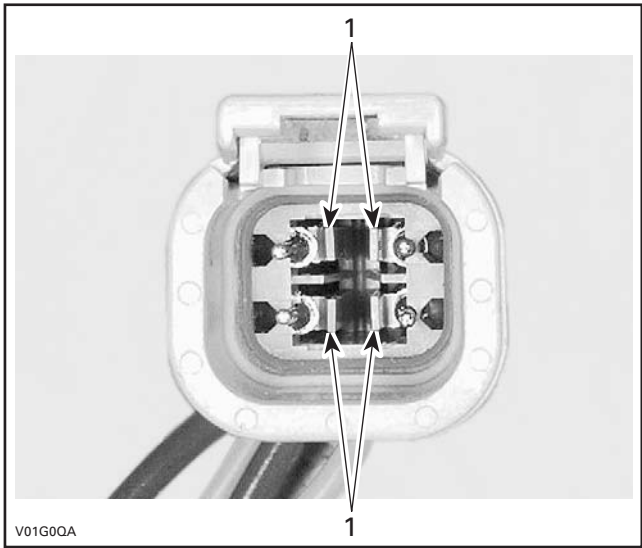
TYPICAL - MALE CONNECTOR

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.

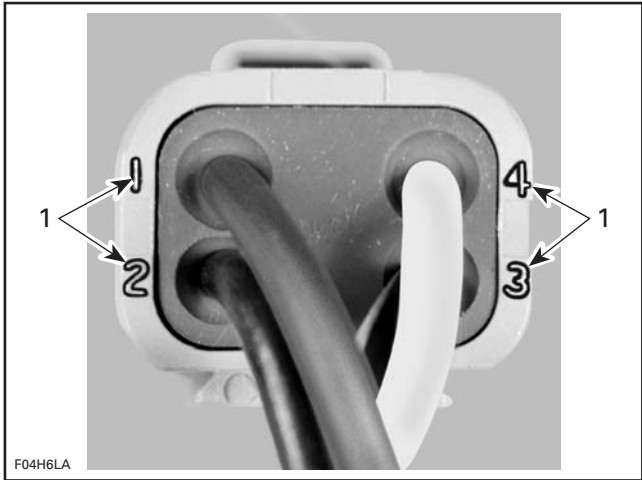
Section 06 ELECTRICAL SYSTEM
Subsection 02 (WIRING HARNESS AND CONNECTORS)



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.



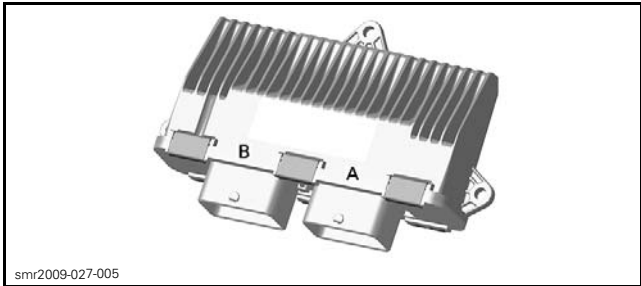
TYPICAL - CONNECTOR PIN-OUT
1. Terminal position identification numbers

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".

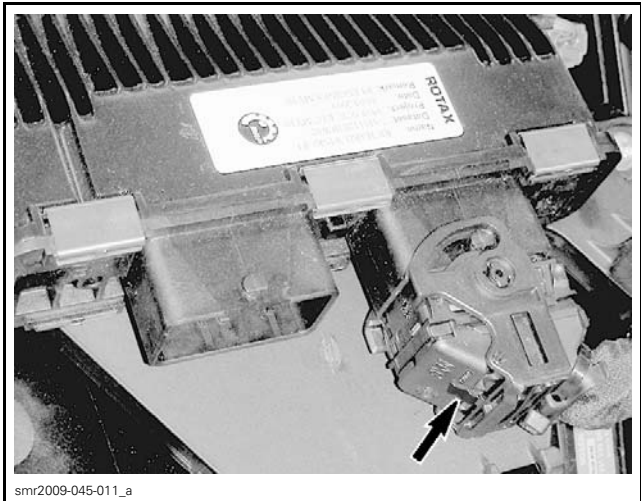
Each ECM connector has 48 pins however, connectors "A" and "B" are not interchangeable due to their specific keyways.



ECM CONNECTORS

Removing Connector

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.

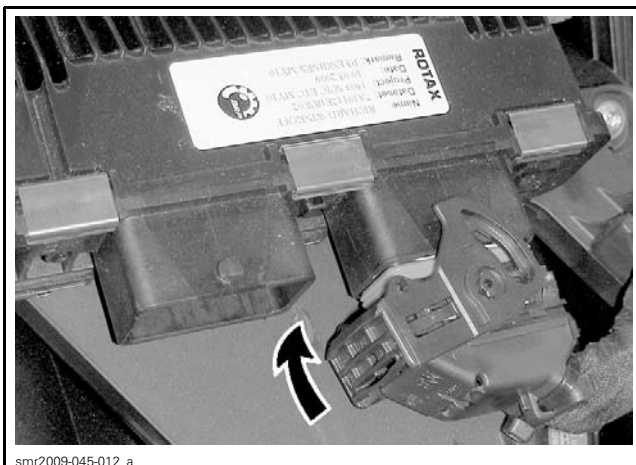


LOCKING TAB TO PRESS AND HOLD

3. As you hold the locking tab, rotate the connector locking cam until it stops.

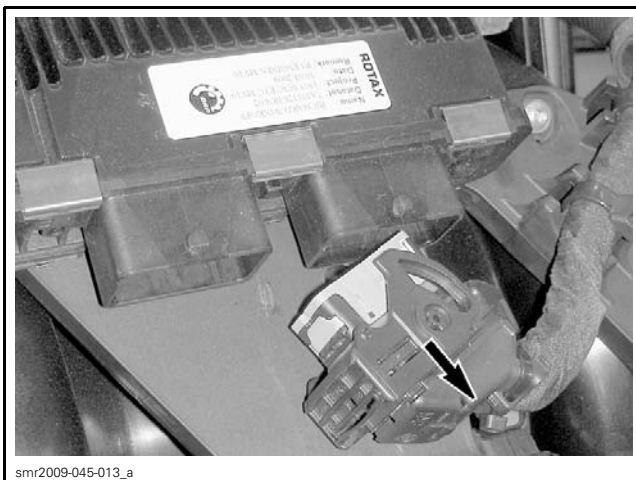
Section 06 ELECTRICAL SYSTEM

Subsection 02 (WIRING HARNESS AND CONNECTORS)



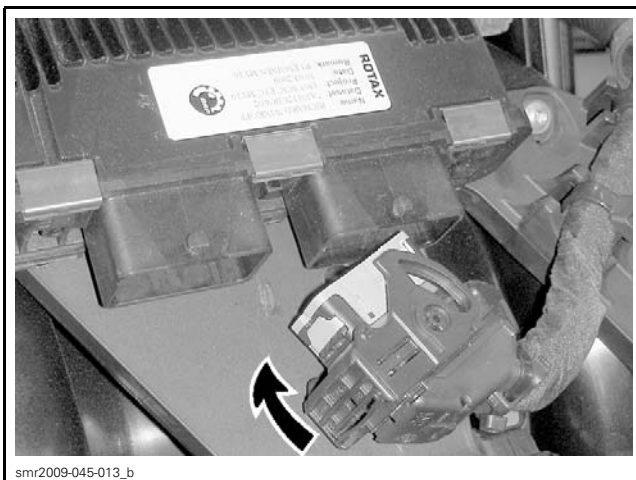
CONNECTOR LOCKING CAM ROTATION TO RELEASE

4. Pull connector off ECM.



Installing the Connector

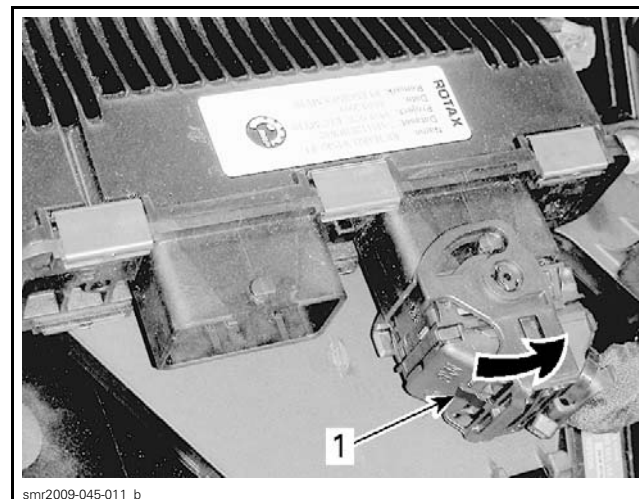
1. Fully open connector locking cam.



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

Inspecting the Connector

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.

Section06 ELECTRICAL SYSTEM


Subsection02 (WIRING HARNESS AND CONNECTORS)

NOTE: A “defective ECM module” could possibly be repaired simply by disconnecting and reconnecting it.

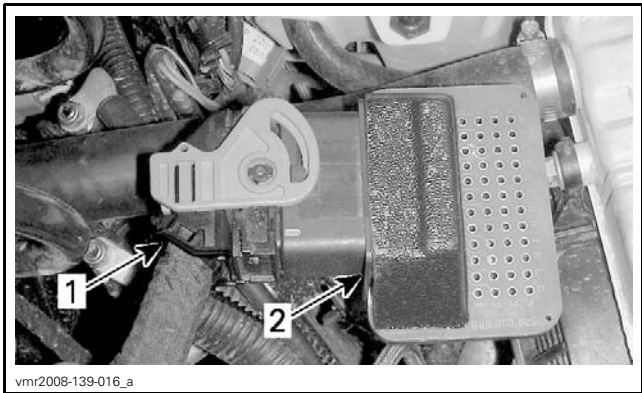
NOTICE Do not apply any lubricant product to the pins of the ECM connector.

Probing the Connector

The most recommended and safest method to probe the MOLEX (ECM) connector terminals is to use the ECM adapter tool. This tool will prevent deforming or enlarging of the terminals, which would lead to bad ECM terminal contact creating intermittent or permanent problems.

REQUIRED TOOL	
ECM ADAPTER TOOL (P/N 529 036 166)	

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.

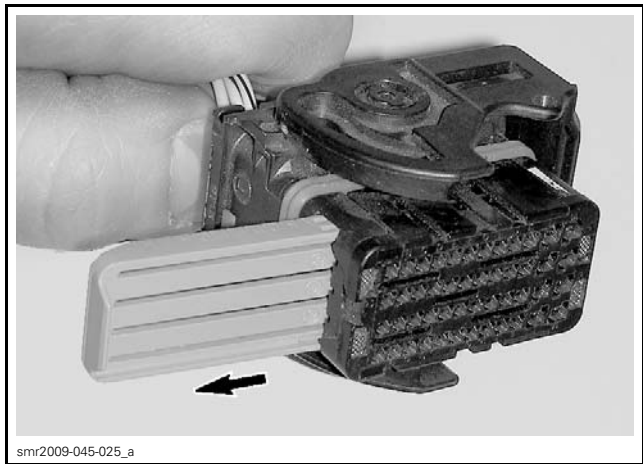
Removing Connector Terminal (Harness Connector)

To remove a signal terminal from the ECM harness connector, use the ECM terminal remover 2.25.

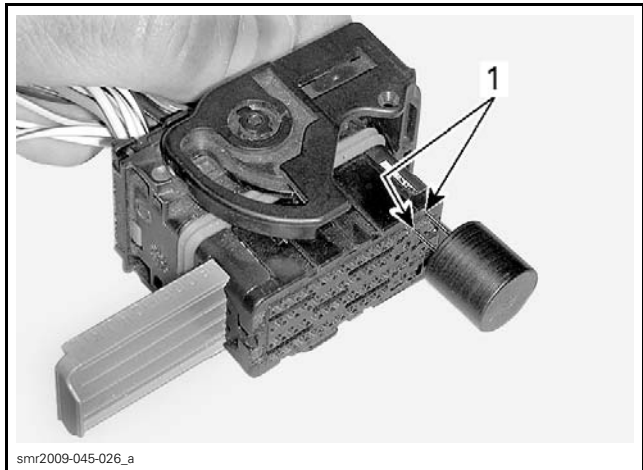
To remove a power terminal, use the ECM terminal remover 3.36.

REQUIRED TOOLS	
ECM TERMINAL REMOVER 2.25 (P/N 529 036 175)	
ECM TERMINAL REMOVER 3.36 (P/N 529 036 174)	

1. Remove rear protector from connector.
2. Pull out the connector lock.

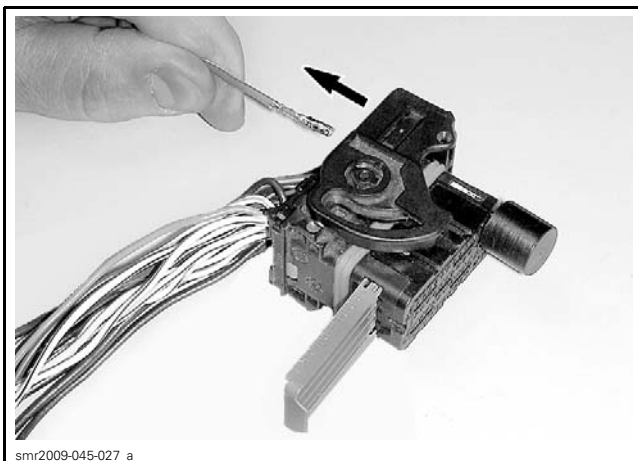


3. Insert tool to unlock terminal.



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.

DS, STS, FP, TAS, BRLS, FB, MSL, MSR CONNECTORS (DELPHI/PACKARD)

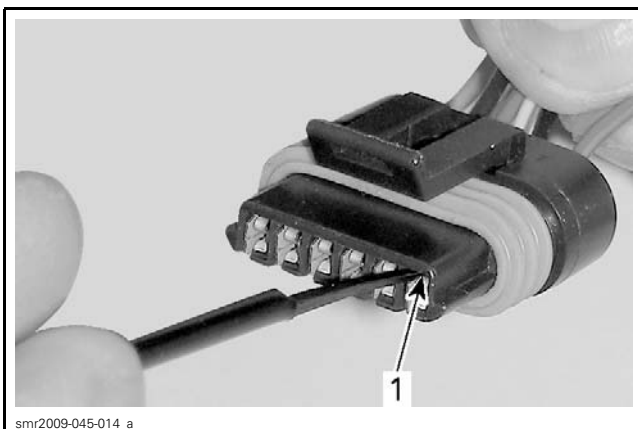
Removing the Connector Terminal

To remove a terminal (pin) from the connector, use a special tool such as the Delphi terminal extractor.

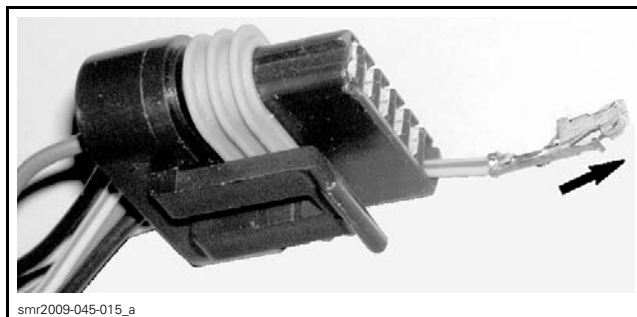
REQUIRED TOOL	
DELPHI TERMINAL EXTRACTOR (P/N 12094429)	

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

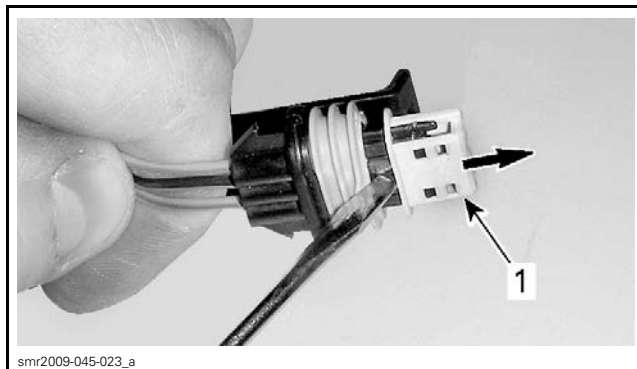


NOTICE Before installing terminals in the connectors, ensure all terminals are properly crimped on the wires. After installation of the wire terminals in the connectors, ensure they are properly locked by gently pushing on them as if to extract them.

MSL, MSR CONNECTORS (DELPHI)


Removing the Terminal

1. To remove a terminal from connector, first remove the locking cap.

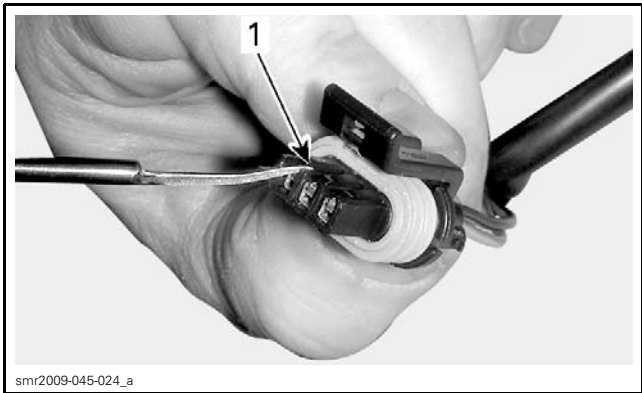


1. Pry out locking cap

2. Carefully insert the Delphi terminal extractor in the space provided to release the pin lock.

REQUIRED TOOL	
DELPHI TERMINAL EXTRACTOR (P/N 12094429)	

Section 06 ELECTRICAL SYSTEM
Subsection 02 (WIRING HARNESS AND CONNECTORS)



1. Unlock here

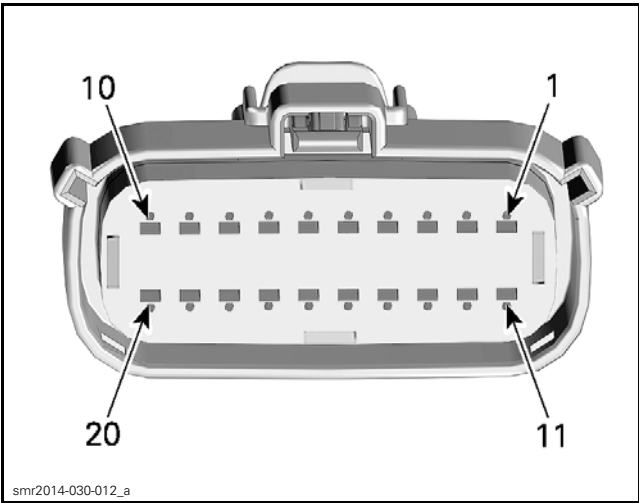
3. Gently pull on the wire to extract the pin out the back of the connector.



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.

ACC, SSIC, HIC, HIC1,HIC2 (MOLEX)

NOTE: 20 pin Molex is shown



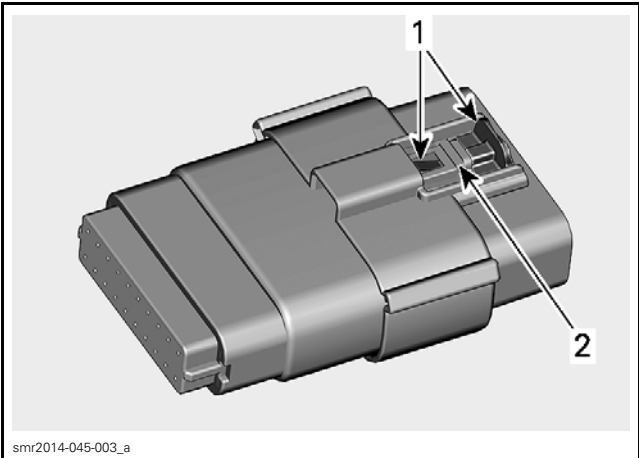
1. Female connector pin-out (sockets)

Disconnecting the Connector

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.



1. Red secondary lock (shown out)
2. Latch lever

Probing the Connector

1. Disconnect the steering connector in the vehicle and connect it to the diagnostic harness.

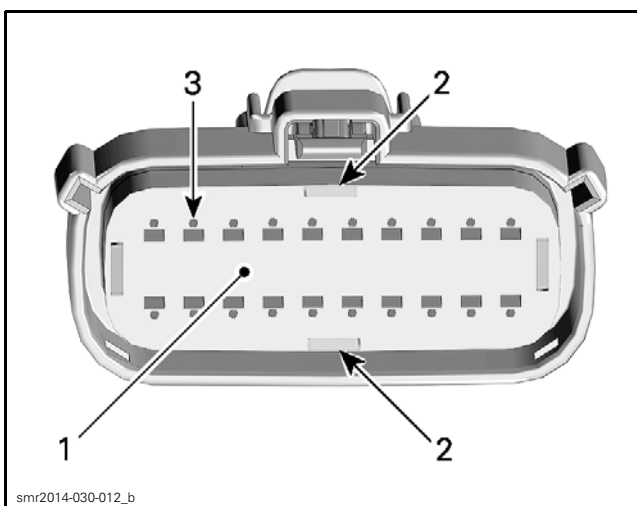
REQUIRED TOOL	
DIAGNOSTIC HARNESS (P/N 529 036 384)	

2. 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.

Extracting the Socket (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.

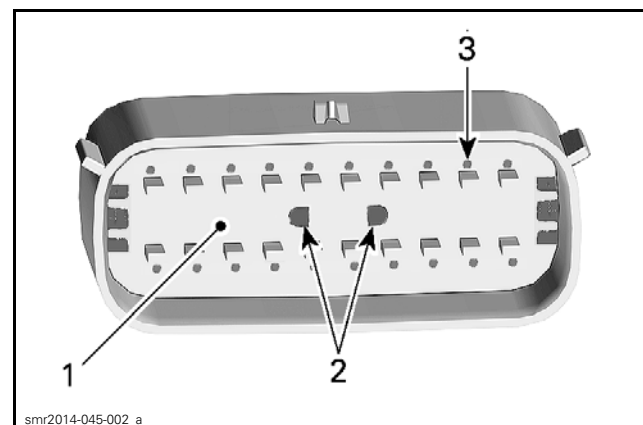
REQUIRED TOOLS	
FCI TERMINAL EXTRACTOR TOOL (P/N 54241678) or,	
MOLEX 150 TERMINAL EXTRACTOR TOOL (P/N 63813 - 1500)	

4. Gently pull on the wire to extract the socket out the back of the connector.

Extracting the Pin (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 TOOLS	
FCI TERMINAL EXTRACTOR TOOL (P/N 54241678) or,	
MOLEX 150 TERMINAL EXTRACTOR TOOL (P/N 63813 - 1500)	

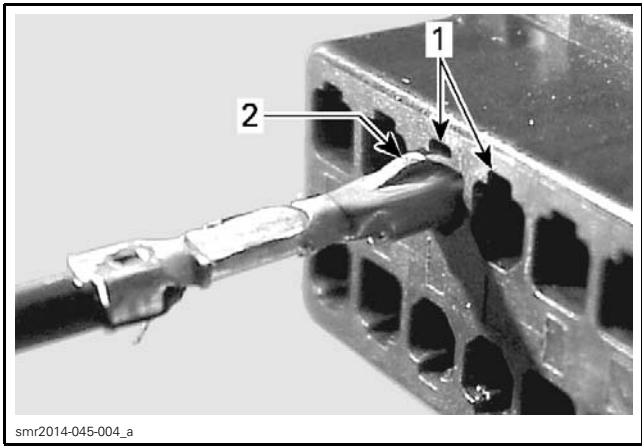
3. Gently pull on the wire to extract the pin out the back of the connector.

Inserting the Pin

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.

Section 06 ELECTRICAL SYSTEM
Subsection 02 (WIRING HARNESS AND CONNECTORS)

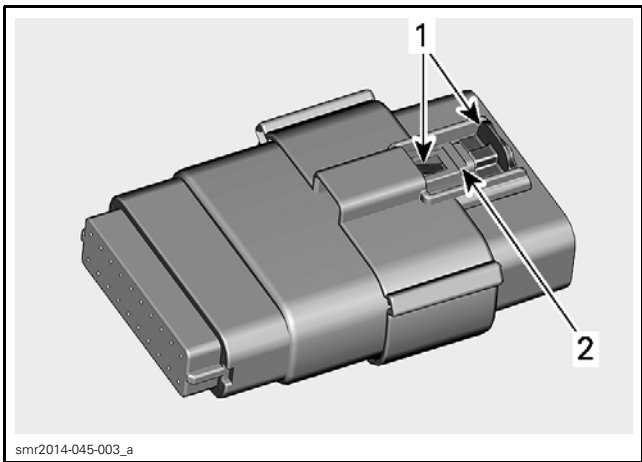


TYPICAL - PIN INSERTION
1. Notch
2. Stepped portion towards notch

- 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 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.

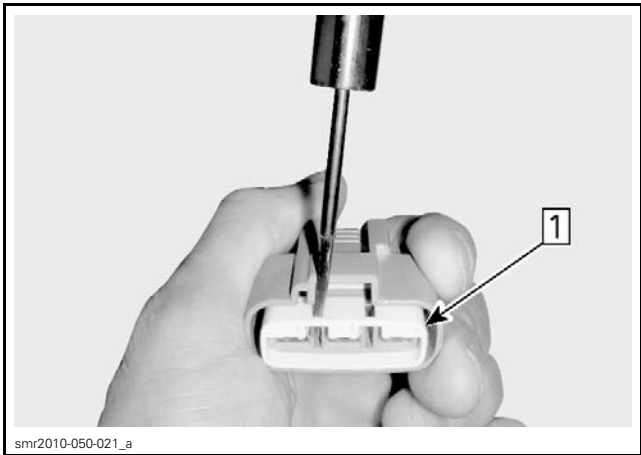


1. Red secondary lock (shown out)
2. Latch lever

**VOLTAGE
REGULATOR/RECTIFIER
CONNECTOR (FURUKAWA)**

Removing the Terminal

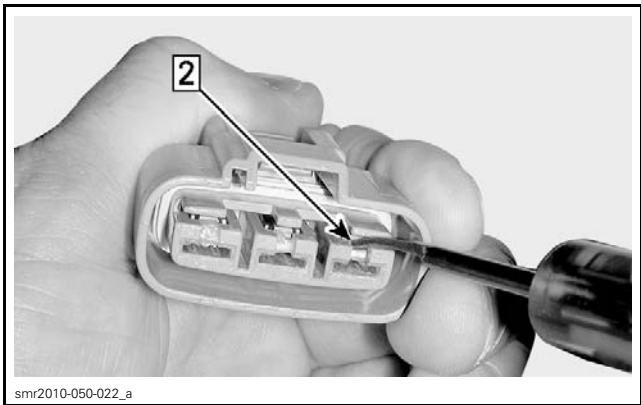
- 1. Remove the secondary lock (plastic insert).



Step 1: Remove the secondary lock

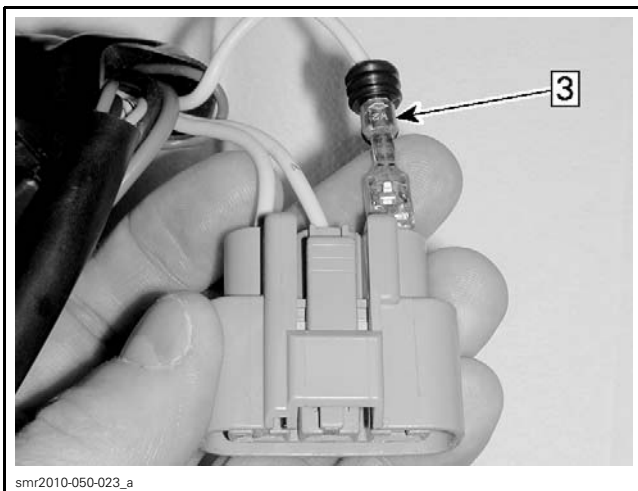
- 2. Carefully insert the GM terminal extractor between the lock and the pin to release the pin.

REQUIRED TOOL	
GM TERMINAL EXTRACTOR (P/N 12094430)	



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.



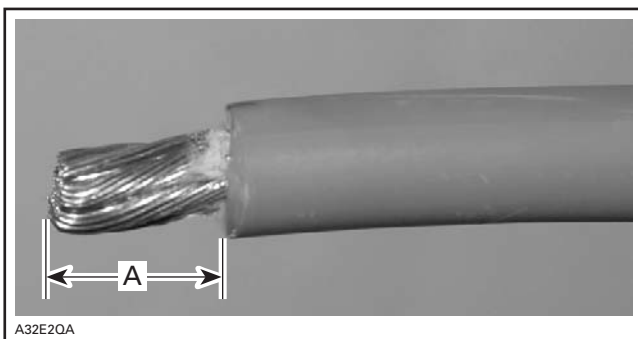
Step 3: Pull wire to extract pin

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

Crimping the Battery Cable

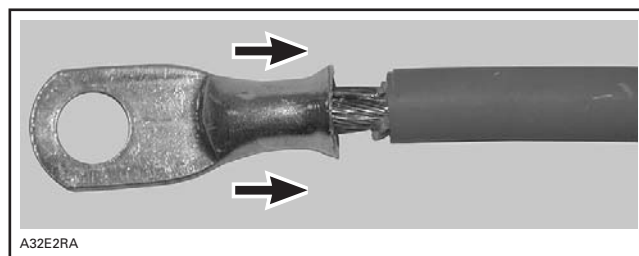
Carefully strip the wire approximately to 10 mm (3/8 in) in length, using a wire stripping tool or sharp blade/knife.



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.



INSTALLATION OF TERMINAL

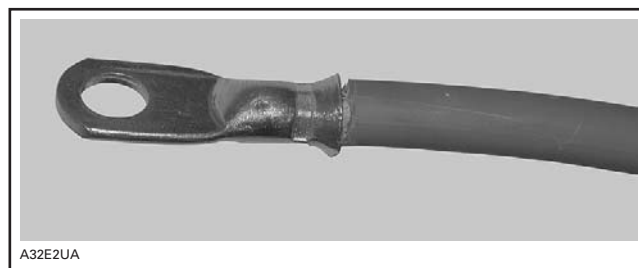
Follow the instructions provided with the crimping tool to select the proper position of the tool.

NOTE: Different wires require different crimping pliers settings, so make sure to follow the instruction supplied with the tool.

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.

Section 06 ELECTRICAL SYSTEM

Subsection 02 (WIRING HARNESS AND CONNECTORS)

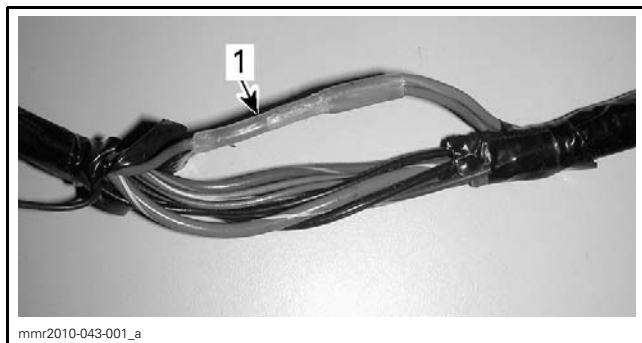
Install the protective heat shrink rubber tube on the terminal. Heat the heat shrink rubber tube using the heat gun so that it grasps the wire and the terminal.

NOTICE Make sure that the protective heat shrink rubber tube has been properly installed and no part of wire is exposed.

SPLICES REPAIR PROCEDURE

CASE 1: Wire Detached from Splice

1. Remove wires from protector tube.
2. Locate the shrink tube protecting the defective splice.



1. Shrink tube

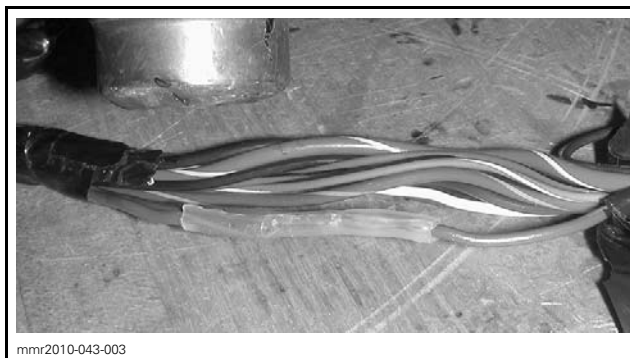
3. Remove the shrink tube.

3.1 Using a blade, cut the shrink tube.



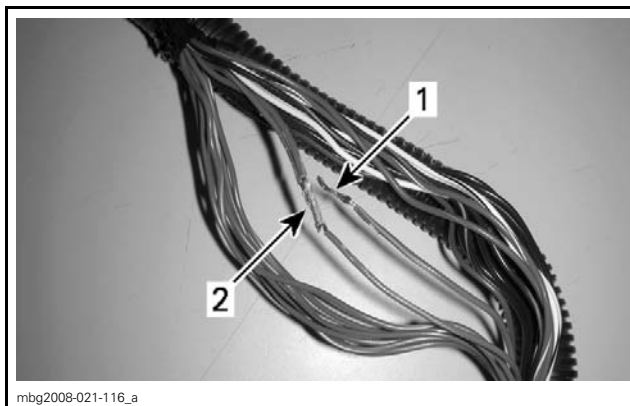
NOTICE Be careful with the blade to avoid cutting wires insulation.

- 3.2 Slightly heat the shrink tube using a heat gun.



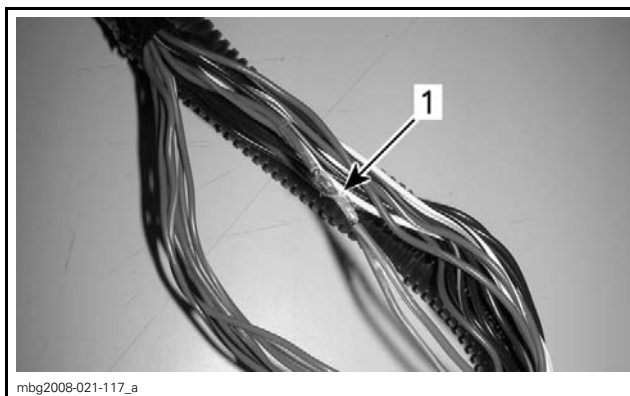
- 3.3 Remove the shrink tube with long nose pliers.

4. Locate detached wire from splice.



1. Detached wire
2. Splice

5. Twist detached wire around splice.



1. Twisted wire

6. Perform a tin solder on twisted wire.

7. Apply electrical tape to cover splice.

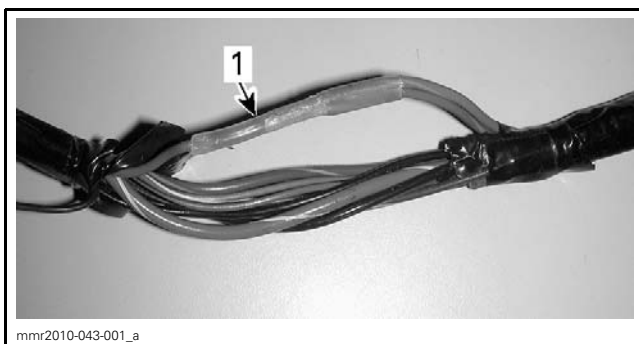
NOTE: Make sure tape overlaps on wire insulation, approximately 13 mm (1/2 in) each side.

8. Reinstall wires into protector tube.

CASE 2: Wire Broken from Splice

1. Remove wires from protector tube.

2. Locate the shrink tube protecting the defective splice.



1. *Shrink tube*

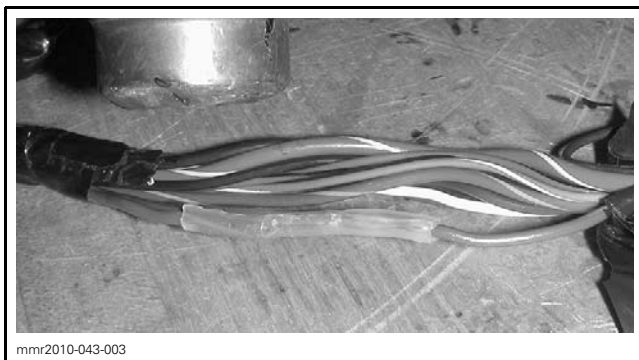
3. Remove the shrink tube.

3.1 Using a blade, cut the shrink tube.



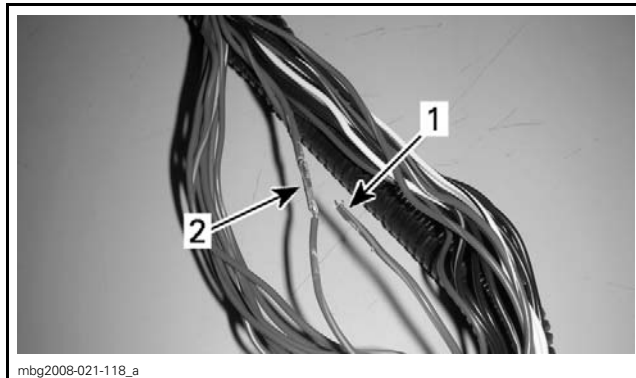
NOTICE Be careful with the blade to avoid cutting wires insulation.

3.2 Slightly heat the shrink tube using a heat gun.



3.3 Remove the shrink tube with long nose pliers.

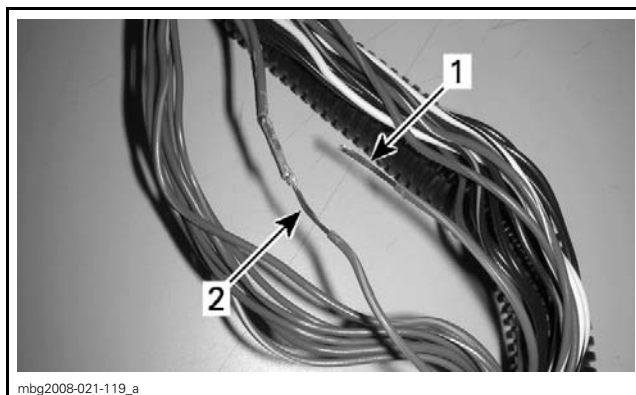
4. Locate broken wire from splice.



1. *Broken wire*
 2. *Splice*

5. Strip wire insulation at the end of broken wire.

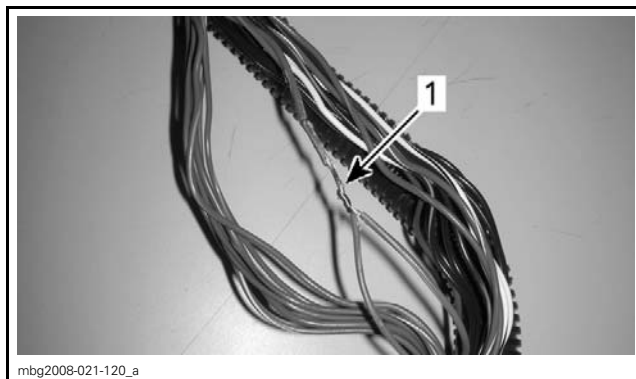
6. Strip wire insulation below the splice.



1. *Broken wire stripped*
 2. *Splice wire stripped*

7. Cut splice wire and insert a new shrink tube.

8. Twist wire around stripped wire.



1. *Twisted wire*

9. Perform a tin solder on twisted wire.

10. Apply electrical tape to cover splice.

NOTE: Make sure tape overlaps on wire insulation, approximately 13 mm (1/2 in) each side.

11. Install the shrink tube as it was before removal.

Section 06 ELECTRICAL SYSTEM

Subsection 02 (WIRING HARNESS AND CONNECTORS)

12. Reinstall wires into protector tube.

NOTE: Always perform a solder on a bigger wire (lower gage).

CHARGING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
SPRING INSTALLER/REMOVER	529 035 983	162

GENERAL

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 stator.

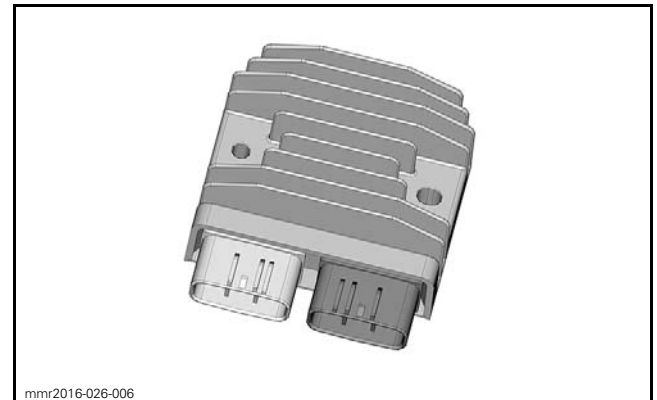


TYPICAL

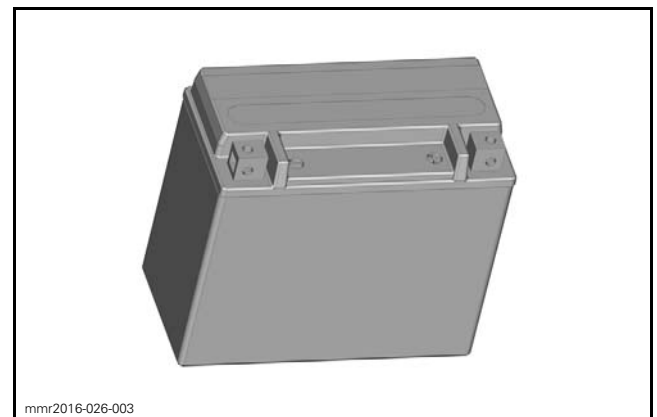
Voltage Regulator/Rectifier

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.



Battery



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.

INSPECTION

CHARGING SYSTEM OUTPUT

First ensure that battery is in good condition prior to performing the following tests.

Section 06 ELECTRICAL SYSTEM

Subsection 03 (CHARGING SYSTEM)

NOTE: It is good practice to check for fault codes using the BRP diagnostic software (BUDS2) as a first troubleshooting step. Refer to *DIAGNOSTIC AND FAULT CODES* subsection.

Testing Output Voltage Using BUDS2

Connect the vehicle to BRP diagnostic software (BUDS2).

- Go to:
- **Measurements** page
 - **ECM** button
 - **Battery voltage** (V)

1. Start engine.

NOTE: Connect a garden hose to cool exhaust system. Refer to *EXHAUST SYSTEM* subsection.

2. Increase engine RPM as specified in the following table and read voltage.

OUTPUT VOLTAGE TEST USING A MULTIMETER	
TEST ENGINE SPEED	VOLTAGE (DC)
5500 RPM	14.5 ± .5 Vdc

If voltage is above specification, replace voltage regulator/rectifier.

If voltage is below specification, check stator output and wiring harness prior to concluding that voltage regulator/rectifier is defective. Refer to *STARTING SYSTEM* subsection.

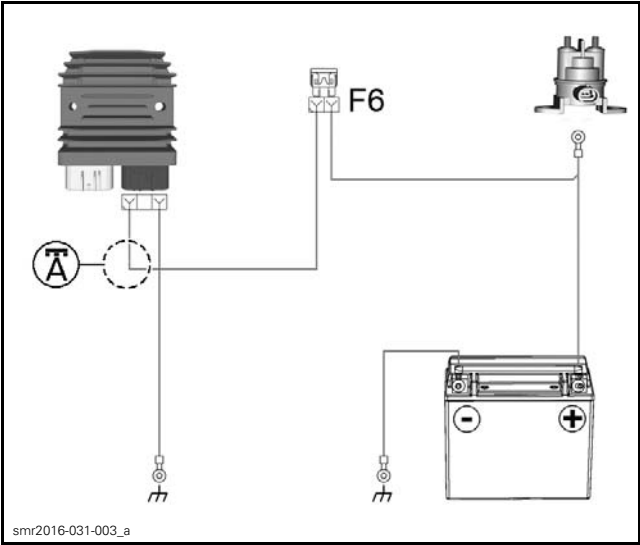
Testing Output Current with an Inductive Ammeter

Use an inductive ammeter that can read at least 200 Aac and 40 Adc current.

1. Turn on the ammeter and select 40 Adc.

NOTE: Zero set the ammeter before use or reading may be erroneous.

VOLTAGE REGULATOR
RE1-1



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

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 F4 on 900 engine or F6 on all other engines.
 - Check F4 or F6 fuse.
2. Defective stator.
 - Test stator. Refer to *STARTING SYSTEM* subsection.
3. Defective charging system wiring or connections.
 - Check for damaged wiring.
 - Check for damaged or loose connections.

REPETITIVE BLOWN F4 (900) OR F6 (ALL OTHERS) FUSE

1. Voltage regulator/rectifier internal circuit shorted to ground.
 - Refer to *TESTING VOLTAGE REGULATOR/RECTIFIER FOR BLOWN F6 FUSE* in this subsection.

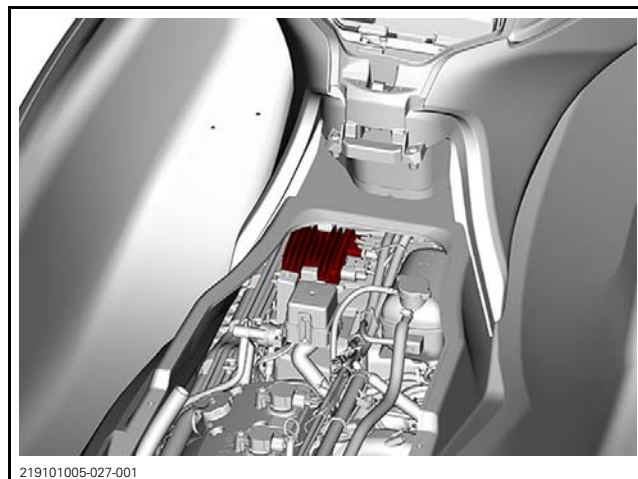
PROCEDURES

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



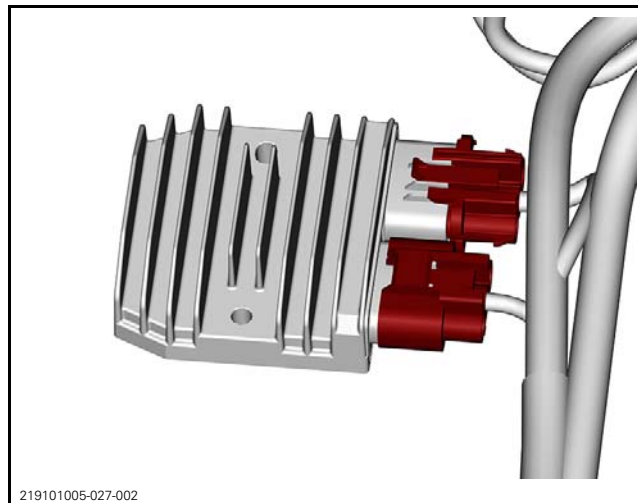
Testing Voltage Regulator/Rectifier for Blown F6 Fuse

1. Remove the voltage regulator/rectifier from the air intake silencer. Refer to *REMOVING THE VOLTAGE REGULATOR/RECTIFIER* in this subsection.
 2. 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

Unclip the voltage regulator/rectifier from the air intake silencer.

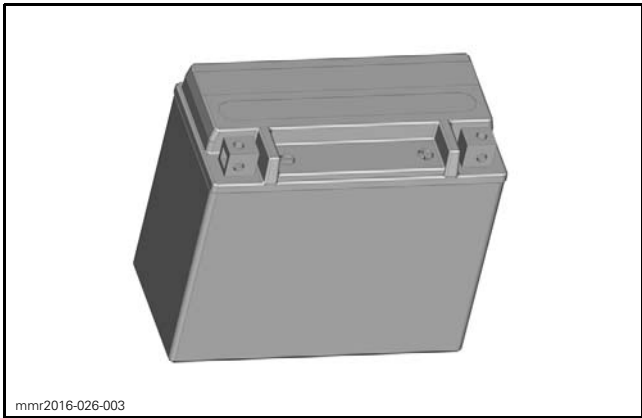
Disconnect both connectors from voltage regulator/rectifier.



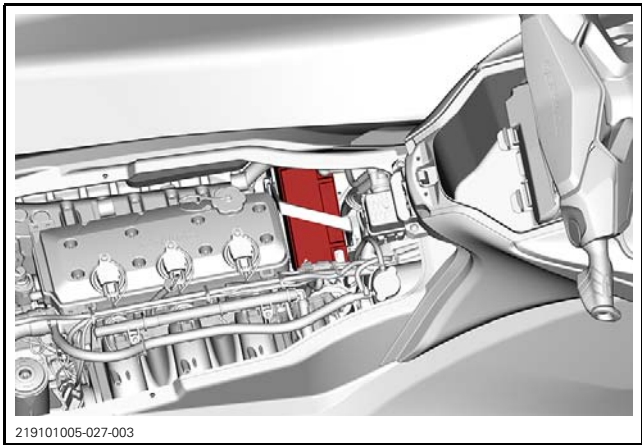
Installing the Voltage
Regulator/Rectifier

The installation is the reverse of the removal procedure.

BATTERY

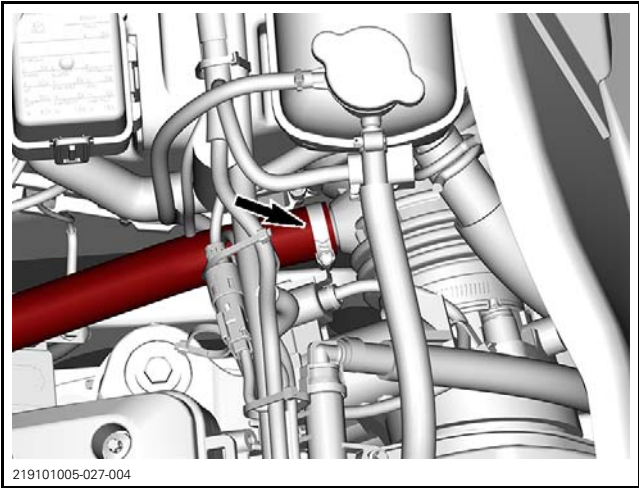


Battery Location




Removing the Battery

- 1. On 130 and 170 engines, remove clamp to disconnect vent hose from outlet hose. Set aside.

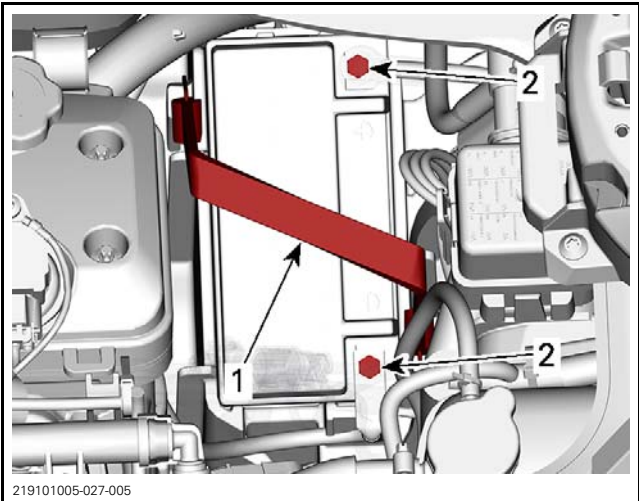


CAUTION It is recommended to wear appropriate protective gloves for the following procedure.

- 2. Use an appropriate tool to remove the battery strap.

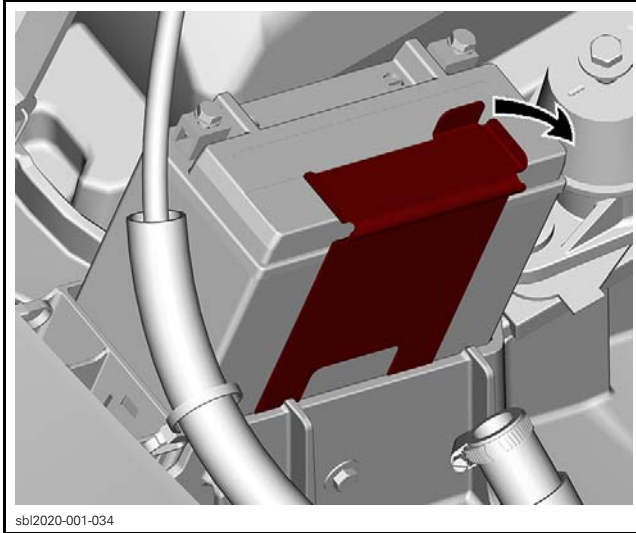
REQUIRED TOOL	
SPRING INSTALLER/REMOVER (P/N 529 035 983)	

- 3. Disconnect battery posts.



- 1. Remove strap.
- 2. Disconnect battery posts.

- 4. Bend the superior battery support rearwards until the battery can be removed.



NOTE: Do not excessively bend the superior battery support.

NOTICE Always disconnect the **BLACK (-)** battery cable first and reconnect last.

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.

Testing the Battery

There are 2 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)

1. Connect a battery load tester to battery.
2. Ensure proper test conditions:
 - Initial battery voltage above 12.5 Vdc
 - Engine OFF
 - Ambient temperature of 20°C (68°F)

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. Refer to *REMOVING THE BATTERY* in this subsection.

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.

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.

Section 06 ELECTRICAL SYSTEM
Subsection 03 (CHARGING SYSTEM)

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.

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, however pay attention to the following.

NOTICE 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

SERVICE TOOLS

Description	Part Number	Page
DIAGNOSTIC HARNESS	529 036 384	167
ECM ADAPTER TOOL.....	529 036 166	167
FLUKE 115 MULTIMETER	529 035 868	167

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.

Required Tools

To perform the tests in this subsection, the following tools are required.

REQUIRED TOOLS	
ECM ADAPTER TOOL (P/N 529 036 166)	
FLUKE 115 MULTIMETER (P/N 529 035 868)	
DIAGNOSTIC HARNESS (P/N 529 036 384)	

TROUBLESHOOTING

DIAGNOSTIC TIPS

NOTE: It is a good practice to check for fault codes using the BRP diagnostic software (BUDS2) 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
- Battery, refer to *CHARGING SYSTEM* subsection
- 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.

Section 06 ELECTRICAL SYSTEM

Subsection 04 (STARTING SYSTEM)

DIAGNOSTIC GUIDELINES

NOTHING HAPPENS WHEN START/STOP BUTTON PRESSED

1. Battery not connected
 - Connect battery.
2. Burnt fuse
 - START/STOP switch circuit.
 - Main DC power fuses.
 - 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. Burnt fuse
 - Starter solenoid power. Carry out TESTING THE SOLENOID INPUT VOLTAGE.
2. Discharged battery
 - Recharge and test. Refer to CHARGING SYSTEM subsection.
3. Battery connections
 - Check/clean/tighten.
4. Poor/bad or corroded ground contacts (engine, battery ground cable, starter etc.)
 - Check/clean/repair, refer to POWER DISTRIBUTION AND GROUNDS subsection.
5. Starter solenoid
 - Test solenoid, wiring and connections.
6. Damaged starter or ground cables
 - Carry out TESTING THE SOLENOID (DYNAMIC).
7. Obstructed starter drive gear assembly
 - Check/repair, refer to PTO HOUSING, MAGNETO AND STARTER subsection.
8. No ground provided by ECM to starter solenoid
 - Refer to TESTING THE START/STOP SWITCH CIRCUIT CONTINUITY in this subsection.
9. Engine cannot be rotated (possibly seized or jet pump blocked)
 - Refer to JET PUMP 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
 - Carry out a TESTING THE SOLENOID (DYNAMIC).
4. Damaged starter or ground cables
 - Carry out TESTING THE SOLENOID (DYNAMIC).
5. Worn starter
 - Check starter motor.

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 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 subsection.

PROCEDURES

NOTICE 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 an explosion. Do not place any tool on the battery.

ENGINE START/STOP SWITCH

Testing the START/STOP Switch Circuit Continuity

1. Remove START/STOP switch fuse.

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 on ECM harness connector "B".

Set the multimeter to Ω .

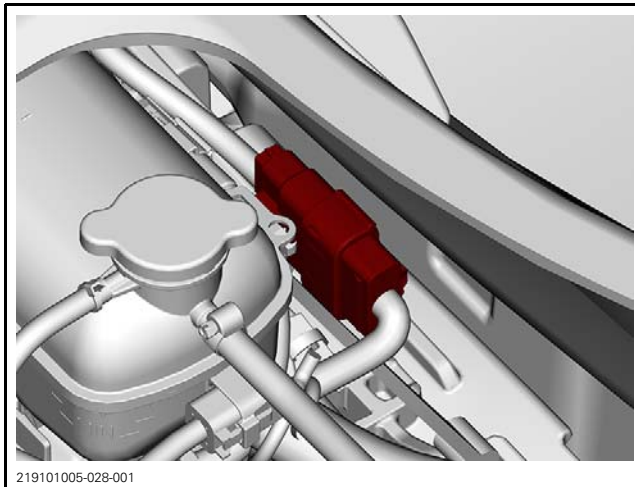
Press and hold the START/STOP switch and test for continuity of the switch circuit as per following table.

CONTINUITY TEST OF START/STOP SWITCH CIRCUIT (BUTTON PRESSED AND HELD)		
FUSE BOX	ECM CONNECTOR B	RESISTANCE
Pin E3	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 *TESTING THE START/STOP SWITCH CONTINUITY*.

Testing the START/STOP Switch Continuity

- Remove START/STOP switch fuse.
Remove seats and engine service cover. Refer to *BODY* subsection.
- Disconnect the 20-pin steering connector (HIC1):



- Connect the diagnostic harness to make an in-line connection between the disconnected connector.
- Use the multimeter 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 1 and 4	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 E3	Steering connector pin 1	Must be close to 0 Ω
Steering connector pin 4	ECM connector B, pin D1	

STARTER SOLENOID

Starter Solenoid Location



Testing Solenoid Input Voltage

- Make sure the starter solenoid fuse is powered and in good condition before testing.
- Disconnect solenoid connector.
- Set the multimeter to Vdc.
- Install tether cord on the engine cut-off switch.
- Press the START/STOP button to activate ECM.
- Measure voltage within 3 minutes after START/STOP switch has been depressed.

Section 06 ELECTRICAL SYSTEM

Subsection 04 (STARTING SYSTEM)

SOLENOID INPUT VOLTAGE TEST (SOLENOID COIL)		
TEST PROBES		VOLTAGE READING
Pin A	Battery ground	Battery voltage

If test succeeded, carry out *TESTING SOLENOID CONTROL CIRCUIT CONTINUITY*.

If test failed, carry out *TESTING THE START/STOP SWITCH CIRCUIT CONTINUITY*.

