

2020 Ski-Doo Expedition Sport/LE/SE ACE 600/900/Turbo Series

If you're on a computer and don't see the clickable index on the left, please see the directions that were sent in the email with the download link, please check your junk mail if you don't see it.

This manual is made up of the base manual with all needed supplements organized into one easy to use manual.

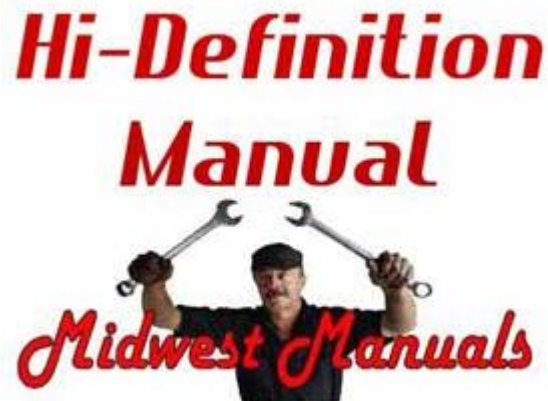
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SAFETY NOTICE

This manual has been prepared as a guide to servicing and repair the Ski-Doo® snowmobile from the REV™ Gen4 platform.

This edition was primarily published to be used by mechanical 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 in this manual will apply only if proper hand tools and special service tools are used.

The contents of this manual depicts parts and/or procedures applicable to a 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 vehicle illegal under existing federal, provincial and state regulations.

This manual emphasizes particular information which, is 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 provided 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.

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 CATALOGS*.

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

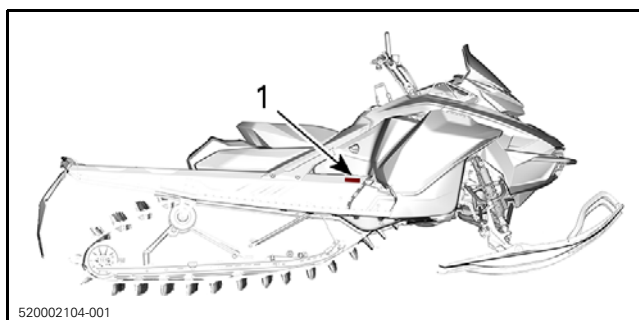
The information and component/system descriptions contained in this manual are correct at time of writing. BRP however, maintains a policy of continuous improvement of its products without imposing upon itself any obligation to install them on products previously manufactured.

Due to late changes, there may be some differences between the manufactured product and the description and/or specifications in this document.

BRP reserves the right at any time to discontinue or change specifications, designs, features, models or equipment without incurring obligation.

VEHICLE INFORMATION

VEHICLE IDENTIFICATION NUMBER (VIN)

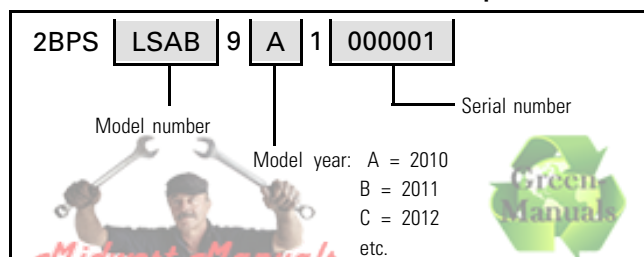


520002104-001

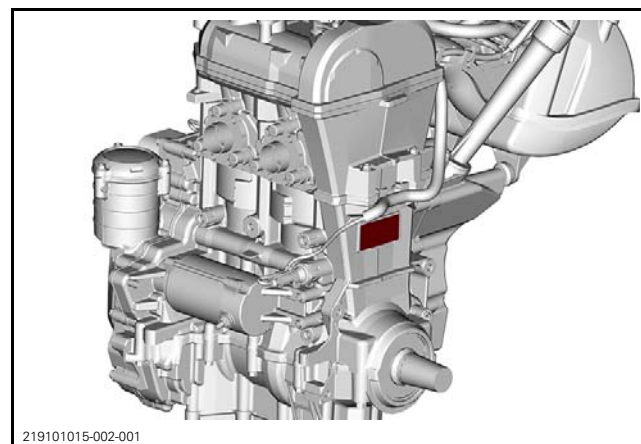
TYPICAL

1. Vehicle identification number

Identification Number Description

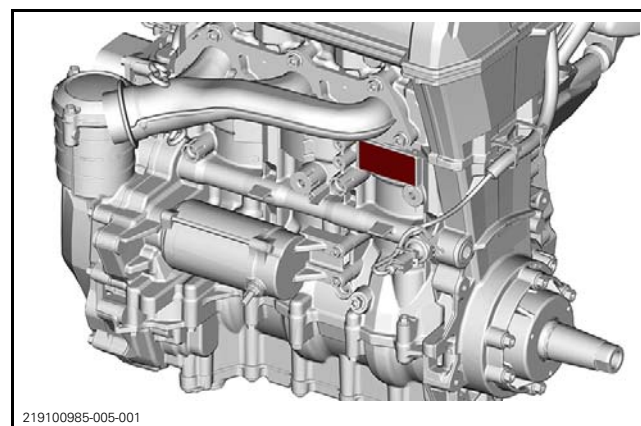


ENGINE IDENTIFICATION NUMBER (EIN)



219101015-002-001

600 ACE



219100985-005-001

900 ACE

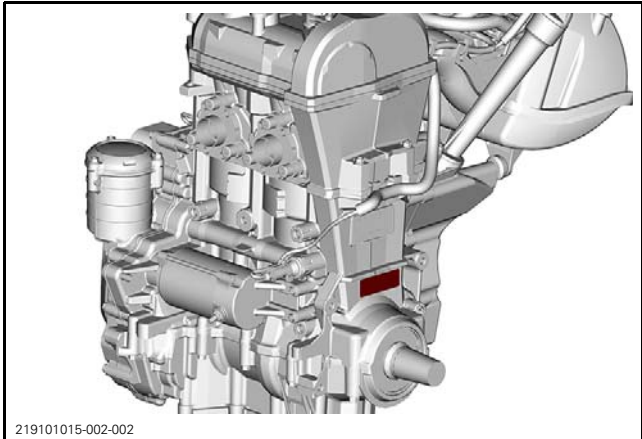
COMPLIANCE LABEL

Regulation (EU) 2016/1628 applicable for Non-Road Mobile Machineries

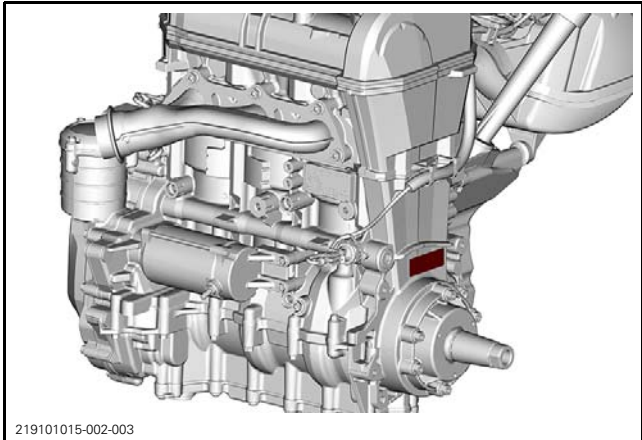
Vehicles who comply to Regulation (EU) 2016/1628 (NRMM) are identified on the engine.

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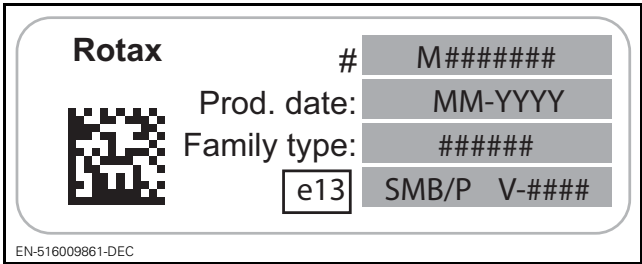
INTRODUCTION



219101015-002-002
600 ACE

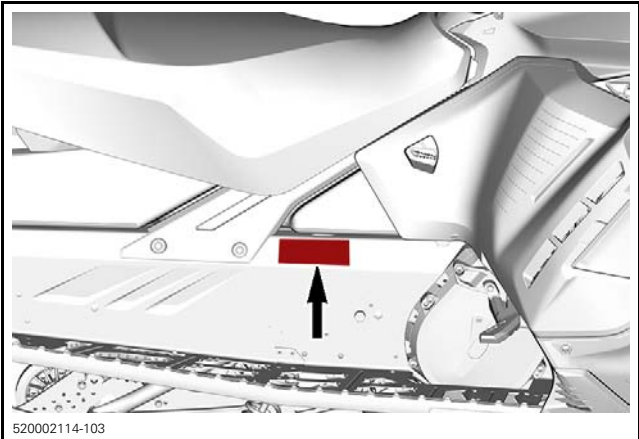


219101015-002-003
900 ACE



TYPICAL NRMM IDENTIFICATION

Depending on your particular vehicle configuration, an additional NRMM identification decal may be installed on the tunnel, near the chaincase.



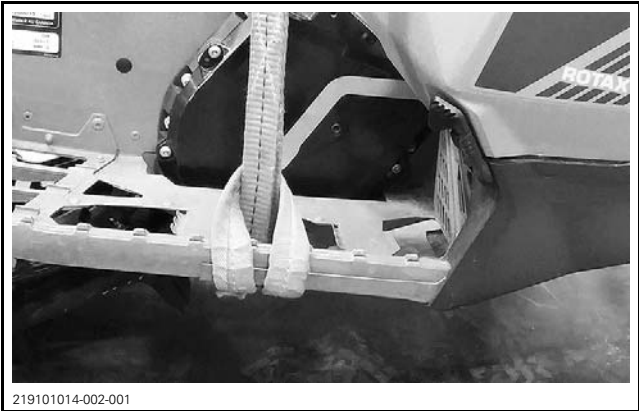
520002114-103
TYPICAL - ON RH SIDE OF TUNNEL



TYPICAL NRMM IDENTIFICATION ON VEHICLE

SNOWMOBILE LIFTING

To lift the snowmobile securely, place the hooks of the lifting tool under the rollers at the front of the footrests.



NOTICE Do not use footrest opening or steering column to lift the snowmobile. Frame or steering system could be seriously damaged.

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 manufacturer's prescribed changes.

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.

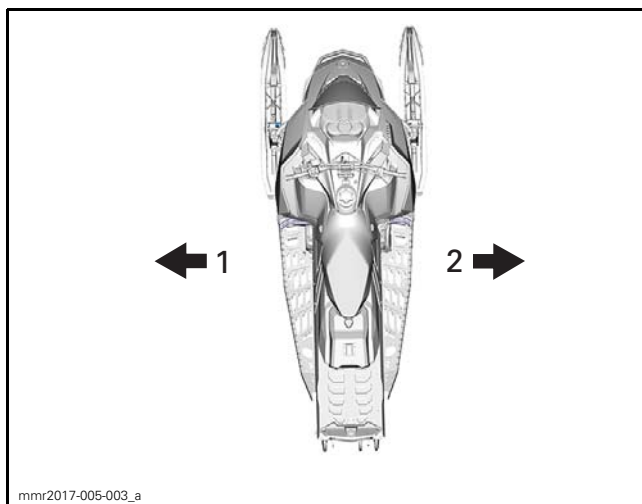
WARNING

Unless otherwise specified, the engine should be turned OFF and cold for all maintenance and repair procedures.

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

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

INTRODUCTION



- 1. Left
- 2. Right

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

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

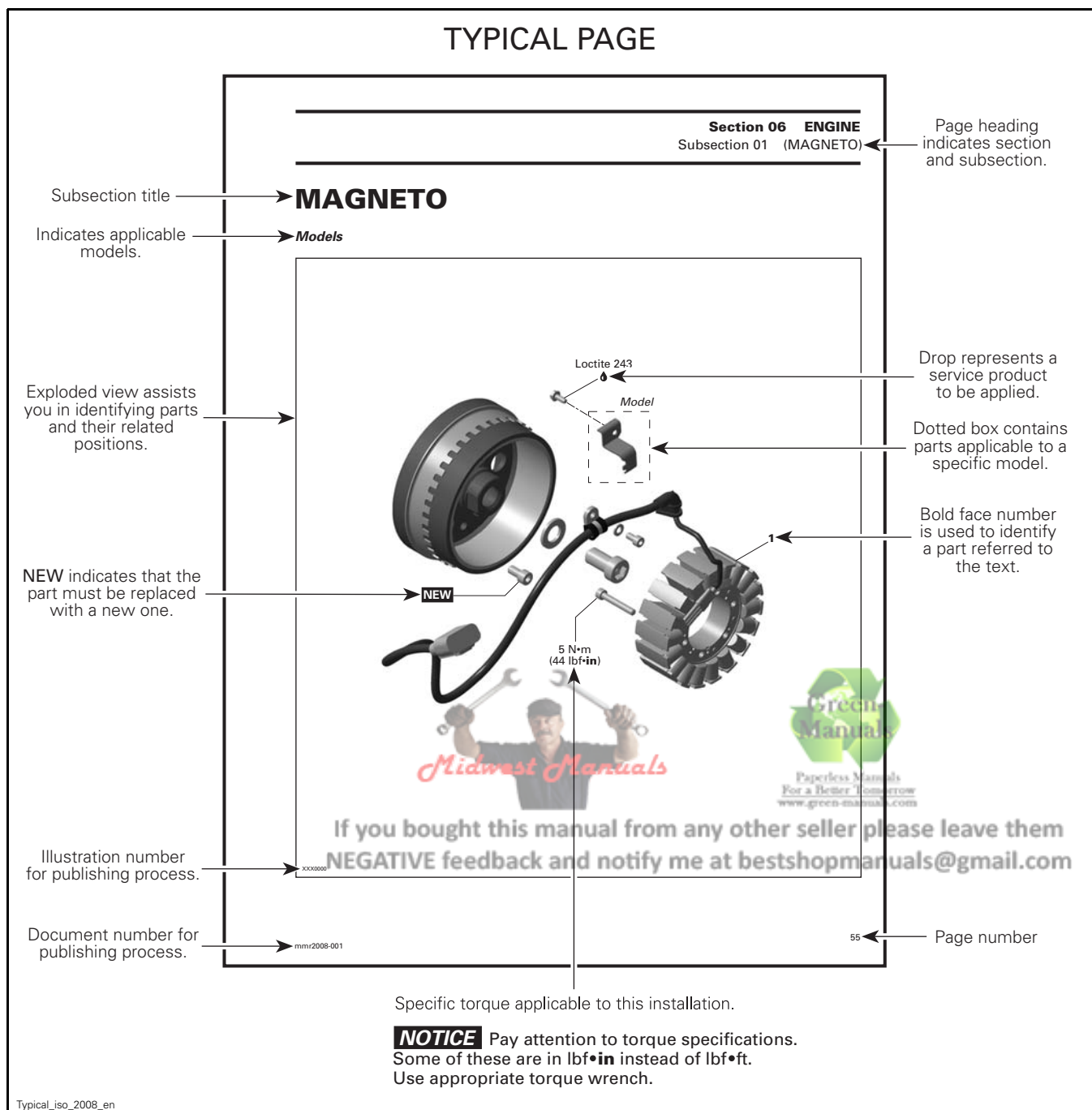
NOTICE Most fasteners are metric, and most components are built with parts dimensioned using the metric system. Consult the appropriate *PARTS CATALOG* to obtain and use the correct parts and fasteners. Mismatched or incorrect fasteners could cause damage to the vehicle.

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.

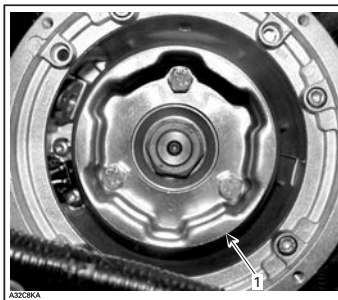
► Magneto Flywheel Removal

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, refer to the following table.

⚠ WARNING

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

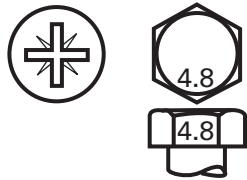
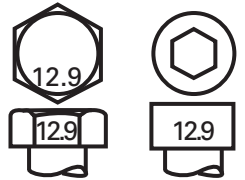
In order to avoid a poor assembly, tighten screws, bolts, or nuts in accordance with the following procedure:

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

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

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

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

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

FASTENER SIZE	FASTENER GRADE/TORQUE			
	5.8 Grade	8.8 Grade	10.9 Grade	12.9 Grade
M4	1.5 – 2 N•m (13 – 18 lbf•in)	2.5 – 3 N•m (22 – 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 – 15 N•m (93 – 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 components in the vehicles are built with parts dimensioned in the metric system. Most fasteners are metric and must not be replaced by customary fasteners or vice-versa. Mismatched or incorrect fasteners could cause damage to the vehicle or possible personal injury.

SELF-LOCKING FASTENERS PROCEDURE



TYPICAL — SELF-LOCKING FASTENER

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

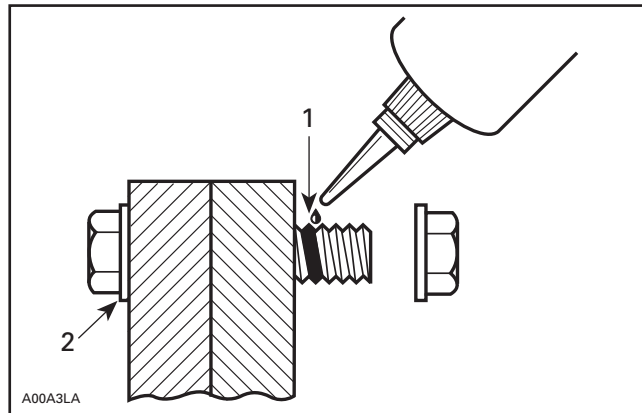
Use a metal brush or a tap to properly clean a threaded hole, then use a solvent. Allow the solvent time to act, approximately 30 minutes, then wipe off. Solvent utilization is to ensure proper adhesion of the product used for locking the fastener.

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.

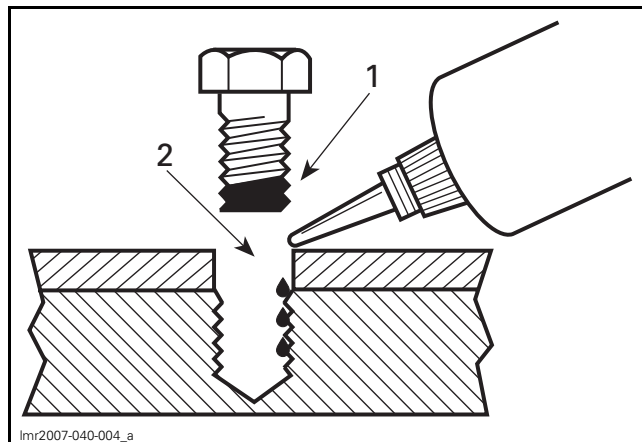
Threadlocker Application for Uncovered Holes (Bolts and Nuts)



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

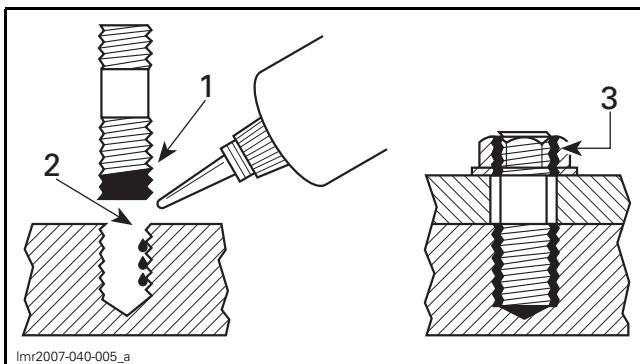


1. On fastener threads
2. On threads and at the bottom of hole

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



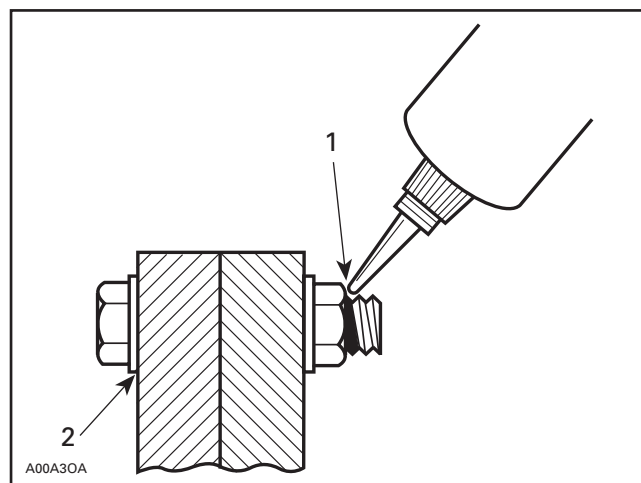
1. On stud threads
2. On threads and in the hole
3. On retaining nut threads

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

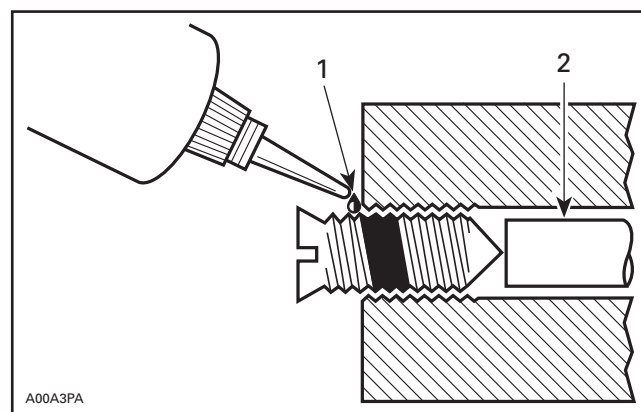


1. Apply here
2. Do not apply

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



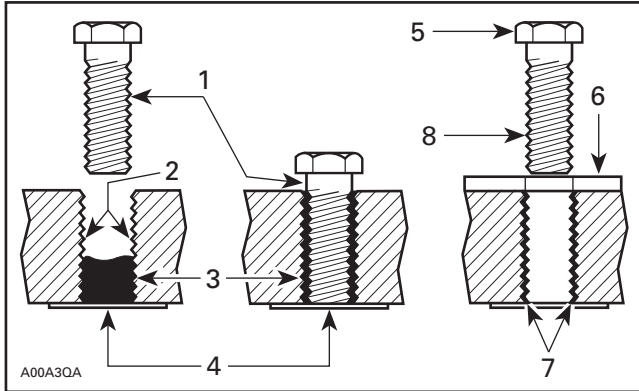
1. Apply here
2. Plunger

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

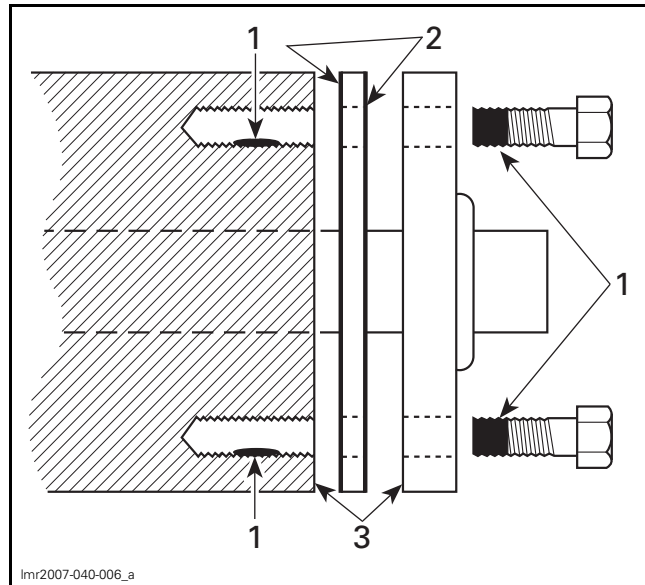
Option 1: Enlarge damaged hole, then follow *STANDARD THREAD REPAIR* procedure.

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

1. Remove old gasket and other contaminants using Loctite chisel (gasket remover). 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.

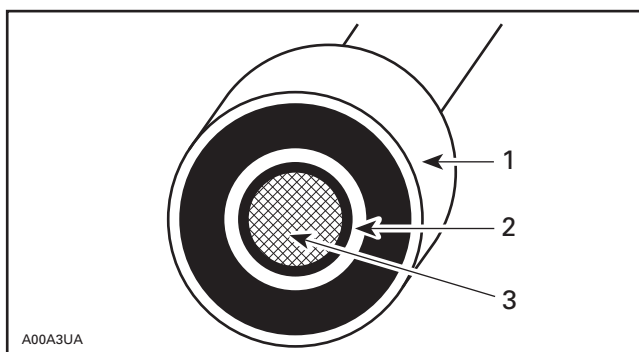
NOTE: If the cover is bolted to blind holes, apply proper strength Loctite in the hole and on threads. Tighten fastener.

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.

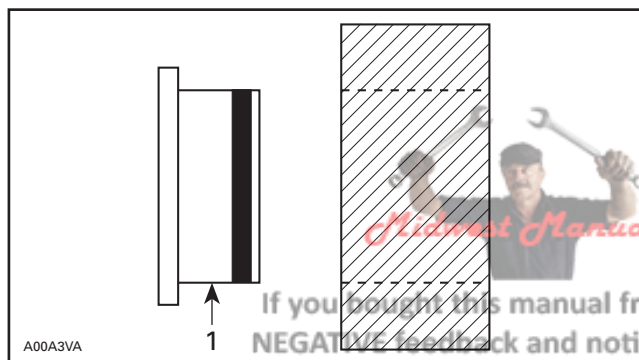
NOTE: Retaining compound is always forced out when applied on shaft.

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.



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PERIODIC MAINTENANCE SCHEDULE

Procedures are detailed in appropriate subsections.

PRE-RIDE INSPECTION	
Body including seat, footrests, lights, air filter, controls and instruments	Check condition and remove snow or ice
Skis and steering actions	Check for free movement and proper operation
Fuel and injection oil	Check for proper level and no leaks
Coolant	Check for proper level and no leaks
Brake fluid	Check for proper level and no leaks
Storage compartment	Check for proper latching and no heavy or breakable objects
Throttle lever	Check for proper action
Track	Check condition and remove snow or ice
Slider shoes	Check for proper operation
Brake lever	Check for proper operation
Parking brake, brake	Check for proper operation
Emergency engine stop switch and engine cut-off switch (tether cord cap)	Check for proper action. Tether cord must be attached to operator clothing eyelet
Lights	Check for proper operation
Ski and runners	Check for proper condition (and operation if adjustable)
Drive belt	Check condition for cracks, fraying or abnormal wear
FIRST INSPECTION AFTER THE FIRST 1 500 KM (1,000 MI)	
Adjust drive chain	
Check chaincase oil level	
Adjust and align track	

Subsection XX (PERIODIC MAINTENANCE SCHEDULE)

EVERY YEAR AT PRESEASON OR 3 000 KM (2,000MI) (WHICHEVER COMES FIRST)
Perform <i>PRE-RIDE INSPECTION</i>
Check fault codes
Charge battery
Adjust drive chain
Inspect track tension, adjust and align (if necessary)
Inspect brake hose, pads and disk
Check coolant density
Inspect drive belt
Inspect and clean drive pulley
Tighten drive pulley retaining screw to specified torque
Inspect and clean driven pulley
Inspect engine seals and gaskets for leaks
Lubricate rear suspension (lubricate whenever the vehicle is used in wet conditions (rain, puddles))
Inspect exhaust system and check for leaks
Tighten exhaust manifold screws or nuts to specified torque
Inspect fuel lines and connections
Inspect front suspension
Inspect rear suspension (including stopper straps and slider shoes)
Inspect tie-rod ends and ski alignment
Adjust headlight beam aiming
EVERY 6 000 KM (4,000 MI) OR AT PRE-SEASON (WHICHEVER COMES FIRST)
Change engine oil and filter
EVERY 2 YEAR OR 6 000KM (4,000 MI) (WHICHEVER COMES FIRST)
Replace brake fluid
Change chaincase oil
EVERY 3 YEARS OR 10 000KM (6,000 MI) (WHICHEVER COMES FIRST)
Replace spark plugs
Replace turbo exhaust gasket (on applicable model)
EVERY 5 YEARS
Replace engine coolant
Replace in-line fuel filter

PERIODIC MAINTENANCE PROCEDURES

SERVICE TOOLS

Description	Part Number	Page
TENSIOMETER.....	414 348 200	13

SERVICE PRODUCTS

Description	Part Number	Page
BRAKE FLUID GTLMA DOT4.....	293 600 131	10
BRP PREMIXED COOLANT	219 700 362	1
PULLEY FLANGE CLEANER	413 711 809	9, 12
SUSPENSION GREASE.....	293 550 033	15–16
XPS 4-STROKE SYNTHETIC OIL.....	293 600 112	4
XPS FUEL STABILIZER.....	413 408 601	7
XPS SYNTHETIC GEAR OIL (75W 140)	293 600 140	12
XPS SYNTHETIC GREASE.....	293 550 010	11

GENERAL

This subsection provides general maintenance instructions. Where detailed instructions for disassembly or reassembly is required, refer to the applicable subsection.

PROCEDURES

ENGINE

Cooling System Inspection

Inspect cooling system pressure cap, hoses and clamps for leaks.

Test pressure cap for proper operation.

Recommended Engine Coolant

RECOMMENDED SERVICE PRODUCT	ACCEPTABLE
BRP premixed coolant BRP PREMIXED COOLANT (P/N 219 700 362)	A blend of 50% distilled water with 50% antifreeze (especially formulated for aluminum engines)

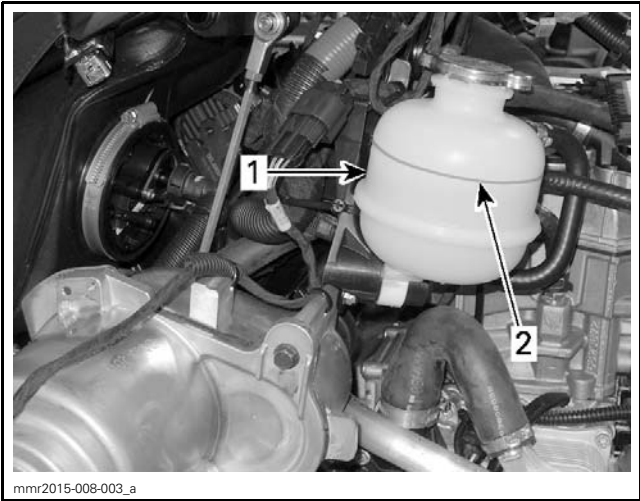
To prevent antifreeze deterioration, always use the same brand. Never mix different brands unless cooling system is completely flushed and refilled.

NOTICE To prevent rust formation or freezing condition, always replenish the system with the BRP premixed coolant or with 50% antifreeze and 50% distilled water. Do not use tap water, straight antifreeze or straight water in the system. Tap water contains minerals and impurities which build up in the system. During cold weather, straight water causes the system to freeze while straight antifreeze thickens (like slush ice) and does not have the same efficiency. Always use ethylene glycol antifreeze containing corrosion inhibitors specifically recommended for aluminum engines.

Engine Coolant Level Verification

Check coolant level at room temperature with the cap removed. Liquid should be at cold level line (engine cold) of coolant tank.

NOTE: When checking level at low temperature it may be slightly lower than the mark.



1. Coolant tank
2. COLD LEVEL line

Engine Coolant Strength Verification

Remove pressure cap.
Use an antifreeze tester to test coolant strength.

MINIMUM RECOMMENDED COOLANT STRENGTH
-30°C (-22°F)

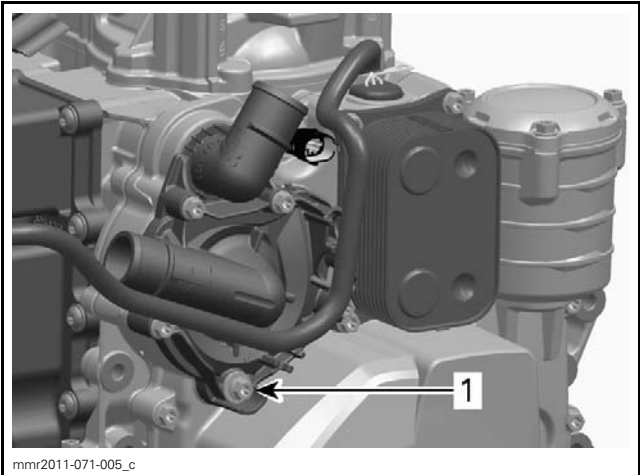
Engine Coolant Replacement

Cooling System Draining

**WARNING**

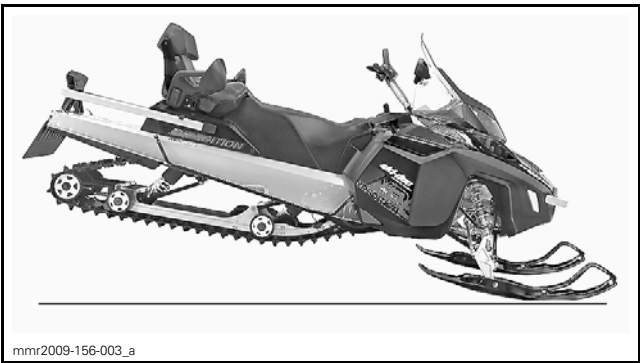
Never drain or refill the cooling system when engine is hot.

1. Remove body parts as required to access to the water pump (RH side).
2. Place a large drain pan under the vehicle bottom pan.
3. Remove drain screw at water pump to drain coolant.



1. Drain screw

4. Remove coolant reservoir cap.
5. When coolant level is low enough, lift the rear of vehicle to drain the heat exchangers.

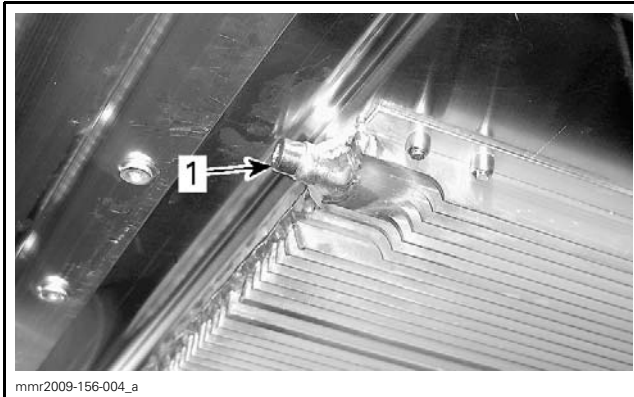


6. Install **NEW** sealing washer on drain screw.
7. Tighten drain screw to specification.

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

Cooling System Refilling and Bleeding

1. Apply parking brake.
2. From underneath the back end of the chassis, remove the heat exchanger drain plug.



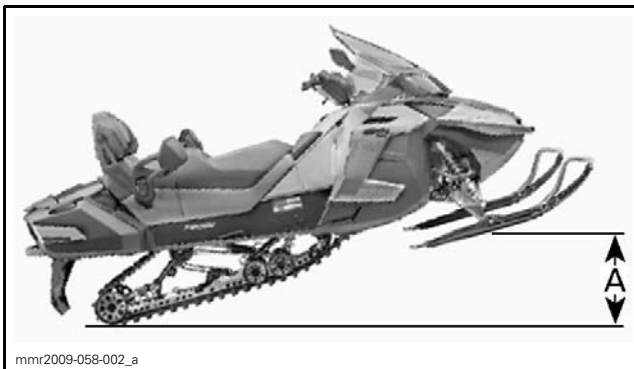
1. Drain plug

3. Fill coolant reservoir until coolant comes out of heat exchanger.

4. Install drain plug and tighten it to specification.

TIGHTENING TORQUE	
Drain plug	10 N•m (89 lbf•in)

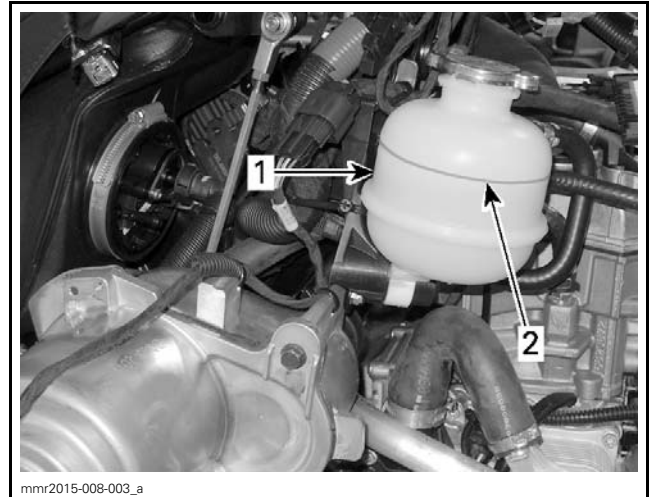
5. Lift front of vehicle by 25 cm ± 5 cm (10 in ± 2 in) and support safely.



TYPICAL VIEW

A. 25 cm ± 5 cm (10 in ± 2 in)

6. Fill coolant tank up to COLD LEVEL line.



1. Coolant tank
2. COLD LEVEL line

7. Start engine.

8. Add coolant up to COLD LEVEL line while engine is idling until rear heat exchangers are warm to the touch (about 4 to 5 minutes).

NOTE: Always monitor coolant level while filling coolant tank to avoid an empty coolant reservoir, and thus allow air to enter the system.

9. Install pressure cap.

Lower vehicle back on the ground.



TYPICAL VIEW

10. Lift rear of vehicle and support it safely.



TYPICAL VIEW

⚠ WARNING

Before revving engine, ensure that the track is free of particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Always lift the snowmobile on a wide-base stand with a rear deflector panel. Ensure no one is standing in close proximity to the snowmobile, especially at the rear of the track. Centrifugal force could cause debris, damaged or loose studs, pieces of torn track, or an entire track to be violently thrown backwards out of the frame with tremendous force, possibly resulting in the loss of a leg or other serious injury.

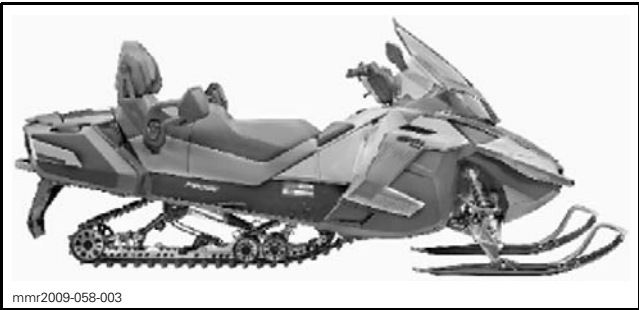
NOTICE The engine of this snowmobile has been developed and validated using the BRP XPS™ Synthetic 4-stroke oil. BRP strongly recommends the use of its XPS Synthetic 4-stroke oil at all times. Damages caused by oil which is not suitable for the engine will not be covered by the BRP limited warranty.

If the recommended oil is not available, use SAE 0W-40 synthetic-based oil that meets or exceeds the requirements for API service classification SM.

Engine Oil Level Verification

NOTICE Operating the engine with an improper oil level may cause severe engine damage. Follow this procedure to obtain a precise reading of the engine oil level.

- 11. Remove parking brake.
- 12. Activate throttle lever 3 - 4 times to bring engine speed to 7000 RPM.
- 13. Apply the brake.
- 14. Lower vehicle back on ground.



TYPICAL VIEW



TYPICAL - LH SIDE
1. Oil tank dipstick

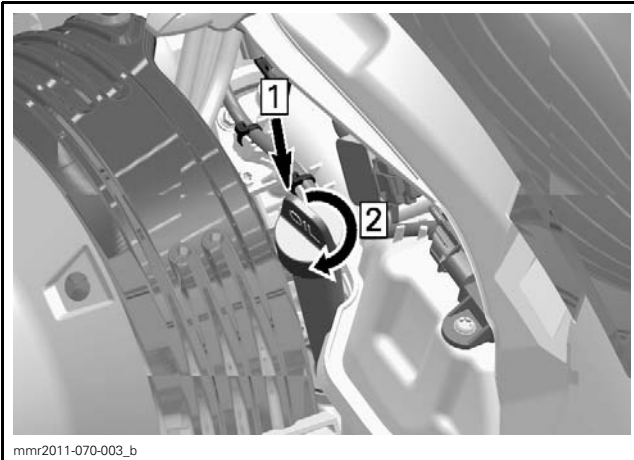
- 15. Stop engine.
- 16. Add coolant up to 15 mm (1/2 in) above the COLD LEVEL line.
- 17. When engine has completely cooled down, recheck coolant level in coolant tank and refill up to line if needed.
- 18. Perform *ENGINE COOLANT STRENGTH VERIFICATION*. See procedure in this subsection.
- 19. Adjust mixture if necessary.
- 20. Reinstall removed parts.
- 21. Run vehicle a few minutes then recheck coolant level.

With the engine at normal operating temperature (90°C (194°F) at oil tank surface), place vehicle on a level surface and proceed as follows to check oil level:

- 1. Start engine and let it idle for at least 20 seconds.
- 2. Stop engine.
- 3. Open the LH side panel.
- 4. If applicable, remove the drive belt guard. Refer to *DRIVE BELT* subsection.
- 5. Unscrew and remove dipstick and wipe clean.
- 6. Insert dipstick in the filler tube and again tighten it.

Recommended Engine Oil

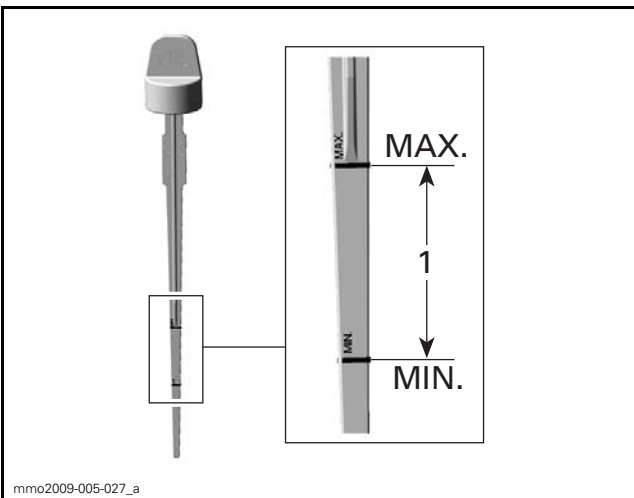
RECOMMENDED ENGINE OIL
XPS 4-STROKE SYNTHETIC OIL (P/N 293 600 112)



TYPICAL

Step 1: Insert dipstick
Step 2: Tighten dipstick.

7. Remove dipstick again and check oil level. It should be near or equal to the upper mark.



1. Operating range

8. To add oil, place a funnel into the filler tube to avoid spillage.
 - 8.1 Add a small amount of oil and recheck oil level.
 - 8.2 Repeat the operation until oil level reaches the dipstick's upper mark. Do not overfill.
- NOTE:** The oil quantity between MIN. and MAX. mark is approximately 500 ml (16.9 U.S. oz).
9. Reinstall dipstick and properly tighten it.
 10. Wipe off any oil spillage.
 11. Install drive belt guard.
 12. Close the LH side panel.

Engine Oil Replacement

⚠ WARNING

The engine oil can be very hot. Wait until engine oil is warm.

NOTICE Engine oil and oil filter must be replaced at the same time.

1. Bring engine to its normal operating temperature (90°C (194°F) at oil tank surface).
2. Place vehicle on a level surface.
3. Remove the LH side panel.
4. Remove dipstick.



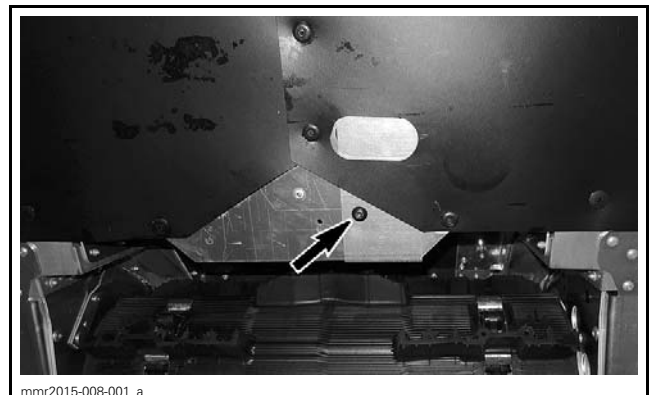
LH SIDE OF VEHICLE

1. Oil tank dipstick

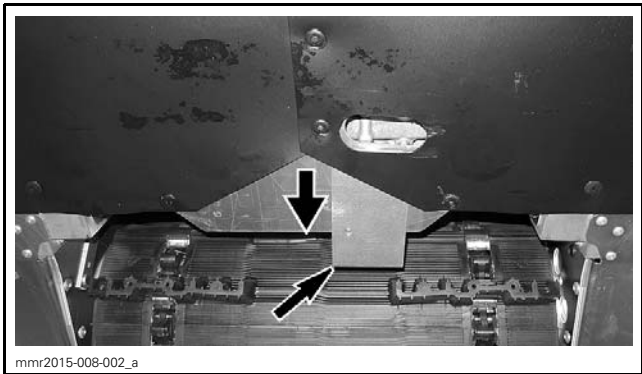
5. Remove oil filter. Refer to *ENGINE OIL FILTER REPLACEMENT* in this subsection.

6. From underneath the vehicle, access the drain plug:

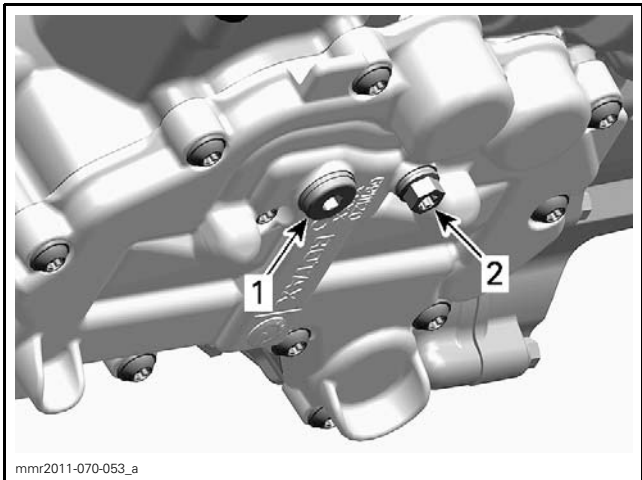
- 6.1 Remove the access cover retaining screw.



- 6.2 Slide the access cover back to clear the bottom pan opening.



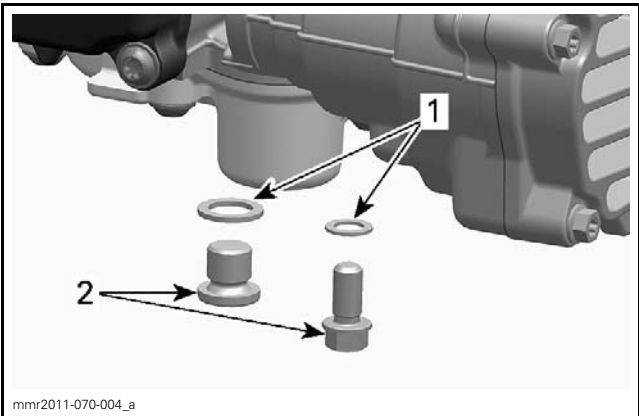
- 7. Clean drain plug area.
- 8. Place a drain pan under the bottom pan opening.
- 9. Remove engine drain plugs in the following order.
 - 9.1 Main drain plug.
 - 9.2 Secondary drain plug.



600 ACE ENGINE SHOWN
UNDERNEATH THE ENGINE
1. Main drain plug
2. Secondary drain plug

- 10. Allow oil to drain completely.
- 11. Install **NEW** sealing washers on oil drain plugs.

NOTICE Never use a sealing washer a second time. Always replace with a new one.



1. Sealing washer
2. Oil drain plug

- 12. Install drain plugs and tighten to the specified torque.

TIGHTENING TORQUE	
Drain plugs	15 N•m ± 2 N•m (133 lbf•in ± 18 lbf•in)

- 13. Replace *OIL FILTER*, see procedure in this subsection.
- 14. Refill oil tank at the proper level with the recommended oil.

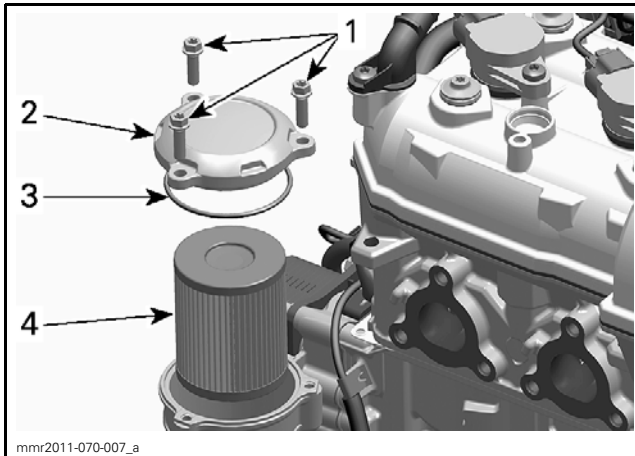
APPROXIMATE ENGINE OIL CAPACITY (WITH FILTER)	
600 ACE	2.1 L (2.2 qt (U.S. liq.))
900 ACE	3.3 L (3.5 qt (U.S. liq.))

- 15. Reinstall dipstick in oil tank and properly tighten it.
- 16. Start engine and let it idle for a few minutes.
- 17. Ensure there are no leaks.
- 18. Stop engine and check oil level as explained in this subsection. Refill if necessary.
- 19. Dispose oil and filter as per your local environmental regulations.

Engine Oil Filter Replacement

Oil Filter Removal

- 1. Remove the RH side panels.
- 2. Clean oil filter area.
- 3. Remove:
 - Oil filter cover screws
 - Oil filter cover with O-ring
 - Oil filter.

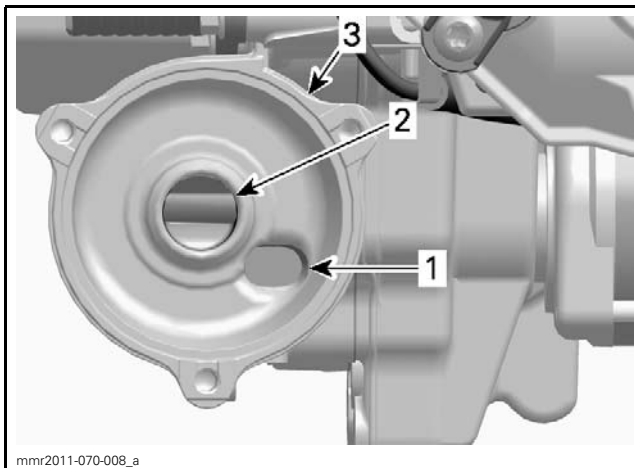


1. Oil filter cover screws
2. Oil filter cover
3. O-ring
4. Oil filter

4. Dispose filter as per your local environmental regulations.

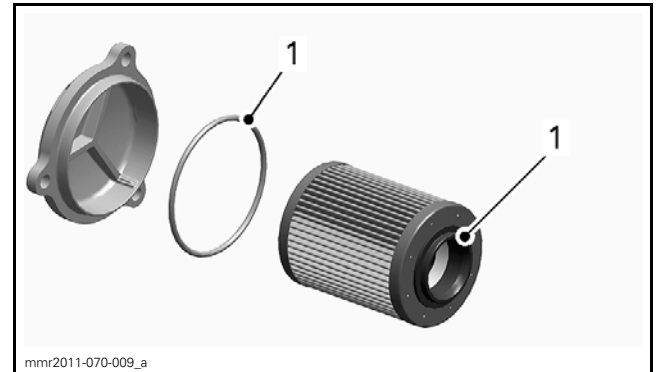
Oil Filter Installation

1. Check the oil filter inlet and outlet orifices inside oil filter receptacle (integrated part of magneto cover) for dirt and contaminations.



1. Oil inlet orifice from the oil pressure pump
2. Oil outlet orifice to the engine lubrication system
3. Oil filter receptacle

2. Install a **NEW** O-ring on oil filter cover.
3. Lubricate filter seal and cover O-ring with engine oil.



1. Lubricate with engine oil

4. Install the oil filter cover.

5. Tighten oil filter cover screws to the specified torque.

TIGHTENING TORQUE	
Oil Filter Cover	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

Engine Seals and Gaskets Inspection

Visually inspect the seal and gasket areas for leaks.

Exhaust System Inspection

Check the following components for leaks, cracks, or other damage:

- Muffler
- Exhaust pipes
- Manifold.

AIR INTAKE SYSTEM

Throttle Body Connecting Socket

Visually inspect throttle body connecting socket for cracks or other damages.

Replace if necessary. Refer to *INTAKE MANIFOLD* in the *AIR INTAKE SYSTEM* subsection.

FUEL SYSTEM

Fuel System Protection

With the new fuel additives used today, it is critical to add a fuel stabilizer to the fuel during storage to prevent fuel deterioration, gum formation and fuel system gumming. Follow manufacturers instructions for proper use.

RECOMMENDED PRODUCT
XPS FUEL STABILIZER (P/N 413 408 601)

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

- 1. Pour fuel stabilizer in fuel tank.
- 2. Fill up fuel tank completely.
- 3. Run engine sufficiently for fuel with stabilizer to be distributed to entire fuel system.
- 4. Ensure there is no water inside fuel tank.

NOTICE Do not drain fuel system.

Fuel Line and Connection Inspection

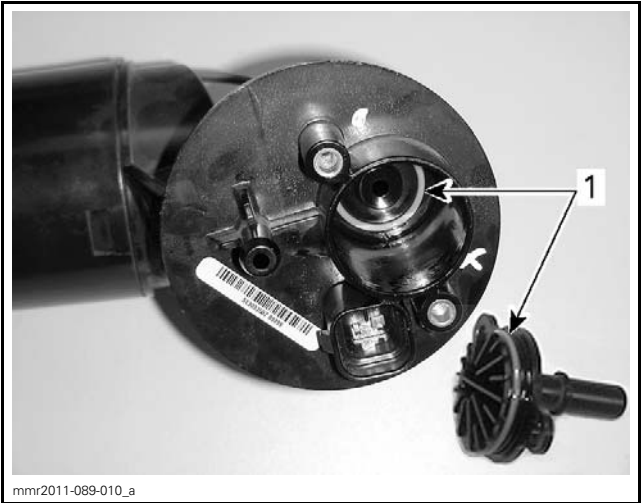
Visually inspect all fuel lines and connections for cracks or leaks.

Fuel Pump Outlet Filter Replacement

NOTE: The fuel pump outlet filter is housed within the mounting flange of the fuel pump module. It can be replaced without removing the fuel pump module from the fuel tank.

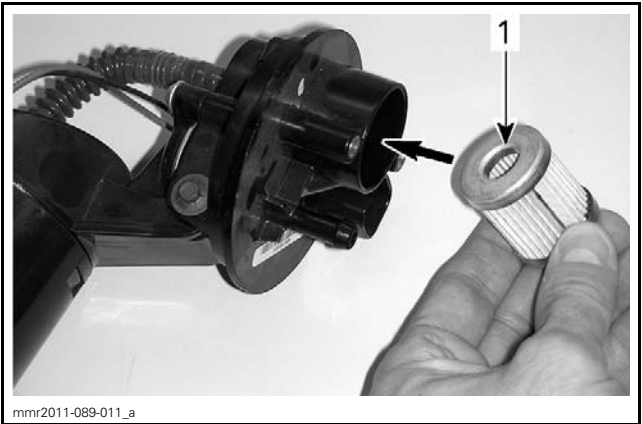
- 1. Disconnect fuel pump electrical connector to deactivate fuel pump.
- 2. Start and run engine until it stalls.
- 3. Place several shop rags under the fuel pump pressure hose fitting to prevent fuel from leaking onto the connectors of the voltage regulator/rectifier unit.
- 4. Remove following parts from fuel pump module.

NOTE: Do not remove fuel pump module from fuel tank.



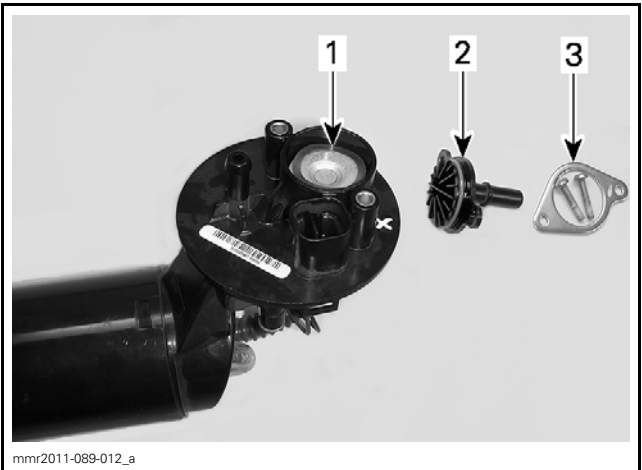
1. New O-ring seals

6. Insert filter element as per following illustration.

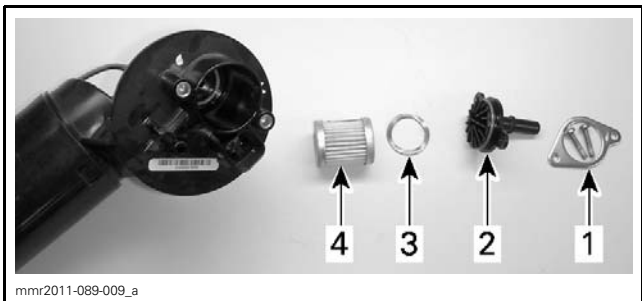


1. This end in first

7. Install remaining filter parts.



1. Wave spring
2. Filter cover
3. Cover retainer with screws (2)



1. Filter cover retainer with screws (2)
2. Filter cover
3. Wave spring
4. Filter element.

5. Install **NEW** O-ring seals on filter cover and in filter housing.

TIGHTENING TORQUE	
Filter cover screw	3 N•m (27 lbf•in)

8. Reconnect fuel pump module (pressure hose and electrical connector), refer to *FUEL PUMP INSTALLATION (600 ACE)* in the *FUEL TANK AND FUEL PUMP* subsection.
9. Carry out a *FUEL SYSTEM PRESSURIZATION AND LEAK TEST* as detailed in the *FUEL TANK AND FUEL PUMP* subsection.
10. Install remaining parts in the reverse order of removal, refer to *FUEL TANK INSTALLATION* in this subsection.

Throttle Body Inspection and Cleaning

Clean throttle plates and throttle body bores using PULLEY FLANGE CLEANER (P/N 413 711 809).

ELECTRICAL SYSTEM

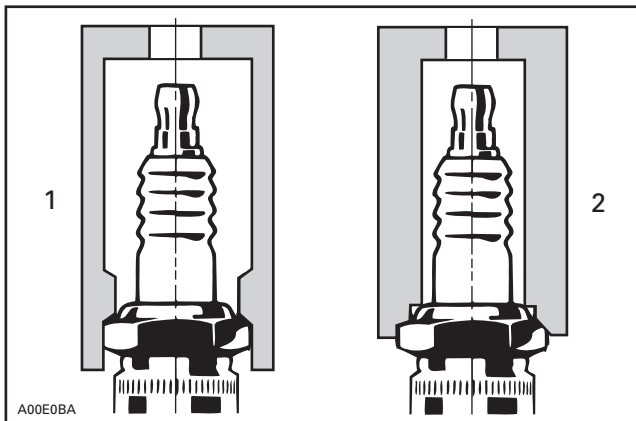
Battery Charging

To charge battery, refer to *CHARGING SYSTEM* subsection.

Spark Plug Inspection and Replacement

Spark Plug Removal

1. Remove ignition coil from spark plug. Refer to *IGNITION SYSTEM* subsection.
2. Using an approved spark plug socket, release the torque applied to the spark plug and unscrew a few turns.



1. Approved socket
2. Improper socket

3. Clean the spark plug and cylinder head with pressurize air.
4. Remove spark plug.

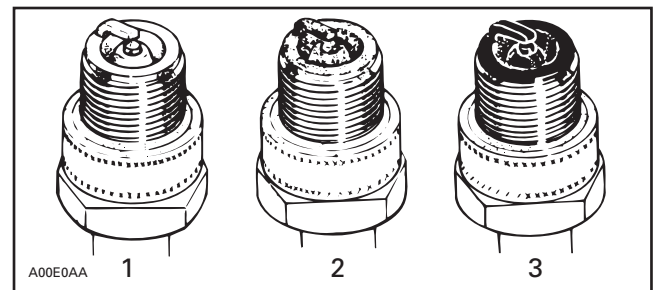
Troubleshooting a Fouled Spark Plug

Fouling of the spark plug is indicated by irregular running or misfiring of the engine, decreased engine speed due to misfiring, reduced performance, and increased fuel consumption.

Other possible causes are: a incorrect or bad fuel, defective ignition system, incorrect spark plug gap, loss of compression, or lubricating oil entering the combustion chamber.

The plug face of a fouled spark plug has either a wet or dry black carbon deposit. Such coatings form a conductive connection between the center electrode and the ground electrode.

Spark Plug Analysis



TYPICAL

1. Overheated (light gray, white)
2. Normal (light brown, brown)
3. Fouled (black, wet or dry, dark deposits, gray, melted coating)

The plug face reveals the condition of the engine, operating condition, method of driving and fuel mixture. For this reason it is advisable to inspect the spark plug at prescribed intervals, examining the plug face (i.e. the part of the plug projecting into the combustion chamber).

Spark Plug Installation

Prior to installation, ensure the contact surfaces of the cylinder head and spark plug are free of grime.

1. Using a wire feeler gauge, check electrode gap as specified in the following chart.

NOTICE Do not adjust gap on this type of spark plug. The adjustment could weaken negative electrodes which may lead to electrode breakage and severe engine damage.

SPARK PLUG	GAP mm (in)	TIGHTENING TORQUE
NGK MR7BI-8	0.7 mm to 0.8 mm (.028 in to .031 in) NOT adjustable	13 N•m (115 lbf•in)

Subsection 03 (PERIODIC MAINTENANCE PROCEDURES)

2. Hand screw spark plug into cylinder head. Then, tighten the spark plug clockwise to specified torque with an approved spark plug socket.
3. Install ignition coil. Refer to *IGNITION SYSTEM* subsection.
4. Complete the installation in the reverse order of the removal.

ELECTRICAL SYSTEM (LIGHTS)

Headlights Beam Aiming Adjustment

Refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.

DRIVE SYSTEM AND BRAKE

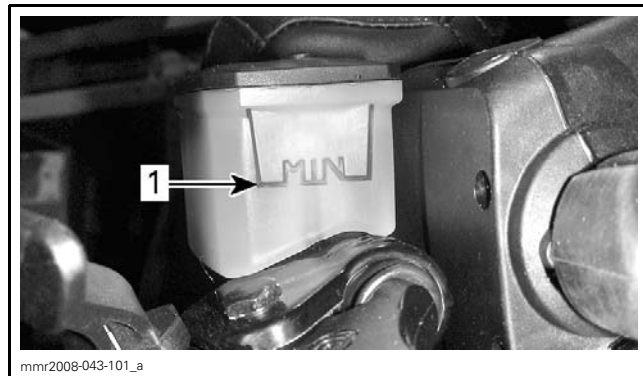
Recommended Brake Fluid

Always use brake fluid meeting the specification DOT 4 such as BRAKE FLUID GTLMA DOT4 (P/N 293 600 131).

Brake Fluid Level Verification

With the vehicle on a level surface, position steering in straight-ahead position to ensure reservoir is level.

Brake fluid must always be above the MIN. line when brake lever is squeezed.



TYPICAL
1. MINIMUM line

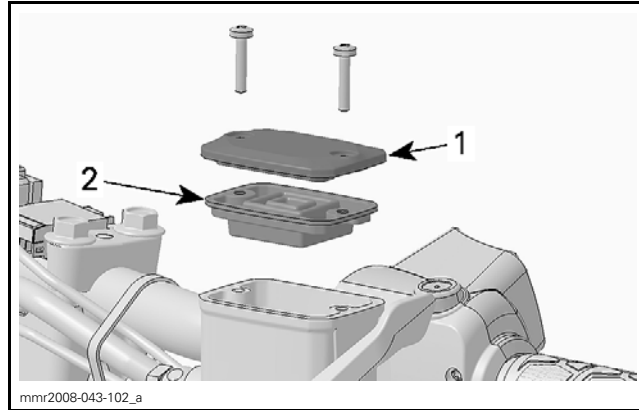
Add fluid as required. Do not overfill.

NOTE: A low level may indicate leaks or worn brake pads.

Brake Fluid Replacement

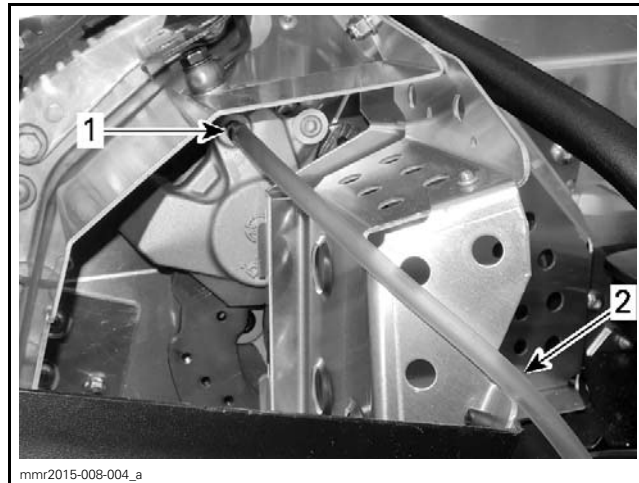
To drain brake fluid, proceed as follows:

1. Place vehicle on a level surface.
2. Remove reservoir cover with its diaphragm.



TYPICAL
1. Reservoir cover
2. Diaphragm

3. Connect a clear hose to caliper bleeder.
4. Place the other end of hose in a container.
5. Loosen bleeder and pump brake lever until no more fluid flows out of bleeder.



TYPICAL
1. Bleeder
2. Clear hose to used brake fluid catch container

To fill brake system when it is empty, proceed as follows:

1. Ensure reservoir cover is removed.
2. Using a large syringe and a suitable tube, inject brake fluid slowly into the caliper.



mmr2015-008-005

TYPICAL

3. Continue to inject brake fluid until master cylinder reservoir is half full.
4. Close bleeder.
5. Fill up reservoir and install cover.
6. Squeeze brake lever.
 - 6.1 If brake lever is firm, bleeding of the brake system is not required. Torque bleeder as specified.

TIGHTENING TORQUE	
Brake caliper bleeder	9 N•m (80 lbf•in)

- 6.2 If brake lever is spongy, refer to *BRAKE SYSTEM BLEEDING* in this subsection.

Brake System Bleeding

1. Install a clear hose on bleeder.
2. Place the other end in a container partially filled with clean brake fluid.
3. Pump up brake system pressure using the brake lever until lever resistance is felt.
4. Squeeze and hold brake lever and open bleeder. When the lever touches the handlebar, do not release it and close the bleeder.
5. Release brake lever slowly.
6. Repeat the procedure until no more air bubbles appear in hose.

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

7. Install cover on reservoir.
8. Squeeze brake lever.

NOTE: If brake lever feels firm; bleeding procedure is complete. Torque bleeder as specified. If brake lever is still spongy; go to step 9

TIGHTENING TORQUE	
Brake caliper bleeder	9 N•m (80 lbf•in)

9. Push back brake pads with caliper still installed and squeeze brake lever.
10. Repeat step 2 to step 5.
11. Torque bleeder as specified.
12. Adjust brake fluid reservoir level.
13. Install diaphragm and cover on reservoir.

Brake Hose, Pads and Disc Inspection

Break-In Inspection

Visually inspect the brake hose for leaks or any damage.

Visually inspect pads and disc for abnormal wear or any damage.

Scheduled Maintenance and Preseason

Visually inspect the brake hose for leaks or any damage.

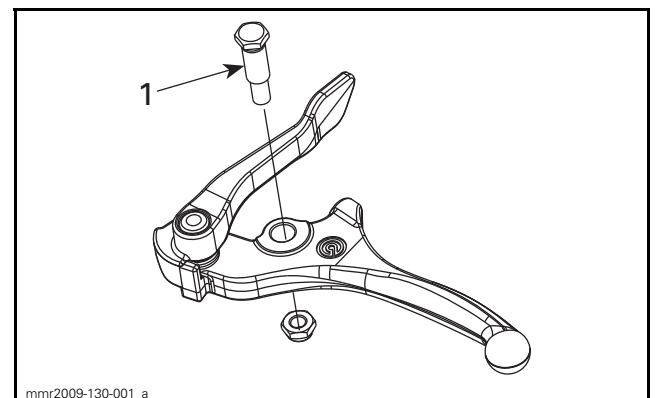
Refer to *BRAKE* subsection and carry out:

- *BRAKE PAD INSPECTION*
- *BRAKE DISC INSPECTION*.

Brake Lever Pivot Lubrication

1. Remove brake lever pivot screw.
2. Lubricate brake lever pivot screw using recommended product.

SERVICE PRODUCT	
Brake lever pivot	XPS SYNTHETIC GREASE (P/N 293 550 010)



mmr2009-130-001_a

1. Lubricate this surface

3. Install brake lever pivot screw.
4. Torque nut on brake lever pivot screw as specified.

Subsection 03 (PERIODIC MAINTENANCE PROCEDURES)

TIGHTENING TORQUE	
Pivot screw brake lever	6 N•m (53 lbf•in)

Drive Belt Inspection

Refer to *DRIVE BELT* subsection.

Drive Pulley Inspection and Cleaning

Refer to *DRIVE PULLEY* subsection.

Drive Pulley Retaining Screw Tightening

Refer to *DRIVE PULLEY* subsection.

Driven Pulley Inspection and Cleaning

Inspect pulley sheaves for dirt, marks or scratches.

Test sliding sheave operation.

Use PULLEY FLANGE CLEANER (P/N 413 711 809) and a clean rag to clean pulley sheaves as necessary.

NOTE: When removing dust on the cam, avoid altering the teflon coating. Use a dry cloth only.

Driven Pulley Spring Preload

Refer to *DRIVEN PULLEY AND COUNTERSHAFT* subsection.

DRIVE SYSTEM (GEARBOX)

Recommended Gearbox Oil

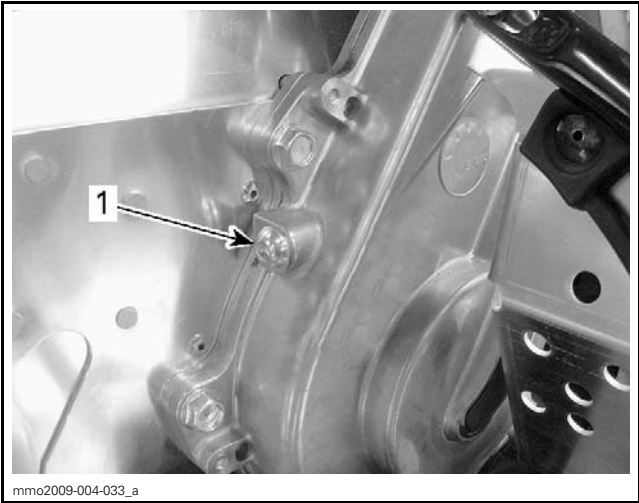
RECOMMENDED GEARBOX OIL
XPS SYNTHETIC GEAR OIL (75W 140) (P/N 293 600 140)

NOTICE The gearbox of this snowmobile has been developed and validated using the XPS™ Synthetic gear oil. BRP strongly recommends the use of its XPS Synthetic gear oil at all times. Damages caused by oil which is not suitable for the gearbox will not be covered by the BRP limited warranty.

Gearbox Oil Level Verification

With the vehicle on a level surface, check the oil level by removing the check plug on the left side of gearbox.

Oil level must reach the threaded hole's lower edge.



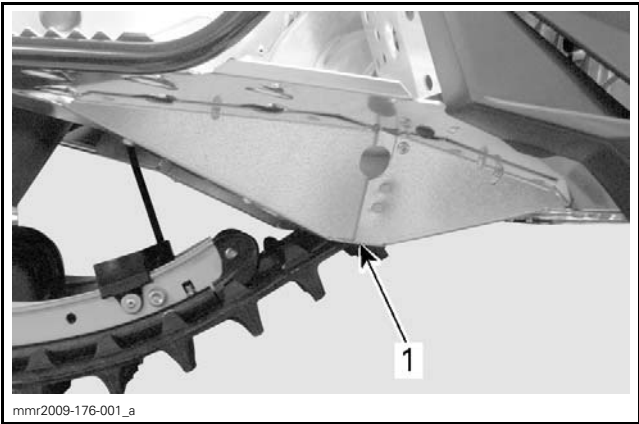
1. Check plug

1. Reinstall check plug and torque to 10 N•m ± 1 N•m (89 lbf•in ± 9 lbf•in).

Gearbox Oil Replacement

Gearbox Oil Draining

1. Place the vehicle on a level surface.
2. Place a drain pan under gearbox drain plug area.
3. Remove filler cap.
4. Remove the drain plug located at the bottom of gearbox.



1. Drain plug access hole

5. Wait a while to allow all oil to drain out of gearbox.
6. Install drain plug and torque to specification.

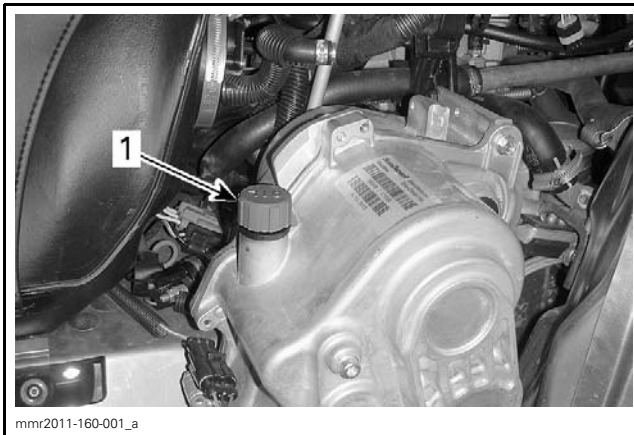
TIGHTENING TORQUE	
Gearbox drain plug	8 N•m (71 lbf•in)

Gearbox Oil Filling

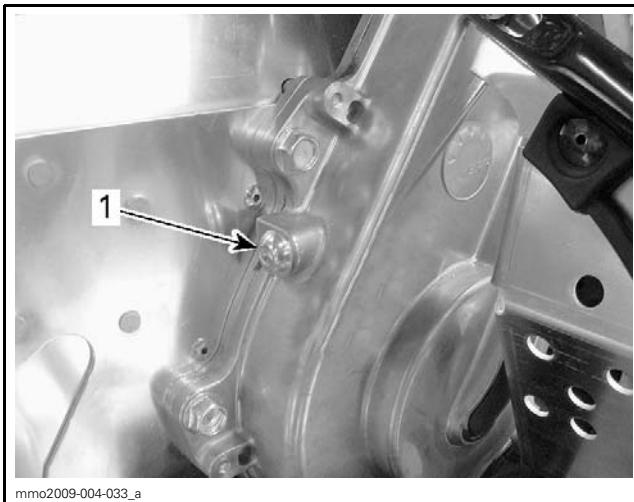
NOTE: Vehicle must be on a level surface.

1. Remove the filler cap.

2. Remove oil level check plug.



1. Filler cap



1. Check plug

3. Pour recommended oil into gearbox through the filler hole.

NOTE: Oil level is correct when it just begins to come out of the check plug orifice.

4. Reinstall check plug and torque to specification.

TIGHTENING TORQUE	
Oil level check plug	10 N•m (89 lbf•in)

DRIVE SYSTEM (TRACK)

Track Adjustment and Alignment

Track tension and alignment are interrelated. Do not adjust one without checking the other. Track tension procedure must be carried out prior to track alignment.

Track Tension Verification

1. Lift rear of vehicle and support it off the ground.
2. Allow rear suspension to fully extend.

3. Preset the TENSIO METER (P/N 414 348 200) as specified in the following table.



TRACK TENSIO METER PRESETTING	
DEFLECTION O-RING (BOTTOM)	LOAD O-RING (TOP)
4.5 cm (1.772 in)	0 kgf (0 lbf)

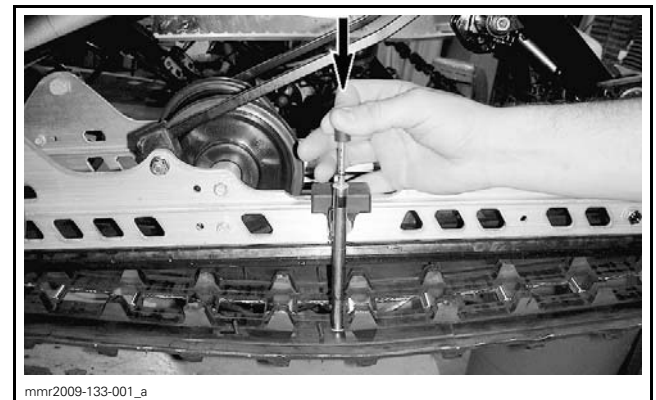


DEFLECTION SETTING

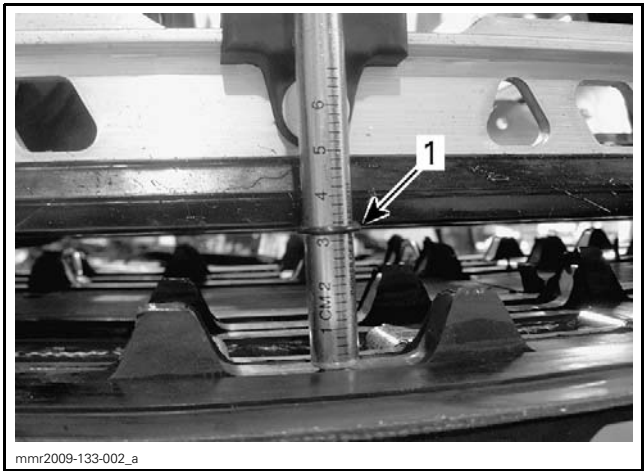
1. Bottom O-ring

4. Position the tensiometer on track, halfway between front and rear idler wheels.

5. Push the tensiometer downwards until bottom O-ring (deflection) be aligned with the bottom of slider shoe.



Subsection 03 (PERIODIC MAINTENANCE PROCEDURES)



1. Deflection O-ring aligned with slider shoe

6. Read load recorded by the upper O-ring on the tensiometer.



LOAD READING
1. Upper O-ring

Load reading must be as per the following table.

TRACK ADJUSTMENT SPECIFICATION	
TRACK DEFLECTION SETTING	4.5 cm (1-9/16 in)
TRACK LOAD READING	6.0 kgf to 8.5 kgf (13 lbf to 19 lbf)

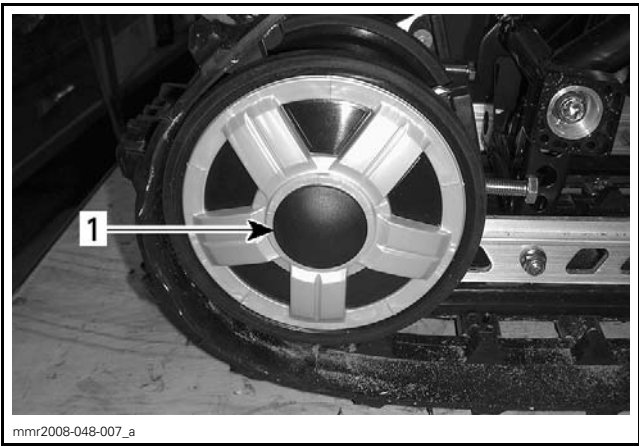
7. If load reading is not in accordance with the specification, adjust track tension. Refer to *TRACK TENSION ADJUSTMENT*.

NOTICE Too much tension will result in power loss and excessive stresses on suspension components.

Track Tension Adjustment

NOTE: After track tension adjustment, ride the snowmobile in snow for 15 to 20 minutes and recheck track tension.

1. Lift rear of vehicle and support it off the ground.
2. Remove rear idler wheel caps.



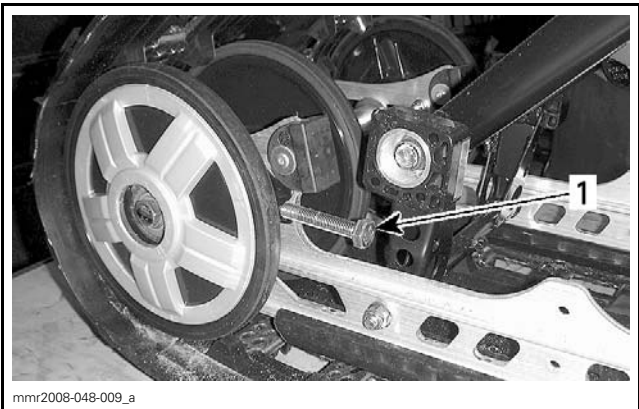
TYPICAL
1. RH rear idler wheel cap

3. Loosen rear axle screws (one each side).



TYPICAL
1. RH rear axle screw

4. Tighten or loosen both adjustment screws to increase or decrease track tension.



TYPICAL
1. RH adjustment screw

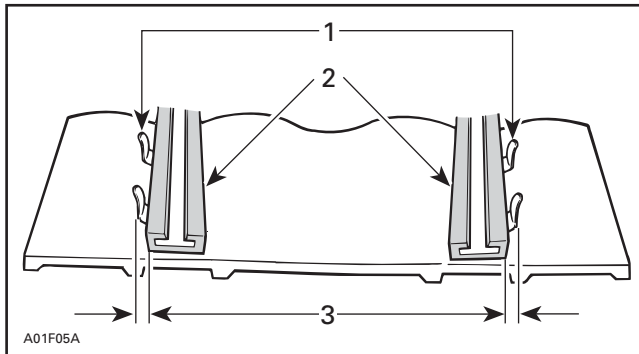
5. Verify track tension, refer to *TRACK TENSION VERIFICATION* in this subsection.

Track Alignment

⚠ WARNING

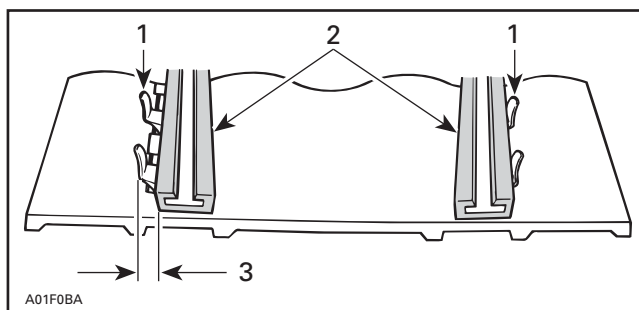
Before checking track alignment, ensure that the track is free of all particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure no one is standing in close proximity to the vehicle. Never rotate at high speed.

1. Start engine and accelerate slightly until the track barely turns. This must be done in a short period of time (1 to 2 minutes).
2. Ensure the track is well centered; equal distance on both sides between edges of track guides and slider shoes.



1. Guides
2. Slider shoes
3. Equal distance

3. To correct track alignment:
 - 3.1 Stop engine.
 - 3.2 Loosen rear wheel screws.
 - 3.3 Tighten adjustment screw on side where the slider shoe is the farthest from the track inset guides.



1. Track guides
2. Slider shoes
3. Tighten on this side

4. Restart engine.
5. Rotate track slowly and recheck alignment.

6. If satisfactory alignment is achieved:

- 6.1 Tighten idler wheel retaining screws.

TIGHTENING TORQUE	
Idler wheel screw	48 N•m (35 lbf•ft)

- 6.2 Reinstall wheel caps.

CHASSIS (SUSPENSION)

Front Suspension Inspection

Visually inspect front suspension for tightness of components:

- Arms
- Stabilizer bar
- Shock absorbers
- Ball joints.

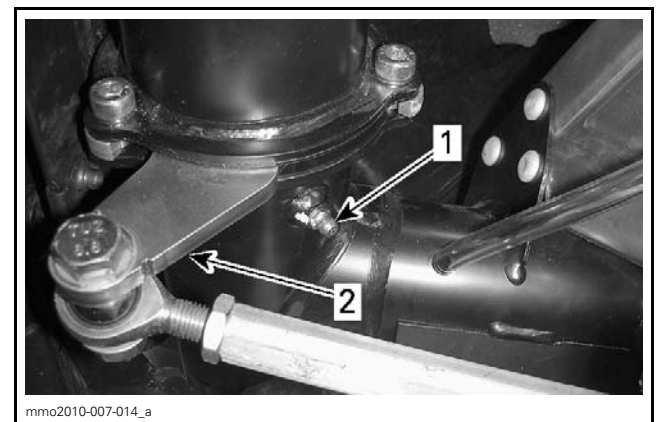
Front Suspension Lubrication (Skandic Models)

Lubricate front suspension at grease fittings using recommended product.

SERVICE PRODUCT	
Front suspension	SUSPENSION GREASE (P/N 293 550 033)

Generally, 4 to 5 grease gun strokes is sufficient.

NOTE: If too much grease is injected, the overflow will come out at steering levers and ski legs. Wipe off any excess of grease to avoid contact with other parts.



LH SIDE SHOWN

1. Grease fitting
2. Steering arm

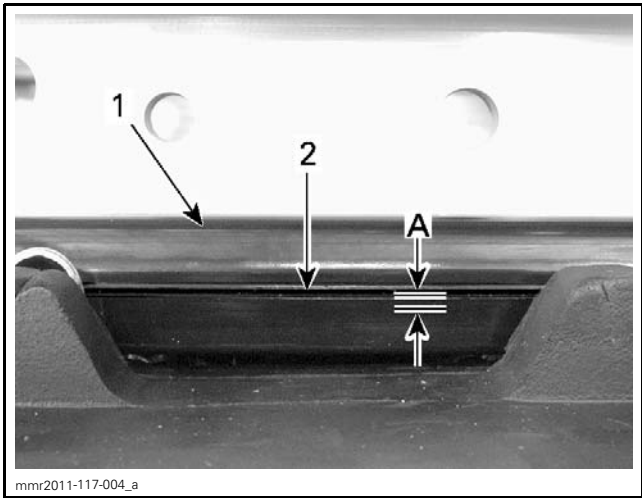
Rear Suspension, Stopper Straps and Slider Shoes Inspection

Rear Suspension Mechanism and Stopper Straps Inspection

- 1. Inspect rear suspension components for wear, deterioration or damage, replace defective parts if necessary.
- 2. Inspect stopper straps for wear or cracks.
- 3. Check bolt and nut securing straps for tightness. If loose, inspect strap holes for deformation. Replace strap if necessary.

Slider Shoe Inspection

Slider shoes are worn out and must be replaced when there is just 1 mm to 2 mm (.04 in to .08 in) of remaining material exceeding the molding line.



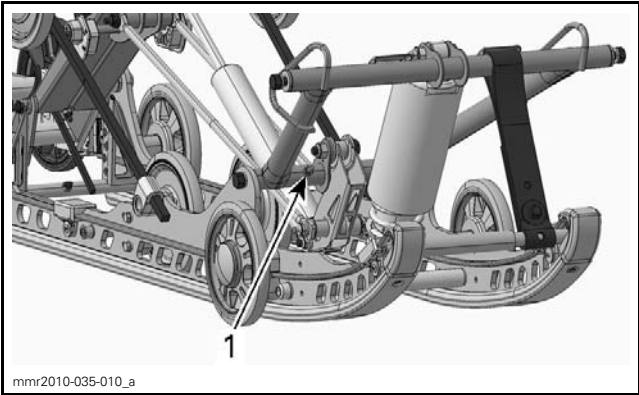
- 1. Slider shoe
- 2. Molding line
- A. Minimum thickness: 1 mm to 2 mm (.04 in to .08 in)

NOTICE Slider shoes must always be replaced in pairs.

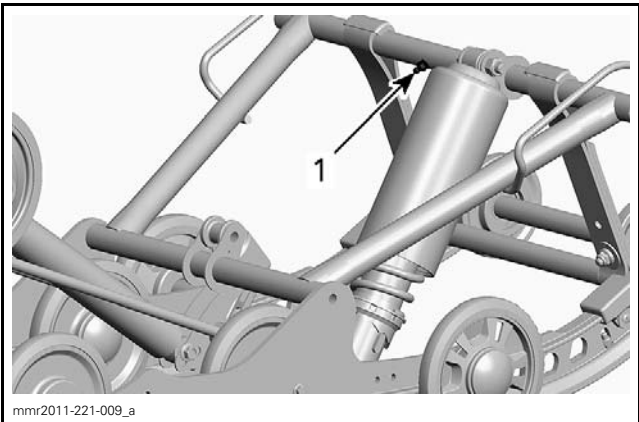
Rear Suspension Lubrication

Lubricate the following suspension pivots at grease fittings using recommended product.

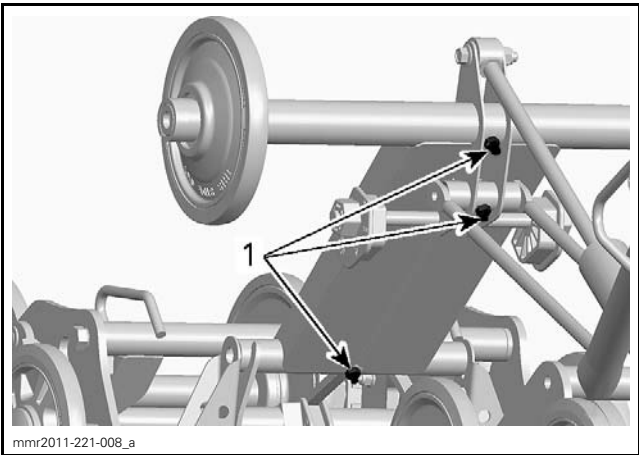
SERVICE PRODUCT	
Rear suspension	SUSPENSION GREASE (P/N 293 550 033)



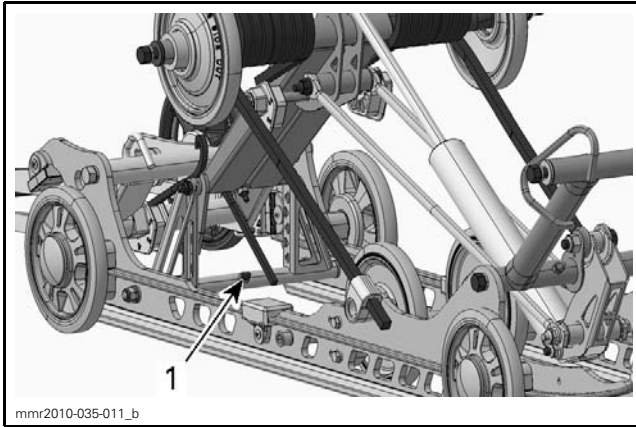
FRONT ARM - LOWER SHAFT
1. Grease fitting



FRONT ARM - UPPER SHAFT
1. Grease fitting

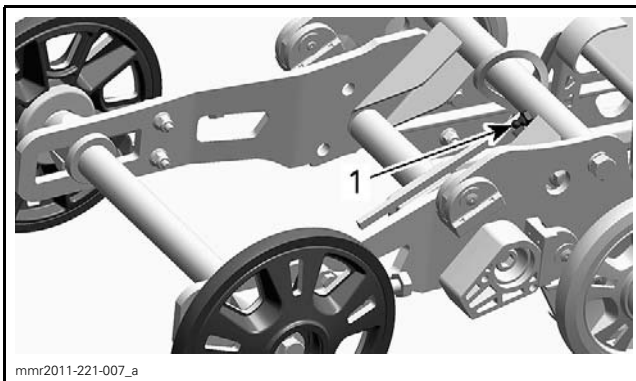


REAR ARM
1. Grease fitting



PIVOT ARM

1. Grease fitting



REAR EXTENSION

1. Grease fitting

CHASSIS (STEERING)

Ski and Runner Inspection

Lift the front of vehicle and check ski runners for wear or damage (missing or broken carbide). Replace if necessary.

Inspect ski for excessive wear or other damage. Replace if necessary.

Steering Mechanism Inspection

Visually inspect steering mechanism for tightness of components (steering arms, tie rods, ski bolts, ski legs, etc.).

STORAGE PROCEDURE

SERVICE PRODUCTS

Description	Part Number	Page
BRP HEAVY DUTY CLEANER	293 110 001	2
CLEANER AND DEGREASER PRO C1	779262	2
CLUTCH AND PULLEY FLANGE CLEANER PRO S1	779244	2
FUEL STABILIZER (EUR)	779183	1
FUEL STABILIZER	779171	1
LUB. & ANTI-CORROSIVE	779168	2
LUBRICANT AND ANTI-CORROSIVE (EUR)	779224	2
OIL STORAGE (EUR) (619590094)	779225	1
OIL STORAGE (EXCEPT USA)	779173	1
OIL STORAGE (USA)	779182	1
PULLEY FLANGE CLEANER (F)	619 600 022	2

GENERAL

If the vehicle is not used or is to be stored for an extended period of time, more than 4 months, be sure to perform the storage procedures described below.

Where applicable, refer to the appropriate subsections in this manual for the required tasks outlined in these procedures.

PROCEDURES

To facilitate the inspection and ensure adequate lubrication of components, it is recommended to clean the entire vehicle. Refer to *VEHICLE CLEANING* in this subsection.

FUEL SYSTEM

Fuel System Protection

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

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

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

Pour fuel stabilizer in fuel tank. Fill up fuel tank.

ENGINE

Engine Internal Lubrication

Engine internal parts must be lubricated to protect them from rust formation during the storage period.

Proceed as follows:

1. Remove spark plugs, refer to *IGNITION COILS AND SPARK PLUGS* subsection.
2. Spray storage oil into each cylinder.

NOTE: Use the storage oil as per country availability.

COUNTRY	SERVICE PRODUCT
Scandinavia	OIL STORAGE (EUR) (619590094) (P/N 779225)
USA	OIL STORAGE (USA) (P/N 779182)
All other countries	OIL STORAGE (EXCEPT USA) (P/N 779173)

3. Press start button, 1 or 2 seconds maximum, to lubricate cylinders.
4. Reinstall the spark plugs.

NOTE: Do not run engine during storage period.

Exhaust System

Block muffler outlet with a rag.

CVT Protection

Remove drive belt. Refer to *DRIVE BELT* subsection.

Subsection XX (STORAGE PROCEDURE)

Inspect and clean pulleys.

COUNTRY	SERVICE PRODUCT
Scandinavia	PULLEY FLANGE CLEANER (F) (P/N 619 600 022)
All other countries	CLUTCH AND PULLEY FLANGE CLEANER PRO S1 (P/N 779244)

Protect pulley faces with anti-corrosive lubricant.

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

NOTE: Do not reinstall drive belt.

ELECTRICAL SYSTEM

Removing the Battery

Remove the battery.

Charge and store battery as per battery manufacturers instructions.

CHASSIS

Lubricating the Suspension

Inspect front suspensions Refer to *FRONT SUSPENSION* subsection.

Inspect and lubricate rear suspension. Refer to *REAR SUSPENSION* subsection.

Track

Lift the rear of vehicle until track is clear of the ground.

Do not release track tension.

Cleaning the Vehicle

Wash and dry the vehicle.

NOTICE Never use a high pressure washer to clean the vehicle. USE LOW PRESSURE ONLY (like a garden hose). The high pressure can cause electrical or mechanical damages.

Remove any dirt or rust.

To clean the vinyl or plastic parts, use only flannel clothes with degreaser.

SERVICE PRODUCT
CLEANER AND DEGREASER PRO C1 (P/N 779262)

NOTICE It is necessary to use flannel cloths on plastic parts to avoid damaging surfaces. Never clean plastic parts with strong detergent, degreasing agent, paint thinner, acetone, products containing chlorine, etc.

To clean the entire vehicle, including metallic parts use BRP cleaner.

SERVICE PRODUCT
BRP HEAVY DUTY CLEANER (P/N 293 110 001)

Inspect the vehicle and repair any damage. Touch up all metal spots where paint has been scratched off. Spray all metal parts with anti-corrosive lubricant.

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

Vehicle Protection

Protect the vehicle with a cover to prevent dust accumulation during storage.

NOTICE The vehicle has to be stored in a cool and dry place and covered with an opaque tarpaulin. This will prevent sun rays and grime from affecting plastic components and vehicle finish.

PRESEASON PREPARATION

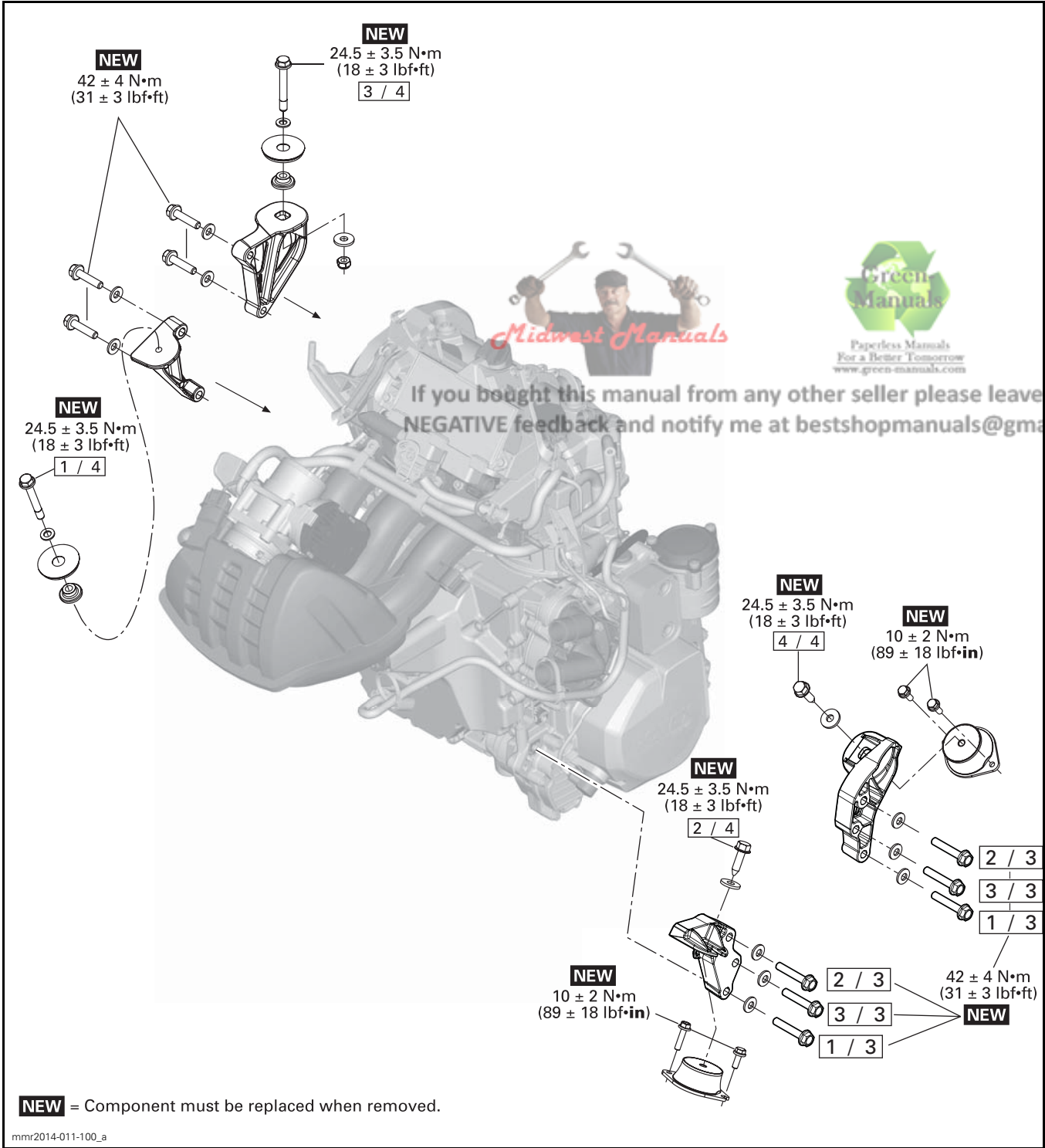
Proper vehicle preparation is necessary when a vehicle has not been used for more than three months. Using the *MAINTENANCE SCHEDULE*, perform the items titled *EVERY YEAR AT PRESEASON*.

ENGINE REMOVAL AND INSTALLATION

SERVICE TOOLS

Description	Part Number	Page
CLUTCH PULLER	529 036 275	6
ENGINE LIFTING TOOL	529 036 217	6
FUEL HOSE DISCONNECT TOOL	529 036 037	5

Subsection 01 (ENGINE REMOVAL AND INSTALLATION)



GENERAL

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

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

⚠ WARNING

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

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

PROCEDURES

ENGINE

Engine Removal

Place vehicle on a workstation equipped with an engine-lifting hoist.

1. Refer to appropriate subsection and remove:

REV-XR Models

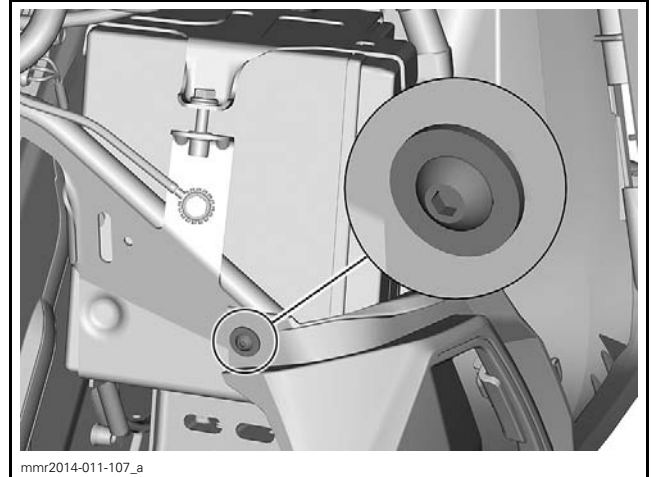
- Side panels
- Hood
- Upper bottom pans
- Console
- Air intake silencer and gauge support assembly.

REV-XS Models

- Side panels
- Upper body module and its support
- Bottom pan cover
- Rear console.

All Models

2. Remove the seat.
3. Move fuel tank rearward without removing it. Refer to *FUEL TANK AND FUEL PUMP* subsection.
4. Remove rear upper screw on RH side bottom pan panel.

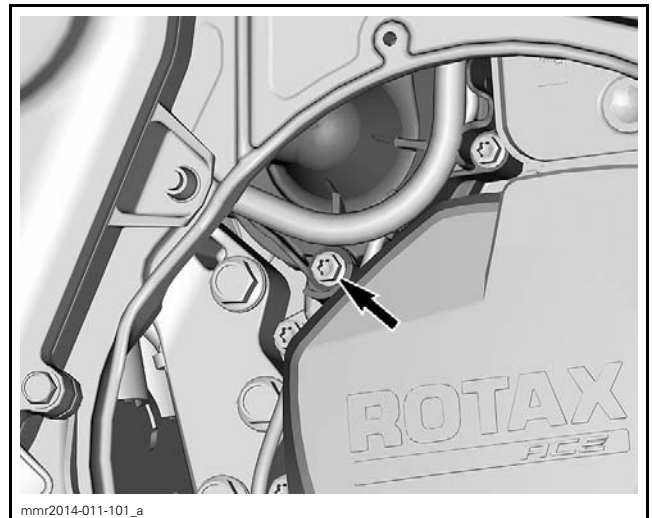


REV-XS ONLY

5. Disconnect black (–) cable from battery.

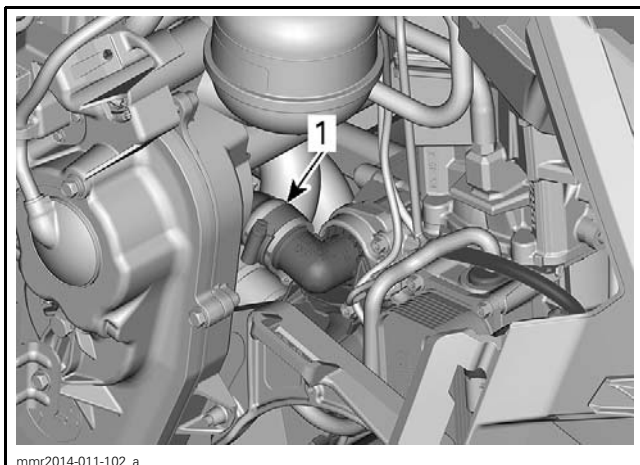
MAG Side Operations

1. Remove breather hose from coolant reservoir. Discard Oetiker clamp.
2. Refer to *EXHAUST SYSTEM* subsection and remove:
 - Muffler
 - Exhaust pipes
 - Exhaust manifold.
3. Drain engine coolant by unscrewing lower screw of water pump.



4. Disconnect outlet hose from thermostat housing.

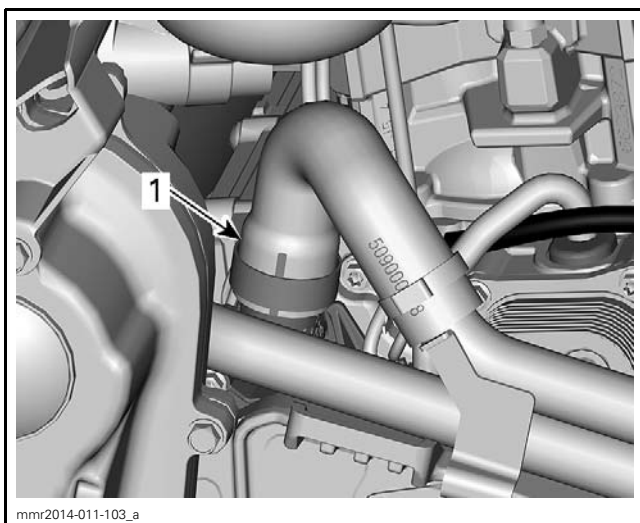
Subsection 01 (ENGINE REMOVAL AND INSTALLATION)



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EXCEPT AIR RADIATOR EQUIPPED MODEL

1. Thermostat housing outlet hose

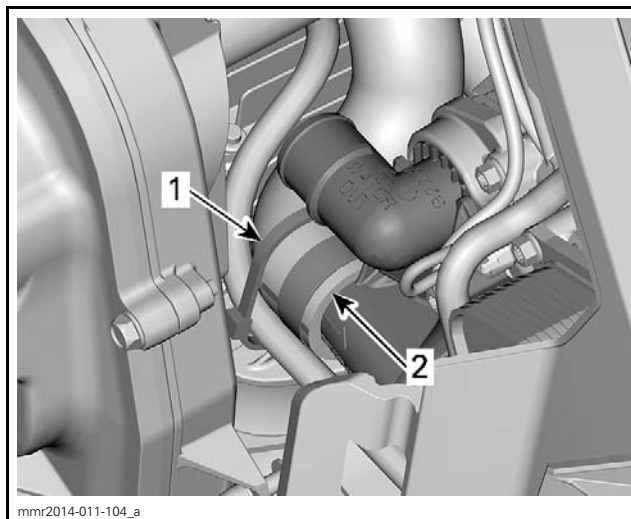


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AIR RADIATOR EQUIPPED MODEL

1. Thermostat housing outlet hose

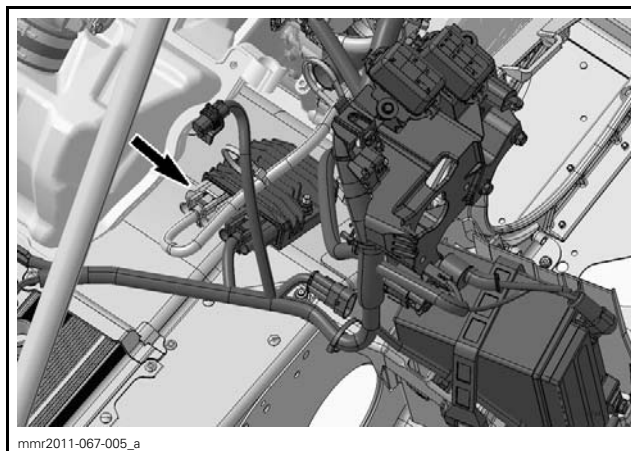
5. Remove locking tie on water pump inlet hose.
6. Disconnect coolant inlet hose from water pump.



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RH FRAME MEMBER REMOVED FOR CLARITY

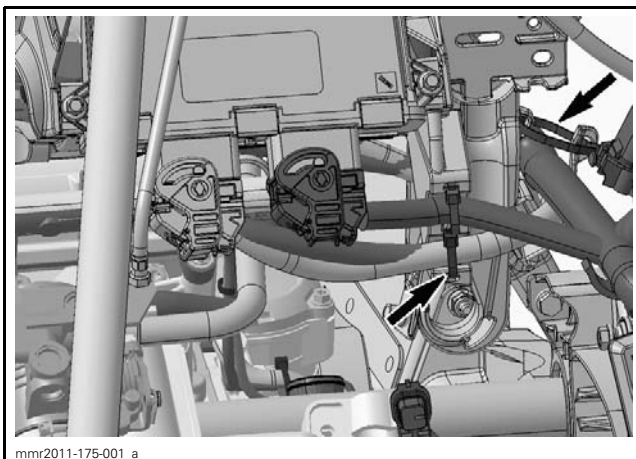
1. Locking tie
 2. Water pump inlet hose
7. Remove locking tie securing magneto connector wires.
 8. Disconnect magneto connector from voltage regulator.



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SOME PARTS REMOVED FOR CLARITY PURPOSE

9. Remove locking ties securing harness of ECM connector A to ECM support.



TYPICAL - SOME PARTS REMOVED FOR CLARITY PURPOSE

10. Disconnect both ECM connector from ECM.



Refer to *CONNECTOR INFORMATION* subsection in 2013 REV-XS / REV-XM shop manual (P/N 219 100 731).

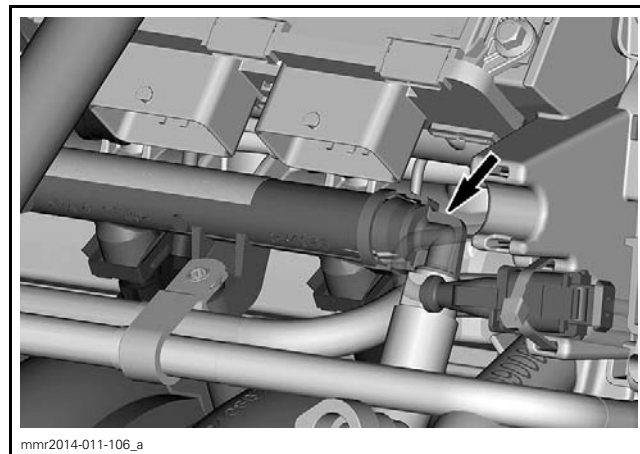
11. Disconnect engine harness connector located in front of ECM support.



12. Disconnect fuel hose from fuel rail using the FUEL HOSE DISCONNECT TOOL (P/N 529 036 037).



NOTE: Wrap a rag around fuel hose end to catch leakage.



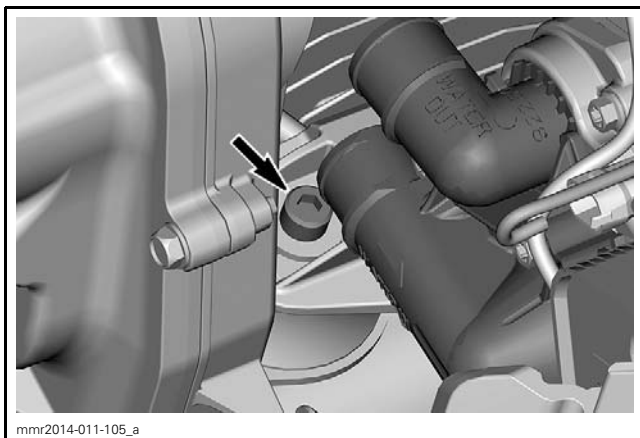
CAUTION Wipe out any fuel leakage.

13. Disconnect blow-by hose from valve cover.

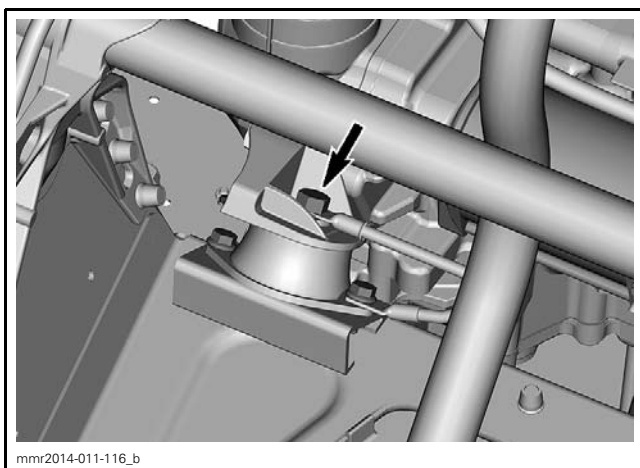


14. Remove screw securing rear MAG rubber mount to engine support.

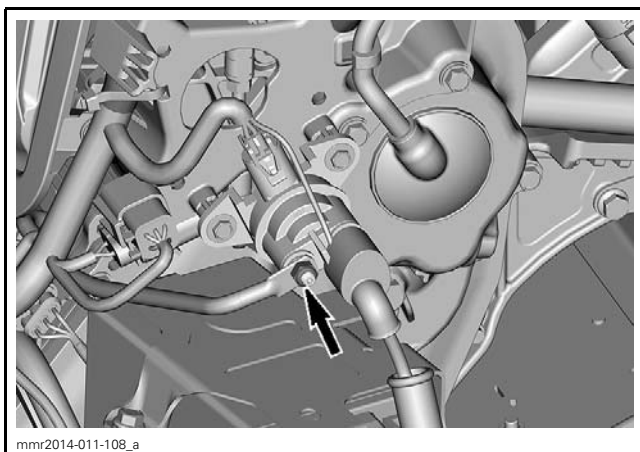
Subsection 01 (ENGINE REMOVAL AND INSTALLATION)



15. Remove screw securing front MAG rubber mount to engine support.



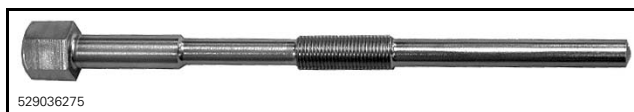
16. Disconnect starter cable from solenoid.



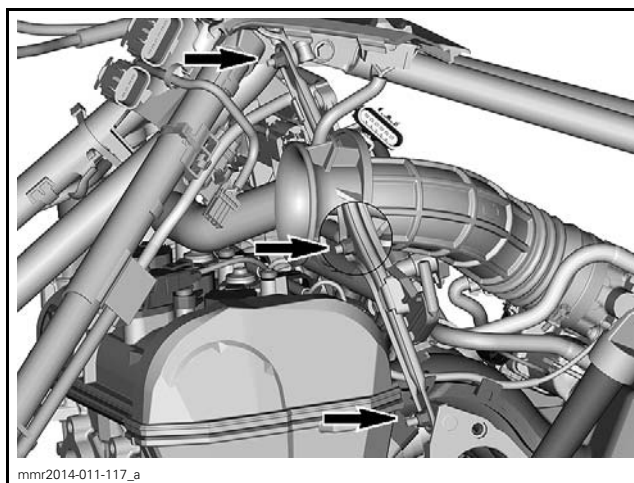
PTO Side Operations

1. Refer to *DRIVE SYSTEM* section and remove:
- Drive pulley
 - Driven pulley
 - Countershaft.

NOTE: Use the new CLUTCH PULLER (P/N 529 036 275) to remove the drive pulley on this engine.

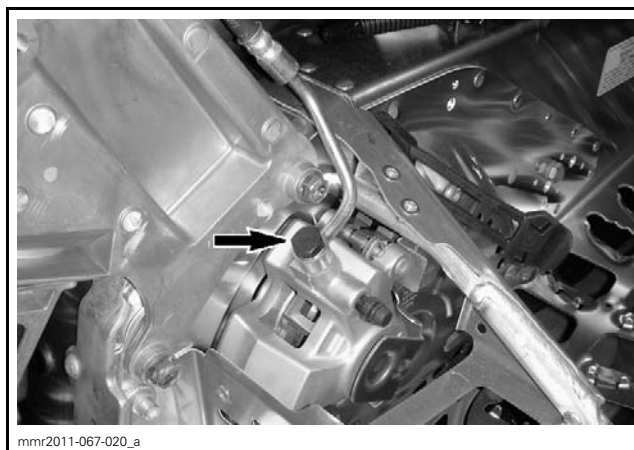


2. Remove LH side upper column support.

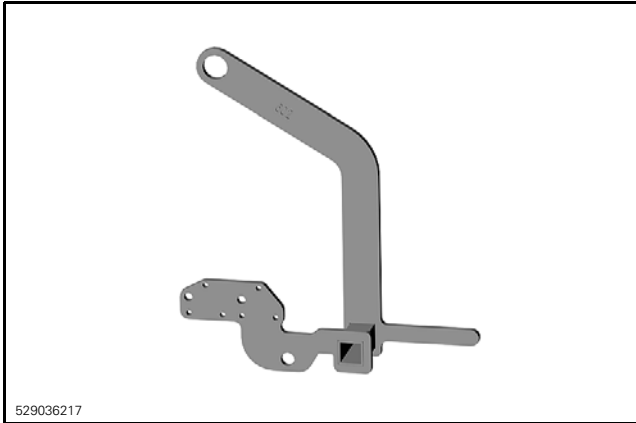


RETAINING SCREWS

3. Remove brake hose from brake caliper and discard sealing washers.

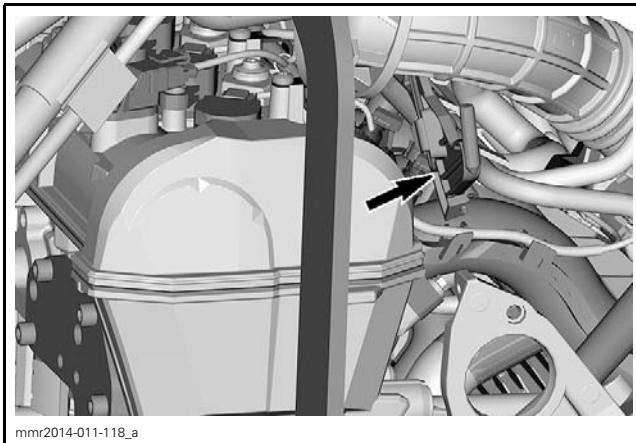


4. Install the ENGINE LIFTING TOOL (P/N 529 036 217) instead of exhaust manifold.



5. Secure lifting tool using exhaust manifold screws.
6. **Slightly** lift engine.
7. Remove countershaft bearing support. Refer to *DRIVEN PULLEY AND COUNTERSHAFT* subsection.

NOTICE Move ECM support rearward to avoid to damage fuel rail during engine removal.



8. Lift engine then slide it out of vehicle.

NOTICE Make sure the starter cable is moving out freely from behind the chaincase.

Engine Installation

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

Install **NEW** self-locking screws where required, refer to exploded view at the beginning of this subsection.

Refill and bleed brake system. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

Tighten Banjo fitting on brake caliper with **NEW** sealing washers. Refer to *BRAKE* subsection for tightening torque.

TIGHTENING TORQUE

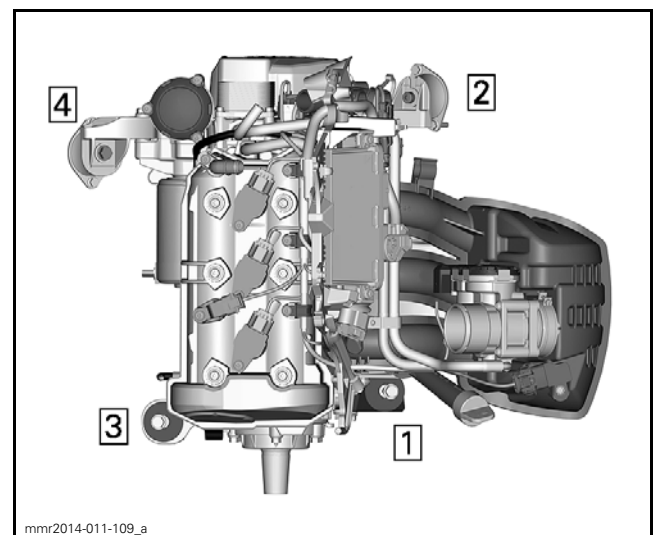
Banjo Fitting	35 N•m (26 lbf•ft)
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Properly tighten countershaft bearing support. Refer to *DRIVEN PULLEY* subsection for tightening sequence.

Tighten engine rubber mount screws to specification as per the following sequence.

TIGHTENING TORQUE

Engine rubber mount screws (M8)	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)
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TIGHTENING SEQUENCE

ENGINE SUPPORTS

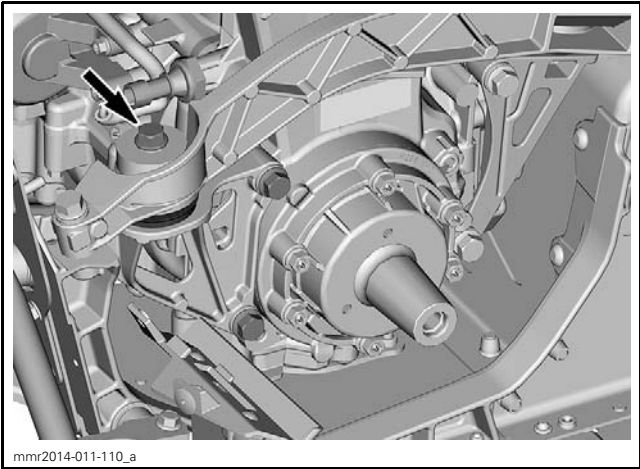
Engine Support Inspection

Check if engine supports are cracked, bent or damaged. Replace if necessary.

Front Engine Support Replacement (PTO Side)

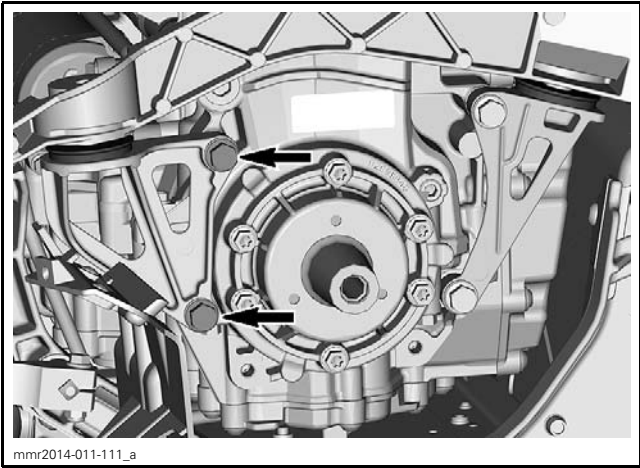
1. Remove body parts and components as required to access to the engine support.
2. Remove and discard bolt securing rubber mount to engine support.

Subsection 01 (ENGINE REMOVAL AND INSTALLATION)



SOME PARTS REMOVED FOR CLARITY PURPOSE

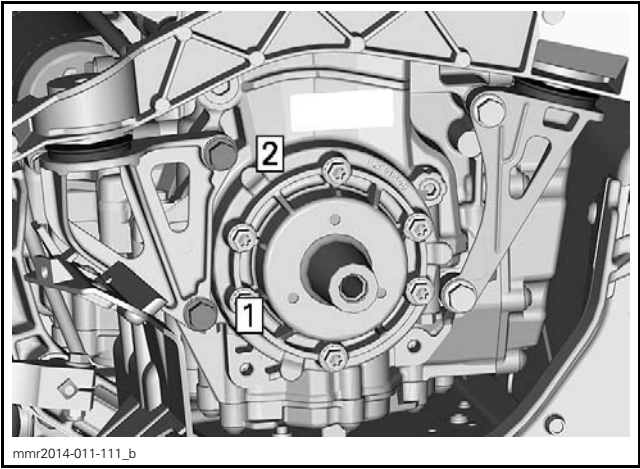
3. Remove and discard screws securing engine to engine support.



SOME PARTS REMOVED FOR CLARITY PURPOSE

4. Replace engine support.
5. Install **NEW** screws to secure engine support on engine.
6. Tighten engine support screws to specification as per the following sequence.

TIGHTENING TORQUE	
Engine support screws	42 N•m ± 4 N•m (31 lbf•ft ± 3 lbf•ft)

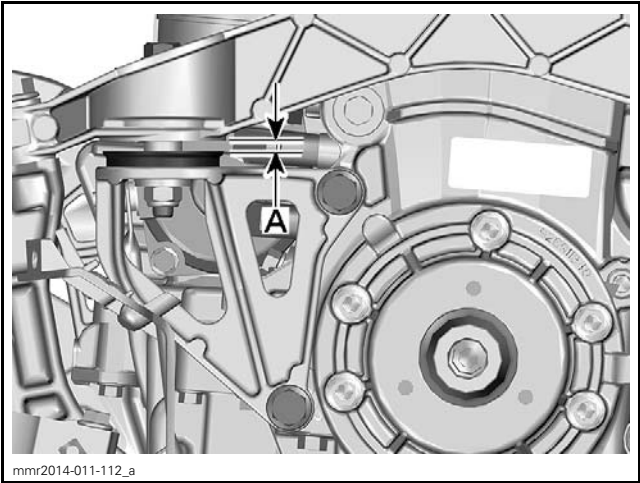


TIGHTENING SEQUENCE

7. Install **NEW** bolt to secure engine rubber mount on engine support.
8. Tighten engine rubber mount screw to specification.

TIGHTENING TORQUE	
Engine rubber mount screws (M8)	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

NOTE: It is normal that a gap (4 mm (5/32 in)) is visible between engine stopper and countershaft bearing support. This gap will allow engine to move and reduce vibration.



A. Normal gap

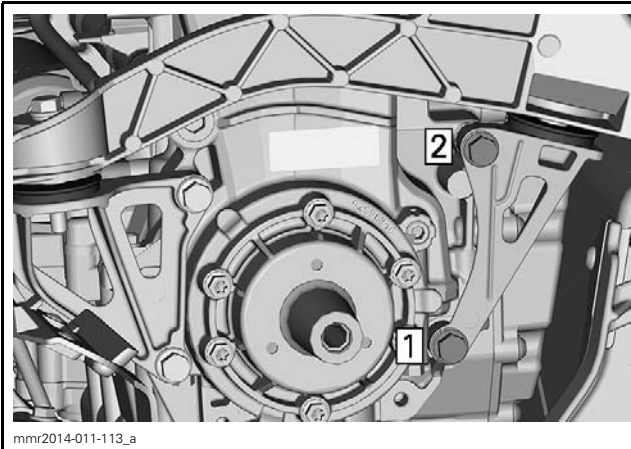
9. Install body parts and components as the reverse of removal procedure.

Rear Engine Support Replacement (PTO Side)

To replace rear engine support, refer to *FRONT ENGINE SUPPORT REPLACEMENT (PTO SIDE)*. However pay attention to the following.

Tighten engine support screws to specification as per the following sequence.

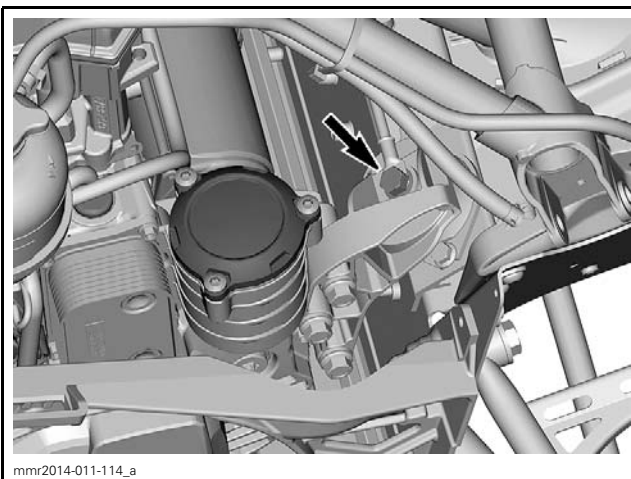
TIGHTENING TORQUE	
Engine support screws	42 N•m ± 4 N•m (31 lbf•ft ± 3 lbf•ft)



TIGHTENING SEQUENCE

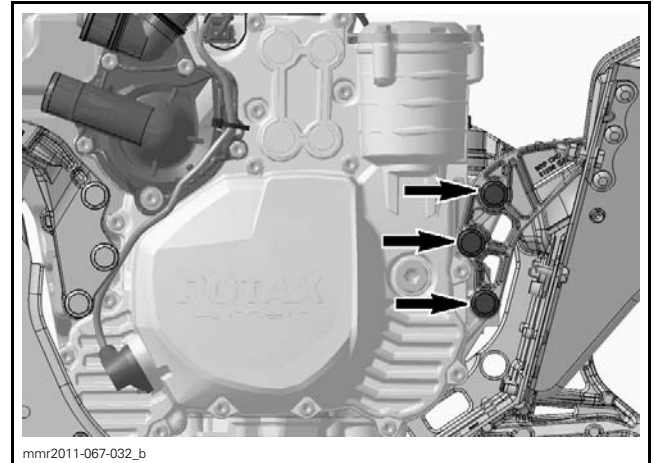
Front Engine Support Replacement (MAG Side)

1. Remove body parts and components as required to access to the engine support.
2. Remove and discard screw securing rubber mount to engine support.



SOME PARTS REMOVED FOR CLARITY PURPOSE

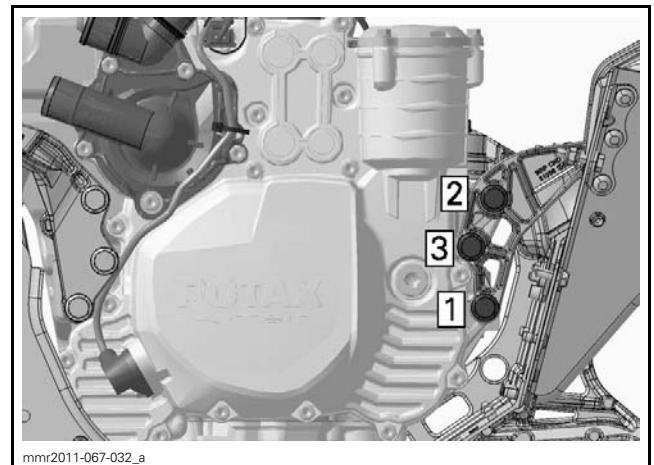
3. Remove and discard screws securing engine to engine support.



SOME PARTS REMOVED FOR CLARITY PURPOSE

4. Replace engine support.
5. Install **NEW** screws to secure engine support on engine.
6. Tighten engine support screws to specification as per the following sequence.

TIGHTENING TORQUE	
Engine support screws	42 N•m ± 4 N•m (31 lbf•ft ± 3 lbf•ft)



TIGHTENING SEQUENCE

7. Install **NEW** screw to secure engine rubber mount on engine support.
8. Tighten engine rubber mount screw to specification.

TIGHTENING TORQUE	
Engine rubber mount screws (M8)	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

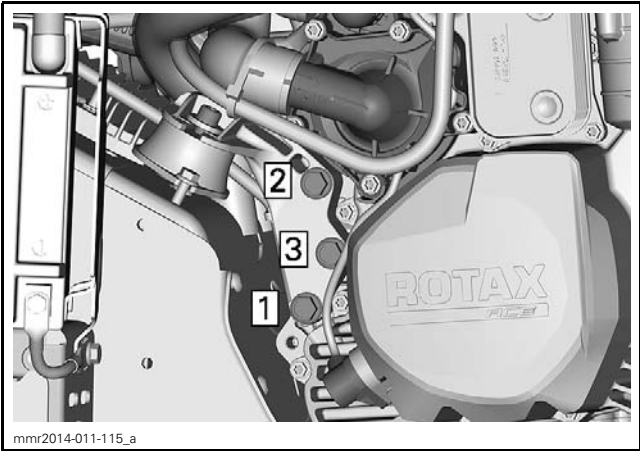
9. Install body parts and components as the reverse of removal procedure.

Rear Engine Support Replacement (MAG Side)

To replace rear engine support, refer to *FRONT ENGINE SUPPORT REPLACEMENT (MAG SIDE)*. However pay attention to the following.

Tighten engine support screws to specification as per the following sequence.

TIGHTENING TORQUE	
Engine support screws	42 N•m ± 4 N•m (31 lbf•ft ± 3 lbf•ft)



TIGHTENING SEQUENCE

ENGINE RUBBER MOUNTS

Engine Rubber Mount Inspection

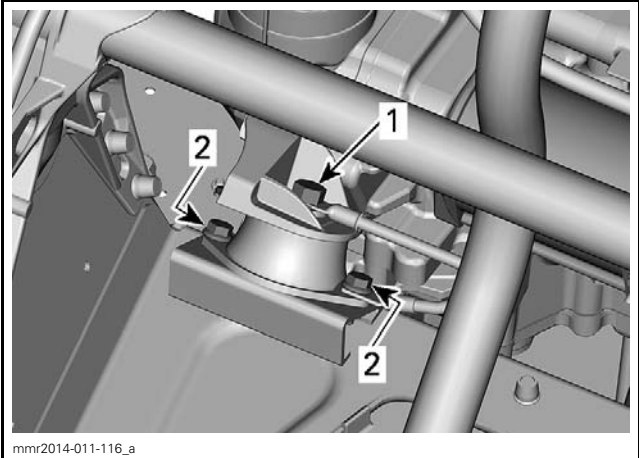
Check rubber mounts. Replace them if brittle, cracked or damaged.

Front and Rear Engine Rubber Mount Replacement (PTO Side)

1. Remove countershaft bearing support. Refer to *DRIVEN PULLEY* subsection.
2. Replace engine rubber mount.
3. Install countershaft bearing support. Refer to *DRIVEN PULLEY* subsection.

Front and Rear Engine Rubber Mount Replacement (MAG Side)

1. Remove body parts and components as required to access to the engine rubber mount.
2. Remove and discard screw securing rubber mount to engine support.
3. Remove and discard screws securing rubber mount to frame.



TYPICAL - FRONT ENGINE RUBBER MOUNT SHOWN
1. Screw securing rubber mount to engine support (M8)
2. Screws securing rubber mount to frame (M6)

4. Replace engine rubber mount.
5. Install **NEW** screws to secure engine rubber mount.
6. Tighten engine rubber mount screws to specification.

TIGHTENING TORQUE	
Engine rubber mount screws (M8)	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

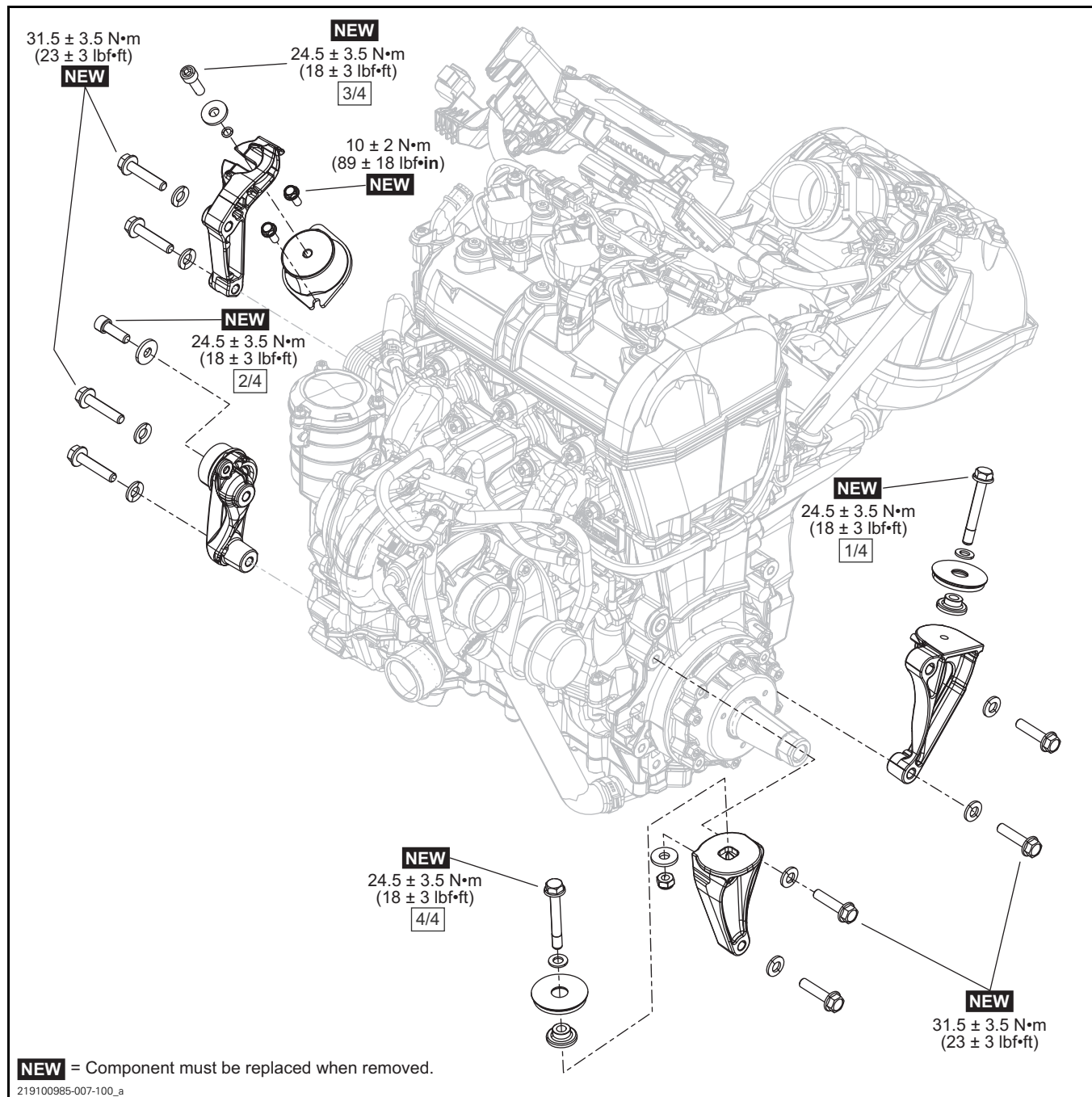
TIGHTENING TORQUE	
Engine rubber mount screws (M6)	10 N•m ± 2 N•m (89 lbf•in ± 18 lbf•in)

7. Install body parts and components as the reverse of removal procedure.

ENGINE REMOVAL AND INSTALLATION

SERVICE TOOLS

Description	Part Number	Page
ENGINE LIFTING TOOL	529 036 217	5
FUEL HOSE DISCONNECT TOOL	529 036 037	3



GENERAL

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

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

WARNING

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

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

PROCEDURES

ENGINE

Removing the Engine

Place vehicle on a workstation equipped with an engine-lifting hoist.

1. Remove fuel pressure. Refer to *ELECTRIC FUEL PUMP* in *FUEL TANK AND FUEL PUMP* subsection.
2. Disconnect the battery.

NOTICE Always disconnect BLACK (-) cable first, then the RED (+) cable.

3. Refer to appropriate subsection and remove:
 - Upper body module
 - LH bottom pan
4. Drain coolant. Refer to *COOLING SYSTEM - VEHICLE COMPONENT* subsection.

Without Turbocharger

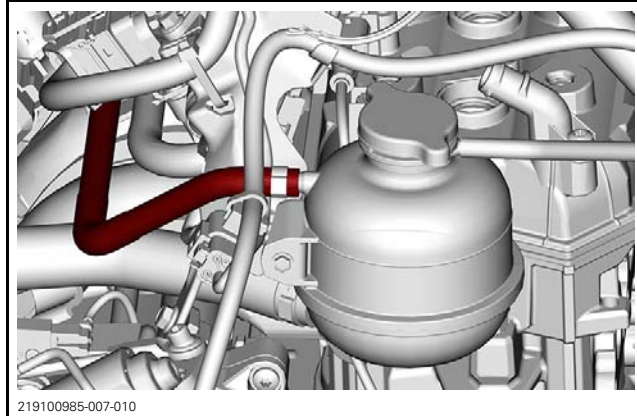
5. Remove the exhaust manifold. Refer to *EXHAUST SYSTEM* subsection.

With Turbocharger

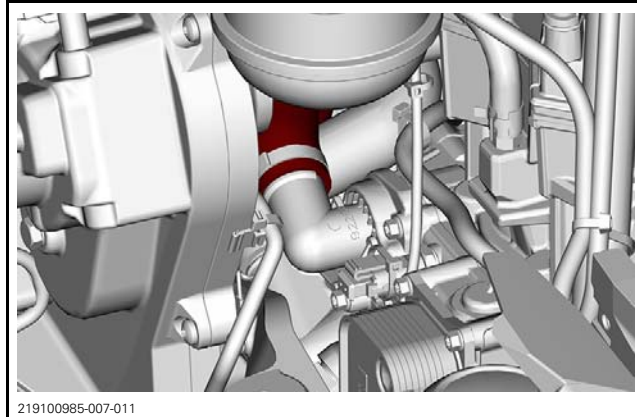
6. Remove the Turbocharger. Refer to *TURBOCHARGER* subsection.

MAG Side Operations

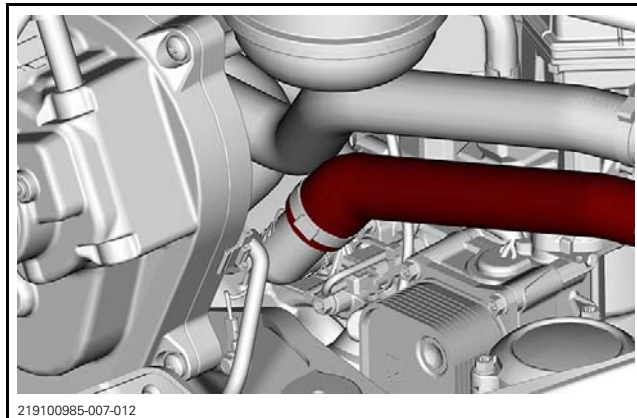
1. Disconnect throttle body coolant return hose from coolant reservoir. Discard Oetiker clamp.



2. Disconnect outlet hose from thermostat housing.

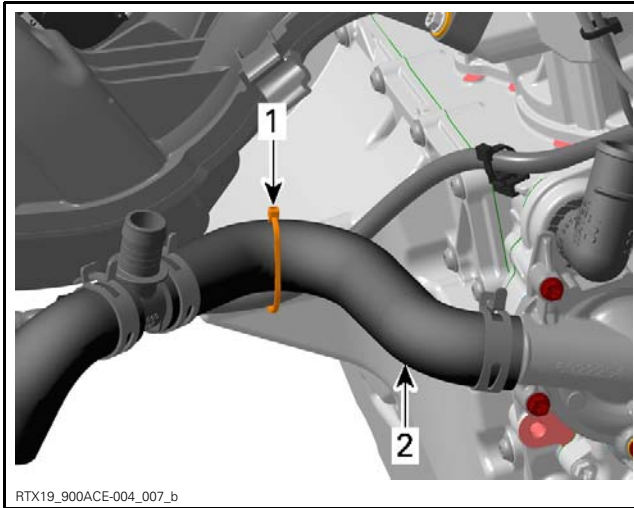


WITHOUT AIR RADIATOR



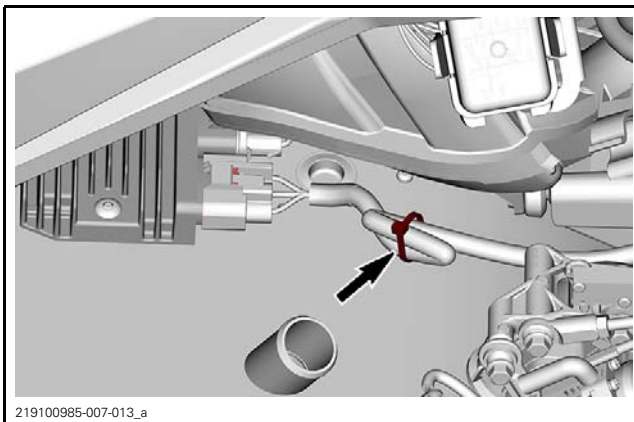
WITH AIR RADIATOR

3. Remove locking tie on water pump inlet hose.
4. Disconnect coolant inlet hose from water pump.

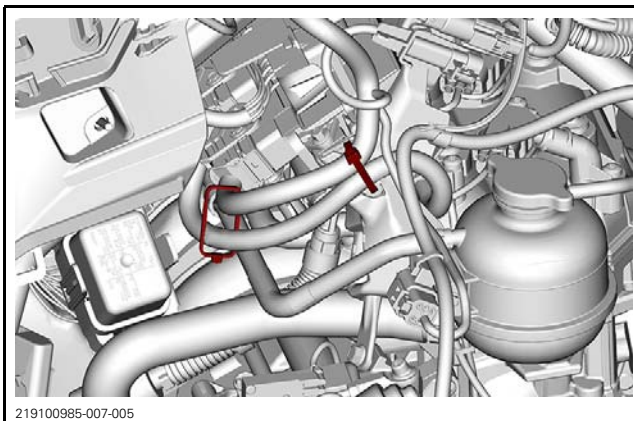


1. Locking tie
2. Water pump inlet hose

5. Remove locking tie securing magneto connector wires.



6. Remove locking ties securing harness of ECM connector A to ECM support.



7. Disconnect ECM connector A from ECM.



8. Disconnect engine harness connector located in front of ECM support.



9. Disconnect fuel hose from fuel rail.

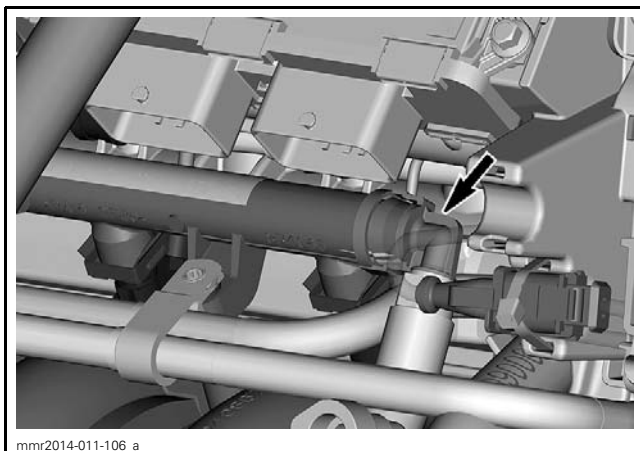
REQUIRED TOOL

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

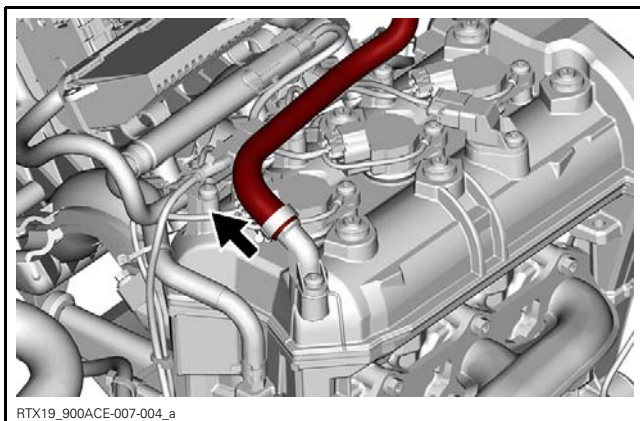


NOTE: Wrap a rag around fuel hose end to catch leakage.

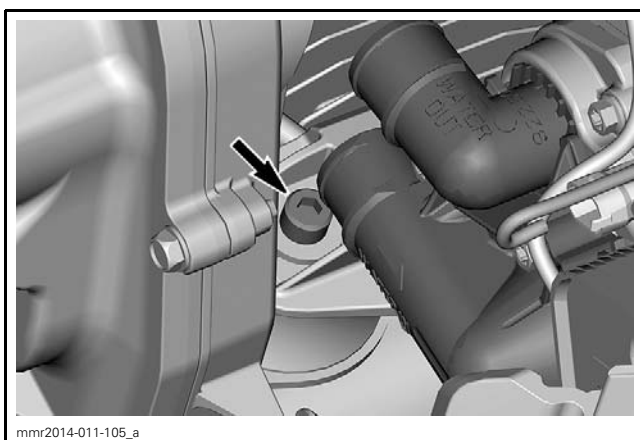
Subsection XX (ENGINE REMOVAL AND INSTALLATION)



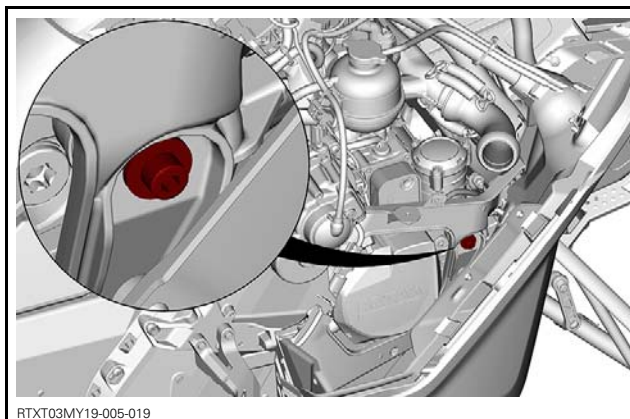
10. Disconnect blow-by hose from valve cover.



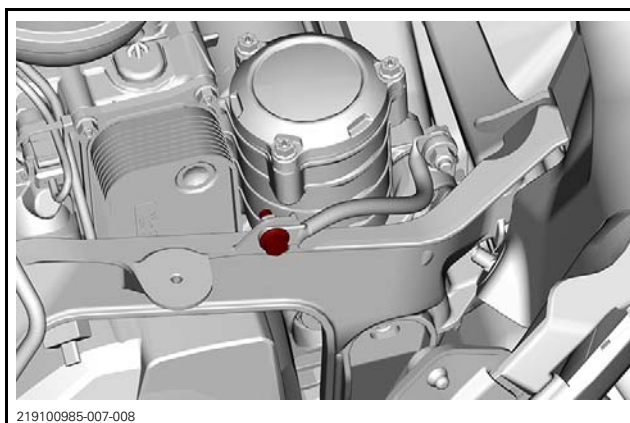
11. Remove screw securing rear MAG rubber mount to engine support.



12. Remove screw securing front MAG rubber mount to engine support.

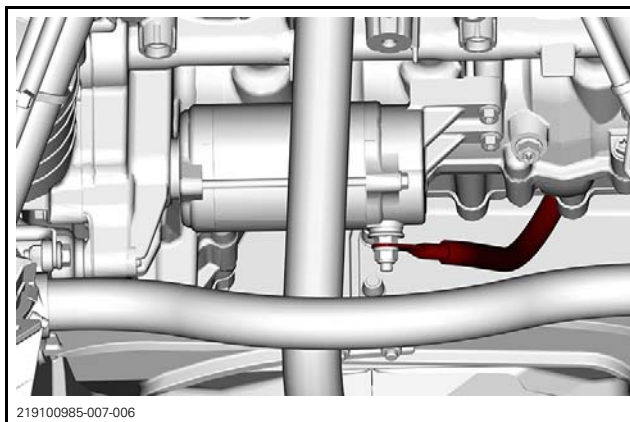


13. Disconnect engine ground cable from frame.

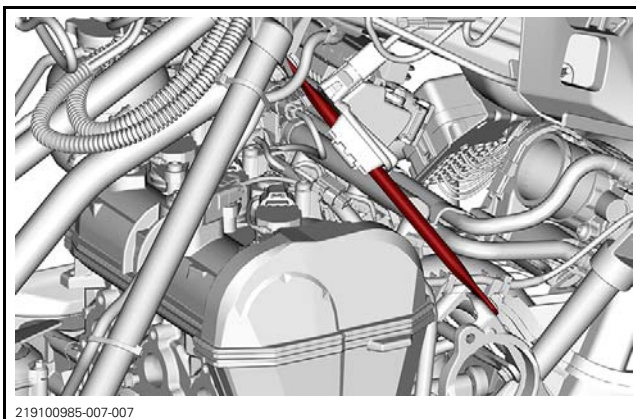


PTO Side Operations

1. Refer to *DRIVE SYSTEM* section and remove:
 - Drive pulley
 - Driven pulley and countershaft.
2. Disconnect starter cable from starter.



3. Remove LH side upper column support.



4. Install the engine lifting tool instead of exhaust manifold.

REQUIRED TOOL	
ENGINE LIFTING TOOL (P/N 529 036 217)	

5. Secure lifting tool using exhaust manifold screws.
6. **Slightly** lift engine.
7. Remove countershaft bearing support. Refer to *FRAME* subsection.
8. Disconnect the magneto connector from the voltage regulator while pulling the engine out of vehicle.

Installing the Engine

The installation is the reverse of the removal procedure. However, pay attention to the following. Install **NEW** self-locking screws and nuts where required. Refer to exploded view at the beginning of this subsection.

Refill and bleed cooling system. Refer to *COOLING SYSTEM - VEHICLE COMPONENTS* subsection.

Properly tighten countershaft bearing support. Refer to *FRAME* subsection for tightening sequence.

Tighten engine rubber mount screws to specification. Refer to the exploded view for tightening torque and sequence.

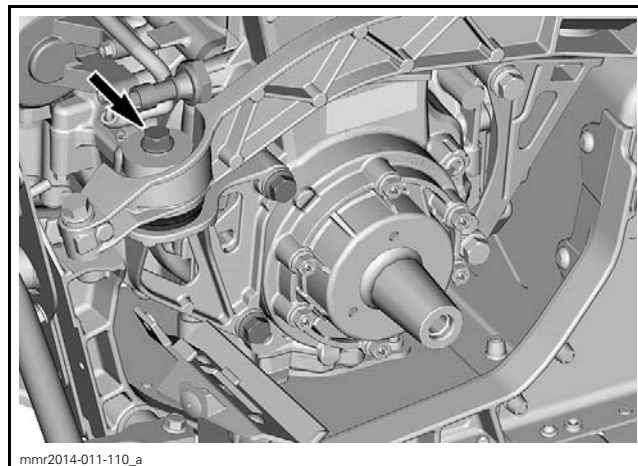
ENGINE SUPPORTS

Engine Support Inspection

Check if engine supports are cracked, bent or damaged. Replace if necessary.

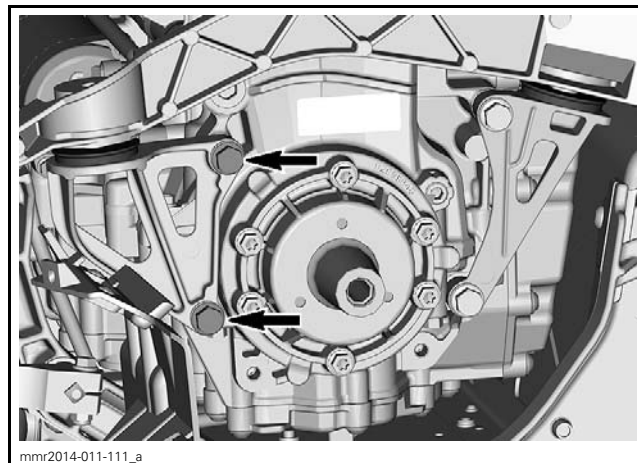
Replacing the Front Engine Support (PTO Side)

1. Remove body parts and components as required to access to the engine support.
2. Remove and discard bolt securing rubber mount to engine support.



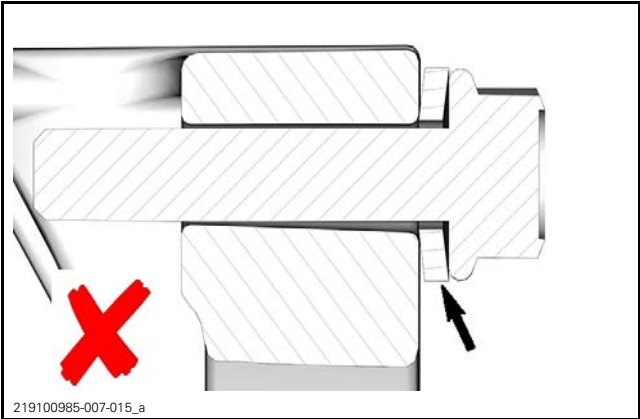
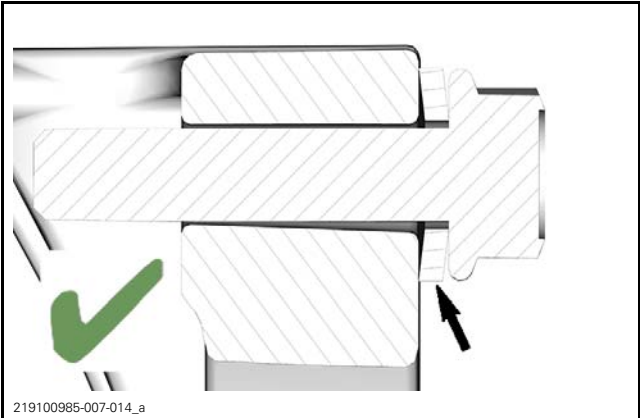
SOME PARTS REMOVED FOR CLARITY PURPOSE

3. Remove and discard screws securing engine to engine support.



SOME PARTS REMOVED FOR CLARITY PURPOSE

4. Replace engine support.
5. Install conical washer as per following illustrations.



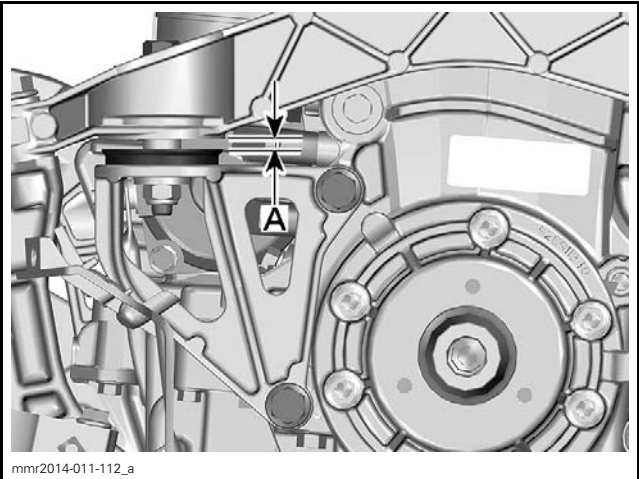
- 6. Install **NEW** screws to secure engine support on engine.
- 7. Tighten engine support screws to specification.

TIGHTENING TORQUE	
Engine support screws	31.5 N•m ± 3.5 N•m (23 lbf•ft ± 3 lbf•ft)

- 8. Install **NEW** bolt to secure engine rubber mount on engine support.
- 9. Tighten engine rubber mount screw to specification.

TIGHTENING TORQUE	
Engine rubber mount screws (M8)	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

NOTE: It is normal that a gap (4 mm (5/32 in)) is visible between engine stopper and countershaft bearing support. This gap will allow engine to move and reduce vibration.



A. Normal gap

- 10. Install remaining parts.

Replacing the Rear Engine Support (PTO Side)

To replace rear engine support, refer to *REPLACING THE FRONT ENGINE SUPPORT (PTO SIDE)*.

Replacing the Front Engine Support (MAG Side)

To replace the front engine support, move the engine 25 mm (1 in) towards LH side. Refer to *REPLACING THE THERMOSTAT* procedure in the *COOLING SYSTEM - ENGINE COMPONENTS* subsection.

For support installation, refer to *REPLACING THE FRONT ENGINE SUPPORT (PTO SIDE)*.

Replacing the Rear Engine Support (MAG Side)

To replace rear engine support, remove the engine. Refer to procedure in this subsection.

For support installation, refer to *REPLACING THE FRONT ENGINE SUPPORT (PTO SIDE)*.

ENGINE RUBBER MOUNTS

Engine Rubber Mount Inspection

Check rubber mounts. Replace them if brittle, cracked or damaged.

Replacing the Front and Rear Engine Rubber Mount (PTO Side)

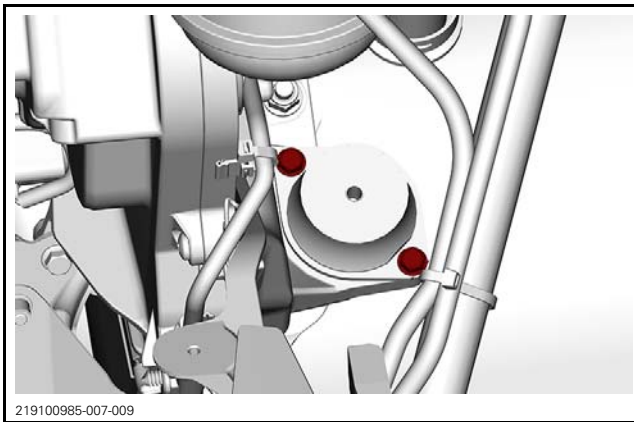
- 1. Remove countershaft bearing support. Refer to *FRAME* subsection.
- 2. Replace engine rubber mount.
- 3. Install countershaft bearing support. Refer to *FRAME* subsection.

Replacing the Front Engine Rubber Mount (MAG Side)

The front engine support on MAG side must be replaced with the rubber mount. Refer to *REPLACING THE FRONT ENGINE SUPPORT (MAG SIDE)*.

Replacing the Rear Engine Rubber Mount (MAG Side)

1. Remove the engine. Refer to procedure in this subsection.
2. Remove and discard screws securing rubber mount to frame.



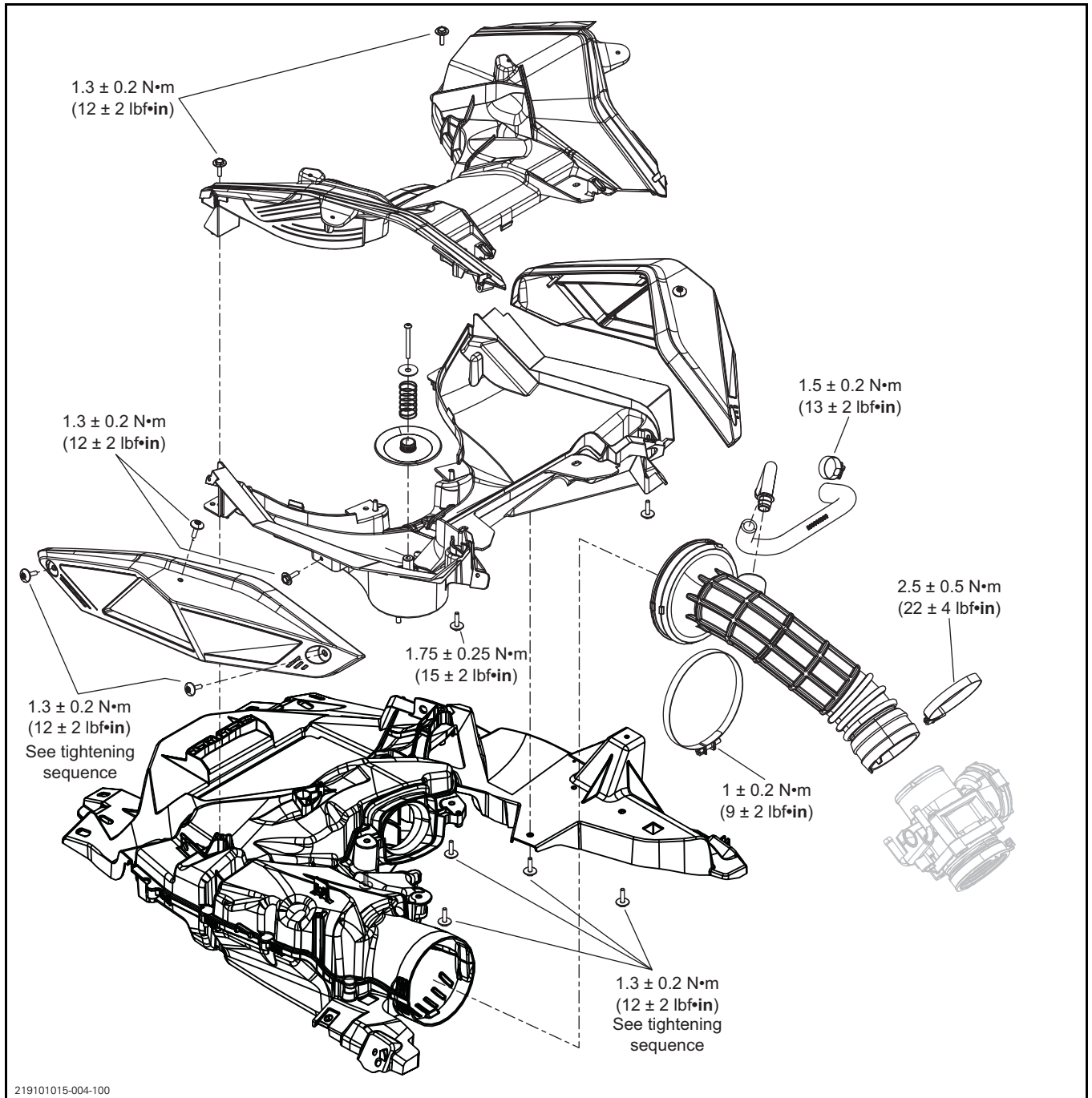
3. Replace engine rubber mount.
4. Install **NEW** screws to secure engine rubber mount.
5. Tighten engine rubber mount screws to specification.

TIGHTENING TORQUE	
Engine rubber mount screws (M8)	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)
Engine rubber mount screws (M6)	10 N•m ± 2 N•m (89 lbf•in ± 18 lbf•in)

6. Install remaining parts.

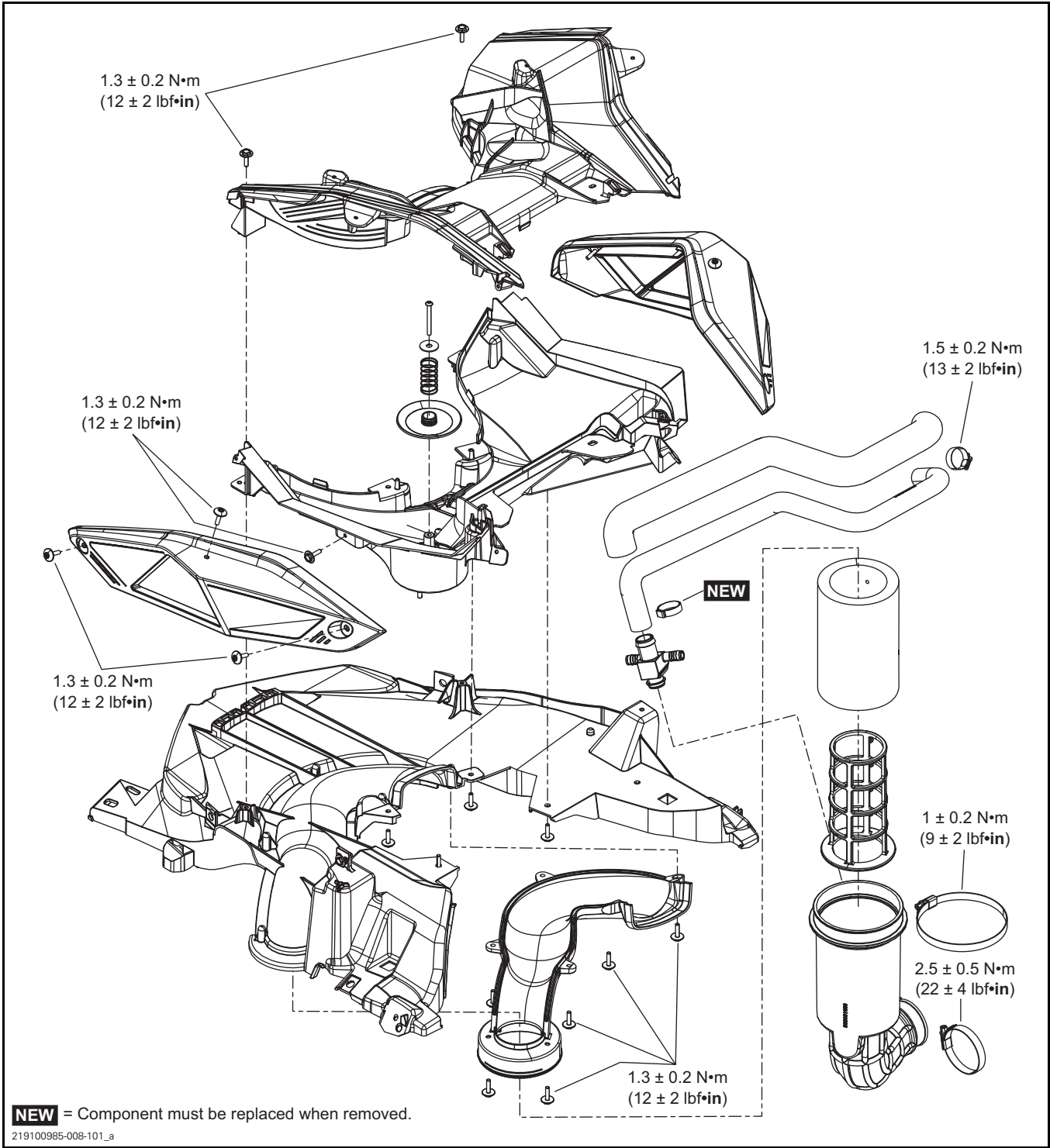
AIR INTAKE SYSTEM

Models without Turbocharger



Subsection XX (AIR INTAKE SYSTEM)

Models with Turbocharger



GENERAL

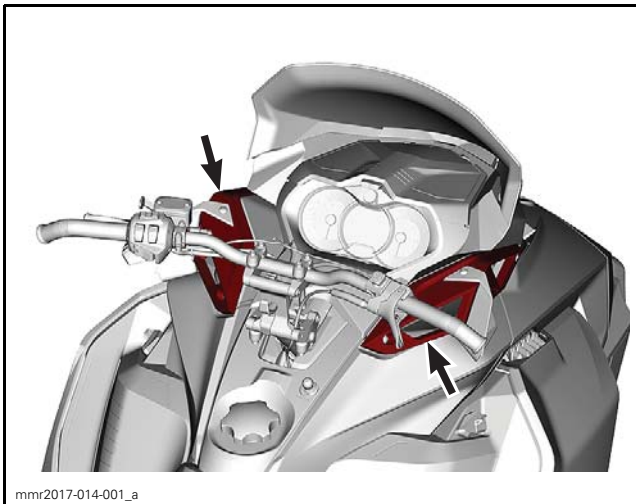
⚠ WARNING

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

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

PROCEDURES

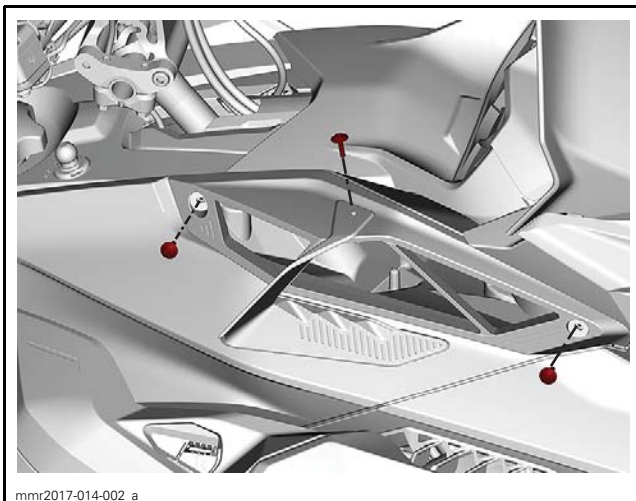
AIR FILTER (MESH)



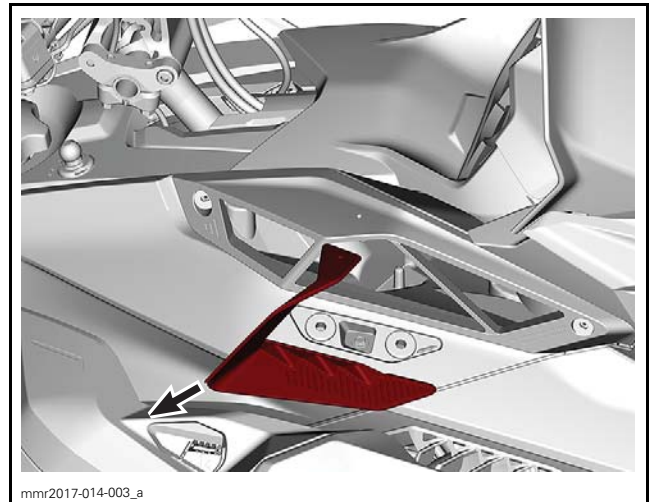
The same procedure applies for RH and LH side.

Removing the Air Filter

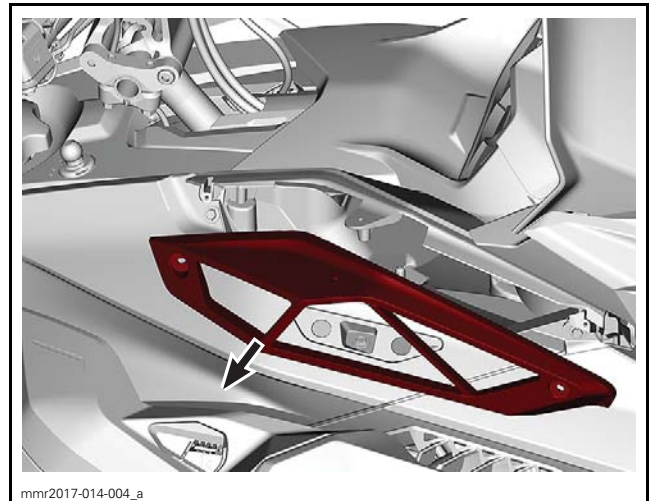
Remove screws from mesh filter housing.



Remove the air deflector if equipped.



Remove the mesh filter housing from the upper body module.



Cleaning the Air Filter

Clean with fresh water and mild soap.

Replace air filter if required.

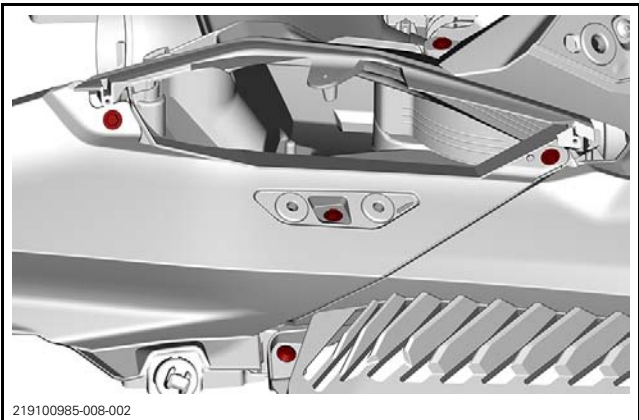
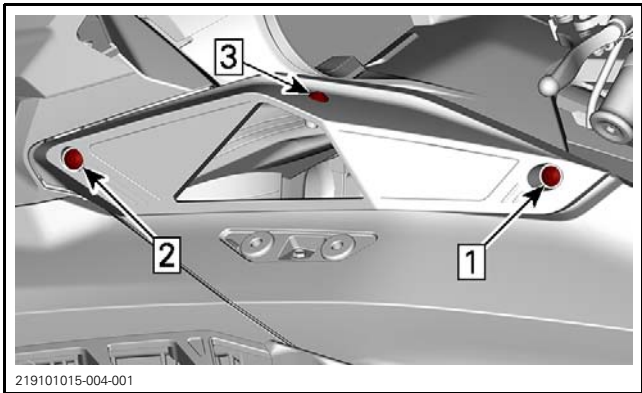
NOTE: If the filter is very dirty, clean the interior of secondary air intake silencer at the same time.

Installing the Air Filter

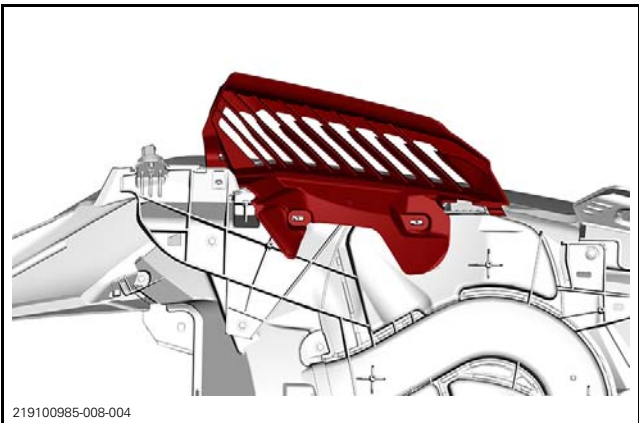
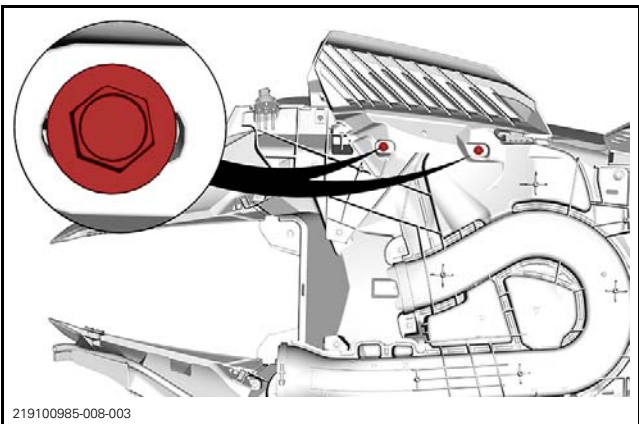
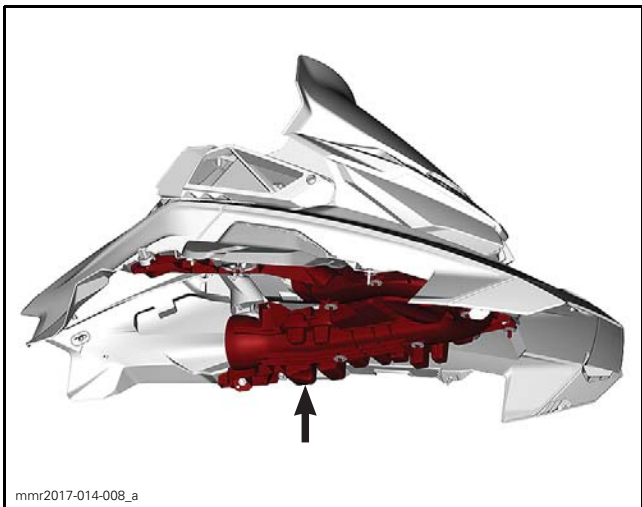
The installation is the reverse of the removal procedure. However, pay attention to the following.

Refer to exploded views for appropriate tightening torques.

Tighten air filter screws following the tightening sequence.

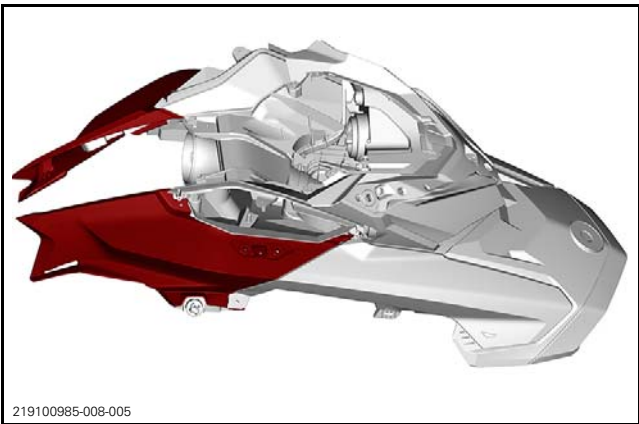
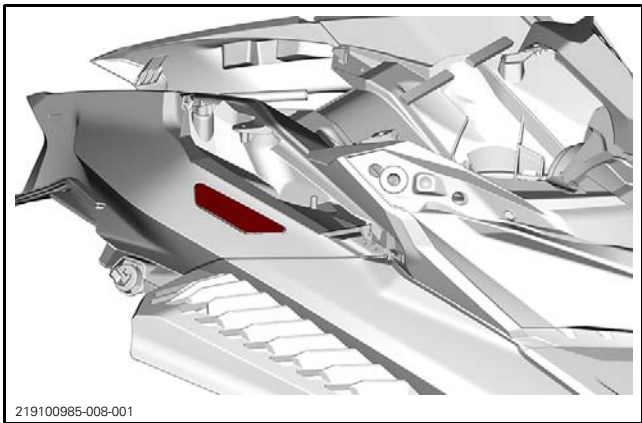


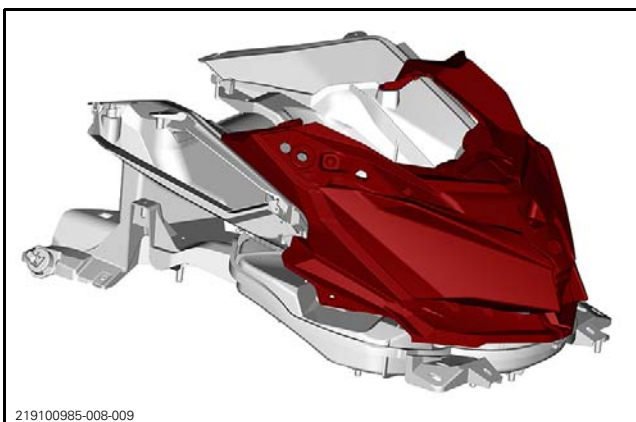
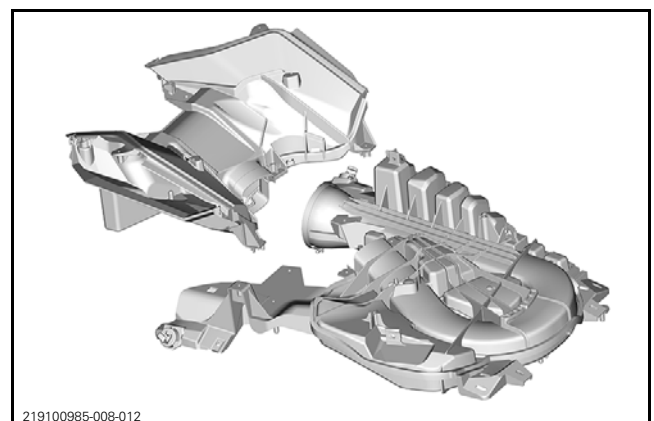
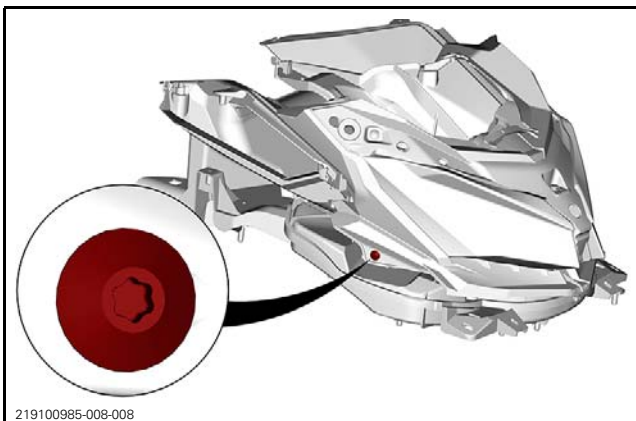
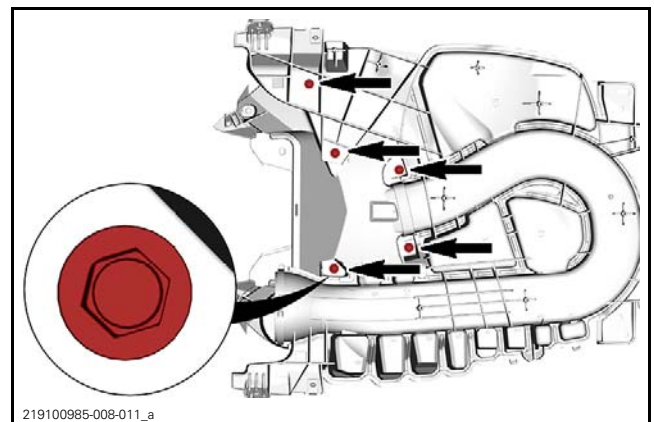
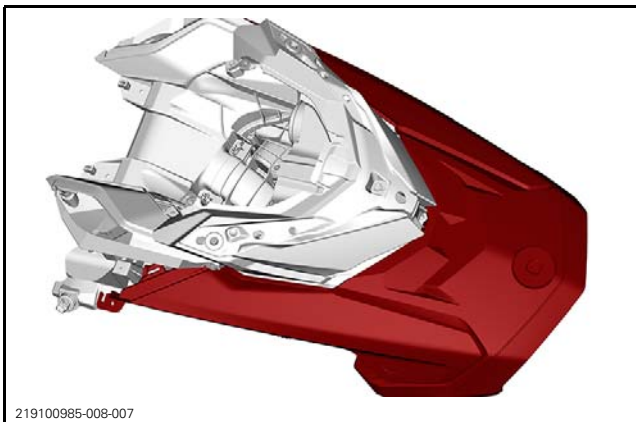
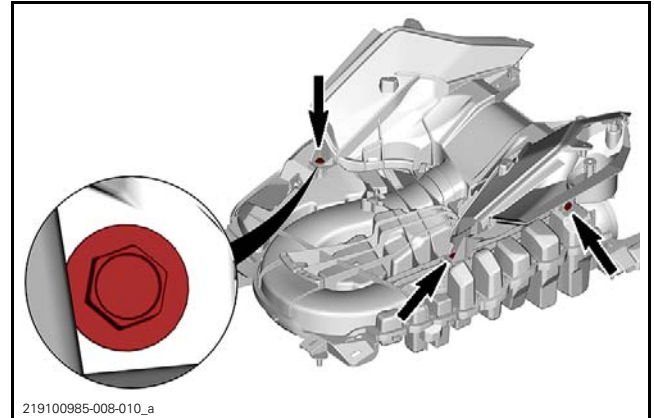
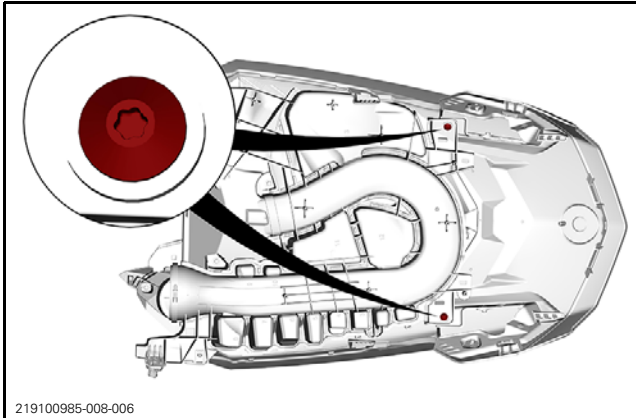
AIR INTAKE SILENCER



Removing the Air Intake Silencer

- The procedure is the same for both sides.
1. Remove the upper body module. Refer to the *BODY* subsection.
 2. Remove the air filters.
 3. Remove the following parts and screws.



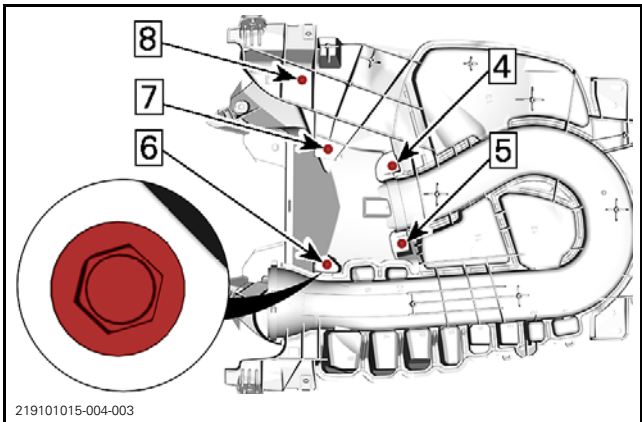
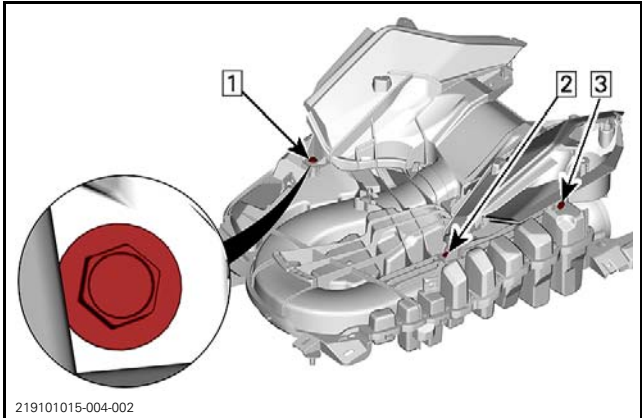


Installing the Air Intake Silencer

The installation is the reverse of the removal procedure. However, pay attention to the following. Refer to exploded views for appropriate tightening torques.

Tighten air intake silencer screws following the tightening sequence.

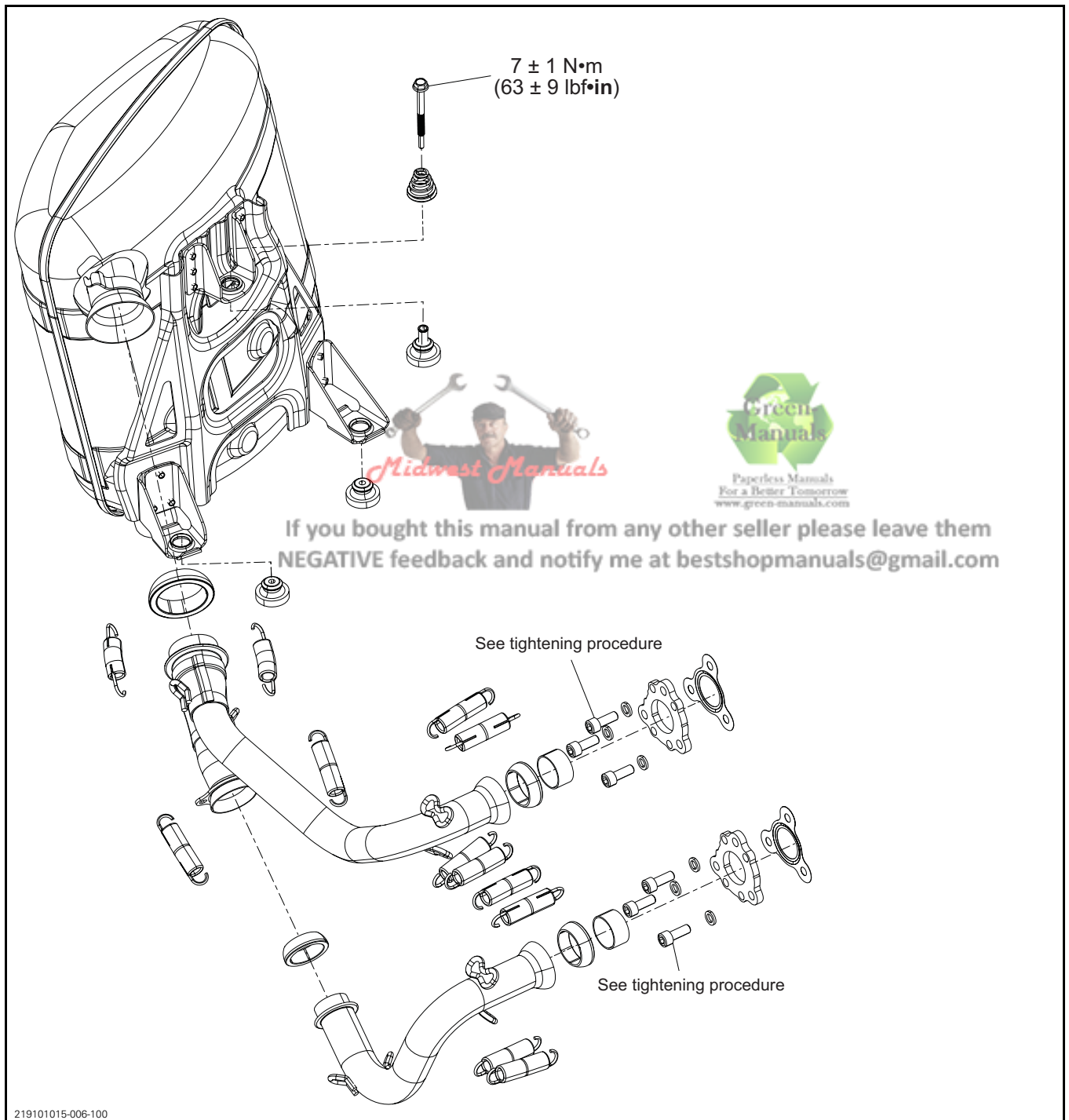
Subsection XX (AIR INTAKE SYSTEM)



EXHAUST SYSTEM (600 ACE)

SERVICE TOOLS

Description	Part Number	Page
SPRING INSTALLER/REMOVER	529 035 983	2



GENERAL

 **WARNING**

To avoid potential burns, never touch ex-haust system components immediately after the engine has been running because these components are very hot. Let engine and ex-haust system cool down before performing any servicing.

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

 **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.

MAINTENANCE

INSPECTING THE EXHAUST SYSTEM COMPONENTS

Check the following components for leaks, cracks, or other damages:

- Springs and retainers
- Exhaust system mounts
- Muffler
- Exhaust pipe
- Donut gaskets
- Shields
- Manifold.

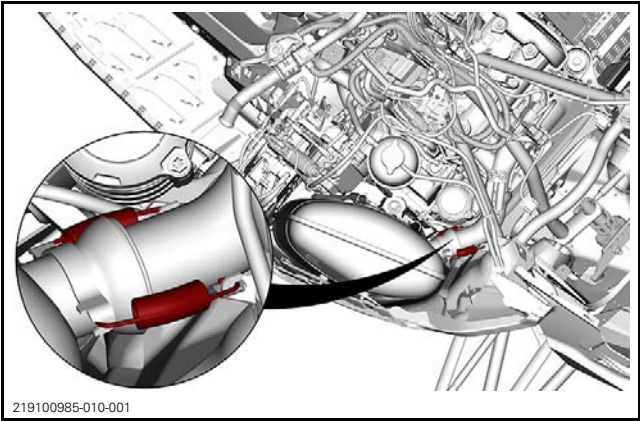
PROCEDURES

MUFFLER

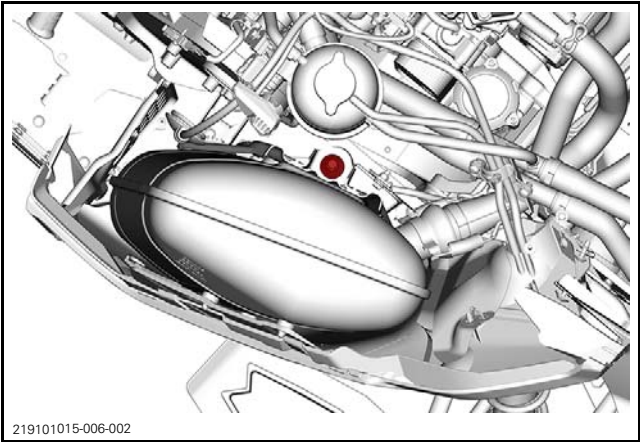
Removing the Muffler

1. Remove the upper body module. Refer to *BODY* subsection.
2. Remove exhaust springs retaining the exhaust pipe to the muffler.

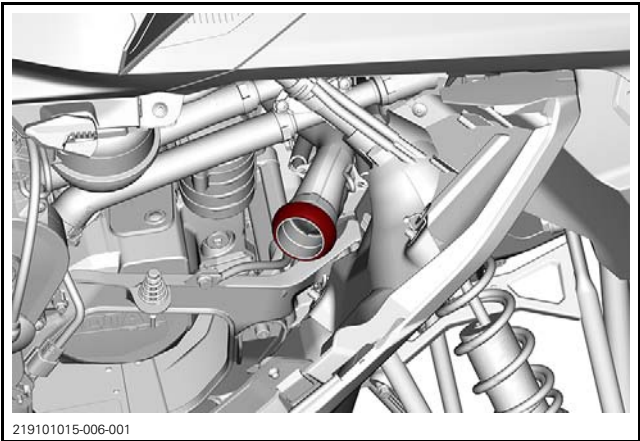
REQUIRED TOOL	
SPRING INSTALLER/REMOVER (P/N 529 035 983)	



3. Behind the muffler, remove the retaining screw and its spring.



4. Remove the muffler.
5. Remove exhaust gasket.



Inspecting the Muffler

Check the muffler for cracks or other damages.
Check grommet condition.
Inspect exhaust gasket condition. Replace as required.

Installing the Muffler

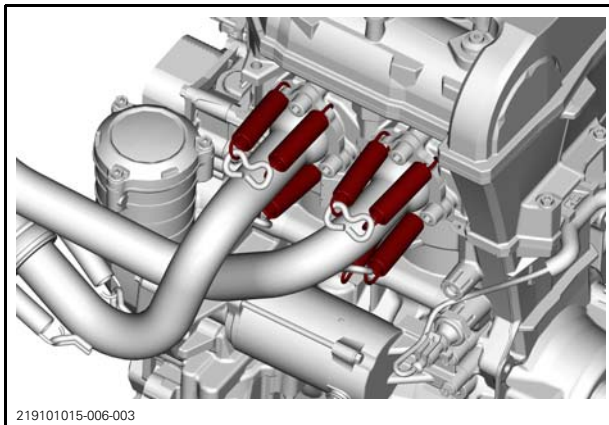
The installation is the reverse of the removal procedure. However, pay attention to the following.

TIGHTENING TORQUE	
Muffler retaining screw	7 N•m ± 1 N•m (62 lbf•in ± 9 lbf•in)

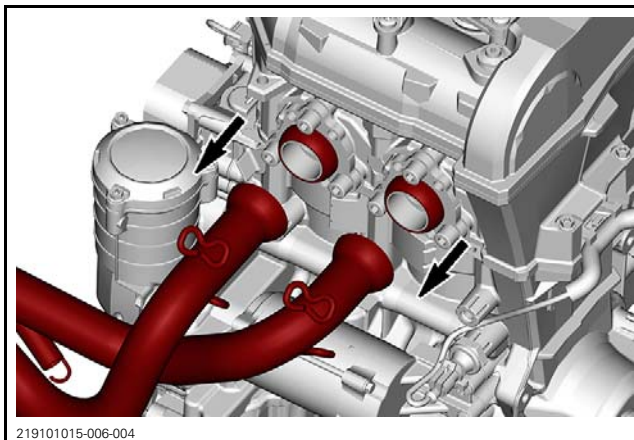
EXHAUST PIPE

Removing the Exhaust Pipe

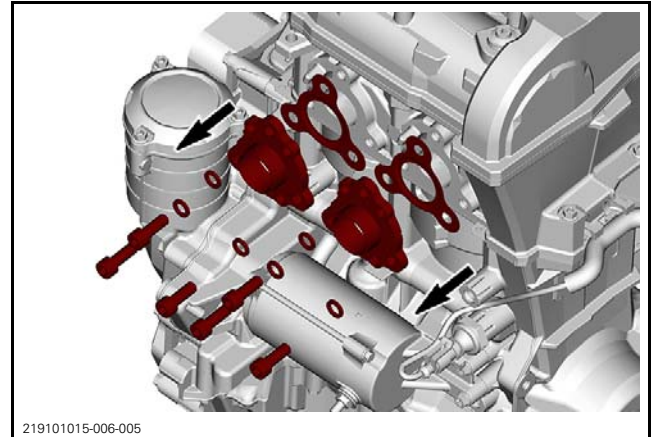
1. Remove the muffler.
2. Remove exhaust springs retaining the exhaust pipe to the exhaust manifold.



3. Remove exhaust pipe and gaskets.



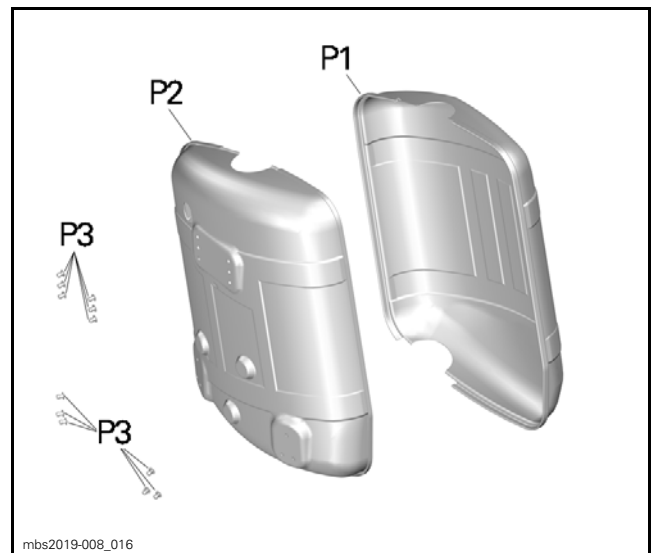
4. Remove spacers by removing the retaining screws, washers and gaskets.



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

TIGHTENING PROCEDURE	
Exhaust pipe retaining screw (Pre-tightening torque)	7 N•m ± 1 N•m (62 lbf•in ± 9 lbf•in)
Exhaust pipe retaining screw (Final tightening torque)	7 N•m ± 1 N•m (62 lbf•in ± 9 lbf•in)

Removing the Heat Shields

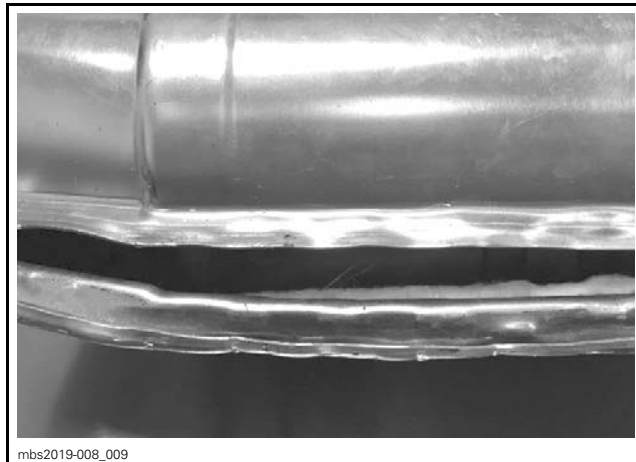


ITEM	DESCRIPTION	PART NUMBER	QUANTITY
P1	RH Deflector	514055792	1
P2	LH Deflector	514055707	1
P3	Rivet Avex	390909100	12

1. Remove muffler. Refer to procedure in this subsection.
2. Place muffler flat on a work bench.

Subsection XX (EXHAUST SYSTEM (600 ACE))

3. Using a pair of adjustable channel lock pliers, unfold the deflector's lip/edges all around the muffler perimeter as depicted below.

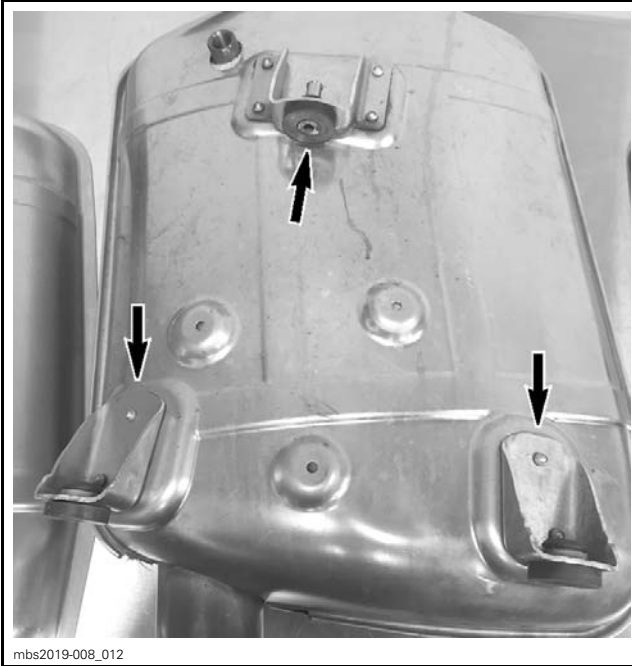


4. Remove and discard the two deflectors, keeping both insulating wool for reuse.



5. Using a 5 mm (3/16 in) drill bit, drill the rivets that hold the three brackets. Keep all three brackets for reuse.





3 brackets



Installing the Heat Shields

1. Put a clean rag on your work bench for protection, reinstall all three brackets on LH deflector **no. P2** using new rivets **no. P3**.



Upper center bracket



Lower bracket

2. Place the new LH deflector face down and insert insulating wool previously removed.



3. Place muffler into LH deflector.

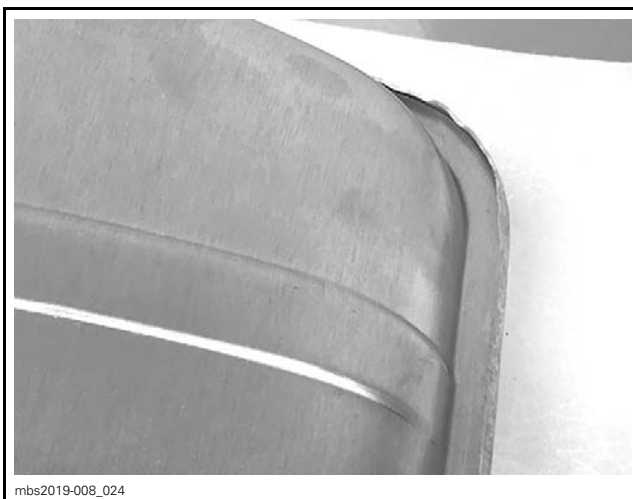
Subsection XX (EXHAUST SYSTEM (600 ACE))



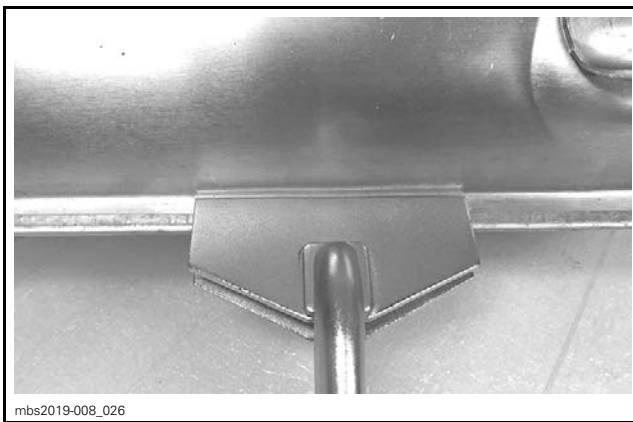
4. Place insulating wool previously removed onto muffler and install the new RH deflector **no. P1**.



5. Start by folding the RH deflector edge onto LH deflector edge at an approximate 60° angle using a nylon head hammer all around the muffler perimeter.



6. Using a pair of flat nose pliers, fold down flat and squeeze tight the RH deflector edge onto LH deflector edge all around the muffler perimeter.



7. Using a cloth type protective tape, put a few layers of tape around deflector's edge for protection.



Installing the Exhaust Pipe

The installation is the reverse of the removal procedure.

8. Using a steel head hammer, fold up deflector edges up against LH deflector sides, after working around the muffler perimeter, remove the protective tape.



9. Reinstall muffler. Refer to procedure in this subsection.

Inspecting the Exhaust Pipe

Check exhaust pipe for:

- Damages
- Cracks.

Inspect exhaust gasket condition. Replace as required.



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MAINTENANCE

THROTTLE BODY CONNECTING SOCKET

Visually inspect throttle body connecting socket for cracks or other damages.

Replace if necessary. Refer to *INTAKE MANIFOLD* in the this subsection.

PROCEDURES

INTAKE MANIFOLD

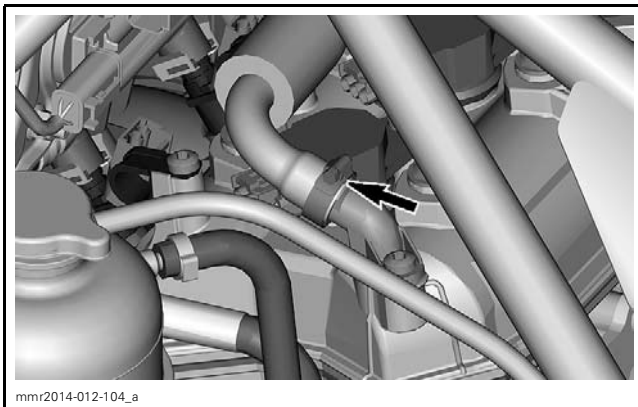
Intake Manifold Access

Refer to appropriate subsections and remove:

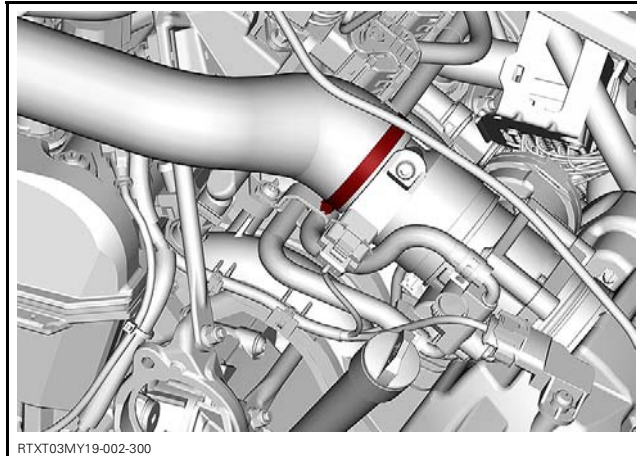
- Side panels (both sides)
- Air intake silencer and gauge support module
- Pulley guard
- Fuel tank
- Driven pulley and countershaft.

Removing the Intake Manifold

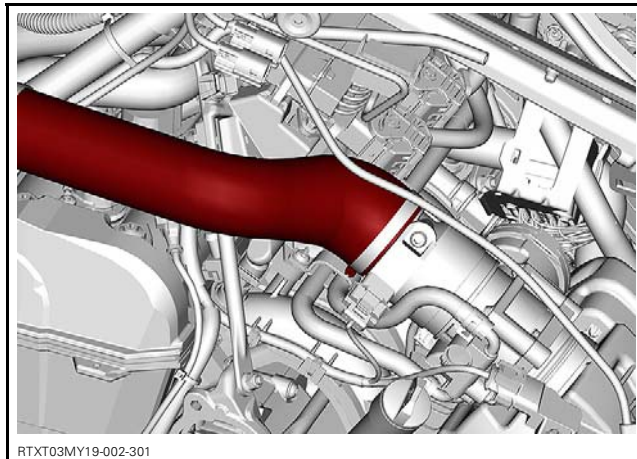
1. Loosen clamp securing breather hose to engine and disconnect hose.



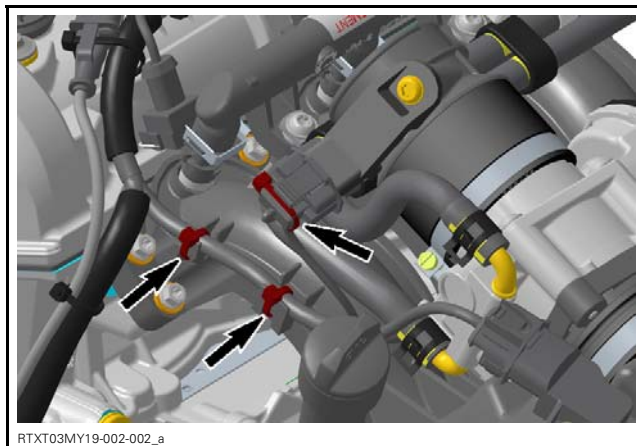
2. Loosen clamp securing air intake hose to connecting socket.



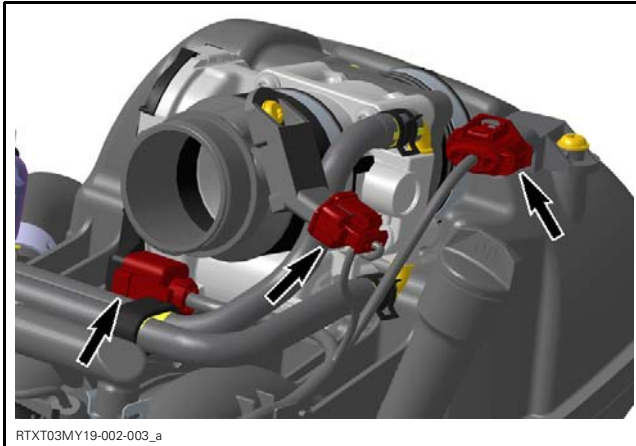
3. Remove air intake hose.



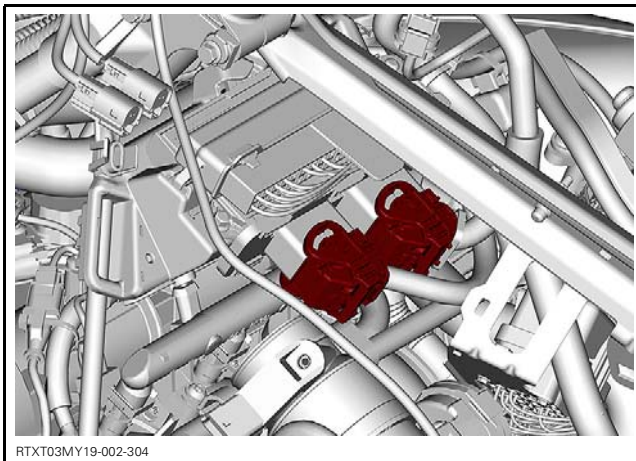
4. Cut locking ties securing the Manifold Absolute Pressure and Temperature Sensor (MAPTS), the Boost Pressure Sensor (BPS) and the Electric Throttle Control (ETC) harness to intake manifold.



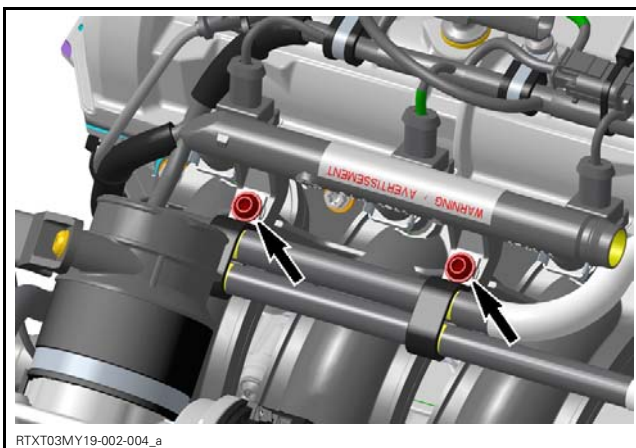
5. Disconnect MAPTS, BPS and ETC connectors.



6. Disconnect both ECM connectors

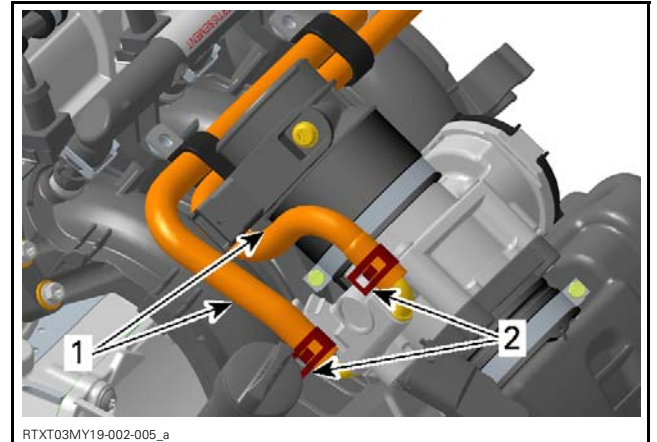


7. Remove screws securing fuel rail and coolant hoses to intake manifold.



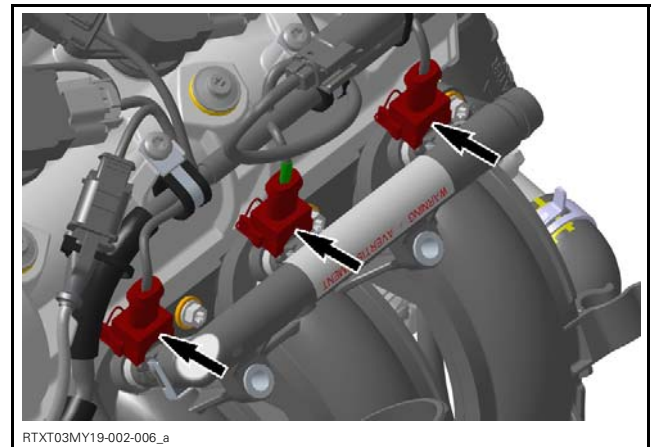
8. Install a hose pincher on each coolant hose connected to throttle body and disconnect the hoses from the throttle body.

REQUIRED TOOL	
SMALL HOSE PINCHER (P/N 295 000 076)	



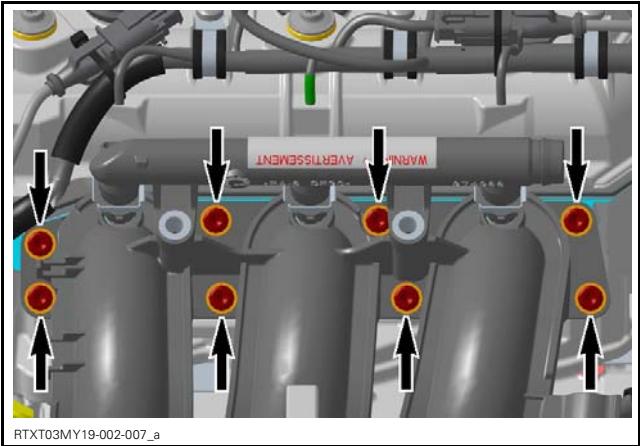
1. Install hose pinchers here
2. Disconnect hoses here

9. Disconnect fuel injector connectors.



INJECTOR CONNECTORS

10. Remove screws securing intake manifold to cylinder head.



INTAKE MANIFOLD SCREWS

11. Remove intake manifold from engine.
12. Remove and discard intake manifold gaskets.
13. If required, remove following parts from intake manifold. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection:
 - Throttle body with connecting socket
 - BPS
 - MAPTS
 - Fuel rail with injectors.

Inspecting the Intake Manifold

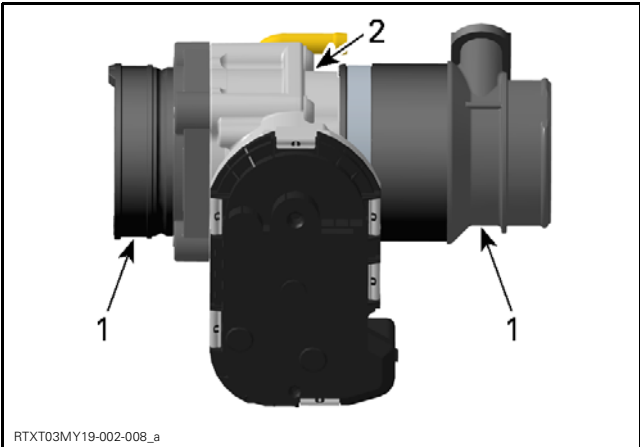
Check intake manifold for cracks, warping at flanges or any other visible damage. Replace if required.

Drain intake manifold of any accumulated liquids.

Flush intake manifold with solvent and let dry.

Inspecting the Connecting Socket

Check connecting sockets for cracks, warping at flanges or any other visible damage. If required, remove it from throttle body and replace it.



1. Connecting sockets
2. Throttle body

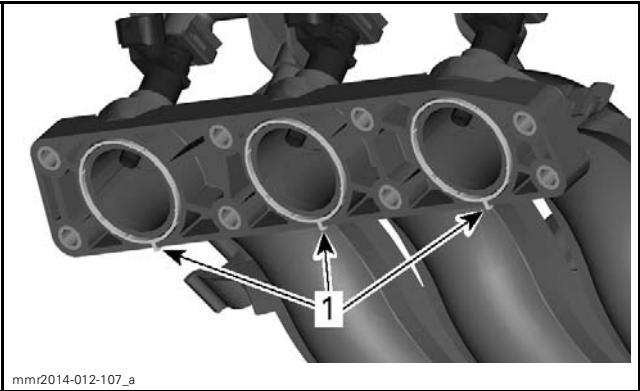
Installing the Intake Manifold

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

If removed, refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection to install:

- MAPTS
- BPS
- Fuel rail with injectors.

Install **NEW** gaskets with tab properly inserted in notch.



1. Gaskets tab properly inserted

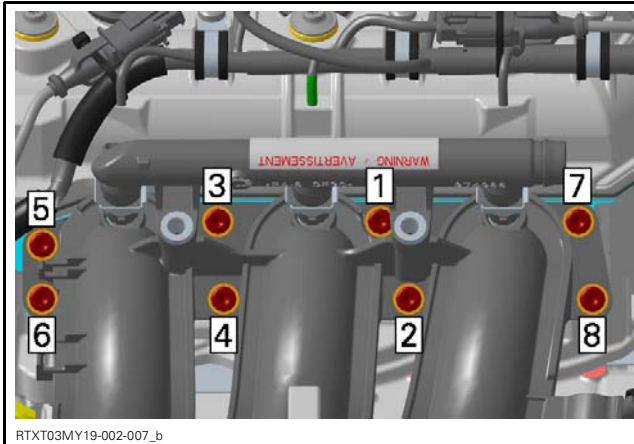
Ensure rubber grommets are properly inserted.



RUBBER GROMMETS

Tighten intake manifold screws to specification as per the following sequence.

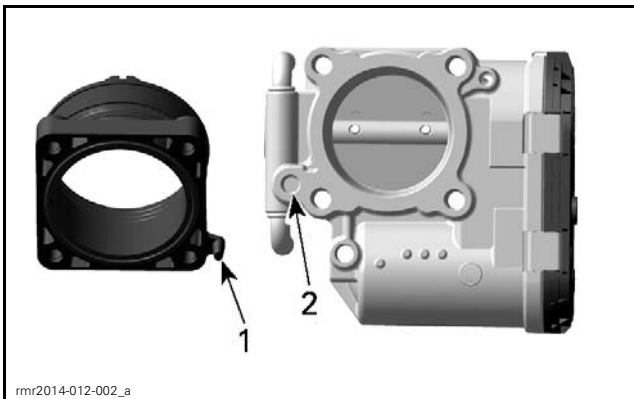
TIGHTENING TORQUE	
Intake manifold screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



TIGHTENING SEQUENCE

If removed, install throttle body on connecting sockets.

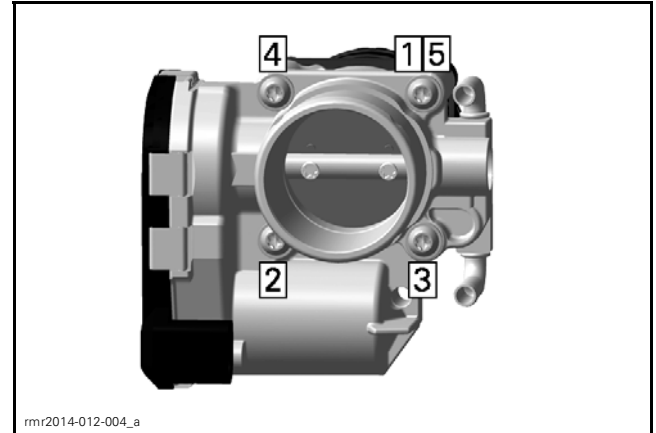
Make sure to index intake manifold pin with throttle body positioning bore.



1. Intake manifold pin
2. Throttle body positioning bore

Tighten throttle body screws to specification as per the following sequence.

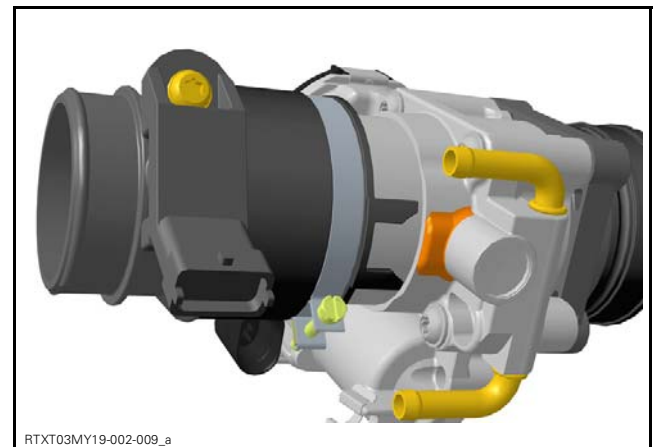
TIGHTENING TORQUE	
Throttle body screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



TIGHTENING SEQUENCE

Install connecting socket clamp on connecting socket.

Make sure to index connecting socket correctly at the throttle body.

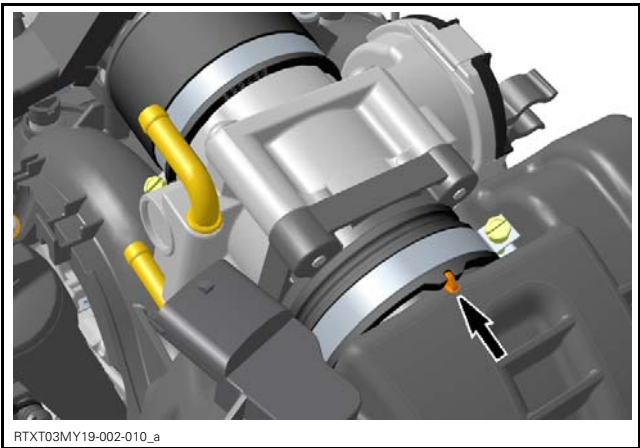


Tighten connecting socket clamp to specification.

TIGHTENING TORQUE	
Connecting socket clamp	0.9 N•m ± 0.1 N•m (8 lbf•in ± 1 lbf•in)

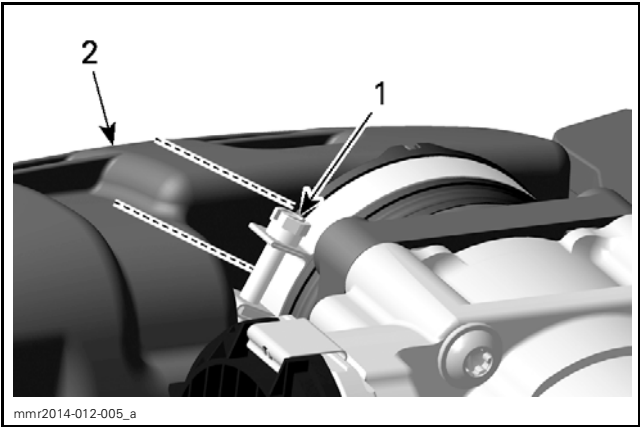
Make sure to index connecting socket notch with the intake manifold tab.

Subsection XX (INTAKE MANIFOLD)



INTAKE MANIFOLD TAB

Install connecting socket clamp in proper position and tighten to specification.



ALLOWED POSITION OF CLAMP SCREW

- 1. Screw of clamp
- 2. Intake manifold

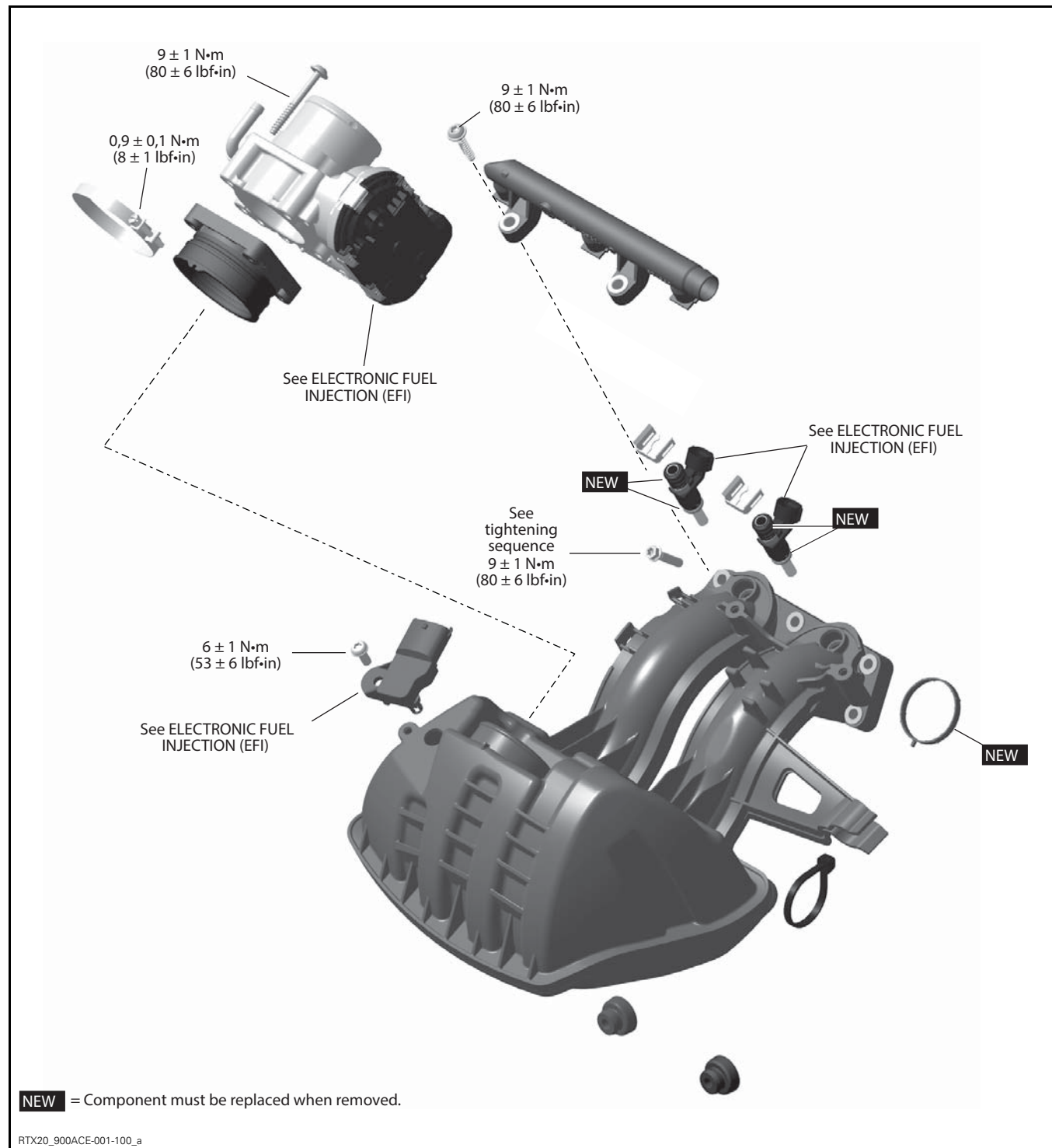
TIGHTENING TORQUE	
Connecting socket clamp	0.9 N•m ± 0.1 N•m (8 lbf•in ± 1 lbf•in)

INTAKE MANIFOLD

SERVICE TOOLS

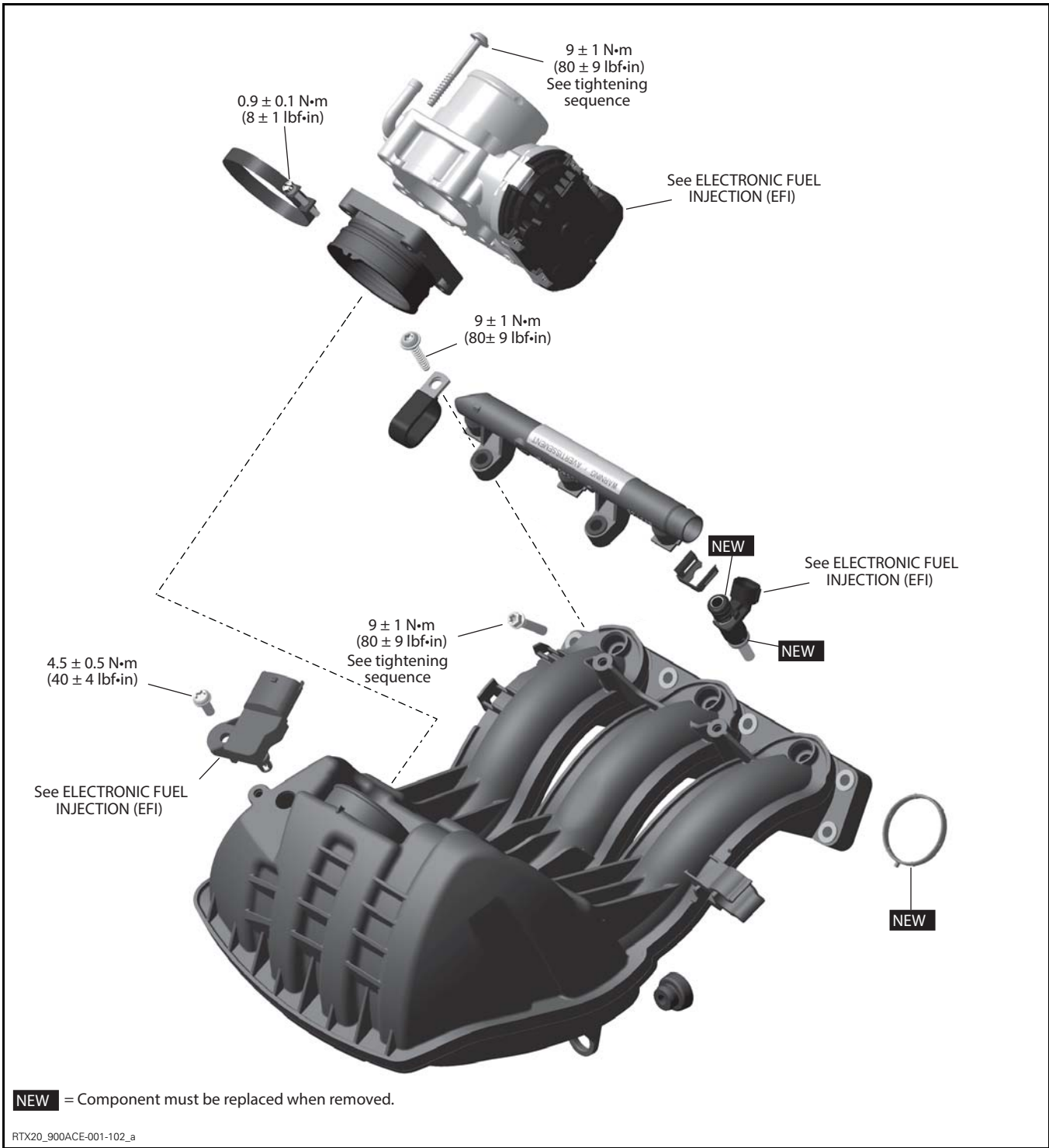
Description	Part Number	Page
SMALL HOSE PINCHER	295 000 076	4

600 ACE



Subsection XX (INTAKE MANIFOLD)

900 ACE



PROCEDURES

INTAKE MANIFOLD

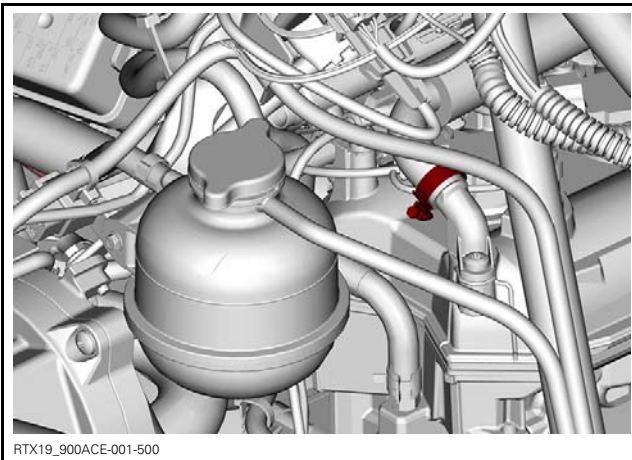
Intake Manifold Access

Refer to appropriate subsections and remove:

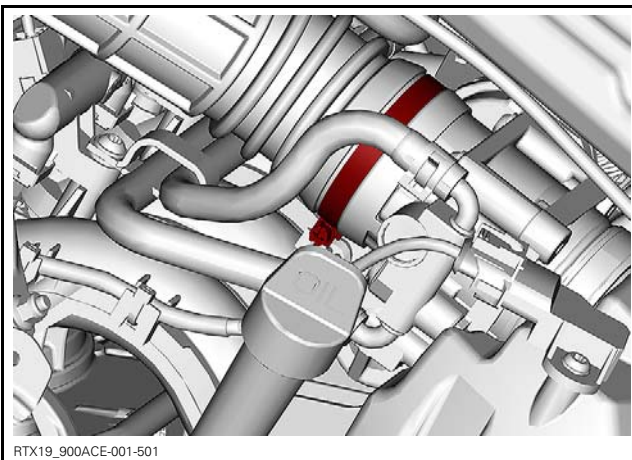
- Side panels (both sides)
- Air intake silencer and gauge support module
- Pulley guard
- Fuel tank
- Driven pulley and countershaft.

Removing the Intake Manifold

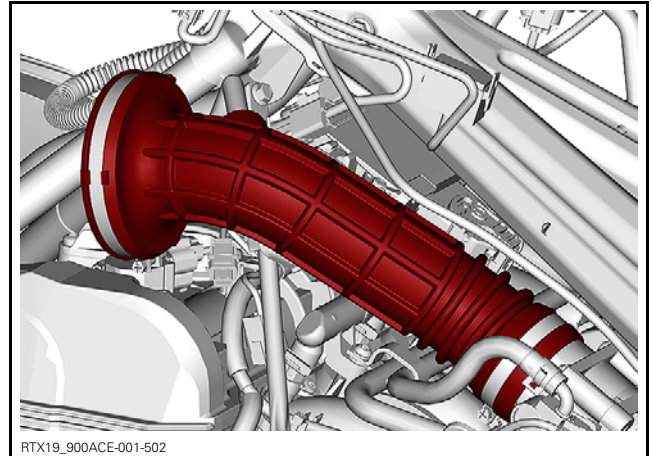
1. Loosen clamp securing breather hose to engine and disconnect hose.



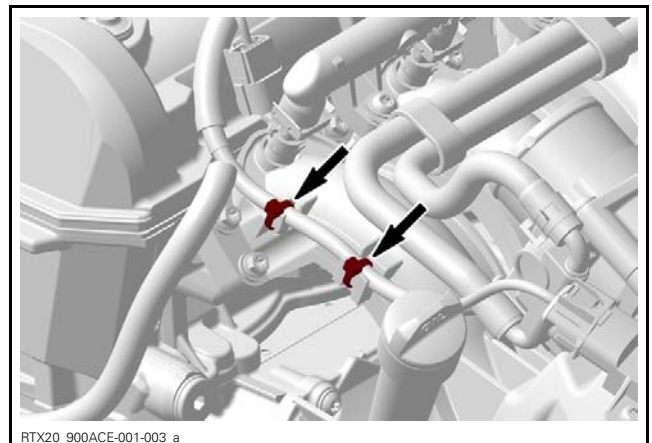
2. Loosen clamp securing air intake hose to throttle body.



3. Remove air intake and breather hoses.

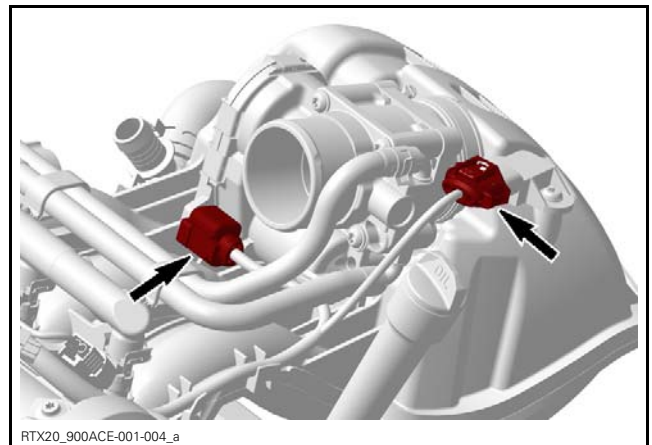


4. Cut locking ties securing MAPTS (manifold absolute pressure and temperature sensor) and ETC (electric throttle control) harness to intake manifold.



900 ACE ENGINE SHOWN

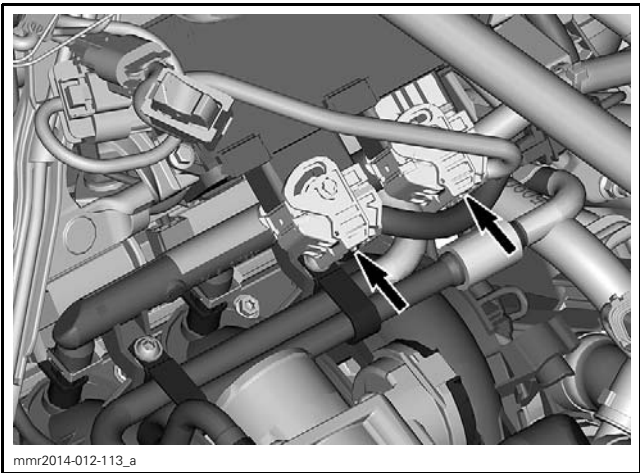
5. Disconnect MAPTS and ETC connectors.



900 ACE ENGINE SHOWN

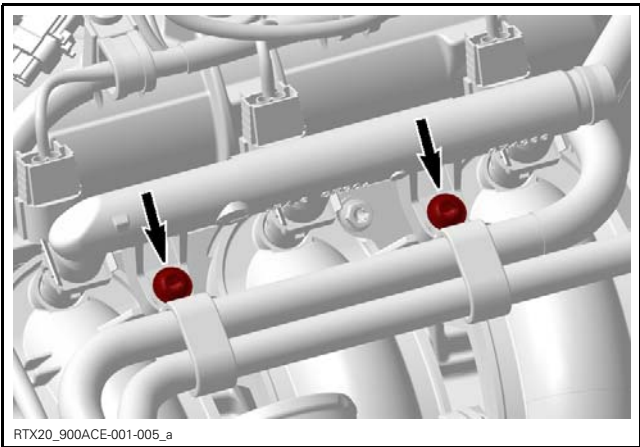
6. Disconnect both ECM connectors

Subsection XX (INTAKE MANIFOLD)



900 ACE

7. Remove screws securing fuel rail and coolant hoses (900 ACE only) to intake manifold.

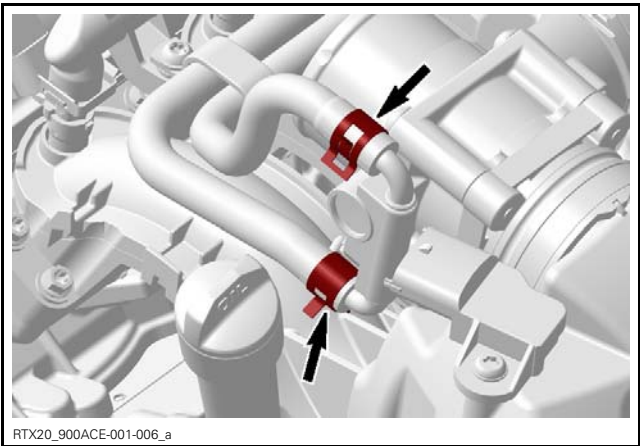


All Models

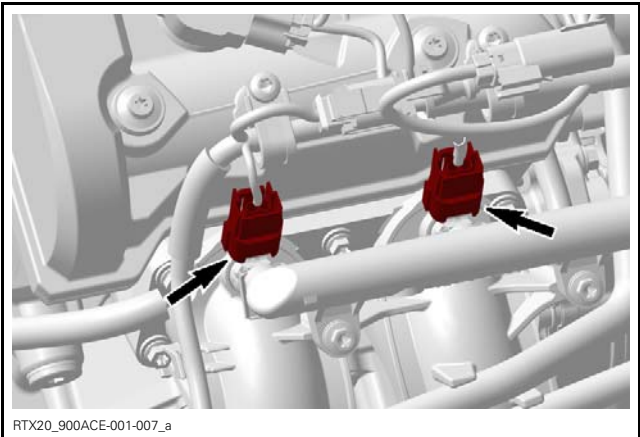
8. Block coolant hoses connected to throttle body.

REQUIRED TOOL	
SMALL HOSE PINCHER (P/N 295 000 076)	

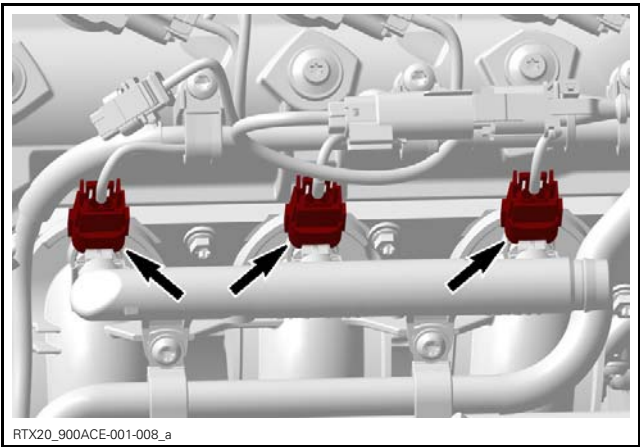
9. Disconnect and remove coolant hoses from throttle body.



10. Disconnect fuel injector connectors.

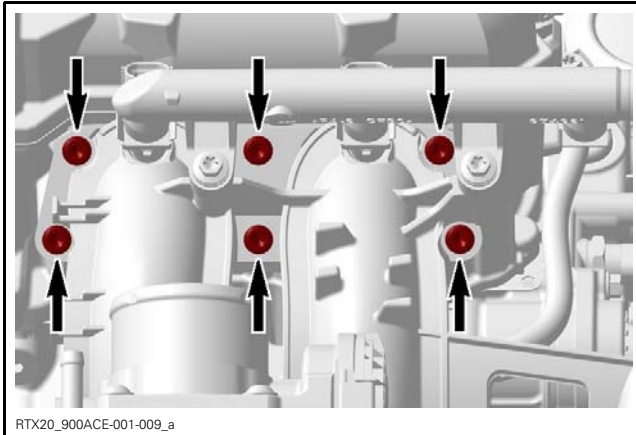


600 ACE ENGINE

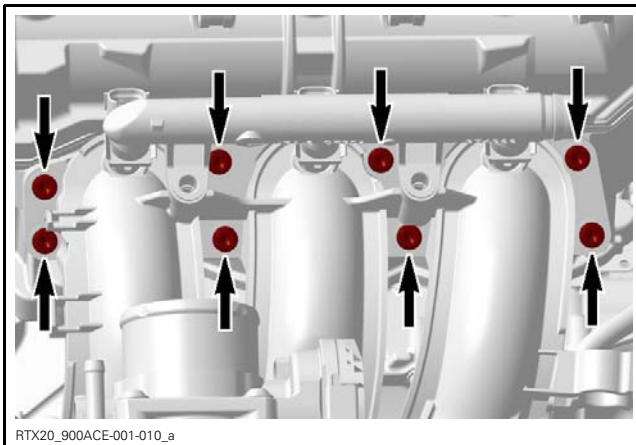


900 ACE ENGINE

11. Remove screws securing intake manifold to cylinder head.



600 ACE ENGINE



900 ACE ENGINE

12. Remove intake manifold from engine.
13. Remove and discard intake manifold gaskets.
14. If required, refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection and remove the following parts from intake manifold:
 - Throttle body with connecting socket
 - MAPTS
 - Fuel rail with injectors.

Inspecting the Intake Manifold

Check intake manifold for cracks, warping at flanges or any other visible damage. Replace as required.

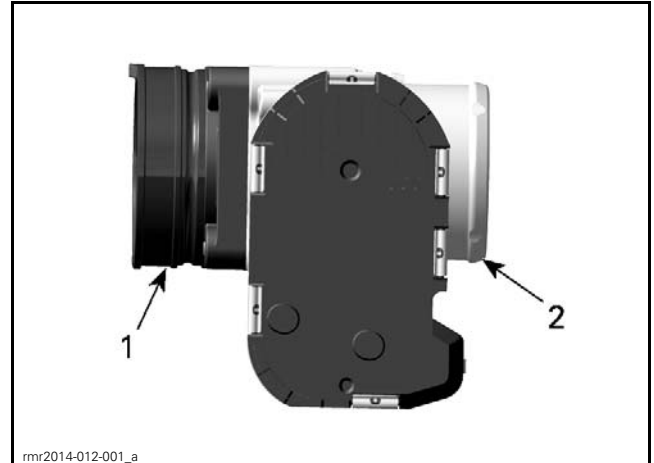
Drain intake manifold of any accumulated liquids.

Flush intake manifold with solvent and let dry.

Check rubber grommets if brittle, hard or damaged. Replace as required.

Inspecting the Connecting Socket

Check connecting socket if brittle hard or otherwise damaged. Check warping at flanges. . Replace as required.



1. Connecting socket
2. Throttle body

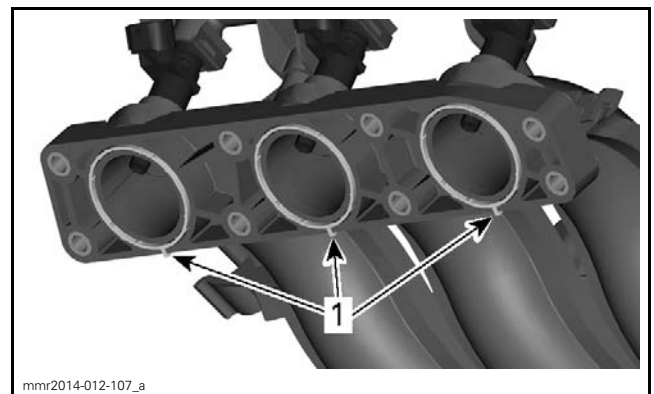
Installing the Intake Manifold

Reverse the removal procedure. However, pay attention to the following.

If removed, refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection to install:

- MAPTS
- Fuel rail with injectors.

Install **NEW** gaskets with tab properly inserted in notch.

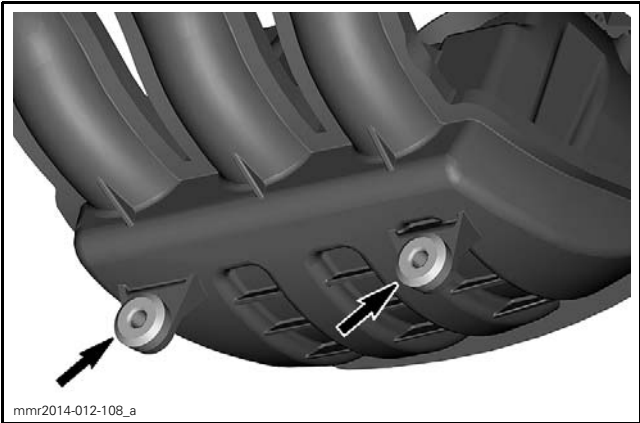


900 ACE ENGINE SHOWN

1. Gaskets tab properly inserted

Ensure rubber grommets are properly inserted.

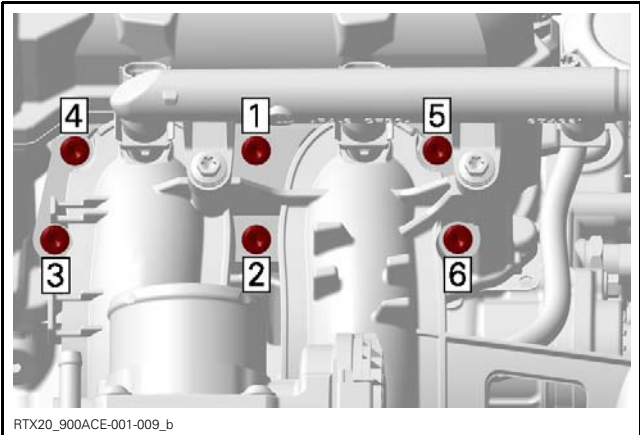
Subsection XX (INTAKE MANIFOLD)



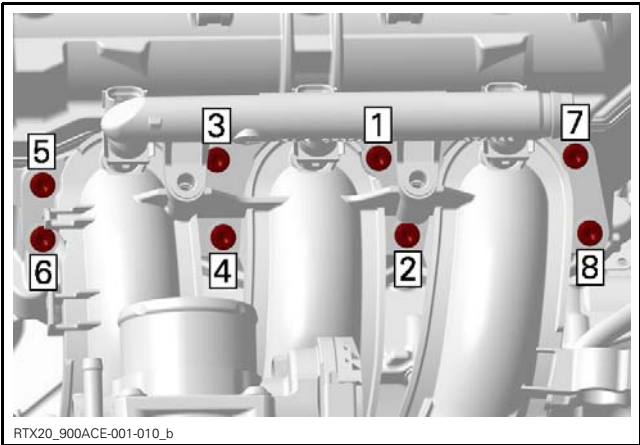
900 ACE ENGINE SHOWN

Tighten intake manifold screws to specification as per the following sequence.

TIGHTENING TORQUE	
Intake manifold screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



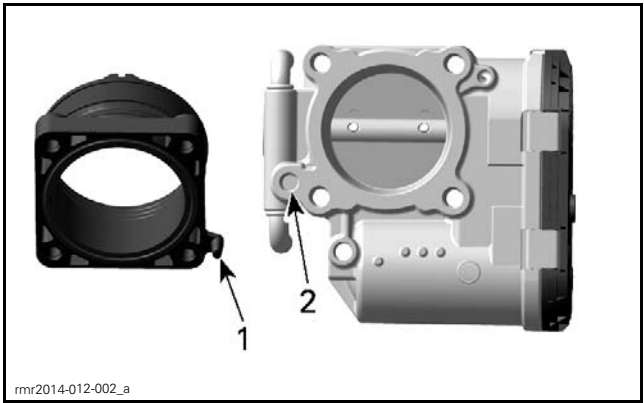
600 ACE ENGINE - TIGHTENING SEQUENCE



900 ACE ENGINE - TIGHTENING SEQUENCE

If removed, install throttle body on connecting socket.

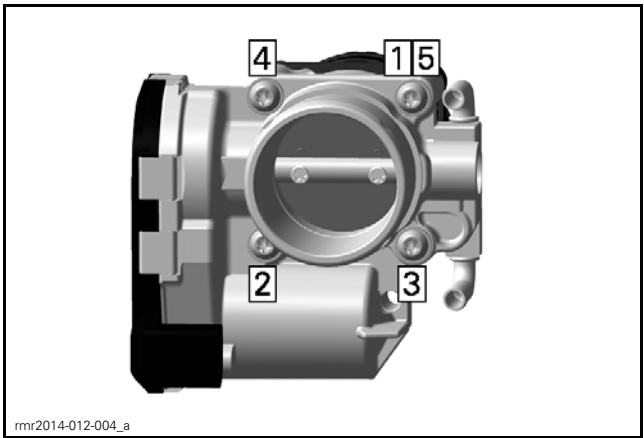
Make sure to index intake manifold pin with throttle body positioning bore.



- 1. Intake manifold pin
- 2. Throttle body positioning bore

Tighten throttle body screws to specification as per the following sequence.

TIGHTENING TORQUE	
Throttle body screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



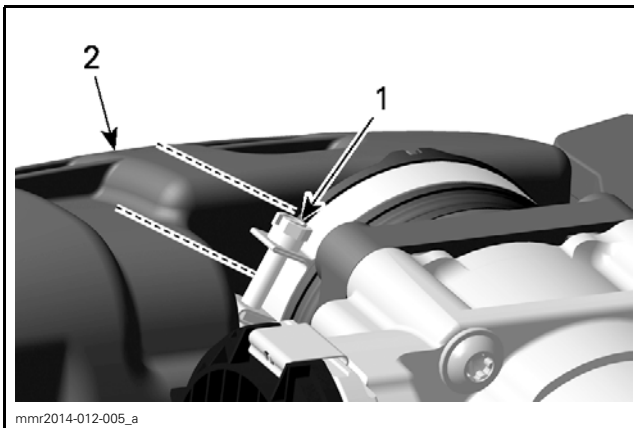
TIGHTENING SEQUENCE

Make sure to index connecting socket notch with the intake manifold tab.



900 ACE ENGINE SHOWN - INTAKE MANIFOLD TAB

Install connecting socket clamp in proper position and tighten to specification.



ALLOWED POSITION OF CLAMP SCREW

1. Screw of clamp
2. Intake manifold

TIGHTENING TORQUE	
Connecting socket clamp	0.9 N•m ± 0.1 N•m (8 lbf•in ± 1 lbf•in)



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NEGATIVE feedback and notify me at bestshopmanuals@gmail.com

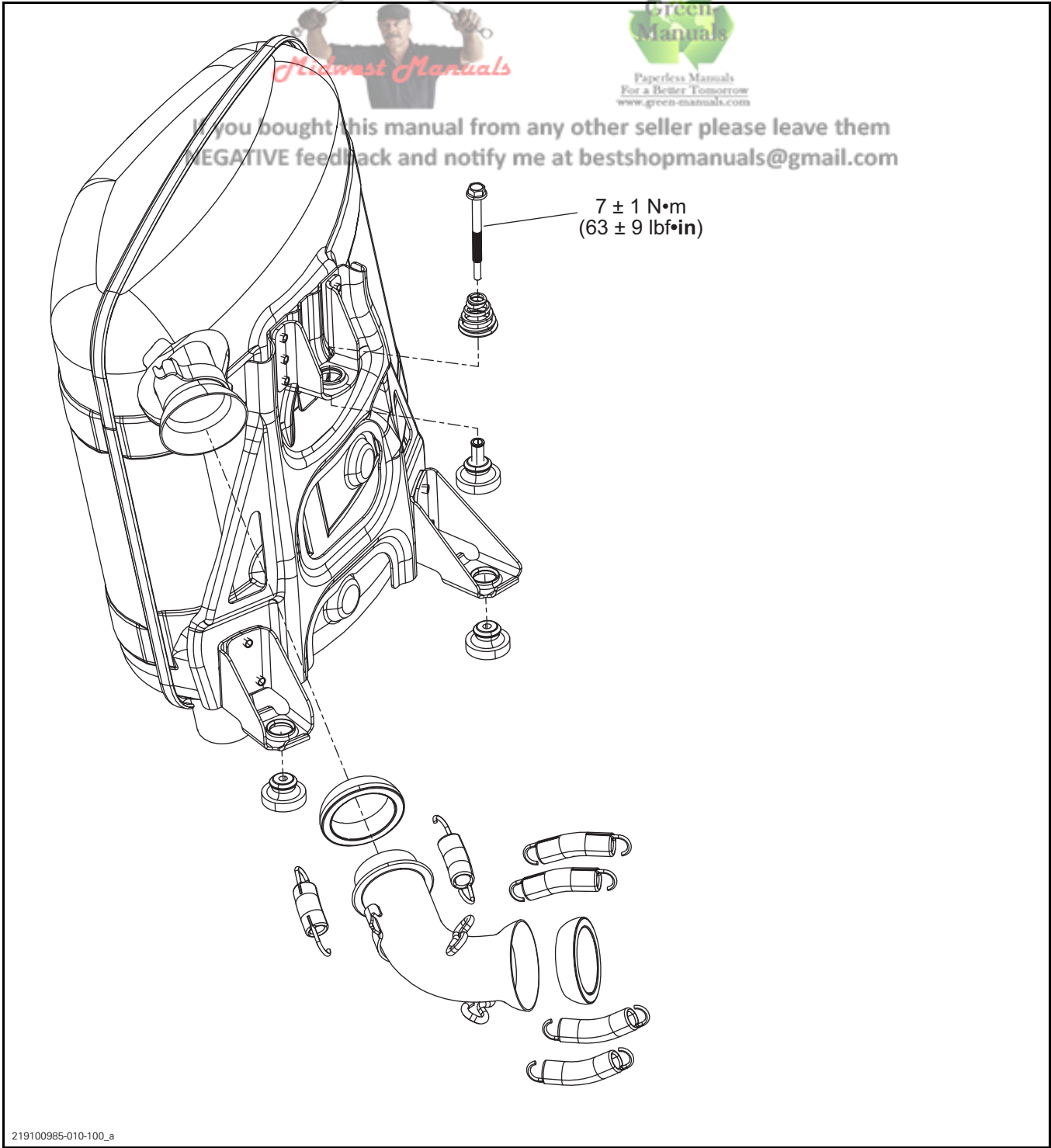
EXHAUST SYSTEM (900 ACE AND 900 ACE TURBO)

SERVICE TOOLS

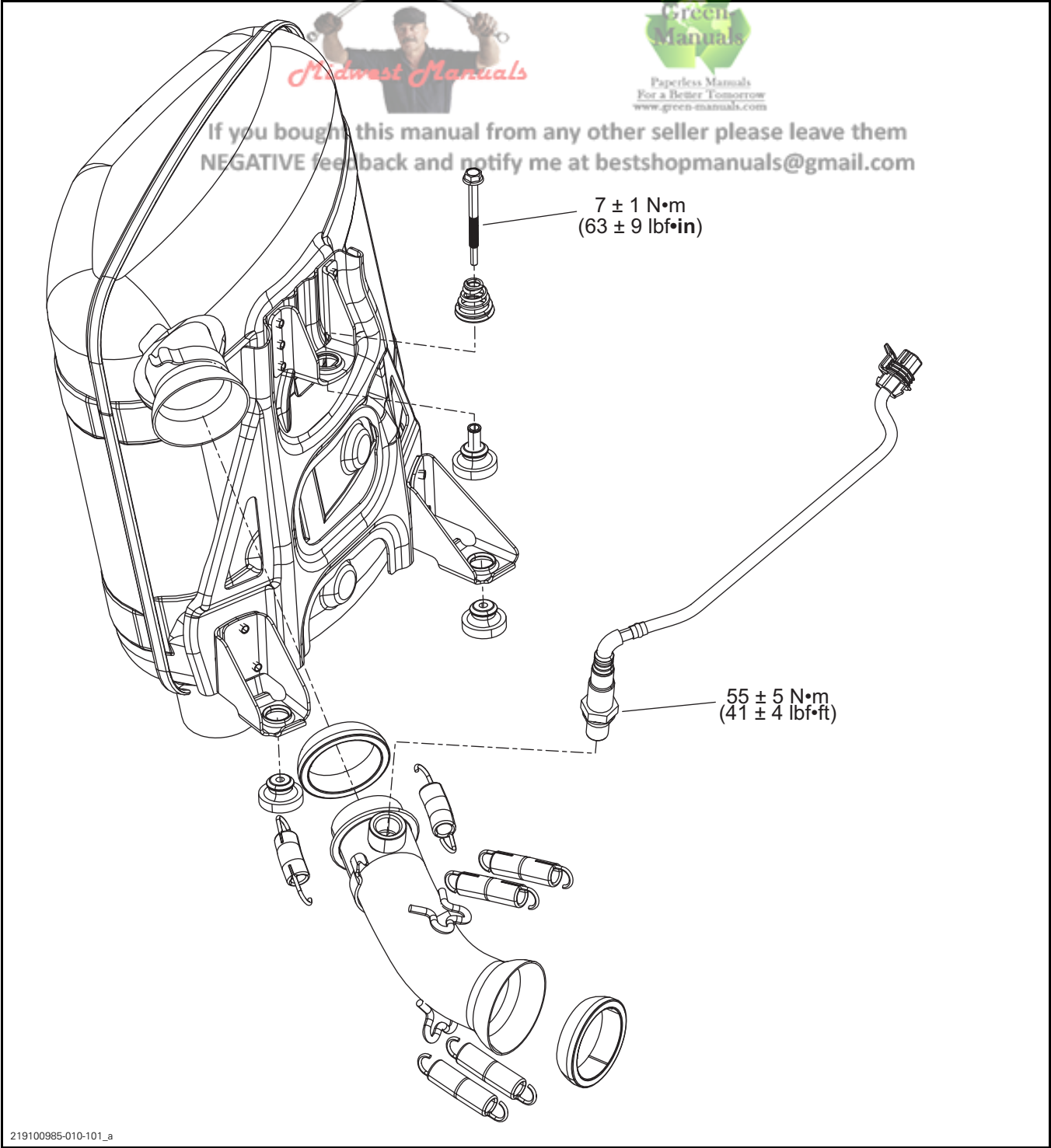
Description	Part Number	Page
SPRING INSTALLER/REMOVER	529 035 983	4

Subsection XX (EXHAUST SYSTEM (900 ACE AND 900 ACE TURBO))

Models without Turbocharger



Models with Turbocharger



GENERAL

 **WARNING**

To avoid potential burns, never touch exhaust system components immediately after the engine has been running because these components are very hot. Let engine and exhaust system cool down before performing any servicing.

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

 **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.

MAINTENANCE

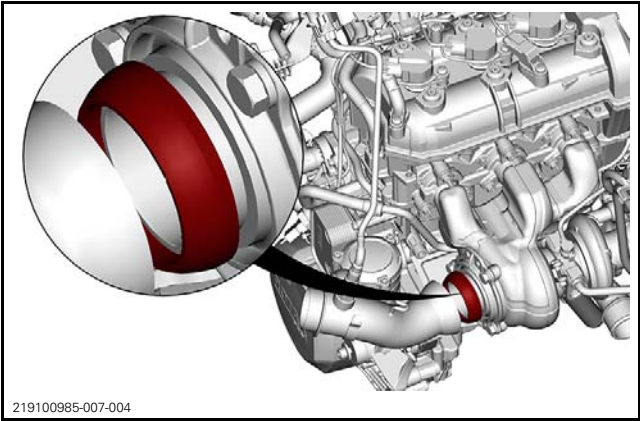
INSPECTING THE EXHAUST SYSTEM COMPONENTS

Check the following components for leaks, cracks, or other damages:

- Springs and retainers
- Exhaust system mounts
- Muffler
- Exhaust pipe
- Donut gaskets
- Shields
- Manifold.

REPLACING THE TURBO EXHAUST GASKET (APPLICABLE MODELS)

1. Remove the exhaust pipe. Refer to procedure in this subsection.
2. Replace the exhaust gasket.



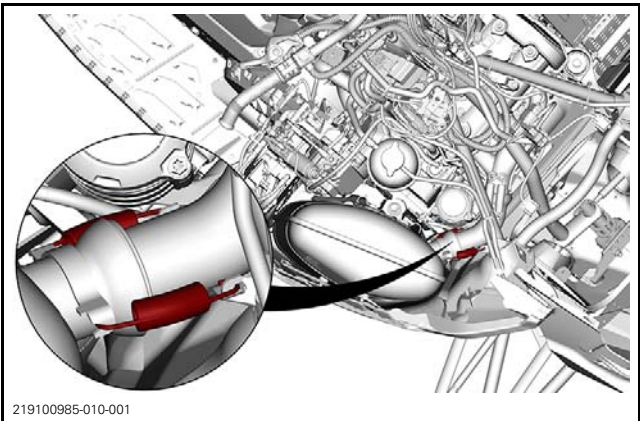
PROCEDURES

MUFFLER

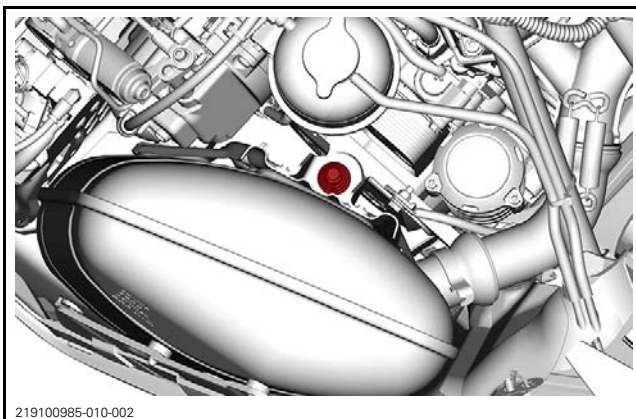
Removing the Muffler

1. Remove the upper body module. Refer to *BODY* subsection.
2. Remove exhaust springs retaining the exhaust pipe to the muffler.

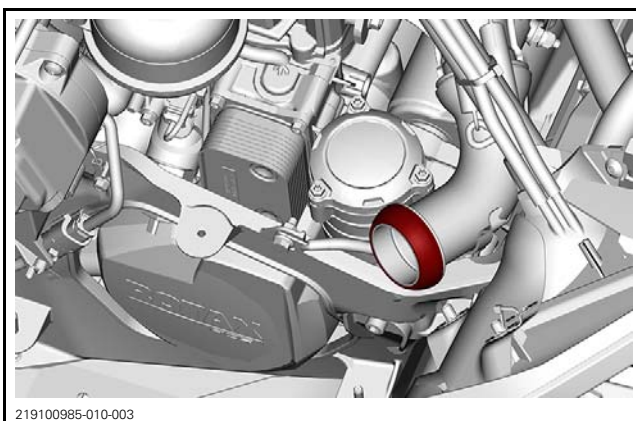
REQUIRED TOOL	
SPRING INSTALLER/REMOVER (P/N 529 035 983)	



3. Behind the muffler, remove the retaining screw and its spring.



4. Remove the muffler.
5. Remove exhaust gasket.



Inspecting the Muffler

Check the muffler for cracks or other damages.
Check grommet condition.
Inspect exhaust gasket condition. Replace as required.

Installing the Muffler

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

TIGHTENING TORQUE	
Muffler retaining screw	7 N•m ± 1 N•m (62 lbf•in ± 9 lbf•in)

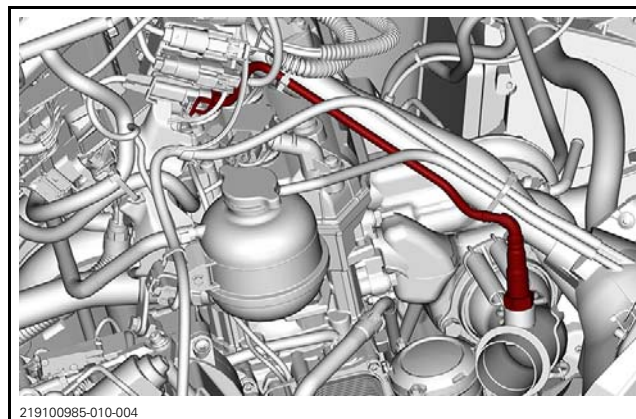
EXHAUST PIPE

Removing the Exhaust Pipe

1. Remove the muffler.

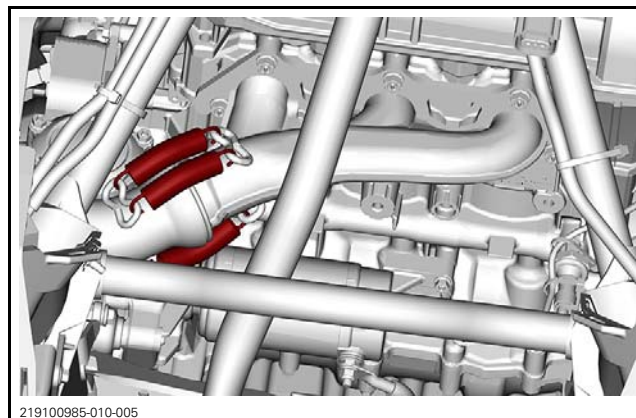
Models with Turbocharger

2. Disconnect the oxygen sensor.

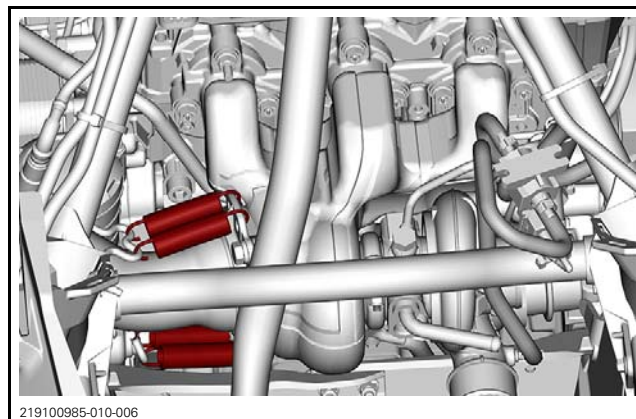


All Models

3. Remove exhaust springs retaining the exhaust pipe to the exhaust manifold.

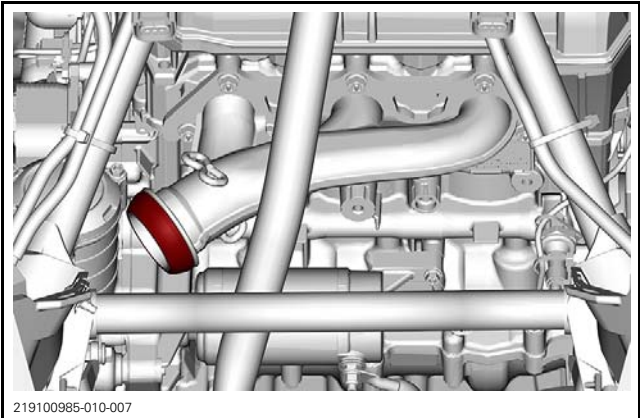


WITHOUT TURBOCHARGER

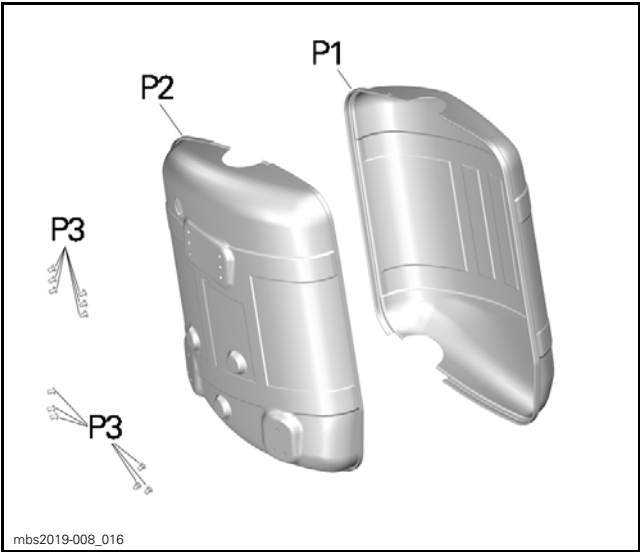


WITH TURBOCHARGER

4. Remove tuned pipe.
5. Remove exhaust gasket.

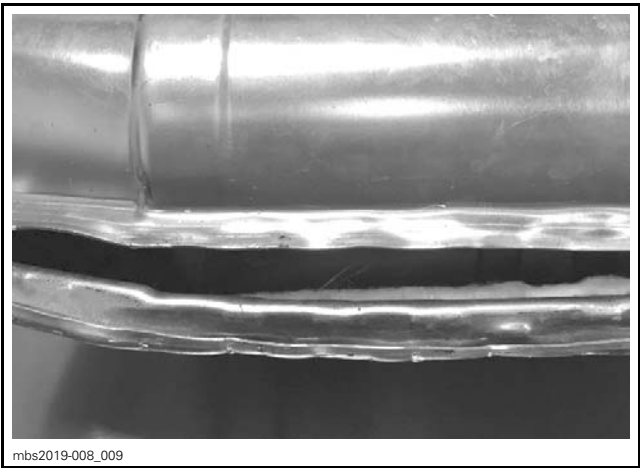


Removing the Heat Shields



ITEM	DESCRIPTION	PART NUMBER	QUANTITY
P1	RH Deflector	514055792	1
P2	LH Deflector	514055707	1
P3	Rivet Avex	390909100	12

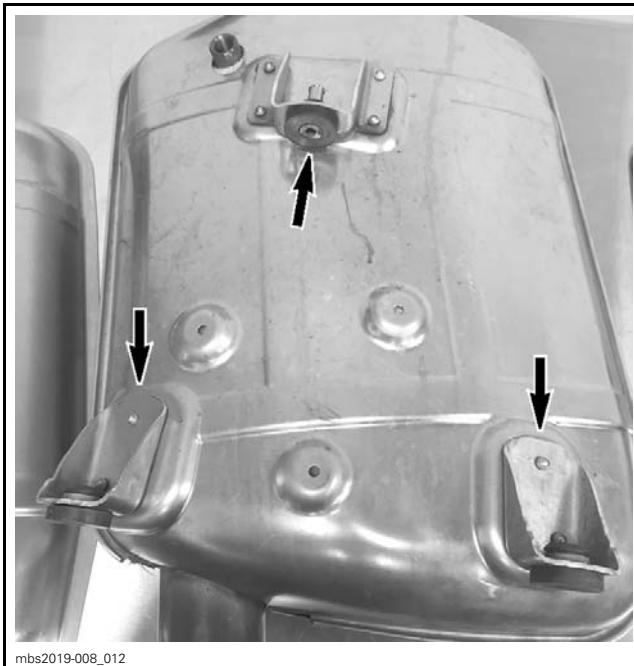
1. Remove muffler. Refer to procedure in this subsection.
2. Place muffler flat on a work bench.
3. Using a pair of adjustable channel lock pliers, unfold the deflectors lip/edges all around the muffler perimeter as depicted below.



4. Remove and discard the two deflectioners, keeping both insulating wool for reuse.



5. Using a 5 mm (3/16 in) drill bit, drill the rivets that hold the three brackets. Keep all three brackets for reuse.



3 brackets



Installing the Heat Shields

1. Put a clean rag on your work bench for protection, reinstall all three brackets on LH deflector no. P2 using new rivets no. P3.



Upper center bracket



Lower bracket

2. Place the new LH deflector face down and insert insulating wool previously removed.

Subsection XX (EXHAUST SYSTEM (900 ACE AND 900 ACE TURBO))



3. Place muffler into LH deflector.

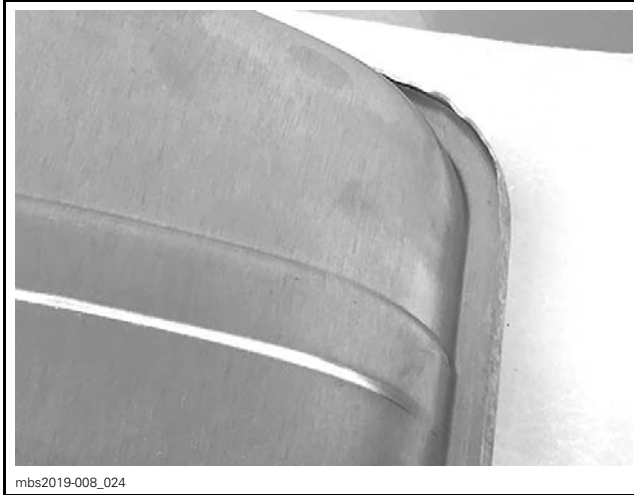


4. Place insulating wool previously removed onto muffler and install the new RH deflector **no. P1**.

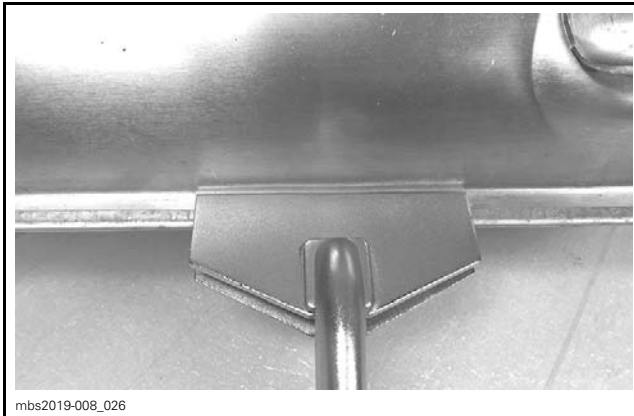


5. Start by folding the RH deflector edge onto LH deflector edge at an approximate 60° angle using a nylon head hammer all around the muffler perimeter.





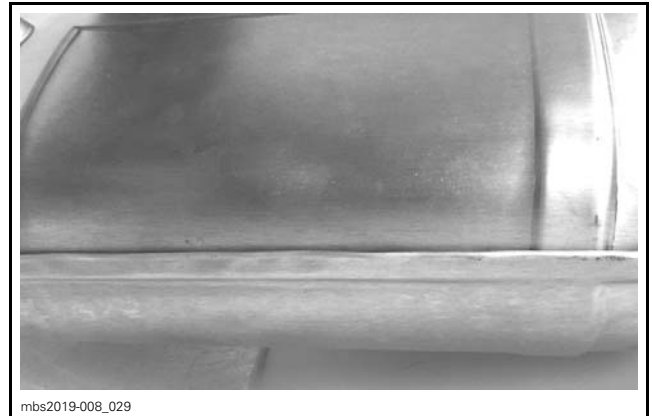
6. Using a pair of flat nose pliers, fold down flat and squeeze tight the RH deflector edge onto LH deflector edge all around the muffler perimeter.



7. Using a cloth type protective tape, put a few layers of tape around deflectors edge for protection.



8. Using a steel head hammer, fold up deflector edges up against LH deflector sides, after working around the muffler perimeter, remove the protective tape.



9. Reinstall muffler. Refer to procedure in this subsection.

Inspecting the Exhaust Pipe

Check exhaust pipe for:

- Damages
- Cracks.

Inspect exhaust gasket condition. Replace as required.

Installing the Exhaust Pipe

The installation is the reverse of the removal procedure.

EXHAUST MANIFOLD

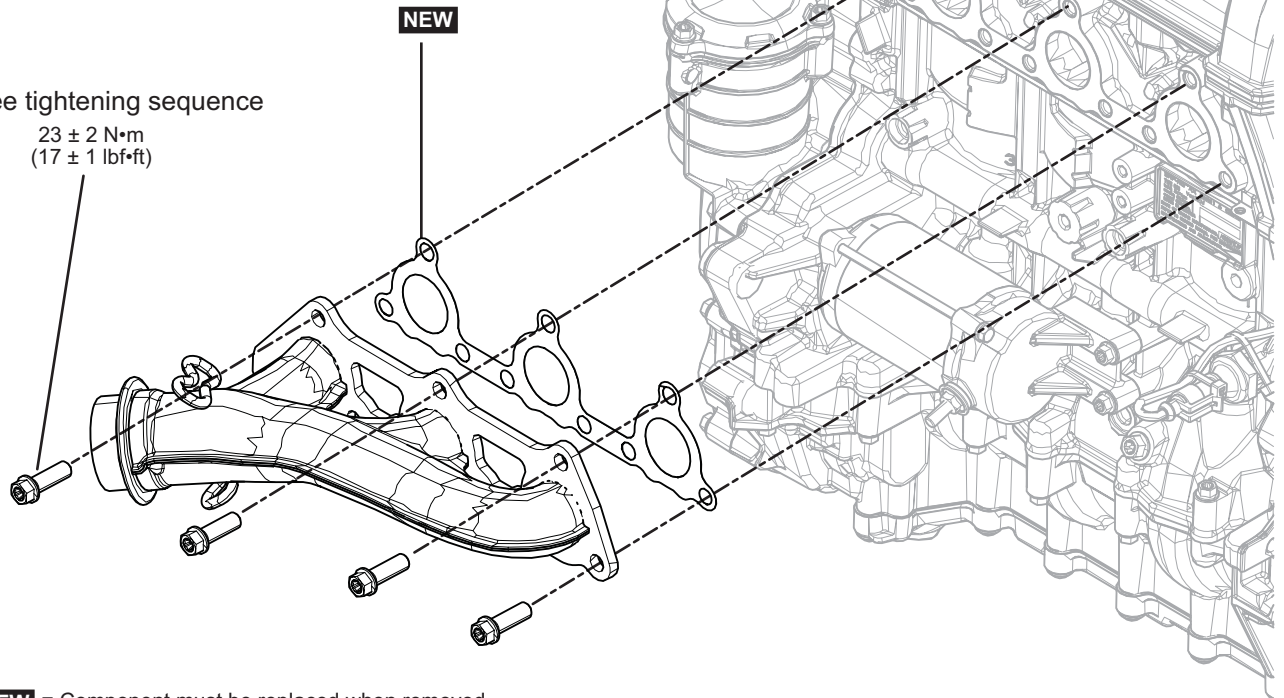
900 ACE



If you bought this manual from any other seller please leave them
NEGATIVE feedback and notify me at bestshopmanuals@gmail.com

See tightening sequence

$23 \pm 2 \text{ N}\cdot\text{m}$
($17 \pm 1 \text{ lbf}\cdot\text{ft}$)



NEW = Component must be replaced when removed.

RTX19_900ACE-002-500

GENERAL



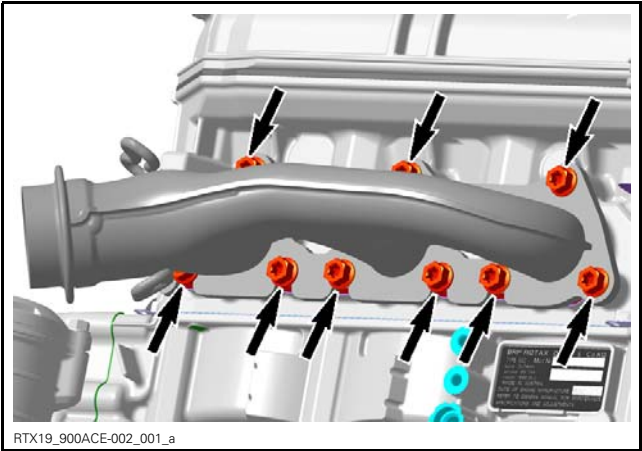
WARNING
To avoid potential burns, never touch ex-
haust system components immediately after
the engine has been running because these
components are very hot. Let engine and ex-
haust system cool down before performing
any servicing.

PROCEDURES

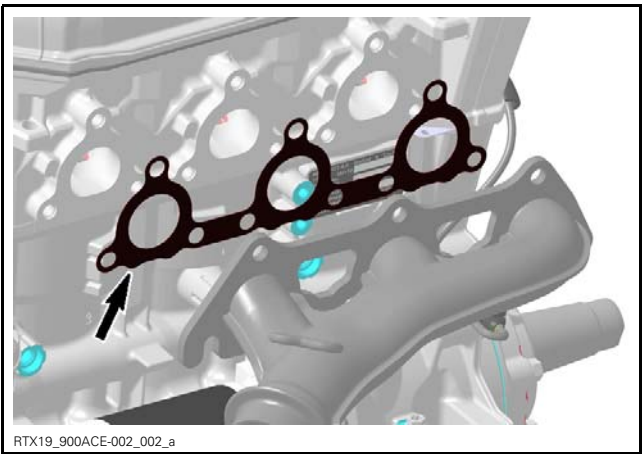
EXHAUST MANIFOLD

Removing the Exhaust Manifold

1. Remove exhaust manifold screws (9).



2. Remove exhaust manifold.
3. Remove and discard exhaust manifold gasket.

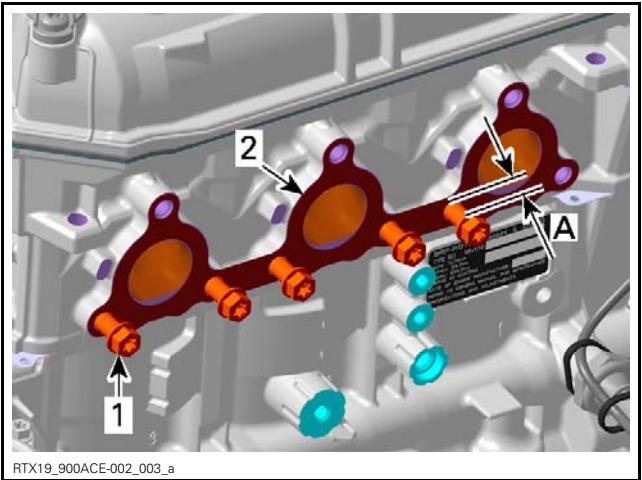


Inspecting the Exhaust Manifold

Check if the manifold is cracked or damaged. Re-
place if necessary.

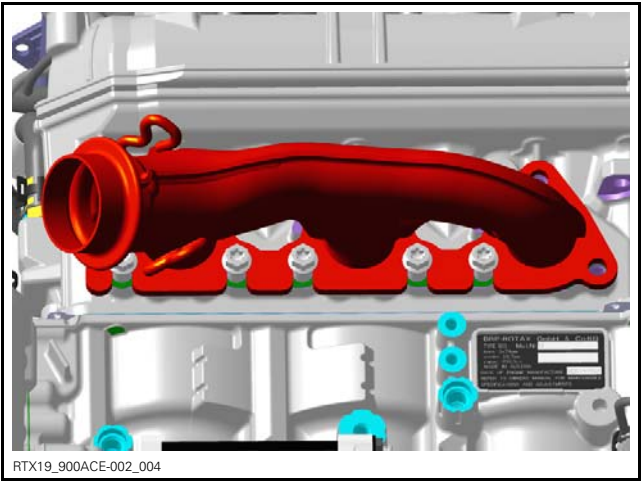
Installing the Exhaust Manifold

Install **NEW** exhaust manifold gasket and exhaust
manifold screws as shown.



1. Exhaust manifold screws
2. Gasket
A. 15 mm (.6 in)

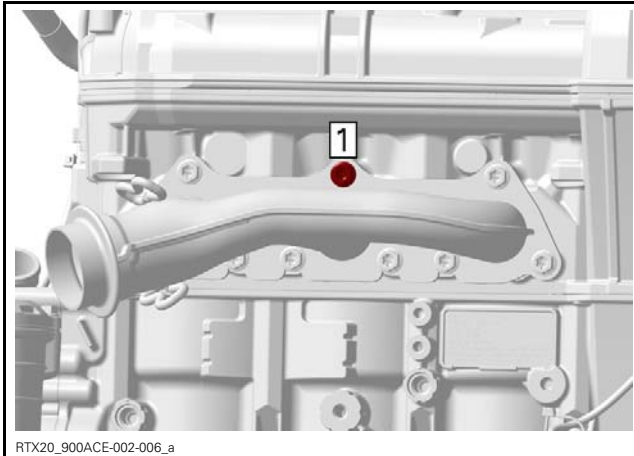
Fit the exhaust manifold on the previously in-
stalled screws.



Install the remaining exhaust manifold screws.
Tighten screws according the following sequence

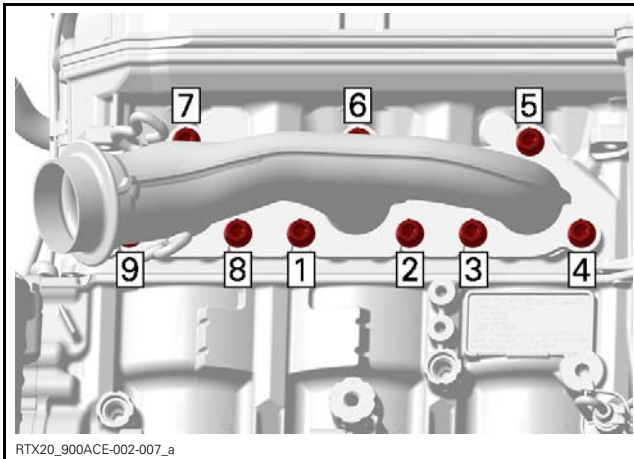
NOTICE Do not use an impact wrench to
tighten exhaust manifold screws.

TIGHTENING TORQUE		
Exhaust manifold screws	STEP A	5 N•m ± 0.6 N•m (44 lbf•in ± 5 lbf•in)



TIGHTENING SEQUENCE - STEP A

TIGHTENING TORQUE		
Exhaust manifold screws	STEP B	23 N•m ± 2 N•m (17 lbf•ft ± 1 lbf•ft)



TIGHTENING SEQUENCE - STEP B

LUBRICATION SYSTEM

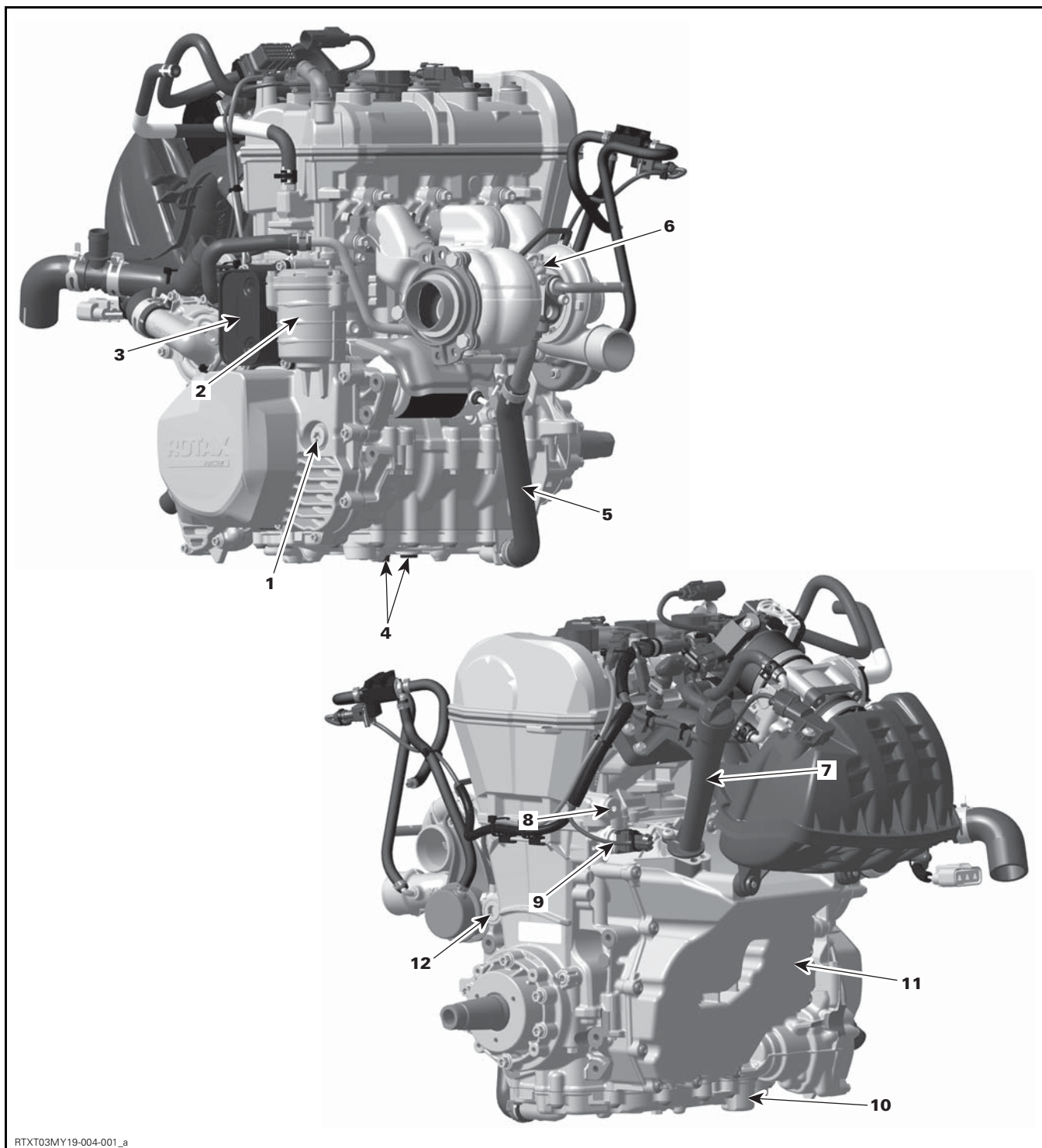
SERVICE TOOLS

Description	Part Number	Page
ECM ADAPTER TOOL.....	529 036 166	9
FLUKE 115 MULTIMETER	529 035 868	9
OIL PRESSURE HOSE	529 036 394	7
PRESSURE GAUGE.....	529 036 395	7

SERVICE PRODUCTS

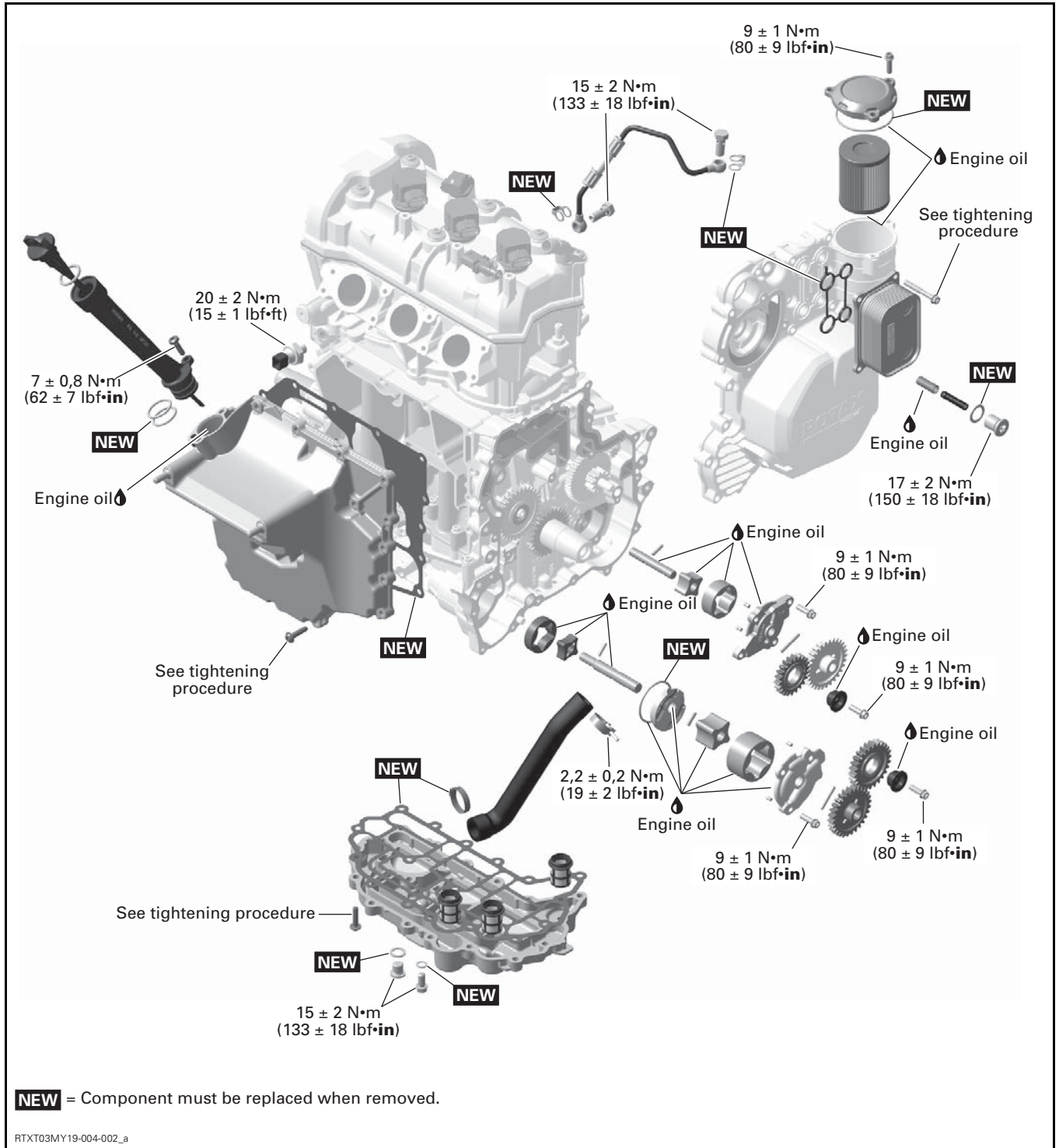
Description	Part Number	Page
4T 0W40 SYNTHETIC OIL (EUR)	779286	4
4T 0W40 SYNTHETIC OIL.....	779139	4

Subsection XX (LUBRICATION SYSTEM)



RTXT03MY19-004-001_a

1. Oil pressure regulator
2. Oil filter
3. Oil cooler
4. Drain plugs
5. Oil return hose
6. Oil pressure line (connection to turbo charger)
7. Oil dip stick
8. Chain tensioner
9. Oil pressure switch
10. Oil strainers
11. Oil tank
12. Oil pressure line (connection to cylinder block)



GENERAL

SYSTEM DESCRIPTION

This engine uses dry sump lubrication. The oil from the cylinder block, timing chain chamber and magneto cover is pumped by two suction pumps. Both suction pumps are integrated into one module.

The 20 mm (.79 in) large oil suction pump returns the crankshaft and magneto chamber oil to the reservoir.

The 11 mm (.43 in) small oil suction pump returns the timing chain chamber oil to the oil reservoir.

An oil filter and three oil strainers are used to filter dirt and debris from the oil circuit.

The oil strainers are located between oil sump cover and crankcase lower underneath the oil pressure pump.

The oil pressure is provided by a pump and regulated by a spring loaded pressure regulator.

MAINTENANCE

RECOMMENDED ENGINE OIL

Rotax® engines were developed and validated using the XPS™ oil. BRP recommends the use of its XPS engine oil or an equivalent at all time. Do not add any oil additives to the recommended engine oil. Damages caused by the use of an oil not suitable for the engine or by adding of an oil additives may not be covered by the BRP Limited Warranty.

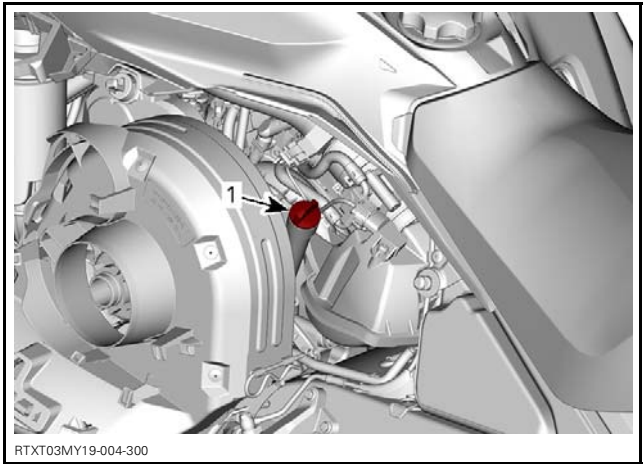
XPS™ RECOMMENDED ENGINE OIL	
Scandinavia	4T 0W40 SYNTHETIC OIL (EUR) (P/N 779286)
All other countries	4T 0W40 SYNTHETIC OIL (P/N 779139)
IF THE RECOMMENDED XPS ENGINE OIL IS NOT AVAILABLE	
Use a 0W40 4-stroke SAE synthetic engine oil meeting or exceeding the following lubricant industry specifications: – API service classification SM or SN Always check the API service label certification on the oil container, it must contain at least the indicated standard.	

ENGINE OIL LEVEL VERIFICATION

NOTICE Operating the engine with an improper oil level may cause severe engine damage. Follow this procedure to obtain a precise reading of the engine oil level.

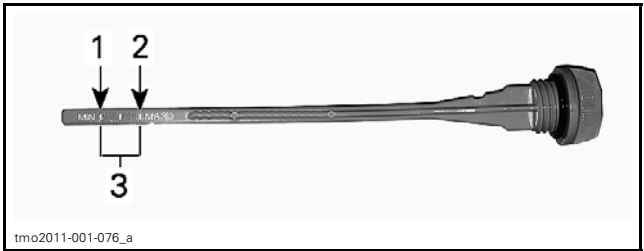
With the engine at normal operating temperature (90°C (194°F) at oil tank surface), place vehicle on a level surface and proceed as follows to check oil level:

- 1. Start engine and let it idle for at least 30 seconds.
- 2. Stop engine.
- 3. Open the LH side panel.
- 4. Unscrew and remove dipstick and wipe clean.



1. Oil tank dipstick

- 5. Put the dipstick back in the filler tube and fully tighten it
- 6. Remove dipstick again and check oil level. It should be near or equal to the MAX mark.



TYPICAL
1. MIN
2. MAX
3. Operating range

- 7. To add oil, place a funnel into the filler tube to avoid spillage.
7.1 Add a small amount of oil and recheck oil level.

- 7.2 Repeat the operation until oil level reaches the dipstick's MAX mark. Do not overfill.

NOTE: The oil quantity between MIN. and MAX. mark is approximately 500 ml (16.9 U.S. oz).

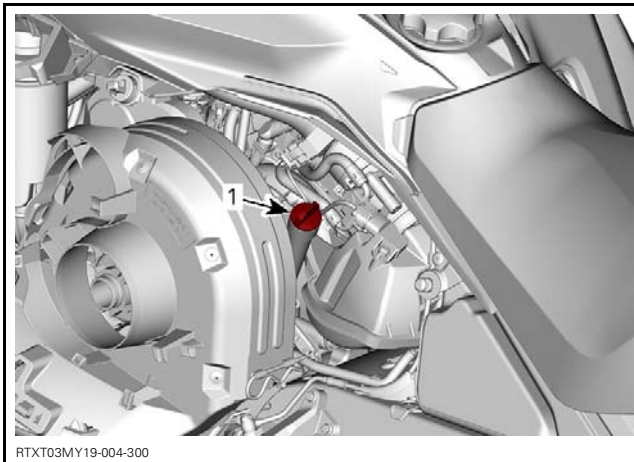
8. Reinstall dipstick and properly tighten it.
9. Wipe off any oil spillage.
10. Close the LH side panel.

ENGINE OIL REPLACEMENT

CAUTION The engine oil can be very hot. Wait until engine oil is warm.

NOTICE Engine oil and oil filter must be replaced at the same time.

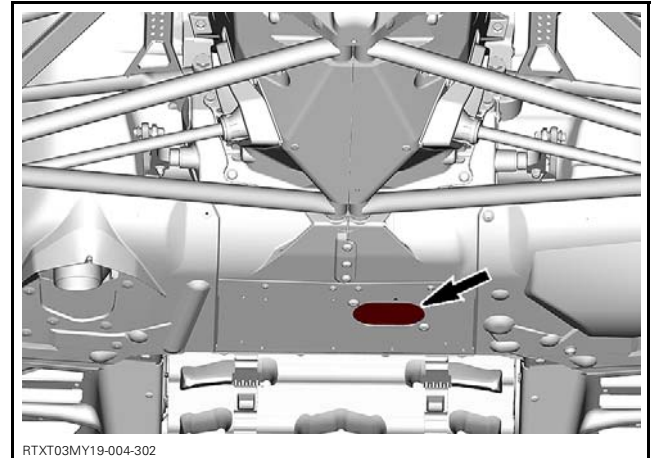
1. Bring engine to its normal operating temperature (90°C (194°F) at oil tank surface).
2. Place vehicle on a level surface.
3. Remove the LH side panel.
4. Remove dipstick.



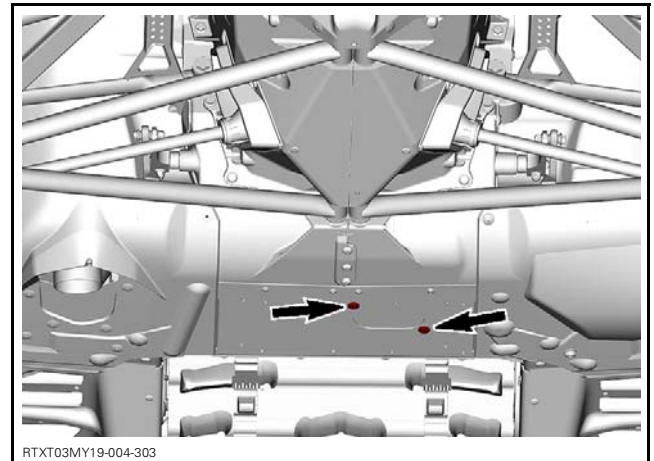
LH SIDE OF VEHICLE

1. Oil tank dipstick

5. Remove oil filter. Refer to *ENGINE OIL FILTER REPLACEMENT* in this subsection.
6. From underneath the vehicle, access the drain plug:
 - 6.1 Remove one access cover retaining screw and loosen the other.
 - 6.2 Pivot the access cover to clear the bottom pan opening.

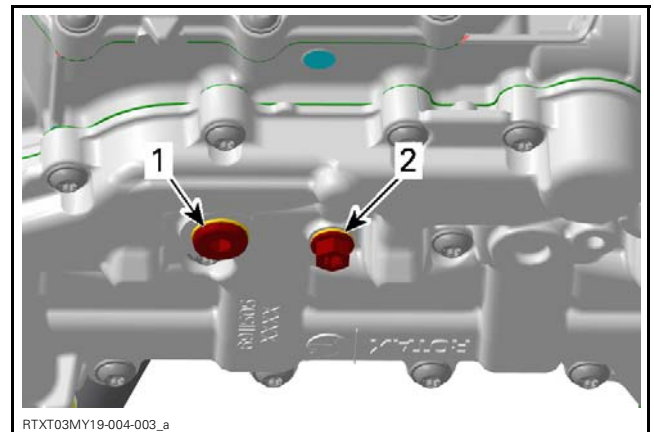


DRAIN PLUGS ACCESS COVER



ACCESS COVER SCREWS

7. Clean drain plug area.
8. Place a drain pan under the bottom pan opening.
9. Remove engine drain plugs in the following order:
 - 9.1 Main drain plug.
 - 9.2 Secondary drain plug.

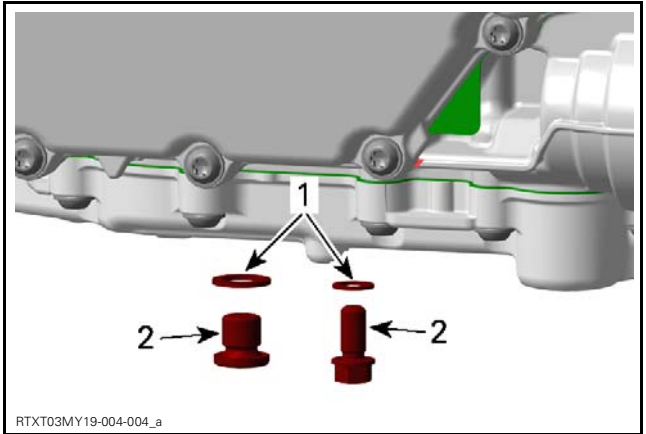


1. Main drain plug
2. Secondary drain plug

Subsection XX (LUBRICATION SYSTEM)

- 10. Allow oil to drain completely.
- 11. Install **NEW** sealing washers on oil drain plugs.

NOTICE Never use a sealing washer a second time. Always replace with a new one.



1. Sealing washers
2. Oil drain plugs

- 12. Install drain plugs and tighten to the specified torque.

TIGHTENING TORQUE	
Drain plugs	15 N•m ± 2 N•m (133 lbf•in ± 18 lbf•in)

- 13. Replace *OIL FILTER*, see procedure in this subsection.
- 14. Refill oil tank at the proper level with the recommended oil.

APPROXIMATE ENGINE OIL CAPACITY (WITH FILTER)
3.3 L (3.5 qt (U.S. liq.))

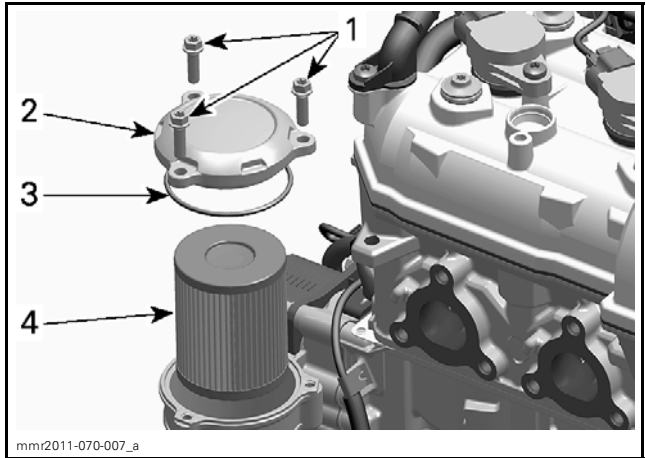
- 15. Reinstall dipstick in oil tank and properly tighten it.
- 16. Start engine and let it idle for a few minutes.
- 17. Ensure there are no leaks.
- 18. Stop engine and check oil level as explained in this subsection. Refill if necessary.
- 19. Dispose oil and filter as per your local environmental regulations.

ENGINE OIL FILTER REPLACEMENT

Removing the Oil Filter

- 1. Remove the RH side panel.
- 2. Remove the muffler. Refer to *EXHAUST SYSTEM* subsection.

- 3. Clean oil filter area.
- 4. Remove:
 - Oil filter cover screws
 - Oil filter cover with O-ring
 - Oil filter.

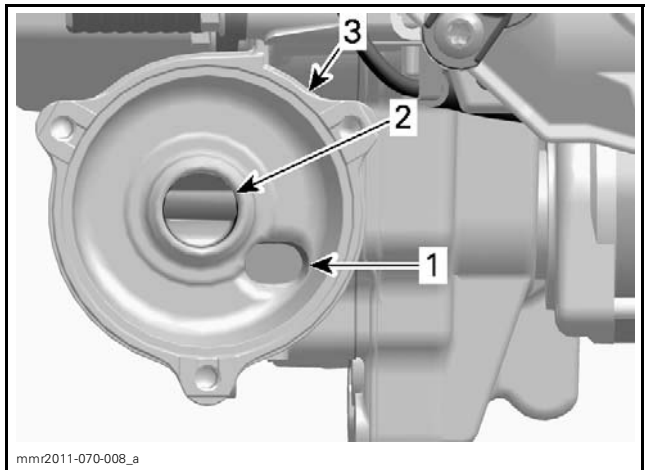


TYPICAL
1. Oil filter cover screws
2. Oil filter cover
3. O-ring
4. Oil filter

- 5. Dispose filter as per your local environmental regulations.

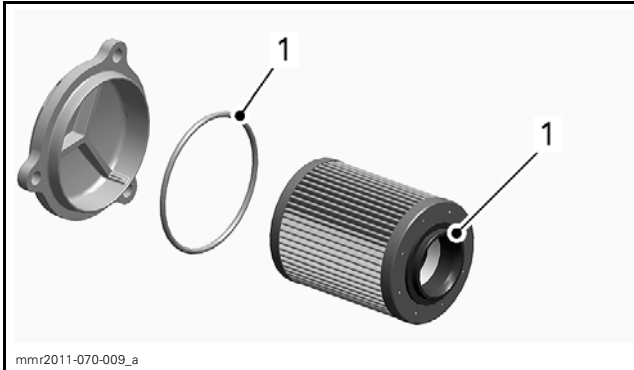
Installing the Oil Filter

- 1. Check the oil filter inlet and outlet orifices inside oil filter housing (integrated in magneto cover) for dirt and contaminations.



1. Oil inlet orifice from the oil pressure pump
2. Oil outlet orifice to the engine lubrication system
3. Oil filter housing

- 2. Install a **NEW** O-ring on oil filter cover.
- 3. Lubricate filter seal and cover O-ring with engine oil.



1. Lubricate with engine oil

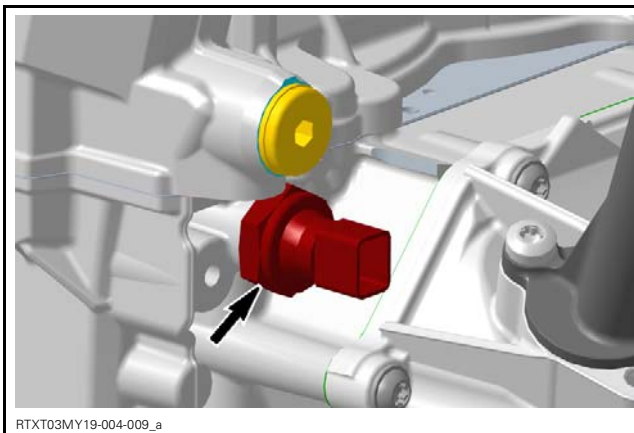
4. Install the oil filter cover.
5. Tighten oil filter cover screws to the specified torque.

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

INSPECTION

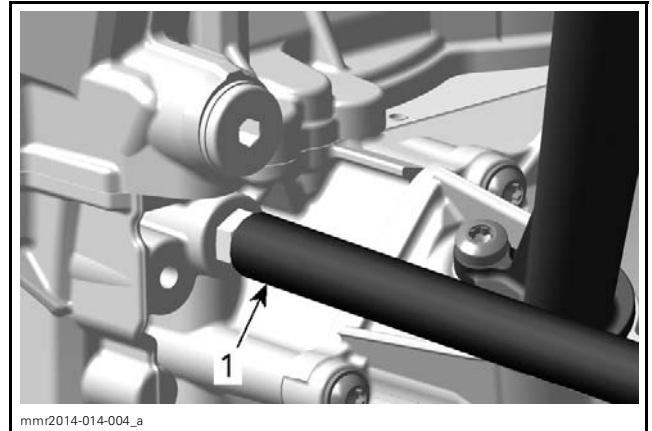
ENGINE OIL PRESSURE TEST

1. Remove countershaft bearing support. Refer to *DRIVEN PULLEY AND COUNTERSHAFT* subsection.
2. Disconnect oil pressure switch connector.
3. Remove oil pressure switch from cylinder block.



4. Install adapter hose on cylinder block.

REQUIRED TOOLS	
OIL PRESSURE HOSE (P/N 529 036 394)	



1. Adapter hose

5. Connect pressure gauge to the oil pressure hose.

REQUIRED TOOL	
PRESSURE GAUGE (P/N 529 036 395)	

6. Start engine and check oil pressure.

ENGINE OIL PRESSURE @ 100°C (212°F) ENGINE OIL TEMPERATURE	
ENGINE SPEED	MINIMUM PRESSURE
Idle	80 kPa (11.6 PSI)
4000 RPM	260 kPa (37.71 PSI)
6000 to 8000 RPM	300 kPa (43.51 PSI)

If the engine oil pressure is out of specification, refer to *TROUBLESHOOTING* in this subsection.

7. Remove engine oil pressure test tools.
8. Clean threads of oil pressure switch before installing it.
9. For the installation of the oil pressure switch, refer to *INSTALLING THE OPS* in this subsection.
10. Install all other removed parts.

TROUBLESHOOTING

Always check for fault codes. If a fault code is detected, service the fault code first.

Subsection XX (LUBRICATION SYSTEM)

LOW OR NO ENGINE OIL PRESSURE

- 1. Oil level is too low.
 - Refill engine oil.
 - Check for high oil consumption. See below.
 - Check for oil leaks (oil leaking out of leak indicator hole, gaskets, oil seal or O-rings). Repair or replace.
- 2. Defective or clogged oil filter
 - Replace engine oil and filter.
- 3. Use of a bad grade oil
 - Replace engine oil with BRP recommended oil.
- 4. Oil pressure regulator valve sticks open, or spring load is insufficient.
 - Clean oil regulator piston and its bore. Replace if necessary.
 - Measure spring free length. Replace if out of specification.
- 5. Defective oil pressure switch, oil pressure warning light does not disappear.
 - Test the OPS, see procedure in this subsection.
- 6. Oil pump(s) worn or damaged.
 - Check if oil pump drive gears are damaged. Replace if necessary.
 - Check oil pump rotors and its bore for wear limits. Replace if out of specification.
- 7. Engine oil strainer is clogged.
 - Remove and clean engine oil strainer.
- 8. Heavy wear on plain bearings.
 - Check radial clearance of plain bearings. Replace if out of specification.

HIGH OIL CONSUMPTION

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

OIL CONTAMINATION
(WHITE APPEARANCE)

- 1. Oil cooler gasket leaking.
 - Replace gasket. Change engine oil.

- 2. Cylinder head screws not properly tightened.
 - Retighten screws with recommended torque. Change engine oil.
- 3. Cylinder head gasket leaking.
 - Replace cylinder head gasket. Change engine oil.
- 4. Damaged engine parts (e.g. cylinder head, cylinder block,...).
 - Check damages or cracks on engine parts. Replace defective part. Change engine oil.
- 5. Oil seal and rotary seal on water pump shaft leaking.
 - Replace oil seal, rotary seal and water pump shaft. Change engine oil.

PROCEDURES

OIL PRESSURE SWITCH (OPS)

OPS Activation

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

NOTE: ECM does not trigger the OPS signal below 2500 rpm.

OIL PRESSURE SWITCH ACTIVATION RANGE
20 kPa to 50 kPa (2.9 PSI to 7.3 PSI)

OPS Access

- 1. Remove countershaft bearing support. Refer to REMOVING THE COUNTERSHAFT BEARING SUPPORT in DRIVEN PULLEY AND COUNTERSHAFT subsection.

Inspecting the OPS

First, check the oil pressure switch. Perform TESTING THE OPS RESISTANCE and TESTING THE OPS CIRCUIT CONTINUITY..

If the oil pressure switch is good, ensure oil pressure is adequate. Refer to ENGINE OIL PRESSURE TEST in this subsection.

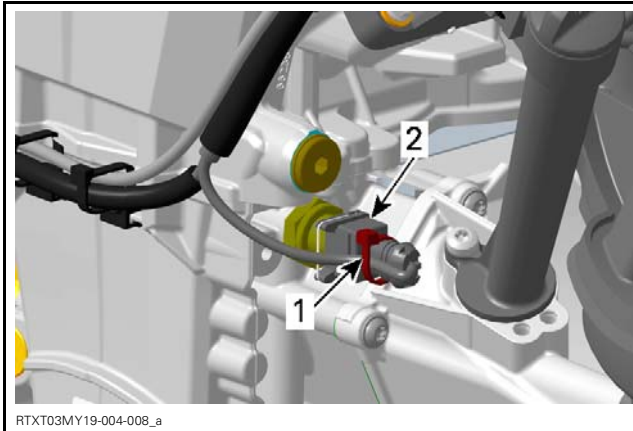
Testing the OPS Resistance

The engine must be warm to check the oil pressure switch properly.

 **WARNING**

Be careful when working near hot parts. Always wear long sleeves and gloves.

- 1. Cut locking tie and disconnect OPS connector.



1. Locking tie
2. OPS connector

2. Check oil pressure switch resistance.

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

3. Read result and compare to table.

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

If resistance is out of specification, replace the oil pressure switch.

If the resistance is correct, continue procedure. It will be necessary to use jumper wires.

4. Install the countershaft bearing support and the driven pulley.

5. Start engine.

6. Read result and compare to table.

RESISTANCE (Ω)		
ENGINE RUNNING		
OPS pin	Engine ground	Infinitely high (OL)

If resistance is out of specification, replace the oil pressure switch.

If the resistance is correct, check the oil pressure switch circuit continuity.

Testing the OPS Circuit Continuity

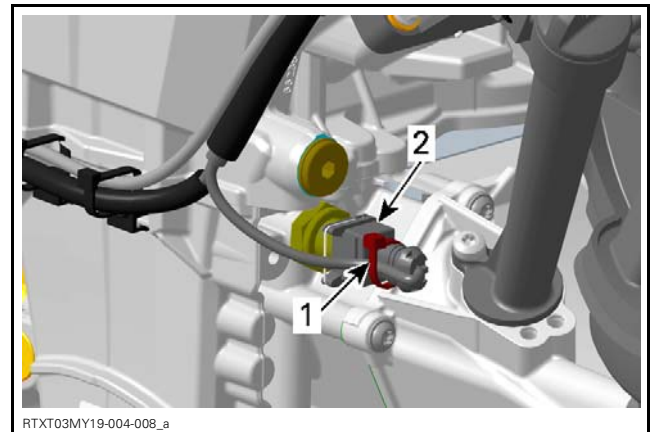
1. Install the ECM connector A on the ECM adapter tool.

REQUIRED TOOL

ECM ADAPTER TOOL
(P/N 529 036 166)



2. Cut locking tie and disconnect the OPS connector.



1. Locking tie
2. OPS connector

3. Check continuity as follows.

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

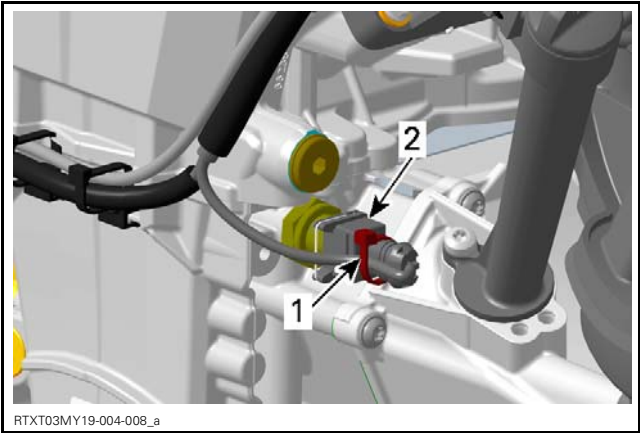
CIRCUIT CONTINUITY		
OPS connector	ECM A pin E3	Close to 0 Ω

If the continuity is good and all other tests are performed, try a **NEW** ECM.

If the continuity is bad, repair or replace defective wire or connectors.

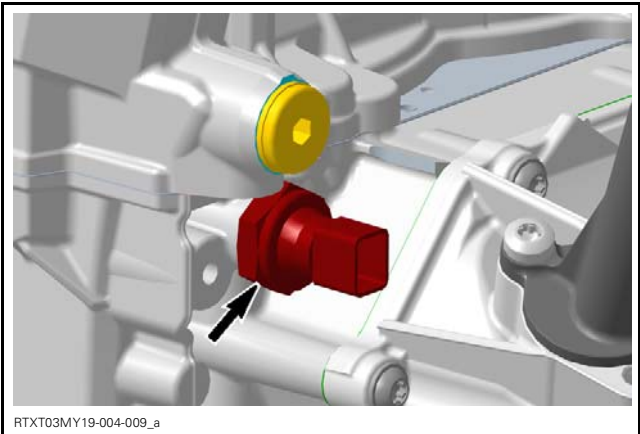
Removing the OPS

1. Cut locking tie and unplug the OPS switch connector.



- 1. Locking tie
- 2. OPS connector

2. Unscrew and remove the OPS.



Installing the OPS

Install oil pressure switch as per following information.

TIGHTENING TORQUE	
Oil pressure switch	20 N•m ± 2 N•m (15 lbf•ft ± 1 lbf•ft)

Install all other removed parts.

NOTICE When installing the locking tie on the OPS connector, avoid making a sharp bend in the wires.

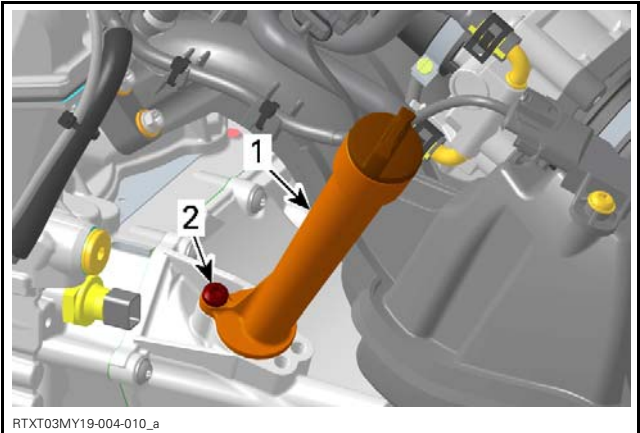
OIL FILLER TUBE

Oil Filler Tube Access

Remove countershaft bearing support. Refer to *REMOVING THE COUNTERSHAFT BEARING SUPPORT* in *DRIVEN PULLEY AND COUNTER-SHAFT* subsection.

Removing the Oil Filler Tube

- 1. Remove oil filler tube retaining screw.

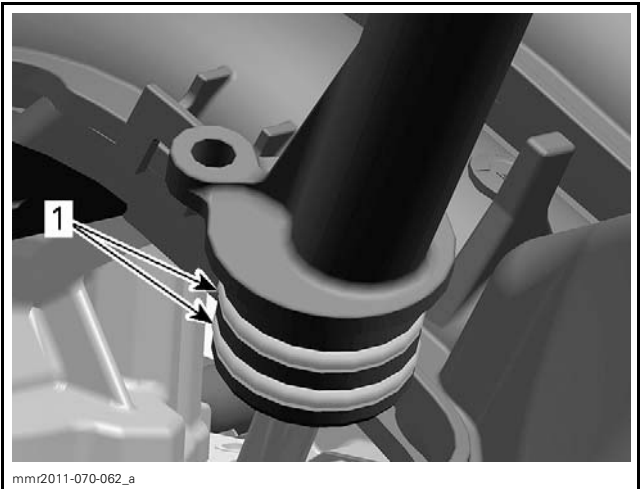


- 1. Oil filler tube
- 2. Retaining screw

- 2. Pull filler tube out of oil tank cover

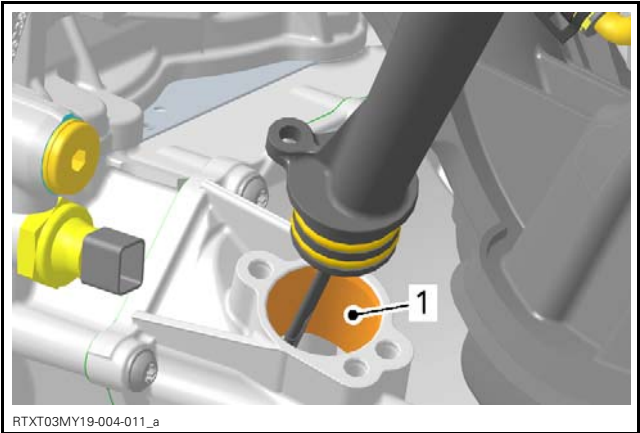
Installing the Oil Filler Tube

- 1. Install **NEW** O-rings on oil filler tube.



- 1. Oil filler tube O-rings

- 2. Lubricate oil tank cover bore with engine oil.



- 1. Lubricate the oil tank cover bore

- 3. Install oil filler tube.

4. Tighten retaining screw to specified torque.

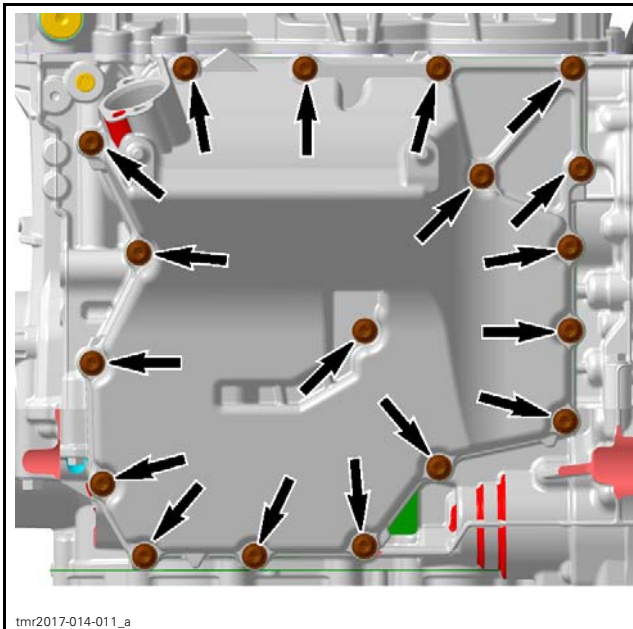
TIGHTENING TORQUE	
Oil filler tube screw	7 N•m ± 0.8 N•m (62 lbf•in ± 7 lbf•in)

5. Install all other removed parts.

OIL TANK

Removing the Oil Tank Cover

1. Remove engine from vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
2. Remove intake manifold. Refer to *INTAKE MANIFOLD* subsection.
3. Place a drain pan underneath oil tank.
4. Unscrew oil tank cover retaining screws.



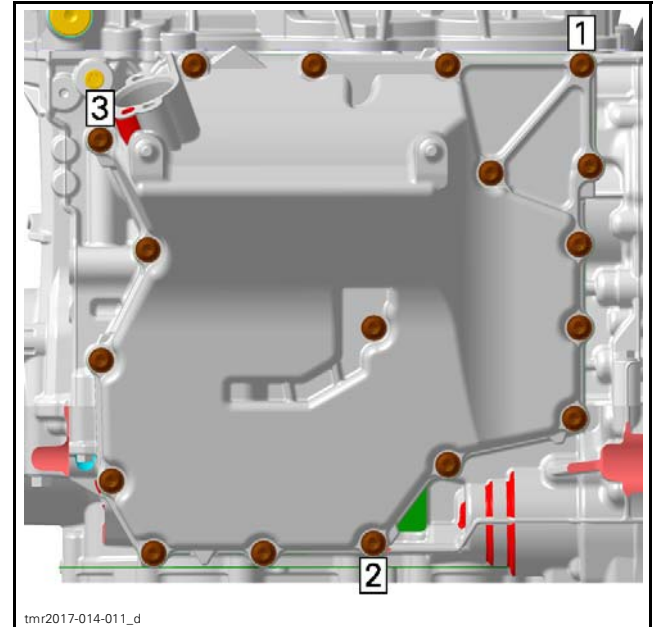
RETAINING SCREWS

5. Remove oil tank from the engine.

Installing the Oil Tank Cover

1. Install NEW gasket.
2. Install oil tank on engine, then tighten screws in two steps as follows:
 - 2.1 Tighten screws to the following specified torque using the specified sequence.

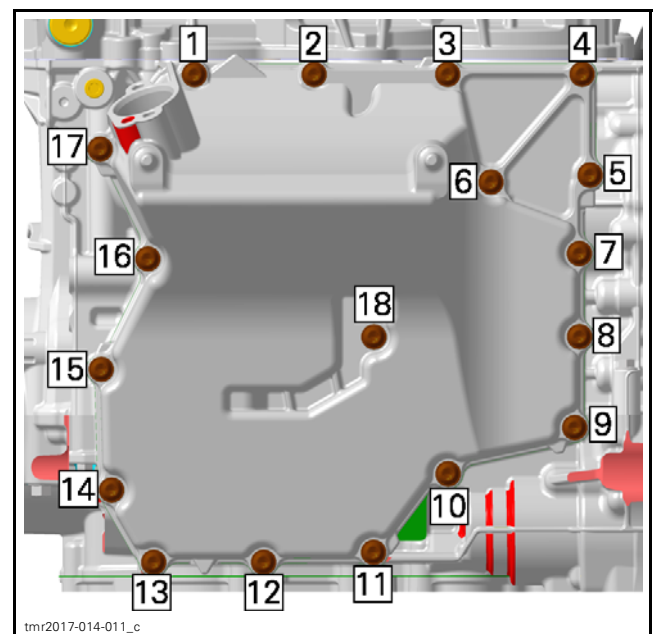
TIGHTENING TORQUE		
Oil tank screws	STEP A	5 N•m ± 0.6 N•m (44 lbf•in ± 5 lbf•in)



TIGHTENING SEQUENCE STEP A

- 2.2 Tighten screws to the following specified torque using the specified sequence.

TIGHTENING TORQUE		
Oil tank screws	STEP B	11 N•m ± 1 N•m (97 lbf•in ± 9 lbf•in)



TIGHTENING SEQUENCE STEP B

3. Wipe up any oil spillage.
4. Install intake manifold. Refer to *INTAKE MANIFOLD* subsection.
5. Install engine in vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
6. Fill up oil tank and check oil level.

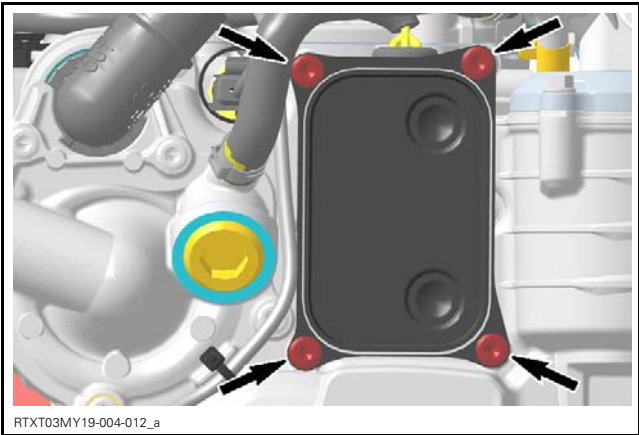
OIL COOLER

Oil Cooler Access

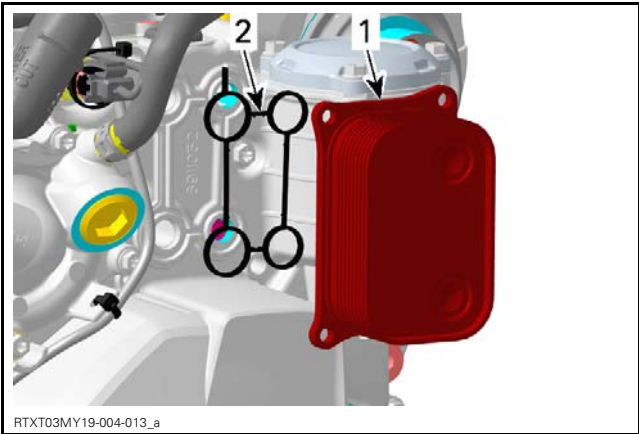
Remove muffler, refer to *EXHAUST SYSTEM* subsection.

Removing the Oil Cooler

- 1. Drain engine oil. Refer to procedure in this subsection.
- 2. Drain cooling system. Refer to *COOLING SYSTEM* subsection..
- 3. Remove oil cooler retaining screws.



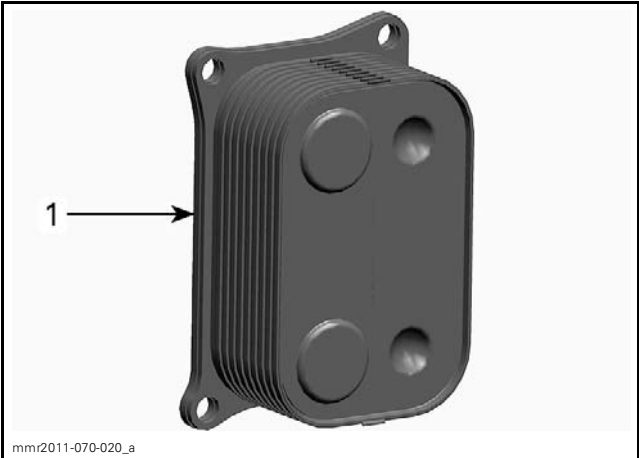
- 4. Place rags or towels under oil cooler to catch remaining oil and coolant.
- 5. Remove oil cooler and gasket.



- 1. Oil cooler
- 2. Gasket

Inspecting the Oil Cooler

Check oil cooler for cracks and other damage.



- 1. Check for cracks

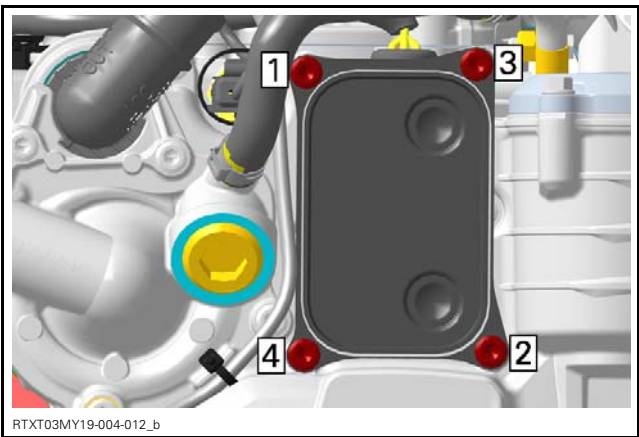
Replace parts as necessary.

Installing the Oil Cooler

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

Tighten oil cooler screws in two steps to the specified torques using the illustrated sequence.

TIGHTENING TORQUE		
Oil cooler screws	STEP A	5 N•m ± 0.6 N•m (44 lbf•in ± 5 lbf•in)
	STEP B	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



TIGHTENING SEQUENCE OIL-COOLER

Wipe up any oil and coolant spillage.

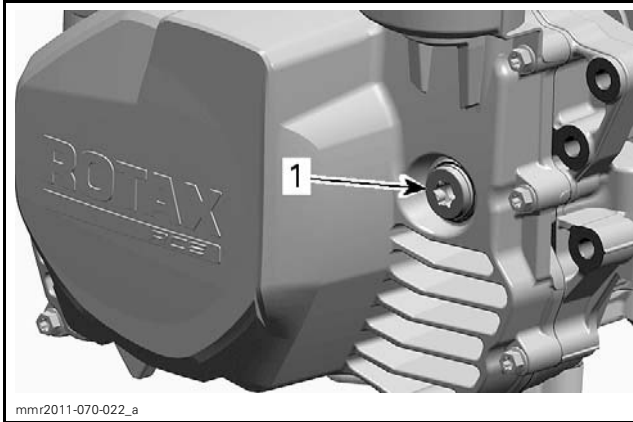
Fill up oil tank and check oil level. Refer to procedure in this subsection.

Refill and bleed cooling system. Refer to *COOLING SYSTEM* subsection.

ENGINE OIL PRESSURE REGULATOR

Oil Pressure Regulator Location

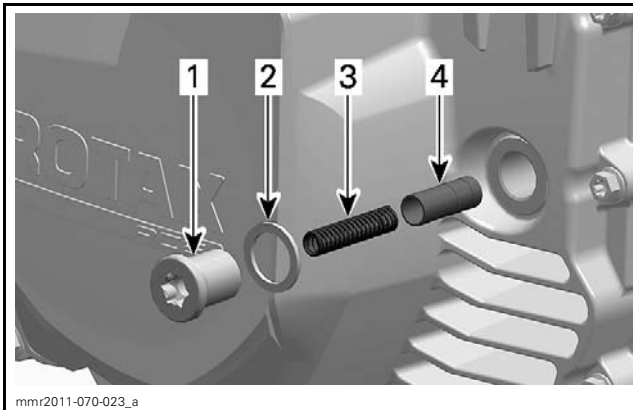
The engine oil pressure regulator is located inside the magneto cover.



1. Engine oil pressure regulator

Removing the Oil Pressure Regulator

1. Remove muffler, refer to *EXHAUST SYSTEM* subsection.
2. Drain engine oil. Refer to procedure in this subsection.
3. Remove:
 - Regulator plug
 - Sealing washer (discard it).
4. Pull oil pressure regulator parts out of the magneto cover.



1. Plug
2. Sealing washer (discard)
3. Regulator spring
4. Regulator piston

Inspecting the Oil Pressure Regulator

Clean bore and thread in the magneto cover of any contamination.

Inspect oil pressure regulator piston and bore in cylinder block for scoring or other damages.

Check if piston moves easily in its bore.

Check compression spring for free length.

SPRING FREE LENGTH	
New nominal	46 mm (1.811 in)
Service limit	45 mm (1.772 in)

Visually check compression spring for squareness.

Replace worn or damaged components.

Installing the Oil Pressure Regulator

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

Install a **NEW** sealing washer on plug.

Tighten regulator plug to the specified torque.

TIGHTENING TORQUE	
Oil pressure regulator plug	17 N•m ± 2 N•m (150 lbf•in ± 18 lbf•in)

Wipe up any oil spillage.

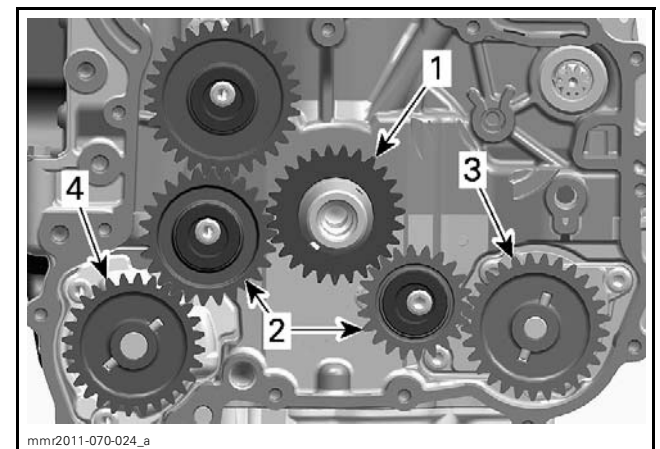
Fill up oil tank and check oil level. Refer to procedure in this subsection.

Install all other removed parts. Refer to applicable subsections.

OIL PUMP DRIVE GEARS

Oil Pump Drive Gear Location

The oil pump gears are located on the MAG side, behind the magneto cover.

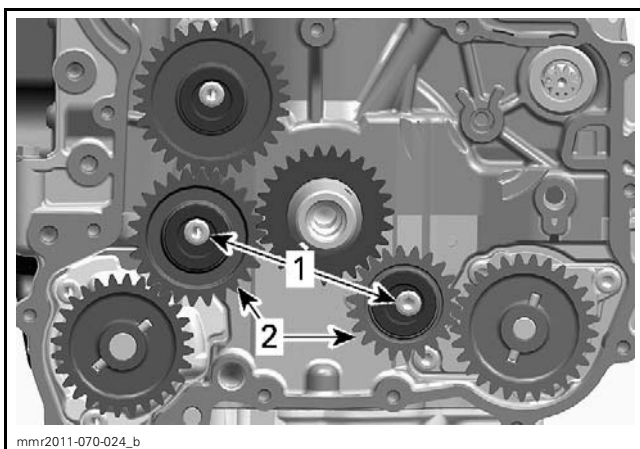


1. Oil pump drive gear
2. Intermediate gears
3. Oil pressure pump gear
4. Oil suction pump gear

Subsection XX (LUBRICATION SYSTEM)

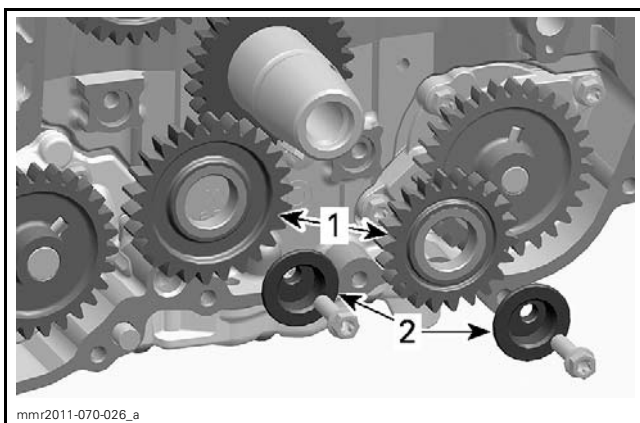
Removing the Oil Pump Drive Gear

1. Refer to *MAGNETO AND STARTER* subsection to remove:
 - Magneto cover
 - Rotor
 - Sprag clutch gear.
2. Unscrew oil pump intermediate gear screws.



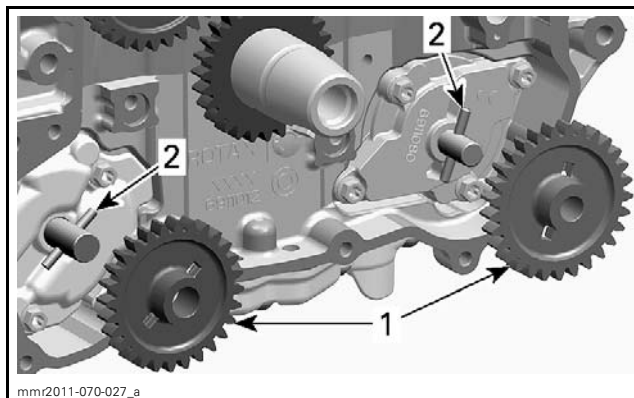
1. Retaining screws
2. Intermediate gears

3. Remove bearing sleeves and oil pump intermediate gears.



1. Intermediate gears
2. Bearing Sleeves

4. Remove oil pump gears and needle pins.



1. Oil pump gears
2. Needle pins

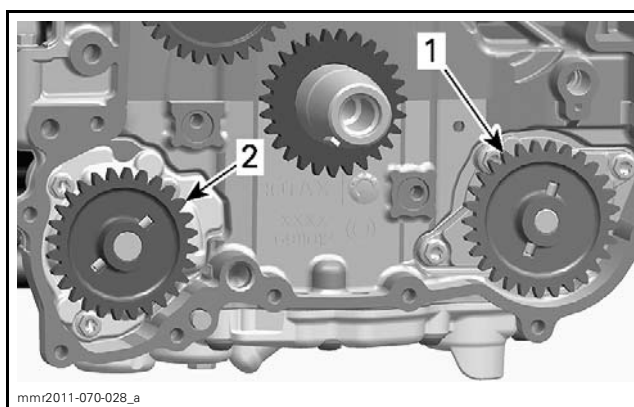
Inspecting the Oil Pump Drive Gear

Inspect gears for wear, cracks or other damage. Replace if damaged.

Installing the Oil Pump Drive Gear

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

1. Be sure to not intermix oil pump gears, see next illustration.
 - 1.1 Install the BROWN oil pump gear (29 teeth) on oil pressure pump.
 - 1.2 Install the BLACK oil pump gear (28 teeth) on oil suction pump.



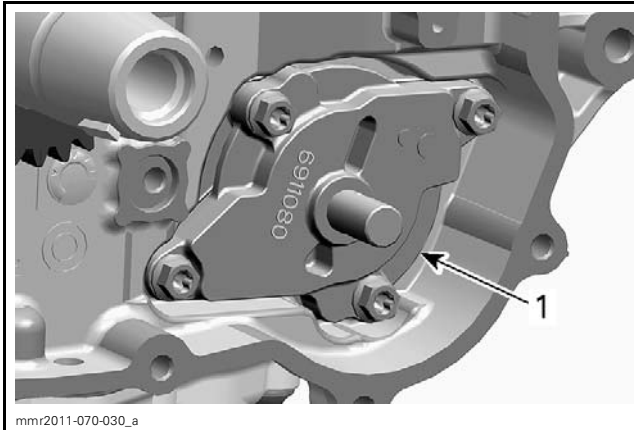
1. BROWN oil pump gear - 29 teeth
2. BLACK oil pump gear - 28 teeth

2. Lubricate intermediate gears bearing sleeves with engine oil, then install gears.
3. Install all other removed parts.
4. Fill up oil tank and check oil level. Refer to procedure in this subsection.

OIL PRESSURE PUMP

Oil Pressure Pump Location

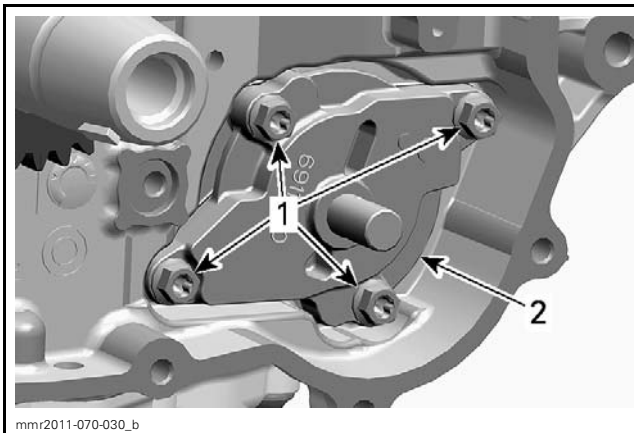
The oil pressure pump is located in the cylinder block, behind the magneto cover.



1. Oil pressure pump

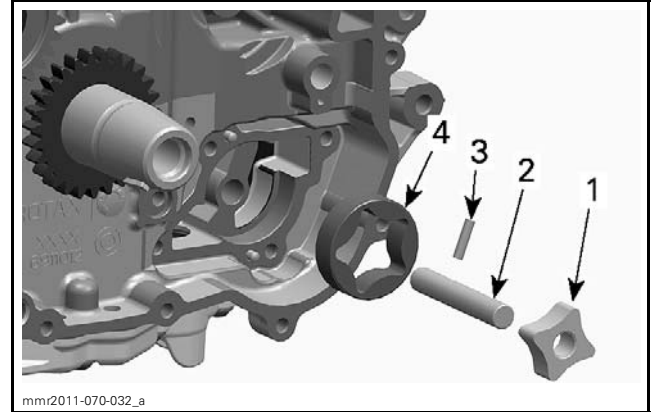
Removing the Oil Pressure Pump

1. Remove *OIL PUMP DRIVE GEARS*, see procedure in this subsection.
2. Remove oil pump cover.



1. Retaining screws
2. Oil pump cover

3. Remove following parts.



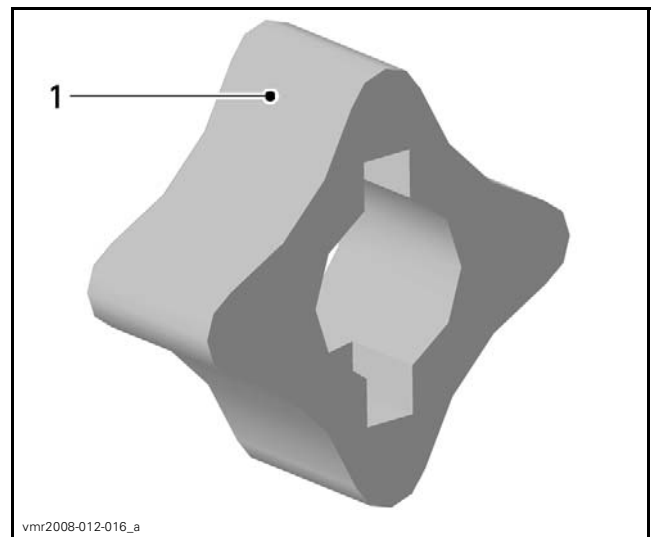
1. Inner rotor
2. Oil pump shaft
3. Needle pin
4. Outer rotor

Inspecting the Oil Pressure Pump

Inspect oil pump and oil pump cover bore for marks, scratches or other damage. Replace any damaged parts.

Check oil pump cover for damages and for surface straightness with a straight edge.

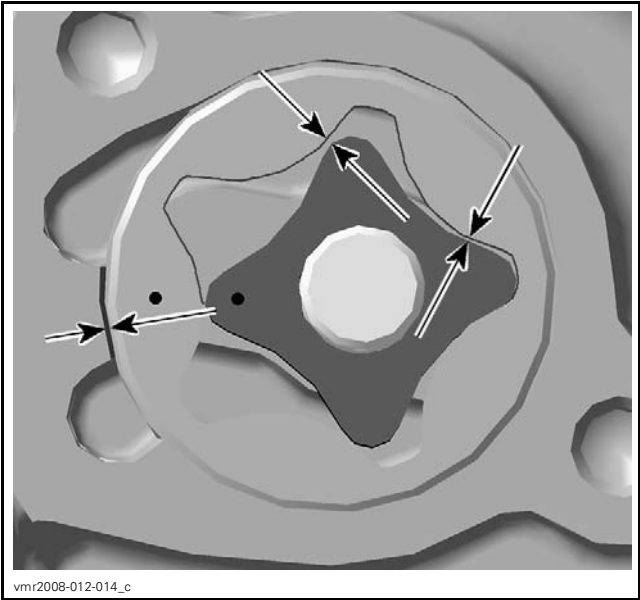
Check inner rotor for corrosion, worn pin slots or other damages. If so, replace inner and outer rotor at the same time.



1. Pitting on the teeth

Radial Clearance

Using a feeler gauge, measure the clearance of outer rotor and inner rotor as indicated by the arrows.

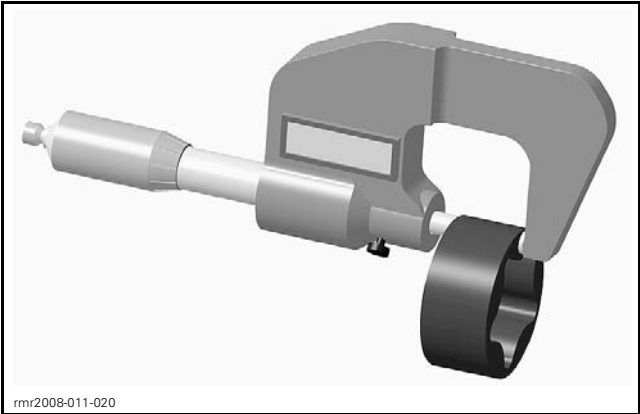


OIL PUMP RADIAL CLEARANCE	
Service limit	0.25 mm (.0098 in)

NOTE: If clearance of inner and outer rotors exceeds the tolerance, replace oil pump.

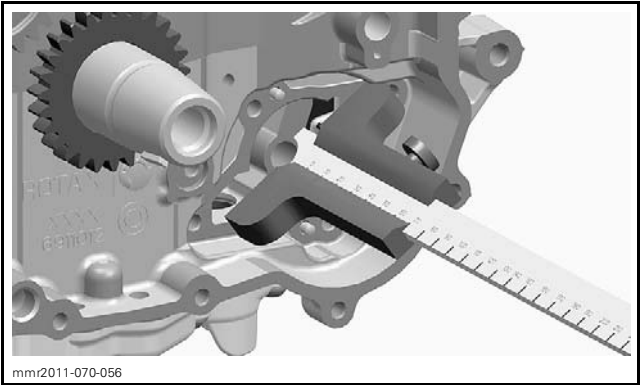
Axial Clearance

Measure outer rotor thickness with a micrometer.



OUTER ROTOR THICKNESS

Using a depth gauge, measure the depth of oil pump bore in the lower crankcase.



OIL PUMP BORE DEPTH (OIL PUMP COVER)

Subtract bore depth from rotor thickness to obtain axial clearance.

OIL PUMP AXIAL CLEARANCE	
Service limit	0.15 mm (.0059 in)

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

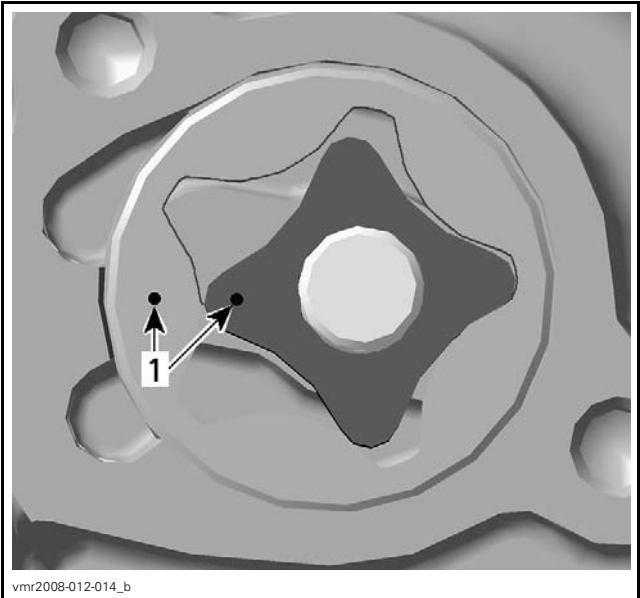
Installing the Oil Pressure Pump

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

1. Lubricate outer rotor with engine oil.

NOTICE Install rotors with the marks outwards.

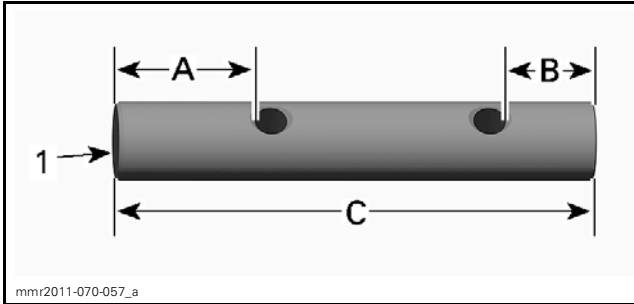
2. Install outer rotor in crankcase oil pump bore.



TYPICAL
1. Marks on inner and outer rotor

3. Install needle pin in oil pump shaft.

NOTICE The oil pump shaft is not symmetrical, the longer side must be installed inward.



1. Towards engine

A. 16.96 mm (.67 in)

B. 11.43 mm (.45 in)

C. 60.5 mm (2.38 in)

4. Place inner rotor on the oil pump shaft. Lubricate oil pump shaft and inner rotor with engine oil.

5. Install oil pump assembly in the crankcase.

After installation of the remaining parts, check for smooth operation of the oil pump assembly and axial play of the oil pump shaft.

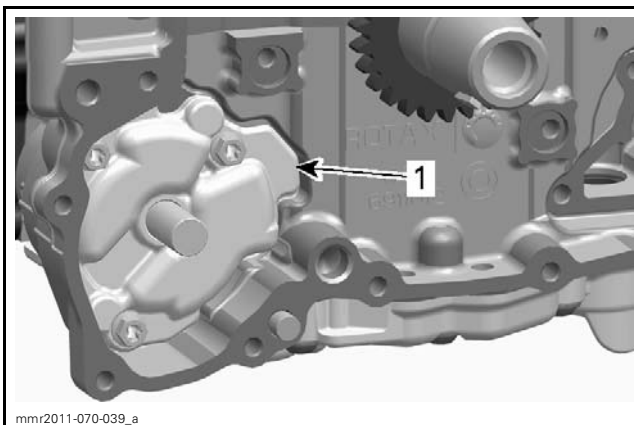
6. Fill up oil tank and check oil level. Refer to procedure in this subsection.

Start engine and make sure oil pressure is within specifications (refer to *ENGINE OIL PRESSURE TEST* in this subsection).

OIL SUCTION PUMP MODULE

Oil Suction Pump Module Location

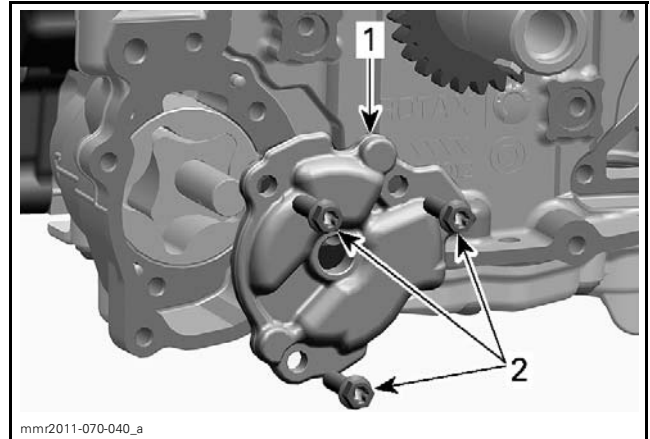
The oil suction pump module is located in the cylinder block, behind the magneto cover.



1. Oil suction pump module

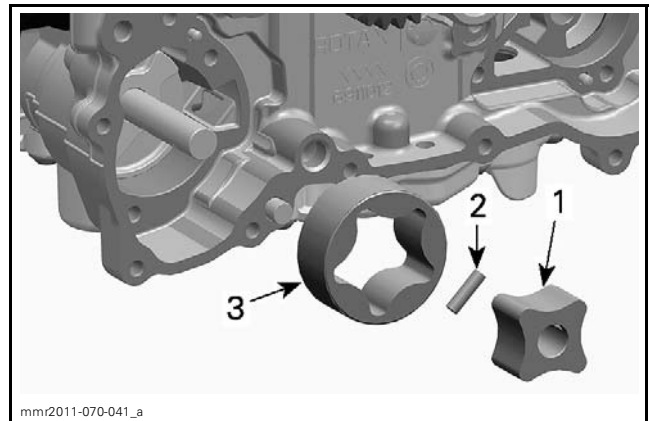
Disassembling the Oil Suction Pump Module

1. Remove *OIL PUMP DRIVE GEARS*, see procedure in this subsection.
2. Remove oil pump module cover.



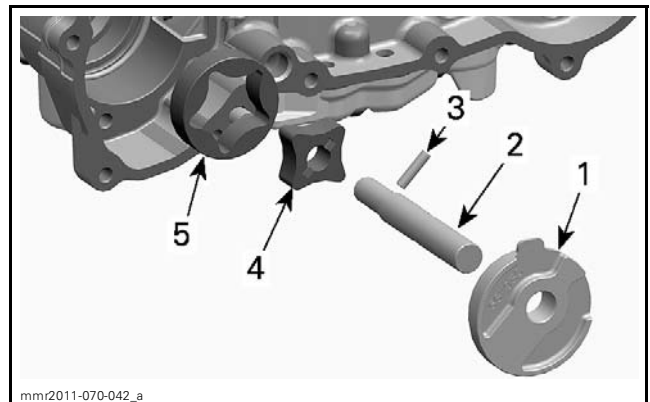
1. Oil pump module cover
2. Retaining screws

3. Disassemble the large oil suction pump as shown.



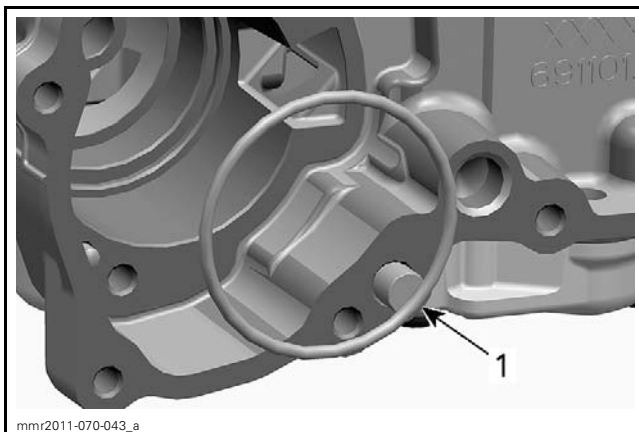
1. Inner rotor
2. Needle pin
3. Outer rotor

4. Disassemble the small oil suction pump as shown.



1. Oil pump cover
2. Oil pump shaft
3. Needle pin
4. Inner rotor
5. Outer rotor

5. Remove and discard the oil pump cover O-ring.



1. Oil pump cover O-ring

Inspecting the Oil Suction Pumps

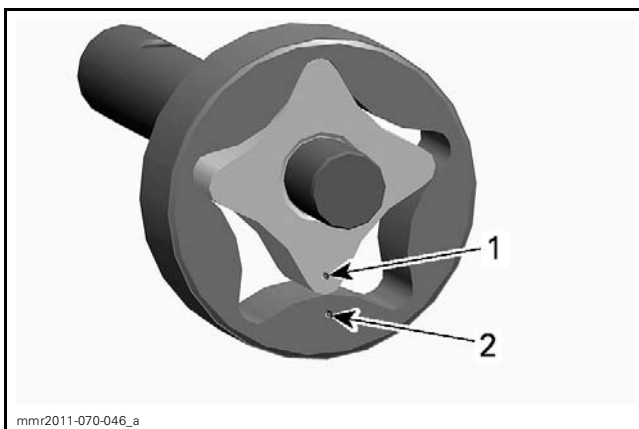
The inspection of both oil suction pumps is the same as for the oil pressure pump. Refer to *OIL PRESSURE PUMP* in this subsection.

Assembling the Oil Suction Pump Module

The assembly is the reverse of the disassembly procedure. However, pay attention to the following.

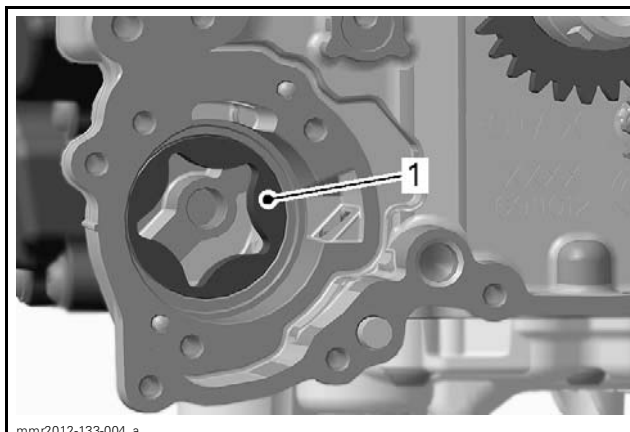
1. Lubricate small oil suction pump outer rotor with engine oil.

NOTICE When installing the oil pump rotors, make sure both marks are pointing toward the inside of the crankcase.



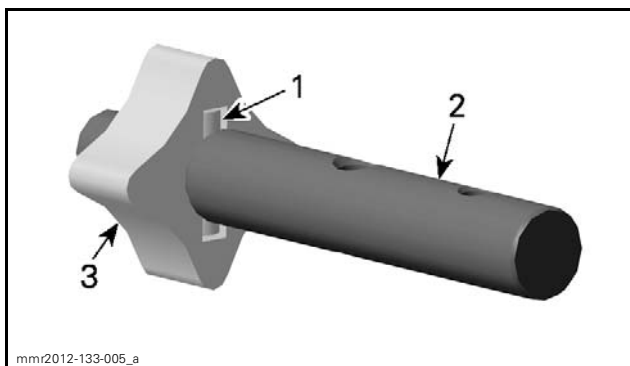
1. Mark on inner rotor
2. Mark on outer rotor

2. Install small oil suction pump outer rotor into crankcase oil pump bore.



1. Small oil suction pump outer rotor

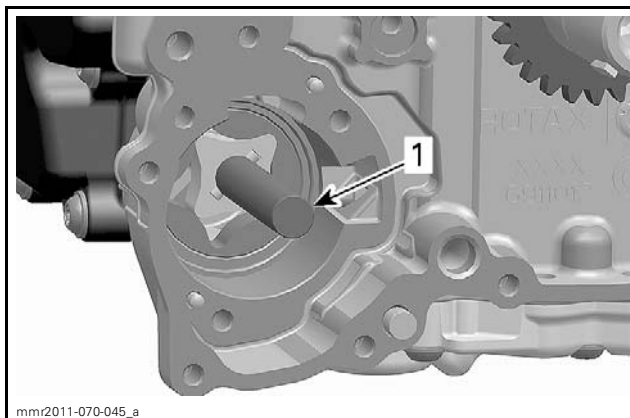
3. Install the needle pin in the bore of the oil pump shaft and place the small inner rotor on the shaft.



1. Needle pin
2. Oil pump shaft
3. Small suction pump inner rotor

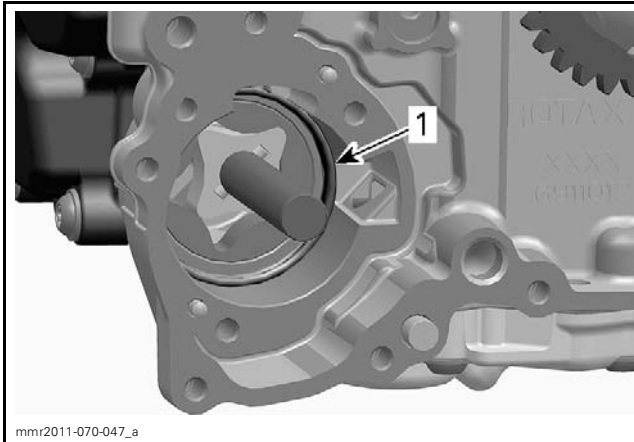
4. Lubricate oil pump shaft and inner rotor with engine oil.

5. Install oil pump shaft assembly into the crankcase.



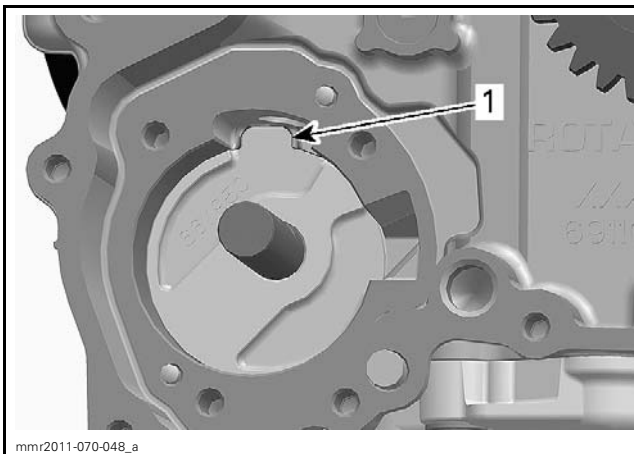
1. Oil pump shaft with small oil suction pump

6. Install a **NEW** oil pump cover O-ring.



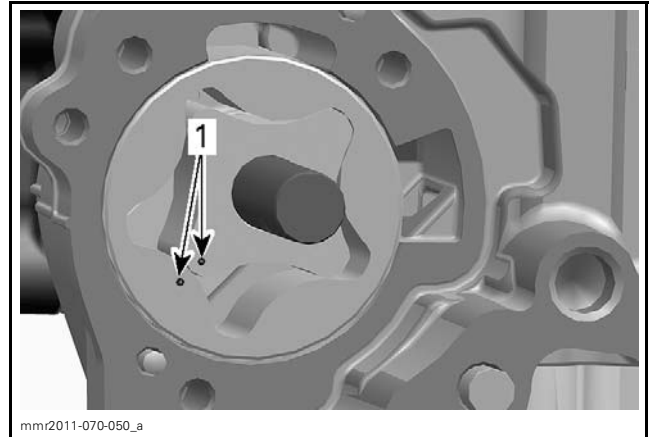
1. Oil pump cover O-ring

7. Lubricate both sides of the oil pump cover with engine oil.
8. Align tab of the oil pump cover with the upper recess in the crankcase. Push cover in until a click is heard, indicating the cover is properly installed.



1. Oil pump cover tab properly positioned

9. Install large oil suction pump needle pin.
10. Install large oil suction pump inner rotor and outer rotor with the marks outwards.



1. Marks on inner and outer rotor

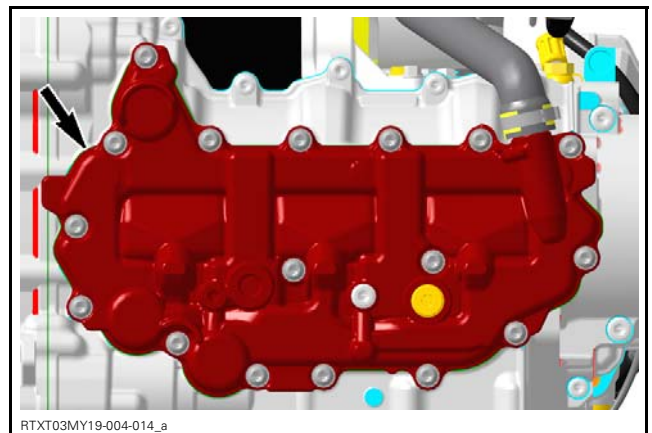
11. Lubricate large oil suction pump parts with engine oil.
 12. Install other removed parts.
- After installation is complete, check for smooth operation of the oil pump assembly and axial play of the oil pump shaft.
13. Fill up oil tank and check oil level. Refer to procedure in this subsection.

Start engine and make sure oil pressure is within specifications (refer to *ENGINE OIL PRESSURE TEST* in this subsection).

OIL SUMP COVER

Oil Sump Cover Location

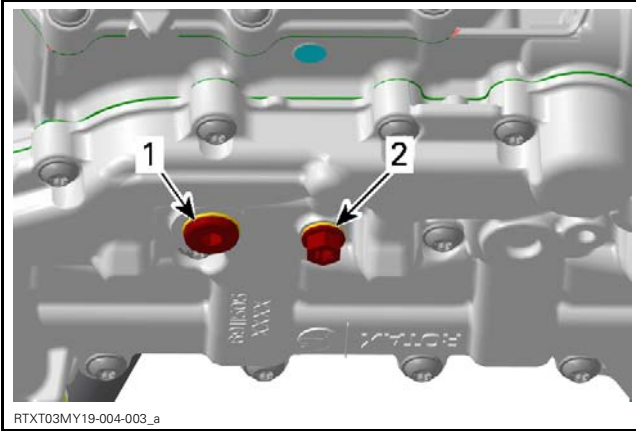
The oil sump cover is located on the engine bottom.



Removing the Oil Sump Cover

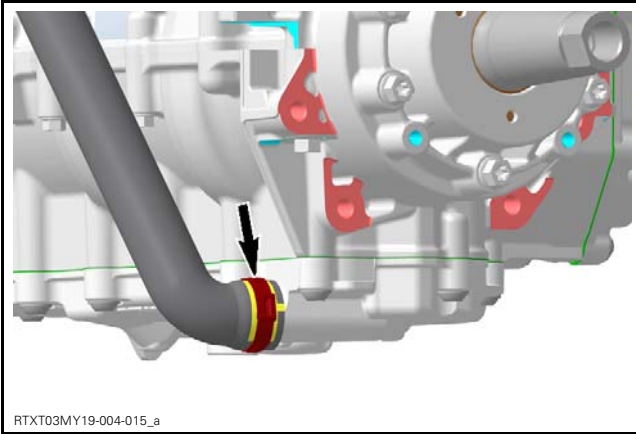
1. Remove engine from vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
2. Drain engine oil, refer to procedure in this subsection.

Subsection XX (LUBRICATION SYSTEM)

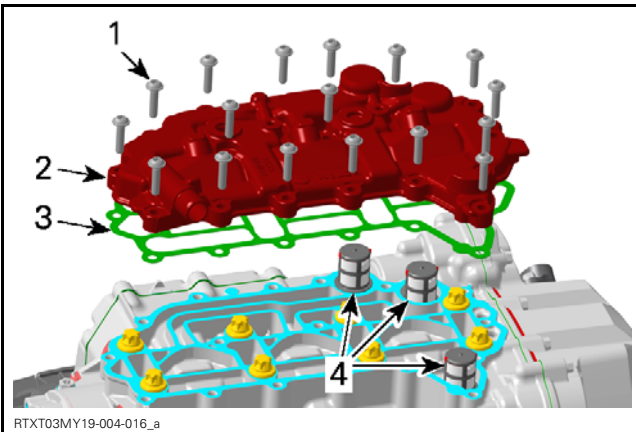


1. Main drain plug
2. Secondary drain plug

3. Remove clamp and turbo charger oil return hose.



4. Unscrew oil sump cover retaining screws.
5. Remove oil sump cover. Discard gasket.
6. Remove and clean engine oil strainers.

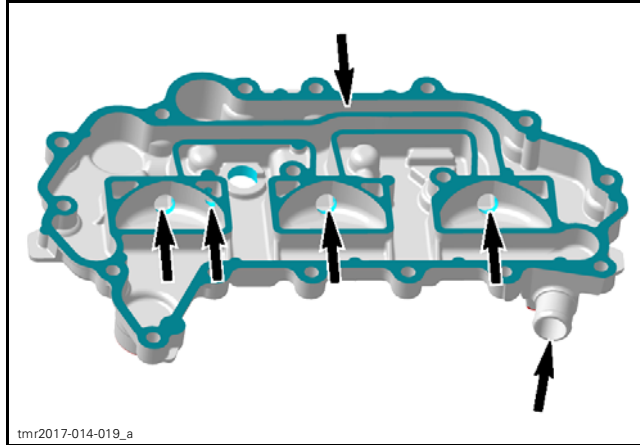


1. Retaining screws
2. Oil sump cover
3. Gasket
4. Engine oil strainers

Inspecting the Oil Sump Cover

Clean oil sump cover and engine oil strainers with a part cleaner, then use an air gun to dry it.

Blow out the oil orifices and check if they are not clogged.



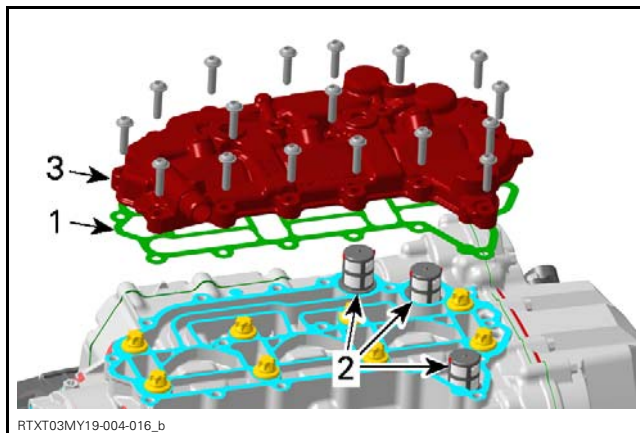
Check oil sump cover for cracks or other damage.
Check oil sump cover for flatness with straight edge.

Replace oil sump cover if necessary.

Check engine oil strainer for damage and change if necessary.

Installing the Oil Sump Cover

1. Install a **NEW** oil sump cover gasket.
2. Install the strainers as shown.

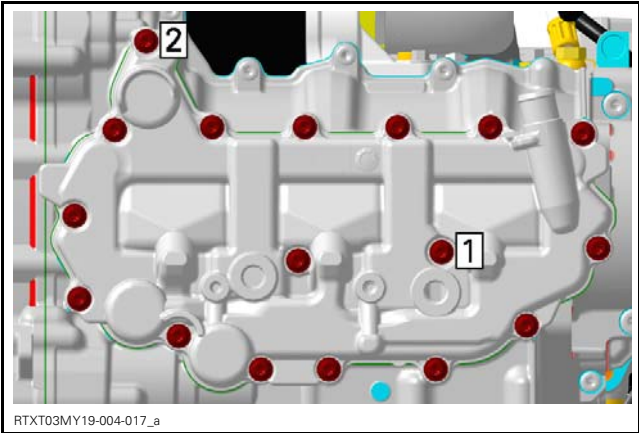


1. Gasket
2. Oil strainers
3. Oil sump cover

3. Install oil sump cover on engine, then tighten screws in two steps as follows:

- 3.1 Tighten screws to the following specified torque using the specified sequence.

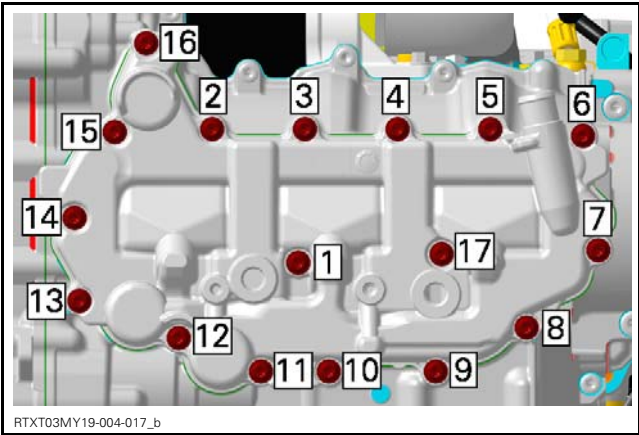
TIGHTENING TORQUE		
Oil sump cover screws	STEP A	5 N•m ± 0.6 N•m (44 lbf•in ± 5 lbf•in)



TIGHTENING SEQUENCE STEP A

3.2 Tighten screws to the following specified torque using the specified sequence.

TIGHTENING TORQUE		
Reused cylinder block	STEP B	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)
New cylinder block		11 N•m ± 1 N•m (97 lbf•in ± 9 lbf•in)



TIGHTENING SEQUENCE STEP B

4. Reinstall oil drain plugs. Refer to *ENGINE OIL REPLACEMENT*
5. Install engine in vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
6. Fill up oil tank and check oil level. Refer to procedure in this subsection.

LUBRICATION SYSTEM

SERVICE TOOLS

Description	Part Number	Page
ECM ADAPTER TOOL.....	529 036 166	11
FLUKE 115 MULTIMETER	529 035 868	11
OIL PRESSURE HOSE	529 036 394	9
PRESSURE GAUGE.....	529 036 395	9

Midwest Manuals

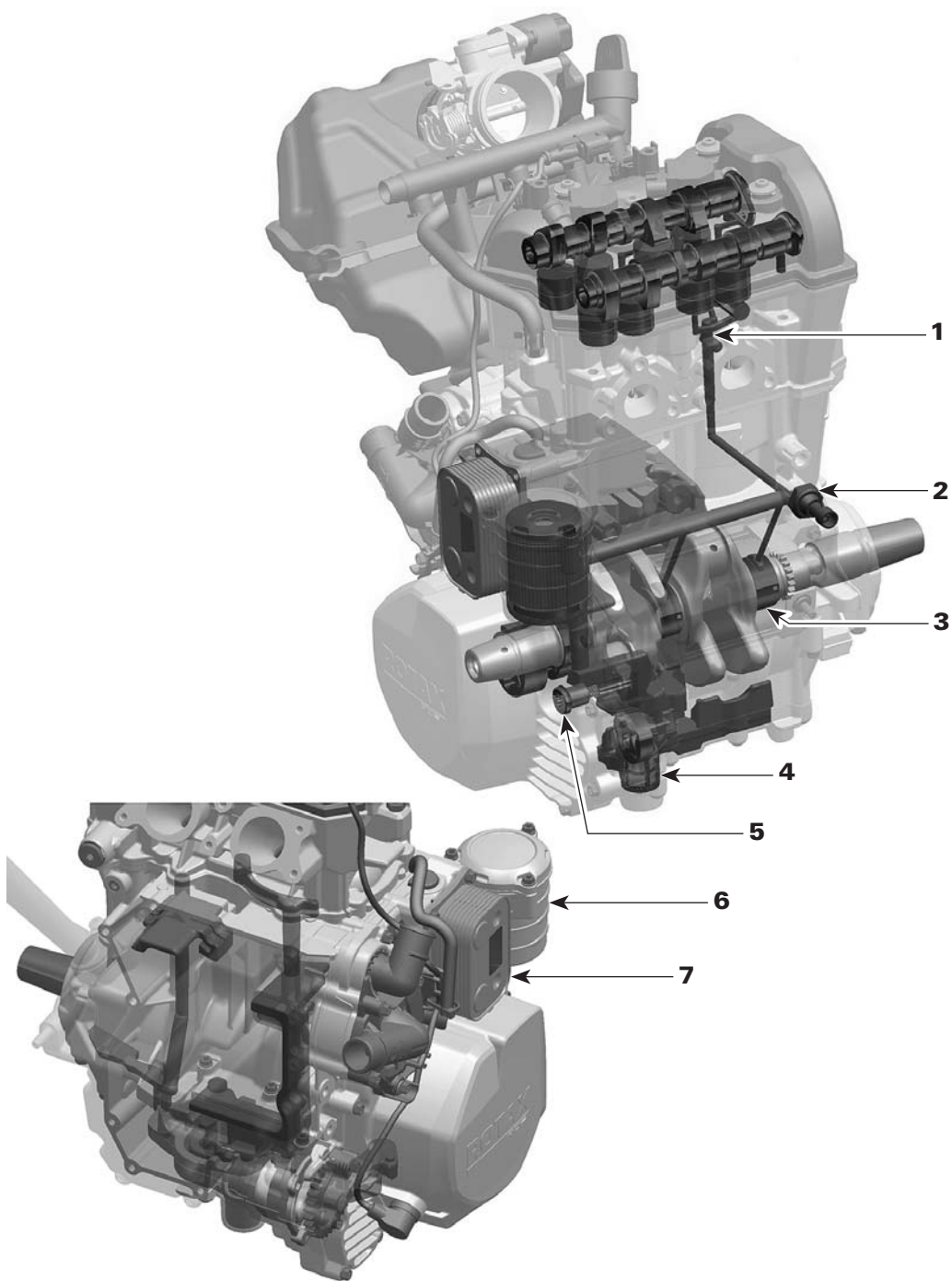
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SERVICE PRODUCTS

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NEGATIVE feedback and notify me at bestshopmanuals@gmail.com

Description	Part Number	Page
4T 0W40 SYNTHETIC OIL (EUR)	779286	6
4T 0W40 SYNTHETIC OIL.....	779139	6
DOW CORNING 111	413 707 000	13
LOCTITE 243 (BLUE).....	293 800 060	9, 12

600 ACE

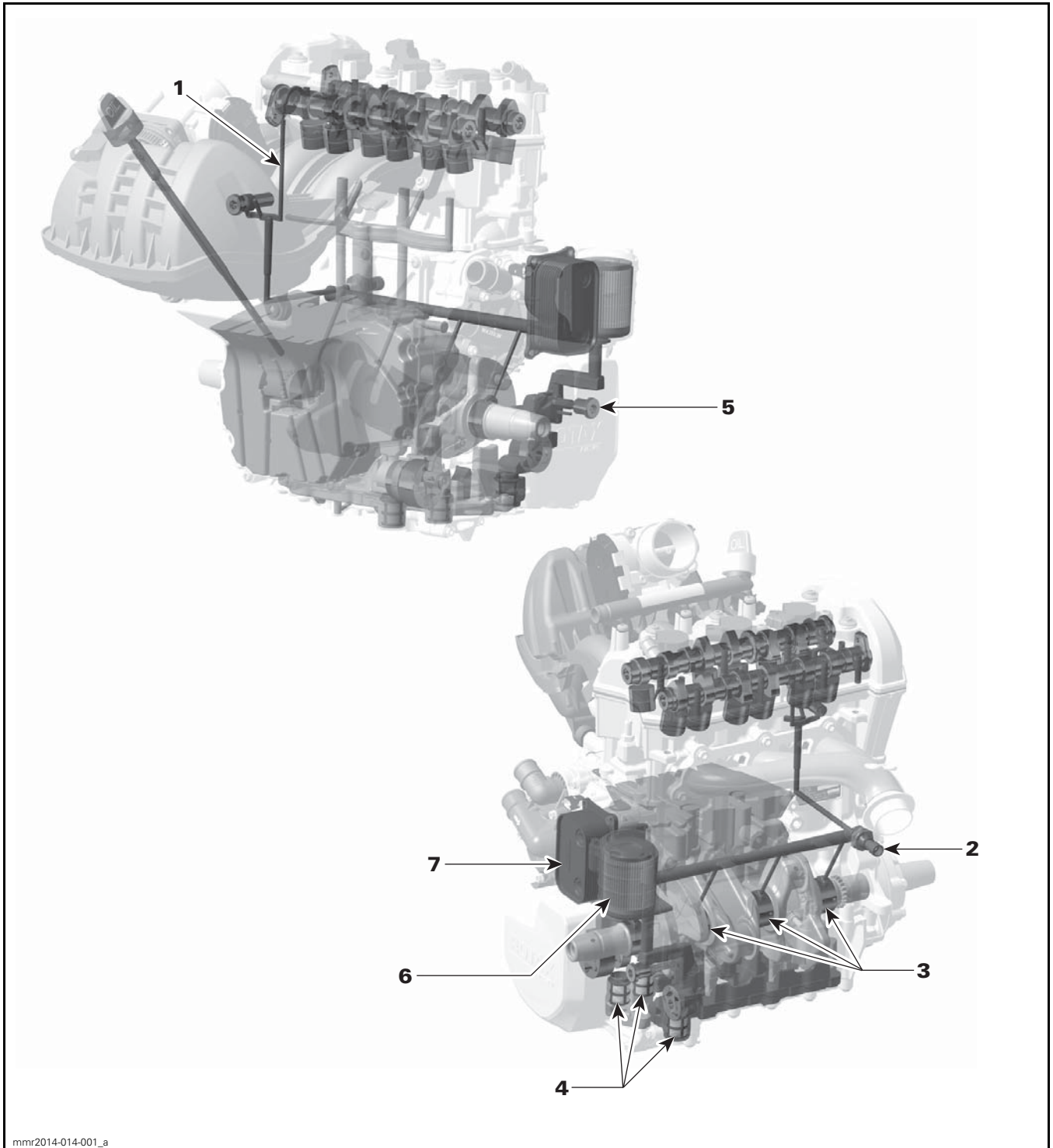


mmr2011-070-002_a

TYPICAL - ENGINE LUBRICATION CIRCUIT

1. Oil channel to camshaft bearings
2. Oil pressure switch
3. Crankshaft main bearings
4. Oil strainers
5. Oil pressure regulator
6. Oil filter
7. Oil cooler

900 ACE



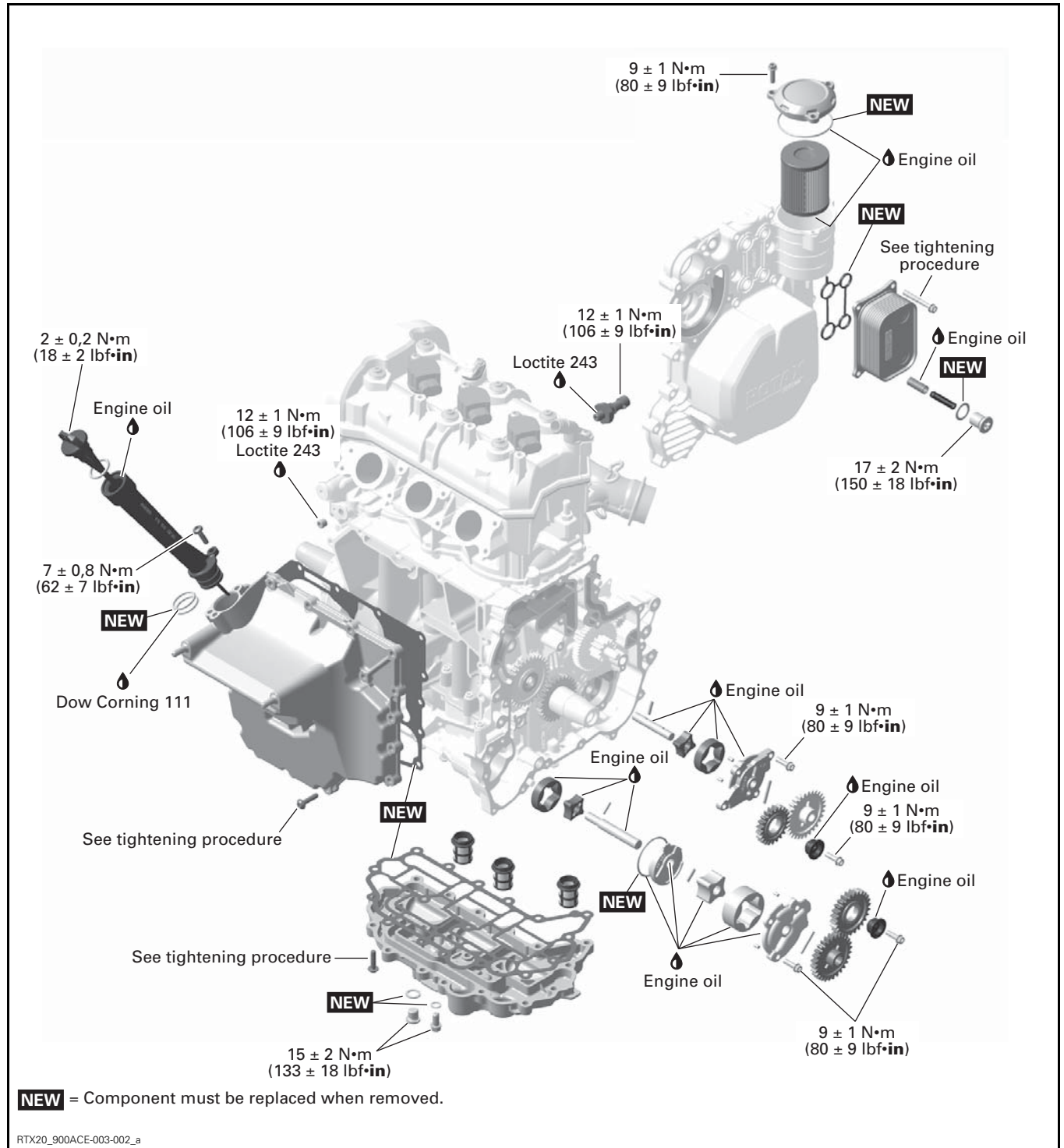
mmr2014-014-001_a

TYPICAL - ENGINE LUBRICATION CIRCUIT

1. Oil channel to camshaft bearings
2. Oil pressure switch
3. Crankshaft main bearings
4. Oil strainers
5. Oil pressure regulator
6. Oil filter
7. Oil cooler



900 ACE



GENERAL

SYSTEM DESCRIPTION

This engine uses dry sump lubrication. The oil from the cylinder block, timing chain chamber and magneto cover is pumped by two scavenge pumps.

Both scavenge pumps are integrated into one module.

The 20 mm (.79 in) large oil scavenge pump returns the crankshaft and magneto chamber oil to the reservoir.

The 11 mm (.43 in) small oil scavenge pump returns the timing chain chamber oil to the oil reservoir.

An oil filter and three oil strainers are used to filter dirt and debris from the oil circuit.

The oil strainers are located between oil sump cover and crankcase lower underneath the oil pressure pump.

The oil pressure is provided by a pump and regulated by a spring loaded pressure regulator.

MAINTENANCE

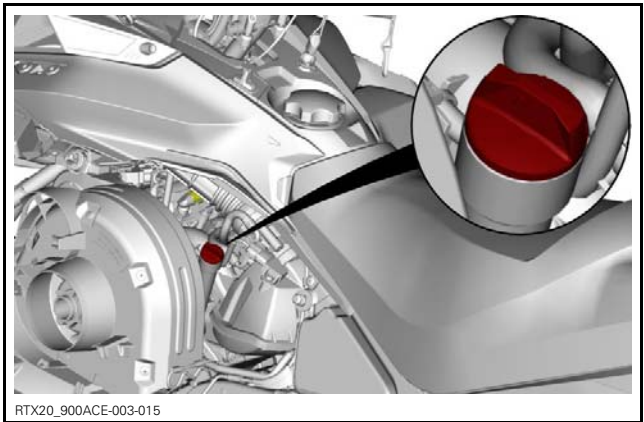
RECOMMENDED ENGINE OIL

Rotax® engines were developed and validated using the XPS™ oil. BRP recommends the use of its XPS engine oil or an equivalent at all time. Do not add any oil additives to the recommended engine oil. Damages caused by the use of an oil not suitable for the engine or by adding of an oil additives may not be covered by the BRP Limited Warranty.

XPS™ RECOMMENDED ENGINE OIL	
Scandinavia	4T 0W40 SYNTHETIC OIL (EUR) (P/N 779286)
All Other Countries	4T 0W40 SYNTHETIC OIL (P/N 779139)
If THE RECOMMENDED XPS ENGINE OIL IS NOT AVAILABLE	
Use a 0W40 4-stroke SAE synthetic engine oil meeting or exceeding the following lubricant industry specifications: – API service classification SM Always check the API service label certification on the oil container, it must contain at least the indicated standard.	

ENGINE OIL LEVEL VERIFICATION

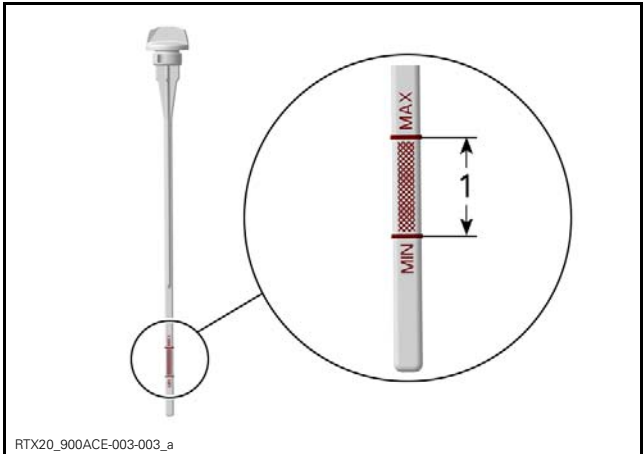
NOTICE Operating the engine with an improper oil level may cause severe engine damage. Follow this procedure to obtain a precise reading of the engine oil level.



TYPICAL - LH SIDE

With the engine at normal operating temperature (90°C (194°F) at oil tank surface), place vehicle on a level surface and proceed as follows to check oil level:

1. Start engine and let it idle for at least 20 seconds.
2. Stop engine.
3. Open the LH side panel.
4. Unscrew and remove dipstick and wipe clean.
5. Insert dipstick in the filler tube and again tighten it.
6. Remove dipstick again and check oil level. It should be near or equal to the upper mark.



1. Operating range

7. To add oil, place a funnel into the filler tube to avoid spillage.

7.1 Add a small amount of oil and recheck oil level.

7.2 Repeat the operation until oil level reaches the dipstick's upper mark. Do not overfill.

NOTE: The oil quantity between MIN. and MAX. mark is approximately 500 ml (16.9 U.S. oz).

8. Reinstall dipstick and properly tighten it.

9. Wipe off any oil spillage.

10. Close the LH side panel.

REPLACING THE ENGINE OIL

⚠ CAUTION The engine oil can be very hot. Wait until engine oil is warm.

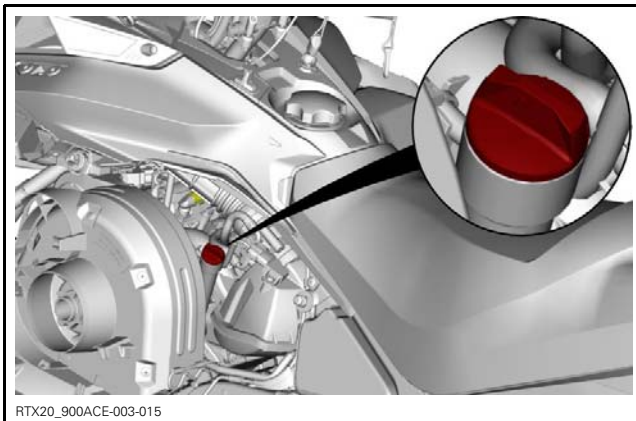
NOTICE Engine oil and oil filter must be replaced at the same time.

1. Bring engine to its normal operating temperature (90°C (194°F) at oil tank surface).

2. Place vehicle on a level surface.

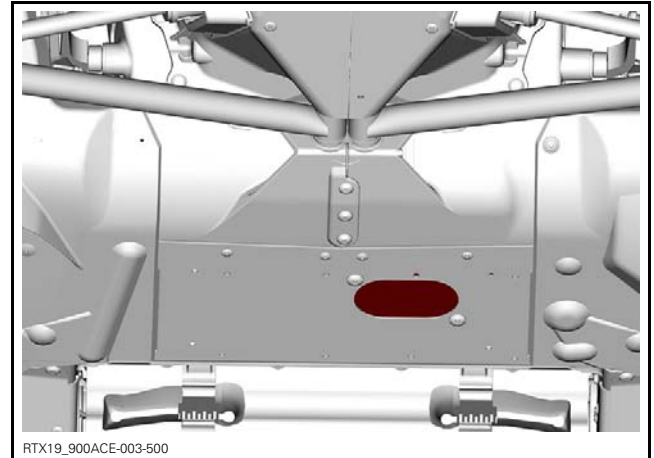
3. Remove the LH side panel.

4. Remove dipstick.



5. Remove oil filter. Refer to *REPLACING THE ENGINE OIL FILTER* in this subsection.

6. From underneath the vehicle, remove the drain plug access cover.



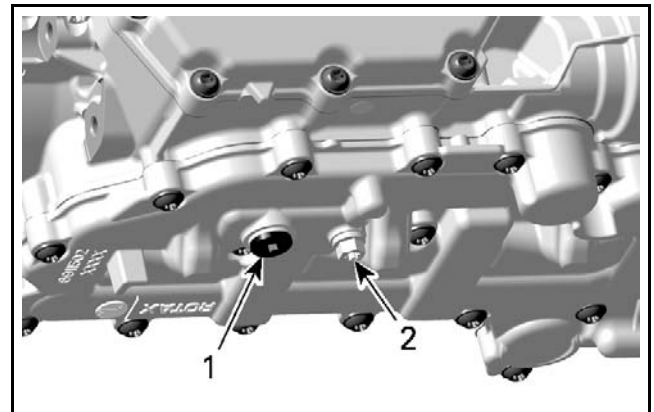
7. Clean drain plug area.

8. Place a drain pan under the bottom pan opening.

9. Remove engine drain plugs in the following order.

1. Main drain plug.

2. Secondary drain plug.



900 ACE ENGINE SHOWN - UNDERNEATH THE ENGINE

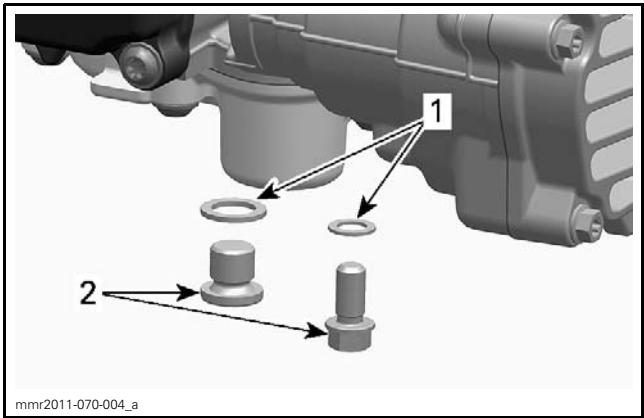
1. Main drain plug

2. Secondary drain plug

10. Allow oil to drain completely.

11. Install **NEW** sealing washers on oil drain plugs.

NOTICE Never use a sealing washer a second time. Always replace with a new one.



1. Sealing washer
2. Oil drain plug

12. Install drain plugs and tighten to the specified torque.

TIGHTENING TORQUE	
Drain plugs	15 N•m ± 2 N•m (133 lbf•in ± 18 lbf•in)

13. Replace the oil filter. Refer to procedure in this subsection.

14. Refill oil tank at the proper level with the recommended oil.

APPROXIMATE ENGINE OIL CAPACITY (WITH FILTER)	
600 ACE	2.1 L (2.22 qt (U.S. liq.))
900 ACE	3.3 L (3.49 qt (U.S. liq.))

15. Reinstall dipstick in oil tank and properly tighten it.

16. Start engine and let it idle for a few minutes.

17. Ensure there are no leaks.

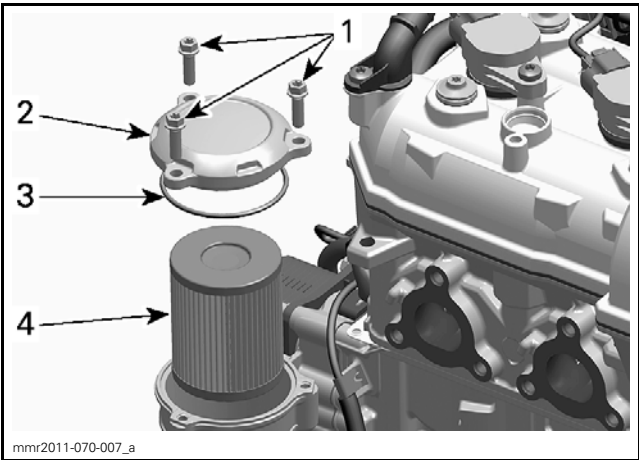
18. Stop engine and check oil level as explained in this subsection. Refill if necessary.

19. Dispose oil and filter as per your local environmental regulations.

REPLACING THE ENGINE OIL FILTER

Removing the Oil Filter

1. Remove the RH side panels.
2. Clean oil filter area.
3. Remove:
 - Oil filter cover screws
 - Oil filter cover with O-ring
 - Oil filter.

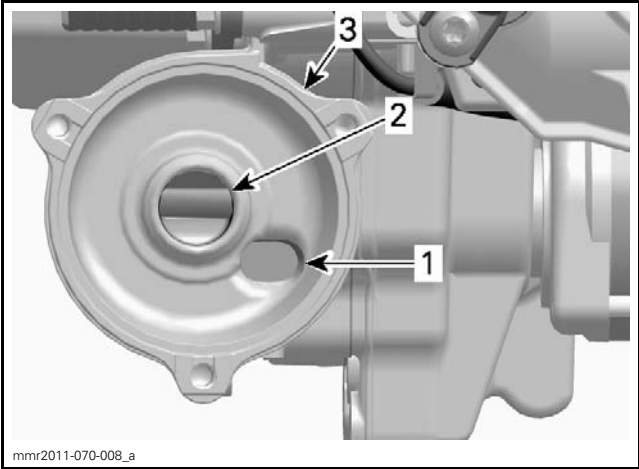


TYPICAL
1. Oil filter cover screws
2. Oil filter cover
3. O-ring
4. Oil filter

4. Dispose filter as per your local environmental regulations.

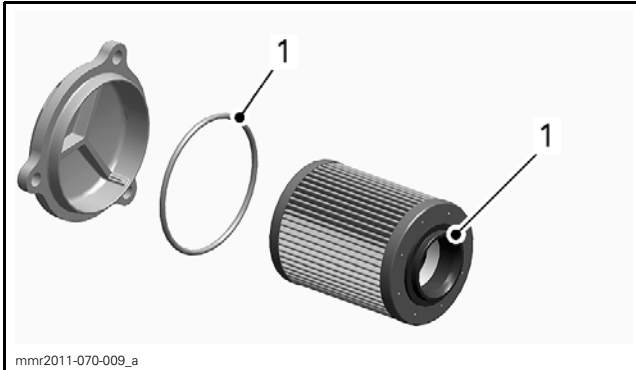
Installing the Oil Filter

1. Check the oil filter inlet and outlet orifices inside oil filter receptacle (integrated part of magneto cover) for dirt and contaminations.



1. Oil inlet orifice from the oil pressure pump
2. Oil outlet orifice to the engine lubrication system
3. Oil filter receptacle

2. Install a **NEW** O-ring on oil filter cover.
3. Lubricate filter seal and cover O-ring with engine oil.



1. Lubricate with engine oil

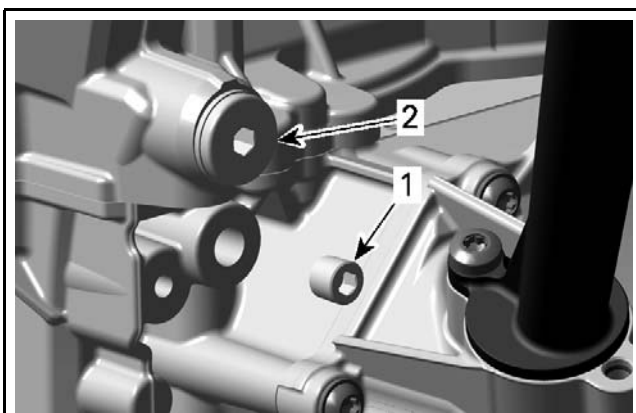
4. Install the oil filter cover.
5. Tighten oil filter cover screws to the specified torque.

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

INSPECTION

TESTING THE ENGINE OIL PRESSURE

1. Remove countershaft bearing support. Refer to *REMOVING THE COUNTERSHAFT BEARING SUPPORT* in *DRIVEN PULLEY AND COUNTERSHAFT* subsection.
2. Remove oil pressure test plug screw from cylinder block.

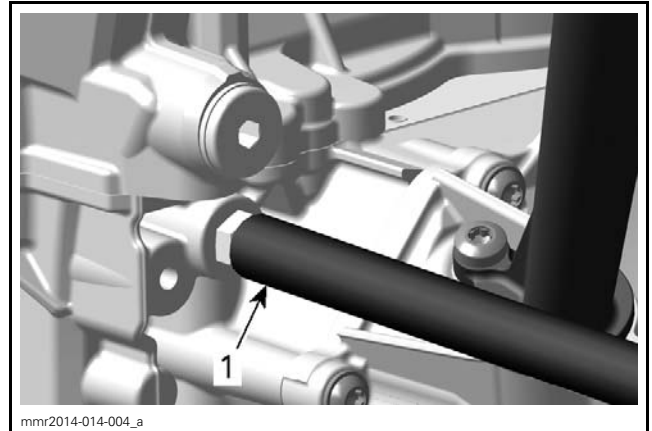


TYPICAL

1. Oil pressure test plug screw
2. Timing chain tensioner

3. Install oil pressure hose on cylinder block.

REQUIRED TOOLS	
OIL PRESSURE HOSE (P/N 529 036 394)	



TYPICAL

1. Oil pressure hose

4. Connect pressure gauge to oil pressure hose.

REQUIRED TOOL	
PRESSURE GAUGE (P/N 529 036 395)	

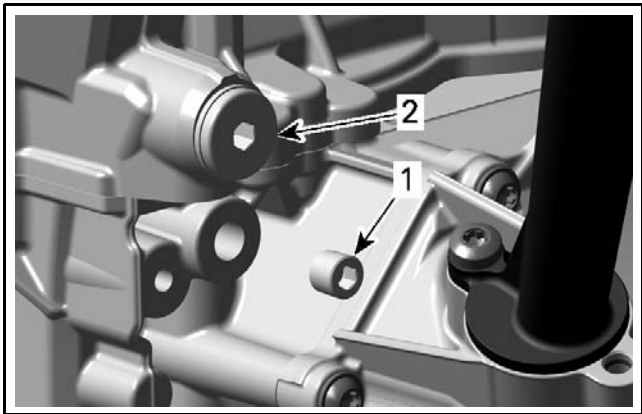
5. Start engine and check oil pressure.

ENGINE OIL PRESSURE @ 100°C (212°F)	
ENGINE SPEED	MINIMUM PRESSURE
Idle	60 kPa (8.7 PSI)
4000 to 7250 RPM	350 kPa (50.8 PSI)

If the engine oil pressure is out of specification, refer to *TROUBLESHOOTING* in this subsection.

6. Remove engine oil pressure test tools.
7. Clean threads of oil pressure test plug screw before installing it.
8. Tighten oil pressure test plug screw to specification.

TIGHTENING TORQUE	
Oil pressure test plug screw	12 N•m ± 1 N•m (106 lbf•in ± 9 lbf•in) + LOCTITE 243 (BLUE) (P/N 293 800 060)



TYPICAL
1. Oil pressure test plug screw
2. Timing chain tensioner

9. Reinstall all removed parts. Refer to applicable subsection.

TROUBLESHOOTING

Always check for fault codes. If a fault code is detected, service the fault code first.

LOW OR NO ENGINE OIL PRESSURE

- 1. Oil level is too low.
 - Refill engine oil.
 - Check for high oil consumption. See below.
 - Check for oil leaks (oil leaking out of leak indicator hole, gaskets, oil seal or O-rings). Repair or replace.
- 2. Defective or clogged oil filter
 - Replace engine oil and filter.
- 3. Use of a bad grade oil
 - Replace engine oil with BRP recommended oil.
- 4. Oil pressure regulator valve sticks open, or spring load is insufficient.
 - Clean oil regulator piston and its bore. Replace if necessary.
 - Measure spring free length. Replace if out of specification.
- 5. Oil pump(s) worn or damaged.
 - Check if oil pump drive gears are damaged. Replace if necessary.
 - Check oil pump rotors and its bore for wear limits. Replace if out of specification.
- 6. Engine oil strainer is clogged.
 - Remove and clean engine oil strainer.
- 7. Heavy wear on plain bearings.
 - Check radial clearance of plain bearings. Replace if out of specification.

HIGH OIL CONSUMPTION

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

OIL CONTAMINATION
(WHITE APPEARANCE)

- 1. Oil seal and rotary seal on water pump shaft leaking.
 - Replace oil seal, rotary seal and water pump shaft. Change engine oil.
- 2. Cylinder head gasket leaking.
 - Replace cylinder head gasket. Change engine oil.
- 3. Cylinder head screws not properly tightened.
 - Retighten screws with recommended torque. Change engine oil.
- 4. Oil cooler gasket leaking.
 - Replace gasket. Change engine oil.

PROCEDURES

OIL PRESSURE SWITCH (OPS)

OPS Activation

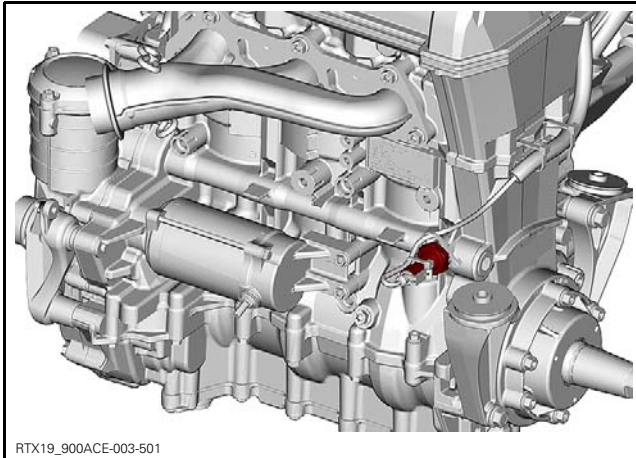
The oil pressure switch activates when the engine oil pressure is lower than following specified pressure range.

NOTE: ECM does not trigger the OPS signal below 4500 rpm.

OIL PRESSURE SWITCH ACTIVATION RANGE
20 kPa to 40 kPa (2.9 PSI to 5.8 PSI)

OPS Location

The OPS is located on the front of the engine, beside the left front engine mount.



RTX19_900ACE-003-501

TYPICAL - 900 ACE ENGINE SHOWN

Inspecting the OPS

First, ensure oil pressure is adequate. Refer to *TESTING THE ENGINE OIL PRESSURE* in this subsection.

If the oil pressure is good, check the resistance of the oil pressure switch.

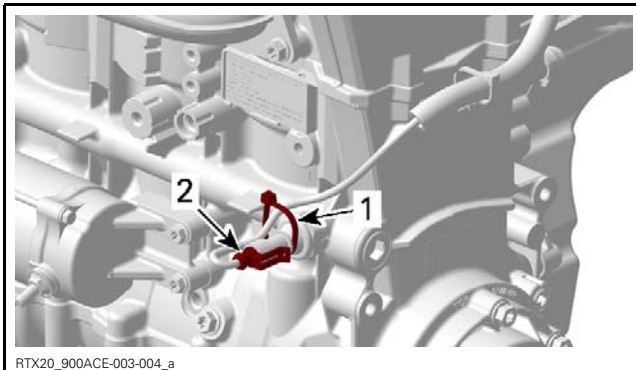
Testing the OPS Resistance

The engine must be warm to check the oil pressure switch properly.

WARNING

Be careful when working near hot parts. To avoid potential burns, never touch exhaust system components immediately after the engine has been running as these components are very hot. Always wear long sleeves and gloves.

1. Cut locking tie and disconnect OPS connector.



RTX20_900ACE-003-004_a

TYPICAL - UNDER EXHAUST MANIFOLD

1. Locking tie
2. OPS connector

2. Check oil pressure switch resistance.
3. Read result and compare to table.

OPS RESISTANCE TEST (ENGINE NOT RUNNING)

OPS	GROUND	SPECIFICATION
Pin 1	Engine ground	Close to 0 Ω (normally closed switch)

If resistance is out of specification, replace the oil pressure switch.

If the resistance is correct, continue procedure. It will be necessary to use jumper wires.

4. Install drive belt guard.
5. Start engine.
6. Read result and compare to table.

OPS RESISTANCE TEST (ENGINE RUNNING)

OPS	GROUND	SPECIFICATION
Pin 1	Engine ground	Infinitely high (OL)

If resistance is out of specification, replace the oil pressure switch.

If the resistance is correct, check the oil pressure switch circuit continuity.

Testing the OPS Circuit Continuity

REQUIRED TOOL

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

1. Disconnect the ECM-A connector . Refer to *ECM CONNECTOR ACCESS* in *ELECTRONIC FUEL INJECTION* subsection.
2. Install ECM-A connector on the ECM adapter tool.
3. Cut locking tie and disconnect the OPS connector. Refer to *TESTING THE OPS RESISTANCE* in this subsection.
4. Check continuity as follows.

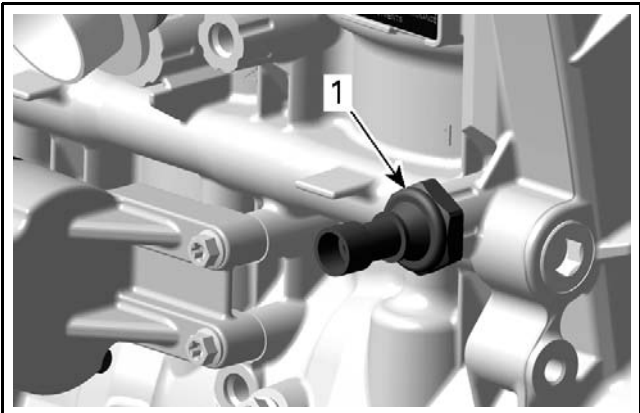
OPS CIRCUIT CONTINUITY TEST		
OPS PIN	ECM A CONNECTOR PIN	SPECIFICATION
1	E3	Close to 0 Ω

If the continuity is good and all other tests are performed, try a **NEW** ECM.

If the continuity is bad, repair or replace defective wire or connectors.

Removing the OPS

- 1. Cut locking tie and unplug the OPS switch connector. Refer to *TESTING THE OPS RESISTANCE* in this subsection.
- 2. Unscrew and remove the OPS.



1. Oil pressure switch

Installing the OPS

Install oil pressure switch as per following information.

TIGHTENING TORQUE	
Oil pressure switch	12 N•m ± 1 N•m (106 lbf•in ± 9 lbf•in) + LOCTITE 243 (BLUE) (P/N 293 800 060)

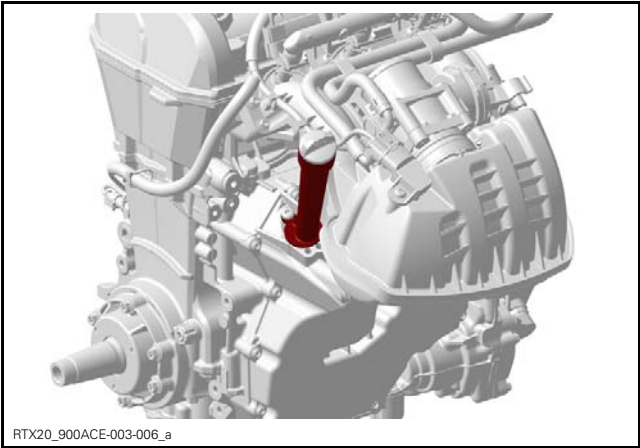
Install all other removed parts.

NOTICE When installing the locking tie on the OPS connector, avoid making a sharp bend in the wires.

OIL FILLER TUBE

Oil Filler Tube Location

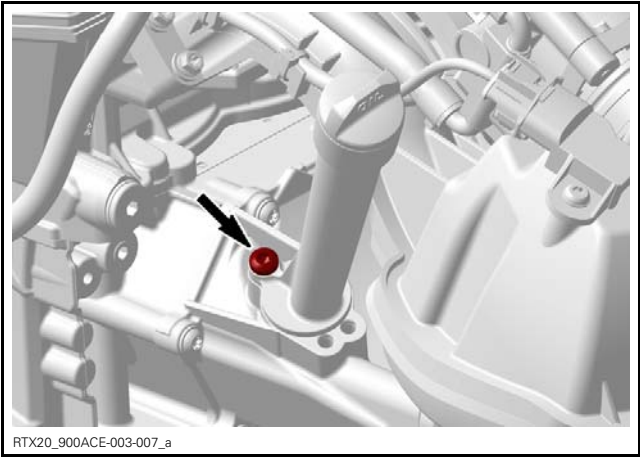
The oil filler tube is located on the rear left side of the engine, on the oil tank.



TYPICAL

Removing the Oil Filler Tube

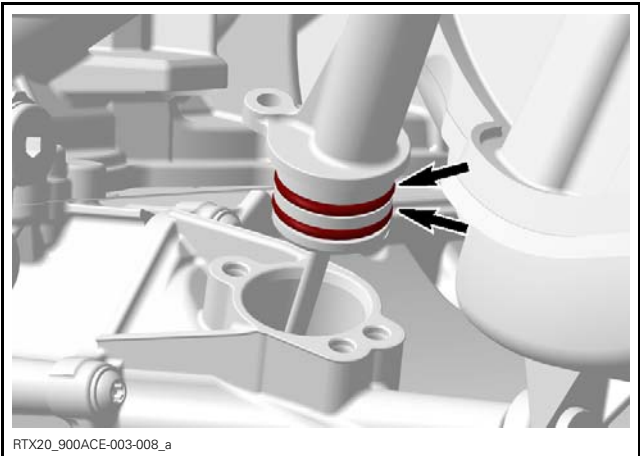
- 1. Remove oil filler tube retaining screw.



- 2. Pull filler tube out of oil tank cover

Installing the Oil Filler Tube

- 1. Install **NEW** o-rings on oil filler tube.



- 2. Lubricate o-rings.

RECOMMENDED SERVICE PRODUCT
DOW CORNING 111 (P/N 413 707 000)

- 3. Install oil filler tube.
- 4. Tighten retaining screw to specified torque.

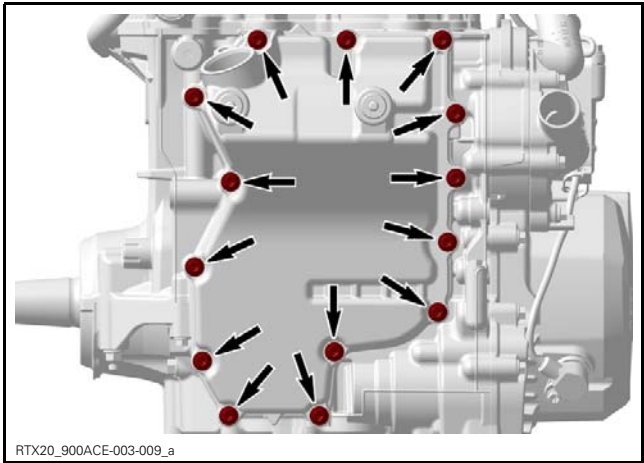
TIGHTENING TORQUE	
Oil filler tube retaining screw	7 N•m ± 0.8 N•m (62 lbf•in ± 7 lbf•in)

- 5. Install all other removed parts.

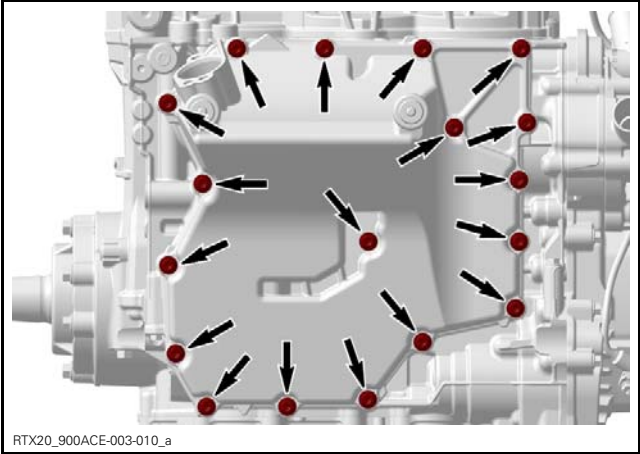
OIL TANK

Removing the Oil Tank Cover

- 1. Drain engine oil. Refer to *REPLACING THE ENGINE OIL* in this subsection.
- 2. Remove engine from vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
- 3. Remove intake manifold. Refer to *AIR INTAKE SYSTEM* subsection.
- 4. Place a drain pan underneath oil tank.
- 5. Unscrew oil tank cover retaining screws.



RTX20_900ACE-003-009_a
600 ACE ENGINE



RTX20_900ACE-003-010_a

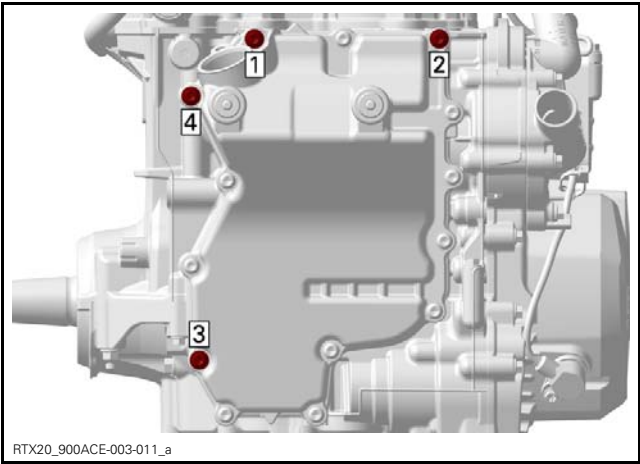
900 ACE ENGINE

- 6. Remove oil tank from the engine.

Installing the Oil Tank Cover

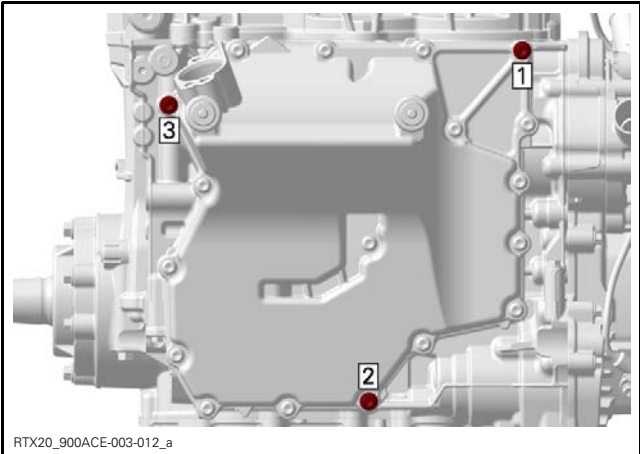
- 1. Install **NEW** gasket.
- 2. Install oil tank on engine, then tighten screws in two steps as follows:
 - 2.1 Tighten screws to specification according to the specified sequence.

TIGHTENING TORQUE		
Oil tank screw	STEP A	5 N•m ± 0.6 N•m (44 lbf•in ± 5 lbf•in)



RTX20_900ACE-003-011_a

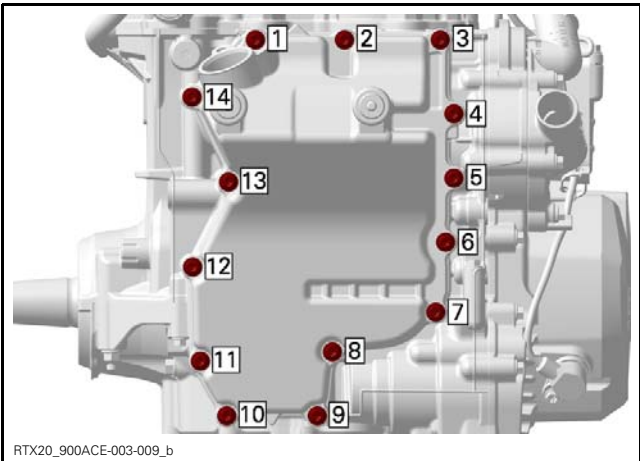
600 ACE ENGINE - TIGHTENING SEQUENCE STEP A



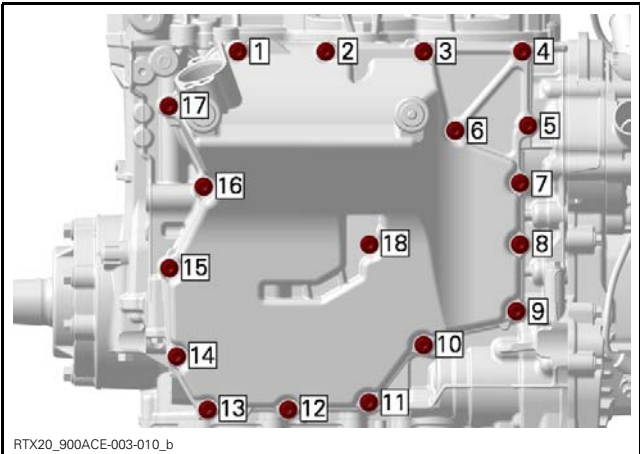
900 ACE ENGINE - TIGHTENING SEQUENCE STEP A

2.2 Tighten screws to specification according to the specified sequence.

TIGHTENING TORQUE		
Oil tank screws	STEP B	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



600 ACE ENGINE - TIGHTENING SEQUENCE STEP B



900 ACE ENGINE - TIGHTENING SEQUENCE STEP B

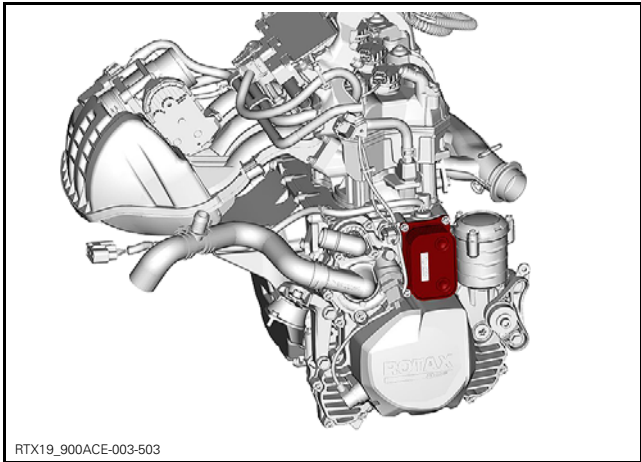
3. Wipe up any oil spillage.

4. Install intake manifold. Refer to *AIR INTAKE SYSTEM* subsection.
5. Install engine in vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
6. Fill up oil tank and check oil level. Refer to *REPLACING THE ENGINE OIL* in this subsection.

OIL COOLER

Oil Cooler Location

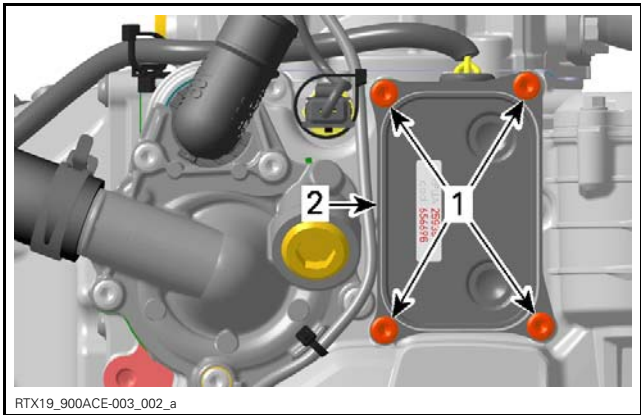
The oil cooler is located on the right side of the engine, beside the oil filter.



TYPICAL

Removing the Oil Cooler

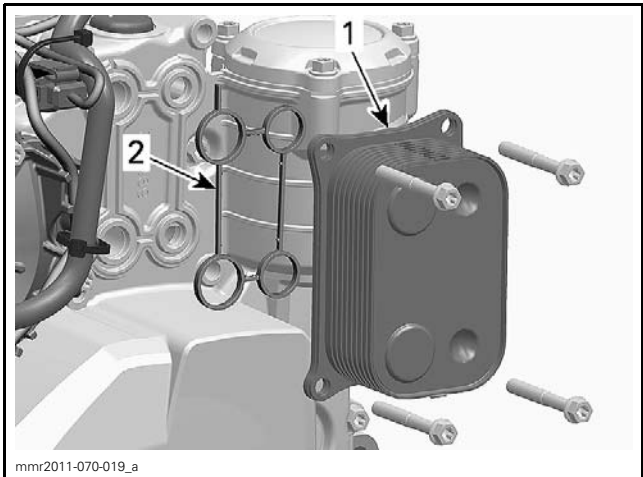
1. Refer to *REPLACING THE ENGINE OIL* in this subsection to :
 - Drain engine oil
 - Drain cooling system.
2. Remove oil cooler retaining screws.



1. Retaining screws
2. Oil cooler

3. Place rags or towels under oil cooler to catch remaining oil and coolant.

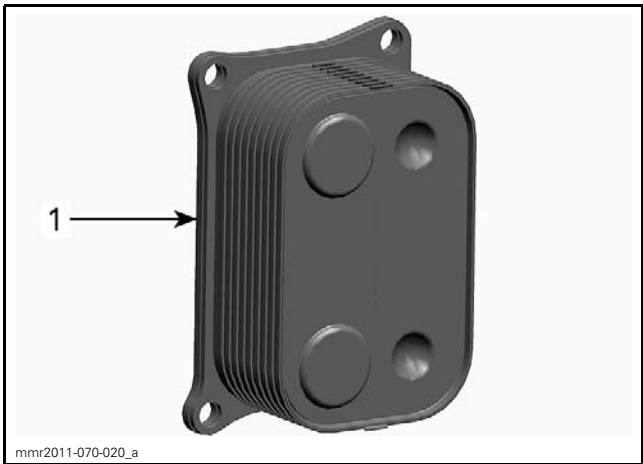
4. Remove oil cooler and discard gasket.



TYPICAL
1. Oil cooler
2. Gasket

Inspecting the Oil Cooler

Check oil cooler for cracks and other damage.



1. Check for cracks

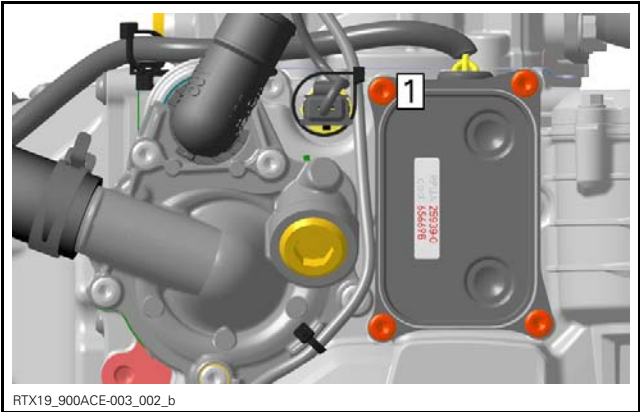
Replace parts as necessary.

Installing the Oil Cooler

The installation is the reverse of the removal procedure. However, pay attention to the following.
Install **NEW** oil cooler gasket.

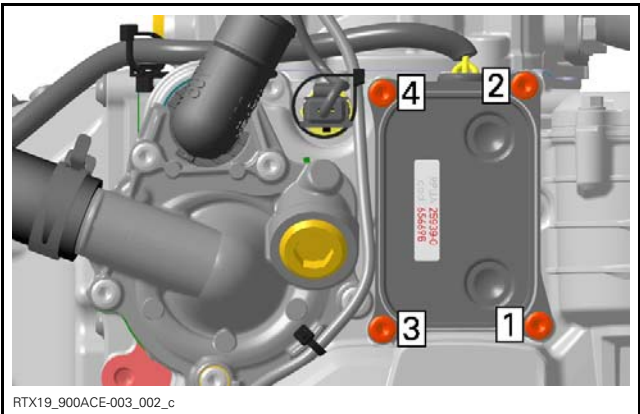
Tighten oil cooler screws in two steps to the specified torques using the illustrated sequence.

TIGHTENING TORQUE		
Oil cooler screw	STEP A	5 N•m ± 0.6 N•m (44 lbf•in ± 5 lbf•in)



TIGHTENING SEQUENCE OIL COOLER

TIGHTENING TORQUE		
Oil cooler screws	STEP B	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



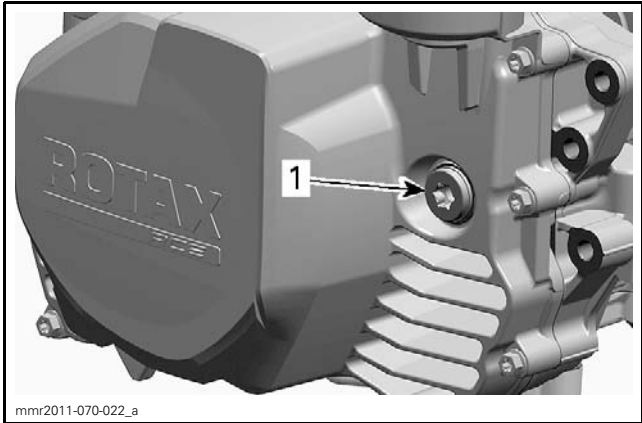
TIGHTENING SEQUENCE OIL-COOLER

Wipe up any oil and coolant spillage.
Fill up oil tank and check oil level. Refer to *REPLACING THE ENGINE OIL* in this subsection.
Refill and bleed cooling system. Refer to *COOLING SYSTEM* subsection.

ENGINE OIL PRESSURE REGULATOR

Oil Pressure Regulator Location

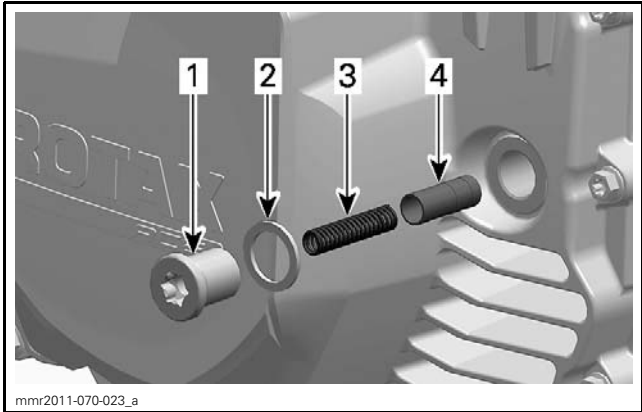
The engine oil pressure regulator is located inside the magneto cover.



1. Engine oil pressure regulator

Removing the Oil Pressure Regulator

- 1. Drain engine oil. Refer to *REPLACING THE ENGINE OIL* in this subsection.
- 2. Remove regulator plug and sealing washer. Discard sealing washer.
- 3. Pull oil pressure regulator parts out of the magneto cover.



- 1. Plug
- 2. Sealing washer
- 3. Regulator spring
- 4. Regulator piston

Inspecting the Oil Pressure Regulator

Clean bore and thread in the magneto cover of any contamination.

Inspect oil pressure regulator piston and bore in cylinder block for scoring or other damages.

Check if piston moves easily in its bore.

Check compression spring for free length.

SPRING FREE LENGTH	
New nominal	46 mm (1.811 in)
Service limit	45 mm (1.772 in)

Visually check compression spring for squareness.

Replace worn or damaged components.

Installing the Oil Pressure Regulator

Reverse the removal procedure. However, pay attention to the following.

Apply engine oil on regulator piston.

Install a **NEW** sealing washer on plug.

Tighten regulator plug to the specified torque.

TIGHTENING TORQUE	
Oil pressure regulator plug	17 N•m ± 2 N•m (150 lbf•in ± 18 lbf•in)

Wipe up any oil spillage.

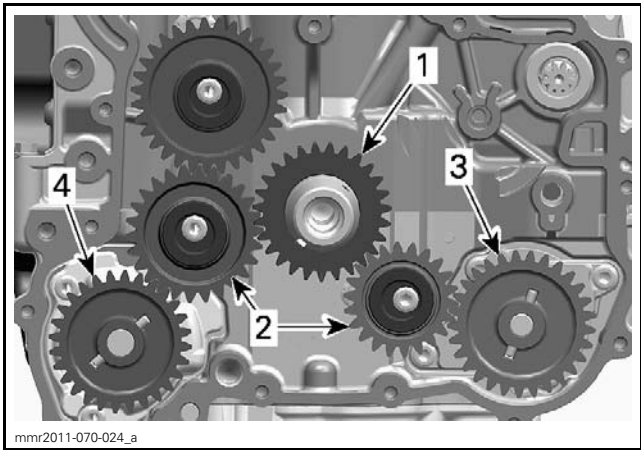
Fill up oil tank and check oil level. Refer to *REPLACING THE ENGINE OIL* in this subsection.

Install all other removed parts. Refer to applicable subsections.

OIL PUMP DRIVE GEARS

Oil Pump Drive Gear Location

The oil pump gears are located on the MAG side, behind the magneto cover.



- 1. Oil pump drive gear
- 2. Intermediate gears
- 3. Oil pressure pump gear
- 4. Oil scavenge pump gear

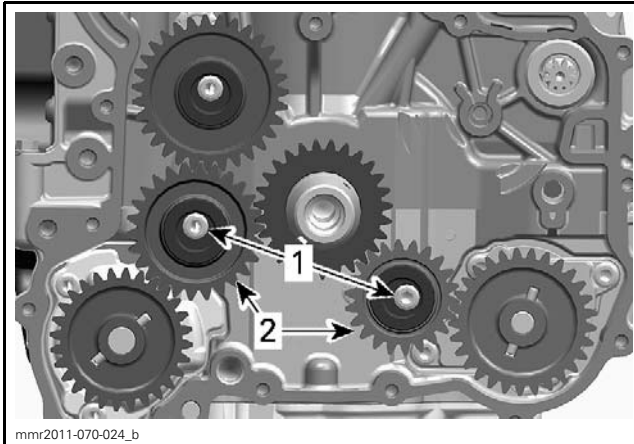
Oil Pump Drive Gear Access

Refer to *MAGNETO AND STARTER* subsection to remove:

- Magneto cover
- Rotor
- Sprag clutch gear.

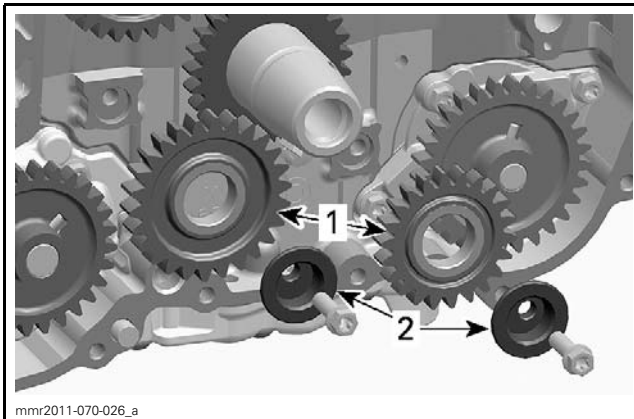
Removing the Oil Pump Drive Gear

- 1. Unscrew oil pump intermediate gear screws.



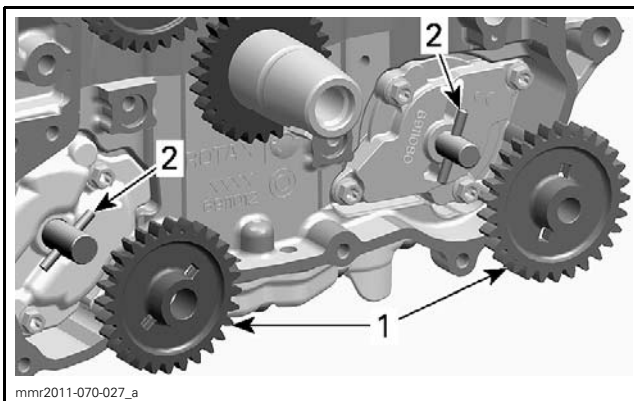
1. Retaining screws
2. Intermediate gears

2. Remove bearing sleeves and oil pump intermediate gears.



1. Intermediate gears
2. Bearing sleeves

3. Remove oil pump gears and needle pins.



1. Oil pump gears
2. Needle pins

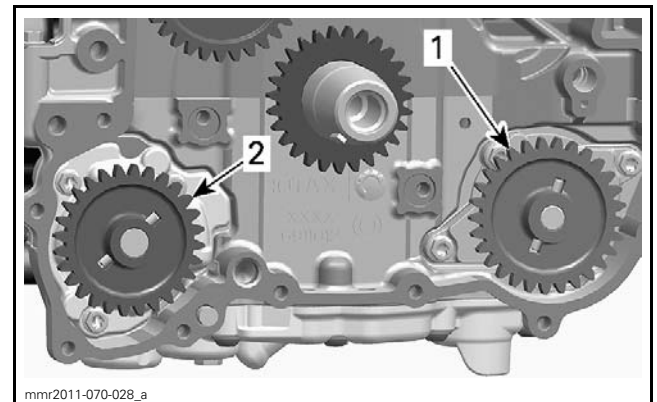
Inspecting the Oil Pump Drive Gear

Inspect gears for wear, cracks or other damage. Replace if damaged.

Installing the Oil Pump Drive Gear

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

1. Be sure to not intermix oil pump gears, see next illustration.
 - 1.1 Install the 29 teeth oil pump gear (BROWN) on oil pressure pump.
 - 1.2 Install the 28 teeth oil pump gear (BLACK) on oil scavenge pump.



1. 29 teeth oil pump gear (BROWN)
2. 28 teeth oil pump gear (BLACK)

2. Lubricate intermediate gears bearing sleeves with engine oil, then install gears and tighten screws to specified torque.

TIGHTENING TORQUE	
Intermediate gear screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

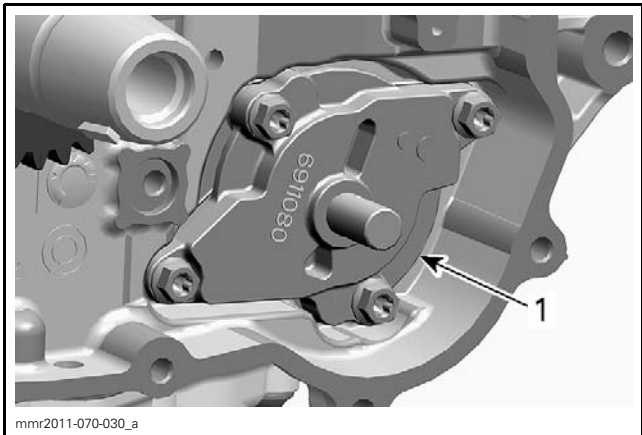
3. Install all other removed parts.

4. Fill up oil tank and check oil level. Refer to *REPLACING THE ENGINE OIL* in this subsection.

OIL PRESSURE PUMP

Oil Pressure Pump Location

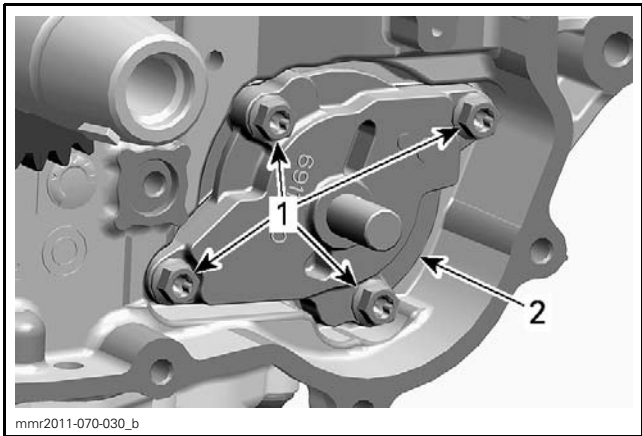
The oil pressure pump is located in the cylinder block, behind the magneto cover.



1. Oil pressure pump

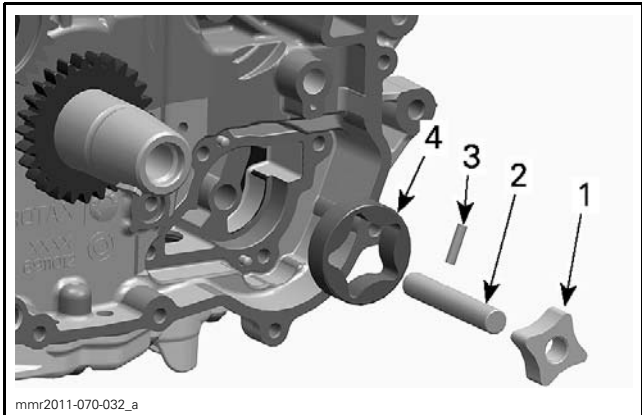
Removing the Oil Pressure Pump

- 1. Remove *OIL PUMP DRIVE GEARS*, see procedure in this subsection.
- 2. Remove oil pump cover.



1. Retaining screws
2. Oil pump cover

- 3. Remove following parts.



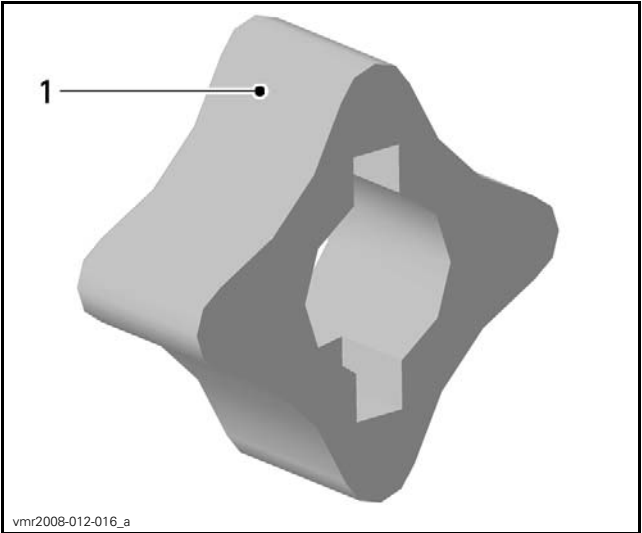
1. Inner rotor
2. Oil pump shaft
3. Needle pin
4. Outer rotor

Inspecting the Oil Pressure Pump

Inspect oil pump and oil pump cover bore for marks, scratches or other damage. Replace any damaged parts.

Check oil pump cover for damages and for surface straightness with a straight edge.

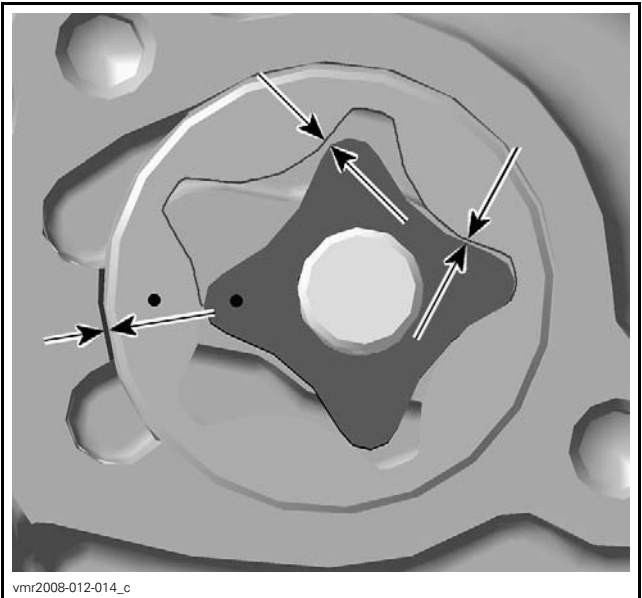
Check inner rotor for corrosion, worn pin slots or other damages. If so, replace inner and outer rotor at the same time.



1. Pitting on the teeth

Radial Clearance

Using a feeler gauge, measure the clearance of outer rotor and inner rotor as indicated by the arrows.

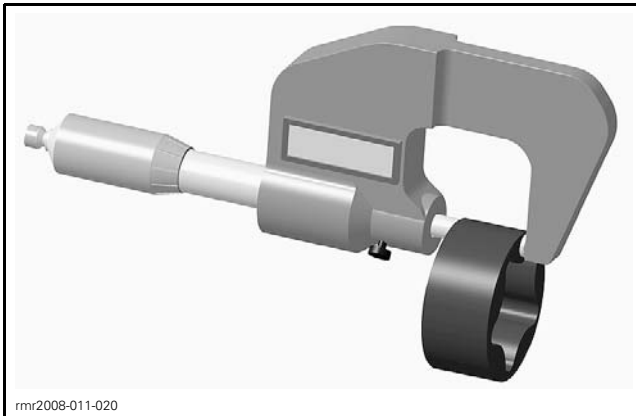


OIL PUMP RADIAL CLEARANCE	
Service limit	0.25 mm (.0098 in)

NOTE: If clearance of inner and outer rotors exceeds the tolerance, replace oil pump.

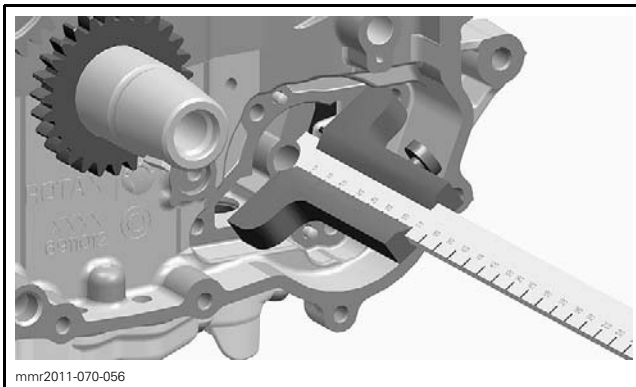
Axial Clearance

Measure outer rotor thickness with a micrometer.



OUTER ROTOR THICKNESS

Using a depth gauge, measure the depth of oil pump bore in the lower crankcase.



OIL PUMP BORE DEPTH (OIL PUMP COVER)

Subtract bore depth from rotor thickness to obtain axial clearance.

OIL PUMP AXIAL CLEARANCE	
Service limit	0.15 mm (.0059 in)

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

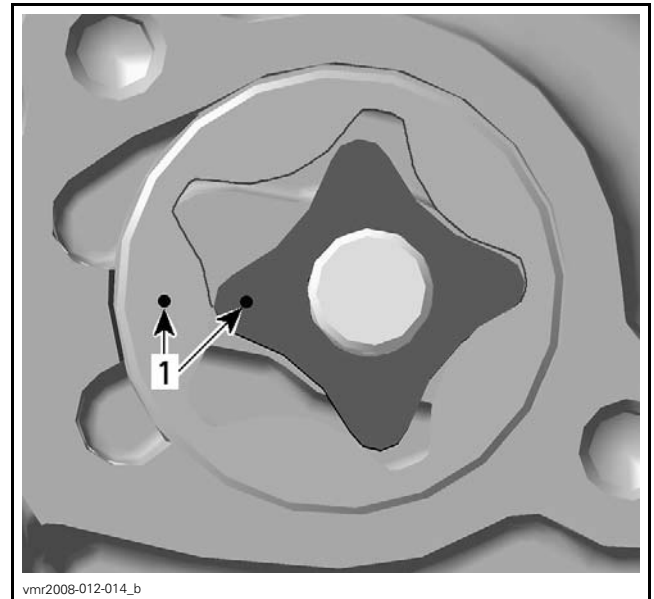
Installing the Oil Pressure Pump

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

1. Lubricate outer rotor with engine oil.

NOTICE Install rotors with the marks outwards.

2. Install outer rotor in crankcase oil pump bore.

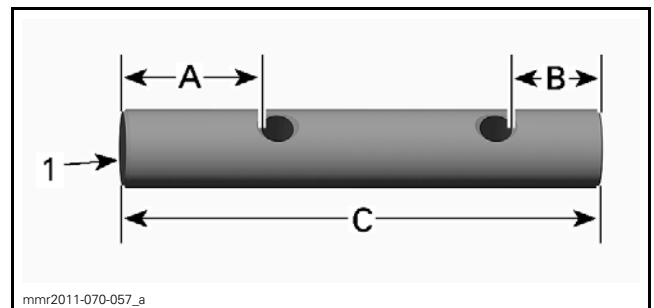


TYPICAL

1. Marks on inner and outer rotor

3. Install needle pin in oil pump shaft.

NOTICE The oil pump shaft is not symmetrical, the longer side must be installed inward.



1. Towards engine

A. 17.23 mm (.68 in)

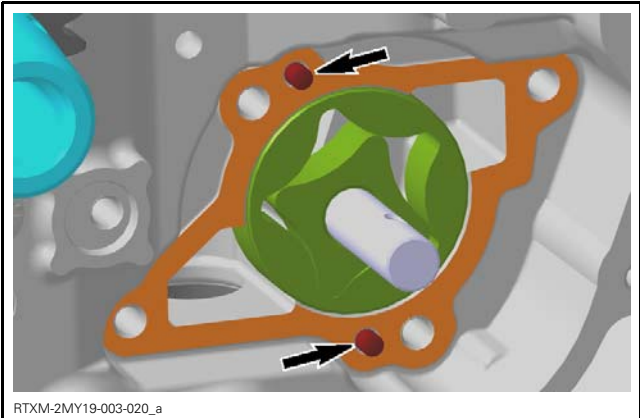
B. 11.43 mm (.45 in)

C. 60.5 mm (2.38 in)

4. Place inner rotor on the oil pump shaft. Lubricate oil pump shaft and inner rotor with engine oil.

5. Install oil pump assembly in the crankcase.

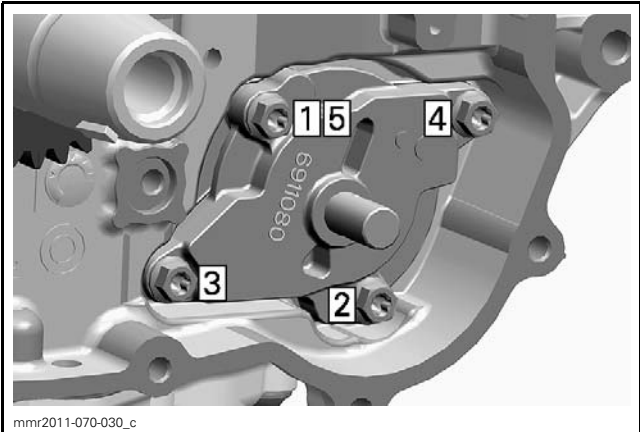
NOTE: check if both needle pins are pressed into the crankcase.



NEEDLE PINS

Install oil pump cover and tighten retaining screws to the following specified torque using the specified sequence.

TIGHTENING TORQUE	
Oil pump cover screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



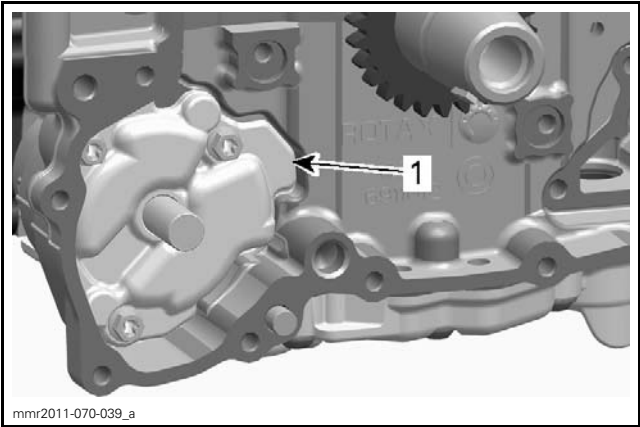
TIGHTENING SEQUENCE

6. Turn oil pump shaft and check for smooth operation of the oil pump assembly and axial play of the oil pump shaft.
7. Fill up oil tank and check oil level. Refer to *REPLACING THE ENGINE OIL* in this subsection. Start engine and make sure oil pressure is within specifications (refer to *TESTING THE ENGINE OIL PRESSURE* in this subsection).

OIL SCAVENGE PUMP MODULE

Oil Scavenge Pump Module Location

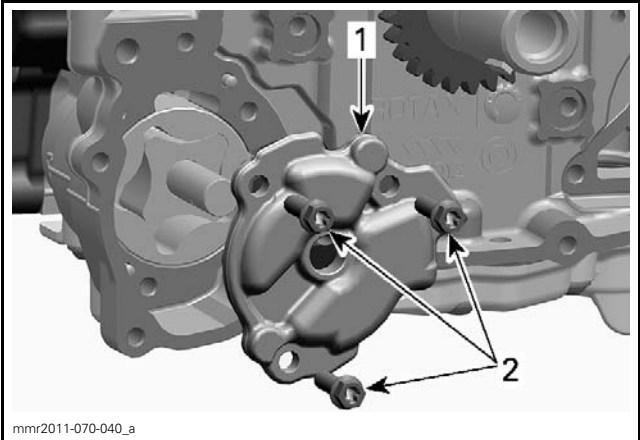
The oil scavenge pump module is located in the cylinder block, behind the magneto cover.



1. Oil scavenge pump module

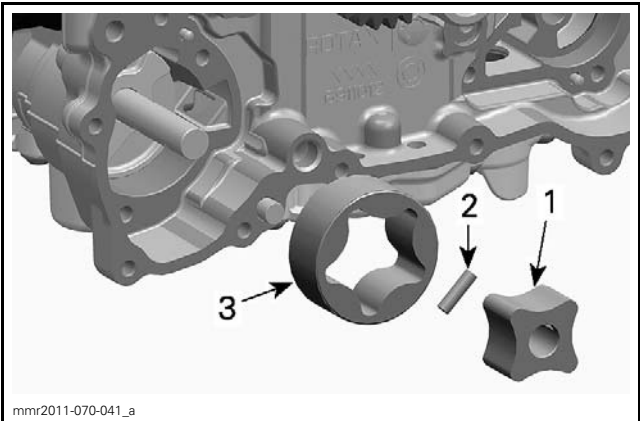
Removing the Oil Scavenge Pump Module

1. Remove *OIL PUMP DRIVE GEARS*, see procedure in this subsection.
2. Remove oil pump module cover.



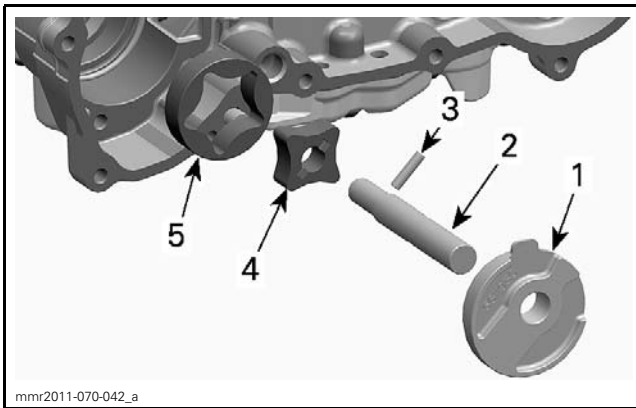
1. Oil pump module cover
2. Retaining screws

3. Disassemble the large oil scavenge pump as shown.



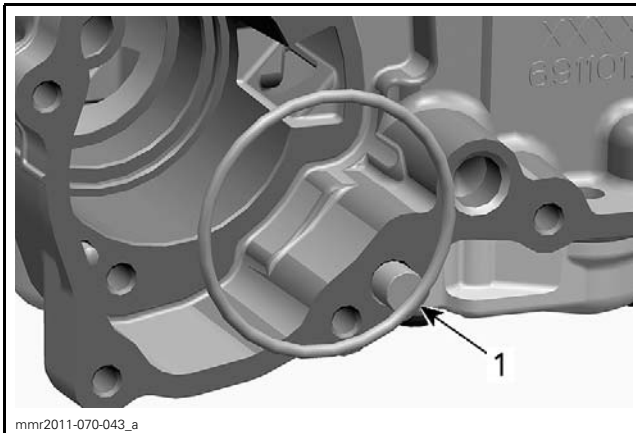
1. Inner rotor
2. Needle pin
3. Outer rotor

4. Disassemble the small oil scavenge pump as shown.



1. Oil pump cover
2. Oil pump shaft
3. Needle pin
4. Inner rotor
5. Outer rotor

5. Remove and discard the oil pump cover O-ring.



1. Oil pump cover O-ring

Inspecting the Oil Scavenge Pumps

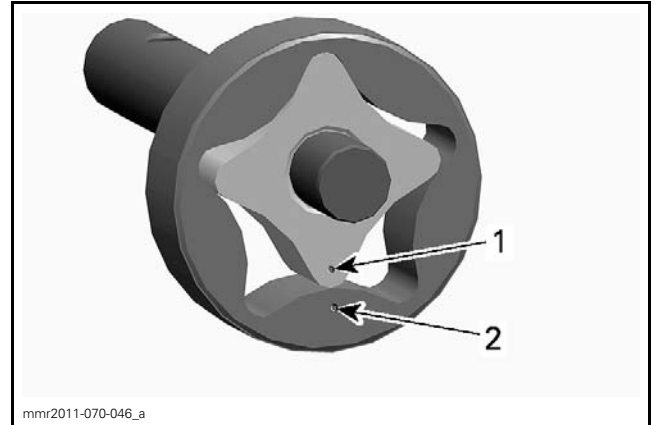
The inspection of both oil scavenge pumps is the same as for the oil pressure pump. Refer to *INSPECTING THE OIL PRESSURE PUMP* in this subsection.

Installing the Oil Scavenge Pump Module

Reverse the removal procedure, however, pay attention to the following.

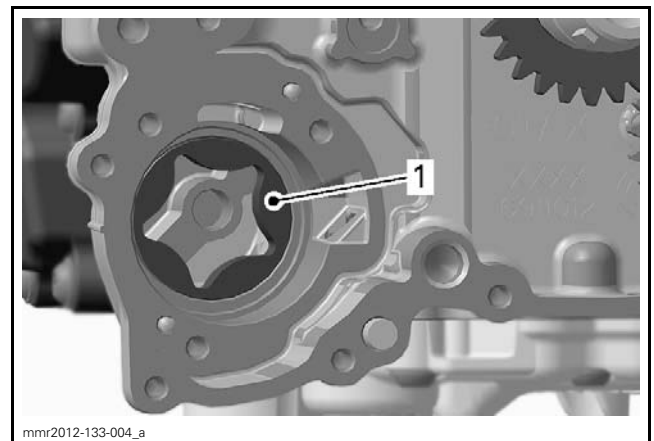
1. Lubricate small oil scavenge pump outer rotor with engine oil.

NOTICE When installing the oil pump rotors, make sure both marks are pointing toward the inside of the crankcase.



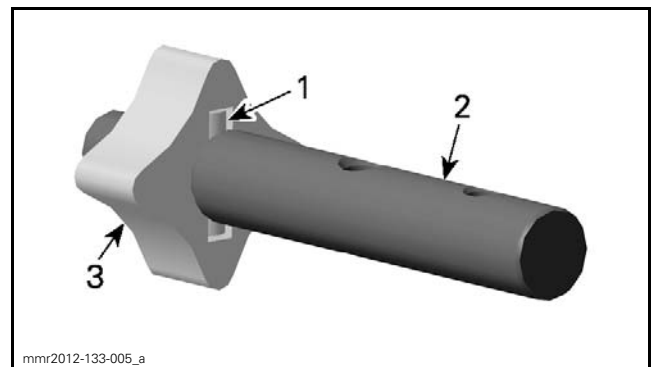
1. Mark on inner rotor
2. Mark on outer rotor

2. Install small oil scavenge pump outer rotor into crankcase oil pump bore.



1. Small oil scavenge pump outer rotor mark must point towards inside of the crankcase

3. Install the needle pin in the bore of the oil pump shaft and place the small inner rotor on the shaft.

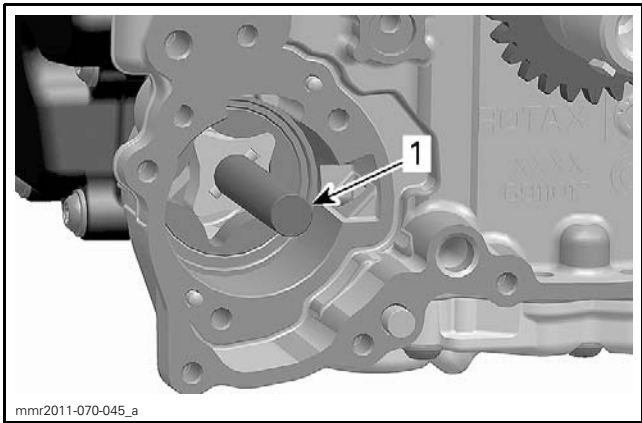


1. Needle pin
2. Oil pump shaft
3. Small scavenge pump inner rotor

4. Lubricate oil pump shaft and inner rotor with engine oil.

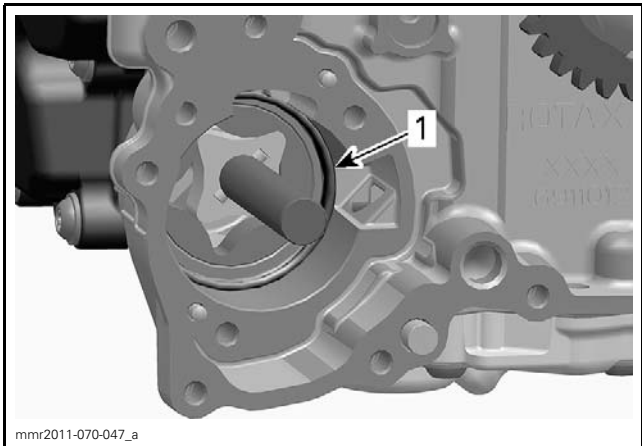
5. Install oil pump shaft assembly into the crankcase.

Subsection XX (LUBRICATION SYSTEM)



1. Oil pump shaft with small oil scavenge pump

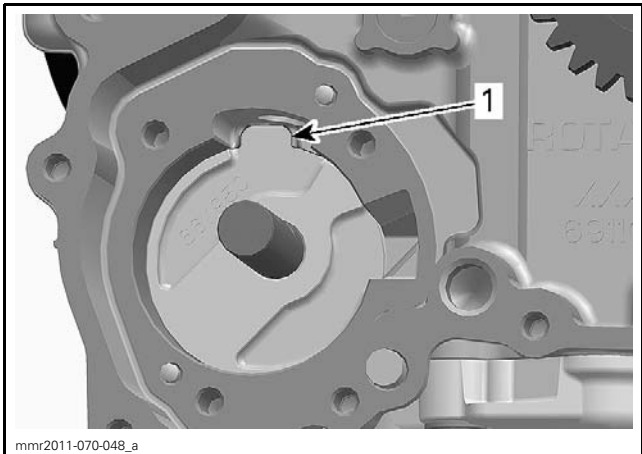
6. Install a **NEW** oil pump cover O-ring.



1. Oil pump cover O-ring

7. Lubricate both sides of the oil pump cover with engine oil.

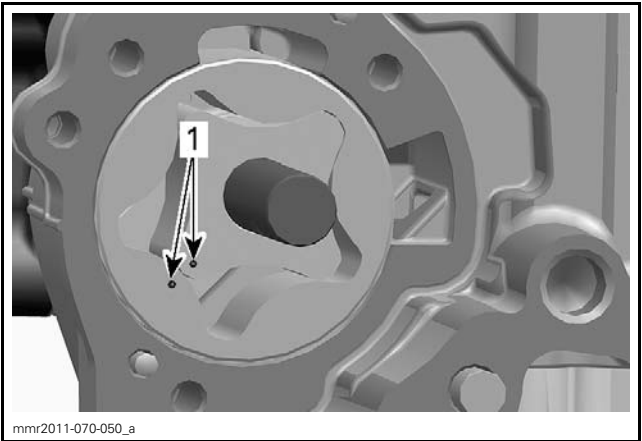
8. Align tab of the oil pump cover with the upper recess in the crankcase. Push cover in until a click is heard, indicating the cover is properly installed.



1. Oil pump cover tab properly positioned

9. Install large oil scavenge pump needle pin.

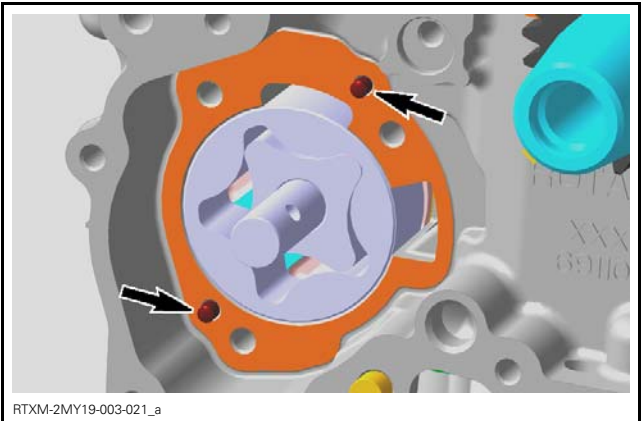
10. Install large oil scavenge pump inner rotor and outer rotor with the marks outwards.



1. Marks on inner and outer rotor

11. Lubricate large oil scavenge pump parts with engine oil.

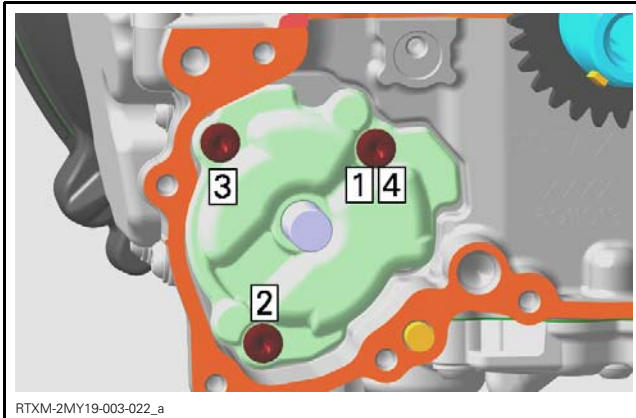
NOTE: Check if both needle pins are pressed into the crankcase.



NEEDLE PINS

12. Install oil pump cover and tighten retaining screws to the following specified torque using the specified sequence.

TIGHTENING TORQUE	
Oil pump cover screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



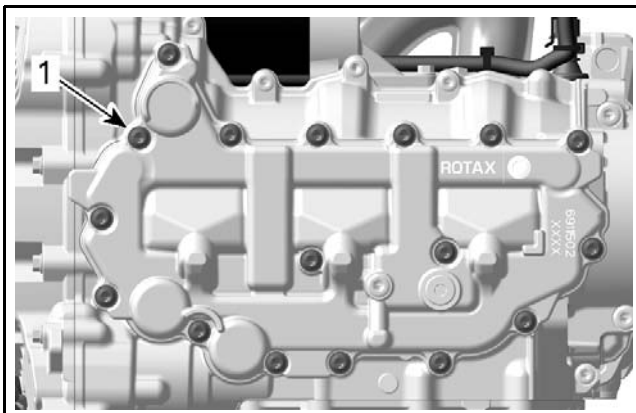
TIGHTENING SEQUENCE

13. Turn oil pump shaft and check for smooth operation of the oil pump assembly and axial play of the oil pump shaft.
14. Install other removed parts.
15. Fill up oil tank and check oil level. Refer to *REPLACING THE ENGINE OIL* in this subsection. Start engine and make sure oil pressure is within specifications (refer to *TESTING THE ENGINE OIL PRESSURE* in this subsection).

OIL SUMP COVER

Oil Sump Cover Location

The oil sump cover is located on the engine bottom.

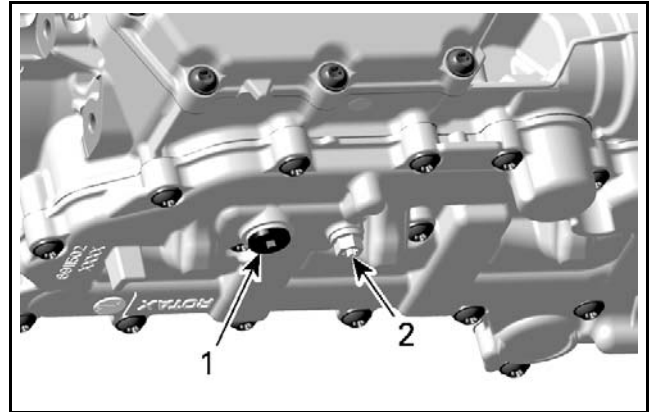


TYPICAL - 900 ACE ENGINE SHOWN

1. Oil sump cover

Removing the Oil Sump Cover

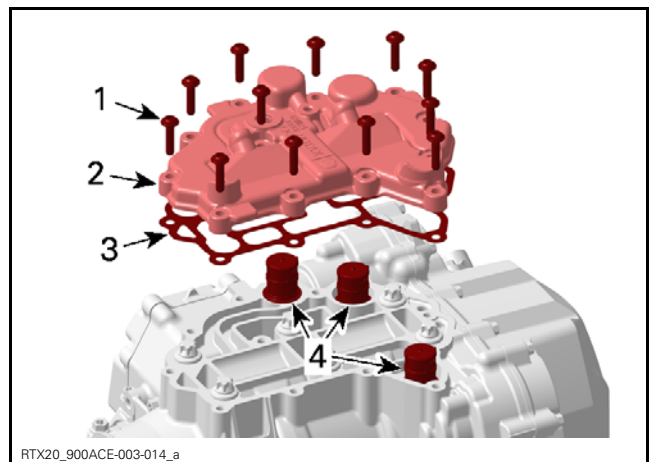
1. Remove engine from vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
2. Drain engine oil, refer to *REPLACING THE ENGINE OIL* in this subsection.



TYPICAL

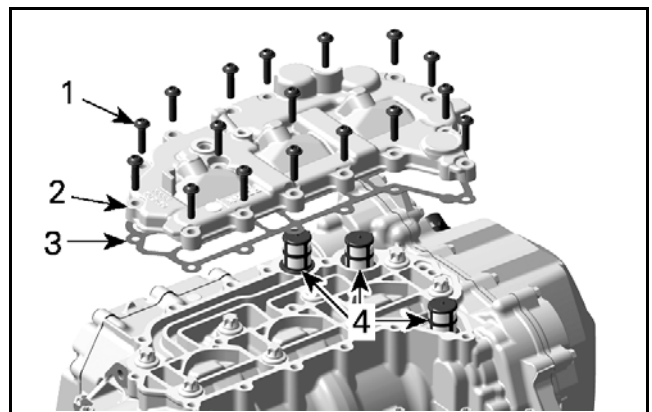
1. Main drain plug
2. Secondary drain plug

3. Unscrew oil sump cover retaining screws.
4. Remove oil sump cover. Discard gasket.
5. Remove and clean engine oil strainers.



600 ACE ENGINE

1. Retaining screws
2. Oil sump cover
3. Gasket
4. Engine oil strainers



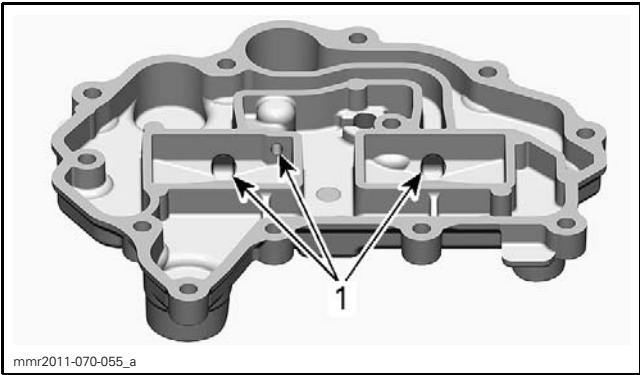
900 ACE ENGINE

1. Retaining screws
2. Oil sump cover
3. Gasket
4. Engine oil strainers

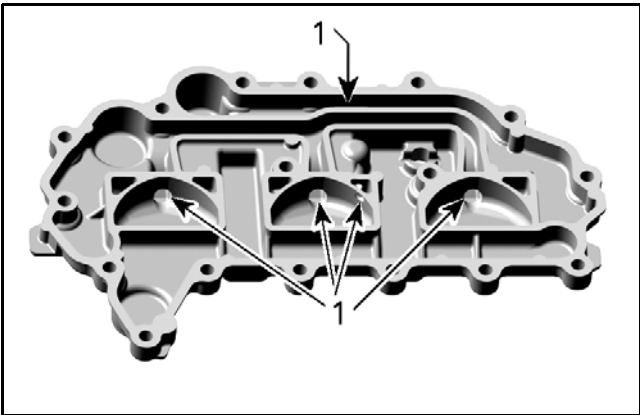
Inspecting the Oil Sump Cover

Clean oil sump cover and engine oil strainers with a part cleaner, then use an air gun to dry it.

Blow out the oil orifices and check if they are not clogged.



600 ACE ENGINE
1. Oil drain bores



900 ACE ENGINE
1. Oil drain bores

Check oil sump cover for cracks or other damage.

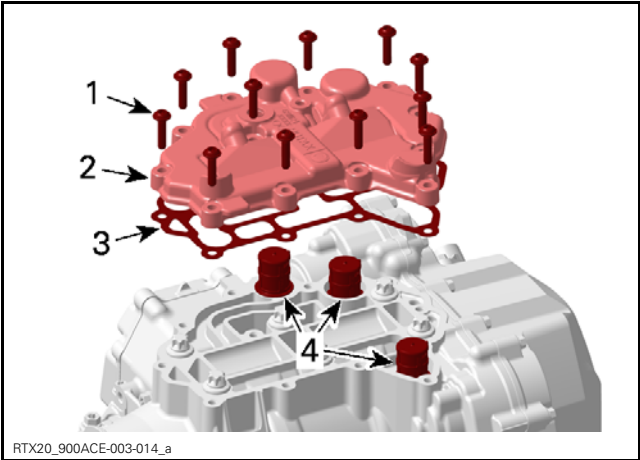
Check oil sump cover for flatness with straight edge.

Replace oil sump cover if necessary.

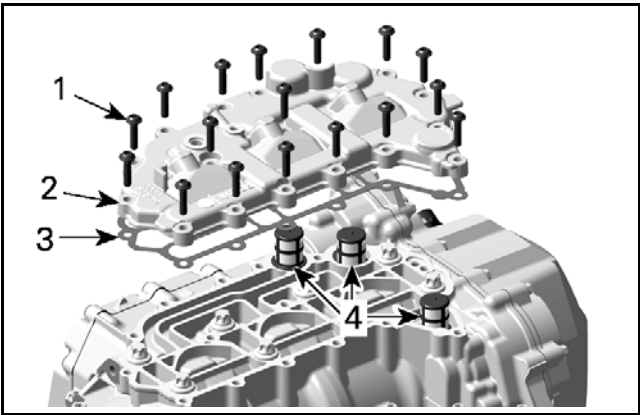
Check engine oil strainer for damage and change if necessary.

Installing the Oil Sump Cover

- 1. Install a **NEW** oil sump cover gasket.
- 2. Install oil strainers as shown.



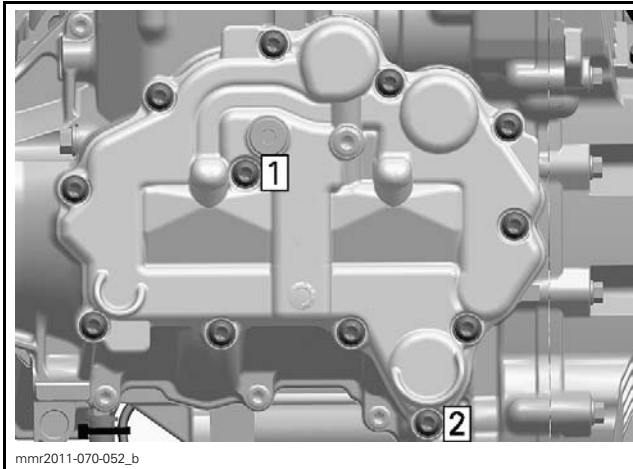
600 ACE ENGINE
1. Retaining screws
2. Oil sump cover
3. Gasket
4. Engine oil strainers



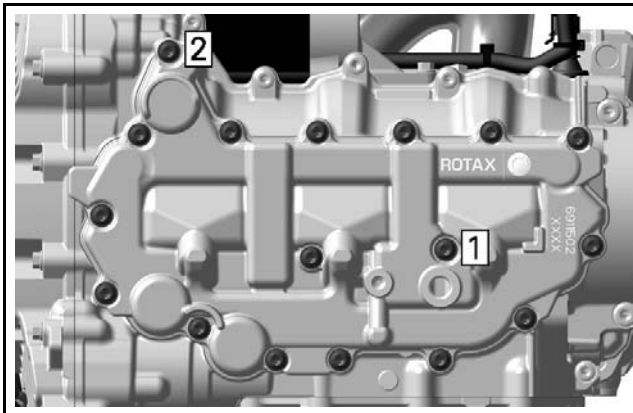
900 ACE ENGINE
1. Retaining screws
2. Oil sump cover
3. Gasket
4. Oil strainers

- 3. Install oil sump cover on engine, then tighten retaining screws in two steps as follows:
 - 3.1 Tighten screws to specification according to the specified sequence.

TIGHTENING TORQUE		
Oil sump cover screws	STEP A	5 N•m ± 0.6 N•m (44 lbf•in ± 5 lbf•in)



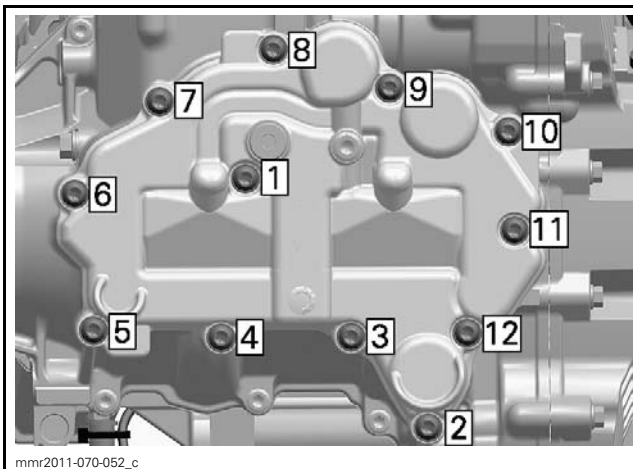
600 ACE ENGINE - TIGHTENING SEQUENCE STEP A



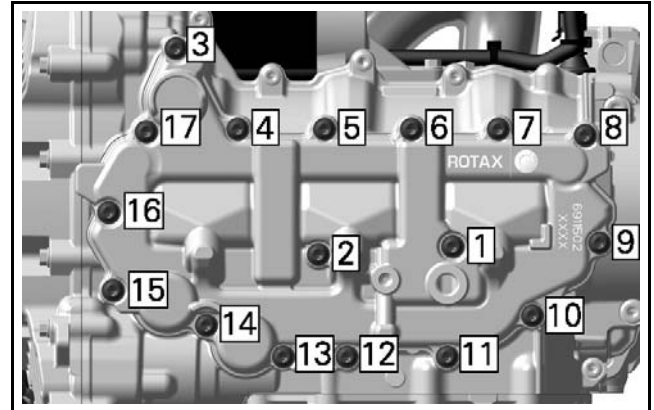
900 ACE ENGINE - TIGHTENING SEQUENCE STEP A

- 3.2 Tighten screws to specification according to the specified sequence.

TIGHTENING TORQUE		
Oil sump cover screws	STEP B	10 N•m ± 1 N•m (89 lbf•in ± 9 lbf•in)



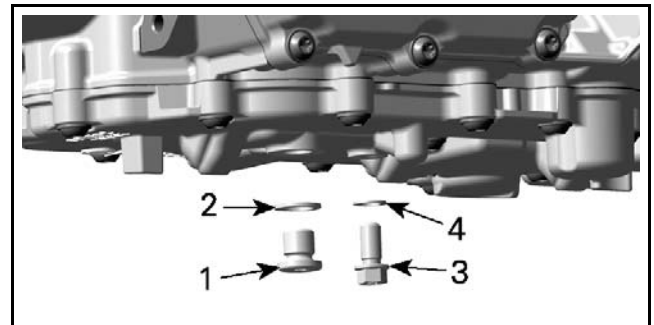
600 ACE ENGINE - TIGHTENING SEQUENCE STEP B



900 ACE ENGINE - TIGHTENING SEQUENCE STEP B

4. Reinstall oil drain plugs using **NEW** sealing washers.

TIGHTENING TORQUE	
Main and secondary drain plug	15 N•m ± 2 N•m (133 lbf•in ± 18 lbf•in)



TYPICAL - 900 ACE ENGINE SHOWN

1. Main drain plug
2. NEW sealing washer
3. Secondary drain plug
4. NEW sealing washer

5. Install engine in vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.

6. Fill up oil tank and check oil level. Refer to *REPLACING THE ENGINE OIL* in this subsection.

COOLING SYSTEM

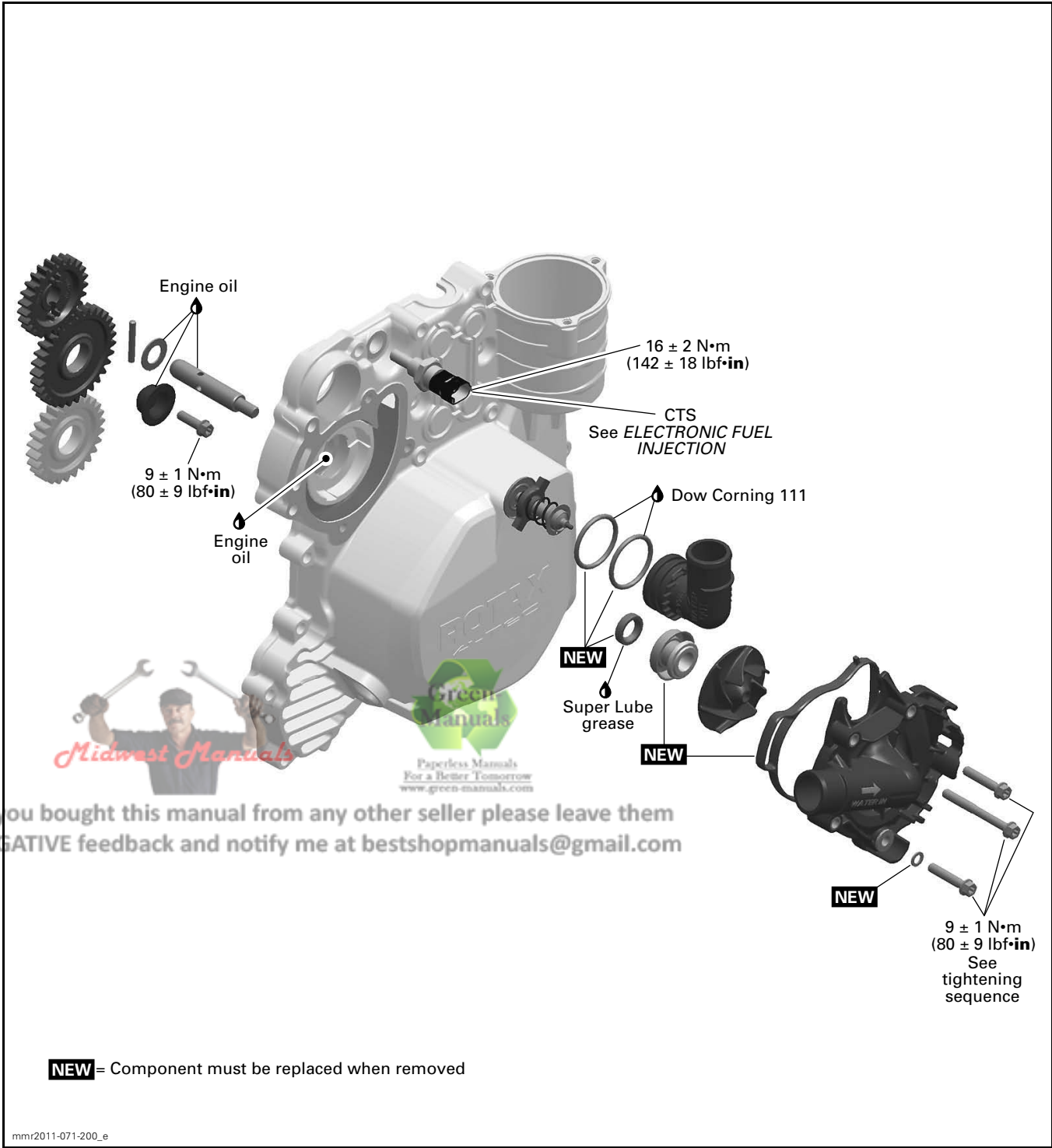
SERVICE TOOLS

Description	Part Number	Page
HANDLE	420 877 650	77
OIL SEAL PUSHER.....	529 036 210	77
ROTARY SEAL INSTALLER	529 036 211	77–78
TEST CAP	529 035 991	72
VACUUM/PRESSURE PUMP	529 021 800	72

SERVICE PRODUCTS

Description	Part Number	Page
DOW CORNING 111	413 707 000	74
SUPER LUBE GREASE.....	293 550 030	77

ENGINE COMPONENTS



GENERAL

For a better understanding, some illustrations were taken with engine out of vehicle.

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



WARNING

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

INSPECTION

COOLING SYSTEM LEAK TEST

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
100 kPa (15 PSI)

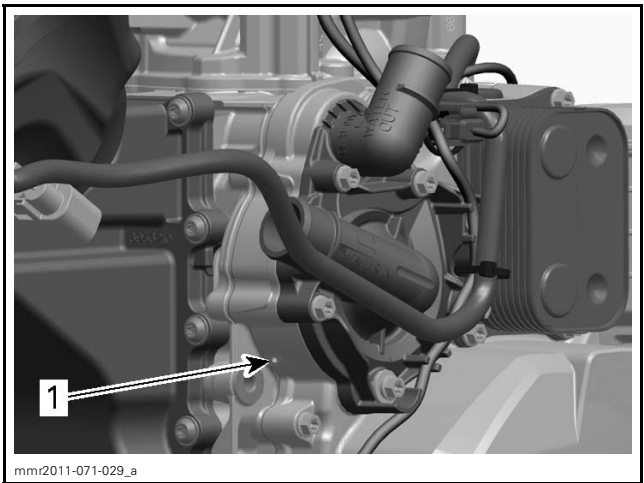


TYPICAL

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

Check the leak indicator hole for an oil or coolant leak.

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 this subsection.



1. Leak indicator hole

TROUBLESHOOTING

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

Always check for fault codes. If a fault code is detected, service the fault code first.

ENGINE OVERHEATING

1. Low coolant level.
 - Refill and check for leaks (coolant leaking out of leak indicator hole, hoses or clamps missing or defective, or cylinder head gaskets leaks). Repair or replace.
2. Dirty heat exchanger.
 - Clean heat exchanger fins. Replace heat exchanger as required.
3. Air in cooling system.
 - Refill and bleed cooling system.
4. Defective thermostat (does not open when engine is warm up).
 - Replace thermostat.
5. Defective water pump.
 - Inspect and replace defective components.
6. Coolant temperature sensor defective.
 - Check and replace.

7. **Wrong coolant concentration.**
 - Check and adjust coolant concentration according to BRP's recommendations or replace coolant.
8. **Defective coolant reservoir cap.**
 - Replace cap.
9. **Defective cooling fan.**
 - Check cooling fan motor operation.
 - Check fuse and relay of cooling fan motor.
 - Check wiring harness of cooling fan motor.
10. **Snow guard is too high.**
 - Check and adjust rear suspension.

PROCEDURES

COOLANT RESERVOIR CAP

Coolant Reservoir Cap Test

Using a pressure cap tester, check the efficiency of coolant reservoir cap. If the cap does not meet specification, replace the cap.

CAP OPENING PRESSURE
110 kPa (16 PSI)

COOLANT RESERVOIR

Coolant Reservoir Removal

1. Install hose pinchers on coolant hoses attached to reservoir.
2. Siphon coolant from reservoir.
3. Disconnect coolant hoses from reservoir.
4. Remove coolant reservoir from vehicle.

Coolant Reservoir Installation

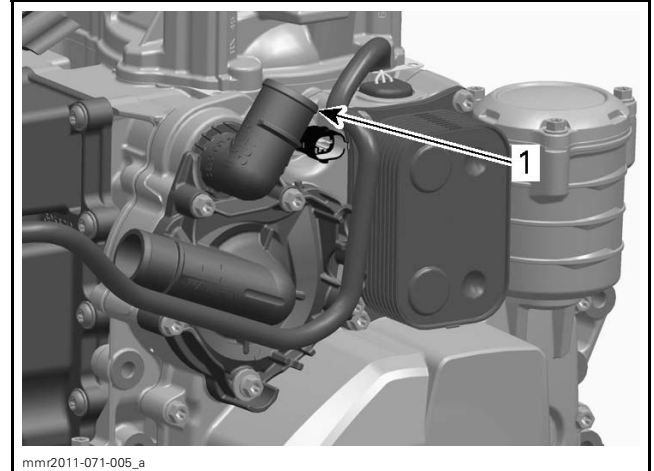
Reverse the removal procedure. However, pay attention to the following.

Refill and bleed cooling system as described in *PERIODIC MAINTENANCE PROCEDURES* subsection.

THERMOSTAT

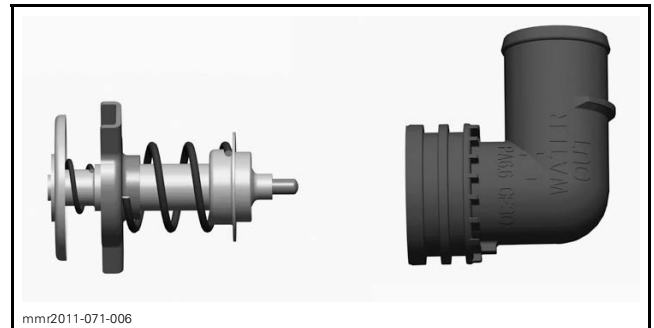
Thermostat Location

The thermostat is located on engine MAG side.



mmr2011-071-005_a

1. Thermostat housing



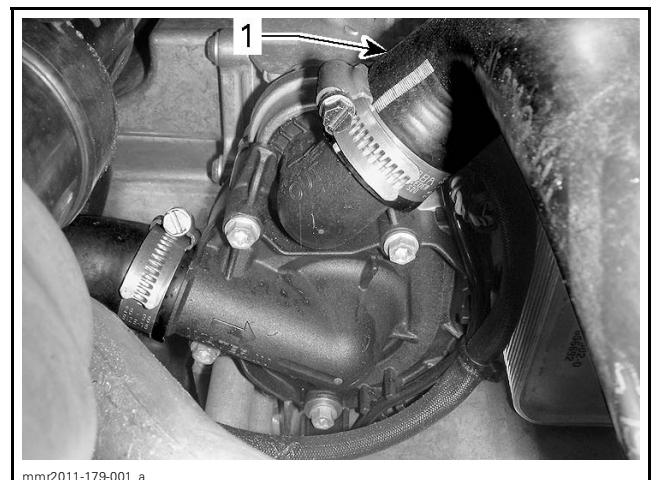
mmr2011-071-006

Thermostat Access

Remove upper RH side panel.

Thermostat Removal

1. Drain engine coolant. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
2. Disconnect outlet hose from thermostat housing.

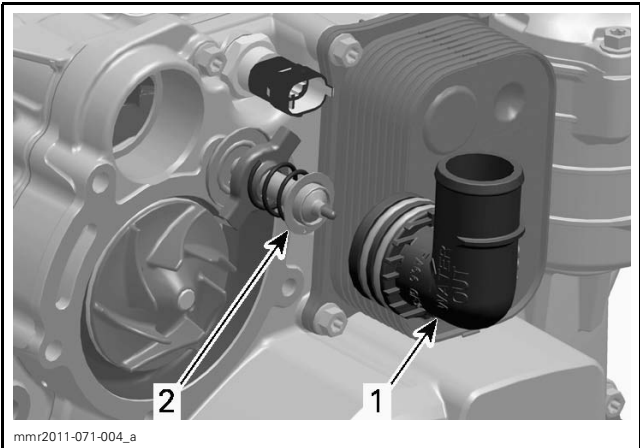


mmr2011-179-001_a

1. Thermostat outlet hose

Section 02 ENGINE (600 ACE)
Subsection 05 (COOLING SYSTEM)

- 3. Proceed with *WATER PUMP HOUSING REMOVAL*. See procedure in this subsection.
- 4. Remove thermostat housing then thermostat.



- 1. Thermostat housing
- 2. Thermostat

NOTE: Use shop rags to catch any spilled engine coolant.

Thermostat Test

To check thermostat, put it in water and heat water.

THERMOSTAT TEMPERATURE	
Starts to open	75°C (167°F)
Fully open	95°C (203°F)

Replace thermostat if out of specification.

Thermostat Installation

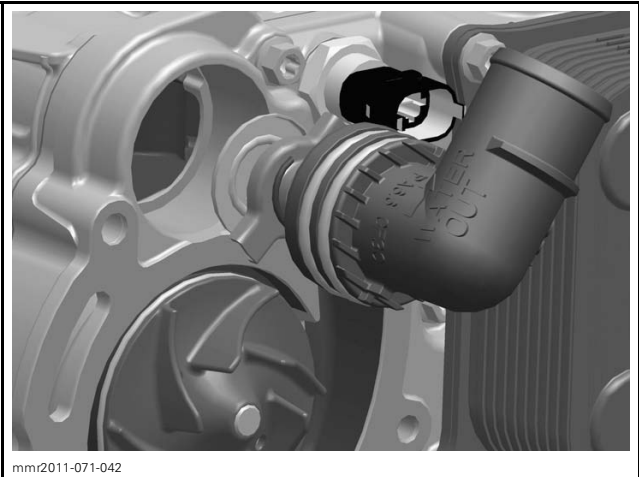
Reverse the removal procedure, however pay attention to the following.

Install **NEW** O-rings on thermostat housing.

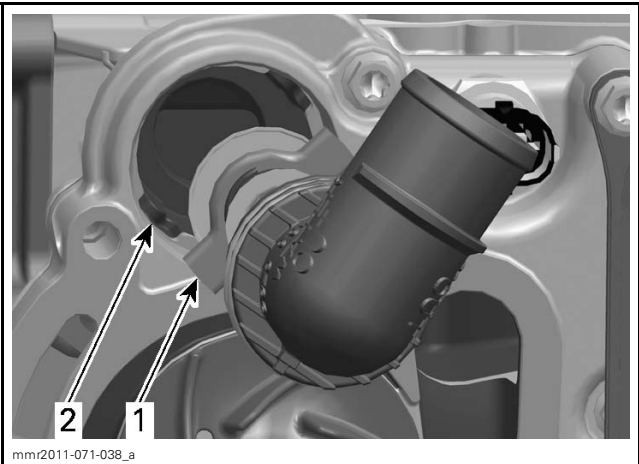
Lubricate O-rings.

THERMOSTAT HOUSING O-RING	
Service product	DOW CORNING 111 (P/N 413 707 000)

Insert thermostat in thermostat housing.



Align both tabs of thermostat with the recess in the magneto cover.



- 1. Thermostat tabs
- 2. Magneto cover recess

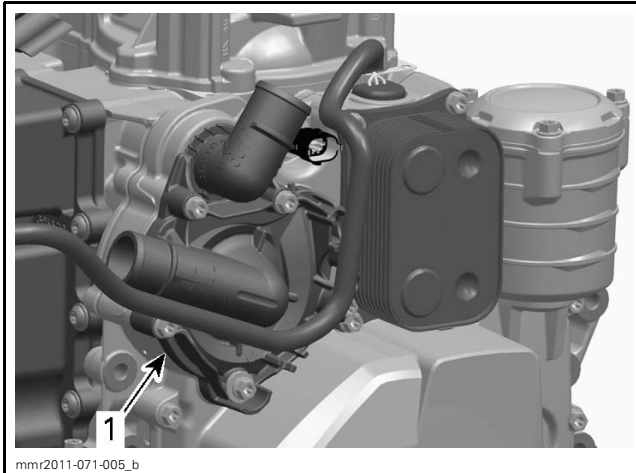
Install water pump housing, refer to *WATER PUMP HOUSING INSTALLATION* in this subsection.

Refill and bleed cooling system. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

WATER PUMP

Water Pump Location

The water pump is located on engine MAG side.



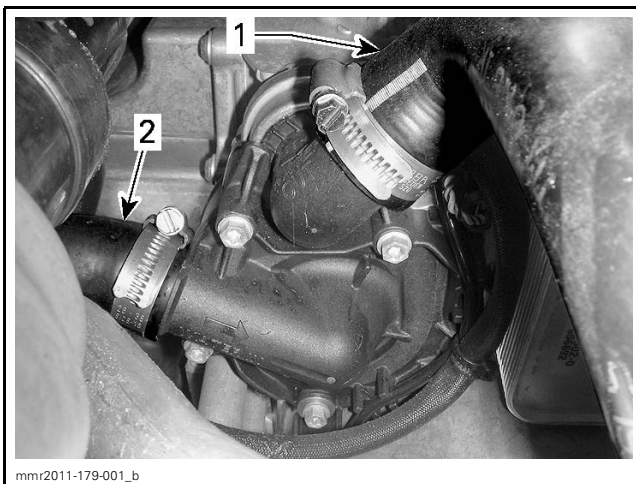
1. Water pump

Water Pump Access

Remove RH side panels.

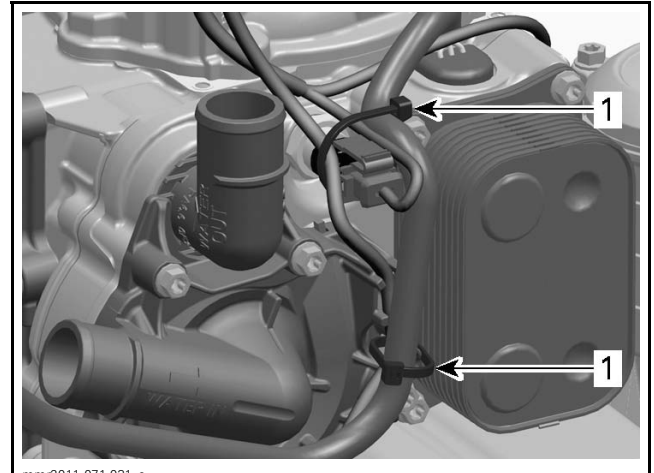
Water Pump Housing Removal

1. Drain engine coolant. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
2. Disconnect outlet hose from thermostat housing.
3. Disconnect inlet hose from water pump.



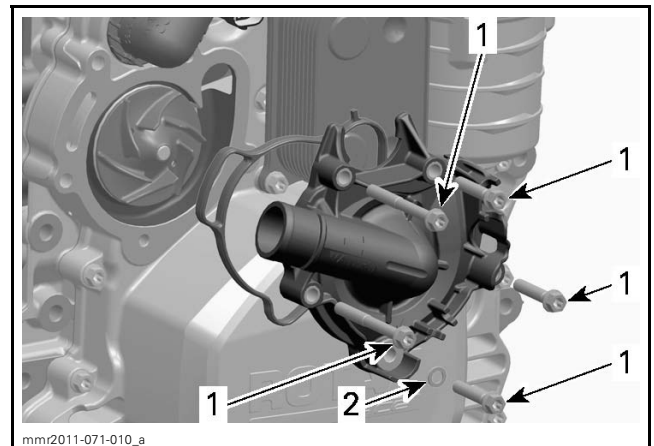
1. Thermostat outlet hose
 2. Water pump inlet hose

4. Remove both locking ties securing magneto wires.



1. Locking ties

5. Remove retaining screws of water pump housing.
6. Discard sealing washer.
7. Remove water pump housing from magneto cover.



1. Retaining screws
 2. Sealing washer

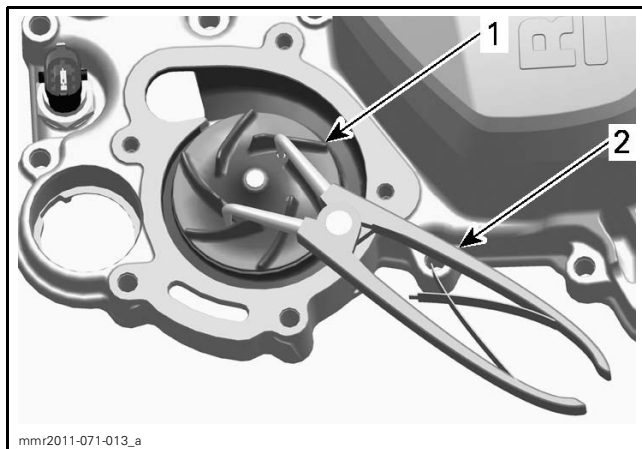
NOTE: Use shop rags to catch any spilled engine coolant.

Water Pump Disassembly

1. Unscrew impeller counterclockwise using appropriate pliers.

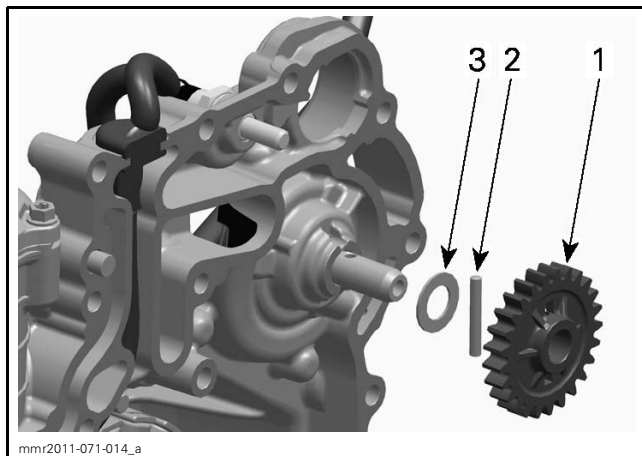
Section 02 ENGINE (600 ACE)

Subsection 05 (COOLING SYSTEM)



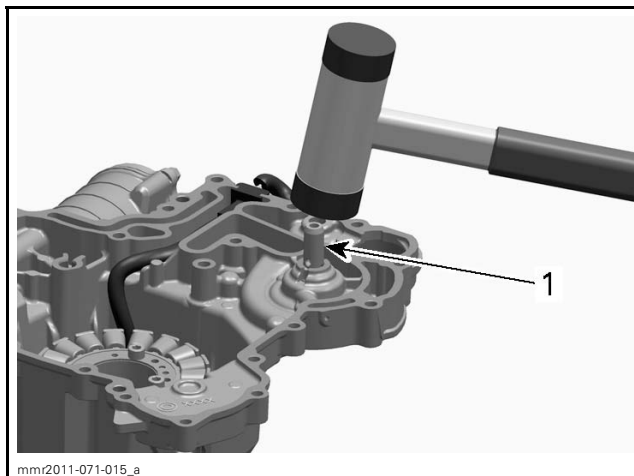
1. Impeller
2. Pliers

2. Remove magneto cover. Refer to *MAGNETO AND STARTER* subsection.
3. Remove the following components from magneto cover:
 - Water pump gear
 - Needle pin
 - Thrust washer.



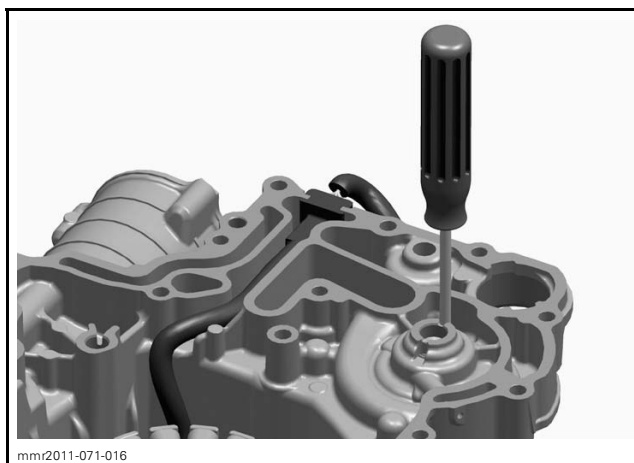
1. Water pump gear
2. Needle pin
3. Thrust washer

4. Remove water pump shaft using a plastic mallet.



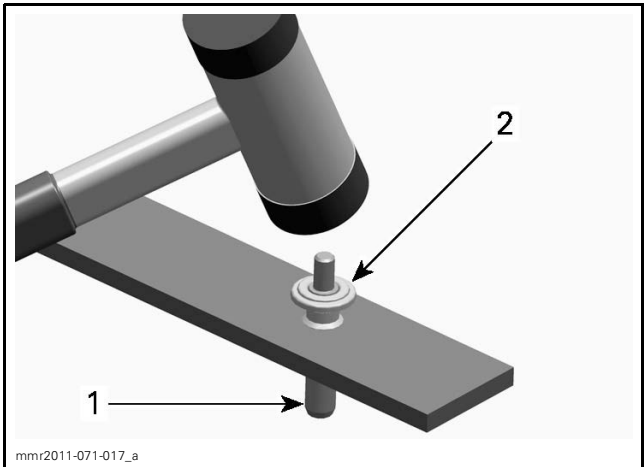
1. Water pump shaft

5. Remove the following components from magneto cover:
 - Oil seal
 - Remaining parts of rotary seal.



NOTICE Be careful not to damage the surface of the rotary seal bore in the magneto cover.

6. Separate rotary seal from water pump shaft.



1. Water pump shaft
2. Rotary seal

Water Pump Inspection

Check area of water pump housing for cracks or other visible damage.

Check water pump gear for wear or broken teeth.

Check if housing gasket is brittle, hard or damaged.

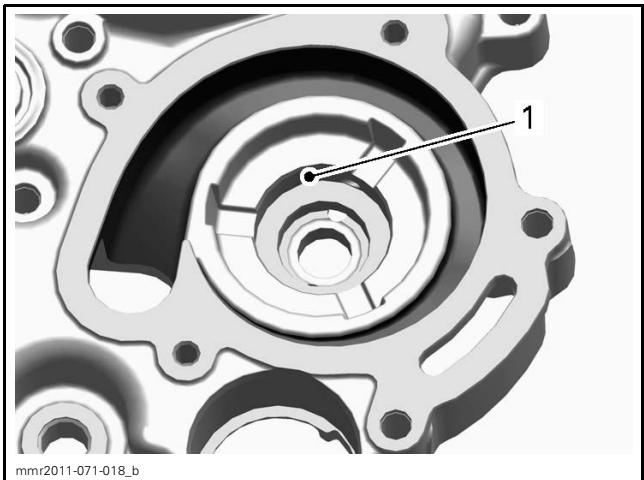
Check water pump shaft for visible damage.

Replace parts if necessary.

Water Pump Assembly

NOTE: Always replace oil seal and rotary seal at the same time.

1. Clean rotary seal surface from old sealant.



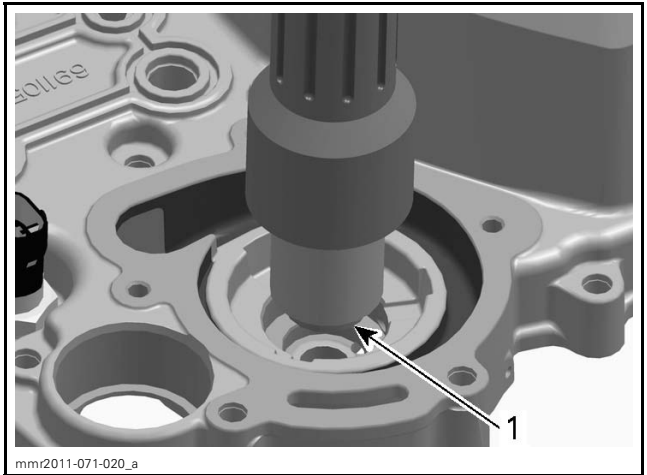
1. Clean surface

2. Apply engine oil on the press fit area of oil seal.

NOTICE Never use engine oil on the press fit area of the rotary seal.

3. Install **NEW** oil seal in magneto cover.

REQUIRED TOOLS	
OIL SEAL PUSHER (P/N 529 036 210)	
HANDLE (P/N 420 877 650)	



1. Oil seal



1. Oil seal correctly installed

4. Lubricate sealing lip of the oil seal.

OIL SEAL	
Service product	SUPER LUBE GREASE (P/N 293 550 030)

5. Install **NEW** rotary seal on magneto cover using a press.

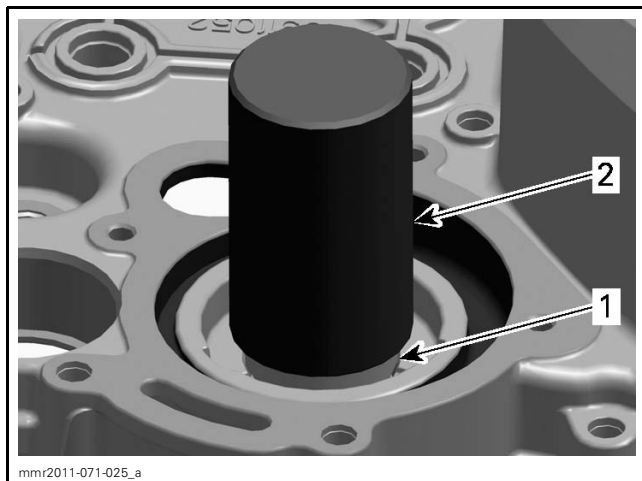
NOTE: Prior to installing, ensure that press fit sealing of rotary seal is not damaged.

REQUIRED TOOL	
Press	
ROTARY SEAL INSTALLER (P/N 529 036 211)	

Section 02 ENGINE (600 ACE)

Subsection 05 (COOLING SYSTEM)

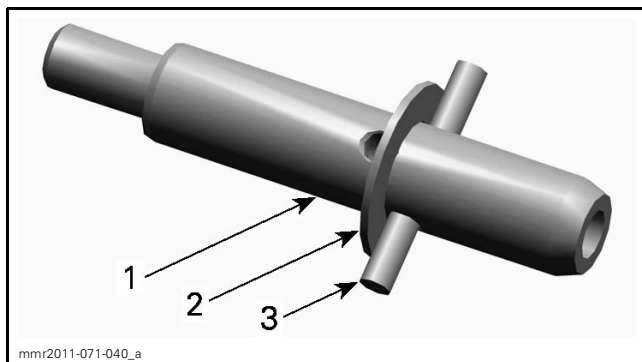
NOTICE Never use a hammer for rotary seal installation. Only use a press to avoid damaging the ceramic component.



1. Rotary seal
2. Rotary seal installer

6. Assemble the following components onto water pump shaft.

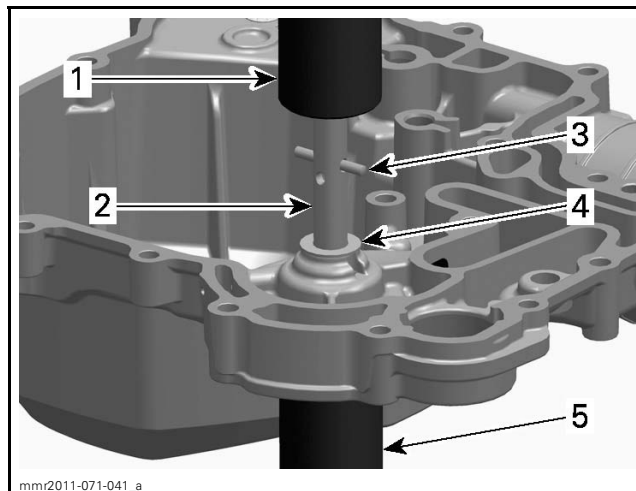
- Needle pin
- Thrust washer.



1. Water pump shaft
2. Thrust washer
3. Needle pin

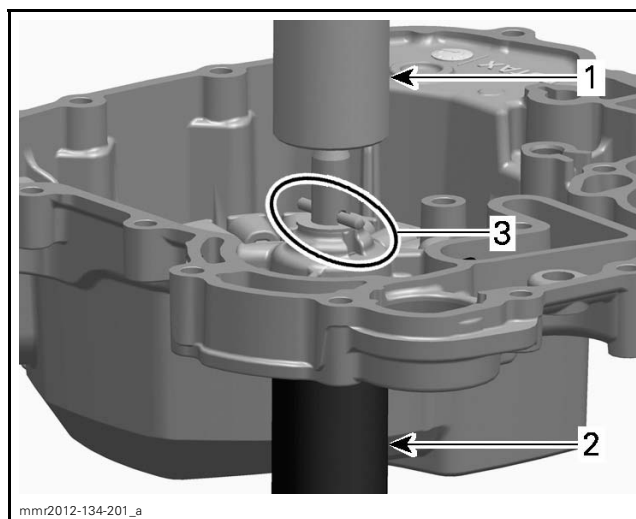
7. Slide water pump shaft into rotary seal using a press.

NOTE: To avoid damaging the rotary seal and to achieve the proper preload support the rotary seal with the ROTARY SEAL INSTALLER (P/N 529 036 211).



1. Press
2. Water pump shaft
3. Needle pin
4. Thrust washer
5. Rotary seal installer

8. Carefully press water pump shaft until needle pin touches thrust washer.



1. Press
2. Rotary seal installer
3. Needle pin touches thrust washer

NOTICE Never use a hammer to install water pump shaft into rotary seal.

NOTE: After installation, water pump shaft must rotate freely.

9. Screw impeller clockwise using appropriate pliers.

NOTICE Be careful not to damage the impeller vanes during its installation.

10. Install magneto cover. Refer to *MAGNETO AND STARTER* subsection.

Water Pump Housing Installation

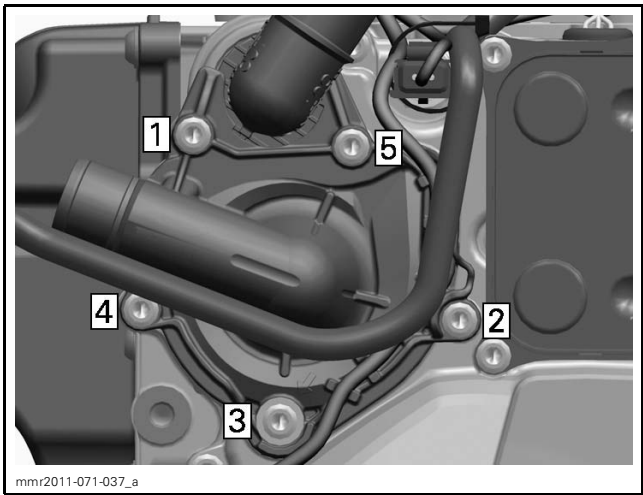
Reverse the removal procedure. However, pay attention to the following.

NOTICE When installing the water pump housing, ensure the NEW gasket is precisely positioned in the pump housing groove to prevent leakage.

Install a NEW sealing washer on drain screw.

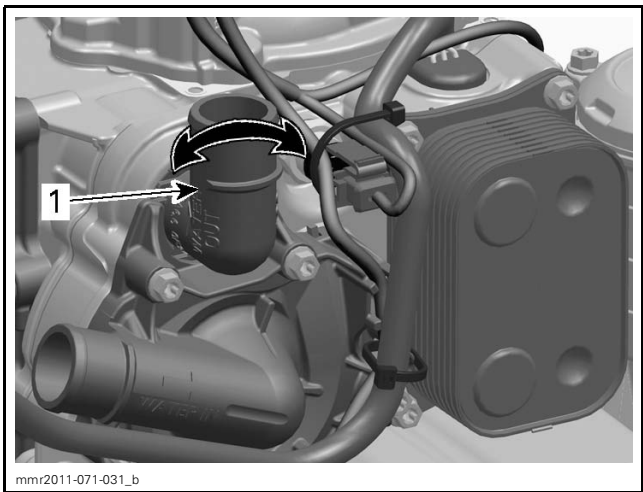
Tighten water pump housing retaining screws as per following procedure.

WATER PUMP HOUSING SCREWS	
Tightening torque	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



TIGHTENING SEQUENCE

Turn thermostat housing to proper position.



1. Thermostat housing

Tighten hose clamps to specification.

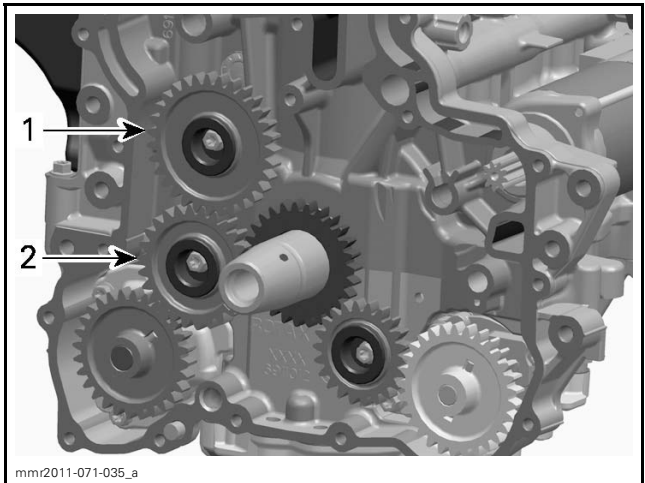
COOLANT HOSE CLAMPS	
Tightening torque	5.5 N•m ± 0.5 N•m (49 lbf•in ± 4 lbf•in)

Install remaining parts. Refer to their applicable subsection.

WATER PUMP DRIVE GEAR

Water Pump Drive Gear Location

The water pump drive gear is located behind the magneto cover.



- 1. Water pump drive gear (31 teeth)
- 2. Intermediate gear, refer to LUBRICATION SYSTEM

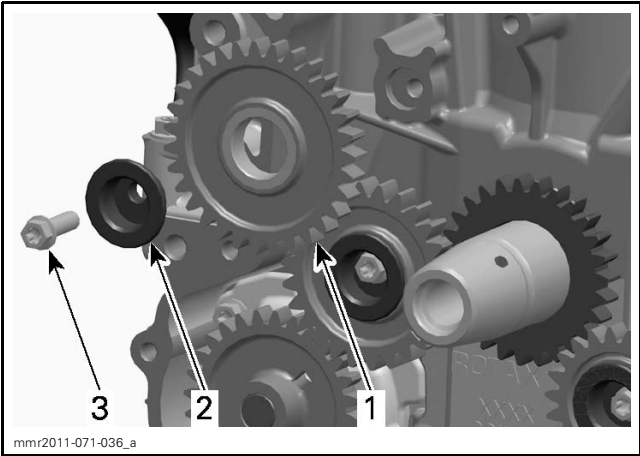
Water Pump Drive Gear Access

Remove magneto cover. Refer to *MAGNETO AND STARTER* subsection.

Water Pump Drive Gear Removal

- 1. Remove screw securing water pump drive gear.
- 2. Remove bearing sleeve.
- 3. Slide off intermediate gear.

Section 02 ENGINE (600 ACE)
Subsection 05 (COOLING SYSTEM)



- 1. Water pump drive gear (31 teeth)
- 2. Bearing sleeve
- 3. M6 x 20 screw

Water Pump Drive Gear Inspection

Inspect gear for wear or other damage.
Replace gear if necessary.

Water Pump Drive Gear Installation

Reverse the removal procedure. However, pay attention to the following.
Apply engine oil on bearing sleeve.
Tighten water pump drive gear retaining screw to specification.

WATER PUMP DRIVE GEAR RETAINING SCREW	
Tightening torque	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

HEAT EXCHANGER

Heat Exchanger Cleaning and Inspection

Remove all debris between heat exchanger fins.
Check if heat exchanger fins are damaged. Replace if necessary.
NOTE: A heat exchanger with many broken fins does not work properly.

Heat Exchanger Removal

1. Drain cooling system, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
2. Remove engine, refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
3. Remove fuel tank. Refer to *FUEL TANK AND FUEL PUMP* subsection.
4. Remove rear suspension. Refer to the *REAR SUSPENSION (SC-5U)* subsection.
5. Disconnect coolant hoses from heat exchanger.

6. Drill or grind all rivets retaining the heat exchanger to the tunnel. Refer to *FRAME* subsection for drilling procedure.
- NOTE:** When pushing the rivets out, support the frame around the rivet with a socket on the opposite side to prevent the frame from warping.
7. Remove heat exchanger from the vehicle.

Heat Exchanger Installation

Reverse the removal procedure.
Refill cooling system as described in *PERIODIC MAINTENANCE PROCEDURES* subsection.

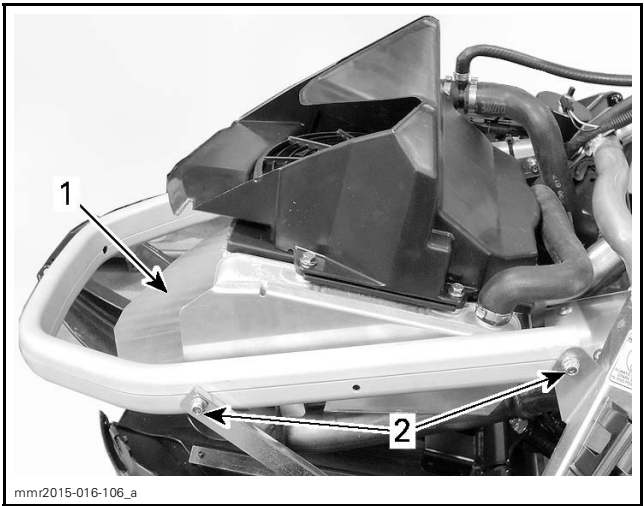
FRONT AIR COOLED RADIATOR

Radiator Access

- Refer to *BODY* subsection and remove the following:
- Upper and lower side panels (both sides)
 - Hood
 - Upper bottom pan panels (both sides)
 - Front grill.

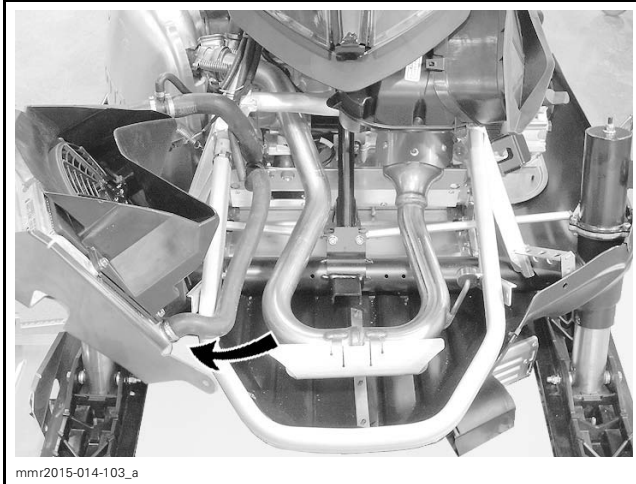
Radiator Removal for Access

- NOTE:** It is not necessary to disconnect or disassemble radiator when removed for access.
1. Remove body parts listed in *RADIATOR ACCESS*.
 2. Remove the fasteners that secure the radiator support plate to the front bumper.



LEFT SIDE ILLUSTRATED, RIGHT SIMILAR
1. Radiator support plate
2. Screws and nuts to remove (both sides)

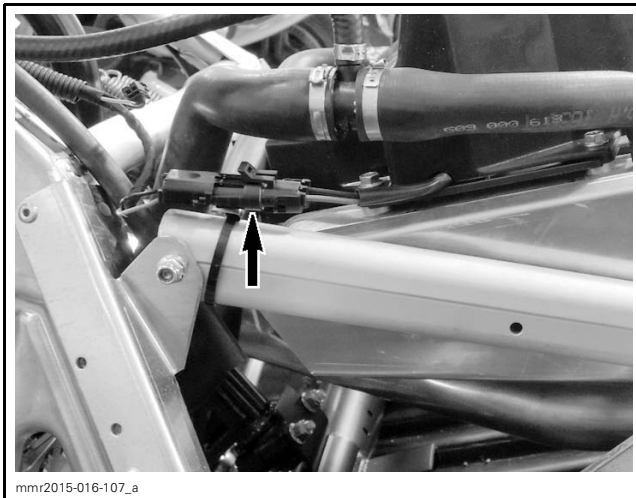
3. Move radiator to RH side of vehicle.



AIR COOLED RADIATOR MOVED FOR ACCESS

Radiator Removal for Replacement

1. Remove body parts listed in *RADIATOR ACCESS*.
2. Drain cooling system, Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
3. Disconnect radiator cooling fan connector.

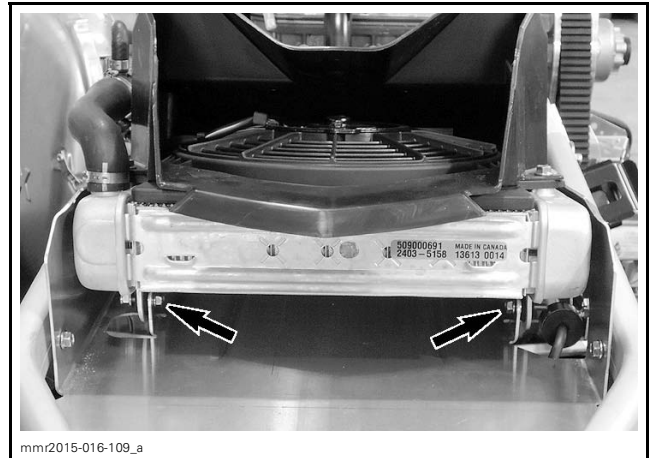


RIGHT SIDE OF VEHICLE

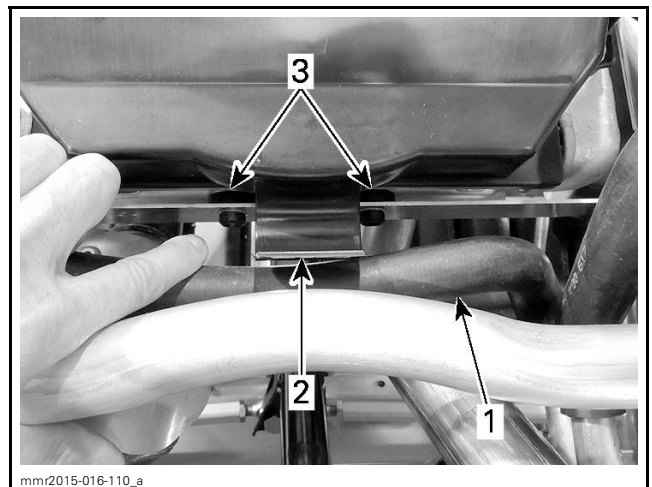
4. Disconnect coolant hoses from radiator. Discard Oetiker clamps.



5. Remove screws retaining the the radiator to the radiator support.



6. At the back of the fan shroud, remove the radiator hose from its support.



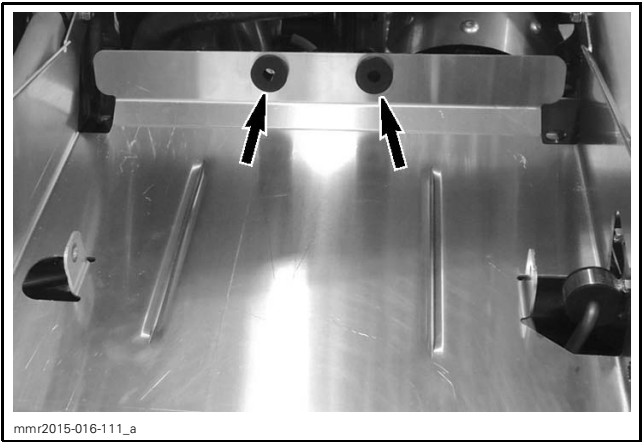
1. Radiator hose
2. Hose support on fan shroud
3. Grommets in radiator support

Section 02 ENGINE (600 ACE)
Subsection 05 (COOLING SYSTEM)

- 7. Pull radiator forward off its support grommets and remove radiator from vehicle.
- 8. Remove fan from radiator. See procedure in this subsection.

Radiator Installation

Reverse the removal procedure. However, pay attention to the following.
Ensure grommets are installed in radiator support.



Install **NEW** Oetiker clamps to secure coolant hoses.
Fill and bleed cooling system as described in *PERIODIC MAINTENANCE PROCEDURES* subsection.

RADIATOR COOLING FAN

Cooling Fan Operating Conditions

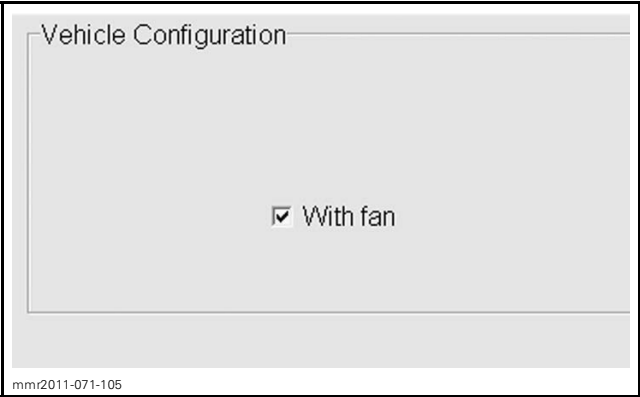
RADIATOR COOLING FAN		
ENGINE TEMPERATURE	COOLING FAN RELAY	COOLING FAN OPERATION
> 100°C (212°F)	Close	Starts
< 95°C (203°F)	Open	Stops

Cooling Fan Relay Location

The cooling fan relay is located in the fuse box. Refer to *POWER DISTRIBUTION* subsection.

Cooling Fan Configuration in B.U.D.S.

- 1. Connect vehicle to B.U.D.S., refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
- 2. In B.U.D.S., select the following:
 - Read Data button
 - Setting tab
 - ECM page.
- 3. Ensure that **With fan** box is properly checked.



VEHICLE CONFIGURATION BOX

Cooling Fan Testing Sequence

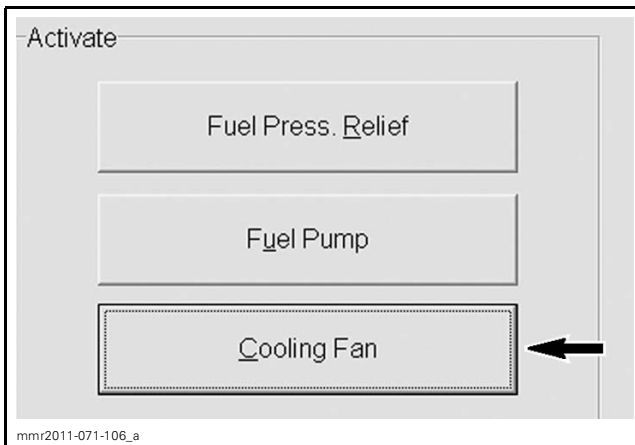
If B.U.D.S. is properly configured and cooling fan does not work, follow this testing sequence to diagnose problem.

- 1. Check for a fault code in B.U.D.S.. Refer to *DIAGNOSTICS AND FAULT CODES* subsection.
- 2. Check cooling fan fuse. Refer to *POWER DISTRIBUTION* subsection.
- 3. Carry out the *COOLING FAN TEST USING B.U.D.S.* in this subsection.
- 4. Retest fan using B.U.D.S. while touching fan relay (R4).
 - If a "click" is felt, see *COOLING FAN MOTOR OPERATION TEST* in this subsection.
 - If a NO "click" is felt, test cooling fan relay. Refer to *POWER DISTRIBUTION* subsection.
- 5. Carry out the *COOLING FAN INPUT VOLTAGE TEST* in this subsection.
- 6. Carry out the *COOLING FAN RELAY INPUT VOLTAGE TEST* further in this subsection.
- 7. Carry out the *COOLING FAN RELAY CONTROL CIRCUIT TEST* further in this subsection.
- 8. Test for continuity of the following. Refer to wiring diagram.
 - Fan ground circuit
 - Relay control circuit.

Cooling Fan Test Using B.U.D.S.

- 1. Connect vehicle to B.U.D.S., refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
- 2. Depress vehicle start button once to activate the ECM.
- 3. In B.U.D.S., select the following:
 - Read Data button
 - Activation tab
 - ECM page.

- Press **Cooling Fan** button to activate cooling fan motor.



COOLING FAN ACTIVATION BUTTON

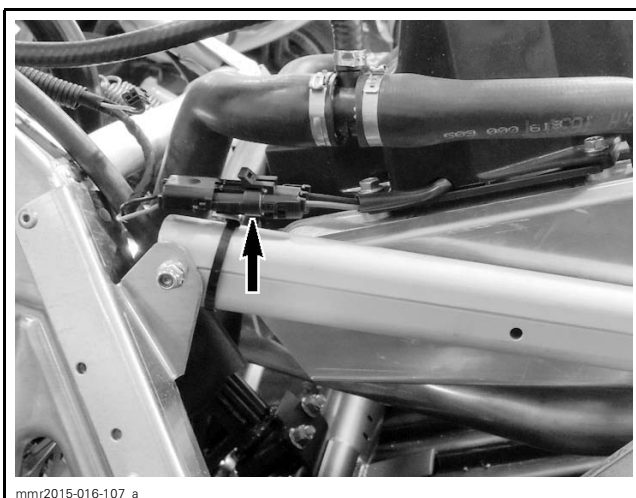
If cooling fan functions properly, test the coolant temperature sensor.

If cooling fan motor does not work, refer back to *COOLING FAN TESTING SEQUENCE* in this subsection.

NOTE: The engine must be started and the engine temperature must attain > 100°C (212°F) before the coolant temperature sensor signal tells the ECM to turn on the cooling fan. Refer to *COOLING FAN OPERATING CONDITIONS* in this subsection.

Cooling Fan Motor Operation Test

- Disconnect radiator cooling fan connector.



RIGHT SIDE OF VEHICLE

- Check cooling fan connector and terminal condition.
- Connect a 12 volt battery directly to the fan motor connector.

If motor does not work, replace it.

If motor works, check:

- Fan ground circuit wiring continuity
- Carry out the *COOLING FAN INPUT VOLTAGE TEST* in this subsection.

Cooling Fan Input Voltage Test

Test conditions:

- Engine running with coolant temperature above 100°C (212°F)
- **OR** cooling fan activated using B.U.D.S. Refer to *COOLING FAN TEST USING B.U.D.S.*

Check input voltage at cooling fan connector (harness side).

COOLING FAN INPUT VOLTAGE TEST	
TEST PROBES	VOLTAGE
GRAY/GREEN	Battery voltage (± 12 Vdc)
BLACK	

Cooling Fan Relay Input Voltage Test

RELAY INPUT VOLTAGE TEST (CONTACTS)	
TEST PROBES	VOLTAGE
Fuse box pin 10C	Battery voltage (± 12 Vdc)
Battery negative (-) post	

RELAY INPUT VOLTAGE TEST (WINDING)	
TEST PROBES	VOLTAGE
Fuse box pin 10D	Battery voltage (± 12 Vdc)
Battery negative (-) post	

Cooling Fan Relay Control Circuit Test

Test conditions:

- Engine running with coolant temperature above 100°C (212°F)
- **OR** cooling fan activated using B.U.D.S. Refer to *COOLING FAN TEST USING B.U.D.S.*

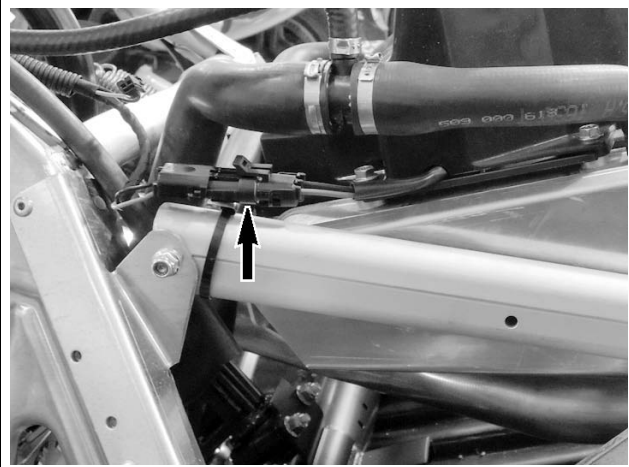
COOLING FAN RELAY CONTROL CIRCUIT TEST	
TEST PROBES	VOLTAGE
Fuse box pin 12C	Approximately battery voltage (± 12 Vdc)
Battery positive (+) post	

Cooling Fan Removal

- Disconnect radiator cooling fan connector.

Section 02 ENGINE (600 ACE)

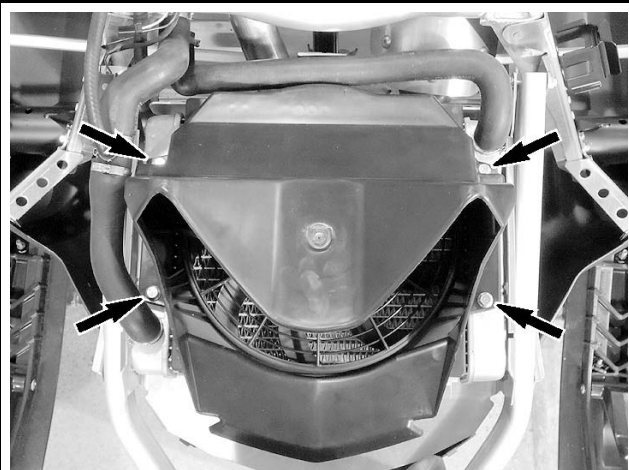
Subsection 05 (COOLING SYSTEM)



mmr2015-016-107_a

RIGHT SIDE OF VEHICLE

2. Remove the 4 screws that secure the fan shroud and fan to the radiator.



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Cooling Fan Installation

Reverse the removal procedure.

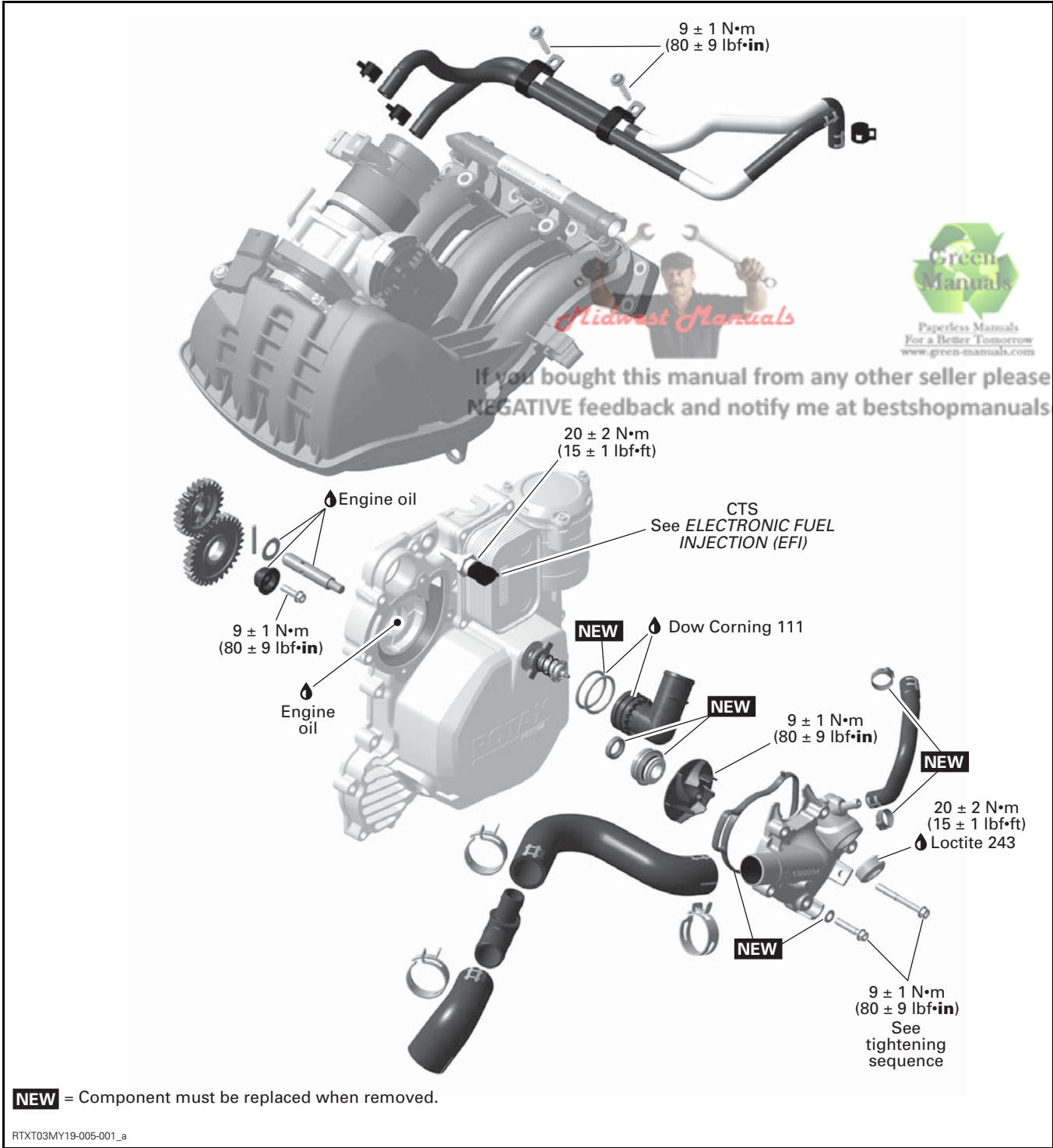
COOLING SYSTEM - ENGINE COMPONENTS

SERVICE TOOLS

Description	Part Number	Page
HANDLE	420 877 650	9
ROTARY SEAL INSTALLER	529 036 211	9
TEST CAP	529 035 991	3
VACUUM/PRESSURE PUMP	529 021 800	3

SERVICE PRODUCTS

Description	Part Number	Page
DOW CORNING 111	413 707 000	4



GENERAL

For a better understanding, some illustrations were taken with engine out of vehicle.

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

⚠ WARNING

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

INSPECTION

COOLING SYSTEM LEAK TEST

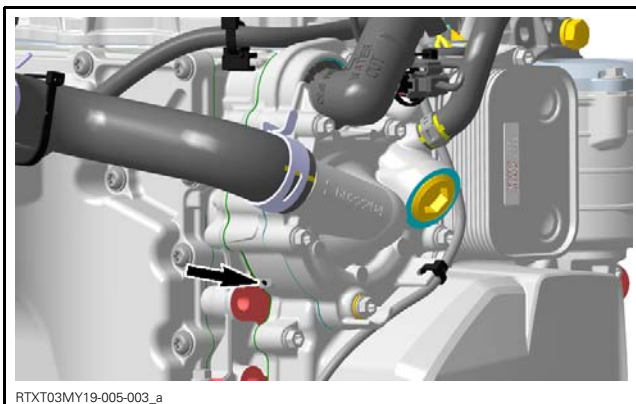
NOTE: This test confirms if there is a leak in the cooling system, including the engine.

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	
100 kPa (15 PSI)	

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

Check the leak indicator hole for an oil or coolant leak.



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 this subsection.

TROUBLESHOOTING

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

Always check for fault codes. If a fault code is detected, service the fault code first.

ENGINE OVERHEATING

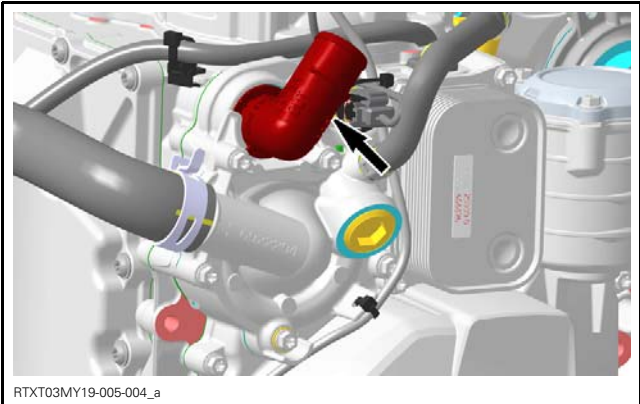
- Low coolant level.**
 - Refill and check for leaks (coolant leaking out of leak indicator hole, hoses or clamps missing or defective, or cylinder head gaskets leaks). Repair or replace.
- Dirty heat exchanger.**
 - Clean heat exchanger fins. Replace heat exchanger as required.
- Air in cooling system.**
 - Refill and bleed cooling system.
- Defective thermostat (does not open when engine is warm up).**
 - Replace thermostat.
- Defective water pump.**
 - Inspect and replace defective components.
- Coolant temperature sensor defective.**
 - Check and replace.
- Wrong coolant concentration.**
 - Check and adjust coolant concentration according to BRP's recommendations or replace coolant.
- Defective coolant reservoir cap.**
 - Replace cap.
- Defective cooling fan.**
 - Check cooling fan motor operation.
 - Check fuse and relay of cooling fan motor.
 - Check wiring harness of cooling fan motor.
- Snow guard is too high.**
 - Check and adjust rear suspension.

PROCEDURES

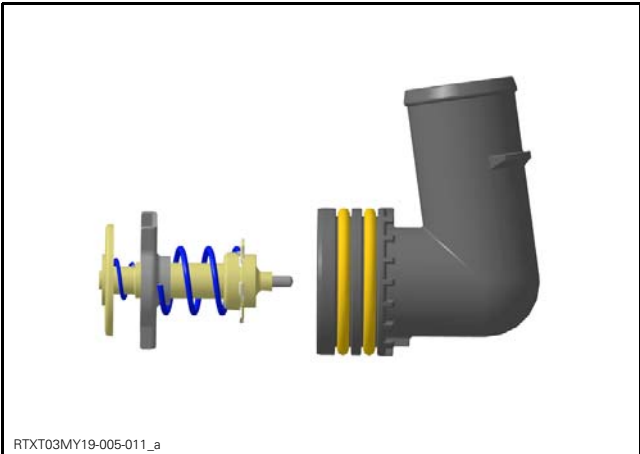
THERMOSTAT

Thermostat Location

The thermostat is located on engine MAG side.

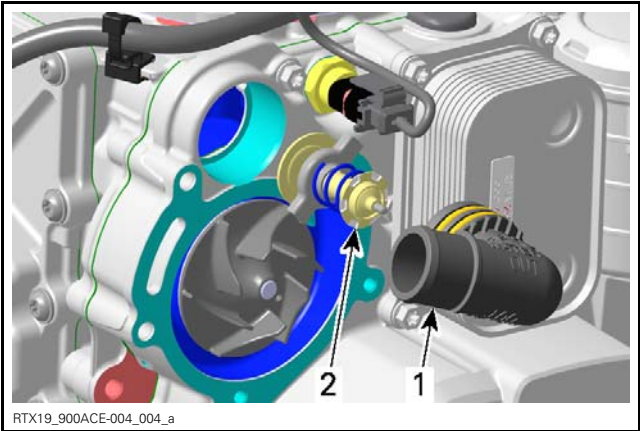


THERMOSTAT HOUSING



Removing the Thermostat

- 1. Remove the water pump housing. Refer to procedure in this subsection.
- 2. Remove thermostat housing then thermostat.



- 1. Thermostat housing
- 2. Thermostat

NOTE: Use shop rags to catch any spilled engine coolant.

Testing the Thermostat

To check thermostat, put it in water and heat water.

THERMOSTAT TEMPERATURE	
Starts to open	75°C (167°F)
Fully open	95°C (203°F)

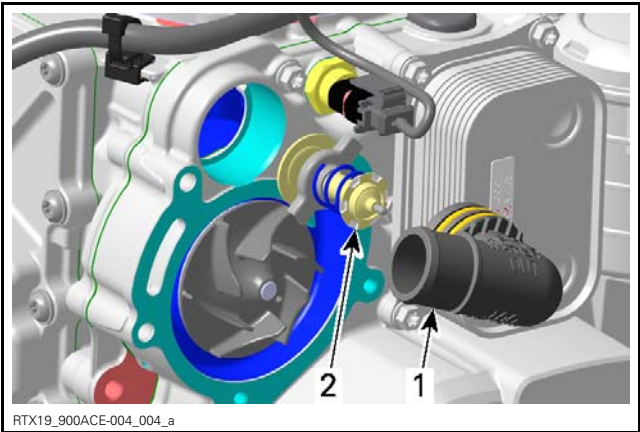
Replace thermostat if out of specification.

Installing the Thermostat

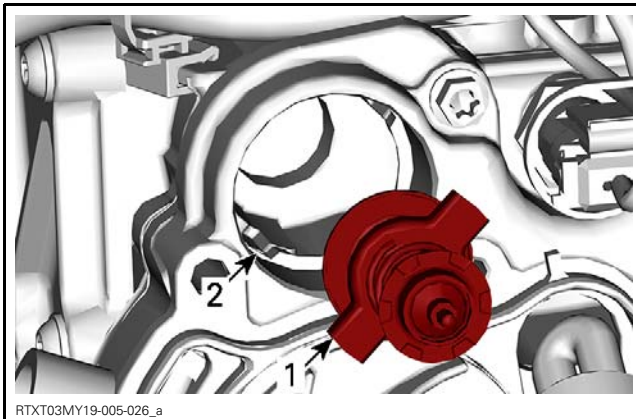
The installation is the reverse of the removal procedure. However pay attention to the following.
Install **NEW** O-rings on thermostat housing.
Lubricate O-rings.

SERVICE PRODUCT
DOW CORNING 111 (P/N 413 707 000)

Insert thermostat in thermostat housing.



Align both tabs of thermostat with the recess in the magneto cover.



1. Thermostat tabs
2. Magneto cover recess

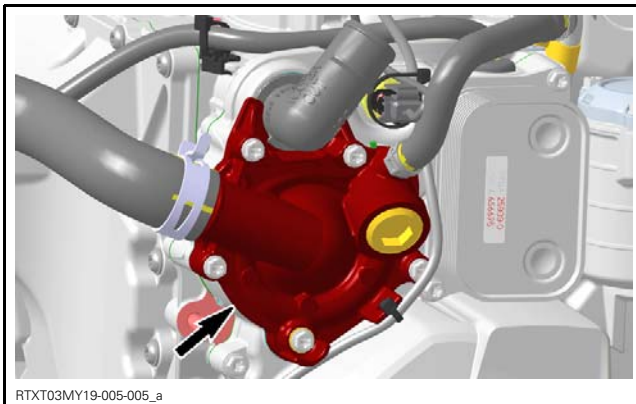
Install water pump housing, refer to *INSTALLING THE WATER PUMP HOUSING* in this subsection.

Refill and bleed cooling system. Refer to *MAINTENANCE* in the *COOLING SYSTEM - VEHICLE COMPONENTS* subsection.

WATER PUMP

Water Pump Location

The water pump is located on engine MAG side.

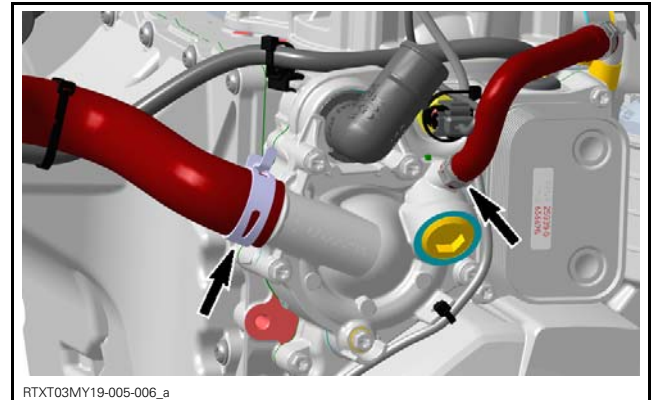


Removing the Water Pump Housing

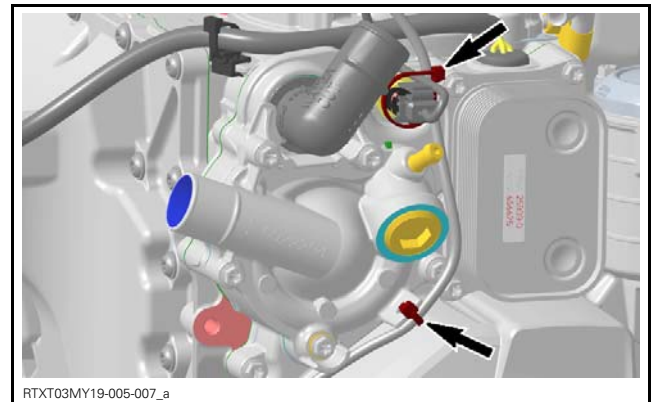
Any work on the water pump requires the engine removal. Only the housing may be removed with the engine in place.

1. Refer to the appropriate subsection to remove:
 - Muffler
 - Driven pulley and countershaft
 - LH side hull
 - Reverse handle and its support (if equipped).
2. Drain engine coolant. Refer to *COOLING SYSTEM - VEHICLE COMPONENTS* subsection.

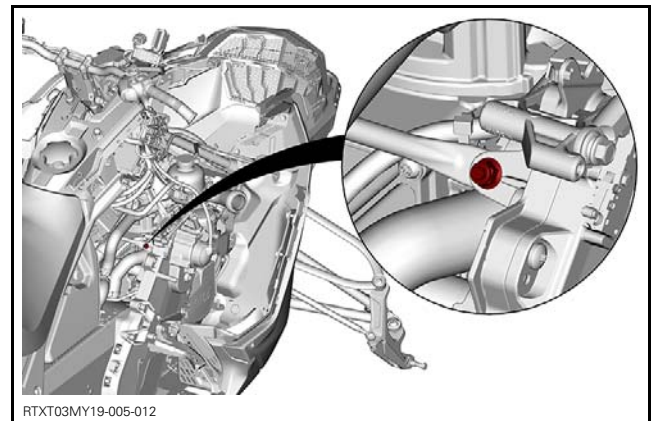
3. Disconnect outlet hose from thermostat housing.
4. Disconnect supercharger cooling hose from water pump (if equipped).
5. Disconnect inlet hose from water pump.

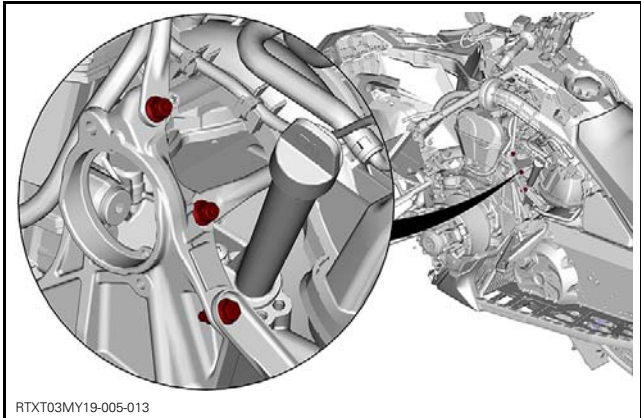


6. Remove locking ties securing CPS wire and the OPS wire.

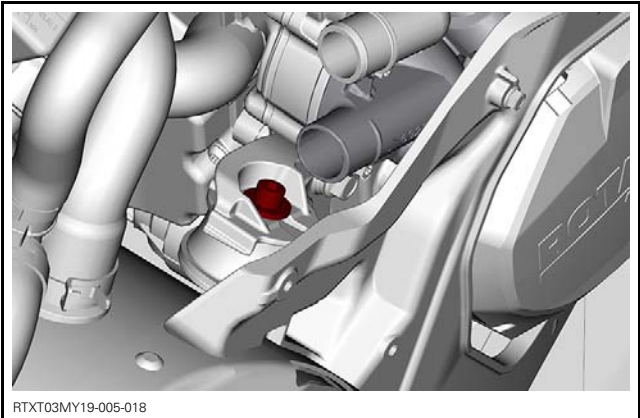
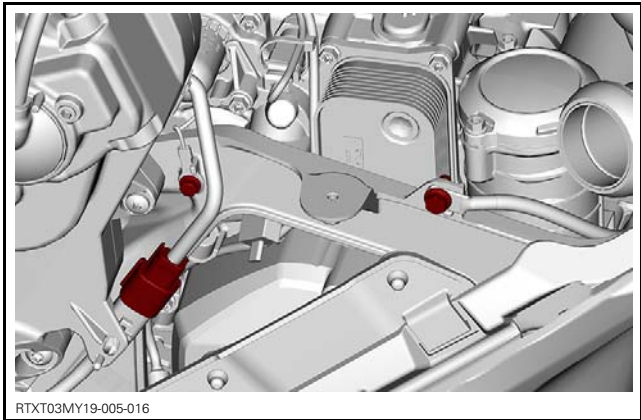
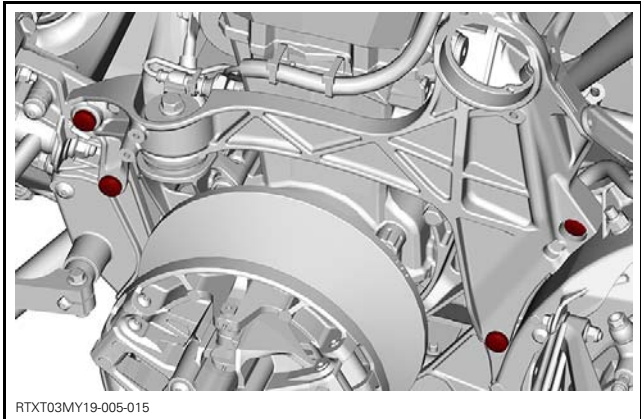


7. Remove the following fasteners.

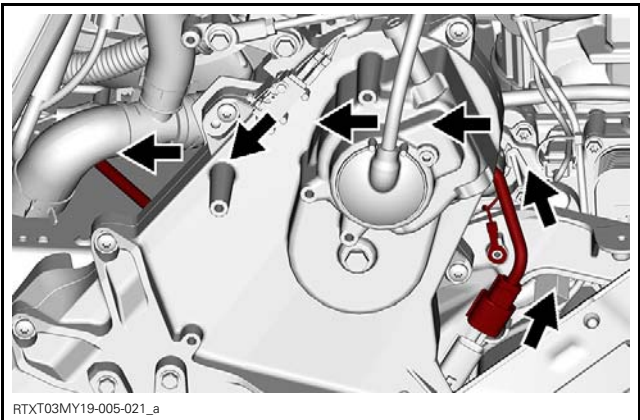
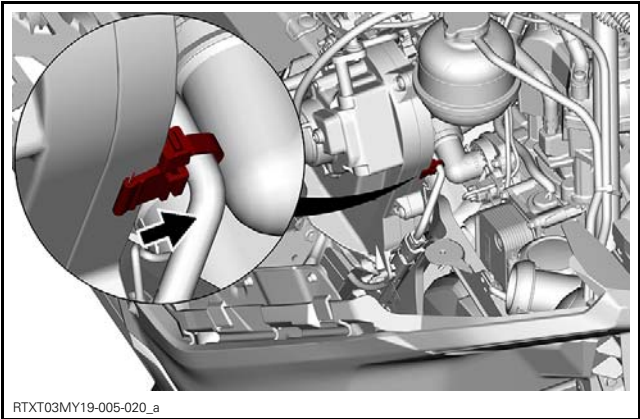
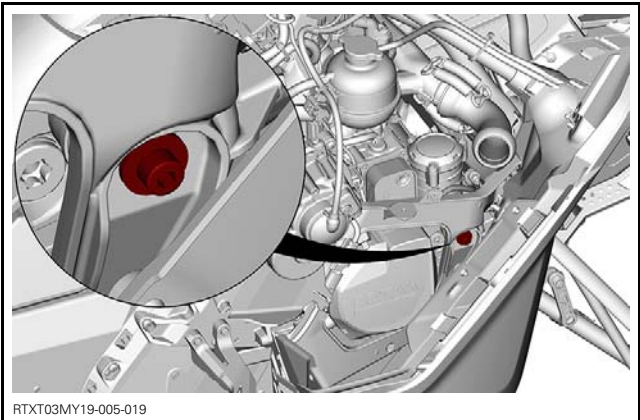




8. Support the engine on the pulley side and remove the following fasteners.



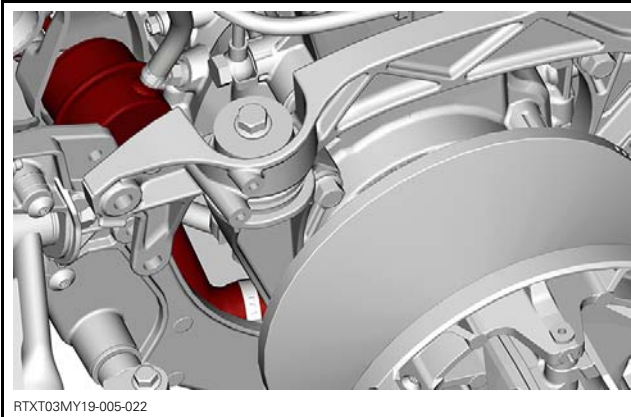
CHAINCASE REMOVED FOR CLARITY



9. Pull on the drive pulley to make room for water pump screws access.

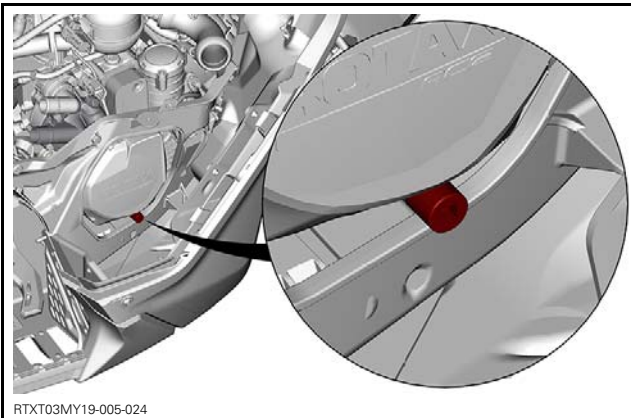
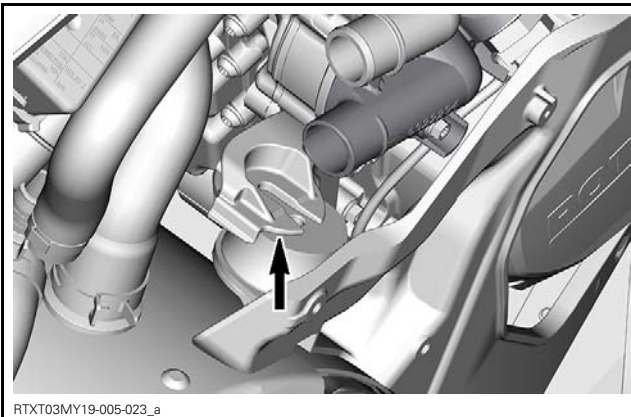
Turbocharged Engine

NOTICE Make sure the waste gate and the oil return hose clear the frame at all time.

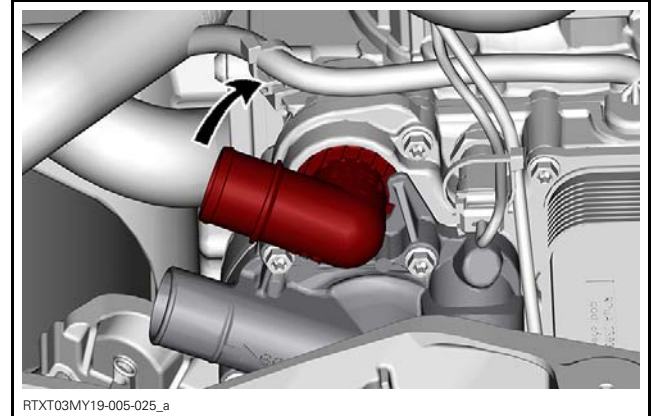


All Engine

10. Place a pry bar between the engine support and the engine rubber mount, and lift the engine to insert a shim between the frame and the magneto cover



12 MM (1/2 IN) SHIM

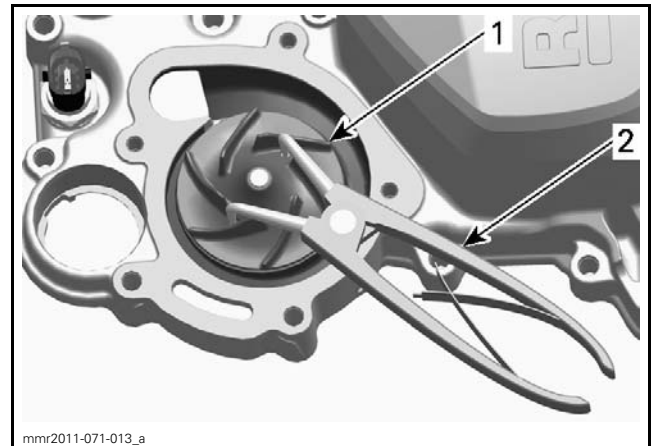


11. Using a compact ratchet wrench and a Torx bit, remove the water pump housing screws.

NOTE: Use shop rags to catch any spilled engine coolant.

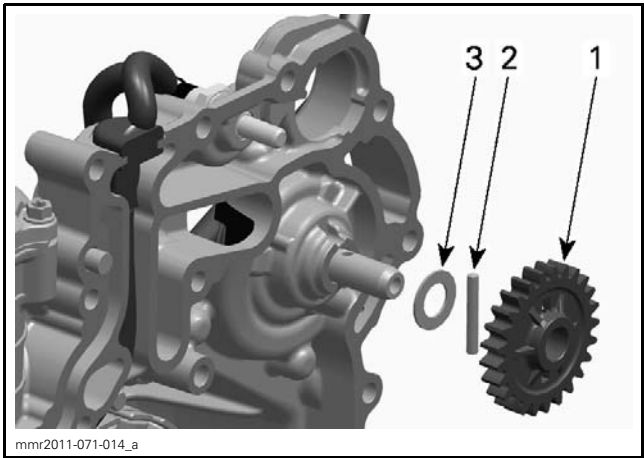
Disassembling the Water Pump

1. Unscrew impeller counterclockwise using appropriate pliers.



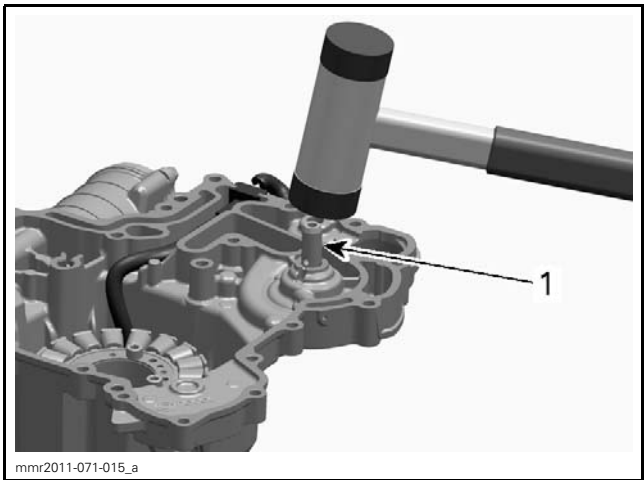
1. Impeller
2. Pliers

2. Remove magneto cover. Refer to *MAGNETO AND STARTER* subsection.
3. Remove the following components from magneto cover:
 - Water pump gear
 - Needle pin
 - Thrust washer.



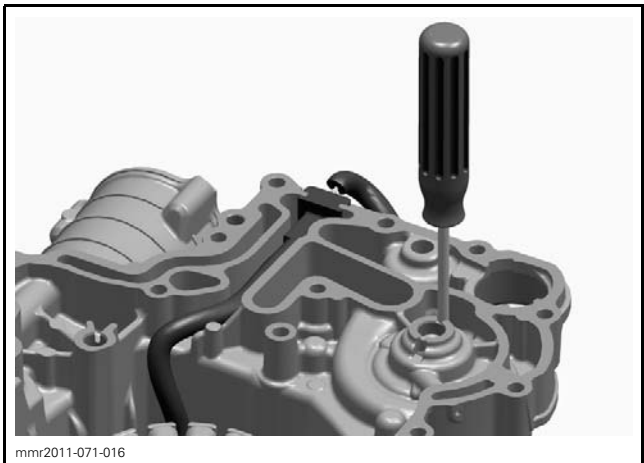
- 1. Water pump gear
- 2. Needle pin
- 3. Thrust washer

4. Remove water pump shaft using a plastic mallet.



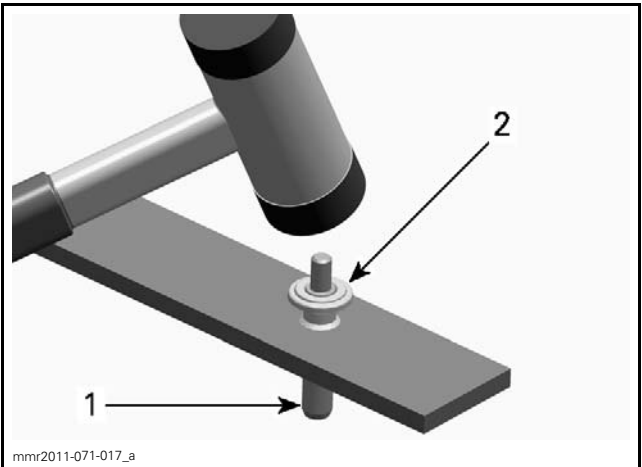
- 1. Water pump shaft

5. Remove the following components from magneto cover:
- Oil seal
 - Remaining parts of rotary seal.



NOTICE Be careful not to damage the surface of the rotary seal bore in the magneto cover.

6. Separate rotary seal from water pump shaft.



- 1. Water pump shaft.
- 2. Rotary seal

Inspecting the Water Pump

Check area of water pump housing for cracks or other visible damage.

Check water pump gear for wear or broken teeth.

Check if housing gasket is brittle, hard or damaged.

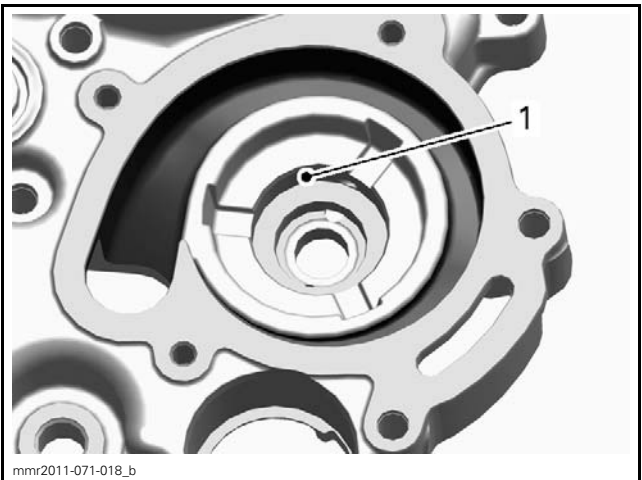
Check water pump shaft for visible damage.

Replace parts if necessary.

Assembling the Water Pump

NOTE: Always replace oil seal and rotary seal at the same time.

1. Clean rotary seal surface from old sealant.



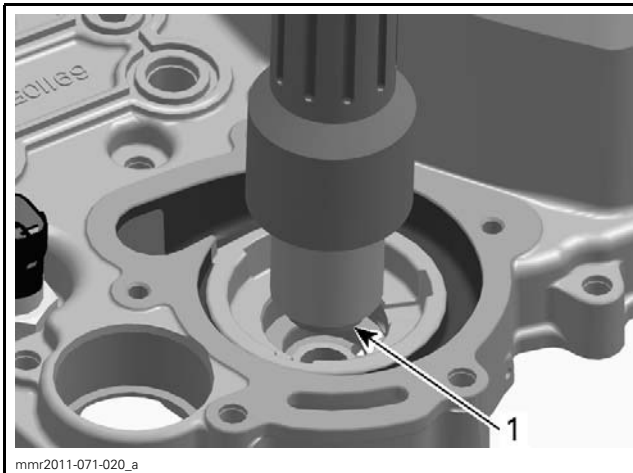
- 1. Clean surface

2. Apply engine oil on press fit area of oil seal.

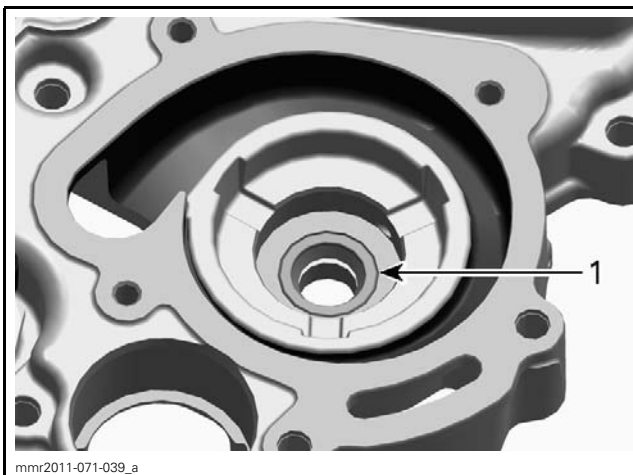
NOTICE Never use engine oil on the press fit area of the rotary seal.

3. Install **NEW** oil seal in magneto cover.

REQUIRED TOOLS	
(P/N 529 036 210)	
HANDLE (P/N 420 877 650)	



1. Oil seal



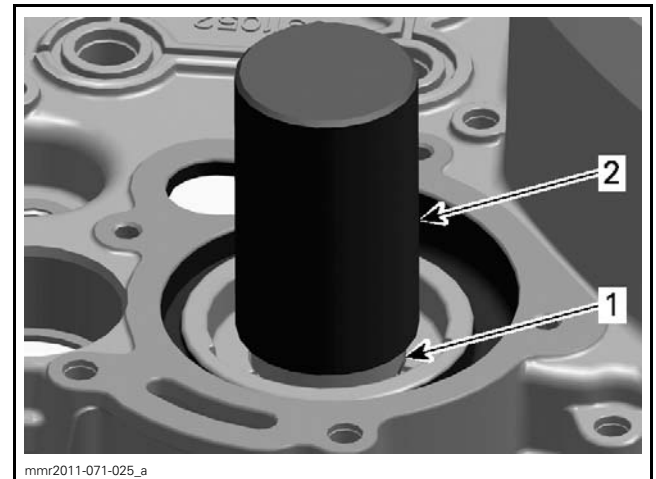
1. Oil seal correctly installed

4. Install **NEW** rotary seal on magneto cover using a press.

NOTE: Prior to installing, ensure that sealing lip of rotary seal is not damaged.

REQUIRED TOOL	
ROTARY SEAL INSTALLER (P/N 529 036 211)	

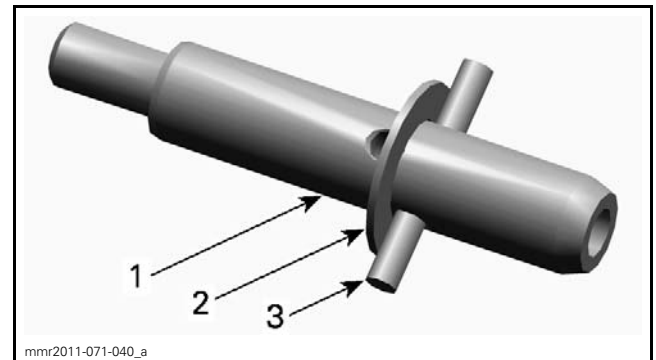
NOTICE Never use a hammer for rotary seal installation. Only use a press to avoid damaging the ceramic component.



1. Rotary seal
2. Rotary seal installer

5. Assemble the following components onto water pump shaft.

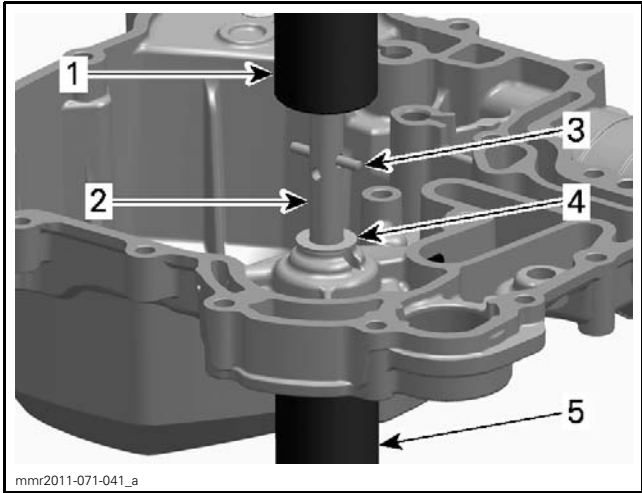
- Needle pin
- Thrust washer.



1. Water pump shaft
2. Thrust washer
3. Needle pin

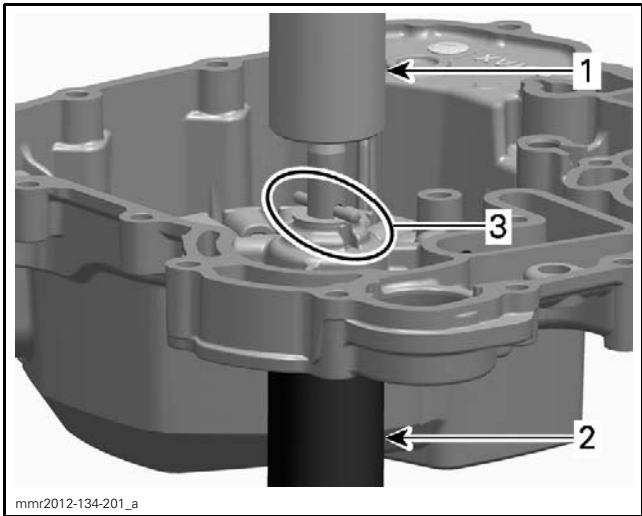
6. Slide water pump shaft into rotary seal using a press.

NOTE: To avoid damaging the rotary seal and to achieve the proper preload support the rotary seal with the rotary seal installer.



- 1. Press
- 2. Water pump shaft
- 3. Needle pin
- 4. Thrust washer
- 5. Rotary seal installer

7. Carefully press water pump shaft until needle pin touches thrust washer.



- 1. Press
- 2. Rotary seal installer
- 3. Needle pin touches thrust washer

NOTICE Never use a hammer to install water pump shaft into rotary seal.

NOTE: After installation, water pump shaft must rotate freely.

8. Screw impeller clockwise using appropriate pliers.

NOTICE Be careful not to damage impeller vanes during its installation.

9. Install magneto cover. Refer to *MAGNETO AND STARTER* subsection.

Installing the Water Pump Housing

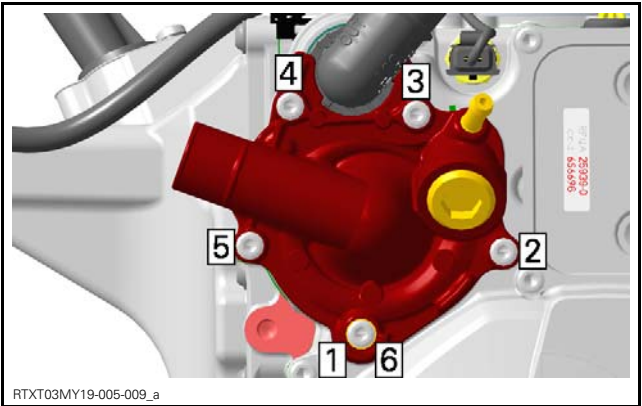
The installation is the reverse of the removal procedure. However, pay attention to the following.

NOTICE When installing the water pump housing, ensure the NEW gasket is precisely positioned in the pump housing groove to prevent leakage.

Install a NEW sealing washer on drain screw.

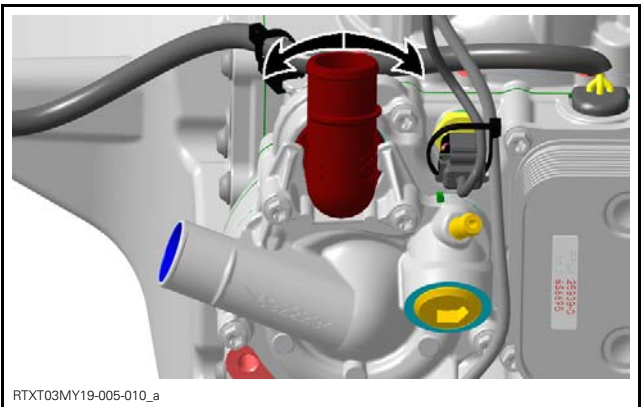
Tighten water pump housing retaining screws to specification as per the following procedure.

TIGHTENING TORQUE	
Water pump housing retaining screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



TIGHTENING SEQUENCE

Turn thermostat housing to proper position.



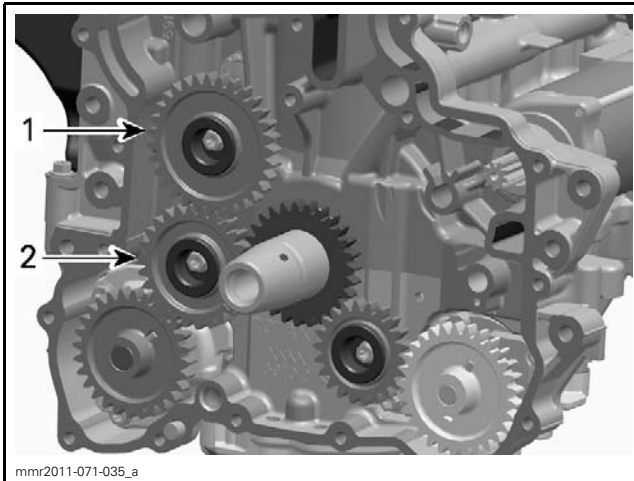
Install hose on thermostat housing with a NEW Oetiker clamp.

Install remaining parts. Refer to their applicable subsection.

WATER PUMP DRIVE GEAR

Water Pump Drive Gear Location

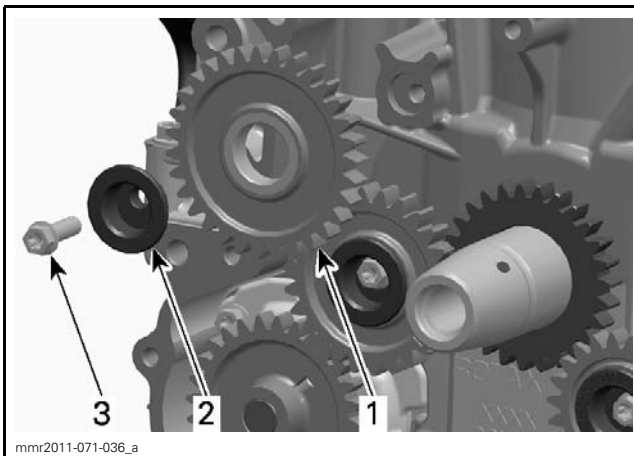
The water pump drive gear is located behind the magneto cover.



1. Water pump drive gear 31 T
2. Intermediate gear, refer to LUBRICATION SYSTEM

Removing the Water Pump Drive Gear

1. Remove engine from vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
2. Refer to *MAGNETO AND STARTER* subsection and remove:
 - Magneto cover
 - Magneto flywheel.
3. Remove screw securing water pump drive gear.
4. Remove bearing sleeve.
5. Slide off water pump drive gear.



1. Water pump drive gear 31 T
2. Bearing sleeve
3. M6 x 20 screw

Inspecting the Water Pump Drive Gear

Inspect gear for wear or other damage.

Replace gear if necessary.

Installing the Water Pump Drive Gear

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

Apply engine oil on bearing sleeve.

Tighten water pump drive gear to specification.

TIGHTENING TORQUE	
Water pump drive gear retaining screw	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

COOLING SYSTEM - VEHICLE

SERVICE TOOLS

Description	Part Number	Page
LARGE HOSE PINCHER.....	529 032 500	7

SERVICE PRODUCTS

Description	Part Number	Page
EXTENDED LIFE PRE-MIXED COOLANT	779150	4





GENERAL

For a better understanding, some illustrations are taken with engine out of vehicle.

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

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

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



WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices when removed (e.g.: locking tabs, elastic stop nuts, cotter pin, etc.) must be replaced with new ones.

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

MAINTENANCE



WARNING

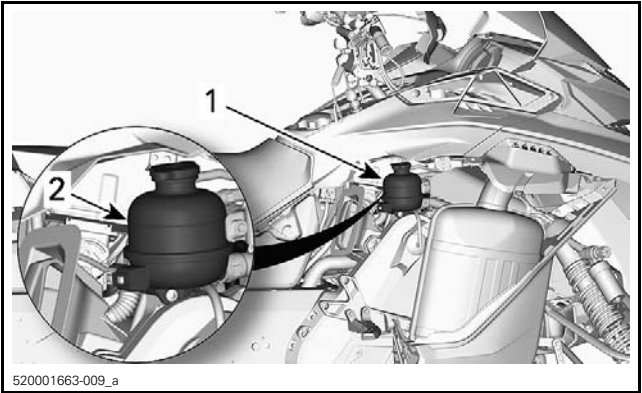
Never open coolant tank cap when engine is hot.

VERIFYING THE ENGINE COOLANT LEVEL

It is required to remove the upper body module to access the coolant tank cap. Refer to *BODY* subsection.

Check coolant level at room temperature with the cap removed. Liquid should be at cold level line (engine cold) of coolant tank.

NOTE: When checking level at low temperature it may be slightly lower then the mark.



TYPICAL
1. Coolant tank
2. COLD LEVEL line

VERIFYING THE ENGINE COOLANT STRENGTH

It is required to remove the upper body module to access the coolant tank cap. Refer to *BODY* subsection.

Remove pressure cap.

Use an antifreeze tester to test coolant strength.

MINIMUM RECOMMENDED COOLANT STRENGTH
-30°C (-22°F)

REPLACING THE COOLANT

Recommended Engine Coolant

RECOMMENDED SERVICE PRODUCT	ACCEPTABLE
EXTENDED LIFE PRE-MIXED COOLANT (P/N 779150)	A blend of 50% distilled water with 50% antifreeze (especially formulated for aluminum engines)

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

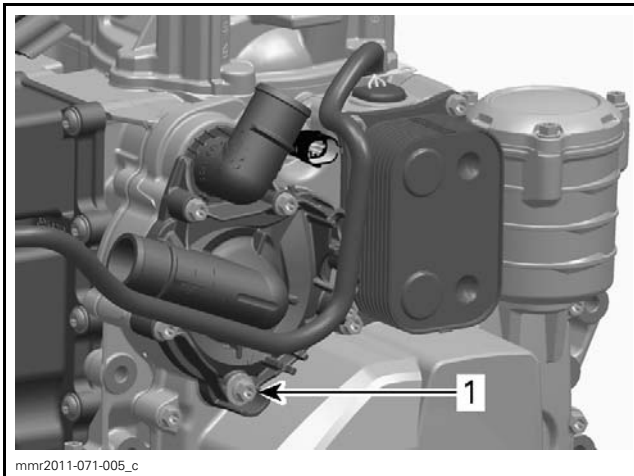
NOTICE To prevent rust formation or freezing condition, always replenish the system with the BRP premixed coolant or with 50% antifreeze and 50% distilled water. Do not use tap water, straight antifreeze or straight water in the system. Tap water contains minerals and impurities which build up in the system. During cold weather, straight water causes the system to freeze while straight antifreeze thickens (like slush ice) and does not have the same efficiency. Always use ethylene glycol antifreeze containing corrosion inhibitors specifically recommended for aluminum engines.

Draining the Cooling System

⚠ WARNING

Never drain or refill the cooling system when engine is hot.

1. Remove body parts as required to access to the water pump.
2. Place a large drain pan under the vehicle bottom pan.
3. Remove drain screw at water pump to drain coolant.



1. Drain screw

4. Remove coolant reservoir cap slowly.
5. When coolant level is low enough, lift the rear of vehicle to drain the heat exchangers.



TYPICAL

6. Install **NEW** sealing washer on drain screw.
7. Tighten drain screw to specification.

TIGHTENING TORQUE

Drain screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)
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Refilling and Bleeding the Cooling System

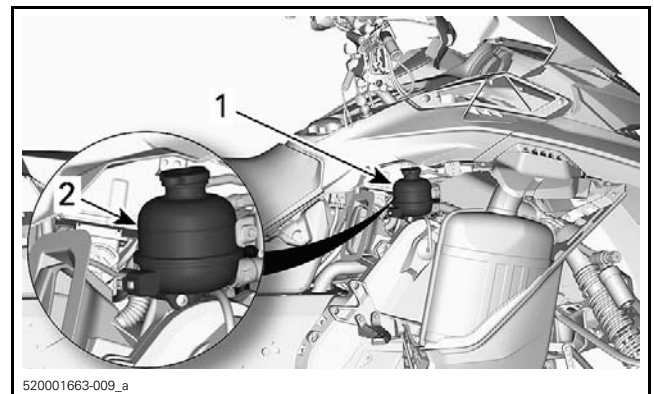
1. Apply parking brake.
2. Lift front of vehicle as shown and support it safely.



TYPICAL

A. 25 cm ± 5 cm (10 in ± 2 in)

3. Refill coolant tank up to COLD LEVEL line.



TYPICAL

1. Coolant tank
2. COLD LEVEL line

4. Start engine.

Subsection XX (COOLING SYSTEM - VEHICLE)

- 5. Refill up to line while engine is idling until rear heat exchangers are warm to the touch (about 4 to 5 minutes).

NOTE: Always monitor coolant level while filling coolant tank to avoid emptying and thus allowing air to enter the system.

- 6. Install pressure cap.
- 7. Lower vehicle back on the ground.
- 8. Lift rear of vehicle and support it safely.

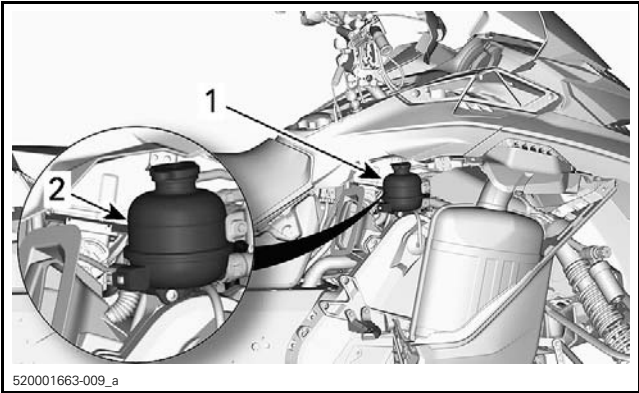


TYPICAL

⚠ WARNING

Before revving engine, ensure that the track is free of particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Always lift the snowmobile on a wide-base stand with a rear deflector panel. Ensure no one is standing in close proximity to the snowmobile, especially at the rear of the track. Centrifugal force could cause debris, damaged or loose studs, pieces of torn track, or an entire track to be violently thrown backwards out of the frame with tremendous force, possibly resulting in the loss of a leg or other serious injury.

- 9. Remove parking brake.
- 10. Activate throttle lever 3 - 4 times to bring engine speed to 7000 RPM.
- 11. Apply the brake.
- 12. Lower vehicle back on ground.
- 13. Stop engine.
- 14. Add coolant up to 15 mm (1/2 in) above the COLD LEVEL line.



TYPICAL

- 1. Coolant tank
- 2. Coolant 15 mm (1/2 in) above COLD LEVEL line

- 15. When engine has completely cooled down, recheck coolant level in coolant tank and refill up to line if needed.
- 16. Perform *VERIFYING THE ENGINE COOLANT STRENGTH*. Refer to procedure in this subsection.
- 17. Adjust mixture as necessary.
- 18. Reinstall removed parts.
- 19. Run vehicle a few minutes then recheck coolant level.

PROCEDURES

COOLANT RESERVOIR CAP

Testing the Coolant Reservoir Cap

Using a pressure cap tester, check the efficiency of coolant reservoir cap. If the efficiency is weak, replace the cap.

CAP OPENING PRESSURE
110 kPa (16 PSI)

COOLANT RESERVOIR

Removing the Coolant Reservoir

- 1. Remove the upper body module. Refer to *BODY* subsection.
- 2. Siphon coolant reservoir.
- 3. Disconnect coolant hoses from reservoir.
- 4. Remove coolant reservoir from vehicle.

Inspecting the Coolant Reservoir

Check if the reservoir is cracked or melted. Replace if necessary.

Installing the Coolant Reservoir

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

Install **NEW** Oetiker clamps.

Refill and bleed cooling system as described in *MAINTENANCE*.

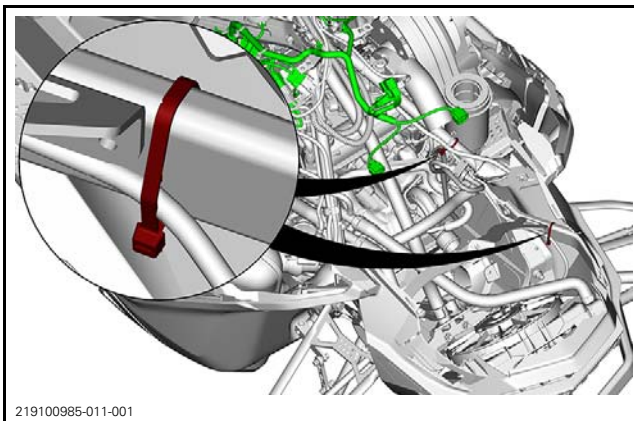
FRONT RADIATOR (IF EQUIPPED)

Removing the Front Radiator

1. Remove the upper body module. Refer to *BODY* subsection.

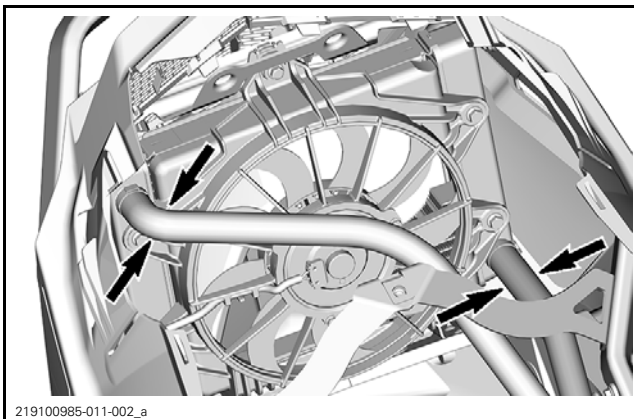
With Intercooler

2. Remove the intercooler. Refer to *INTER-COOLER* subsection.
3. Cut cooling fan harness locking ties.



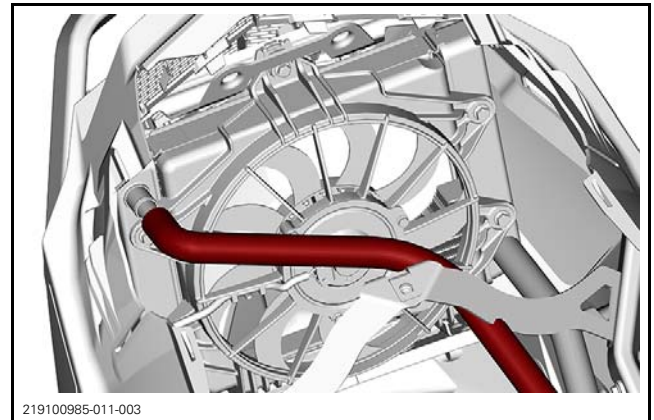
4. Disconnect front radiator cooling fan connector.
5. Install hose pincher on both radiator hoses.

REQUIRED TOOL	
LARGE HOSE PINCHER (P/N 529 032 500)	

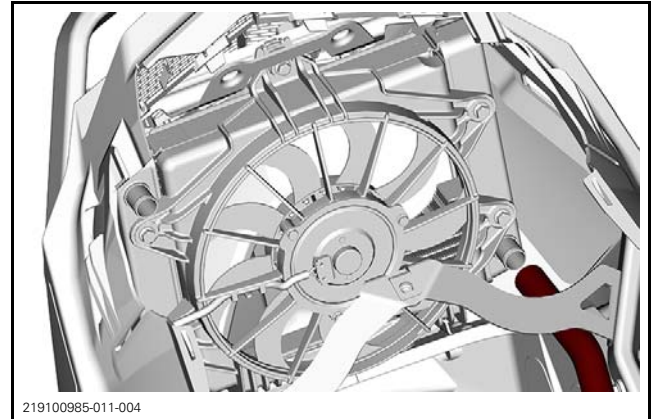


6. Remove Oetiker clamps and discard.

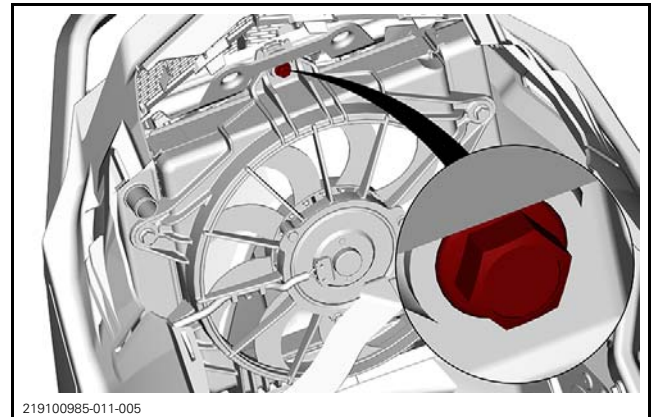
7. Disconnect upper coolant hose from radiator.



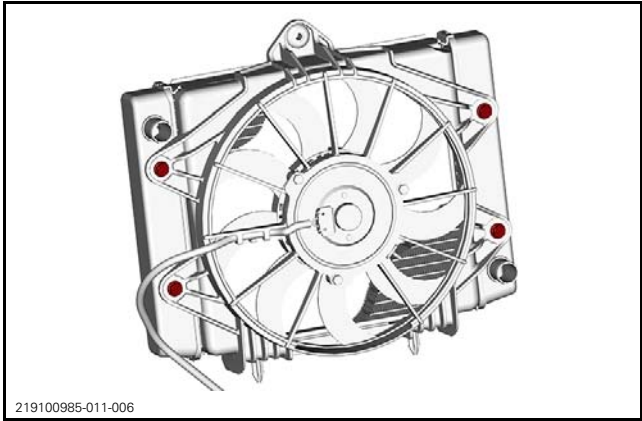
8. Siphon coolant from radiator.
9. Disconnect lower coolant hose from radiator.



10. Remove screw securing the radiator shroud to frame.



11. Remove front radiator assembly from vehicle.
12. Remove screws securing radiator to shroud.



Installing the Front Radiator

The installation is the reverse of the removal procedure. However, pay attention to the following. Install **NEW** Oetiker clamps to secure coolant hoses.

COOLING FAN

Cooling Fan Operating Condition

RADIATOR COOLING FAN		
ENGINE TEMPERATURE	COOLING FAN RELAY	COOLING FAN OPERATION
> 100°C (212°F)	Close	Starts
< 95°C (203°F)	Open	Stops

NOTE: If voltage decrease to 11 V and cooling fan is running, the ECM will shut it off. If voltage remains low and coolant temperature reaches 118°C (244°F), the ECM will turn on the cooling fan.

Cooling Fan Configuration in BUDS2

1. Connect vehicle to the BRP diagnostic software (BUDS2). Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. In BUDS2, select the following:
 - **Settings** page
 - **ECM** button.
3. Ensure that **With fan box** is properly checked.

Testing the Cooling Fan Motor Operation

1. Go to:
 - **Functions** page
 - **ECM** button.
2. Press **Cooling Fan** button to activate cooling fan motor.

3. If cooling fan motor does not work, continue with *COOLING FAN TESTING SEQUENCE*.

Cooling Fan Testing Sequence

If BUDS2 is properly configured and cooling fan does not work, follow this testing sequence to diagnose problem.

1. Check cooling fan connector and terminal condition.
 - Refer to *POWER DISTRIBUTION*.
2. Check cooling fan fuse.
 - Refer to *POWER DISTRIBUTION*.
3. Check cooling fan relay.
 - Refer to *POWER DISTRIBUTION*.
4. Check cooling fan motor operation.
 - Refer to *TESTING THE COOLING FAN MOTOR OPERATION*.
5. Check input voltage at cooling fan motor.

NOTE: Engine must be started and engine temperature must be > 100°C (212°F).

INPUT VOLTAGE AT COOLING FAN MOTOR	
TEST PROBES	VOLTAGE
Pin B	Battery voltage (±12 Vdc)
Pin A	

6. Check input voltage at cooling fan relay.

INPUT VOLTAGE AT COOLING FAN RELAY	
TEST PROBES	VOLTAGE
Pin 85	Battery voltage (±12 Vdc)
Battery negative (-) post	

INPUT VOLTAGE AT COOLING FAN RELAY	
TEST PROBES	VOLTAGE
Pin 30	Battery voltage (±12 Vdc)
Battery negative (-) post	

7. Check ECM ground continuity test (relay).

ECM GROUND CONTINUITY TEST (RELAY)	
TEST PROBES	VOLTAGE
ECM-B pin J4	Close to 0 Ω
Relay pin 86	

MAGNETO AND STARTER

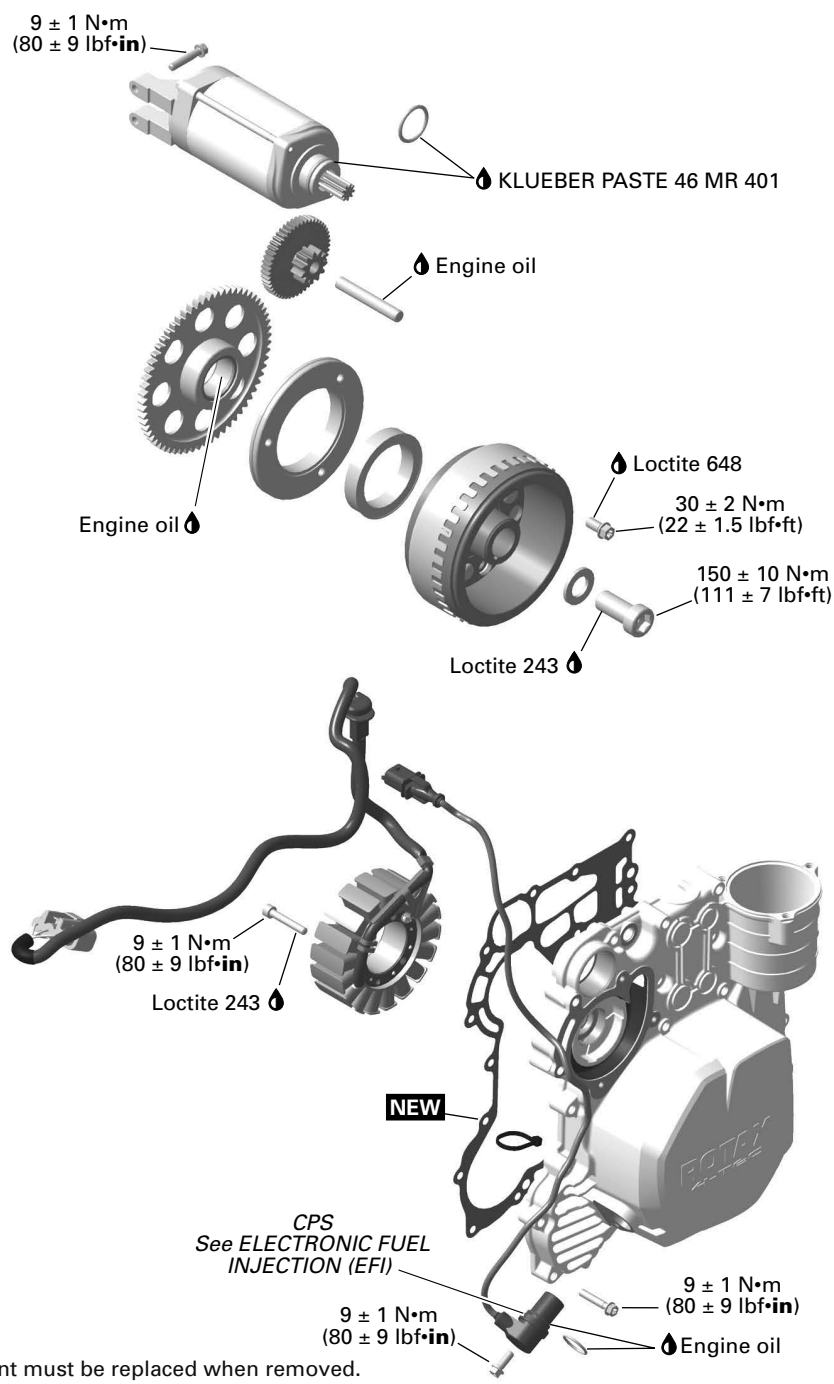
SERVICE TOOLS

Description	Part Number	Page
CRANKSHAFT PROTECTOR	529 036 213	91
FLUKE 115 MULTIMETER	529 035 868	89
FLYWHEEL PULLER.....	420 976 235	91

SERVICE PRODUCTS

Description	Part Number	Page
KLÜEBER PASTE 46 MR 401	420 297 616	96
LOCTITE 243 (BLUE)	293 800 060	90, 92
LOCTITE 648 (GREEN)	413 711 400	93
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	87
PULLEY FLANGE CLEANER	413 711 809	91, 93

Section 02 ENGINE (600 ACE)
Subsection 06 (MAGNETO AND STARTER)



NEW = Component must be replaced when removed.

mmr2015-043-001_a

TROUBLESHOOTING

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

ENGINE DOES NOT CRANK

1. **Battery voltage too low.**
 - Check battery condition.
2. **Starter is turning but engine does not crank.**
 - Check sprag clutch for wear or other damages.
3. **Starter is defective.**
 - Check starter condition. Perform *STARTER OPERATION TEST* and *STARTER VOLTAGE DROP TEST*.
4. **Engine is only cranking 1 - 2 seconds before it stops.**
 - Check battery condition.

PROCEDURES

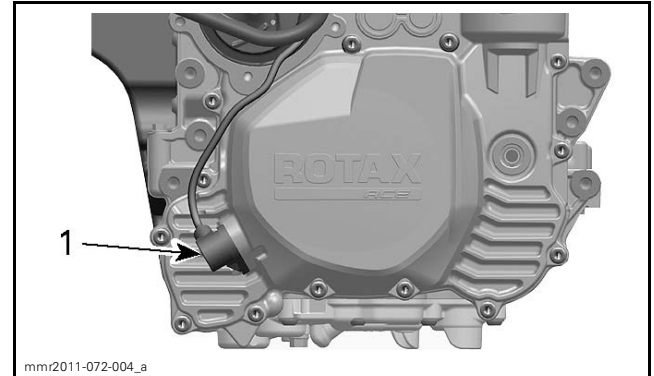
MAGNETO COVER

Magneto Cover Access

1. Refer to applicable subsection and remove:
 - Air intake silencer and headlight/gauge module as an assembly
 - Muffler
 - Exhaust pipes.
2. Detach coolant tank from the frame.
3. Detach radiator coolant pipes from frame.

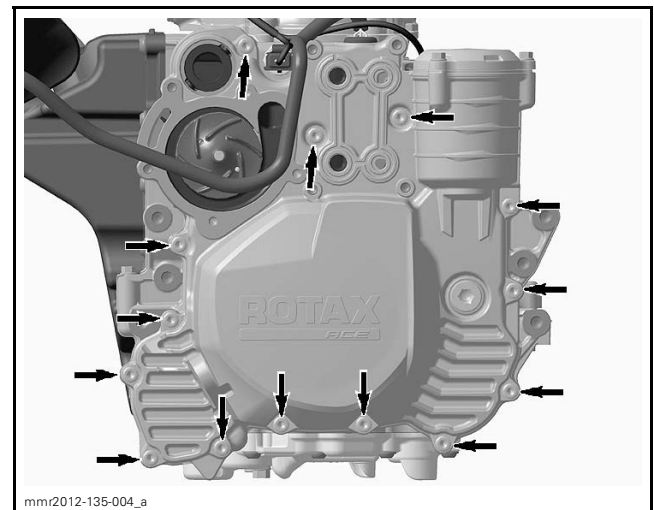
Magneto Cover Removal

1. Cut the locking tie securing the stator wiring and disconnect stator connector.
2. Disconnect the CTS connector.
3. Refer to *PERIODIC MAINTENANCE PROCEDURES* and drain:
 - Engine oil
 - Engine coolant.
4. Refer to *COOLING SYSTEM* and remove:
 - Water pump housing
 - Thermostat housing.
5. Refer to *LUBRICATION SYSTEM* subsection and remove:
 - Oil pressure regulator
 - Oil cooler.
6. Remove the CPS.



1. CPS

7. Remove magneto cover retaining screws.



MAGNETO COVER SCREWS

8. Pull magneto cover off.

Magneto Cover Inspection

Check magneto cover for cracks or other damage. Replace if necessary.

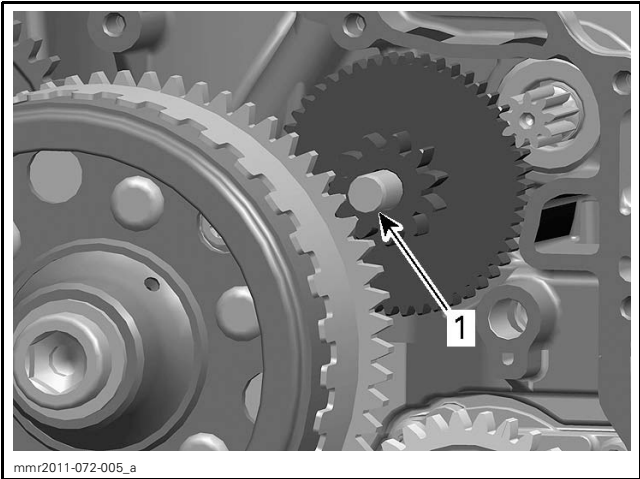
Magneto Cover Installation

1. Clean magneto cover.

MAGNETO COVER CLEANING	
Service product	LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500)

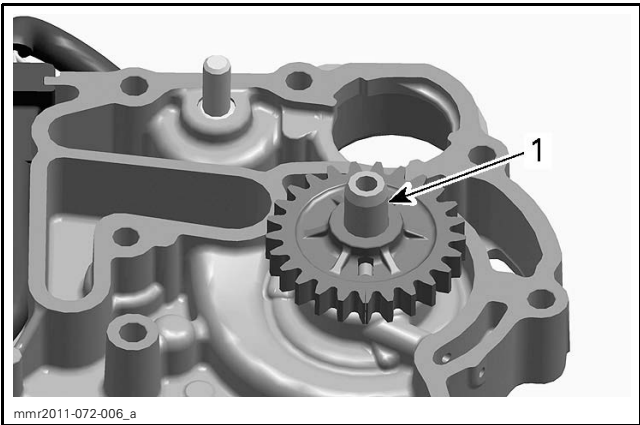
2. Install a **NEW** magneto cover gasket.
3. Ensure starter drive gear pin is in place.
4. Apply engine oil on starter drive gear pin.

Section 02 ENGINE (600 ACE)
Subsection 06 (MAGNETO AND STARTER)



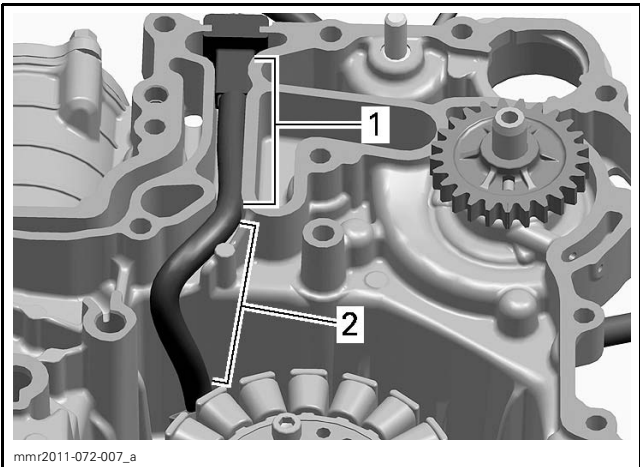
1. Starter drive gear pin

5. Apply engine oil on water pump shaft.



1. Water pump shaft - apply engine oil

NOTICE Make sure the stator cable harness is embedded in the cover channel provided. The part of the harness that is out of the channel must be tight, otherwise it might chafe or jam.



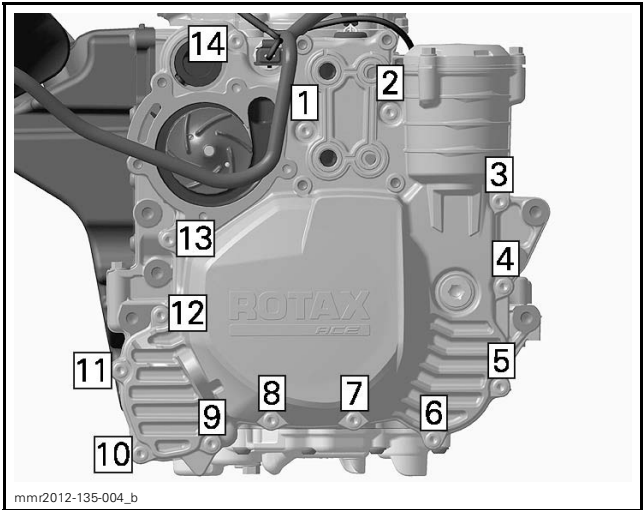
1. Embedded in that area
2. Tight in this area

6. Carefully install magneto cover.

⚠ CAUTION Magnetic force between magneto flywheel and stator is very high. Avoid finger contusions.

7. Tighten to specification magneto cover screws according to the following sequence.

MAGNETO COVER SCREWS	
Tightening torque	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



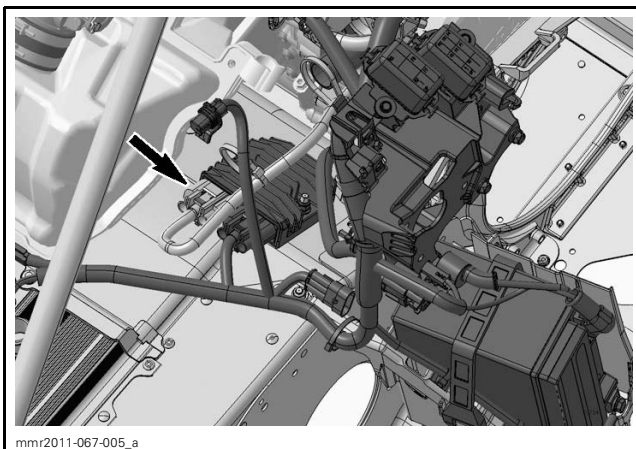
TIGHTENING SEQUENCE

8. Install all other removed parts, refer to applicable subsections.

STATOR

Stator Connector Access

1. Move fuel tank backward. Refer to *MOVING FUEL TANK REARWARD FOR SERVICING* in *FUEL TANK AND FUEL PUMP* subsection.
2. Disconnect magneto connector from voltage regulator.



TYPICAL - SOME PARTS REMOVED FOR CLARITY

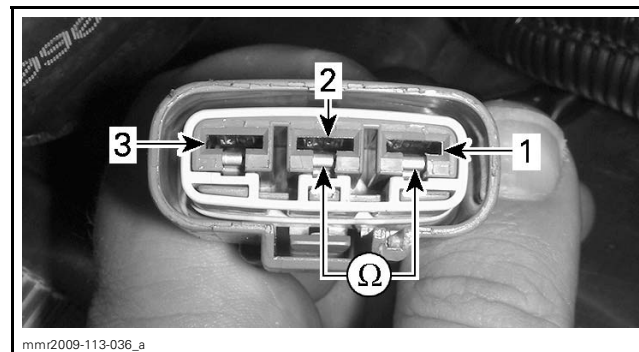
Stator Continuity Test

1. Disconnect the magneto connector from voltage regulator, refer to *STATOR CONNECTOR ACCESS* in this subsection.
2. Set multimeter to Ω .

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

3. Probe between each pair of YELLOW wires by touching (NOT inserting) terminals lock tabs as shown.

NOTICE Never insert a multimeter probe into a terminal as it would ruin the terminal.



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

4. Read resistance as per following table.

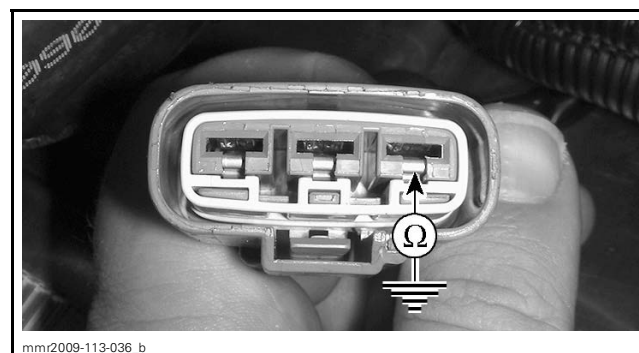
STATOR CONTINUITY TEST	
YELLOW WIRES (EACH PAIR)	RESISTANCE @ 20°C (68°F)
Pins 1 and 2	0.1 - 1 Ω
Pins 1 and 3	
Pins 2 and 3	

If any resistance reading is not as specified, the stator or the wiring (including connector) is open and needs to be repaired or replaced.

If resistance is good, perform the stator insulation test.

Stator Insulation Test

1. Connect multimeter between any YELLOW wire and chassis ground.



2. Read resistance.

Section 02 ENGINE (600 ACE)
Subsection 06 (MAGNETO AND STARTER)

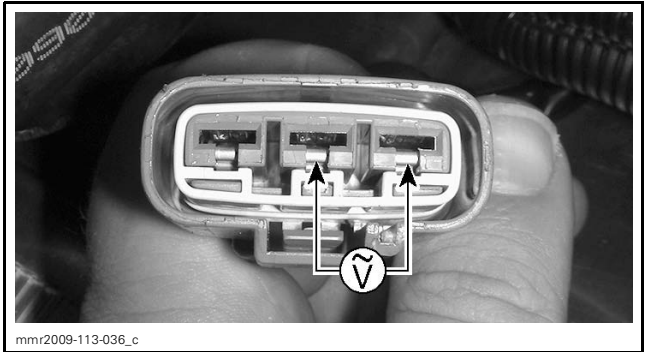
STATOR INSULATION TEST	
PROBE POSITIONS	RESISTANCE @ 20°C (68°F)
Any YELLOW wire and chassis ground	Infinity (OL)

If any resistance reading is not as specified, the stator or the wiring is shorted to ground and needs to be repaired or replaced.

If the insulation test is good, perform the output voltage test.

Stator Output Voltage Test

- 1. Disconnect stator at voltage regulator.
- NOTE:** To ease access, move fuel tank back carefully, but do not disconnect. Refer to *FUEL TANK AND FUEL PUMP*.
- 2. Start engine and let it reach its operating temperature.
- 3. Set multimeter to Vac scale.
- 4. With engine idling, connect multimeter between each pair of YELLOW wires.



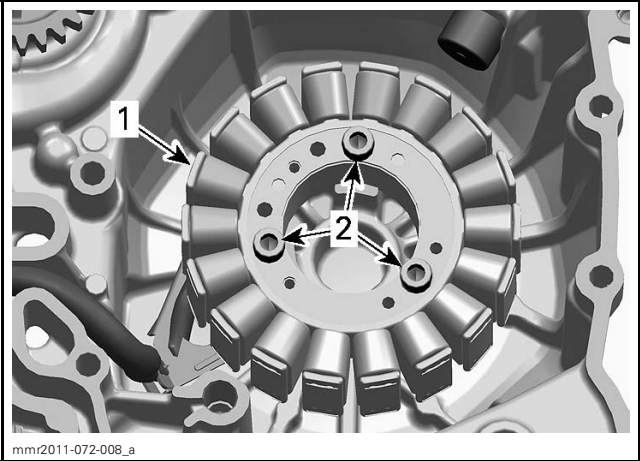
- 5. Read voltage.

STATOR OUTPUT VOLTAGE TEST		
TEST ENGINE SPEED	TERMINAL	VOLTAGE
Idle speed	1 and 2	± 25 Vac
	1 and 3	
	2 and 3	

If any voltage reading is significantly lower than specification, replace the stator.

Stator Removal

- 1. Remove the *MAGNETO COVER*, see procedure in this subsection.
- 2. Remove stator retaining screws.



- 1. Stator
- 2. Stator retaining screws

- 3. Remove stator.

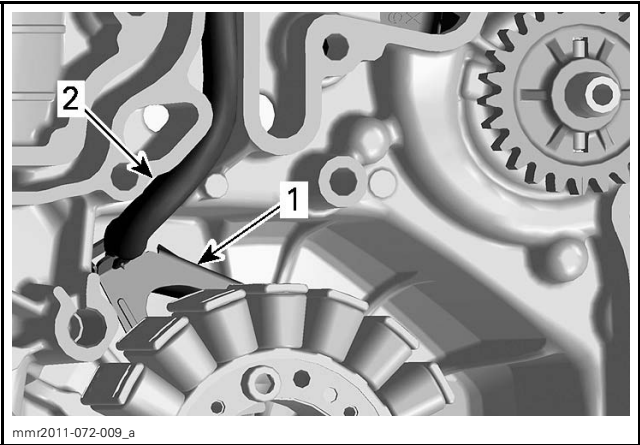
Stator Inspection

Check stator windings and insulation for cracks and other damages. If damaged replace it.

Check if stator wires are brittle, hard or otherwise damaged.

Stator Installation

- 1. Ensure stator cable is underneath cable holder during installation of stator.



- 1. Cable holder
- 2. Stator cable

- 2. Install stator retaining screws and tighten to specified torque.

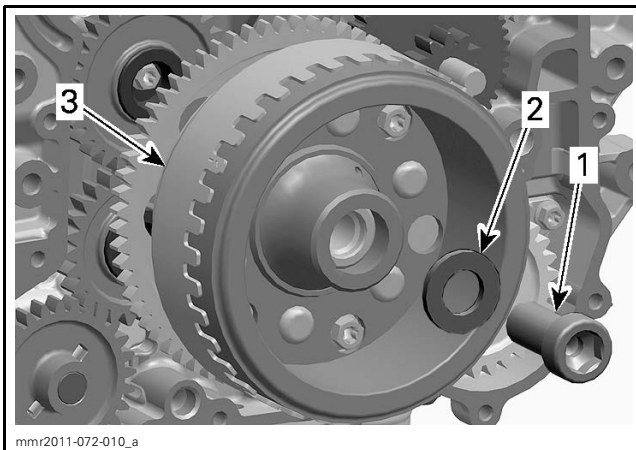
STATOR RETAINING SCREWS	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening torque	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

- 3. Reinstall *MAGNETO COVER*, see procedure in this subsection.

ROTOR

Rotor Removal

1. Remove *MAGNETO COVER*, see procedure in this subsection.
2. Lock crankshaft. Refer to *BOTTOM END* subsection.
3. Remove rotor retaining screw and lock washer.

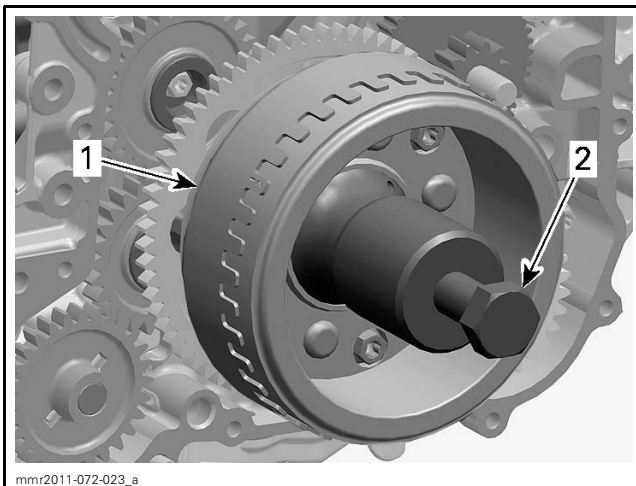


1. Retaining screw
2. Lock washer
3. Rotor

4. Remove rotor.

REQUIRED TOOLS	
CRANKSHAFT PROTECTOR (P/N 529 036 213)	
FLYWHEEL PULLER (P/N 420 976 235)	

NOTE: Apply some grease on the crankshaft protector surface to ease puller operation.



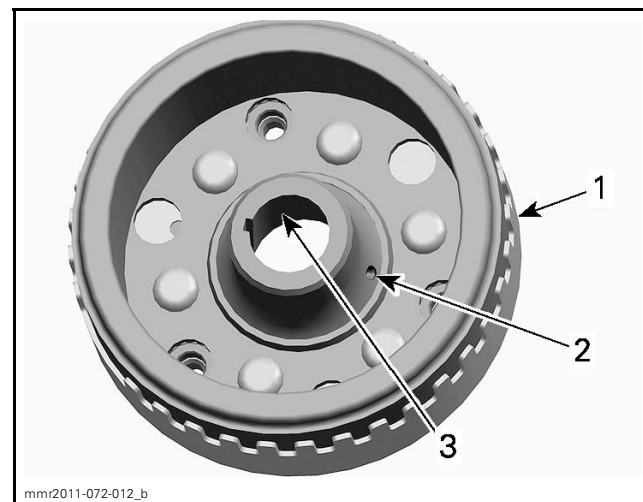
1. Rotor
2. Flywheel puller screw

Rotor Inspection

Check the inner side of the rotor for scratches or other damage.

Check keyway for wear or damages.

Check if trigger wheel teeth are bent or otherwise damaged.



1. Rotor with trigger wheel
2. Oil passage in magneto hub
3. Rotor taper

Check woodruff key and keyway on crankshaft for wear or damages.

Replace parts as necessary.

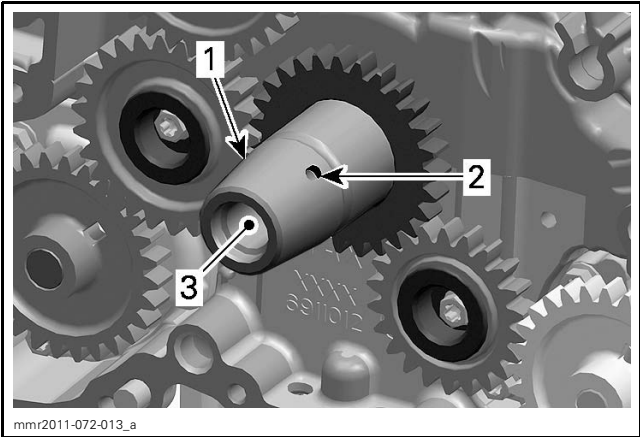
Rotor Installation

Reverse the removal procedure. However, pay attention to the following.

1. Blow compressed air through oil passage in magneto hub. Check if it is clogged.
2. Using PULLEY FLANGE CLEANER (P/N 413 711 809), clean:
 - The oil passage
 - The crankshaft threads
 - The crankshaft taper
 - The rotor taper.

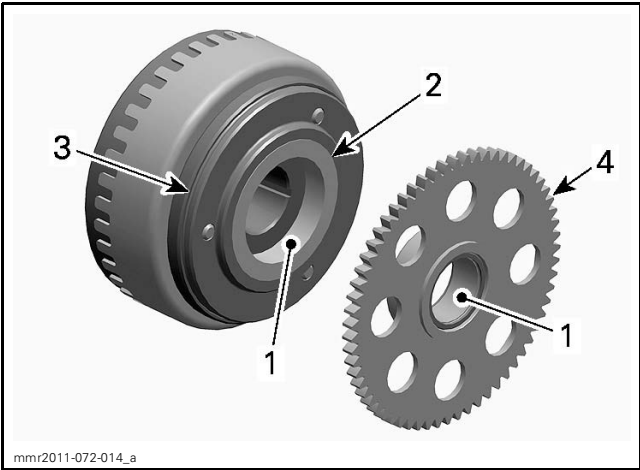
NOTICE Taper on crankshaft and rotor must be free of grease.

Section 02 ENGINE (600 ACE)
Subsection 06 (MAGNETO AND STARTER)



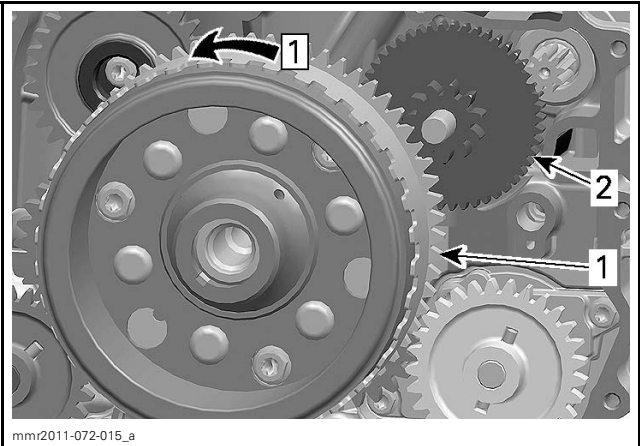
- 1. Crankshaft MAG side
- 2. Oil passage
- 3. Thread

- 3. Apply oil on sprag clutch and needle bearing.
- 4. Install sprag clutch gear onto the rotor.



- 1. Apply engine oil here
- 2. Sprag clutch
- 3. Sprag clutch housing
- 4. Sprag clutch gear

- 5. Slide rotor along with the sprag clutch gear onto the crankshaft. The woodruff key and keyway must be aligned.
- 6. Rotate sprag clutch gear counterclockwise to align with starter double gear.



- Step 1: Rotate to align teeth
- 1. Sprag clutch gear
 - 2. Starter double gear

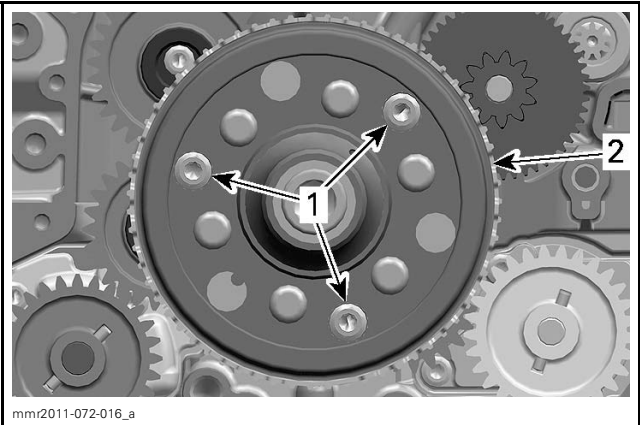
- 7. Install washer and retaining screw.
- 8. Tighten to specified torque.

ROTOR RETAINING SCREW	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening torque	150 N•m ± 10 N•m (111 lbf•ft ± 7 lbf•ft)

SPRAG CLUTCH

Sprag Clutch Removal

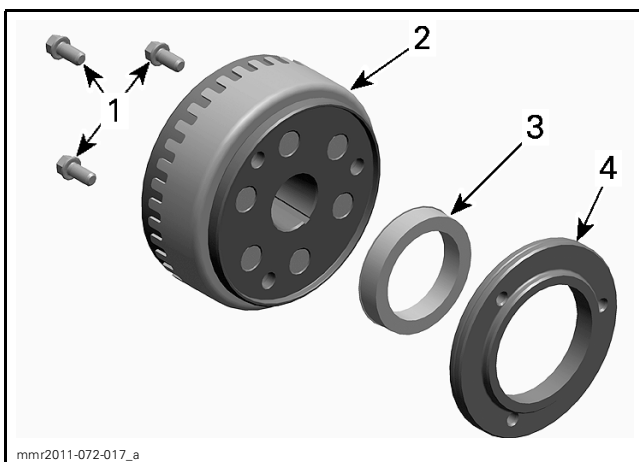
- 1. Remove the *MAGNETO COVER*, see procedure in this subsection.
- 2. Lock crankshaft. Refer to *CYLINDER BLOCK* subsection.
- 3. Loosen and remove sprag clutch housing screws.



- 1. Sprag clutch housing screws
- 2. Rotor

- 4. Remove *ROTOR*, see procedure in this subsection.
- 5. Remove sprag clutch housing.

6. Remove sprag clutch from sprag clutch housing.



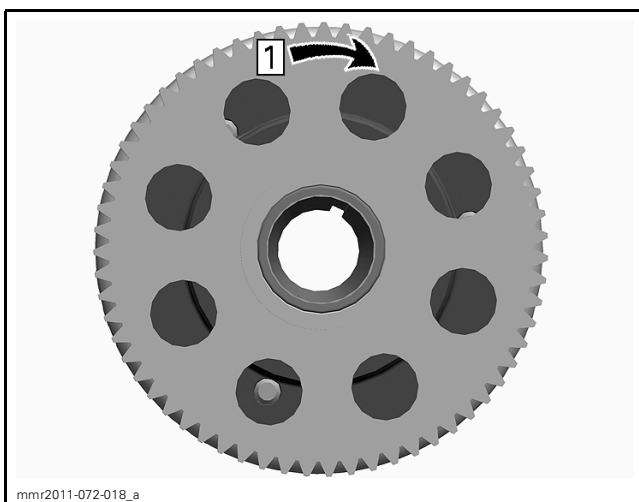
1. Sprag clutch housing screws
2. Rotor
3. Sprag clutch
4. Sprag clutch housing

Sprag Clutch Inspection

Inspect sprag clutch and sprag clutch housing for wear and damage.

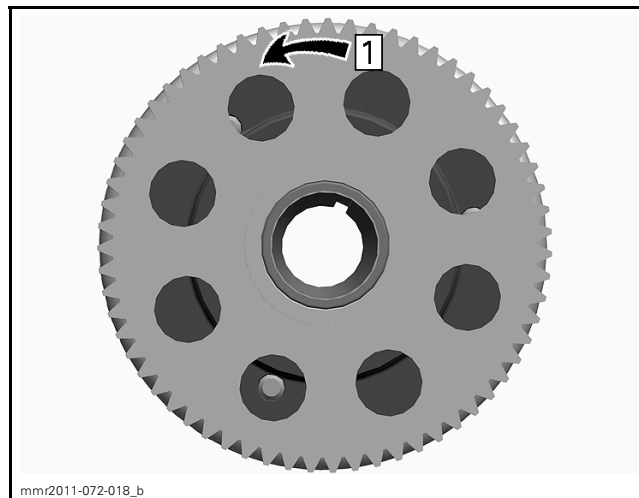
Check the collar of the sprag clutch gear, refer to *SPRAG CLUTCH GEAR* in this subsection.

Rotate sprag clutch gear clockwise. Gear must rotate freely.



Step 1: Free

Rotate sprag clutch gear counterclockwise. Gear must lock.



Step 1: Lock

Sprag Clutch Installation

1. Clean sprag clutch housing with a parts cleaner.

NOTICE Threads of sprag clutch housing must be free of any lubricants.

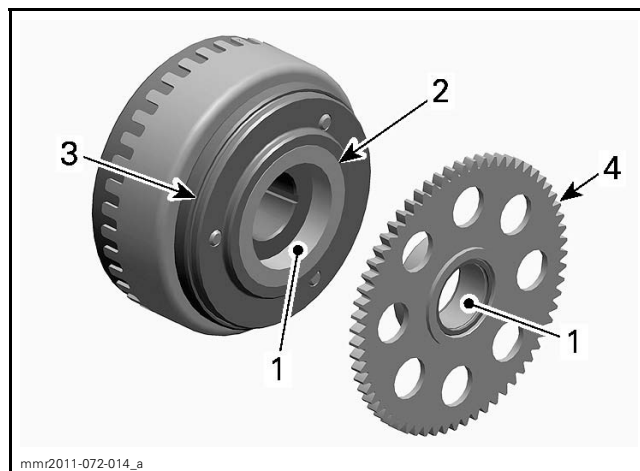
SPRAG CLUTCH HOUSING	
Service product	PULLEY FLANGE CLEANER (P/N 413 711 809)

2. Apply thread locker on threads of sprag clutch housing screws.

SPRAG CLUTCH HOUSING SCREWS	
Service product	LOCTITE 648 (GREEN) (P/N 413 711 400)

3. Loosely install screws.

4. Apply engine oil on sprag clutch and sprag clutch gear needle bearing.



1. Apply engine oil here
2. Sprag clutch
3. Sprag clutch housing
4. Sprag clutch gear

Section 02 ENGINE (600 ACE)
Subsection 06 (MAGNETO AND STARTER)

- 5. Install *ROTOR*, see procedure in this subsection.
- 6. Tighten sprag clutch housing screws to the specified torque.

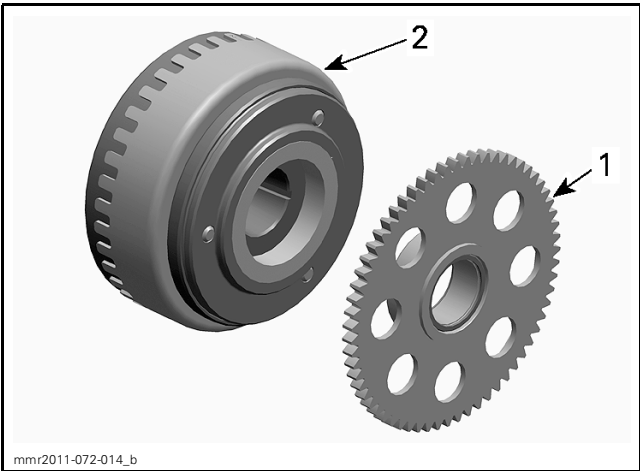
SPRAG CLUTCH HOUSING SCREWS	
Tightening torque	30 N•m ± 2 N•m (22 lbf•ft ± 1 lbf•ft)

- 7. Install all other removed parts.

SPRAG CLUTCH GEAR

Sprag Clutch Gear Removal

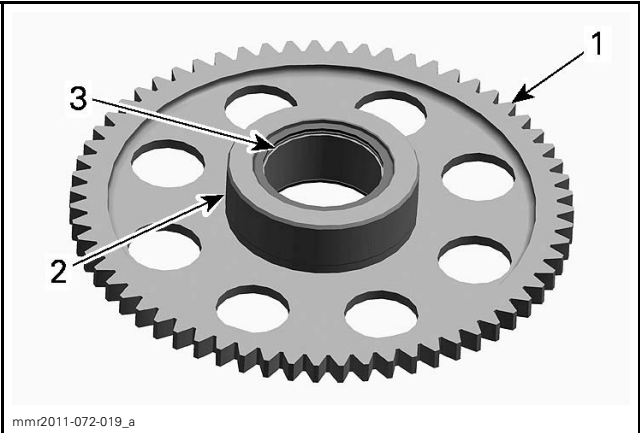
- 1. Remove rotor and sprag clutch gear together. Refer to *ROTOR* in this subsection.
- 2. Pull sprag clutch gear out of the rotor.



- 1. Sprag clutch gear
- 2. Rotor

Sprag Clutch Gear Inspection

Inspect gear, especially teeth and sprag clutch collar for wear and other damage.
Check needle bearing for wear and pittings.



- 1. Teeth
- 2. Collar
- 3. Needle bearing

Replace sprag clutch gear if necessary.

Sprag Clutch Gear Installation

Reverse the removal procedure. However, pay attention to the following.

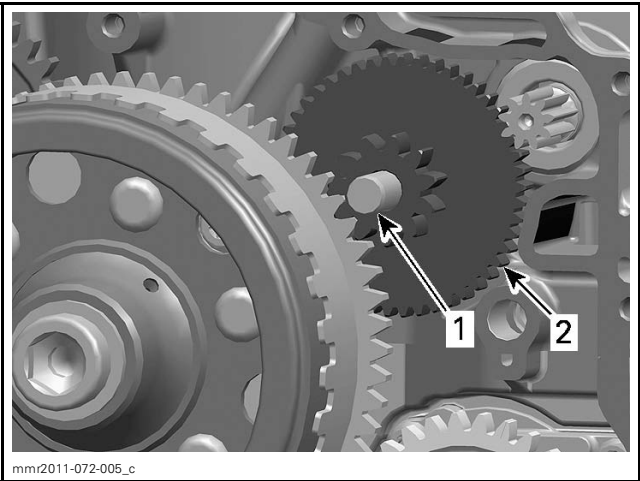
NOTE: Apply engine oil on needle bearing and collar of sprag clutch gear.

STARTER DRIVE GEARS

The starter drive gears are located on the engine MAG side, behind the magneto cover.

Starter Drive Gear Removal

- 1. Remove *MAGNETO COVER*, see procedure in this subsection.
- 2. Remove location pin and starter double gear.



- 1. Location pin
- 2. Starter double gear

Starter Drive Gear Inspection

Inspect starter drive gears and location pin for wear and damage.

Replace parts if necessary.

Starter Drive Gear Installation

Reverse the removal procedure. However, pay attention to the following.

Apply engine oil on the location pin.

STARTER

Starter Operation Test

Before carrying out any starter test, make sure:

- Battery is fully charged and in good condition
- Cable connections at battery, starter and solenoid are tight
- Cables are in good condition.

1. Disconnect the negative battery cable.

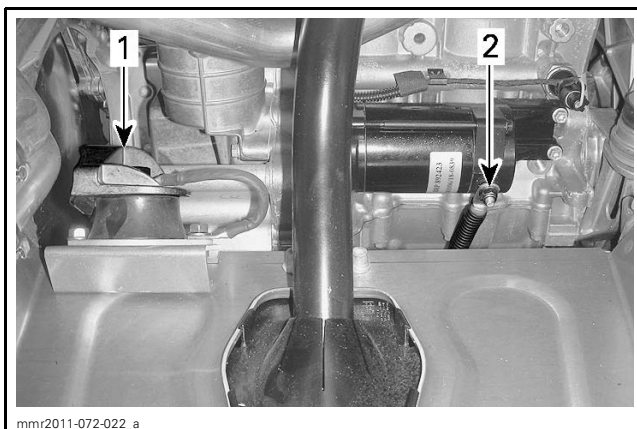
⚠ WARNING

Sparks can occur when connecting jumper cables. To avoid fire hazard, be sure that no flammable liquids or fuel vapors are in the test area.

2. Using booster cables and a fully charged battery (or a power pack), carefully supply current directly to the starter.

- 2.1 Connect the negative booster cable or power pack cable to a good ground such as an engine support.

- 2.2 Momentarily touch the starter positive terminal.



TYPICAL

1. Engine support
2. Starter positive terminal

If starter turns at normal speed, test the starting circuit. Refer to *STARTING SYSTEM* subsection.

If starter turns slowly, carry out the *STARTER VOLTAGE DROP TEST (AT BATTERY)*.

If starter does not turn, replace starter.

Starter Voltage Drop Test (at Battery)

NOTE: This test will confirm if starter draws too much current. Battery must be fully charged and in good condition.

1. Set the multimeter to Vdc.
2. Probes battery posts.
3. Crank engine in drownd mode (accelerator held all the way in).
4. Read voltage while cranking.

NOTE: Battery voltage will drop approximately 2 Vdc and fluctuate with starter cranking load.

If the result is close to battery voltage, the starter is in good condition.

If the result is below battery voltage (- 2 Vdc and more), the starter may be defective.

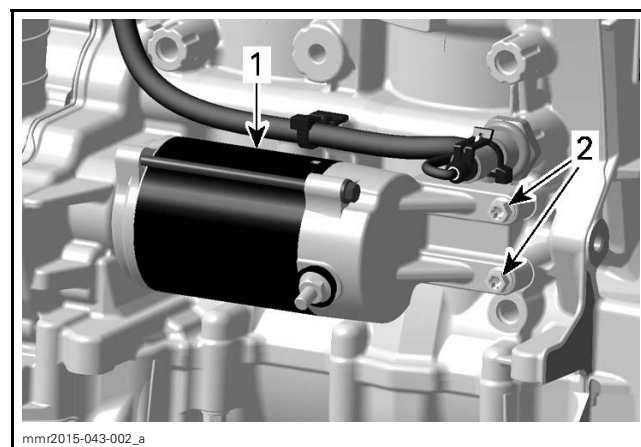
Starter Access

Refer to appropriate section and remove:

- LH side panel
- Drive belt guard.

Starter Removal

1. Disconnect the BLACK (-) cable from the battery.
2. Remove starter cable from starter.
3. Remove starter retaining screws.



1. Starter
2. Starter retaining screws

4. Remove starter from engine.

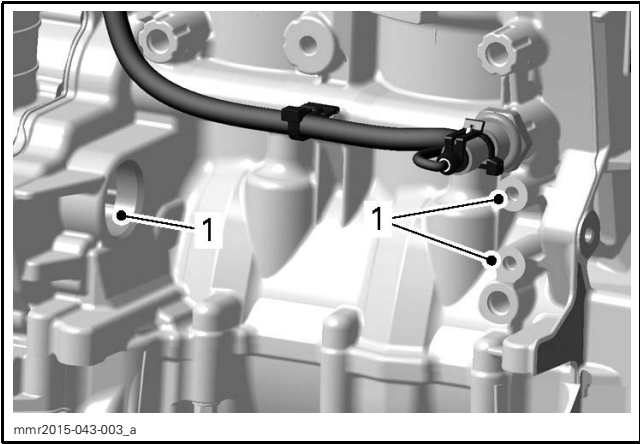
Starter Installation

1. Ensure starter and engine mating surfaces are free of debris.

NOTICE Serious problems may arise if the starter is not properly aligned.

Section 02 ENGINE (600 ACE)

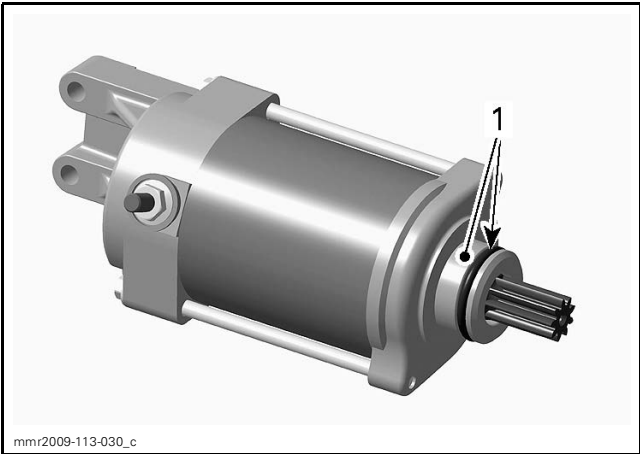
Subsection 06 (MAGNETO AND STARTER)



1. Clean mating surfaces

2. Lubricate starter boss and starter O-ring before installation.

STARTER BOSS +O-RING	
Service product	KLÜEBER PASTE 46 MR 401 (P/N 420 297 616)



1. Lubricate starter boss
2. Lubricate starter O-ring

3. Insert starter gear in engine.

4. Install starter screws and tighten to specified torque.

STARTER SCREWS	
Tightening torque	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

5. Connect starter cable to starter terminal and tighten nut to specified torque.

STARTER CABLE NUT	
Tightening torque	7 N•m ± 1 N•m (62 lbf•in ± 9 lbf•in)

6. Install all other removed parts.

7. Reconnect BLACK (-) cable on battery post.



WARNING

Always connect RED (+) starter cable first, and BLACK (-) battery cable last. Whenever connecting the RED (+) cable to the starter motor, always make sure the BLACK (-) battery cable is disconnected to prevent electric shock.

8. Test for proper starter operation.

MAGNETO AND STARTER

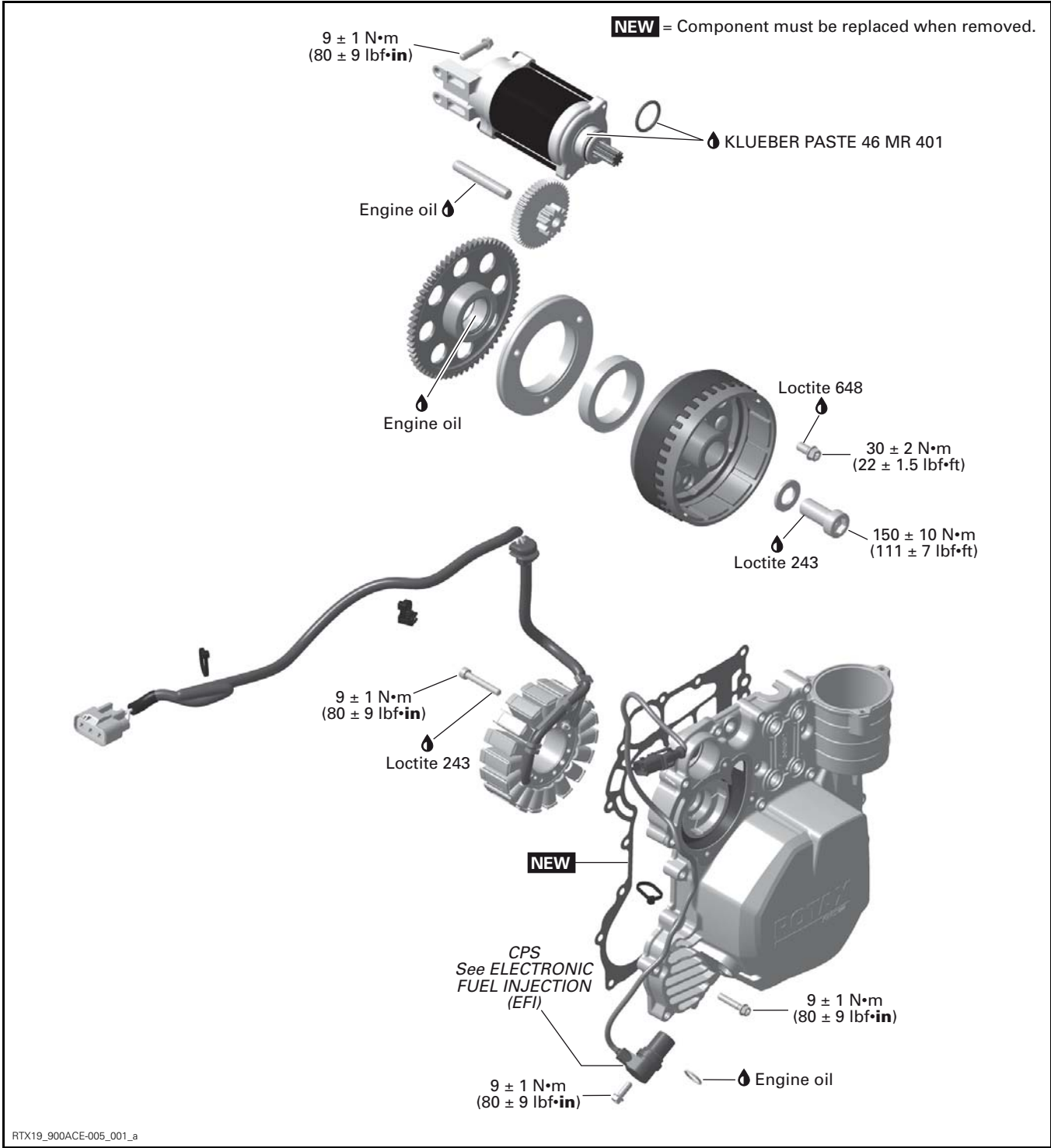
SERVICE TOOLS

Description	Part Number	Page
CRANKSHAFT PROTECTOR	529 036 213	7
FLYWHEEL PULLER.....	420 976 235	7

SERVICE PRODUCTS

Description	Part Number	Page
BRAKE AND PARTS CLEANER PRO S2	779245	7, 9
KLÜEBER PASTE 46 MR 401	420 297 616	11
LOCTITE 243 (BLUE)	293 800 060	6, 8
LOCTITE 648 (GREEN) (F)	619 600 012	9
LOCTITE 648 (GREEN)	413 711 400	9
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	3

Subsection XX (MAGNETO AND STARTER)



TROUBLESHOOTING

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

ENGINE DOES NOT CRANK

1. **Battery voltage too low.**
- Check battery condition.
2. **Starter is turning but engine does not crank.**
- Check sprag clutch for wear or other damages.
3. **Starter is defective.**
- Check starter condition. Perform *TESTING THE STARTER OPERATION* and *TESTING THE STARTER VOLTAGE DROP*.
4. **Engine is only cranking 1 - 2 seconds before it stops.**
- Check battery condition.

PROCEDURES

MAGNETO COVER

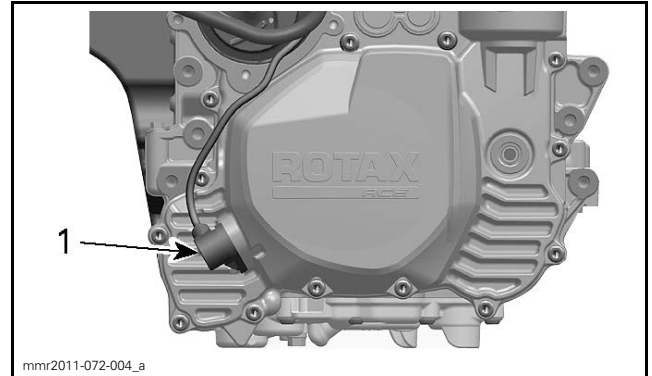
Magneto Cover Location

The magneto cover is located on the right side of the engine.

NOTE: Magneto cover cannot be removed without removing engine from vehicle.

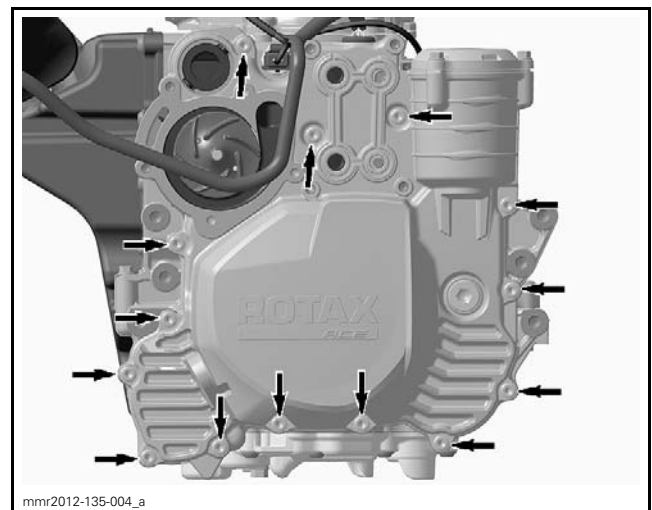
Removing the Magneto Cover

1. Refer to *ENGINE REMOVAL AND INSTALLATION* and remove engine.
2. Refer to *LUBRICATION SYSTEM* and drain engine oil.
3. Refer to *COOLING SYSTEM* and remove:
 - Water pump housing
 - Thermostat housing.
4. Refer to *LUBRICATION SYSTEM* subsection and remove:
 - Oil pressure regulator
 - Oil cooler.
5. Remove the CPS.



1. CPS

6. Remove magneto cover retaining screws.



MAGNETO COVER SCREWS

7. Place an oil pan under magneto area to catch remaining oil.
8. Pull magneto cover off.

Inspecting the Magneto Cover

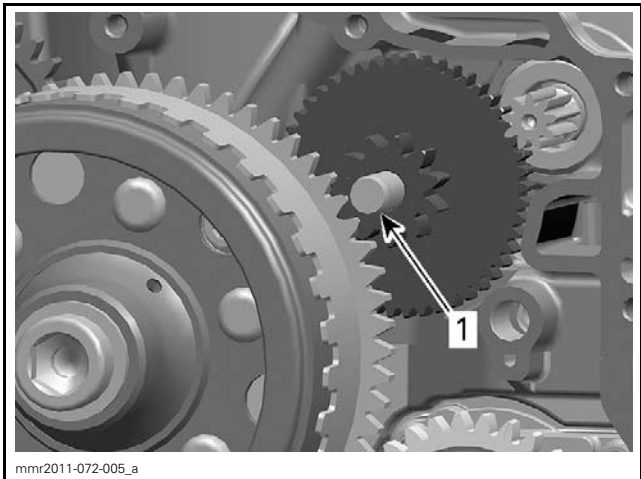
Check magneto cover for cracks or other damage. Replace if necessary.

Installing the Magneto Cover

1. Clean magneto cover.

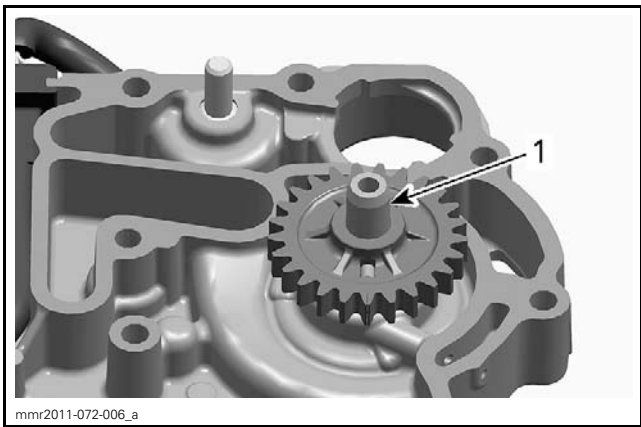
SERVICE PRODUCT
LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500)

2. Install a **NEW** magneto cover gasket.
3. Ensure starter drive gear pin is in place.
4. Apply engine oil on starter drive gear pin.



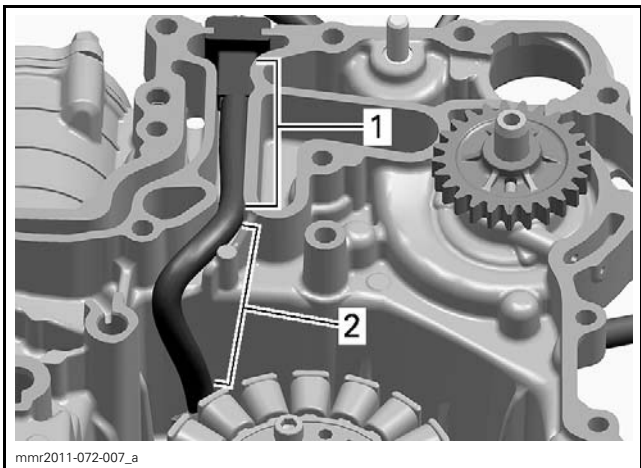
APPLY ENGINE OIL
1. Starter drive gear pin

5. Apply engine oil on water pump shaft.



1. Water pump shaft - apply engine oil

NOTICE Make sure the stator cable harness is embedded in the cover channel provided. The part of the harness that is out of the channel must be tight, otherwise it might chafe or jam.



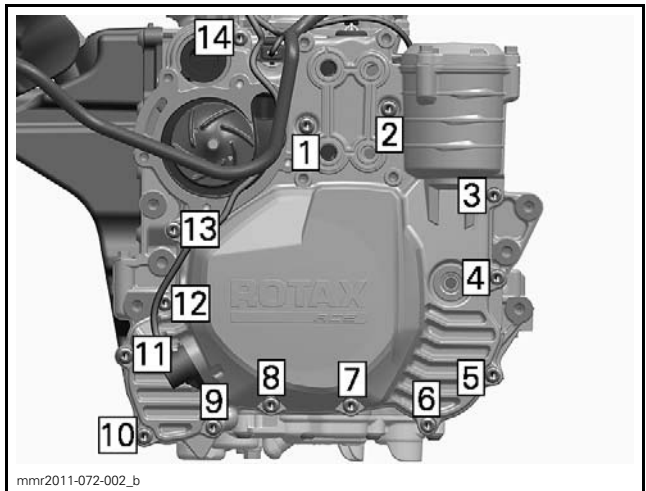
1. Embedded in that area
2. Tight in this area

6. Carefully install magneto cover.

CAUTION Magnetic force between magneto flywheel and stator is very high. Avoid finger contusions.

7. Tighten to specification magneto cover screws according to the following sequence.

TIGHTENING TORQUE	
Magneto cover screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



TIGHTENING SEQUENCE

8. Install all other removed parts, refer to applicable subsections.

STATOR

Stator Connector Location

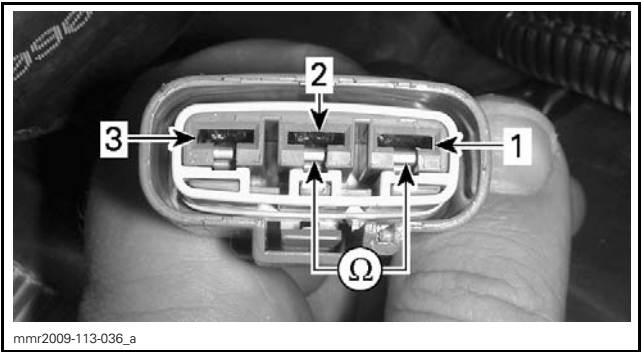
The stator connector is located on the tunnel, under the front of the fuel tank.

To reach it, move fuel tank backward. Refer to *MOVING FUEL TANK REARWARD FOR SERVICING* in *FUEL TANK AND FUEL PUMP* subsection.

Testing the Stator Continuity

1. Disconnect the stator connector from voltage regulator.
2. Set multimeter to Ω .
3. Probe each pair of YELLOW wires by touching (NOT inserting) terminals lock tabs as shown.

NOTICE Never insert a multimeter probe into a terminal as it would ruin the terminal.



- 1. Pin #1
- 2. Pin #2
- 3. Pin #3

4. Read resistance as per following table.

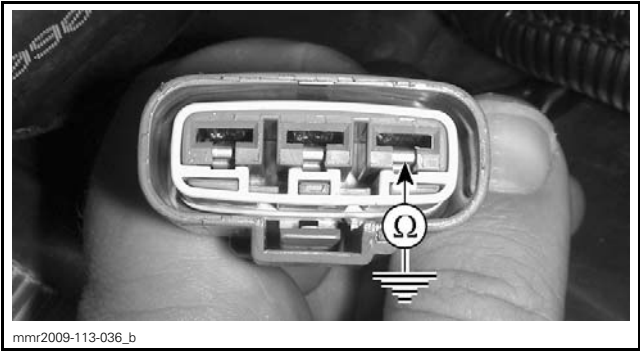
STATOR CONTINUITY TEST	
YELLOW WIRES (EACH PAIR)	RESISTANCE @ 20°C (68°F)
Pins 1 and 2	0.1 - 1 Ω
Pins 1 and 3	
Pins 2 and 3	

If any resistance reading is not as specified, the stator or the wiring (including connector) is open and needs to be repaired or replaced.

If resistance is good, perform the stator insulation test.

Testing the Stator Insulation

1. Connect multimeter between any YELLOW wire and chassis ground.



2. Read resistance.

STATOR INSULATION TEST	
PROBE POSITIONS	RESISTANCE @ 20°C (68°F)
Any YELLOW wire and chassis ground	Infinity (OL)

If any resistance reading is not as specified, the stator or the wiring is shorted to ground and needs to be repaired or replaced.

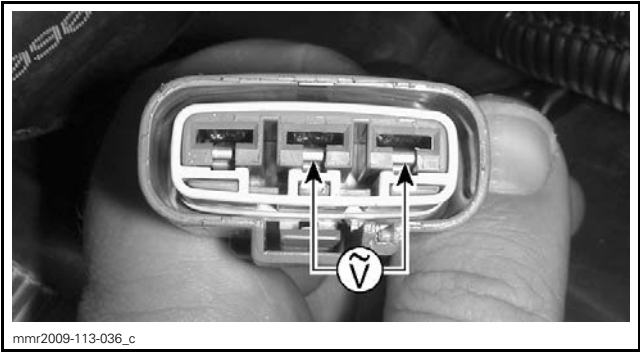
If the insulation test is good, perform the output voltage test.

Testing the Stator Output Voltage

1. Disconnect stator at voltage regulator.

NOTE: To ease access, move fuel tank back carefully, but do not disconnect. Refer to *FUEL TANK AND FUEL PUMP*.

2. Start engine and let it reach its operating temperature.
3. Set multimeter to Vac scale.
4. With engine idling, connect multimeter between each pair of YELLOW wires.



5. Read voltage.

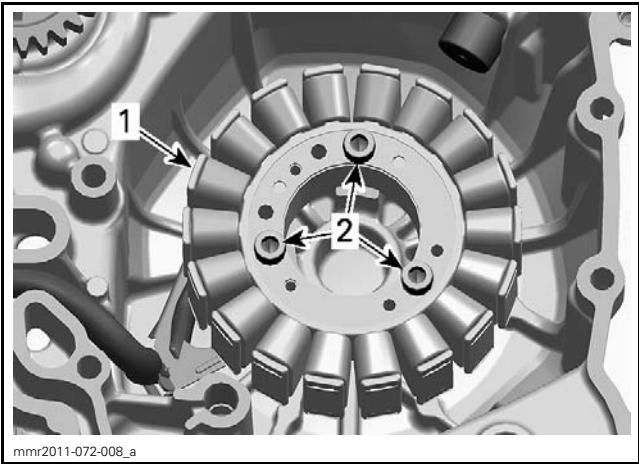
Subsection XX (MAGNETO AND STARTER)

STATOR OUTPUT VOLTAGE TEST		
TEST ENGINE SPEED	TERMINAL	VOLTAGE
Idle speed	1 and 2	± 25 Vac
	1 and 3	
	2 and 3	

If any voltage reading is significantly lower than specification, replace the stator.

Removing the Stator

- 1. Remove the *MAGNETO COVER*, see procedure in this subsection.
- 2. Remove stator retaining screws.



- 1. Stator
- 2. Stator retaining screws

- 3. Remove stator.

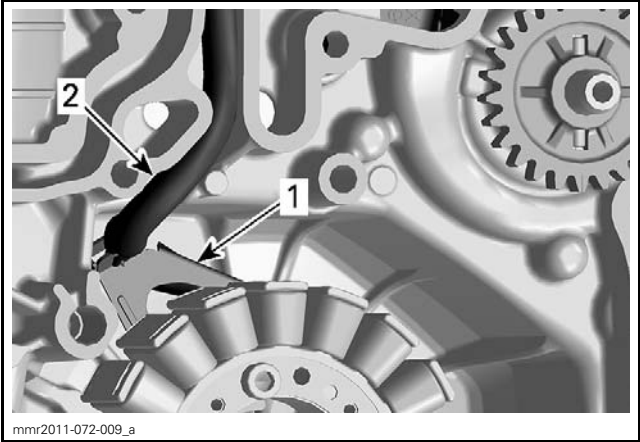
Inspecting the Stator

Check stator windings and insulation for cracks and other damages. If damaged replace it.

Check if stator wires are brittle, hard or otherwise damaged.

Installing the Stator

- 1. Ensure stator cable is underneath cable holder during installation of stator.



- 1. Cable holder
- 2. Stator cable

- 2. Install stator retaining screws and tighten to specified torque.

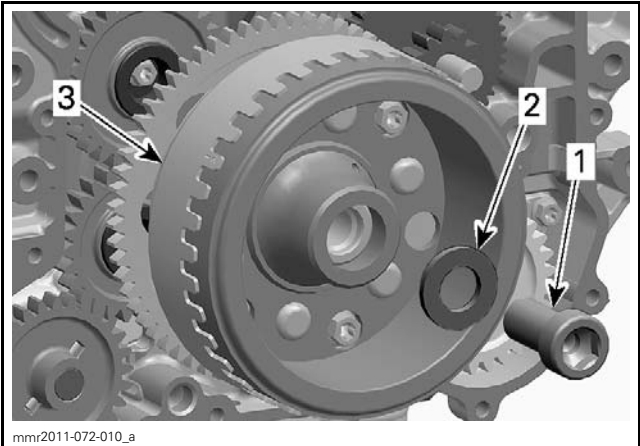
TIGHTENING TORQUE	
Stator retaining screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)
	+ LOCTITE 243 (BLUE)
	(P/N 293 800 060)

- 3. Reinstall *MAGNETO COVER*, see procedure in this subsection.

ROTOR

Removing the Rotor

- 1. Remove *MAGNETO COVER*, see procedure in this subsection.
- 2. Lock crankshaft. Refer to *BOTTOM END* subsection.
- 3. Remove rotor retaining screw and lock washer.

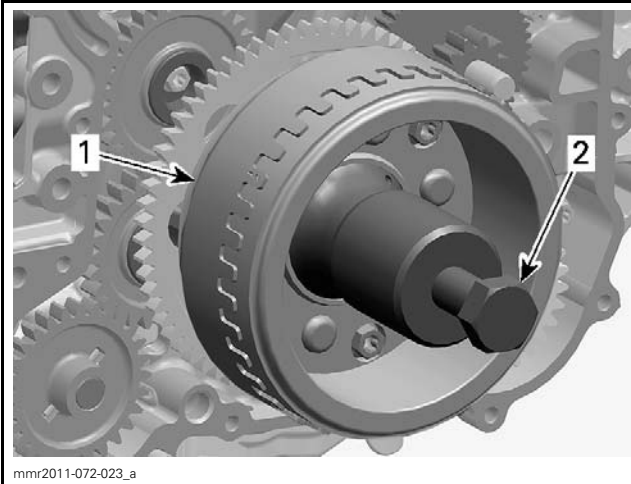


- 1. Retaining screw
- 2. Lock washer
- 3. Rotor

- 4. Remove rotor.

REQUIRED TOOL	
CRANKSHAFT PROTECTOR (P/N 529 036 213)	
FLYWHEEL PULLER (P/N 420 976 235)	

NOTE: Apply some grease on the crankshaft protector surface to ease puller operation.



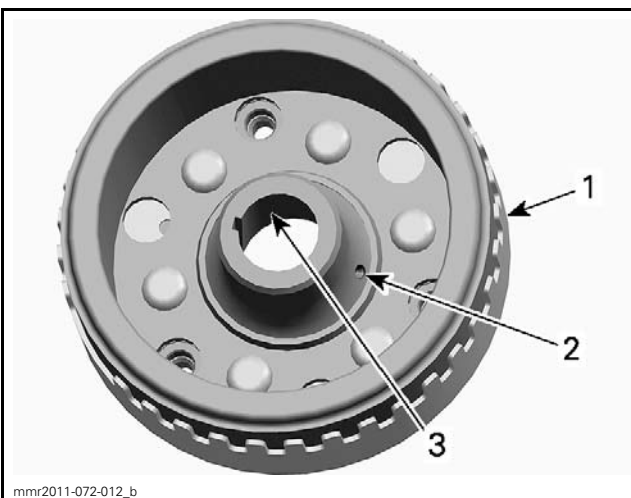
1. Rotor
2. Flywheel puller screw

Inspecting the Rotor

Check the inner side of the rotor for scratches or other damage.

Check keyway for wear or damages.

Check if trigger wheel teeth are bent or otherwise damaged.



1. Rotor with trigger wheel
2. Oil passage in magneto hub
3. Rotor taper

Check woodruff key and keyway on crankshaft for wear or damages.

Replace parts as necessary.

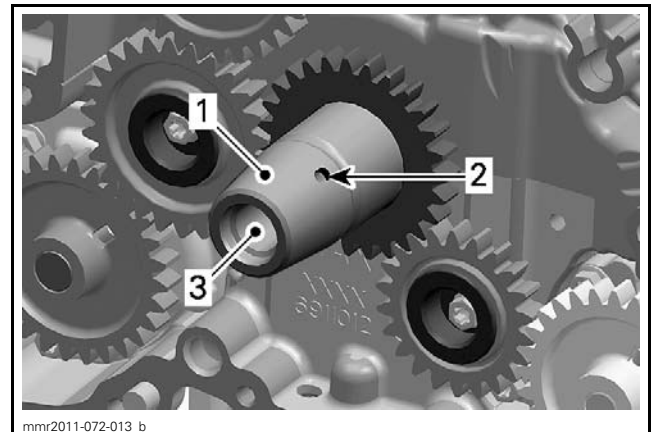
Installing the Rotor

Reverse the removal procedure. However, pay attention to the following.

1. Blow compressed air through oil passage in magneto hub. Check if it is clogged.
2. Clean:
 - The oil passage
 - The crankshaft thread
 - The crankshaft taper
 - The rotor taper.

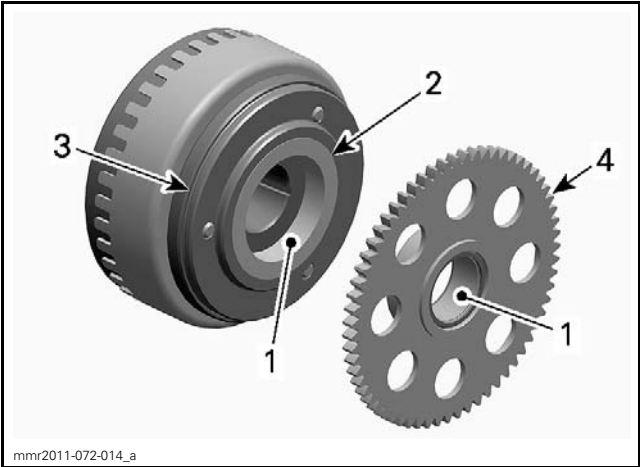
SERVICE PRODUCT
BRAKE AND PARTS CLEANER PRO S2 (P/N 779245)

NOTICE Taper on crankshaft and rotor must be free of grease.



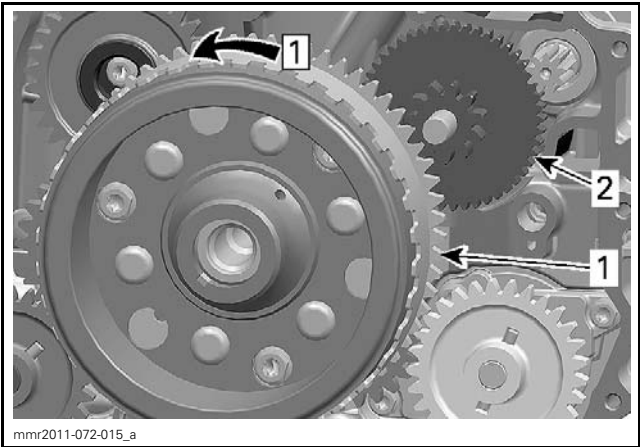
1. Crankshaft taper
2. Oil passage
3. Thread

3. Apply oil on sprag clutch and needle bearing.
4. Install sprag clutch gear onto the rotor.



- 1. Apply engine oil here
- 2. Sprag clutch
- 3. Sprag clutch housing
- 4. Sprag clutch gear

- 5. Slide rotor along with the sprag clutch gear onto the crankshaft. The woodruff key and keyway must be aligned.
- 6. Rotate sprag clutch gear counterclockwise to align with starter double gear.



Step 1: Rotate to align teeth

- 1. Sprag clutch gear
- 2. Starter double gear

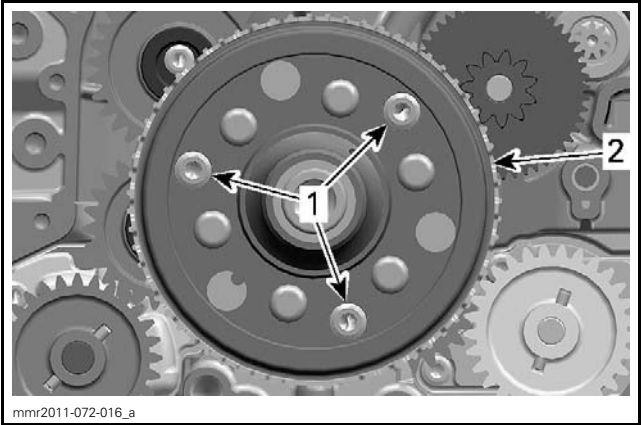
- 7. Install washer and retaining screw.
- 8. Tighten to specified torque.

TIGHTENING TORQUE	
Rotor retaining screw	150 N•m ± 10 N•m (111 lbf•ft ± 7 lbf•ft) + LOCTITE 243 (BLUE) (P/N 293 800 060)

SPRAG CLUTCH

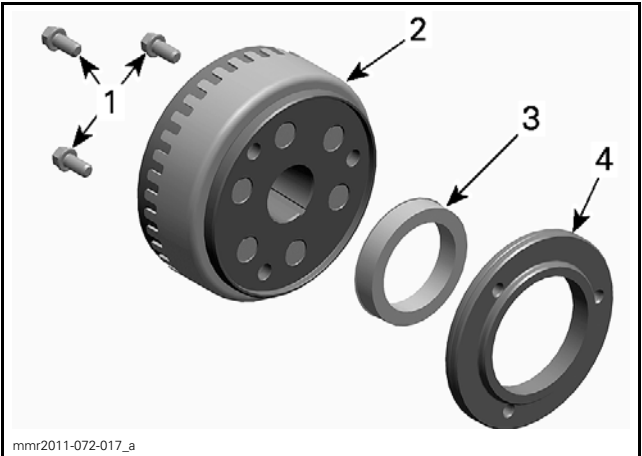
Removing the Sprag Clutch

- 1. Remove the *MAGNETO COVER*, see procedure in this subsection.
- 2. Lock crankshaft. Refer to *BOTTOM END* subsection.
- 3. Loosen and remove sprag clutch housing screws.



- 1. Sprag clutch housing screws
- 2. Rotor

- 4. Remove *ROTOR*, see procedure in this subsection.
- 5. Remove sprag clutch housing.
- 6. Remove sprag clutch from sprag clutch housing.



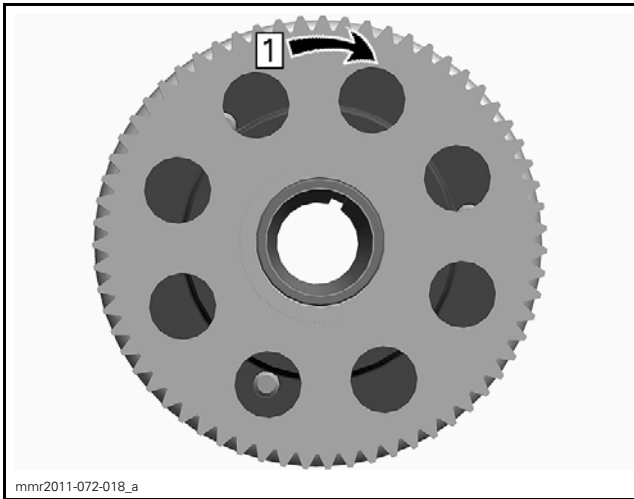
- 1. Sprag clutch housing screws
- 2. Rotor
- 3. Sprag clutch
- 4. Sprag clutch housing

Inspecting the Sprag Clutch

Inspect sprag clutch and sprag clutch housing for wear and damage.

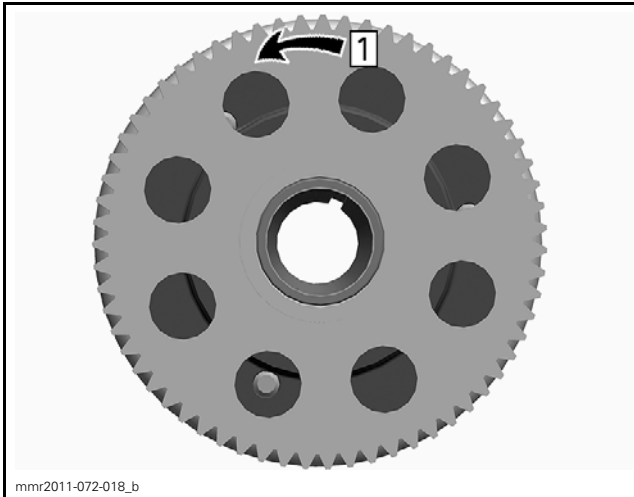
Check the collar of the sprag clutch gear, refer to *SPRAG CLUTCH GEAR* in this subsection.

Rotate sprag clutch gear clockwise. Gear must rotate freely.



Step 1: Free

Rotate sprag clutch gear counterclockwise. Gear must lock.



Step 1: Lock

Installing the Sprag Clutch

1. Clean sprag clutch housing with a parts cleaner.

NOTICE Threads of sprag clutch housing must be free of any lubricants.

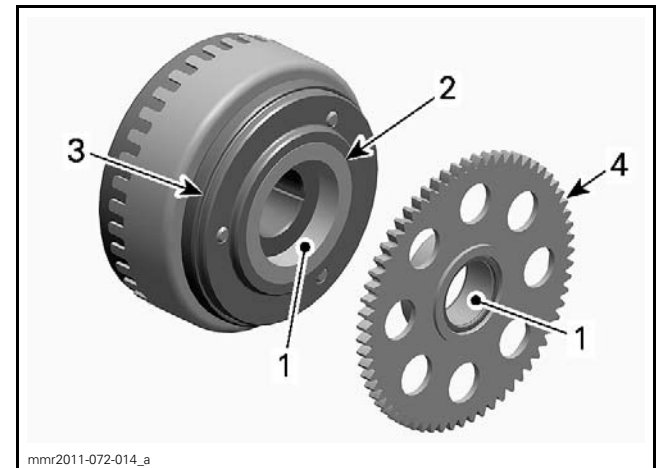
SERVICE PRODUCT
BRAKE AND PARTS CLEANER PRO S2 (P/N 779245)

2. Apply thread locker on threads of sprag clutch housing screws.

COUNTRY	SERVICE PRODUCT
Scandinavia	LOCTITE 648 (GREEN) (F) (P/N 619 600 012)
All other countries	LOCTITE 648 (GREEN) (P/N 413 711 400)

3. Loosely install screws.

4. Apply engine oil on sprag clutch and sprag clutch gear needle bearing.



1. Apply engine oil here
2. Sprag clutch
3. Sprag clutch housing
4. Sprag clutch gear

5. Install *ROTOR*, see procedure in this subsection.

6. Tighten sprag clutch housing screws to the specified torque.

TIGHTENING TORQUE	
Sprag clutch housing screws	30 N•m ± 2 N•m (22 lbf•ft ± 1 lbf•ft)

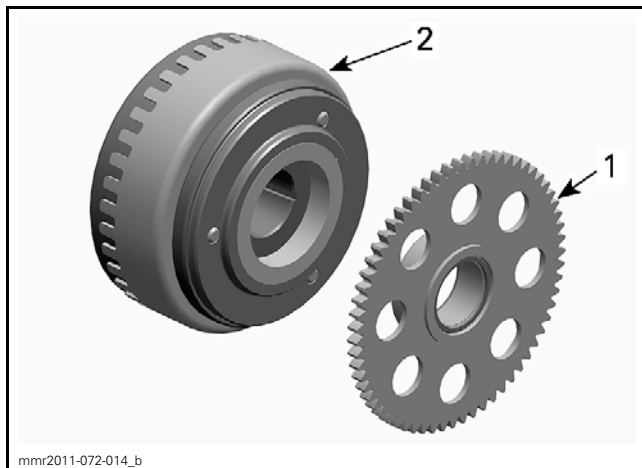
7. Install all other removed parts.

SPRAG CLUTCH GEAR

Removing the Sprag Clutch Gear

1. Remove rotor and sprag clutch gear together. Refer to *ROTOR* in this subsection.
2. Pull sprag clutch gear out of the rotor.

Subsection XX (MAGNETO AND STARTER)

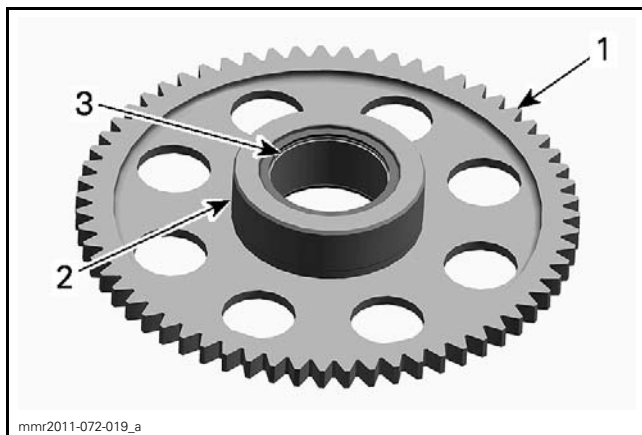


1. Sprag clutch gear
2. Rotor

Inspecting the Sprag Clutch Gear

Inspect gear, especially teeth and sprag clutch collar for wear and other damage.

Check needle bearing for wear and pittings.



1. Teeth
2. Collar
3. Needle bearing

Replace sprag clutch gear if necessary.

Installing the Sprag Clutch Gear

Reverse the removal procedure. However, pay attention to the following.

NOTE: Apply engine oil on needle bearing and collar of sprag clutch gear.

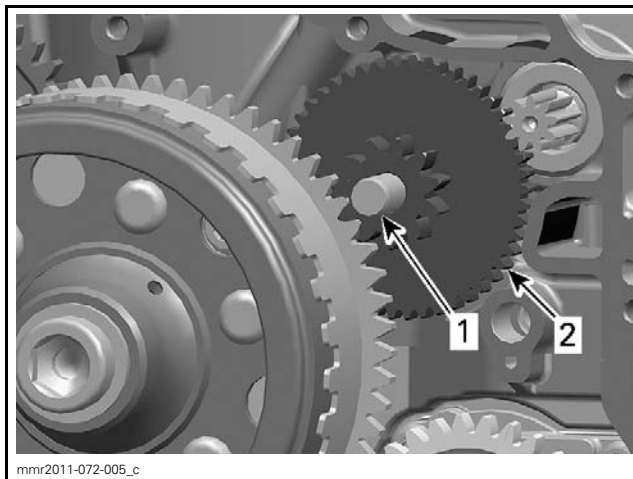
STARTER DRIVE GEARS

The starter drive gears are located on the engine MAG side, behind the magneto cover.

Removing the Starter Drive Gear

1. Remove *MAGNETO COVER*, see procedure in this subsection.

2. Remove location pin and starter double gear.



1. Location pin
2. Starter double gear

Inspecting the Starter Drive Gear

Inspect starter drive gears and location pin for wear and damage.

Replace parts if necessary.

Installing the Starter Drive Gear

Reverse the removal procedure. However, pay attention to the following.

Apply engine oil on the location pin.

STARTER

Testing the Starter Operation

Before carrying out any starter test, make sure:

- Battery is fully charged and in good condition.
- Cable connections at battery, starter and solenoid are tight.
- Cables are in good condition.

1. Disconnect the negative battery cable.

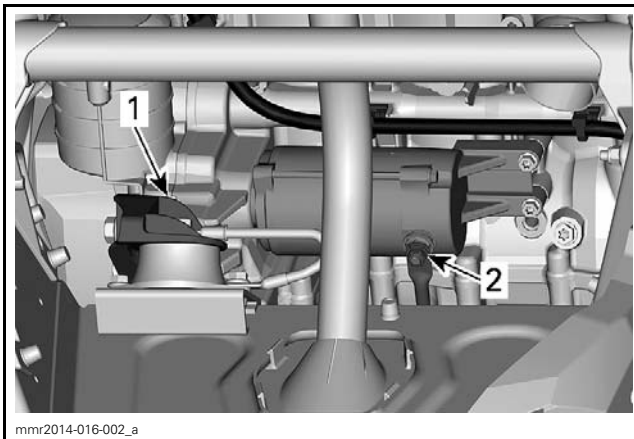
WARNING

Sparks can occur when connecting jumper cables. To avoid fire hazard, be sure that no flammable liquids or fuel vapors are in the test area.

2. Using booster cables and a fully charged battery (or a power pack), carefully supply current directly to the starter.

- 2.1 Connect the negative booster cable or power pack cable to a good ground such as an engine support.

- 2.2 Momentarily touch the starter positive terminal.



1. Engine support
2. Starter positive terminal

If starter turns at normal speed, test the starting circuit. Refer to *STARTING SYSTEM* subsection.

If starter turns slowly, carry out the *TESTING THE STARTER VOLTAGE DROP (AT BATTERY)*.

If starter does not turn, replace starter.

Testing the Starter Voltage Drop (at Battery)

NOTE: This test will confirm if starter draws too much current. Battery must be fully charged and in good condition.

1. Set multimeter to Vdc.
2. Probe battery posts.
3. Crank engine in drowned mode (accelerator held all the way in).
4. Read voltage while cranking.

NOTE: Battery voltage will drop approximately 2 Vdc and fluctuate with starter cranking load.

If the result is close to battery voltage, the starter is in good condition.

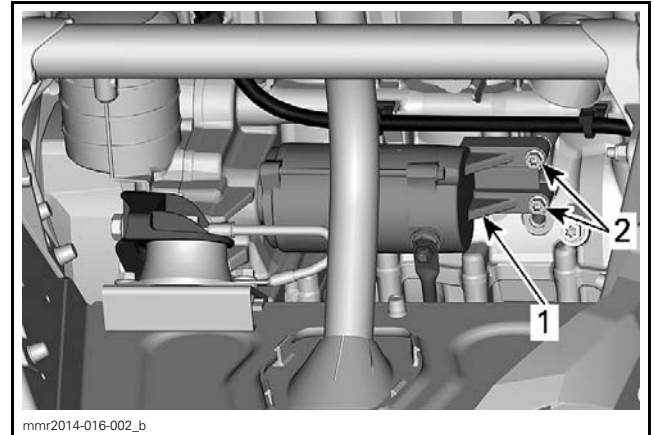
If the result is below battery voltage (- 2 Vdc and more), the starter may be defective.

Starter Location

The starter is located on the front of the engine, under the exhaust manifold..

Removing the Starter

1. Disconnect the BLACK (-) cable from the battery.
2. Remove starter cable from starter.
3. Remove starter retaining screws.



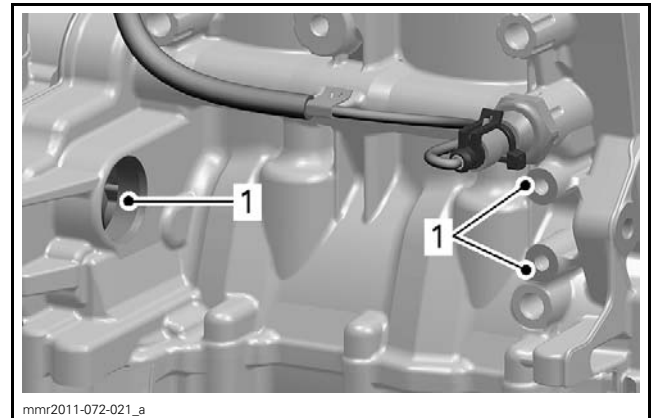
1. Starter
2. Starter retaining screws

4. Remove starter from engine.

Installing the Starter

1. Ensure starter and engine mating surfaces are free of debris.

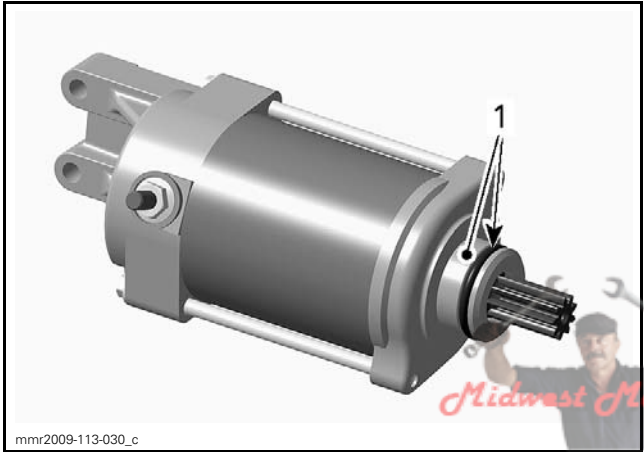
NOTICE Serious problems may arise if the starter is not properly aligned.



1. Clean mating surfaces
2. Lubricate starter boss and starter O-ring before installation.

SERVICE PRODUCT

KLÜEBER PASTE 46 MR 401 (P/N 420 297 616)



- 1. Lubricate starter boss
- 2. Lubricate starter O-ring

If you bought this manual from any other seller please leave them
NEGATIVE feedback and notify me at bestshopmanuals@gmail.com

- 3. Insert starter gear in engine.
- 4. Install starter screws and tighten to the specified torque.

TIGHTENING TORQUE	
Starter screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

- 5. Connect starter cable to starter terminal and tighten nut to specified torque.

TIGHTENING TORQUE	
Starter cable nut	7 N•m ± 1 N•m (62 lbf•in ± 9 lbf•in)

- 6. Install all other removed parts.
- 7. Reconnect BLACK (–) cable on battery post.

NOTICE Always connect RED (+) starter cable first, and BLACK (–) battery cable last.

- 8. Test for proper starter operation.



MAGNETO AND STARTER

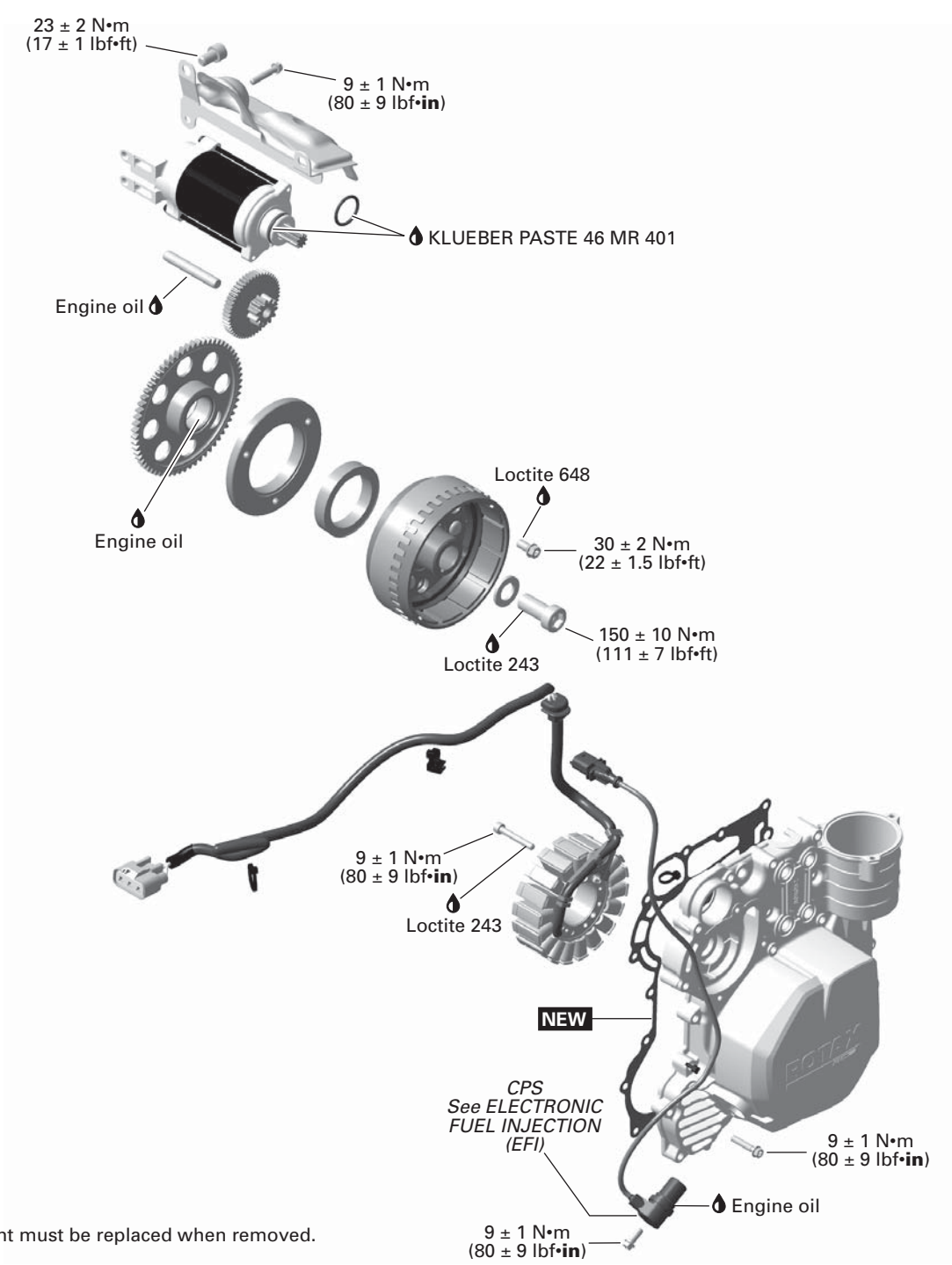
SERVICE TOOLS

Description	Part Number	Page
CRANKSHAFT PROTECTOR	529 036 213	7
FLUKE 115 MULTIMETER	529 035 868	4
FLYWHEEL PULLER.....	420 976 235	7

SERVICE PRODUCTS

Description	Part Number	Page
BRAKE AND PARTS CLEANER PRO S2	779245	7, 9
KLÜEBER PASTE 46 MR 401.....	420 297 616	11
LOCTITE 243 (BLUE).....	293 800 060	6, 8
LOCTITE 648 (GREEN).....	413 711 400	9
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	3

Subsection XX (MAGNETO AND STARTER)



NEW = Component must be replaced when removed.

RTXT03MY19-006-001_a

TROUBLESHOOTING

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

ENGINE DOES NOT CRANK

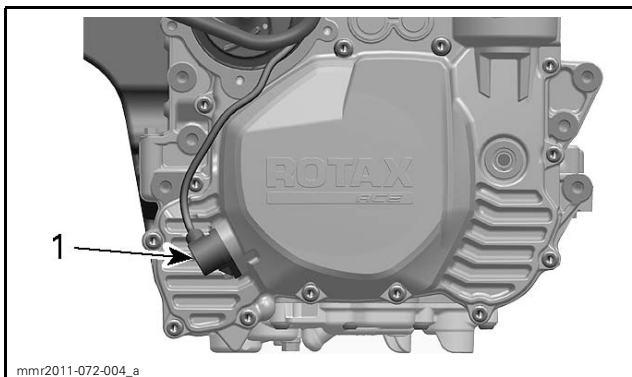
1. **Battery voltage too low.**
- Check battery condition.
2. **Starter is turning but engine does not crank.**
- Check sprag clutch for wear or other damages.
3. **Starter is defective.**
- Check starter condition. Perform *TESTING THE STARTER OPERATION* and *TESTING THE STARTER VOLTAGE DROP*.
4. **Engine is only cranking 1 - 2 seconds before it stops.**
- Check battery condition.

PROCEDURES

MAGNETO COVER

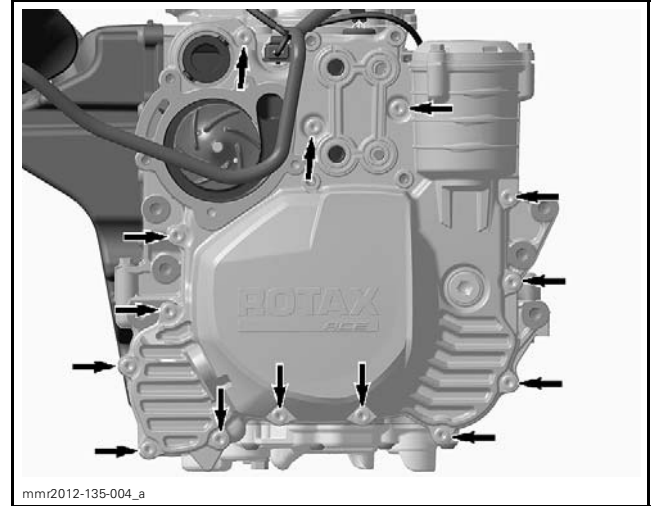
Removing the Magneto Cover

1. Refer to *ENGINE REMOVAL AND INSTALLATION* and remove engine.
2. Refer to *LUBRICATION SYSTEM* and drain engine oil.
3. Refer to *COOLING SYSTEM* and remove:
 - Water pump housing
 - Thermostat housing.
4. Refer to *LUBRICATION SYSTEM* subsection and remove:
 - Oil pressure regulator
 - Oil cooler.
5. Remove the CPS.



1. CPS

6. Remove magneto cover retaining screws.



MAGNETO COVER SCREWS

7. Place an oil pan under magneto area to catch remaining oil.
8. Pull magneto cover off.
9. Discard the magneto cover gasket.

Inspecting the Magneto Cover

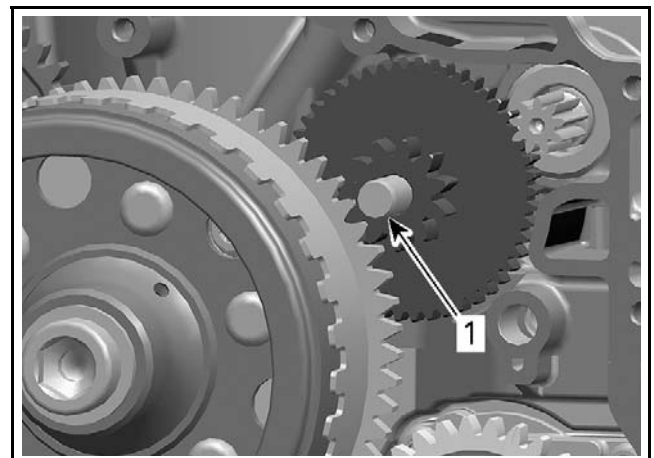
Check magneto cover for cracks or other damage. Replace if necessary.

Installing the Magneto Cover

1. Clean magneto cover.

MAGNETO COVER CLEANING	
Service product	LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500)

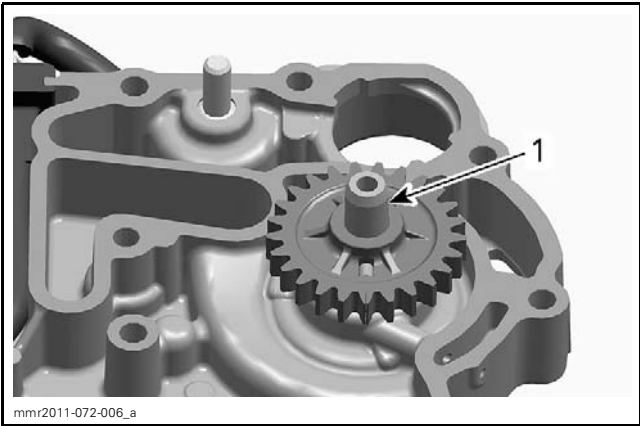
2. Install a **NEW** magneto cover gasket.
3. Ensure starter drive gear pin is in place.
4. Apply engine oil on starter drive gear pin.



APPLY ENGINE OIL

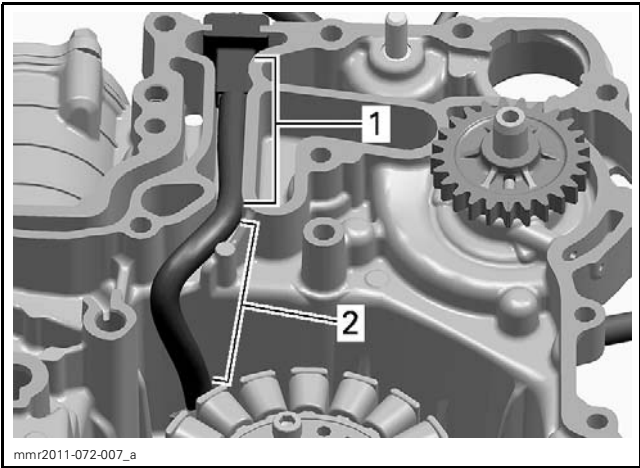
1. Starter drive gear pin

5. Apply engine oil on water pump shaft.



1. Water pump shaft - apply engine oil

NOTICE Make sure the stator cable harness is embedded in the cover channel provided. The part of the harness that is out of the channel must be tight, otherwise it might chafe or jam.



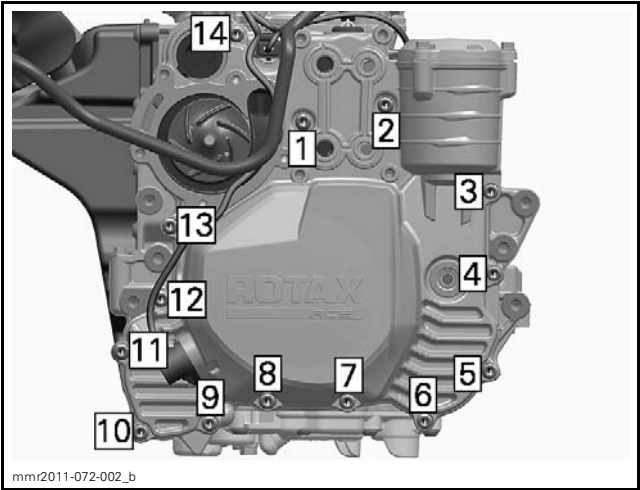
1. Embedded in that area
2. Tight in this area

6. Carefully install magneto cover.

CAUTION Magnetic force between magneto flywheel and stator is very high. Avoid finger contusions.

7. Tighten to specification magneto cover screws according to the following sequence.

TIGHTENING TORQUE	
Magneto cover screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



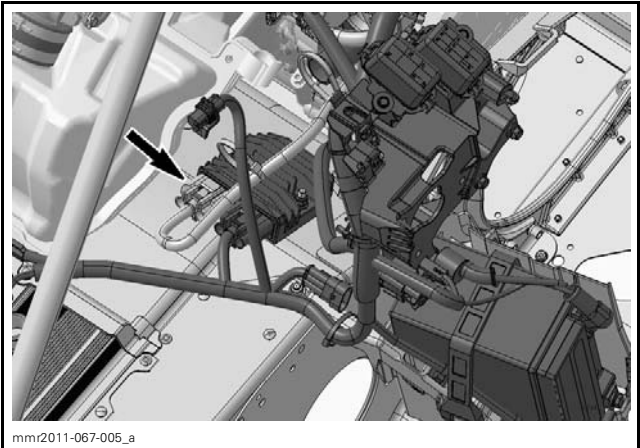
TIGHTENING SEQUENCE

8. Install all other removed parts, refer to applicable subsections.

STATOR

Stator Connector Location

1. Move fuel tank backward to reach the stator connector. Refer to *MOVING FUEL TANK REARWARD FOR SERVICING* in *FUEL TANK AND FUEL PUMP* subsection.



TYPICAL - SOME PARTS REMOVED FOR CLARITY

Testing the Stator Continuity

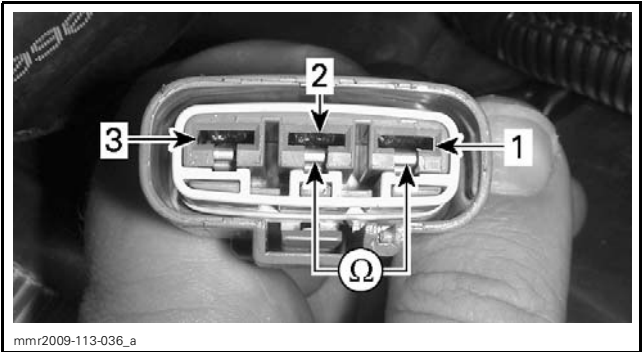
1. Disconnect the stator connector from voltage regulator, refer to *STATOR CONNECTOR LOCATION* in this subsection.

2. Set multimeter to Ω .

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

3. Probe each pair of YELLOW wires by touching (NOT inserting) terminals lock tabs as shown.

NOTICE Never insert a multimeter probe into a terminal as it would ruin the terminal.



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

4. Read resistance as per following table.

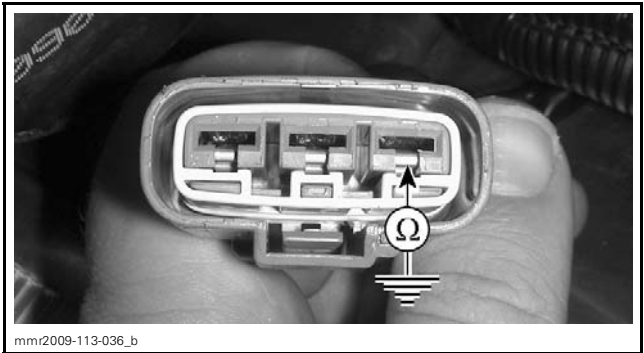
STATOR CONTINUITY TEST	
YELLOW WIRES (EACH PAIR)	RESISTANCE @ 20°C (68°F)
Pins 1 and 2	0.1 - 1 Ω
Pins 1 and 3	
Pins 2 and 3	

If any resistance reading is not as specified, the stator or the wiring (including connector) is open and needs to be repaired or replaced.

If resistance is good, perform the stator insulation test.

Testing the Stator Insulation

1. Connect multimeter between any YELLOW wire and chassis ground.



2. Read resistance.

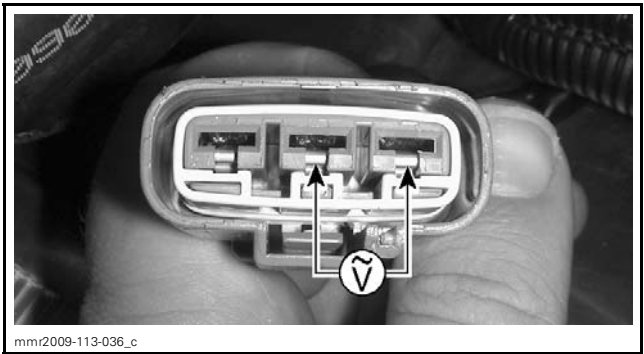
STATOR INSULATION TEST	
PROBE POSITIONS	RESISTANCE @ 20°C (68°F)
Any YELLOW wire and chassis ground	Infinity (OL)

If any resistance reading is not as specified, the stator or the wiring is shorted to ground and needs to be repaired or replaced.