Testing Solenoid Control Circuit Continuity

1. Set the multimeter to Ω .
2. Disconnect connector "B" from ECM.
3. Install ECM adapter tool on ECM harness connector.
4. 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 *TESTING SOLENOID COIL RESISTANCE*.

Testing Solenoid Coil Resistance

1. Set multimeter to Ω .
2. Disconnect solenoid connector.
3. 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

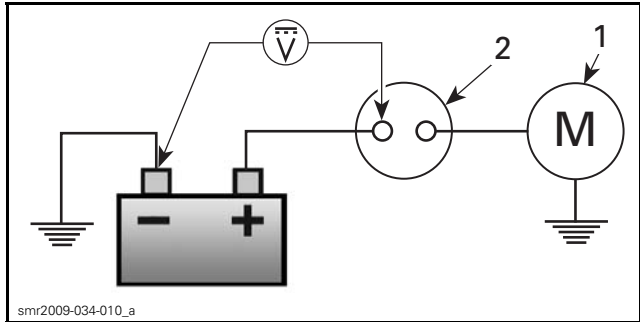
If test fails, replace solenoid.

Testing Solenoid (Dynamic)

1. Ensure starter solenoid fuse, battery and starter solenoid are properly connected.
2. Make sure the battery ground cable is securely connected to the engine. Refer to *POWER DISTRIBUTION AND GROUNDS* subsection.
3. Set ECM in engine drowned mode:
 - 3.1 Depress throttle lever.

- 3.2 Install a rubber band to hold lever in full throttle position.
4. Set multimeter to Vdc.
5. Crank engine.
6. **As engine is cranking**, measure the voltage as per following tables.

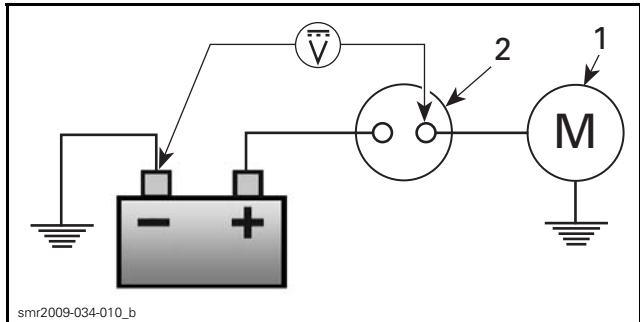
SOLENOID DYNAMIC TEST (ENGINE CRANKING)		
TEST PROBES		VOLTAGE (DC)
Solenoid battery post	Battery ground	Battery voltage



1. Starter motor
2. Starter solenoid

7. If test failed, check battery positive cable (from battery to solenoid).
8. If test succeeded, continue with next step.

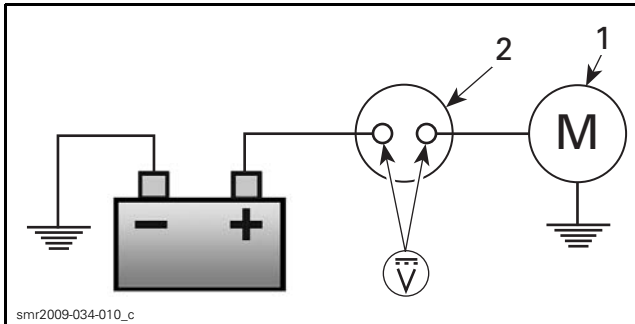
SOLENOID DYNAMIC TEST (ENGINE CRANKING)		
TEST PROBES		VOLTAGE (DC)
Solenoid starter post	Battery ground	Battery voltage



1. Starter motor
2. Starter solenoid

9. If test failed, carry out *TESTING SOLENOID INPUT VOLTAGE*.
10. 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.

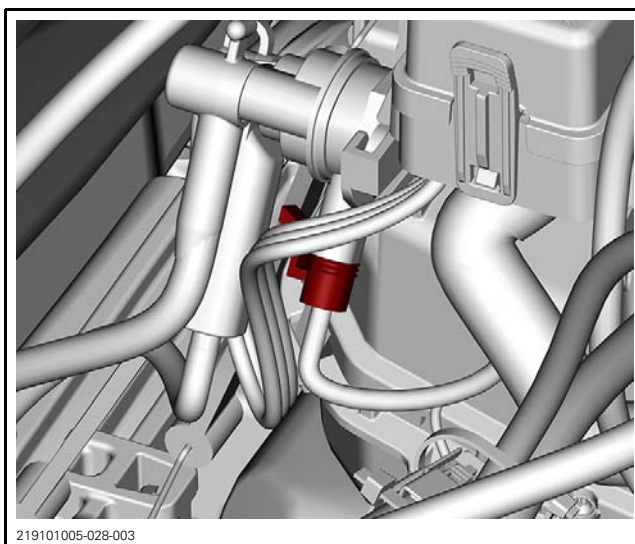
11. Remove rubber band from throttle lever.
12. Reinstall removed parts.

Removing the Solenoid

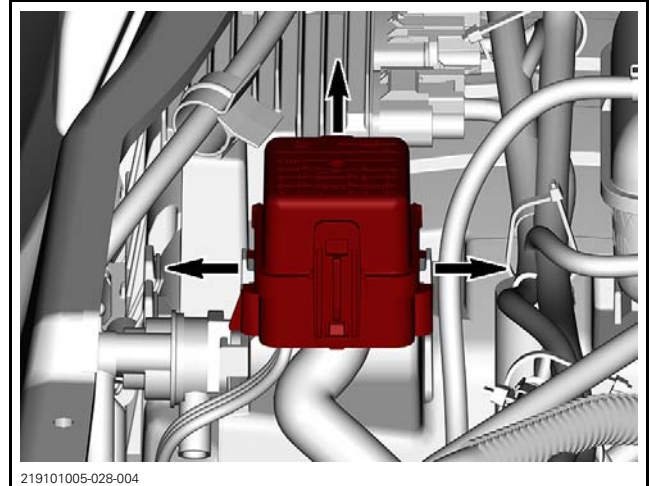
1. Disconnect battery. Refer to *CHARGING SYSTEM* subsection.

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

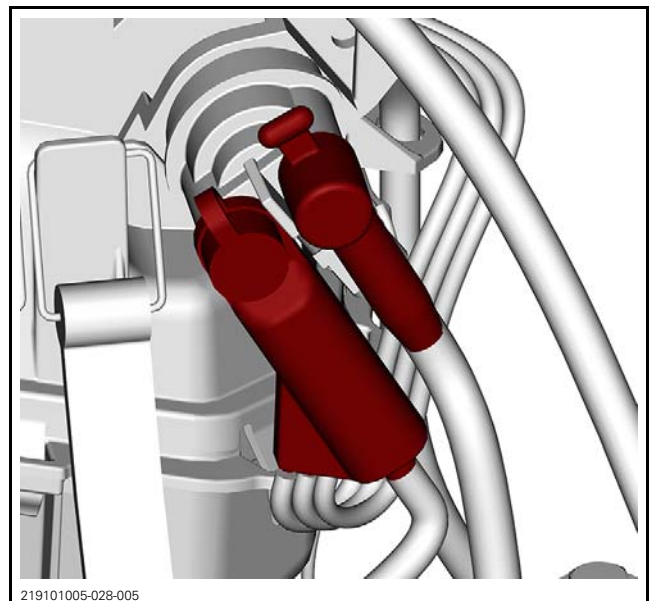
2. Disconnect solenoid connector.



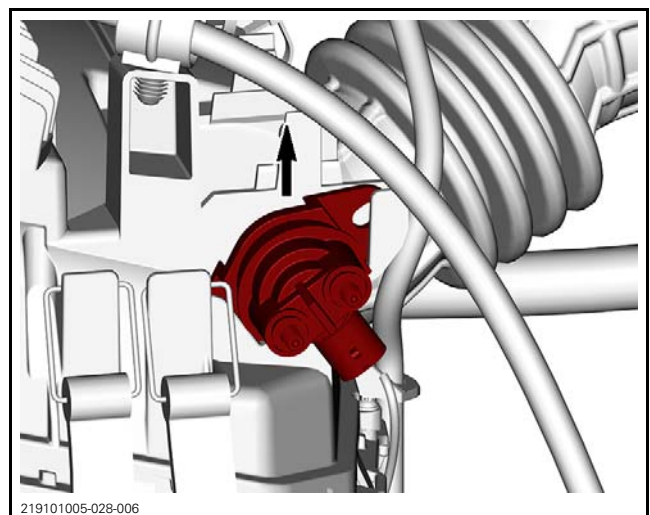
3. Unclip fuse box from air intake silencer and set aside.



4. Disconnect solenoid cables.



5. Lift starter solenoid.



Section 06 ELECTRICAL SYSTEM

Subsection 04 (STARTING SYSTEM)

Installing the Solenoid

The installation is the reverse of the removal procedure.

STARTER

For starter information, refer to *PTO HOUSING, MAGNETO AND STARTER* subsection.

RFID DIGITALLY ENCODED SECURITY SYSTEM (RF D.E.S.S.)

SERVICE TOOLS

Description	Part Number	Page
D.E.S.S. POST REMOVER	529 035 943	175
DIAGNOSTIC HARNESS	529 036 188	175
FLUKE 115 MULTIMETER	529 035 868	175

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 BRP diagnostic system (BUDS2) 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

Upon tether cord installation, the key type used is momentarily displayed by the digital display.

Learning 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.

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.

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.

KEY NOT READ (CONDITION CAN BE DUPLICATED WITH A MAGNET ON THE D.E.S.S. POST)

1. Damaged RFID chip
2. Engine stop switch is in OFF position (if equipped)
3. No voltage at RFID-D connector
4. No voltage at RFID-C connector
 - Try a new key
 - Refer to *WIRING DIAGRAM* and / or *IGNITION SYSTEM* subsection and troubleshoot D.E.S.S. / Engine Cut-Off Switch

KEY NOT PRESENT (CONDITION CAN BE DUPLICATED BY UNPLUGGING THE RFID CONNECTOR)

1. No key installed
2. No **ground** at RFID-A connector
3. No voltage at RFID-B connector
4. No voltage at RFID-C connector
5. No voltage at RFID-D connector
 - Refer to *WIRING DIAGRAM* and / or *IGNITION SYSTEM* subsection and troubleshoot D.E.S.S. / Engine Cut-Off Switch

Section 06 ELECTRICAL SYSTEM

Subsection 05 (RFID DIGITALLY ENCODED SECURITY SYSTEM (RF D.E.S.S.))

INVALID KEY

1. Key not programmed to ECM
- *Program key*

PROCEDURES

D.E.S.S. KEY

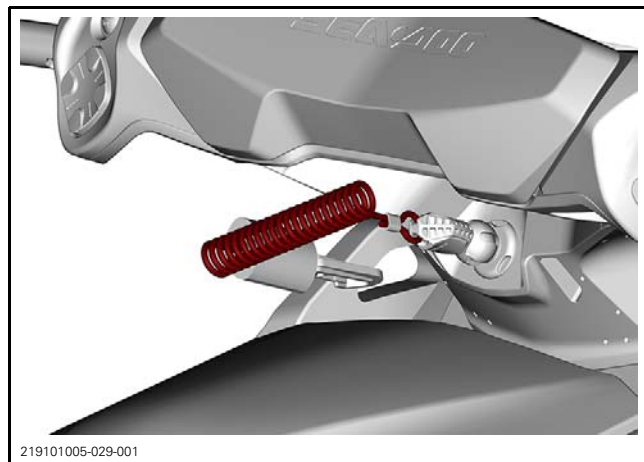
D.E.S.S. Key Recognition

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

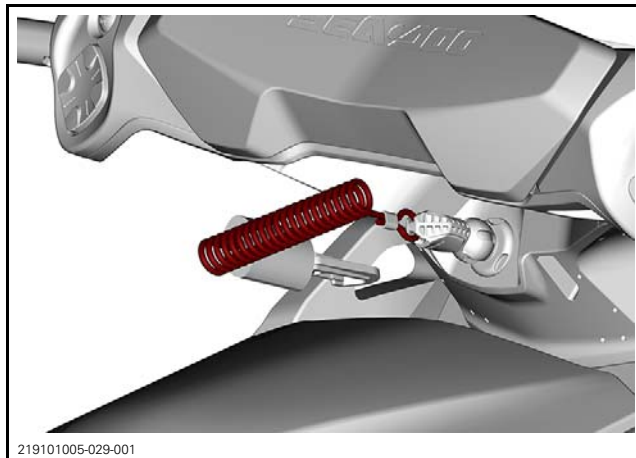
1. Connect the vehicle to the BRP diagnostic software (BUDS2). Refer to *COMMUNICATION TOOLS* subsection.
2. Briefly press START/STOP button to power the ECM.
3. Install a tether cord on the engine cut-off switch to program a D.E.S.S. key.



4. Go to the key page.
5. Ensure that anti-theft system is activated. If not, activate it before trying to add a key.
6. Install new key on the D.E.S.S. post.
7. Press the READ button (top right of the table).
8. Select key type
9. Press ADD button to register the key. The new key should be displayed in the table. Repeat steps 6 to 9 to add other keys.

Erasing Keys

1. Install the D.E.S.S. key (tether cord) on the D.E.S.S. post (engine cut-off switch).



2. Click on **Erase Key**.

After approximately 10 seconds the following message will appear.

The key is now erased.

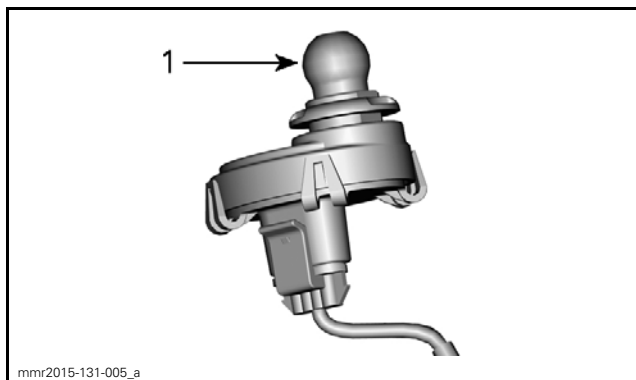
Erasing All Keys

1. Click on **Erase All Keys**.
2. When done, program at least one new key to the vehicle. Refer to *PROGRAMMING D.E.S.S. KEY* in this subsection.

D.E.S.S. / Engine Cut-Off Operation

Normal Operation

The electrical system provides power to RFID-D. The ECM provides 5Vdc to the DESS module DS-B. The ECM provides a ground to the DESS module DS-A. When the D.E.S.S. key (tether cord) is installed on the D.E.S.S. post (engine cut-off), a hall effect switch closes and sends a 12-15Vdc signal to the ECM.



1. RFID D.E.S.S. post

Section 06 ELECTRICAL SYSTEM



Subsection 05 (RFID DIGITALLY ENCODED SECURITY SYSTEM (RF D.E.S.S.))

RFID CONNECTOR PIN	SPECIFICATIONS WITH D.E.S.S. KEY INSTALLED AND ELECTRICAL SYSTEM (WAKE-UP OR ON)
A	ECM ground
B	3.3 Vdc
C	Data communication 2 -4.5 Vdc
D	12 - 15 Vdc

Testing Engine Cut-Off Switch

Connect BUDS2 and use the **Measurements** page to monitor key status and ensure the D.E.S.S. module recognizes that a key is installed on the D.E.S.S. post.

Ensure power and ground are available at D.E.S.S. connector.

REQUIRED TOOLS	
DIAGNOSTIC HARNESS (P/N 529 036 188)	
FLUKE 115 MULTIMETER (P/N 529 035 868)	

1. Connect the diagnostic harness to the vehicle steering connector.



STEERING CONNECTOR

2. Push start button to wake up ECM.

NOTICE Do not attempt to probe the steering connector on the watercraft. Use the test connector on the diagnostic harness.

3. Set multimeter to Vdc.
4. Measure voltage as follows.

D.E.S.S. KEY	DIAGNOSTIC HARNESS	READING
Removed	Probe between pins 11 and 13	3.3 Vdc
Installed		0 Vdc

NOTE: This tests for voltage at D.E.S.S. connector pin B.

If test fails:

- Check steering harness between steering connector and D.E.S.S. module. Repair or replace.
- If harness is good, replace the D.E.S.S. module.

Replacing Engine Cut-Off Switch

REQUIRED TOOL	
D.E.S.S. POST REMOVER (P/N 529 035 943)	

INFORMATION CENTER (DIGITAL DISPLAY)

SERVICE TOOLS

Description	Part Number	Page
FLUKE 115 MULTIMETER	529 035 868	177

GENERAL

Most of the electrical tests require the following tool.





REQUIRED TOOL
<div style="display: flex; justify-content: space-between; align-items: center;"> <div> FLUKE 115 MULTIMETER (P/N 529 035 868) </div>  </div>

Refer to *WIRING DIAGRAM INFORMATION* subsection for diagnostic tips on troubleshooting electrical problems.

NOTICE It is recommended to always disconnect the battery when replacing any electrical component. Always disconnect battery as specified, BLACK (-) cable first.



INDICATOR LAMPS DESCRIPTION

Important information about vehicle condition is displayed on the digital display. When starting the engine, always look at the display for any indicator lamps or special messages.

INDICATOR LAMPS (MALFUNCTIONS)			
INDICATOR LAMP(S)	DIGITAL WARNING	CAUSE	WHAT TO DO
None	BAD KEY	Defective key	<ul style="list-style-type: none"> - Program a new key if the previous key is defective. - Check wiring and connectors. Refer to the <i>WIRING DIAGRAM</i>.
None	CHECK KEY	Wrong key	Use the right key for the vehicle.
 ON	HIGH ENGINE TEMPERATURE	Engine is overheating	<ul style="list-style-type: none"> - Stop and wait for engine to cool off. - Check for leaks. - Check and adjust the coolant level.
 ON	LO BATT VOLT or HI BATT VOLT	Low or high battery voltage	<ul style="list-style-type: none"> - Recharge battery. - Check battery connections. - Check the charging system.
 ON	CHECK ENGINE	Engine management component malfunction	<ul style="list-style-type: none"> - Stop the engine. Connect the vehicle to the BRP diagnostic software (BUDS2). Check faults codes and perform recommended actions.
 FLASHING	LIMP HOME MODE	Important engine management component or VSS malfunction	<ul style="list-style-type: none"> - Connect the vehicle to the BRP diagnostic software (BUDS2). Check faults codes and perform recommended actions.

Section 06 ELECTRICAL SYSTEM

Subsection 06 (INFORMATION CENTER (DIGITAL DISPLAY))

INDICATOR LAMPS (MALFUNCTIONS)			
INDICATOR LAMP(S)	DIGITAL WARNING	CAUSE	WHAT TO DO
 ON	NONE	Low oil pressure	<ul style="list-style-type: none">- Check for oil leaks.- Check and adjust the engine oil.
 ON	Variable messages - Connect the vehicle to the BRP diagnostic software (BUDS2) for proper diagnostic.		

TROUBLESHOOTING

DIAGNOSTIC TIPS

IMPORTANT: When solving an electrical problem, the first thing to do is to check the battery condition as well as its cables and connections.

Make sure the battery is fully charged or install a power pack for any tests that involves a prolonged "key ON" period. If battery voltage gets too low, not only test results can be altered, but the vehicle electrical system may not operate normally.

Pay attention to ground wires. They could become loose or corroded which causes them to act as an additional load in a circuit, dropping voltage and reducing current to components. Some components may be grounded through their outer casing and mounted hardware. This should also be considered.

Electrical Connectors

Pay particular attention to ensure that pins are not out of their connectors, loose, or damaged. The troubleshooting procedures may not cover problems resulting from one of these causes.

NOTICE Ensure all terminals are properly crimped on wires and connector housings are properly fastened. When replacing any electric or electronic part(s), always check electrical connections. Make sure that they are clean, corrosion-free, tight and make good contact. The voltage and current might be too weak to go through dirty or corroded connector pins or terminals.

DIGITAL DISPLAY TROUBLESHOOTING

DISPLAY FUNCTIONS INOPERATIVE OR WORKING INTERMITTENTLY

1. Power supply or ground problem
 - Check power supply and ground circuits.

PROCEDURES

DIGITAL DISPLAY

Testing the Digital Display

Before beginning any troubleshooting, test or repair, always check for fault codes.

1. Check for fault codes using BUDS2.
2. Record all fault codes, then erase them.
3. Perform a complete shutdown of the electrical system and reactivate it.
4. Check fault codes. If a previous fault codes reappears, perform the required service actions.

Testing the Digital Display Using BRP Diagnostic Software (BUDS2)

Connect the vehicle to the BRP diagnostic software (BUDS2).

In BUDS2, select the following:

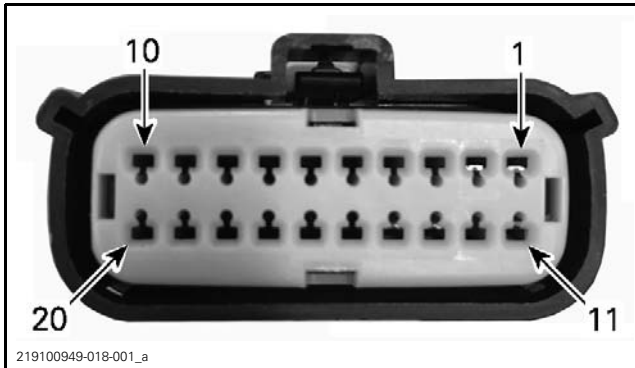
- **Functions** page
- **Routines - Execute Cluster WOW test.**

All indications will come and stay ON so that you can verify each indication.

NOTE: The **WOW Test** only tests the display LEDs and LCD. It does not test the actual circuit functions related to each indication.

Testing the Digital Display Power Input

1. Remove digital display.
2. Perform the test at digital display connector as per following illustration and tables.



DIGITAL DISPLAY CONNECTOR (PIN-OUT)

DIGITAL DISPLAY POWER SUPPLY TEST		
CL CONNECTOR PIN	BATTERY POST	SPECIFICATION
With the D.E.S.S. key installed		
11	Negative (-)	Battery voltage
With the D.E.S.S. key installed and START button pressed		
1	Negative (-)	Battery voltage

If there is no power at pin 1, check fuse F10 and the related circuit.

If there is no power at pin 11, in check fuse F7, MAIN relay RY1, and the related circuit.

If the power test is within specification, continue with *TESTING THE DIGITAL DISPLAY GROUND CIRCUIT*.

Testing the Digital Display Ground Circuit

Test as per the following table.

DIGITAL DISPLAY GROUND TEST		
CL CONNECTOR PIN	BATTERY POST	SPECIFICATION
2	Negative (-)	1 Ω

If the ground at pin 2 is not within specification, check the related circuit.

If the ground tested to specification, continue with *TESTING THE DIGITAL DISPLAY CAN WIRE CIRCUIT*.

Testing the Digital Display CAN Circuit

1. Remove the seats for access to the DLC (Diagnostic Link Connector). Refer to *BODY* subsection.
2. Test as per the following table.

DIGITAL DISPLAY CAN WIRE TEST		
CL CONNECTOR PIN	DLC PIN	SPECIFICATION
13 (CAN HI)	1	0.4 Ω
14 (CAN LO)	2	0.4 Ω

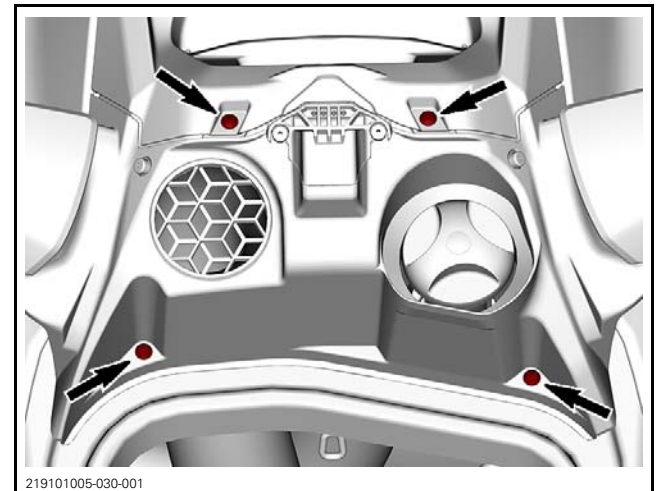
If the CAN wire verification test fails, check the related circuit.

If the digital display functions, however there is a suspected communication problem with another component, perform this test between the digital display and that component.

If the digital display power, ground and CAN verification tests are all to specifications and the digital display is inoperative, replace the digital display.

Removing the Digital Display

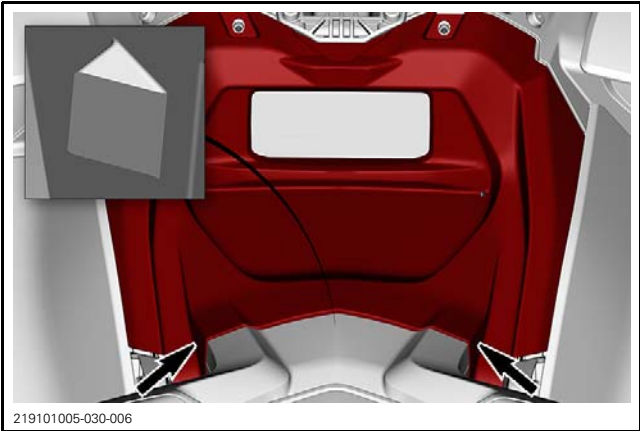
1. Open storage compartment to access and remove mirror support and console panel retaining screws.



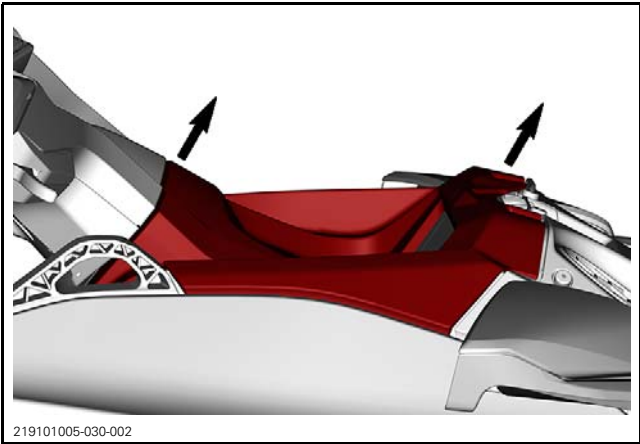
2. Remove console panel.

- 2.1 Push on both rear ends of the console panel towards the center of the vehicle to release tab.

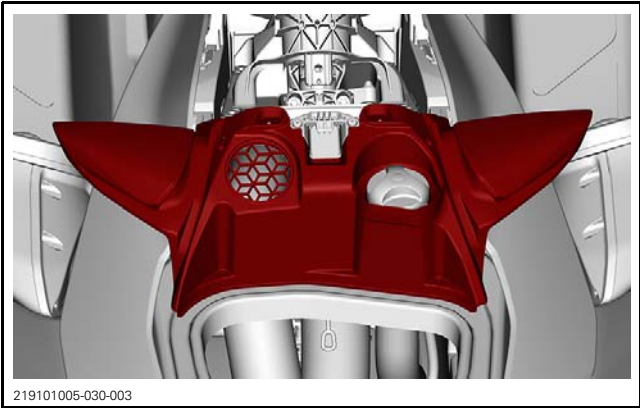
Section 06 ELECTRICAL SYSTEM
Subsection 06 (INFORMATION CENTER (DIGITAL DISPLAY))



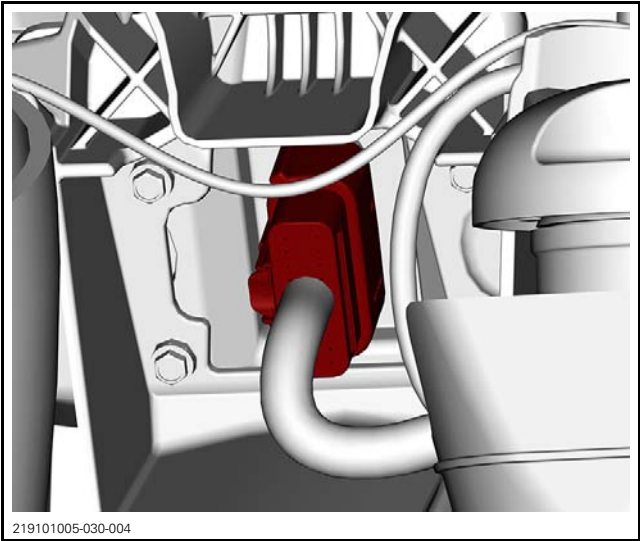
2.2 Pull the console panel upwards.



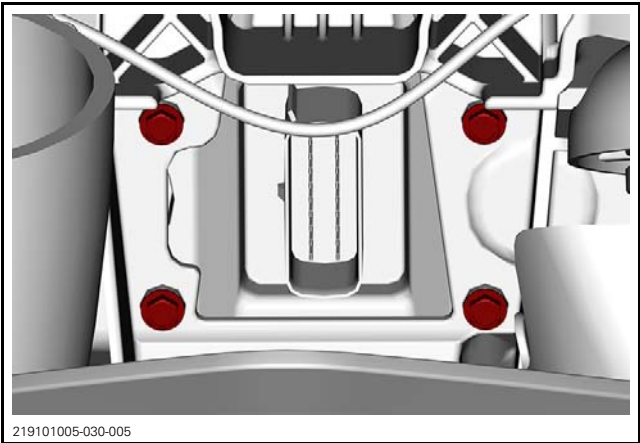
3. Remove mirror support.



4. Disconnect cluster connector (CL1).



5. Remove K50 screws securing the display to the console.



6. Remove digital display.

Installing the Digital Display

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

TIGHTENING TORQUES	
Mirror support / Console panel retaining screws	4.5 N•m ± 0.5 N•m (40 lbf•in ± 4 lbf•in)
K50 screws	2.5 N•m ± 0.5 N•m (22 lbf•in ± 4 lbf•in)

If the digital display was replaced, connect the vehicle to the BRP diagnostic software (BUDS2) and apply any available updates.

When updates are completed, perform the following:

- Transfer the vehicle mileage as described in *VEHICLE MILEAGE TRANSFER*.
- Change settings as per customer preferences (language and units) as described in *SETTING LANGUAGE AND UNITS OF MEASUREMENT*

Vehicle Mileage Transfer

1. In BUDS2, go to:
 - **SETTINGS** page
 - **CLUSTER** button
 - **SETTINGS** tab.
2. Select **Increase Odometer Mileage**.
3. Click on the upper right arrow in the green circle.
4. Read carefully the on-screen instructions before clicking in the value box.
5. Enter the new mileage if it is different from the indicated one.
6. Press SET button.
7. Press the WRITE TOTAL button.
8. Select OK to confirm the mileage.
9. Close the window.

Setting Language and Units of Measurement

1. Connect the vehicle to the BRP diagnostic software (BUDS2), refer to the *COMMUNICATION TOOLS* subsection.
2. Press the START/STOP button to energize the electrical system.
3. In BUDS2, go to:
 - **SETTINGS** page
 - **CLUSTER** button
 - **SETTINGS** tab
 - **CONFIGURE LANGUAGE AND UNITS**.

ACCESSORIES

GENERAL

Refer to *WIRING DIAGRAM* subsection for diagnostic tips on troubleshooting electrical problems.

NOTE: The accessory circuit stays ON for a period of up to 60 minutes after the engine is turned OFF if the key remains on the D.E.S.S. post. If battery voltage drops below 12.3V, the ECM will not allow the accessory circuit back ON until the engine has been started.

⚠ WARNING

It is recommended to always disconnect the battery when replacing any electrical component. Always disconnect battery as specified, BLACK (-) cable first. Do not place tools on battery.

TROUBLESHOOTING

DIAGNOSTIC TIPS

IMPORTANT: When solving an electrical problem, the first thing to do is to check the battery condition as well as its cables and connections.

Install a battery charger on battery terminals for any tests that involves a prolonged "key ON" period. If battery voltage gets too low, not only test results can be altered, but the vehicle electrical system may not operate normally.

Pay attention to ground wires. They could become loose or corroded which causes them to act as an additional load in a circuit, dropping voltage and reducing current to components. Some components may be grounded through their outer casing and mounted hardware. This should also be considered.

Electrical Connectors

Pay particular attention to ensure that pins are not out of their connectors, loose, or damaged. The troubleshooting procedures may not cover problems resulting from one of these causes.

NOTICE Ensure all terminals are properly crimped on wires and connector housings are properly fastened. When replacing any electric or electronic part(s), always check electrical connections. Make sure that they are clean, corrosion-free, tight and make good contact. The voltage and current might be too weak to go through dirty or corroded connector pins or terminals.

PROCEDURES

REMOVING AND INSTALLING THE SOUND SYSTEM

Refer to *BODY* subsection.

PREREQUISITES OF SOUND SYSTEM TESTS

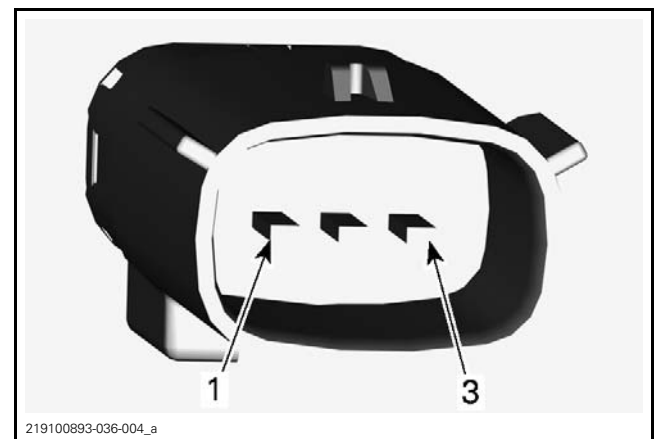
Make sure diagnostic tool 1 fuse (F14) and cluster fuse (F7) is in good condition and powered.

Make sure the battery is fully charged.

TESTING SOUND SYSTEM GROUND WIRE CONTINUITY

1. Remove lateral trim panels. Refer to *BODY* subsection.
2. Disconnect the sound system connector.

GROUND TEST AT SOUND SYSTEM CONNECTOR		
PROBE		RESISTANCE
Pin 3	Battery -	Close to 0 Ohms



SOUND SYSTEM CONNECTOR PIN-OUT

If ground test is good, test the INPUT VOLTAGE.

TESTING SOUND SYSTEM INPUT VOLTAGE

Press the START button and install the tether cord on the engine cut-off switch.

Section 06 ELECTRICAL SYSTEM

Subsection 07 (ACCESSORIES)

INPUT VOLTAGE TEST AT SOUND SYSTEM CONNECTOR		
PROBE		VOLTAGE
Pin 1 (Hot at all times)	Pin 3 (Permanent ground)	Battery voltage
Pin 2 (Hot with main relay on)		

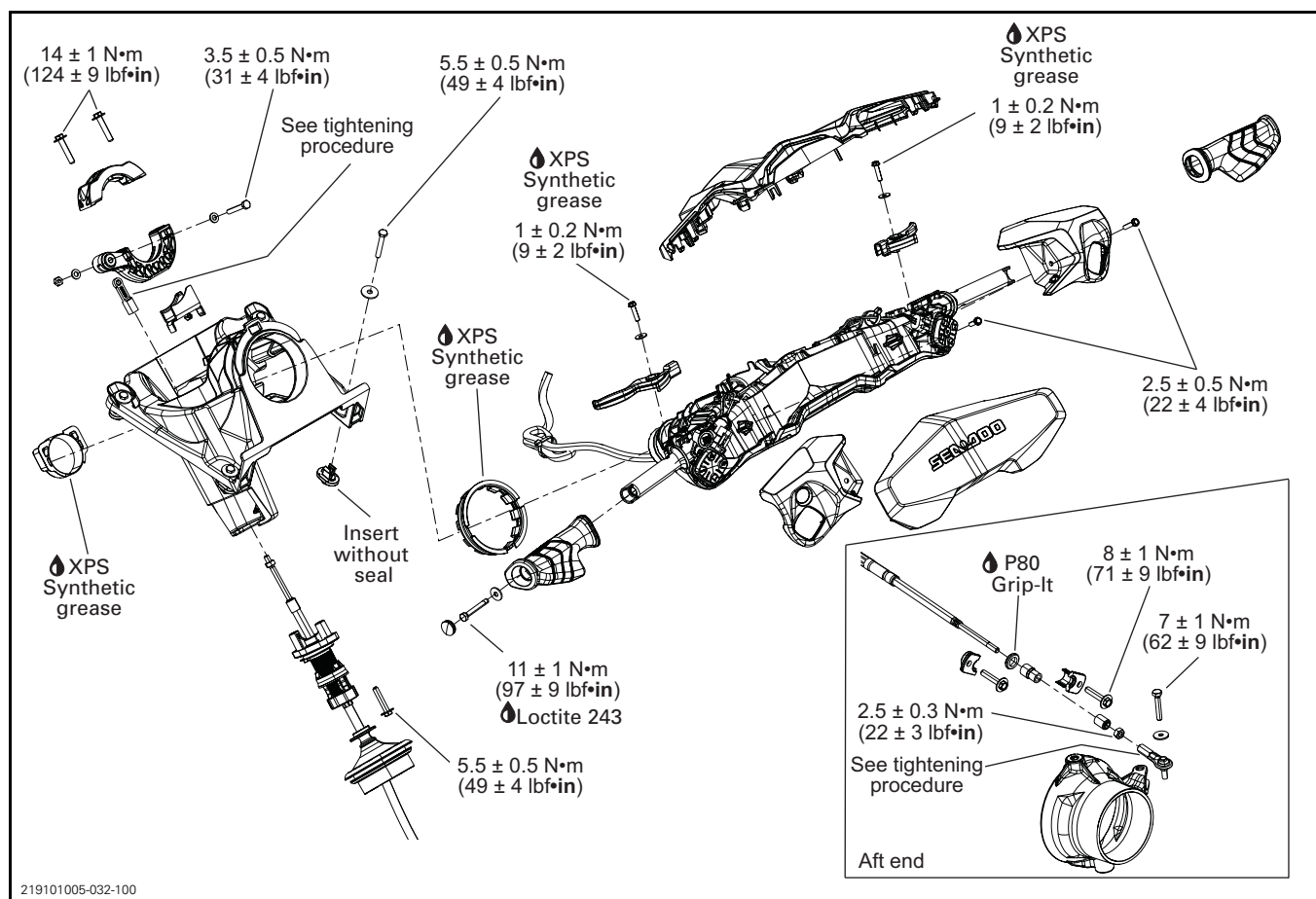
Repair wiring and connectors as required.

STEERING SYSTEM

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE).....	293 800 060	188
P80 GRIP-IT	296 000 406	194
SYNTHETIC GREASE (EUR)	779231	191
SYNTHETIC GREASE	779162	191

STEERING COLUMN

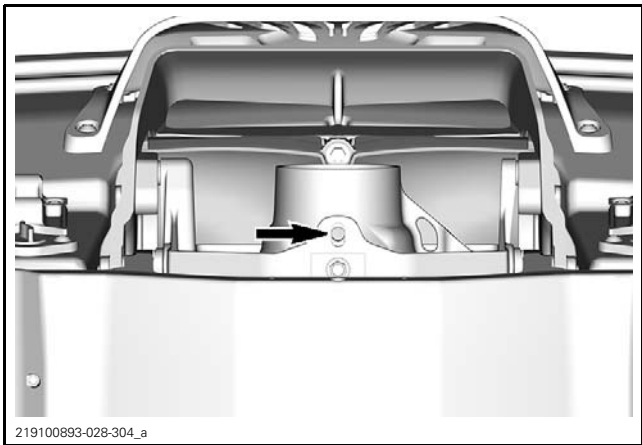


ADJUSTMENT

**ADJUSTING THE ALIGNMENT
OF THE STEERING**

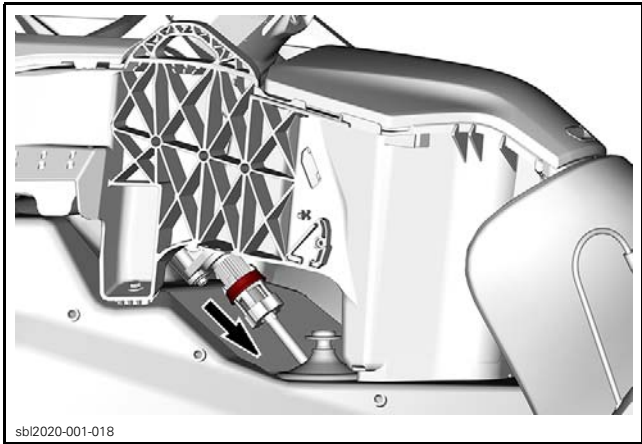
Remove the lateral trim panels. Refer to *BODY* subsection.

- 1. Raise the iBR gate by activating the iBR over-ride function.
- 2. Lock the jet pump nozzle position by installing a 10 mm (3/8 in) rod through the trimming ring as the following illustration.

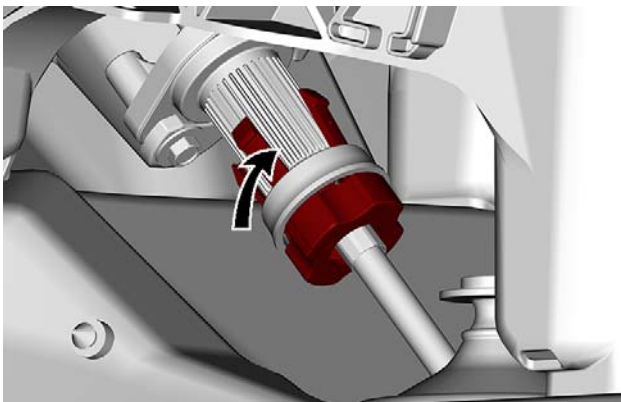
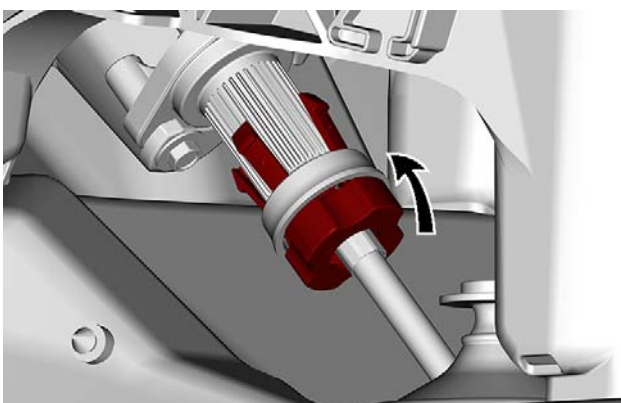


VIEW FROM UNDERSIDE

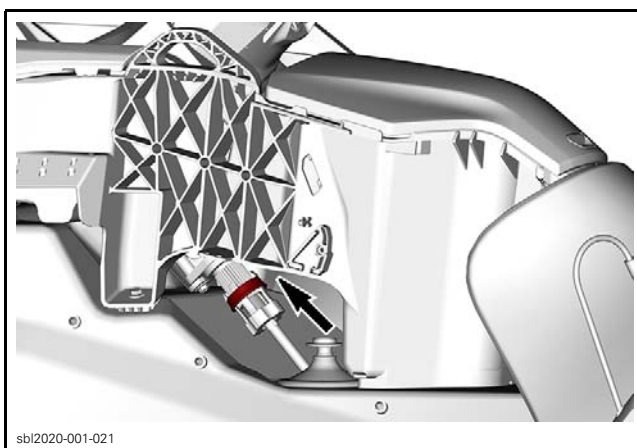
- 3. Slide the cable lock toward the bottom of watercraft.



- 4. Turn adjustment 1 turn at a time in the direction shown in following table.

WATERCRAFT BEHAVIOR	WHAT TO DO
Pulls on left side	
Pulls on right side	

5. Slide back the cable lock in place.



6. Perform adjustments until steering column is centered and body lines align.

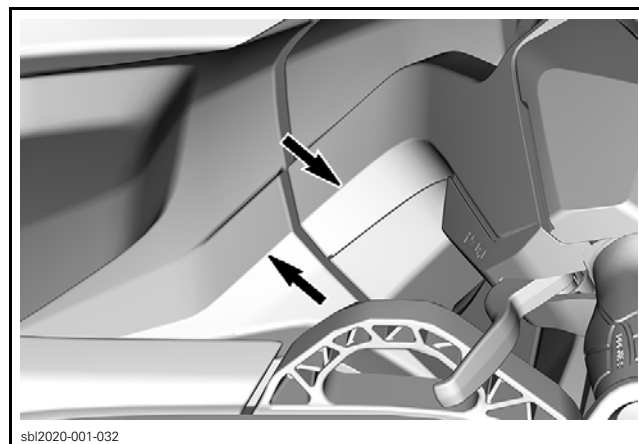
7. Test watercraft.

8. Readjust as necessary.

NOTICE When the handlebar is turned completely to the left or right side, verify that there is no interference between the jet pump and the iBR system parts.

9. Once the steering is correctly adjusted, reinstall all previously removed parts.

NOTE: It is a good starting point to align body lines when replacing the steering cable.



PROCEDURES

HANDLEBAR GRIP

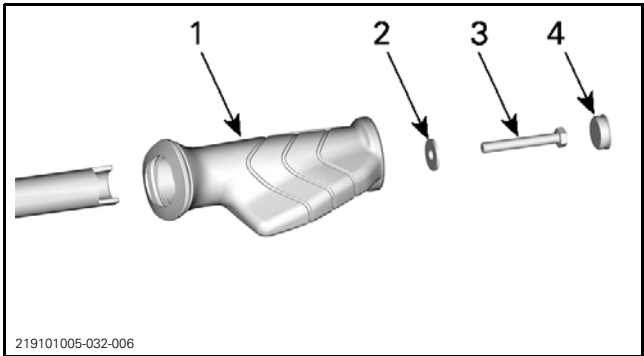
Removing the Handlebar Grip

To remove handlebar grip, remove the cap, then the retaining screw.

Section 07 STEERING AND PROPULSION

Subsection 01 (STEERING SYSTEM)

Pull out handlebar grip from handlebar.



- 1. Handlebar grip
- 2. Handlebar grip screw
- 3. Handlebar grip cap

Installing the Handlebar Grip

Install handlebar grip on handlebar matching it to the notch in the handlebar.

Apply blue Loctite on screw threads (or use new self-locking screws).

SERVICE PRODUCT
LOCTITE 243 (BLUE) (P/N 293 800 060)

Install handlebar grip screw.

Torque handlebar grip screw to specification.

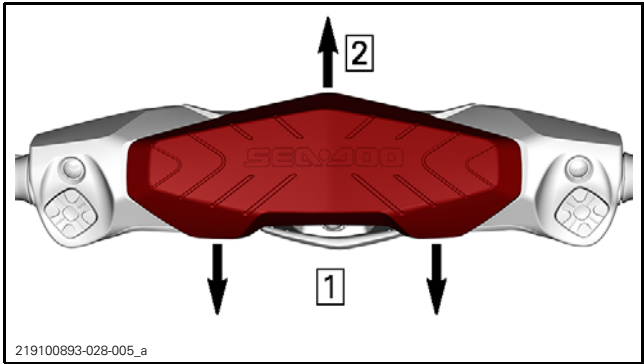
TIGHTENING TORQUE	
Handlebar grip screw	11 N•m ± 1 N•m (97 lbf•in ± 9 lbf•in)

Install cap.

HANDLEBAR SWITCH COVER
(LH OR RH)

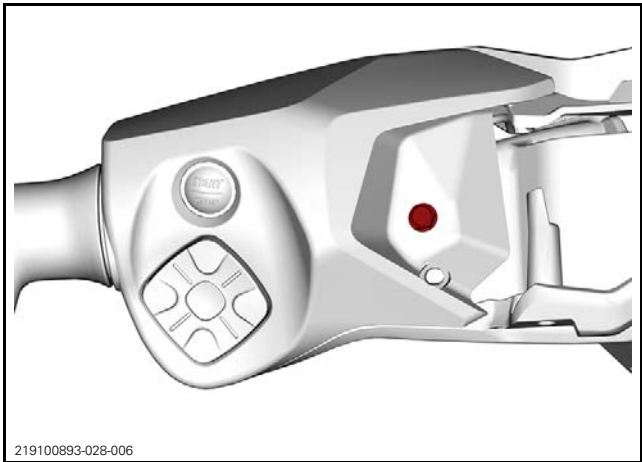
Removing the Handlebar Switch Cover
(LH or RH)

- 1. Remove steering pad by pulling the bottom first and then the top.



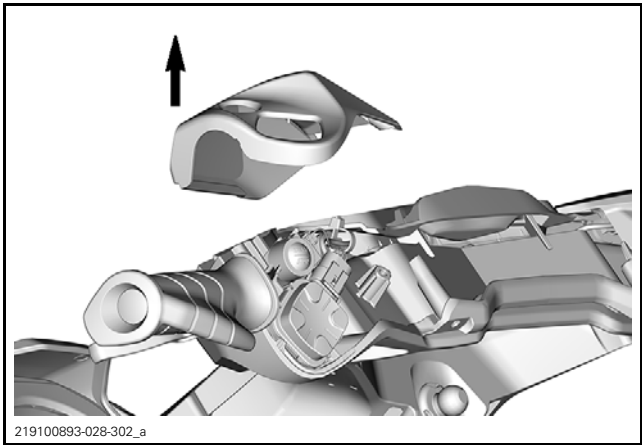
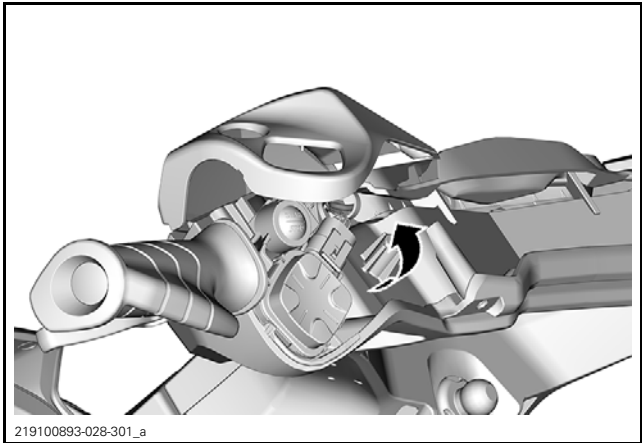
TYPICAL

- 2. Remove the switch cover retaining screw.



LH SIDE SHOWN

- 3. Remove the switch cover.



Installing the Handlebar Switch Cover
(LH or RH)

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

- 1. Route wires to avoid pinching them.

2. Position the switch cover onto the steering cover.
3. Ensure positioning of steering electrical harness.
4. Ensure proper engagement of the upper housing and cover tabs.
5. Ensure proper engagement of upper and lower switch covers.
6. Tighten housing cover screw to specification.

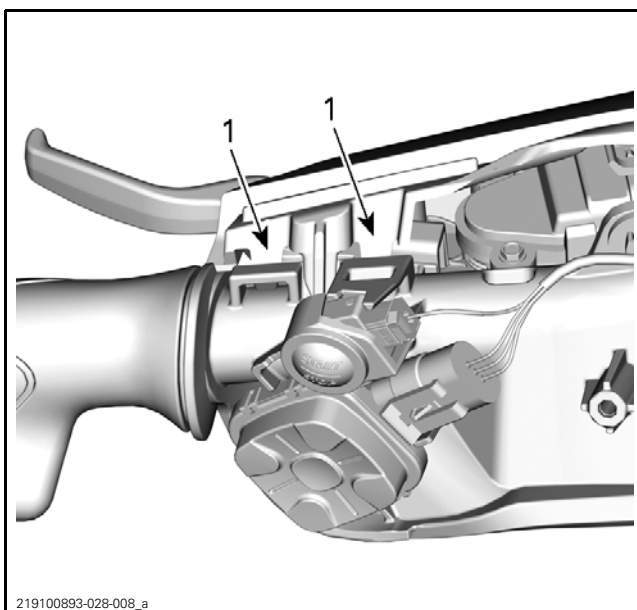
TIGHTENING TORQUE	
Housing cover screw	2.5 N•m ± 0.5 N•m (22 lbf•in ± 4 lbf•in)

STEERING COVER

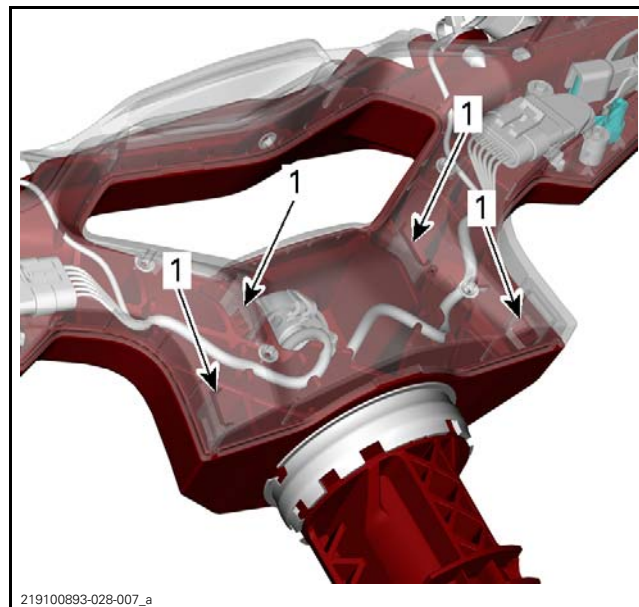
Removing the Steering Cover

1. Remove steering pad and both handlebar switch covers. Refer to this subsection.
2. Unlock steering cover from steering.
 - 2.1 Insert a small tool, such as a small flat screwdriver, 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.

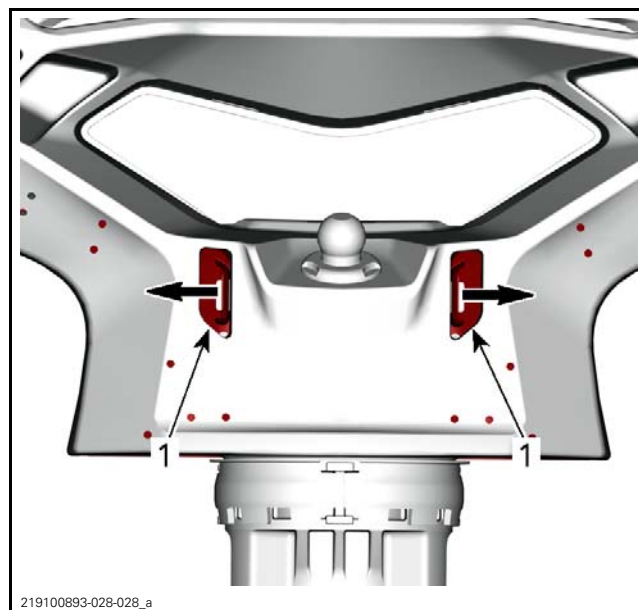


1. Retaining tab



1. Retaining tab

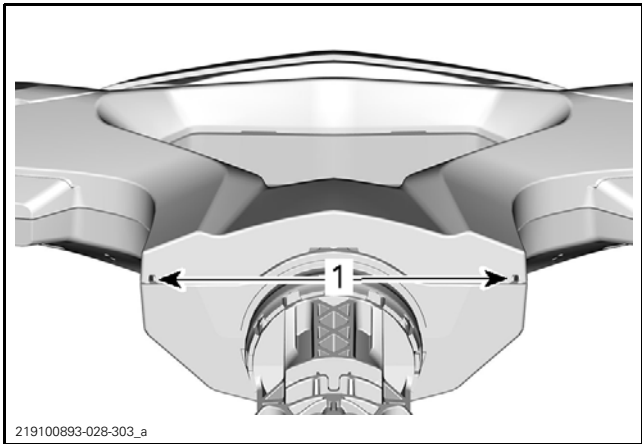
- 2.2 In both cavities under the steering cover, release both inner retaining tabs using a long screwdriver.



VIEWED FROM UNDERNEATH

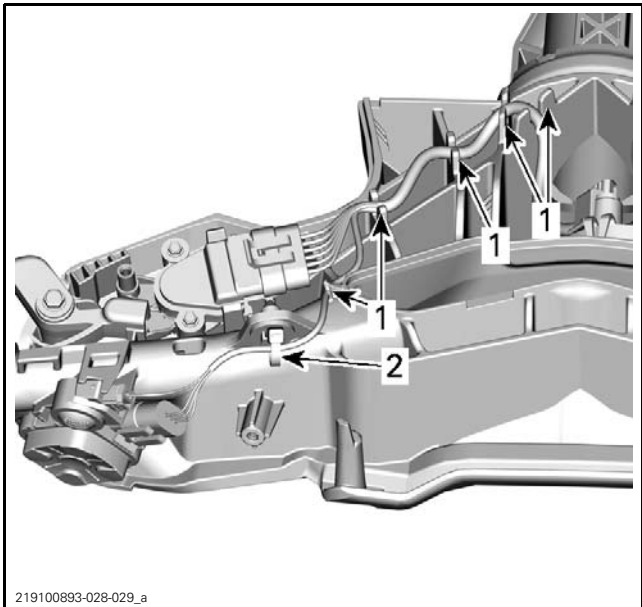
1. Rear cavity

Section 07 STEERING AND PROPULSION
Subsection 01 (STEERING SYSTEM)



Installing the Steering Cover

1. Make sure all harnesses are routed properly into their positioning slots and are away from the outer edges. This will ensure the wires will not get pinched.



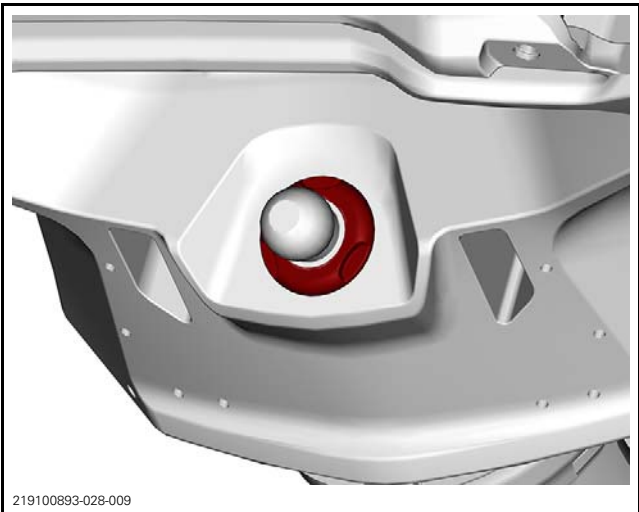
1. *Harness slots*
2. *Locking tie*

2. Clip the top of the cover.
3. Push both side of the cover to lock it with the steering column.
4. Install switch covers.