If the insulation test is good, perform the output voltage test.

Testing the Stator Output Voltage

1. Start engine and let it reach its operating temperature.
2. Set multimeter to Vac scale.
3. With engine idling, connect multimeter between each pair of YELLOW wires.



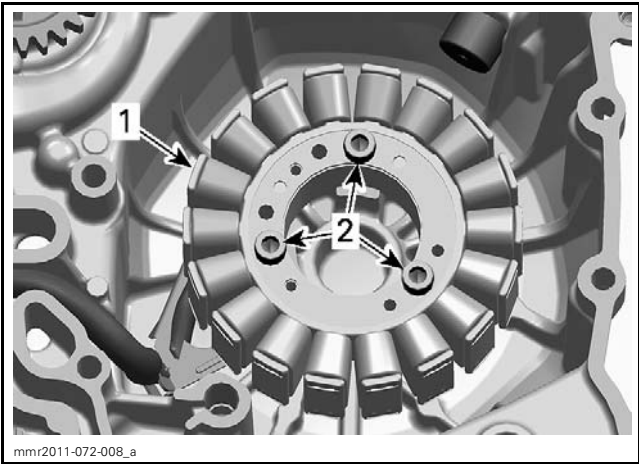
4. Read voltage.

STATOR OUTPUT VOLTAGE TEST		
TEST ENGINE SPEED	TERMINAL	VOLTAGE
Idle speed	1 and 2	± 25 Vac
	1 and 3	
	2 and 3	

If any voltage reading is significantly lower than specification, replace the stator.

Removing the Stator

- 1. Remove the *MAGNETO COVER*, see procedure in this subsection.
- 2. Remove stator retaining screws.



- 1. Stator
- 2. Stator retaining screws

- 3. Remove stator.

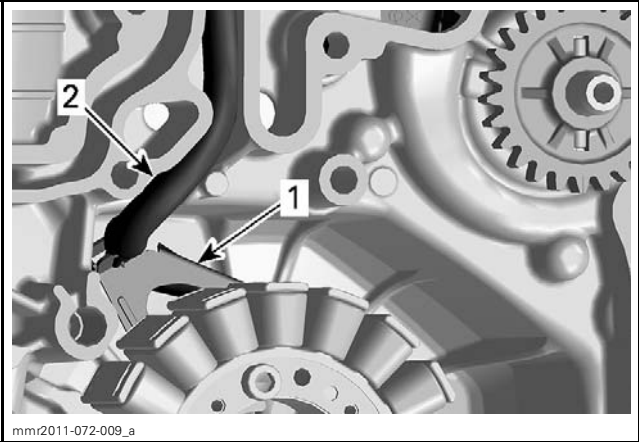
Inspecting the Stator

Check stator windings and insulation for cracks and other damages. If damaged replace it.

Check if stator wires are brittle, hard or otherwise damaged.

Installing the Stator

- 1. Ensure stator cable is underneath cable holder during installation of stator.



- 1. Cable holder
- 2. Stator cable

- 2. Install stator retaining screws and tighten to specified torque.

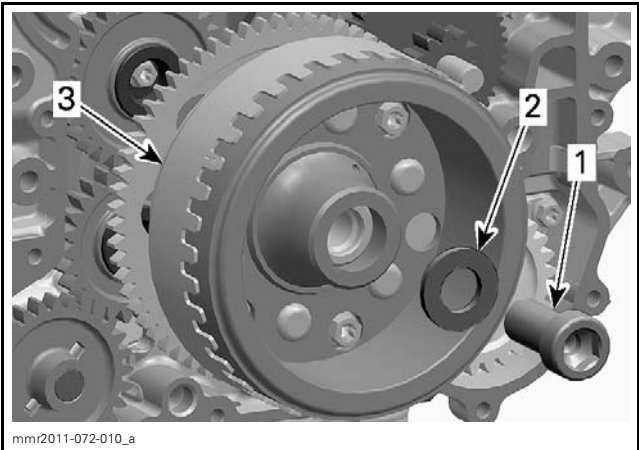
TIGHTENING TORQUE	
Stator retaining screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)
	+ LOCTITE 243 (BLUE) (P/N 293 800 060)

- 3. Reinstall *MAGNETO COVER*, see procedure in this subsection.

ROTOR

Removing the Rotor

- 1. Remove *MAGNETO COVER*, see procedure in this subsection.
- 2. Lock crankshaft. Refer to *BOTTOM END* subsection.
- 3. Remove rotor retaining screw and lock washer.

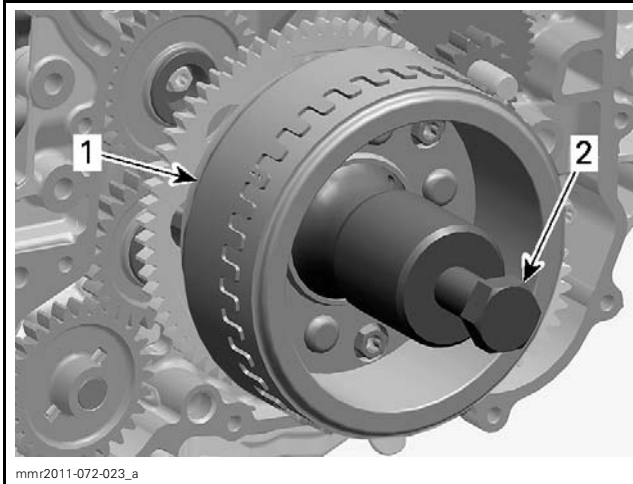


- 1. Retaining screw
- 2. Lock washer
- 3. Rotor

- 4. Remove rotor.

REQUIRED TOOLS	
CRANKSHAFT PROTECTOR (P/N 529 036 213)	
FLYWHEEL PULLER (P/N 420 976 235)	

NOTE: Apply some grease on the crankshaft protector surface to ease puller operation.



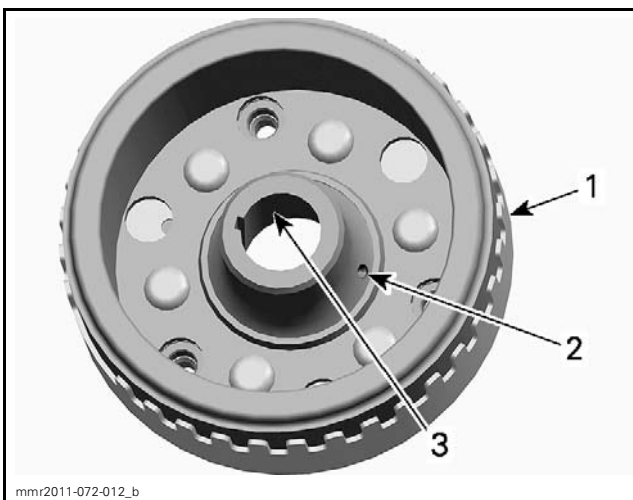
1. Rotor
2. Flywheel puller screw

Inspecting the Rotor

Check the inner side of the rotor for scratches or other damage.

Check keyway for wear or damages.

Check if trigger wheel teeth are bent or otherwise damaged.



1. Rotor with trigger wheel
2. Oil passage in magneto hub
3. Rotor taper

Check woodruff key and keyway on crankshaft for wear or damages.

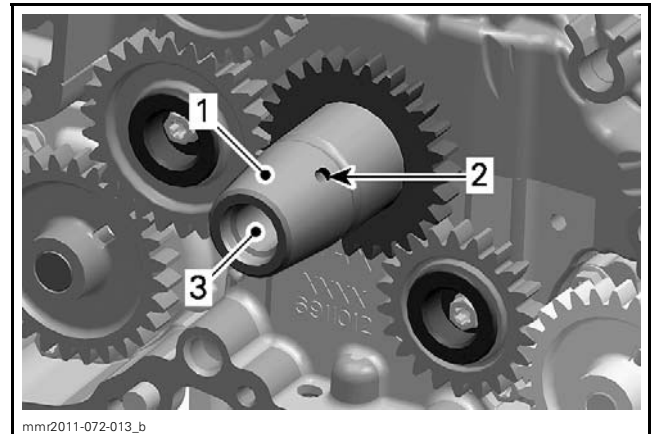
Replace parts as necessary.

Installing the Rotor

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

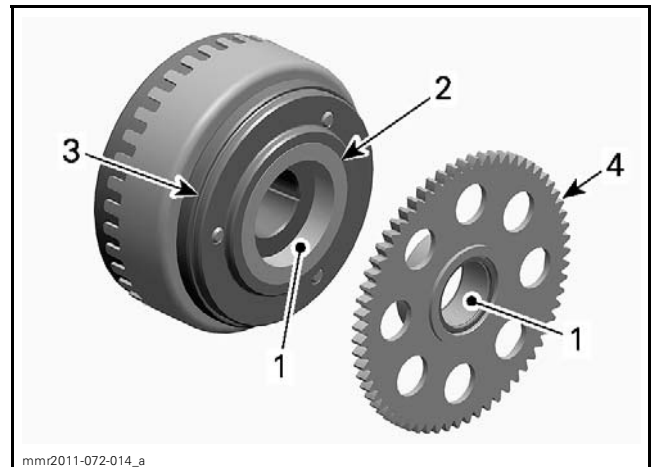
1. Blow compressed air through oil passage in magneto hub. Check if it is clogged.
2. Using BRAKE AND PARTS CLEANER PRO S2 (P/N 779245), clean:
 - The oil passage
 - The crankshaft thread
 - The crankshaft taper
 - The rotor taper.

NOTICE Taper on crankshaft and rotor must be free of grease.



1. Crankshaft taper
2. Oil passage
3. Thread

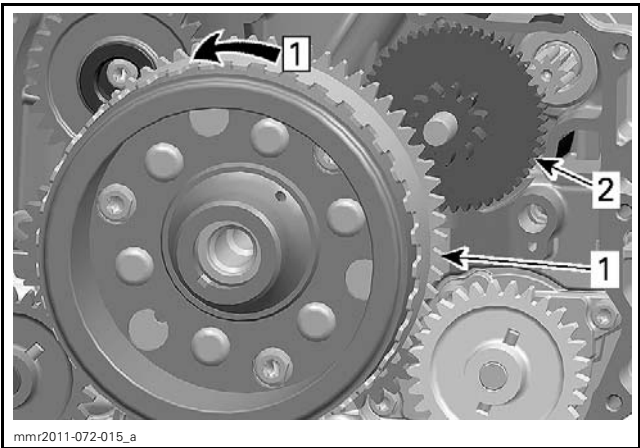
3. Apply oil on sprag clutch and needle bearing.
4. Install sprag clutch gear onto the rotor.



1. Apply engine oil here
2. Sprag clutch
3. Sprag clutch housing
4. Sprag clutch gear

Subsection XX (MAGNETO AND STARTER)

- 5. Slide rotor along with the sprag clutch gear onto the crankshaft. The woodruff key and keyway must be aligned.
- 6. Rotate sprag clutch gear counterclockwise to align with starter double gear.



Step 1: Rotate to align teeth

- 1. Sprag clutch gear
- 2. Starter double gear

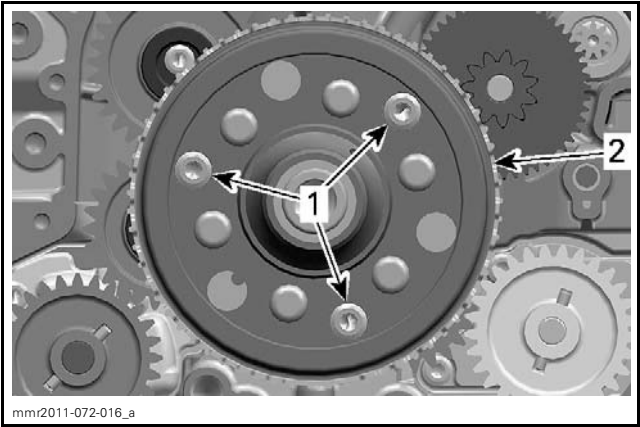
- 7. Install washer and retaining screw.
- 8. Tighten to specified torque.

TIGHTENING TORQUE	
Rotor retaining screw	150 N•m ± 10 N•m (111 lbf•ft ± 7 lbf•ft)
	+ LOCTITE 243 (BLUE) (P/N 293 800 060)

SPRAG CLUTCH

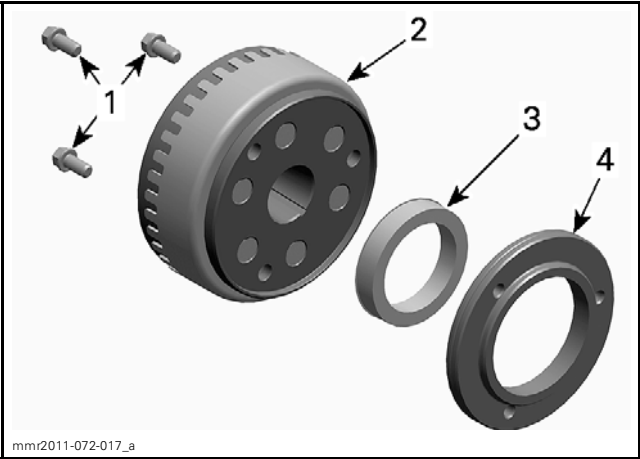
Removing the Sprag Clutch

- 1. Remove the *MAGNETO COVER*, see procedure in this subsection.
- 2. Lock crankshaft. Refer to *BOTTOM END* subsection.
- 3. Loosen and remove sprag clutch housing screws.



- 1. Sprag clutch housing screws
- 2. Rotor

- 4. Remove *ROTOR*, see procedure in this subsection.
- 5. Remove sprag clutch housing.
- 6. Remove sprag clutch from sprag clutch housing.



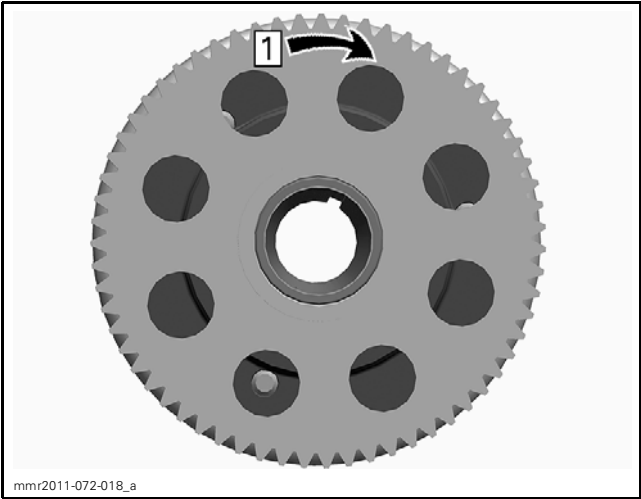
- 1. Sprag clutch housing screws
- 2. Rotor
- 3. Sprag clutch
- 4. Sprag clutch housing

Inspecting the Sprag Clutch

Inspect sprag clutch and sprag clutch housing for wear and damage.

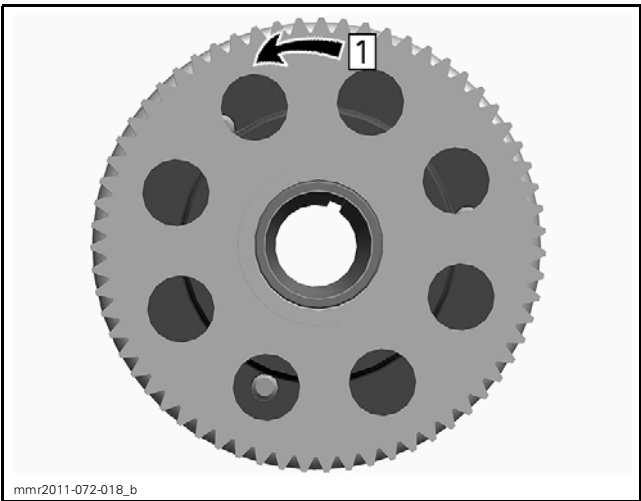
Check the collar of the sprag clutch gear, refer to *SPRAG CLUTCH GEAR* in this subsection.

Rotate sprag clutch gear clockwise. Gear must rotate freely.



Step 1: Free

Rotate sprag clutch gear counterclockwise. Gear must lock.



Step 1: Lock

Installing the Sprag Clutch

1. Clean sprag clutch housing with a parts cleaner.

NOTICE Threads of sprag clutch housing must be free of any lubricants.

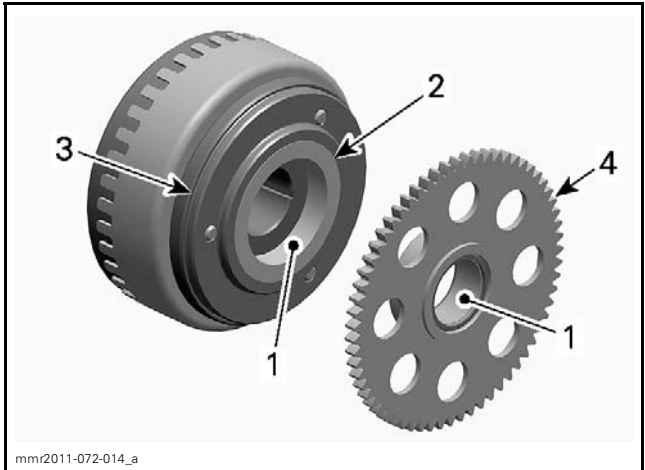
SPRAG CLUTCH HOUSING	
Service product	BRAKE AND PARTS CLEANER PRO S2 (P/N 779245)

2. Apply thread locker on threads of sprag clutch housing screws.

SPRAG CLUTCH HOUSING SCREWS	
Service product	LOCTITE 648 (GREEN) (P/N 413 711 400)

3. Loosely install screws.

4. Apply engine oil on sprag clutch and sprag clutch gear needle bearing.



1. Apply engine oil here
2. Sprag clutch
3. Sprag clutch housing
4. Sprag clutch gear

5. Install *ROTOR*, see procedure in this subsection.

6. Tighten sprag clutch housing screws to the specified torque.

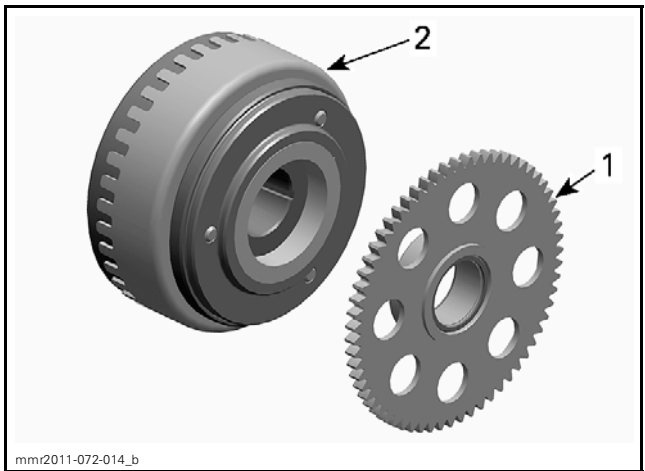
TIGHTENING TORQUE	
Sprag clutch housing screws	30 N•m ± 2 N•m (22 lbf•ft ± 1 lbf•ft)

7. Install all other removed parts.

SPRAG CLUTCH GEAR

Removing the Sprag Clutch Gear

1. Remove rotor and sprag clutch gear together. Refer to *ROTOR* in this subsection.
2. Pull sprag clutch gear out of the rotor.

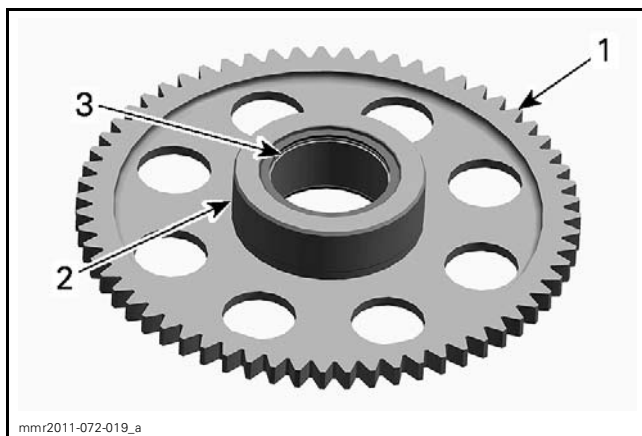


1. Sprag clutch gear
2. Rotor

Inspecting the Sprag Clutch Gear

Inspect gear, especially teeth and sprag clutch collar for wear and other damage.

Check needle bearing for wear and pittings.



1. Teeth
2. Collar
3. Needle bearing

Replace sprag clutch gear if necessary.

Installing the Sprag Clutch Gear

Reverse the removal procedure. However, pay attention to the following.

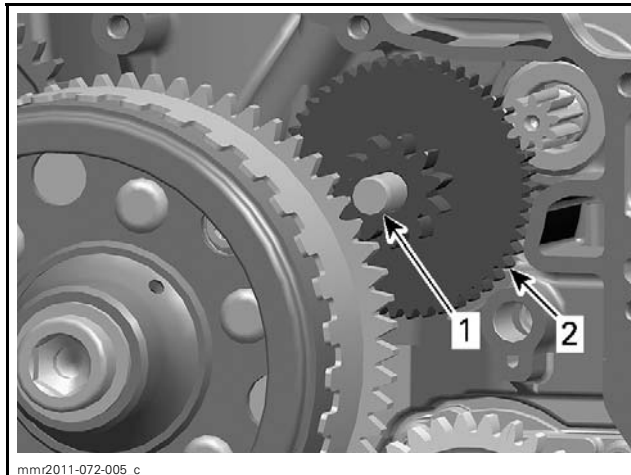
NOTE: Apply engine oil on needle bearing and collar of sprag clutch gear.

STARTER DRIVE GEARS

The starter drive gears are located on the engine MAG side, behind the magneto cover.

Removing the Starter Drive Gear

1. Remove *MAGNETO COVER*, see procedure in this subsection.
2. Remove location pin and starter double gear.



1. Location pin
2. Starter double gear

Inspecting the Starter Drive Gear

Inspect starter drive gears and location pin for wear and damage.

Replace parts if necessary.

Installing the Starter Drive Gear

The installation is the reverse of the removal procedure. However, pay attention to the following. Apply engine oil on the location pin.

STARTER

Testing the Starter Operation

Before carrying out any starter test, make sure:

- Battery is fully charged and in good condition.
- Cable connections at battery, starter and solenoid are tight.
- Cables are in good condition.

1. Disconnect the negative battery cable.

WARNING

Sparks can occur when connecting jumper cables. To avoid fire hazard, be sure that no flammable liquids or fuel vapors are in the test area.

2. Using booster cables and a fully charged battery (or a power pack), carefully supply current directly to the starter.
 - 2.1 Connect the negative booster cable or power pack cable to a good ground such as an engine support.
 - 2.2 Momentarily touch the starter positive terminal.

If starter turns at normal speed, test the starting circuit. Refer to *STARTING SYSTEM* subsection.
If starter turns slowly, carry out the *STARTER VOLTAGE DROP TEST (AT BATTERY)*.

If starter does not turn, replace starter.

Testing the Starter Voltage Drop (at Battery)

NOTE: This test will confirm if starter draws too much current. Battery must be fully charged and in good condition.

1. Set multimeter to Vdc.
2. Probe battery posts.
3. Crank engine in drowned mode (accelerator held all the way in).
4. Read voltage while cranking.

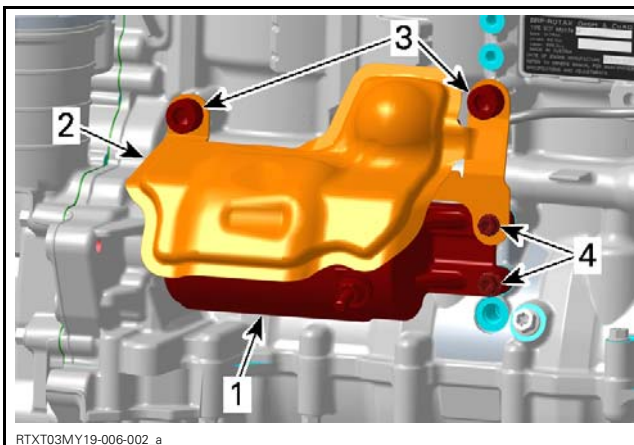
NOTE: Battery voltage will drop approximately 2 Vdc and fluctuate with starter cranking load.

If the result is close to battery voltage, the starter is in good condition.

If the result is below battery voltage (- 2 Vdc and more), the starter may be defective.

Removing the Starter

1. Remove turbo charger. Refer to *TURBO CHARGER* subsection.
2. Disconnect the BLACK (-) cable from the battery.
3. Remove starter cable from starter.
4. Remove heat shield and starter retaining screws.



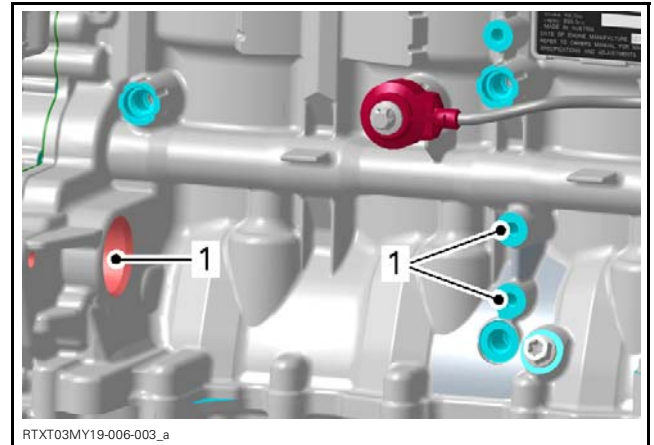
1. Starter
2. Heat shield
3. Heat shield retaining screws (2x)
4. Starter retaining screws (2x)

5. Remove starter from engine.

Installing the Starter

1. Ensure starter and engine mating surfaces are free of debris.

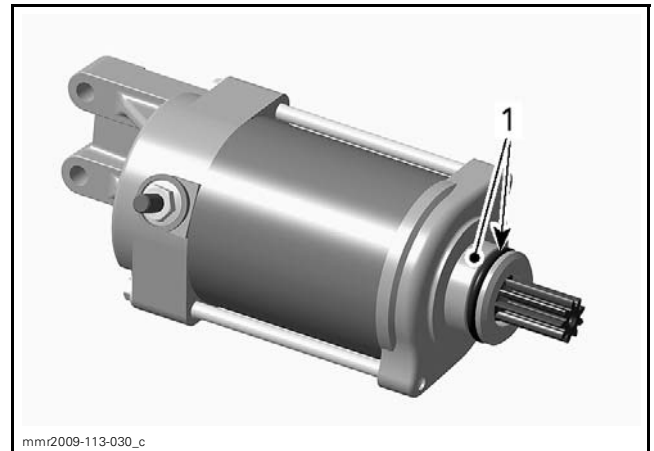
NOTICE Serious problems may arise if the starter is not properly aligned.



1. Clean mating surfaces

2. Lubricate starter boss and starter O-ring before installation.

STARTER BOSS +O-RING	
Service product	KLÜEBER PASTE 46 MR 401 (P/N 420 297 616)



1. Lubricate starter boss
2. Lubricate starter O-ring

3. Insert starter gear in engine.
4. Install heat shield.
5. Install heat shield and starter retaining screws and tighten to the specified torque.

Subsection XX (MAGNETO AND STARTER)

TIGHTENING TORQUE	
Starter retaining screws M6	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)
Heat shield retaining screws M10	23 N•m ± 2 N•m (17 lbf•ft ± 1 lbf•ft)

6. Connect starter cable to starter terminal and tighten nut to specified torque.

TIGHTENING TORQUE	
Starter cable nut	7 N•m ± 1 N•m (62 lbf•in ± 9 lbf•in)

7. Install all other removed parts.
8. Reconnect BLACK (–) cable on battery post.

NOTICE Always connect RED (+) starter cable first, and BLACK (-) battery cable last.

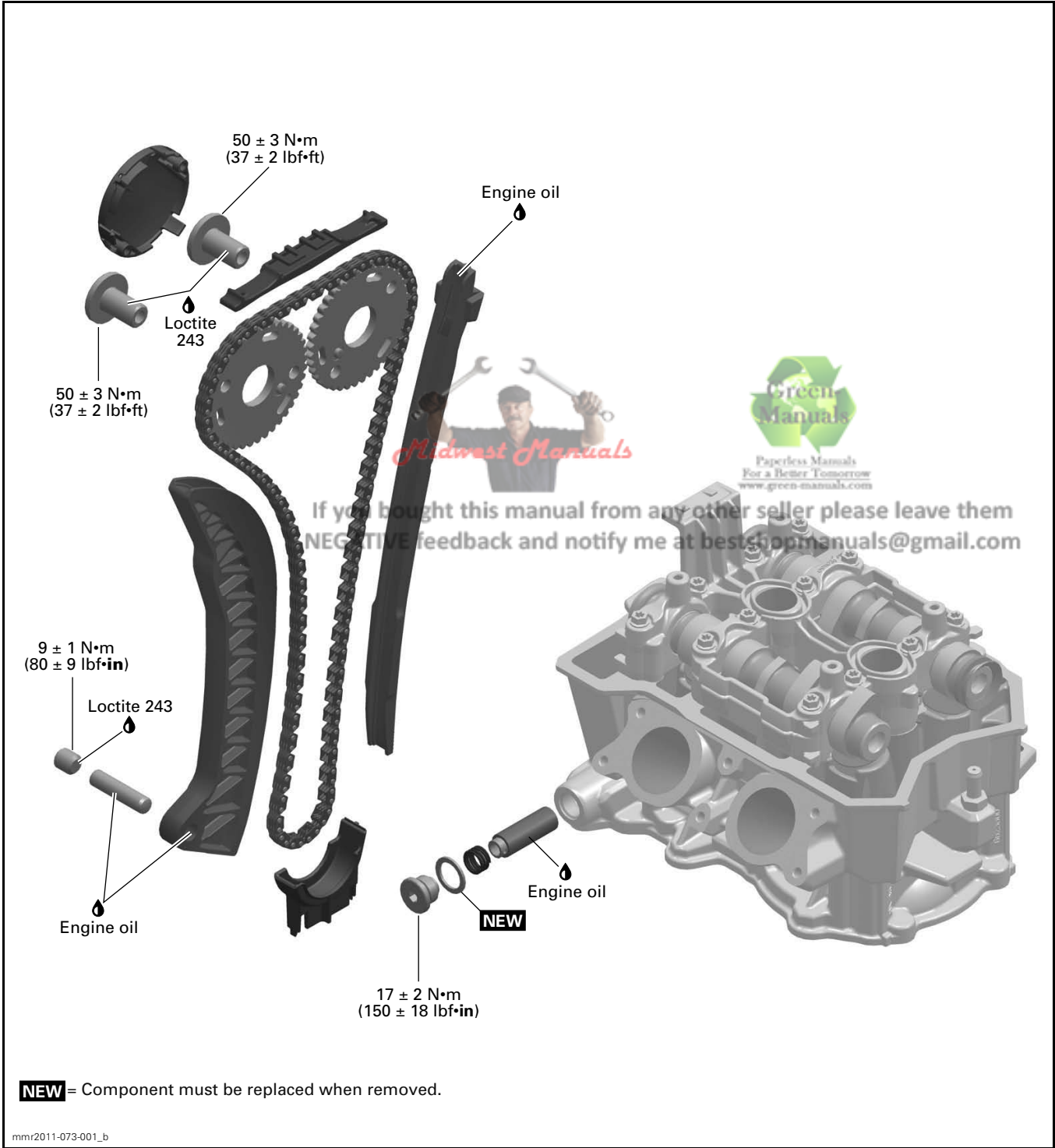
9. Test for proper starter operation.

TIMING CHAIN

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE).....	293 800 060	100, 105
LOCTITE 767 (ANTISEIZE LUBRICANT)	293 800 070	103
SUPER LUBE GREASE.....	293 550 030	103

Section 02 ENGINE (600 ACE)
Subsection 07 (TIMING CHAIN)



GENERAL

Engine removal is necessary to work on the following components:

- Timing chain
- Timing chain guide (tensioner side).

When disassembling parts that are duplicated in the engine, (e.g.: valves, springs, etc.), it is strongly recommended to note their position and to keep the parts of the same assembly as a "group". If you find a defective component, it will be much easier to find the cause of the failure. Since parts were broken-in together during engine operation, they will maintain their matched fit when reassembled together within their "group".

TROUBLESHOOTING

The following is provided to help in diagnosing the probable source of troubles. It is a guideline and should not be assumed to provide solutions to every cause of all problems.

UNUSUAL ENGINE NOISE OR VIBRATIONS

1. **Faulty chain tensioner.**
- Replace chain tensioner.
2. **Chain guide(s) worn out.**
- Replace chain guide(s).
3. **Stretched timing chain or worn sprockets.**
- Replace timing chain and sprockets.
4. **Camshaft timing gear screws loose.**
- Retighten screws to recommended torque.
5. **Incorrect camshaft timing adjustment.**
- Replace damaged components and readjust camshaft timing.

ENGINE LACKS ACCELERATION OR POWER

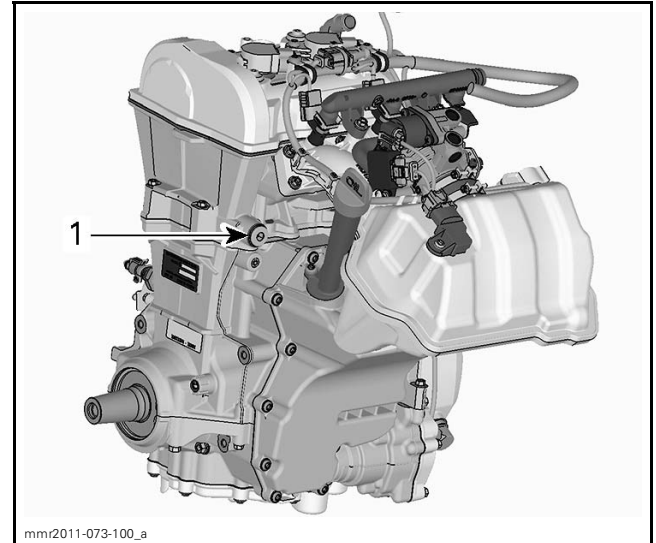
1. **Incorrect camshaft timing adjustment.**
- Replace damaged components and readjust camshaft timing.

PROCEDURES

TIMING CHAIN TENSIONER

Timing Chain Tensioner Location

The timing chain tensioner is located in the cylinder head beside the intake port of the PTO cylinder.



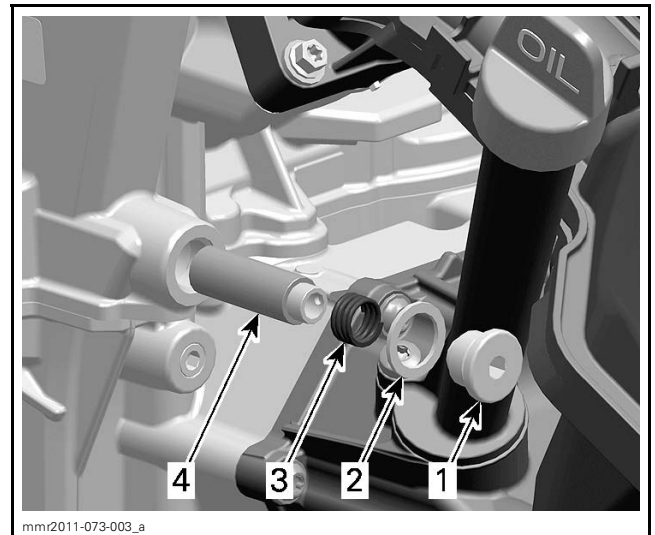
1. Screw plug location, timing chain tensioner

Timing Chain Tensioner Access

Remove driven pulley and countershaft. Refer to *DRIVEN PULLEY AND COUNTERSHAFT* subsection.

Timing Chain Tensioner Removal

1. Lock crankshaft, refer to *BOTTOM END* subsection.
2. Remove screw plug and discard the sealing washer.
3. Pull out spring and chain tensioner.



1. Screw plug
2. Sealing washer
3. Spring
4. Chain tensioner

Timing Chain Tensioner Inspection

1. Check chain tensioner for scoring and freedom of movement in bore.

Section 02 ENGINE (600 ACE)
Subsection 07 (TIMING CHAIN)

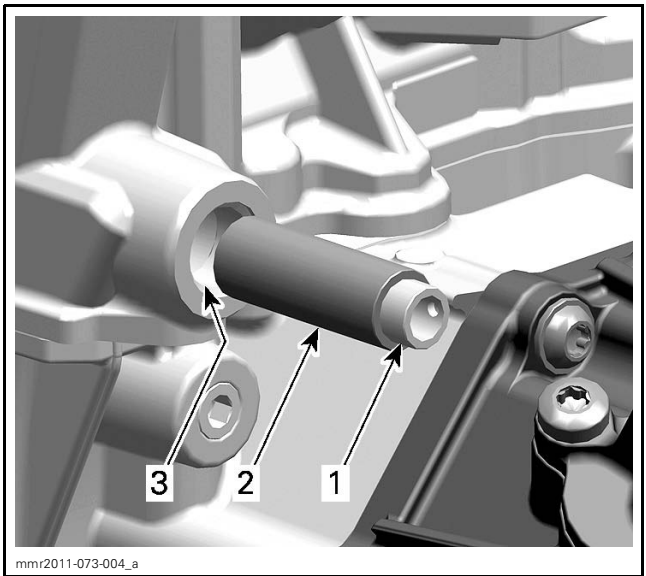
2. Compress chain tensioner and check for proper operation.

NOTE: The chain tensioner is difficult to compress when properly charged with oil, and easily compressed when it is not.

3. Check spring for straightness, corrosion and other visible damage.

Timing Chain Tensioner Installation

- 1. Apply engine oil on chain tensioner.
- 2. Insert chain tensioner in its bore with the plunger pointing outwards.



TIMING CHAIN TENSIONER INSTALLATION

- 1. Plunger
- 2. Chain tensioner
- 3. Tensioner bore in cylinder head

- 3. Install spring on chain tensioner.
- 4. Tighten screw plug to specified torque.

SCREW PLUG TIMING CHAIN TENSIONER	
Sealing washer	NEW
Tightening torque	17 N•m ± 2 N•m (150 lbf•in ± 18 lbf•in)

5. Install all other removed parts.

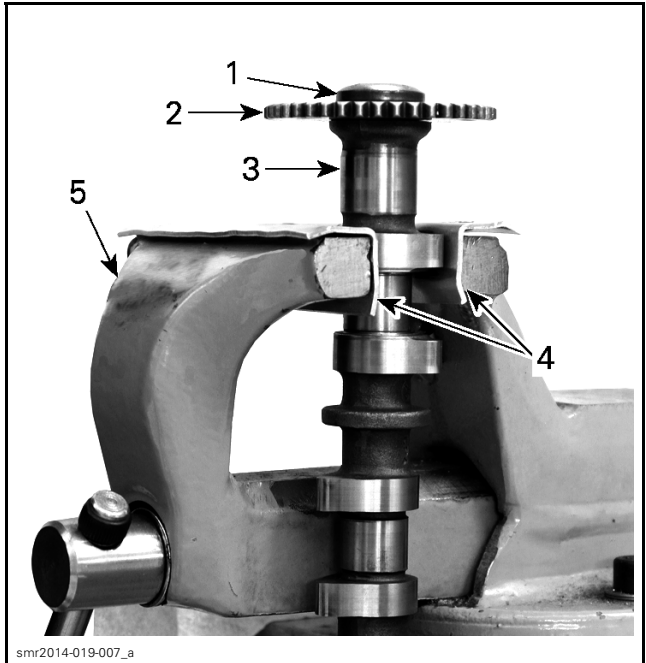
CAMSHAFT TIMING GEARS

Camshaft Timing Gear Removal

- 1. Remove camshaft assembly. Refer to *BOTTOM END* subsection.
- 2. Clamp camshaft in a vice using aluminium protectors.

NOTICE Take care not damaging the cams.

- 3. Unscrew and remove camshaft timing gear screw.
- 4. Remove camshaft timing gear.



TYPICAL

- 1. Camshaft timing gear screw
- 2. Camshaft timing chain gear
- 3. Camshaft
- 4. Aluminium protectors
- 5. Vice

Camshaft Timing Gear Inspection

Check camshaft timing gears for wear or deterioration. If a gear is worn or damaged, replace camshaft timing gears and timing chain as a set.

NOTE: For crankshaft timing gear inspection, refer to *BOTTOM END* subsection.

Camshaft Timing Gear Installation

Reverse the removal procedure. However, pay attention to the following details.

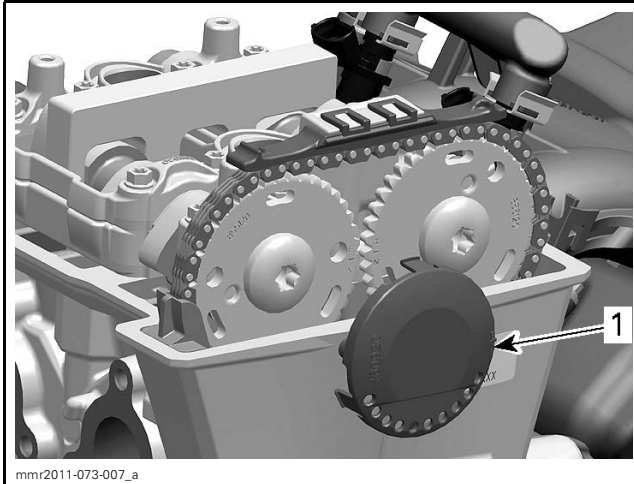
Tighten camshaft timing gear screw to specification.

NOTICE Do not torque timing gear screws when camshafts are installed in cylinder head to avoid overstressing timing chain.

TIMING GEAR SCREWS	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening torque	50 N•m ± 3 N•m (37 lbf•ft ± 2 lbf•ft)

NOTICE Improper camshaft timing will damage engine components. Make sure camshafts and crankshaft are still locked. If not, lock them before beginning this procedure. Refer to *CAMSHAFTS* in the *TOP END* subsection.

Install breather cover on exhaust camshaft.



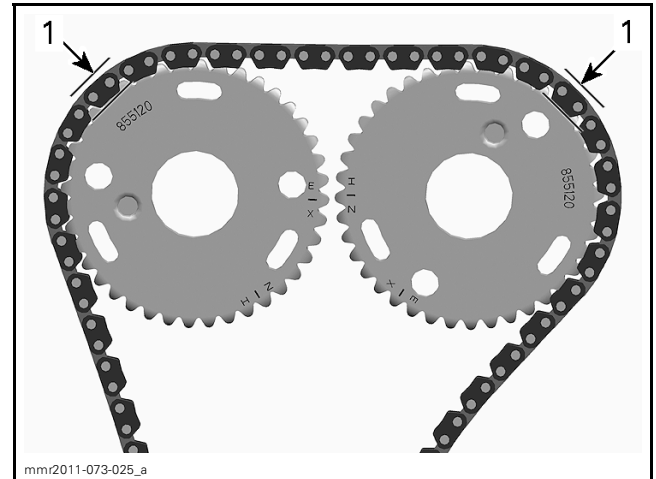
1. Breather cover

Install remaining parts.

TIMING CHAIN

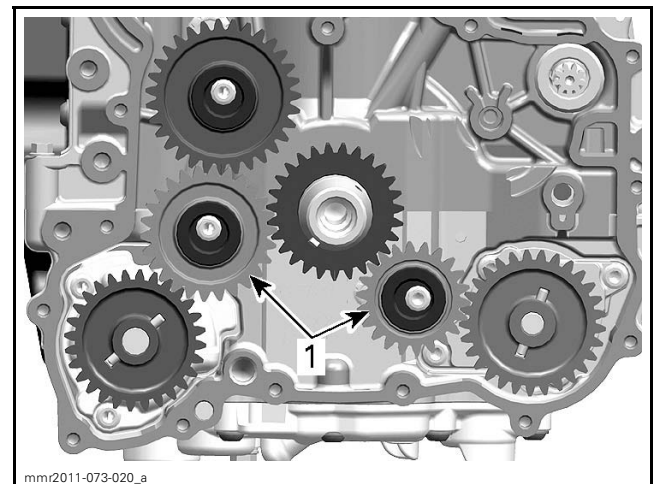
Timing Chain Removal

1. Remove engine from vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
2. Remove air intake manifold, refer to *AIR INTAKE SYSTEM* subsection.
3. Remove valve cover, refer to *BOTTOM END* subsection.
4. Refer to *LUBRICATION SYSTEM* subsection and remove the following parts:
 - Oil tank
 - Oil pressure regulator valve
 - Oil cooler
 - Oil sump cover.
5. Refer to *COOLING SYSTEM* subsection and remove following parts:
 - Water pump housing
 - Thermostat.
6. Check timing chain for excessive radial play while still installed on timing gears.



1. Radial play

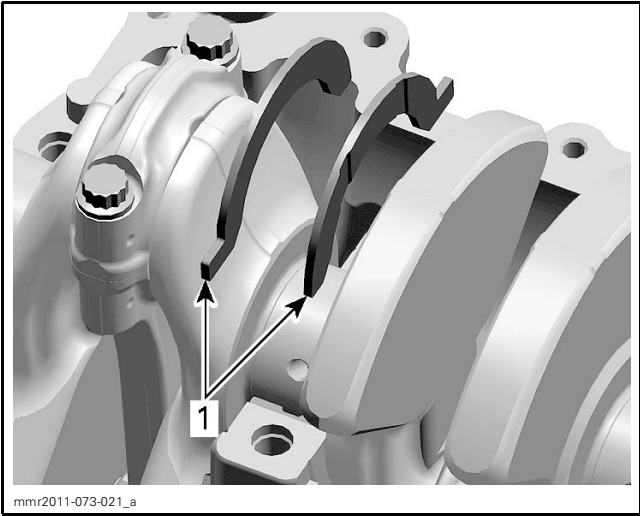
7. Remove the *CAMSHAFTS*, refer to *BOTTOM END* subsection.
8. Refer to *MAGNETO AND STARTER* subsection and remove the following parts:
 - Magneto cover
 - Rotor
 - Starter drive gears.
9. Remove oil pump intermediate gears, refer to *LUBRICATION SYSTEM* subsection.



1. Oil pump intermediate gears

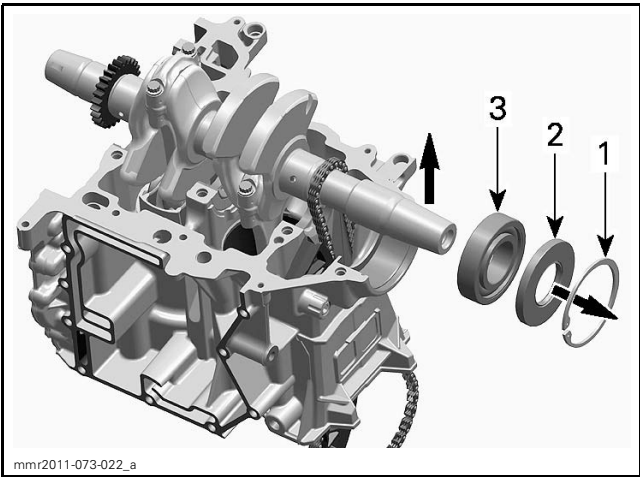
10. Remove crankshaft locking bolt.
11. Separate cylinder block, refer to *BOTTOM END* subsection.
12. Remove crankshaft thrust washers.

Section 02 ENGINE (600 ACE)
Subsection 07 (TIMING CHAIN)



1. Crankshaft thrust washers

- 13. Remove retaining ring that secures the oil seal and PTO ball bearing.
- 14. Slightly lift the crankshaft and remove oil seal and PTO ball bearing.

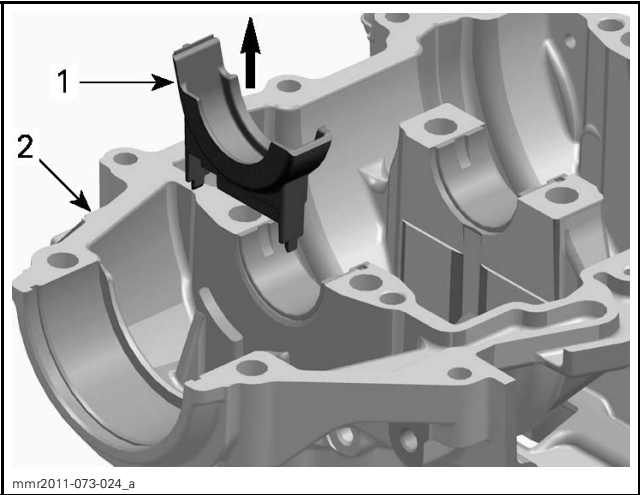


1. Retaining ring
2. Oil seal
3. Ball bearing

- 15. Remove timing chain.

NOTE: Make a mark on the timing chain to indicate the operating direction of the chain before removal.

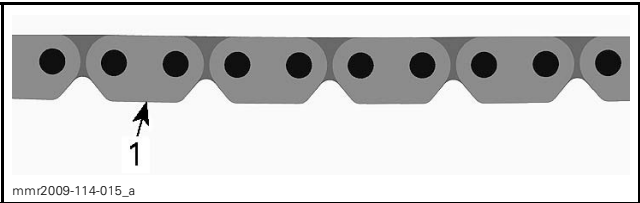
- 16. Remove lower timing chain guide from lower half of cylinder block.



1. Lower timing chain guide
2. Lower half of cylinder block

Timing Chain Inspection

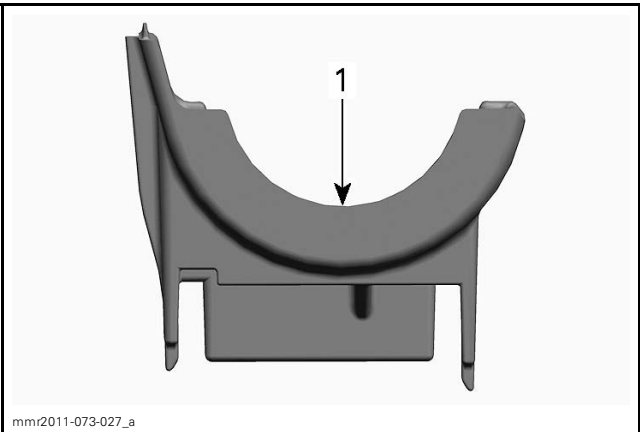
Check timing chain for wear and teeth condition.



1. Check teeth condition

NOTICE If timing chain is excessively worn or damaged, replace timing chain and camshaft timing gears as a set.

Check lower chain guide for wear, cracks or deformation. Replace as required.



1. Lower chain guide

Replace lower chain guide if timing chain wear grooves are visible.

CHAIN GUIDE GROOVE DEPTH	
SERVICE LIMIT	No timing chain wear groove allowed

NOTE: Also check the chain guide, tensioner side. Refer to *CHAIN GUIDE INSPECTION (TENSIONER SIDE)* further in this subsection.

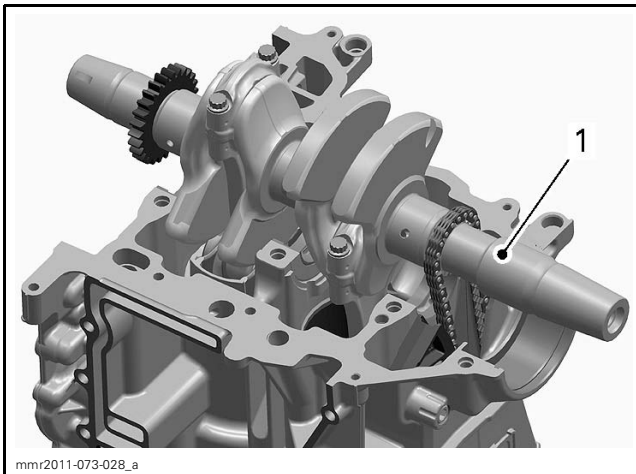
Timing Chain Installation

Reverse of the removal procedure. However, pay attention to the following details.

1. Install timing chain.

NOTE: If the same timing chain is reinstalled, be sure to reinstall it in the same operating direction as marked during removal procedure.

2. Apply LOCTITE 767 (ANTISEIZE LUBRICANT) (P/N 293 800 070) on crankshaft at PTO bearing surface area.

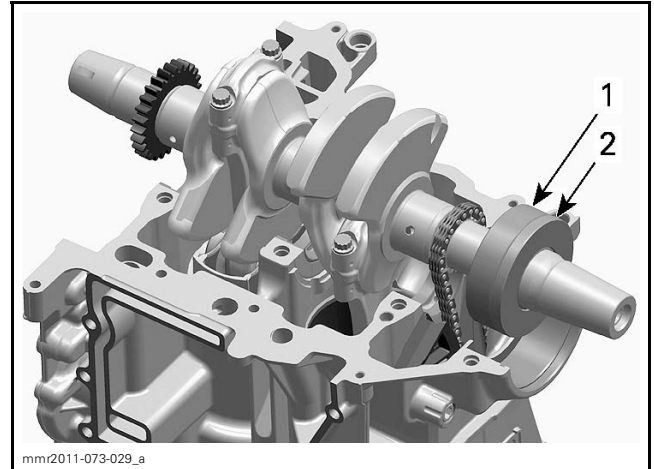


1. Apply LOCTITE 767 (ANTISEIZE LUBRICANT) (P/N 293 800 070) here

NOTE: After bearing installation, clean oil seal running surface on crankshaft.

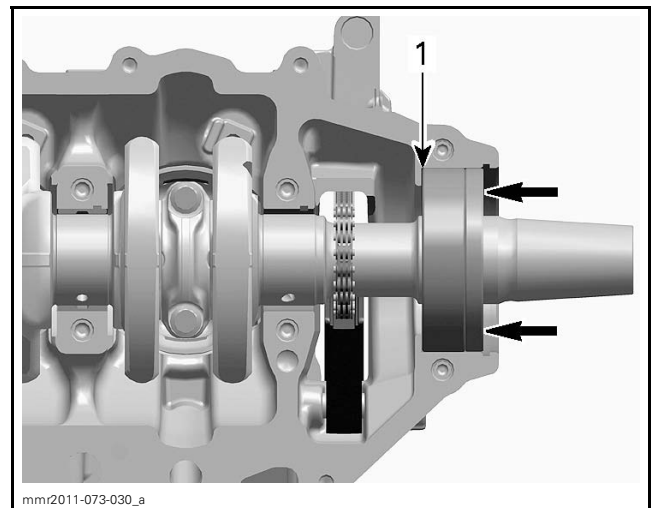
3. Lubricate sealing lip of oil seal with SUPER LUBE GREASE (P/N 293 550 030).
4. Reinstall PTO ball bearing and oil seal on crankshaft.

NOTICE Oil seal must be installed with sealing lip toward the engine.



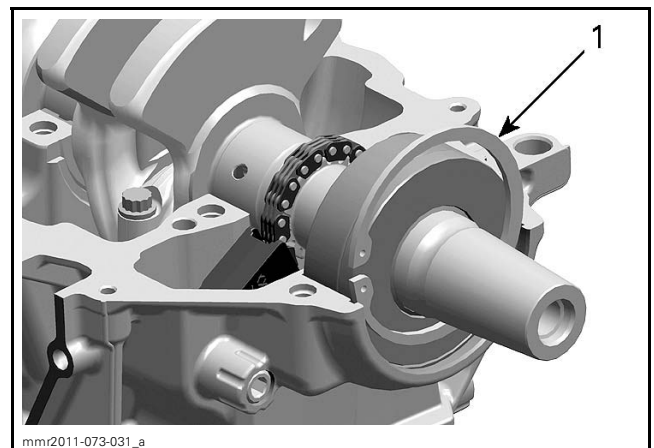
1. PTO ball bearing
2. Oil seal

5. Install crankshaft and push ball bearing and oil seal against axial stop.



1. PTO ball bearing against axial stop

6. Install retaining ring.



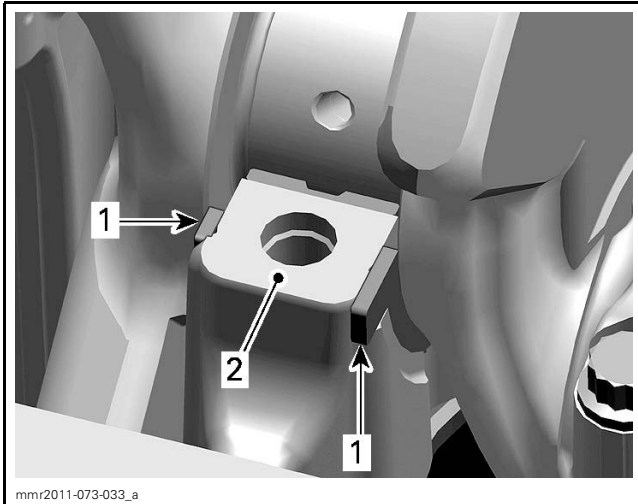
1. Retaining ring

Section 02 ENGINE (600 ACE)

Subsection 07 (TIMING CHAIN)

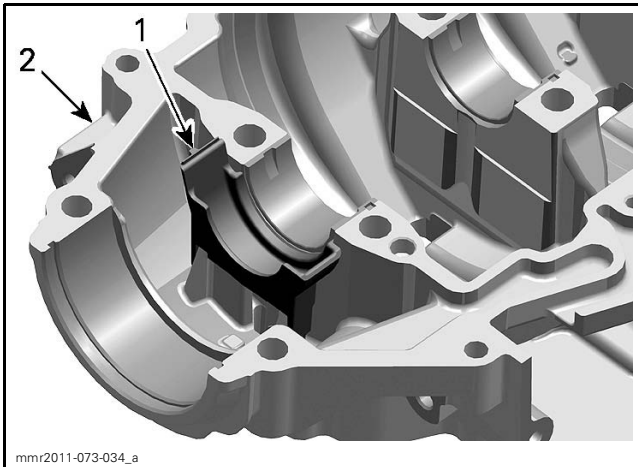
7. Properly install the crankshaft thrust washers with the slots facing against crankshaft counterweights.

NOTE: Crankshaft thrust washers must be flush with the cylinder block sealing surface.



1. Crankshaft thrust washers
2. Sealing surface

8. Reinstall lower chain guide in lower half of cylinder block.



1. Lower chain guide
2. Lower half of cylinder block

9. Reassemble cylinder block, refer to *BOTTOM END* subsection.

10. Reinstall timing chain properly on camshaft timing gears. Refer to *CAMSHAFT INSTALLATION* in the *BOTTOM END* subsection.

NOTICE Improper camshaft timing will damage engine components.

11. Install all other removed parts.

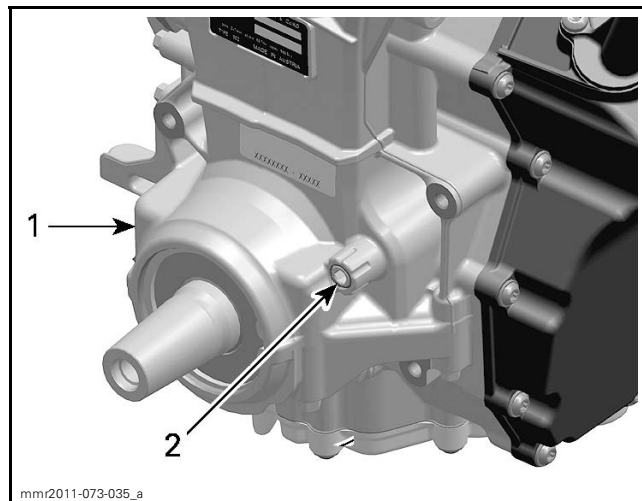
NOTE: Be sure to remove camshaft and crankshaft locking tools when timing chain is completely installed.

CHAIN GUIDE (TENSIONER SIDE)

Chain Guide Removal (Tensioner Side)

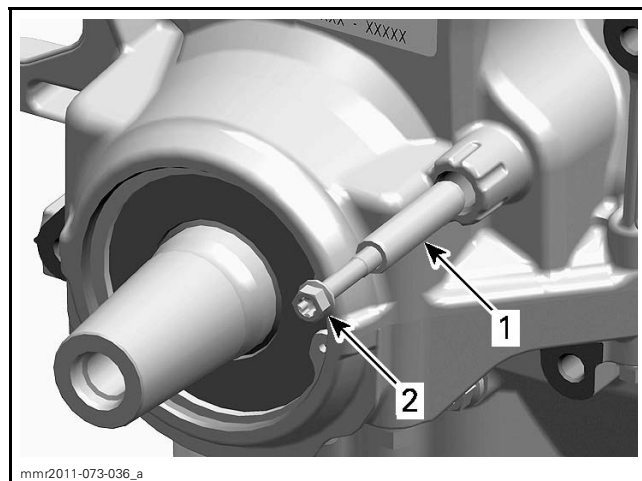
NOTE: Removal of chain guide is not recommended if there is no need for replacement.

1. Remove the *CAMSHAFTS*. Refer to *BOTTOM END* subsection.
2. Remove screw plug that covers the chain guide bearing pin.



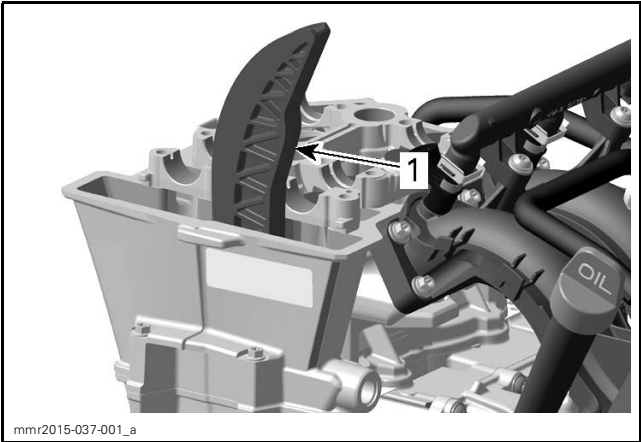
1. Cylinder block PTO side
2. Screw plug location

3. Use an M6 bolt to pull chain guide bearing pin out of cylinder block.



1. Chain guide bearing pin
2. M6 bolt

4. Remove chain guide (tensioner side).



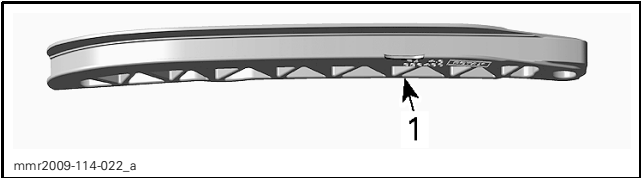
1. Chain guide (tensioner side)

Chain Guide Inspection
(Tensioner Side)

Check chain guide for wear, cracks or deforming. Replace as required.

Replace chain guide if groove depth caused by timing chain exceeds service limit.

CHAIN GUIDE GROOVE DEPTH	
SERVICE LIMIT	1 mm (.039 in)



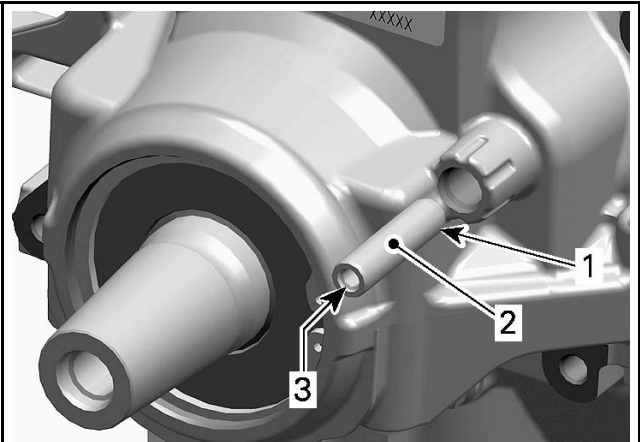
TYPICAL
1. Chain guide

Chain Guide Installation
(Tensioner Side)

Reverse of the removal procedure. However, pay attention to the following details.

1. Insert chain guide.
2. Apply engine oil on bearing pin and install it with M6 threads facing outwards.

NOTICE Ensure chain guide bearing pin is properly inserted in the chain guide.



1. Bearing pin
2. Apply engine oil here
3. M6 threads facing outwards

3. Tighten screw plug as specified.

NOTE: Install screw plug only in final assembled cylinder block to avoid warping of sealing surface.

SCREW PLUG	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening torque	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

4. Properly reinstall camshaft timing gears. Refer to *CAMSHAFTS* in the *TOP END* subsection.

NOTICE Improper camshaft timing will damage engine components.

Subsection XX (TIMING CHAIN)

GENERAL

Engine removal is necessary to work on the following components:

- Timing chain
- Timing chain guide (tensioner side).

Disconnect the BLACK (-) cable from the battery, then RED (+) cable before working on the engine.

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

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

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

⚠ WARNING

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

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

When disassembling parts that are duplicated in the engine, (e.g.: valves, springs, etc.), it is strongly recommended to note their position and to keep the parts of the same assembly as a "group". If you find a defective component, it will be much easier to find the cause of the failure. Since parts were broken-in together during engine operation, they will maintain their matched fit when reassembled together within their "group".

TROUBLESHOOTING

The following is provided to help in diagnosing the probable source of troubles. It is a guideline and should not be assumed to provide solutions to every cause of all problems.

UNUSUAL ENGINE NOISE OR VIBRATIONS

1. Faulty chain tensioner.
 - Replace chain tensioner.
2. Chain guide(s) worn out.
 - Replace chain guide(s).

3. Stretched timing chain or worn sprockets.
 - Replace timing chain and sprockets.
4. Camshaft timing gear screws loose.
 - Retighten screws to recommended torque.
5. Incorrect camshaft timing adjustment.
 - Replace damaged components and readjust camshaft timing.

ENGINE LACKS ACCELERATION OR POWER

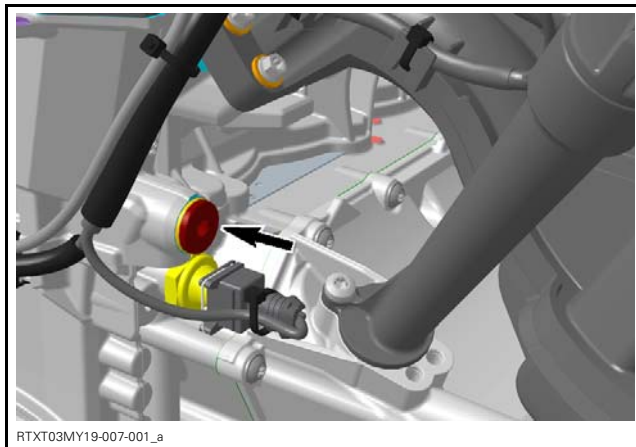
1. Incorrect camshaft timing adjustment.
 - Replace damaged components and readjust camshaft timing.

PROCEDURES

TIMING CHAIN TENSIONER

Timing Chain Tensioner Location

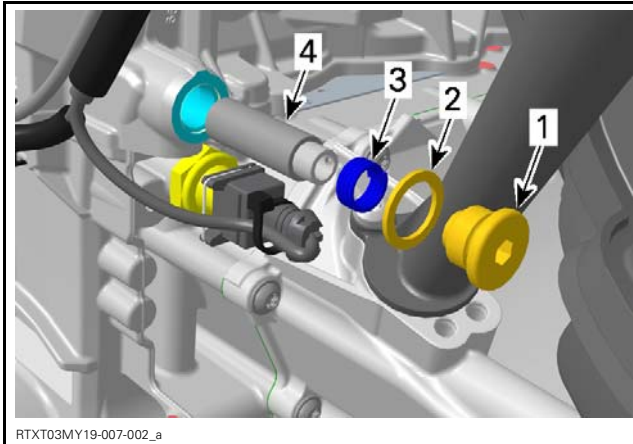
The timing chain tensioner is located in the cylinder head beside the intake port of the PTO cylinder.



RTXT03MY19-007-001_a
SCREW PLUG, TIMING CHAIN TENSIONER

Removing the Timing Chain Tensioner

1. Lock crankshaft, refer to *CYLINDER BLOCK* subsection.
2. Remove screw plug and discard the sealing washer.
3. Pull out spring and chain tensioner.



1. Screw plug
2. Sealing washer
3. Spring
4. Chain tensioner

Inspecting the Timing Chain Tensioner

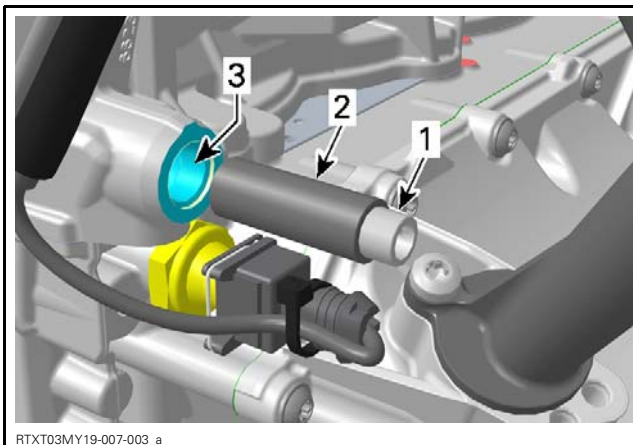
1. Check chain tensioner for scoring and freedom of movement in bore.
2. Compress chain tensioner and check for proper operation.

NOTE: The chain tensioner is difficult to compress when properly charged with oil, and easily compressed when it is not.

3. Check spring for straightness, corrosion and other visible damage.

Installing the Timing Chain Tensioner

1. Apply engine oil on chain tensioner.
2. Insert chain tensioner in its bore with the plunger pointing outwards.



TIMING CHAIN TENSIONER INSTALLATION

1. Plunger
2. Chain tensioner
3. Tensioner bore in cylinder head

3. Install spring on chain tensioner.
4. Tighten screw plug with a **NEW** sealing washer to specified torque.

TIGHTENING TORQUE	
Screw plug timing chain tensioner	17 N•m ± 2 N•m (150 lbf•in ± 18 lbf•in)

5. Install all other removed parts.

CAMSHAFT TIMING GEARS

Removing the Camshaft Timing Gear

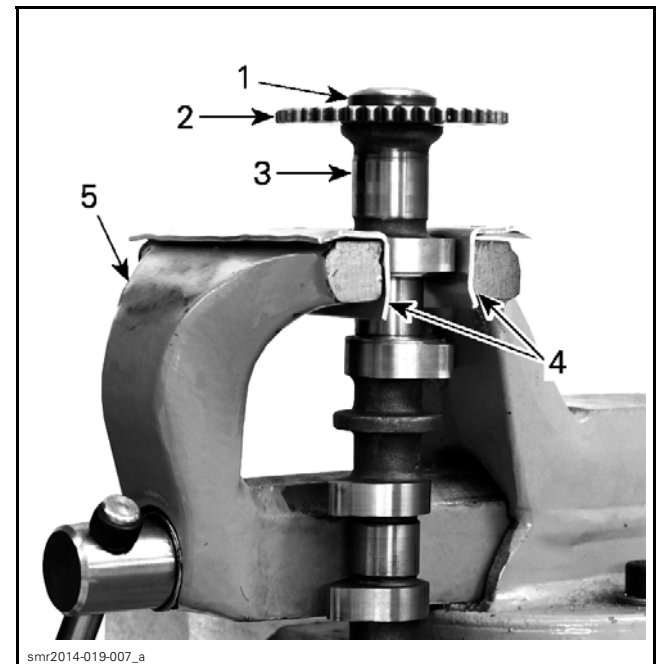
Remove camshaft assembly. Refer to *CYLINDER HEAD* subsection.

Clamp camshaft in a vice using aluminium protectors.

NOTICE Take care not damaging the cams.

Unscrew and remove camshaft timing gear screw.

Remove camshaft timing gear.



1. Camshaft timing gear screw
2. Camshaft timing chain gear
3. Camshaft
4. Aluminium protectors
5. Vice

Inspecting the Camshaft Timing Gear

Check camshaft timing gears for wear or deterioration. If a gear is worn or damaged, replace camshaft timing gears and timing chain as a set.

NOTE: For crankshaft timing gear inspection, refer to *CYLINDER BLOCK* subsection.

Subsection XX (TIMING CHAIN)

Installing the Camshaft Timing Gear

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

Tighten camshaft timing gear screw to specification.

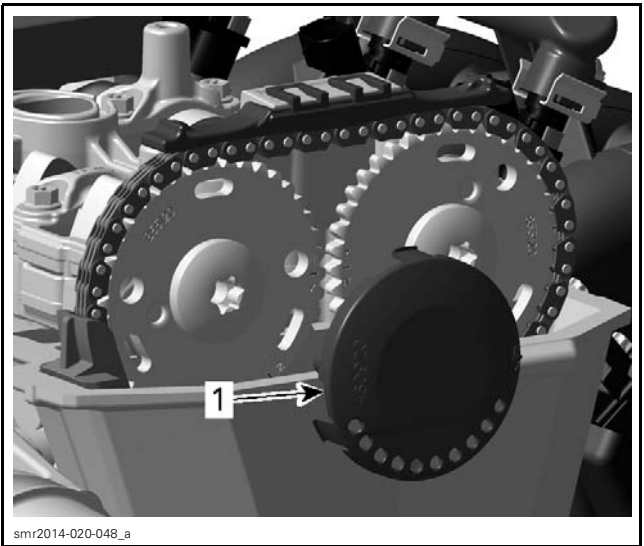
NOTICE Do not torque timing gear screws when camshafts are installed in cylinder head to avoid overstressing timing chain.

TIGHTENING TORQUE	
Timing gear screws	50 N•m ± 3 N•m (37 lbf•ft ± 2 lbf•ft) + LOCTITE 243 (BLUE) (P/N 293 800 060)

NOTICE Improper camshaft timing will damage engine components. Make sure camshafts and crankshaft are still locked. If not, lock them before beginning this procedure. Refer to *CAMSHAFTS* in the *CYLINDER HEAD* subsection.

Install breather cover on exhaust camshaft.

NOTE: Check condition of the breather cover before installation. Replace if necessary.



1. Breather cover

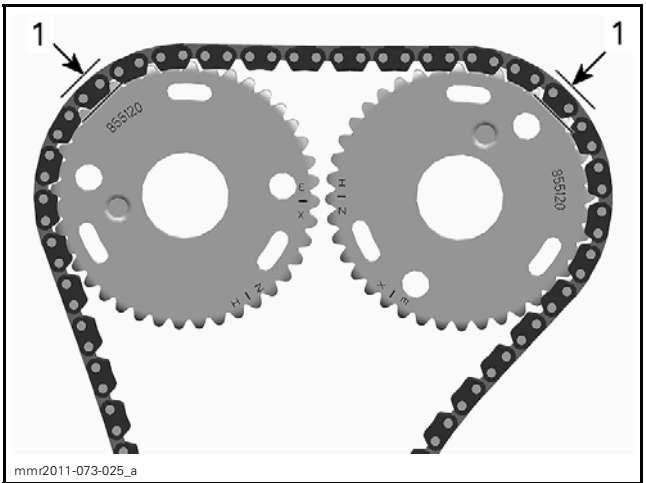
Install remaining parts.

TIMING CHAIN

Removing the Timing Chain

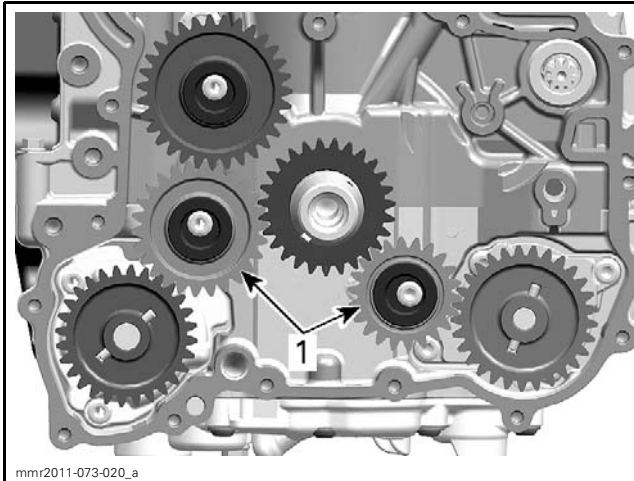
1. Remove engine from vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.

2. Remove air intake manifold, refer to *AIR INTAKE SYSTEM* subsection.
3. Remove valve cover, refer to *CYLINDER HEAD* subsection.
4. Refer to *LUBRICATION SYSTEM* subsection and remove the following parts:
 - Oil tank
 - Oil pressure regulator valve
 - Oil cooler
 - Oil sump cover.
5. Refer to *COOLING SYSTEM (ENGINE)* subsection and remove following parts:
 - Water pump housing
 - Thermostat.
6. Check timing chain for excessive radial play while still installed on timing gears.



1. Radial play

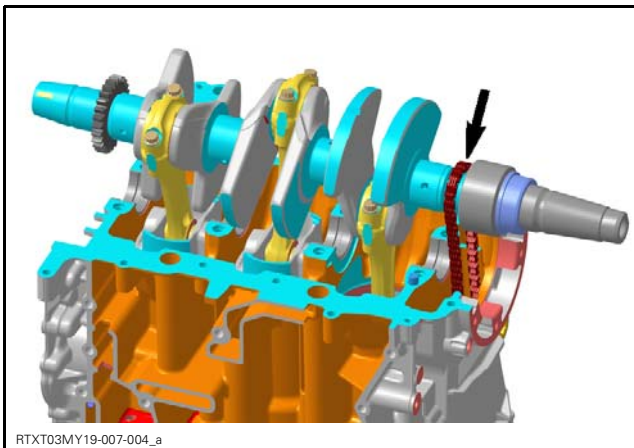
7. Remove the *CAMSHAFTS*, refer to *CYLINDER HEAD* subsection.
8. Refer to *MAGNETO AND STARTER* subsection and remove the following parts:
 - Magneto cover
 - Rotor
 - Starter drive gears.
9. Remove oil pump intermediate gears, refer to *LUBRICATION SYSTEM* subsection.



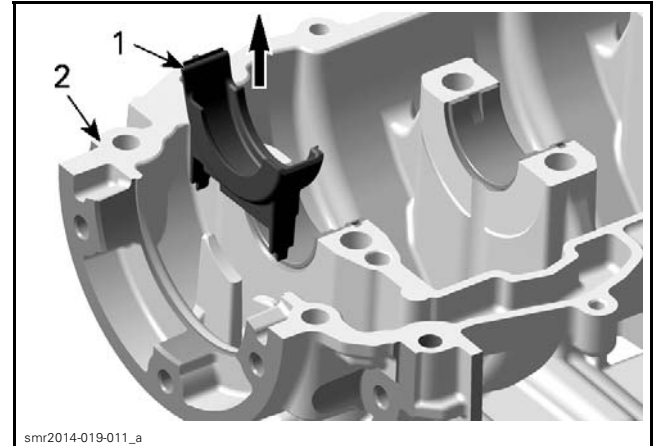
1. Oil pump intermediate gears

10. Remove crankshaft locking bolt.
11. Separate cylinder block, refer to *CYLINDER BLOCK* subsection.
12. Slightly lift the crankshaft, then remove timing chain.

NOTE: Make a mark on the timing chain to indicate the operating direction of the chain before removal.



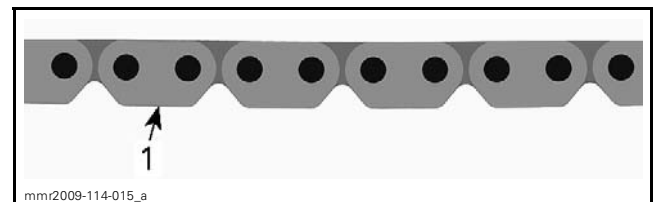
13. Remove lower timing chain guide from lower half of cylinder block.



1. Lower timing chain guide
2. Lower half of cylinder block

Inspecting the Timing Chain

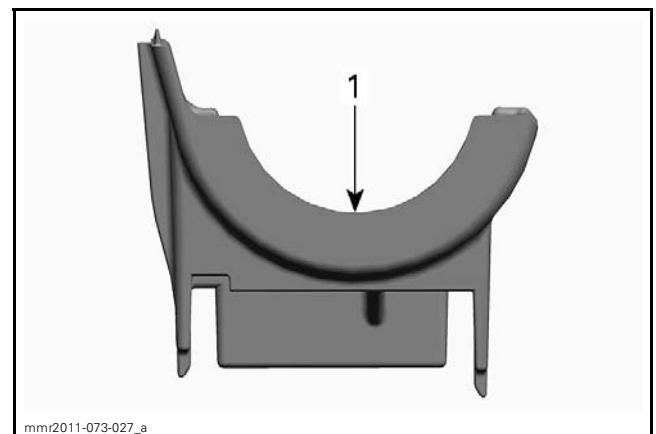
Check timing chain for wear and teeth condition.



1. Check teeth condition

NOTICE If timing chain is excessively worn or damaged, replace timing chain and camshaft timing gears as a set.

Check lower chain guide for wear, cracks or deformation. Replace as required.



1. Lower chain guide

Replace lower chain guide if timing chain wear grooves are visible.

CHAIN GUIDE GROOVE DEPTH	
Service limit	No timing chain wear groove allowed

Subsection XX (TIMING CHAIN)

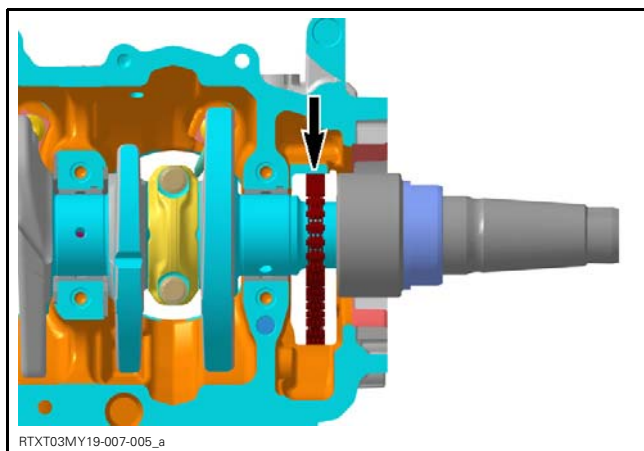
NOTE: Also check the chain guide, tensioner side. Refer to *INSPECTING THE CHAIN GUIDE (TENSIONER SIDE)* in this subsection.

Installing the Timing Chain

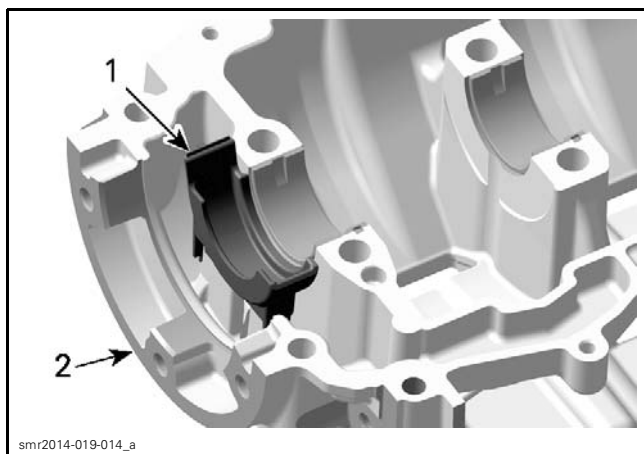
The installation is the reverse of the removal procedure. However, pay attention to the following details.

1. Install timing chain on crankshaft timing gear.

NOTE: If the same timing chain is reinstalled, be sure to reinstall it in the same operating direction as marked during removal procedure.



2. Reinstall lower chain guide in lower half of cylinder block.



1. Lower chain guide
2. Lower half of cylinder block

3. Reassemble cylinder block, refer to *CYLINDER BLOCK* subsection.
4. Lock crankshaft, refer to *CRANKSHAFT LOCKING PROCEDURE* in the *CYLINDER BLOCK* subsection.

5. Reinstall timing chain properly on camshaft timing gears. Refer to *INSTALLING THE CAMSHAFT* in the *CYLINDER HEAD* subsection.

NOTICE Improper camshaft timing will damage engine components.

6. Install all other removed parts.

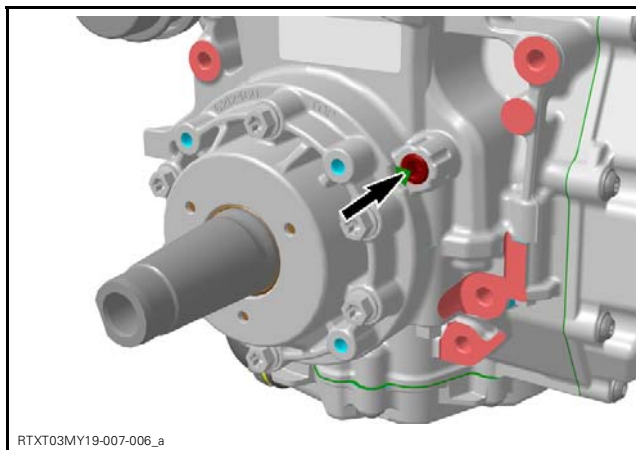
NOTE: Be sure to remove camshaft and crankshaft locking tools when timing chain is completely installed.

CHAIN GUIDE (TENSIONER SIDE)

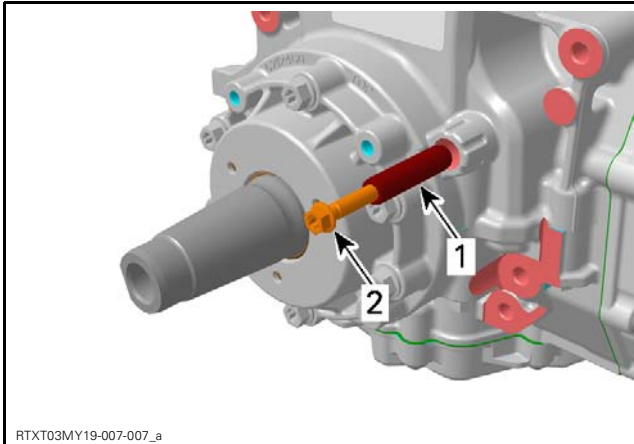
Removing the Chain Guide (Tensioner Side)

NOTE: Removal of chain guide is not recommended if there is no need for replacement.

1. Remove the *CAMSHAFTS*. Refer to *CYLINDER HEAD* subsection.
2. Remove screw plug that covers the chain guide bearing pin.

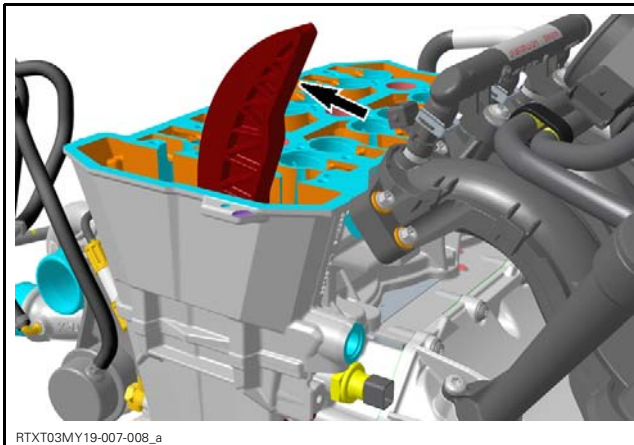


3. Use an M6 bolt to pull chain guide bearing pin out of cylinder block.



1. Chain guide bearing pin
2. M6 bolt

4. Remove chain guide (tensioner side).

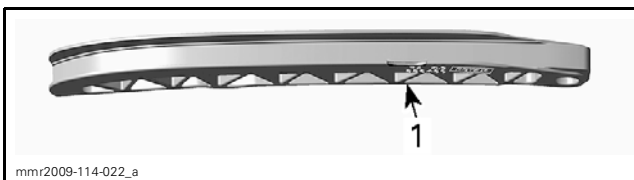


Inspecting the Chain Guide (Tensioner Side)

Check chain guide for wear, cracks or deforming. Replace as required.

Replace chain guide if groove depth caused by timing chain exceeds service limit.

CHAIN GUIDE GROOVE DEPTH	
Service limit	1 mm (.039 in)



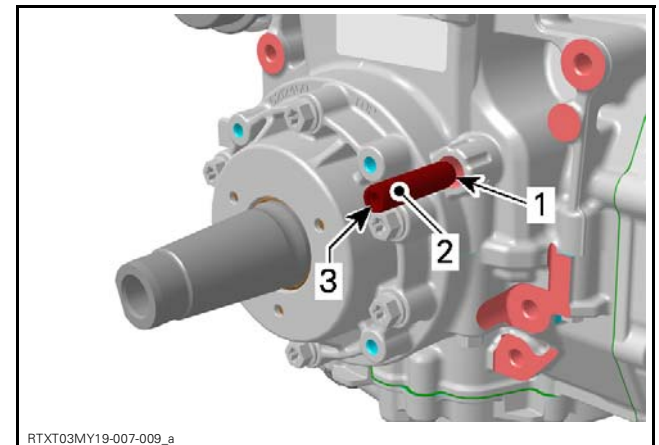
- TYPICAL**
1. Chain guide

Installing the Chain Guide (Tensioner Side)

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

1. Insert chain guide.
2. Apply engine oil on bearing pin and install it with M6 threads facing outwards.

NOTICE Ensure chain guide bearing pin is properly inserted in the chain guide.



1. Bearing pin
2. Apply engine oil here
3. M6 threads facing outwards

3. Tighten screw plug as specified.

NOTE: Install screw plug only in final assembled cylinder block to avoid warpage of sealing surface.

TIGHTENING TORQUE	
Screw plug	$9 \text{ N}\cdot\text{m} \pm 1 \text{ N}\cdot\text{m}$ $(80 \text{ lbf}\cdot\text{in} \pm 9 \text{ lbf}\cdot\text{in})$ + LOCTITE 243 (BLUE) (P/N 293 800 060)

4. Properly reinstall camshafts. Refer to *CAMSHAFTS* in the *CYLINDER HEAD* subsection.

NOTICE Improper camshaft timing will damage engine components.

BOTTOM END

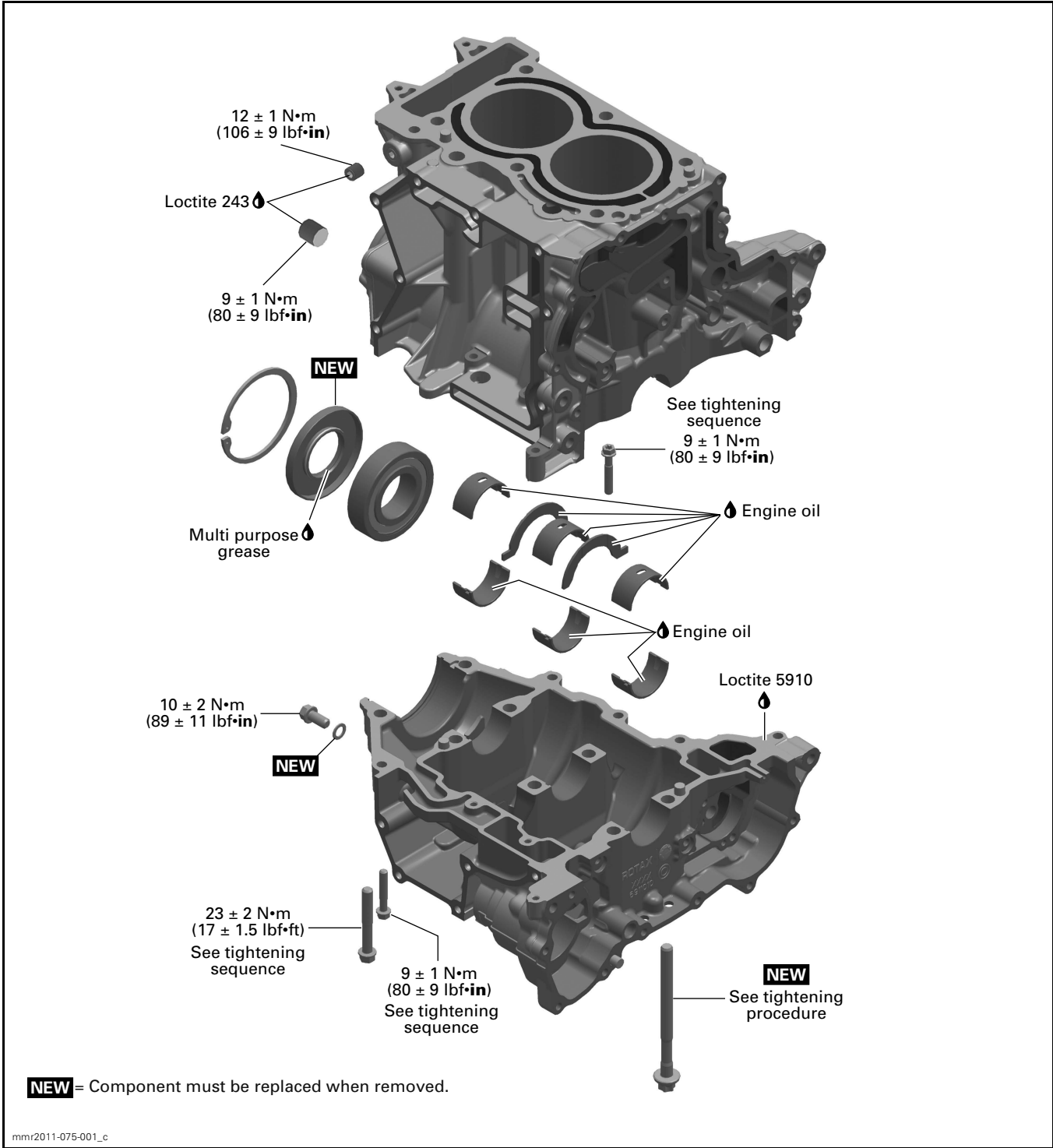
SERVICE TOOLS

Description	Part Number	Page
CRANKSHAFT LOCKING TOOL	529 036 205	140
CRANKSHAFT PROTECTOR (PTO)	420 876 552	132
PISTON CIRCLP INSTALLER.....	529 036 207	146
PISTON RING COMPRESSOR	529 036 208	148
PTO OIL SEAL INSTALLER	529 036 216	133

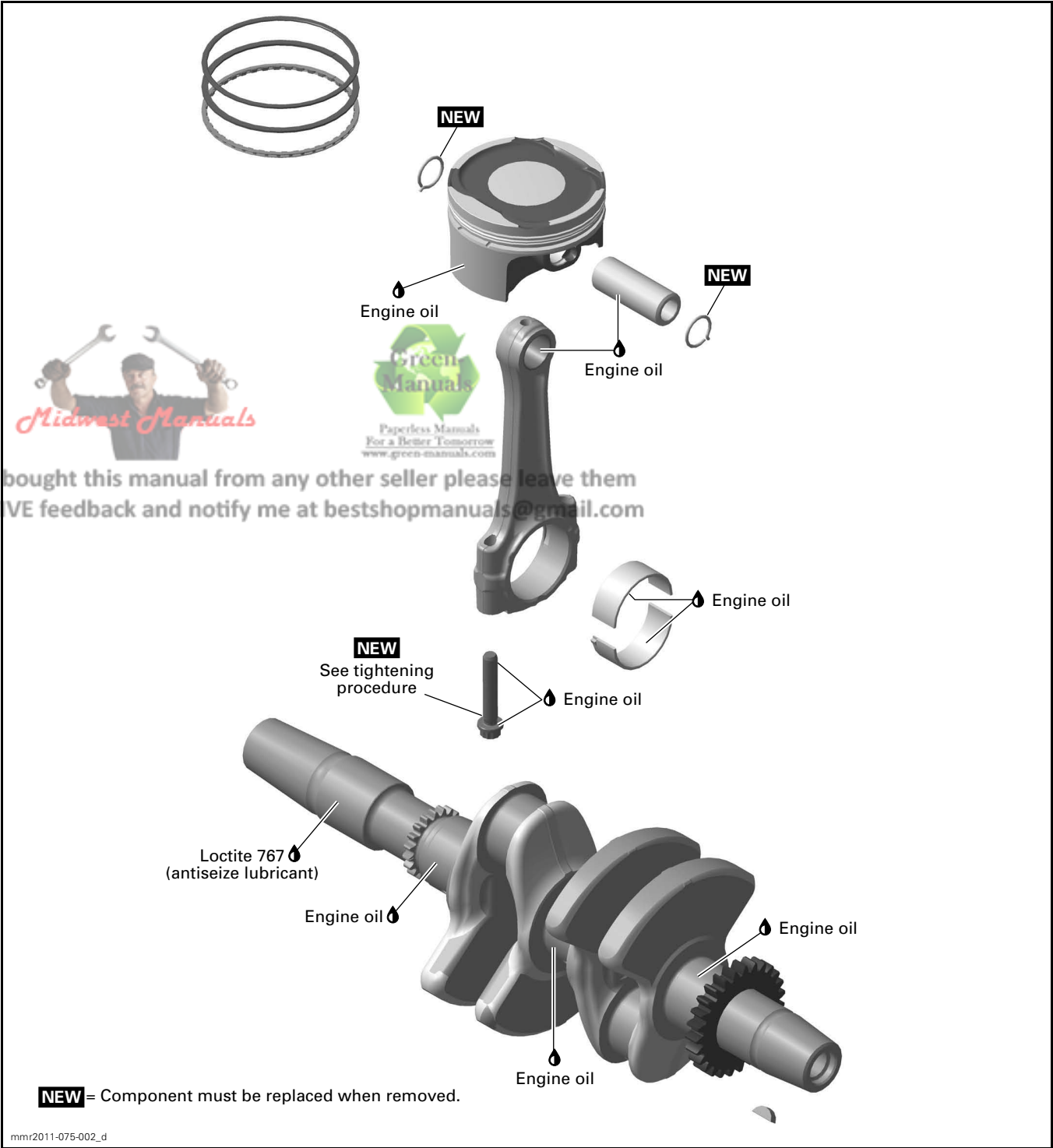
SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 5910	293 800 081	138
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	136
SUPER LUBE GREASE.....	293 550 030	133

Section 02 ENGINE (600 ACE)
Subsection 09 (BOTTOM END)



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GENERAL

When disassembling parts that are duplicated in the engine, (e.g.: pistons, connecting rods etc.), it is strongly recommended to note their position and to keep the parts of the same assembly as a "group". If you find a defective component, it would be much easier to find the cause of the failure. Since parts were broken-in during engine operation, they will maintain their matched fit when reassembled together within their "group".

TROUBLESHOOTING

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

UNUSUAL ENGINE NOISE OR VIBRATIONS

- 1. Heavy wear on plain bearings.
- Check radial play of plain bearings. Replace if out of specification.
- 2. Crankshaft axial play out of specification.
- Measure crankshaft axial play. If crankshaft axial play is out of specification, replace thrust washers.
- 3. Connecting rod axial play out of specification.
- Measure connecting rod axial play on crankshaft. Replace connecting rod or crankshaft if out of specification.
- 4. Connecting rod screws got loose.
- Replace damaged components and retighten screws with the recommended torque.
- 5. Crankshaft PTO ball bearing is worn.
- Separate crankcase and check ball bearing for excessive play. Replace ball bearing if necessary.

BLUE SMOKE IN THE EXHAUST

- 1. Oil scraper rings worn out.
- Replace piston rings.

ENGINE SUDDENLY TURNS OFF (POOR IDLING)

- 1. Piston rings worn out.
- Replace piston rings.
- 2. Piston/cylinder clearance out of specification.
- Check piston/cylinder clearance. Replace if out of specification.
- 3. Melted or broken piston.
- Replace piston and cylinder block if necessary.

PROCEDURES

PTO OIL SEAL

PTO Oil Seal Replacement

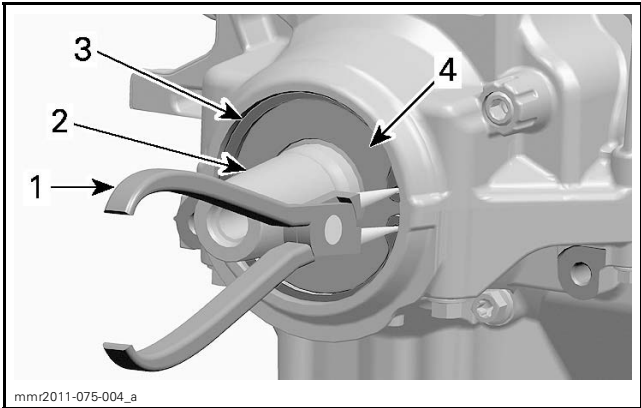
NOTE: To replace the PTO oil seal, it is not necessary to remove engine from the vehicle.

PTO Oil Seal Access

Remove drive pulley. Refer to *DRIVE PULLEY (eDRIVE)* subsection.

PTO Oil Seal Removal

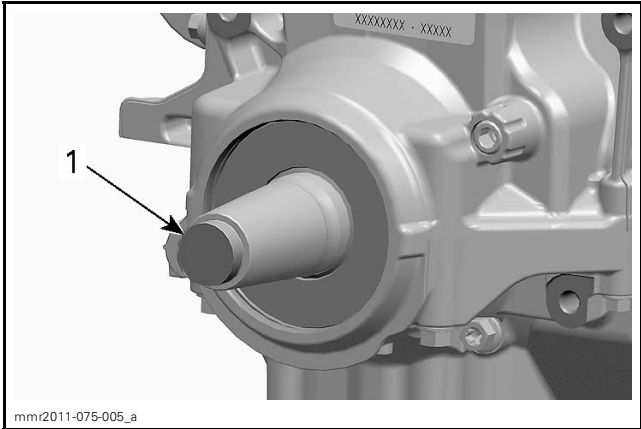
- 1. Use pliers to remove retaining ring.



- 1. Pliers
- 2. Crankshaft PTO journal
- 3. Retaining ring
- 4. Oil seal

- 2. Protect crankshaft.

REQUIRED TOOL	
CRANKSHAFT PROTECTOR (PTO) (P/N 420 876 552)	



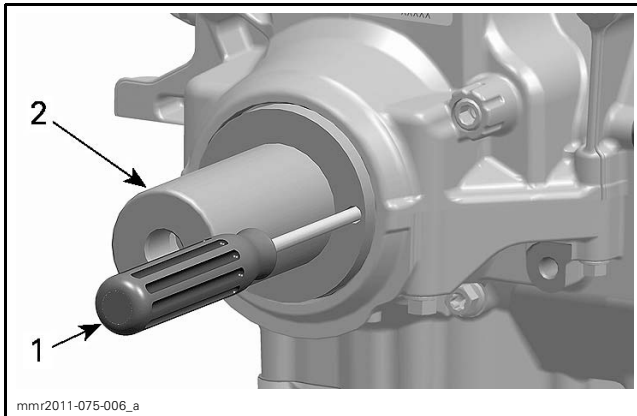
- 1. Crankshaft protector

3. Install the oil seal installer over the crankshaft end PTO.

REQUIRED TOOL	
PTO OIL SEAL INSTALLER (P/N 529 036 216)	

4. Carefully punch two holes in the old oil seal using a suitable pin.

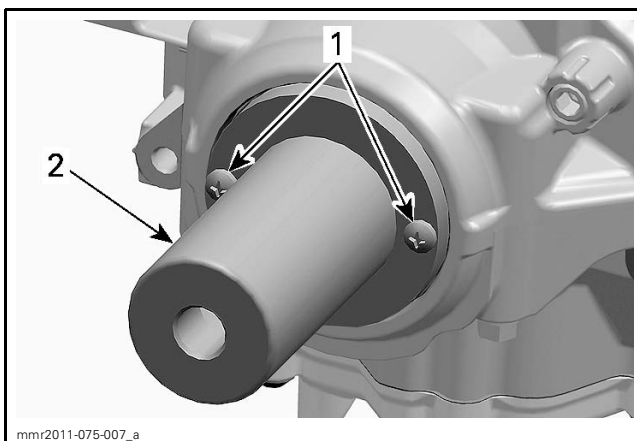
NOTE: The holes punched in the old seal must allow the self tapping screws to bite into the seal.



1. Pin
2. Oil seal installer

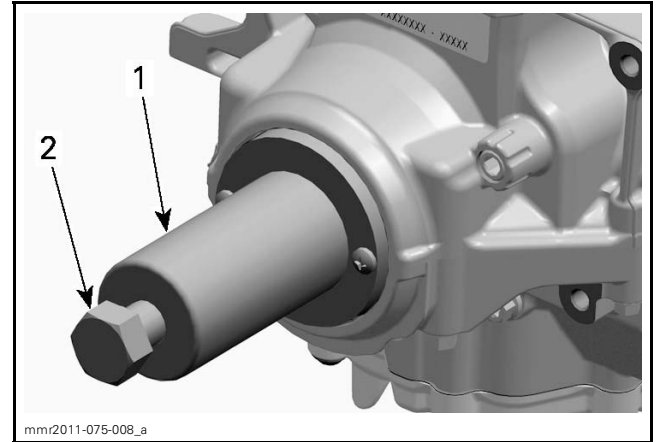
5. Thread the self tapping screws provided through the seal installer holes and into the oil seal.

NOTICE If self tapping screws other than the ones provided are used, their length must not exceed 16 mm (5/8 in).



1. Self tapping screws
2. Oil seal installer

6. Thread the M16 x 1.5 x 40 mm screw provided into the seal installer, then pull the old seal off the crankcase by turning screws in.



1. Oil seal installer
2. M16 x 1.5 x 40 mm screw

7. Remove crankshaft protector and clean oil seal area.

PTO Oil Seal Installation

NOTE: Check the oil seal running surface of crankshaft for grooves, before installation of NEW oil seal.

1. Clean crankshaft PTO side of deposits.
2. Lubricate oil seal sealing lip and outer diameter.

OIL SEAL SEALING LIP AND OUTER DIAMETER	
Service product	SUPER LUBE GREASE (P/N 293 550 030)

3. Place the **NEW** oil seal on crankshaft and install it.

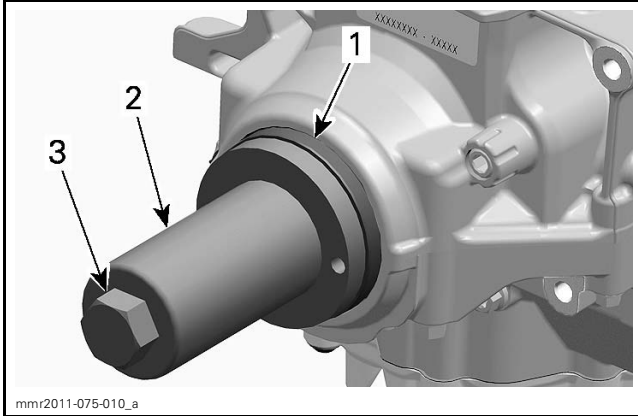
NOTICE Oil seal must be installed with sealing lip in, towards engine.

REQUIRED TOOL	
PTO OIL SEAL INSTALLER (P/N 529 036 216)	

- 3.1 Install oil seal installer tool over the crankshaft PTO end.
- 3.2 Thread the provided M14 x 1.5 x 55 mm screw in the crankshaft.
- 3.3 Turn screw in to push the seal in place.

Section 02 ENGINE (600 ACE)

Subsection 09 (BOTTOM END)



1. Oil seal
2. Oil seal installer
3. M14 x 1.5 x 55 mm hex. screw

4. Install retaining ring.

CYLINDER BLOCK

Cylinder Block Disassembly

1. Remove engine from vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
2. Refer to *PERIODIC MAINTENANCE PROCEDURES* and drain engine oil.
3. Refer to *TOP END* subsection and remove:
 - Ignition coils
 - Valve cover
 - Spark plugs.
4. Lock crankshaft, refer to *CRANKSHAFT LOCKING PROCEDURE* in this subsection.
5. Remove air intake manifold. Refer to *AIR INTAKE SYSTEM* subsection.
6. Refer to *COOLING SYSTEM* subsection and remove:
 - Water pump housing
 - Thermostat
 - Water pump drive gear.
7. Refer to *LUBRICATION SYSTEM* subsection and remove:
 - Oil tank
 - Oil cooler
 - Oil pressure regulator
 - Oil pump drive gears and oil pumps
 - Oil sump cover
 - Oil strainers.
8. Refer to *MAGNETO AND STARTER* subsection and remove:
 - Magneto cover
 - Rotor

- Starter drive gears
- Electric starter.

9. Refer to *TIMING CHAIN* subsection and remove:

- Timing chain tensioner
- Timing chain guides.

10. Refer to *TOP END* subsection and remove:

- Camshaft holders
- Cylinder head.

NOTE: Before splitting the cylinder block, measure crankshaft axial play. Refer to *CRANKSHAFT* in this subsection.

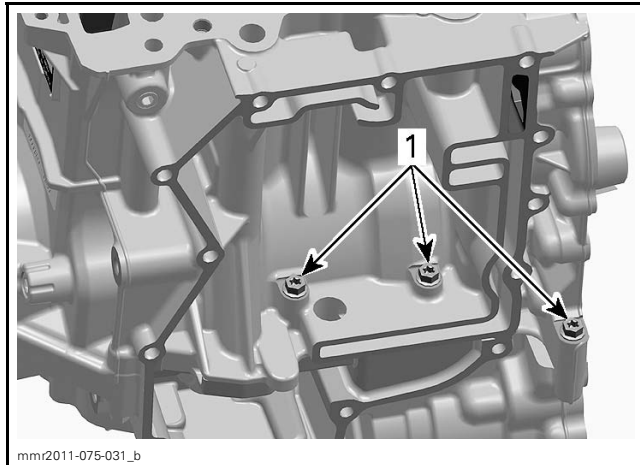
11. Remove crankshaft locking tool.

12. Remove cylinder block screws.

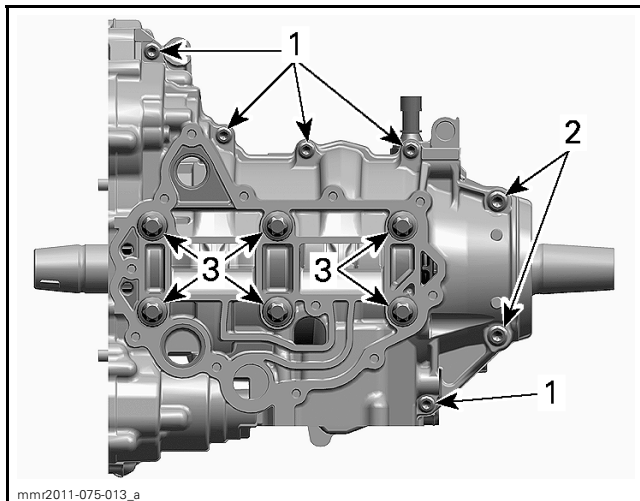
12.1 Start by removing M6 screws.

12.2 Then remove M8 screws.

12.3 Finally remove and discard M9 screws.



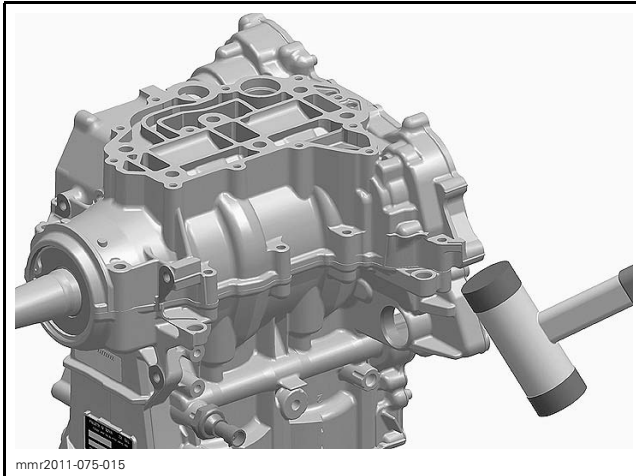
1. Cylinder block screws (M6) screwed from top to bottom



1. M6 screws
2. M8 screws
3. M9 screws (discard)

13. Carefully remove cylinder block lower half using a soft hammer.

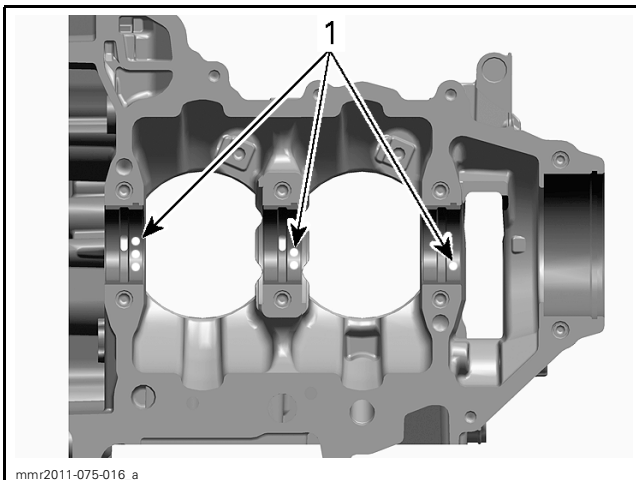
NOTE: Take care not to damage the sealing surfaces of the cylinder block halves.



14. Remove connecting rod caps. Refer to *PISTONS AND CONNECTING RODS* in this subsection.
15. Refer to *CRANKSHAFT* in this subsection and remove:
- Crankshaft thrust washers
 - Crankshaft.
16. Remove pistons and connecting rods. See procedure in this subsection.

Plain Bearing Removal

When the plain bearings need to be removed from the cylinder block, mark them to identify the correct position at installation. See the illustration as an example.

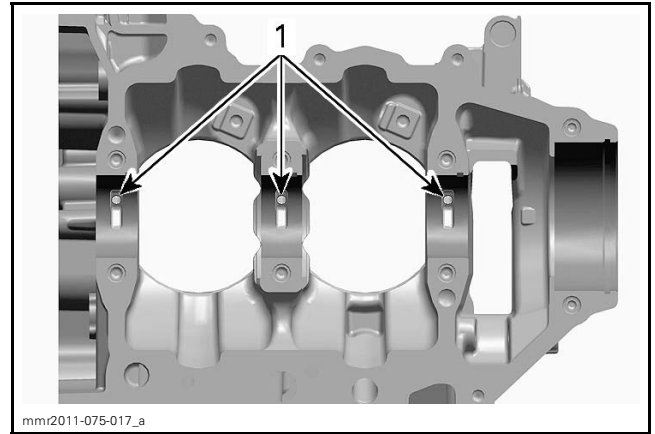


1. Mark on crankshaft plain bearings

Cylinder Block Cleaning

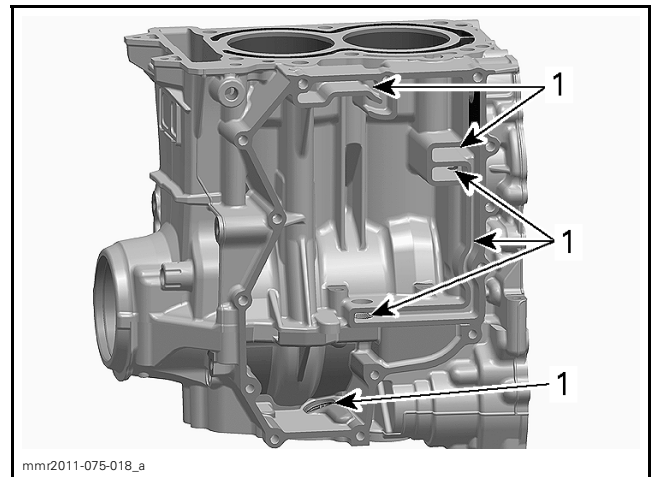
Clean cylinder block using a part cleaner, then use compressed air to dry it.

Blow out the oil orifices using compressed air and make sure they are not clogged.



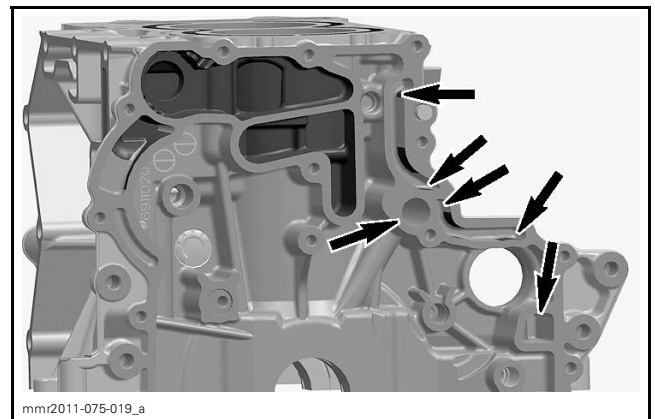
CYLINDER BLOCK UPPER HALF

1. Oil orifices



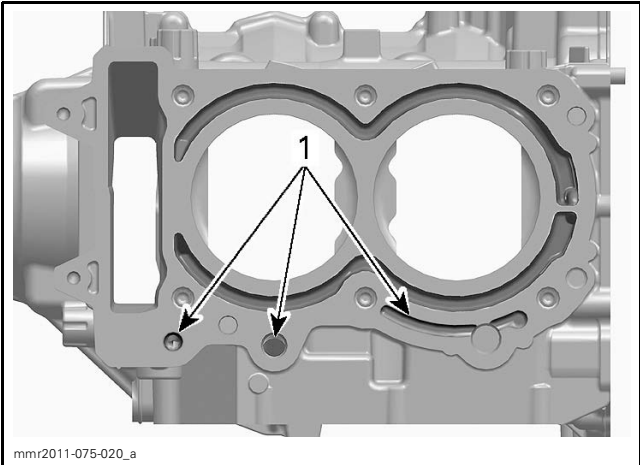
CYLINDER BLOCK - REAR

1. Oil orifices

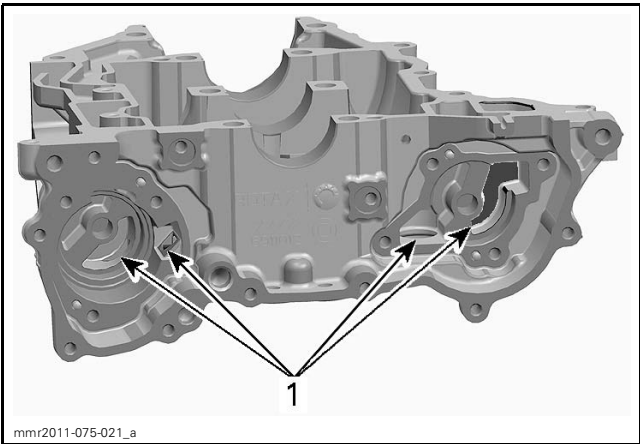


CYLINDER BLOCK - MAG SIDE OIL ORIFICES

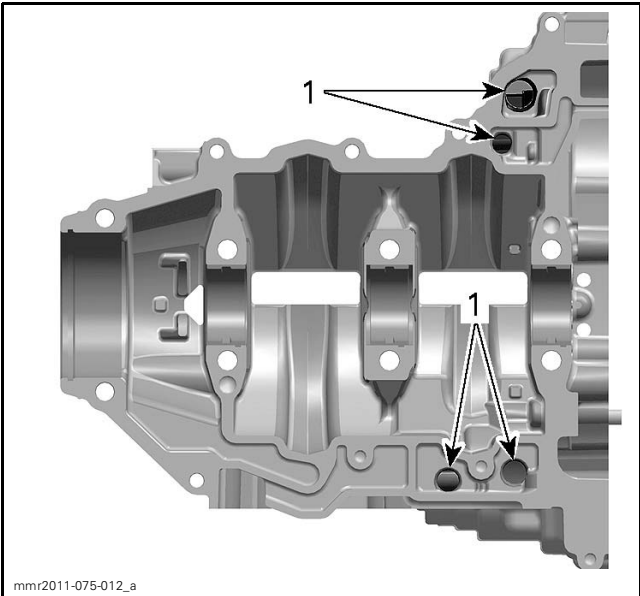
Section 02 ENGINE (600 ACE)
Subsection 09 (BOTTOM END)



CYLINDER BLOCK - TOP
1. Oil orifices



CYLINDER BLOCK LOWER HALF
1. Oil orifices



CYLINDER BLOCK LOWER HALF
1. Oil orifices

Clean cylinder block mating surfaces with LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500) and a brass wire brush. Brush a first pass in one direction, then make the final brushing perpendicularly (90°) to the first pass (cross hatch).

NOTE: Do not wipe with rags. Use a new clean hand towel only.

Cylinder Block Inspection

Check cylinder block for cracks or other damage.

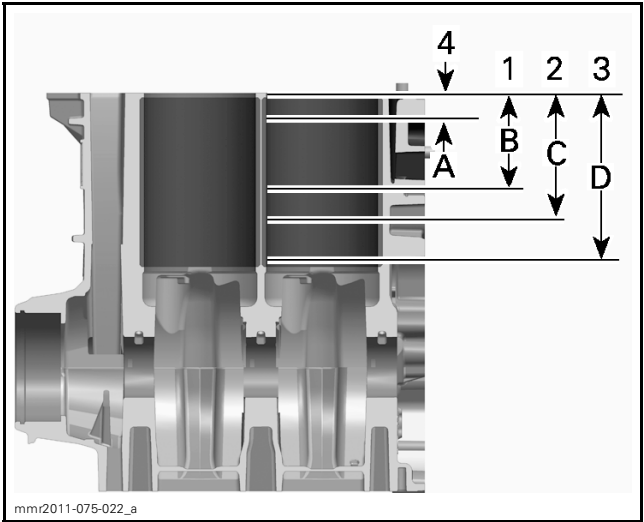
Check cylinder block mating surfaces for flatness using a straight edge.

Replace cylinder block if necessary.

Check cylinder bores for cracks, scoring and wear ridges on top and bottom of the cylinders.

Cylinder Taper

Measure cylinder bore diameter at 4 recommended positions. See illustration.



TYPICAL

- 1. First measure
- 2. Second measure
- 3. Third measure
- 4. Fourth measure

- A. 5 mm to 10 mm (.197 in to .394 in)
- B. 30 mm to 35 mm (1.181 in to 1.378 in)
- C. 57 mm to 62 mm (2.244 in to 2.441 in)
- D. 111 mm to 113 mm (4.37 in to 4.449 in)

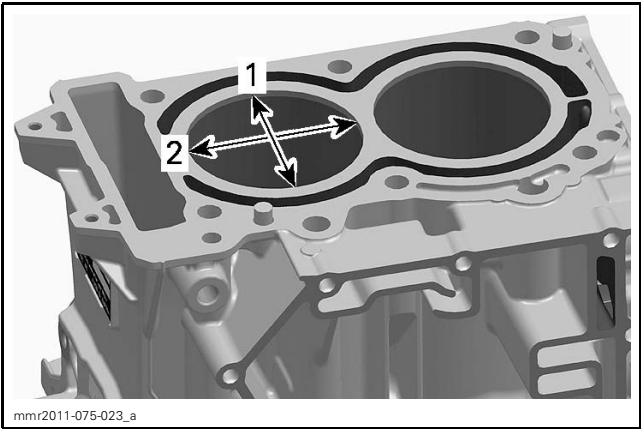
The difference between measurements should not exceed the service limit mentioned in next table.

CYLINDER TAPER	
NEW MAXIMUM	0.030 mm (.0012 in)
SERVICE LIMIT	0.050 mm (.002 in)

Clean all metal components in a solvent.

Cylinder Out of Round

Measure cylinder bore diameter as shown, and at same measuring points as for *CYLINDER TAPER*.



- 1. Perpendicular to piston pin axis
- 2. Parallel to piston pin axis

To obtain the cylinder out of round, calculate the difference between the perpendicular measures.

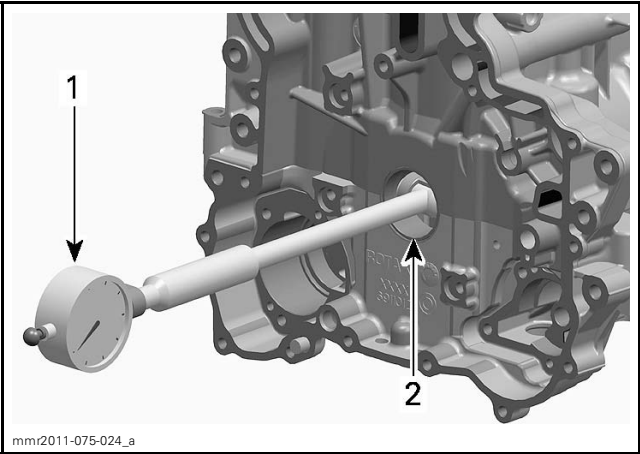
CYLINDER OUT OF ROUND	
NEW MAXIMUM	0.008 mm (.0003 in)
SERVICE LIMIT	0.030 mm (.0012 in)

Crankshaft Plain Bearings Inside Diameter

Check the plain bearings for scoring or other damages.

Measure plain bearing inside diameter and compare with crankshaft bearing journal diameter (refer to *CRANKSHAFT* in this subsection). Proceed as follows.

- Using the OLD plain bearings, assemble both cylinder block halves together.
- Tighten screws as described in *CYLINDER BLOCK ASSEMBLY*.
- Measure the inside diameter of the crankshaft plain bearings using a bore gauge.



- 1. Bore gauge
- 2. Crankshaft plain bearing

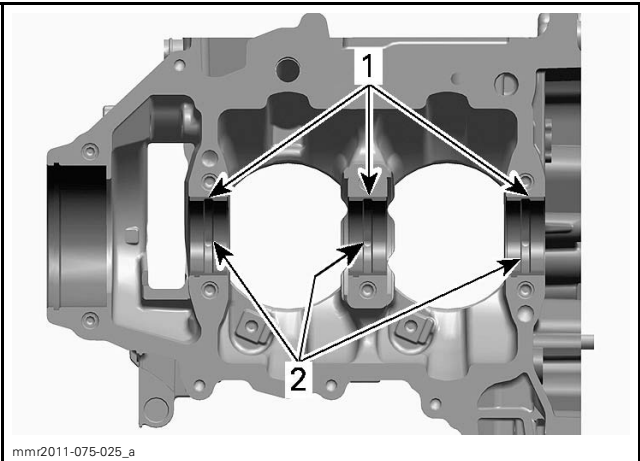
CRANKSHAFT PLAIN BEARING INSIDE DIAMETER	
SERVICE LIMIT	36.080 mm (1.4205 in)

Replace bearings if out of specifications.

Cylinder Block Assembly

Reverse the disassembly procedure. Pay attention to the following details.

- 1. Correctly reinstall plain bearings as follows.
 - 1.1 Use NEW bearings if diameters are out of specification. Refer to *PLAIN BEARING INSPECTION* in this subsection.
 - 1.2 Install bearings with lubrication grooves in the cylinder block upper half.

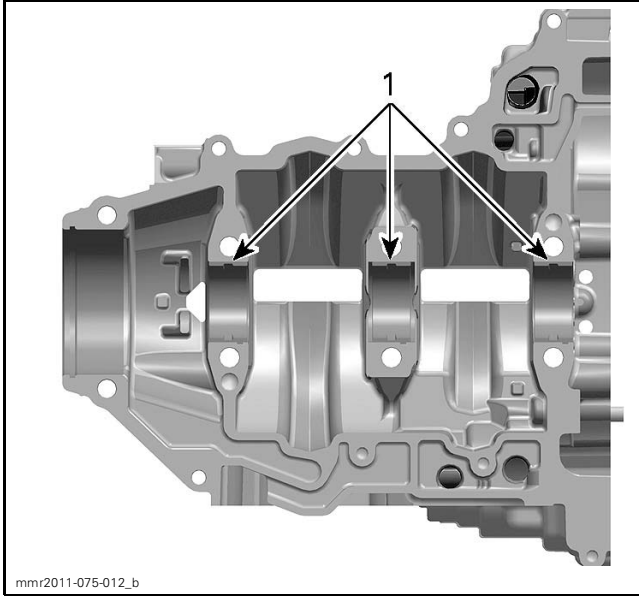


- 1. Plain bearings
- 2. Lubrication grooves

- 1.3 Install flat bearings in cylinder block lower half.

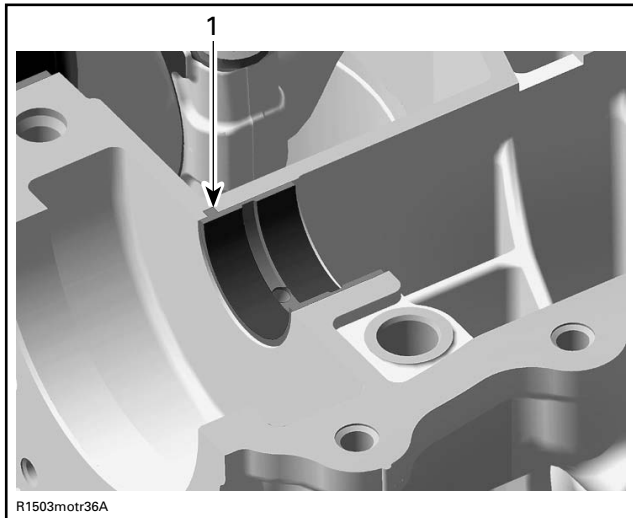
Section 02 ENGINE (600 ACE)

Subsection 09 (BOTTOM END)



1. Flat bearings

NOTICE Bearings must be flush with the cylinder block split surface, and their protrusions must fit in the notched areas in the cylinder block seat.

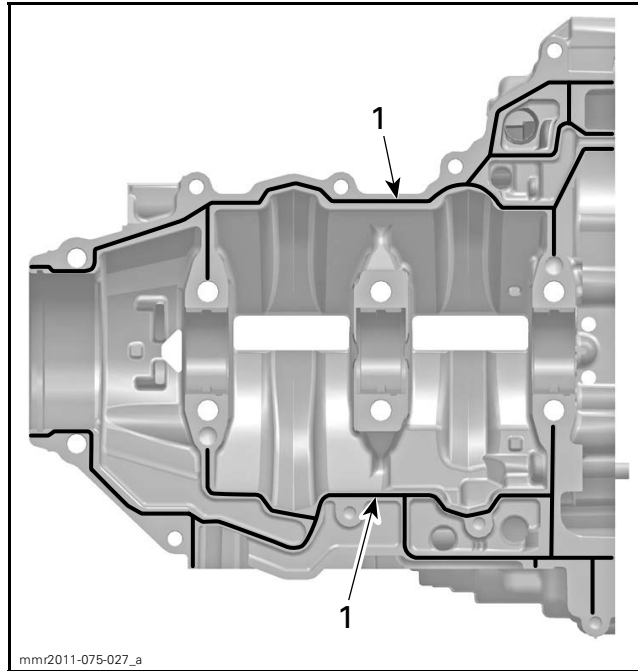


TYPICAL

1. Bearing protrusion in cylinder block notch

2. Install pistons, refer to *PISTONS AND CONNECTING RODS* in this subsection.
3. Apply engine oil on all plain bearings.
4. Install the following components:
 - Crankshaft and thrust washers (refer to *CRANKSHAFT*)
 - Connecting rod caps (refer to *PISTONS AND CONNECTING RODS*).
5. Apply LOCTITE 5910 (P/N 293 800 081) on mating surface of cylinder block lower half as shown in following illustration.

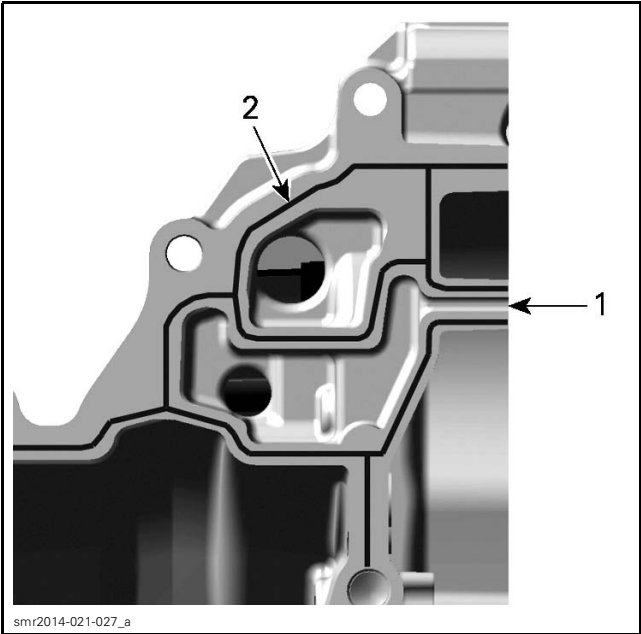
IMPORTANT: When beginning the application of the cylinder block sealant, the assembly and first tightening must be done within 12 minutes. It is suggested to have all you need on hand to save time.



1. Apply Loctite 5910 following this pattern

NOTICE Ensure not to apply too much sealant, as it will spread out inside the cylinder block.

NOTICE Take care to ensure the bypass passage of the engine oil pressure regulator is not clogged with sealant.



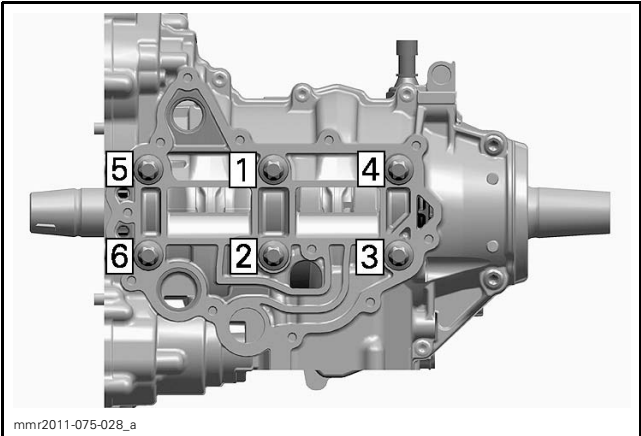
1. Bypass passage of engine oil pressure regulator
2. Loctite 5910 applied

6. Install NEW cylinder block M9 screws and tighten as follows.

NOTICE This assembly uses stretch screws. Always use NEW screws and strictly adhere to the tightening procedure.

6.1 Torque the M9 screws according to following sequence.

CYLINDER BLOCK M9 SCREWS TIGHTENING PROCEDURE	
FIRST STEP	20 N•m ± 2 N•m (15 lbf•ft ± 1 lbf•ft)



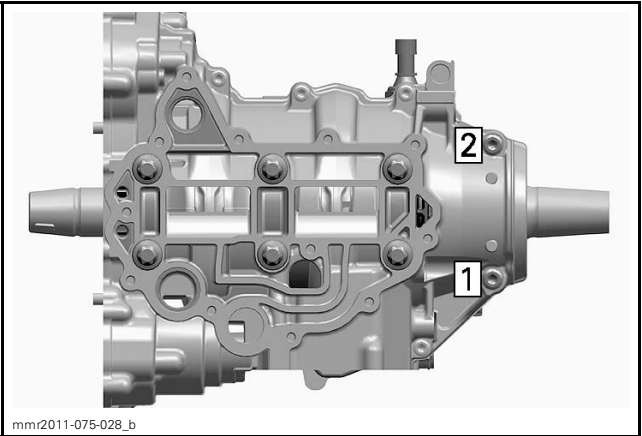
M9 SCREWS TIGHTENING SEQUENCE - FIRST AND SECOND STEPS

6.2 Use a torque angle gauge to carry out the second step, following the same sequence.

CYLINDER BLOCK M9 SCREWS TIGHTENING PROCEDURE	
SECOND STEP	Additional 150° ± 5°

7. Install M8 screws and tighten as follows.

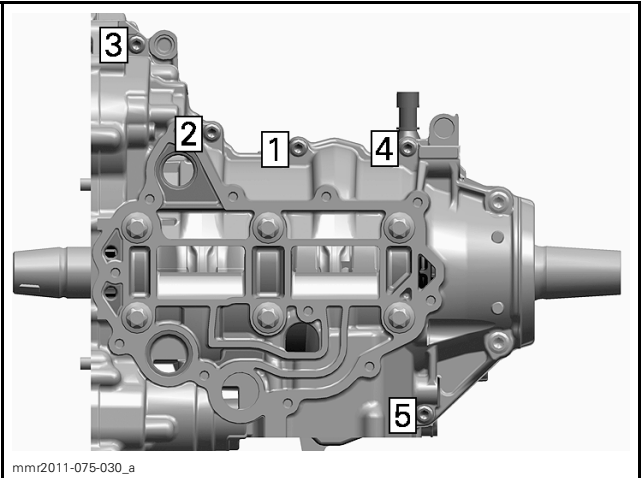
CYLINDER BLOCK M8 SCREWS	
Tightening torque	23 N•m ± 2 N•m (17 lbf•ft ± 1 lbf•ft)



M8 SCREWS TIGHTENING SEQUENCE

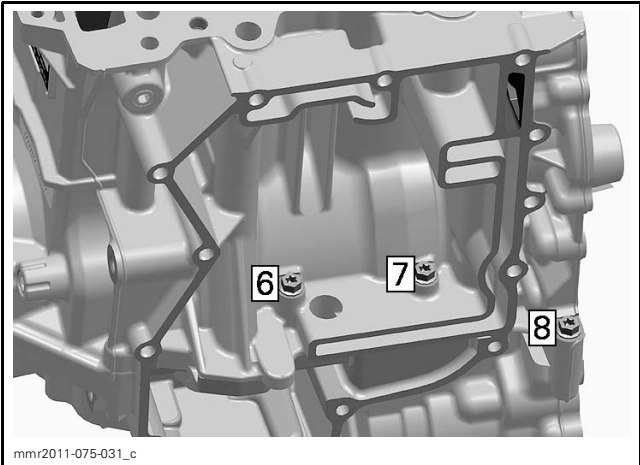
8. Install M6 screws and tighten as follows.

CYLINDER BLOCK M6 SCREWS	
Tightening torque	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



M6 SCREWS TIGHTENING SEQUENCE (BOTTOM OF CRANKCASE)

Section 02 ENGINE (600 ACE)
Subsection 09 (BOTTOM END)



M6 SCREWS TIGHTENING SEQUENCE (REAR OF CRANKCASE)

NOTE: Check crankshaft axial play before continuing the assembly. Refer to *CRANKSHAFT* in this subsection.

9. Reassemble engine in accordance with proper assembly procedures.

CRANKSHAFT

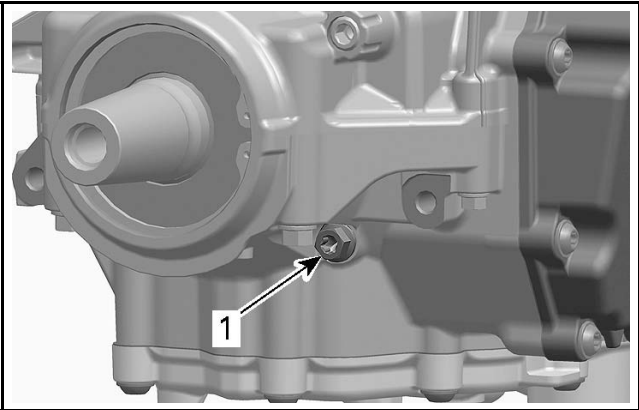
Crankshaft Locking Procedure

NOTICE When the crankshaft is locked, neither first nor second cylinder is set to TDC.

The crankshaft must be locked whenever the magneto rotor retaining nut has to be removed, or whenever working on the valve train.

NOTICE When working on the valve train or timing chain, the crankshaft must be locked with the marks "IN" and "EX" on the camshaft timing gears facing each other.

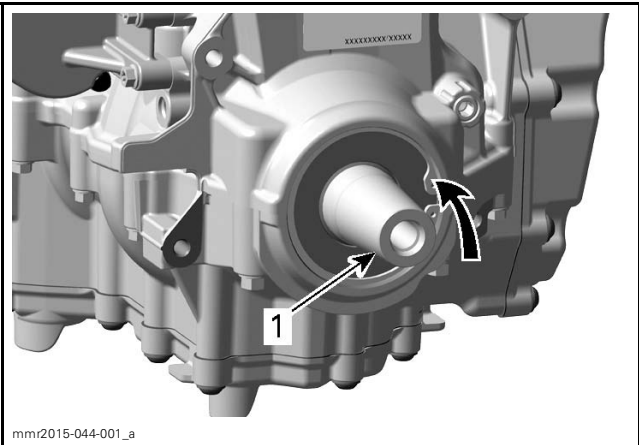
- 1. If working on the valve train or timing chain, remove the valve cover. Refer to *TOP END* subsection.
- 2. Remove spark plugs.
- 3. Remove crankshaft access plug and discard gasket ring.



1. Crankshaft access plug

4. On PTO side , turn engine crankshaft counter-clockwise to the locking position.

To turn the crankshaft, install the drive pulley, or use a suitable screw locked by a counter nut.

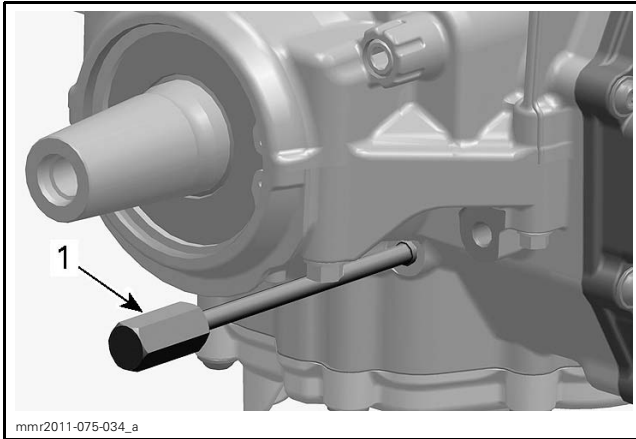


1. Crankshaft PTO side

NOTICE Crankshaft locking position is reached when marks "IN" and "EX" on the camshaft timing gears face each other.

- 5. Use a flashlight to check if the crankshaft groove is aligned with the hole.
- 6. Lock crankshaft.

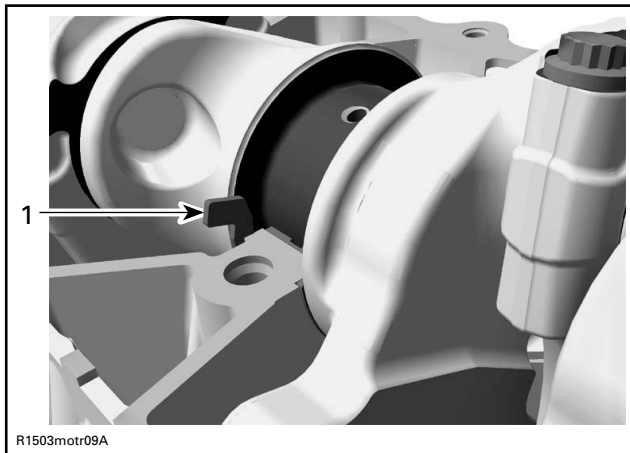
REQUIRED TOOL	
CRANKSHAFT LOCKING TOOL (P/N 529 036 205)	



1. Crankshaft locking tool

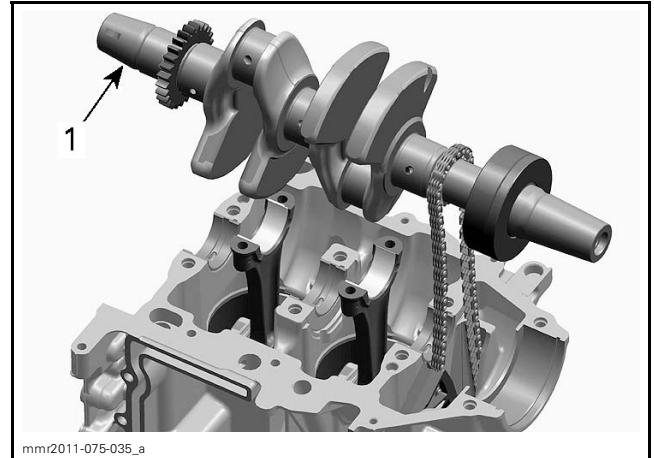
Crankshaft Removal

1. Disassemble *CYLINDER BLOCK*, see procedure in this subsection.
2. Remove connecting rod caps. Refer to *PISTONS AND CONNECTING RODS* in this subsection.
3. Remove crankshaft thrust washers.



TYPICAL
1. Thrust washer

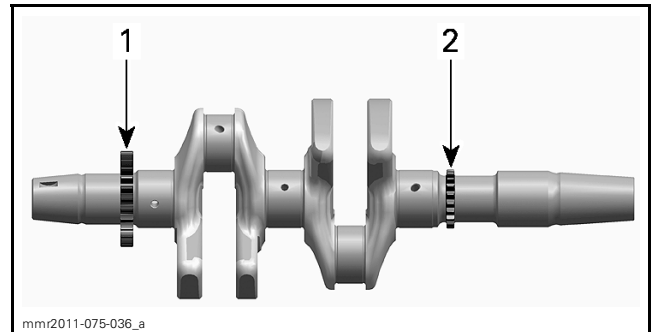
4. Remove crankshaft from cylinder block.



1. Crankshaft

Crankshaft Inspection

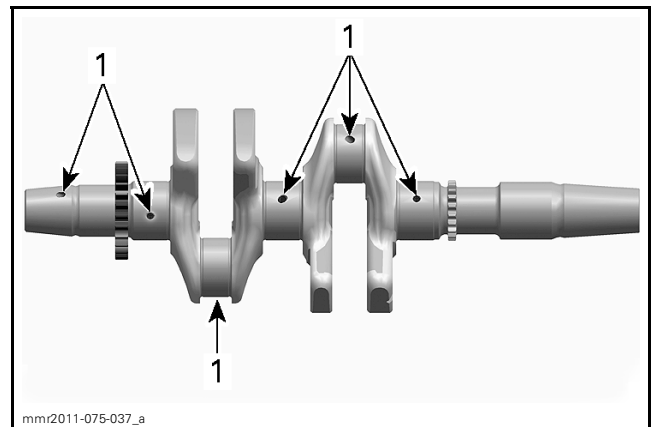
Check each bearing journal of crankshaft for scoring, scuffing, cracks or other signs of wear. Check crankshaft gears for wear or other damage.



1. Oil pump drive gear
2. Crankshaft timing gear

Replace crankshaft if damaged.

Blow the oil orifices using compressed air and ensure they are not clogged.

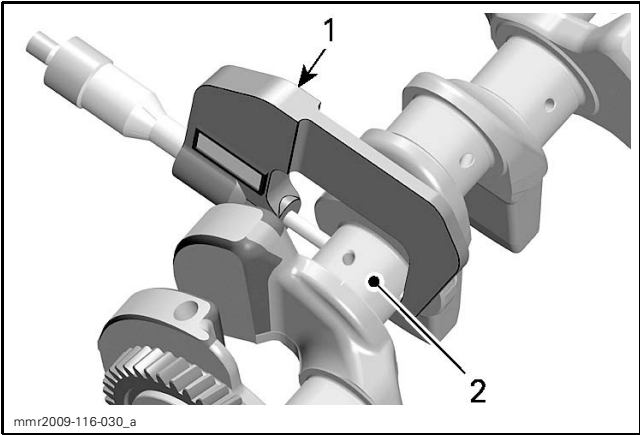


1. Check oil orifices

Crankshaft Radial Play

Measure crankshaft bearing journal diameter using a micrometer.

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TYPICAL
1. Micrometer
2. Crankshaft area for plain bearing

To obtain crankshaft radial play, calculate the difference between the bearing journal diameter and the crankshaft plain bearings inner diameter (see *CYLINDER BLOCK*) in this subsection.

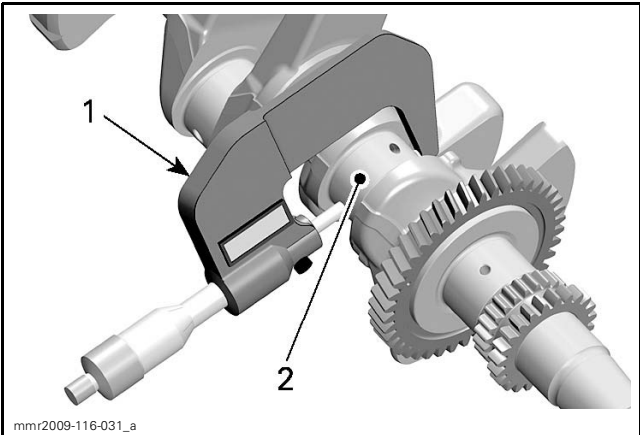
CRANKSHAFT BEARING JOURNAL DIAMETER	
NEW	35.990 mm to 36.006 mm (1.4169 in to 1.4176 in)
SERVICE LIMIT	35.960 mm (1.4157 in)

CRANKSHAFT RADIAL PLAY	
SERVICE LIMIT	0.080 mm (.0031 in)

Crankshaft Pin Diameter

Measure crankshaft pin diameter using a micrometer.

To obtain connecting rod radial play (big end), calculate the difference between the crankshaft pin diameter and the inner diameter of the connecting rod plain bearings (see *CONNECTING ROD INSPECTION*) in this subsection.



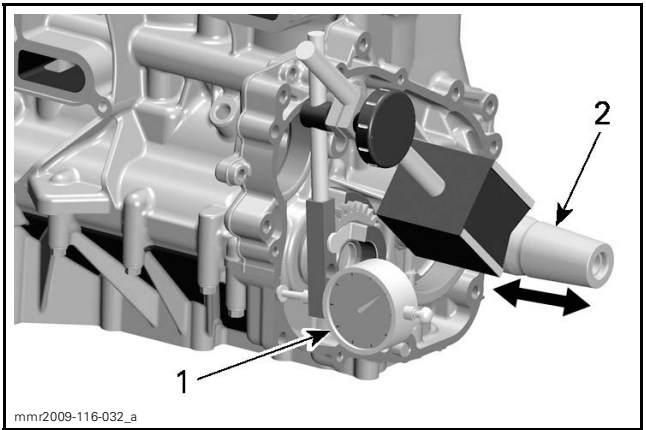
TYPICAL
1. Micrometer
2. Crankshaft pin area for plain bearing

CRANKSHAFT PIN DIAMETER	
NEW	35.979 mm to 35.995 mm (1.416 in to 1.417 in)
SERVICE LIMIT	35.969 mm (1.416 in)

CONNECTING ROD BIG END RADIAL PLAY	
SERVICE LIMIT	0.080 mm (.0031 in)

Crankshaft Axial Play

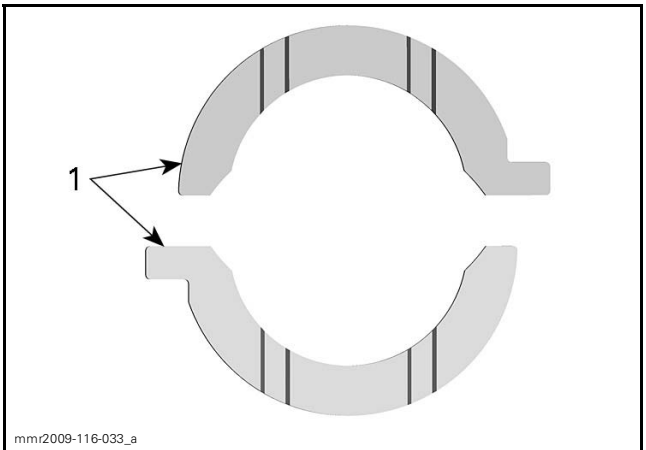
With the crankshaft in the cylinder block, measure the crankshaft axial play, using a dial indicator.



TYPICAL
1. Dial indicator
2. Crankshaft

CRANKSHAFT AXIAL PLAY	
NEW	0.120 mm to 0.392 mm (.005 in to .015 in)
SERVICE LIMIT	0.450 mm (.018 in)

If axial play is out of specification, replace the crankshaft thrust washers and repeat measurement.



TYPICAL
1. Crankshaft thrust washers

Crankshaft Installation

Reverse the removal procedure. However, pay attention to following details.

Turn cylinder block upside down.

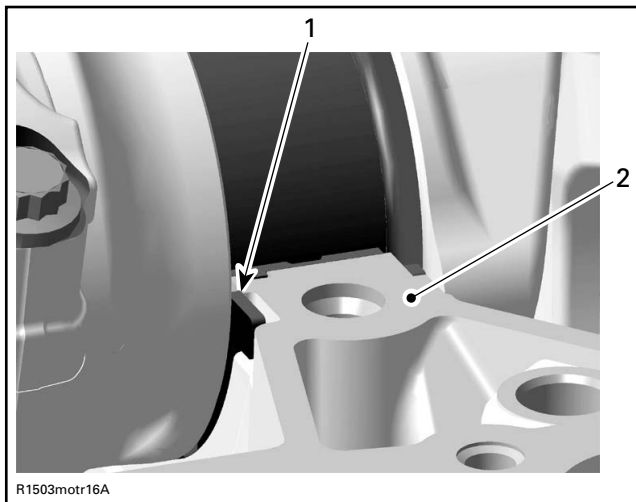
NOTICE Be careful that connecting rods do not hit the cylinder block.

Apply engine oil on all plain bearings before installing them.

Install crankshaft along with the timing chain.

Lubricate (both sides) and reinstall crankshaft thrust washers with the slots facing against crankshaft counterweights.

NOTE: Thrust washers must be flush with cylinder block sealing surface.



TYPICAL
1. Thrust washer
2. Sealing surface

Install connecting rod caps. Refer to *PISTONS AND CONNECTING RODS* in this subsection.

NOTICE It is absolutely necessary to follow this procedure. Otherwise, severe engine damage can occur.

Install cylinder block lower half. Refer to *CYLINDER BLOCK* in this subsection.

Lock crankshaft before further assembly of the engine. See *CRANKSHAFT LOCKING PROCEDURE* in this subsection.

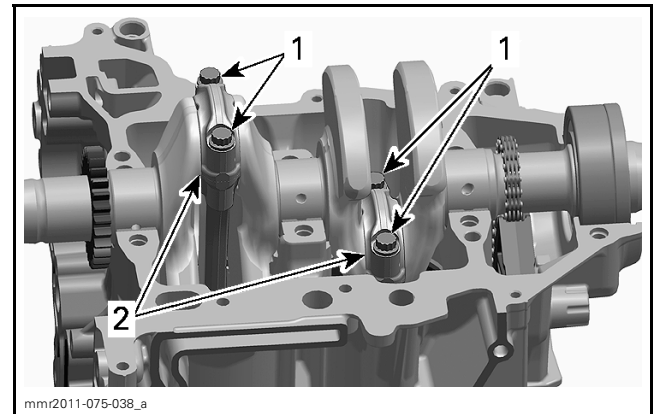
PISTONS AND CONNECTING RODS

Piston and Connecting Rod Removal

NOTE: It is recommended to measure connecting rod big end axial play prior to removing connecting rod. Refer to *CONNECTING ROD INSPECTION* in this subsection.

1. Disassemble *CYLINDER BLOCK* as per procedure in this subsection.
2. Remove connecting rod cap.

NOTICE Mark cylinder position of connecting rod before disassembly.

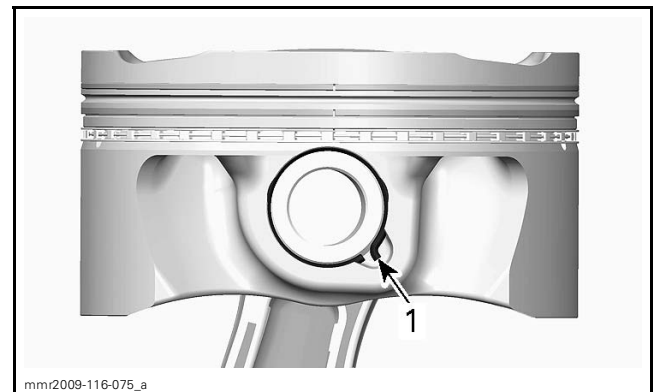


1. Connecting rod screws
2. Connecting rod cap

3. Remove *CRANKSHAFT* as per procedure in this subsection.
4. Turn cylinder block and push piston and connecting rod out of the cylinder.

Piston and Connecting Rod Disassembly

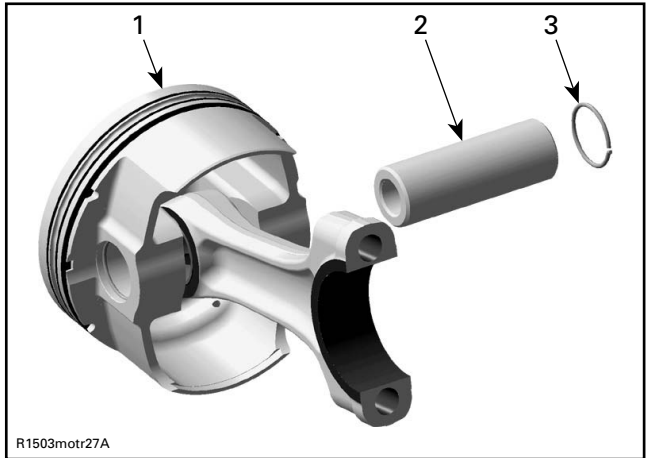
1. Remove one piston pin circlip and discard it.



TYPICAL
1. Piston pin circlip

Section 02 ENGINE (600 ACE)
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NOTE: The removal of both piston pin circlips is not necessary to remove the piston pin.
2. Push piston pin out of the piston.



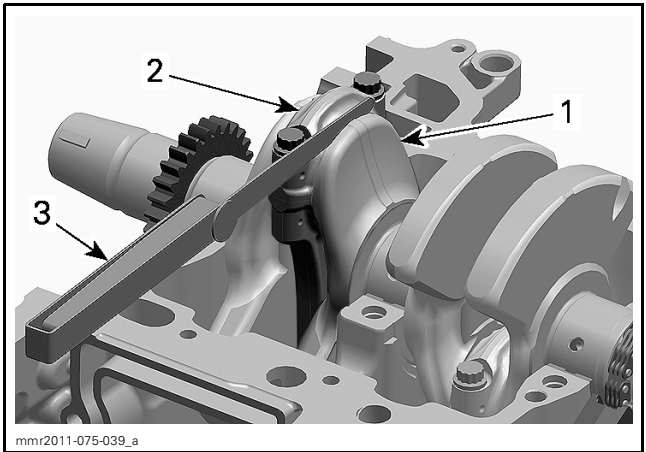
TYPICAL
1. Piston
2. Piston pin
3. Circlip

3. Detach piston from connecting rod.

Connecting Rod Inspection

Connecting Rod Big End Axial Play

Using a feeler gauge, measure the distance between the butting face of the connecting rod, and the crankshaft counterweight. If the distance exceeds specified tolerance, replace the worn part.

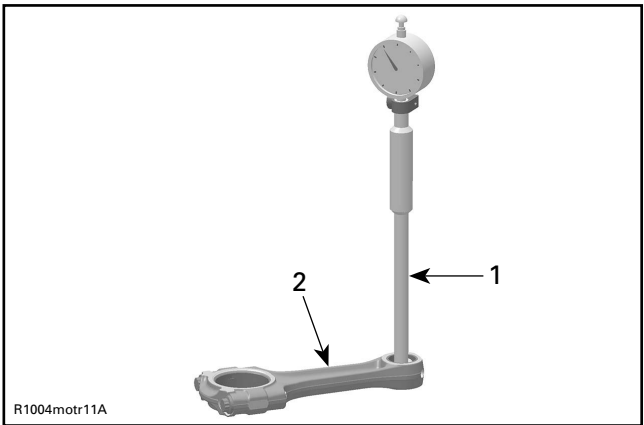


1. Crankshaft
2. Connecting rod
3. Feeler gauge

CONNECTING ROD BIG END AXIAL PLAY	
NEW	0.100 mm to 0.352 mm (.004 in to .014 in)
SERVICE LIMIT	0.450 mm (.018 in)

Connecting Rod Small End Radial Play

Measure connecting rod small end using a bore gauge.



TYPICAL
1. Bore gauge
2. Connecting rod

CONNECTING ROD SMALL END DIAMETER	
NEW	17.010 mm to 17.020 mm (.6697 in to .6701 in)
SERVICE LIMIT	17.060 mm (.6717 in)

If the connecting rod small end diameter is out of specification, replace the connecting rod.

To obtain the connecting rod radial play (small end), calculate the difference between the piston pin diameter (*PISTON PIN INSPECTION*) and the inner diameter of the connecting rod small end.

CONNECTING ROD SMALL END RADIAL PLAY	
SERVICE LIMIT	0.040 mm (.0016 in)

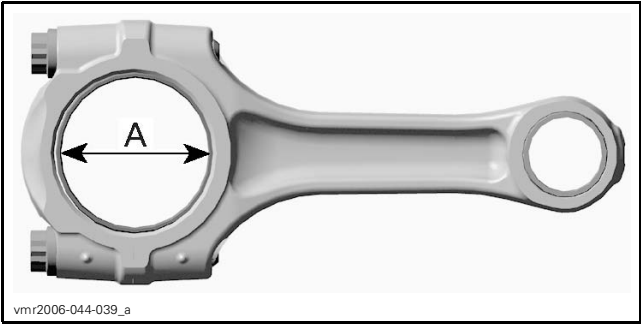
Connecting Rod Big End Radial Play

1. Measure inside diameter of connecting rod big end.

- 1.1 Install the OLD plain bearings as they were mounted initially.
- 1.2 Perform the tightening procedure as described in *PISTON AND CONNECTING ROD INSTALLATION* in this subsection.

NOTE: To measure the connecting rod big end diameter, ALWAYS use the OLD connecting rod screws.

1.3 Measure inside diameter in longitudinal direction of the connecting rod.



TYPICAL
A. Connecting rod big end bearing

CONNECTING ROD BIG END DIAMETER	
SERVICE LIMIT	36.060 mm (1.4197 in)

To obtain the connecting rod big end radial play, calculate the difference between the big end diameter and the crankshaft pin diameter (see *CRANKSHAFT INSPECTION*) in this subsection.

CONNECTING ROD BIG END RADIAL PLAY	
SERVICE LIMIT	0.080 mm (.0031 in)

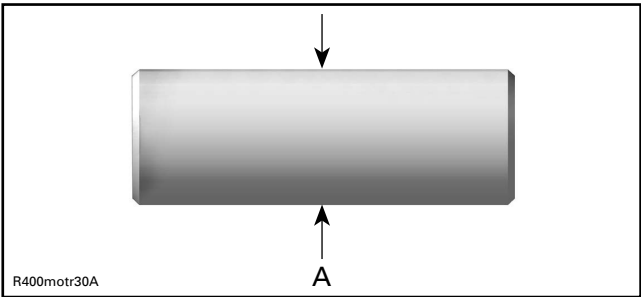
If connecting rod big end diameter is out of specification, install NEW plain bearings.

Piston Pin Inspection

Using a woven synthetic abrasive, clean piston pin of deposits.

Inspect piston pin for scoring, cracks or other damage.

Measure piston pin diameter, using a micrometer. See following illustration for proper measurement position.



TYPICAL
A. Measure piston pin diameter here

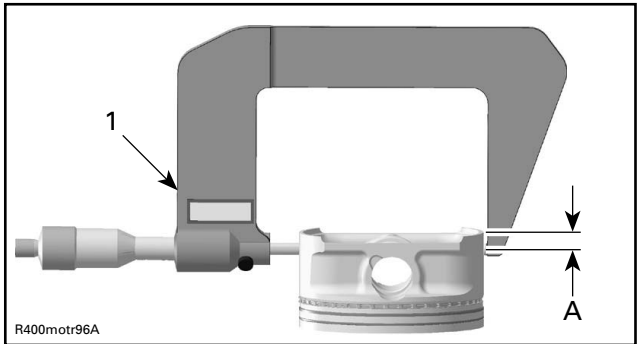
PISTON PIN DIAMETER	
NEW	16.996 mm to 17.000 mm (.6691 in to .6693 in)
SERVICE LIMIT	16.986 mm (.6687 in)

Replace piston pin if out of specification.

Piston Inspection

Inspect piston for scoring, scuffing, cracks or other damage. Replace piston and piston rings if necessary.

Using a micrometer, measure piston perpendicularly (90°) to piston pin axis at 8.5 mm (11/32 in) from the skirt edge.



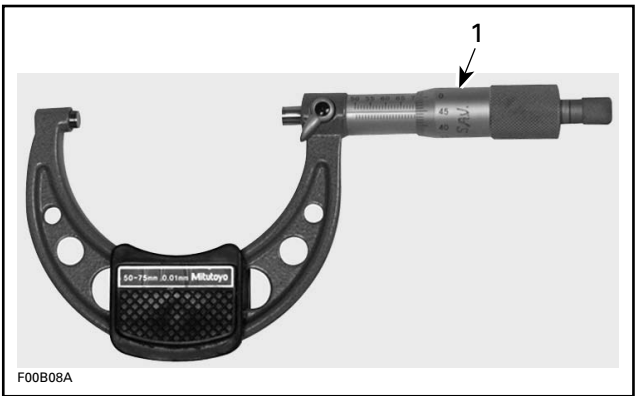
TYPICAL
1. Measuring perpendicularly (90°) to piston pin axis
A. 8.5 mm (11/32 in)

PISTON MEASUREMENT	
NEW	73.950 mm to 73.966 mm (2.911 in to 2.912 in)
SERVICE LIMIT	73.920 mm (2.9102 in)

Replace piston if out of specification.

Piston/Cylinder Clearance

1. Adjust and lock a micrometer to the piston dimension.

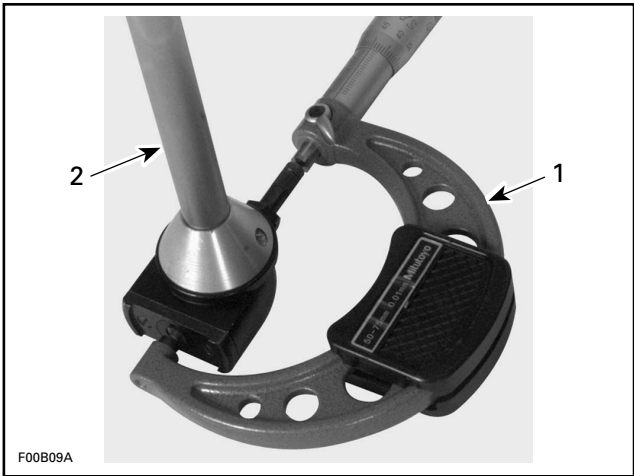


TYPICAL
1. Micrometer set to the piston dimension

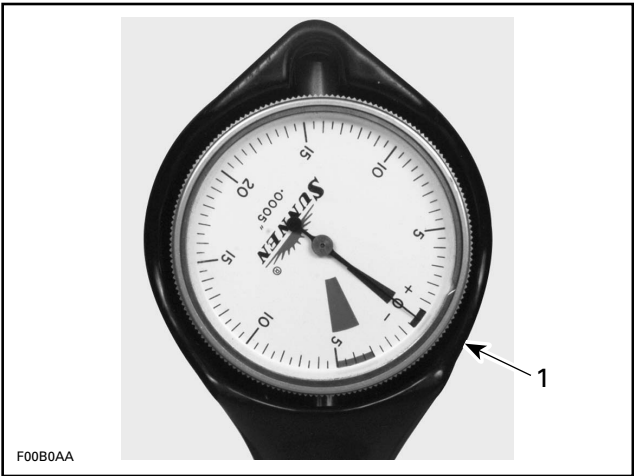
NOTE: Make sure used piston is not worn.

2. With the micrometer locked at step 1, adjust a cylinder bore gauge to the micrometer dimension and set the indicator to 0 (zero).

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TYPICAL
1. Use the micrometer to set the cylinder bore gauge
2. Cylinder bore gauge



TYPICAL
1. Indicator set to 0 (zero)

NOTE: Make sure the cylinder bore gauge indicator is set exactly at the same position as with the micrometer, otherwise the reading will be false.

3. Position the cylinder bore gauge 35 mm (1-3/8 in) below the cylinder head mating surface, measuring perpendicularly (90°) to piston pin axis.
4. Read measurement on cylinder bore gauge. The result is the exact piston/cylinder clearance.

PISTON/CYLINDER CLEARANCE	
NEW	0.037 mm to 0.067 mm (.0015 in to .0026 in)
SERVICE LIMIT	0.080 mm (.0031 in)

If clearance exceeds specified tolerance, replace piston and repeat measurement procedure.

Piston and Connecting Rod Assembly

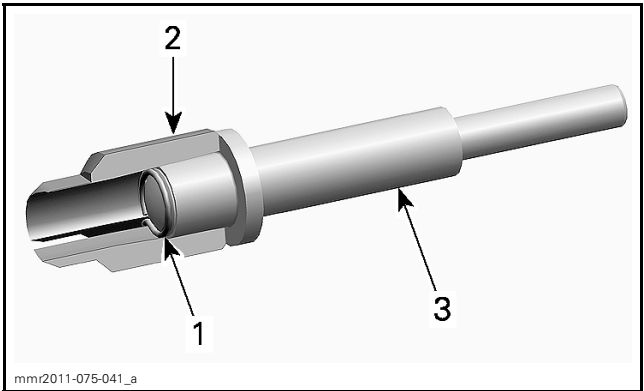
Reverse the disassembly procedure. However, pay attention to the following details.

1. Apply engine oil on piston pin.
 2. Insert piston pin in piston and connecting rod.
- NOTE:** Be sure to reinstall all parts in their original position as marked during removal.
3. Install **NEW** piston pin circlip(s).

REQUIRED TOOL	
PISTON CIRCLIP INSTALLER (P/N 529 036 207)	

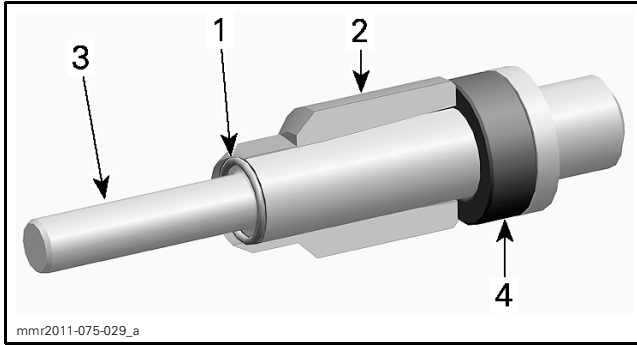
NOTICE Always replace removed piston pin circlips by **NEW** ones.

- 3.1 Place the circlip in the sleeve and push piston circlip installer handle until circlip reaches the mid position in the sleeve.



TYPICAL
1. Circlip
2. Sleeve
3. Installer handle

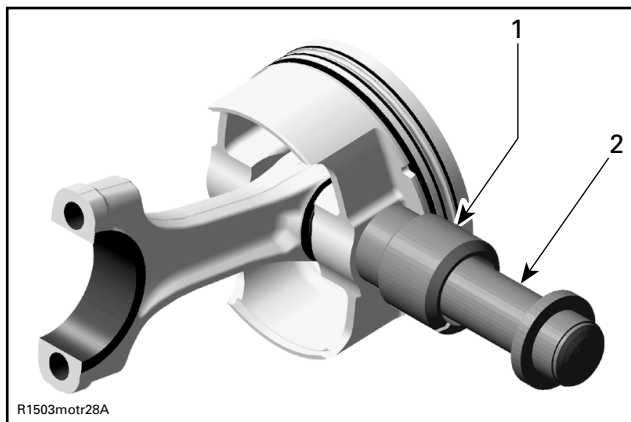
- 3.2 Put the distance sleeve on the installer handle.
- 3.3 Push piston circlip installer handle until distance sleeve makes contact with the sleeve.



1. Circlip
2. Sleeve
3. Installer handle
4. Distance sleeve

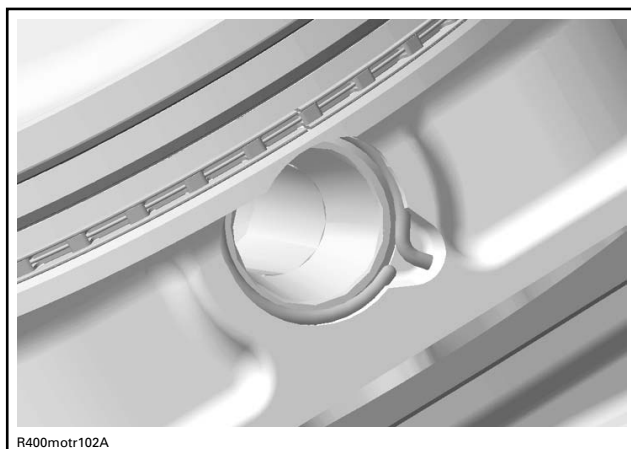
3.4 Remove distance sleeve and insert installer handle into the sleeve.

3.5 Insert the end of the handle into the piston pin, then push to engage the circlip in the piston groove.



- TYPICAL**
1. Sleeve with piston circlip inside
 2. Piston clip installer handle

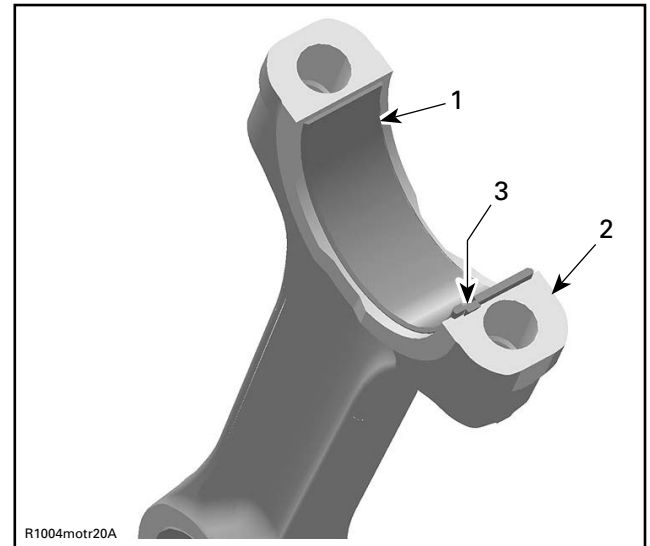
NOTE: Ensure the hook of the piston pin circlip is properly positioned.



CORRECT POSITION OF PISTON PIN CIRCLIP

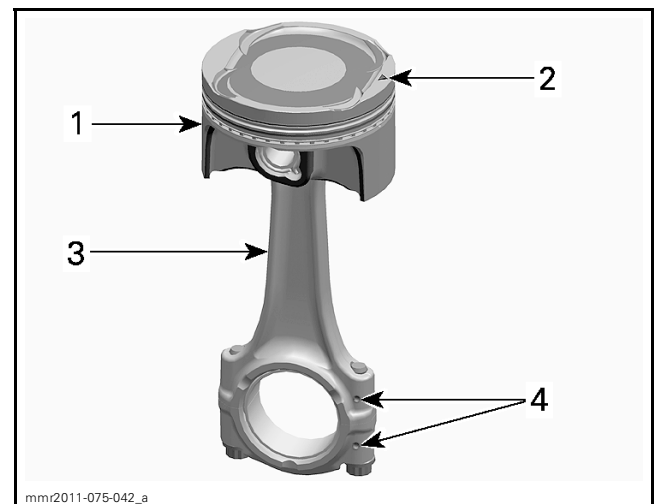
NOTICE If piston pin circlip installation fails, repeat step 3 by using a NEW circlip.

4. Correctly install plain bearings and carefully clean split surface on both sides (cracked area) with compressed air.



- TYPICAL**
1. Half bearing of connecting rod big end
 2. Split surface of the connecting rod
 3. Protrusion of bearing in line with connecting rod groove

NOTICE The arrow on top of the piston and the punch marks on the connecting rods must always point towards the exhaust.



1. Piston
2. Arrow on top
3. Connecting rod
4. Punch marks

Piston and Connecting Rod Installation

1. Using recommended engine oil, lubricate:
 - Piston
 - Piston rings

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Subsection 09 (BOTTOM END)

- Cylinder bore
 - Connecting rod bearings.
2. Slide piston in cylinder bore. Pay attention to the following.

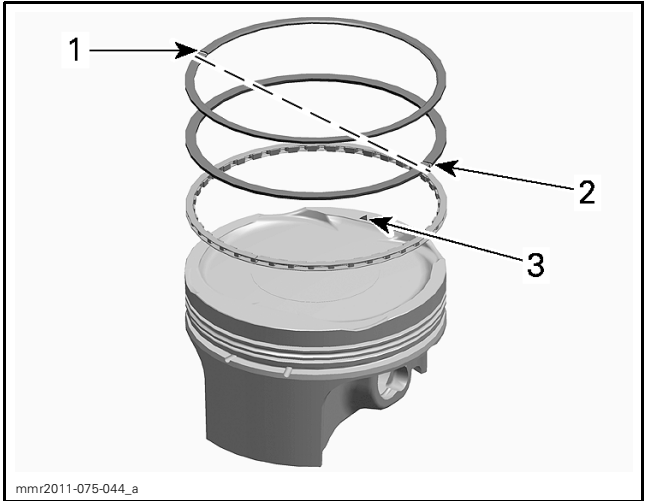
REQUIRED TOOL	
PISTON RING COMPRESSOR (P/N 529 036 208)	



TYPICAL

- 2.1 If reused, install piston in its original bore.
- 2.2 Make sure piston rings are properly spaced.

NOTICE The ring gaps of both compression rings should always be 180° from each other and 90° from the arrow on top of the piston.

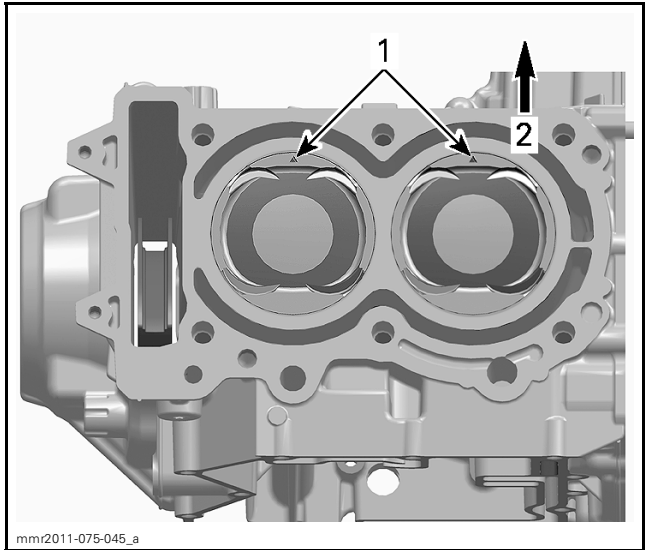


RING GAPS AT 180° FROM EACH OTHER AND 90° FORM ARROW

1. Rectangular ring - ring gap
2. Taper-face ring - ring gap
3. Arrow

- 2.3 The arrow on top of the piston must point towards the exhaust.

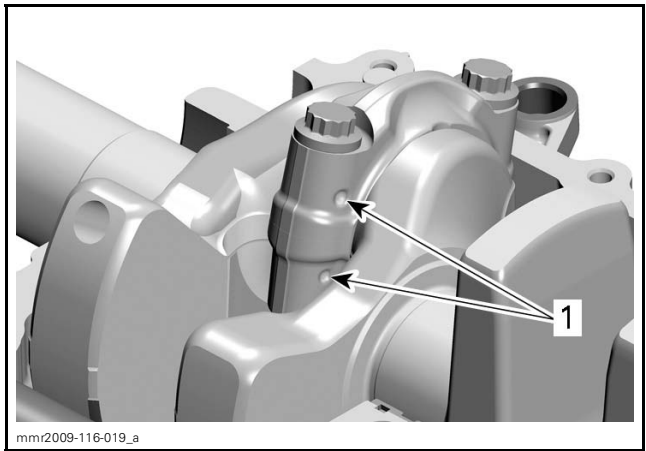
NOTICE A piston installed with the arrow in the wrong direction would cause serious engine damage.



1. Arrows
2. Exhaust

3. Turn cylinder block upside down.
4. Install *CRANKSHAFT* as per procedure in this subsection.
5. Oil crankshaft pin.
6. Install connecting rod caps.

NOTE: Printed marks on connecting rod and cap must point together.



TYPICAL
1. Printed marks

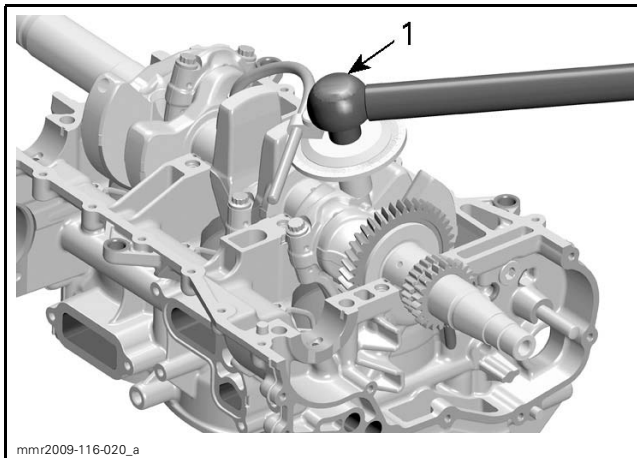
NOTICE This assembly uses stretch screws. Always use NEW screws and strictly adhere to the tightening procedure.

7. Tighten connecting rod screws as follows:
 - 7.1 Apply oil on connecting rod screw heads.
 - 7.2 Torque both connecting rod screws of a connecting rod.

CONNECTING ROD SCREWS TIGHTENING PROCEDURE	
FIRST STEP	12 N•m ± 2 N•m (106 lbf•in ± 18 lbf•in)

- 7.3 Use a torque angle gauge to carry out the second step.

CONNECTING ROD SCREWS TIGHTENING PROCEDURE	
SECOND STEP	Additional 70° ± 5°



1. Torque angle gauge

NOTICE Failure to strictly follow this procedure may cause screws to loosen and lead to severe engine damage.

8. Install all other removed parts.

PISTON RINGS

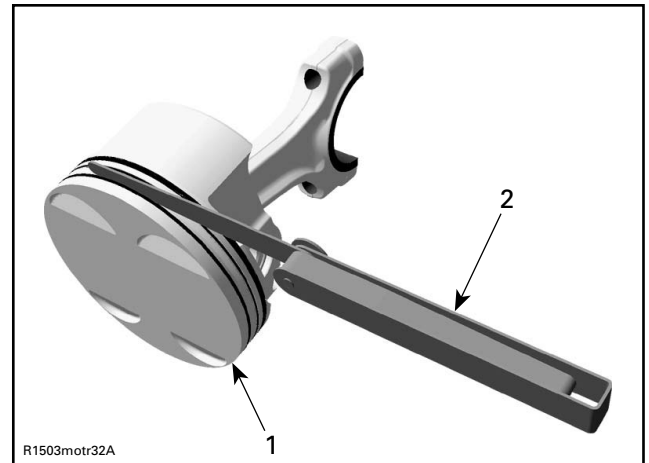
Piston Ring Removal

1. Remove piston, see procedure in this subsection.
2. Remove rings from piston.

Piston Ring Inspection

Ring/Piston Groove Clearance

Using a feeler gauge measure each ring/piston groove clearance.



TYPICAL
 1. Piston
 2. Feeler gauge

RING/PISTON GROOVE CLEARANCE	
UPPER COMPRESSION RING	
NEW	0.030 mm to 0.066 mm (.0012 in to .0026 in)
SERVICE LIMIT	0.120 mm (.0047 in)
LOWER COMPRESSION RING	
NEW	0.020 mm to 0.056 mm (.0008 in to .0022 in)
SERVICE LIMIT	0.120 mm (.0047 in)
OIL SCRAPER RING	
NEW	0.010 mm to 0.040 mm (.0004 in to .0016 in)
SERVICE LIMIT	0.150 mm (.0059 in)

If clearance is out of specification, the piston and rings should be replaced.

Ring End Gap

1. Place piston ring in cylinder bore between 8 mm to 16 mm (5/16 in to 5/8 in) from the top of cylinder.

NOTE: In order to correctly position the ring in the cylinder bore, use a piston as a pusher.

2. Using a feeler gauge, check ring end gap.

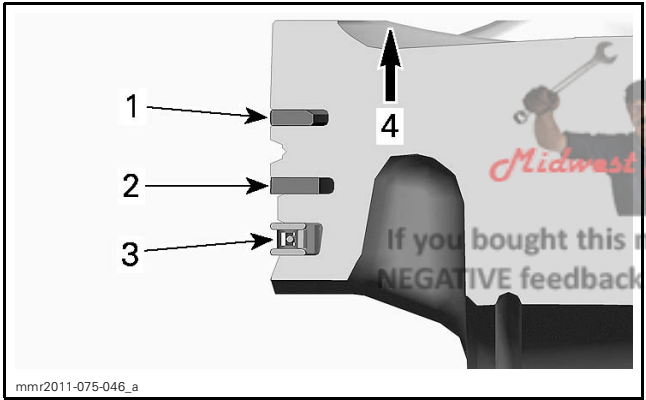
Section 02 ENGINE (600 ACE)
Subsection 09 (BOTTOM END)

RING END GAP	
UPPER COMPRESSION RING	
NEW	0.20 mm to 0.35 mm (.008 in to .014 in)
SERVICE LIMIT	1.20 mm (.047 in)
LOWER COMPRESSION RING	
NEW	0.30 mm to 0.50 mm (.012 in to .02 in)
SERVICE LIMIT	1.20 mm (.047 in)
OIL SCRAPER RING	
NEW	0.20 mm to 0.70 mm (.0079 in to .0276 in)
SERVICE LIMIT	1.20 mm (.047 in)

If ring end gap is out of specification, replace piston rings.

Piston Ring Installation

- 1. Install piston rings in the following order.
NOTE: Use a ring expander to prevent breakage during installation. The oil ring must be installed by hand.
 - 1.1 Install oil scraper ring.
 - 1.2 Install the lower compression ring with the letter "N" facing up.
 - 1.3 Install upper compression ring with the letter "N" facing up.



- 1. Rectangular ring
- 2. Taper-face ring
- 3. Oil scraper ring
- 4. Letter "N" facing up

NOTICE Ensure the upper and lower compression rings are not interchanged.

- 2. Ensure rings rotate smoothly after installation.



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CYLINDER BLOCK

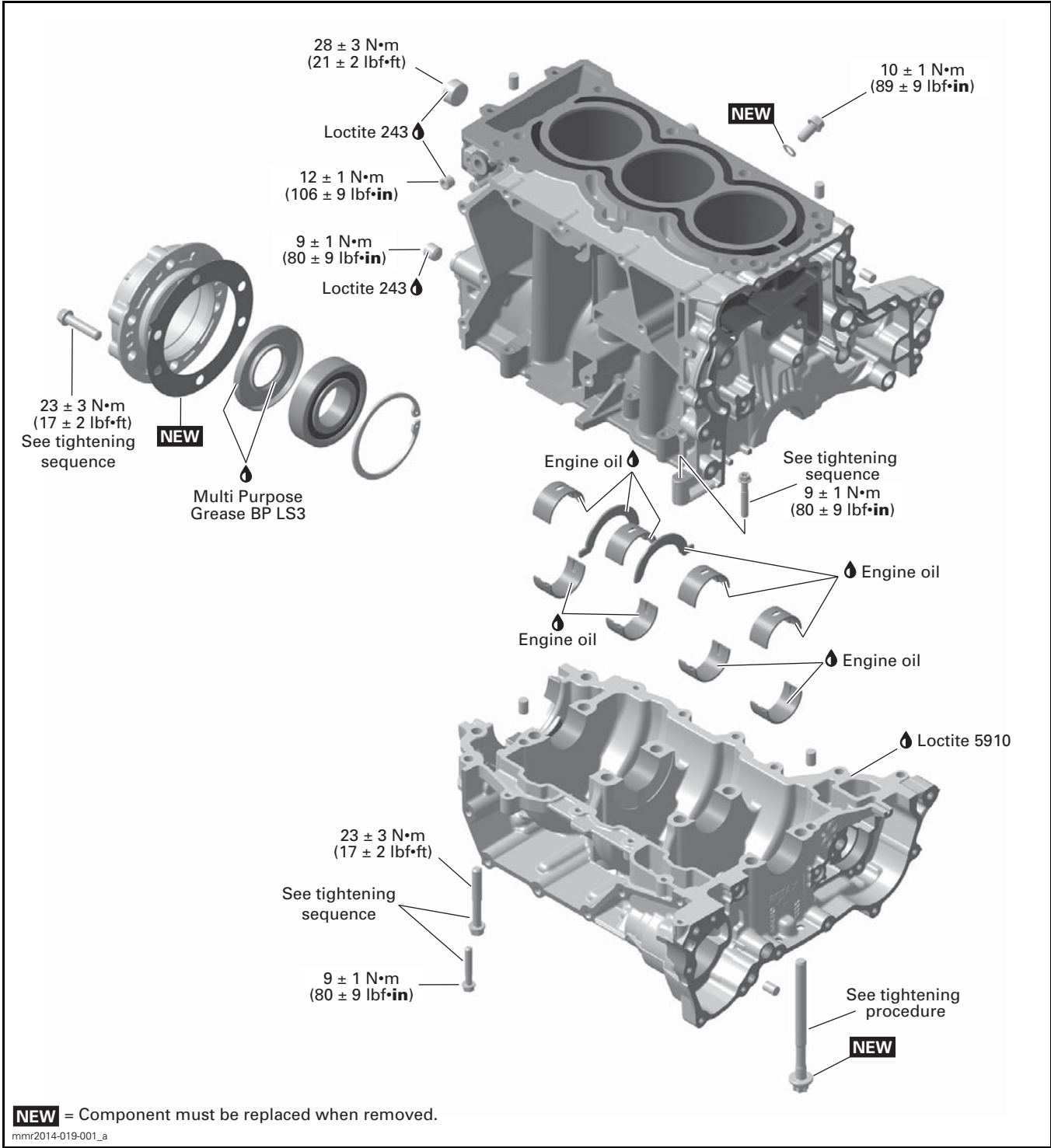
SERVICE TOOLS

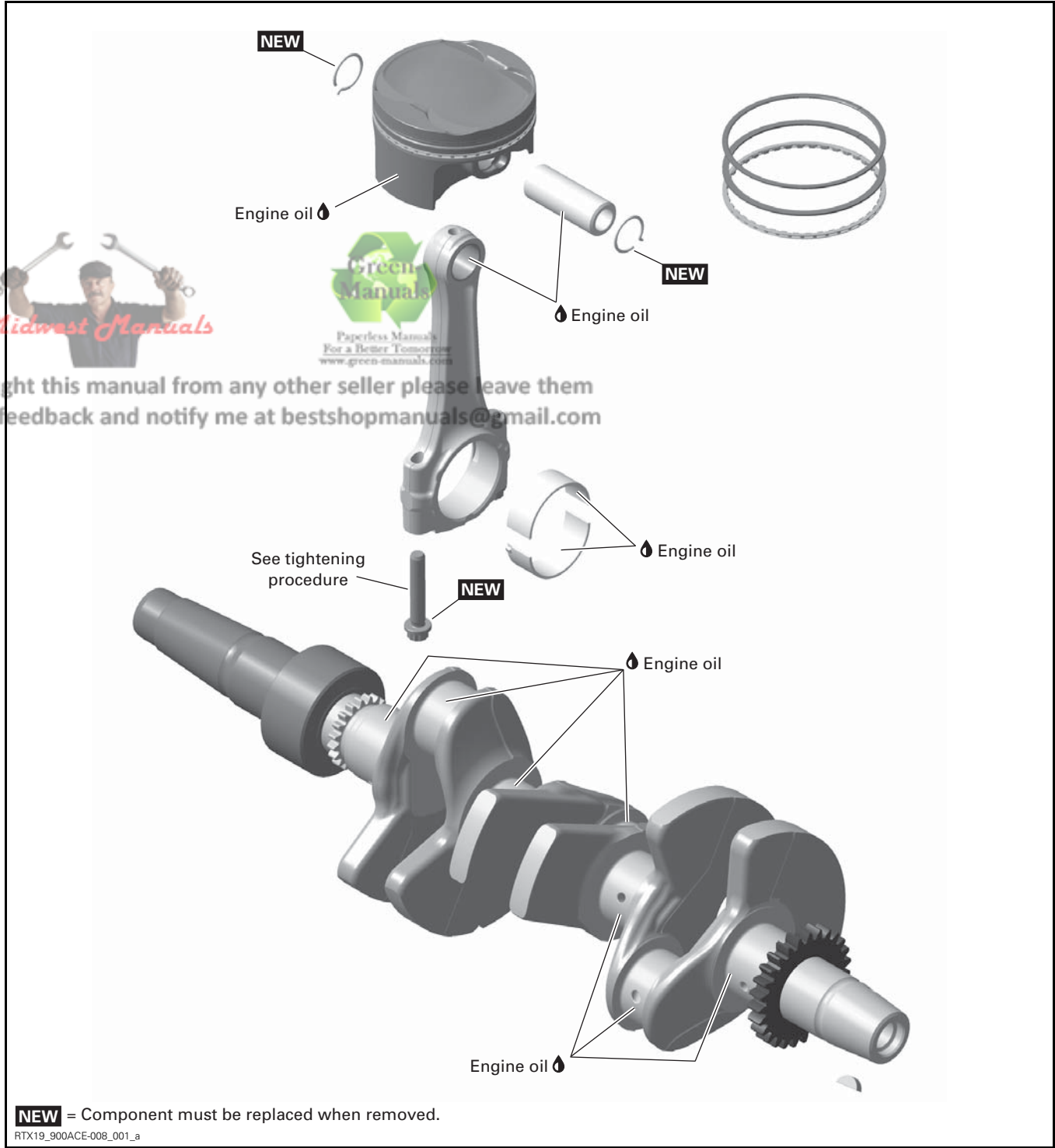
Description	Part Number	Page
CRANKSHAFT LOCKING TOOL	529 036 272	14
OIL SEAL/BEARING PUSHER	529 036 284	5-6
PISTON CIRCLP INSTALLER.....	529 036 207	20
PISTON RING COMPRESSOR	529 036 208	22

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 5910	293 800 081	11
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	10
SUPER LUBE GREASE.....	293 550 030	5

Subsection XX (CYLINDER BLOCK)





RTX19_900ACE-008_001_a

GENERAL

When disassembling parts that are duplicated in the engine, (e.g.: pistons, connecting rods etc.), it is strongly recommended to note their position and to keep the parts of the same assembly as a "group". If you find a defective component, it would be much easier to find the cause of the failure. Since parts were broken-in during engine operation, they will maintain their matched fit when reassembled together within their "group".

TROUBLESHOOTING

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

UNUSUAL ENGINE NOISE OR VIBRATIONS

1. Heavy wear on plain bearings.
 - Check radial play of plain bearings. Replace if out of specification.
2. Crankshaft axial play out of specification.
 - Measure crankshaft axial play. If crankshaft axial play is out of specification, replace thrust washers.
3. Connecting rod axial play out of specification.
 - Measure connecting rod axial play on crankshaft. Replace connecting rod or crankshaft if out of specification.
4. Connecting rod screws got loose.
 - Replace damaged components and retighten screws with the recommended torque.
5. Crankshaft PTO ball bearing is worn.
 - Remove PTO cover and check ball bearing for excessive play. Replace ball bearing if necessary.

BLUE SMOKE IN THE EXHAUST

1. Oil scraper rings worn out.
 - Replace piston rings.

ENGINE SUDDENLY TURNS OFF (POOR IDLING)

1. Piston rings worn out.
 - Replace piston rings.
2. Piston/cylinder clearance out of specification.
 - Check piston/cylinder clearance. Replace if out of specification.
3. Melted or broken piston.
 - Replace piston and cylinder block if necessary.

PROCEDURES

PTO COVER AND PTO OIL SEALS

PTO Cover Access

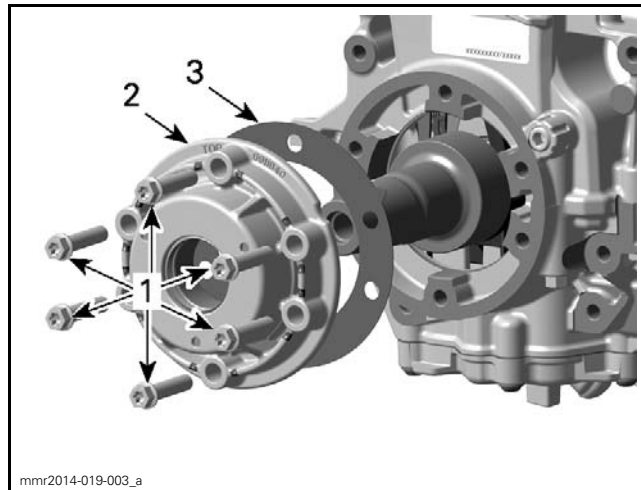
NOTE: To replace the PTO oil seal, it is not necessary to remove engine from the vehicle.

Remove drive pulley. Refer to *DRIVE PULLEY (e-Drive)* subsection.

Removing the PTO Cover

Remove screws retaining the PTO cover.

Remove PTO cover and discard gasket.



1. PTO cover screws
2. PTO cover
3. Gasket

PTO Oil Seal and Bearing Replacement

NOTE: Always replace PTO oil seal and ball bearing at the same time.

Removing the PTO Oil Seal and Bearing

1. Use pliers to remove inner retaining ring.



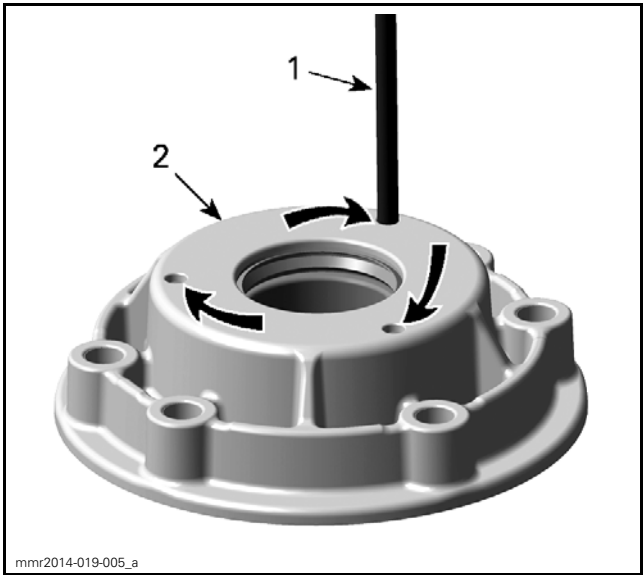
- 1. Retaining ring
- 2. PTO cover

2. Heat PTO cover to 130°C (266°F) before removing ball bearing and oil seal.

NOTICE Clean PTO cover of oil before heating.

3. Carefully push out oil seal and ball bearing.

REQUIRED TOOL
Punch 4 mm (.157 in)



PUSH OUT CIRCULAR

- 1. Punch
- 2. PTO cover

4. Remove and discard ball bearing and oil seal.



- 1. Ball bearing
- 2. Oil seal
- 3. PTO cover

Installing the PTO Oil Seal and Bearing

NOTE: Check the oil seal running surface on the crankshaft for grooves and deposits before installation of a NEW oil seal.

- 1. Clean crankshaft PTO side of deposits.
- 2. Clean oil seal and ball bearing areas in PTO cover.
- 3. Lubricate oil seal sealing lip and outer diameter.

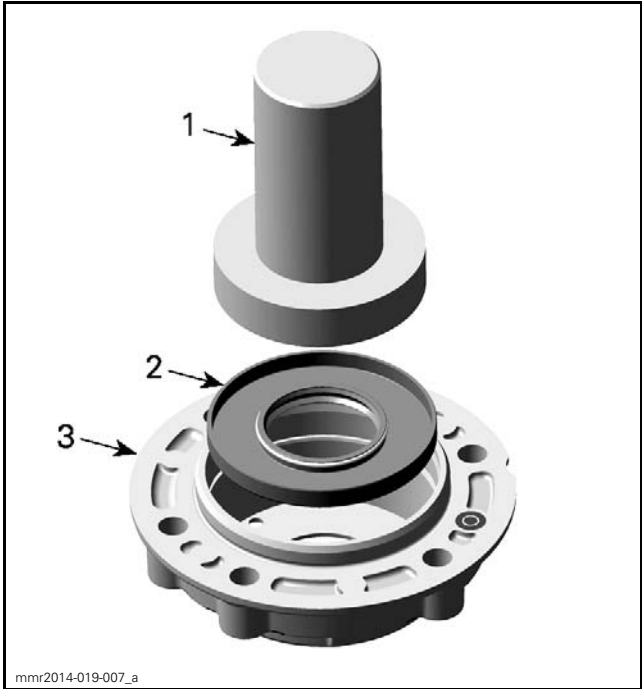
SERVICE PRODUCT
SUPER LUBE GREASE (P/N 293 550 030)

4. Press NEW oil seal in PTO cover.

NOTICE Oil seal must be installed with sealing lip in, towards the engine.

REQUIRED TOOL
OIL SEAL/BEARING PUSHER (P/N 529 036 284)



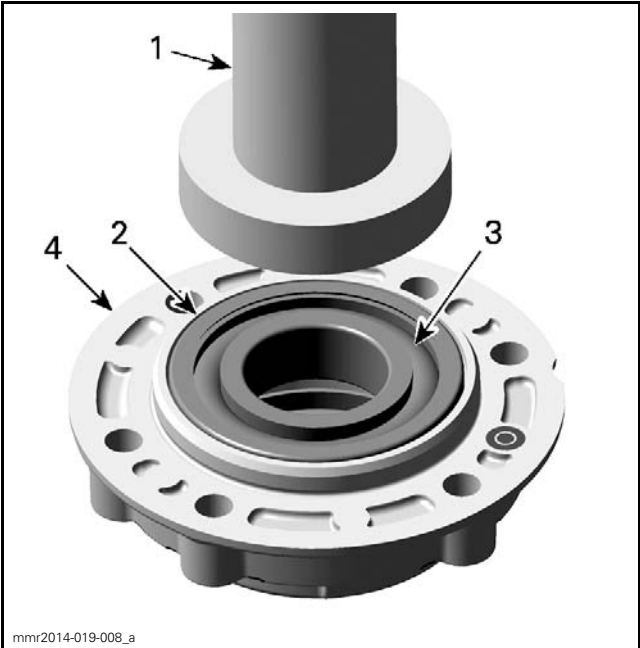


- 1. Oil seal/bearing pusher
- 2. Oil seal
- 3. PTO cover

- 5. Place **NEW** ball bearing in PTO cover with open side of plastic cage facing towards the engine.
- 6. Carefully press in the ball bearing.

NOTICE During installation never push on the inner race of the bearing.

REQUIRED TOOL	
OIL SEAL/BEARING PUSHER (P/N 529 036 284)	



- 1. Oil seal/bearing pusher
- 2. Ball bearing
- 3. Open side of plastic cage
- 4. PTO cover

- 7. Install retaining ring.

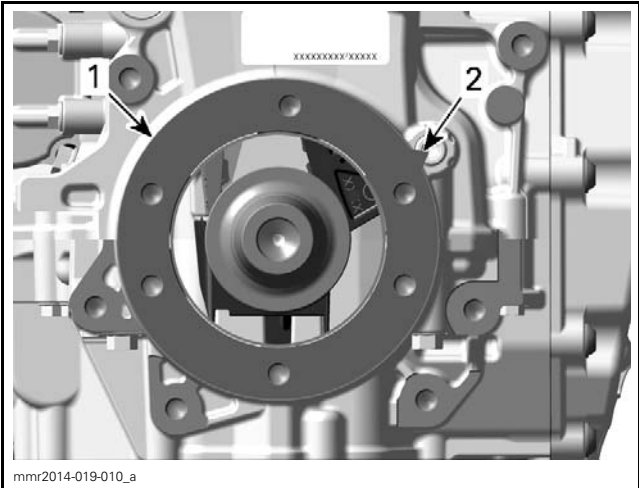


- 1. Retaining ring
- 2. PTO cover

Installing the PTO Cover

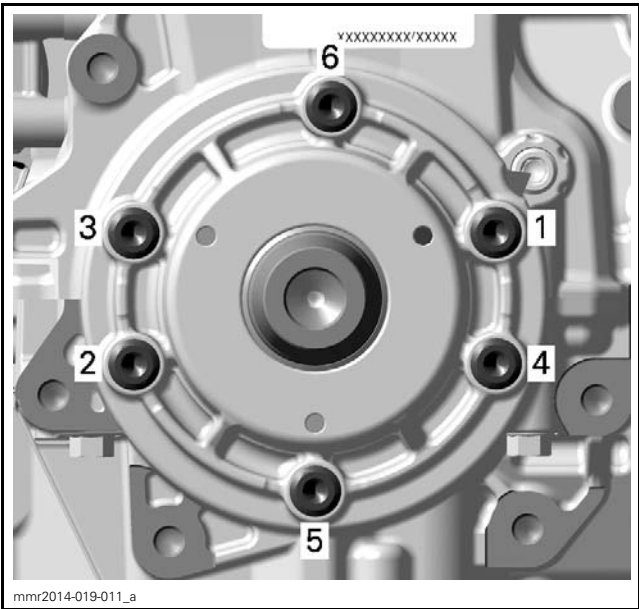
Reverse the removal procedure. However, pay attention to following details.

Install a **NEW** PTO cover gasket in proper position.



1. Gasket
2. Tab

Tighten PTO cover screws as per following sequence and specified torque.



PTO COVER TIGHTENING SEQUENCE

TIGHTENING TORQUE	
PTO cover screws	23 N•m ± 3 N•m (17 lbf•ft ± 2 lbf•ft)

CYLINDER BLOCK

Disassembling the Cylinder Block

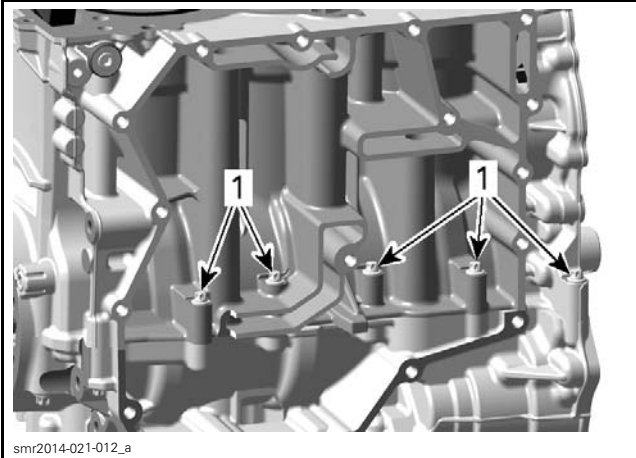
1. Remove engine from vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
2. Refer to *LUBRICATION SYSTEM* and drain engine oil.
3. Remove the valve cover. Refer to *TOP END* subsection.

4. Lock crankshaft, refer to *CRANKSHAFT LOCKING PROCEDURE* in this subsection.
5. Remove air intake manifold. Refer to *INTAKE MANIFOLD* subsection.
6. Refer to *COOLING SYSTEM - ENGINE* subsection and remove:
 - Water pump housing
 - Thermostat
 - Water pump drive gear.
7. Refer to *LUBRICATION SYSTEM* subsection and remove:
 - Oil tank
 - Oil cooler
 - Oil pressure regulator
 - Oil pump drive gears and oil pumps
 - Oil sump cover
 - Oil strainers.
8. Refer to *MAGNETO AND STARTER* subsection and remove:
 - Magneto cover
 - Rotor
 - Starter drive gears
 - Electric starter.
9. Refer to *TIMING CHAIN* subsection and remove:
 - Timing chain tensioner
 - Timing chain guides.
10. Refer to *TOP END* subsection and remove:
 - Camshaft holders
 - Cylinder head.
11. Remove PTO cover. Refer to *PTO COVER AND PTO OIL SEAL* in this subsection.

NOTE: Before splitting the cylinder block, measure crankshaft axial play. Refer to *CRANKSHAFT* in this subsection.

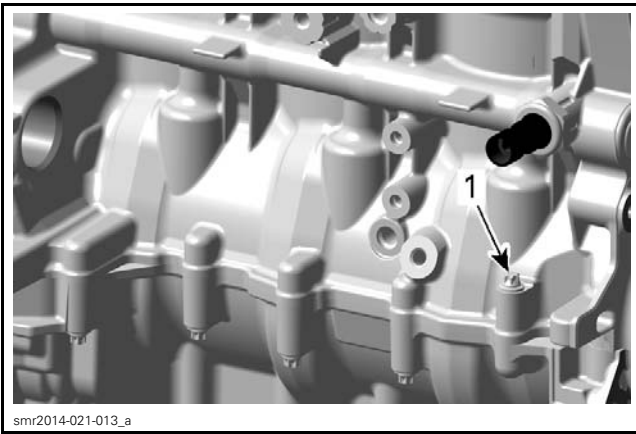
12. Remove crankshaft locking tool.
13. Remove cylinder block screws.
 - 13.1 Start by removing M6 screws.
 - 13.2 Then remove M8 screws.
 - 13.3 Finally remove and discard M9 screws.

Subsection XX (CYLINDER BLOCK)



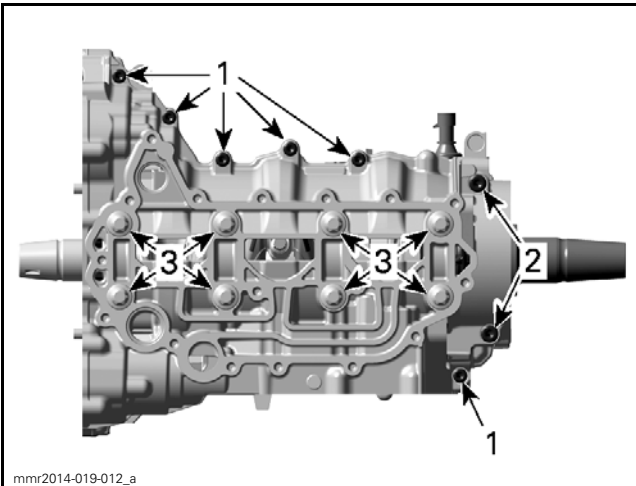
INTAKE SIDE

1. Cylinder block screws (M6) screwed from top to bottom



EXHAUST SIDE

1. Cylinder block screw (M6) screwed from top to bottom

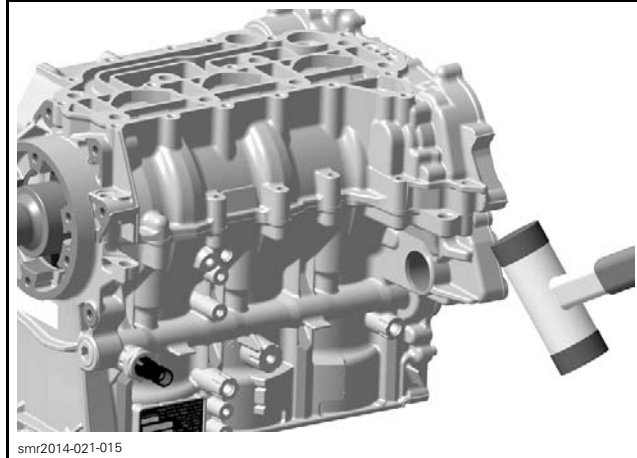


BOTTOM SIDE

1. M6 screws
2. M8 screws
3. M9 screws (discard)

14. Carefully remove cylinder block lower half using a soft hammer.

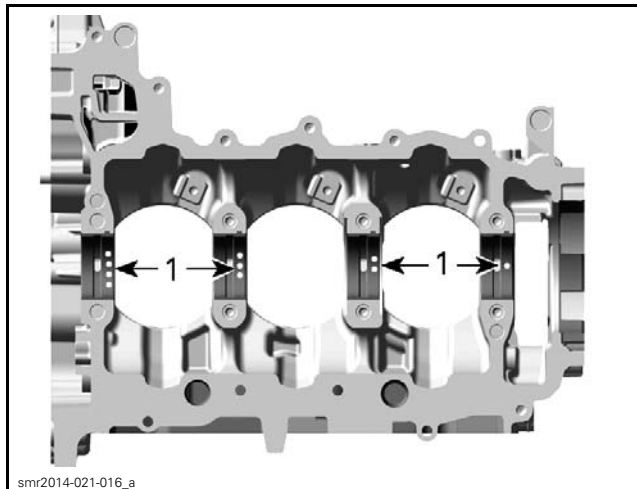
NOTE: Take care not to damage the sealing surfaces of the cylinder block halves.



15. Remove connecting rod caps. Refer to *PISTONS AND CONNECTING RODS* in this subsection.
16. Refer to *CRANKSHAFT* in this subsection and remove:
 - Crankshaft thrust washers
 - Crankshaft.
17. Remove pistons and connecting rods. See procedure in this subsection.

Removing the Plain Bearing

When the plain bearings need to be removed from the cylinder block, mark them to identify the correct position at installation. See the illustration as an example.

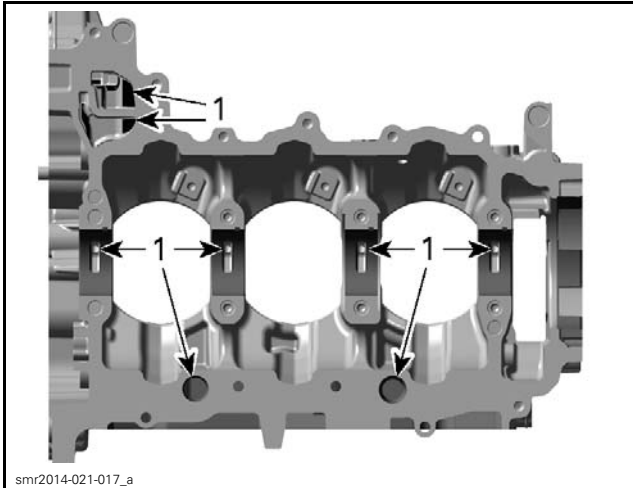


1. Mark on crankshaft plain bearings

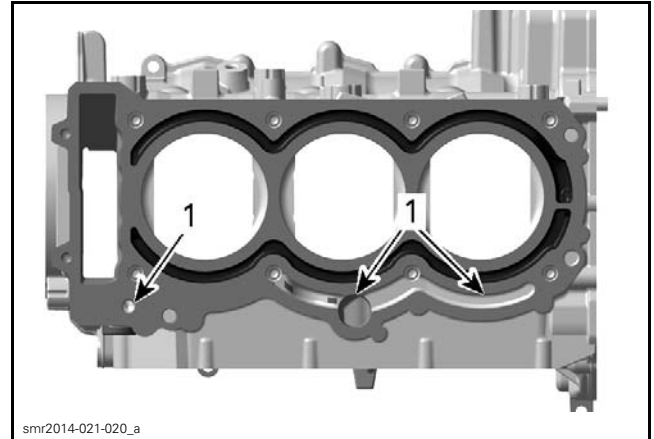
Cleaning the Cylinder Block

Clean cylinder block using a part cleaner, then use compressed air to dry it.

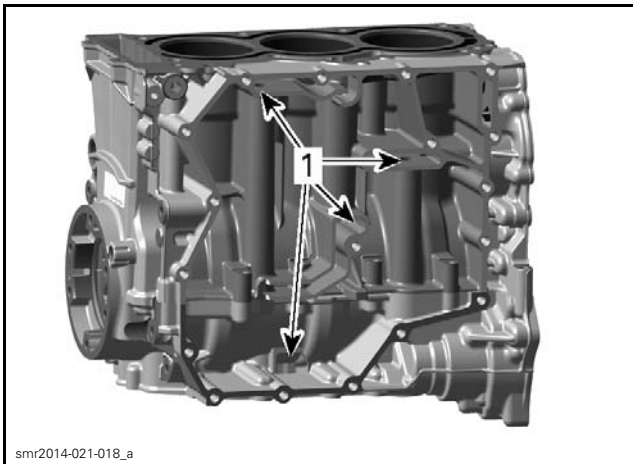
Blow out the oil orifices using compressed air and make sure they are not clogged.



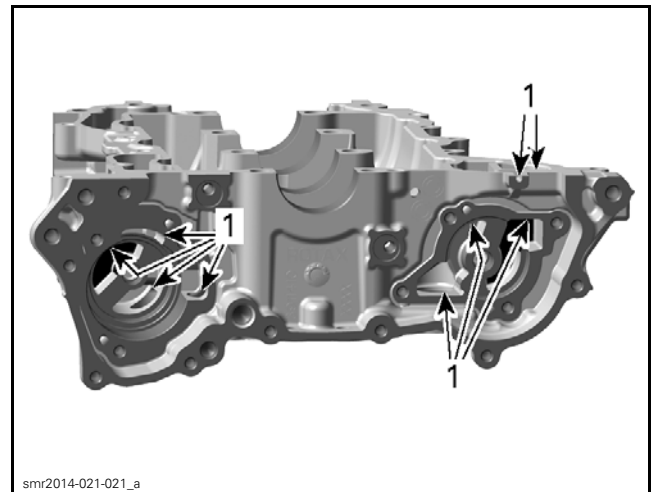
CYLINDER BLOCK UPPER HALF
1. Oil orifices



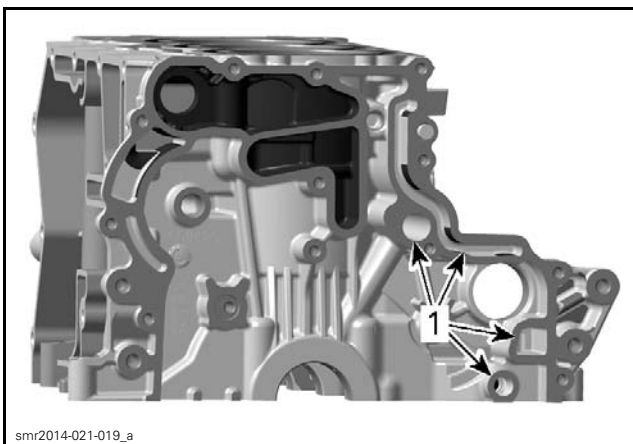
CYLINDER BLOCK - TOP
1. Oil orifices



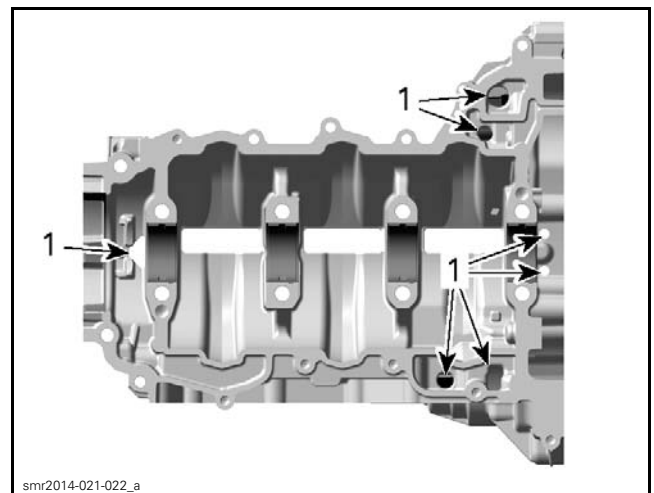
CYLINDER BLOCK - REAR
1. Oil orifices



CYLINDER BLOCK LOWER HALF
1. Oil orifices



CYLINDER BLOCK - MAG SIDE
1. Oil orifices



CYLINDER BLOCK LOWER HALF
1. Oil orifices

Clean all metal components in a solvent.

Clean cylinder block mating surfaces with gasket remover and a brass wire brush. Brush a first pass in one direction then make the final brushing perpendicularly (90°) to the first pass (cross hatch).

Subsection XX (CYLINDER BLOCK)

NOTE: Do not wipe with rags. Use a new clean hand towel only.

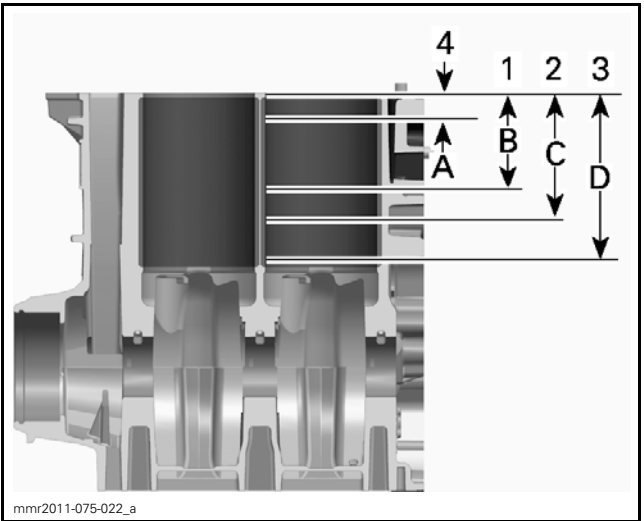
SERVICE PRODUCT
LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500)

Inspecting the Cylinder Block

Check cylinder block for cracks or other damage.
Check cylinder block mating surfaces for flatness using a straight edge.
Replace cylinder block if necessary.
Check cylinder bores for cracks, scoring and wear ridges on top and bottom of the cylinders.

Cylinder Taper

Measure cylinder bore diameter at 4 recommended positions. See illustration.



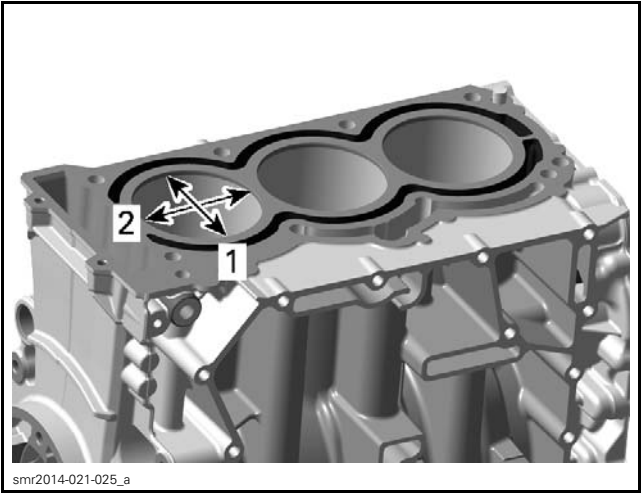
- TYPICAL**
- 1. First measure
 - 2. Second measure
 - 3. Third measure
 - 4. Fourth measure
- A. 5 mm to 10 mm (.197 in to .394 in)
B. 30 mm to 35 mm (1.181 in to 1.378 in)
C. 57 mm to 62 mm (2.244 in to 2.441 in)
D. 111 mm to 113 mm (4.37 in to 4.449 in)

The difference between measurements should not exceed the service limit mentioned in next table.

CYLINDER TAPER	
New	0.030 mm (.0012 in)
Service limit	0.050 mm (.002 in)

Cylinder Out of Round

Measure cylinder bore diameter as shown, and at same measuring points as for *CYLINDER TAPER*.



- 1. Perpendicular to piston pin axis
- 2. Parallel to piston pin axis

To obtain the cylinder out of round, calculate the difference between the perpendicular measures.

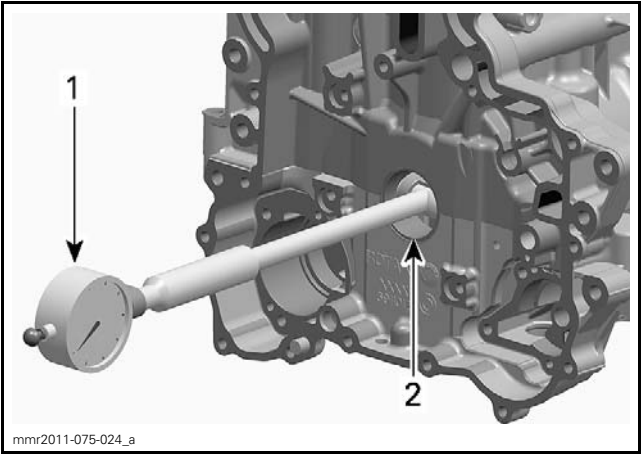
CYLINDER OUT OF ROUND	
New maximum	0.008 mm (.0003 in)
Service limit	0.030 mm (.0012 in)

Crankshaft Plain Bearings Inside Diameter

Check the plain bearings for scoring or other damages.

Measure plain bearing inside diameter and compare with crankshaft bearing journal diameter (refer to *CRANKSHAFT* in this subsection). Proceed as follows.

- Using the OLD plain bearings, assemble both cylinder block halves together.
- Tighten screws as described in *ASSEMBLING THE CYLINDER BLOCK*.
- Measure the inside diameter of the crankshaft plain bearings using a bore gauge.



- 1. Bore gauge
- 2. Crankshaft plain bearing

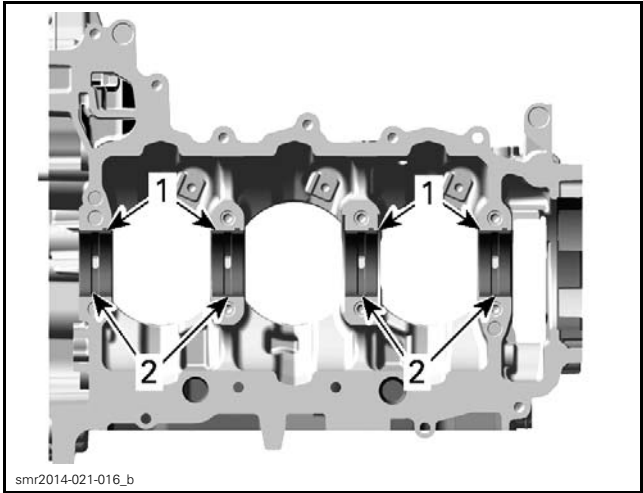
CRANKSHAFT PLAIN BEARING INSIDE DIAMETER	
Service limit	36.080 mm (1.4205 in)

Replace bearings if tout of specifications.

Assembling the Cylinder Block

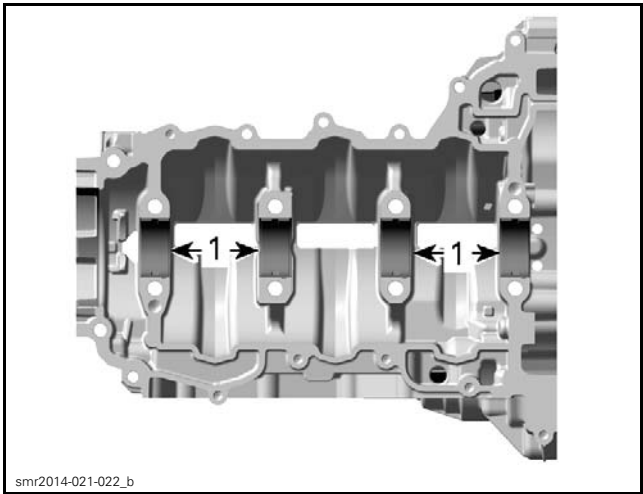
For assembly, reverse the disassembly procedure. Pay attention to the following details.

- 1. Correctly reinstall plain bearings as follows.
 - 1.1 Use NEW bearings if diameters are out of specification. Refer to *CRANKSHAFT PLAIN BEARINGS INSIDE DIAMETER* in this subsection.
 - 1.2 Install bearings with lubrication grooves in the cylinder block upper half.



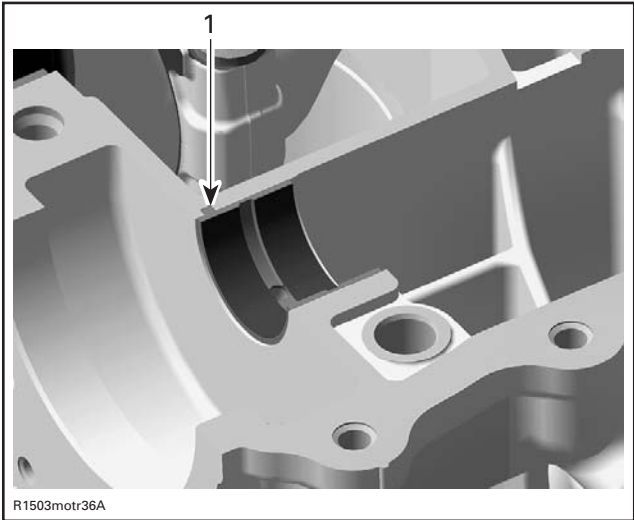
1. Plain bearings
2. Lubrication grooves

- 1.3 Install flat bearings in cylinder block lower half.



1. Flat bearings

NOTICE Bearings must be flush with the cylinder block split surface, and their protrusions must fit in the notched areas in the cylinder block seat.



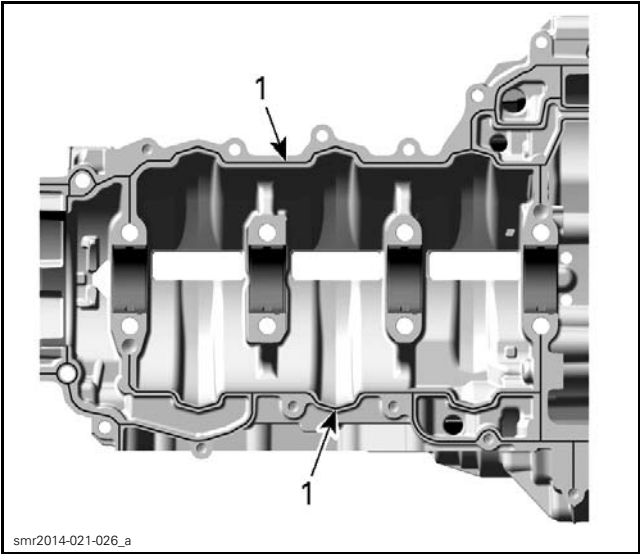
TYPICAL
1. Bearing protrusion in cylinder block notch

- 2. Install pistons, refer to *PISTONS AND CONNECTING RODS* in this subsection.
- 3. Apply engine oil on all plain bearings.
- 4. Install the following components:
 - Crankshaft and thrust washers (refer to *CRANKSHAFT*)
 - Connecting rod caps (refer to *PISTONS AND CONNECTING RODS*).
- 5. Apply sealant on mating surface of cylinder block lower half as shown on next illustration.

SERVICE PRODUCT
LOCTITE 5910 (P/N 293 800 081)

IMPORTANT: When beginning the application of the cylinder block sealant, the assembly and first tightening must be done within 12 minutes. It is suggested to have all you need on hand to save time.

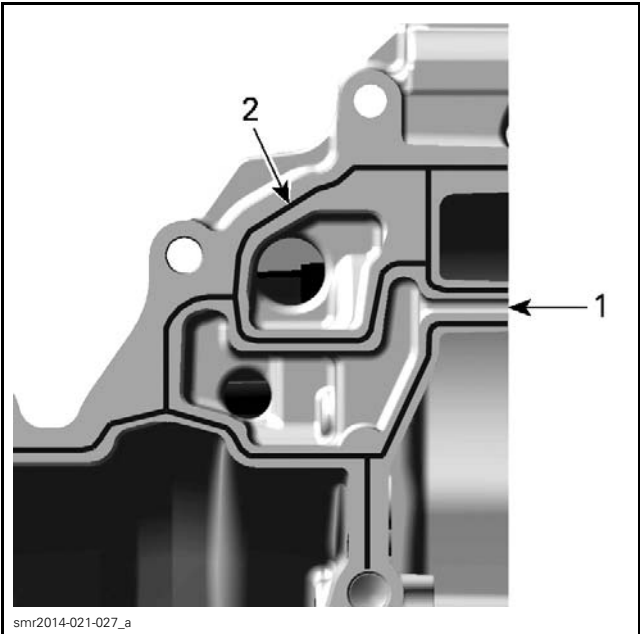
Subsection XX (CYLINDER BLOCK)



1. Apply sealant following this pattern

NOTICE Ensure not to apply too much sealant, as it will spread out inside the cylinder block.

NOTICE Take care to ensure the bypass passage of the engine oil pressure regulator is not clogged with sealant.



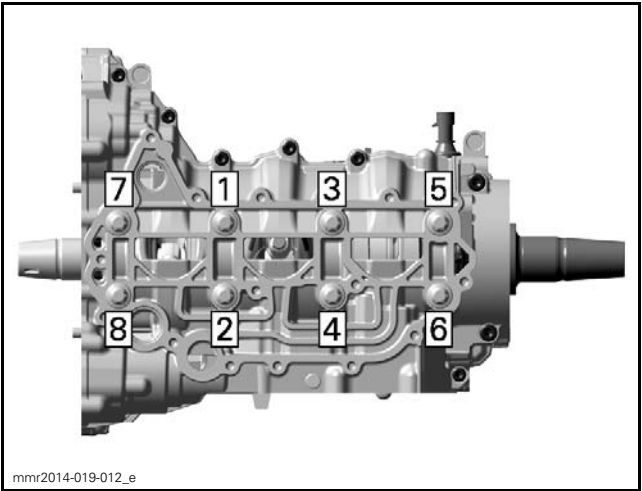
1. Bypass passage of engine oil pressure regulator
2. Sealant applied

6. Install **NEW** cylinder block M9 screws and tighten as follows.

NOTICE This assembly uses stretch screws. Always use **NEW** screws and strictly adhere to the tightening procedure.

6.1 Torque the M9 screws according to following sequence.

TIGHTENING TORQUE		
Cylinder block M9 screws	STEP A	20 N•m ± 2 N•m (15 lbf•ft ± 1 lbf•ft)



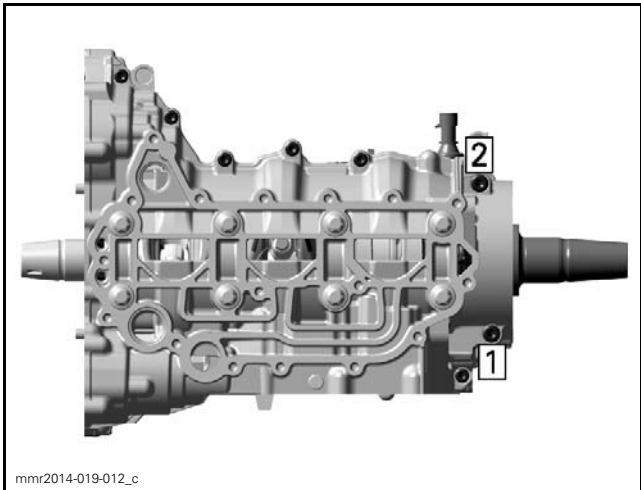
M9 SCREWS TIGHTENING SEQUENCE - FIRST AND SECOND STEPS

6.2 Use a torque angle gauge to carry out the second step, following the same sequence.

TIGHTENING TORQUE		
Cylinder block M9 screws	STEP B	Additional 150° ± 5°

7. Install M8 screws and tighten as follows.

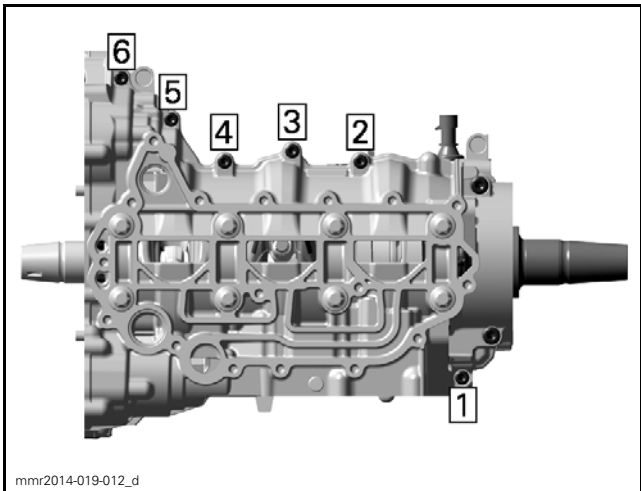
TIGHTENING TORQUE	
Cylinder block M8 screws	23 N•m ± 2 N•m (17 lbf•ft ± 1 lbf•ft)



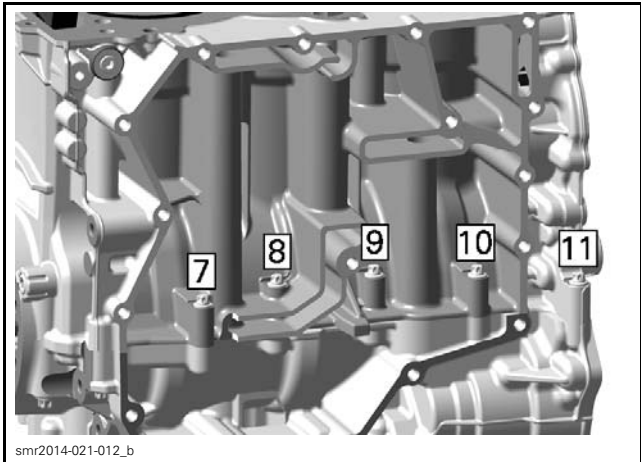
M8 SCREWS TIGHTENING SEQUENCE

8. Install the screws and tighten as follows.

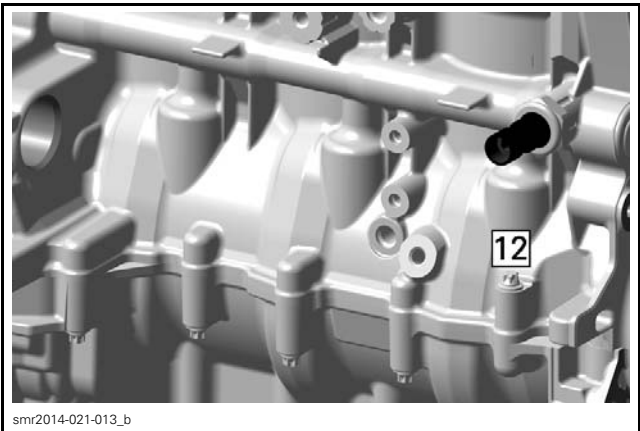
TIGHTENING TORQUE	
Cylinder block M6 screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



M6 SCREWS TIGHTENING SEQUENCE (BOTTOM OF CRANKCASE)



M6 SCREWS TIGHTENING SEQUENCE (INTAKE SIDE OF CRANKCASE)



M6 SCREW TIGHTENING SEQUENCE (EXHAUST SIDE OF CRANKCASE)

NOTE: Check crankshaft axial play before continuing the assembly. Refer to *CRANKSHAFT* in this subsection.

9. Lubricate PTO oil seals properly before reinstalling the PTO cover. Refer to *PTO COVER AND PTO OIL SEALS* in this subsection.

10. Reassemble engine in accordance with proper assembly procedures.

CRANKSHAFT

Crankshaft Locking Procedure

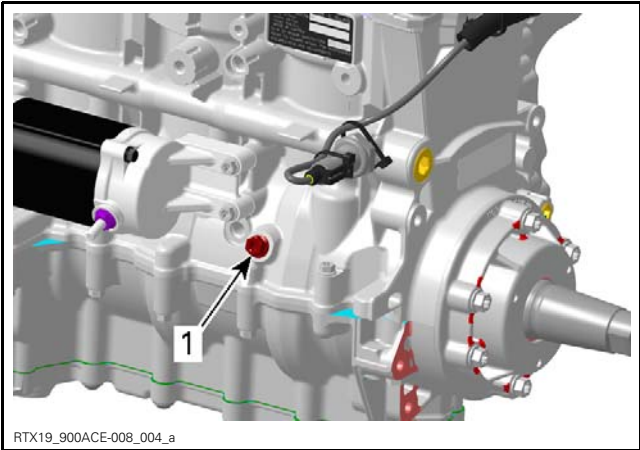
NOTICE When the crankshaft is locked, the second cylinder is set to TDC.

The crankshaft must be locked whenever the magneto rotor retaining nut has to be removed, or whenever working on the valve train.

NOTICE When working on the valve train or timing chain, the crankshaft must be locked with the marks "IN" and "EX" on the camshaft timing gears facing each other.

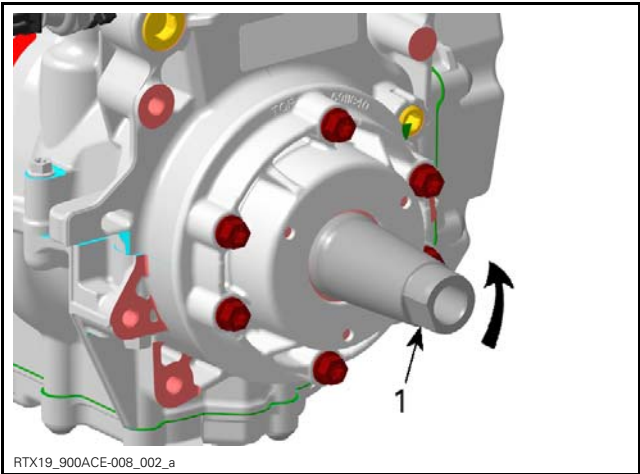
1. If working on the valve train or timing chain, remove the valve cover. Refer to *TOP END* subsection.
2. Remove spark plugs.
3. Remove crankshaft access plug and discard gasket ring.

Subsection XX (CYLINDER BLOCK)



1. Crankshaft access plug

4. On PTO side , turn engine crankshaft counter-clockwise to bring it to the locking position.
To turn the crankshaft, install the drive pulley, or use a suitable screw locked by a counter nut.

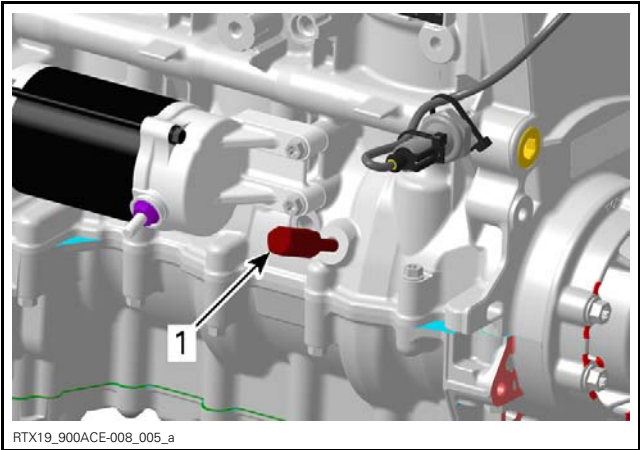


1. Crankshaft PTO side

NOTICE Crankshaft locking position is reached when marks "IN" and "EX" on the camshaft timing gears face each other.

5. Use a flashlight to check if the crankshaft groove is aligned with the hole.
6. Lock crankshaft.

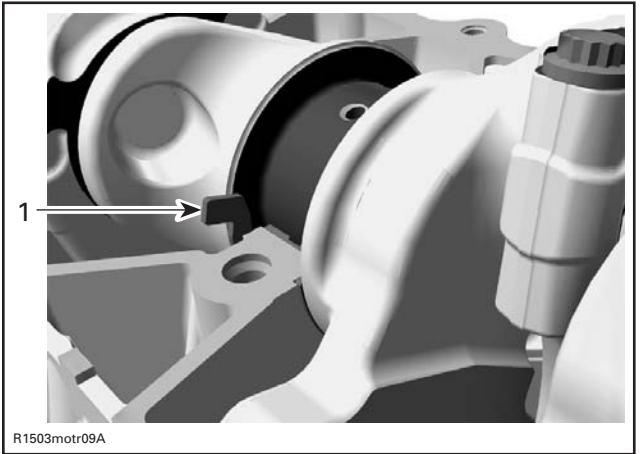
REQUIRED TOOL	
CRANKSHAFT LOCKING TOOL (P/N 529 036 272)	



1. Crankshaft locking tool

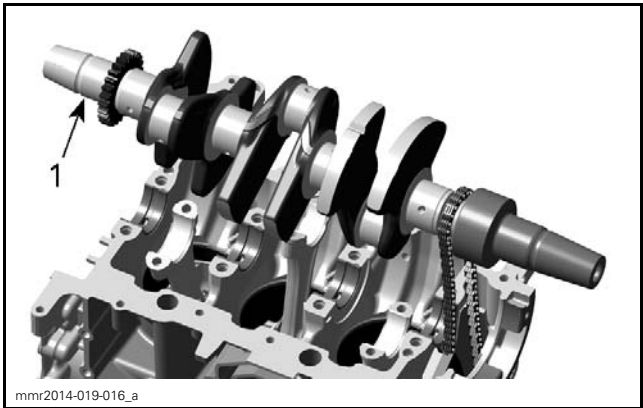
Removing the Crankshaft

1. Disassemble *CYLINDER BLOCK*, see procedure in this subsection.
2. Remove connecting rod caps. Refer to *PISTONS AND CONNECTING RODS* in this subsection.
3. Remove crankshaft thrust washers.



TYPICAL
1. Thrust washer

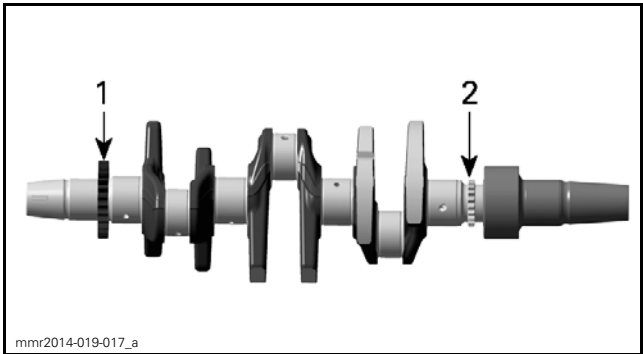
4. Remove crankshaft from cylinder block.



1. Crankshaft

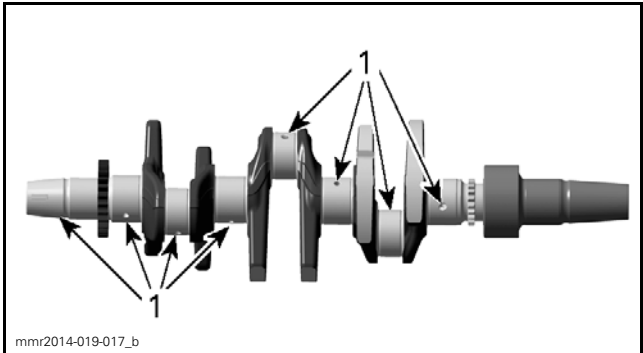
Inspecting the Crankshaft

Check each bearing journal of crankshaft for scoring, scuffing, cracks or other signs of wear.
Check crankshaft gears for wear or other damage.



1. Oil pump drive gear
2. Crankshaft timing gear

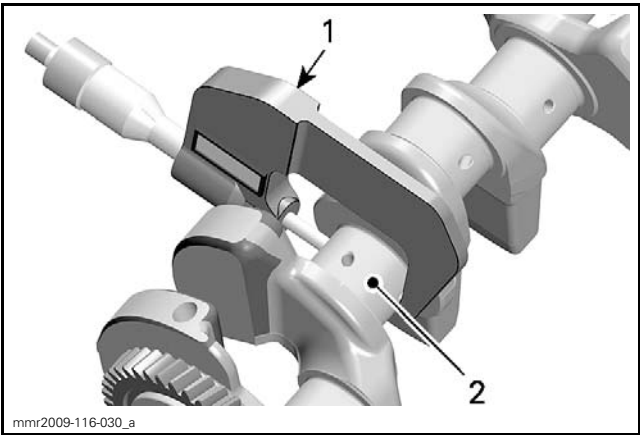
Replace crankshaft if damaged.
Blow the oil orifices using compressed air and ensure they are not clogged.



1. Check oil orifices

Crankshaft Radial Play

Measure crankshaft bearing journal diameter, using a micrometer.



TYPICAL
1. Micrometer
2. Crankshaft area for plain bearing

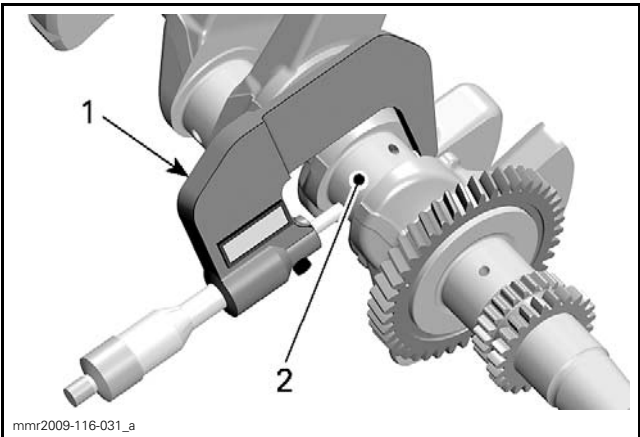
To obtain crankshaft radial play, calculate the difference between the bearing journal diameter and the crankshaft plain bearings inner diameter (see *CYLINDER BLOCK* in this subsection).

CRANKSHAFT BEARING JOURNAL DIAMETER	
New	35.990 mm to 36.006 mm (1.4169 in to 1.4176 in)
Service limit	35.960 mm (1.4157 in)

CRANKSHAFT RADIAL PLAY	
Service limit	0.08 mm (.0031 in)

Crankshaft Pin Diameter

Measure crankshaft pin diameter, using a micrometer.
To obtain connecting rod radial play (big end), calculate the difference between the crankshaft pin diameter and the inner diameter of the connecting rod plain bearings inner diameter (see *INSPECTING THE CONNECTING ROD* in this subsection).



TYPICAL
1. Micrometer
2. Crankshaft pin area for plain bearing

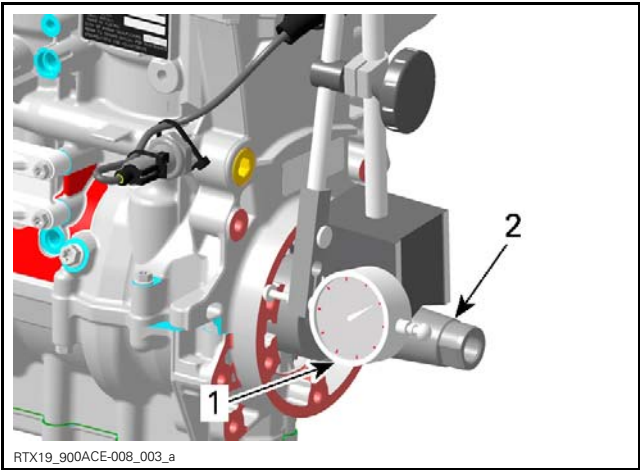
Subsection XX (CYLINDER BLOCK)

CRANKSHAFT PIN DIAMETER	
New	35.979 mm to 35.995 mm (1.416 in to 1.417 in)
Service limit	35.969 mm (1.416 in)

CONNECTING ROD BIG END RADIAL PLAY	
Service limit	0.08 mm (.0031 in)

Crankshaft Axial Play

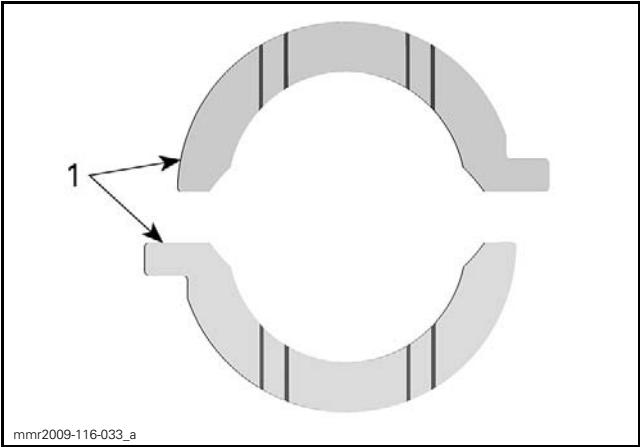
With the crankshaft in the cylinder block, measure the crankshaft axial play, using a dial indicator.



TYPICAL
1. Dial indicator
2. Crankshaft

CRANKSHAFT AXIAL PLAY	
New	0.120 mm to 0.352 mm (.005 in to .014 in)
Service limit	0.450 mm (.018 in)

If axial play is out of specification, replace the crankshaft thrust washers and repeat measurement.



TYPICAL
1. Crankshaft thrust washers

Installing the Crankshaft

The reverse is the reverse of the removal procedure. However, pay attention to following details. Turn cylinder block upside down.

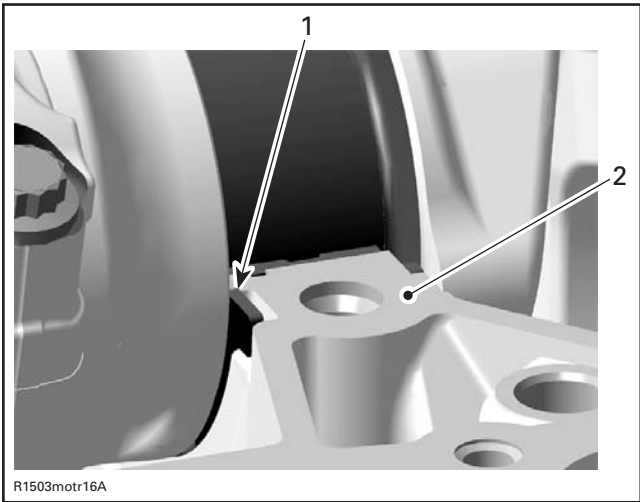
NOTICE Be careful that connecting rods do not hit the cylinder block.

Apply engine oil on all plain bearings before installing them.

Install crankshaft along with the timing chain.

Lubricate (both sides) and reinstall crankshaft thrust washers with the slots facing against crankshaft counterweights.

NOTE: Thrust washers have to be flush with the cylinder block sealing surface.



TYPICAL
1. Thrust washer
2. Sealing surface

Install connecting rod caps. Refer to *PISTONS AND CONNECTING RODS* in this subsection.

NOTICE It is absolutely necessary to follow this procedure. Otherwise severe engine damage can occur.

Install cylinder block lower half. Refer to *CYLINDER BLOCK* in this subsection.

Lock crankshaft before further assembly of the engine. See *CRANKSHAFT LOCKING PROCEDURE* in this subsection.

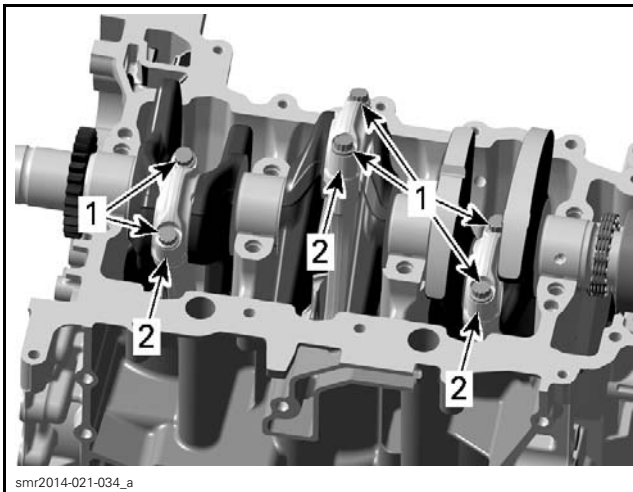
PISTONS AND CONNECTING RODS

Removing the Piston and Connecting Rod

NOTE: It is recommended to measure connecting rod big end axial play prior to remove connecting rod. Refer to *INSPECTING THE CONNECTING ROD* in this subsection.

1. Disassemble *CYLINDER BLOCK* as per procedure in this subsection.
2. Remove connecting rod cap.

NOTICE Mark cylinder position of connecting rod before disassembly.



1. Connecting rod screws
2. Connecting rod cap

3. Remove *CRANKSHAFT* as per procedure in this subsection.
4. Turn cylinder block and push piston and connecting rod out of the cylinder.

Disassembling the Piston and the Connecting Rod

1. Remove one piston pin circlip and discard it.

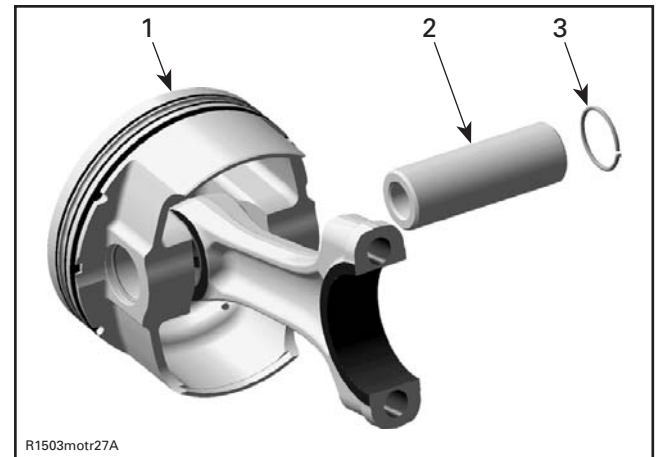


TYPICAL

1. Piston pin circlip

NOTE: The removal of both piston pin circlips is not necessary to remove the piston pin.

2. Push piston pin out of the piston.



TYPICAL

1. Piston
2. Piston pin
3. Circlip

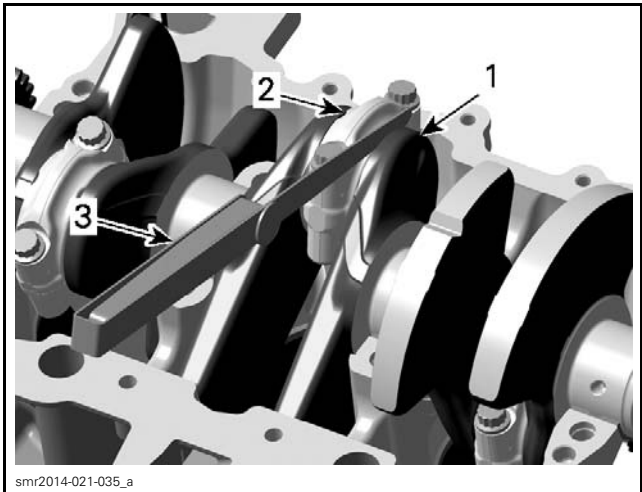
3. Detach piston from connecting rod.

Inspecting the Connecting Rod

Connecting Rod Big End Axial Play

Using a feeler gauge, measure the distance between the butting face of the connecting rod and crankshaft counterweight. If the distance exceeds specified tolerance, replace the worn part.

Subsection XX (CYLINDER BLOCK)

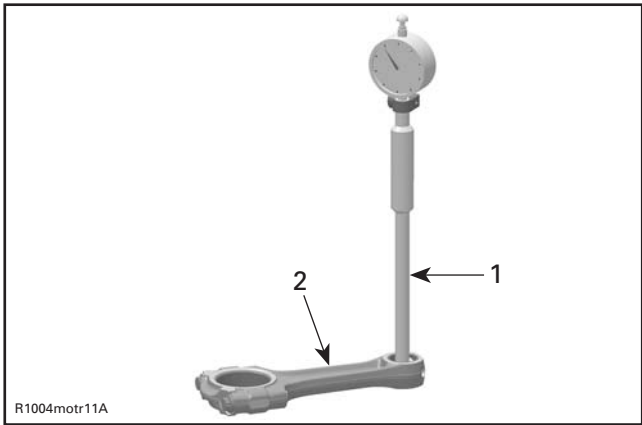


1. Crankshaft
2. Connecting rod
3. Feeler gauge

CONNECTING ROD BIG END AXIAL PLAY	
New	0.100 mm to 0.352 mm (.004 in to .014 in)
Service limit	0.450 mm (.018 in)

Connecting Rod Small End Radial Play

Measure connecting rod small end using a bore gauge.



TYPICAL
1. Bore gauge
2. Connecting rod

CONNECTING ROD SMALL END DIAMETER	
New	17.010 mm to 17.020 mm (.6697 in to .6701 in)
Service limit	17.060 mm (.6717 in)

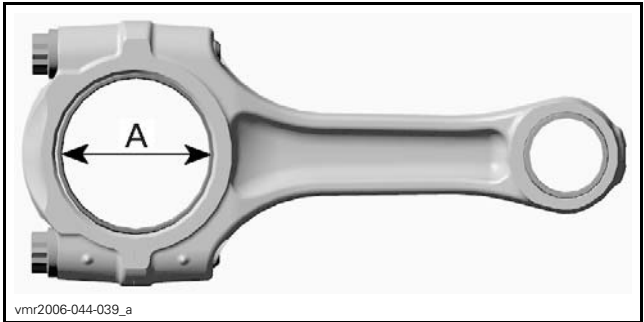
If the connecting rod small end diameter is out of specification, replace the connecting rod.

To obtain the connecting rod radial play (small end), calculate the difference between the piston pin diameter (*PISTON PIN INSPECTION*) and the inner diameter of the connecting rod small end.

CONNECTING ROD SMALL END RADIAL PLAY	
Service limit	0.040 mm (.0016 in)

Connecting Rod Big End Radial Play

1. Measure inside diameter of connecting rod big end.
 - 1.1 Install the OLD plain bearings as they were mounted initially.
 - 1.2 Perform the tightening procedure as described in *PISTON AND CONNECTING ROD INSTALLATION* in this subsection.
- NOTE:** To measure the connecting rod big end diameter, ALWAYS use the OLD connecting rod screws.
- 1.3 Measure inside diameter in longitudinal direction of the connecting rod.



TYPICAL
A. Connecting rod big end bearing

CONNECTING ROD BIG END DIAMETER	
Service limit	36.06 mm (1.4197 in)

To obtain the connecting rod big end radial play, calculate the difference between the big end diameter and the crankshaft pin diameter (see *CRANKSHAFT INSPECTION*) in this subsection.

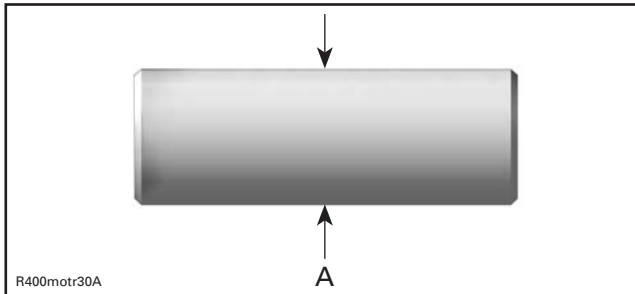
CONNECTING ROD BIG END RADIAL PLAY	
Service limit	0.080 mm (.0031 in)

If connecting rod big end diameter is out of specification, install NEW plain bearings.

Inspecting the Piston Pin

Using woven synthetic abrasive, clean piston pin of deposits.
Inspect piston pin for scoring, cracks or other damage.

Measure piston pin diameter, using a micrometer. See following illustration for proper measurement position.



TYPICAL

A. Measure piston pin diameter here

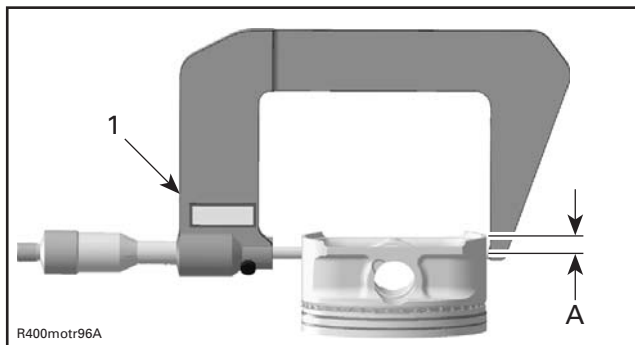
PISTON PIN DIAMETER	
New	16.996 mm to 17.000 mm (.6691 in to .6693 in)
Service limit	16.986 mm (.6687 in)

Replace piston pin if out of specification.

Inspecting the Piston

Inspect piston for scoring, scuffing, cracks or other damage. Replace piston and piston rings if necessary.

Using a micrometer, measure piston perpendicularly (90°) to piston pin axis at 8.5 mm (11/32 in) from the skirt edge.



TYPICAL

1. Measuring perpendicularly (90°) to piston pin axis

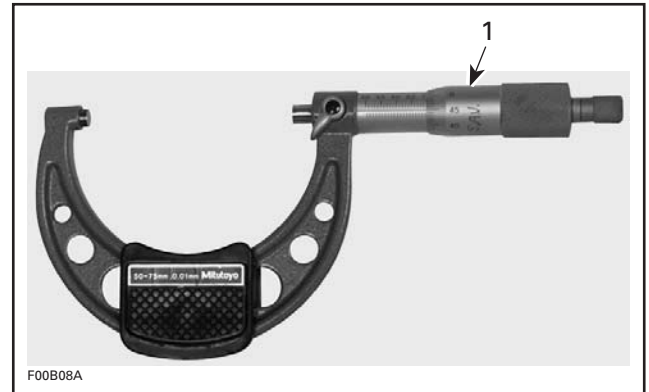
A. 8.5 mm (11/32 in)

PISTON MEASUREMENT	
New	73.950 mm to 73.966 mm (2.911 in to 2.912 in)
Service limit	73.920 mm (2.9102 in)

Replace piston if out of specification.

Piston/Cylinder Clearance

1. Adjust and lock a micrometer to the piston dimension.

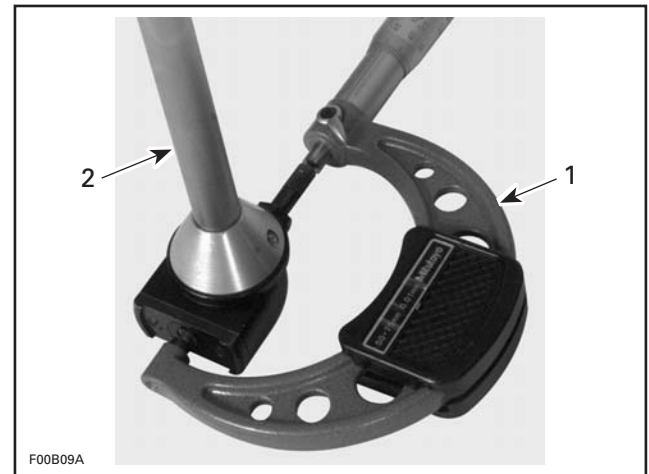


TYPICAL

1. Micrometer set to the piston dimension

NOTE: Make sure used piston is not worn.

2. With the micrometer locked at step 1, adjust a cylinder bore gauge to the micrometer dimension and set the indicator to 0 (zero).

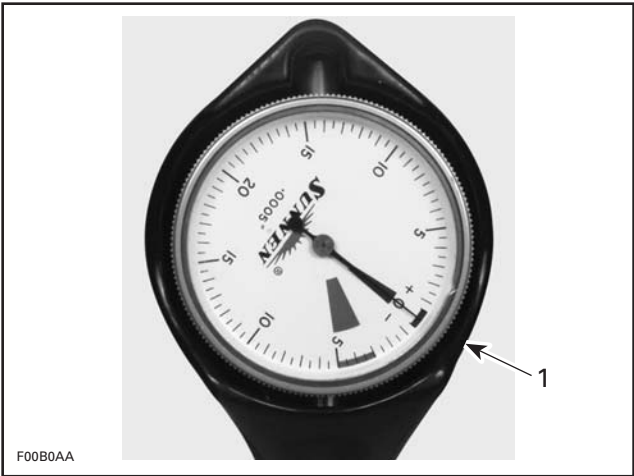


TYPICAL

1. Use the micrometer to set the cylinder bore gauge

2. Cylinder bore gauge

Subsection XX (CYLINDER BLOCK)



TYPICAL
1. Indicator set to 0 (zero)

NOTE: Make sure the cylinder bore gauge indicator is set exactly at the same position as with the micrometer, otherwise the reading will be false.

- 3. Position the cylinder bore gauge 35 mm (1-3/8 in) below the cylinder head mating surface, measuring perpendicularly (90°) to piston pin axis.
- 4. Read measurement on cylinder bore gauge. The result is the exact piston/cylinder clearance.

PISTON/CYLINDER CLEARANCE	
New	0.037 mm to 0.067 mm (.0015 in to .0026 in)
Service limit	0.080 mm (.0031 in)

If clearance exceeds specified tolerance, replace piston and repeat measurement procedure.

Assembling the Piston and Connecting Rod

Reverse the disassembly procedure. However, pay attention to the following details.

- 1. Apply engine oil on piston pin.
- 2. Insert piston pin in piston and connecting rod.

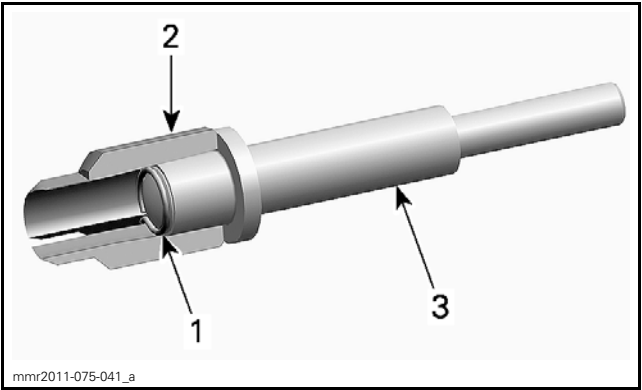
NOTE: Be sure to reinstall all parts in their original position as marked during removal.

- 3. Install **NEW** piston pin circlip(s).

REQUIRED TOOL	
PISTON CIRCLP INSTALLER (P/N 529 036 207)	

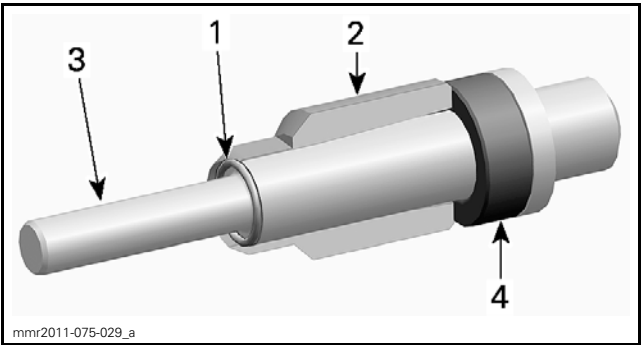
NOTICE Always replace removed piston pin circlips by **NEW** ones.

- 3.1 Place the circlip in the sleeve and push piston circlip installer handle until circlip reaches the mid position in the sleeve.



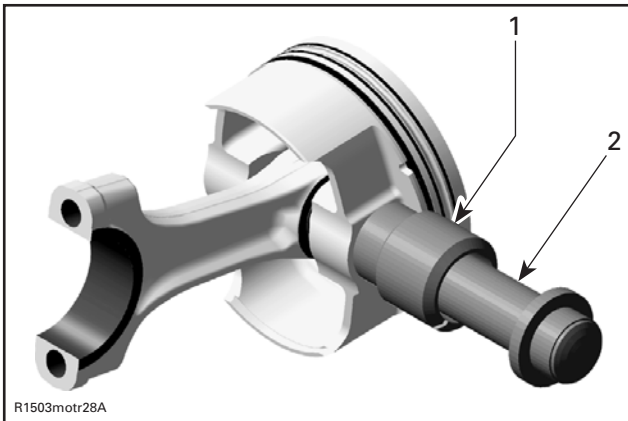
TYPICAL
1. Circlip
2. Sleeve
3. Installer handle

- 3.2 Put the distance sleeve on the installer handle.
- 3.3 Push piston circlip installer handle until distance sleeve makes contact with the sleeve.



1. Circlip
2. Sleeve
3. Installer handle
4. Distance sleeve

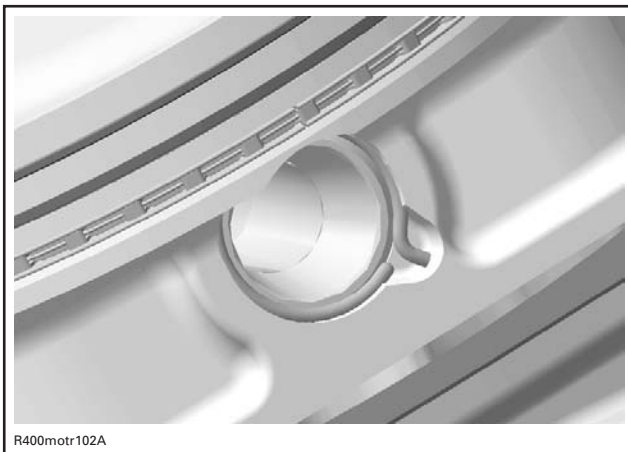
- 3.4 Remove distance sleeve and insert installer handle into the sleeve.
- 3.5 Insert the end of the handle into the piston pin, then push to engage the circlip into the piston groove.



TYPICAL

1. Sleeve with piston circlip inside
2. Piston clip installer handle

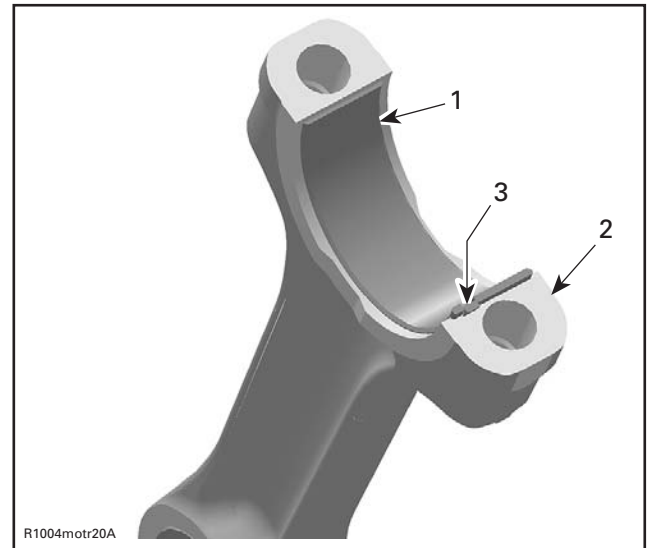
NOTE: Ensure the hook of the piston pin circlip is properly positioned.



CORRECT POSITION OF PISTON PIN CIRCLIP

NOTICE If piston pin circlip installation fails, repeat step 3 by using a NEW circlip.

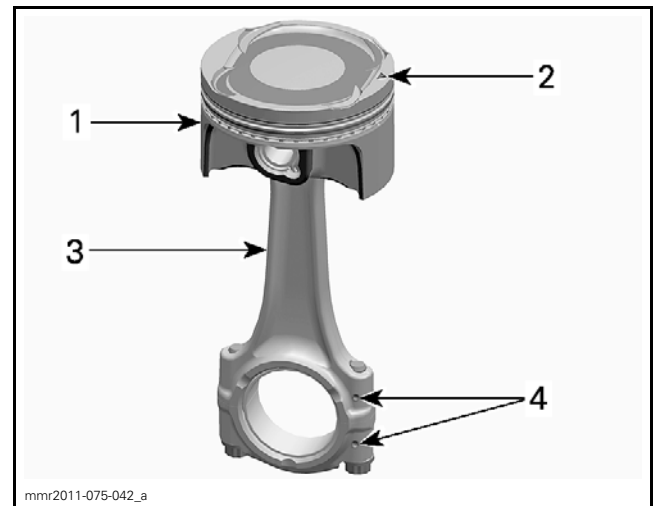
4. Correctly install plain bearings and carefully clean split surface on both sides (cracked area) with compressed air.



TYPICAL

1. Half bearing of connecting rod big end
2. Split surface of the connecting rod
3. Protrusion of bearing in line with connecting rod groove

NOTICE The arrow on top of the piston and the punch marks on the connecting rods must always point towards the exhaust.



1. Piston
2. Arrow on top
3. Connecting rod
4. Punched marks

Installing the Piston and Connecting Rod

1. Use engine oil and lubricate:
 - Piston
 - Piston rings
 - Cylinder bore
 - Connecting rod bearings.
2. Slide piston in cylinder bore. Pay attention to the following.

Subsection XX (CYLINDER BLOCK)

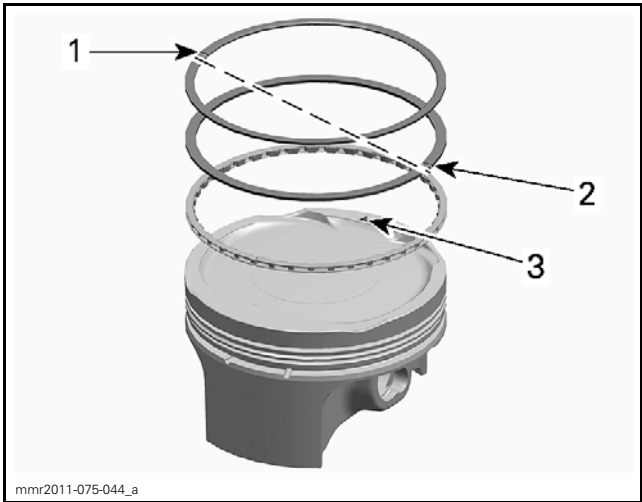
REQUIRED TOOL	
PISTON RING COMPRESSOR (P/N 529 036 208)	



TYPICAL

- 2.1 If reused, install piston in its original bore.
- 2.2 Make sure piston rings are properly spaced.

NOTICE The ring gaps of both compression rings should always be 180° from each other and 90° from the arrow on top of the piston.

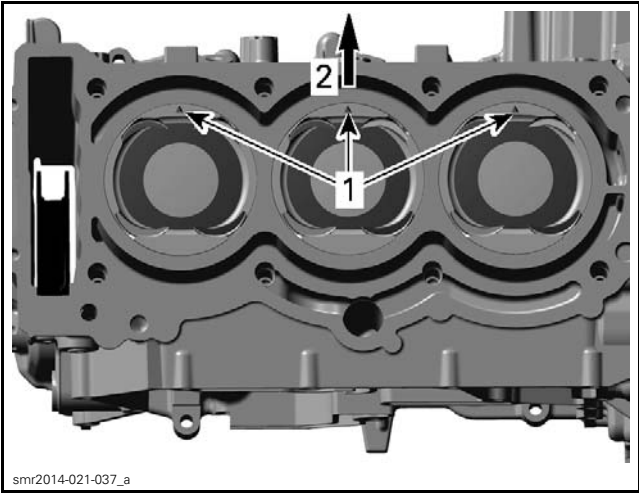


RING GAPS AT 180° FROM EACH OTHER AND 90° FROM ARROW

- 1. Rectangular ring - ring gap
- 2. Taper-face ring - ring gap
- 3. Arrow

- 2.3 The arrow on top of the piston must point towards exhaust.

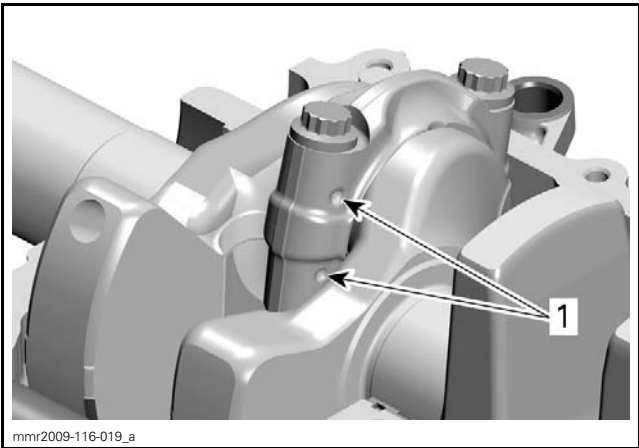
NOTICE A piston installed with the arrow in the wrong direction would cause serious engine damage.



- 1. Arrows
- 2. Exhaust

- 3. Turn cylinder block upside down.
- 4. Install *CRANKSHAFT* as per procedure in this subsection.
- 5. Oil crankshaft pin.
- 6. Install connecting rod caps.

NOTE: Printed marks on connecting rod and cap must point together.



TYPICAL
1. Printed marks

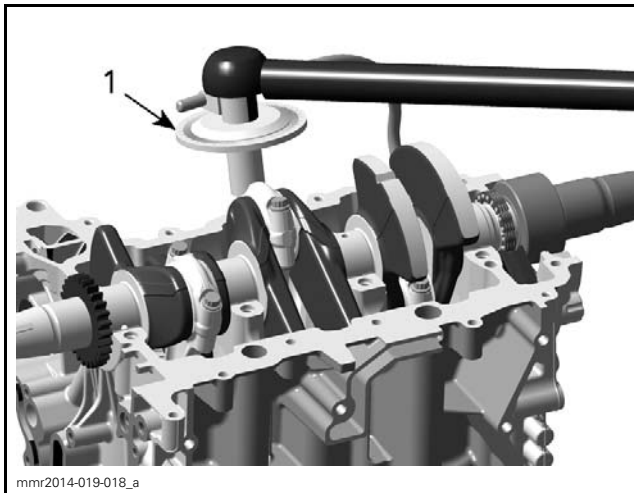
NOTICE This assembly uses stretch screws. Always use NEW screws and strictly adhere to the tightening procedure.

- 7. Tighten connecting rod screws as follows:
 - 7.1 Torque both connecting rod screws of a connecting rod.

TIGHTENING TORQUE		
Connecting rod screws	STEP A	12 N•m ± 2 N•m (106 lbf•in ± 18 lbf•in)

7.2 Use a torque angle gauge to carry out the second step.

TIGHTENING TORQUE		
Connecting rod screws	STEP B	Additional 70° ± 5°



1. Torque angle gauge

NOTICE Failure to strictly follow this procedure may cause screws to loosen and lead to severe engine damage.

8. Install all other removed parts.

PISTON RINGS

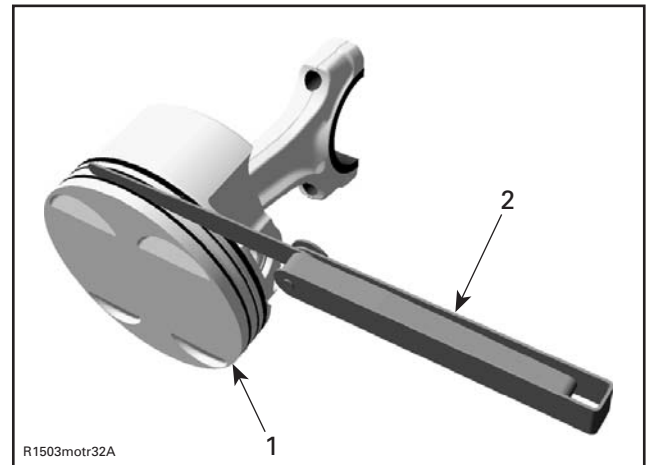
Removing the Piston Ring

1. Remove piston, see procedure in this subsection.
2. Remove rings from piston.

Inspecting the Piston Ring

Ring/Piston Groove Clearance

Using a feeler gauge measure each ring/piston groove clearance.



TYPICAL

1. Piston
2. Feeler gauge

RING/PISTON GROOVE CLEARANCE		
Upper compression ring	New	0.030 mm to 0.066 mm (.0012 in to .0026 in)
	Service limit	0.120 mm (.0047 in)
Lower compression ring	New	0.020 mm to 0.056 mm (.0008 in to .0022 in)
	Service limit	0.120 mm (.0047 in)
Oil scraper ring	New	0.010 mm to 0.040 mm (.0004 in to .0016 in)
	Service limit	0.150 mm (.0059 in)

If clearance is out of specification, the piston and rings should be replaced.

Ring End Gap

1. Place piston ring in cylinder bore between 8 mm to 16 mm (5/16 in to 5/8 in) from the top of cylinder.

NOTE: In order to correctly position the ring in the cylinder bore, use a piston as a pusher.

2. Using a feeler gauge, check ring end gap.

RING END GAP		
Upper compression ring	New	0.20 mm to 0.35 mm (.008 in to .014 in)
	Service limit	1.20 mm (.047 in)

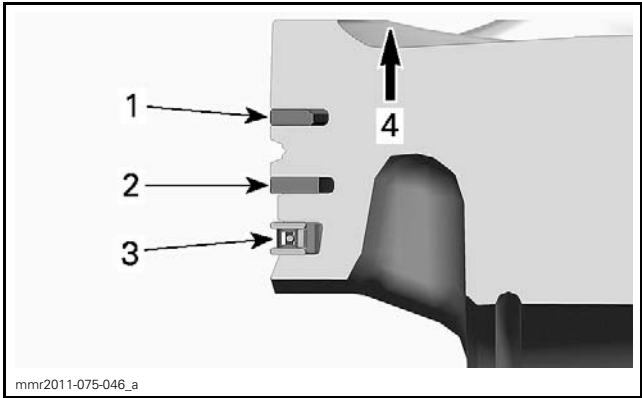
Subsection XX (CYLINDER BLOCK)

RING END GAP		
Lower compression ring	New	0.30 mm to 0.50 mm (.012 in to .02 in)
	Service limit	1.20 mm (.047 in)
Oil scraper ring	New	0.20 mm to 0.70 mm (.0079 in to .0276 in)
	Service limit	1.20 mm (.047 in)

If ring end gap is out of specification, replace piston rings.

Installing the Piston Ring

1. Install piston rings in the following order.
- NOTE:** Use a ring expander to prevent breakage during installation. The oil ring must be installed by hand.
- 1.1 Install oil scraper ring.
 - 1.2 Install the lower compression ring with the letter "N" facing up.
 - 1.3 Install upper compression ring with the letter "N" facing up.



- 1. Rectangular ring
- 2. Taper-face ring
- 3. Oil scraper ring
- 4. Letter "N" facing up

NOTICE Ensure the upper and lower compression rings are not interchanged.

2. Ensure rings rotate smoothly after installation.

CYLINDER BLOCK

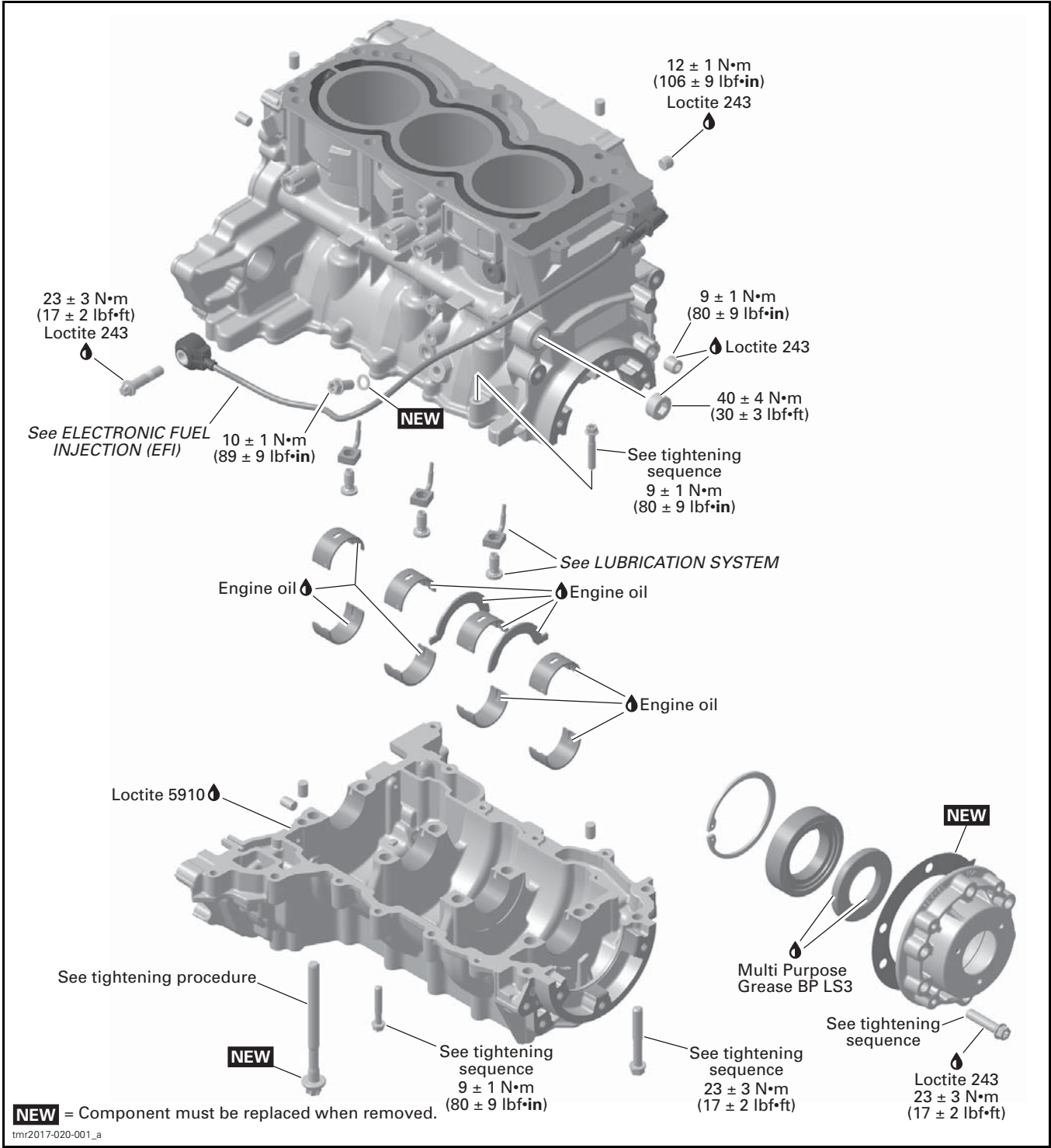
SERVICE TOOLS

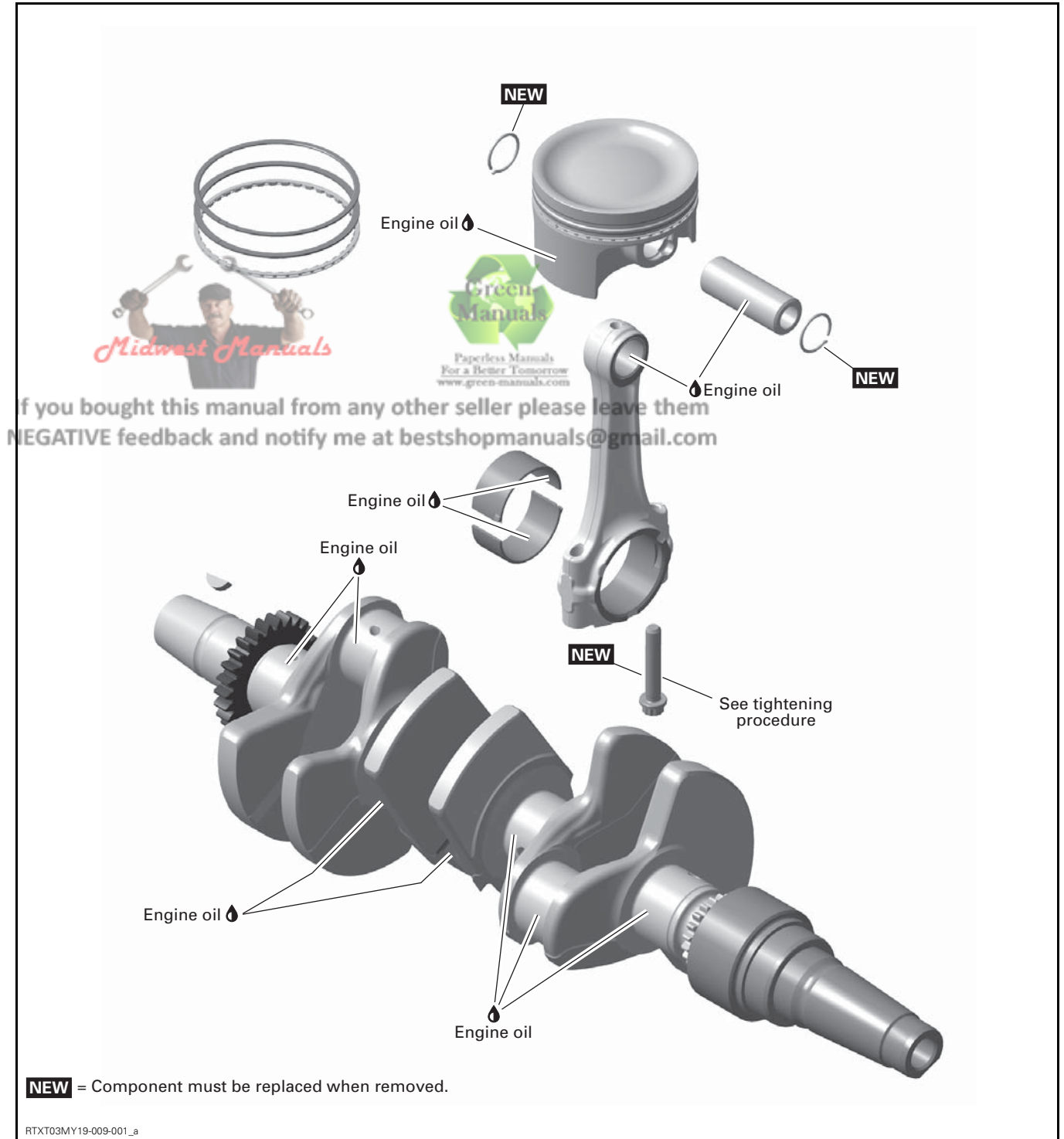
Description	Part Number	Page
CRANKSHAFT LOCKING TOOL	529 036 272	14
OIL SEAL/BEARING PUSHER	529 036 284	5-6
PISTON CIRCLIP INSTALLER.....	529 036 426	20
PISTON RING COMPRESSOR	529 036 208	22

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	7
LOCTITE 5910	293 800 081	12
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	10
SUPER LUBE GREASE.....	293 550 030	5

Subsection XX (CYLINDER BLOCK)





GENERAL

When disassembling parts that are duplicated in the engine, (e.g.: pistons, connecting rods etc.), it is strongly recommended to note their position and to keep the parts of the same assembly as a "group". If you find a defective component, it would be much easier to find the cause of the failure. Since parts were broken-in during engine operation, they will maintain their matched fit when reassembled together within their "group".

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

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

⚠ WARNING

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

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

TROUBLESHOOTING

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

UNUSUAL ENGINE NOISE OR VIBRATIONS

1. Heavy wear on plain bearings.
 - Check radial play of plain bearings. Replace if out of specification.
2. Crankshaft axial play out of specification.
 - Measure crankshaft axial play. If crankshaft axial play is out of specification, replace thrust washers.
3. Connecting rod axial play out of specification.
 - Measure connecting rod axial play on crankshaft. Replace connecting rod or crankshaft if out of specification.
4. Connecting rod screws got loose.
 - Replace damaged components and retighten screws with the recommended torque.

5. Crankshaft PTO roller bearing is worn.
 - Remove PTO cover and check roller bearing for excessive play. Replace roller bearing if necessary.

BLUE SMOKE IN THE EXHAUST

1. Oil scraper rings worn out.
 - Replace piston rings.

ENGINE SUDDENLY TURNS OFF (POOR IDLING)

1. Piston rings worn out.
 - Replace piston rings.
2. Piston/cylinder clearance out of specification.
 - Check piston/cylinder clearance. Replace if out of specification.
3. Melted or broken piston.
 - Replace piston and cylinder block if necessary.

PROCEDURES

PTO COVER AND PTO OIL SEAL

PTO Cover Access

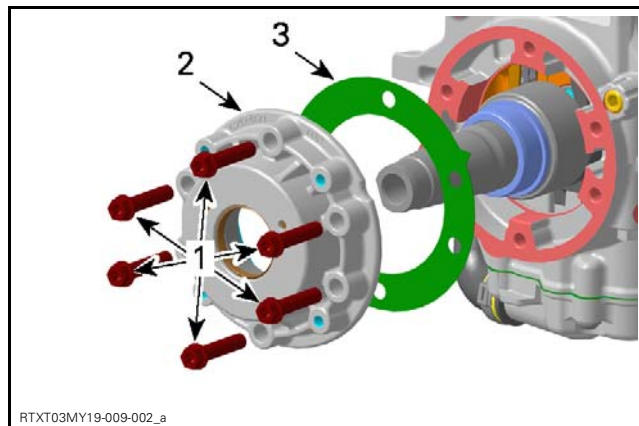
To replace the PTO oil seal, it is not necessary to remove engine from the vehicle.

Remove drive pulley. Refer to *CONTINUOUSLY VARIABLE TRANSMISSION (CVT)* subsection.

Removing the PTO Cover

Remove screws retaining the PTO cover.

Remove PTO cover and discard gasket.



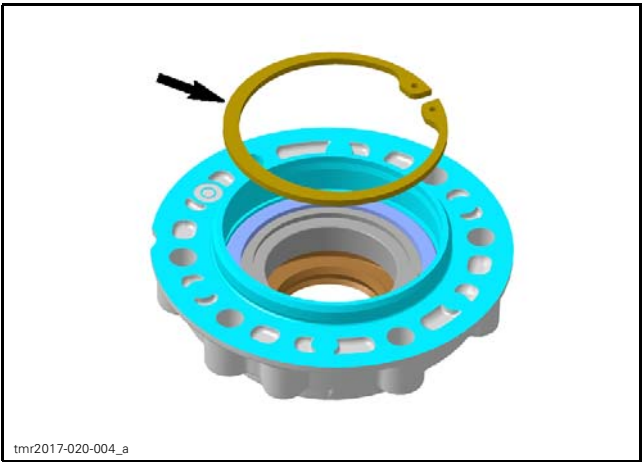
- RTXT03MY19-009-002_a
1. PTO cover screws
 2. PTO cover
 3. Gasket

PTO Oil Seal and Bearing Replacement

NOTE: Always replace PTO oil seal and roller bearing at the same time.

Removing the PTO Oil Seal and Bearing

1. Use pliers to remove inner retaining ring.

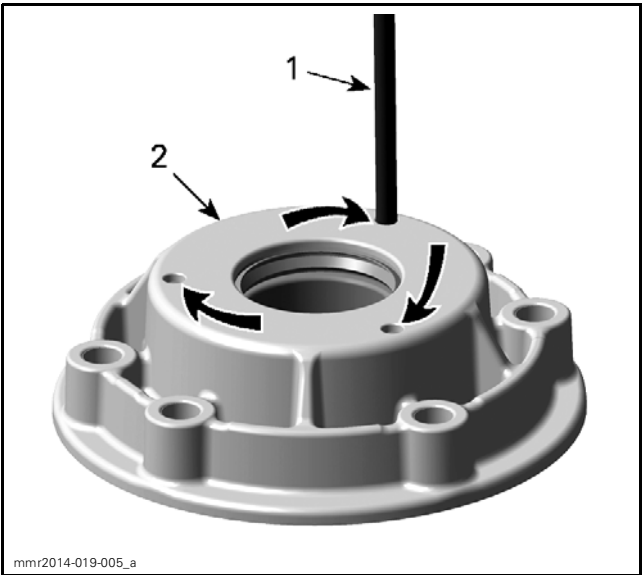


2. Heat PTO cover up to 130°C (266°F) before removing the roller bearing and oil seal.

NOTICE Clean PTO cover from oil before heating.

3. Carefully push out oil seal and roller bearing.

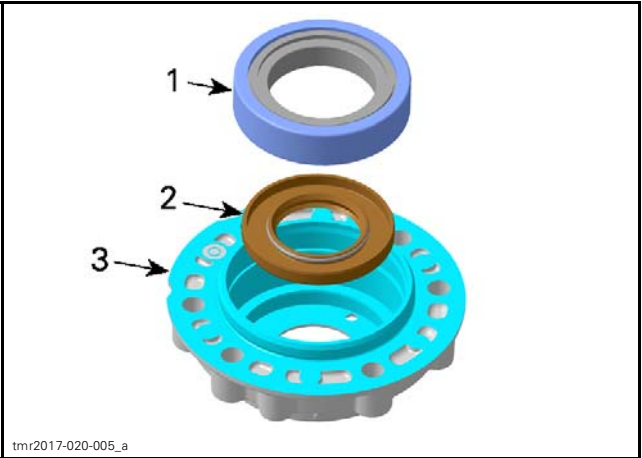
REQUIRED TOOL
Punch 4 mm (.157 in)



TYPICAL - PUSH OUT CIRCULAR

- 1. Punch
- 2. PTO cover

4. Remove and discard roller bearing and oil seal.



- 1. Roller bearing
- 2. Oil seal
- 3. PTO cover

Installing the PTO Oil Seal and Bearing

NOTE: Check the oil seal running surface of crankshaft for grooves and deposits, before installation of NEW oil seal.

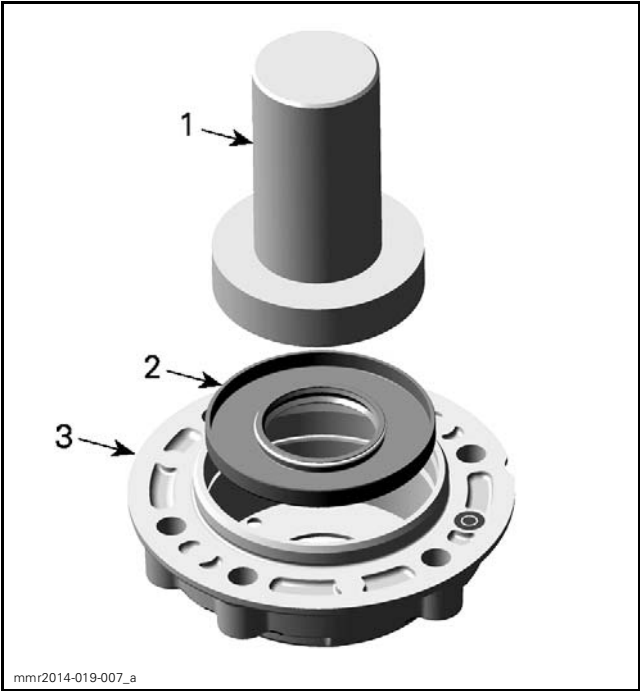
- 1. Clean crankshaft PTO side from deposits.
- 2. Clean oil seal and roller bearing areas in PTO cover.
- 3. Lubricate oil seal outer diameter and sealing lip.

OIL SEAL SEALING LIP AND OUTER DIAMETER	
Service product	SUPER LUBE GREASE (P/N 293 550 030)

4. Press NEW oil seal in PTO cover.

NOTICE Oil seal must be installed with sealing lip facing to the engine.

REQUIRED TOOL	
OIL SEAL/BEARING PUSHER (P/N 529 036 284)	

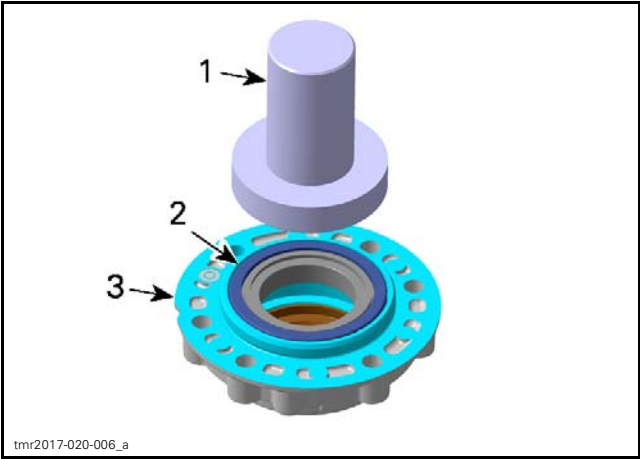


- 1. OIL SEAL/BEARING PUSHER (P/N 529 036 284)
- 2. Oil seal
- 3. PTO cover

- 5. Place **NEW** roller bearing in PTO cover.
- 6. Carefully press in the roller bearing.

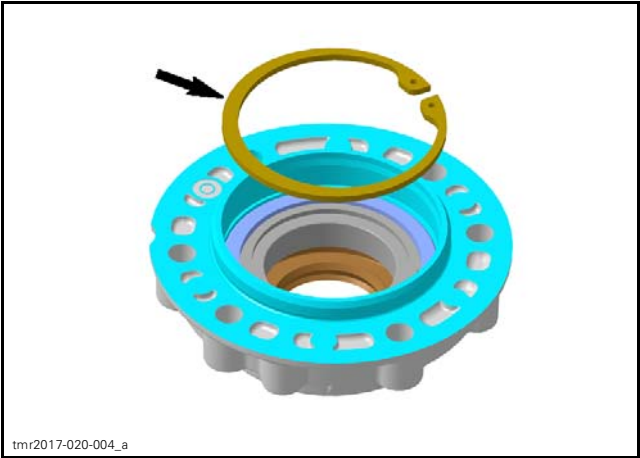
NOTICE During installation never push on the inner race of the bearing.

REQUIRED TOOL	
OIL SEAL/BEARING PUSHER (P/N 529 036 284)	



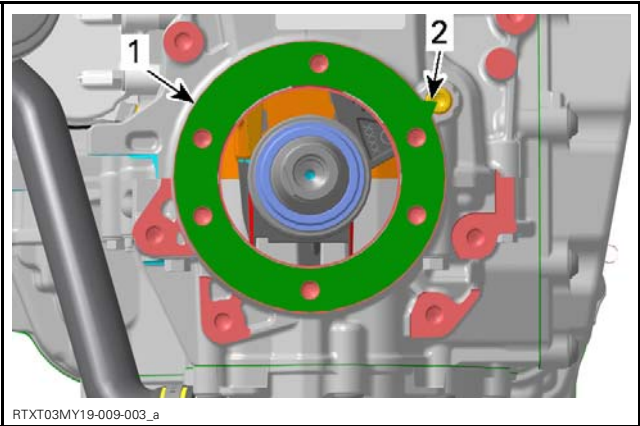
- 1. OIL SEAL/BEARING PUSHER (P/N 529 036 284)
- 2. Roller bearing
- 3. PTO cover

- 7. Install retaining ring.



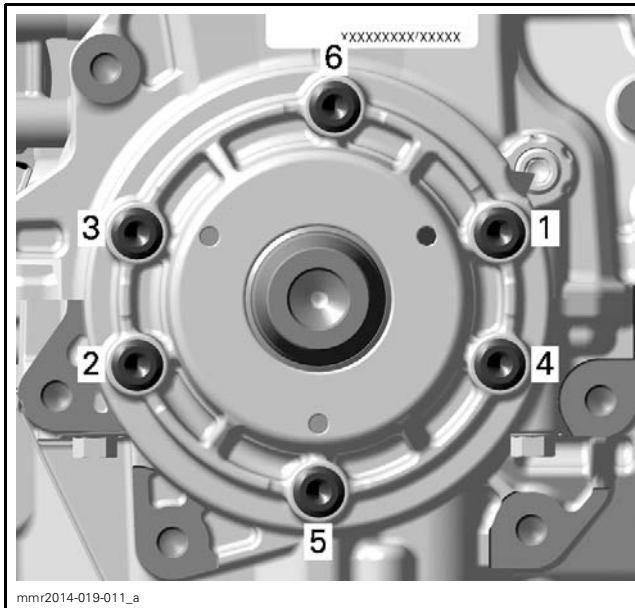
Installing the PTO Cover

The installation is the reverse of the removal procedure. However, pay attention to the following. Install a **NEW** PTO cover gasket in proper position.



- 1. Gasket
- 2. Tab

Tighten PTO cover screws as per following sequence.



PTO COVER TIGHTENING SEQUENCE

TIGHTENING TORQUE	
PTO cover screws	$23 \text{ N}\cdot\text{m} \pm 3 \text{ N}\cdot\text{m}$ $(17 \text{ lbf}\cdot\text{ft} \pm 2 \text{ lbf}\cdot\text{ft})$ + LOCTITE 243 (BLUE) (P/N 293 800 060)

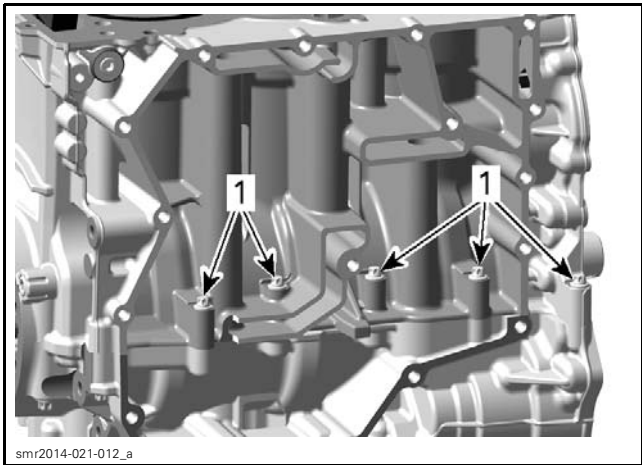
CYLINDER BLOCK

Disassembling the Cylinder Block

1. Remove muffler and tuned pipe. Refer to *EXHAUST SYSTEM* subsection.
2. Remove turbo charger. Refer to *TURBO CHARGER AND INTERCOOLER* subsection.
3. Remove engine from the vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
4. Drain engine oil. Refer to *LUBRICATION SYSTEM* subsection.
5. Refer to *CYLINDER HEAD* subsection and remove:
 - Ignition coils
 - Valve cover
 - Spark plugs.
6. Lock crankshaft, refer to *CRANKSHAFT LOCKING PROCEDURE* in this subsection.
7. Remove air intake manifold. Refer to *AIR INTAKE SYSTEM* subsection.
8. Refer to *COOLING SYSTEM* subsection and remove:
 - Water pump housing

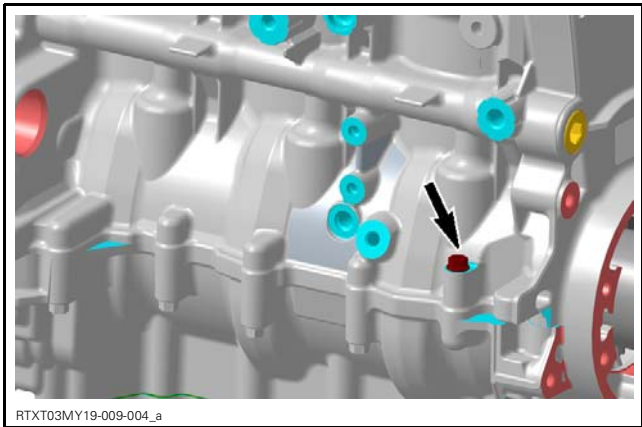
- Thermostat
 - Water pump drive gear.
9. Refer to *LUBRICATION SYSTEM* subsection and remove:
 - Oil tank
 - Oil cooler
 - Oil pressure regulator
 - Oil pump drive gears and oil pumps
 - Oil sump cover
 - Oil strainers.
 10. Refer to *MAGNETO AND STARTER* subsection and remove:
 - Magneto cover
 - Rotor
 - Starter drive gears
 - Electric starter.
 11. Refer to *TIMING CHAIN* subsection and remove:
 - Timing chain tensioner
 - Timing chain guides.
 12. Refer to *CYLINDER HEAD* subsection and remove:
 - Camshaft holders
 - Cylinder head.
 13. Remove PTO cover. Refer to *PTO COVER AND PTO OIL SEAL* in this subsection.
- NOTE:** Before splitting the cylinder block, measure crankshaft axial play. Refer to *CRANKSHAFT* in this subsection.
14. Remove crankshaft locking tool.
 15. Remove cylinder block screws.
 - 15.1 Start removing the M6 screws.
 - 15.2 Then remove the M8 screws.
 - 15.3 Finally remove and discard the M9 screws.

Subsection XX (CYLINDER BLOCK)

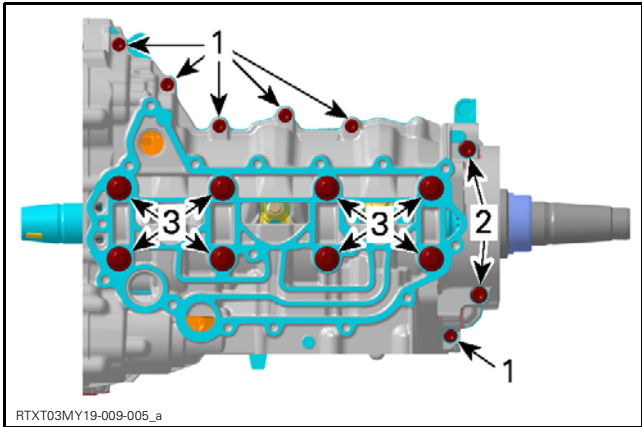


INTAKE SIDE

1. Cylinder block screws (M6) screwed from top to bottom



CYLINDER BLOCK SCREW (M6) SCREWED FROM TOP TO BOTTOM - EXHAUST SIDE

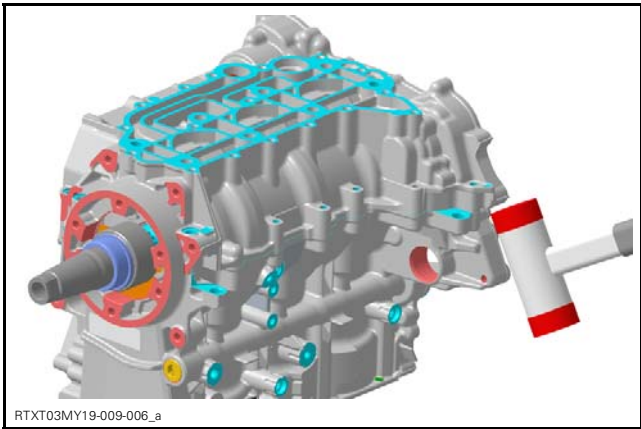


BOTTOM SIDE

- 1. M6 screws
- 2. M8 screws
- 3. M9 screws (discard)

16. Carefully remove cylinder block lower half by using a soft hammer.

NOTE: Take care not to damage the sealing surfaces of the cylinder block halves.



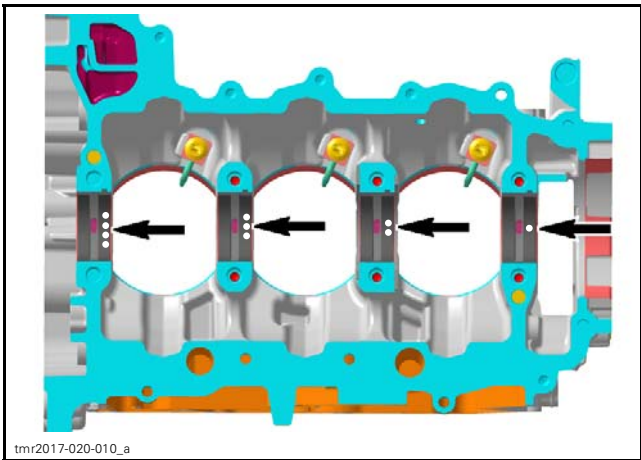
17. Remove connecting rod caps. Refer to *PISTONS AND CONNECTING RODS* in this subsection.

18. Refer to *CRANKSHAFT* in this subsection and remove:
- Crankshaft thrust washers
 - Crankshaft.

19. Remove pistons and connecting rods. See procedure in this subsection.

Removing the Plain Bearing

When the plain bearings need to be removed from the cylinder block, mark them to identify the correct position at installation. See the illustration as an example.



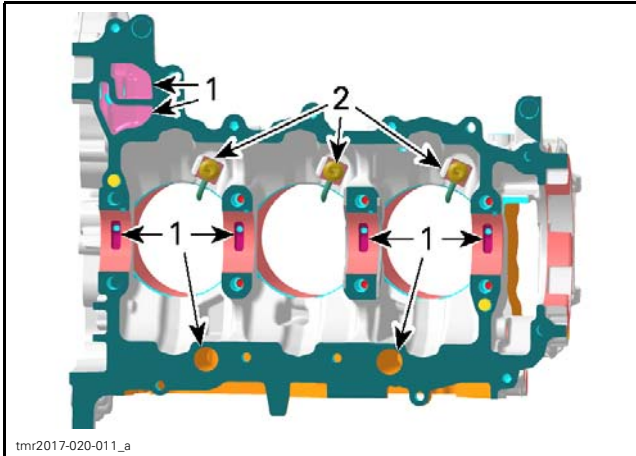
MARKS ON CRANKSHAFT PLAIN BEARINGS

Cleaning the Cylinder Block

Clean cylinder block using a part cleaner, then use compressed air to dry it.

Blow out the oil orifices using compressed air and make sure they are not clogged.

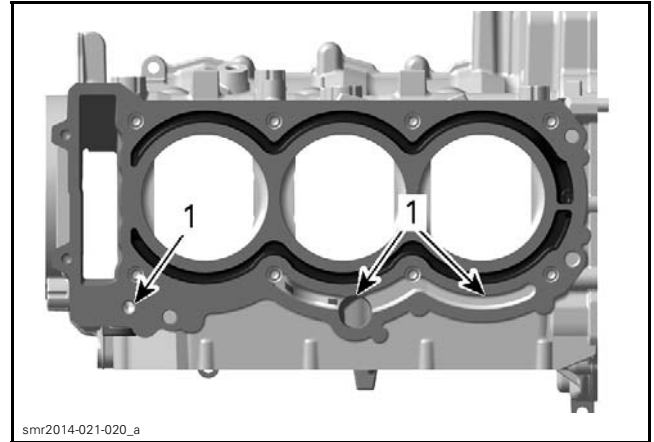
Inspect oil nozzles, refer to *LUBRICATION SYSTEM* subsection.



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CYLINDER BLOCK UPPER HALF

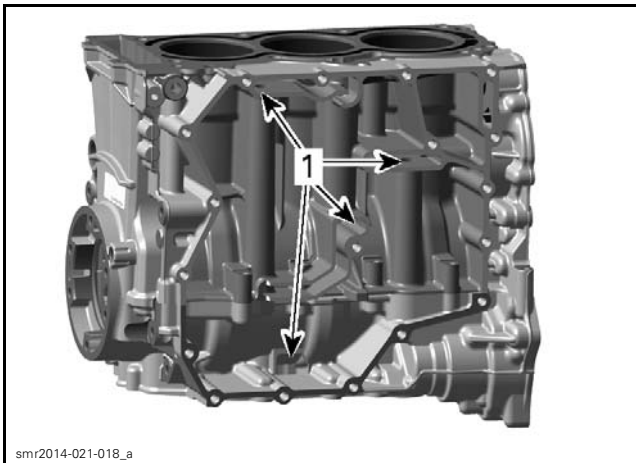
1. Oil orifices
2. Oil nozzles



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CYLINDER BLOCK - TOP

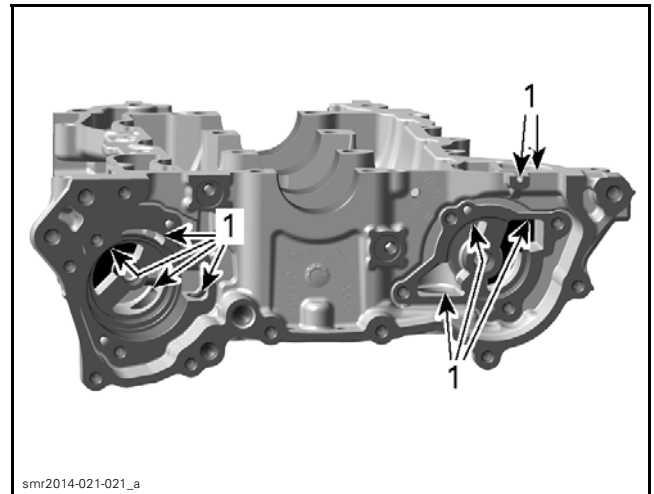
1. Oil orifices



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CYLINDER BLOCK - REAR

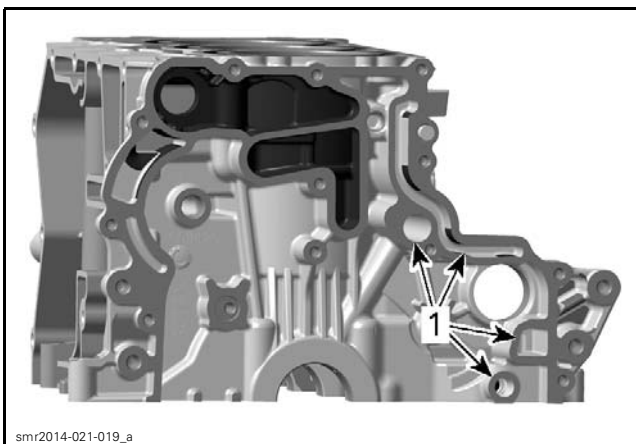
1. Oil orifices



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CYLINDER BLOCK LOWER HALF

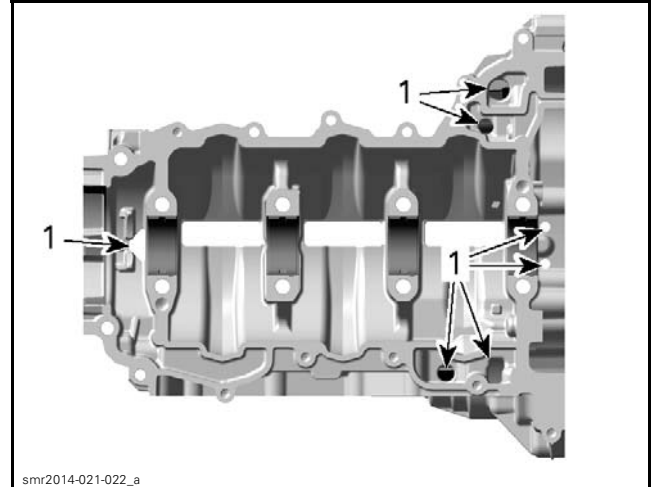
1. Oil orifices



smr2014-021-019_a

CYLINDER BLOCK - MAG SIDE

1. Oil orifices



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CYLINDER BLOCK LOWER HALF

1. Oil orifices

Clean all metal components in a solvent.

Subsection XX (CYLINDER BLOCK)

Clean cylinder block mating surfaces with LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500) and a brass brush. Brush a first pass in one direction then make the final brushing perpendicularly (90°) to the first pass (cross hatch).

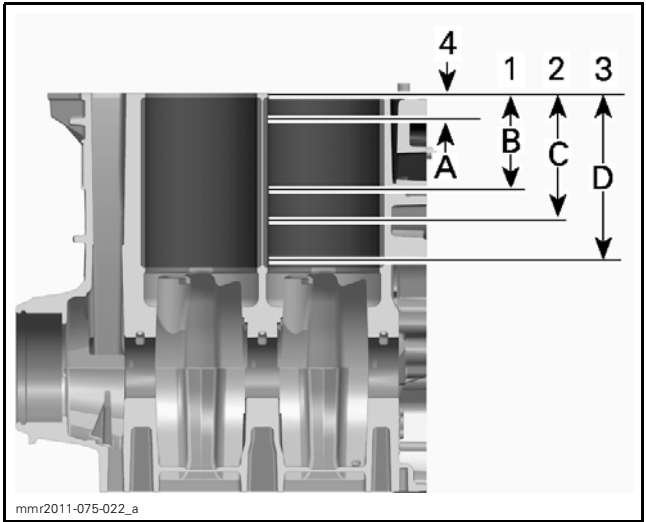
NOTE: Do not wipe with rags. Use a new clean hand towel only.

Inspecting the Cylinder Block

- Check cylinder block for cracks or other damage.
- Check cylinder block mating surfaces for flatness using a straight edge.
- Replace cylinder block if necessary.
- Check cylinder bores for cracks, scoring and wear ridges on top and bottom of the cylinders.

Cylinder Taper

Measure cylinder bore diameter at 4 recommended positions. See illustration.



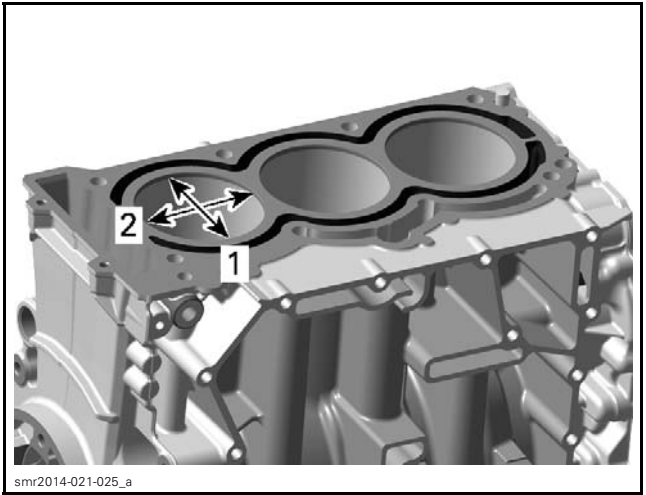
- TYPICAL**
- 1. First measure
 - 2. Second measure
 - 3. Third measure
 - 4. Fourth measure
- A. 5 mm to 10 mm (.197 in to .394 in)
 - B. 30 mm to 35 mm (1.181 in to 1.378 in)
 - C. 57 mm to 62 mm (2.244 in to 2.441 in)
 - D. 111 mm to 113 mm (4.37 in to 4.449 in)

The difference between measurements should not exceed the service limit mentioned in next table.

CYLINDER TAPER	
NEW MAXIMUM	0.030 mm (.0012 in)
SERVICE LIMIT	0.050 mm (.002 in)

Cylinder Out of Round

Measure cylinder bore diameter as shown and at the same measuring points as for *CYLINDER TAPER*.



- 1. Perpendicular to piston pin axis
- 2. Parallel to piston pin axis

To obtain the cylinder out of round, calculate the difference between the perpendicular measures.

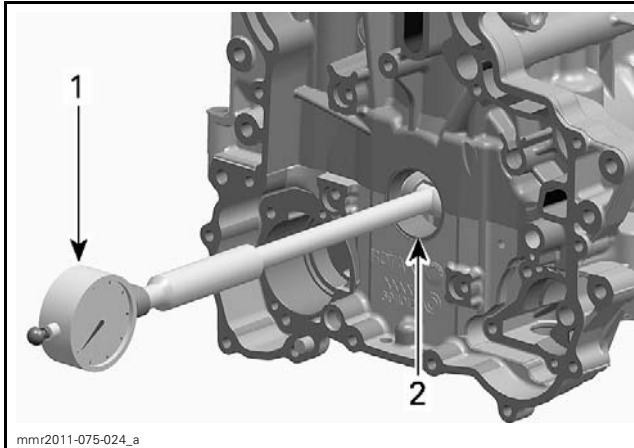
CYLINDER OUT OF ROUND	
NEW MAXIMUM	0.008 mm (.0003 in)
SERVICE LIMIT	0.030 mm (.0012 in)

Inspecting Plain Bearings Diameter

Check the plain bearings for scoring or other damages.

Measure plain bearing inside diameter and compare with crankshaft bearing journal diameter (refer to *CRANKSHAFT* in this subsection). Proceed as follows.

- Use the OLD plain bearings and put both cylinder block halves together.
- Tighten screws as described in *ASSEMBLING THE CYLINDER BLOCK*.
- Measure the inside diameter of the crankshaft plain bearings using a bore gauge.



1. Bore gauge
2. Crankshaft plain bearing

CRANKSHAFT PLAIN BEARING INSIDE DIAMETER

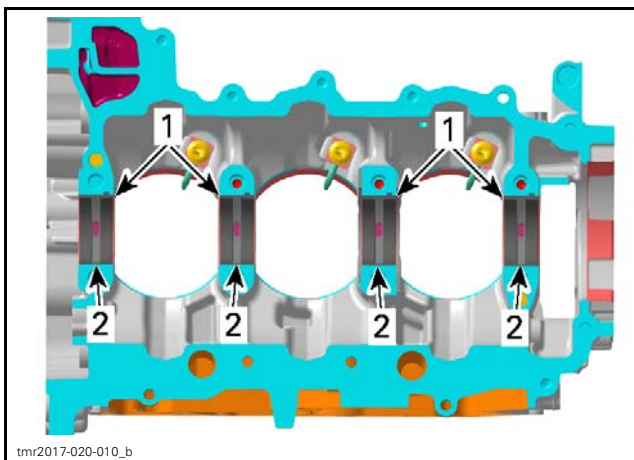
SERVICE LIMIT	36.080 mm (1.4205 in)
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Replace bearings if they are out of specifications.

Assembling the Cylinder Block

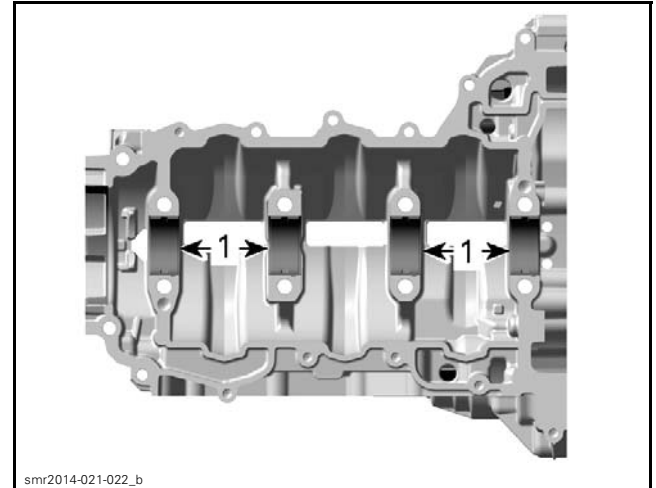
For assembly, reverse the disassembly procedure. Pay attention to the following details.

1. Correctly reinstall plain bearings as follows.
 - 1.1 Use NEW bearings if diameters are out of specification. Refer to *INSPECTING PLAIN BEARING DIAMETER* in this subsection.
 - 1.2 Install bearings with lubrication grooves in the cylinder block upper half.



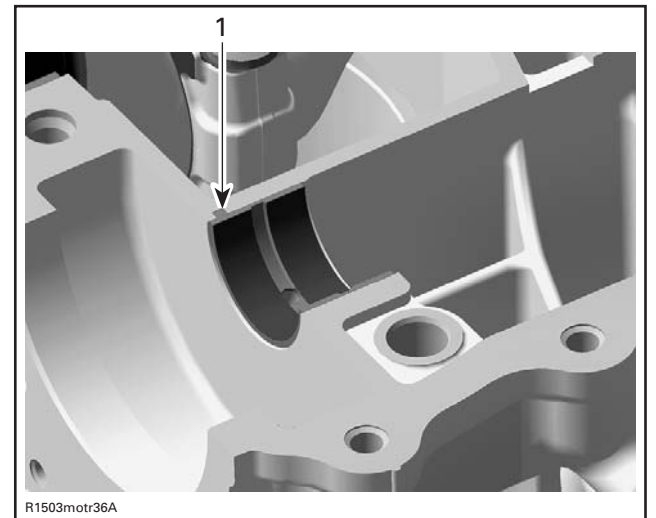
1. Plain bearings
2. Lubrication grooves

- 1.3 Install flat bearings in the cylinder block lower half.



1. Flat bearings

- 1.4 Bearings must be flush with the cylinder block split surface and their protrusions have to fit in the notched areas in the cylinder block seat.



TYPICAL

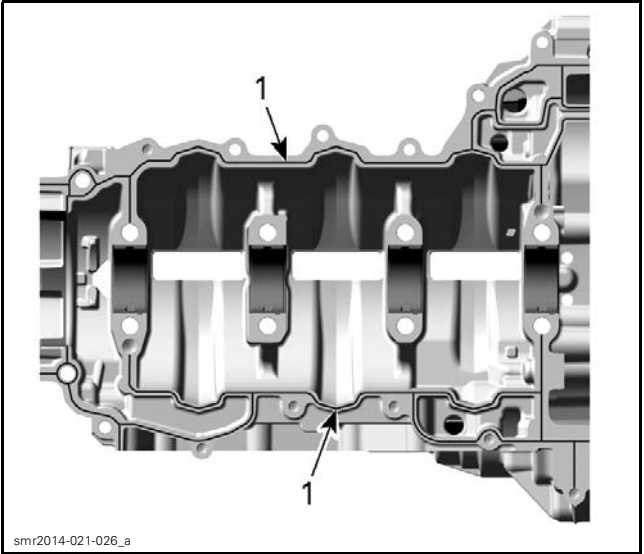
1. Bearing protrusion in cylinder block notch

2. Install pistons, refer to *PISTONS AND CONNECTING RODS* in this subsection.
3. Apply engine oil on all plain bearings.
4. Install the following components:
 - Crankshaft and thrust washers (refer to *CRANKSHAFT*)
 - Connecting rod caps (refer to *PISTONS AND CONNECTING RODS*).
5. Apply sealant on mating surface of cylinder block lower half as shown on next illustration.

Subsection XX (CYLINDER BLOCK)

CYLINDER BLOCK SEALANT	
Service product	LOCTITE 5910 (P/N 293 800 081)

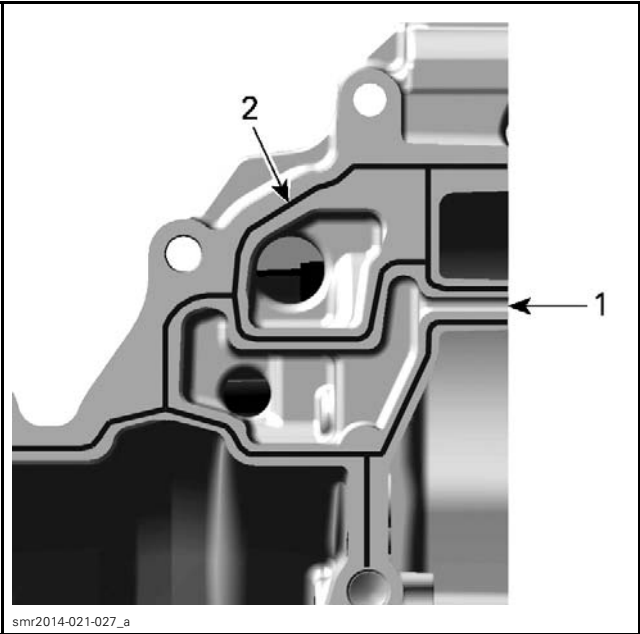
IMPORTANT: When beginning the application of the cylinder block sealant, the assembly and first tightening have to be done within 12 minutes. It is suggested to have all you need on hand to save time.



1. Apply Loctite 5910 following this pattern

NOTICE Ensure not to apply too much sealant, as it will spread out inside the cylinder block.

NOTICE Take care that the bypass passage of the engine oil pressure regulator is not clogged with sealant.



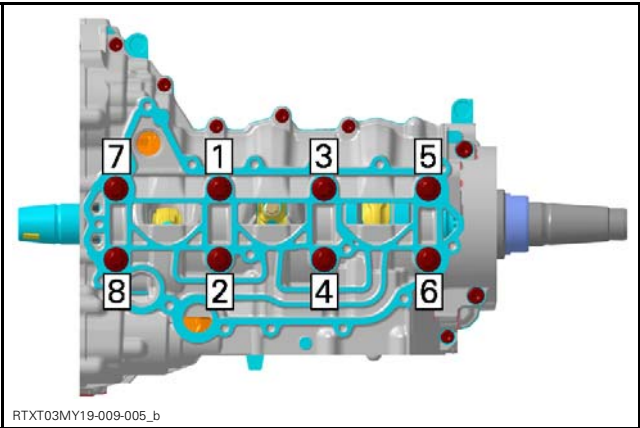
1. Bypass passage of engine oil pressure regulator
2. Loctite 5910 applied

6. Install **NEW** cylinder block M9 screws and tighten as follows.

NOTICE This assembly uses stretch screws. Always use **NEW** screws and strictly adhere to the tightening procedure.

6.1 Torque the M9 screws according the sequence.

TIGHTENING PROCEDURE		
Cylinder block M9 screws	STEP A	20 N•m ± 2 N•m (15 lbf•ft ± 1 lbf•ft)



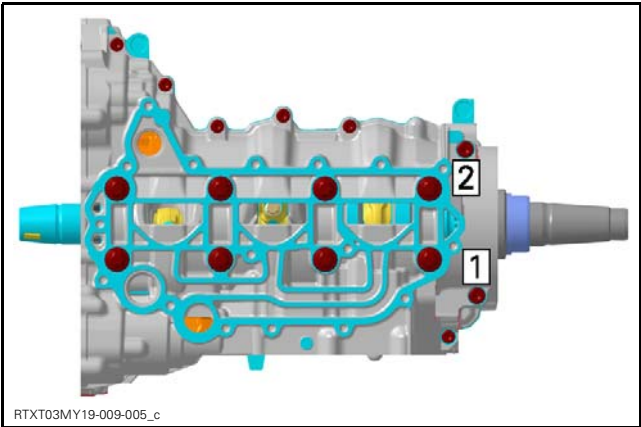
M9 SCREWS TIGHTENING SEQUENCE - FIRST AND SECOND STEPS

6.2 Use a torque angle gauge to carry out the second step, following the same sequence.

TIGHTENING PROCEDURE		
Cylinder block M9 screws	STEP B	Additional 150° ± 5°

7. Install M8 screws and tighten as follows.

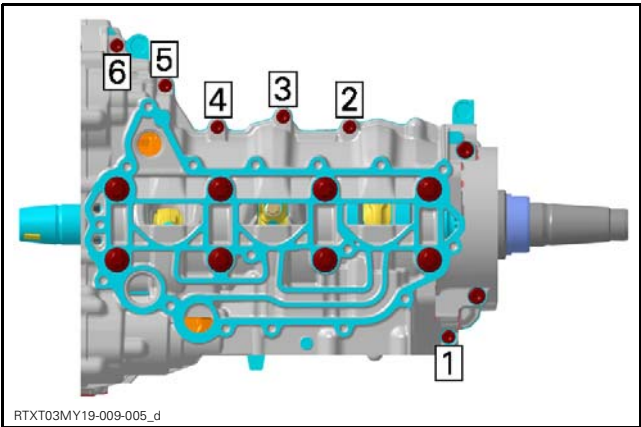
TIGHTENING TORQUE	
Cylinder block M8 screws	23 N•m ± 2 N•m (17 lbf•ft ± 1 lbf•ft)



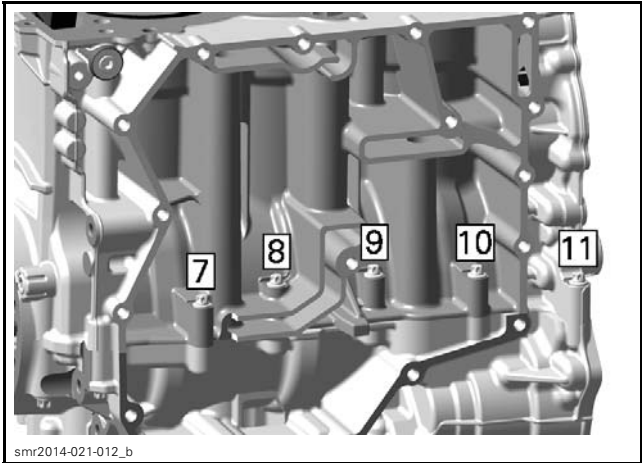
M8 SCREWS TIGHTENING SEQUENCE

8. Install the M6 screws and tighten as follows.

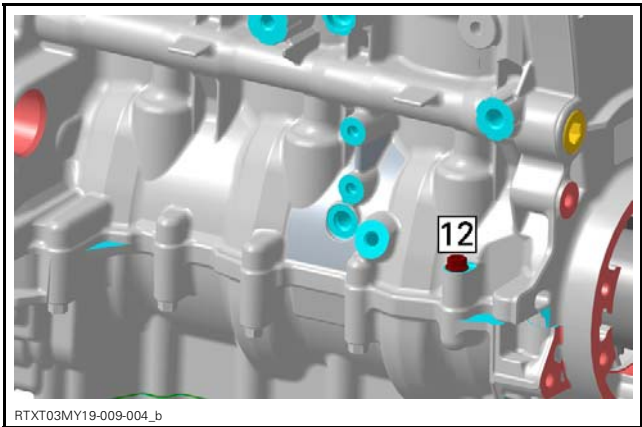
TIGHTENING TORQUE	
Cylinder block M6 screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



M6 SCREWS TIGHTENING SEQUENCE (BOTTOM OF CRANKCASE)



M6 SCREWS TIGHTENING SEQUENCE (INTAKE SIDE OF CRANKCASE)



M6 SCREW TIGHTENING SEQUENCE (EXHAUST SIDE OF CRANKCASE)

NOTE: Check the crankshaft axial play before continuing the assembly. Refer to *CRANKSHAFT* in this subsection for the procedure.

9. Lubricate PTO oil seal properly before reinstalling the PTO cover. Refer to *PTO COVER AND PTO OIL SEAL* in this subsection.

10. Reassemble engine in accordance with the proper assembly procedures.

CRANKSHAFT

Crankshaft Locking Procedure

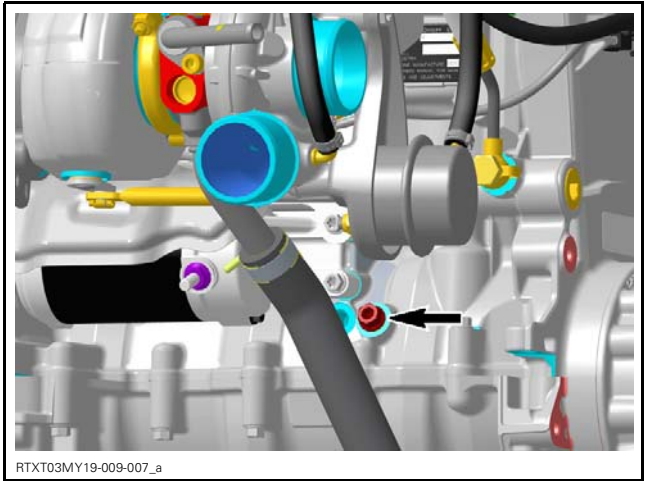
NOTICE When crankshaft is locked, the second cylinder is set to TDC.

Crankshaft must be locked whenever the magneto rotor retaining nut has to be removed or whenever working on the valve train.

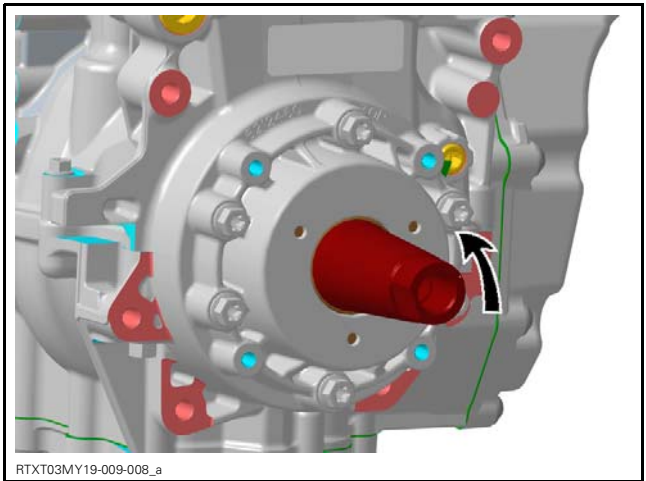
Subsection XX (CYLINDER BLOCK)

NOTICE When working on the valve train or timing chain, crankshaft must be locked with the marks "IN" and "EX" on the camshaft timing gears facing each other.

- 1. If working on the valve train or timing chain, remove the valve cover. Refer to *CYLINDER HEAD* subsection.
- 2. Remove spark plugs.
- 3. Remove crankshaft access plug and discard gasket ring.



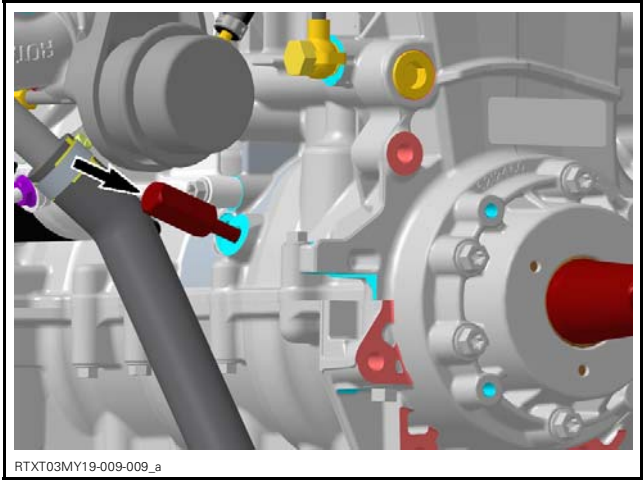
- 4. Turn engine on PTO side counterclockwise to bring crankshaft to locking position.
- For turning the crankshaft install drive pulley or use a suitable screw locked by a counter nut.



NOTICE Crankshaft locking position is reached when marks "IN" and "EX" on the camshaft timing gears face each other.

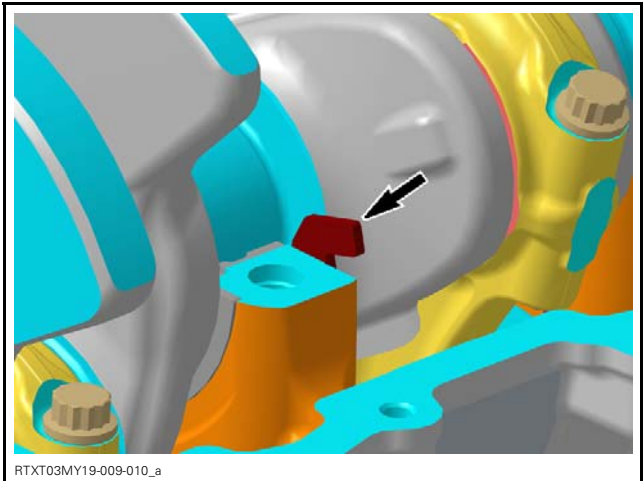
- 5. Use a flashlight to check if the groove in the crankshaft is aligned with the hole.
- 6. Lock crankshaft.

REQUIRED TOOL	
CRANKSHAFT LOCKING TOOL (P/N 529 036 272)	

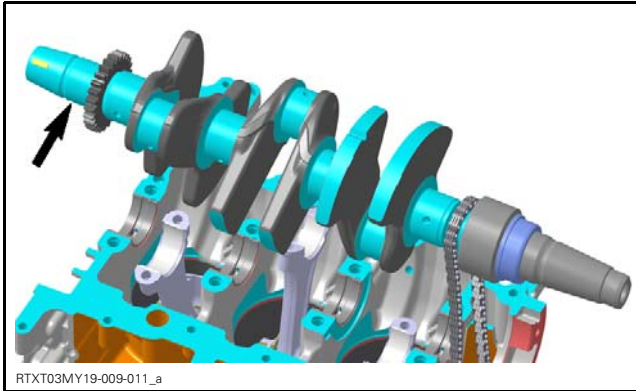


Removing the Crankshaft

- 1. Disassemble *CYLINDER BLOCK*, see procedure in this subsection.
- 2. Remove connecting rod caps. Refer to *PISTONS AND CONNECTING RODS* in this subsection.
- 3. Remove crankshaft thrust washers.



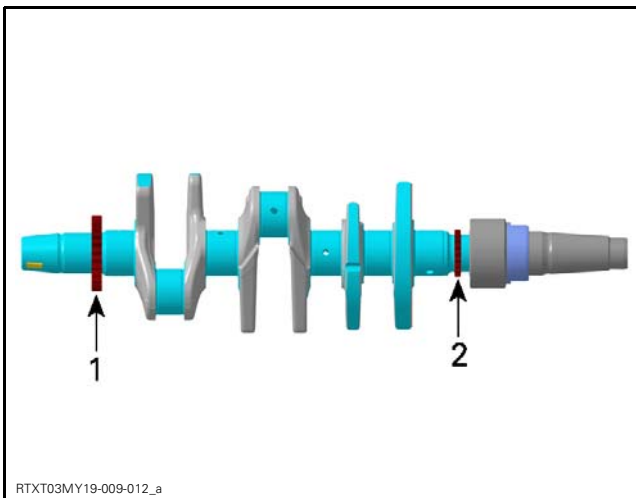
- 4. Remove crankshaft from cylinder block.



Inspecting the Crankshaft

Check each bearing journal of crankshaft for scoring, scuffing, cracks or other signs of wear.

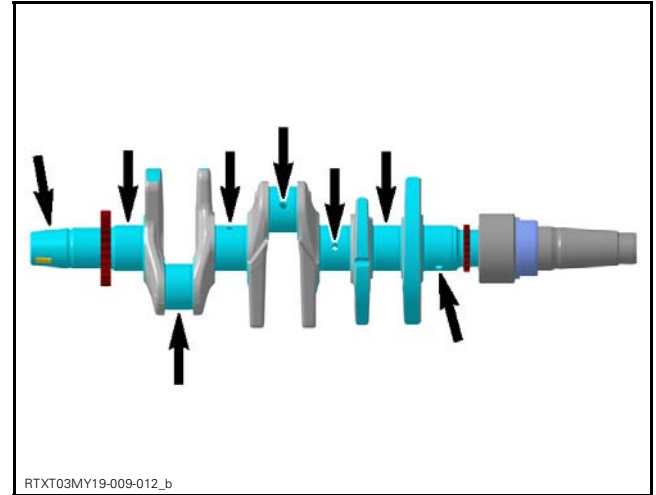
Check if crankshaft gears are worn or otherwise damaged.



1. Oil pump drive gear
2. Crankshaft timing gear

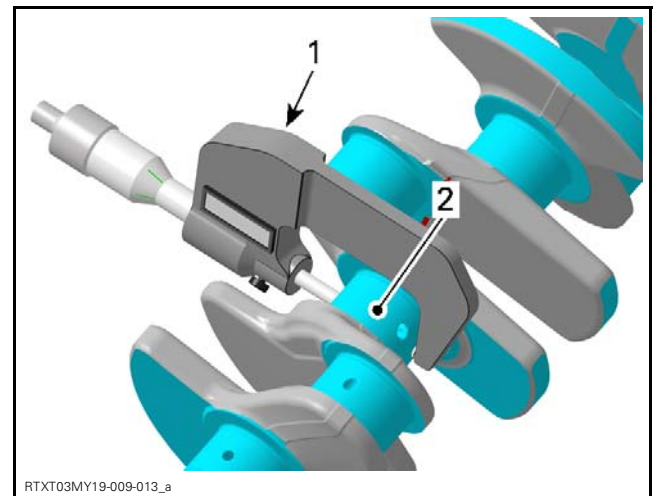
Replace crankshaft if damaged.

Blow the oil orifices using compressed air and make sure they are not clogged.



Crankshaft Radial Play

Measure crankshaft bearing journal diameter, using a micrometer.



1. Micrometer
2. Crankshaft area for plain bearing

To obtain the radial play, calculate the difference between the bearing journal diameter and the crankshaft plain bearings inner diameter (see *CYLINDER BLOCK*).

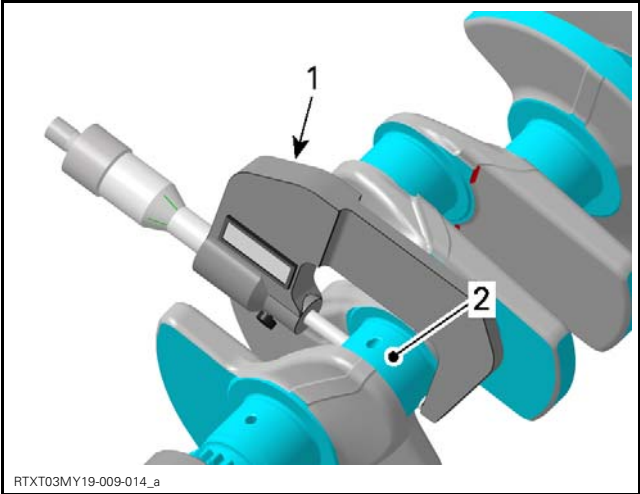
CRANKSHAFT BEARING JOURNAL DIAMETER	
NEW	35.990 mm to 36.006 mm (1.4169 in to 1.4176 in)
SERVICE LIMIT	35.960 mm (1.4157 in)
CRANKSHAFT RADIAL PLAY	
SERVICE LIMIT	0.08 mm (.0031 in)

Crankshaft Pin Diameter

Measure crankshaft pin diameter, using a micrometer.

Subsection XX (CYLINDER BLOCK)

To obtain the radial play, calculate the difference between the crankshaft pin diameter and the connecting rod plain bearings inner diameter (see *INSPECTING THE CONNECTING ROD*).



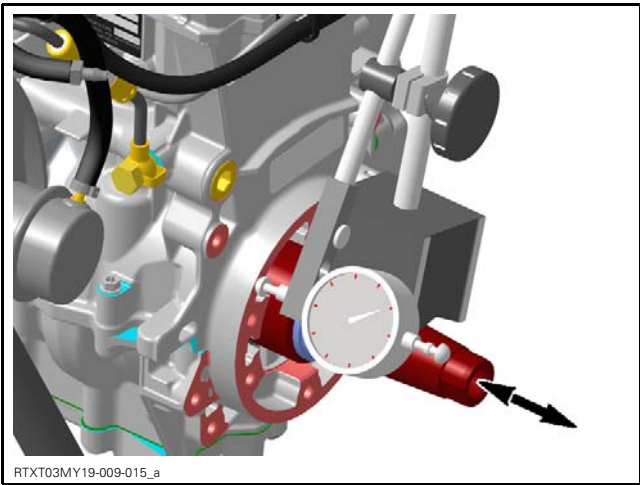
1. Micrometer
2. Crankshaft pin area for plain bearing

CRANKSHAFT PIN DIAMETER	
NEW	35.979 mm to 35.995 mm (1.4165 in to 1.4171 in)
SERVICE LIMIT	35.969 mm (1.4161 in)

CONNECTING ROD BIG END RADIAL PLAY	
SERVICE LIMIT	0.08 mm (.0031 in)

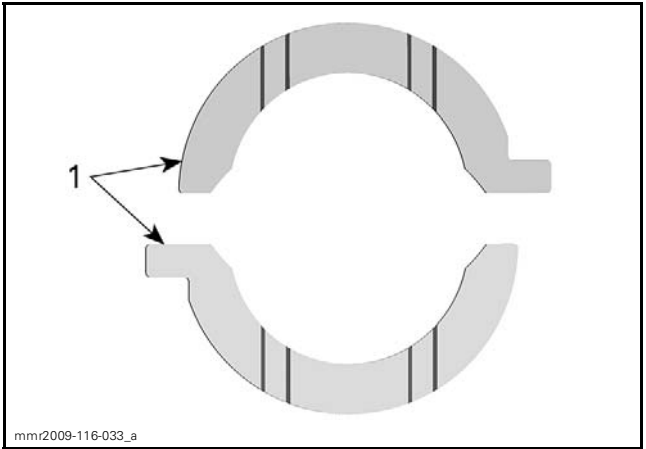
Crankshaft Axial Play

With the crankshaft in the cylinder block, measure the crankshaft axial play, using a dial indicator.



CRANKSHAFT AXIAL PLAY	
NEW	0.120 mm to 0.352 mm (.005 in to .014 in)
SERVICE LIMIT	0.450 mm (.018 in)

If play is out of specification, replace the crankshaft thrust washers and repeat measurement.



TYPICAL
1. Crankshaft thrust washers

Installing the Crankshaft

Reverse the removal procedure. Pay attention to following details.

Turn cylinder block upside down.

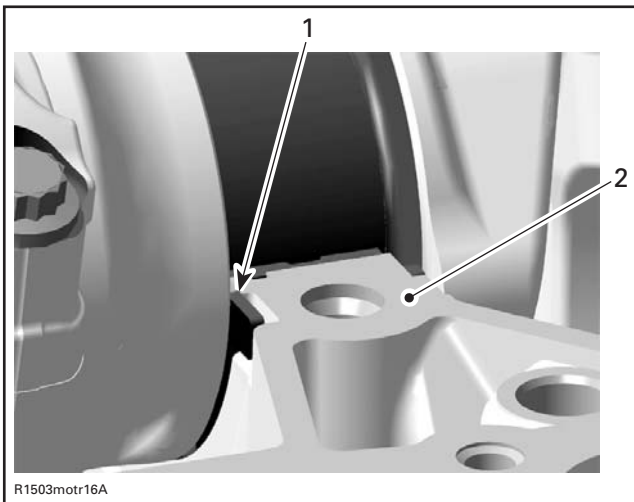
NOTICE Be careful that connecting rods do not hit the cylinder block.

Apply engine oil on all plain bearings before installing them.

Install crankshaft along with the timing chain.

Lubricate (both sides) and reinstall crankshaft thrust washers with the slots facing against crankshaft counterweights.

NOTE: Thrust washers have to be flush with the cylinder block sealing surface.



TYPICAL

1. Thrust washer
2. Sealing surface

Install connecting rod caps. Refer to *PISTONS AND CONNECTING RODS* in this subsection.

NOTICE It is absolutely necessary to follow this procedure. Otherwise severe engine damage can occur.

Install cylinder block lower half. Refer to *CYLINDER BLOCK* in this subsection.

Lock crankshaft before further assembly of the engine. See *CRANKSHAFT LOCKING PROCEDURE* in this subsection.

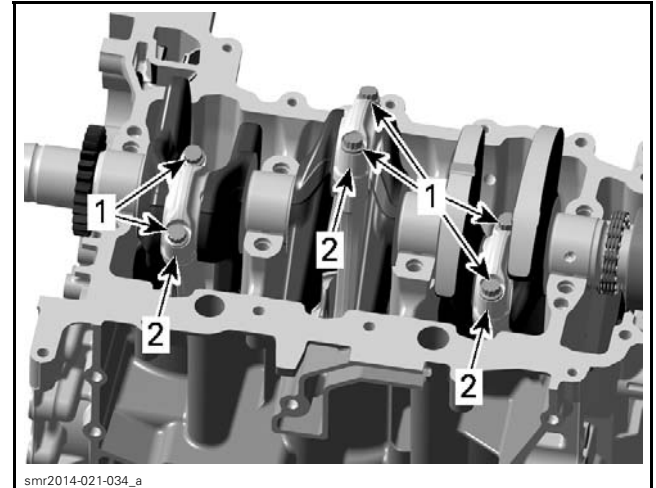
PISTONS AND CONNECTING RODS

Removing the Piston and Connecting Rod

NOTE: It is recommended to measure connecting rod big end axial play prior to remove connecting rod. Refer to *CONNECTING ROD INSPECTION*.

1. Disassemble *CYLINDER BLOCK* as per procedure in this subsection.
2. Remove connecting rod cap.

NOTICE Mark cylinder position of connecting rod before disassembly.

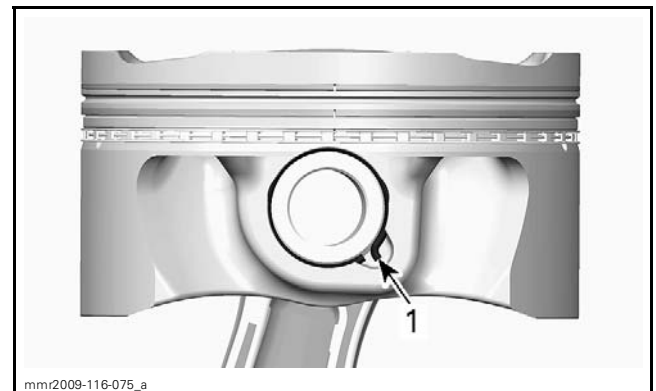


1. Connecting rod screws
2. Connecting rod cap

3. Remove *CRANKSHAFT* as per procedure in this subsection.
4. Turn cylinder block and push piston with connecting rod out of the cylinder.