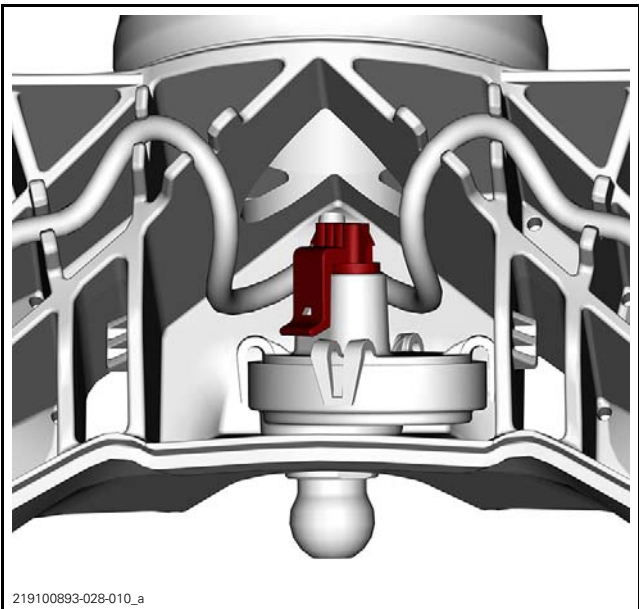
REPLACING THE ENGINE CUT-OFF SWITCH

Remove steering pad. Refer to procedure in this subsection.

Remove cut-off switch nut.



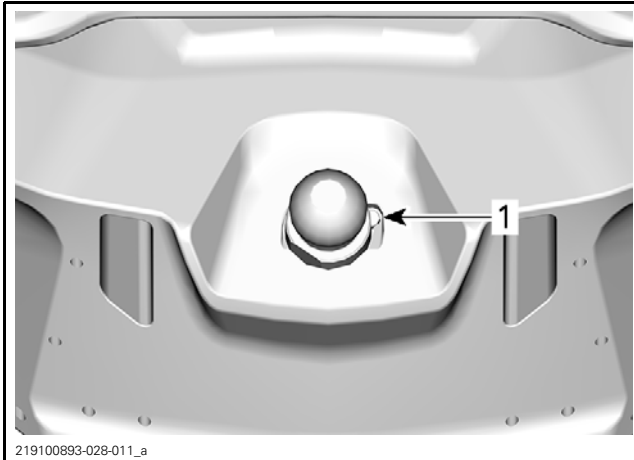
Disconnect cut-off switch connector.



Push cut-off switch out of the steering column.
Install the engine cut-off switch by aligning the alignment pin into the notch of steering column.

Section 07 STEERING AND PROPULSION

Subsection 01 (STEERING SYSTEM)



1. Alignment pin

Connect and install all removed parts using appropriate procedures.

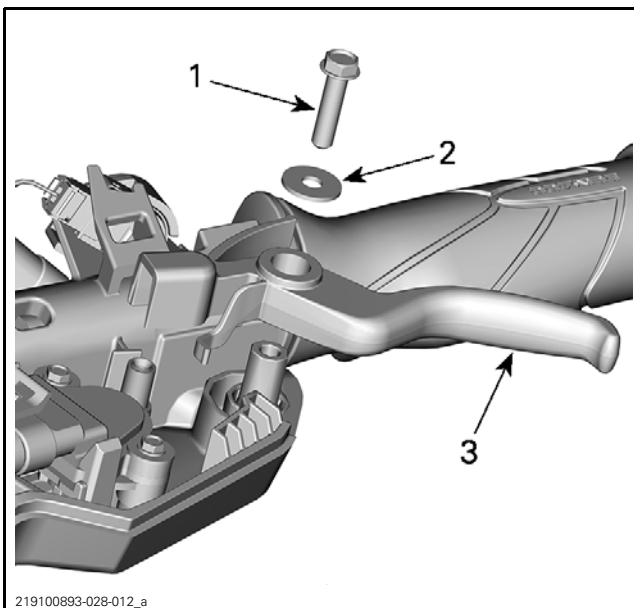
TIGHTENING TORQUE	
Engine cut-off switch nut	2 N•m (18 lbf•in)

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

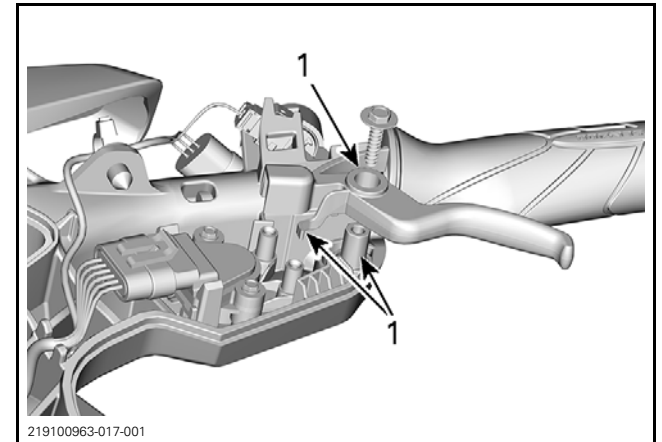
1. Remove steering cover. Refer to procedure in this subsection.
2. Remove the screw and washer securing throttle lever.
3. Remove throttle lever.



1. Retaining screw
2. Washer
3. Throttle lever

4. Clean throttle lever area from dust or any deposits.
5. Apply grease on pivot and the outer surface of the return tab.

SERVICE PRODUCT	
Scandinavia	SYNTHETIC GREASE (EUR) (P/N 779231)
All other countries	SYNTHETIC GREASE (P/N 779162)



1. Apply grease here

6. Install the lever.
 - 6.1 Install lever on pivot.
 - 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	1 N•m ± 0.2 N•m (9 lbf•in ± 2 lbf•in)

7. Reinstall all removed parts using appropriate procedures.

STEERING CABLE

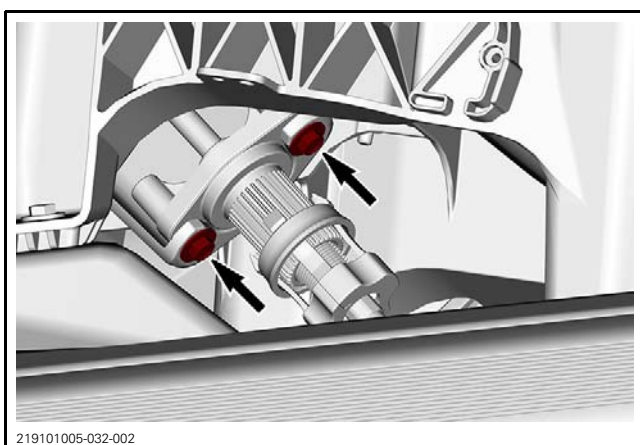
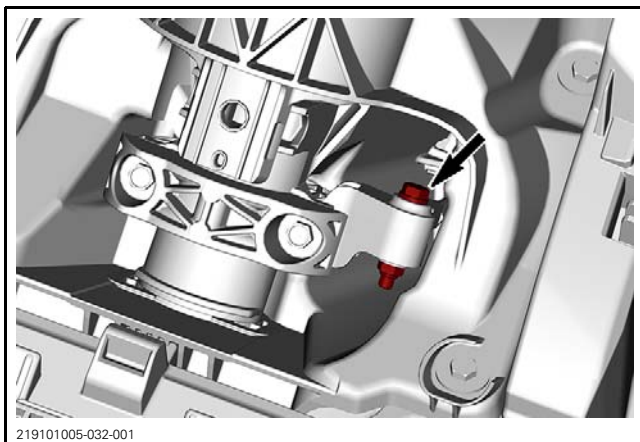
Replacing the Steering Cable

Remove the gauge support, the seat and the service cover. Refer to *BODY* subsection.

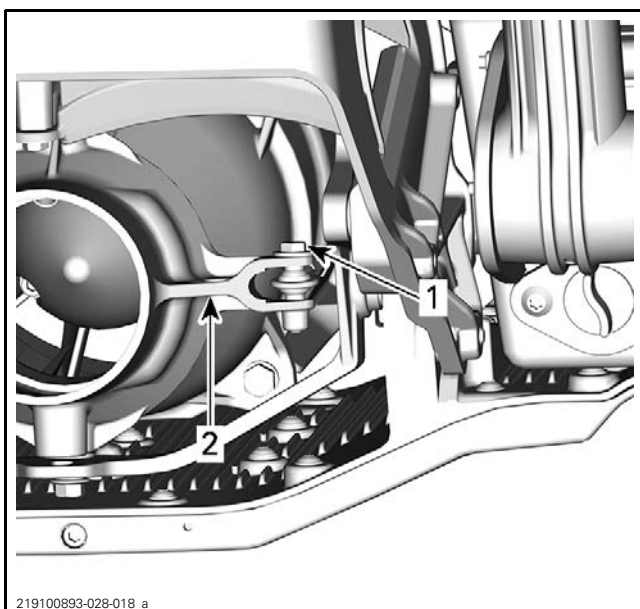
1. Detach steering cable from steering column.
 - 1.1 Remove following fasteners.

Section 07 STEERING AND PROPULSION

Subsection 01 (STEERING SYSTEM)

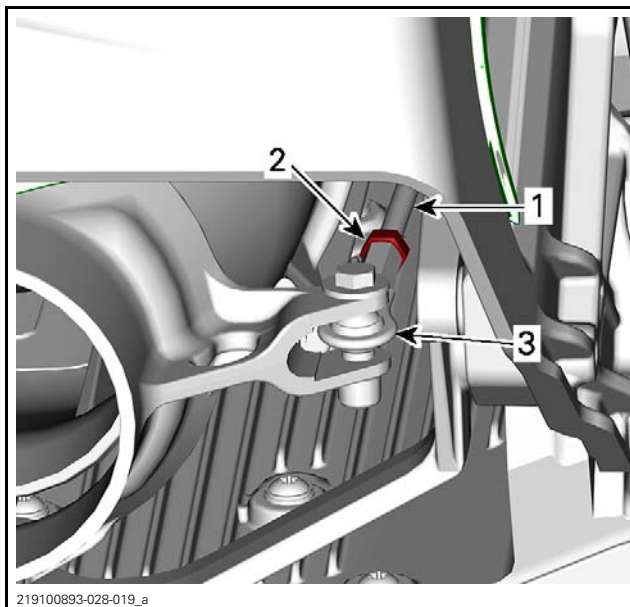


2. At rear of the watercraft, disconnect ball joint from jet pump nozzle arm.



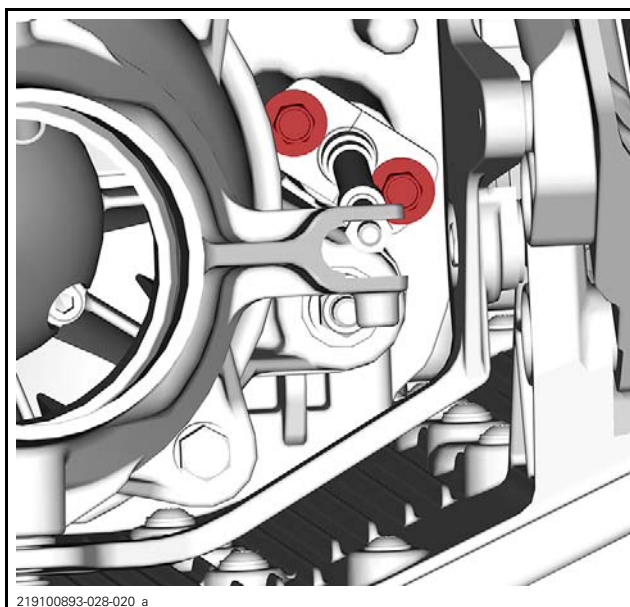
1. Steering cable bolt
2. Nozzle arm

3. Remove ball joint and jam nut from cable.



1. Steering cable
2. Jam nut
3. Ball joint

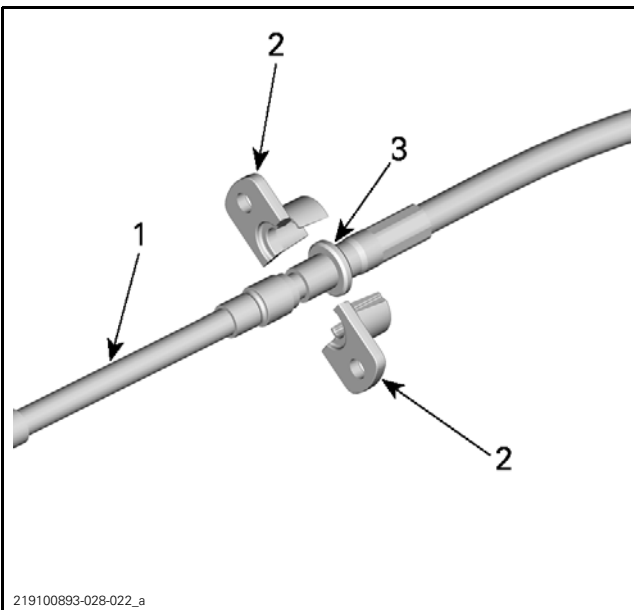
4. Remove half-rings retaining screws.



5. Pull the cable assembly to remove the half-rings and O-ring.

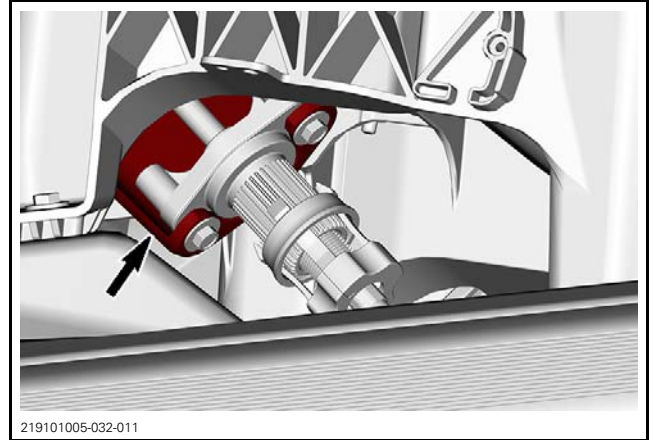
Section 07 STEERING AND PROPULSION

Subsection 01 (STEERING SYSTEM)



- 1. Steering cable
- 2. Half ring
- 3. O ring

6. Carefully slide cable plastic adjustment fittings out of steering support tunnel.



STEERING SUPPORT TUNNEL

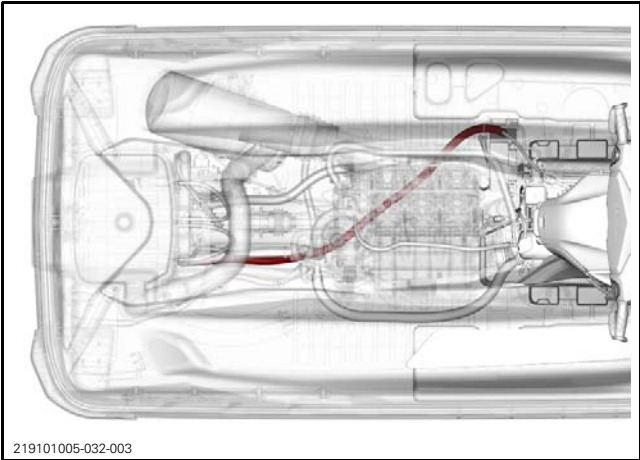
TIP : Remove steering support from console to ease procedure. Refer to procedure in this subsection.

7. Remove the adjusting nut from the new steering cable.
8. Using a piece of hose, attach the aft end of cable to 2.5 m (8.25 ft) long hose / fish tape. As you pull out the cable from the deck and the cable rubber bellows, the fish tape will gradually take the place of the previous cable. This ensure proper routing.

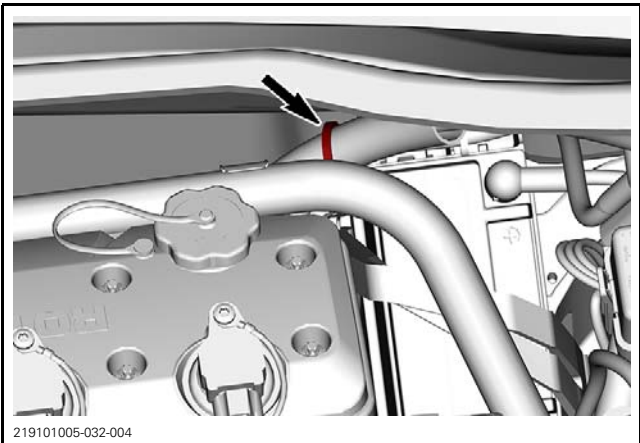
NOTE: Make sure cable hose / fish tape is long enough to stay outside hull (pump box).

9. From inside the hull, pull the aft end of the cable through the hull fitting.
10. Slowly pull the cable out of the vehicle through the gap from the lateral trim panel. Make sure the corrugated sheath stays on the cable.
11. Inspect cable and sheath. Replace as required.
12. Route the aft end of the cable through the cable rubber bellows.
13. Route the cable as shown and secure it using locking tie near battery.

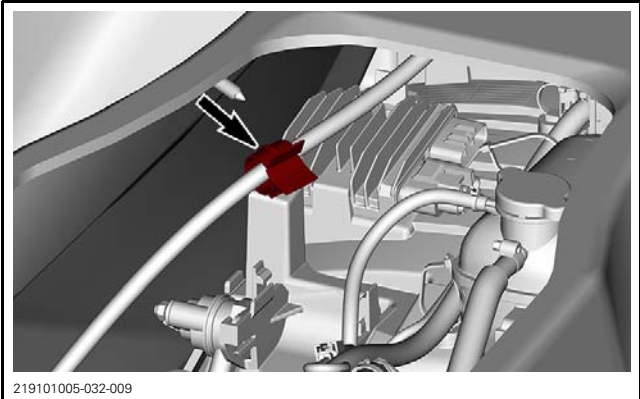
Section07 STEERING AND PROPULSION
Subsection01 (STEERING SYSTEM)



219101005-032-003



219101005-032-004



219101005-032-009

NOTE: The cable is initially routed under the engine. Make sure the cable is loose before the next step.

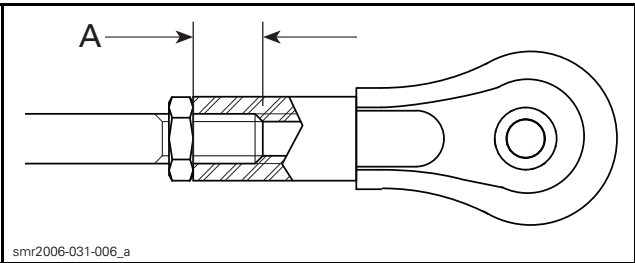
- 14. From inside of the hull, route the aft end of the cable through the hull fitting.
- 15. Secure the steering cable to the hull fitting.
15.1 Apply lubricant on O-ring and install it with half rings.

Table with 2 rows: SERVICE PRODUCT, P80 GRIP-IT (P/N 296 000 406)

15.2 Tighten the half-rings retaining screws to specification.

Table with 2 columns: Half-rings retaining screws, 8 N•m ± 1 N•m (71 lbf•in ± 9 lbf•in)

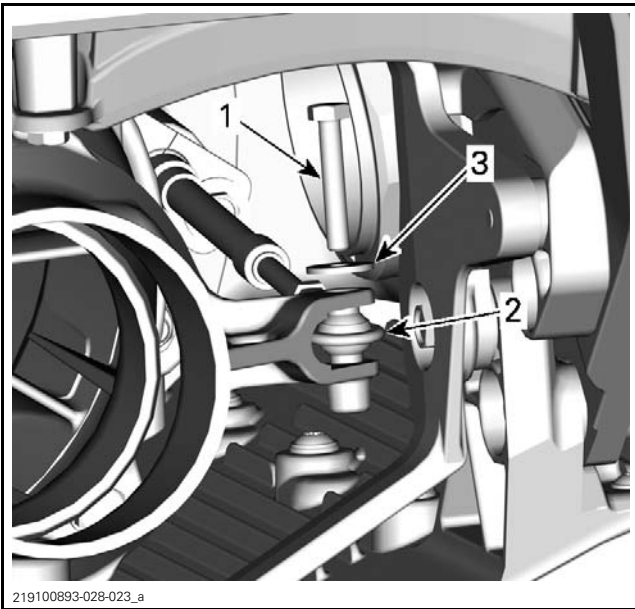
- 16. Install the ball joint on the end of the steering cable.
16.1 The threaded portion of steering cable inserted into ball joint should be within 9 mm ± 1 mm (.354 in ± .039 in).



smr2006-031-006_a

A. 9 mm ± 1 mm (.354 in ± .039 in)

- 16.2 Tighten jam nut to specification.
- 16.3 Position the steering cable ball joint to the nozzle as per following illustration.



- 1. Ball joint bolt
2. Ball joint
3. Washer

Table with 2 columns: TIGHTENING TORQUE, Ball joint jam nut, 2.5 N•m ± 0.3 N•m (22 lbf•in ± 3 lbf•in), Ball joint bolt, 7 N•m ± 1 N•m (62 lbf•in ± 9 lbf•in)

Section 07 STEERING AND PROPULSION

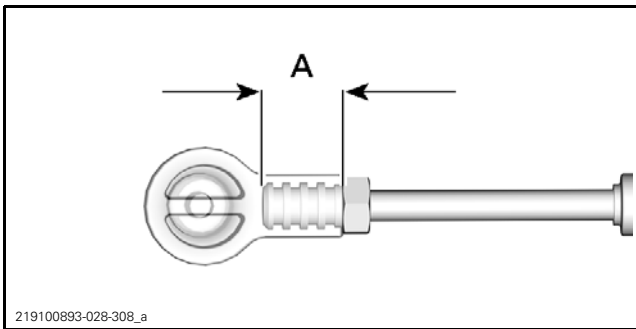
Subsection 01 (STEERING SYSTEM)

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

TIGHTENING TORQUE	
Cable support retaining screw	3.5 N•m ± 0.5 N•m (31 lbf•in ± 4 lbf•in)

Carry out *ADJUSTING THE ALIGNMENT OF THE STEERING*. See procedure in this subsection.

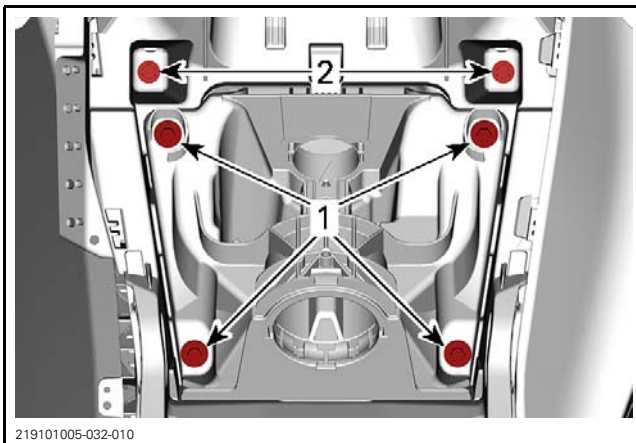
The threaded portion of steering cable inserted into the end fitting should be $9\text{ mm} \pm 1\text{ mm}$ ($.354\text{ in} \pm .039\text{ in}$).



A. $9\text{ mm} \pm 1\text{ mm}$ ($.354\text{ in} \pm .039\text{ in}$)

Install all removed parts using appropriate procedure.

NOTE: Be aware that some inserts have a seal and others do not. Refer to the following image.



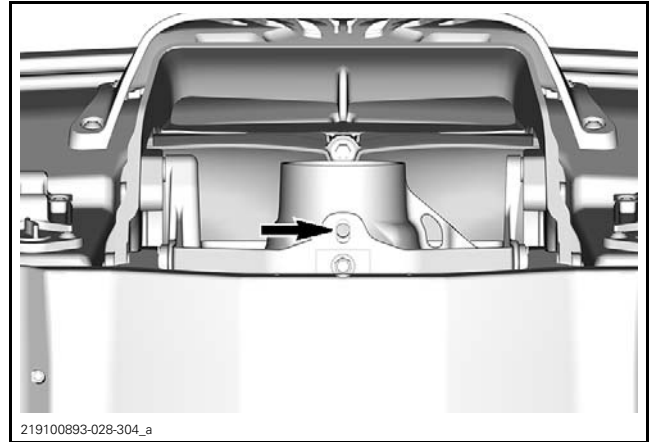
1. Inserts without seal
2. Inserts with seal

Adjusting the Steering Cable

- 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.

- Lock the jet pump nozzle position by installing a 10 mm (3/8 in) rod through the trimming ring as the following illustration.



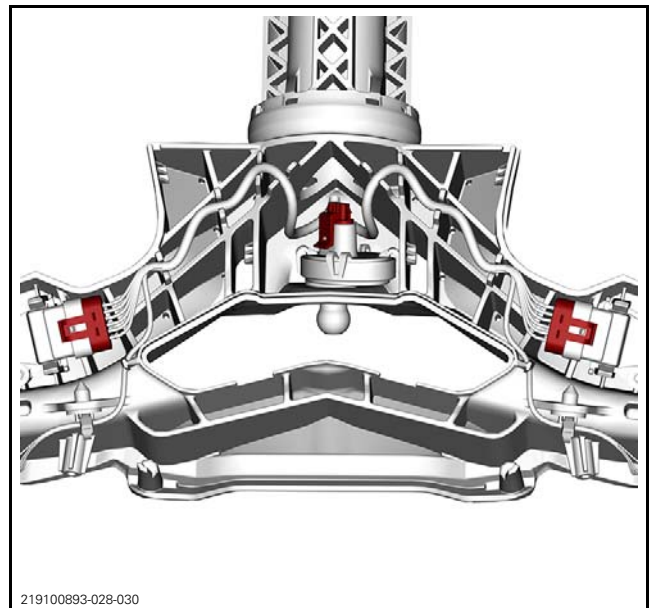
VIEW FROM UNDERSIDE

- Adjust steering cable as described in *STEERING ALIGNMENT* in this subsection.

STEERING COLUMN

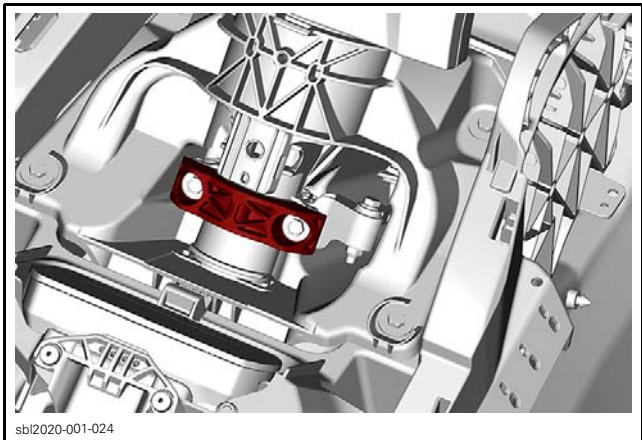
Removing the Steering Column

- Remove the top cover and the gauge support, Refer to *BODY* subsection.
- Remove the steering cover.
- Disconnect both iBR and throttle connectors and engine cut off switch connector.



Section 07 STEERING AND PROPULSION
Subsection 01 (STEERING SYSTEM)

4. Remove both screws securing the steering column arm and clamp.



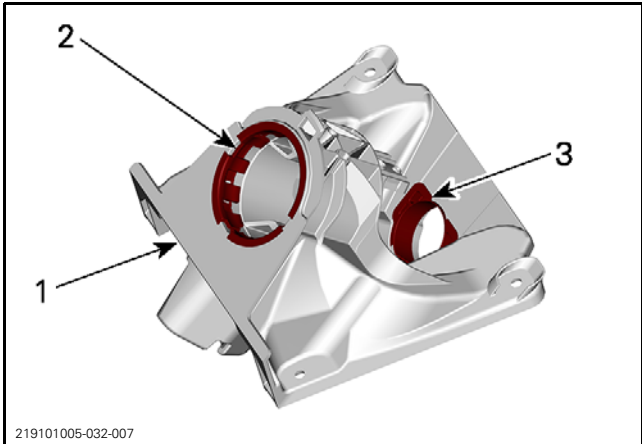
5. Pull steering column out of its support.

Inspecting the Steering Column

Check steering column for:

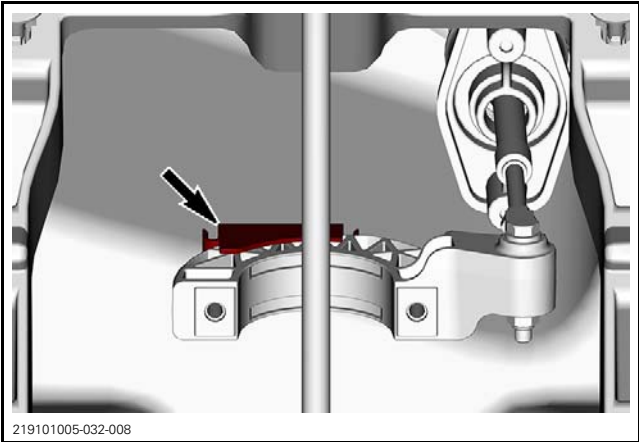
- Cracks
- Stress marks
- Signs of wear.

Check steering column support bushings.



1. Steering column support
2. Upper bushing
3. Lower bushing

Check wear sleeve behind the steering column arm.

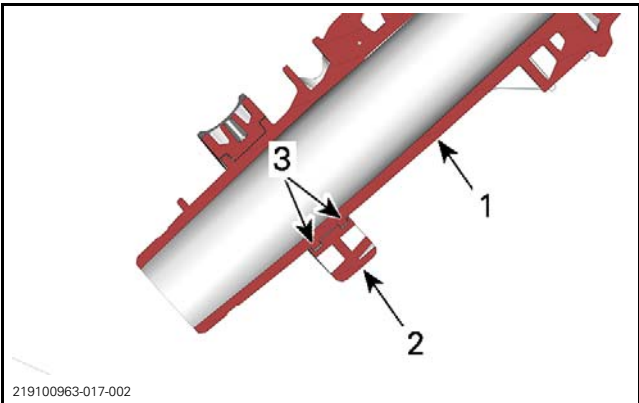


Replace any damaged or worn parts.

Installing the Steering Column

The installation is the reverse of the removal procedure. However, pay attention to the following. Carefully, drive steering column through steering column support.

Make sure the locating grooves of the steering column arm are properly engaged in the steering column as shown.



1. Steering column
2. Steering arm
3. Locating grooves

Tighten steering column arm screws to specifications.

TIGHTENING TORQUE	
Steering column arm screws	14 N•m ± 1 N•m (124 lbf•in ± 9 lbf•in)

NOTICE Ensure the head of the screws touches the upper steering arm.

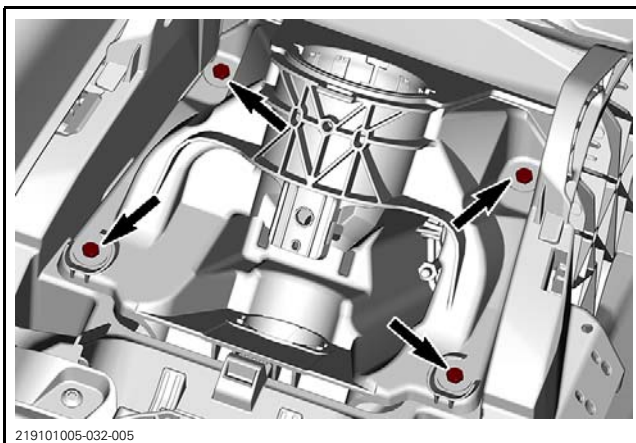
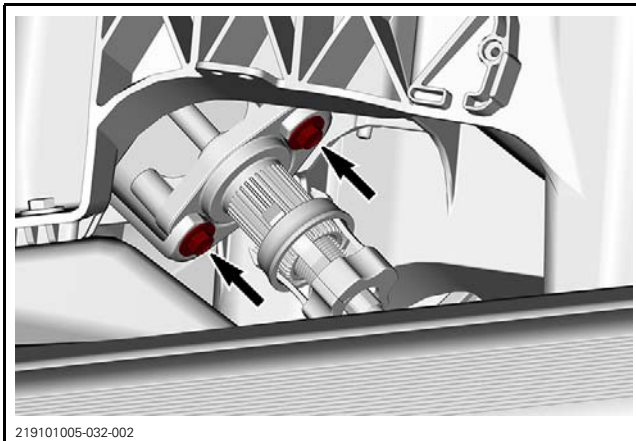
Ensure the steering system is working properly by turning side to side.

Reinstall all removed parts using appropriate procedure.

STEERING COLUMN SUPPORT

Removing the Steering Column Support

1. Remove steering column, refer to *REMOVING THE STEERING COLUMN* in this subsection.
2. Remove following fasteners.



3. Remove steering column support from vehicle.

Installing the Steering Column Support

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

TIGHTENING TORQUE	
Steering column support retaining screws	5.5 N•m ± 0.5 N•m (49 lbf•in ± 4 lbf•in)

iBR, REVERSE AND VTS

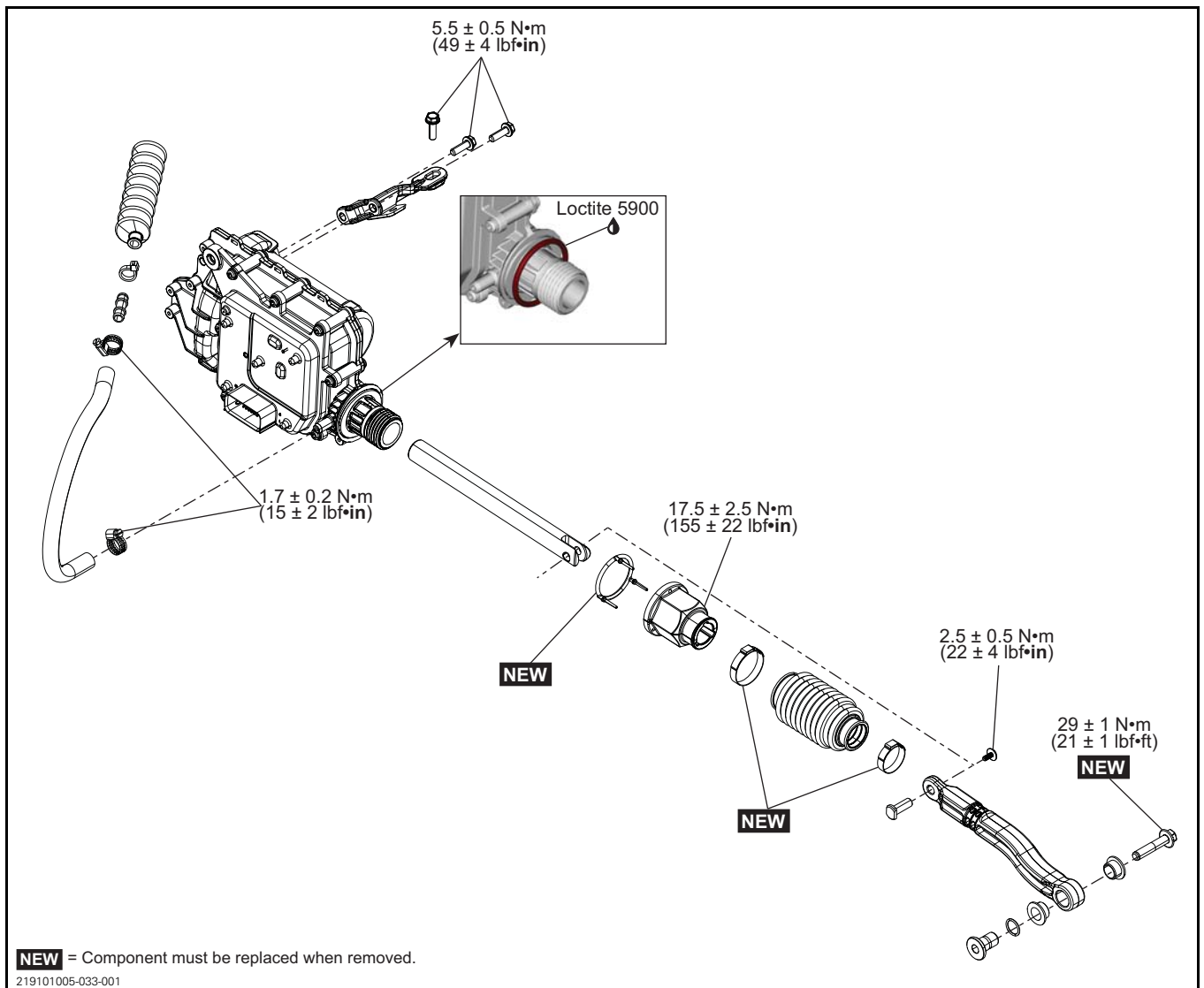
SERVICE TOOLS

Description	Part Number	Page
DIAGNOSTIC HARNESS	529 036 384	214
IBR NUT SOCKET.....	529 036 379	210

SERVICE PRODUCTS

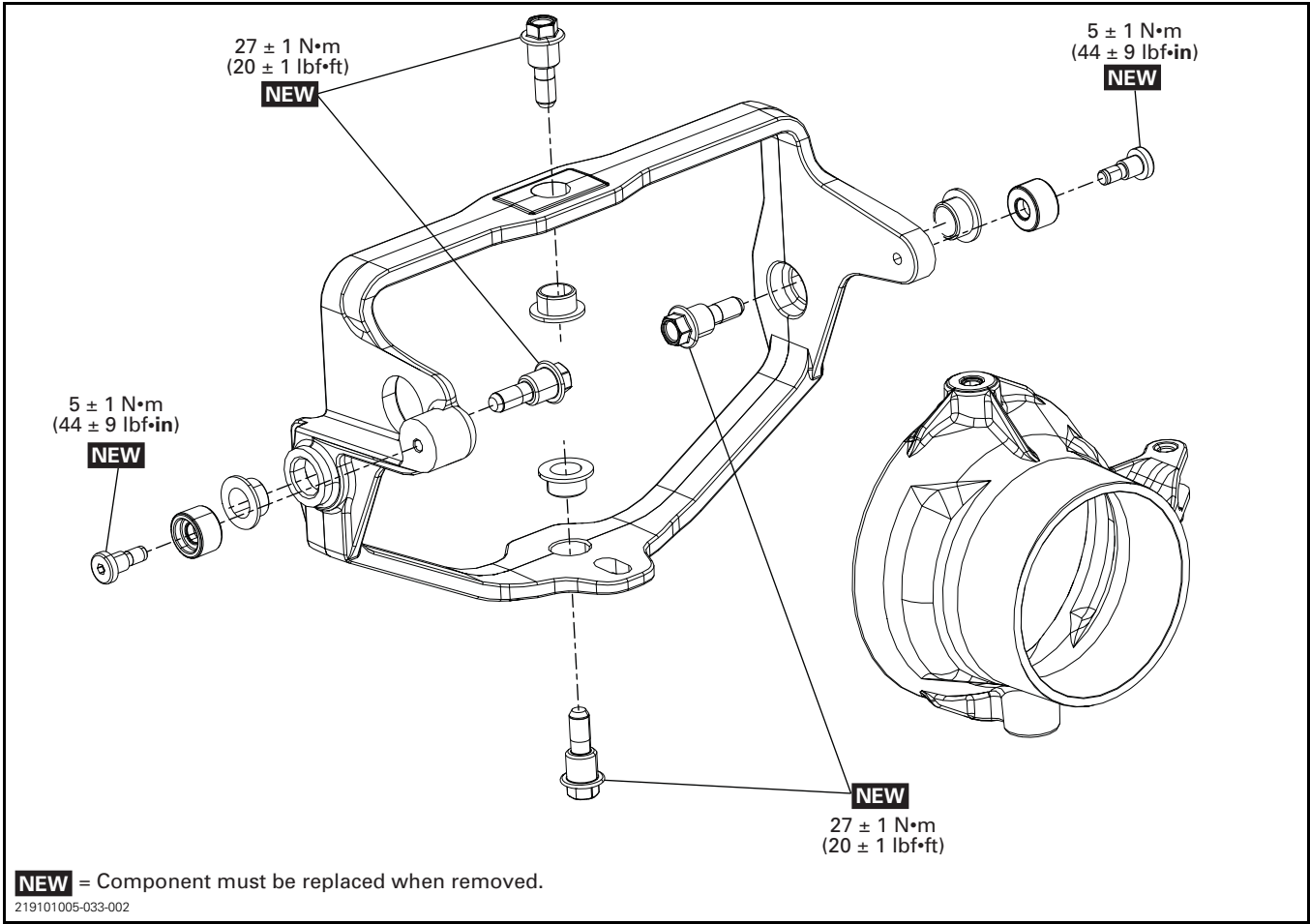
Description	Part Number	Page
CLEAR SILICONE SEALANT	296 000 309	211
LOCTITE 5900	293 800 066	211

iBR ACTUATOR

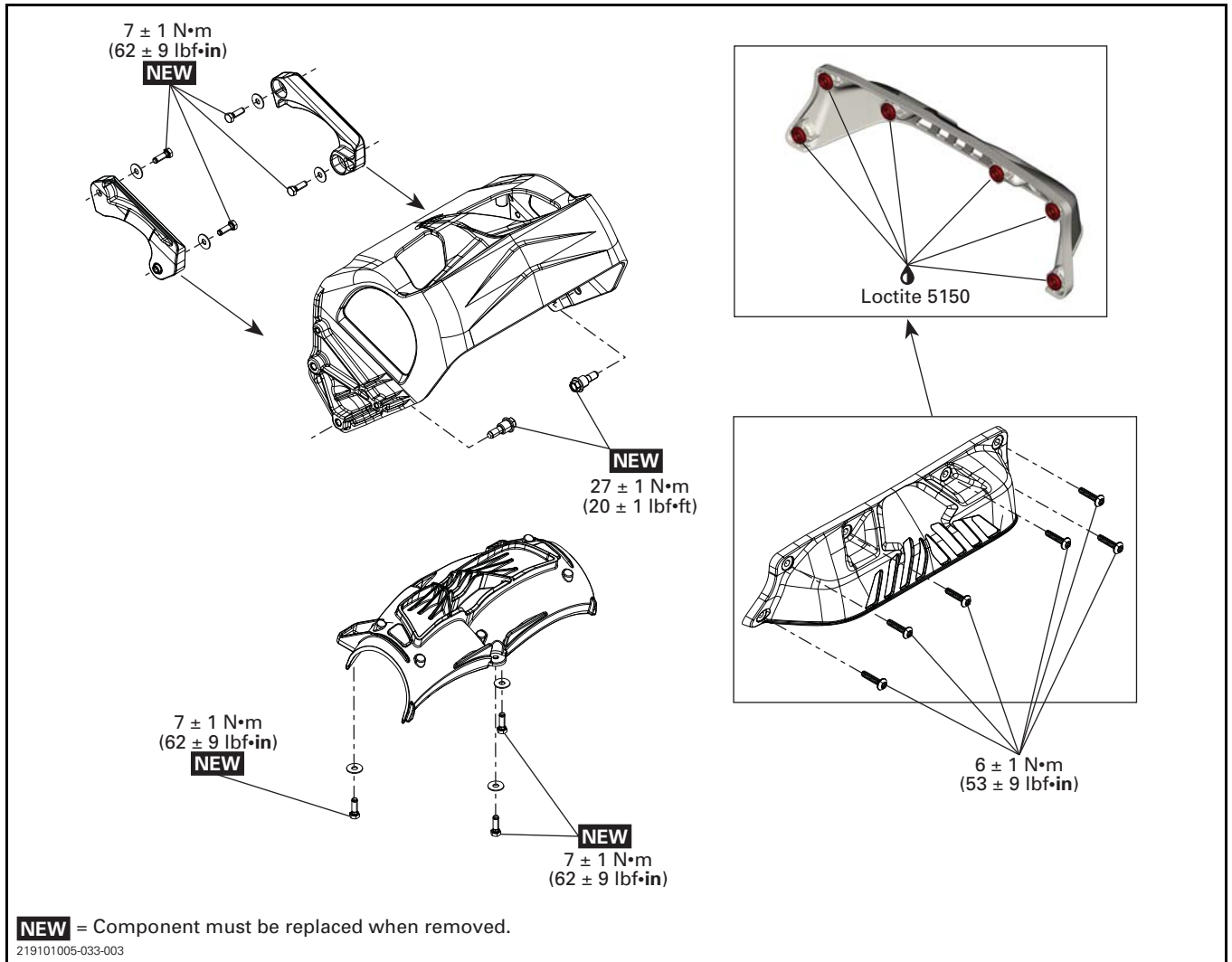


Section 07 STEERING AND PROPULSION
Subsection 02 (iBR, REVERSE AND VTS)

VTS TRIM RING AND NOZZLE




iBR GATE



GENERAL

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

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



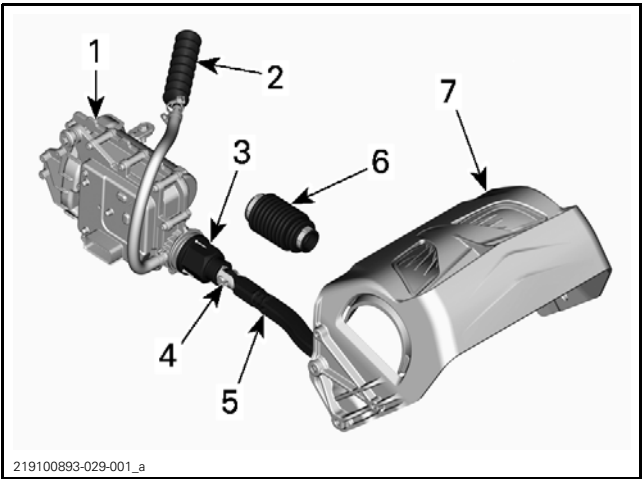
WARNING

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.

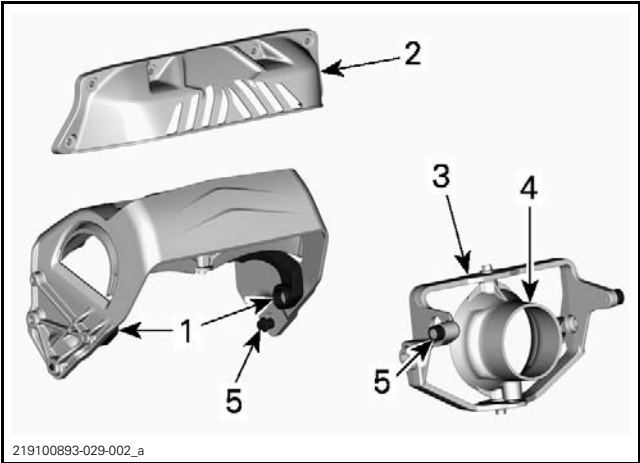
Hoses, cables or locking ties removed during a procedure must be reinstalled as per factory standards.

SYSTEM DESCRIPTION (iBR)

iBR System Components



- TYPICAL
- 1. Actuator
 - 2. Air chamber
 - 3. iBR nut
 - 4. Actuator shaft
 - 5. Connecting arm
 - 6. Connecting arm bellows
 - 7. iBR Reverse Gate



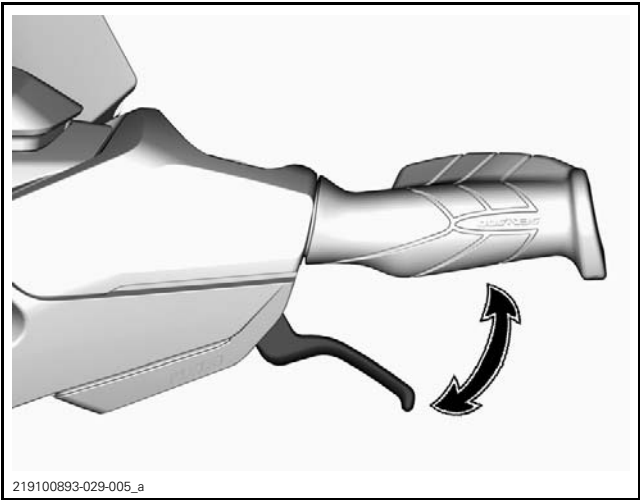
- 1. Support plates
- 2. Protective guard
- 3. VTS trim
- 4. Nozzle
- 5. Friction sleeves

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.

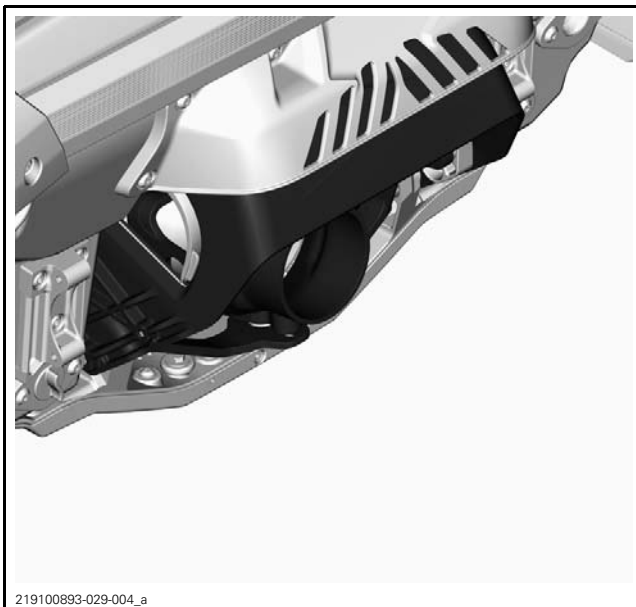
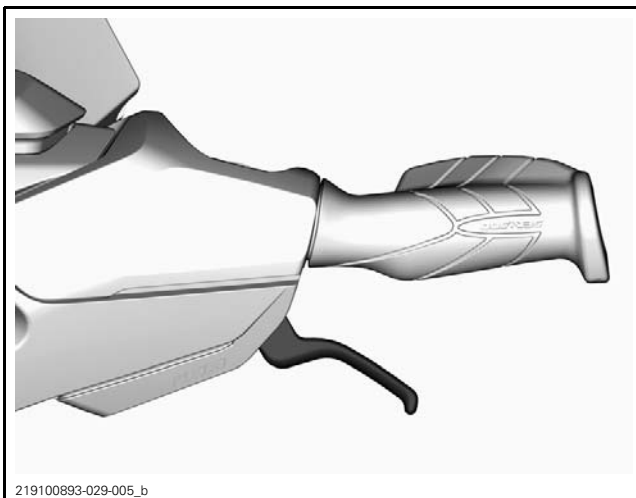


When the iBR lever is pulled in, it operates the brake and reverse lever sensor (BRLS). It is a double output hall effect sensor. The redundancy is used for security purposes.

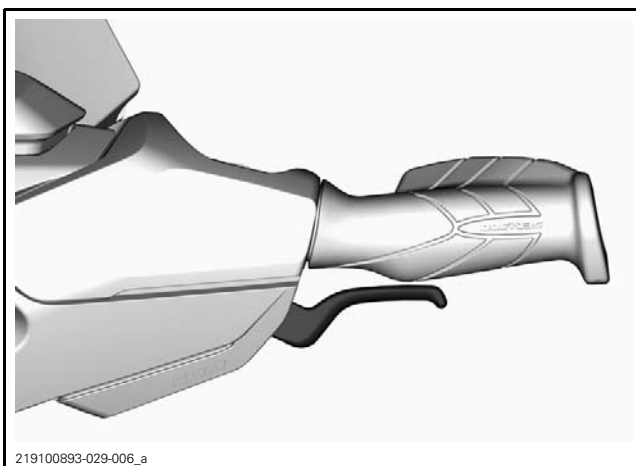
The BRLS sends the signals to the iBR module. The iBR module controls an electric motor that in turn raises or lowers the iBR gate through a mechanical drive unit.

Section 07 STEERING AND PROPULSION

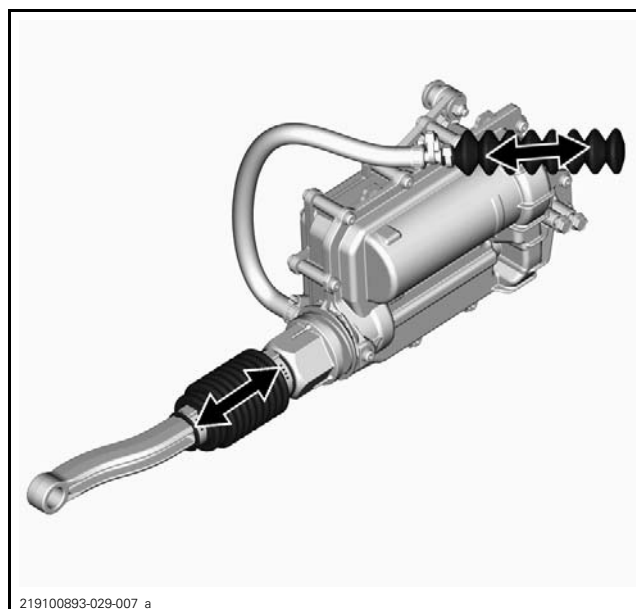
Subsection 02 (iBR, REVERSE AND VTS)



FORWARD



REVERSE



iBR ACTUATOR AIR CHAMBER MOVEMENT

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.

Section 07 STEERING AND PROPULSION

Subsection 02 (iBR, REVERSE AND VTS)

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.

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.
 - 3.2 Press the SET or OK button on the information center (gauge).
4. Press the VTS UP or DOWN button to move the iBR gate.

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 the 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 RPM ramps up to the engine power commanded by the iBR lever.

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 lever position. 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.

SYSTEM DESCRIPTION (VTS)

The VTS system is actually part of the iBR system. It provides watercraft pitch trim adjustments by adjusting the vertical position of the jet nozzle.

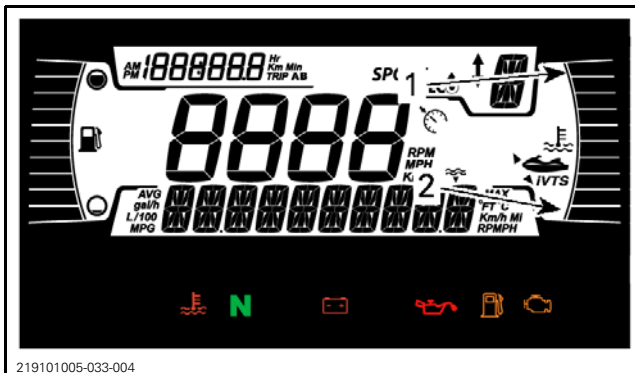
The VTS can be electrically trimmed to the desired attitude within the VTS range, or to one of 2 preset trim positions (on applicable models).

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 3 preset trim positions

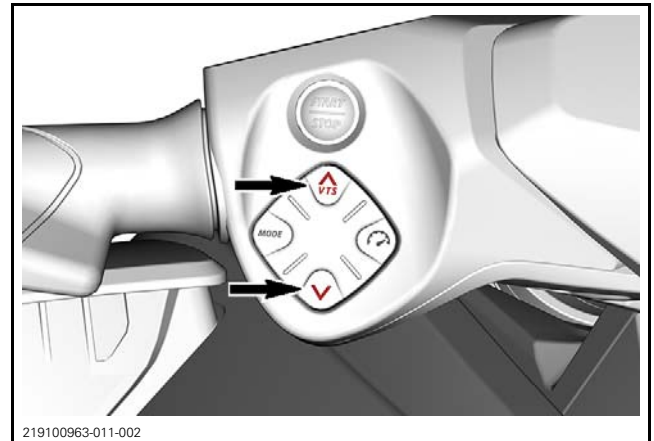
Nozzle Trimming

Watercraft must be operating in forward position.

9 trim positions are available.

Using the VTS Button (LH Side of Handlebar)

Press the UP or DOWN arrow button to change the VTS setting.



Using Preset Trim Positions

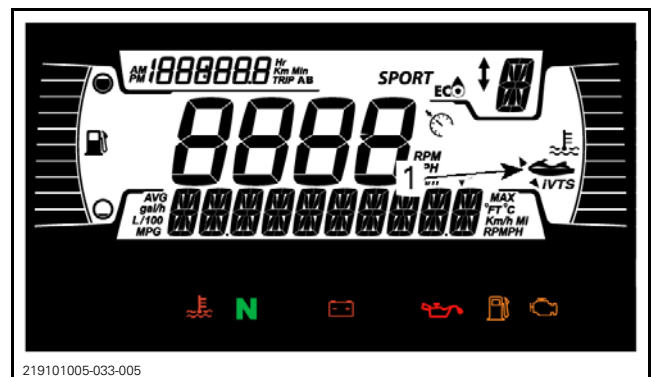
Three preset trim positions can be selected.

To select the **highest** trim position, double-click on the VTS UP arrow button (bow up).

To select the **lowest** trim position, double-click on the VTS DOWN arrow button (bow down).

Launch Control (If equipped)

The Launch Control is an automatic adjustment of the VTS to achieve optimum acceleration. When the speed is below 20 km/h (12 MPH), the VTS lowers to its lowest position and the iVTS indicator flashes to indicate the system is ready. When the speed exceeds 30 km/h (19 MPH) the VTS returns to the user selected position.

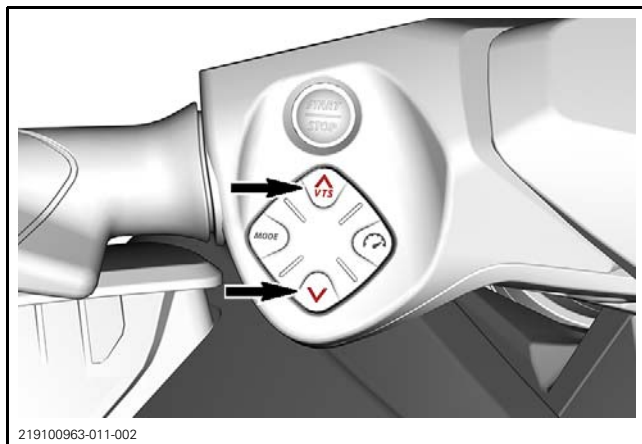


1. Launch Control indicator

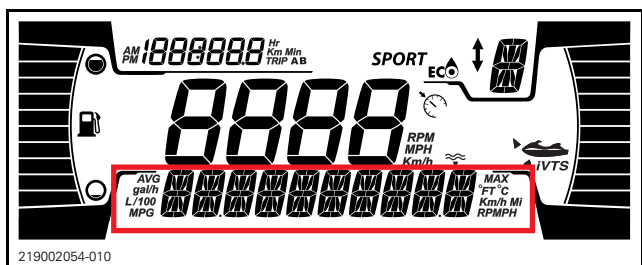
To activate the Launch Control, press simultaneously both the VTS UP and DOWN buttons.

Section 07 STEERING AND PROPULSION

Subsection 02 (iBR, REVERSE AND VTS)



The message LAUNCH ON will be displayed.



To deactivate the Launch Control, press simultaneously both UP/DOWN buttons again.

The message LAUNCH OFF will be displayed.

Lock/Unlock iBR Actuator

Locking/Unlocking the iBR Actuator

When working on the iBR, lock the iBR to avoid accidental movement.

Connect the vehicle to the BRP diagnostic software (BUDS2).

In BUDS2, go to:

- Settings page
- iBR button
- Configuration - Lock/Unlock iBR

ADJUSTMENT

iBR FLASHING

NOTICE Make sure the unit's battery is fully charged before undertaking this operation.

NOTICE Continuous power to the computer is mandatory while performing this operation.

Perform after replacing the iBR actuator.

Connect the vehicle to the BRP diagnostic software (BUDS2).

In BUDS2, go to:

- Flash page
- iBR button

Select the update file in the *VALID FIRMWARE UPDATES* window and click *YES* when prompted.

The following message will confirm that the update has been done successfully.

Click *OK* and proceed to the *IBRM* update.

iBRM FLASHING

NOTICE Make sure the unit's battery is fully charged before undertaking this operation.

NOTICE Continuous power to the computer is mandatory while performing this operation.

Perform after flashing the iBR.

Connect the vehicle to the BRP diagnostic software (BUDS2).

In BUDS2, go to:

- Flash page
- iBRM button

Select the update file in the *VALID FIRMWARE UPDATES* window and click *YES* when prompted.

The following message will confirm that the update has been done successfully.

iBR AUTO CALIBRATION

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 the vehicle to the BRP diagnostic software (BUDS2).

In BUDS2, go to:

- Functions page
- iBR button
- Functions tab
- Routines - Auto Calibrate iBR

NOTICE Make sure the iBR actuator is unlocked before pressing the Auto Calibration button.

MAINTENANCE

Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection of this shop manual.

INSPECTION

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, the BRP diagnostics software (BUDS2) must be used to read the fault.

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 vehicle to the BRP diagnostic software (BUDS2) to check for iBR system or CAN bus related fault codes. Carry out service actions as indicated in BUDS2.
- If a CAN bus communication fault with the iBR actuator is indicated, or the iBR actuator is not visible in BUDS2, carry out a continuity test of the CAN bus wires. Refer to *TESTING CAN COMMUNICATION* in this subsection.
- Try moving the iBR using the iBR UP and iBR DOWN buttons on the iBR activation page in BUDS2.
- Check for proper gate and actuator movement. Refer to *TESTING THE iBR SYSTEM FUNCTION* in this subsection.
- 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.

TESTING THE iBR SYSTEM FUNCTION

This test requires two persons. One person to start engine and operate controls, and one person to observe iBR gate movement.

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.

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.

Test out of Water

NOTICE This procedure must be completed within one minute of the engine starting.

1. Connect a water hose to the watercraft to provide exhaust system cooling when operating engine. DO NOT open water tap yet.
2. Start engine, open water tap and let idle.

NOTE: If iBR gate was not in the neutral position, it will move to the neutral position on engine start up.

3. 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.
4. Depress the iBR lever fully and confirm the iBR gate moves to the full down position.
5. Release the iBR lever completely and confirm the iBR gate moves to the neutral position.
6. Close water tap and shut engine off.
7. Remove water hose from vehicle.

Test with Watercraft on a Waterway

1. Start engine.

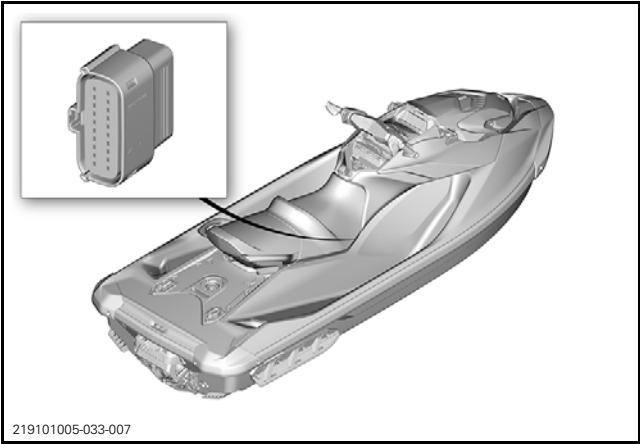
Section 07 STEERING AND PROPULSION
Subsection 02 (iBR, REVERSE AND VTS)

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.

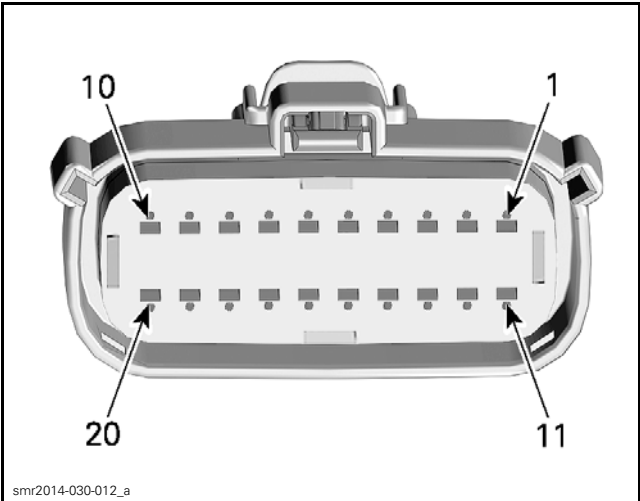
- 2. Depress the throttle lever slightly, then release it. Forward movement of the watercraft confirms the iBR gate has moved to the forward position.
- 3. Depress the iBR lever fully. Rearward movement of the watercraft confirms the iBR gate has moved to the reverse position.
- 4. Release the iBR lever 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.

PROCEDURES

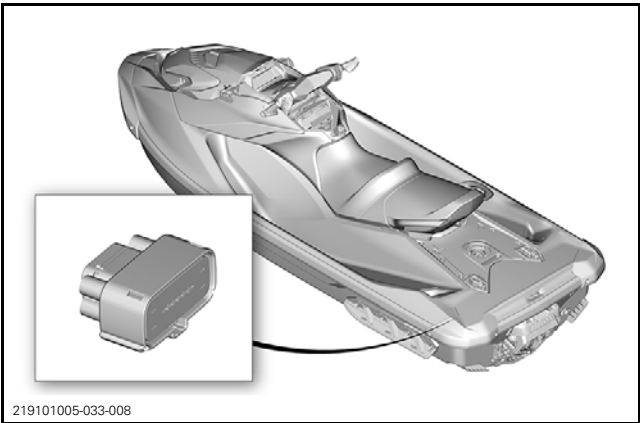
SWITCHES LOCATION AND PIN-OUT



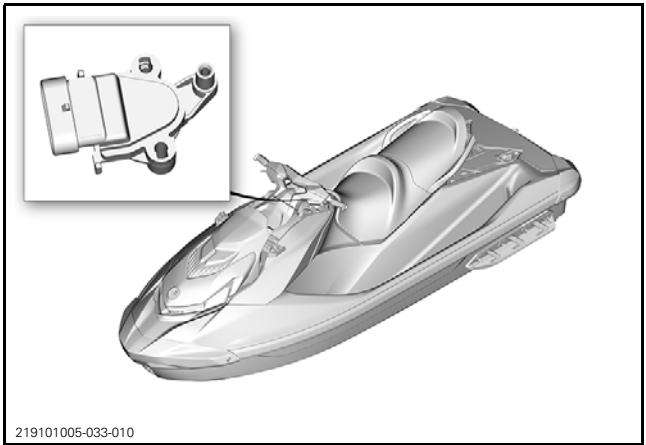
STEERING CONNECTOR LOCATION



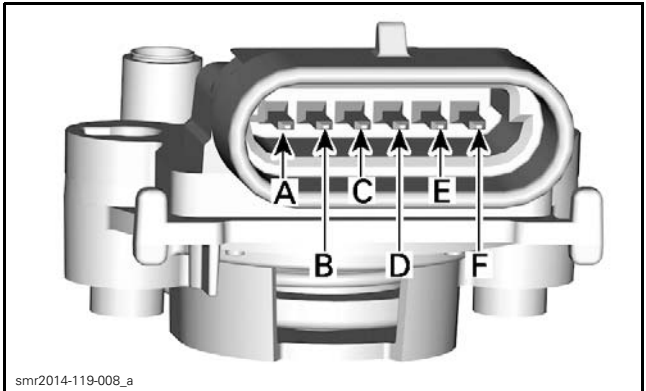
STEERING CONNECTOR



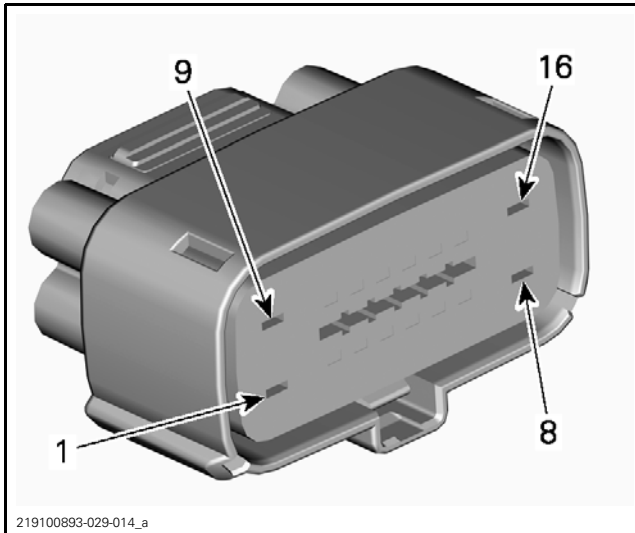
IBR ACTUATOR CONNECTOR LOCATION



BRLS LOCATION



BRLS PINOUT



219100893-029-014_a
iBR ACTUATOR CONNECTOR

iBR ACTUATOR

Specifications

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

1. Connect the vehicle to the BRP diagnostic software (BUDS2).
2. In BUDS2, go to:
 - Functions page
 - iBR button
 - Functions tab
 - Move iBR Up/Down
3. Click **iBR UP** and **iBR DOWN** buttons alternately and look for a change in **iBR Position (Deg)**.

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

1. Connect the vehicle to the BRP diagnostic software (BUDS2).
2. In BUDS2, go to:
 - Measurements page
 - iBR button
3. Note the **Gate Position (°)** indication.
4. Activate the iBR override function.
5. Move the iBR to the full up position and look for the **Motor Current (A)** indication. Also look for a change of **Gate Position (°)** indication.

NOTE: Current draw indication will not be stable. High and low peaks will be observed. Look for the maximum average current draw.

6. Move the iBR to the full down position and look for the **Motor Current (A)** draw indication. Also look for a change of **iBR Position (°)** indication.

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 .

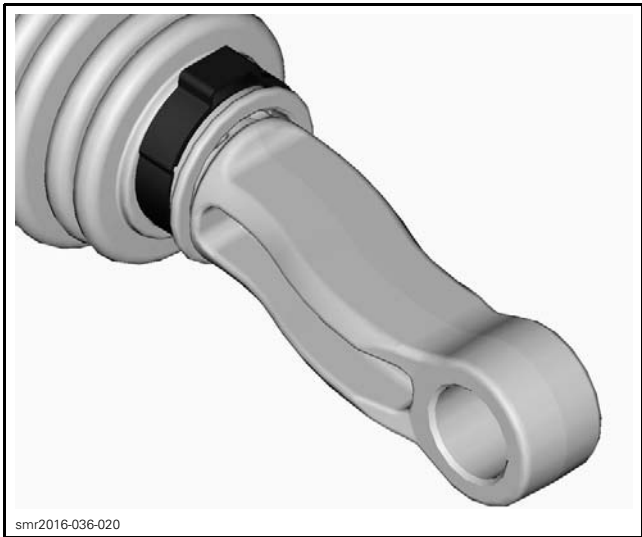
Remove debris, replace iBR gate components, or replace the iBR actuator as applicable.

Removing the iBR Actuator

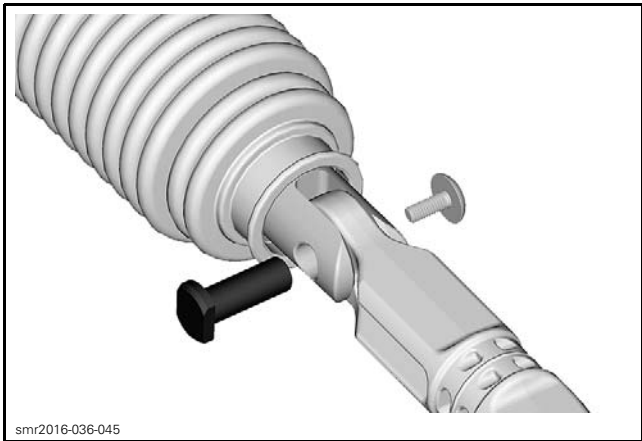
NOTICE Do not try to manually force the iBR gate when all components are installed.

1. Remove iBR reverse gate. Refer to *iBR REVERSE GATE* in this subsection.
2. Remove VTS trim ring. Refer to *VTS TRIM RING* in this subsection.
3. Remove the small Oetiker clamp retaining the connecting arm bellows.

Section 07 STEERING AND PROPULSION
Subsection 02 (iBR, REVERSE AND VTS)



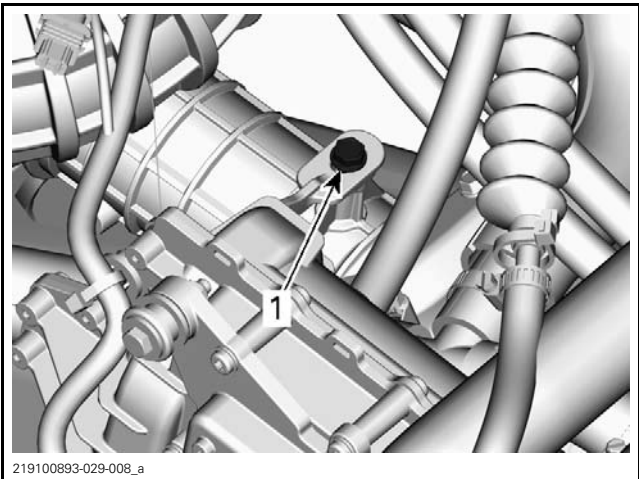
4. Remove connecting arm pin and screw.



5. Remove iBR nut and bellows using the iBR nut socket.

REQUIRED TOOL	
IBR NUT SOCKET (P/N 529 036 379)	

6. Move muffler. Refer to *EXHAUST SYSTEM* subsection.
7. Unplug electrical connector.
8. Remove actuator retaining screw.



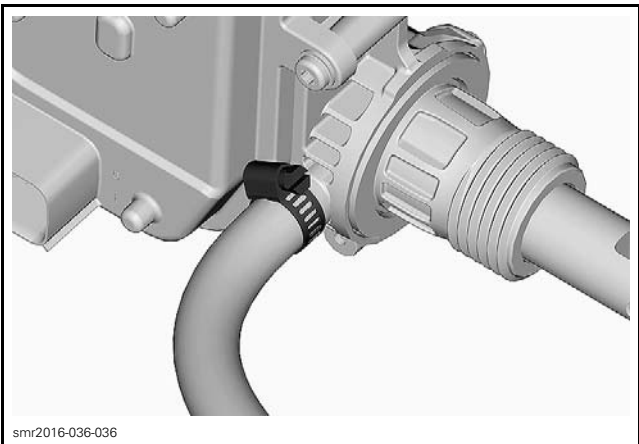
1. Actuator retaining screw

9. Remove iBR actuator and air chamber.

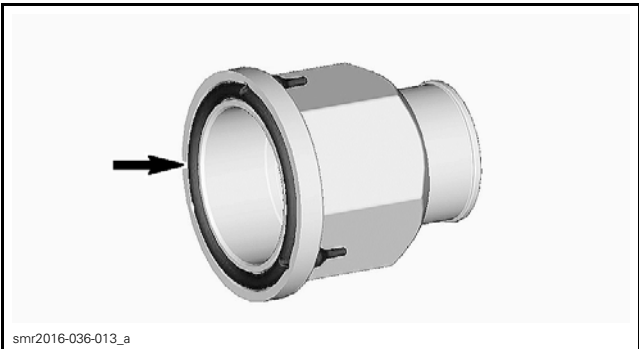
Installing the iBR Actuator

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. Slide the O-ring into position on iBR nut.



4. If the same actuator is reinstalled, clean all residues of sealing compound near the threaded area.
5. Apply Loctite 5900 on actuator, between actuator housing and threads, as shown in the exploded view.

SERVICE PRODUCT
LOCTITE 5900 (P/N 293 800 066)

NOTICE Ensure no sealing agents contact the iBR shaft.

6. Tighten iBR nut to specification. Refer to exploded view.
7. Install actuator retaining screw. Refer to exploded view for tightening torque specifications.
8. Install connecting arm.
9. Reinstall other removed parts.

NOTICE Allow 24 hours for thread locker on retaining screws to cure.

Perform *iBR FLASHING* procedure.

Perform *iBR AUTO-CALIBRATION* procedure.

iBR REVERSE GATE



Removing the iBR Reverse Gate

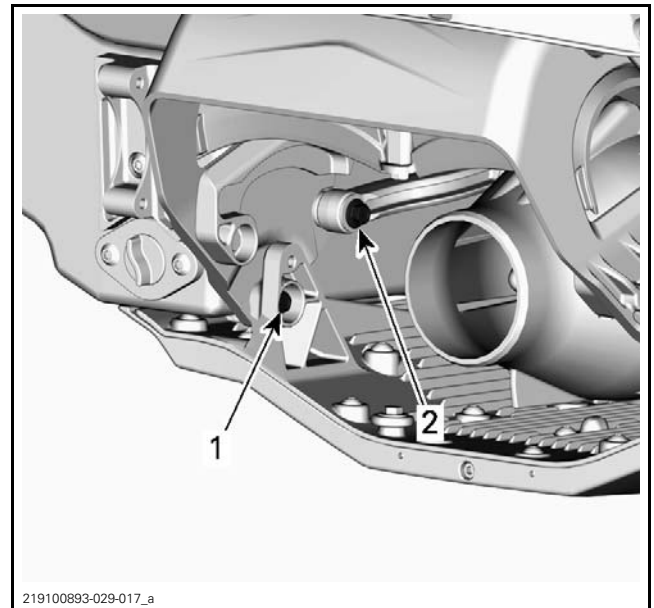
Remove the guard.



Remove VTS trim ring.

Remove the iBR reverse gate retaining screws.

Remove the connecting arm retaining screw.



1. iBR retaining screw
2. Connecting arm retaining screw

Installing the iBR Reverse Gate

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

Refer to exploded view for tightening torque specifications.

Apply service product on guard screws.

SERVICE PRODUCT
CLEAR SILICONE SEALANT (P/N 296 000 309)

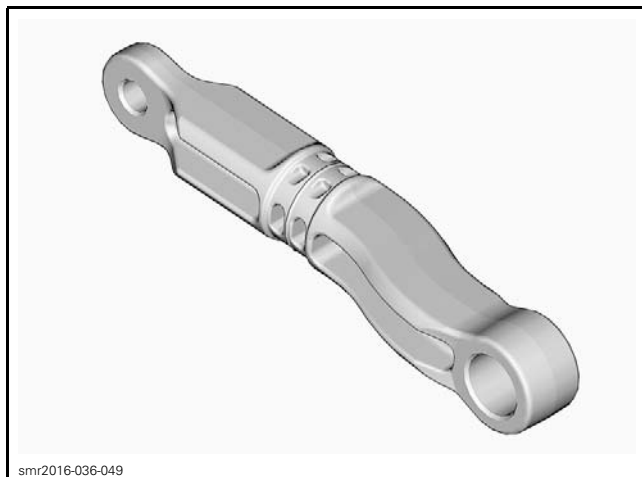
Section 07 STEERING AND PROPULSION

Subsection 02 (iBR, REVERSE AND VTS)

NOTICE Allow 24 hours for thread locker on retaining screws to cure

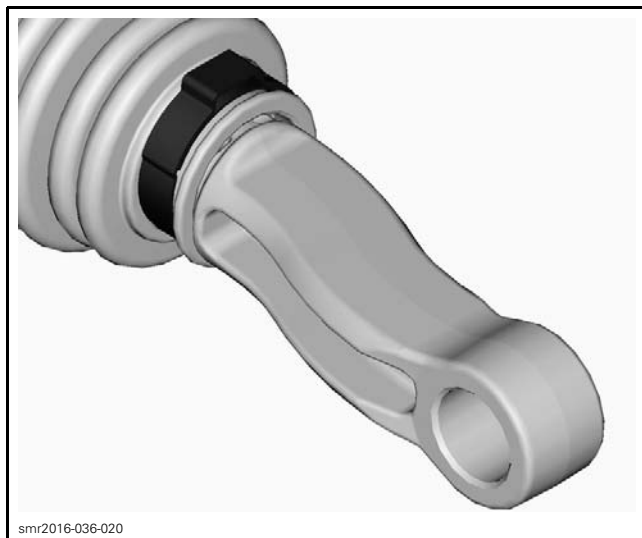
Perform *iBR AUTO-CALIBRATION* procedure.

CONNECTING ARM

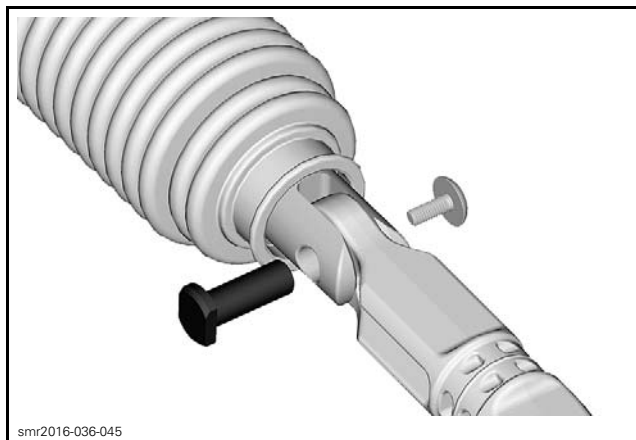


Removing the Connecting Arm

1. Remove VTS trim ring. Refer to *VTS TRIM RING* in this subsection.
2. Remove iBR Reverse Gate. Refer to *iBR REVERSE GATE* in this subsection.
3. Remove the small Oetiker clamp retaining the connecting arm bellows.



4. Remove connecting arm pin and screw.

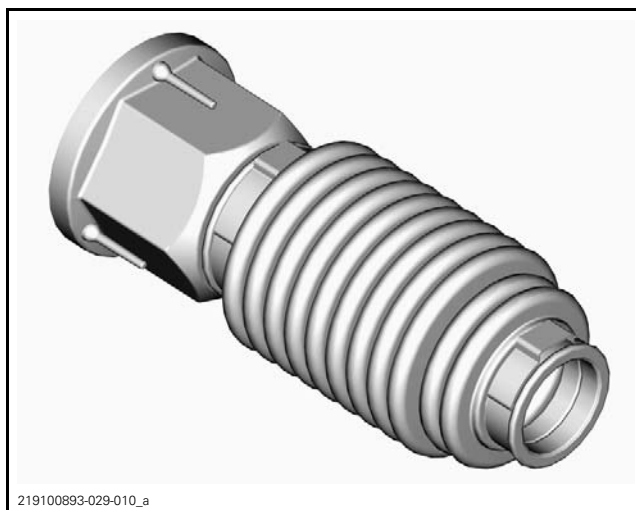


5. Remove connecting arm.

Installing the Connecting Arm

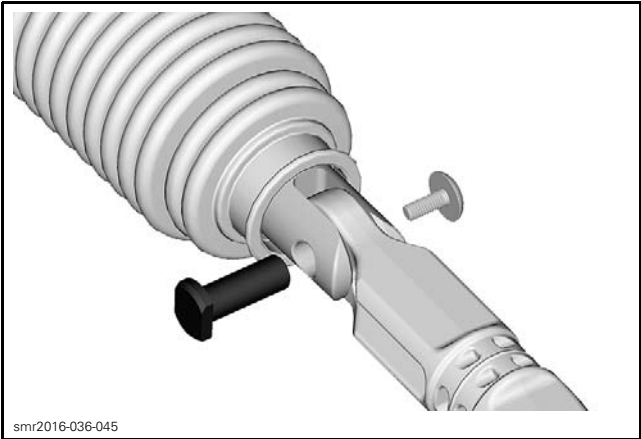
Use iBR override function to move iBR actuator to the full down setting.

NOTE: The bellows should already be installed and clamped on the iBR nut.

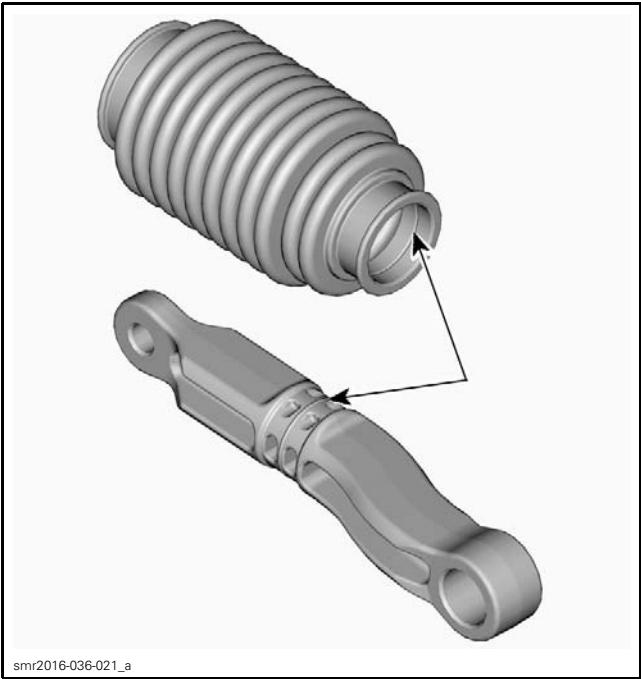


NOTICE Failure to adhere to the sequence in the following steps will cause the iBR air chamber to rupture or burst and cause premature failure of the iBR actuator.

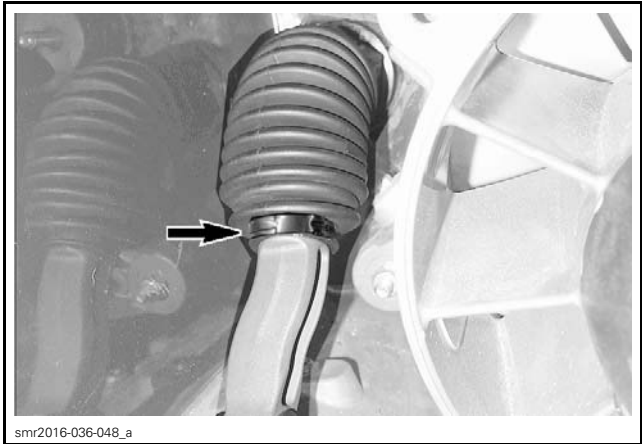
1. Push the bellows back towards iBR actuator.
2. Install connecting arm pin and screw.
 - 2.1 Tighten screw.



3. Position the bellows over the connecting arm.



4. Compress the air chamber (attached to iBR actuator).
- 4.1 Clamp the Oetiker clamp on the connecting arm bellows.



5. Reinstall other removed parts.
Perform *iBR AUTO-CALIBRATION* procedure.

ACTUATOR OUTPUT SHAFT

Removing the Actuator Output Shaft

1. Remove the connecting arm.
2. Unscrew the output shaft from the iBR actuator.

Installing the Actuator Output Shaft

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

TIGHTENING TORQUE	
Actuator output shaft	4.3 N•m (38 lbf•in)

Make sure output shaft is aligned with the connecting arm by only unscrewing the shaft no more than 1/2 of a turn after tightening. Do not thread the shaft in further to align the connecting arm. Over tightening the shaft may result in iBR malfunction

Perform *iBR AUTO-CALIBRATION* procedure. Refer to *iBR AUTO-CALIBRATION* in this subsection.

VTS TRIM RING



Removing the VTS Trim Ring

- 1. Disconnect the steering cable. Refer to *STEERING* subsection.
- 2. Remove VTS trim ring retaining screws.
- 3. Remove nozzle pivot screws.

Installing the VTS Trim Ring

The installation is the reverse of the removal procedure. However, pay attention to the following. Refer to exploded view for tightening torque specifications.

Perform *iBR AUTO-CALIBRATION* procedure. refer to *iBR AUTO-CALIBRATION* in this subsection.

BRAKE AND REVERSE LEVER SWITCH (BRLS)

Testing and Specifications

BRLS PINOUT	
PIN	SIGNAL
BRLS-A	5 VDC
BRLS-B	GND
BRLS-C	View signal % in BUDS2
BRLS-D	5VDC
BRLS-E	GND
BRLS-F	View signal % in BUDS2

NOTE: When moving BRLS lever, the BRLS percentage should increase or decrease in a steady linear fashion.

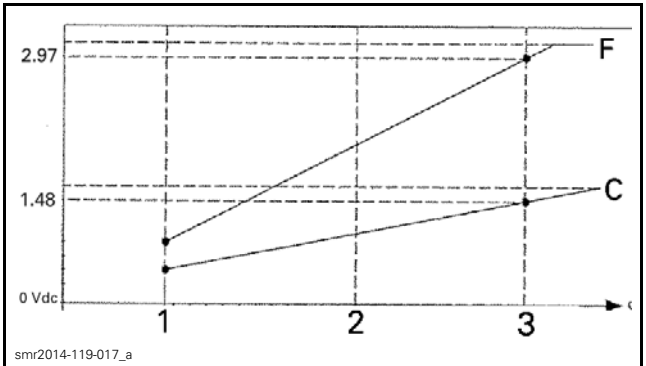
If BUDS2 does not show BRLS percentage moving or if reading is erratic:

- 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 between steering harness connectors.

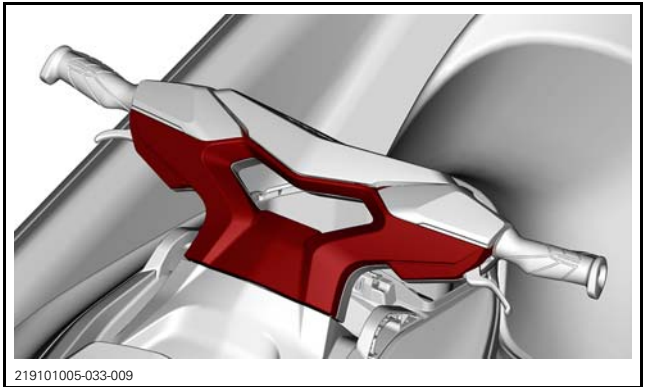
REQUIRED TOOL	
DIAGNOSTIC HARNESS (P/N 529 036 384)	

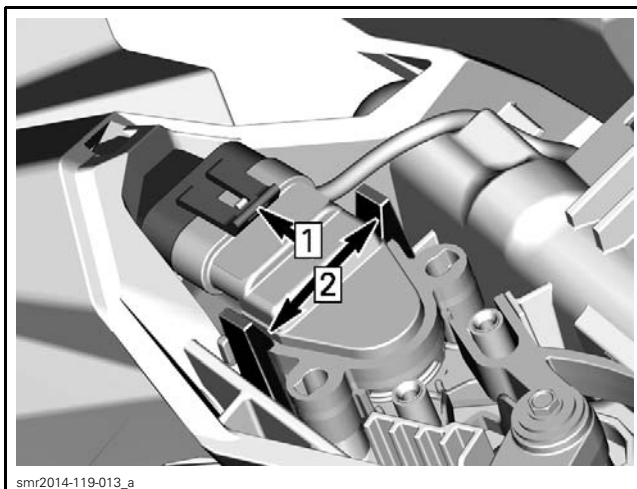


APPROXIMATE BRLS SIGNAL VOLTAGE CURVE PINS F AND C

- 1. BRLS released
- 2. BRLS at 50% pulled
- 3. BRLS fully pulled

Removing the BRLS



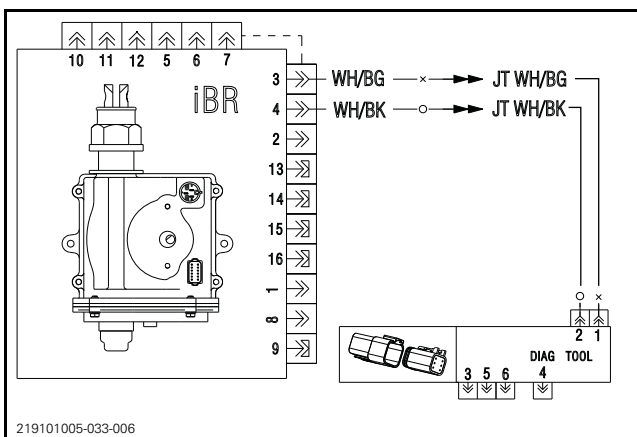


Installing the BRLS

The installation is the reverse of the removal procedure.

TESTING CAN COMMUNICATION

CAN WIRE RESISTANCE TEST		
IBR ACTUATOR CONNECTOR PIN	DLC CONNECTOR PIN	SPECIFIED RESISTANCE
iBR-3	DLC-1	0 Ω
iBR-4	DLC-2	0 Ω



Refer to *PROCEDURES* in this subsection for pinouts.

Refer to *CONTROLLER AREA NETWORK (CAN)* subsection for additional information.

JET PUMP

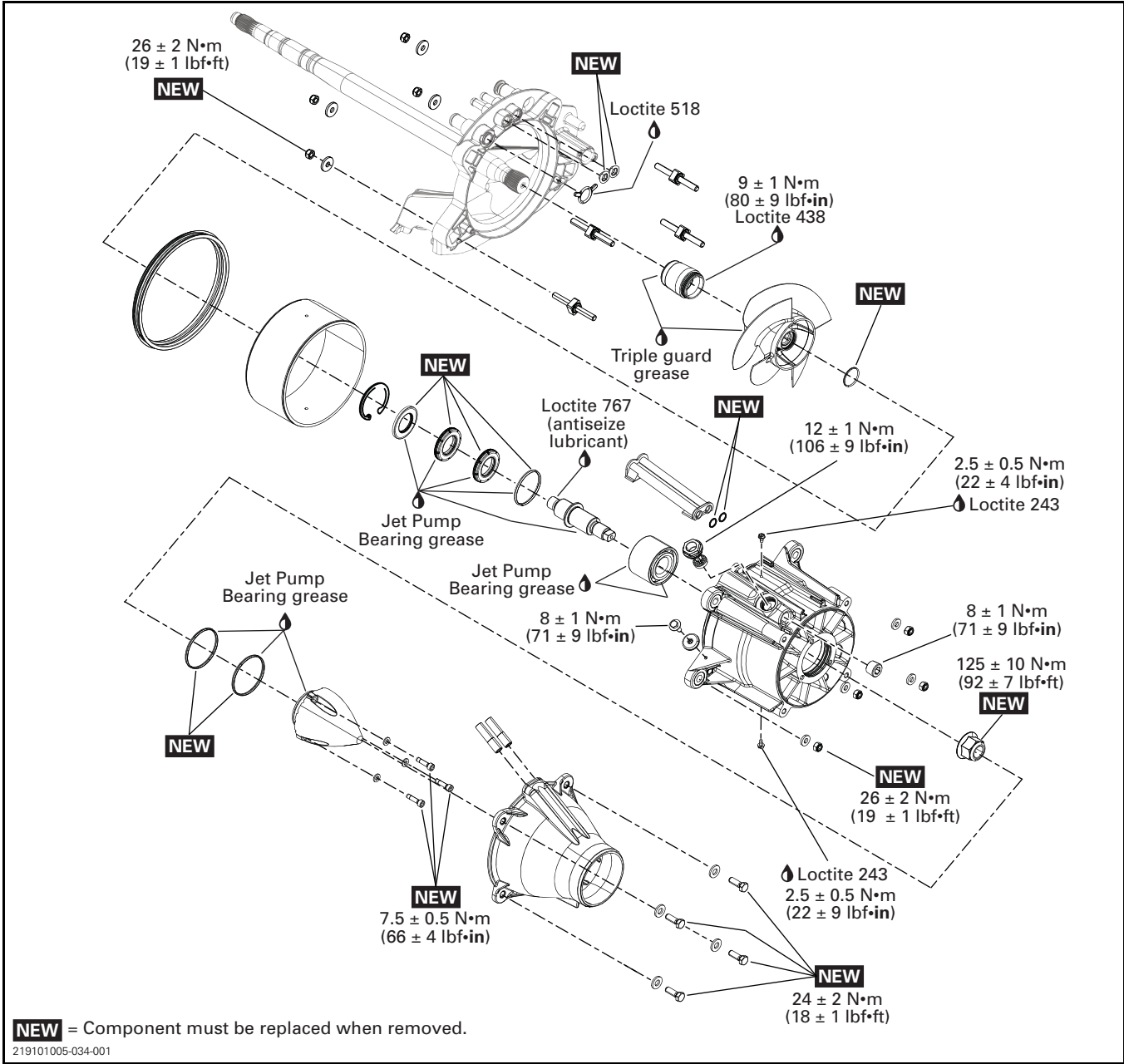
SERVICE TOOLS

Description	Part Number	Page
IMPELLER REMOVER/INSTALLER.....	529 035 956	219
IMPELLER SHAFT BEARING TOOL	529 036 168	219
IMPELLER SHAFT PUSHER.....	529 035 955	219
PRESSURE CAP	529 036 283	220
PUMP PLATE.....	529 036 224	222
VACUUM/PRESSURE PUMP	529 021 800	220

SERVICE PRODUCTS


Description	Part Number	Page
CLUTCH AND PULLEY FLANGE CLEANER PRO S1.....	779244	222
JET PUMP BEARING GREASE	293 550 032	225, 230–231, 233
LOCTITE 243 (BLUE).....	293 800 060	228
LOCTITE 438.....	296 000 424	227
LOCTITE 518.....	293 800 038	223
LOCTITE 767 (ANTI-SEIZE LUBRICANT)	293 800 070	226
LUBRICANT AND ANTI-CORROSIVE (EUR)	779224	224, 227
LUBRICANT AND ANTI-CORROSIVE.....	779168	224, 227
TRIPLE-GUARD GREASE	508298	222–223, 227

Section 07 STEERING AND PROPULSION
Subsection 03 (JET PUMP)

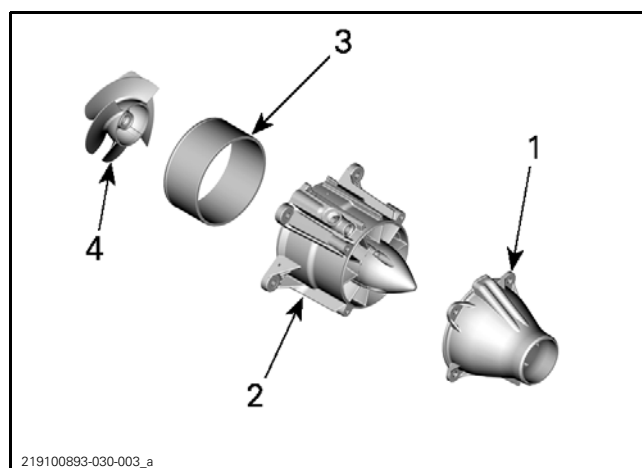


GENERAL

The following tools are required to perform the installation and removal of impeller related components.

REQUIRED TOOLS	
IMPELLER SHAFT PUSHER (P/N 529 035 955)	
IMPELLER REMOVER/INSTALLER (P/N 529 035 956)	
IMPELLER SHAFT BEARING TOOL (P/N 529 036 168)	

JET PUMP MAIN COMPONENTS

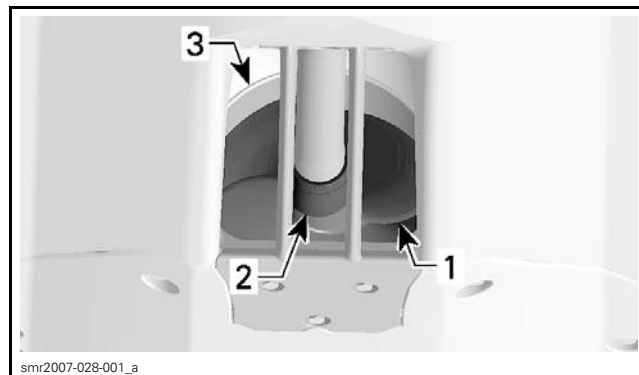


1. Venturi
2. Jet pump housing
3. Wear ring
4. Impeller

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.



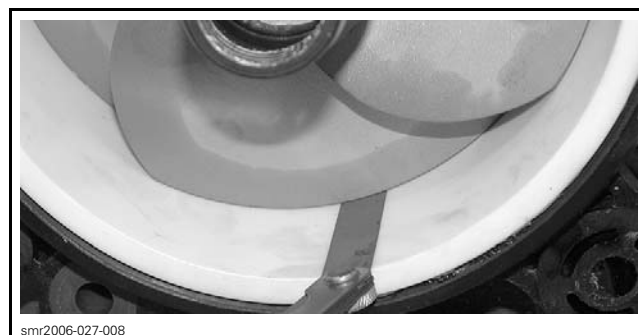
TYPICAL — UNDERNEATH HULL

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

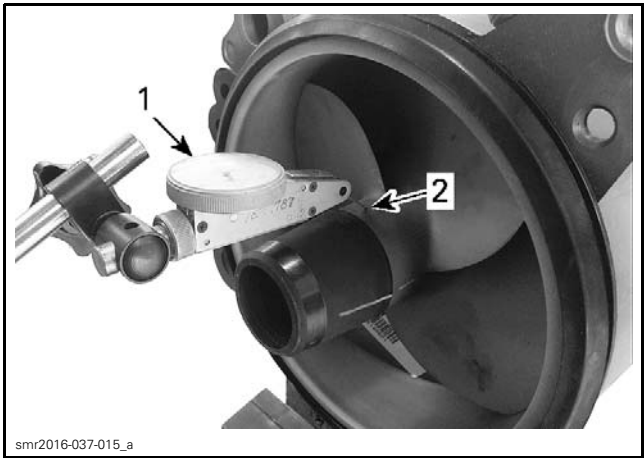
Radial play is critical for jet pump life span.

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.

Section07 STEERING AND PROPULSION
Subsection 03 (JET PUMP)



TYPICAL — MEASURING IMPELLER SHAFT RADIAL PLAY
1. Dial gauge
2. Measure close to impeller hub end

Table with 2 rows: RADIALLY PLAY, 0.5 mm (.02 in)

Excessive play can come either from worn bearing or damaged jet pump housing bearing surface.

LEAK TEST

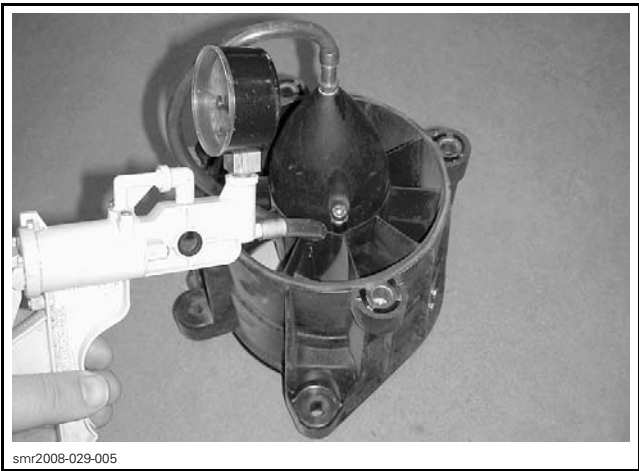
Whenever performing any type of repair on the jet pump, a leak test should be carried out.

Proceed as follows:

- 1. Remove impeller cover. Refer to IMPELLER COVER in this subsection.
- 2. Install the pressure cap on pump housing.

Table with 2 rows: REQUIRED TOOLS, PRESSURE CAP (P/N 529 036 283), VACUUM/PRESSURE PUMP (P/N 529 021 800)

- 3. Connect the vacuum/pressure pump to the pressure cap fitting.



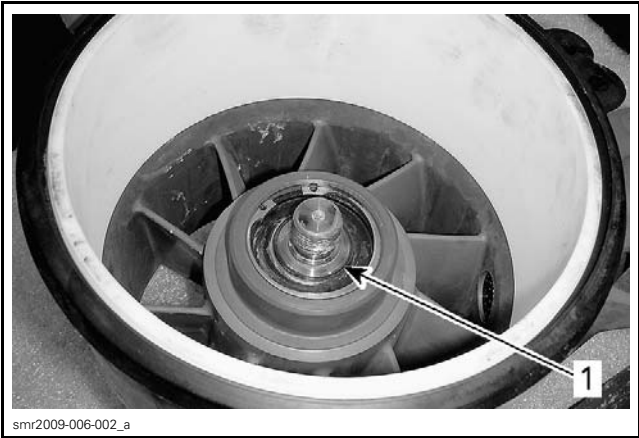
TYPICAL

- 4. Pressurize pump.

Table with 2 rows: LEAK TEST PRESSURE, Maximum 70 kPa (10 PSI)

- 5. Pump must maintain this pressure for at least 5 minutes.

NOTE: Only 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.

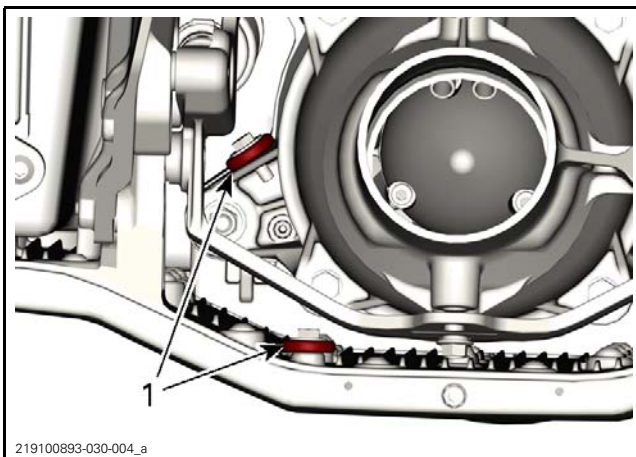
PROCEDURES

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 ANODES

Inspecting the Sacrificial Anodes

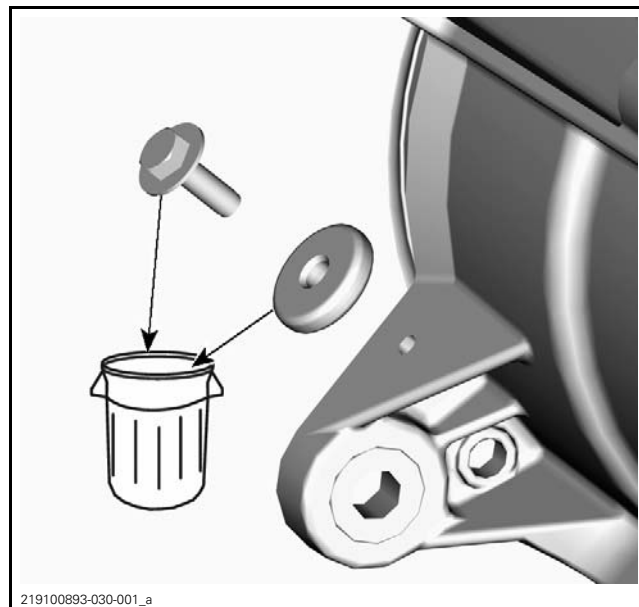
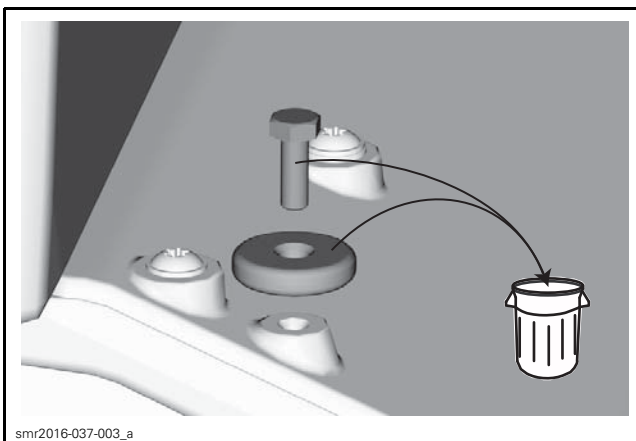
Check for wear. If worn more than half, replace anode.



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. However, pay attention to the following.

Refer to exploded view for tightening torque specifications.

VENTURI

Removing the Venturi

1. Remove the iBR gate, VTS trim ring and nozzle. Refer to *iBR, REVERSE AND VTS* subsection.
2. Remove the venturi from the jet pump housing.

Installing the Venturi

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

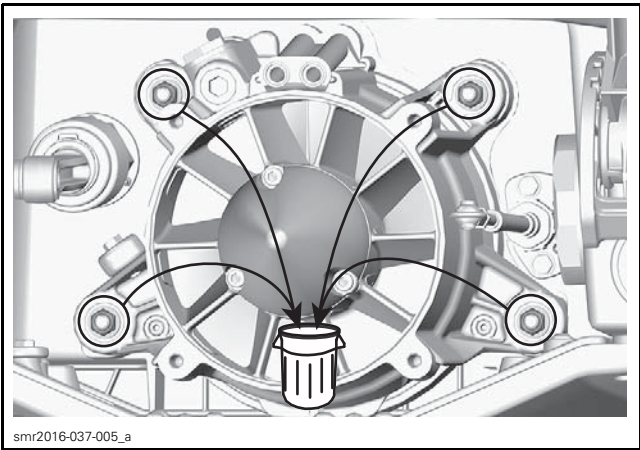
Refer to exploded view for tightening torque specifications.

JET PUMP HOUSING

Removing the Jet Pump Housing

1. Remove the iBR gate, VTS trim ring and nozzle. Refer to *iBR, REVERSE AND VTS* subsection.
2. Remove the venturi.
3. Remove and discard the nuts that retain the jet pump to the pump support.

Section07 STEERING AND PROPULSION
Subsection 03 (JET PUMP)

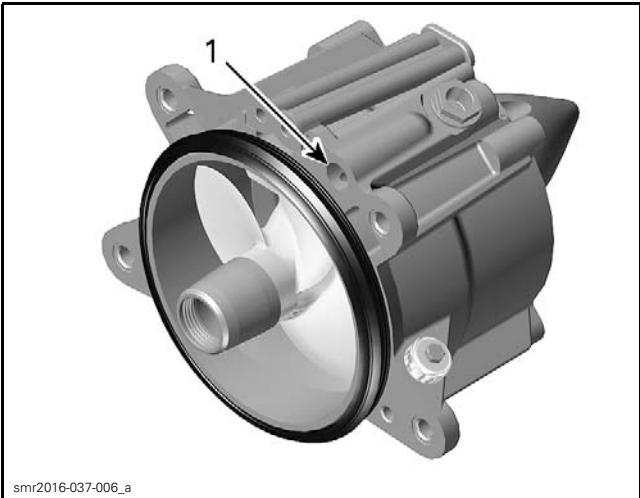


4. Pull back jet pump housing to remove it from the pump support. It may be necessary to wiggle it slightly as you pull back on the pump. Temporarily fasten the engine alignment plate to pump support to support drive shaft and avoid PTO oil seal damage.

Table with 2 columns: REQUIRED TOOL, and an image of the pump plate. Row 1: PUMP PLATE (P/N 529 036 224)

Inspecting and Cleaning the Jet Pump Housing

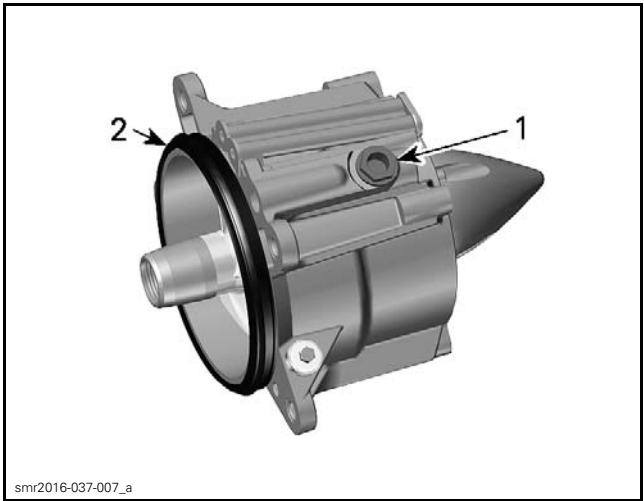
- 1. Visually inspect jet pump housing. Pay attention to the stator. Ensure the assembly is clean and free of any debris and defects. Do the following as applicable.
- 2. Blow low pressure compressed air through the pressure outlet fitting and make sure it is clear.



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

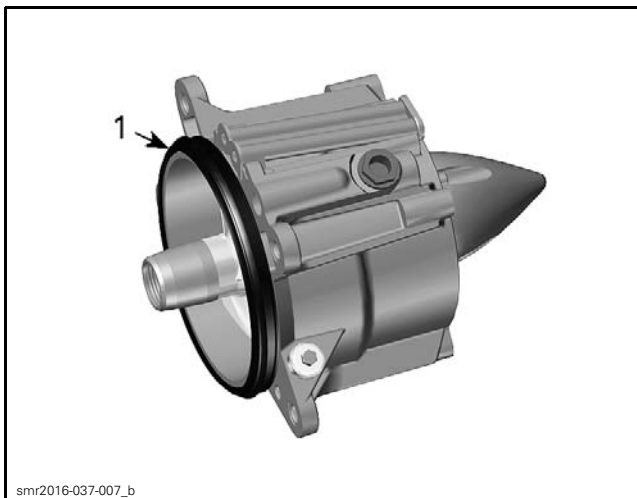
The installation is the reverse of the removal procedure. However, pay attention to the following. Clean impeller splines and drive shaft splines with Clutch and pulley flange cleaner or equivalent. Splines must be free of any residue.

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 grease.

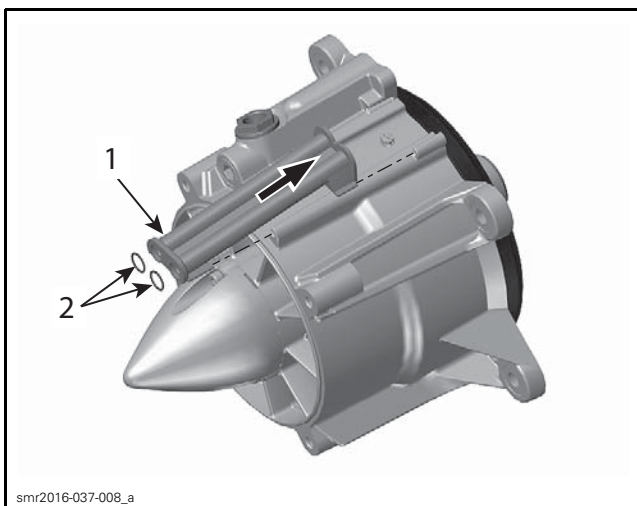
Table with 2 columns: SERVICE PRODUCTS, and a list of products. Row 1: CLUTCH AND PULLEY FLANGE CLEANER PRO S1 (P/N 779244). Row 2: TRIPLE-GUARD GREASE (P/N 508298)

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.

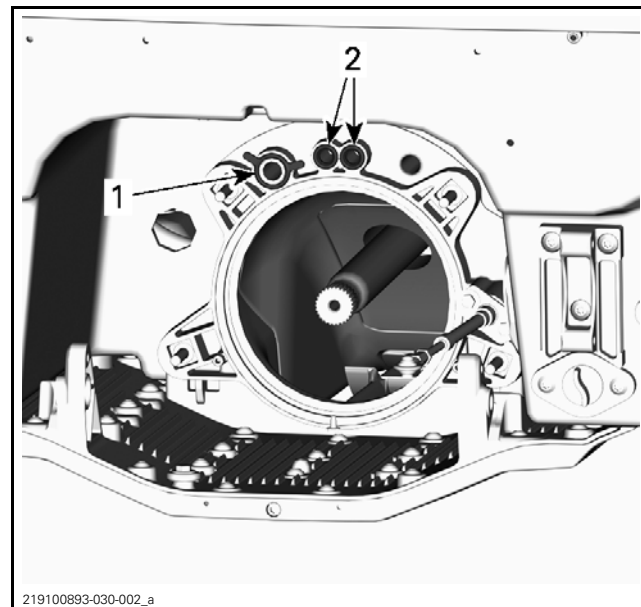


1. Slide adapter onto pump
2. New O-rings here

Install new O-rings on pump support.

Apply a thin layer of Loctite on the rounded portion of the O-rings to hold it against the support.

SERVICE PRODUCT
LOCTITE 518 (P/N 293 800 038)



1. Install new O-rings
2. O-rings (with tabs)

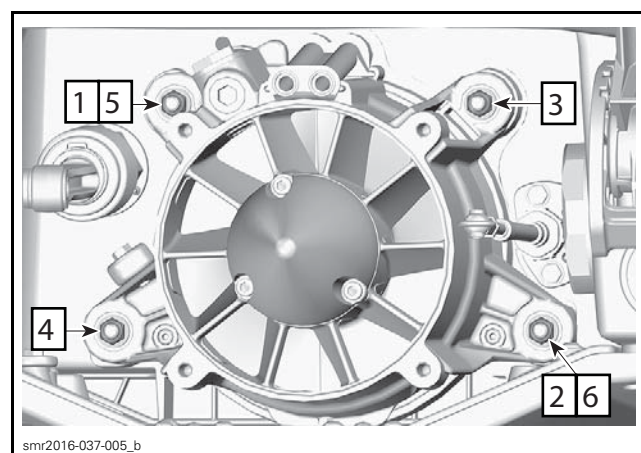
Generously apply grease on drive shaft splines.

SERVICE PRODUCT
TRIPLE-GUARD GREASE (P/N 508298)

Install jet pump.

NOTE: If necessary, wiggle jet pump to engage drive shaft splines in impeller.

Install new nuts and tighten as per table and the illustrated sequence. Refer to exploded view for tightening torque specifications.



Slightly lubricate wear ring with Lubricant and anti-corrosive to minimize friction during initial impeller start.