Disassembling the Piston and Connecting Rod

1. Remove one piston pin circlip and discard it.



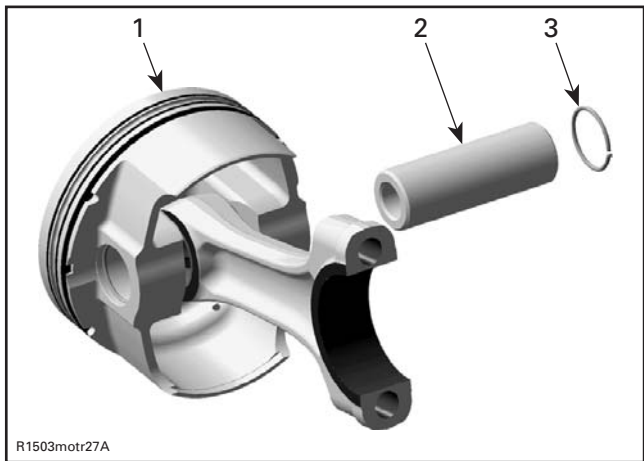
TYPICAL

1. Piston pin circlip

NOTE: The removal of both piston pin circlips is not necessary to remove the piston pin.

2. Push piston pin out of the piston.

Subsection XX (CYLINDER BLOCK)



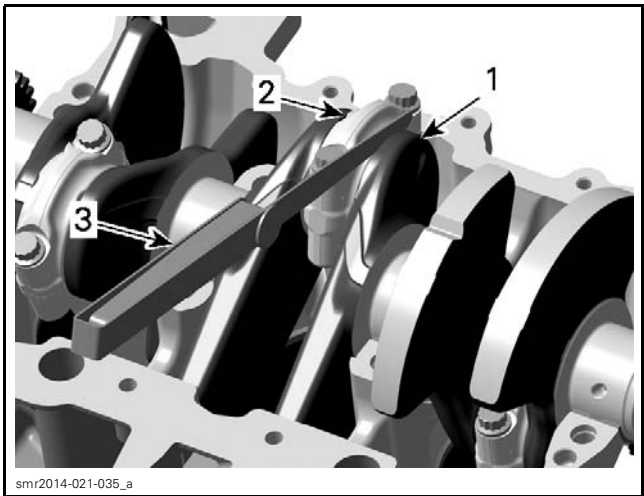
TYPICAL
1. Piston
2. Piston pin
3. Circlip

3. Detach piston from connecting rod.

Inspecting the Connecting Rod

Connecting Rod Big End Axial Play

Using a feeler gauge, measure distance between butting face of connecting rod and crankshaft counterweight. If the distance exceeds specified tolerance, replace the worn part.

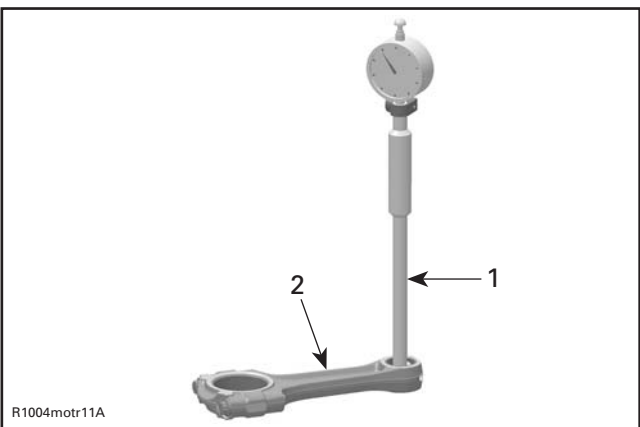


1. Crankshaft
2. Connecting rod
3. Feeler gauge

CONNECTING ROD BIG END AXIAL PLAY	
NEW	0.100 mm to 0.352 mm (.004 in to .014 in)
SERVICE LIMIT	0.450 mm (.018 in)

Connecting Rod Small End Radial Play

Measure connecting rod small end, using a bore gauge.



TYPICAL
1. Bore gauge
2. Connecting rod

CONNECTING ROD SMALL END DIAMETER	
NEW	18.010 mm to 18.020 mm (.7091 in to .7094 in)
SERVICE LIMIT	18.060 mm (.711 in)

If the connecting rod small end diameter is out of specification, replace the connecting rod.

To obtain the radial play, calculate the difference between the piston pin diameter (*INSPECTING THE PISTON PIN*) and the connecting rod small end inner diameter.

CONNECTING ROD SMALL END RADIAL PLAY	
SERVICE LIMIT	0.040 mm (.0016 in)

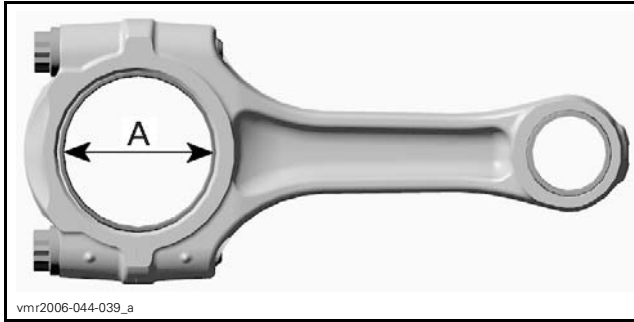
Connecting Rod Big End Radial Play

1. Measure inside diameter of connecting rod big end.

- 1.1 Install the OLD plain bearings as they were mounted initially.
- 1.2 Perform the tightening procedure as described in *INSTALLING PISTON AND CONNECTING ROD* in this subsection.

NOTE: To measure the connecting rod big end diameter, ALWAYS use the OLD connecting rod screws.

1.3 Measure inside diameter in longitudinal direction of the connecting rod.



TYPICAL
A. Connecting rod big end bearing

CONNECTING ROD BIG END DIAMETER	
SERVICE LIMIT	36.06 mm (1.4197 in)

To obtain the connecting rod big end radial play, calculate the difference between the big end diameter and the crankshaft pin diameter (see *INSPECTING THE CRANKSHAFT*).

CONNECTING ROD BIG END RADIAL PLAY	
SERVICE LIMIT	0.080 mm (.0031 in)

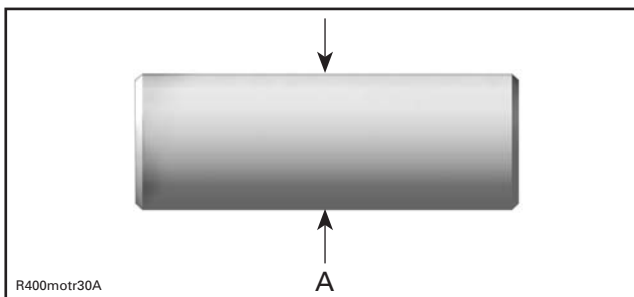
If connecting rod big end diameter is out of specification, install NEW plain bearings.

Inspecting the Piston Pin

Using synthetic abrasive woven, clean piston pin from deposits.

Inspect piston pin for scoring, cracks or other damage.

Measure piston pin diameter, using a micrometer. See the following illustration for the proper measurement position.



TYPICAL
A. Measure piston pin diameter here

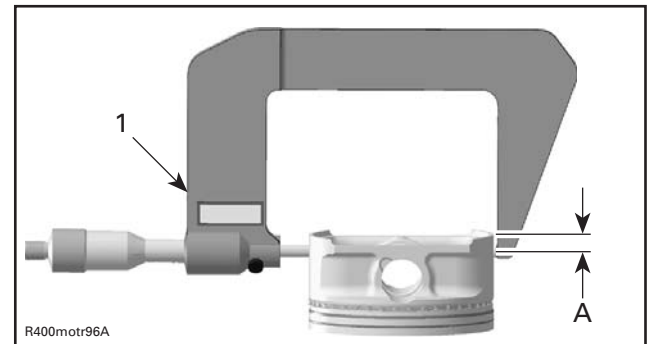
PISTON PIN DIAMETER	
NEW	17.996 mm to 18.00 mm (.7085 in to .7087 in)
SERVICE LIMIT	17.986 mm (.7081 in)

Replace the piston pin if it is out of specification.

Inspecting the Piston

Inspect piston for scoring, scuffing, cracks or other damage. Replace piston and piston rings if necessary.

Using a micrometer, measure piston perpendicularly (90°) to piston pin axis at 8.5 mm (11/32 in) from the skirt edge.



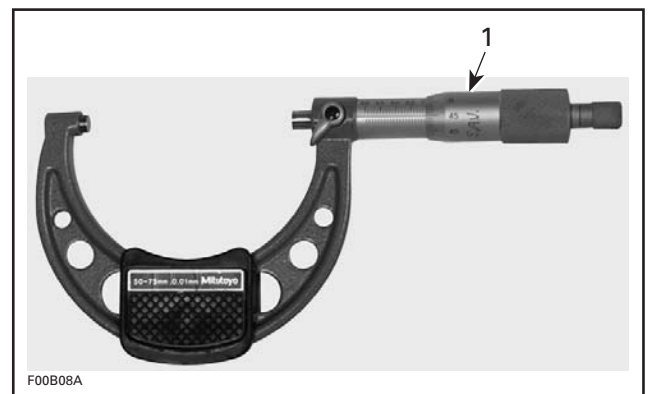
TYPICAL
1. Measuring perpendicularly (90°) to piston pin axis
A. 8.5 mm (11/32 in)

PISTON MEASUREMENT	
NEW	73.950 mm to 73.966 mm (2.9114 in to 2.912 in)
SERVICE LIMIT	73.920 mm (2.9102 in)

Replace piston if it is out of specification.

Piston/Cylinder Clearance

1. Adjust and lock a micrometer to the piston dimension.

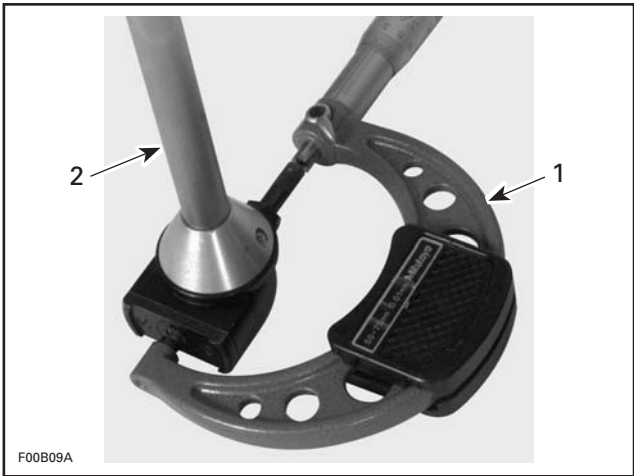


TYPICAL
1. Micrometer set to the piston dimension

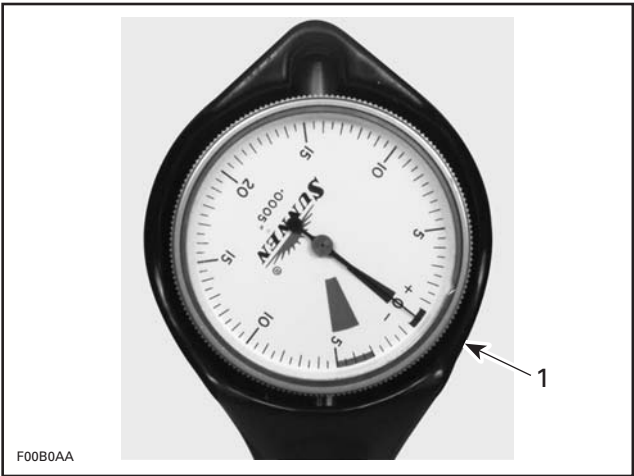
NOTE: Make sure used piston is not worn.

2. With the micrometer locked at step 1, adjust a cylinder bore gauge to the micrometer dimension and set the indicator to 0 (zero).

Subsection XX (CYLINDER BLOCK)



TYPICAL
1. Use the micrometer to set the cylinder bore gauge
2. Cylinder bore gauge



TYPICAL
1. Indicator set to 0 (zero)

NOTE: Make sure the cylinder bore gauge indicator is set exactly at the same position as with the micrometer, otherwise the reading will be false.

3. Position the cylinder bore gauge 35 mm (1-3/8 in) below the cylinder head mating surface, measuring perpendicularly (90°) to piston pin axis.
4. Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder clearance.

PISTON/CYLINDER CLEARANCE	
NEW	0.037 mm to 0.067 mm (.0015 in to .0026 in)
SERVICE LIMIT	0.080 mm (.0031 in)

If clearance exceeds the specified tolerance, replace the piston and repeat the measurement procedure.

Assembling Piston and Connecting Rod

For assembly, reverse the disassembly procedure. Pay attention to the following details.

1. Apply engine oil on the piston pin.
2. Insert piston pin into piston and connecting rod.

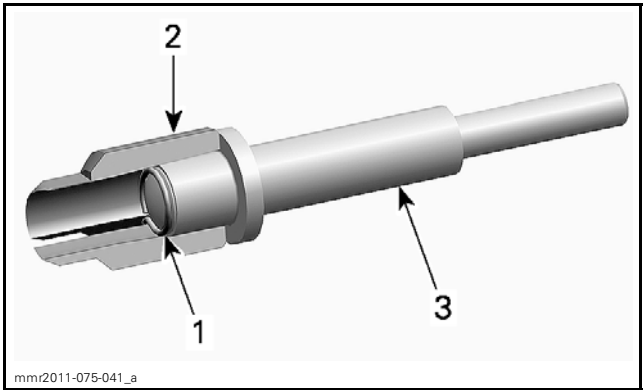
NOTE: Ensure to reinstall all parts in their original position as marked during removal.

3. Install **NEW** piston pin circlip(s).

REQUIRED TOOL	
PISTON CIRCLIP INSTALLER (P/N 529 036 426)	

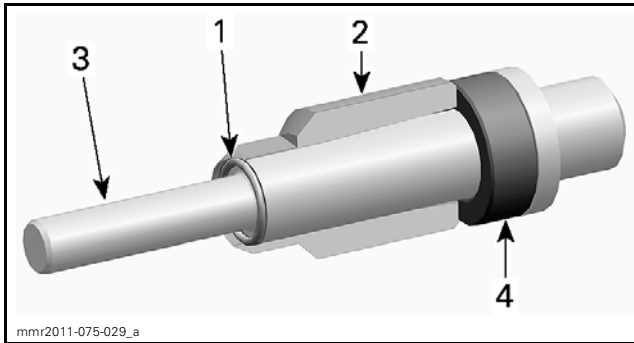
NOTICE Always replace removed piston pin circlips by **NEW** ones.

- 3.1 Place the circlip in the sleeve and push piston circlip installer handle until circlip reaches the mid position in the sleeve.



TYPICAL
1. Circlip
2. Sleeve
3. Installer handle

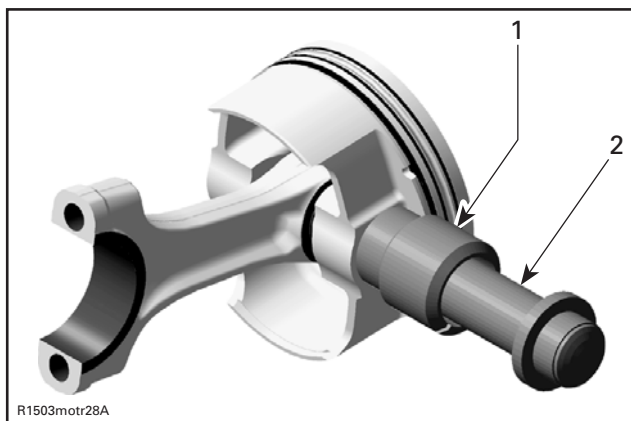
- 3.2 Put the distance sleeve on the installer handle.
- 3.3 Push piston circlip installer handle until distance sleeve makes contact with the sleeve.



1. Circlip
2. Sleeve
3. Installer handle
4. Distance sleeve

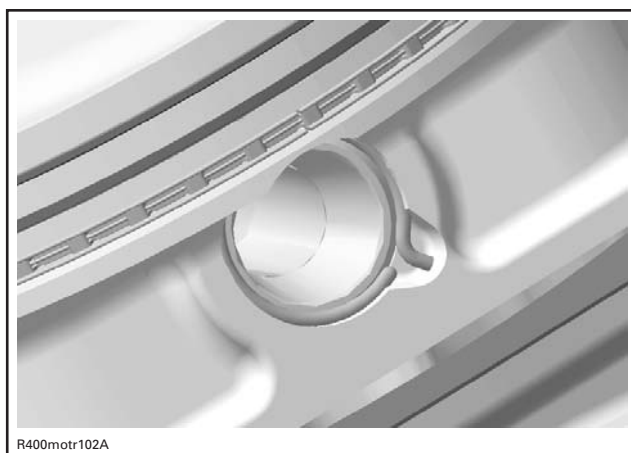
3.4 Remove distance sleeve and insert installer handle into the sleeve.

3.5 Insert the end of the handle into the piston pin, then push to engage the circlip into the piston groove.



- TYPICAL**
1. Sleeve with piston circlip inside
 2. Piston clip installer handle

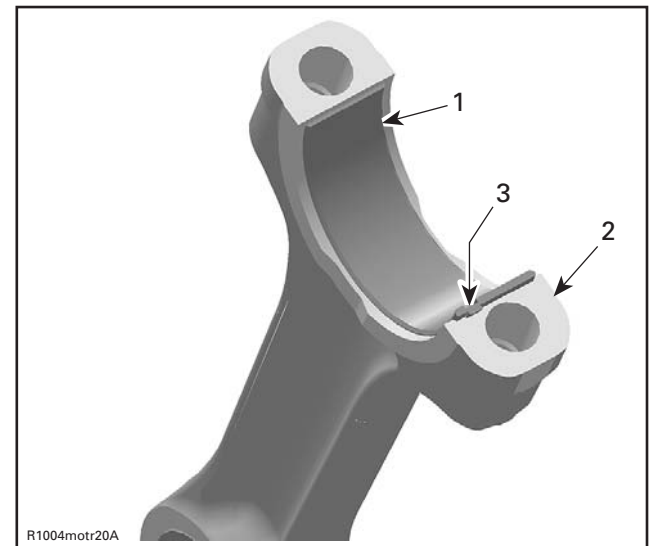
NOTE: Take care that the hook of the piston pin circlip is positioned properly.



TYPICAL - CORRECT POSITION OF THE PISTON PIN CIRCLIP

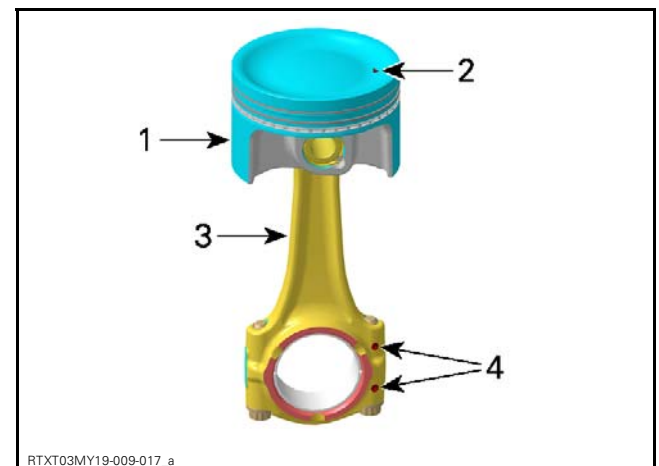
NOTICE If piston pin circlip installation fails, repeat step 3 by using a NEW circlip.

4. Correctly install plain bearings and carefully clean split surface on both sides (cracked area) with compressed air.



- TYPICAL**
1. Half bearing of connecting rod big end
 2. Split surface of the connecting rod
 3. Protrusion of bearing in line with connecting rod groove

NOTICE The arrow on top of the piston and the punched marks on the connecting rods must always point towards exhaust.



1. Piston
2. Arrow on top
3. Connecting rod
4. Punched marks

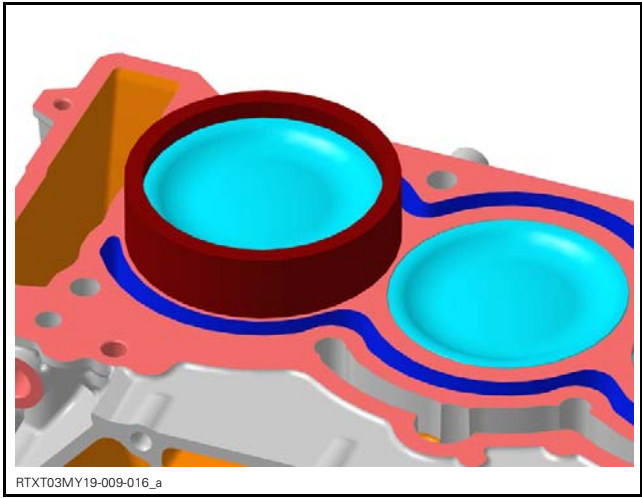
Installing the Piston and Connecting Rod

1. Use engine oil and lubricate:
 - Piston
 - Piston rings

Subsection XX (CYLINDER BLOCK)

- Cylinder bore
 - Connecting rod bearings.
2. Slide piston into cylinder bore. Pay attention to the following.

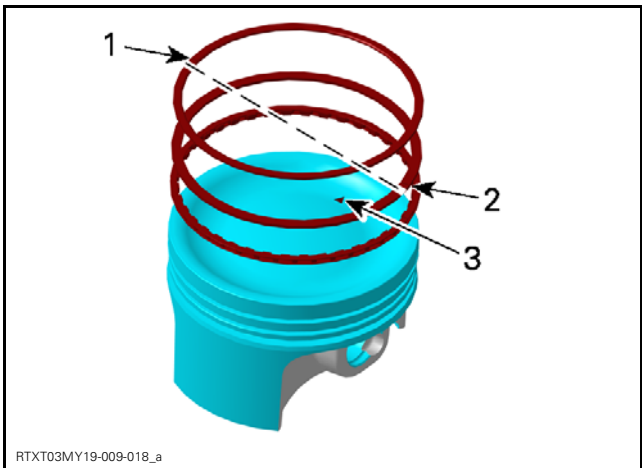
REQUIRED TOOL	
PISTON RING COMPRESSOR (P/N 529 036 208)	



TYPICAL

- 2.1 If reused, install piston in its original bore.
- 2.2 Make sure piston rings are properly spaced.

NOTICE The ring gaps of both compression rings should always be 180° from each other and 90° from the arrow on top of the piston.

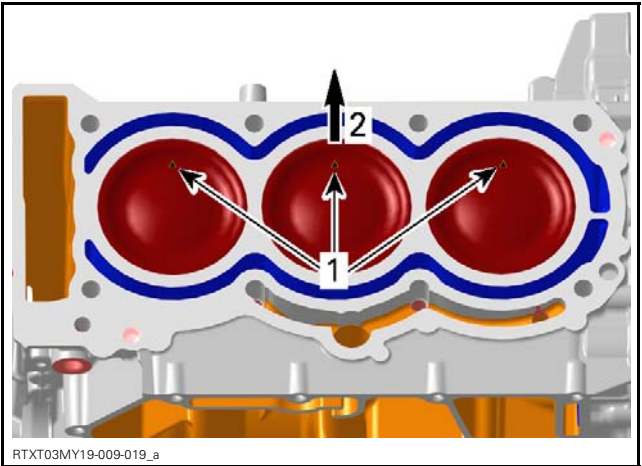


RING GAPS AT 180° FROM EACH OTHER AND 90° FORM ARROW

1. Rectangular ring - ring gap
2. Taper-face ring - ring gap
3. Arrow

- 2.3 The arrow on top of the piston must point towards exhaust.

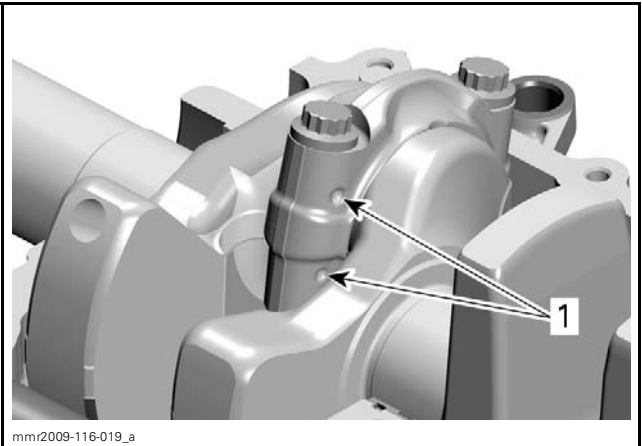
NOTICE Piston installed with the arrow in the wrong direction would cause serious engine damage.



1. Arrows
2. Exhaust

3. Turn cylinder block upside down.
4. Install *CRANKSHAFT* as per procedure in this subsection.
5. Oil the crankshaft pin.
6. Install connecting rod caps.

NOTE: Printed marks on connecting rod and cap must point together.



TYPICAL
1. Printed marks

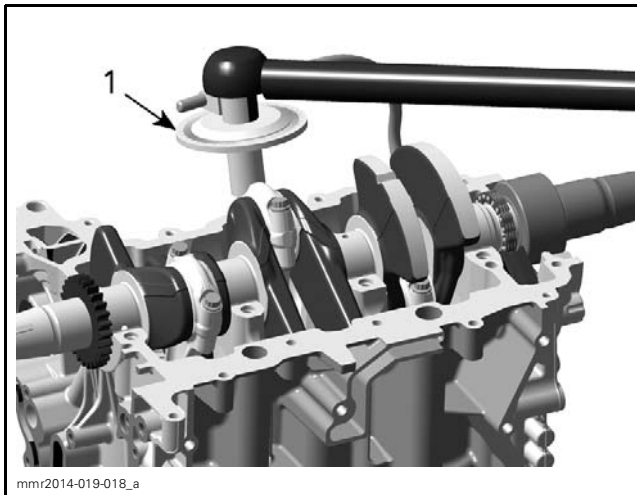
NOTICE This assembly uses stretch screws. Always use NEW screws and strictly adhere to the tightening procedure.

7. Tighten connecting rod screws as follows:
- 7.1 Torque both connecting rod screws of a connecting rod.

TIGHTENING PROCEDURE		
Connecting rod screws	STEP A	12 N•m ± 2 N•m (106 lbf•in ± 18 lbf•in)

- 7.2 Use a torque angle gauge to carry out the second step.

TIGHTENING PROCEDURE		
Connecting rod screws	STEP B	Additional 70° ± 5°



TYPICAL

NOTICE Failure to strictly follow this procedure may cause screws to loosen and lead to severe engine damage.

8. Install all other removed parts.

PISTON RINGS

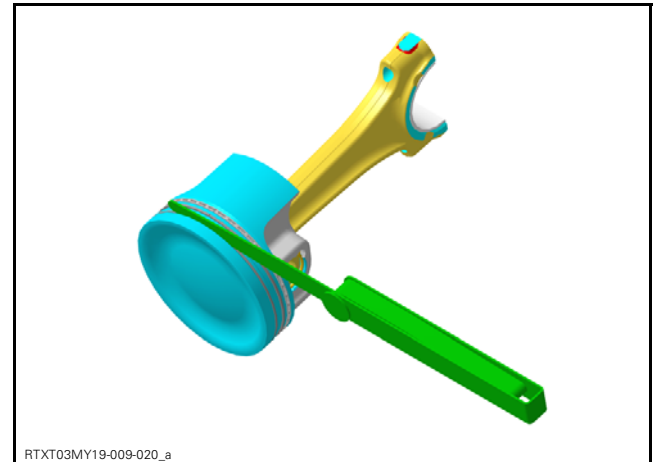
Removing the Piston Ring

1. Remove piston, see procedure in this subsection.
2. Remove rings from piston.

Inspecting the Piston Ring

Ring/Piston Groove Clearance

Using a feeler gauge measure each ring/piston groove clearance.



RING/PISTON GROOVE CLEARANCE	
UPPER COMPRESSION RING	
NEW	0.030 mm to 0.066 mm (.0012 in to .0026 in)
SERVICE LIMIT	0.120 mm (.0047 in)
LOWER COMPRESSION RING	
NEW	0.020 mm to 0.056 mm (.0008 in to .0022 in)
SERVICE LIMIT	0.120 mm (.0047 in)
OIL SCRAPER RING	
NEW	0.010 mm to 0.040 mm (.0004 in to .0016 in)
SERVICE LIMIT	0.150 mm (.0059 in)

If clearance is out of specification, the piston and rings should be replaced.

Ring End Gap

1. Place piston ring in the cylinder bore between 8 mm to 16 mm (5/16 in to 5/8 in) from the top of cylinder.

NOTE: In order to correctly position the ring in the cylinder bore, use a piston as a pusher.

2. Using a feeler gauge, check ring end gap.

Subsection XX (CYLINDER BLOCK)

RING END GAP	
UPPER COMPRESSION RING	
NEW	0.20 mm to 0.35 mm (.008 in to .014 in)
SERVICE LIMIT	1.20 mm (.047 in)
LOWER COMPRESSION RING	
NEW	0.30 mm to 0.50 mm (.012 in to .02 in)
SERVICE LIMIT	1.20 mm (.047 in)
OIL SCRAPER RING	
NEW	0.20 mm to 0.70 mm (.008 in to .028 in)
SERVICE LIMIT	1.20 mm (.047 in)

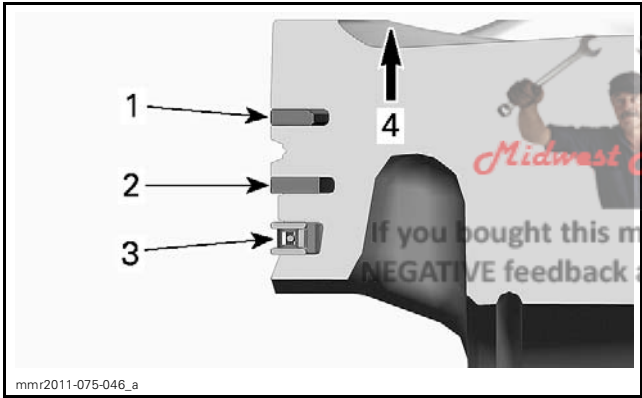
If ring end gap is out of specification, replace piston rings.

Installing the Piston Ring

1. Install piston rings in the following order.

NOTE: Use a ring expander to prevent breakage during installation. The oil ring must be installed by hand.

- 1.1 Install oil scraper ring.
- 1.2 Install the lower compression ring with the letter "N" facing up.
- 1.3 Install upper compression ring with the letter "N" facing up.



- TYPICAL**
- 1. Rectangular ring
 - 2. Taper-face ring
 - 3. Oil scraper ring
 - 4. Letter "N" facing up

NOTICE Ensure that upper and lower compression rings are not interchanged.

2. Check that rings rotate smoothly after installation.



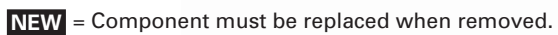
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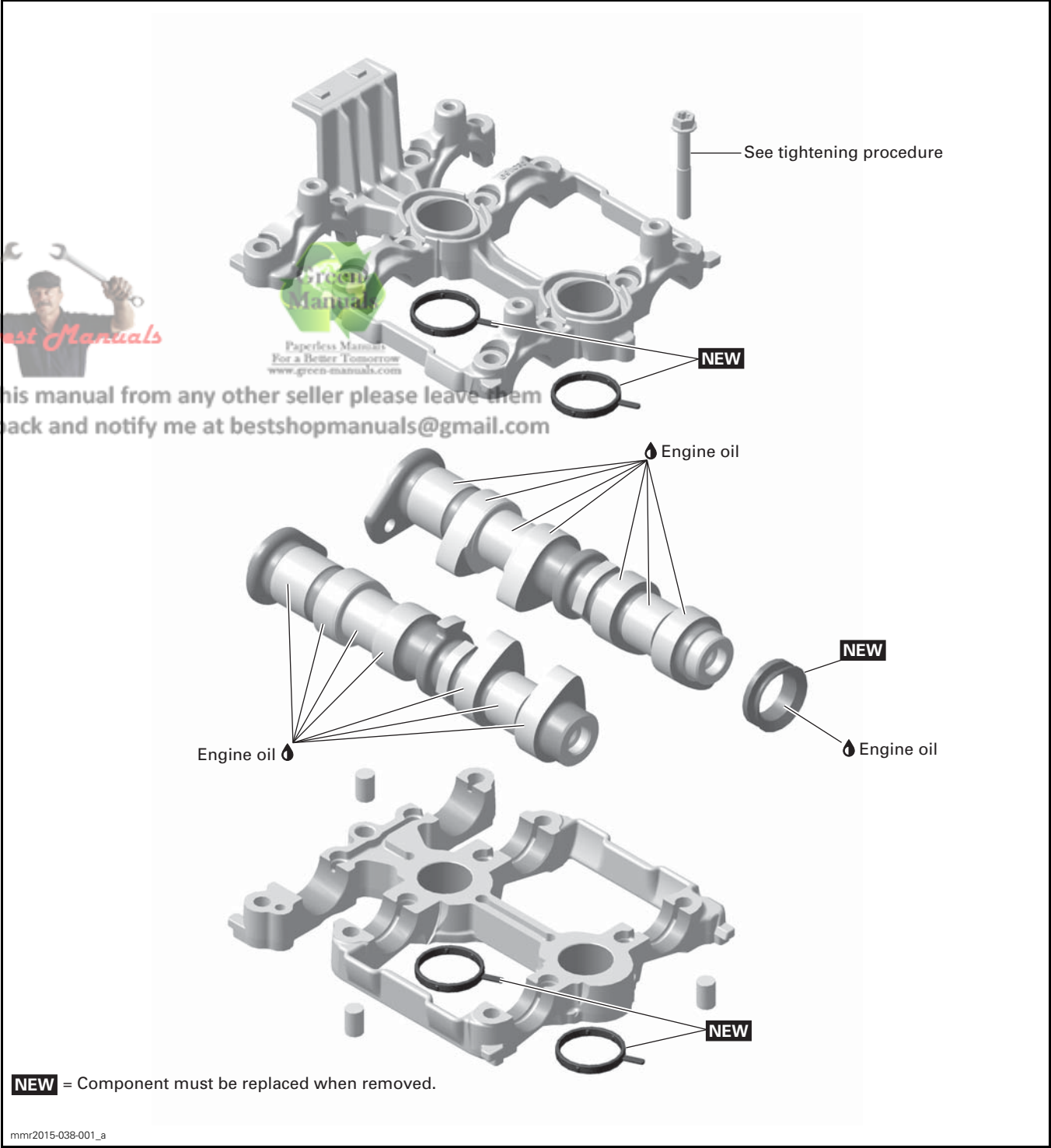
CYLINDER HEAD

SERVICE TOOLS

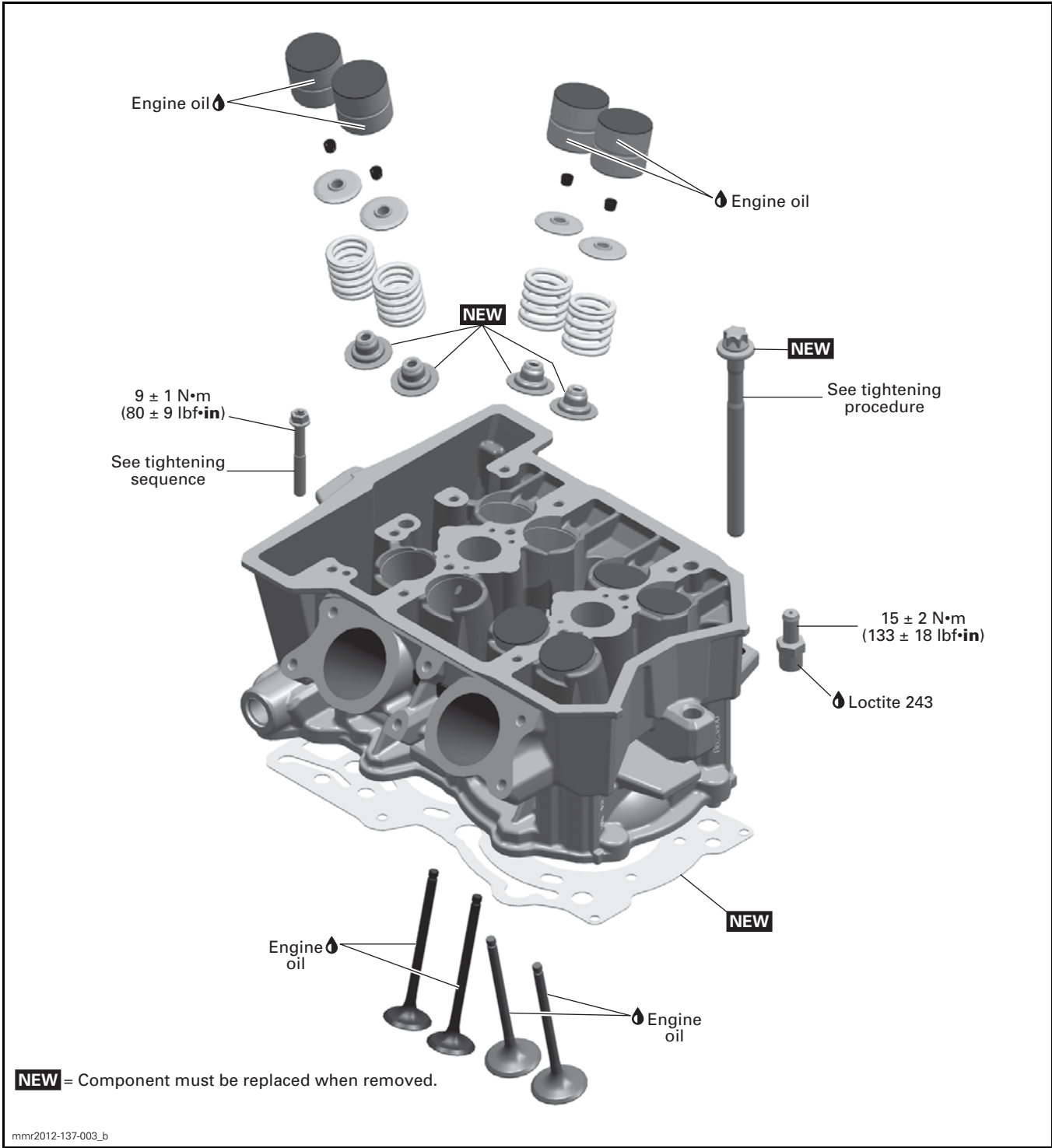
Description	Part Number	Page
CAMSHAFT LOCKING TOOL (900 ACE).....	529 036 206	13
ENGINE LEAK DOWN TEST KIT	529 035 661	5
VALVE SPRING COMPRESSOR CUP	529 036 209	19
VALVE SPRING COMPRESSOR	529 035 724	19



CAMSHAFTS



CYLINDER HEAD



GENERAL

NOTE: For a better understanding, some illustrations are taken with engine out of the vehicle.

Disconnect the battery before working on the engine.

WARNING

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

When disassembling parts that are duplicated in the engine, (e.g.: valves, springs, etc.), it is strongly recommended to note their position and to keep the parts of the same assembly as a "group". If you find a defective component, it will be much easier to find the cause of the failure. Since parts were break-in together during the engine operation, they will keep their matched fit when parts are reassemble together within their "group".

INSPECTION

CYLINDER LEAK TEST

General

Before performing the cylinder leak test, verify the following:

- Clamp tightness
- Hoses condition.

NOTE: For best accuracy, the leak test should be done with the engine at normal operating temperature.

 CAUTION Engine parts could be hot.

NOTE: The following steps are the same for each cylinder.

Preparation

1. Remove the *VALVE COVER*, see procedure in this subsection.
2. Remove spark plug.
3. Using the drive pulley, turn the engine counter-clockwise to bring piston to TDC of compression stroke. Use a dial gauge or a suitable tool to position the piston to TDC.

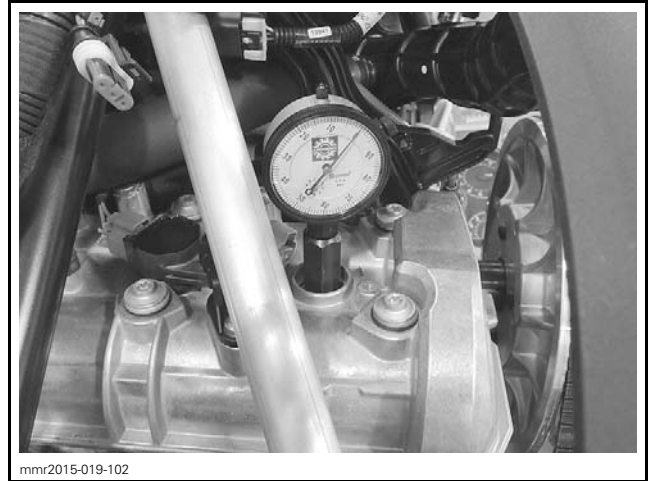
NOTE: The piston must be set precisely to TDC of compression stroke. If not, the engine will continue to rotate when pressure builds up.

RECOMMENDED TOOLS

Dial gauge



Dial gauge extension/adaptor



Leak Test

1. Install a gauge adaptor into spark plug hole.

REQUIRED TOOL

ENGINE LEAK DOWN TEST
KIT (P/N 529 035 661)



2. Connect the leak down tester to an adequate air supply.
3. Set gauge needle to zero.

NOTE: All testers have specific instructions on gauge operation and required pressure. Refer to manufacturer's instructions.

4. Supply combustion chamber with air pressure.



5. Note the amount or percentage of leakage (depending on tester).

LEAKAGE PERCENTAGE	ENGINE CONDITION
0% to 15%	Excellent condition
16% to 25%	Good condition
26% to 40%	Fair condition; reduced engine performance
41% and higher	Poor condition, diagnose and repair engine

Diagnosis

Listen for air leaks.

- Air escaping on intake port or throttle body means leaking intake valve(s).
- Air escaping on exhaust port means leaking exhaust valve(s).
- Air bubbles out of coolant tank means leaking cylinder head gasket.
- Air or coolant escaping from cylinder head means damaged gasket or loosened screws.
- Air escaping into crankcase area means excessively worn cylinder or broken piston rings.
- Air or oil escaping from crankcase means damaged gasket or loosened screws.

Repair Tips

Blue exhaust gas means damaged or worn piston rings or valve stem seals.

White exhaust gas means damaged cylinder head gasket.

Coolant tank cap opening without overheat means damaged cylinder head gasket.

Leaking valves can be caused by carbon deposits or burnt valve face.

Assembly

Reverse the preparation procedure.

TROUBLESHOOTING

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

NOTE: When diagnosing an engine problem, always perform the cylinder leak test. This will help pinpoint a problem. Refer to *CYLINDER LEAK TEST* in this subsection.

UNUSUAL ENGINE NOISE OR VIBRATIONS

1. Discharged or defective valve lifters.
 - Check engine oil pressure, refer to *LUBRICATION SYSTEM* subsection.
 - Replace valve lifters.
2. Camshaft(s) or camshaft holder(s) worn out.
 - Check and replace damaged parts.
3. Faulty chain tensioner.
 - Replace chain tensioner. Refer to *TIMING CHAIN* subsection.
4. Chain guide(s) worn out.
 - Replace chain guide(s). Refer to *TIMING CHAIN* subsection.
5. Stretched timing chain or worn out sprockets.
 - Replace timing chain and sprockets. Refer to *TIMING CHAIN* subsection.
6. Loose timing chain gear screws.
 - Retighten screws with recommended torque.
7. Incorrect camshaft timing.
 - Replace damaged components and readjust camshaft timing.

OIL LEAKAGE FROM CYLINDER HEAD

1. Leaking valve cover gasket.
 - Replace valve cover gaskets and retighten valve cover with recommended torque.
 - Check valve cover for cracks or other damage.
2. Leaking spark plug tube O-rings.
 - Replace spark plug tube O-rings.
 - Clean spark plug area from oil spillage.
3. Blow-by connector is leaking.
 - Replace blow by connector O-ring.

4. Leaking cylinder head gasket.
 - Check cylinder head for damage.
 - Replace cylinder head gasket and retighten screws with recommended torquing procedure.

ENGINE SUDDENLY TURNS OFF OR LACKS ACCELERATION OR POWER

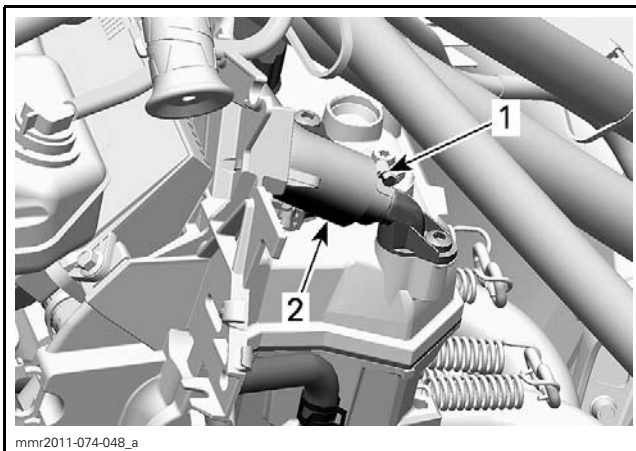
1. Incorrect camshaft timing.
 - Replace damaged components and readjust camshaft timing.
2. Leaking intake or exhaust valves.
 - Perform a *CYLINDER LEAK TEST*. Repair or replace damaged components.
3. Broken valve spring(s).
 - Replace defective parts.

PROCEDURES

VALVE COVER

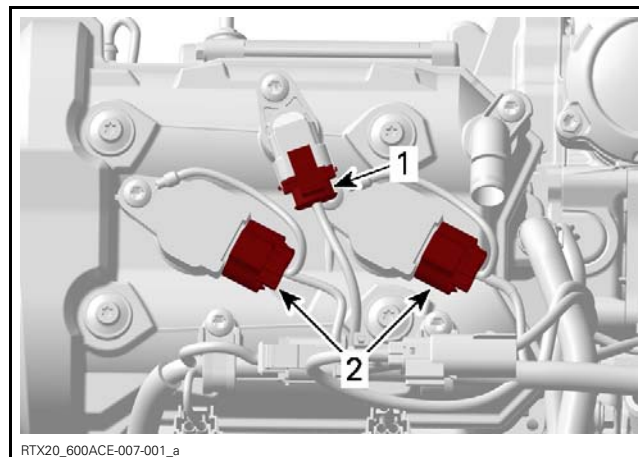
Removing the Valve Cover

1. Refer to *EXHAUST SYSTEM* subsection and remove the exhaust manifold.
2. Remove the pulley guard.
3. Disconnect vent tube from the blow-by-connector.



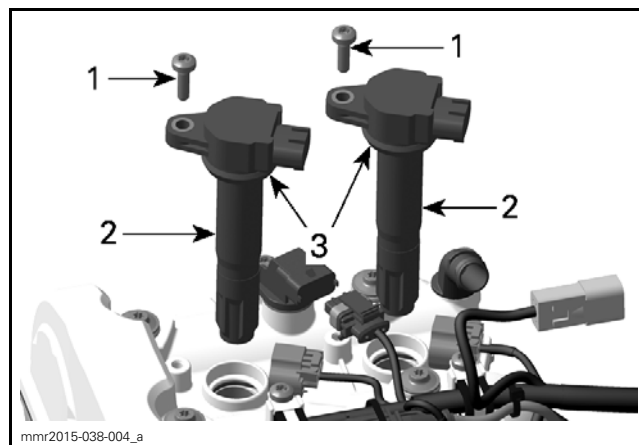
1. Clamp
2. Vent tube

4. Unplug CAPS (camshaft position sensor).
5. Unplug ignition coils.



1. CAPS connector
2. Ignition coil connectors

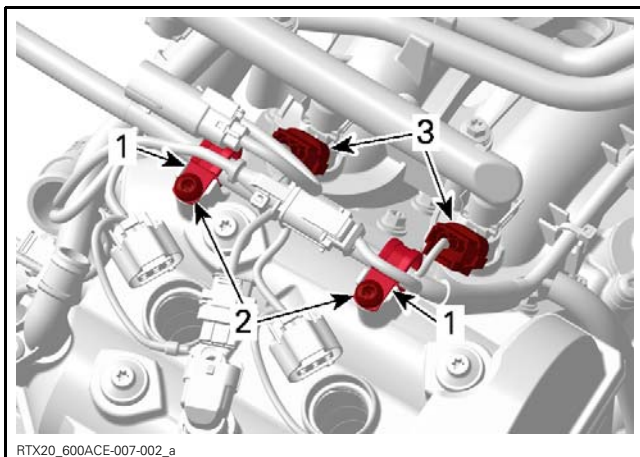
6. Remove ignition coils with gaskets.



- TYPICAL**
1. Retaining screws
 2. Ignition coils
 3. Gaskets

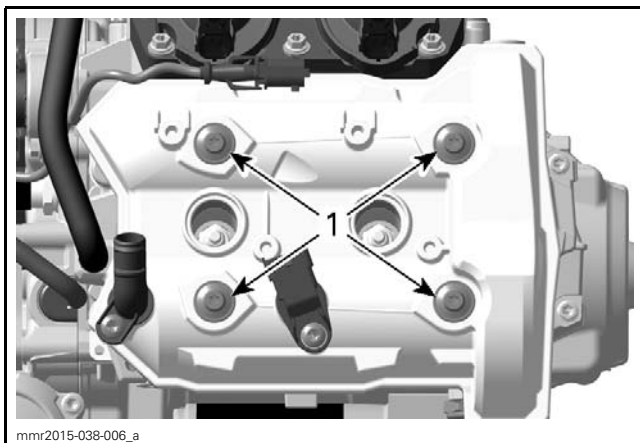
7. Remove screws securing the electrical harness to the valve cover.
8. Unplug both fuel injectors.

Subsection XX (CYLINDER HEAD)



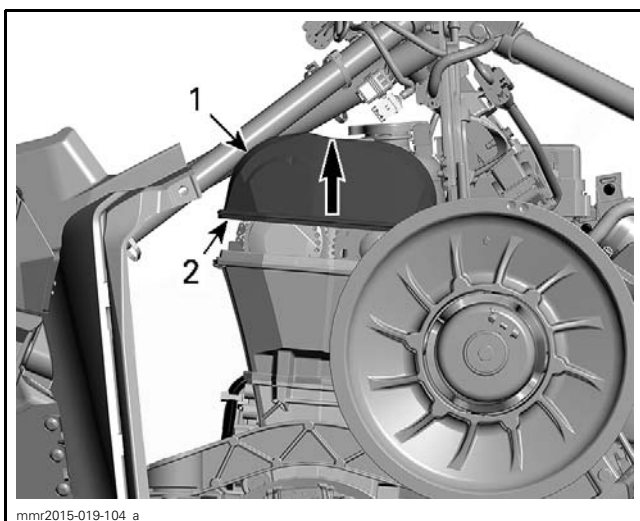
1. Cable clamps
2. Retaining screws
3. Fuel injector connector

9. Remove valve cover retaining screws.

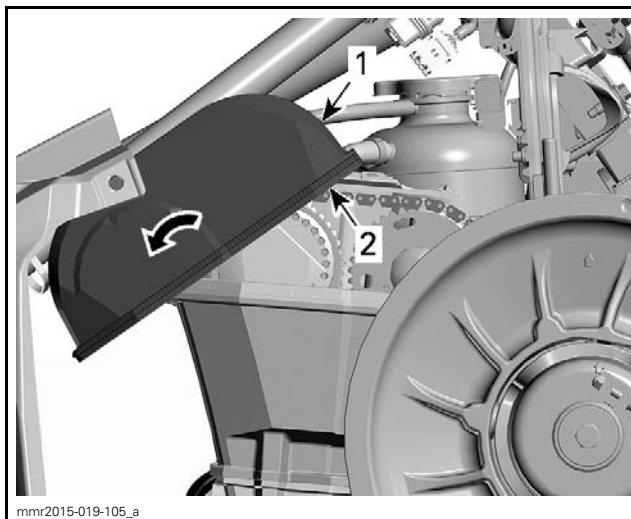


1. Valve cover screws

10. Lift and tilt valve cover with gasket towards front of engine.

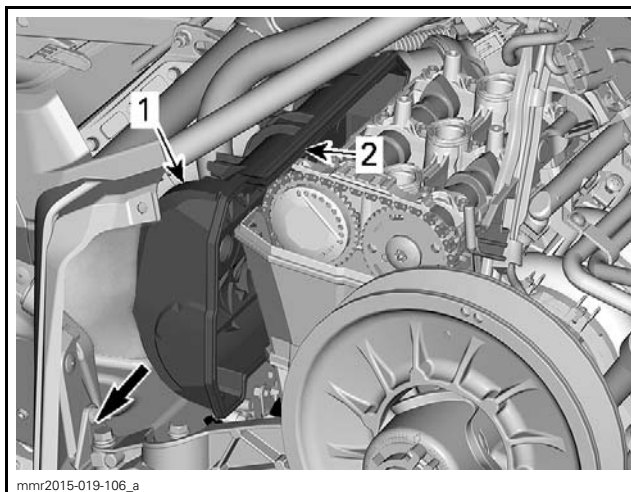


- TYPICAL**
1. Valve cover
 2. Gasket



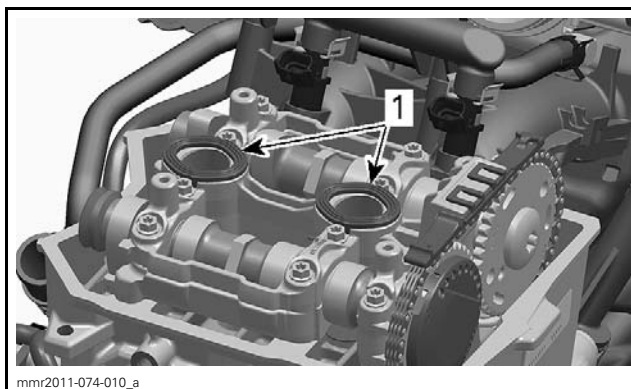
- TYPICAL**
1. Valve cover
 2. Gasket

11. Pull valve cover and gasket out through LH side of vehicle.



- TYPICAL**
1. Valve cover
 2. Gasket

12. Remove valve cover small gaskets (spark plug tubes).



1. Small gaskets

Inspecting the Valve Cover

Check the valve cover for cracks or other damage.
Check if the valve cover gaskets are brittle, hard or otherwise damaged.
Replace defective parts.

Installing the Valve Cover

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

- 1. Properly fit small gaskets into camshaft holder grooves.
- 2. Properly fit large gasket into valve cover groove.
- 3. Apply engine oil to sealing surface of V-ring.

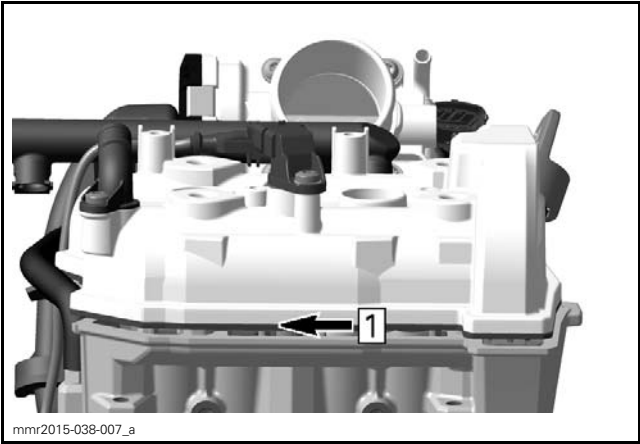


INSIDE VALVE COVER
1. Apply engine oil here

- 4. Install valve cover.

NOTICE Adhere to the following procedure, otherwise damage to the V-ring will occur causing crankcase venting malfunction.

- 4.1 Move valve cover towards MAG side.

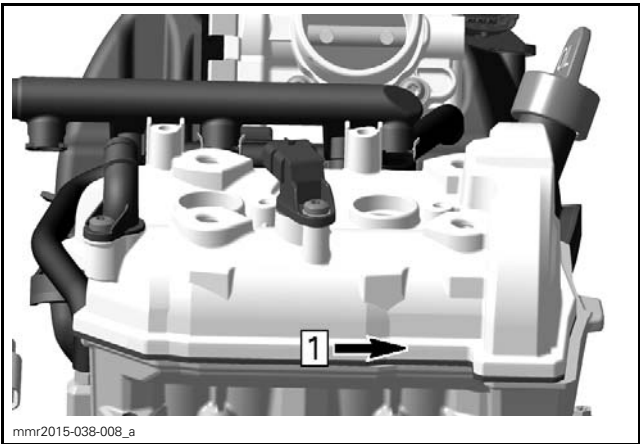


Step 1: Move valve cover towards MAG side

- 4.2 Put valve cover onto cylinder head.

NOTICE Make sure the valve cover gasket is well positioned in the cover groove.

- 4.3 Push valve cover towards the PTO side to ensure the V-ring properly seals on sealing surface inside the cover.

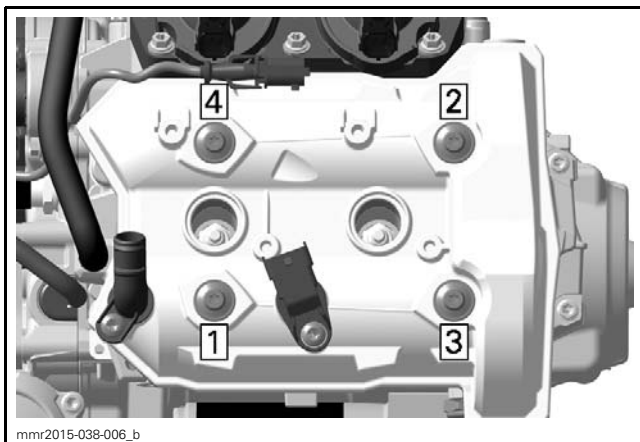


Step 1: Push valve cover towards PTO side

- 5. Install valve cover screws and tighten as per following sequence:

TIGHTENING TORQUE	
Valve cover screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

Subsection XX (CYLINDER HEAD)



TIGHTENING SEQUENCE

CAMSHAFTS

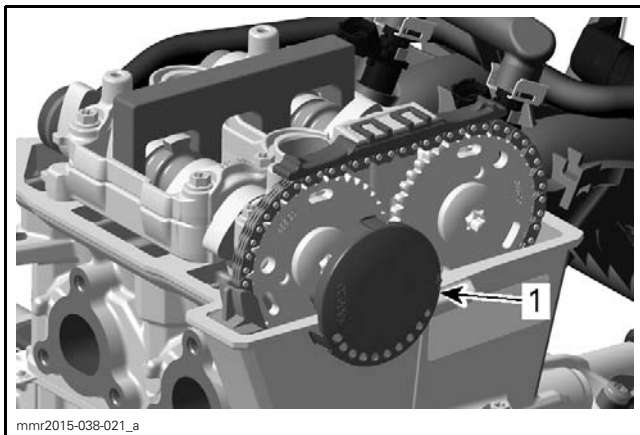
Removing the Camshaft

1. Remove *VALVE COVER*, see procedure in this subsection.
2. Lock crankshaft, refer to *CRANKSHAFT LOCKING PROCEDURE* in the *BOTTOM END* subsection.

Remove timing chain tensioner. Refer to *TIMING CHAIN* subsection.

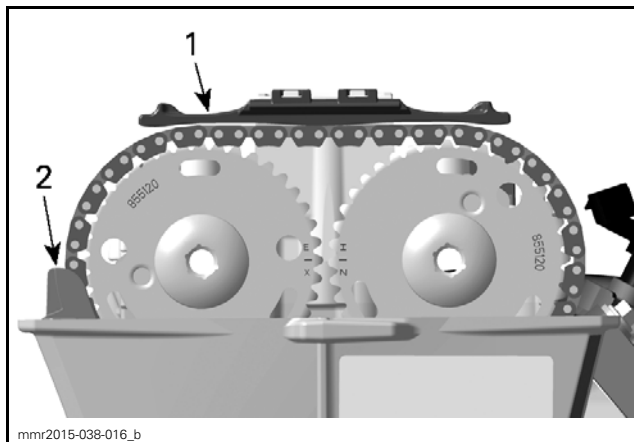
3. Remove:

- 3.1 Breather cover



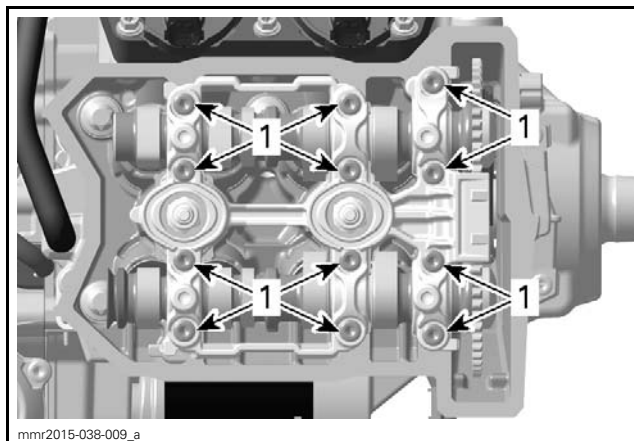
1. Breather cover

- 3.2 Upper timing chain guide
 - 3.3 Timing chain guide



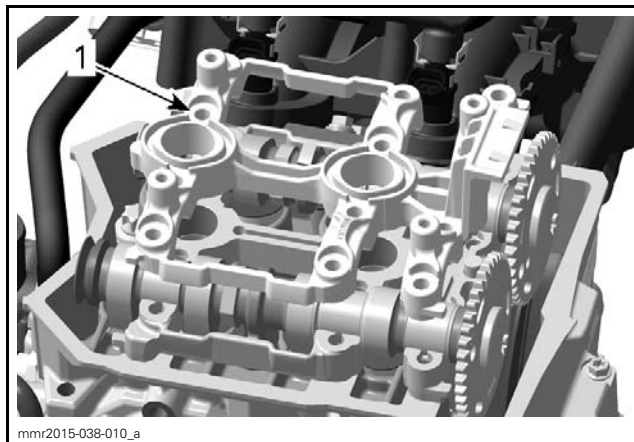
1. Upper timing chain guide
2. Timing chain guide

4. Remove timing chain from camshaft timing gears.
5. Remove camshaft holder retaining screws (x12).



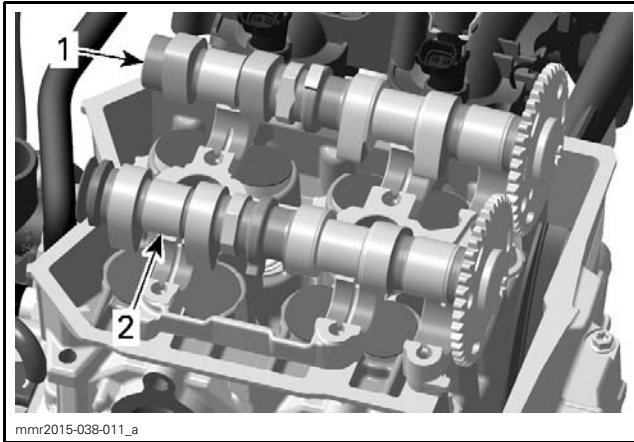
1. Camshaft holder retaining screws

6. Remove upper half of camshaft holder.



1. Upper half of camshaft holder

7. Remove camshafts with timing gears.

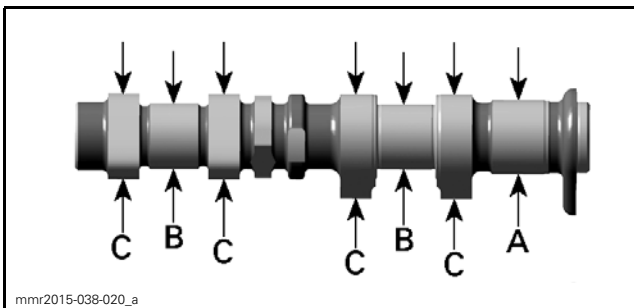


1. Intake camshaft
2. Exhaust camshaft

NOTE: Remove camshaft timing gears only if necessary. Refer to *TIMING CHAIN* subsection.

Inspecting the Camshaft

1. Check each lobe and bearing journal for scoring, scuffing, cracks, or other signs of wear.
2. Check if V-ring is brittle, hard or otherwise damaged.
3. Measure camshaft bearing journal diameter and lobe height, using a micrometer.



A. Camshaft journal (PTO)
B. Camshaft journal (center and MAG)
C. Camshaft lobes

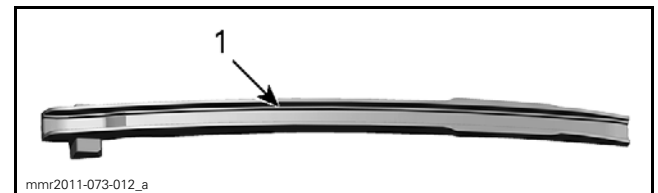
CAMSHAFT JOURNAL DIAMETER	
PTO JOURNAL (A)	
NEW	25.947 mm to 25.960 mm (1.0215 in to 1.022 in)
SERVICE LIMIT	25.920 mm (1.0205 in)
CENTER AND MAG JOURNAL (B)	
NEW	22.947 mm to 22.960 mm (.9034 in to .9039 in)
SERVICE LIMIT	22.920 mm (.9024 in)

CAMSHAFT LOBE HEIGHT	
INTAKE CAMSHAFT (C)	
NEW	38.70 mm to 38.90 mm (1.524 in to 1.531 in)
SERVICE LIMIT	38.67 mm (1.522 in)
EXHAUST CAMSHAFT (C)	
NEW	39.40 mm to 39.60 mm (1.551 in to 1.559 in)
SERVICE LIMIT	39.38 mm (1.55 in)

For camshaft journal radial clearance and camshaft holder bearing diameter refer to *CAMSHAFT HOLDER* in this subsection.

4. Check timing chain guide for wear, cracks or deformation. Replace as required.
5. Replace timing chain guide if any groove caused by timing chain exceeds service limit.

CHAIN GUIDE GROOVE DEPTH	
SERVICE LIMIT	1 mm (.039 in)



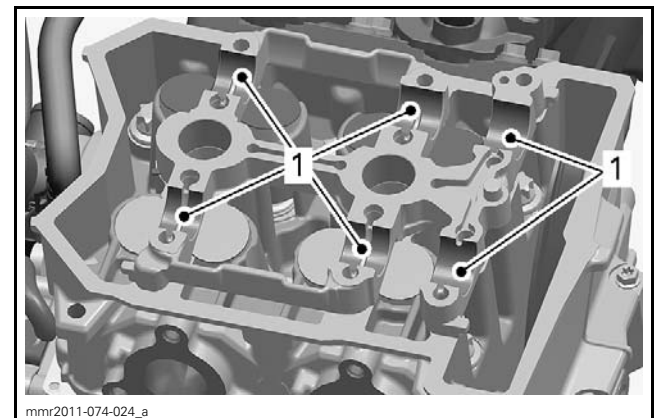
1. Timing chain guide

Replace parts if necessary.

Installing the Camshaft

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

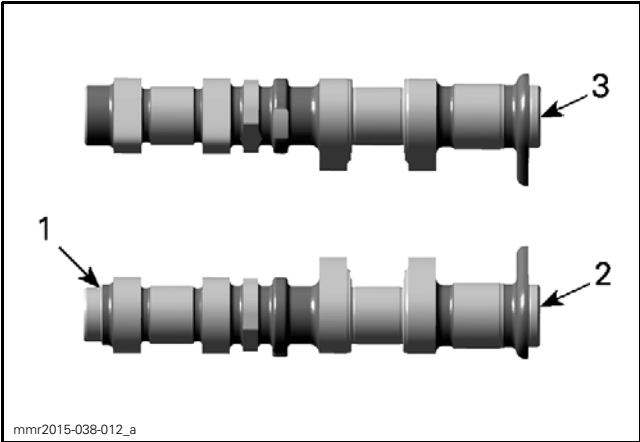
1. Ensure crankshaft is still locked.
2. Apply engine oil on camshaft bearings.



1. Areas where to apply engine oil

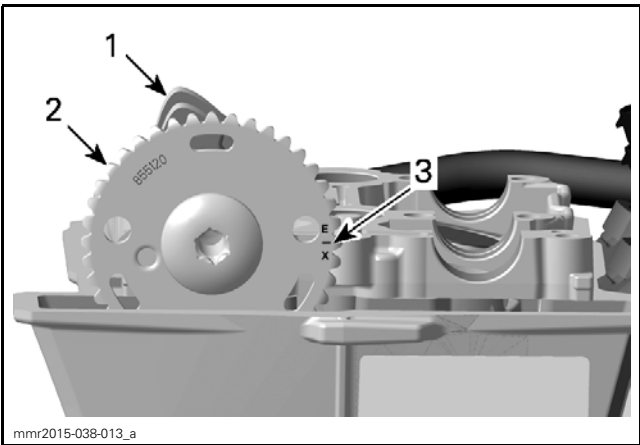
Subsection XX (CYLINDER HEAD)

NOTE: The camshafts are not identical. Any mix-up of the components would lead to engine damage. The exhaust camshaft has a machined area on MAG side for the V-ring.



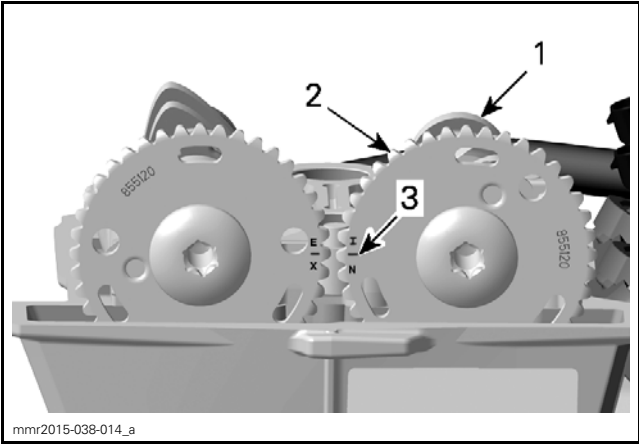
- 1. Machined area
- 2. Exhaust camshaft
- 3. Intake camshaft

- 3. If removed, reinstall camshaft timing gears on camshafts. Refer to *CAMSHAFT TIMING GEARS* in the *TIMING CHAIN* subsection.
- 4. Apply engine oil on camshaft journal diameter.
- 5. Install exhaust camshaft assembly with mark "EX" parallel to cylinder head gasket.



- 1. Exhaust camshaft
- 2. Camshaft timing gear
- 3. Mark "EX"

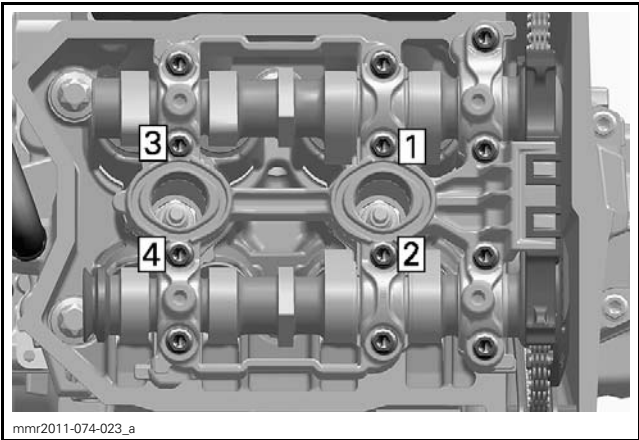
- 6. Install intake camshaft assembly with mark "IN" parallel to cylinder head gasket.



- 1. Intake camshaft
- 2. Camshaft timing gear
- 3. Mark "EX"

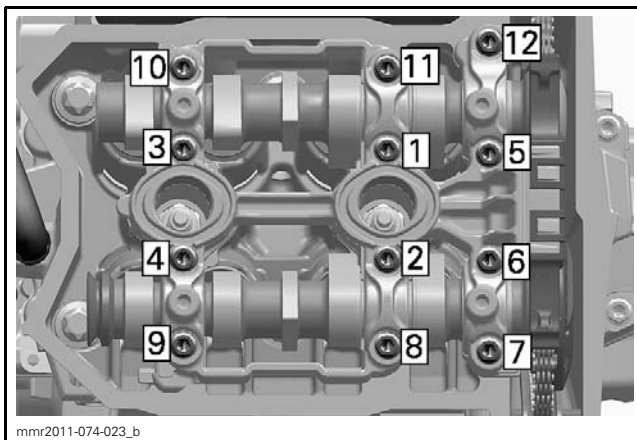
- 7. Install upper half of camshaft holder, then tighten screws as per following sequence:

TIGHTENING TORQUE		
Camshaft holder screws	STEP A	5 N•m ± 0.5 N•m (44 lbf•in ± 4 lbf•in)



CAMSHAFT HOLDER TIGHTENING SEQUENCE - STEP A

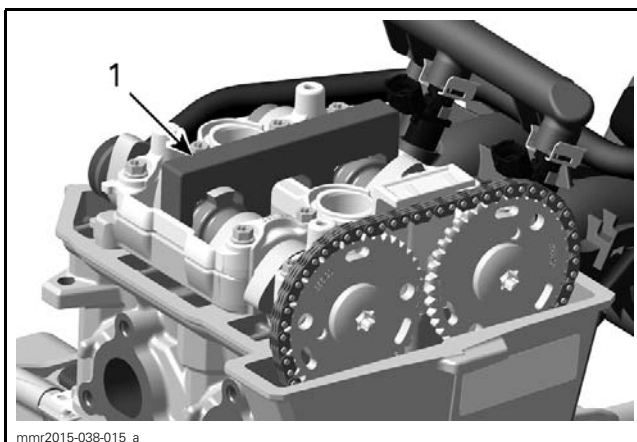
TIGHTENING TORQUE		
Camshaft holder screws	STEP B	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



CAMSHAFT HOLDER TIGHTENING SEQUENCE - STEP B

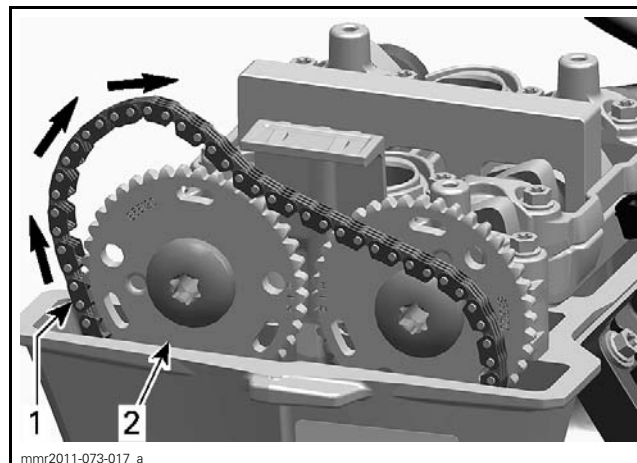
NOTE: After reassembly of camshafts is completed, check if camshafts can be turned easily.
8. Lock camshafts.

REQUIRED TOOL	
CAMSHAFT LOCKING TOOL (900 ACE) (P/N 529 036 206)	



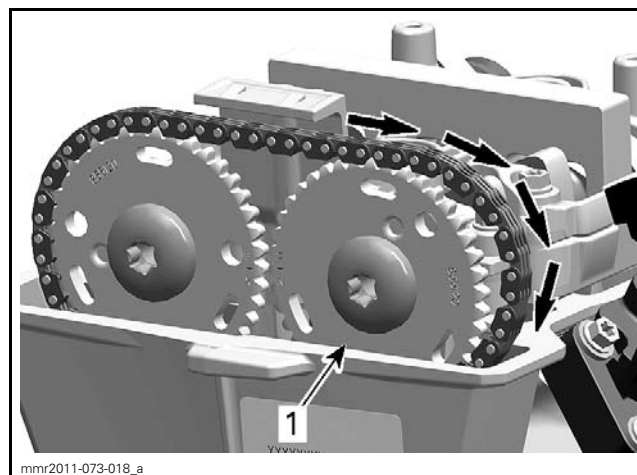
1. Camshaft locking tool

9. Lift timing chain out of timing chain compartment.
10. Pull timing chain up on exhaust side and install it on the exhaust camshaft timing gear.

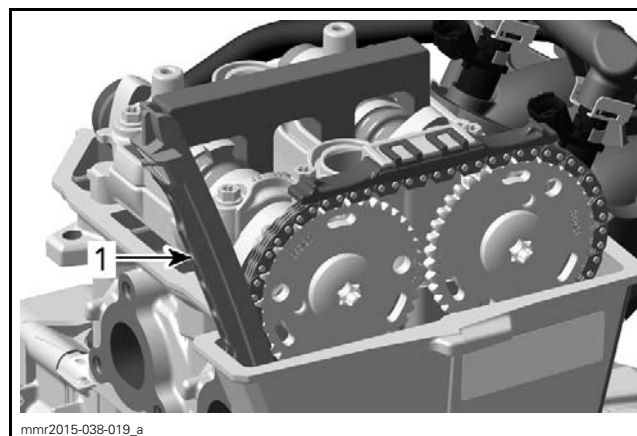


1. Timing chain
2. Exhaust camshaft timing gear

11. Pull timing chain towards intake side and install it on the intake camshaft timing gear.



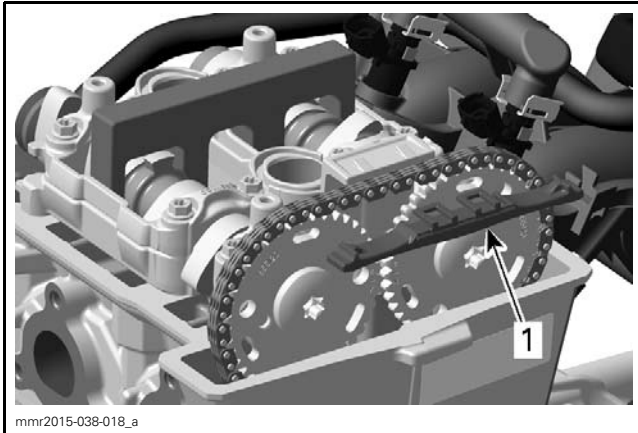
12. Install timing chain guide.



1. Timing chain guide

13. Install upper timing chain guide on camshaft holder.

Subsection XX (CYLINDER HEAD)

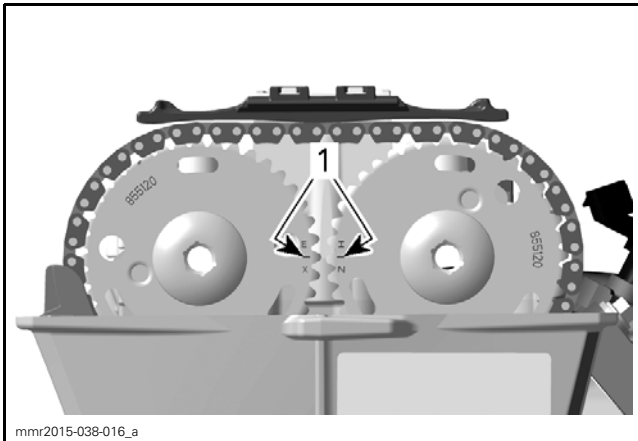


1. Upper timing chain guide

14. Install *TIMING CHAIN TENSIONER*, refer to *TIMING CHAIN* subsection.

15. Ensure marks on camshaft timing gears are still aligned. If not, repeat procedure.

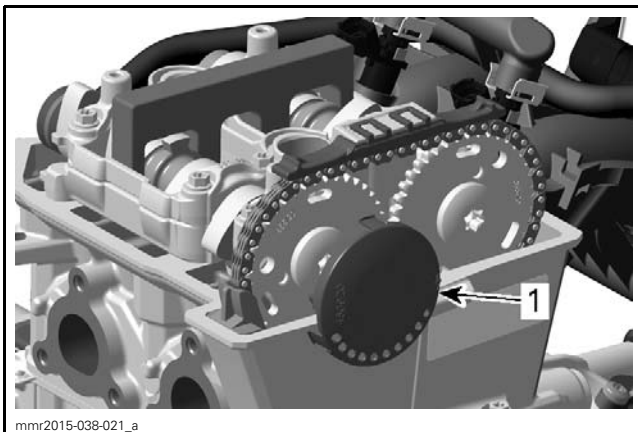
NOTICE After installation of timing chain tensioner, the marks "IN" on intake and "EX" on exhaust camshafts must be aligned.



CAMSHAFT TIMING GEARS

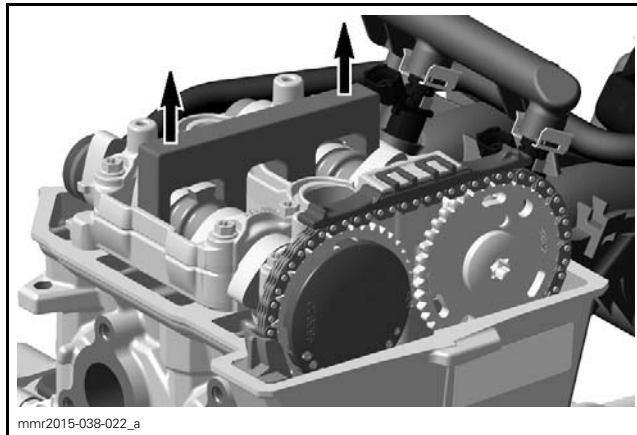
1. Marks must be aligned

16. Install breather cover.



1. Breather cover

17. Remove camshaft locking tool.



1. Camshaft locking tool removal

18. Remove crankshaft locking tool.

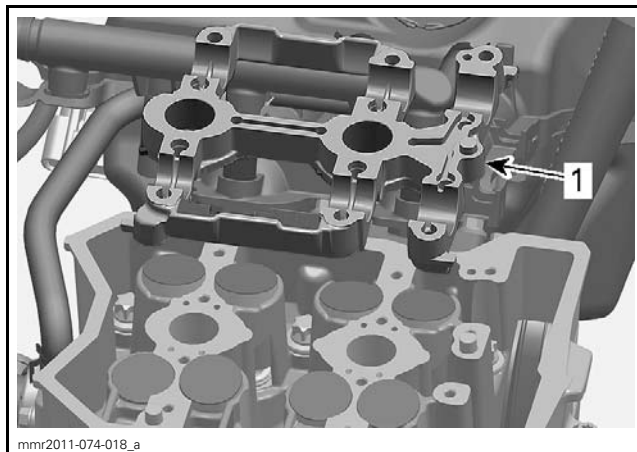
CAMSHAFT HOLDER

Removing the Camshaft Holder

Remove camshafts, see procedure in this subsection.

Remove lower half of camshaft holder with gaskets from cylinder head.

Remove gaskets from camshaft holder halves and discard gaskets.

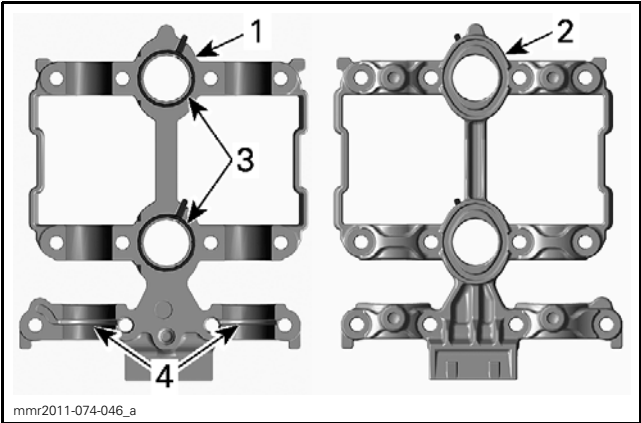


1. Camshaft holder lower half

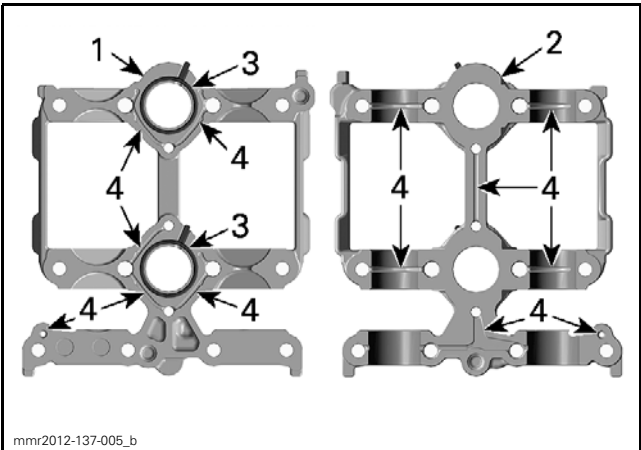
Inspecting the Camshaft Holder

Check camshaft holder for scoring, scuffing, cracks, or other signs of wear.

Make sure oil orifices are not clogged. Blow them out with pressurized air.



1. Camshaft holder upper half - view from beneath
2. Camshaft holder upper half - view from above
3. Gaskets
4. Oil orifices

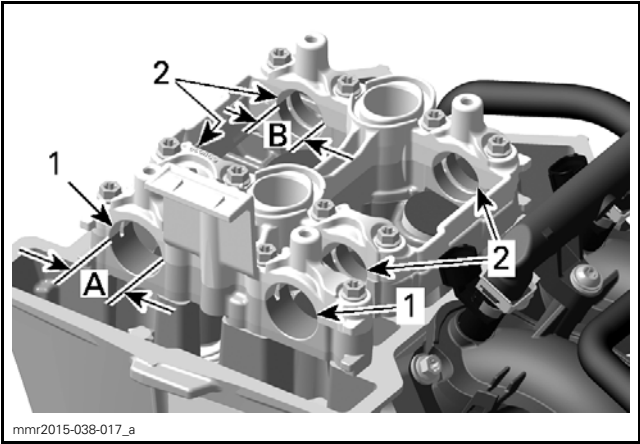


1. Camshaft holder lower half - view from beneath
2. Camshaft holder lower half - view from above
3. Gaskets
4. Oil orifices

Install camshaft holder on cylinder head.

Tighten camshaft holder screws to specification, refer to *INSTALLING THE CAMSHAFT* in this subsection.

Measure camshaft holder bearing diameter.



CAMSHAFT HOLDER BEARINGS
1. PTO bearings
2. Center and MAG bearings
A. Diameter PTO bearing
B. Diameter center and MAG bearing

CAMSHAFT HOLDER BEARING DIAMETER	
PTO BEARING	
NEW	26.000 mm to 26.021 mm (1.024 in to 1.024 in)
SERVICE LIMIT	26.050 mm (1.026 in)
CENTER AND MAG BEARING	
NEW	23.000 mm to 23.021 mm (.906 in to .906 in)
SERVICE LIMIT	23.050 mm (.907 in)

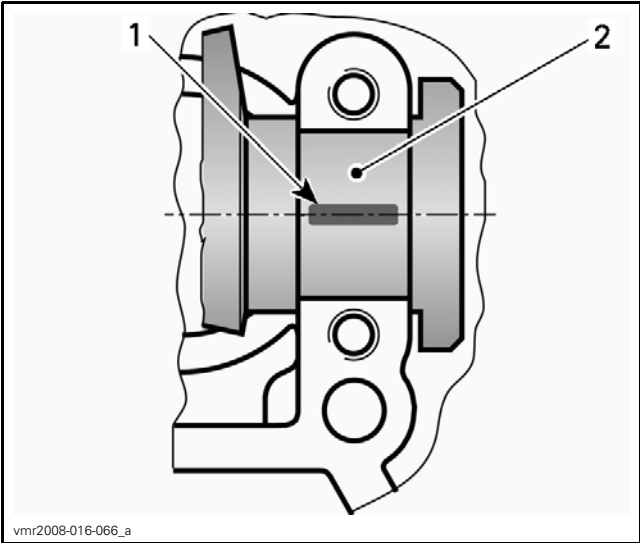
Measure the clearance between camshaft journals and camshaft holder, using the plastic feeler gauge.

NOTE: The plastic feeler gauge is available at automotive parts retailer.

Install camshaft holder lower half on cylinder head.

Place camshafts in lower half of camshaft holder and apply a plastic-gauge on the camshaft bearing journal.

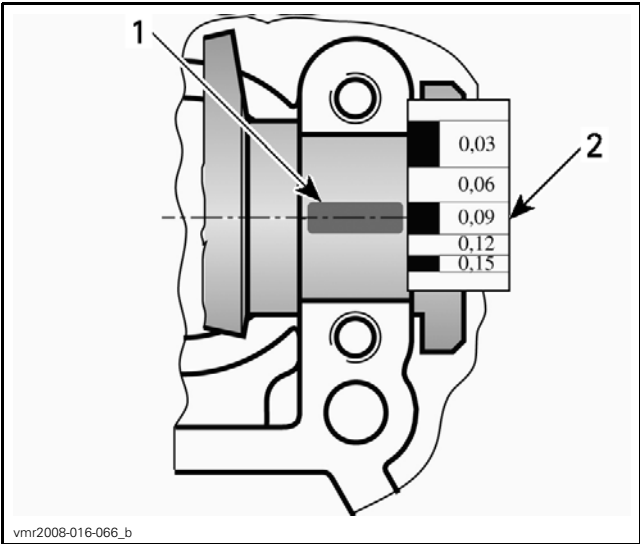
Subsection XX (CYLINDER HEAD)



TYPICAL
1. Plastic gauge
2. Camshaft bearing journal

Install camshaft holder upper half in its proper position and tighten screws to specification, refer to *INSTALLING THE CAMSHAFT* in this subsection. Unfasten camshaft holder.

Measure the maximum width of the pressed plastic gauge with the corresponding graduated scale.



TYPICAL
1. Pressed plastic gauge
2. Graduated scale

CAMSHAFT JOURNAL RADIAL CLEARANCE	
PTO, CENTER AND MAG BEARING	
NEW	0.020 mm to 0.054 mm (.001 in to .002 in)
SERVICE LIMIT	0.080 mm (.003 in)

Replace parts if necessary.

Installing the Camshaft Holder

Install camshaft holder lower half.
Continue procedure as explained in *INSTALLING THE CAMSHAFT* in this subsection.

HYDRAULIC VALVE LIFTERS

Removing the Hydraulic Valve Lifter

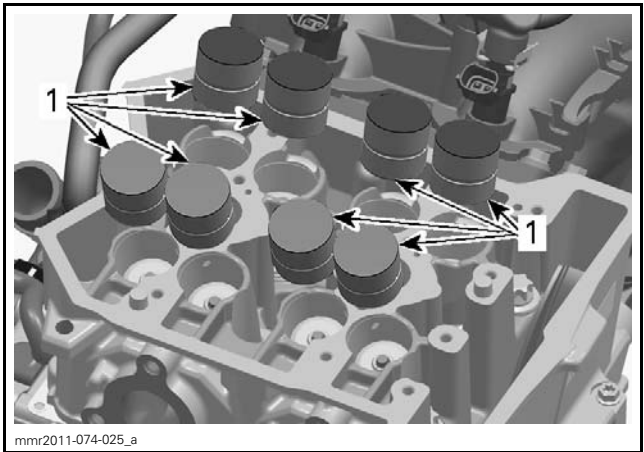
NOTE: Hydraulic valve lifter are maintenance free.

See procedures in this subsection to remove the following:

- Valve cover
- Camshafts
- Camshaft holder.

Pull hydraulic valve lifter out of cylinder head.

NOTE: When disassembling the hydraulic valve lifter, it is strongly recommended to note their original position.



1. Hydraulic valve lifter

Inspecting the Hydraulic Valve Lifter

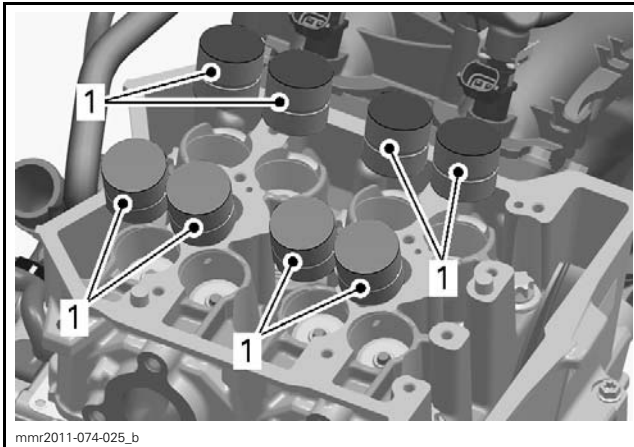
1. Check surface of hydraulic valve lifter for scoring or other damage.
2. Measure valve lifter diameter. Replace if out of specification.

HYDRAULIC VALVE LIFTER	
NEW	28.354 mm to 28.370 mm (1.1163 in to 1.1169 in)
SERVICE LIMIT	28.340 mm (1.1157 in)
HYDRAULIC VALVE LIFTER RADIAL CLEARANCE	
SERVICE LIMIT	0.100 mm (.0039 in)

Installing the Hydraulic Valve Lifter

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

Apply engine oil on the outside diameter of the hydraulic valve lifter.



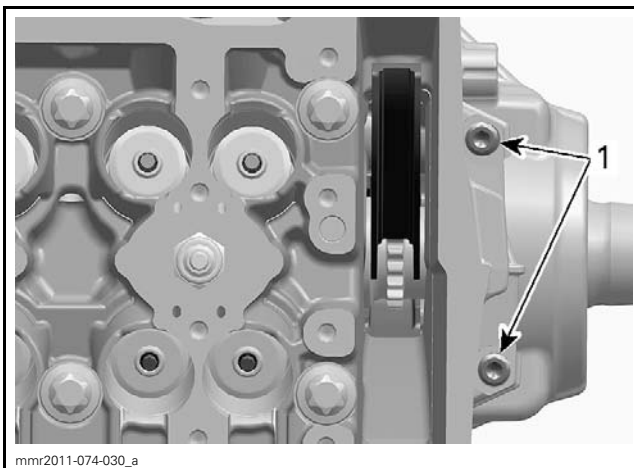
mmr2011-074-025_b

1. Apply engine oil on outer diameter

CYLINDER HEAD

Removing the Cylinder Head

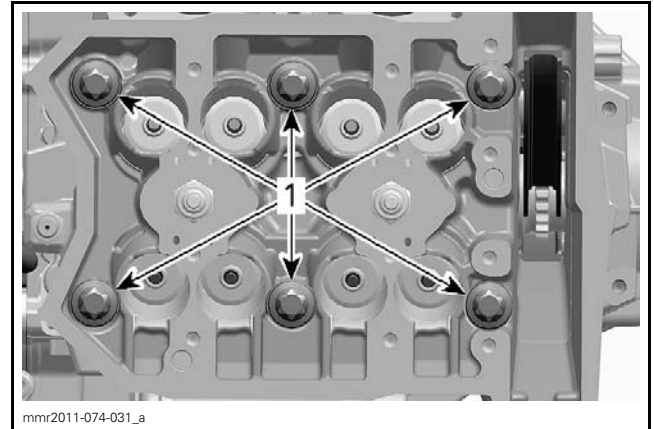
1. Remove engine from vehicle. Refer to *ENGINE REMOVE AND INSTALLATION* subsection.
2. See procedures in this subsection to remove:
 - Valve cover
 - Camshafts
 - Camshaft holder
 - Hydraulic valve lifters.
3. Remove M6 cylinder head screws.



mmr2011-074-030_a

1. Remove M6 cylinder head screws

4. Remove and discard M9 cylinder head screws.



mmr2011-074-031_a

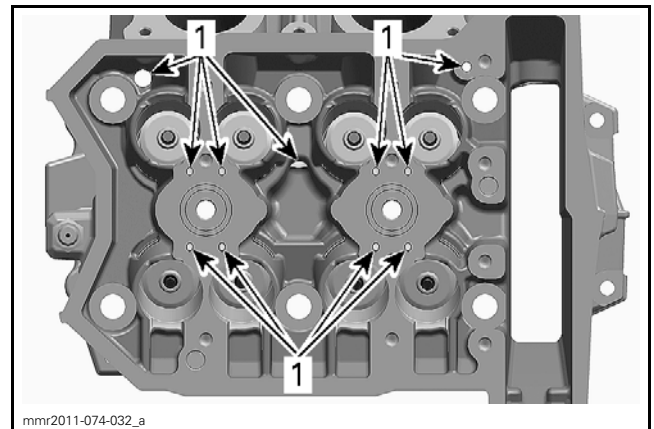
1. Remove M9 cylinder head screws

5. Pull cylinder head off the cylinder block.

6. Remove and discard cylinder head gasket.

Cleaning the Cylinder Head

1. Remove carbon deposits from combustion chambers, exhaust ports and piston tops.
2. Clean cylinder head, especially cylinder head screw surface from oil spillage.
3. Blow out the oil orifices with pressurized air and make sure they are not clogged.



mmr2011-074-032_a

1. Oil orifices

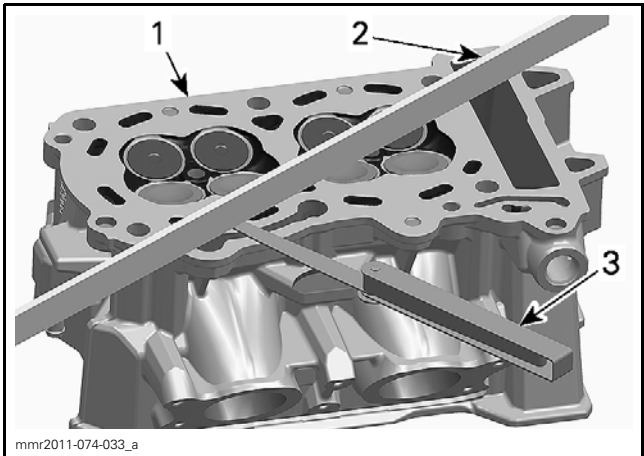
Inspecting the Cylinder Head

Check for cracks between valve seats or other damage, if so, replace cylinder head.

Check cylinder head mating surface for flatness using a straight edge.

Check hydraulic valve lifter bores for scoring or other damage, if so, replace cylinder head.

Subsection XX (CYLINDER HEAD)



1. Cylinder head
2. Straight edge
3. Feeler gauge

Check for cylinder head warpage.

CYLINDER HEAD WARPAGE	
Maximum	0.15 mm (.0059 in)

If warpage exceeds specification, resurface the cylinder head as follows.

Use a 400 - 600 grit wet sandpaper on a surface plate and gently grind off the mating surface.

NOTE: To ensure an even surface, rotate cylinder head several times during resurfacing.

Replace cylinder head, if resurfacing fails.

Installing the Cylinder Head

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

1. Install a **NEW** cylinder head gasket.

NOTICE Each installation of the cylinder head requires a **NEW** cylinder head gasket. Using a gasket twice would cause engine damage.

2. Install cylinder head on the cylinder block.

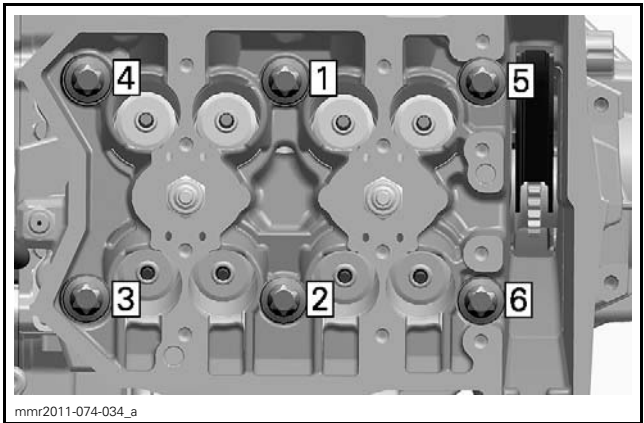
3. Install **NEW** M9 cylinder head screws.

NOTICE This assembly uses stretch screws. Always use **NEW** screws and strictly adhere to the tightening procedure.

4. Tighten cylinder head screws as follows:

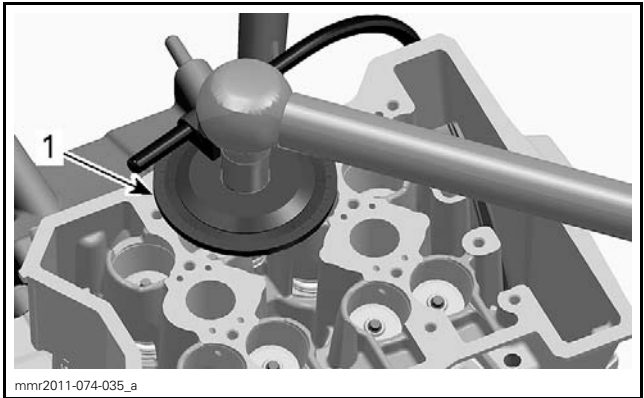
NOTE: Always perform step 1 on all M9 cylinder head screws before going to step B.

TIGHTENING TORQUE		
Cylinder head M9 screws	Step A	20 N•m ± 2 N•m (15 lbf•ft ± 1 lbf•ft)
	Step B	Additional 150° ± 5°



M9 SCREWS TIGHTENING SEQUENCE

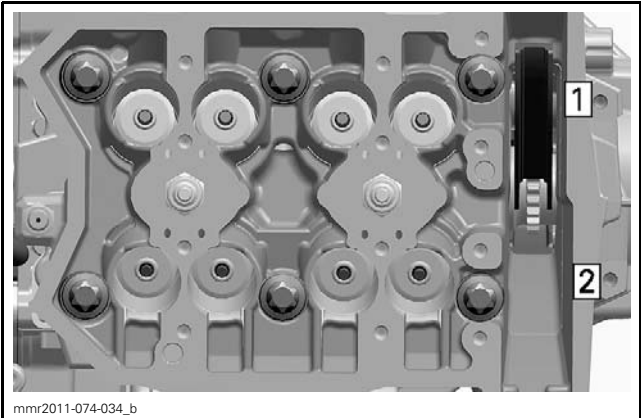
NOTE: Use a torque angle gauge to carry out step B.



1. Torque angle gauge

5. Install M6 screws. Tighten as follows.

TIGHTENING TORQUE	
Cylinder head M6 screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



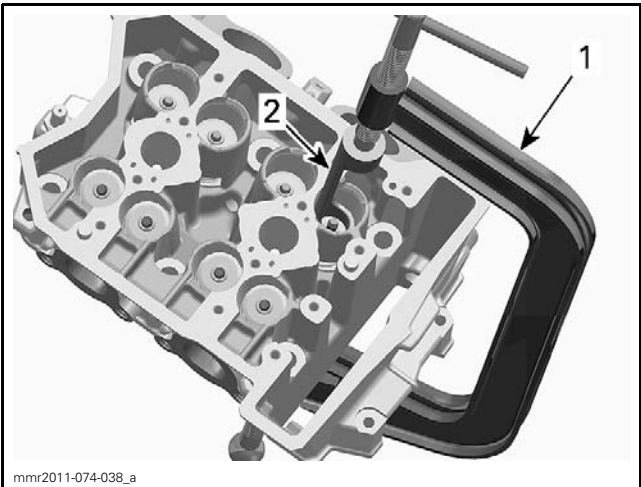
M6 SCREWS TIGHTENING SEQUENCE

VALVE SPRINGS

Removing the Valve Spring

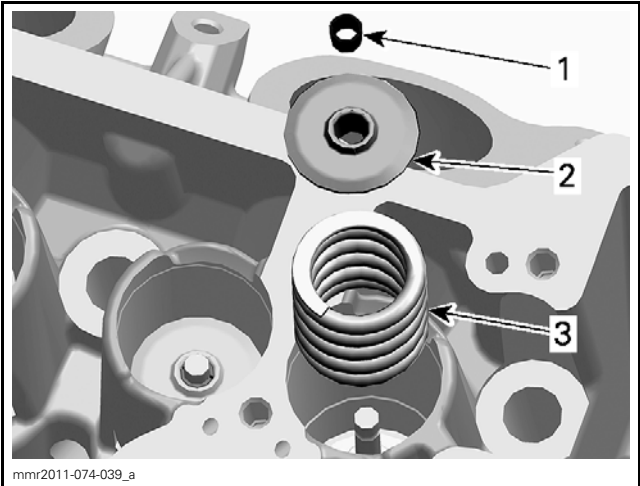
1. Remove *CYLINDER HEAD*, see procedure in this subsection.
2. Compress valve spring.

REQUIRED TOOLS	
VALVE SPRING COMPRESSOR (P/N 529 035 724)	
VALVE SPRING COMPRESSOR CUP (P/N 529 036 209)	



1. Valve spring compressor clamp
2. Valve spring compressor cup

3. Remove valve cotters.
4. Withdraw valve spring compressor tools.
5. Remove valve spring retainer and valve spring.

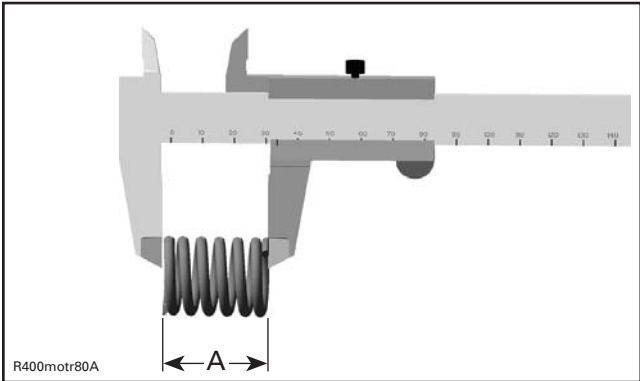


1. Valve cotters
2. Valve spring retainer
3. Valve spring

NOTE: Identify the position of each part very carefully, so it can be reinstalled in its original place.

Inspecting the Valve Spring

1. Check valve spring for rust, corrosion or other visible damage.
2. Check valve spring free length and straightness.



A. Spring free length

VALVE SPRING FREE LENGTH	
NEW	31.35 mm (1.2343 in)
SERVICE LIMIT	29.50 mm (1.1614 in)

Replace valve spring, if out of specification.

Installing the Valve Spring

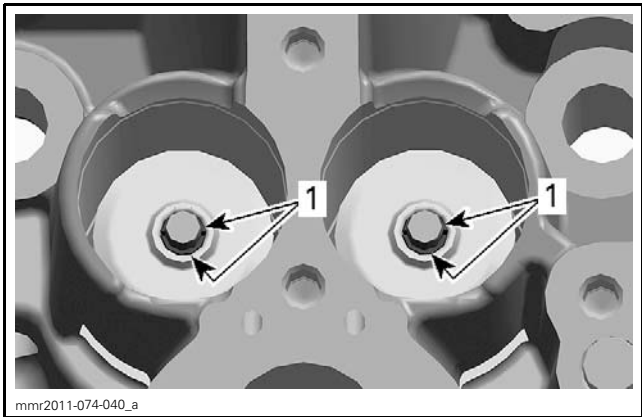
The installation is the reverse of the removal procedure. However, pay attention to the following.

NOTE: Ensure to reinstall all parts in their original position as marked during removal.

Apply some grease on valve cotters, so that they remain in place while releasing the valve spring.

Subsection XX (CYLINDER HEAD)

Make sure valve cotters are properly engaged into valve stem groove.



1. Valve cotters

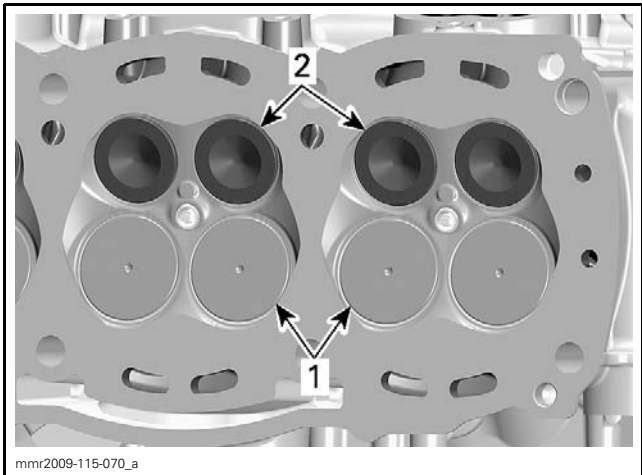
After spring is installed, ensure it is properly locked by lightly tapping on valve stem end with a soft hammer so that valve opens and closes a few times.

NOTICE Improperly locked valve spring will cause severe engine damage and hitting the valve stem end with excessive force could damage the valve.

VALVES

Removing the Valve

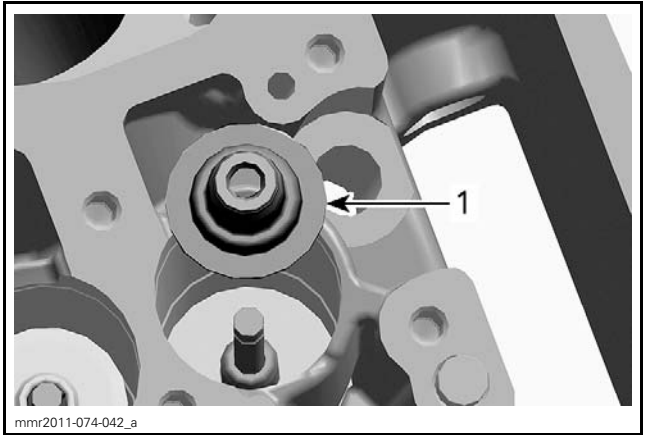
- 1. Remove *VALVE SPRING*, see procedure in this subsection.
- 2. Push on the valve stem, then pull valves out of cylinder head.



1. Intake valves 29 mm
2. Exhaust valves 25 mm

- 3. Remove and discard valve stem seal using special pliers.

REQUIRED TOOL	
Valve stem seal pliers	

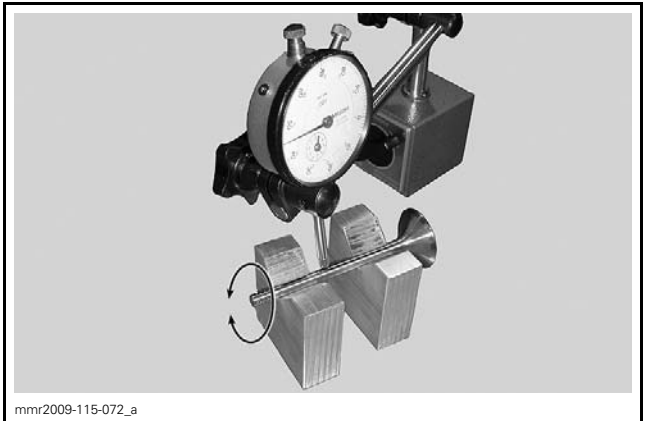


1. Valve stem seal

NOTE: Identify the position of each part very carefully, so it can be reinstalled in its original place.

Inspecting the Valve

Inspect valve surface, check for abnormal stem wear and bending.

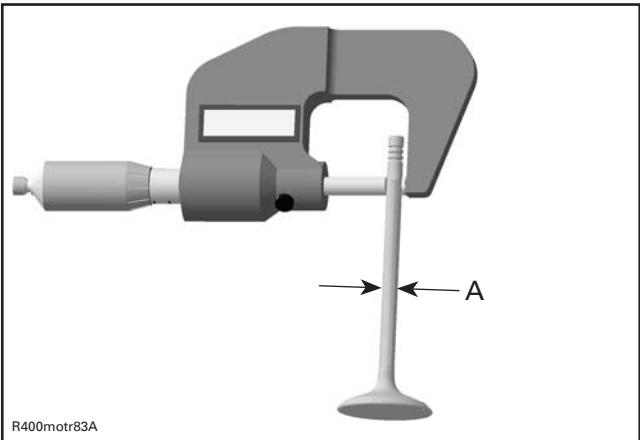


VALVE OUT OF ROUND INTAKE AND EXHAUST VALVE	
NEW	0.005 mm (.0002 in)
SERVICE LIMIT	0.060 mm (.0024 in)

Replace valve if out of specification.

Valve Stem and Valve Guide Clearance

- 1. Measure valve stem at three places, using a micrometer.



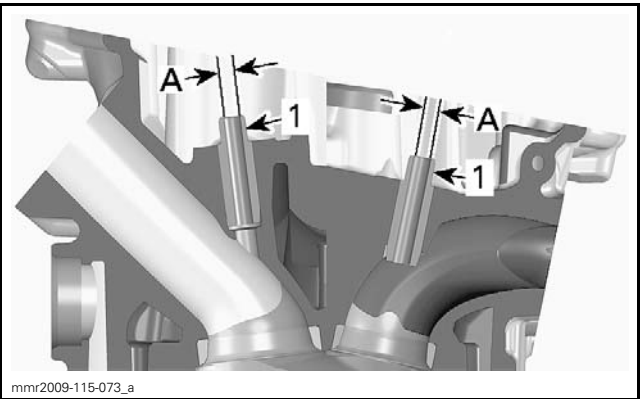
A. Valves stem diameter

VALVE STEM DIAMETER	
INTAKE VALVE	
NEW	4.958 mm to 4.972 mm (.1952 in to .1957 in)
SERVICE LIMIT	4.940 mm (.1945 in)
EXHAUST VALVE	
NEW	4.956 mm to 4.970 mm (.1951 in to .1957 in)
SERVICE LIMIT	4.940 mm (.1945 in)

Replace valve if stem is out of specification or if its surface is damaged or worn.

2. Measure valve guide inner diameter, using a small bore gauge.

NOTE: Clean valve guide from carbon deposits before measuring.



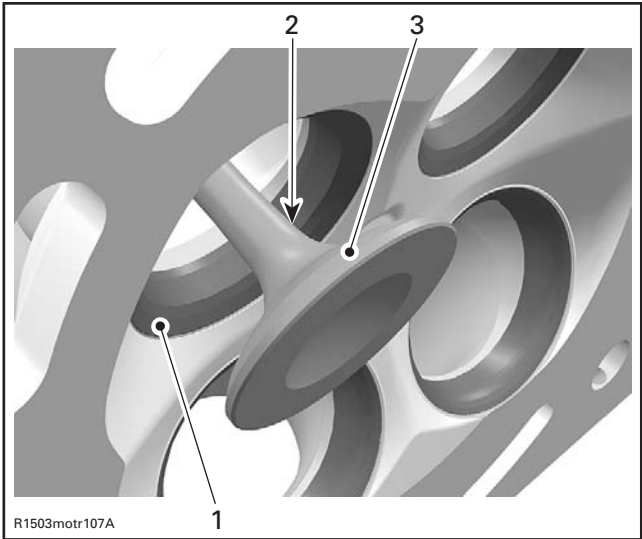
1. Valve guides

A. Valve guide inner diameter

VALVE GUIDE INNER DIAMETER	
NEW	5.000 mm to 5.020 mm (.1969 in to .1976 in)
SERVICE LIMIT	5.050 mm (.1988 in)

Replace cylinder head, if valve guide is out of specification.

Valve Face and Seat



TYPICAL

1. Valve seat
2. Exhaust valve contaminated area
3. Valve face (contact surface to valve seat)

1. Check valve face and seat for burning, pitting and other signs of damage.
2. Check if valve seats properly in cylinder head. Proceed as follows.

- 2.1 Apply some lapping compound on valve face and work valve on its seat with a lapping tool.

REQUIRED TOOL
Valve holder

NOTE: The location of contact area should be in center of valve face.

- 2.2 Repeat procedure until valve seat and valve face fit together.
3. Measure valve seat contact width, using a caliper.

Subsection XX (CYLINDER HEAD)



A. Valve face contact width
B. Valve seat contact width

VALVE SEAT CONTACT WIDTH	
INTAKE VALVE	
NEW	1.05 mm to 1.35 mm (.041 in to .053 in)
SERVICE LIMIT	1.70 mm (.067 in)
EXHAUST VALVE	
NEW	1.25 mm to 1.45 mm (.049 in to .057 in)
SERVICE LIMIT	1.80 mm (.071 in)

Replace parts if out of specification.

Installing the Valve

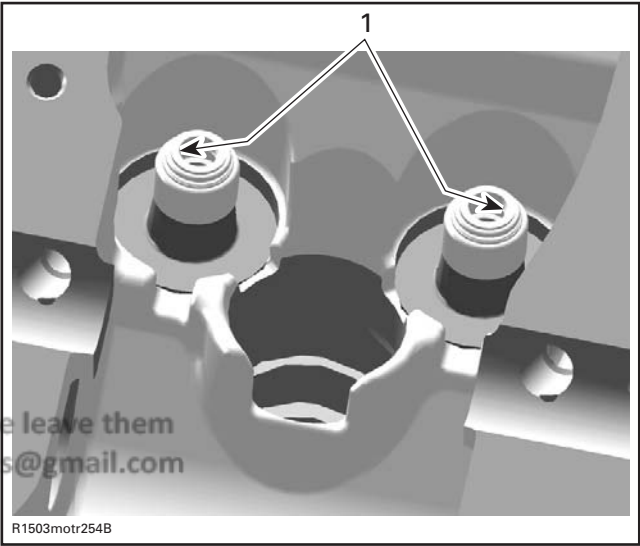
The installation is the reverse of the removal procedure. However, pay attention to the following.

NOTE: Ensure to reinstall all parts in their original position as marked during removal.

Install a **NEW** valve stem seal whenever valve is removed.

Apply engine oil on valve stem and carefully slide through cylinder head and valve stem seal.

NOTICE Be careful when passing the valve stem through the sealing lip of the seal.



TYPICAL
1. Sealing lips of valve stem seal

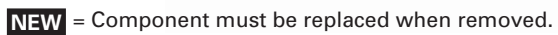
Install *VALVE SPRING*. See procedure in this subsection.

Install all other removed parts.

CYLINDER HEAD

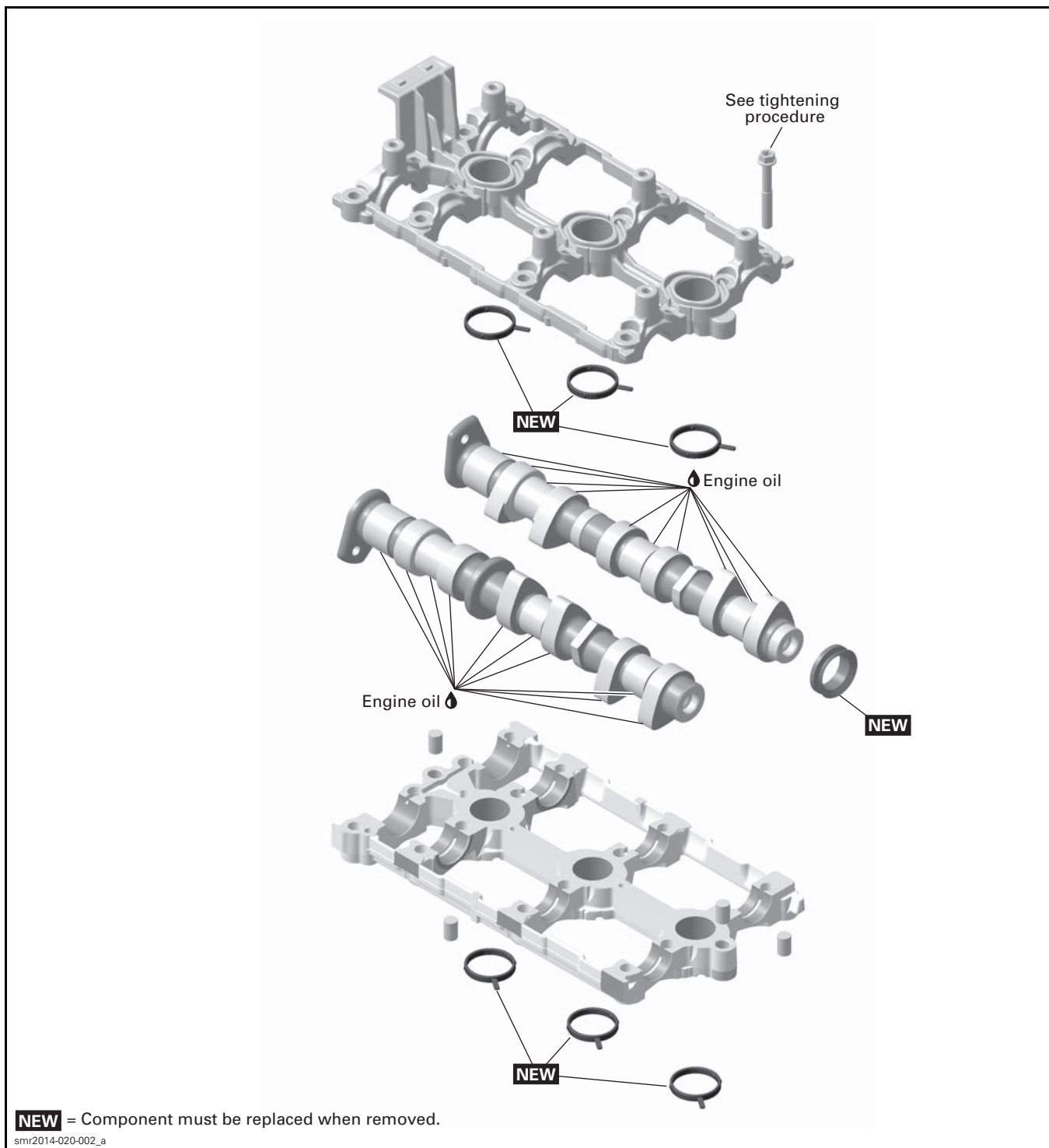
SERVICE TOOLS

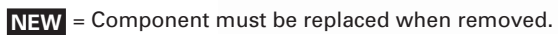
Description	Part Number	Page
CAMSHAFT LOCKING TOOL.....	529 036 206	12
ENGINE LEAK DOWN TEST KIT	529 035 661	5
VALVE SPRING COMPRESSOR CUP.....	529 036 209	19
VALVE SPRING COMPRESSOR	529 035 724	19



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CAMSHAFTS





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GENERAL

NOTE: For a better understanding, some illustrations are taken with engine out of the vehicle.

Disconnect the battery before working on the engine.

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

When disassembling parts that are duplicated in the engine, (e.g.: valves, springs, etc.), it is strongly recommended to note their position and to keep the parts of the same assembly as a "group". If you find a defective component, it will be much easier to find the cause of the failure. Since parts were break-in together during the engine operation, they will keep their matched fit when parts are reassemble together within their "group".

INSPECTION

CYLINDER LEAK TEST

General

Before performing the cylinder leak test, verify the following:

- Clamp tightness
- Hoses condition.

NOTE: For best accuracy, the leak test should be done with the engine at normal operating temperature.

⚠ CAUTION Engine parts could be hot.

NOTE: The following steps are the same for each cylinder.

Preparation

1. Remove the *VALVE COVER*, see procedure in this subsection.
2. Remove spark plug.
3. Using the drive pulley, turn the engine counter-clockwise to bring piston to TDC of compression stroke. Use a dial gauge or a suitable tool to position the piston to TDC.

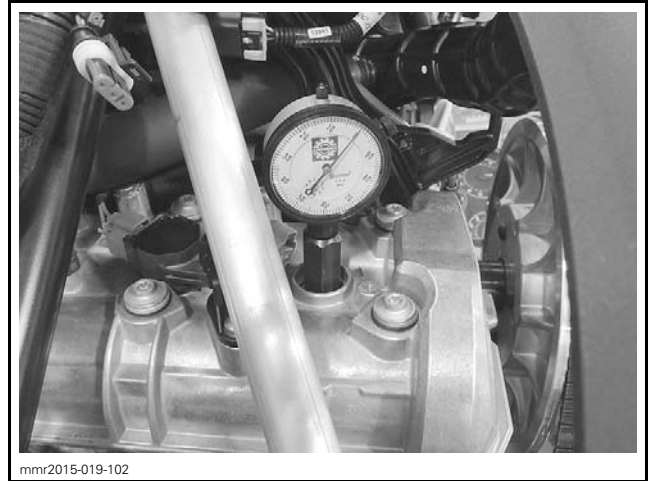
NOTE: The piston must be set precisely to TDC of compression stroke. If not, the engine will continue to rotate when pressure builds up.

RECOMMENDED TOOLS

Dial gauge



Dial gauge extension/adaptor



Leak Test

1. Install a gauge adaptor into spark plug hole.

REQUIRED TOOL

ENGINE LEAK DOWN TEST
KIT (P/N 529 035 661)



2. Connect the leak down tester to an adequate air supply.
3. Set gauge needle to zero.

NOTE: All testers have specific instructions on gauge operation and required pressure. Refer to manufacturer's instructions.

4. Supply combustion chamber with air pressure.

Subsection XX (CYLINDER HEAD)



5. Note the amount or percentage of leakage (depending on tester).

LEAKAGE PERCENTAGE	ENGINE CONDITION
0% to 15%	Excellent condition
16% to 25%	Good condition
26% to 40%	Fair condition; reduced engine performance
41% and higher	Poor condition, diagnose and repair engine

Diagnosis

Listen for air leaks.

- Air escaping on intake port or throttle body means leaking intake valve(s).
- Air escaping on exhaust port means leaking exhaust valve(s).
- Air bubbles out of coolant tank means leaking cylinder head gasket.
- Air or coolant escaping from cylinder head means damaged gasket or loosened screws.
- Air escaping into crankcase area means excessively worn cylinder or broken piston rings.
- Air or oil escaping from crankcase means damaged gasket or loosened screws.

Repair Tips

Blue exhaust gas means damaged or worn piston rings or valve stem seals.

White exhaust gas means damaged cylinder head gasket.

Coolant tank cap opening without overheat means damaged cylinder head gasket.

Leaking valves can be caused by carbon deposits or burnt valve face.

Assembly

Reverse the preparation procedure.

TROUBLESHOOTING

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

When diagnosing an engine problem, always perform the cylinder leak test. This will help pinpoint a problem. Refer to *CYLINDER LEAK TEST* in this subsection.

UNUSUAL ENGINE NOISE OR VIBRATIONS

1. **Discharged or defective valve lifters.**
 - Check engine oil pressure, refer to *LUBRICATION SYSTEM* subsection.
 - Replace valve lifters.
2. **Camshaft(s) or camshaft holder(s) worn out.**
 - Check and replace damaged parts.
3. **Faulty chain tensioner.**
 - Replace chain tensioner. Refer to *TIMING CHAIN* subsection.
4. **Chain guide(s) worn out.**
 - Replace chain guide(s). Refer to *TIMING CHAIN* subsection.
5. **Stretched timing chain or worn out sprockets.**
 - Replace timing chain and sprockets. Refer to *TIMING CHAIN* subsection.
6. **Loose timing chain gear screws.**
 - Retighten screws with recommended torque.
7. **Incorrect camshaft timing.**
 - Replace damaged components and readjust camshaft timing.

OIL LEAKAGE FROM CYLINDER HEAD

1. **Leaking valve cover gasket.**
 - Replace valve cover gaskets and retighten valve cover with recommended torque.
 - Check valve cover for cracks or other damage.
2. **Leaking spark plug tube O-rings.**
 - Replace spark plug tube O-rings.
 - Clean spark plug area from oil spillage.
3. **Blow-by connector is leaking.**
 - Replace blow by connector O-ring.

4. Leaking cylinder head gasket.
 - Check cylinder head for damage.
 - Replace cylinder head gasket and retighten screws with recommended torquing procedure.

ENGINE SUDDENLY TURNS OFF OR LACKS ACCELERATION OR POWER

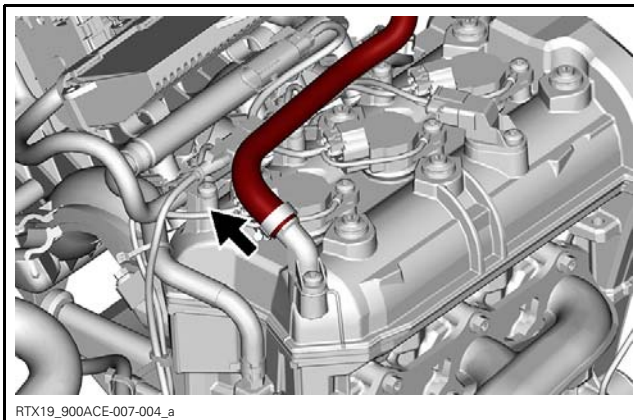
1. Incorrect camshaft timing.
 - Replace damaged components and readjust camshaft timing.
2. Leaking intake or exhaust valves.
 - Perform a *CYLINDER LEAK TEST*. Repair or replace damaged components.
3. Broken valve spring(s).
 - Replace defective parts.

PROCEDURES

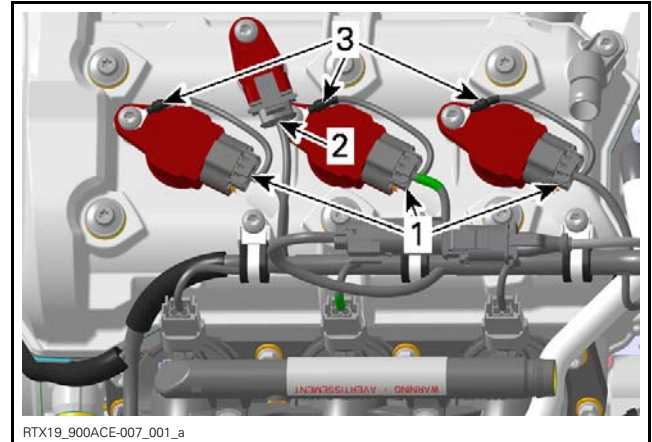
VALVE COVER

Removing the Valve Cover

1. Remove the upper body module. Refer to *BODY* subsection.
2. Remove pulley guard.
3. Remove the exhaust manifold.
4. Disconnect vent tube from the blow-by connector.

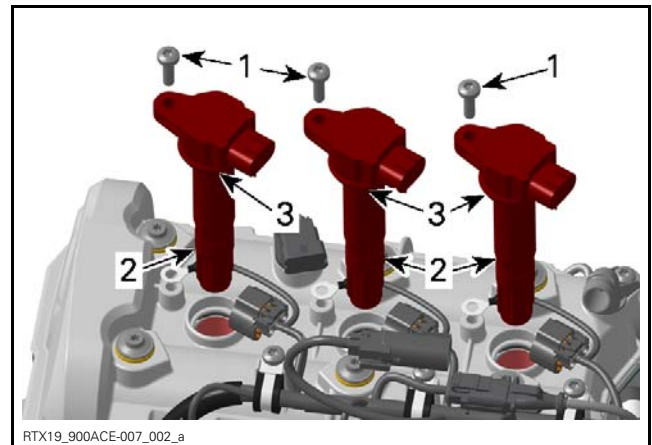


5. Unplug CAPS (camshaft position sensor).
6. Unplug ignition coils.



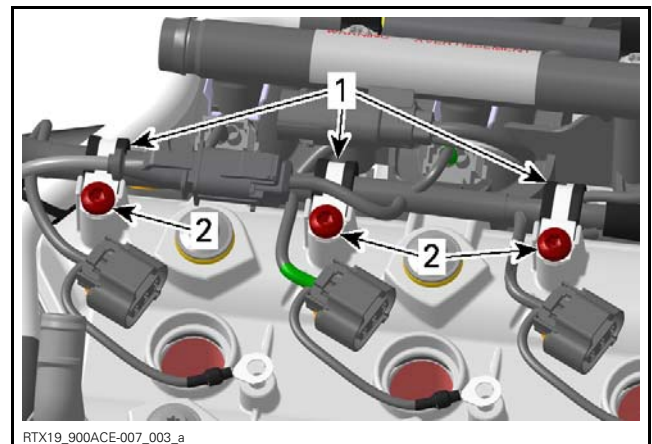
1. Ignition coil connectors
2. CAPS connector
3. Ground wires

7. Remove ignition coils with gaskets.



1. Retaining screws
2. Ignition coils
3. Gaskets

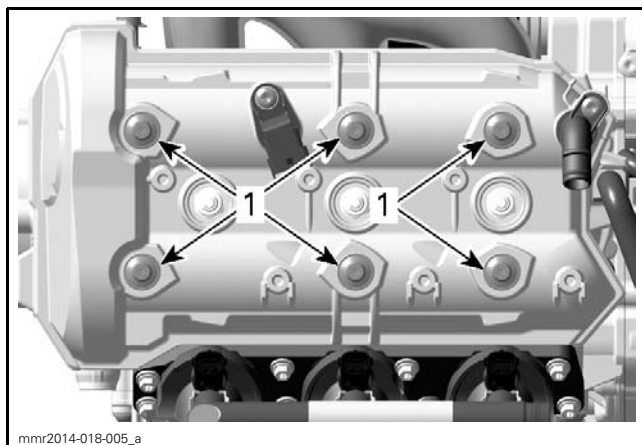
8. Remove screws securing the electrical harness to the valve cover.



1. Cable clamps
2. Retaining screws

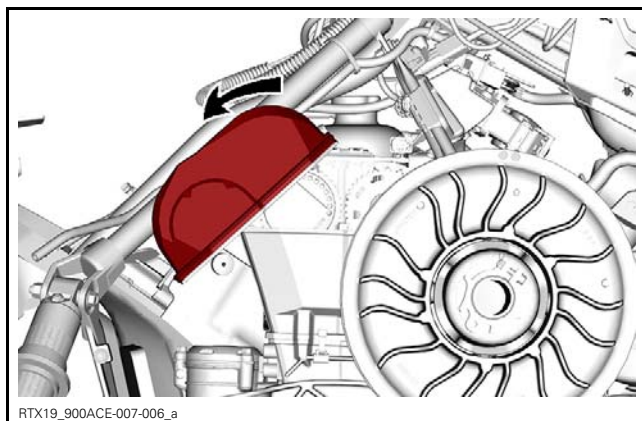
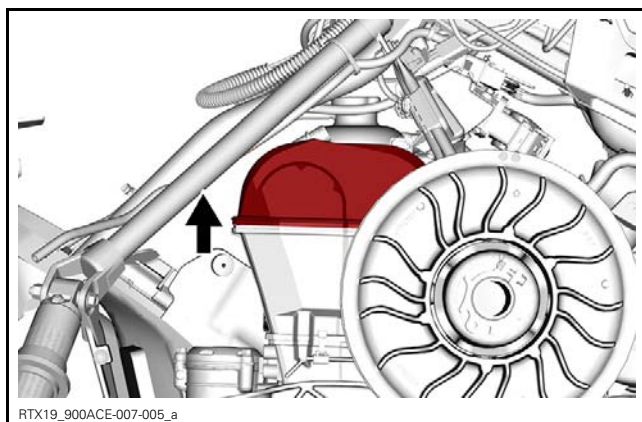
Subsection XX (CYLINDER HEAD)

9. Remove valve cover retaining screws.

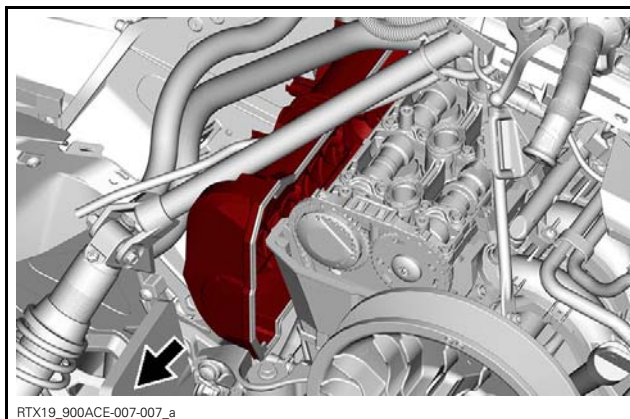


1. Valve cover screws

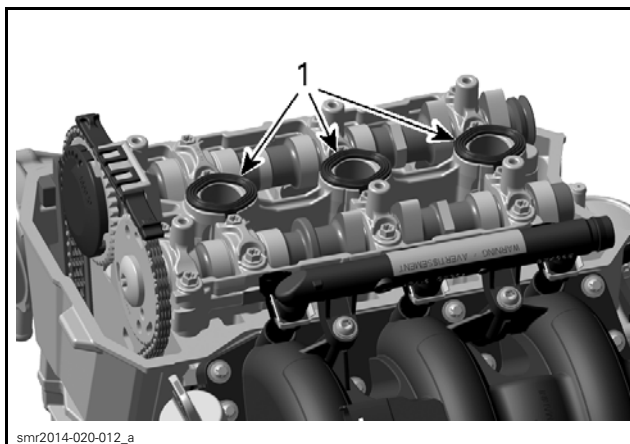
10. Lift and tilt valve cover with gasket towards front of engine.



11. Pull valve cover and gasket out through LH side of vehicle.



12. Remove the small valve cover gaskets (spark plug holes).



1. Small gaskets

Inspecting the Valve Cover

Check the valve cover for cracks or other damage.

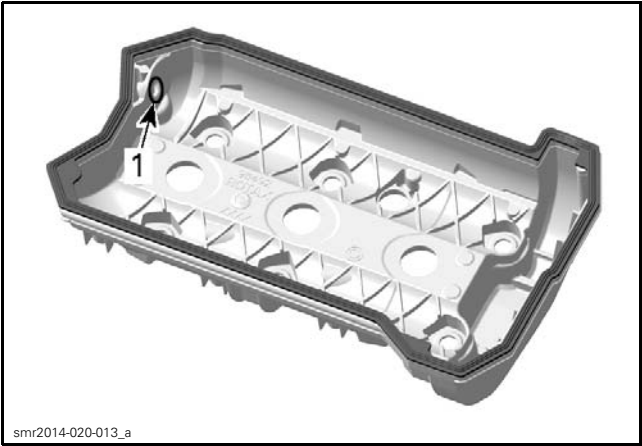
Check if the valve cover gaskets are brittle, hard or otherwise damaged.

Replace defective parts.

Installing the Valve Cover

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

1. Properly fit small gaskets into camshaft holder grooves.
2. Properly lay large gasket onto cylinder head flat surface.
3. Apply engine oil to sealing surface of V-ring.

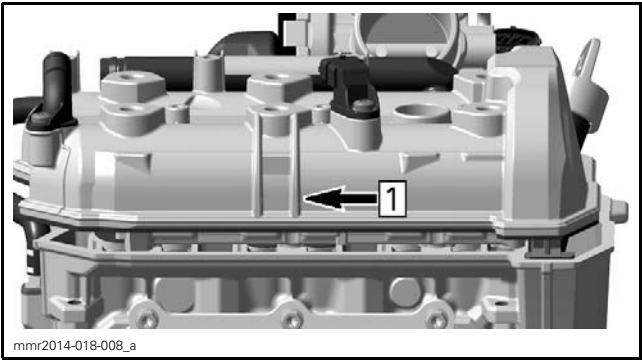


INSIDE VALVE COVER
1. Apply engine oil here

4. Install valve cover.

NOTICE Adhere to the following procedure, otherwise damage to the V-ring will occur causing crankcase venting malfunction.

4.1 Move valve cover towards MAG side.

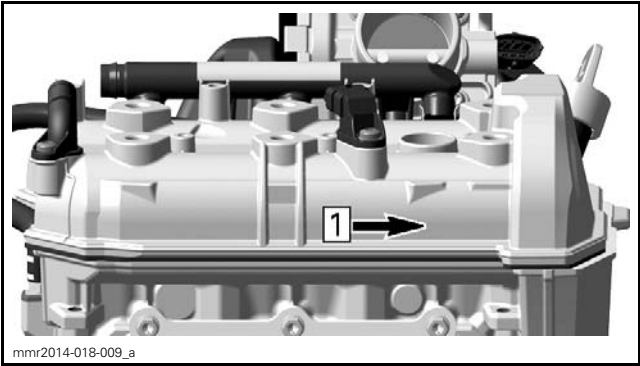


Step 1: Move valve cover towards MAG side

4.2 Place valve cover onto cylinder head.

NOTICE Make sure the valve cover gasket is well positioned in the cover groove.

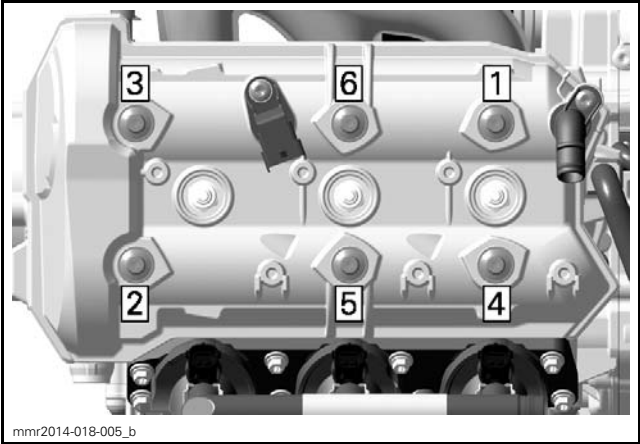
4.3 Push valve cover towards PTO side to ensure the V-ring properly seals on sealing surface inside the cover.



Step 1: Push valve cover towards PTO side

5. Install valve cover screws and tighten as per following sequence:

TIGHTENING TORQUE		
Valve cover screws	STEP A	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)
	STEP B	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



TIGHTENING SEQUENCE

CAMSHAFTS

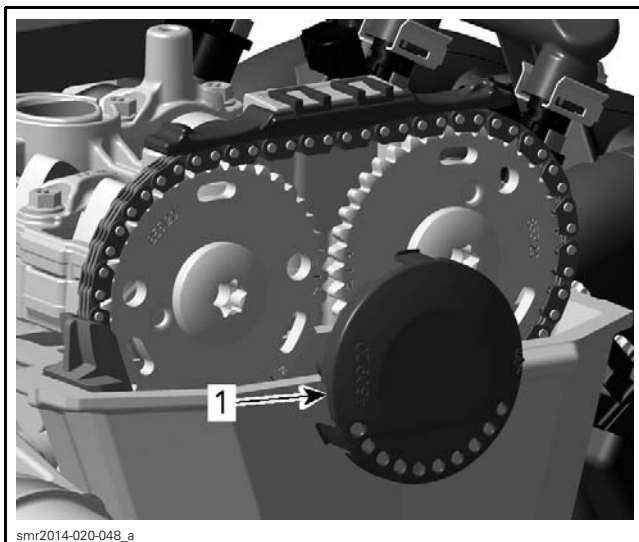
Removing the Camshaft

1. Remove *VALVE COVER*, see procedure in this subsection.
2. Lock crankshaft, refer to *CRANKSHAFT LOCKING PROCEDURE* in the *BOTTOM END* subsection.

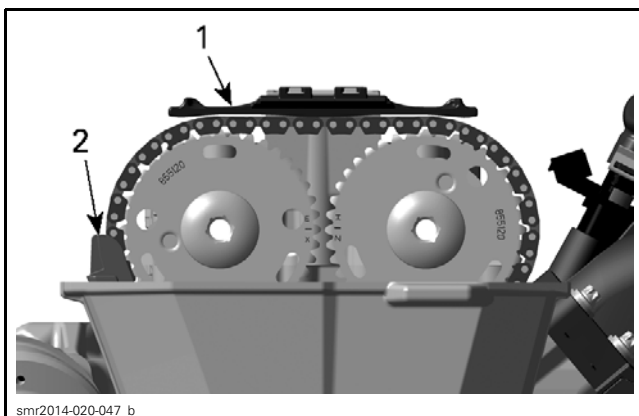
Remove timing chain tensioner. Refer to *TIMING CHAIN* subsection.

3. Remove the breather cover, the upper timing chain guide and the timing chain guide.

Subsection XX (CYLINDER HEAD)



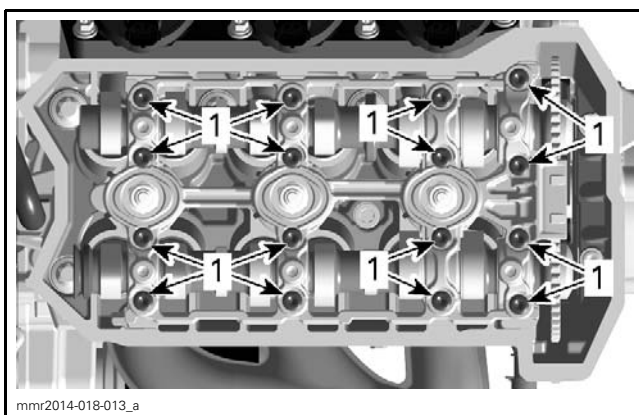
1. Breather cover



1. Upper timing chain guide
2. Timing chain guide

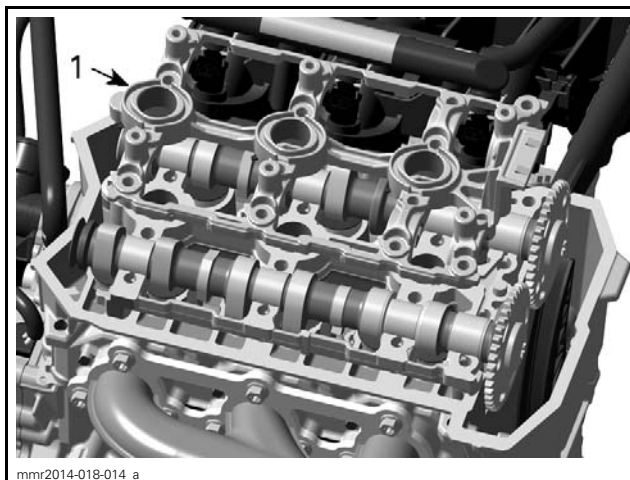
4. Remove timing chain from camshaft timing gears.

5. Remove camshaft holder retaining screws (x16).



1. Camshaft holder retaining screws

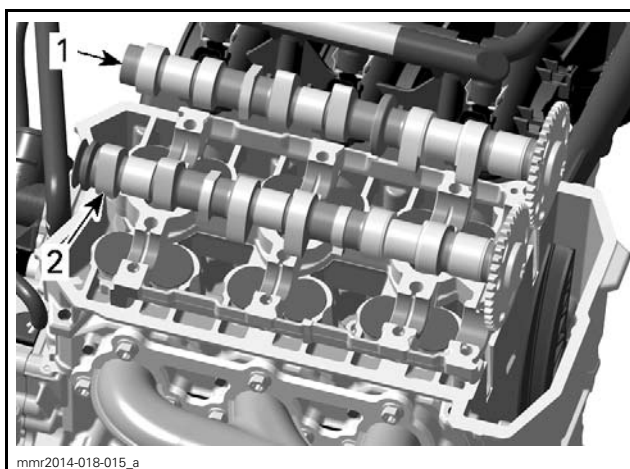
6. Remove upper half of camshaft holder.



1. Upper half of camshaft holder

7. Put timing chain aside.

8. Remove camshafts with timing gears.

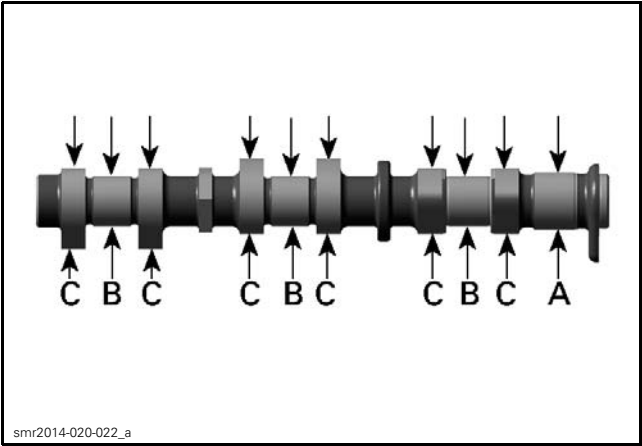


1. Intake camshaft
2. Exhaust camshaft

NOTE: Remove camshaft timing gears only if necessary. Refer to *TIMING CHAIN* subsection.

Inspecting the Camshaft

1. Check each lobe and bearing journal for scoring, scuffing, cracks, or other signs of wear.
2. Check if V-ring is brittle, hard or otherwise damaged.
3. Measure camshaft bearing journal diameter and lobe height, using a micrometer.



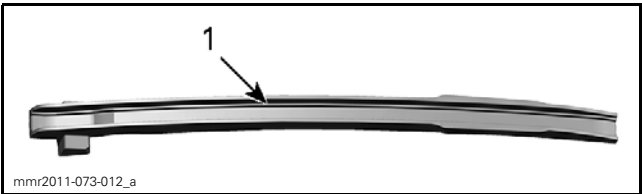
A. Camshaft journal (PTO)
B. Camshaft journal (center and MAG)
C. Camshaft lobes

CAMSHAFT JOURNAL DIAMETER		
PTO journal (A)	New	25.967 mm to 25.980 mm (1.0223 in to 1.0228 in)
	Service limit	25.940 mm (1.0213 in)
Center and MAG journals (B)	New	22.957 mm to 22.970 mm (.9038 in to .9043 in)
	Service limit	22.930 mm (.9028 in)

CAMSHAFT LOBE HEIGHT		
Exhaust and Intake Camshaft (C)	New	38.35 mm to 38.55 mm (1.51 in to 1.518 in)
	Service limit	38.33 mm (1.509 in)

- Replace parts if necessary.
- For camshaft journal radial clearance and camshaft holder bearing diameter refer to *CAMSHAFT HOLDER* in this subsection.
4. Check timing chain guide for wear, cracks or deformation. Replace as required.
 5. Replace timing chain guide if any groove caused by timing chain exceeds service limit.

CHAIN GUIDE GROOVE DEPTH	
Service limit	1 mm (.039 in)

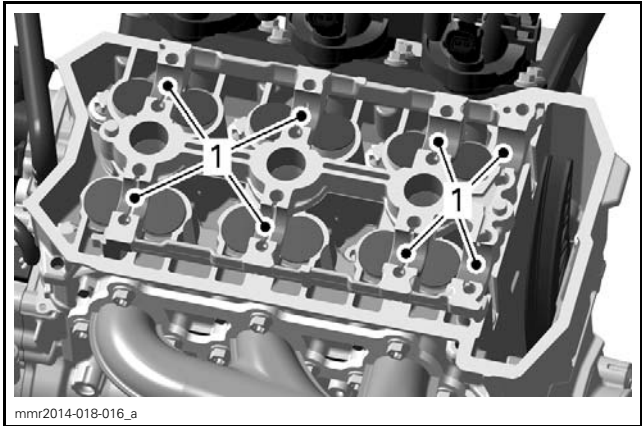


1. Timing chain guide

Installing the Camshaft

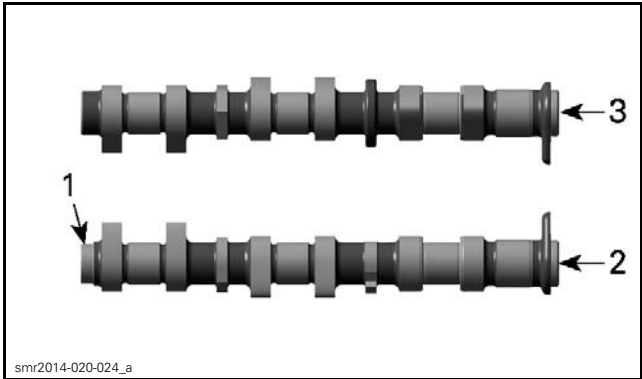
The installation is the reverse of the removal procedure. However, pay attention to the following details.

1. Ensure crankshaft is still locked.
2. Apply engine oil on camshaft bearings.



1. Areas where to apply engine oil

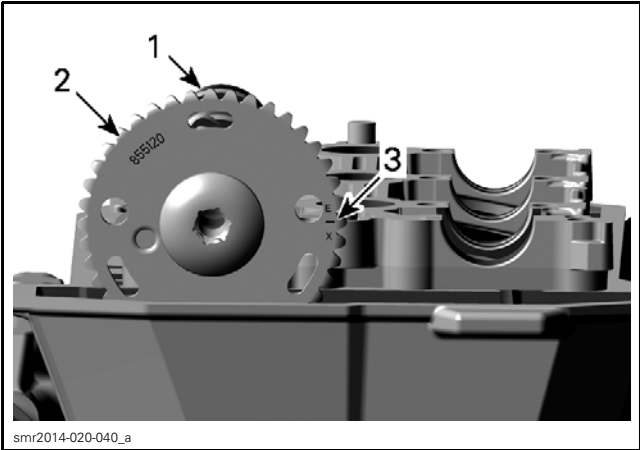
NOTE: The camshafts are not identical. Any mix-up of the components would lead to engine damage. The exhaust camshaft has a machined area on MAG side for the V-ring.



1. Machined area
2. Exhaust camshaft
3. Intake camshaft

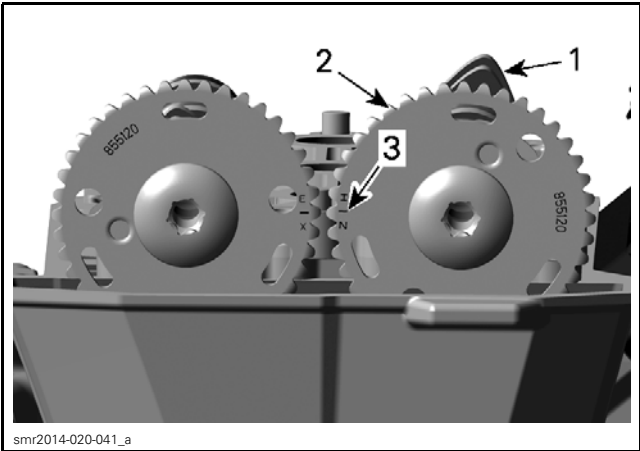
3. If removed, reinstall camshaft timing gears on camshafts. Refer to *CAMSHAFT TIMING GEARS* in the *TIMING CHAIN* subsection.
4. Apply engine oil on camshaft journal diameter.
5. Install exhaust camshaft assembly with mark "EX" parallel to cylinder head gasket.

Subsection XX (CYLINDER HEAD)



- 1. Exhaust camshaft
- 2. Camshaft timing gear
- 3. Mark "EX"

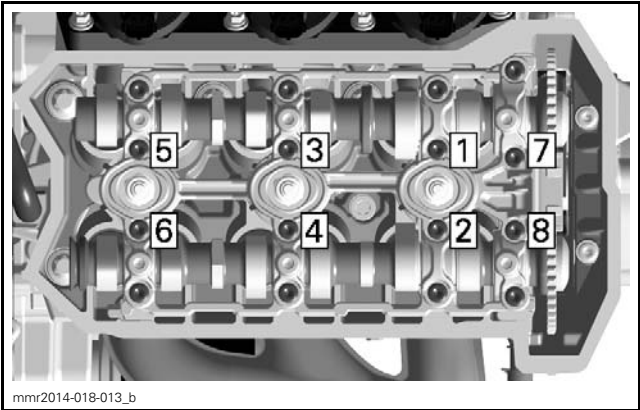
6. Install intake camshaft assembly with mark "IN" parallel to cylinder head gasket.



- 1. Intake camshaft
- 2. Camshaft timing gear
- 3. Mark "IN"

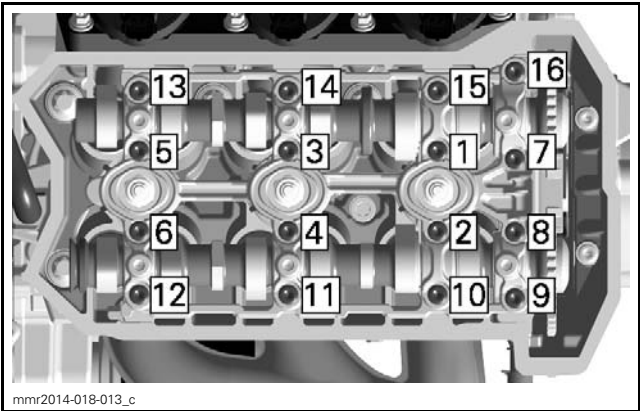
7. Install upper half of camshaft holder, then tighten screws as per following sequence:

TIGHTENING TORQUE		
Camshaft holder screws	STEP A	5 N•m ± 0.5 N•m (44 lbf•in ± 4 lbf•in)



CAMSHAFT HOLDER TIGHTENING SEQUENCE - STEP A

TIGHTENING TORQUE		
Camshaft holder screws	STEP B	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

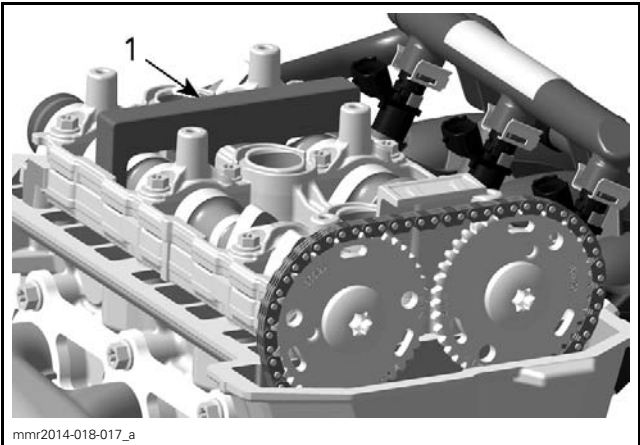


CAMSHAFT HOLDER TIGHTENING SEQUENCE - STEP B

NOTE: After reassembly of camshafts is completed, check if camshafts can be turned easily.

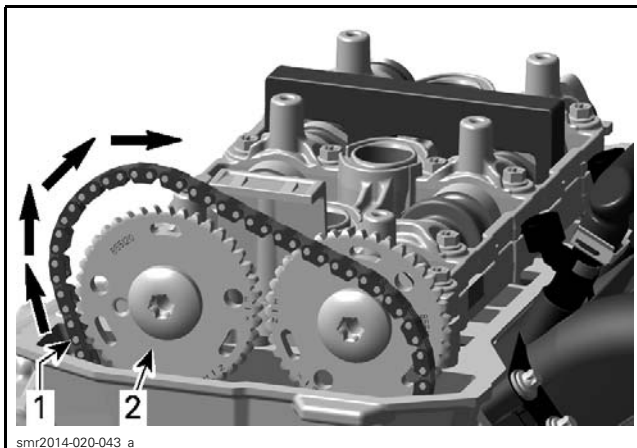
8. Lock camshafts.

REQUIRED TOOL	
CAMSHAFT LOCKING TOOL (P/N 529 036 206)	



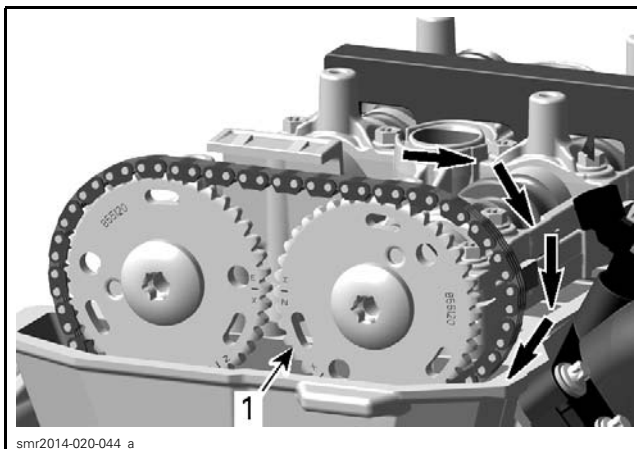
1. Camshaft locking tool

9. Lift timing chain out of timing chain compartment.
10. Pull timing chain up on exhaust side and install it on the exhaust camshaft timing gear.



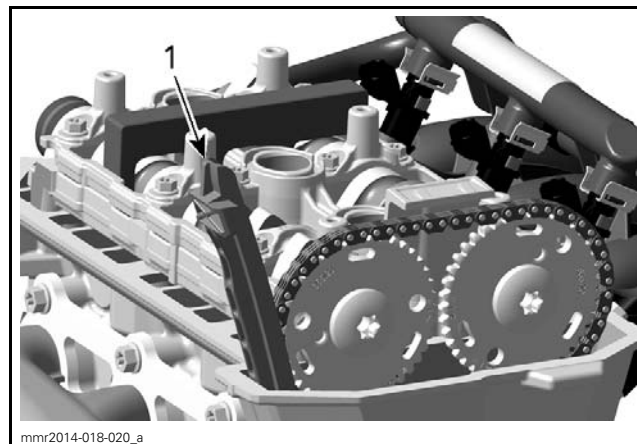
1. Timing chain
2. Exhaust camshaft timing gear

11. Pull timing chain towards intake side and install it on the intake camshaft timing gear.



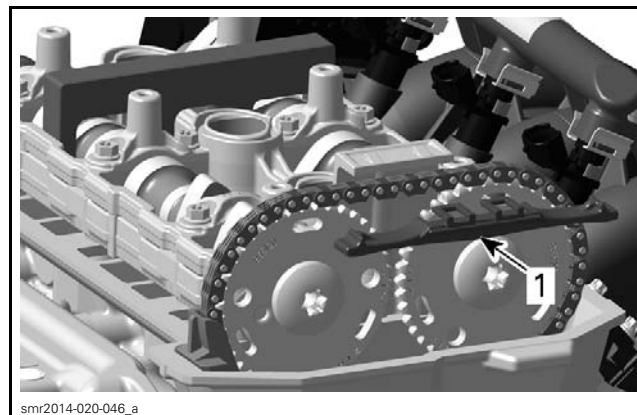
1. Intake camshaft timing gear

12. Install timing chain guide.



1. Timing chain guide

13. Install upper timing chain guide on camshaft holder.

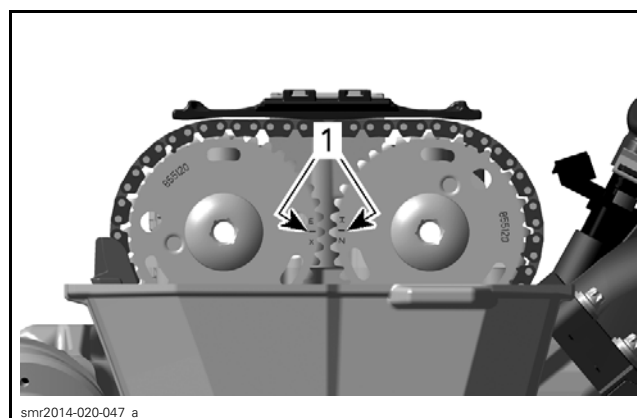


1. Upper timing chain guide

14. Install *TIMING CHAIN TENSIONER*, refer to *TIMING CHAIN* subsection.

15. Ensure marks on camshaft timing gears are still aligned. If not, repeat procedure.

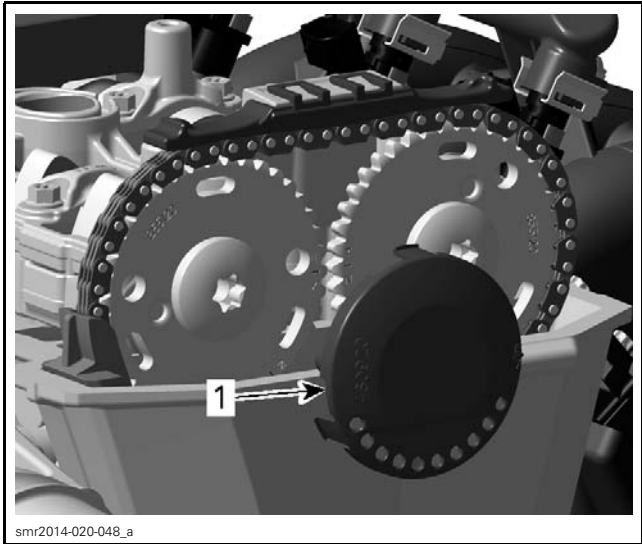
NOTICE After installation of timing chain tensioner, the marks "IN" on intake and "EX" on exhaust camshafts must be aligned.



CAMSHAFT TIMING GEARS

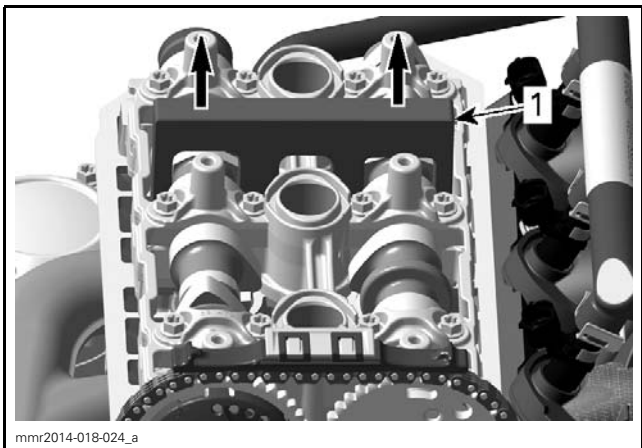
1. Marks must be aligned

16. Install breather cover.



1. Breather cover

17. Remove camshaft locking tool.



1. Camshaft locking tool removal

18. Remove crankshaft locking tool.

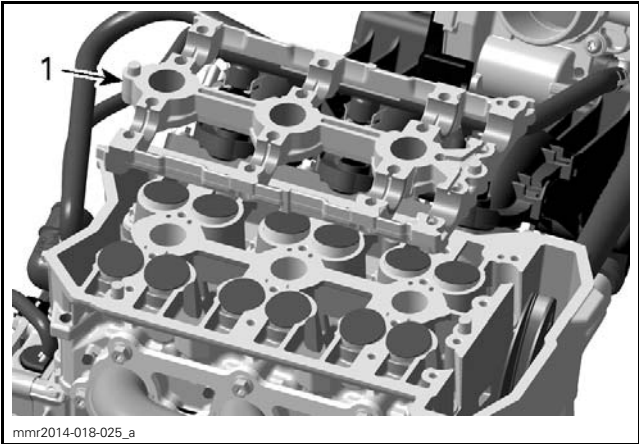
CAMSHAFT HOLDER

Removing the Camshaft Holder

Remove camshafts, see procedure in this subsection.

Remove lower half of camshaft holder with gaskets from cylinder head.

Remove gaskets from camshaft holder halves and discard gaskets.

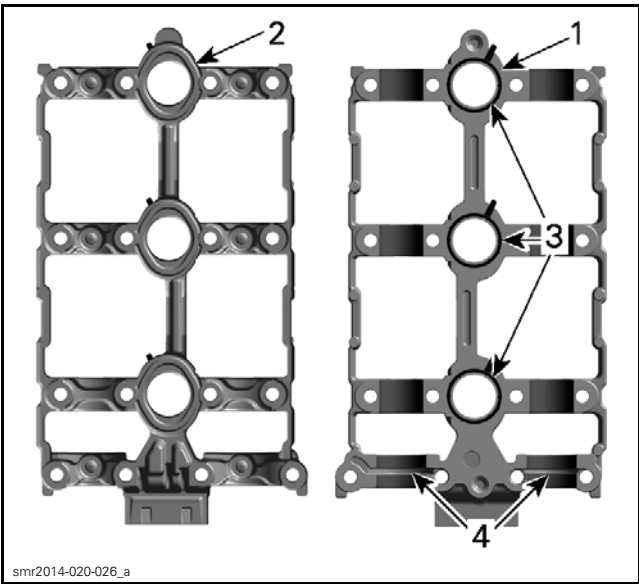


1. Camshaft holder lower half

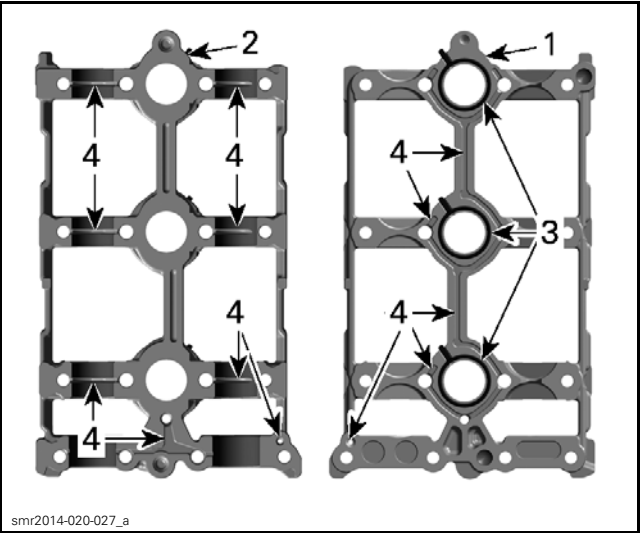
Inspecting the Camshaft Holder

Check camshaft holder for scoring, scuffing, cracks, or other signs of wear.

Make sure oil orifices are not clogged. Blow them out with pressurized air.

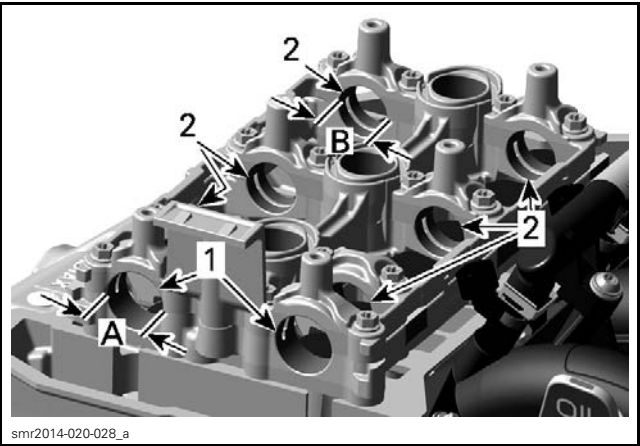


1. Camshaft holder upper half - view from beneath
2. Camshaft holder upper half - view from above
3. Gaskets
4. Oil orifices



1. Camshaft holder lower half - view from beneath
2. Camshaft holder lower half - view from above
3. Gaskets
4. Oil orifices

Install camshaft holder on cylinder head.
Tighten camshaft holder screws to specification, refer to *INSTALLING THE CAMSHAFT* in this subsection.
Measure camshaft holder bearing diameter.



CAMSHAFT HOLDER BEARINGS
1. PTO bearings
2. Center and MAG bearings
A. Diameter PTO bearing
B. Diameter center and MAG bearing

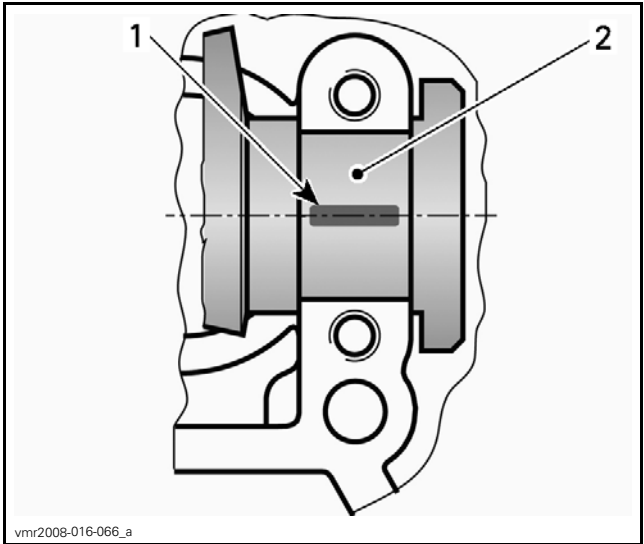
CAMSHAFT HOLDER BEARING DIAMETER		
PTO bearing	New	26.000 mm to 26.021 mm (1.024 in to 1.024 in)
	Service limit	26.050 mm (1.026 in)
Center and MAG bearings	New	23.000 mm to 23.021 mm (.906 in to .906 in)
	Service limit	23.050 mm (.907 in)

Measure the clearance between camshaft journals and camshaft holder, using the plastic feeler gauge.

NOTE: The plastic feeler gauge is available at automotive parts retailer.

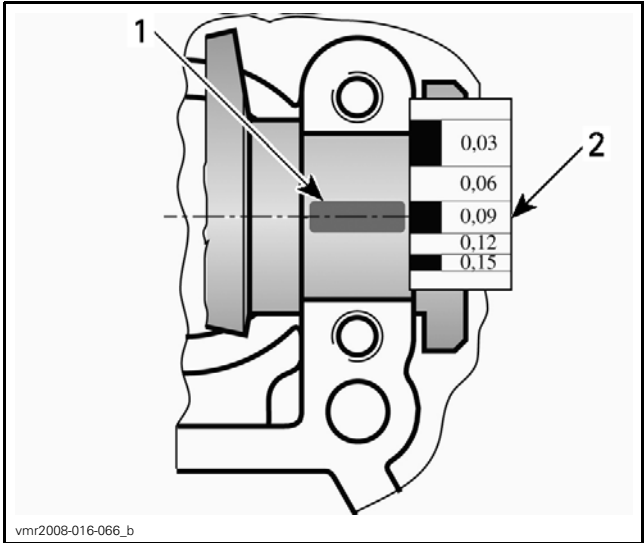
Install camshaft holder lower half on cylinder head.

Place camshafts in lower half of camshaft holder and apply a plastic-gauge on the camshaft bearing journal.



TYPICAL
1. Plastic gauge
2. Camshaft bearing journal

Install camshaft holder upper half in its proper position and tighten screws to specification, refer to *INSTALLING THE CAMSHAFT* in this subsection.
Unfasten camshaft holder.
Measure the maximum width of the pressed plastic gauge with the corresponding graduated scale.



TYPICAL
1. Pressed plastic gauge
2. Graduated scale

CAMSHAFT JOURNAL RADIAL CLEARANCE (PTO, CENTER AND MAG BEARING)	
New	0.020 mm to 0.054 mm (.001 in to .002 in)
Service limit	0.080 mm (.003 in)

Replace parts if necessary.

Installing the Camshaft Holder

Install camshaft holder lower half.

Continue procedure as explained in *INSTALLING THE CAMSHAFT* in this subsection.

HYDRAULIC VALVE LIFTERS

Removing the Hydraulic Valve Lifter

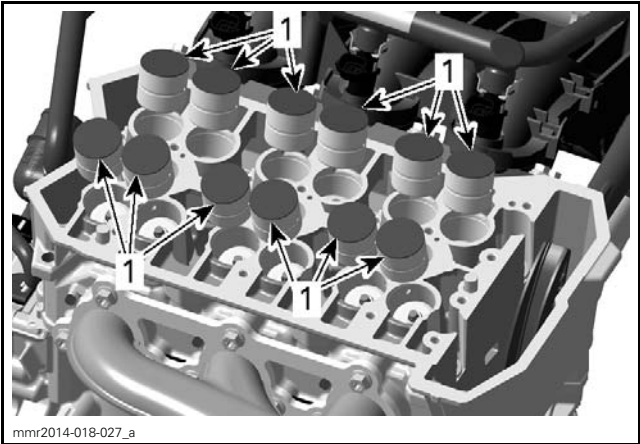
NOTE: Hydraulic valve lifter are maintenance free.

See procedures in this subsection to remove the following:

- Valve cover
- Camshafts
- Camshaft holder.

Pull hydraulic valve lifter out of cylinder head.

NOTE: When disassembling the hydraulic valve lifter, it is strongly recommended to note their original position.



1. Hydraulic valve lifter

Inspecting the Hydraulic Valve Lifter

1. Check surface of hydraulic valve lifter for scoring or other damage.
2. Measure valve lifter diameter. Replace if out of specification.

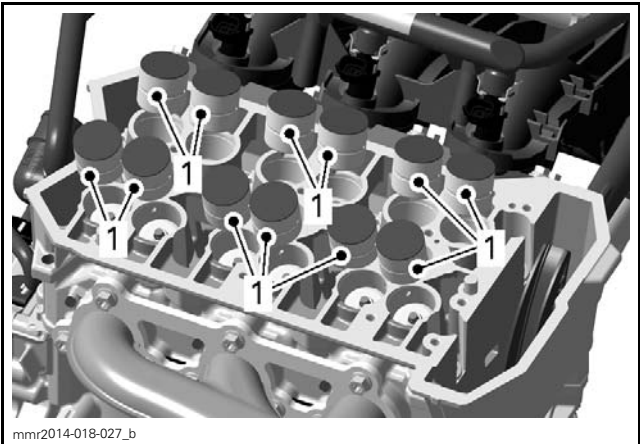
HYDRAULIC VALVE LIFTER	
New	28.354 mm to 28.370 mm (1.1163 in to 1.1169 in)
Service limit	28.340 mm (1.1157 in)

HYDRAULIC VALVE LIFTER RADIAL CLEARANCE	
Service limit	0.100 mm (.0039 in)

Installing the Hydraulic Valve Lifter

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

Apply engine oil on the outside diameter of the hydraulic valve lifter.

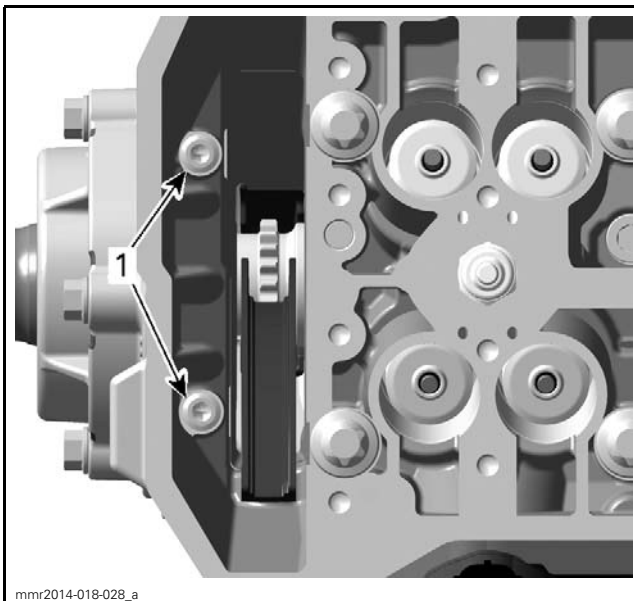


1. Apply engine oil on outer diameter

CYLINDER HEAD

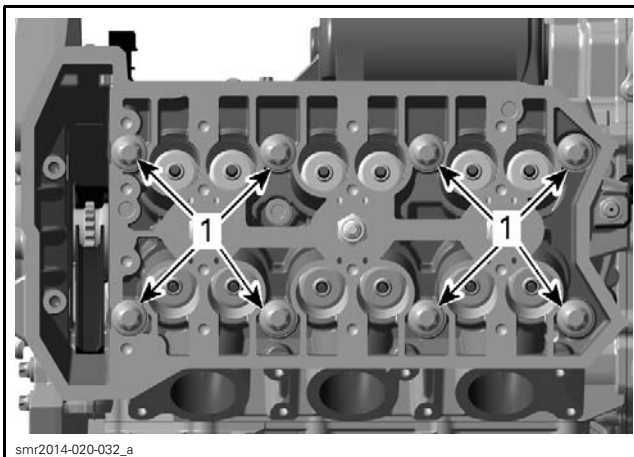
Removing the Cylinder Head

1. Remove the engine from the vehicle. Refer to *ENGINE REMOVE AND INSTALLATION* subsection.
2. See procedures in this subsection to remove:
 - Valve cover
 - Camshafts
 - Camshaft holder
 - Hydraulic valve lifters.
3. Remove M6 cylinder head screws.



1. Remove M6 cylinder head screws

4. Remove and discard M9 cylinder head screws.

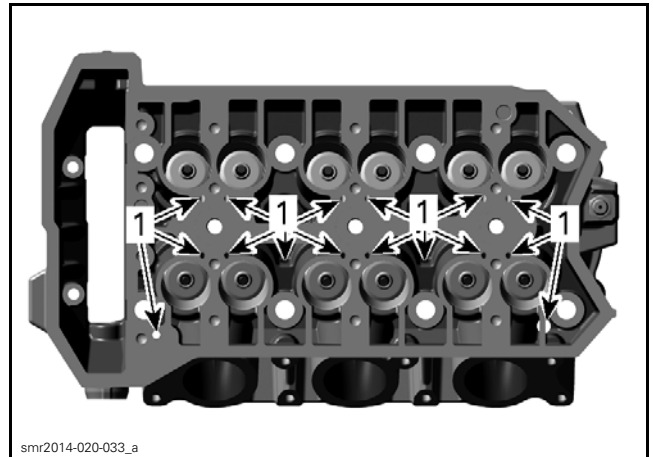


1. Remove M9 cylinder head screws

5. Pull cylinder head off the cylinder block.
6. Remove and discard cylinder head gasket.

Cleaning the Cylinder Head

1. Remove carbon deposits from combustion chambers, exhaust ports and piston tops.
2. Clean cylinder head, especially cylinder head screw surface from oil spillage.
3. Blow out the oil orifices with pressurized air and make sure they are not clogged.



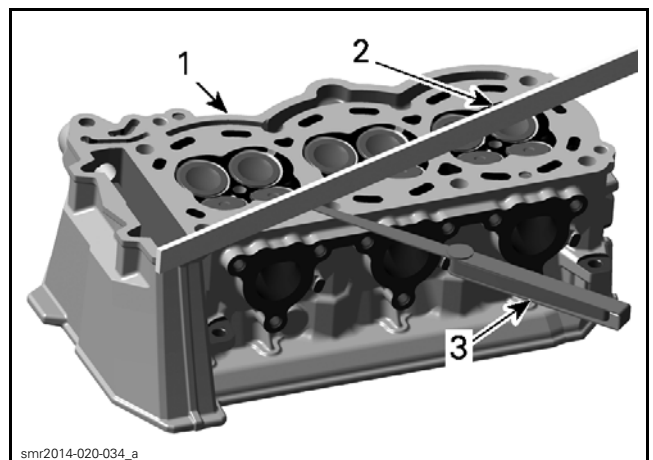
1. Oil orifices

Inspecting the Cylinder Head

Check for cracks between valve seats or other damage, if so, replace cylinder head.

Check cylinder head mating surface for flatness using a straight edge.

Check hydraulic valve lifter bores for scoring or other damage, if so, replace cylinder head.



1. Cylinder head
2. Straight edge
3. Feeler gauge

Check for cylinder head warping.

Subsection XX (CYLINDER HEAD)

CYLINDER HEAD WARPAGE	
Service limit	0.15 mm (.0059 in)

If warping exceeds specification, resurface the cylinder head as follows.

Use a 400 - 600 grit wet sandpaper on a surface plate and gently grind off the mating surface.

NOTE: To ensure an even surface, rotate cylinder head several times during resurfacing.

Replace cylinder head, if resurfacing fails.

Installing the Cylinder Head

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

1. Install a **NEW** cylinder head gasket.

NOTICE Each installation of the cylinder head requires a **NEW** cylinder head gasket. Using a gasket twice would cause engine damage.

2. Install cylinder head on the cylinder block.

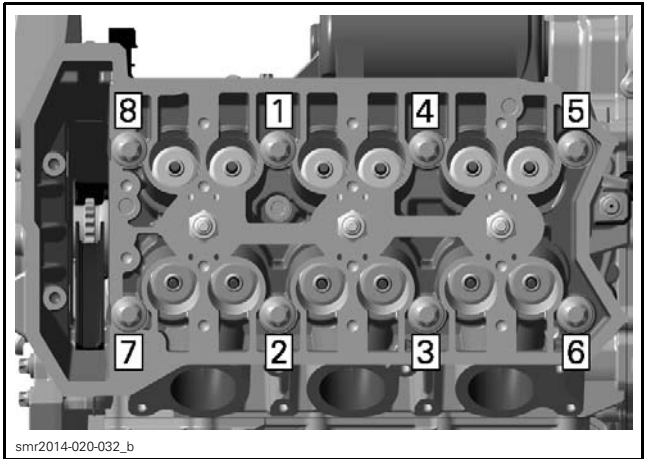
3. Install **NEW** M9 cylinder head screws.

NOTICE This assembly uses stretch screws. Always use **NEW** screws and strictly adhere to the tightening procedure.

4. Tighten cylinder head screws as follows:

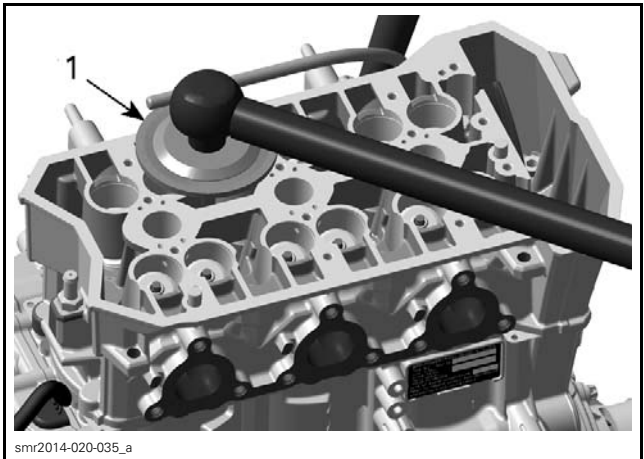
NOTE: Always perform step A on all M9 cylinder head screws before going to step B.

TIGHTENING TORQUE		
Cylinder head M9 screws	STEP A	20 N•m ± 2 N•m (15 lbf•ft ± 1 lbf•ft)
	STEP B	Additional 150° ± 5°



M9 SCREWS TIGHTENING SEQUENCE

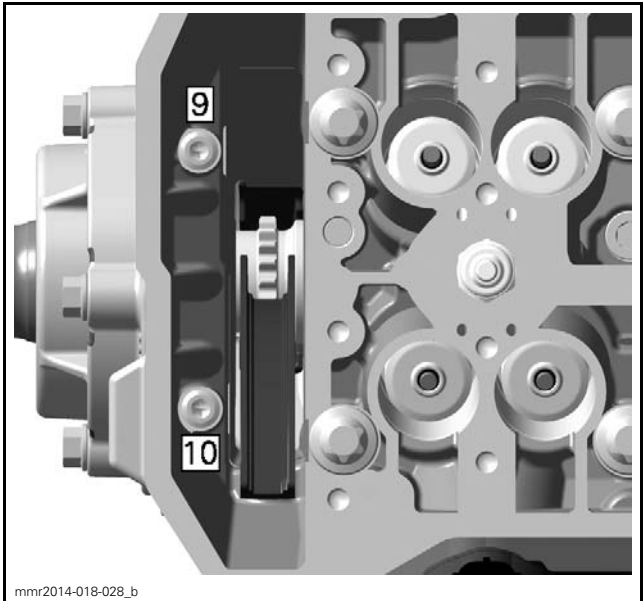
NOTE: Use a torque angle gauge to carry out step B.



1. Torque angle gauge

5. Install M6 screws. Tighten as follows.

TIGHTENING TORQUE	
Cylinder head M6 screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



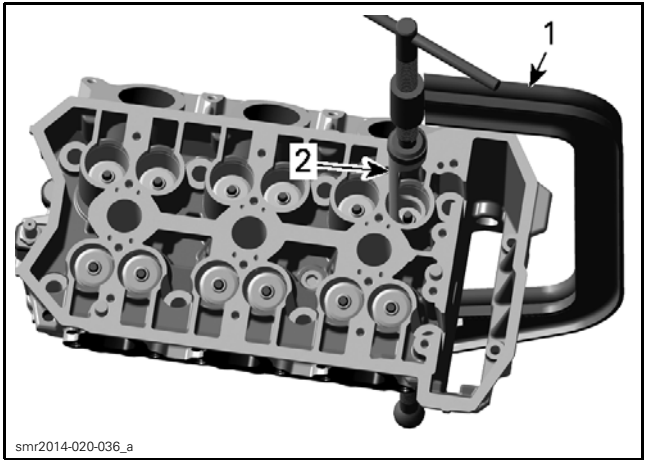
M6 SCREWS TIGHTENING SEQUENCE

VALVE SPRINGS

Removing the Valve Spring

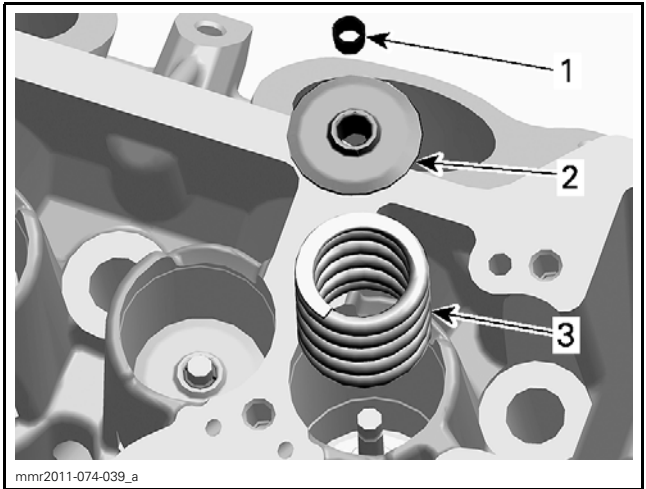
1. Remove *CYLINDER HEAD*, see procedure in this subsection.
2. Compress valve spring.

REQUIRED TOOLS	
VALVE SPRING COMPRESSOR (P/N 529 035 724)	
VALVE SPRING COMPRESSOR CUP (P/N 529 036 209)	



1. Valve spring compressor clamp
2. Valve spring compressor cup

3. Remove valve cotters.
4. Withdraw valve spring compressor tools.
5. Remove valve spring retainer and valve spring.

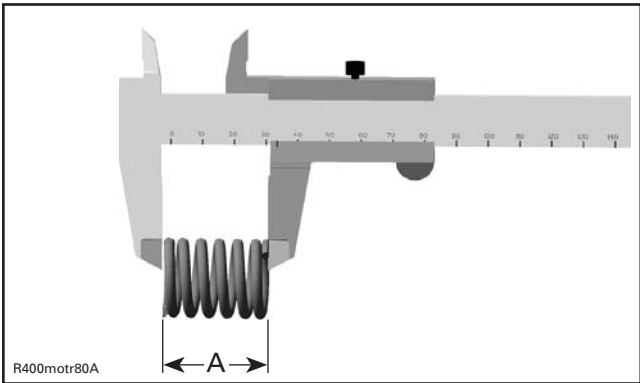


1. Valve cotters
2. Valve spring retainer
3. Valve spring

NOTE: Identify the position of each part very carefully, so it can be reinstalled in its original place.

Inspecting the Valve Spring

1. Check valve spring for rust, corrosion or other visible damage.
2. Check valve spring free length and straightness.



A. Spring free length

VALVE SPRING FREE LENGTH	
New	31.35 mm (1.2343 in)
Service limit	29.50 mm (1.1614 in)

Replace valve spring, if out of specification.

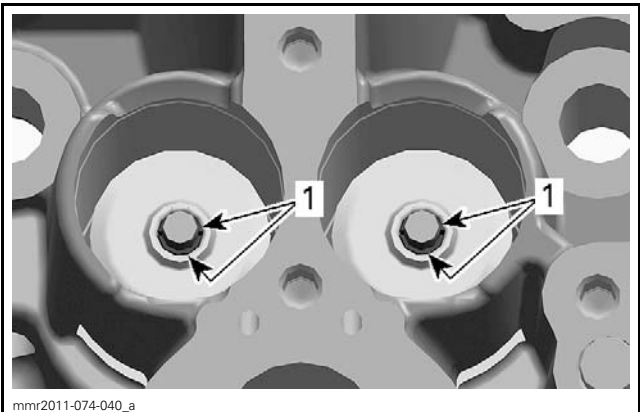
Installing the Valve Spring

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

NOTE: Ensure to reinstall all parts in their original position as marked during removal.

Apply some grease on valve cotters, so that they remain in place while releasing the valve spring.

Make sure valve cotters are properly engaged into valve stem groove.



1. Valve cotters

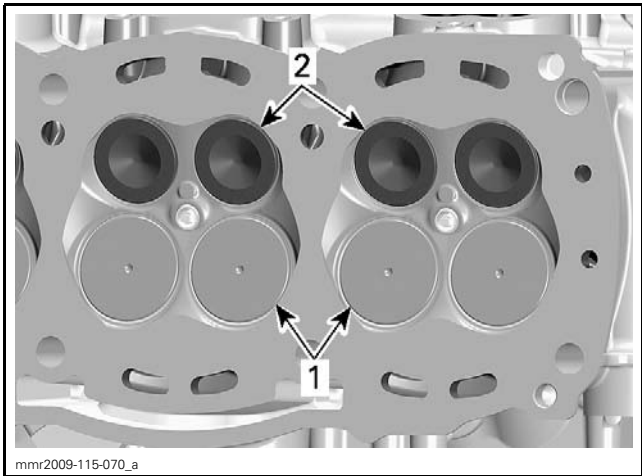
After spring is installed, ensure it is properly locked by lightly tapping on valve stem end with a soft punch and a hammer so that valve opens and closes a few times.

NOTICE Improperly locked valve spring will cause severe engine damage and hitting the valve stem end with excessive force could damage the valve.

VALVES

Removing the Valve

- 1. Remove *VALVE SPRING*, see procedure in this subsection.
- 2. Push on the valve stem, then pull valves out of cylinder head.

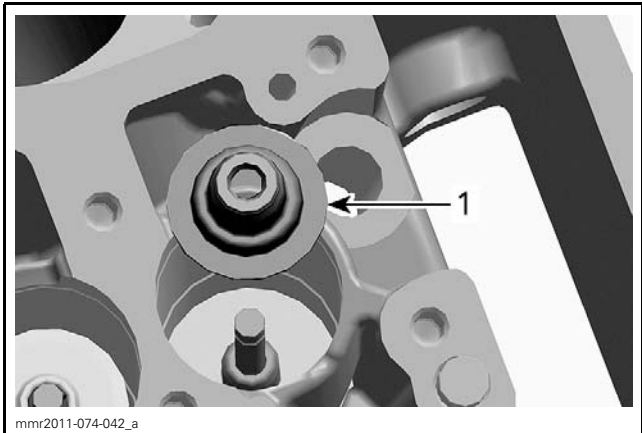


- 1. Intake valves 29 mm
- 2. Exhaust valves 25 mm

NOTE: Identify the position of each part very carefully, so it can be reinstalled in its original place.

- 3. Remove and discard valve stem seal.

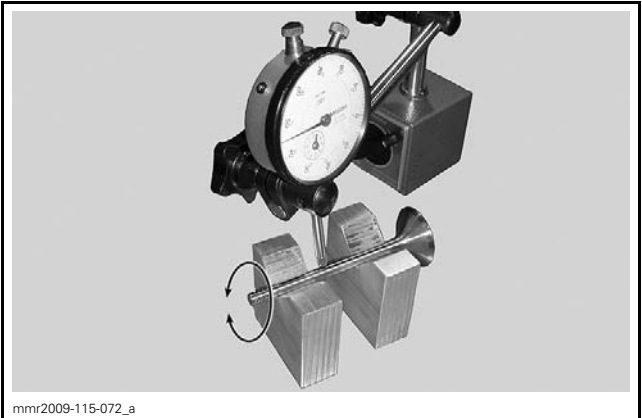
NOTE: Pliers to remove the valve stem seals are available in all automotive parts stores.



- 1. Valve stem seal

Inspecting the Valve

Inspect valve surface, check for abnormal stem wear and bending.

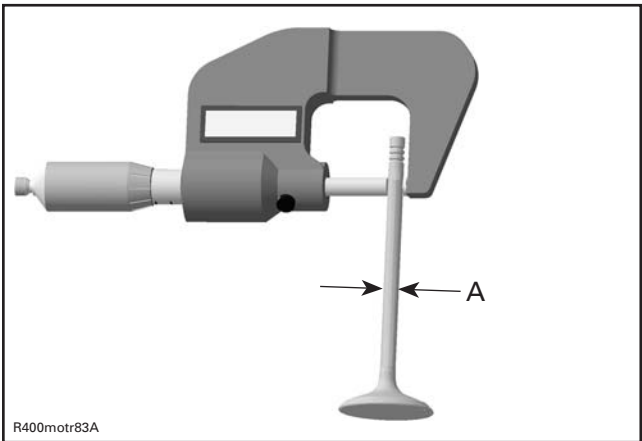


VALVE OUT OF ROUND INTAKE AND EXHAUST VALVE	
New	0.005 mm (.0002 in)
Service limit	0.060 mm (.0024 in)

Replace valve if out of specification.

Valve Stem and Valve Guide Clearance

- 1. Measure valve stem at three places, using a micrometer.



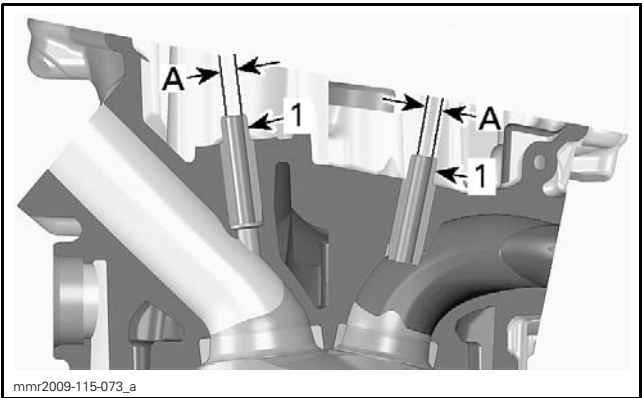
A. Valves stem diameter

VALVE STEM DIAMETER		
Intake valve	New	4.958 mm to 4.972 mm (.1952 in to .1957 in)
	Service limit	4.940 mm (.1945 in)
Exhaust valve	New	4.956 mm to 4.970 mm (.1951 in to .1957 in)
	Service limit	4.940 mm (.1945 in)

Replace valve if stem is out of specification or if its surface is damaged or worn.

- 2. Measure valve guide inner diameter, using a small bore gauge.

NOTE: Clean valve guide from carbon deposits before measuring.

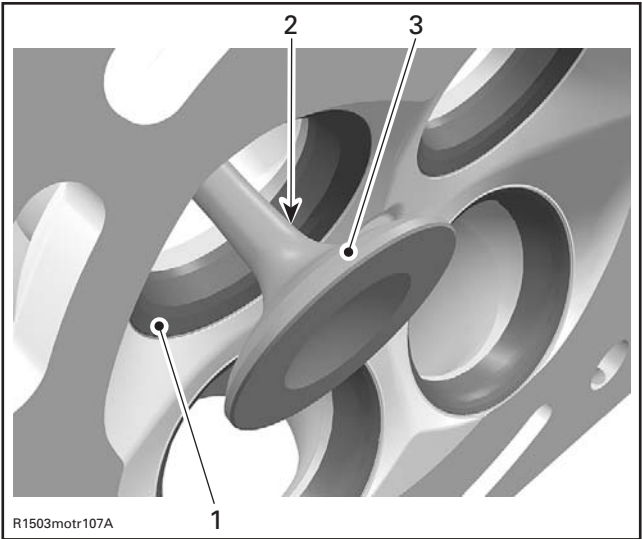


1. Valve guides
A. Valve guide inner diameter

VALVE GUIDE INNER DIAMETER	
New	5.000 mm to 5.020 mm (.1969 in to .1976 in)
Service limit	5.050 mm (.1988 in)

Replace cylinder head, if valve guide is out of specification.

Valve Face and Seat

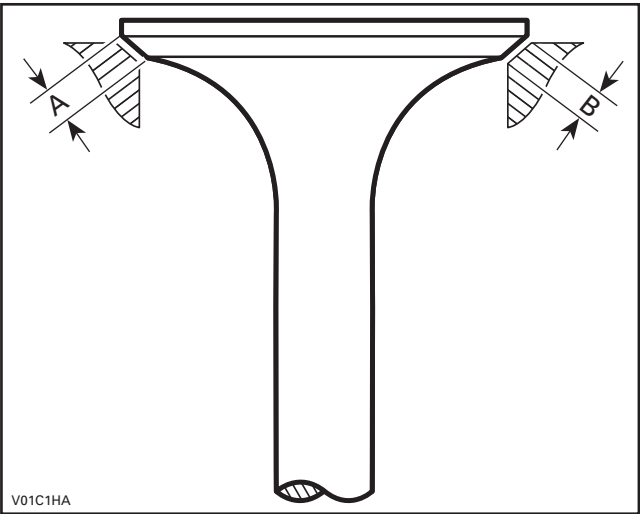


TYPICAL
1. Valve seat
2. Exhaust valve contaminated area
3. Valve face (contact surface to valve seat)

1. Check valve face and seat for burning, pitting and other signs of damage.
2. Check if valve seats properly in cylinder head. Proceed as follows.
 - 2.1 Apply some lapping compound on valve face and work valve on its seat with a lapping tool.

NOTE: The location of contact area should be in center of valve face.

- 2.2 Repeat procedure until valve seat and valve face fit together.
3. Measure valve seat contact width, using a caliper.



A. Valve face contact width
B. Valve seat contact width

VALVE SEAT CONTACT WIDTH (B)		
Intake valve	New	1.05 mm to 1.35 mm (.041 in to .053 in)
	Service limit	1.70 mm (.067 in)
Exhaust valve	New	1.25 mm to 1.45 mm (.049 in to .057 in)
	Service limit	1.80 mm (.071 in)

Replace parts if out of specification.

Installing the Valve

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

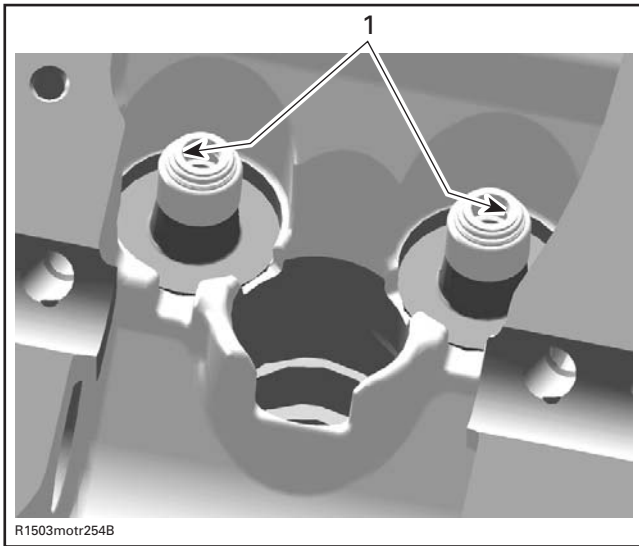
NOTE: Ensure to reinstall all parts in their original position as marked during removal.

Install a **NEW** valve stem seal whenever valve is removed.

Apply engine oil on valve stem and carefully slide through cylinder head and valve stem seal.

NOTICE Be careful when passing the valve stem through the sealing lip of the seal.

Subsection XX (CYLINDER HEAD)



TYPICAL

1. *Sealing lips of valve stem seal*

Install *VALVE SPRING*. See procedure in this subsection.

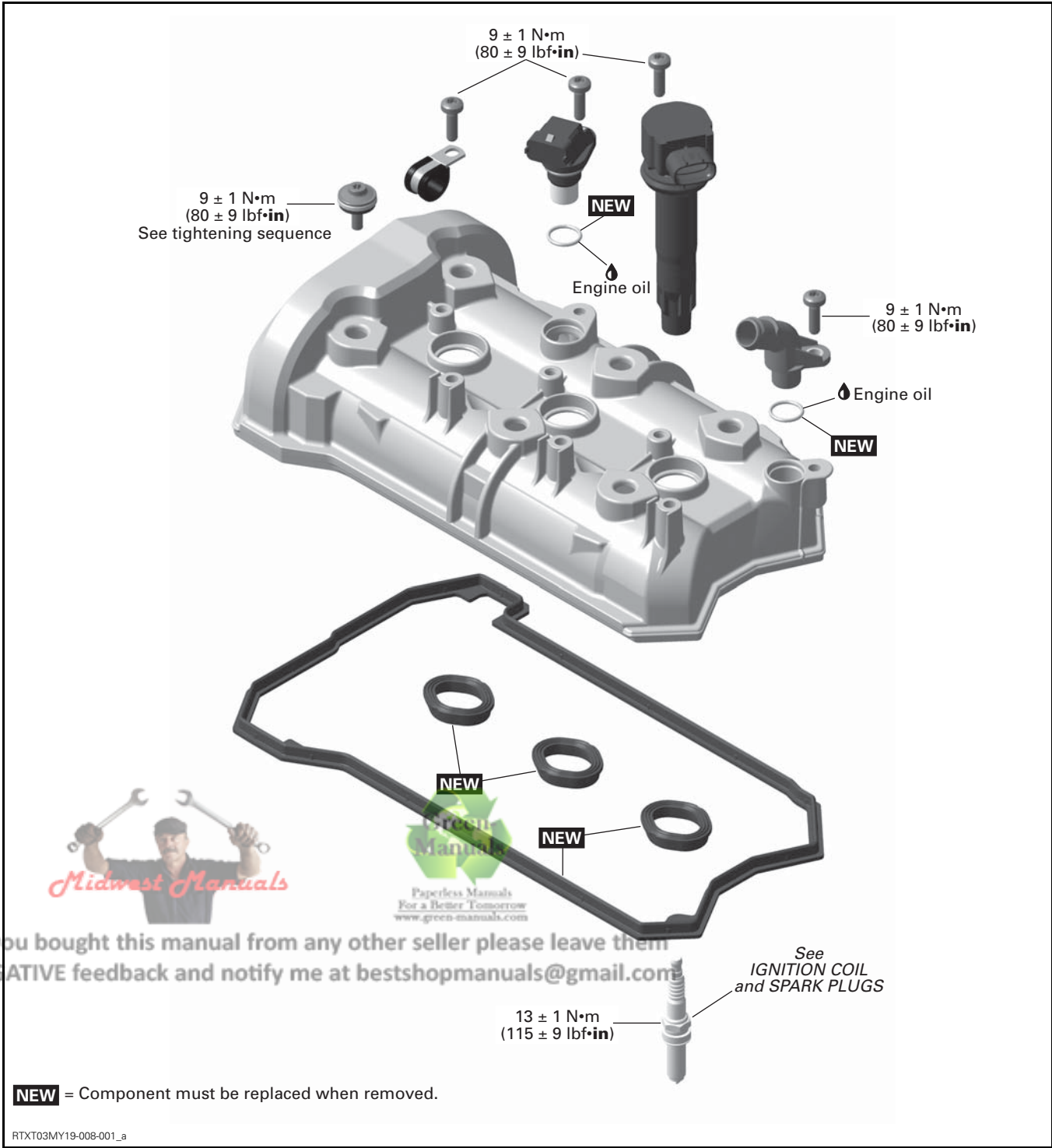
Install all other removed parts.

CYLINDER HEAD

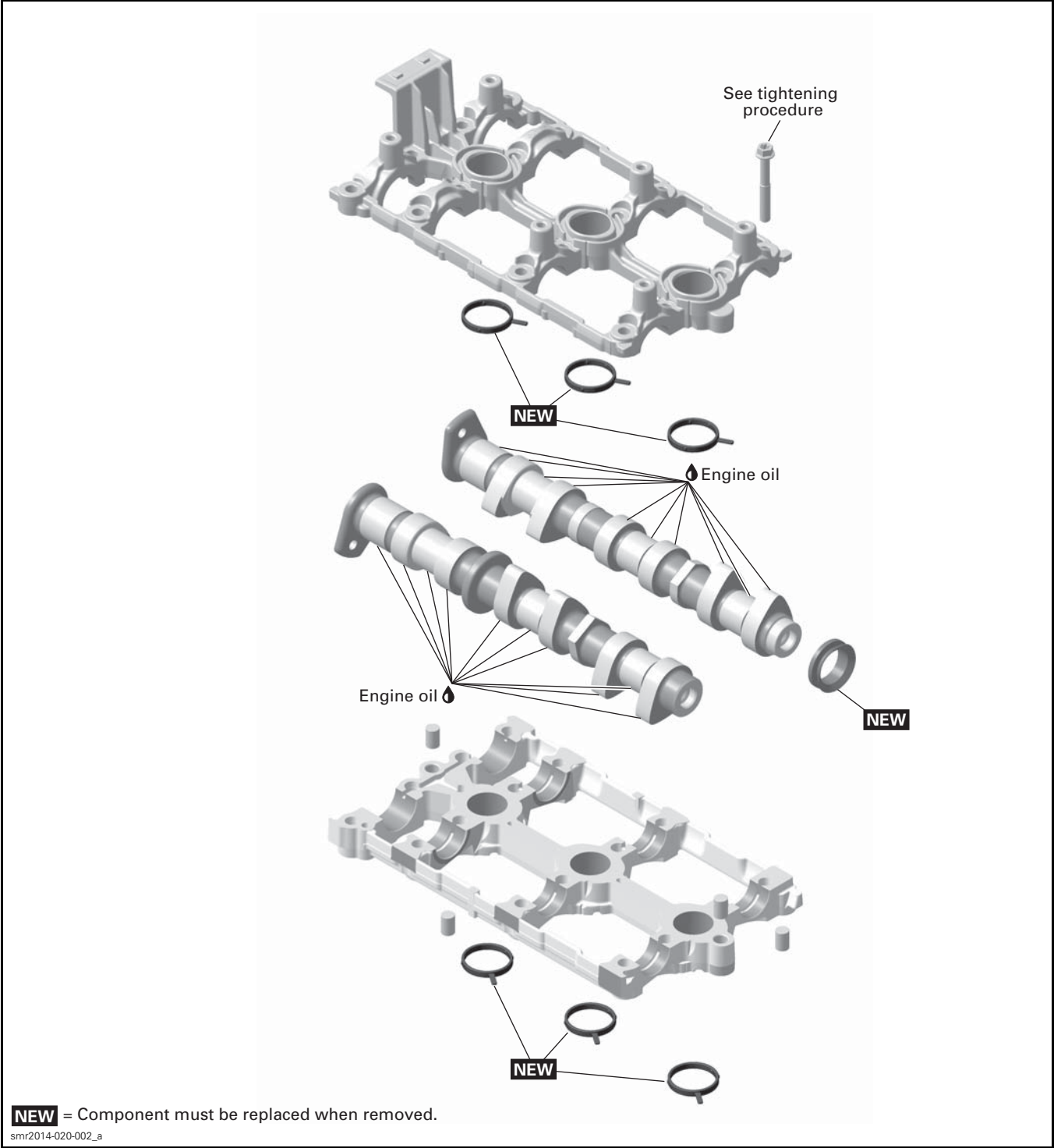
SERVICE TOOLS

Description	Part Number	Page
CAMSHAFT LOCKING TOOL.....	529 036 206	12
ENGINE LEAK DOWN TEST KIT	529 035 661	5
VALVE SPRING COMPRESSOR CUP.....	529 036 209	19
VALVE SPRING COMPRESSOR	529 035 724	19

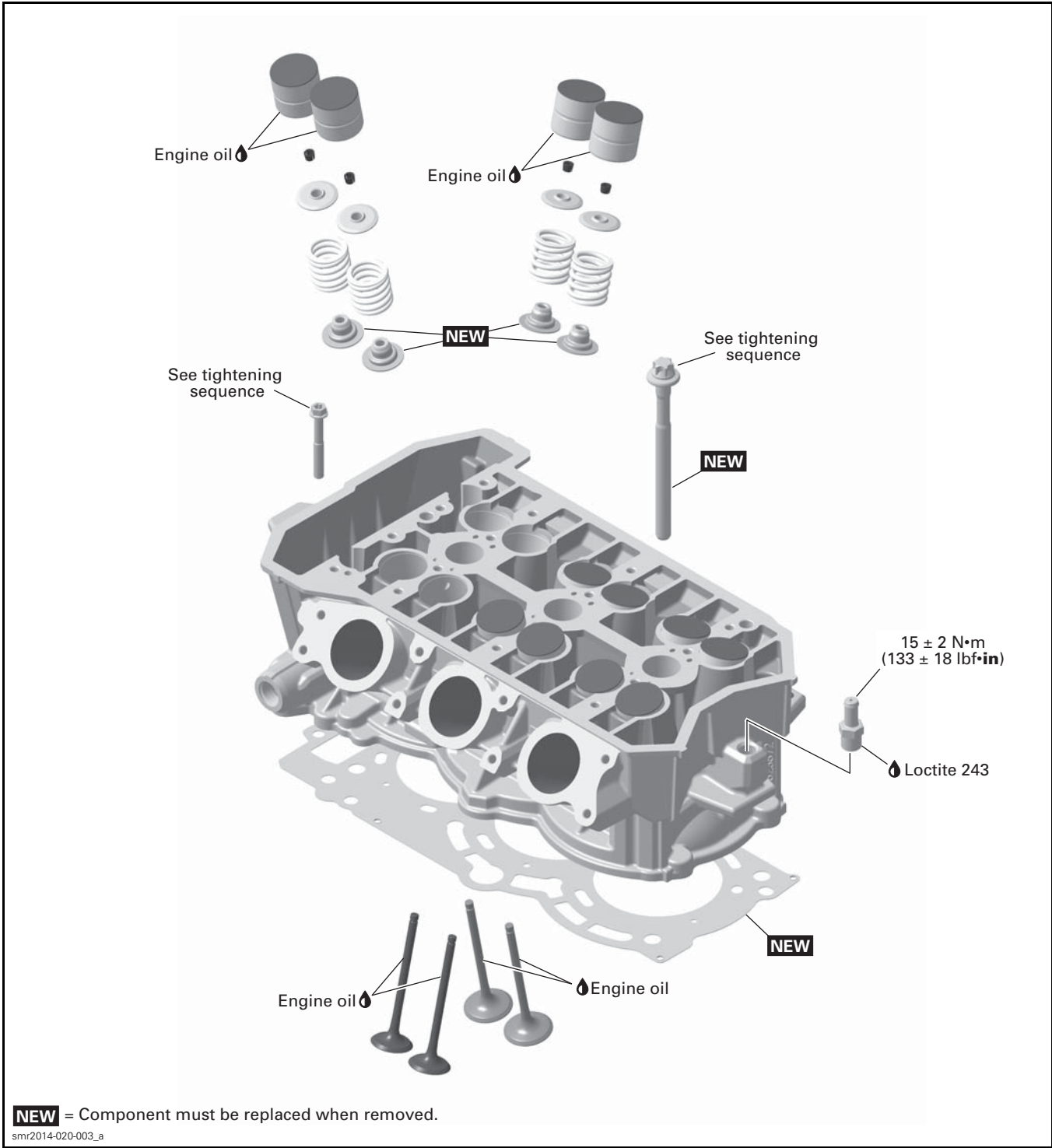
VALVE COVER



CAMSHAFTS



CYLINDER HEAD



GENERAL

NOTE: For a better understanding, some illustrations are taken with engine out of the vehicle.

Disconnect the battery before working on the engine.

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

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

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

WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices when removed (e.g.: locking tabs, cotter pin, etc.) must be replaced.

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

When disassembling parts that are duplicated in the engine, (e.g.: valves, springs, etc.), it is strongly recommended to note their position and to keep the parts of the same assembly as a "group". If you find a defective component, it will be much easier to find the cause of the failure. Since parts were break-in together during the engine operation, they will keep their matched fit when parts are reassemble together within their "group".

INSPECTION

CYLINDER LEAK TEST

General

Before performing the cylinder leak test, verify the following:

- Clamp tightness
- Hoses condition.

NOTE: For best accuracy, the leak test should be done with the engine at normal operating temperature.

CAUTION  Engine parts could be hot.

NOTE: The following steps are the same for each cylinder.

Preparation

1. Remove an ignition coil and a spark plug. Refer to *IGNITION COILS AND SPARK PLUGS* subsection.
2. Remove the *VALVE COVER*, see procedure in this subsection.
3. Using the drive pulley, turn the engine counterclockwise to bring piston to TDC of compression stroke. Use a dial gauge or a suitable tool to position the piston to TDC.

NOTE: The piston must be set precisely to TDC of compression stroke. If not, the engine will continue to rotate when pressure builds up.

Leak Test

1. Install a gauge adaptor into spark plug hole.

REQUIRED TOOL	
ENGINE LEAK DOWN TEST KIT (P/N 529 035 661)	

2. Connect the leak down tester to an adequate air supply.
3. Set gauge needle to zero.

NOTE: All testers have specific instructions on gauge operation and required pressure. Refer to manufacturer's instructions.

4. Supply combustion chamber with air pressure.
5. Note the amount or percentage of leakage (depending on tester).

LEAKAGE PERCENTAGE	ENGINE CONDITION
0% to 15%	Excellent condition
16% to 25%	Good condition
26% to 40%	Fair condition; reduced engine performance
41% and higher	Poor condition, diagnose and repair engine

Diagnosis

Listen for air leaks.

- Air escaping on intake port or throttle body means leaking intake valve(s).
- Air escaping on exhaust port means leaking exhaust valve(s).

Subsection XX (CYLINDER HEAD)

- Air bubbles out of coolant tank means leaking cylinder head gasket.
- Air or coolant escaping from cylinder head means damaged gasket or loosened screws.
- Air escaping into crankcase area means excessively worn cylinder or broken piston rings.
- Air or oil escaping from crankcase means damaged gasket or loosened screws.

Repair Tips

Blue exhaust gas means damaged or worn piston rings or valve stem seals.

White exhaust gas means damaged cylinder head gasket.

Coolant tank cap opening without overheat means damaged cylinder head gasket.

Leaking valves can be caused by carbon deposits or burnt valve face.

Assembly

Reverse the preparation procedure.

TROUBLESHOOTING

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

NOTE: When diagnosing an engine problem, always perform the cylinder leak test. This will help pinpoint a problem. Refer to *CYLINDER LEAK TEST* in this subsection.

UNUSUAL ENGINE NOISE OR VIBRATIONS

1. Discharged or defective valve lifters.
 - Check engine oil pressure, refer to *LUBRICATION SYSTEM* subsection.
 - Replace valve lifters.
2. Camshaft(s) or camshaft holder(s) worn out.
 - Check and replace damaged parts.
3. Faulty chain tensioner.
 - Replace chain tensioner. Refer to *TIMING CHAIN* subsection.
4. Chain guide(s) worn out.
 - Replace chain guide(s). Refer to *TIMING CHAIN* subsection.
5. Stretched timing chain or worn out sprockets.
 - Replace timing chain and sprockets. Refer to *TIMING CHAIN* subsection.

6. Loose timing chain gear screws.
 - Retighten screws with recommended torque.
7. Incorrect camshaft timing.
 - Replace damaged components and readjust camshaft timing.

OIL LEAKAGE FROM CYLINDER HEAD

1. Leaking valve cover gasket.
 - Replace valve cover gaskets and retighten valve cover with recommended torque.
 - Check valve cover for cracks or other damage.
2. Leaking spark plug tube O-rings.
 - Replace spark plug tube O-rings.
 - Clean spark plug area from oil spillage.
3. Blow-by connector is leaking.
 - Replace blow by connector O-ring.
4. Leaking cylinder head gasket.
 - Check cylinder head for damage.
 - Replace cylinder head gasket and retighten screws with recommended torquing procedure.

ENGINE SUDDENLY TURNS OFF OR LACKS ACCELERATION OR POWER

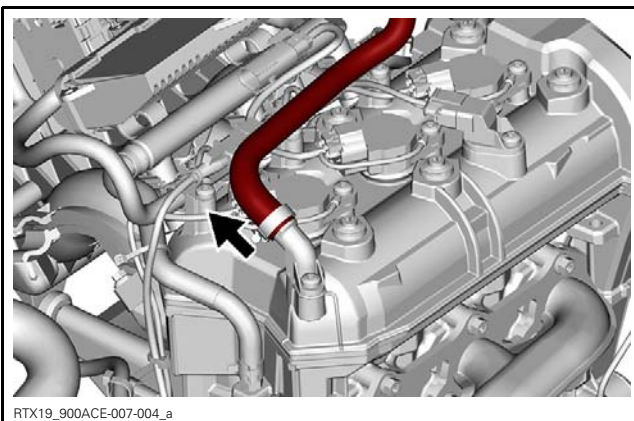
1. Incorrect camshaft timing.
 - Replace damaged components and readjust camshaft timing.
2. Leaking intake or exhaust valves.
 - Perform a *CYLINDER LEAK TEST*. Repair or replace damaged components.
3. Broken valve spring(s).
 - Replace defective parts.

PROCEDURES

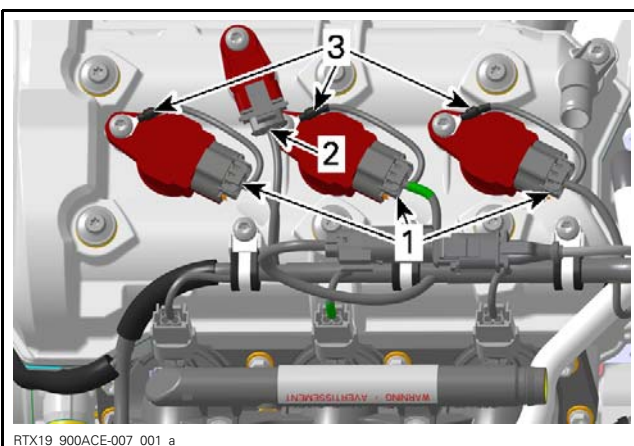
VALVE COVER

Removing the Valve Cover

1. Remove the upper body module. Refer to *BODY* subsection.
2. Remove pulley guard.
3. Remove the exhaust manifold.
4. Disconnect vent tube from the blow-by connector.

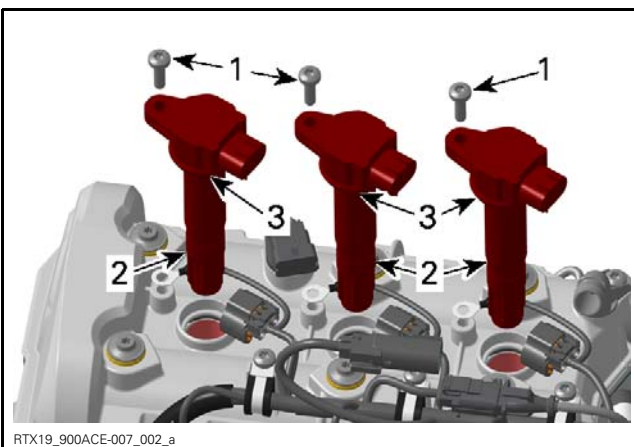


5. Unplug CAPS (camshaft position sensor).
6. Unplug ignition coils.



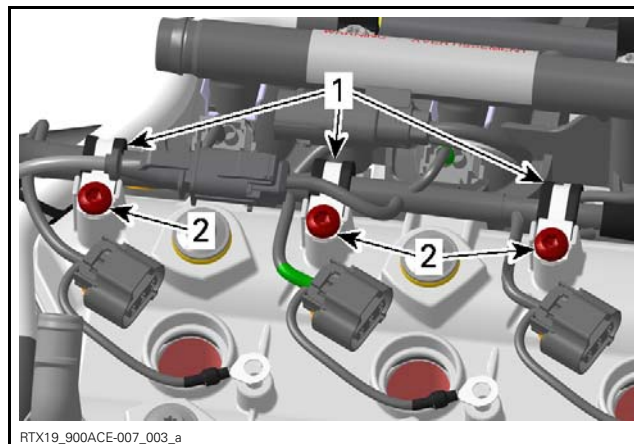
1. Ignition coil connectors
2. CAPS connector
3. Ground wires

7. Remove ignition coils with gaskets.



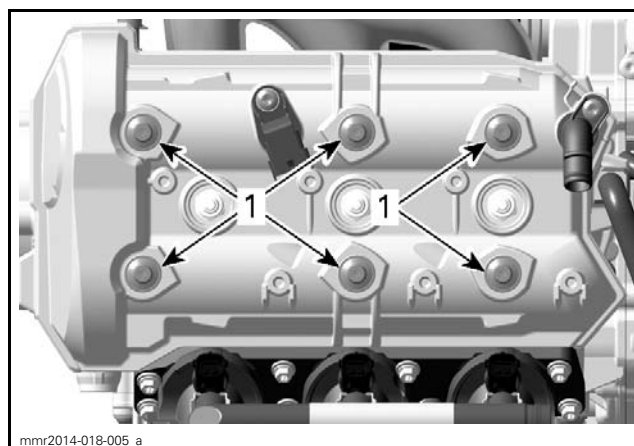
1. Retaining screws
2. Ignition coils
3. Gaskets

8. Remove screws securing the electrical harness to the valve cover.



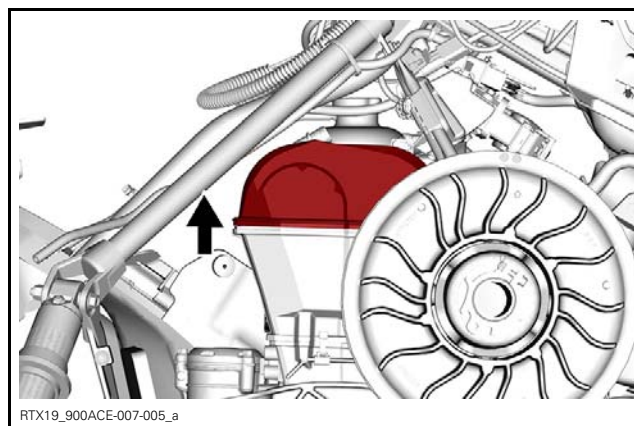
1. Cable clamps
2. Retaining screws

9. Remove valve cover retaining screws.

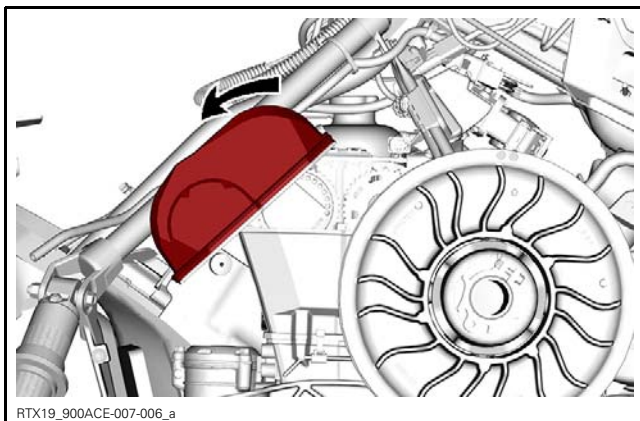


1. Valve cover screws

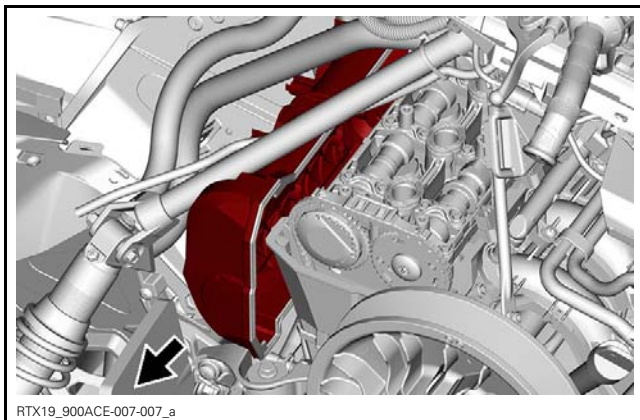
10. Lift and tilt valve cover with gasket towards front of engine.



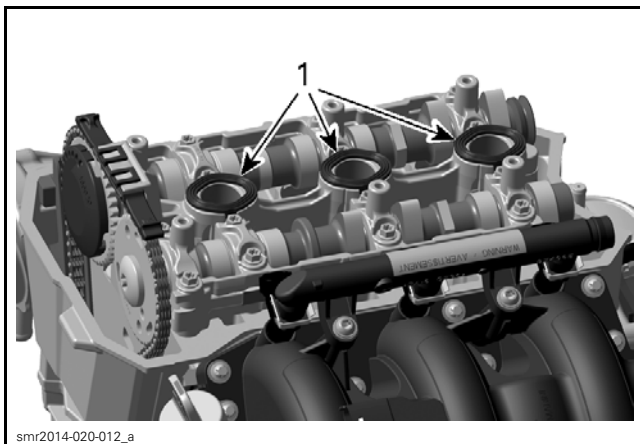
Subsection XX (CYLINDER HEAD)



11. Pull valve cover and gasket out through LH side of vehicle.



12. Remove the small valve cover gaskets (spark plug holes).



1. Small gaskets

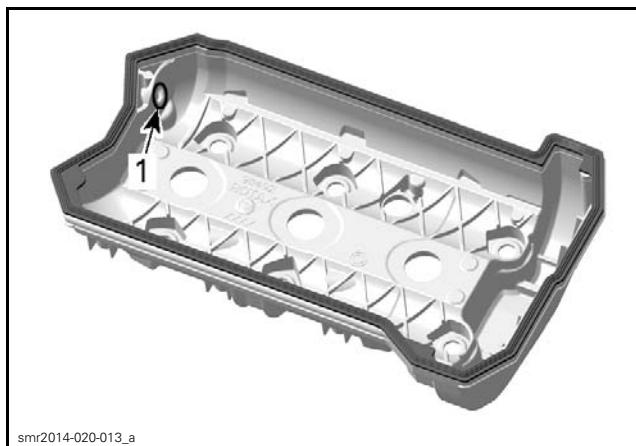
Inspecting the Valve Cover

Check the valve cover for cracks or other damage. Replace defective parts.

Installing the Valve Cover

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

1. Properly fit the **NEW** small gaskets into the camshaft holder grooves.
2. Properly lay the **NEW** large gasket onto the cylinder head flat surface.
3. Apply engine oil to the sealing surface of the V-ring.



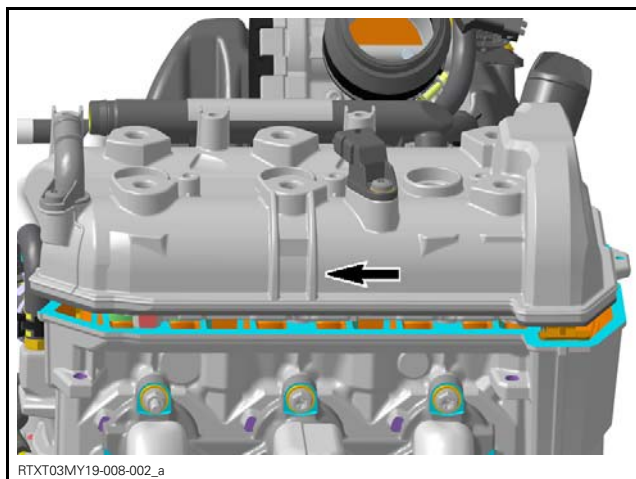
INSIDE VALVE COVER

1. Apply engine oil here

4. Install valve cover.

NOTICE Adhere to the following procedure, otherwise damage to the V-ring will occur causing crankcase venting malfunction.

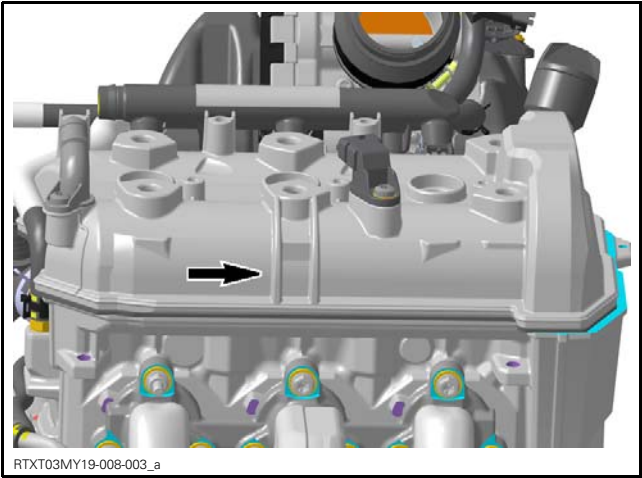
- 4.1 Move the valve cover towards the MAG side.



- 4.2 Put valve cover onto cylinder head.

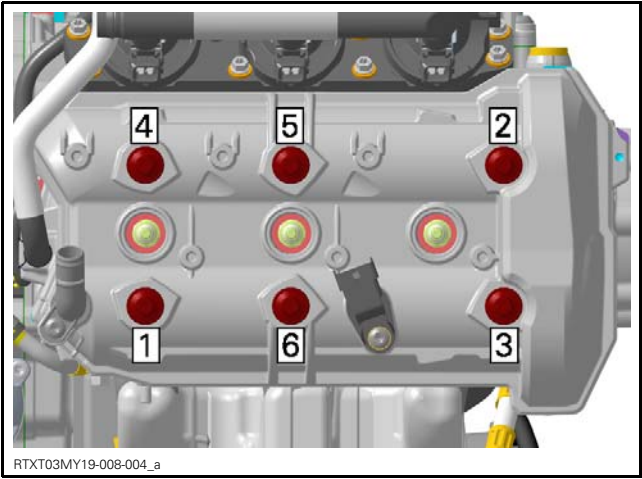
NOTICE Make sure the valve cover gasket is well positioned in the cover groove.

4.3 Push valve cover towards the PTO side to ensure that the V-ring properly seals on sealing surface inside the cover.



5. Install valve cover screws and tighten as per following sequence:

TIGHTENING TORQUE		
Valve cover screw	Step A	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)
	Step B	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



TIGHTENING SEQUENCE

CAMSHAFTS

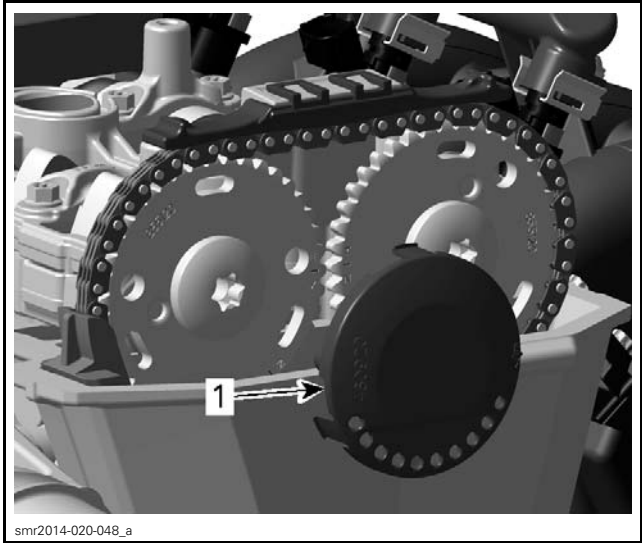
Removing the Camshaft

1. Remove *VALVE COVER*, see procedure in this subsection.
2. Lock crankshaft, refer to *CRANKSHAFT LOCKING PROCEDURE* in the *CYLINDER BLOCK* subsection.

Remove timing chain tensioner. Refer to *TIMING CHAIN* subsection.

3. Remove:

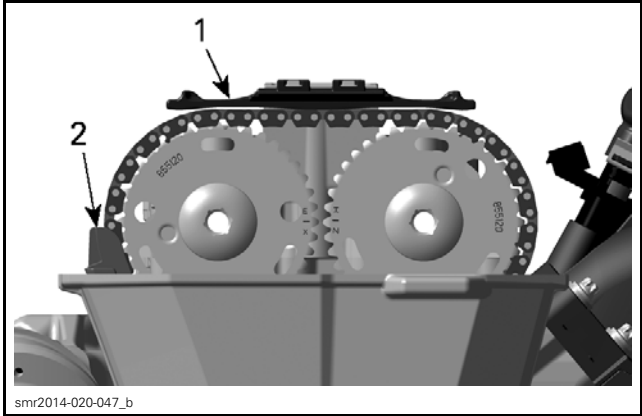
3.1 Breather cover



1. Breather cover

3.2 Upper timing chain guide

3.3 Timing chain guide.

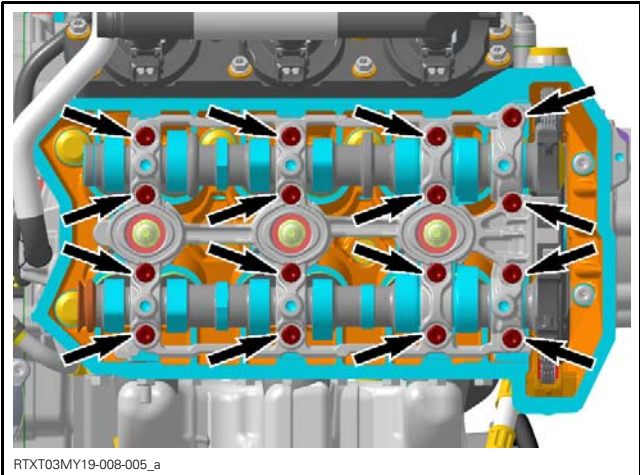


1. Upper timing chain guide
2. Timing chain guide

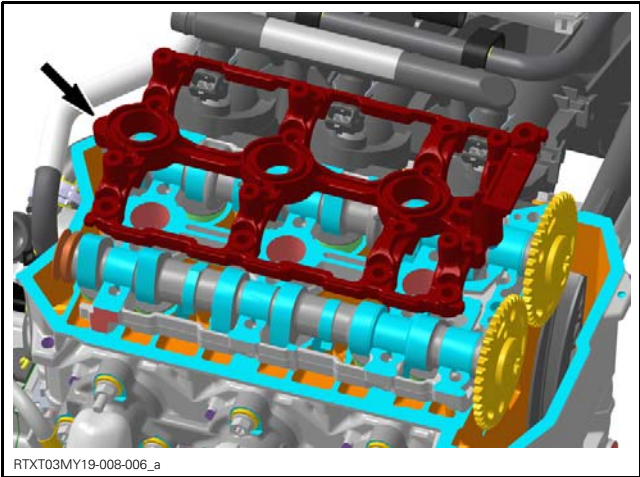
4. Remove timing chain from camshaft timing gears.

5. Remove camshaft holder retaining screws (x16).

Subsection XX (CYLINDER HEAD)

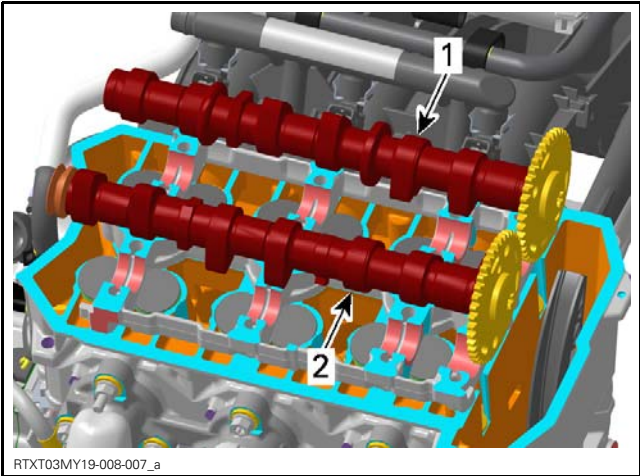


6. Remove the camshaft holder upper half.



7. Put timing chain aside.

8. Remove camshafts with timing gears.

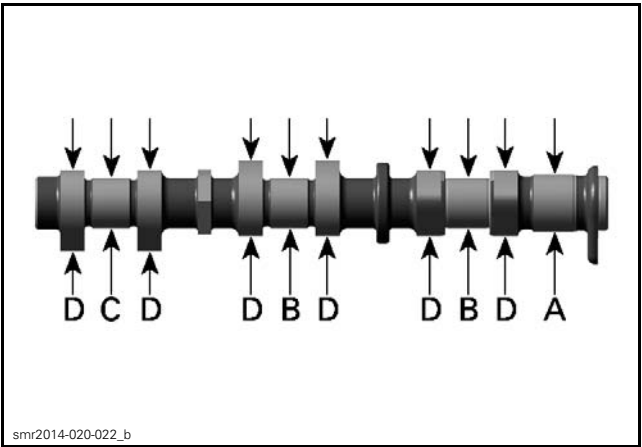


1. Intake camshaft
2. Exhaust camshaft

9. Remove camshaft timing gears only if necessary. Refer to *TIMING CHAIN* subsection.

Inspecting the Camshaft

1. Check each lobe and bearing journal for scoring, scuffing, cracks, or other signs of wear.
2. Check V-ring if it is brittle, hard or otherwise damaged.
3. Measure camshaft bearing journal diameter and lobe height, using a micrometer.



A. Camshaft journal (PTO)
B. Camshaft journal (center)
C. Camshaft journal (MAG)
D. Camshaft lobes

CAMSHAFT JOURNAL DIAMETER		
PTO journal (A)	New	25.967 mm to 25.980 mm (1.0223 in to 1.0228 in)
	Service limit	25.940 mm (1.0213 in)
Center journals (B)	New	22.957 mm to 22.970 mm (.9038 in to .9043 in)
	Service limit	22.930 mm (.9028 in)
MAG journal (C)	New	22.967 mm to 22.980 mm (.9042 in to .9047 in)
	Service limit	22.940 mm (.9031 in)

CAMSHAFT LOBE HEIGHT		
Exhaust and Intake Camshaft (D)	New	37.40 mm to 37.60 mm (1.472 in to 1.48 in)
	Service limit	38.38 mm (1.511 in)

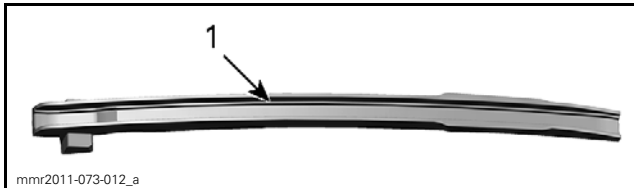
Replace parts if necessary.

For camshaft journal radial clearance and camshaft holder bearing diameter refer to *CAMSHAFT HOLDER* in this subsection.

4. Check timing chain guide for wear, cracks or deformation. Replace as required.

5. Replace timing chain guide if any groove caused by timing chain exceeds service limit.

CHAIN GUIDE GROOVE DEPTH	
SERVICE LIMIT	1 mm (.039 in)

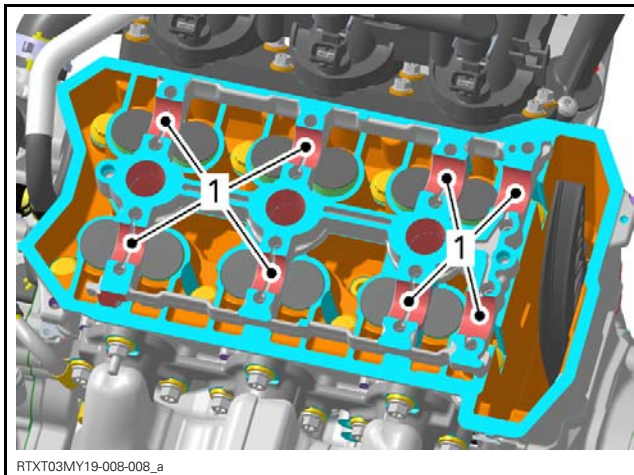


1. Timing chain guide

Installing the Camshaft

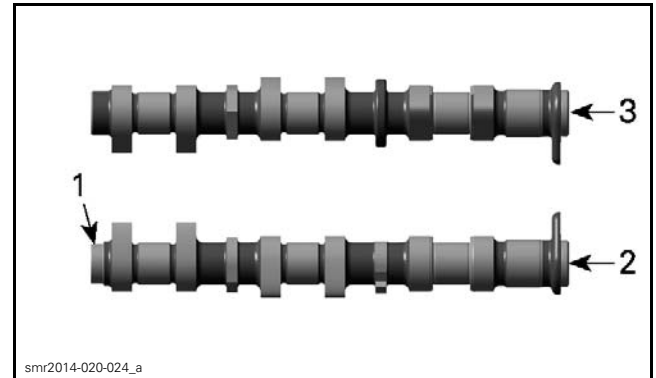
The assembly is the reverse of the removal procedure. However pay attention to the following details.

1. Ensure crankshaft is still locked.
2. Apply engine oil on camshaft bearings.



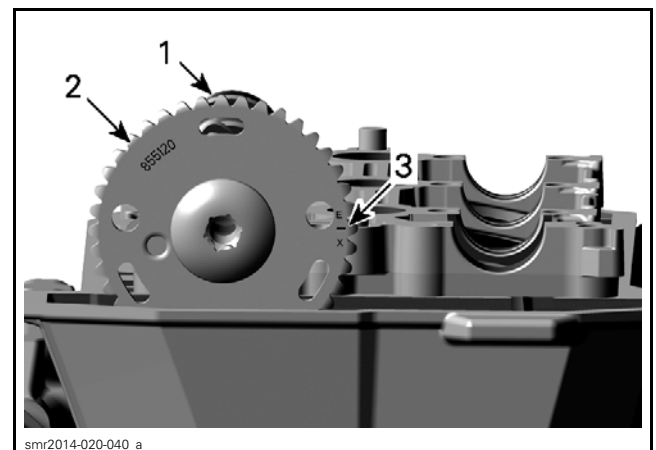
1. Areas where to apply engine oil

NOTE: The camshafts are not identical. Any mix-up of the components would lead to engine damage. The exhaust camshaft has a machined area on MAG side for the V-ring.



1. Machined area
2. Exhaust camshaft
3. Intake camshaft

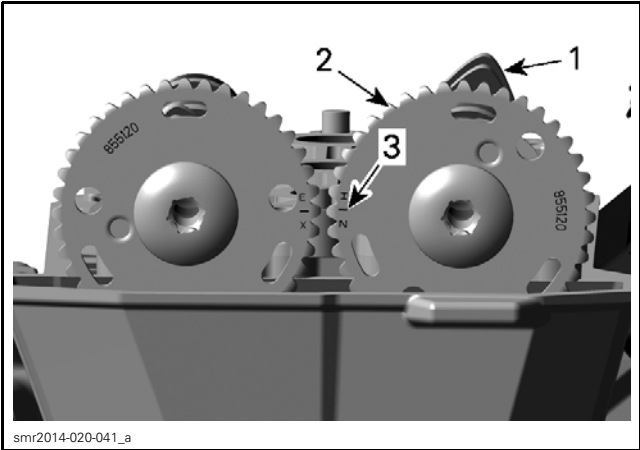
3. If removed, reinstall camshaft timing gears on camshafts. Refer to *CAMSHAFT TIMING GEARS* in the *TIMING CHAIN* subsection.
4. Apply engine oil on camshaft journal diameter.
5. Install exhaust camshaft assembly with mark "EX" parallel to cylinder head gasket.



1. Exhaust camshaft
2. Camshaft timing gear
3. Mark "EX"

6. Install intake camshaft assembly with mark "IN" parallel to cylinder head gasket.

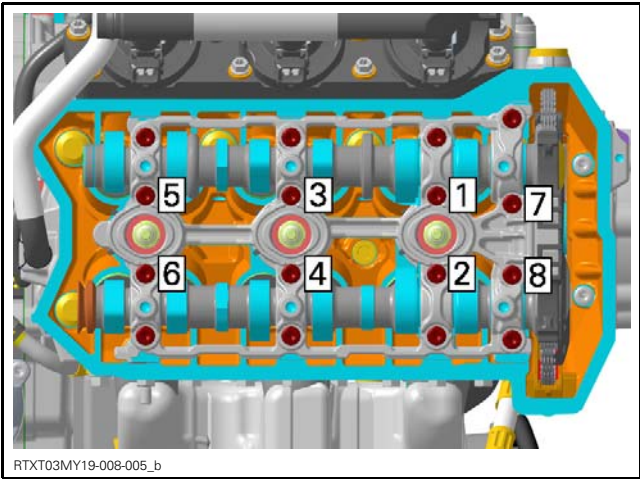
Subsection XX (CYLINDER HEAD)



- 1. Intake camshaft
- 2. Camshaft timing gear
- 3. Mark "IN"

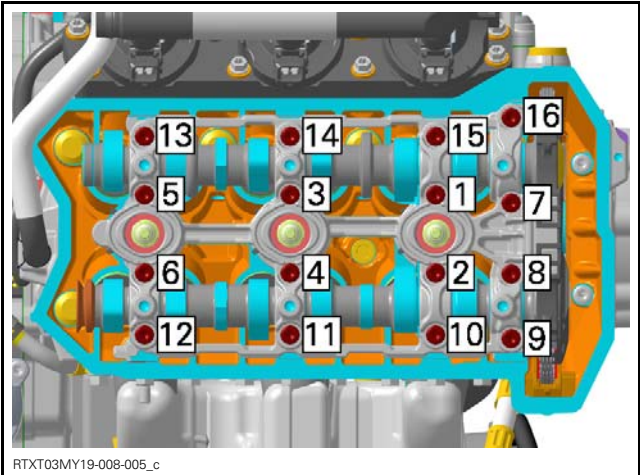
7. Install the camshaft holder upper half, then tighten screws as per following sequence:

TIGHTENING TORQUE		
Camshaft holder	Step A	5 N•m ± 0.5 N•m (44 lbf•in ± 4 lbf•in)



CAMSHAFT HOLDER TIGHTENING SEQUENCE - STEP A

TIGHTENING TORQUE		
Camshaft holder	Step B	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

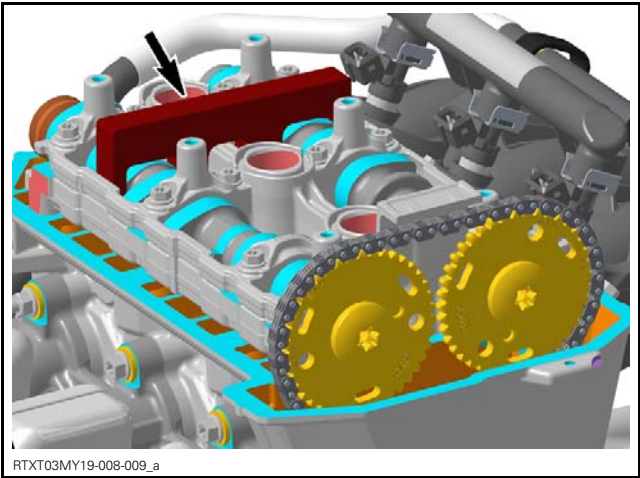


CAMSHAFT HOLDER TIGHTENING SEQUENCE - STEP B

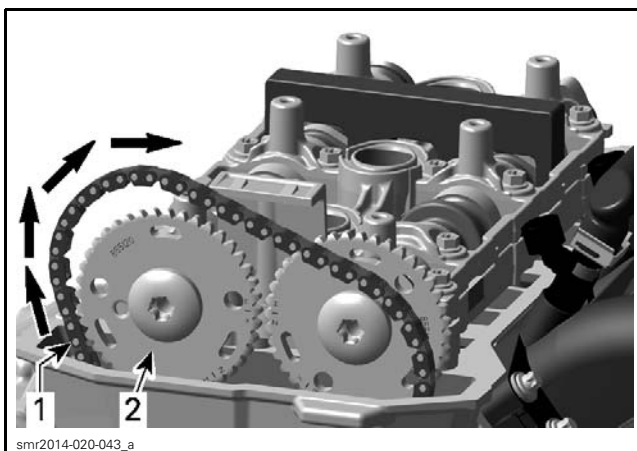
NOTE: After the reassembly of the camshafts is completed, check if camshafts can be turned easily.

8. Lock camshafts.

REQUIRED TOOL	
CAMSHAFT LOCKING TOOL (P/N 529 036 206)	

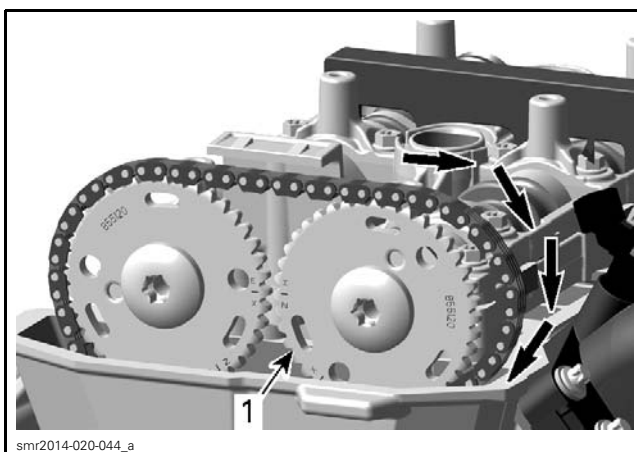


- 9. Lift timing chain out of timing chain compartment.
- 10. Pull timing chain up on exhaust side and install it on the exhaust camshaft timing gear.



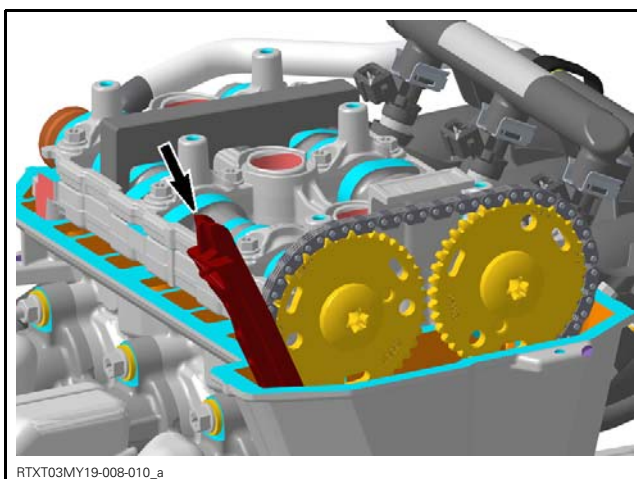
1. Timing chain
2. Exhaust camshaft timing gear

11. Pull timing chain towards intake side and install it on the intake camshaft timing gear.

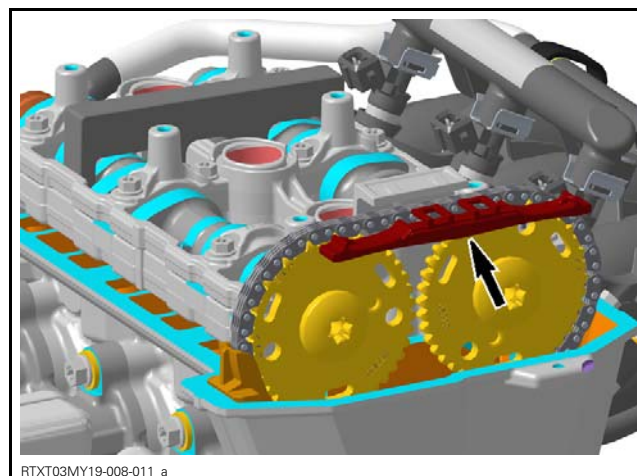


1. Intake camshaft timing gear

12. Install timing chain guide.



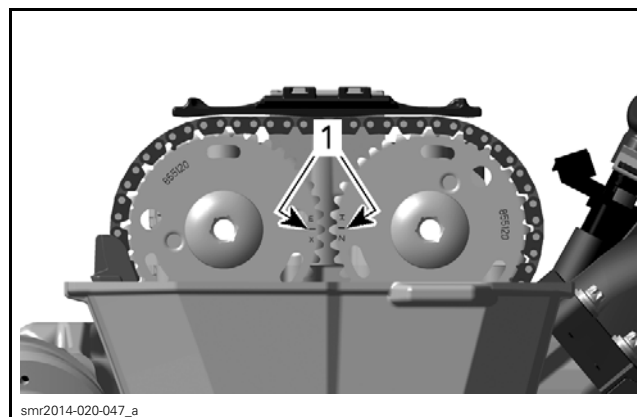
13. Install upper timing chain guide on camshaft holder.



14. Install *TIMING CHAIN TENSIONER*, refer to *TIMING CHAIN* subsection.

15. Ensure marks on camshaft timing gears are still aligned. If not, repeat procedure.

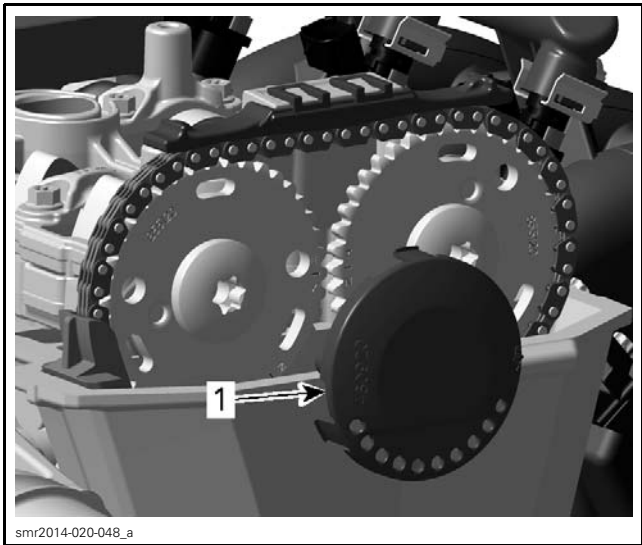
NOTICE After installation of timing chain tensioner, the marks "IN" on intake and "EX" on exhaust camshafts must be aligned.



CAMSHAFT TIMING GEARS

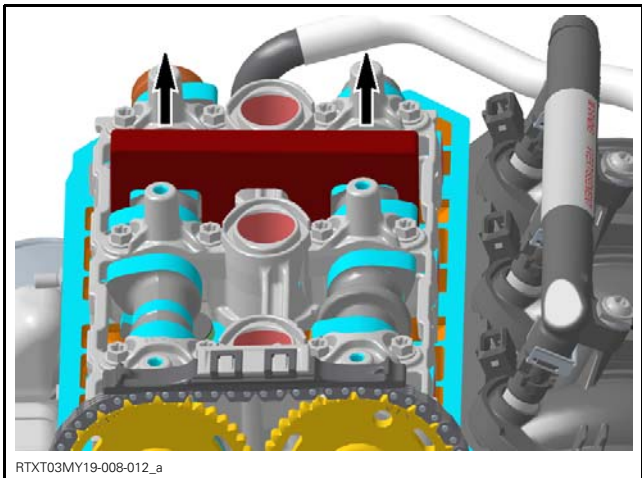
1. Marks must be aligned

16. Install breather cover.



1. Breather cover

17. Remove camshaft locking tool.



1. Camshaft locking tool removal

18. Remove crankshaft locking tool.

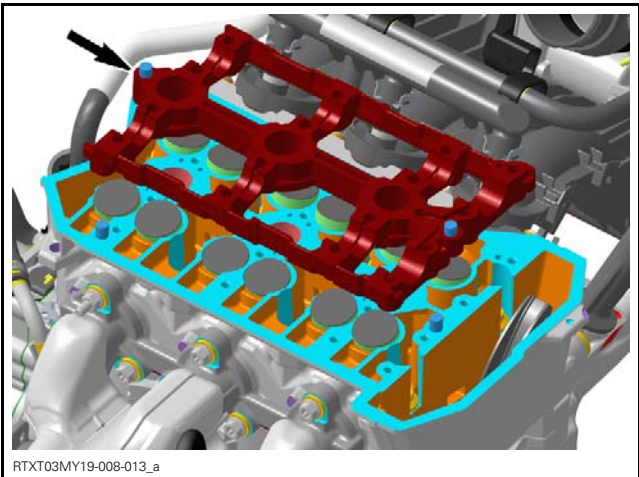
CAMSHAFT HOLDER

Removing the Camshaft Holder

Remove camshafts, see procedure in this subsection.

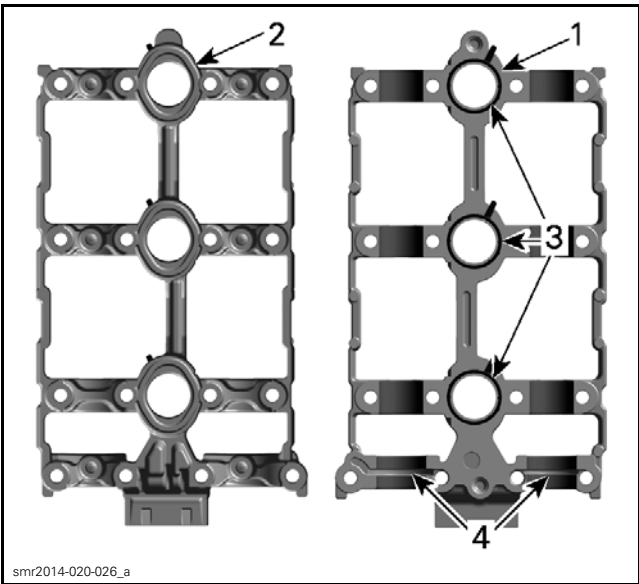
Remove the camshaft holder lower half with gaskets from cylinder head.

Remove and discard gaskets from camshaft holder halves.

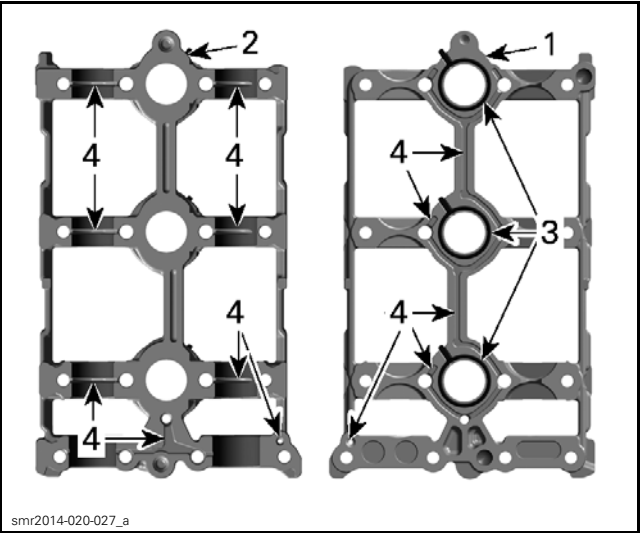


Inspecting the Camshaft Holder

1. Check camshaft holder for scoring, scuffing, cracks, or other signs of wear.
2. Make sure oil orifices are not clogged. Blow them out with pressurized air.

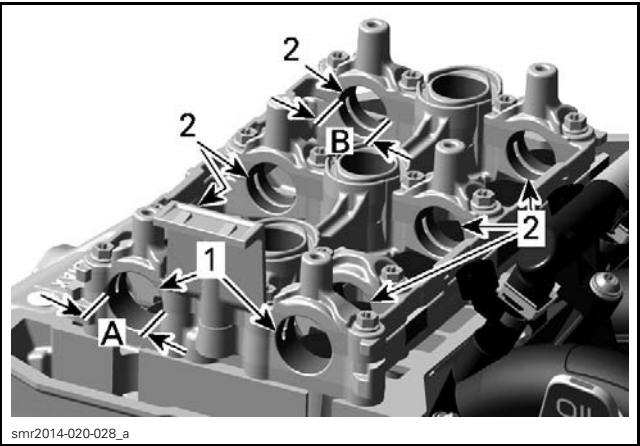


1. Camshaft holder upper half - view from beneath
2. Camshaft holder upper half - view from above
3. Gaskets
4. Oil orifices



1. Camshaft holder lower half - view from beneath
2. Camshaft holder lower half - view from above
3. Gaskets
4. Oil orifices

Install camshaft holder on cylinder head.
Tighten camshaft holder screws to specification, refer to *INSTALLING THE CAMSHAFT* in this subsection.
Measure camshaft holder bearing diameter.



CAMSHAFT HOLDER BEARINGS
1. PTO bearings
2. Center and MAG bearings
A. Diameter PTO bearing
B. Diameter center and MAG bearing

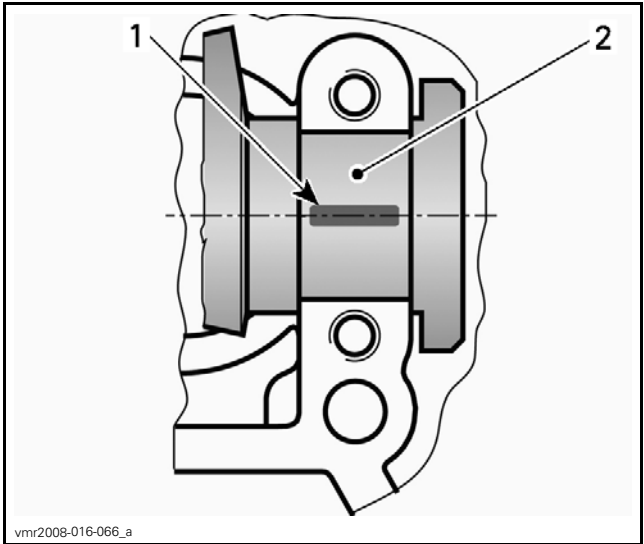
CAMSHAFT HOLDER BEARING DIAMETER		
PTO bearing	New	26.000 mm to 26.021 mm (1.024 in to 1.024 in)
	Service limit	26.050 mm (1.026 in)
Center and MAG bearings	New	23.000 mm to 23.021 mm (.906 in to .906 in)
	Service limit	23.050 mm (.907 in)

Measure clearance between camshaft journals and camshaft holder, using the plastic feeler gauge.

NOTE: The plastic feeler gauge is available at automotive parts retailer.

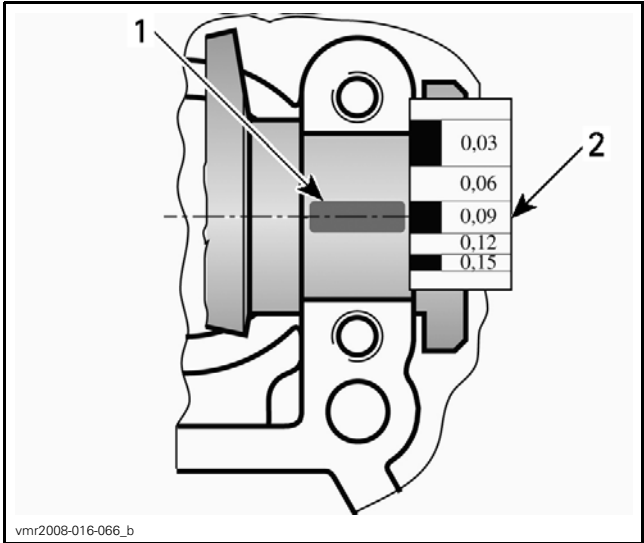
Install camshaft holder lower half on cylinder head.

Place the camshafts in the camshaft holder lower half and apply a plastic-gauge on the camshaft bearing journal.



TYPICAL
1. Plastic gauge
2. Camshaft bearing journal

Install camshaft holder upper half in the proper position and tighten screws to specification, refer to *INSTALLING THE CAMSHAFT* in this subsection.
Unfasten camshaft holder.
Measure the maximum width of the pressed plastic gauge with the corresponding graduated scale.



TYPICAL
1. Pressed plastic gauge
2. Graduated scale

CAMSHAFT JOURNAL RADIAL CLEARANCE		
PTO AND MAG BEARING	New	0.020 mm to 0.054 mm (.001 in to .002 in)
	Service limit	0.080 mm (.003 in)
CENTER BEARING	New	0.03 mm to 0.064 mm (.001 in to .003 in)
	Service limit	0.090 mm (.004 in)

Replace parts if necessary.

Installing the Camshaft Holder

Install camshaft holder lower half.

Continue procedure as explained in *INSTALLING THE CAMSHAFT* in this subsection.

HYDRAULIC VALVE LIFTERS

Removing the Hydraulic Valve Lifter

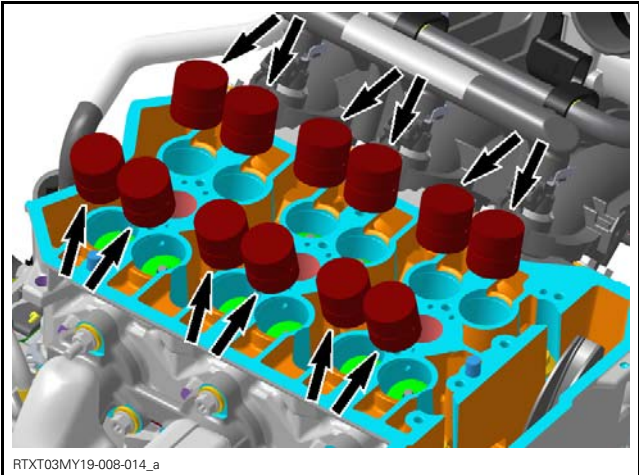
NOTE: Hydraulic valve lifter are maintenance free.

See procedures in this subsection to remove:

- Valve cover
- Camshafts
- Camshaft holder.

Pull hydraulic valve lifter off the cylinder head.

NOTE: When disassembling the hydraulic valve lifter, it is strongly recommended to note their original position.



Inspecting the Hydraulic Valve Lifter

1. Check surface of hydraulic valve lifter for scoring or other damage.
2. Measure valve lifter diameter. Replace if out of specification.

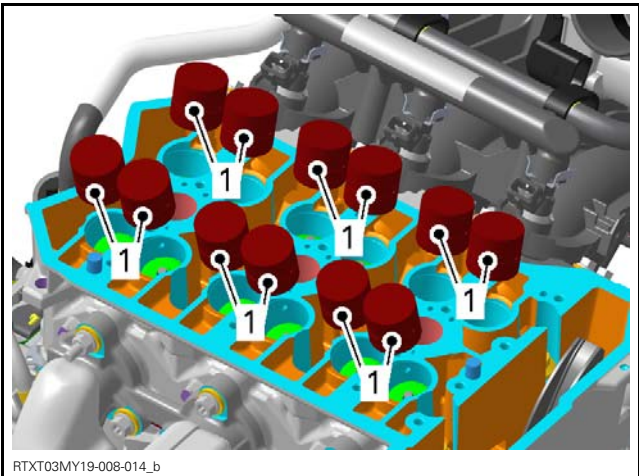
HYDRAULIC VALVE LIFTER	
New	28.354 mm to 28.370 mm (1.1163 in to 1.1169 in)
Service limit	28.340 mm (1.1157 in)

HYDRAULIC VALVE LIFTER RADIAL CLEARANCE	
Service limit	0.100 mm (.0039 in)

Installing the Hydraulic Valve Lifter

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

1. Apply engine oil on the outside diameter of the hydraulic valve lifter.

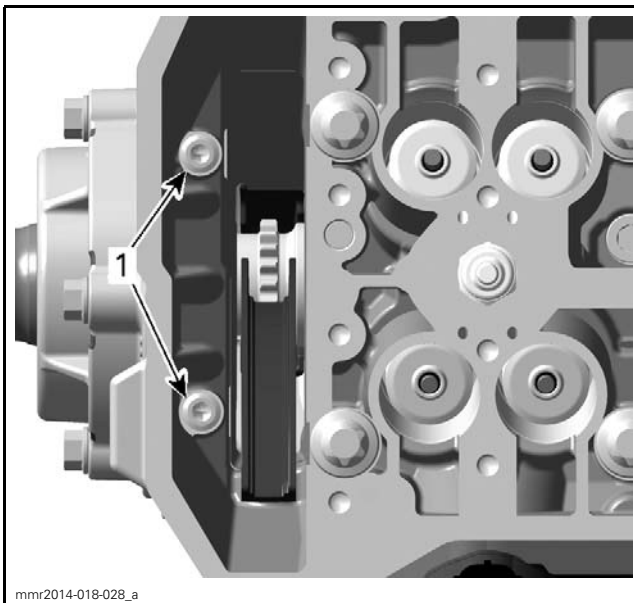


1. Apply engine oil on outer diameter

CYLINDER HEAD

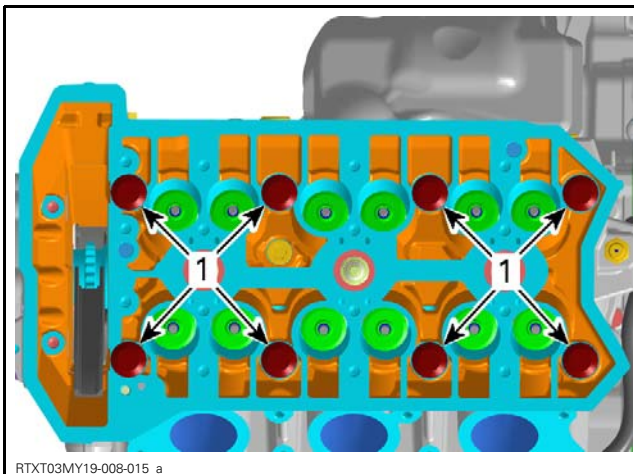
Removing the Cylinder Head

1. Remove the engine from the vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
2. Remove the following components, see procedures in this subsection.
 - Valve cover
 - Camshafts
 - Camshaft holder
 - Hydraulic valve lifters.
3. Remove M6 cylinder head screws.



1. Remove M6 cylinder head screws

4. Remove and discard M9 cylinder head screws.

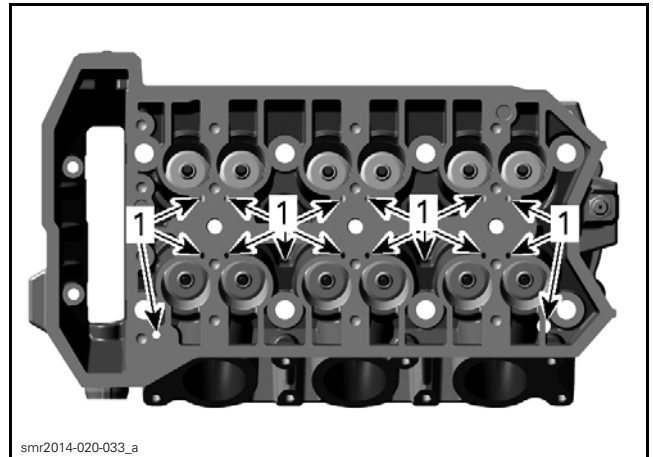


1. Remove M9 cylinder head screws

5. Pull cylinder head off the cylinder block.
6. Remove and discard cylinder head gasket.

Cleaning the Cylinder Head

1. Remove carbon deposits from combustion chambers, exhaust ports and piston tops.
2. Clean cylinder head, especially cylinder head screw surface from oil spillage.
3. Blow out the oil orifices with pressurized air and make sure they are not clogged.



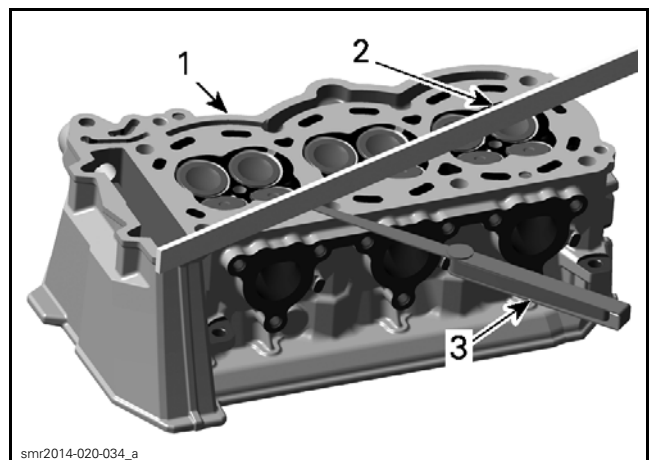
1. Oil orifices

Inspecting the Cylinder Head

Check for cracks between valve seats or other damage, if so, replace cylinder head.

Check cylinder head mating surface for flatness using a straight edge.

Check hydraulic valve lifter bores for scoring or other damage, if so, replace cylinder head.


1. Cylinder head
2. Straight edge
3. Feeler gauge

Check cylinder head warpage.

Subsection XX (CYLINDER HEAD)

CYLINDER HEAD WARPAGE	
SERVICE LIMIT	0.15 mm (.0059 in)

If warpage exceeds specification, resurface the cylinder head as follows.

Use a 400 - 600 grit wet sandpaper on a surface plate and gently grind off the mating surface.

NOTE: To ensure an even surface, rotate cylinder head several times during resurfacing.

Replace cylinder head, if resurfacing fails.

Installing the Cylinder Head

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

1. Install a **NEW** cylinder head gasket.

NOTICE Each installation of the cylinder head requires a **NEW** cylinder head gasket. Using a gasket twice would cause engine damage.

2. Install cylinder head on the cylinder block.

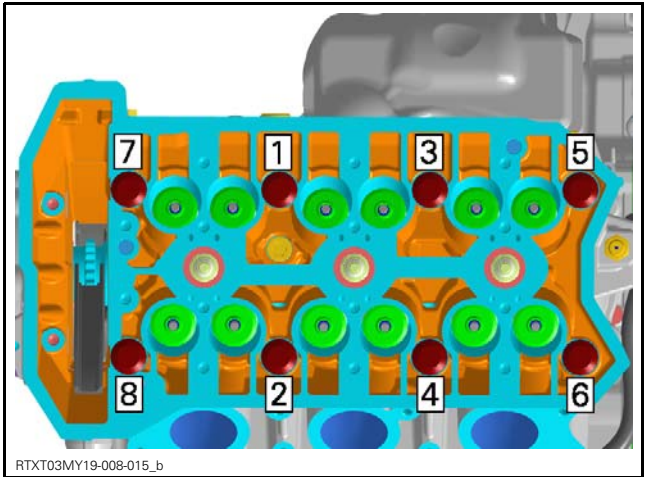
3. Install **NEW** M9 cylinder head screws.

NOTICE This assembly uses stretch screws. Always use **NEW** screws and strictly adhere to the tightening procedure.

4. Tighten cylinder head screws as follows:

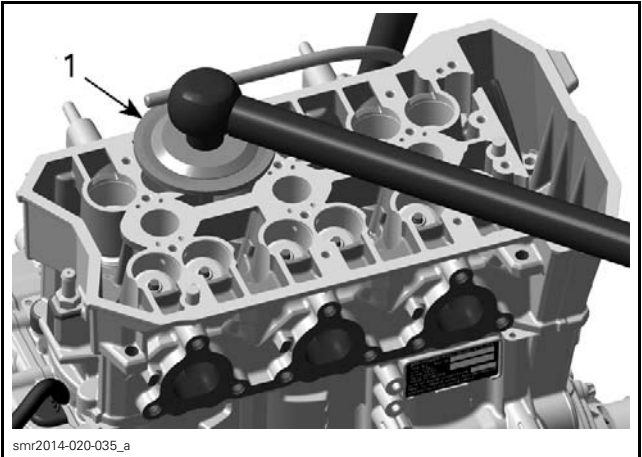
NOTE: Always perform step A on all M9 cylinder head screws before going to the step B.

TIGHTENING PROCEDURE		
Cylinder head M9 screws	Step A	20 N•m ± 2 N•m (15 lbf•ft ± 1 lbf•ft)
	Step B	Additional 150° ± 5°



M9 SCREWS TIGHTENING SEQUENCE

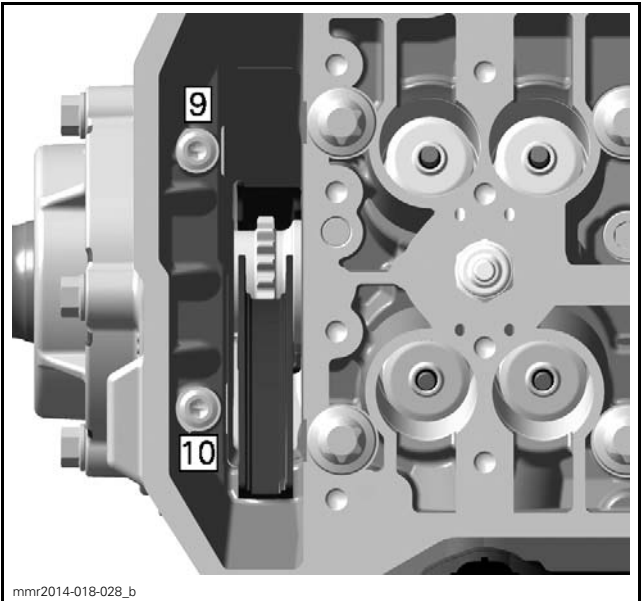
NOTE: Use a torque angle gauge to carry out the step B.



1. Torque angle gauge

5. Install M6 screws. Tighten as follows.

TIGHTENING TORQUE	
Cylinder head M6 screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)



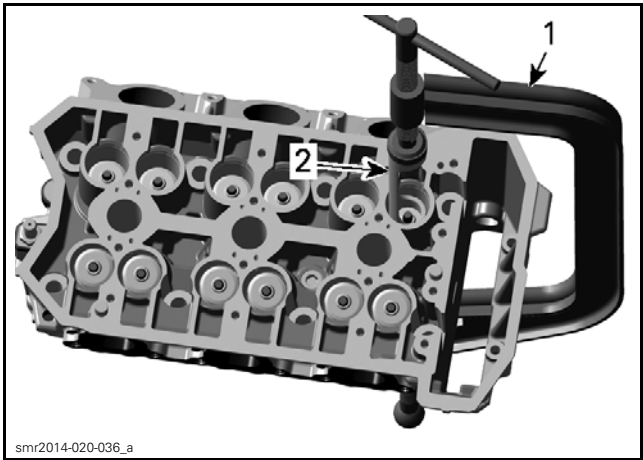
M6 SCREWS TIGHTENING SEQUENCE

VALVE SPRINGS

Removing the Valve Spring

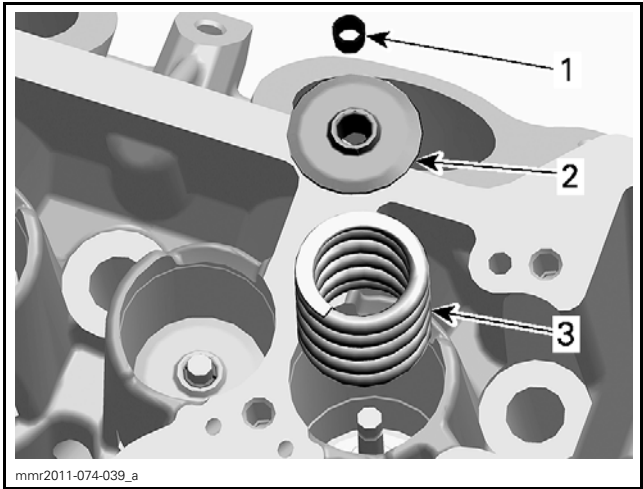
1. Remove *CYLINDER HEAD*, see procedure in this subsection.
2. Compress valve spring.

REQUIRED TOOLS	
VALVE SPRING COMPRESSOR (P/N 529 035 724)	
VALVE SPRING COMPRESSOR CUP (P/N 529 036 209)	



1. Valve spring compressor clamp
2. Valve spring compressor cup

3. Remove valve cotters.
4. Withdraw valve spring compressor tools.
5. Remove valve spring retainer and valve spring.

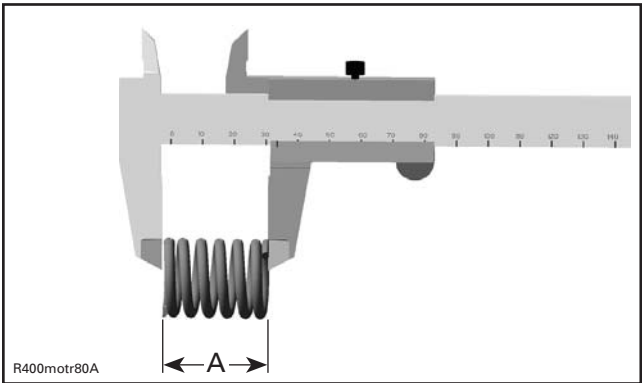


1. Valve cotters
2. Valve spring retainer
3. Valve spring

NOTE: Identify the position of each part very carefully, so it can be reinstalled in its original place.

Inspecting the Valve Spring

1. Check valve spring for rust, corrosion or other visible damage.
2. Check valve spring free length and straightness.



A. Spring free length

VALVE SPRING FREE LENGTH	
New	31.35 mm (1.2343 in)
Service limit	29.50 mm (1.1614 in)

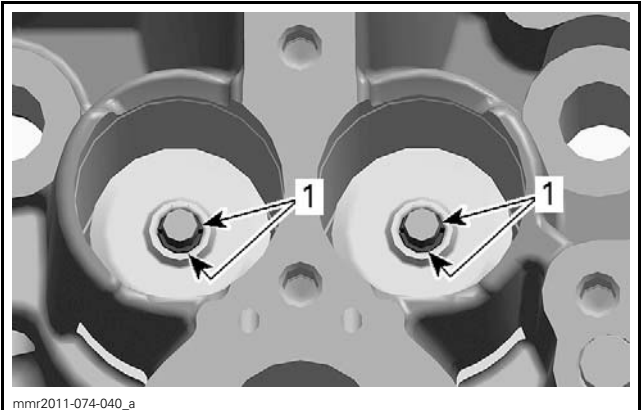
Replace valve spring, if out of specification.

Installing the Valve Spring

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

NOTE: Ensure to reinstall all parts in their original position as marked during removal.

1. Apply some grease on valve cotters, so that they remain in place while releasing the valve spring.
2. Make sure valve cotters are properly engaged into valve stem groove.



1. Valve cotters

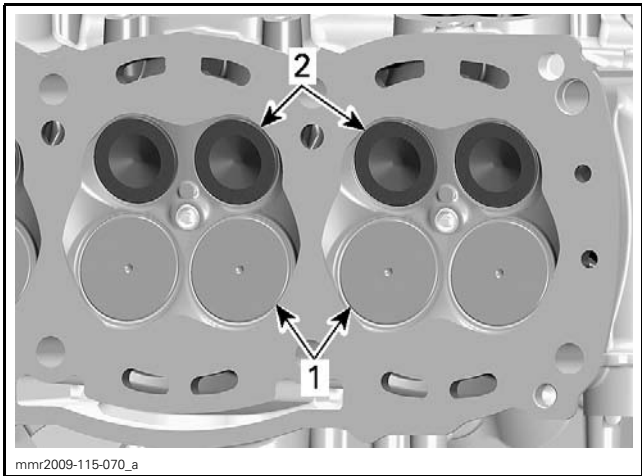
3. After spring is installed, ensure it is properly locked by lightly tapping on valve stem end with a soft punch and a hammer so that valve opens and closes a few times.

NOTICE Improperly locked valve spring will cause severe engine damage and hitting the valve stem end with excessive force could damage the valve.

VALVES

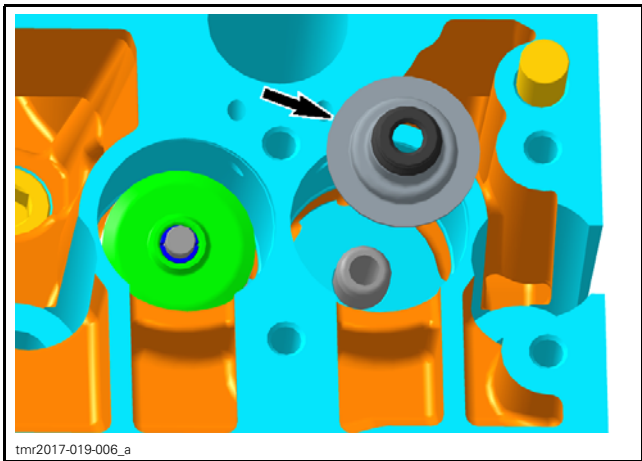
Removing the Valve

- 1. Remove *VALVE SPRING*, see procedure in this subsection.
- 2. Push on the valve stem, then pull valves out of cylinder head.



- 1. Intake valves 29 mm
- 2. Exhaust valves 25 mm

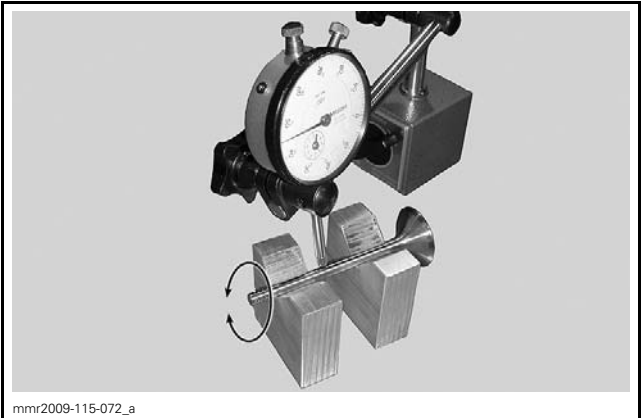
- 3. Remove and discard valve stem seal. Use a valve stem seal pliers available in automotive parts retailers.



NOTE: Identify the position of each part very carefully, so it can be reinstalled in its original place.

Inspecting the Valve

Inspect valve surface, check for abnormal stem wear and bending.

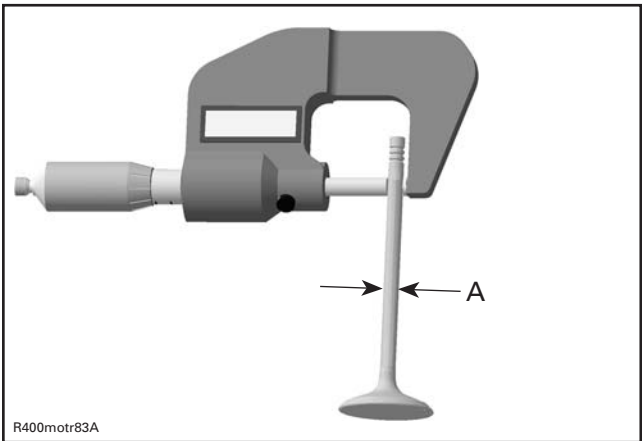


VALVE OUT OF ROUND INTAKE AND EXHAUST VALVE	
New	0.005 mm (.0002 in)
Service limit	0.060 mm (.0024 in)

Replace valve if out of specification.

Valve Stem and Valve Guide Clearance

- 1. Measure valve stem at three places, using a micrometer.

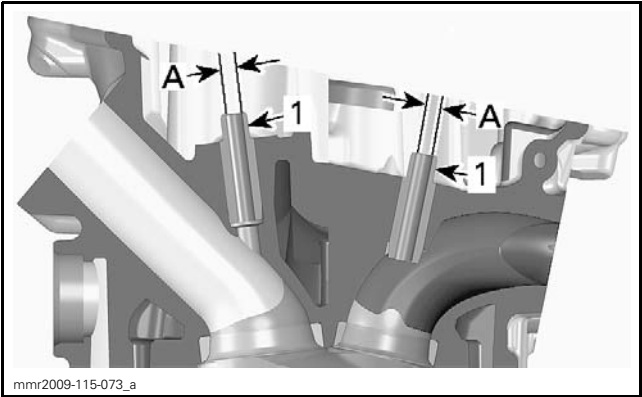


A. Valves stem diameter

VALVE STEM DIAMETER		
Intake valve	New	4.958 mm to 4.972 mm (.1952 in to .1957 in)
	Service limit	4.940 mm (.1945 in)
Exhaust valve	New	4.956 mm to 4.970 mm (.1951 in to .1957 in)
	Service limit	4.940 mm (.1945 in)

Replace valve if stem is out of specification or if its surface is damaged or worn.

- 2. Clean valve guide from carbon deposits.
- 3. Measure valve guide inner diameter, using a small bore gauge.

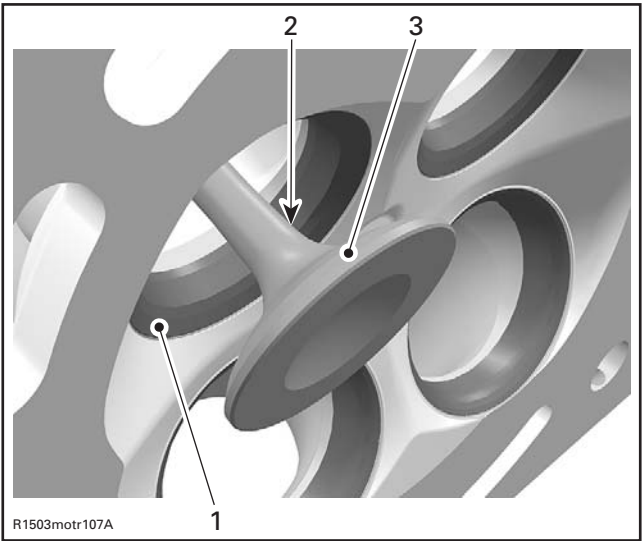


1. Valve guides
A. Valve guide inner diameter

VALVE GUIDE INNER DIAMETER	
New	5.000 mm to 5.020 mm (.1969 in to .1976 in)
Service limit	5.050 mm (.1988 in)

Replace cylinder head, if valve guide is out of specification.

Valve Face and Seat



TYPICAL
1. Valve seat
2. Exhaust valve contaminated area
3. Valve face (contact surface to valve seat)

1. Check valve face and seat for burning, pitting and other signs of damage.

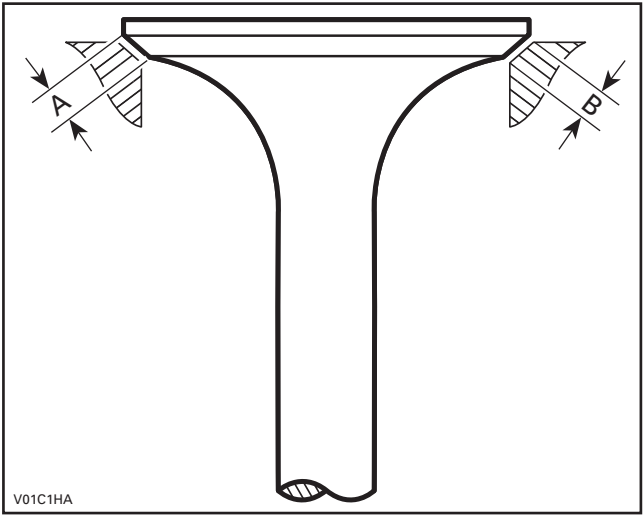
2. Check if valve seats properly in cylinder head. Proceed as follows.

2.1 Apply some lapping compound on valve face and work valve on its seat with a lapping tool.

NOTE: The location of contact area should be in center of valve face.

2.2 Repeat procedure until valve seat and valve face fit together.

3. Measure valve seat contact width, using a caliper.



A. Valve face contact width
B. Valve seat contact width

VALVE SEAT CONTACT WIDTH (B)		
Intake valve	New	1.05 mm to 1.35 mm (.041 in to .053 in)
	Service limit	1.70 mm (.067 in)
Exhaust valve	New	1.25 mm to 1.45 mm (.049 in to .057 in)
	Service limit	1.80 mm (.071 in)

Replace parts if out of specification.

Installing the Valve

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

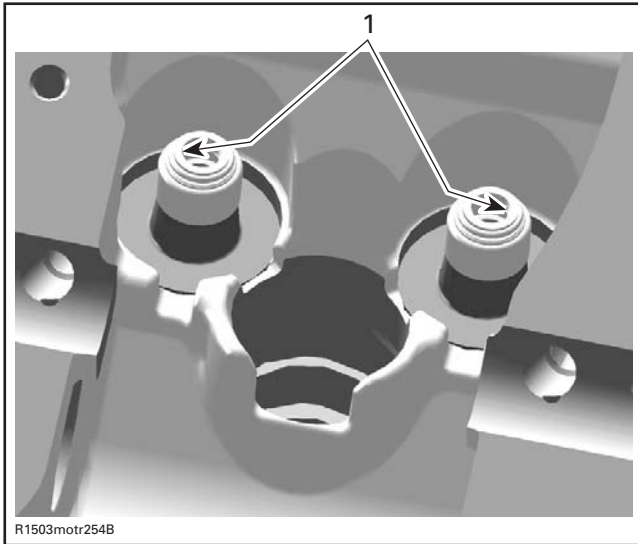
NOTICE Ensure to reinstall all parts in their original position as marked during removal.

1. Install a **NEW** valve stem seal whenever valve is removed.

2. Apply engine oil on valve stem and carefully slide through cylinder head and valve stem seal.

NOTICE Be careful when passing the valve stem through the sealing lip of the seal.

Subsection XX (CYLINDER HEAD)



TYPICAL

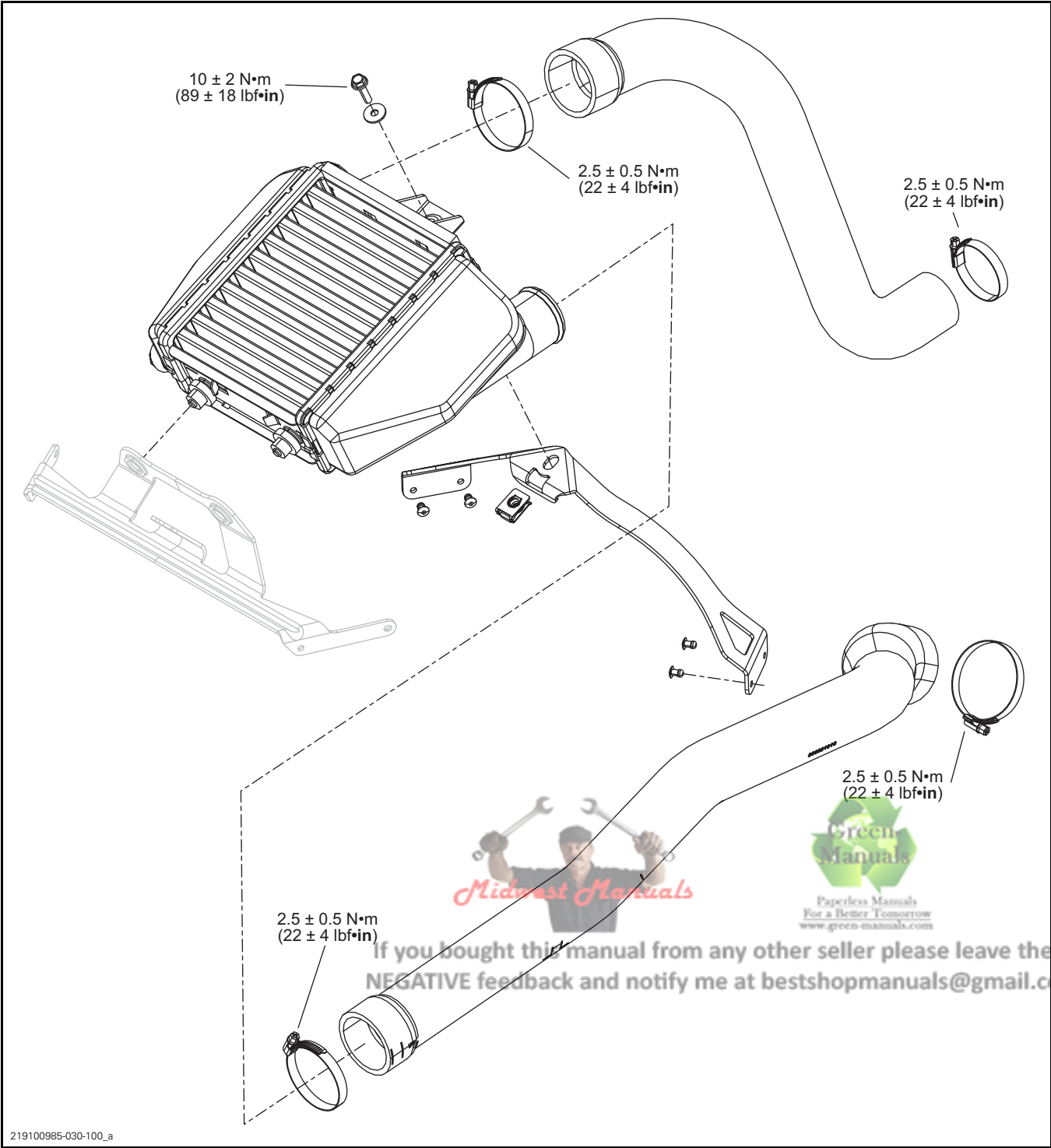
1. *Sealing lips of valve stem seal*

3. Install *VALVE SPRING*. See procedure in this subsection.
4. Install all other removed parts.

INTERCOOLER

SERVICE TOOLS

Description	Part Number	Page
VACUUM/PRESSURE PUMP	529 021 800	2



GENERAL

An exhaust gas turbocharger heats the air that it compresses.

The intercooler cools the hot compressed air from the compressor outlet.

INSPECTION

NOTE: When vehicle is running at operating temperature, intercooler outlet air temperature should be lower than inlet air temperature. The temperature difference will vary with atmospheric conditions.

Check radiating fins for clogging or damage.
Remove any obstructions with compressed air or low pressure water.

Leak Test

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

- Block outlet hose.
- Unplug the inlet hose from the intercooler.
- Install the pressure pump with an adaptor on the inlet fitting.
- Pressurize the intercooler.

NOTICE Testing at higher pressures can damage the system.

PRESSURE TEST
100 kPa (14.5 PSI) for 2 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.

PROCEDURES

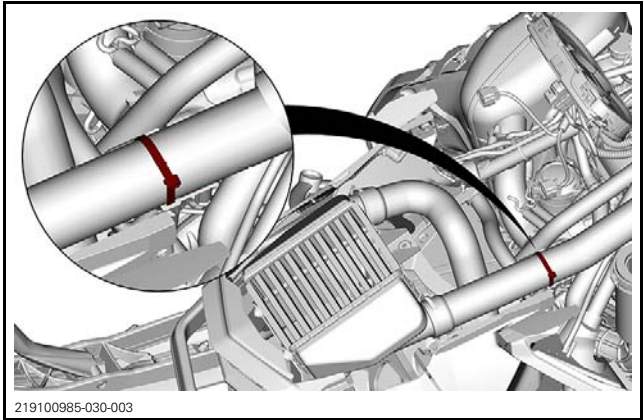
INTERCOOLER ACCESS

Remove the upper body module. Refer to *BODY* subsection.

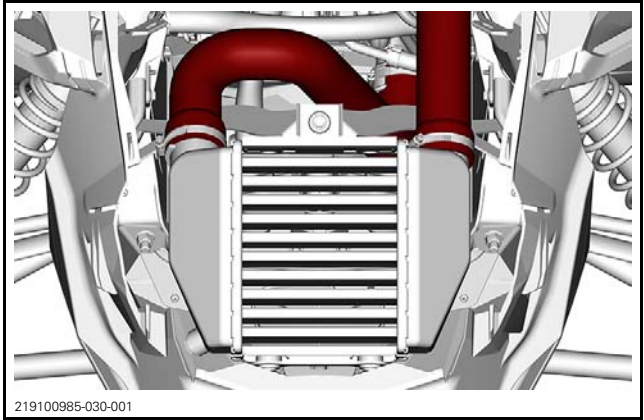
REMOVING THE INTERCOOLER

NOTICE When removing the intercooler, always plug the turbocharger hoses with clean rags to prevent dirt from entering the turbo.

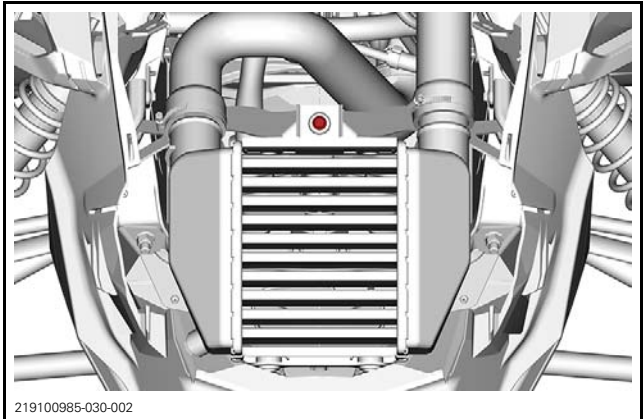
- 1. Cut locking tie securing outlet hose.



- 2. Loosen the clamps and disconnect both intercooler hoses.



- 3. Remove the intercooler retaining screws.



- 4. Remove intercooler.

INSTALLING THE INTERCOOLER

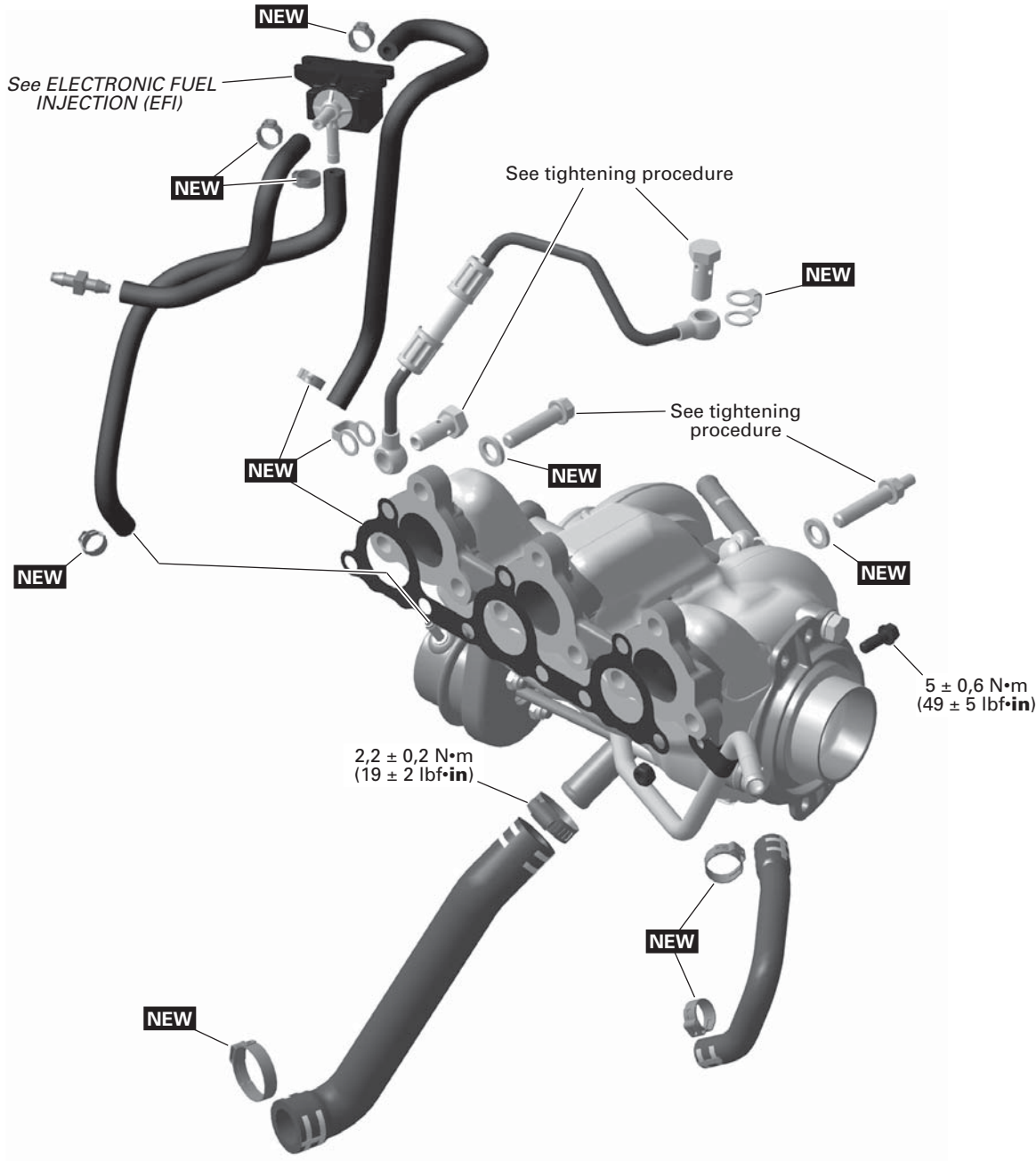
The installation is the reverse of the removal procedure.

TURBOCHARGER

SERVICE TOOLS

Description	Part Number	Page
ADAPTER GAUGE (TURBO).....	529 036 461	11
ENGINE LEAK DOWN TEST KIT	529 035 661	11
PLUG (TURBO).....	529 036 460	11
VACUUM/PRESSURE PUMP	529 021 800	13

TURBOCHARGER

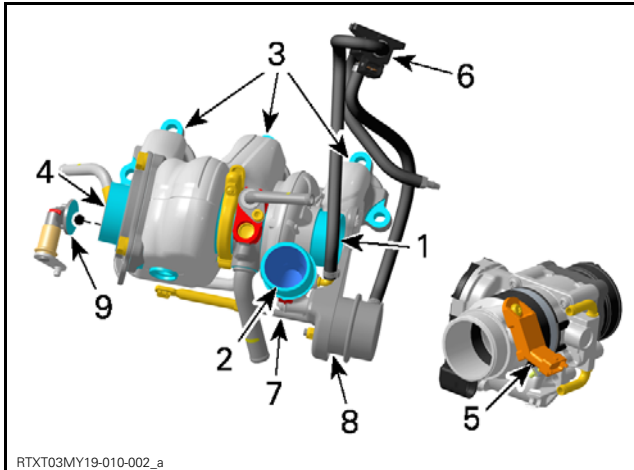


NEW = Component must be replaced when removed.

RTXT03MY19-010-001_a

GENERAL

TURBOCHARGER

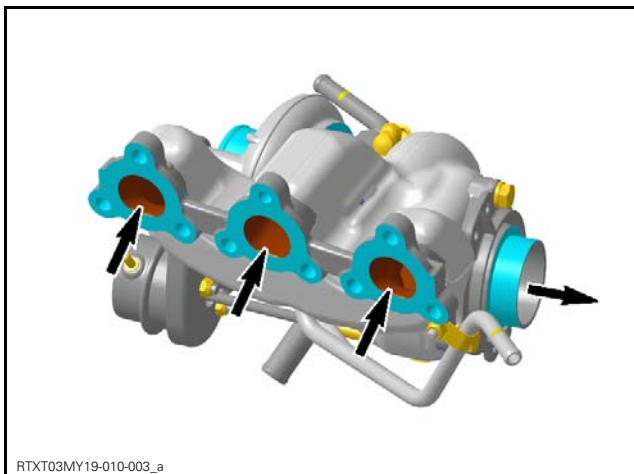


1. Compressor inlet
2. Compressor outlet
3. Turbine inlet
4. Turbine outlet
5. Boost Pressure Sensor (BPS)
6. Boost Control Valve (BCV)
7. Waste gate actuator rod
8. Actuator rod spring
9. Waste gate

Turbine

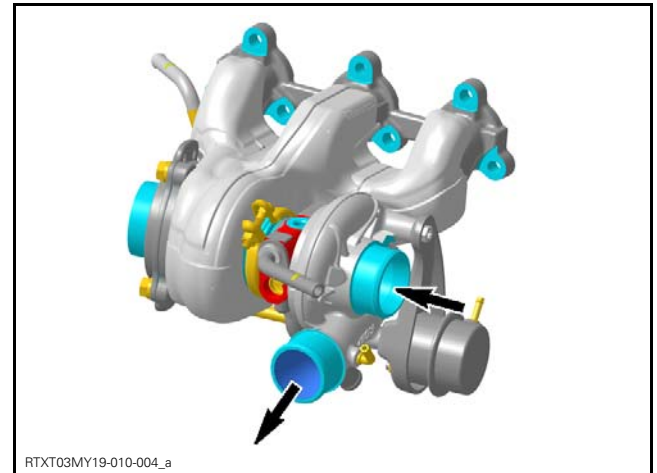
The exhaust gases cause the turbine wheel to spin and accelerate. The gases then exit through the turbine outlet towards the muffler.

The turbine wheel drives the compressor wheel through the rotor shaft. When the turbine wheel is spinning, the compressor wheel is spinning at the same speed.



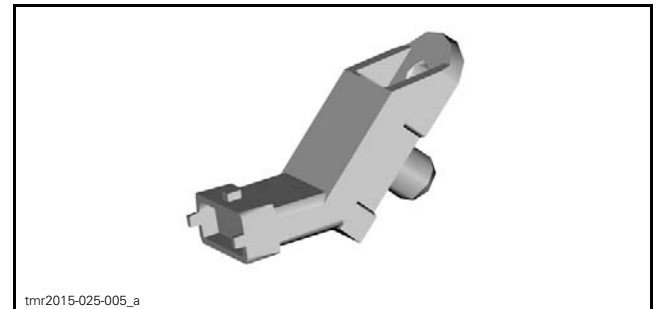
Compressor

The compressor wheel spinning causes filtered air to enter through the compressor inlet. The air is then compressed and exits through the compressor outlet.



Boost Pressure Sensor (BPS)

To ensure optimal engine operation in all conditions, the ECM system requires 2 pressure sensors: The BPS and the MAPTS. The BPS measures the air pressure upstream the throttle plate and the MAPTS measures the pressure downstream the throttle plate.



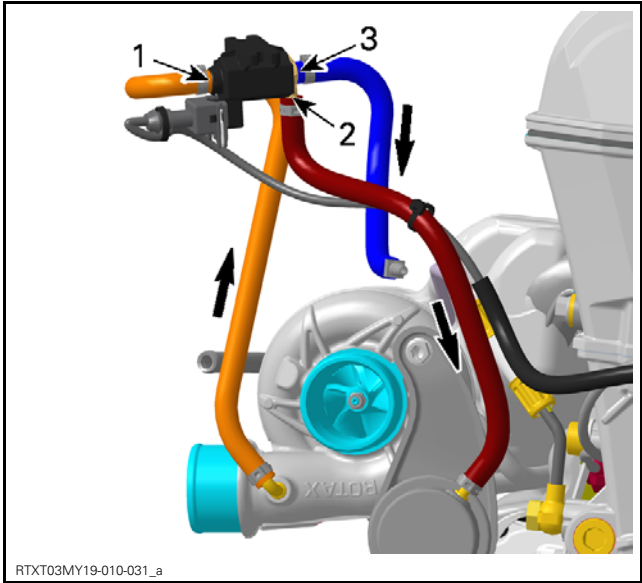
Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection for testing and replacement.

Boost Control Valve (BCV)

The BCV controls the pressure acting on the waste gate actuator rod spring. The ECM uses pulse width modulation to control the BCV.

If too high boost pressure is measured by the BPS, the ECM will control the BCV and open the waste gate when the actuation pressure has been reached.

Excess pressure may also be returned to the intake hose before the compressor inlet.



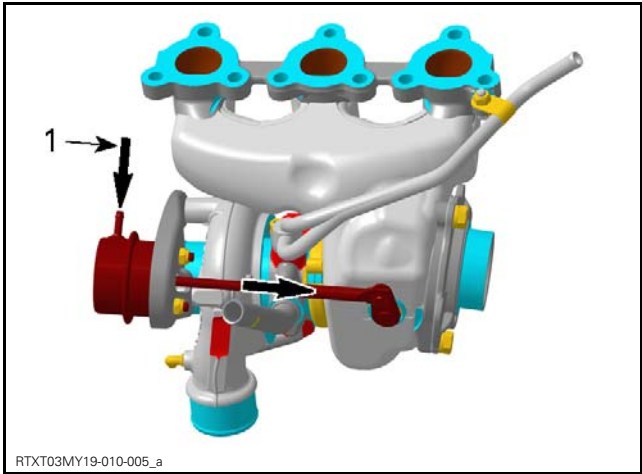
- 1. Boost pressure indication port
- 2. Waste gate pressure modulation port
- 3. Excess pressure return port

NOTE: A BCV malfunction will activate Limp Home Mode.

Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection for testing and replacement.

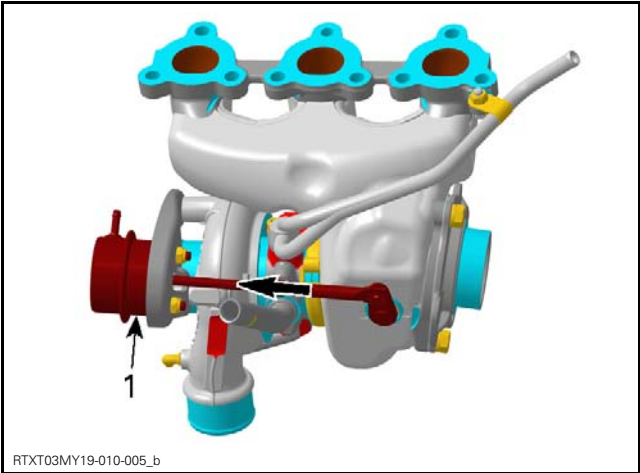
Waste Gate Actuator Rod and Spring

When the BCV allows compressed air to enter the waste gate actuator, the actuator rod will move to open the waste gate.



WASTE GATE OPENS
1. Compressed air

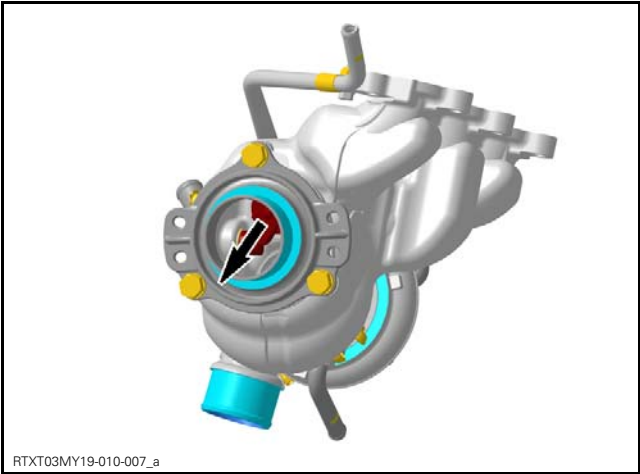
When the air pressure inside the actuator drops, the spring will return the actuator rod to its initial position and close the waste gate.



WASTE GATE CLOSES
1. Compression spring inside actuator

Waste Gate

The waste gate regulates turbine speed by allowing exhaust gas to bypass the turbine.



ADJUSTMENT

WASTE GATE

NEW turbocharger assembly are factory adjusted. Do not try to adjust the waste gate.

WASTE GATE ACTUATOR ROD

NEW turbocharger assembly are factory adjusted. Do not try to adjust the waste gate actuator rod.

MAINTENANCE

The turbocharger is maintenance free. However it is susceptible to damage caused by failures from other systems. Refer to *TROUBLESHOOTING* in this subsection.

NOTICE If particles are suspected of entering the exhaust system, take the proper actions to remove them.

NOTICE Never operate engine without an air filter.

NOTICE Engine oil change intervals and procedure must be respected.

For air filter cleaning, refer to *AIR INTAKE SYSTEM* subsection.

PRECAUTIONS

Engine Warming and Cooling

Allow the vehicle to reach operating temperature before placing high demand on the engine. This allows oil to reach the correct viscosity to properly lubricate the turbo.

Allow the vehicle to idle before turning it off. This will allow the engine to lubricate and cool the turbo.

TROUBLESHOOTING

LACK OF POWER

1. **Cold start**
 - Allow vehicle to reach operating temperature up for turbo to be at maximum efficiency.
2. **Clogged air filter.**
 - Check air filter. Refer to *AIR INTAKE SYSTEM* subsection.
3. **Intake system collapsed, restricted or leaking.**
 - Check tightness of clamps and screws.
 - Damaged or missing gaskets.
 - Check for foreign object between air filter and turbocharger.
 - Inspect parts for damage, cracks or obstructions. Repair or replace. Refer to *AIR INTAKE SYSTEM* and *INTAKE MANIFOLD* subsection.
4. **Exhaust system collapsed, restricted or leaking.**
 - Check if the exhaust system is blocked or damaged. Replace parts as necessary. Refer to *EXHAUST SYSTEM* subsection.
 - Check turbocharger housing for cracks, blown or missing gaskets. Replace parts as necessary. Refer to procedure in this subsection.
 - Check for foreign object in the exhaust system.
5. **Fuel pump malfunction.**
 - Perform a fuel pump pressure test and check fuel pump. Refer to *FUEL TANK AND FUEL PUMP* subsection.
6. **Sensor or injector malfunction.**
 - Check fault codes with the BRP diagnostic software (BUDS2). Refer to *ENGINE MANAGEMENT SYSTEM* subsection.
 - Check fuel injection system is in good condition and correctly adjusted. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.
 - Check Boost Pressure Sensor (BPS). Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.
 - Check Turbo Control Valve (BCV) function and for correct installation. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.
7. **Engine damage or malfunction.**
 - Check for proper valve timing. Refer to *TIMING CHAIN* subsection.
 - Perform engine leak test. Refer to *CYLINDER HEAD* subsection.

8. **Waste gate malfunction.**
 - Check waste gate actuator. Refer to procedure in this subsection.
 - Check waste gate for smooth movement.
 - Check Turbo Control Valve (BCV) function and for correct installation. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.
9. **Intercooler malfunction.**
 - Check if intercooler is clogged or contaminated.
 - Check for correct intercooler fan electric connection (direction of rotation).
10. **Turbocharger blocked or damaged.**
 - Check for excessive carbon build up on housing.
 - Check for signs of contact of the compressor wheel on housing.
 - Check for rotor radial clearance.
 - Check if rotor shaft bearing is worn out.
 - Check turbocharger housing if damaged or restricted.

NOISY PERFORMANCE

1. **Support brackets, turbocharger flanges or clamps are loose.**
 - Check tightness of clamps and screws.
 - Check if support brackets and parts connected to the turbocharger are not loose or damaged.
2. **Foreign object in intake or exhaust system.**
 - Check and clean intake and/or exhaust system.
3. **Intake system collapsed, restricted or leaking.**
 - Check tightness of clamps and screws.
 - Inspect parts for damage, cracks or obstructions.
 - Check for damaged or missing gaskets.
4. **Exhaust system collapsed, restricted or leaking.**
 - Check tightness of clamps and screws.
 - Inspect parts for damage, cracks or obstructions.
 - Check for damaged or missing gaskets.
5. **Turbocharger blocked or damaged.**
 - Check for excessive carbon build up on housing.
 - Check for imbalance due to damaged or broken rotor blades.
 - Check turbocharger housing if damaged or restricted.
 - Check for rotor radial clearance.
 - Check if rotor shaft bearing is worn out.

BLUE SMOKE AND/OR OIL CONSUMPTION

1. **Clogged air filter.**
 - Inspect air filter. Refer to *AIR INTAKE SYSTEM* subsection.

2. **Intake system collapsed, restricted or leaking.**
 - Check tightness of clamps and screws.
 - Inspect parts for damage, cracks or obstructions.
 - Check for damaged or missing gaskets.
3. **Use of unsuitable engine oil type.**
 - Replace engine oil by the recommended engine oil.
4. **Excessive carbon build up on housing.**
 - Check for excessive pressure in crankcase and correct function of crankcase ventilation system.
 - Check if the oil return hose is clean and not restricted.

EXCESSIVE ENGINE OIL IN TURBOCHARGER

1. **Worn out bearings of rotor shaft.**
 - Perform a pressure drop test, see procedure in this subsection.
 - Note that some oil traces are normal.
2. **Blocked oil return hose.**
 - Check if oil return hose is free.
3. **Plugged crankcase ventilation system.**
 - Check if crankcase ventilation system is blocked.
4. **Intake system collapsed or restricted.**
 - Check tightness of clamps and screws.
 - Check for damaged or missing gaskets.
 - Check for foreign object between air filter and turbocharger.
 - Inspect parts for damage, cracks or obstructions.
5. **Exhaust system collapsed, restricted or leaking.**
 - Check tightness of clamps and screws.
 - Inspect parts for damage, cracks or obstructions.
 - Check for damaged or missing gaskets.
 - Check for foreign object in the exhaust system.
6. **Support brackets, turbocharger flanges or clamps are loose.**
 - Check tightness of clamps and screws.
 - Check if support brackets and parts connected to the turbocharger are not loose or damaged.
7. **Excessive carbon build up on housing.**
 - Check if crankcase ventilation system is blocked.

DAMAGED ROTOR OF TURBINE OR COMPRESSOR

1. **Intake system leaking.**
 - Check for foreign object between air filter and turbocharger.
 - Inspect air filter. Refer to AIR INTAKE SYSTEM subsection.
 - Check tightness of clamps and screws.
 - Inspect parts for damage, cracks or obstructions.
2. **Exhaust system collapsed, restricted or leaking.**
 - Check tightness of clamps and screws.
 - Inspect parts for damage, cracks or obstructions.
 - Check for damaged or missing gaskets.
 - Check for foreign object in the exhaust system.
3. **Turbocharger blocked or damaged**
 - Check for excessive carbon build up on housing.
 - Check for rotor radial clearance.
 - Check if rotor shaft bearing is worn out.
 - Check turbocharger housing if damaged or restricted.
4. **Oil supply hose and/or oil return hose blocked.**
 - Check and/or replace oil hoses, refer to procedures in this subsection.
5. **Too little warm up time.**
 - Extend warm up period.

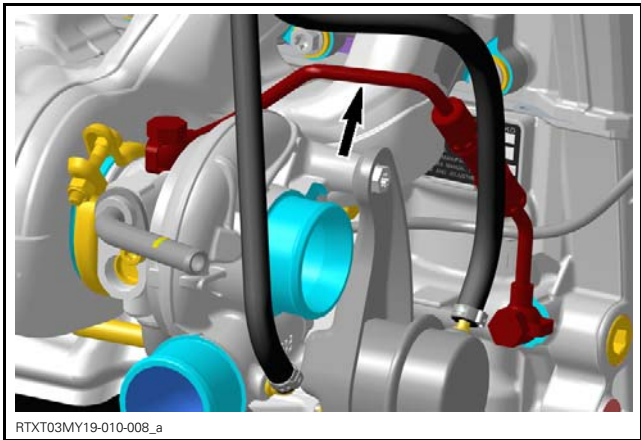
EXCESSIVE RADIAL AND/OR AXIAL CLEARANCE OF ROTOR SHAFT

1. **Intake system leaking.**
 - Check for foreign object between air filter and turbocharger.
 - Inspect air filter. Refer to AIR INTAKE SYSTEM subsection.
 - Inspect parts for damage, cracks or obstructions.
2. **Exhaust system collapsed, restricted or leaking.**
 - Check tightness of clamps and screws.
 - Inspect parts for damage, cracks or obstructions.
 - Check for damaged or missing gaskets.
 - Check for foreign object in the exhaust system.
3. **Insufficient lubrication or oil lag at start up.**
 - Inspect oil pressure line if restricted, blocked or leaking.
 - Inspect engine oil filter if restricted or blocked, refer to LUBRICATION SYSTEM subsection.
 - Check engine oil pressure, refer to LUBRICATION SYSTEM subsection.

- 4. Engine oil contaminated or unsuitable engine oil type.
- Replace engine oil and filter, refer to LUBRICATION SYSTEM subsection.
- 5. Excessive carbon build up on housing.
- Check if crankcase ventilation system is blocked.
- 6. Worn out bearings of rotor shaft.
- Perform a pressure drop test, see procedure in this subsection.

PROCEDURES

OIL PRESSURE LINE

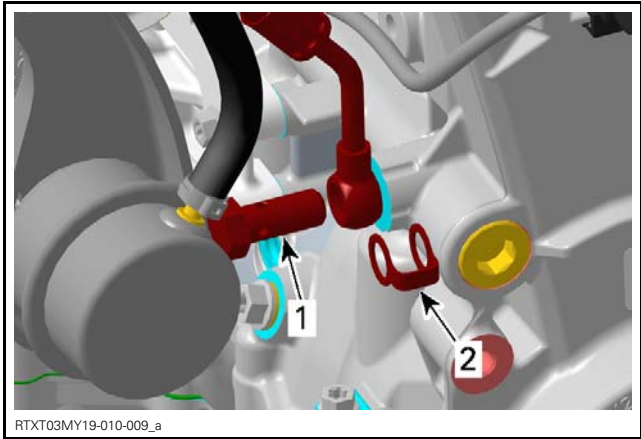


Oil Pressure Line Access

Remove the upper body module. Refer to BODY subsection.

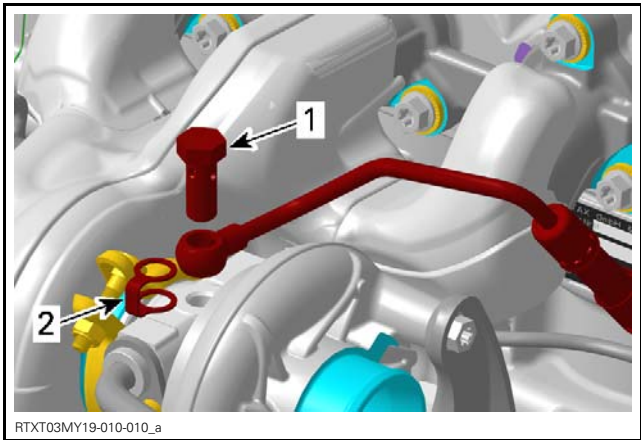
Removing the Oil Pressure Line

- 1. Remove:
 - Banjo bolt
 - Double sealing ring (discard it).



- 1. Banjo bolt
- 2. Double sealing ring

- 2. Place oil pressure line over a drain pan to catch up oil spillage.
- 3. Remove:
 - Banjo bolt
 - Double sealing ring (discard it)



- 1. Banjo bolt
- 2. Double sealing ring

- 4. Pull oil pressure line out of vehicle.

NOTICE Clean all spilled oil.

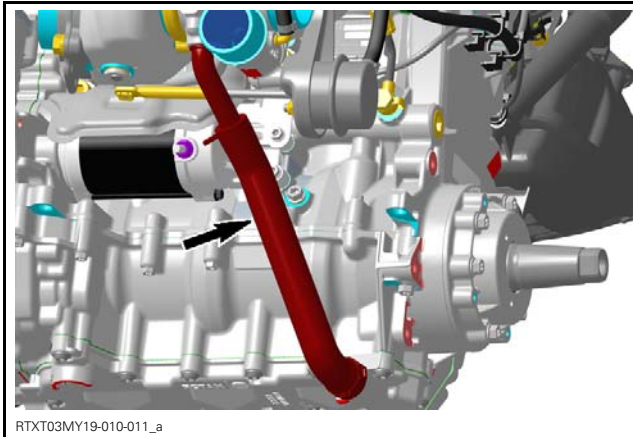
Installing the Oil Pressure Line

The installation is the reverse of the removal procedure, however pay attention to the following.
Tighten banjo bolts to specification.

TIGHTENING TORQUE		
Banjo bolts	Step A	8 N•m (71 lbf•in)
	Step B	15.75 N•m ± 0.75 N•m (139 lbf•in ± 7 lbf•in)

Refill engine with recommended engine oil. Refer to *LUBRICATION SYSTEM* subsection.

OIL RETURN HOSE

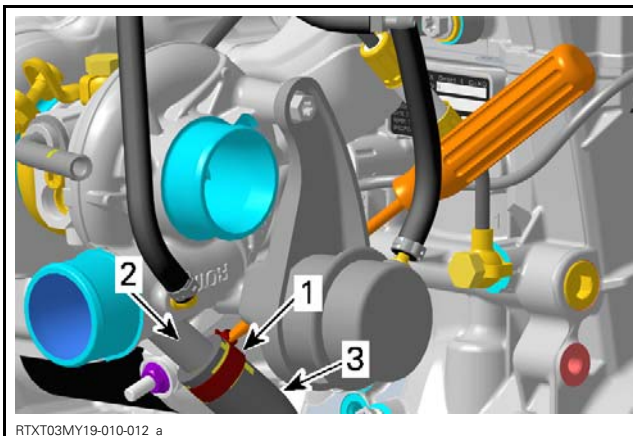


Oil Return Hose Access

Remove the upper body module. Refer to *BODY* subsection.

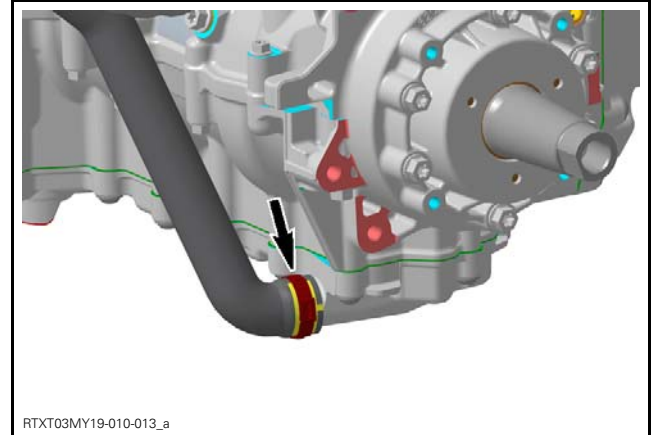
Removing the Oil Return Hose

1. Remove clamp and withdraw hose from oil tube.



1. Clamp
2. Oil tube
3. Hose

2. Remove and discard 1-ear-clamp and withdraw hose from oil sump cover.



NOTICE Clean all spilled oil.

Installing the Oil Return Hose

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

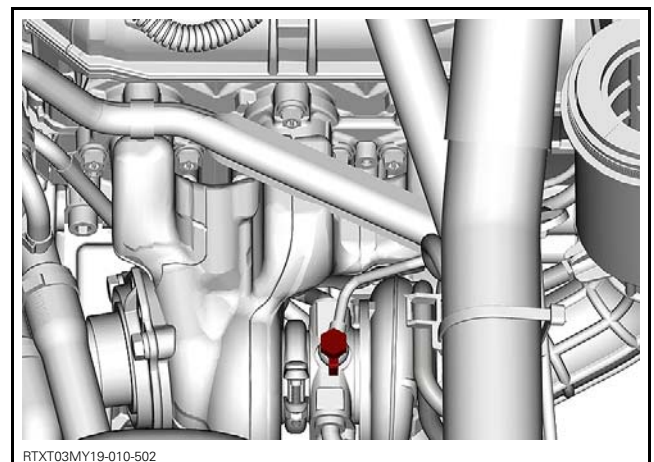
TIGHTENING TORQUE	
Clamp	2.2 N•m ± 0.2 N•m (19 lbf•in ± 2 lbf•in)

Refill engine with recommended engine oil. Refer to *LUBRICATION SYSTEM* subsection.

TURBOCHARGER

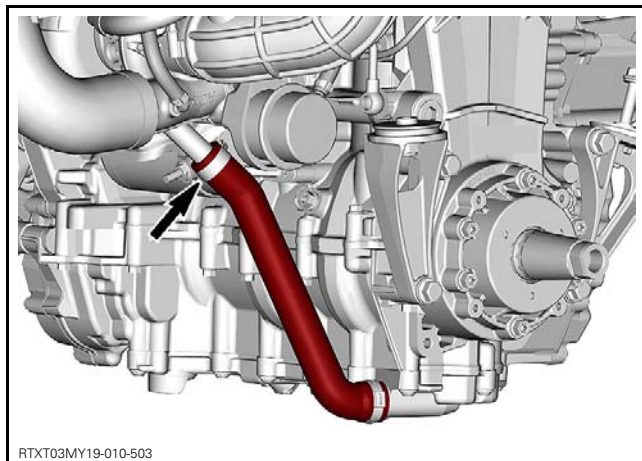
Removing the Turbocharger

1. Remove the upper body module. Refer to *BODY* subsection.
2. Drain coolant. Refer to *COOLING SYSTEM - VEHICLE COMPONENT* subsection.
3. Remove the muffler and the exhaust pipe. Refer to *EXHAUST SYSTEM* subsection.
4. Remove *OIL PRESSURE LINE* from turbo. Refer to procedure in this subsection.

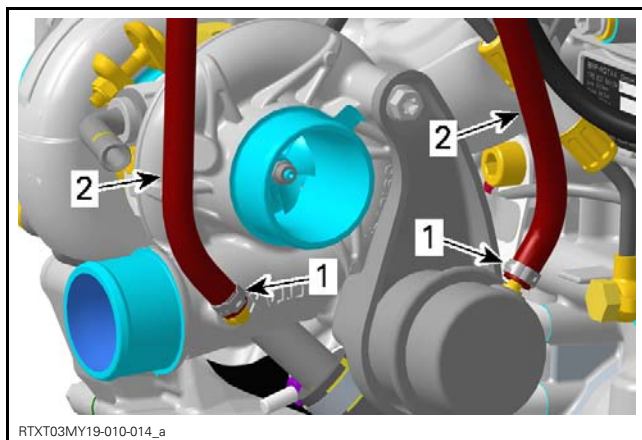


Subsection XX (TURBOCHARGER)

5. Detach oil return hose from turbo oil tube. Discard the double sealing ring.

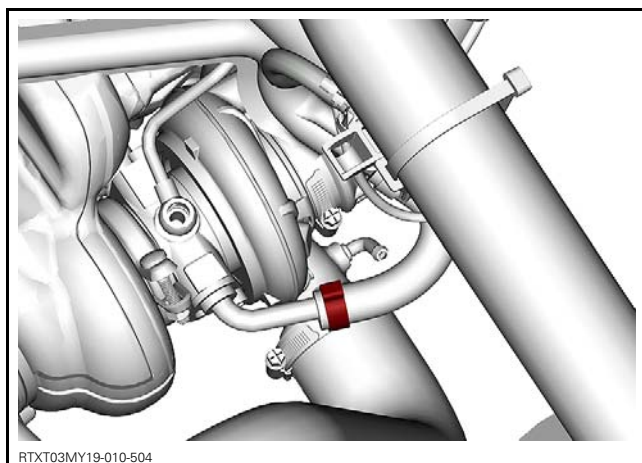


6. Remove Oetiker clamps and disconnect BCV hoses from turbo and actuator.

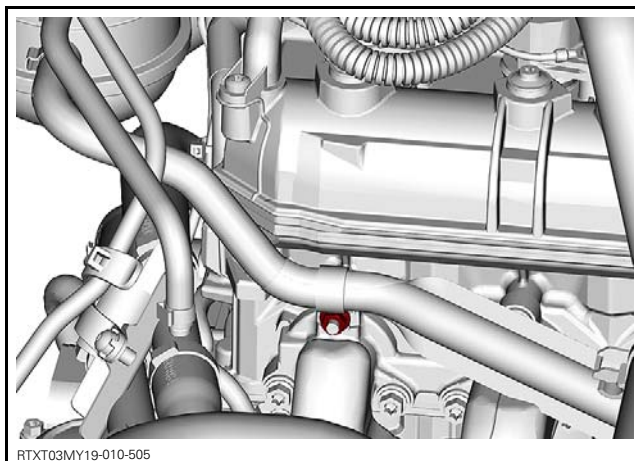


1. Oetiker clamps
2. BCV hoses

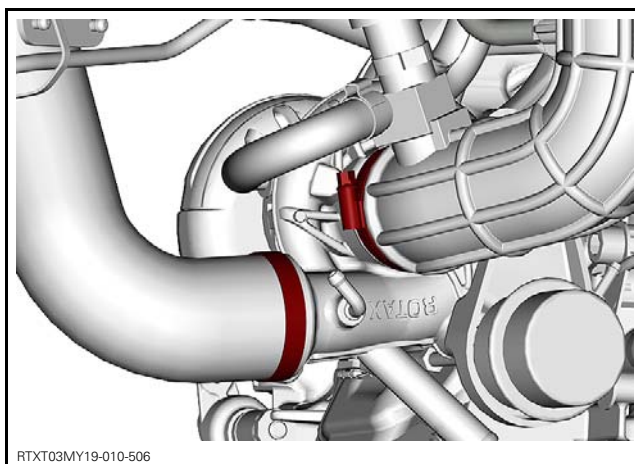
7. Unplug the coolant hose from the inlet tube.



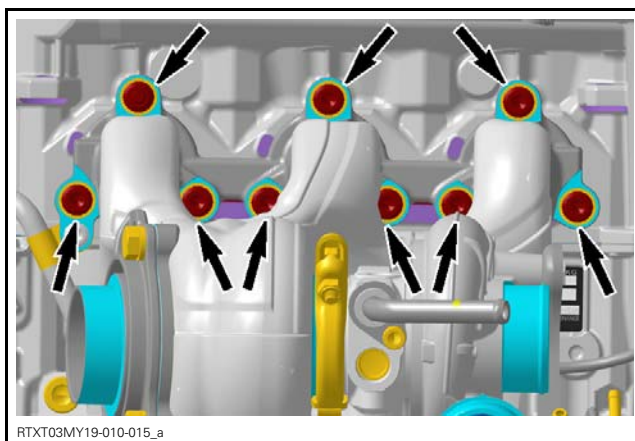
8. Remove the nut retaining the coolant hose to cylinder head.



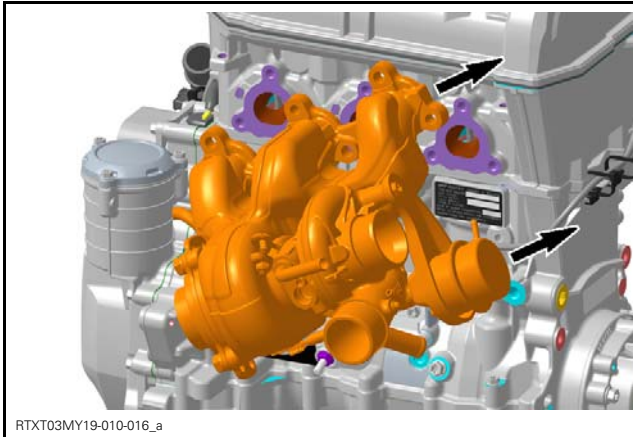
9. Loosen clamps and disconnect air inlet and outlet hoses.



10. Remove the turbocharger retaining screws and washers.



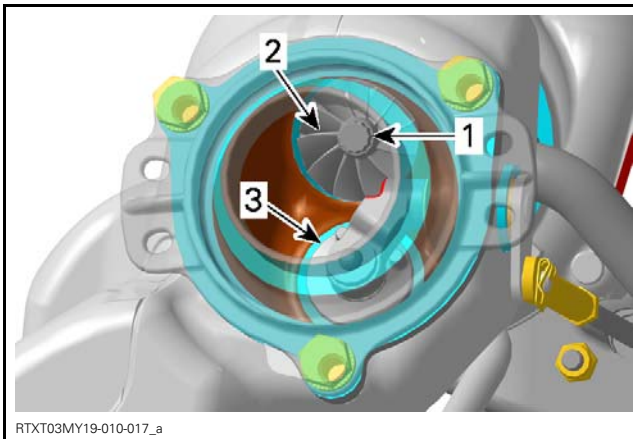
11. Lift turbocharger and pull it out of vehicle.



Inspecting the Turbocharger

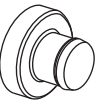
Check turbocharger:

- for any damages or cracks
- for corrosion
- for any oil leak
- for contamination and/or oil coking at oil inlet and outlet
- if rotor shaft turns smooth and easily.

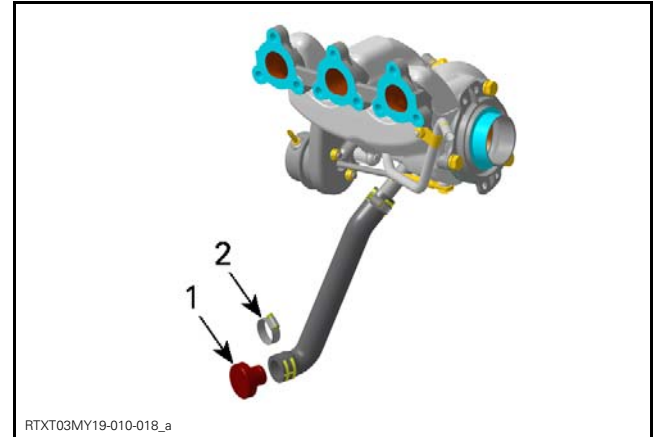


1. Rotor shaft
2. Turbine rotor
3. Waste gate

Testing the Rotor Shaft Bearing Leakage

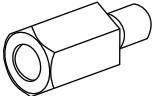
REQUIRED TOOL	
ENGINE LEAK DOWN TEST KIT (P/N 529 035 661)	
PLUG (TURBO) (P/N 529 036 460)	

Block the oil return hose.

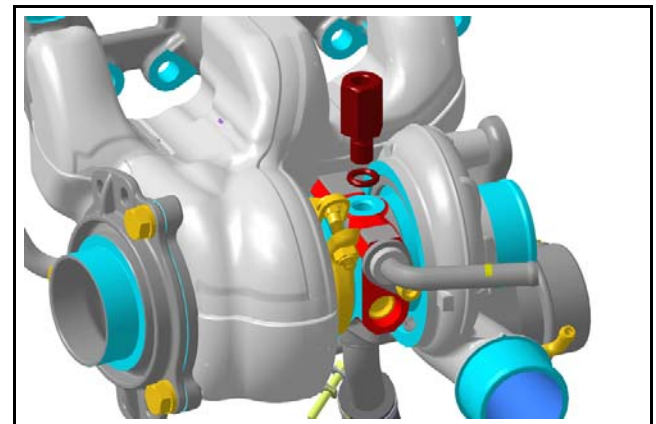


1. Plug
2. Clamp

Clean oil supply bore.

REQUIRED TOOL	
ADAPTER GAUGE (TURBO) (P/N 529 036 461)	

Install adapter with o-ring into oil supply bore.



Install gauge adapter into adapter.

Connect leak tester to adequate air supply.

Set needle of measuring gauge to zero.

NOTE: All testers have specific instructions on gauge operation and required pressure.

Supply turbocharger with air pressure.

NOTICE During leakage test apply slightly a alternating radial pressure onto the shaft to achieve a proper test result.

ROTOR SHAFT BEARING LEAKAGE TEST	
SERVICE LIMIT	50%

Subsection XX (TURBOCHARGER)

Waste Gate Lever and Waste Gate

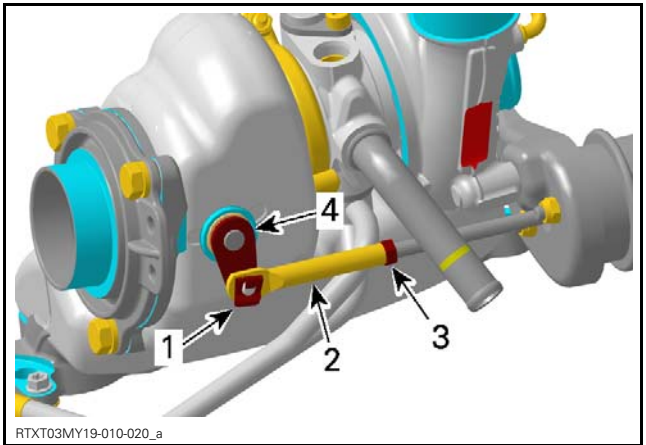
Remove retaining clip.

Check for waste gate actuator rod play on lever pin.

Disconnect the waste gate actuator rod from the waste gate lever.

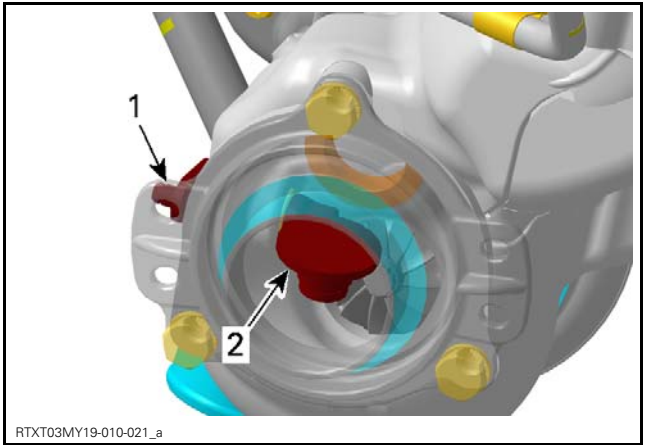
Check counter nut of waste gate actuator rod for tightness.

NOTICE Do not open counter nut of waste gate actuator rod. Length of waste gate actuator rod assembly must not change.



- 1. Retaining clip
- 2. Waste gate actuator rod
- 3. Counter nut
- 4. Waste gate lever

Check the waste gate lever for free movement.
Check waste gate and its seat for wear or damage.



- 1. Waste gate lever
- 2. Waste gate

Rotor of Turbine and Compressor

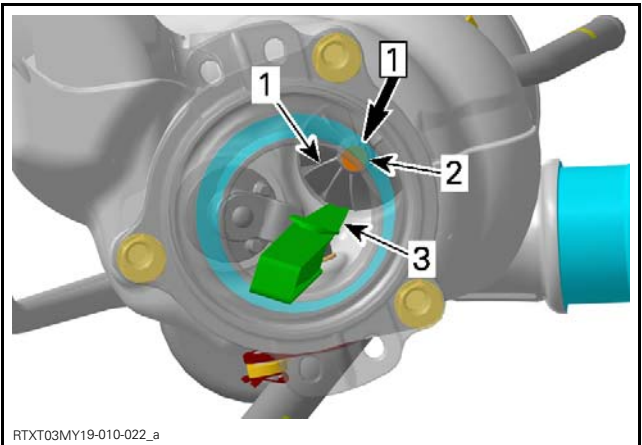
Check rotor visually for:

- bent blades

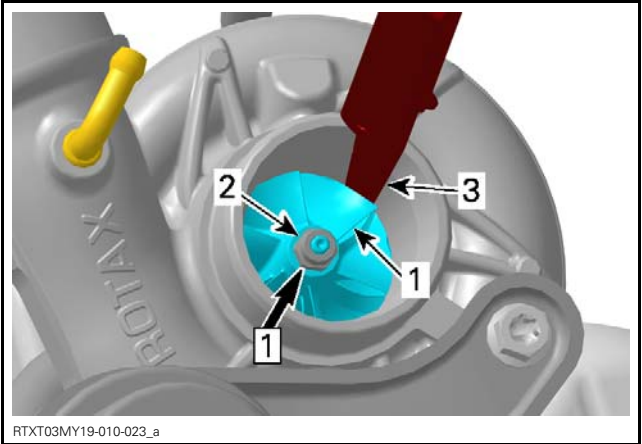
- any damages
- thermal stress (turbine rotor).

Apply slightly a radial pressure onto the shaft to minimize the gap between rotor and housing.

Check radial clearance of the rotors in the complete circumference.



TURBINE ROTOR
Step 1: Push slightly
1. Rotor
2. Shaft
3. Feeler gauge



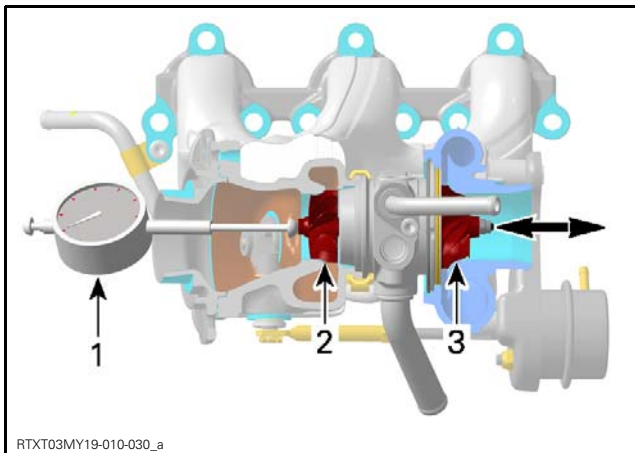
COMPRESSOR ROTOR
Step 1: Push slightly
1. Rotor
2. Shaft
3. Feeler gauge

REQUIRED TOOL	
Feeler gauge 0.1 mm (.004 in)	
ROTOR RADIAL CLEARANCE	
SERVICE LIMIT	Minimum of 0.1 mm (.004 in)

Rotor Shaft

Check discoloration of the shaft due to overheating.

Move rotor shaft back and forth to measure axial clearance by using a dial gauge.



1. Dial gauge
2. Turbine rotor
3. Compressor rotor

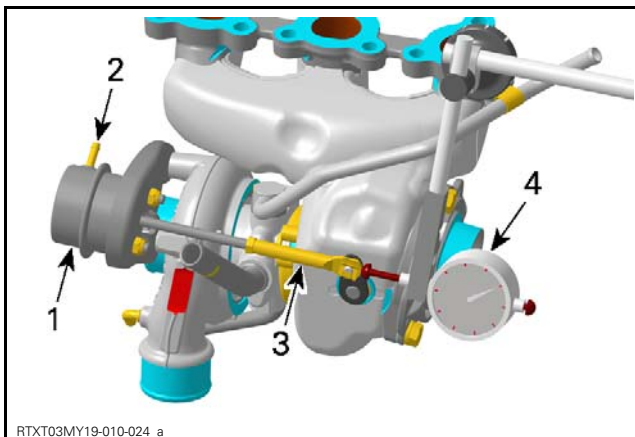
ROTOR SHAFT AXIAL CLEARANCE	
SERVICE LIMIT	Maximum of 0.1 mm (.004 in)

Waste Gate Actuator

Apply air pressure to the actuator.

Measure movement of waste gate actuator rod at specified air pressure.

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



ALIGN DIAL BORE GAUGE WITH WASTE GATE ACTUATOR ROD

1. Actuator
2. Fitting for air pressure supply
3. Waste gate actuator rod
4. Dial gauge

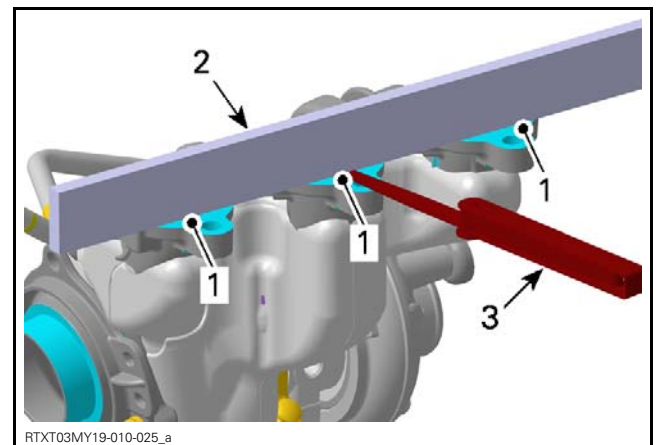
MOVEMENT OF WASTE GATE ACTUATOR ROD	
AIR PRESSURE	MOVEMENT
43 kPa (6.24 PSI)	1 mm $\pm$ 0.5 mm (.039 in $\pm$.02 in)
57 kPa (8.27 PSI)	5 mm $\pm$ 0.8 mm (.197 in $\pm$.031 in)

If movement of the waste gate actuator rod is out of specification replace turbo charger

Turbine Flange Surface

Check warpage of turbine flange.

REQUIRED TOOL	
Straight edge	
Feeler gauge 0.1 mm (.004 in)	



1. Turbine flange
2. Straight edge
3. Feeler gauge

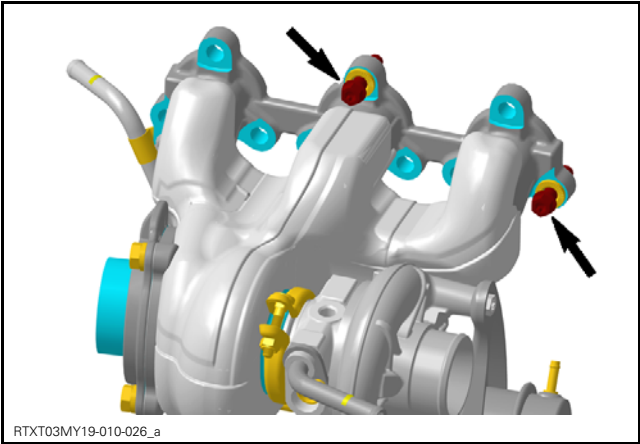
TURBINE FLANGE WARPAGE	
SERVICE LIMIT	Maximum of 0.1 mm (.004 in)

Installing the Turbocharger

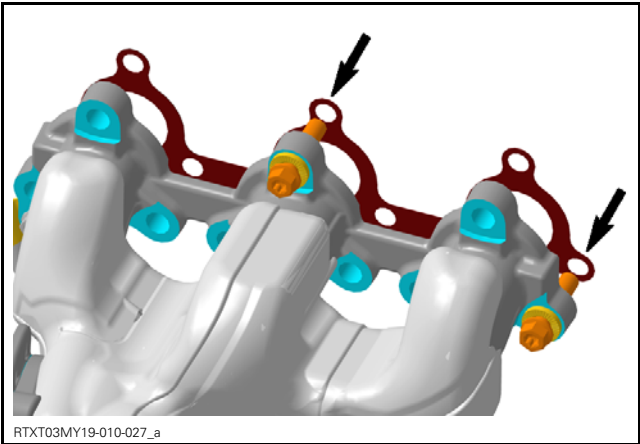
The installation is the reverse of the removal procedure. However, pay attention to the following.

Place turbocharger retaining screws with **NEW** washers into turbine housing (2x).

Subsection XX (TURBOCHARGER)



Place **NEW** gasket on screws with the raised side towards the turbine housing.

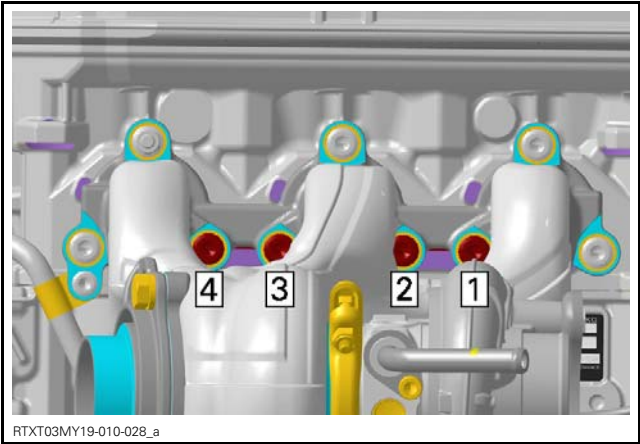


Install turbocharger and hand-tighten the 2 retaining screws.

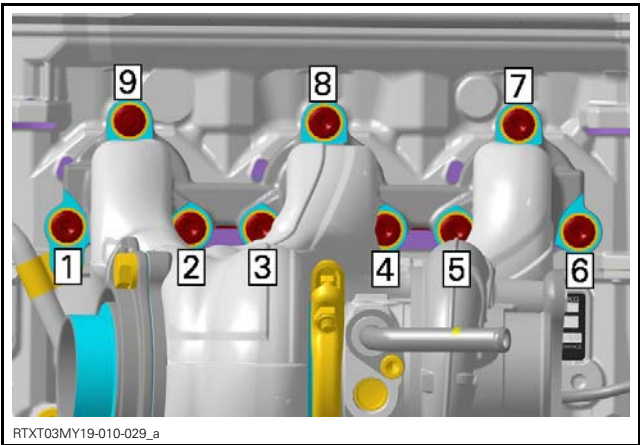
Install remaining turbo charger retaining screws with **NEW** washers.

Tighten turbocharger retaining screws according the following sequence.

TIGHTENING TORQUE		
Turbocharger retaining screws	STEP A	5 N•m ± 0.6 N•m (44 lbf•in ± 5 lbf•in)



TIGHTENING TORQUE		
Turbocharger retaining screws	STEP B	23 N•m ± 3 N•m (17 lbf•ft ± 2 lbf•ft)



Fill turbocharger at oil supply bore with engine oil and turn rotor shaft until turbocharger is filled completely.