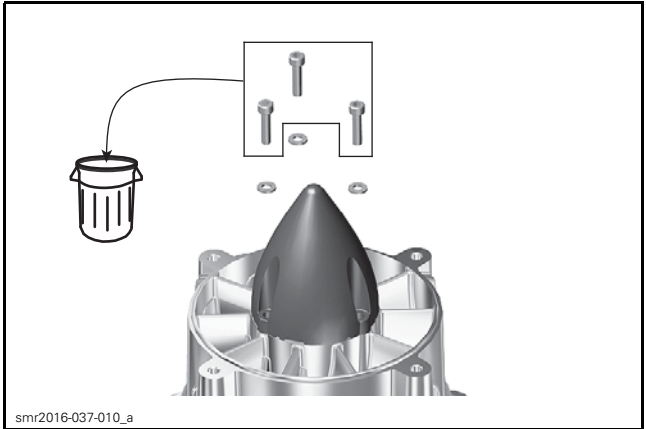
Section 07 STEERING AND PROPULSION
Subsection 03 (JET PUMP)

SERVICE PRODUCTS	
Scandinavia	LUBRICANT AND ANTI-CORROSIVE (EUR) (P/N 779224)
All other countries	LUBRICANT AND ANTI-CORROSIVE (P/N 779168)

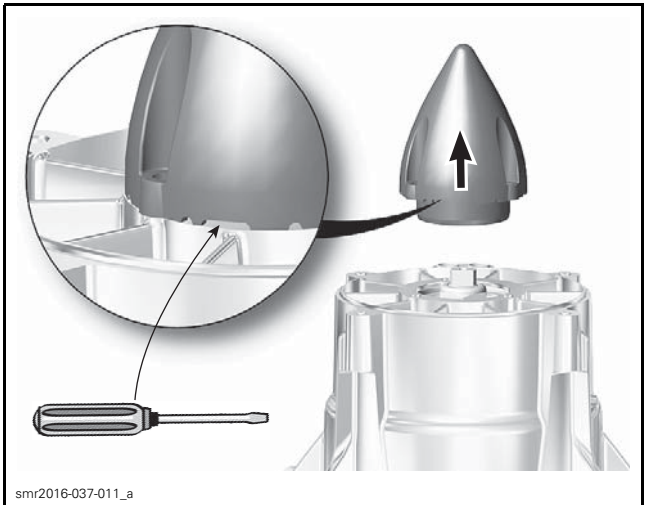
IMPELLER COVER

Removing the Impeller Cover

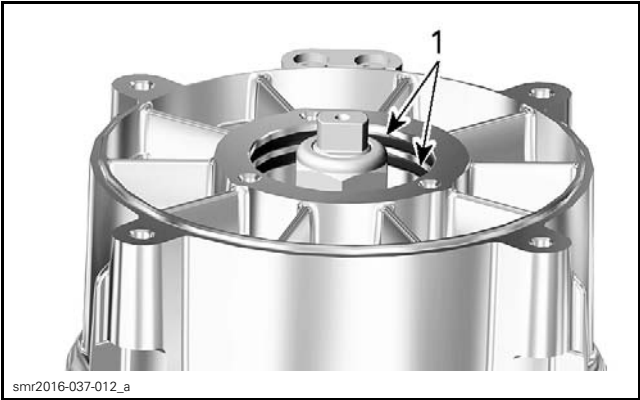
- 1. Remove the jet pump housing.
- 2. With pump housing in vertical position, remove and discard the 3 retaining screws.



- 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.



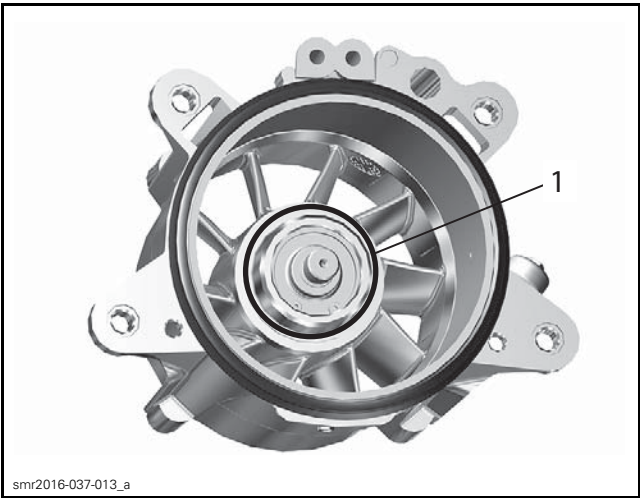
- 5. Remove both cover O-rings.



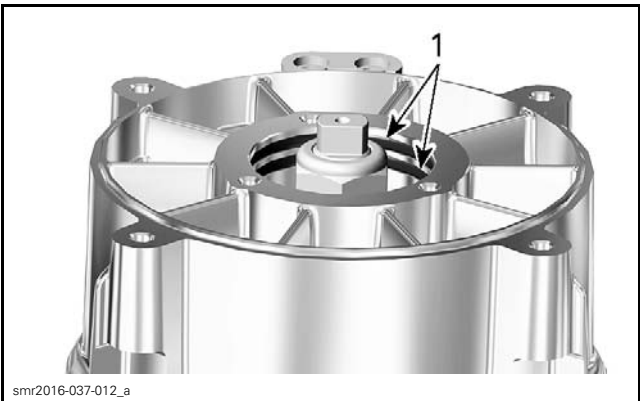
1. Cover O-rings

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.

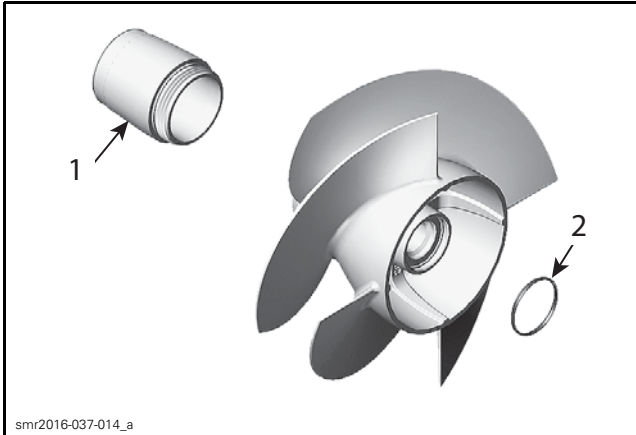


1. Seal on impeller side



1. Cover O-rings

Check impeller boot and O-rings condition on impeller. Replace as required.



1. Impeller boot
2. Impeller O-ring

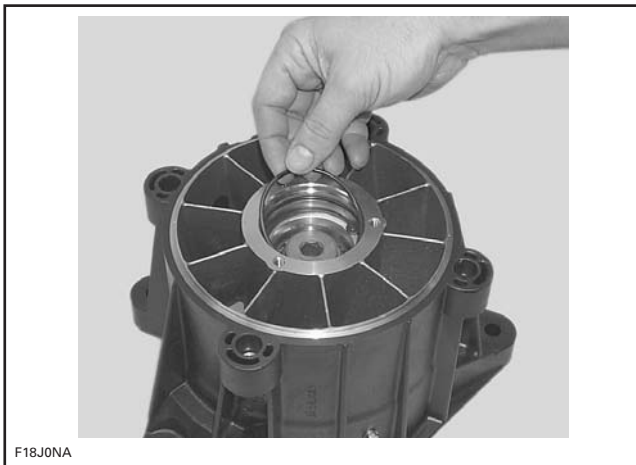
Perform a leak test. Refer to *LEAK TEST* in this subsection.

Installing the Impeller Cover

1. Apply a thin layer of grease in O-ring grooves.

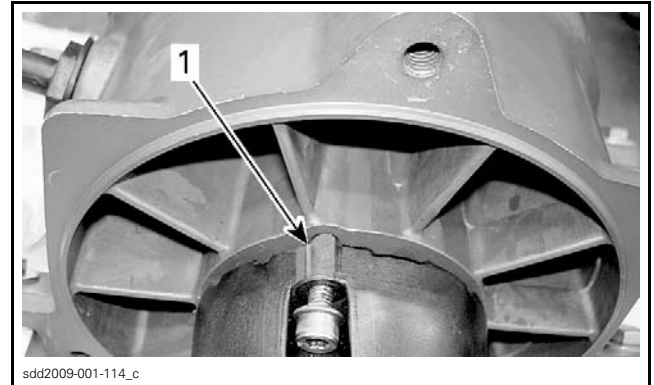
SERVICE PRODUCT
JET PUMP BEARING GREASE (P/N 293 550 032)

2. Install O-rings in their respective groove and make sure they are properly lubricated.



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. Refer to exploded view for tightening torque specifications.

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.

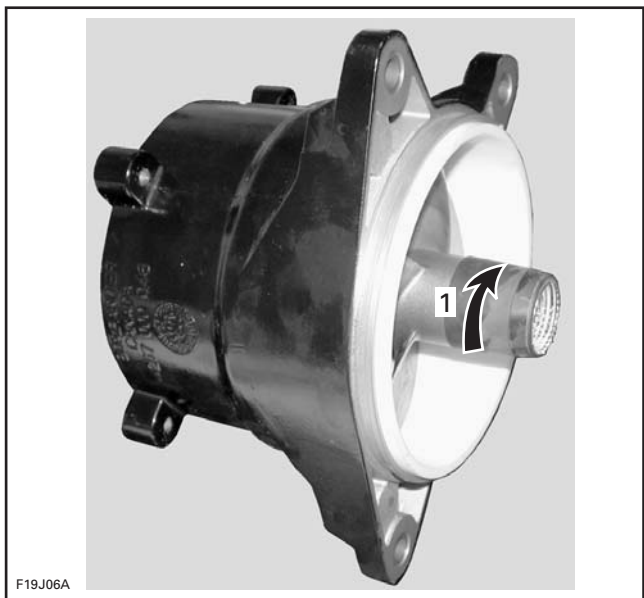
IMPELLER

Removing the Impeller

NOTE: If impeller shaft is to be disassembled, loosen the impeller shaft nut prior to removing the impeller.

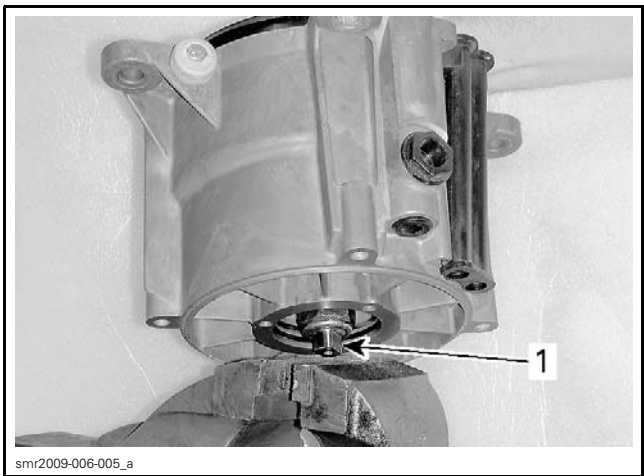
1. Remove jet pump housing. Refer to *JET PUMP HOUSING* in this subsection.
2. Remove impeller cover. Refer to *IMPELLER COVER* in this subsection.
3. Remove impeller boot by turning it **clockwise** (LH threads).

Section 07 STEERING AND PROPULSION
Subsection 03 (JET PUMP)



TYPICAL
1. Unscrew clockwise

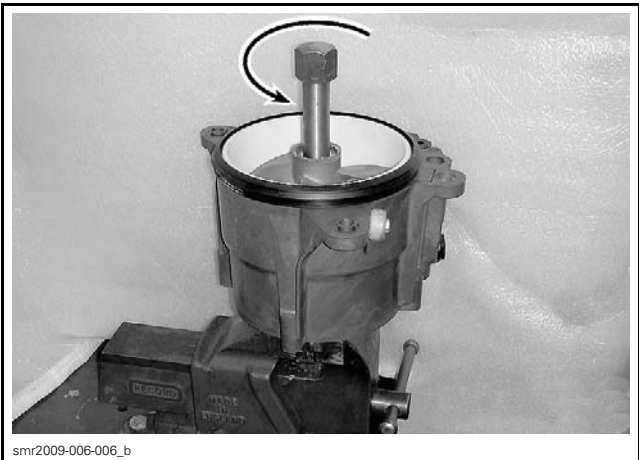
4. Mount the flat sides of impeller shaft in a vise.



TYPICAL
1. Flat side

5. Unscrew the impeller counterclockwise using the impeller remover/installer.

NOTICE Never use an impact wrench to loosen impeller.

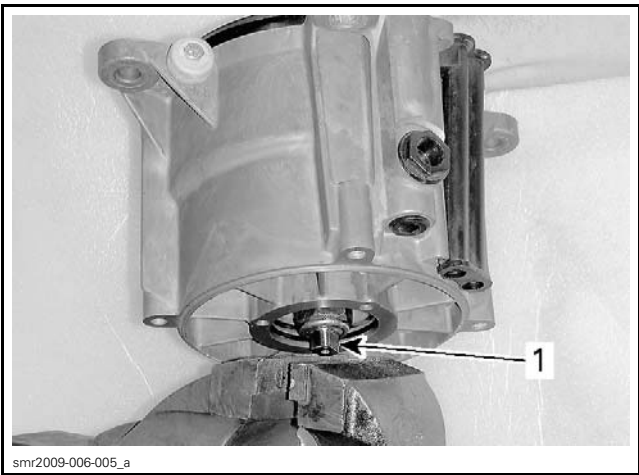


TYPICAL

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 antiseize lubricant on threads of impeller shaft.

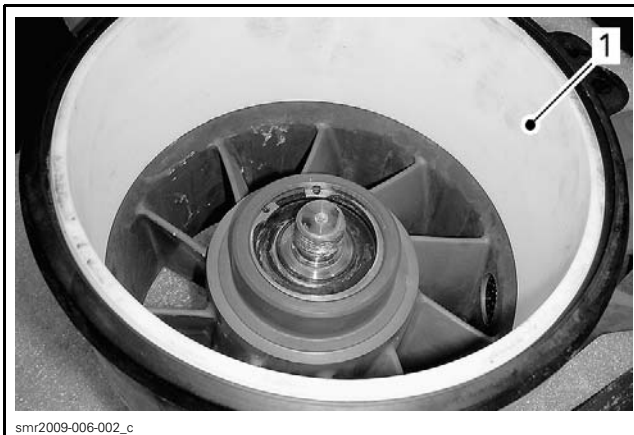
SERVICE PRODUCT
LOCTITE 767 (ANTI-SEIZE LUBRICANT) (P/N 293 800 070)



TYPICAL
1. Antiseize lubricant

3. Apply Lubricant and anti-corrosive on the wear ring surface.

SERVICE PRODUCTS	
Scandinavia	LUBRICANT AND ANTI-CORROSIVE (EUR) (P/N 779224)
All other countries	LUBRICANT AND ANTI-CORROSIVE (P/N 779168)



TYPICAL
1. Spray XPS lube on this surface

4. Start screwing the impeller on its shaft.



TYPICAL

5. Mount the impeller remover/installer in impeller splines.
6. Tighten impeller to specification.

NOTICE Never use an impact wrench to tighten impeller shaft.

TIGHTENING TORQUE	
Impeller	125 N•m ± 10 N•m (92 lbf•ft ± 7 lbf•ft)

Remove tool.

7. Apply Loctite on impeller boot threads.
8. Apply grease inside impeller boot.

SERVICE PRODUCTS
LOCTITE 438 (P/N 296 000 424)
TRIPLE-GUARD GREASE (P/N 508298)

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.

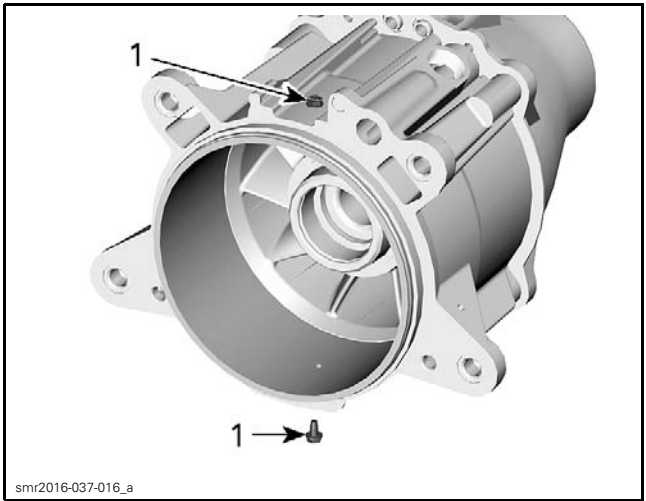
Removing the Wear Ring

1. Remove jet pump housing. Refer to *JET PUMP HOUSING* in this subsection.
2. Remove impeller, refer to *IMPELLER* in this subsection.

Section 07 STEERING AND PROPULSION

Subsection 03 (JET PUMP)

3. On models equipped with the 230 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.

NOTE: The freezer method will help but the 230 wear ring will not come completely loose using this method.

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 placed in the freezer) in the housing.

On models equipped with the 230 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 blue Loctite on screw threads.

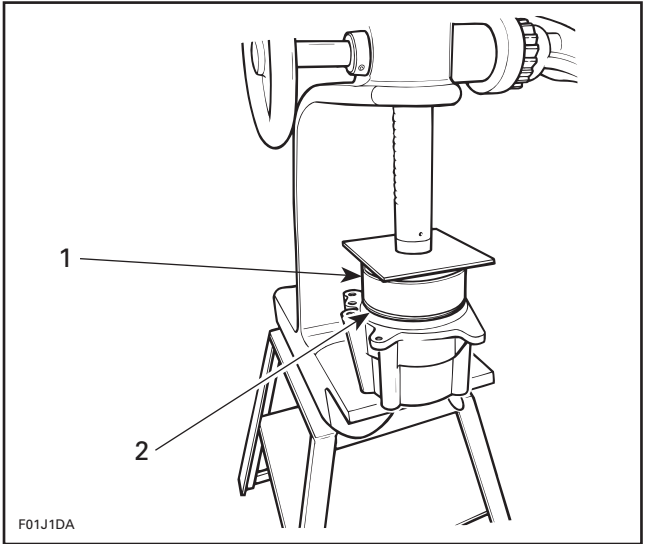
Refer to exploded view for tightening torque specifications.

SERVICE PRODUCT
LOCTITE 243 (BLUE) (P/N 293 800 060)

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 230 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 blue Loctite on screw threads.

Refer to exploded view for tightening torque specifications.

SERVICE PRODUCTS
LOCTITE 243 (BLUE) (P/N 293 800 060)

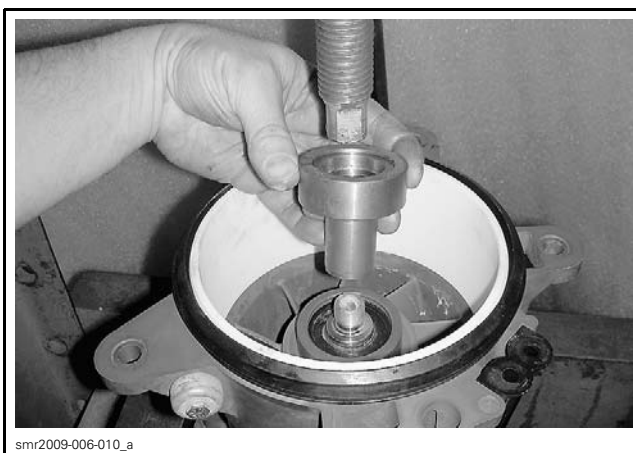
IMPELLER SHAFT, BEARING AND SEALS

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 tool to press impeller shaft out of pump housing.

NOTE: Bearing will come out with the impeller shaft.



smr2009-006-010_a

TYPICAL

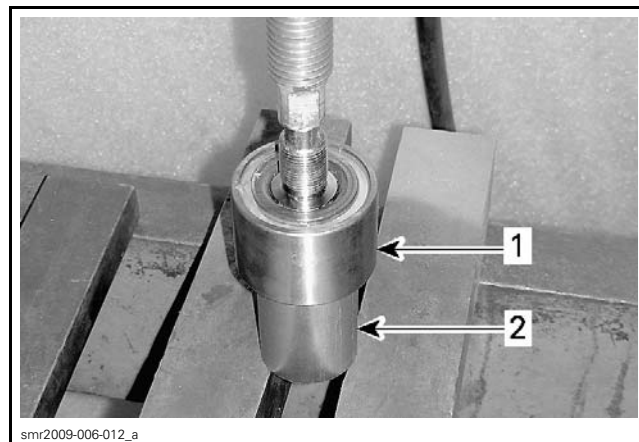


smr2009-006-011

TYPICAL

Removing the Bearing

1. Remove the bearing retaining nut.
2. Use the Impeller shaft bearing tool to press bearing off impeller shaft.



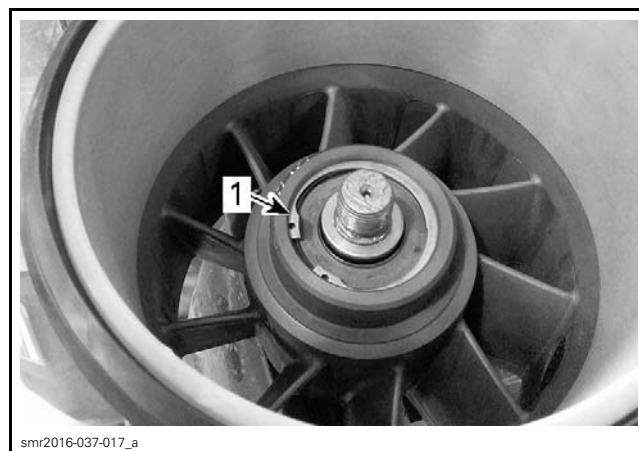
smr2009-006-012_a

TYPICAL

1. Impeller shaft and bearing
2. Bearing tool on INNER race

Removing The Seals

1. Remove and discard the circlip securing the seals.



smr2016-037-017_a

1. Circlip

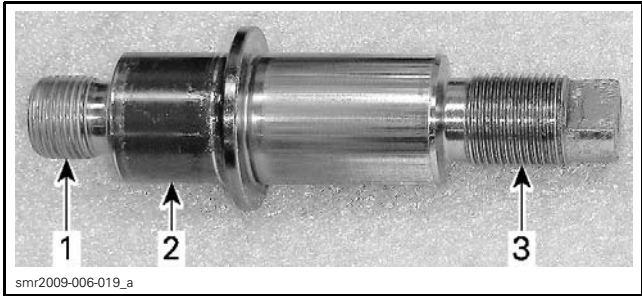
2. Using an appropriate tool, press seals out of the housing.

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.

Section 07 STEERING AND PROPULSION
Subsection 03 (JET PUMP)



TYPICAL
1. Threads
2. Seal lip contact surface
3. Threads

Inspect ball bearing for corrosion.

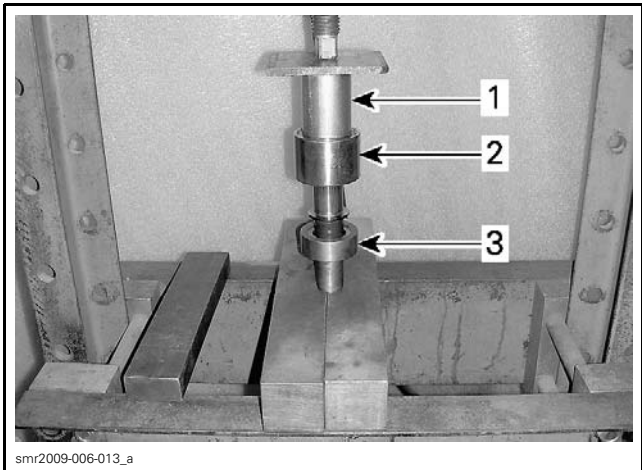
Installing the Impeller Shaft, Bearing and Seals

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 on the bearing inner race, press the bearing on the impeller shaft.
2. Use the Impeller shaft pusher tool to protect the impeller shaft threads.

NOTE: The bearing can be installed in either direction.



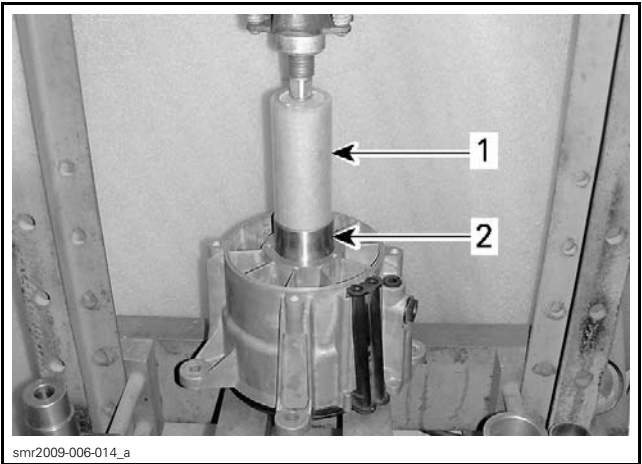
TYPICAL
1. Impeller shaft bearing tool on INNER race
2. Impeller shaft and bearing
3. Impeller shaft installer/pusher tool

3. Press bearing until it bottoms.

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.

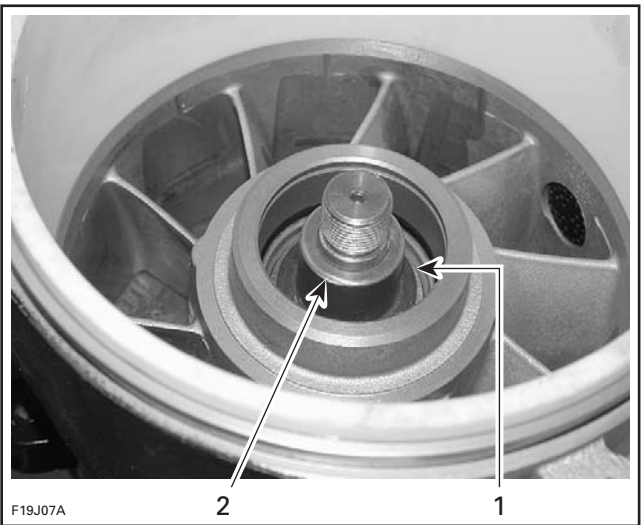


TYPICAL
1. Bearing tool
2. Impeller shaft and bearing

2. Press bearing until it bottoms.
- NOTE:** Ensure impeller shaft turns freely and smoothly.
3. Turn pump upside down.
 4. Coat shaft surface and O-ring with grease.

SERVICE PRODUCT
JET PUMP BEARING GREASE (P/N 293 550 032)

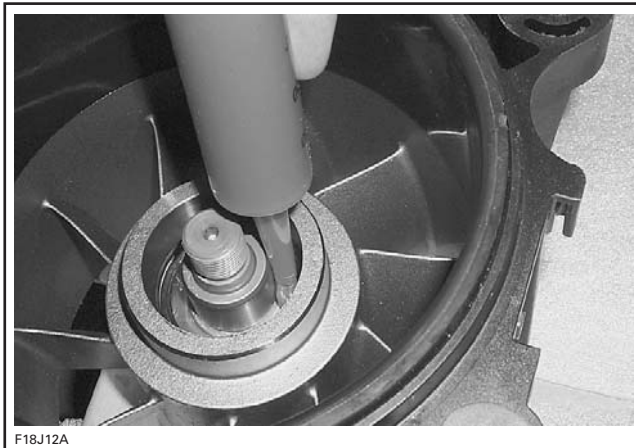
5. Install greased O-ring at bottom.



TYPICAL
1. O-ring at bottom
2. Coat surface

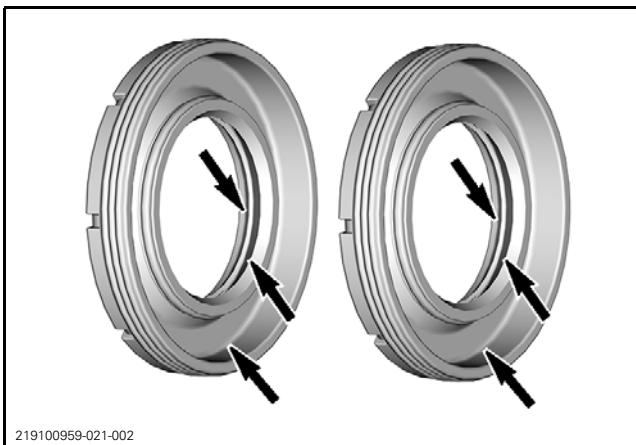
6. Apply 5 g (.2 oz) of grease on bearing.

SERVICE PRODUCT
JET PUMP BEARING GREASE (P/N 293 550 032)



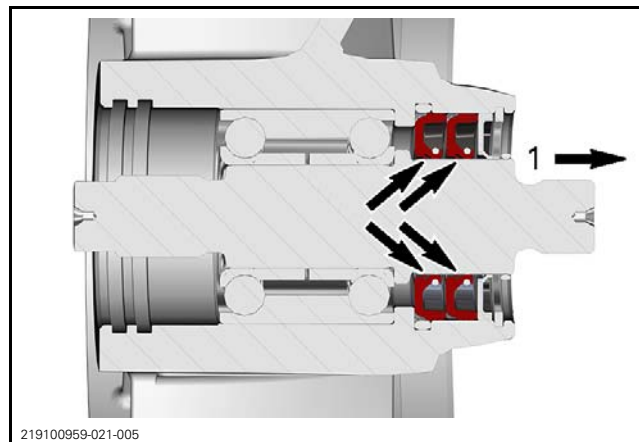
TYPICAL

7. Apply 11 g (.4 oz) of grease inside **NEW** double lip seal and in the seal lips.

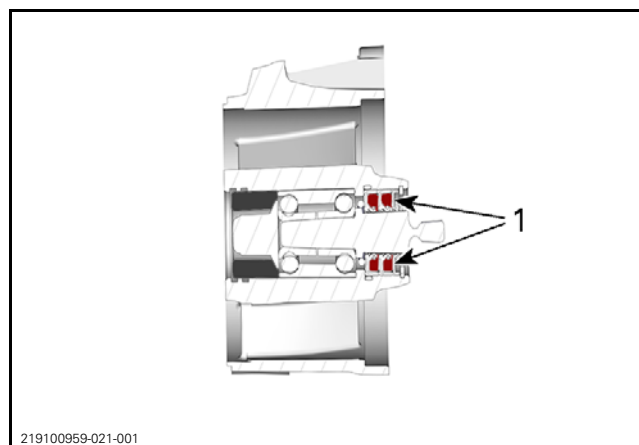


PUT GREASE IN ALL SEAL CAVITIES.

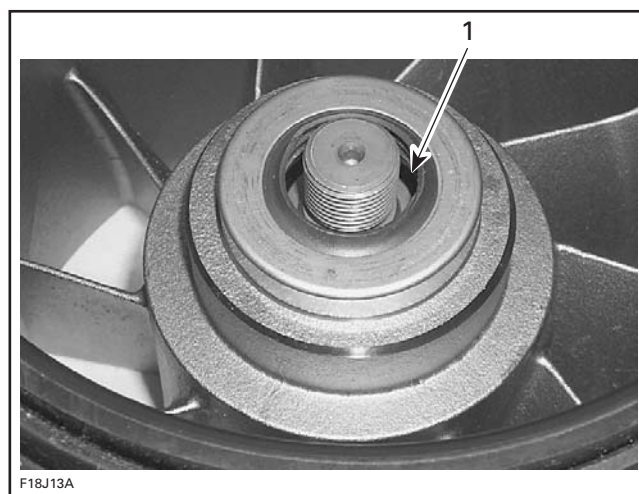
8. Install double lip seals making sure seal lip are facing upwards (toward impeller side).



1. Toward impeller



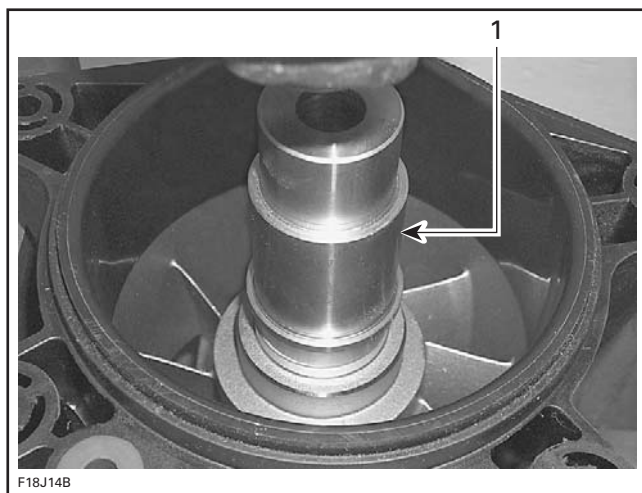
1. Grease in seals cavities



1. Seal lip facing up

Section 07 STEERING AND PROPULSION

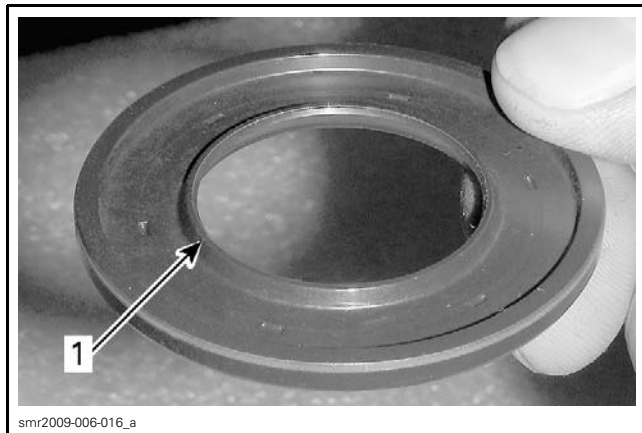
Subsection 03 (JET PUMP)



TYPICAL

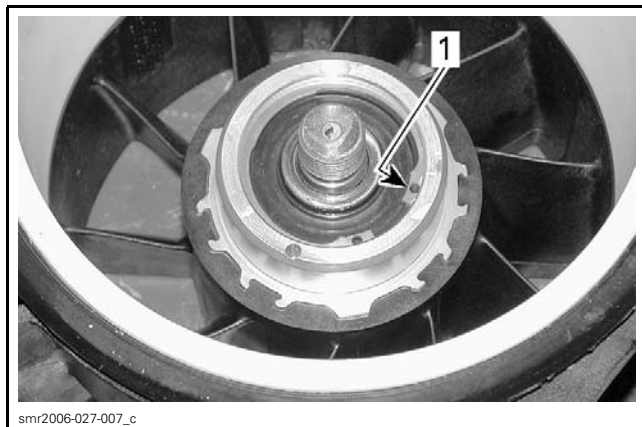
1. Seal/bearing pusher

9. Install the other seal (thin). Ensure seal lip is facing up.



1. Seal lip facing up

10. Install circlip.



TYPICAL

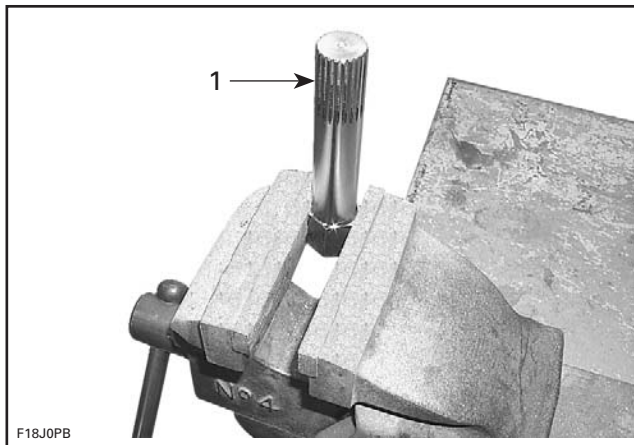
1. Circlip

11. Turn pump upside down.

12. Before installing any other parts, pressurize jet pump to insure proper seal installation. Refer to *LEAK TEST* in this subsection.

13. Install impeller. Refer to *IMPELLER* in this subsection.

14. Mount in a vise the impeller remover/installer.



1. Impeller remover/installer tool

15. Install jet pump housing over tool.



TYPICAL

16. Using a 30 mm socket, screw the impeller shaft nut on clockwise.

17. Tighten nut as specified in exploded view.

Section 07 STEERING AND PROPULSION

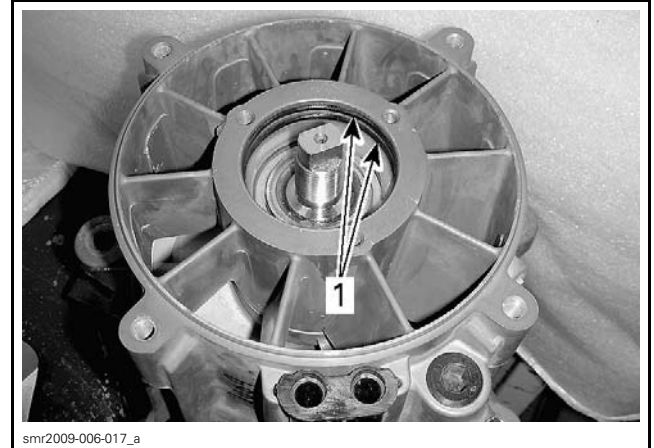
Subsection 03 (JET PUMP)



18. Apply 30 g (1.1 oz) of grease around nut.

SERVICE PRODUCT

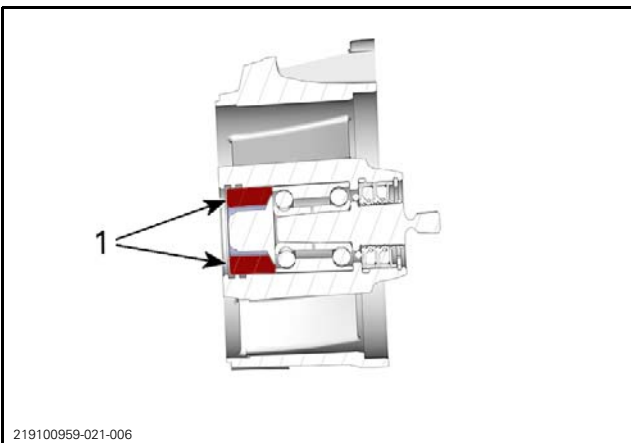
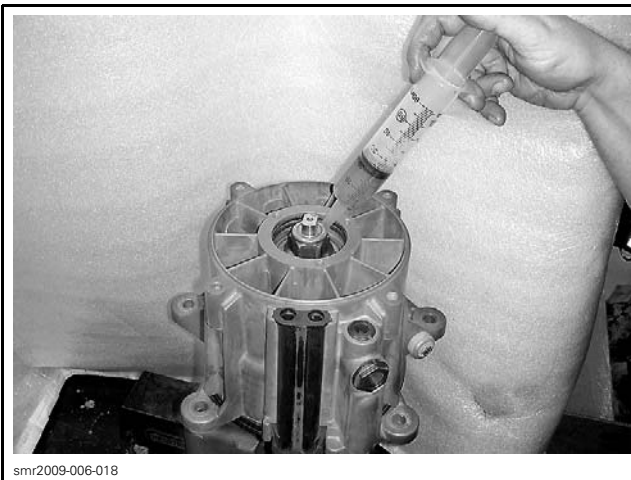
JET PUMP BEARING GREASE (P/N 293 550 032)



TYPICAL

1. O-rings

20. Install the impeller cover. Refer to *IMPELLER COVER* in this subsection.



1. Grease around nut

19. Install the two O-rings in pump housing and make sure they are properly lubricated.

**REFER TO DRIVE
SHAFT - 900 ACE**

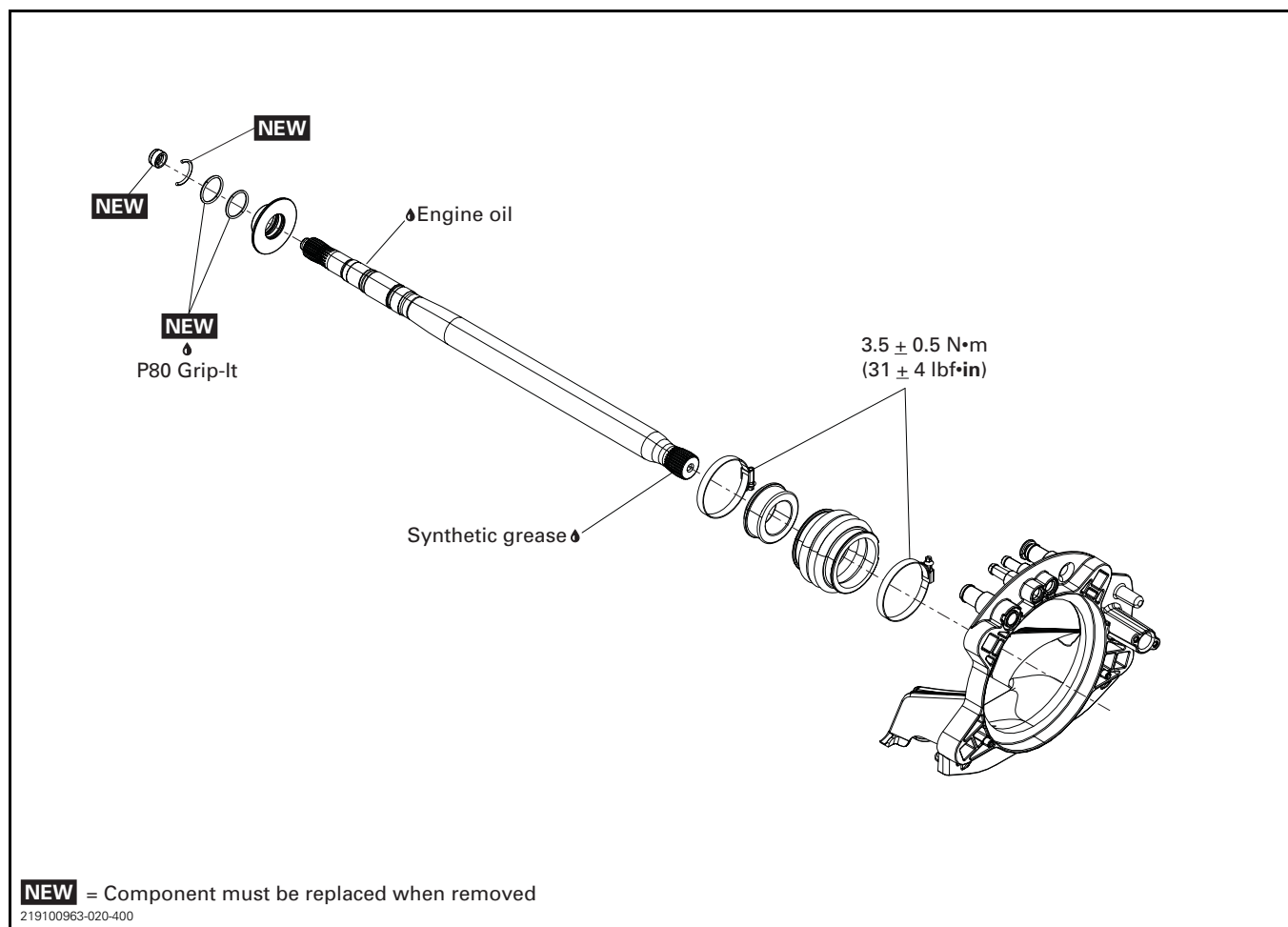
DRIVE SHAFT (1630 ACE)

SERVICE TOOLS

Description	Part Number	Page
DRIVE SHAFT C-CLIP REMOVER	529 036 026	242
FLOATING RING TOOL (TYPE II)	529 036 116	242
PTO SUPPORT TOOL	529 035 842	243, 246

SERVICE PRODUCTS

Description	Part Number	Page
CLUTCH AND PULLEY FLANGE CLEANER PRO S1	779244	244
LUBRICANT AND ANTI-CORROSIVE (EUR)	779224	243
LUBRICANT AND ANTI-CORROSIVE.....	779168	243
P80 GRIP-IT	296 000 406	246



PROCEDURES

DRIVE SHAFT

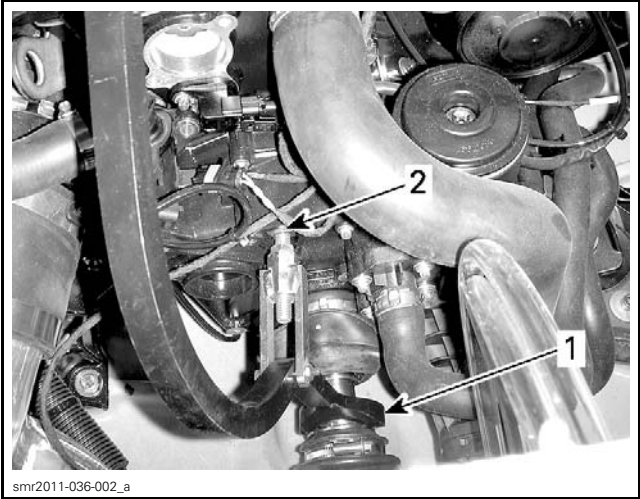
Accessing the Drive Shaft

Remove the seat and engine service cover. Refer to *BODY* subsection.

Removing the Drive Shaft

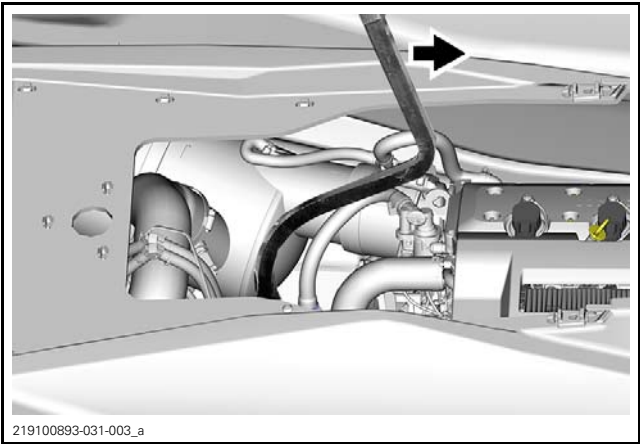
NOTE: Ensure jet pump is installed before beginning this procedure.

- 1. On supercharged engines, remove air intake hose.



TYPICAL
1. Fork against floating ring
2. Adjustable arm

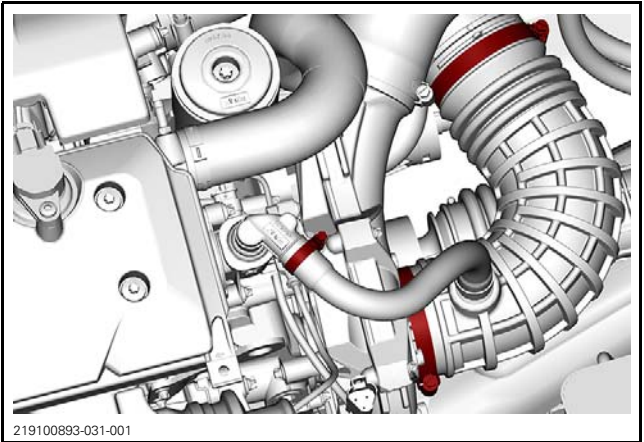
- 3.3 Move the tool handle toward the front of vehicle to push floating ring rearward.




The next steps (4 to 12) should be performed only if the floating ring seems stuck or hard to move. Otherwise, go to the step 13.

NOTE: Do not remove circlip at this time.


- 4. Remove the drive shaft C-clip remover.
- 5. If equipped, remove the supercharger. Refer to *SUPERCHARGER* subsection.
- 6. Install the following tool on drive shaft with its largest opening on PTO side.



- 2. Lift rubber protector to expose PTO seal assembly.
- 3. Confirm the floating ring is not stuck on drive shaft as follows:

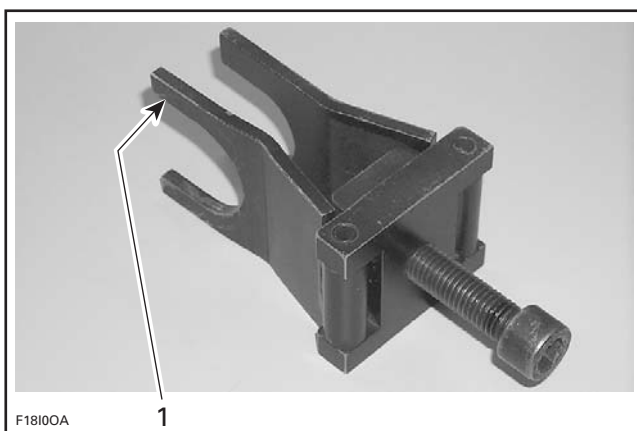
REQUIRED TOOL	
DRIVE SHAFT C-CLIP REMOVER (P/N 529 036 026)	

- 3.1 Place the fork of drive shaft C-clip remover against floating ring.
- 3.2 Place the adjustable arm against the engine block or the supercharger.

REQUIRED TOOL	
FLOATING RING TOOL (TYPE II) (P/N 529 036 116)	

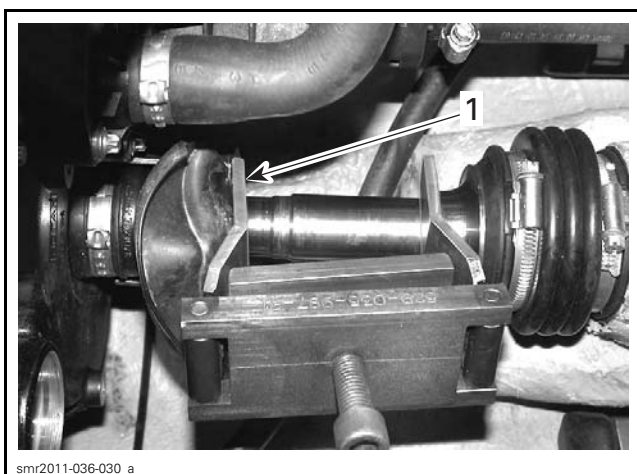
Section 07 STEERING AND PROPULSION

Subsection 05 (DRIVE SHAFT (1630 ACE))



TYPICAL

1. Largest opening on PTO seal side



TYPICAL

1. Largest opening here

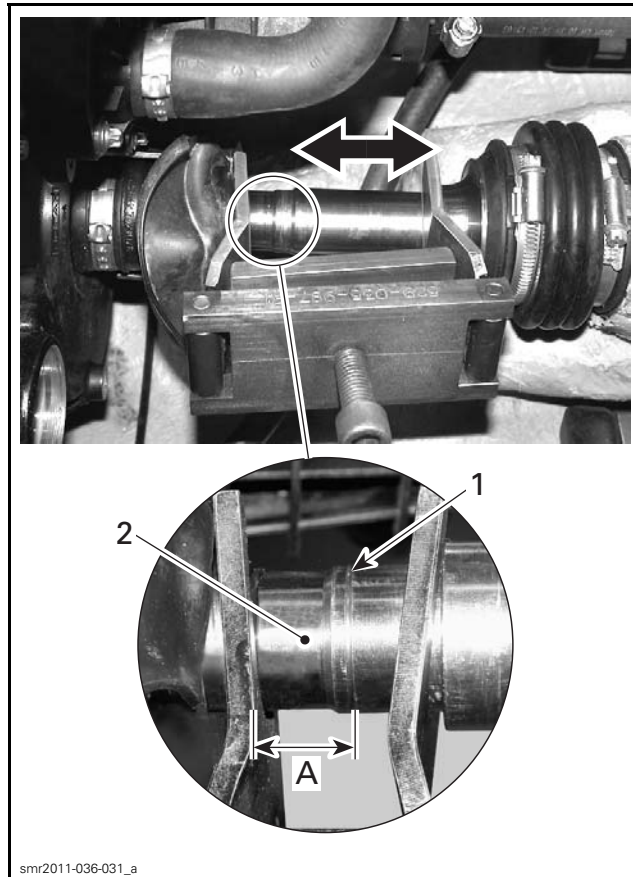
7. To expose the O-ring contact area, tighten tool screw until the following gap is obtained.

GAP BETWEEN TELLTALE GROOVE AND TOOL EDGE	
18 mm (11/16 in)	

8. Lubricate O-ring contact area with anti-corrosive lubricant.

SERVICE PRODUCT	
Scandinavia	LUBRICANT AND ANTI-CORROSIVE (EUR) (P/N 779224)
All other countries	LUBRICANT AND ANTI-CORROSIVE (P/N 779168)

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)

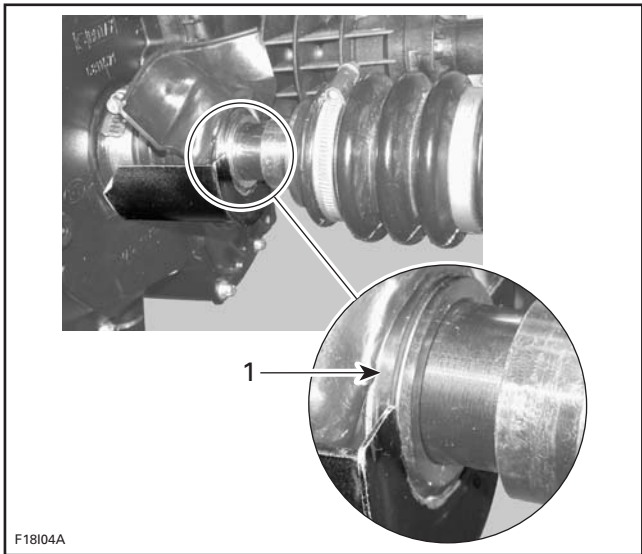
9. Remove the floating ring tool.

10. Install the following tool to PTO seal assembly.

REQUIRED TOOL	
PTO SUPPORT TOOL (P/N 529 035 842)	

Section 07 STEERING AND PROPULSION

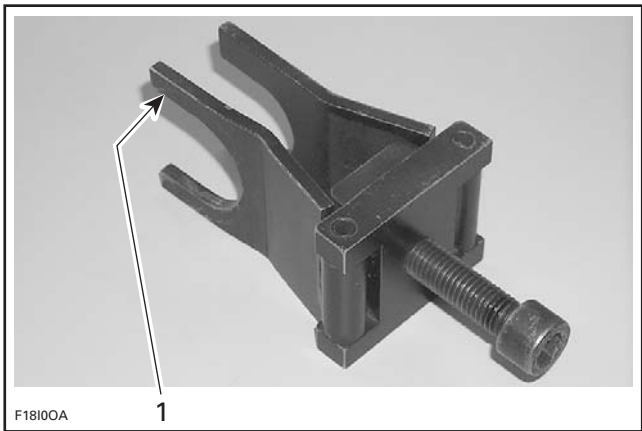
Subsection 05 (DRIVE SHAFT (1630 ACE))



1. Insert in groove of PTO seal assembly

NOTICE Strictly follow this procedure otherwise damage to component might occur.

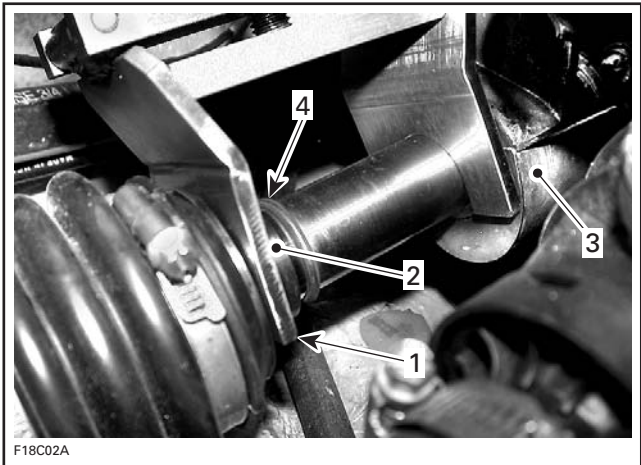
11. Reinstall the floating ring tool as shown.



TYPICAL
1. Largest opening on PTO seal side

12. Tighten tool screw to push floating ring rearward and expose circlip.

13. Remove and discard circlip.



TYPICAL
1. Largest opening here
2. Floating ring
3. PTO seal support tool
4. Remove circlip

14. Remove the floating ring tool.

15. Place rags under PTO housing to prevent spillage. If spillage occurs, clean immediately with pulley flange cleaner to prevent oil stains.

SERVICE PRODUCT
CLUTCH AND PULLEY FLANGE CLEANER PRO S1 (P/N 779244)

16. Remove jet pump. Refer to *JET PUMP* subsection.

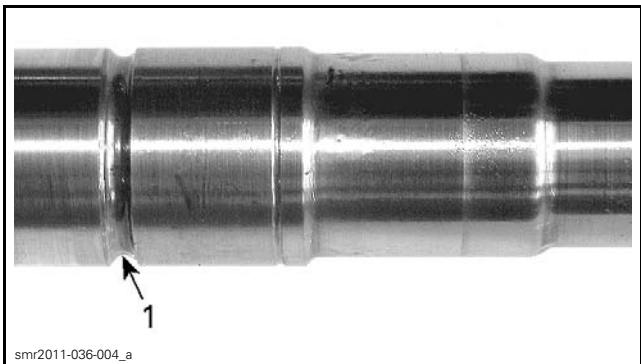
17. Remove drive shaft.

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.



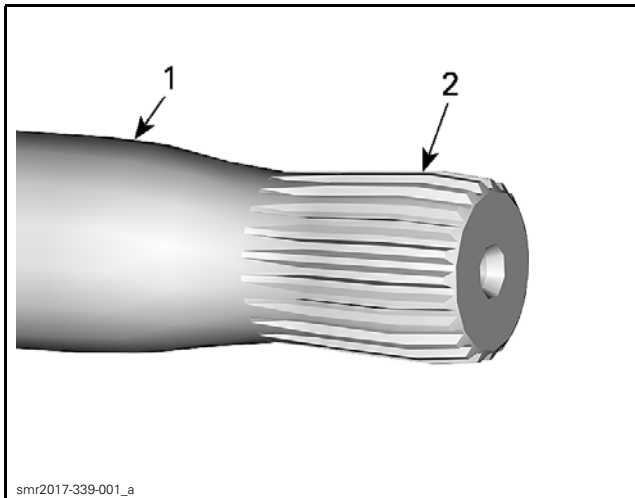
1. Circlip groove

Section 07 STEERING AND PROPULSION

Subsection 05 (DRIVE SHAFT (1630 ACE))

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, replace drive shaft.