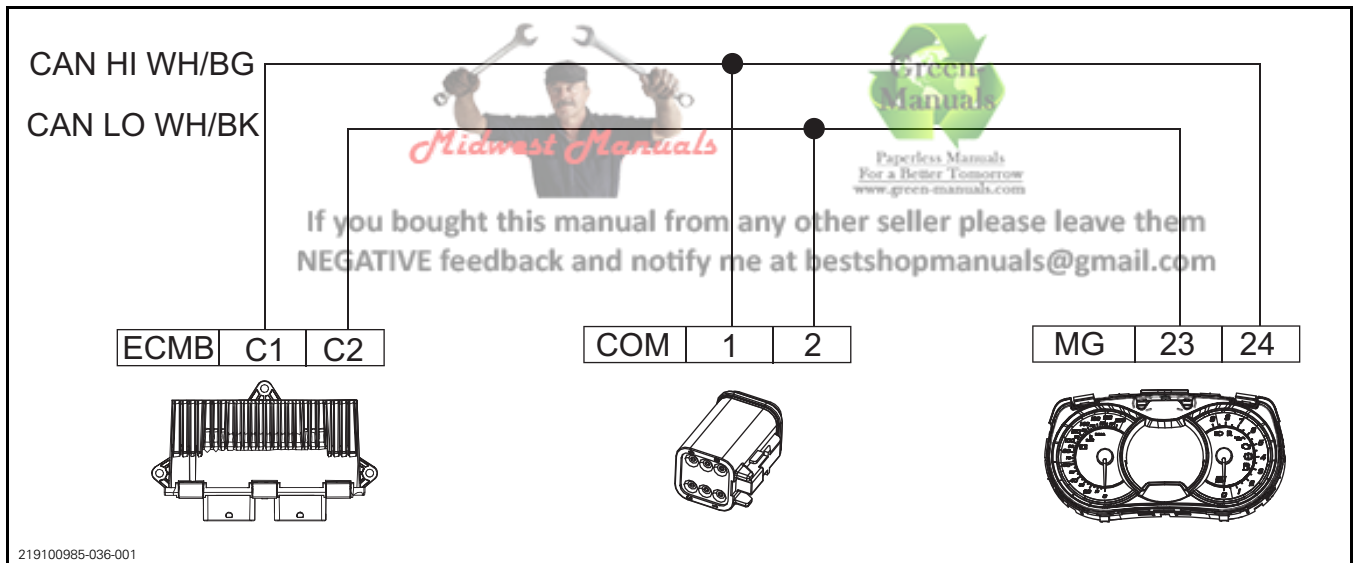
Then immediately install oil return hose and oil supply hose, refer to procedures in this subsection.

Refill engine with recommended engine oil. Refer to *LUBRICATION SYSTEM* subsection.

Install all other parts which were previously removed.

Start the engine and let it idle for a few minutes to ensure proper turbocharger lubrication.

COMMUNICATION PROTOCOLS



COM (Diagnostic connector)
ECM (Engine control module)
MG (Multifunction gauge)
WH/BG (White/beige)
WH/BK (White/black)

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.

TROUBLESHOOTING

CAN COMMUNICATION PROBLEMS

1. Measure CAN network resistance from the COM connector pins.

2. Disconnect modules one by one and observe change in network resistance to find network communication fault.

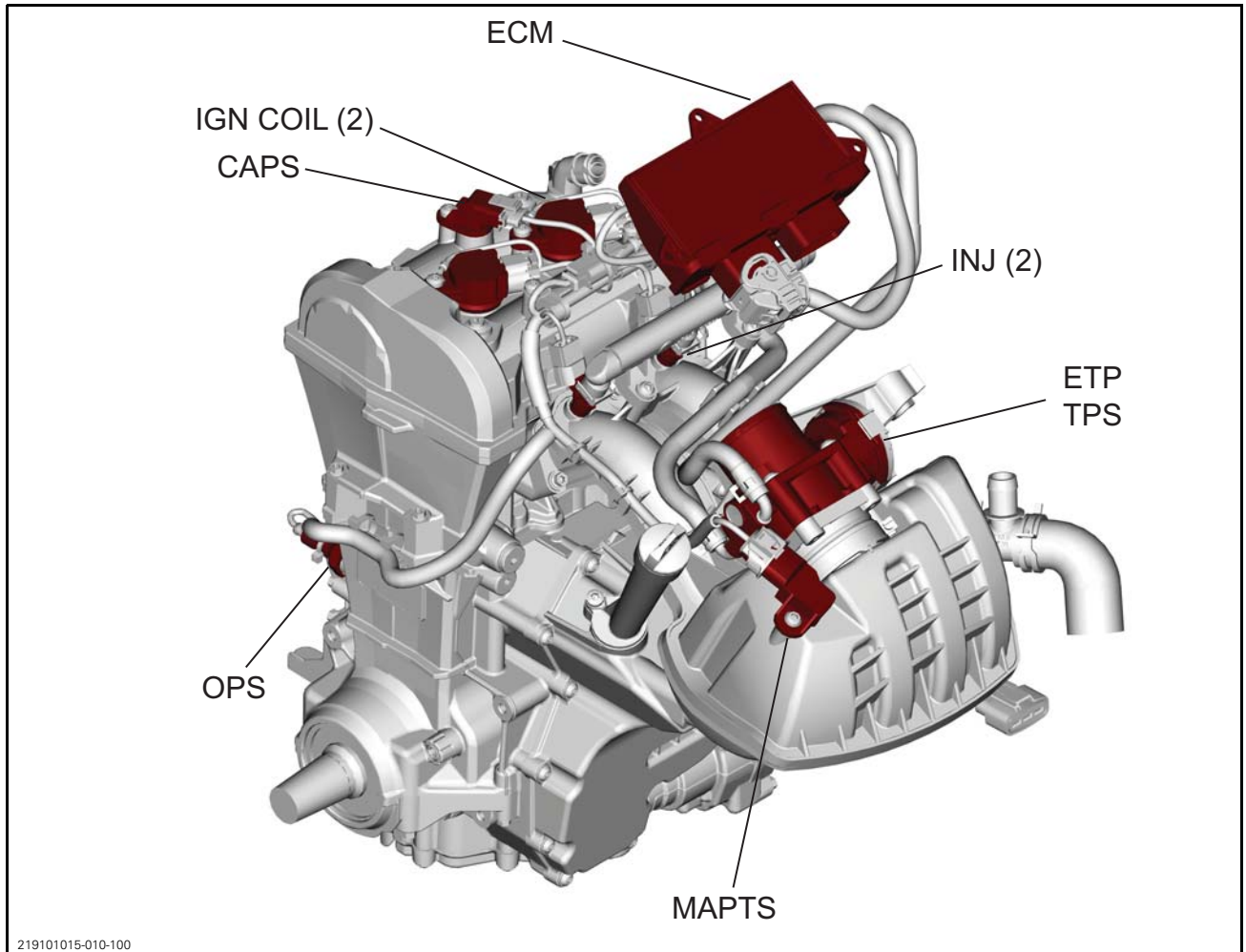
CAN NETWORK RESISTANCE	
CONDITION	SPECIFICATION $\pm 10\%$
Good network	60 Ω
ECM or MG network fault	120 Ω
ECM and MG network fault	O.L.

If the resistance does not vary when a module is unplugged ensure wiring harness and pins are in good condition before replacing a module.

NOTE: There is no resistor in the COM connector.

ENGINE MANAGEMENT SYSTEM (EMS)

600 ACE



CAPS = Camshaft Position Sensor

ECM = Engine Control Module

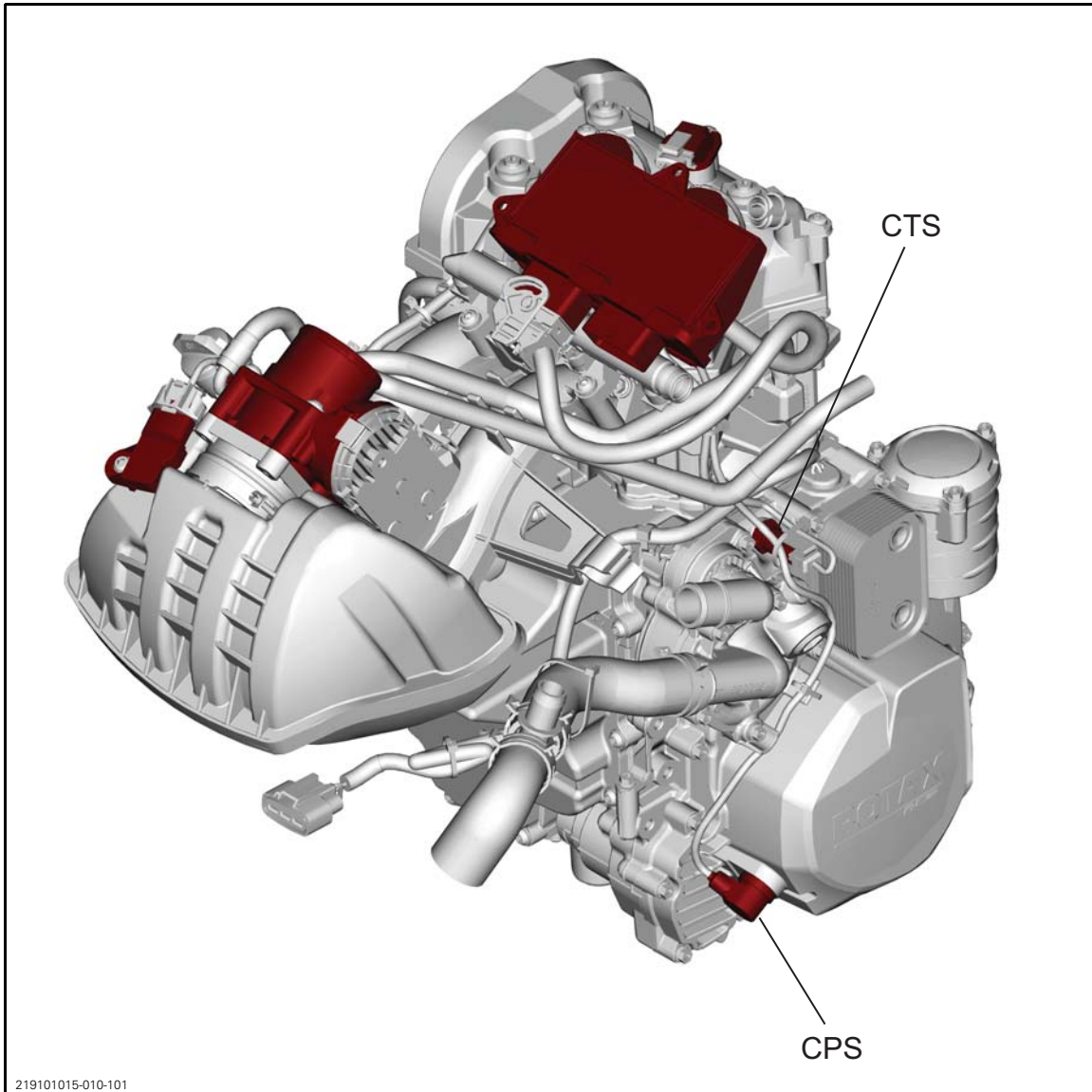
IGN COIL = Ignition coil

INJ = Injector

MAPTS = Manifold Air Pressure/Temperature Sensor

OPS = Oil Pressure Switch

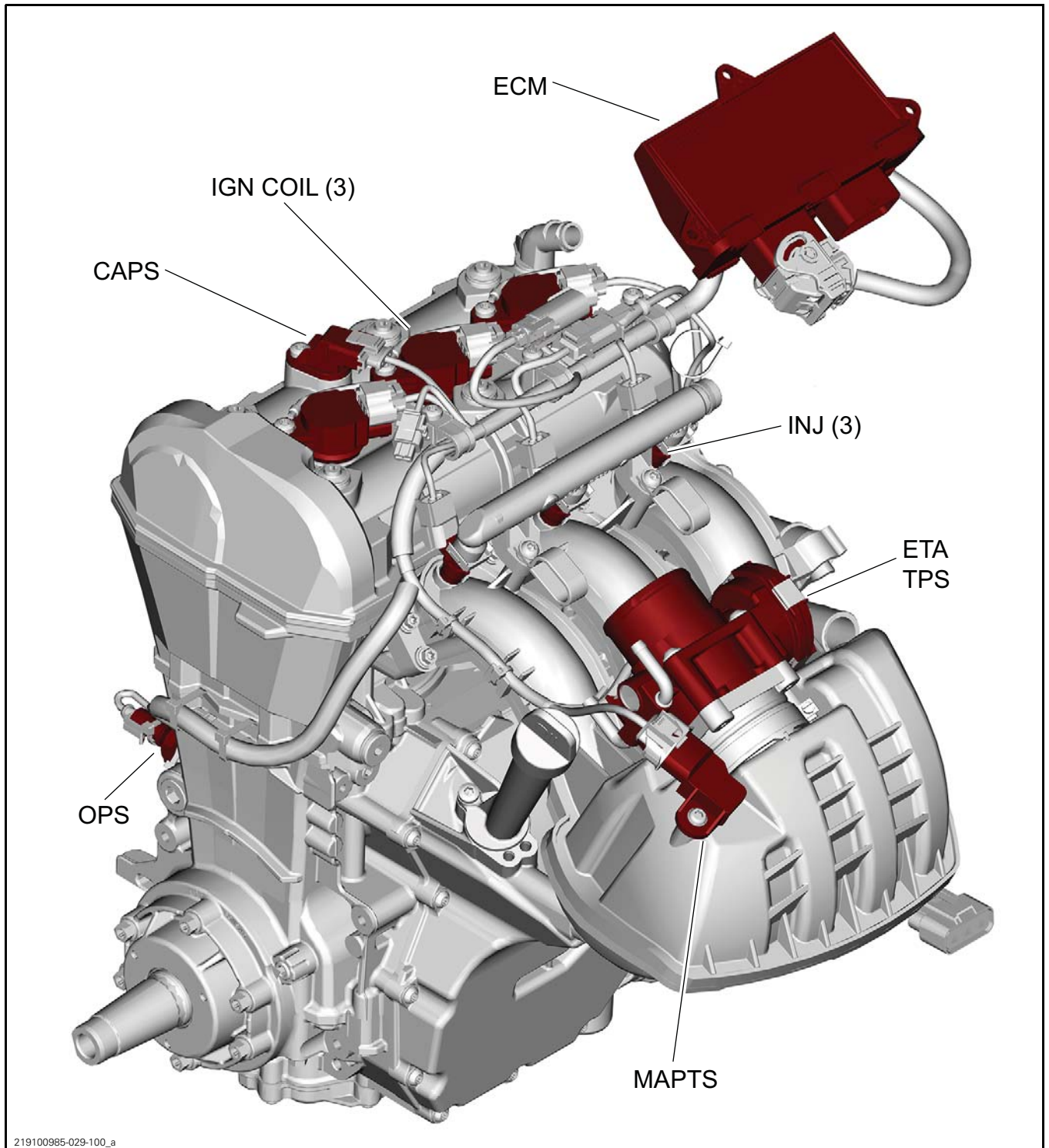
TPS = Throttle Position Sensor



219101015-010-101

CPS = Crankshaft Position Sensor
CTS = Cooling Temperature Sensor

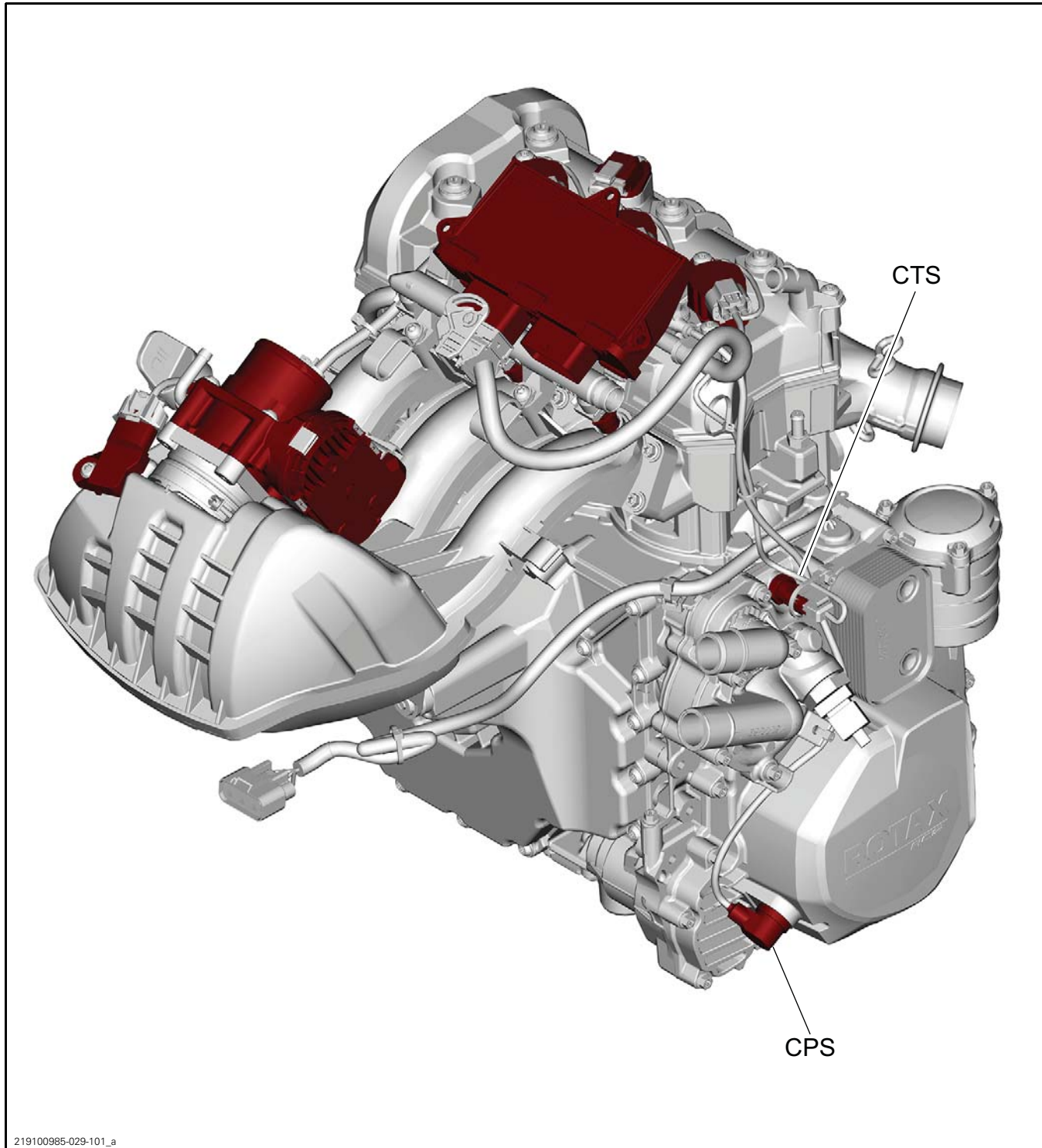
900 ACE



219100985-029-100_a

CAPS = Camshaft Position Sensor
ECM = Engine Control Module
ETA = Electric Throttle Actuator
IGN COIL = Ignition coil

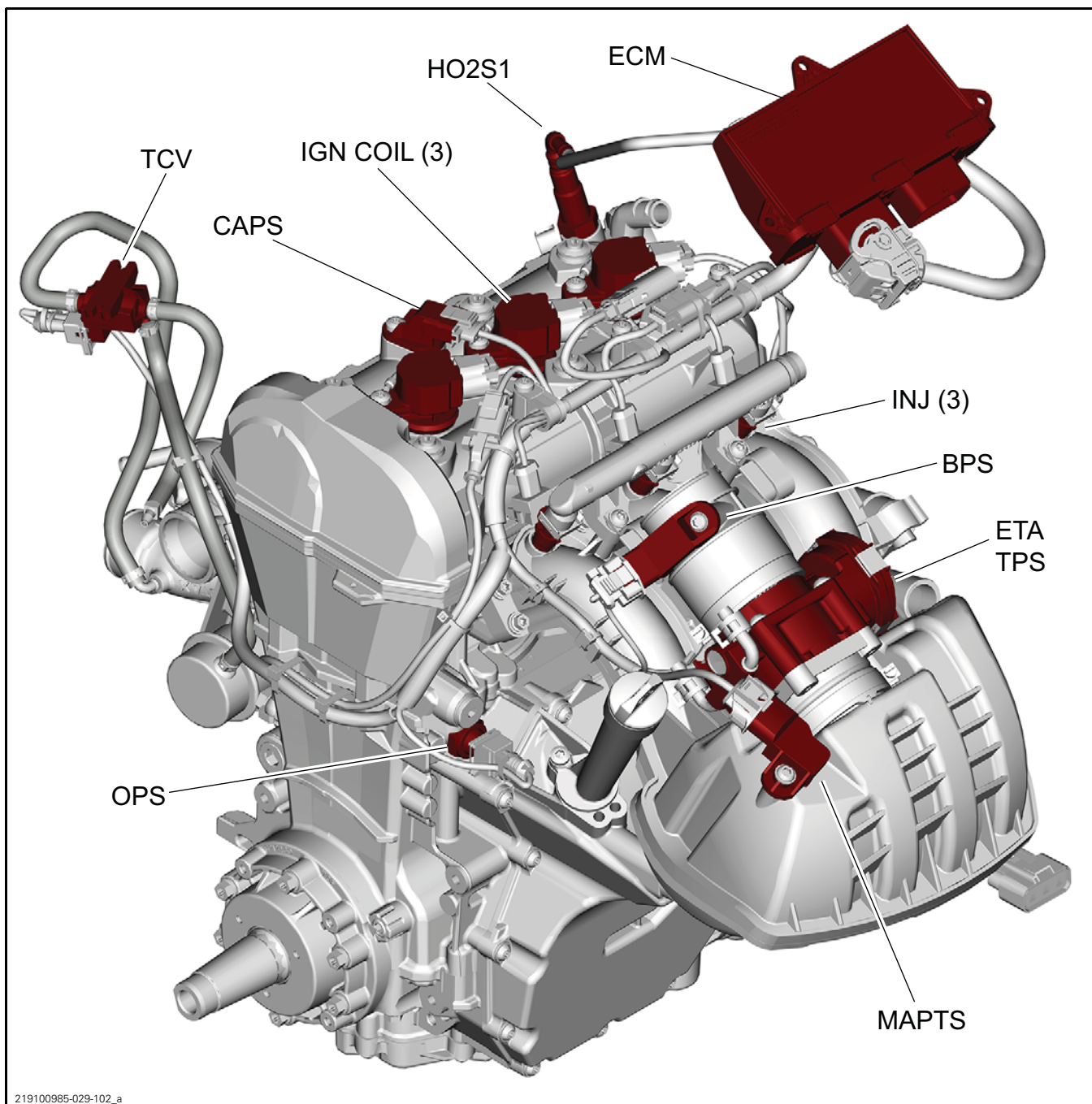
INJ = Injector
MAPTS = Manifold Air Pressure/Temperature Sensor
OPS = Oil Pressure Switch
TPS = Throttle Position Sensor



219100985-029-101_a

CPS = Crankshaft Position Sensor
CTS = Cooling Temperature Sensor

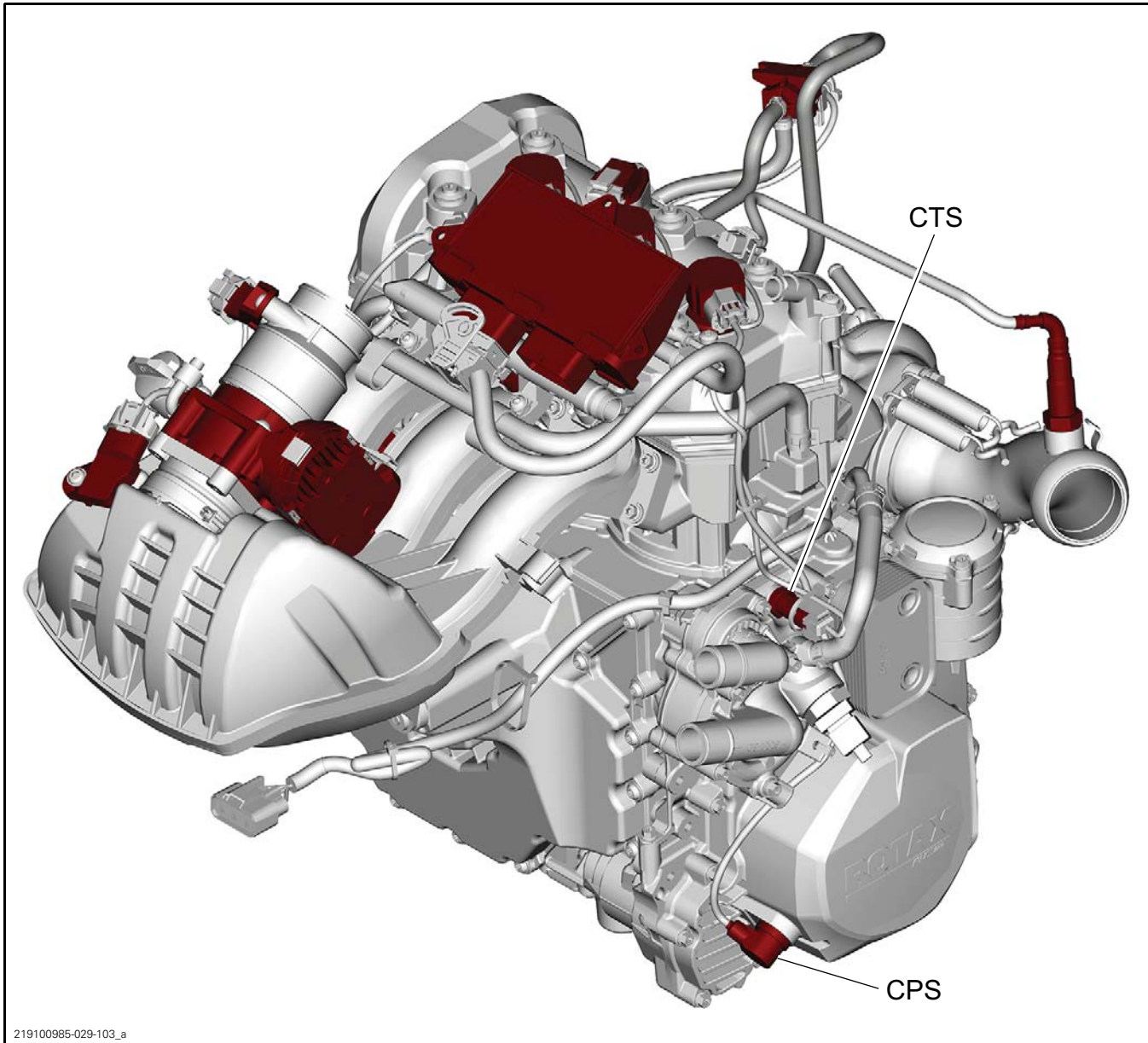
900 ACE Turbo



219100985-029-102_a

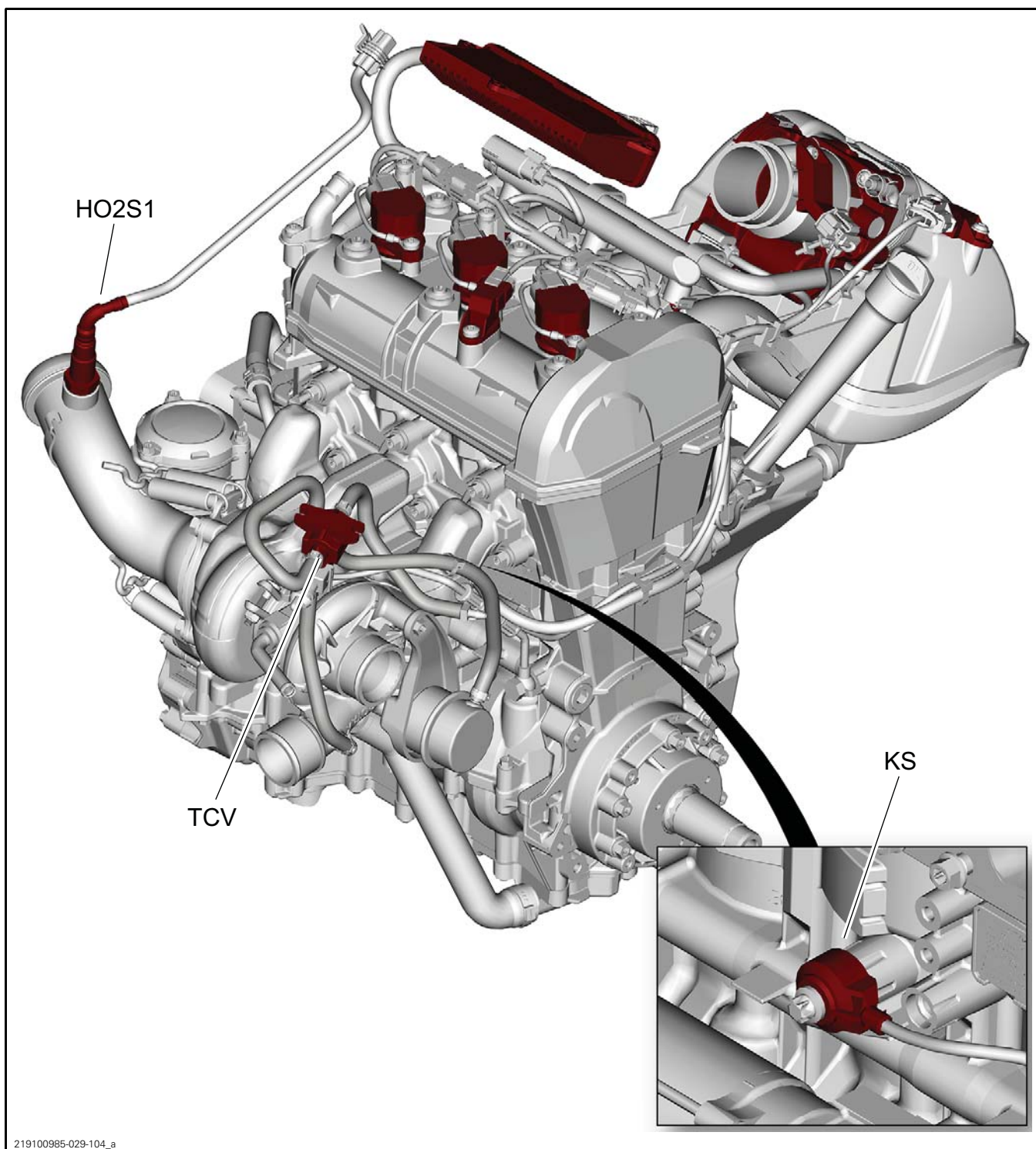
TCV = Turbo Control Valve
BPS = Boost Pressure Sensor
CAPS = Camshaft Position Sensor
ECM = Engine Control Module
ETA = Electric Throttle Actuator
HO2S1 = Oxygen sensor

IGN COIL = Ignition coil
INJ = Injector
MAPTS = Manifold Air Pressure/Temperature Sensor
OPS = Oil Pressure Switch
TPS = Throttle Position Sensor



219100985-029-103_a

CPS = Crankshaft Position Sensor
CTS = Cooling Temperature Sensor



1. HO2S1 = Oxygen Sensor
2. TCV = Turbo Control Valve
3. KS = Knock Sensor

GENERAL

SYSTEM DESCRIPTION

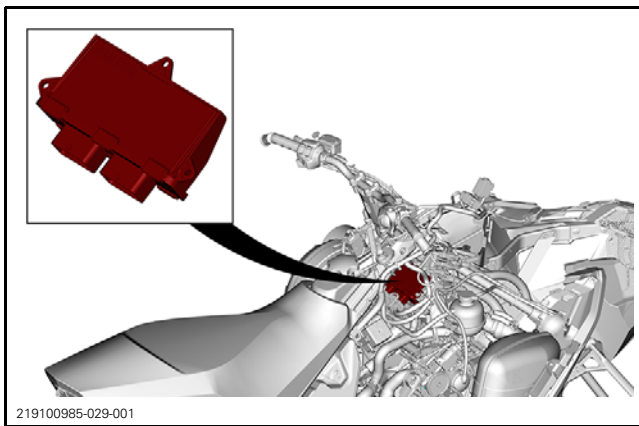
The ECM ensures a high power output with clean combustion.

There are 7 main systems that are controlled by the ECM:

1. Electronic Fuel Injection (EFI)
2. Intelligent throttle control (iTC)
3. Cooling system (cooling fan)
4. Ignition system
5. Starting system
6. Fuel system
7. D.E.S.S.

NOTE: For further information related to these systems, refer to the applicable subsection.

The ECM is the central point of the engine management system.



ECM LOCATION

The ECM reads input signals from various switches, controls, and sensors, that it compares to predetermined parameters, makes computations, and provides control signal outputs required for proper engine management.

The ECM also interacts through CAN bus with other electronic modules for various functions, information exchange and display of messages. Refer to *CONTROLLER AREA NETWORK (CAN)*.

The ECM also features a permanent memory that will store the information on the various ignition keys programmed to the vehicle, fault codes, customer information, and other engine information, even when the battery is removed from the vehicle.

Diagnostic Mode

The ECM features a self-diagnostic mode that is activated on system power up (ignition key ON) for certain systems and components, and when the engine is running for others. Refer to *DIAGNOSTIC AND FAULT CODES* subsection for more information.

Monitoring System

The MONITORING SYSTEM monitors various electrical and electronic components of the engine control systems such as the:

- ETA (Electric Throttle Actuator)
- TPS (Throttle Position Sensor)
- TAS (Throttle Accelerator Sensor)
- ECM (Engine Control Module).

The engine management system provides for redundancies in these components should a failure or partial failure occur to which it will adjust system operation to protect the vehicle and most of importantly, the driver.

Should the engine management system not respond (or not respond correctly) to a failure, then the monitoring system will react to ensure vehicle and driver safety.

The monitoring system therefore ensures the engine management system is functioning correctly.

Limp Home Mode

When a major component of the EMS is not operating properly, limp home mode will be set.

Engine RPM will be limited and/or engine behavior and control may be modified depending on the cause of the failure.

LIMP HOME will be displayed in the multifunction gauge and the CHECK ENGINE light symbol will be on in the gauge.

A failure of any of the following major components will force the vehicle into LIMP HOME MODE:

- TPS / ETA / TAS
- Injectors
- Low oil pressure
- High engine coolant temp
- MAPTS signal fault.

COMMUNICATION TOOLS AND B.U.D.S.

SERVICE TOOLS

Description	Part Number	Page
12 V BATTERY SUPPLY CABLE	529 035 997	1
DIAGNOSTIC CABLE	710 000 851	1
MPI-2 INTERFACE CARD	529 036 018	1
MPI-3 INTERFACE CARD	529 036 353	1
POWER INTERFACE	515 177 223	1

GENERAL

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

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

REQUIRED TOOLS

MANDATORY TOOLS	
A personal computer (laptop or desktop)	
MPI-2 INTERFACE CARD (P/N 529 036 018)	
OR	
MPI-3 INTERFACE CARD (P/N 529 036 353)	
DIAGNOSTIC CABLE (P/N 710 000 851)	
POWER INTERFACE (P/N 515 177 223)	
12 V BATTERY SUPPLY CABLE (P/N 529 035 997)	
OPTIONAL TOOL	
Extension cable available at electronic retail outlets. Do not exceed 7.5 m (25 ft)	

Multi-Purpose Interface Card (MPI-2 or MPI-3)

The Multi-Purpose Interface (MPI) in conjunction with the diagnostic cable is used with BUDS2 to communicate with the engine control module (ECM) and other modules.

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

Power Interface

The power interface and power supply cable allows the connection of a fully charged external battery to provide stable voltage to the unit and BUDS2.

Stable voltage is essential to prevent update crashes.

Do not use a charger on the battery (unit or external) during software updates.

The power interface and power supply cable connected to external battery can be used for extended diagnostic time.



mbs2018-006-002

TYPICAL

The power interface with or without the power supply cable will keep the unit powered even if the ignition switch is turned off or the D.E.S.S. key is removed.

The power interface has a fuse protected volt-meter included and an extra fuse to protect from polarity inversion of the power supply cable.

TROUBLESHOOTING

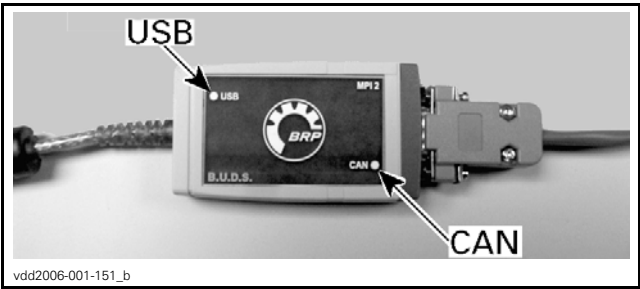
Refer to the BRP BUDS chart to ensure you are using the appropriate hardware and tools.

COMMUNICATION PROBLEMS

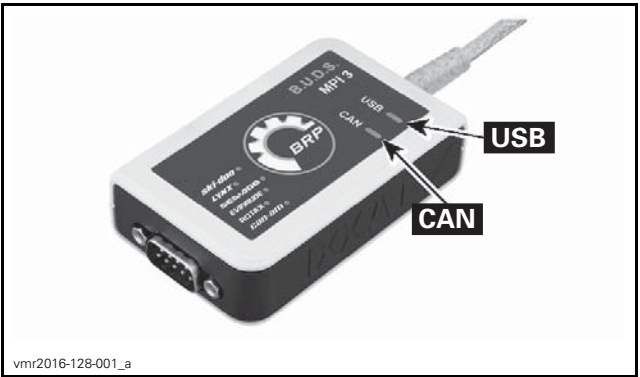
MPI Connection Troubleshooting

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

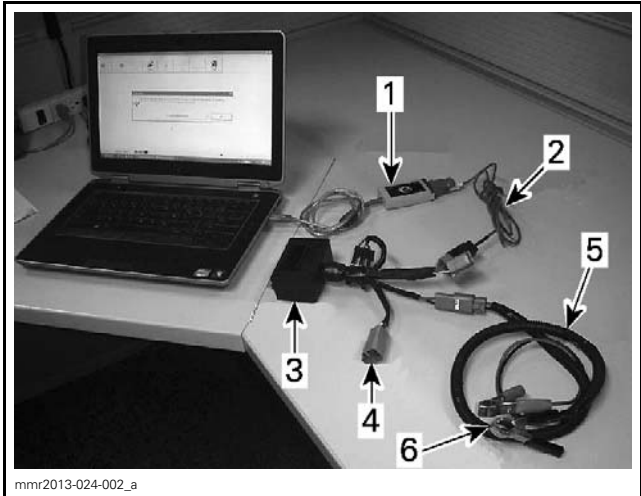
Prerequisite for USB Communication:

- PC Computer turned ON
- MPI connected to PC computer.

COMMUNICATION PROBLEM (USB)	
STATUS	WHAT TO DO
USB Light is OFF	– Check USB connection between MPI-2 and PC computer. – Check USB operation on PC computer (hardware or Windows drivers).
USB Light is GREEN	– Connections are GOOD. Communication can take place on USB side.

Prerequisite for CAN Communication:

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



1. MPI Interface card
2. Diagnostic cable
3. Power interface
4. To vehicle diagnostic connector
5. 12 V battery supply cable
6. To 12 V battery

NOTE: The battery supply cable is only necessary on models without a battery.

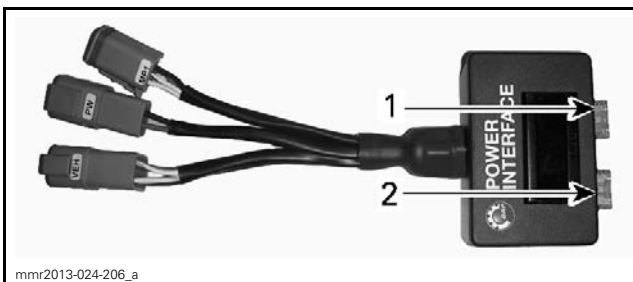
COMMUNICATION PROBLEM (CAN)	
STATUS	WHAT TO DO
CAN Light is OFF	– B.U.D.S. does not communicate with the vehicle. – Check connections from computer to vehicle. – Check if B.U.D.S. is started. – Check if vehicle is powered: is cluster turned ON. If it is not ON, install the tether cord cap (D.E.S.S. key) on the engine cut-off switch and pull the emergency stop switch.
CAN Light is RED	This occurs when B.U.D.S. loses communication with vehicle. – 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 and pull the emergency stop switch.
CAN Light is GREEN	– Connections are GOOD. B.U.D.S. communicates normally with the vehicle.

NOTE: This is especially **IMPORTANT** if you are updating vehicle software. In case of doubt, charge battery for at least 15 minutes; disconnect charger prior to updating software.

Power Interface Test

When the power interface is connected to the vehicle diagnostic connector and the emergency stop switch is pulled, the multifunction gauge and the headlight should turn on. If any test failed, check the following and repair or replace power interface.

1. Set the emergency stop switch to run position.
2. Power interface fuses.



1. Fuse 1
2. Fuse 2

3. External battery voltage should be displayed on Power interface (primary voltage if engine running).
 - 3.1 Ensure battery charge is high enough to keep the vehicle ON for the duration of the maintenance.

DIAGNOSTIC AND FAULT CODES

GENERAL

MONITORING SYSTEM

This system monitors the electronic components of the EMS (engine management system), the multifunction gauge, 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 require 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, MAPTS, CTS, OPS). Throttle actuator, ignition coils and fuel injectors
ECM
CAN
Engine starter solenoid (SD)
Fuel pump (FP)
Multifunction gauge (MG)
Cooling Fan Module (CFM)
Eco Mode Switch (ECO)
Radio Frequency Identification (RFID)
Relays

MULTIFUNCTION GAUGE MONITORING
Multifunction gauge
Light Switch
Vehicle Speed Sensor (VSS)
MODE switch
CAN
Fuel level sensor
ECM

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 multifunction gauge which provides beeper codes, fault indicators and fault messages to inform the rider of a particular condition.

When a minor or transient fault occurs, the fault and beeper will cease automatically if the condition that caused the fault no longer exists.

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 RPM) 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.

Section 04 ENGINE MANAGEMENT SYSTEM

Subsection 04 (DIAGNOSTIC AND FAULT CODES)

Engine Overheat Protection

COOLANT TEMPERATURE	ENGINE OPERATING CONDITION	EMS ACTION
Above 70°C (158°F)	Idling more than: – 12 minutes (with radiator fan) – 5 minutes (without radiator fan)	Engine is stopped. 5 seconds before stopping engine: – Beeper is activated. – SHUTDOWN is displayed in multifunction gauge.
Above 110°C (230°F)	Riding	Beeper is continuously activated. Temperature light is turned ON. ENGINE_TEMP is displayed in multifunction gauge.
Above 118°C (244°F)	Idling more than 30 seconds	Engine is stopped. 5 seconds before stopping engine: – Beeper is activated. – SHUTDOWN is displayed in multifunction gauge.
	Riding	Beeper is activated. Temperature light is turned ON. ENGINE_TEMP is displayed in multifunction gauge. Check engine light is turned ON. Engine speed is limited to 5500 RPM. A fault code is set.

HOW TO FIND FAULT CODE DESCRIPTIONS

For the latest fault code table, use the **Info Center** submenu in BOSSWeb and search for: Ski-Doo DTC.

NOTE: Only select "TST" in the advanced search when searching for a DTC table.

DIAGNOSTIC AND FAULT CODES

GENERAL

FAULT CODE TABLES

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0106	ECM	Manifold air pressure sensor voltage not plausible.	Vacuum leakage between throttle body and plenum (ex: rubber hose disconnected, loose screws, missing gasket at cylinder head flange, missing injector o-rings, cracks) Air intake duct or filter severely clogged MAPTS sensor Defective Damaged circuit wires, damaged connector or damaged ECM pins, ECM voltage supply.	Make sure sensor connector is fully inserted. Measure voltage between harness connector MAPTS-1 and MAPTS-3 (expected value: 4.8 to 5.1 volts).
P0107	ECM	Manifold air pressure sensor voltage too low.	Voltage on system circuit MAPTS-4 reached a low value. Sensor may be disconnected. Circuit wires MAPTS-3 or MAPTS-4 may be disconnected. MAPTS-4 is shorted to ground No 5 volts supply on MAPTS-3 circuit. Damaged sensor.	Make sure sensor's connector is fully inserted. Measure voltage between harness connector MAPTS-1 and MAPTS-3 with the vehicle turned on (expected value: 4.8 to 5.1 volts) Check continuity between ECMA-H2 and MAPTS-1. Check continuity between ECMA-B4 and MAPTS-3. Check continuity between ECMA-G4 and MAPTS-4.
P0108	ECM	Manifold air pressure sensor voltage too high.	Voltage on system circuit MAPTS-4 reached a high value. Circuit wire MAPTS-4 shorted to a supply Circuit wire MAPTS-1 is not connected. Damaged sensor.	Make sure sensor's connector is fully inserted. Measure voltage between harness connector MAPTS-1 and MAPTS-3 with the vehicle turned on (expected value: 4.8 to 5.1 volts) Check continuity between ECMA-H2 and MAPTS-1. Check continuity between ECMA-B4 and MAPTS-3. Check continuity between ECMA-G4 and MAPTS-4.

Section 01 ENGINE MANAGEMENT SYSTEM

Subsection 01 (DIAGNOSTIC AND FAULT CODES)

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0112	ECM	Manifold air temperature sensor voltage too high.	Voltage on system circuit MAPTS-2 reached a high value. Sensor may be disconnected. Circuit wires MAPTS-1 or MAPTS-2 may be disconnected. Damaged sensor.	Make sure sensor's connector is fully inserted. If it is correct then disconnect it and perform the following tests. Check MAPTS sensor pins 1 and 2 for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F). If the sensor resistivity is out of range replace the sensor. Check system circuits ECMA-H3 for continuity to terminal 2 of the MAPTS sensor. Check system circuits ECMA-H2 for continuity to terminal 1 of the MAPTS sensor.
P0113	ECM	Manifold air temperature sensor voltage too low.	Voltage on system circuit MAPTS-2 reached a low value. System circuit MAPTS-2 shorted to ground. Damaged sensor.	Disconnect the sensor and check for a change in the fault code. If the fault code stays the same, look for a short circuit on the harness. If the fault code is different, replace the sensor. Check MAPTS sensor pins 1 and 2 for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F). If the sensor resistivity is out of range replace the sensor. If the sensor resistivity is correct according to the specified temperature range then check circuit wire MAPTS-2 for a short to the ground.
P0117	ECM	Engine coolant temperature sensor voltage too high.	Voltage on system circuit CTS-2 reached a high value. Sensor may be disconnected. Circuit wires CTS-1 or CTS-2 may be disconnected. Circuit CTS-2 shorted to 5 or 12 volts. Damaged sensor.	Make sure sensor's connector is fully inserted. Check system circuit ECMA-1A for continuity to terminal 1 of the CTS connector and ECMA-J2 for continuity to terminal 2 of the CTS connector. Check CTS resistivity on the sensor pins for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F). If the sensor resistivity is out of range replace the sensor.



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Section 01 ENGINE MANAGEMENT SYSTEM
Subsection 01 (DIAGNOSTIC AND FAULT CODES)

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0118	ECM	Engine coolant temperature sensor voltage too low.	Voltage on system circuit CTS-2 reached a low value. Circuit wire CTS-2 shorted to ground. Damaged sensor.	Disconnect the sensor and check for a change in the fault code. If the fault code stays the same, look for a short circuit on the harness. If the fault code is different, replace the sensor. Check system circuit CTS-2 for resistivity to ground (Expected value = 1.2 Kohms when ECMA connector is still connected). Check system circuit ECMA-1A for continuity to terminal 1 of the CTS connector and ECMA-J2 for continuity to terminal 2 of the CTS connector. Check CTS sensor pins for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F). If the sensor resistivity is out of range replace the sensor.
P0122	ECM	First Throttle Accelerator Sensor (TAS) Short circuit to GND	Damaged circuit wires, damaged throttle position sensor or damaged ECM pins.	Make sure sensor connector is fully inserted. Measure resistance from connector: ECMB-K1 to TAS-D (expected value: < 2 ohms). Measure resistance from connector: ECMB-K3 to TAS-E (expected value: < 2 ohms). Measure resistance from connector: ECMB-E1 to TAS-F (expected value: < 2 ohms).
P0123	ECM	First Throttle Accelerator Sensor (TAS) shorted to supply	Damaged circuit wires, damaged throttle position sensor or damaged ECM pins.	Make sure sensor connector is fully inserted. Measure resistance from connector: ECMB-K1 to TAS-D (expected value: < 2 ohms). Measure resistance from connector: ECMB-K3 to TAS-E (expected value: < 2 ohms). Measure resistance from connector: ECMB-E1 to TAS-F (expected value: < 2 ohms).

Section 01 ENGINE MANAGEMENT SYSTEM

Subsection 01 (DIAGNOSTIC AND FAULT CODES)

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0127	ECM	Torque reduction due to high manifold air temperature.	Temperature detected by the MAPTS sensor exceeded the maximum limit. Could happen during extended idling at high ambient temperatures or very low speed with load	
P0201	ECM	Injector Cyl. #1 (PTO) open circuit.	Circuit wires INJ1-1 or INJ1-2 open circuit. Blown fuse. Disconnected injector connector. Disconnected HIC connector. Injector coil open circuit,	Check fuel injector fuse. Make sure injector connector is fully inserted. Make sure HIC connector is connected. Check system circuit ECMA-B3 for continuity to pin 2 of INJ1 connector. Check system circuit INJ-1 for continuity to the fusebox. Check injector resistivity for approximately 14.5 ohms.
P0202	ECM	Injector Cyl. #2 (MAG) open circuit.	Circuit wires INJ2-1 or INJ2-2 open circuit. Blown fuse. Disconnected injector connector. Disconnected HIC connector. Injector coil open circuit.	Check fuel injector fuse. Make sure injector connector is fully inserted. Make sure HIC connector is connected. Check system circuit ECMA-K1 for continuity to pin 2 of INJ1 connector. Check system circuit INJ-1 for continuity to the fusebox. Check injector resistivity for approximately 14.5 ohms.
P0217	ECM	Torque reduction due to high engine coolant temperature.	Warm riding condition, lack of cooling.	Check coolant level. Check for air pocket in cooling system.
P0222	ECM	2nd Throttle Accelerator Sensor (TAS) shorted to GND	Damaged circuit wires, damaged throttle position sensor or damaged ECM pins.	Make sure sensor connector is fully inserted. Measure resistance from connector: ECMB-J3 to TAS-A (expected value: < 2 ohms). Measure resistance from connector: ECMB-B3 to TAS-B (expected value: < 2 ohms). Measure resistance from connector: ECMB-A3 to TAS-C (expected value: < 2 ohms).

Section 01 ENGINE MANAGEMENT SYSTEM
Subsection 01 (DIAGNOSTIC AND FAULT CODES)

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0223	ECM	2nd Throttle Accelerator Sensor (TAS) shorted to supply	Damaged circuit wires, damaged throttle position sensor, or damaged ECM pins.	Make sure sensor connector is fully inserted. Measure resistance from connector: ECMB-J3 to TAS-A (expected value: < 2 ohms). Measure resistance from connector: ECMB-B3 to TAS-B (expected value: < 2 ohms). Measure resistance from connector: ECMB-A3 to TAS-C (expected value: < 2 ohms).
P0231	ECM	Fuel pump open circuit or shorted to ground.	There is no load on circuit wire ECMB-M1 or it is shorted to ground. Blown fuse. Fuel pump connector is not connected. Fuel pump motor is open.	Check fuse. Make sure the fuel pump connector is fully inserted. Open ECM ACTIVATION page in B.U.D.S. Activate fuel pump and check if it reacts as expected. With vehicle power ON check voltage on FP-C connector (Expected value = battery voltage). Check system circuit ECMB-M1 for continuity to FP-A connector. Measure resistance between FP-C and FP-A (expected value: < 2 ohms)
P0232	ECM	Fuel pump shorted to battery.	Circuit wire ECMB-M1 is shorted to 12 volts. Fuel pump motor is stuck or shorted.	Disconnect the fuel pump and check if the fault disappears. If it does then replace the fuel pump. Check if system circuits FP-A and FP-C are shorted together.
P0261	ECM	Injector Cyl. #1 (PTO) shorted to ground.	Circuit wire INJ1-1 is shorted to ground.	Disconnect injector 1. Measure resistance between injector pin 1 and 2 (Expected value = 10 to 15 ohms). With vehicle power ON and engine not running, check the voltage on pin 2 of the INJ2 connector (Expected value = around 3.3 volts). If the voltage is close to 12 volts check for a short to 12 volts on this circuit.

Section 01 ENGINE MANAGEMENT SYSTEM

Subsection 01 (DIAGNOSTIC AND FAULT CODES)

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0262	ECM	Injector Cyl. #1 (PTO) shorted to battery.	Circuit wire INJ1-1 is shorted to battery. Injector coil is shorted.	Disconnect injector 1. Measure resistance between injector pin 1 and 2 (Expected value = 10 to 15 ohms). With vehicle power ON and engine not running, check the voltage on pin 2 of the INJ2 connector (Expected value = around 3.3 volts). If the voltage is close to 12 volts check for a short to 12 volts on this circuit.
P0264	ECM	Injector Cyl. #2 (MAG) shorted to ground.	Circuit wire INJ2-1 is shorted to ground. Injector coil is open	Disconnect injector 2. Measure resistance between injector pin 1 and 2 (Expected value = 10 to 15 ohms). With vehicle power ON and engine not running, check the voltage on pin 2 of the INJ2 connector (Expected value = around 3.3 volts). If the voltage is close to 12 volts check for a short to 12 volts on this circuit.
P0265	ECM	Injector Cyl. #2 (MAG) shorted to battery.	Circuit wire INJ2-1 is shorted to battery. Injector coil is shorted.	Disconnect injector 2. Measure resistance between injector pin 1 and 2 (Expected value = 10 to 15 ohms). With vehicle power ON and engine not running, check the voltage on pin 2 of the INJ2 connector (Expected value = around 3.3 volts). If the voltage is close to 12 volts check for a short to 12 volts on this circuit.
P0335	ECM	Crankshaft signal fault.	Slow engine cranking due to low battery voltage Intermittent signal from crankshaft position sensor. Damaged circuit wires, damaged sensor. Sensor may not be properly secured.	Verify that the battery is properly charged Make sure sensor connector is fully inserted. Measure resistance from connector: ECMA-H1 to CPS-1 (Expected value: < 2 ohms). Measure resistance from connector: ECMA-K2 to CPS-2 (Expected value: < 2 ohms).

Section 01 ENGINE MANAGEMENT SYSTEM
Subsection 01 (DIAGNOSTIC AND FAULT CODES)

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0340	ECM	Engine phase determination error.	CAPS signal not plausible, damaged circuit wires, damaged connector or damaged tooth wheel.	Make sure sensor connector is fully inserted. Measure voltage between harness connector CAPS-3 and CAPS-1 (expected value: 11 to 13 volts). Measure resistance between connector ECMA-E2 to CAPS-2. (expected value : <2 ohms)
P0359	ECM	Ignition coil Cyl. #2 (MAG) shorted to battery.	Circuit wire IGN2-3 is shorted to battery. Ignition coil is damaged.	Disconnect ignition coil #2. With vehicle power ON and engine not running check voltage on pin 3 of IGN2 connector. (Expected value = 0 volt). If voltage is close to 12 volts, check for a short on this circuit.
P0360	ECM	Ignition coil Cyl. #1 (PTO) shorted to battery.	Circuit wire IGN1-3 is shorted to battery. Ignition coil is damaged.	Disconnect ignition coil #1. With vehicle power ON and engine not running check voltage on pin 3 of IGN1 connector. (Expected value = 0 volt). If voltage is close to 12 volts, check for a short on this circuit.
P0361	ECM	ECM ignition coil driver #2 (MAG) fault	Ignition coil or HIC connector not connected or damaged. Blown fuse. Broken wire or terminal.	Check if HIC connector connected. Check ignition fuse. Check circuit wire IGN2-3.
P0362	ECM	ECM ignition coil driver #1 (PTO) fault	Ignition coil or HIC connector not connected or damaged. Blown fuse. Broken wire or terminal.	Check if HIC connector connected. Check ignition fuse. Check circuit wire IGN1-3.
P0480	ECM	Fan relay circuit	Blown fuse, damaged or disconnected relay, damaged circuit wires, damaged connectors or damaged ECM output pins.	Check fuse. Disconnect Fan relay. Measure voltage between harness connector CFM-4 and ground (expected value: 11 to 13 volts). Measure resistance from harness connector: ECMB-J4 to CFM-2 (expected value: < 2 ohms). With the engine turned off measure voltage between CFM-2 and ground (expected value: 11 to 13 volts). Use BUDS to activate the fan and measure voltage between CFM-2 and ground (expected value: close to 0 volts). Check fuse F4

Section 01 ENGINE MANAGEMENT SYSTEM

Subsection 01 (DIAGNOSTIC AND FAULT CODES)

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0513	ECM	Invalid Access Key Detected	A non stored access key was detected when key switch was turned to ON. If no access key is available, program a new one and retry.	
P0520	ECM	Engine oil pressure switch functional problem.	Defective oil pressure switch, damaged circuit wires, damaged connector or loose terminals, damaged ECM pins.	Measure resistance between harness connector EOP and ground when engine stopped (expected value < 2 ohms). Measure resistance between harness connector EOP and ground when engine running (expected value = open). Measure resistance from harness connector: EOP to ECMA-E3 (expected value: < 2 ohms). Check if HIC connector is properly connected (engine harness to the vehicle harness).
P0523	ECM	Engine oil pressure switch sticking	Disconnected oil pressure switch Damaged oil pressure switch, damaged circuit wires, damaged connector, damaged ECM pins.	Measure resistance between harness connector EOP and ground when engine stopped (expected value < 2 ohms). Measure resistance between harness connector EOP and ground when engine running (expected value = open). Measure resistance from harness connector: EOP to ECMA-E3 (expected value: < 2 ohms). Check if HIC connector is properly connected (engine harness to the vehicle harness).
P0524	ECM	Low oil pressure.	Oil level too low Engine mechanical problem Defective oil pressure switch, damaged circuit wires, damaged connector, damaged ECM pins. Vehicle was turned upside down with the engine running	Check oil level. Check system circuit ECMA-E3 for continuity to the terminal of the OPS connector. Check oil pressure. If the vehicle was turned upside down while the engine was running, delete the fault
P0560	ECM	Non-plausibility error on system voltage	ECU internal failure in reading system voltage	Replace ECU if fault is persisting

Section 01 ENGINE MANAGEMENT SYSTEM
Subsection 01 (DIAGNOSTIC AND FAULT CODES)

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0562	ECM	Battery voltage too low.	Battery voltage dropped under 11 volts.	Check battery voltage for 11 to 13 volts with engine stopped. Check battery voltage for 13.5 to 14.5 volts with engine speed above 2500 RPM. Check connections on regulator. Check charging system.
P0563	ECM	Battery voltage too high.	Battery voltage exceeded 15.6 volts.	Check battery voltage for 11 to 13 volts with engine stopped. Check battery voltage for 13.5 to 14.5 volts with engine speed above 2500 RPM. Check connections on regulator. Check charging system.
P060D	ECM	Throttle Accelerator Sensor (TAS) signals not synchronized.	Throttle Accelerator Sensors (TAS) plausibility check error.	Make sure sensor connector is fully inserted. Check voltages on connector TAS-F and TAS-C. Voltage on pin TAS-F must be 2 times greater than voltage on pin TAS-C at any given position of the lever. Check for 5 volts on pin TAS-A and TAS-D.
P060E	ECM	Electrical Throttle Actuator (ETA) control fault	Damaged wiring harness Damaged TPS Damaged ECM	Disconnect throttle body Measure resistance between ETC pin 3 and 5 (expected value = 2 to 3 ohms). Disconnect ECMA. Measure resistance from harness connector: ETC-5 to ECMA-L1 (expected value: < 2 ohms). Measure resistance from harness connector: ETC-3 to ECMA-L2 (expected value: < 2 ohms).
P0610	ECM	Variant Coding error.	Faulty variant coding, faulty programming, wrong ECM after replacement	

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Subsection 01 (DIAGNOSTIC AND FAULT CODES)

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P062C	ECM	Loss of vehicle speed information from multifunction gauge.	ECM lost communication with the cluster. Multifunction gauge may be disconnected. Loss of power on the multifunction gauge. Loss of communication with the multifunction gauge via the CAN bus. CAN bus lines shorted together. CAN bus line shorted to ground.	Make sure the multidunction gauge connector is fully inserted. Check for bent pin on the cluster connector Measure voltage between harness connector MG-8 and ground with the vehicle turned on (expected value: 11 to 13 volts). Measure voltage between harness connector MG-9 and ground with the vehicle turned off (expected value: 11 to 13 volts). Measure resistivity between harness connector MG-11 for continuity to the ground (Expected value < 2 ohms). Check continuity between harness connector MG-24 and ECMB-C1 Check continuity between harness connector MG-23 and ECMB-C2 Resistance between harness connector MG-23 and MG-24 should be around 120 ohms Verify that harness connector MG-23 and MG-24 are not shorted to ground or anything else



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Section 01 ENGINE MANAGEMENT SYSTEM
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PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0685	ECM	Lighting relay circuit	Blown fuse, damaged or disconnected relay, damaged circuit wires, damaged connectors or damaged ECM output pins.	Check fuse. Disconnect lighting relay. Measure voltage between harness connector FB-D1 and ground (expected value: 11 to 13 volts). Measure voltage between harness connector FB-D2 and ground (expected value: 11 to 13 volts). Measure resistance from harness connector: ECMB-G1 to FB-C2 (expected value: < 2 ohms). With the engine turned off measure voltage between FB-C2 and ground (expected value: 11 to 13 volts). With the engine turned on measure voltage between FB-C2 and ground (expected value: close to 0 volts). Measure resistance between terminals 85 and 86 on the 2 relays (expected value: 70 to 90 ohms).
P0686	ECM	Lighting relay circuit shorted to ground or open circuit	Blown fuse, damaged or disconnected relay, damaged circuit wires, damaged connectors or damaged ECM output pins.	Check fuse. Disconnect lighting relay. Measure voltage between harness connector FB-D1 and ground (expected value: 11 to 13 volts). Measure voltage between harness connector FB-D2 and ground (expected value: 11 to 13 volts). Measure resistance from harness connector: ECMB-G1 to FB-C2 (expected value: < 2 ohms). With the engine turned off measure voltage between FB-C2 and ground (expected value: 11 to 13 volts). With the engine turned on measure voltage between FB-C2 and ground (expected value: close to 0 volts). Measure resistance between terminals 85 and 86 on the 2 relays (expected value: 70 to 90 ohms).

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Subsection 01 (DIAGNOSTIC AND FAULT CODES)

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0687	ECM	Lighting relay circuit shorted to battery +	Damaged relay, damaged circuit wires, damaged connector or damaged ECM output pins.	Check fuse. Disconnect lighting relay. Measure voltage between harness connector FB-D1 and ground (expected value: 11 to 13 volts). Measure voltage between harness connector FB-D2 and ground (expected value: 11 to 13 volts). Measure resistance from harness connector: ECMB-G1 to FB-C2 (expected value: < 2 ohms). With the engine turned off measure voltage between FB-C2 and ground (expected value: 11 to 13 volts). With the engine turned on measure voltage between FB-C2 and ground (expected value: close to 0 volts). Measure resistance between terminals 85 and 86 on the 2 relays (expected value: 70 to 90 ohms).
P0691	ECM	Fan relay circuit shorted to ground or open circuit	Blown fuse, damaged or disconnected relay, damaged circuit wires, damaged connectors or damaged ECM output pins.	Check fuse. Disconnect Fan relay. Measure voltage between harness connector CFM-4 and ground (expected value: 11 to 13 volts). Measure resistance from harness connector: ECMB-J4 to CFM-2 (expected value: < 2 ohms). With the engine turned off measure voltage between CFM-2 and ground (expected value: 11 to 13 volts). Use BUDS to activate the fan and measure voltage between CFM-2 and ground (expected value: close to 0 volts). Check fuse F4

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Subsection 01 (DIAGNOSTIC AND FAULT CODES)

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0692	ECM	Fan relay circuit shorted to battery +	Damaged relay, damaged circuit wires, damaged connector or damaged ECM output pins.	Check fuse. Disconnect Fan relay. Measure voltage between harness connector CFM-4 and ground (expected value: 11 to 13 volts). Measure resistance from harness connector: ECMB-J4 to CFM-2 (expected value: < 2 ohms). With the engine turned off measure voltage between CFM-2 and ground (expected value: 11 to 13 volts). Use BUDS to activate the fan and measure voltage between CFM-2 and ground (expected value: close to 0 volts). Check fuse F4
P1120	ECM	Wrong ratio between both throttle position sensor (TPS)	Damaged wiring harness Damaged TPS Damaged ECM	Make sure the TPS connector is fully inserted. Reset TPS position. Measure voltage between harness connector ETC-6 and ETC-2 with the vehicle turned on (expected value: 3.3 volts) Check for short between ETC-1 or ETC-4 and a supply or a ground Check continuity between harness connector ETC-1 and ECMA-F3 Check continuity between harness connector ETC-4 and ECMA-K3 Check continuity between harness connector ETC-6 and ECMA-K4 Check continuity between harness connector ETC-2 and ECMA-A2
P160E	ECM	Electrical Throttle Actuator (ETA) control fault	Damaged wiring harness Damaged TPS Damaged ECM	Disconnect throttle body Measure resistance between ETC pin 3 and 5 (expected value = 2 to 3 ohms). Disconnect ECMA. Measure resistance from harness connector: ETC-5 to ECMA-L1 (expected value: < 2 ohms). Measure resistance from harness connector: ETC-3 to ECMA-L2 (expected value: < 2 ohms).

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PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P1610	ECM	Electrical Throttle Actuator (ETA) shorted to supply	Damaged ETC module, damaged circuit wires, damaged connector or damaged ECM output pins.	Disconnect ETC module. Check for a short between ECMA-L1 or ECMA-L2 and a supply Measure resistance from connector: ECMA-L1 to ETC-5 (expected value: < 2 ohms). Measure resistance from connector: ECMA-L2 to ETC-3 (expected value: < 2 ohms).
P1611	ECM	Electrical Throttle Actuator (ETA) shorted to ground	Damaged ETC module, damaged circuit wires, damaged connector or damaged ECM output pins.	Disconnect ETC module. Check for a short between ECMA-1L or ECMA-L2 and gnd Measure resistance from connector: ECMA-L1 to ETC-5 (expected value: < 2 ohms). Measure resistance from connector: ECMA-L2 to ETC-3 (expected value: < 2 ohms).
P1612	ECM	Electrical Throttle Actuator (ETA) signal not plausible	Damaged ETC module, damaged circuit wires, damaged connector or damaged ECM output pins.	Disconnect ETC module. Measure resistance from connector: ECMA-L1 to ETC-5 (expected value: < 2 ohms). Measure resistance from connector: ECMA-L2 to ETA-3 (expected value: < 2 ohms).
P1613	ECM	Electrical Throttle Actuator (ETA) open electrical load	Damaged ETC module, damaged circuit wires, damaged connector or damaged ECM output pins.	Disconnect ETC module. Measure resistance from connector: ECMA-L1 to ETC-5 (expected value: < 2 ohms). Measure resistance from connector: ECMA-L2 to ETA-3 (expected value: < 2 ohms). Measure resistance between ETC-5 and ETC-3 (expected value < 5 ohms)

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Subsection 01 (DIAGNOSTIC AND FAULT CODES)

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P1614	ECM	Electronic throttle control (ETC) return spring check not passed	Throttle mechanical adjustment. No TPS reset after throttle body/ECM replacement. Damaged throttle body	Check throttle plate movement. Check idle stop for wear. Check throttle position sensor angle at idle, expected value 1-4.5 degrees Perform THROTTLE POSITION SENSOR RESET in B.U.D.S. with throttle grip accelerator not activated since at least 30 seconds. Refer to the SERVICE MANUAL for more details.
P1615	ECM	Electronic throttle control (ETC) position deviation fault	Throttle mechanical adjustment. No TPS reset after throttle body/ECM replacement.	Check throttle plate movement. Check idle stop for wear. Check throttle position sensor angle at idle, expected value 1-4.5 degrees Perform THROTTLE POSITION SENSOR RESET in B.U.D.S. with throttle grip accelerator not activated since at least 30 seconds. Refer to the SERVICE MANUAL for more details.
P1616	ECM	Electronic throttle control (ETC) check of limp-home position failed	Throttle mechanical stop. No TPS reset after throttle body/ECM replacement.	Check throttle plate movement. Check idle stop for wear. Check throttle position sensor angle at idle, expected value 1-4.5 degrees Perform THROTTLE POSITION SENSOR RESET in B.U.D.S. with throttle grip accelerator not activated since at least 30 seconds. Refer to the SERVICE MANUAL for more details.
P1619	ECM	TPS adaptation failure	Wrong throttle body mechanical position during reset of closed TPS or no TPS reset after ECM replacement.	Check idle stop for wear. Perform THROTTLE POSITION SENSOR RESET in B.U.D.S. with throttle grip accelerator not activated since at least 30 seconds.
P1620	ECM	TPS adaptation failure	Wrong throttle body mechanical position during reset of closed TPS or no TPS reset after ECM replacement.	Check idle stop for wear. Perform THROTTLE POSITION SENSOR RESET in B.U.D.S. with throttle grip accelerator not activated since at least 30 seconds.

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PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P1621	ECM	TPS adaptation cancelled lower mechanical stop failed	Throttle mechanical stop. No TPS reset after throttle body/ECM replacement.	Check idle stop for wear. Ensure throttle plate is against throttle stop. Check throttle Position sensor angle at idle. Perform THROTTLE POSITION SENSOR RESET in B.U.D.S. with throttle grip accelerator not activated since at least 30 seconds. Refer to the SERVICE MANUAL for more details.
P1622	ECM	TPS adaptation failed	Throttle mechanical stop. No TPS reset after throttle body/ECM replacement.	Check idle stop for wear. Check throttle position sensor angle at idle. Perform THROTTLE POSITION SENSOR RESET in B.U.D.S. with throttle grip accelerator not activated since at least 30 seconds. Refer to the SERVICE MANUAL for more details.
P1672	ECM	Accessories relay circuit shorted to battery +	Damaged relay, damaged circuit wires, damaged connector or damaged ECM output pins.	Check fuse. Disconnect lighting relay. Measure voltage between harness connector FB-C6 and ground (expected value: 11 to 13 volts). Measure voltage between harness connector FB-C5 and ground (expected value: 11 to 13 volts). Measure resistance from harness connector: ECMB-J2 to FB-D5 (expected value: < 2 ohms). With the engine turned off measure voltage between FB-D5 and ground (expected value: 11 to 13 volts). With the engine turned on measure voltage between FB-D5 and ground (expected value: close to 0 volts). Measure resistance between terminals 85 and 86 on the 2 relays (expected value: 70 to 90 ohms).

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PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P1673	ECM	Accessories relay circuit shorted to ground or open circuit	Blown fuse, damaged or disconnected relay, damaged circuit wires, damaged connectors or damaged ECM output pins.	Check fuse. Disconnect lighting relay. Measure voltage between harness connector FB-C6 and ground (expected value: 11 to 13 volts). Measure voltage between harness connector FB-C5 and ground (expected value: 11 to 13 volts). Measure resistance from harness connector: ECMB-J2 to FB-D5 (expected value: < 2 ohms). With the engine turned off measure voltage between FB-D5 and ground (expected value: 11 to 13 volts). With the engine turned on measure voltage between FB-D5 and ground (expected value: close to 0 volts). Measure resistance between terminals 85 and 86 on the 2 relays (expected value: 70 to 90 ohms).
P1674	ECM	Accessories relay circuit	Blown fuse, damaged or disconnected relay, damaged circuit wires, damaged connectors or damaged ECM output pins.	Check fuse. Disconnect lighting relay. Measure voltage between harness connector FB-C6 and ground (expected value: 11 to 13 volts). Measure voltage between harness connector FB-C5 and ground (expected value: 11 to 13 volts). Measure resistance from harness connector: ECMB-J2 to FB-D5 (expected value: < 2 ohms). With the engine turned off measure voltage between FB-D5 and ground (expected value: 11 to 13 volts). With the engine turned on measure voltage between FB-D5 and ground (expected value: close to 0 volts). Measure resistance between terminals 85 and 86 on the 2 relays (expected value: 70 to 90 ohms).
P16C0	ECM	ECU ADC plausibility check	Monitoring plausibility check failed.	Check for ECM fault.
P16C1	ECM	ECU ADC test failed	Monitoring plausibility check failed.	Check for ECM fault.

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PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P16C2	ECM	ECU monitoring error	Monitoring plausibility check failed.	Check for ECM fault.
P16C3	ECM	Throttle Accelerator Sensors (TAS) monitoring check fault	Monitoring plausibility check failed.	Check for ECM fault.
P16C4	ECM	Engine speed monitoring check fault	Monitoring plausibility check failed.	Check for ECM fault.
P16C5	ECM	Safety fuel cut-off activated monitoring check level 1	Monitoring plausibility check failed.	Check for ECM fault.
P16C6	ECM	Safety fuel cut-off activated monitoring check level 2	Monitoring plausibility check failed.	Check for ECM fault.
P16C7	ECM	Throttle valve plausibility check failed	Monitoring plausibility check failed.	Check for ECM fault.
P16C8	ECM	Permitted throttle valve position monitoring check exceeded	Monitoring plausibility check failed.	Check for ECM fault.
P16C9	ECM	function monitoring: monitoring of the emergency switch in level 2 (DFC_MoFEmgcySwOff)	Monitoring plausibility check failed.	Check for ECM fault.
P1790	ECM	Driving mode selector switch	Driving mode selector switch has the up and down selection pressed at the same time	Check for a short between ECMB-D3 or ECO-A with ECM-A1 or ECO-B Check for a short between ECMB-E3 or ECO-C with ECM-A1 or ECO-B
P20EB	ECM	Main relay de-energized too late or sticking	Damaged circuit wires Damaged connectors Damaged ECM output pins Damaged main relay	Disconnect main relay. Measure resistance between terminals 85 and 86 on relay (expected value: 70 to 90 ohms). Measure resistance between terminals 30 and 87 on relay (expected value: open circuit). Disconnect relay and measure resistance between terminals FB-A4 and ground (expected value: open circuit).

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PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P212C	ECM	Throttle position sensor #2 voltage too low.	Low voltage or short to ground on circuit wire ETC-4. No 3.3 volts supply on ETC-6. ETC-1 is shorted to ground Damaged sensor.	Make sure the TPS connector is fully inserted. Reset TPS position. Measure voltage between harness connector ETC-6 and ETC-2 with the vehicle turned on (expected value: 3.3 volts) Check continuity between harness connector ETC-4 and ECMA-K3 Check continuity between harness connector ETC-6 and ECMA-K4 Check continuity between harness connector ETC-2 and ECMA-A2 Check for a short between ETC-4 and a supply
P212D	ECM	Throttle position sensor #2 voltage too high.	Voltage on circuit wire ETC-4 too high. Circuit wire ETC-4 shorted to a supply. Circuit wire ETC-2 is open.	Make sure the TPS connector is fully inserted. Reset TPS position. Measure voltage between harness connector ETC-6 and ETC-2 with the vehicle turned on (expected value: 3.3 volts) Check continuity between harness connector ETC-4 and ECMA-K3 Check continuity between harness connector ETC-6 and ECMA-K4 Check continuity between harness connector ETC-2 and ECMA-A2 Check for a short between ETC-4 and a supply
P2279	ECM	Air leak from intake plenum	Cracked plenum Leak in air intake system. TPS learning position not done correctly. MAP Sensor problem. Throttle body air leakage.	Reset TPS position. Check for faulty Air Pressure Sensor. Check for faulty TPS. Check for cracked plenum. Check for leak on the throttle body
P2299	ECM	Throttle and break paddle are used at the same time		

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PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P2621	ECM	Throttle position sensor #1 voltage too low.	Low voltage or short to ground on circuit wire ETC-1. No 3.3 volts supply on ETC-6. ETC-1 is shorted to ground Damaged sensor.	Make sure the TPS connector is fully inserted. Reset TPS position. Measure voltage between harness connector ETC-6 and ETC-2 with the vehicle turned on (expected value: 3.3 volts) Check continuity between harness connector ETC-1 and ECMA-F3 Check continuity between harness connector ETC-6 and ECMA-K4 Check continuity between harness connector ETC-2 and ECMA-A2 Check for a short between ETC-1 and a supply
If you bought this manual from any other seller please leave them NEGATIVE feedback and notify me at bestshopmanuals@gmail.com				
P2622	ECM	Throttle position sensor #1 voltage too high.	Voltage on circuit wire ETC-1 too high. Circuit wire ETC-1 shorted to a supply. Circuit wire ETC-2 is open.	Make sure the TPS connector is fully inserted. Reset TPS position. Measure voltage between harness connector ETC-6 and ETC-2 with the vehicle turned on (expected value: 3.3 volts) Check continuity between harness connector ETC-1 and ECMA-F3 Check continuity between harness connector ETC-6 and ECMA-K4 Check continuity between harness connector ETC-2 and ECMA-A2 Check for a short between ETC-1 and a supply
U0167	ECM	No communication with DESS key.	Damaged circuit wires, damaged or disconnected DESS post, damaged DESS key.	Measure voltage between harness connector RFID-D and ground (expected value: 11 to 13 volts). Check continuity between hesness connector RFID-A and ECMB-F2 Check continuity between hesness connector RFID-B and ECMB-E4 Check continuity between hesness connector RFID-C and ECMB-B2

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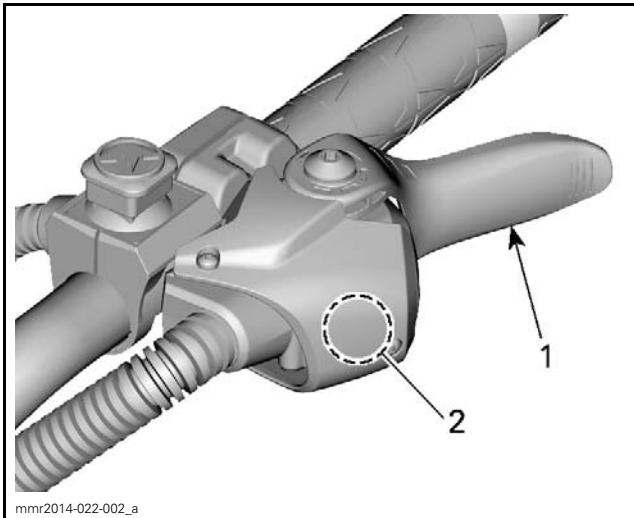
PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
U0400	ECM	Variant coding failure software incompatibility	Faulty variant coding. Faulty programming.	Try updating the ECM. If the problem persists, make sure the ECM part number is correct for the model it is installed on.
U0426	ECM	DESS key communication error.	Damaged circuit wires, damaged or disconnected DESS post, damaged DESS key.	Measure voltage between harness connector RFID-D and ground (expected value: 11 to 13 volts). Check continuity between hesness connector RFID-A and ECMB-F2 Check continuity between hesness connector RFID-B and ECMB-E4 Check continuity between hesness connector RFID-C and ECMB-B2
U300A	ECM	State of the DESS key switch not plausible	Damaged wiring harness Damaged RFID module	Measure voltage between harness connector RFID-D and ground (expected value: 11 to 13 volts). Check continuity between hesness connector RFID-A and ECMB-F2 Check continuity between hesness connector RFID-B and ECMB-E4 Check continuity between hesness connector RFID-C and ECMB-B2

INTELLIGENT THROTTLE CONTROL (iTC)

GENERAL

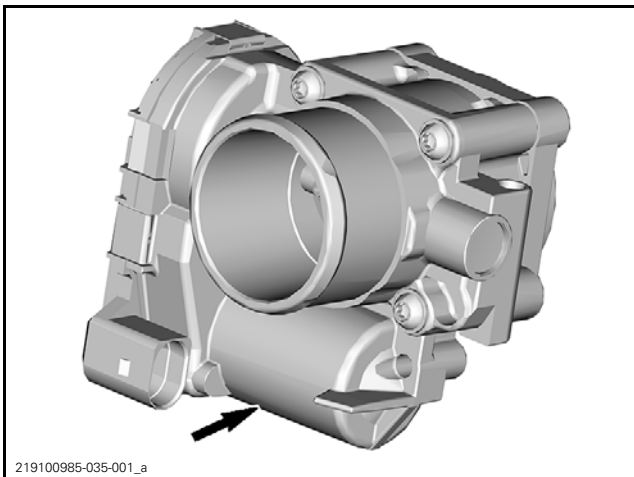
SYSTEM DESCRIPTION

The iTC is an electronic throttle control system that includes a cableless throttle accelerator sensor (TAS) located on the RH side of handlebar, an electronic throttle control (ETC) located on the throttle body and the engine control module (ECM). The iTC is often referred to as a "throttle by wire" system.



TYPICAL

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



THROTTLE ACTUATOR

The ETC is equipped with a motor which controls the throttle opening.

The position of the throttle is measured with two potentiometers.

The ECM evaluates the throttle position with these two measures and controls the motor to reach the desired position.

These potentiometers are powered by the ECM with a voltage of 3.3 volts.

The signals given by these potentiometers vary from 0.33V to 2.97V for (SIGNAL 1) and 2.97V to 0.33V for (SIGNAL 2).

The relation between these two signals is (SIGNAL 1) + (SIGNAL 2) = 3.3V.

When ECM is woken up, throttle body will close completely to reinitialize. For both signals to be properly set at idle position.

If a problem occurs with any of these controls or signals then a diagnostic fault code will be generated.

Throttle Accelerator Sensor (TAS)

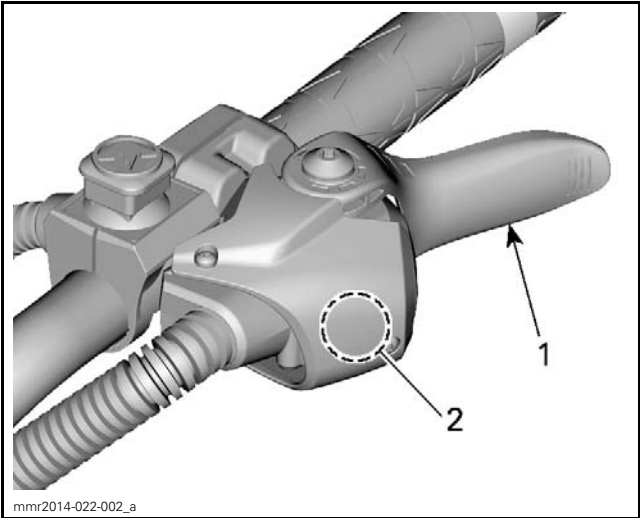
The throttle accelerator sensor (TAS) is a double hall effect sensor, which translates the position of the lever into two analog voltage and sends a signal to the ECM which is proportional to the throttle lever angle.

These Hall effect sensors are powered by the ECM with a voltage of 5.0 volts.

The signals given by these sensors vary from 0.6V to 2.97V for (SIGNAL 1) and 0.3V to 1.49V for (SIGNAL 2).

The relation between these two signals is (Signal 1) = (Signal 2) X 2.

If a problem occurs with any of these signals then a diagnostic fault code will be generated.



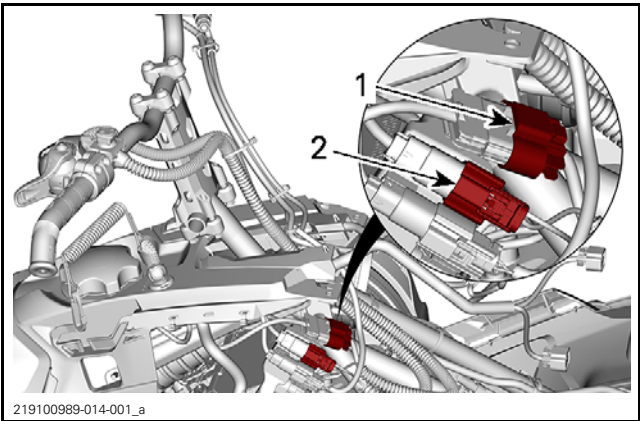
1. Throttle lever
2. Throttle accelerator sensor (TAS)

PROCEDURES

THROTTLE ACCELERATOR SENSOR (TAS)

Testing the TAS Voltage

Disconnect TAS connector and measure voltage on the main harness side.



1. Throttle lever connector
2. RH steering connector

TAS VOLTAGE TEST		
PIN		VOLTAGE
B	A	5V
D	E	5V

If not 5V, ECM might be defective, oxidation might be present in circuits or terminals might not have good contact.

Reconnect TAS connector and backprobe to measure voltage.

If 2 for 1 relation is not met for signal 1 and 2 ratio, then TAS sensor is defective. Refer to *REPLACING THE TAS* in this subsection for replacement procedure.

Replacing the TAS

1. Remove throttle lever housing from vehicle. Refer to *STEERING SYSTEM* subsection.
2. Replace the throttle lever with its housing.

Testing the ETC Voltage

Disconnect ETC connector on throttle body and measure on the engine harness.

ETC VOLTAGE TEST		
PIN		VOLTAGE
6	2	3.3V

If not 3.3V, ECM is might be defective, oxidation might be present in circuits or terminals might not have good contact.

Reconnect ETC connector and backprobe to measure voltage.

If (Signal 1) + (Signal 2) does not equal 3.3V, then the ETC is defective. Refer to *REPLACING THE ETC* in this subsection for replacement procedure.

Replacing the ETC

The ETC comes assembled with the complete throttle body unit.

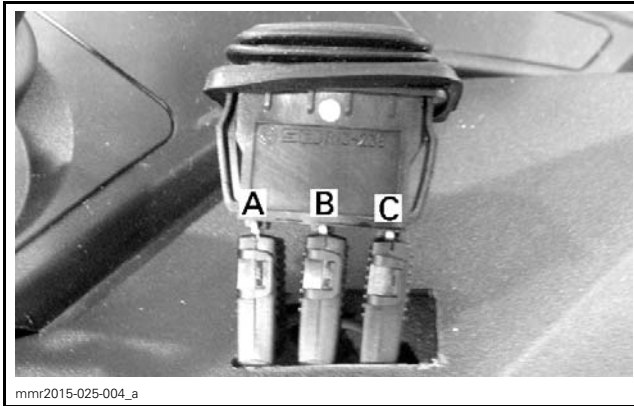
To replace throttle body assembly. Refer to *A/R INTAKE SYSTEM*.

Initialize the Throttle Position Sensor. Refer to *ELECTRONIC FUEL INJECTION* subsection for BUDS2 procedure.

ECO MODE SWITCH

Testing the ECO Mode Switch Operation

1. Unclip and raise switch.
2. Disconnect the ECO mode switch connectors.



1. *Driving mode switch*
2. *Driving mode switch connector*
3. Set multimeter to Ω .
4. Test the ECO mode switch for continuity as per following table.

ECO MODE SWITCH CONTINUITY TEST		
SWITCH POSITION	PIN	RESISTANCE
UP	B to A	0 Ω
Released	B to A	Infinite (OL)
DOWN	B to C	0 Ω
Released	B to C	Infinite (OL)

ELECTRONIC FUEL INJECTION (EFI)

SERVICE TOOLS

Description	Part Number	Page
ECM ADAPTER TOOL.....	529 036 166	5
FLUKE 115 MULTIMETER	529 035 868	5
FUEL HOSE DISCONNECT TOOL	529 036 037	12

SERVICE PRODUCTS

Description	Part Number	Page
DIELECTRIC GREASE	293 550 004	22

GENERAL

⚠ WARNING

When electrically disconnecting or removing the throttle body from the intake manifold, always remove the tether cord from the engine cut-off switch and disconnect the battery.

⚠ WARNING

Always disconnect battery prior to working on the fuel system. Always disconnect battery exactly in the specified order, BLACK (-) cable first. Electrical connections should be disconnected prior to disconnecting fuel lines.

⚠ WARNING

Fuel is flammable and explosive under certain conditions. Work in a well ventilated area. Do not smoke or allow open flames or sparks in the vicinity.

⚠ WARNING

Proceed with care and use appropriate safety equipment when working on the fuel system. Wipe off any fuel spillage in the engine compartment. Do not allow fuel to spill on hot engine parts and/or on electrical connectors.

Cover the fuel line connection with an absorbent shop rag before disconnecting them. Slowly disconnect the fuel hose to minimize spilling.

⚠ WARNING

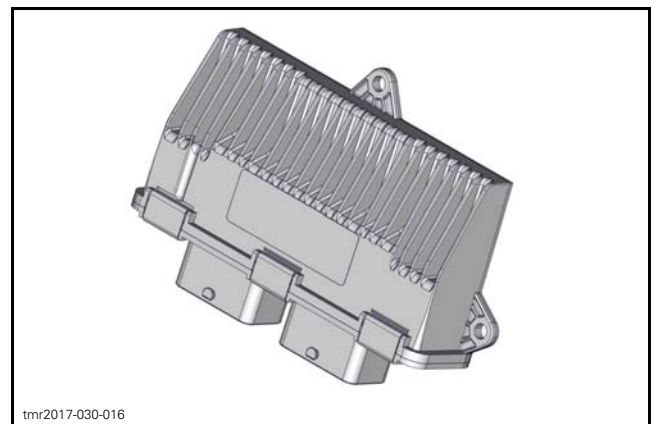
Replace any damaged, leaking or deteriorated fuel lines or connections. After working on the fuel system, always pressurize the fuel system and check for fuel leaks. Refer to *FUEL SYSTEM PRESSURIZATION* in *FUEL TANK AND FUEL PUMP* subsection.

SYSTEM DESCRIPTION

The electronic fuel injection system (EFI) is comprised of various sensors used for detecting ongoing operating conditions of the engine and vehicle, and includes all the components that perform the required adjustments to the engine.

Electrical System

ECM (Electronic Control Module)



The ECM controls the engine operation and the vehicle power management. To control the engine, the ECM reads the inputs from the sensors which it compares to predetermined parameters

Subsection XX (ELECTRONIC FUEL INJECTION (EFI))

stored in the ECM (fuel and ignition maps), makes computations, and activates the outputs accordingly (injectors, ignition coils etc.).

Refer to *ENGINE MANAGEMENT SYSTEM (EMS)* subsection for more information.

EFI Sensors

To control the injection system, the engine management uses input signals from the following sensors:

- Camshaft position sensor (CAPS)
- Crankshaft position sensor (CPS)
- Manifold absolute pressure and temperature sensor (MAPTS)
- Throttle position sensor (TPS) which is integrated to the throttle body (Electronic Throttle Control (ETC))
- Throttle accelerator sensor (TAS)
- Coolant Temperature Sensor (CTS)
- Oil Pressure Sensor (OPS).

Refer to *ENGINE MANAGEMENT SYSTEM (EMS)* subsection for more information.

Air Intake System

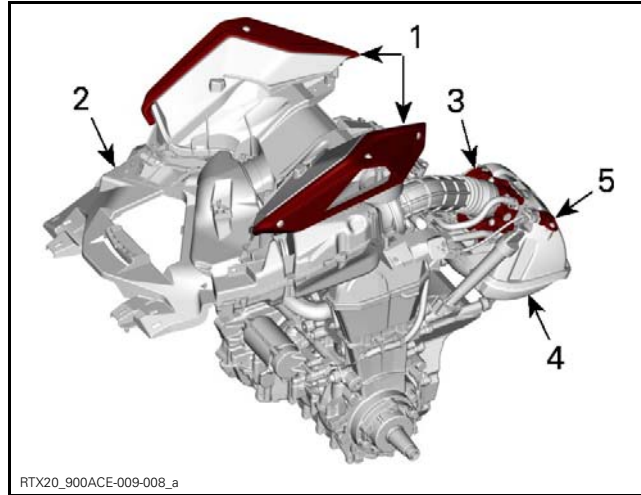
Air Filter

Air flows through a mesh screen filter in the air intake silencer mounted over the engine. The mesh filter prevents snow from being drawn into the engine.

Air is then drawn in through the throttle body, the air intake manifold and into the engine.

Manifold absolute pressure and temperature are measured in the intake manifold.

Refer to *AIR INTAKE SYSTEM* subsections for more information.



TYPICAL

1. Mesh screen filter
2. Air intake silencer
3. Throttle body (Electronic Throttle Control (ETC))
4. Intake manifold
5. Manifold absolute pressure and temperature sensor (MAPTS)

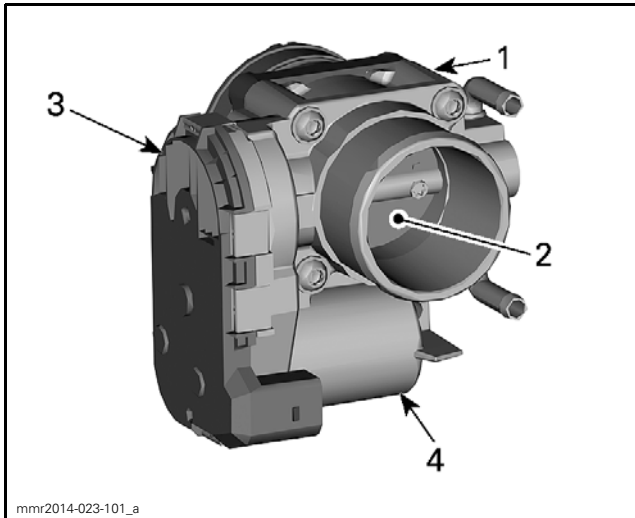
Throttle Body ((ETC) Electronic Throttle Control)

Air for combustion is drawn in by the engine. The air flows through the throttle body (ETC) and is controlled by a throttle plate.

The Electronic Throttle Control (ETC) is a heated single 46 mm throttle body with integrated dual throttle position sensors (TPS) and electric throttle actuator (ETA) and is mounted on the intake manifold.

The ETA allows the ECM to electronically control the throttle plate opening which regulates the amount of air that enters the engine, and therefore engine speed.

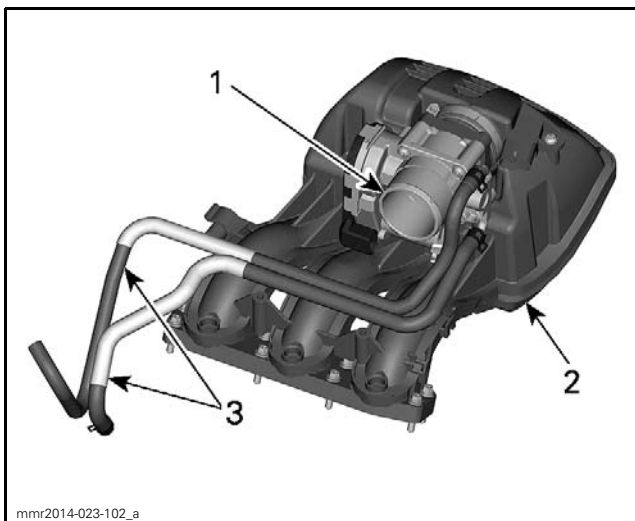
There is no idle air control valve (IACV).



ELECTRONIC THROTTLE CONTROL (ETC)

1. Throttle body (ETC)
2. Throttle plate
3. Dual Throttle Position Sensor (TPS)
4. Electric throttle actuator (ETA) (electric motor)

Engine coolant flows through the throttle body (ETC) to prevent potential freezing of the throttle plate.



TYPICAL - 900 ACE SHOWN

1. Throttle body (ETC)
2. Intake manifold
3. Coolant-heated lines

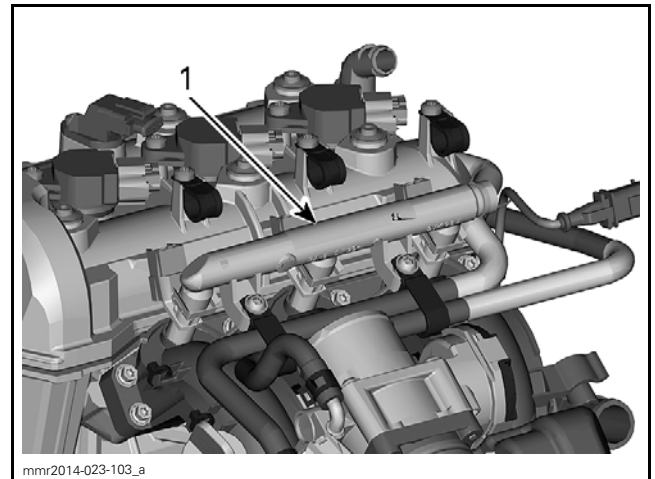
Refer to *INTELLIGENT THROTTLE CONTROL (ITC)* subsection for more information.

Fuel System

Fuel Rail

A fuel rail is mounted on the intake manifold. The fuel rail, which is used to secure the injectors to the manifold, also provides to the injectors the fuel pressure that it receives from the fuel pump.

The fuel pressure applied to the fuel rail is regulated by the fuel pressure regulator located in the fuel pump module.

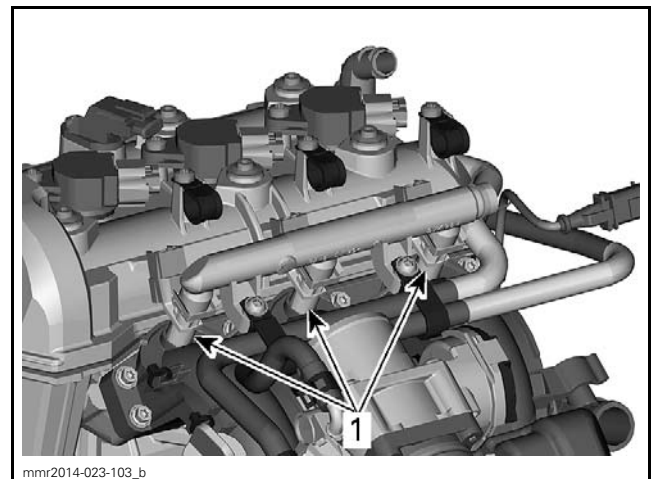


TYPICAL - 900 ACE ENGINE SHOWN

1. Fuel rail

Fuel Injectors

Each cylinder is supplied by its own injector that injects the fuel into the intake ports of the cylinder head.



TYPICAL - 900 ACE ENGINE SHOWN

1. Fuel injectors

Fuel is injected in accordance with injection signals received from the ECM.

Fuel Pump

An electric fuel pump with an integrated pressure regulator and fuel system filters is used. For more details on the fuel pump unit, refer to *FUEL TANK AND FUEL PUMP* subsection.

ADJUSTMENT

IDLE SPEED

Idle speed is not adjustable. The EMS (Engine Management System) controls the idle speed of the engine through the iTC system by controlling throttle plate opening using the ETA (electric throttle actuator).

The engine RPM may also be verified using the BRP diagnostic software (BUDS2).

In BUDS2, go to:

- **Measurements** page
- **ECM** button.

NOTE: The multifunction gauge and the BRP diagnostic software (BUDS2) use the same signal to provide the engine RPM indication.

TROUBLESHOOTING

DIAGNOSTIC TIPS

Engine problems are not necessarily related to the fuel injection system.

It is important to ensure that the engine and propulsion system, fuel delivery and electrical systems are functioning normally.

For diagnostics purposes, use the BRP diagnostic software (BUDS2).

After a problem has been solved, be sure to clear the fault(s) recorded in the ECM using the BRP diagnostic software.

 **WARNING**

Electrical actuators and electronic modules may be powered up as soon as the START/STOP button is depressed. Always disconnect the battery prior to disconnecting any electrical or electronic parts.

Never use a battery charger to temporarily substitute the battery as it may cause the ECM to function erratically, or not at all.

Check related-circuit fuse solidity and condition with an ohmmeter. A visual inspection could lead to a false diagnosis.

Poor Idling

If poor idling is experienced, check the following:

- Poor quality fuel or water in the fuel
- Fault codes using BUDS2

- Throttle body cleanliness
- Engine leaks or other mechanical problem.

Electrical Related Problems

It is important to check the following in the electrical system:

- Battery voltage
- Fuses
- Ground connections
- Wiring and connectors.

Ensure that all electronic components are original BRP recommended components. Any modification to the wiring harness may lead to poor system operation or generate fault codes.

Electrical Connections

Pay particular attention to ensure that terminals and pins are not out of their connectors, corroded, or out of shape.

When probing terminals, pay attention not to deform the terminals as this could cause a loose or intermittent connection that would be difficult to troubleshoot.

NOTE: Do not apply dielectric grease or other lubricants on the ECM connectors.

PROCEDURES

ENGINE CONTROL MODULE (ECM)

As a first troubleshooting step, always check for applicable fault codes using the BRP diagnostic software (BUDS2).

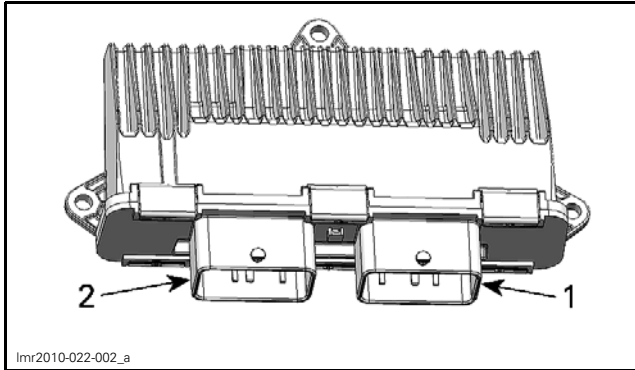
Locating the ECM

Refer to *WIRING HARNESS AND CONNECTORS* subsection.

ECM Connector Identification

There are 2 connectors connected to the ECM:

- Engine harness connected to ECM-A
- Vehicle system control harness connected to ECM-B.



ECM CONNECTOR IDENTIFICATION - COOLING FINS FACING OUT

1. Connector A
2. Connector B

The ECM connectors have 48 pins.

NOTE: For connector information, cleaning and probing, refer to *WIRING HARNESS AND CONNECTORS* subsection.

Quick Test to Validate ECM Operation

Briefly press START/STOP button.

This should wake up the ECM. The ECM will then activate relay 1 for approximately 12 seconds after which it will turn off all power. If the D.E.S.S. key is installed when the START/STOP button is pressed, the power will stay on for approximately 40 seconds.

QUICK INDICATION THAT ECM IS POWERED (ASSUMING THE OBSERVED COMPONENT IS WORKING)

Multifunction gauge comes ON.

Fuel pump turns on for approx. 2 seconds (if key on D.E.S.S. post installed).

If ECM does not turn on, check the following:

- Main fuse.
- Battery voltage. Refer to *CHARGING SYSTEM* subsection.
- Main relay RY1
- START/STOP switch. Refer to *STARTING SYSTEM* subsection.
- ECM power circuit wires and ground wires.

For testing of main fuse and main relay RY1, refer to *POWER DISTRIBUTION* subsection.

NOTE: When the main relay is not working, the ECM and the complete vehicle electrical system will not be powered.

ECM Testing Tools

To test and probe the ECM connector terminals, the following tools are required. The ECM replacement will be required if connectors or terminals are damaged.

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

Testing the ECM Wake Up Circuit

1. Disconnect ECM-B connector and connect it to the ECM adapter tool.
2. Set the multimeter to Vdc.
3. While pressing the START/STOP button, read voltage as follows.

ECM WAKE UP CIRCUIT TEST		
ECM ADAPTER PIN	BATTERY POST	SPECIFICATION
B-D1	Negative	Battery Voltage

If voltage is as per specification, refer to *TESTING THE ECM POWER SUPPLY*.

If voltage is out of specification:

- Test the START/STOP switch, refer to *STARTING SYSTEM* subsection.
- If the START/STOP switch tests good, test wiring and connectors from battery to ECM. Refer to *WIRING DIAGRAM*.

Testing the ECM Power Supply

1. Disconnect ECM-B connector and connect it to the ECM adapter tool.
2. Install a jumper wire between B-H2 and B-M2 on the ECM adapter tool.
3. Turn the ignition switch to ON.
4. Set the multimeter to Vdc.
5. Check for voltage as follows.

Subsection XX (ELECTRONIC FUEL INJECTION (EFI))

ECM POWER SUPPLY TEST		
ECM ADAPTER PIN	BATTERY POST	SPECIFICATION
B-M4	Negative	Battery Voltage

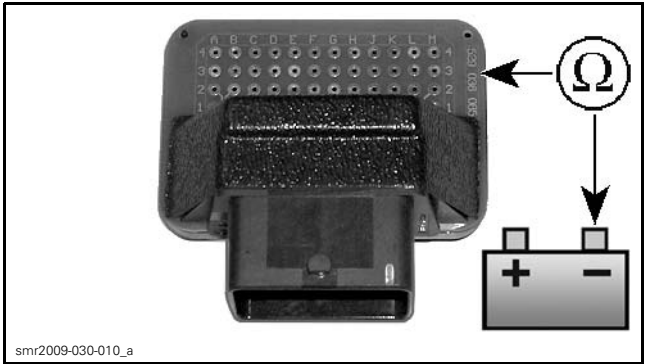
If voltage is not measured, check the following:

- Main relay
- Wiring and connections, refer to the *WIRING DIAGRAM*.

Testing the Continuity of ECM Ground Circuits

1. Connect ECM-B connector on the ECM adapter tool.
2. Set multimeter to Ω and probe adapter terminals as per following table.

ECM GROUND CIRCUITS CONTINUITY TEST		
ECM ADAPTER PIN	BATTERY POST	SPECIFICATION
L1	Negative	Close to 0 Ω
M2		
M3		



If any measurement is out of specification refer to *POWER DISTRIBUTION AND GROUNDS* subsection and check the following:

- Wiring and connections
- Engine ground
- Battery ground
- Frame ground.

Removing the ECM

NOTE: If a new ECM is to be installed, first read the procedures in *REPLACING THE ECM* in this subsection.

1. Disconnect battery cables.

NOTICE Always disconnect the BLACK (–) battery cable first, then disconnect RED (+) cable.

2. Remove the upper body module. Refer to *BODY* subsection.
3. Disconnect both connectors.
4. Remove both screws retaining the ECM to the its support.
5. Remove the ECM from the vehicle.

Installing the ECM

1. The installation is the reverse of the removal procedure. However, pay attention to the following.
2. Install and secure the ECM.

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

3. Reconnect ECM connectors.
4. Reinstall the upper body module.
5. Reconnect battery.

NOTICE Always reconnect the RED (+) battery cable first, then reconnect BLACK (–) cable.

If a new ECM is installed, refer to *REPLACING THE ECM* in this subsection.

Replacing the ECM

Prior to replacing an ECM, ensure that all the recommendations in the general introduction of this subsection have been followed and all applicable testing procedures have been carried out.

If the ECM is replaced, data must be transferred into the new ECM.

ECM Data Entry for ECM Replacement

Use one of the following 2 methods to collect the required information. The 1st being the easiest:

1. Use BUDS2 to obtain the data from a saved "*.buds2" file on your PC computer.
2. Collect the information from the vehicle and on the Knowledge Center.

Once the required information has been collected, refer to *ENTERING THE COLLECTED INFORMATION INTO THE ECM*.

1st Collecting Method: Obtaining the Data from a Saved .buds2 File

1. Start BUDS2.

NOTE: It is not necessary to perform any connection. The PC computer can be used alone.

2. In BUDS2, click on the **Open a BUDS2 file** button.

Make sure you are at: C:\Program Files(x86)\BRP\BUDS2\Files.

IMPORTANT: Be sure to use the file that specifically matches the vehicle you are servicing.

NOTE: The file name structure is as follows:

VIN_date read (yyyymmdd)_hour read (hhmmss).mpem

Example:

2BPSBK8C68V000168_20090206_111640.buds2

Therefore:

VIN: 2BPSBK8C68V000168

Date: 2009 02 06

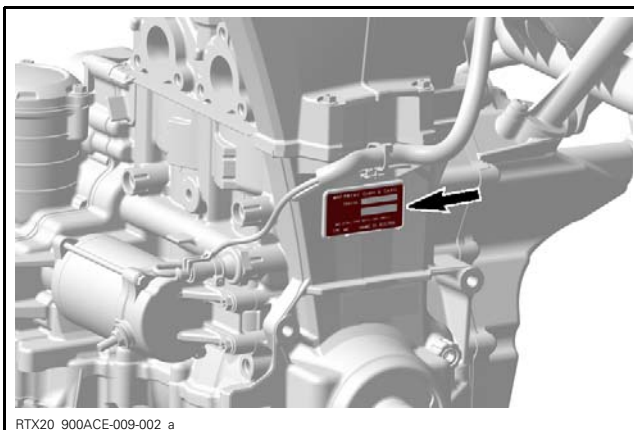
Hour: 11h 16m 40s

3. Select the **Summary** page then the **Vehicle** button and record (write down) the following information.

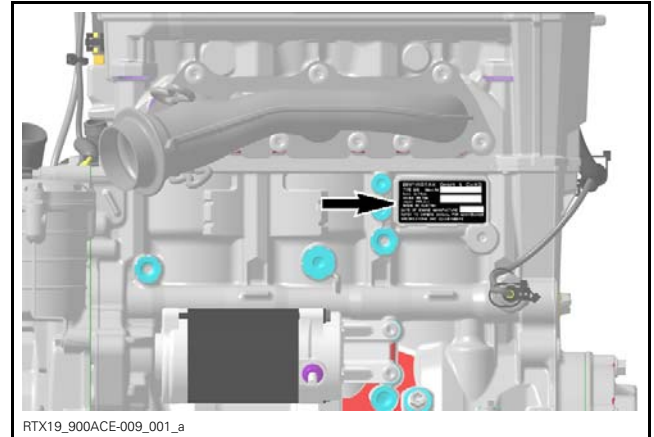
1. Vehicle serial number
2. Engine serial number
3. Vehicle model number
4. Customer name.

2nd Collecting Method: Collect the Information from the Vehicle and BOSSWeb

1. Record engine serial number.



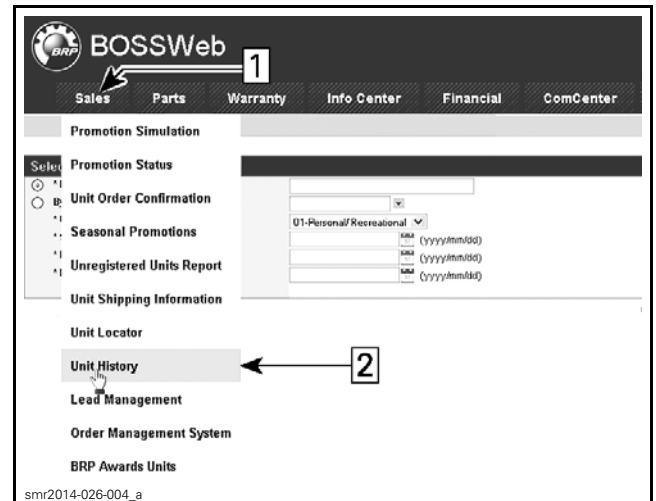
600 ACE



900 ACE

2. Record the following numbers from BOSSWeb. Look in **Sales** menu and choose **Unit history**.

1. Vehicle serial number
2. Vehicle model number
3. Customer name.



SERVICE, UNIT HISTORY

1. Click on **SALES** menu
2. Select **Unit History**



1. Vehicle Serial Number here

3. Enter the recorded data in the new ECM as detailed in *ENTERING THE COLLECTED INFORMATION INTO THE ECM*.

Entering the Collected Information Into the ECM

1. Connect the vehicle to the BRP diagnostic software (BUDS2).
2. In **BUDS2**, click the **Scan** button to read the new ECM.
3. Select:
 - **Summary** page
 - **Vehicle** button.
4. Write all of the following information you recorded previously.
 1. Vehicle serial number (VIN)
 2. Engine serial number
 3. Vehicle model number
 4. Customer name.

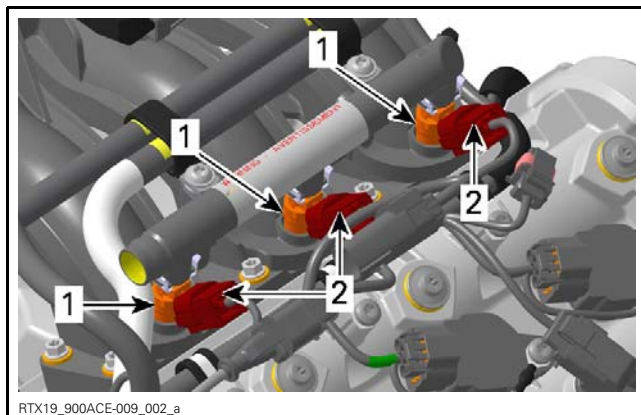
NOTICE . Enter only the appropriate product model number as obtained when gathering the information.

NOTICE Pay particular attention when typing the V.I.N. and model numbers. Once **Write Data** button is pressed, the data cannot be modified.

5. Perform the *THROTTLE POSITION SENSOR INITIALIZATION* procedure, refer to *ADJUSTMENTS* in this subsection.
6. Start the engine and ensure proper operation.
7. Reinstall any remaining removed parts.

FUEL INJECTOR

Fuel Injector Connector Location



900 ACE ENGINE SHOWN
1. Fuel Injectors
2. Fuel Injector connectors

Testing the Fuel Injector Operation Using BUDS2 (Dynamic)

NOTE: As a first troubleshooting step, always check for applicable fault codes using the BRP diagnostic software (BUDS2).

1. Connect the vehicle to the BRP diagnostic software (BUDS2).
2. Start engine.
3. In BUDS2, select the following:
 - **Functions** page
 - **ECM** button
 - **Activators** tab.
4. Select an injector.
5. Repeat for all injectors.

If the engine RPM drops momentarily when clicking on a cylinder, the injector on this cylinder is functioning normally.

If the engine RPM does not drop momentarily when clicking on a cylinder, this cylinder is not functioning properly. Check the following:

- Fuel injector operation. Refer to *TESTING THE FUEL INJECTOR BALANCE USING BUDS2*
- Spark plug and ignition coil. Refer to *IGNITION SYSTEM* subsection.
- Engine condition.

Testing the Fuel Injector Balance Using BUDS2

NOTICE After fuel injector activation using BUDS2, always crank engine in drowned mode to ventilate the engine of fuel.

1. Install a fuel pressure gauge as described in *TESTING THE FUEL PUMP PRESSURE* of *FUEL TANK AND FUEL PUMP* subsection.
2. Connect the vehicle to the BRP diagnostic software (BUDS2).
3. Press the Start button to activate the ECM.
4. In BUDS2, select the following:
 - **Functions** page
 - **ECM** button
 - **Functions** tab
 - **IO Controls - Activate Fuel Pump**.
5. Click on the **ACTIVATE** button to activate fuel pump.
6. Fuel pressure must be within specification. Refer to *FUEL TANK AND FUEL PUMP* subsection. Re-activate fuel pump as necessary.
7. In BUDS2, energize fuel injector **no. 1**.

8. Record the fuel pressure drop for injector **no. 1**.
9. Re-activate fuel pump.
10. Repeat the procedure for fuel injector **no. 2** and **no. 3** and record the pressure drop for each injector.
11. The maximum fuel pressure drop between injectors should not exceed the following specification:

MAXIMUM FUEL PRESSURE DROP ALLOWED BETWEEN FUEL INJECTORS
10 kPa (1.5 PSI)

If the pressure drop between fuel injectors is greater than the specification, replace the injector with the least pressure drop, then repeat the test.

12. Using the valve on the fuel pressure gauge, release the pressure in the system (if so equipped).
13. Remove fuel pressure gauge and reinstall removed parts.
14. Crank engine in drowned mode (accelerator held all the way in) to ventilate the engine of the fuel that was injected during the test.

⚠ WARNING

Always crank engine in drowned mode to ventilate all fuel that was injected during the test. Failure to do so may result in severe engine damage and injury.

Testing for Fuel Injector Leakage

Test Setup

1. Ensure there is enough fuel in fuel tank.
2. Ensure fuel pressure from fuel pump is within specification. Refer to *FUEL TANK AND FUEL PUMP* subsection.

NOTE: Keep the pressure gauge installed for the leakage test.

3. Connect the vehicle to the BRP diagnostic software (BUDS2).
4. In BUDS2, go to:
 - **Functions** page
 - **Vehicle** or **ECM** button
 - **Functions** tab
 - **Execute Fuel Pressure Relief**.
5. Remove fuel rail with injectors from engine. However, **do not** disconnect fuel pump pressure hose from fuel rail. Refer to *FUEL INJECTORS* in this subsection.

6. Position fuel rail so that an appropriate container may be placed under the injectors to collect any fuel leakage.



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INJECTOR LEAKAGE TEST SETUP

7. Install key on D.E.S.S. post.

Testing the Leakage

1. In BUDS2, go to:
 - **Functions** page
 - **Vehicle** or **ECM** button
 - **Functions** tab
 - **IO - Activate Fuel Pump**.
2. Check for fuel leakage from the injector nozzles.
3. Monitor fuel pressure at fuel pressure gauge. If pressure drops below 372 kPa (54 PSI) during the test, reactivate fuel pump as necessary.

FUEL INJECTOR LEAK TEST	
TEST DURATION	SPECIFICATION
2 minutes	1 drop per minute maximum

If test is not within specification, replace the faulty fuel injector.

4. Properly reinstall fuel rail. Refer to *FUEL RAIL* in this subsection.
5. Reinstall remaining removed components.

⚠ WARNING

Wipe up any spilled fuel.

Testing the Fuel Injector Resistance

1. Ensure vehicle electrical power is off.

Subsection XX (ELECTRONIC FUEL INJECTION (EFI))

- 2. Disconnect ECM-A connector from the ECM and connect it to the ECM adapter tool. Refer to *ECM CONNECTOR ACCESS* in this subsection.
- 3. Remove cover from the fuse box and locate the fuel injector fuse.
- 4. Check resistance value between fuse box and ECM connector terminals as follows.

600 ACE

FUEL INJECTOR RESISTANCE TEST			
INJ.	ECM ADAPTER PIN	FUSE	SPECIFICATION @ 20°C (68°F)
Cyl. 1	A-J1	F7	11.4 - 12.6 Ω
Cyl. 2	A-K1		

900 ACE

FUEL INJECTOR RESISTANCE TEST			
INJ.	ECM ADAPTER PIN	FUSE	SPECIFICATION @ 20°C (68°F)
Cyl. 1	A-B3	F5	11.4 - 12.6 Ω
Cyl. 2	A-K1		
Cyl. 3	A-J1		

If resistance value obtained is correct, carry out *TESTING THE FUEL INJECTOR INPUT VOLTAGE*.
If resistance value obtained is incorrect, repeat test at HIC connector located behind the ECM support Refer to *WIRING HARNESS AND CONNECTORS* subsection.

600 ACE

FUEL INJECTOR RESISTANCE TEST			
INJ.	ECM ADAPTER PIN	HIC PIN	SPECIFICATION @ 20°C (68°F)
Cyl. 1	A-J1	1	11.4 - 12.6 Ω
Cyl. 2	A-K1		

900 ACE

FUEL INJECTOR RESISTANCE TEST			
INJ.	ECM ADAPTER PIN	HIC PIN	SPECIFICATION @ 20°C (68°F)
Cyl. 1	A-B3	1	11.4 - 12.6 Ω
Cyl. 2	A-K1		
Cyl. 3	A-J1		

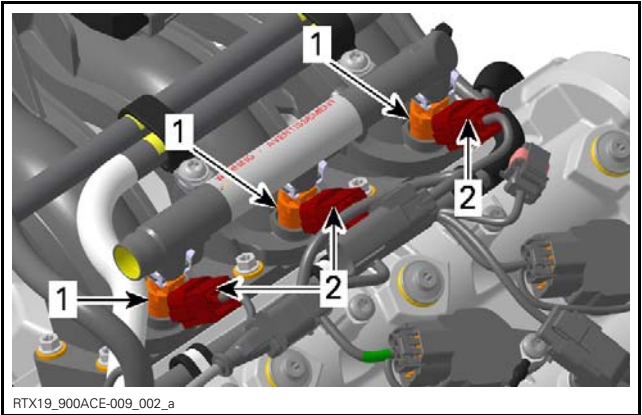
If resistance value obtained is incorrect, remove injector connector and check resistance value between injector pins as follows.

FUEL INJECTOR RESISTANCE TEST		
INJECTOR PIN		SPECIFICATION @ 20°C (68°F)
1	2	11.4 - 12.6 Ω

If readings are out of specifications, replace injector.

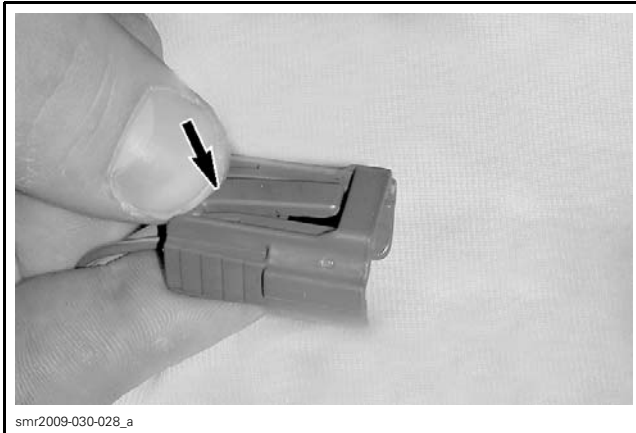
Testing the Fuel Injector Input Voltage

- 1. Ensure both ECM connectors are properly connected.
- 2. Ensure the HIC connector is properly connected.
- 3. Disconnect the fuel injector connector.



900 ACE SHOWN
1. Fuel Injectors
2. Fuel Injector connectors

NOTE: Press against tab underneath connector as illustrated to unlock it.



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PRESS HERE TO UNLOCK

4. Ensure fuel injector fuse is properly installed. Refer to the appropriate wiring diagram.
 5. Install key on D.E.S.S post.
 6. Momentarily press the START/STOP button to wake up the ECM without holding the brakes.
- NOTE:** It is not necessary to activate the injector since it is continuously powered when the ECM is awake.
7. Set the multimeter to Vdc. Read voltage.

FUEL INJECTOR INPUT VOLTAGE TEST			
INJ.	INJECTOR WIRE	BATTERY POST	SPECIFICATION
Cyl. 1	VIOLET/ BLUE	Negative	Battery voltage
Cyl. 2			
Cyl. 3			

If injector input voltage is good, carry out the following:

- Circuit continuity test between injector and ECM, refer to *WIRING DIAGRAM* subsection.
- Test the injector signal, go to: *TESTING THE FUEL INJECTOR SIGNAL* subsection

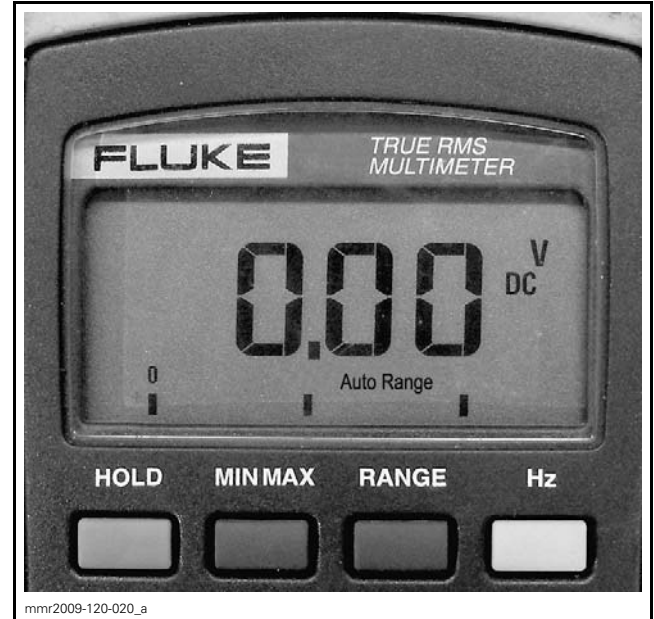
If injector input voltage is not good, check the following:

- Fuel injector fuse
- Circuit continuity between fuel injector fuse and injector. Refer to *POWER DISTRIBUTION* and *WIRING DIAGRAM* subsections.

Testing the Fuel Injector Signal

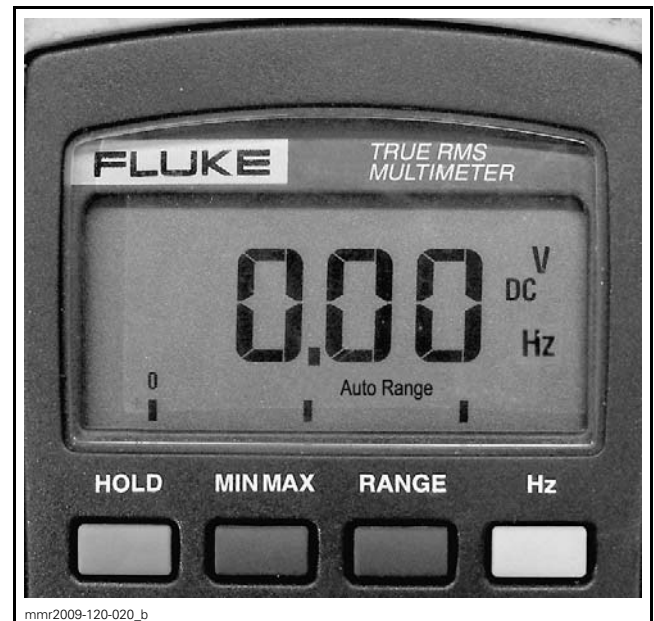
1. Set multimeter to Vdc.

NOTE: Make sure multimeter is in the **Auto** mode.



mmr2009-120-020_a

2. Press the **Hz** button so that the display shows Hz.



mmr2009-120-020_b

3. Connect the multimeter probes as indicated in the following table and using the BUDS2 software, activate each injector and read the frequency on the multimeter.

NOTE: The multimeter counts the pulses per seconds (Hertz) of current the ECM sends to the injector.

Subsection XX (ELECTRONIC FUEL INJECTION (EFI))

FUEL INJECTOR SIGNAL TEST			
INJ.	INJECTOR WIRE	BATTERY POST	SPECIFICATION
Cyl. 1	BROWN/RED	Negative	9 Hz
Cyl. 2	BROWN/BLUE		
Cyl. 3	BROWN/GREY		

If reading is good, the control circuit is functional.
If there is no reading, check continuity of control circuit (ECM to injectors). Refer to *WIRING DIAGRAM* for circuit details.

Removing the Fuel Injector

1. Connect the vehicle to the BRP diagnostic software (BUDS2).
2. In BUDS2, go to:
 - Functions page
 - Vehicle or ECM button
 - Functions tab
 - Execute Fuel Pressure Relief.
3. Disconnect the battery, refer to *CHARGING SYSTEM* subsection.

 **WARNING**

When removing or disconnecting the fuel injectors, always disconnect the battery.

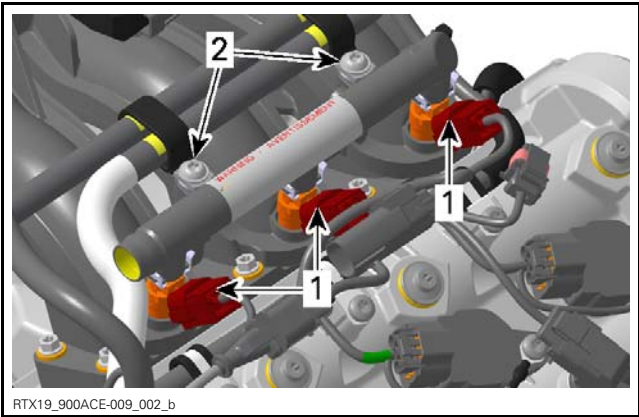
4. Remove parts required for access to the fuel rail and fuel injectors.
5. Disconnect the fuel injector electrical connectors.
6. Disconnect the fuel pressure hose from the fuel rail.

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



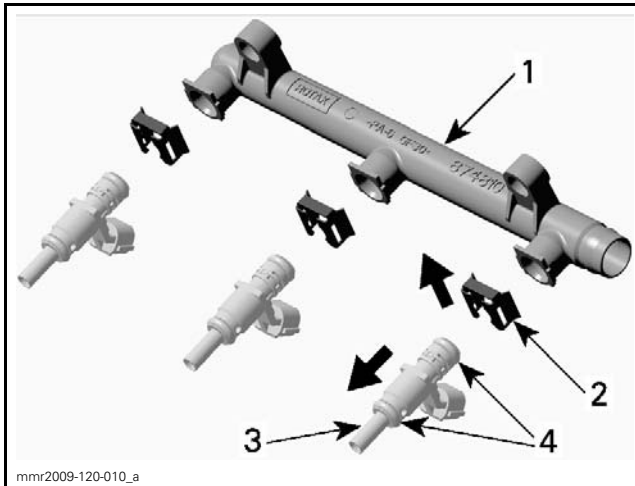
NOTE: Wrap a rag around the hose end to catch any fuel leakage.

7. Remove the fuel rail mounting screws.



900 ACE ENGINE SHOWN
1. Injector connectors
2. Fuel rail mounting screws

8. Pull on fuel rail to remove the fuel rail and injectors from the engine.
9. Remove the fuel injector retaining clips from the fuel rail.



TYPICAL - 900 ACE SHOWN

1. Fuel rail
2. Fuel injector retaining clip
3. Injector
4. Injector O-rings

10. Pull the fuel injector(s) out of the fuel rail.
11. Remove and discard injector O-rings.

Installing the Fuel Injector

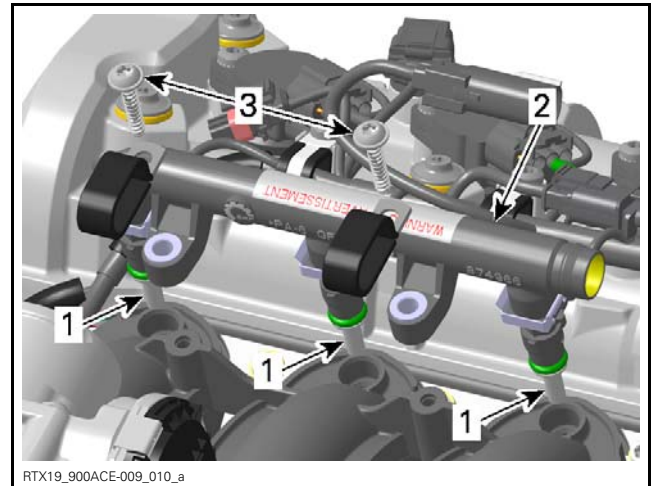
The installation is the reverse of the removal procedure. However, pay attention to the following.

1. Install **NEW** O-rings on fuel injector(s).
2. Apply a thin film of engine oil to O-rings to ease insertion in rail.

SERVICE PRODUCT
Engine oil

3. Install fuel injector with your hand. Do not use any tool.
4. Firmly push injector until it bottoms out.
5. Install fuel rail.

NOTE: When installing the fuel rail, make sure to identify the fuel injector type. See *IDENTIFYING THE FUEL INJECTOR*.

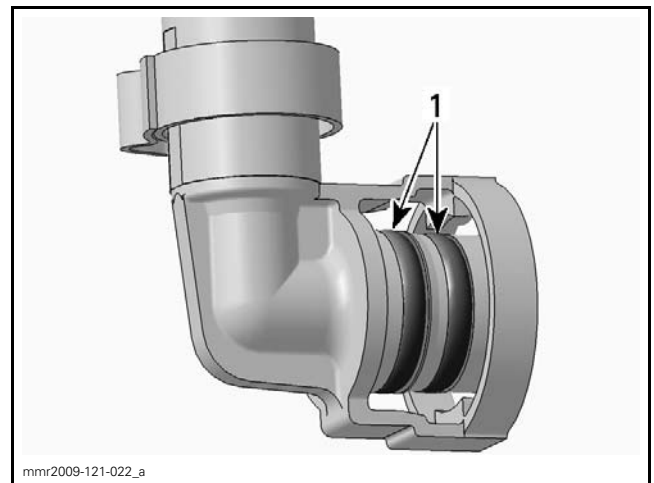


TYPICAL - 900 ACE ENGINE SHOWN

1. Fuel injectors
2. Fuel rail
3. Fuel rail retaining screws

TIGHTENING TORQUE	
Fuel rail retaining screw	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

6. Apply engine oil on O-rings of fuel pressure hose fitting.



FUEL PRESSURE HOSE FITTING

1. Apply oil on O-rings

7. Connect fuel pressure hose to fuel rail.

IMPORTANT: Push fuel hose fitting on fuel rail until you hear a "click". Try pulling on fuel hose fitting to ensure it is properly locked.

Pressurize the fuel system and check for fuel leaks. Refer to *FUEL SYSTEM PRESSURIZATION* in *FUEL TANK AND FUEL PUMP* subsection.

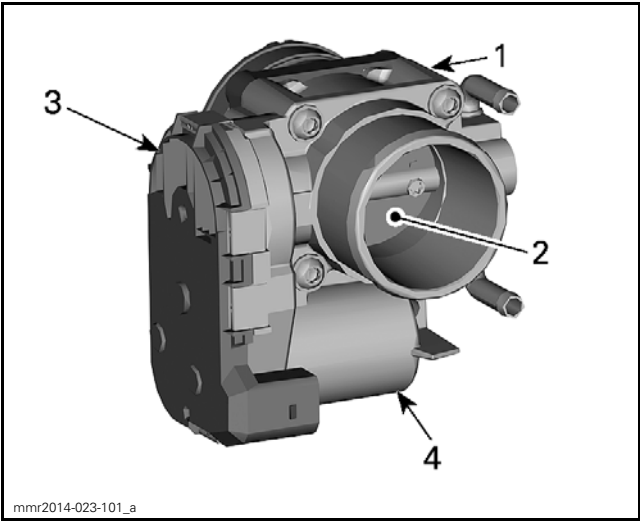
 **WARNING**

Failure to pressurize the fuel system and checking for fuel leaks may result in severe injury or a life threatening situation should a leak occur.

8. Reinstall all remaining removed parts.

THROTTLE BODY (ELECTRONIC THROTTLE CONTROL (ETC))

Throttle Body (ETC) Description



- 1. Throttle body
- 2. Throttle plate
- 3. TPS (Throttle Position Sensor) (inside)
- 4. ETA (Electric Throttle Actuator) (electric motor inside)

Electric Throttle Actuator (ETA)

The electric throttle actuator (ETA) is a DC motor on the throttle body that regulates the throttle plate via a drive gear. It receives its control signal from the ECM. Pulse width modulation (PWM) is used to control the motor.

Throttle Plate Operating Positions

Two torsional springs are connected to the throttle plate. A main spring and another one in a plunger mechanism.

When there is no power to the throttle actuator (ETA), the plunger mechanism maintains the throttle plate at a rest position. This also serves as the limp home position.

When the throttle plate is opened by the ETA as commanded by the ECM, it acts against the main spring. If the ETA failed, the return spring would bring the throttle plate back to the limp home position.

ECM	ENGINE	THROTTLE BODY
OFF	Stopped	Throttle actuator: Off. Throttle plate: Rest position, maintained opened at approximately 8° (1). This is also the limp home position.
ON	Not started	Throttle actuator: On. Throttle plate: Moves from the rest position to approximately 15°. It then moves back to the rest position. This is the diagnostic mode where the rest position, actuator opening force to overcome the return springs and the motor return rate are monitored. If any of these parameters are out of range, a fault code is initiated.
ON	Not started. Very cold environment	Throttle actuator: On. Throttle plate: Execute check for ice on throttle plate. If throttle plate does not reach the fully closed position, throttle plate is moving until closed position can be reached.
ON	Started. Normal operation at idle	Throttle actuator: On. Throttle plate: Moves from the rest position to idle position (approximately 1-3°) according to ECM injection and ignition maps. Throttle plate is opened and closed as necessary to control the idle speed.
ON	Started. Normal operation at various RPM	Throttle actuator: On. Throttle plate: Opens and closes according to ECM torque management priorities.
(1) Degree values are given from the fully closed position.		

Throttle Body (ETC) Faults and Effects

NOTE: Among other things, a weak or broken spring and a sticky throttle plate are validated by the throttle body diagnostic mode.

FAULT	EFFECT
Partial failure of TAS sensor (one internal sensor only)	Limp home mode. Engine speed limited to idle. ECM will use the remaining TAS sensor. Fault code set and beeper activated to emit warning signals. Check engine light is turned ON. Driveability could be reset by releasing and reapplying the throttle.
Complete failure of TAS sensor (both internal sensors)	Limp home mode. Engine speed limited to 2500 RPM. Fault code set and beeper activated to emit warning signals. Check engine light is turned ON.
Any throttle body failure	Limp home mode. Engine speed limited to 2500 RPM. Engine speed can still be increased up to 3200 RPM using the throttle lever. Fault code set and beeper activated to emit warning signals. Check engine light is turned ON.

NOTE: Refer to *DIAGNOSTIC AND FAULT CODES* and *INTELLIGENT THROTTLE CONTROL (iTC)* subsections for more informations.

Lubricating the Throttle Body (ETC)

No lubrication is required.

Testing the Electric Throttle Actuator (ETA)

Electric Throttle Actuator (ETA) Test with BUDS2

1. Connect the vehicle to the BRP diagnostic software (BUDS2).
2. Install key on D.E.S.S. post.
3. Press the START/STOP button without holding the brakes to wake up the ECM.
4. In BUDS2, go to:
 - **Measurements** page
 - **ECM** button
 - **Presets** and **ECM - BASIC** tabs
 - **Throttle Opening**.
5. Slowly depress the throttle to WOT. The ETA should go from almost 10% to 100%.

If result is out of specification, carry out a *THROTTLE POSITION SENSOR INITIALIZATION*. Refer to *THROTTLE POSITION SENSOR (TPS)* in this subsection.

NOTE: The ETA is reset at the same time as the TPS.

After the reset, test ETA again.

If the result is still out of specification, check wire continuity between ECM and throttle body before assuming the ETA is at fault.

Inspecting the Throttle Body (ETC)

1. Remove parts required to access throttle body.
2. Carry out the following:
 - Inspect throttle body for cleanliness.
 - Ensure throttle plate opens fully and smoothly.
 - Check for corroded or damaged wiring or damaged ETC connectors.

Testing the Throttle Body (ETC) (Dynamic)

1. Remove the parts required to access the throttle body (ETC).
2. Remove the air inlet hose from the throttle body.
3. Observe the throttle plate with the engine stopped.

The throttle plate should be in the rest position (slightly opened).

⚠ CAUTION Keep your fingers out of the throttle plate area while the ECM turns on. The throttle actuator will cycle. This could cause serious finger injuries as throttle plate quickly moves.

4. As you observe the throttle plate, have someone press the START/STOP button to wake up the ECM.

The throttle plate should cycle quickly from the rest position to a partially open position (approximately 15°), then back to the rest position.

5. Install the tether cord on the D.E.S.S. post.

The throttle plate should cycle again.

6. As you observe the throttle plate, have someone gradually and evenly pull in the throttle lever, then release it in the same way.

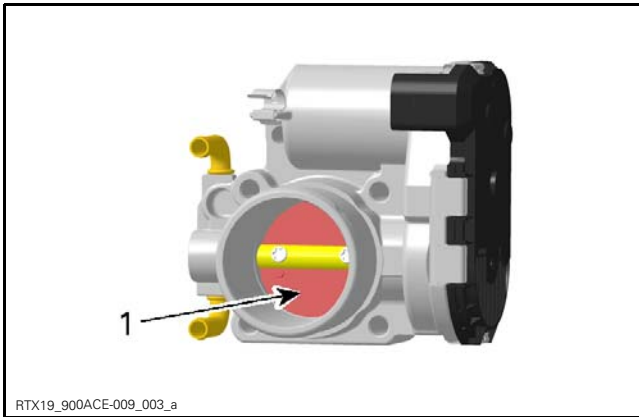
The throttle plate should open then close according to throttle lever position however, the movement of the throttle plate may not be linear with the displacement of the throttle lever.

If any test failed, proceed with *TESTING THE THROTTLE BODY (ETC) (STATIC)*.

Testing the Throttle Body (ETC) (Static)

⚠ CAUTION First ensure the ECM is off. Do not move the throttle plate using your fingers. Otherwise, should the START/STOP button be pressed, the ECM would turn on and quickly cycle the throttle plate which could cause serious finger injury.

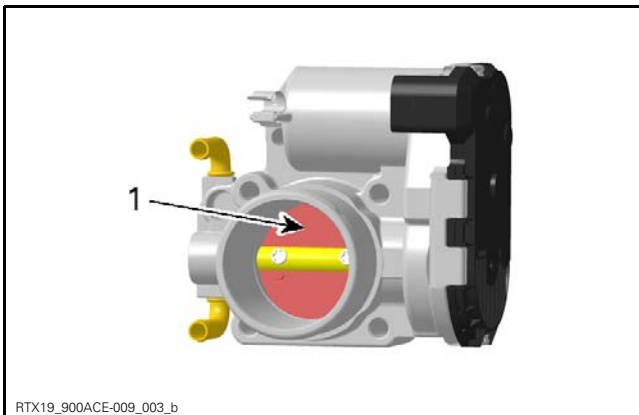
1. Using a blunt tool, push in on the throttle plate and ensure it opens smoothly within the throttle body.



1. Push here to open

NOTE: The throttle plate must open fully and return freely to the rest position (slightly opened) when released.

2. Push throttle plate closed as indicated in following illustration. It must close completely and return freely to the rest position (slightly opened) when released.



1. Push here to close

If the throttle plate does not move smoothly or does not return freely to the rest position, the problem is mechanical. Check for dirt accumulation on throttle plate shaft. It may also be an actuator or gear problem. Replace throttle body as necessary.

If throttle plate operates normally, the problem is electrical. Check electric throttle actuator (ETA) wiring continuity, throttle position sensor (TPS) and throttle accelerator sensor (TAS).

Cleaning the Throttle Body (ETC)

1. Remove throttle body from intake manifold.
2. Check throttle body cleanliness using a flashlight. Fully open throttle plate and verify:
 - Throttle body bore
 - Throttle plate edge.

Look for:

- Dirt
- Oily surfaces
- Carbon and dirt deposits on throttle plate and the surrounding bore.

3. Clean as necessary.

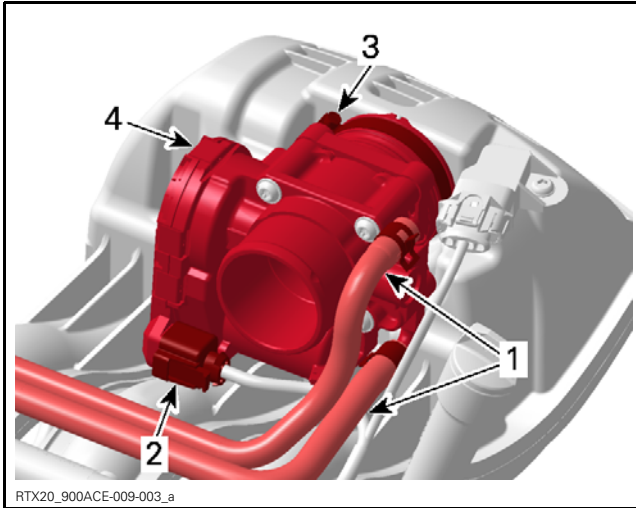
NOTICE Only use an appropriate throttle body cleaner that will not damage O-rings and EFI sensors.

4. To avoid getting dirt into engine, spray cleaner on a clean rag then rub rag against throttle plate and bore. A toothbrush may also be used.
5. Gently open throttle plate and hold fully open to clean all surfaces.
6. To remove residual dirt, spray cleaner on throttle plate and throttle bore.
7. Reinstall all removed parts.

Removing the Throttle Body (ETC)

⚠ CAUTION Ensure the key is removed from D.E.S.S. post and battery cables are disconnected so that nobody can activate the electrical system, otherwise the ECM would turn on and the throttle actuator (ETA) would cycle. This could cause serious finger injury as the throttle plate moves quickly.

1. Remove parts required to access throttle body.
2. Block coolant hoses connected to throttle body and remove them. Refer to *INTAKE MANIFOLD* subsection.
3. Disconnect ETC connector.
4. Loosen gear clamp.
5. Remove throttle body with connecting socket from intake manifold.



900 ACE ENGINE SHOWN

1. Coolant hoses
2. ETC connector
3. Gear clamp
4. Throttle body with connecting socket

Installing the Throttle Body (ETC)

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

1. Refill and bleed cooling system. Refer to *COOLING SYSTEM* subsection.
2. Perform the *THROTTLE POSITION SENSOR INITIALIZATION* reset procedure. Refer to *THROTTLE POSITION SENSOR (TPS)* in this subsection.
3. Install all remaining removed parts, refer to applicable subsections.
4. Start engine and ensure proper idle and throttle control.

THROTTLE POSITION SENSOR (TPS)

TPS Description

The TPS is part of the throttle body (ETC).

The throttle position sensor (TPS) is a double potentiometer that sends signals to the ECM that are proportional to the throttle plate angle.

As a first troubleshooting step, always check for applicable fault codes using the BRP diagnostic software (BUDS2).

Throttle Position Sensor Initialization

NOTE: The TPS initialization procedure **must** be carried out whenever the throttle body (ETC) is replaced.

This operation performs a reset of the TPS basic values in the ECM. This reset is very important as the TPS values are part of the basic parameters

for all fuel mapping calculations and control of several settings such as for idle speed, LIMP HOME mode and maximum RPM of the engine.

NOTICE An improperly set TPS may lead to improper idle speed (too low or too high), poor engine performance, poor engine starting and engine stop on deceleration, fault codes and possible engine damage. Emission compliance may also be affected.

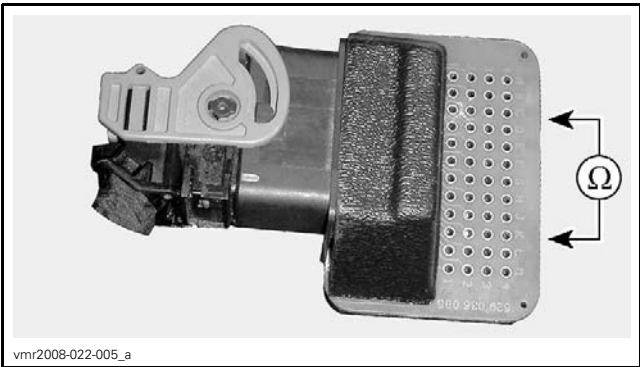
1. Install key on D.E.S.S. post.
 2. Press the START/STOP button to wake up the ECM.
 3. Ensure accelerator pedal is completely released.
 4. Connect the vehicle to the BRP diagnostic software (BUDS2).
 5. In BUDS2, select
 - Settings button
 - ECM page tab
 - Settings page
 - Initialization - Reset TPS.
 6. In the **Reset TPS** box, click on the **Reset** button. A message will be displayed if the operation is successful.
- If an error occurred or the TPS is not within the allowed range while resetting, the ECM will generate a fault code and will not accept the setting.
7. Start engine and make sure it operates normally through its full engine RPM range.
 8. Check for fault codes using BUDS2. If a fault code related to the throttle actuator appears, clear it, then carry out another Closed Throttle Reset procedure. To clear faults, refer to *DIAGNOSTIC AND FAULT CODES* subsection.

Testing the TPS Resistance

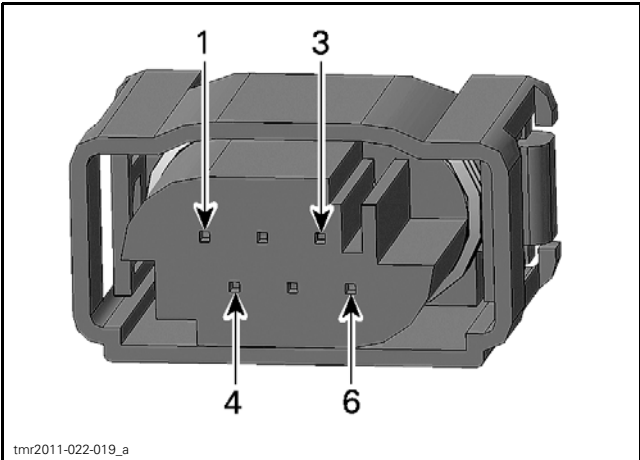
1. Ensure the throttle body connector is properly connected.
2. Disconnect ECM connector A from the ECM and install it on the ECM adapter tool.
3. Set multimeter to Ω .
4. Probe circuit as per following table while using your hand to manually move throttle plate.

ECM ADAPTER		FULLY CLOSED THROTTLE PLATE ⁽¹⁾		FULLY OPEN THROTTLE PLATE	
		RESISTANCE (Ω)			
PIN		MIN.	MAX.	MIN.	MAX.
A-A2	A-K4	875	1625	875	1625
A-A2	A-K3	954	1934	228	585
A-A2	A-F3	254	634	980	1983
A-K3	A-K4	228	585	954	1934
A-K3	A-F3	1385	2315	1385	2315
A-K4	A-F3	980	1983	254	634

(1) To obtain the fully closed position, it is necessary to push against the throttle plate in the throttle body with your hand and hold it in this position for the measurement.



If any resistance value is incorrect, check wire continuity between ECM and throttle body before assuming the TPS is at fault. Refer to *WIRING DIAGRAM* subsection.



THROTTLE BODY CONNECTOR PIN-OUT

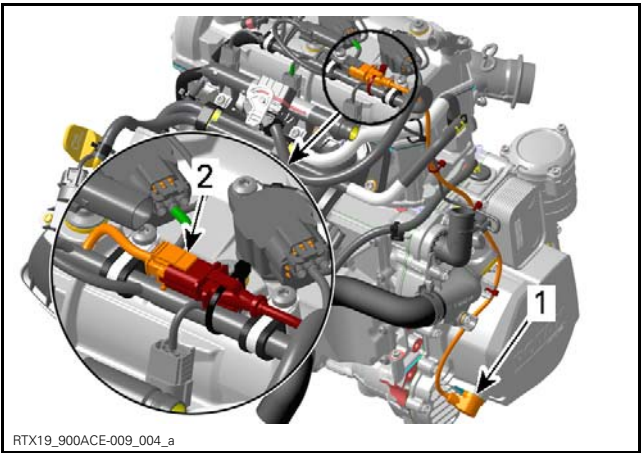
CRANKSHAFT POSITION SENSOR (CPS)

CPS TROUBLESHOOTING

When troubleshooting a CPS fault, take into account that a CPS fault can be triggered by bent or missing encoder wheel teeth.

Push START/STOP button and crank engine. If engine does not start within 15 seconds check for fault codes using the BRP diagnostic software (BUDS2).

CPS and CPS Connector Location

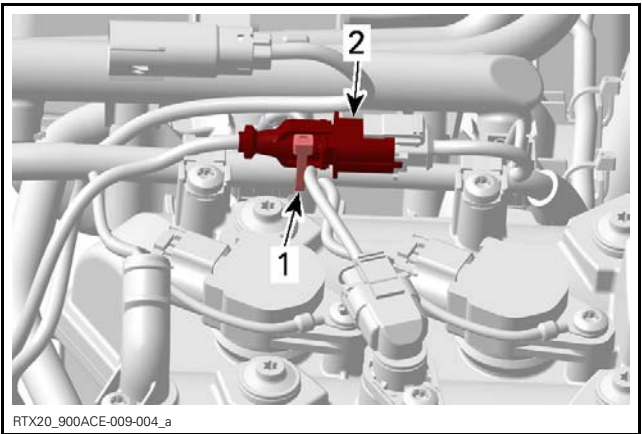


900 ACE ENGINE SHOWN

- 1. CPS location
- 2. CPS connector location

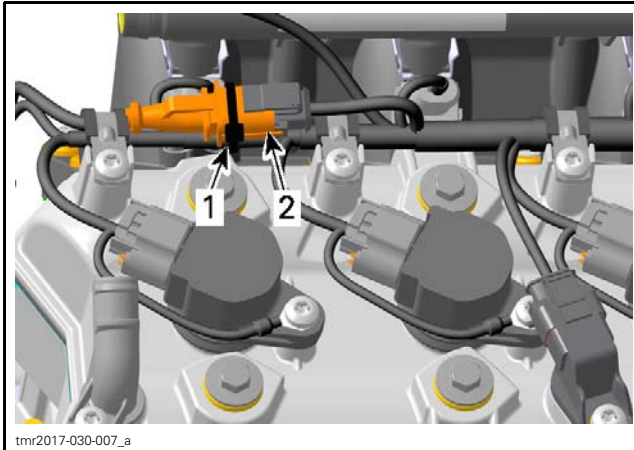
Testing the CPS Resistance

- 1. Cut locking tie and disconnect CPS connector.



600 ACE

- 1. Locking tie
- 2. CPS connector



900 ACE
1. Locking tie
2. CPS connector

2. Probe CPS connector terminals as per following table.

CPS RESISTANCE TEST		
CPS PIN		SPECIFICATION @ 20°C (68°F)
1	2	775 - 950 Ω

If resistance is not within specifications, replace the CPS.

If resistance tests good, **reconnect** the CPS connector.

1. Disconnect ECM-A connector from the ECM and connect it to the ECM adapter.
2. Recheck resistance as per table.

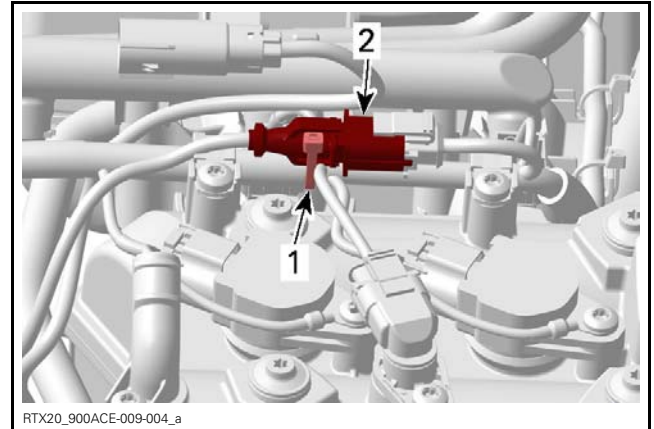
CPS RESISTANCE TEST		
ECM ADAPTER PIN		SPECIFICATION @ 20°C (68°F)
A-H1	A-K2	775 - 950 Ω

If resistance is as specified, test continuity of wiring between ECM-A and CPS connectors. Refer to *WIRING DIAGRAM* subsection.

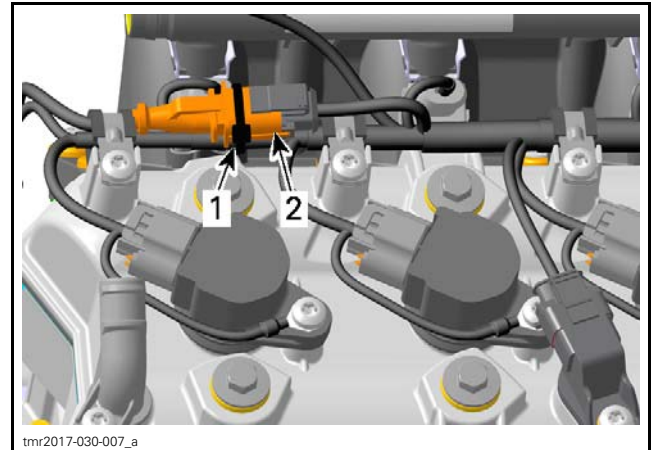
If resistance value is not as specified, reconnect ECM-A connector to the ECM and refer to *TESTING THE CPS OUTPUT VOLTAGE*.

Testing the CPS Output Voltage

1. Remove the fuel injector fuse. Refer to the wiring diagram.
2. Cut locking tie and disconnect the CPS connector.



600 ACE
1. Locking tie
2. CPS connector



900 ACE
1. Locking tie
2. CPS connector

3. Probe CPS connector terminals while cranking engine, as per following table.

CPS OUTPUT VOLTAGE TEST		
CPS CONNECTOR PIN		SPECIFICATION
1	2	1 - 2 Vac min.

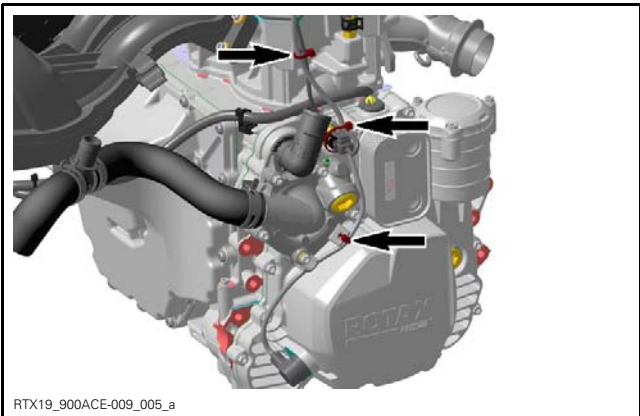
If voltage is out of specification, inspect wiring and connectors. Replace CPS if wiring is good.

If voltage is within specification, the problem may be related to the ECM.

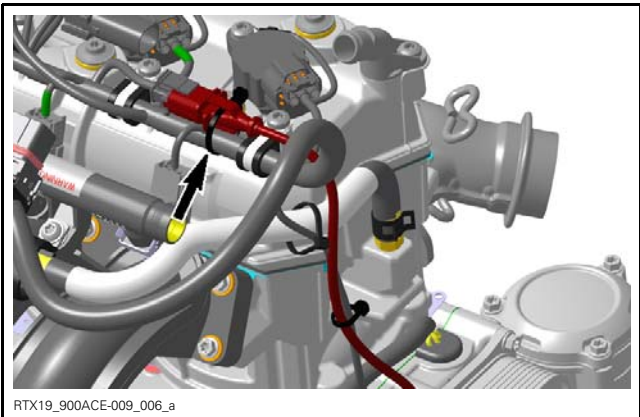
4. Reconnect CPS connector and install all removed parts.

Replacing the CPS

1. Remove parts required to access the CPS.
2. Take note of factory CPS wire harness routing for reinstallation.
3. Cut harness locking ties.

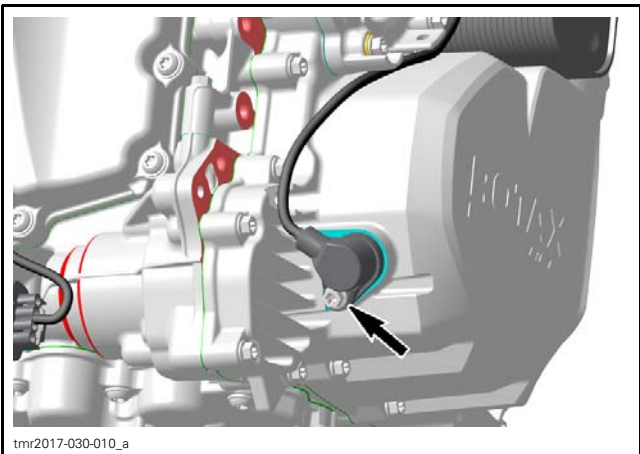


900 ACE ENGINE SHOWN



900 ACE ENGINE SHOWN

4. Disconnect CPS connector.
5. Remove CPS retaining screw and pull out CPS.



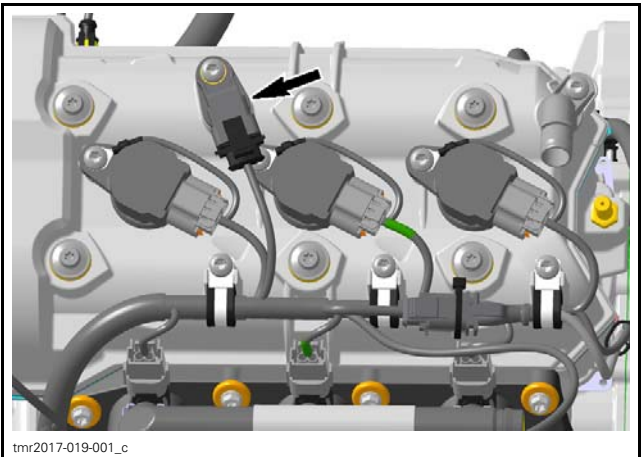
6. Apply engine oil on O-ring.
7. Install new CPS.

TIGHTENING TORQUE	
CPS retaining screw	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

8. Route and secure CPS harness using harness clamp and locking ties as noted prior to removal.

CAMSHAFT POSITION SENSOR (CAPS)

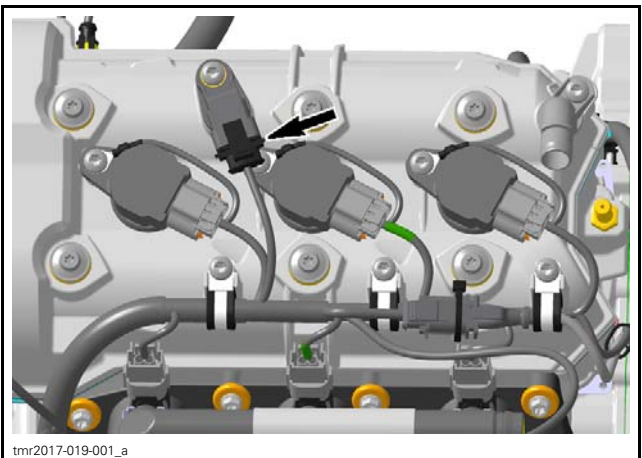
CAPS Location



900 ACE ENGINE SHOWN

Testing the CAPS Voltage (Harness Side)

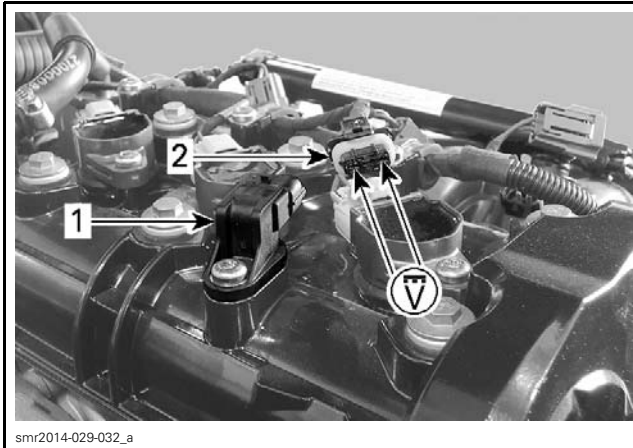
1. Remove the parts required to access the CAPS.
2. Disconnect CAPS connector.



900 ACE ENGINE SHOWN

3. Install key on D.E.S.S. post.
4. Press the START/STOP button to wake up the ECM without holding the brakes.
5. Probe harness connector terminals as per following table.

CAPS VOLTAGE TEST		
CAPS CONNECTOR PIN		SPECIFICATION
1	3	Battery Voltage

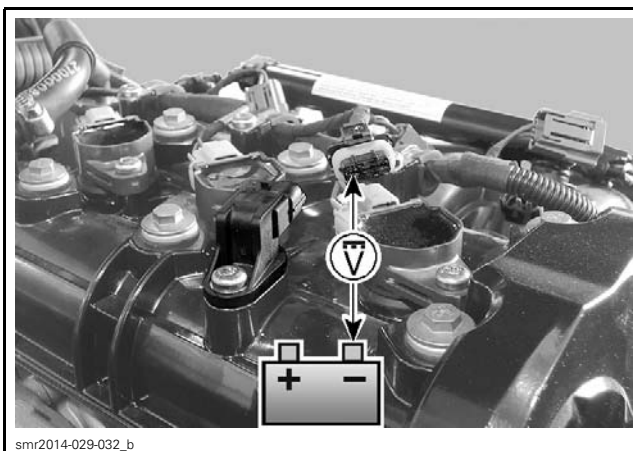


TYPICAL
1. CAPS
2. CAPS connector

If battery voltage is read, proceed with *TESTING THE CAPS (DYNAMIC)* further in this subsection.

If battery voltage is not read, probe circuit as per following table.

CAPS VOLTAGE TEST		
CAPS CONNECTOR PIN	BATTERY POST	SPECIFICATION
3	Negative	Battery Voltage



TYPICAL

If voltage is read to battery ground, check continuity of ground circuit between CAPS pin 1 and ECM-A connector pin D4. Repair or replace wiring and connectors.

If voltage is not read to battery ground, carry out *TESTING THE CONTINUITY OF CAPS POWER CIRCUIT*.

Testing the Continuity of CAPS Power Circuit

1. Remove the F4 fuse.
2. Set the multimeter to Ω .
3. Read resistance of the CAPS circuit as per following table.

CAPS POWER CIRCUIT CONTINUITY TEST		
CAPS CONNECTOR PIN	FUSE	SPECIFICATION
3	F4	Close to 0 Ω

If continuity is good, wiring and connectors are functional.

If a high resistance or an open circuit is measured, refer to *WIRING DIAGRAM* and check the following:

- Continuity from CAPS connector pin 3 to HIC connector pin 4.
- Continuity from HIC connector pin 4 to fuse F4.

Pay attention to connector pin contact and wire junction.

Repair or replace wiring and connectors as required.

4. Reinstall all removed parts.

Testing the CAPS (Dynamic)

1. Remove the parts required to access the CAPS.
2. Remove CAPS sensor from engine.
3. Back-probe connector and read voltage as follows.

NOTE: To safely probe wire terminals through the back of the connector, use the following tool or an equivalent.

REQUIRED TOOL	
Automotive back probe pin	

NOTICE Do not use sharp end probes. They could damage the connector seal.

4. Briefly press the START/STOP button to wake up the ECM.
5. Install the tether cord cap on the D.E.S.S. post.

Subsection XX (ELECTRONIC FUEL INJECTION (EFI))

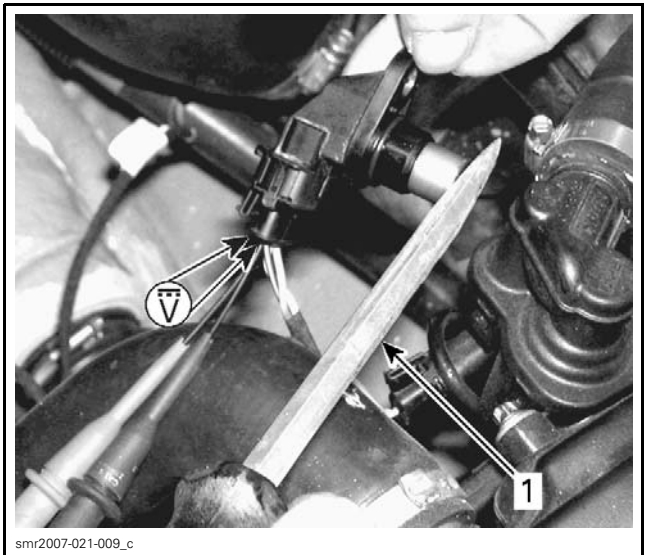
6. Read voltage as per following tables.

CAPS TEST (DYNAMIC)			
CAPS PIN		CAPS SENSOR END	SPECIFICATION
3	2	Free	Battery Voltage



TYPICAL

CAPS TEST (DYNAMIC)			
CAPS CONNECTOR PIN		CAPS SENSOR END	SPECIFICATION
3	2	Metallic Object on Sensor	Close to 0 Vdc



TYPICAL

1. Metallic object

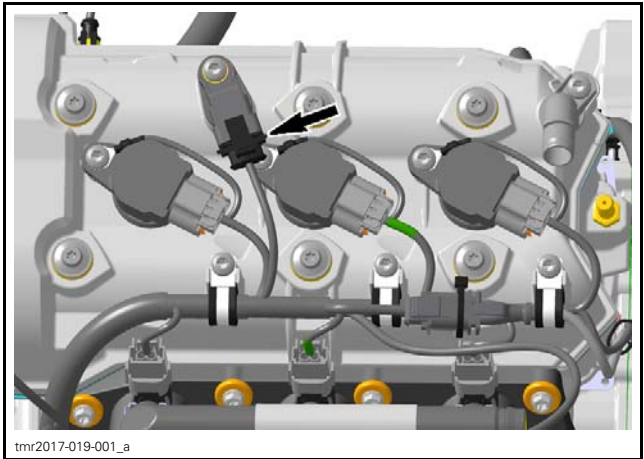
If voltage is as specified, repair or replace wiring and connectors between sensor and ECM.

If wiring is good, check ECM. Refer to *ENGINE CONTROL MODULE (ECM)*.

If battery voltage is not measured as specified, try a new CAPS.

Replacing the CAPS

1. Disconnect CAPS connector.



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2. Unscrew the CAPS retaining screw.
3. Pull out CAPS.
4. Apply engine oil on the new sensor O-ring.
5. Install new CAPS.

NOTICE Be sure to install NEW O-ring.

TIGHTENING TORQUE	
CAPS retaining screw	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

6. Apply dielectric grease in the CAPS connectors.

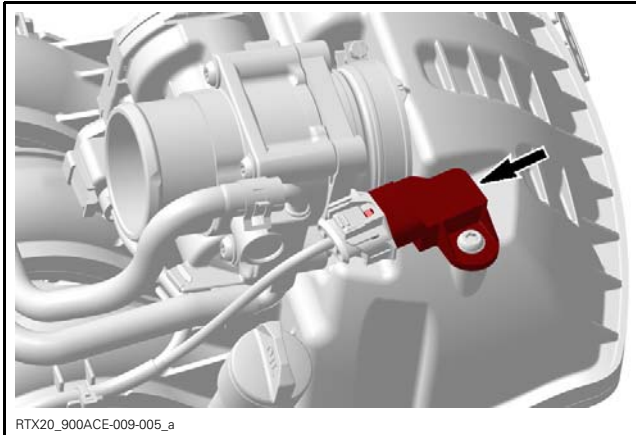
SERVICE PRODUCT
DIELECTRIC GREASE (P/N 293 550 004)

MANIFOLD ABSOLUTE PRESSURE AND TEMPERATURE SENSOR (MAPTS)

This sensor is a multifunction device. It measures manifold absolute pressure and intake temperature for air flow calculations.

MAPTS Location

The MAPTS is located on the intake plenum.



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MAPTS Pressure Function

Before the engine is started, when power is applied to the system, the sensor measures the ambient air atmospheric pressure. The ambient pressure is, at that moment, stored in the ECM. Thereafter, once the engine is started, it measures the air pressure in the intake manifold at operating RPMs.

The sensor must be correctly installed on the intake manifold. Otherwise, the MAPTS could generate a fault code for an unexpected sensor range at idle when it reads the atmospheric pressure. If this is the case, remove sensor and check for oil or dirt on its end and if problem persists, check throttle plate condition/position and the wiring harness. Perform the following tests.

Testing the MAPTS (Pressure Function)

1. Connect vehicle to the .BRP diagnostic software (BUDS2)
2. In BUDS2, select the following:
 -
 - **Measurements** page
 - **ECM** button
 - **Custom** tab
 - **Manifold Pressure With Altitude Correction.**
3. Look for and take note of the MAPTS pressure reading while the engine is stopped.
4. Perform the same test with a new MAPTS and compare both readings.

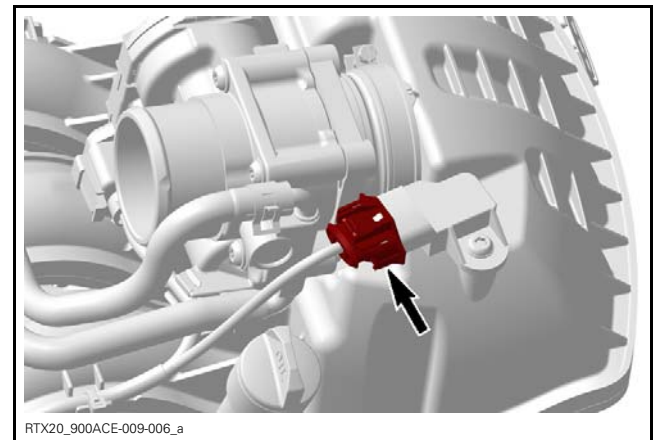
Values have to be within ± 3.4 kPa (.5 PSI).

NOTE: 1 kPa = 10 hPa.

MAPTS PRESSURE FUNCTION QUICK TEST			
RESULT	SERVICE ACTION		
NO READING	Circuit Continuity Test of MAPTS Pressure Function	MAPTS Input Voltage Test	Repair or replace wiring
VALUE IS OUT OF RANGE	Replace MAPTS		

Testing the MAPTS Input Voltage

1. Disconnect MAPTS connector.



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2. Briefly push START/STOP button.
3. Set multimeter to Vdc, measure for MAPTS input voltage as per following table.

MAPTS INPUT VOLTAGE TEST		
MAPTS CONNECTOR PIN	SPECIFICATION	
1	3	5 Vdc

If voltage test is good, replace the MAPTS.

If voltage test is not good, carry out *TESTING THE MAPTS CIRCUIT CONTINUITY (PRESSURE FUNCTION)*.

Testing the MAPTS Circuit Continuity (Pressure Function)

1. Disconnect the ECM-A connector and install it on ECM adapter tool.
2. Check continuity of the following circuits.

Subsection XX (ELECTRONIC FUEL INJECTION (EFI))

MAPTS CIRCUIT CONTINUITY TEST (PRESSURE FUNCTION)		
ECM ADAPTER PIN	MAPTS CONNECTOR PIN	SPECIFICATION
B4	3	Close to 0 Ω
G4	4	
H2	1	
H3	2	

If resistance is not within specification, repair or replace the wiring harness between ECM connector and the MAPTS.

MAPTS Temperature Function

The MAPTS also monitors the temperature of the air in the intake manifold.

Quick Testing the MAPTS (Temperature Function)

1. Connect the vehicle to the BRP diagnostic software (BUDS2).
2. In BUDS2, select the following:
 - **Measurement** page
 - **ECM** button
 - **Custom** tab.
3. Look for **Intake Temperature** reading while the engine is stopped.
4. Perform the same test with a new MAPTS and compare both readings.

If the engine's MAPTS temperature reading is significantly different than the new MAPTS, replace it.

NOTE: Both sensors must feel same ambient air temperature.

If there is no reading, carry out *TESTING THE MAPTS RESISTANCE (TEMPERATURE FUNCTION)*.

Testing the MAPTS Resistance (Temperature Function)

1. Disconnect the MAPTS connector.
2. Test MAPTS resistance at the sensor as per following tables.

MAPTS RESISTANCE TEST (TEMPERATURE FUNCTION)		
MAPTS PIN		SPECIFICATION
1	2	Refer to MAPTS TEMPERATURE SENSOR TABLE

MAPTS TEMPERATURE SENSOR TABLE	
TEMPERATURE	SPECIFICATION
-40°C (-40°F)	40528 to 56935 Ω
-10°C (14°F)	8103 to 10919 Ω
20°C (68°F)	2193 to 2863 Ω
80°C (176°F)	294 to 368 Ω
120°C (248°F)	98 to 122 Ω

If resistance is not within specification, replace the MAPTS.

If resistance tests good, **reconnect** the MAPTS and proceed with the following steps.

3. Install ECM-A connector on the ECM adapter tool.
4. Recheck resistance value as per following table.

MAPTS RESISTANCE TEST (TEMPERATURE FUNCTION)		
ECM ADAPTER PIN		SPECIFICATION
H2	H3	Refer to MAPTS TEMPERATURE SENSOR TABLE

MAPTS TEMPERATURE SENSOR TEST RESULTS			
RESULT	SERVICE ACTION		
NO READING	Circuit Continuity Test of MAPTS Temperature Function	MAPTS Input Voltage Test	Repair or replace wiring
INCORRECT RESISTANCE VALUE	Check condition of connector pins, replace MAPTS		
CORRECT RESISTANCE VALUE	Try a new ECM		

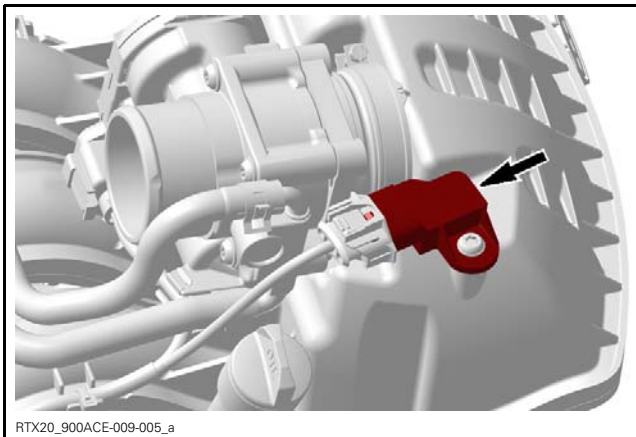
Testing the MAPTS Circuit Continuity (Temperature Function)

MAPTS CIRCUIT CONTINUITY TEST (TEMPERATURE FUNCTION)		
ECM ADAPTER PIN	MAPTS CONNECTOR PIN	SPECIFICATION
H2	1	Close to 0 Ω
H3	2	

Repair or replace wiring as required.

Replacing the MAPTS

1. Disconnect MAPTS connector and remove the MAPTS from the intake manifold.



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2. Apply engine oil on MAPTS O-ring.
3. Install new MAPTS as per following table.

TIGHTENING TORQUE	
MAPTS retaining screw	4.5 N•m $\pm$ 0.5 N•m (40 lbf•in $\pm$ 4 lbf•in)

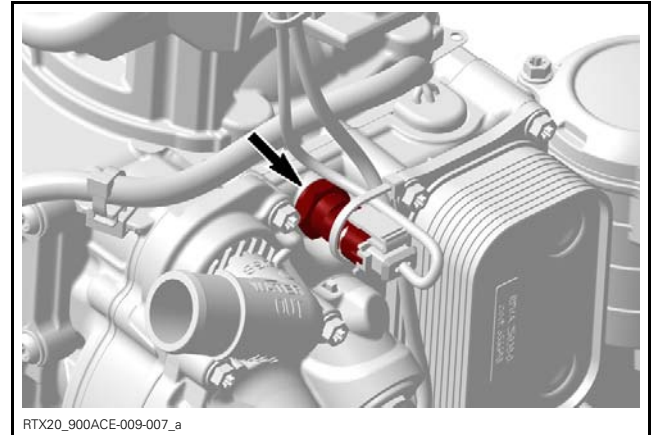
COOLANT TEMPERATURE SENSOR (CTS)

Overheat Warning

The CTS will cause the engine overheat warning to come on when the coolant temperature is above 110°C (230°F).

CTS Location

The CTS is located between the water pump and the oil cooler.



Testing the CTS using BUDS2

1. Connect the vehicle to BUDS2. Refer to *COMMUNICATION TOOLS* subsection.
2. Select the following:
 - **Measurements** page
 - **ECM** button
 - **Presets** and **ECM - BASIC** tabs.
3. Look for the engine temperature indication.

The engine temperature gauge in BUDS2 should provide an indication of the actual engine coolant temperature. Otherwise, perform *TESTING THE CTS RESISTANCE*.

Testing the CTS Resistance

1. Disconnect the CTS connector.
2. Test the resistance of the sensor as per following tables.

CTS RESISTANCE TEST (TEMPERATURE FUNCTION)		
CTS PIN		SPECIFICATION
1	2	Refer to CTS TEMPERATURE SENSOR TABLE

CTS TEMPERATURE SENSOR TABLE	
TEMPERATURE	SPECIFICATION
-40°C (-40°F)	38400 to 52600 Ω
-10°C (14°F)	8200 to 10600 Ω
0°C (32°F)	5900 to 6900 Ω
20°C (68°F)	2200 to 2800 Ω
80°C (176°F)	295 to 350 Ω
120°C (248°F)	105 to 120 Ω

Subsection XX (ELECTRONIC FUEL INJECTION (EFI))

NOTE: To test sensor at various temperatures, remove sensor and use a heat gun, ice and a thermometer.

If resistance is out of specification, replace the CTS.

If resistance test is good, proceed with the following steps.

- 3. Reconnect the CTS connector.
- 4. Install ECM-A connector on adapter tool.
- 5. Recheck resistance from the ECM connector as per following table.

CTS RESISTANCE TEST (TEMPERATURE FUNCTION)		
ECM ADAPTER PIN		SPECIFICATION
A-A1	A-J2	Refer to CTS TEMPERATURE SENSOR TABLE

If resistance value is correct, refer to *REPLACING THE CTS*.

If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the CTS.

Replacing the CTS

- 1. Drain coolant, refer to *COOLING SYSTEM* subsection.
- 2. Cut locking ties of wiring harnesses and move wiring aside for access.

NOTE: Take note of wiring and locking tie position before removal.

- 3. Disconnect CTS connector.
- 4. Remove CTS from engine.
- 5. Install new CTS and torque as specified.

TIGHTENING TORQUE	
CTS	22 N•m ± 2 N•m (16 lbf•ft ± 1 lbf•ft)

- 6. Reinstall remaining removed parts.

NOTE: Ensure to reinstall wiring harness as noted prior to removal.

- 7. Refill and bleed the cooling system, refer to *COOLING SYSTEM* subsection.

FUEL TANK AND FUEL PUMP

SERVICE TOOLS

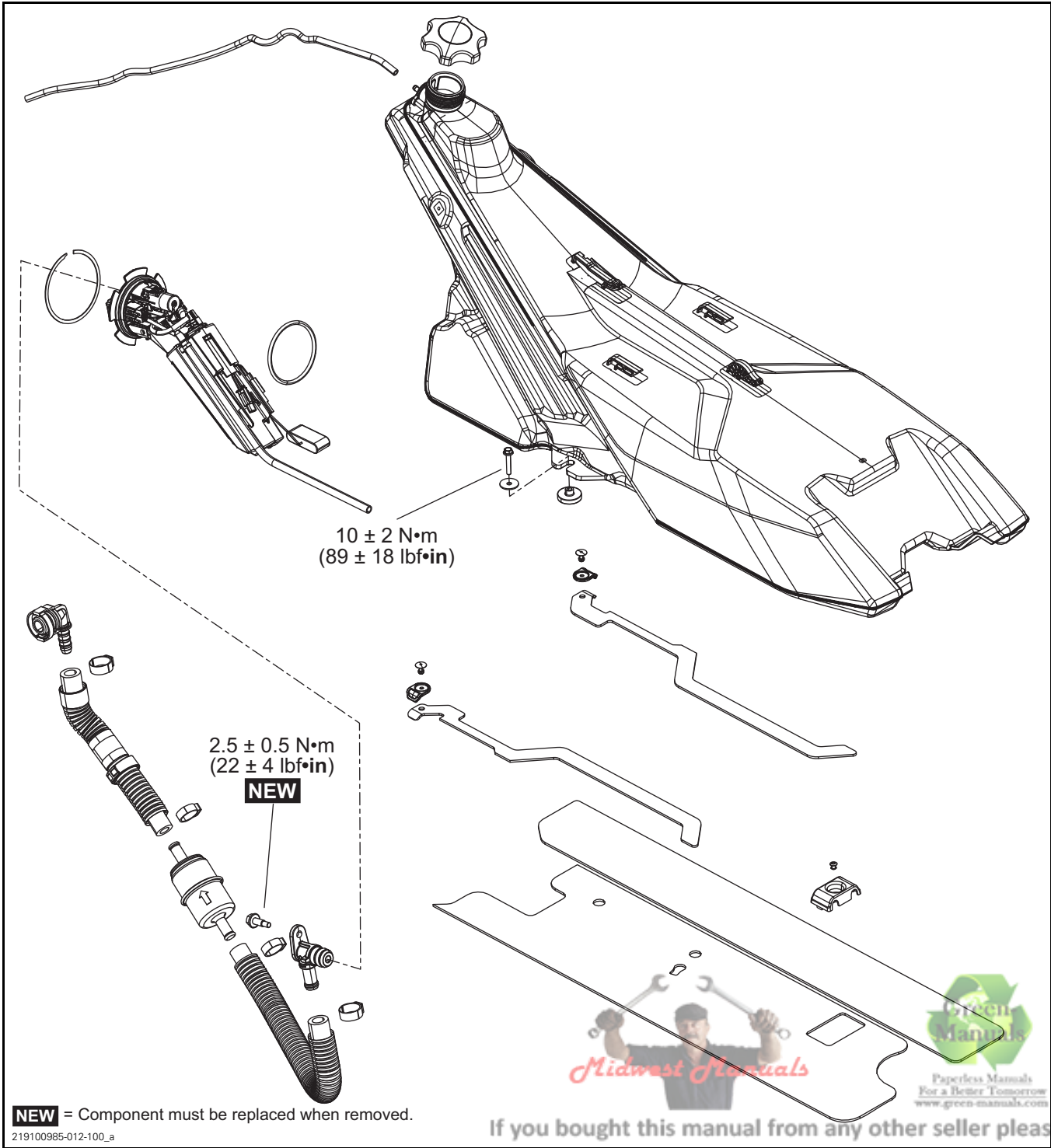
Description	Part Number	Page
LEAK TEST KIT	529 033 100	8
OETIKER PLIER	295 000 070	7, 10
PRESSURE GAUGE	529 036 395	9
SMALL HOSE PINCHER	295 000 076	8
T FITTING FUEL PRESSURE	529 036 509	9
VACUUM/PRESSURE PUMP	529 021 800	8

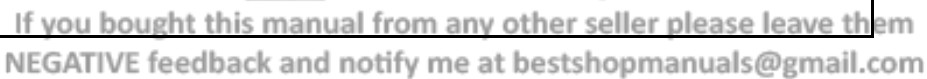
SERVICE PRODUCTS

Description	Part Number	Page
CLUTCH AND PULLEY FLANGE CLEANER PRO S1	779244	7

Subsection XX (FUEL TANK AND FUEL PUMP)

16 in Track





GENERAL

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*.

⚠ WARNING

Always disconnect the magneto connector prior to:

- Disconnecting any fuel hose.
 - Removing a fuel injector.
 - Removing a spark plug cable or spark plug.
- Otherwise, if the engine is cranked, fuel vapors may ignite in presence of a spark creating a fire hazard.

When disconnecting a fuel line, cover the connection with an absorbent shop rag and proceed slowly to minimize spilling.

⚠ WARNING

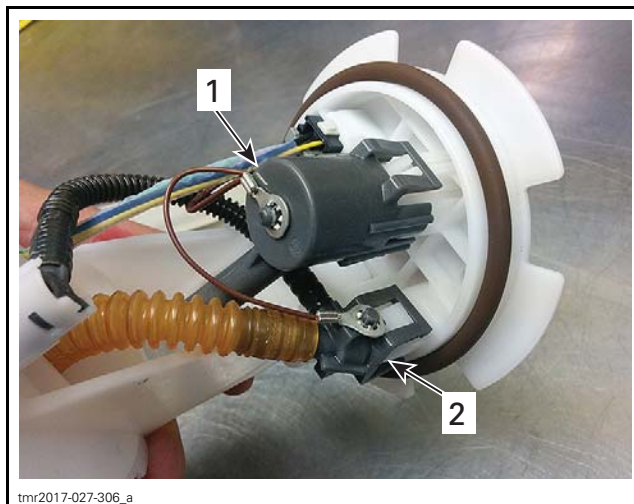
Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions.

⚠ WARNING

After working on the fuel system, always carry out a fuel system pressurization test to check for leaks.

⚠ WARNING

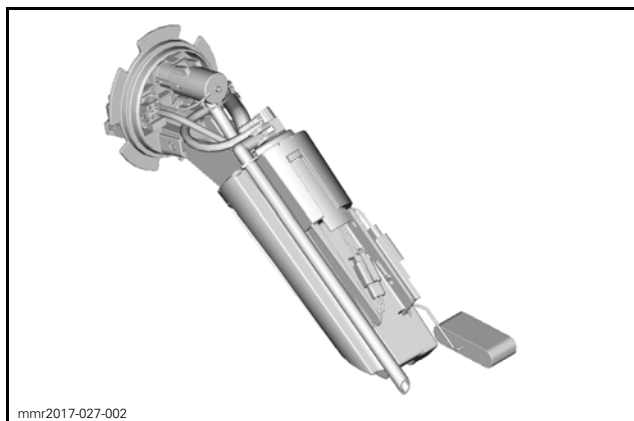
Never remove the eyelet connectors from the fuel pressure regulator and the fuel hose connector. A bad connection may create a static electricity discharge causing a fire hazard.



1. Fuel pressure regulator
2. Fuel hose connector

SYSTEM DESCRIPTION

Electric Fuel Pump



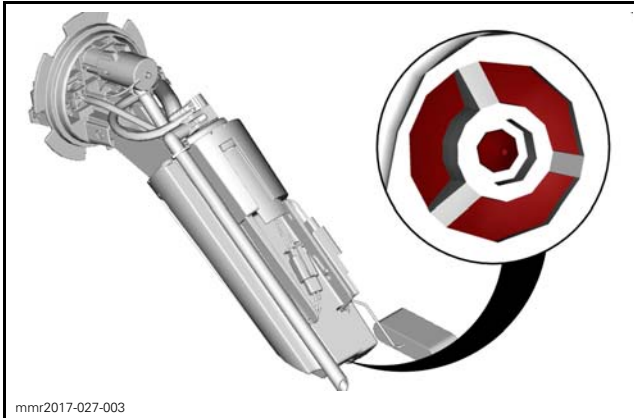
An electric fuel pump is mounted in the front center portion of the fuel tank.

A 12 Vdc high pressure fuel pump with an integrated jet pump is used.

As soon as the engine is cranking, the electric fuel pump turns on in preparation for the engine start. When the engine runs, the fuel pump is ON continuously to provide a constant fuel pressure to the injectors.

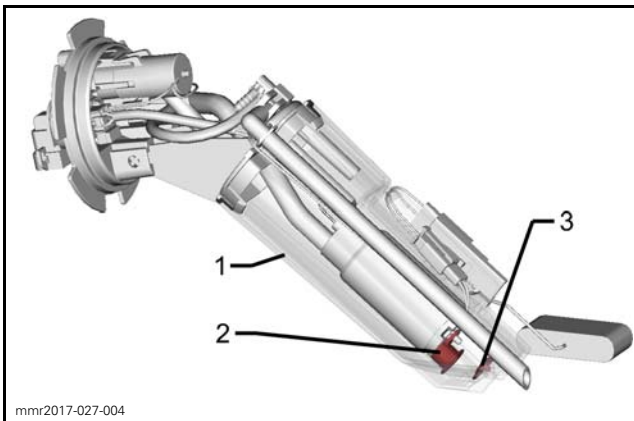
To ensure a constant delivery of fuel to the engine for all riding conditions when the fuel level is low, a rear pickup and a fuel pump reservoir is used.

The fuel pump reservoir is actually the housing of the fuel pump module in which the fuel pump is located. A check valve at the bottom of the housing allows the fuel in the tank to enter the fuel pump reservoir.



When the fuel pump runs, it draws the fuel from the fuel pump reservoir and feeds it to the injection system. This causes fuel in the tank to enter the fuel pump reservoir, by gravity, through its bottom inlet check valve.

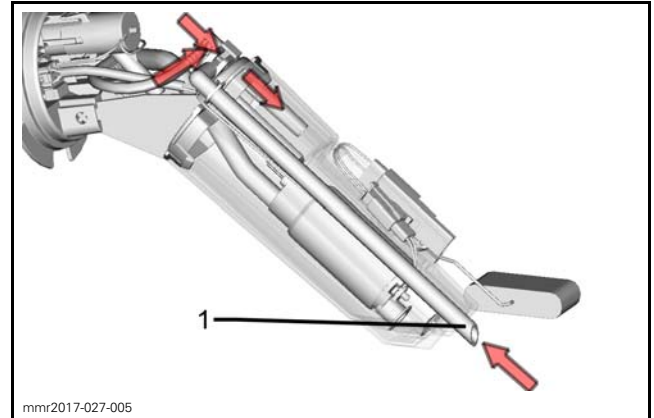
At the same time, a portion of the fuel flow from the electric fuel pump flows through a jet pump that contains a venturi.



TYPICAL - VIEW INSIDE FUEL PUMP RESERVOIR

1. Fuel pump reservoir
2. Bottom inlet
3. Check valve (open upwards)

As the fuel accelerates through the venturi, it generates a low pressure area at a connection to the remote pickup, which draws fuel into the fuel pump reservoir from the remote pickup.



1. Remote pickup

When riding the vehicle on a level surface, fuel enters into the fuel pump reservoir through its check valve and through the remote pickup simultaneously, as long as there is enough fuel in the tank to cover the remote pickup.

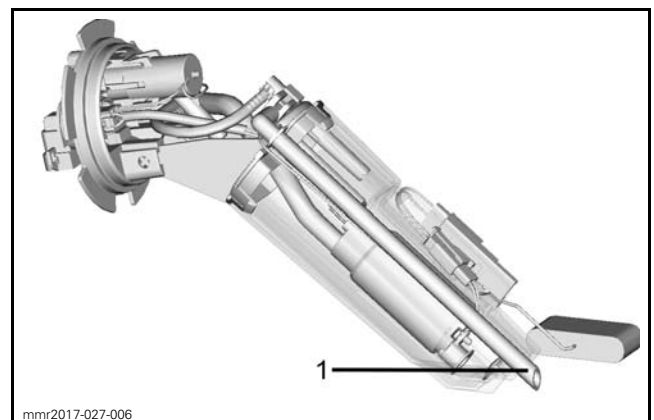
When riding downhill with a low amount of fuel in the tank, the fuel moves towards the front of fuel tank. The fuel enters the fuel pump reservoir through the check valve only as there is no fuel at the remote pickup.

When riding uphill with a low amount of fuel in the tank, the fuel moves towards the rear of the fuel tank. The check valve closes and traps the fuel in the pump reservoir. The fuel pump continues to draw fuel from the fuel pump reservoir, which is now only fed by the jet pump using the remote pickup. This prevents air from being drawn into the fuel lines from the fuel tank.

The continuous fuel flow cools down the fuel pump.

Fuel Pickup

Fuel enters the fuel pump reservoir from either a check valve at the bottom of the fuel pump reservoir, or from a remote pickup in the rear portion of the fuel tank.

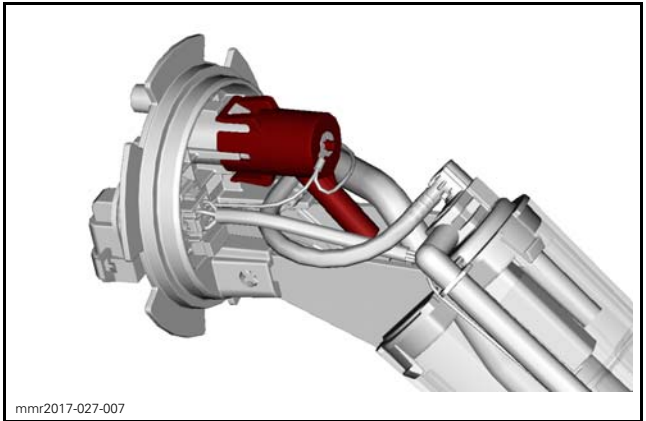


1. Remote pickup

Subsection XX (FUEL TANK AND FUEL PUMP)

Fuel Pressure Regulator

An integrated fuel pressure regulator is mounted on the fuel pump flange. It is basically a spring loaded valve that opens and closes the path of fuel returning to the tank, thus maintaining a constant fuel pressure in the system.



FUEL PRESSURE
Approximately 400 kPa ± 10 kPa (58 PSI ± 1 PSI) at 2000 RPM (will be lower at idle)

Fuel pressure should drop less than 35 kPa (5 PSI) when engine stops running.

If a leak is present, pressure will continue to drop within the first minute after engine stops running.

Fuel Tank Vent

The fuel tank is vented through a combination type check valve that allows ambient air pressure to enter fuel tank at all times.

As fuel is consumed by the engine, a negative pressure would occur in the fuel tank. This could eventually prevent the fuel pump from drawing enough fuel. The **negative pressure relieve function** of the valve allows the higher outside air pressure in

If pressure builds up and exceeds 7.58 kPa (1.1 PSI) in the fuel tank, the check valve opens and lets the excess pressure vent out of the tank.

Fuel Filters

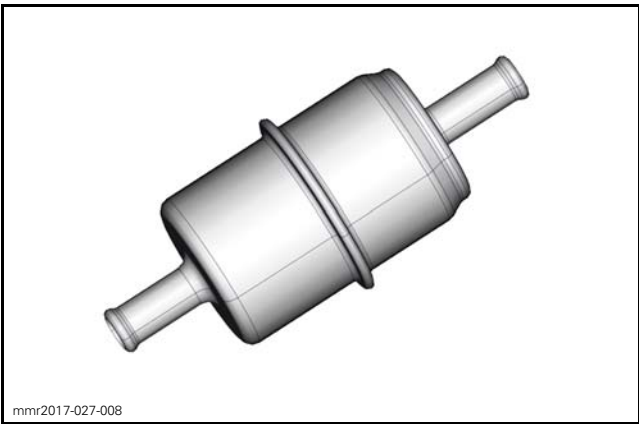
Fuel Pump Pre-Filter

A fuel pump pre-filter is used at the electric fuel pump inlet. It is a replaceable nylon mesh filter located within the fuel pump module housing (fuel pump reservoir).



The fuel pump pre-filter protects the fuel pump and prevents clogging of the fuel passages within the fuel pump module.

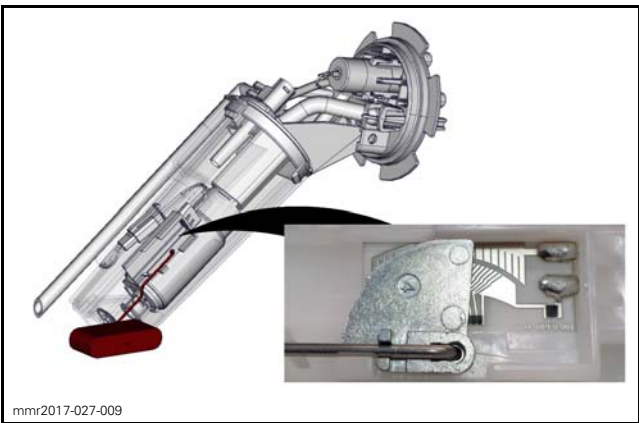
In-Line Fuel Filter



An in-line filter on the supply side is located between the fuel pump and the ECM.

It is a replaceable metallic canister type filter used to deliver dirt-free fuel to the injectors.

Fuel Level Indication



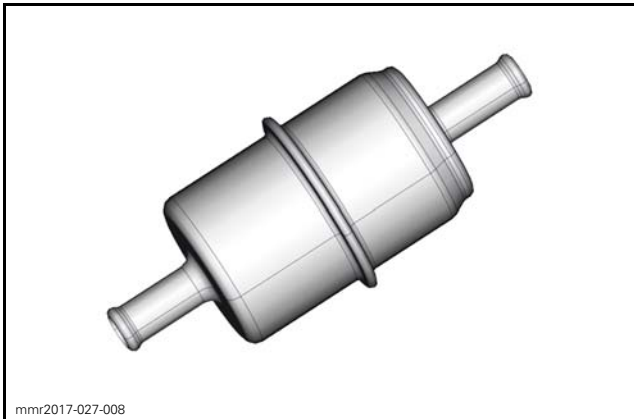
A float type fuel level sensor varies its resistance with fuel level thus providing a signal to the multifunction gauge for fuel level indication.

MAINTENANCE

INSPECTING THE FUEL LINES AND CONNECTIONS

Visually inspect fuel lines and connections for cracks or leaks.

REPLACING THE IN-LINE FUEL FILTER



Removing the In-line Fuel Filter

⚠ WARNING

Work in a well ventilated area. Wipe up all spilled fuel.

1. Release fuel pressure in the system. Refer to procedure in this subsection.
2. Remove the upper body module. Refer to *BODY* subsection.
3. Disconnect magneto connector.

⚠ WARNING

The magneto connector must be disconnected to prevent any spark in the engine compartment and to remove power from the fuel pump. Otherwise, if the engine is cranked, fuel vapors may ignite in presence of a spark creating a fire hazard.

4. Place a rag between fuel filter and oil injection tank.
5. Cut both Oetiker clamps securing the fuel filter.
6. Remove fuel filter from vehicle.

Dispose fuel filter as per your local environmental regulations.

Installing the In-Line Fuel Filter

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

Insert new Oetiker clamps on both hoses.

Install the new filter. Make sure printed arrow pointed towards the fuel rail.

Secure the fuel filter with new Oetiker clamps.

REQUIRED TOOL

OETIKER PLIER
(P/N 295 000 070)



⚠ WARNING

Ensure hose clamp is tight and that hose cannot turn on the fitting.

When installation is complete, carry out a fuel system leak test. Refer to procedure in this subsection.

⚠ WARNING

After working on the fuel system, carry out a fuel system pressurization test to check for leaks. Failure to carry out a fuel system leak test could result in severe injury or a life threatening situation should a leak occur.

Reinstall all removed parts.

INSPECTING AND CLEANING THE THROTTLE BODY

Clean throttle plates and throttle body bores.

SERVICE PRODUCT

CLUTCH AND PULLEY FLANGE CLEANER
PRO S1 (P/N 779244)

INSPECTION

TESTING FUEL SYSTEM FOR LEAKS

Activate the fuel pump from the **Functions** page in BUDS2.

Check for fuel leaks.

Subsection XX (FUEL TANK AND FUEL PUMP)

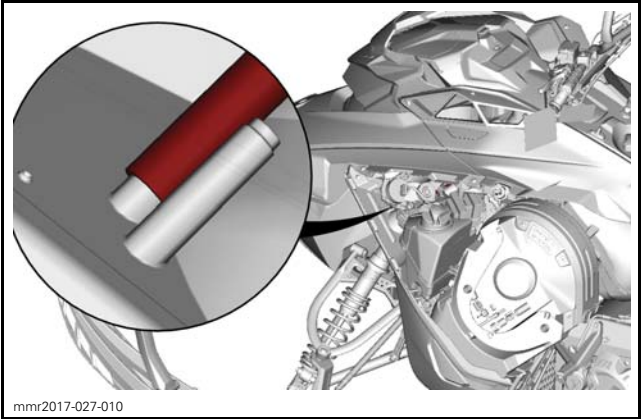
**WARNING**

After working on the fuel system, carry out a fuel system pressurization test to check for leaks. Failure to carry out a fuel system pressurization test could result in severe injury or a life threatening situation should a leak occur.

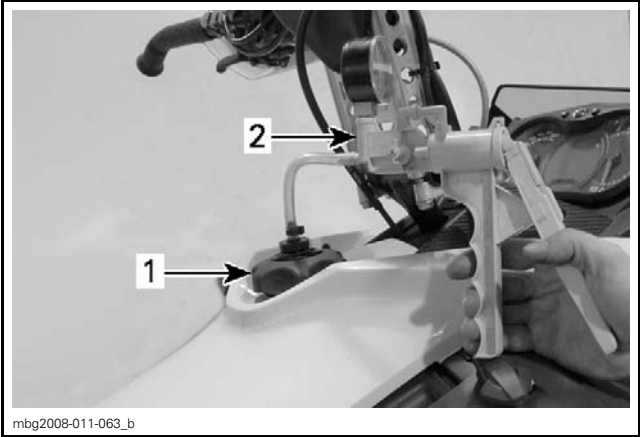
TESTING FUEL TANK FOR LEAKS

REQUIRED TOOLS	
SMALL HOSE PINCHER (P/N 295 000 076)	
LEAK TEST KIT (P/N 529 033 100)	
VACUUM/PRESSURE PUMP (P/N 529 021 800)	

1. Fill up fuel tank.
2. Open the left side panel to access the fuel vent tube.
3. Install a small hose pincher on the vent tube.



4. Install the appropriate test cap from the leak test kit on fuel tank inlet.
5. Install the vacuum/pressure pump on pressure test fuel cap.



TYPICAL
1. Pressure test fuel cap
2. Vacuum/pressure pump

6. Set pump selector to pressure.
7. Pressurize fuel tank as follows.

PRESSURE	TIME WITHOUT PRESSURE DROP
21 kPa (3 PSI)	3 minutes

If pressure drops, locate fuel leak(s) and repair or replace leaking component(s).
To ease locating leak(s), spray soapy water on components; bubbles will indicate leak location(s).

Fuel Tank Vent Valve Test

1. While the fuel tank is still pressurized as in the previous test, carry out the following:
2. Place a finger over the vent hose outlet.
3. When removing hose pincher, alternately touch and release vent hose outlet. You should feel pressurized air flowing out indicating the pressure relief valve function is working.
4. Release any remaining pressure in the fuel tank by slowly unscrewing fuel tank cap.
5. Remove the pressure test fuel cap.
6. Remove the fuel tank vent tube from its fitting on the lower left front body panel.
7. Install the vacuum/pressure pump on the vent tube and apply air pressure through the vent valve. Air must flow freely towards the fuel tank neck.



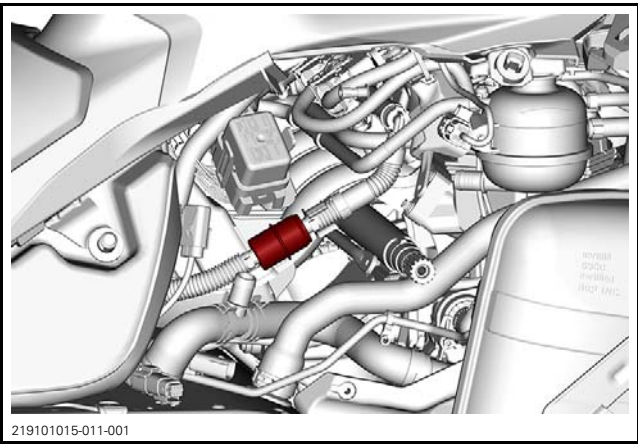
TYPICAL - VACUUM/PRESSURE PUMP ON VENT TUBE

- NOTE:** If fuel vent check valve does not function as indicated in test, replace vent valve.
- 8. Remove vacuum/pressure pump.
 - 9. Install vent tube on its fitting.
 - 10. Install normal fuel tank cap.

TESTING FUEL PRESSURE

REQUIRED TOOLS	
PRESSURE GAUGE (P/N 529 036 395)	
T FITTING FUEL PRESSURE (P/N 529 036 509)	

- Open right hand side panel.
- The pressure test provides an indication of the available fuel pressure at the fuel pump outlet. It validates the pressure regulator and the fuel pump.
- 1. Ensure there is enough gas in fuel tank.
 - 2. Install a rag under the fuel filter to catch fuel spillage.
 - 3. Remove fuel filter.



- 4. Install the T fitting tool in place of the fuel filter. Secure with gear clamps.



- 5. Install the pressure gauge on the T fitting tool.

⚠ WARNING

When carrying out pressure test, ensure fuel is not leaking from test equipment onto hot exhaust system or electrical components. Ensure fuel hose do not come into contact with hot engine parts or hot exhaust system.

- 6. Start engine.
- 7. Run engine above 2000 RPM and observe the fuel pressure.

FUEL PRESSURE	
400 kPa ± 10 kPa (58 PSI ± 1 PSI)	
FUEL PRESSURE TROUBLESHOOTING	
RESULT	POSSIBLE CAUSE
Pressure above specifications	Defective fuel regulator

Subsection XX (FUEL TANK AND FUEL PUMP)

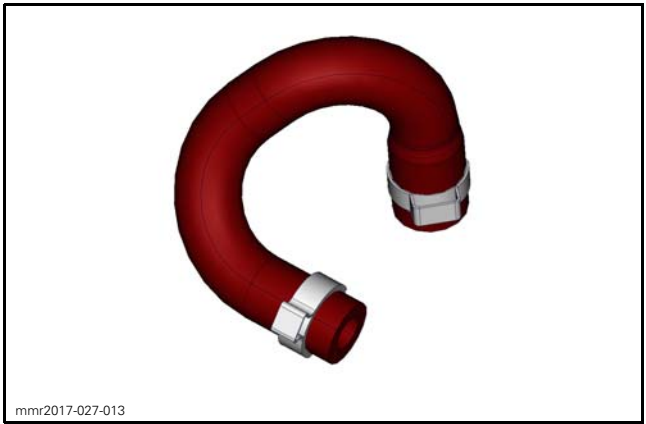
FUEL PRESSURE TROUBLESHOOTING	
RESULT	POSSIBLE CAUSE
Pressure below specifications	Clogged fuel filter
	Poor electrical connection
	Defective fuel regulator
	Defective fuel pump
	Leak in the fuel system circuit

8. Stop engine.
Fuel pressure should remain stable.
9. If fuel pressure drops, check the following for leaks:
- Tools
 - Hoses
 - Fuel injectors
 - Fuel pressure regulator
 - Fuel pump.
10. Bleed away any remaining fuel in the pressure gauge and fuel hose adapter using the bleed valve on the fuel hose adapter.
11. Remove pressure gauge and T-fitting fuel pressure.
12. Reinstall the fuel filter with **NEW** Oetiker clamps Refer to *FUEL HOSE AND OETIKER CLAMPS* in this subsection..
13. Reinstall all remaining removed parts.

PROCEDURES

FUEL HOSE AND OETIKER CLAMPS

Replacing Fuel Hoses



TYPICAL PRE-FORMED FUEL HOSE

When replacing fuel hoses, be sure to use hoses as available from BRP parts department. This will ensure continued proper and safe operation.

 **WARNING**

Use of fuel lines other than those recommended by BRP may compromise fuel system integrity.

 **WARNING**

- Never use a hose pincher on high pressure hoses.
- Never change the routing of a fuel hose.
- Always reinstall the corrugated protective tubing on fuel hoses.
- Secure fuel hoses using the appropriate locking tie or fastener to prevent contact with sharp edges or hot, rotating and moving parts.
- After connecting a hose or a quick connect fitting, pull on the hose near the fitting to make sure it is securely locked.
- Always validate fuel system tightness by performing a *FUEL SYSTEM PRESSURIZATION AND LEAK TEST*.

Replacing Oetiker Clamps



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

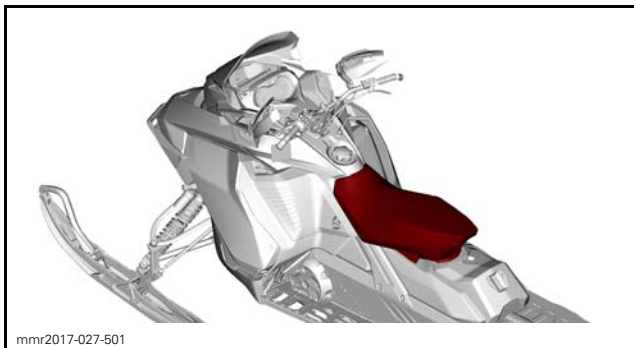
 **WARNING**

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

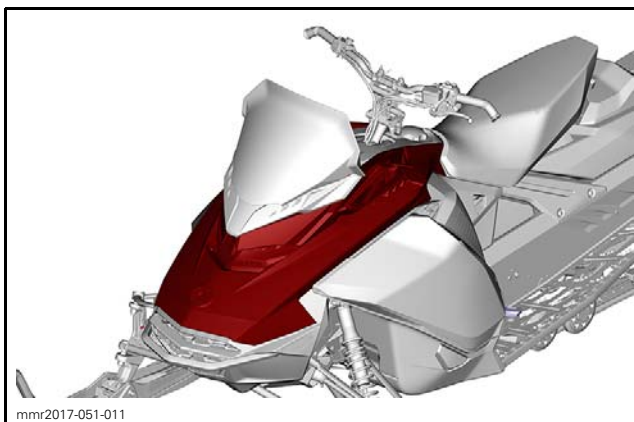
FUEL TANK

Removing the Fuel Tank

1. Remove seat.

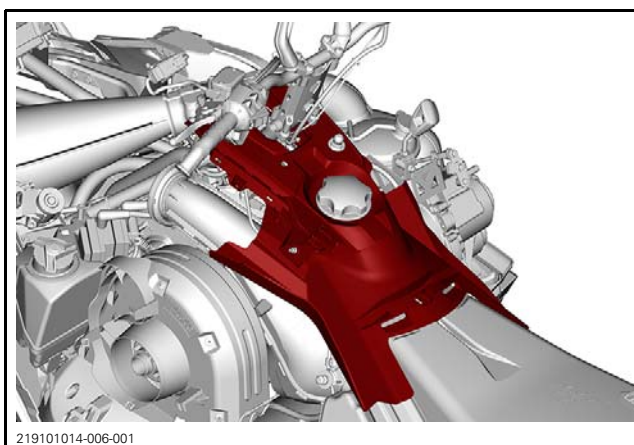


2. Remove upper body module. Refer to *BODY* subsection.



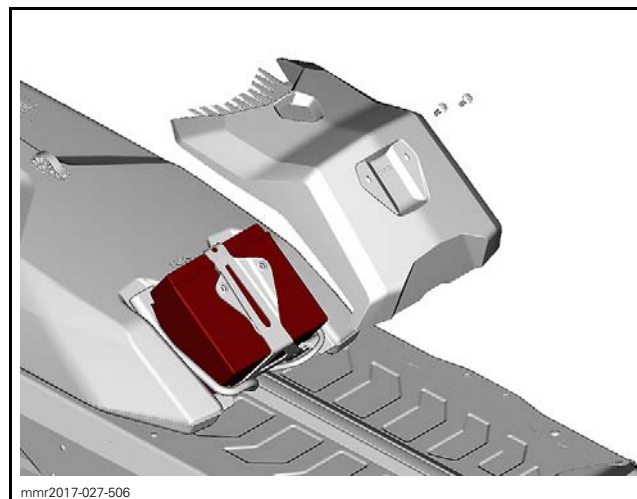
TYPICAL

3. Remove rear console. Refer to *BODY* subsection.

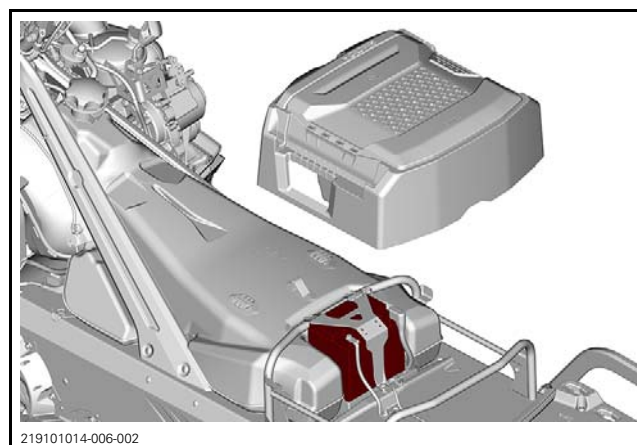


4. Remove the battery.

16 in Track

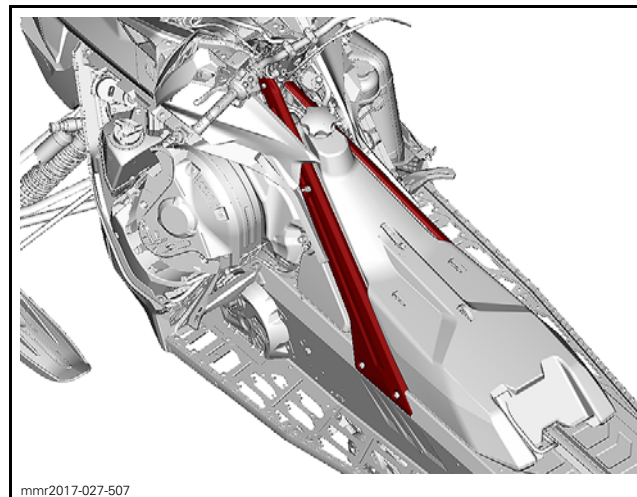


20 in Track



All Models

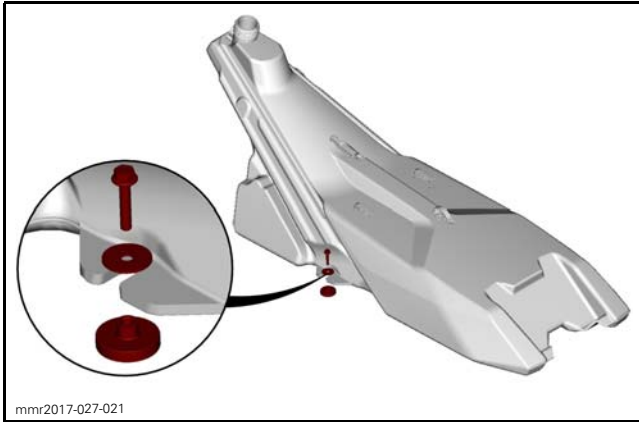
5. Remove rear frame members. Refer to *FRAME* subsection.



Subsection XX (FUEL TANK AND FUEL PUMP)

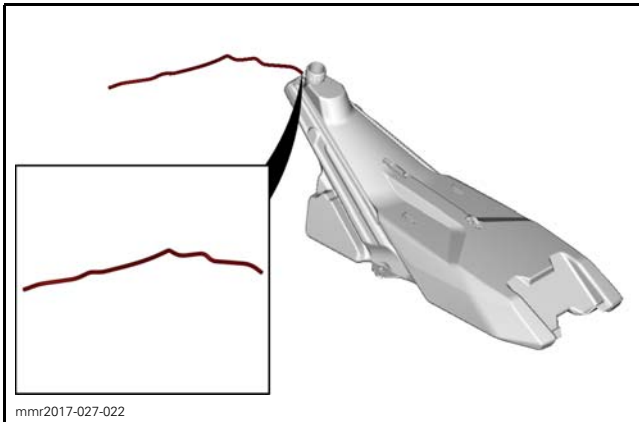
16 in Track

6. Remove and discard fuel tank retaining screws.

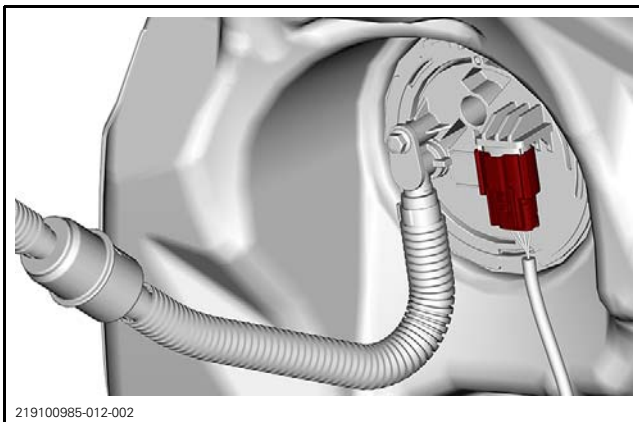


All Models

7. Disconnect fuel tank vent.



8. Remove fuel pump electrical connector.



9. Disconnect fuel hose from fuel rail.
10. Remove fuel tank.

Installing the Fuel Tank

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

Refer to appropriate subsections to properly reinstall all removed components.

Pressurize and test fuel system for leaks.

FUEL PUMP

Relieving Fuel Pressure

1. Connect vehicle to BUDS2, refer to the *COMMUNICATION TOOLS* subsection.
2. From the **Functions** page, relieve fuel pressure.

Activating the Fuel Pump with BUDS2

NOTE: Activating the fuel pump as described in this procedure can be used for purging air from the fuel system whenever a fuel hose has been disconnected and reconnected. The pump should be activated for 15 seconds to ensure proper purging of the system.

1. Connect vehicle to BUDS2 software, refer to *COMMUNICATION TOOLS* subsection.
2. From the **Functions** page, activate the fuel pump.
3. Listen for fuel pump operation.

If you do not hear the pump come ON, select the **Faults** tab in BUDS2 and check for fault codes.

If there is no fault code, connect a known good fuel pump to the vehicle harness (in parallel) and repeat the test.

NOTE: No voltage test can be done when the fuel pump is disconnected.

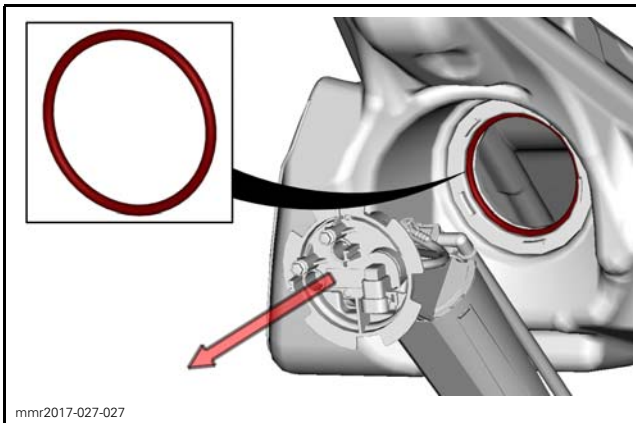
If the second fuel pump functions when connected to the vehicle harness, then replace the fuel pump installed in the vehicle.

Removing the Fuel Pump

1. Remove the fuel tank.
2. Remove fuel pump assembly snap ring from fuel tank.



3. Remove and discard fuel pump gasket.



4. Visually inspect for broken or damaged ground wires, if any issue are found, the module should be replaced.

Installing the Fuel Pump

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

Make sure the remote pick-up is inserted all the way to the rear of fuel tank and does not interfere with the fuel level sensor float.

Install a **NEW** gasket on the fuel pump prior to installing the pump in the tank.

Ensure the fuel pump snap ring is fully engaged with the gap on top. Refer to image in removal procedure.

NOTE: The gasket must be installed on the fuel tank side so it is located between the pump and the fuel tank.

Install fuel tank.

⚠ WARNING

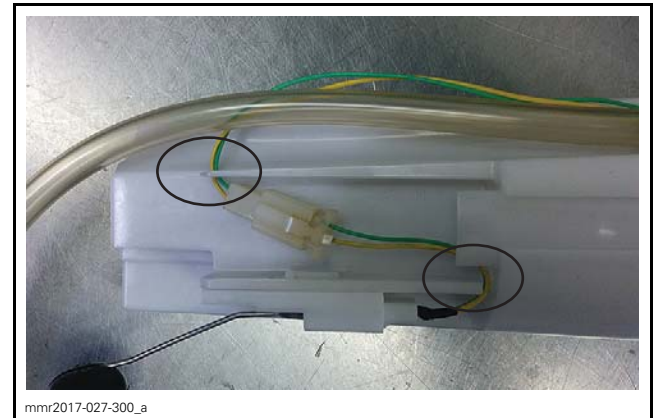
After working on the fuel system, carry out a fuel system pressurization test to check for leaks. Failure to carry out a fuel system leak test could result in severe injury or a life threatening situation should a leak occur.

FUEL PUMP INLET FILTER

Replacing the Fuel Pump Inlet Filter

1. Remove fuel pump assembly from fuel tank. Refer to procedure in this subsection.
2. Free the wires of the fuel level sensor of the fuel pump reservoir.

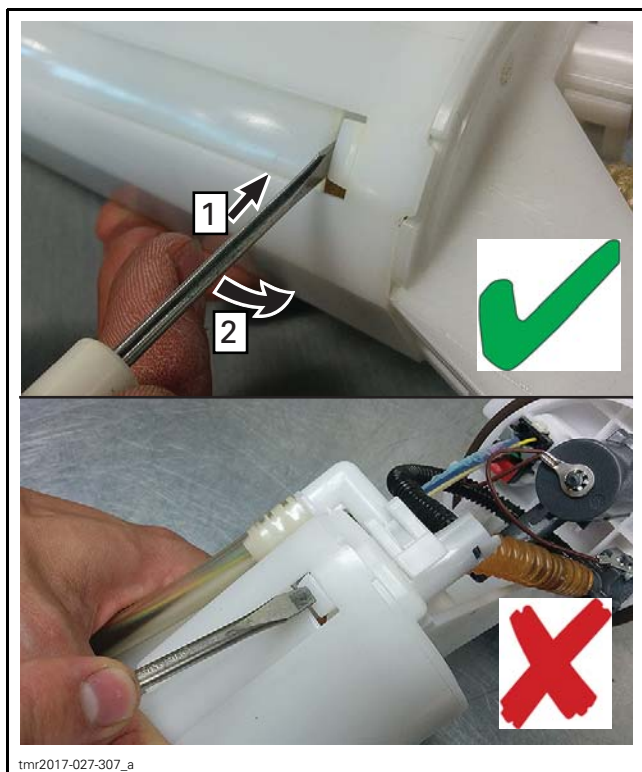
NOTICE Do not pull / push on wires or metal terminals that connect the grounding wires to the plastic parts. Keep hands and tools away from this area.



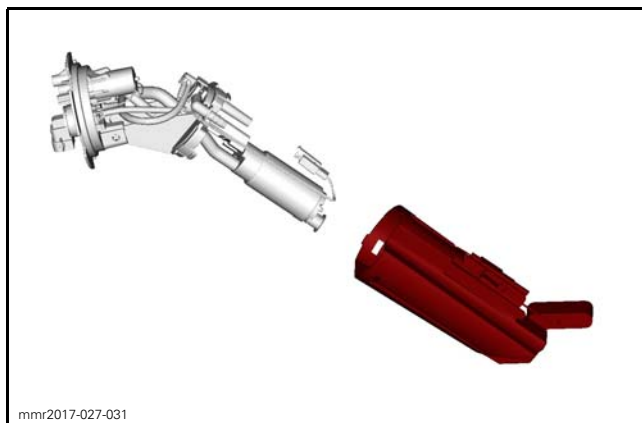
3. Unlock fuel pump reservoir by carefully inserting a small screwdriver between the tab and the fuel pump reservoir.

NOTICE Do not push directly on tabs or twist the screwdriver.

Subsection XX (FUEL TANK AND FUEL PUMP)



4. Completely remove fuel pump reservoir by pulling it carefully.



NOTICE To avoid damaging wires, Pull the reservoir carefully and do not let reservoir hang by wires.

5. Remove inlet fuel pump filter by pulling on it. If the filter is hard to remove, pry the filter gently using a small screwdriver.

NOTICE Be careful to avoid scratching the outside diameter of the pump inlet fitting where the filter fits.

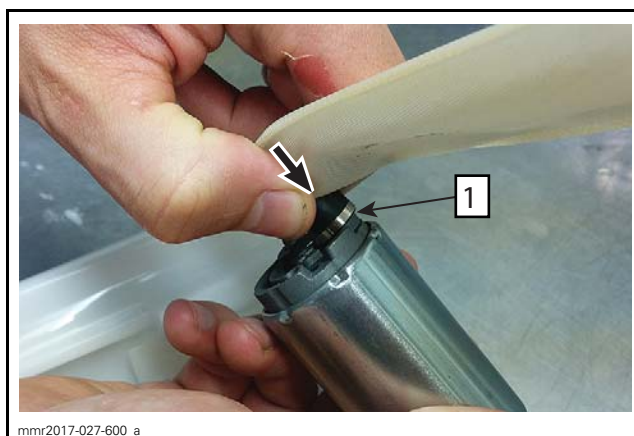


6. Discard inlet fuel pump filter and steel ring.

7. Install new fuel pump inlet filter.

7.1 Insert inlet filter onto fuel pump by pressing it downward.

7.2 Push the filter on until the fitting bottoms out on the pump inlet face, there should be no gap.



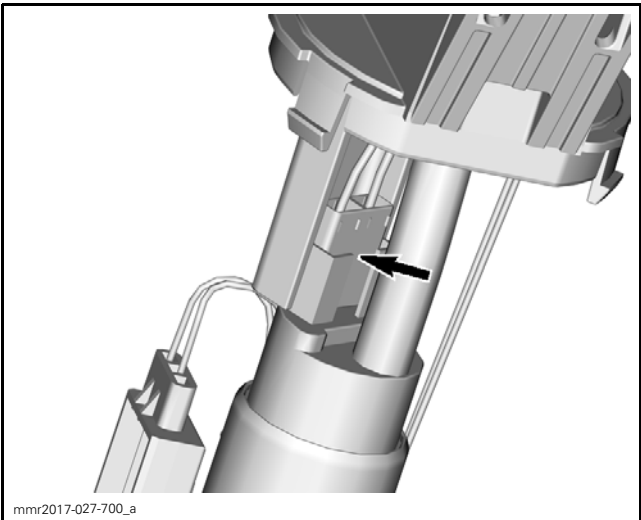
1. No gap here

7.3 Ensure that the filter hole is properly positioned into the pin.



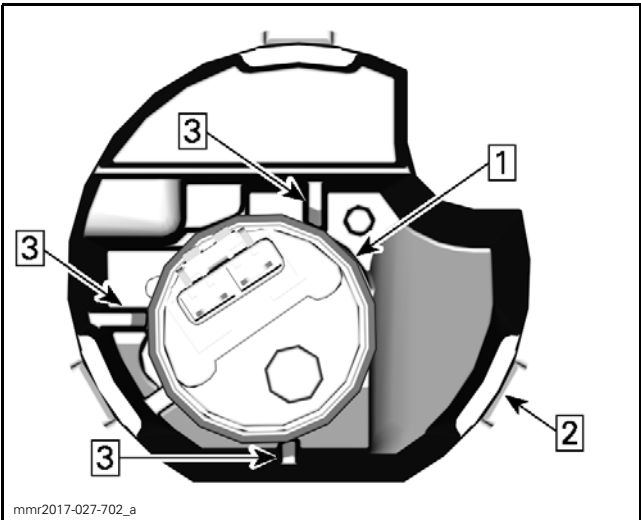
1. Pin

8. Install fuel pump reservoir carefully and ensure that all parts are properly positioned.

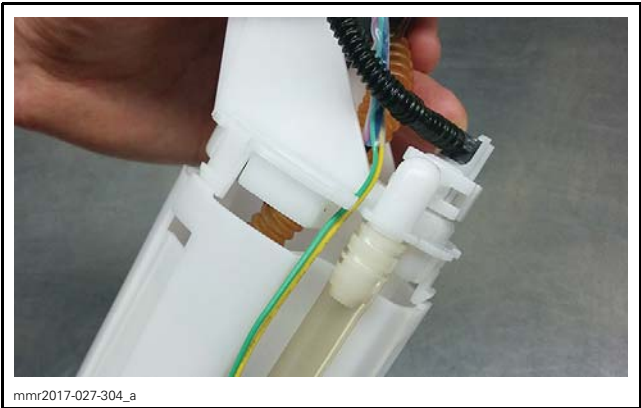


ELECTRICAL CONNECTOR MUST BE IN THIS POSITION

NOTE: Make sure the pump motor is positioned between the molded ribs in the reservoir.

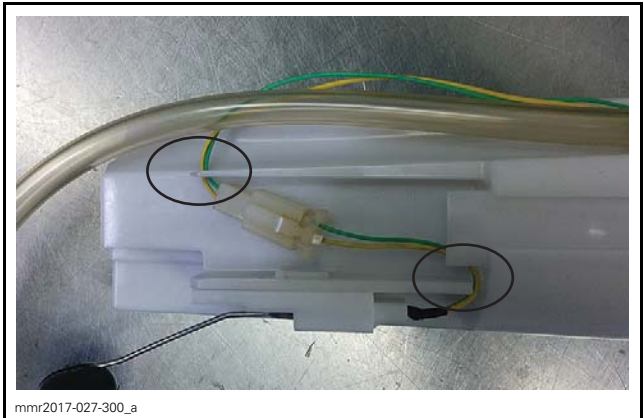


- 1. Fuel pump motor
- 2. Reservoir
- 3. Ribs



9. Ensure that fuel tank reservoir tabs are properly locked.

10. Route the fuel level sensor wires properly.



11. Reinstall fuel pump in fuel tank. Refer to procedure in this subsection.

FUEL LEVEL SENSOR

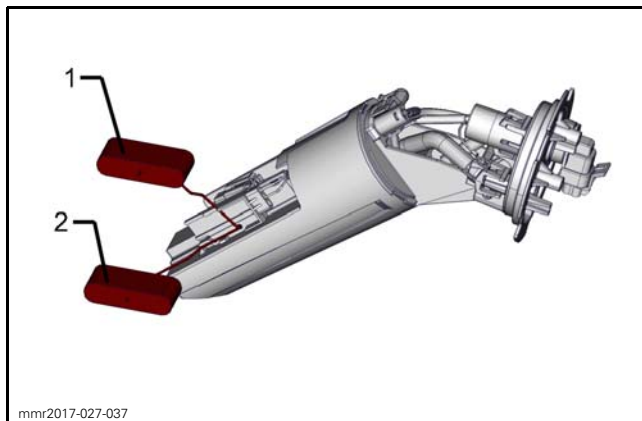
NOTE: Verify the gauge functions related to the fuel level sensor before testing the sensor. Refer to *GAUGE* subsection.

Testing Fuel Level Sensor Resistance

- 1. Remove fuel pump from fuel tank, refer to *FUEL PUMP* in this subsection.
- 2. Ensure the fuel level sensor is properly connected in the fuel pump module.
- 3. Measure the resistance at the fuel pump connector (FP).

FUEL LEVEL SENSOR BENCH TEST		
PROBE	FLOAT POSITION	RESISTANCE
FP- B to FP-D	Empty	95 Ω $\pm$ 5 Ω
	Full	9 Ω $\pm$ 2 Ω

Subsection XX (FUEL TANK AND FUEL PUMP)



TYPICAL FUEL PUMP FLOAT

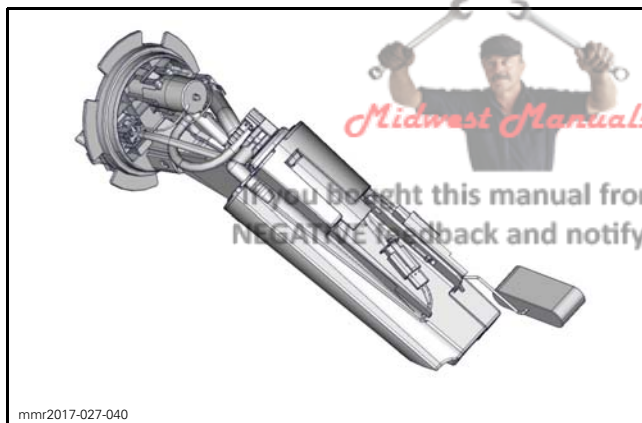
1. Full position
2. Empty position

4. When fuel level sensor travels from full to empty or vice-versa, there should be a constant linearity to the resistance readings. Any spike or drop of resistance indicates a "flat spot" in the fuel level sensor circuitry.

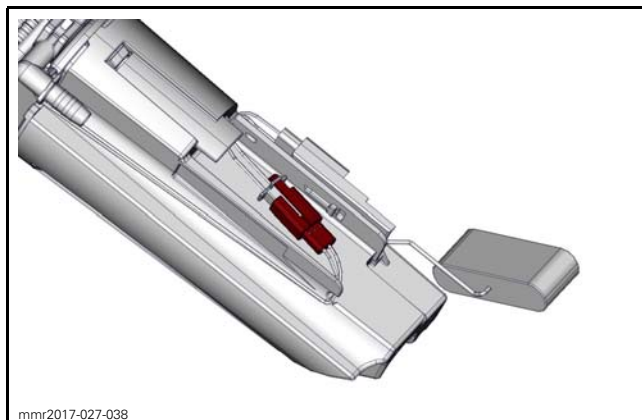
If fuel level sensor fails bench test, replace the fuel level sensor.

Replacing the Fuel Level Sensor

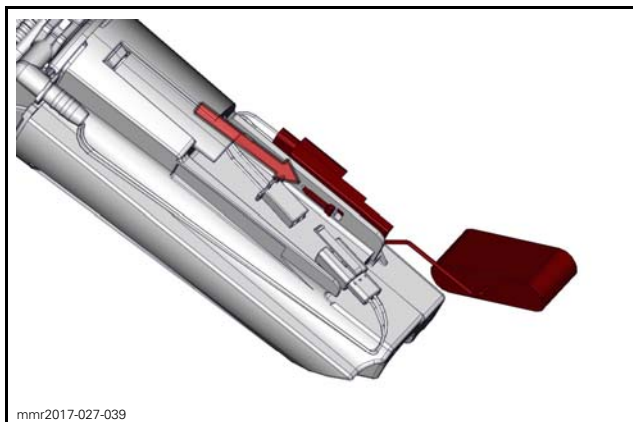
1. Remove the fuel pump.



2. Disconnect fuel level sensor connector.



3. Slide the potentiometer out of the fuel pump reservoir.



4. Remove fuel level sensor.

5. Replace the fuel level sensor with a new one and reverse steps.



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POWER DISTRIBUTION AND GROUNDS

GENERAL

OVERVIEW

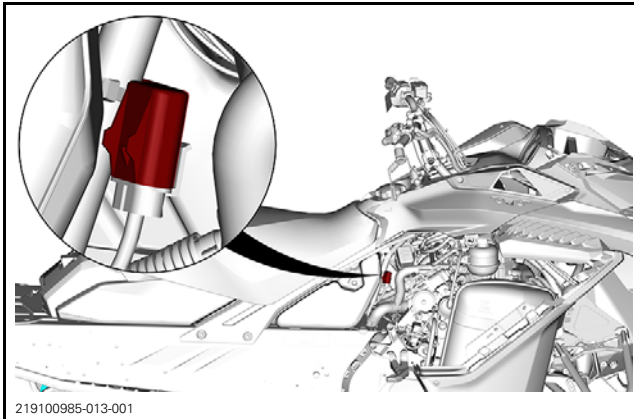
The battery is the primary source of power for the electrical system, it is recharged by the magneto.

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

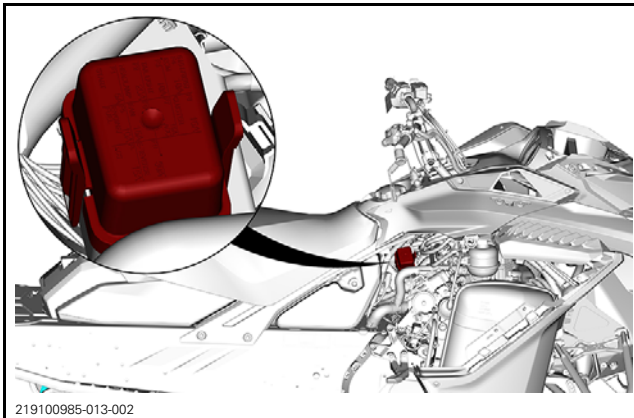
At high RPM if the magneto power is greater than the loads, the rectifier/regulator will regulate power as necessary.

The system uses an external voltage regulator/rectifier.

FUSE HOLDER (FA)

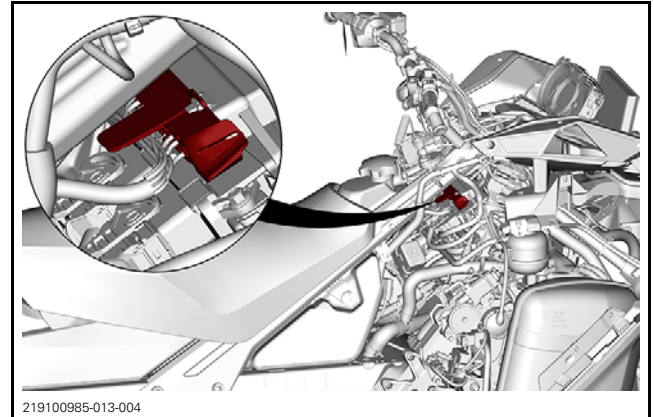


FUSE BOX (FB1)

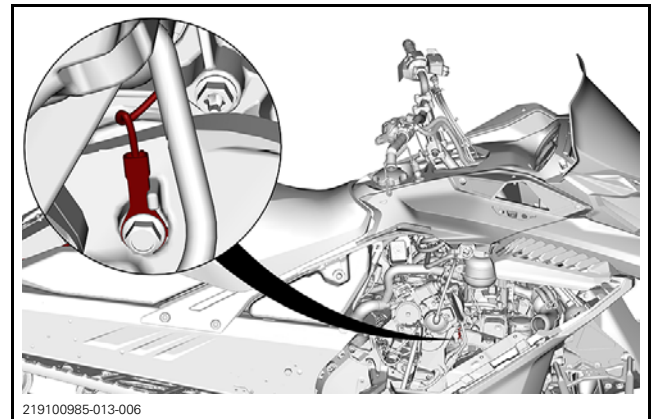


RELAY BOX (FB2)

With Electric Reverse and Air Controlled Suspension

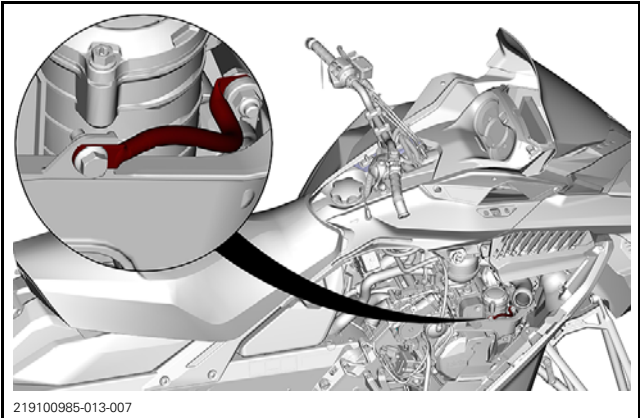


GROUND LOCATIONS



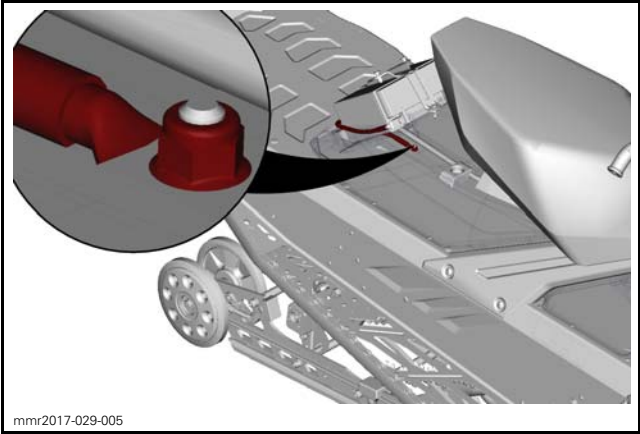
CHASSIS GROUND

TIGHTENING TORQUE	
Chassis ground terminal	8 N•m ± 0.5 N•m (71 lbf•in ± 4 lbf•in)



ENGINE GROUND

TIGHTENING TORQUE	
Engine ground terminal	10 N•m ± 2 N•m (89 lbf•in ± 18 lbf•in)



BATTERY GROUND

TIGHTENING TORQUE	
M6 shoulder nut	10 N•m ± 2 N•m (89 lbf•in ± 18 lbf•in)

WIRING HARNESS AND CONNECTORS

SERVICE TOOLS

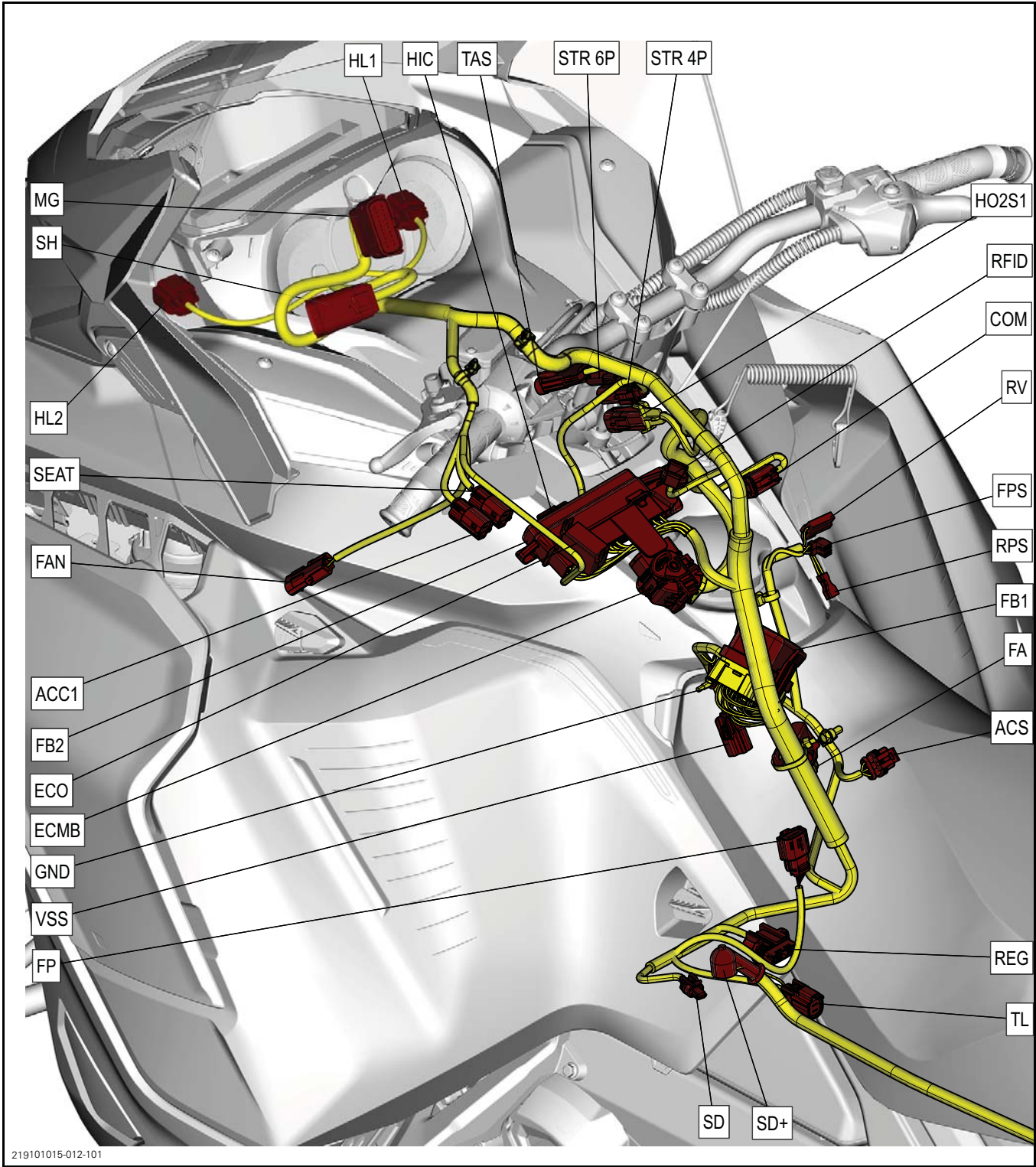
Description	Part Number	Page
ECM ADAPTER TOOL.....	529 036 166	10
ECM TERMINAL REMOVER 2.25.....	529 036 175	10
ECM TERMINAL REMOVER 3.36.....	529 036 174	10

SERVICE TOOLS – OTHER SUPPLIER

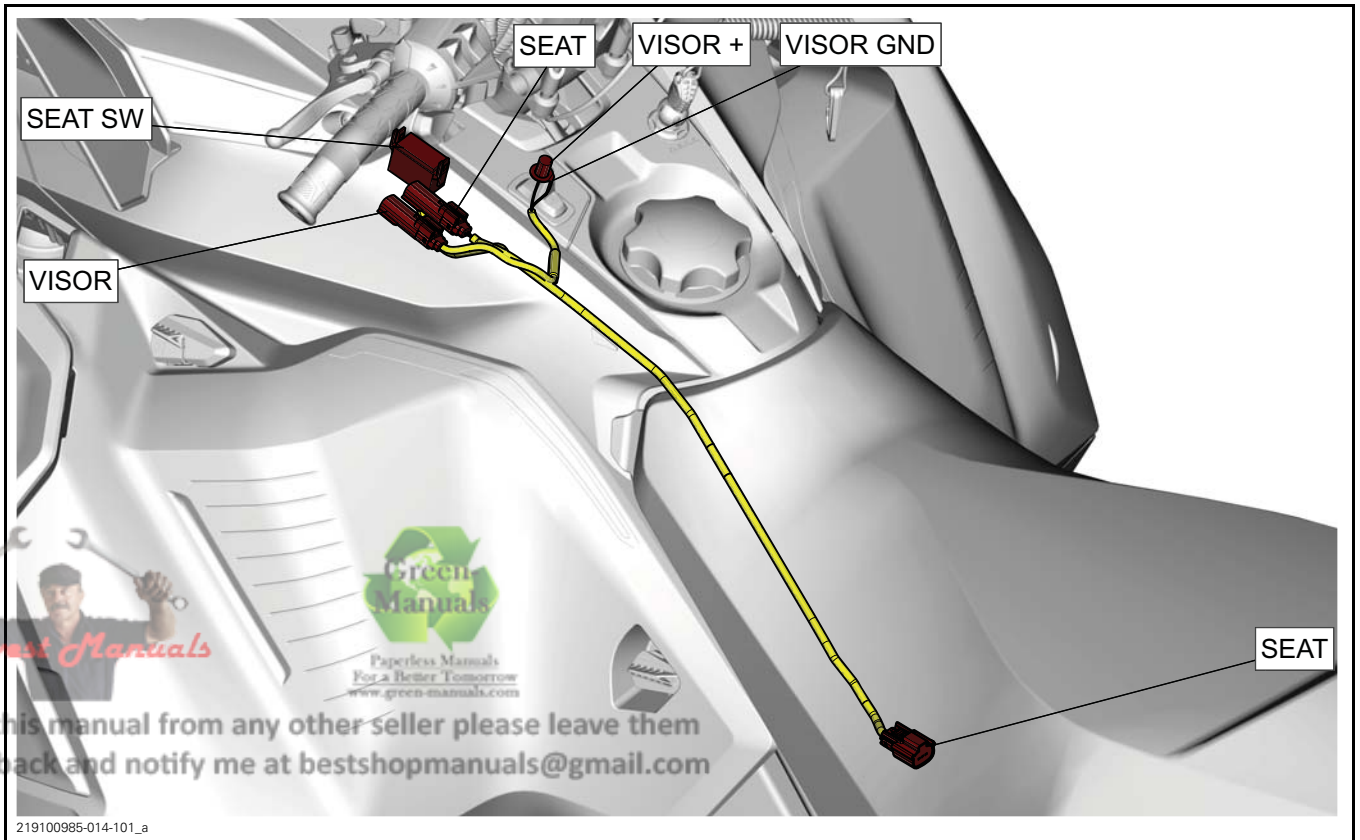
Description	Part Number	Page
DELPHI TERMINAL EXTRACTOR.....	12094429	12–13
FCI TERMINAL EXTRACTOR TOOL	54241678	11–12
MOLEX 150 TERMINAL EXTRACTOR TOOL	63813 - 1500	11–12

NOTE: Vehicles may not be equipped with all connectors shown in illustrations.

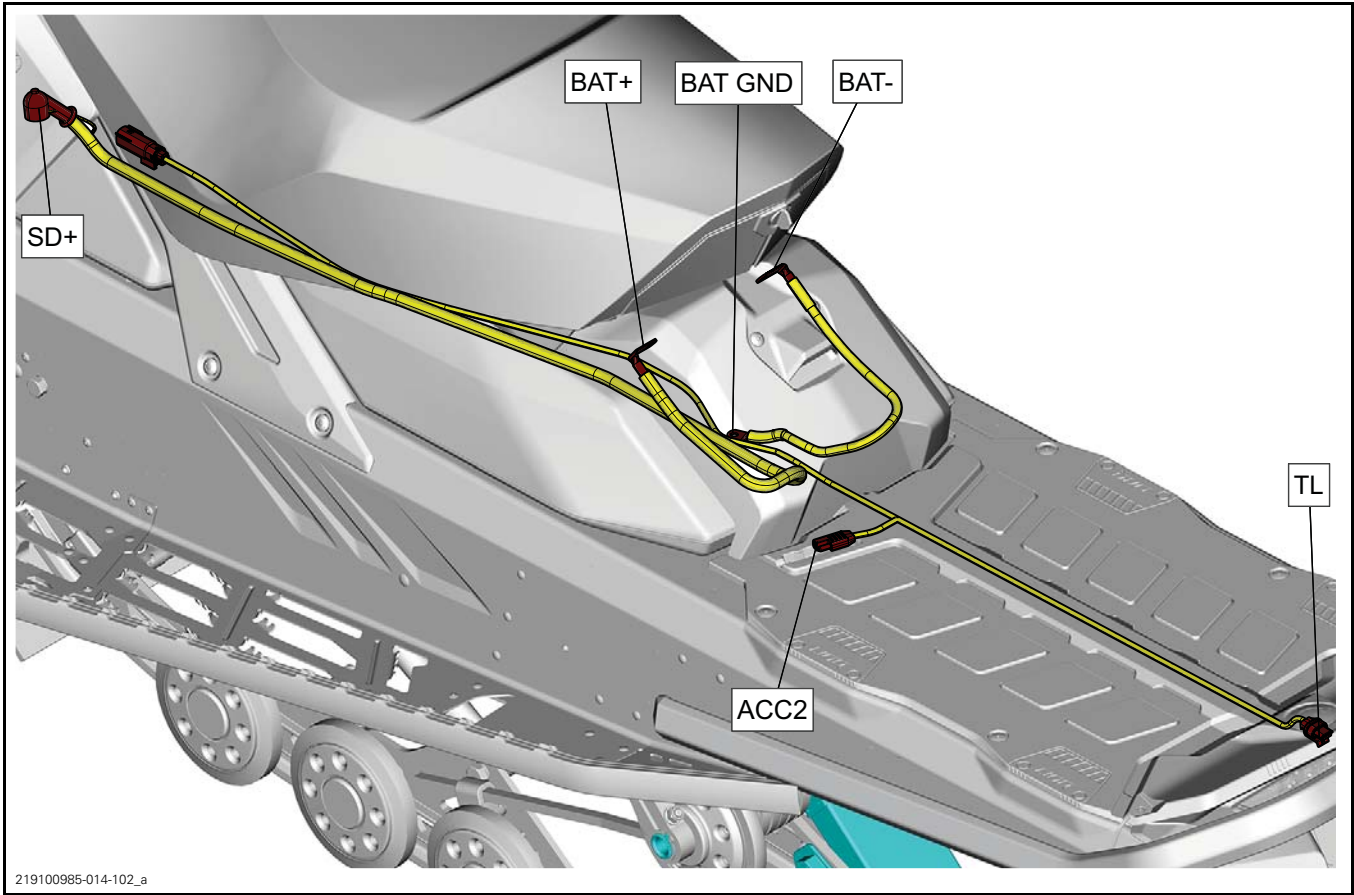
MAIN HARNESS



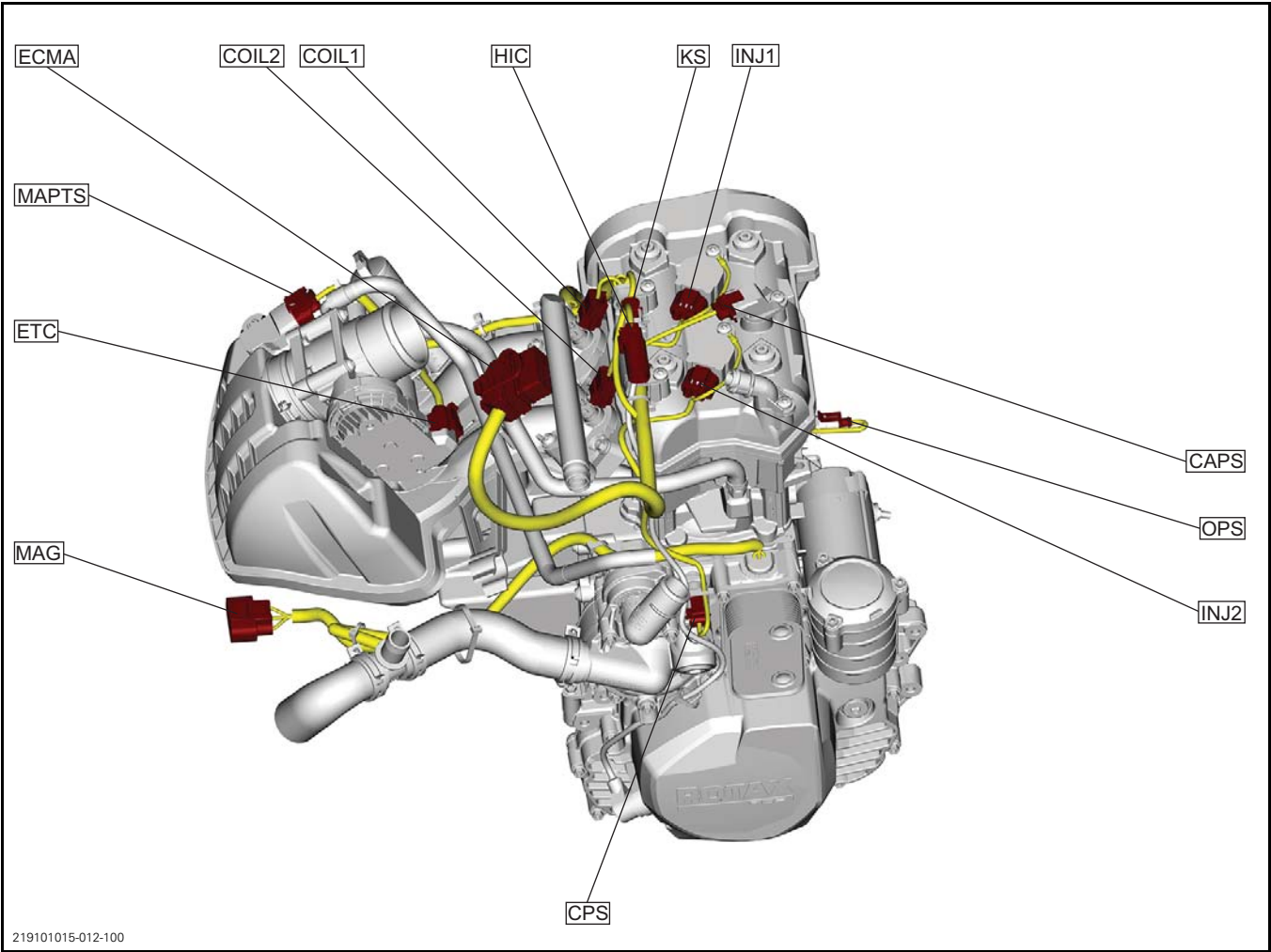
SECONDARY HARNESS - VISOR AND SEAT



SECONDARY HARNESS - TAILLIGHT AND BATTERY



ENGINE HARNESS



GENERAL

ACRONYMS

ACRONYM	DESCRIPTION	ACRONYM	DESCRIPTION
ACC	Accessory	HL	HeadLamp
ACS	Air Controlled Suspension	HO2S1	Oxygen Sensor
BAT	Battery	INJ	Injector
BAT GND	Battery ground	KS	Knock Sensor
CAPS	Camshaft Position Sensor	MAG	Magneto
COM	Communication	MAPTS	Manifold Air Pressure and Temperature Sensor
COIL	Coil	MG	Multifunction Gauge
CPS	Crankshaft Position Sensor	OPS	Oil Pressure Sensor
ECMA	ECM connector A (Engine harness)	REG	Voltage Regulator
ECMB	ECM connector B (Chassis harness)	RFID	Radio Frequency Identification
ECO	Riding mode switch	RPS	Reverse Position Switch
ETC	Electronic Throttle Control	RV	Electric Reverse Motor
FA	Main fuse	SD	Starter Solenoid
FAN	Radiator fan	SEAT SW	Heated seat switch
FB	Fusebox	SH	Switch Housing
FP	Fuel Pump	STR	Steering Connector
FPS	Forward Position Switch	TAS	Throttle Actuator Sensor
GND	Ground	TL	Tail Light
HIC	Harness interconnect	VSS	Vehicle Speed Sensor

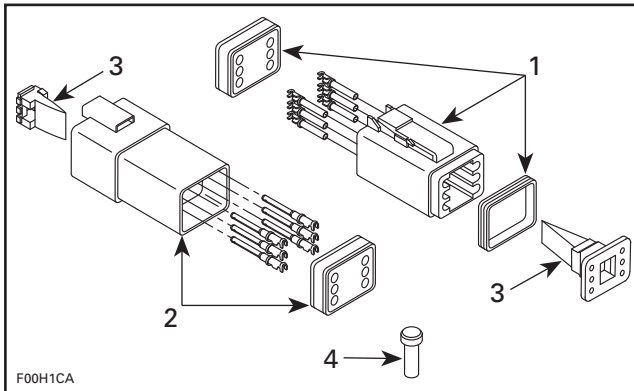
PROCEDURES

⚠ WARNING

When disassembling any connector for repair or replacement on the vehicle, always disconnect the battery to ensure all electrical power is removed and prevent any possibility of a short circuit. Refer to *CHARGING SYSTEM* subsection.

DIAGNOSTIC CONNECTOR (DEUTSCH)

Disassembling and Reassembling the Connector



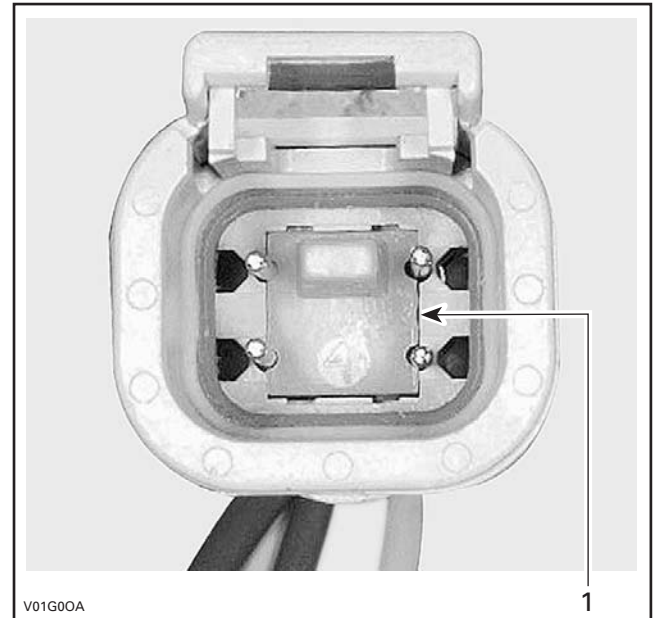
TYPICAL - DEUTSCH CONNECTOR

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

NOTICE Do not apply dielectric grease on terminal inside connector.

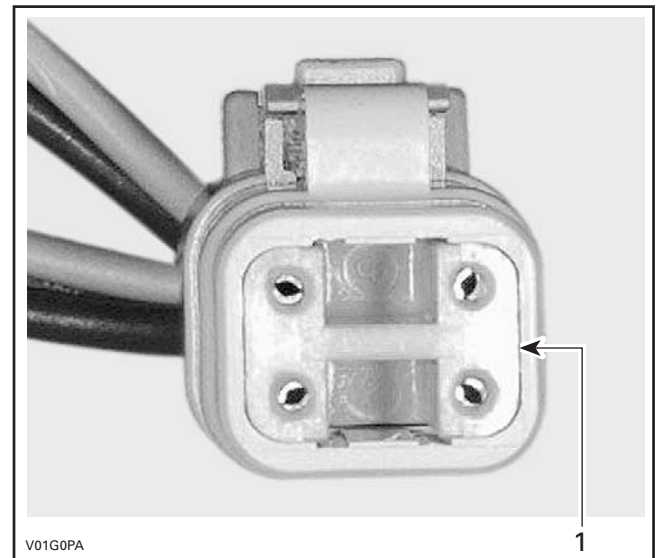
To remove terminals from connector, proceed as follows:

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



TYPICAL - MALE CONNECTOR

1. Female lock



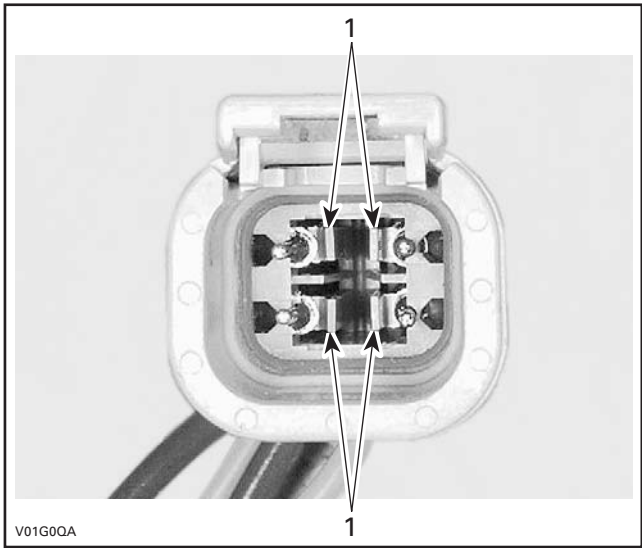
TYPICAL - FEMALE CONNECTOR

1. Male lock

NOTE: Before pin extraction, push wire forward to relieve pressure on retaining tab.

2. Insert a 4.8mm (.189in) wide screwdriver blade inside the front of the terminal cavity.
3. Pry the retaining tab away from the terminal while gently pulling the wire and terminal out of the back of the connector.

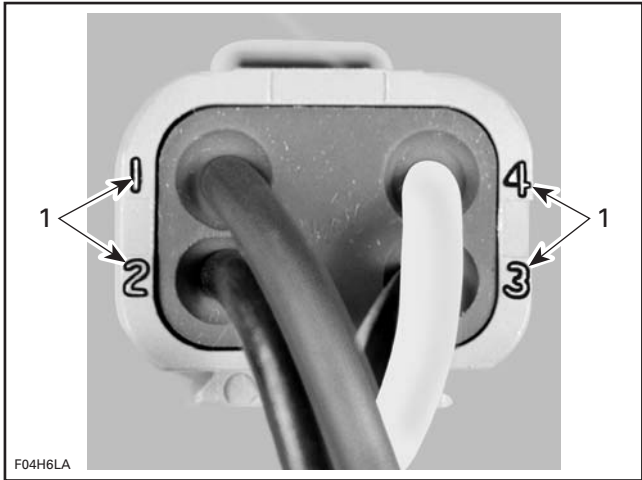
Subsection XX (WIRING HARNESS AND CONNECTORS)



TYPICAL - MALE 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)

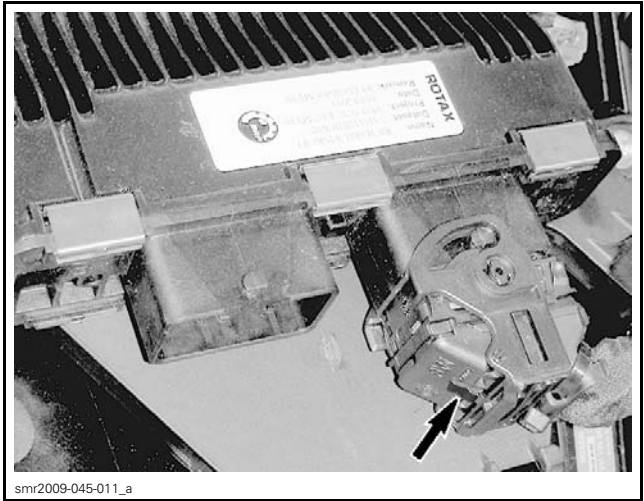
There are 2 connectors on the ECM.

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.

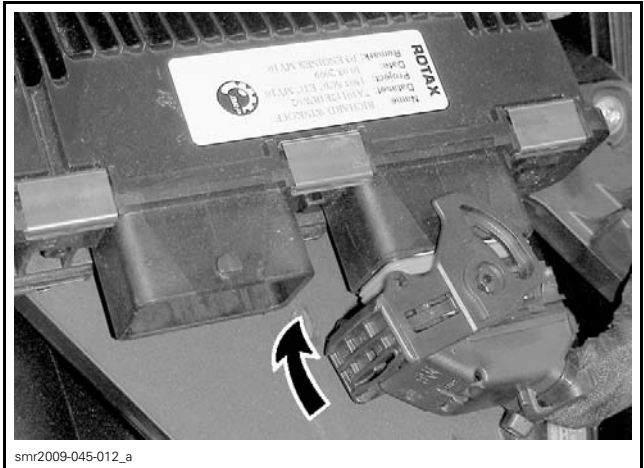
Removing the Connector

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.



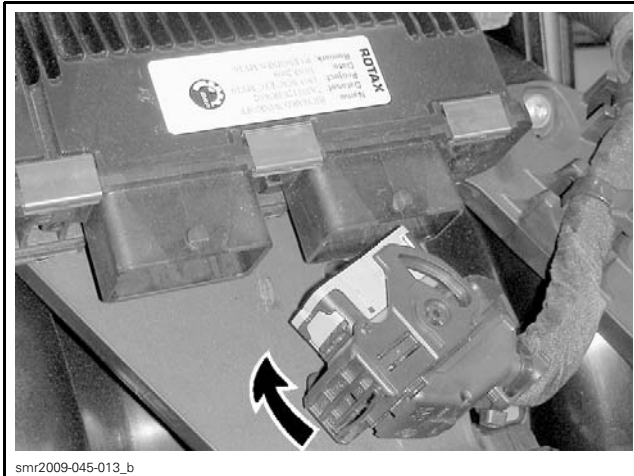
CONNECTOR LOCKING CAM ROTATION TO RELEASE

4. Pull connector off ECM.



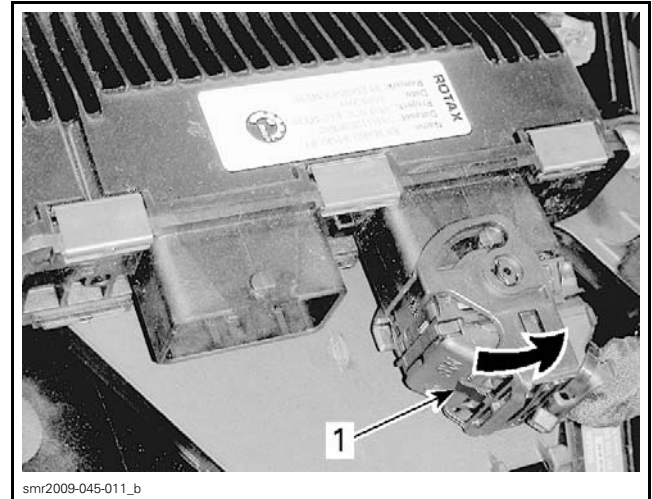
Installing the Connector

1. Fully open connector locking cam.



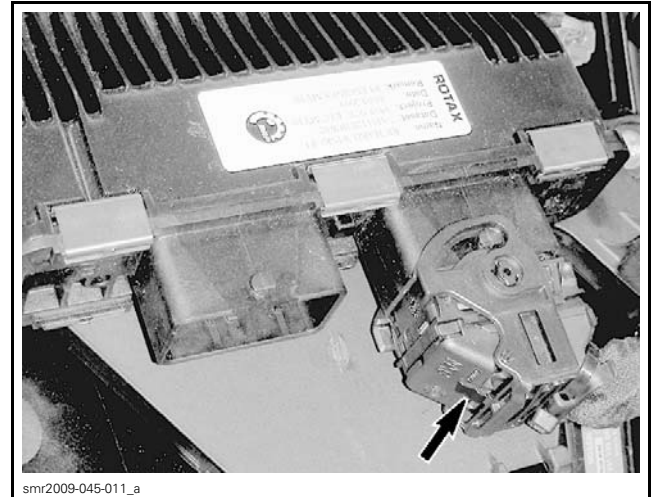
CONNECTOR LOCKING CAM IN RELEASE POSITION

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.

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

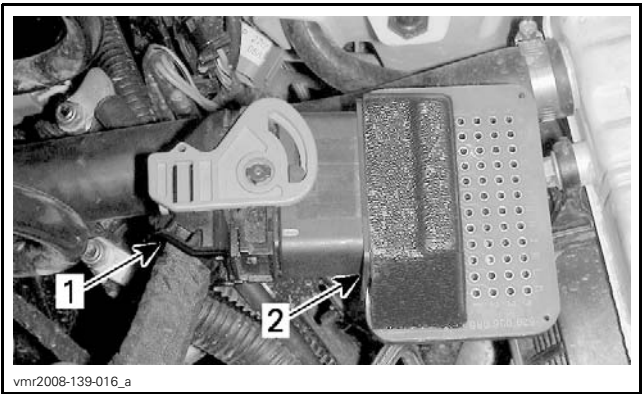
NOTICE Do not apply any lubricant product to the pins of the ECM connector.

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.

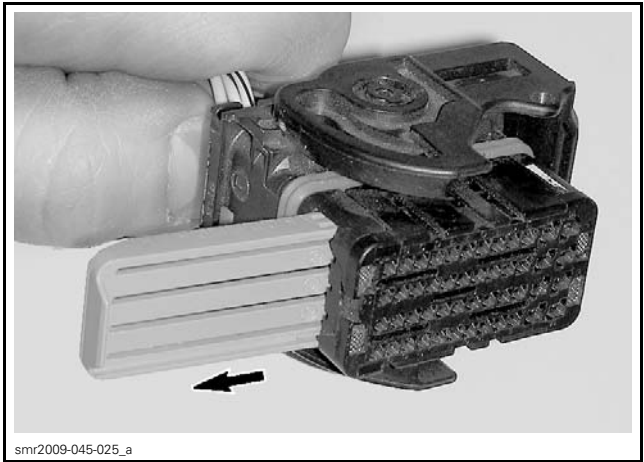
Removing the Connector Terminal (Harness Connector)

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

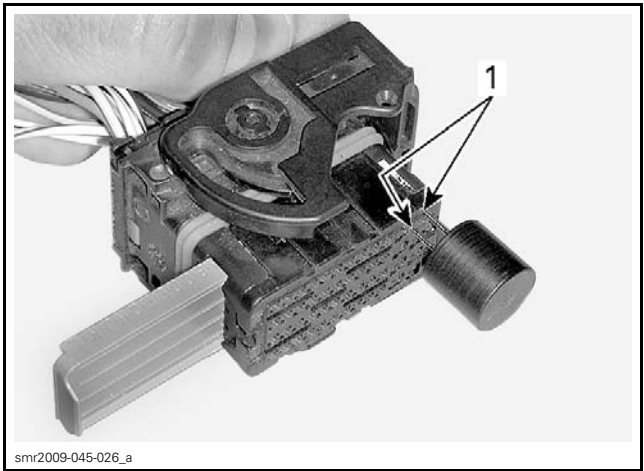
To remove a power terminal, use the ECM terminal remover 3.36.

REQUIRED TOOL	
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.

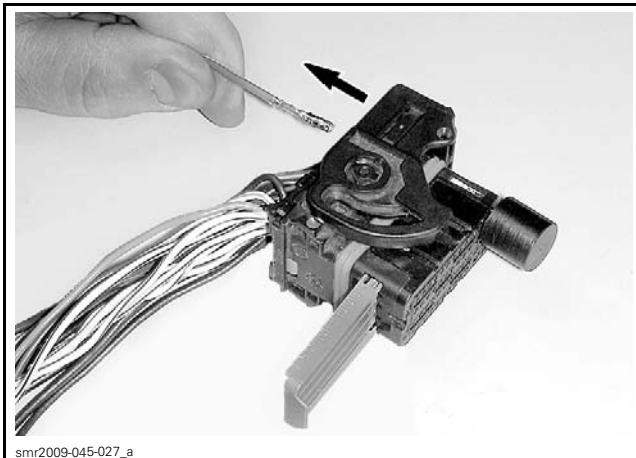


- 3. Insert tool to unlock terminal.



1. Unlock here

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



smr2009-045-027_a

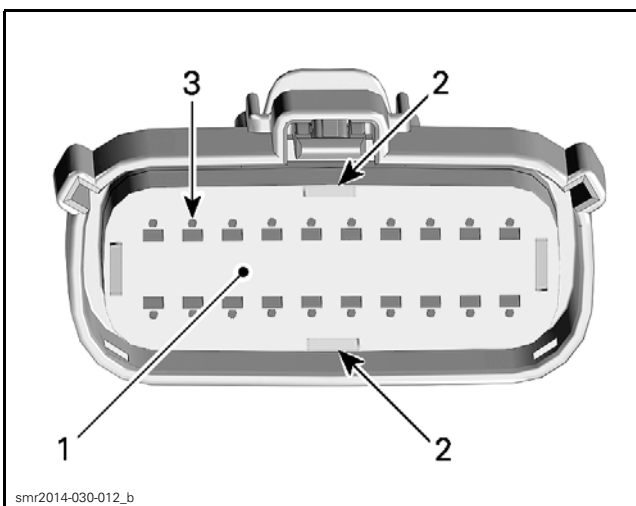
NOTICE Before installing wire terminals in the connector, ensure all terminals are properly crimped on wires. After installation of wire terminals in the connectors, ensure they are properly locked by gently pulling on them as if to extract them.

MOLEX CONNECTORS (EXCEPT ECM)

Extracting a Terminal (Female Connector)

The same procedure must be done to remove a seal plug.

1. Insert a small flat screwdriver in the pry holes of the terminal locator, on the terminal side of the connector.



smr2014-030-012_b

1. Terminal locator
2. Pry holes
3. Holes for inserting terminal extractor tool

2. Apply slight pressure and pry the terminal locator out until it clicks (± 4 mm (.16 in)).

NOTE: Do not remove the terminal locator from the connector housing.

3. Insert the extractor tool in the small hole adjacent to the terminal.

NOTE: Push the extractor tool in only as far as required to release the lock from the terminal. The tool should slide along the terminal and be inserted between the connector housing and the terminal lock.

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

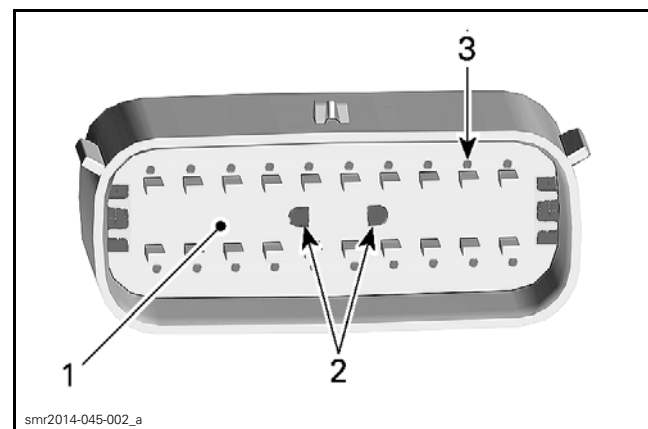
4. Gently pull on the wire to extract the terminal out the back of the connector.

Extracting the Terminal (Male Connector)

The same procedure must be done to remove a seal plug.

1. Using a pair of thin long nose pliers, pull the terminal locator (the white plastic insert in the connector) out to the detent position (± 13 mm (1/2 in) between terminal locator and connector housing face). This will allow unlocking of the pins.

NOTICE Do not attempt to remove the terminal locator or damage will occur. Be careful not to bend the pins when using the pliers.



smr2014-045-002_a

1. Terminal 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 terminal.

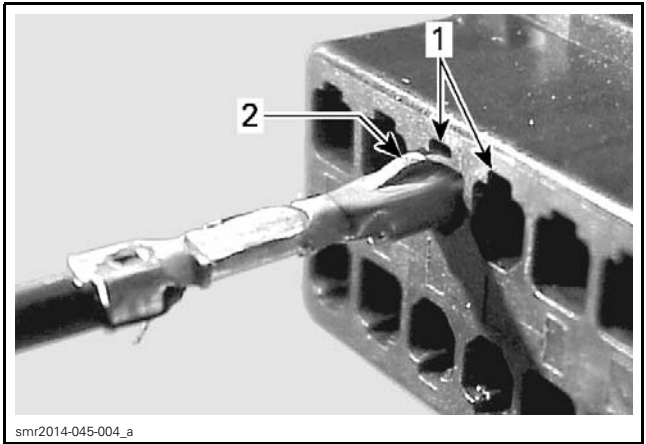
NOTE: Push the extractor tool in only as far as required to release the lock from the terminal. The tool should slide along the terminal and be inserted between the connector housing and the terminal lock.

REQUIRED TOOL	
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 terminal out the back of the connector.

Inserting the Terminal

- 1. Ensure the terminal is properly crimped onto the wire.
- 2. Ensure the terminal locator (the white plastic insert in the connector) is out in the detent position.
- 3. Orient the key on the back of the male terminal with the keyway on the rear of the housing



TYPICAL - PIN INSERTION

- 1. Keyway
- 2. Terminal key

- 4. Push the terminal into the housing until it clicks.
- 5. Gently pull on the terminal to ensure it is properly locked.
- 6. Repeat previous steps for each terminal to be inserted.
- 7. Push the terminal locator into the connector to the locked position.

DELPHI/PACKARD CONNECTORS

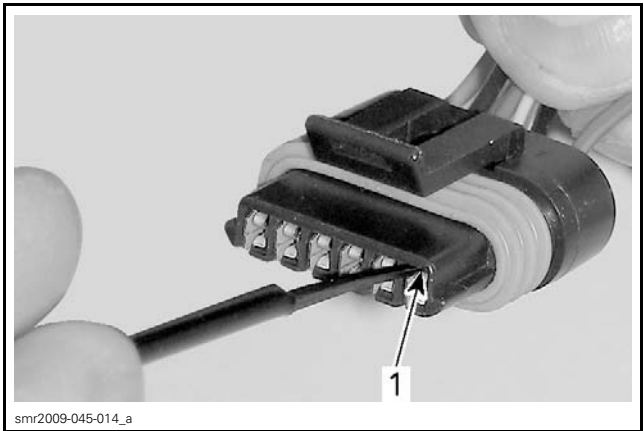
Removing the Connector Terminal

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

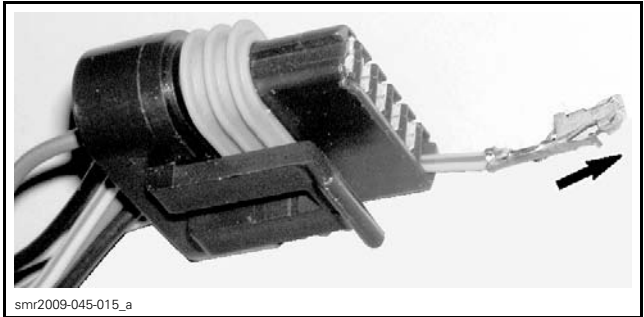
REQUIRED TOOL	
DELPHI TERMINAL EXTRACTOR (P/N 12094429)	

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

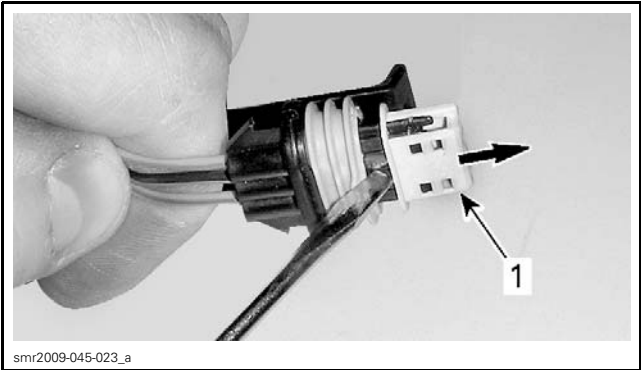


NOTICE Before installing terminals in the connectors, ensure all terminals are properly crimped on the wires. After installation of the wire terminals in the connectors, ensure they are properly locked by gently pushing on them as if to extract them.

DELPHI CONNECTORS

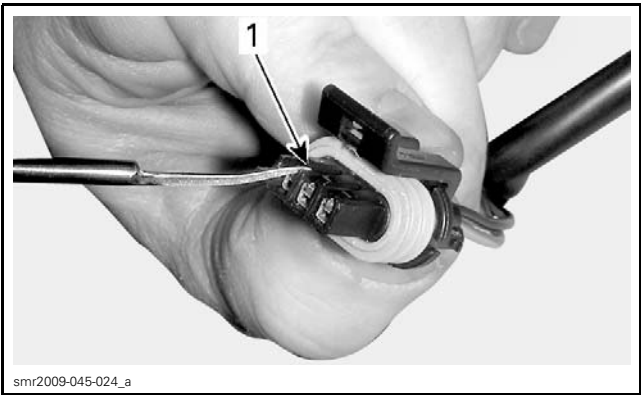
Removing the Terminal

- 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)	



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

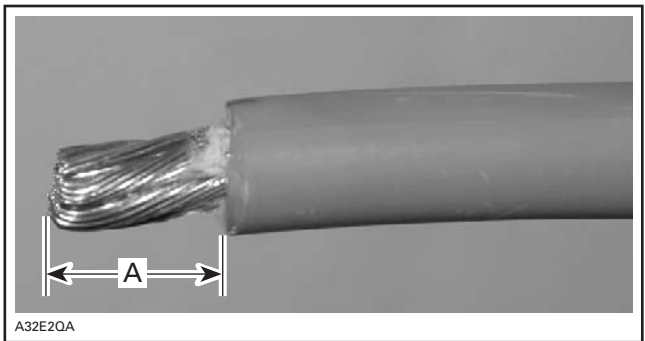


NOTICE Before installing terminals in the connectors, ensure all terminals are properly crimped on the wires. After installation of the wire terminals in the connectors, ensure they are properly locked by gently pushing on them as if to extract them.

BATTERY CABLES

Crimping the Battery Cable

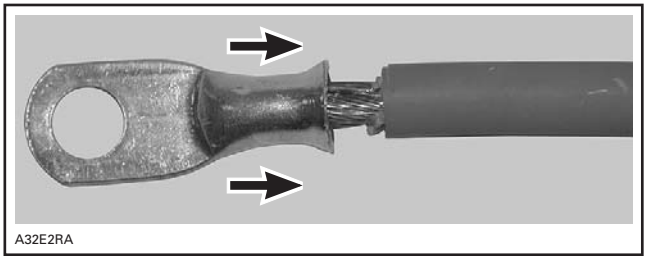
Carefully strip the wire approximately to 10 mm (3/8 in) in length, using a wire stripping tool or sharp blade/knife.



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. Refer to appropriate *PARTS CATALOG*.



INSTALLATION OF TERMINAL

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

Crimp the terminal on the wire.



CRIMPING OF WIRE



PROPERLY CRIMPED WIRE

To verify if the wire is properly crimped, apply some pulling force on wire and the terminal at the same time from both directions.

NOTICE Never weld the wire to the terminal. Welding can change the property of the wire and it can become brittle and break.

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

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

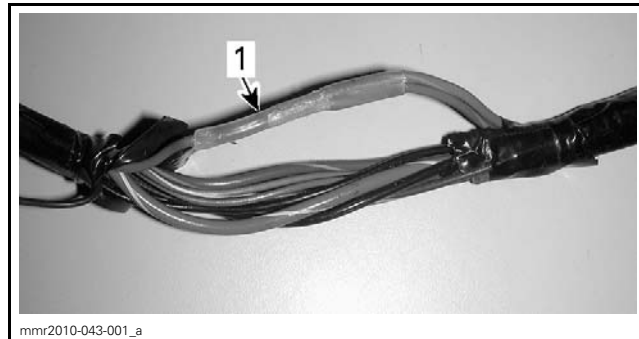
SPLICES REPAIR PROCEDURE

CASE 1: Wire Detached from Splice

NOTICE Repairs described in this section should never be performed on harness sections that can be exposed to water.

1. Locate splice. Refer to splices location diagrams.
2. Remove wires from protector tube.

3. Locate the shrink tube protecting the defective splice.



1. Shrink tube

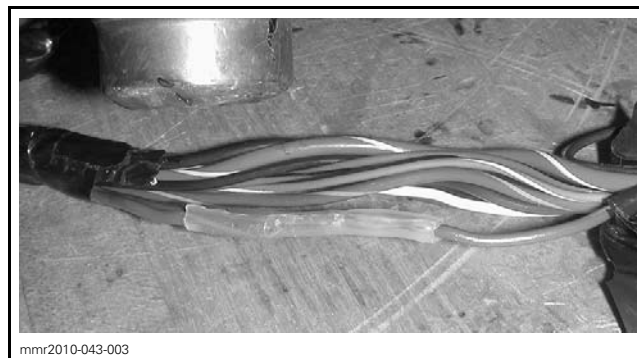
4. Remove the shrink tube.

- 4.1 Using a blade, cut the shrink tube.



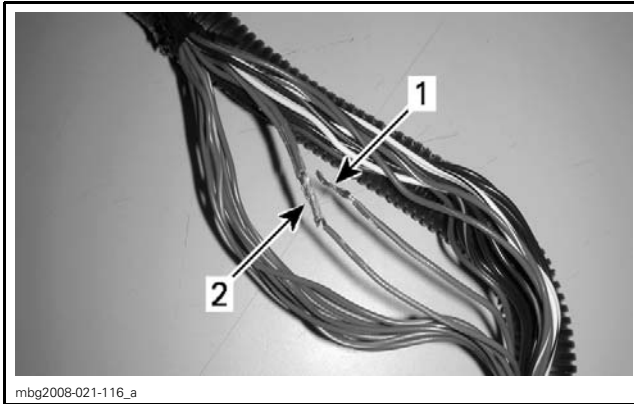
NOTICE Be careful with the blade to avoid cutting wires insulation.

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



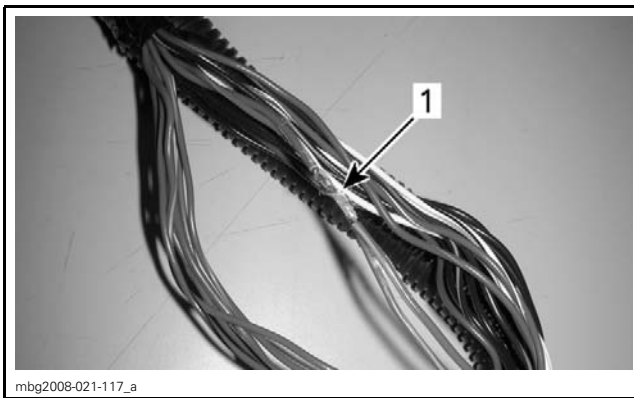
- 4.3 Remove the shrink tube with long nose pliers.

5. Locate detached wire from splice.



- 1. Detached wire
- 2. Splice

6. Twist detached wire around splice.



- 1. Twisted wire

7. Perform a tin solder on twisted wire.

8. Apply electrical tape to cover splice.

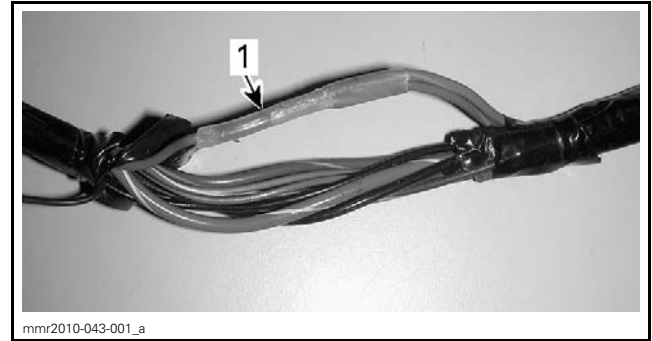
NOTE: Make sure tape overlaps on wire insulation, approximately 13 mm (1/2 in) each side.

9. Reinstall wires into protector tube.

CASE 2: Wire Broken from Splice

NOTICE Repairs described in this section should never be performed on harness sections that can be exposed to water.

1. Locate splice. Refer to splices location diagrams.
2. Remove wires from protector tube.
3. Locate the shrink tube protecting the defective splice.



- 1. Shrink tube

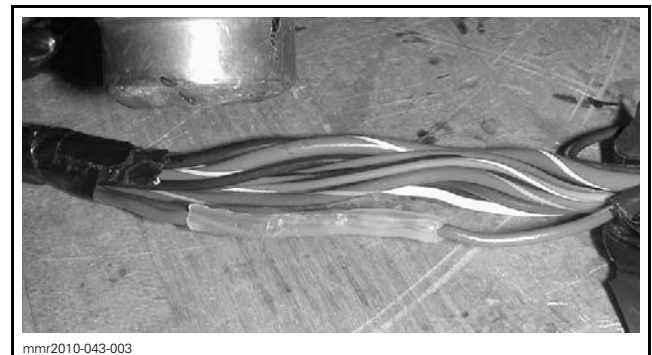
4. Remove the shrink tube.

4.1 Using a blade, cut the shrink tube.



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

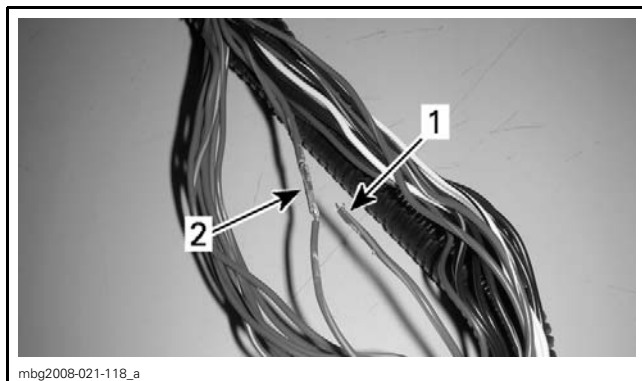
4.2 Slightly heat the shrink tube using a heat gun.



4.3 Remove the shrink tube with long nose pliers.

5. Locate broken wire from splice.

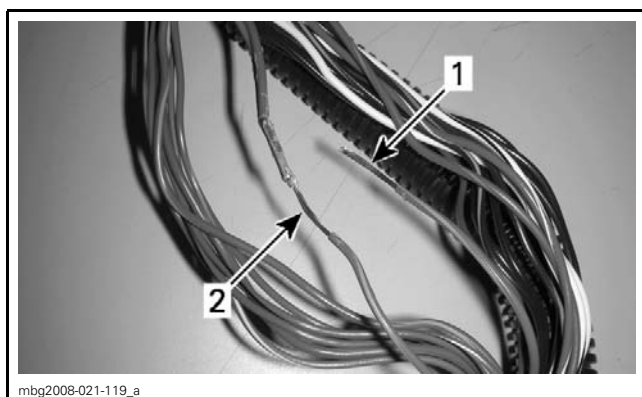
Subsection XX (WIRING HARNESS AND CONNECTORS)



- 1. Broken wire
- 2. Splice

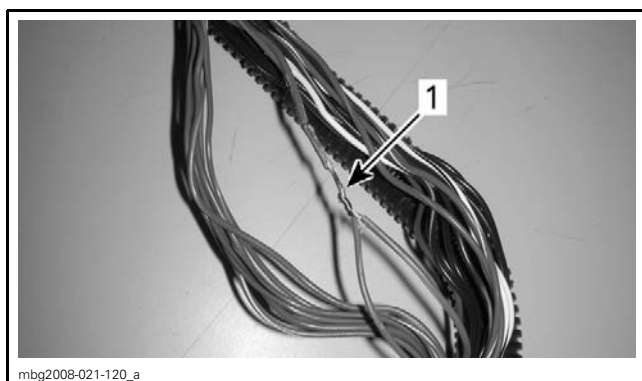
6. Strip wire insulation at the end of broken wire.

7. Strip wire insulation below the splice.



- 1. Broken wire stripped
- 2. Splice wire stripped

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. Reinstall wires into protector tube.

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

IGNITION COILS AND SPARK PLUGS

SERVICE TOOLS

Description	Part Number	Page
ECM ADAPTER TOOL.....	529 036 166	1
FLUKE 115 MULTIMETER	529 035 868	1

GENERAL

WARNING

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

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

WARNING

Never check for engine ignition spark from an open coil and/or spark plug as spark may cause potential fuel vapors to ignite. Always use an approved spark tester.

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

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

MAINTENANCE

Verify the spark plug gap. For spark plug removal and installation, refer to *SPARK PLUG* further in this subsection.

NOTICE Do not adjust gap on this type of spark plug. The adjustment could weaken negative electrodes which may lead to electrode breakage and severe engine damage.

ENGINE	SPARK PLUG TYPE	GAP mm (in)
600 ACE	NGK MR7BI-8	0.7 mm to 0.8 mm (.028 in to .031 in)
900 ACE	NGK MR8BI-8	NOT adjustable

PROCEDURES

IGNITION COILS

Ignition Coil Access

1. Disconnect the stator connector. Refer to *STATOR CONNECTOR ACCESS* in the *MAGNETO AND STARTER* subsection.
2. Remove the upper body module. Refer to *BODY* subsection.

Testing the Ignition Coil using BUDS2

1. Connect the vehicle to the BRP diagnostic software (BUDS2). Refer to *COMMUNICATION TOOLS* subsection.
2. In BUDS2, select:
 - **Functions** page
 - **ECM** button
 - **Activators** tab.

3. Energize the ignition coil to be tested.

You should hear the spark occurring. If in doubt, use a sealed **vapor proof** spark tester or an inductive spark tester as available from tool suppliers, to prevent a spark from occurring.

If there is no ignition at one or more coils, carry out *TESTING THE IGNITION COIL INPUT VOLTAGE*.

If spark is weak, try a new spark plug. If spark is still weak, try a new ignition coil.

NOTE: The voltage required to produce a spark in the combustion chamber is higher when the engine is running.

Subsection 03 (IGNITION COILS AND SPARK PLUGS)

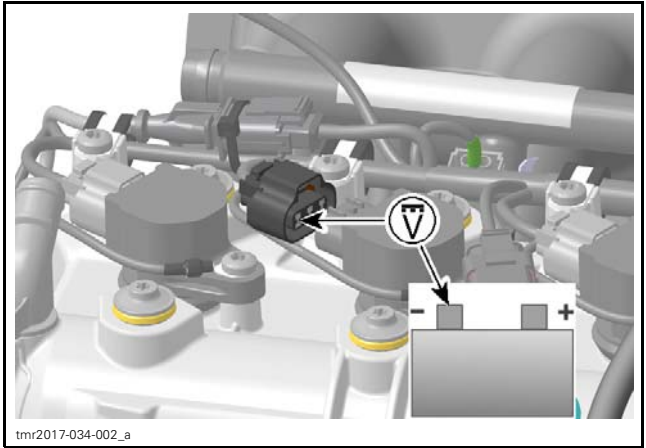
Testing the Ignition Coil Input Voltage

Make sure the fuel pump fuse and the relay are good before testing.

- 1. Disconnect the applicable ignition coil connector.
- 2. Install key on D.E.S.S. post.
- 3. Set emergency engine stop switch to RUN.
- 4. Briefly press on START/RER switch to wake up ECM.
- 5. Set the multimeter to Vdc.
- 6. Measure voltage.

NOTICE Test is valid only if ECM is active (gauge will be on).

TEST PROBES		VOLTAGE
Ignition coil connector Pin 1 (ignition coil no. 1)	Battery ground	Battery voltage
Ignition coil connector Pin 1 (ignition coil no. 2)		
Ignition coil connector Pin 1 (ignition coil no. 3) (900 ACE)		



900 ACE ENGINE SHOWN - IGNITION COIL INPUT VOLTAGE TEST

If test succeeds, carry out a *TESTING THE IGNITION COIL RESISTANCE*.

If test fails, carry out a *TESTING THE IGNITION COIL POWER CIRCUIT CONTINUITY*.

Testing the Ignition Coil Power Circuit Continuity

- 1. Remove key from D.E.S.S. post.
- 2. Ensure emergency engine stop switch is set to STOP.
- 3. Locate and remove the fuel pump fuse.

- 4. Set the multimeter to Ω .
- 5. Read resistance of the desired ignition coil circuit.

Without Electro-Mechanical Reverse

IGNITION COIL	PIN	FUSE BOX	MEASUREMENT
1	1	Terminal B4	Close to 0 Ω
2			
3 (900 ACE)			

With Electro-Mechanical Reverse

IGNITION COIL	PIN	FUSE BOX	MEASUREMENT
1	1	Terminal A3	Close to 0 Ω
2			
3 (900 ACE)			

If test fails at any ignition coil, test the following items separately and repair/replace wiring or terminals from fuse box to the applicable ignition coil. Refer to *WIRING DIAGRAM* for details.

- Wiring from fuse box to engine connector
- Wiring from engine connector to ignition coil.

Testing the Ignition Coil Control Circuit Continuity

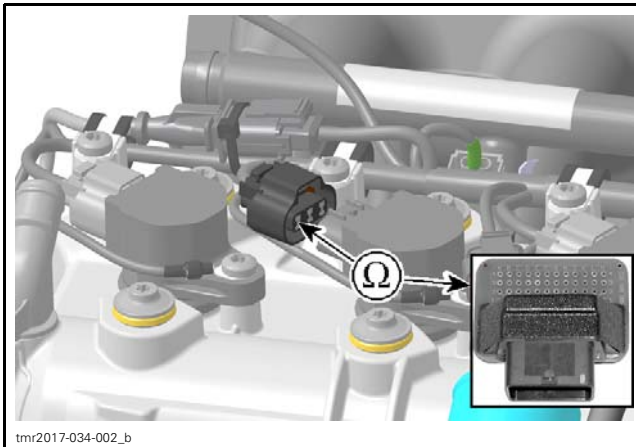
- 1. Connect the ECM connector A to the ECM adapter tool.
- 2. Disconnect ignition coil connector.
- 3. Test for continuity of circuit as per following table.

600 ACE

IGNITION COIL	PIN	ECM ADAPTER	RESISTANCE
Cylinder 1	3	M1	Close to 0 Ω (continuity)
Cylinder 2		M2	

900 ACE

IGNITION COIL	PIN	ECM ADAPTER	RESISTANCE
Cylinder 1	3	M4	Close to 0 Ω (continuity)
Cylinder 2		M2	
Cylinder 3		M1	



900 ACE ENGINE SHOWN - IGNITION COIL CONTROL CIRCUIT TEST

If test fails, repair the connector or replace the engine wiring harness.

Testing the Ignition Coil Resistance

An ignition coil with a good resistance measurement can still be faulty. Current leakage can occur at high voltage levels which is not detectable with an ohmmeter. Replacing the ignition coil may be necessary as a test.

1. Remove ignition coil. Refer to *REMOVING THE IGNITION COIL* in this subsection.
2. Perform a visual inspection of the ignition coils. Check for corrosion, bent pins, loose or burnt contacts, and cracked or torn insulator.
3. Using a multimeter, test the resistance of primary winding.



PRIMARY WINDING

CIRCUIT	TERMINAL	RESISTANCE @ 20°C (68°F)
Primary winding	1 and 2	0.79 - 0.97 Ω

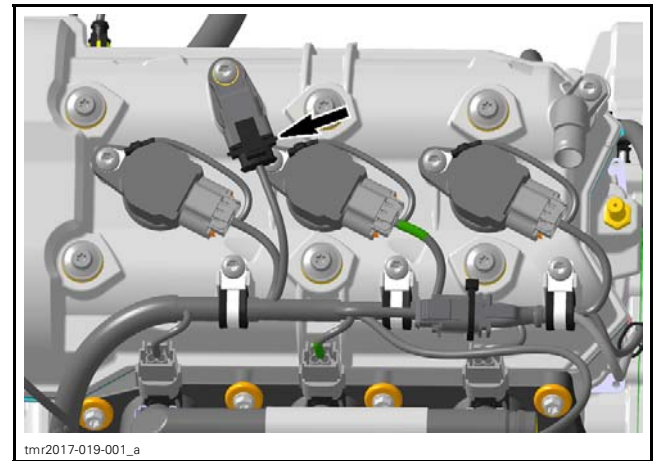
NOTICE The secondary winding on this type of ignition coil cannot be tested.

If test fails, replace ignition coil.

If test succeeds, carry out *TESTING THE IGNITION COIL CONTROL CIRCUIT CONTINUITY*.

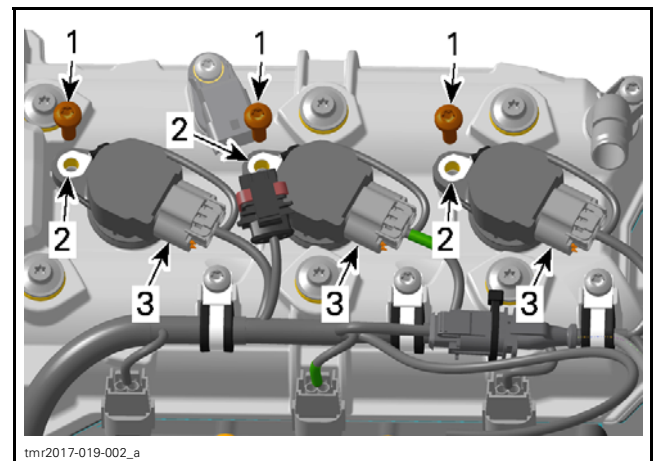
Removing the Ignition Coil

1. Unplug CAPS (camshaft position sensor).



900 ACE ENGINE SHOWN

2. Remove:
 - Ignition coil retaining screws.
 - Ground connectors.
3. Disconnect ignition coil connectors.

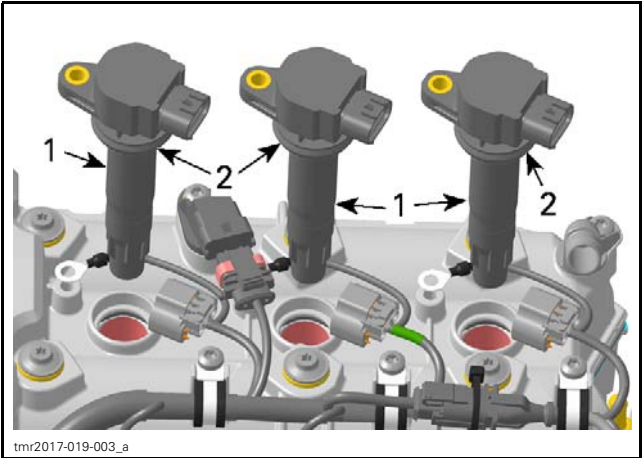


900 ACE ENGINE SHOWN

1. Retaining screws
2. Ground connectors
3. Ignition coil connectors

NOTICE Do not pry on ignition coil with a tool.

4. Remove ignition coils with gaskets from spark plug by rotating coil side to side as you pull up.



900 ACE ENGINE SHOWN
1. Ignition coils
2. Gaskets

Installing the Ignition Coil

Install the ignition coil on the spark plug.
Align the retaining screw hole of the ignition coil with the threaded hole on the valve cover.
Push the ignition coil all the way down until it rests on the valve cover.
Place GND connector on ignition coil and install retaining screw.

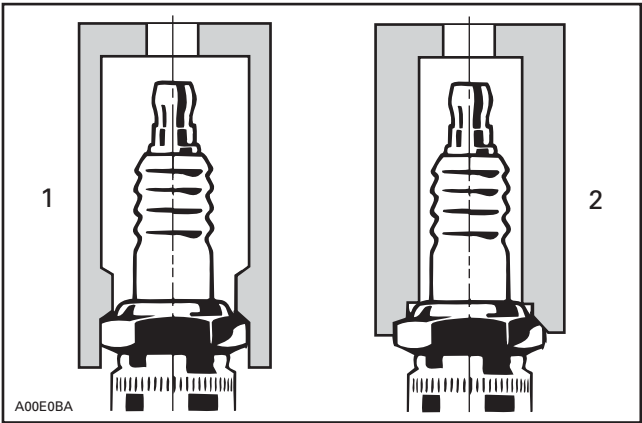
TIGHTENING TORQUE	
Ignition coil retaining screw	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

Connect ignition coil connectors.

SPARK PLUGS

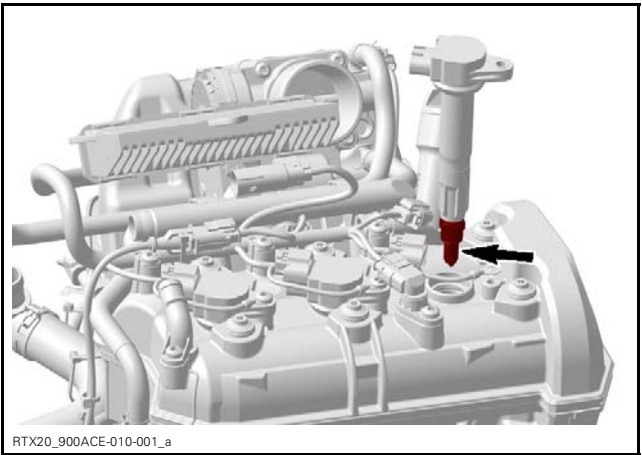
Removing the Spark Plugs

1. Remove ignition coils.
2. Using a spark plug socket, release the torque applied to the spark plug.



1. Approved socket
2. Improper socket

3. Clean the spark plug area with pressurized air.
4. Unscrew spark plug.
5. Use the ignition coil to take spark plug out of spark plug hole.

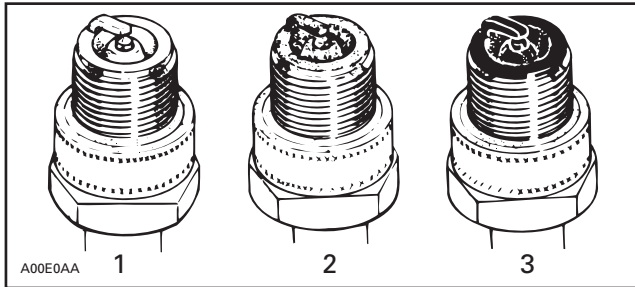


900 ACE ENGINE SHOWN

Troubleshooting a Fouled Spark Plug

Fouling of the spark plug is indicated by irregular running or misfiring of the engine, decreased engine speed due to misfiring, reduced performance, and increased fuel consumption.
Other possible causes are: use of an incorrect or bad fuel, defective ignition system, incorrect spark plug gap, loss of compression, or lubricating oil entering the combustion chamber.
The plug face of a fouled spark plug has either a wet or dry black carbon deposit. Such coatings form a conductive connection between the center electrode and the ground electrode.

Spark Plug Analysis



TYPICAL

1. Overheated (light gray, white)
2. Normal (light brown, brown)
3. Fouled (black, wet or dry, dark deposits, gray, melted coating)

The plug face reveals the condition of the engine, operating condition, method of driving and fuel mixture. For this reason it is advisable to inspect the spark plug at prescribed intervals, examining the plug face (i.e. the part of the plug projecting into the combustion chamber).

Installing the Spark Plug

Prior to installation make sure that contact surfaces of the cylinder head and spark plug are free of grime.

1. Using a wire feeler gauge, set electrode gap as specified in *TECHNICAL SPECIFICATIONS*.
2. Hand screw spark plug into cylinder head, then tighten with a torque wrench and an appropriate socket.

TIGHTENING TORQUE	
Spark plug	13 N•m ± 1 N•m (115 lbf•in ± 9 lbf•in)

3. Install ignition coil.

IGNITION SYSTEM

SERVICE TOOLS

Description	Part Number	Page
D.E.S.S. POST REMOVER	529 035 943	3
FLUKE 115 MULTIMETER	529 035 868	1

GENERAL

The following tool is required to test most of the electrical parts.

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



⚠ WARNING

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

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

⚠ WARNING

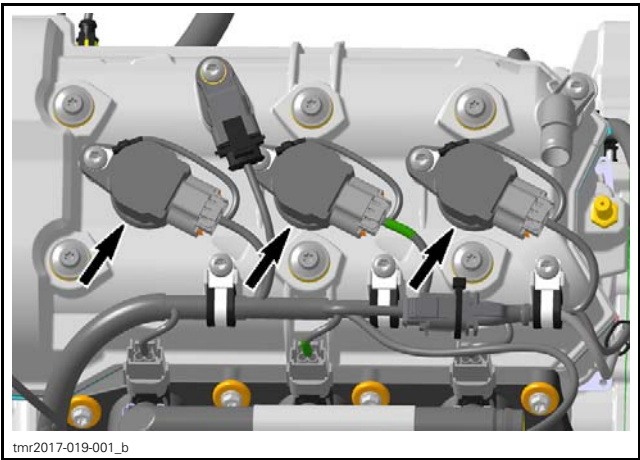
Never check for engine ignition spark from an open coil and/or spark plug as spark may cause potential fuel vapors to ignite. Always use an approved spark tester.

SYSTEM DESCRIPTION

The ignition system is a digital inductive type (IDI) system.

Ignition system parameters such as ignition timing, spark duration, and firing order, as well as many other engine related functions are controlled by the engine management system (EMS) in order to meet engine operational requirements. The EMS can detect many abnormalities including a short circuit in the primary winding of the ignition coils as well as its associated circuits.

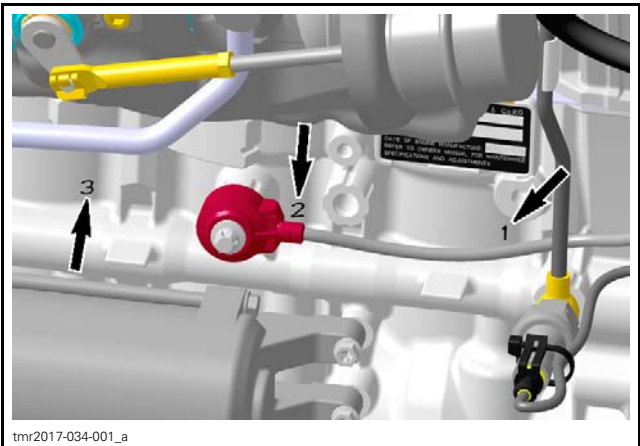
Three direct ignition coils receive power from the fuse F5.



IGNITION COILS

When a ground signal is provided by the ECM to an ignition coil primary winding, a high voltage is induced in the coil secondary winding that is used to produce a spark at the spark plug electrode.

Cylinder 1 is located on the PTO side of the engine. Each cylinder is identified by a number on cylinder block housing.



CYLINDER BLOCK - EXHAUST SIDE

Ignition Timing

Ignition timing is not adjustable.

The ECM is programmed with data (ignition mappings) that it uses to establish optimum ignition timing under all engine operating conditions.

Subsection XX (IGNITION SYSTEM)

It receives signals from a variety of sensors that it compares with the ignition mappings and uses it to control the ignition spark timing, duration and firing order.

The firing of each spark plug is independent of the others.

Engine RPM Limiter

The ECM will limit the maximum engine speed by cutting off ignition spark and fuel at a predetermined engine RPM.

ENGINE SPEED LIMITER SETTING	8300 RPM
------------------------------	----------

Knock Sensor

A knock sensor is mounted on the cylinder block below the exhaust manifold. It detects specific vibrations that would typically be generated by engine detonation.

If detonation occurs, the knock sensor detects it and the ECM goes into a specific operating mode whereby it temporarily retards the ignition advance until detonation stops.

The ECM is able to identify in which cylinder the knocking occurs and modifies the ignition advance on that cylinder only.

Refer to the *ELECTRONIC FUEL INJECTION (EFI)* subsection for testing and replacement procedures.

TROUBLESHOOTING

It is good practice to check for fault codes using the BUDS2 as a first troubleshooting step. Refer to *DIAGNOSTIC AND FAULT CODES* subsection.

Refer to *POWER DISTRIBUTION AND GROUNDS* for fuses and relay information.

Always refer to the *WIRING DIAGRAM* when troubleshooting an electrical circuit.

IGNITION SYSTEM TESTING

The ECM controls the ignition system.

If a fault is detected by the ECM, the check engine light will turn on.

The ECM can detect a problem on the primary winding or circuit of the ignition coils.

The secondary winding of the ignition coils is not monitored by the ECM.

Other sensors in relation with the ignition system are also monitored by the ECM.

Testing Ignition System

Check for fault codes using BUDS2 software as a first troubleshooting step. Refer to *DIAGNOSTIC SYSTEM AND FAULT CODES* subsection.

Ensure fuse F5 and relay are powered and in good condition.

If a fuse is burnt, test for a short circuit or faulty component on that fuse circuit before replacing the fuse.

Check ignition spark, refer to *TESTING THE IGNITION COIL WITH BUDS2*. in this subsection.

DIAGNOSTIC GUIDELINES

The following is provided to help in diagnosing the probable cause of a problem. It is a guideline and should not be assumed to list all possible causes.

ENGINE WILL NOT STOP WHEN REMOVING KEY FROM D.E.S.S. POST

- 1. Defective D.E.S.S. post
 - Check D.E.S.S. post. Replace if necessary.

ENGINE WILL NOT START (ENGINE TURNS OVER)

- 1. Fouled or defective spark plug
 - Check spark plug condition. Replace if necessary.
- 2. Defective CPS
 - Test CPS, refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.
- 3. Defective trigger wheel
 - Check. Refer to *MAGNETO AND STARTER* subsection.
- 4. Defective ignition circuit
 - Check fuses, ignition coils, wiring and connectors.

ENGINE HARD TO START

- 1. Faulty, fouled or worn out spark plug
 - Check spark plug condition. Replace if necessary.
- 2. Drowned engine
 - Check engine temperature value using *B.U.D.S.2 measurements* page. If the temperature read is lower than the ambient temperature, CTS sensor may be defective or have a bad connection. Therefore, the ECM would erroneously set the engine in cold start mode and it could flood the spark plugs.

ENGINE MISFIRES, RUNS IRREGULARLY

1. Fouled, defective, worn spark plugs
- Check spark plug condition. Replace if necessary.
2. Damaged trigger wheel/loose CPS
- Check. Refer to *MAGNETO AND STARTER* subsection.
3. Defective ignition circuit
- Check fuses, ignition coils, wiring and connectors.
4. Poor engine grounds
- Check ground condition, refer to *POWER DISTRIBUTION AND GROUNDS* subsection.

ENGINE CONTINUALLY BACKFIRES

1. Fouled, defective spark plugs
- Check spark plug condition. Replace if necessary.
2. Damaged trigger wheel/defective or loose CPS
- Check, refer to *MAGNETO AND STARTER* and *ELECTRONIC FUEL INJECTION (EFI)* subsections.

ENGINE DETONATION OR PINGING

1. Faulty or disconnected knock sensor
- Check, refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.

ENGINE LACKS ACCELERATION OR POWER

1. Weak spark
- Check spark plugs, coils, wiring and connections.

PROCEDURES**D.E.S.S. POST****Testing Continuity of D.E.S.S. post**

Refer to *RADIO FREQUENCY DIGITALLY ENCODED SECURITY SYSTEM (RF D.E.S.S.)* subsection.

Replacing the D.E.S.S. post

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

START/STOP BUTTON**Start/stop Button Wire Identification**

FUNCTION	PIN
12 volt input from F1	1
12 volt output to ECM-B pin D1	2

Start/Stop Button Test with BUDS2

Connect to BUDS2 software. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

Select the **Measurements** and **ECM** tabs.

Press the vehicle's start button and look at the **Start Button LED**.

It should turn on, indicating the start signal reaches the ECM.

If it does not turn on, check the start button and wiring.

Start/Stop Button Resistance Test

Disconnect start/stop button connector.

Using a multimeter, measure resistance as per the following table.

POSITION	START BUTTON CONNECTOR PIN		RESISTANCE
Switch released	1	2	Infinite (OL)
Switch depressed and held			0.6 Ω max.

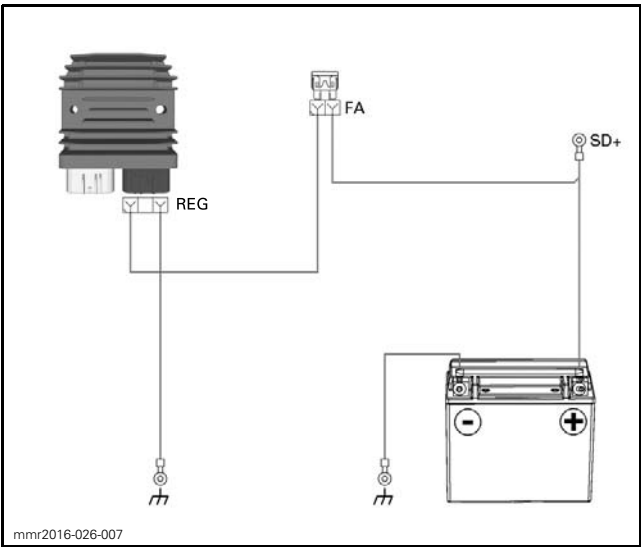
Replace start/stop button if defective.

CHARGING SYSTEM

GENERAL

SYSTEM DESCRIPTION

The purpose of the charging system is to keep the battery at a full state of charge.



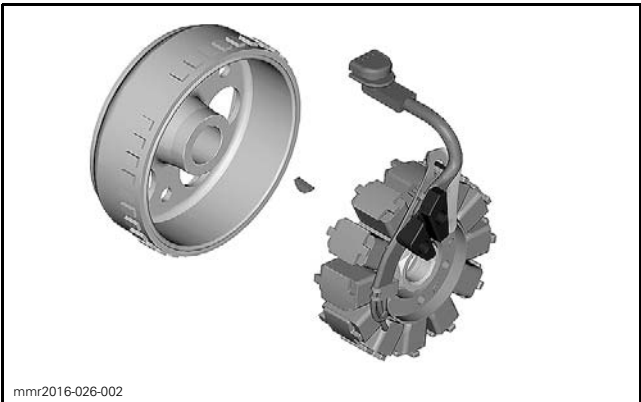
Magneto

The magneto is the primary source of electrical energy. It transforms a magnetic field into electric current (AC).

The alternating current is regulated and transformed into direct current (DC) by the voltage regulator, and normally powers all of the vehicle's systems and accessories.

The magneto has a 3 phase delta wound stator.

To test magneto, refer to *MAGNETO AND STARTER* subsection.

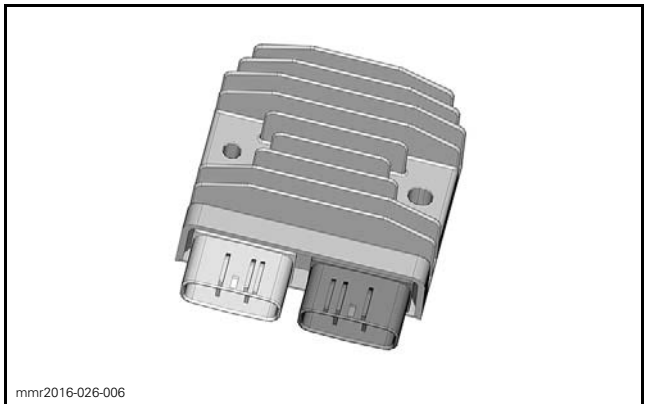


Voltage Regulator

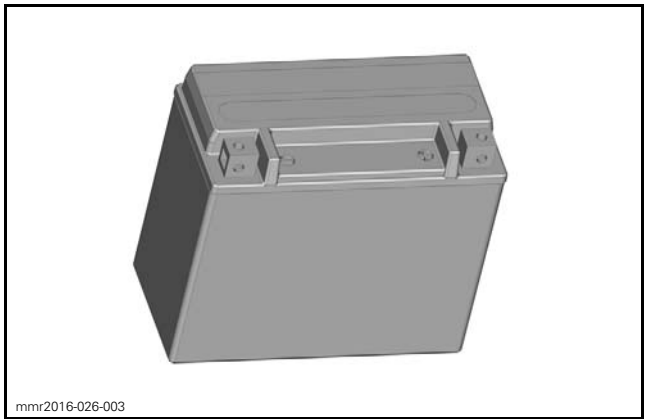
The regulator receives AC current from the magneto and transforms it into direct current (DC).

The voltage regulator limits voltage to prevent any damage to electrical components.

CONDITION	VOLTAGE Vdc
Idle	Minimum 12.5
Fast idle	Target 14.5
All	Maximum 15



Battery



The battery 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's output as required, and helps to maintain a steady system voltage.

TROUBLESHOOTING

It is good practice to check for fault codes using the BUDS2 software as a first troubleshooting step. Refer to *DIAGNOSTIC SYSTEM AND FAULT CODES* subsection.

BATTERY REGULARLY DISCHARGED OR WEAK

- 1. Loose or corroded battery cable connections.
- Tighten or repair battery cable connections.
- 2. Worn or defective battery.
- Charge and test battery.
- 3. Defective magneto stator.
- Test stator, refer to *MAGNETO AND STARTER SYSTEM* subsection.
- 4. Defective regulator/rectifier.
- Test system voltage.
- 5. Damaged magneto rotor or Woodruff key.
- Replace magneto rotor or Woodruff key, refer to *MAGNETO AND STARTER SYSTEM* subsection.

PROCEDURES

Ensure battery is fully charged.
Refer to *WIRING HARNESS AND CONNECTORS* subsection for harness layout and connector locations on vehicle.
Refer to appropriate *WIRING DIAGRAM* for additional information.
The magneto is covered in *MAGNETO AND STARTER* subsection.

⚠ WARNING

Ensure vehicle cannot move when performing charging system tests with the engine running.

BATTERY LOAD TEST

- 1. Connect a battery load tester.
- 2. Ensure proper test conditions.

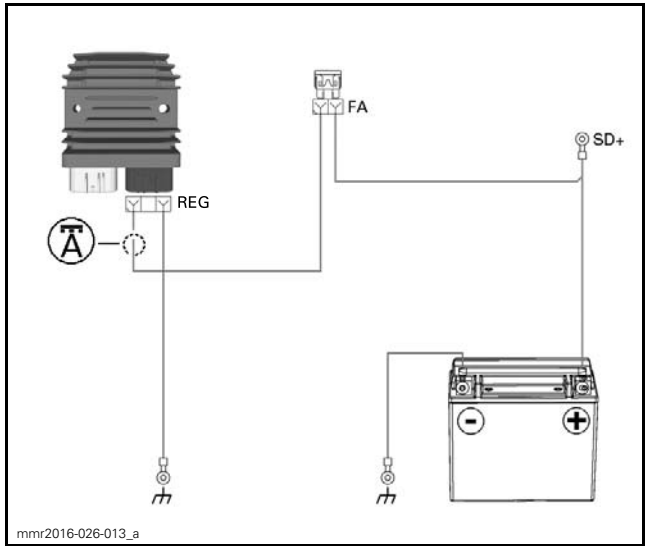
TEST CONDITIONS	
Initial battery voltage‡	Above 12.5 Vdc
Engine	OFF
Load	3 times the amp-hour (AH) rating
Time	15 seconds
‡ Required for accurate testing	

SPECIFICATION	
Battery	Above 9.6 Vdc

If battery voltage drops below specification during test, replace battery and perform a *CHARGING SYSTEM LOAD TEST*.

CHARGING SYSTEM LOAD TEST

NOTE: Ammeter location is important. Only clamp over positive wire near regulator.



- 1. Connect a battery load tester.
- 2. Start vehicle and read voltage on tester.

SPECIFICATION	
Voltage	12.5 - 15 Vdc

- If voltage is **above** specification, replace regulator and continue with next steps.
- 3. Connect an AC/DC clamp ammeter around REG-1 wire.
 - 4. Ensure proper test conditions.

TEST CONDITIONS	
Battery voltage at idle‡	Above 12.6 Vdc
Engine	Increase to 4000 RPM
Load	As required to decrease battery voltage to 12 Vdc
‡ Required for accurate testing	

- 5. Read amperage on ammeter.

MAGNETO	SPECIFICATION
500 W	41 ± 5 Amps

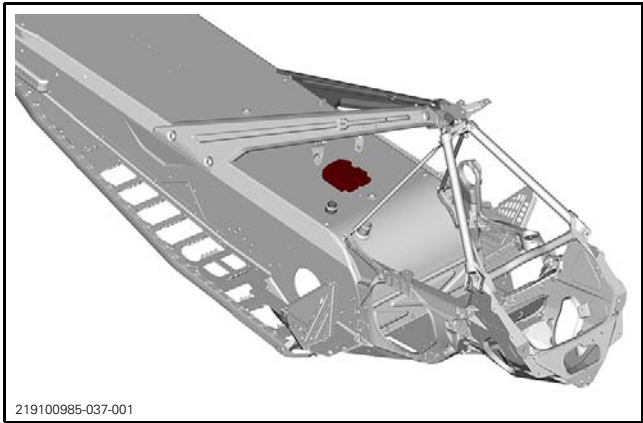
NOTE: With a fully charged battery and no electrical loads, specification is less than 7A.

If amperage or voltage is not within specification, verify magneto and wires. Refer to *MAGNETO AND STARTER* subsection. Replace:

- Voltage regulator if magneto test is within specifications.
- Magneto if magneto test is not within specifications.

VOLTAGE REGULATOR (REG)

Voltage Regulator Location

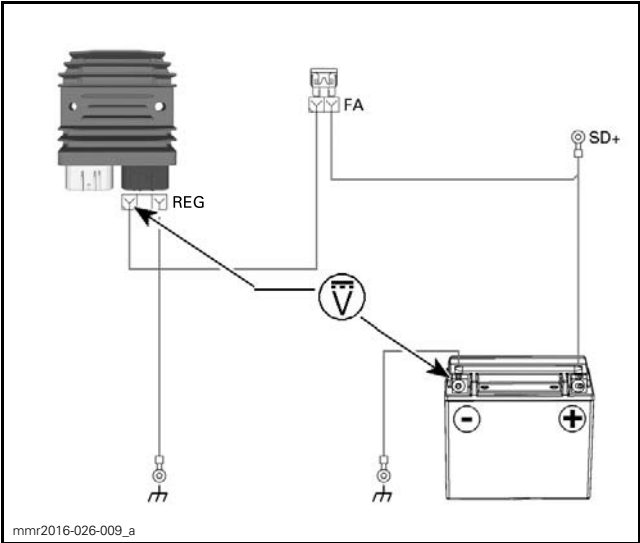


Testing the Voltage Regulator Continuity

Due to internal circuitry, there is no static test available.

Testing the Voltage Regulator Power

1. Check voltage at REG-1.

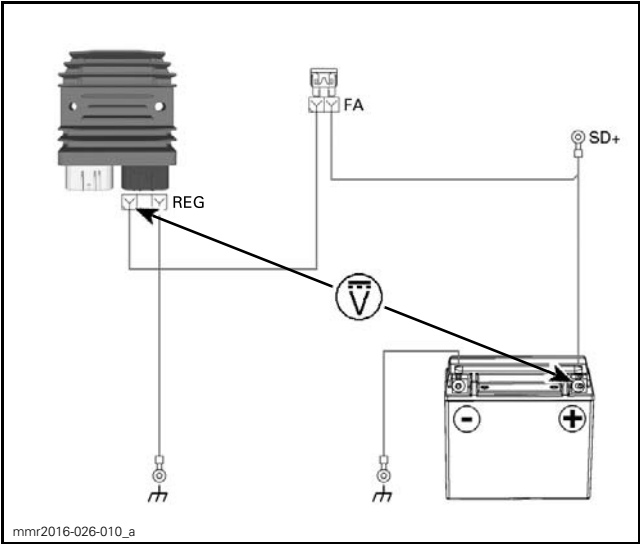


TEST CONDITIONS		
REG-1		Hot at all times
BACKPROBE	PROBE	SPECIFICATION
REG-1	BAT (-)	Battery voltage

2. Connect a battery load tester.
3. Start vehicle.
4. Ensure proper test conditions.

TEST CONDITIONS	
Battery voltage at idle‡	Above 12.6 Vdc
Engine	Increase to 4000 RPM
Load	As required to decrease battery voltage to 12 Vdc
‡ Required for accurate testing	

5. Measure voltage drop.



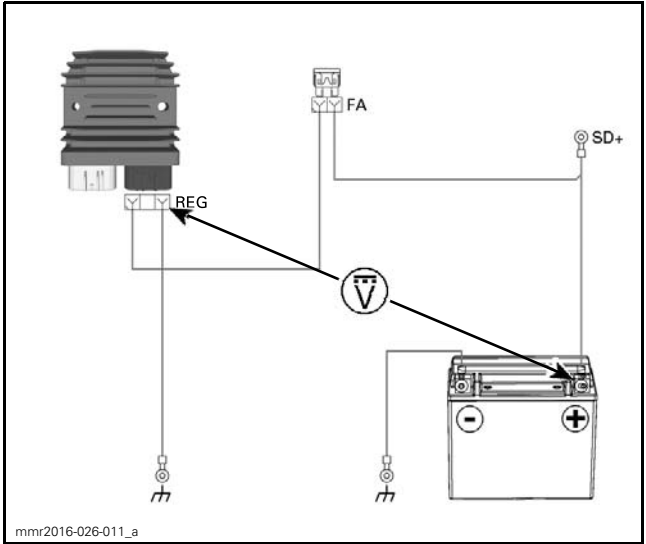
Subsection XX (CHARGING SYSTEM)

BACKPROBE	PROBE	SPECIFICATION
REG-1	BAT1 (+)	Under 0.2 Vdc

If voltage drop is above specification, locate and repair damaged connector/wire.

Testing the Voltage Regulator Ground

1. Check ground at REG-3.



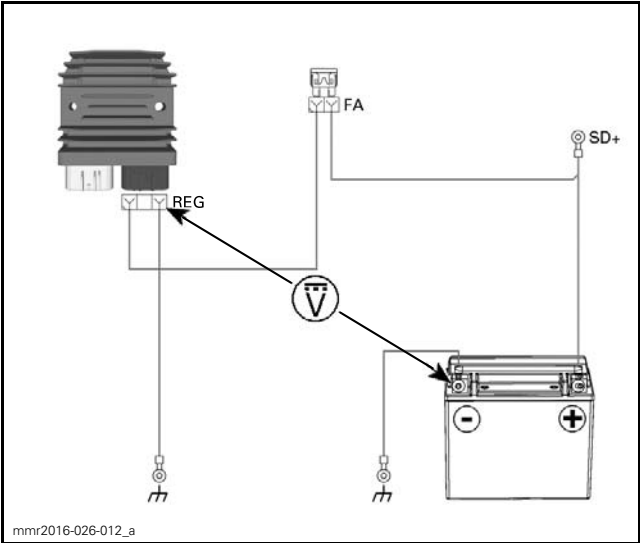
TEST CONDITIONS	
REG-3	Permanent ground

BACKPROBE	PROBE	SPECIFICATION
REG-3	BAT (+)	Battery voltage

- 2. Connect a battery load tester.
- 3. Start vehicle.
- 4. Ensure proper test conditions.

TEST CONDITIONS	
Battery voltage at idle‡	Above 12.6 Vdc
Engine	Increase to 4000 RPM
Load	As required to decrease battery voltage to 12 Vdc
‡ Required for accurate testing	

5. Measure voltage drop.



BACKPROBE	PROBE	SPECIFICATION
REG-3	BAT (-)	Under 0.4 Vdc

If voltage drop is above specification, locate and repair damaged connector/wire.

BATTERY

Battery Information

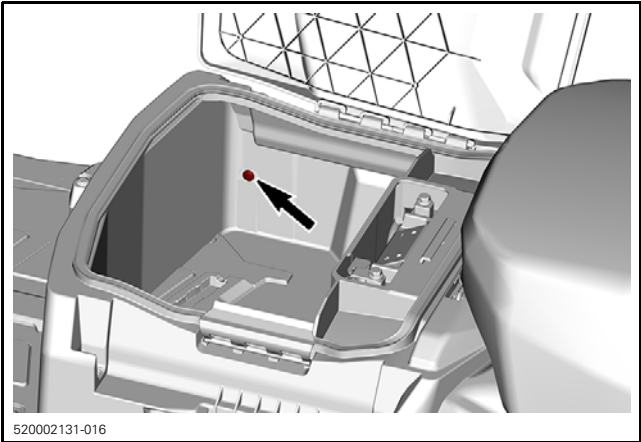
These vehicles are equipped with a VRLA battery (Valve Regulated Lead Acid). It is a maintenance-free type battery.

Refer to *BATTERY ACTIVATION, CHARGING, AND MAINTENANCE* article for procedures.

Removing Battery

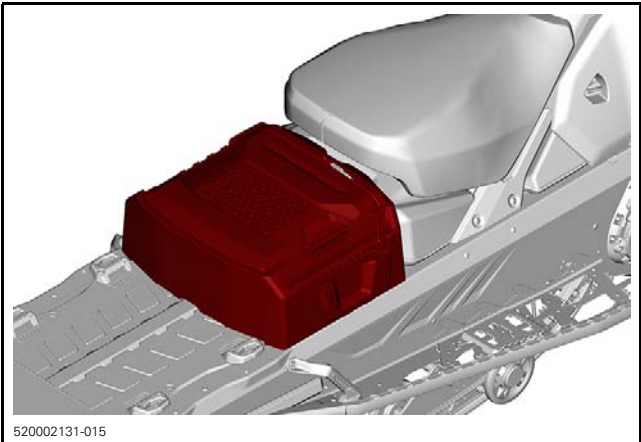
**WARNING**
Battery BLACK (-) cable must always be disconnected first and connected last. Never charge or boost battery while installed on vehicle.

- 1. Remove passenger seat and backrest (if applicable).
- 2. Open cargo box, remove battery cover and all mounting screws.

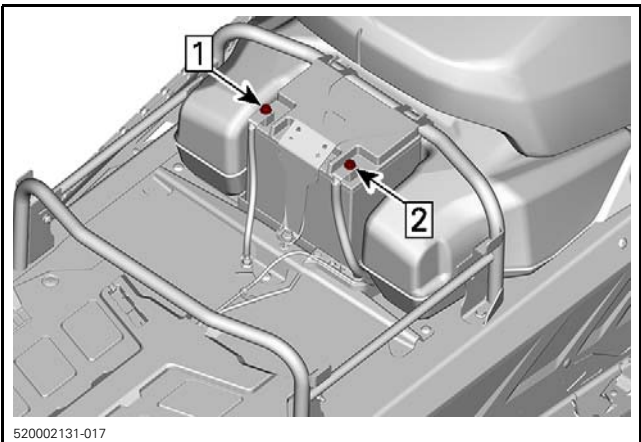


LH SIDE SCREW SHOWN

3. Remove cargo box.

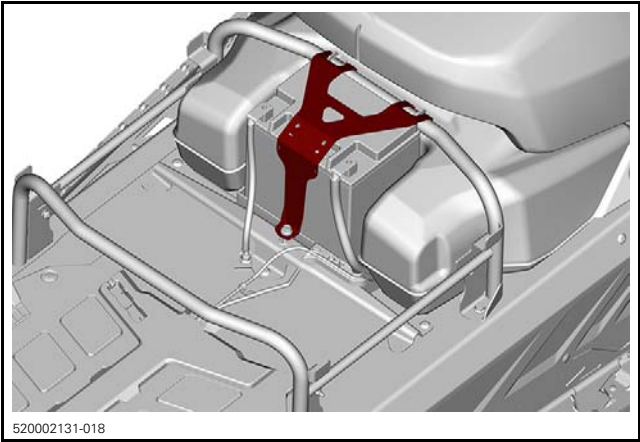


4. Disconnect negative before positive terminal.

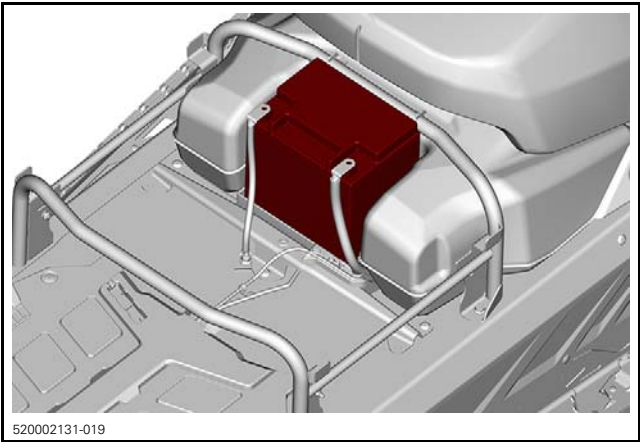


Step 1: Disconnect negative
Step 2: Disconnect positive

5. Remove battery hold down bracket.



6. Remove battery.



Installing Battery

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

TIGHTENING TORQUE	
Battery terminals (positive and negative)	10 N•m ± 2 N•m (89 lbf•in ± 18 lbf•in)
Battery hold down bracket	7 N•m ± 1 N•m (62 lbf•in ± 9 lbf•in)
Battery cover retaining screws	7 N•m ± 1 N•m (62 lbf•in ± 9 lbf•in)

Reinstall the seat, backrest and cargo box if applicable.

STARTING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
ECM ADAPTER TOOL.....	529 036 166	2
FLUKE 115 MULTIMETER	529 035 868	2



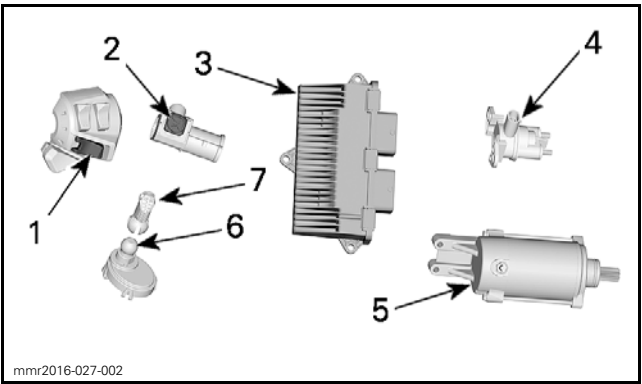
SERVICE PRODUCTS If you bought this manual from any other seller please leave them
NEGATIVE feedback and notify me at bestshopmanuals@gmail.com

Description	Part Number	Page
DIELECTRIC GREASE (F)	619 600 021	5
DIELECTRIC GREASE	293 550 004	5

GENERAL

BASIC STARTING SYSTEM OPERATION

When the START button is pressed, 12 Vdc is applied to the ECM. The ECM activates the main relay which provides 12 volts to one end of the coil of the starter solenoid. If the engine cranking conditions are met, the ECM completes the starter solenoid control circuit by providing a ground.



1. Start button
2. Emergency engine stop switch
3. ECM
4. Starter solenoid
5. Starter
6. D.E.S.S. post
7. D.E.S.S. key

Engine Cranking Conditions

The following conditions must be met to allow engine cranking:

1. Emergency engine stop switch set to RUN.
2. D.E.S.S. key on the D.E.S.S. post.
3. START button pressed and held.

Starting System Logic

If the START 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 button is held after engine has started, the ECM automatically stops the starter if engine speed reaches at least 1400 RPM.

TROUBLESHOOTING

DIAGNOSTIC TIPS

NOTE: It is a good practice to check for fault codes using BUDS2 as a first troubleshooting step. Refer to *DIAGNOSTIC SYSTEM 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 and start fuse. Refer to *WIRING DIAGRAM*.
- Battery, refer to *CHARGING SYSTEM*
- START/RER button
- Starter solenoid
- Emergency engine stop 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 is in good condition. Refer to applicable subsection.

DIAGNOSTIC GUIDELINES

NOTHING HAPPENS WHEN START/RER
BUTTON IS PRESSED

- 1. Battery not connected
 - Connect battery.
- 2. Burnt fuse
 - Check fuses
- 3. Defective relay or related circuits
 - Test relay and circuits.
- 4. Defective START/RER switch
 - Test START/RER switch, wiring and connections.

ENGINE DOES NOT CRANK

- 1. Discharged battery
 - Recharge and test. Refer to CHARGING SYSTEM subsection.
- 2. Battery connections
 - Check/clean/tighten.
- 3. Poor/bad or corroded ground contacts (engine, battery ground cable, starter etc.)
 - Check/clean/repair, refer to POWER DISTRIBUTION AND GROUNDS subsection.
- 4. Starter solenoid
 - Test solenoid, wiring and connections.
- 5. Damaged starter or ground cables
 - Carry out SOLENOID DYNAMIC TEST.
- 6. No ground provided by ECM to starter solenoid
 - Refer to TESTING THE START/RER SWITCH CONTROL CIRCUIT CONTINUITY in this subsection.
- 7. Engine cannot be rotated (possibly seized)
 - Refer to ENGINE subsection.

ENGINE CRANKS SLOWLY

- 1. Loose, corroded or dirty battery cable connections
 - Check/clean/tighten.
- 2. Discharged/weak battery
 - Recharge and test. Refer to CHARGING SYSTEM subsection.
- 3. Low voltage from starter solenoid
 - Carry out a SOLENOID DYNAMIC TEST.
- 4. Damaged starter or ground cables
 - Carry out SOLENOID DYNAMIC TEST.

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 MAGNETO AND STARTER subsection.
- 2. Defective drive
 - Replace starter drive. Refer to MAGNETO AND STARTER subsection.

STARTER KEEPS RUNNING

- 1. Sticking solenoid contacts
 - Replace solenoid.
- 2. Sticking or defective starter drive
 - Lubricate or replace. Refer to MAGNETO AND STARTER.

PROCEDURES

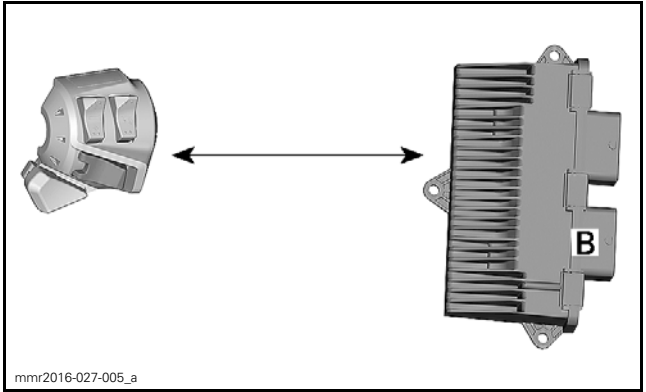
REQUIRED TOOLS	
ECM ADAPTER TOOL (P/N 529 036 166)	
FLUKE 115 MULTIMETER (P/N 529 035 868)	

 **WARNING**

Ensure vehicle cannot move when performing starting system tests.

START/RER SWITCH

Testing the START/RER Switch Circuit Continuity



In BUDS2, verify the **Monitor** page and **ECM** tab to see if the button is working.

- 1. Remove start button fuse.

Disconnect connector "B" from the ECM, refer to *WIRING HARNESS AND CONNECTOR* subsection.

Install the ECM adapter on ECM harness connector "B".

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

CONTINUITY TEST OF START/RER SWITCH CIRCUIT (BUTTON PRESSED AND HELD)		
FUSE BOX	ECM CONNECTOR B	RESISTANCE
Pin D3	ECMB-D1	Close to 0 Ω (continuity)

2. If the reading is as specified, the START/RER switch and its wiring are good.
3. If a high resistance or an open circuit is measured, carry out *TESTING THE START/RER SWITCH CONTINUITY*.

Testing the START/RER Switch Circuit Continuity



1. Disconnect the steering connector SH1. Refer to *WIRING HARNESS AND CONNECTORS* subsection.
2. Measure resistance through switch as per following table.

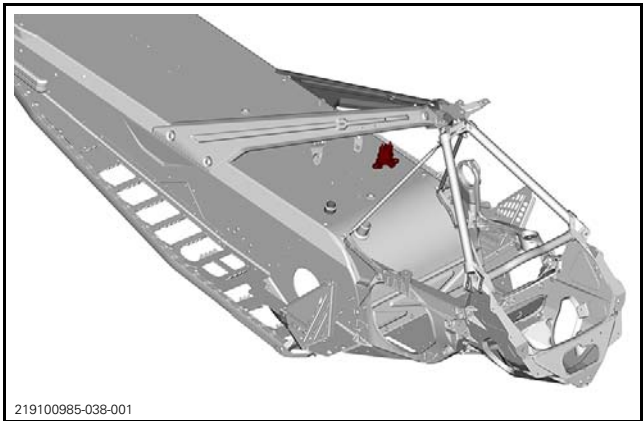
START/RER SWITCH CIRCUIT CONTINUITY TEST		
SWITCH POSITION	SH1	RESISTANCE
Released	Pins B and C	Close to 0 Ω
Pressed and held	Pins H and C	Close to 0 Ω

If the switch does not test as specified, replace the START/RER switch.

If the switch tests as specified, check for an open circuit in harness.

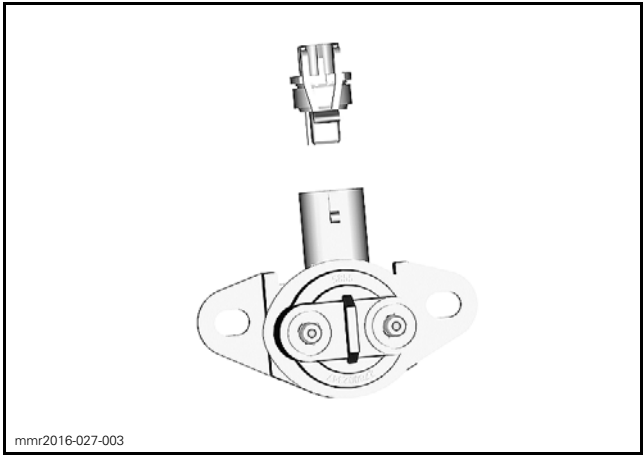
STARTER SOLENOID

Starter Solenoid Location



Testing the Solenoid Input Voltage (Solenoid Coil)

1. Disconnect solenoid connector.



2. Set the multimeter to Vdc.
3. Install D.E.S.S. key on post.
4. Press the START/RER button to activate ECM.
5. Measure voltage.

Subsection XX (STARTING SYSTEM)

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

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

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

Testing the Solenoid Control Circuit Continuity

1. Set the multimeter to Ω .
2. Disconnect connector "B" from ECM, refer to *WIRING HARNESS AND CONNECTORS* sub-section.
3. Install the ECM adaptor 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 A	ECMB-L4	Close to 0 Ω (continuity)

If test failed, repair or replace wiring/connectors.

If test succeeded, carry out a *TESTING THE SOLENOID COIL RESISTANCE*.

Testing the 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

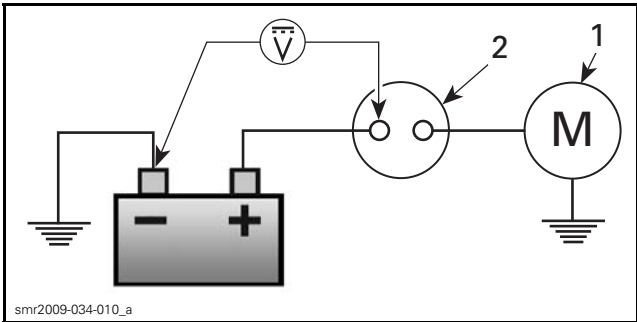
If test fails, replace solenoid.

Solenoid Dynamic Test

1. Depress the throttle lever to place the ECM in engine drowned mode. Hold throttle lever in place using a rubber band.
2. Set multimeter to Vdc.
3. Crank engine.

4. 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

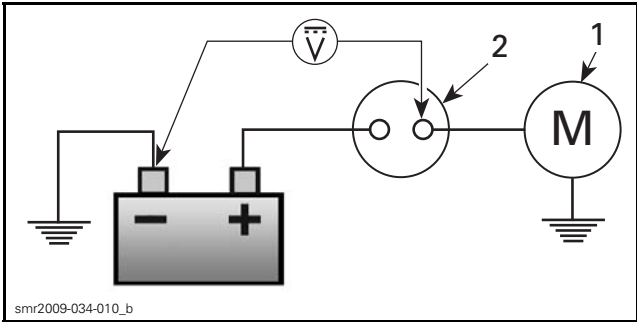


1. Starter motor
2. Starter solenoid

5. If test failed, check battery positive cable (from battery to solenoid).

6. If test succeeded, continue with next step.

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

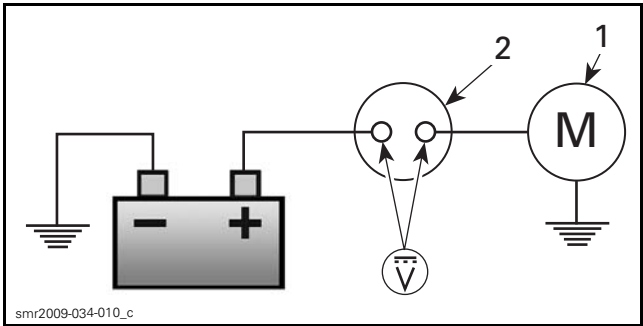


1. Starter motor
2. Starter solenoid

7. If test failed, carry out a *TESTING THE SOLENOID INPUT VOLTAGE (SOLENOID COIL)*.

8. 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.
- 9. Remove rubber band from throttle lever.
 - 10. Reinstall removed parts.

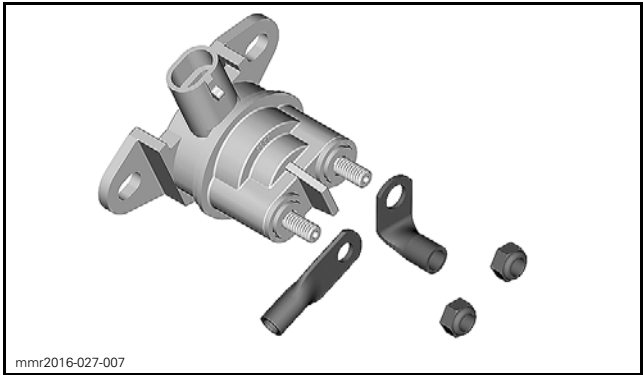
Removing the Solenoid

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

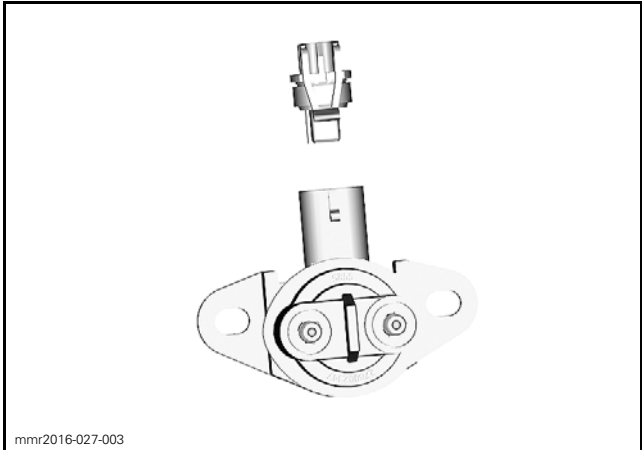
WARNING

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

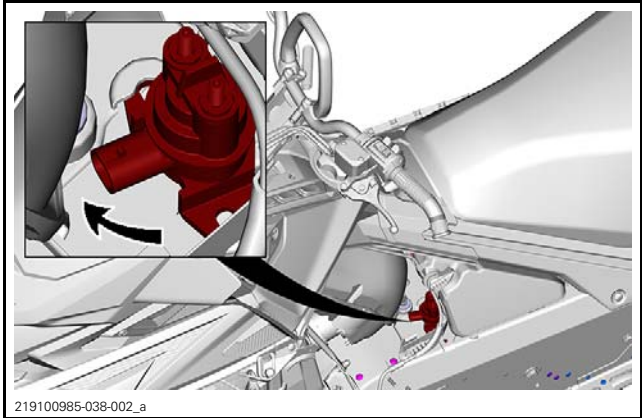
- 2. Open LH side panel
- 3. Disconnect solenoid cables.



- 4. Disconnect starter solenoid connector.



- 5. Pivot to remove the solenoid.



Installing the Solenoid

The installation is the reverse of the removal procedure. However, pay attention to the following. Apply dielectric grease under and over each connections and make sure each nut are well covered.

COUNTRY	SERVICE PRODUCT
Scandinavia	DIELECTRIC GREASE (F) (P/N 619 600 021)
All other countries	DIELECTRIC GREASE (P/N 293 550 004)

TIGHTENING TORQUE	
Solenoid cable retaining nuts	4 N•m ± 0.5 N•m (35 lbf•in ± 4 lbf•in)

- 1. Close or slide protective caps.
- 2. Reconnect battery and test starter solenoid operation.

STARTER

For starter information refer to *MAGNETO AND STARTER* subsection.

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

SERVICE TOOLS

Description	Part Number	Page
POWER INTERFACE	515 177 223	2

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.

This system allows the engine to reach pulley engagement speed only if a D.E.S.S. key is installed on engine cut-off switch and the key is recognized as valid by the ECM.

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.

Up to 8 D.E.S.S. keys may be programmed in the ECM memory using the B.U.D.S. The keys can also be erased individually.

NOTE: If desired, a 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. Beeper Codes

When starting the engine with a D.E.S.S. key on the engine cut-off switch, the key is identified by the ECM and D.E.S.S. signals will be issued according to the key recognition. See table.

D.E.S.S. SIGNAL		DESCRIPTION	COMMENT
BEEPER	DISPLAYED MESSAGE		
2 shorts beeps	Compact digital gauge: "Good Key" Other gauges: DESS tell-tale light will flash	Valid key read	Working D.E.S.S. key.
Short beeps repeating slowly	CHECK KEY	Unable to read key	– Reinstall key – RPM limited to 2500 – Check D.E.S.S. status in B.U.D.S. – No voltage at RFID connector pin D
Shorts beeps repeating rapidly	BAD KEY	Invalid key or key not programmed	– Use the proper key for this vehicle or have the key programmed. – Vehicle can not be driven.

PROCEDURES

D.E.S.S. KEY

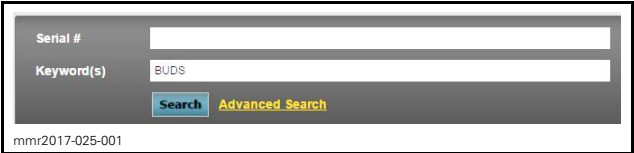
D.E.S.S. Key Programming

Use BUDS2.

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

- Current version download link
- User manual (programming keys, reading fault codes, writing data to modules etc.)
- Installation instructions
- Navigation through menus
- BRP BUDS chart

Search keyword: "BUDS".



D.E.S.S. / ENGINE CUT-OFF OPERATION

Connect BUDS2, refer to *COMMUNICATION TOOLS AND BUDS*.

Navigate to the **keys** page.

Read key. Consult the sections below to troubleshoot a key problem.

Normal Operation (Good Key)

Refer to *WIRING DIAGRAM*.

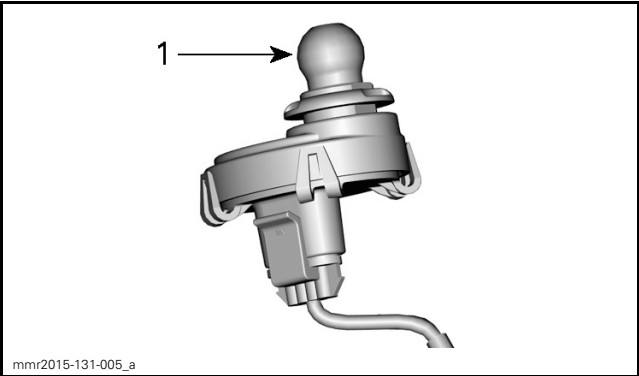
RFID CONNECTOR PIN	SPECIFICATIONS with POWER INTERFACE (P/N 515 177 223) installed
A	ECM ground
B	12 - 15 Vdc
C	5 Vdc
D	12 Vdc

Key Not Read

Possible causes:

- Damaged RFID chip
- No voltage at RFID-D connector
- No voltage at RFID-C connector

Condition can be duplicated with a magnet on the D.E.S.S. post.



1. D.E.S.S. post

Key Not Present

Possible causes:

- No key installed
- No voltage at RFID-B connector
- No ground at RFID-A connector

Condition can be duplicated by unplugging the RFID connector.

Invalid Key

Possible causes:

- Key not programmed to ECM

BEEPER

The beeper is integrated in the multifunction gauge and cannot be replaced alone.

If the beeper does not sound when starting the engine, check the beeper operation. Refer to *GAUGE* subsection.

LIGHTS

SERVICE TOOLS

Description	Part Number	Page
12 V BATTERY SUPPLY CABLE	529 035 997	1
POWER INTERFACE	515 177 223	1

GENERAL

Refer to *WIRING HARNESS AND CONNECTORS* for electrical connector locations.