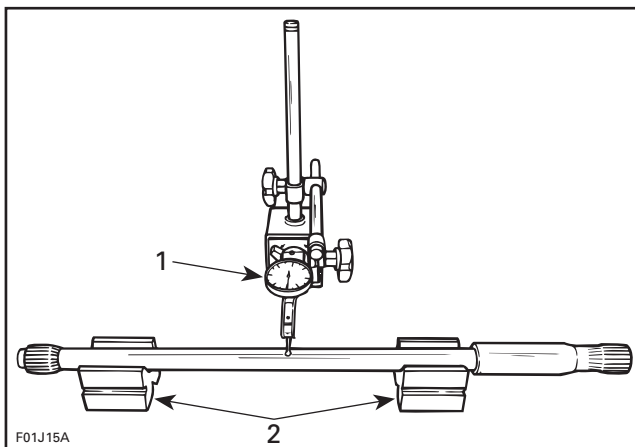


TYPICAL

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

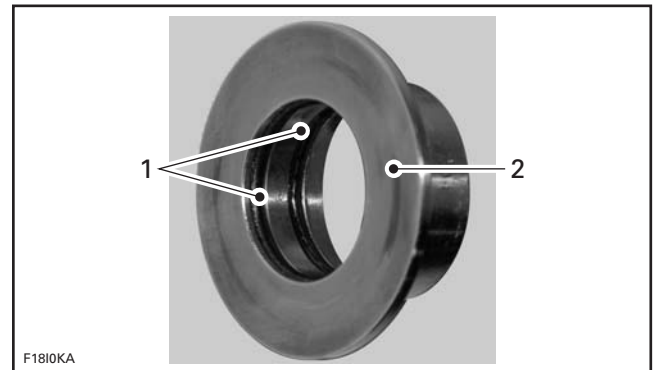
MAXIMUM DEFLECTION

0.5 mm (.02 in)

Floating Ring

Inspect condition of O-rings and contact surface of floating ring.

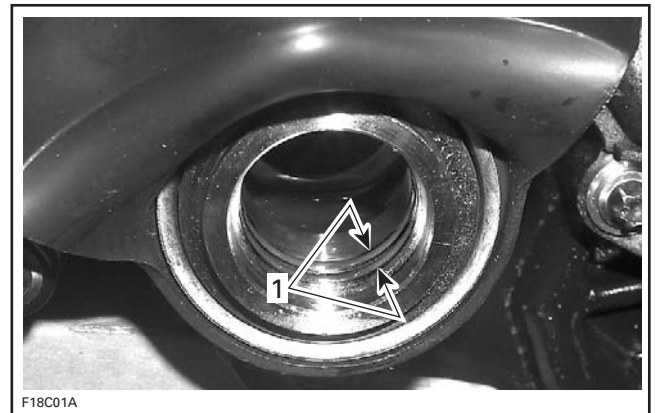
Replace as required.



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.

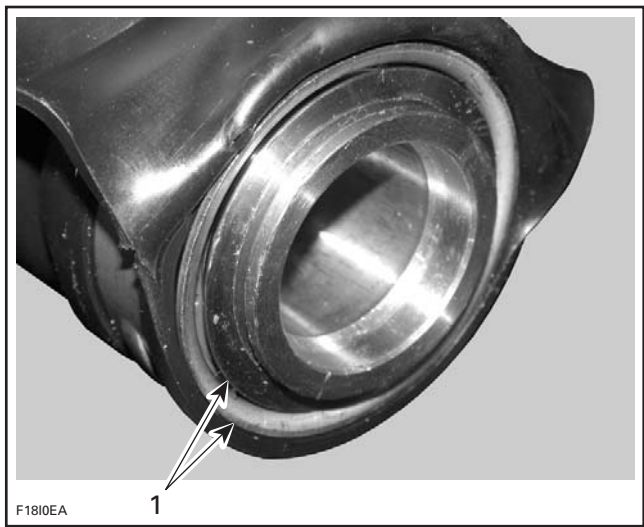


1. O-rings

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.

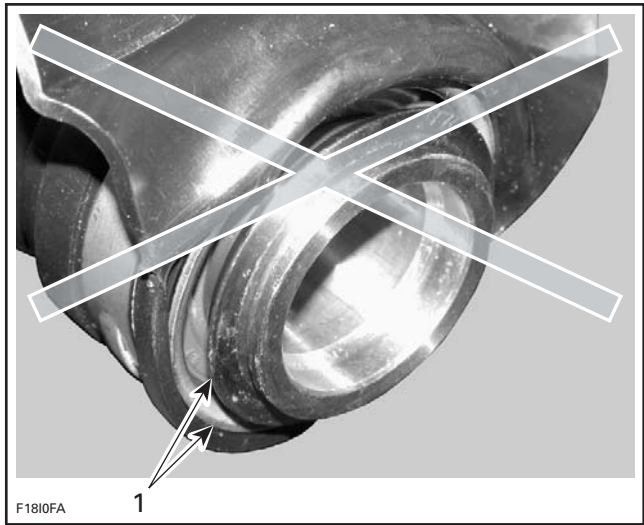
Section 07 STEERING AND PROPULSION

Subsection 05 (DRIVE SHAFT (1630 ACE))



CORRECT POSITION

1. Inner sleeve flush with outer circumference



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.



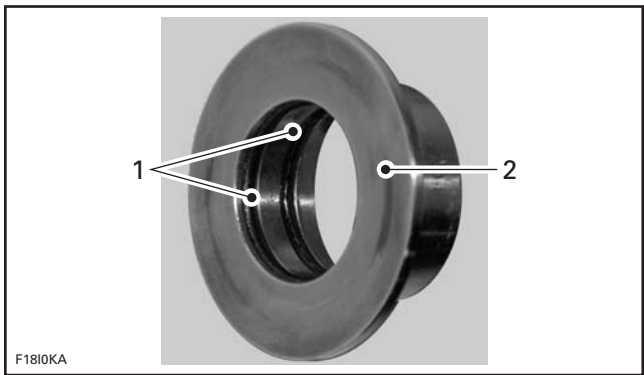
1. Damper

Install the PTO support tool on PTO seal assembly.

REQUIRED TOOL	
PTO SUPPORT TOOL (P/N 529 035 842)	

Apply a thin coat of Grip-it on the floating ring O-rings. Do not get grease on floating ring contact surface.

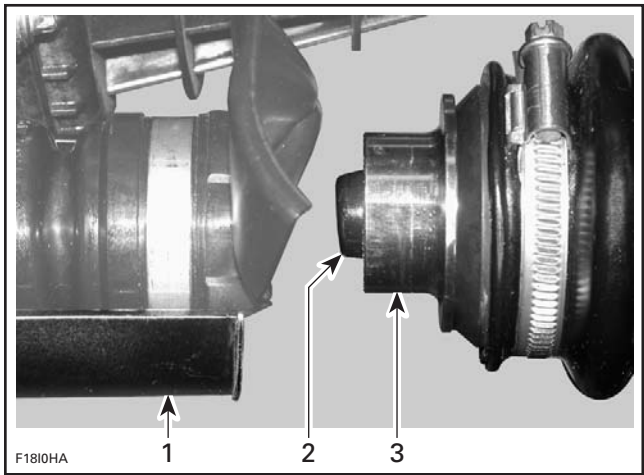
SERVICE PRODUCT
P80 GRIP-IT (P/N 296 000 406)



1. P80 Grip-it 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

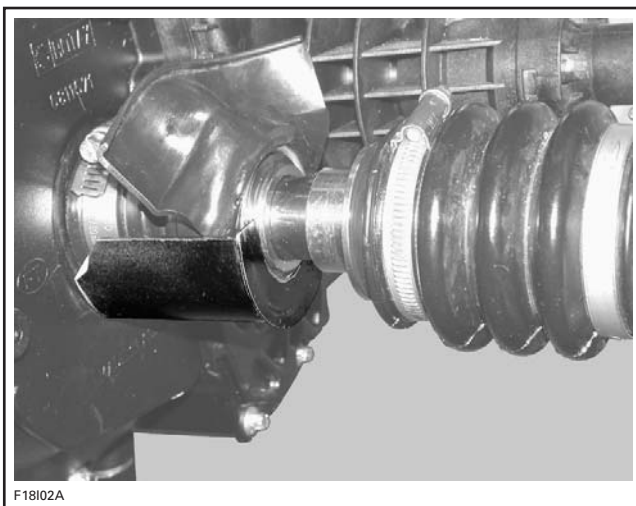
3. Insert floating ring on shaft end

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.

Section 07 STEERING AND PROPULSION

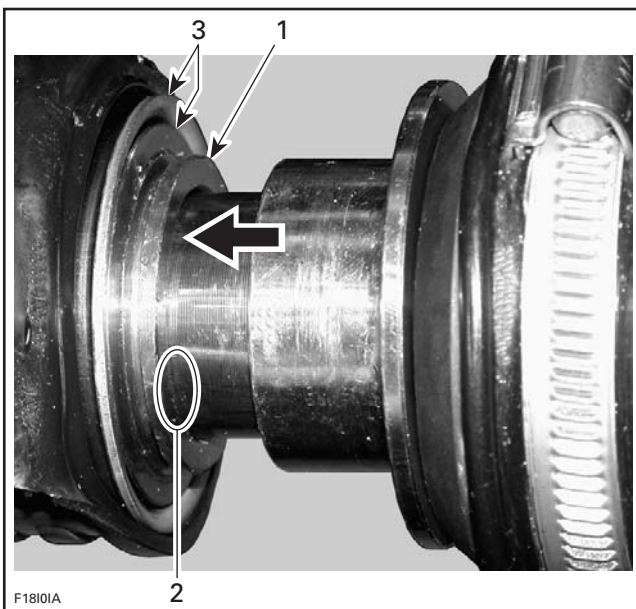
Subsection 05 (DRIVE SHAFT (1630 ACE))



TYPICAL

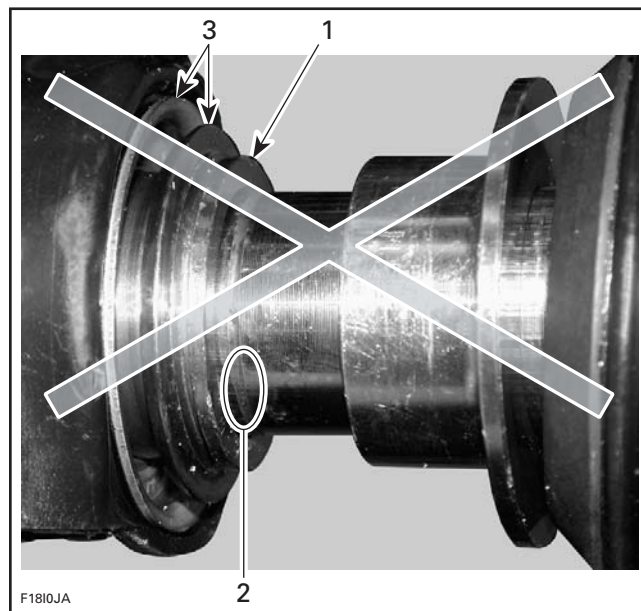
Maintain PTO seal assembly in the proper position and tap shaft end until it bottoms against engine. At this time, the telltale groove **MUST NOT** be visible. This validates the correct position.

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 BELLOWS

Inspecting the Drive Shaft Bellows

Inspect the condition of bellows. If there is any damage or evidence of wear, replace it.

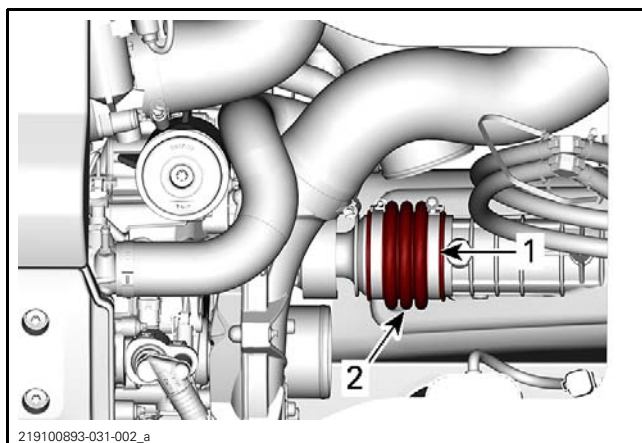
Removing the Drive Shaft Bellows

Remove drive shaft. Refer to *REMOVING THE DRIVE SHAFT* in this subsection.

Section 07 STEERING AND PROPULSION

Subsection 05 (DRIVE SHAFT (1630 ACE))

Loosen gear clamp holding bellows, then carefully pull bellows and carbon ring from hull insert.



TYPICAL

1. Loosen this clamp
2. Drive shaft bellows

Installing the Drive Shaft Bellows

The installation is the reverse of the removal procedure.

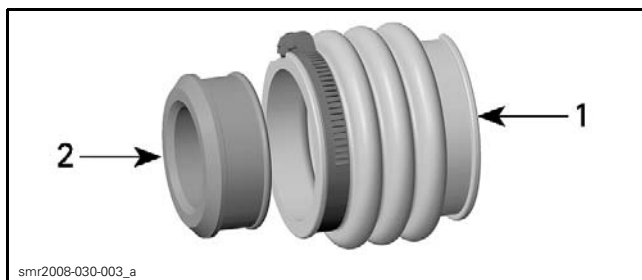
CARBON RING

Removing the Carbon Ring

NOTE: Always replace the floating ring when replacing the carbon ring.

Remove drive shaft bellows. Refer to *REMOVING THE DRIVE SHAFT BELLOWS* in this subsection.

Loosen gear clamp then pull carbon ring from drive shaft bellows.



1. Drive shaft bellows
2. Carbon ring

Installing the Carbon Ring

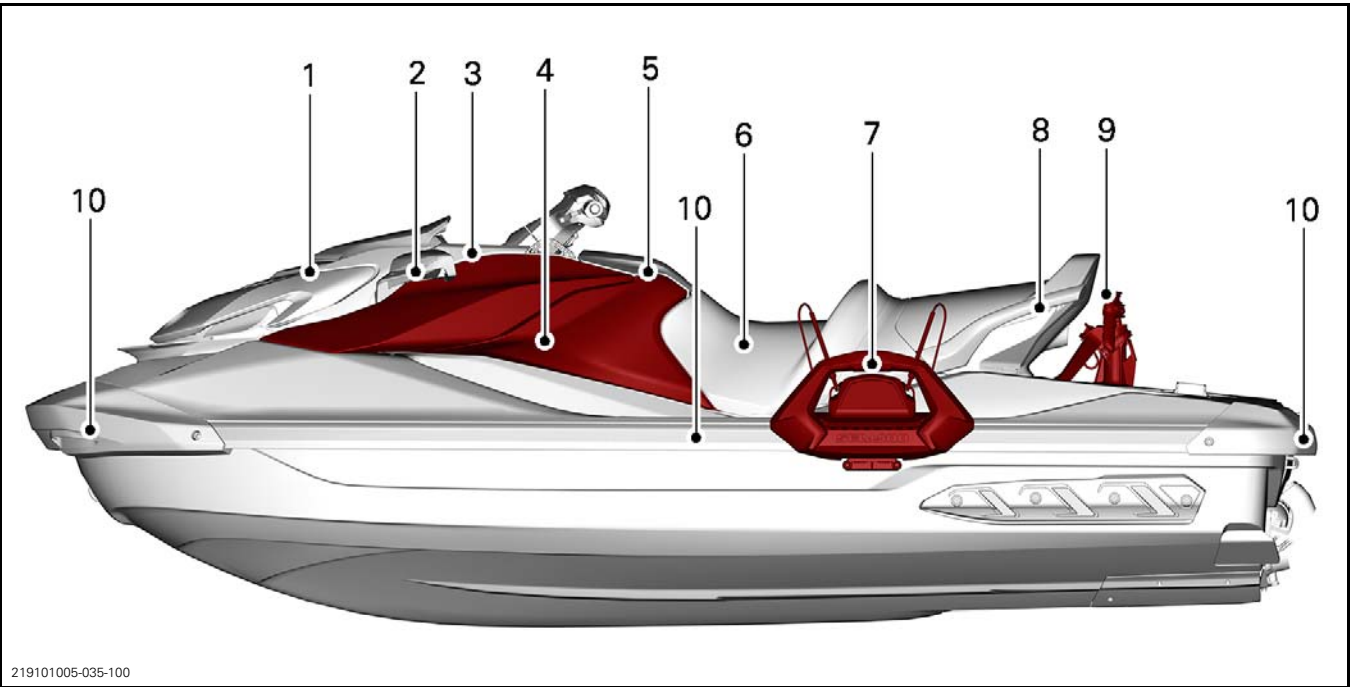
The installation is the reverse of the removal procedure.

BODY

SERVICE PRODUCTS

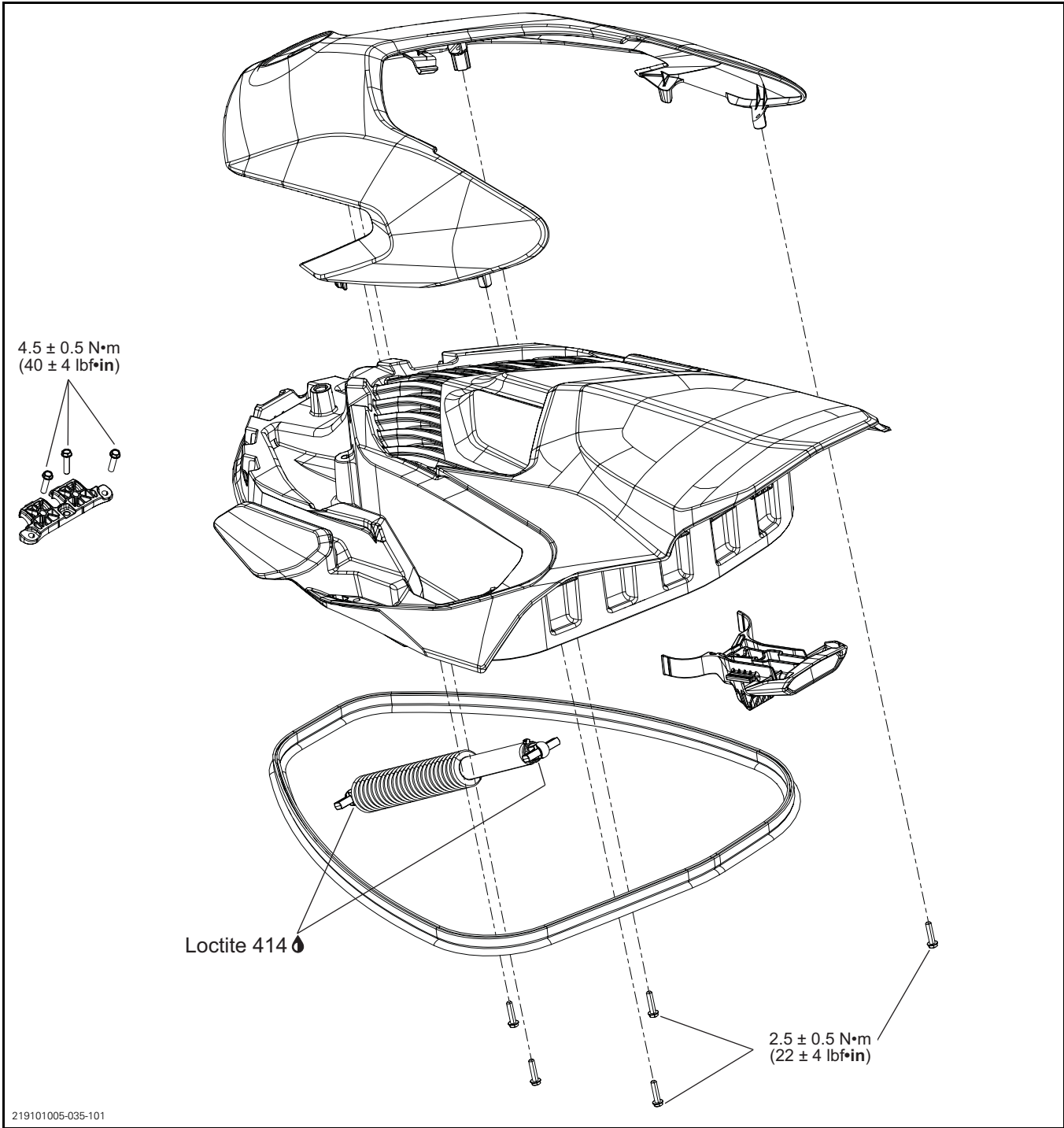
Description	Part Number	Page
LOCTITE 414	413 705 800	257
LOCTITE 5900	293 800 066	259, 264, 270
SYNTHETIC GREASE (EUR)	779231	266–267
SYNTHETIC GREASE	779162	266–267

BODY PARTS NOMENCLATURE (WAKE MODEL SHOWN)

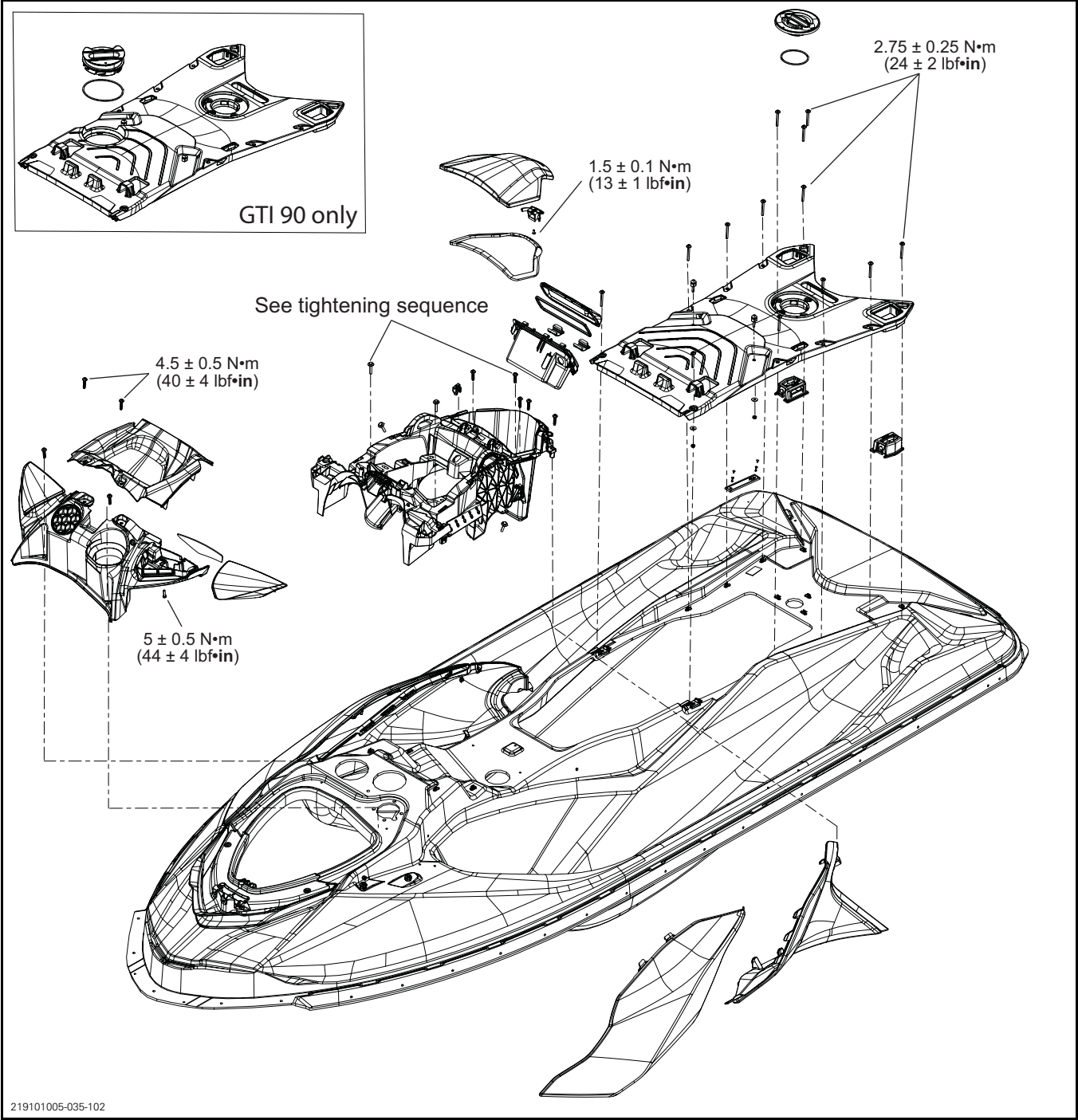


- 1. Storage compartment cover
- 2. Mirror support
- 3. Gauge panel
- 4. Lateral trim panels
- 5. Glove box cover
- 6. Seat
- 7. Wakeboard rack (Wake model only)
- 8. Passenger handholds
- 9. Retractable Ski Pylon (Wake model only)
- 10. Bumper

STORAGE COMPARTMENT COVER

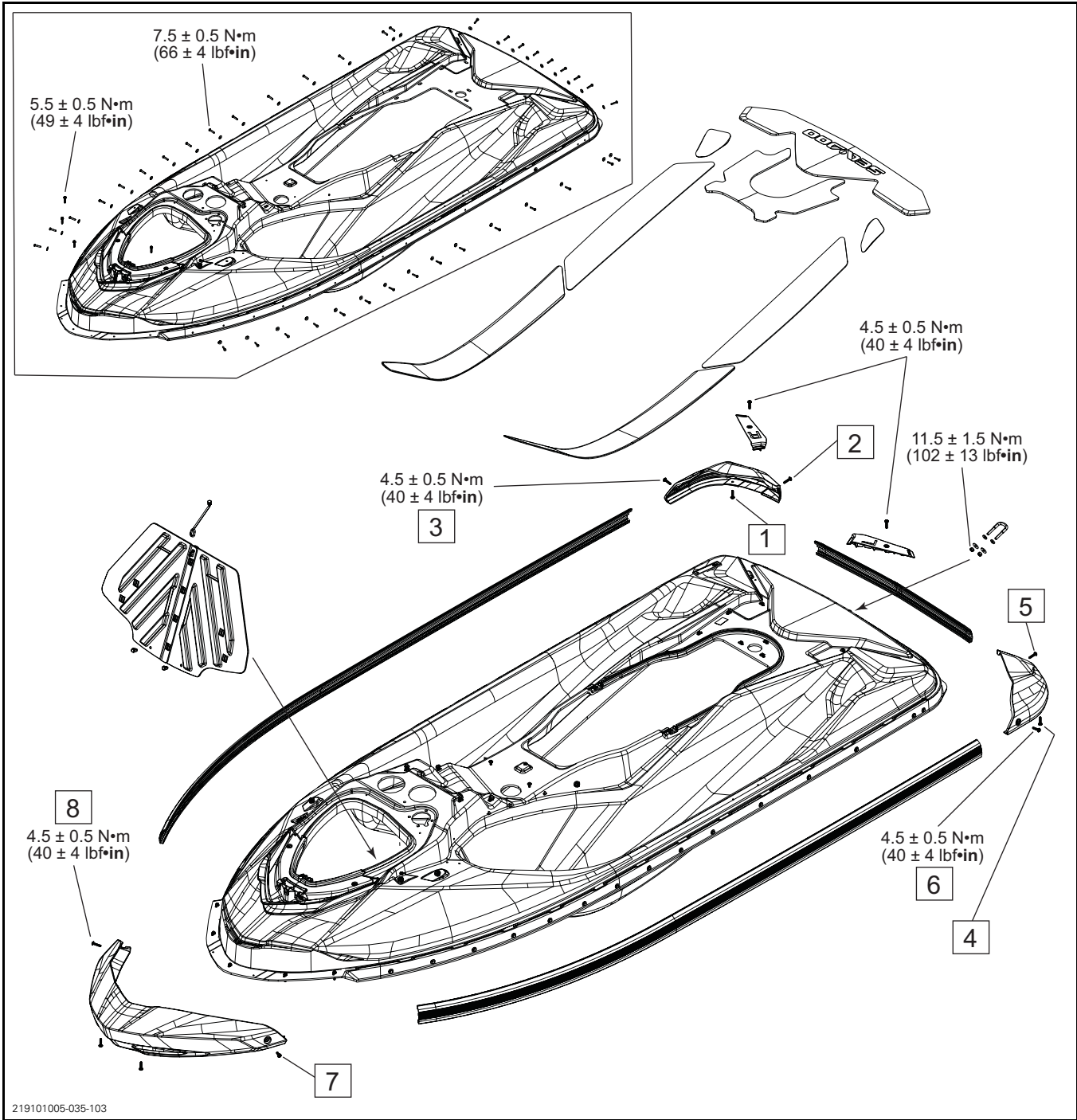


BODY PARTS

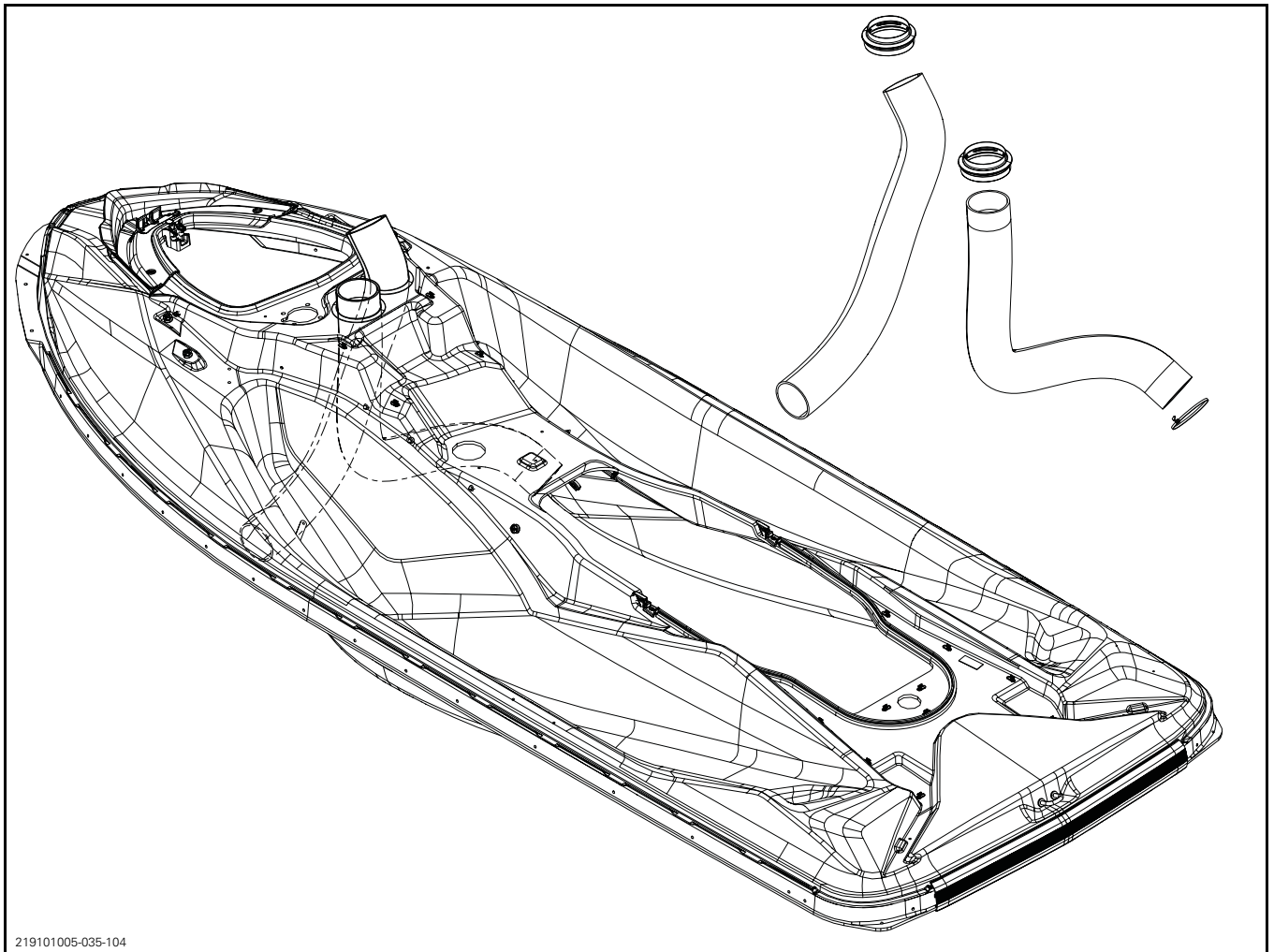


Section 08 BODY AND HULL
Subsection 01 (BODY)

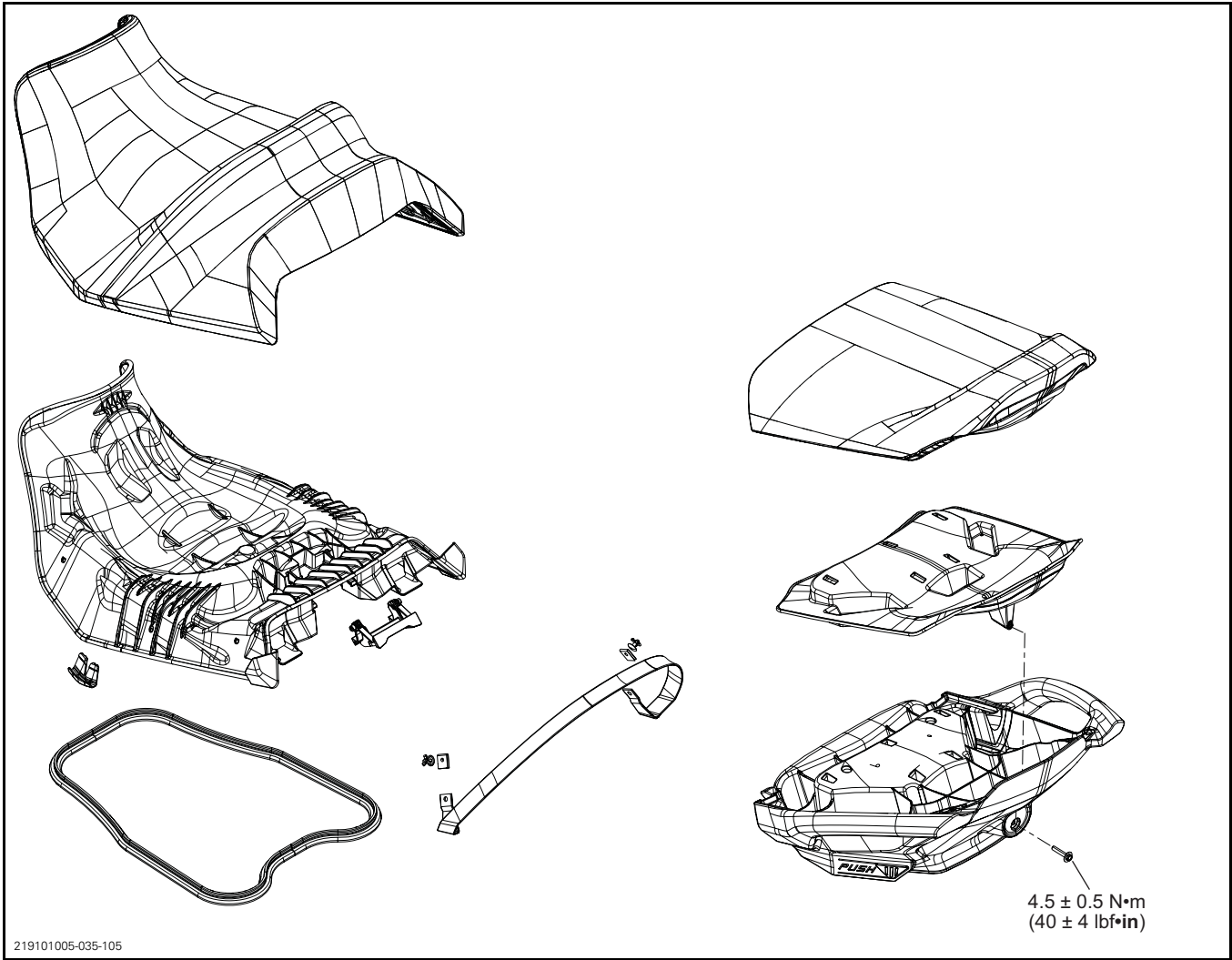
BODY PARTS



VENTILATION

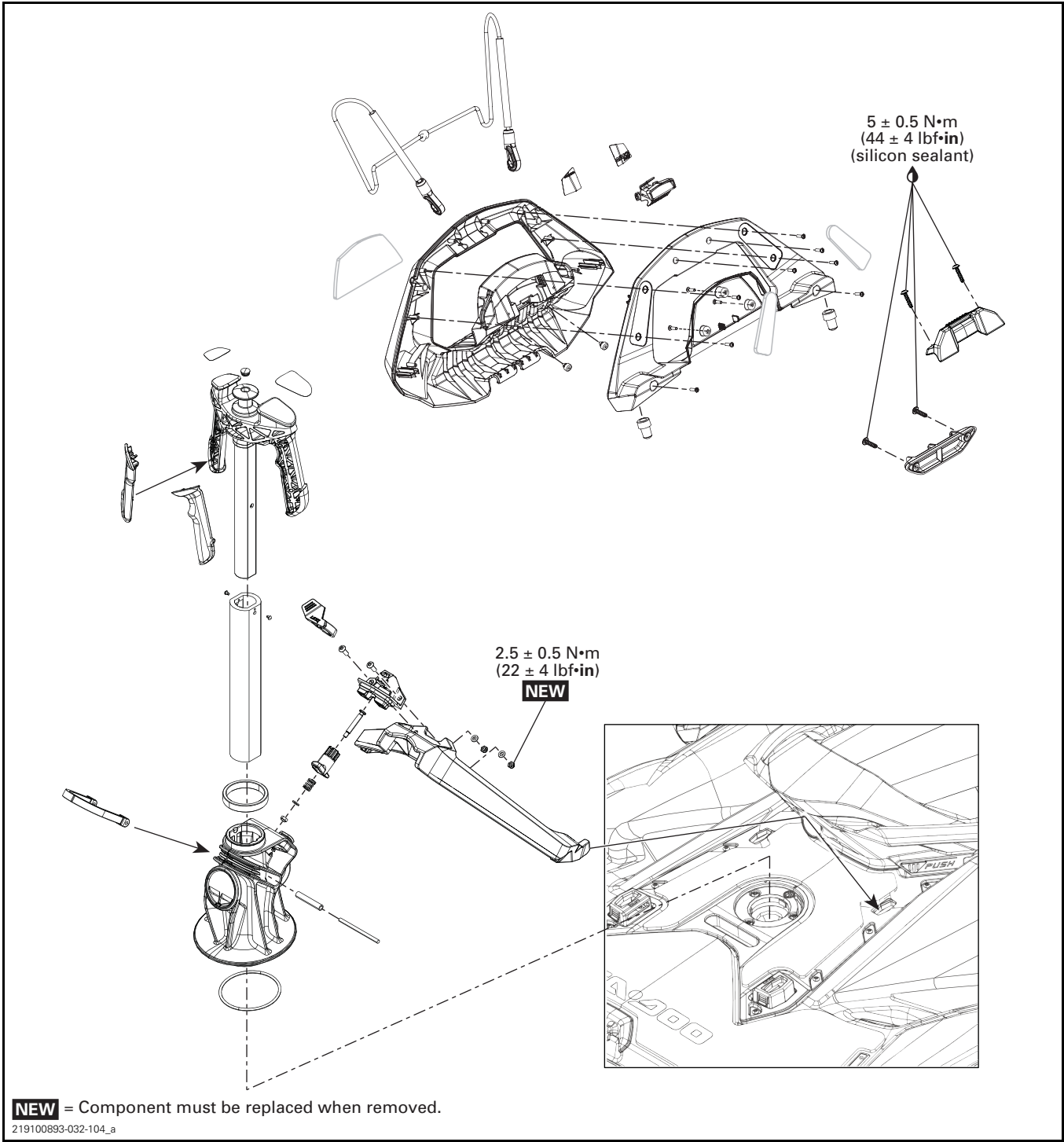


SEAT



WAKEBOARD RACK AND WAKE PYLON

Wake 170



Section 08 BODY AND HULL

Subsection 01 (BODY)

PROCEDURES

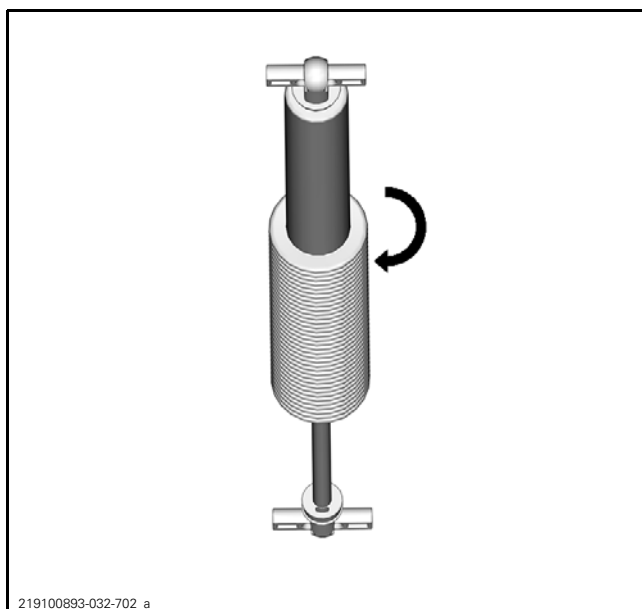
DECALS AND CARPETS

For information and repair, refer to appropriate *CARE AND REPAIR ONLINE BOOKLET* on www.operatorsguides.brp.com.

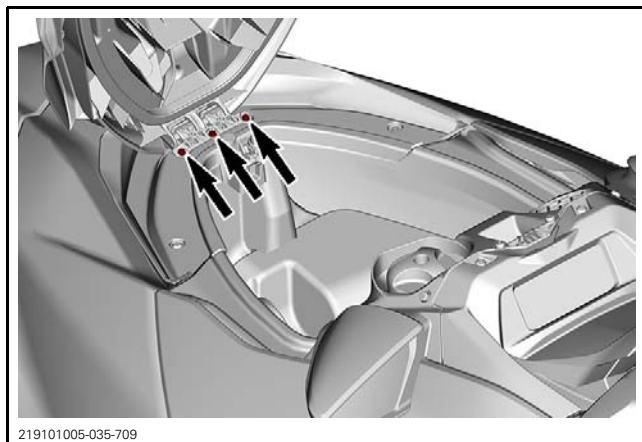
STORAGE COMPARTMENT COVER

Removing the Storage Compartment Cover

1. Open storage compartment cover.
2. Remove gas shock by turning it.



3. Remove hinge screws.

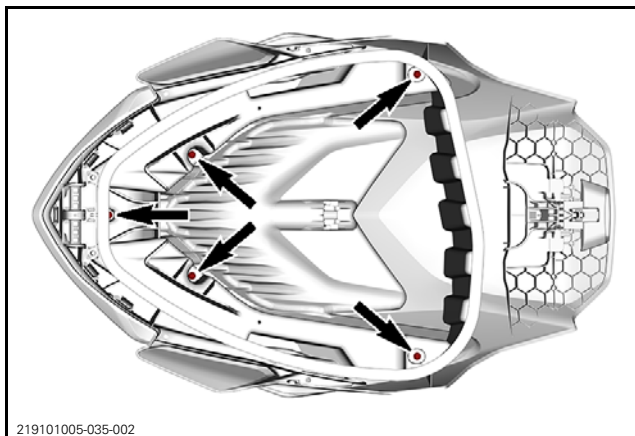


4. Remove storage compartment cover.

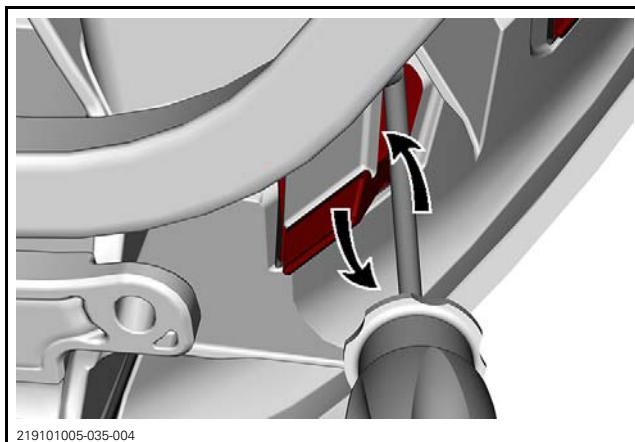
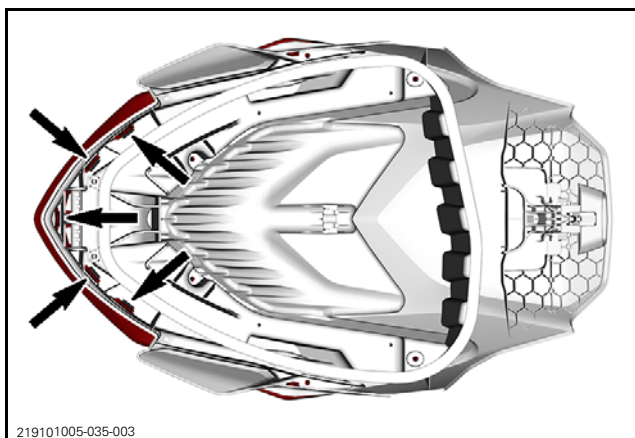
Disassembling the Storage Compartment Cover

Storage Compartment Cover Inner Shell

1. Remove inner shell retaining screws.



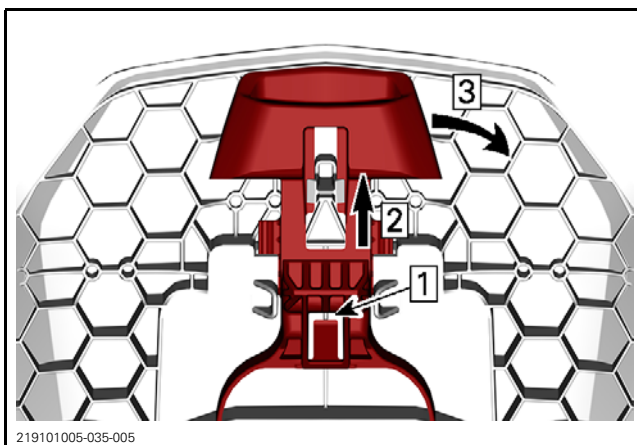
2. Unlatch simultaneously the following retaining tabs using screwdrivers.



3. Disassemble inner shell from storage compartment cover.

Storage Compartment Cover Latch

1. Open storage compartment cover.
2. Lift the rear tab. An appropriate tool might be required to ease lifting.
3. Slide the latch.
4. Remove latch from hood.



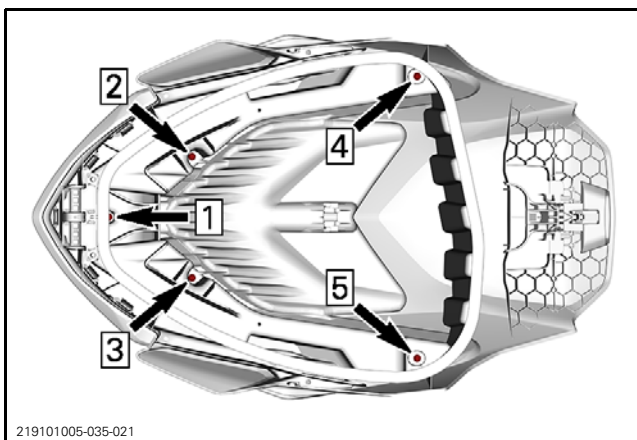
219101005-035-005
 Step 1: Lift rear tab
 Step 2: Slide the latch
 Step 3: Remove latch

Assembling the Storage Compartment Cover

The assembly is the reverse of the disassembly procedure. However, pay attention to the following.

Tighten inner shell retaining screws and bolt to specification as per the following sequence.

TIGHTENING TORQUE	
Inner shell retaining screws	2.5 N•m ± 0.5 N•m (22 lbf•in ± 4 lbf•in)



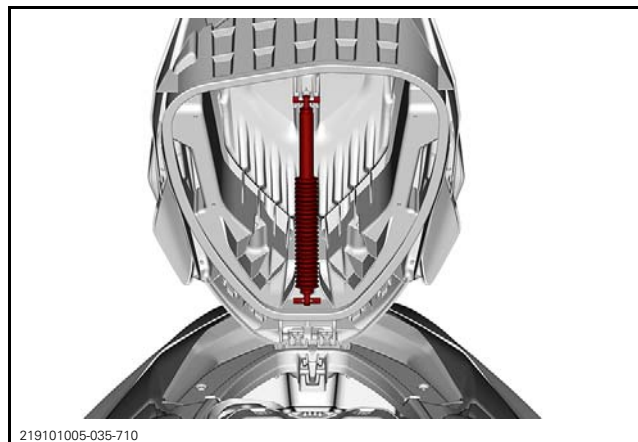
219101005-035-021

TIGHTENING SEQUENCE

Installing the Storage Compartment Cover

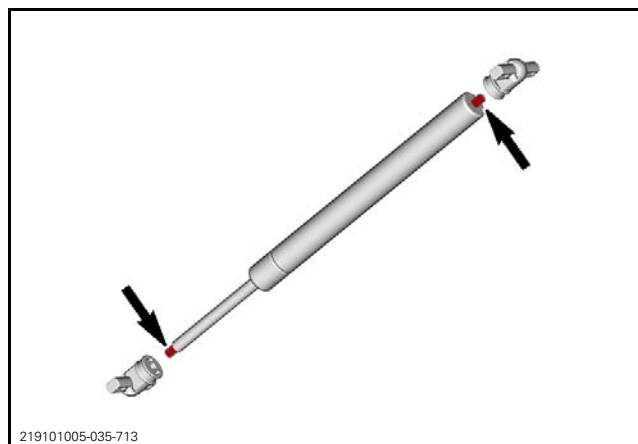
The installation is the reverse of the removal procedure. However, pay attention to the following. Install shock at the end of the assembly procedure.

When reinstalling gas shock, make sure to place the rod at the bottom.



219101005-035-710

NOTE: If the shock ends have been removed, apply LOCTITE 414 (P/N 413 705 800) before installation.



219101005-035-713

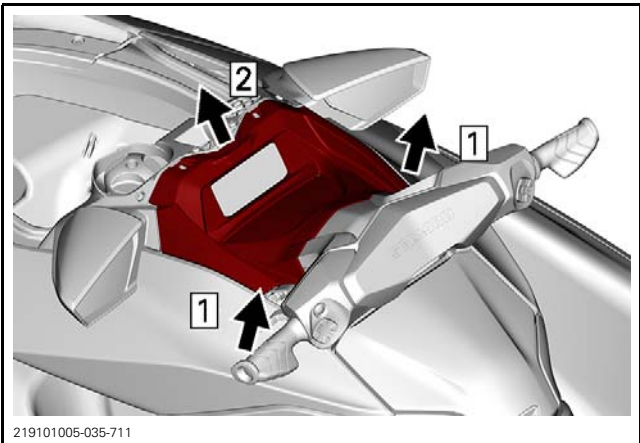
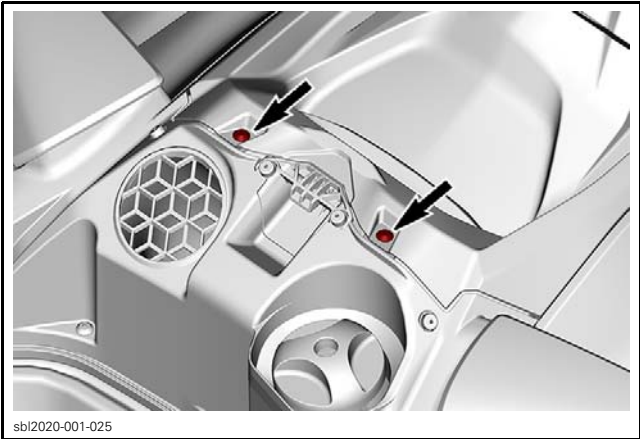
GAUGE PANEL

Removing the Gauge Panel

1. Open storage compartment cover.
2. Remove following retaining screws.

Section 08 BODY AND HULL

Subsection 01 (BODY)



Step 1: Push upwards on each side to disengage central tab
Step 2: Pull rearwards to remove gauge panel

3. Remove lateral trim panels. Refer to procedure in this subsection.
4. Remove gauge panel from mirror support.

Installing the Gauge Panel

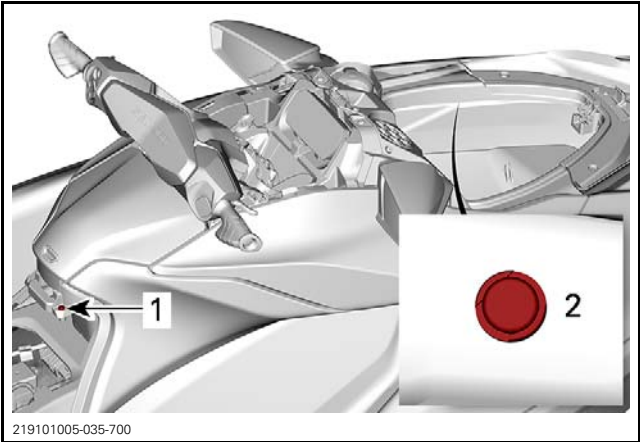
The installation is the reverse of the removal procedure. However, pay attention to the following. Prior to inserting gauge panel into mirror support, ensure that all tabs are properly aligned.

TIGHTENING TORQUE	
Gauge panel screws	4.5 N•m ± 0.5 N•m (40 lbf•in ± 4 lbf•in)

LATERAL TRIM PANEL

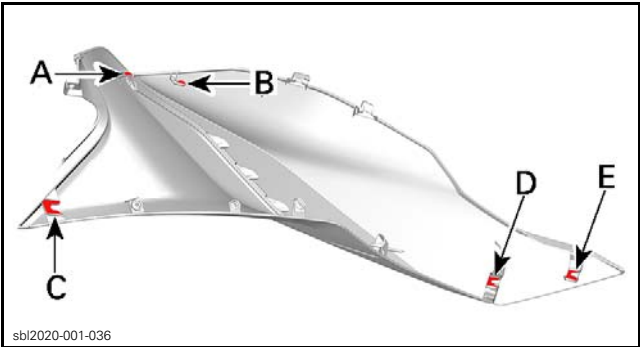
Removing the Lateral Trim Panel

1. Remove seat. Refer to procedure in this subsection
2. Remove following fasteners

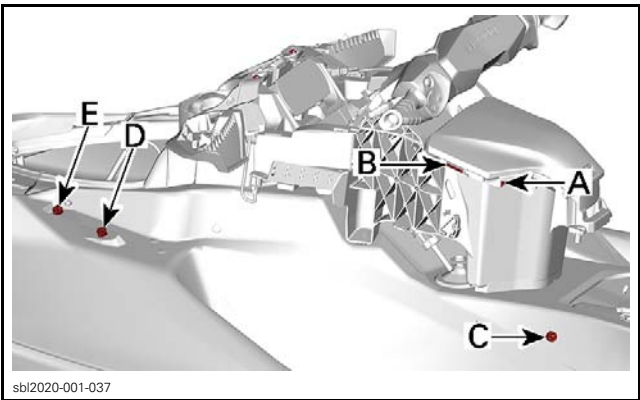


1. Screw
2. Plastic rivet

3. Disengage tabs A and B.

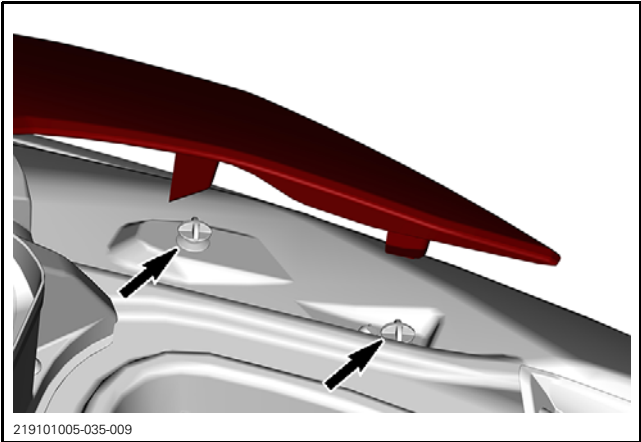


4. Pull toward the rear to disengage both lateral trim panels
5. Slide until all the darts are disengaged.



Installing the Lateral Trim Panel

The installation is the reverse of the removal procedure. However, pay attention to the following. Make sure to properly install the front darts into the front grooves of the lateral trim panel.

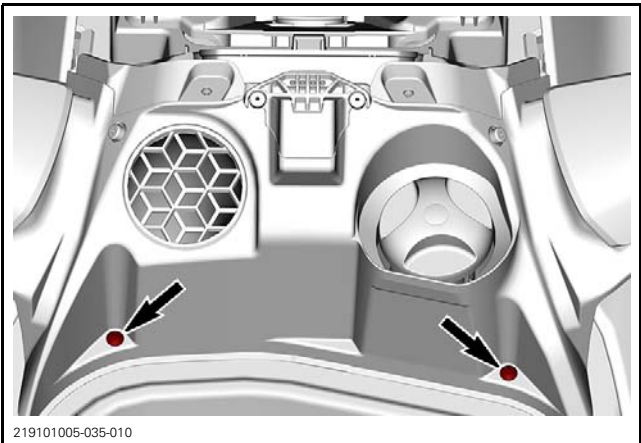


Make sure to properly secure all the rubber stoppers and tape of the lateral trim panel on vehicle as well as the plastic rivets.

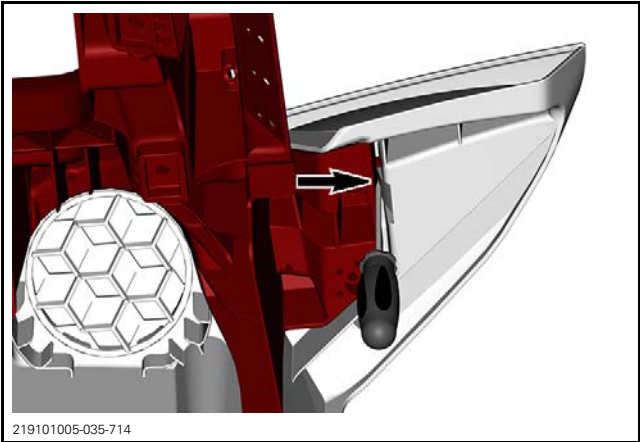
MIRROR SUPPORT

Removing the Mirror Support

1. Remove gauge support and side panels. Refer to procedure in this subsection.
2. Remove the following screws.



3. From underneath, push locking tabs outwards using a flat screwdriver.



4. Remove mirror support by pulling it upwards.

Installing the Mirror Support

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

TIGHTENING TORQUE	
Mirror support screws	4.5 N•m ± 0.5 N•m (40 lbf•in ± 4 lbf•in) + LOCTITE 5900 (P/N 293 800 066)
Gauge panel screws	4.5 N•m ± 0.5 N•m (40 lbf•in ± 4 lbf•in)

MIRRORS

Replacing the Mirror Cover

Remove mirror support. Refer to *REMOVING THE MIRROR SUPPORT* in this subsection.