⚠ WARNING

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

SYSTEM TESTING

All vehicle lights are powered from the primary 12 Vdc circuit. This circuit is powered from and controlled by the ECM when the engine reaches 800 RPM. Refer to *POWER DISTRIBUTION AND GROUNDS* subsection for more information on how power is distributed to various systems.

For models without a battery, connect the following tools in order to provide electrical power to the vehicle.

REQUIRED TOOLS

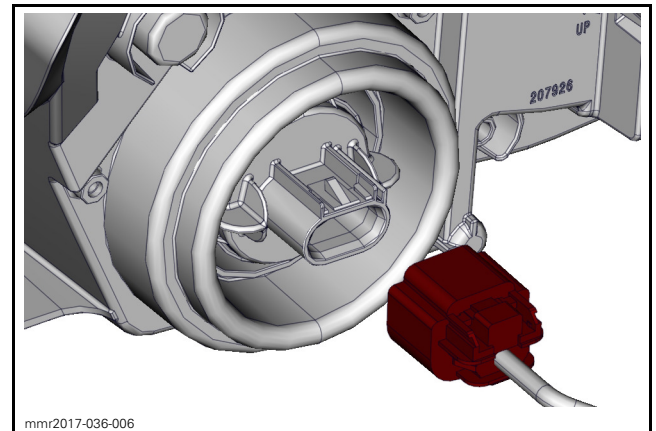
- POWER INTERFACE (P/N 515 177 223)
- 12 V BATTERY SUPPLY CABLE (P/N 529 035 997)
- 12-volt battery

PROCEDURES

HEADLIGHTS

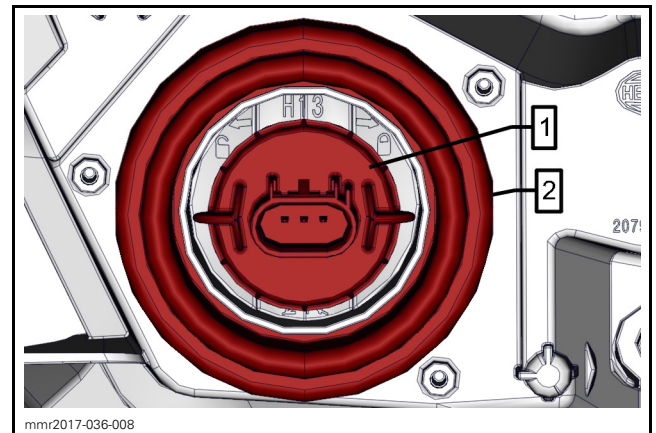
Removing Headlight Bulb

1. Remove gauge and trim. Refer to *BODY* subsection.
2. Remove front glove box. Refer to *BODY* subsection.
3. Unplug electrical connector.



4. Turn bulb socket to unlock and remove bulb.

NOTE: Ensure bulb seal stays in place.



1. Bulb socket
2. Bulb seal

Installing Headlight Bulb

NOTICE Never touch glass portion of a halogen bulb with bare fingers, it shortens its operating life. If glass is touched, clean it with isopropyl alcohol which will not leave a film on the bulb.

Reverse removal procedure.

Measuring Headlight Input Voltage

1. Disconnect headlight connector(s).
2. Provide electrical power to the headlights for testing.

Subsection XX (LIGHTS)

3. Read voltage at headlight connector as follows.

SWITCH POSITION	WIRE COLOR (HEADLIGHT CONNECTOR)		VOLTAGE
LO beam	GY/OG	BK	Battery voltage (Vdc)
HI beam	GY/WH	BK	

If voltage is inadequate, carry out the following to find the source of the problem:

- Test headlights dimmer switch.
- Test wiring harness and connectors.
- Test primary 12 Vdc system. Refer to *CHARGING SYSTEM*.

Testing Headlight Dimmer with BUDS2

The headlight dimmer switch status can be monitored using BUDS2.

Testing Headlight Dimmer Switch Continuity

1. Disconnect the applicable connector depending on gauge, refer to following tables.
2. Test switch circuits on applicable connector on switch side as per table.

MODELS WITH COMPACT DIGITAL GAUGE			
SWITCH POSITION	DIMMER PINS		SPECIFICATION
HIGH	2	4	Close to 0 Ω
	2	1	Infinite (OL)
LOW	2	4	Infinite (OL)
	2	1	Close to 0 Ω

MODELS WITH ANALOG/DIGITAL GAUGE			
SWITCH POSITION	SH PINS		SPECIFICATION
HIGH	12	7	Close to 0 Ω
	6	7	Infinite (OL)
LOW	12	7	Infinite (OL)
	6	7	Close to 0 Ω

If tests were good, switch is functioning properly.

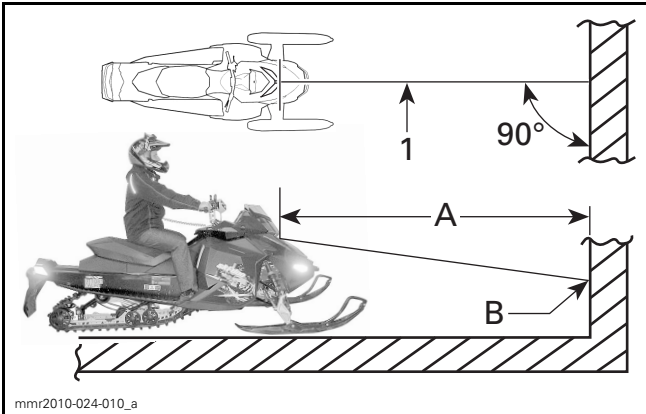
If any test failed, check wiring and connections going to switch.

If test of wiring and connections was good, replace switch.

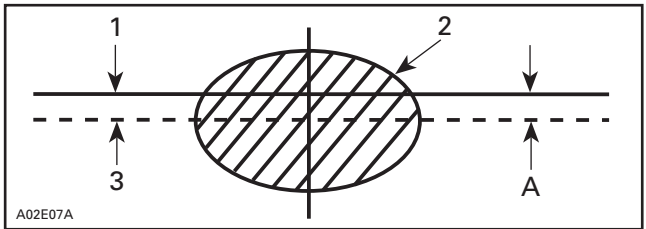
Aiming Headlight Beam

Beam aiming is correct when center of high beam is 25 mm (1 in) below the headlight horizontal center line, scribed on a test surface, 381 cm (12 ft 6 in) away.

1. Place the vehicle on a flat surface perpendicular to test surface (wall or screen) and 381 cm (12 ft 6 in) away from it.
2. Ask rider to sit on vehicle seat, or apply equivalent weight on the vehicle.
3. Select **high** beam.
4. Measure headlight center distance from ground. Scribe a line at this height on test surface (wall or screen). Light beam center should be 25 mm (1 in) below scribed line.



TYPICAL
1. Headlight center line
A. 381 cm (12 ft 6 in)
B. 25 mm (1 in) below center line



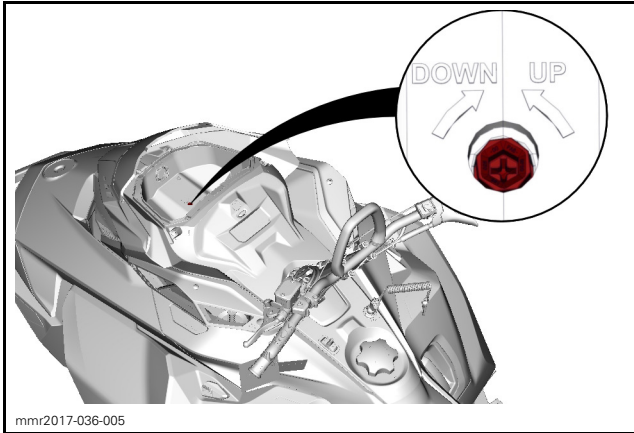
1. Headlight horizontal
2. Light beam (high beam) (projected on the wall)
3. Light beam center
A. 25 mm (1 in)

Adjusting Beam

Open the front storage compartment.

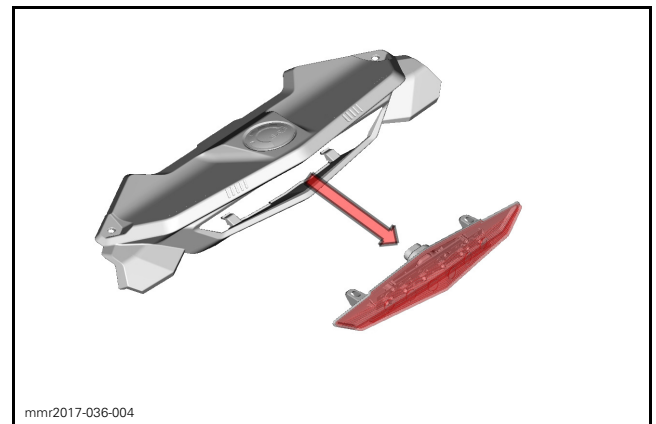
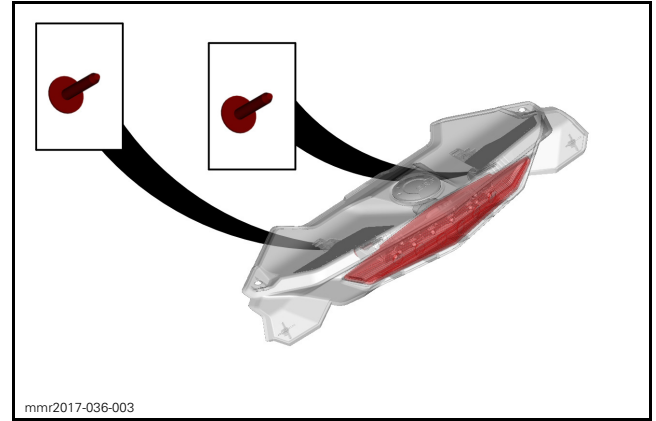
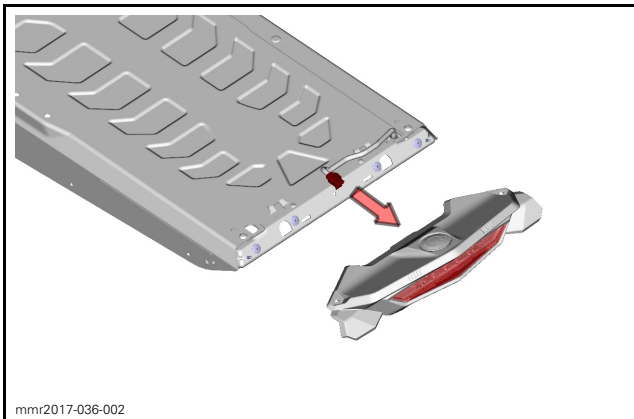
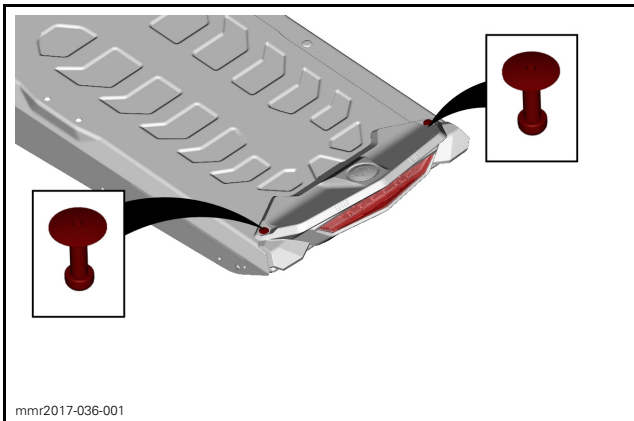
Turn knob to adjust the beam height.

NOTE: Avoid reaching extreme adjustments as the headlight assembly might move out of position.



TAILLIGHT / BRAKE LIGHT

Replacing Taillight



Replace taillight.

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

TIGHTENING TORQUE	
Taillight retaining screw	0.4 N•m (4 lbf•in)

GAUGE 4.5" DIGITAL DISPLAY

SERVICE TOOLS

Description	Part Number	Page
FLUKE 115 MULTIMETER	529 035 868	1

GENERAL

Most of the electrical tests require the following tool.

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

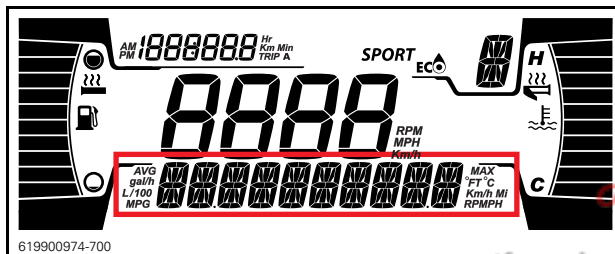
Refer to *WIRING DIAGRAM INFORMATION* subsection for diagnostic tips on troubleshooting electrical problems.

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 multifunction gauge. When starting the engine, always look at the gauge for any indicator lamps or special messages.

Important information messages can also be displayed temporarily in the lower display to assist indicator lamps.



LOWER DISPLAY

NOTE: Depending on the vehicle, not all the indicator lamps and messages will be applicable.

INDICATOR LAMPS (MALFUNCTIONS)			
INDICATOR LAMP(S)	DIGITAL WARNING	CAUSE	WHAT TO DO
None	BAD KEY	Wrong or defective key	- Use the right key for the vehicle. - Program a new key if the previous key is defective. - Check wiring and connectors. Refer to the <i>WIRING DIAGRAM</i>.
None	BELT OVERLOAD	Belt reached its limit	- Stop vehicle. - Inspect drive belt. Replace as required.
 ON	HIGH ENGINE TEMPERATURE	Engine is overheating	- Stop and wait for engine to cool off. - Check for leaks. - Check and adjust the coolant level.

Subsection XX (GAUGE 4.5" DIGITAL DISPLAY)

INDICATOR LAMPS (MALFUNCTIONS)			
INDICATOR LAMP(S)	DIGITAL WARNING	CAUSE	WHAT TO DO
 ON	LO BATT VOLT or HI BATT VOLT	Low or high battery voltage	- Recharge battery. - Check battery connections. - Check the charging system.
 ON	BRAKE	Throttle lever is applied when park brake is on	- Disengage park brake.
 ON	CHECK ENGINE	Engine management component malfunction	- Stop the engine. The cluster must be completely shuts down.
 FLASHING	LIMP HOME MODE	Important engine management component	- Connect the vehicle to the BRP diagnostic software (BUDS2). Check faults codes and perform recommended actions.
 ON	STOP ENGINE (ACE engines)	Low oil pressure	- Check for oil leaks.
	LOW OIL (E-TEC engines)	Low oil tank level	- Check and adjust the engine .
 ON	Variable messages - The message changes in accordance with the defective component.		

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.

MULTIFUNCTION GAUGE TROUBLESHOOTING

GAUGE FUNCTIONS INOPERATIVE OR WORKING INTERMITTENTLY

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

PROCEDURES

MULTIFUNCTION GAUGE



Testing the Multifunction Gauge

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 Multifunction Gauge Using BRP Diagnostic Software (BUDS2)

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

In BUDS2, go to:

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

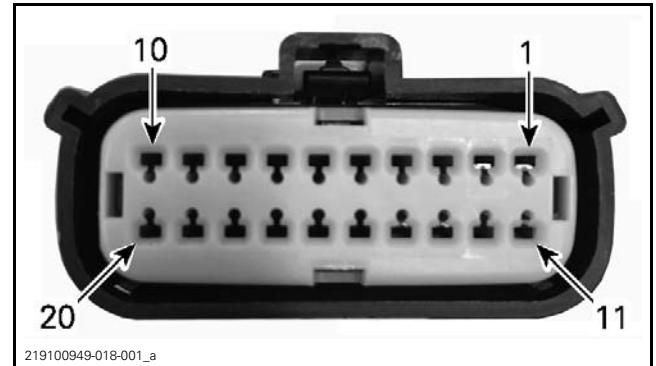
All indications will come and stay ON so that you can verify each indication.

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

Testing the Multifunction Gauge Power Input

If the multifunction gauge is inoperative, first check for fault codes with BRP Diagnostic Software, record all faults then erase them. Reactivate the electrical system and recheck for faults. If any fault code appears, perform service actions required. Refer to *COMMUNICATION TOOLS* subsection.

1. Remove multifunction gauge.
2. Perform the test at multifunction gauge connector as per following illustration and tables.



MULTIFUNCTION GAUGE CONNECTOR (PIN-OUT)

MULTIFUNCTION GAUGE POWER TEST			
CL_A CONNECTOR	BATTERY	IGNITION POSITION	RESULTS
Multifunction connector pin 1	Negative (-) post	Any	Close to battery voltage
Multifunction connector pin 11		ON	Close to battery voltage

If there is no power at pin 1, check fuse F4 and the related circuit.

If there is no power at pin 11, in check fuse F2 and the related circuit.

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

Testing the Multifunction Gauge Ground Circuit

Test as per the following table.

MULTIFUNCTION GAUGE GROUND TEST		
CL CONNECTOR	BATTERY	RESULT
Pin 2	Negative (-) post	Close to 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 MULTIFUNCTION GAUGE CAN WIRE CIRCUIT*.

Testing the Multifunction Gauge CAN Circuit

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

Subsection XX (GAUGE 4.5" DIGITAL DISPLAY)

MULTIFUNCTION GAUGE CAN WIRE TEST		
CL CONNECTOR	DLC	RESULTS
Pin 13 (CAN HI)	Pin 1	Close to 0.4 Ω
Pin 14 (CAN LO)	Pin 2	Close to 0.4 Ω

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

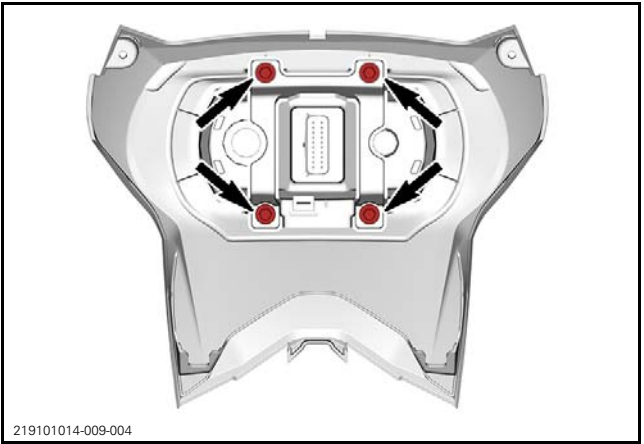
If the multifunction gauge functions, however there is a suspected communication problem with another component, perform this test between the multifunction gauge and that component.

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

Removing the Multifunction Gauge

Remove gauge support. Refer to procedure in *BODY* subsection

Disconnect the gauge connector. Remove following fasteners.



Installing the Multifunction Gauge

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

TIGHTENING TORQUE	
Multifunction gauge retaining screws	1 N•m ± 0.2 N•m (9 lbf•in ± 2 lbf•in)

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

When updates are completed, change settings as per customer preferences (language and units) as described in *SETTING LANGUAGE AND UNITS OF MEASUREMENT* in this subsection.

Setting Language and Units of Measurement

- 1. Connect the vehicle to the BRP diagnostic software (BUDS2), refer to the *COMMUNICATION TOOLS* subsection.
- 2. In BUDS2, go to:
 - **SETTINGS** page
 - **CLUSTER** button
 - **SETTINGS** tab
 - **CONFIGURATION** - Change Cluster Language and Units

Subsection XX (GAUGE 7.2" DIGITAL DISPLAY)

INDICATOR LAMPS (MALFUNCTIONS)			
INDICATOR LAMP(S)	DIGITAL WARNING	CAUSE	WHAT TO DO
 ON	LO BATT VOLT or HI BATT VOLT	Low or high battery voltage	- Recharge battery. - Check battery connections. - Check the charging system.
 ON	BRAKE	Throttle lever is applied when park brake is on	- Disengage park brake.
 ON	CHECK ENGINE	Engine management component malfunction	- Stop the engine. The cluster must be completely shut down.
 FLASHING	LIMP HOME MODE	Important engine management component	- Connect the vehicle to the BRP diagnostic software (BUDS2). Check faults codes and perform recommended actions.
 ON	STOP ENGINE (ACE engines)	Low oil pressure	- Check for oil leaks.
	LOW OIL (E-TEC engines)	Low oil tank level	- Check and adjust the engine .
 ON	Variable messages - The message changes in accordance with the defective component.		

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.

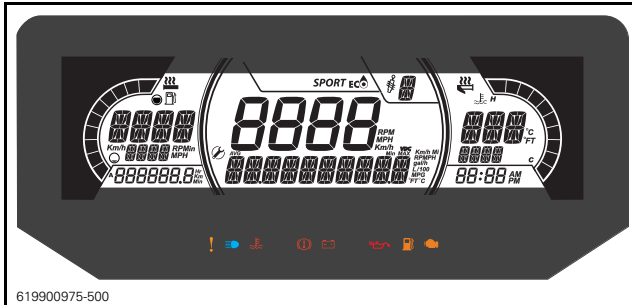
MULTIFUNCTION GAUGE TROUBLESHOOTING

GAUGE FUNCTIONS INOPERATIVE OR WORKING INTERMITTENTLY

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

PROCEDURES

MULTIFUNCTION GAUGE



Testing the Multifunction Gauge

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 Multifunction Gauge Using BRP Diagnostic Software (BUDS2)

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

In BUDS2, go to:

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

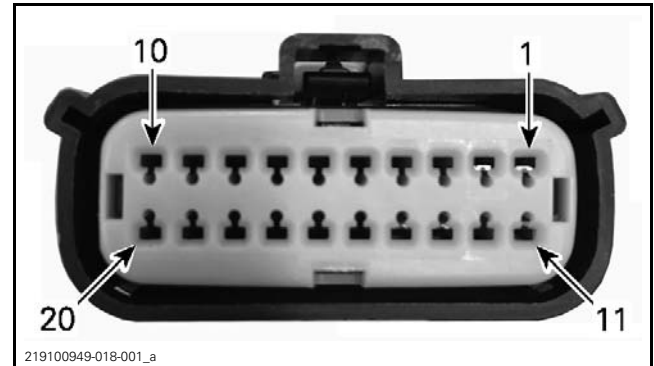
All indications will come and stay ON so that you can verify each indication.

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

Testing the Multifunction Gauge Power Input

If the multifunction gauge is inoperative, first check for fault codes with BRP Diagnostic Software, record all faults then erase them. Reactivate the electrical system and recheck for faults. If any fault code appears, perform service actions required. Refer to *COMMUNICATION TOOLS* subsection.

1. Remove multifunction gauge.
2. Perform the test at multifunction gauge connector as per following illustration and tables.



MULTIFUNCTION GAUGE CONNECTOR (PIN-OUT)

MULTIFUNCTION GAUGE POWER TEST			
CL_A CONNECTOR	BATTERY	IGNITION POSITION	RESULTS
Multifunction connector pin 1	Negative (-) post	Any	Close to battery voltage
Multifunction connector pin 11		ON	Close to battery voltage

If there is no power at pin 1, check fuse F4 and the related circuit.

If there is no power at pin 11, in check fuse F2 and the related circuit.

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

Testing the Multifunction Gauge Ground Circuit

Test as per the following table.

MULTIFUNCTION GAUGE GROUND TEST		
CL CONNECTOR	BATTERY	RESULT
Pin 2	Negative (-) post	Close to 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 MULTIFUNCTION GAUGE CAN WIRE CIRCUIT*.

Testing the Multifunction Gauge 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.

Subsection XX (GAUGE 7.2" DIGITAL DISPLAY)

MULTIFUNCTION GAUGE CAN WIRE TEST		
CL CONNECTOR	DLC	RESULTS
Pin 13 (CAN HI)	Pin 1	Close to 0.4 Ω
Pin 14 (CAN LO)	Pin 2	Close to 0.4 Ω

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

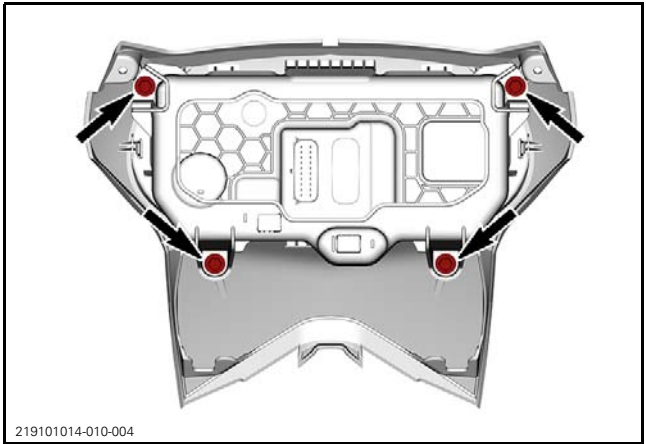
If the multifunction gauge functions, however there is a suspected communication problem with another component, perform this test between the multifunction gauge and that component.

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

Removing the Multifunction Gauge

Remove gauge support. Refer to procedure in *BODY* subsection

Disconnect the gauge connector. Remove following fasteners.



Installing the Multifunction Gauge

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

TIGHTENING TORQUE	
Multifunction gauge retaining screws	1 N•m ± 0.2 N•m (9 lbf•in ± 2 lbf•in)

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

When updates are completed, change settings as per customer preferences (language and units) as described in *SETTING LANGUAGE AND UNITS OF MEASUREMENT* in this subsection.

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
 - CONFIGURATION - Change Cluster Language and Units

ACCESSORIES

GENERAL

On multifunction analog/digital gauge, heated grips and heated throttle lever output are OFF when idling.

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

WARNING

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

SYSTEM TESTING

Connect vehicle to BUDS2 in order to provide electrical power to the vehicle. Refer to *COMMUNICATION TOOL AND B.U.D.S.*

SYSTEM DESCRIPTION (HEATED THROTTLE LEVER)



Power to the heated throttle lever is controlled through the gauge.

A three position switch allows the selection various heat levels, which are displayed in the gauge.

The switch selection sends a signal to the gauge to increase or decrease heat.



mmr2017-038-002

HEATER SWITCH

The gauge then applies the appropriate amount of current to the heater according to the selection.

To turn OFF the heaters, select heat down until there is no more indication on the bar graph.

When released, the 3 position switch springs back to the center neutral position.

SYSTEM DESCRIPTION (HEATED HANDLEBAR GRIPS)



The grip heat is controlled through the gauge.

A three position switch allows the selection of various heat levels, which are displayed in the gauge.



mmr2017-038-006

HEATER SWITCH - MODELS WITH MULTIFUNCTION SWITCH

NOTE: The heating intensity is displayed via the gauge with the activation of the heated grips switch.

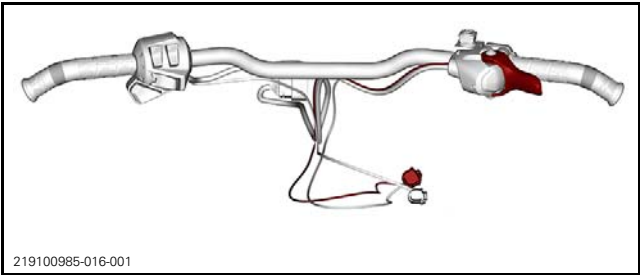
The gauge then applies the appropriate amount of current to the heater according to the selection.

To turn OFF the heaters, select heat down until there is no more indication on the bar graph.

When released, the switch springs back to the center neutral position.

PROCEDURES

HEATED THROTTLE LEVER



Testing Heated Throttle Lever Switch with BUDS2

Heating elements are permanently connected to ground. Positive voltages are supplied by gauges.

- 1. Provide electrical power to the gauge for testing.
- 2. Using BUDS2, select the **Measurements** page.
- 3. Alternately increase or decrease heat using heated throttle lever switch.
- 4. Look for the applicable value to change to confirm the gauge receives the signal.

If test is good, refer to *TESTING GAUGE HEATED THROTTLE LEVER POWER OUTPUT* in this subsection.

If test failed, refer to *TESTING THROTTLE LEVER HEAT SWITCH* in this subsection.

Testing Gauge Heated Throttle Lever Power Output

- 1. Provide electrical power to the gauge for testing.
- 2. Using BUDS2, select the **Functions** page..
- 3. In BUDS2, turn on the heated throttle grip.
- 4. Touch throttle lever to confirm it heats up.
- 5. Backprobe gauge no. **MG** connector as per following table.

MODELS WITH ANALOG/DIGITAL GAUGE	
TERMINAL	SPECIFICATION
MG-4	12 Vdc

- 6. If test is good, the gauge output to throttle lever heater is good. Proceed with *TESTING THROTTLE LEVER HEATING ELEMENT* in this subsection.
- 7. If the test failed, replace the gauge.

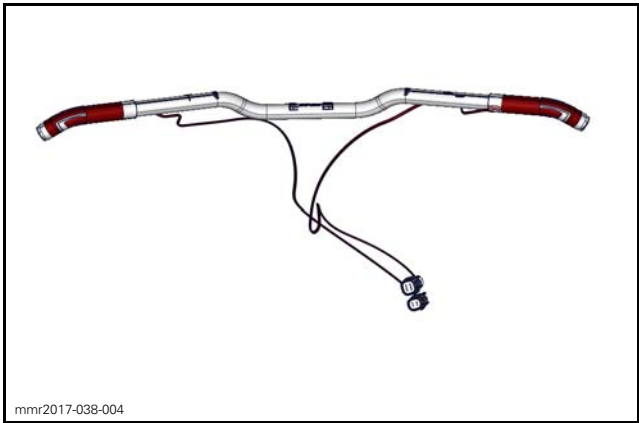
Testing Throttle Lever Heating Element

Refer to *WIRING HARNESS AND CONNECTORS* subsection for connector location.

STR 6P CONNECTOR		RESISTANCE @ 20°C (68°F)
STR 6P-5	STR 6P-2	1.73 - 4.22 Ω

- 1. If readings are out of specifications, replace throttle lever.
- 2. If heating element readings are within specifications, check wiring and connections to gauge.
- 3. Reconnect connectors.

HEATED HANDLEBAR GRIPS



Testing Handlebar Heated Grip Switch with BUDS2

Heating elements are permanently connected to ground. Positive voltages are supplied by gauges.

- 1. Provide electrical power to the gauge for testing.
- 2. Using the BUDS2, navigate to the **Measurements** page.
- 3. Press on the vehicle handle grip heat switch to alternately increase or decrease heat.
- 4. In BUDS2, look for the applicable to change.

If test is good, proceed with *TESTING GAUGE HEATER GRIPS POWER OUTPUT WITH BUDS2* in this subsection.

If test failed, proceed with *TESTING HANDLEBAR GRIP HEAT SWITCH* in this subsection.

Testing Gauge Heater Grips Power Output with BUDS2

- 1. Provide electrical power to the gauge for testing.

- Using the BUDS2, navigate to the **Functions** page.
- In BUDS2, turn the heated grips on.

MODELS WITH ANALOG/DIGITAL GAUGE	
TERMINAL	SPECIFICATION
MG-5	12 Vdc

- If test is good, the gauge heater to handlebar grip heater is good. Proceed with *TESTING HANDLEBAR GRIP HEATING ELEMENT* in this subsection.
- If the test failed, replace the gauge.

Testing Handlebar Grip Heating Element

If you cannot feel the temperature increase of a hand grip heating element, carry out the following steps.

- Disconnect heated grip connector.
- Test heating elements on either side as per following specifications.

Refer to *WIRING HARNESS AND CONNECTORS* subsection for connector location.

RIGHT HEATED GRIP		RESISTANCE @ 20°C (68°F)
STR 6P-4	STR 6P-1	5.3 - 6.6 Ω
LEFT HEATED GRIP		RESISTANCE @ 20°C (68°F)
STR 4P-3	STR 4P-1	5.3 - 6.6 Ω

- If readings are out of specifications, replace applicable handle grip heating element.
- If heating element readings are within specifications, check wiring and connections.
- Reconnect connectors.

Removing Heater Element

NOTICE Heater wire routing may vary significantly due to different type handlebars and vehicles. Its highly important to take note of exact positioning of grip heaters, locking ties, and wire routing before removing them from the handlebars. Failure to properly route wires may lead to equipment damage or failure.

- Disconnect the connector, Refer to *WIRING DIAGRAM AND CONNECTORS* subsection for connector location.

1.1 STR 4P for left hand handlebar heater

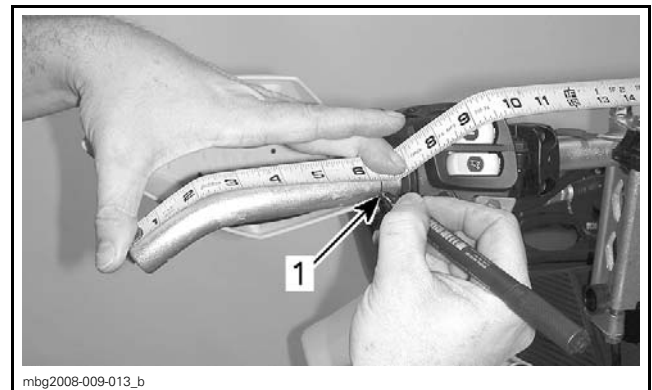
1.2 STR 6P for right hand handlebar heater

Use procedures for *MOLEX* connectors in the *WIRING DIAGRAM AND CONNECTORS* subsection.

- Cut locking ties securing heater wires to handlebars.
- Pull wires from harness protective sheath, multifunction switch housing or throttle lever housing.
- Cut and remove black electrical tape from heater element and remove heater from cork insulator.
- If damaged, remove cork insulator from handlebar and clean all adhesive residue from the handlebar.

Installing Heated Grips Heater Element

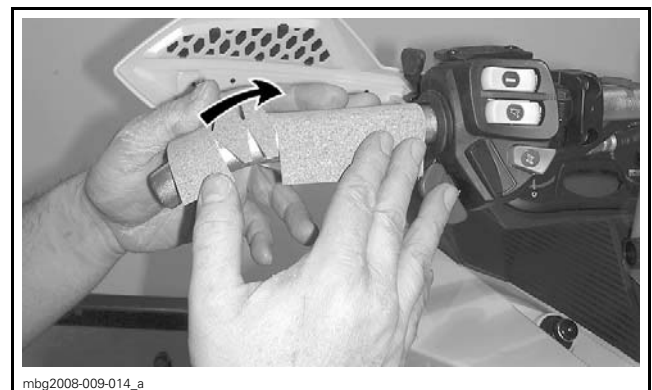
- Measure 159 mm (6.25 in) from the end of the handlebar, and across the top of the bend in the bar. Trace a reference line with a marker at that point on the handlebar.



TYPICAL — MEASURING FOR HEATER POSITION

1. Trace reference line

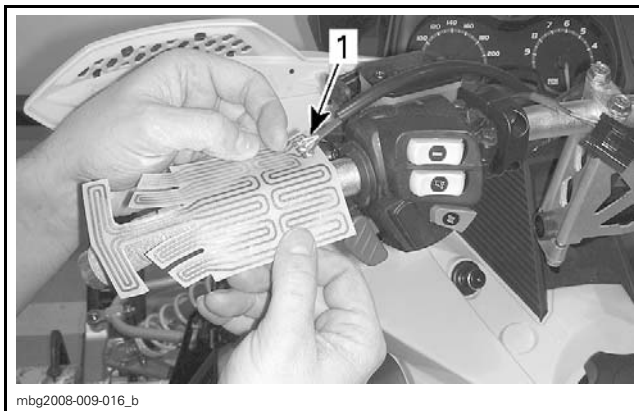
- Align the edge of the cork insulator with the reference line centered with the handlebar folding axis as illustrated.



TYPICAL — CORK INSULATOR ALIGNMENT

Subsection XX (ACCESSORIES)

3. Apply firm pressure to cork insulator to assure proper adherence to handlebar.
4. Align the film heater element with the cork insulator and center of handlebar folding axis as illustrated.



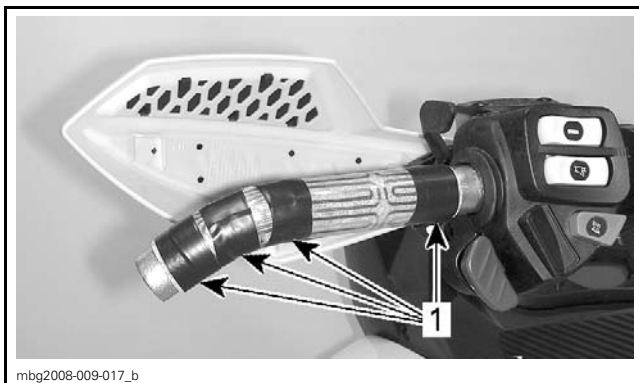
TYPICAL — HEATER ALIGNMENT

1. Heater wire position (LH front, RH rear)

5. Apply firm pressure to heater to assure proper adherence to cork insulator.

NOTE: The same heater element is used for both the LH and RH sides. Therefore, the electrical wiring will be in front of the handlebar on the LH side, and behind the handlebar (towards driver) on the RH side.

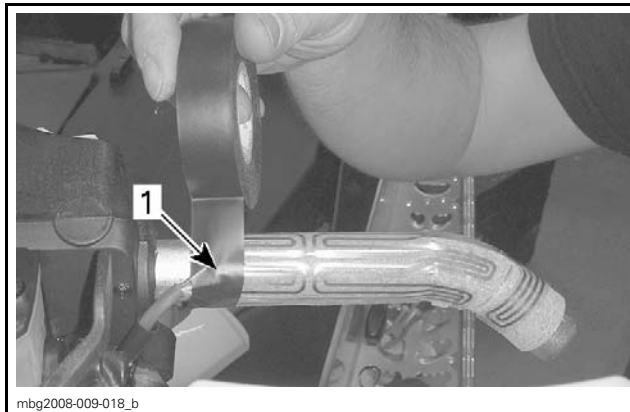
6. Apply two turns of black electrical tape at each of the four locations illustrated so that it covers the edges of the heater element and prevents snagging and damage to the element during rubber grip installation.



TYPICAL

1. Electrical tape application (4x)

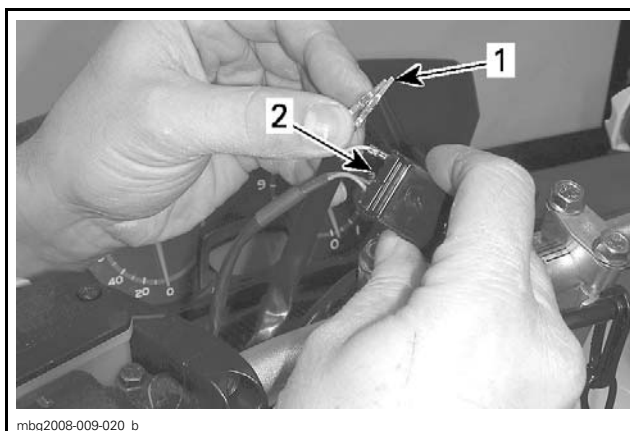
NOTE: It is highly important to apply tape so that it fully secures the electrical wire connections. This will ease installation of the rubber hand grip and prevent undue stress to the connections.



TYPICAL — IMPORTANT

1. Tape application over wire connections

7. Install rubber hand grip, refer to *STEERING SYSTEM* subsection for detail.
8. Route wiring as noted during the removal procedure.
9. Insert wire in housing, refer to *WIRING DIAGRAM* for wire color and pin number locations.



TYPICAL

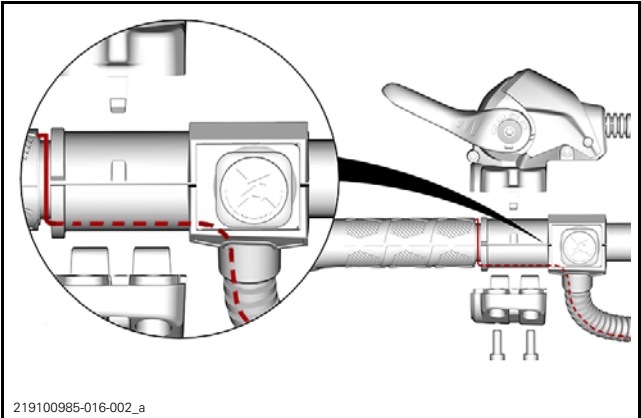
1. Heater wire terminals

2. Insertion through back of connector

10. Install locking ties to secure the heater wire as it was routed originally.

⚠ WARNING

To ensure RH heater wires does not prevent smooth operation of throttle lever, it must be passed straight through the emergency engine cut-off switch housing and routed in the corrugated sheave.



NOTICE Ensure LH heater wires are properly routed through multifunction switch housing to prevent them from being pinched when installing housing cover. Pinched or damaged wires may result in a short circuit.

11. Provide electrical power to the heaters for testing.
12. Using the hand grip heat switch, turn on the hand grip heaters and ensure they are functioning correctly.

TESTING THROTTLE LEVER HEAT SWITCH

NOTE: On models with the compact digital gauge, there is only one switch that controls both the heated grips and heated throttle lever.

1. Using a multimeter, select the Ω position.
2. Test throttle lever heat switch and circuits as per table.



THROTTLE LEVER HEAT SWITCH TEST			
SWITCH SELECTION	TERMINAL		RESISTANCE
UP	SH-1	SH-9	Close to 0 Ω
	SH-1	SH-3	Infinite (OL)
DOWN	SH-1	SH-9	Infinite (OL)
	SH-1	SH-3	Close to 0 Ω

If continuity test is as per specification, check wiring to gauge connector.

If continuity test is out of specification, check switch circuit as per wiring diagram. If good, replace switch.

TESTING HANDLEBAR HEATED GRIP SWITCH

NOTE: On models with the compact digital gauge, there is only one switch that controls both the heated grips and heated throttle lever.

1. Test throttle lever heat switch and circuits as per table.



HEATED GRIP HEAT SWITCH TEST			
SWITCH SELECTION	TERMINAL		RESISTANCE
UP	SH-1	SH-10	Close to 0 Ω
	SH-1	SH-4	Infinite (OL)
DOWN	SH-1	SH-10	Infinite (OL)
	SH-1	SH-4	Close to 0 Ω

If continuity test is as per specification, check wiring to gauge connector.

If continuity test is out of specification, check switch circuit as per wiring diagram. If good, replace switch.

HEATED SEATS AND PASSENGER HEATED GRIPS

Testing Heated Seats

Unplug connector and measure resistance as per following table.

Single Seat

HEATED SEAT CONNECTOR - PROBE		RESISTANCE (APPROXIMATELY) @ 20°C (68°F)
YE wire	BK wire	32 Ω
RD wire		17.5 Ω

Double Seat

HEATED SEAT CONNECTOR - PROBE		RESISTANCE (APPROXIMATELY) @ 20°C (68°F)
YE wire	BK wire	11 Ω
RD wire		11 Ω

If resistance is not as specified, replace heated seat.

If resistance is as specified, continue testing.

Start and idle engine.

NOTE: On some models, you may need to increase RPM to above 2000 RPM in order to power this secondary 12v circuit.

Measure voltage at the heated seat connector as indicated in following table.

HEATED SEAT SWITCH POSITION	HEATED SEAT CONNECTOR - PROBE		VOLTAGE (APPROXIMATELY)
High (single seat) Front + rear (double seat)	YE wire	BK wire	12Vdc
	RD wire		
Low (single seat) Rear only (double seat)	YE wire	BK wire	12Vdc
	RD wire		0Vdc

If voltage is not as indicated, test switch and/or wires from element to switch. Refer to *WIRING DIAGRAM*.

Testing Passenger Heated Grips (Left or Right)

Unplug connector and measure resistance as per following table.

PROBE		RESISTANCE (APPROXIMATELY) @ 20°C (68°F)
OG wire	BK wire	9.5 Ω
OG/VT wire	BK wire	19 Ω

If resistance is not as specified, replace heated grip.

If resistance is as specified, continue testing.

Start and idle engine.

NOTE: On some models, you may need to increase RPM to above 2000 RPM in order to power this secondary 12v circuit.

Measure voltage at the heated grip connector as indicated in following table.

HEATED GRIP SWITCH POSITION	PROBE		VOLTAGE (APPROXIMATELY)
High	OG wire	BK wire	12Vdc
	OG/VT wire		0Vdc
Low	OG wire	BK wire	0Vdc
	OG/VT wire		12Vdc

If voltage is not as indicated, test switch and/or wires from element to switch. Refer to *WIRING DIAGRAM*.

Testing Heated Seat and Grip Switches

Measure switch resistance as per following table.

SWITCH POSITION	PROBE		RESISTANCE
High	Pin 6	Pin 8	Close to 0 Ω
Off	Pin 6	Pin 8	O.L.
		Pin 5	O.L.
Low	Pin 6	Pin 5	Close to 0 Ω

If resistance is not as specified, replace switch.

If resistance is as specified, continue testing.

Start and idle engine.

NOTE: On some models, you may need to increase RPM to above 2000 RPM in order to power this secondary 12v circuit.

Measure voltage at the switch connector as indicated in following table.

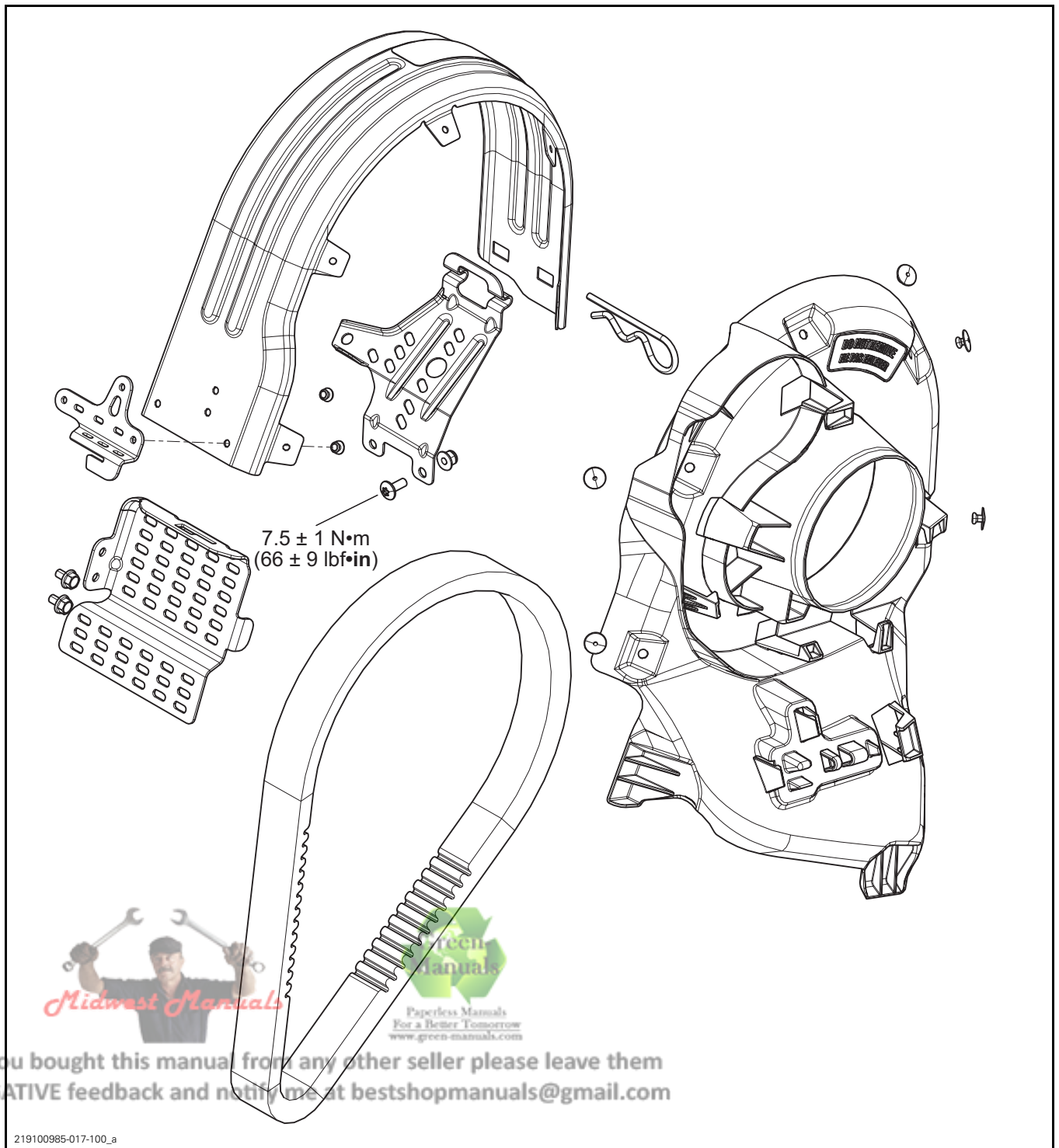
SWITCH POSITION	PROBE		VOLTAGE (APPROXIMATELY)
Any	Pin 6	Chassis ground	12Vdc

If voltage is not as indicated, test power distribution circuit to switch. Refer to *WIRING DIAGRAM*.

DRIVE BELT

SERVICE TOOLS

Description	Part Number	Page
TENSIOMETER.....	414 348 200	5



GENERAL

DRIVE BELT APPLICATION

Always use the drive belt specified in the BRP *PARTS CATALOG* as applicable to vehicle and engine model.

TROUBLESHOOTING

VEHICLE CREEPS FORWARD AT IDLE

1. Improper drive belt height (too high)
- Refer to *ADJUSTING THE DRIVE BELT HEIGHT* procedure in this subsection.

ENGINE STALLS WHEN ENGAGING RER

1. Improper drive belt height (too high)
- Refer to *ADJUSTING THE DRIVE BELT HEIGHT* procedure in this subsection.

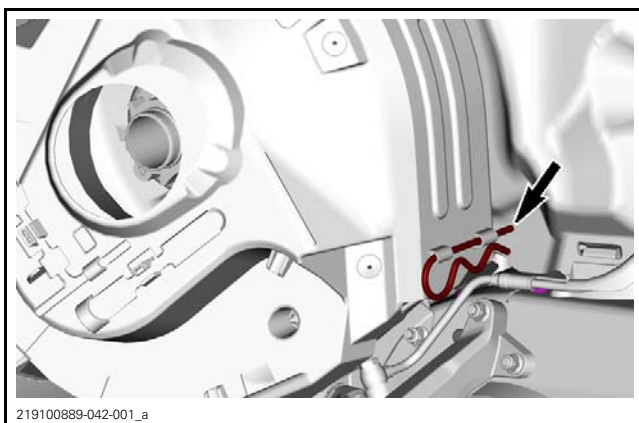
PROCEDURES

DRIVE BELT GUARD

NOTE: Belt guard is purposely made slightly over-size to maintain tension on its pins and retainers preventing undue noise and vibration.

Removing the Drive Belt Guard

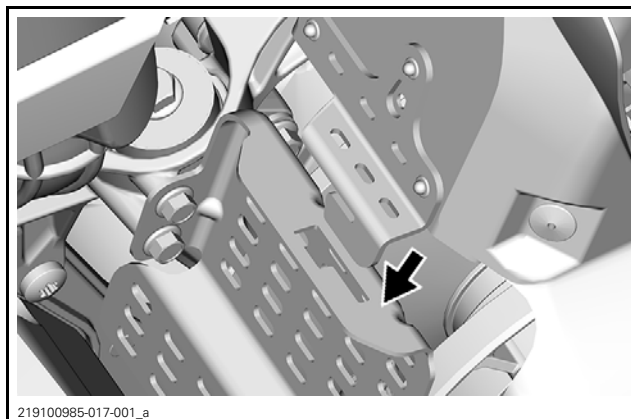
1. Remove LH side panel.
2. Remove retaining pin.



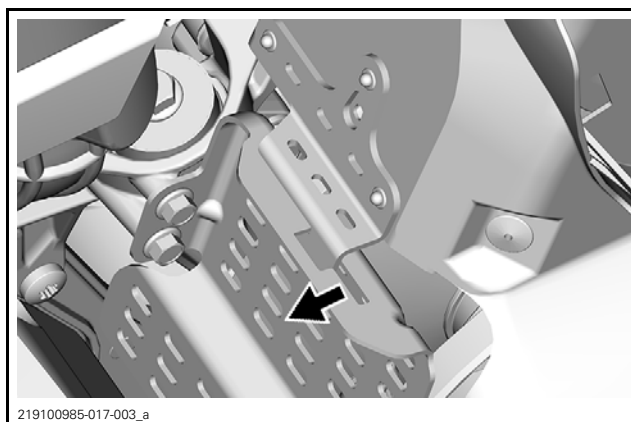
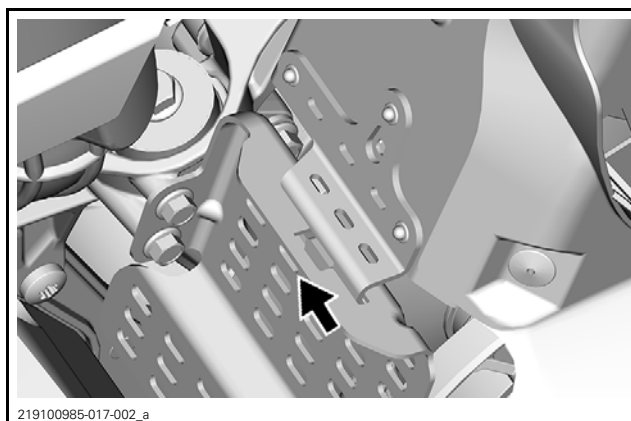
3. Lift rear portion of guard then release from front tabs.

Installing the Drive Belt Guard

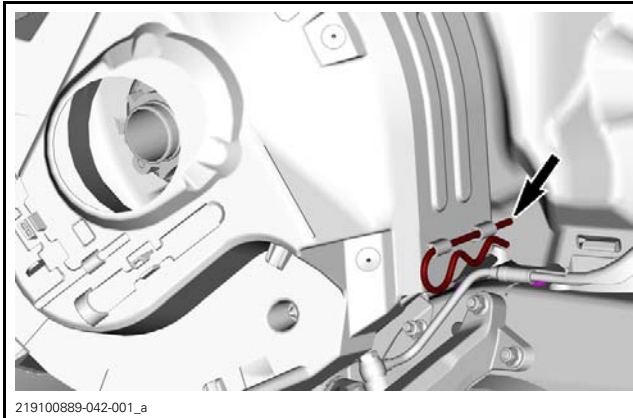
1. Insert belt guard tab in front support slot.



2. Push drive belt guard toward engine then toward front of vehicle.



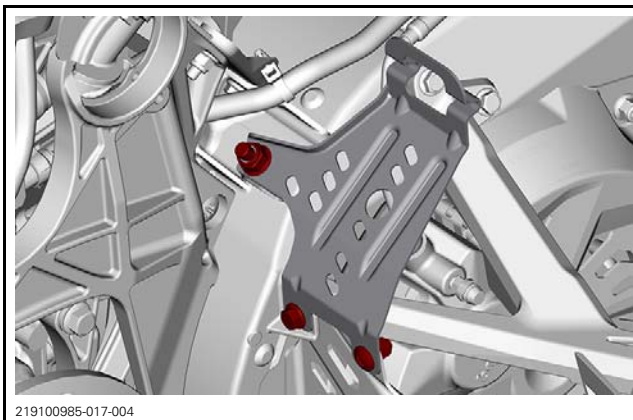
3. Position rear portion of the drive belt guard over the retainer and secure it using the retaining pin.



DRIVE BELT GUARD SUPPORT

Removing the Drive Belt Guard Support

1. Remove the drive belt guard.
2. Remove screws securing the support to vehicle.



Installing the Drive Belt Guard Support

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

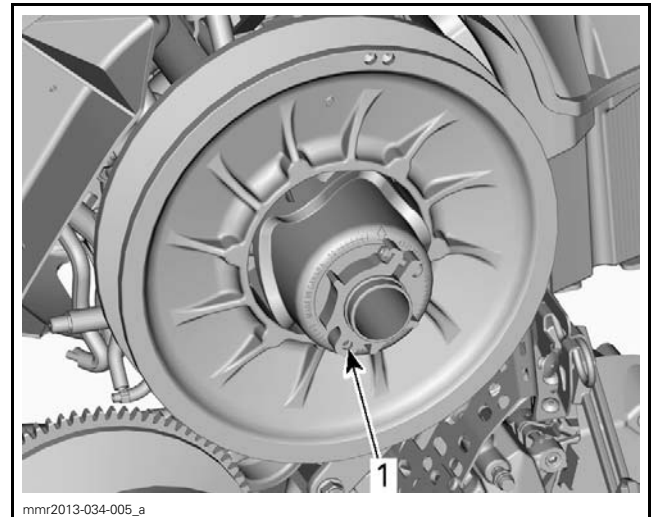
TIGHTENING TORQUE	
M6 Torx screw	7.5 N•m ± 1 N•m (66 lbf•in ± 9 lbf•in)
M6 Hexagonal flange Screw	10 N•m ± 2 N•m (89 lbf•in ± 18 lbf•in)
M8 Hexagonal flange nut	23.5 N•m ± 3.5 N•m (17 lbf•ft ± 3 lbf•ft)

DRIVE BELT

Removing the Drive Belt

1. Remove tether cord cap from engine cut-off switch.
2. Remove LH side panel.

3. Remove drive belt guard, refer to *REMOVING THE DRIVE BELT GUARD*.
4. Insert the driven pulley expander provided in the tool kit in the threaded hole on the adjuster hub as illustrated.



1. PULLEY expander to be installed here - on Adjuster hub

5. Open the driven pulley by screwing the tool in.
6. Remove the belt by slipping it over the top of the driven pulley, then out of the drive pulley.

Inspecting the Drive Belt

Inspect belt for:

- Cracks
- Fraying
- Abnormal wear (uneven wear, wear on one side, missing cogs, torn fabric).

If abnormal wear is noted, the probable cause could be:

- Pulley misalignment
- Excessive RPM with frozen track
- Fast starts without warm-up period
- Scratched or rusty sheave
- Oil on belt
- Distorted spare belt.

Check drive belt width. Replace the drive belt if its width is under minimum recommended specification.

DRIVE BELT WIDTH	
NEW	WEAR LIMIT
38.3 mm (1.508 in)	35.9 mm (1.413 in)

Installing the Drive Belt

- 1. If necessary, open the driven pulley, refer to *REMOVING THE DRIVE BELT*.
- 2. Insert drive belt in the drive pulley, then pull it over the driven pulley.

NOTICE Do not force or use tools to pry the belt into place, as this could cut or break the cords in the belt.

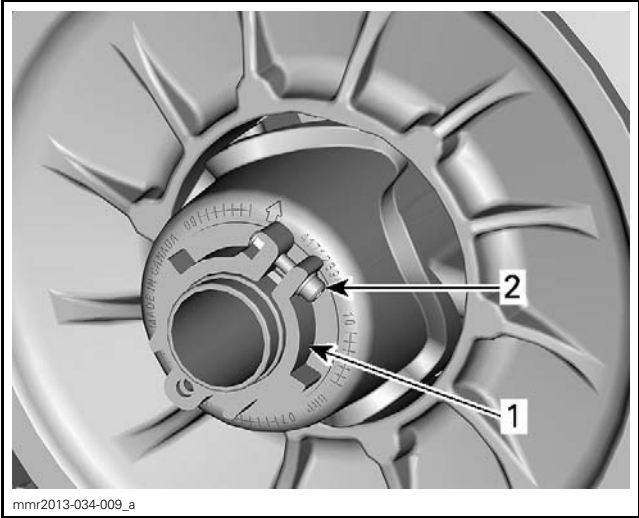
NOTE: The maximum drive belt life span is obtained when the belt is installed with the arrows on the belt pointing in the direction of rotation.



- 3. Unscrew and remove the driven pulley expander from the driven pulley.
- 4. Rotate the driven pulley several times to properly set the belt between the sheaves.
- 5. Adjust drive belt height. Refer to *ADJUSTING THE DRIVE BELT HEIGHT* procedure.
- 6. Install drive belt guard, refer to *INSTALLING THE DRIVE BELT GUARD*.
- 7. Install LH side panel.

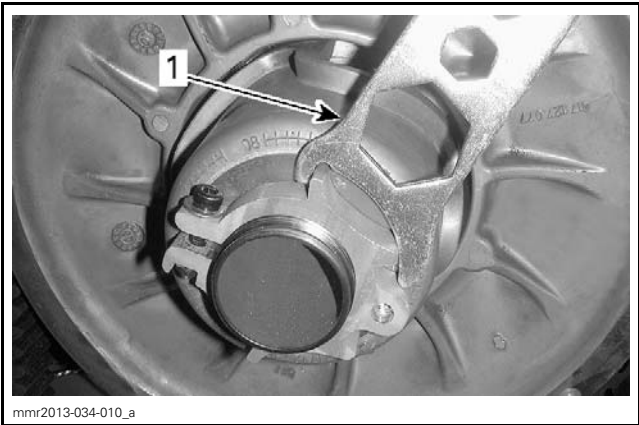
Adjusting the Drive Belt Height

- 1. Remove tether cord cap from engine cutout switch.
- 2. Remove LH side panel.
- 3. Remove drive belt guard, refer to *REMOVING THE DRIVE BELT GUARD*.
- 4. Loosen the clamping screw.



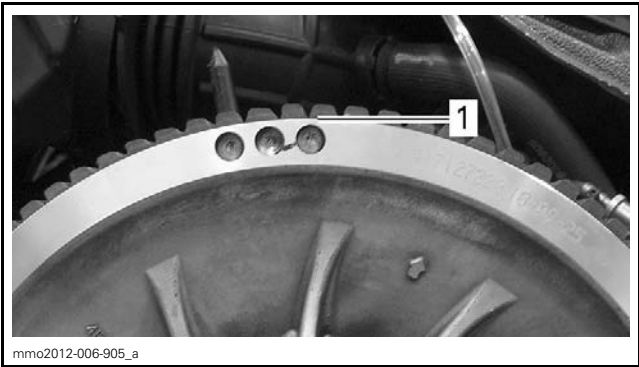
1. Adjustment ring
2. Clamping screw

- 5. Using the suspension adjustment tool provided in the tool kit, turn the adjustment ring 1/4 turn at a time then rotate the driven pulley to properly set the belt between the pulley sheaves.



1. Suspension adjustment tool

NOTE: The adjustment ring has left hand treads. Repeat step 5 until the lowest portion of the cogs on the external surface of drive belt is even with the driven pulley edge.



PRELIMINARY SETTING

- 1. Lowest portion of cogs even with external surface of drive belt

NOTE: Turning the adjustment ring counterclockwise lowers the belt in the pulley. Turning the ring clockwise raises the belt in the pulley.

6. Tighten the adjustment ring clamping screw.

TIGHTENING TORQUE	
Adjustment ring clamping screw	5.5 N•m ± 0.5 N•m (49 lbf•in ± 4 lbf•in)



1. Clamping screw

7. Install belt guard, refer to *INSTALLING THE DRIVE BELT GUARD*.

8. Install LH side panel.

9. Start engine and check if vehicle creeps.

9.1 If vehicle does not creep, adjustment is complete.

9.2 If vehicle creeps, check the drive belt deflection.

Reverse Activation

Reverse may not activate or may be harder to activate if the belt is positioned too high in the driven pulley. If reverse activation does not work properly, ensure the drive belt is properly adjusted.

Adjust the drive belt lower in the driven pulley if needed.

Verifying the Drive Belt Deflection

REQUIRED TOOL	
TENSIOMETER (P/N 414 348 200)	

1. Make sure drive belt height is adjusted (preliminary setting).

2. Position a reference rule on drive belt.

3. Use the tensiometer as explained below.

4. Set deflection as per following table using bottom O-ring.

DRIVE BELT DEFLECTION	
DRIVE BELT DEFLECTION SETTING	32 mm ± 5 mm (1.26 in ± .2 in)



DEFLECTION SETTING

1. Bottom O-ring

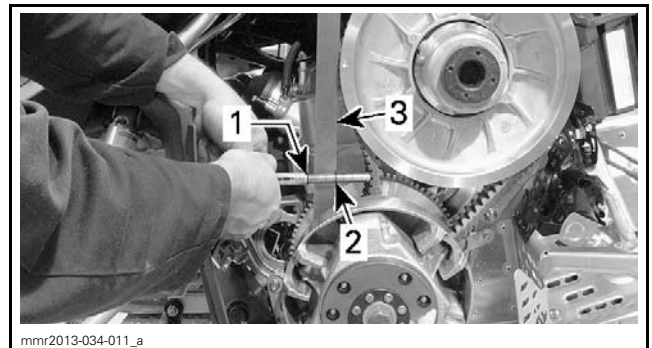
5. Place upper O-ring to 0 kgf (0 lbf).



LOAD READING

1. Upper O-ring

6. Apply pressure until bottom O-ring (deflection) is flush with edge of rule.



TYPICAL

1. Upper O-ring — load
2. Bottom O-ring — deflection
3. Reference rule

7. Read drive belt load. Compare result with the following table.

DRIVE BELT DEFLECTION	
DRIVE BELT LOAD READING	11.30 kgf (25 lbf)

8. If deflection is within specification, drive belt is properly adjusted.

Subsection XX (DRIVE BELT)

9. If deflection is out of specification, try the following:
 - Lower drive belt height from initial setting.
 - Try another drive belt.
10. If proper load still cannot be obtained, check the following:
 - Inspect engine supports.
 - Inspect countershaft and bearing.
 - Inspect chassis for damages.

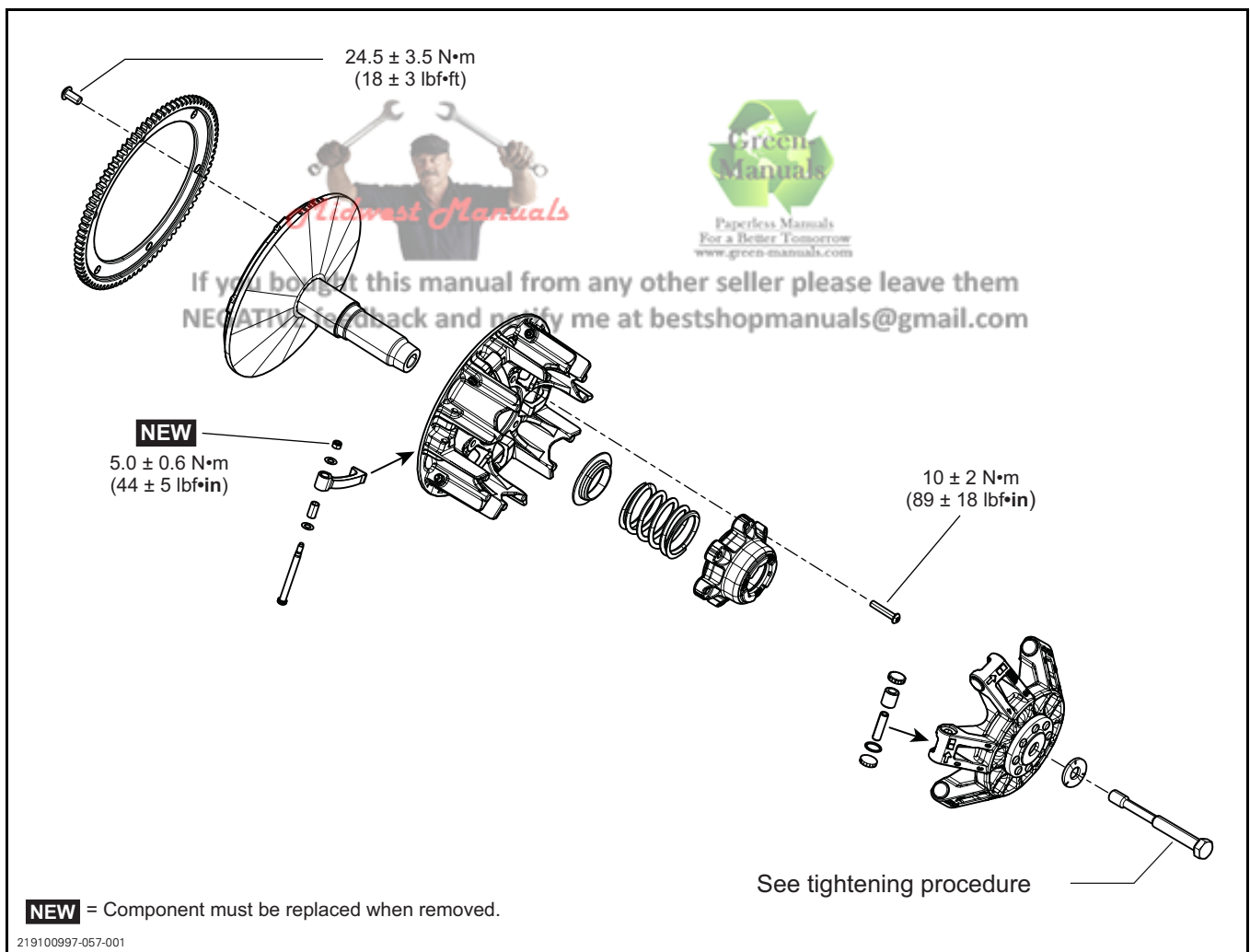
DRIVE PULLEY (eDRIVE II LC)

SERVICE TOOLS

Description	Part Number	Page
CLUTCH HOLDER.....	529 036 235	2, 10
DRIVE PULLEY PULLER	529 000 064	2
PULLEY SPRING COMPRESSOR TOOL.....	529 036 012	4

SERVICE PRODUCTS

Description	Part Number	Page
CLUTCH AND PULLEY FLANGE CLEANER PRO S1.....	779244	5



GENERAL

This drive pulley is lubrication free. Never lubricate any components.

Some drive pulley calibration components (spring, ramps) can be changed to adapt to different altitudes. Refer to appropriate Service Bulletin.

 **WARNING**

Any drive pulley repairs must be performed by an authorized Ski-Doo dealer. Subcomponent installation and assembly tolerances require strict adherence to procedures detailed.

 **WARNING**

The clutch assembly is a precisely balanced unit. Never replace parts with used parts from another clutch assembly.

TROUBLESHOOTING

ERRATIC DRIVE PULLEY PERFORMANCE

- 1. Damaged slider shoe O-ring.
- Install new O-rings, refer to *DRIVE PULLEY ASSEMBLY*.
- 2. Missing slider shoe O-ring.
- Install new O-rings, refer to *DRIVE PULLEY ASSEMBLY*.
- 3. Excessive wear on slider shoes.
- Inspect slider shoes, refer to *DRIVE PULLEY INSPECTION*.

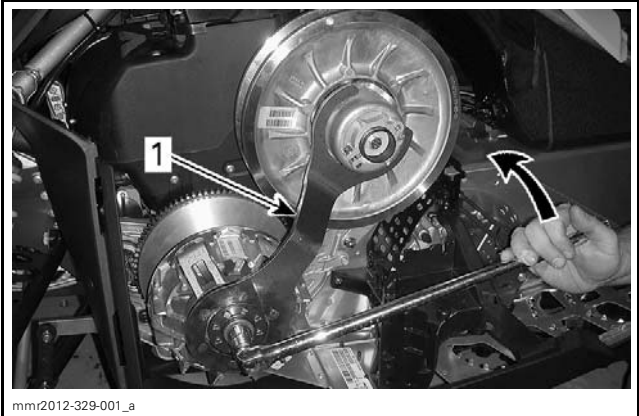
PROCEDURES

DRIVE PULLEY

Drive Pulley Removal

- 1. Remove drive belt. Refer to *DRIVE BELT* subsection.
- 2. Remove the drive pulley from engine as follows.
 - 2.1 Hold the drive pulley.

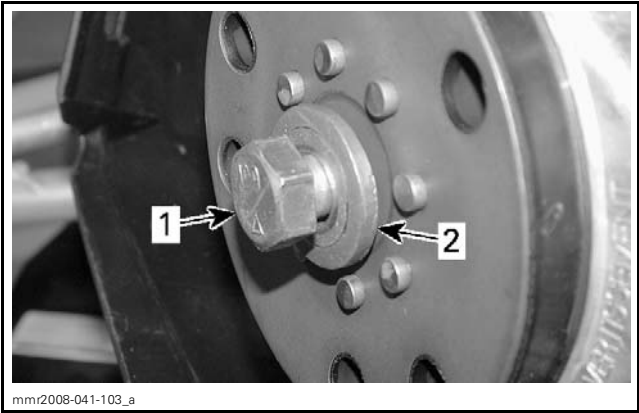
REQUIRED TOOL	
CLUTCH HOLDER (P/N 529 036 235)	



1. Clutch holder

- 2.2 Remove the drive pulley screw.

NOTICE Never use any type of impact wrench for drive pulley removal.



TYPICAL
1. Drive pulley retaining screw
2. Conical spring washer

- 2.3 Remove the drive pulley from crankshaft.

REQUIRED TOOL	
DRIVE PULLEY PULLER (P/N 529 000 064)	

NOTICE Always use the specified tool to avoid damaging crankshaft.

Drive Pulley Disassembly

Fixed Sheave Removal

- Separate fixed sheave from sliding sheave as follows:
- Screw puller into fixed sheave shaft (about 13 mm (1/2 in).
 - Hold drive pulley in your hand by the sliding sheave as illustrated.
 - Tap on puller head to disengage fixed sheave.

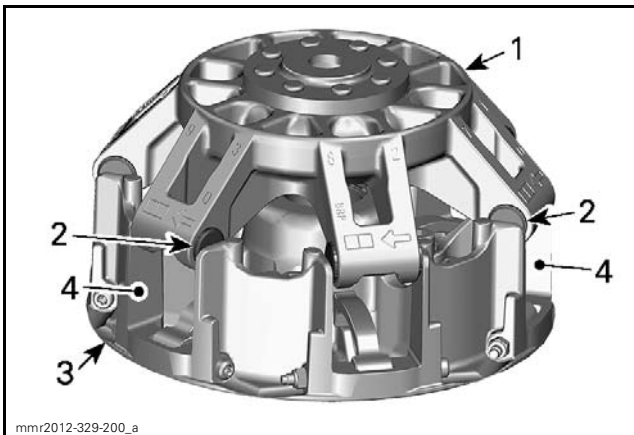


NOTE: If necessary, use a heat gun to slightly heat the governor cup to ease disassembly.

NOTICE Never use any type of torch to heat governor cup.

Governor Cup Removal

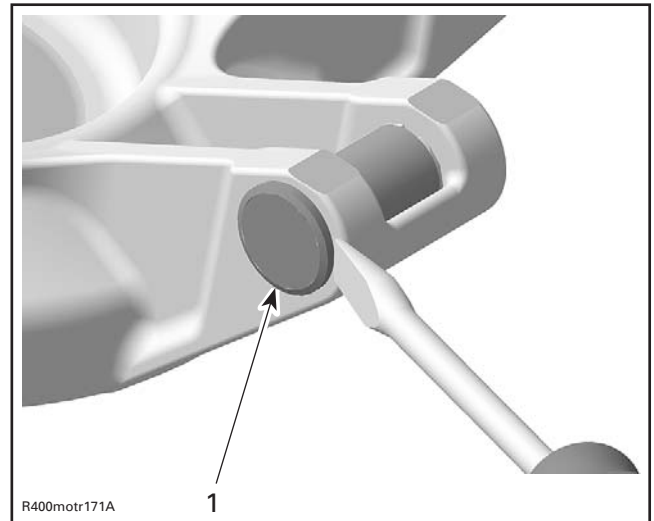
Carefully pull up on governor cup until the slider shoes are at their highest position in the guides.



1. Governor cup
2. Slider shoes
3. Sliding sheave
4. Guides

Slider Shoes and Roller Removal

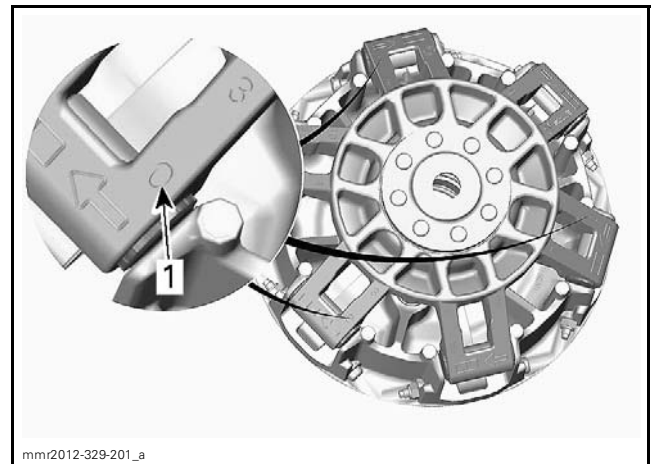
1. Remove slider shoes from governor cup using a flat screwdriver.



1. Slider shoe

2. Remove O-ring from slider shoes.

NOTE: The O-rings are positioned on the slider shoes identified by an O on the governor cup. (total of 3 slider shoes with O-rings).

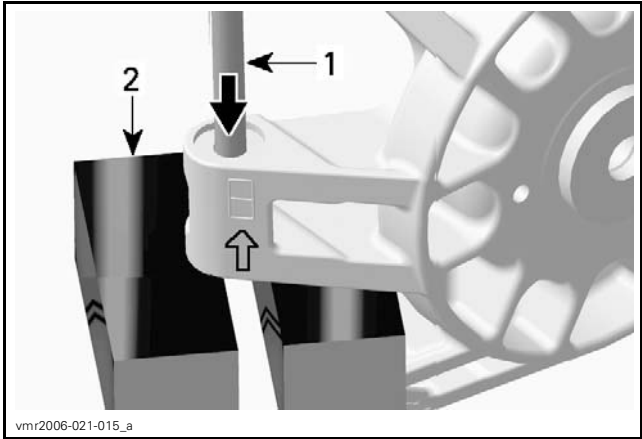


O-RING POSITION

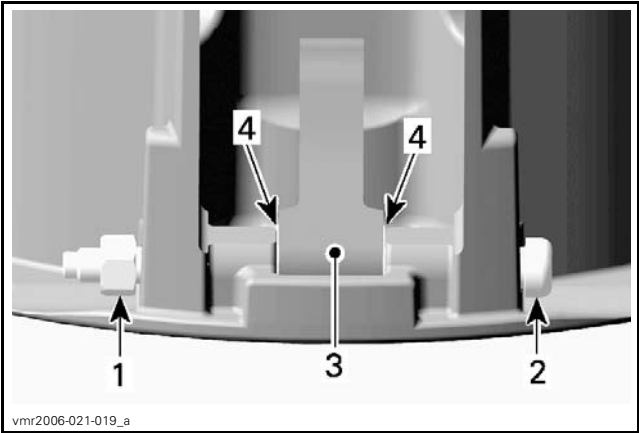
1. O on governor cup

3. Place governor cup on a vice using protection plates.

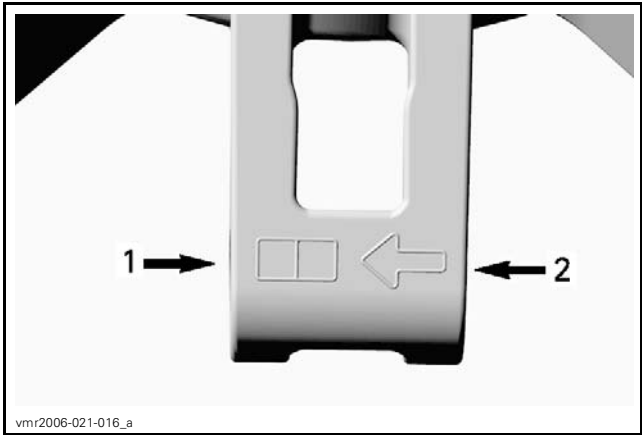
4. Remove bearing sleeve using a punch by pushing it towards the opposite direction of the arrow.



- 1. Punch
- 2. Vice



- 1. Lock nut
- 2. Centrifugal lever pivot bolt
- 3. Centrifugal lever
- 4. Thrust washers



- 1. Removal direction
- 2. Assembly direction

NOTICE Do not clamp governor cup in the vice to avoid damaging it.

Centrifugal Lever Removal

- 1. Unscrew lock nut and remove centrifugal lever pivot bolt.
- 2. Remove centrifugal lever and both thrust washers.

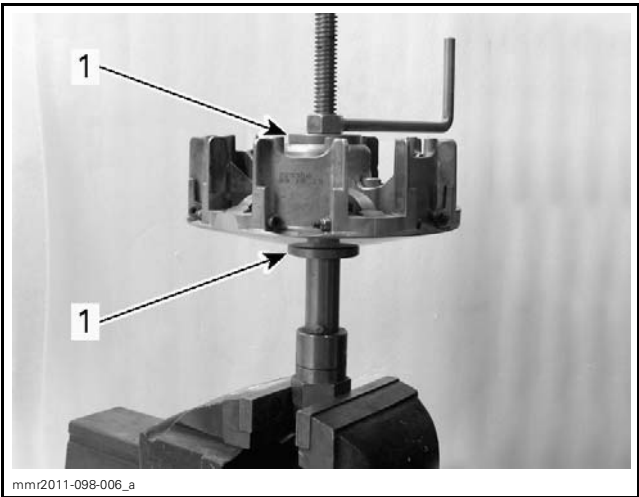
Spring Cover Removal

 **WARNING**

The spring cover is under high clutch spring preload. Never attempt to remove the spring cover without the recommended tool.

REQUIRED TOOL	
PULLEY SPRING COMPRESSOR TOOL (P/N 529 036 012)	

- 1. Install tool in a vice with the sliding sheave between the washers.



- 1. Washers
- 2. Remove retaining screws from spring cover.



1. Retaining screw

3. Unscrew tool to disengage spring cover from sliding sheave.

Drive Pulley Cleaning

NOTICE Always use the specified cleaning solvent and abrasive type to avoid damaging components.

Clean pulley faces and shaft using fine steel wool and dry cloth.

Clean the following components using a paper towel with CLUTCH AND PULLEY FLANGE CLEANER PRO S1 (P/N 779244).

- Crankshaft tapered end
- Crankshaft threads
- Fixed sheave shaft
- Inside the fixed sheave taper
- Drive pulley screw threads.

NOTICE Avoid contact between cleaner and crankshaft seal.

If additional cleaning is required on tapered surfaces, use a medium or coarse steel wool or a no. 600 sand paper.

Reclean tapered surfaces with paper towel and CLUTCH AND PULLEY FLANGE CLEANER PRO S1 (P/N 779244).

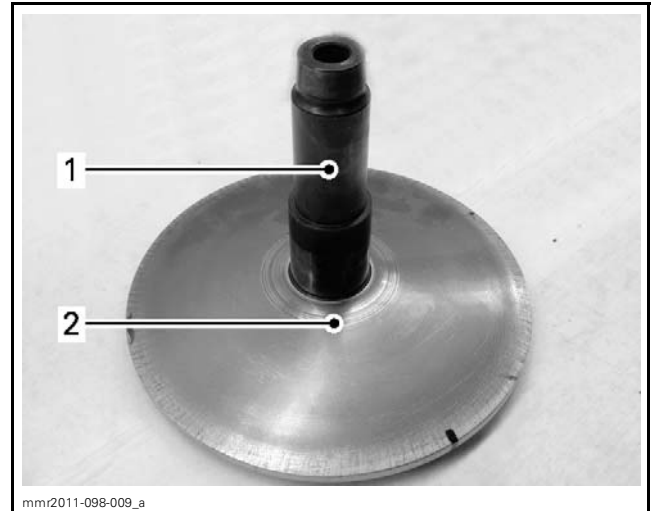
NOTICE Tapered surfaces must be free of any foreign particles.

Drive Pulley Inspection

NOTE: Unless otherwise noted, during inspection, replace any component found defective or out of specifications.

Fixed Sheave Inspection

Check fixed sheave shaft and surface for scratches or other damage.



1. Fixed sheave shaft
2. Fixed sheave surface

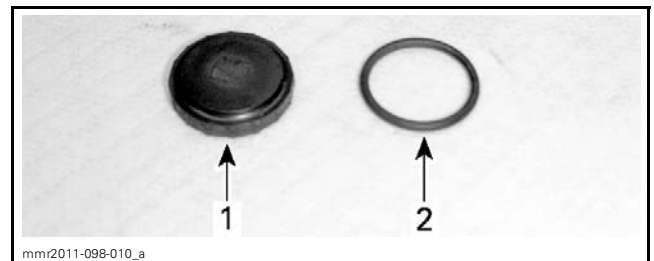
Governor Cup Inspection

Check governor cup for cracks or other visible damage.

Slider Shoes and Roller Inspection

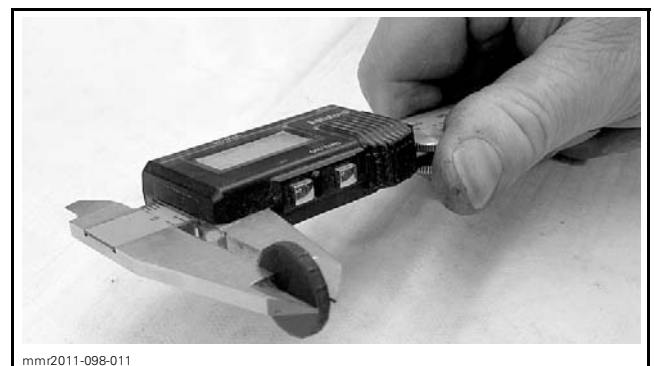
Check if O-rings of slider shoes are cracked, cut or crushed.

Check slider shoes for visible wear.



1. Slider shoe
2. O-ring

Measure the thickness of the slider shoes.



Subsection XX (DRIVE PULLEY (eDRIVE II LC))

NOTE: Take measurement at the center of slider shoe.

SLIDER SHOE SERVICE LIMIT	
With O-ring	3.70 mm (.146 in)
Without O-ring	3.80 mm (.15 in)

Check each roller for roundness of external diameter.

Check if rollers move freely.

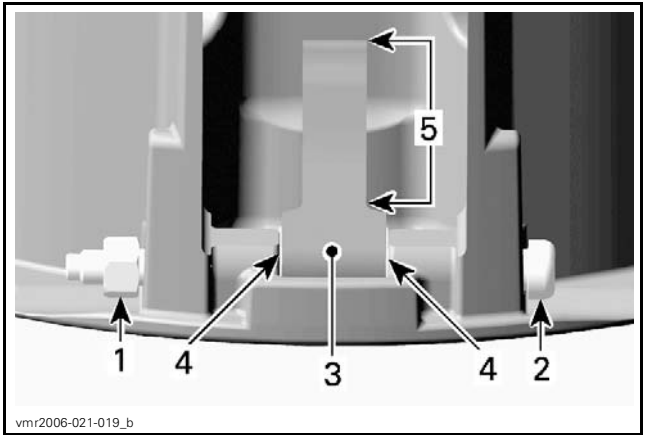
NOTICE Whenever replacing rollers and slider shoes, always replace all rollers and slider shoes at the same time.

Centrifugal Lever Inspection

Check contact surfaces of centrifugal lever for visible wear.

If major wear is visible, replace the following:

- Centrifugal levers
- Thrust washers
- Centrifugal lever pivot bolts
- Centrifugal lever pivot lock nuts.

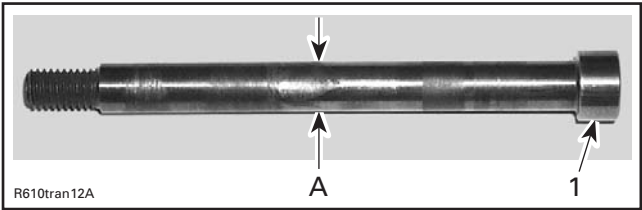


- 1. Lock nut
- 2. Centrifugal lever pivot bolt
- 3. Centrifugal lever
- 4. Thrust washers
- 5. Contact surface to the roller

**WARNING**

Whenever replacing centrifugal levers, always replace all levers at the same time. Otherwise, drive pulley imbalance will occur.

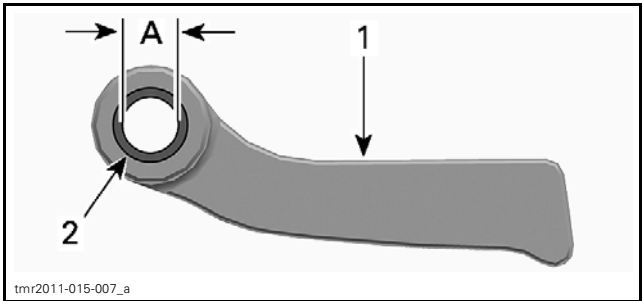
Measure diameter of centrifugal lever pivot bolt.



- 1. Centrifugal lever pivot bolt
- A. Measure diameter here

CENTRIFUGAL LEVER PIVOT BOLT	
SPECIFICATION	DIAMETER
NOMINAL	6.063 mm to 6.091 mm (.239 in to .24 in)
SERVICE LIMIT	6.00 mm (.236 in)

Measure diameter of centrifugal lever bushing.



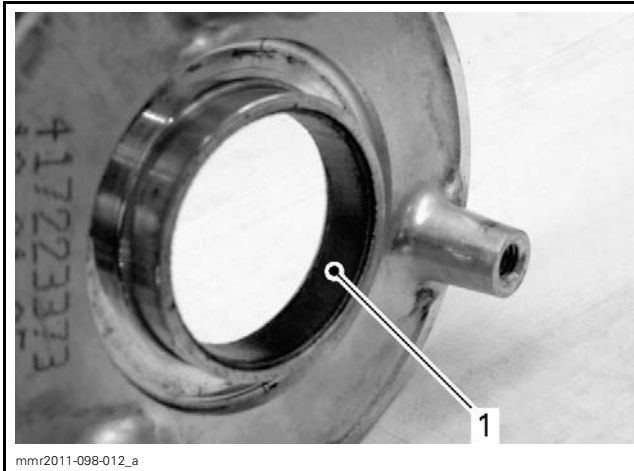
- 1. Centrifugal lever
- 2. Bushing
- A. Bushing inner diameter

CENTRIFUGAL LEVER BUSHING	
SPECIFICATION	INNER DIAMETER
NOMINAL	6.00 mm to 6.12 mm (.236 in to .241 in)
SERVICE LIMIT	6.200 mm (.244 in)

Spring Cover Inspection

Check spring cover for cracks or wear.

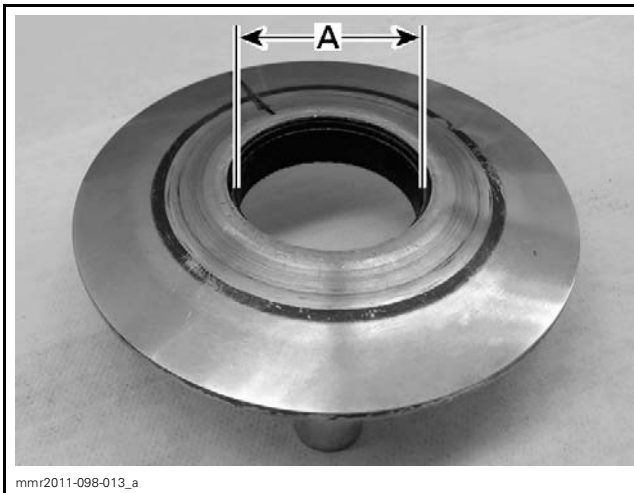
Check coating of spring cover bushing for wear.



1. Coating of spring cover bushing

Using a bore gauge, measure the inner diameter of spring cover bushing.

NOTE: Measuring point must be at least 6 mm (1/4 in) from bushing edge.



A. Inner diameter of spring cover bushing

SPRING COVER BUSHING	
SPECIFICATION	INNER DIAMETER
SERVICE LIMIT	38.37 mm (1.511 in)

If bushing is out of specification, replace spring cover.

Spring Inspection

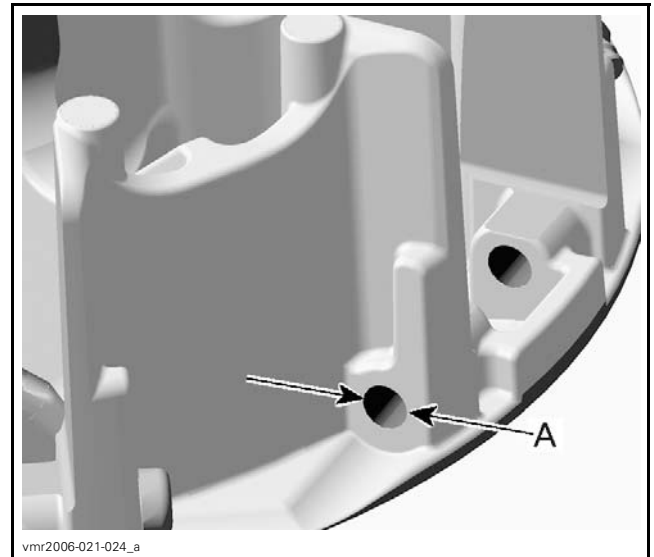
Check spring free length.

SPRING FREE LENGTH	
COLOR CODE	FREE LENGTH
RED/WHITE	115.0 mm (4.528 in)

Sliding Sheave Inspection

Check sliding sheave for cracks or other damage.

Check sliding contact surface for excessive wear. Measure centrifugal lever pivot bolt bores.

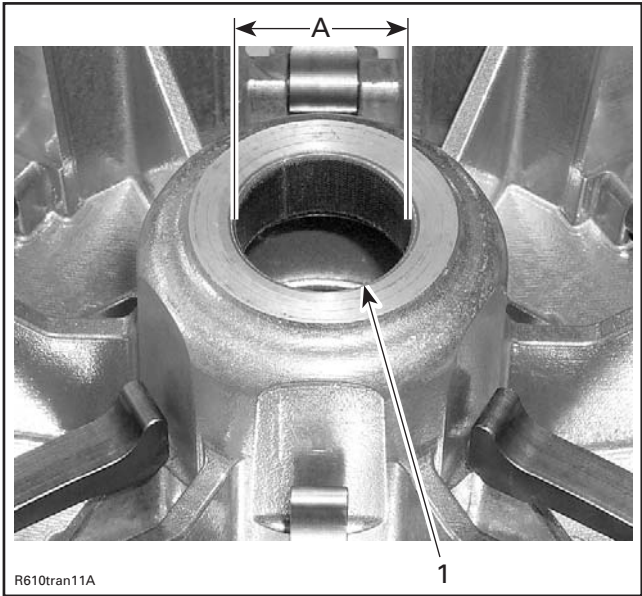


A. Centrifugal lever pivot bolt bore diameter

CENTRIFUGAL LEVER PIVOT BOLT	
SPECIFICATION	BORE DIAMETER
NOMINAL	6.113 mm to 6.171 mm (.241 in to .243 in)
SERVICE LIMIT	6.300 mm (.248 in)

Check coating of sliding sheave bushing for wear. Measure bushing diameter of sliding sheave.

NOTE: Use a dial bore gauge to measure bushing diameter. Measuring point must be at least 5 mm (1/4 in) from bushing edge.



TYPICAL
1. Sliding sheave bushing
A. Inner diameter of bushing

SLIDING SHEAVE BUSHING	
SPECIFICATION	INNER DIAMETER
NOMINAL	32.01 mm to 32.13 mm (1.26 in to 1.265 in)
SERVICE LIMIT	33.22 mm (1.308 in)

If bushing is out of specification, replace sliding sheave.

Drive Pulley Assembly

Spring Cover Installation

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

Tighten spring cover retaining screws to specification.

TIGHTENING TORQUE	
Spring cover retaining screws	10 N•m ± 2 N•m (89 lbf•in ± 18 lbf•in)

Centrifugal Lever Installation

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

Install centrifugal levers with both thrust washers.

NOTICE Centrifugal levers must move easily after installation.

Tighten centrifugal lever pivot nuts to specification.

TIGHTENING TORQUE	
Centrifugal lever pivot nut	5 N•m ± 0.6 N•m (44 lbf•in ± 5 lbf•in)

Slider Shoes and Roller Installation

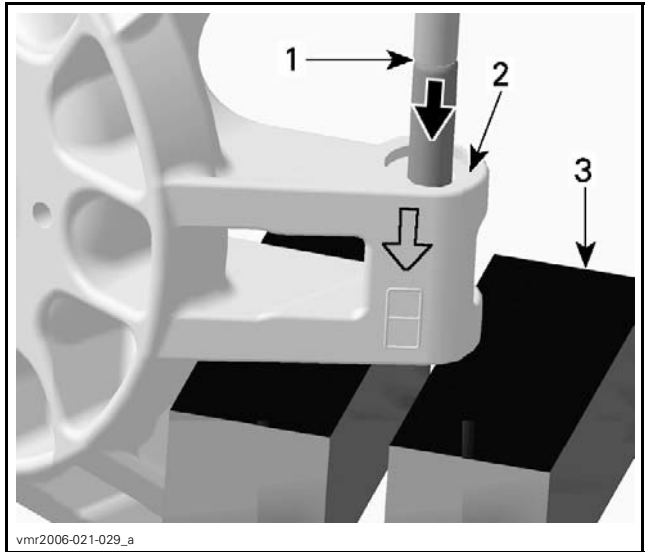
The installation is the reverse of removal procedure, however pay attention to the following.

Ensure that rollers move easily after installation.

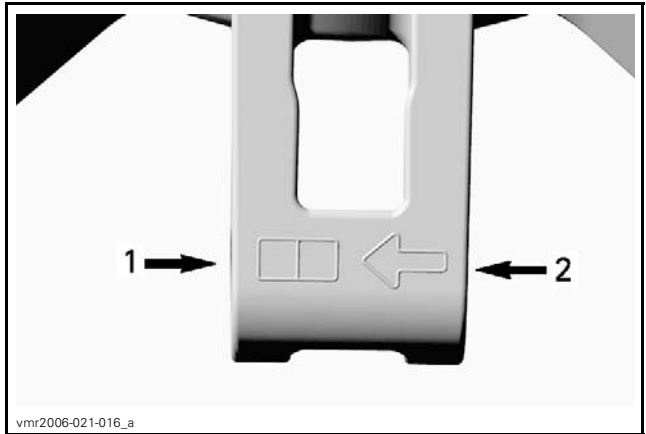
Install bearing sleeve by pushing it towards the same direction as the arrow.

Ensure the bearing sleeve is aligned with the contact surface of the slider shoes (no protrusion).

NOTICE Do not clamp governor cup in the vice to avoid to damaging it.

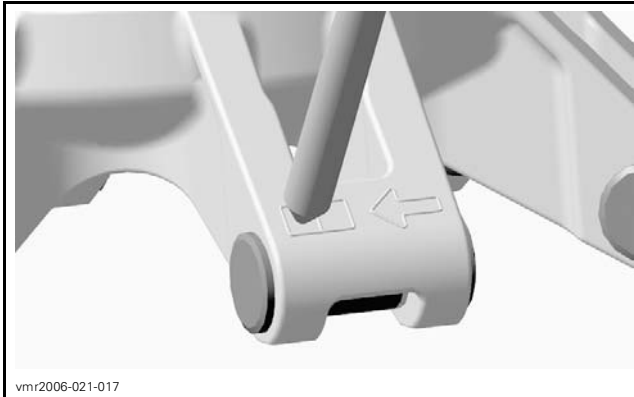


1. Top edge of bearing sleeve
2. Contact surface of slider shoes
3. Vice

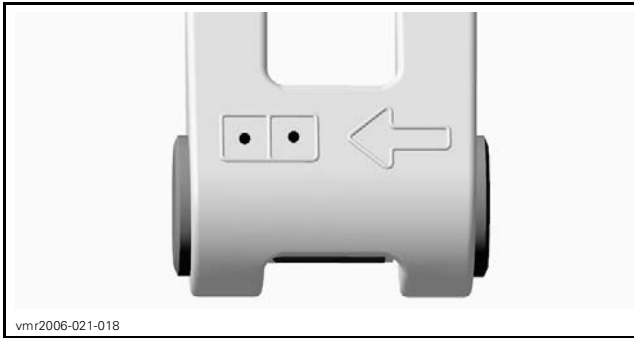


1. Removal direction
2. Assembly direction

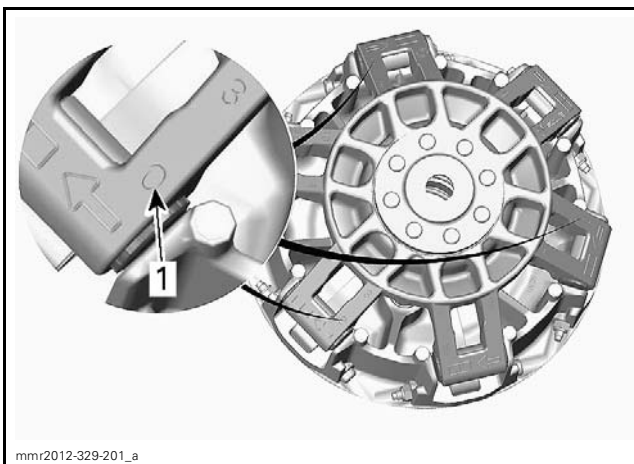
Carefully mark governor cup box using a punch.



NOTE: Never install a governor cup with two marks.



Install O-rings on slider shoes identified by an O on the governor cup. (total of 3 slider shoes with O-rings).



O-RING POSITION
1. O on governor cup

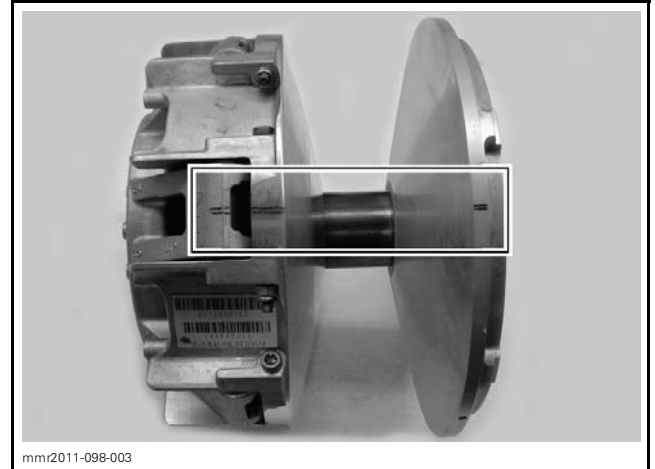
Governor Cup Installation

The installation is the reverse of removal procedure.

Fixed Sheave Assembly

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

Align fixed sheave, sliding sheave and governor cup together using the index marks (index marks have been traced at the factory).



Drive Pulley Installation

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

Clean mounting surfaces as described in *DRIVE PULLEY CLEANING* above.

NOTICE Do not apply antiseize or any lubricant on crankshaft and drive pulley tapers.

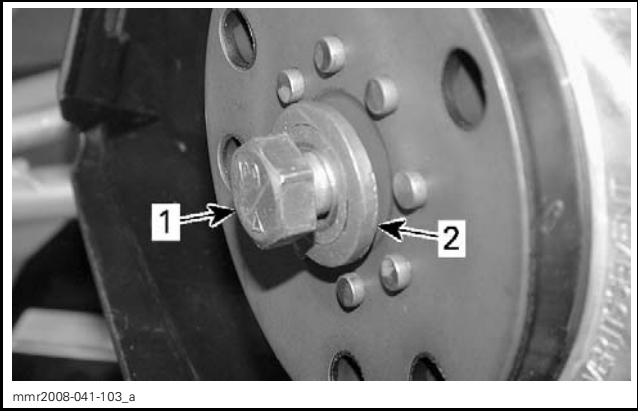
Install **NEW** conical spring washer with its concave side towards drive pulley.

Install drive pulley screw with a **NEW** conical spring washer.

NOTE: Spring washer concave side must be towards drive pulley.

NOTICE Always use BRP genuine parts for conical spring washer and screw.

Subsection XX (DRIVE PULLEY (eDRIVE II LC))



TYPICAL
1. Drive pulley screw
2. Conical spring washer

1. Tighten drive pulley retaining screw to specification.

NOTICE Never use any type of impact wrench for drive pulley installation.

REQUIRED TOOL	
CLUTCH HOLDER (P/N 529 036 235)	
DRIVE PULLEY FIRST TORQUE	
120 N•m (89 lbf•ft)	

2. Lift rear of vehicle and support it safely.

 **WARNING**

Ensure the track is free of particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure nobody is standing near the vehicle.

3. Start engine.
4. Release parking brake.
5. Accelerate vehicle at low speed (maximum 32 km/h (20 MPH)).
6. Apply brake.
7. Repeat the above sequence 5 times.
8. Stop engine.
9. Lower vehicle back on ground.
10. Retighten drive pulley retaining screw to specification.

REQUIRED TOOL	
CLUTCH HOLDER (P/N 529 036 235)	

DRIVE PULLEY FINAL TORQUE
120 N•m (89 lbf•ft)

 **WARNING**

After 10 hours of operation, the torque of the drive pulley retaining screw must be checked.

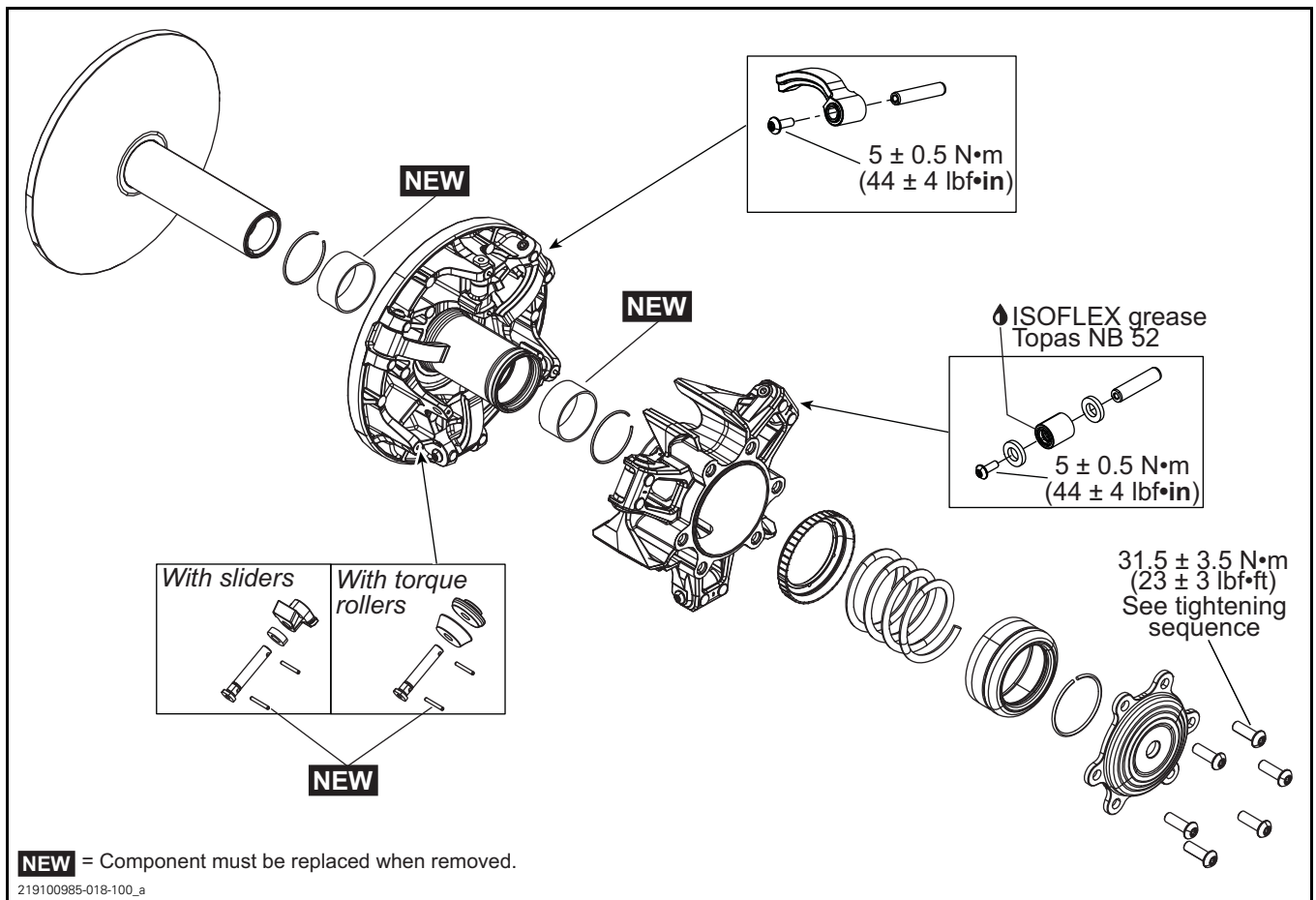
pDRIVE PULLEY

SERVICE TOOLS

Description	Part Number	Page
CIRCLIP INSTALLER/REMOVER	529 036 375	3
CLUTCH HOLDER	529 036 369	2, 12
DRIVE PULLEY OPENING TOOL	529 036 378	3
DRIVE PULLEY SUPPORT	529 036 371	3
GREASE INJECTOR	529 036 376	9
PDRIVE PULLER	529 036 370	2-3
PULLEY SPRING COMPRESSOR TOOL.....	529 036 373	3
REMOVING AXLE TOOL.....	529 036 372	3

SERVICE PRODUCTS

Description	Part Number	Page
CLUTCH AND PULLEY FLANGE CLEANER PRO S1	779244	8
ISOFLEX GREASE TOPAS NB 52	293 550 021	9



GENERAL

The pDrive pulleys are lubrication-free drive pulleys. Only the needle bearings inside the rollers need to be lubricated when replaced.

Always refer to appropriate *PARTS CATALOG* for replacement parts.

NOTICE Never use any type of impact wrench for drive pulley removal and installation. The use of impact wrench could damage the drive pulley and modify the calibration.

Some drive pulley components (like the spring and ramps) can be changed to improve vehicle performance in high altitude regions. A Service Bulletin provides information about calibration according to altitude.

NOTICE Such modifications should only be performed by experienced mechanics since they can greatly affect vehicle performance. Verify spring specifications before installation. Do not only refer to the spring color code.

⚠ WARNING

Any drive pulley repairs must be performed by an authorized Ski-Doo dealer. Subcomponent installation and assembly tolerances require strict adherence to procedures detailed.

During assembly/installation, use torque values as in the exploded view.

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

⚠ WARNING

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

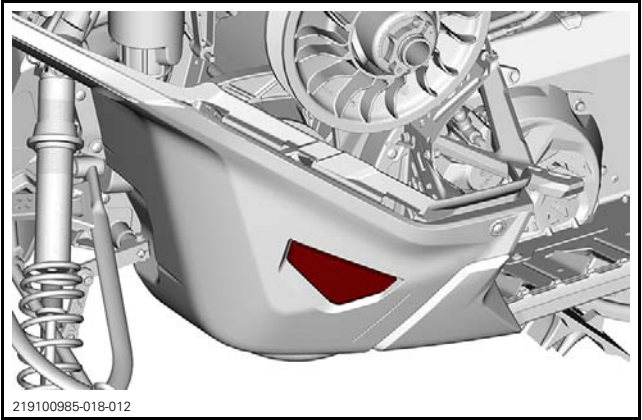
PROCEDURES

DRIVE PULLEY

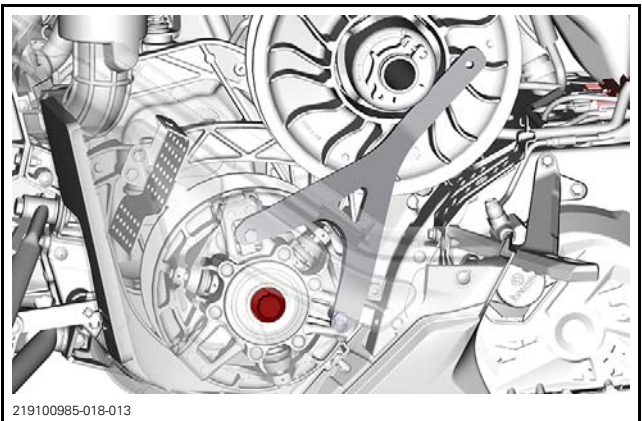
Removing the Drive Pulley

REQUIRED TOOLS	
CLUTCH HOLDER (P/N 529 036 369)	
PDRIVE PULLER (P/N 529 036 370)	

- 1. Remove drive belt. Refer to *DRIVE BELT* sub-section.
- 2. Remove the drive pulley screw access cap from the LH hull.



- 3. Remove the drive pulley bolt.
 - 3.1 Secure the drive pulley with the clutch holder.
 - 3.2 Using a breaker bar, remove the drive pulley bolt and its conical spring washer.



- 4. Remove the drive pulley from engine.
 - 4.1 Make sure the clutches holder is properly installed.

- 4.2 Screw the pDrive puller in place of the drive pulley bolt.
- 4.3 Tighten the pDrive puller until pulley is disengaged from the crankshaft end.

NOTICE These pulleys have metric threads. Do not use a puller with ANS (American National Standard) or IS (International Standard) type threads. Always tighten puller by hand to ensure that the drive pulley has the same type of threads (metric vs ANS or IS) prior to fully tightening.

Disassembling the Drive Pulley

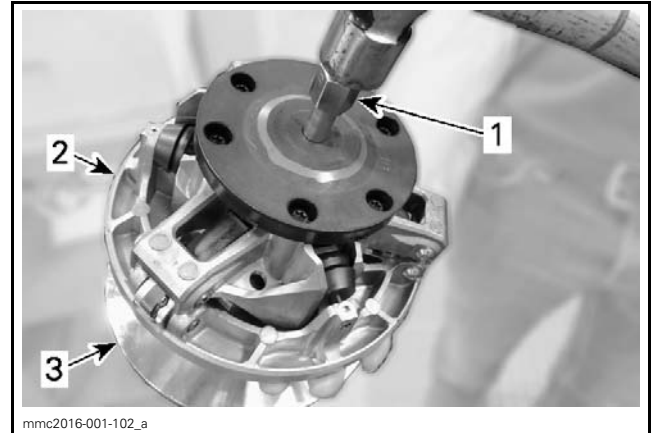
REQUIRED TOOLS	
PDRIVE PULLER (P/N 529 036 370)	
DRIVE PULLEY SUPPORT (P/N 529 036 371)	
PULLEY SPRING COMPRESSOR TOOL (P/N 529 036 373)	
CIRCLIP INSTALLER/REMOVER (P/N 529 036 375)	
REMOVING AXLE TOOL (P/N 529 036 372)	
DRIVE PULLEY OPENING TOOL (P/N 529 036 378)	

Separating Fixed and Sliding Sheaves

To separate fixed sheave from sliding sheave, screw puller into fixed sheave shaft about 13 mm (1/2 in).

Raise drive pulley and hold it by the sliding sheave while knocking on puller head to disengage fixed sheave.

NOTICE NEVER tap on spider.



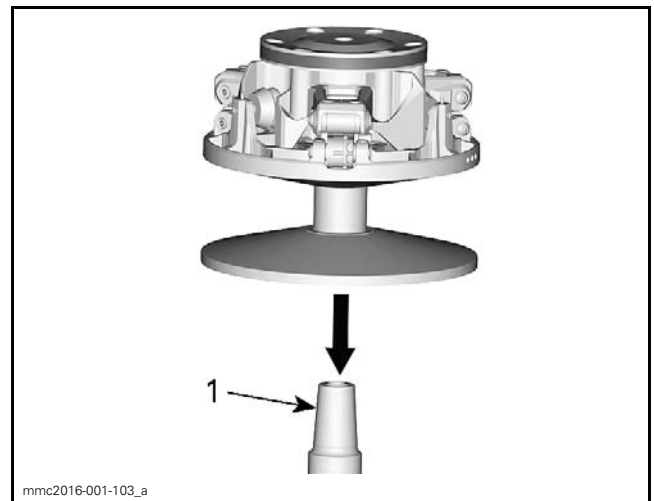
1. Puller screwed 13 mm (1/2 in) in fixed sheave
2. Sliding sheave
3. Fixed sheave

NOTE: No component marking is required before disassembly. This drive pulley features factory ap-posed index marks as references.

NOTICE Never use any type of torch to heat spider.

Removing the Damper

1. Secure the drive pulley support in a vice.
2. Install the drive pulley over the support.



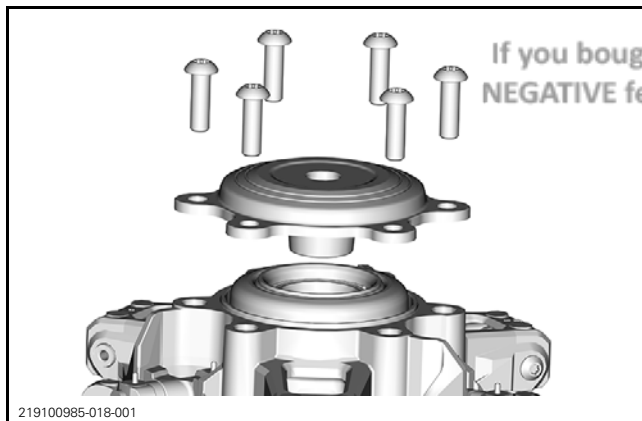
1. Drive pulley support

3. Remove the damper.

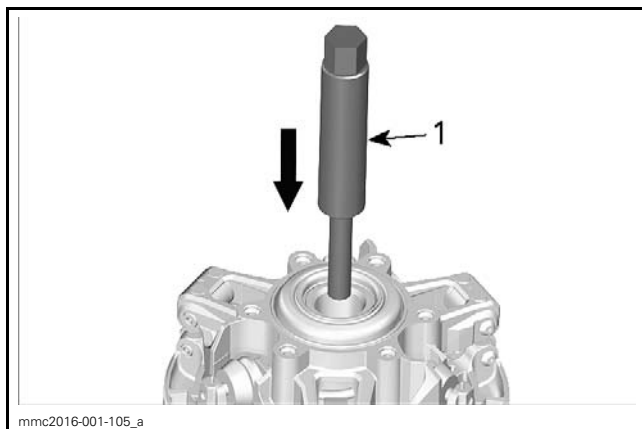


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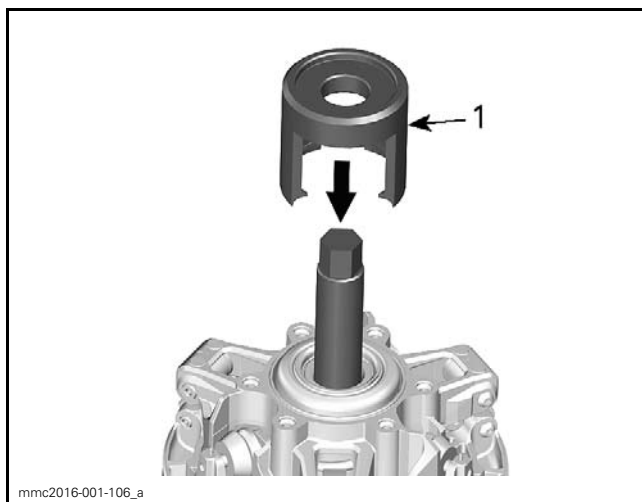
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NEGATIVE feedback and notify me at bestshopmanuals@gmail.com



Removing the Spring



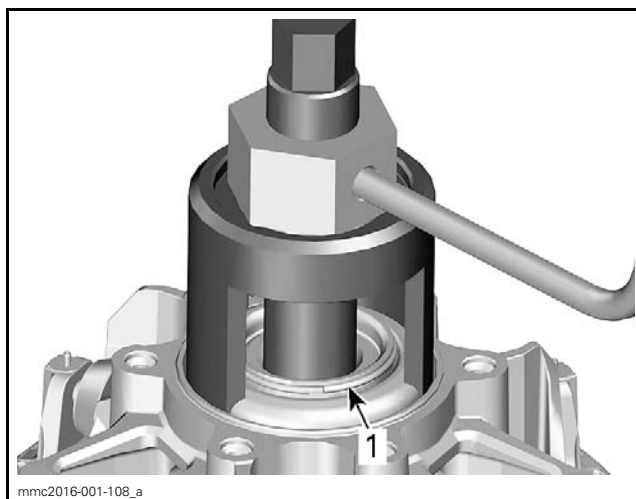
1. Threaded shaft of the pulley spring compressor



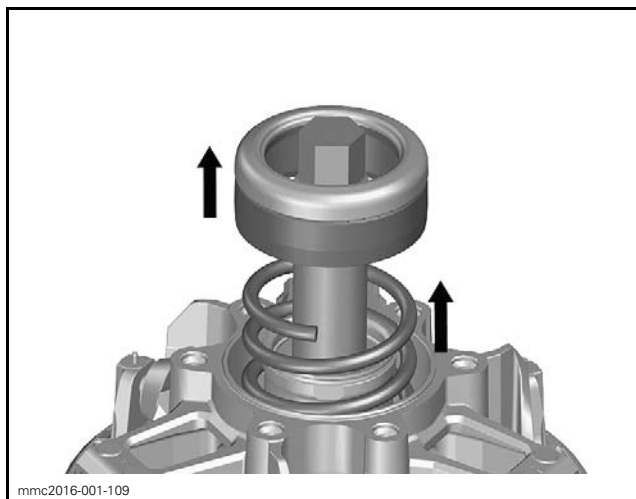
1. Circlip installer/remover



1. Handle of the pulley spring compressor

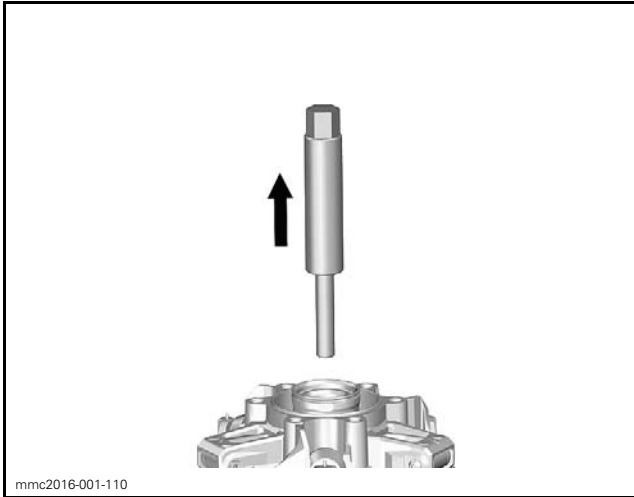


1. Remove the circlip



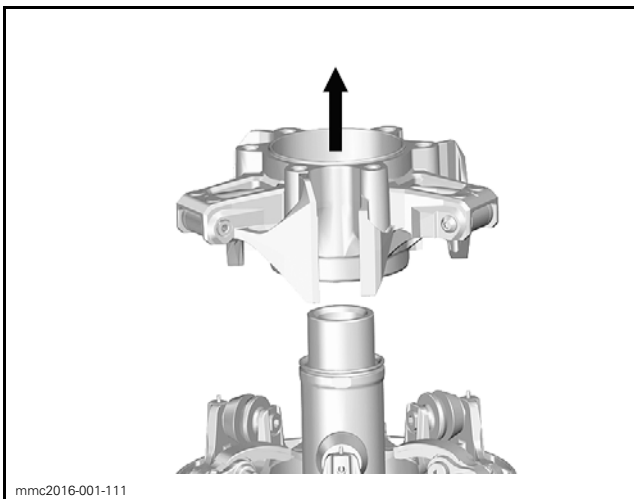
Removing the Spider

1. Remove the threaded shaft.



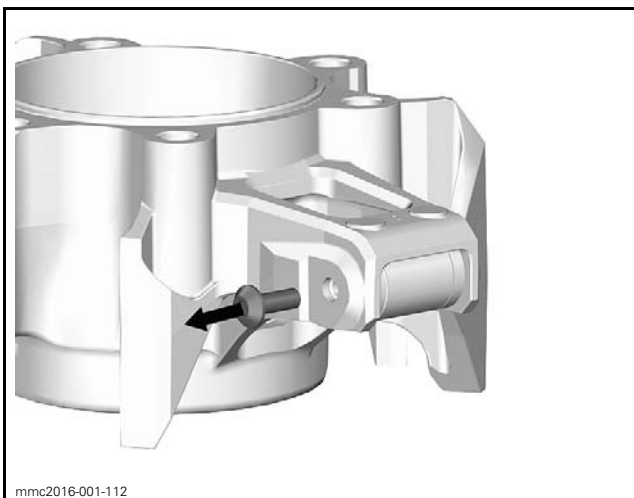
NOTICE Remove the threaded shaft to avoid damaging the bushings inside the spider.

2. Remove the spider.

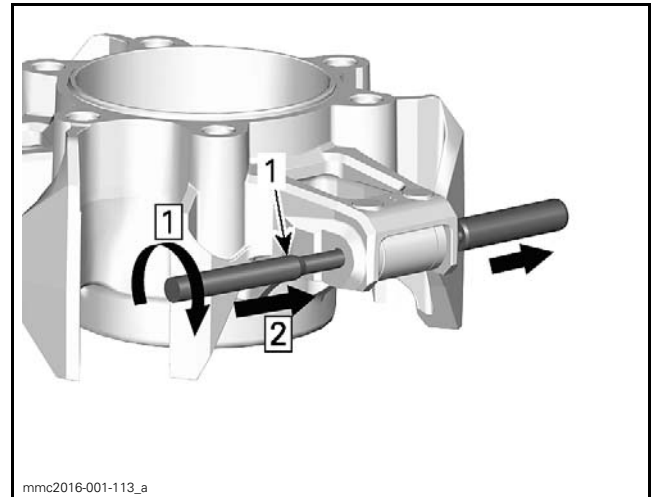


Removing the Roller

1. Remove axle retaining screw.



2. Remove the axle.

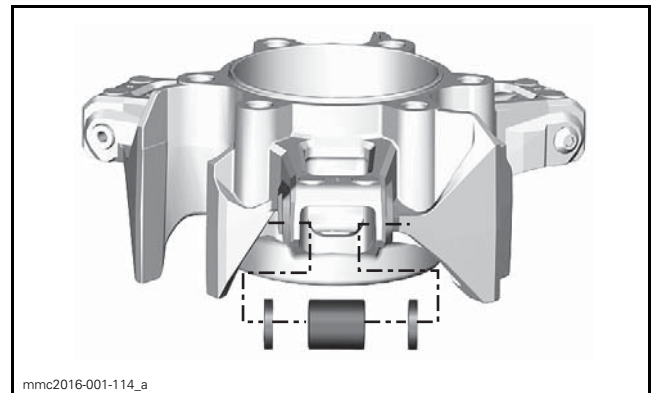


1. Removing axle tool

Step 1: Screw the tool into the axle

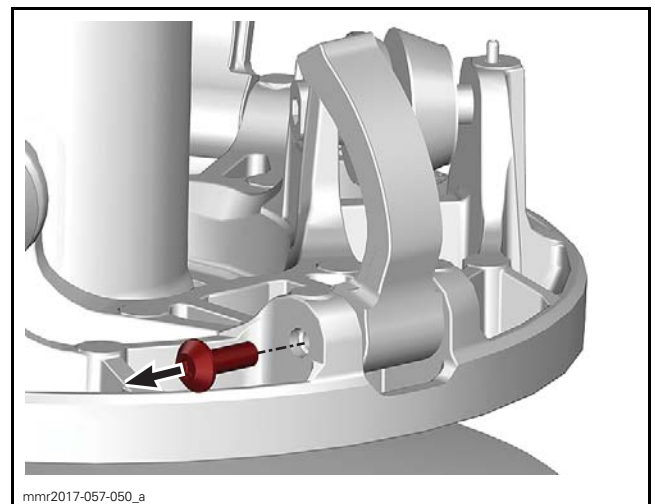
Step 2: Push axle to the right side

3. Remove the roller and its thrust washers.



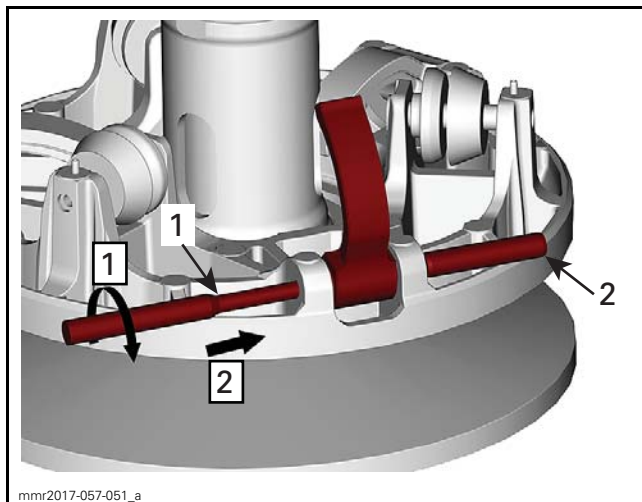
Removing the Ramp (without Spider)

1. Remove axle retaining screw.



2. Remove the axle.

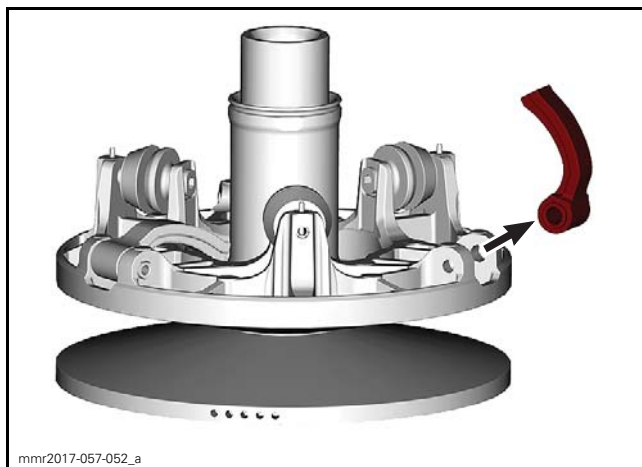
Subsection XX (pDRIVE PULLEY)



1. Removing axle tool
2. Axle

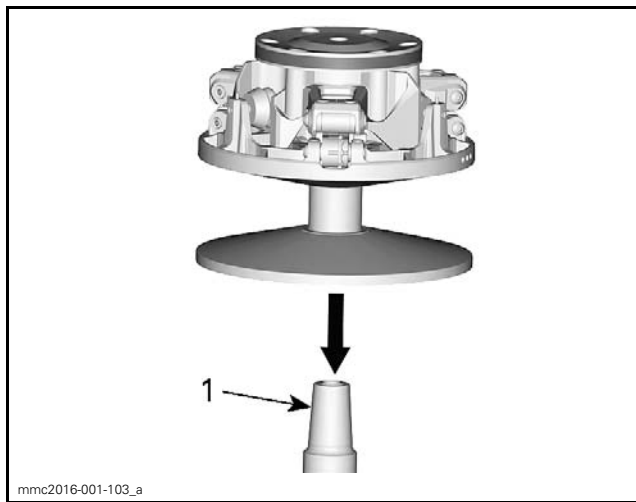
Step 1: Screw the tool into the axle
Step 2: Push axle to the right side

3. Remove ramp assembly.

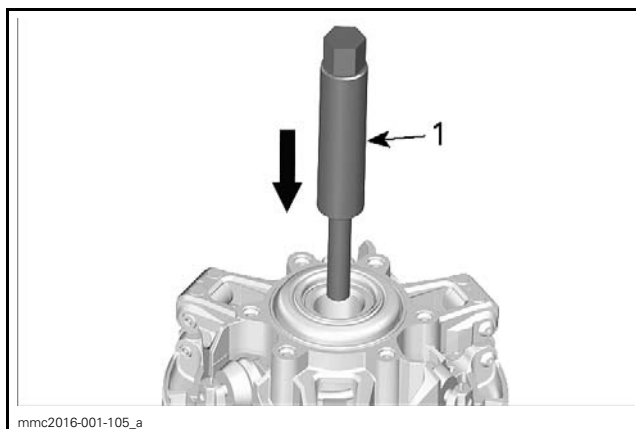


Removing the Ramp (Spider Installed)

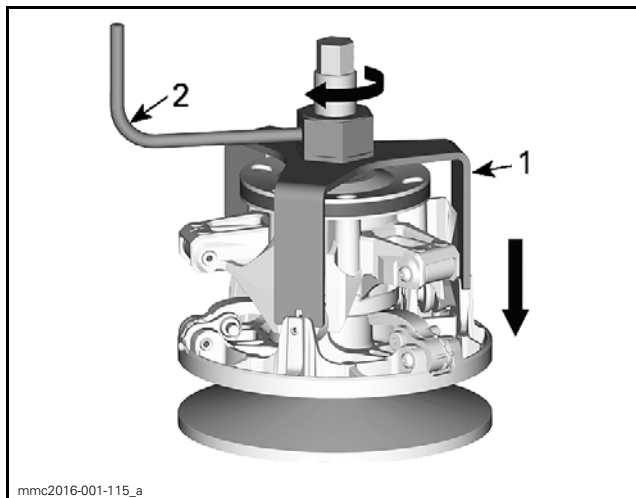
1. Lower the sliding sheave.
 - 1.1 Secure the drive pulley support in a vice.
 - 1.2 Install the drive pulley over the support.
 - 1.3 Install the drive pulley opening tool.



1. Drive pulley support

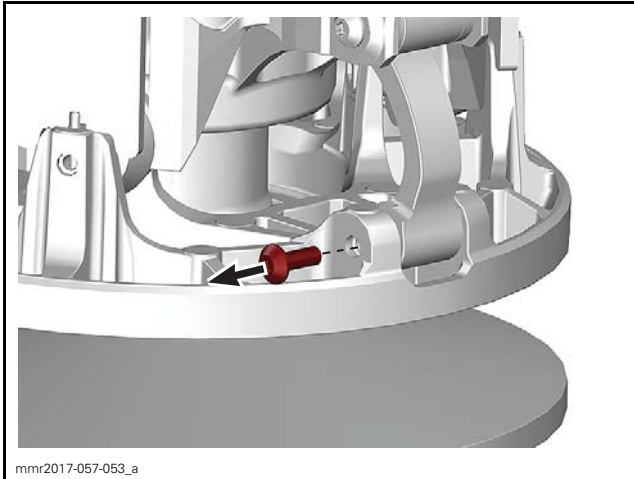


1. Threaded shaft of the pulley spring compressor

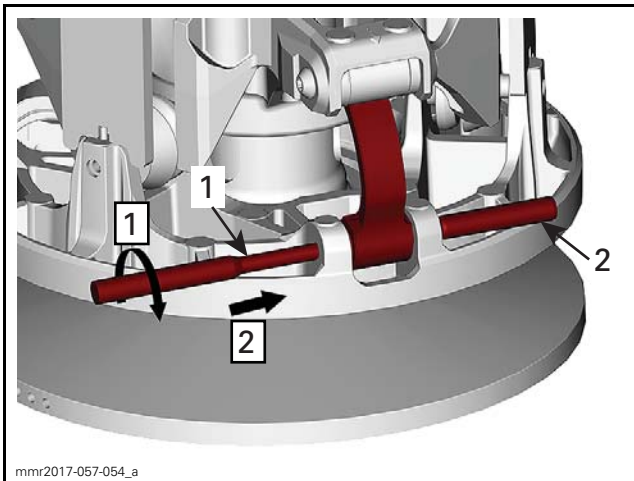


1. Drive pulley opening tool
2. Handle of the pulley spring compressor

2. Remove axle retaining screw.



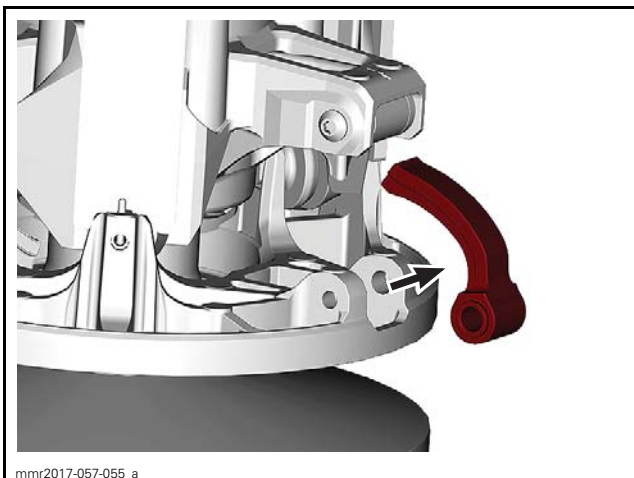
3. Remove the axle.



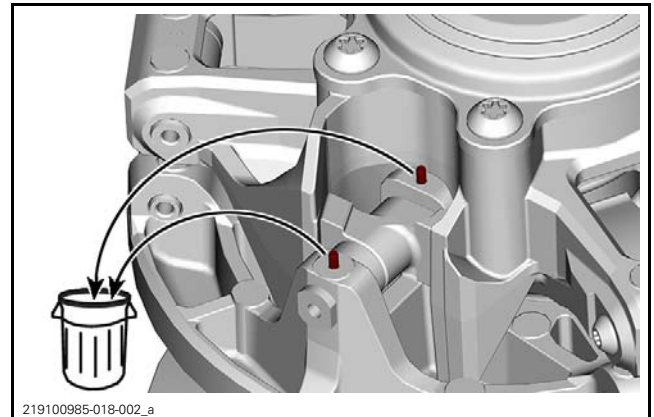
1. Removing axle tool
2. Axle

Step 1: Screw the tool into the axle
Step 2: Push axle to the right side

4. Remove ramp assembly.



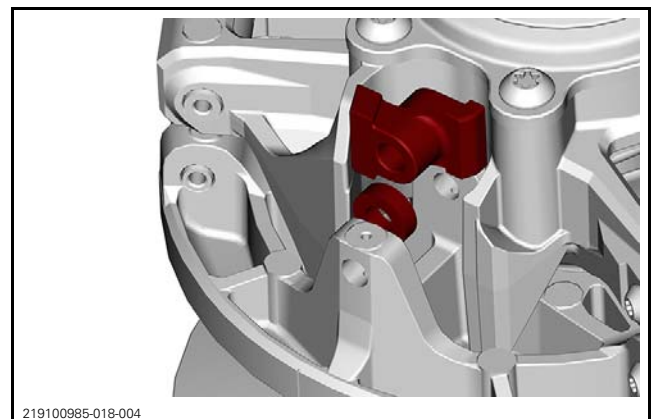
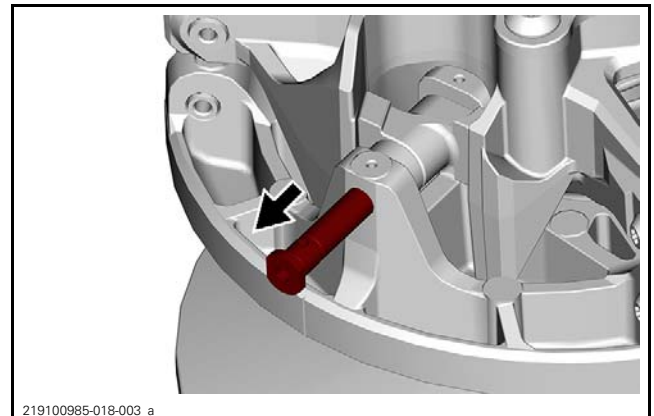
Removing the Torque Sliders (if equipped)



REQUIRED TOOL

Blind hole puller

M5 x 0.8 adaptor



Removing the Torque Rollers (if equipped)

Refer to *REMOVING THE TORQUE SLIDERS* procedure.

Subsection XX (pDRIVE PULLEY)

Replacing the Sliding Sheave Bushing

In case of worn out bushing, it is advisable to replace whole sliding sheave assembly as replacing just the bushing may reduce drive pulley performance.

Cleaning the Drive Pulley

NOTE: Parts must be at room temperature before cleaning.

Clean pulley sheaves and shaft with fine steel wool and dry cloth.

Using a paper towel and cleaner, clean the following components.

- Crankshaft tapered end
- Taper inside fixed sheave of drive pulley
- Crankshaft threads
- Retaining screw threads.

SERVICE PRODUCT
CLUTCH AND PULLEY FLANGE CLEANER PRO S1 (P/N 779244)

NOTICE Avoid contact between cleaner and crankshaft seal because damage may occur.

Remove all hardened oil deposits that are baked on crankshaft and pulley tapered surfaces with coarse or medium steel wool and/or sand paper no. 600.

NOTICE Do not use any other type of abrasive.

Reclean mounting surfaces with paper towel and cleaning solvent.

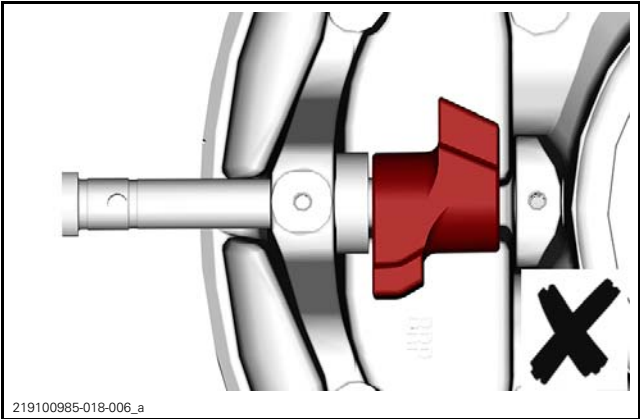
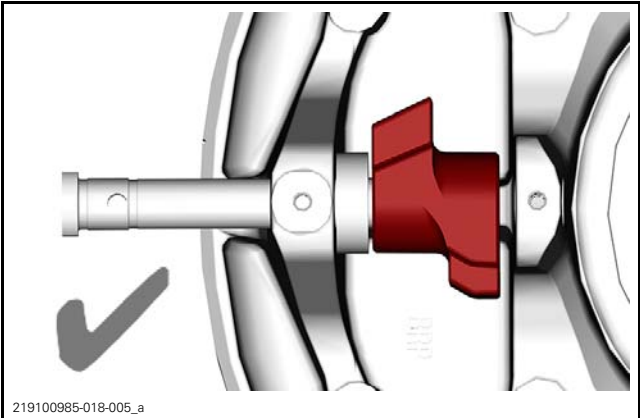
Wipe off the mounting surfaces with a clean, dry paper towel.

NOTICE Mounting surfaces must be free of any oil, cleaner or towel residue.

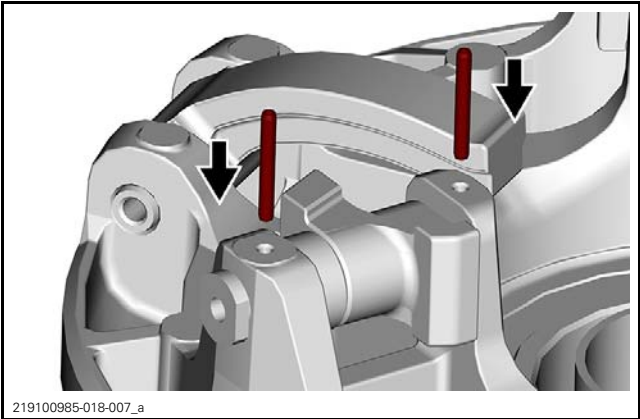
Assembling the Drive Pulley

Sliders

Position sliders as illustrated.

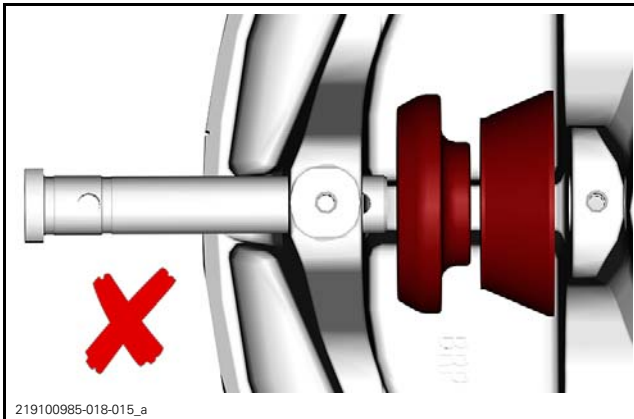
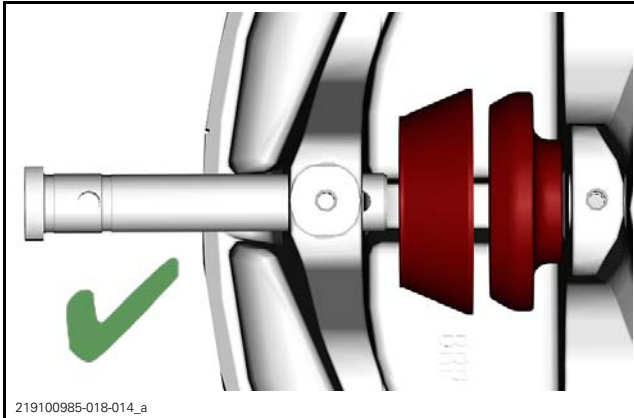


Position the flat sides of the axle head vertically. Use a C vise clamp to push the axle back in place. Install a new spring pin.

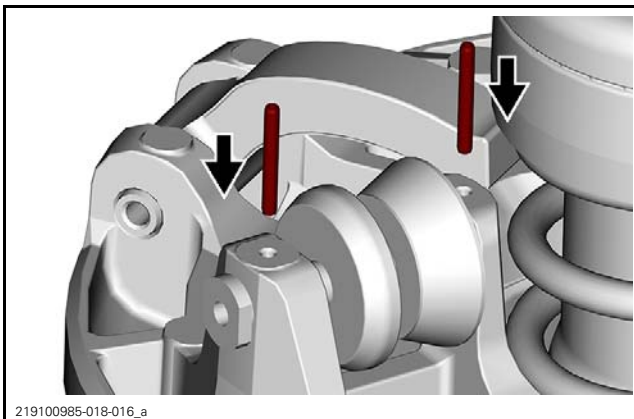


Torque Rollers

Position sliders as illustrated.

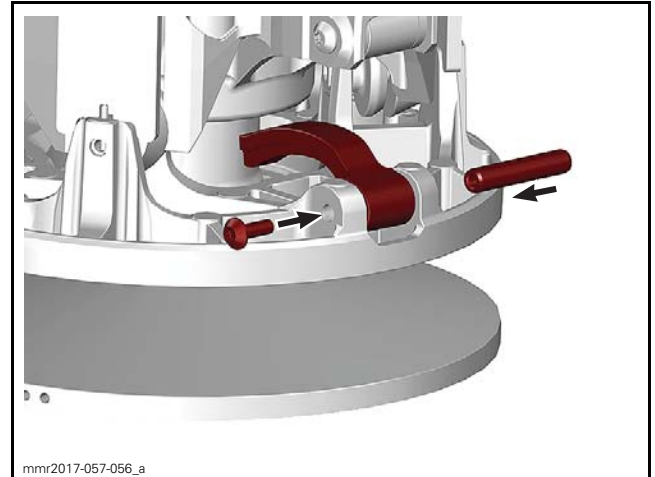


Position the flat sides of the axle head vertically.
Use a C vise clamp to push the axle back in place.
Install a new spring pin.



Ramp

Install the ramp on the sliding sheave.



TIGHTENING TORQUE

Axle screw	5 N•m ± 0.5 N•m (44 lbf•in ± 4 lbf•in)
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Roller

Lubricate the roller bearing.

REQUIRED SERVICE PRODUCT

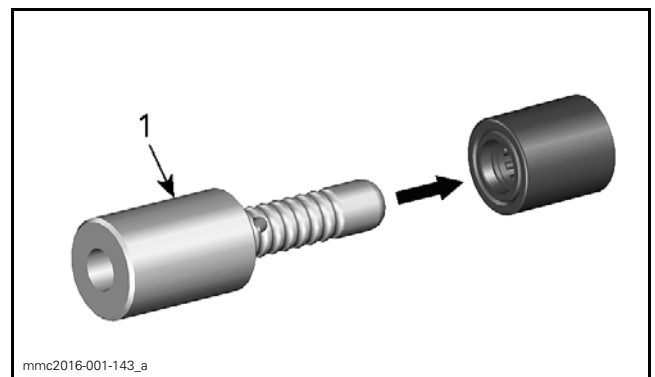
ISOFLEX GREASE TOPAS NB 52 (P/N 293 550 021)

REQUIRED TOOL

GREASE INJECTOR
(P/N 529 036 376)



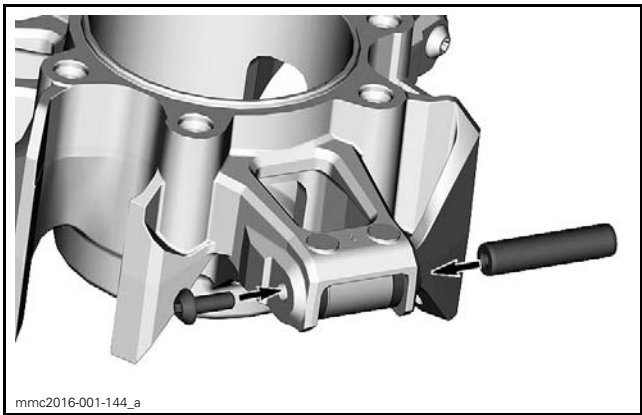
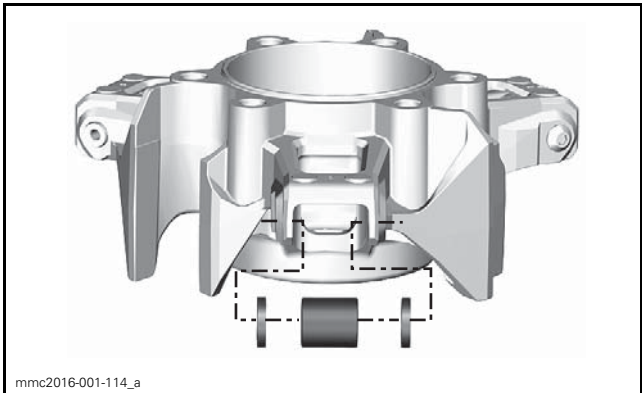
NOTE: A threaded end is required on the grease gun for using the grease injector.



1. Grease injector

Install roller.

Subsection XX (pDRIVE PULLEY)

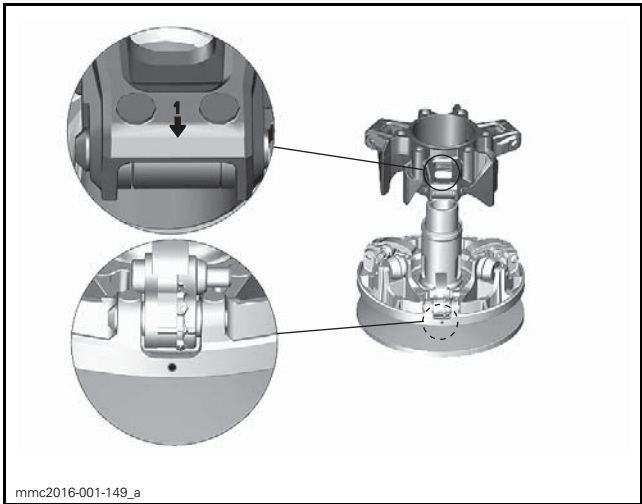


TIGHTENING TORQUE	
Roller axle screw	5 N•m ± 0.5 N•m (44 lbf•in ± 4 lbf•in)

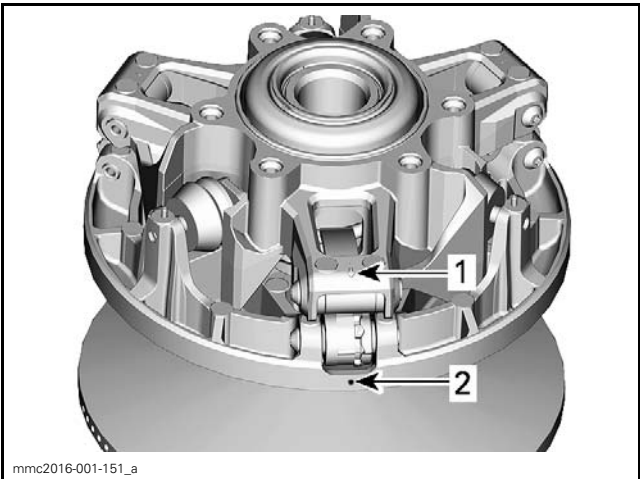
Spider

Install the spider on the sliding sheave by aligning the indexing marks.

- Spider - the arrow on the arms #1, just above the roller.
- Sliding sheave - the dot on the external side of the sheave.



TYPICAL

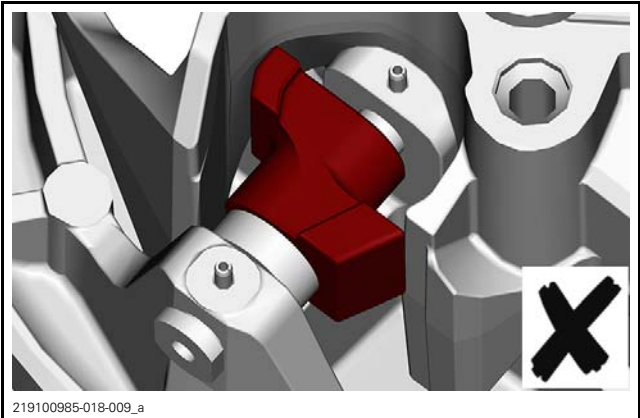
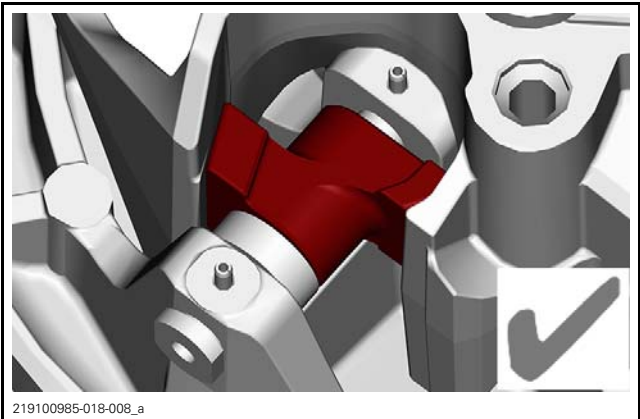


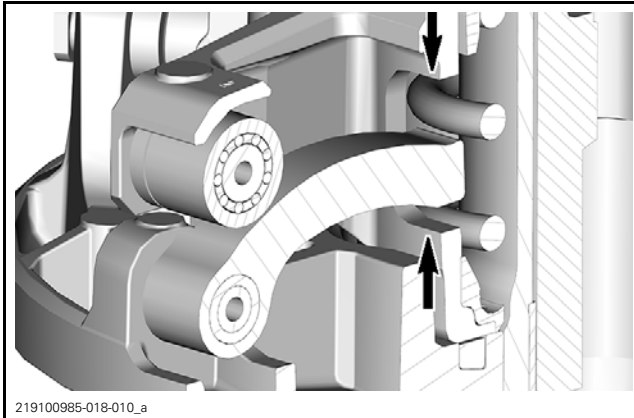
TYPICAL - FINAL POSITION

- 1. Arrow - spider arm
- 2. Dot - sliding sheave

With Sliders

NOTICE During installation of the spider, make sure to correctly position all three sliders with spider legs and ensure that ramps are positioned inside the openings of the spider.

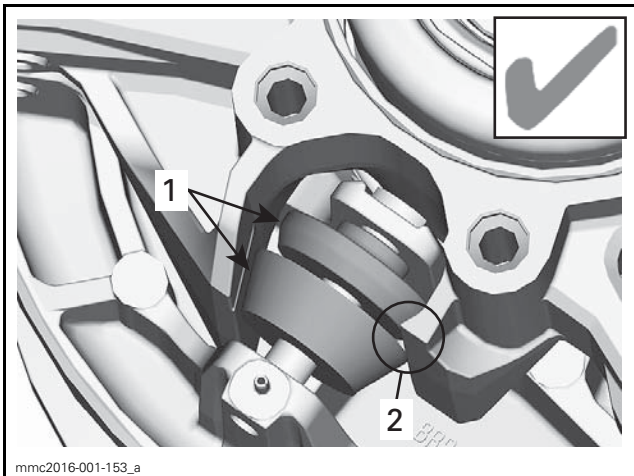




RAMP POSITIONING

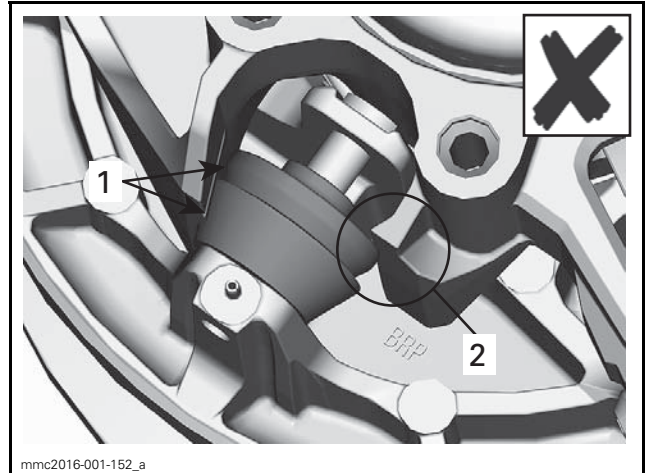
With Torque Rollers

NOTICE During installation of the spider, make sure to position the three spurs of spider legs between torque rollers and ensure that ramps are positioned inside the openings of the spider.



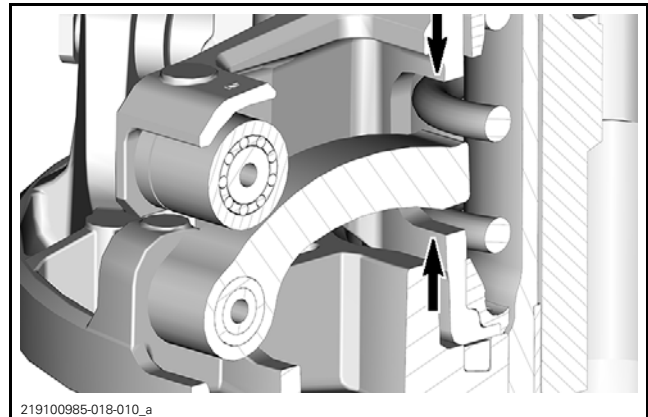
ROLLER - GOOD INSTALLATION

1. Torque rollers
2. Spur of the spider leg



ROLLER - WRONG INSTALLATION

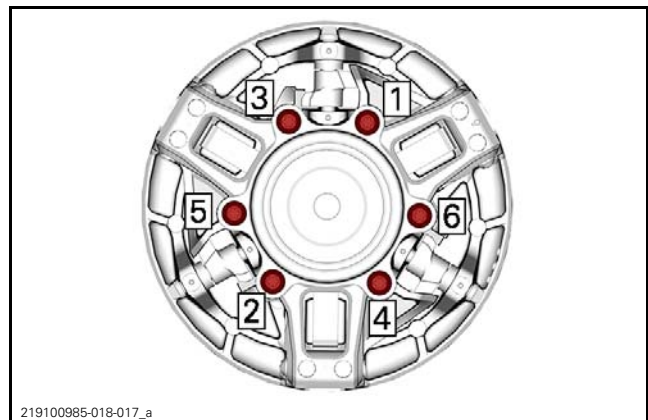
1. Torque rollers
2. Spur of the spider leg



RAMP POSITIONING

Damper

Install the damper using the following sequence.



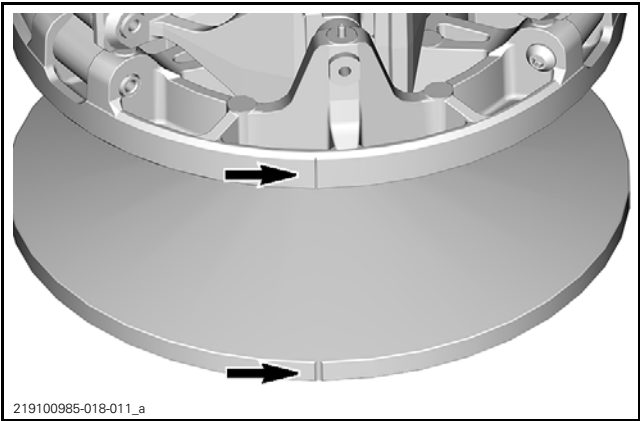
TIGHTENING TORQUE

Damper screws	31.5 N•m ± 3.5 N•m (23 lbf•ft ± 3 lbf•ft)
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Subsection XX (pDRIVE PULLEY)

Sliding Sheave and Fixed Sheave Assembly

Index sliding sheave with fixed sheave by aligning index marks.



Drive Pulley Installation

REQUIRED TOOLS	
CLUTCH HOLDER (P/N 529 036 369)	

1. Clean mounting surfaces as described in *DRIVE PULLEY CLEANING* above.

NOTICE Do not apply antiseize or any lubricant on crankshaft and drive pulley tapers.

2. Install drive pulley on crankshaft end.

NOTE: The drive pulley can be installed in one position only. Drive pulley and crankshaft are indexed.

3. Install a **NEW** conical spring washer with its concave side towards drive pulley.

4. Install drive pulley bolt.

NOTICE Always use BRP genuine parts for conical spring washer and bolt.

5. Secure the drive pulley with the clutch holder.

6. Using a torque wrench, tighten the drive pulley bolt. Refer to *TIGHTENING THE DRIVE PULLEY* for the completed procedure.

Tightening the Drive Pulley

Tighten the drive pulley bolt.

TIGHTENING TORQUE		
Drive pulley bolt	First torque	120 N•m ± 5 N•m (89 lbf•ft ± 4 lbf•ft)

Before starting engine, perform drive pulley adjustment. Refer to *ADJUSTMENT*, at the beginning of this subsection.

Install drive belt and guard.

Raise the rear of the vehicle and support it with a mechanical stand.

 **WARNING**

Ensure that the track is free of particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure nobody is standing near the vehicle.

Accelerate the vehicle at low speed (maximum 32 km/h (20 MPH) and apply the brake, repeat 5 times.

Tighten the drive pulley bolt again.

TIGHTENING TORQUE		
Drive pulley bolt	Final torque	120 N•m ± 5 N•m (89 lbf•ft ± 4 lbf•ft)

 **WARNING**

After 10 hours of operation the transmission system of the vehicle must be inspected to ensure drive pulley bolt is still properly torqued.

GENERAL

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

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

 **WARNING**

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced with new ones.

 **WARNING**

Never start engine when the pulley guard is removed.

MAINTENANCE

INSPECTING AND CLEANING THE DRIVEN PULLEY

Inspect pulley sheave for dirt, marks or scratches.
Test sliding sheave operation.

Use cleaner and a clean rag to clean pulley sheaves as necessary.

SERVICE PRODUCT
CLUTCH AND PULLEY FLANGE CLEANER PRO S1 (P/N 779244)

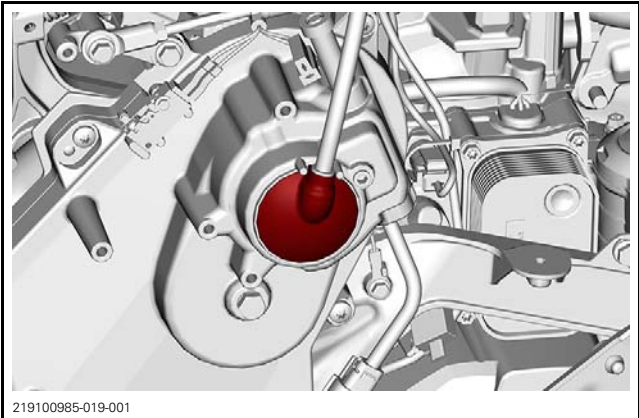
PROCEDURES

DRIVEN PULLEY

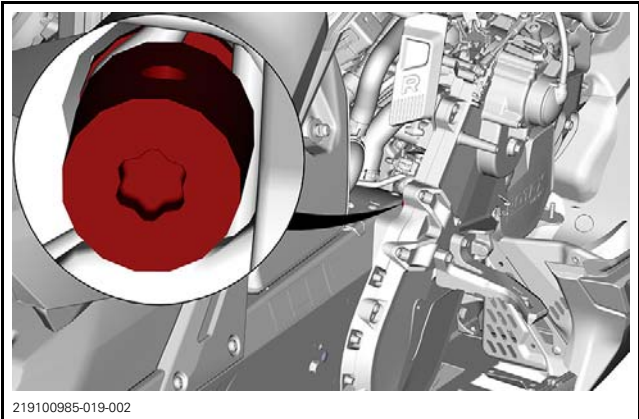
Removing the Driven Pulley

NOTE: The driven pulley is removed with the countershaft.

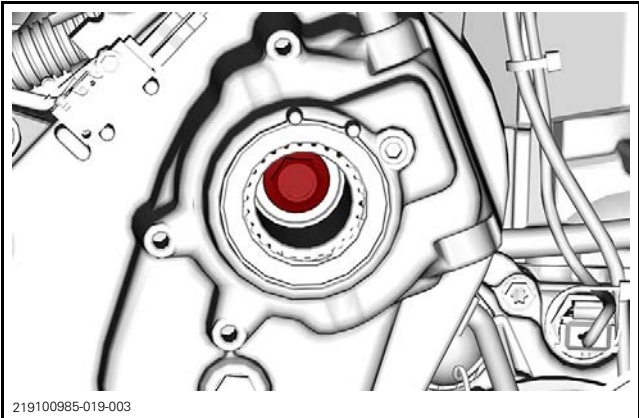
1. Remove the muffler. Refer to *EXHAUST SYSTEM* subsection.
2. Remove the filling plug on the chaincase cover.



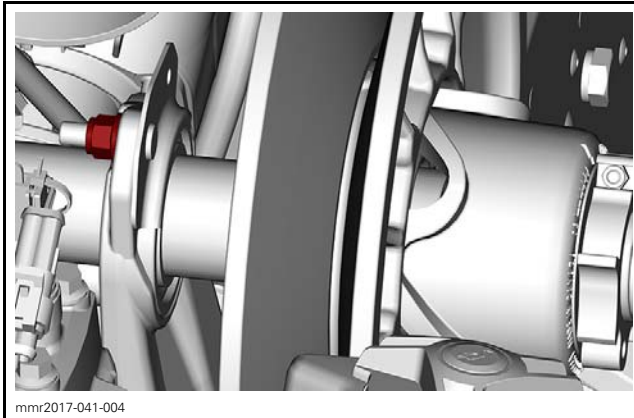
3. Release drive chain tension by unscrewing tensioner adjustment screw.



4. Remove the upper gear screw and the cap.



5. Thread a M10 x 1.5 x 80 mm screw through the cap, the gear and in the countershaft.
6. Remove the drive belt. Refer to *DRIVE BELT* subsection.
7. Behind driven pulley, remove nut securing the countershaft bearing flange.



8. Pull out bearing flange.
9. Use the bearing puller to extract the bearing from the support.

REQUIRED TOOL	
BEARING PULLER DRIVEN SUPPORT (P/N 529 036 485)	

10. Pull the driven pulley to disengage countershaft from upper gear.

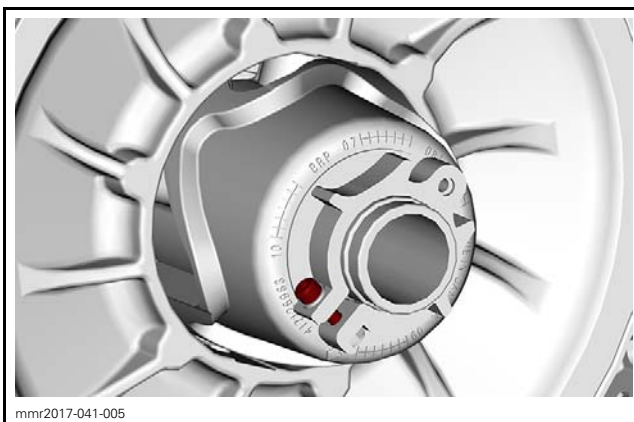
NOTE: If necessary, tap the M10 screw with a plastic hammer.

11. Unscrew countershaft from the M10 screw.
Leave the M10 screw in the chaincase in order to hold the gear in place.

Driven Pulley Disassembly

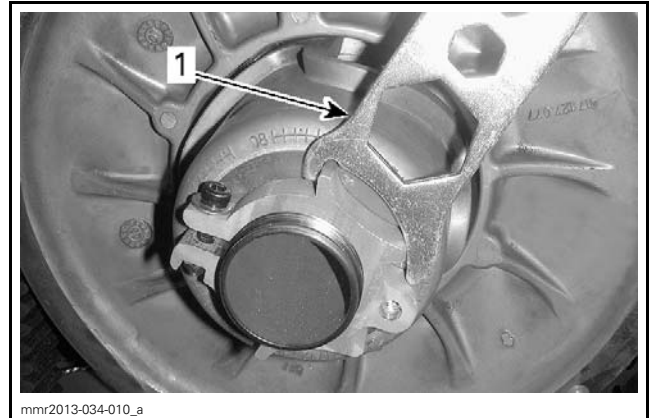
Removing Cam and Spring

1. Loosen the clamping screw.



2. Unscrew the adjuster hub **clockwise** using the suspension adjustment tool provided in the vehicle tool kit.

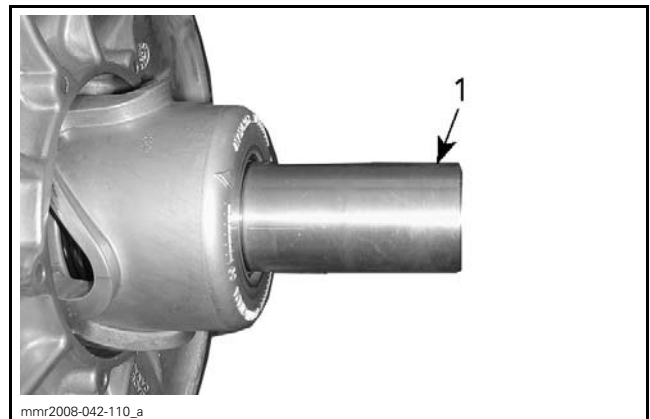
NOTE: The adjuster hub has LH treads.



1. Suspension adjustment tool shown

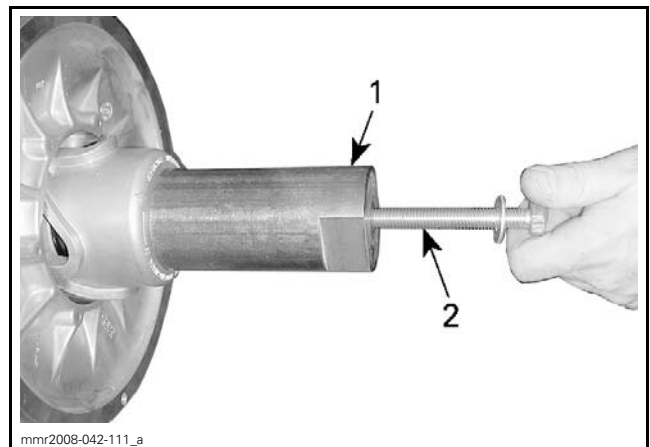
REQUIRED TOOL	
DRIVEN PULLEY SPRING COMPRESSOR (P/N 529 036 182)	

3. Install the threaded adapter of the spring compressor on the countershaft.



1. Threaded adapter

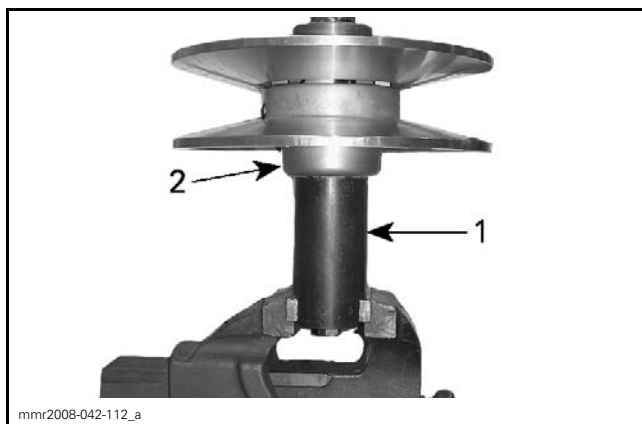
4. Install the external sleeve over the threaded adapter and secure sleeve with the tool screw.



1. External sleeve
2. Driven pulley spring compressor screw

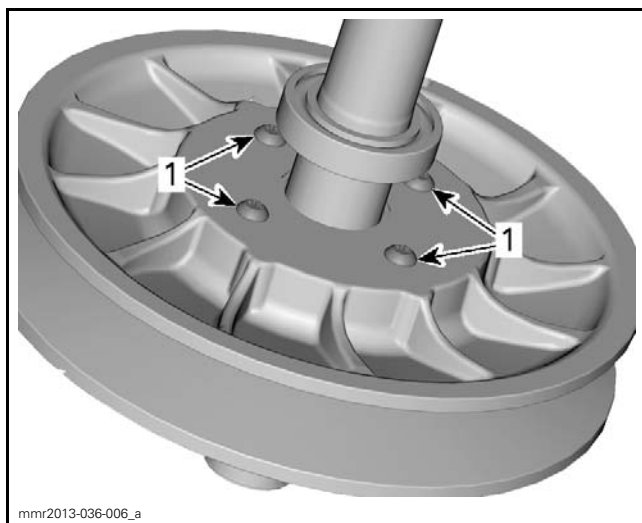
Subsection XX (DRIVEN PULLEY AND COUNTERSHAFT)

5. Tighten the tool screw to compress the cam.
6. Install the tool in a vice.



1. Driven pulley spring compressor
2. Driven pulley

7. Using a heat gun, heat cam screws to break the thread locker.

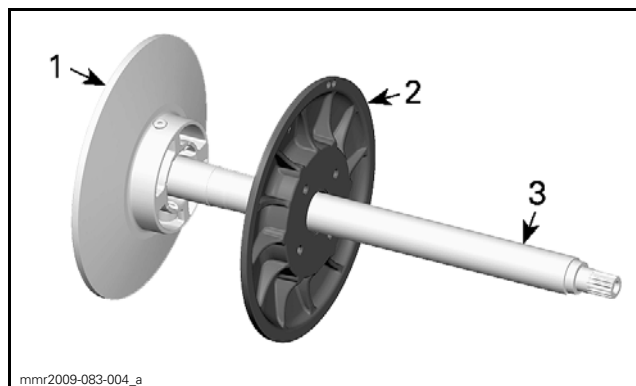


1. Heat cam screws

8. Remove and discard cam screws.
9. Unscrew the tool screw completely.
10. Remove cam, spring stoppers and spring.

Removing the Sliding Sheave

1. Remove the cam and spring. Refer to procedure in this subsection.
2. Remove the countershaft bearing. Refer to procedure in this subsection.
3. Remove sliding sheave.



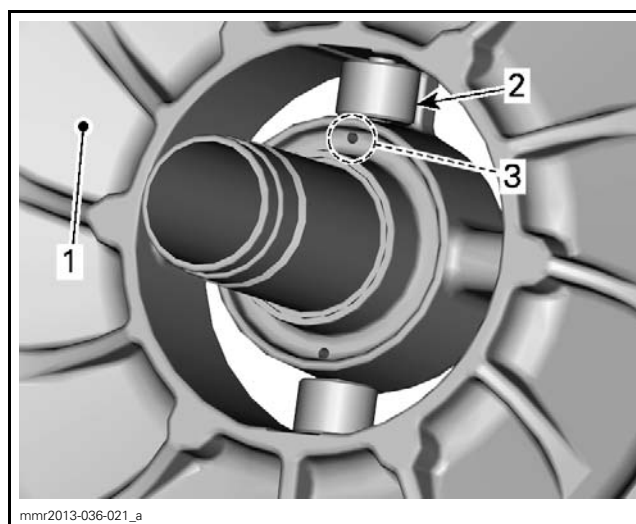
1. Fixed sheave
2. Sliding sheave
3. Countershaft

Removing the Fixed Sheave

The fixed sheave and countershaft are sold as an assembly. They are not available separately.

Removing the Driven Pulley Rollers

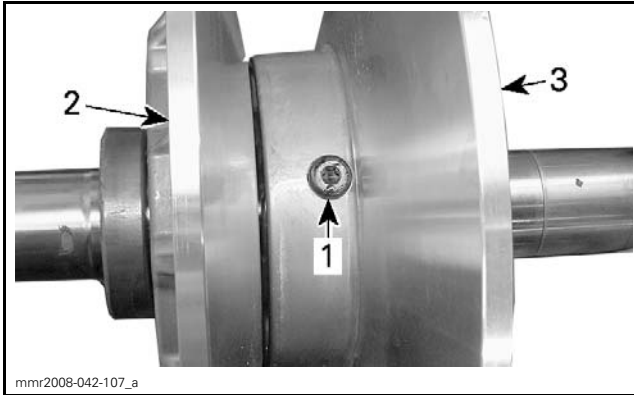
1. Move sliding and fixed sheaves apart.
2. Remove spring pins used to lock pivot screws.
 - 2.1 Use tap wrench to start removing spring pin.
 - 2.2 Once spring pin is accessible to pliers, pull pin out using pliers.



1. Fixed sheave outer face
2. Roller
3. Spring pin location

3. Identify pivot screws location before removal.
4. Remove pivot screw and ribbed lock washer; keep both for reuse.

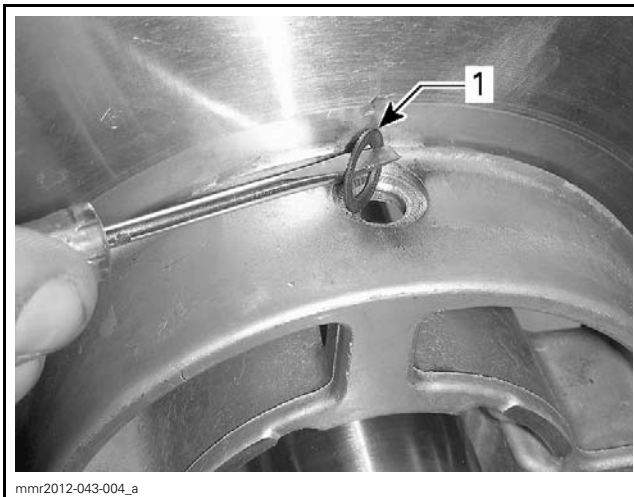
NOTICE Make sure not to damage or lose pivot screws. If screws need to be replaced, replace fixed sheave assembly.



1. Pivot screw
2. Sliding sheave
3. Fixed sheave



PIVOT SCREW REMOVAL



1. Ribbed lock washer

5. Remove roller.

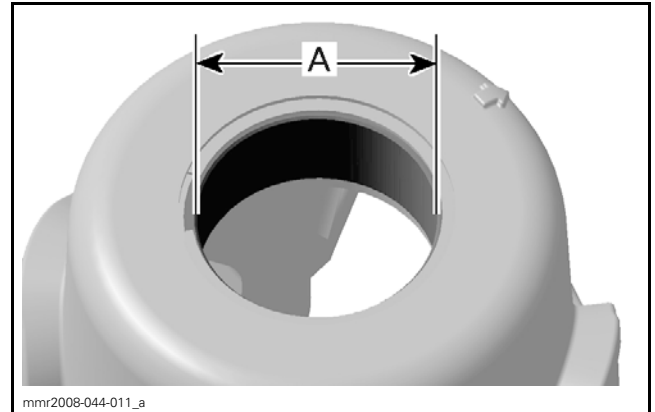
6. Proceed with removal of other roller.

IMPORTANT: For proper fit, each pivot screw must be reinstalled where originally mounted in the fixed sheave.

Inspecting the Driven Pulley

Inspecting Cam and Spring

1. Verify contact surfaces of cam for visible damages. Ensure circlip properly locks the inner bushing. Replace part if necessary.
2. Using a dial bore gauge, measure the inner diameter of cam bushing. Measuring point must be at least 5 mm (1/4 in) from bushing edge.



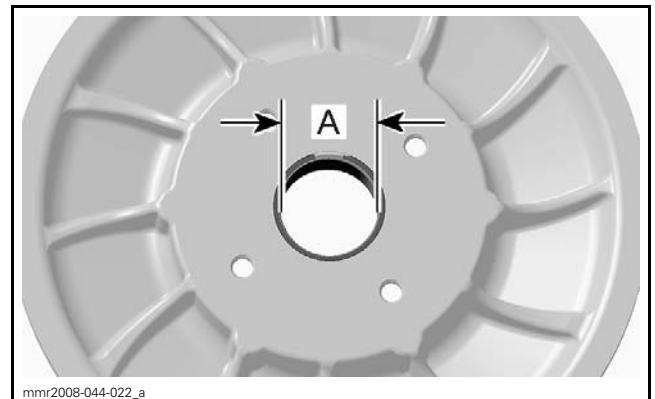
A. Inner diameter of cam bushing

CAM BUSHING	SERVICE LIMIT
Inner diameter	41.5 mm (1.634 in)

3. Replace the cam if the inner diameter of bushing is out of specification.

Inspecting the Sliding Sheave

1. Inspect pulley sheave for marks or scratches.
2. Ensure circlip properly locks the inner bushing. Replace part if necessary.
3. Using a dial bore gauge, measure the inner diameter of sliding sheave bushing. Measuring point must be at least 5 mm (1/4 in) from bushing edge.



A. Inner diameter of sliding sheave bushing

Subsection XX (DRIVEN PULLEY AND COUNTERSHAFT)

SLIDING SHEAVE BUSHING	SERVICE LIMIT
Inner diameter	41.5 mm (1.634 in)

4. Replace the sliding sheave if the inner diameter of bushing is out of specification.

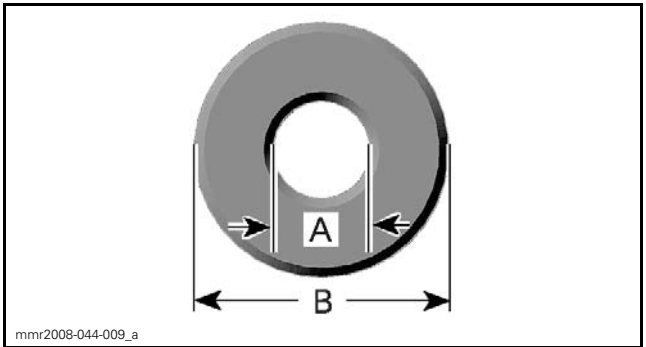
Inspecting the Fixed Sheave

Replace fixed sheave and countershaft if one of the following problem is detected:

- Marks or scratches on pulley sheave
- Bent, twisted or otherwise damaged counter-shaft
- Defective splines and threads at the end of countershaft.

Inspecting the Driven Pulley Roller

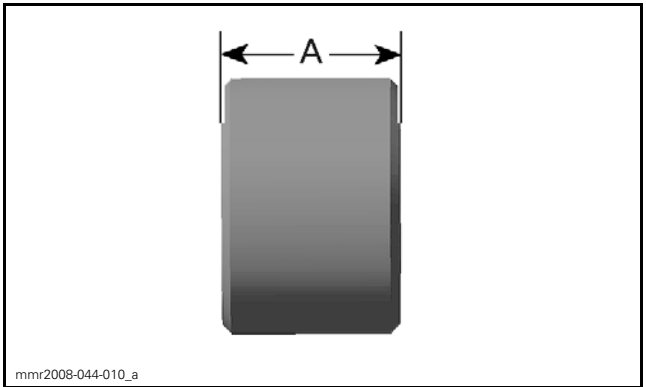
1. Check the rollers for flat spots, cracks or other visible damages. Replace if necessary (as a set).
2. Measure inner and outer diameter of rollers.



A. Inner diameter
B. Outer diameter

DRIVEN PULLEY ROLLER	SERVICE LIMIT
Inner diameter	8.5 mm (.335 in)
Outer diameter	21.5 mm (.846 in)

3. Measure the roller thickness.



A. Thickness of roller

DRIVEN PULLEY ROLLER	SERVICE LIMIT
Thickness	14.75 mm (.581 in)

4. If a roller is out of specifications, replace both rollers at the same time.

Cleaning the Driven Pulley

Use cleaner and a clean rag to clean pulley sheaves.

SERVICE PRODUCT
the CLUTCH AND PULLEY FLANGE CLEANER PRO S1 (P/N 779244)

Cleaning Cam and Spring

During break-in period, anti-friction coating from bushing moves to cam or countershaft surface. It is normal to see gray anti-friction coating deposit on cam or countershaft. Do not remove this deposit.

When a dust deposit has to be removed from the cam or the countershaft, use dry cloth to avoid removing transferred anti-friction coating.

Driven Pulley Assembly

Installing the Driven Pulley Roller

NOTE: Exceptionally, do **NOT** clean threaded hole to avoid changing the screw position when torqued.

1. Using a hand wire brush, clean pivot screw threads.

IMPORTANT: Do not use a thread die to clean pivot screw of threadlocker as this may alter the screw threads.

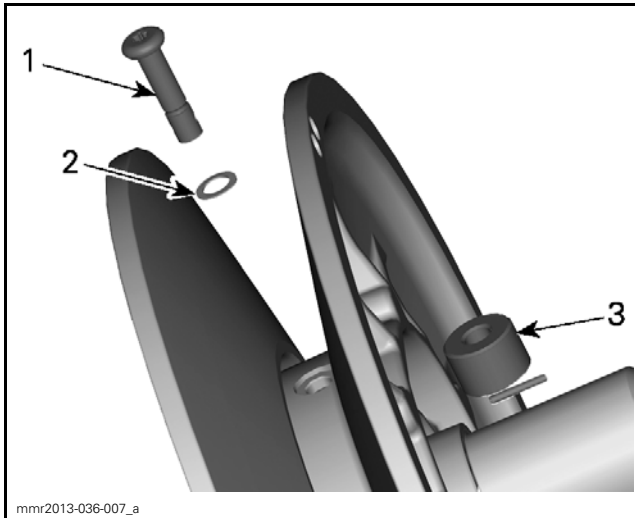
NOTE: Pivot screw and ribbed lock washer must be reused if in good condition. If damaged, replace fixed sheave assembly.

2. Apply the following threadlocker to the pivot screw threads.

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

3. Insert roller in fixed sheave, thread in pivot screw with ribbed lock washer.

NOTE: The ribbed locked washer must be installed with the concave side towards the fixed sheave.



1. Pivot screw
2. Ribbed lock washer (concave side towards fixed sheave)
3. Roller

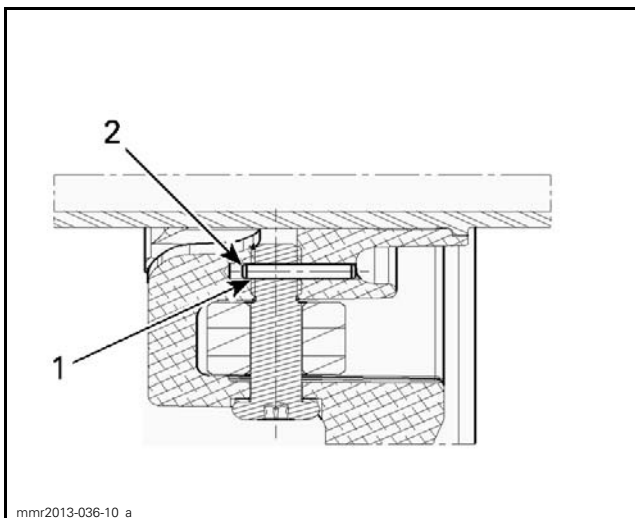
IMPORTANT: For proper fit, each pivot screw must be reinstalled where originally mounted in the fixed sheave.

4. Torque pivot screw as specified.

TIGHTENING TORQUE	
Pivot screws	17 N•m ± 1 N•m (150 lbf•in ± 9 lbf•in)

NOTE: Spring pin hole in the fixed sheave and pivot screw must perfectly line up when torque is applied.

NOTICE If not properly aligned, spring pin will not insert in pivot screw hole and spring pin threads in fixed sheave will be damaged.

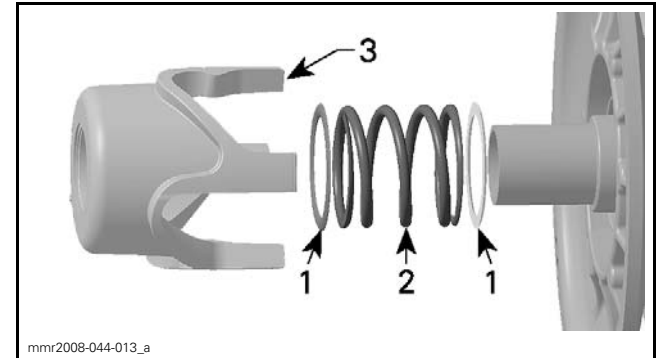


1. Hole in pivot screw
2. Spring pin

5. Install spring pin.

Installing Cam and Spring

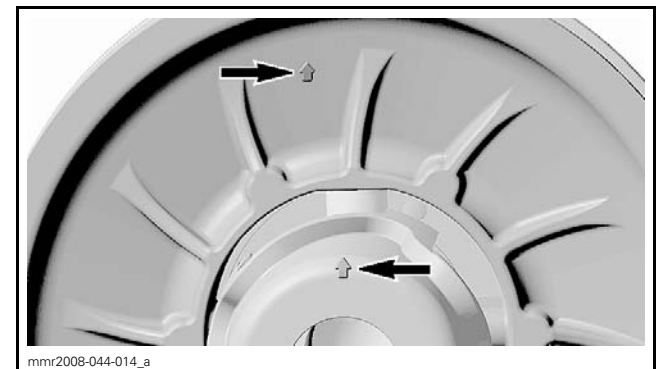
1. Install a spring stopper, the spring, the other spring stopper and the cam.



1. Spring stopper
2. Spring
3. Cam

2. Align the arrow on the cam with the arrow on the fixed sheave.

NOTE: On completion of cam installation, the arrow on the cam should have moved clockwise (approximately 30°).



3. Install the driven pulley spring compressor sleeve and tighten the tool screw until the cam is completely pressed against the sliding sheave.

4. Apply threadlocker on the thread of 4 new cam screws.

RECOMMENDED SERVICE PRODUCT
LOCTITE 648 (GREEN) (P/N 413 711 400)

5. From the back of the sliding sheave, install the 4 new cam screws.

6. Torque cam screws as specified.

Subsection XX (DRIVEN PULLEY AND COUNTERSHAFT)

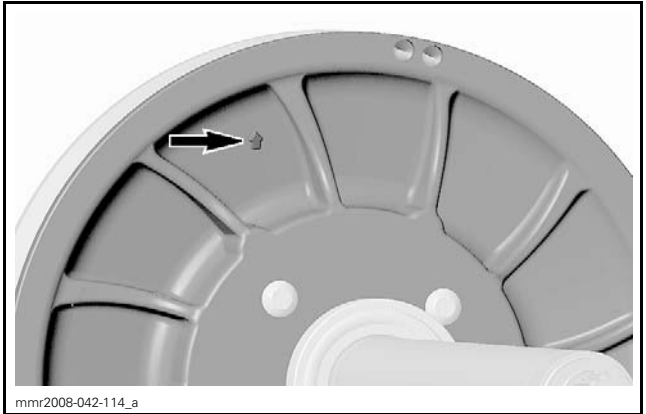
TIGHTENING TORQUE	
Cam screw	31.5 N•m ± 3.5 N•m (23 lbf•ft ± 3 lbf•ft) + LOCTITE 648 (GREEN) (P/N 413 711 400)

7. Remove the tool.

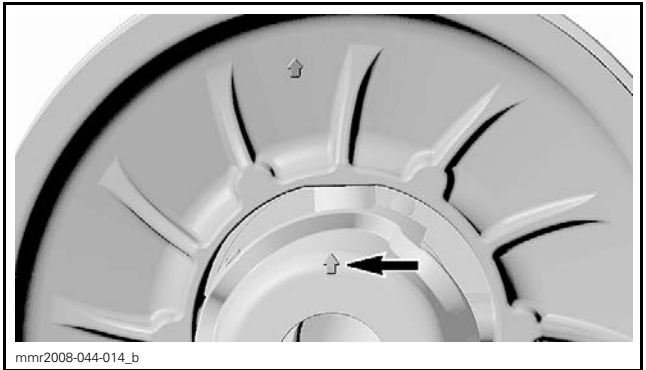
Installing the Sliding Sheave

The assembly of sliding sheave is the reverse of the disassembly. However, pay attention to the following.

When installing sliding sheave, make sure to align its arrow with the arrow on cam.



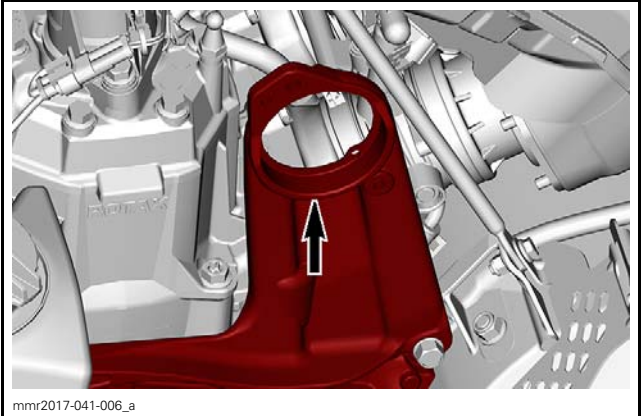
SLIDING SHEAVE ARROW



CAM ARROW

Installing the Driven Pulley

1. Using sand paper (600-grit or 1000-grit) or steel wool, remove any rust on bearing shoulder of countershaft bearing support.



BEARING SUPPORT SHOULDER

2. Apply a thin layer of antiseize lubricant on bearing shoulder.

SERVICE PRODUCT
LOCTITE 767 (ANTI-SEIZE LUBRICANT) (P/N 293 800 070)

3. Insert countershaft through countershaft bearing support.

4. Fasten the M10 screw to the end of countershaft.

5. Align countershaft splines with upper gear splines.

6. Using the M10 screw as a puller, engage countershaft splines in upper gear splines. Ensure countershaft bearing is installed properly in countershaft bearing support.

7. Remove the M10 screw.

8. Install the upper gear screw and the cap.

9. Tighten upper gear screw to specification.

TIGHTENING TORQUE	
Upper gear screw	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)

10. Install chaincase filler plug.

11. Install the bearing flange. Tighten nut to specification.

TIGHTENING TORQUE	
Bearing flange nut	15.5 N•m ± 1.5 N•m (137 lbf•in ± 13 lbf•in)

12. Install the adjuster hub onto the countershaft end and temporarily tighten.

13. Install and adjust drive belt. Refer to *DRIVE BELT* subsection.

14. Install all other removed parts.

COUNTERSHAFT

The countershaft and the fixed sheave are sold as an assembly. They are not available separately.

Removing and Installing the Countershaft

Refer to *DRIVEN PULLEY* in this subsection.

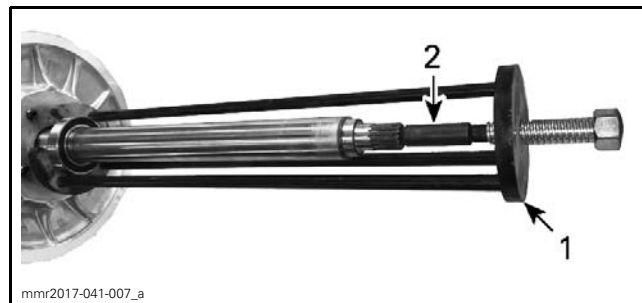
COUNTERSHAFT BEARING

Removing the Countershaft Bearing

Remove the driven pulley. Refer to procedure in this subsection.

Install the bearing remover on countershaft.

REQUIRED TOOL	
COUNTERSHAFT BEARING REMOVER (P/N 529 036 065)	
COUNTERSHAFT ADAPTER (P/N 529 036 424)	



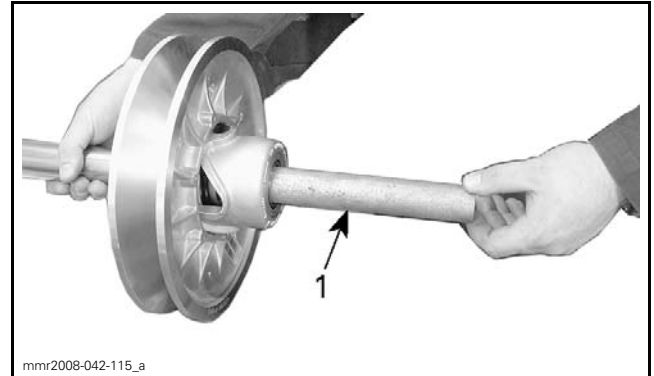
1. Countershaft adapter
2. Countershaft bearing remover

Tighten the screw at the end of tool to extract the bearing. Discard bearing.

Installing the Countershaft Bearing

1. Remove the adjuster hub from the cam.
2. Insert the countershaft support in the countershaft.

REQUIRED TOOL
COUNTERSHAFT SUPPORT (P/N 529 036 067)



1. Countershaft support

NOTICE The countershaft support is mandatory to avoid damaging the countershaft threaded end and the cam during bearing installation.

3. Clean residues on countershaft bearing surface.

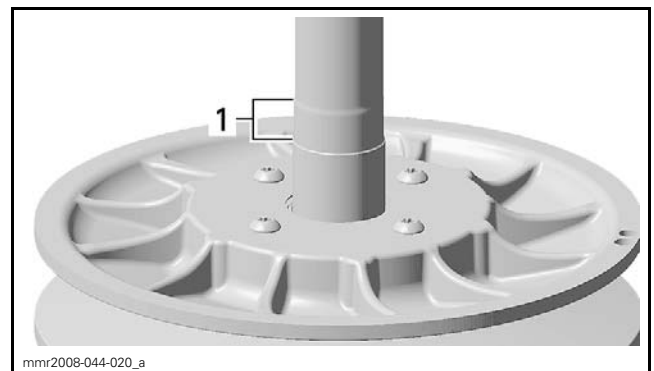
SERVICE PRODUCT
CLUTCH AND PULLEY FLANGE CLEANER PRO S1 (P/N 779244)

4. Check countershaft bearing surface for wear.
5. Apply curing speed activator on countershaft bearing surface and let dry 5 minutes.

SERVICE PRODUCT
LOCTITE 7649 (PRIMER) (P/N 293 800 041)

6. Apply rapid curing adhesive on primer.

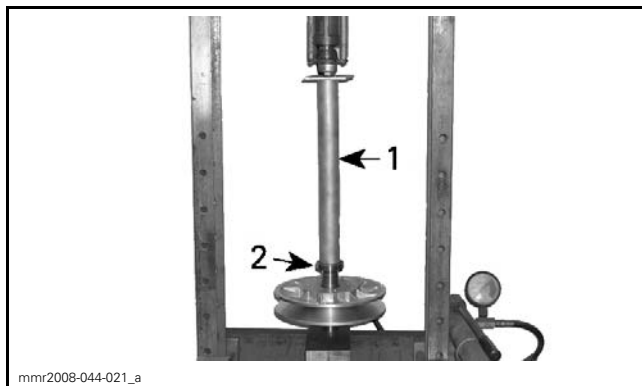
SERVICE PRODUCT
LOCTITE 609 (P/N 413 703 100)



1. Apply Loctite 7649 (Primer) before Loctite 609 in this region

7. Using a press and the bearing installer, install the new bearing on countershaft.

REQUIRED TOOL
COUNTERSHAFT BEARING INSTALLER (P/N 529 036 066)



- 1. Countershaft bearing installer
- 2. New bearing

NOTICE Use a press only, never tap on countershaft bearing installer with an hammer to avoid damaging bearing and countershaft.

- 8. Clean the surplus Loctite with a rag to avoid having Loctite on sliding sheave bushing.

COUNTERSHAFT BEARING SUPPORT

For countershaft bearing support removal and installation, refer to *COUNTERSHAFT BEARING SUPPORT* in *FRAME*.

GENERAL

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

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

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to. Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced with new ones.

⚠ WARNING

Never start engine when the pulley guard is removed.

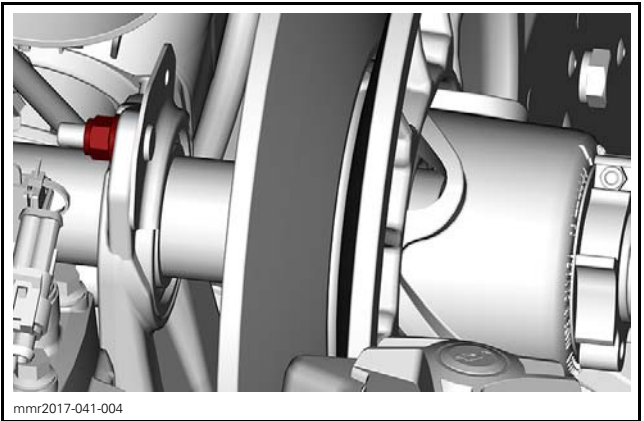
PROCEDURES

DRIVEN PULLEY

Removing the Driven Pulley

NOTE: The driven pulley is removed with the countershaft.

- 1. Remove the drive belt. Refer to *DRIVE BELT* subsection.
- 2. Behind driven pulley, remove nut securing the countershaft bearing flange.



- 3. Pull out bearing flange.
- 4. Use the bearing puller to extract the bearing from the support.

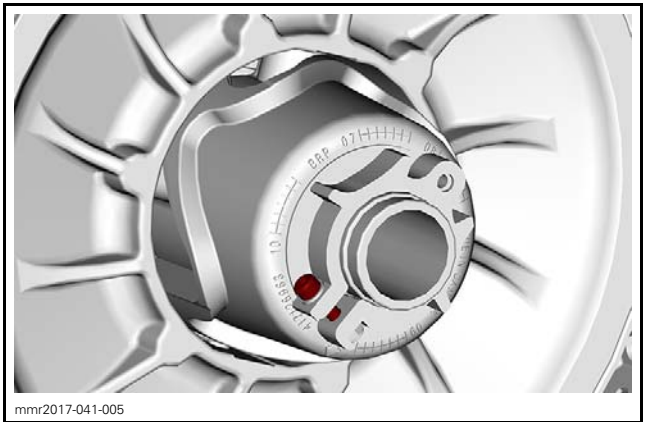
REQUIRED TOOL	
BEARING PULLER DRIVEN SUPPORT (P/N 529 036 485)	

- 5. Pull the driven pulley to disengage countershaft and upper gear.

Driven Pulley Disassembly

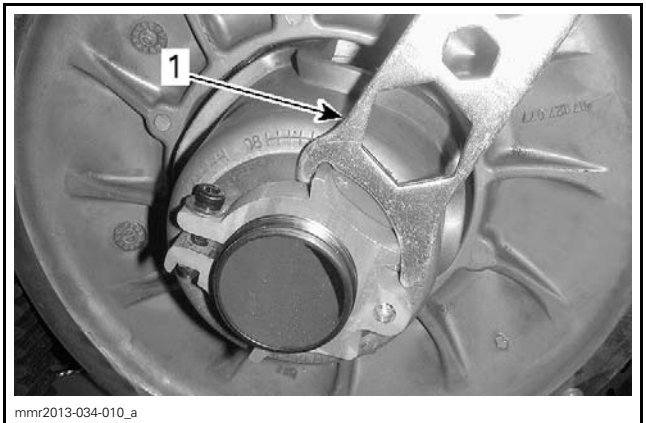
Removing Cam and Spring

- 1. Loosen the clamping screw.



- 2. Unscrew the adjuster hub **clockwise** using the suspension adjustment tool provided in the vehicle tool kit.

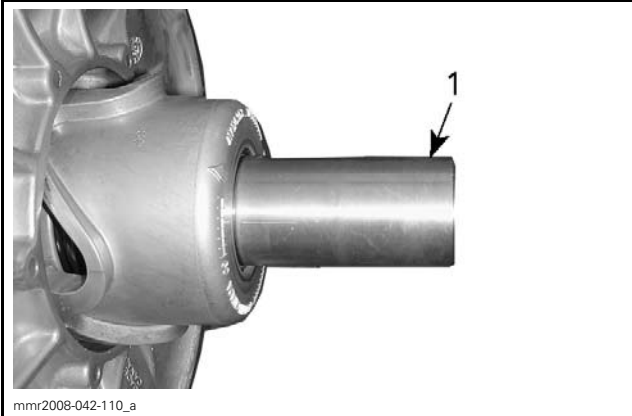
NOTE: The adjuster hub has LH treads.



1. Suspension adjustment tool shown

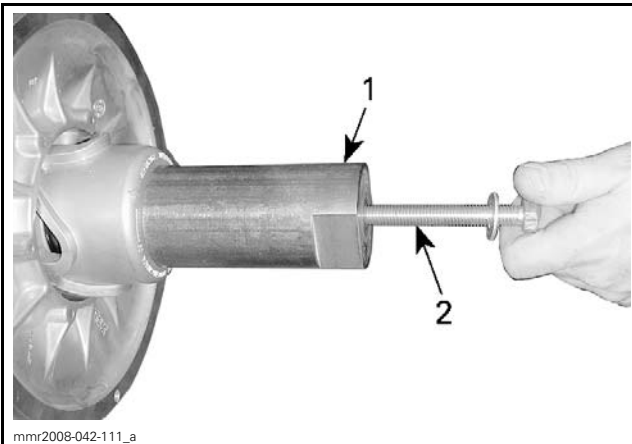
REQUIRED TOOL	
DRIVEN PULLEY SPRING COMPRESSOR (P/N 529 036 182)	

- 3. Install the threaded adapter of the spring compressor on the countershaft.



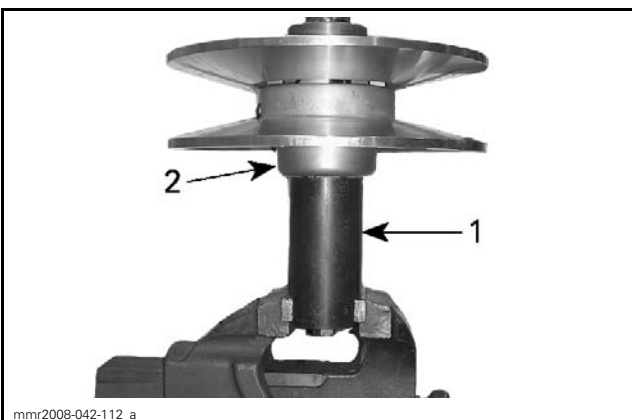
1. Threaded adapter

4. Install the external sleeve over the threaded adapter and secure sleeve with the tool screw.



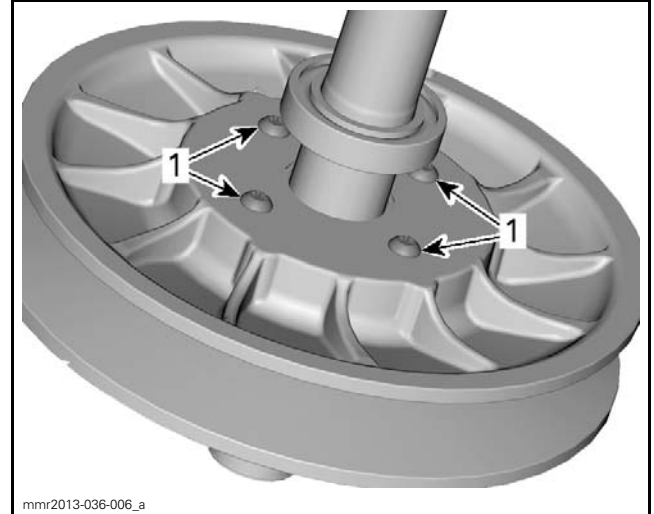
1. External sleeve
2. Driven pulley spring compressor screw

5. Tighten the tool screw to compress the cam.
6. Install the tool in a vice.



1. Driven pulley spring compressor
2. Driven pulley

7. Using a heat gun, heat cam screws to break the thread locker.

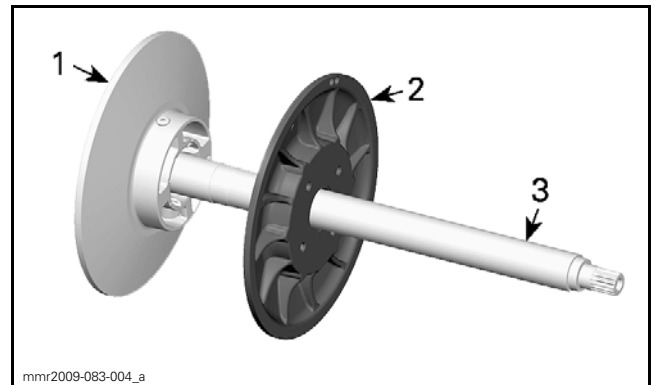


1. Heat cam screws

8. Remove and discard cam screws.
9. Unscrew the tool screw completely.
10. Remove cam, spring stoppers and spring.

Removing the Sliding Sheave

1. Remove the cam and spring. Refer to procedure in this subsection.
2. Remove the countershaft bearing. Refer to procedure in this subsection.
3. Remove sliding sheave.



1. Fixed sheave
2. Sliding sheave
3. Countershaft

Removing the Fixed Sheave

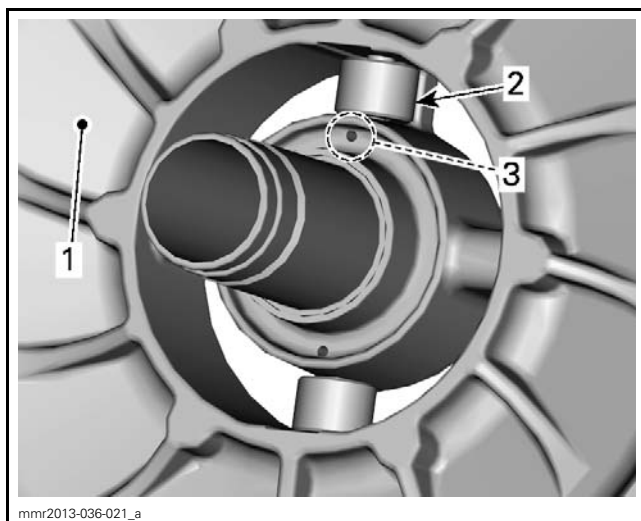
The fixed sheave and countershaft are sold as an assembly. They are not available separately.

Removing the Driven Pulley Rollers

1. Move sliding and fixed sheaves apart.
2. Remove spring pins used to lock pivot screws.
 - 2.1 Use tap wrench to start removing spring pin.

Subsection 03 (DRIVEN PULLEY AND COUNTERSHAFT (WITH GEARBOX))

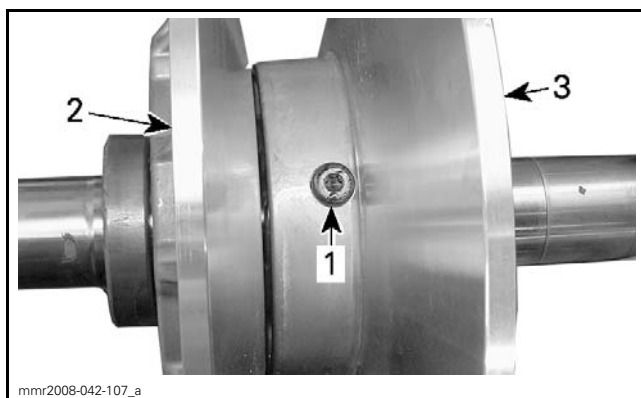
- 2.2 Once spring pin is accessible to pliers, pull pin out using pliers.



1. Fixed sheave outer face
2. Roller
3. Spring pin location

3. Identify pivot screws location before removal.
4. Remove pivot screw and ribbed lock washer; keep both for reuse.

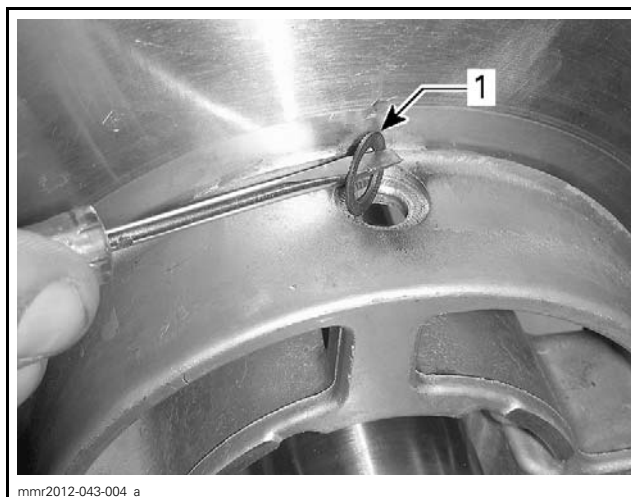
NOTICE Make sure not to damage or lose pivot screws. If screws need to be replaced, replace fixed sheave assembly.



1. Pivot screw
2. Sliding sheave
3. Fixed sheave



PIVOT SCREW REMOVAL



1. Ribbed lock washer

5. Remove roller.
6. Proceed with removal of other roller.

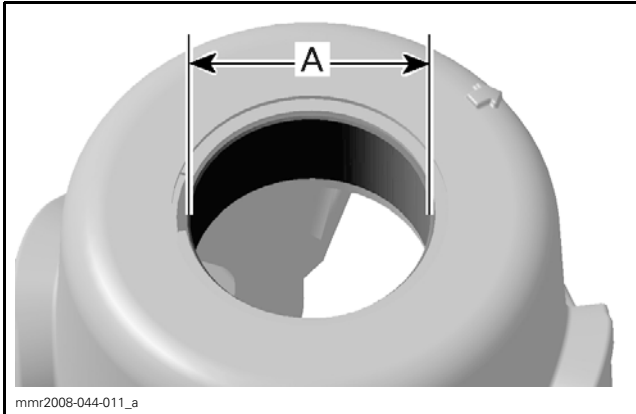
IMPORTANT: For proper fit, each pivot screw must be reinstalled where originally mounted in the fixed sheave.

Inspecting the Driven Pulley

Inspecting Cam and Spring

1. Verify contact surfaces of cam for visible damages. Ensure circlip properly locks the inner bushing. Replace part if necessary.
2. Using a dial bore gauge, measure the inner diameter of cam bushing. Measuring point must be at least 5 mm (1/4 in) from bushing edge.

Subsection 03 (DRIVEN PULLEY AND COUNTERSHAFT (WITH GEARBOX))



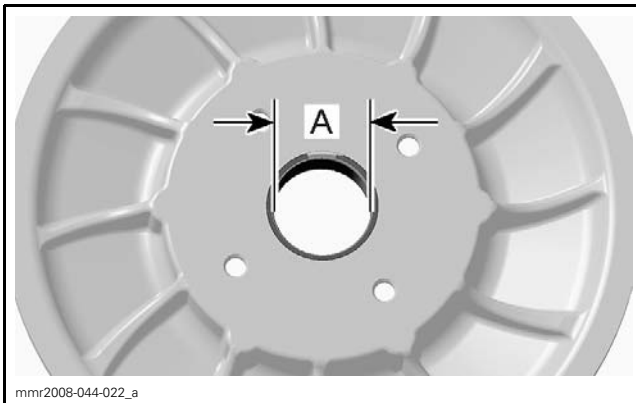
A. Inner diameter of cam bushing

CAM BUSHING	SERVICE LIMIT
Inner diameter	41.5 mm (1.634 in)

3. Replace the cam if the inner diameter of bushing is out of specification.

Inspecting the Sliding Sheave

1. Inspect pulley sheave for marks or scratches.
2. Ensure circlip properly locks the inner bushing. Replace part if necessary.
3. Using a dial bore gauge, measure the inner diameter of sliding sheave bushing. Measuring point must be at least 5 mm (1/4 in) from bushing edge.



A. Inner diameter of sliding sheave bushing

SLIDING SHEAVE BUSHING	SERVICE LIMIT
Inner diameter	41.5 mm (1.634 in)

4. Replace the sliding sheave if the inner diameter of bushing is out of specification.

Inspecting the Fixed Sheave

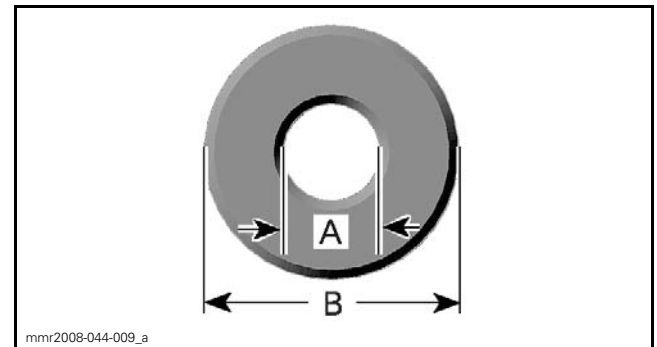
Replace fixed sheave and countershaft if one of the following problem is detected:

- Marks or scratches on pulley sheave

- Bent, twisted or otherwise damaged countershaft
- Defective splines and threads at the end of countershaft.

Inspecting the Driven Pulley Roller

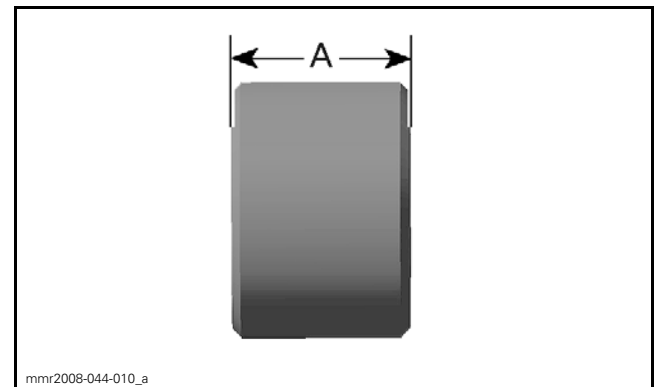
1. Check the rollers for flat spots, cracks or other visible damages. Replace if necessary (as a set).
2. Measure inner and outer diameter of rollers.



A. Inner diameter
B. Outer diameter

DRIVEN PULLEY ROLLER	SERVICE LIMIT
Inner diameter	8.5 mm (.335 in)
Outer diameter	21.5 mm (.846 in)

3. Measure the roller thickness.



A. Thickness of roller

DRIVEN PULLEY ROLLER	SERVICE LIMIT
Thickness	14.75 mm (.581 in)

4. If a roller is out of specifications, replace both rollers at the same time.

Cleaning the Driven Pulley

Use the a clean rag to clean pulley sheaves.

Subsection 03 (DRIVEN PULLEY AND COUNTERSHAFT (WITH GEARBOX))

SERVICE PRODUCT	
Scandinavia	PULLEY FLANGE CLEANER (F) (P/N 619 600 022)
Other Countries	CLUTCH AND PULLEY FLANGE CLEANER PRO S1 (P/N 779244)

Cleaning Cam and Spring

During break-in period, teflon from bushing moves to cam or countershaft surface. A teflon over teflon running condition occurs, leading to low friction. So it is normal to see gray teflon deposit on cam or countershaft. Do not remove this deposit.

When a dust deposit has to be removed from the cam or the countershaft, use dry cloth to avoid removing transferred teflon.

Driven Pulley Assembly

Installing the Driven Pulley Roller

NOTE: Exceptionally, do **NOT** clean threaded hole to avoid changing the screw position when torqued.

1. Using a hand wire brush, clean pivot screw threads.

IMPORTANT: Do not use a thread die to clean pivot screw of threadlocker as this may alter the screw threads.

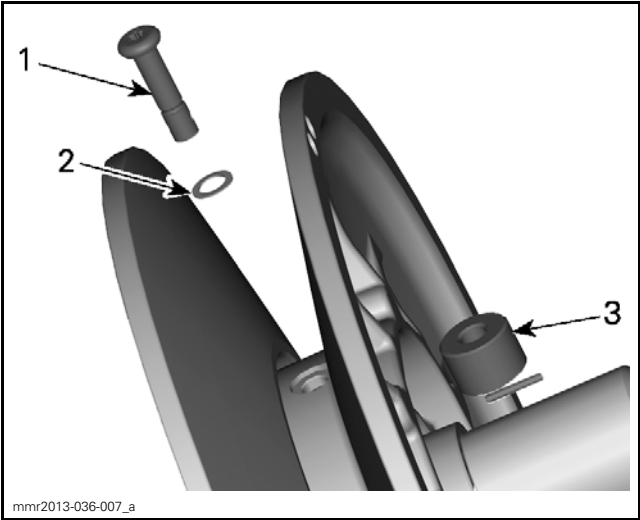
NOTE: Pivot screw and ribbed lock washer must be reused if in good condition. If damaged, replace fixed sheave assembly.

2. Apply the following threadlocker to the pivot screw threads.

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

3. Insert roller in fixed sheave, thread in pivot screw with ribbed lock washer.

NOTE: The ribbed lock washer must be installed with the concave side towards the fixed sheave.



- 1. Pivot screw
- 2. Ribbed lock washer (concave side towards fixed sheave)
- 3. Roller

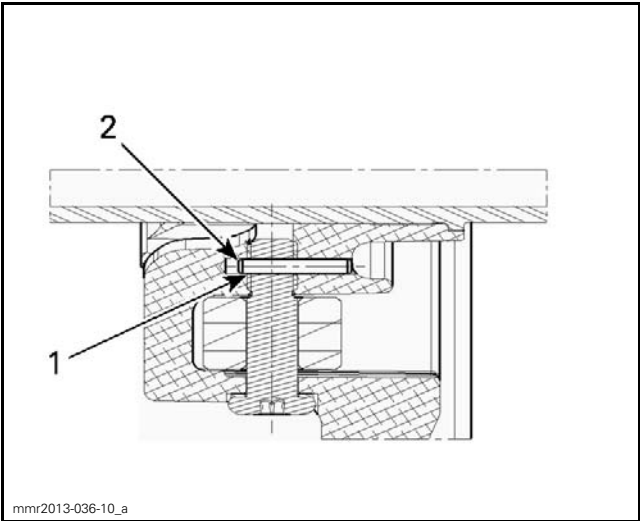
IMPORTANT: For proper fit, each pivot screw must be reinstalled where originally mounted in the fixed sheave.

4. Tighten pivot screw as specified.

TIGHTENING TORQUE	
Pivot screws	17 N•m ± 1 N•m (150 lbf•in ± 9 lbf•in)

NOTE: Spring pin hole in the fixed sheave and pivot screw must perfectly line up when tighten torque is applied.

NOTICE If not properly aligned, spring pin will not insert in pivot screw hole and spring pin threads in fixed sheave will be damaged.

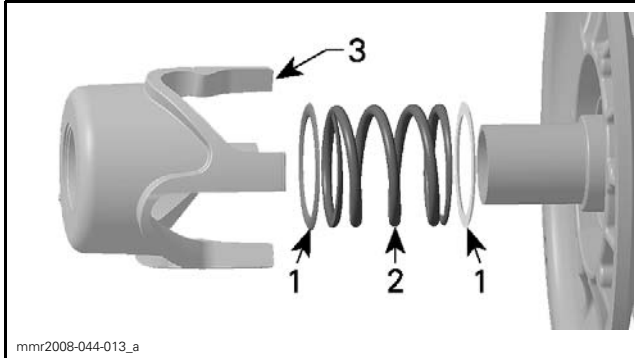


- 1. Hole in pivot screw
- 2. Spring pin

5. Install spring pin.

Installing Cam and Spring

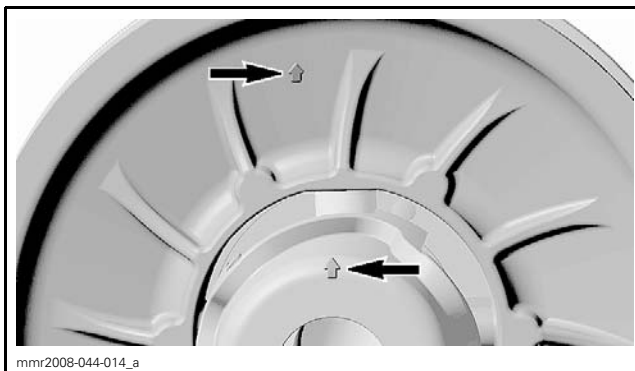
1. Install a spring stopper, the spring, the other spring stopper and the cam.



1. Spring stopper
2. Spring
3. Cam

2. Align the arrow on the cam with the arrow on the fixed sheave.

NOTE: On completion of cam installation, the arrow on the cam should have moved clockwise (approximately 30°).



3. Install the driven pulley spring compressor sleeve and tighten the tool screw until the cam is completely pressed against the sliding sheave.
4. From the back of the sliding sheave, install 4 new cam screws.
5. Tighten cam screws to specification.

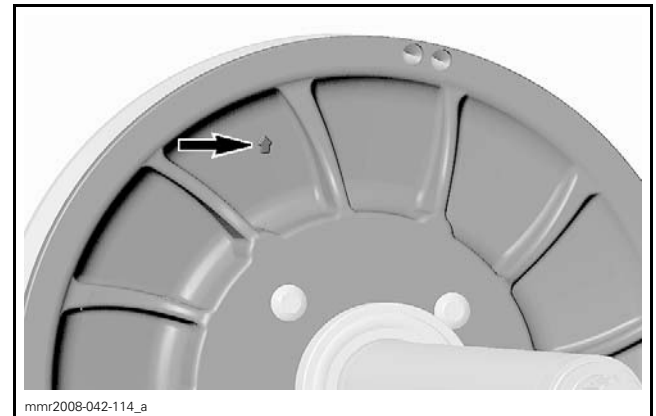
TIGHTENING TORQUE	
Cam screw	31.5 N•m ± 3.5 N•m (23 lbf•ft ± 3 lbf•ft)

6. Remove the tool.

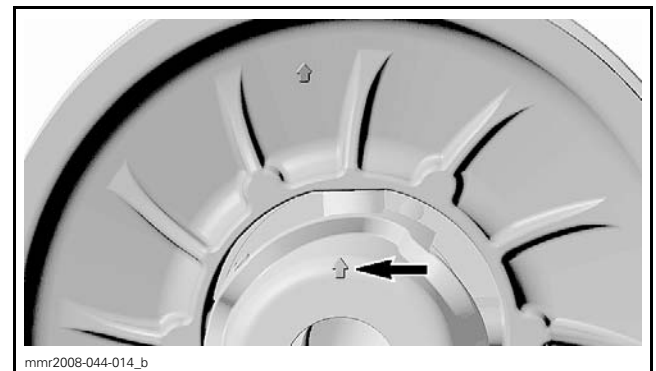
Installing the Sliding Sheave

The assembly of the sliding sheave is the reverse of the disassembly. However, pay attention to the following.

When installing sliding sheave, make sure to align its arrow with the arrow on cam.



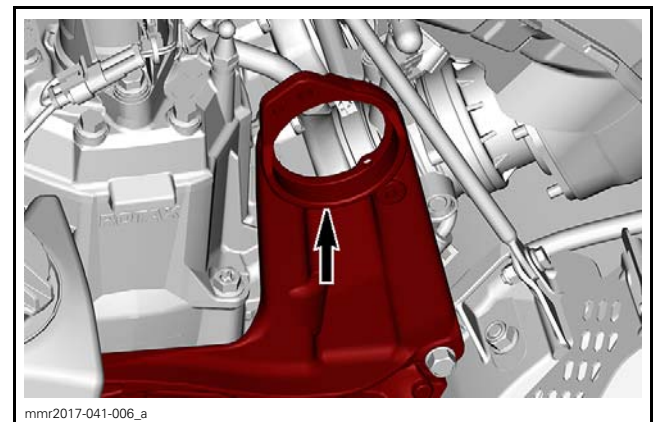
SLIDING SHEAVE ARROW



CAM ARROW

Installing the Driven Pulley

1. Using sand paper (600-grit or 1000-grit) or steel wool, remove any rust on bearing shoulder of countershaft bearing support.



BEARING SUPPORT SHOULDER

2. Apply a thin layer of antiseize lubricant on bearing shoulder.

Subsection 03 (DRIVEN PULLEY AND COUNTERSHAFT (WITH GEARBOX))

SERVICE PRODUCT

LOCTITE 767 (ANTI-SEIZE LUBRICANT)
(P/N 293 800 070)

3. Insert countershaft through countershaft bearing support.
4. Align countershaft splines with upper gear splines.
5. On LH side, install the bearing flange. Tighten nut to specification.

TIGHTENING TORQUE

Bearing flange nut	15.5 N•m ± 1.5 N•m (137 lbf•in ± 13 lbf•in)
--------------------	--

6. Install the adjuster hub onto the countershaft end and temporarily tighten.
7. Install and adjust drive belt. Refer to *DRIVE BELT* subsection.
8. Install all other removed parts.

COUNTERSHAFT

The countershaft and the fixed sheave are sold as an assembly. They are not available separately.

Removing and Installing the Countershaft

Refer to *DRIVEN PULLEY* in this subsection for the procedures.

COUNTERSHAFT BEARING

Removing the Countershaft Bearing

Remove the driven pulley. Refer to procedure in this subsection.

Install the bearing remover on countershaft.

REQUIRED TOOL

COUNTERSHAFT
BEARING REMOVER
(P/N 529 036 065)



4 stroke
COUNTERSHAFT
ADAPTER
(P/N 529 036 424)
2 stroke;
DRIVEN ADAPTER
(P/N 529 036 508)



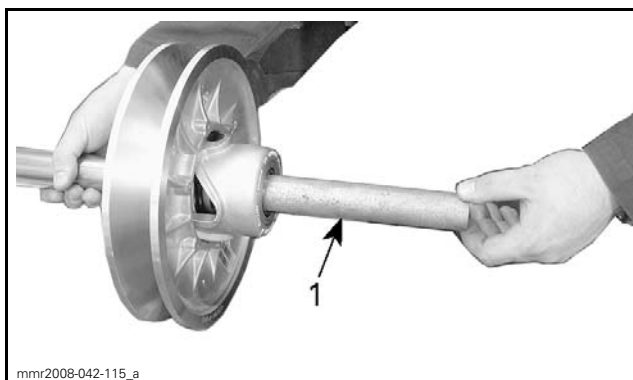
Tighten the screw at the end of tool to extract the bearing. Discard bearing.

Installing the Countershaft Bearing

1. Remove the adjuster hub from the cam.
2. Insert the countershaft support in the countershaft.

REQUIRED TOOL

COUNTERSHAFT SUPPORT (P/N 529 036 067)



1. Countershaft support

NOTICE The countershaft support is mandatory to avoid damaging the countershaft threaded end and the cam during bearing installation.

3. Clean residues on countershaft bearing surface.

SERVICE PRODUCT

Scandinavia

PULLEY FLANGE CLEANER
(F) (P/N 619 600 022)

Other
Countries

CLUTCH AND PULLEY FLANGE
CLEANER PRO S1 (P/N 779244)

4. Check countershaft bearing surface for wear.
5. Apply Loctite 7649 on countershaft bearing surface and let dry 5 minutes.

SERVICE PRODUCT

Scandinavia

LOCTITE 7649 (F)
(P/N 619 600 100)

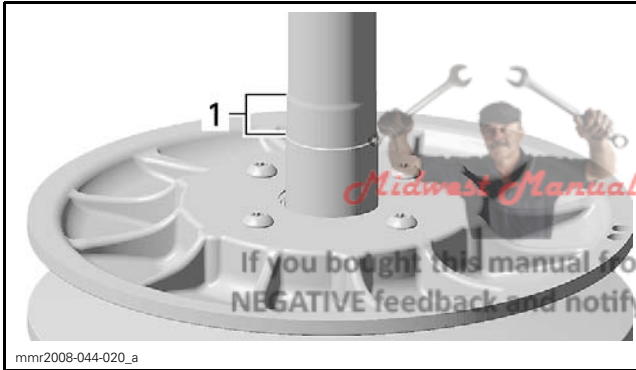
Other
Countries

LOCTITE 7649 (PRIMER)
(P/N 293 800 041)

6. Apply Loctite 609 on primer.

SERVICE PRODUCT

LOCTITE 609 (P/N 413 703 100)

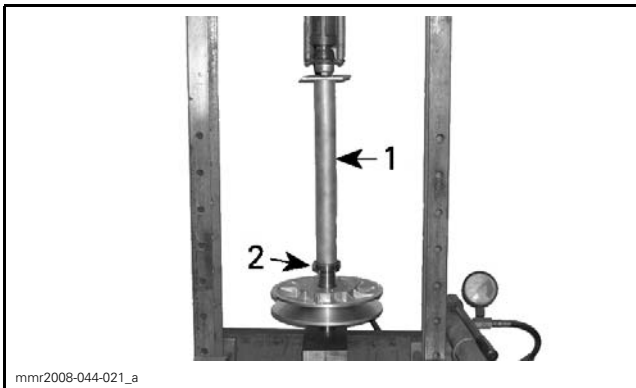


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NEGATIVE feedback and notify me at bestshopmanuals@gmail.com

1. Apply Loctite 7649 (Primer) before Loctite 609 in this region

7. Using a press and the bearing installer, install the new bearing on countershaft.

REQUIRED TOOL
COUNTERSHAFT BEARING INSTALLER (P/N 529 036 066)



1. Countershaft bearing installer
2. New bearing

NOTICE Use a press only, never tap on countershaft bearing installer with an hammer to avoid damaging bearing and countershaft.

8. Clean the surplus Loctite with a rag to avoid having Loctite on sliding sheave bushing.

COUNTERSHAFT BEARING SUPPORT

For countershaft bearing support removal and installation, refer to *COUNTERSHAFT BEARING SUPPORT* in *FRAME*.

BRAKE

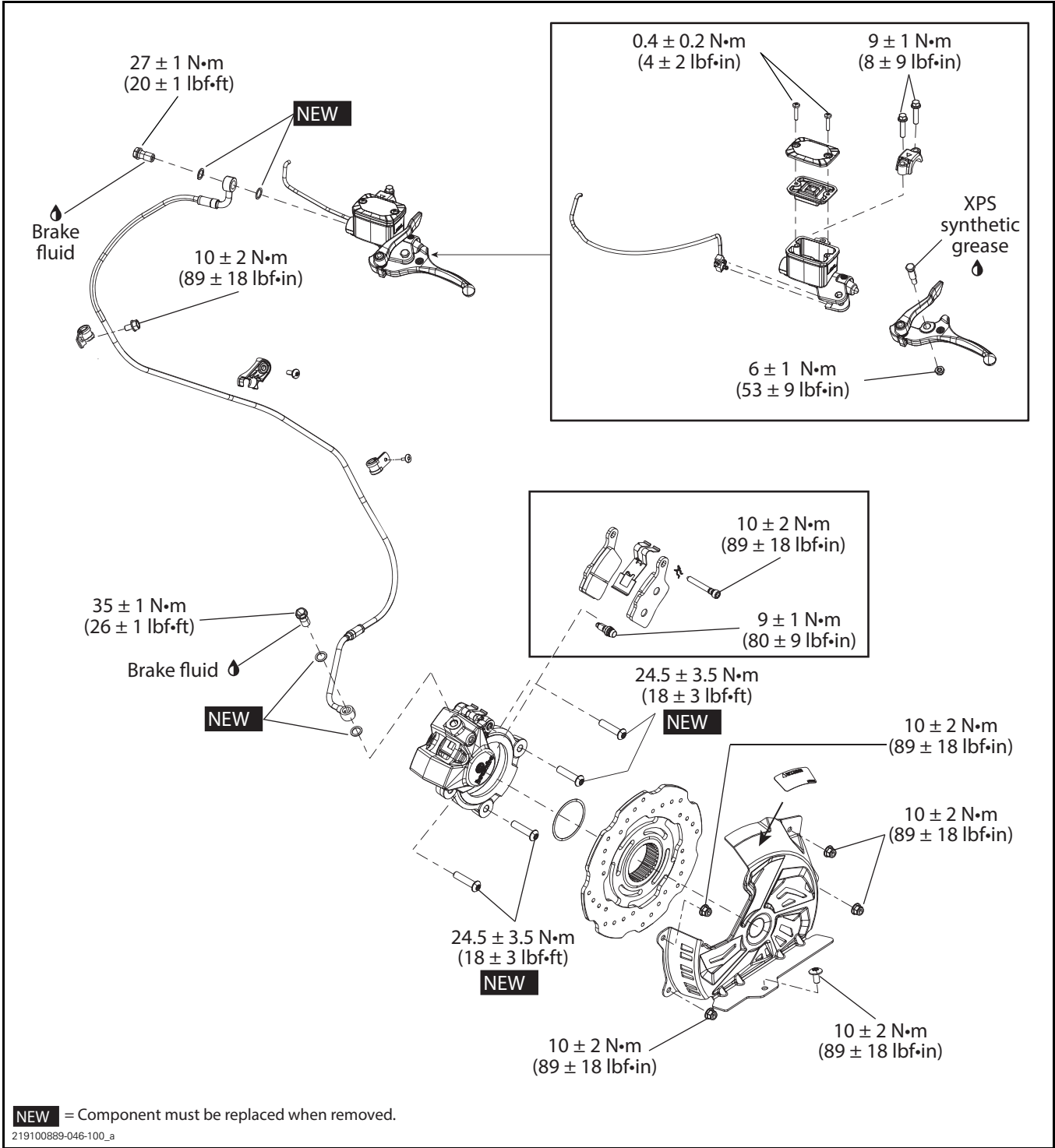
SERVICE TOOLS

Description	Part Number	Page
CALIPER PULLER	529 036 145	8
PROTECTIVE CAP	529 036 150	8

SERVICE PRODUCTS

Description	Part Number	Page
BRAKE FLUID DOT 4	779151	3
LOCTITE 767 (ANTISEIZE LUBRICANT)	293 800 070	8
SYNTHETIC GREASE	779162	5

Subsection XX (BRAKE)



GENERAL

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

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

⚠ WARNING

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

Hoses or cables removed or disconnected must be installed and routed as per factory specifications.

NOTICE Locking ties removed must be replaced as per factory specifications.

⚠ WARNING

Never apply any product to brake fittings. The use of thread sealant or Teflon tape could cause brake system failure.

⚠ WARNING

A contaminated brake disc or pad reduces braking efficiency. Discard contaminated pads and clean contaminated disc with a high quality brake degreasing agent.

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

NOTICE Wipe up any brake fluid spillage.

NOTICE To avoid serious damage to the brake system, use only DOT 4 brake fluid from a sealed container. Do not use brake fluid taken from an old or already opened containers, or mix different fluids for topping up the system.

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

Dispose of brake fluid as per your local environmental regulation.

MAINTENANCE

RECOMMENDED BRAKE FLUID

Always use brake fluid meeting the DOT 4 specification.

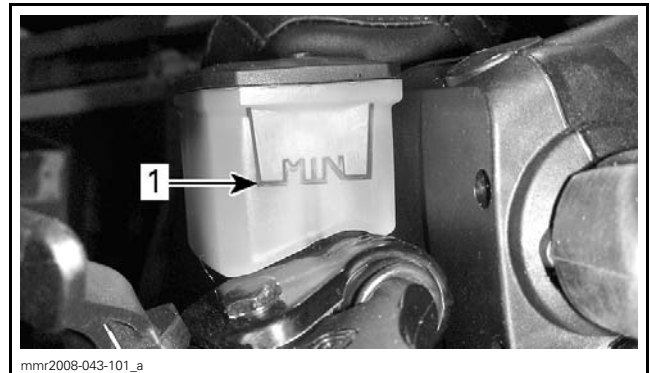
RECOMMENDED SERVICE PRODUCT

BRAKE FLUID DOT 4 (P/N 779151)

VERIFYING THE BRAKE FLUID LEVEL

With the vehicle on a level surface, position steering in the straight-ahead position to ensure reservoir is level.

Brake fluid must always be above the MIN. line when brake lever is squeezed.



TYPICAL
1. MINIMUM line

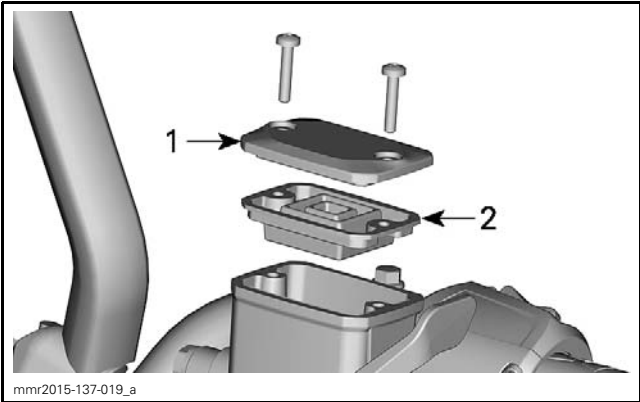
Add fluid as required. Do not overfill.

NOTE: A low level may indicate leaks or worn brake pads.

REPLACING THE BRAKE FLUID

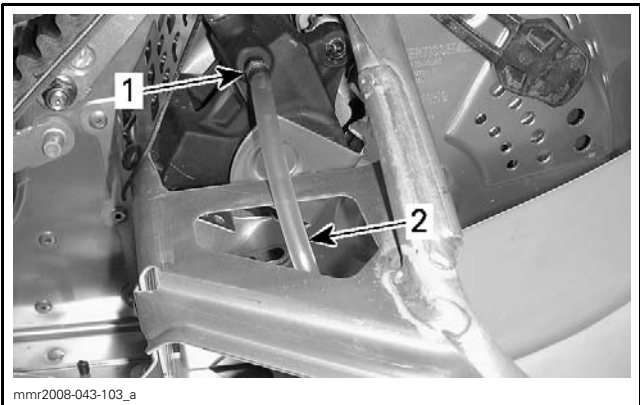
Draining the Brake Fluid

1. Place vehicle on a level surface.
2. Remove reservoir cover with its diaphragm.



1. Reservoir cover
2. Diaphragm

- 3. Connect a clear hose to caliper bleeder.
- 4. Place the other end of hose in a container.
- 5. Loosen bleeder and pump brake lever until no more fluid flows out of bleeder.



TYPICAL
1. Bleeder
2. Clear hose to catch used brake fluid

NOTE: To drain the fluid trapped in the caliper, push the pistons in.

Filling the Brake Fluid

To fill brake circuit when it is empty do the following:

- 1. Ensure reservoir cover is removed.
- 2. Using a large syringe and a suitable tube, push brake fluid slowly into the caliper.



TYPICAL

- 3. Continue to push brake fluid until master cylinder reservoir is half full.
- 4. Close bleeder.
- 5. Fill up reservoir and install diaphragm and cover.
- 6. Squeeze brake lever.
 - 6.1 If brake lever is firm, the brake system does not require bleeding. Torque bleeder as specified.

TIGHTENING TORQUE	
Brake caliper bleeder	8.5 N•m ± 1.5 N•m (75 lbf•in ± 13 lbf•in)

- 6.2 If brake lever is spongy, bleed brake system as per following procedure.

BLEEDING THE BRAKE SYSTEM

- 1. Install a clear hose on bleeder.
- 2. Place the other end in a container partially filled with clean brake fluid.
- 3. Remove reservoir cover and diaphragm.
- 4. Pump up circuit pressure with brake lever until lever resistance is felt.
- 5. Squeeze brake lever and open bleeder. When lever touches the handlebar, do not release lever and close bleeder.
- 6. Release brake lever slowly.
- 7. Repeat the procedure until no more air bubbles appear in hose.

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

- 8. Install cover and diaphragm on reservoir.
- 9. Squeeze brake lever.
 - 9.1 If brake lever is firm, bleeding procedure is completed. Torque bleeder as specified.
 - 9.2 If brake lever is still spongy, repeat step 2 to step 6.

10. Torque bleeder as specified.

TIGHTENING TORQUE	
Brake caliper bleeder	8.5 N•m ± 1.5 N•m (75 lbf•in ± 13 lbf•in)

11. Refill reservoir.

12. Install diaphragm and cover on reservoir.

INSPECTING THE BRAKE HOSE, PADS AND DISC

Break-In Inspection

Visually inspect the brake hose for leaks or any damage.

Visually inspect pads and disc for abnormal wear or any damage.

Scheduled Maintenance and Preseason

Visually inspect the brake hose for leaks or any damage.

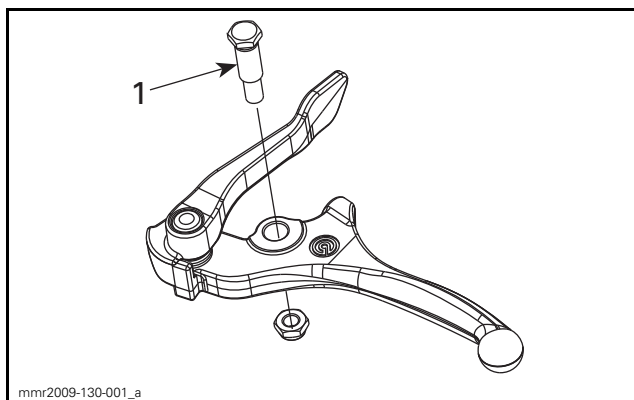
Refer to *BRAKE* subsection and carry out:

- *INSPECTING THE BRAKE PAD*
- *INSPECTING THE BRAKE DISC*.

LUBRICATING THE BRAKE LEVER PIVOT

1. Remove brake lever pivot.
2. Lubricate brake lever pivot using recommended product.

SERVICE PRODUCT
SYNTHETIC GREASE (P/N 779162)



1. Lubricate this surface

3. Install brake lever pivot.
4. Torque pivot nut of brake lever as specified.

TIGHTENING TORQUE

Brake lever pivot nut	6 N•m ± 1 N•m (53 lbf•in ± 9 lbf•in)
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PROCEDURES

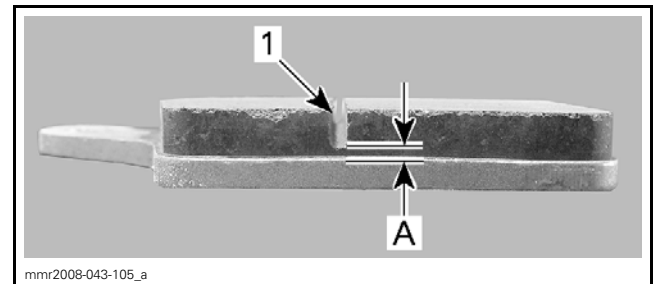
BRAKE PADS

Inspecting the Brake Pads

1. Measure brake pad lining thickness.

SERVICE LIMIT	
Brake pad thickness A	1 mm (1/32 in)

NOTICE Brake pads must always be replaced in pairs.



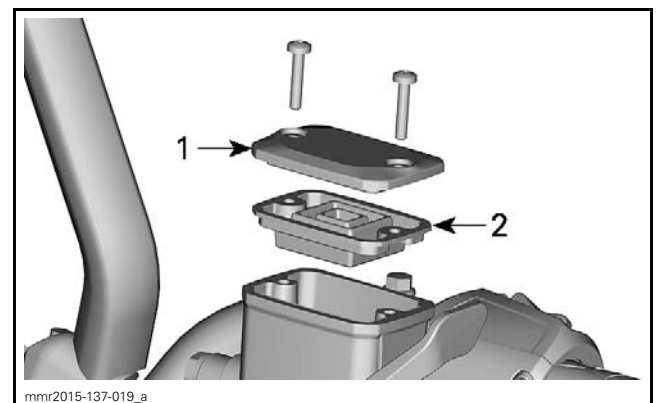
1. Groove on pad lining

2. Also inspect the brake disc, refer to *INSPECTING THE BRAKE DISC* in this subsection.

Replacing the Brake Pads

Removing the Brake Pads

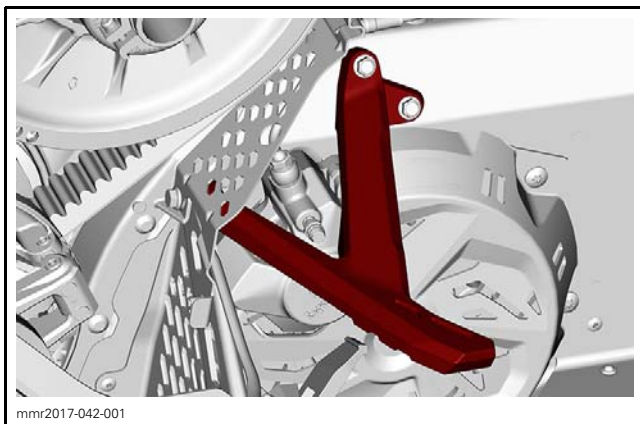
1. Place the vehicle on a level surface.
2. Cover the plastic parts under and near master cylinder in the event that brake fluid would be spilled.
3. Remove reservoir cover with its diaphragm seal.



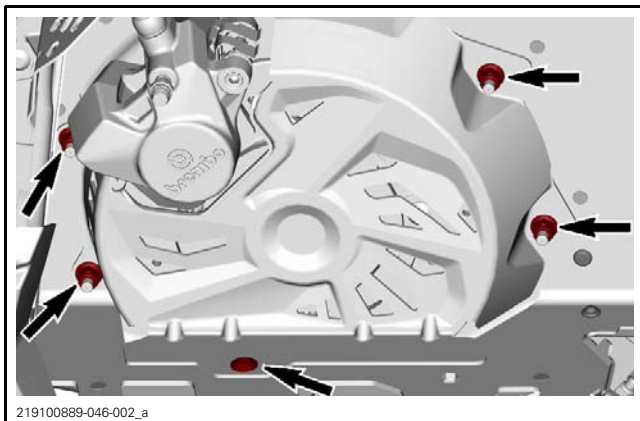
1. Reservoir cover
2. Diaphragm

Subsection XX (BRAKE)

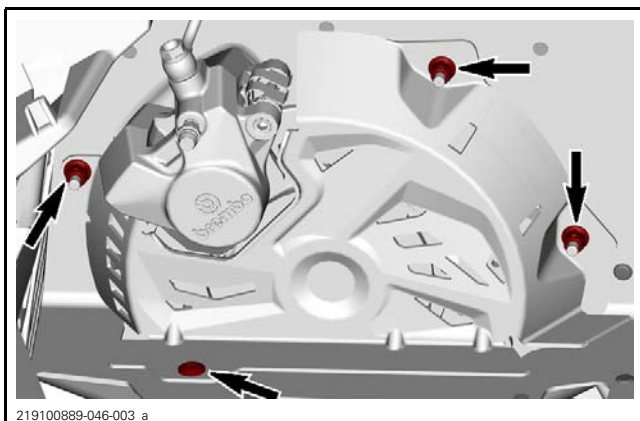
4. Open the LH side panel.
5. Remove the LH toe hook.



6. Remove the disc brake protective cover.

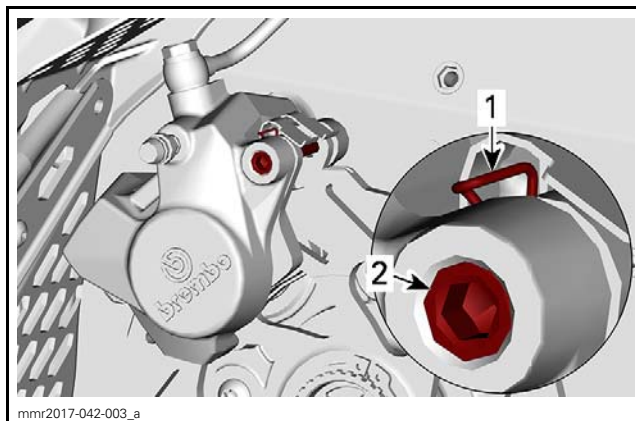


5 HOLES MOUNT



4 HOLES MOUNT

7. Remove the clip securing brake pad pin.
8. Unscrew and remove the brake pad pin.



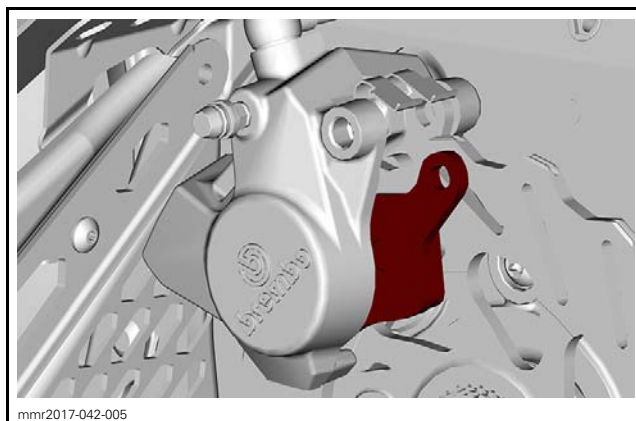
1. Clip
2. Brake pad pin

9. Using a flat screwdriver, depress caliper pistons into their bores. Pay attention for pistons to go back in straight. Insert screwdriver alternatively backwards and forwards and move pistons by small steps.

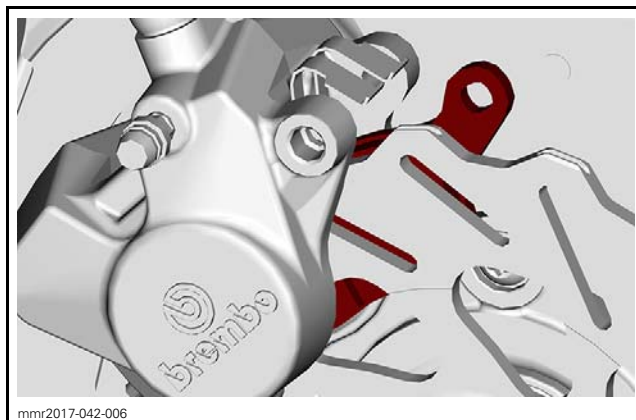
NOTICE Pay attention to avoid scratching brake disc.

10. Remove brake pads.

10.1 Remove the external pad first.



10.2 Pull the brake disc outward and remove the internal pad.



Installing the Brake Pads

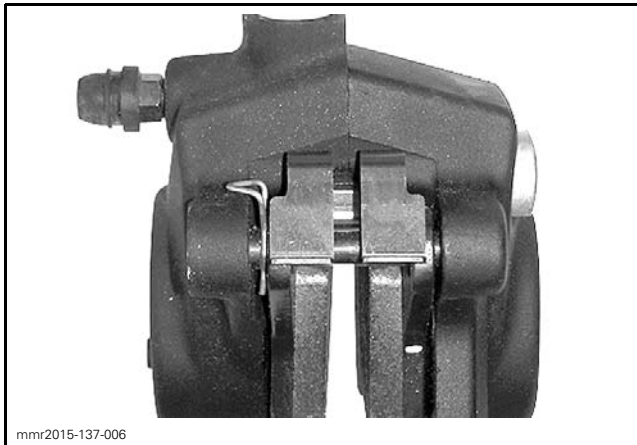
The installation is the reverse of the removal. However, pay attention to the following.

1. Install new brake pads with tabs facing upward.
2. Install brake pad pin and tighten to specification.

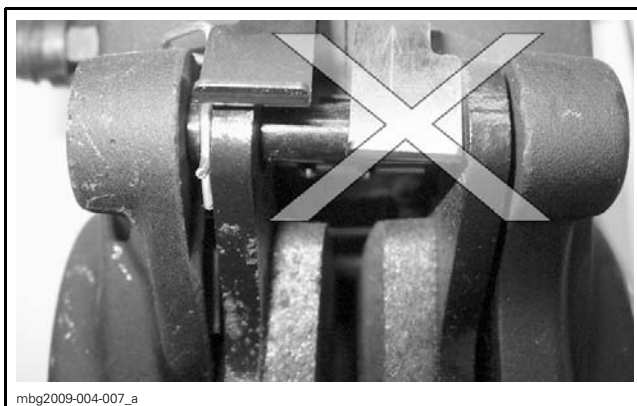
TIGHTENING TORQUE	
Brake pad pin	10 N•m ± 2 N•m (89 lbf•in ± 18 lbf•in)

3. Install spring clip on brake pad pin. If the clip seems loose, replace it with a new one.

NOTE: Make sure anti-rattle spring ends on brake pads tabs are correctly installed as per following pictures.



CORRECT



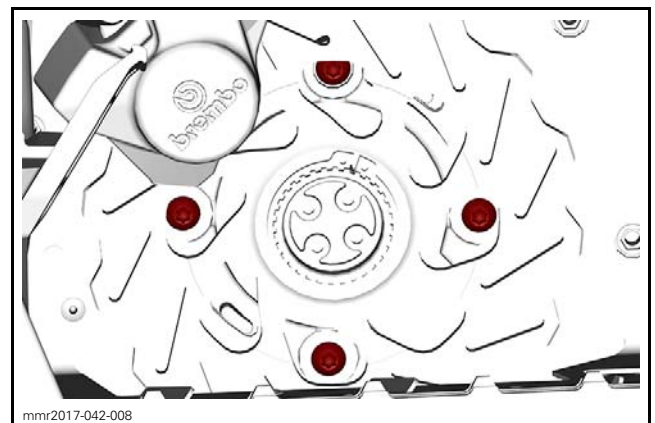
INCORRECT (RIGHT SIDE SPRING CLIP)

4. Operate the brake lever several times to bring the brake pads into contact with the disc brake.
5. Check brake fluid level in master cylinder and refill if necessary.
6. Reinstall the diaphragm and the cover.
7. Ride the vehicle a few minutes to make sure the repair is successful.

CALIPER

Removing the Caliper

1. Open the RH side panel.
 2. Refer to *CHAINCASE* subsection and carry the following steps.
 - 2.1 Remove chaincase cover.
 - 2.2 Loosen drive chain.
 - 2.3 Remove lower sprocket.
 3. Open LH side panel.
 4. Remove drive belt guard support. Refer to *DRIVE BELT* subsection.
 5. Remove the LH toe hook.
- NOTE:** If the caliper is not replaced, omit steps 5 and 6 concerning the brake system draining and brake hose removal.
6. Remove the brake pads, Refer to procedure in this subsection.
 7. Lift the rear of vehicle and release track tension completely.
 8. Turn track to align brake disc slots with caliper bracket screws.
 9. Remove caliper screws (4) behind brake disc.



10. Pull the assembly (brake disc, caliper, bearing, and drive axle) from LH side in order to make room for the caliper puller.



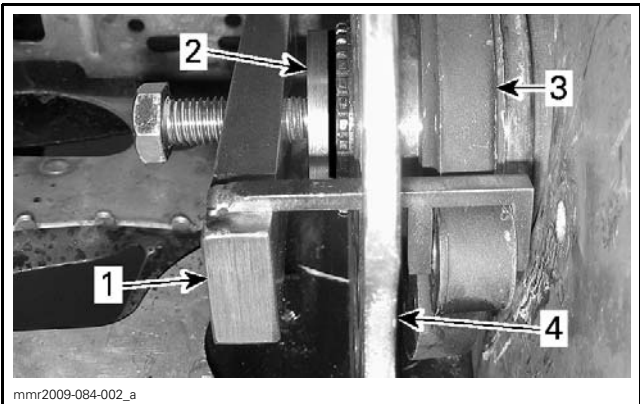
TYPICAL

REQUIRED TOOL	
CALIPER PULLER (P/N 529 036 145)	
PROTECTIVE CAP (P/N 529 036 150)	

11. Install the caliper puller on the brake caliper through brake disc slots.

NOTE: Make sure puller tabs are correctly engaged on caliper.

12. Install the protective cap between caliper puller bolt and plastic cap in drive axle end.



TYPICAL

- 1. Caliper puller
- 2. Protective cap
- 3. Caliper bracket
- 4. Brake disc

13. Tighten caliper puller bolt to separate caliper from drive axle bearing.

NOTICE Never use an impact tool to operate caliper puller. The caliper or the puller could break.

14. When brake disc is out of splines, remove it.

15. Remove caliper.

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

Inspecting the Caliper

- 1. Check caliper pistons for:
 - Proper operation
 - Rust
 - Scratches
 - Leaks.
- 2. Check caliper bracket for:
 - Cracks
 - Rust on bearing shoulder (clean with a steel wood).
- 3. Replace caliper if required.

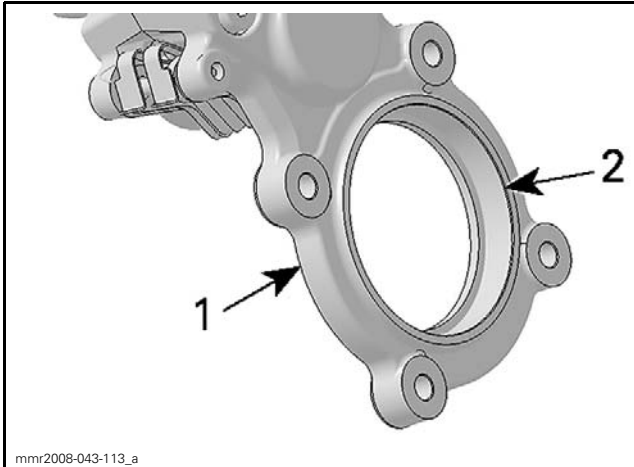
Installing the Caliper

- 1. Using your fingers or a small piece of wood, push both pistons into their bores.
- 2. Clean brake caliper bearing shoulder with fine steel wool.
- 3. Apply antiseize lubricant on drive axle splines and on bearing shoulder of caliper bracket.

SERVICE PRODUCT
LOCTITE 767 (ANTISEIZE LUBRICANT) (P/N 293 800 070)

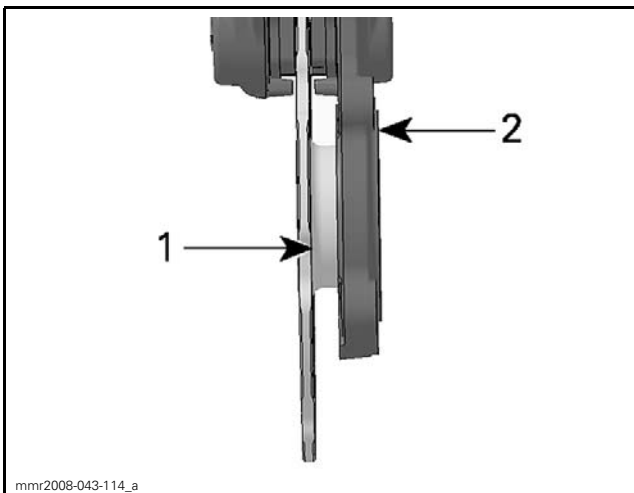


DRIVE AXLE SPLINES



1. Caliper bracket
2. Bearing shoulder

4. Insert brake disc in the caliper. The brake disc collar must be inserted in the caliper bracket.



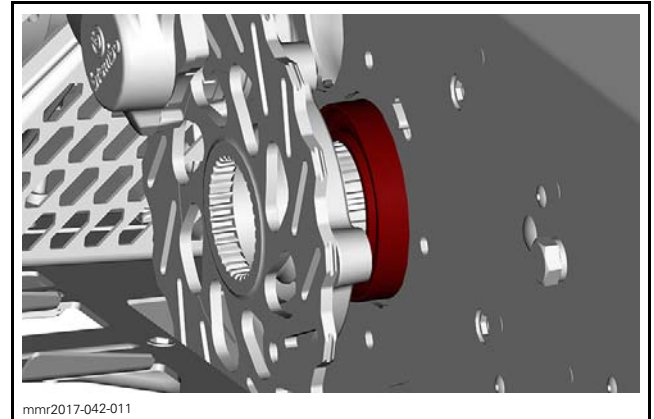
1. Brake disc collar
2. Caliper bracket

5. Ensure bearing flange is properly locked in the frame. Tabs must be properly inserted in frame slots.

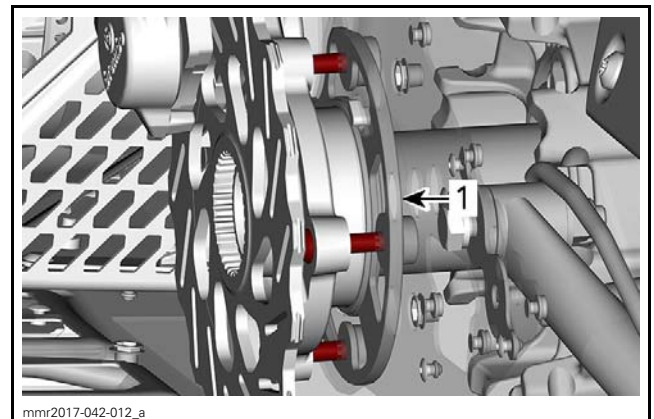


VIEW FROM OUTSIDE FRAME

6. Align brake disc splines with drive axle splines and push brake disc onto drive axle.
7. Push the caliper bracket over the drive axle bearing.



8. Align caliper bracket holes with bearing flange holes and install caliper screws.



TYPICAL - TUNNEL IS TRANSPARENT FOR CLARITY

1. Bearing flange (inside frame)

9. **HAND TIGHTEN** each caliper bracket screw evenly in a criss-cross pattern until bracket is correctly positioned against frame.

NOTICE Never use an air tool to tighten caliper screws. The caliper bracket could crack.

10. Install the brake pads. Refer to procedure in this subsection.
11. Install the brake disc circlip.
12. Tighten the brake caliper screws to specification.

Subsection XX (BRAKE)

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

- 13. Apply brake fluid on Banjo fitting threads.
- 14. Install the Banjo fitting with two new sealing washers.
- 15. Tighten Banjo fitting to specification.

TIGHTENING TORQUE	
Banjo fitting	35 N•m ± 1 N•m (26 lbf•ft ± 1 lbf•ft)

- 16. Fill and bleed the brake system. Refer to *MAINTENANCE* in this subsection.
- 17. Install all other removed parts.
- 18. Check the operation of the brake carefully before riding the snowmobile.

BRAKE DISC

Inspecting the Brake Disc (Not Removed)

- 1. Remove the disc brake protective cover.
- 2. Check for scoring, cracking or bending, replace as required.
- 3. Measure brake disc thickness. If the brake disc is out of specification, replace it with a new one.

NOTICE Brake disc should never be machined.

BRAKE DISC SPECIFICATION	
Minimum thickness	4.5 mm (.177 in)

Inspecting the Brake Disc (Removed)

- 1. Check brake disc splines and drive axle splines for wear or other damages. Replace defective parts.

Removing and Installing the Brake Disc

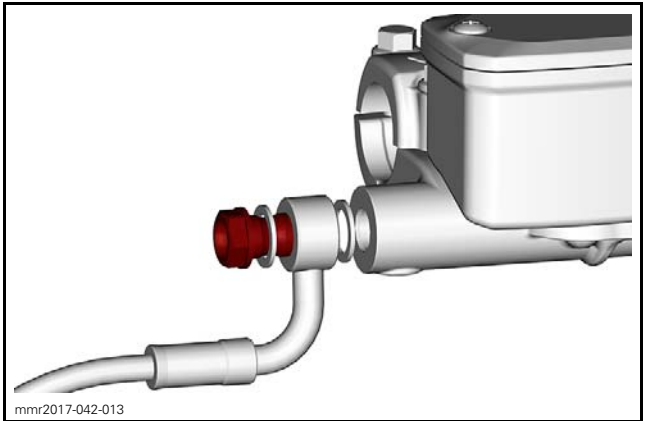
Follow procedures for caliper removal and installation.

MASTER CYLINDER

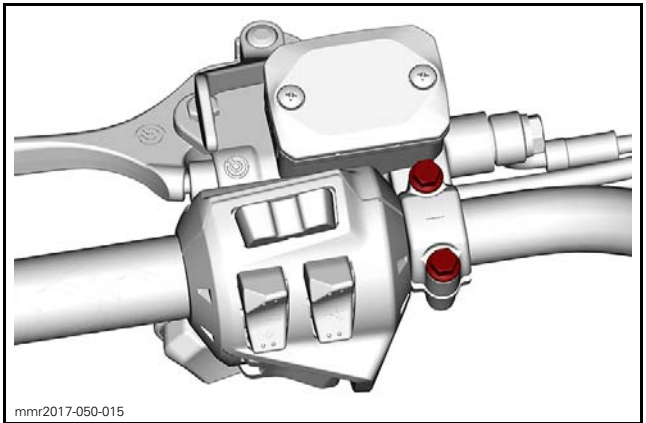
Removing the Master Cylinder

NOTE: If the master cylinder is not replaced, omit the steps concerning brake system draining and brake hose removal.

- 1. Drain brake system, Refer to *MAINTENANCE* in this subsection.
- 2. Remove the Banjo fitting and discard the sealing washers.



- 3. Remove screws and clamp securing master cylinder to handlebar.



- 4. Remove master cylinder.

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

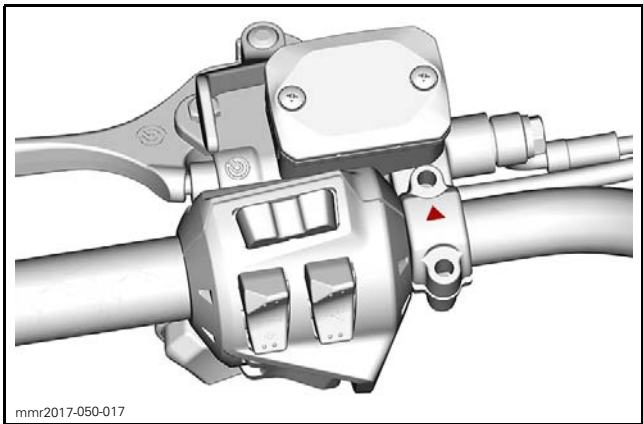
Inspecting the Master Cylinder

- 1. Discard all remaining fluid inside master cylinder reservoir.
- 2. Check if the reservoir cap seal is brittle, hard or damaged. Replace as necessary.
- 3. If the reservoir is damaged or leaking, replace master cylinder.

- 4. Check if brake lever is bent, cracked or otherwise damaged. Replace brake lever if required.

Installing the Master Cylinder

- 1. Place the master cylinder on the handlebar.
- 2. Install master cylinder retaining clamp with its arrow pointing toward the front of vehicle.



- 3. Install master cylinder clamp screws and tighten loosely.
- 4. With the handlebar in the straight ahead position, place the reservoir parallel to the ground.
- 5. Tighten master cylinder clamp screws to specification.

TIGHTENING TORQUE	
Master cylinder clamp screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

- 6. Install the Banjo fitting with two new sealing washers.
- 7. Tighten Banjo fitting to specification.

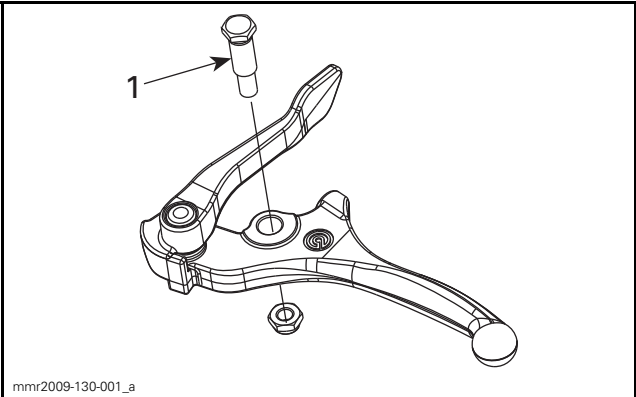
TIGHTENING TORQUE	
Banjo fitting	27 N•m ± 1 N•m (20 lbf•ft ± 1 lbf•ft)

- 8. Fill and bleed the brake system. Refer to *MAINTENANCE* in this subsection.
- 9. Install brake light switch.
- 10. Install steering cover.

BRAKE LEVER

Replacing the Brake Lever

Always lubricate brake lever pivot when replacing brake lever or pivot. Refert to *LUBRICATING THE BRAKE LEVER PIVOT*.



TYPICAL
1. Lubricate brake lever pivot

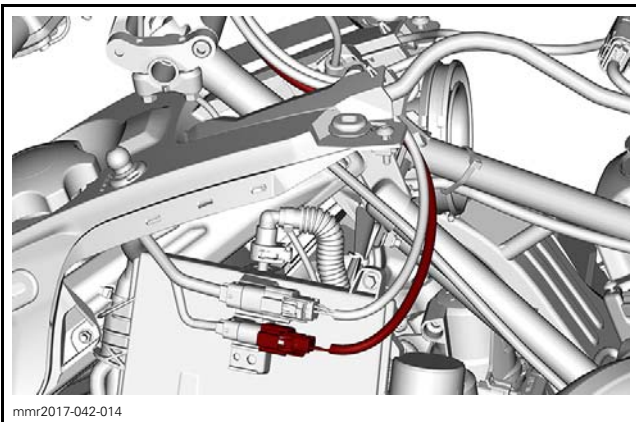
Tighten the pivot nut of brake lever to specification.

TIGHTENING TORQUE	
Brake lever pivot nut	6 N•m ± 1 N•m (53 lbf•in ± 9 lbf•in)

BRAKE LIGHT SWITCH

Testing the Brake Light Switch Resistance

- 1. Remove the upper body module. Refer to *BODY* subsection.
- 2. Disconnect the brake light switch connector located on the ECM.



- 3. Validate switch operation with an ohmmeter as follows.

Subsection XX (BRAKE)

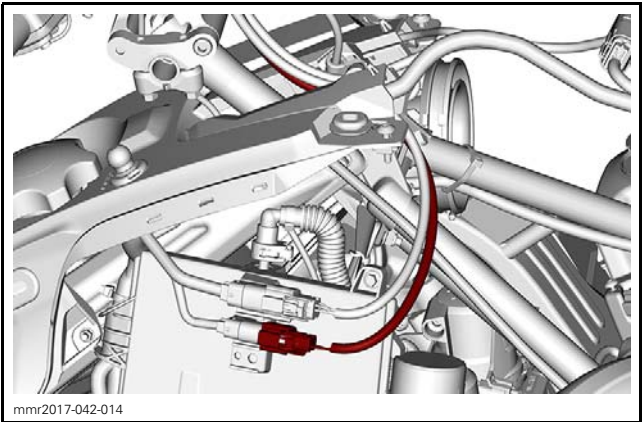
LH HANDLEBAR CONNECTOR (4-PIN)		
SWITCH	WIRE	RESISTANCE
Released	Pin 2 and pin 4	Infinite (OL)
Squeezed and held		Close to 0 Ω

If readings do not correspond to the above specifications, replace switch.

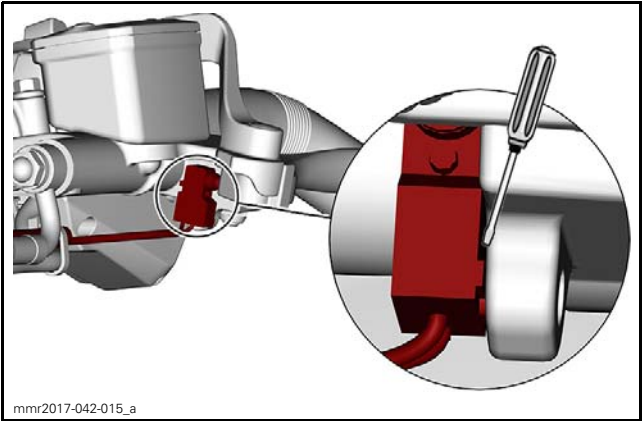
If readings correspond to the above specifications, check fuse, wiring and connectors going to switch. Repair or replace defective part(s).

Removing the Brake Light Switch

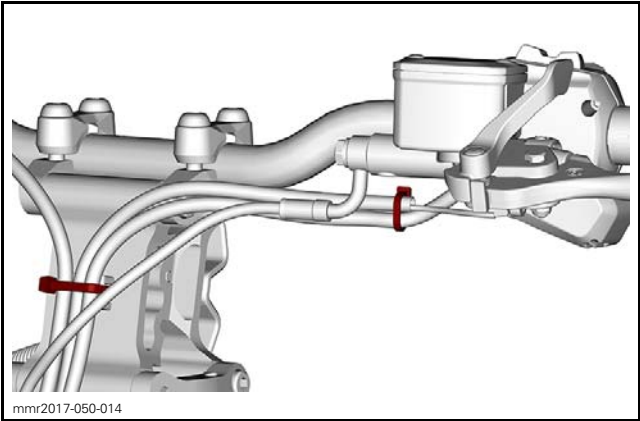
- 1. Remove the upper body module. Refer to *BODY* subsection.
- 2. Disconnect the brake light switch connector located on the ECM.



- 3. Slip a small screwdriver between brake light switch and master cylinder housing and separate them.



- 4. Cut all locking ties securing switch wires.



TYPICAL

- 5. Remove switch wires from connector. Refer to *WIRING HARNESS AND CONNECTORS*.

NOTE: Check wires location for reinstallation.

Installing the Brake Light Switch

The installation is the reverse of the removal procedure. However, pay attention to the following. Plug switch wires into connector as per following tables.

LH HANDLEBAR CONNECTOR (4-PIN)	
WIRE	CONNECTOR
GRAY	Pin 4
BROWN	Pin 2

Check if switch is working properly.
Install new locking ties.

BRAKE HOSE

Replacing the Brake Hose

- 1. Remove the console. Refer to *BODY* subsection.
- 2. Drain the brake system. Refer to *MAINTENANCE* in this subsection.
- 3. Remove Banjo fittings at both ends of hose. Refer to *REMOVING THE MASTER CYLINDER* and *REMOVING THE CALIPER*.
- 4. Remove fasteners that secure the hose clamps to the frame.

NOTICE Take care not to overdrill the lower clamp rivet. The fuel tank could be damaged.

The installation is the reverse of the removal procedure. However, pay attention to the following. Install new sealing washer.

TIGHTENING TORQUE	
Middle clamp nut	2.3 N•m ± 0.2 N•m (20 lbf•in ± 2 lbf•in)
Caliper Banjo fitting	35 N•m ± 1 N•m (26 lbf•ft ± 1 lbf•ft)
Master cylinder Banjo fitting	27 N•m ± 1 N•m (20 lbf•ft ± 1 lbf•ft)

CHAINCASE AND REVERSE

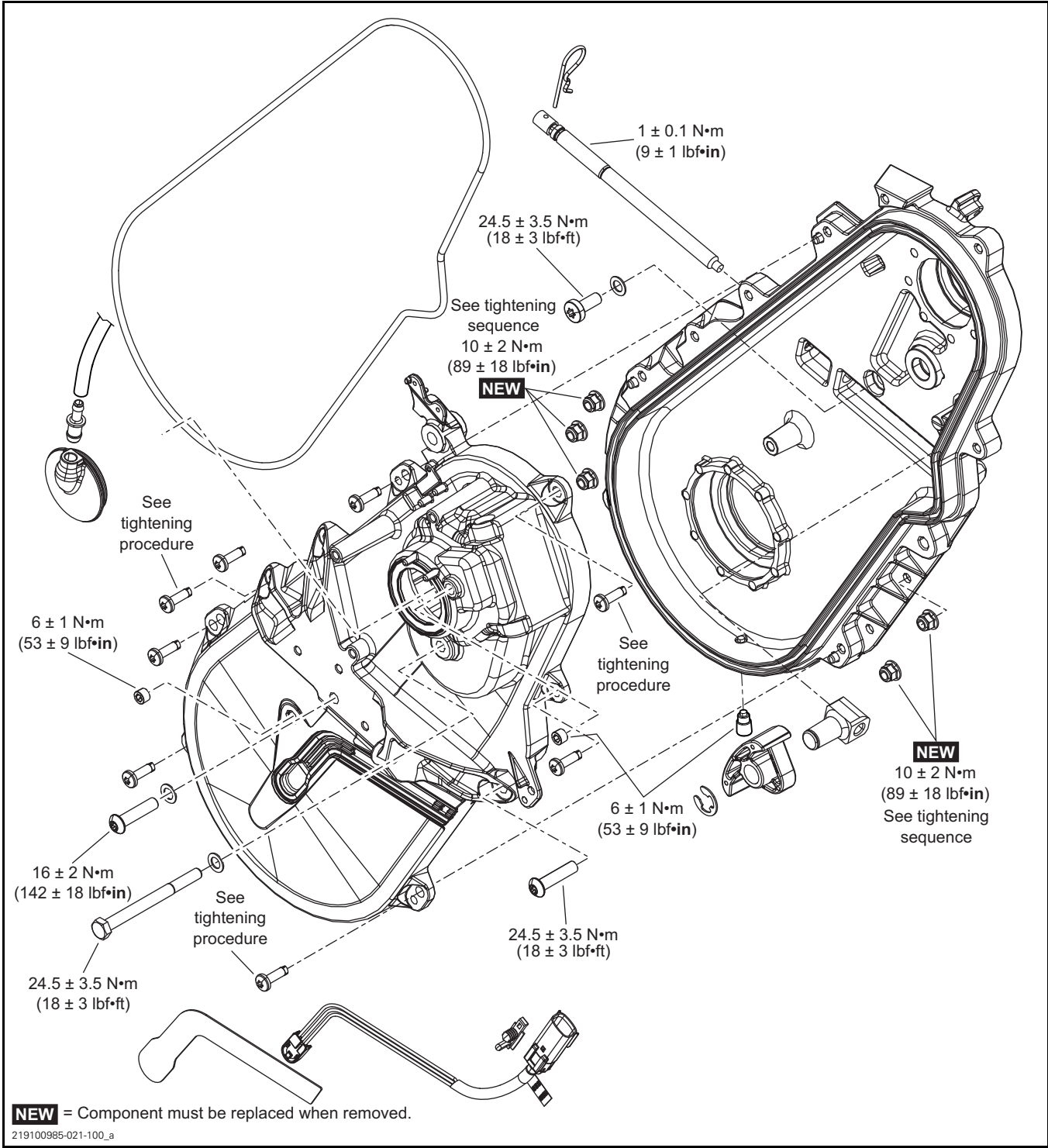
SERVICE TOOLS

Description	Part Number	Page
BEARING PULLER/PUSHER	529 036 111	17
BEARING PULLER/PUSHER	529 036 112	17
ECM ADAPTER TOOL.....	529 036 166	5
FLUKE 115 MULTIMETER	529 035 868	5

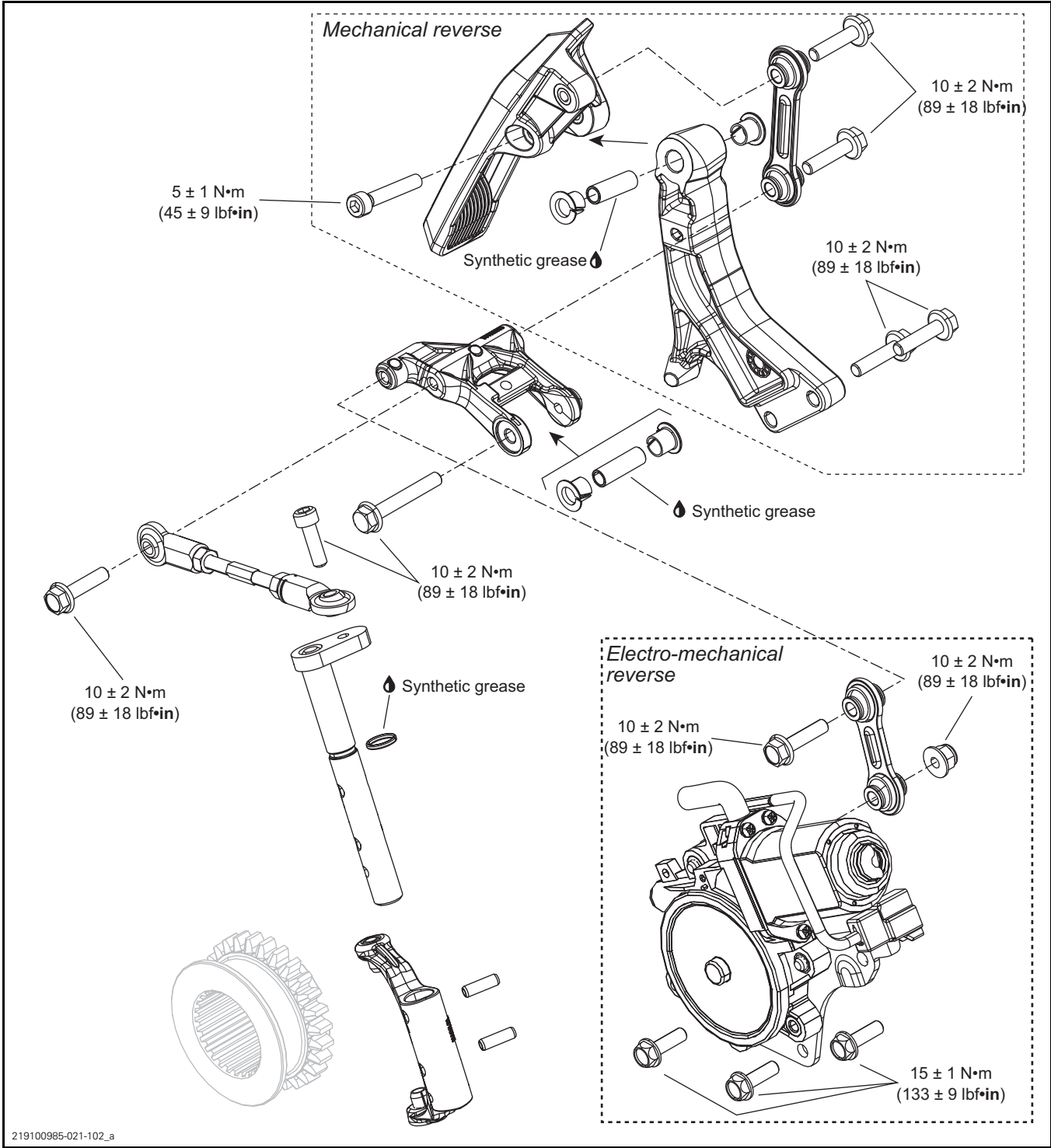
SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 5900	293 800 066	24
SYNTHETIC CHAINCASE OIL	779156	6
SYNTHETIC GREASE	779162	9

Subsection XX (CHAINCASE AND REVERSE)



Subsection XX (CHAINCASE AND REVERSE)



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GENERAL

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

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

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

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

WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices when removed (e.g.: locking tabs, elastic stop nuts, cotter pin, etc.) must be replaced with new ones.

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

SYSTEM DESCRIPTION

Mechanical Reverse

This reverse system integrated in the chaincase is controlled mechanically by link rods. When reverse handle is engaged, the shift fork moves sliding gear and switches its power to the reverse sprocket. This reverse sprocket turns backwards and transmits its power to the lower sprocket. When the mechanism is engaged forward, it works like a normal chaincase with the upper sprocket giving its power to the lower sprocket.

Electro-Mechanical Reverse

This system works mechanically the same way as the mechanical reverse, except that the sliding gear is controlled electrically by the ECM and the electrical actuator. When the START/REVERSE button is pressed, the ECM transmits its signal through either the reverse or forward relay to the electric

motor. The ECM will not engage the reverse if the engine RPM is above 2200 or the vehicle speed is above 1 km/h.

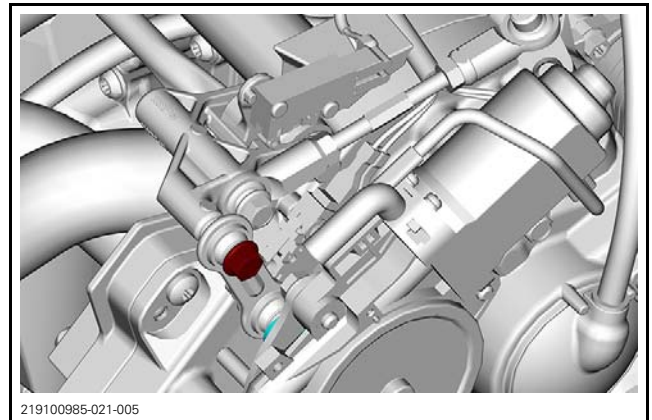
ADJUSTMENT

SHIFTER LINK ROD ADJUSTMENT

NOTICE It is of the uppermost importance for the adjustment reliability to follow entirely this procedure.

Electro-Mechanical Reverse

1. Remove link screw from the shifter lever.

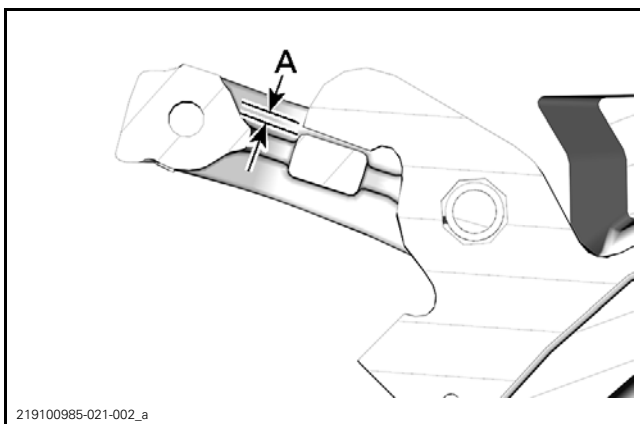
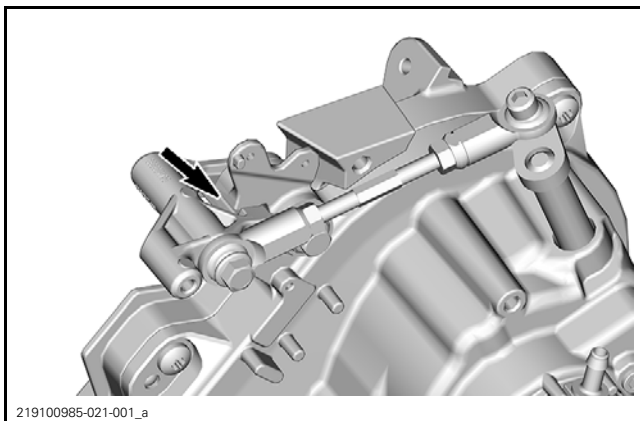


Mechanical and Electro-Mechanical Reverse

1. Lift rear of vehicle and support it off the ground.
2. Rotate driven pulley a few turns to ensure reverse mechanism is properly engaged.
3. Verify gap between shifter lever and chaincase front stopper using a feeler gauge. Refer to the following table.

SHIFT LINKAGE ADJUSTMENT	
Gap no. A	0.4 mm to 0.6 mm (.016 in to .024 in)

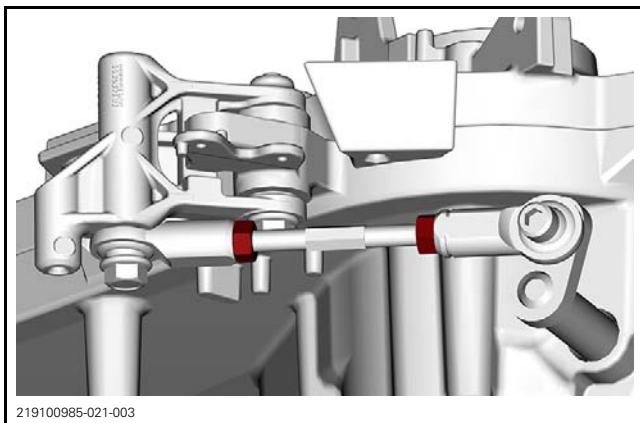
Subsection XX (CHAINCASE AND REVERSE)



A. Gap = 0.4 mm to 0.6 mm (.016 in to .024 in)

4. If gap is out of specification, adjust shifter link rod as follows.

- 4.1 Loosen link rod lock nuts.



- 4.2 Turn link rod accordingly.

NOTE: Turn the link rod clockwise to reduce the gap and counterclockwise to increase the gap.

- 4.3 Tighten link rod lock nuts.

5. Engage and release reverse mechanism 10 times using reverse handle or shifter lever.

6. Rotate driven pulley a few turns to ensure reverse mechanism is properly engaged.

7. Verify again adjustment gap. Readjust if necessary.

MAINTENANCE

CHAINCASE OIL

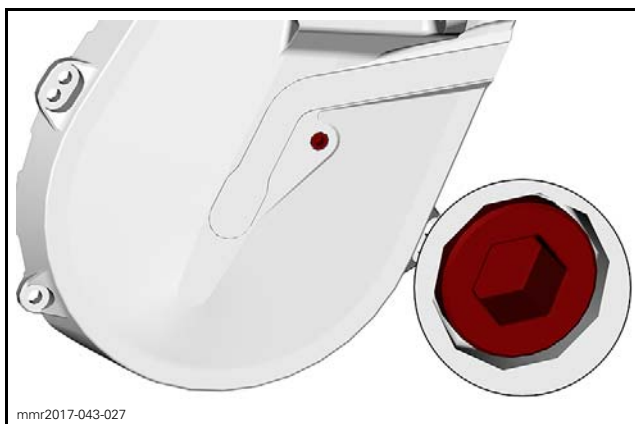
Recommended Chaincase Oil

RECOMMENDED SERVICE PRODUCT
SYNTHETIC CHAINCASE OIL (P/N 779156)

NOTICE Use only the recommended type oil when servicing. Do not mix synthetic oil with other types of oil.

Verifying the Chaincase Oil Level

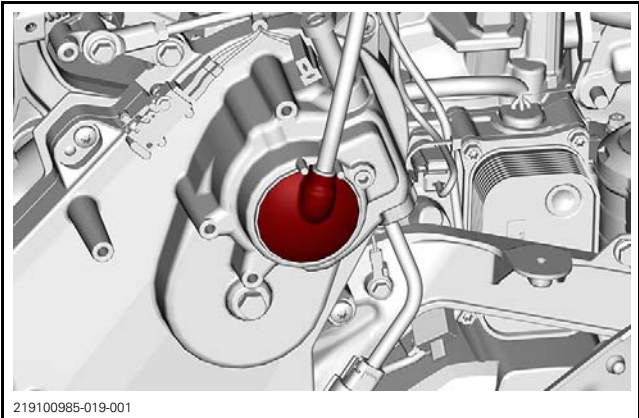
1. Place vehicle on a level surface.
2. Remove the check plug beside the speed sensor on the chaincase cover. Oil level must be equal with the lower edge.



3. Remove metal particles from magnetic check plug.

NOTE: It is normal to find metallic particles stuck to magnetic check plug. If bigger pieces of metal are found, remove the chaincase cover and inspect the chaincase parts.

4. To add oil, remove the filler cap on top of chaincase cover.

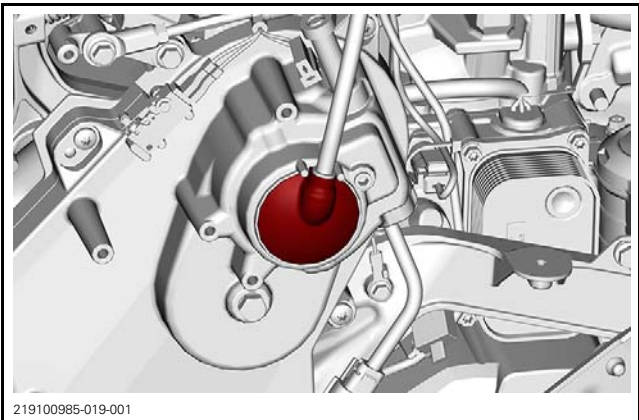


5. Pour recommended oil in chaincase by the filler hole until oil comes out by the magnetic check plug hole.
6. Reinstall magnetic check plug and torque to specification.

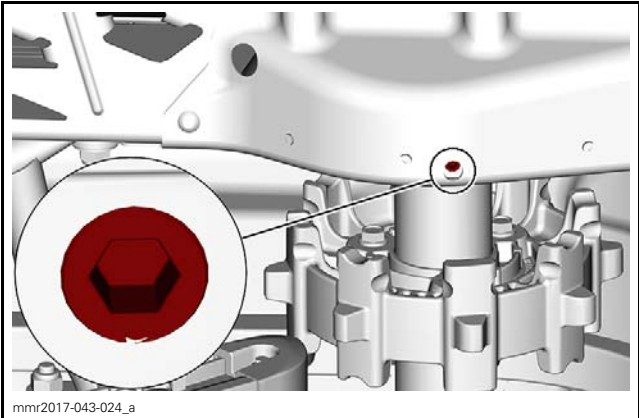
TIGHTENING TORQUE	
Magnetic check plug	$6\text{ N}\cdot\text{m} \pm 1\text{ N}\cdot\text{m}$ (53 lbf•in $\pm$ 9 lbf•in)

Replacing the Chaincase Oil

1. Place vehicle on a level surface.
2. Place a container under vehicle in line with chaincase to catch chaincase oil.
3. Remove the filler plug.



4. Remove the drain plug on the bottom of the chaincase.



5. Reinstall the drain plug.

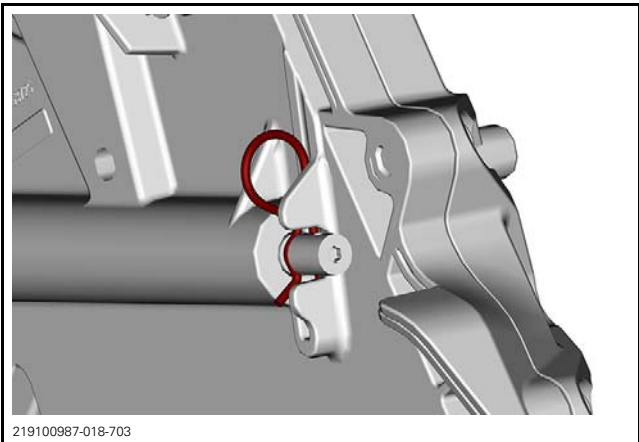
TIGHTENING TORQUE	
Drain plug	$6\text{ N}\cdot\text{m} \pm 1\text{ N}\cdot\text{m}$ (53 lbf•in $\pm$ 9 lbf•in)

6. Remove the magnetic check plug.
7. Pour approximately 550 ml (19 U.S. oz) of recommended oil in chaincase through the filler hole until oil comes out by the magnetic check plug hole.
8. Clean the magnetic check plug. Refer to *CHAINCASE OIL LEVEL VERIFICATION*, see procedure in this subsection.

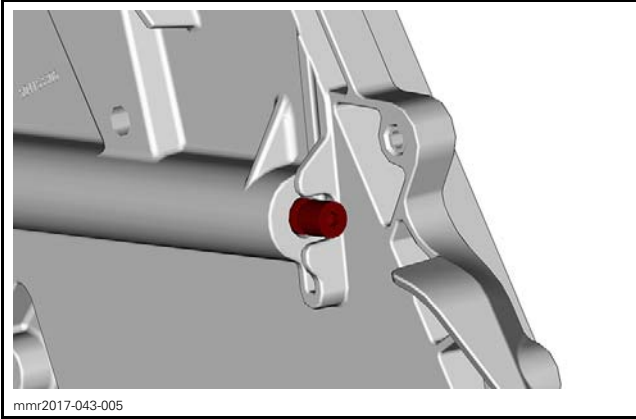
DRIVE CHAIN

Adjusting the Drive Chain

1. Remove the hair pin from behind the chaincase.



2. Tighten tensioner adjustment screw **BY HAND**.
NOTE: Turn adjustment screw until resistance is strong enough that it can not be turned by hand.



3. Reinstall the hair pin.

TROUBLESHOOTING

DIAGNOSTIC TIPS (ELECTRO-MECHANICAL REVERSE)

BUDS2 Configuration

If the electro-mechanical reverse is not working, make sure the required option is selected in BUDS2. Otherwise, the electro-mechanical reverse will not work and no fault code will be set.

Fault Code P0736

The fault code P0736 can appear for different reasons that are not necessarily a failure of the electro-mechanical reverse. It can appear for the following reason:

- Reverse gears are not aligned in chaincase to engage properly.

If fault code appears:

1. Clear the fault using BUDS2
2. Lift rear of vehicle and support it off the ground
3. Rotate driven pulley a few turns to move gears in chaincase
4. Retry changing gears.

If fault code appears again:

- Check drive belt height (refer to *DRIVE BELT* subsection)
- Check shift linkage adjustment. Refer to procedure in this subsection.

If fault code persists:

- Refer to *TESTING SEQUENCE* below.

TESTING SEQUENCE (ELECTRO-MECHANICAL REVERSE)

Reverse Does Not Engage

First, make sure the following settings are as per specifications:

- Drive belt height
- Shift linkage adjustment.

If BUDS2 is properly configured, drive belt and shift linkage are properly adjusted, follow this testing sequence to diagnose problem:

1. Check reverse position switch (RVPS) continuity.
2. Check actuator fuse.
3. Check actuator connector.
4. Check relays continuity.
5. Check actuator operation.
6. Check input voltage to actuator.
7. Check input voltage to relays.
8. Check relay grounds.
9. Check relay ground signals.
10. Check ECM ground continuity.

Refer to the appropriate topic to see the complete testing procedures.

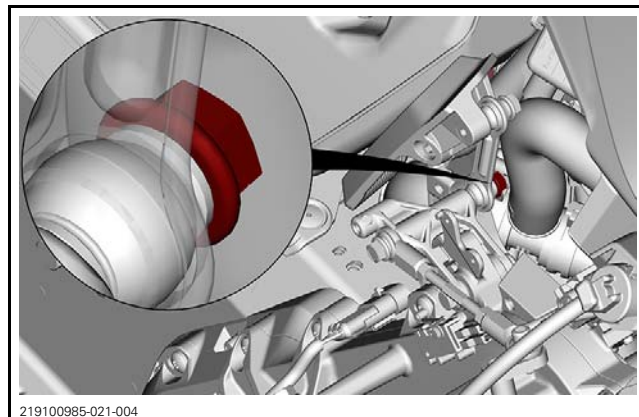
PROCEDURES

SHIFT LEVER

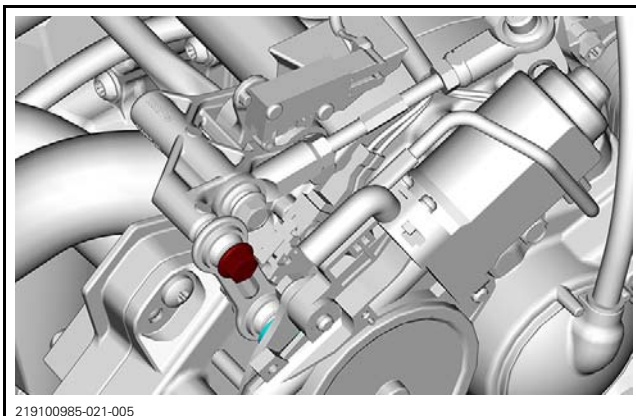
Removing the Shift Lever

1. Remove the following screws.

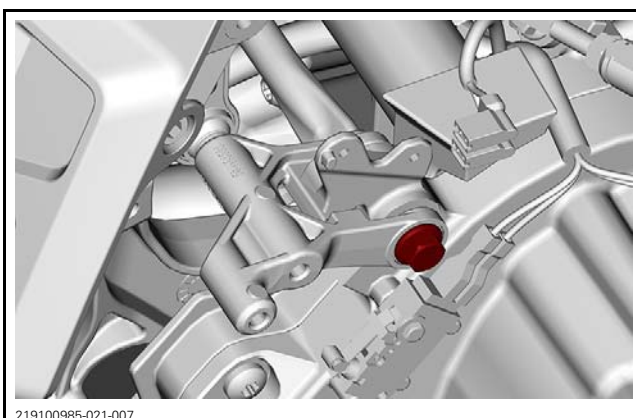
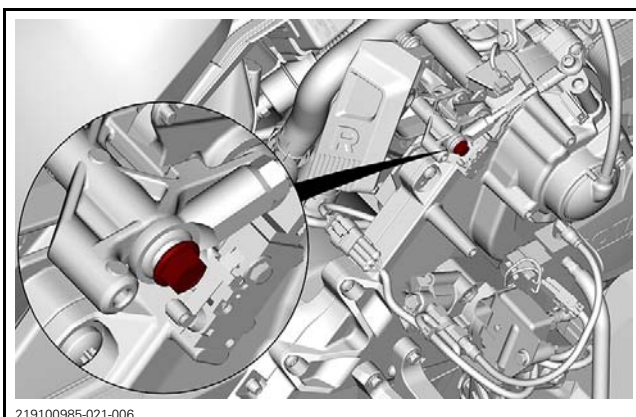
Mechanical Reverse



Electro-Mechanical Reverse



All Reverse



Installing the Shift Lever

The installation is the reverse of the removal procedure. However, pay attention to the following. Lubricate shift lever pivots and moving parts.

SERVICE PRODUCT
SYNTHETIC GREASE (P/N 779162)

Refer to exploded view for appropriate tightening torque.

ELECTRO-MECHANICAL REVERSE

Removing the Actuator

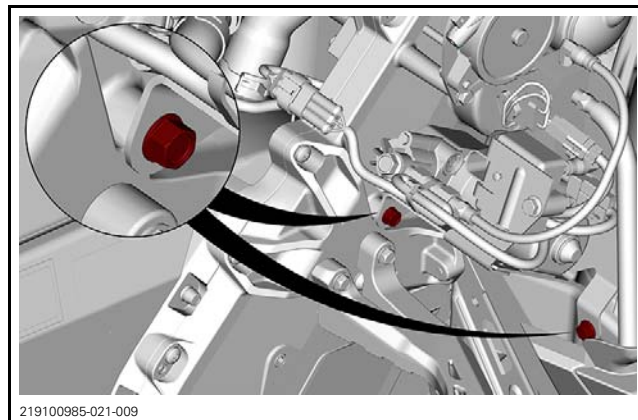
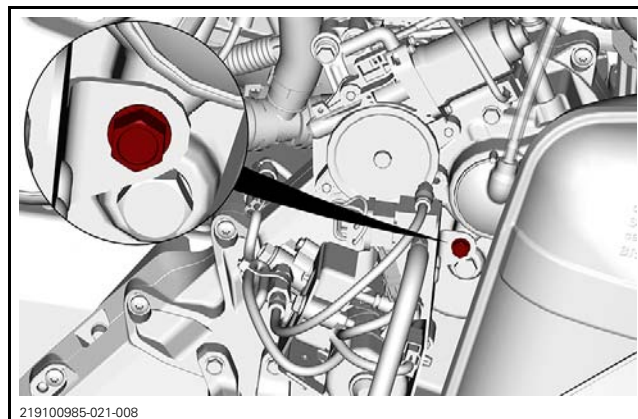
⚠ WARNING

Battery BLACK (–) cable must always be disconnected first and connected last.

1. Disconnect BLACK negative cable from battery.

Models with ACS

2. Disconnect compressor connector.
3. Remove ACS compressor module support screws.

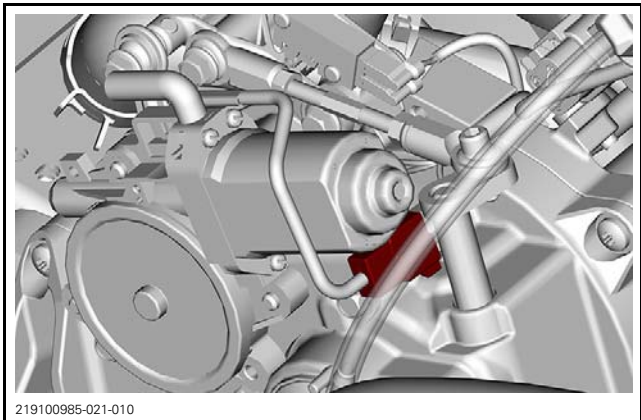


4. Move the ACS assembly aside.

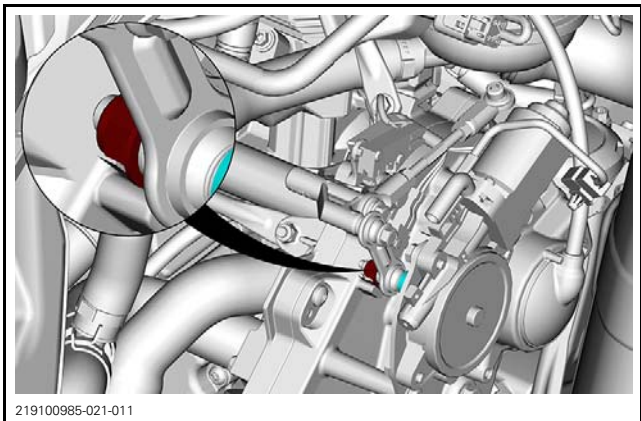
All Models

5. Disconnect actuator connector.

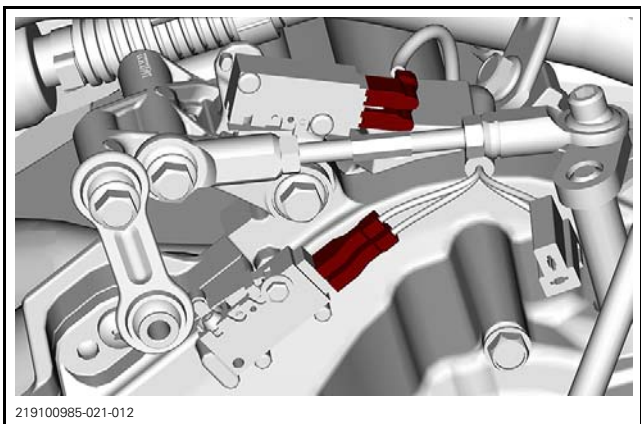
Subsection XX (CHAINCASE AND REVERSE)



6. Remove actuator link nut.



7. Remove actuator support screws.



8. Remove the actuator from vehicle.

Inspecting the Actuator

Inspect actuator connector for corrosion, clean if necessary.

Inspect RVPS switches for correct spring tension when pressed and released, replace if necessary.

Inspect actuator coupling shaft for straightness, replace if necessary.

Inspect actuator stopper in support for straightness.

Installing the Actuator

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

Lubricate shifter pivots and moving parts.

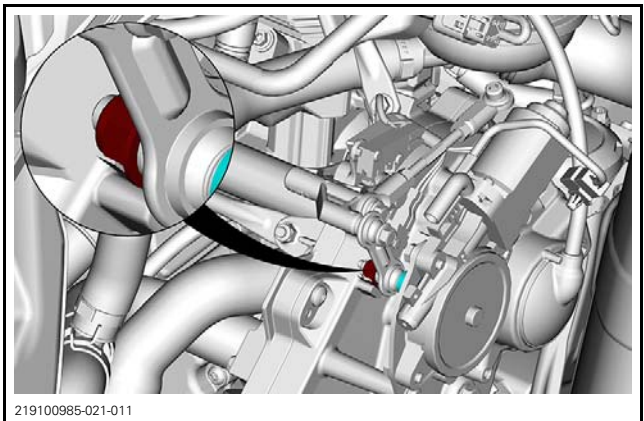
Tighten coupling shaft nut to specification.

TIGHTENING TORQUE	
Actuator coupling shaft nut	7 N•m ± 0.5 N•m (62 lbf•in ± 4 lbf•in)

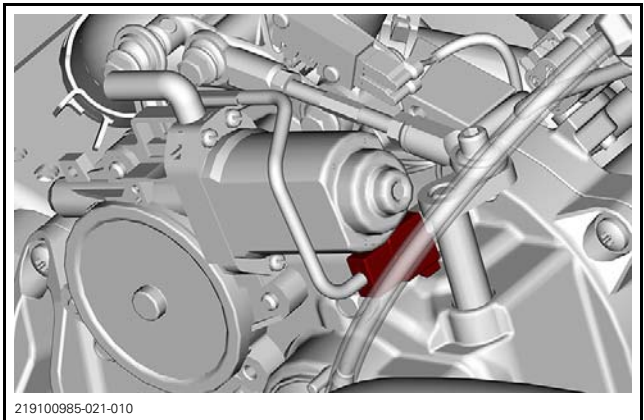
Testing the Actuator Operation

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

1. Remove actuator coupling shaft nut.

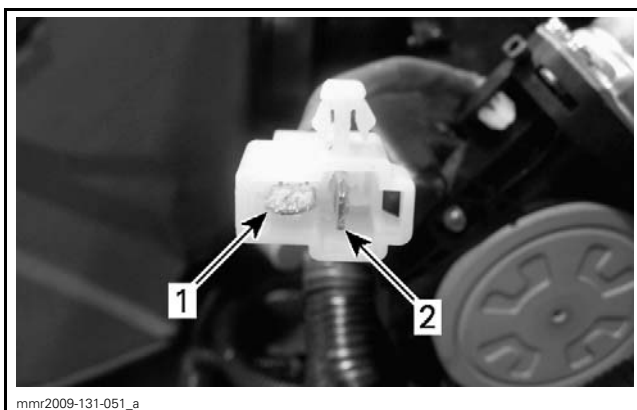


2. Disconnect actuator connector.



3. Connect actuator connector pin 2 (BLACK wire) to a 20 A suitable fuse jumper and then directly to the positive battery post.

- Connect actuator connector pin 1 (RED wire) directly to the negative battery post.

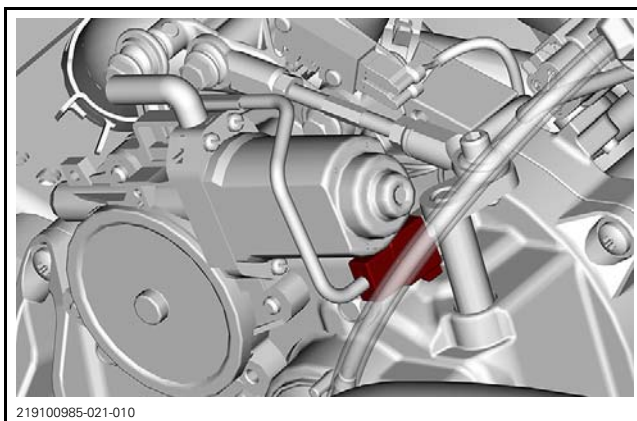


- Pin 1 (RED wire)
- Pin 2 (BLUE wire)

- Verify if actuator works properly.
- Invert battery polarities and verify if actuator works properly in the opposite direction.

Testing the Actuator Input Voltage

- Set the multimeter to Vdc.
- Disconnect actuator connector.



- Start engine.
- Press on START/REVERSE button while engine runs at idle.
- Measure voltage between harness connector terminals as per the following table.

TEST PROBES	MEASUREMENT
Pin 1	Battery voltage (~12 Vdc)
Pin 2	

If measure is not as per specification, test:

- The battery voltage
- The actuator relay and fuse
- The actuator circuit continuity.

Refer to electrical diagram for more information.

Testing the Relay Continuity

- Remove relays.
- Set the multimeter to Ω .
- Measure resistance as per the following table.

TEST PROBES	RESISTANCE
Terminal 30	Open (OL)
Terminal 87	

- Measure resistance as per the following table.

TEST PROBES	RESISTANCE
Terminal 30	Close to 0 Ω
Terminal 87a	

- Apply 12 volts on terminals 85 and 86.
- Measure resistance again as per the following table.

TEST PROBES	RESISTANCE
Terminal 30	Close to 0 Ω
Terminal 87	

- Apply 12 volts on terminals 85 and 86.
- Measure resistance again as per the following table.

TEST PROBES	RESISTANCE
Terminal 30	Open (OL)
Terminal 87a	

If results are not as per the above tables, replace relay.

Testing the Relay Input Voltage

- Set the multimeter to Vdc.
- Start engine.
- Measure voltage as per the following tables.

FORWARD AND REVERSE RELAYS	
TEST PROBES	VOLTAGE
Pin 86	Battery voltage (~12 Vdc)
Battery negative (-) post	

Subsection XX (CHAINCASE AND REVERSE)

FORWARD AND REVERSE RELAYS	
TEST PROBES	VOLTAGE
Pin 87	Battery voltage (~12 Vdc)
Battery negative (-) post	

If voltage is not as specified, repair open circuit in wiring. Refer to *WIRING DIAGRAM*.

Testing the Relay Ground

1. Set the multimeter to Vdc.
2. Start engine.
3. Measure voltage as per the following table.

FORWARD AND REVERSE RELAYS	
TEST PROBES	VOLTAGE
Pin 87a	Battery voltage (~12 Vdc)
Battery positive (+) post	

If voltage is not as specified, repair open circuit in wiring. Refer to *WIRING DIAGRAM*.

Testing the Relay Ground Signal

Forward Relay

For this test, electronic reverse must be set in reverse position.

NOTE: The measured voltage will be transmitted during a short period of time.

1. Set the multimeter to Vdc.
2. Start engine and let it run at idle.
3. Press on START/RER button while measuring voltage as per the following table.

FORWARD RELAY	
TEST PROBES	VOLTAGE
Pin 85	Battery voltage (~12 Vdc)
Battery positive (+) post	

If voltage is not as specified, repair open circuit in wiring. Refer to *WIRING DIAGRAM*.

Reverse Relay

For this test, electronic reverse must be set in forward position.

NOTE: The measured voltage will be transmitted during a short period of time.

1. Set the multimeter to Vdc.
2. Start engine and let it run at idle.
3. Press on START/RER button while measuring voltage as per the following table.

REVERSE RELAY	
TEST PROBES	VOLTAGE
Pin 85	Battery voltage (~12 Vdc)
Battery positive (+) post	

If voltage is not as specified, repair open circuit in wiring. Refer to *WIRING DIAGRAM*.

Testing the ECM Ground Continuity

Forward Relay

1. Disconnect ECM connector "A".
2. Install connector "A" on the ECM adapter tool.
3. Set the multimeter to Ω .
4. Measure resistance as per the following table.

FORWARD RELAY	
TEST PROBES	RESISTANCE
ECM pin A-13	Close to 0 Ω
Relay pin 85	

Reverse Relay

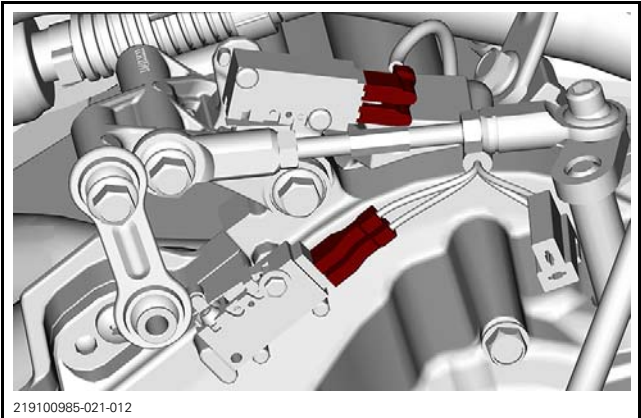
1. Disconnect ECM connector "B".
2. Install connector "B" on the ECM adapter tool.
3. Set the multimeter to Ω .
4. Measure resistance as per the following table.

REVERSE RELAY	
TEST PROBES	RESISTANCE
ECM pin B-33	Close to 0 Ω
Relay pin 85	

REVERSE MECHANISM POSITION SWITCHES

Testing the Switches Continuity

1. Disconnect Reverse Position Switch (RVPS) and Forward Position Switch (FWPS) connectors.



- 2. Set the multimeter to Ω .
- 3. Release RVPS.
- 4. Measure resistance as per the following table.

TEST PROBES	RESISTANCE
Pin 1	Open (OL)
Pin 2	

- 5. Press RVPS.
- 6. Measure resistance again as per the following table.

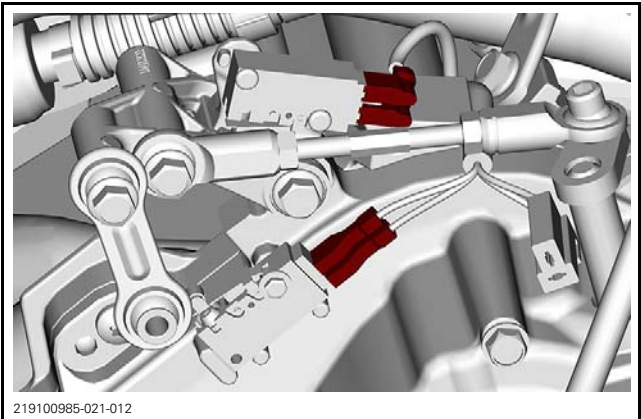
TEST PROBES	RESISTANCE
Pin 1	Close to 0 Ω
Pin 2	

If results are not as per the above tables, replace RVPS.

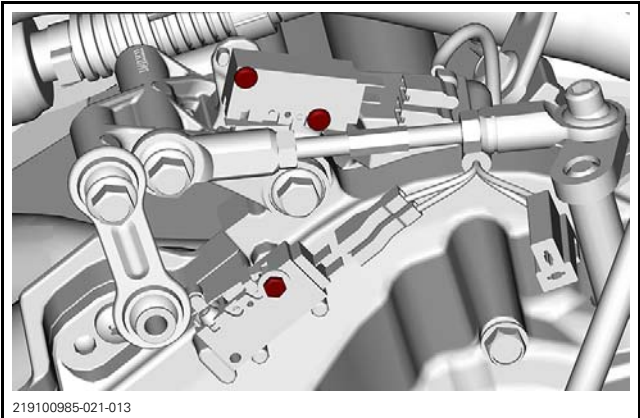
Repeat the test for the FWPS.

Replacing the Reverse Mecanism Position Switch

- 1. Remove switch connectors.



- 2. Remove switch fasteners.

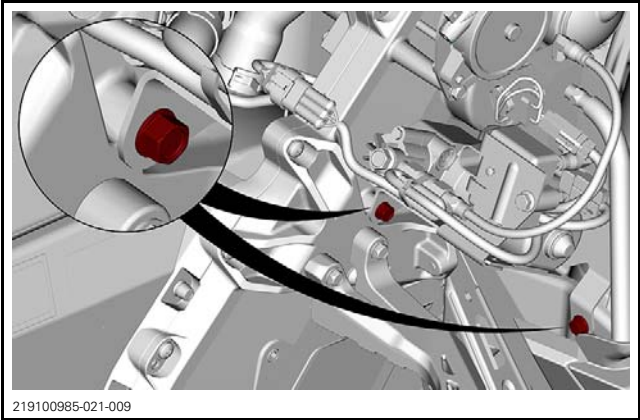
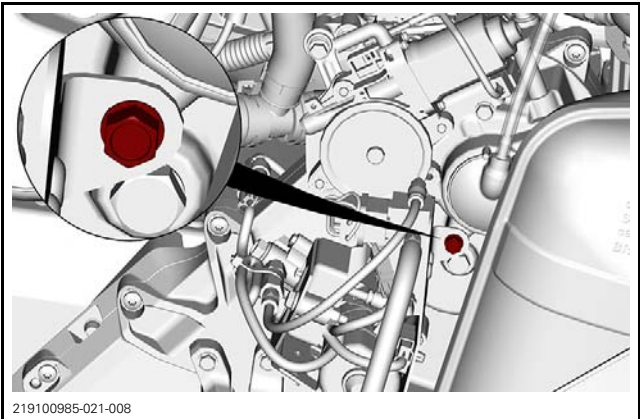


CHAINCASE

Removing the Chaincase Cover

Models with ACS

- 1. Disconnect compressor connector.
- 2. Remove ACS compressor module support screws.

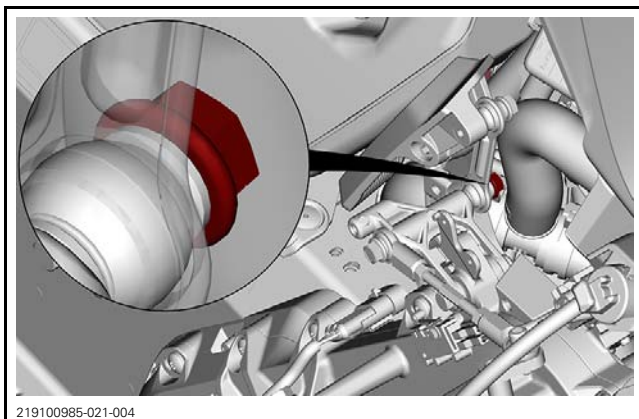


- 3. Move the ACS assembly aside.

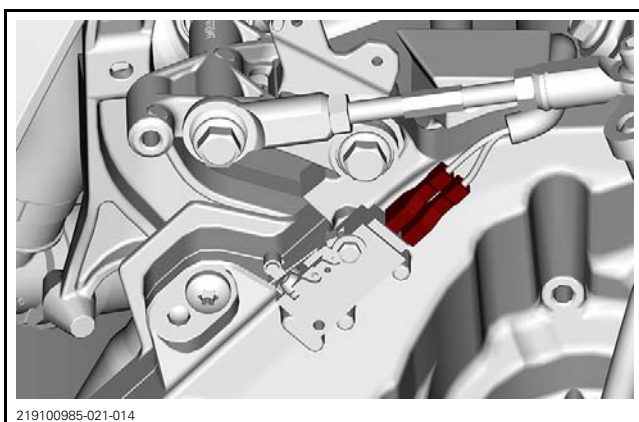
Models with Mechanical Reverse

- 4. Remove the lower reverse handle link screw.

Subsection XX (CHAINCASE AND REVERSE)



5. Disconnect the RVPS.

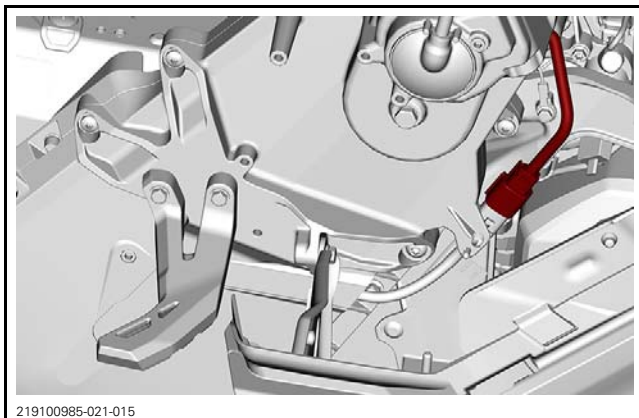


Models with Electro-Mechanical Reverse

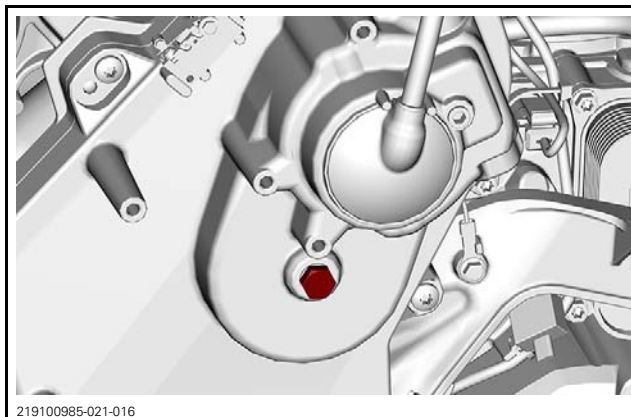
1. Remove actuator. Refer to *REMOVING THE ACTUATOR* in this subsection.
2. Disconnect the RVPS.

All Models

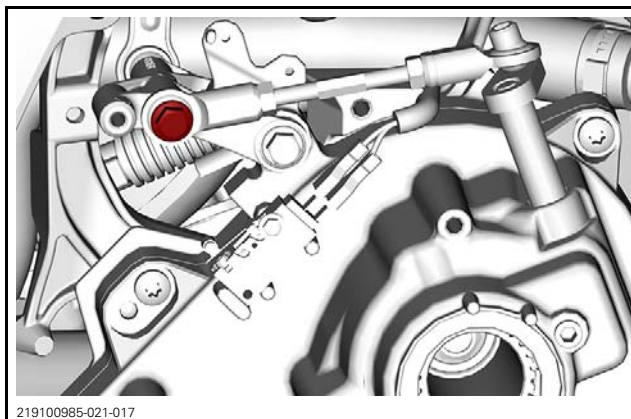
1. Apply parking brake.
2. Remove muffler. Refer to *EXHAUST SYSTEM* subsection.
3. Drain the chaincase oil. Refer to procedure in this subsection.
4. Disconnect speed sensor connector.



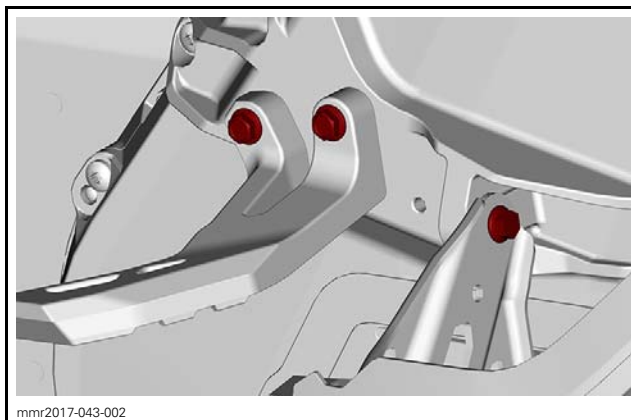
5. Remove reverse gear retaining screw.



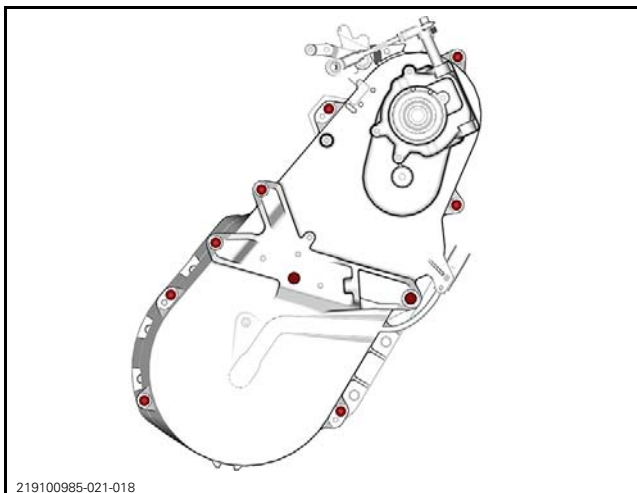
6. Remove lower retaining screw from shifter link rod.



7. Remove the RH side toe hook and the screw securing the cover to the footrest.



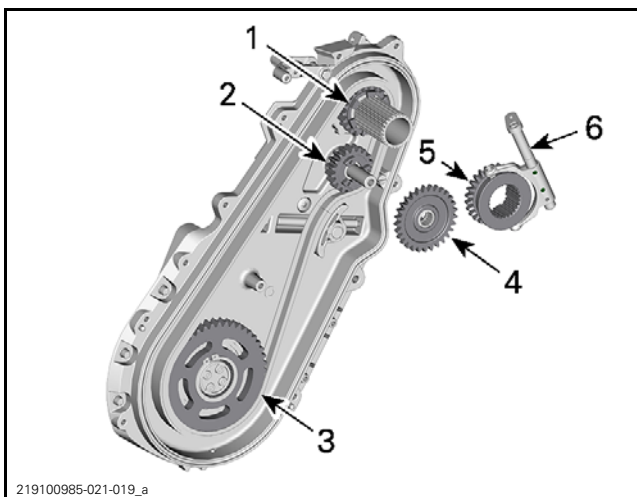
8. Unscrew and remove chaincase cover screws.



9. Pull the bottom of chaincase cover to drain oil.

Chaincase Disassembly

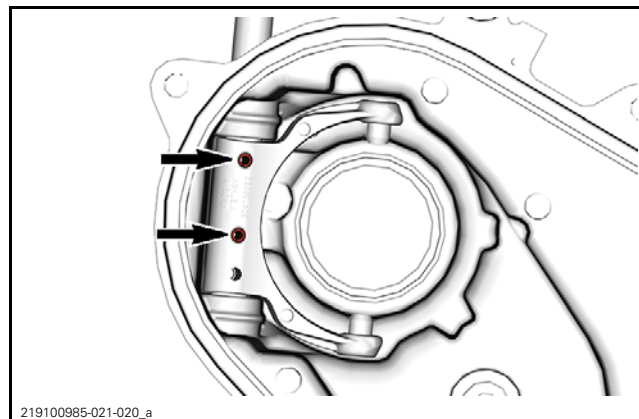
1. Apply parking brake.
2. Remove chaincase cover. Refer to *REMOVING THE CHAINCASE COVER* in this subsection.



1. Upper sprocket
2. Reverse sprocket
3. Lower sprocket
4. Reverse gear
5. Sliding gear
6. Shift fork

Shift Fork (in Chaincase Cover)

1. Remove spring pins using a punch as shown.

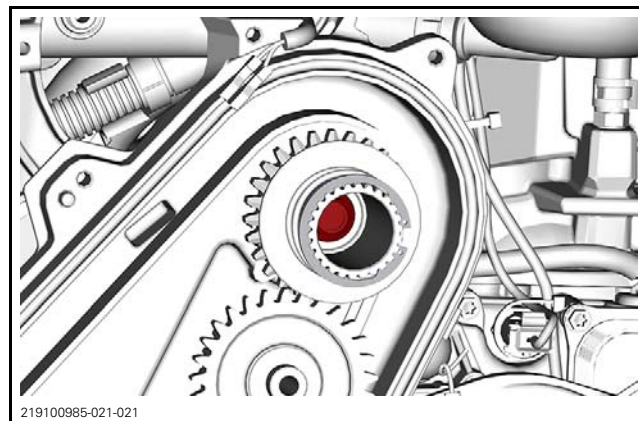


2. Pull out shift rod from chaincase cover.
3. Remove shift fork.

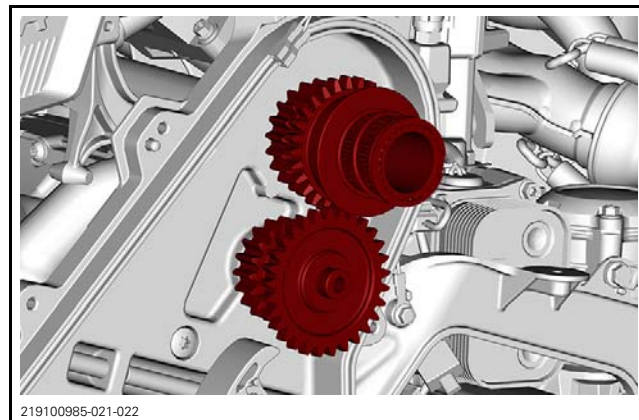
Gears and Sprockets

Do not remove tension on drive chain for the moment.

1. Remove upper screw that hold sliding gear assembly.



2. Remove chain tensioner from chaincase.
3. Remove sliding gear assembly, reverse sprocket and reverse gear simultaneously.

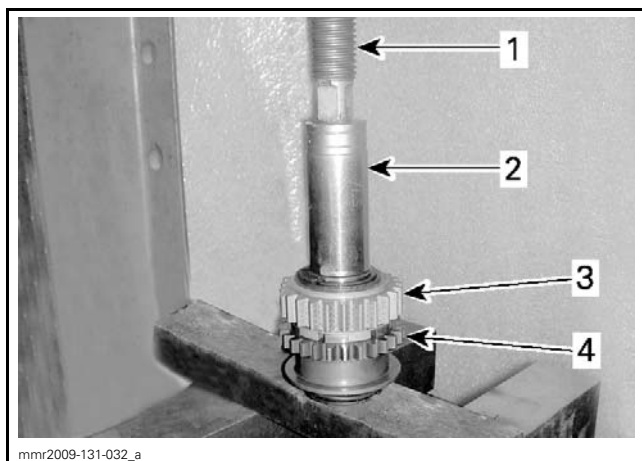


Subsection XX (CHAINCASE AND REVERSE)

Sliding Gear Disassembly

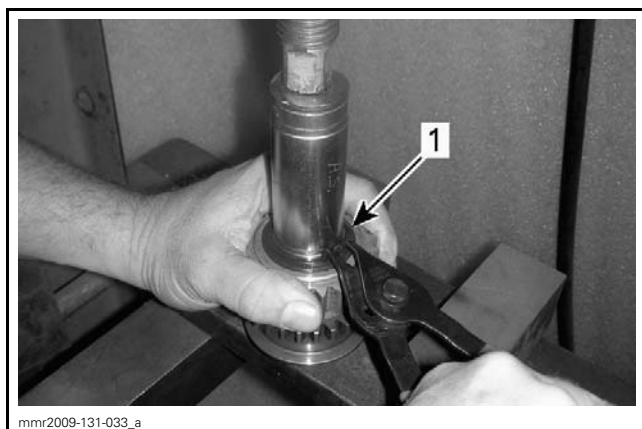
NOTICE Do not use the press to compress the sliding gear while disassembling. Use the press **ONLY** as a guide to ensure that the spring tension will be released safely.

1. Install sliding gear assembly on a press.
2. Position a 25 mm (1 in) deep socket on the upper sprocket side.
3. Adjust press rod on the socket, do not apply pressure on the assembly.



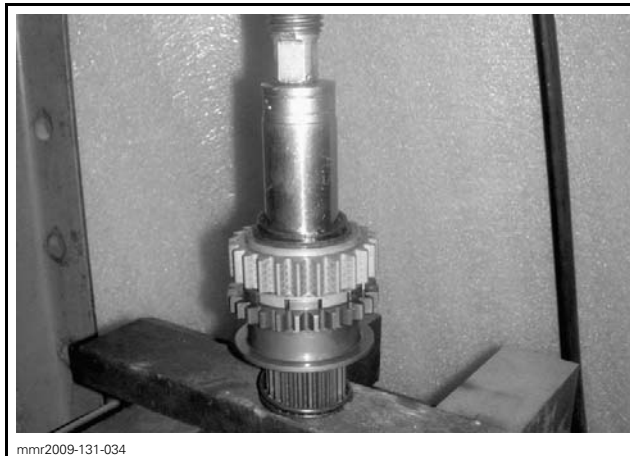
1. Press rod
2. Deep socket (25 mm (1 in))
3. Upper sprocket
4. Sliding gear

4. Firmly retain upper sprocket with one hand.
5. Remove circlip from coupling shaft.



1. Circlip

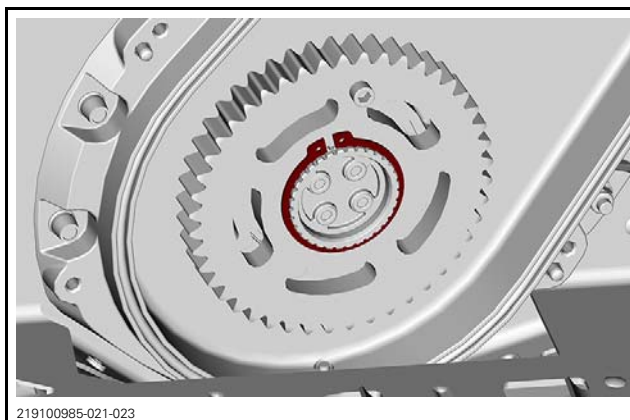
6. Carefully release spring tension.



7. Remove upper sprocket and sliding gear from press.

Chain and Lower Sprocket

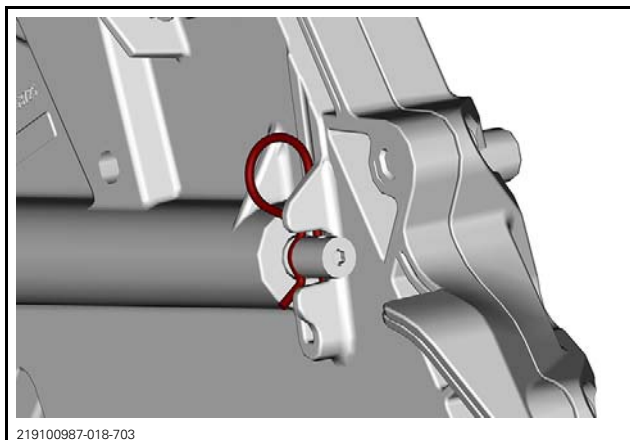
1. Remove the lower sprocket circlip.



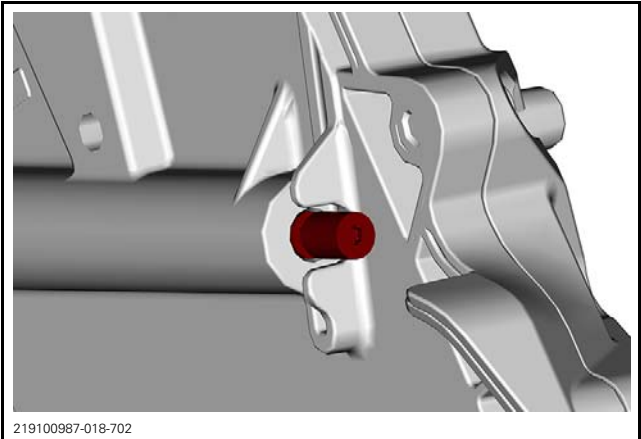
2. Remove lower sprocket and drive chain simultaneously.

Chain Tensioner

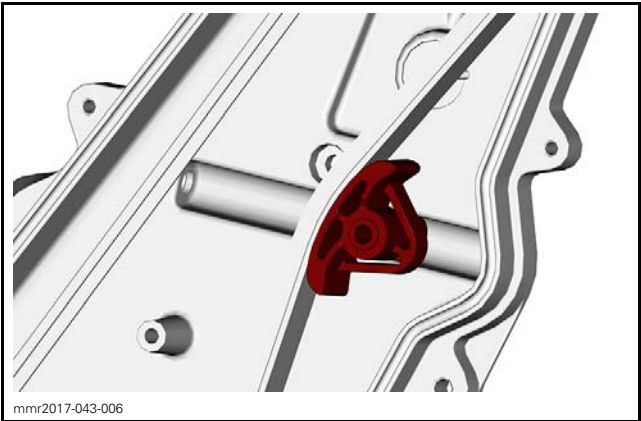
1. Remove the hair pin from behind the chaincase.



2. Remove the tensioner adjustment screw.

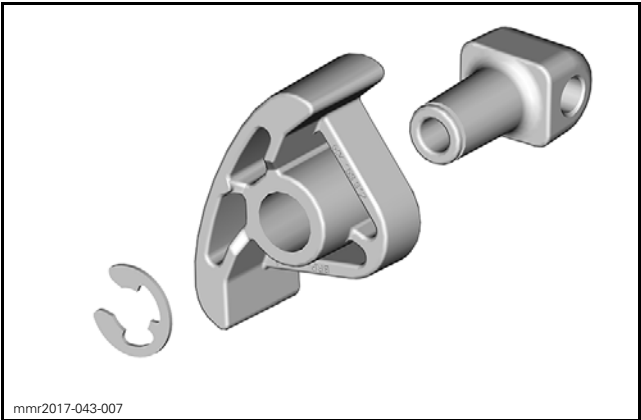


3. Remove tensioner.



NOTE: The following steps are required only if the tensioner or the slider is defective.

4. Remove the circlip securing the slider to tensioner.

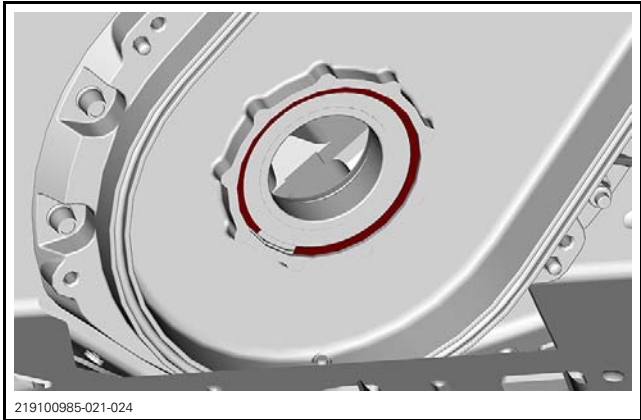


1. Circlip
2. Tensioner
3. Slider

Chaincase Bearings

NOTE: This procedure can be applied either for the countershaft bearing or the drive shaft bearing.

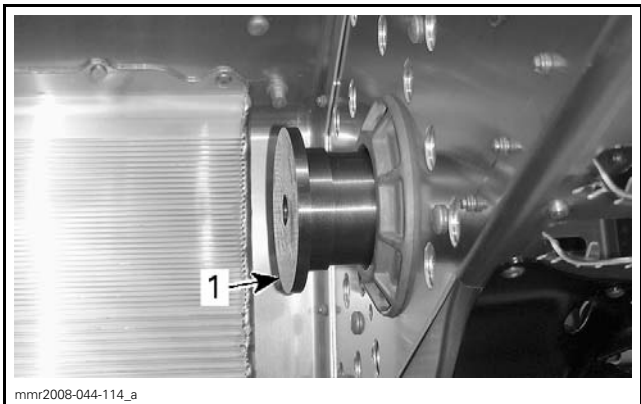
1. Remove the countershaft or the drive axle, depending which bearing is replaced. Refer to *DRIVE SYSTEM AND BRAKE* section.
2. Remove the snap ring securing bearing into chaincase.



3. Install the appropriate bearing extractor:

REQUIRED TOOL	
Countershaft bearing	
BEARING PULLER/PUSHER (P/N 529 036 111)	
Drive axle bearing	
BEARING PULLER/PUSHER (P/N 529 036 112)	

4. Install the extractor/installer tool behind the bearing.

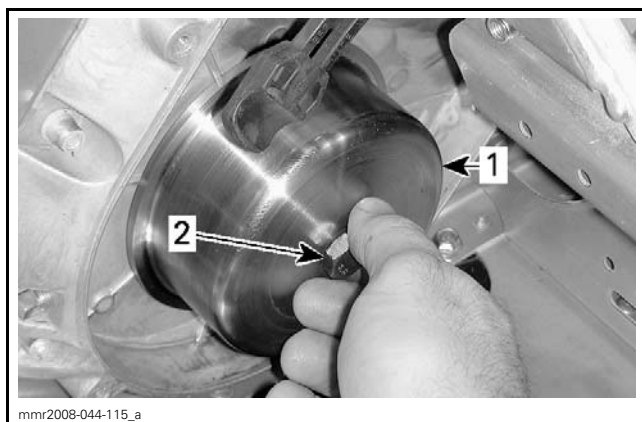


1. Extractor/installer tool

5. Install the extractor cup over bearing.

Subsection XX (CHAINCASE AND REVERSE)

6. Tighten the extractor/installer tool screw to remove the bearing.



1. Extractor cup
2. Tighten to remove bearing

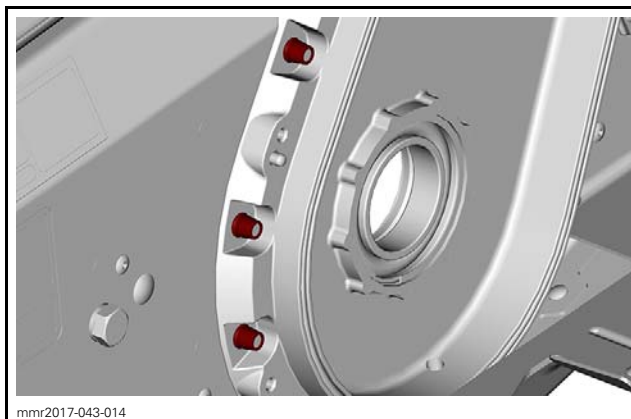
7. Using a seal puller, remove and discard the oil seal.



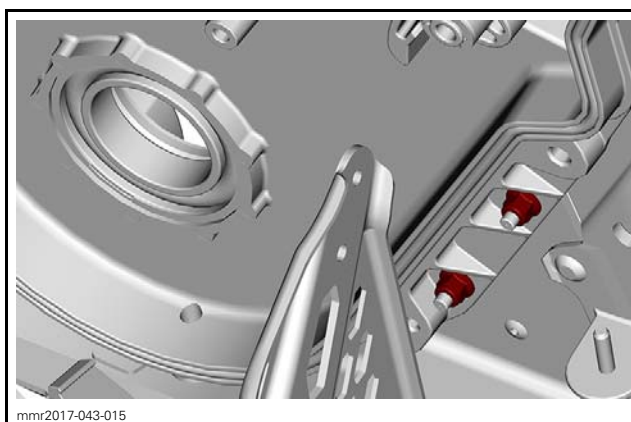
Removing the Chaincase

IMPORTANT: Ensure you have a new mounting plate on hand along with the 5 attachment nuts before removing the chaincase assembly. Refer to the appropriate *ELECTRONIC PARTS CATALOG* that fits your model to determine required part number.

1. Disassemble chaincase. Refer to *CHAINCASE DISASSEMBLY* in this subsection.
2. Remove drive axle and countershaft. Refer to *DRIVE SYSTEM AND BRAKE* section.
3. Remove the Huck rivets. Refer to *FRAME* subsection for proper removal procedure.



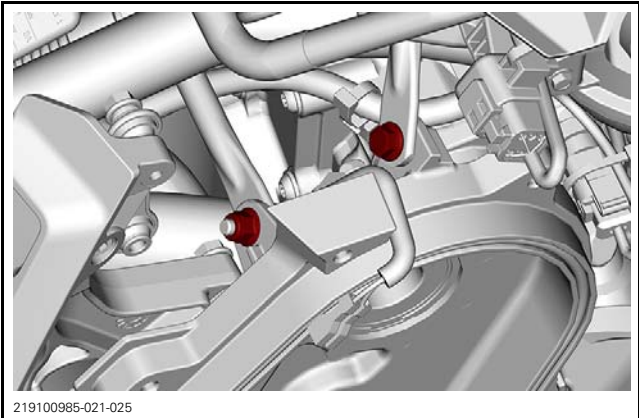
4. Remove nuts beside the footrest.



5. Remove the screw above the tensioner.



6. Remove bolts behind the top of chaincase.



7. Using 2 large pry bars inserted between chaincase and frame, pry chaincase out of vehicle.

Chaincase Inspection

Chaincase Cover

Inspect cover for cracks or other damages, replace if necessary.

Inspect cover front and rear stopper for crack, replace if necessary.

Inspect O-ring inside cover is brittle, hard or damaged, replace if necessary.

Shift Fork, Lever and Link Rod

Inspect shift fork for straightness, replace if necessary.

Inspect shift fork wear or other damages, replace if necessary.

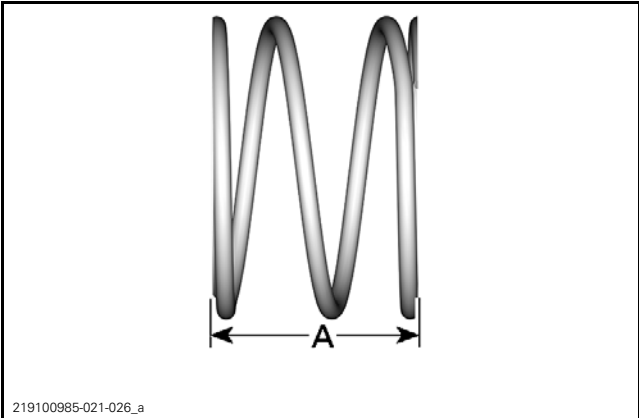
Inspect shift lever for straightness and for rotation movement, replace if necessary.

Inspect link rod for straightness and other damages, replace if necessary.

Spring

Measure spring free length, replace if out of specification.

SPRING FREE LENGTH	
SERVICE LIMIT	48 mm ± 1 mm (1.89 in ± .04 in)



A. Free length

Chain, Gears and Sprockets

Inspect the chain, gears and sprockets for:

- Wear
- Cracks
- Damages teeth
- Missing links.

If a problem is detected:

- Replace drive chain and sprockets as an assembly.
- Replace upper sprocket and sliding gear as an assembly.
- Replace reverse sprocket and reverse gear as an assembly.

Check the drive chain deflection.

If the deflection is greater than 38 mm (1-1/2 in) without the chain tensioner, replace the drive chain.

Chain Tensioner

Check chain tensioner slider for wear or other damages. A longitudinal groove in the slider indicate a broken chain link. Replace if necessary.

Check threads of tensioner adjustment screw for damages or wear.

Check straightness of adjustment screw. Replace screw if necessary. Check chaincase for damages.

Bearings

Inspect all bearings for smooth operation:

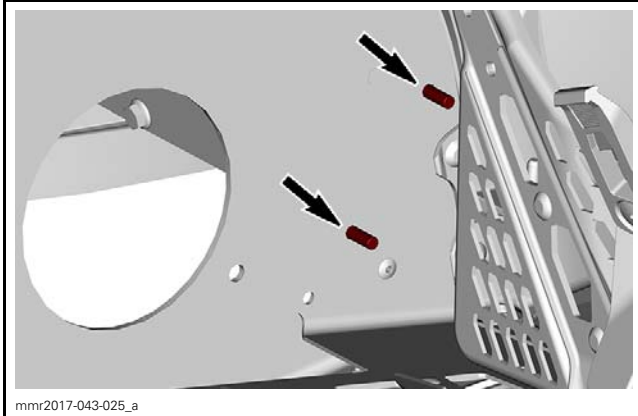
- If rough or excessive play is detected, replace bearing.

Installing the Chaincase Housing

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

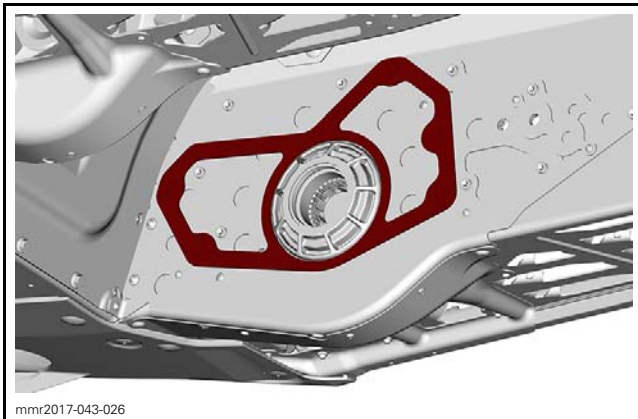
Remove the clinch studs from the frame.

Subsection XX (CHAINCASE AND REVERSE)



Use a suitable box to support the frame around the stud head and hit the stud from the outside with a hammer.

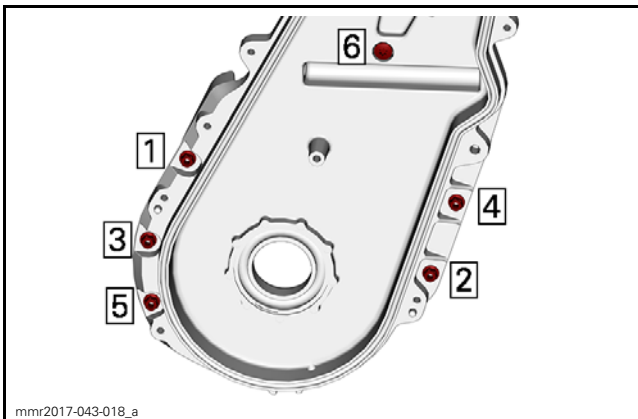
Install the new mounting plate underneath the frame.



UNDERNEATH FRAME

Install 5 elastic flanged nuts to secure chaincase on mounting plate.

Tighten fasteners as per the following sequence.



Proceed with drive chain adjustment. Refer to procedure in this subsection.

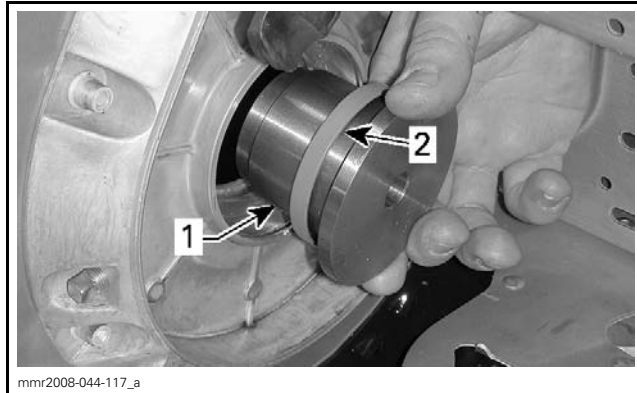
Refill chaincase with recommended oil. Refer to procedure in this subsection.

Chaincase Assembly

Chaincase Bearings

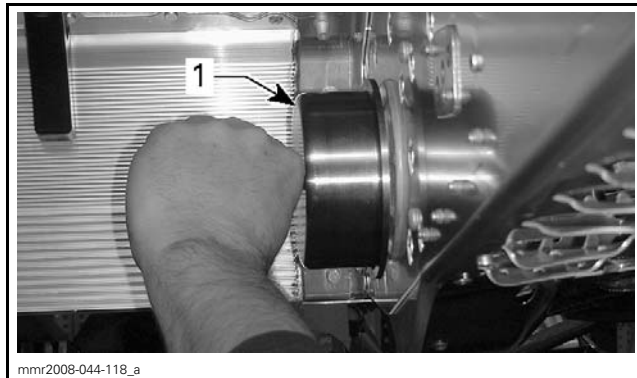
NOTE: This procedure can be applied either for the countershaft bearing or the drive shaft bearing.

1. Install the NEW oil seal on the extractor/installer tool. Position the lips toward bearing.



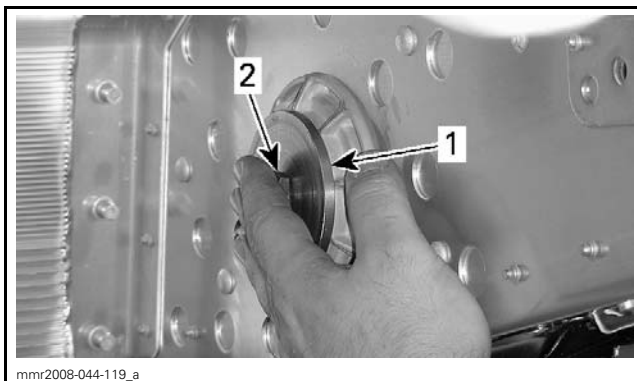
1. Extractor/installer tool
2. Oil seal lips on this side

2. Install extractor cup inside frame.



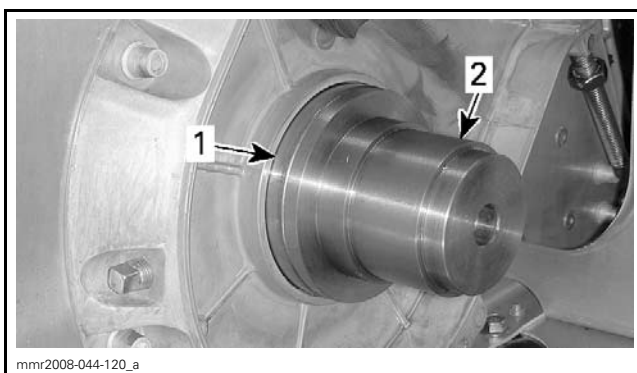
1. Extractor cup

3. Tighten extractor/installer tool screw to install the oil seal.
4. Install large washer and extractor/installer tool screw inside frame.



1. Large washer
2. Extractor/installer tool screw

5. In chaincase, install a NEW bearing and extractor/installer tool.



1. Bearing
2. Extractor/installer tool

6. Tighten extractor/installer tool screw to install the bearing.

7. Remove tool.

Chain Tensioner

The installation procedure is the reverse of the removal.

Chain and Lower Sprocket

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

Install sprocket with its inscription outward.

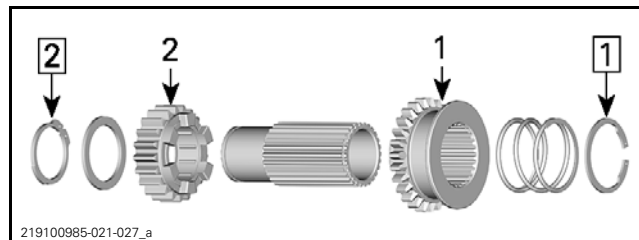
Sliding Gear

NOTICE Do not use the press to compress the sliding gear while assembling. Use the press ONLY as a guide to ensure that the spring tension will be applied safely.

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

Install coupling shaft circlip on the splines side.

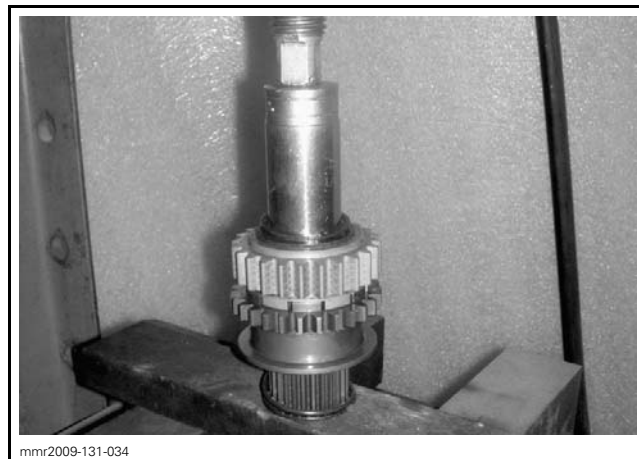
Install upper sprocket circlip on a press.



Step 1: Install splines circlip

Step 2: Install upper sprocket circlip on a press

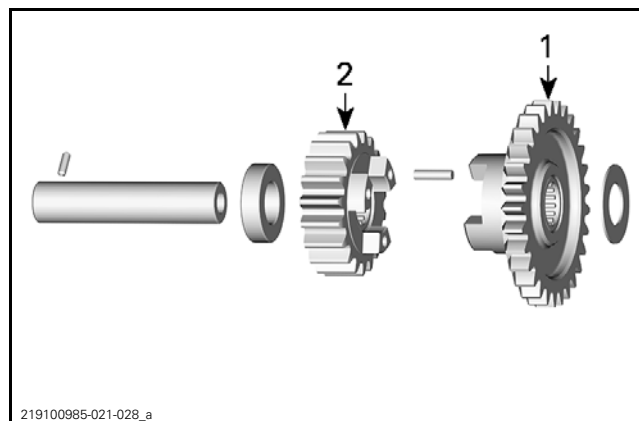
1. Sliding gear
2. Upper sprocket



Gears and Sprockets

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

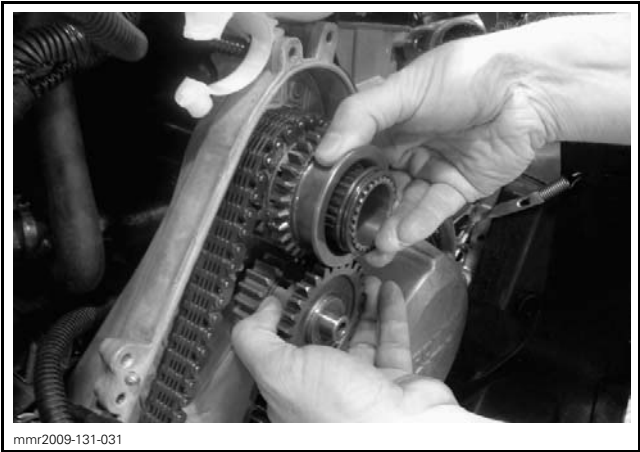
Assemble reverse sprocket and reverse gear as per the following illustration.



1. Reverse sprocket
2. Reverse gear

Install sliding gear assembly, reverse sprocket and reverse gear simultaneously.

Subsection XX (CHAINCASE AND REVERSE)



Install upper screw that hold sliding gear assembly. (do not tighten for the moment).

Adjust tension on the drive chain. Refer to *DRIVE CHAIN ADJUSTMENT* in this subsection.

Apply parking brake.

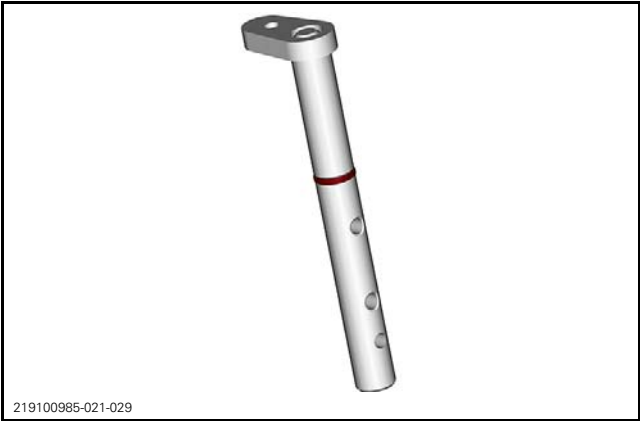
Tighten upper gear screw to specification.

TIGHTENING TORQUE	
Upper gear screw	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)

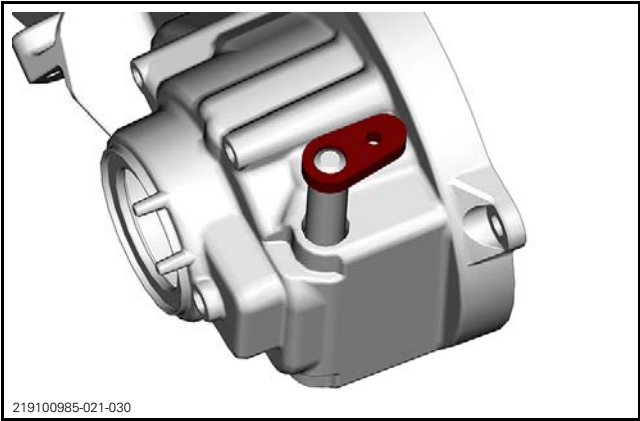
Shift Fork (in Chaincase Cover)

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

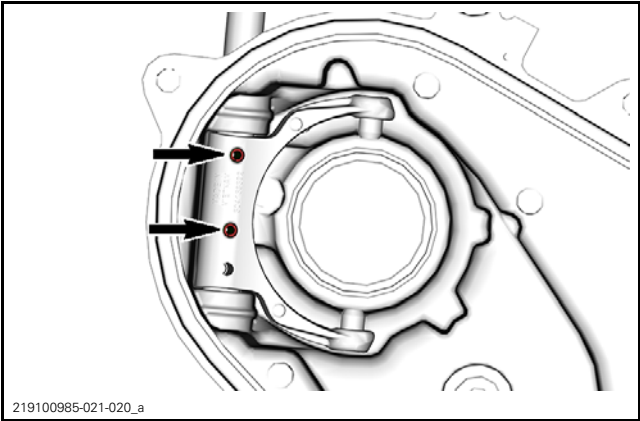
Ensure that seal is properly seated on the shift fork lever.



Position shift fork lever toward the inside.



Install spring pins into both holes.



Chaincase Cover

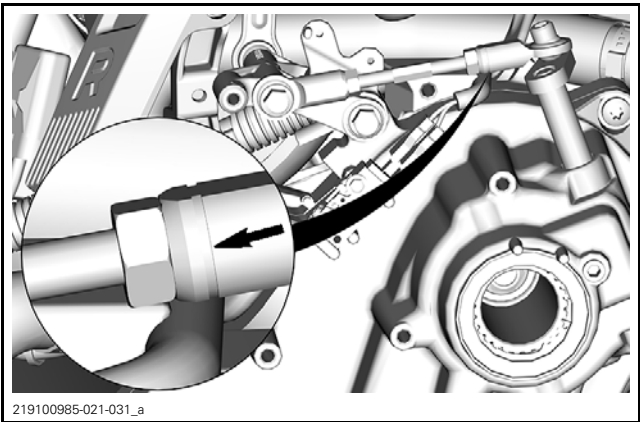
Install chaincase cover. Refer to *CHAINCASE COVER* in this subsection.

Installing the Chaincase Cover

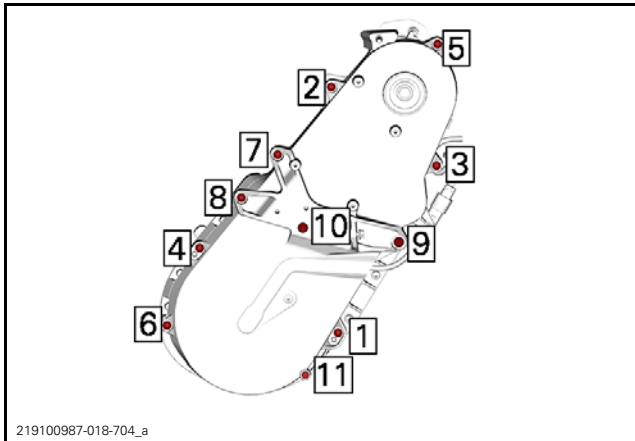
The installation is the reverse of the removal procedure. However, pay attention to the following.

Ensure cover O-ring is positioned correctly in its groove.

Ensure that link rod is positioned with the reference mark upwards.



Screw 11 is present on long chaincase only.



TYPICAL

TIGHTENING TORQUE		
Screws 1 to 8 and 11 (long chaincase)	Same chaincase	10 N•m ± 2 N•m (89 lbf•in ± 18 lbf•in)
	New chaincase	15 N•m ± 1 N•m (133 lbf•in ± 9 lbf•in)
Screw 9		24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)
Screw 10		16 N•m ± 2 N•m (142 lbf•in ± 18 lbf•in)
Reverse gear screw		24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

Adjust shift linkage, refer to *SHIFT LINKAGE (MECHANICAL AND ELECTRONIC REVERSE)* in this subsection.

Refill chaincase. Refer to *REPLACING THE CHAINCASE OIL* in this subsection.

SPEED SENSOR (VSS)

The speed sensor is a hall effect sensor.

Speed Sensor Location

The speed sensor is mounted in the chaincase cover.

Testing the Speed Sensor Signal

1. Ensure speed sensor is properly connected.
2. Wake up ECM.
3. Back-probe VSS connector as per table and test for proper specification.

NOTICE Be careful not to damage connector seals when back probing.

SPEED SENSOR (VSS) CONNECTOR	SPECIFICATION
Pin 2	Ground
Pin 3	5 Vdc reference voltage

If test failed, check wiring harness going to ECM.

4. Lift and support rear of vehicle.

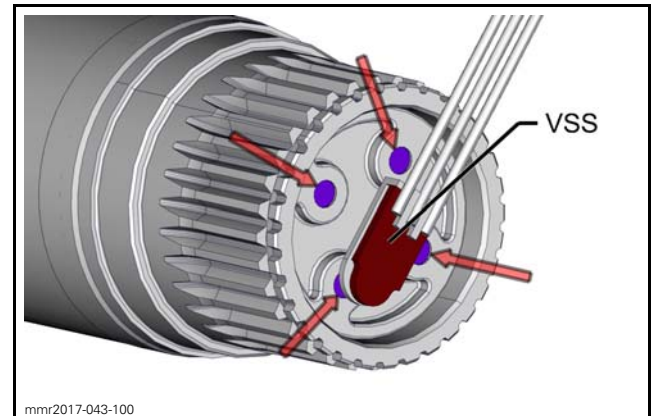
5. Back-probe VSS connector as per table and test for proper specification.

6. Rotate track/driven pulley.

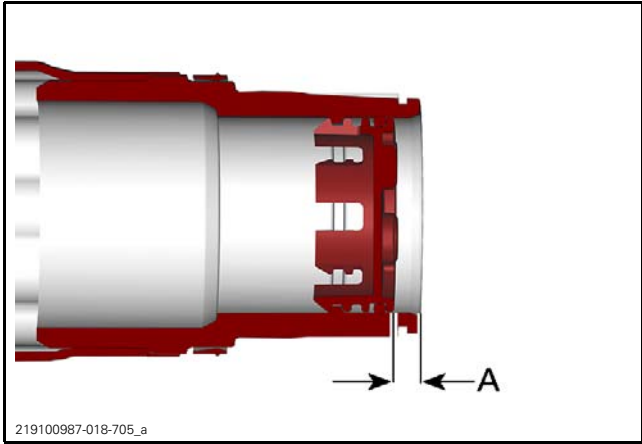
SPEED SENSOR SIGNAL TEST			
ROTATE DRIVEN PULLEY	SPEED SENSOR CONNECTOR (SENSOR SIDE)		VOLTAGE
	Pin 1	Pin 2	Alternate 7 Vdc and 0 Vdc

If reference voltage and ground are available at sensor, but no signal, replace sensor.

NOTE: During chaincase disassembly, ensure magnets are intact on shaft.



Measure the distance between magnetic cap and end of shaft. It must be as specified.



A. Distance to measure

DISTANCE SPECIFICATION	
no. A Measured between magnetic cap and shaft end	5 mm (.2 in)

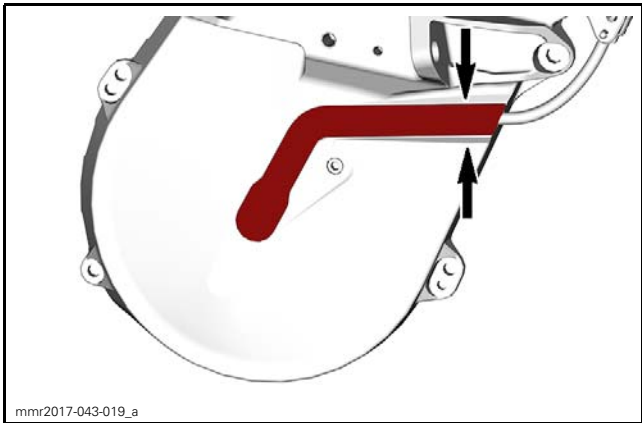
Replacing the Speed Sensor

The sensor can be replaced with the chaincase cover as an assembly. In such a case, refer to CHAINCASE subsection.

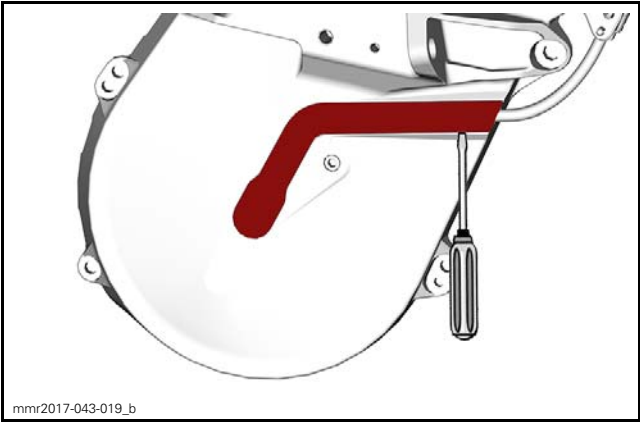
To replace sensor only, proceed as follows.

Removing the Speed Sensor

- 1. Remove chaincase cover. Refer to procedure in this subsection.
- 2. Heat the upper end of the speed sensor protective plate with a heat gun.



- 3. Use a flat screwdriver to pry out the end of the protective plate from chaincase cover.



NOTICE Use care when prying out the plate not to damage the chaincase cover.

- 4. Heat the next section of the plate.
- 5. Pry out the heated section using the flat screwdriver.
- 6. Repeat steps 4 and 5 until the protective plate is completely removed.
- 7. Remove the speed sensor.
- 8. Use the flat screwdriver to remove the remaining sealant from the chaincase cover.

NOTICE Do not apply excessive pressure when removing the remaining sealant not to damage the chaincase cover.

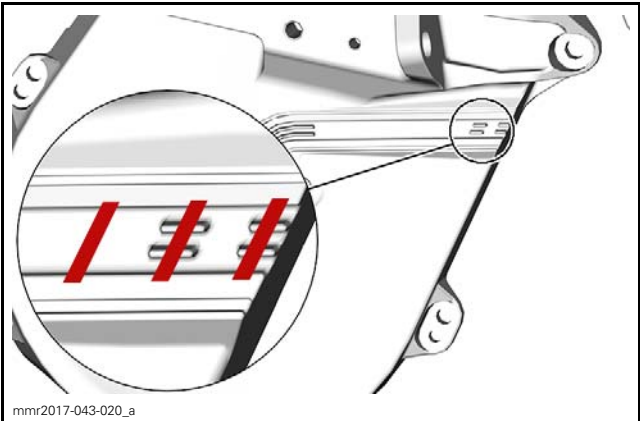
- 9. Rub the sealant using a scouring pad.

Installing the Speed Sensor

Make sure surface is clean and free of grease. The assembly must be watertight.

PRODUCT REQUIRED
LOCTITE 5900 (P/N 293 800 066)

- 1. Apply 3 beads of sealant in the chaincase cover as per the following illustration.

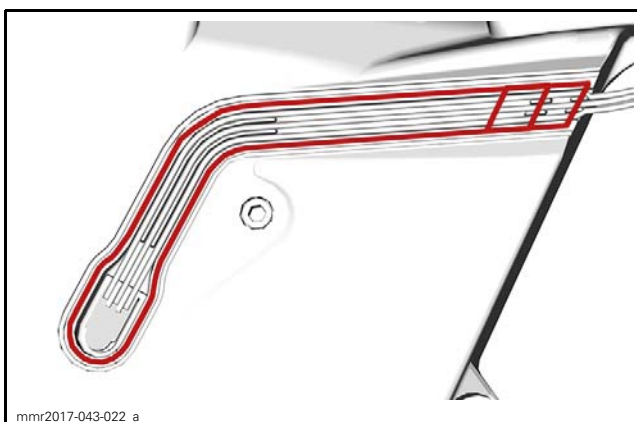


2. Install the speed sensor in the chaincase cover.



3. Apply sealant all around the protective plate bed on the chaincase cover.

Follow the pattern shown on the next picture.



4. Place the protective plate in position and firmly push in order to evacuate all the surplus sealant. Keep pressure for at least 1 minute.
5. Wipe off all the sealant surplus.
6. Once cleaned up, inspect all the circumference for sealant lacks.

NOTE: Sealant must be visible all around.

7. Place some adhesive tape on the protective plate to maintain a pressure for at least 24 hours.

NOTE: Wait for at least 1 hour before exposing vehicle to cold temperature.

8. Reinstall chaincase cover. Refer to procedure in this subsection.

GEARBOX

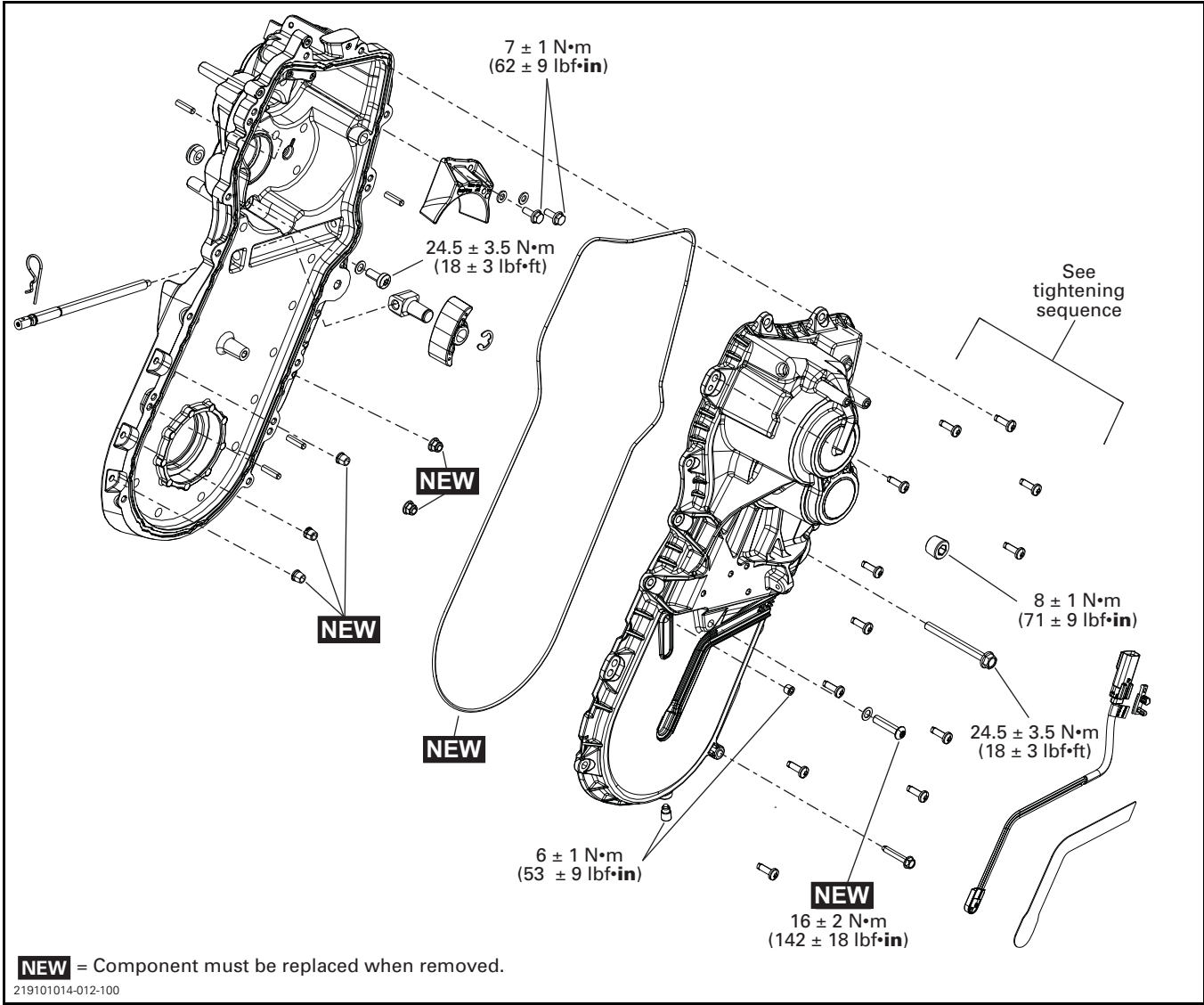
SERVICE TOOLS

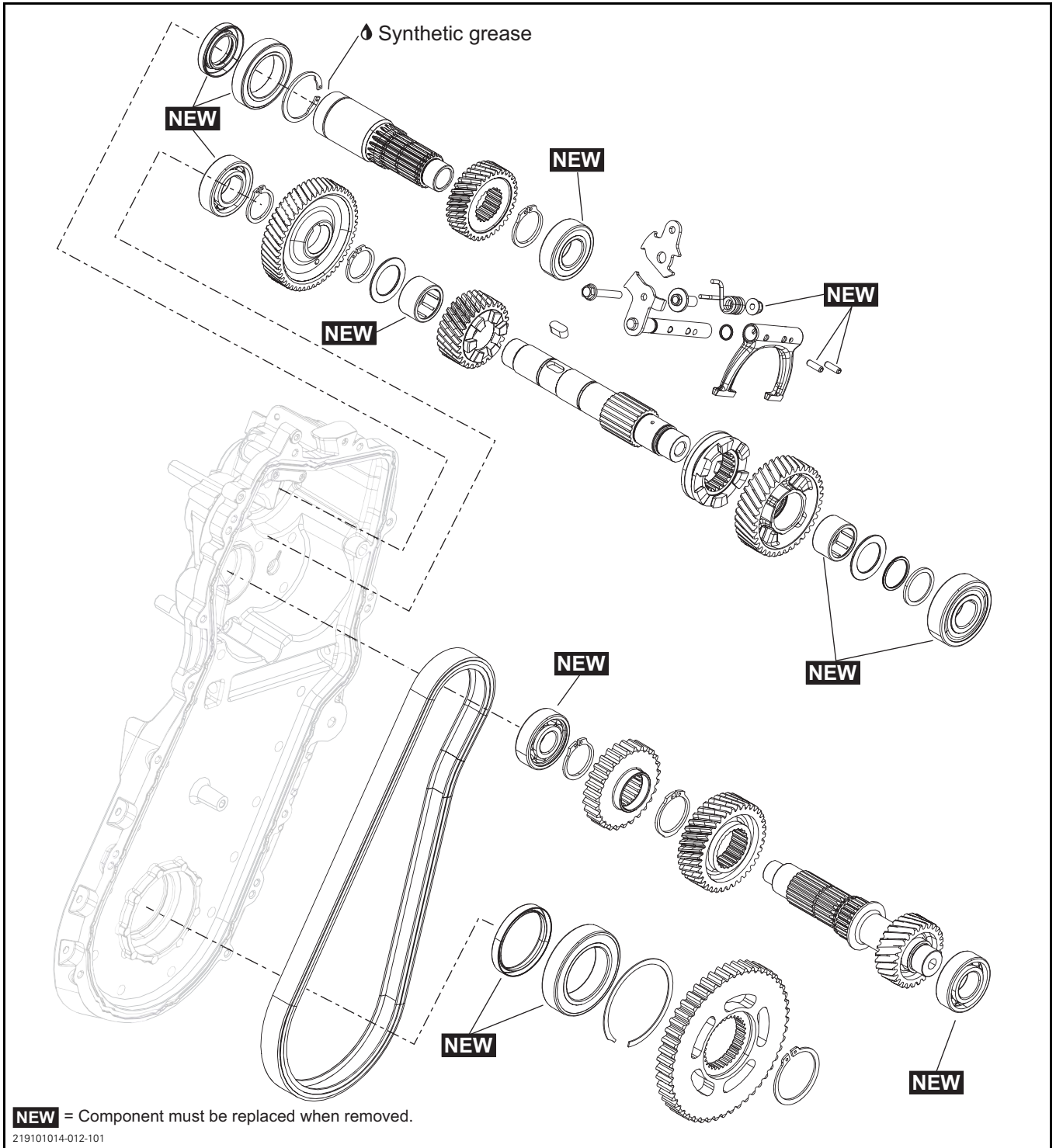
Description	Part Number	Page
BEARING PULLER/PUSHER	529 036 112	20
ECM ADAPTER TOOL.....	529 036 166	5
FLUKE 115 MULTIMETER	529 035 868	5
UPPER OIL SEAL INSTALLER	529 036 510	20

SERVICE PRODUCTS

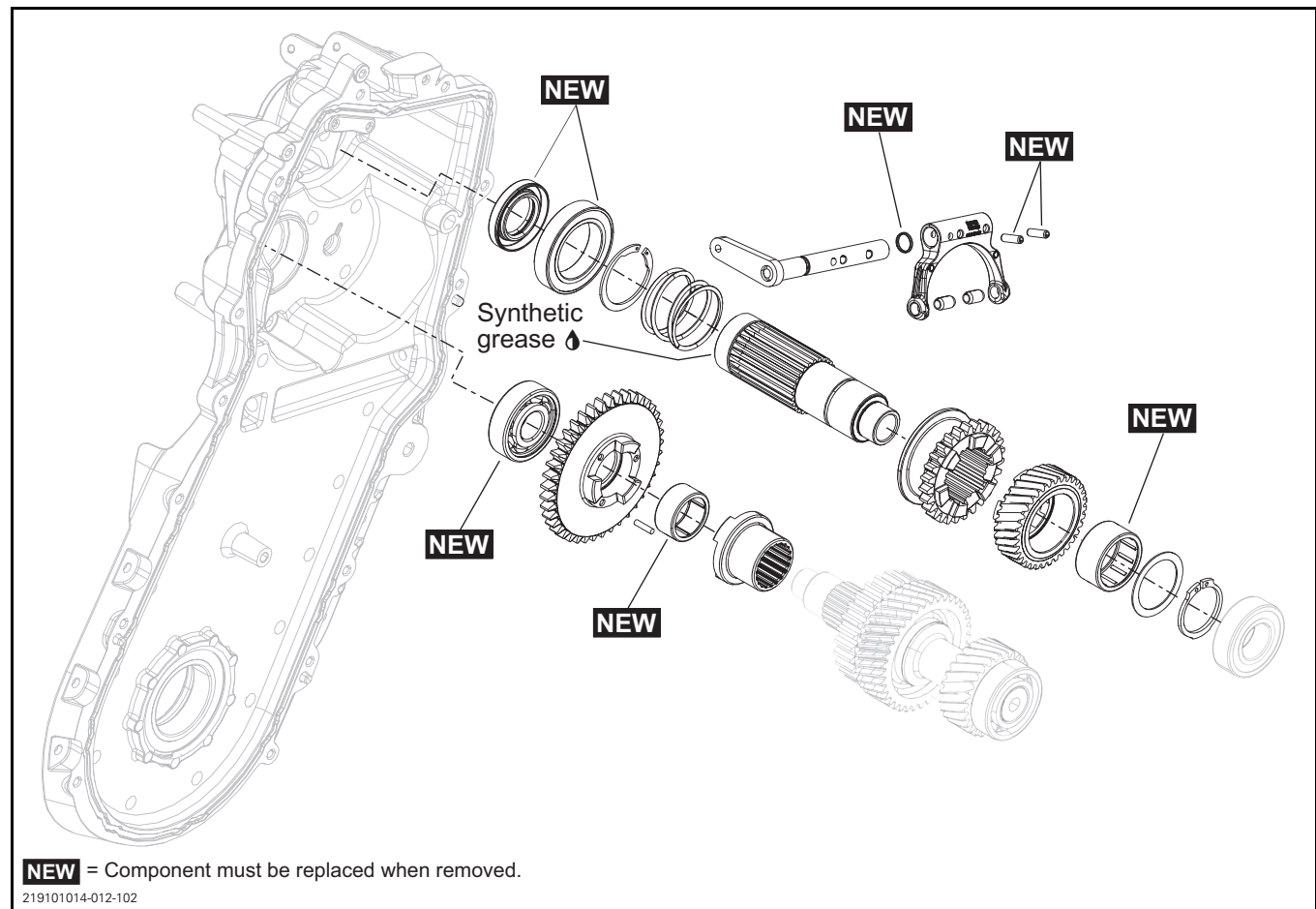
Description	Part Number	Page
LOCTITE 5900	293 800 066	27
SYNCHROMESH TRANSMISSION SYNTHETIC OIL (EUR).....	779211	6
SYNCHROMESH TRANSMISSION SYNTHETIC OIL	779170	6
SYNTHETIC GREASE (EUR)	779231	9, 25
SYNTHETIC GREASE	779162	9, 25

Subsection XX (GEARBOX)





Reverse Mechanism - ACE Engine



GENERAL

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

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

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

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

WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices when removed (e.g.: locking tabs, elastic stop nuts, cotter pin, etc.) must be replaced with new ones.

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

SYSTEM DESCRIPTION

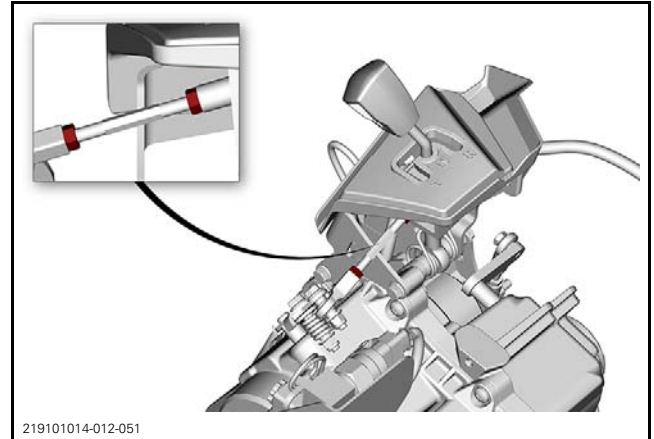
ADJUSTMENT

ADJUSTING THE SHIFTER LINK ROD

The link rod adjustment is required only when the shifter or reverse actuator is removed from gearbox. Periodic adjustment is not required.

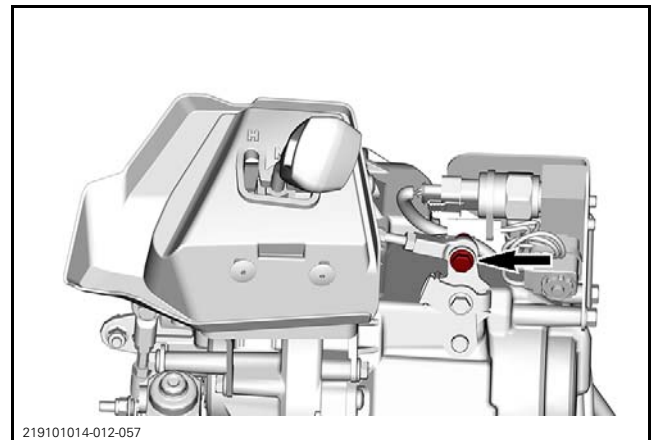
All Models

1. Loosen link rod lock nuts.

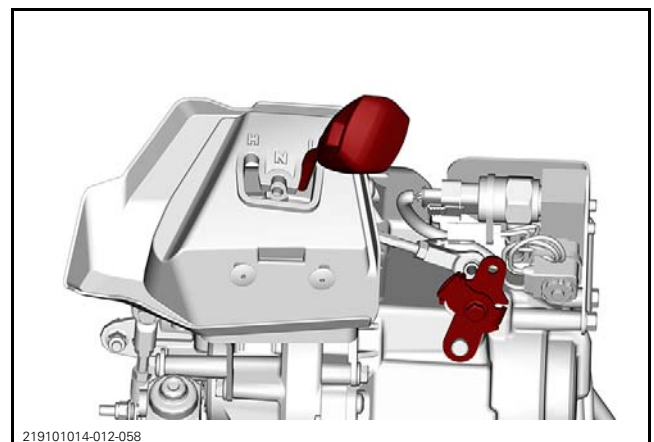


219101014-012-051
SHIFTER LINK ROD

2. Remove link rod screw and nut.

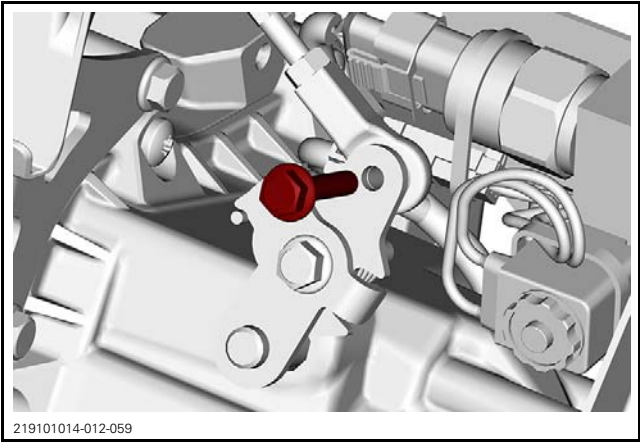


3. Manually put shift fork and shifter in LOW gear.



4. Turn driven pulley to ensure the gearbox is properly engaged.

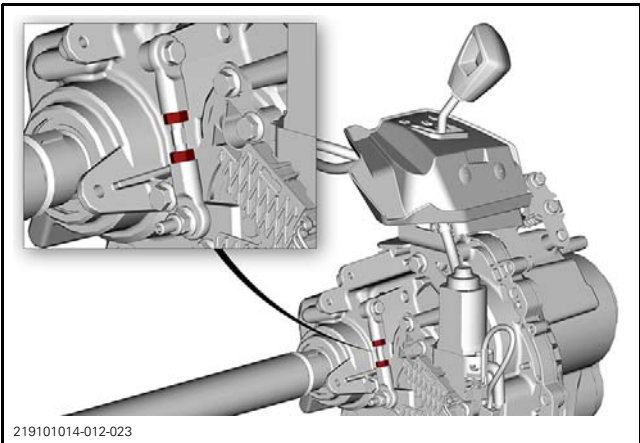
5. Adjust link rod length until the holes line up and the screw can be inserted freely.



6. Tighten screw and lock nuts.

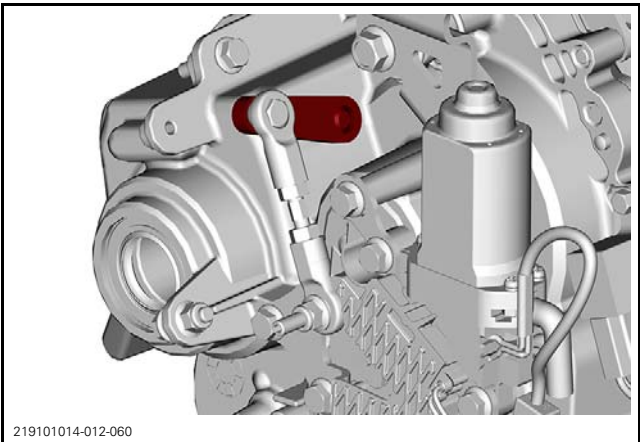
Reverse Actuator - ACE Engine

1. Loosen link rod lock nuts and shorten rod to the shortest length.

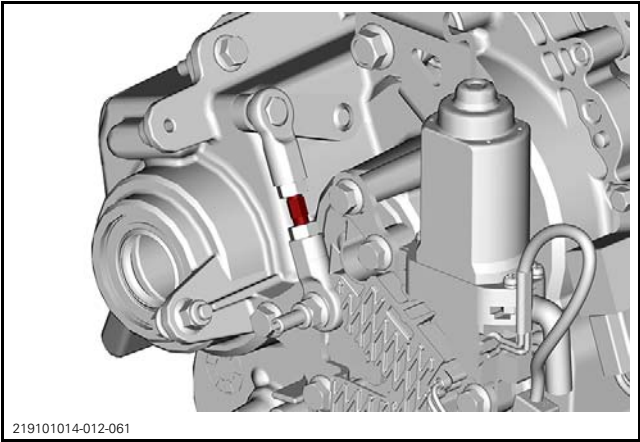


4 STROKE REVERSE ACTUATOR LINK ROD

2. Manually put shift fork in FORWARD gear.



3. Rotate driven pulley a few turns to ensure reverse mechanism is properly engaged.
4. Adjust link rod **by hand** until a resistance is felt.



5. Tighten lock nuts.

MAINTENANCE

GEARBOX OIL

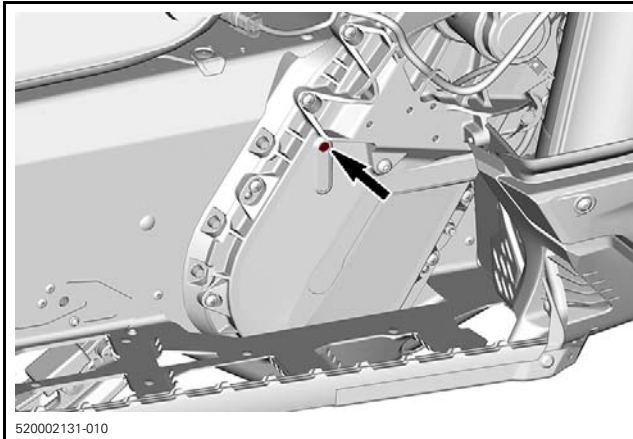
Recommended Gearbox Oil

RECOMMENDED SERVICE PRODUCT	
Scandinavia	SYNCHROMESH TRANSMISSION SYNTHETIC OIL (EUR) (P/N 779211)
All other countries	SYNCHROMESH TRANSMISSION SYNTHETIC OIL (P/N 779170)

NOTICE If the recommended XPS gearbox oil is not available, use a 75W140 gear oil that meets the API GL-5 specification. The gearbox of this snowmobile has been developed and validated using the XPS™ Synthetic gearbox oil. BRP strongly recommends the use of its XPS Synthetic gearbox oil at all times. Damages caused by oil which is not suitable for the gearbox will not be covered by the BRP limited warranty.

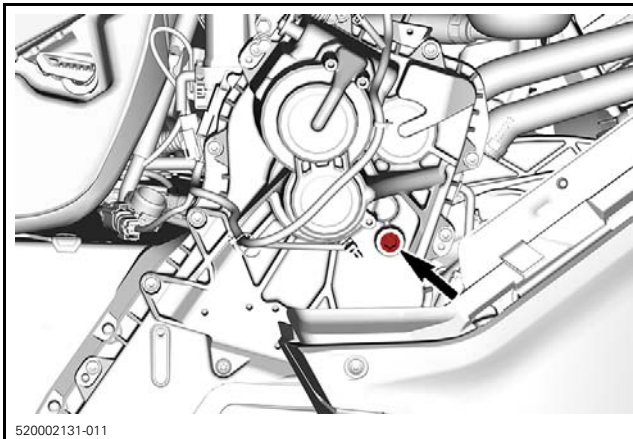
Verifying the Gearbox Oil Level

1. Place vehicle on a level surface, check the oil level by removing the check plug on the left side of gearbox.
2. Oil level must reach the threaded hole's lower edge.



CHECK PLUG

3. To add oil, remove the filler plug.

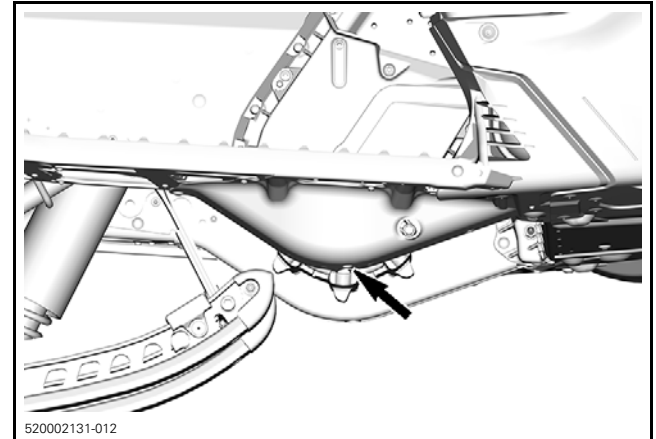


4. Pour recommended oil in gearbox by the filler hole until oil comes out by the check plug hole.
5. Reinstall check and filler plugs. Tighten to specification.

TIGHTENING TORQUE	
Check plug	$6 \text{ N}\cdot\text{m} \pm 1 \text{ N}\cdot\text{m}$ (53 lbf•in $\pm$ 9 lbf•in)
Filler plug	$8 \text{ N}\cdot\text{m} \pm 1 \text{ N}\cdot\text{m}$ (71 lbf•in $\pm$ 9 lbf•in)

Replacing the Gearbox Oil

1. Place vehicle on a level surface.
2. Place a drain pan under gearbox drain plug area.
3. Remove the filler plug.
4. Remove the drain plug on the bottom of gearbox.



5. Let oil drain.
6. Reinstall the drain plug and tighten to specification.

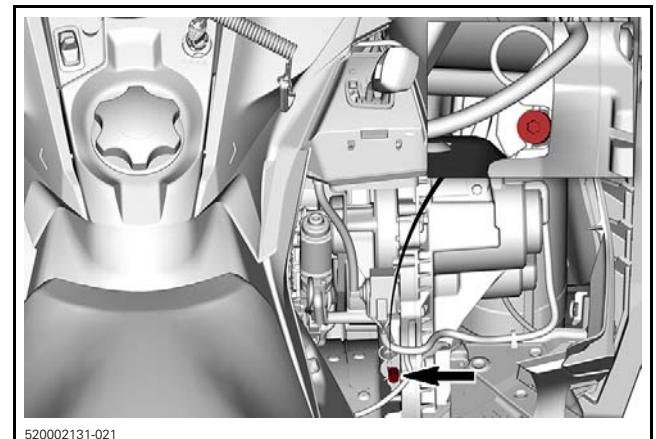
TIGHTENING TORQUE	
Drain plug	$6 \text{ N}\cdot\text{m} \pm 1 \text{ N}\cdot\text{m}$ (53 lbf•in $\pm$ 9 lbf•in)

7. Remove the check and filler plugs.
8. Pour approximately 900 ml (30 U.S. oz) of recommended oil in gearbox through the filler hole until oil comes out by the check plug hole.
9. Clean the check plug. Refer to *VERIFYING THE GEARBOX OIL LEVEL*, see procedure in this subsection.

DRIVE CHAIN

Adjusting the Drive Chain

Using the Torx end of the driven pulley expander, gently turn tensioner adjustment screw clockwise to eliminate the play.



ADJUSTMENT SCREW

Do not force the tensioner in.

NOTE: Do not remove the cotter pin.

NOTICE Overtightening the drive chain could result in severe damage to the gearbox components.

TROUBLESHOOTING

DIAGNOSTIC TIPS (ELECTRO-MECHANICAL REVERSE - ACE ENGINE)

BUDS2 Configuration

If the electro-mechanical reverse is not working, make sure the required option is selected in BUDS2. Otherwise, the electro-mechanical reverse will not work and no fault code will be set.

Fault Code P0736

The fault code P0736 can appear for the following reasons:

- Reverse gears are not aligned to engage properly
- Failure of the reverse electrical components.

If fault code appears:

1. Clear the fault using BUDS2
2. Lift rear of vehicle and support it off the ground
3. Rotate driven pulley a few turns to move gears in chaincase
4. Retry changing gears.

If fault code appears again:

- Check drive belt height (refer to *DRIVE BELT* subsection)
- Check shift linkage adjustment. Refer to procedure in this subsection.

If fault code persists:

- Refer to *TESTING SEQUENCE* below.

TESTING SEQUENCE (ELECTRO-MECHANICAL REVERSE - ACE ENGINE)

Reverse Does Not Engage

First, make sure the following settings are as per specifications:

- Drive belt height
- Shift linkage adjustment.

If BUDS2 is properly configured, drive belt and shift linkage are properly adjusted, follow this testing sequence to diagnose problem:

1. Check reverse position switch (RVPS) continuity.
2. Check actuator fuse.
3. Check actuator connector.
4. Check relays continuity.
5. Check actuator operation.
6. Check input voltage to actuator.
7. Check input voltage to relays.
8. Check relay grounds.
9. Check relay ground signals.
10. Check ECM ground continuity.

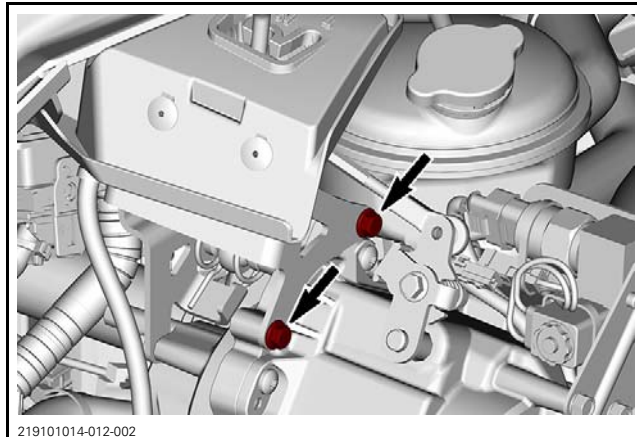
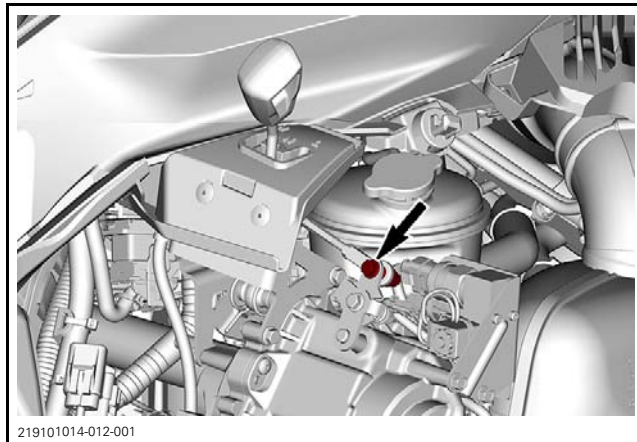
Refer to the appropriate topic to see the complete testing procedures.

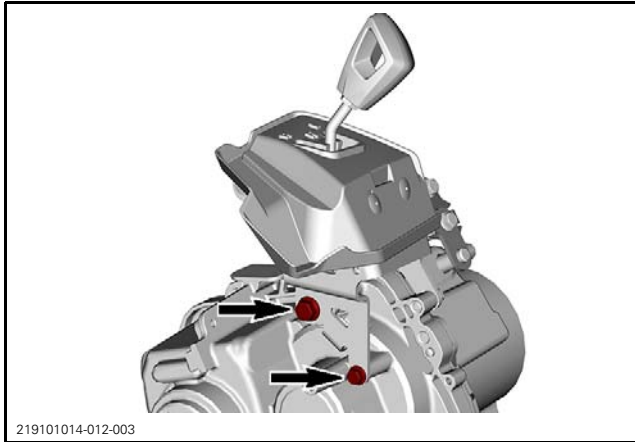
PROCEDURES

SHIFT LEVER

Removing the Shift Lever

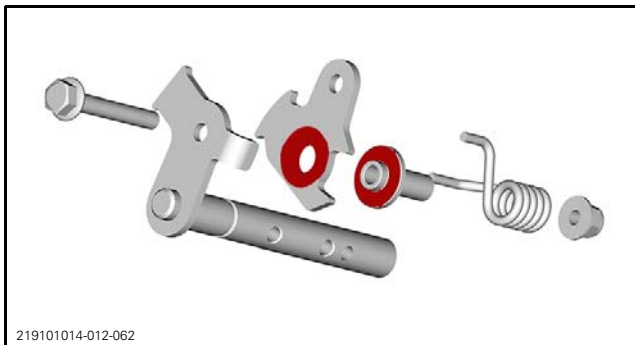
1. Remove the following screws.





Installing the Shift Lever

The installation is the reverse of the removal procedure. However, pay attention to the following. Lubricate shift lever pivots and moving parts as shown.



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

Tighten retaining screws to specification.

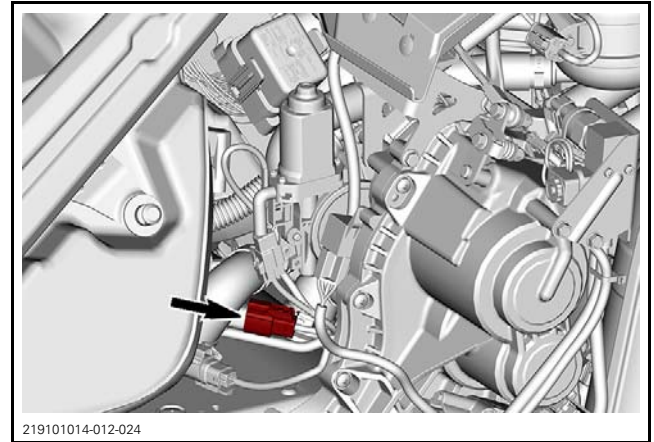
TIGHTENING TORQUE	
Shift lever retaining screw	10 N•m ± 2 N•m (89 lbf•in ± 18 lbf•in)

ELECTRO-MECHANICAL REVERSE - ACE ENGINE

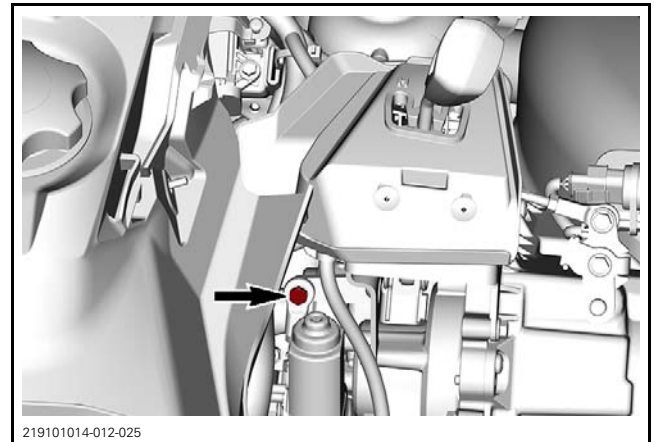
Removing the Actuator

⚠ CAUTION Battery BLACK (–) cable must always be disconnected first and connected last.

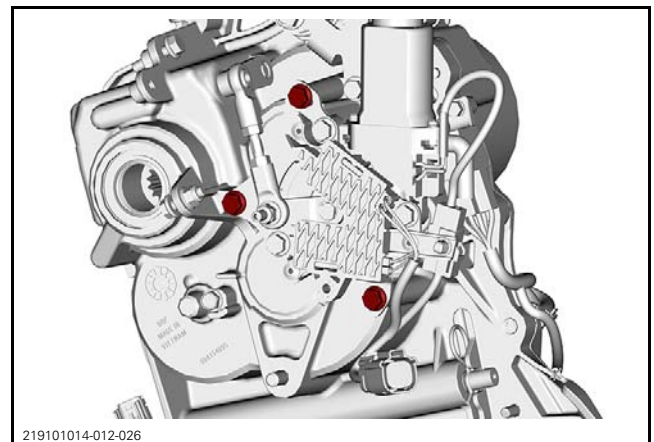
1. Disconnect BLACK negative cable from battery.
2. Disconnect actuator connector.



3. Remove actuator link nut.



4. Remove actuator support screws.



5. Remove the actuator from vehicle.

Inspecting the Actuator

Inspect actuator connector for corrosion, clean if necessary.

Inspect RVPS switches for correct spring tension when pressed and released, replace if necessary.

Inspect actuator coupling shaft for straightness, replace if necessary.

Subsection XX (GEARBOX)

Inspect actuator stopper in support for straightness.

Installing the Actuator

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

Lubricate shifter pivots and moving parts.

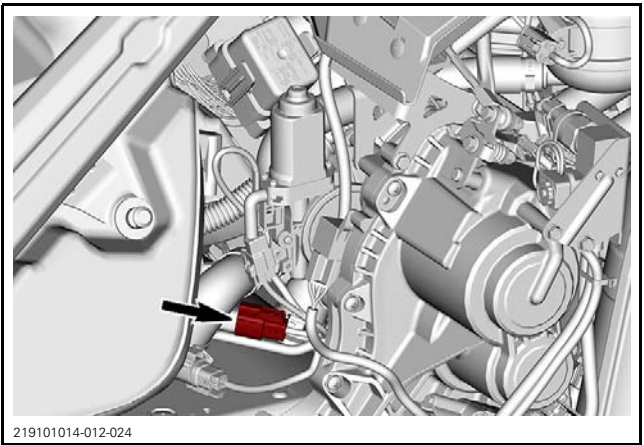
Tighten coupling shaft nut to specification.

TIGHTENING TORQUE	
Actuator coupling shaft nut	7 N•m ± 0.5 N•m (62 lbf•in ± 4 lbf•in)
Actuator support screws	10 N•m ± 2 N•m (89 lbf•in ± 18 lbf•in)

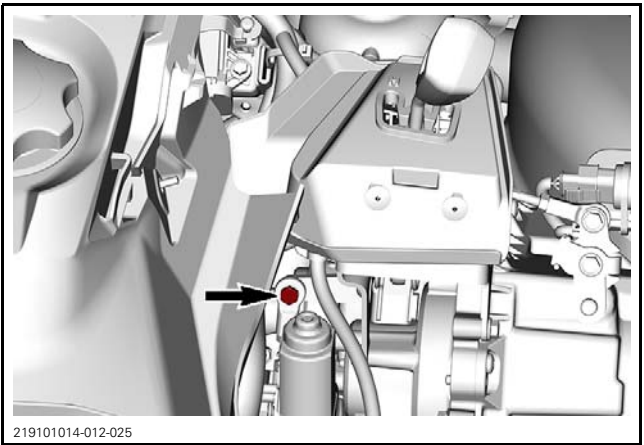
Testing the Actuator Operation

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

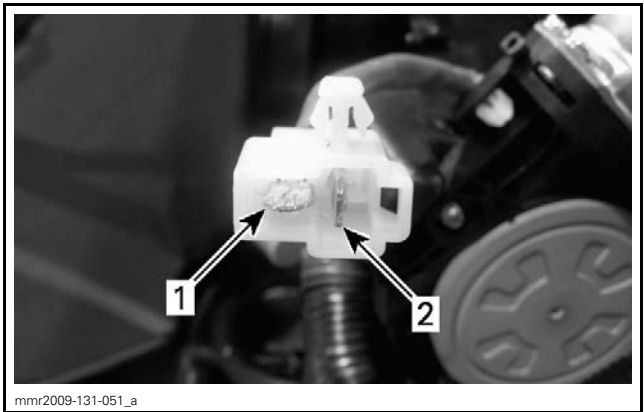
- 1. Disconnect actuator connector.



- 2. Remove actuator link nut.



- 3. Connect actuator connector pin 2 to a 20 A suitable fused jumper and then directly to the positive battery post.
- 4. Connect actuator connector pin 1 directly to the negative battery post.

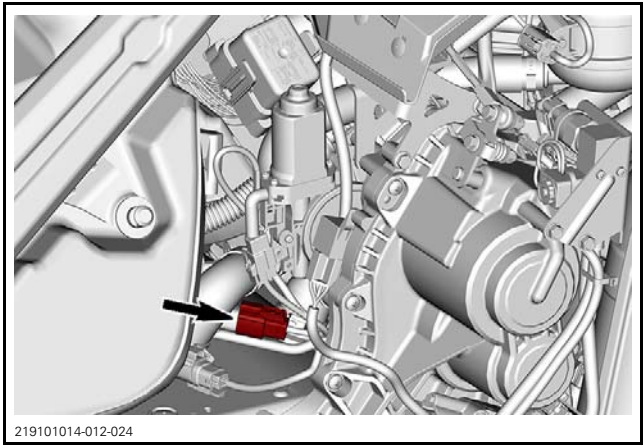


- 1. Pin 1
- 2. Pin 2

- 5. Verify if actuator works properly.
- 6. Invert battery polarities and verify if actuator works properly in the opposite direction.

Testing the Actuator Input Voltage

- 1. Set the multimeter to Vdc.
- 2. Disconnect actuator connector.



- 3. Start engine.
- 4. Press on START/RER button while engine is idling.
- 5. Measure voltage between harness connector terminals.

ACTUATOR INPUT VOLTAGE TEST		
ACTUATOR CONNECTOR PIN		SPECIFICATION
1	2	Battery voltage (~12 Vdc)

If measure is not as per specification, test:

- The battery voltage
- The actuator relay and fuse
- The actuator circuit continuity.

Refer to *WIRING DIAGRAM* for more information.

Testing the Relay Continuity

1. Remove relays.
2. Set the multimeter to Ω .
3. Measure resistance as per the following table.

RELAY CONTINUITY TEST		
RELAY PIN		SPECIFICATION
87	30	Open (OL)
87a		Close to 0 Ω

4. Apply 12 volts on terminals 85 and 86.
5. Measure resistance again as per the following table.

RELAY CONTINUITY TEST		
RELAY PIN		SPECIFICATION
87	30	Close to 0 Ω
87a		Open (OL)

If results are not as per the above tables, replace relay.

Testing the Relay Input Voltage (Forward and Reverse)

1. Set the multimeter to Vdc.
2. Start engine.
3. Measure voltage as per the following tables.

RELAY INPUT VOLTAGE TEST		
RELAY PIN	BATTERY POST	SPECIFICATION
86	Negative (-)	Battery voltage
87		

If voltage is not as specified, repair open circuit in wiring. Refer to *WIRING DIAGRAM*.

Testing the Relay Ground (Forward and Reverse)

1. Set the multimeter to Vdc.
2. Start engine.
3. Measure voltage as per the following table.

RELAY GROUND TEST		
RELAY PIN	BATTERY POST	SPECIFICATION
87a	Positive (+)	Battery voltage

If voltage is not as specified, repair open circuit in wiring. Refer to *WIRING DIAGRAM*.

Testing the Relay Ground Signal

Forward Relay

For this test, electronic reverse must be set in reverse position.

NOTE: The measured voltage will be transmitted during a short period of time.

1. Set the multimeter to Vdc.
2. Start engine and let it run at idle.
3. Press on START/RER button while measuring voltage as per the following table.

FORWARD RELAY TEST		
RELAY PIN	BATTERY POST	SPECIFICATION
85	Positive (+)	Battery voltage

If voltage is not as specified, repair open circuit in wiring. Refer to *WIRING DIAGRAM*.

Reverse Relay

For this test, electronic reverse must be set in forward position.

NOTE: The measured voltage will be transmitted during a short period of time.

1. Set the multimeter to Vdc.
2. Start engine and let it run at idle.
3. Press on START/RER button while measuring voltage as per the following table.

REVERSE RELAY TEST		
RELAY PIN	BATTERY POST	SPECIFICATION
85	Positive (+)	Battery voltage

If voltage is not as specified, repair open circuit in wiring. Refer to *WIRING DIAGRAM*.

Testing the ECM Ground Continuity

Forward Relay

- 1. Disconnect ECM-B connector.
- 2. Install connector on the ECM adapter tool.
- 3. Set the multimeter to Ω .
- 4. Measure resistance as per the following table.

FORWARD RELAY TO ECM GROUND CONTINUITY TEST		
RELAY PIN	ECM ADAPTER PIN	SPECIFICATION
85	B-L3	Close to 0 Ω

Reverse Relay

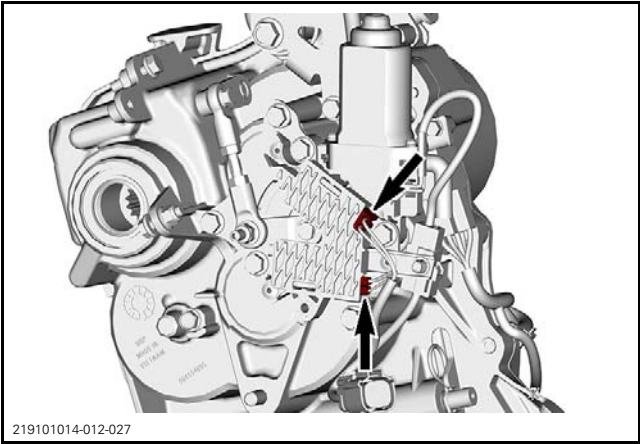
- 1. Disconnect ECM-B connector.
- 2. Install connector on the ECM adapter tool.
- 3. Set the multimeter to Ω .
- 4. Measure resistance as per the following table.

REVERSE RELAY TO ECM GROUND CONTINUITY TEST		
RELAY PIN	ECM ADAPTER PIN	SPECIFICATION
85	B-F1	Close to 0 Ω

REVERSE MECHANISM POSITION SWITCHES

Testing the Switches Continuity

- 1. Disconnect Reverse Position Switch (RPS) and Forward Position Switch (FPS) connectors.



- 2. Set the multimeter to Ω .
- 3. Press RPS.
- 4. Measure resistance as per the following table.

SWITCH CONTINUITY TEST		
RPS PIN		SPECIFICATION
1	2	Close to 0 Ω

- 5. Release RPS.
- 6. Measure resistance again as per the following table.

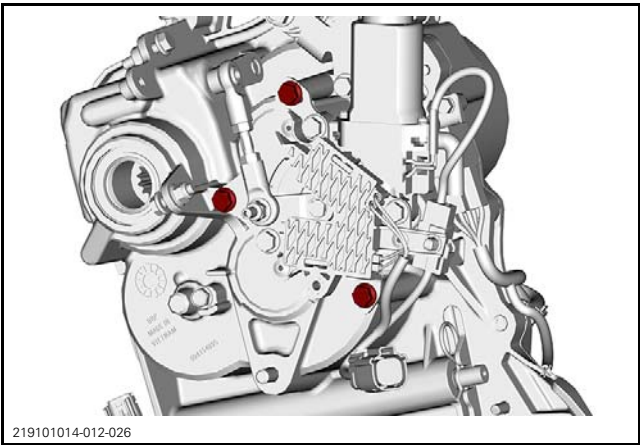
SWITCH CONTINUITY TEST		
FPS PIN		SPECIFICATION
1	2	Open (OL)

If results are not as per the above tables, replace RPS.

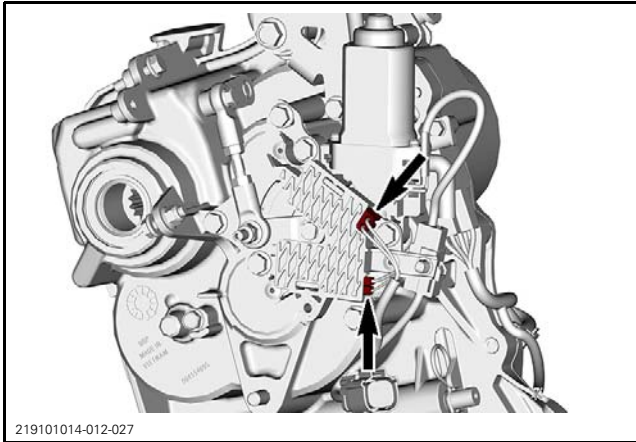
Repeat the test for the FPS.

Replacing the Reverse Mechanism Position Switches Assembly

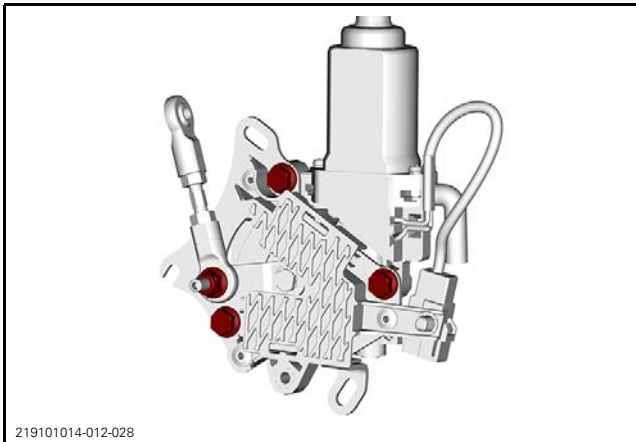
- 1. Remove actuator support screws.



- 2. Remove switch connectors.



3. Remove link rod and switch fasteners.



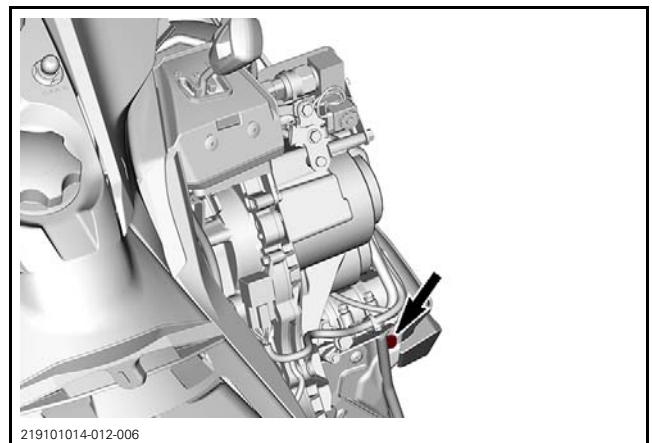
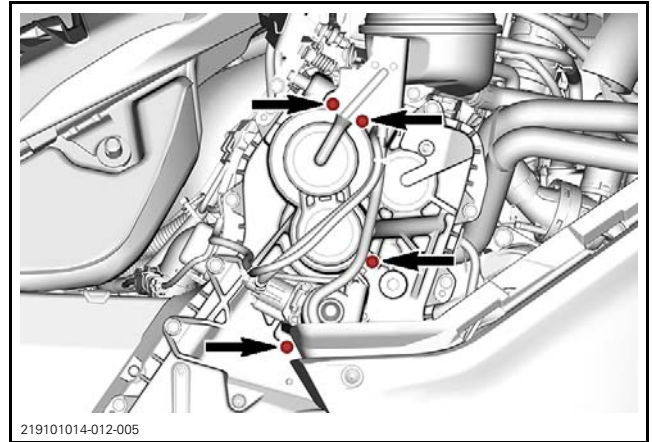
GEARBOX

Removing the Gearbox Cover

1. Apply parking brake.
2. Remove muffler. Refer to *EXHAUST SYSTEM* subsection.

Models with ACS

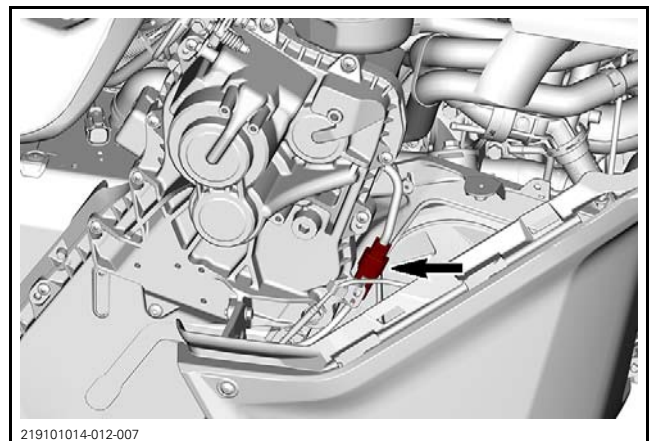
3. Disconnect compressor connector.
4. Remove ACS compressor module and compressor support screws.



5. Move the ACS assembly aside.

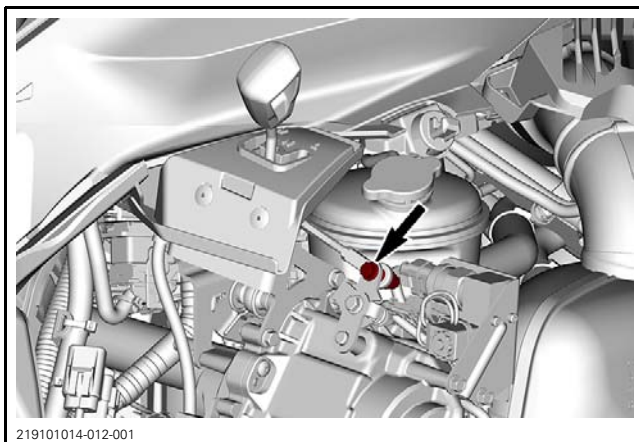
All Models

1. Drain the gearbox oil. Refer to procedure in this subsection.
2. Disconnect speed sensor connector.

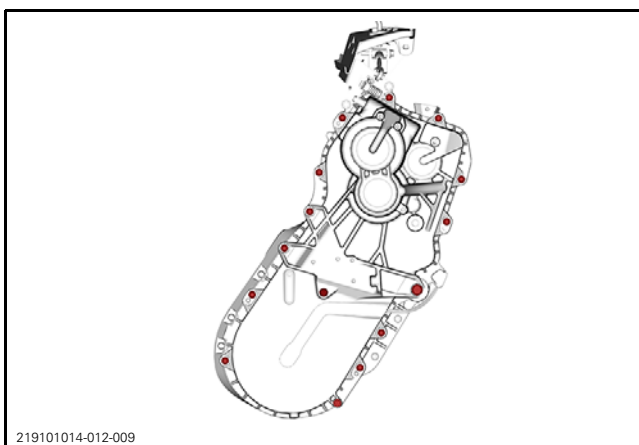
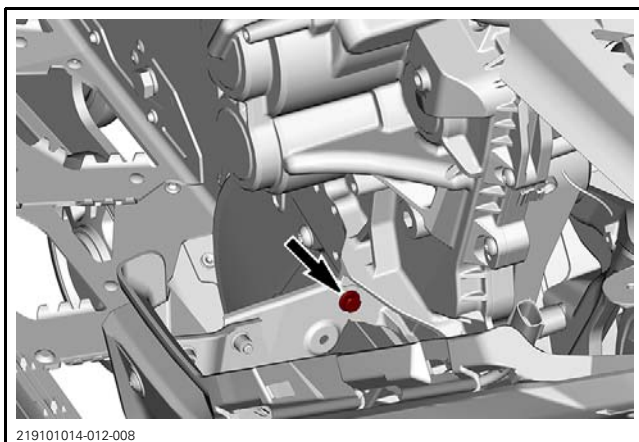


3. Remove lower retaining screw from shifter link rod.

Subsection XX (GEARBOX)



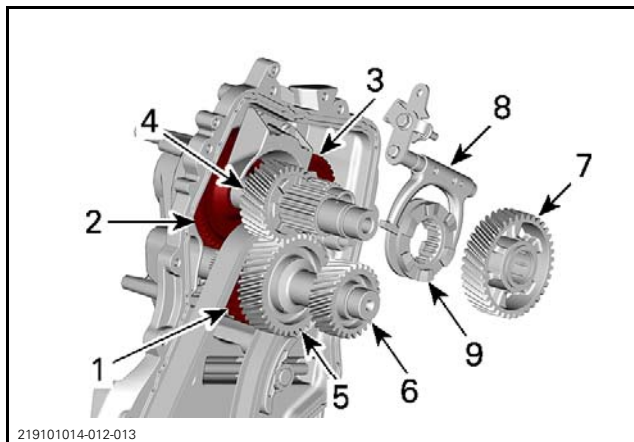
4. Unscrew and remove gearbox cover screws.



5. Pull the bottom of gearbox cover to drain oil.

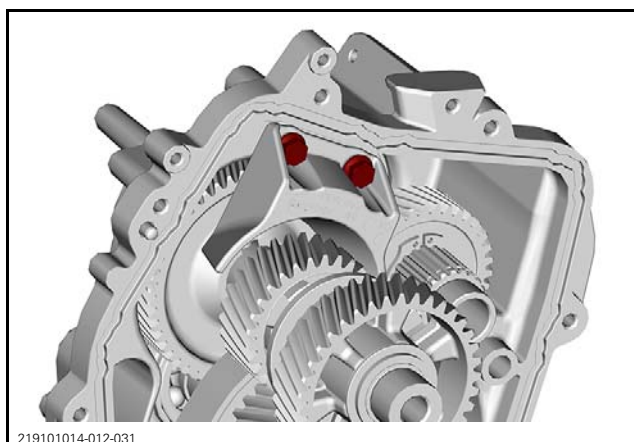
Gearbox Disassembly

1. Apply parking brake.
2. Remove gearbox cover. Refer to *REMOVING THE GEARBOX COVER* in this subsection.

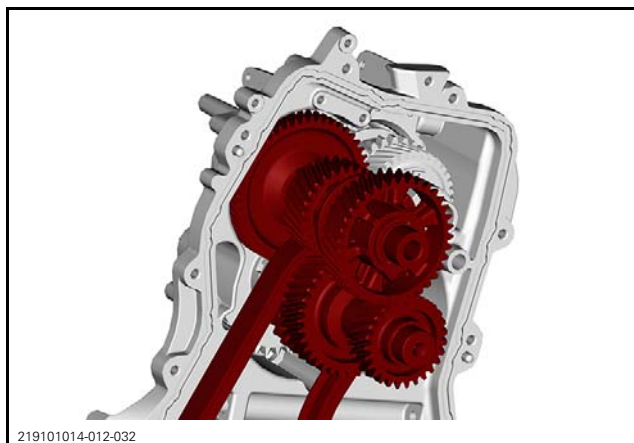


1. Upper chain sprocket
2. 51 teeth drive gear
3. 34 teeth drive gear
4. 28 teeth High gear
5. 37 teeth High gear
6. Output shaft
7. 37 teeth Low gear
8. Shift fork
9. Sliding sleeve

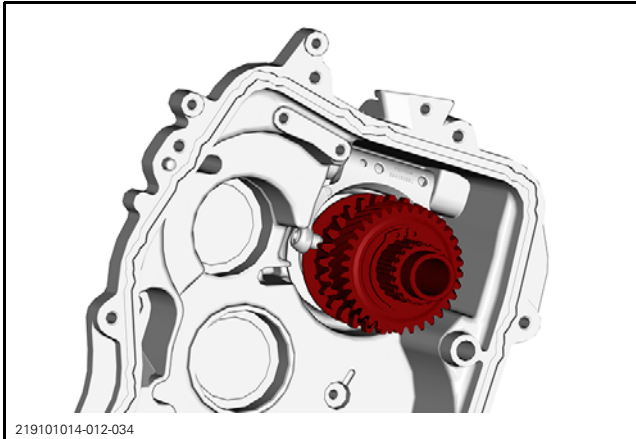
3. Remove the oil deflector.



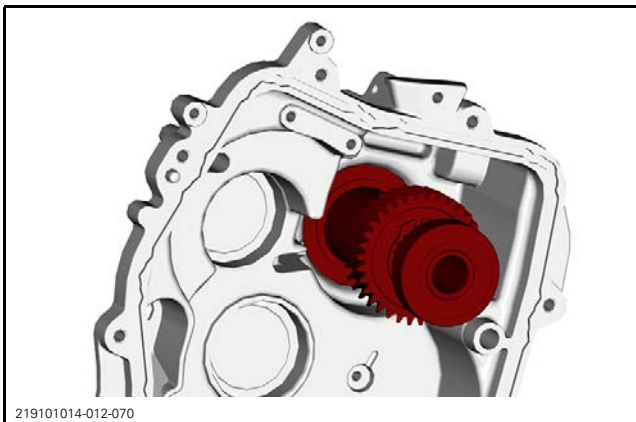
4. Loosen chain tension.
5. Remove upper shaft, lower shaft and chain simultaneously.



6. Remove input shaft assembly.



MODELS WITH ACE ENGINE

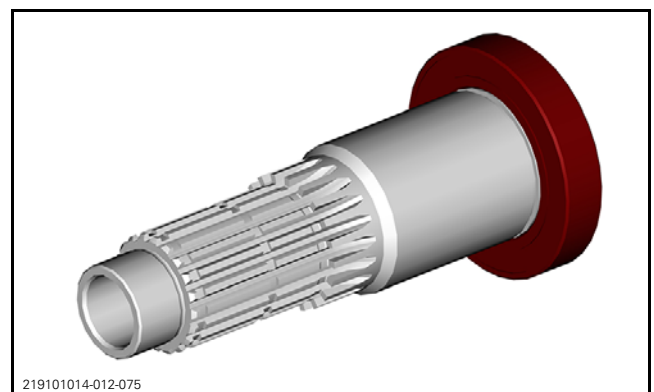
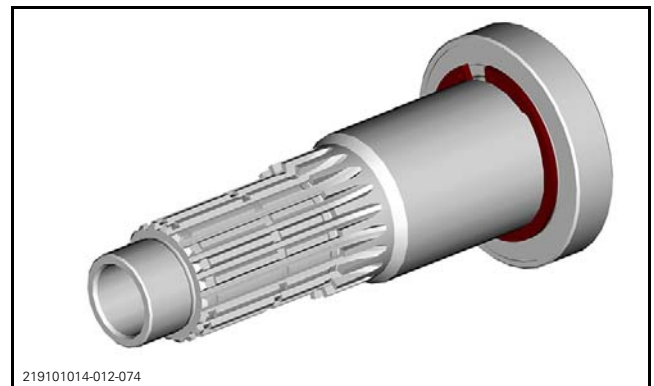
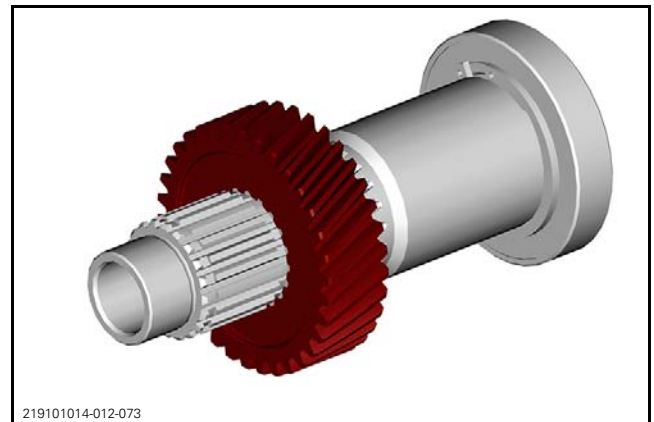
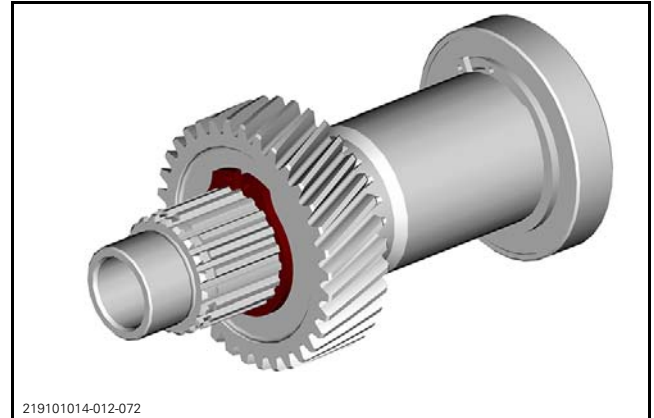
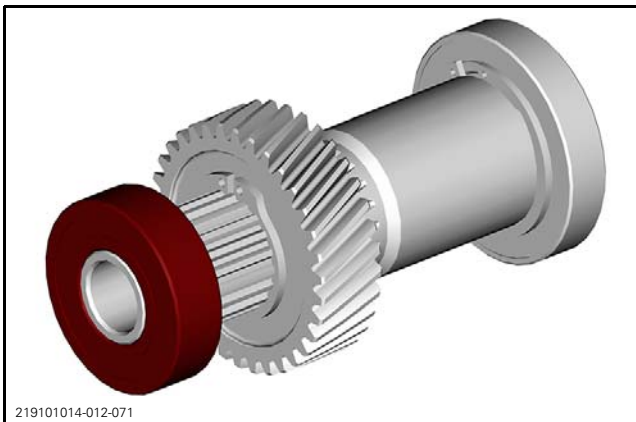


MODELS WITH E-TEC ENGINE

Input Shaft (E-TEC Engine)

Use a press to remove bearings.

Disassemble the input shaft in the following sequence.

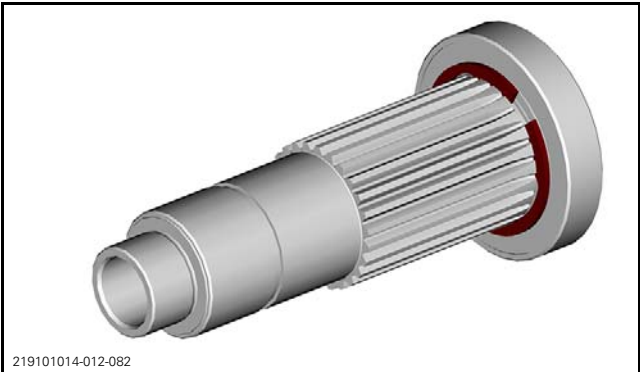
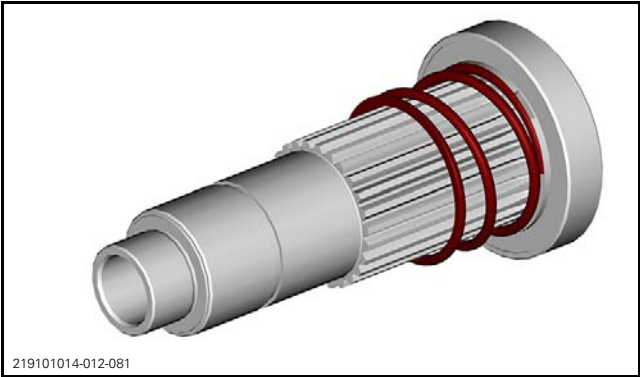
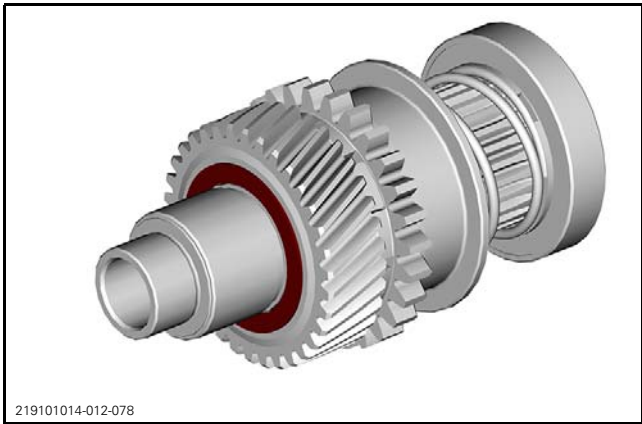
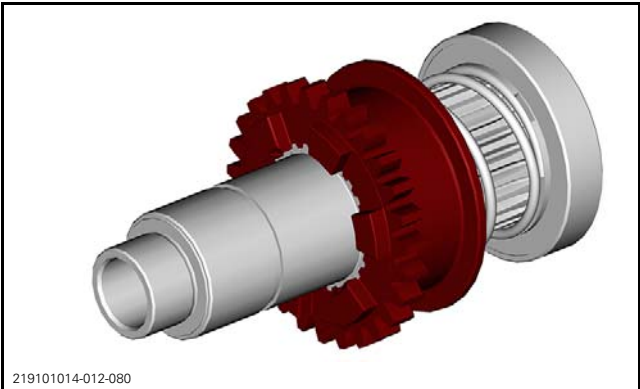
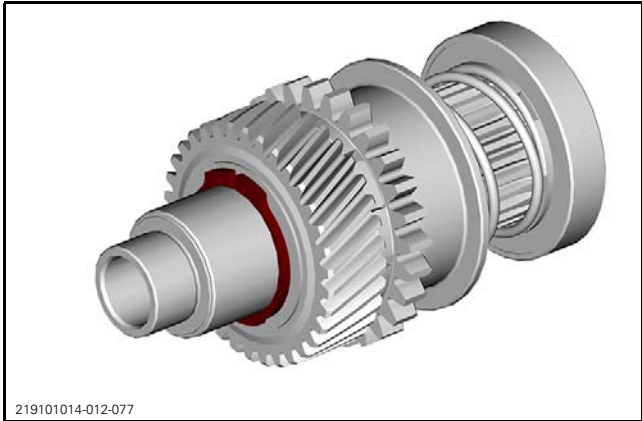
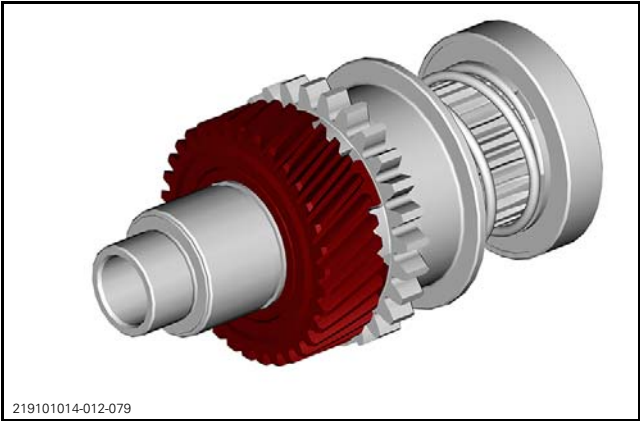
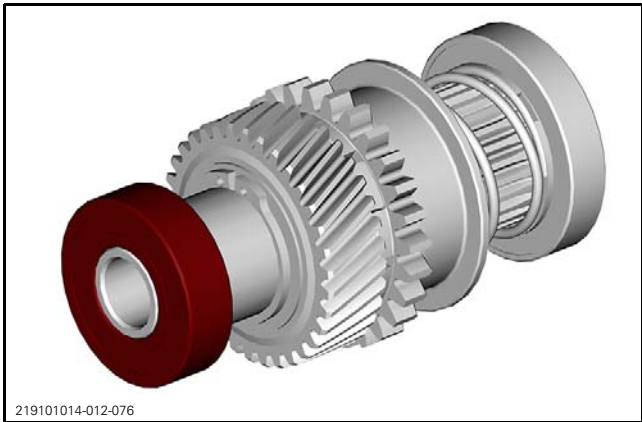


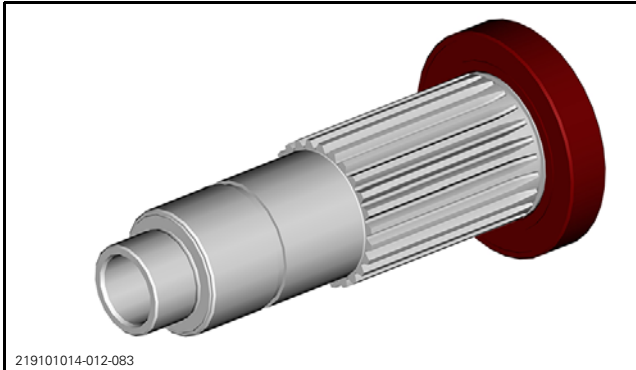
Input Shaft (ACE Engine)

Use a press to remove bearings.

Subsection XX (GEARBOX)

Disassemble the input shaft in the following sequence.

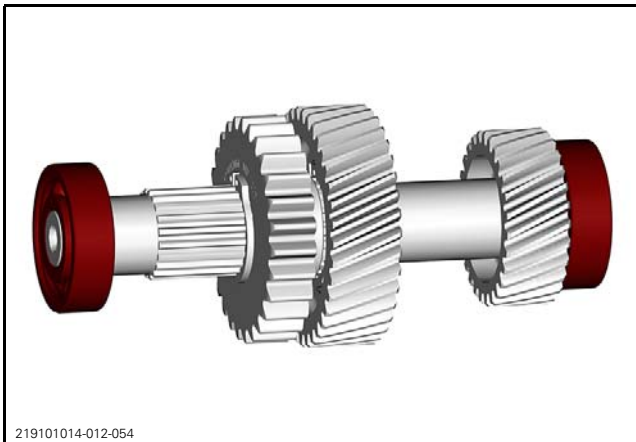




Lower Gear Shaft

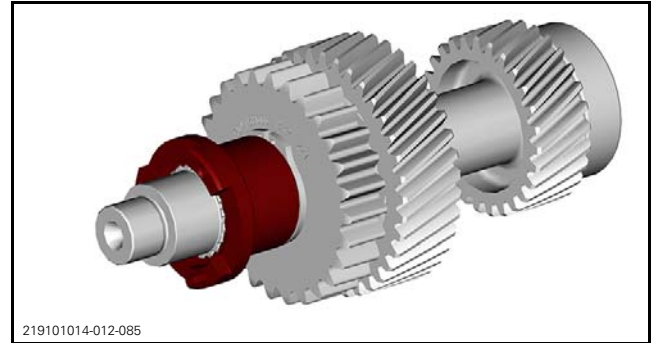
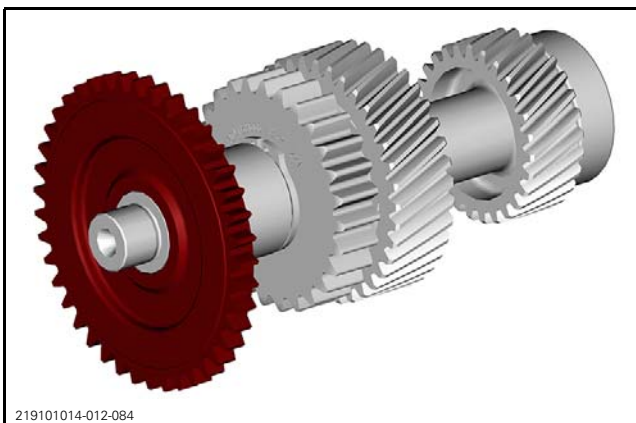
Use a press to remove bearings.

Disassemble the input shaft in the following sequence.

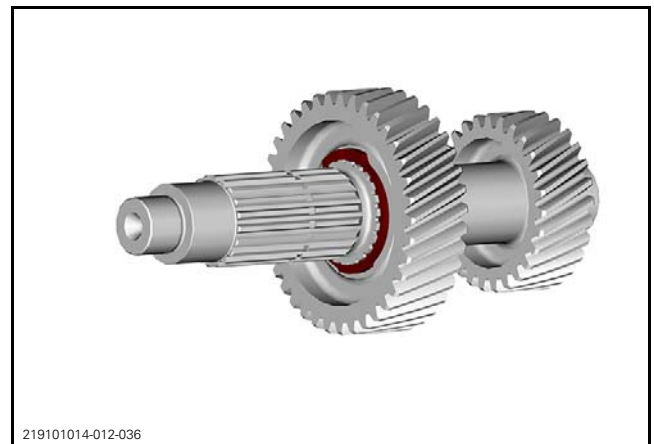
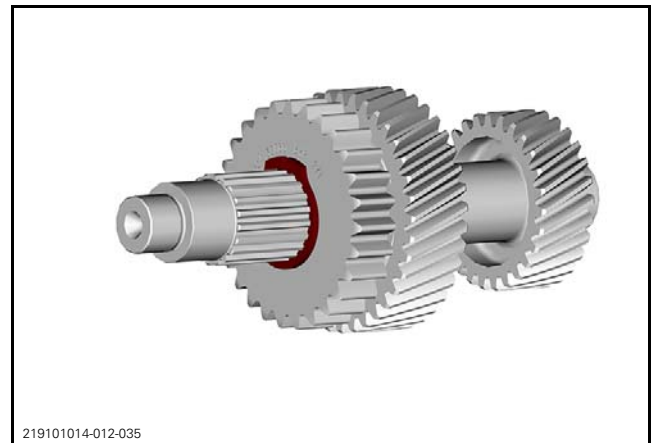


TYPICAL - E-TEC ENGINE SHOWN

ACE Engine Models



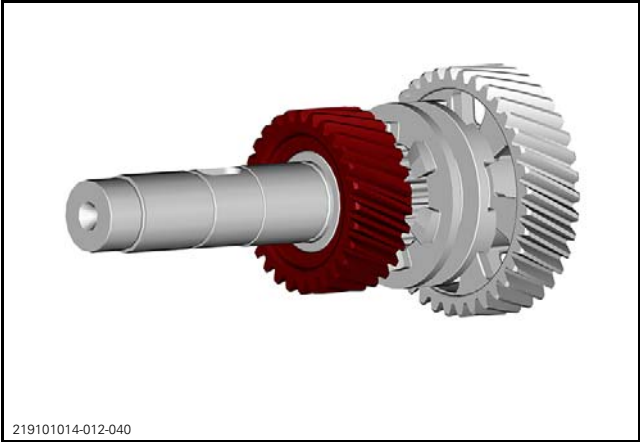
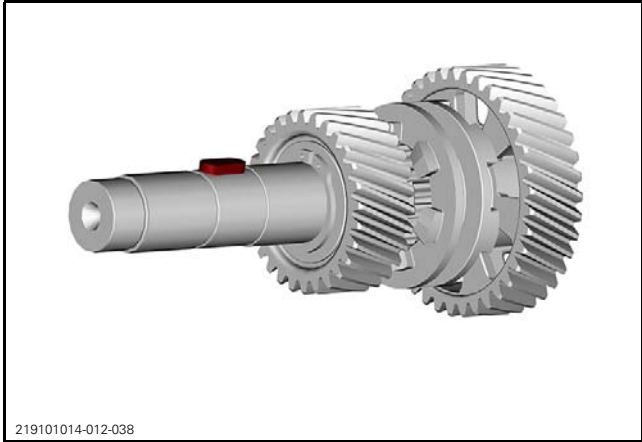
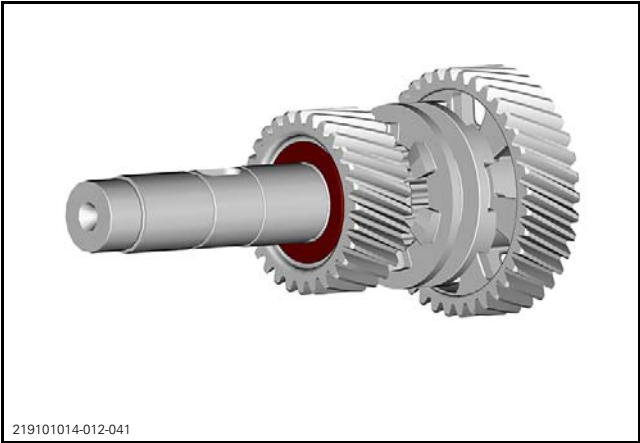
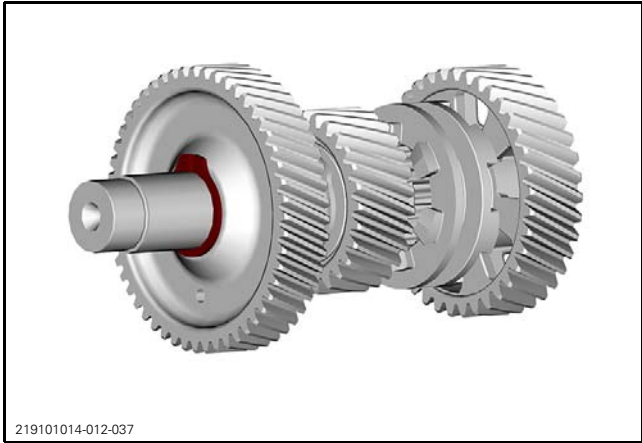
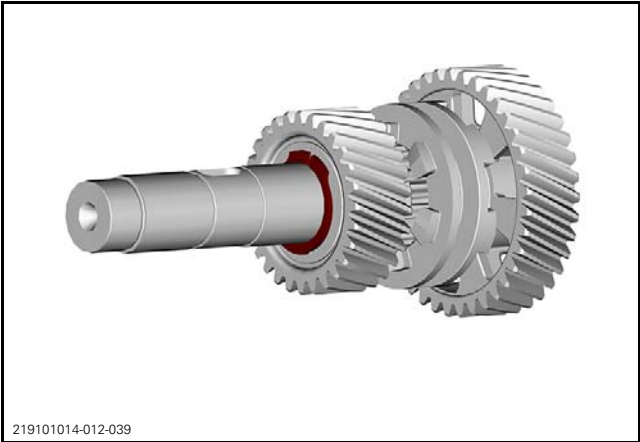
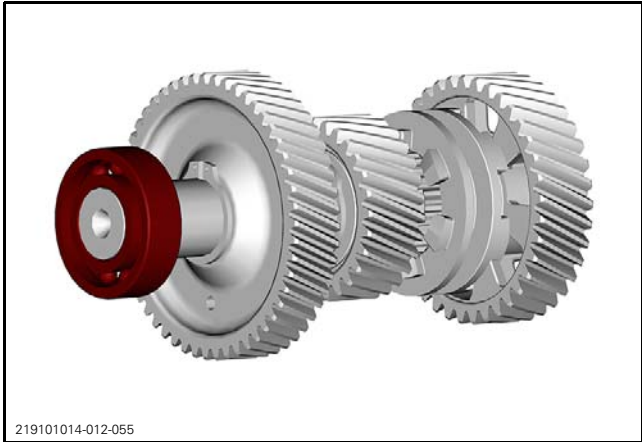
All Models

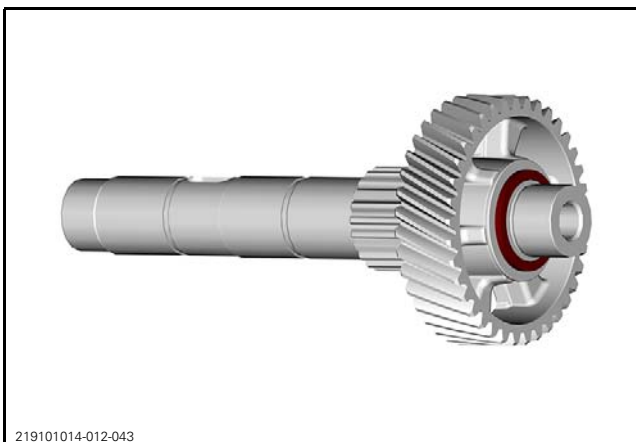
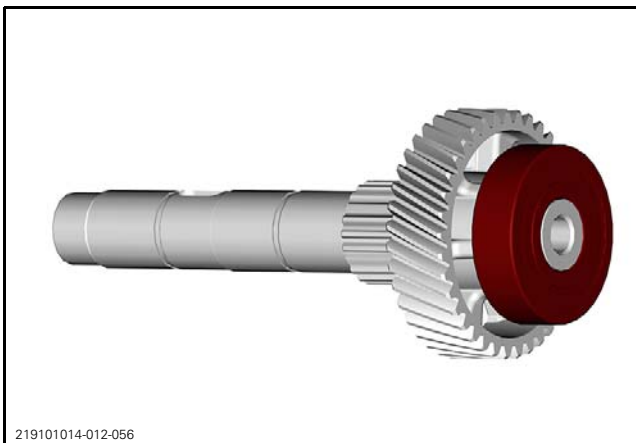
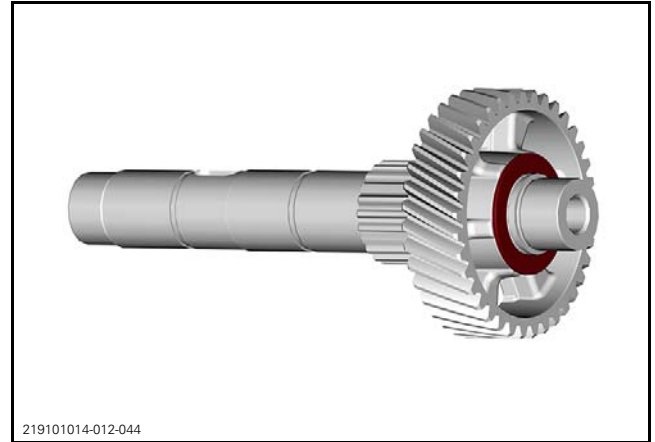
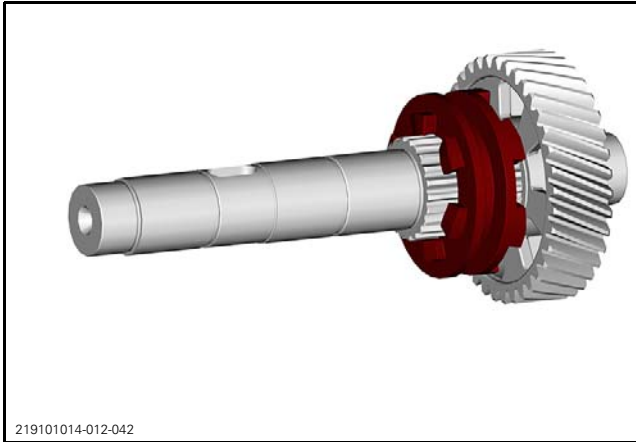


Upper Gear Shaft

Use a press to remove bearings.

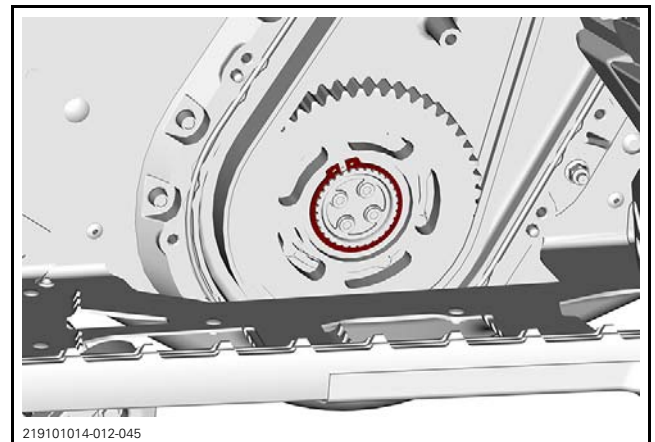
Disassemble the input shaft in the following sequence.





Lower Chain Sprocket

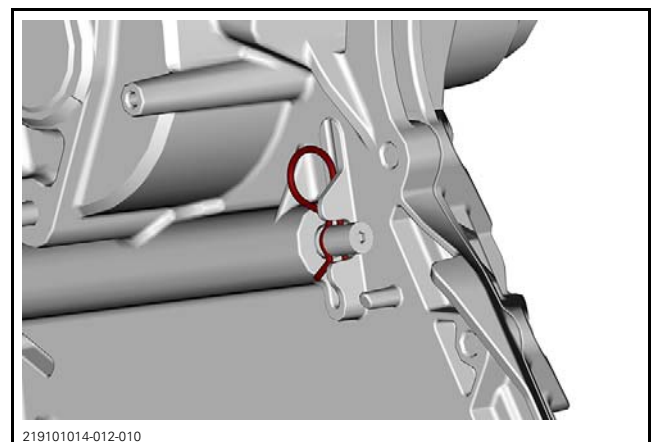
1. Remove the lower sprocket circlip.



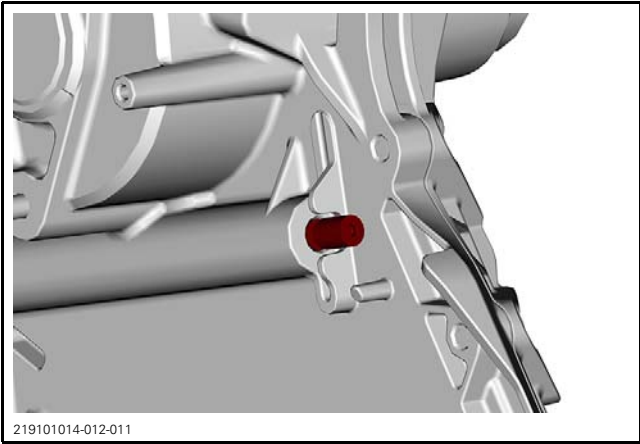
2. Loosen the chain tension if upper chain gear still in place.
3. Remove lower sprocket and drive chain simultaneously.

Chain Tensioner

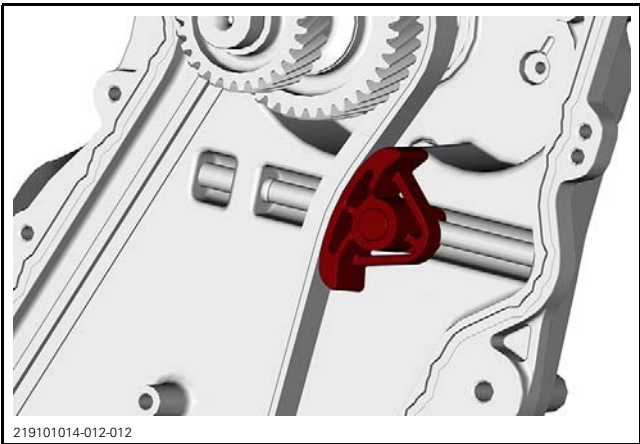
1. Remove the hair pin from behind the gearbox.



2. Remove the tensioner adjustment screw.

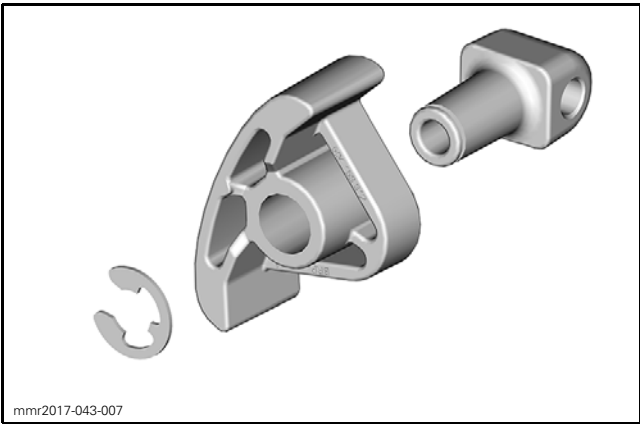


3. Remove tensioner.



NOTE: The following steps are required only if the tensioner or the slider is defective.

4. Remove the circlip securing the slider to tensioner.

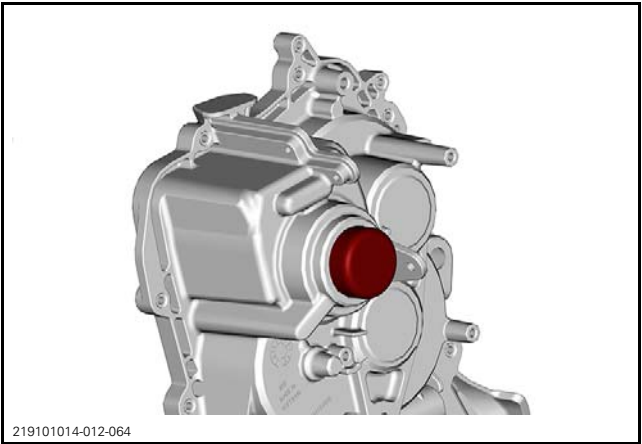


1. Circlip
2. Tensioner
3. Slider

Gearbox Upper Oil Seal

REQUIRED TOOL	
UPPER OIL SEAL INSTALLER (P/N 529 036 510)	
Soft head hammer	

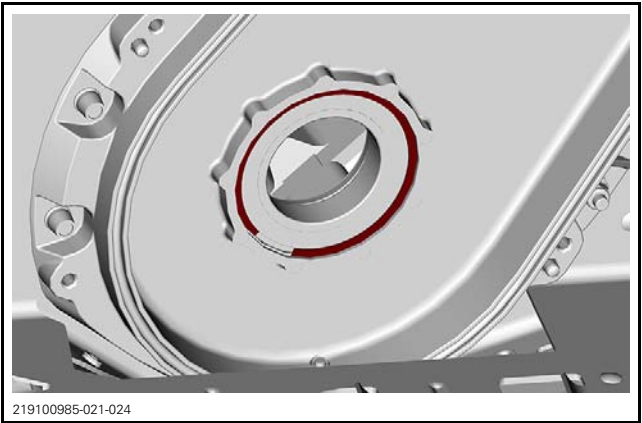
1. Remove the input shaft. Refer to procedure in this subsection.
2. Gently tap on the tool until the seal comes out of the housing.



UPPER SEAL

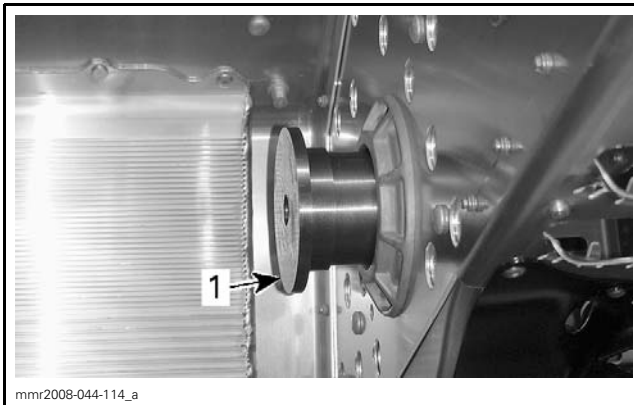
Gearbox Lower Bearing and Oil Seal

1. Remove the drive axle. Refer to *DRIVE AXLE* subsection.
2. Remove the snap ring securing bearing into gearbox.



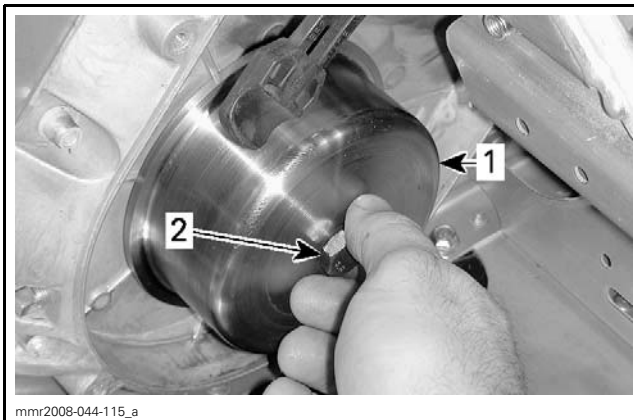
REQUIRED TOOL	
BEARING PULLER/PUSHER (P/N 529 036 112)	

3. Install the extractor/installer tool behind the bearing.



1. Extractor/installer tool

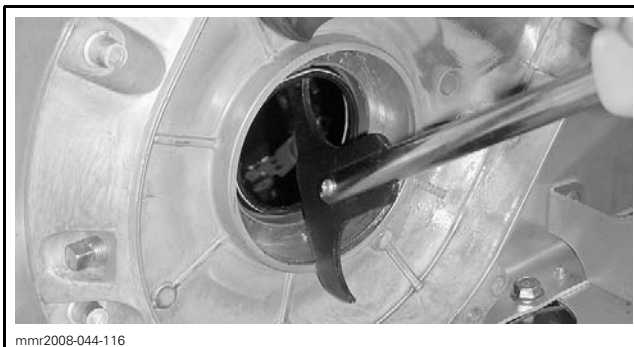
4. Install the extractor cup over bearing.
5. Tighten the extractor/installer tool screw to remove the bearing.



TYPICAL

1. Extractor cup
2. Tighten to remove bearing

6. Using a seal puller, remove and discard the oil seal.



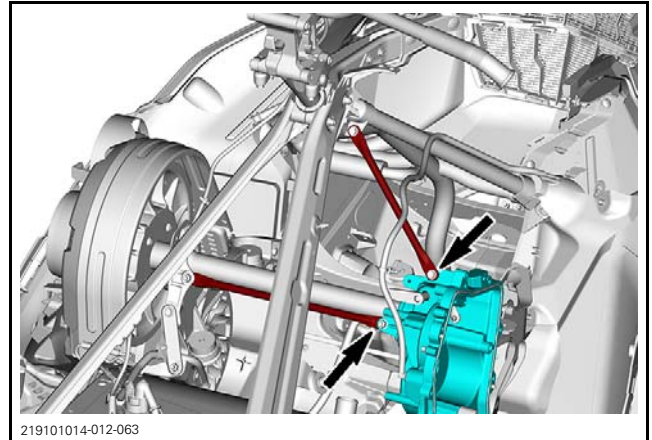
Removing the Gearbox Housing

1. Disassemble gearbox. Refer to *GEARBOX DIS-ASSEMBLY* in this subsection.

2. Remove drive axle and countershaft. Refer to *DRIVE AXLE* and *DRIVEN PULLEY AND COUNTERSHAFT* subsections.

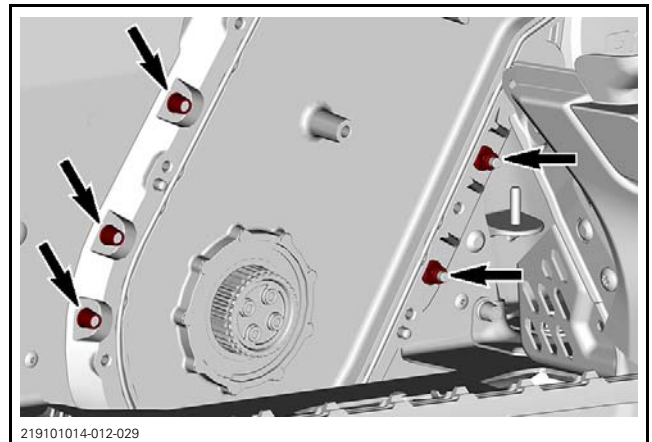
ACE Engine

3. Remove the upper column retaining screws.

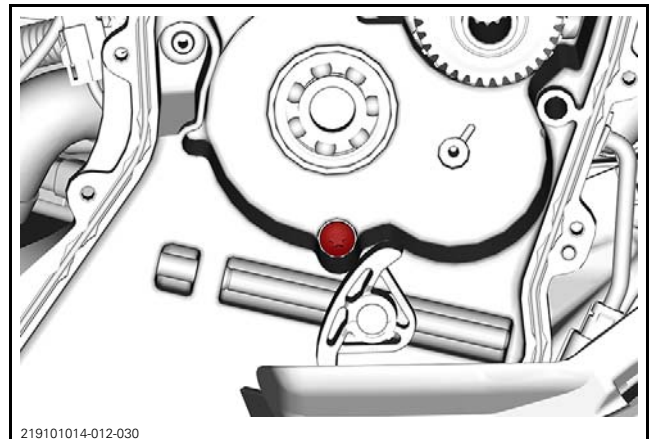


All Engines

4. Remove the nuts and Huck rivets. Refer to *FRAME* subsection for proper removal procedure.



5. Remove the screw above the tensioner.



Subsection XX (GEARBOX)

6. Using 2 large pry bars inserted between gearbox and frame, pry gearbox housing out of vehicle.

Gearbox Inspection

Gearbox Cover

Inspect cover for cracks or other damages, replace if necessary.

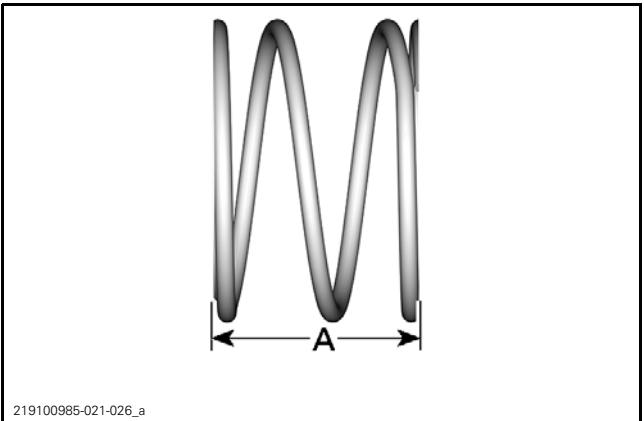
Inspect cover front and rear stopper for crack, replace if necessary.

Inspect O-ring inside cover is brittle, hard or damaged, replace if necessary.

Spring

Measure spring free length, replace if out of specification.

SPRING FREE LENGTH	
SERVICE LIMIT	48 mm ± 1 mm (1.89 in ± .04 in)



A. Free length

Chain, Gears and Sprockets

Inspect the chain, gears and sprockets for:

- Wear
- Cracks
- Damaged teeth
- Missing links.

If a problem is detected:

- Replace drive chain and sprockets as an assembly.
- Replace upper sprocket and sliding gear as an assembly.

Check the drive chain deflection.

If the deflection is greater than 38 mm (1-1/2 in) without the chain tensioner, replace the drive chain.

Chain Tensioner

Check chain tensioner slider for wear or other damages. A longitudinal groove in the slider indicate a broken chain link. Replace if necessary.

Check threads of tensioner adjustment screw for damages or wear.

Check straightness of adjustment screw. Replace screw if necessary. Check gearbox for damages.

Bearings

Inspect all bearings for smooth operation:

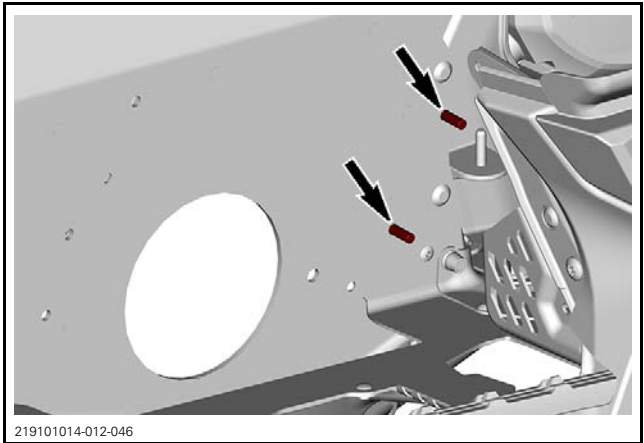
- If rough or excessive play is detected, replace bearing.

Installing the Gearbox Housing

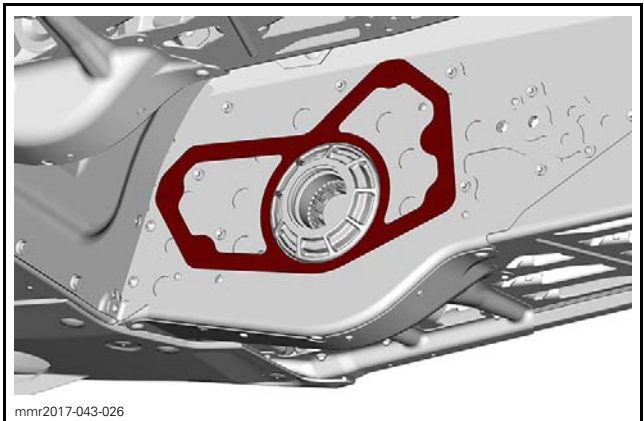
The installation is the reverse of the removal procedure. However, pay attention to the following.

Remove the clinch studs from the frame.

Use a suitable socket to support the frame around the stud head and hit the stud from the outside with a hammer.

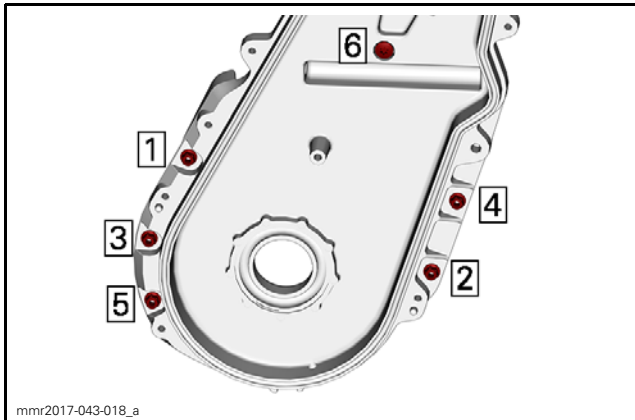


Install the new mounting plate.



Install 5 elastic flanged nuts to secure gearbox housing on mounting plate.

Tighten fasteners as per the following sequence.



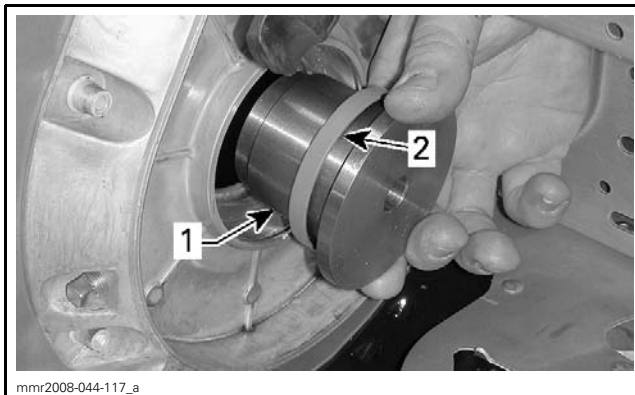
Proceed with drive chain adjustment. Refer to procedure in this subsection.

Refill gearbox with recommended oil. Refer to procedure in this subsection.

Gearbox Assembly

Gearbox Lower Bearing and Seal

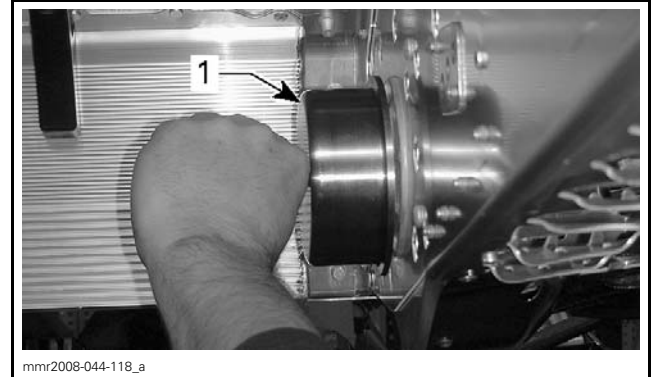
1. Install the NEW oil seal on the extractor/installer tool. Position the lips toward bearing.



TYPICAL

1. Extractor/installer tool
2. Oil seal lips on this side

2. Install extractor cup inside frame.

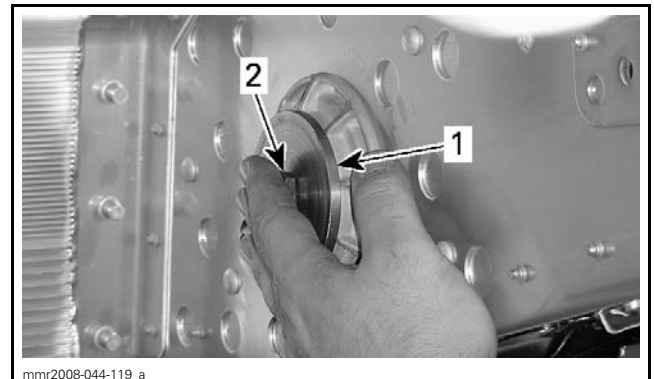


TYPICAL

1. Extractor cup

3. Tighten extractor/installer tool screw to install the oil seal.

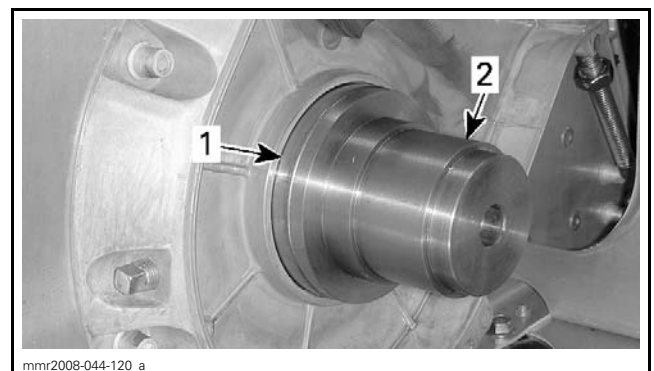
4. Install large washer and extractor/installer tool screw inside frame.



TYPICAL

1. Large washer
2. Extractor/installer tool screw

5. In gearbox, install a NEW bearing and extractor/installer tool.



TYPICAL

1. Bearing
2. Extractor/installer tool

6. Tighten extractor/installer tool screw to install the bearing.

7. Remove tool.

Subsection XX (GEARBOX)

Chain Tensioner

The installation is the reverse of the removal procedure.

Chain and Lower Sprocket

The installation is the reverse of the removal procedure. However, pay attention to the following. Install sprocket with its inscription outward.

Gear Shafts

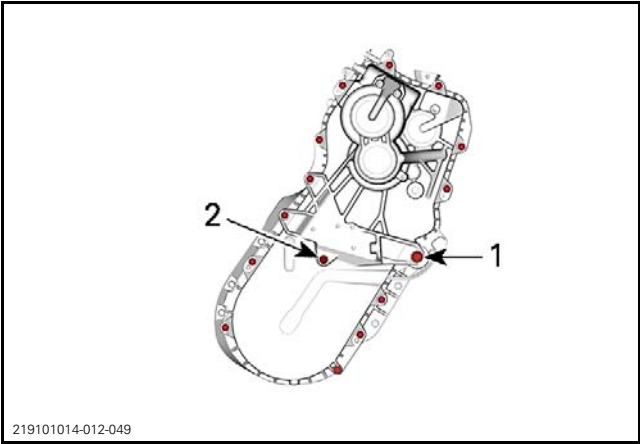
The installation is the reverse of the removal procedure.

Gearbox Cover

Install gearbox cover. Refer to *INSTALLING THE GEARBOX COVER* in this subsection.

Installing the Gearbox Cover

The installation is the reverse of the removal procedure. However, pay attention to the following. Ensure cover O-ring is positioned correctly in its groove. Tighten screws in the following order.



- 1. M8 x 85 screw
- 2. M8 x 35 screw

TIGHTENING TORQUE	
M8 x 85 screw	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)
M8 x 35 screw	16 N•m ± 2 N•m (142 lbf•in ± 18 lbf•in)

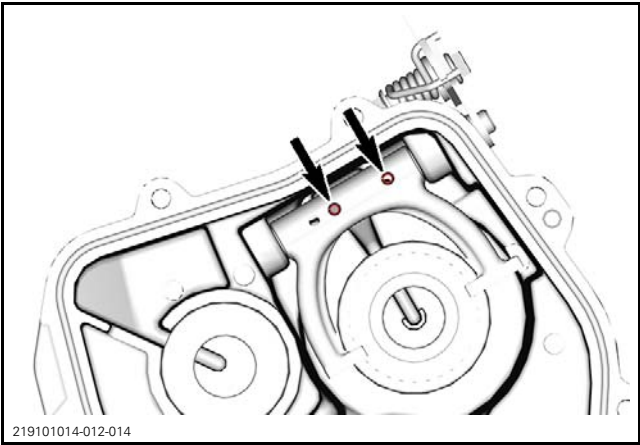
Adjust shift linkage, refer to *ADJUSTING THE SHIFTER LINK ROD* in this subsection.
Refill gearbox. Refer to *REPLACING THE GEARBOX OIL* in this subsection.

SHIFT FORK

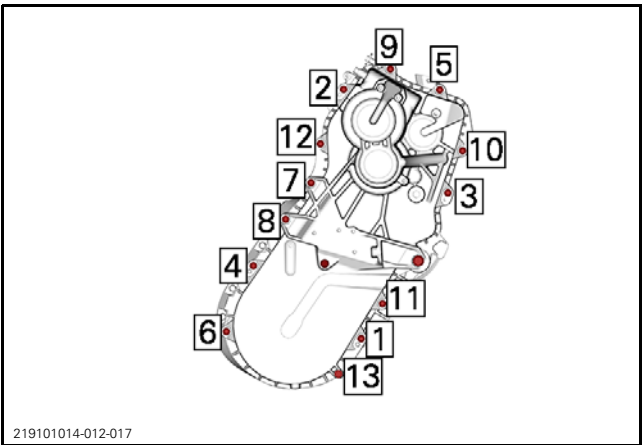
NOTE: The procedure is the same for the HI-LOW and the REVERSE forks unless otherwise specified.

Removing the Shift Fork

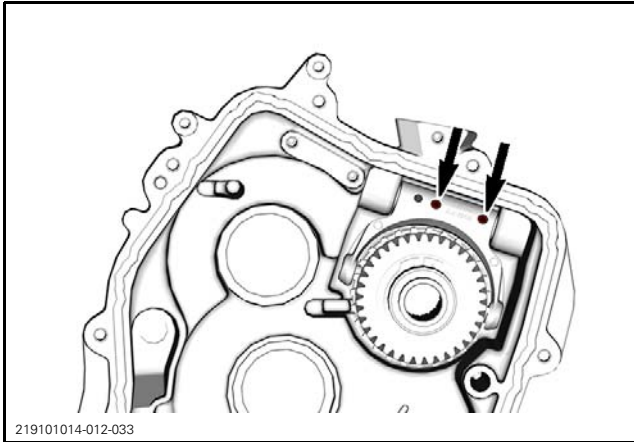
- 1. Remove spring pins using a punch.



HI-LOW FORK



TIGHTENING TORQUE		
M6 x 20 Cover screws	Step 1	10 N•m ± 2 N•m (89 lbf•in ± 18 lbf•in)
	Step 2	15 N•m ± 1 N•m (133 lbf•in ± 9 lbf•in)



REVERSE FORK - ACE ENGINE

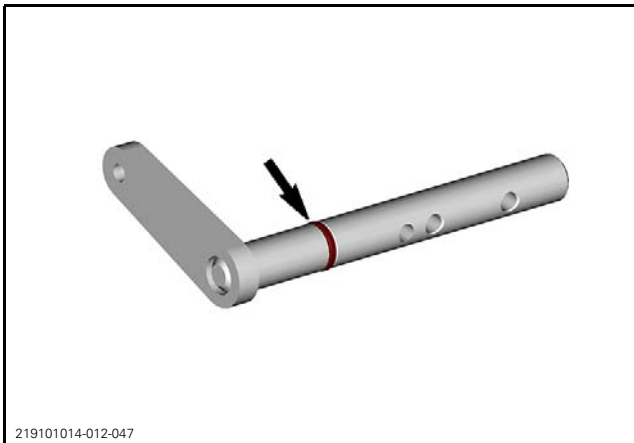
2. Pull out shift rod from gearbox cover.
3. Remove shift fork.

Inspecting the Shift Fork

Inspect shift fork for straightness, wear or other damages. Replace if necessary.

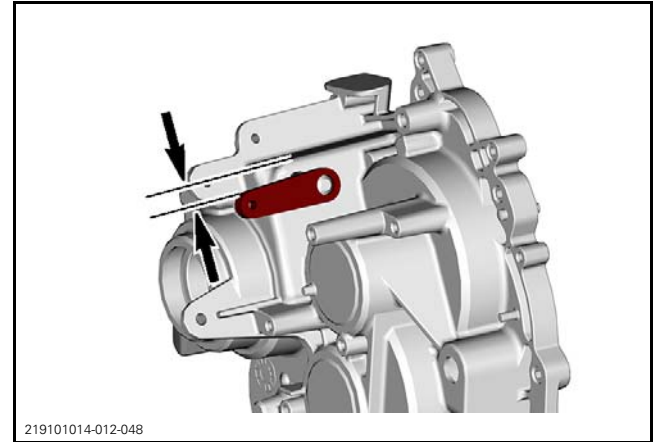
Installing the Shift Fork

The installation is the reverse of the removal procedure. However, pay attention to the following. Ensure that seal is properly lubricated and seated on the shift fork lever.

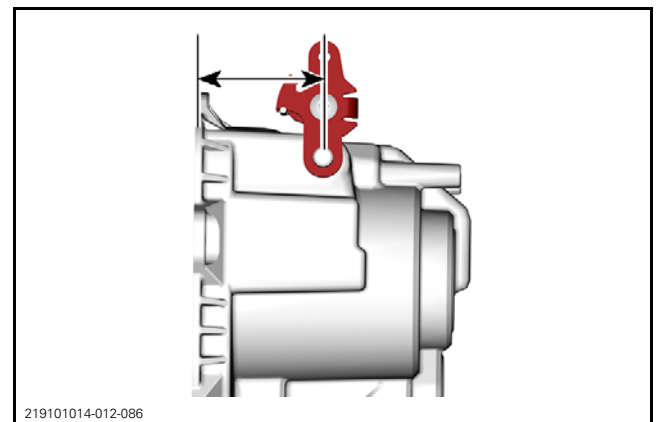


SERVICE PRODUCT	
Scandinavia	SYNTHETIC GREASE (EUR) (P/N 779231)
All other countries	SYNTHETIC GREASE (P/N 779162)

Position shift fork lever parallel to the casting as shown.



REVERSE SHIFT FORK



HI-LOW SHIFT FORK

Install new spring pins into both holes.

SPEED SENSOR (VSS)

The speed sensor is a hall effect sensor.

Speed Sensor Location

The speed sensor is mounted in the gearbox cover.

Testing the Speed Sensor Signal

1. Ensure speed sensor is properly connected.
2. Wake up ECM.
3. Back-probe VSS connector as per table and test for proper specification.

NOTICE Be careful not to damage connector seals when back probing.

Subsection XX (GEARBOX)

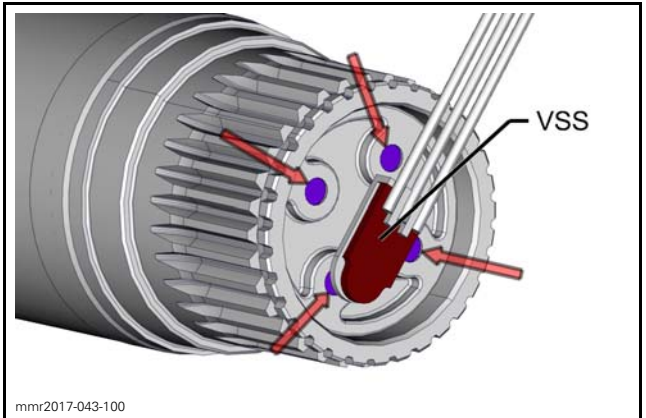
SPEED SENSOR SIGNAL TEST		
SPEED SENSOR CONNECTOR (SENSOR SIDE)	Frame	SPECIFICATION
Pin 1	Ground	5 Vdc
Pin 2		

- If test failed, check wiring harness going to ECM.
- Lift and support rear of vehicle.
 - Back-probe VSS connector as per table and test for proper specification.
 - Rotate track/driven pulley.

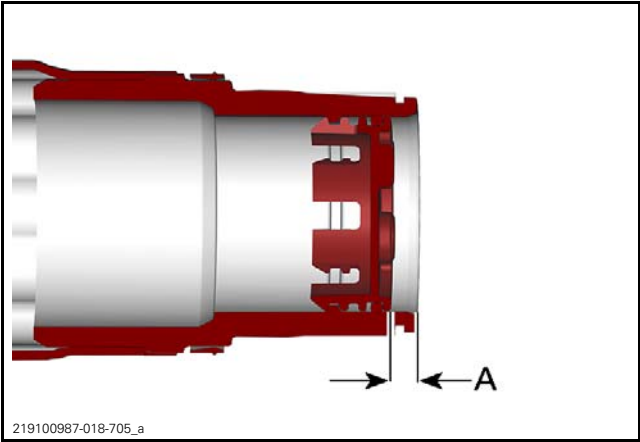
SPEED SENSOR SIGNAL TEST			
ROTATE DRIVEN PULLEY	SPEED SENSOR CONNECTOR (SENSOR SIDE)		SPECIFICATION
	Pin 1	Pin 2	Alternate 7 Vdc and 0 Vdc

If reference voltage and ground are available at sensor, but no signal, replace sensor.

NOTE: During gearbox disassembly, ensure magnets are intact on shaft.



Measure the distance between magnetic cap and end of shaft. It must be as specified.



A. Distance to measure

DISTANCE SPECIFICATION	
no. A Measured between magnetic cap and shaft end	5 mm (.2 in)

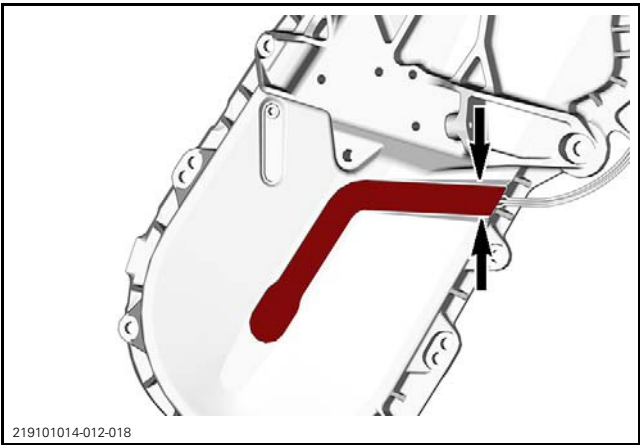
Replacing the Speed Sensor

The sensor can be replaced with the gearbox cover as an assembly. In such a case, refer to *REMOVING THE GEARBOX COVER* in this subsection.

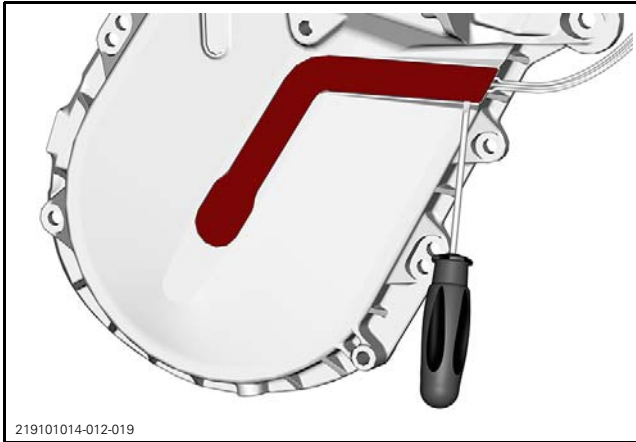
To replace sensor only, proceed as follows.

Removing the Speed Sensor

- Remove gearbox cover. Refer to procedure in this subsection.
- Heat the upper end of the speed sensor protective plate with a heat gun.



- Use a flat screwdriver to pry out the end of the protective plate from gearbox cover.



NOTICE Use care when prying out the plate not to damage the gearbox cover.

4. Heat the next section of the plate.
5. Pry out the heated section using the flat screwdriver.
6. Repeat steps 4 and 5 until the protective plate is completely removed.
7. Remove the speed sensor.
8. Use the flat screwdriver to remove the remaining sealant from the gearbox cover.

NOTICE Do not apply excessive pressure when removing the remaining sealant not to damage the gearbox cover.

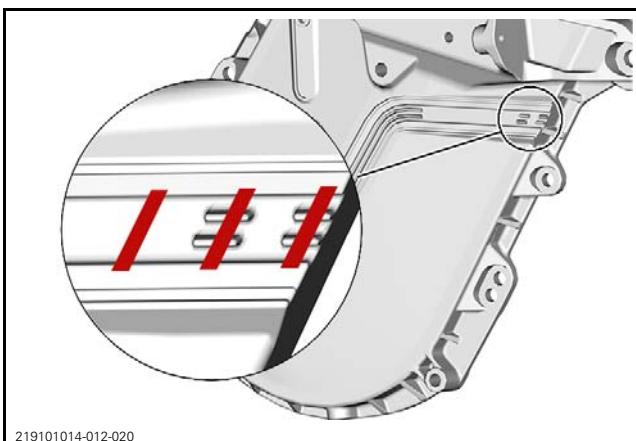
9. Remove the sealant using a scouring pad.

Installing the Speed Sensor

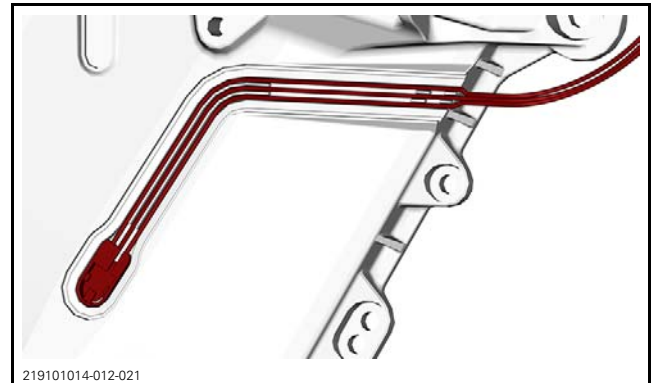
Make sure surface is clean and free of grease.
The assembly must be watertight.

PRODUCT REQUIRED
LOCTITE 5900 (P/N 293 800 066)

1. Apply 3 beads of sealant in the gearbox cover as per the following illustration.

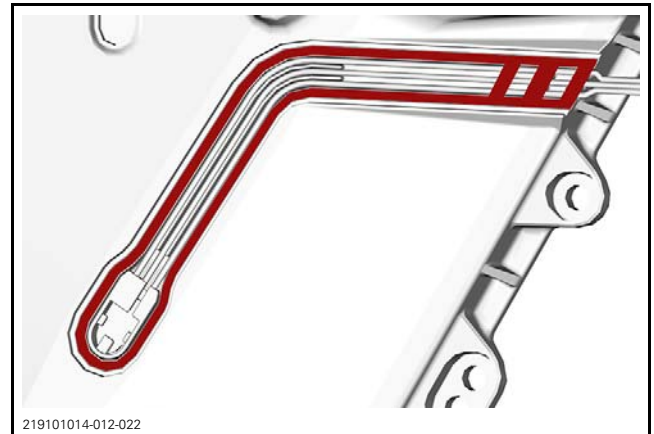


2. Install the speed sensor in the gearbox cover.



3. Apply sealant all around the protective plate bed of the gearbox cover.

Follow the pattern shown in the next picture.



4. Place the protective plate in position and firmly push in order to evacuate all the surplus sealant. Keep pressure for at least 1 minute.
5. Wipe off all the sealant surplus.
6. Once cleaned up, inspect all the circumference for sealant.

NOTE: Sealant must be visible all around.

7. Place some adhesive tape on the protective plate to maintain a pressure for at least 24 hours.

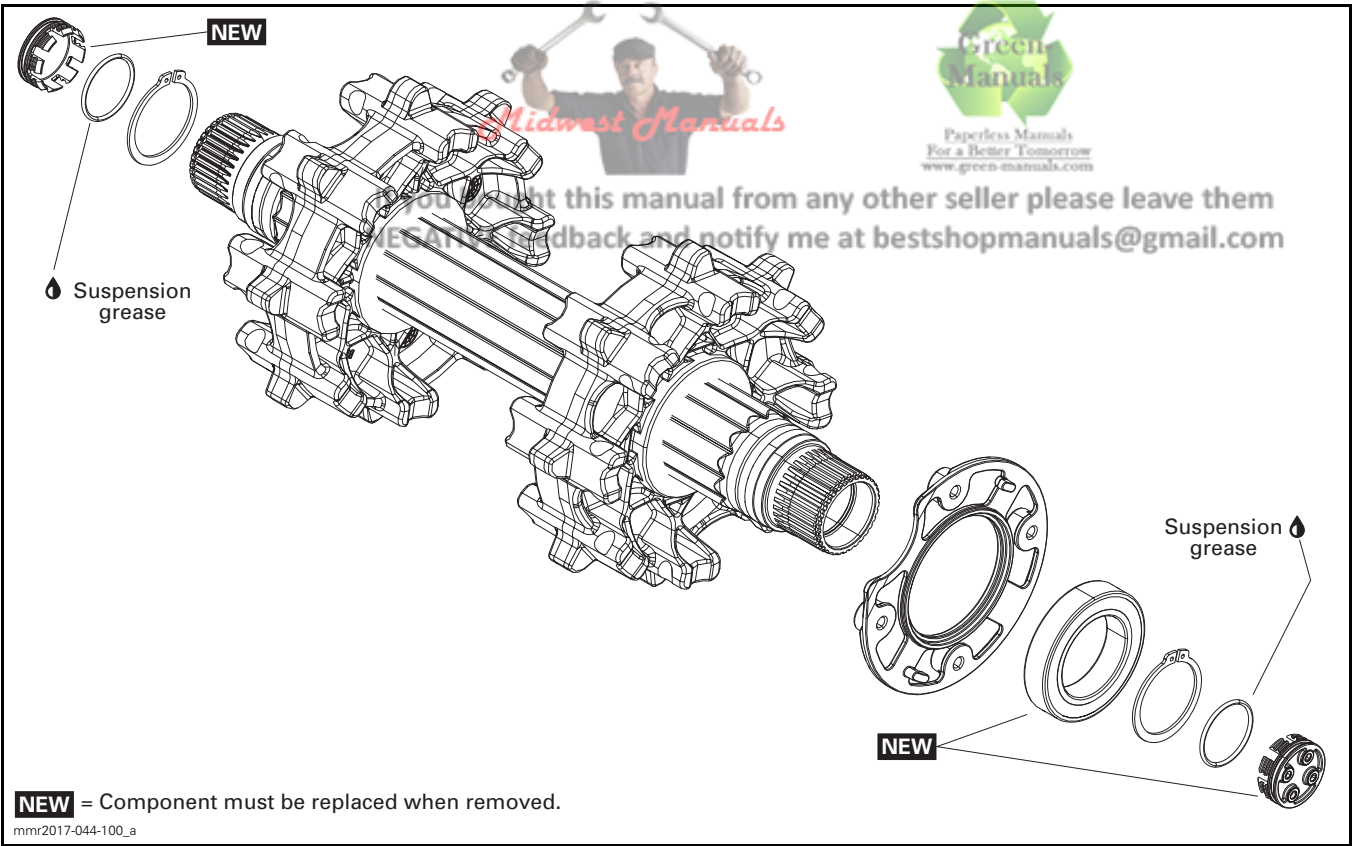
NOTE: Wait for at least 1 hour before exposing vehicle to cold temperature.

8. Reinstall gearbox cover. Refer to procedure in this subsection.

DRIVE AXLE

SERVICE PRODUCTS

Description	Part Number	Page
SYNTHETIC SUSPENSION GREASE.....	779163	3



GENERAL

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

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

WARNING

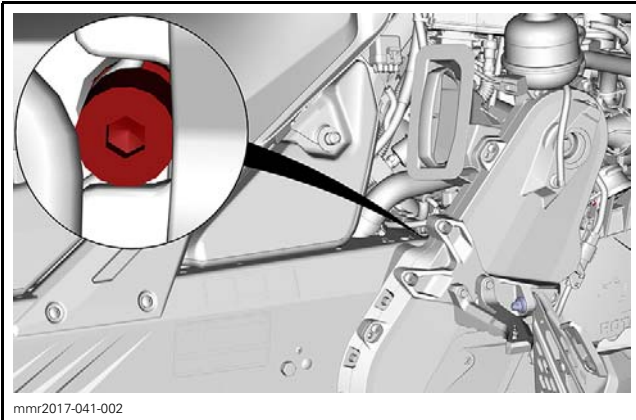
Torque wrench tightening specifications must be strictly adhered to.
Locking devices must be replaced with new ones when removed (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.).

PROCEDURES

DRIVE AXLE

Removing the Drive Axle

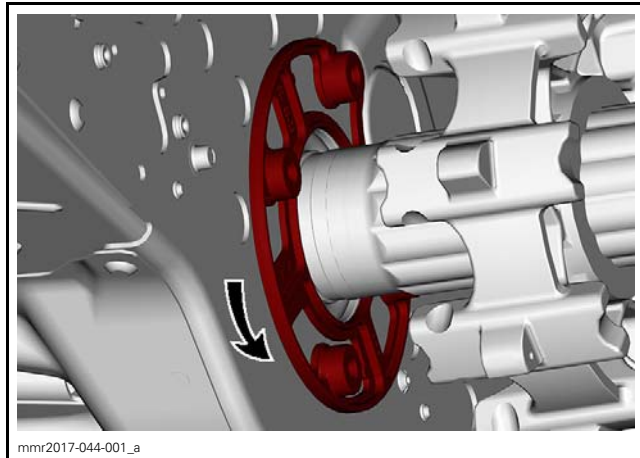
1. Remove the rear suspension. Refer to *REAR SUSPENSION* subsection.
2. Remove the chaincase cover. Refer to *CHAINCASE* subsection.
3. Release tension from drive chain by unscrewing the tensioner adjustment screw.



4. Remove the lower sprocket circlip.



5. Remove lower gear and drive chain.
6. Remove the caliper. Refer to *BRAKE* subsection.
7. From underneath of vehicle, turn the LH bearing flange counterclockwise to unlock it from frame.



8. Release drive axle sprockets from track and at the same time, push the drive axle towards left side until it comes out of the chaincase.
9. Move the drive axle towards the right side to remove it from vehicle.

Inspecting the Drive Axle

Check if bearing turns smoothly and freely. Replace bearing if necessary.

Check if bearing seals are damaged. Replace bearing if necessary.

Check if the bearing flange is cracked, bent or otherwise damaged. Replace if required.

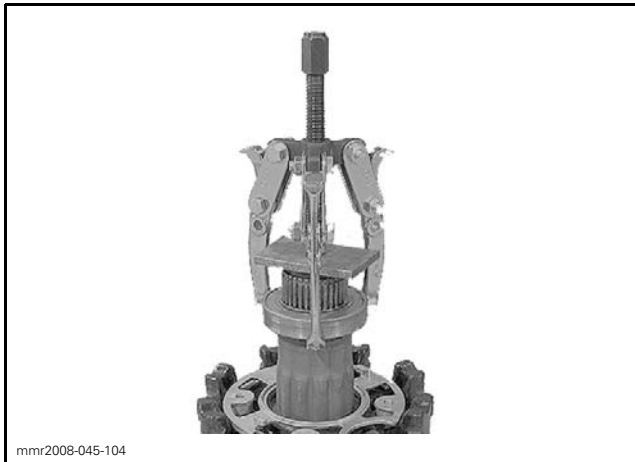
Replace drive axle if one of the following situations is detected:

- Cracked, worn or damaged drive axle
- Worn or damaged drive axle splines

- Worn or damaged sprockets
- Worn bearing journal.

Removing the Drive Axle Bearing

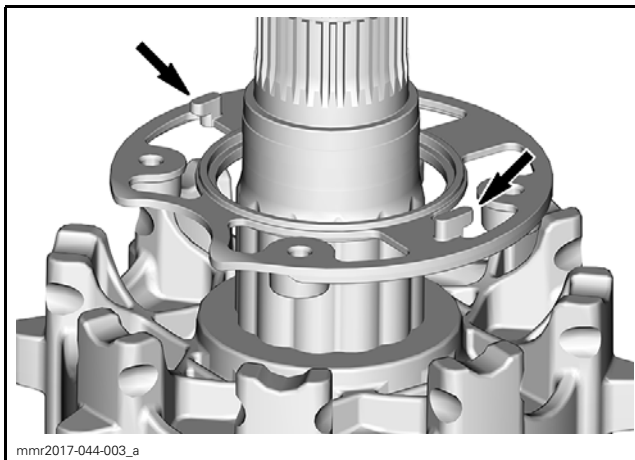
1. Use a 3-jaw puller to remove the drive axle bearing.



2. Remove the bearing flange.

Installing the Drive Axle Bearing

1. Install bearing flange on drive axle with locking tabs outwards.



2. Using a press and a suitable pipe, push the bearing onto drive axel.

NOTICE Always push the bearing by inner race.

Installing the Drive Axle

The installation is the reverse of the removal procedure. However, pay attention to the following. Insert drive axle and lock the bearing flange on frame.

NOTE: Ensure bearing flange is properly locked. Tabs must be properly inserted in frame slots.



VIEW FROM OUTSIDE FRAME

Install the caliper and the disc brake. Refer to *BRAKE* subsection for the specific procedure.

Install all other removed parts. Refer to appropriate subsections.

MAGNETIC CAPS

Removing the Magnetic Cap

1. For the LH cap, remove brake disc protective cover. Refer to *BRAKE* subsection.
2. For the RH cap, remove the chaincase cover. Refer to *CHAINCASE* subsection.
3. By screwing a large screw in the middle of the cap, pry or pull the magnetic cap out of drive axle end.
4. To remove the other cap, push through axle with a long metal bar or wood stick.
5. Discard the magnetic cap.

Installing the Magnetic Cap

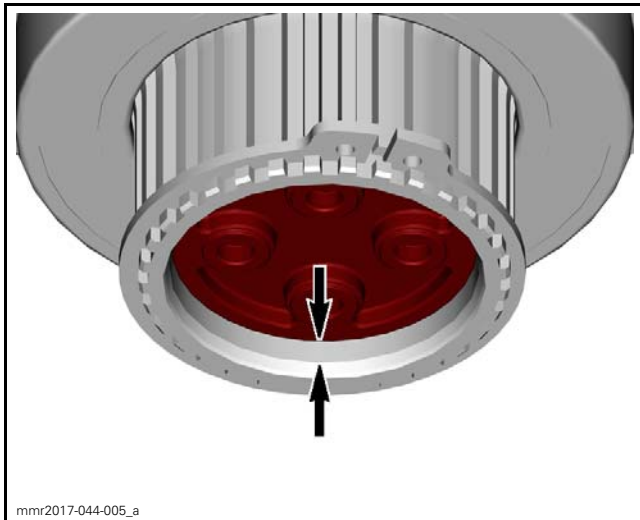
1. Apply grease on O-ring.

SERVICE PRODUCT
SYNTHETIC SUSPENSION GREASE (P/N 779163)

2. Insert new magnetic cap in drive axle, Push until caps is secure into groove.

NOTE: Cap should have outside contour face 5 mm (.197 in) inwards.

Subsection XX (DRIVE AXLE)



5 MM (.197IN) INWARDS

3. Install all other removed parts.

TRACK

SERVICE TOOLS

Description	Part Number	Page
TENSIOMETER.....	414 348 200	1
TRACK CLEAT INSTALLER.....	529 036 044	3

MAINTENANCE

INSPECTING THE TRACK

Visually inspect track for:

- Cuts and abnormal wear
- Broken rods
- Broken or missing track cleats
- Perforations in the track
- Tears in the track (particularly around traction product holes)
- Lugs that are broken or torn off, exposing portion of rods
- Delamination of the rubber
- Missing track guide(s).

If track is damaged or rods are broken, replace track. For damaged or missing cleats, replace by new ones.

WARNING

Do not operate a snowmobile with a cut, torn or damaged track.

ADJUSTING AND ALIGNING THE TRACK

Track tension and alignment are interrelated. Do not adjust one without checking the other. Track tension procedure must be carried out prior to track alignment.

Verifying the Track Tension

1. Lift rear of vehicle and support it off the ground.
2. Allow rear suspension to fully extend.
3. Use a tensiometer.

REQUIRED TOOL	
TENSIOMETER (P/N 414 348 200)	

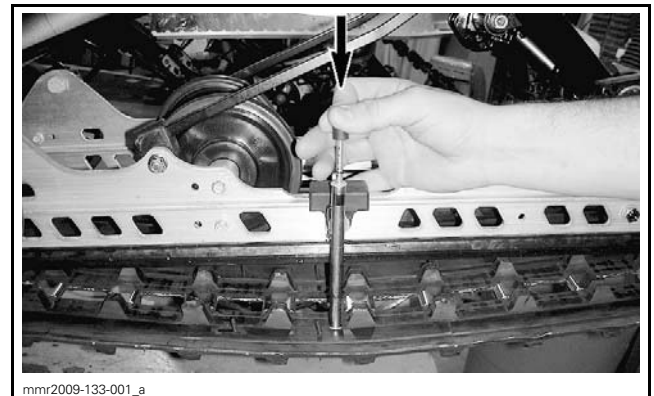
4. Set deflection to 3.2 cm (1.26 in) using bottom O-ring.



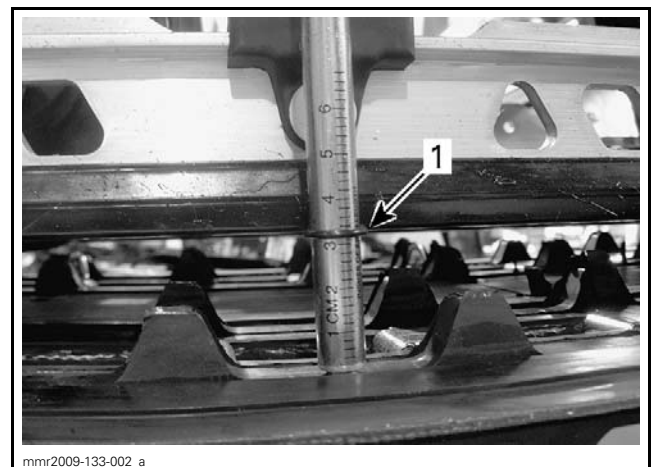
DEFLECTION SETTING

1. Bottom O-ring

5. Place upper O-ring to 0 kgf (0 lbf).
6. Position the tensiometer on track, halfway between runner ends.
7. Push the tensiometer downwards until bottom O-ring (deflection) is aligned with the bottom of slider shoe.



TYPICAL



1. Deflection O-ring aligned with slider shoe

Subsection XX (TRACK)

8. Read load recorded by the upper O-ring on the tensiometer.



LOAD READING
1. Upper O-ring

Load reading must be as per the following table.

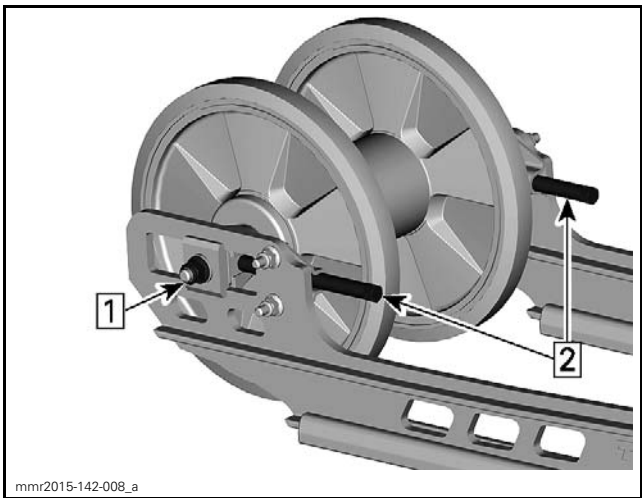
TRACK ADJUSTMENT SPECIFICATION	
Track deflection setting	3.2 cm (1.26 in)
Track load reading	6.0 kgf to 8.5 kgf (13 lbf to 19 lbf)

9. If load reading is not in accordance with the specification, adjust track tension. Refer to *ADJUSTING THE TRACK TENSION*.

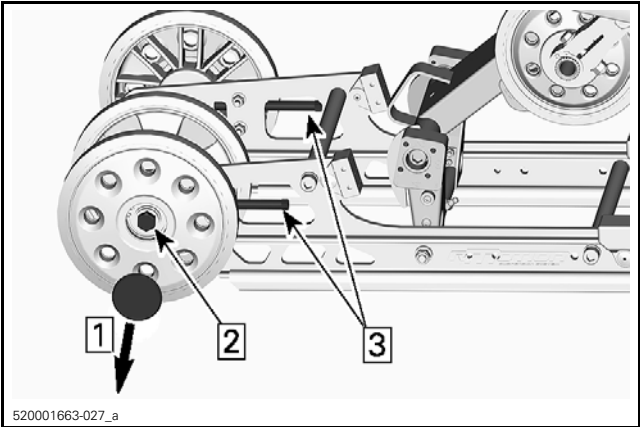
NOTICE Too much tension will result in power loss and excessive stresses on suspension components.

Adjusting the Track Tension

1. Lift rear of vehicle and support it off the ground.
2. Loosen rear axle
 - 2.1 Loosen nut on 2 wheel idler system
 - 2.2 Loosen screw on 3 or 4 wheel idler system
3. Tighten or loosen both adjustment screws to increase or decrease track tension.



TYPICAL - 2 IDLER WHEELS MODELS
Step 1: Loosen axle nut
Step 2: Tighten or loosen adjustment screws



TYPICAL - 3 OR 4 IDLER WHEELS MODELS
Step 1: Remove caps
Step 2: Loosen one the axle screw
Step 3: Tighten or loosen adjustment screws

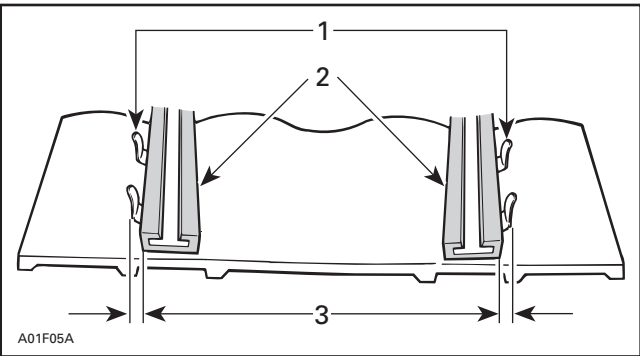
4. Verify track tension, refer to *VERIFYING THE TRACK TENSION*.
5. Ensure track is properly aligned, refer to *ALIGNING THE TRACK*.

Aligning the Track

**WARNING**

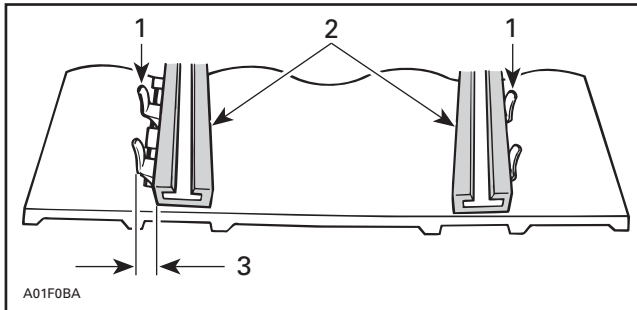
Before checking track alignment, ensure that the track is free of all particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure no one is standing in close proximity to the vehicle. Never rotate at high speed.

1. Lift rear of vehicle and support it off the ground.
2. Start engine and accelerate slightly so that track barely turns. This must be done in a short period of time (10 seconds).
3. Check that the track is well centered; equal distance on both sides between edges of track guides and slider shoes.



1. Guides
2. Slider shoes
3. Equal distance

4. To correct track alignment:
 - 4.1 Stop engine.
 - 4.2 Loosen rear wheel nut.
 - 4.3 Tighten adjustment screw on side where the slider shoe is the farthest from the track insert guides.



1. Guides
2. Slider shoes
3. Tighten on this side

5. Restart engine.
6. Rotate track slowly and recheck alignment.
7. If satisfactory track alignment is achieved tighten idler wheels axle nut to specification:

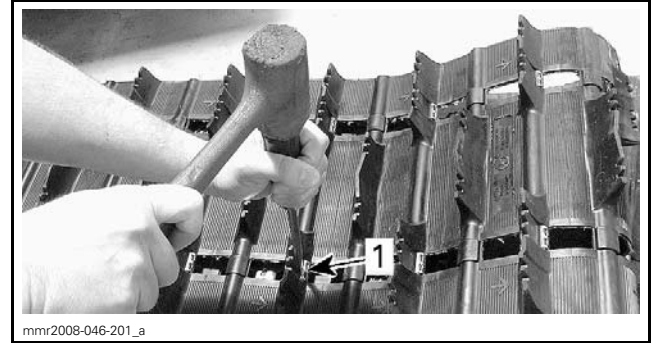
TIGHTENING TORQUE	
Rear idler wheel retaining screws (3 and 4 idler wheels system)	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)
Rear idler wheel retaining nut and screw (2 idler wheels system)	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

PROCEDURES

TRACK

Replacing a Track Cleave

- Raise rear of vehicle off the ground.
- Lift snow guard.
- Rotate track to expose a cleat to be replaced.
- Remove cleat from track using plastic hammer and a big screwdriver.



TYPICAL
1. Cleave

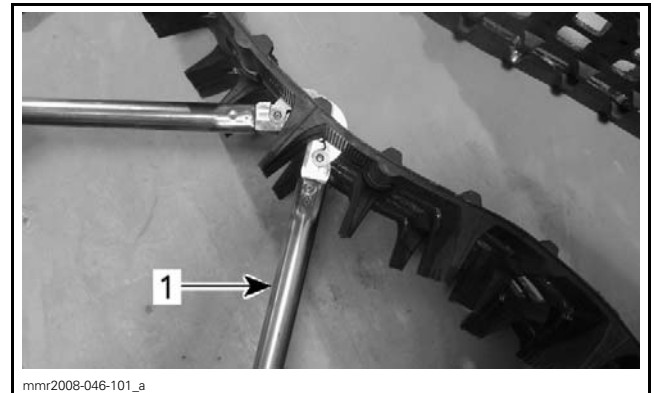
- Place new cleat in position on the track.
- Secure cleat with the cleat installer.

REQUIRED TOOL

TRACK CLEAT
INSTALLER (P/N 529
036 044)



- Bend cleat and push tabs into rubber.



TYPICAL
1. Narrow-cleave installer

- Reopen narrow-cleave installer.
- Position cleat tabs on open end of tool.
- Squeeze tabs until they are indented in rubber.

Removing the Track

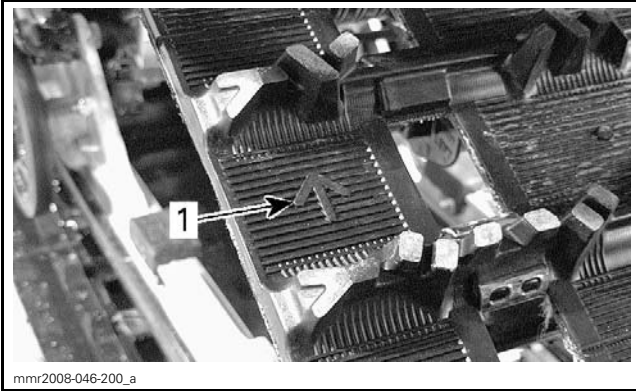
- Remove rear suspension from vehicle. Refer to *REAR SUSPENSION*.
- Remove drive axle. Refer to *DRIVE AXLE* subsection.
- Remove track.

Installing the Track

- Reverse the removal procedure.

NOTE: When installing the track, respect rotation direction indicated by an arrow on track thread.

Subsection XX (TRACK)



1. Arrow pointing forwards

Adjusting and aligning the Track

Refer to *MAINTENANCE* in this subsection.

SUSPENSION ADJUSTMENT

GENERAL

NOTICE Whenever adjusting rear suspension, check track tension and adjust if necessary.

ADJUSTMENT

Choice of suspension adjustments vary with vehicle load, personal preference, riding speed and terrain condition.

The best way to set up the suspension, is to start from factory settings, then customize each adjustment one at a time.

Front and rear adjustments are interrelated. It may be necessary to readjust the rear shock absorbers after adjusting front shock absorbers for instance.

Test run the vehicle under the same conditions; trail, speed, load, etc. Change one adjustment and retest. Proceed methodically until you are satisfied.

Following are guidelines to fine-tune suspension.

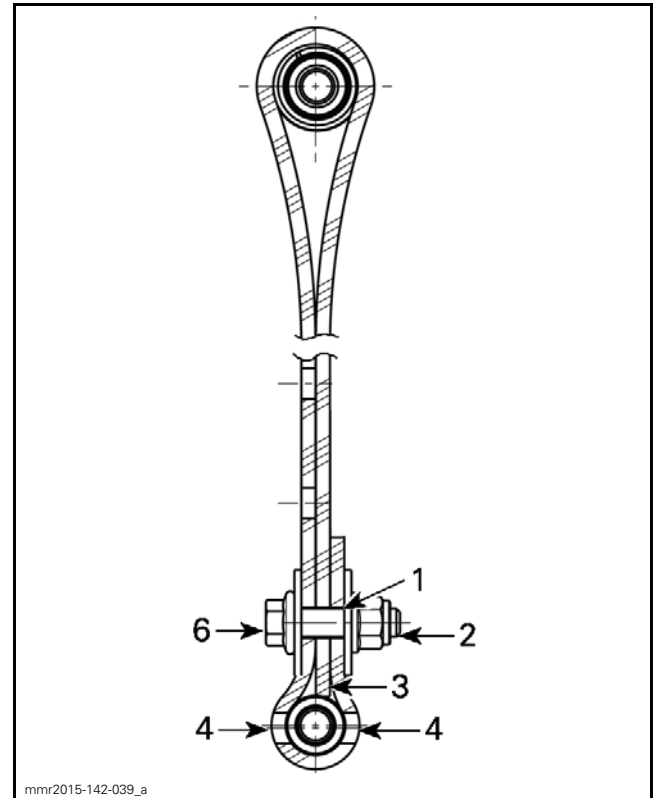
STOPPER STRAP

Stopper strap length has an effect on the amount of weight the center spring has to carry especially during acceleration, therefore on the front end up-lift.

Stopper strap length also has an effect on center spring travel.

ACTION	RESULT
Increasing stopper strap length	Lighter ski pressure under acceleration
	More center spring travel
	More bump absorption capability
Decreasing stopper strap length	Heavier ski pressure under acceleration
	Less center spring travel
	Less bump absorption capability

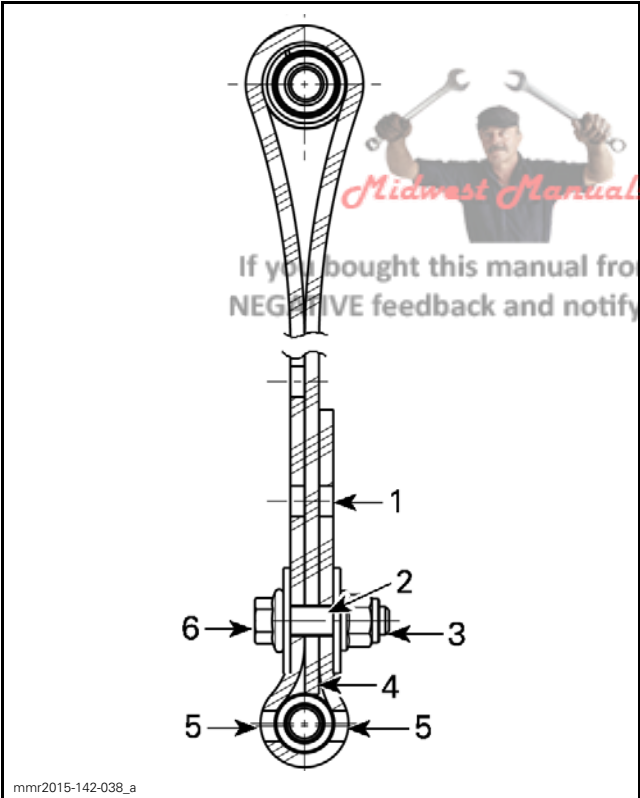
NOTE: Stopper strap could be set to position 1, 2, 3, 4 and 5. Below are illustrations for position 1, 2, 3. Smaller numbers correspond to a longer strap setting.



STOPPER STRAP POSITION 1 (1ST HOLE, LONGEST)

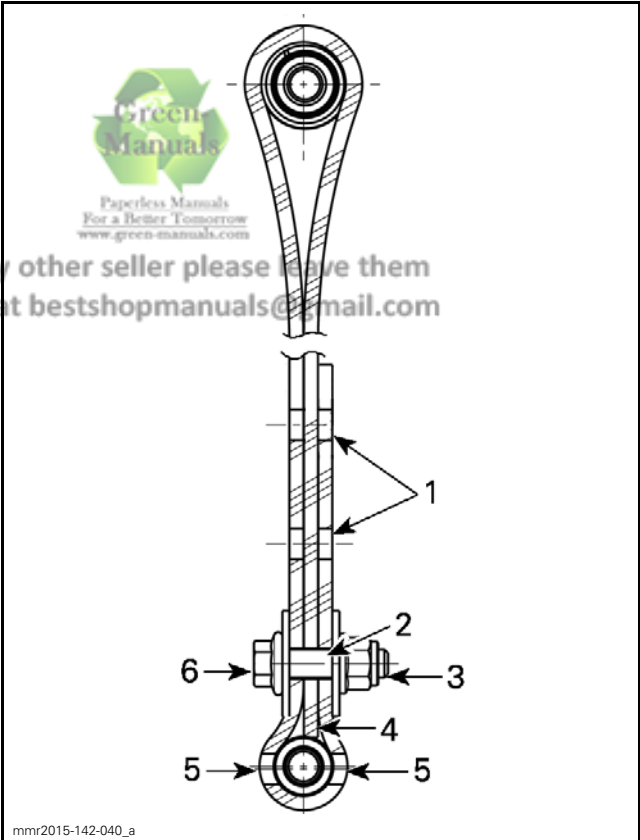
1. 1st hole from end
2. Towards rear
3. Tip of strap touching strap axis
4. Two holes left open between screw head and nut
5. Towards front

Subsection XX (SUSPENSION ADJUSTMENT)



STOPPER STRAP POSITION 2 (2ND HOLE)

- 1. Free hole
- 2. 2nd hole from end
- 3. Towards rear
- 4. Tip of strap touching strap axis
- 5. Two holes left open between screw head and nut
- 6. Towards front



STOPPER STRAP POSITION 3 (3RD HOLE)

- 1. Free holes
- 2. 3rd hole from end
- 3. Towards rear
- 4. Tip of strap touching strap axis
- 5. Two holes left open between screw head and nut
- 6. Towards front

NOTE: Always install stopper strap bolt as close as possible to the lower shaft.

When operating the snowmobile in deep snow or hill climbing, it may be necessary to vary stopper strap length and/or riding position, to change the angle at which the track rides on the snow. Operator's familiarity with the various adjustments as well as snow conditions will dictate the most efficient combination.

Generally, a longer stopper strap setting gives better performance on a flat landscape and a shorter setting will improve handling in steep hill climbing and deep snow conditions.

STOPPER STRAP SETTING	
POSITION	USE
1	Not used
2	Boon docking: – Better boon docking manoeuvrability – Better bump absorption – Better deep snow starts (forward and reverse)

STOPPER STRAP SETTING	
POSITION	USE
3	Factory setting: Best overall setting (General use)
4	Hill climb: – Better track attack angle for hill climbing
5	Steep hill climb: – Better track attack angle for hill climbing – Less transfer – Lower ride height

SPRING PRELOAD

Front Springs

Front springs preload has an effect on:

- front suspension firmness
- The steering behavior.

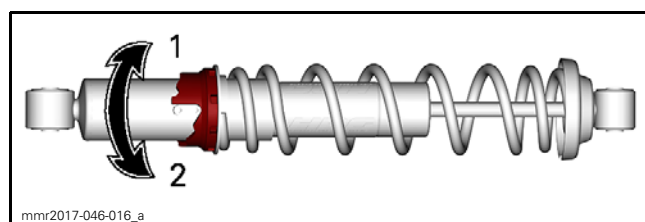
ACTION	RESULT
Increasing preload	Firmer front suspension
	Higher front end
	More precise steering
	More bump absorption capability
Decreasing preload	Softer front suspension
	Lower front end
	Lighter steering
	Less bump absorption capability

⚠ WARNING

Adjust both springs to the same preload. Uneven adjustment can cause poor handling and loss of stability, and/or control, and increase the risk of an accident.

Cam Type Adjuster

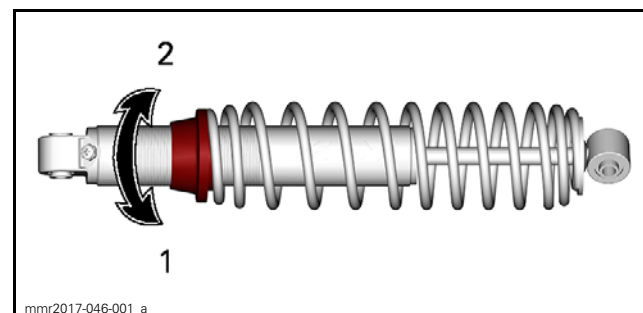
Using the suspension adjustment tool (included in the vehicle tool kit), turn the cam to increase or decrease spring preload.



1. Increase preload
2. Decrease preload

Ring Type Adjuster

Grab and turn the spring to increase or decrease spring preload.



1. Increase preload
2. Decrease preload

Center Spring

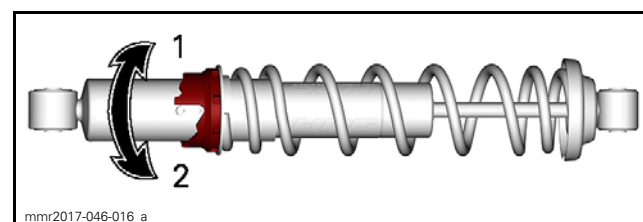
Center spring preload has an effect on steering effort, handling and bump absorption.

Also, since center spring preload adjustment puts more or less pressure on the front of the track, it has an effect on the performance in deep snow.

ACTION	RESULT
Increasing preload	Lighter steering
	More bump absorption capability
	Better deep snow starts
	Better deep snow performance and handling
Decreasing preload	Heavier steering
	Less bump absorption capability
	Better trail handling

Cam Type Adjuster

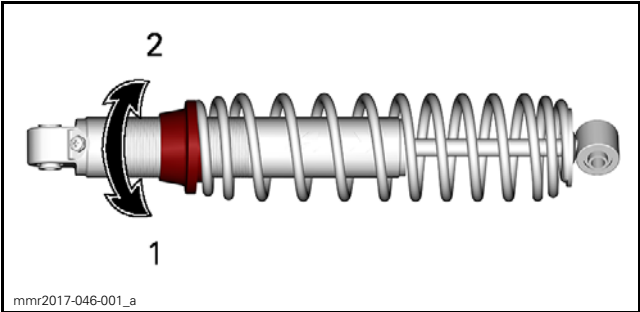
Using the suspension adjustment tool (included in the vehicle tool kit), turn the cam to increase or decrease spring preload.



1. Increase preload
2. Decrease preload

Ring Type Adjuster

Grab and turn the spring to increase or decrease spring preload.



- 1. Increase preload
- 2. Decrease preload

Rear Springs

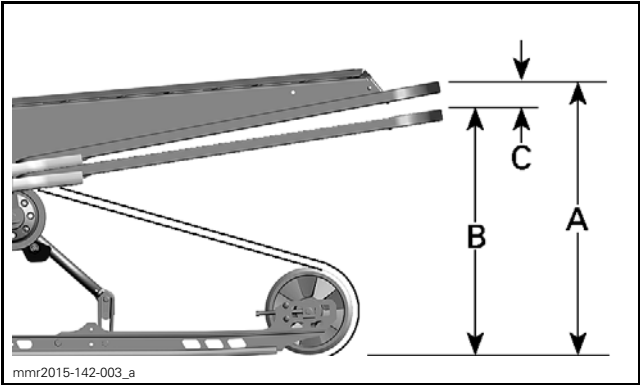
Rear spring preload has an effect on comfort, ride height and load compensation.

Also, adjusting rear spring preload shifts more or less weight to the snowmobile front end. As a result, more or less weight is applied to the skis. This has an effect on performance in deep snow, steering effort and handling.

Slight suspension bottoming occurring under the worst riding conditions indicates a good choice of spring preload.

ACTION	RESULT
Increasing preload	Firmer rear suspension
	Higher rear end
	More bump absorption capability
	Heavier steering
Decreasing preload	Softer rear suspension
	Lower rear end
	Less bump absorption capability
	Lighter steering
	Better deep snow performance and handling

Refer to the following to determine if preload is correct.



- PROPER ADJUSTMENT**
- A. Suspension fully extended
 - B. Suspension has collapsed with operator, passenger and load added
 - C. Distance between dimension "A" and "B", see table below

SC-5 / SC-5M / rMOTION	
"C"	WHAT TO DO
50 mm to 75 mm (2 in to 3 in)	No adjustment required
More than 75 mm (3 in)	Adjusted too soft. Increase preload
Less than 50 mm (2 in)	Adjusted too firm. Decrease preload

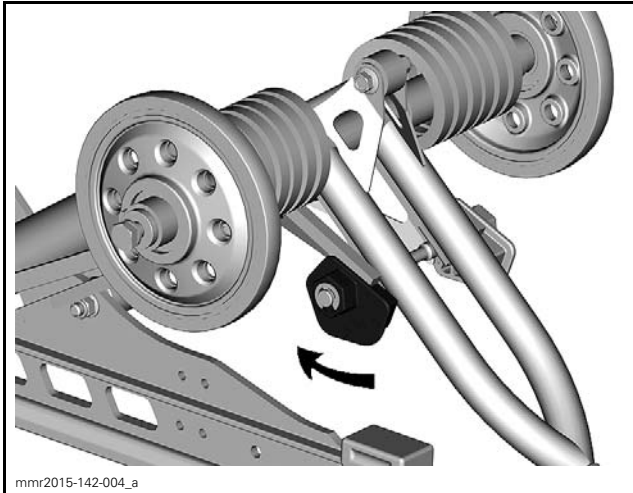
SC-5U / cMOTION / tMOTION	
"C"	WHAT TO DO
65 mm to 100 mm (2.5 in to 4 in)	No adjustment required
More than 100 mm (4 in)	Adjusted too soft. Increase preload
Less than 65 mm (2.5 in)	Adjusted too firm. Decrease preload

If the specification is unattainable with the original springs, refer to the applicable *SPRING CHART* bulletin for other available springs.

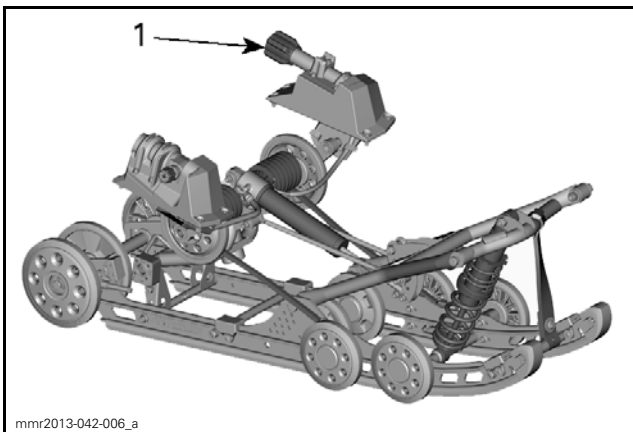
NOTICE To increase spring preload, always turn the left side adjustment cam in a clockwise direction, and the right side cam in a counter-clockwise direction.

CAUTION Never set preload cams directly from position 5 to 1 or directly from position 1 to 5.

The adjustment cams have 5 different settings, 1 being the softest.



TYPICAL - EXCEPT QUICK ADJUST SYSTEM


rMOTION WITH QUICK ADJUST SYSTEM
1. LH side knob to adjust spring preload

Dampers

Compression Damping (KYB PRO Series)

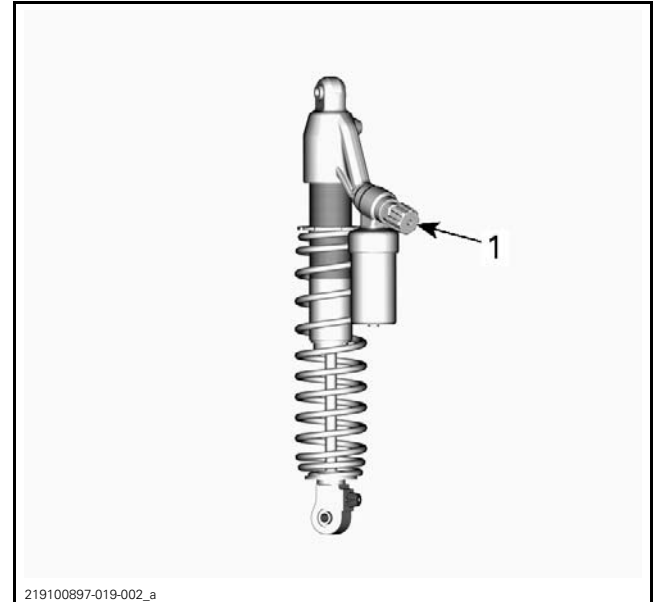
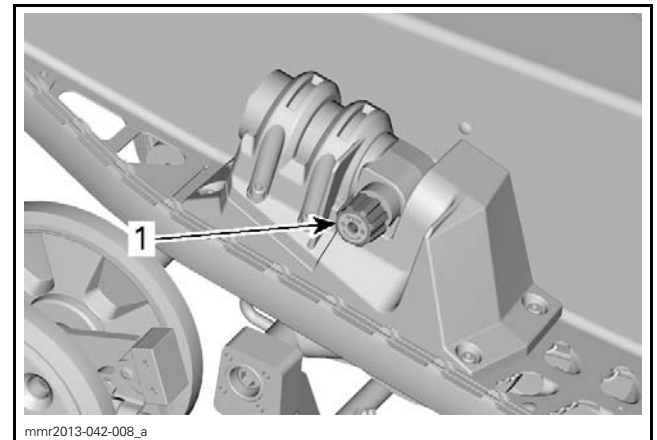
NOTE: Both low and high speed compression damping are adjusted simultaneously.

Low speed compression damping controls how the shock absorber reacts to a low suspension velocity (slow compression strokes, in most cases when riding at lower speeds).

High speed compression damping controls how the shock absorber reacts to a high suspension velocity (quick compression strokes, in most cases when riding at higher speeds).

ACTION	RESULT
Increasing compression damping force	Firmer compression damping
Decreasing compression damping force	Softer compression damping

To adjust, turn compression damping adjustment knob clockwise to increase compression damping force and counterclockwise to decrease compression damping force.


TYPICAL - EXCEPT QUICK ADJUST SYSTEM
1. Compression damping adjustment knob

rMOTION WITH QUICK ADJUST SYSTEM
1. Knob to adjust low/high speed compression damping

Rebound Damping (KYB PRO Series)

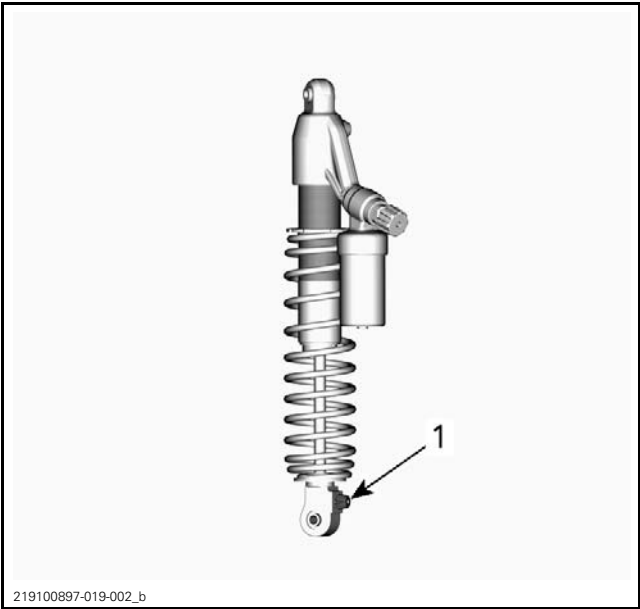
Rebound damping controls how the shock absorber restrains the extension stroke.

ACTION	RESULT
Increasing rebound damping force	Firmer rebound damping (slower extension speed)
Decreasing rebound damping force	Softer rebound damping (faster extension speed)

NOTE: In repetitive shorts small bumps (ripple), it is recommended to use a lower rebound damping setting.

Subsection XX (SUSPENSION ADJUSTMENT)

To adjust, turn rebound adjustment knob clockwise to increase rebound damping force and counterclockwise to decrease rebound damping force.

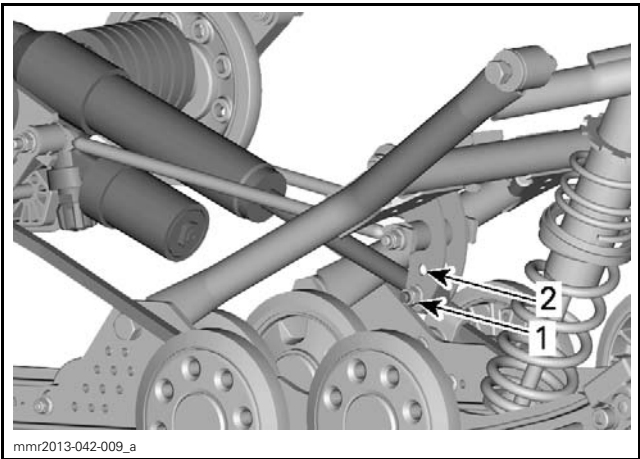


219100897-019-002_b
TYPICAL - EXCEPT QUICK ADJUST SYSTEM
1. Rebound damping adjustment knob

Rear Shock Mounting Position

Two rear shock mounting positions are available: high performance and sport.

Factory setting is set to lowest mounting position (high performance) which will suit most operators riding preferences. The sport mounting hole adjustment allows for another range of softer settings, but all other rear suspension adjustments should be performed before changing the rear shock mounting position.



mmr2013-042-009_a
REAR SHOCK MOUNTING POSITION
1. High performance position
2. Sport position

Coupling Blocks

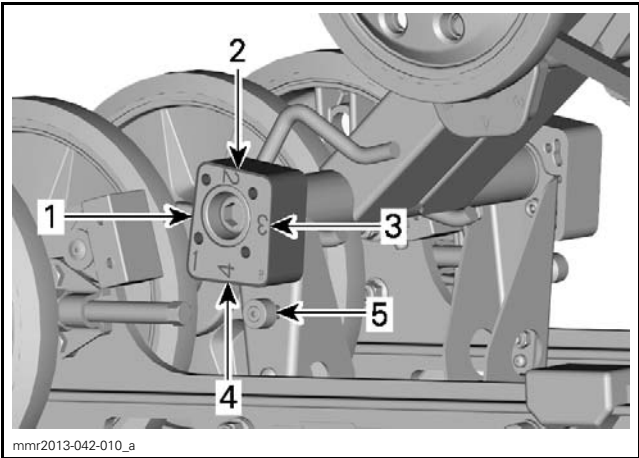
Coupling blocks adjustment has an effect on vehicle handling during acceleration only.

NOTE: A high coupling block setting will reduce both comfort and transfer under acceleration.

To adjust, push on release button under cam and turn coupling block to the desired setting.

 **WARNING**

Both blocks must be set at the same position. Otherwise vehicle behavior may be unpredictable and suspension may become warped.



mmr2013-042-010_a
COUPLING BLOCK — RIGHT SIDE VIEW
("R" — RIGHT EMBOSSED ON BLOCK)
1. Position 1 (minimum)
2. Position 2
3. Position 3
4. Position 4 (maximum)
5. Release button

Coupling Blocks Setting

POSITION	USE
1	More ski lift during acceleration - and best comfort
2	Intermediate setting
3	Intermediate setting
4	Less ski lift during acceleration - and some comfort loss

GENERAL

The procedure explained below is the same for the RH and LH sides unless otherwise noted.

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

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

 **WARNING**

Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced with new ones.

Check for loose, bent, worn out, rusted or otherwise damaged components. Replace the faulty components.

ADJUSTMENT

SPRINGS

Front spring preload has an effect on front suspension firmness.

Front spring preload also has an effect on the steering behavior.

ACTION	RESULT
Increasing preload	Firmer front suspension
	Higher front end
	More precise steering
	More bump absorption capability
Decreasing preload	Softer front suspension
	Lower front end
	Lighter steering
	Less bump absorption capability

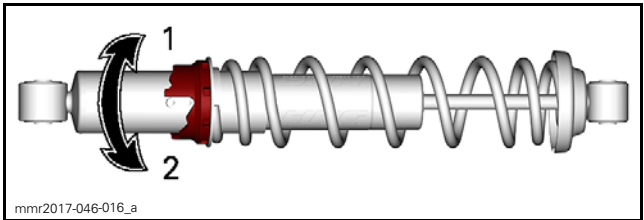
 **WARNING**

Adjust both springs to the same preload. Uneven adjustment can cause poor handling and loss of stability, and/or control, and increase the risk of an accident.

Spring Preload Adjustment

Cam Type Adjustment

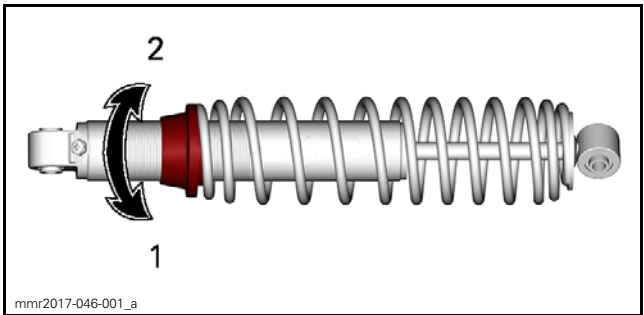
Using the suspension adjustment tool (included in the vehicle tool kit), turn the cam to increase or decrease spring preload.



- 1. Increase preload
- 2. Decrease preload

Ring Type Adjustment

Grab and turn the spring to increase or decrease spring preload.



- 1. Increase preload
- 2. Decrease preload

DAMPERS

Compression Damping (KYB PRO Series)

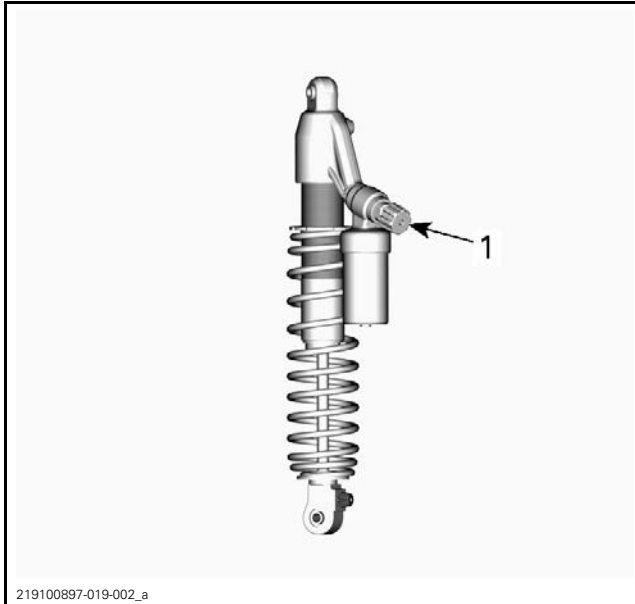
NOTE: Both low and high speed compression damping are adjusted simultaneously.

Low speed compression damping controls how the shock absorber reacts to a low suspension velocity (slow compression strokes, in most cases when riding at lower speeds).

High speed compression damping controls how the shock absorber reacts to a high suspension velocity (quick compression strokes, in most cases when riding at higher speeds).

ACTION	RESULT
Increasing compression damping force	Firmer compression damping
Decreasing compression damping force	Softer compression damping

To adjust, turn compression damping adjustment knob clockwise to increase compression damping force and counterclockwise to decrease compression damping force.



1. Compression damping adjustment knob

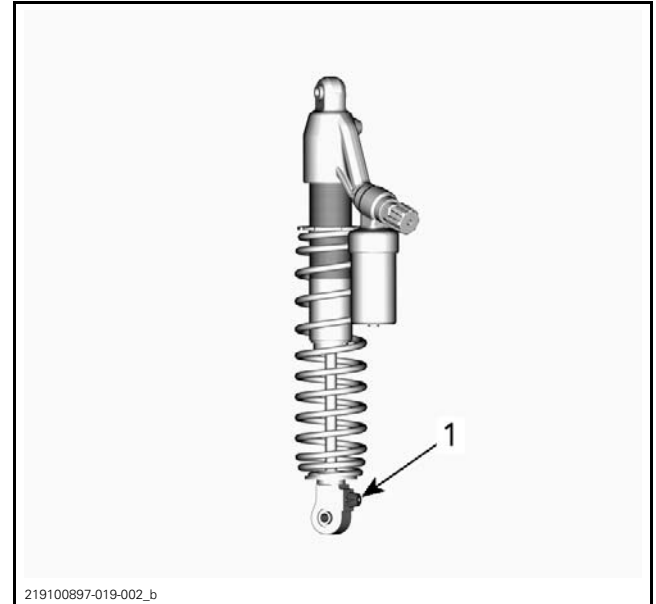
Rebound Damping (KYB PRO Series)

Rebound damping controls how the shock absorber restrains the extension stroke.

ACTION	RESULT
Increasing rebound damping force	Firmer rebound damping (slower extension speed)
Decreasing rebound damping force	Softer rebound damping (faster extension speed)

NOTE: In repetitive shorts small bumps (ripple), it is recommended to use a lower rebound damping setting.

To adjust, turn rebound adjustment knob clockwise to increase rebound damping force and counterclockwise to decrease rebound damping force.



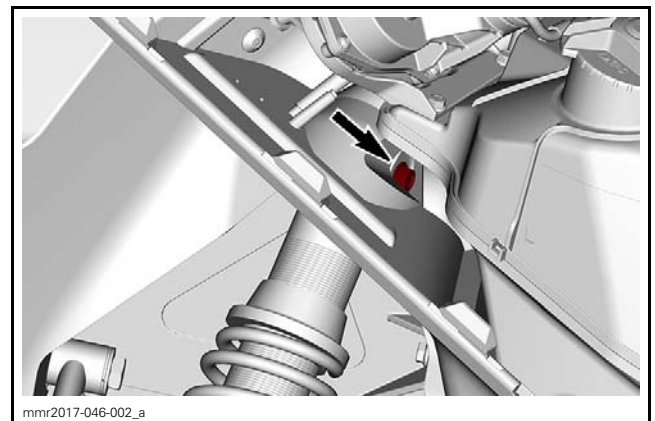
1. Rebound damping adjustment knob

PROCEDURES

SHOCK ABSORBER

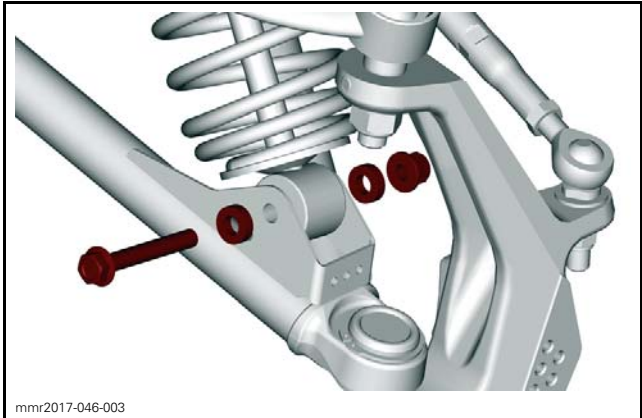
Removing the Shock Absorber

1. Remove the side panel. Refer to *BODY* subsection.
2. Lift the front of vehicle until skis are off the ground.
3. Remove the shock absorber upper bolt.



4. Remove the shock absorber lower bolt, nut, and spacers.

Subsection XX (FRONT SUSPENSION)



5. Remove the shock absorber.

Inspecting the Shock Absorber

Refer to *REAR SUSPENSION (RMOTION)* sub-section.

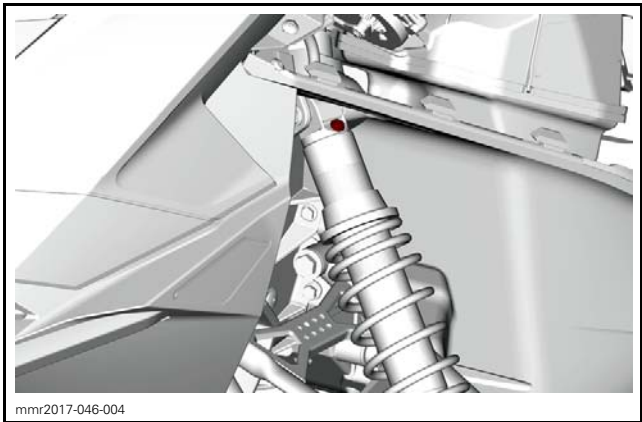
Installing the Shock Absorber

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

Install upper bolt first while shock absorber lower mount is not engaged into the bracket.

Install shock absorber with body up and valve (if equipped) towards outside.

Make sure to install both of the lower spacers.

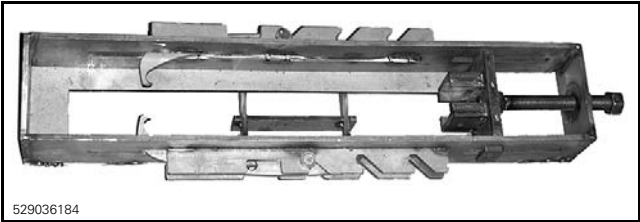


TIGHTENING TORQUE	
Front shock absorber retaining nuts	31.5 N•m ± 3.5 N•m

SPRING

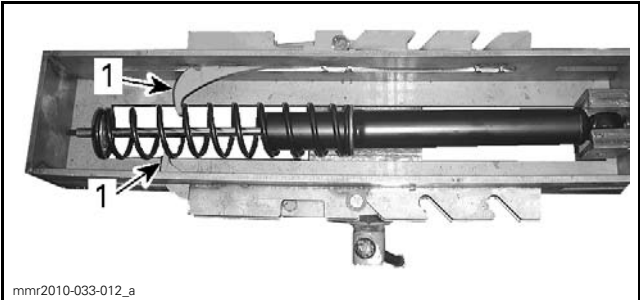
Removing the Spring

1. Secure the SPRING COMPRESSOR (P/N 529 036 184) in a vise.



SPRING COMPRESSOR

2. Position the shock absorber in the tool and install the spring compressor hooks.



TYPICAL

1. Spring compressor hooks

3. Tighten the spring compressor tool screw until the spring is sufficiently compressed to remove spring stopper.

4. Release the spring compressor tool screw.

5. Remove spring from shock absorber.

Inspecting the Spring

Inspect spring for apparent damage, any defect such as scratches or rust can affect the spring durability.

When the adjustment is at the lowest preload, ensure that adjustment cam and spring stopper are not loose. They must be under spring pressure. Otherwise, the spring stopper might fall off.

Installing the Spring

For installation, reverse the removal procedure.

UPPER SUSPENSION ARM

Inspecting the Upper Suspension Arm

1. Check suspension arm for distortion or damage. Replace if necessary.

2. Lift the front of vehicle until skis are off the ground.

3. Move suspension arm from side to side.

4. Lower vehicle to the ground.

5. Move suspension up and down.

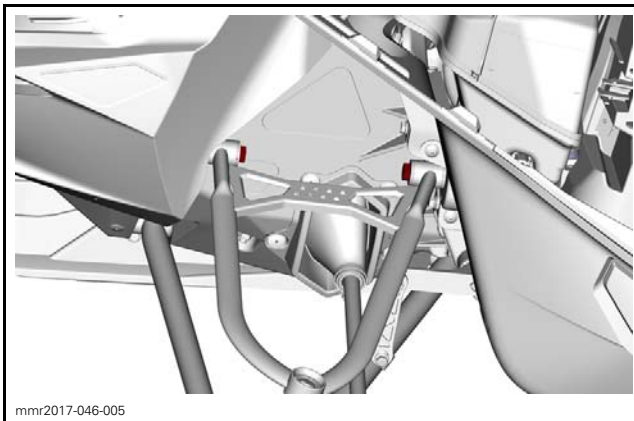
6. There should be no noticeable looseness. Replace bushings and/or sleeves if necessary.

NOTE: A play of 2 mm is acceptable when the suspension arm is moved forward and backward.

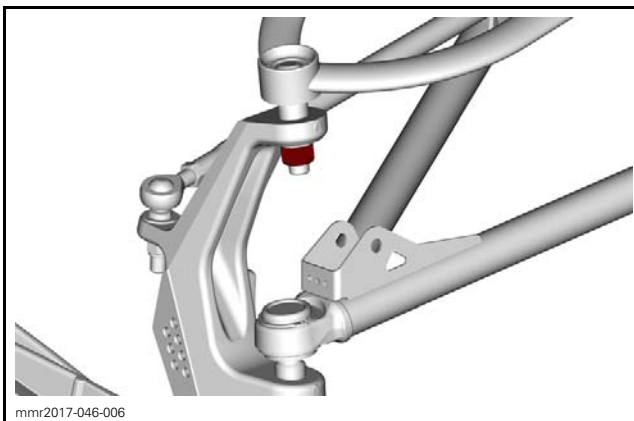
7. Check sleeves inside suspension arm attachments for wear or damage.

Removing the Upper Suspension Arm

1. Lift the front of vehicle until skis are off the ground.
2. Remove muffler and tuned pipe. Refer to *EXHAUST SYSTEM* subsection.
3. Remove shock absorber. See procedure in *REMOVING THE SHOCK ABSORBER* in this subsection.
4. Remove the upper suspension arm bolts.



5. Detach ball joint from ski leg as follows.
 - 5.1 Remove nut securing ball joint to ski leg.



- 5.2 Use the extractor to detach ball joint from ski leg.

REQUIRED TOOL

BALL JOINT EXTRACTOR
(P/N 529 035 827)

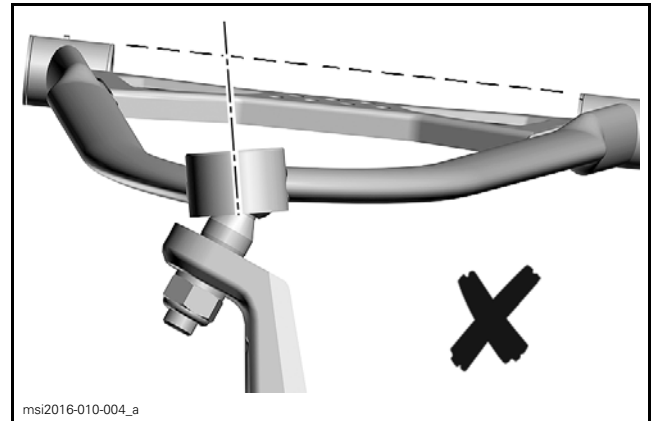


6. Remove upper suspension arm.

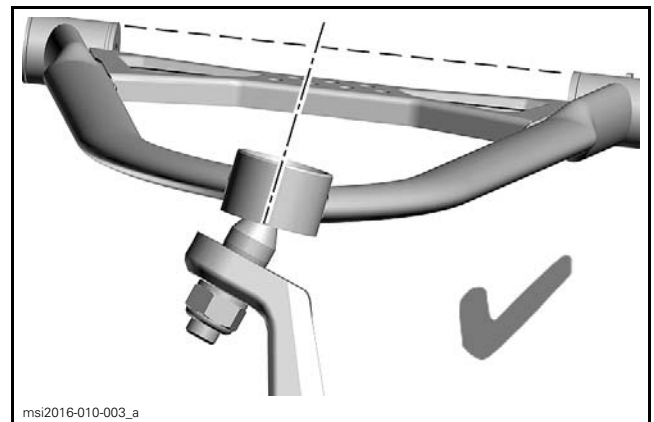
Installing the Upper Suspension Arm

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

NOTICE Make sure not to invert LH and RH arm.



RH UPPER ARM INSTALLED ON LH SIDE



LH UPPER ARM INSTALLED ON LH SIDE

UPPER BALL JOINT

Inspecting the Upper Ball Joint

Check both upper ball joints for damage, pitting, looseness and roughness. If so, replace with a new one.

Subsection XX (FRONT SUSPENSION)

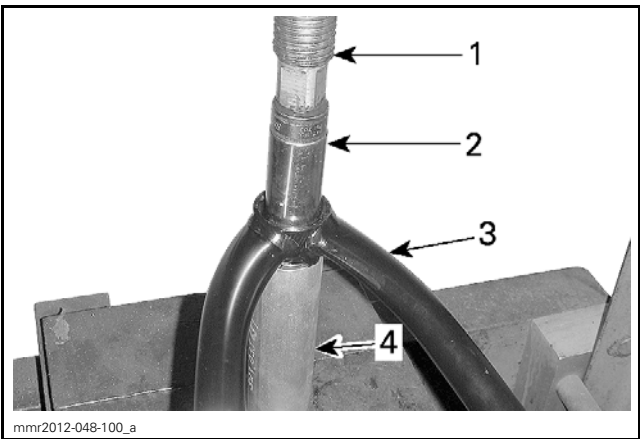
Removing the Upper Ball Joint

- 1. Remove the *UPPER SUSPENSION ARM*, see procedure in this subsection.
- 2. Remove circlip securing ball joint to suspension arm.



- 3. Press ball joint out of the suspension arm.

REQUIRED TOOLS	
Shop press	
SUSPENSION ARM SUPPORT (P/N 529 035 637)	
Suitable socket	



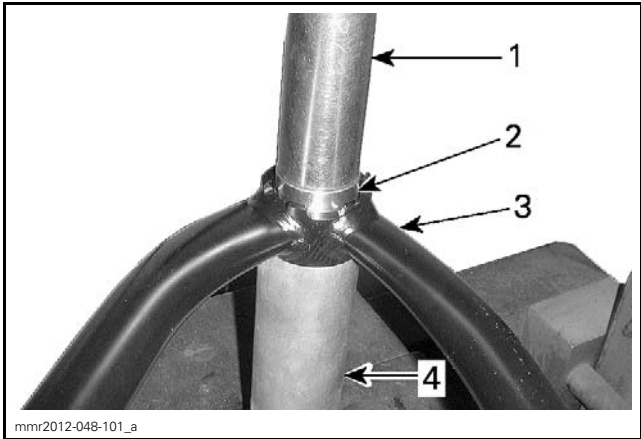
- TYPICAL**
- 1. Press rod
 - 2. Socket
 - 3. Suspension arm
 - 4. Suspension arm support

Installing the Upper Ball Joint

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

- 1. Press ball joint into the suspension arm.

REQUIRED TOOLS	
Shop press	
SUSPENSION ARM SUPPORT (P/N 529 035 637)	
Suitable socket	



- TYPICAL**
- 1. Socket
 - 2. Ball joint
 - 3. Suspension arm
 - 4. Suspension arm support (P/N 529 035 637)

- 2. Reinstall the circlip. If it seems loose, replace it with a new one.

LOWER SUSPENSION ARM

Inspecting the Lower Suspension Arm

- 1. Check suspension arm for distortion or damage. Replace if necessary.
- 2. Lift the front of vehicle until skis are off the ground.
- 3. Detach shock absorber and stabilizer bar link from lower suspension arm.
- 4. Move suspension arm from side to side.
- 5. Lower vehicle to the ground.
- 6. Move suspension up and down.
- 7. There should be no noticeable loose. Replace bushings and/or sleeves if necessary.

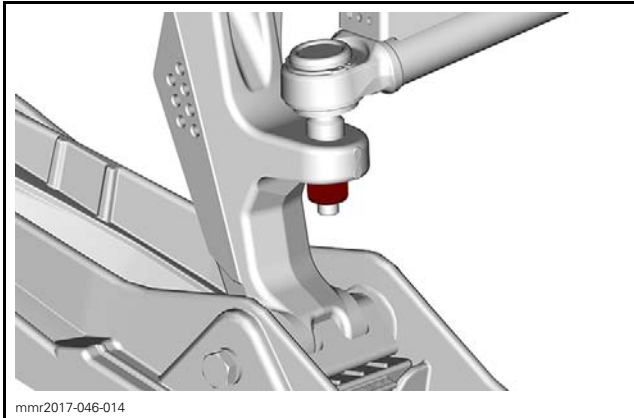
NOTE: A play of 2mm is acceptable when the suspension arm is moved forward and backward.

- 8. Check sleeves inside suspension arm attachments for wear or damage.

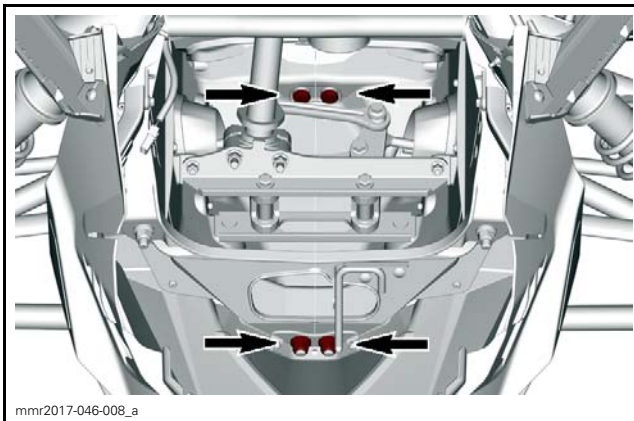
Removing the Lower Suspension Arm

- 1. Lift the front of vehicle until skis are off the ground.

2. Remove the tune pipe. Refer to *EXHAUST SYSTEM* subsection.
3. Remove shock absorber lower bolt.
4. Detach stabilizer bar link from lower suspension arm. Refer to *STABILIZER BAR* further in this subsection.
5. Remove lower ball joint nut.



6. Using a suitable ball joint remover, detach lower ball joint from ski leg.
7. Remove suspension arm screws from inside the vehicle.

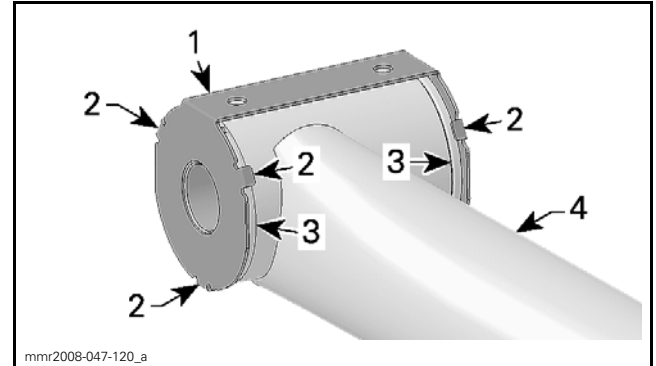


8. Remove lower suspension arm from vehicle.

Installing the Lower Suspension Arm

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

1. Install a wear plate over bushings.
2. Position the wear plate on top.
3. Fold all tabs against bushings.



1. Wear plate
2. Wear plate tabs
3. Bushings
4. Lower suspension arm

Install all other removed parts.

LOWER BALL JOINT

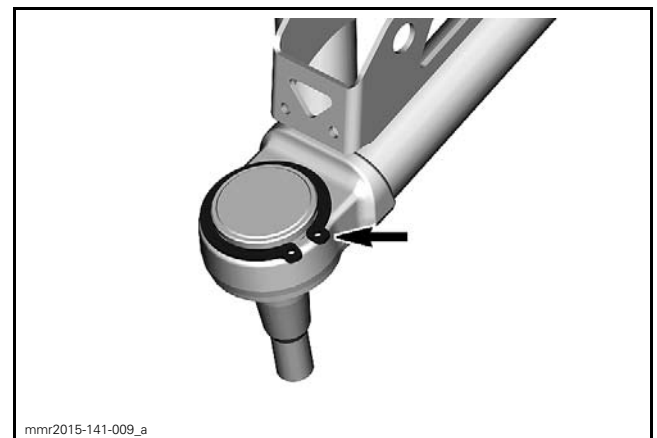
NOTE: The MX Z / Renegade lower ball joint is different from the Summit / Freeride lower ball joint.

Inspecting the Lower Ball Joint

Inspect ball joint end for damage. Ensure it's moving freely, a 0.3 mm axial play is acceptable. Replace ball joints as required.

Removing the Lower Ball Joint

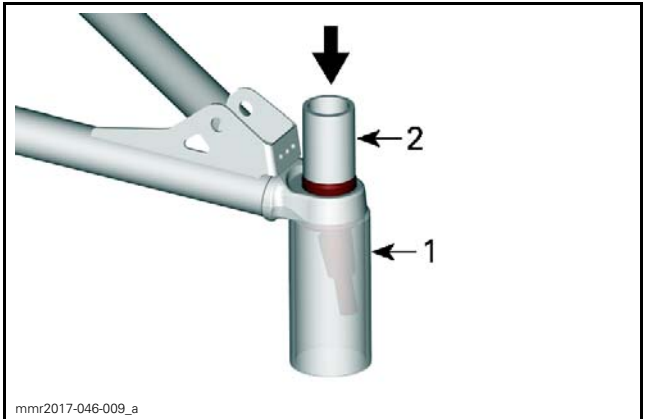
1. Remove the *LOWER SUSPENSION ARM*, see procedure in this subsection.
2. Remove circlip securing ball joint to suspension arm.



3. Use a shop press and the specified tools to press the ball joint out of the lower suspension arm.

Subsection XX (FRONT SUSPENSION)

REQUIRED TOOLS	
BALL JOINT REMOVER SUPPORT (P/N 529 036 400)	
Suitable box	

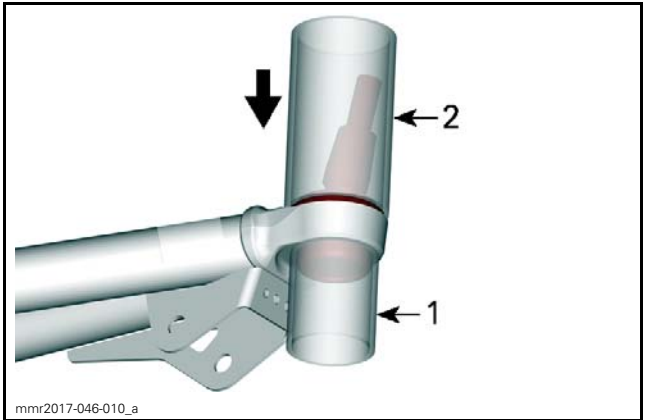


- 1. Ball joint remover support
- 2. Suitable box

Installing the Lower Ball Joint

- 1. Use a press and the specified tools to press the ball joint into the suspension arm end.

REQUIRED TOOLS	
BALL JOINT INSTALLER SUPPORT (P/N 529 036 398)	
BALL JOINT INSTALLER (P/N 529 036 399)	



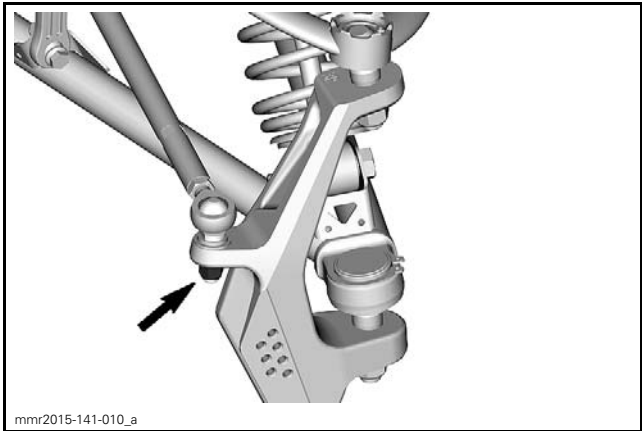
- 1. Ball joint installer support
- 2. Ball joint installer

- 2. Reinstall the circlip. If the circlip seems loose, replace it with a new one.
- 3. Install the *LOWER SUSPENSION ARM* on vehicle, see procedure in this subsection.

SKI LEG

Removing the Ski Leg

- 1. Remove ski from ski leg.
- 2. Detach tie-rod end from ski leg.



- 3. Remove upper and lower ball joints from ski leg. Refer to *UPPER BALL JOINT* and *LOWER BALL JOINT* in this subsection.

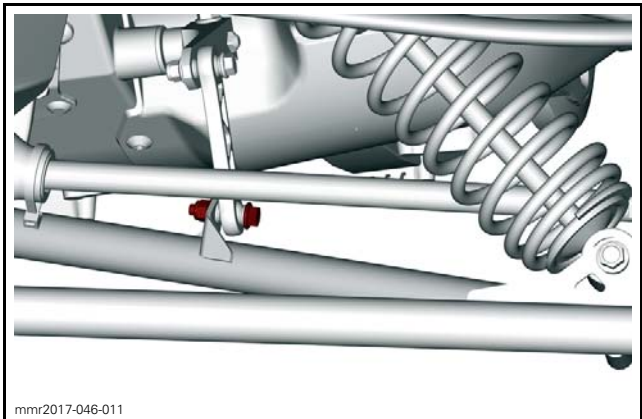
Installing the Ski Leg

The installation is the reverse of the removal procedure.

STABILIZER BAR

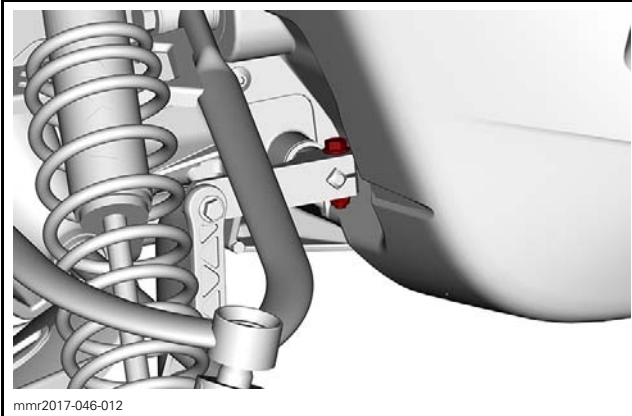
Removing the Stabilizer Bar

- 1. Remove bolts and nuts securing stabilizer links to lower suspension arms.

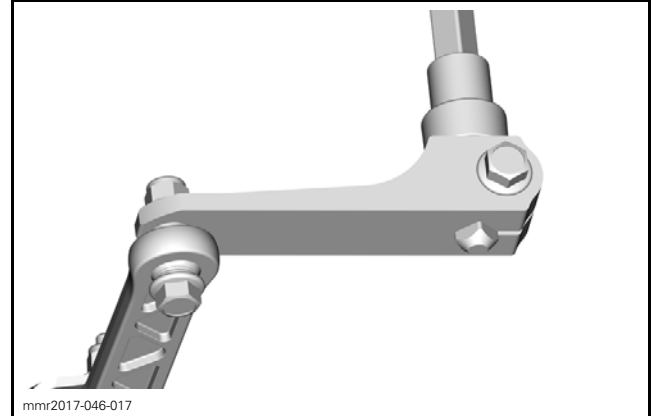


LH SIDE SHOWN

- 2. Remove stabilizer lever bolts and nuts.

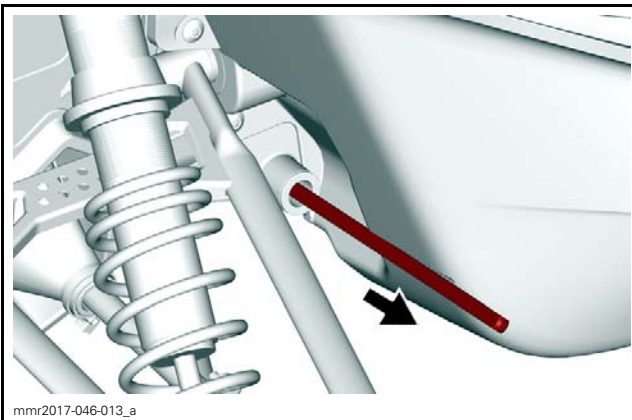


LH SIDE SHOWN



FLAT SIDE FACING OUTWARDS

3. Remove stabilizer levers and plastic bushings from stabilizer bar.
4. Slide stabilizer bar out of vehicle from the LH side.



Installing the Stabilizer Bar

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

Ensure to install the flat side outwards.

Install the screw with the head upwards.

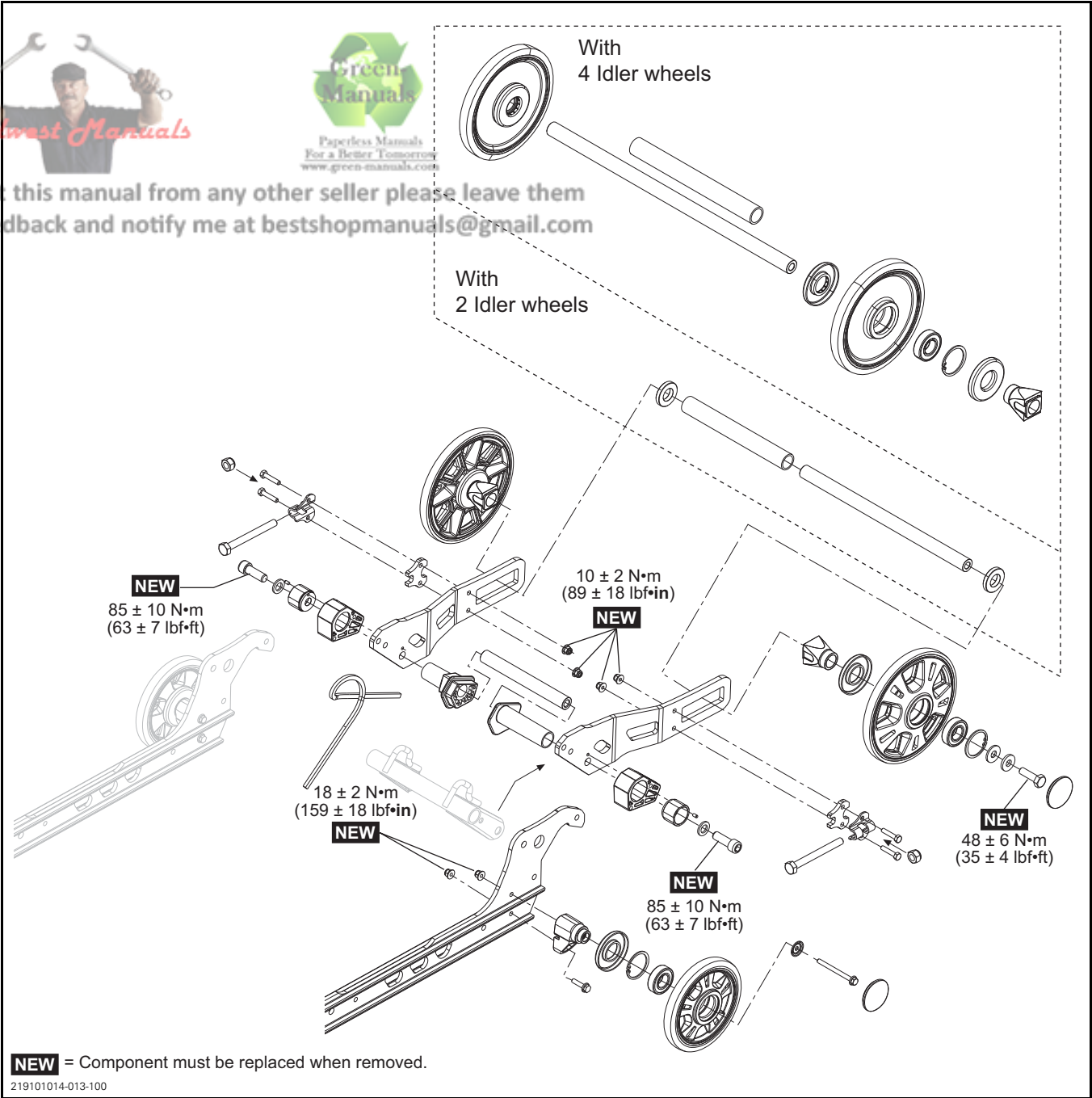
TIGHTENING TORQUE	
Stabilizer bar link nut	19 N•m ± 2 N•m

REAR SUSPENSION (SC-5U)

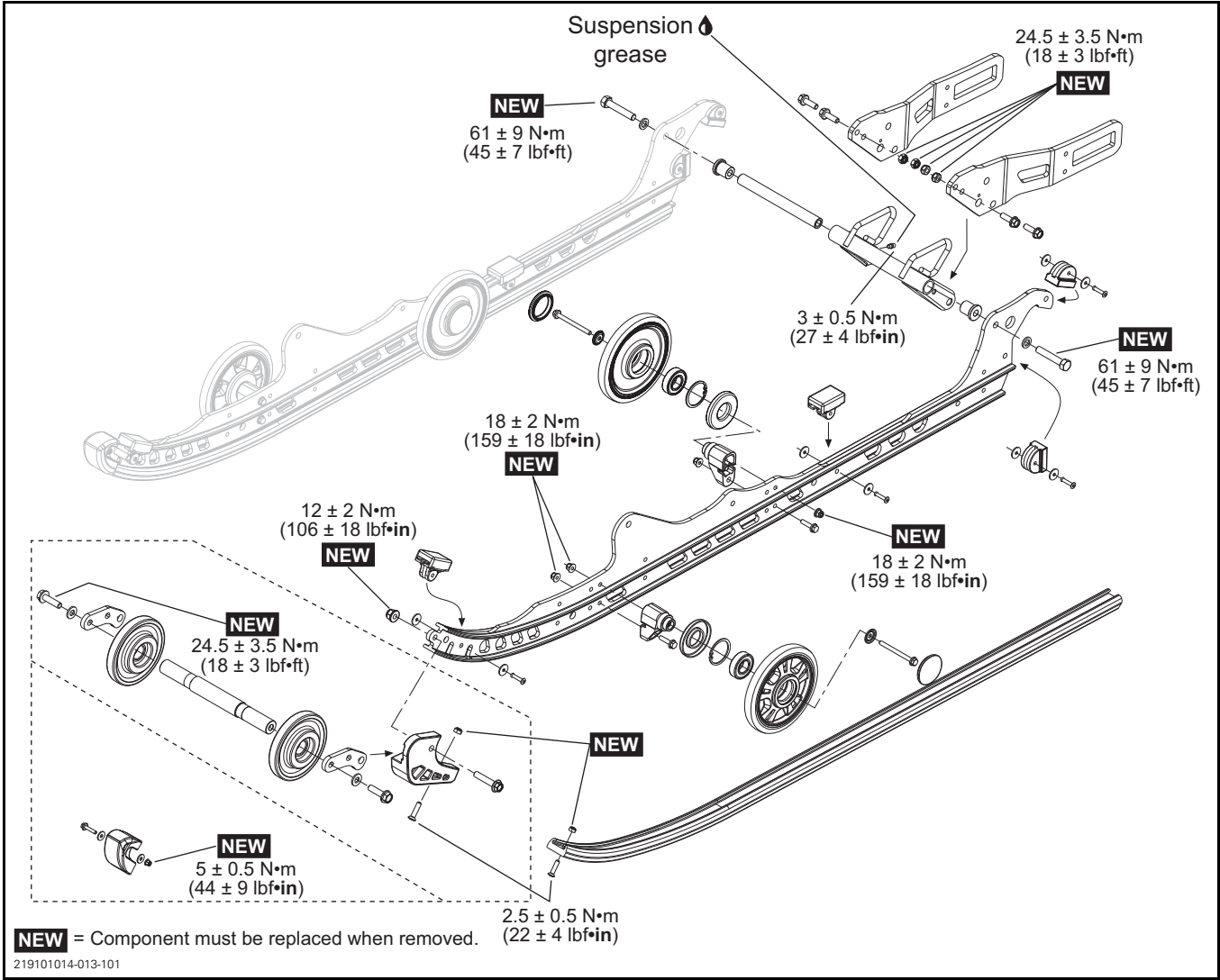
SERVICE PRODUCTS

Description	Part Number	Page
SYNTHETIC SUSPENSION GREASE.....	779163	8

RAILS AND IDLER WHEELS

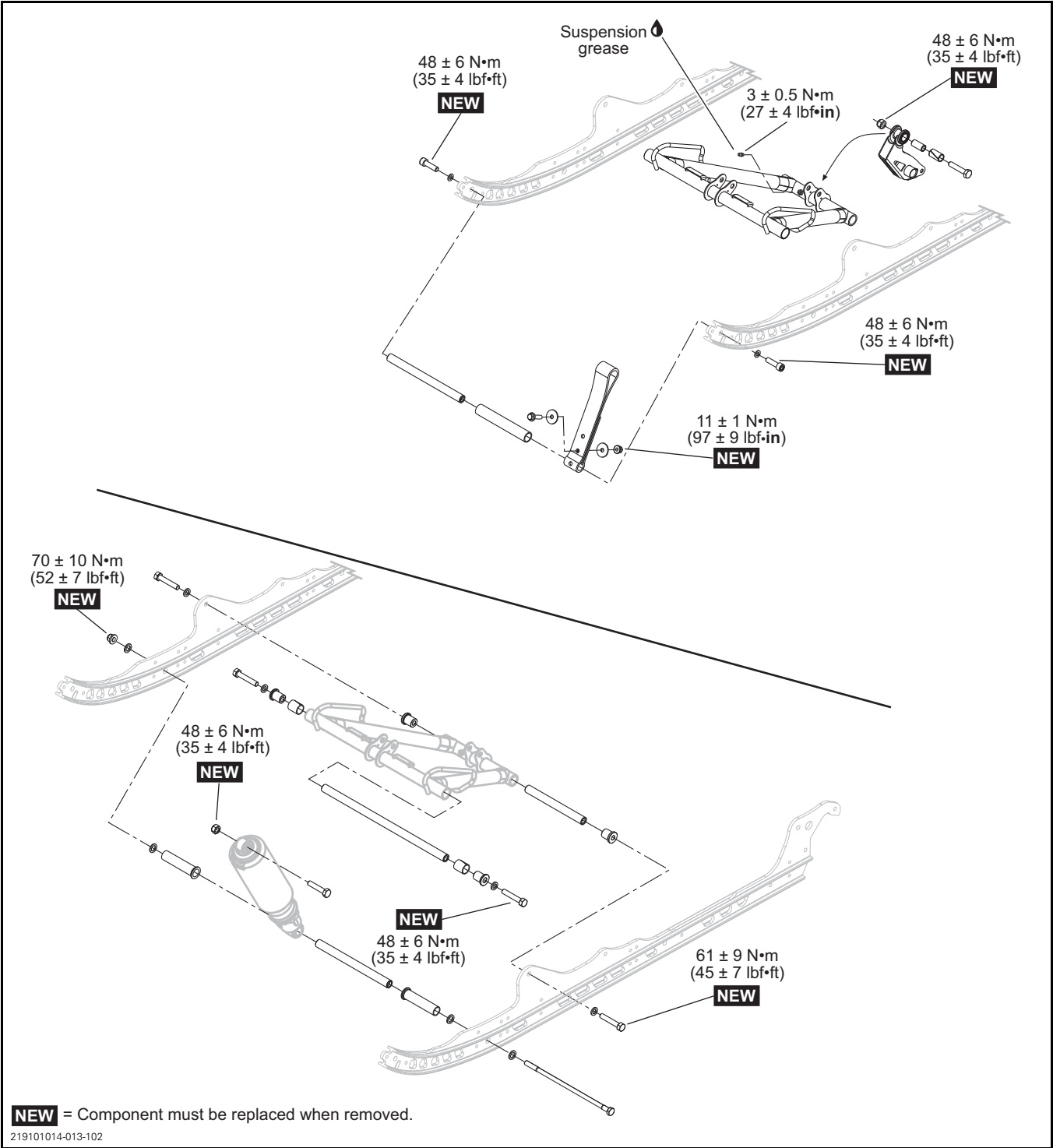


Subsection XX (REAR SUSPENSION (SC-5U))



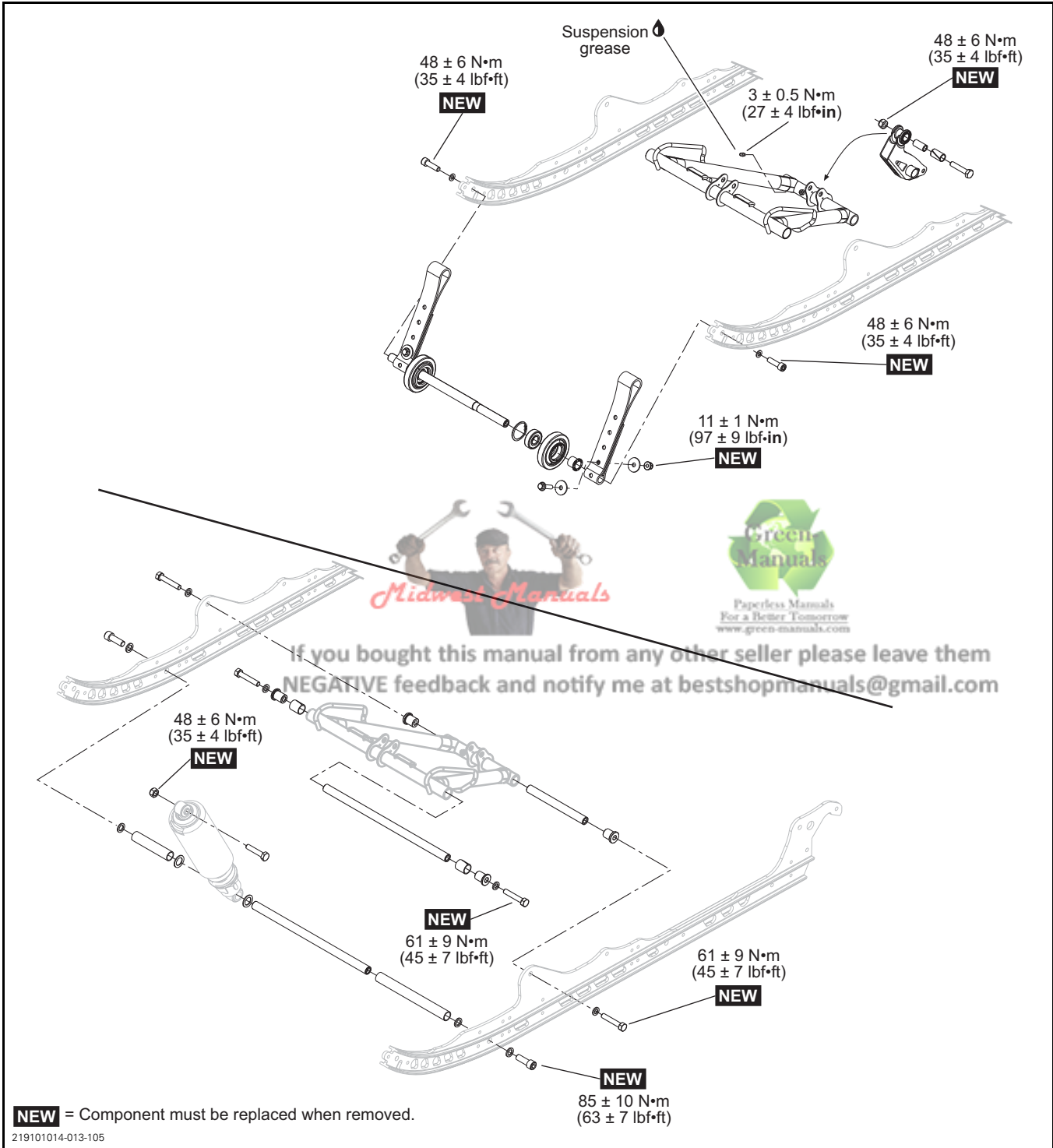
FRONT ARM

16in Wide Suspension



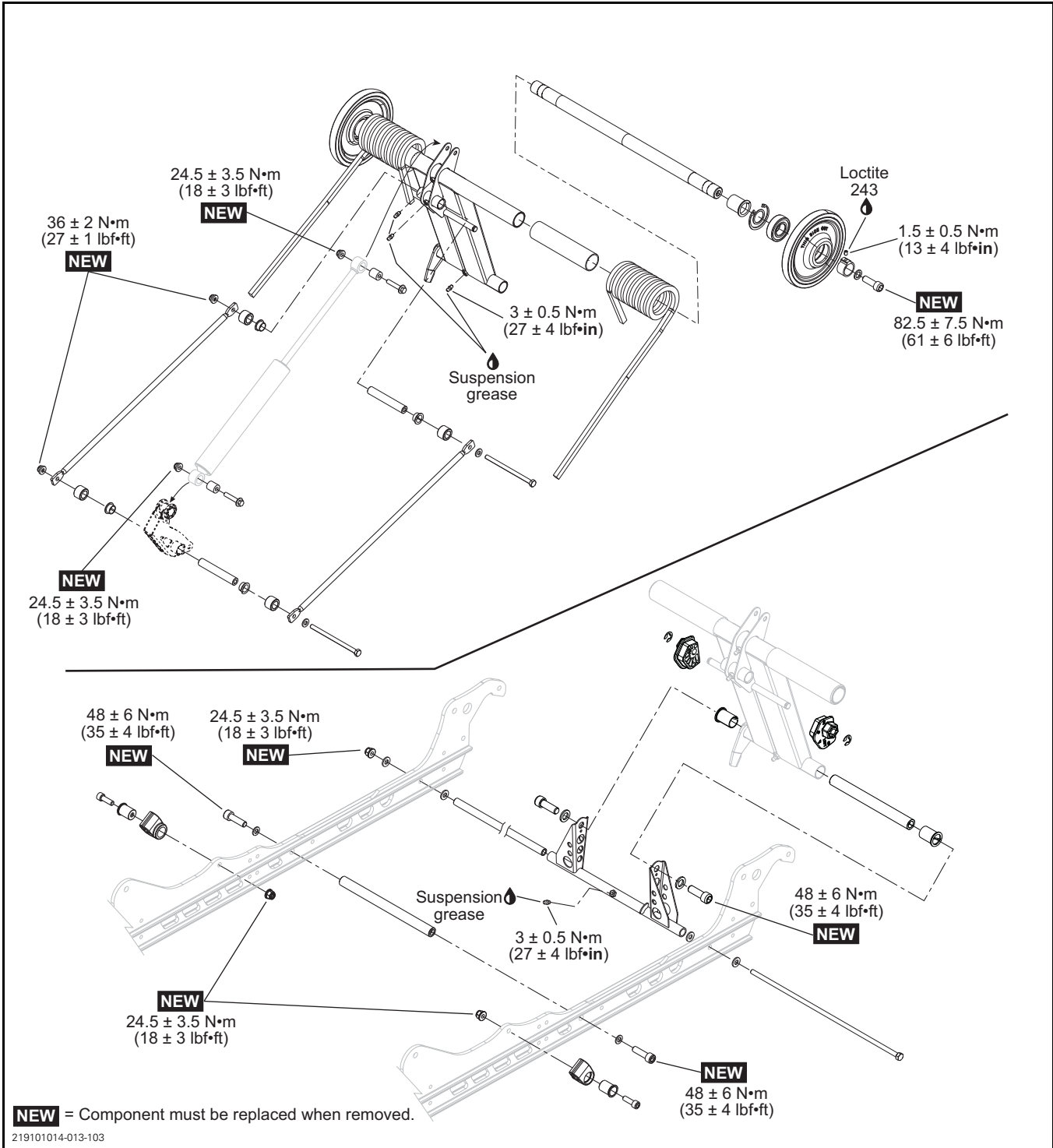
Subsection XX (REAR SUSPENSION (SC-5U))

20in Wide Suspension

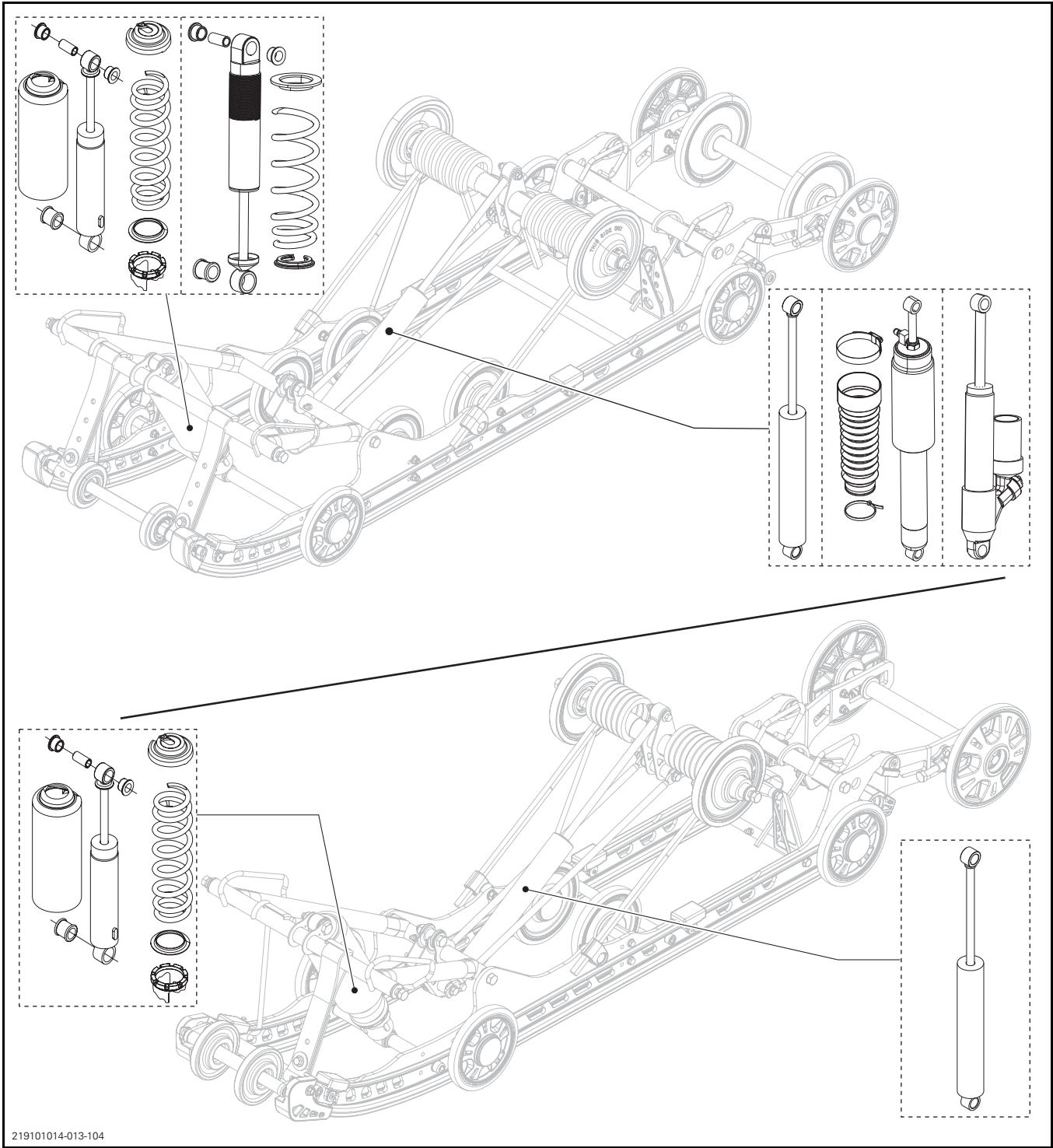


Subsection XX (REAR SUSPENSION (SC-5U))

20in Wide Suspension



SHOCK ABSORBERS



ADJUSTMENT

For suspension adjustment, refer to *SUSPENSION ADJUSTMENT* subsection.

MAINTENANCE

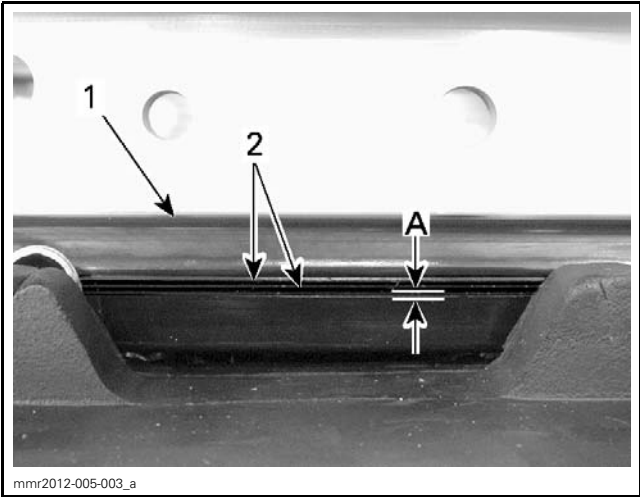
INSPECTING THE REAR SUSPENSION MECHANISM AND STOPPER STRAP

- 1. Inspect rear suspension components for wear, deterioration or damage, replace defective parts if necessary.
- 2. Inspect stopper strap(s) for wear or cracks.
- 3. Check bolt and nut securing strap(s) for tightness. If loose, inspect strap holes for deformation. Replace strap if necessary.

INSPECTING THE SLIDER SHOES

Slider shoes are worn out and must be replaced when remaining material exceeding the 2 molding lines is as specified.

MINIMUM SLIDER SHOE THICKNESS
1 mm (.04 in) material remaining exceeding the 2 molding lines



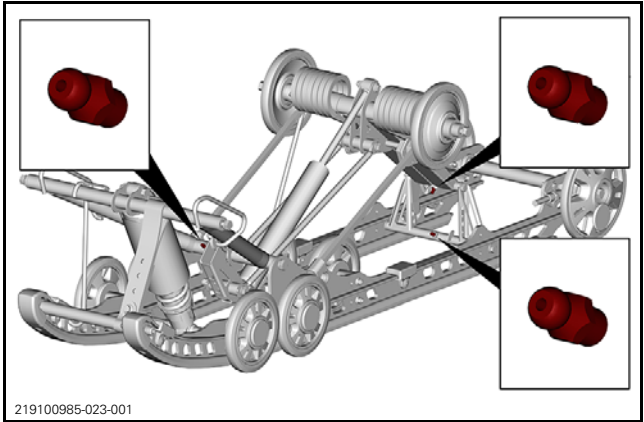
- 1. Slider shoe
- 2. Molding lines
- A. Minimum thickness: 1 mm (.04 in)

NOTICE Slider shoes must always be replaced in pairs.

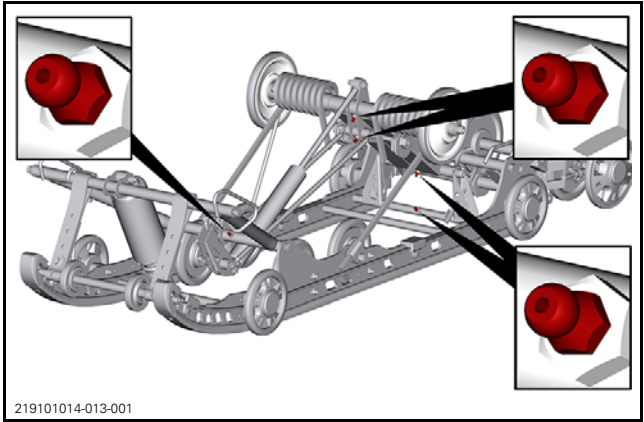
LUBRICATING THE REAR SUSPENSION

Lubricate the following suspension pivots at grease fittings.

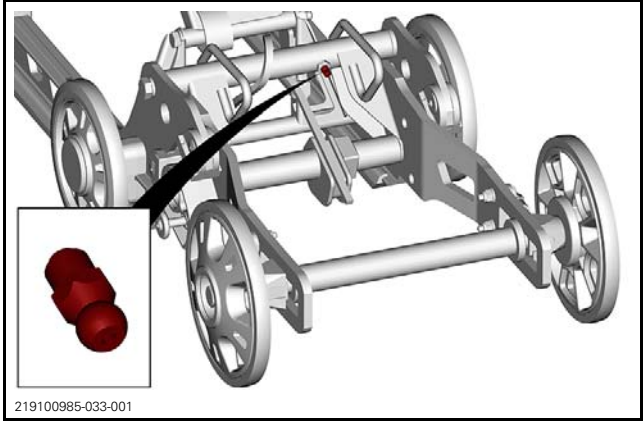
SERVICE PRODUCT
SYNTHETIC SUSPENSION GREASE (P/N 779163)



16in WIDE SUSPENSION



20in WIDE SUSPENSION



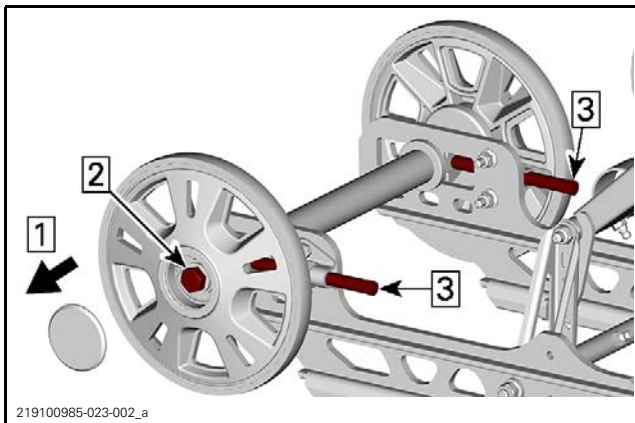
PROCEDURES

NOTE: Parts can be replaced without removing the rear suspension, unless otherwise specified.

SUSPENSION ASSEMBLY

Removing Suspension Assembly

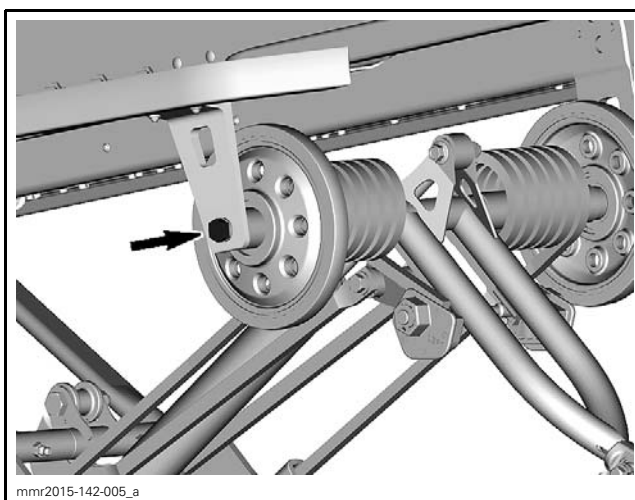
1. Lift rear of vehicle and support it off the ground.
2. Completely loosen track tension.



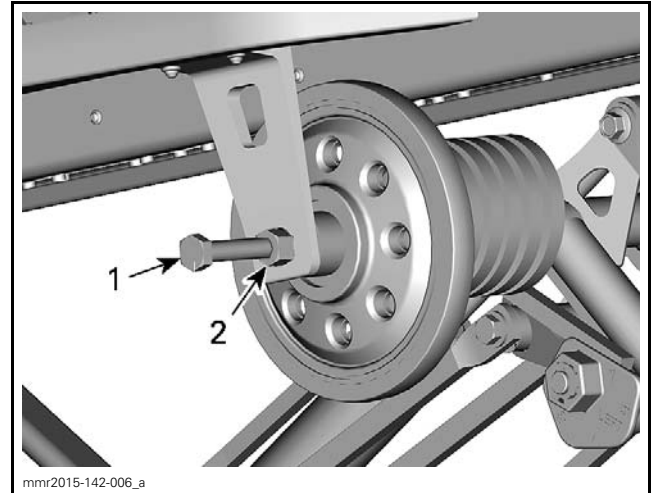
Step 1: Remove caps
Step 2: Loosen one of the axle screws
Step 3: Loosen adjustment screws

3. Remove and discard rear arm bolts from chassis. Use the following procedure to remove bolts easily.

- 3.1 Remove one of the bolts securing the rear arm to frame.



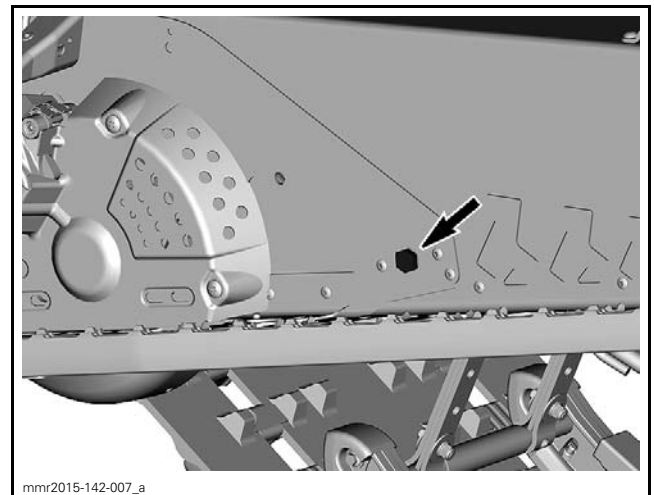
- 3.2 Replace this bolt with a longer one and a nut.
- 3.3 Screw in by approximately 7 turns.
- 3.4 Hold the bolt and tighten locking nut.



1. Long bolt
2. Locking nut

- 3.5 Remove the bolt on the other side then unlock nut and remove the long bolt.
4. Remove bolts retaining front arm to tunnel the same way rear arm bolts have been removed.

NOTE: Discard the front arm bolts.



5. Lift rear of vehicle until front arm as enough clearance to pass underneath tunnel.
6. Remove suspension.

Installing Suspension Assembly

The installation is the reverse of the removal procedure. However, pay attention to the following. Inspect track thoroughly before reinstalling suspension. Refer to *TRACK* subsection.

Install suspension into track with front end first. Install new front and rear arm bolts. Tighten bolts to specification.

Subsection XX (REAR SUSPENSION (SC-5U))

16in Wide Suspension

TIGHTENING TORQUE	
Front and rear arm upper bolts	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)

20in Wide Suspension

TIGHTENING TORQUE	
Front arm upper bolts	61 N•m ± 9 N•m (45 lbf•ft ± 7 lbf•ft)
Rear arm upper bolts	82.5 N•m ± 7.5 N•m (61 lbf•ft ± 6 lbf•ft)

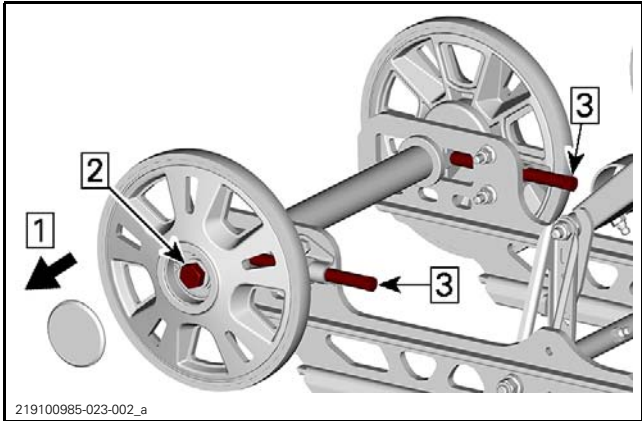
All Suspension

Adjust track tension, refer to *TRACK* subsection.

REAR AXLE

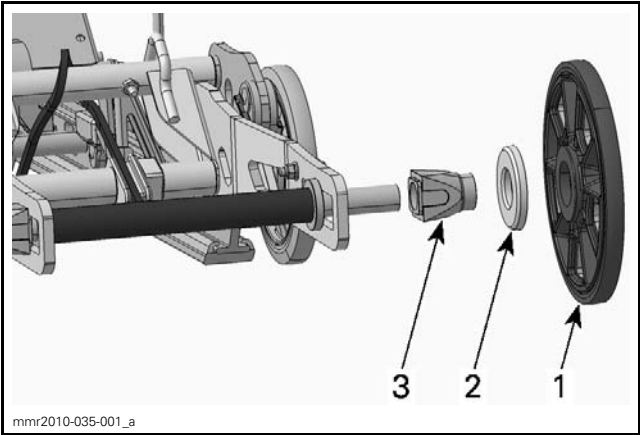
Removing the Rear Axle

- 1. Lift rear of vehicle and support it off the ground.
- 2. Completely loosen track tension.



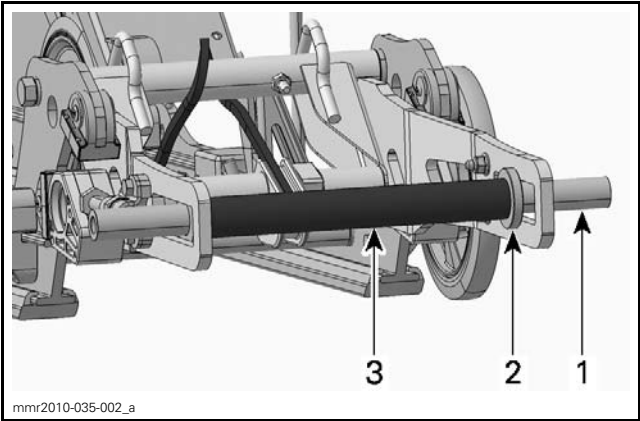
Step 1: Remove caps
Step 2: Loosen one of the axle screws
Step 3: Loosen adjustment screws

- 3. Remove both rear axle screws.
- 4. Remove rear idler wheels, seals and wheel spacers.



2 IDLER WHEELS CONFIGURATION SHOWN
1. Rear idler wheel
2. Seal
3. Wheel spacer

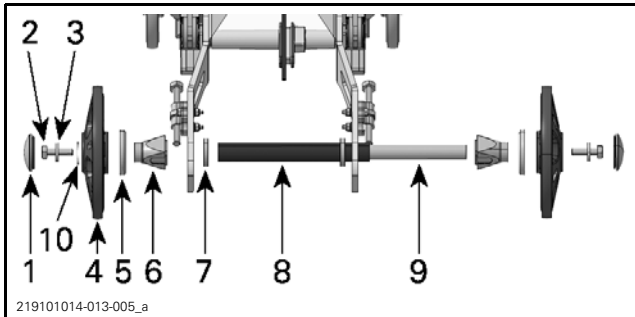
- 5. Pull out the rear axle.
- 6. Remove rear spacer and washers.



2 IDLER WHEELS CONFIGURATION SHOWN
1. Rear axle
2. Washers
3. Rear axle spacer

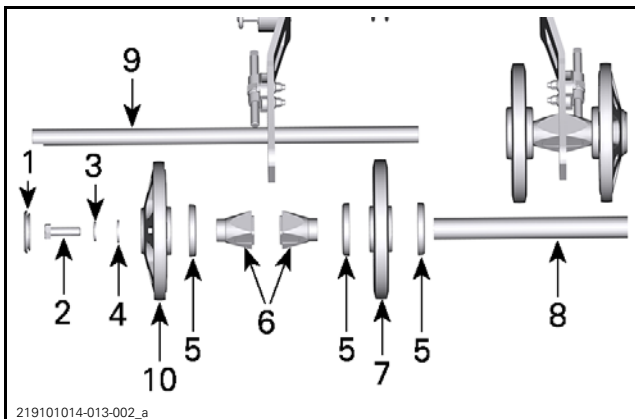
Installing the Rear Axle

The installation is reverse of the removal procedure. However, pay attention to the following.
Make sure to position all parts correctly.



2 IDLER WHEELS

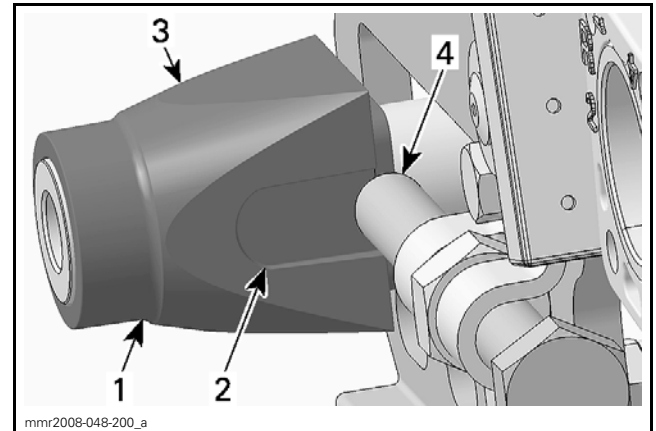
1. Idler wheel cap
2. Screw
3. Conical washer
4. Idler wheel
5. Seal
6. Wheel spacer
7. Washer
8. Rear axle spacer
9. Rear axle
10. Flat washer



4 IDLER WHEELS

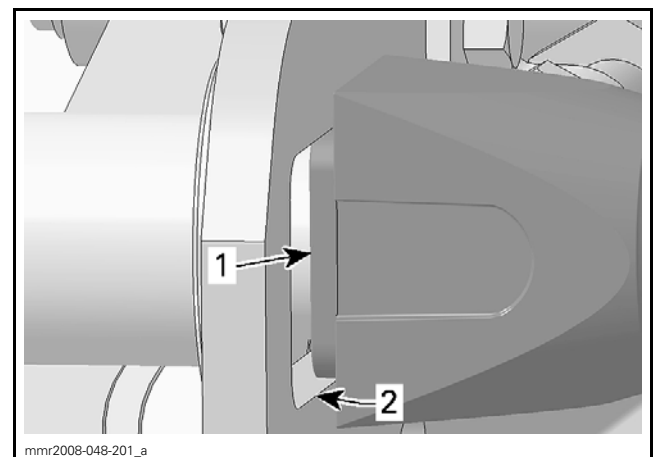
1. Idler wheel cap
2. Screw
3. Conical washer
4. Flat washer
5. Seal
6. Wheel spacers
7. Inner idler wheel
8. Rear axle spacer
9. Rear axle
10. Outer idler wheel

Position wheel spacers with a flat side up and a groove in front of tensioner screw.



1. Wheel spacer
2. Groove
3. Flat side
4. Tensioner screw

When tightening rear axle, make sure each wheel spacer protuberance is engaged into runner slot.



1. Wheel spacer protuberance
2. Runner slot

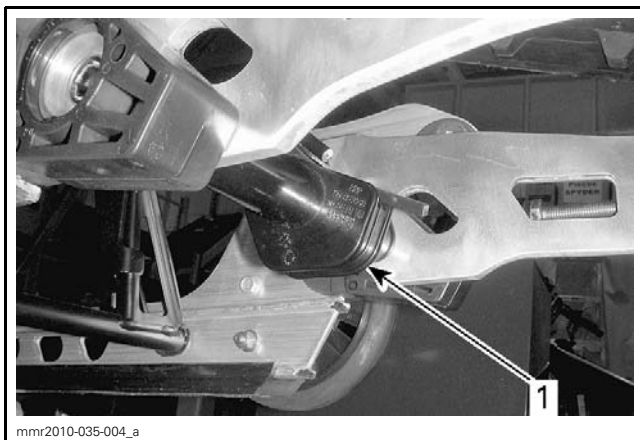
Adjust track tension. Refer to *TRACK* subsection.

REAR EXTENSION

Removing the Rear Extension

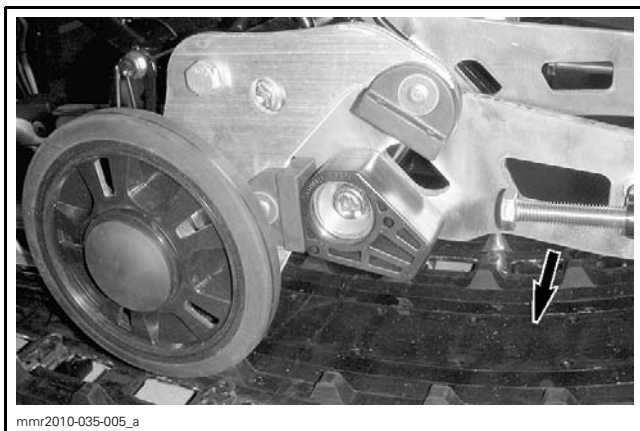
1. Lift rear of vehicle and support it off the ground.
2. Proceed with *REMOVING THE REAR AXLE*. Refer to procedure in this subsection.
3. Unload the spring cam of rear extension by placing it to position 1.

Subsection XX (REAR SUSPENSION (SC-5U))

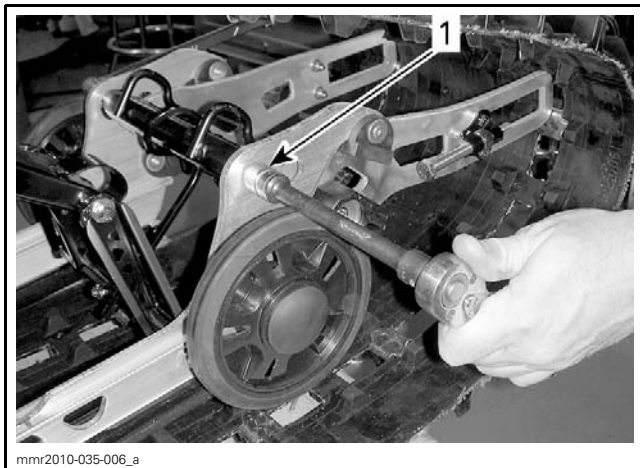


1. Spring cam set to position 1

4. Ensure that rear extension is positioned fully downwards (against lower stopper).



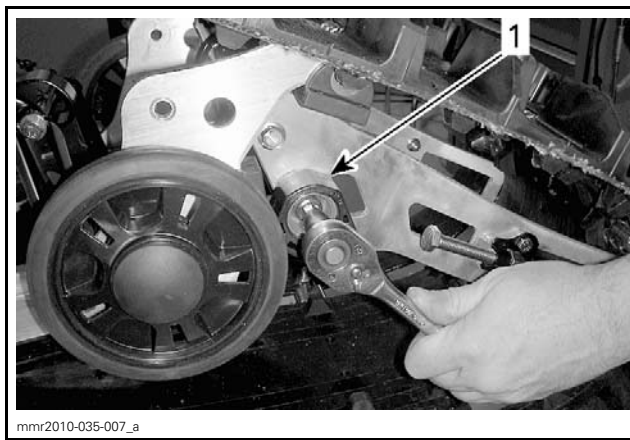
5. Remove retaining screws and washers from rear extension pivot.



1. Retaining screw of rear extension pivot

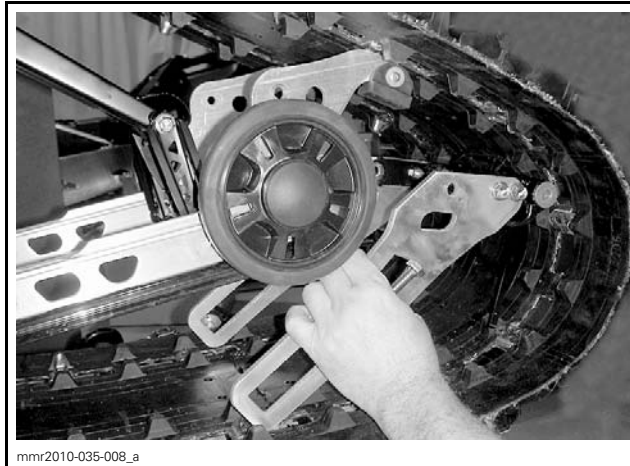
6. Remove retaining screws and washers from rear extension block.

7. Remove rear extension blocks and spacer.



1. Rear extension block

8. Rotate rear extension downwards then remove it from rear suspension.



Installing the Rear Extension

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

Lubricate rear extension pivot. Refer to *MAINTENANCE* in this subsection.

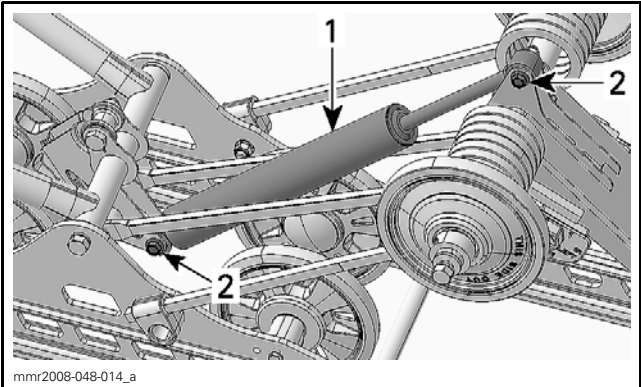
SHOCK ABSORBERS

Removing the Rear Shock Absorber

1. Lift rear of vehicle and support it off the ground.

NOTE: If necessary, to ease shock removal, unfasten stopper strap to release shock pressure.

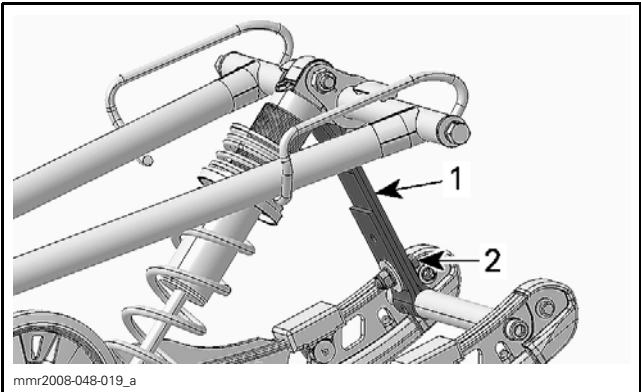
2. Remove bolts and nuts from shock.



TYPICAL
1. Rear shock absorber
2. Remove bolts and nuts

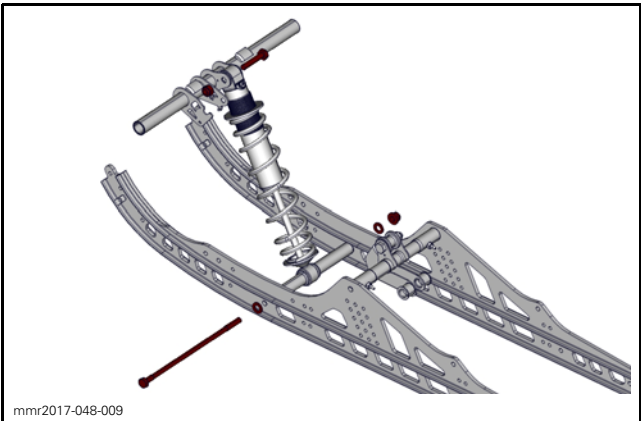
Removing the Center Shock Absorber

1. Lift the rear of vehicle and support it off the ground.
2. Unfasten stopper strap.



TYPICAL
1. Stopper strap
2. Stopper strap bolt

3. Remove upper and lower shock absorber bolts and nuts.



4. Remove shock absorber from vehicle.
5. Remove bushings and shock shaft from shock absorber.

Inspecting the Shock Absorber

Refer to *REAR SUSPENSION (rMOTION)* subsection for complete procedures.

Installing the Rear Shock Absorber

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

To ease shock installation, secure upper side of shock first.

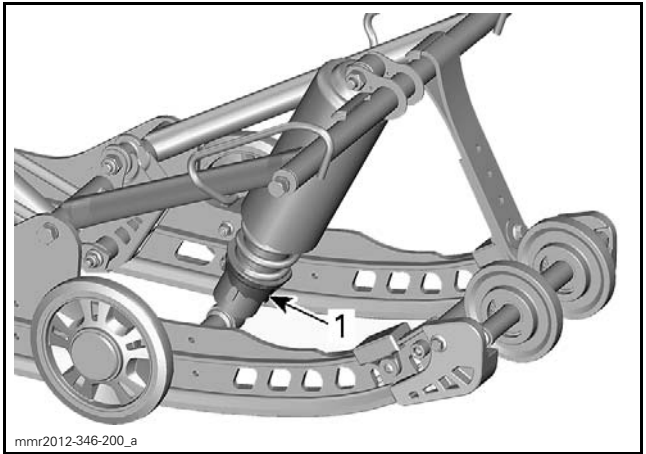
Install **NEW** shock absorber retaining nuts and tighten to specification.

TIGHTENING TORQUE	
Rear shock absorber retaining nuts	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

Installing the Center Shock Absorber

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

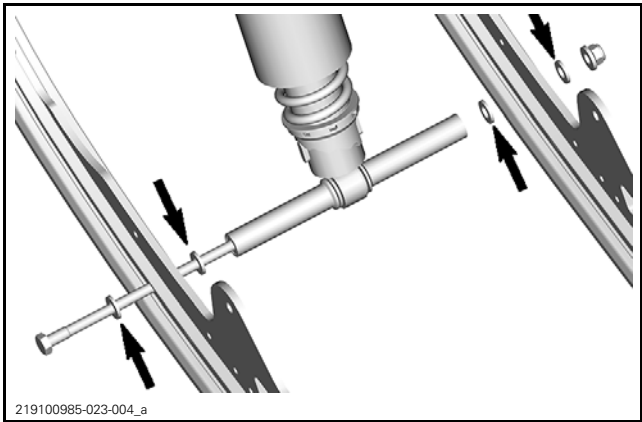
1. Position the adjustment ring or cam downwards.



TYPICAL
1. Cam

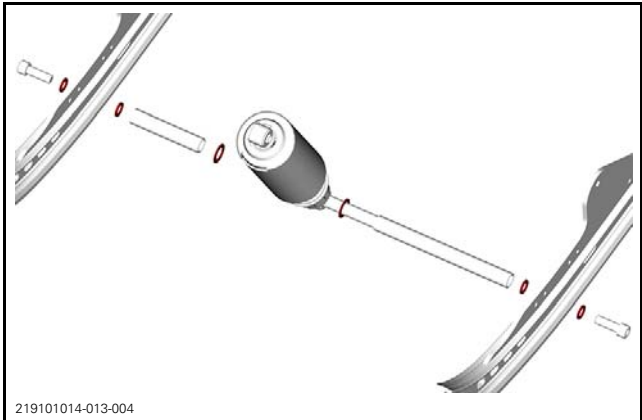
2. Using **NEW** socket screws, install shock shaft to runners.
3. Position washers in proper position. Tighten nut to specification.

16in Wide Suspension



TIGHTENING TORQUE	
Center shock shaft retaining nut	70 N•m ± 10 N•m (52 lbf•ft ± 7 lbf•ft)

20in Wide Suspension

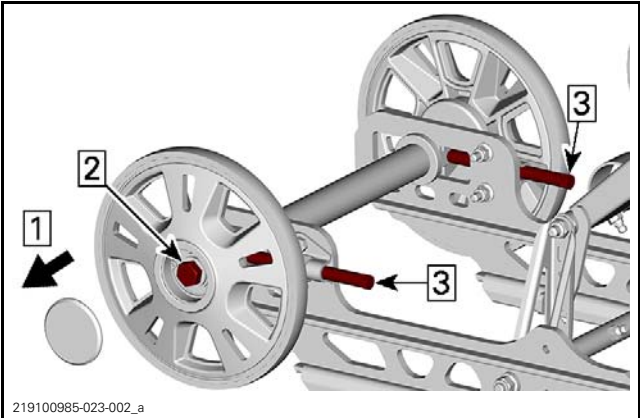


TIGHTENING TORQUE	
Center shock shaft retaining screws	85 N•m ± 10 N•m (63 lbf•ft ± 7 lbf•ft)

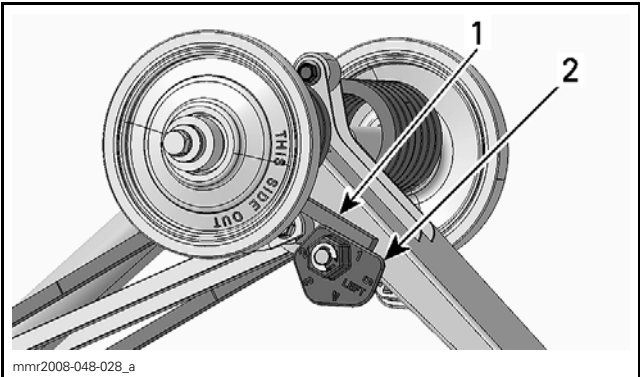
REAR SPRINGS

Removing the Rear Spring

1. Lift rear of vehicle and support it off the ground.
2. Completely loosen track tension.



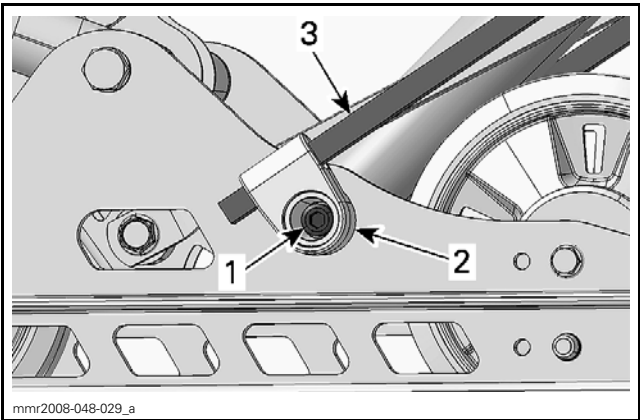
3. Decrease springs preload by turning cams accordingly.



4. Firmly hold the spring support and unscrew its retaining bolt (one each side).

**WARNING**

Supports are spring loaded.



5. Remove screws and washers from rear arm top axle. Refer to *REMOVING SUSPENSION ASSEMBLY*.
6. Loosen set screw from locking rings.
7. Remove locking rings.

16in Track

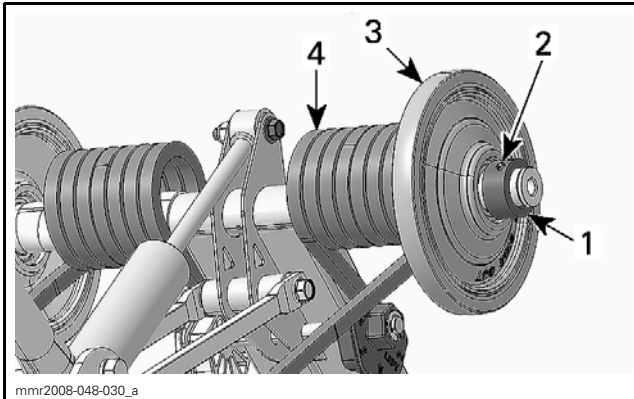
8. Remove upper idler wheels.

20in Track

9. Hand tighten a M12 x 30 screw in the axle with contact between the screw head and the axle.
10. Hit on the screw head to slide the axle out of the idler wheel.

All Tracks

11. Remove springs.



LH SIDE SHOWN

1. Locking ring
2. Set screw
3. Upper idler wheel
4. Rear spring

Installing the Rear Spring

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

1. Respect THIS SIDE OUT inscription on top idler wheels.

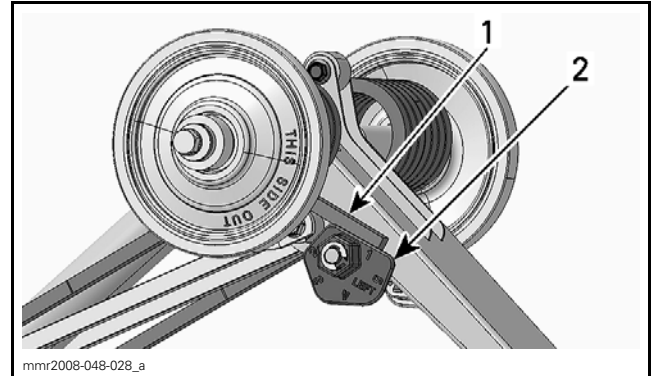
20in Track

2. Use a hammer and a suitable sleeve to slide the idler wheel back in place.

NOTICE Lean on the bearing inner race to slide it on the axle.

All Tracks

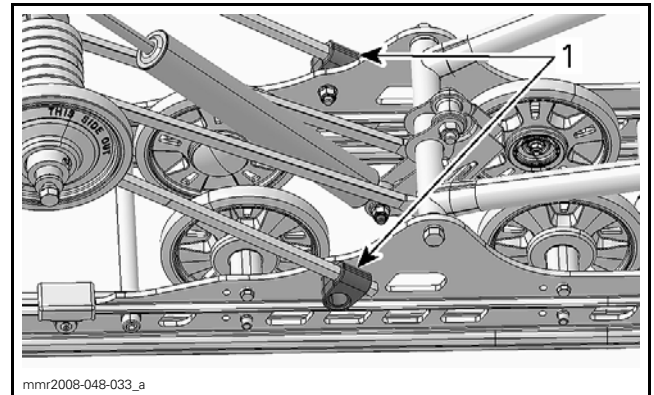
3. Make sure that spring end is in cam adjuster.



LH SIDE SHOWN

1. Spring end
2. Cam

4. Install spring supports upwards.



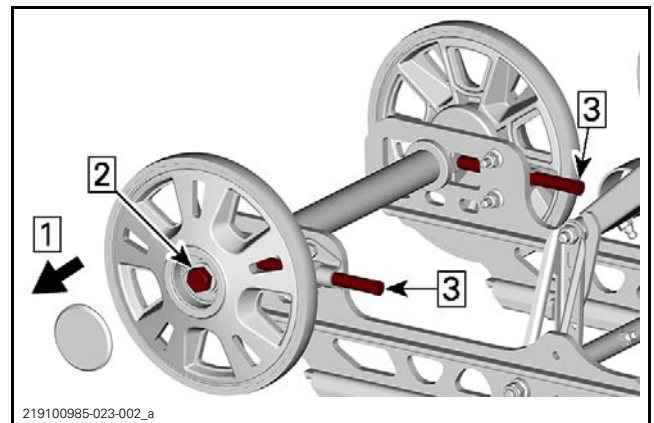
TYPICAL

1. Spring supports upwards

SLIDER SHOES

Removing the Slider Shoe

1. Lift rear of vehicle and support it off the ground.
2. Completely loosen track tension.



Step 1: Remove caps

Step 2: Loosen one of the axle screws

Step 3: Loosen adjustment screws

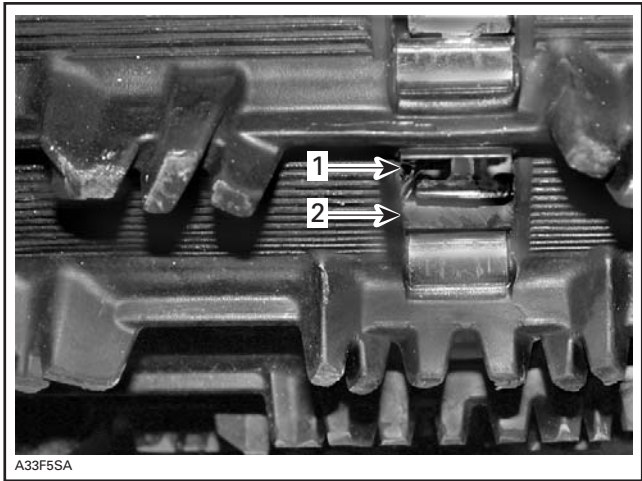
3. Remove nut and screw of each runner.

Subsection XX (REAR SUSPENSION (SC-5U))



REMOVE NUT AND SCREW OF EACH RUNNER

4. At the rear of vehicle, align a track window with slider shoe.



TYPICAL
1. Track window
2. Slider shoe

5. Using a pry bar or a screwdriver, push slider shoe rearward until it comes in contact with track.



PUSH ON SLIDER SHOE

6. Using locking pliers, pull slider shoe through track window to remove.

NOTE: If necessary, lubricate track window to facilitate slider shoe removal.



PULL ON SLIDER SHOE TO REMOVE

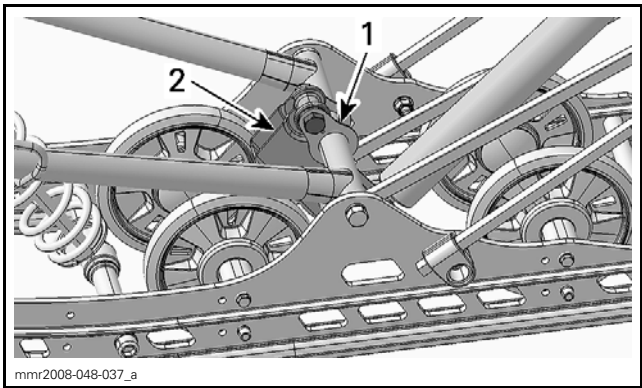
Installing the Slider Shoe

The installation is the reverse of the removal procedure. However, pay attention to the following. Make sure to insert slider shoe end with hole first.

FRONT ARM

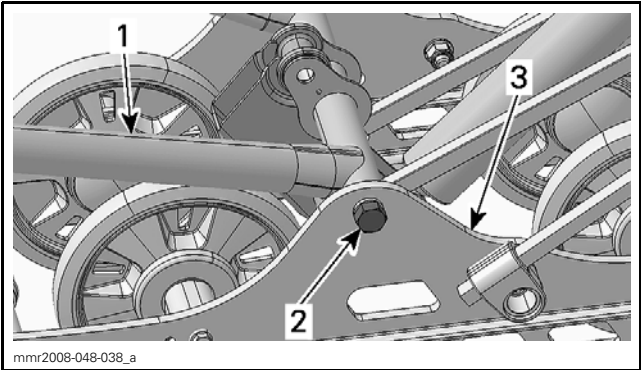
Removing the Front Arm

1. Proceed with *REMOVING THE SUSPENSION ASSEMBLY*. Refer to procedure in this subsection.
2. Remove the bolt securing rocker to front arm.



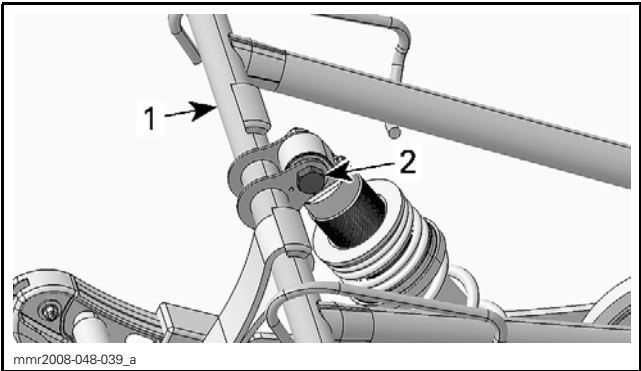
1. Front arm
2. Rocker

3. Unscrew and remove the front arm lower bolts and washers.



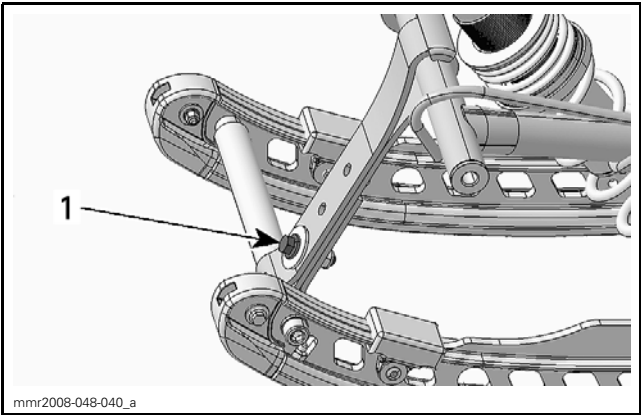
1. Front arm
2. Lower bolt
3. LH runner

4. Remove the shock absorber upper bolt.



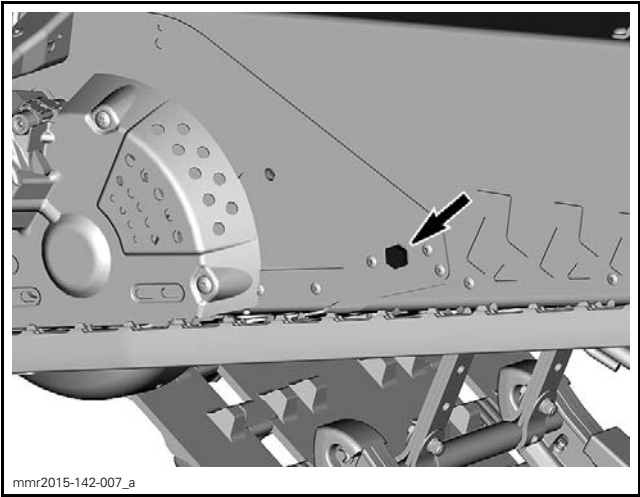
1. Front arm
2. Shock absorber upper bolt

5. Unfasten stopper strap.



1. Stopper strap bolt

6. Remove and discard front arm upper bolts.



7. Remove front arm.

Installing the Front Arm

The installation is the reverse of the removal procedure. However, pay attention to the following. Install **NEW** front arm upper and lower bolts. Tighten screws to specification.

16in Wide Suspension

TIGHTENING TORQUE	
Front arm lower bolts	61 N•m ± 9 N•m (45 lbf•ft ± 7 lbf•ft)
Front arm upper bolts	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)

20in Wide Suspension

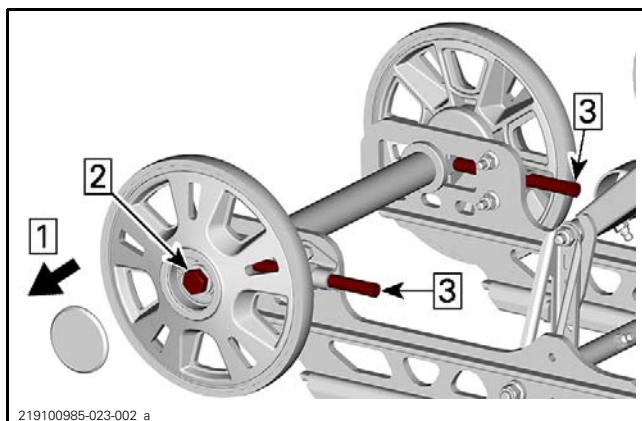
TIGHTENING TORQUE	
Front arm upper and lower bolts	61 N•m ± 9 N•m (45 lbf•ft ± 7 lbf•ft)

REAR ARM

Removing the Rear Arm

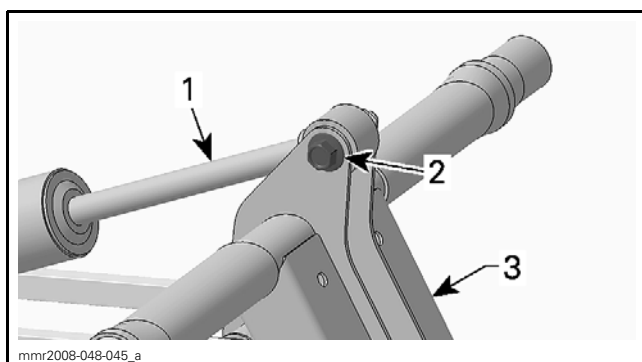
1. Lift rear of vehicle and support it off the ground.
2. Completely loosen track tension.

Subsection XX (REAR SUSPENSION (SC-5U))



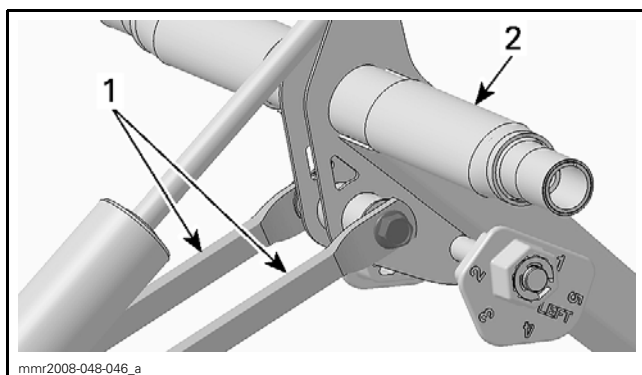
Step 1: Remove caps
Step 2: Loosen one of the axle screws
Step 3: Loosen adjustment screws

3. Proceed with **REMOVING THE REAR SPRING**. Refer to procedure in this subsection.
4. Remove the rear shock absorber upper bolt.



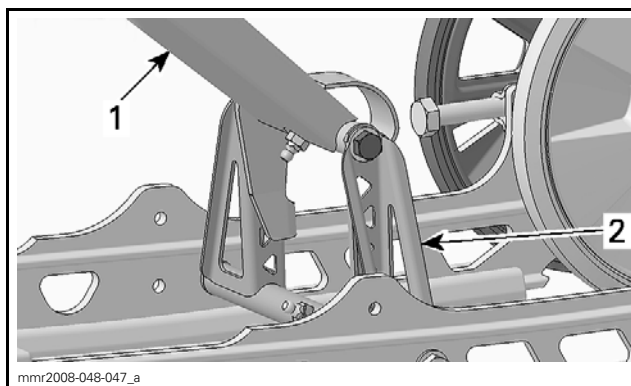
1. Rear shock absorber
2. Shock absorber bolt
3. Rear arm

5. Remove throttle rods from rear arm.



1. Throttle rods
2. Rear arm

6. Remove bolts and washers holding rear arm to pivot arm.



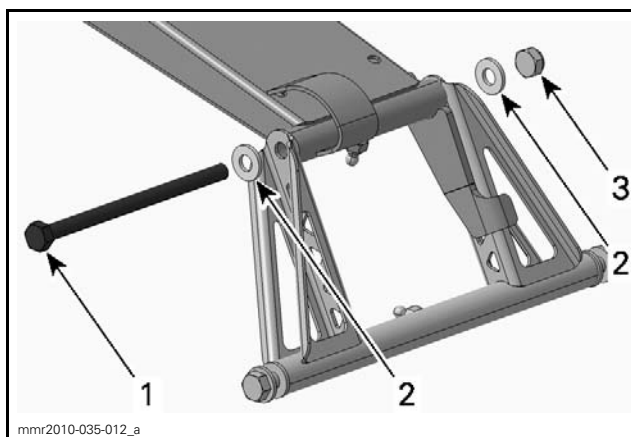
1. Rear arm
2. Pivot arm

Installing the Rear Arm

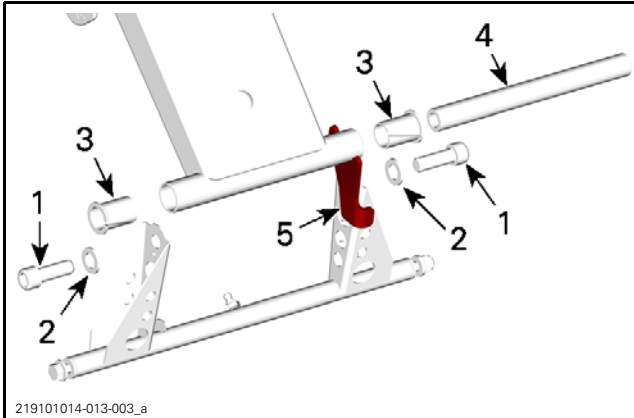
The installation is the reverse of the removal procedure. However, pay attention to the following. Pivot arm grease fitting must be towards the front of the vehicle.

At installation, rear arm stroke limiter must be towards rear.

Assemble rear arm fasteners as per following illustrations.

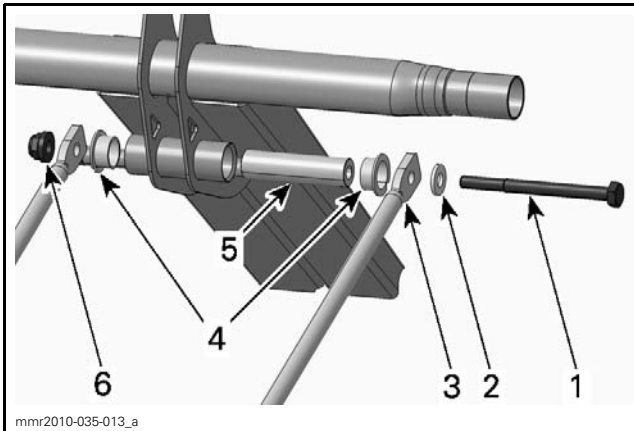


16in SUSPENSION
1. Rear arm lower bolt
2. Washers
3. Rear arm lower nut



20in SUSPENSION

1. Rear arm lower bolts
2. Washers
3. Bushings
4. Axle
5. Stroke limiter



SOME PARTS REMOVED FOR CLARITY PURPOSE

1. Throttle rod upper bolt
2. Washer
3. Throttle rod
4. Bushings
5. Axle
6. Throttle rod upper nut

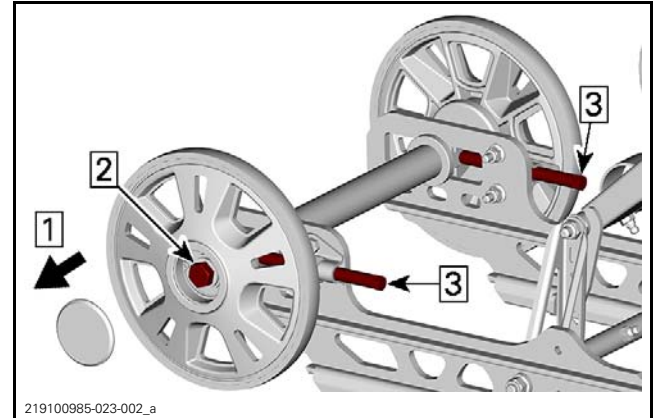
Refer to exploded view for new fasteners to install and tightening torques.

Lubricate rear arm pivot. Refer to *MAINTENANCE* in this subsection.

PIVOT ARM

Removing the Pivot Arm

1. Lift rear of vehicle and support it off the ground.
2. Completely loosen track tension.

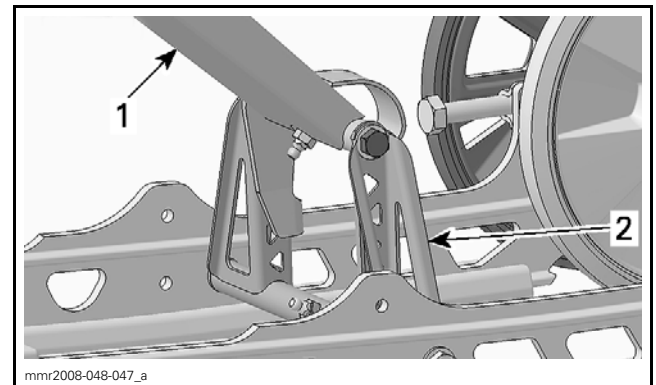


Step 1: Remove caps

Step 2: Loosen one of the axle screws

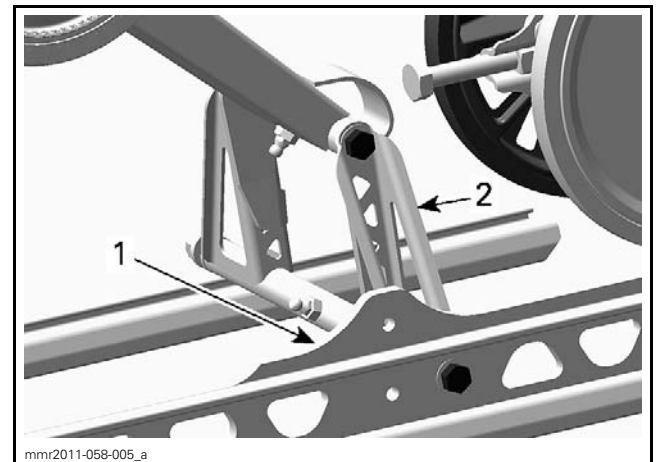
Step 3: Loosen adjustment screws

3. Remove bolt and washers retaining rear arm to pivot arm.



1. Rear arm
2. Pivot arm

4. Remove bolt and washers retaining pivot arm to runners.



1. Runner
2. Pivot arm

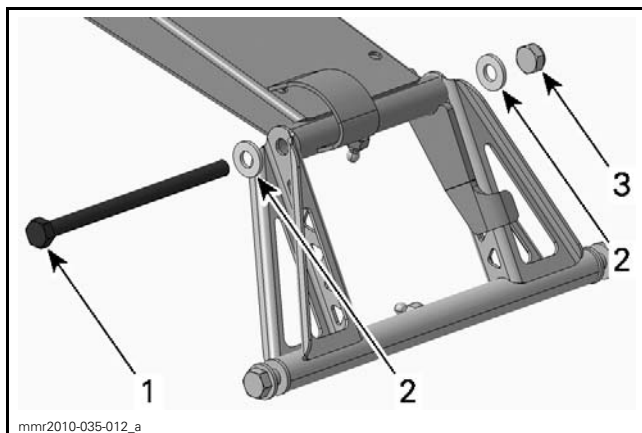
5. Carefully remove pivot arm from rear arm.

Subsection XX (REAR SUSPENSION (SC-5U))

Installing the Pivot Arm

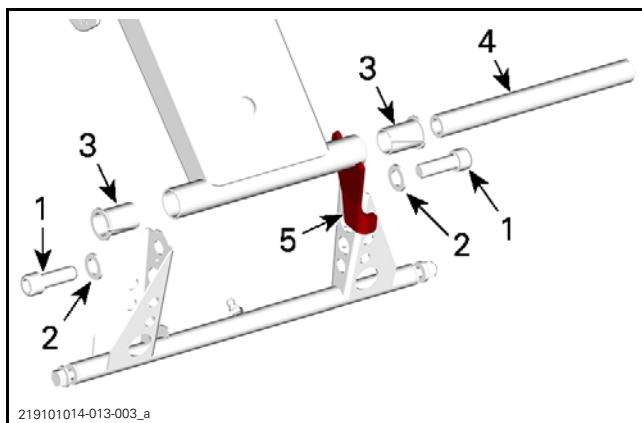
The installation is the reverse of the removal procedure. However, pay attention to the following.

Assemble pivot arm fastener as per following illustrations.



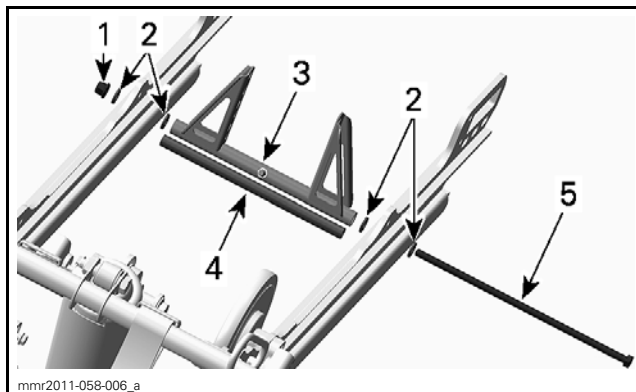
16in SUSPENSION

1. Rear arm lower bolt
2. Washers
3. Rear arm lower nut



20in SUSPENSION

1. Rear arm lower bolts
2. Washers
3. Bushings
4. Axle
5. Stroke limiter



PARTS REMOVED FOR CLARITY PURPOSE

1. Pivot arm lower nut
2. Washers
3. Pivot arm
4. Axle
5. Pivot arm lower screw

Refer to exploded view for new fasteners to install and tightening torques.

Lubricate pivot arm. Refer to *MAINTENANCE*.

IDLER WHEELS AND SUPPORTS

Refer to the exploded views at the beginning of this subsection for parts layout and fasteners tightening torque.

STOPPER STRAP

Refer to the exploded views at the beginning of this subsection for parts layout and fasteners tightening torque.

AIR CONTROLLED SUSPENSION (ACS) SYSTEM

SERVICE TOOLS

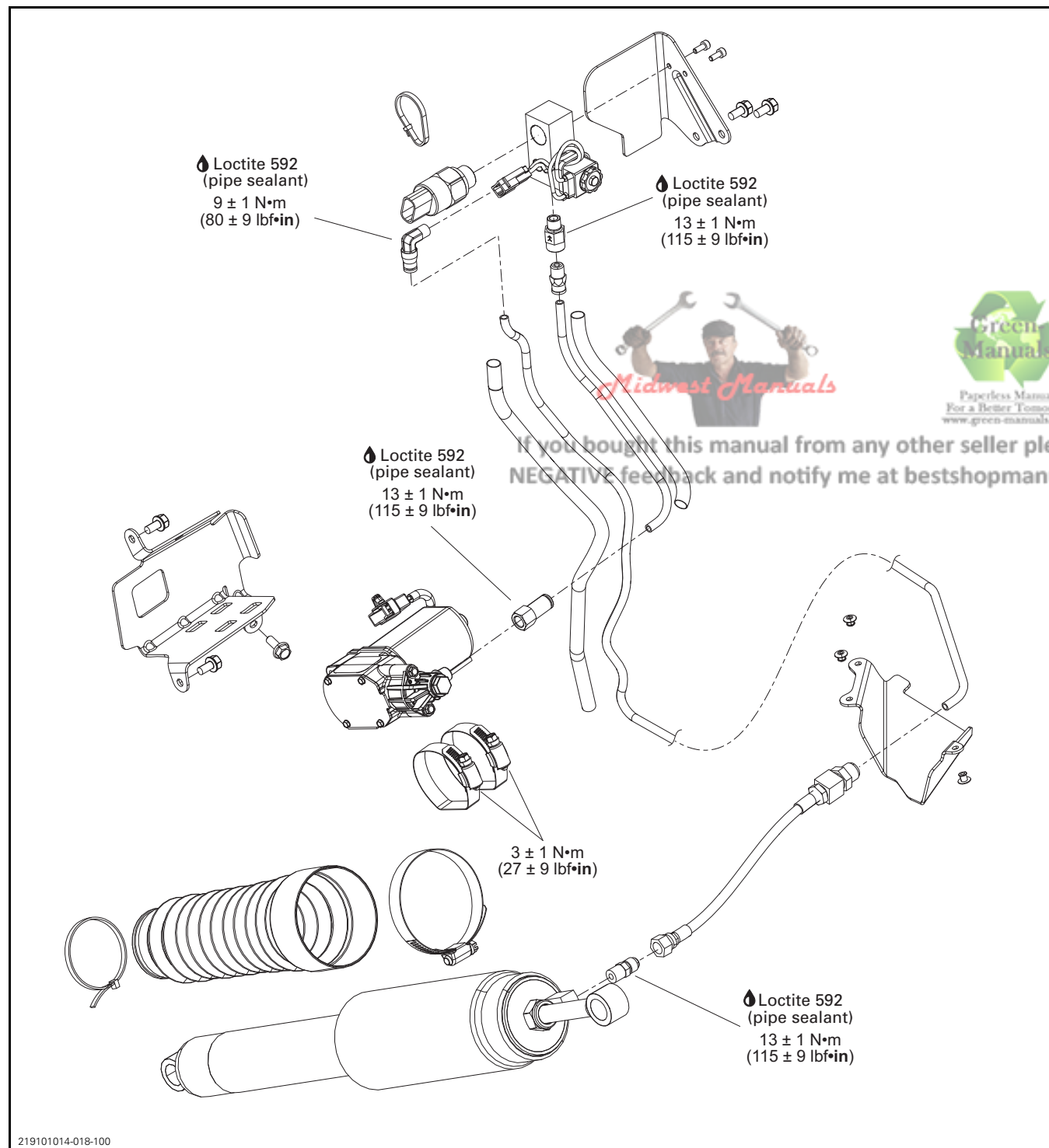
Description	Part Number	Page
ENGINE LEAK DOWN TEST KIT	529 035 661	10
FLUKE 115 MULTIMETER	529 035 868	4

SERVICE PRODUCTS

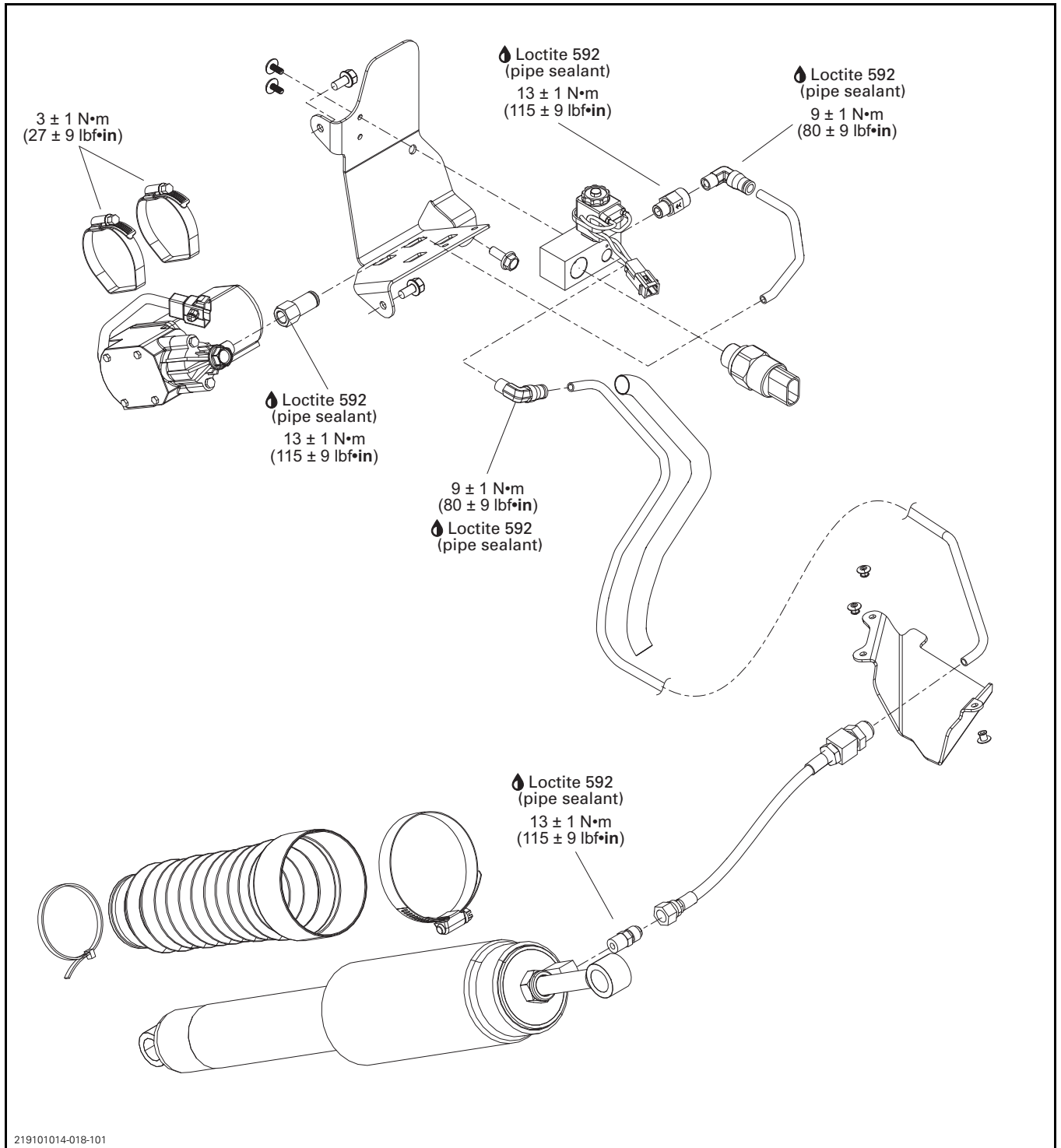
Description	Part Number	Page
LOCTITE 592 (PIPE SEALANT)	293 800 018	11, 15

Subsection XX (AIR CONTROLLED SUSPENSION (ACS) SYSTEM)

ACE Models



E-TEC Models



GENERAL

The following tool is required to test most of the electrical parts.

REQUIRED TOOL

FLUKE 115 MULTIMETER
(P/N 529 035 868)



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

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

 **WARNING**

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

 **WARNING**

The ACS suspension system may be under high pressure (up to 8.6 bar (125 PSI)). Release air pressure before working on the system. Refer to *ACS SYSTEM AIR PRESSURE RELEASE* in this subsection.

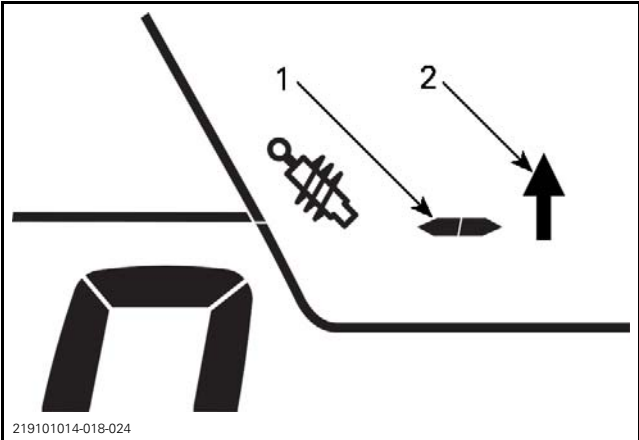
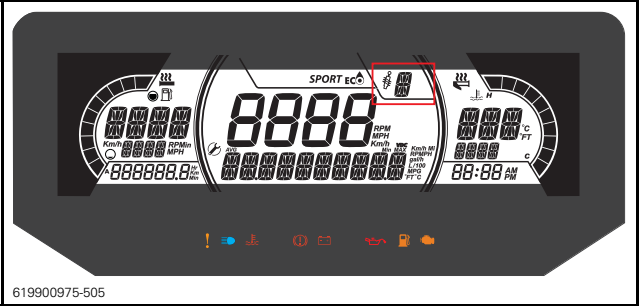
 **WARNING**

Some components may be HOT. Always wait for engine to cool down before performing work.

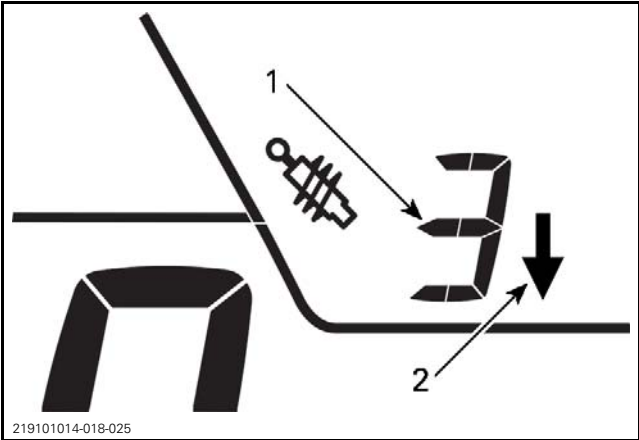
SYSTEM DESCRIPTION
(FEATURES)

The air controlled suspension (ACS) system adjusts the comfort and ride height by setting the air pressure in the rear shock absorber. The operator can choose the desired pressure setting, by using the MODE (M) button, whenever the engine is running.

The air pressure setting is controlled by the gauge. The gauge gets feedback from the pressure sensor to keep air pressure constant in the system. Depending on the rider desired setting, the gauge will increase pressure using the ACS compressor or release pressure using the solenoid valve.



- 1. Pressure setting not detected (Flashing)
- 2. Pressure increasing

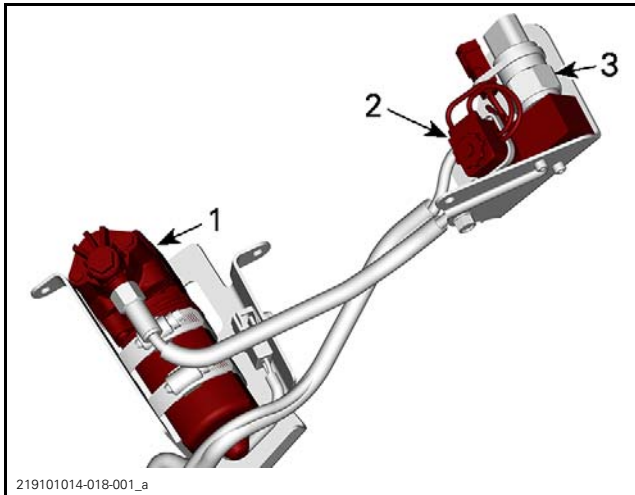


- 1. Requested setting (Flashing when being selected)
- 2. Pressure decreasing

The following table shows the air pressure maintained in the rear shock absorber depending on the setting.

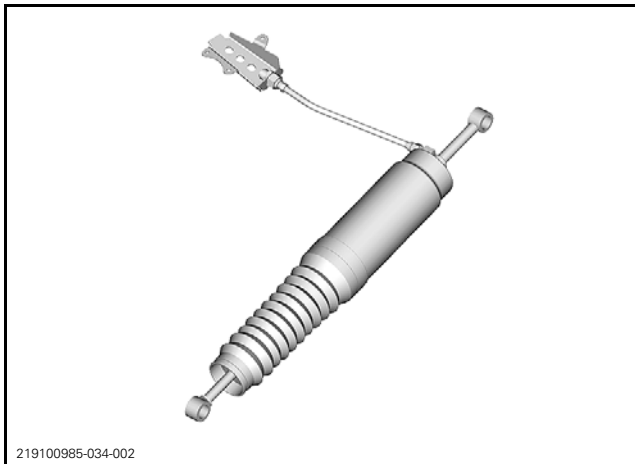
SUSPENSION SETTING (SHOWN IN DIGITAL DISPLAY)	AIR SUSPENSION PRESSURE
1	1.4 bar (20 PSI)
2	3.1 bar (45 PSI)
3	5.2 bar (75 PSI)
4	6.6 bar (96 PSI)
5	8.6 bar (125 PSI)

SYSTEM DESCRIPTION (COMPONENTS)



TYPICAL

1. ACS compressor
2. ACS manifold assembly (Solenoid valve built in)
3. Pressure sensor (PS)



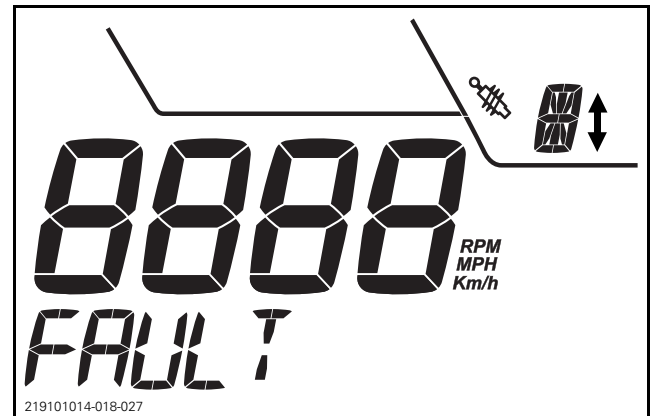
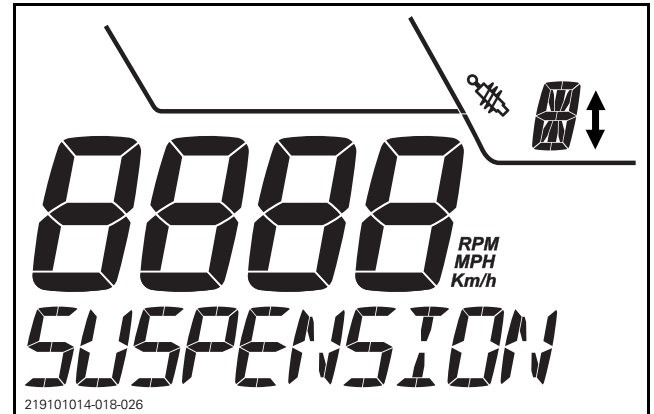
SHOCK ABSORBER

TROUBLESHOOTING

DIAGNOSTIC TIPS

Suspension Fault Code

The **suspension fault** code can appear on the gauge for different reasons. This does not necessarily mean a failure of the ACS system.



If the fault code appears on the gauge, it indicates a disparity between the requested and the actual suspension settings. Turn off the vehicle to reset the fault code.

If the fault code remains active for more than 2 minutes, it may indicate a major leak in the system. In this case, the gauge will automatically shut down the ACS compressor to prevent it from overheating.

If there is a major leak in the system, check hoses and fittings first, refer to *ACS HOSE LEAK TEST* procedure in this subsection to properly locate and repair the problem.

If no leak is detected from hoses or fittings, inspect the ACS compressor check valve, refer to *CHECK VALVE LEAK TEST (ACS COMPRESSOR)* in this subsection.

Suspension Fault Code Displayed and Suspension Setting Can Not Be Adjusted

If no leak is found, it is probably an electrical problem. In this case, an electrical failure of the ACS compressor or the solenoid valve will result the impossibility to change the actual suspension setting.

Subsection XX (AIR CONTROLLED SUSPENSION (ACS) SYSTEM)

After multiple attempts to change suspension setting, the gauge will activate a **suspension fault** code. Refer to *TESTING SEQUENCE* for further troubleshooting procedure.

TESTING SEQUENCE

SUSPENSION SETTING CANNOT BE CHANGED.

1. Faulty gauge or wiring (refer to *PRESSURE SENSOR (PS)* for testing).
 - Test PS signal wire continuity.
 - Test PS input voltage.
 - Test PS ground.

ACS SYSTEM CAN ONLY DECREASE PRESSURE.

1. Faulty ACS compressor or wiring (refer to *ACS COMPRESSOR* for testing).
 - Test ACS compressor operation.
 - Test ACS compressor input voltage.

ACS SYSTEM CAN ONLY INCREASE PRESSURE.

1. Faulty ACS solenoid valve or wiring (refer to *ACS SOLENOID VALVE* for testing).
 - Test ACS solenoid valve operation.
 - Test ACS solenoid valve input voltage.

REQUESTED SETTING DISPLAY IS FLASHING AND DOES NOT CHANGE IN GAUGE WHEN REQUESTED.

1. *SUSPENSION FAULT* error code displayed.
 - Turn off vehicle and turn it back on to reset error code..
2. Hose(s) disconnected and/or leaks.
 - Check hoses connections and leaks. Refer to *ACS HOSE LEAK TEST* and/or *CHECK VALVE LEAK TEST (ACS COMPRESSOR)*.

PROCEDURES

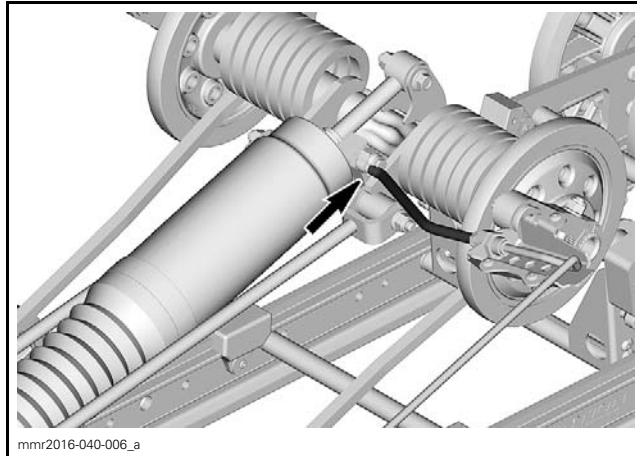
This subsection covers ACS components only. For all other suspension components, refer to *REAR SUSPENSION (TMOTION or SC-5U)*.

ACS SHOCK ABSORBER

Removing the Rear Shock Absorber

Release air pressure. Refer to *ACS SYSTEM AIR PRESSURE RELEASE* in this subsection.

1. Disconnect ACS hose from shock absorber. Refer to *ACS HOSE REMOVAL AND INSTALLATION IN QUICK FITTING* in this subsection.



NOTE: To ease shock absorber removal, it may be necessary to unfasten stopper strap to release shock absorber pressure.

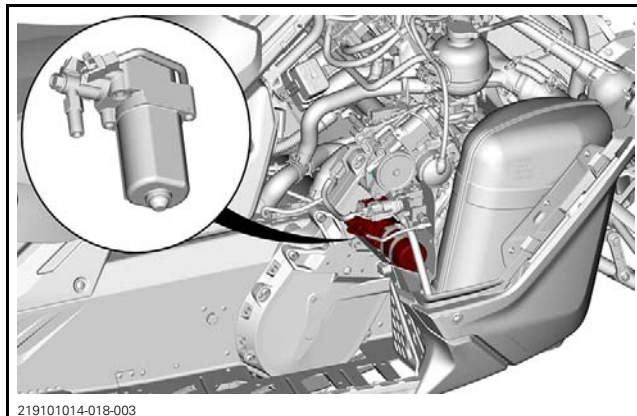
1. Lift rear of vehicle and support it off the ground.
2. Remove bolts and nuts from the shock absorber.
3. Remove rear shock absorber.

Installing the Rear Shock Absorber

The installation is the reverse of the removal procedure.

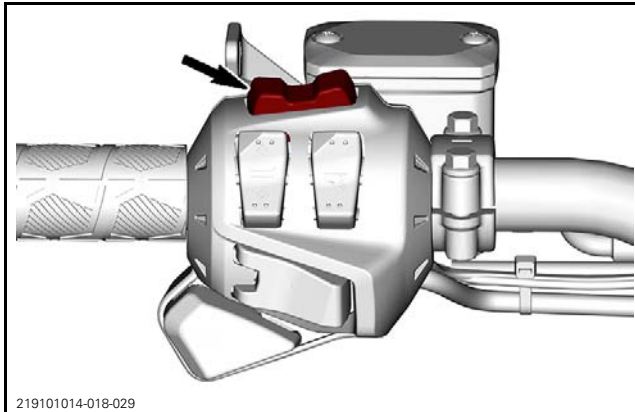
AIR CONTROLLED SUSPENSION (ACS) COMPRESSOR

The ACS compressor is located on the RH side of the vehicle, beside the muffler.

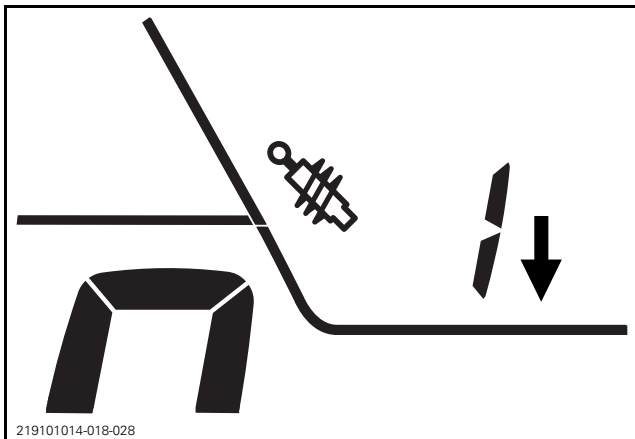


ACS System Air Pressure Release

1. Apply parking brake.
2. Start engine.
3. Press and hold MODE (M) button until requested setting starts flashing.
4. Set suspension mode to 1 (lowest pressure) by pressing the MODE (M) button to cycle through settings.



5. Wait until the actual setting shows 1 (lower display).



Testing the ACS Compressor with BUDS

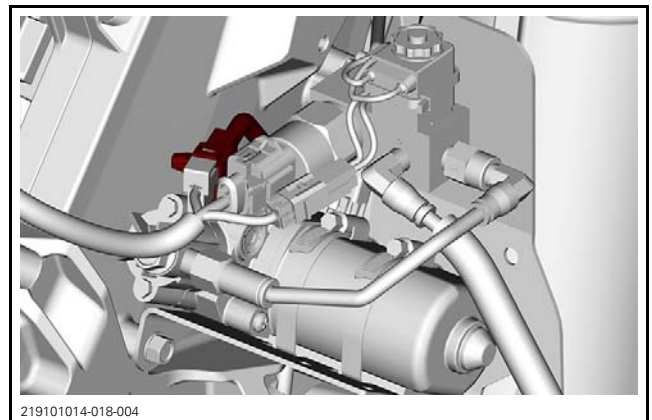
Connect the vehicle to the BRP diagnostic software (BUDS2) and activate the function *SUSPENSION POSITION*. Follow instruction on screen.

If necessary, proceed with the following sequence.

Testing the ACS Compressor Operation

NOTICE Do not power the ACS compressor directly with the battery for more than 10 seconds. Apply voltage quickly to ensure that the ACS compressor will not over pressurize the ACS system. Respect a 1 minute cool down between tests.

1. Release air pressure. Refer to *ACS SYSTEM AIR PRESSURE RELEASE* in this subsection.
2. Disconnect ACS compressor connector.

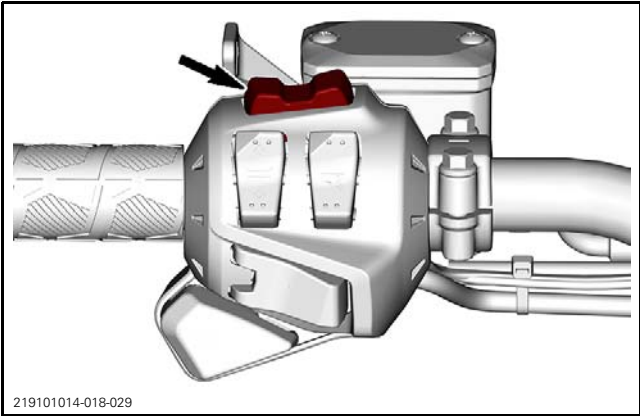


3. Connect ACS compressor connector pin 2 to a 15 A fuse jumper and then directly to the positive battery post.
4. Connect ACS compressor connector pin 1 directly to the negative battery post.
5. Verify if ACS compressor works properly.
 - If it works, carry out *TESTING THE ACS COMPRESSOR INPUT VOLTAGE*
 - If it does not work - replace the compressor.

Testing the ACS Compressor Input Voltage

1. Release air pressure. Refer to *ACS SYSTEM AIR PRESSURE RELEASE* in this subsection.
2. Set the multimeter to Vdc.
3. Disconnect ACS compressor connector.
4. Apply parking brake.
5. Start engine.
6. Press and hold MODE (M) button until requested setting starts flashing.
7. Set suspension mode to 2 by pressing the MODE (M) button to cycle through settings.

Subsection XX (AIR CONTROLLED SUSPENSION (ACS) SYSTEM)



8. Measure voltage as per the following table.

ACS COMPRESSOR INPUT VOLTAGE TEST		
COMPRESSOR CONNECTOR PIN		SPECIFICATIONS
1	4	Battery voltage

If voltage is not as specified, carry out the following.

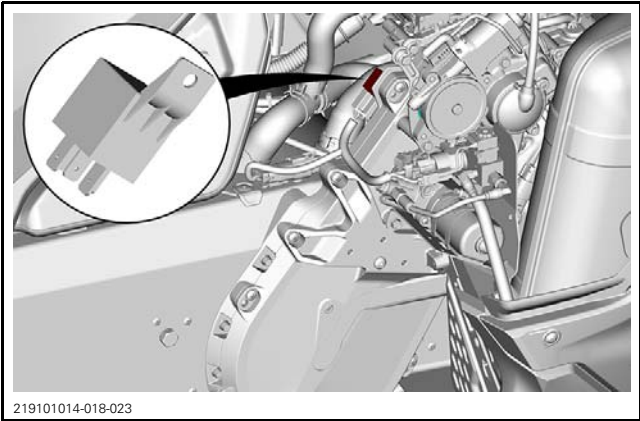
ACS COMPRESSOR INPUT VOLTAGE TEST		
COMPRESSOR CONNECTOR PIN	BATTERY	SPECIFICATIONS
2	Negative (-) post	Battery voltage

If voltage is to specification, check the compressor ground circuit continuity.

If voltage is not to specification, carry out *TESTING THE COMPRESSOR RELAY*.

Testing the Compressor Relay

The compressor relay is mounted on the chain-case.



1. Pull off the relay connector without completely removing it.

2. Install a fused jumper wire between pin 85 and battery positive (+) post.

If the relay "clicks", it is good and the compressor should start.

If the relay does not "click", replace the relay and retest.

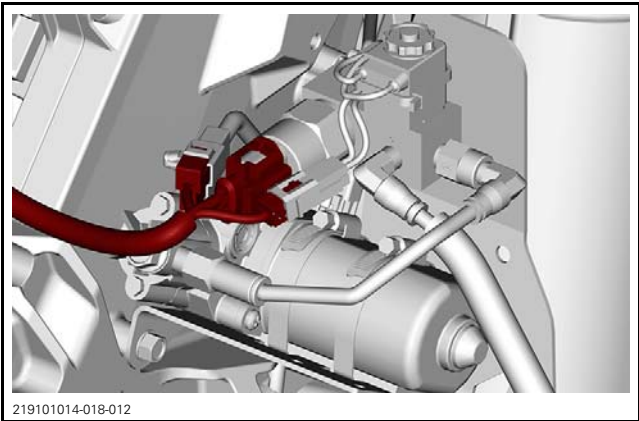
If the new relay does not "click":

- Check the fuse
- Check the relay control circuit continuity. Refer to *WIRING DIAGRAM*.

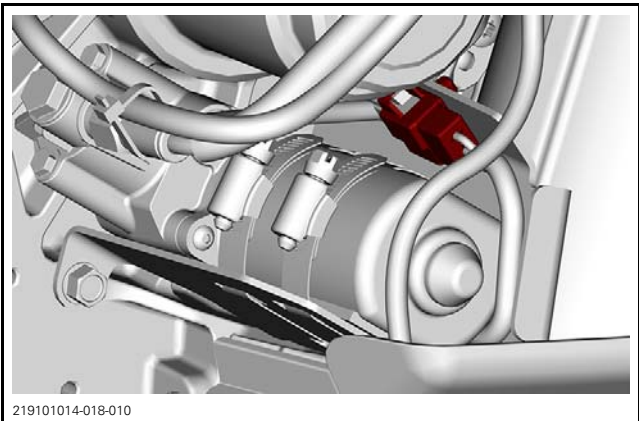
Removing the ACS Compressor

1. Release air pressure. Refer to *ACS SYSTEM AIR PRESSURE RELEASE* in this subsection.

2. Disconnect ACS harness connectors.



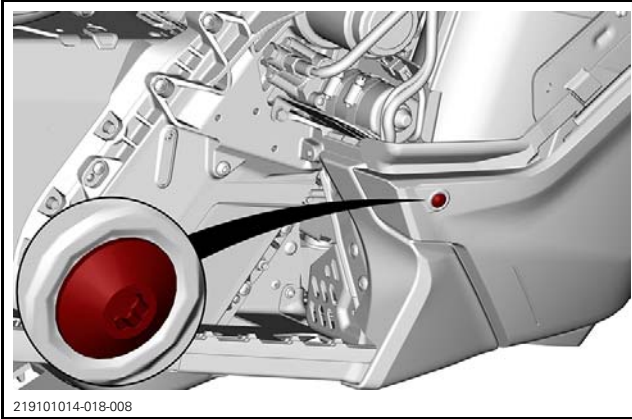
16in TRACK



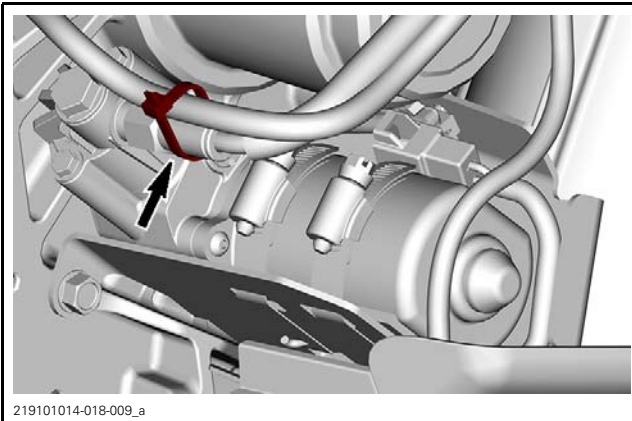
20in TRACK

With 20in Track

3. Remove RH side bottom pan rear screw to access compressor support screw.

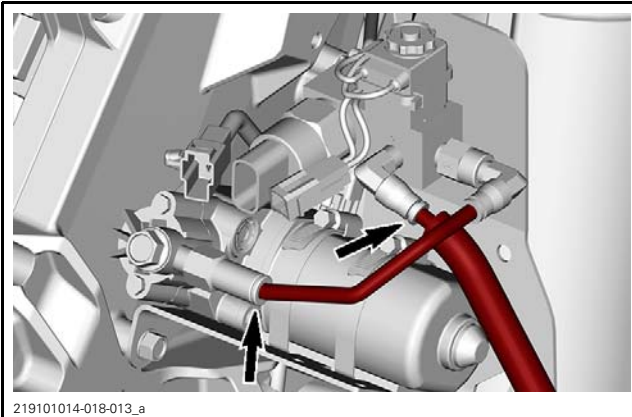


4. Cut ACS harness locking tie.

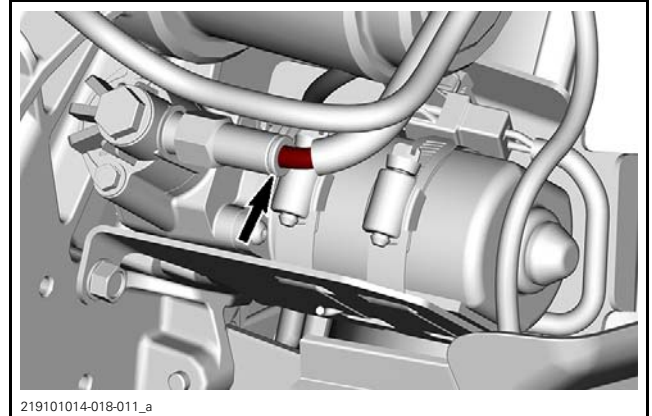


All Models

5. Disconnect hose from ACS compressor. Refer to *ACS HOSE REMOVAL AND INSTALLATION IN QUICK FITTING* in this subsection.

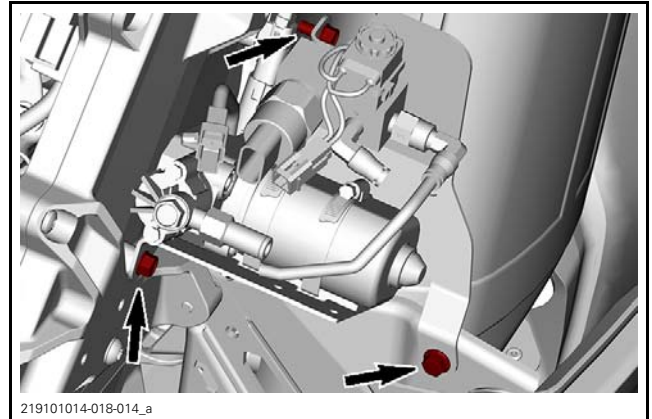


16in TRACK

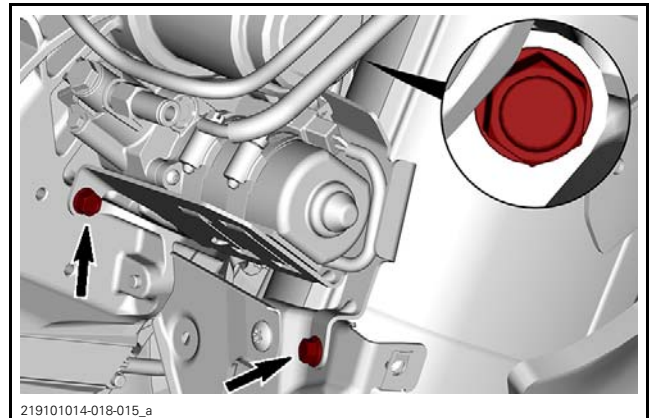


20in TRACK

6. Remove compressor support screws.

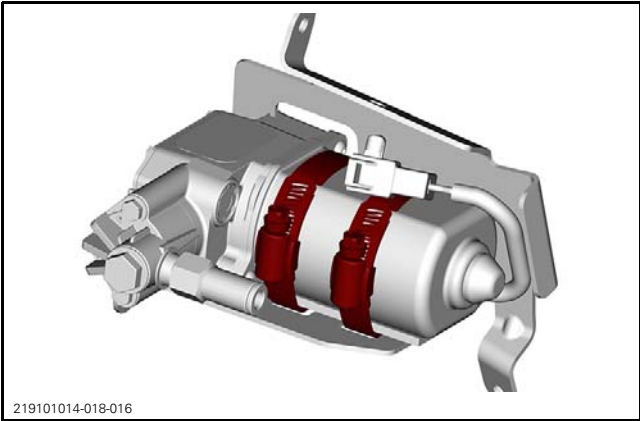


16in TRACK



20in TRACK

7. Loosen ACS compressor gear clamps.



8. Slide the compressor out of the clamps.

Installing the ACS Compressor

The installation is the reverse of the removal procedure.

CHECK VALVE

Testing Check Valve with BUDS

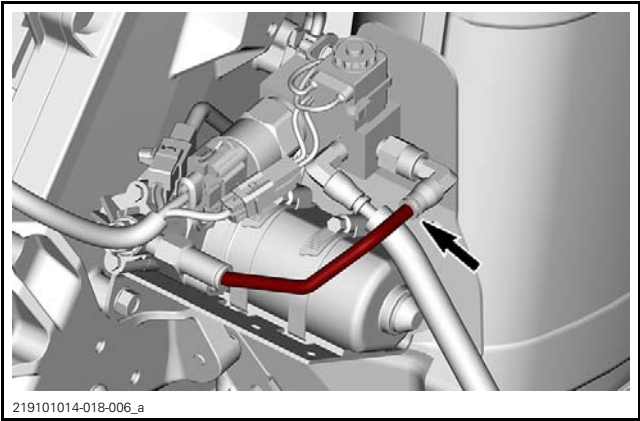
Connect the vehicle to the BRP diagnostic software (BUDS2) and activate the function *SUSPENSION POSITION*. Follow instruction on screen.

If necessary, proceed with the following sequence.

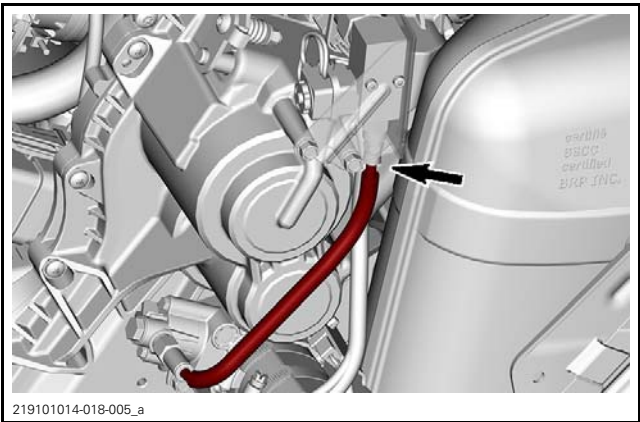
Check Valve Leak Test (ACS Compressor)

REQUIRED TOOL	
ENGINE LEAK DOWN TEST KIT (P/N 529 035 661)	

- 1. Release air pressure. Refer to *ACS SYSTEM AIR PRESSURE RELEASE* in this subsection.
- 2. Disconnect inlet hose from ACS manifold. Refer to *ACS HOSE REMOVAL AND INSTALLATION IN QUICK FITTING* in this subsection.

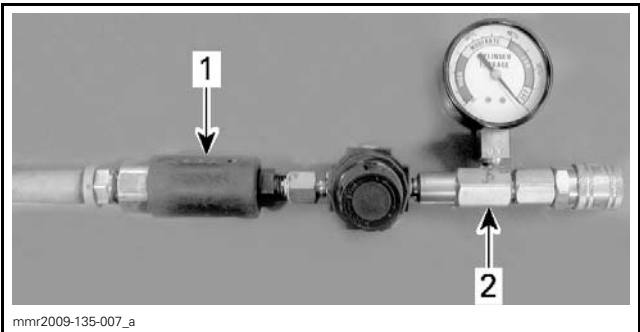


16in TRACK



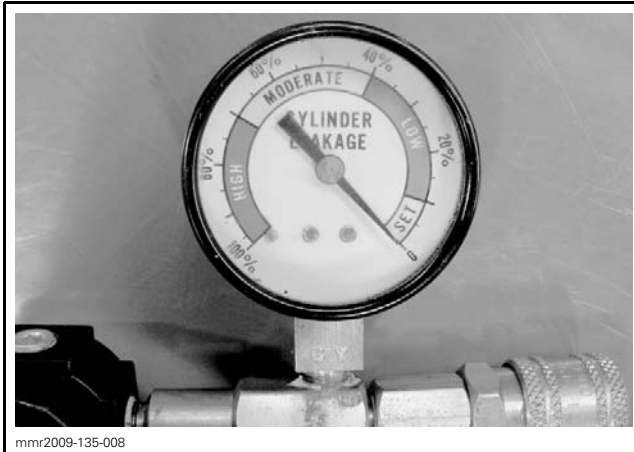
20in TRACK

- 3. Connect workshop air supply into engine leak down test kit.



- 1. Workshop air supply
- 2. Engine leak down test kit

- 4. Adjust engine leak down test kit reading to 0 using knob.



5. Connect a suitable adapter between the manifold hose end and engine leak down test kit output hose.
6. Refer to the following table for check valve leak.

LEAK PERCENTAGE	CHECK VALVE
Below 10%	Good (do not replace)
Above 10%	Faulty (replace it)

Replacing the ACS Check Valve

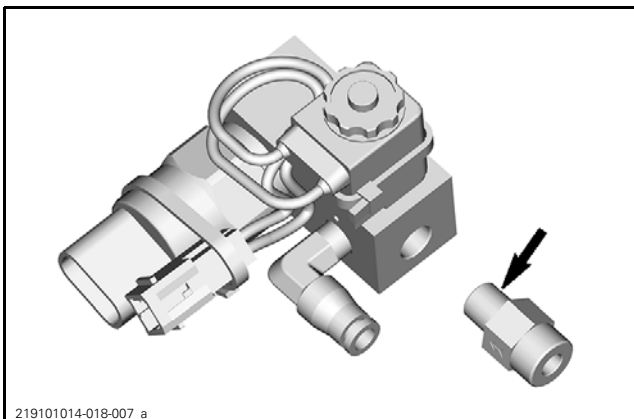
NOTE: It is not required to remove the manifold from its support.

1. Disconnect hose from quick fitting.
2. Remove quick fitting and check valve.

At check valve installation, pay attention to the following.

Apply pipe sealant on threads of the check valve.

SERVICE PRODUCT
LOCTITE 592 (PIPE SEALANT) (P/N 293 800 018)



TIGHTENING TORQUE	
Check valve (to manifold)	13 N•m ± 1 N•m (115 lbf•in ± 9 lbf•in)

PRESSURE SENSOR (PS)

Testing the PS Input Voltage

1. Disconnect PS connector.
2. Set the multimeter to Vdc.
3. Apply parking brake.
4. Start engine.
5. Measure voltage as per the following table.

PS INPUT VOLTAGE TEST		
PS CONNECTOR PIN		SPECIFICATIONS
1	3	Battery voltage

If reading is to specification, carry out *TESTING THE PS SIGNAL VOLTAGE*.

If reading is out of specification, carry out *TESTING THE PS CIRCUIT CONTINUITY*.

Testing the PS Circuit Continuity

1. Disconnect PS connector.
2. Set the multimeter to Vdc.
3. Measure voltage as per the following table.

PS CIRCUIT CONTINUITY TEST		
PS CONNECTOR PIN	BATTERY	SPECIFICATIONS
3	Positive (+) post	Battery voltage

If reading is out of specification, check the fuse, connector and wire. Repair if required.

If reading is to specification, carry out the following.

PS INPUT VOLTAGE TEST		
PS CONNECTOR PIN	BATTERY	SPECIFICATIONS
1	Negative (-) post	Battery voltage

If reading is out of specification, check the fuse, connector and wire. Repair if required.

Testing the PS Signal Voltage

1. Set the multimeter to Vdc.
2. Apply parking brake.
3. Start engine.
4. Using backprobes, measure as per the following table.

Subsection XX (AIR CONTROLLED SUSPENSION (ACS) SYSTEM)

PS SIGNAL WIRE CONTINUITY TEST			
PS CONNECTOR PIN		SUSPENSION SETTING	SPECIFICATIONS
2	3	1	0.5 Vdc (approx.)
		3	2.5 Vdc (approx.)
		5	4.5 Vdc (approx.)

If reading is to specification, carry out *TESTING THE PS SIGNAL CIRCUIT CONTINUITY*.

Testing the PS Signal Circuit Continuity

- 1. Disconnect multifunction gauge connector. Refer to *BODY* subsection.
- 2. Disconnect PS connector. Refer to *REMOVING THE PS*.
- 3. Set the multimeter to Ω .
- 4. Measure resistance as per the following table.

PS SIGNAL CIRCUIT CONTINUITY TEST		
PS CONNECTOR PIN	GAUGE CONNECTOR PIN	SPECIFICATIONS
2	5	Close to 0 Ω

If reading is to specification, the problem may come from the gauge.

If reading is not to specification, check and repair connectors or wire.

Removing the PS

- 1. Release air pressure. Refer to *ACS SYSTEM AIR PRESSURE RELEASE* in this subsection.
- 2. Remove the manifold from its support. Refer to *REMOVING THE MANIFOLD*.
- 3. Place the manifold in a vise.
- 4. Remove the PS.

Installing the PS

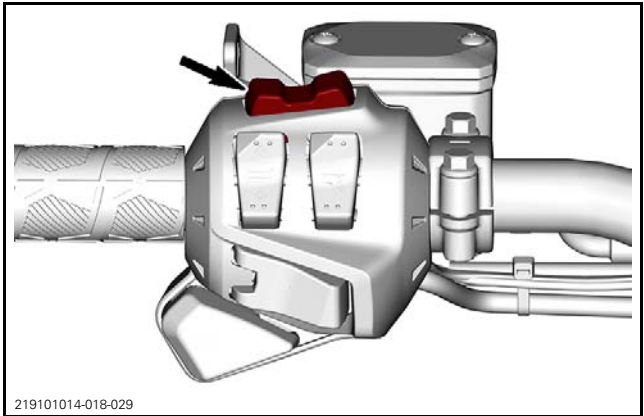
The installation is the reverse of the removal procedure. However, pay attention to the following. Tighten PS to specification.

TIGHTENING TORQUE	
Pressure sensor	27.5 N•m $\pm$ 2.5 N•m (20 lbf•ft $\pm$ 2 lbf•ft)

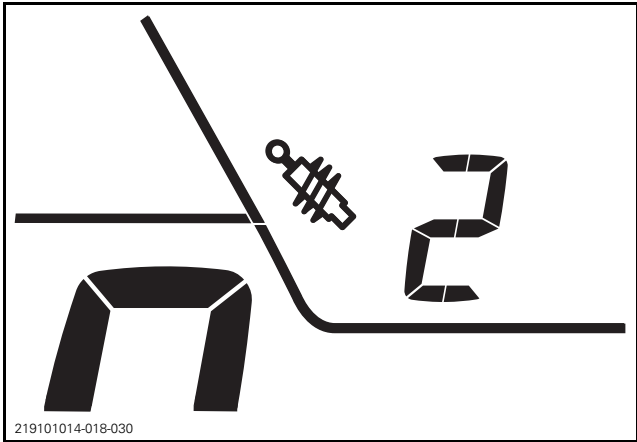
ACS SOLENOID VALVE

Testing the ACS Solenoid Valve Operation

- 1. Apply parking brake.
- 2. Start engine.
- 3. Press and hold MODE (M) button until requested setting starts flashing.
- 4. Set suspension mode to 2 by pressing the mode (M) button to cycle through setting.

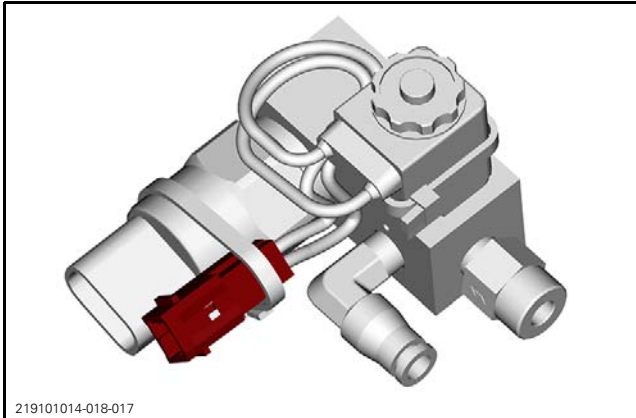


- 5. Wait until the actual setting shows 2.



NOTE: Make sure to let the system adjust the air pressure.

- 6. Stop engine.
- 7. Open RH side panel.
- 8. Disconnect solenoid valve connector.



9. Connect solenoid valve connector pin 2 to a 15 A fuse jumper and then directly to the positive battery post.

NOTE: Apply voltage shortly to ensure that the valve will not completely empty the ACS system.

10. Connect solenoid valve connector pin 1 directly to the negative battery post.
11. Verify that air exits from solenoid valve area to confirm solenoid operation.

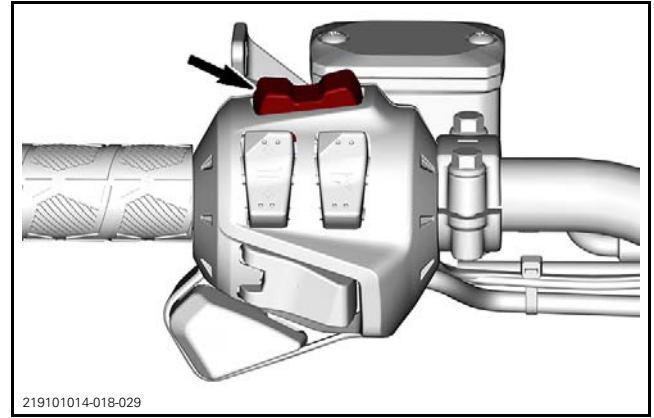
Testing the ACS Solenoid Valve Input Voltage

1. Install D.E.S.S. key on its post.
2. Make sure the emergency stop switch is in RUN position.
3. Measure voltage as per following table.

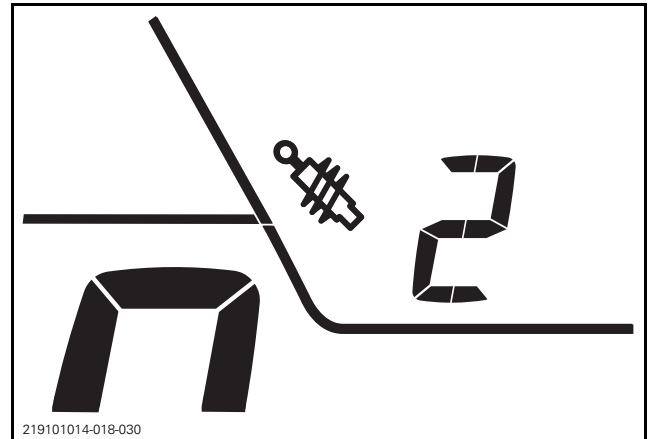
SOLENOID INPUT VOLTAGE TEST		
SOLENOID CONNECTOR PIN	BATTERY	SPECIFICATIONS
2	Negative (-) post	Battery voltage

Testing the ACS Solenoid Valve Input Voltage (Dynamic)

1. Apply parking brake.
2. Start engine.
3. Press MODE (M) button until requested setting starts flashing.
4. Set suspension mode to 2 by pressing the MODE (M) button to cycle through settings.



5. Wait until the actual setting shows 2 (lower display).



NOTE: Make sure to let the system adjust the air pressure.

6. Set the multimeter to Vdc.
7. Open RH side panel.
8. Back probe solenoid connector (without disconnecting).
9. Press and hold MODE (M) button until requested setting flash.
10. Set suspension mode to 1 by pressing the MODE (M) button to cycle through settings.
11. Measure voltage between solenoid connector terminals as per the following table.

PS INPUT VOLTAGE TEST		
PS CONNECTOR PIN	BATTERY	SPECIFICATIONS
1	Negative (-) post	Battery voltage

If voltage is not as specified, test ground and input voltage circuits separately.

Subsection XX (AIR CONTROLLED SUSPENSION (ACS) SYSTEM)

Removing the ACS Solenoid Valve

ACS solenoid valve is part of the ACS manifold. Refer to *REMOVING THE ACS MANIFOLD*.

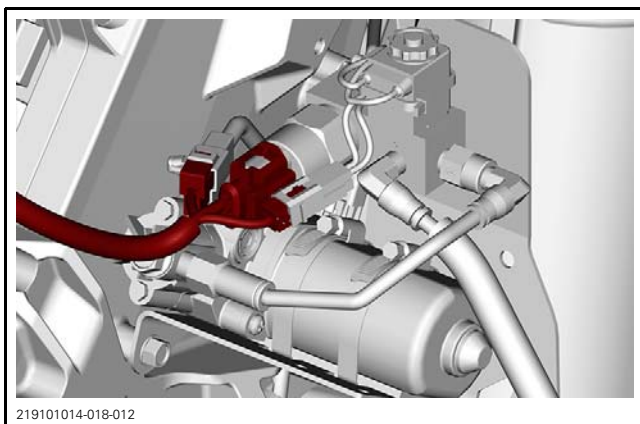
ACS MANIFOLD

Removing the ACS Manifold

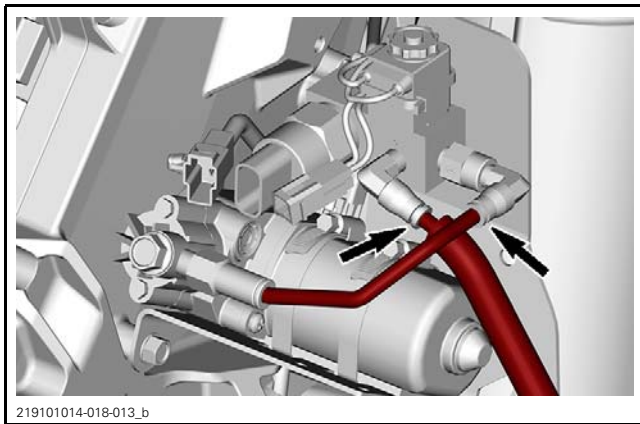
1. Release air pressure. Refer to *ACS SYSTEM AIR PRESSURE RELEASE* in this subsection
2. Remove RH side panel.