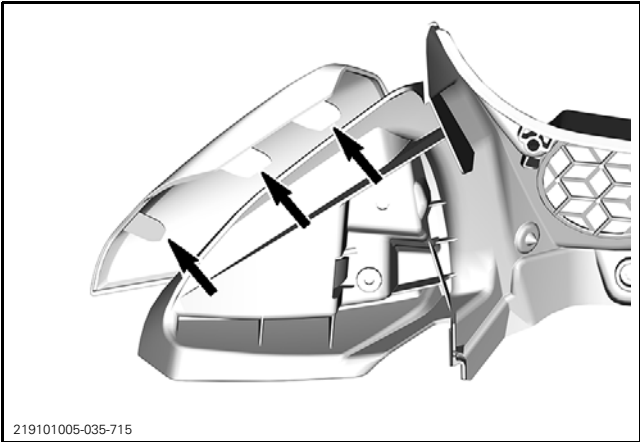
Remove screws from underneath.



Slide cover to release tabs.

Section 08 BODY AND HULL

Subsection 01 (BODY)



The installation is the reverse of the removal procedure.

Replacing the Mirror

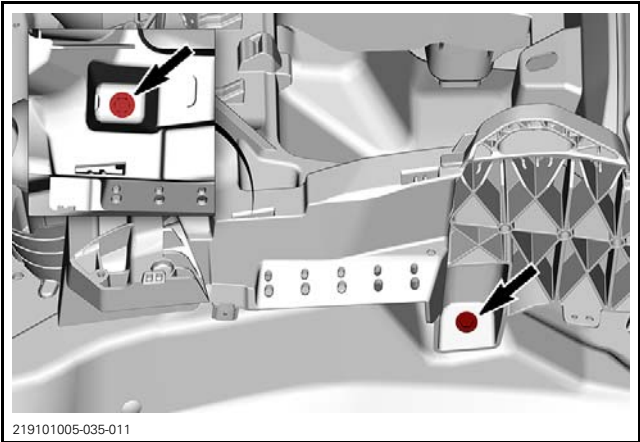
1. Remove mirror support. Refer to procedure in this subsection.
2. From inside mirror support, slightly heat mirror.
3. Push at the back of mirror to remove it.
4. Properly clean mirror support surface of any glue residue.
5. Perform a flame treatment.
6. Install mirror using adhesive tape at the back of mirror.

The installation is the reverse of the removal procedure.

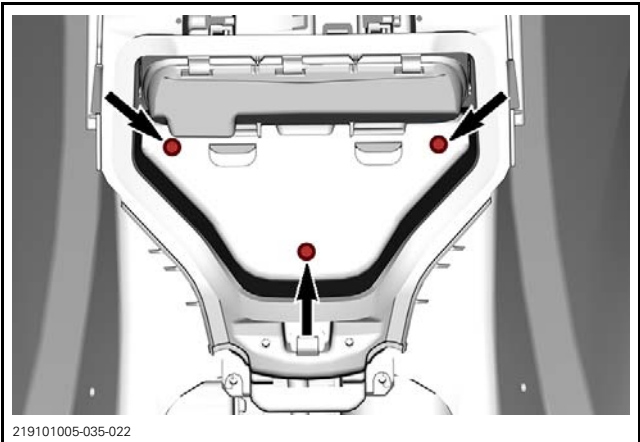
CONSOLE

Removing the Console

1. Remove gauge panel. Refer to procedure in this subsection.
2. Disconnect all accessories plugged on console.
3. Remove seat. Refer to procedure in this subsection.
4. Remove steering column support. Refer to *STEERING SYSTEM* subsection.
5. Remove side panels.
6. Remove the following screws securing console to deck.



CONSOLE SIDE



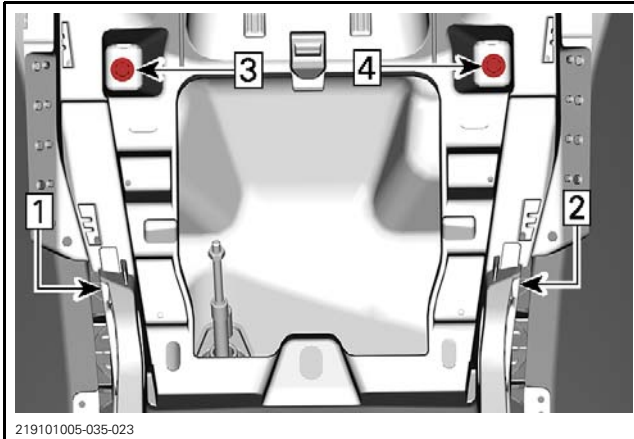
INSIDE GLOVE BOX

7. Remove console by pulling it upwards.

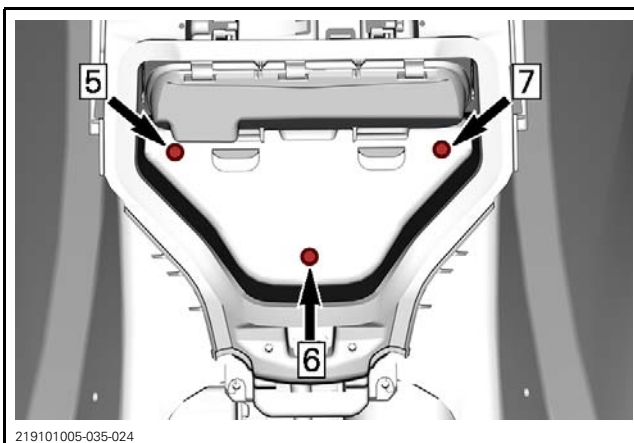
Installing the Console

The installation is the reverse of the removal procedure. However, pay attention to the following. Tighten console screws to specification as per the following sequence.

TIGHTENING TORQUE	
Hexagonal head M6 console screws (Step 1 to 4)	5.5 N•m ± 0.5 N•m (49 lbf•in ± 4 lbf•in)
Plastite console screws (Step 5 to 7)	4.5 N•m ± 0.5 N•m (40 lbf•in ± 4 lbf•in)



TIGHTENING SEQUENCE 1

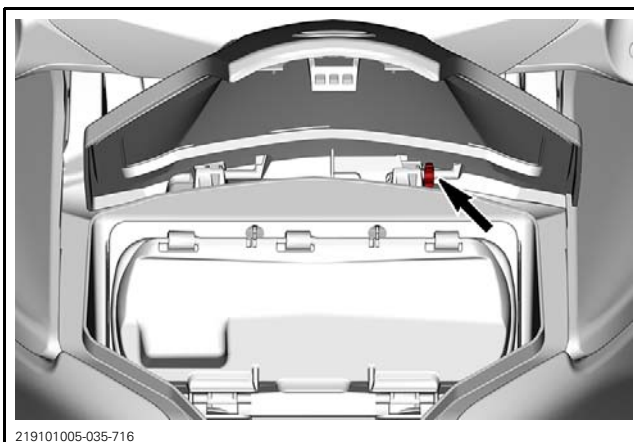


TIGHTENING SEQUENCE 2

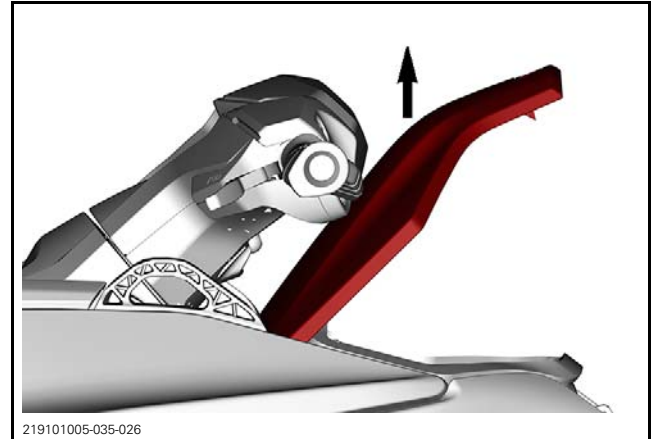
GLOVE BOX COVER

Replacing the Glove Box Cover

1. Open glove box cover.
2. Remove retainer using long nose pliers.



3. Slide cover sideways 6 mm (1/4 in).
4. Pull glove box cover upwards to release it from console hinge.



The installation is the reverse of the removal procedure.

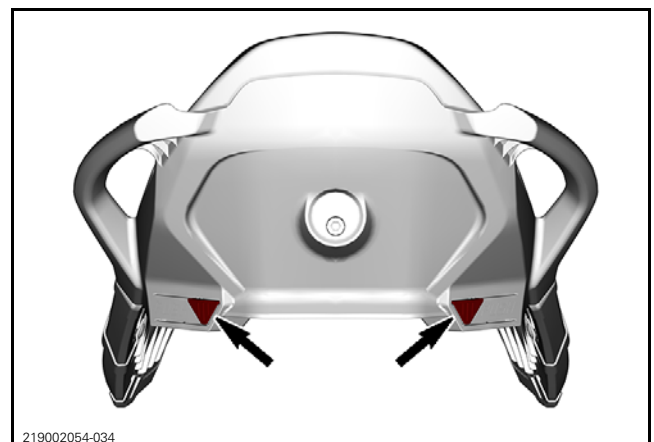
SEAT

Cleaning the Seat

For information, refer to appropriate *CARE AND REPAIR ONLINE BOOKLET* on www.operators-guides.brp.com.

Removing the Seat

To remove the seat, push on the two release buttons and lift the back end of the rear seat.

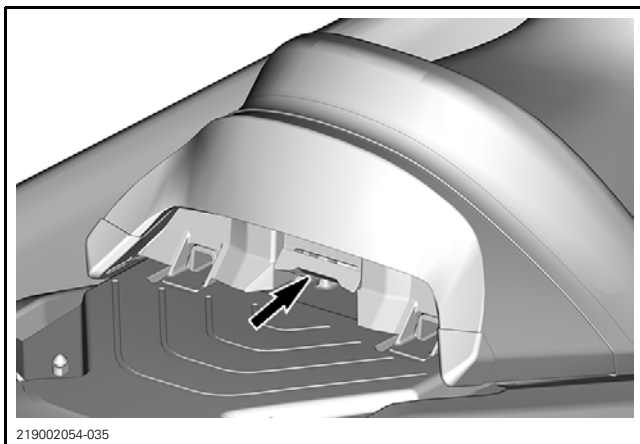


RELEASE BUTTONS

Then pull the latch handle up and remove the front seat from the watercraft.

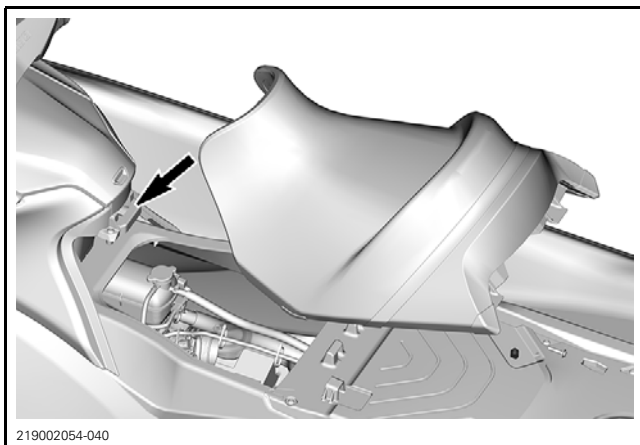
Section 08 BODY AND HULL

Subsection 01 (BODY)



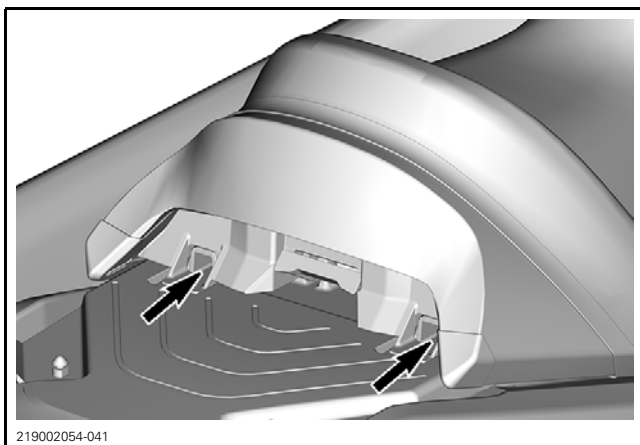
Installing the Seat

To install the seat, insert the forward end of the front seat in its retainer.



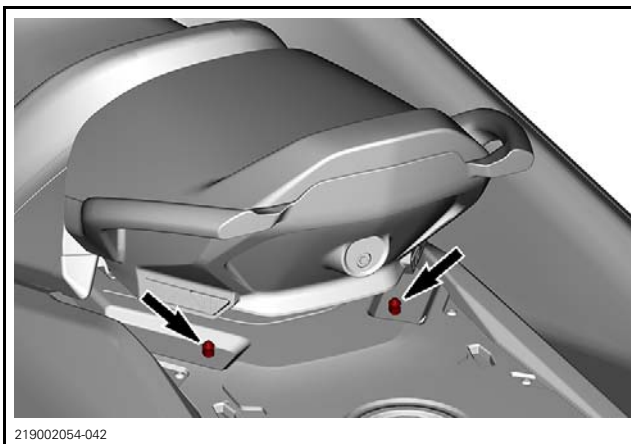
SEAT RETAINER

Insert the forward part of the rear seat into the retainers.



SEAT RETAINERS

Align the seat latch with the latch pins and firmly press down on the rear portion of the seat to lock it in place.



LATCH PINS

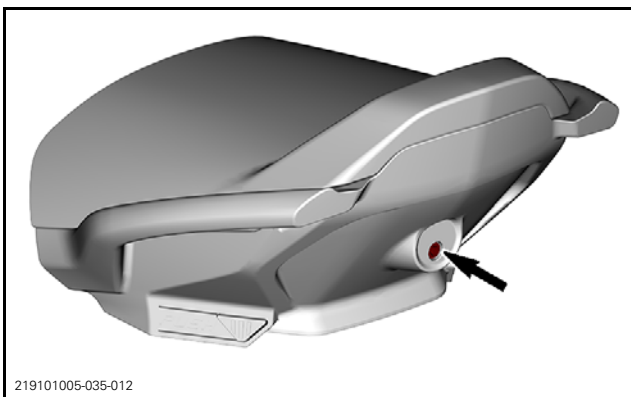
Pull up on the rear portion of the seat to ensure it is properly latched.

CAUTION Ensure the latch is properly locked onto the pin.

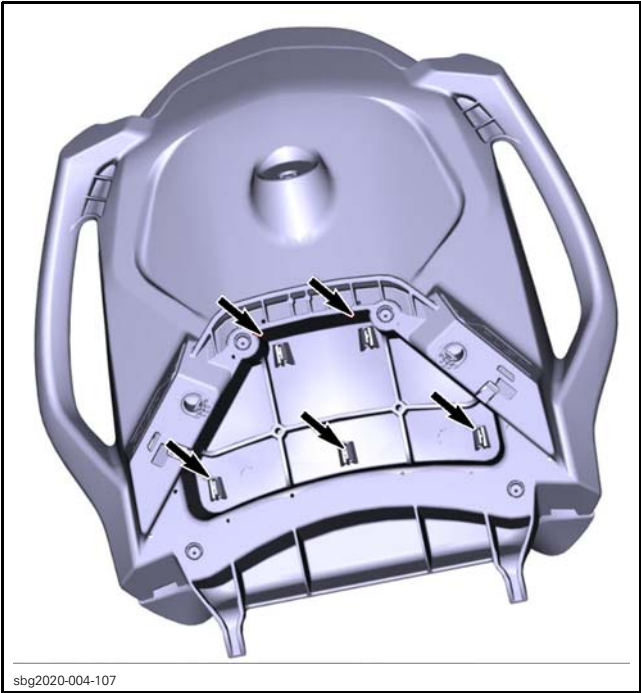
REAR HANDLE

Removing the Rear Handle

1. Remove seat. Refer to procedure this subsection.
2. Remove and discard the BRP logo.
3. Remove and keep the screw retaining the foam seat in place.



4. Unclip the 5 tabs under the base.
5. Using a flat screwdriver, open the tabs under the seat.



6. Remove the rear handle.

Installing the Rear Handles

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

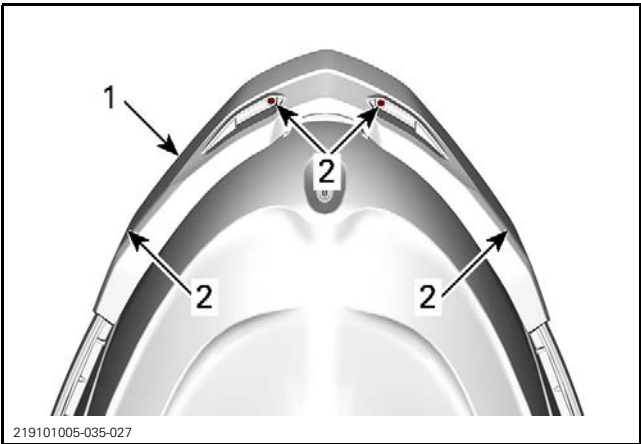
TIGHTENING TORQUE	
Rear handle screw	6.5 N•m ± 0.5 N•m (58 lbf•in ± 4 lbf•in)

Install a new BRP logo.

BUMPER

Removing the Bumper

Front Bumper



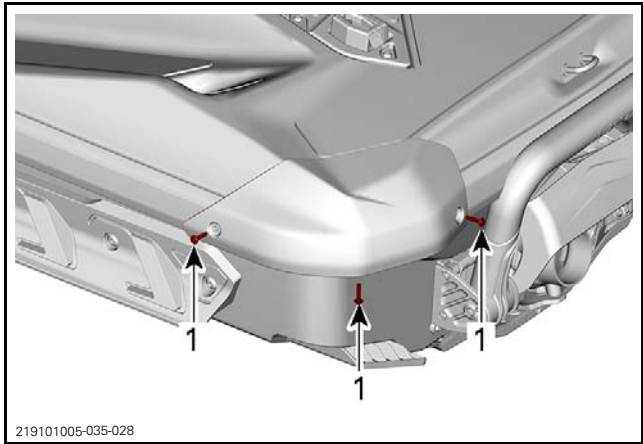
- 1. Front bumper
- 2. Retaining screw

1. Remove screws securing front bumper to body.

2. Remove front bumper from vehicle.

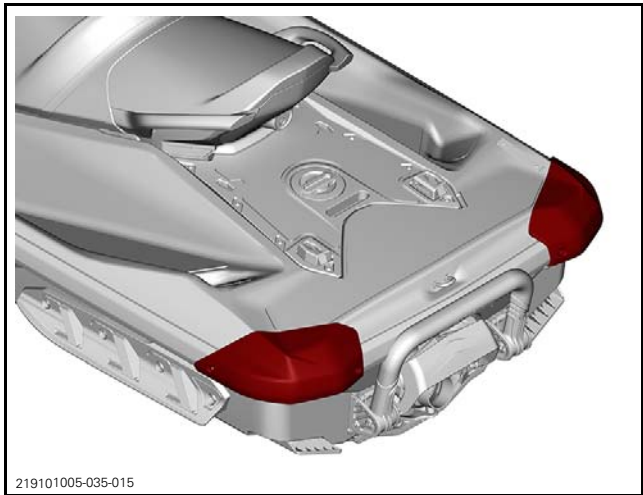
Rear Bumper

1. Remove protective caps retaining screws.



1. Protective cap retaining screw

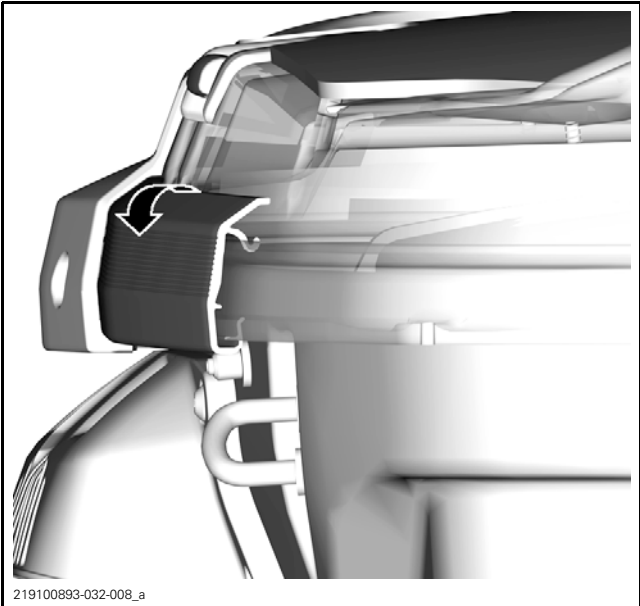
2. Remove both protective caps.



3. Pull the top of bumper to unclip it from body.

Section08 BODY AND HULL

Subsection 01 (BODY)



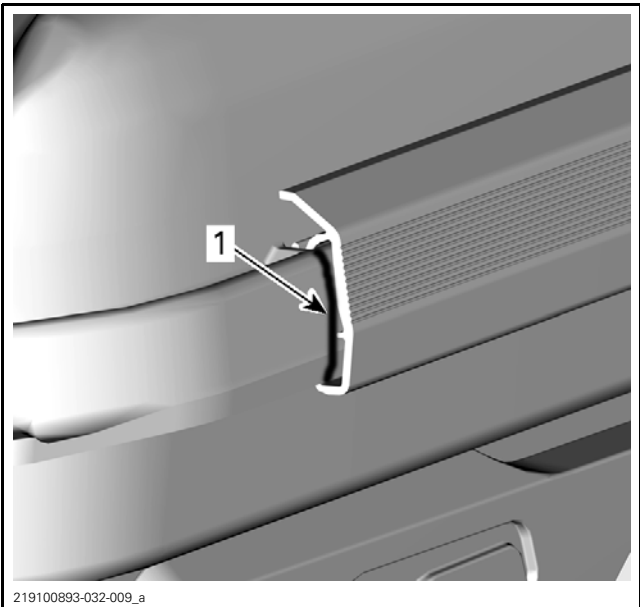
TYPICAL

4. Remove rear bumper from vehicle.

Side Bumpers

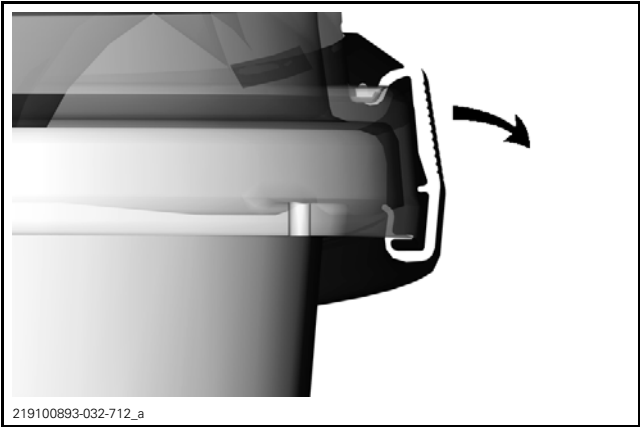
1. Remove front and rear bumpers.
2. Using a marker, trace a line at bumper end.

NOTE: These marks will be used during installation.



1. Trace a line at end of bumper

3. Pull the top of bumper to unclip it from body.



TYPICAL

Installing the Bumper

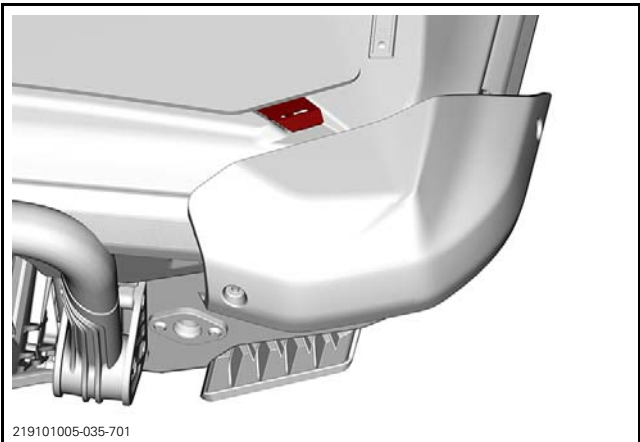
The installation is the reverse of the removal procedure. However, pay attention to the following. Make sure the double face tape on the bumper is still sticky. Replace as required.

Tighten front bumper lower retaining screws to specification.

TIGHTENING TORQUE	
Front bumper lower screws	4.5 N•m ± 0.5 N•m (40 lbf•in ± 4 lbf•in)

Tighten bumper retaining screws to specification as per the following sequence. Refer to exploded view.

Ensure the clips are properly engaged.



TIGHTENING TORQUE		
1-4	Rear corner bumper center screws	4.5 N•m ± 0.5 N•m (40 lbf•in ± 4 lbf•in) + LOCTITE 5900 (P/N 293 800 066)
2-3-5 6-7-8	Lateral bumper end screws	4.5 N•m ± 0.5 N•m (40 lbf•in ± 4 lbf•in)

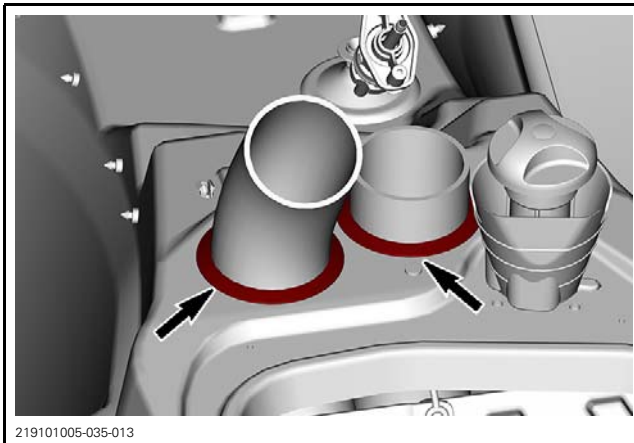
VENTILATION DUCT

Replacing the Ventilation Duct

1. Open storage cover.
2. Remove mirror support . Refer to procedure in this subsection.

NOTE: The console can be removed for easier access.

3. Disconnect all connectors that might be in the way.
4. Remove ventilation duct support.



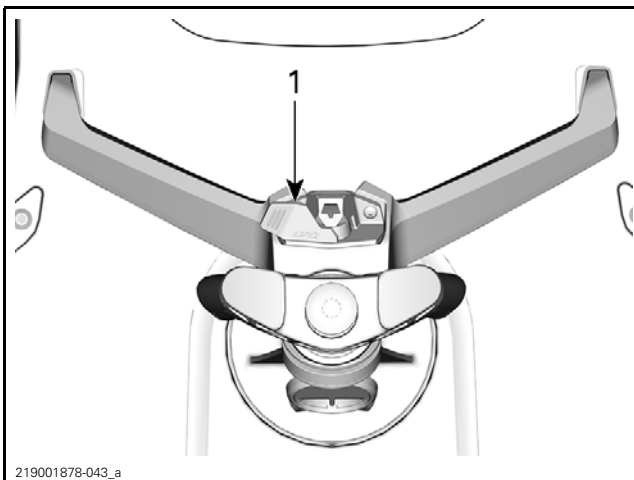
The installation is the reverse of the removal procedure.

WAKE PYLON (WAKE)

Removing the Wake Pylon

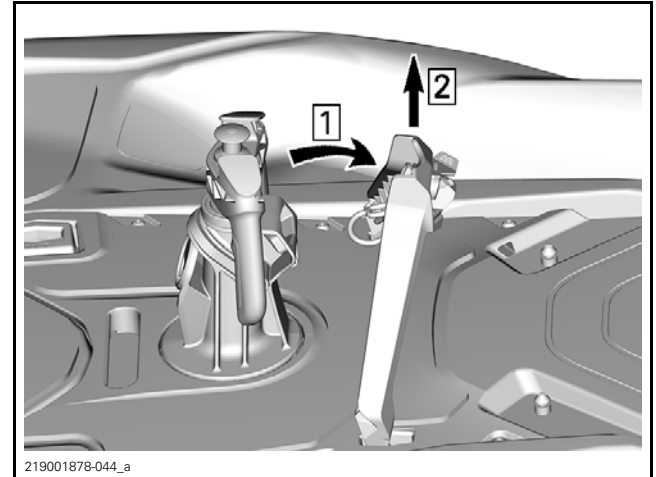
Remove the rear seat.

Unlock the LinQ attachment.



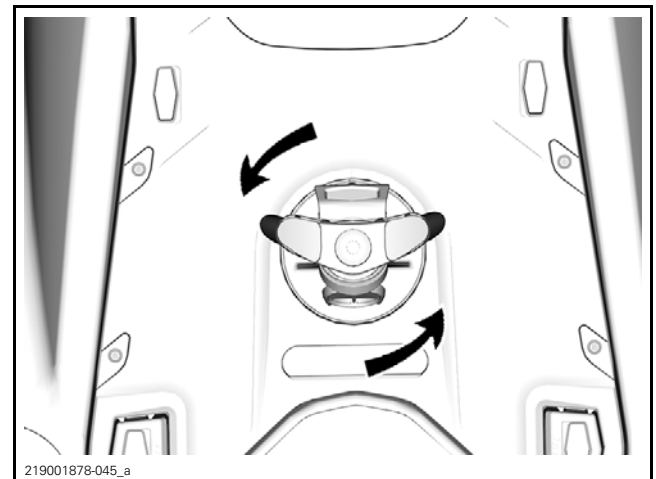
TYPICAL
1. LinQ lever

Tilt the support toward the front and lift.



TYPICAL
Step 1: Tilt support
Step 2: Lift support

Unscrew the pole by turning it one quarter of a turn and lifting it.



TYPICAL

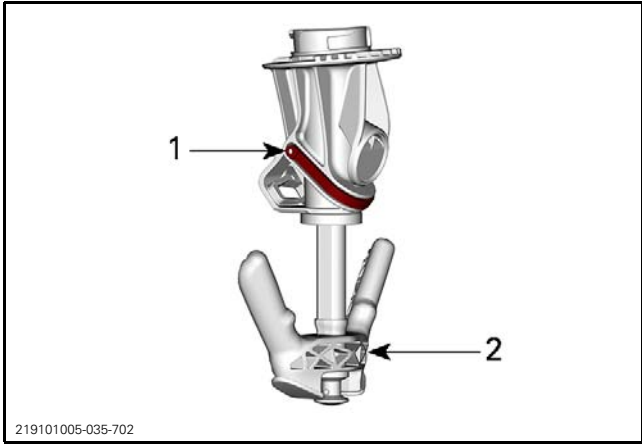
Disassembling the Wake Pylon

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.

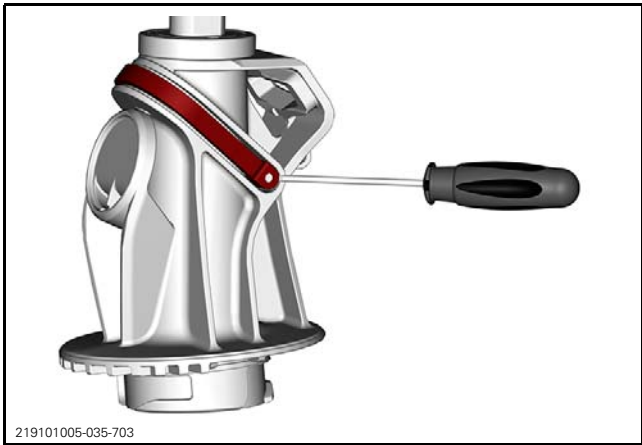
Section 08 BODY AND HULL
Subsection 01 (BODY)



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.

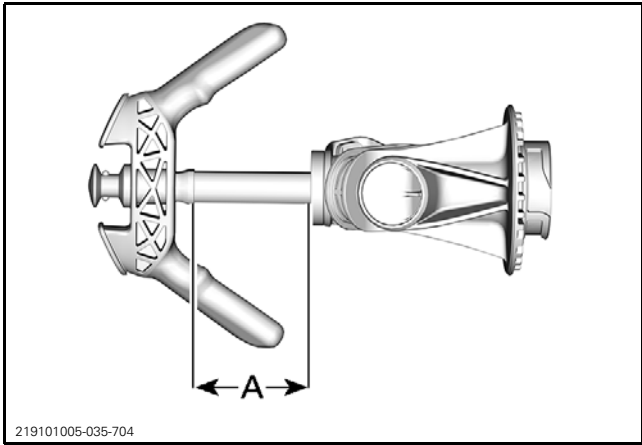


1. Locking strap

Remove locking strap and the inner lock.

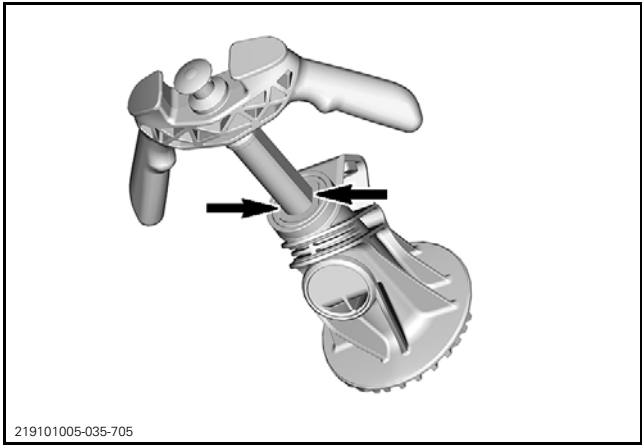
Handle

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 grease on each ends of spring.

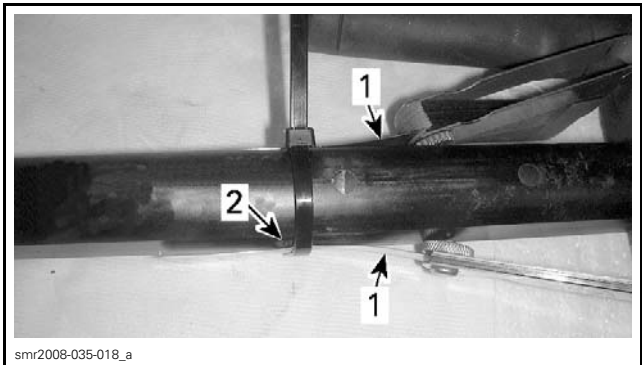
Table with 2 columns: SERVICE, PRODUCT. Row 1: Scandinavia, SYNTHETIC GREASE (EUR) (P/N 779231). Row 2: All other countries, SYNTHETIC GREASE (P/N 779162).

Insert the spring in the handle stem hole.

Position a ball on each ends of spring.

Install a feeler gauge over each balls.

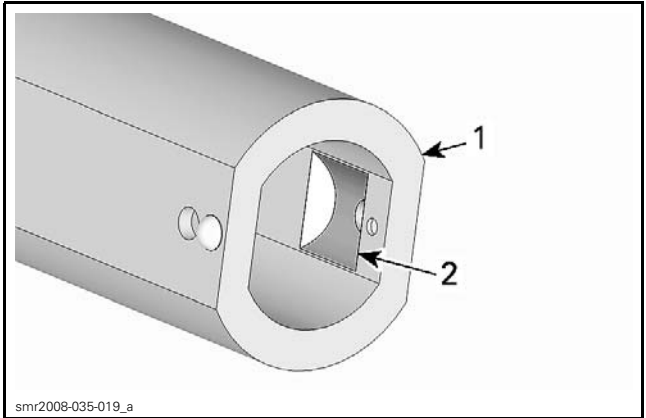
Tighten the locking tie in order to retain feeler gauges and balls.



1. Feeler gauges
2. Ball

Apply grease in both recesses of the extension tube.

SERVICE PRODUCT	
Scandinavia	SYNTHETIC GREASE (EUR) (P/N 779231)
All other countries	SYNTHETIC GREASE (P/N 779162)

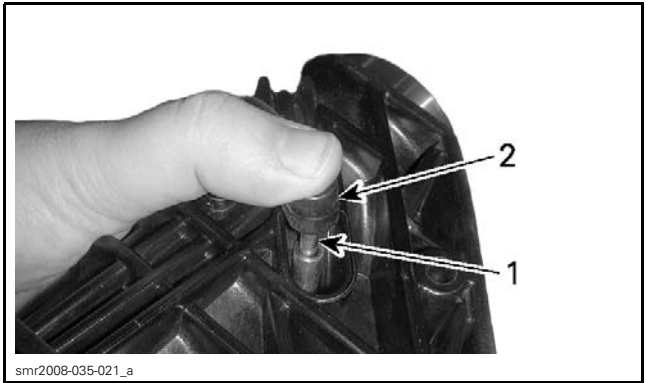


1. Extension tube
2. Recesses

Slide the handle stem into the extension tube.
Remove feeler gauges and locking tie.

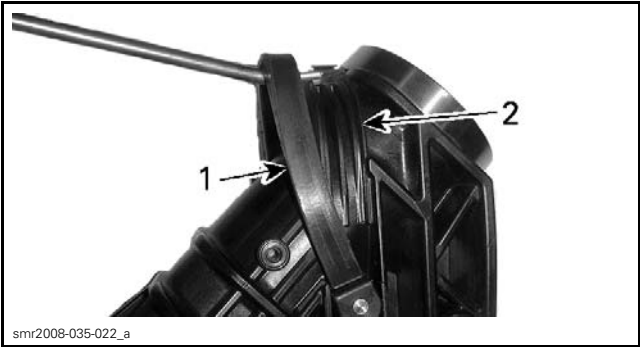
Locking Strap

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.

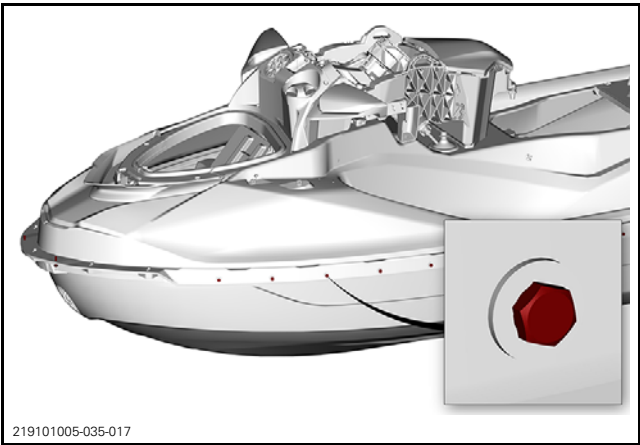
Installing the Wake Pylon

The installation is the reverse of the removal procedure.

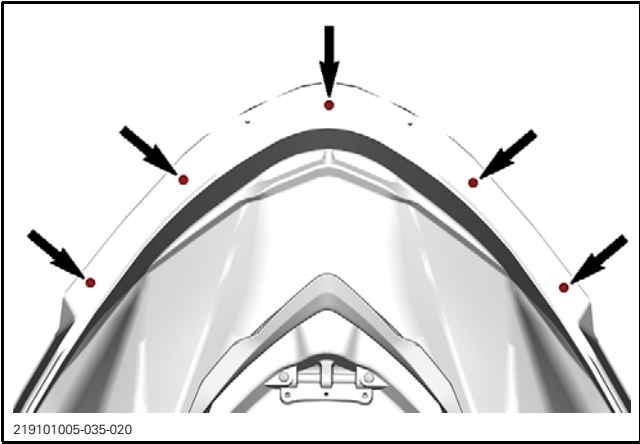
BODY

Removing the Body

1. Remove steering column. Refer to *STEERING SYSTEM* subsection.
2. Remove bumpers, gauge support, seat and service cover. Refer to procedure in this subsection.
3. Remove wakeboard support and wake pylon (if equipped). Refer to procedure in this subsection.
4. Insert a clean cloth rag in the fuel tank nozzle.
5. Remove following fasteners.



Section 08 BODY AND HULL
Subsection 01 (BODY)

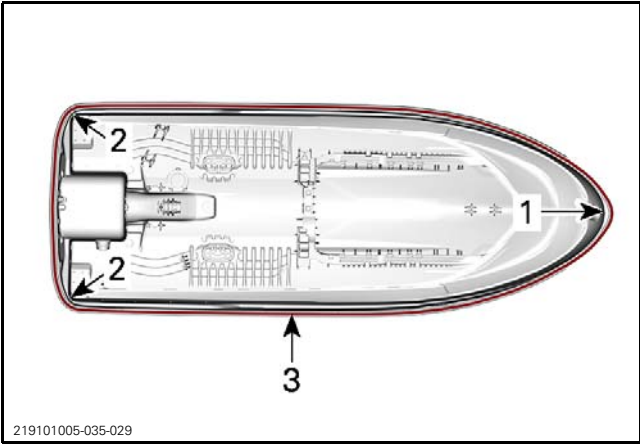


- 6. Remove the body.
- 7. Remove and discard the seal.

Installing the Body

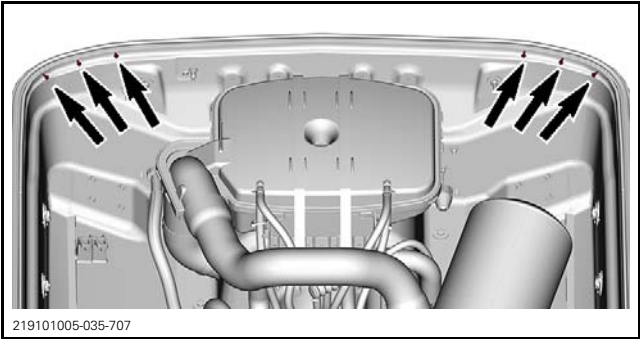
NOTICE If installing the deck on a new hull, refer to instruction sheet includes with the hull to drill the holes and prepare the hull properly.

- 1. Install a new seal.
- NOTE: Double face tape can be used to maintain the hull seal in place while installing the body.



DOUBLE FACE TAPE LOCATION
1. Bow
2. Stern
3. Seal joint

- 2. Install holding screws. Tighten to specification.

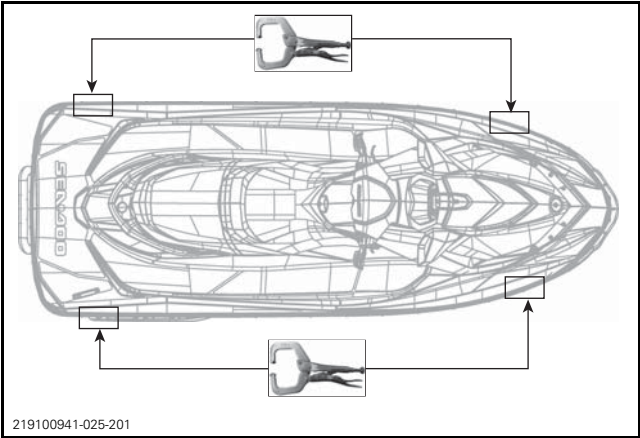


TIGHTENING TORQUE

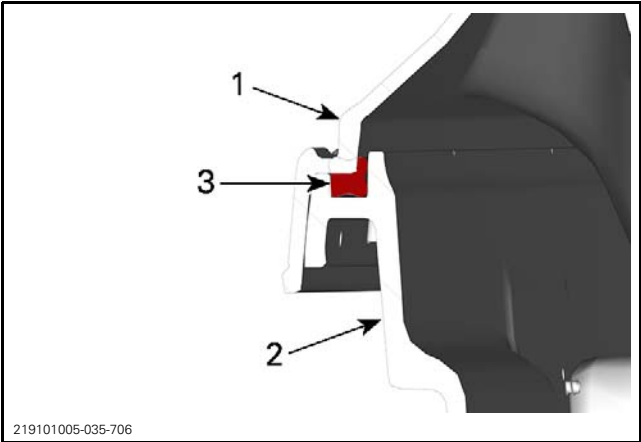
Holding screws	3.5 N•m ± 0.5 N•m (31 lbf•in ± 4 lbf•in)
----------------	---

- 3. Make sure hull and body holes are aligned when installing screws.
3.1 Secure the deck on the hull using four C-clamp pliers, one at each corner.

NOTE: Ensure to have the smallest gap between the rear of the deck and the hull.



NOTICE The pliers must be enough tight to compress the seal and align holes of deck and hull but without damaging the deck surface layer.

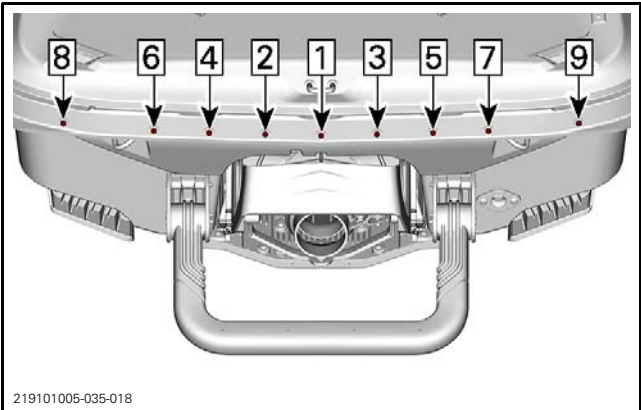


CUTAWAY VIEW

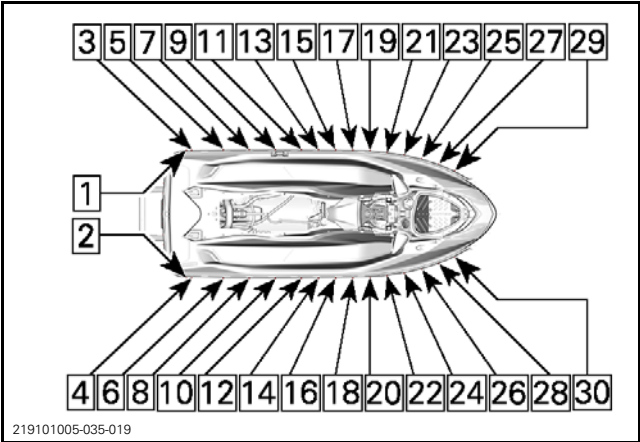
- 1. Body
- 2. Hull
- 3. Seal

4. Install and tighten rear screws first.
- 4.1 Install another C-clamp pliers near a hole to compress the seal properly and make sure holes are aligned.
 - 4.2 Install the screw.
 - 4.3 Remove the pliers and repeat the procedure for all other holes.

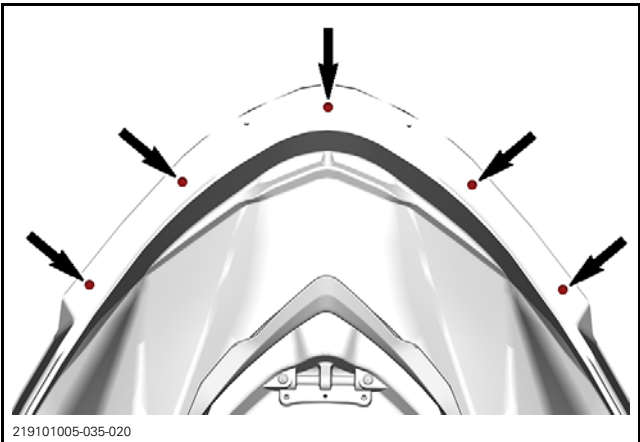
Tighten the screws to specification. See tightening sequence.



5. Start sides sequence with the left rear screw then alternate between right side and left side up to the front.



6. Install and tighten following screws



TIGHTENING TORQUE	
Body screws	7.5 N•m ± 0.5 N•m (66 lbf•in ± 4 lbf•in)

Reinstall all previously removed parts.

NOTE: Make sure to remove the cloth rag in the fuel tank nozzle.

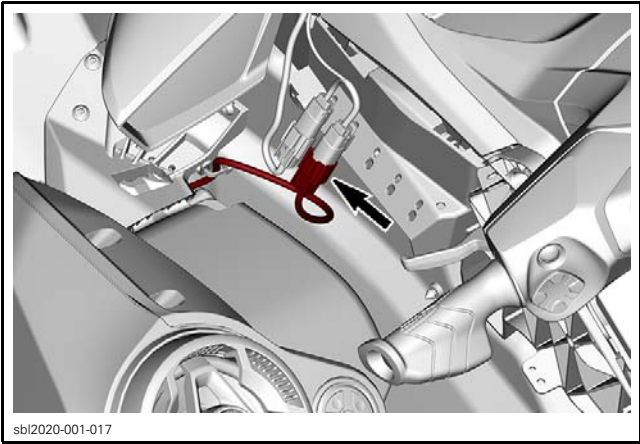
PREMIUM AUDIO SYSTEM

Removing the Premium Audio System

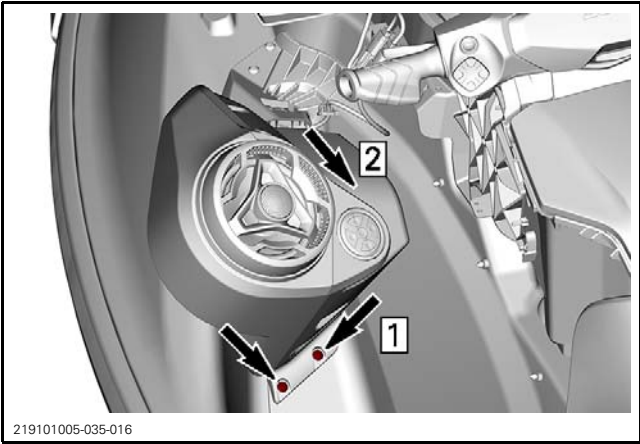
LH side shown, the procedure is the same for both sides.

- 1. Remove both lateral trim panels. Refer to procedure in this subsection.
- 2. Disconnect following connector and remove locking tie.

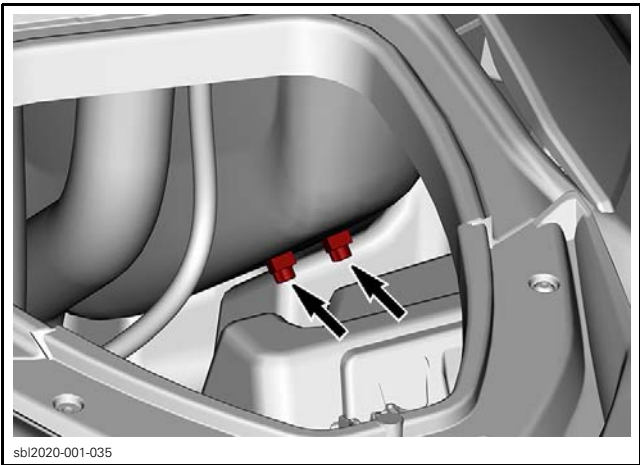
Section08 BODY AND HULL
Subsection 01 (BODY)



3. Remove following fasteners and slide the left speaker to remove it.



Step 1: Remove fasteners
Step 2: Slide speaker



PARTS REMOVED FOR CLARITY

Installing the Premium Audio System

NOTE: Make sure to perform a steering alignment before installing the Premium Audio System. Refer to STEERING SYSTEM subsection.
The installation is the reverse of the removal procedure. However, pay attention to the following.

Apply a small amount of sealant in each hole.

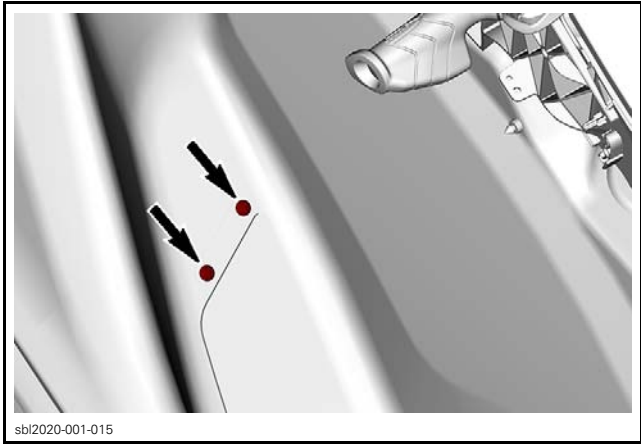


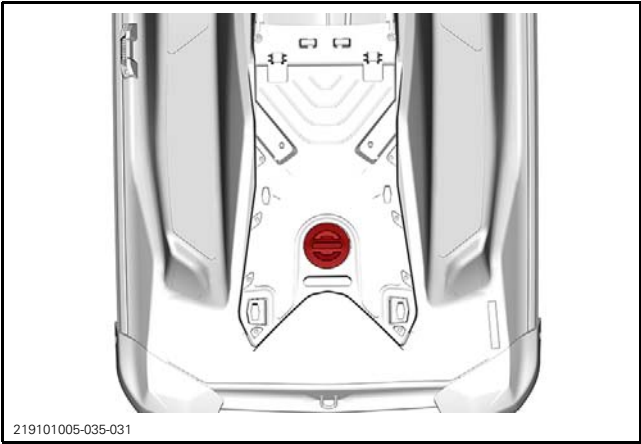
Table with 2 columns: Component, Value. Row 1: SERVICE PRODUCT, LOCTITE 5900 (P/N 293 800 066). Row 2: TIGHTENING TORQUE, Premium Audio System screws, 6.5 N•m ± 0.5 N•m (58 lbf•in ± 4 lbf•in).

ENGINE SERVICE COVER

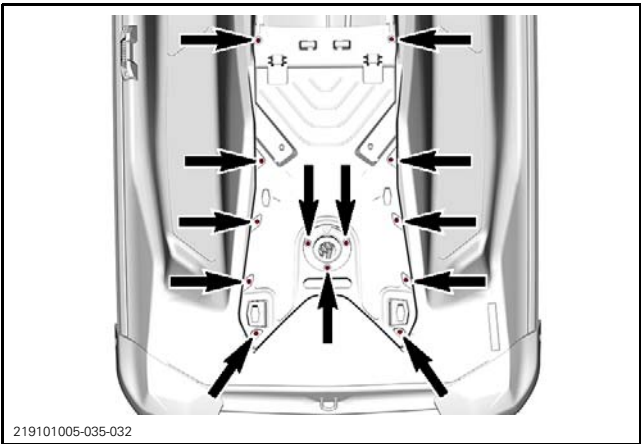


Removing the Engine Service Cover

- 1. Remove seats.
- 2. Remove wake pole cover.



3. Remove the following screws.



Installing the Engine Service Cover

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

Tighten screws to specification.

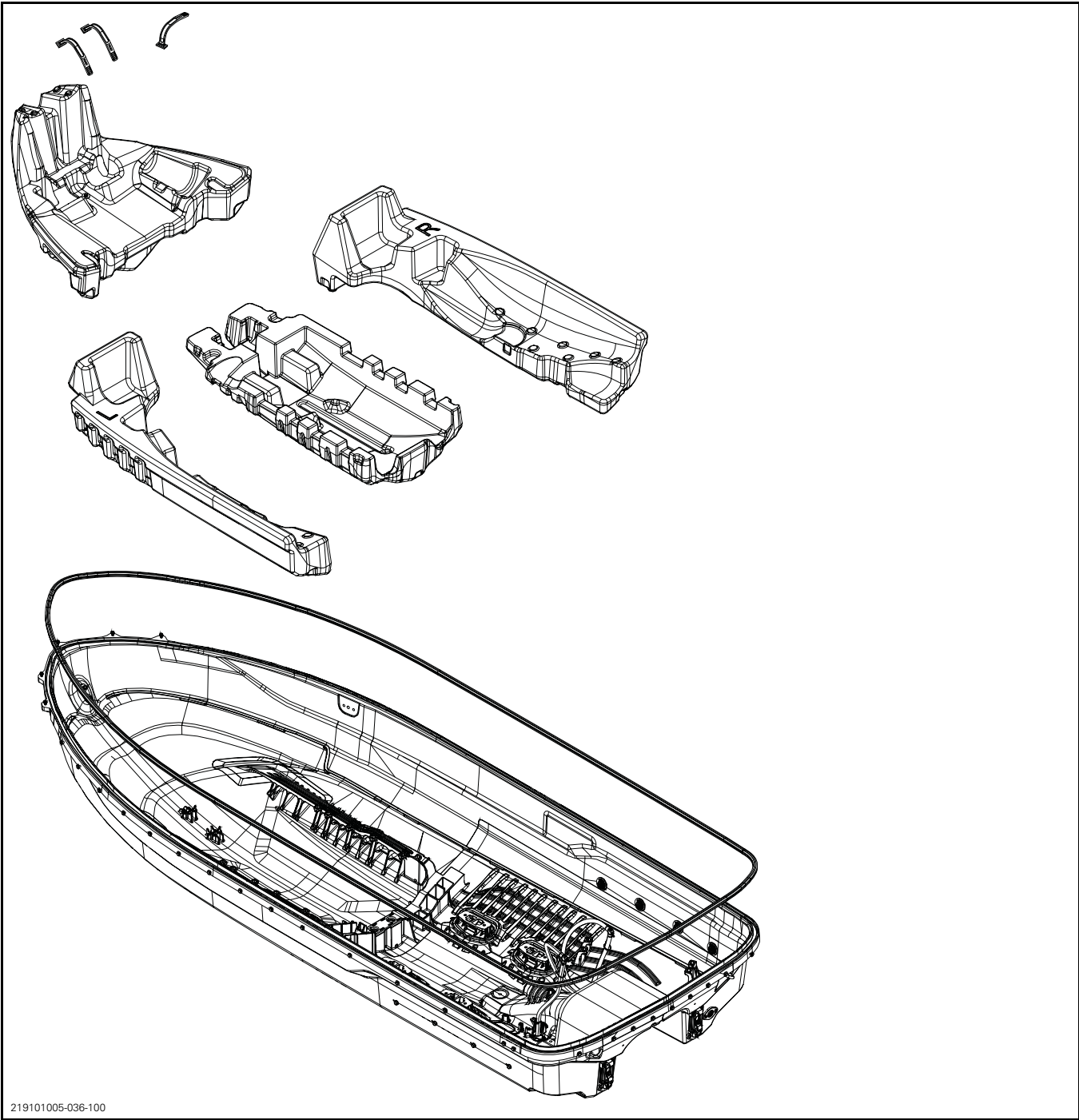
TIGHTENING TORQUE	
Engine service cover screw	2.75 N•m ± 0.25 N•m (24 lbf•in ± 2 lbf•in)

HULL

SERVICE PRODUCTS

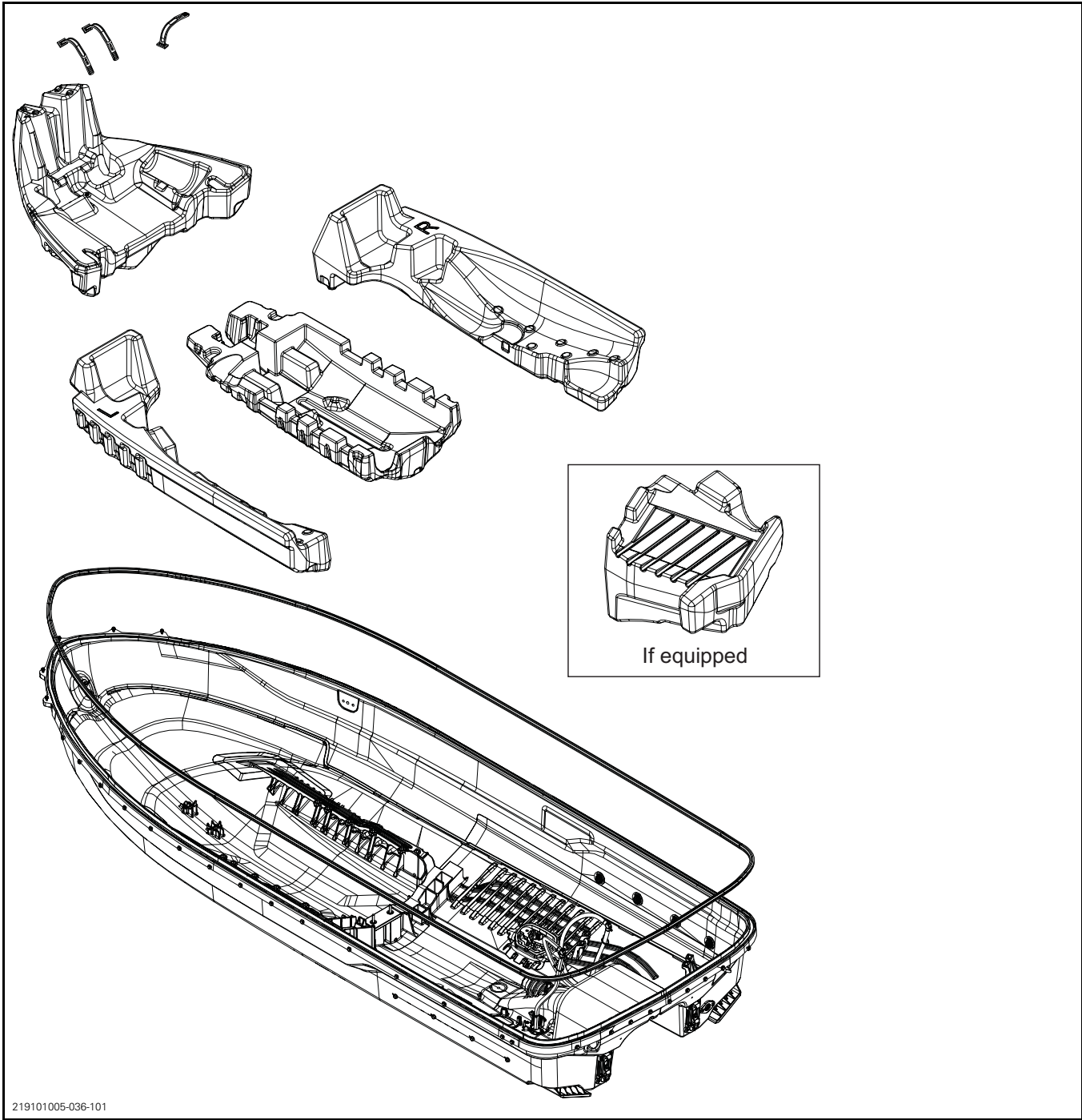
Description	Part Number	Page
BRP HEAVY DUTY CLEANER	293 110 001	278, 280, 282
CLEAR SILICONE SEALANT	296 000 309	283, 285
LOCTITE 5900	293 800 066	278, 280, 282

Models GTI 90

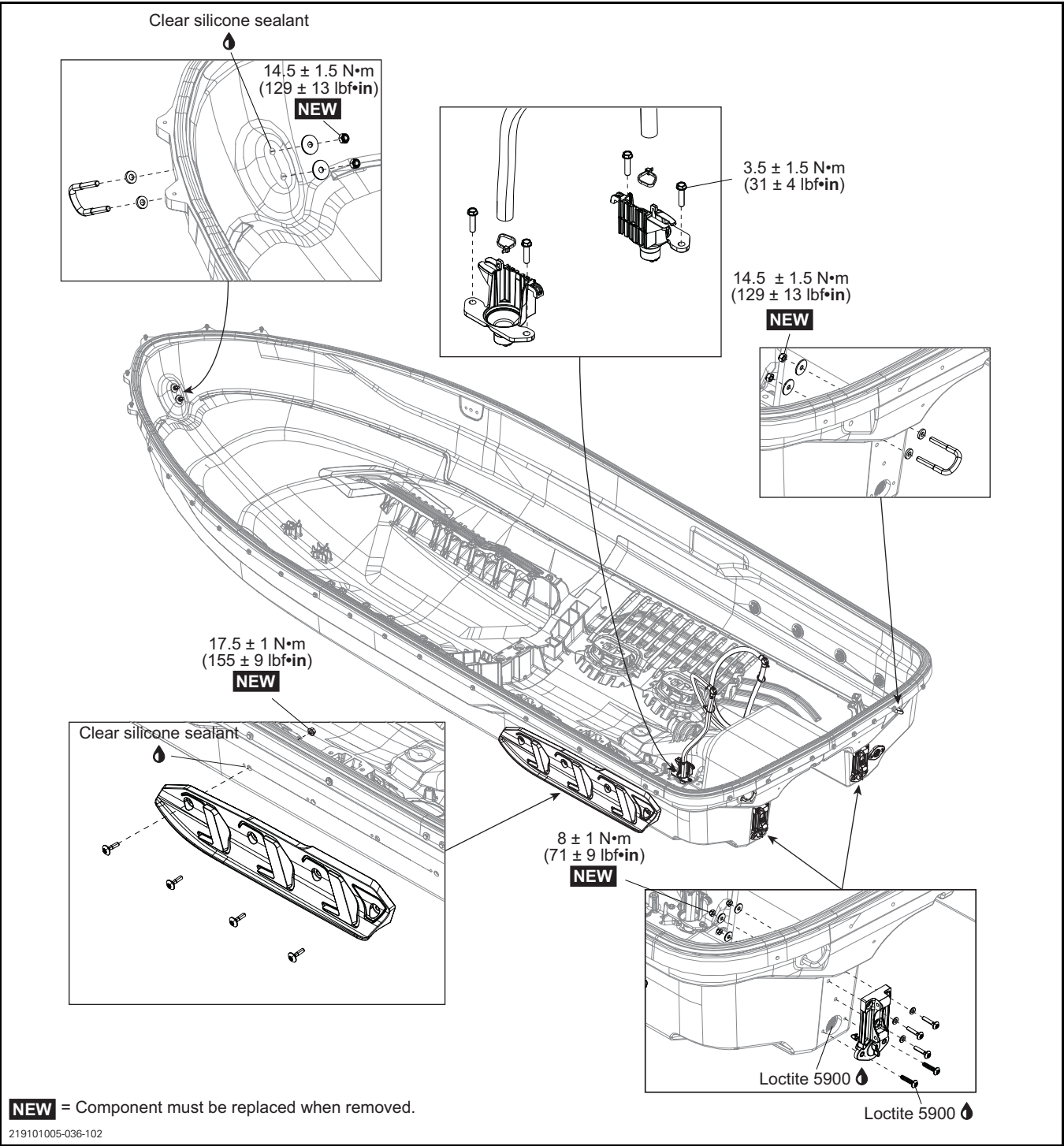


Section 08 BODY AND HULL
Subsection 02 (HULL)

Models GTI 130, GTI 170, Wake 170 and GTR 230



Models GTI 90



Subsection 02 (HULL)

Clear silicone sealant

$14.5 \pm 1.5 \text{ N}\cdot\text{m}$
($129 \pm 13 \text{ lbf}\cdot\text{in}$)
NEW

$3.5 \pm 1.5 \text{ N}\cdot\text{m}$
($31 \pm 4 \text{ lbf}\cdot\text{in}$)

$14.5 \pm 1.5 \text{ N}\cdot\text{m}$
($129 \pm 13 \text{ lbf}\cdot\text{in}$)
NEW

$8 \pm 1 \text{ N}\cdot\text{m}$
($71 \pm 9 \text{ lbf}\cdot\text{in}$)
NEW

$5 \pm 0.5 \text{ N}\cdot\text{m}$
($44 \pm 4.5 \text{ lbf}\cdot\text{in}$)
NEW

If equipped

$17.5 \pm 1 \text{ N}\cdot\text{m}$
($155 \pm 9 \text{ lbf}\cdot\text{in}$)
NEW

Clear silicone sealant

Clear silicone sealant

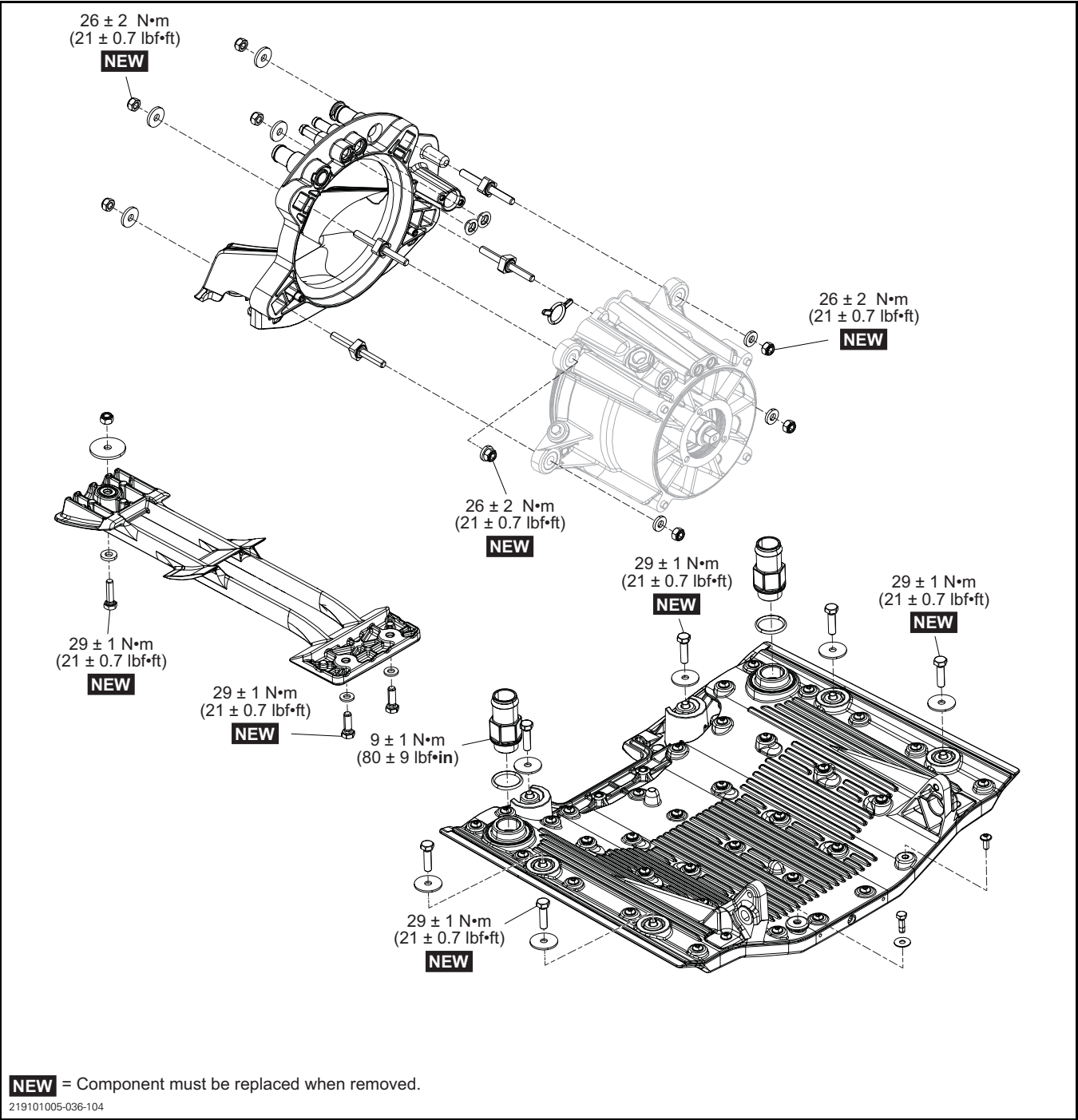
$15 \pm 1 \text{ N}\cdot\text{m}$
($133 \pm 9 \text{ lbf}\cdot\text{in}$)
NEW

$5 \pm 0.5 \text{ N}\cdot\text{m}$
($44 \pm 4.5 \text{ lbf}\cdot\text{in}$)
NEW

If equipped

NEW = Component must be replaced when removed.

219101005-036-103



PROCEDURES

HULL

Repairing the Hull

For hull repair, refer to appropriate CARE AND REPAIR ONLINE BOOKLET on www.operators-guides.brp.com.

Replacing the Hull

The hull is sold separately and may be replaced if damage is deemed too severe.

NOTICE The following list is not exhaustive and represents the general order in which to proceed with hull replacement.

Remove the following components:

- 1. Deck. Refer to BODY.
- 2. Battery.
- 3. Jet pump. Refer to JET PUMP.
- 4. Drive shaft. Refer to DRIVE SHAFT.
- 5. Air intake silencer. AIR INTAKE SYSTEM.
- 6. Engine. Refer to ENGINE REMOVAL AND INSTALLATION.
- 7. Remaining cooling system components. Refer to COOLING SYTEM.
- 8. Remaining exhaust system components. Refer to EXHAUST SYSTEM.
- 9. Remaining fuel system components. Refer to FUEL SYSTEM.
- 10.Electrical harness.
- 11.Steering cable. Refer to STEERING subsection
- 12.Remaining hull components.

Reverse steps for reassembling.

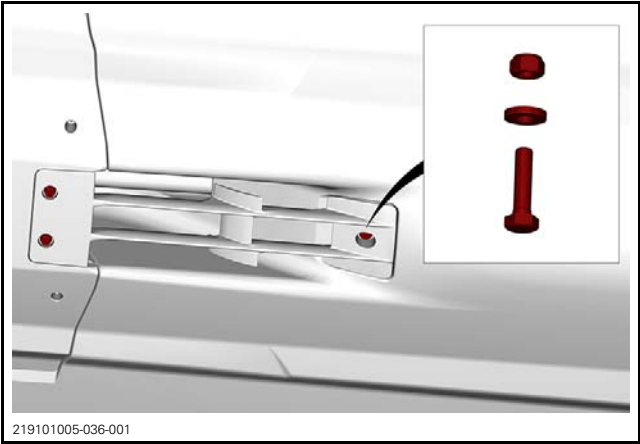
Refer to INSTALLING THE BODY in BODY subsection for hull seal installation.

NOTE: If a new hull is installed, perform a flame treat where required, to increase the adhesion of the Loctite 5900.

INLET GRATE

Removing the Inlet Grate

- 1. Remove inlet grate retaining screws using an impact tool. Discard screws, and nut.



- 2. Remove inlet grate.

Cleaning the Inlet Grate

Carefully scrape off all excess sealant from inlet grate, jet pump support and hull.

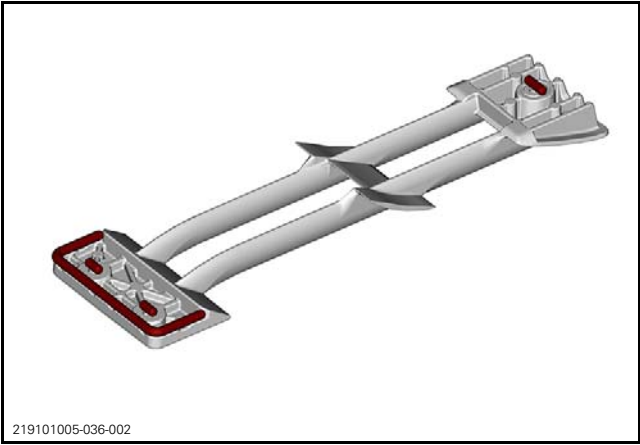
Clean ride plate and hull surface with recommended cleaner to eliminate grease, dust and sealant residue. Clean fitting threads.

SERVICE PRODUCT
BRP HEAVY DUTY CLEANER (P/N 293 110 001)

Installing the Inlet Grate

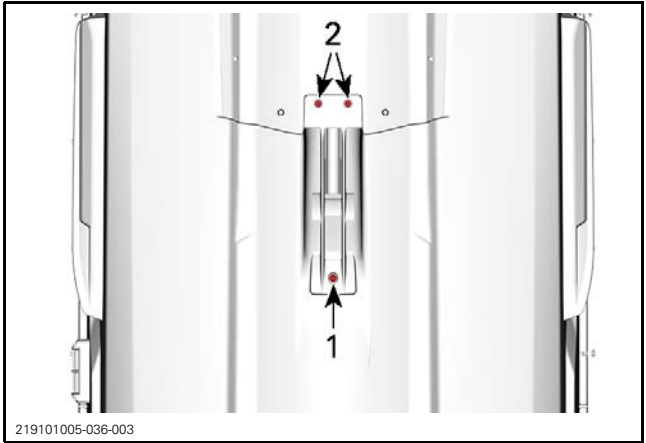
- 1. Apply Loctite on the inlet grate all around the front screw hole and on the edge that make contact with the jet pump support.

SERVICE PRODUCT
LOCTITE 5900 (P/N 293 800 066)



- 2. Install new inlet grate retaining screws and nut at the proper location.

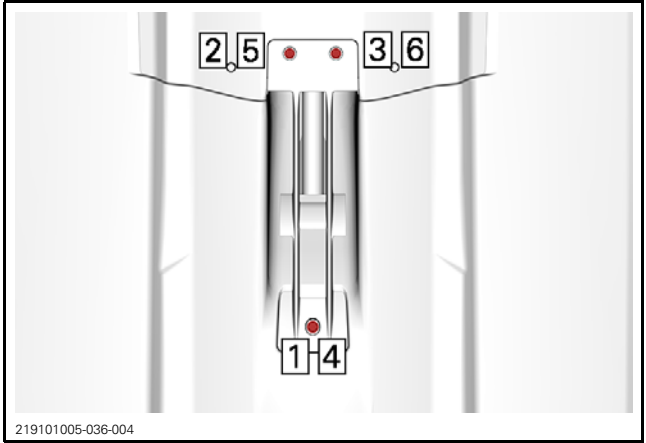
INLET GRATE SCREWS	
LOCATION	SCREW SIZE
Front	M8 x 45
Rear	M8 x 16



SCREW LOCATION
1. Front
2. Rear

3. Tighten screws to the specified torque and sequence.
- NOTE:** Start the tightening sequence by hand tighten.

TIGHTENING TORQUE		
INLET GRATE SCREWS	First step (1-4)	Hand tighten
	Second step (5-8)	27 N•m ± 1 N•m (20 lbf•ft ± 1 lbf•ft)



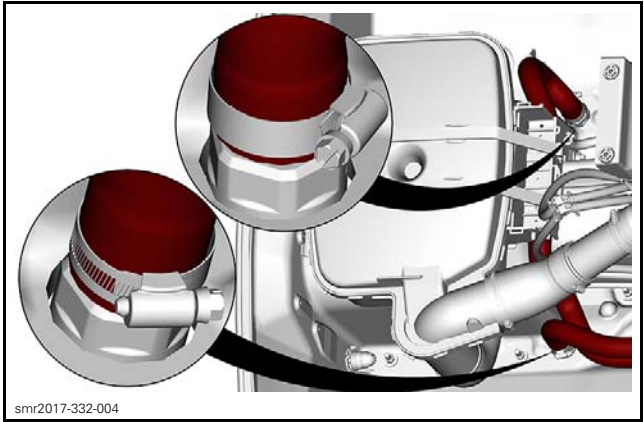
TIGHTENING SEQUENCE

RIDE PLATE

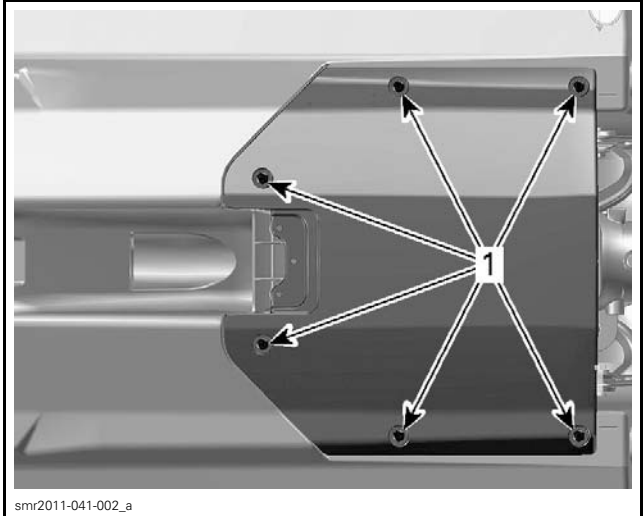
Removing the Ride Plate

1. Remove the deck. Refer to *BODY* subsection.

2. Remove inlet grate. Refer to procedure in this subsection.
3. Remove jet pump. Refer to *JET PUMP*.
4. Drain cooling system. Refer to *COOLING SYSTEM*.
5. From inside the hull, disconnect coolant hoses from the ride plate.



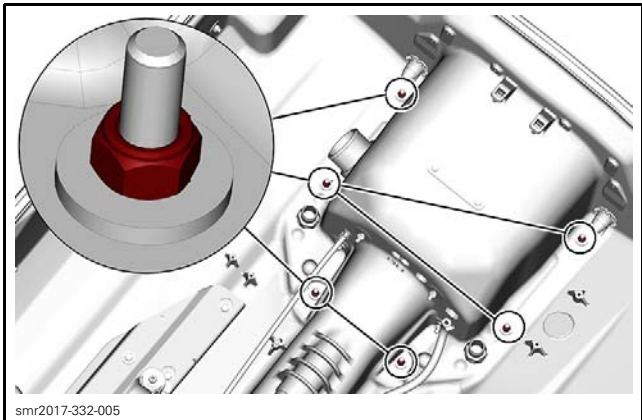
6. Remove coolant hose fittings from the ride plate.
- NOTICE** If possible, remove the hose fittings from the ride plate before removing the ride plate. If fittings cannot be removed, proceed with care when removing the ride plate.
7. Using an impact tool, remove nuts and screws and discard nuts.



TYPICAL
1. Ride plate retaining screws

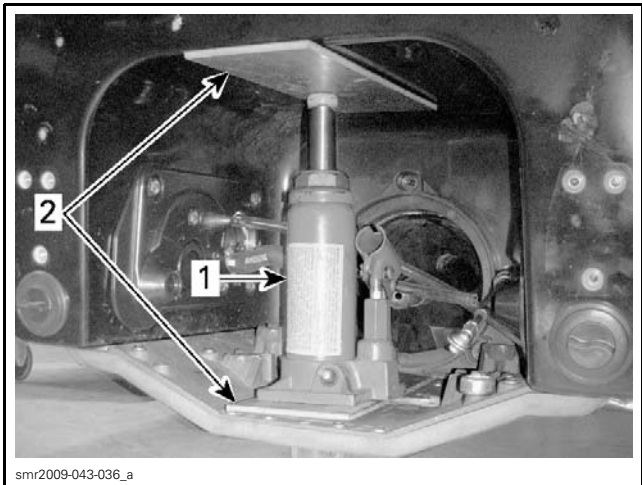
Section 08 BODY AND HULL

Subsection 02 (HULL)



TYPICAL - RIDE PLATE RETAINING NUTS

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. Start pumping the hydraulic jack slowly.
10. Using a sharp knife, carefully cut the sealant around the ride plate edges.
11. Pump the hydraulic jack slowly to pry the ride plate from the hull.

Cleaning the Ride Plate

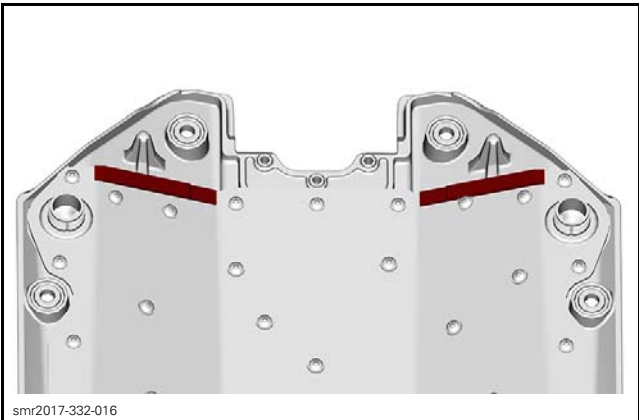
Carefully scrape off all excess sealant from ride plate and hull.

Clean ride plate and hull surface with recommended cleaner to eliminate grease, dust and sealant residue. Clean fitting threads.

SERVICE PRODUCT
BRP HEAVY DUTY CLEANER (P/N 293 110 001)

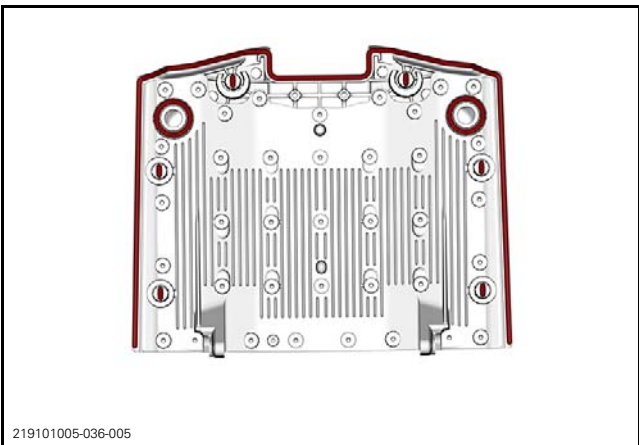
Installing the Ride Plate

1. Install seals on ride plate.



2. Apply Loctite sealant as illustrated.

SERVICE PRODUCT
LOCTITE 5900 (P/N 293 800 066)



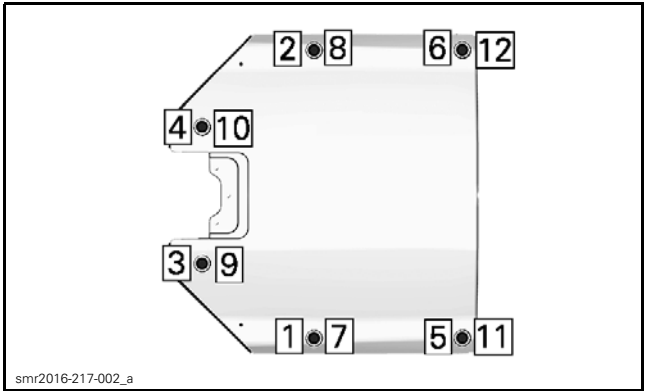
SEALANT APPLICATION

3. Install both hose fittings on the ride plate. Tighten to the specified torque.

TIGHTENING TORQUE	
Hose fittings	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

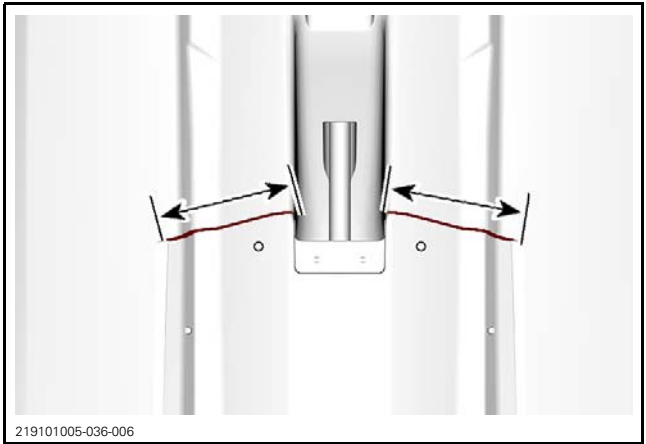
4. Position ride plate on hull and thread new nuts by hand.
5. Position inlet grate and thread new screws 5 turns by hand. Refer to *INLET GRATE* in this subsection.
6. Tighten screws and nuts to the specified torque and sequence.

TIGHTENING TORQUE		
Ride plate nuts	First step (1-6)	Hand tighten
	Second step (7-12)	25 N•m ± 1 N•m (18 lbf•ft ± 1 lbf•ft)

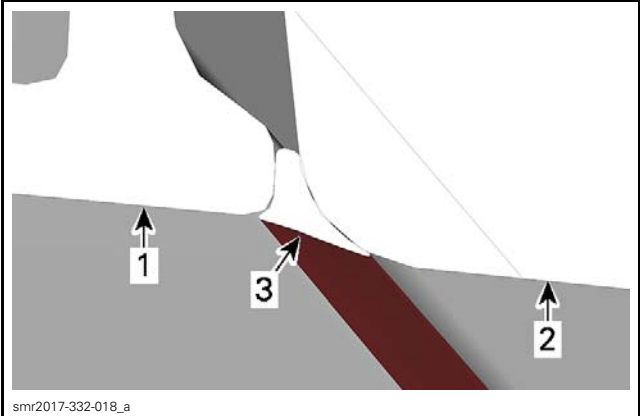


TYPICAL - RIDE PLATE TIGHTENING SEQUENCE

7. Tighten inlet grate screws to the specified torque and sequence. Refer to *INLET GRATE* in this subsection.
8. Remove the excess sealant.
9. Smooth the sealant in the gap between the ride plate and the hull.



GAP BETWEEN RIDE PLATE AND HULL



CROSS CUT - SIDE VIEW

1. Ride plate
2. Hull
3. Smoothed sealant

10. Reinstall coolant hoses on ride plate fittings.

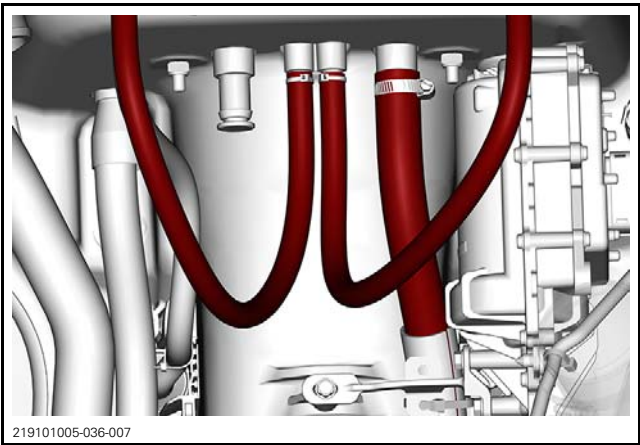
NOTICE Make sure the coolant hose clamp screws do not rub on any component.

11. Fill and bleed cooling system and carry out a leak test. Refer to *COOLING SYSTEM* subsection.
12. Install all remaining parts. Refer to the applicable procedures.

JET PUMP SUPPORT

Removing the Jet Pump Support

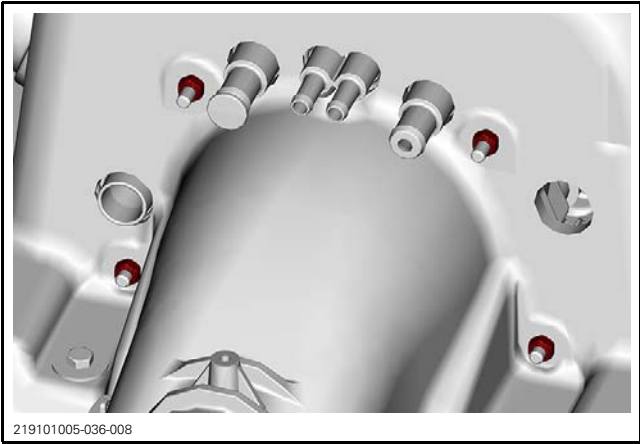
1. Remove the ride plate. Refer to procedure in this subsection.
2. Disconnect hoses from jet pump support.



3. Remove jet pump support retaining nuts and washers.

Section 08 BODY AND HULL

Subsection 02 (HULL)



- 4. Pull jet pump support off the hull.
- 5. Note the alignment shims location.

NOTICE Alignment shims have to be reinstalled at the same location.

Cleaning the Jet Pump Support

Scrape off all excess sealant from jet pump support, ride plate, and hull.

Inspect pump support for cracks or other damage.

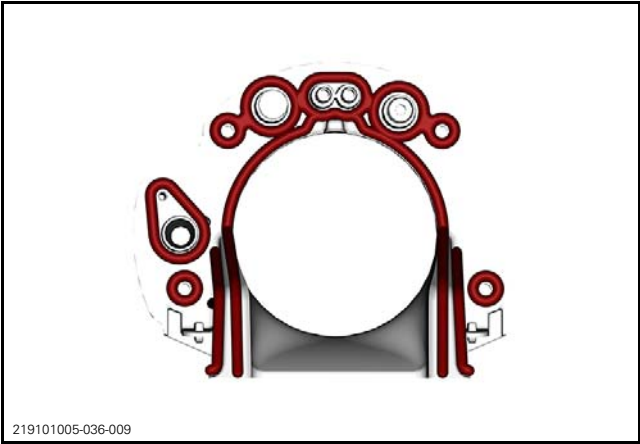
Clean jet pump support and hull surface with recommended cleaner to eliminate grease, dust, and sealant residue.

SERVICE PRODUCT
BRP HEAVY DUTY CLEANER (P/N 293 110 001)

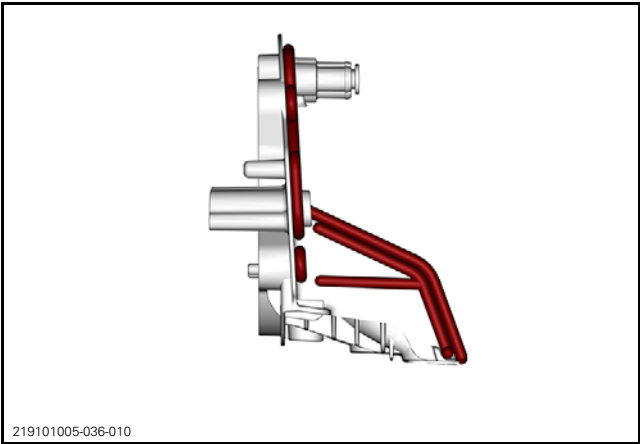
Installing the Jet Pump Support

- 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 on the jet pump support as shown.

SERVICE PRODUCT
LOCTITE 5900 (P/N 293 800 066)



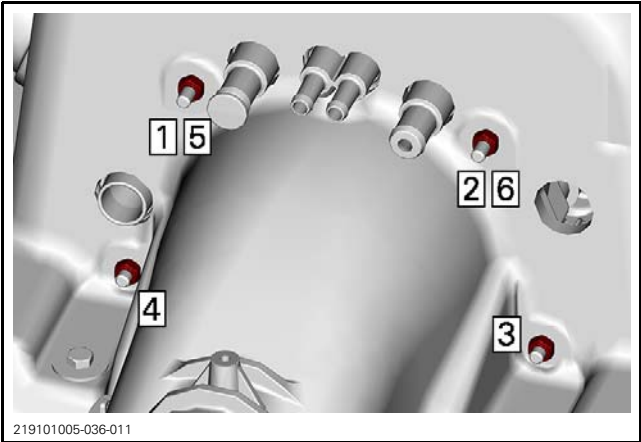
SEALANT APPLICATION



SEALANT APPLICATION

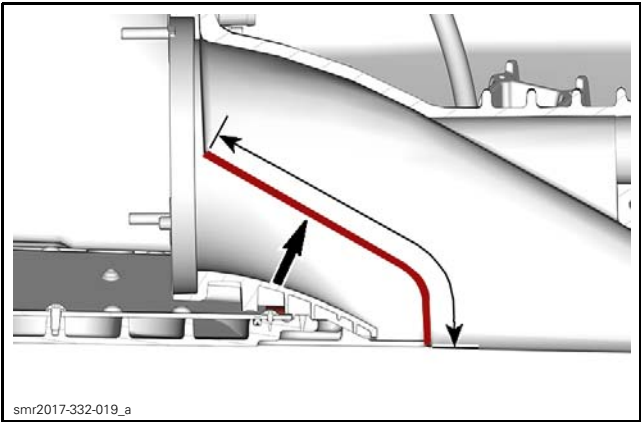
- 3. Insert the studs in the jet pump support square holes.
- 4. Slide the alignment shims on the studs.
- 5. Position the jet pump support against the hull.
- 6. Inside the hull, thread all 4 retaining nuts.
- 7. Tighten retaining nuts to the specified torque and sequence.

TIGHTENING TORQUE	
Jet pump support retaining nuts	25 N•m ± 1 N•m (18 lbf•ft ± 1 lbf•ft)

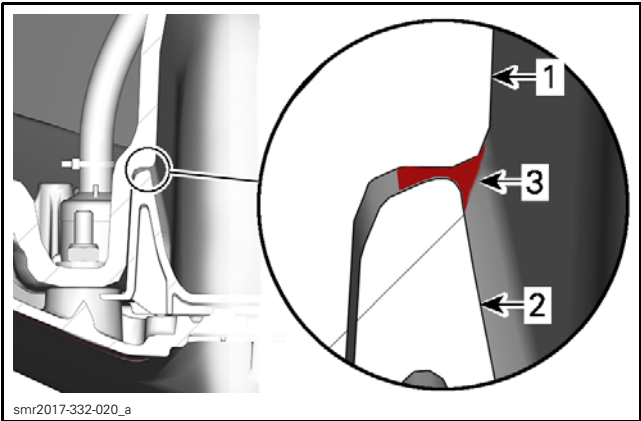


JET PUMP SUPPORT TIGHTENING SEQUENCE

8. Remove excess sealant.
9. Smooth the sealant in the gap between the jet pump support and the hull.



GAP BETWEEN JET PUMP SUPPORT AND HULL



CROSS CUT - REAR VIEW

1. Hull
2. Jet pump support
3. Smoothed sealant

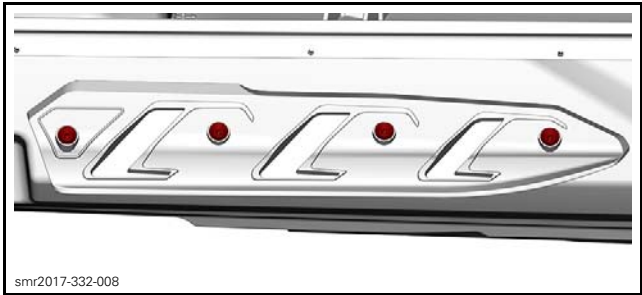
10. Reinstall other removed parts. Refer to appropriate subsections for procedures.

FIXED REAR SPONSONS

NOTE: Removal and installation procedure for RH and LH sponson is similar.

Removing the Fixed Rear Sponson

From inside hull, hold sponson nuts while removing sponson retaining bolts and washers.

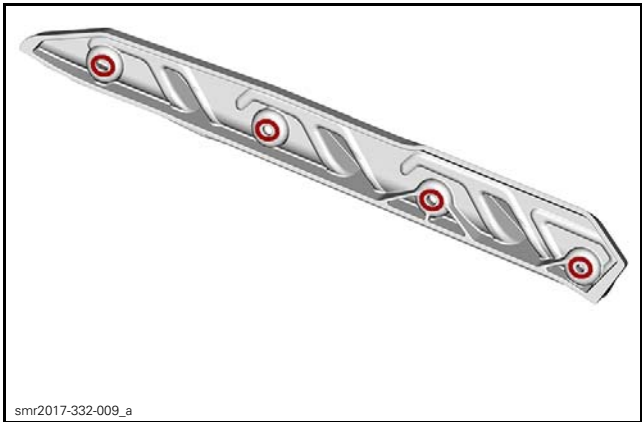


TYPICAL

Installing the Fixed Rear Sponson

1. Clean any residues of silicone sealant on hull and sponsons.
2. Apply clear silicone sealant on back side of sponson around screw holes.

SERVICE PRODUCT
CLEAR SILICONE SEALANT (P/N 296 000 309)

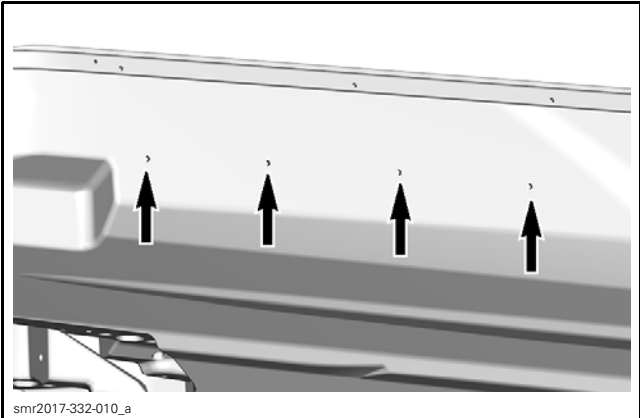


TYPICAL

3. Apply a small amount of silicone into each hull hole.

Section 08 BODY AND HULL

Subsection 02 (HULL)



TYPICAL

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 to specification.

TIGHTENING TORQUE	
Sponson retaining nuts	17.5 N•m ± 1 N•m (155 lbf•in ± 9 lbf•in)

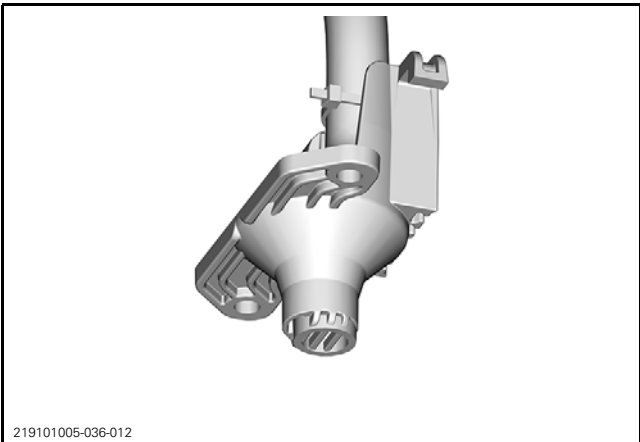
BAILERS

Two bailers (one each side), draw water from the bilge when watercraft is in operation.

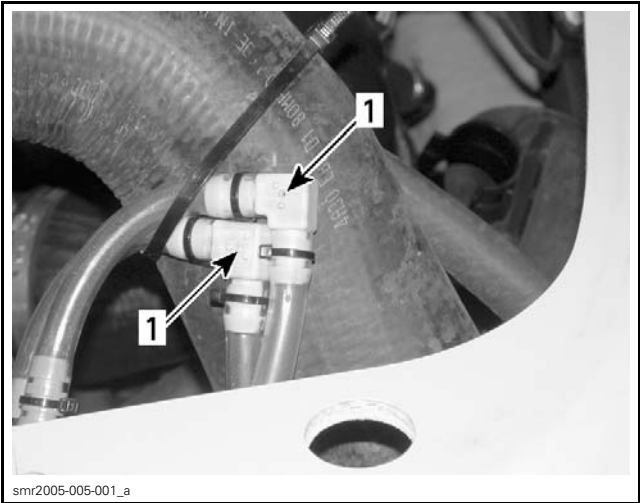
The bailers are connected to syphon tubes mounted in the jet pump venturi that use the jet pump thrust to create a vacuum.

Inspecting the Bailer

Check opening in the bailer to see if they are obstructed. Clean if necessary.



Check if the hole on each bailer hose elbow fitting is obstructed. Clean elbow fittings if necessary.



TYPICAL

1. Elbow fitting holes

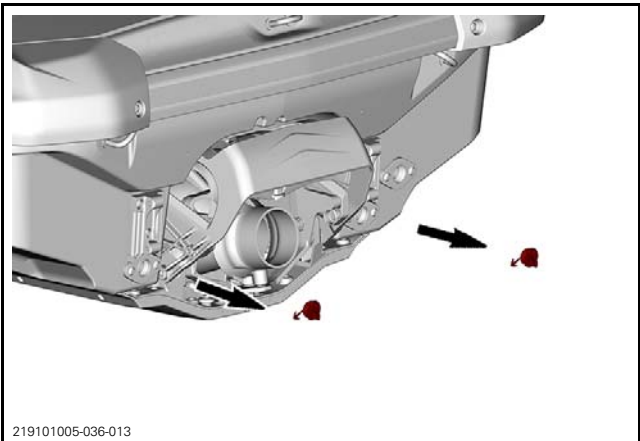
NOTE: When repositioning the bailer hose elbows, attach them at the highest available point on the exhaust hose.

DRAIN PLUGS

NOTE: Each drain plug on the stern are each connected to a bailer. When watercraft is off the water, the drain plugs can be removed to manually drain the bilge.

Removing the Drain Plug Neck

1. Unscrew the drain plug. from the drain neck.
2. Use a small flat screwdriver to release the arrow head from the drain plug neck.



3. Insert a ratchet extension in the square hole, then unscrew the drain neck from the hull.



DRAIN NECK REMOVAL

Installing the Drain Plug Neck

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

TIGHTENING TORQUE	
Drain plug neck	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

BOW AND STERN EYELETS

Accessing Bow Eyelet

Open the front storage cover.

Accessing Stern Eyelets

Remove seat.

Removing Eyelets

1. Unscrew and discard both bow eyelet retaining nuts.

NOTE: Keep all washers for installation. Bow and stern eyelets have the same hardware layout.



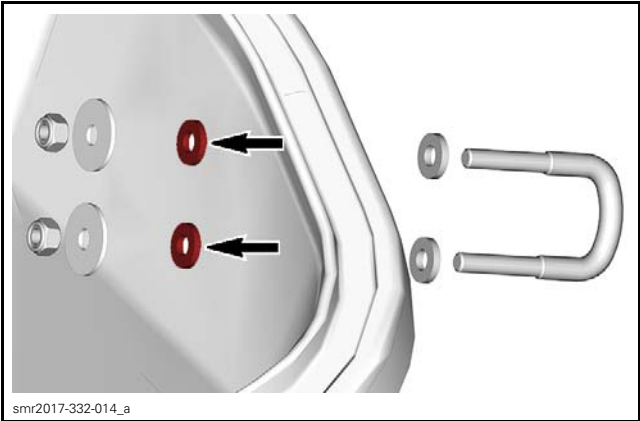
TYPICAL

2. Pull eyelet off the hull.

Installing Eyelets

The installation is the reverse of the removal procedure. However, pay attention to the following.
Apply clear silicone sealant inside the hull, around the hole.

SERVICE PRODUCT
CLEAR SILICONE SEALANT (P/N 296 000 309)



TYPICAL

TIGHTENING TORQUE	
Eyelet retaining nuts	14.5 N•m ± 1.5 N•m (128 lbf•in ± 13 lbf•in)

VEHICLES

COOLING SYSTEM		
Type	Closed loop cooling system	
Coolant	BRP long life antifreeze Low silicate, extended life ethylene-glycol premixed coolant (50%-50%) specifically formulated for internal combustion aluminum engines.	
Cooling system capacity	900 ACE Series	4 L (4.23 qt (U.S. liq.)) total
	1630 ACE Series	5.4 L (5.71 qt (U.S. liq.)) total
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	900 ACE Series	4 x 3.5 mm (.138 in) on exhaust pipe
	1630 ACE Series	3 x 3.5 mm (.138 in) on exhaust pipe and 1 x 3.5 mm (.138 in) on muffler
FUEL SYSTEM		
Fuel type	Inside North America ((RON + MON)/2)	87 recommended
	Outside North America (RON)	91 recommended
Fuel tank (including reserve)		60 L (15.9 U.S. gal.)
Fuel tank reserve (from low level signal)		approx. 14 L (3.7 U.S. gal.)
ELECTRICAL SYSTEM		
Battery	Battery 12 volt, 18 A.h. Yuasa - YTX20HL	
Anti-start system	RF D.E.S.S. with selectable maximum vehicle speed settings for learning key	

Section 09 TECHNICAL SPECIFICATIONS

Subsection 01 (VEHICLES)

ELECTRICAL SYSTEM			
Fuses	#1:	Not used	—
	#2:	Fuel Inj., Ing. Coils and Fuel Pump	15 A
	#3:	Bilge Pump (if equipped)	3 A
	#4:	Not used	—
	#5:	Not used	—
	#6:	Charge	30 A
	#7:	Cluster	5 A
	#8:	Not used	—
	#9:	iBR	30 A
	#10:	Start/Stop	5 A
	#11:	ECM	5 A
	#12:	Battery	30 A
	#13:	Diagnostic Tool 2	15 A
	#14:	Diagnostic Tool 1, Accessory connector	15 A

STEERING	
Steering	Fixed column
Steering nozzle pivoting angle	20°

PROPULSION			
Jet pump	Type		Axial flow single stage
	Grease type		Jet pump bearing grease (P/N 293550032)
Impeller	Rotation (seen from rear)		Counterclockwise
	Pitch	GTI 90	11.5°/16°
		GTI 130 GTI SE 130 GTI SE 170 Wake 170	11°/18°
		GTR 230	12°/17°
	Outside diameter	GTI 90	150 mm ± 0.06 mm (5.906 in ± .002 in)
		GTI 130 GTI SE 130 GTI SE 170 Wake 170	155.5 mm ± 0.06 mm (6.122 in ± .002 in)
		GTR 230	161 mm ± 0.06 mm (6.339 in ± .002 in)
Impeller/wear ring clearance	New		0 mm to 0.23 mm (0 in to .009 in)
	Wear limit		0.35 mm (.0138 in)

Section 09 TECHNICAL SPECIFICATIONS

Subsection 01 (VEHICLES)

PROPULSION		
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	Normal	Approx. from +5° to -3°
		X package X module (PAC)	Approx. from +10° to -5°
	Neutral		Approx. -55°
	Braking		Approx. -70°
	Reverse		Approx. -70°
VTS system			Electronically-controlled through the VTS control button with 3 presets position full up
VTS range angle		Normal	+8° / -3°
		X package X module (PAC)	+10° / -5°
Actuator			12 V, 75 A max. capacity. Reversible PWM (pulse-width modulation) motor

WEIGHT AND LOADING CAPACITY		
Dry weight	GTI 90	303 kg (668 lb)
	GTI 130 GTI SE 130 GTI SE 170	335 kg (739 lb)
	GTR 230	351 kg (774 lb)
	Wake 170	339 kg (747 lb)
Number of passenger (driver incl.)		3
Load limit (passenger(s) and luggages)		272 kg (600 lb)
Storage capacity		160.8 L (42.5 U.S. gal.)

DIMENSIONS	
Overall length	331.8 cm (130.6 in)
Overall width	125 cm (49.2 in)
Overall height	114 cm (44.9 in)

Section 09

TECHNICAL SPECIFICATIONS

Subsection 01 (VEHICLES)

MATERIALS	
Impeller material	Stainless steel
Impeller housing/stator	Aluminum/aluminum
Deck	CM-TEC process, composite
Hull	Polytech process
	Fiberglass reinforced polypropylene
	CM-TEC process, composite
Inlet grate	Aluminum
Steering cover	Thermoplastic
Venturi	Aluminum
Nozzle	Aluminum
Fuel tank	Polyethylene
Seat	Polyurethane/foam

WIRING DIAGRAM INFORMATION

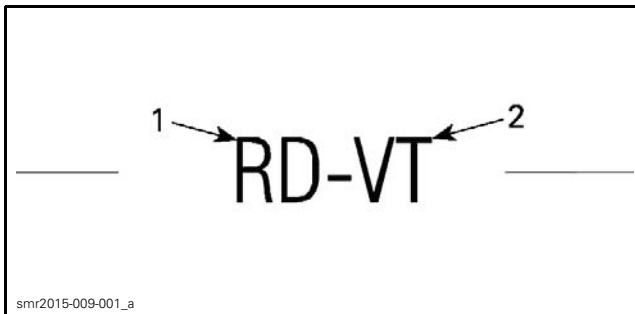
GENERAL

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

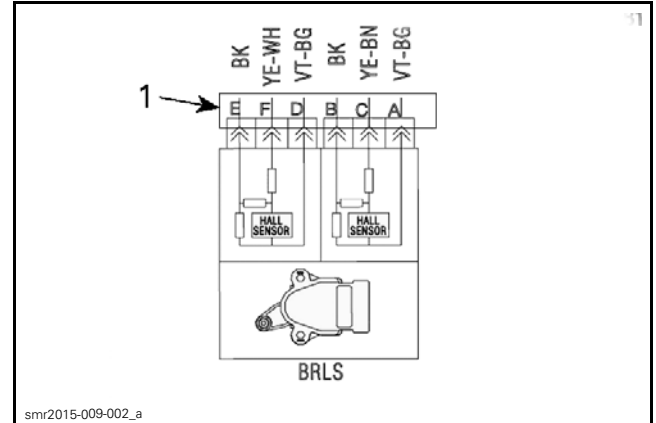
COLOR	USE
RED	Battery power (12 Vdc directly connected to battery)
RED + tracer	Fused 12 Vdc power or switched power from relay
VIOLET or VIOLET + tracer	Fused 12 Vdc accessory power from fuse box
YELLOW	Alternating current (AC) from magneto
BLACK	Ground
WHITE/BEIGE WHITE/BLACK	CAN HI wires, CAN LO wires

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

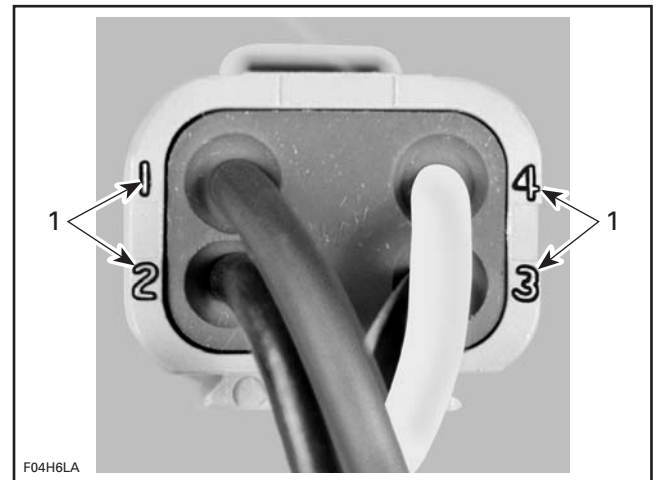
Terminal Identification on Connector

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.



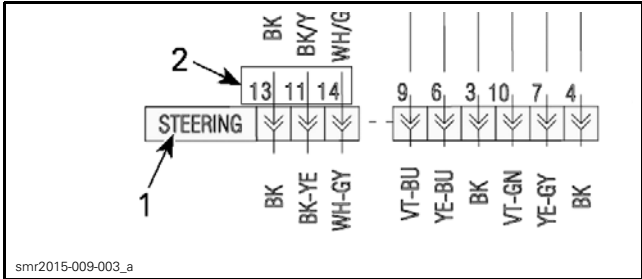
TYPICAL

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.

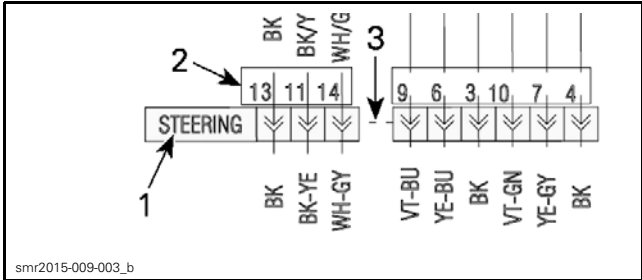
Section 10 WIRING DIAGRAM
Subsection 01 (WIRING DIAGRAM INFORMATION)



TYPICAL
1. Connector location
2. Wire pin location in connector

Connectors Linked by a Dashed Line

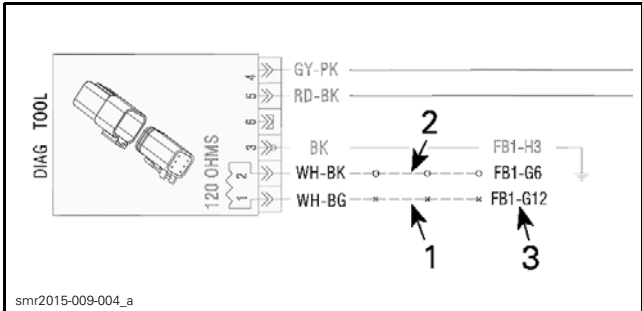
Connectors may be divided into segments linked by dashed lines, however, some segments of the same connector may be found elsewhere on the wiring diagram.



TYPICAL
1. Connector identification and location
2. Connector pin number
3. Dashed line links connector segments as one

CAN Wire Circuit References

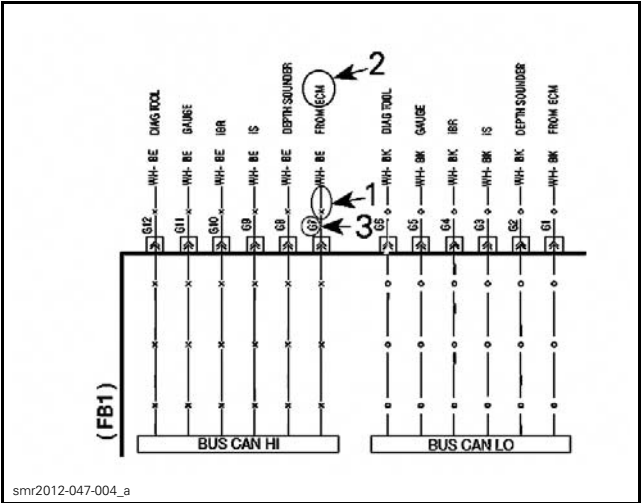
On the wiring diagram, CAN linked components use the following coding.



TYPICAL
1. CAN HI wire (x)
2. CAN LOW wire (o)
3. Wire destination

FB1 - G12 = : Terminal G12 in the fuse box no. 1

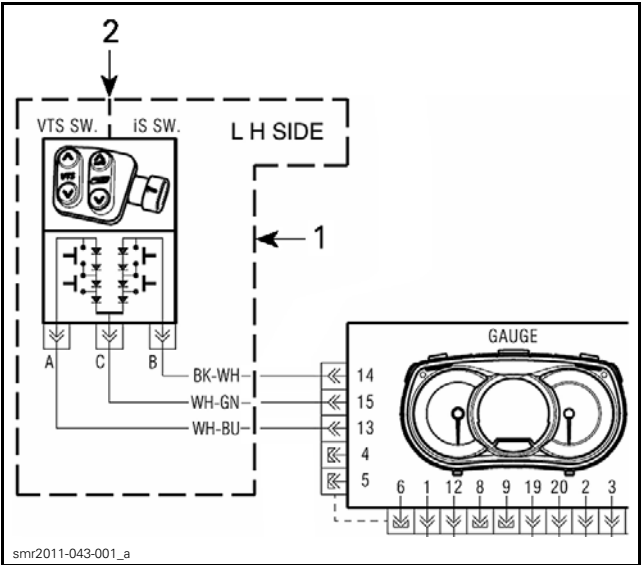
Corresponding CAN links are identified at fuse box using the following coding.



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