With 16in Track

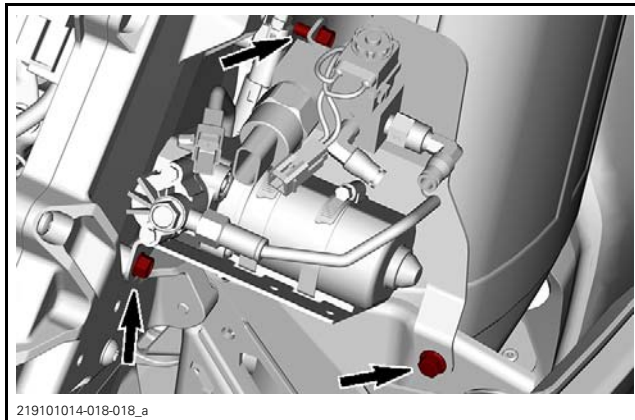
3. Disconnect manifold connectors.



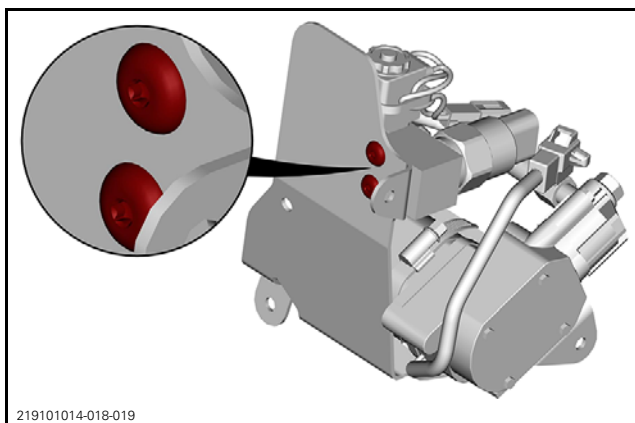
4. Disconnect all hoses from manifold.



5. Remove manifold support screws.

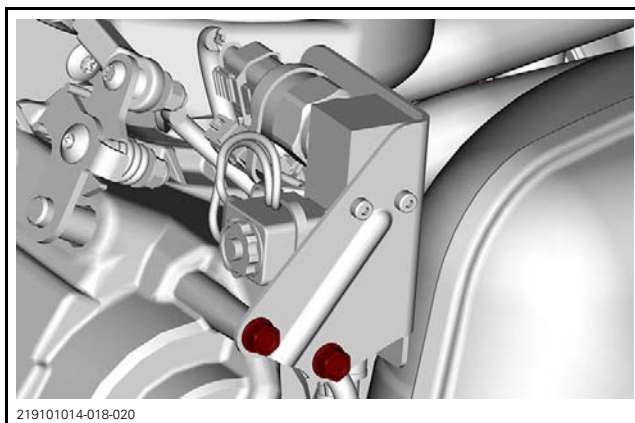


6. Remove manifold retaining screws.

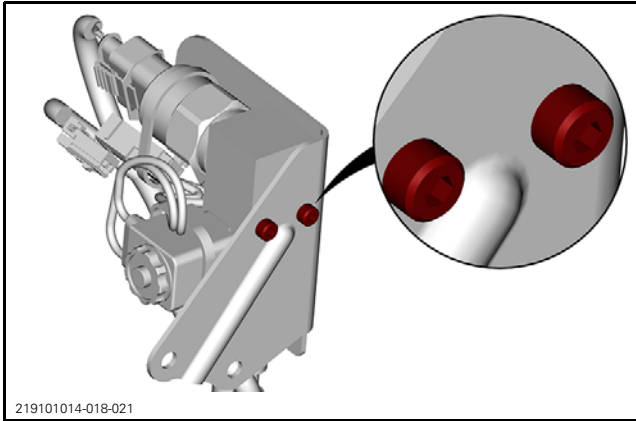


With 20in Track

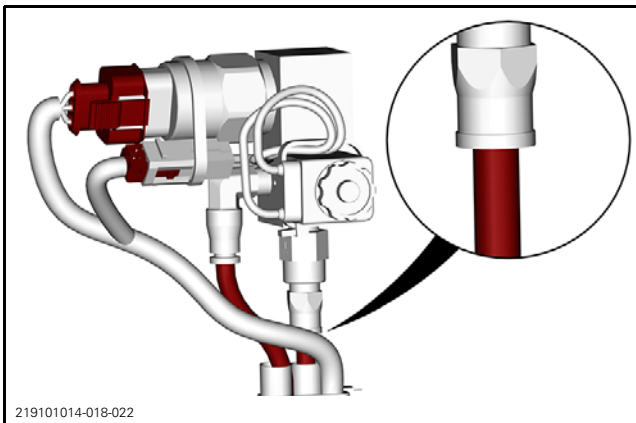
7. Remove manifold support screws.



8. Remove manifold retaining screws.



9. Disconnect manifold connectors and hoses.



Installing the ACS Manifold

The installation is the reverse of the removal procedure.

ACS Manifold Quick Fitting

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

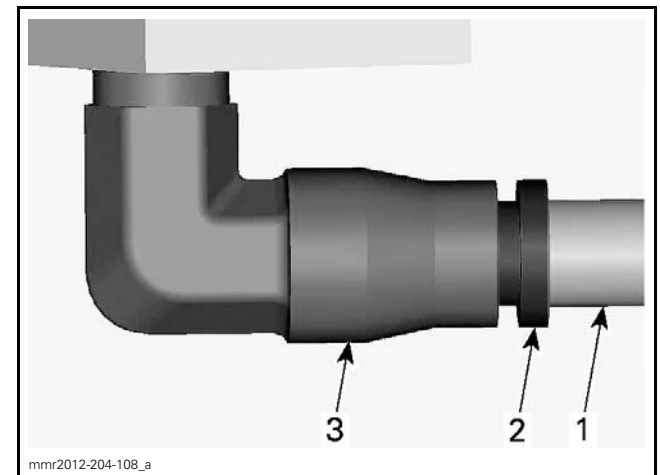
TIGHTENING TORQUE	
Straight quick fittings	13 N•m ± 1 N•m (115 lbf•in ± 9 lbf•in)
	+ LOCTITE 592 (PIPE SEALANT) (P/N 293 800 018)
90° quick fitting	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)
	+ LOCTITE 592 (PIPE SEALANT) (P/N 293 800 018)

ACS HOSES

ACS Hose Removal and Installation in Quick Fitting

Release air pressure, refer to *ACS SYSTEM AIR PRESSURE RELEASE* in this subsection.

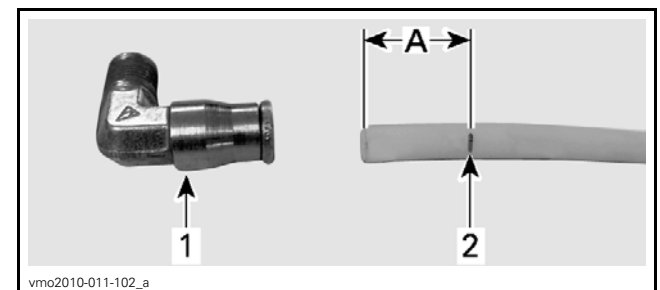
1. To disconnect ACS hose from the quick fitting, proceed as follows:
 - 1.1 Push ring towards hose fitting.
 - 1.2 Hold ring in place.
 - 1.3 Pull out ACS hose.



1. Hose
2. Ring
3. Fitting

2. To connect ACS hose to the quick fitting, proceed as follows:

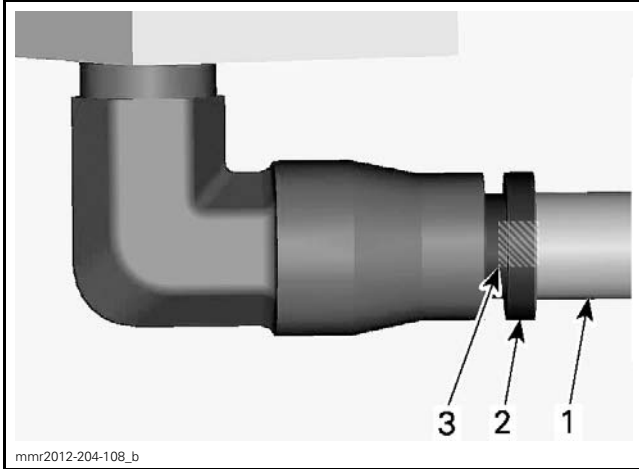
- 2.1 Insert ACS hose (approx. 17 mm (.67 in)) into fitting ring until the painted mark disappears under the fitting.



PUSH HOSE UNTIL THE MARK IS COMPLETELY INSERTED

1. Fitting
 2. Painted mark
- A. approx. 17 mm (.67 in)

Subsection XX (AIR CONTROLLED SUSPENSION (ACS) SYSTEM)



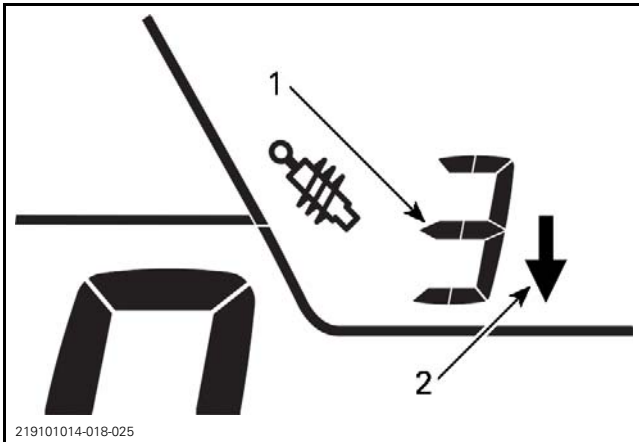
1. Hose
2. Ring
3. Painted mark

- The long hose in the running board roller
- In the compressor area.

2.2 The ring will automatically lock the ACS hose.

ACS Hose Leak Test

1. Apply parking brake.
2. Start engine.
3. Press and hold MODE (M) button until requested setting starts flashing.
4. Set suspension mode to **3** by pressing the MODE (M) button to cycle through settings.
5. Wait until the actual setting shows 3 (lower display).



1. Requested setting (Flashing when being selected)
2. Pressure decreasing

NOTE: Make sure to let the system adjust the air pressure.

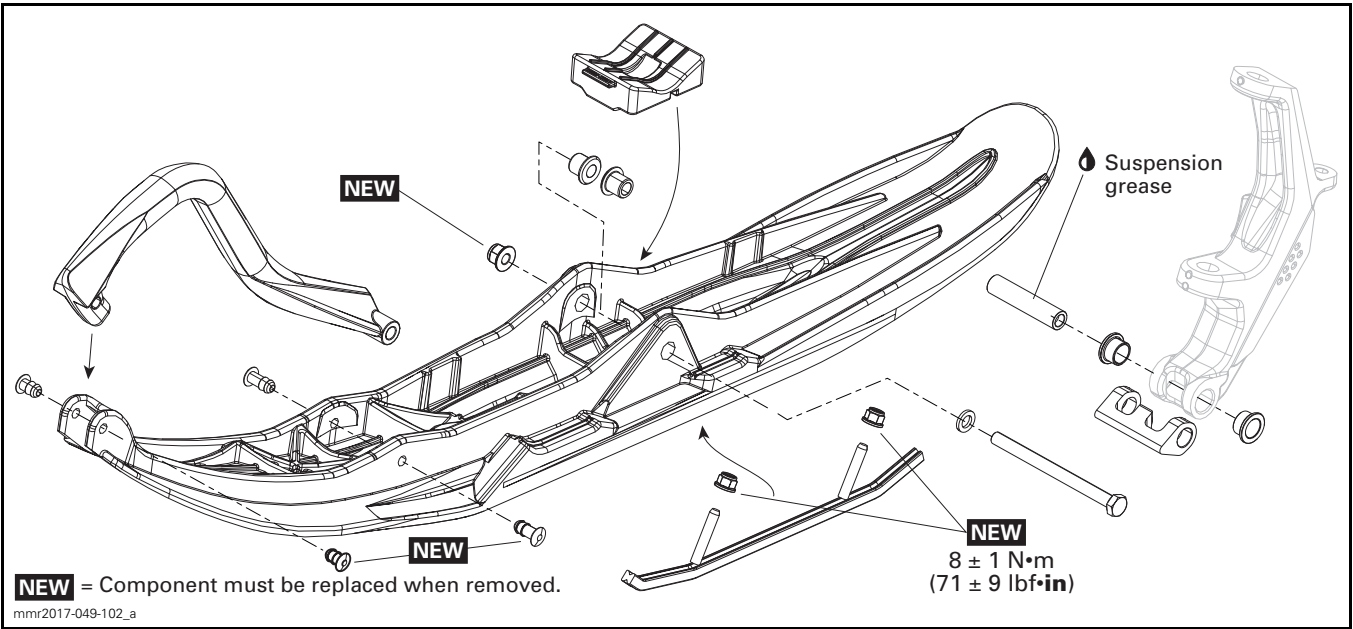
6. Inspect all hoses and fittings with soapy water to detect leaks.
 - At the shock absorber
 - Under the running board

STEERING SYSTEM

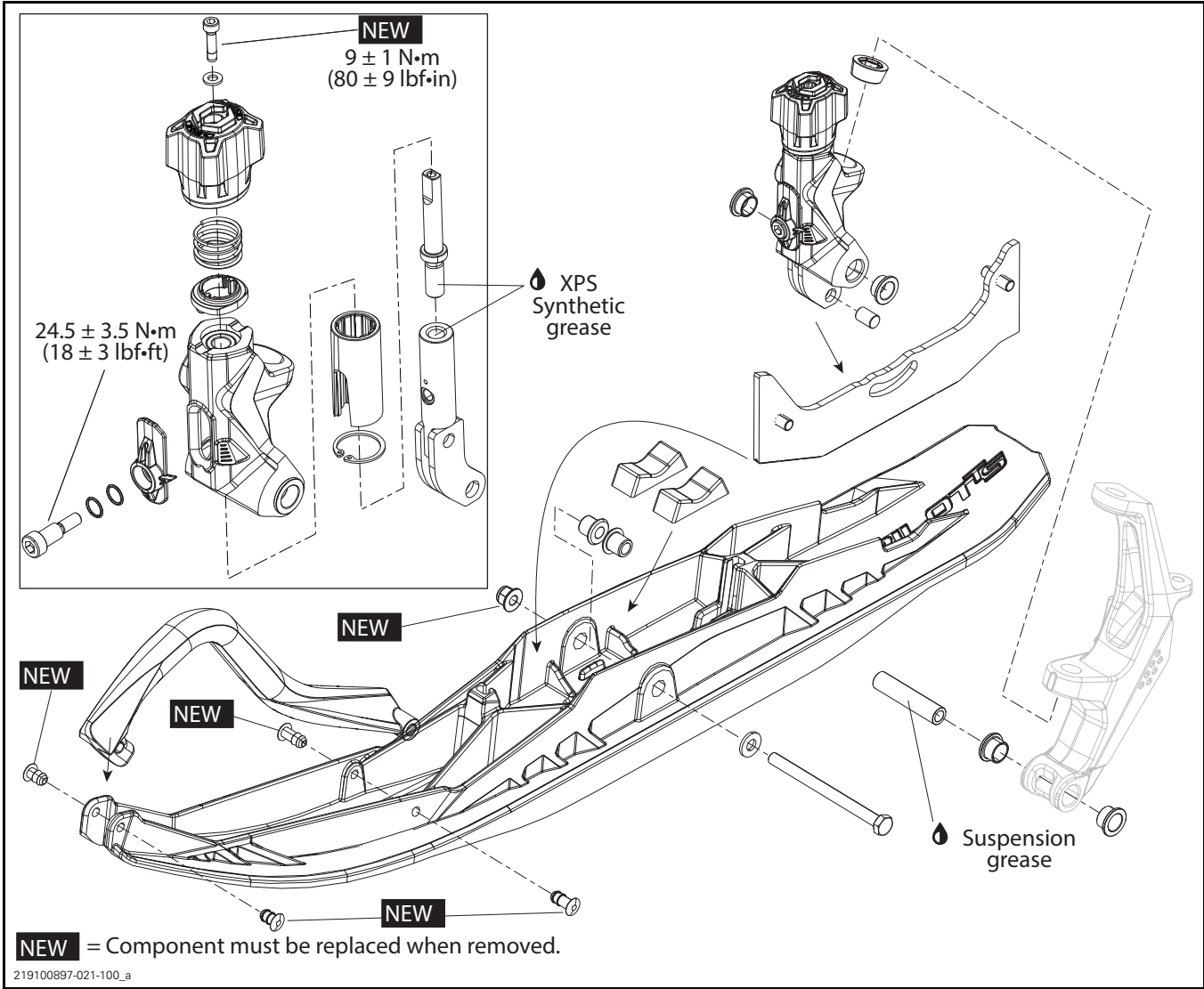
SERVICE PRODUCTS

Description	Part Number	Page
SYNTHETIC GREASE	779162	12
SYNTHETIC SUSPENSION GREASE.....	779163	8, 21
XPS BRAKES AND PARTS CLEANER (USA)	219 701 705	11
XPS BRAKES AND PARTS CLEANER	219 701 776	11

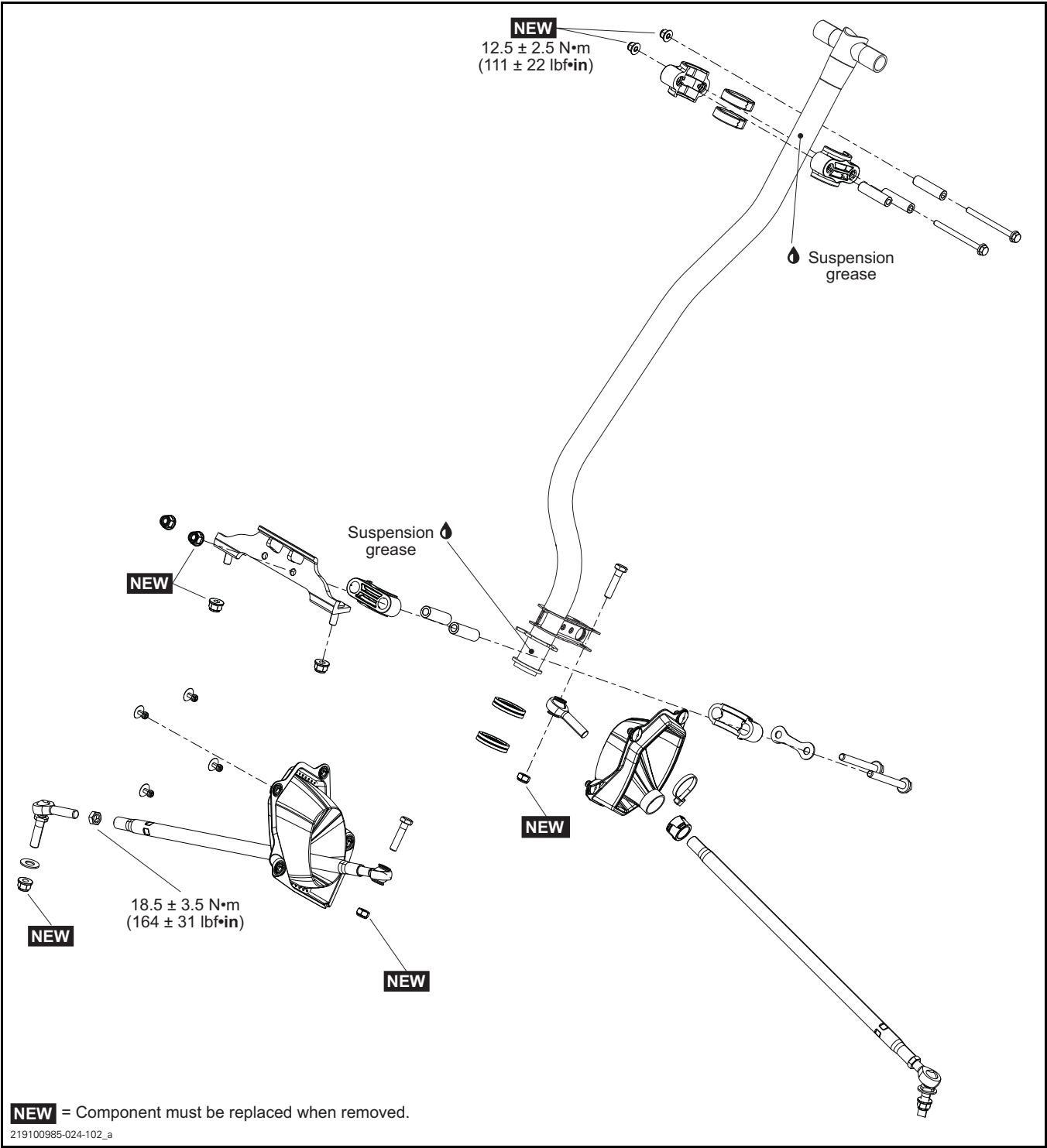
SKIS (WITHOUT ADJUSTABLE RUNNER)



SKIS (WITH ADJUSTABLE RUNNER)

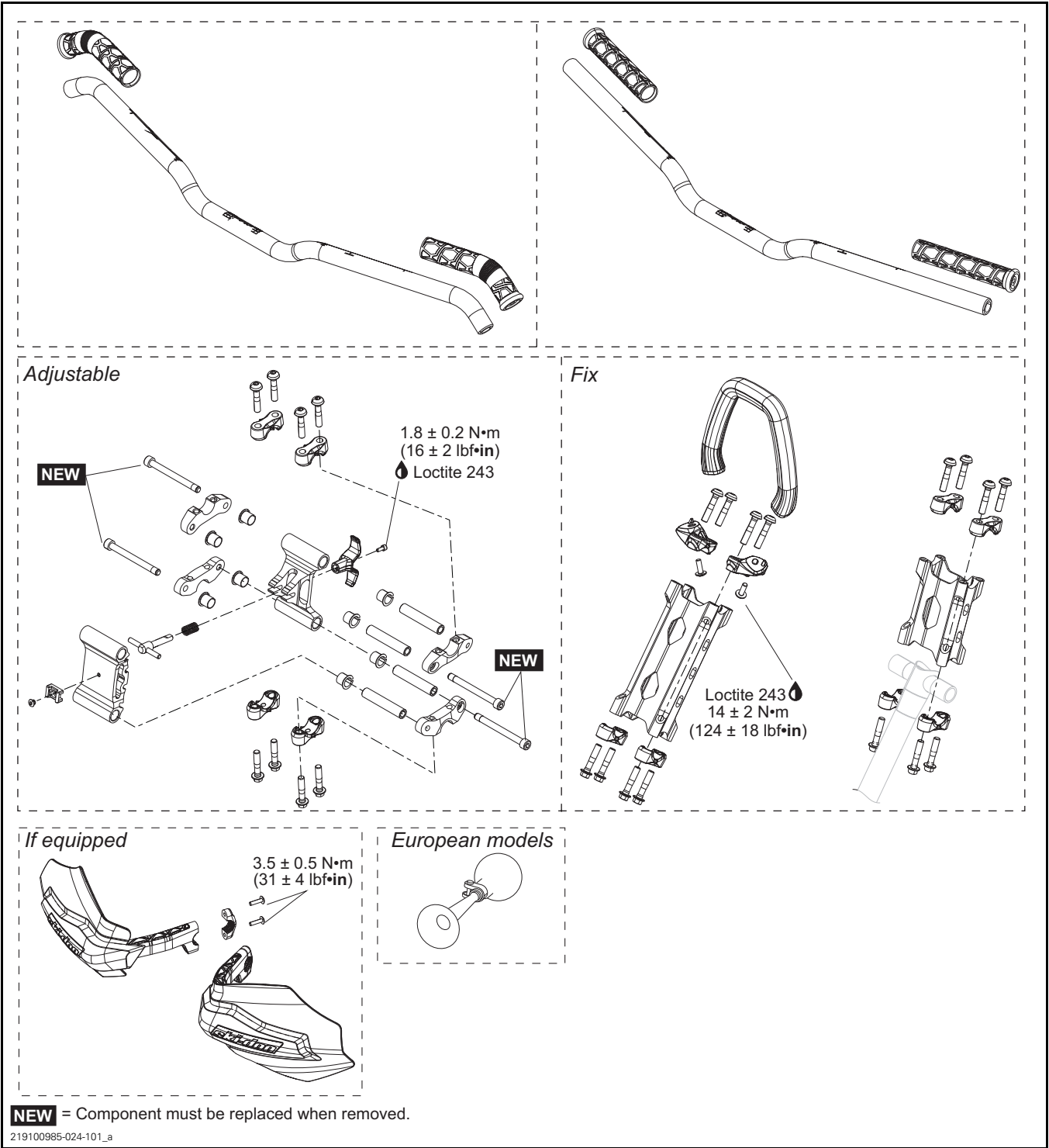


STEERING COLUMN AND TIE-RODS - PITMAN ARM





HANDLEBAR



GENERAL

When removing or replacing a part of the steering mechanism, perform the steering alignment, refer to *ALIGNING THE STEERING* in this subsection.

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

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

 **WARNING**

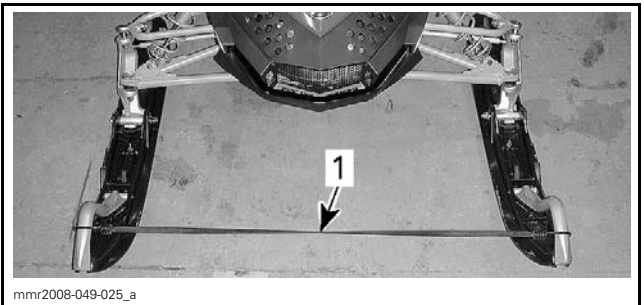
Torque wrench tightening specifications must be strictly adhered to.
Locking devices when removed (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced.

NOTICE Hoses, cables and locking ties removed during a procedure must be reinstalled at the same location.

ADJUSTMENT

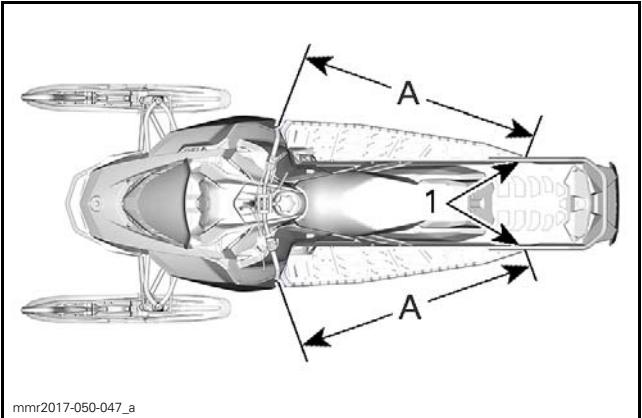
ALIGNING THE STEERING

- Ski alignment is performed by adjusting the length of left and right tie-rods.
1. Leave the vehicle on the ground on its own weight.
 2. Attach ski handles together with a bungee cord.



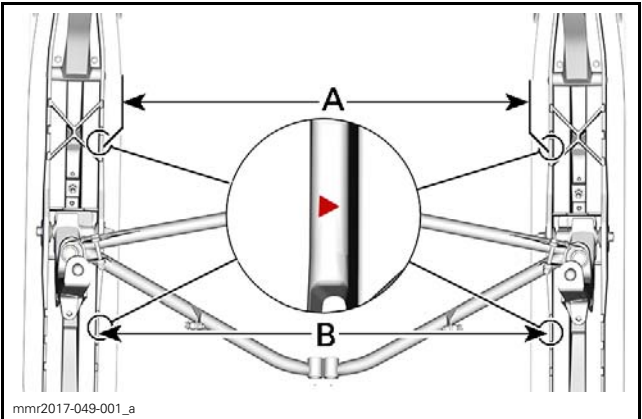
TYPICAL
1. Bungee cord

3. Position handlebar so that it is straight ahead position by measuring from the extremities of the grips to the rear most edge of the tunnel, as shown.
- NOTE:** The reference point must be the same to each side.



TYPICAL
1. Same reference point
A. Equal distance on each side

4. Ensure track is properly aligned.
5. Verify if skis are in straight-ahead position by placing a straight edge against track and measuring distance between front and rear ski bridges and straight edge.
6. With skis in straight ahead position, adjust the toe-out.
7. Measure the distance between front and rear ski bridges in line with arrows on skis.
8. Use the following illustration and this equation to determine the steering adjustment.

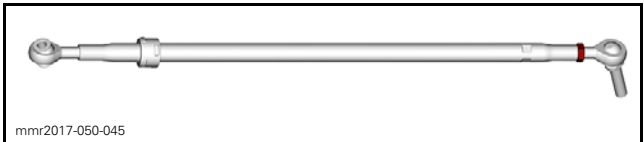


STEERING ALIGNMENT	
Toe-out	$A - B = 5 \text{ mm } (.197 \text{ in})$

9. If adjustment is needed, loosen tie-rod jam nuts then turn tie-rods to change their length.
10. Tighten jam nuts to specification.

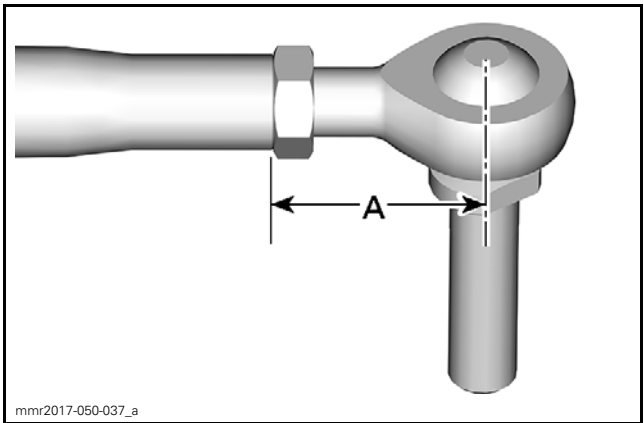
NOTE: There is no jam nut on the inner tie-rods.

TIGHTENING TORQUE	
Jam nut	18.5 N•m ± 3.5 N•m (164 lbf•in ± 31 lbf•in)



 **WARNING**

The maximum tie-rod end length (A) not engaged in the tie rod must not exceed 34 mm (1.339 in).



INSPECTION

INSPECTING THE SKI AND RUNNER

Lift the front of vehicle and check ski runners for wear or damage (missing or broken carbide). Replace if necessary.

Inspect ski for excessive wear or other damage. Replace if necessary.

Refer to *ADJUSTABLE RUNNER MECHANISM* in this subsection for adjustable ski mechanism inspection.

INSPECTING THE STEERING MECHANISM

Visually inspect steering mechanism for tightness of components (steering arms, tie rods, ski bolts, ski legs, etc.).

PROCEDURES

SKI RUNNER

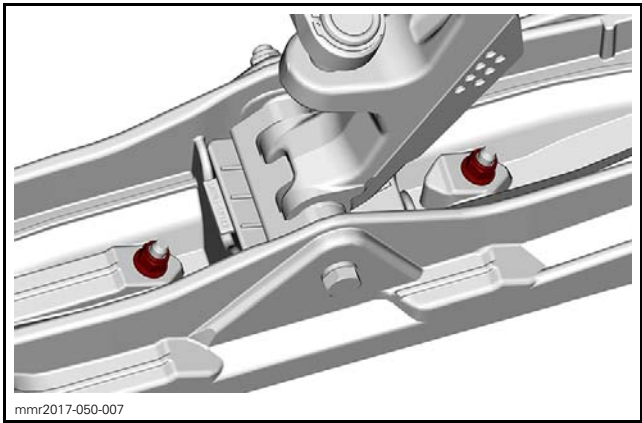
Inspecting the Ski Runner

Refer to *INSPECTION*.

Removing the Ski Runner

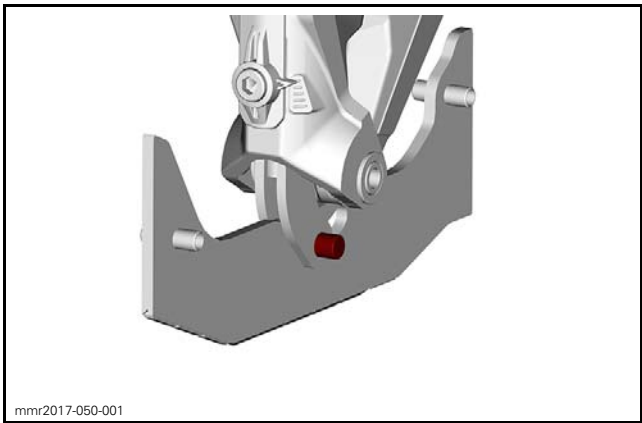
Ski Without Adjustable Runner

1. Lift the front of vehicle and support it off the ground.
2. Unscrew the ski runner nuts, then remove the ski runner.



Ski With Adjustable Runner

1. Remove the ski.
2. Remove the pin.



Installing the Ski Runner

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

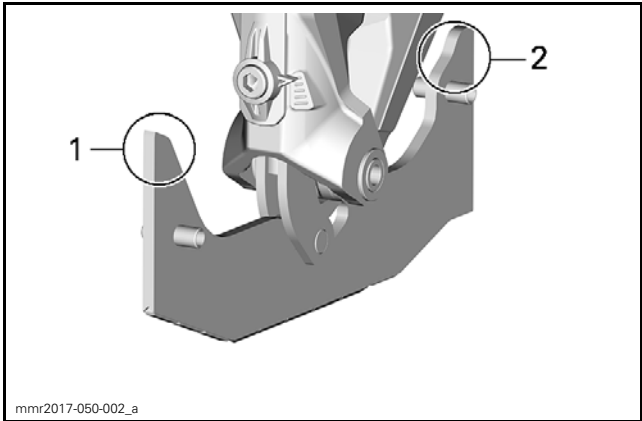
Ski Without Adjustable Runner

Tighten ski runner nuts to specification.

Subsection XX (STEERING SYSTEM)

TIGHTENING TORQUE	
Runner nut	8 N•m ± 1 N•m (71 lbf•in ± 9 lbf•in)

Ski With Adjustable Runner



- 1. Towards front
- 2. Towards rear

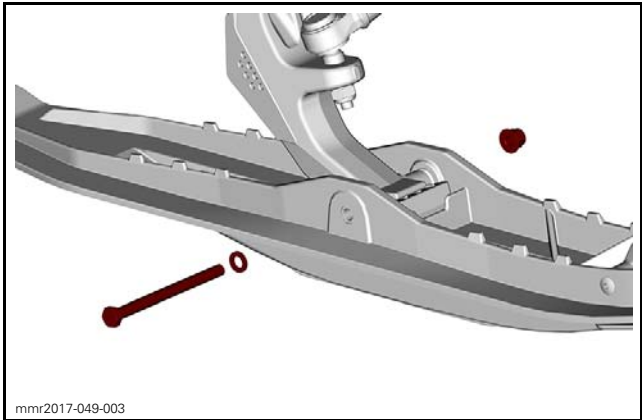
SKIS

Inspecting the Ski

Refer to *INSPECTION*.

Removing the Ski

- 1. Lift front of vehicle and support it off ground.
- 2. Unscrew nut then pull ski bolt out.

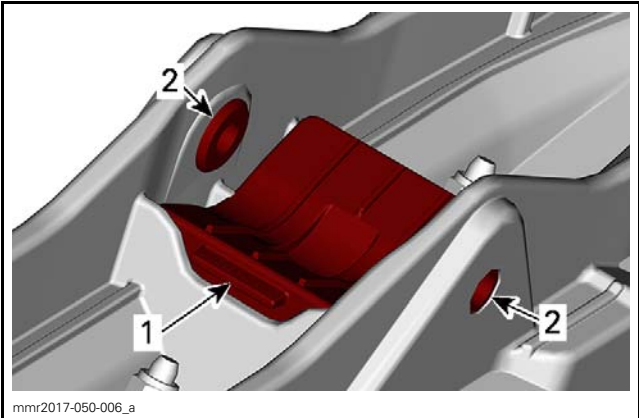


- 3. Remove ski from vehicle.

Installing the Ski - Without Adjustable Runner

Make sure bushings are installed in ski holes.

Install the ski stopper. Position indicator in front and make sure the bump in the ski is in the groove of the ski stopper.

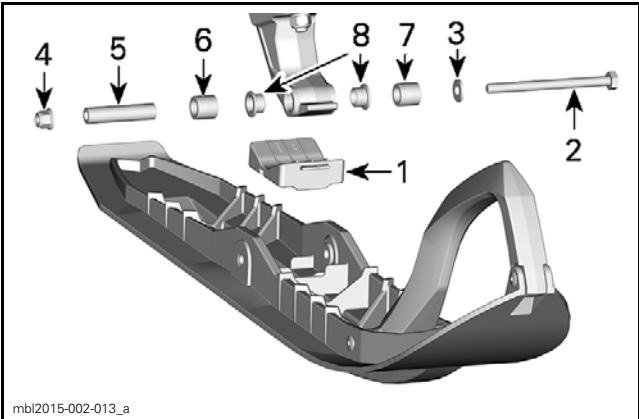


- 1. Ski stopper
- 2. Bushings

Apply grease on the ski axle.

SERVICE PRODUCT
SYNTHETIC SUSPENSION GREASE (P/N 779163)

With Adjustable Ski Stance



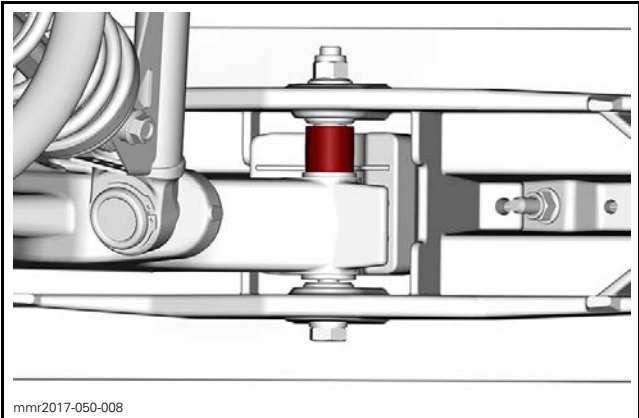
LH SIDE SHOWN

- 1. Ski stopper
- 2. M10 x 130 screw
- 3. M10 flat washer
- 4. M10 flanged nut
- 5. Ski axle
- 6. Narrow adjustment
- 7. Wide adjustment

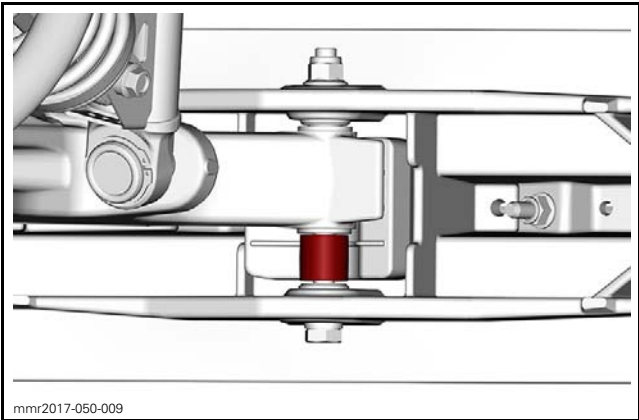
Install the spacer inside for the narrower stance and outside for the wider stance.

 **WARNING**

Proceed to the same setting for both skis.



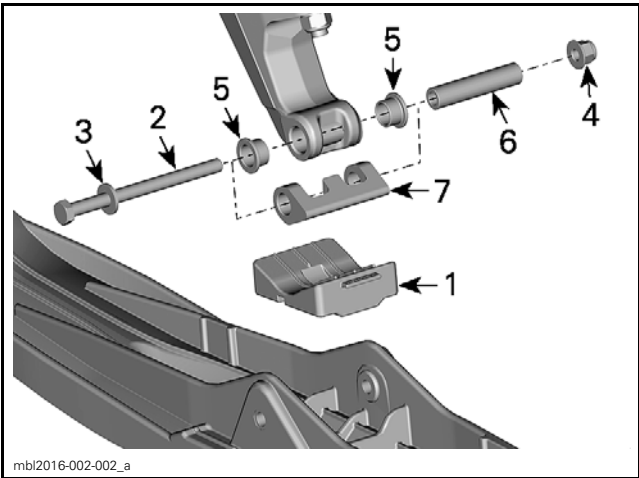
NARROWER STANCE — RIGHT SKI SHOWN



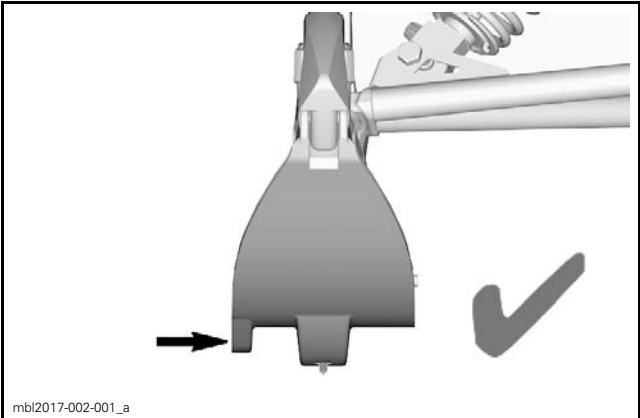
WIDER STANCE — RIGHT SKI SHOWN

Without Adjustable Ski Stance

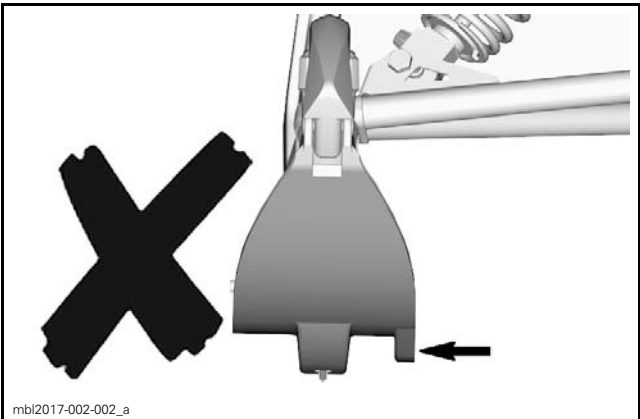
Install ski on ski leg as per the following illustrations.



- 1. Ski stopper
- 2. M10 x 130 screw
- 3. M10 flat washer
- 4. M10 flanged nut
- 5. Ski leg bushings
- 6. Ski Axle
- 7. Ski leg stopper



LATERAL SKI KEEL TOWARDS OUTSIDE (IF EQUIPPED) - CORRECT



LATERAL SKI KEEL TOWARDS INSIDE (IF EQUIPPED) - NOT CORRECT

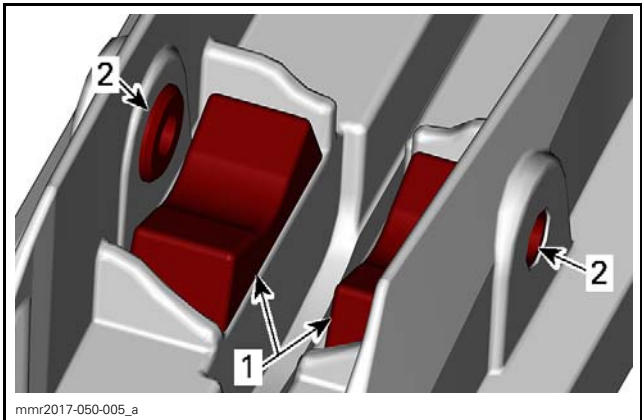
All Models

TIGHTENING TORQUE	
Ski nut	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)

Installing the Ski With Adjustable Runner

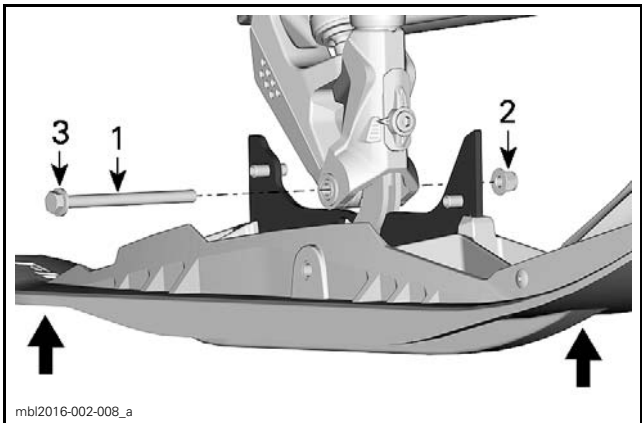
Make sure bushings are installed in ski holes.
Install the ski stopper.

Subsection XX (STEERING SYSTEM)

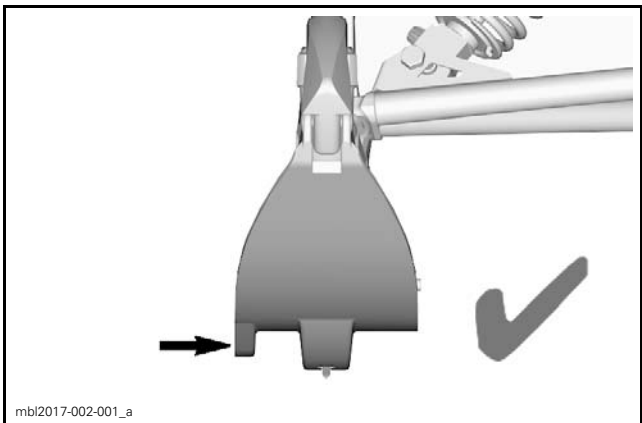


- 1. Ski stopper
- 2. Bushings

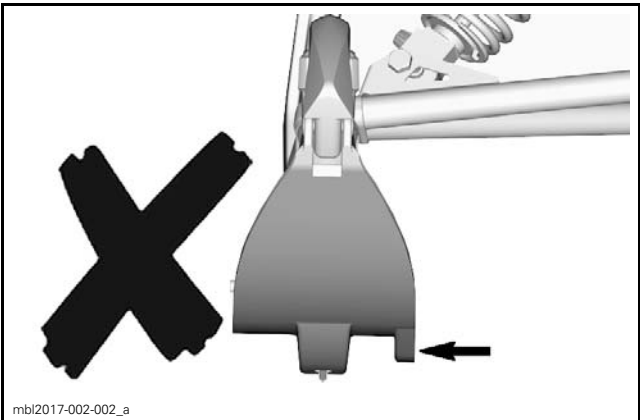
Install ski on ski leg as per the following illustrations.



- 1. Ski screw
- 2. Nut
- 3. Washer



LATERAL SKI KEEL TOWARDS OUTSIDE (IF EQUIPPED) - CORRECT



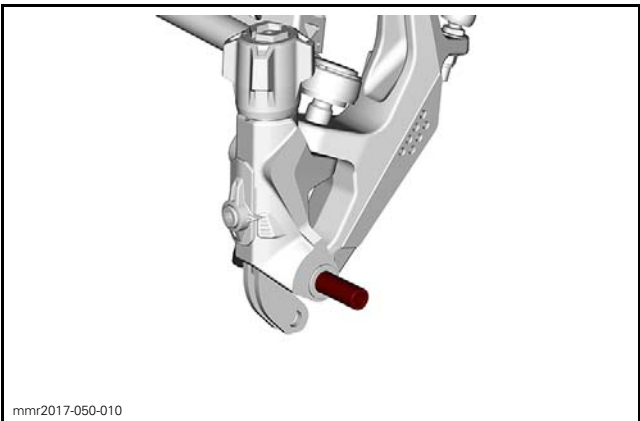
LATERAL SKI KEEL TOWARDS INSIDE (IF EQUIPPED) - NOT CORRECT

TIGHTENING TORQUE	
Ski nut	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)

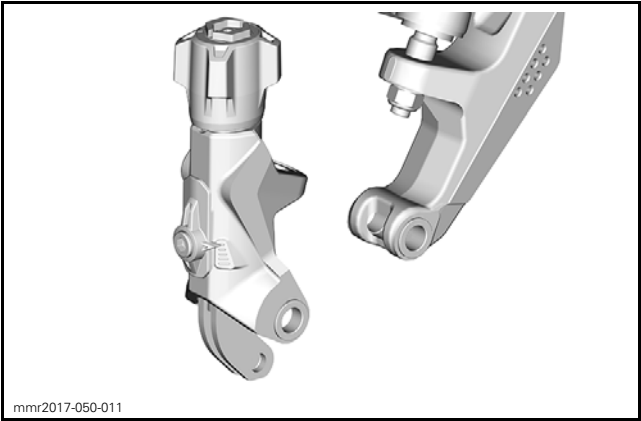
ADJUSTABLE RUNNER MECHANISM

Removing the Adjustable Runner Mechanism

1. Remove the ski and the runner.
2. Slide the sleeve out of the ski leg.



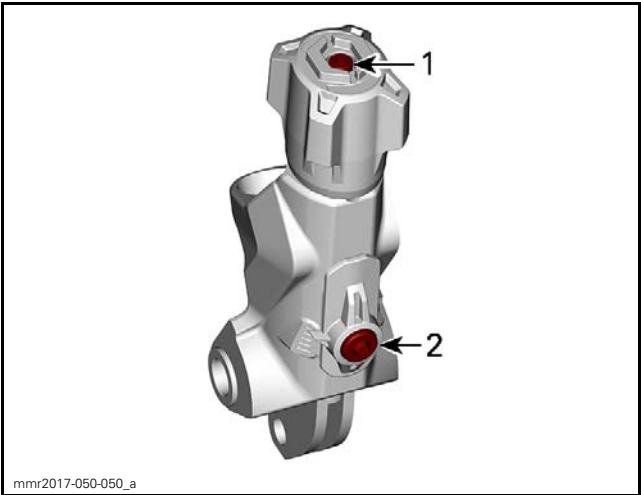
3. Remove the mechanism from the ski leg.



Disassembling the Adjustable Runner Mechanism

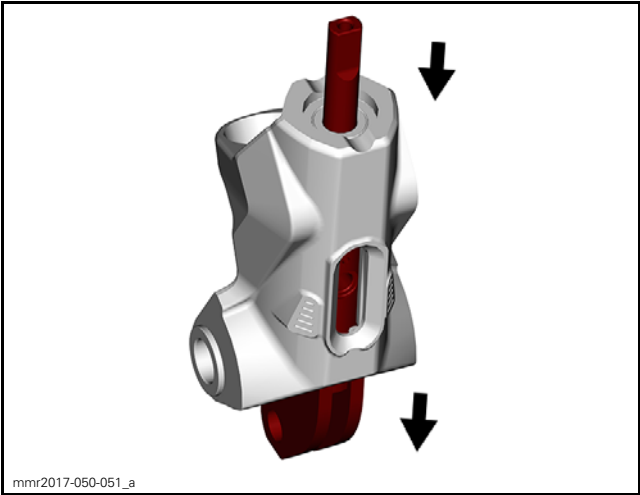
1. Remove the adjusting knob and the indicator screws.

NOTE: There are two O-rings on the indicator screw.

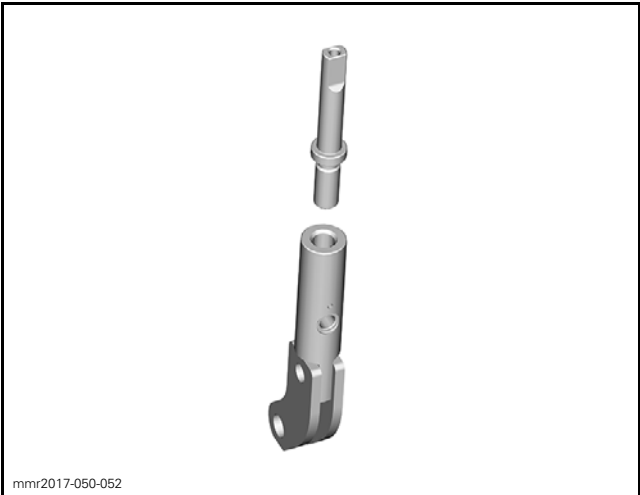


1. Adjusting knob screw
2. Indicator screw

2. Slide the adjusting screw and the adjusting shaft out of the body.



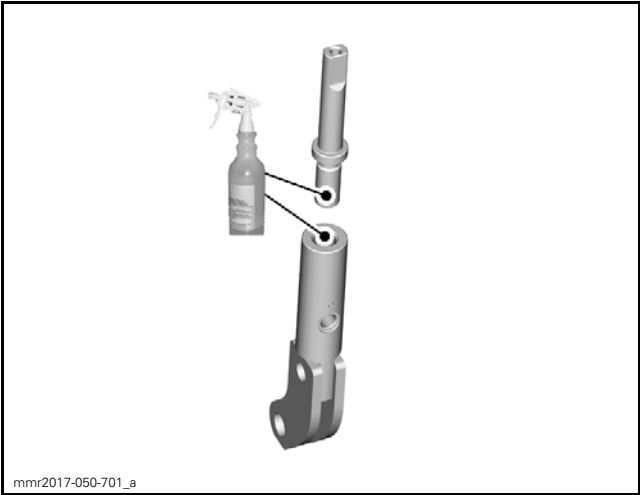
3. Remove the screw from the shaft.



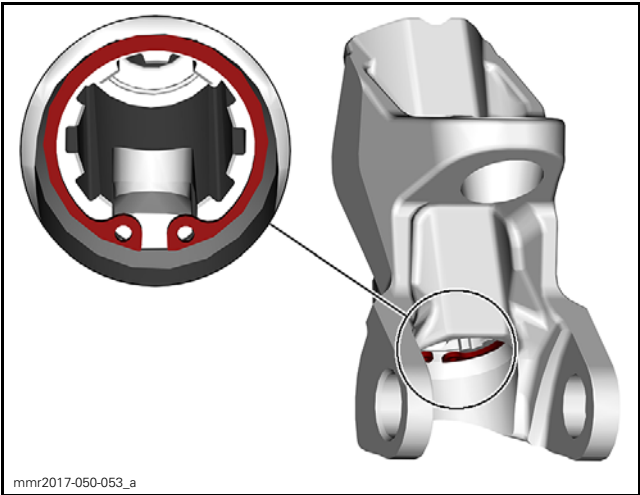
4. Clean the screw and the shaft inner threads with brake and parts cleaner and a small brush.

SERVICE PRODUCT

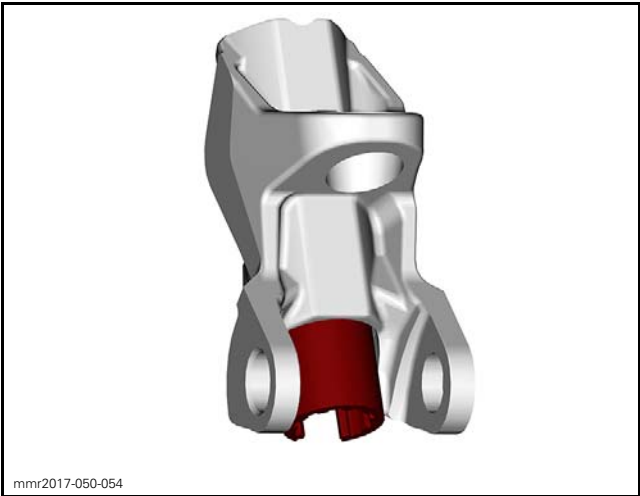
XPS BRAKES AND PARTS CLEANER
(USA) (P/N 219 701 705) or
XPS BRAKES AND PARTS CLEANER
(P/N 219 701 776)



5. Remove the snap ring.



6. Slide the sleeve out of the body.



Inspecting the Adjustable Runner Mechanism

Inspect the mechanism body for cracks. Replace if required.

Inspect the adjusting screw and shaft for:

- Thread damages
- Bending.

Replace if required.

Inspect the sleeve for:

- Cracks
- Spline damages

Replace if required.

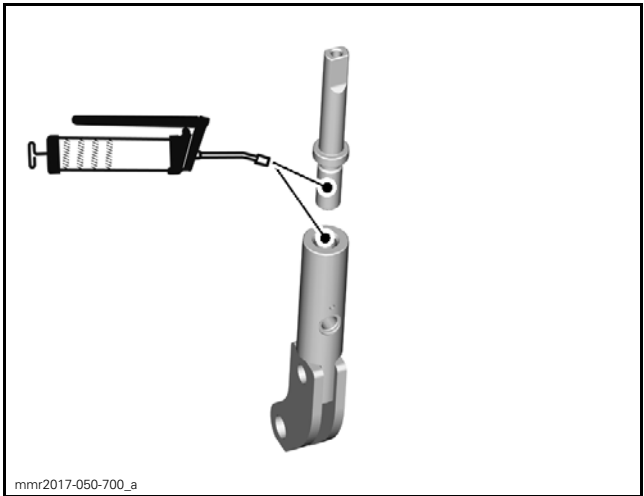
Inspect the ball bearing. It should turn freely and smoothly. If bearing needs to be replaced, replace the mechanism assembly.

Assembling the Adjustable Runner Mechanism

The assembly is the reverse of the disassembly procedure. However, pay attention to the following.

Apply grease on screw thread and shaft inner thread.

SERVICE PRODUCT
SYNTHETIC GREASE (P/N 779162)



Install a new knob screw.

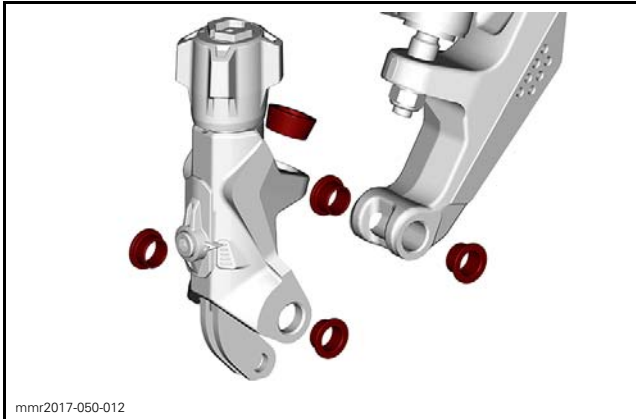
TIGHTENING TORQUE	
Adjusting knob screw	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)
Indicator screw	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

Installing the Adjustable Runner Mechanism

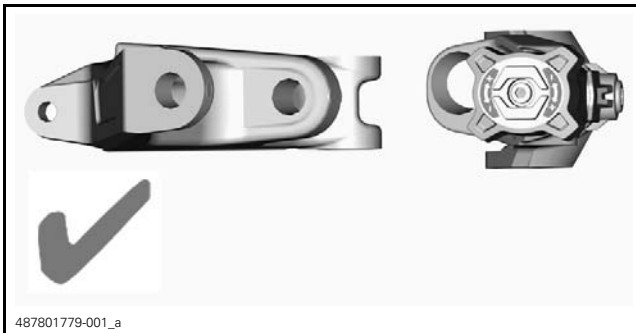
The installation is the reverse of the removing procedure. However, pay attention to the following.

Install rubber grommet on nut first. Align flat against flat.

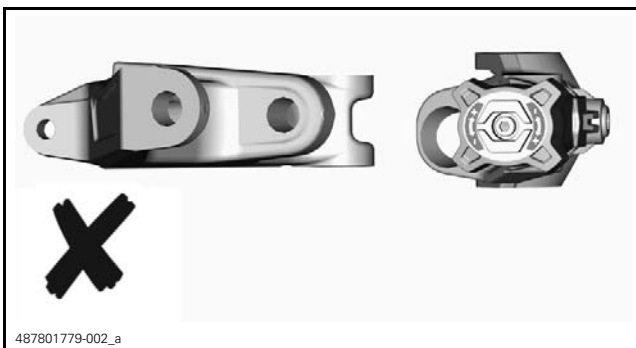
Ensure all bushings, and the grommet are in place and fully seated.



The mechanism is offset and has to be installed on the correct side.



RH SIDE SHOWN



RH SIDE SHOWN

SKI HANDLES

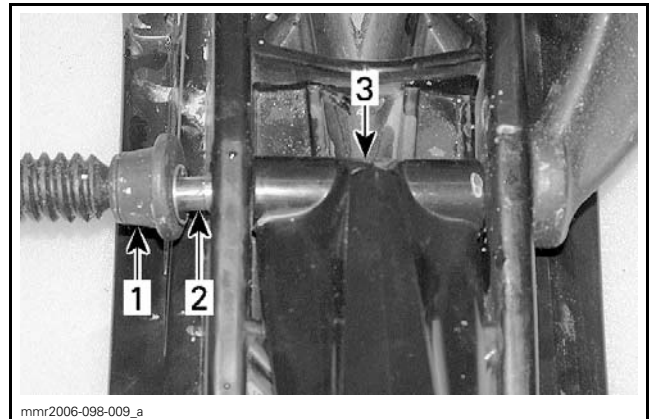
Removing the Ski Handle

1. Remove ski from vehicle.
2. Using a 9 mm (3/8 in) drill bit, remove ski handle rivets. Only drill the head of rivet. Do not try to drill all the way through the rivet. Angle the drill bit to reduce the chance of spinning the rivet in the ski.

3. Remove handle from ski.
4. Place handle in hot water for 10 minutes then using a punch, drive the inner part of rivet out of handle.

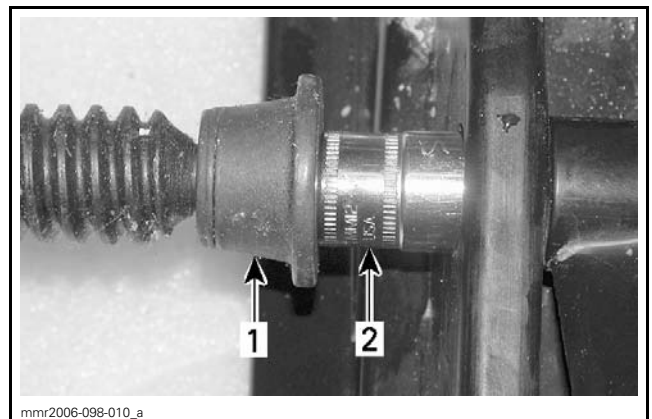
Installing the Ski Handle

1. To install rivets, use a C-clamp and a short 10 mm socket.
2. Place a rivet in position and insert it into ski and ski handle. Repeat the procedure for the other side.



1. C-clamp
2. Rivet
3. Handle

3. When both rivets are installed, use the short 10 mm socket to push rivet heads against the ski.



1. C-clamp
2. 10 mm socket

SKI LEG

To replace a ski leg, refer to *FRONT SUSPENSION* subsection.

HANDLEBAR GRIP

To verify or replace heating elements, refer to *ACCESSORIES* subsection.

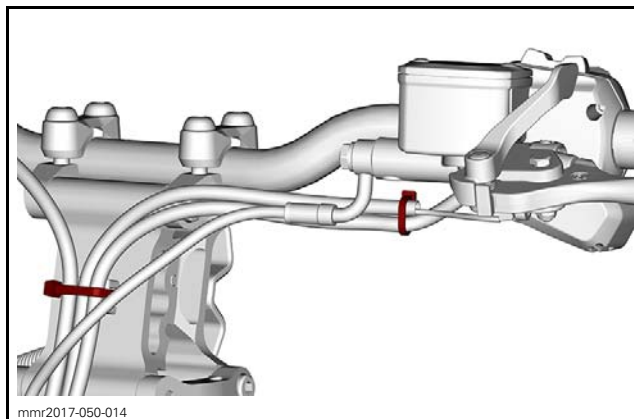
Removing the Handlebar Grip

Remove grips by pulling while using compressed air, which will inflate or loosen the fit between the grip and handlebar.

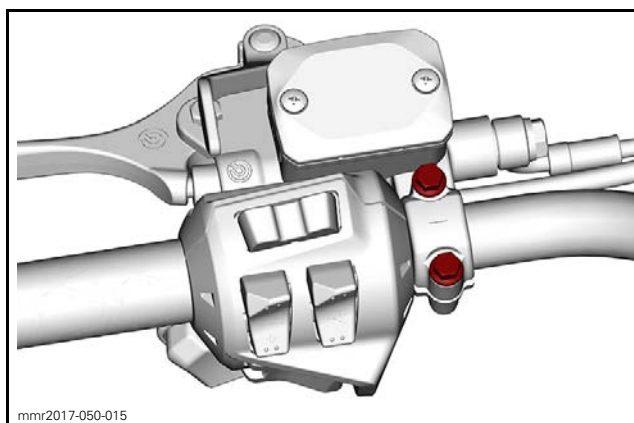


Installing the Handlebar Grip

Insert the handlebar grip on handlebar while blowing compressed air to inflate or loosen the fit between grip and handlebar.



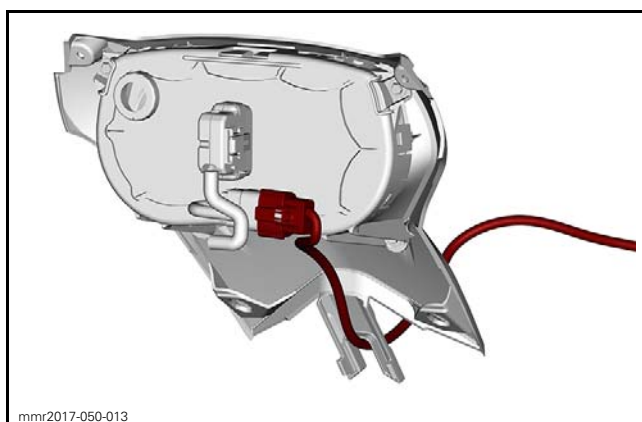
4. Unscrew master cylinder from handlebar.



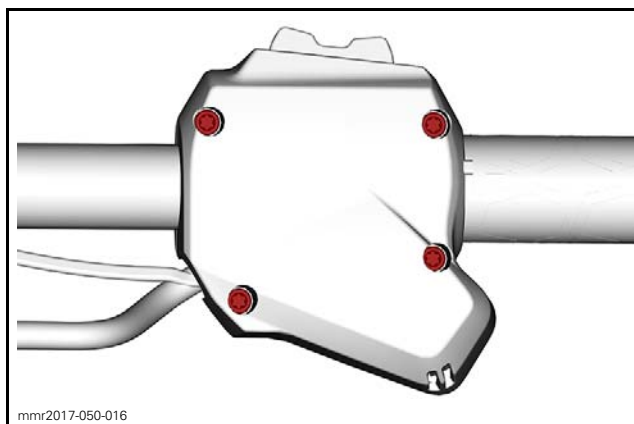
5. Remove master cylinder.

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

6. Remove multifunction switch screws.



3. Cut locking ties securing multifunction switch harness.

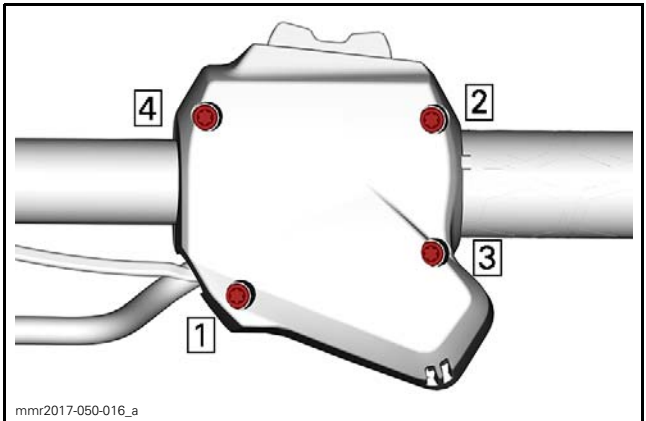


7. Remove multifunction switch from vehicle.

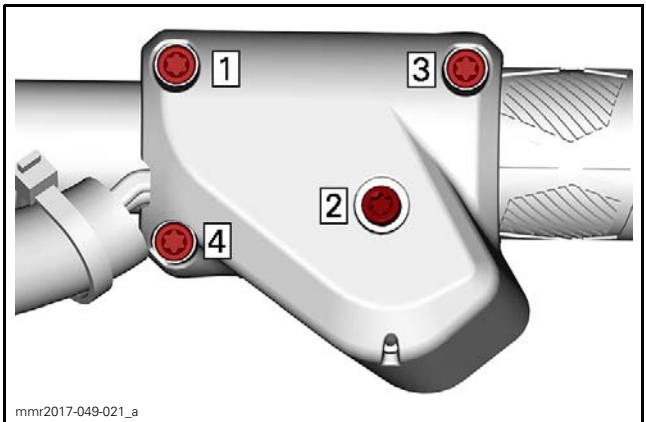
Installing the Multifunction Switch

The installation is the reverse of the removal procedure. However, pay attention to the following. Tighten the multifunction switch screws to specification, as per the following sequence.

TIGHTENING TORQUE	
Multifunction switch screw	2.4 N•m ± 0.2 N•m (21 lbf•in ± 2 lbf•in)

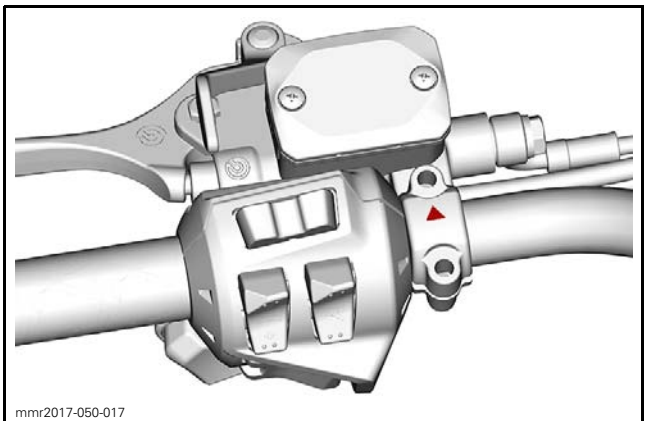


TRAIL AND CROSSOVER MODELS



MOUNTAIN MODELS

Place the master cylinder on the handlebar.
Install master cylinder retaining clamp with its arrow pointing toward the front of vehicle.



Install master cylinder clamp screws and tighten loosely.

With the handlebar in the straight ahead position, place the reservoir parallel to the ground.
Tighten master cylinder clamp screws to specification.

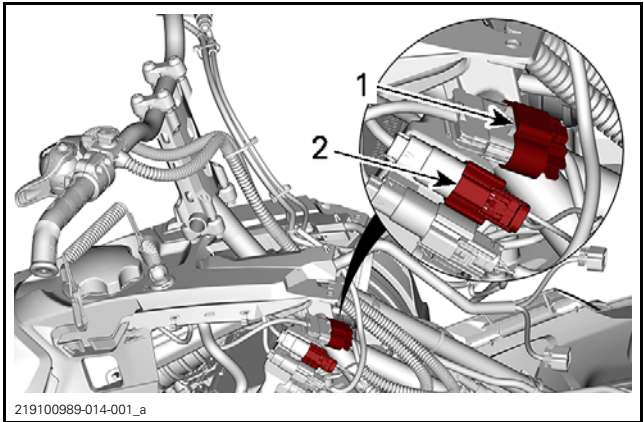
TIGHTENING TORQUE	
Master cylinder clamp screws	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

Turn handlebar completely from side to side making sure it does not exert unwanted tension on handlebar wires.

THROTTLE LEVER HOUSING (iTC)

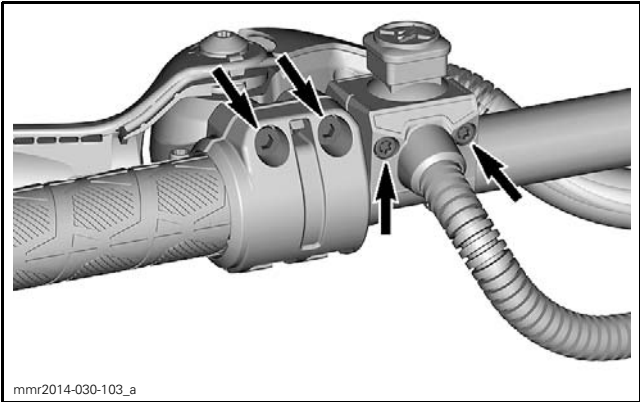
Removing the Throttle Lever Housing

1. Remove the upper body module. Refer to *BODY* subsection.
2. From the RH side of vehicle, disconnect the throttle lever connector.
3. Disconnect *RH* steering connector (6-pin).



1. Throttle lever connector
2. RH steering connector

4. Cut locking ties securing the throttle lever harness.
5. Remove the throttle lever housing and emergency stop switch support retaining screws.



Installing the Throttle Lever Housing

The installation is the reverse of the removal procedure. However, pay attention to the following. Tighten emergency stop switch support retaining screws to specification.

TIGHTENING TORQUE	
Emergency stop switch support retaining screws	2 N•m ± 0.5 N•m (18 lbf•in ± 4 lbf•in)

Tighten the throttle lever housing retaining screws to specification.

TIGHTENING TORQUE	
Throttle lever housing retaining screws	1.9 N•m ± 0.1 N•m (17 lbf•in ± 1 lbf•in)

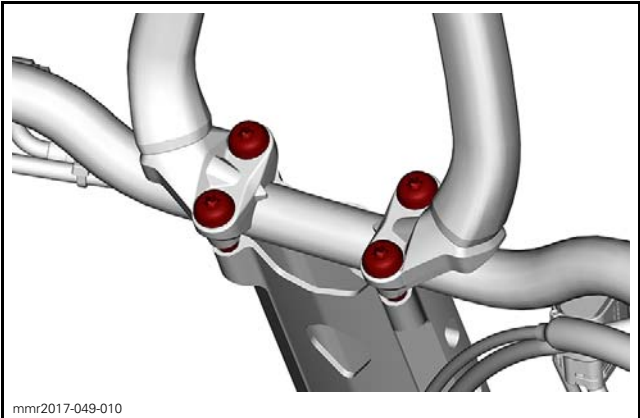
Turn handlebar completely from side to side making sure it does not exert unwanted tension on handlebar wires.

HANDLEBAR

Removing the Handlebar

NOTE: If the handlebar must be changed, remove all components (handlebar grip, throttle lever housing, etc.) before removing it from vehicle.

- 1. Remove handlebar retaining clamp screws.



- 2. Remove handlebar from handlebar extension.

Inspecting the Handlebar

- 1. Inspect the handlebar for:
 - Damages
 - Cracks
 - Bending.
- 2. Replace if any of these problems is detected.

**WARNING**
Do not try to repair a defective handlebar.

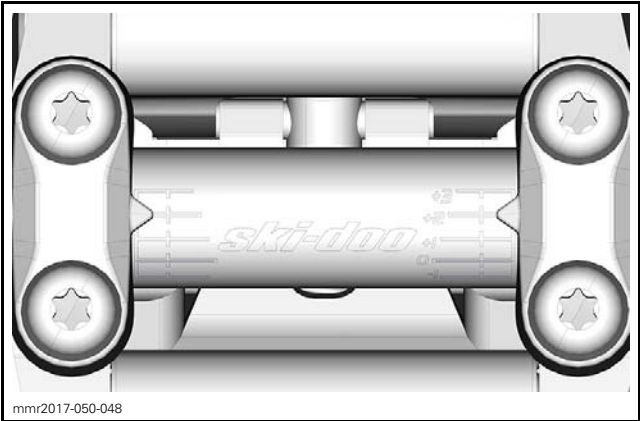
- 3. Check handlebar clamps for cracks or distortion, replace if necessary.

Installing the Handlebar

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

With Adjustable Handlebar

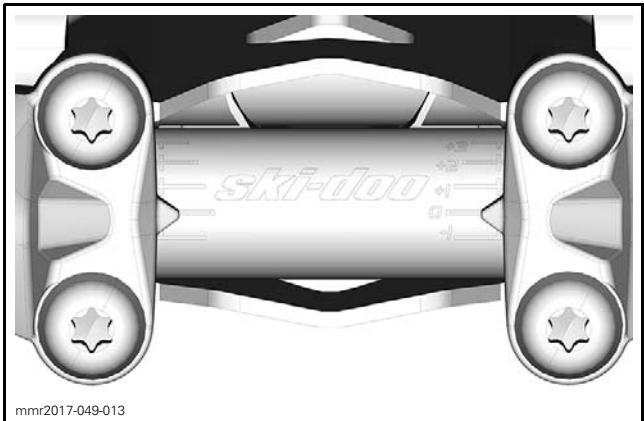
Position the handlebar at +2 with clamps.



Without Adjustable Handlebar

Position the handlebar with clamps, as per the following table.

MODEL	HANDLEBAR POSITION
All	+1

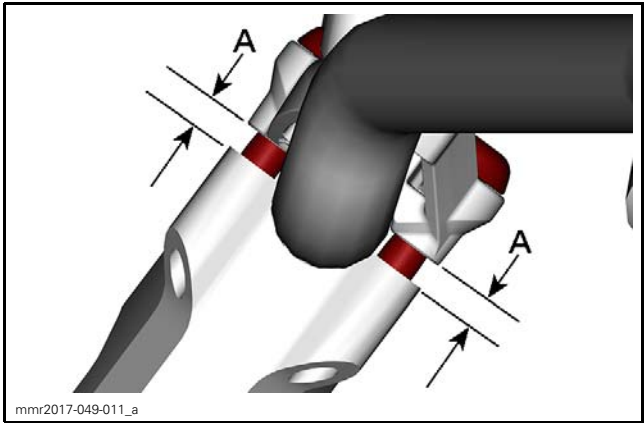


HANDLEBAR POSITION - MOUNTAIN MODEL SHOWN

Tighten handlebar clamps screws to specification.

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

Ensure handlebar clamps are parallel with handlebar extension.



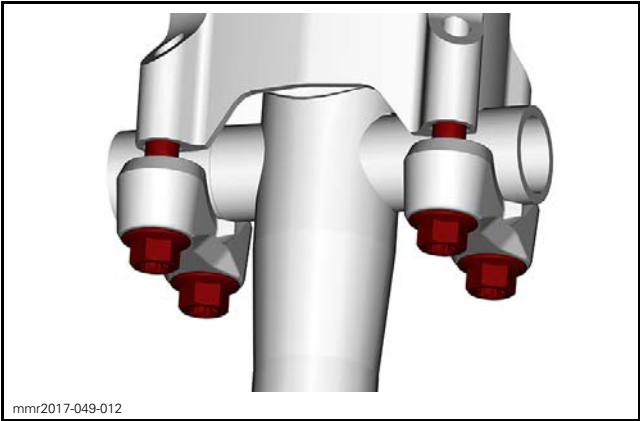
A. Must be equal on each side

Turn handlebar completely from side to side making sure it does not exert unwanted tension on handlebar wires.

HANDLEBAR EXTENSION

Removing the Handlebar Extension

1. Proceed with *REMOVING THE HANDLEBAR*, see procedure in this subsection.
2. Remove screws retaining the extension to steering column.



3. Remove handlebar extension from vehicle.

Inspecting the Handlebar Extension

1. Check handlebar extension for:
 - Cracks
 - Bending
 - Other damages.
2. Replace if any of these problems is detected.

**WARNING**

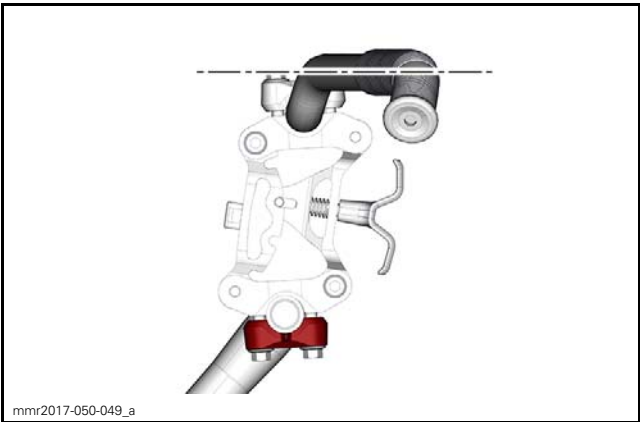
Do not try to repair a defective handlebar extension.

Installing the Handlebar Extension

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

With Adjustable Handlebar

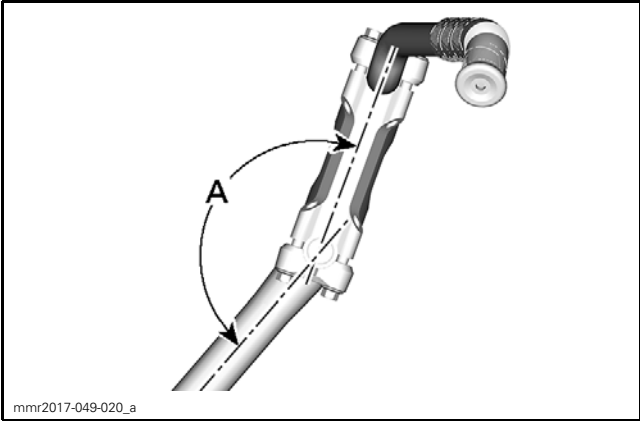
Position the extension in order to have the handlebar horizontal.



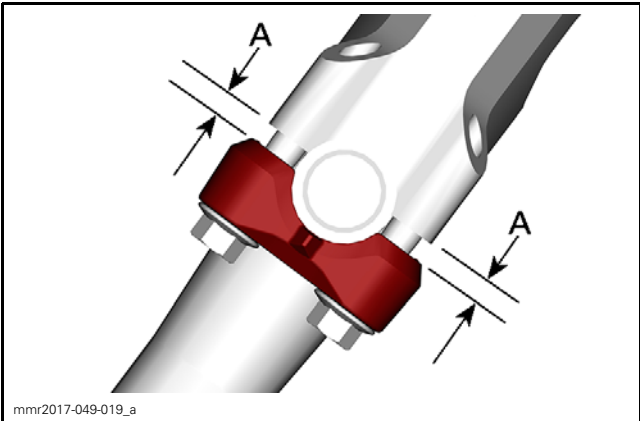
Without Adjustable Handlebar

Position the extension with the steering column, as per the following table.

MODEL	HANDLEBAR EXTENSION POSITION ANGLE
All	159°



Ensure extension clamps are parallel with handlebar extension.



A. Must be equal on each side

WARNING

Handlebar and it's components must not get in contact with anything (windshield, fuel tank cap, etc.) when steering is turned.

TIE-RODS

NOTE: The same procedure is applied on RH and LH side.

Inspecting the Tie-Rod

Check tie-rod ends for looseness. If play is excessive, replace tie-rod.

Check if the tie-rod is bent, cracked or otherwise damaged. Replace if necessary.

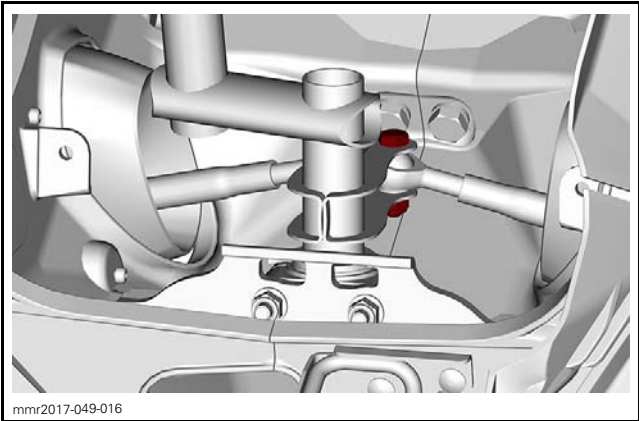
Removing the Tie-Rod

With 900 ACE Turbo

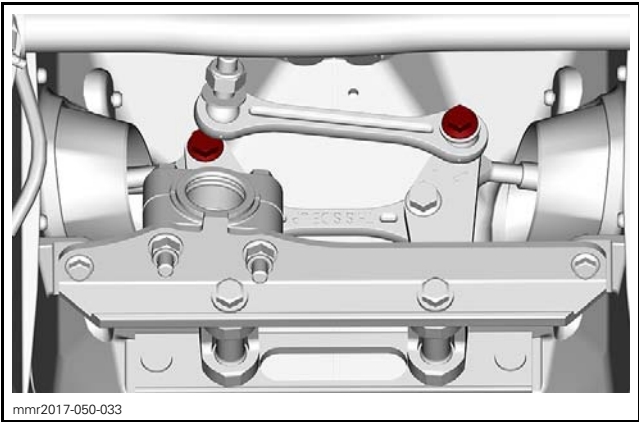
1. Remove the intercooler. Refer to *INTER-COOLER* subsection.

All Models

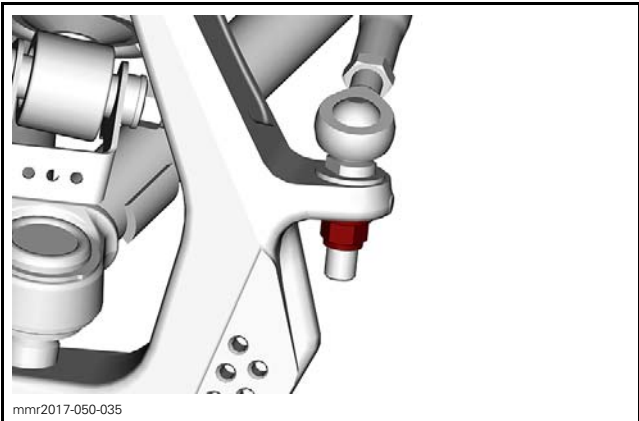
2. Remove the tie-rod end nuts and screws from the steering column and ski leg.



STEERING COLUMN WITH PITMAN ARM

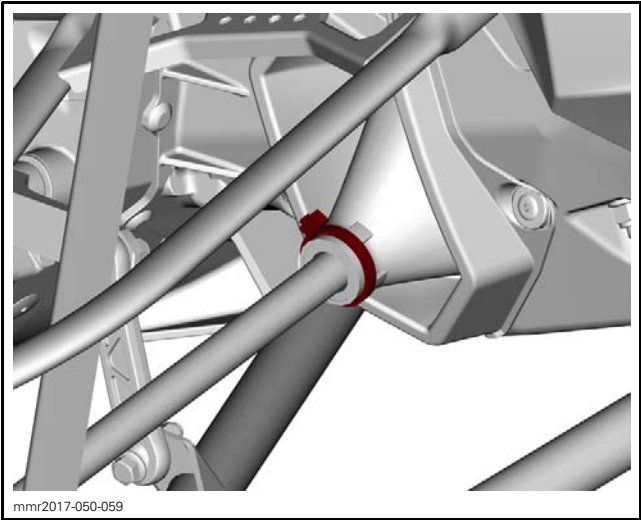


STEERING RACK - STEERING COLUMN REMOVED FOR CLARITY

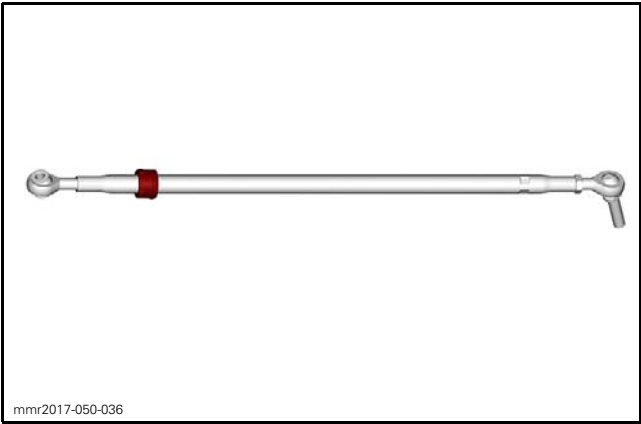


SKI LEG

3. Cut the locking tie on the steering boot.

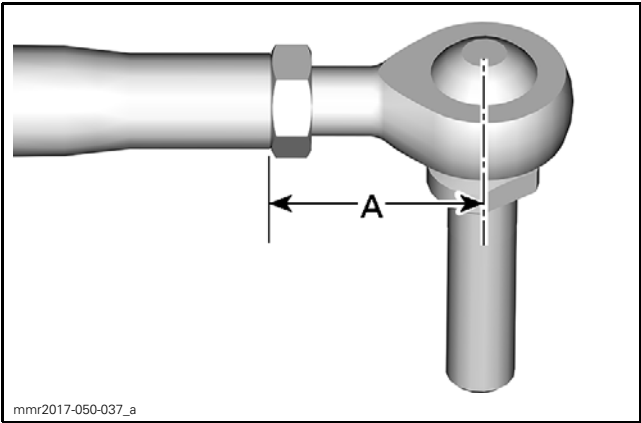


4. Remove tie-rod with ring from vehicle.



Installing the Tie-Rod

The installation is the reverse of the removal procedure. However, pay attention to the following. Adjust the length of all tie-rod end to specification without tightening the jam nuts.

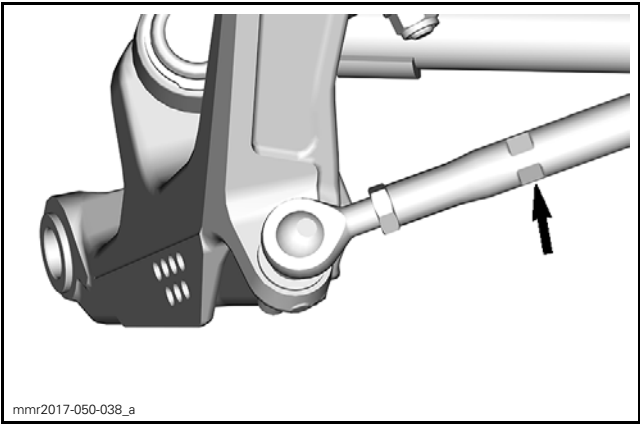


TIE-ROD LENGTH (A)
30 mm (1.181 in)

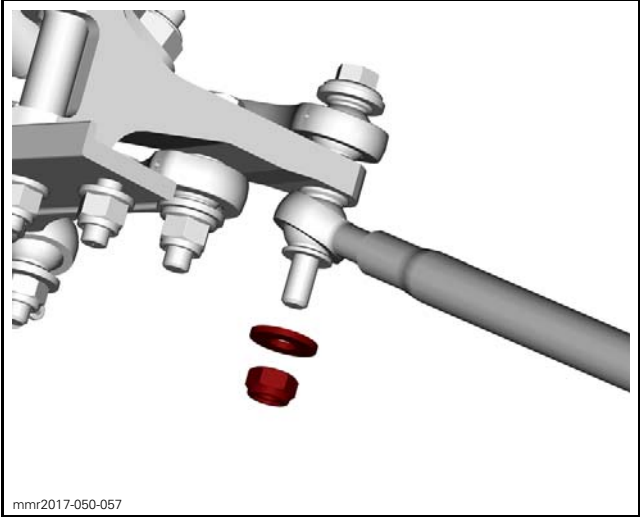
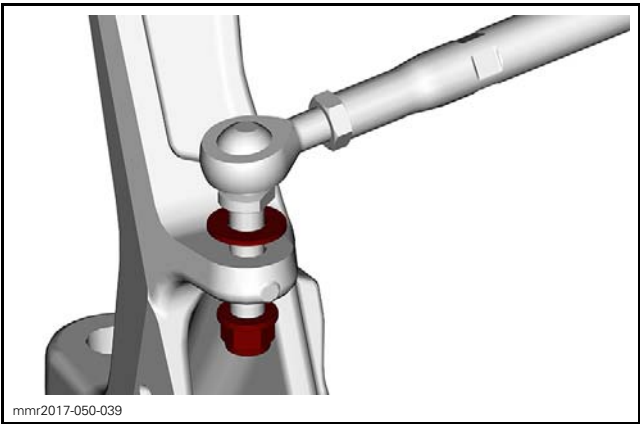
⚠ WARNING

The maximum tie-rod end length (A) not engaged in the tie rod must not exceed 34 mm (1.339 in).

Install tie-rod with the groove on ski leg side.



Install the washer and the nut, and tighten to specification.

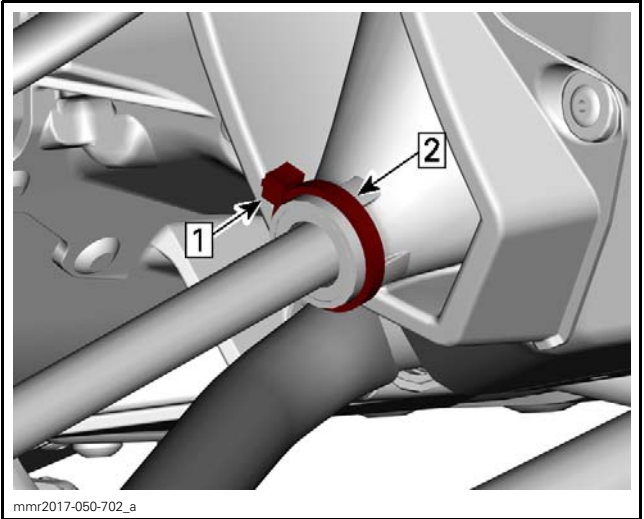


Subsection XX (STEERING SYSTEM)

TIGHTENING TORQUE	
Outer tie-rod end nut	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)
Inner tie-rod end nut	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

Ensure the new locking tie is fully seated and the head is positioned upwards.

NOTICE To avoid bellows damage, make sure locking tie head is positioned upwards.



- 1. Head up
- 2. Fully seated

Perform the steering alignment, refer to *ALIGNING THE STEERING* in this section.

STEERING COLUMN

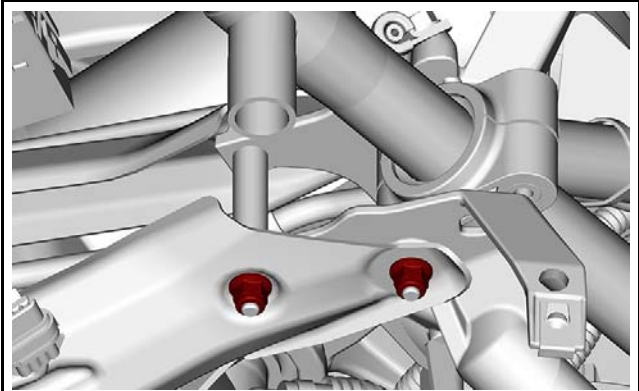
Removing the Steering Column - With Pitman Arm

With 900 ACE Turbo

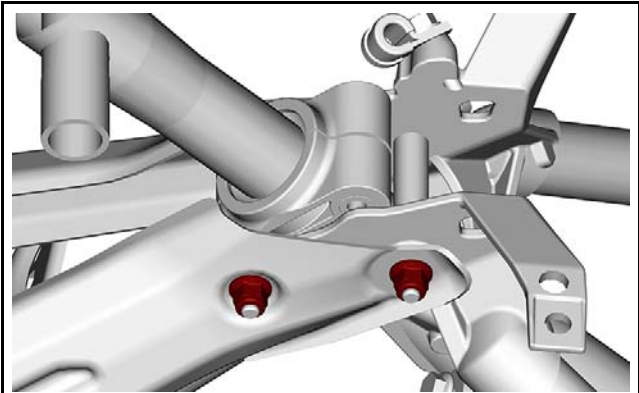
- 1. Remove the intercooler. Refer to *INTER-COOLER* subsection.

All Models

- 2. Remove the rear console. Refer to *BODY* subsection.
- 3. Remove *HANDLEBAR EXTENSION* from steering column. Refer to the procedure in this subsection.
- 4. Remove the inner tie-rod end nuts and screws. Refer to *TIE-RODS* in this subsection.
- 5. Remove nuts and screws securing steering column upper support.

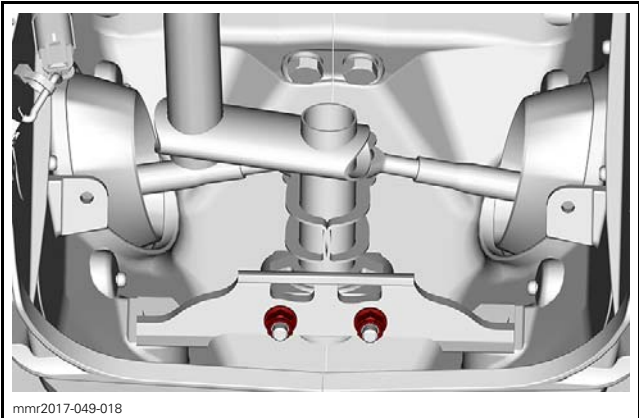


FRONTWARD POSITION COLUMN



REARWARD POSITION COLUMN

- 6. Remove nuts and screws securing the steering column lower support.



- 7. Pull steering column from top.

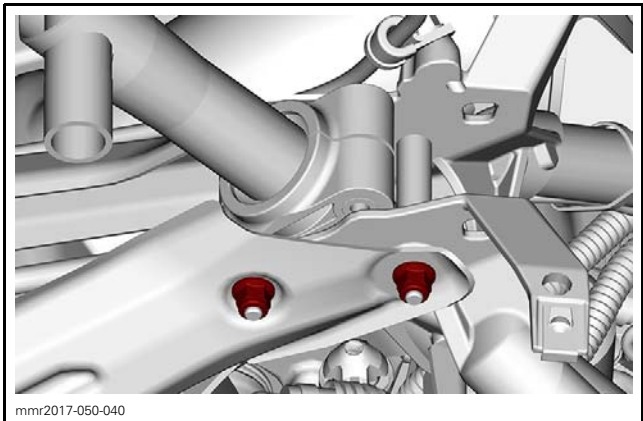
Removing the Steering Column - With Steering Rack

With 900 ACE Turbo

- 1. Remove the intercooler. Refer to *INTER-COOLER* subsection.

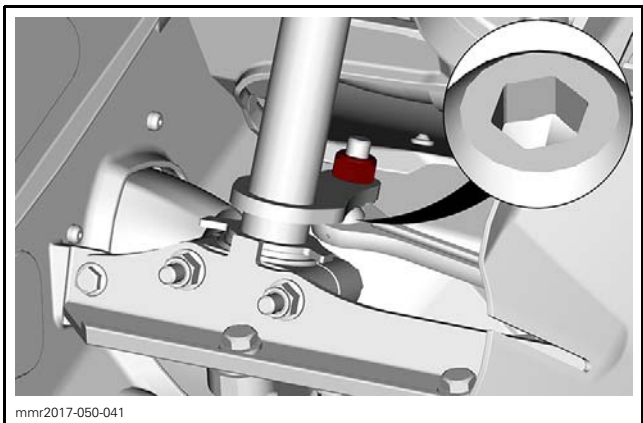
All Models

- 2. Remove the rear console. Refer to *BODY* sub-section.
- 3. Remove *HANDLEBAR EXTENSION* from steering column. Refer to the procedure in this sub-section.
- 4. Remove nuts and screws securing steering column upper support.

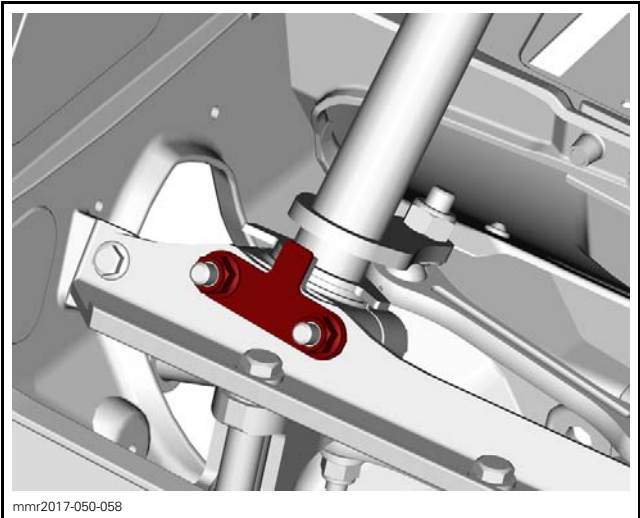


- 5. From inside engine compartment, remove the steering column pitman arm nut.

NOTE: Use an Allen key to lock the ball joint.



- 6. Remove nuts, stopper plate and screws securing the steering column lower support.



- 7. Pull steering column from top.

Inspecting the Steering Column

Check if steering column is:

- Cracked
- Bent
- Twisted
- Otherwise damaged.

Replace steering column if necessary.

⚠ WARNING

Do not try to repair a defective steering column.

Installing the Steering Column

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

- 1. Apply grease on vibration dampers before installing upper and lower supports.

SERVICE PRODUCT

SYNTHETIC SUSPENSION GREASE (P/N 779163)

- 2. Install new elastic nuts on the steering column retaining screws.
- 3. Tighten nuts to specification.

TIGHTENING TORQUE

Upper steering column support nut	12.5 N•m ± 2.5 N•m (111 lbf•in ± 22 lbf•in)
Lower steering column support nut	23.5 N•m ± 3.5 N•m (17 lbf•ft ± 3 lbf•ft)

STEERING RACK

Inspecting the Steering Rack

With 900 ACE Turbo

Remove the intercooler. Refer to *INTERCOOLER* subsection.

All Models

Check if steering rack component are:

- Cracked
- Bent
- Twisted
- Otherwise damaged.

Check steering rack for looseness.

Check if stopper plate is deformed or otherwise damaged.

Replace component if necessary.

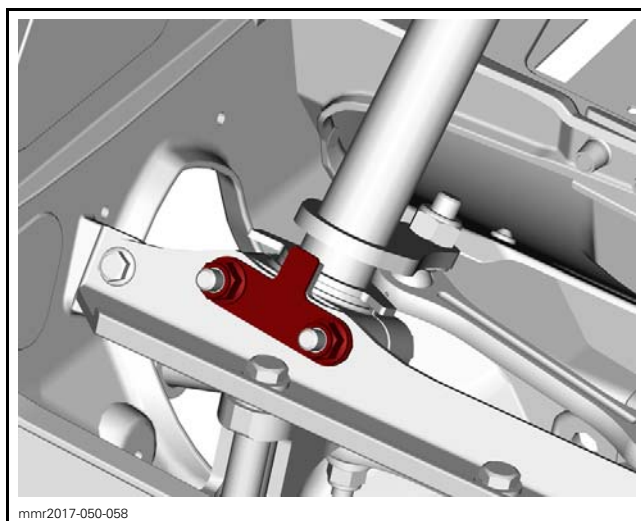
Removing the Steering Rack

With 900 ACE Turbo

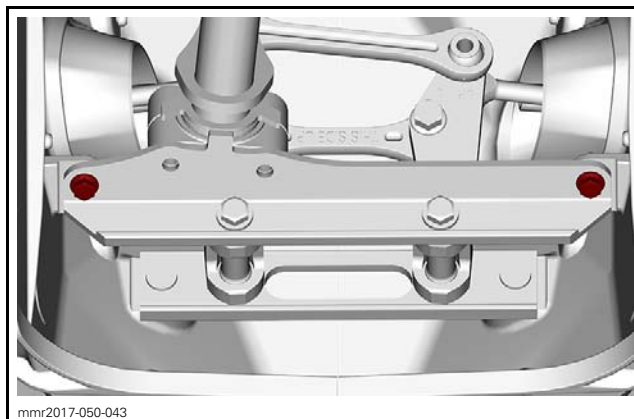
1. Remove the intercooler. Refer to *INTERCOOLER* subsection.

All Models

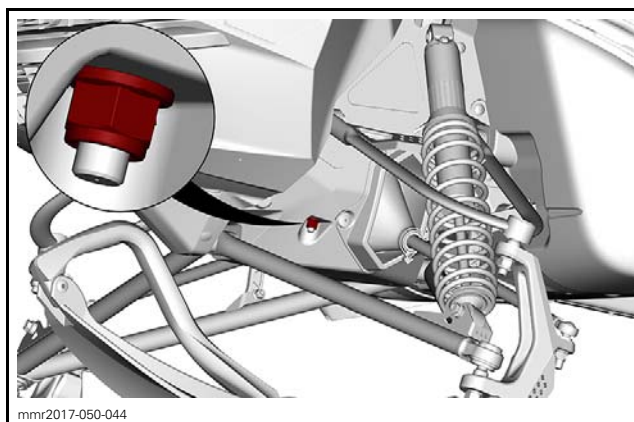
2. Remove inner tie-rod end nuts and screws.
3. Remove the nuts, stopper plate and screws as per the following illustrations.



INSIDE ENGINE COMPARTMENT



INSIDE ENGINE COMPARTMENT



Installing the Steering Rack

The installation is the reverse of the removal procedure.

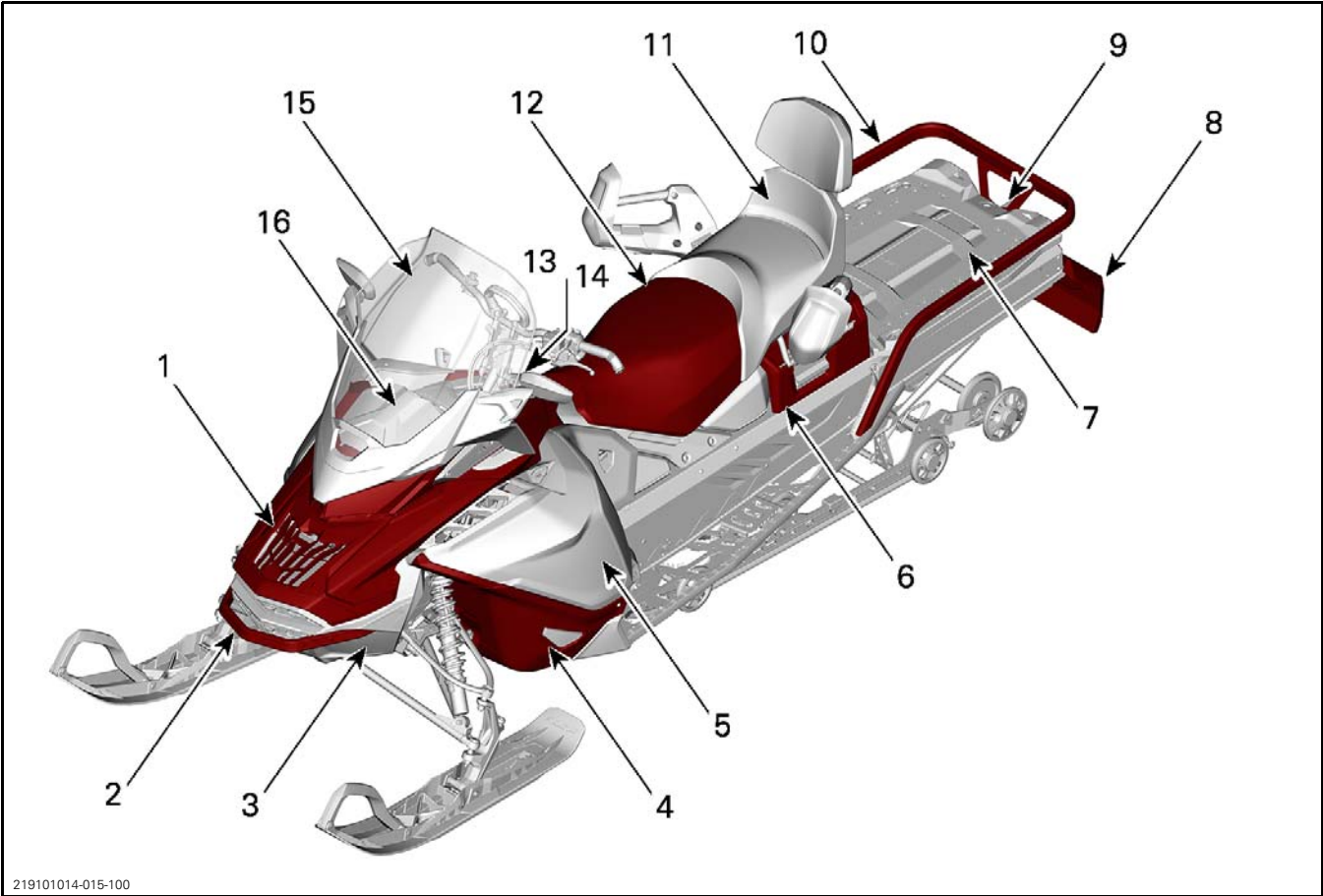
BODY (EXPEDITION LE/SE/XTREME)

SERVICE TOOLS

Description	Part Number	Page
SUPERTANIUM DRILL BIT 3/16".....	529 031 800	8

SERVICE PRODUCTS

Description	Part Number	Page
XPS ATV CLEANING KIT	219 701 713	2
XPS ATV FINISHING SPRAY.....	219 701 704	2
XPS ATV WASH.....	219 701 702	2



- 219101014-015-100

 - 1. Upper body module
 - 2. Front bumper
 - 3. Bottom pan
 - 4. Side bottom pan
 - 5. Side panel
 - 6. Storage compartment
 - 7. Multi-LinQ plate
 - 8. Snow guard
- 9. Rear hitch
 - 10. Rear rack
 - 11. Passenger seat
 - 12. Operator seat
 - 13. Console
 - 14. Gauge support
 - 15. Windshield
 - 16. Storage compartment cover

GENERAL

CLEANING

Cleaning the Seat

It is recommended to clean the seat with a solution of warm soapy water, using a soft clean cloth.

NOTICE Avoid use of harsh detergents such as strong soaps, degreasing solvents, abrasive cleaners, paint thinners, etc. that may cause damage to the seat cover.

Cleaning the Plastic

Clean the vehicle thoroughly, removing all dirt and grease accumulation.

To clean use a soft clean cloth and either soapy water or isopropyl alcohol.

To remove grease, oil or glue use isopropyl alcohol.

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

Follow these recommendations to protect the glossy finish of polypropylene parts.

Apply a non abrasive wax on glossy finish only.

Non Compatible Cleaning Products

NOTICE Polypropylene is not compatible with PETROLEUM BASE PRODUCTS. Contact with petroleum base products, such as cleaners or lubricants will permanently alter the glossy finish of polypropylene parts.

NOTICE The following products must not be applied on the plastic components used on the vehicles:

- Gasoline
- Brake fluid
- Kerosene
- Diesel fuel
- Lighter fluid
- Varsol
- Naphtha
- Acetone
- Strong detergents
- Abrasive cleaners
- Waxes containing an abrasive or a cleaning agent in their formula.

MATERIAL TYPE	NON-COMPATIBLE CLEANING PRODUCTS
Polypropylene	ANY PETROLEUM BASE CLEANING PRODUCTS
	XPS ATV FINISHING SPRAY (P/N 219 701 704)
	XPS ATV CLEANING KIT (P/N 219 701 713)



DO NOT USE ON POLYPROPYLENE

Compatible Cleaning Products

MATERIAL TYPE	COMPATIBLE CLEANING PRODUCT
Polypropylene	XPS ATV WASH (P/N 219 701 702)
	Soapy water



SAFE FOR POLYPROPYLENE

REPAIRING BODY PARTS

The very first step before repairing plastic materials is to find out exactly which type of material is involved.

On the inner surface of each part, the production date, part number, and material code are molded in.

PLASTIC PARTS	
CODE	MATERIAL
PP	Polypropylene
EMA+PA	Surlyn

NOTICE Some repair products are not compatible with certain plastics.

WARNING

Polycarbonate windshields must never be repaired by welding or otherwise.

The following company provides a complete line of products to repair plastic materials:

CREST INDUSTRIES, INC.
Trenton, MI 48183
Phone: 734 479-4141
Toll Free: 1 800 822-4100
Fax: 734 479-4040
E-Mail: info@crestauto.com
www.crestauto.com

PROCEDURES

NOTE: The same procedure applies for RH and LH side. Most of the time, only one side is described in this subsection.

DECAL

Replacing the Decal

1. To remove a decal; heat old decal with a heat gun (low temperature) and peel off slowly.
2. Using isopropyl alcohol, clean the surface and dry thoroughly.

NOTICE Do not apply isopropyl alcohol or solvent directly on decals. Use only in a well ventilated area.

3. Just before beginning to affix the new decals, wipe the surface with a clean damp cloth and allow to dry.
4. Use a pallet to affix the decal. Always work from the center towards the edges.

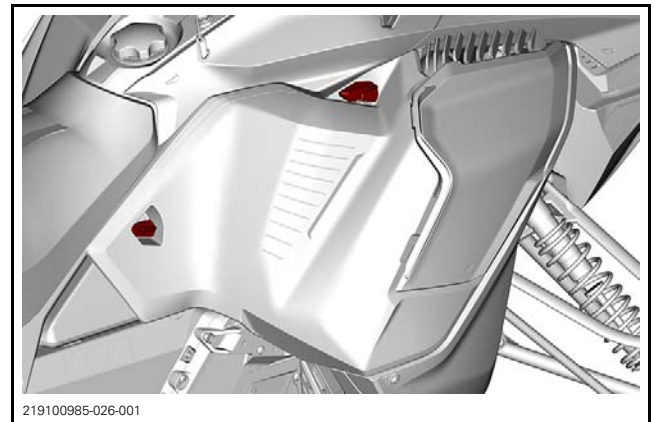
NOTICE Do not remove the pre-mask yet.

5. Once the decal is correctly affixed, carefully make a final pass with the pallet. Apply enough pressure to make sure the glue sticks well on the surface.
6. Remove the pre-mask.

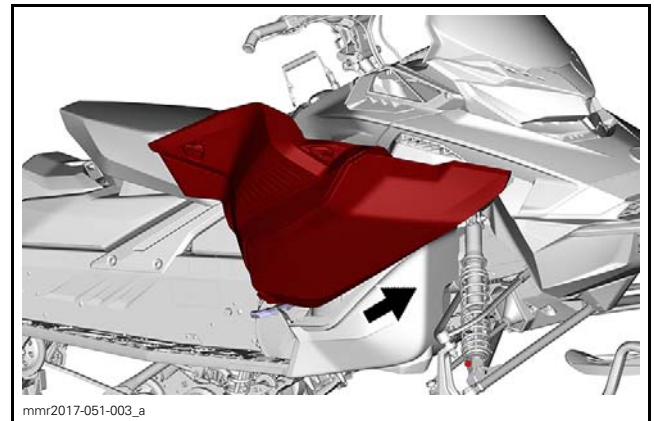
SIDE PANEL

Removing the Side Panel

1. Release all lock devices.



2. Open side panel.
3. Lift the side panel up and towards front.



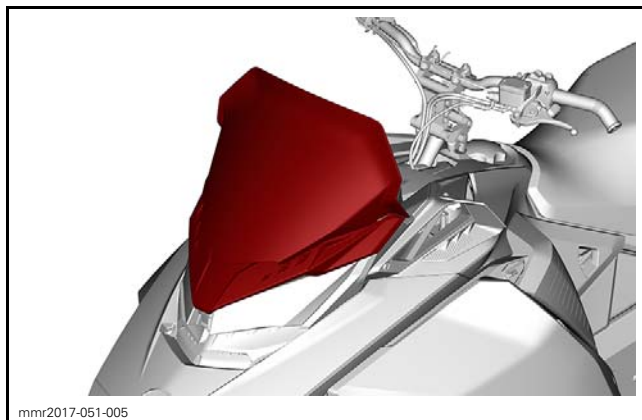
TYPICAL

NOTICE Make sure to place panels in a safe place to avoid scratching.

Installing the Side Panel

The installation is the reverse of the removal procedure.

WINDSHIELD



TYPICAL

Removing the Windshield

Place your hands on each side of windshield.

Pull the windshield until its pins come out of rubber grommets then pull in the center to remove center pin from grommet.

Installing the Windshield

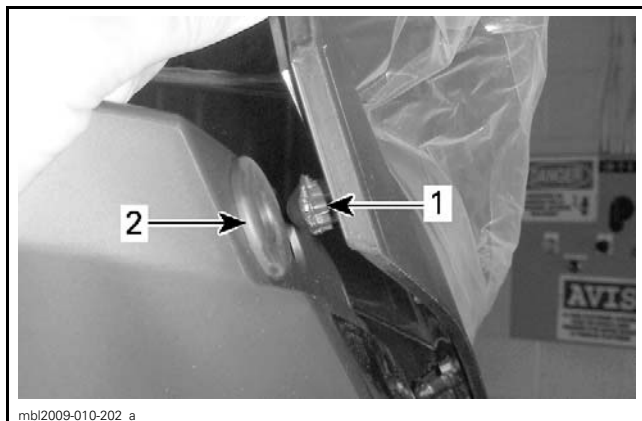
The installation is the reverse of removal procedure.

Lubricate the grommets using soapsuds.

NOTICE Do not lubricate grommets with any type of grease.

Secure windshield by inserting the windshield pins into the grommets.

NOTE: Make sure not to push grommets through gauge support holes.



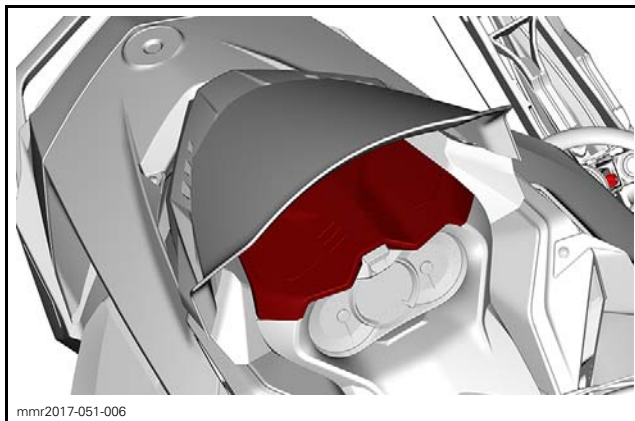
TYPICAL

1. Windshield tab
2. Gauge support front grommet

⚠ WARNING

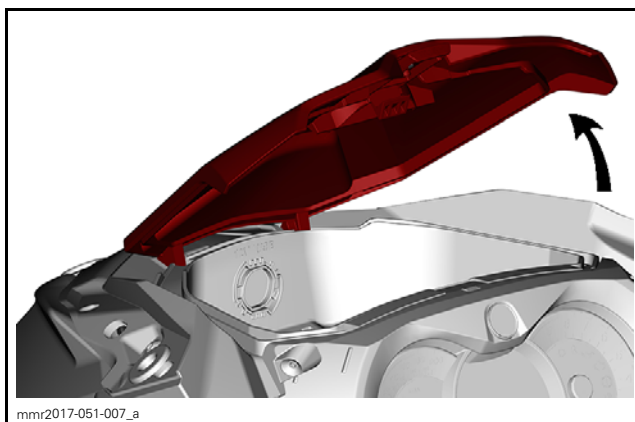
Make sure that handlebar turns freely in both directions. Make sure that there is no contact at any time between handlebar wind deflectors (if so equipped) and windshield.

STORAGE COMPARTMENT COVER

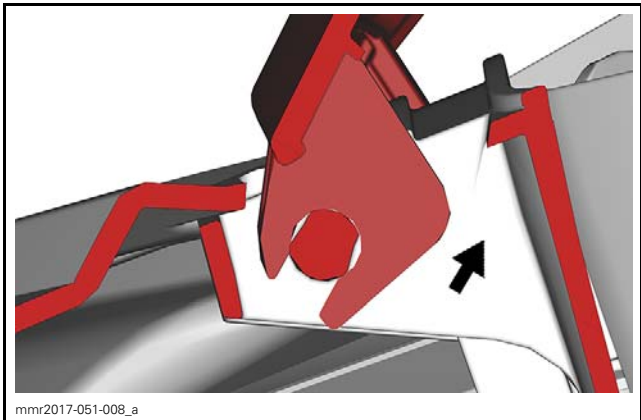


Removing the Storage Compartment Cover

1. Remove windshield. Refer to procedure in this subsection.
2. Open storage cover until it is almost vertical.



3. Pull out storage cover.

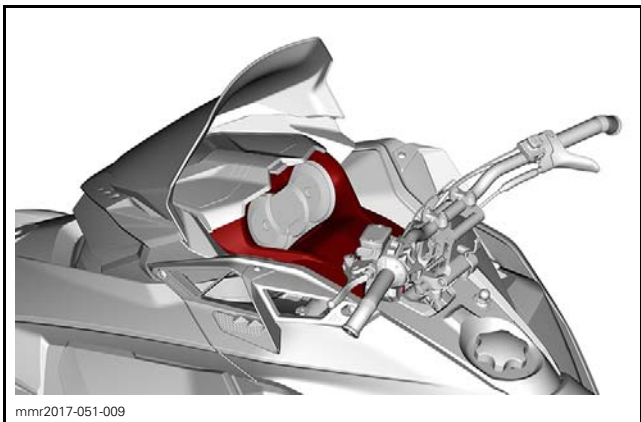


Installing the Storage Compartment Cover

The installation is the reverse of the removal procedure.

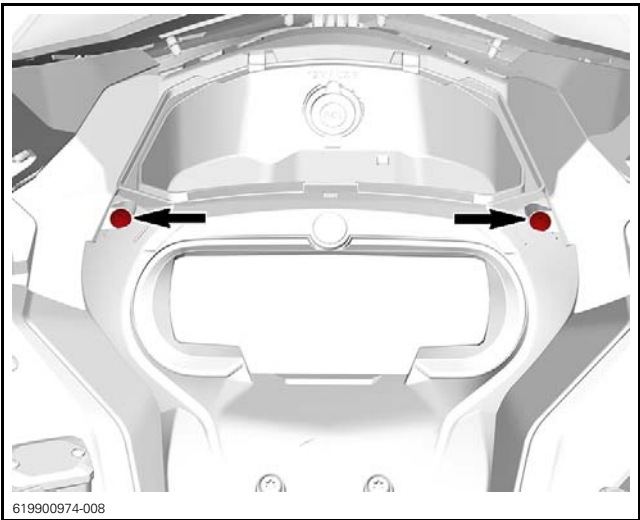
NOTICE Ensure windshield is NOT installed. Otherwise, the storage cover could be damaged during installation.

GAUGE SUPPORT



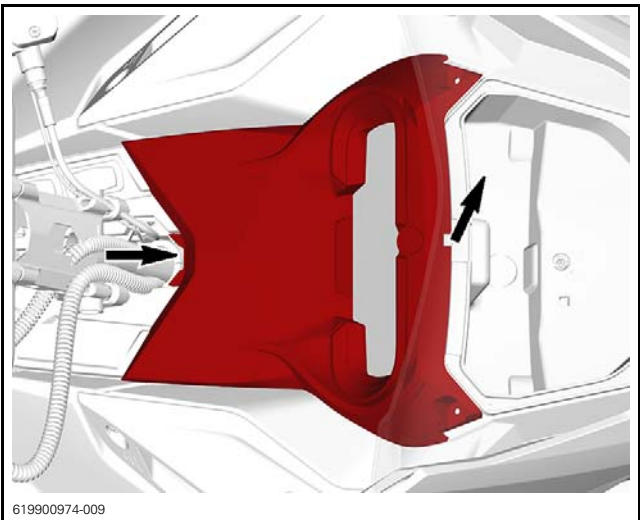
Removing the Gauge Support

1. Remove the windshield. Refer to procedure in this subsection.
2. Open the storage compartment cover
3. Remove the gauge support screws.



SE MODEL SHOWN

4. Lift the front of the gauge support, then slide it forward to remove it.



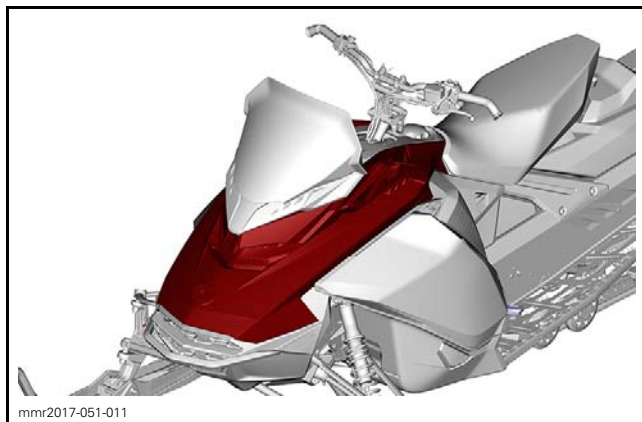
5. Remove the multifunction gauge from support. Refer to *GAUGE* subsection.

Installing the Gauge Support

The installation is the reverse of removal procedure.

TIGHTENING TORQUE	
Gauge support screw	2.3 N•m ± 0.2 N•m (20 lbf•in ± 2 lbf•in)

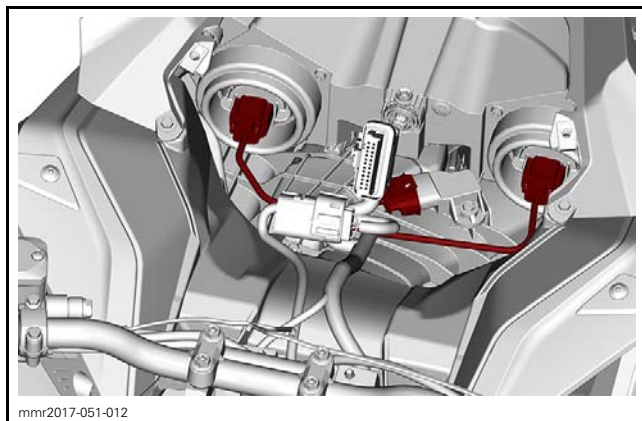
UPPER BODY MODULE



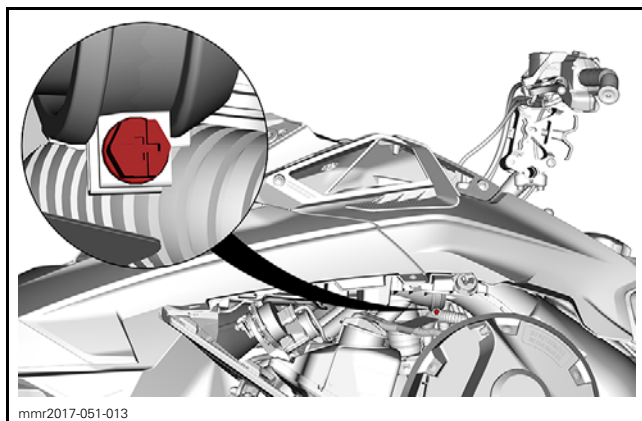
TYPICAL

Removing the Upper Body Module

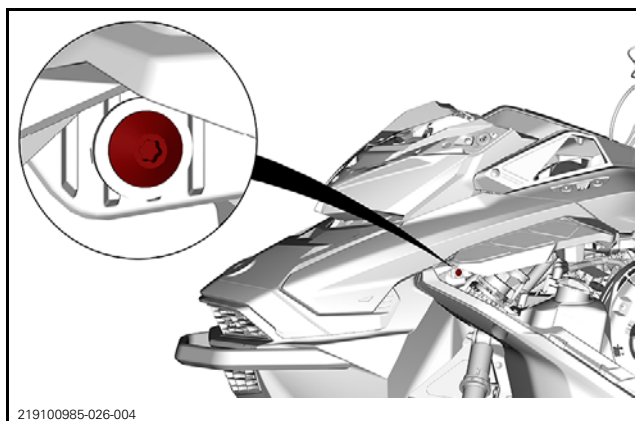
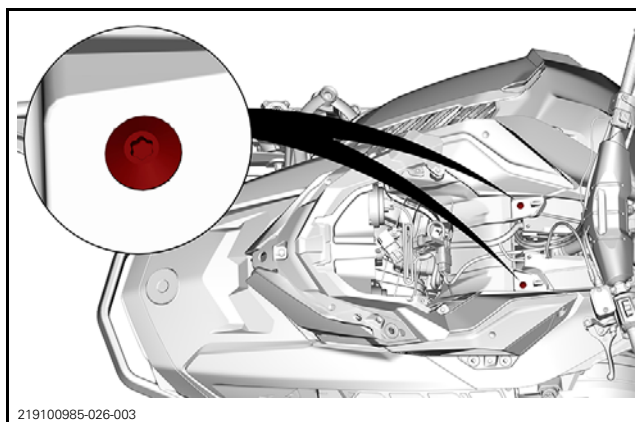
1. Refer to procedures in this subsection and remove:
 - Side panels
 - Gauge support
 - Storage compartment and its cover.
2. Disconnect the MAPTS and headlight connectors.



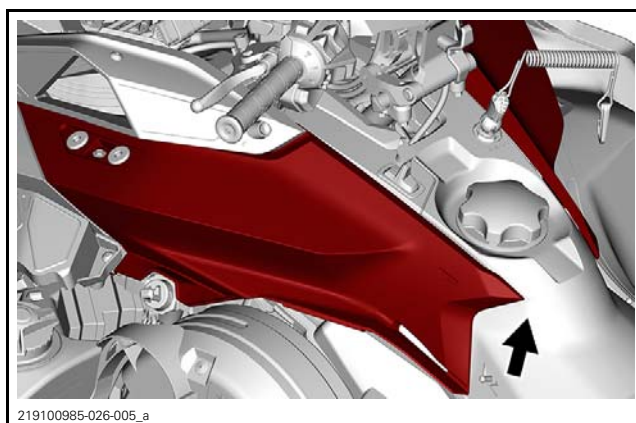
3. Loosen the air intake hose clamp.



4. Remove the upper body module retaining screws.



5. Lift the rear end of both lateral hood until their tabs come out of the rear console.



6. Remove the upper body module.
 - 6.1 Grab the upper body module in the gauge support section.
 - 6.2 Pull the module forward.
 - 6.3 Remove the module from the vehicle.

Installing the Upper Body Module

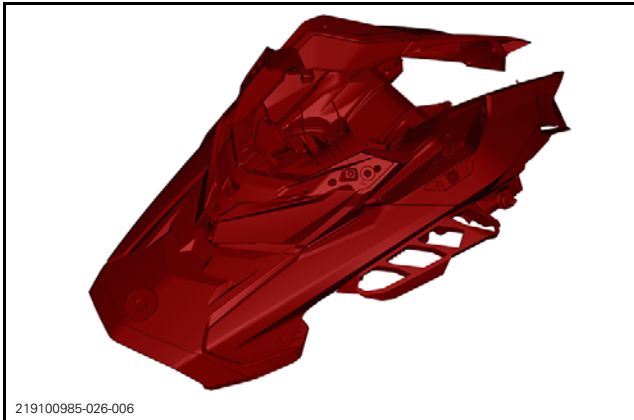
The installation is the reverse of the removal procedure. However, pay attention to the following. Ensure to engage rear hood tabs in rear console.



Ensure to connect the air intake hose.

TIGHTENING TORQUE	
Upper body module screw	1.8 N•m ± 0.2 N•m (16 lbf•in ± 2 lbf•in)

UPPER BODY MODULE COMPONENTS



Disassembling the Upper Body Module

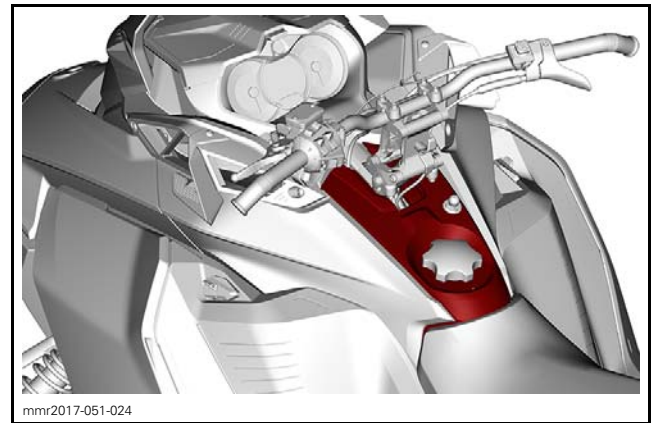
1. Remove the upper body module. Refer to procedure in this subsection.
2. Refer to *AIR INTAKE SYSTEM* subsection to disassemble the upper body module.
3. Remove both sides air deflector and air intake filter.

Assembling the Upper Body Module

The installation is the reverse of removal procedure.

TIGHTENING TORQUE	
Upper body module screw	1.8 N•m ± 0.2 N•m (16 lbf•in ± 2 lbf•in)

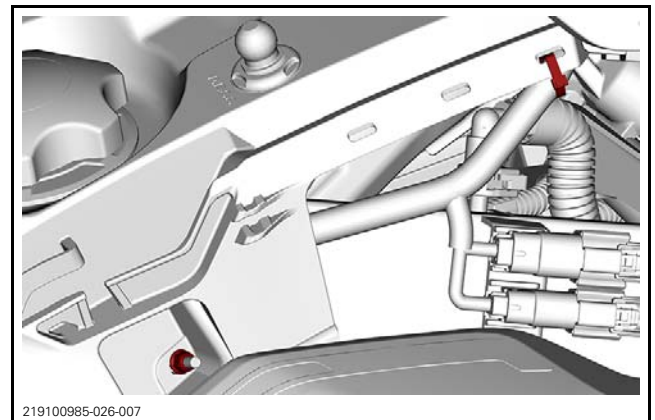
CONSOLE



TYPICAL

Removing the Console

1. Remove *UPPER BODY MODULE*. Refer to procedure in this subsection.
2. Remove the seat. Refer to procedure in this subsection.
3. Cut harness locking ties.
4. Remove console nuts.



5. Remove fuel tank cap.
6. Lift up the console and unplug all connectors.
7. Install fuel tank cap.

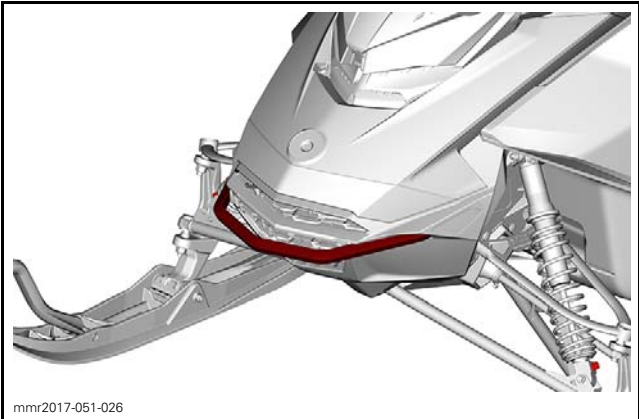
Installing the Console

The installation is the reverse of the removal procedure.

TIGHTENING TORQUE	
Console nut	2.3 N•m ± 0.2 N•m (20 lbf•in ± 2 lbf•in)

FRONT BUMPER

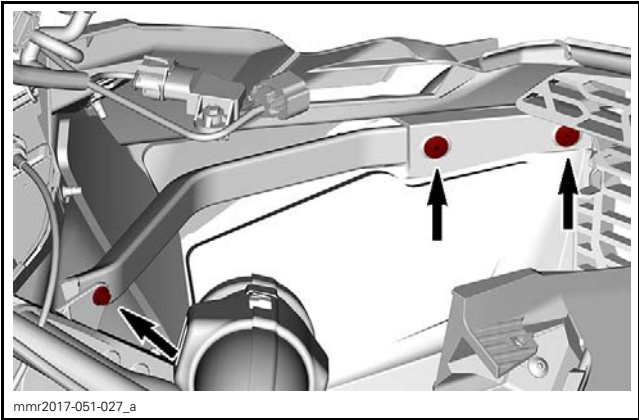
Removing the Front Bumper



1. Remove tuned pipe. Refer to *EXHAUST SYSTEM* subsection.
2. Drill out rivets from front bumper.

REQUIRED TOOL
SUPERTANIUM DRILL BIT 3/16" (P/N 529 031 800)

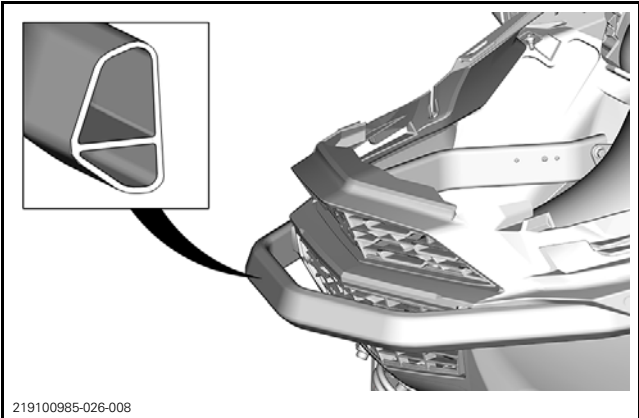
3. Remove front bumper screws.



4. Pull out bumper towards front.

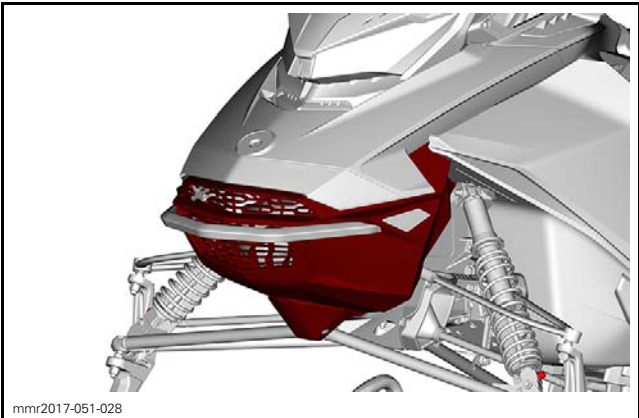
Installing the Front Bumper

The installation is the reverse of the removal procedure. However, pay attention to the following. Make sure to install front bumper as shown.



TIGHTENING TORQUE	
Front bumper nut	5 N•m ± 0.5 N•m (44 lbf•in ± 4 lbf•in)

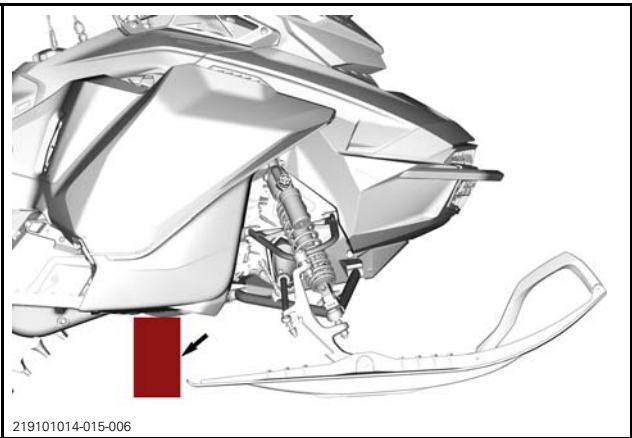
FRONT BOTTOM PAN



TYPICAL

Removing the Front Bottom Pan

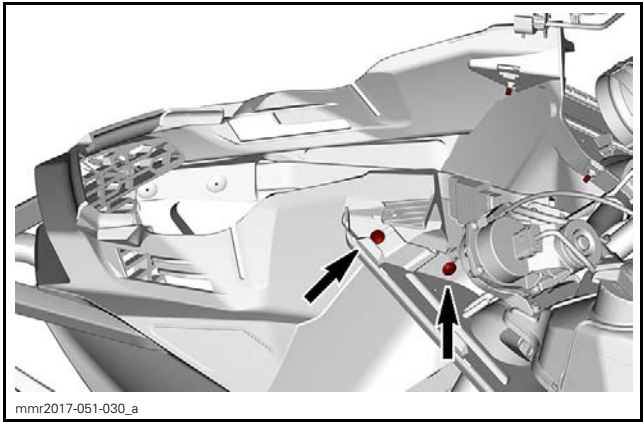
1. Lift front of vehicle until skis are off the ground.
2. Place the front portion of frame on a wooden box to support it securely.



3. Remove *FRONT BUMPER*. Refer to procedure in this subsection.

If the front bottom pan does not need to be replaced, the bumper may remain attached to bottom pan.

4. Remove bottom pan screws.

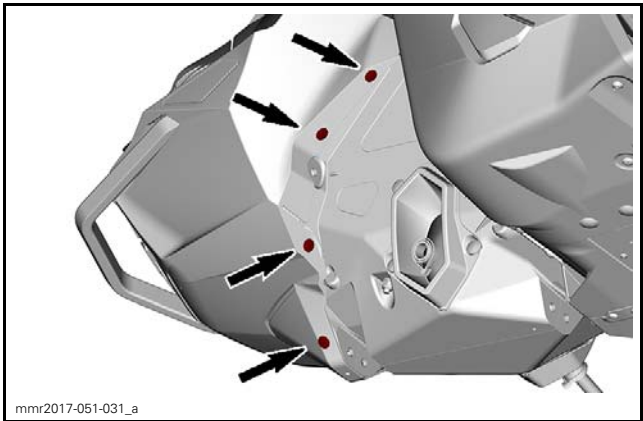


TYPICAL

5. Remove front shock absorbers. Refer to *FRONT SUSPENSION* subsection.

6. Drill out all rivets retaining bottom pan.

NOTE: Refer to *FRAME* for proper procedure when drilling rivets retaining plastic parts.



LH SIDE SHOWN — SOME PARTS REMOVED FOR CLARITY

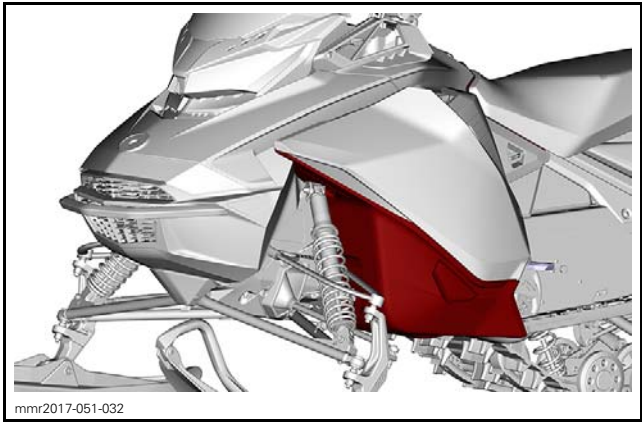
7. Remove bottom pan.

Installing the Front Bottom Pan

The installation is the reverse of the removal procedure.

TIGHTENING TORQUE	
Bottom pan screw	1.8 N•m ± 0.2 N•m (16 lbf•in ± 2 lbf•in)

SIDE BOTTOM PAN



TYPICAL

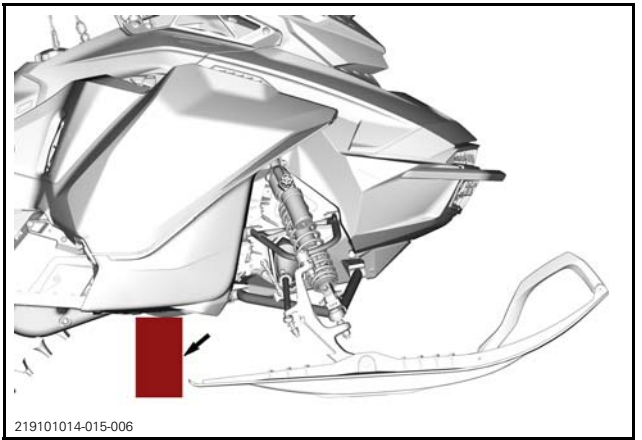
Removing the Side Bottom Pan

1. Remove the side panel. Refer to procedure in this subsection.

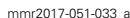
2. Lift front of vehicle until skis are off the ground.

3. Place the front portion of frame on a wooden box to support it securely.

NOTE: Ensure to clear side bottom pans so they can move freely.



4. Disconnect vent tube from side bottom pan, and remove the screws.

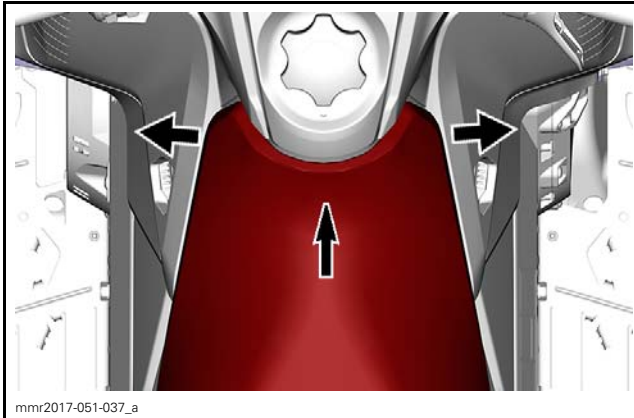


mmr2017-051-035

mmr2017-051-036 a

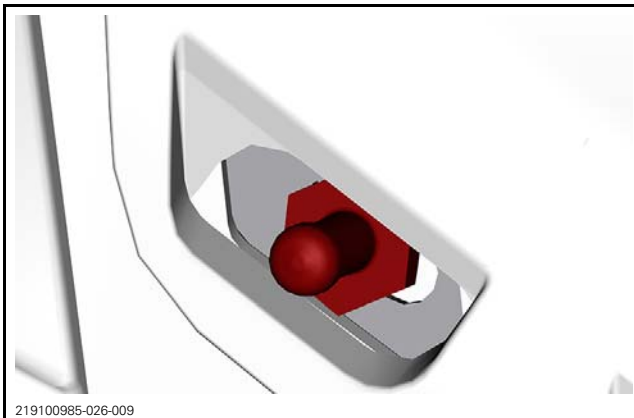
219101014-015-005

TIGHTENING TORQUE	
Side bottom pan screw on pinched nut	2.8 N•m ± 0.2 N•m (25 lbf•in ± 2 lbf•in)
Side bottom pan screw on panel nut	1.8 N•m ± 0.2 N•m (16 lbf•in ± 2 lbf•in)



The installation is the reverse of the removal procedure.

Ensure the seat is locked.



FOAM REMOVED FOR CLARITY

Replacing the Seat Cover

Remove seat.

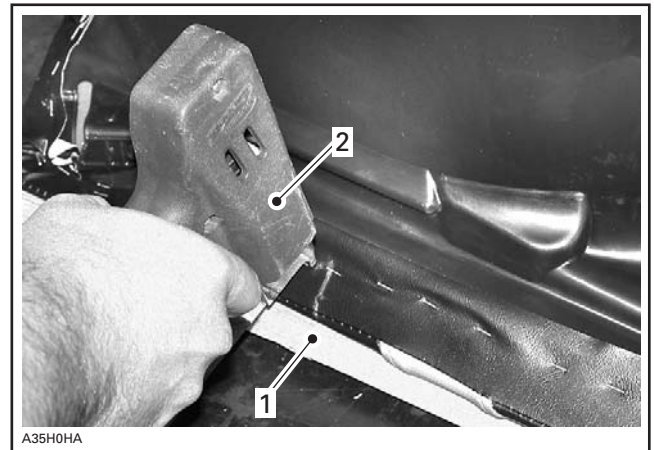
Remove the old seat cover. Check the foam and replace it if necessary.

Install the new seat cover with staples.

NOTICE Ensure to use the proper length staples. Extra long staples would pierce the exposed side of the leatherette.

NOTE: For an easier installation, it is highly recommended to use an electric stapler.

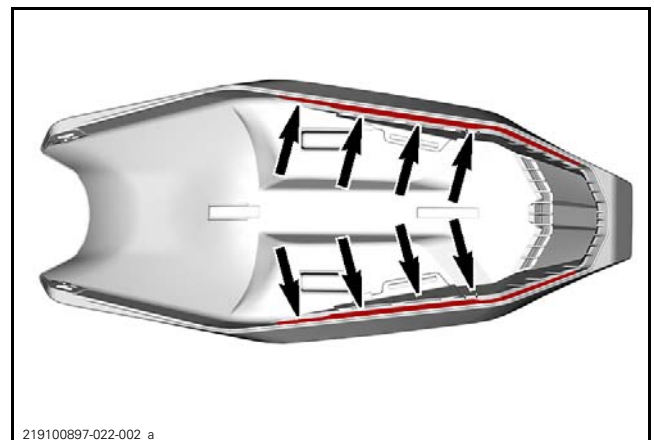
Ensure that the seat rest firmly against a hard surface such as a piece of wood. This is done to get the staples completely pushed in place.



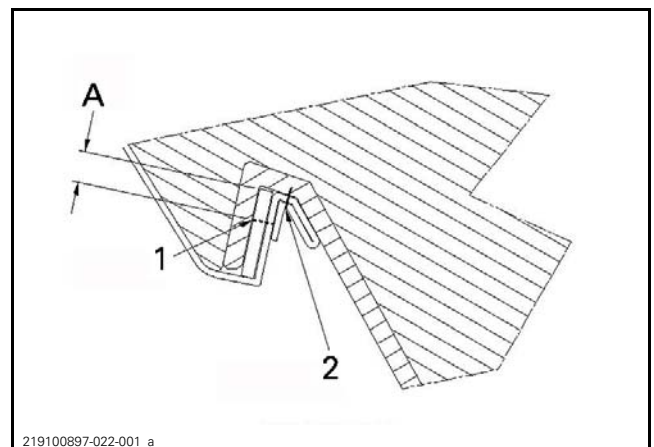
TYPICAL

1. Piece of wood
2. Tacker

The seat needs a special stapling procedure to ensure a strong and durable seat cover installation. Make sure the staples on the rear part of the seat are installed as shown.



The staples go inside the crease on each side of the seat.

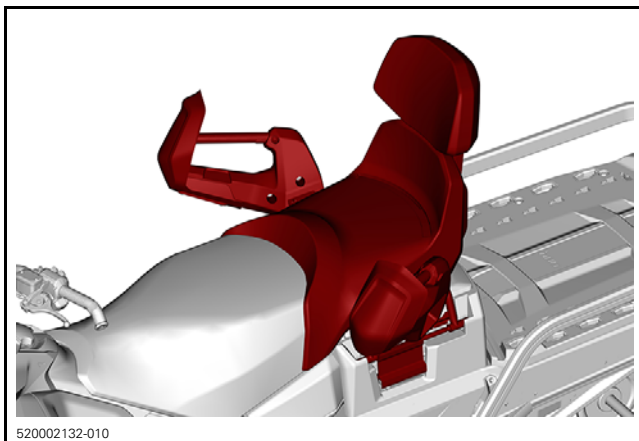


A = 5 MM (1/4 IN)

1. Sewing
2. Staple

After seat cover installation, cut out excess material leaving 5 mm (1/4 in) between staple and edge.

PASSENGER SEAT (ON APPLICABLE MODELS)

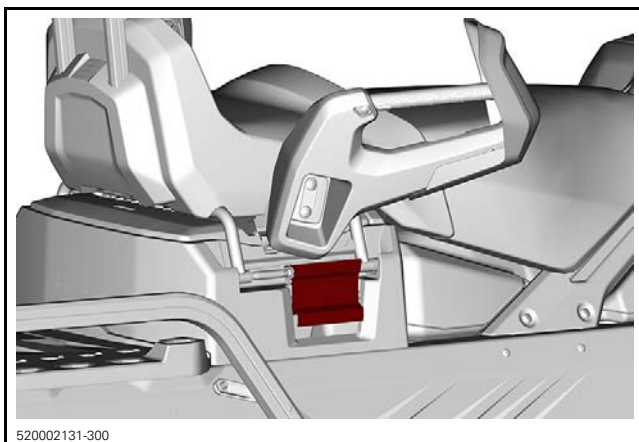


⚠ WARNING

Any passenger must be able to firmly lay his feet on the footrests and keep his hands on the handholds at all times when seated. Respecting those physical criteria is important to ensure that the passenger is stable and to reduce the risks of ejection.

Removing the Passenger Seat

1. Unlock seat latch on both sides.

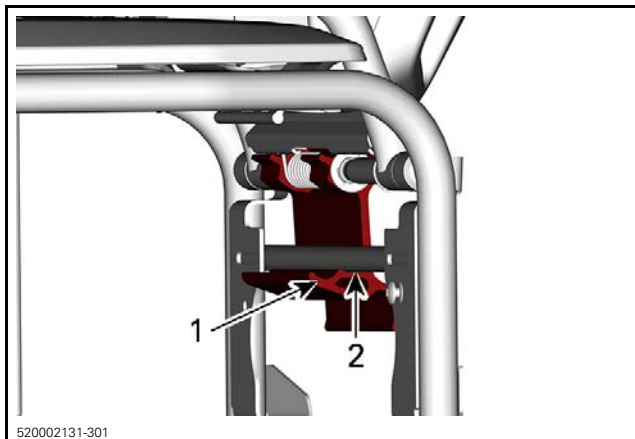


2. Lift the seat to disconnect the electrical connector.
3. Remove passenger seat.

Installing the Passenger Seat

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

Ensure to reach the second step when latching.



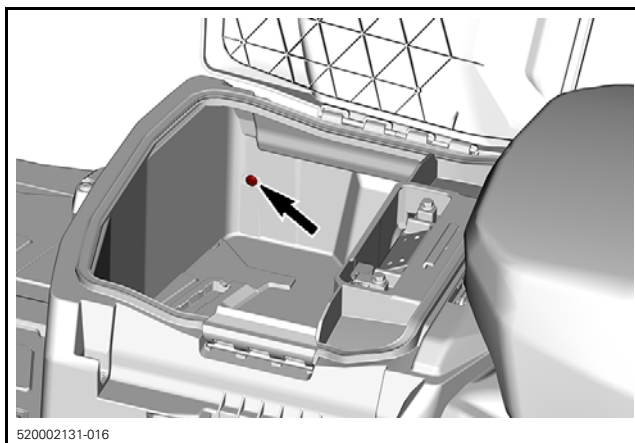
1. First step
2. Second step

⚠ CAUTION Ensure the latch is on the second step before riding.

STORAGE COMPARTMENT

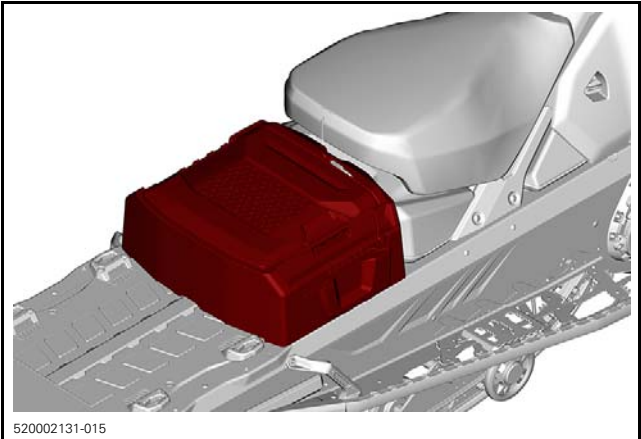
Removing the Storage Compartment

1. Remove passenger seat and backrest. Refer to this subsection.
2. Open storage compartment, remove battery cover and all mounting screws.



LH SIDE SCREW SHOWN

3. Remove storage compartment.



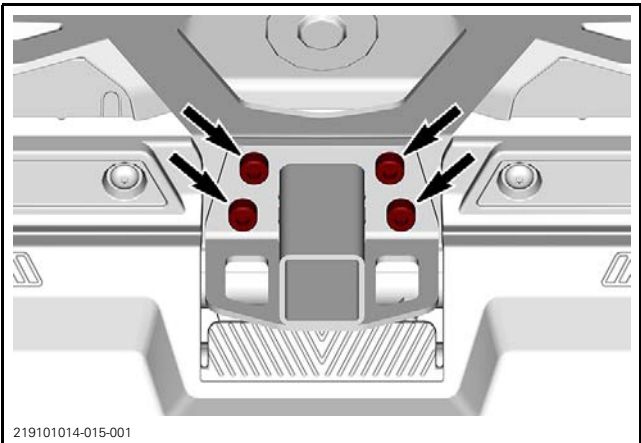
Installing the Storage Compartment

The installation is the reverse of removal procedure.

REAR HITCH

Removing the Rear Hitch

Remove following fasteners.



Installing the Rear Hitch

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

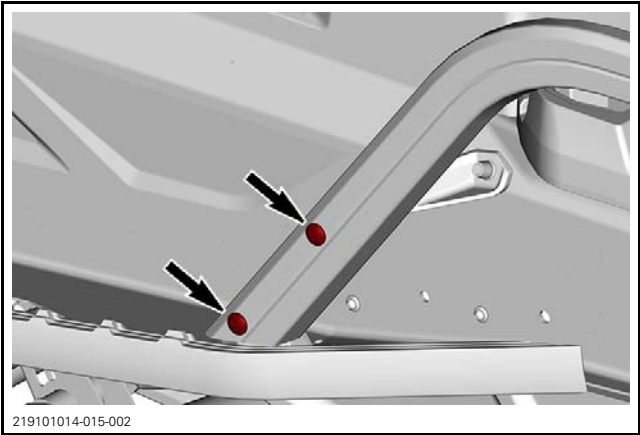
TIGHTENING TORQUE	
Rear hitch nuts	31.5 N•m ± 3.5 N•m (23 lbf•ft ± 3 lbf•ft)

REAR RACK

Removing the Rear Rack

Remove rear hitch. Refer to procedure in this subsection.

Remove following fasteners on both side.



Installing the Rear Rack

The installation is the reverse of removal procedure.

REAR BUMPER (IF EQUIPPED)

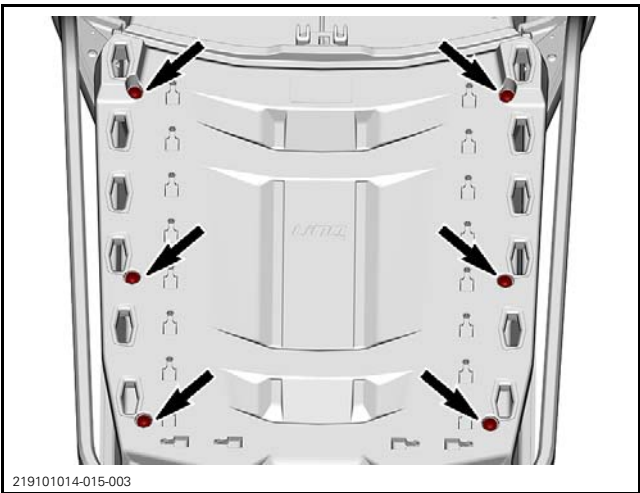
TIGHTENING TORQUE	
Rear bumper screws	16 N•m ± 2 N•m (142 lbf•in ± 18 lbf•in)

MULTI-LINQ PLATE

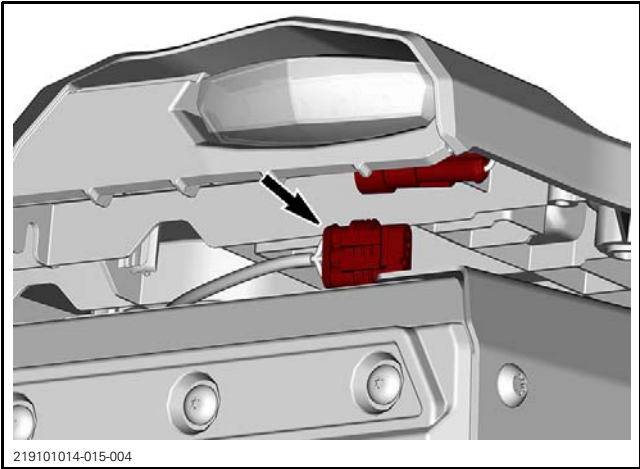
Removing the Multi-LinQ Plate

Remove storage compartment under passenger seat. Refer to this subsection.

Remove following fasteners.



Slightly lift the rear portion of the multi-LinQ plate to disconnect the taillight connectors.



Installing the Multi-LinQ Plate

The installation is the reverse of removal procedure. However, pay attention to the following.
Make sure to avoid pinching the wiring harness when installing the multi-LinQ plate in its place.

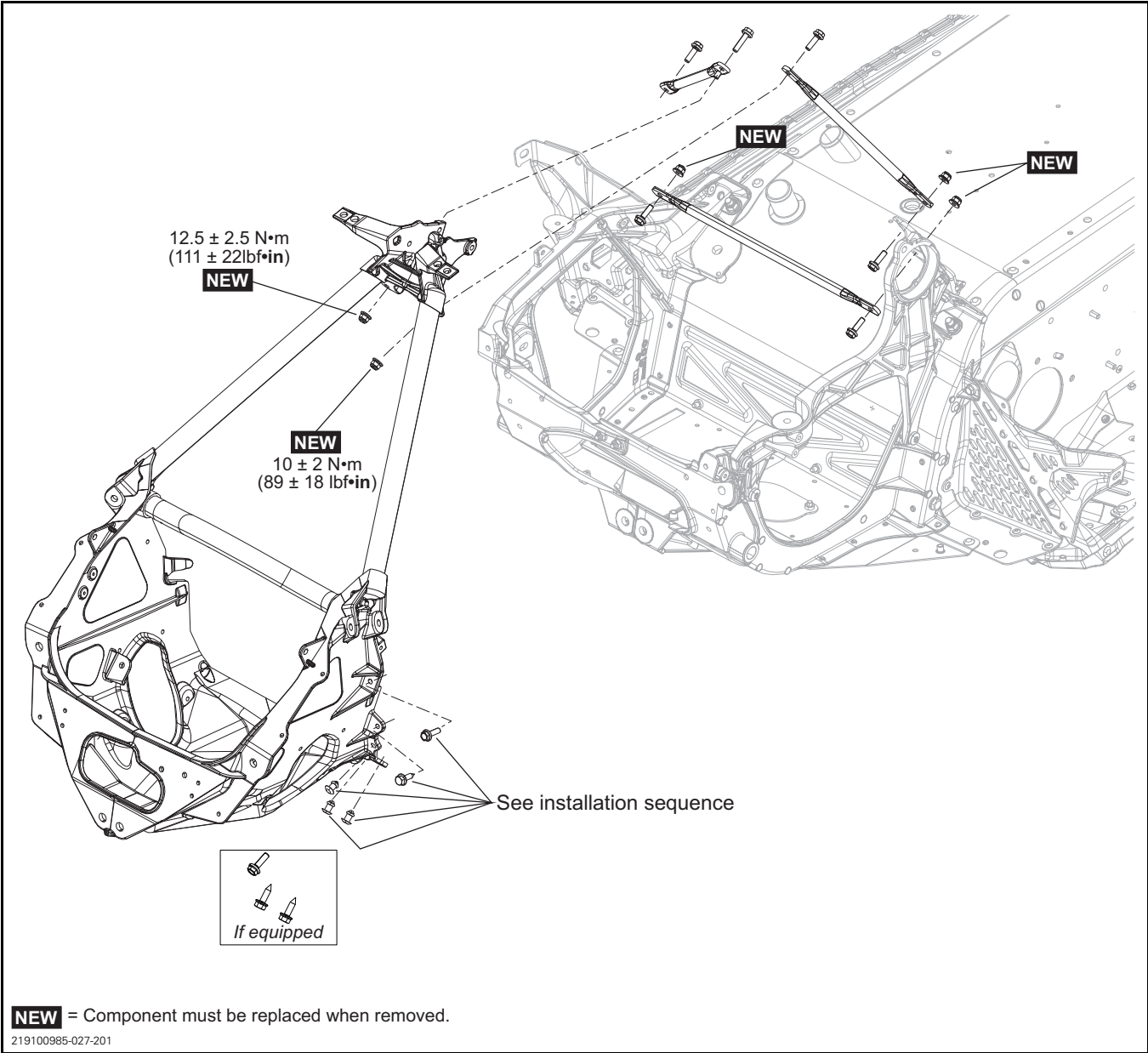
TIGHTENING TORQUE	
Multi-LinQ plate screws	7 N•m ± 1 N•m (62 lbf•in ± 9 lbf•in)

FRAME

SERVICE TOOLS

Description	Part Number	Page
RADIATOR INSTALLATION GAUGES.....	529 036 422	14
SUPERTANIUM DRILL BIT 3/16".....	529 031 800	5

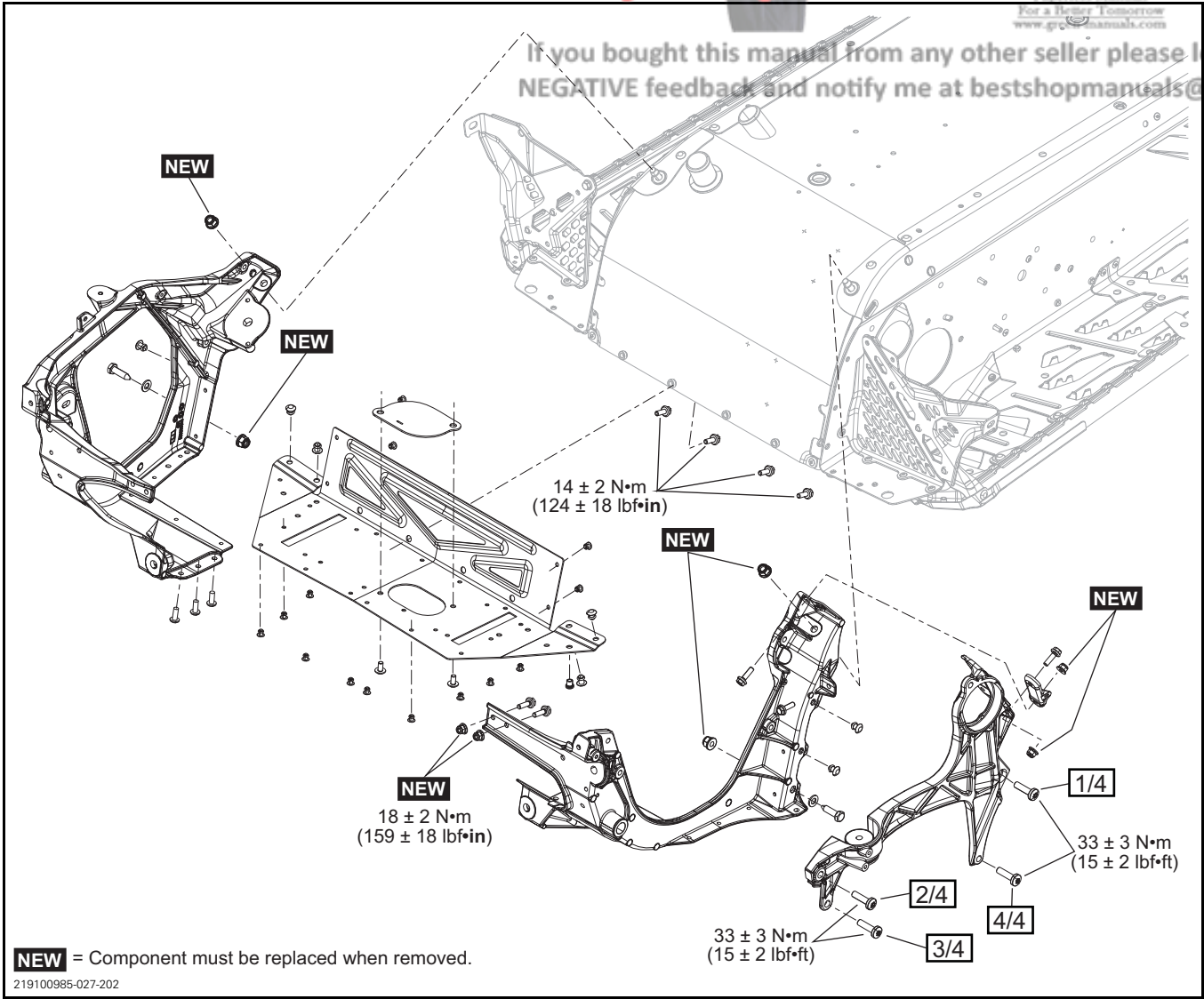
SUSPENSION MODULE



ENGINE MODULE

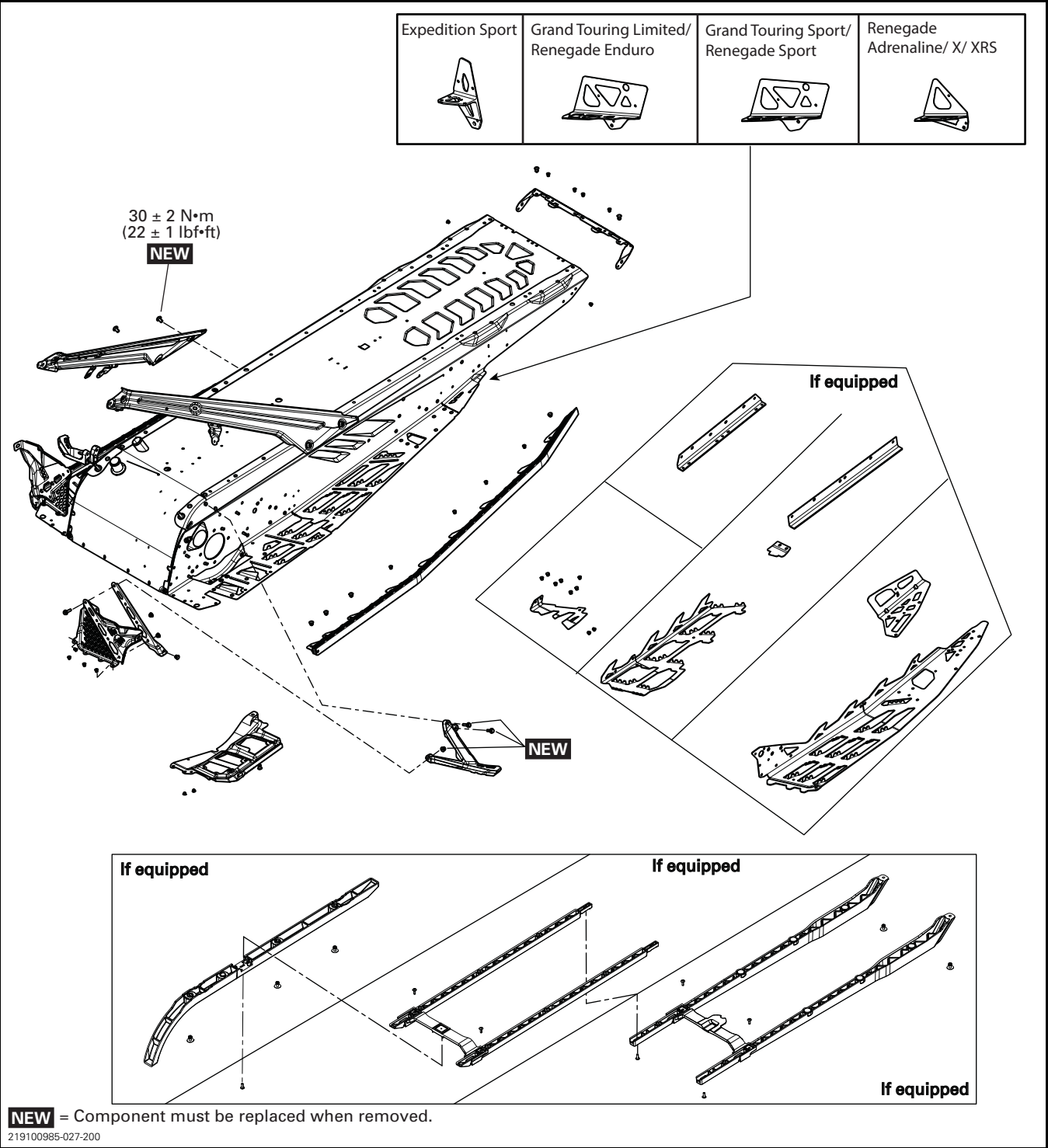


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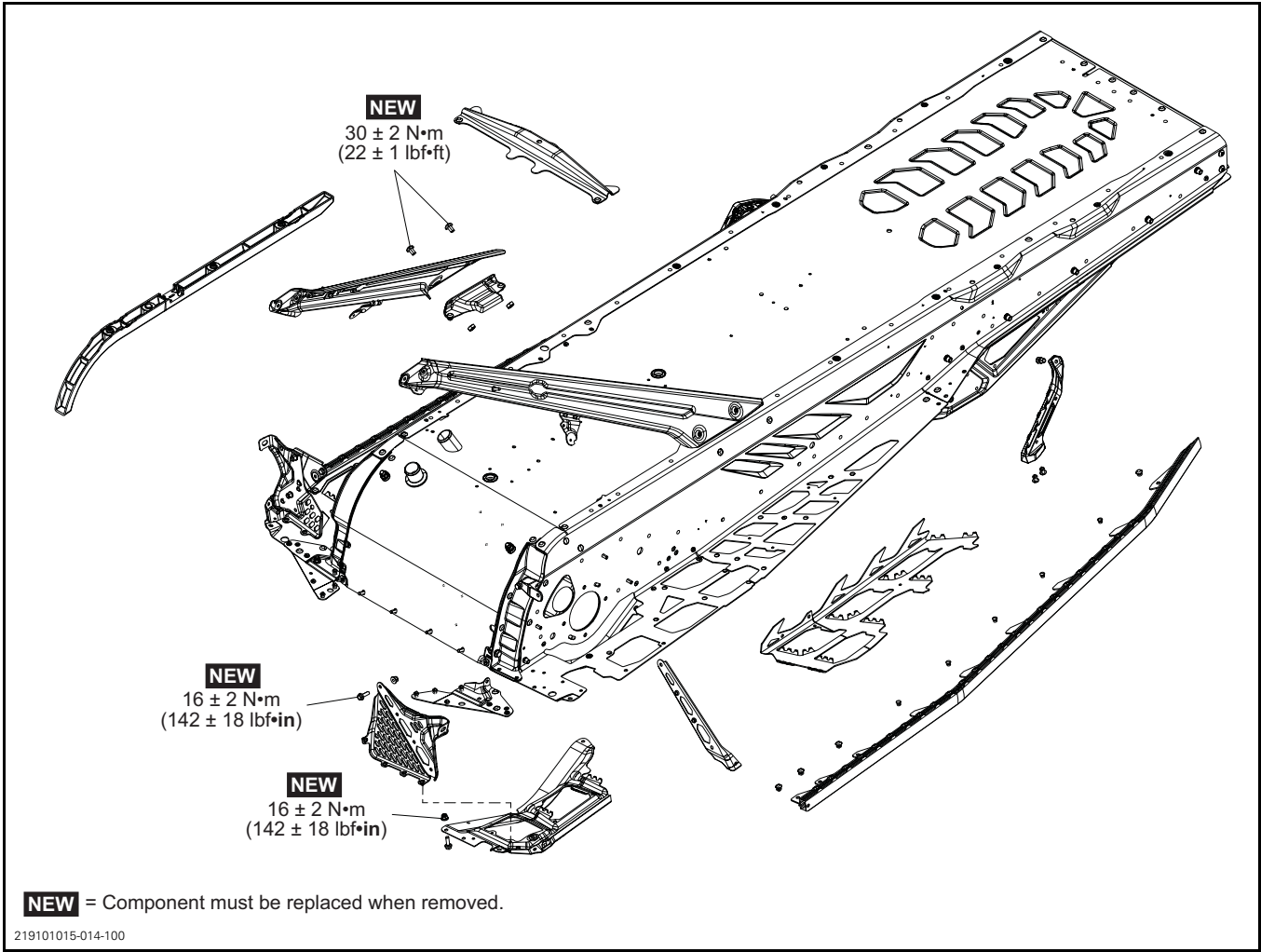
TUNNEL MODULE

16in Track



Subsection XX (FRAME)

20in Track



GENERAL

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

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

⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to. Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced with new ones.

Check for loose, bent, worn out, rusted or otherwise damaged components. Replace the faulty components.

PROCEDURES

RIVETS

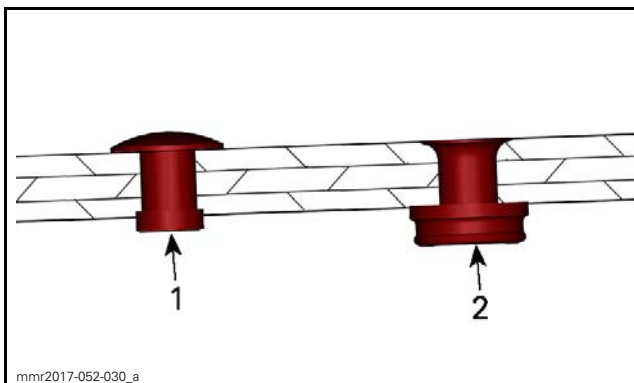
For proper drilling instructions and to prevent premature wear, follow the procedures as detailed.

NOTICE When removing rivets, do not enlarge or deform the rivet holes in the frame.

Removing a Self-Piercing Rivet

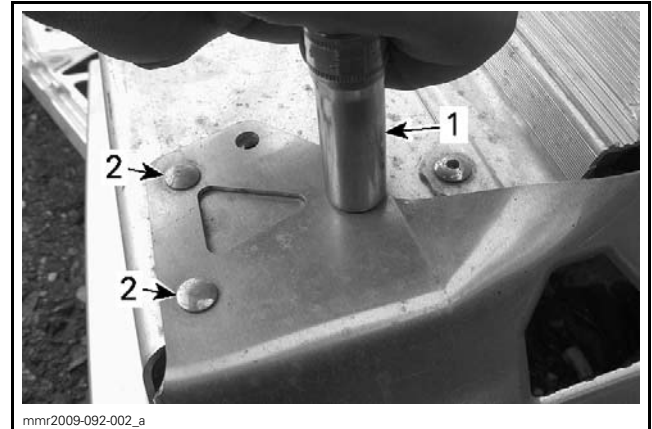
Henrob and Thomson rivets are self-piercing rivets. They are installed with specific robotized equipment.

1. Using a grinding disk, grind the rivet end.



1. Thomson rivet
2. Henrob rivet

2. Support the frame around the rivet head with a socket on the opposite side to avoid warpage.



TYPICAL

1. 11 mm socket over a rivet head
2. Rivet heads

3. Drive out remaining rivet using a punch.

Removing a Pop Rivet

Stavex, Avibulb, and Hemlock rivets are standard pop rivets. They are installed with standard manual or pneumatic tool.

1. Drill rivet head sufficiently to cut through it.

NOTE: To drill a Hemlock rivet, remove the riveting nail using a punch first.

NOTICE It is highly recommended to support the frame locally around a Hemlock rivet when punching its nail out.



HEMLOCK RIVET

RECOMMENDED TOOL

SUPERTANIUM DRILL BIT 3/16" (P/N 529 031 800)

NOTICE Drill only sufficiently to cut rivet head. Do not drill into frame material, or part secured using the rivet. When rivet is used to secure a plastic part, use pliers to avoid rotation of rivet with drill bit and heating or melting of the plastic part.

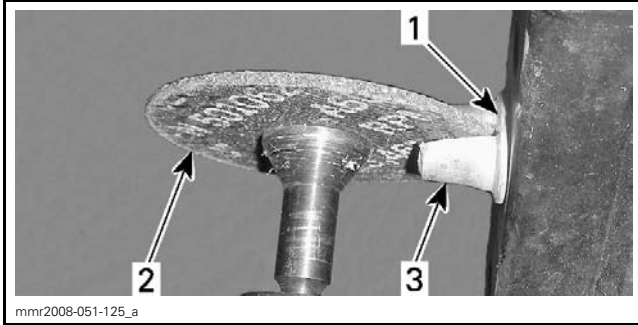
Subsection XX (FRAME)

2. Using a small punch, drive out the remaining rivet end.

Removing a HUCK Rivet

Huck rivet is a 2 parts type rivet. It is installed with a specific pneumatic tool.

1. Using a cut-off tool, cut the rivet retainer without touching the retainer's shoulder.



1. Rivet retainer's shoulder
2. Cutter wheel
3. Rivet retainer

NOTE: Apply a thin layer of grease on cutter wheel to increase its durability.

2. Break the rivet retainer's shoulder using a chisel.
3. Use a small punch to drive out the rivet stem.

FRAME

Cleaning the Frame

Clean frame and tunnel with appropriate cleaners and rinse with high pressure hose.

NOTE: For bare aluminum frames use only aluminum cleaner and follow instructions on container.

NOTICE Never direct high-pressure water jet towards decals. They will peel off.

Welding the Frame

No welding is permitted unless it is specified on a BRP bulletin.

However, the heat exchanger can be welded to plug a small leak.

Repairing the Frame

The following is specific information for aluminum chassis painting. Use common painting techniques.

1. Sand the area to be painted.
2. Clean and dry the area.

3. Apply a thin layer of paint of the appropriate color.

4. Allow paint to dry before re-coating.

NOTE: Paint takes approximately 15 minutes to dry following application.

5. Apply a thin coat of clear.

6. Immediately after the clear coat application, apply a thin coat of HR50 blending solvent **around** the painted area.

7. Allow clear coat to dry.

NOTE: Clear coat takes approximately 2 hours to dry following application.

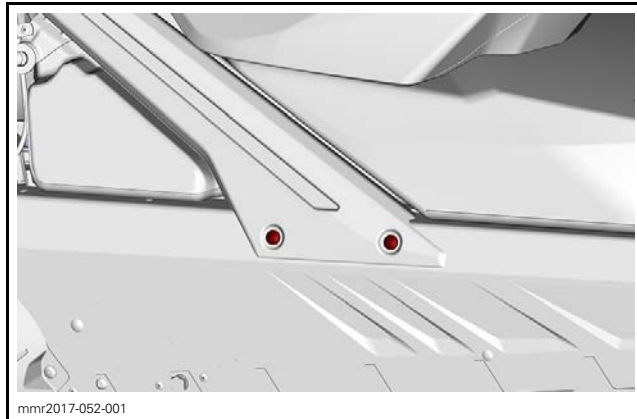
REAR BUMPER

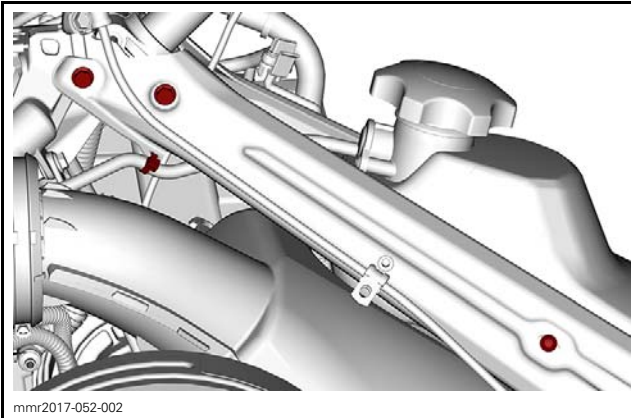
Refer to *BODY* subsection for rear bumper removal and installation procedure.

REAR FRAME MEMBER

Removing the Rear Frame Member

1. Refer to *BODY* subsection to remove the following:
 - Seat
 - Upper body module
 - Rear console.
2. Remove fasteners as per the following illustrations.



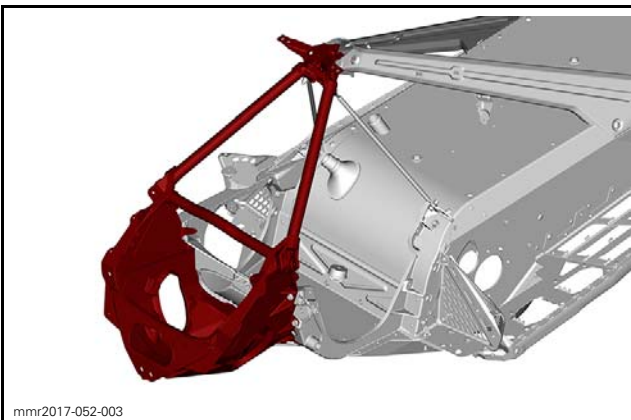


3. Remove rear frame member.

Installing the Rear Frame Member

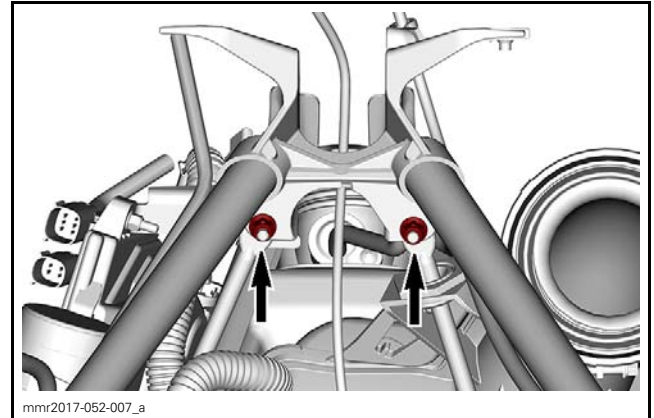
The installation is the reverse of the removal procedure. However, pay attention to the following. Install all screws and nuts before tightening them. Refer to exploded views for proper tightening torque.

FRONT SUSPENSION MODULE

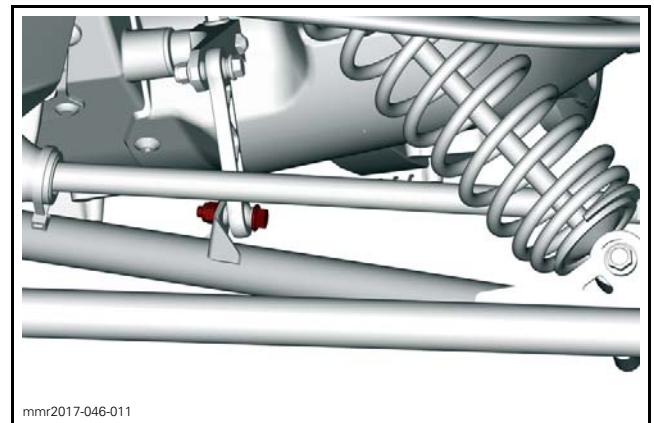


Removing the Front Suspension Module

1. Lift front of vehicle until skis are off the ground.
2. Place a wooden box under the engine module to support the frame securely.
3. Refer to the appropriate subsection and remove:
 - Engine
 - Steering column.
4. Detach the brake hose clamp next of the upper steering column support.
5. Detach side frame members from upper steering column support.

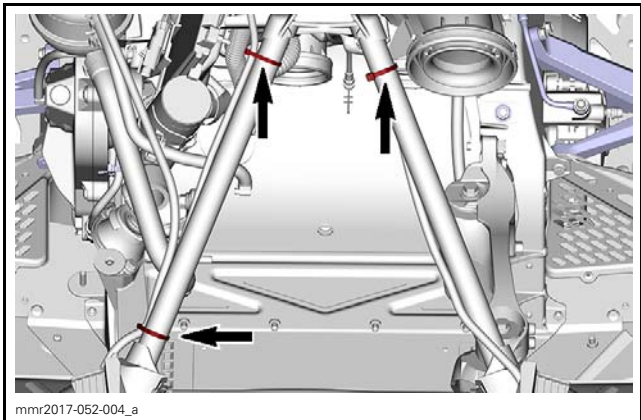


6. Remove the front suspension assembly in the following manner:
 - 6.1 Detach tie-rod ends from steering column.
 - 6.2 Remove upper shock absorber screws.
 - 6.3 Remove screw that secures stabilizer link to lower arm.



- 6.4 Remove upper and lower suspension arms screws and nuts. Refer to *FRONT SUSPENSION* subsection.
 - 6.5 Remove front suspension assembly from vehicle.
 7. Remove the stabilizer bar. Refer to *FRONT SUSPENSION* subsection.
 8. Remove the front bottom pan. Refer to *BODY* subsection.
- NOTE:** Keep the front bumper installed on front bottom pan.
9. Cut locking ties that secure vents and electrical harness to module tubes.

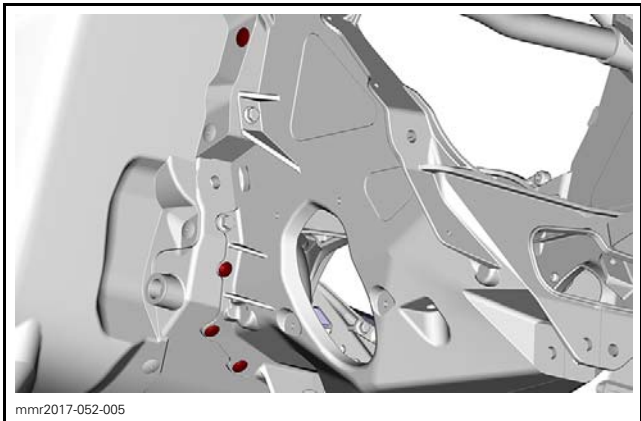
Subsection XX (FRAME)



10. If the suspension module needs to be replaced, remove:
- Steering rack / lower steering column support
 - Tie rod boots.
- Refer to *STEERING SYSTEM* subsection.

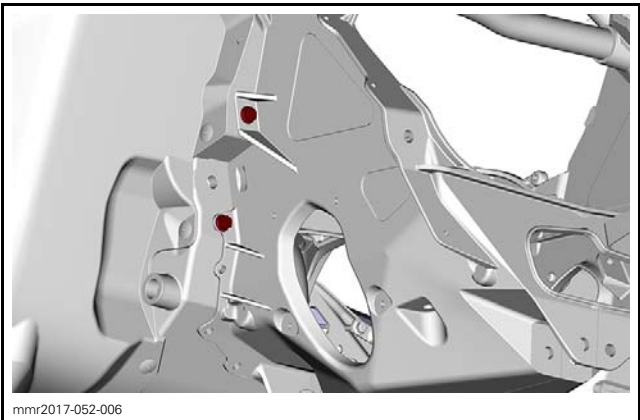
11. Remove the lower retaining fasteners.
- For riveted models, refer to *REMOVING A POP RIVET* at the beginning of this subsection for procedure.

NOTICE It is highly recommended to support the frame locally around a Hemlock rivet when punching its nail out.



RH SIDE SHOWN

12. Remove the upper retaining fasteners.



RH SIDE SHOWN

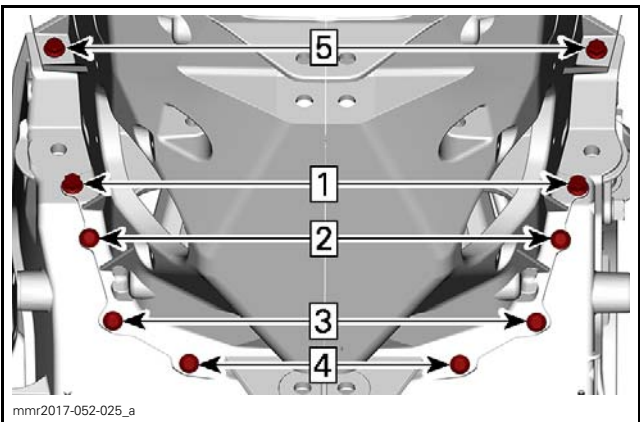
13. Remove the front suspension module.

Installing the Front Suspension Module

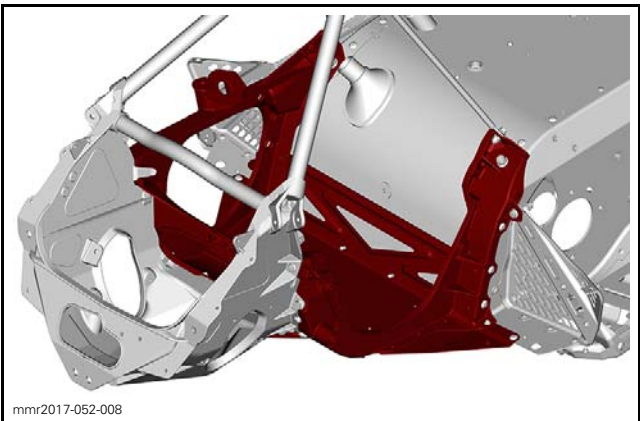
The installation is the reverse of the removal procedure. However, pay attention to the following.

Refer to exploded views for proper tightening torque.

Install fasteners as per the following sequence.

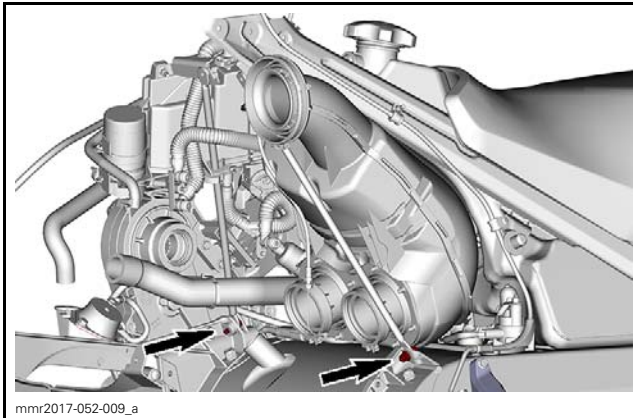


ENGINE MODULE

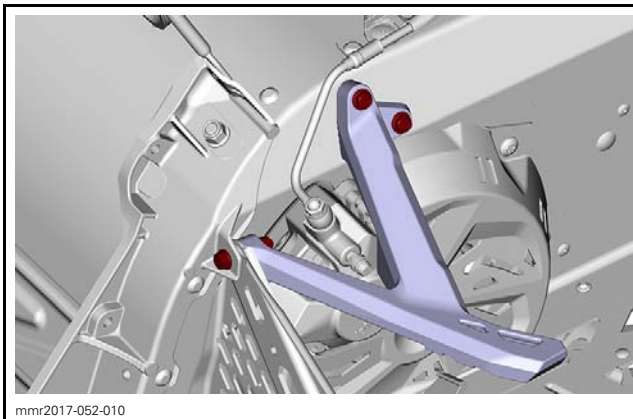


Removing the Engine Module

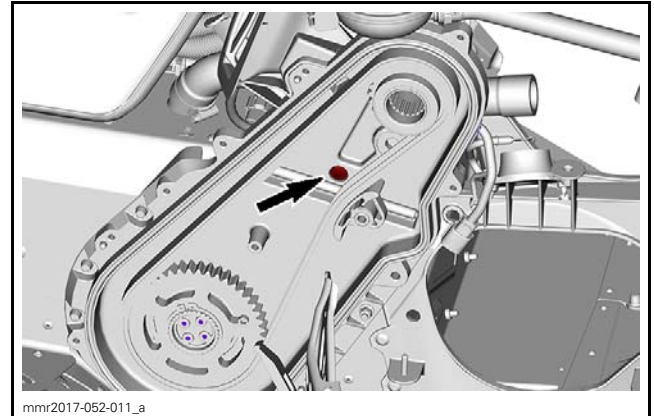
1. Remove the *FRONT SUSPENSION MODULE*, see procedure in this subsection.
2. Remove RH side bottom pan. Refer to *BODY* subsection.
3. Remove the RH side engine rubber mount. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
4. Detach side frame members from engine module.



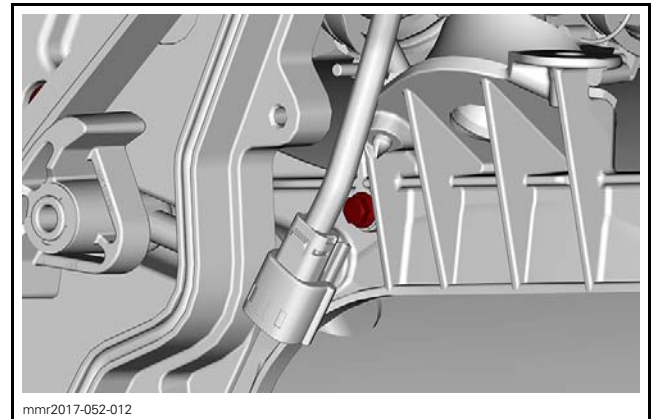
5. Remove toe hook fasteners, if equipped.



6. Remove the chaincase cover. Refer to *CHAINCASE* subsection.
7. Remove the screw that secure the chaincase to the engine module.

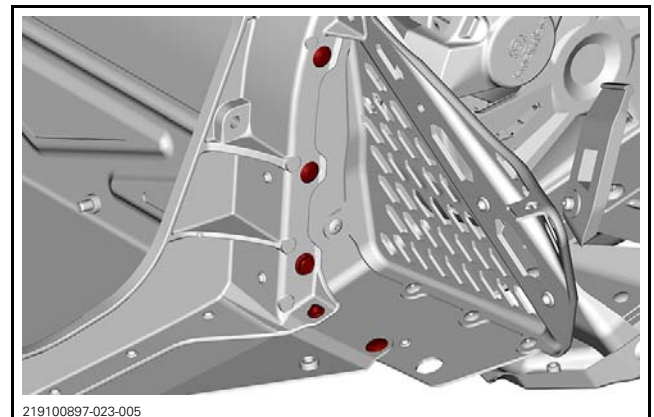


8. Remove the electrical ground screw located between the chaincase and the engine mount.



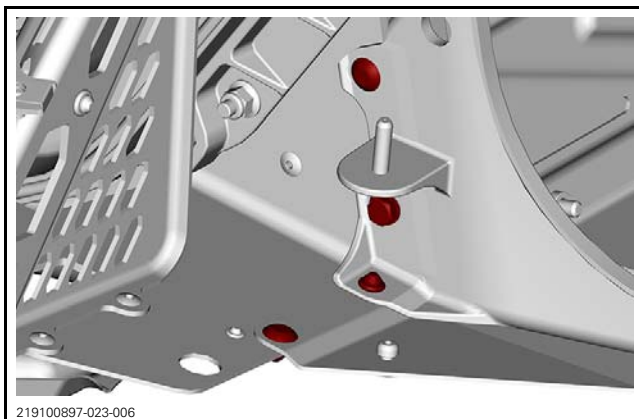
9. Remove rivets and bolts as per the following illustrations. Refer to *REMOVING A POP RIVET* in this subsection.

NOTICE It is highly recommended to support the frame locally around a Hemlock rivet when punching its nail out.



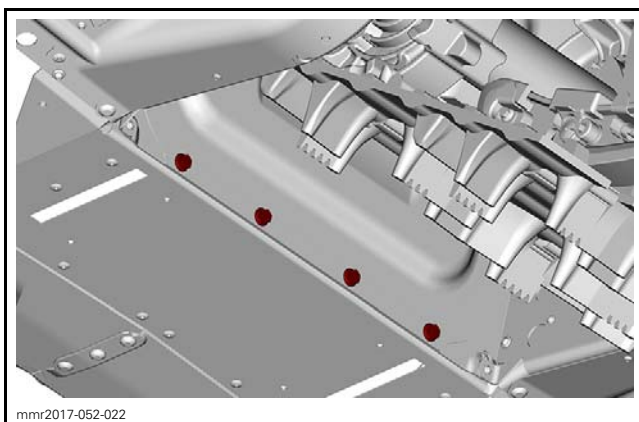
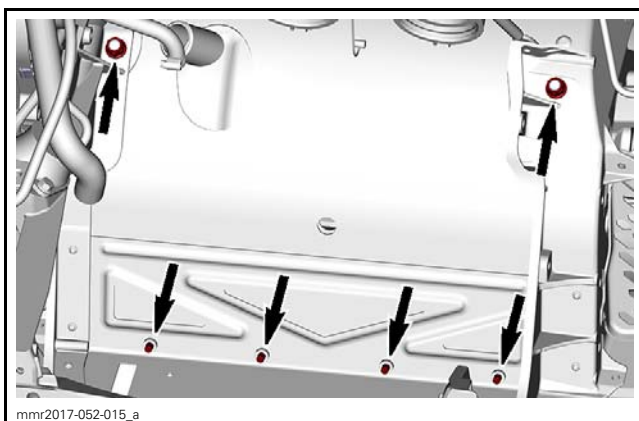
LH SIDE

Subsection XX (FRAME)



RH SIDE

10. Remove nuts and screws securing the engine module to the tunnel.

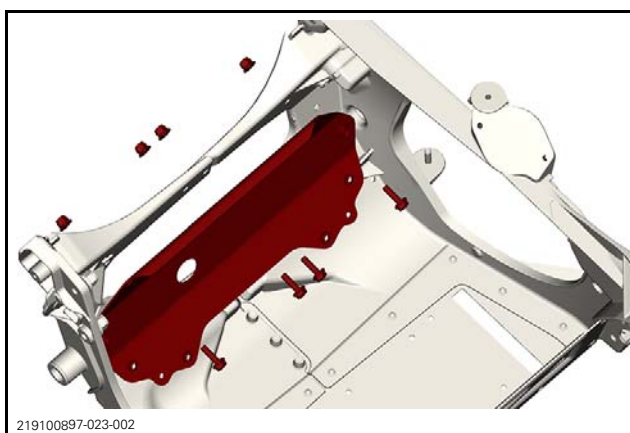
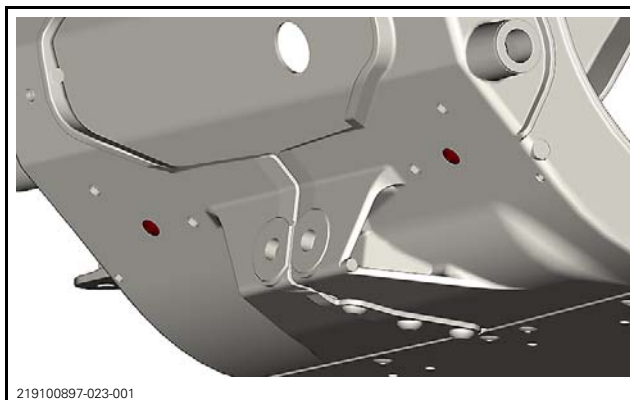


VIEW FROM INSIDE THE TUNNEL

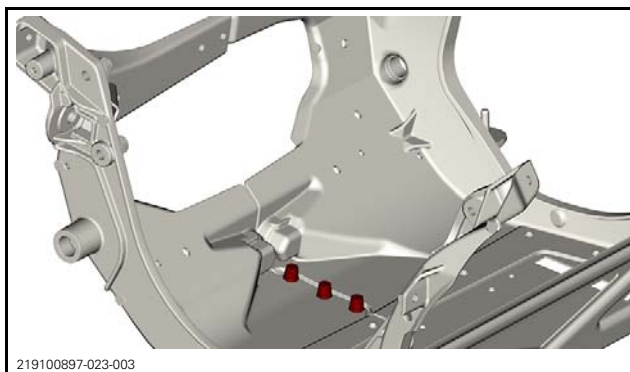
11. Remove the engine module.
If only one of the two side members is replaced:

Models with Reinforcement Plate

Remove the rivets and bolts retaining the reinforcement plate.

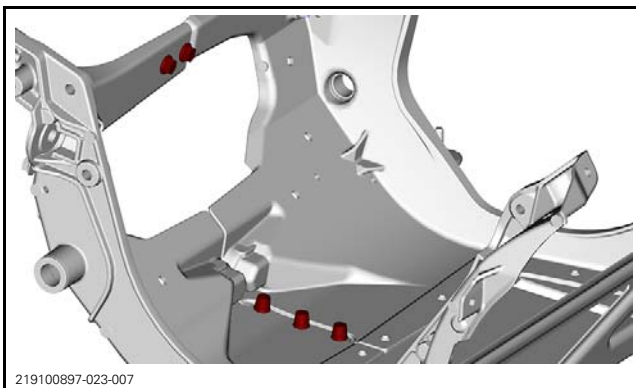


Remove HUCK rivets as per the procedure in this subsection.



Models without Reinforcement Plate

Remove HUCK rivets and bolts as per the procedure in this subsection.



Installing the Engine Module

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

Assemble LH and RH side frame member before to fix on the tunnel module.

If the HUCK rivets were removed, replace with the following parts.

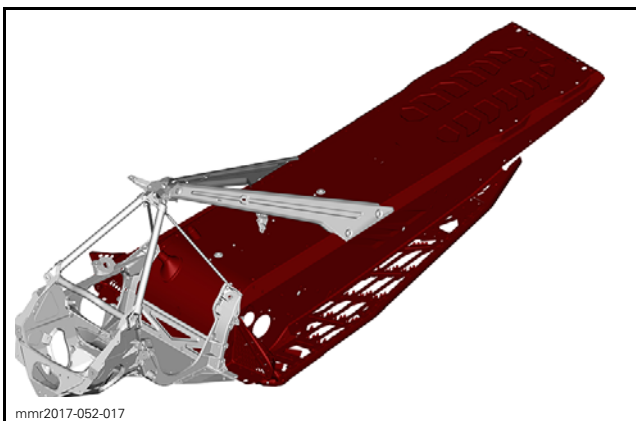
NEW FASTENERS	
Torx screw M6 x 20	(P/N 250000712)
Hexagonal flanged elastic stop nut M6	(P/N 233261414)

NOTE: Install the 3 bottom screws with heads downwards and the 2 upper screws with heads towards the engine.

Install all screws and rivets in there hole (including reinforcement fasteners) before tightening and riveting.

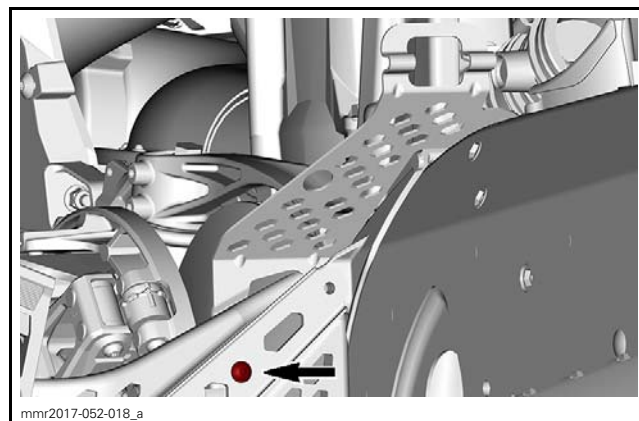
Refer to exploded views for proper tightening torque. Use standard tightening torque when not specified.

TUNNEL MODULE

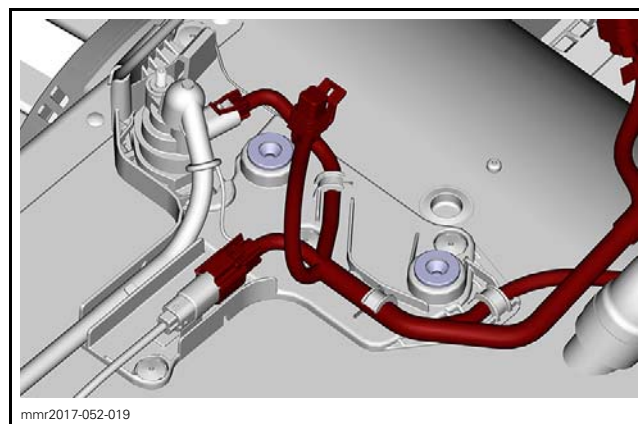


Removing the Tunnel Module

1. Drain cooling system, Refer to *COOLING SYSTEM - VEHICLE COMPONENTS* subsection.
2. Place a wooden box under the engine module to support the frame.
3. Refer to the appropriate subsection and remove:
 - Driven pulley and countershaft
 - Fuel tank
 - Primary air intake silencer
 - LH bottom pan
 - Track
4. Remove the remaining drive belt guard bracket screw.



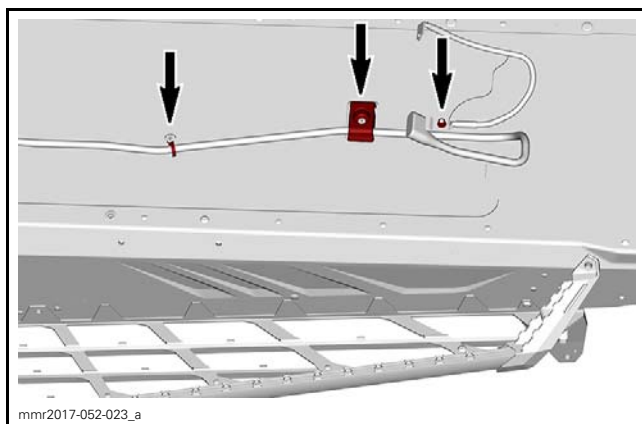
5. Disconnect the starter cable from the solenoid, if equipped.
6. Disconnect and remove the electric harness from the plastic bracket.



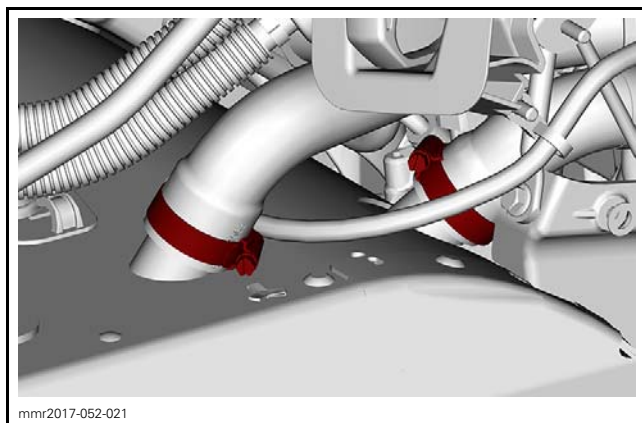
7. If the tunnel is replaced, remove:
 - Chaincase
 - The plastic bracket
 - Devices that retain the battery cable, if equipped
 - Rear bumper

Subsection XX (FRAME)

- Taillight
- Snowguard.

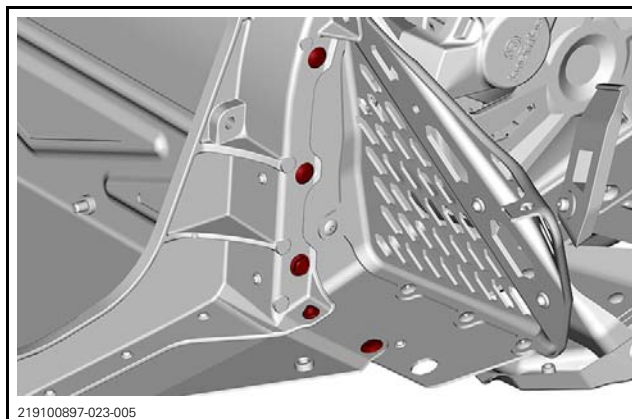


8. Move the plastic bracket, electrical harness, and fuel hoses aside to clear the tunnel.
9. Loosen the coolant hose clamps and disconnect hoses.

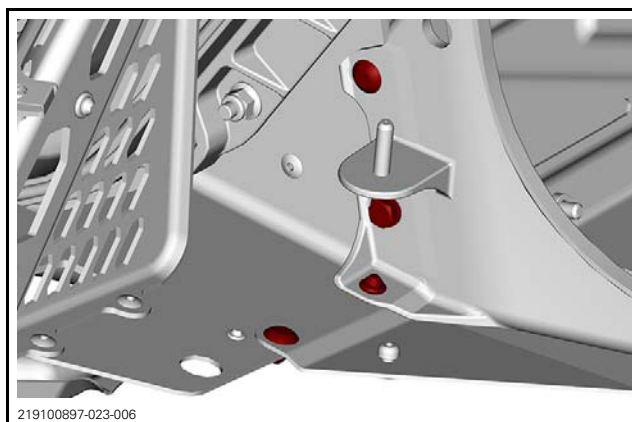


10. Remove rivets as per the following illustrations. Refer to *REMOVING A POP RIVET* in this subsection.

NOTICE It is highly recommended to support the frame locally around a Hemlock rivet when punching its nail out.

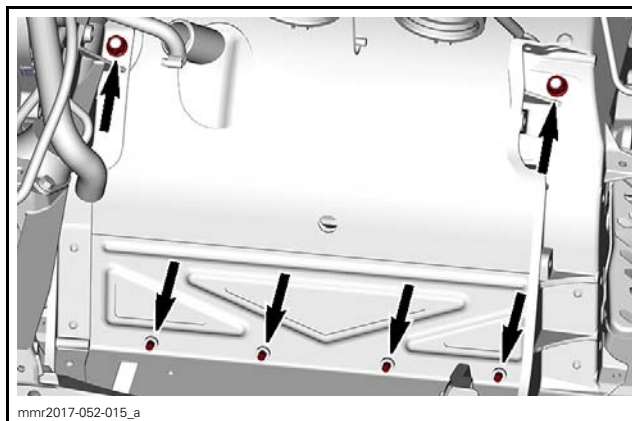


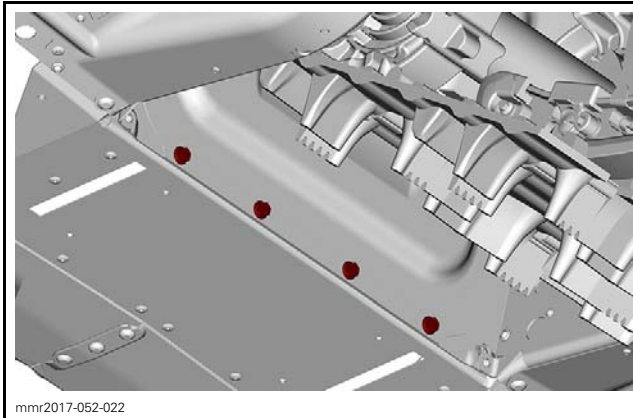
LH SIDE



RH SIDE

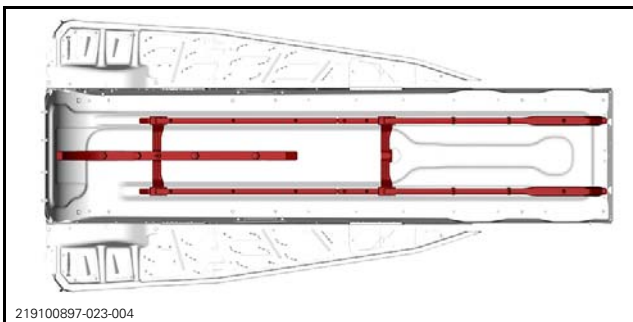
11. Remove nuts and screws securing the engine module to the tunnel.





VIEW FROM INSIDE THE TUNNEL

12. Separate the tunnel module from the rest of the frame.
13. Remove the tunnel protectors under the tunnel, if equipped.

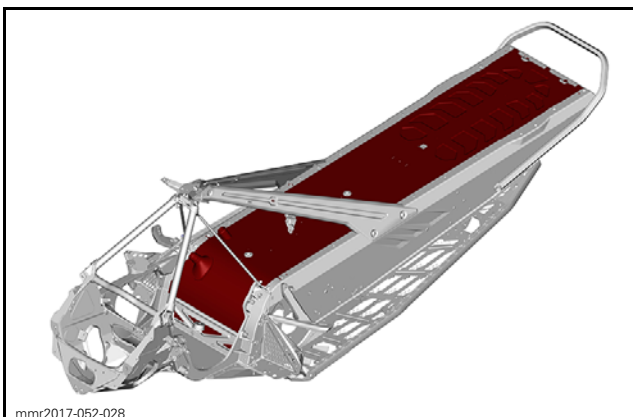


Installing the Tunnel Module

The installation is the reverse of the removal procedure. However, pay attention to the following. Refer to exploded views or appropriate subsections for proper tightening torque.

Properly refill cooling system. Refer to *COOLING SYSTEM - VEHICLE COMPONENTS* subsection.

HEAT EXCHANGER



Welding the Heat Exchanger

NOTICE Welding aluminum requires special skills, do not try if you're not familiar with the process.

1. Lower coolant level in the heat exchanger.
2. Clean the leak area with acetone.
3. Use a stainless steel brush to remove all residues.
4. Clean again with acetone.
5. Weld the leak area using a MIG or a TIG welder.
6. Properly refill cooling system. Refer to *COOLING SYSTEM - VEHICLE COMPONENTS* subsection.

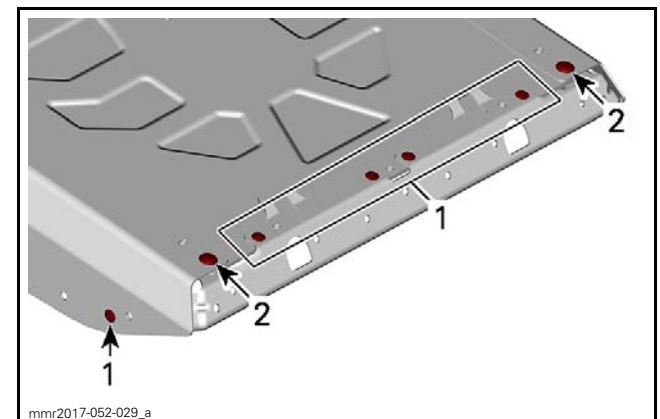
Replacing the Heat Exchanger

1. Remove the tunnel. Refer to the procedure in this subsection.

Do not remove the chaincase.

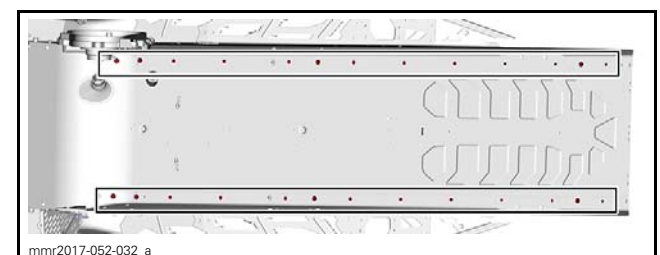
2. Remove the tunnel rear cap. Refer to *RIVETS* in this subsection.

NOTICE It is highly recommended to support the frame locally around a Hemlock rivet when punching its nail out.

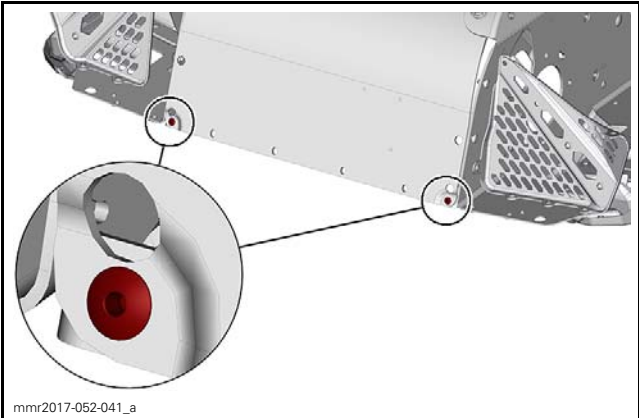


1. Avibulb rivets (pop rivets)
2. Hemlock rivets (pop rivets)

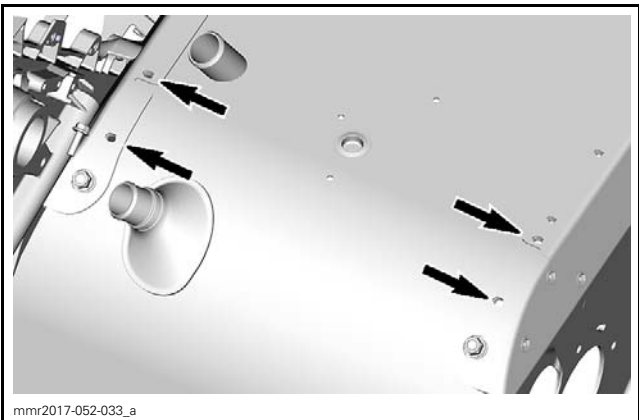
3. Remove the following rivets.



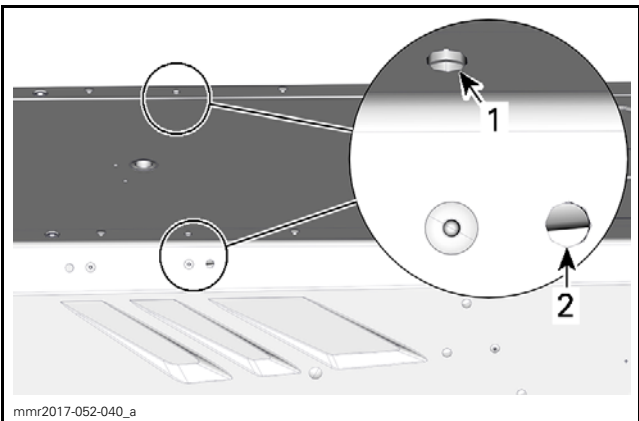
Subsection XX (FRAME)



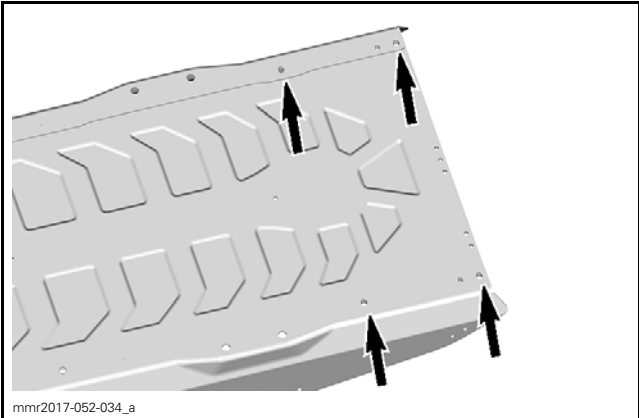
4. Position the new heat exchanger.
5. Install M6 screws and nuts loosely in the Hemlock rivet holes.
- NOTE:** M6 screws will not fit in self-piercing rivet holes.



FRONT RIVET HOLES



- MID-LENGTH RIVET HOLES**
1. Install M6 screws and nuts here
2. Rear mounting hole for rear frame member



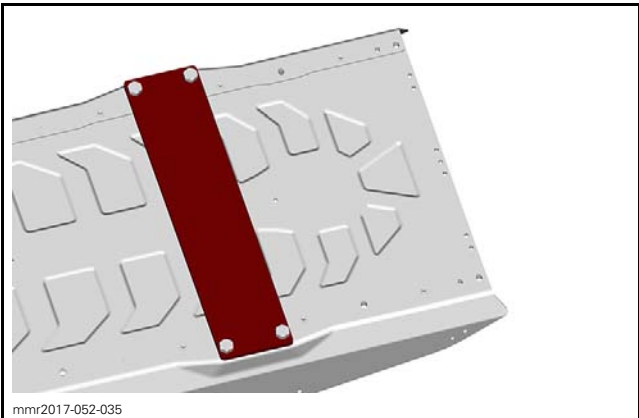
REAR RIVET HOLES

6. Install the gauge kit (according to vehicle model) loosely with the appropriate screws, as per the following illustrations.

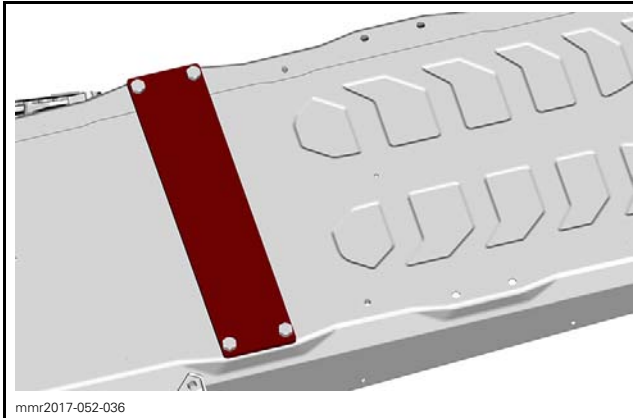
NOTICE It is imperative to use the gauge kit and to follow each steps of this procedure to avoid drive axle misalignment.

MODEL	REQUIRED TOOL	
16in Track	RADIATOR INSTALLATION GAUGES (P/N 529 036 422)	
20in Track	RADIATOR INSTALLATION GAUGES (P/N 529 036 504)	

CYLINDRICAL GAUGES LENGHT	
Rear suspension hole gauges	419.2 mm (16-1/2 in)
Tail gauge	426.4 mm (16-25/32 in)

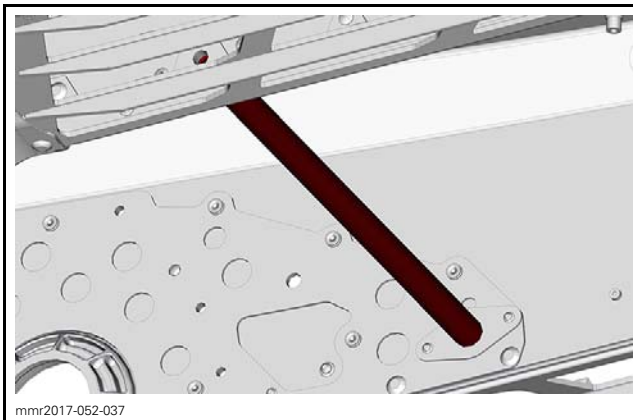


1 LINQ KIT FRAME



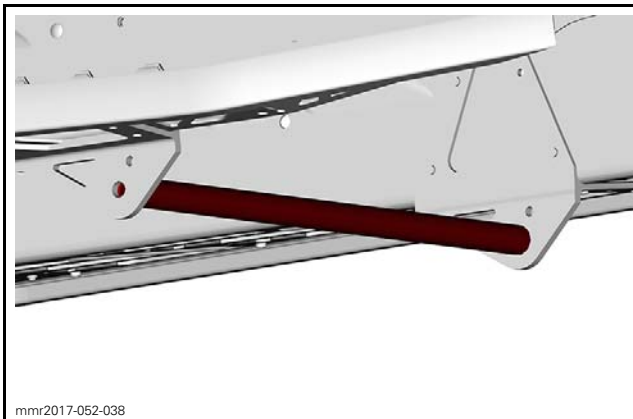
mmr2017-052-036

2 LINQ KIT FRAME - INSTALL ON FRONT HOLES



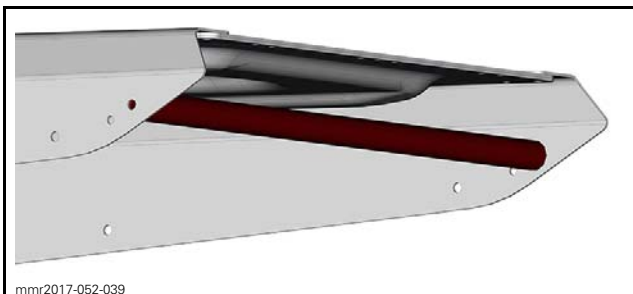
mmr2017-052-037

REAR SUSPENSION FRONT ARM GAUGE



mmr2017-052-038

REAR SUSPENSION REAR ARM GAUGE



mmr2017-052-039

TAIL GAUGE

7. Install the drive axle. Refer to *DRIVE AXLE* subsection.

NOTE: It is not required to install the chain and the brake disc.

8. Tighten gauges and M6 screws with standard torque.

9. Enlarge self-piercing rivet holes.

REQUIRED TOOL

Drill bit 6.35 mm (1/4 in)

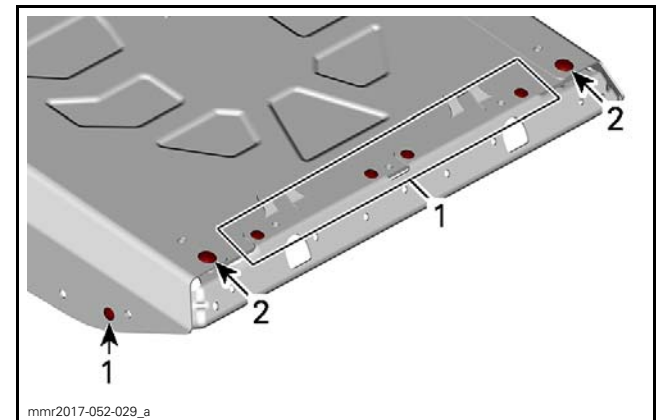
10. Install Hemlock rivets in enlarged holes.

REQUIRED PARTS

Hemlock rivets

(P/N 293150119)

11. Install the tunnel rear cap.



1. Avibulb 4.76 mm (3/16 in) rivets
2. Hemlock 6.4 mm (1/4 in) rivets

12. Remove the M6 screws and nuts, and install Hemlocks rivets.

13. Remove all gauges and the drive axle.

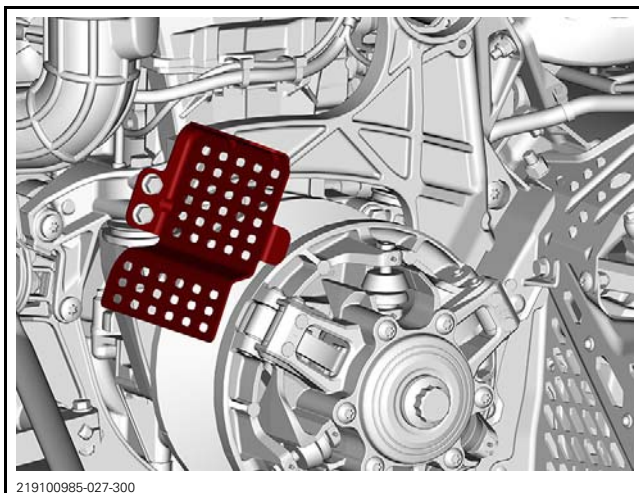
14. Reassemble the vehicle.

COUNTERSHAFT BEARING SUPPORT

Removing the Countershaft Bearing Support

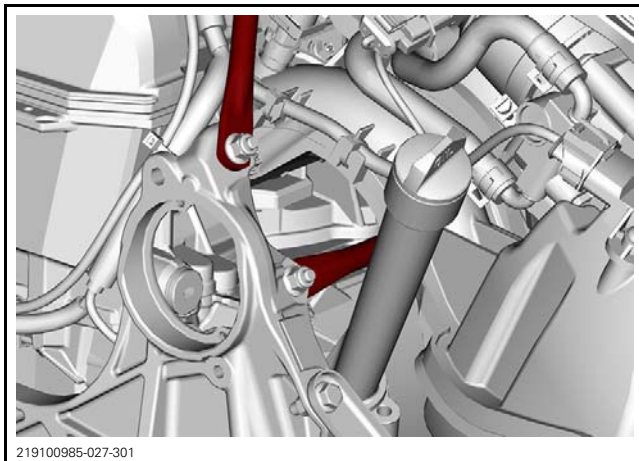
1. Refer to the appropriate subsection and remove:
 - Driven pulley and countershaft
 - LH side bottom pan.
2. Remove the belt guard support.

Subsection XX (FRAME)

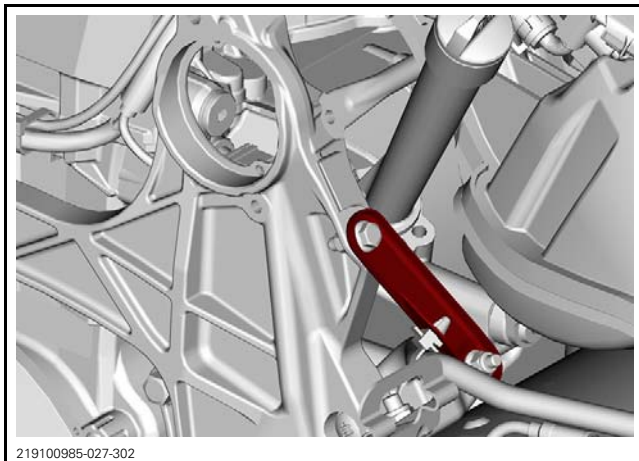


3. Insert a pry bar between the engine module and the bottom of the engine to support it during the countershaft bearing support removal.

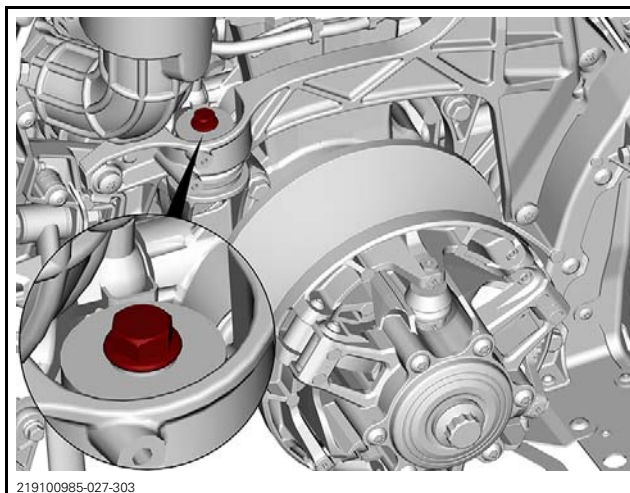
4. Detach both supports from the top of the countershaft bearing support



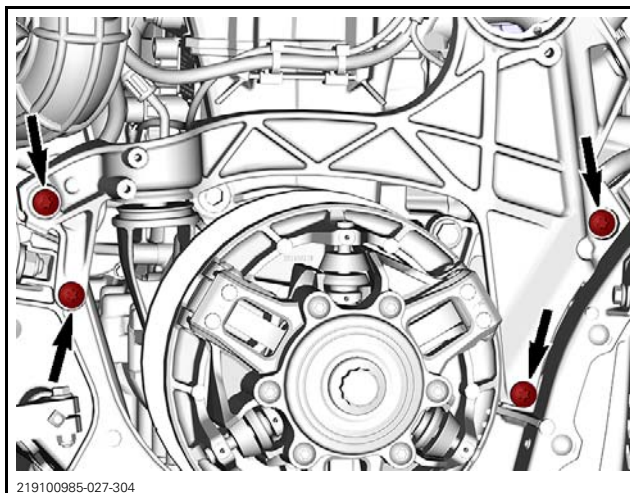
5. Detach the top of the support link.



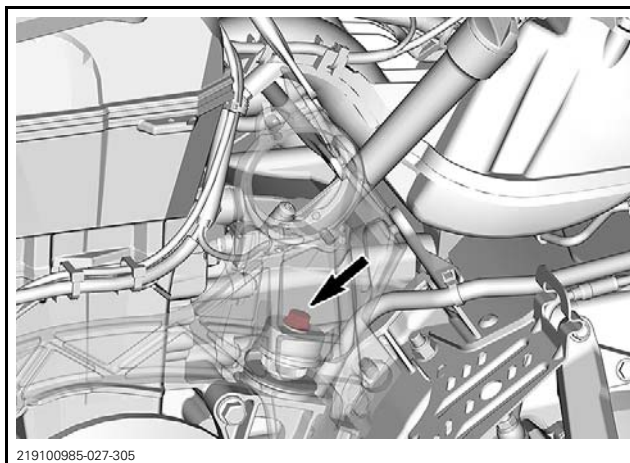
6. Remove the front engine support screw.



7. Remove the countershaft bearing support screws.



8. Remove the rear engine support screw located behind the support.



9. Remove the countershaft bearing support.

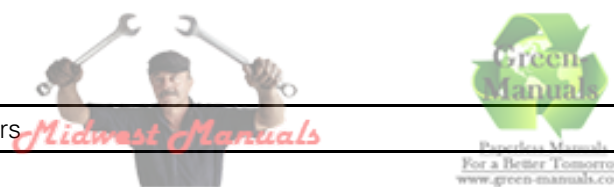
Installing the Countershaft Bearing Support

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

IF INSTALLED ON THE SAME FRAME MEMBER	
M8 Hexagonal flange screw (all fasteners)	(P/N 207683044)
IF INSTALLED ON A NEW FRAME MEMBER	
M8 Hexagonal flange self-tapping screw (at rear of bearing support)	(P/N 210283040)

Refer to exploded views for tightening torque and sequence.

ENGINE - 600 ACE

ENGINE			
 If you bought this manual from any other seller please leave them NEGATIVE feedback and notify me at bestshopmanuals@gmail.com			ROTAX® 600 ACE
			4-stroke, Double Over Head Camshaft (DOHC), dry sump, liquid cooled
Engine type			2
Number of cylinders			8 valves (self adjusting hydraulic valve lifters)
Number of valves			74 mm (2.91 in)
Bore			69.7 mm (2.74 in)
Stroke			599.54 cm³ (36.59 in³)
Displacement			12.0 : 1
Compression ratio			7250 (± 100) RPM
Maximum HP RPM			3° BTDC
Intake valve opening			37° ABDC
Intake valve closing			44° BBDC
Exhaust valve opening			6° ATDC
Exhaust valve closing			
Valve stem diameter	Intake	New	4.958 mm to 4.972 mm (.1952 in to .1957 in)
		Service limit	4.94 mm (.1945 in)
	Exhaust	New	4.956 mm to 4.970 mm (.1951 in to .1957 in)
		Service limit	4.94 mm (.194 in)
Valve guide inner diameter		New	5.000 mm to 5.020 mm (.1969 in to .1976 in)
		Service limit	5.050 mm (.1988 in)
Valve spring free length		New	31.35 mm (1.2343 in)
		Service limit	29.50 mm (1.1614 in)
Valve seat contact width	Intake	New	1.05 mm to 1.35 mm (.0413 in to .0531 in)
		Service limit	1.70 mm (.067 in)
	Exhaust	New	1.25 mm to 1.45 mm (.0492 in to .0571 in)
		Service limit	1.80 mm (.071 in)
Piston measurement		New	73.95 mm to 73.966 mm (2.9114 in to 2.912 in)
		Service limit	73.92 mm (2.91 in)
Piston/cylinder wall clearance		New	0.037 mm to 0.067 mm (.0015 in to .0026 in)
		Service limit	0.08 mm (.0031 in)

Subsection XX (ENGINE - 600 ACE)

ENGINE			
Piston ring type		1st	Upper compression ring, rectangular
		2nd	Lower compression ring, tapered face
		3rd	Oil scraper ring
Ring end gap	Rectangular	New	0.20 mm to 0.35 mm (.0079 in to .0138 in)
		Service limit	1.20 mm (.0472 in)
	Taper-face	New	0.30 mm to 0.50 mm (.0118 in to .0197 in)
		Service limit	1.20 mm (.0472 in)
	Oil scraper ring	New	0.20 mm to 0.70 mm (.0079 in to .0276 in)
		Service limit	1.20 mm (.0472 in)
Ring/piston groove clearance	Rectangular	New	0.030 mm to 0.066 mm (.0012 in to .0026 in)
		Service limit	0.12 mm (.0047 in)
	Taper-face	New	0.020 mm to 0.056 mm (.0008 in to .0022 in)
		Service limit	0.12 mm (.0047 in)
	Oil scraper ring	New	0.010 mm to 0.040 mm (.0004 in to .0016 in)
		Service limit	0.15 mm (.0059 in)
Cylinder bore		New	74.003 mm to 74.017 mm (2.9135 in to 2.9141 in)
Cylinder taper		Maximum New	0.030 mm (.0012 in)
		Service limit	0.05 mm (.002 in)
Cylinder out of round		Maximum New	0.008 mm (.0003 in)
		Service limit	0.03 mm (.0012 in)
Camshaft bearing journal diameter	PTO	New	25.947 mm to 25.960 mm (1.0215 in to 1.022 in)
		Service limit	25.92 mm (1.0205 in)
	MAG/Center	New	22.947 mm to 22.960 mm (.9034 in to .9039 in)
		Service limit	22.92 mm (.9024 in)
Camshaft holder bore diameter	PTO	New	26.00 mm to 26.021 mm (1.0236 in to 1.0244 in)
		Service limit	26.05 mm (1.0256 in)
	MAG/Center	New	23.00 mm to 23.021 mm (.9055 in to .9063 in)
		Service limit	23.05 mm (.9075 in)

ENGINE			
Camshaft lobe height	Intake	New	38.70 mm to 38.90 mm (1.5236 in to 1.5315 in)
		Service limit	38.68 mm (1.5228 in)
	Exhaust	New	39.40 mm to 39.60 mm (1.5512 in to 1.5591 in)
		Service limit	39.38 mm (1.5504 in)
Crankshaft bearing journal diameter		New	35.990 mm to 36.006 mm (1.4169 in to 1.4176 in)
		Service limit	35.960 mm (1.4157 in)
Crankshaft radial play		Service limit	0.080 mm (.0031 in)
Crankshaft axial play		New	0.120 mm - 0.392 mm (.0047 in - .0154 in)
		Service limit	0.450 mm (.0177 in)
Crankshaft pin diameter		New	35.979 mm to 35.995 mm (1.416 in to 1.417 in)
		Service limit	35.969 mm (1.416 in)
Crankshaft deflection	MAG	Maximum	0.050 mm (.002 in)
	Center	Maximum	0.050 mm (.002 in)
	PTO	Maximum	0.050 mm (.002 in)
Crankshaft plain bearing inside diameter		Service limit	36.08 mm (1.4205 in)
Connecting rod big end diameter		Service limit	36.06 mm (1.4197 in)
Connecting rod big end radial play		Service limit	0.08 mm (.0031 in)
Connecting rod big end axial play		New	0.100 mm to 0.352 mm (.0039 in to .0139 in)
		Service limit	0.450 mm (.0177 in)
Connecting rod small end diameter		New	17.010 mm to 17.020 mm (.6697 in to .6701 in)
		Service limit	17.060 mm (.6717 in)
Piston pin diameter		New	16.996 mm to 17.000 mm (.6691 in to .6693 in)
		Service limit	16.986 mm (.6687 in)
Connecting rod small end radial play		Service limit	0.04 mm (.0016 in)

Subsection XX (ENGINE - 600 ACE)

COOLING SYSTEM			
Coolant		Type	Ethyl glycol and distilled water (50%/50%) or coolant specifically formulated for aluminum engines For best performance use BRP LONG LIFE ANTIFREEZE
		Quantity	5.0 L (1.32 U.S. gal.)
Thermostat opening temperature			75°C (167°F)
Radiator cap opening pressure			110 kPa (16 PSI)
LUBRICATION SYSTEM			
Lubrication	Type		Dry sump. Replaceable oil filter
	Oil filter		BRP Rotax paper type, replaceable
	Minimum engine oil pressure		60 kPa (8.7 PSI) @ idle speed
			350 kPa (50.8 PSI) @ 4000 to 7250 RPM
	Engine oil	Capacity (oil change with filter)	2.1 L (2.22 qt (U.S. liq.))
		Recommended	XPS 4-stroke full synthetic oil (All climate) or a SAE 0W 40 API service SM or SN synthetic oil
FUEL SYSTEM			
Fuel injection type			Multipoint fuel injection
Throttle body type			46 mm heated Dell'Orto throttle body with iTC (intelligent Throttle Control)
Idle speed	Normal idle	Standard/ECO mode	1500 ± 100 RPM
		Sport	1650 ± 100 RPM
	Fast idle at -40°C (-40°F)		2100 ± 100 RPM
ELECTRICAL SYSTEM			
Magneto generator output	Models	Except Skandic and Tundra	420 W @ 6000 RPM @ 14 V
		Skandic and Tundra	650 W @ 6000 RPM @ 14 V
Magneto stator resistance (between any pair of yellow wires)			0.1 to 1 Ohm @ 20°C (68°F)
Ignition type			IDI (Inductive Digital Ignition)
Spark plug	Make and type		NGK MR7BI-8
	Gap		.70 mm to 0.80 mm (.028 in to .031 in)
Ignition timing			Not adjustable

900 ACE

ENGINE			
Engine type			ROTAX® 900 ACE
			4-stroke, Double Over Head Camshaft (DOHC), dry sump, liquid cooled
Number of cylinders			3
Number of valves			12 valves (self adjusting hydraulic valve lifters)
Bore			74 mm (2.91 in)
Stroke			69.7 mm (2.74 in)
Displacement			899.31 cm³ (54.88 in³)
Compression ratio			12.0 : 1
Maximum HP RPM			7250 ± 200 RPM
Intake valve opening			5° ATDC
Intake valve closing			40° ABDC
Exhaust valve opening			40° BBDC
Exhaust valve closing			5° BTDC
Valve stem diameter	Intake	New	4.958 mm to 4.972 mm (.1952 in to .1957 in)
		Service limit	4.940 mm (.1945 in)
	Exhaust	New	4.956 mm to 4.970 mm (.1951 in to .1957 in)
		Service limit	4.940 mm (.1945 in)
Valve guide diameter		New	5.000 mm to 5.020 mm (.1969 in to .1976 in)
		Service limit	5.050 mm (.1988 in)
Valve out of round		New	0.005 mm (.0002 in)
		Service limit	0.060 mm (.0024 in)
Valve spring free length		New	31.35 mm (1.2343 in)
		Service limit	29.50 mm (1.1614 in)
Valve seat contact width	Intake	New	1.05 mm to 1.35 mm (.0413 in to .0531 in)
		Service limit	1.70 mm (.0669 in)
	Exhaust	New	1.25 mm to 1.45 mm (.0492 in to .0571 in)
		Service limit	1.80 mm (.0709 in)
Cylinder head warpage		Service limit	0.15 mm (.0059 in)
Piston measurement		New	73.950 mm to 73.966 mm (2.9114 in to 2.912 in)
		Service limit	73.920 mm (2.9102 in)
Piston/cylinder wall clearance		New	0.037 mm to 0.067 mm (.0015 in to .0026 in)
		Service limit	0.080 mm (.0031 in)

Subsection XX (900 ACE)

ENGINE			
Piston ring type		1 st	Upper compression ring, rectangular
		2 nd	Lower compression ring, tapered face
		3 rd	Oil scraper ring
Ring end gap	Rectangular	New	0.20 mm to 0.35 mm (.0079 in to .0138 in)
		Service limit	1.20 mm (.0472 in)
	Taper-face	New	0.30 mm to 0.50 mm (.0118 in to .0197 in)
		Service limit	1.20 mm (.0472 in)
	Oil scraper ring	New	0.20 mm to 0.70 mm (.0079 in to .0276 in)
		Service limit	1.20 mm (.0472 in)
Ring/piston groove clearance	Rectangular	New	0.030 mm to 0.066 mm (.0012 in to .0026 in)
		Service limit	0.120 mm (.0047 in)
	Taper-face	New	0.020 mm to 0.056 mm (.0008 in to .0022 in)
		Service limit	0.120 mm (.0047 in)
	Oil scraper ring	New	0.010 mm to 0.040 mm (.0004 in to .0016 in)
		Service limit	0.150 mm (.0059 in)
Cylinder bore		New	74.003 mm to 74.017 mm (2.9135 in to 2.9141 in)
Cylinder taper		Maximum New	0.030 mm (.0012 in)
		Service limit	0.050 mm (.002 in)
Cylinder out of round		Maximum New	0.008 mm (.0003 in)
		Service limit	0.03 mm (.0012 in)
Camshaft bearing journal diameter	PTO	New	25.967 mm to 25.980 mm (1.0223 in to 1.0228 in)
		Service limit	25.940 mm (1.0213 in)
	MAG/Center	New	22.957 mm to 22.970 mm (.9038 in to .9043 in)
		Service limit	22.930 mm (.9028 in)
Camshaft holder bore diameter	PTO	New	26.00 mm to 26.021 mm (1.0236 in to 1.0244 in)
		Service limit	26.05 mm (1.0256 in)
	MAG/Center	New	23.00 mm to 23.021 mm (.9055 in to .9063 in)
		Service limit	23.05 mm (.9075 in)
Camshaft journal radial play	All	New	0.020 mm to 0.054 mm (.0008 in to .0021 in)
		Service limit	0.080 mm (.0031 in)
Camshaft lobe height	Intake	New	38.35 mm to 38.55 mm (1.51 in to 1.518 in)
		Service limit	38.33 mm (1.509 in)
	Exhaust	New	38.35 mm to 38.55 mm (1.51 in to 1.518 in)
		Service limit	38.33 mm (1.509 in)

ENGINE			
Crankshaft bearing journal diameter		New	35.990 mm to 36.006 mm (1.4169 in to 1.4176 in)
		Service limit	35.960 mm (1.4157 in)
Crankshaft radial play		Service limit	0.08 mm (.003 in)
Crankshaft axial play		New	0.120 mm to 0.353 mm (.0047 in to .0139 in)
		Service limit	0.450 mm (.0177 in)
Crankshaft deflection	MAG	Maximum	0.050 mm (.002 in)
	Center	Maximum	0.050 mm (.002 in)
	PTO	Maximum	0.080 mm (.003 in)
Crankshaft plain bearing inside diameter		Service limit	36.08 mm (1.4205 in)
Connecting rod big end diameter		Service limit	36.06 mm (1.4197 in)
Connecting rod big end radial play		Service limit	0.08 mm (.0031 in)
Connecting rod big end axial play		New	0.100 mm to 0.352 mm (.0039 in to .0139 in)
		Service limit	0.450 mm (.0177 in)
Connecting rod small end diameter		New	17.010 mm to 17.020 mm (.6697 in to .6701 in)
		Service limit	17.060 mm (.6717 in)
Piston pin diameter		New	16.996 mm to 17.000 mm (.6691 in to .6693 in)
		Service limit	16.986 mm (.6687 in)
Connecting rod small end radial play		Service limit	0.04 mm (.0016 in)
Chain guide groove depth		Service limit	1 mm (.039 in)
Oil pressure regulator spring free length		New	46 mm (1.811 in)
		Service limit	45 mm (1.772 in)
Oil pump radial clearance		Service limit	0.25 mm (.0098 in)
Oil pump axial clearance		Service limit	0.15 mm (.0059 in)
COOLING SYSTEM			
Coolant	Type	Ethyl glycol and distilled water (50%/50%). Use BRP premixed coolant (P/N 219 700 362) or coolant specifically formulated for aluminum engines	
	Quantity	6 L (1.59 U.S. gal.)	
Thermostat opening temperature			75°C (167°F)
Coolant tank cap opening pressure			110 kPa (16 PSI)

Subsection XX (900 ACE)

LUBRICATION SYSTEM			
Lubrication	Type		Dry sump. Replaceable oil filter
	Oil filter		BRP Rotax paper type, replaceable
	Engine oil pressure at 100°C (212°F)	Minimum	60 kPa (8.7 PSI) @ idle speed
			350 kPa (50.8 PSI) @ 4000 to 7250 RPM
	Engine oil	Capacity (oil change with filter)	3.3 L (3.5 qt (U.S. liq.))
Recommended		XPS Synthetic 4-Stroke oil (All climate) (P/N 293 600 112) or a SAE 0W 40 API service SM synthetic oil	
FUEL SYSTEM			
Fuel injection type			Multipoint fuel injection
Throttle body type			46 mm heated Dell'Orto throttle body with iTC (intelligent Throttle Control)
Idle speed	Normal idle	Standard/ECO Mode	1300 ± 100 RPM
		Sport Mode	1500 ± 100 RPM
	Fast idle at -40°C (-40°F)		1850 ± 100 RPM
Gasoline type			Regular Unleaded
Minimum octane rating	Inside North America ((R+M)/2)		87 (No ethanol)
			91 (10% MAX ethanol)
	Outside North America (RON)		92 (No ethanol)
			95 (10% MAX ethanol)
ELECTRICAL SYSTEM			
Magneto generator output		Renegade	420 W @ 6000 RPM @ 14 V
		Expedition LE/SE Grand Touring Limited	650 W @ 6000 RPM @ 14 V
Magneto stator resistance (between any pair of yellow wires)			0.1 to 1 Ohm @ 20°C (68°F)
Ignition type			IDI (Inductive Digital Ignition)
Spark plug	Make and type		NGK MR8BI-8
	Gap		.70 mm to 0.80 mm (.028 in to .031 in)
Ignition timing			Not adjustable
Ignition coil	Primary		0.79 to 0.97 Ω
Engine speed limiter setting			8000 RPM

ENGINE 900 ACE TURBO

ENGINE			
Engine		Type	ROTAX® 900 ACE TURBO
		Configuration	4-stroke, Double Over Head Camshaft (DOHC), dry sump,liquid cooled
		Declination	Turbo With Intercooler
Number of cylinders			3
Number of valves			12 valves (self adjusting hydraulic valve lifters)
Bore			74 mm (2.91 in)
Stroke			69.7 mm (2.74 in)
Displacement			899.31 cm³ (54.88 in³)
Compression ratio			9.1 ± 0.3
Maximum HP RPM		Grand Touring Limited	7250 ± 100 RPM
		Expedition LE/SE	7300 ± 100 RPM
		All other	7750 ± 100 RPM
Intake valve opening			5° ATDC
Intake valve closing			25° ABDC
Exhaust valve opening			40° BBDC
Exhaust valve closing			5° BTDC
Valve stem diameter	Intake	New	4.958 mm to 4.972 mm (.1952 in to .1957 in)
		Service limit	4.940 mm (.1945 in)
	Exhaust	New	4.956 mm to 4.970 mm (.1951 in to .1957 in)
		Service limit	4.940 mm (.1945 in)
Valve out of round		New	0.005 mm (.0002 in)
		Service limit	0.060 mm (.0024 in)
Valve guide diameter		New	4.992 mm to 5.012 mm (.1965 in to .1973 in)
		Service limit	5.050 mm (.1988 in)
Valve spring free length		New	31.35 mm (1.2343 in)
		Service limit	29.50 mm (1.1614 in)

Subsection XX (ENGINE 900 ACE TURBO)

ENGINE			
Valve seat contact width	Intake	New	1.05 mm to 1.35 mm (.041 in to .053 in)
		Service limit	1.70 mm (.067 in)
	Exhaust	New	1.25 mm to 1.45 mm (.049 in to .057 in)
		Service limit	1.80 mm (.071 in)
Cylinder head warpage		Service limit	0.15 mm (.0059 in)
Piston diameter		New	73.950 mm to 73.966 mm (2.9114 in to 2.912 in)
		Service limit	73.920 mm (2.9102 in)
Piston/cylinder clearance		New	0.037 mm to 0.067 mm (.0015 in to .0026 in)
		Service limit	0.080 mm (.0031 in)
Piston ring type		1st	Upper compression ring, rectangular
		2nd	Lower compression ring, tapered face
		3rd	Oil scraper ring
Ring end gap	Rectangular	New	0.20 mm to 0.35 mm (.008 in to .014 in)
	Tapered face		0.30 mm to 0.50 mm (.012 in to .02 in)
	Oil scraper ring		0.20 mm to 0.70 mm (.008 in to .028 in)
	Rectangular	Service limit	1.20 mm (.047 in)
	Tapered face		1.20 mm (.047 in)
	Oil scraper ring		1.20 mm (.047 in)
Ring/piston groove clearance	Rectangular	New	0.030 mm to 0.066 mm (.0012 in to .0026 in)
	Tapered face		0.020 mm to 0.056 mm (.0008 in to .0022 in)
	Oil scraper ring		0.010 mm to 0.040 mm (.0004 in to .0016 in)
	Rectangular	Service limit	0.120 mm (.0047 in)
	Tapered face		0.120 mm (.0047 in)
	Oil scraper ring		0.150 mm (.0059 in)
Cylinder bore		New	74.003 mm to 74.017 mm (2.9135 in to 2.9141 in)
Cylinder taper		Maximum New	0.030 mm (.0012 in)
		Service limit	0.050 mm (.002 in)
Cylinder out of round		Maximum New	0.008 mm (.0003 in)
		Service limit	0.030 mm (.0012 in)

ENGINE			
Camshaft bearing journal diameter	PTO	New	25.967 mm to 25.980 mm (1.0223 in to 1.0228 in)
		Service limit	25.940 mm (1.0213 in)
	Center	New	22.957 mm to 22.970 mm (.9038 in to .9043 in)
		Service limit	22.930 mm (.9028 in)
	MAG	New	22.967 mm to 22.980 mm (.9042 in to .9047 in)
		Service limit	22.940 mm (.9031 in)
Camshaft holder bore diameter	PTO	New	26.000 mm to 26.021 mm (1.024 in to 1.024 in)
		Service limit	26.050 mm (1.026 in)
	MAG/Center	New	23.000 mm to 23.021 mm (.906 in to .906 in)
		Service limit	23.050 mm (.907 in)
Camshaft journal radial clearance	PTO and MAG	New	0.020 mm to 0.054 mm (.001 in to .002 in)
		Service limit	0.080 mm (.003 in)
	Center	New	0.03 mm to 0.064 mm (.001 in to .003 in)
		Service limit	0.090 mm (.004 in)
Camshaft lobe height	Intake and Exhaust valve	New	37.40 mm to 37.60 mm (1.472 in to 1.48 in)
		Service limit	38.38 mm (1.511 in)
Hydraulic valve lifter diameter		New	28.354 mm to 28.370 mm (1.1163 in to 1.1169 in)
		Service limit	28.340 mm (1.1157 in)
Hydraulic valve lifter radial clearance		Service limit	0.100 mm (.0039 in)
Crankshaft bearing journal diameter		New	35.990 mm to 36.006 mm (1.4169 in to 1.4176 in)
		Service limit	35.960 mm (1.4157 in)
Crankshaft radial play		Service limit	0.08 mm (.0031 in)
Crankshaft axial play		New	0.120 mm to 0.352 mm (.005 in to .014 in)
		Service limit	0.450 mm (.018 in)
Crankshaft pin diameter		New	35.979 mm to 35.995 mm (1.4165 in to 1.4171 in)
		Service limit	35.969 mm (1.4161 in)
Crankshaft deflection	MAG	Maximum	0.050 mm (.002 in)
	Center		0.050 mm (.002 in)
	PTO		0.050 mm (.002 in)
Crankshaft plain bearing inner diameter		Service limit	36.080 mm (1.4205 in)

Subsection XX (ENGINE 900 ACE TURBO)

ENGINE		
Connecting rod big end diameter	Service limit	36.06 mm (1.4197 in)
Connecting rod big end radial play	Service limit	0.08 mm (.0031 in)
Connecting rod big end axial play	New	0.100 mm to 0.352 mm (.004 in to .014 in)
	Service limit	0.450 mm (.018 in)
Connecting rod small end diameter	New	18.010 mm to 18.020 mm (.7091 in to .7094 in)
	Service limit	18.060 mm (.711 in)
Piston pin diameter	New	17.996 mm to 18.00 mm (.7085 in to .7087 in)
	Service limit	17.986 mm (.7081 in)
Connecting rod small end radial clearance	Service limit	0.040 mm (.0016 in)
Chain guide groove depth	Service limit	1 mm (.039 in)
Oil pressure regulator spring free length	New	46 mm (1.811 in)
	Service limit	45 mm (1.772 in)
Oil pump radial clearance	Service limit	0.25 mm (.0098 in)
Oil pump axial clearance	Service limit	0.15 mm (.0059 in)

LUBRICATION SYSTEM			
Type		Dry sump	
Oil filter		Replaceable cartridge oil filter	
Minimum engine oil pressure at 100°C (212°F) oil temperature	At idle	80 kPa (11.6 PSI)	
	At 4000 RPM	260 kPa (37.71 PSI)	
	Between 6000 to 8000 RPM	300 kPa (43.51 PSI)	
Engine oil	Capacity	Engine oil and engine oil filter replacement	3.3 L (3.5 qt (U.S. liq.))
	Recommended	XPS 4T 0W40 synthetic oil If the recommended XPS engine oil is not available: use a 0W40 4-stroke SAE synthetic engine oil meeting or exceeding the following lubricant industry specifications: API service classification SM or SN	

COOLING SYSTEM		
Coolant	Type	Ethyl glycol/water mix (50%/50%). Use premixed coolant sold by BRP or coolant specifically designed for aluminum engines
Thermostat	Starts to open	75°C (167°F)
	Fully open	95°C (203°F)

TURBO CHARGER		
Rotor shaft bearing leakage test	Service limit	50%
Rotor radial clearance	Service limit	Minimum of 0.1 mm (.004 in)
Rotor shaft axial clearance	Service limit	Maximum of 0.1 mm (.004 in)
Movement of waste gate actuator rod	At 43 kPa (6.24 PSI) air pressure - 1 mm $\pm$ 0.5 mm (.039 in $\pm$.02 in) movement	
	At 57 kPa (8.27 PSI) air pressure - 5 mm $\pm$ 0.8 mm (.197 in $\pm$.031 in) movement	
Turbine flange warpage	Service limit	Maximum of 0.1 mm (.004 in)
ELECTRICAL SYSTEM		
Magneto generator output		650 W @ 6000 RPM @ 14 V
Ignition system type		IDI (Inductive Discharge Ignition)
Ignition timing		Not adjustable
Spark plug	Make and type	NGK LMAR9AI-8
	Gap	0.7 mm to 0.8 mm (.028 in to .031 in)
Ignition coil	Primary	0.80 to 0.97 Ω
Engine speed limiter setting		8300 RPM
FUEL SYSTEM		
Fuel injection type		Electronic Fuel Injection (EFI) , 1 injector per cylinder
Throttle body type		46 mm heated throttle body with iTC (Intelligent Throttle Control)
Idle speed	Normal idle	Standard/ECO mode 1200 $\pm$ 100 RPM (not adjustable)
		SPORT mode 1500 $\pm$ 100 RPM (not adjustable)
	Fast idle at -40°C (-40°F) 1850 RPM $\pm$ 100 RPM (not adjustable)	

VEHICLES

COOLING SYSTEM			
Coolant	Type		Ethyl glycol and distilled water (50%/50%) Use BRP EXTENDED LIFE PRE-MIXED COOLANT or coolant specifically formulated for aluminum engines.
	Quantity	With radiator	6.9 L (7.3 qt (U.S. liq.))
		Without radiator	5.9 L (6.2 qt (U.S. liq.))
Radiator fan			Turn on @ 100°C (212°F) Turn off @ 95°C (203°F)
Radiator cap opening pressure			110 kPa (16 PSI)

FUEL SYSTEM				
Fuel delivery system		Operating pressure		400 kPa ± 20 kPa (58 PSI ± 2.9 PSI) @ 2000 RPM
Fuel pump		Type		Electrical module in fuel tank
Fuel	Fuel with NO ethanol	North America	600 ACE 900 ACE	87 (R+M)/2
			900 ACE Turbo	
		Outside North America	600 ACE 900 ACE	92 RON
			900 ACE Turbo	
	Fuel which may contain up to 10% MAX ethanol	North America		91 (R+M)/2
		Outside North America		95 RON
Fuel tank capacity				36 L (9.5 U.S. gal.)
Idle speed				1200 RPM ± 200 (not adjustable)

ELECTRICAL SYSTEM		
Battery	Expedition Sport All Renegade All Grand Touring	12 V, 18 A•h
	Expedition LE Expedition SE	12 V, 30 A•h
Headlamp		2 x 60/55 W (H-13)
Taillight and stoplight		2.6 W / 139m W LED

Subsection XX (VEHICLES)

ELECTRICAL SYSTEM			
Fuses – Grand Touring Limited – Renegade Enduro – Expedition LE – Expedition SE	F1: Clock / Start / Relays		5 A
	F2: Headlamps		20 A
	F3: Taillight / Brake / PAC		10 A
	F4: ECM / RFID /O2 Sensor / CAPS		10 A
	F5: Fuel Pump/Starter		10 A
	F6: Fan		15 A
	F7: Accessory		15 A
	F8: Cluster		15 A
	F9: ACS		15 A
	F10: RER		30 A
Fuses – Expedition Sport – Grand Touring Sport – Renegade Adrenaline – Renegade X – Renegade X-RS – Expedition Sport	F1: Start / Relays		5 A
	F2: Accessory		15 A
	F3: Taillight / Brake / PAC		10 A
	F4: ECM / RFID /O2 Sensor / CAPS		10 A
	F7: Fuel Pump		10 A
	F8: Cluster		15 A
	F9: Fan		15 A
	F10: Headlamps		20 A
Relays – Grand Touring Limited – Renegade Enduro – Expedition LE – Expedition SE	RY1		Main
	RY2		Headlamps
	RY3		Fan
	RY4		Reverse
	RY5		Accessories
	RY6		Lighting
Relays – Expedition Sport – Grand Touring Sport – Renegade Adrenaline – Renegade X – Renegade X-RS – Expedition Sport	RY1		Main
	RY2		Accessories
	RY3		Fan
	RY4		Lighting
DRIVE SYSTEM			
Chaincase oil (If equipped)	Type		XPS Synthetic chaincase oil
	Quantity	All Renegade All Expedition	500 ml (16.9 U.S. oz)
		All Grand Touring	350 ml (12 U.S. oz)

DRIVE SYSTEM				
Chain drive ratio			600 ACE	21/51
			900 ACE	24/49
			900 ACE Turbo	25/45
Chain		Pitch		9.530 mm (.375 in)
		Type		Silent
		Links qty	Expedition Sport (600 and 900 ACE)	116
			Expedition LE / SE (900 ACE Turbo)	100
			Expedition LE / SE (900 ACE)	96
			600 ACE	110
			900 ACE - All other	110
			900 ACE Turbo - All other	108
Gearbox oil (if equipped)		Type		Synchromesh Transmission Synthetic Oil
		Capacity		900 ml (30.4 U.S. oz)
Gearbox ratio		900 ACE	Low	4.24:1
			High	2.36:1
		900 ACE Turbo	Low	3.59::1
			High	2.0:1
Drive pulley	Type	All Renegade	600 ACE	eDrive II LC
		All Expedition All Grand Touring	600 ACE	eDrive II
		All Grand Touring	900 ACE	pDrive
		All Grand Touring	900 ACE Turbo	pDrive
		All Renegade All Expedition	900 ACE 900 ACE Turbo	pDrive
Drive pulley calibration		Clutch engagement	Expedition (900 ACE turbo)	2000 ± 100 RPM
			All others	2200 ± 100 RPM
		Spring color code	All 600 ACE	Red/Red
			All 900 ACE	Red/Blue
			All 900 ACE Turbo	Red/Yellow
		Spring length	Red/Blue	90.8 mm (3.575 in)
			Red/Red	124.3 mm (4.894 in)
			Red/Yellow	96.6 mm (3.803 in)

Subsection XX (VEHICLES)

DRIVE SYSTEM			
Drive pulley calibration	Ramp	Expedition SE (900 ACE Turbo) Grand Touring Limited (900 ACE Turbo)	880
		Expedition SE (900 ACE)	882
		Expedition Sport (600 ACE)	716
		Grand Touring Sport (600 ACE) Renegade Sport (600 ACE)	715
		Expedition Sport (900 ACE) Expedition Sport (900 ACE) Grand Touring Limited (900 ACE) Renegade Adrenaline (900 ACE) Renegade Enduro (900 ACE)	826
		Grand Touring Limited (900 ACE Turbo)	880
		All Renegade (900 ACE Turbo)	873
Drive pulley calibration	Clicker position		No clicker

DRIVE SYSTEM				
Driven pulley		Type	600 ACE 900 ACE	QRS-4s
			900 ACE Turbo	QRS-4s ventilated
		Spring color code	600 ACE	Red/Red
			900 ACE (except Expedition LE / SE)	Red/Red
			Expedition LE Expedition SE	Beige/Beige
			900 ACE Turbo	Blue
		Spring length	Red/Red	124.3 mm (4.894 in)
			Beige/Beige	135 mm (5.315 in)
			Blue	120 mm (4.724 in)
		Cam angle	600 ACE	43° ± 2°
			900 ACE - Expedition Sport	40°
			900 ACE Expedition LE / SE	42°
			900 ACE - All other	44°/40°
			900 ACE Turbo	47°/40°
Driven pulley	Spring preload	All models except Expedition LE / SE 900 (ACE)	New	7.3 kgf ± 0.7 kgf (16.1 lbf ± 1.5 lbf)
			After break-in	6.6 kgf ± 0.7 kgf (14.6 lbf ± 1.5 lbf)
		Expedition LE / SE 900 (ACE)	New	7.0 kgf ± 0.7 kgf (15.4 lbf ± 1.5 lbf)
			After break-in	6.4 kgf ± 0.7 kgf (14.1 lbf ± 1.5 lbf)
Pulley distance		Z	Not adjustable 21.4 mm (.843 in)	
		X	Not adjustable 41.9 mm ± 1.8 mm (1.65 in ± .071 in)	
Offset		Y - X		Not adjustable 0 mm to 1.63 mm (0 in to .064 in)
Drive belt		Width		38.3 mm (1.508 in)
		Wear limit		35.9 mm (1.413 in)
Drive sprocket number of teeth			Grand Touring Limited	16
			All other	8

Subsection XX (VEHICLES)

DRIVE SYSTEM			
Track	Width	Expedition LE Expedition SE	50 cm (20 in)
		Expedition Sport	40.6 cm (16 in)
		All other	38.1 cm (15 in)
	Length	All Expedition	392.3 cm (154 in)
		All other	348.7 cm (137 in)
	Profile height	All Expedition	38 mm (1.5 in)
		All other	31.8 mm (1.25 in) OR 40.6 mm (1.6 in)
Track adjustment	Deflection	All Expedition	40 mm to 50 mm (1.57 in to 1.97 in)
		All other	32 mm (1.26 in)
	Force	All Expedition	7.3 kgf (16 lbf)
		All other	6.0 kgf to 8.5 kgf (13 lbf to 19 lbf)

BRAKE SYSTEM		
Brake	Type	Single 200 mm cross drilled carbon steel disc
Brake fluid	Type	DOT 4
	Quantity	65 ml (2.2 U.S. oz)
Caliper		Fixed twin pistons (2 x 40mm)
Brake pad material		Organic
Minimum brake pad thickness (includes backing plate)		5 mm (.197 in)
Minimum brake disc thickness		4.5 mm (.177 in)
Maximum brake disc warpage		0.25 mm (.01 in)
Brake lining minimum thickness		1 mm (.039 in)

FRONT SUSPENSION		
Suspension type		RAS 3
Suspension maximum travel	All Expedition	210 mm (8.3 in)
	Renegade X	233 mm (9.2 in)
	Renegade X-RS	255 mm (10 in)
	All other	220 mm (8.7 in)

FRONT SUSPENSION			
Shock absorber type		All Expedition Grand Touring Sport Renegade Sport	Motion Control
		Renegade X-RS	KYB PRO 36 R
		Grand Touring Limited	HPG
		All other	HPG Plus
Stabilizer bar type			Link
REAR SUSPENSION			
Suspension type		Grand Touring Sport Renegade Sport	SC-5M
		All Expedition	SC-5U
		All Renegade (except Sport) Grand Touring Limited	rMotion
Suspension maximum travel		All Expedition	239 mm (9.4 in)
		Grand Touring Sport Renegade Sport	245 mm (9.6 in)
		Grand Touring Limited All Renegade (except Sport)	270 mm (10.6 in)
Shock absorber type	Center	Renegade X	HPG Plus
		All Expedition Grand Touring Sport Renegade Sport	Motion Control
		Renegade X-RS	KYB PRO 40 EA
		All other	HPG
	Rear	Grand Touring Limited Renegade Enduro Expedition SE	ACS (Air Controlled Suspension)
		Renegade X	KYB PRO 36
		Renegade X-RS	KYB PRO 40 EA
		All other	HPG
Stroke limiter standard position		All Expedition Grand Touring Sport	3
		Grand Touring Limited	2
		All Renegade	1

Subsection XX (VEHICLES)

STEERING SYSTEM		
Handlebar	Renegade Sport Renegade Enduro Expedition Sport	Aluminum with J-Hooks
	Renegade X Renegade X-RS Renegade Adrenaline	Aluminum with J-Hooks and handguard
	All Grand Touring	U-shaped Aluminium
	Expedition SE Expedition LE	Aluminum with J-Hooks and low grab handle
Riser block height	Grand Touring Sport Renegade Adrenaline Renegade Enduro Renegade Sport	120 mm (4.7 in)
	Grand Touring Limited Renegade X Renegade X-RS Expedition SE	Adjustable - 120 mm (4.7 in)
	Expedition LE Expedition Sport	145 mm (5.7 in)
Ski type	Grand Touring Sport (CA/US) Grand Touring Limited	Pilot 5.7 SL
	Renegade Enduro Renegade X (with adjustable kit) Renegade X-RS (with adjustable kit)	Pilot TS
	Renegade Adrenaline (CA/US) Renegade X Renegade Sport (CA/US) Renegade X-RS (CA/US)	Pilot 5.7
	Expedition LE Expedition SE	Pilot 7.4
	Expedition Sport Renegade Adrenaline (EUR) Renegade X-RS (EUR) Renegade Sport (EUR) Grand Touring Sport (EUR)	Pilot DS2
Ski alignment		5 mm (.197 in) (toe-out)



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WEIGHT AND DIMENSIONS		
Mass (dry)	Renegade Adrenaline 900 ACE	228 kg (503 lb)
	Renegade Adrenaline 900 ACE Turbo	239 kg (527 lb)
	Renegade Enduro 900 ACE	242 kg (534 lb)
	Renegade Enduro 900 ACE Turbo	253 kg (558 lb)
	Renegade X (without Quick Adjust Suspension and ski Pilot TS)	240 kg (529 lb)
	Renegade X (with Quick Adjust Suspension and ski Pilot TS)	248 kg (547 lb)
	Renegade X-RS	244 kg (538 lb)
	Renegade Sport	213 kg (470 lb)
	Grand Touring Limited 900 ACE	227 kg (498 lb)
	Grand Touring Limited 900 ACE Turbo	236 kg (519 lb)
	Grand Touring Sport 600 ACE	265 kg (582 lb)
	Grand Touring Sport 900 ACE	274 kg (602 lb)
	Expedition Sport 600 ACE	241 kg (531 lb)
	Expedition Sport 900 ACE	251 kg (553 lb)
	Expedition LE 900 ACE	288 kg (634 lb)
	Expedition LE 900 ACE Turbo	302 kg (663 lb)
	Expedition SE 900 ACE	301 kg (663 lb)
	Expedition SE 900 ACE Turbo	315 kg (693 lb)
Overall length	All except Expedition	303.8 cm (119.6 in)
	Expedition LE Expedition SE	333.6 cm (131.3 in)
	Expedition Sport	335 cm (131.9 in)
Overall width	All except Expedition	121.7 cm (47.9 in)
	All Expedition	114 cm (44.9 in) to 118 cm (46.5 in)

Subsection XX (VEHICLES)

WEIGHT AND DIMENSIONS		
Overall height	Renegade Enduro	133.1 cm (52.4 in)
	Renegade X Renegade Adrenaline Renegade Sport	126.7 cm (49.9 in)
	Renegade X-RS	122.2 cm (48.1 in)
	All Grand Touring All Expedition	140.5 cm (55.3 in)
Ski stance	All except Expedition	107.7 cm (42.4 in)
	All Expedition	97.5 cm (38.4 in) to 102 cm (40.2 in)
MATERIAL		
Frame		Aluminum
Side bottom pan, Front bottom pan, gauge support, gauge support cover, side panel, rear console, windshield support, glove box cover and headlamp surrounding		Polypropylene
Rear lateral hood, front hood and top side panel		Surlyn

WIRING DIAGRAM INFORMATION

GENERAL

WIRING DIAGRAM LOCATION

Wiring diagrams are found in the *WIRING DIAGRAM BOOKLET*.

WIRING DIAGRAM WITH COLORED LINES

The wiring diagram on the *KNOWLEDGE CENTER* is in color.

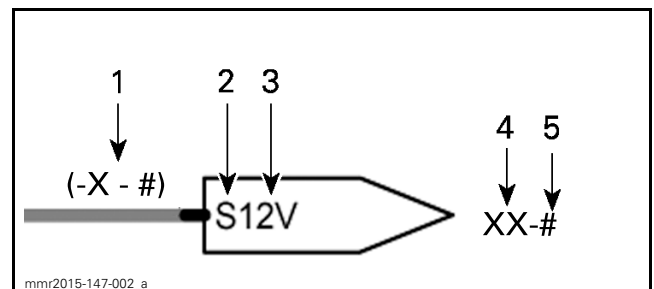
Color Definition

NOTE: To find the color of the wire on the vehicle skip to *WIRE COLORS AND SIZES* in this subsection. The following colors refer to the color of the line drawn in the wiring diagram.

LINE COLOR	LINE TYPE	FUNCTION	DEFINITION
Red	Thick	Unswitched 12 V	Hot at all times
	Thin	3.3 and 5 V	Sensor reference voltage
Orange	Thick	55 - 60 V	High voltage
Blue	Thin	Analog signal	Variable voltage
Cyan	Thin	Digital signal	Pulsed or constant digital (on/off)
Pink	Thick	12V switched	Condition must be met to activate circuit
Green	Thin dotted	Communication	Data communication between modules using a protocol (CAN, LIN, & other)
Brown	Thick	Power control	Controls a circuit by providing an on/off control to activate the circuit
Yellow	Thick	AC Volts	Alternative current exiting the magneto
Black	Thick	Permanent ground	A ground that is in permanent contact
	Thin	Module (analog/digital) ground	A ground that is controlled by a module

WIRING DIAGRAM CODES

The wiring diagrams use the following codes.

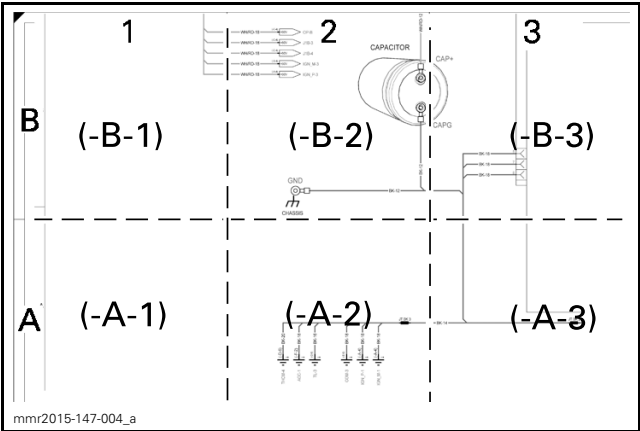


1. Wiring diagram index
2. Power condition
3. Voltage of a powered circuit
4. Connector code
5. Connector pin

Subsection XX (WIRING DIAGRAM INFORMATION)

Wiring Diagram Index

The wiring diagram is separated by rows (letters) and columns (numbers).



WIRING DIAGRAM INDEX

Power Condition (12V Circuits Only)

The wiring diagram indicates when a circuit is powered:

- S: Switched. Certain conditions must be met;
- U: Unswitched (hot at all times).

Voltage of Powered Circuit

Voltage references are approximate for a powered circuit in good condition.

INDICATED VOLTAGE	APPROXIMATION
12V	Battery voltage
5V	Regulated 4.95 - 5V
60V	Regulated 55 - 60V

Connector Code

The wire connects to the indicated connector. See image at the beginning of this subsection.

Connector Pin

The wire is the indicated pin in the connector.

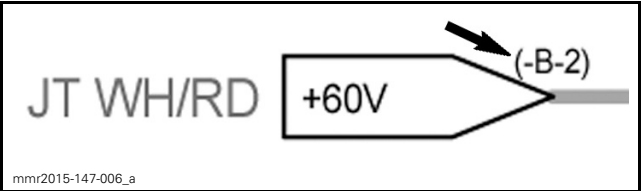
NOTE: Could be identified by either a number or by a letter depending on the type of connector used.

FOLLOWING A CIRCUIT

To follow a circuit, search the in section of the wiring diagram shown in the wiring diagram index.

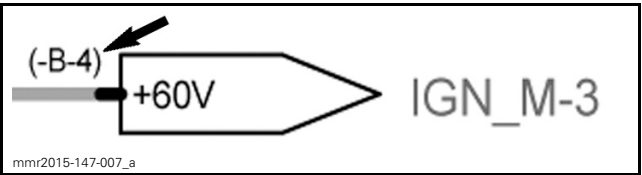
In this example, the 60V comes **from** JT WH/RD in section (-B-2).

NOTE: The arrow indicates the direction of the power in the circuit.



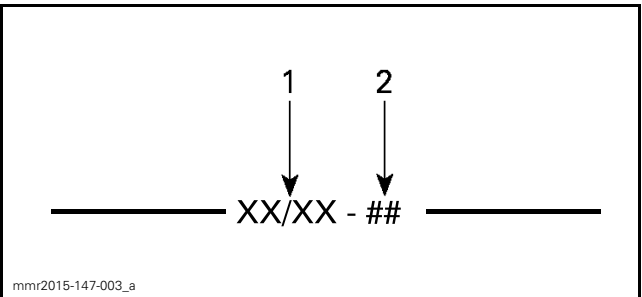
FROM JT WH/RD (-B-2)

In following example, the 60V goes **to** the IGN_M connector pin 3 in section (-B-4).



TO ING_M-3 (-B-4)

WIRE COLORS AND SIZES



1. Wire color
2. Wire gauge (AWG)

The first color of a wire is the main color, second color is the stripe.

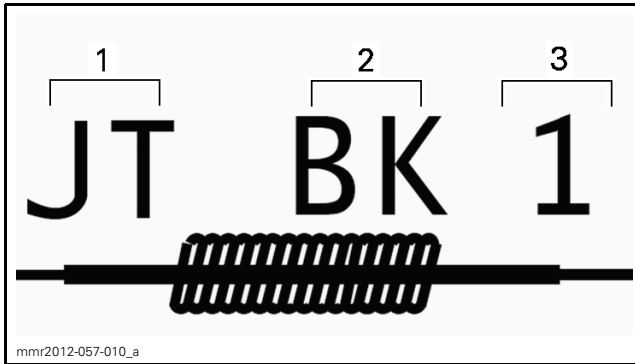
Example: YE/BK is a YELLOW wire with a BLACK stripe.

COLOR CODE					
BG	—	BEIGE	OG	—	ORANGE
BK	—	BLACK	RD	—	RED
BU	—	BLUE	VT	—	VIOLET
BN	—	BROWN	WH	—	WHITE
GN	—	GREEN	YE	—	YELLOW
GY	—	GRAY	PK	—	PINK

LT prefix means a "light" color. E.g: LT GN = Light green.

SPLICES IN WIRING HARNESS

Splices in wiring harness are indicated on the wiring diagram as follows.

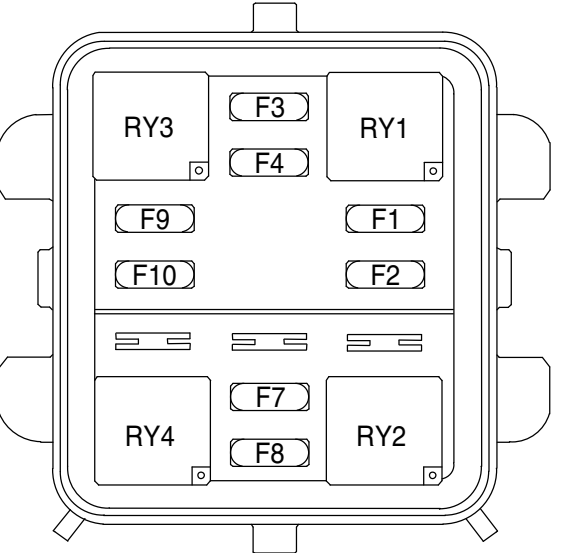


1. JT: Splice indication
2. Spliced wire color
3. Splice number on the wire

Refer to *SPLICE INFORMATION* subsection for more details.

600 ACE

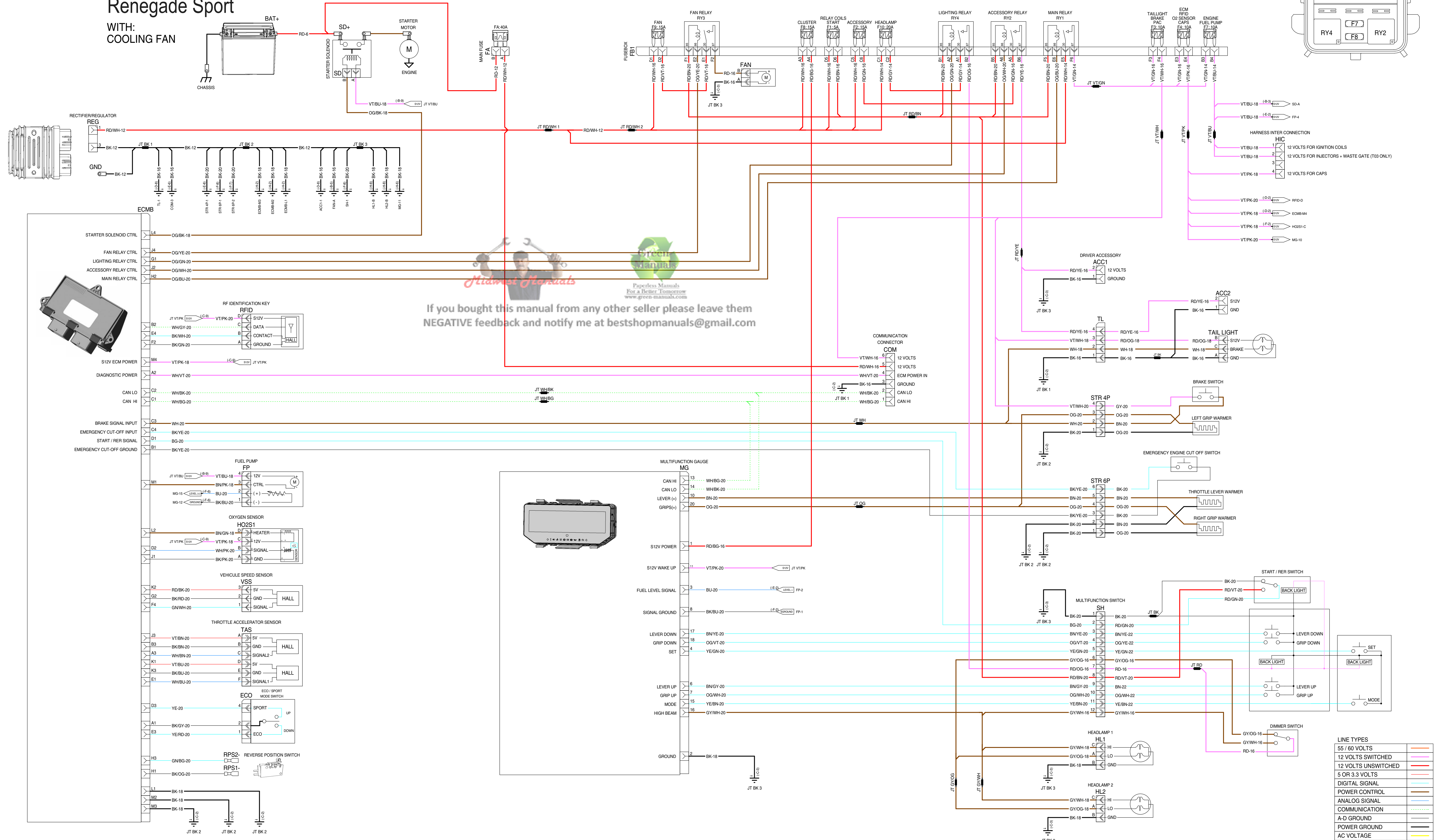
Grand Touring Sport Renegade Sport with cooling fan



LINE TYPES	
55 / 60 VOLTS	
12 VOLTS SWITCHED	
12 VOLTS UNSWITCHED	
5 OR 3.3 VOLTS	
DIGITAL SIGNAL	
POWER CONTROL	
ANALOG SIGNAL	
COMMUNICATION	
A-D GROUND	
POWER GROUND	
AC VOLTAGE	

900 ACE and 900 ACE Turbo
Expedition Sport
Grand Touring Sport
Renegade Sport

WITH:
COOLING FAN

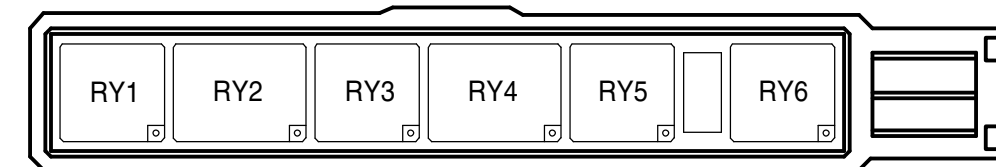
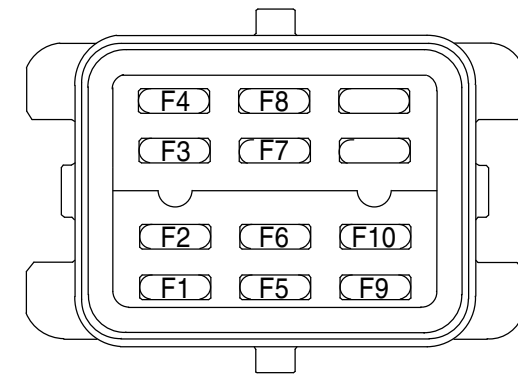


LINE TYPES	
55 / 60 VOLTS	
12 VOLTS SWITCHED	
12 VOLTS UNSWITCHED	
5 OR 3.3 VOLTS	
DIGITAL SIGNAL	
POWER CONTROL	
ANALOG SIGNAL	
COMMUNICATION	
A-D GROUND	
POWER GROUND	
AC VOLTAGE	

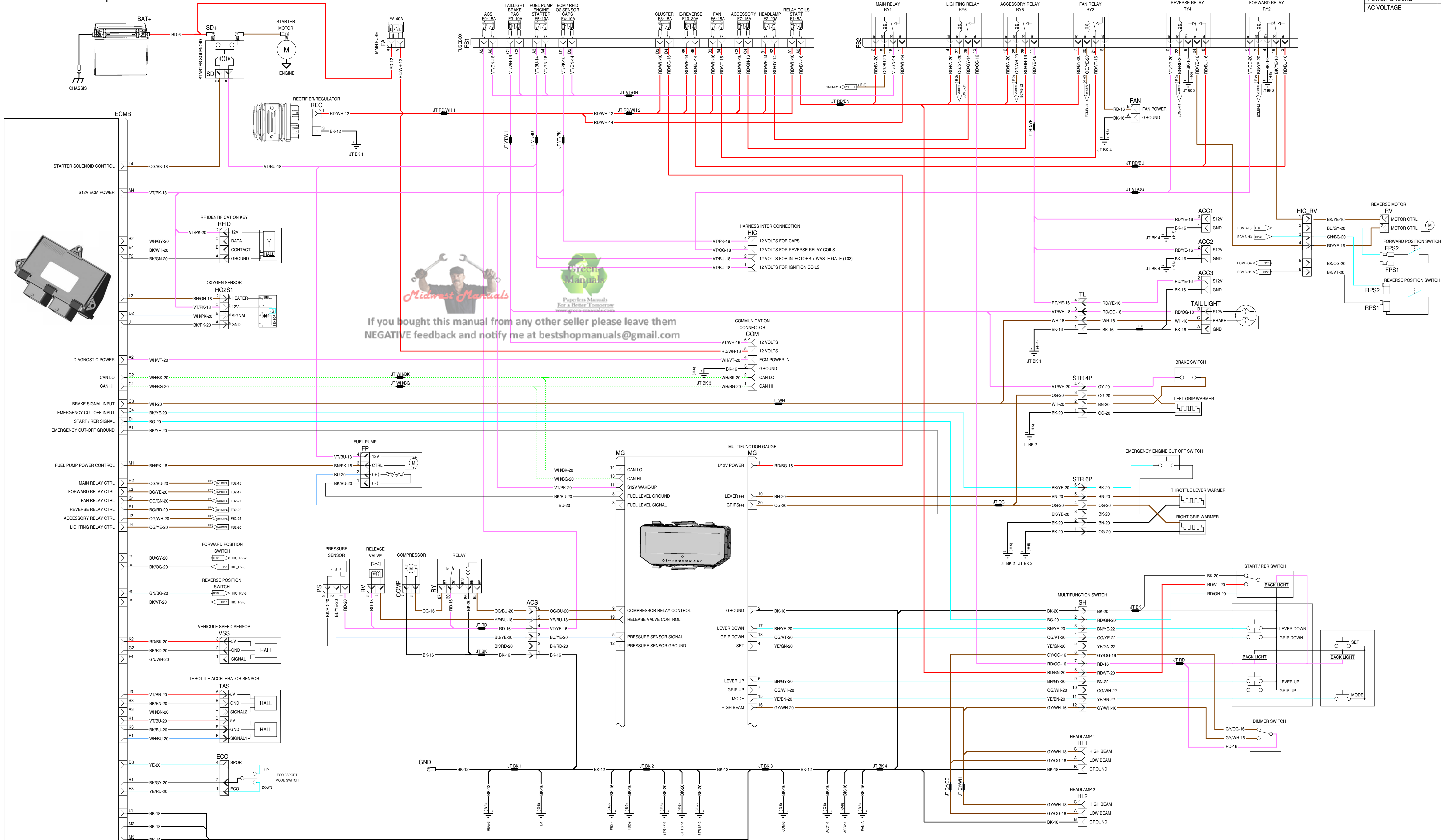
2020 900 ACE and 900 ACE Turbo

Expedition LE
Expedition SE

WITH :
COOLING FAN
ELECTRO-MECHANICAL REVERSE
ACS (EXPEDITION SE ONLY)



LINE TYPES	
55 / 60 VOLTS	
12 VOLTS SWITCHED	
12 VOLTS UNSWITCHED	
5 OR 3.3 VOLTS	
DIGITAL SIGNAL	
POWER CONTROL	
ANALOG SIGNAL	
COMMUNICATION	
A-D GROUND	
POWER GROUND	
AC VOLTAGE	

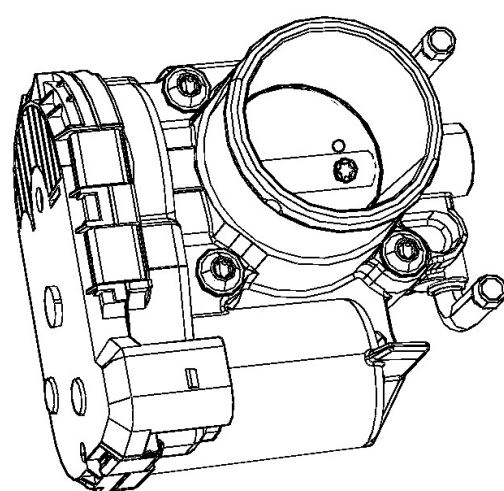


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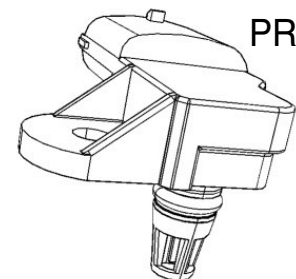
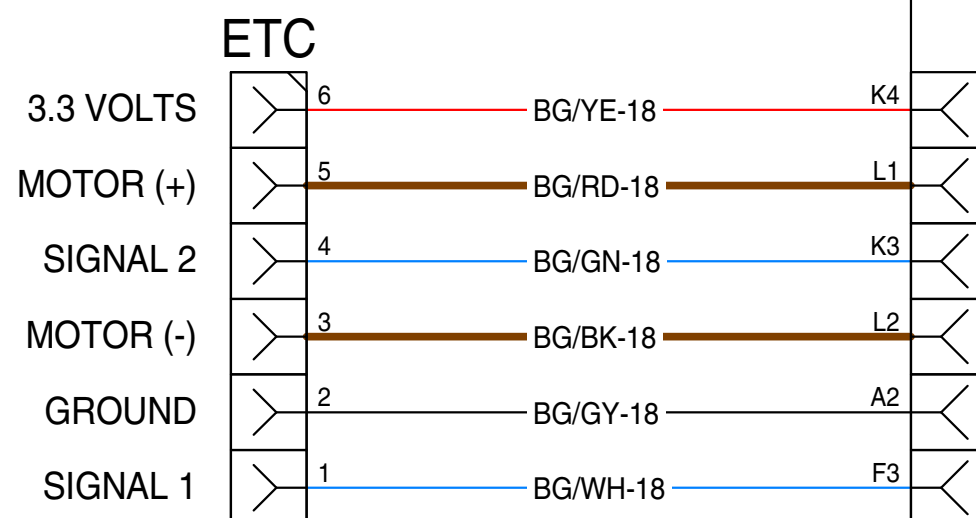
2020 Engine Harness

900 Ace

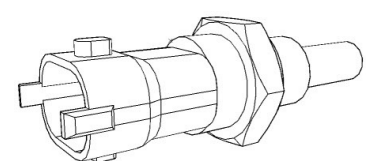
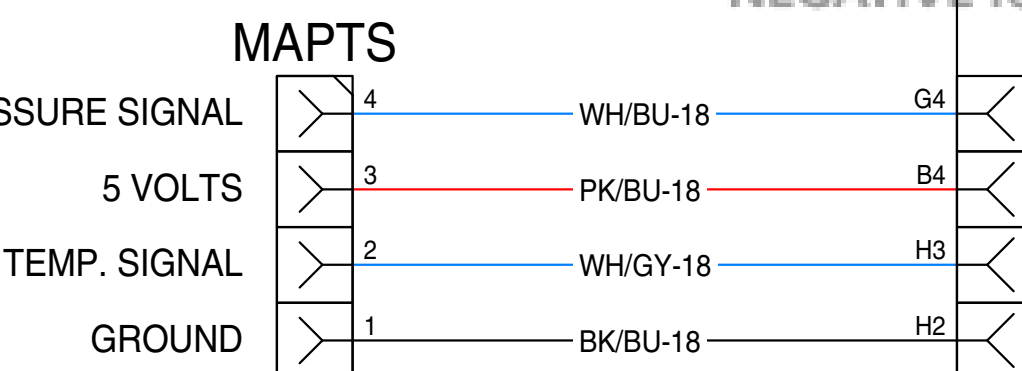
WITHOUT:
TURBO



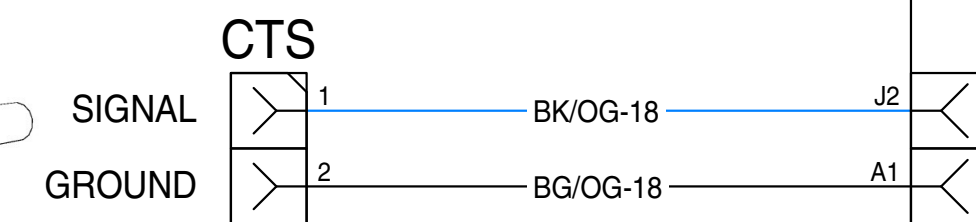
ELECTRONIC THROTTLE CONTROL



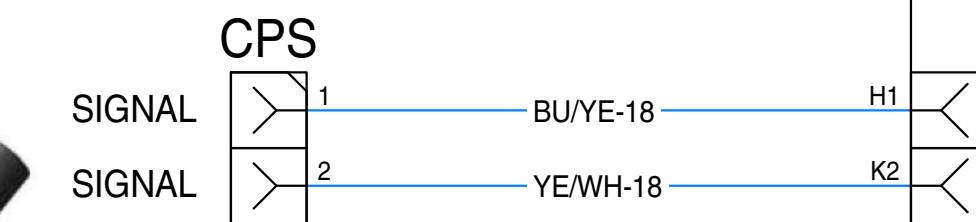
MANIFOLD ABSOLUTE PRESSURE AND TEMPERATURE SENSOR



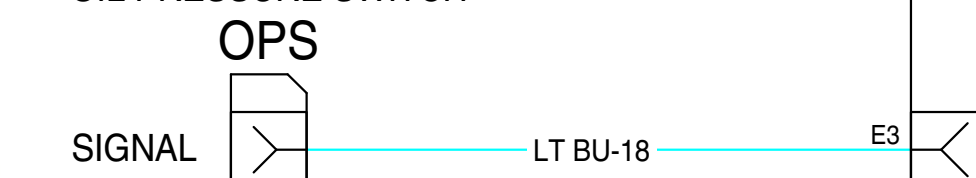
COOLANT TEMPERATURE SENSOR



CRANKSHAFT POSITION SENSOR



OIL PRESSURE SWITCH

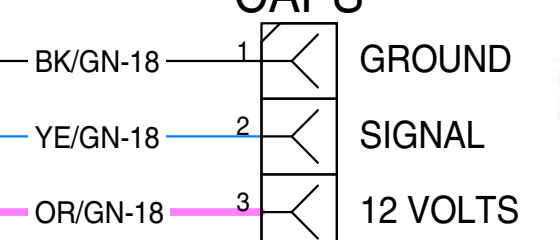


ECMA

ECMA

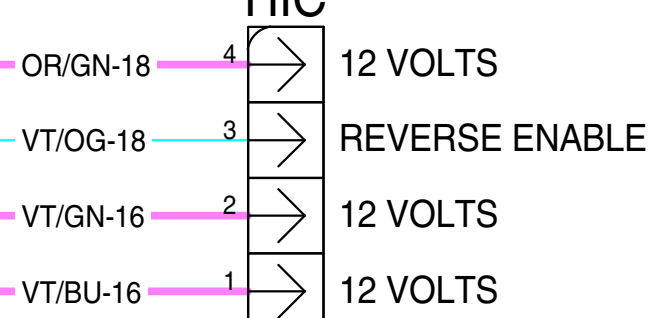
CAMSHAFT POSITION SENSOR

CAPS



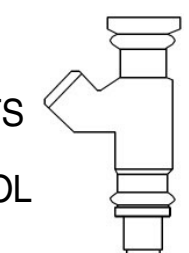
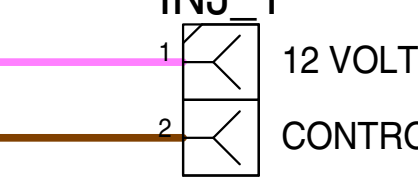
HARNESS INTER CONNECTOR

HIC



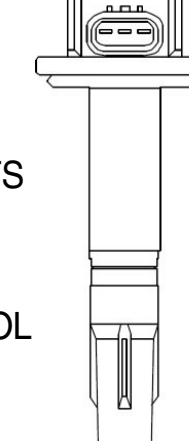
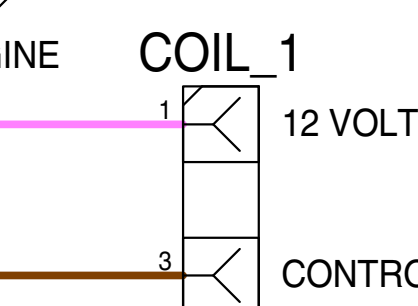
INJECTOR CYLINDER 1

INJ_1



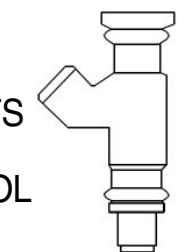
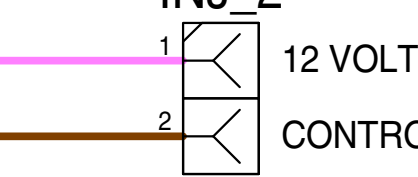
IGNITION COIL
CYLINDER 1

COIL_1



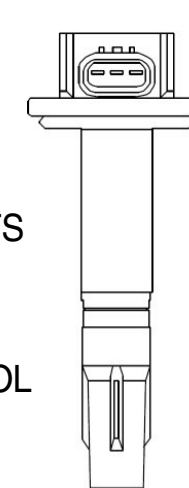
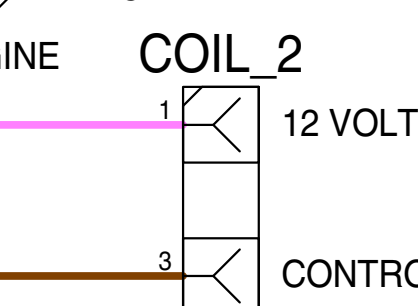
INJECTOR CYLINDER 2

INJ_2



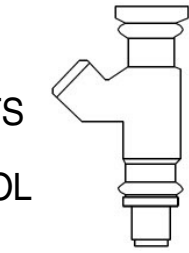
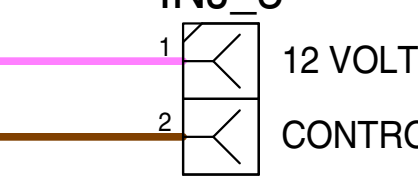
IGNITION COIL
CYLINDER 2

COIL_2



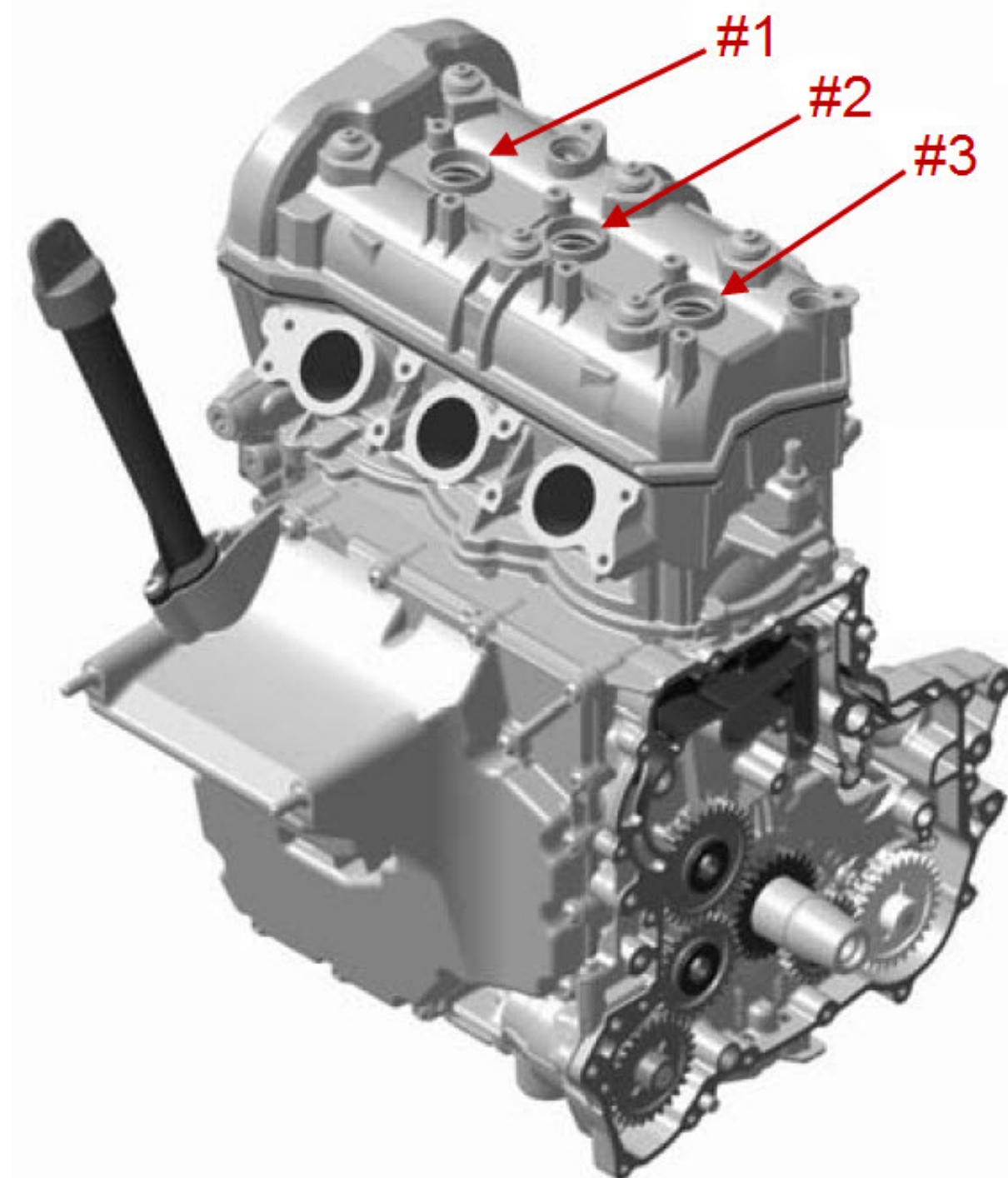
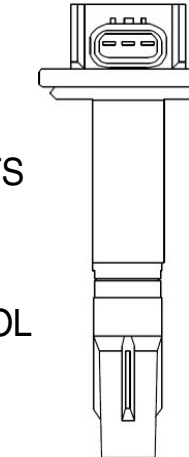
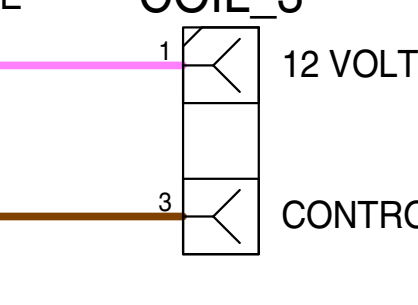
INJECTOR CYLINDER 3

INJ_3



IGNITION COIL
CYLINDER 3

COIL_3



LINE TYPES

55 / 60 VOLTS	
12 VOLTS SWITCHED	
12 VOLTS UNSWITCHED	
5 OR 3.3 VOLTS	
DIGITAL SIGNAL	
POWER CONTROL	
ANALOG SIGNAL	
COMMUNICATION	
A-D GROUND	
POWER GROUND	
AC VOLTAGE	

REF

264422

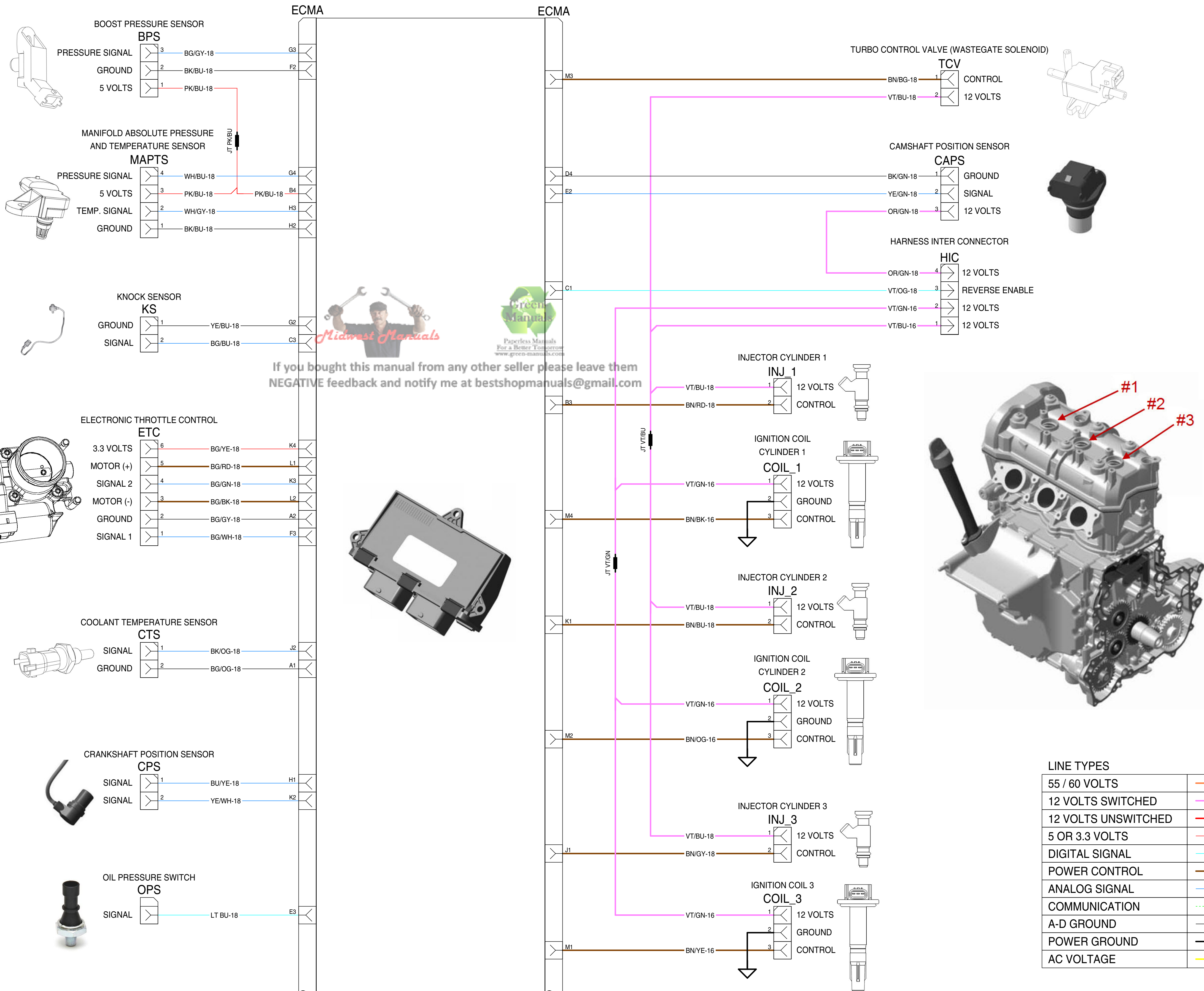
REV

2020

Engine Harness

900 Ace

WITH:
TURBO



If you bought this manual from any other seller please leave them
NEGATIVE feedback and notify me at bestshopmanuals@gmail.com

LINE TYPES	
55 / 60 VOLTS	
12 VOLTS SWITCHED	
12 VOLTS UNSWITCHED	
5 OR 3.3 VOLTS	
DIGITAL SIGNAL	
POWER CONTROL	
ANALOG SIGNAL	
COMMUNICATION	
A-D GROUND	
POWER GROUND	
AC VOLTAGE	

2020

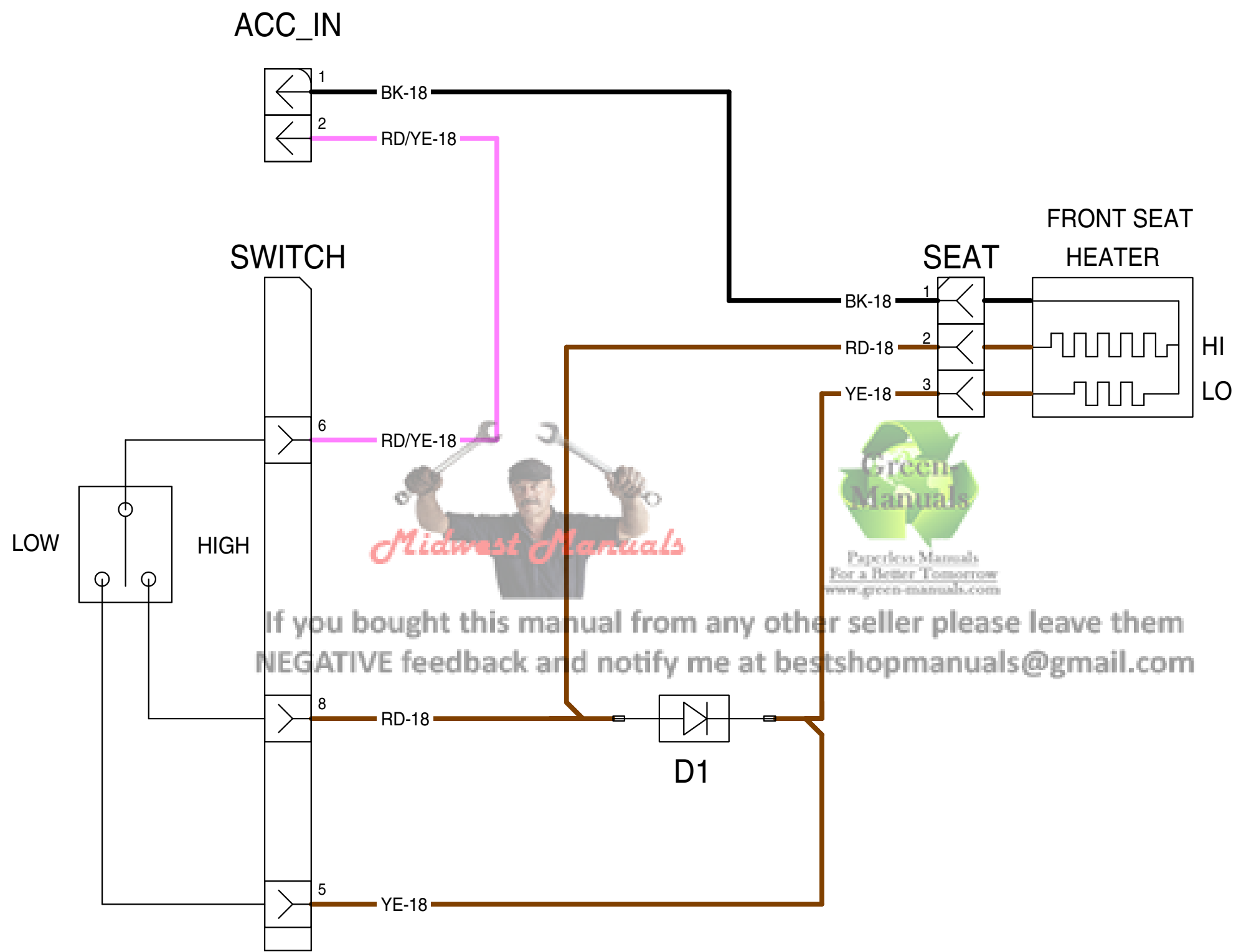
Secondary harnesses

Expedition LE

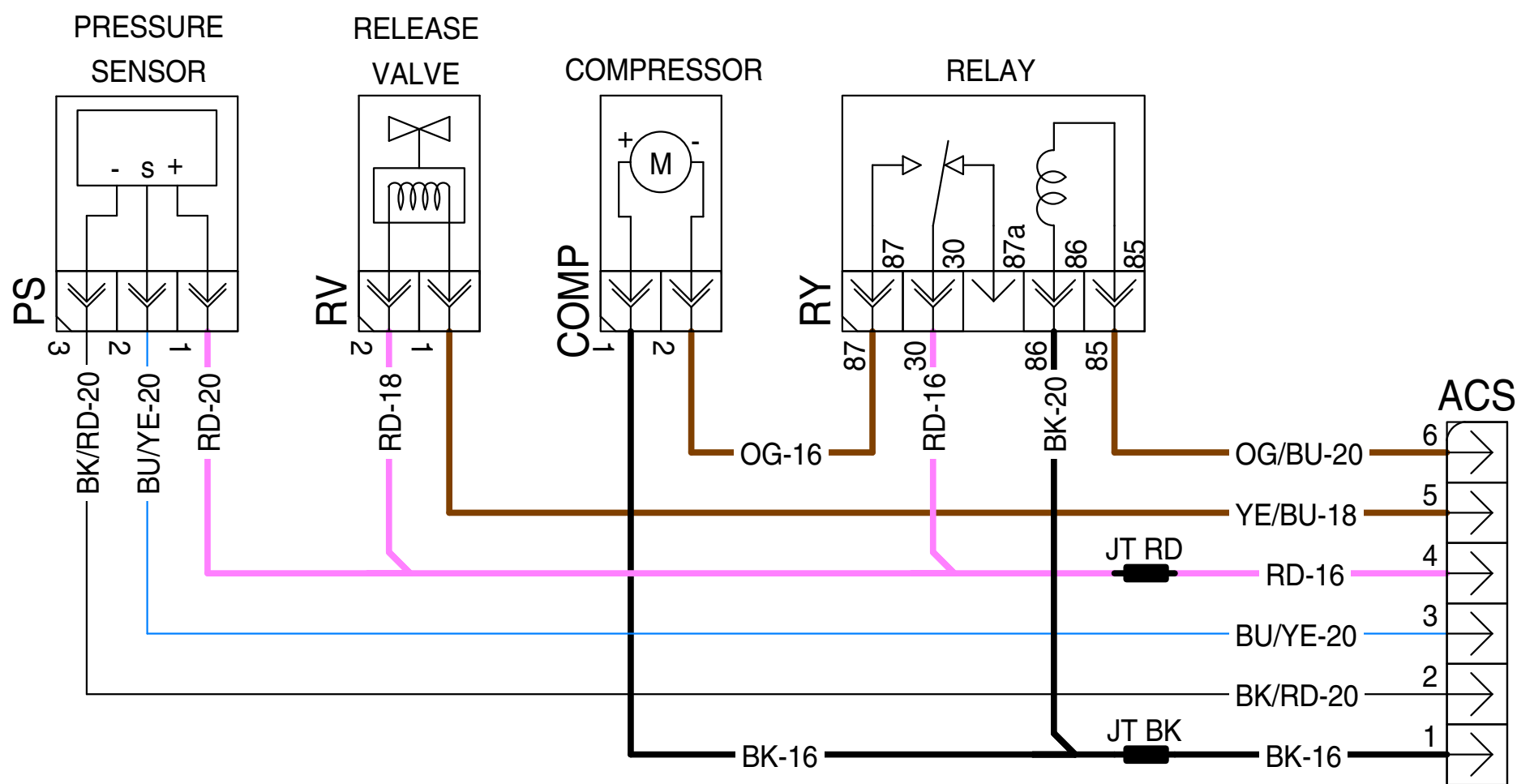
Expedition SE

(IF THE OPTION IS INSTALLED ON THE VEHICLES)

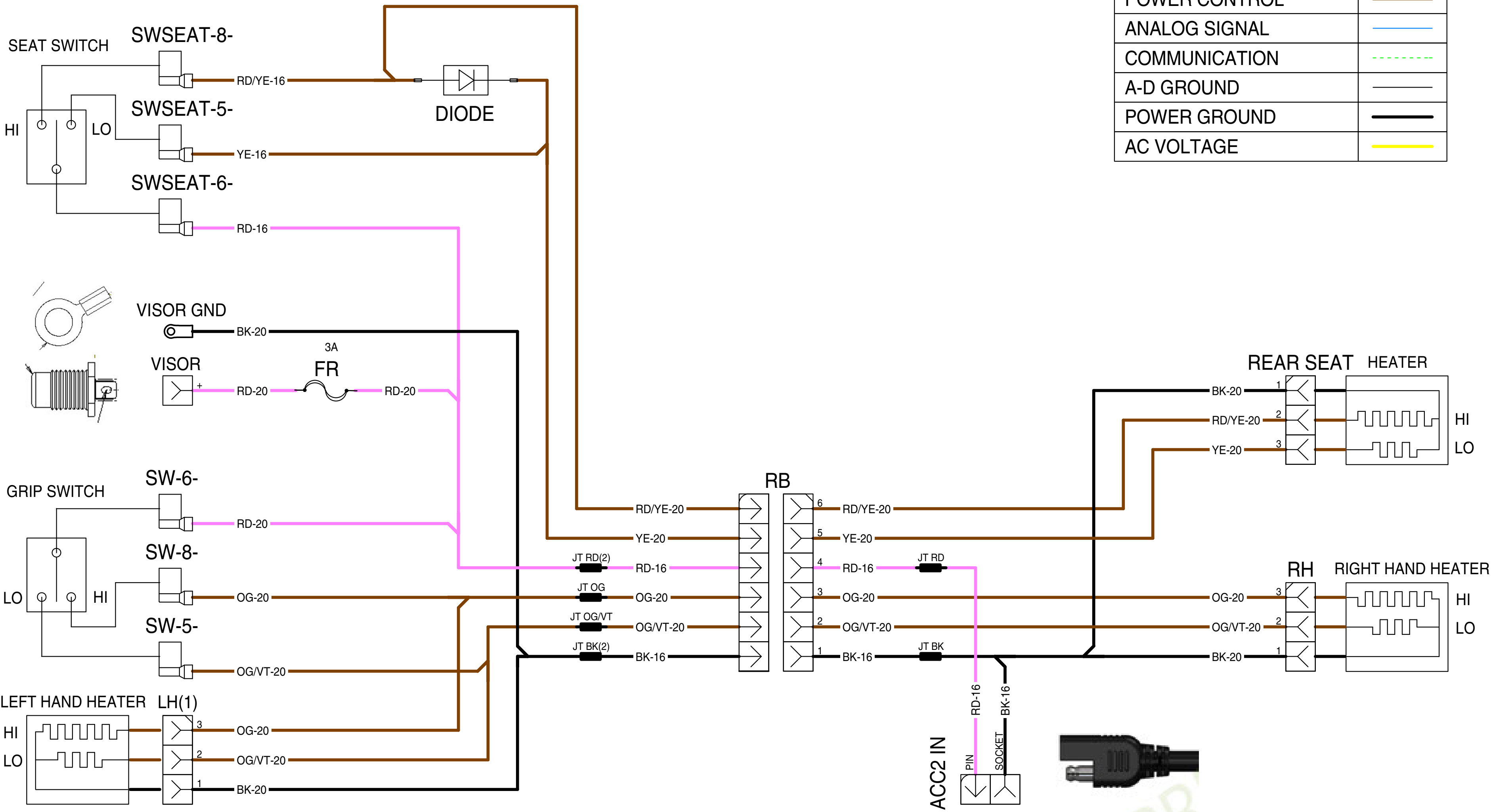
FRONT HEATED SEAT HARNESS



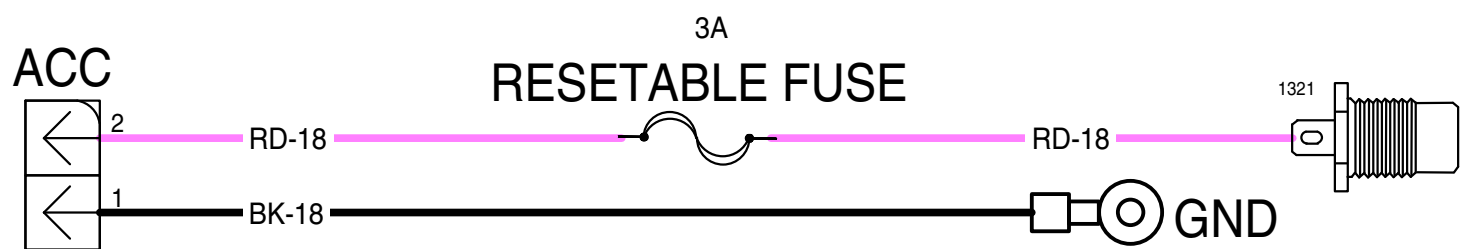
AIR CONTROLLED SUSPENSION HARNESS



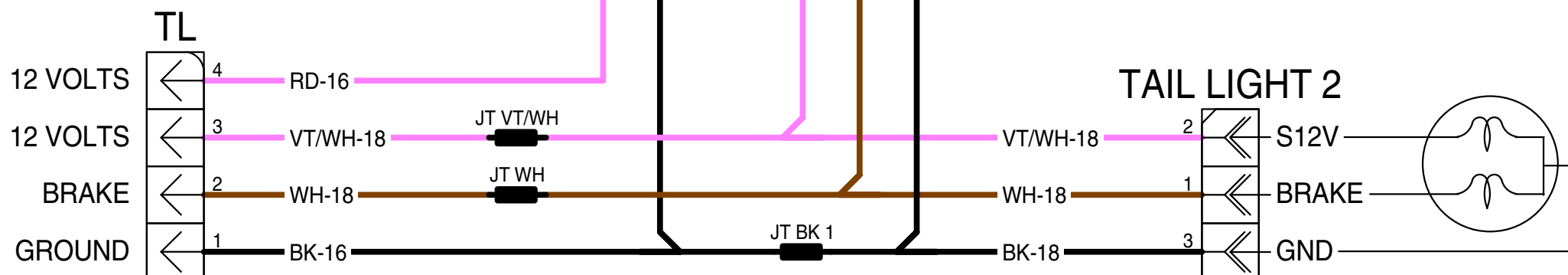
REAR SEAT HARNESS (HEATED GRIPS & SEAT)



FRONT HEATED VISOR HARNESS



DOUBLE TAIL LIGHT HARNESS WITH ACCESSORY PLUG



LINE TYPES

55 / 60 VOLTS	
12 VOLTS SWITCHED	
12 VOLTS UNSWITCHED	
5 OR 3.3 VOLTS	
DIGITAL SIGNAL	
POWER CONTROL	
ANALOG SIGNAL	
COMMUNICATION	
A-D GROUND	
POWER GROUND	
AC VOLTAGE	

REF

REV

2

Flat rate times are what the manufacturer pays the authorized dealer for warranty work, the times listed are usually unrealistic for even the most experienced mechanic and will take longer to actually complete.

Because of this dealers will usually charge more than the times posted.

I cannot be held responsible for any errors BRP has made in these service flat rate or parts manuals.

If you bought this manual from any other seller, they could be reselling my work.

Please leave them negative feedback & email me at bestshopmanuals@gmail.com.

Our goal is to be one of the BEST sellers on the internet by providing you with the BEST customer service and the BEST manuals on the market.

Thank you for choosing us.



INTRODUCTION

This publication governs all warranty labor allowances for 2020 BRP Snowmobiles.

1. HOW DOES IT WORK

We follow the procedures detailed in the BRP *Snowmobiles Shop Manual*. The flat rate time is the maximum time allowed for a repair involving any given part. **FLAT RATE TIME IS NOT CUMULATIVE.** You must use the flat rate time given for the longest lasting operation.

NOTE: The *Flat Rate Time Schedule* was prepared by skilled mechanics using the hand tool usually found in workshops and all the special tools mentioned in the *Shop Manual*.

2. COMPILATION

The *Flat Rate Time Schedule* is compiled as follows:

The actual required time to perform the repair plus (+) 30% correction factor up to 3.0 hours or (+) 15% over 3.0 hours time to take into account, among others:

- Vehicle handling
- Obtaining the parts
- Diagnosis
- Cleaning
- Special compensation (rusted bolts).

3. HOW TO USE IT

Refer to the system you need, locate part of series of parts replaced. List JOB CODE in the appropriate column on claim.

SYSTEM		PAGE
01	ENGINE	04
02	CARBURETOR AND FUEL SYSTEM	19
03	IGNITION SYSTEM	23
04	STARTER	25
05	TRANSMISSION SYSTEM	26
06	BRAKE SYSTEM	32
07	STEERING SYSTEM AND FRONT SUSPENSION	34
08	REAR SUSPENSION SYSTEM AND TRACK	39
09	BODY	45
10	ELECTRICAL SYSTEM	58

NOTE: Unless otherwise specified, dismantling order is: top to bottom, exterior to interior, front to rear.

All fractions of hours are in tenths:

0.1 = 6 minutes

0.2 = 12 minutes, and so on

LEGEND:

- * REQUIRES PRIOR AUTHORIZATION BY DISTRIBUTOR.
- ** INDICATE LABOUR TIME ON LINE "LABOUR ONLY" OF CLAIM.
- *** INDICATE \$\$\$ AMOUNT ON "SUB-CONTRACTED LABOUR" OF CLAIM.

IMPORTANT: Always use the longest flat rate time applicable to the repair performed.

4. JOB REQUIREMENTS

All the flat rate times mentioned in the following pages include the required operations such as: engine timing (rotary valve and ignition), connecting rod(s) alignment, cylinder head(s) torque or use of parallel bar, use of ignition tester, piston clearance/ring end gap measurement, crankshaft to crankcase measurement, cylinder honing, engine leak test.

5. ILLUSTRATIONS

The illustrations contained in this manual do not necessarily show every components of a given system as *Parts Catalog* do. Their purpose is to facilitate recognition of parts related to a flat rate time. **Item numbers on illustrations correspond to the four digit Job Code.**

6. FLAT RATE TIME SUGGESTION

SEND A WARRANTY CASE ON BOSSWeb INFO CENTER

In the case, you must provide the following information:

Section *Subject*:

- Flat rate time suggestion

Section *Your Question*:

- Model year;
- Model description;
- Description job code;
- Job code;
- Present flat rate;
- Suggested flat rate;
- Detailed repair procedure;

To ensure that your case will be promptly and efficiently processed please indicate the step by step repair procedure you performed.

INTRODUCTION

Cette publication détermine le temps de main-d'oeuvre couvert par la garantie pour les motoneiges BRP 2020.

1. UTILISATION DU MANUEL

En procédant de la façon indiquée dans le *Manuel de réparation motoneiges* BRP, chaque temps donné représente le maximum permis pour une réparation portant sur cette pièce. **LES TEMPS NE SONT PAS CUMULATIFS.** On doit inscrire le temps donné pour l'opération qui prend le plus de temps.

REMARQUE: Le *Barème de temps à taux fixe* a été préparé par des mécaniciens compétents utilisant les outils que l'on retrouve normalement dans les ateliers de réparation, en plus de tous les outils spéciaux mentionnés dans le *Manuel de réparation*.

2. COMPILATION

Le *Barème de temps à taux fixe* a été établi en compilant le temps nécessaire pour faire la réparation plus (+) un facteur de correction de 30% lorsqu'un travail dure 3.0 heures et moins, ou (+) 15% lorsqu'un travail dure plus de 3.0 heures. Cette compilation comprend, entre autres, les étapes suivantes:

- Manutention du véhicule
- Nettoyage
- Aller chercher les pièces, essais physiques
- Compensation spéciale (boulons rouillés)
- Diagnostic.

3. UTILISATION DU BARÈME

Se reporter à la section désirée, repérer la pièce ou l'ensemble de pièces remplacées et inscrire le CODE DE TRAVAIL dans la colonne appropriée sur la formule de réclamation.

SYSTÈME		PAGE
01	MOTEUR	4
02	CARBURATEUR ET SYSTÈME D'ALIMENTATION D'ESSENCE	11
03	SYSTÈME D'ALLUMAGE	17
04	DÉMARREUR	19
05	SYSTÈME DE TRANSMISSION	21
06	SYSTÈME DE FREIN	28
07	SYSTÈME DE DIRECTION ET SUSPENSION AVANT	30
08	SYSTÈME DE SUSPENSION ARRIÈRE ET CHENILLE	35
09	CARROSSERIE	41
10	SYSTÈME ÉLECTRIQUE	53

REMARQUE: Sauf indication contraire, le démontage doit s'effectuer de haut en bas, de l'extérieur vers l'intérieur, de l'avant vers l'arrière.

Toutes les fractions d'heures sont exprimées en dixièmes:

0.1 = 6 minutes

0.2 = 12 minutes, et ainsi de suite

LÉGENDE:

- * AUTORISATION REQUISE AVANT LE REMPLACEMENT.
- ** INSCRIRE LE TEMPS À LA LIGNE «MAIN-D'OEUVRE SEULEMENT».
- *** INSCRIRE LE MONTANT \$\$\$ À LA LIGNE «OUVRAGE SOUS-CONTRACTÉ».

IMPORTANT: Toujours utiliser le temps donné à l'opération qui nécessite le plus de temps.

4. TRAVAUX REQUIS

Tous les temps mentionnés dans les pages suivantes incluent les opérations telles que: réglage du moteur (valve rotative et allumage), alignement de la ou des bielles, couple de serrage de la ou des culasses ou l'utilisation de barres parallèles, utilisation du vérificateur d'allumage, mesure du jet des pistons/jeu en bout des segments, mesure de l'écart entre le vilebrequin et le carter, rectification du cylindre, vérification de fuite du moteur.

5. ILLUSTRATIONS

Contrairement aux *Catalogues de pièces*, les illustrations de ce manuel ne montrent pas nécessairement chacune des pièces qu'elles représentent, leur raison d'être étant plutôt de faciliter la reconnaissance des pièces reliées à un barème de temps à taux fixe. **Les numéros d'items sur les illustrations correspondent aux quatre derniers chiffres du code de travail.**

6. SUGGESTION DE BARÈME DE TEMPS À TAUX FIXE

ENVOYEZ UNE REQUÊTE GARANTIE BOSSWeb DEPUIS LA SECTION INFO CENTRE

Dans cette requête, vous devez fournir les informations suivantes:

Section *Objet*:

- Suggestion de barème de temps à taux fixe

Section *Votre Question*:

- L'année modèle;
- Description du modèle;
- Description du code de travail;
- Code de travail;
- Temps actuel;
- Temps suggéré;
- Détails de la marche à suivre;

Pour s'assurer que votre demande sera traitée dans les plus brefs délais et efficacement, s.v.p. nous fournir toutes les étapes de réparation dans les détails de la marche à suivre.

2020

LIQUID COOLED 4-STROKE 4 TEMPS REFROIDIS PAR LIQUIDE

TABLE	DESCRIPTION	MODEL MODÈLE	ENGINE MOTEUR	CHASSIS TYPE TYPE DE CHÂSSIS	REAR SUSPENSION SUSPENSION ARRIÈRE
24	RENEGADE Sport 600 ACE	MCLA/MCLB	602 ACE	REV-XS 137"	SC-5
25	GT Sport 600 ACE	ETLA/ETLB	602 ACE	REV-XS 137"	SC-5
26	EXPEDITION Sport 600 ACE	KCLA/KCLB	602 ACE	REV-XP 154"	SC-5U
27	TUNDRA Sport 600 ACE	GMLA	602 ACE	REV-XU 137"	SC-5
	TUNDRA LT 600 ACE	GNLA/GNLB		REV-XU 154"	SC-5U
28	SKANDIC WT 600 ACE	FHLB	602 ACE	REV-XU 154"	SC-5U

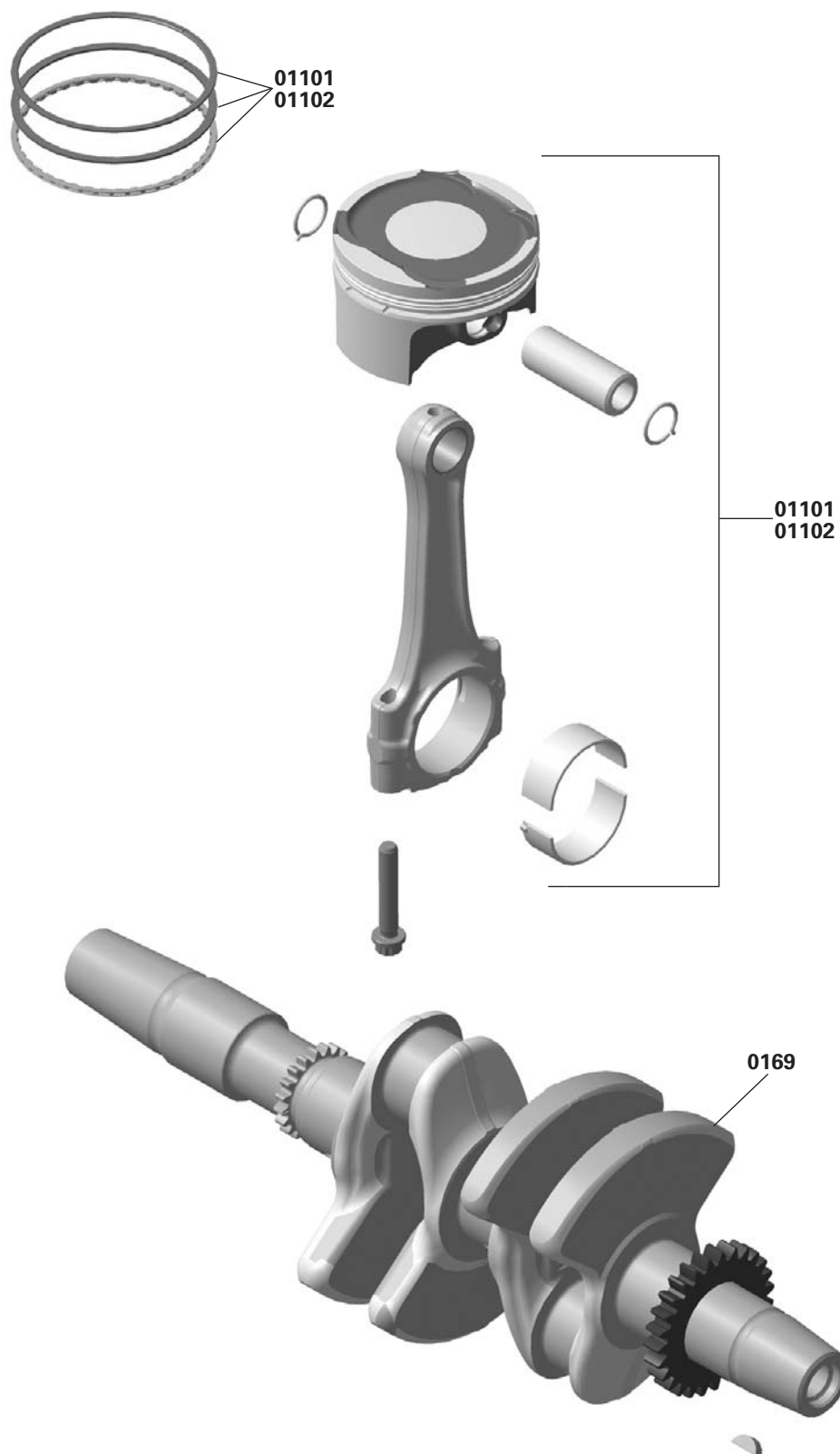
SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIAC 600 ACE
			24	25	26	27	28

01	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0
01*	01	REMOVE AND REPLACE ENGINE (ASS'Y) REPLACEMENT MOTEUR (COMPLET)	3.5	3.5	3.5	3.5	3.5
01	03	OIL PRESSURE SWITCH INTERRUPTEUR DE PRESSION D'HUILE	0.3	0.3	0.3	0.3	0.3
01	07	AIR DUCT CONDUIT D'AIR				0.3	
01	08	FAN VENTILATEUR		0.3	0.3	0.4	0.3
01	18	COOLANT TEMPERATURE SENDER CAPTEUR DE TEMPÉRATURE LIQUIDE DE REFROIDISSEMENT	0.4	0.4	0.4	0.4	0.4
01	19	THERMOSTAT THERMOSTAT	1.0	1.0	1.0	0.6	0.6
01	38	WATER PUMP SHAFT (ALL PARTS) ARBRE DE LA POMPE À EAU (TOUTES LES PIÈCES)	3.5	3.5	3.5	3.0	2.7
01	39	OIL TANK RÉSERVOIR D'HUILE	3.8	3.8	3.8	3.8	3.8
01	46	RADIATOR AND/OR GROMMET RADIATEUR ET/OU PASSE FILS		0.6	0.6	0.6	0.6
01	51	CYLINDER HEAD GASKET JOINT DE CULASSE	3.8	3.8	3.8	3.8	3.8
01	69	CRANKSHAFT VILEBREQUIN	7.0	7.0	7.0	7.0	7.0
01	75	MUFFLER AND/OR EXHAUST GROMMET/SUPPORT SILENCIEUX ET/OU BAGUE D'ÉCHAPPEMENT/SUPPORT	0.3	0.3	0.3	0.3	0.3
01	79	COOLANT HOSE (TANK TO ENGINE) BOYAU SYSTÈME DE REFROIDISSEMENT (RÉSERVOIR AU MOTEUR)	1.0	1.0	1.0	1.0	1.0
01	83	EXHAUST MANIFOLD (FRONT) COLLECTEUR D'ÉCHAPPEMENT (AVANT)	0.4	0.4	0.4	0.4	0.4
01	88	RUBBER MOUNT (MUFFLER) TAMPON D'ANCRAGE (SILENCIEUX)	0.3	0.3	0.3	0.3	0.3
01	90	ENGINE OIL FILTER FILTRE À HUILE DU MOTEUR	0.3	0.3	0.3	0.3	0.3
01	94	REAR RADIATOR RADIATEUR ARRIÈRE	4.3	4.3	4.3	4.3	4.9
01	96	OIL SIEVE CRIBLE D'HUILE	4.2	4.2	4.2	4.2	4.2
01	98	COOLING RESERVOIR RÉSERVOIR D'ANTIGEL	0.4	0.4	0.4	0.4	0.4
01	100	RADIATOR OUTLET HOSE BOYAU DE SORTIE DU RADIATEUR	0.6	0.6	0.6	0.6	0.6
01	101	PISTON, PIN, CIRCLIP, RING (1) PISTON, AXE, FREIN D'AXE, SEGMENT (1)	6.0	6.0	6.0	6.0	6.0

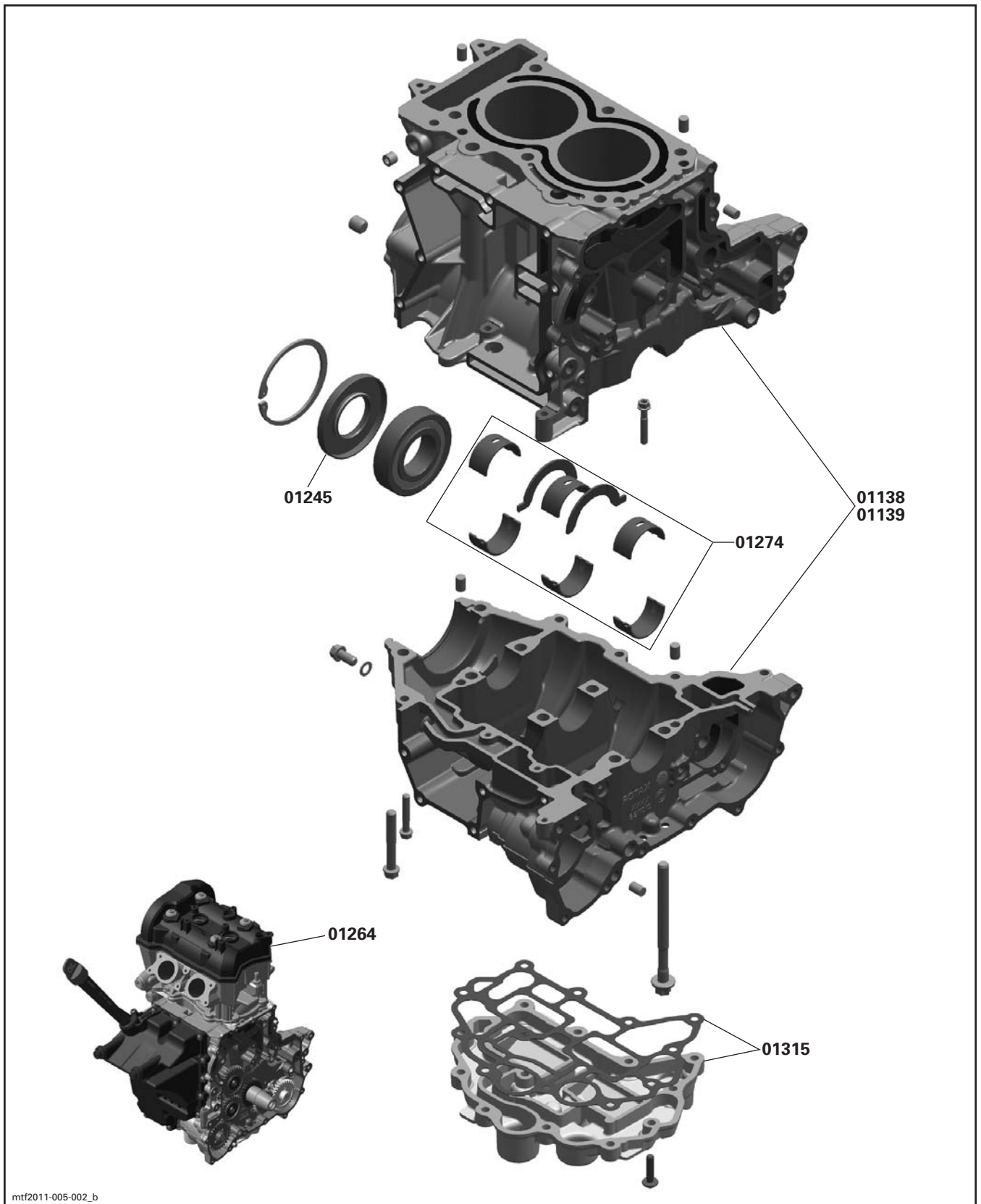
SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIC 600 ACE
			24	25	26	27	28
01	102	PISTONS, PINS, CIRCLIPS, RINGS (2) PISTONS, AXES, FREINS D'AXE, SEGMENTS (2)	6.1	6.1	6.1	6.1	6.1
01	109	VALVE COVER AND/OR GASKET COUVERCLE DE SOUPAPE ET/OU JOINT D'ÉTANCHÉITÉ	0.5	0.5	0.5	0.5	0.5
01	111	TIMING GEARS ENGRENAGES DE LA DISTRIBUTION	1.4	1.4	1.4	1.4	1.4
01	114	CYLINDER HEAD AND/OR GASKET CULASSE ET/OU JOINT D'ÉTANCHÉITÉ	4.8	4.8	4.8	4.8	4.8
01	116	EXHAUST AND/OR INLET VALVE AND/OR SPRING AND/OR SEAL VALVE D'ADMISSION ET/OU D'ÉCHAPPEMENT ET/OU RESSORT ET/OU ANNEAU D'ÉTANCHÉITÉ	4.0	4.0	4.0	4.0	4.0
01	119	WATER PUMP HOUSING AND/OR IMPELLER CARTER DE POMPE À EAU ET/OU ROUE AILETTES	0.8	0.8	0.8	0.8	0.8
01	132	OIL PUMP GEAR ENGRENAGE DE LA POMPE À HUILE	3.0	3.0	3.0	3.0	3.0
01	138	CRANKCASE RESEAL AND/OR GASKET RESCHELLEMENT CARTER ET/OU JOINT D'ÉTANCHÉITÉ	5.0	5.0	5.0	5.0	5.0
01	139	CRANKCASE REPLACEMENT REPLACEMENT DU CARTER	6.3	6.3	6.3	6.3	6.3
01	146	OIL PUMP GEAR (2) ENGRENAGE POMPE À L'HUILE (2)	3.0	3.0	3.0	3.0	3.0
01	154	TIMING CHAIN (PTO SIDE) CHAÎNE D'ENGRENAGE (CÔTÉ PDM)	5.8	5.8	5.8	5.8	5.8
01	179	CHAIN GUIDE GUIDE DE CHAÎNE	1.2	1.2	1.2	1.2	1.2
01	182	OIL RADIATOR AND/OR O-RING RADIATEUR D'HUILE ET/OU JOINT	0.5	0.5	0.5	0.5	0.5
01	183	OIL PUMP COVER AND/OR SHAFT AND/OR ROTOR COUVERCLE POMPE ET/OU ARBRE ET/OU ROTOR	3.2	3.2	3.2	3.2	3.2
01	184	OIL PUMP HOUSING AND/OR ALL PARTS BOÎTIER POMPE HUILE ET/OU TOUTES LES PIÈCES	3.2	3.2	3.2	3.2	3.2
01	191	CHAIN TENSION GUIDE GUIDE DE TENSION DE CHAÎNE	5.0	5.0	5.0	5.0	5.0
01	192	CHAIN TENSIONER (ASS'Y) TENDEUR DE CHAÎNE (COMPLET)	0.4	0.4	0.4	0.4	0.4
01	200	WATER PUMP GEAR ENGRENAGE POMPE À EAU	3.0	3.0	3.0	3.0	3.0
01	206	COOLANT HOSE (REAR RADIATOR TO FRONT RADIATOR) BOYAU REFROIDISSEMENT (RADIATEUR ARRIÈRE AU RADIATEUR AVANT)	1.1	1.1	1.1	1.1	1.3
01	207	COOLANT HOSE (ENGINE TO REAR RADIATOR) BOYAU DE REFROIDISSEMENT (MOTEUR AU RADIATEUR ARRIÈRE)	1.1	1.1	1.1	1.1	1.3
01	215	OIL DIPSTICK JAUGE À L'HUILE	0.3	0.3	0.3	0.3	0.3
01	216	PRESSURE CAP BOUCHON DU RADIATEUR	0.3	0.3	0.3	0.3	0.3

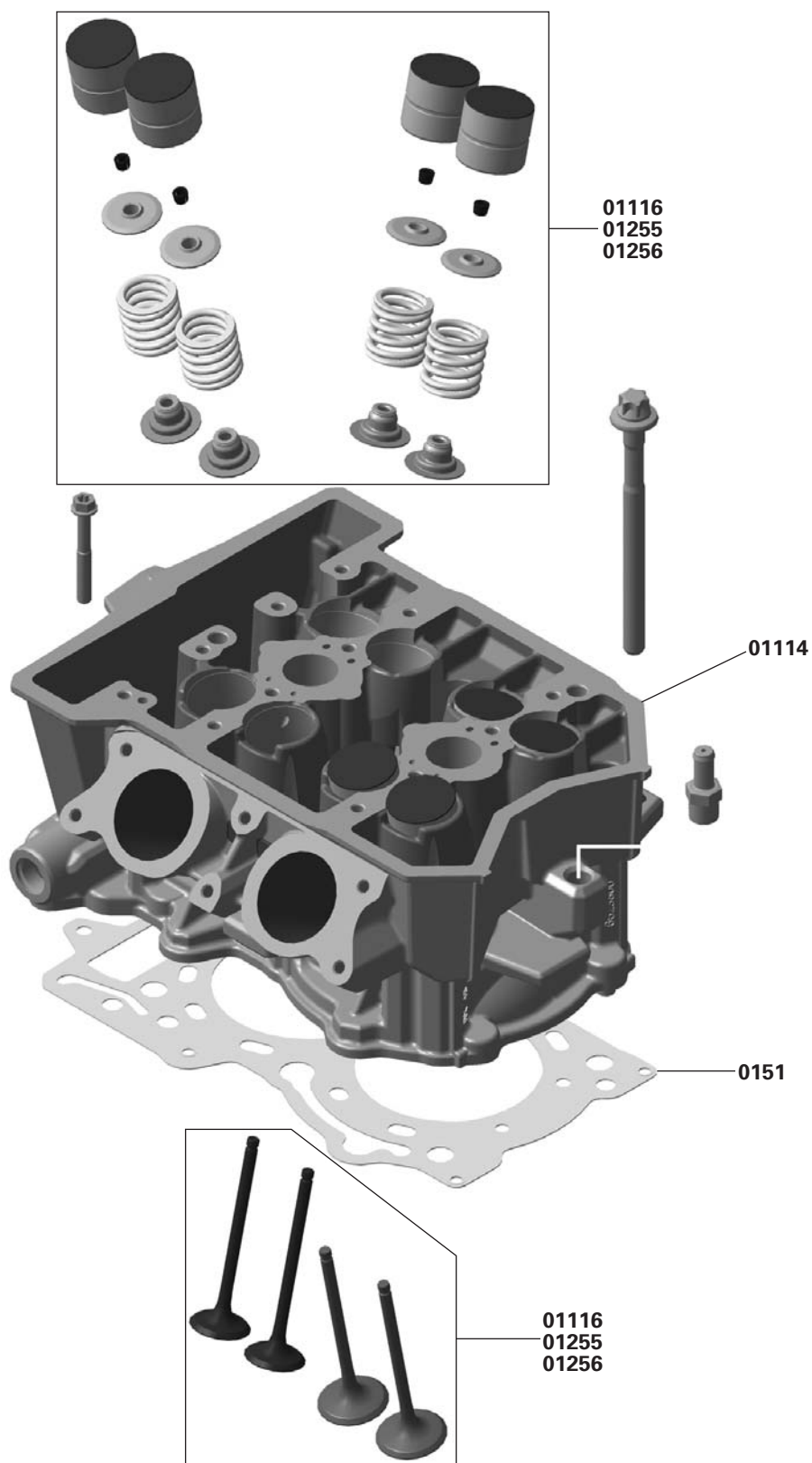
SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIC 600 ACE
			24	25	26	27	28
01	245	OUTPUT CRANKSHAFT SEAL (PTO SIDE) ANNEAU D'ÉTANCHÉITÉ SORTIE VILEBREQUIN (CÔTÉ PDM)	0.4	0.4	0.4	0.4	0.4
01	246	WATER PUMP GEARS AND/OR SEAL ENGRENAGES POMPE À EAU ET/OU JOINT D'ÉTANCHÉITÉ	3.0	3.0	3.0	3.0	3.0
01	248	BREATHER GEAR AND/OR V-RING RENIFLARD ET/OU ANNEAU D'ÉTANCHÉITÉ EN V	1.0	1.0	1.0	1.0	1.0
01	250	CRANKSHAFT POSITION SENSOR (CPS) CAPTEUR POSITION DU VILEBREQUIN (CPV)	0.4	0.4	0.4	0.4	0.4
01	255	EXHAUST/INLET VALVES AND/OR SPRINGS AND/OR SEALS (4) VALVES D'ADMISSION/D'ÉCHAPPEMENT ET/OU RESSORTS ET/OU ANNEAUX (4)	4.1	4.1	4.1	4.1	4.1
01	256	EXHAUST/INLET VALVES AND/OR SPRINGS AND/OR SEALS (8) VALVES D'ADMISSION/D'ÉCHAPPEMENT ET/OU RESSORTS ET/OU ANNEAUX (8)	4.3	4.3	4.3	4.3	4.3
01	264	LONG BLOCK ENSEMBLE CARTER-CYLINDRE-CULASSE	5.0	5.0	5.0	5.0	5.0
01	274	CRANKSHAFT PLAIN BEARINGS PALIERS LISSE DU VILEBREQUIN	7.0	7.0	7.0	7.0	7.0
01	289	FRONT ENGINE SUPPORT (PTO SIDE) SUPPORT MOTEUR AVANT (CÔTÉ PDM)	0.6	0.6	0.6	0.6	0.6
01	290	REAR ENGINE SUPPORT (PTO SIDE) SUPPORT MOTEUR ARRIÈRE (CÔTÉ PDM)	0.6	0.6	0.6	0.6	0.6
01	291	FRONT ENGINE SUPPORT (MAG SIDE) SUPPORT MOTEUR AVANT (CÔTÉ MAG)	0.6	0.6	0.6	0.6	0.6
01	292	REAR ENGINE SUPPORT (MAG SIDE) SUPPORT MOTEUR ARRIÈRE (CÔTÉ MAG)	0.6	0.6	0.6	0.6	0.6
01	293	FRONT RUBBER MOUNT (PTO SIDE) TAMPON D'ANCRAGE AVANT (CÔTÉ PDM)	0.6	0.6	0.6	0.6	0.6
01	294	REAR RUBBER MOUNT (PTO SIDE) TAMPON D'ANCRAGE ARRIÈRE (CÔTÉ PDM)	1.0	1.0	1.0	1.0	1.0
01	295	FRONT RUBBER MOUNT (MAG SIDE) TAMPON D'ANCRAGE AVANT (CÔTÉ MAG)	0.6	0.6	0.6	0.6	0.6
01	296	REAR RUBBER MOUNT (MAG SIDE) TAMPON D'ANCRAGE ARRIÈRE (CÔTÉ MAG)	0.8	0.8	0.8	0.8	0.8
01	311	CAMSHAFT INTAKE/EXHAUST AND/OR CAMSHAFT BRACKETS ARBRE À CAME D'ADMISSION/ÉCHAPPEMENT ET/OU SUPPORTS D'ARBRE À CAME	2.0	2.0	2.0	2.0	2.0
01	315	OIL SUMP COVER AND GASKET COUVERCLE DU CARTER D'HUILE ET JOINT D'ÉTANCHÉITÉ	3.9	3.9	3.9	3.9	3.9
01	318	RADIATOR SUPPORT SUPPORT DE RADIATEUR				0.3	0.3
01	321	MODULE SUPPORT SUPPORT DU MODULE	1.3	1.3	1.3	1.3	1.3
01	322	WATER PIPE TUYAU D'EAU		0.4	0.4	0.4	0.4

SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIC 600 ACE
			24	25	26	27	28
01	323	WATER PIPE DOUBLE TUYAU D'EAU DOUBLE		0.6	0.6	0.6	0.6
01	324	FAN SUPPORT SUPPORT DU VENTILATEUR		0.5	0.5		
01	325	COOLANT HOSE (WATER PUMP HOUSING TO RADIATOR) BOYAU DE REFROIDISSEMENT (BOÎTIER DE LA POMPE À EAU AU RADIATEUR)	0.6	0.6	0.6	0.6	0.6
01	326	EXHAUST MANIFOLDS (FRONT) (2) COLLECTEURS D'ÉCHAPPEMENT (AVANT) (2)	0.5	0.5	0.5	0.5	0.5
01	327	EXHAUST PIPE (MAG) TUYAU D'ÉCHAPPEMENT (MAG)	0.3	0.3	0.3	0.3	0.3
01	328	EXHAUST PIPE (PTO) TUYAU D'ÉCHAPPEMENT (PDM)	0.3	0.3	0.3	0.3	0.3
01	353	INJECTOR (ONE OR ALL) INJECTEUR (UN OU TOUS)	0.8	0.8	0.8	0.8	0.8

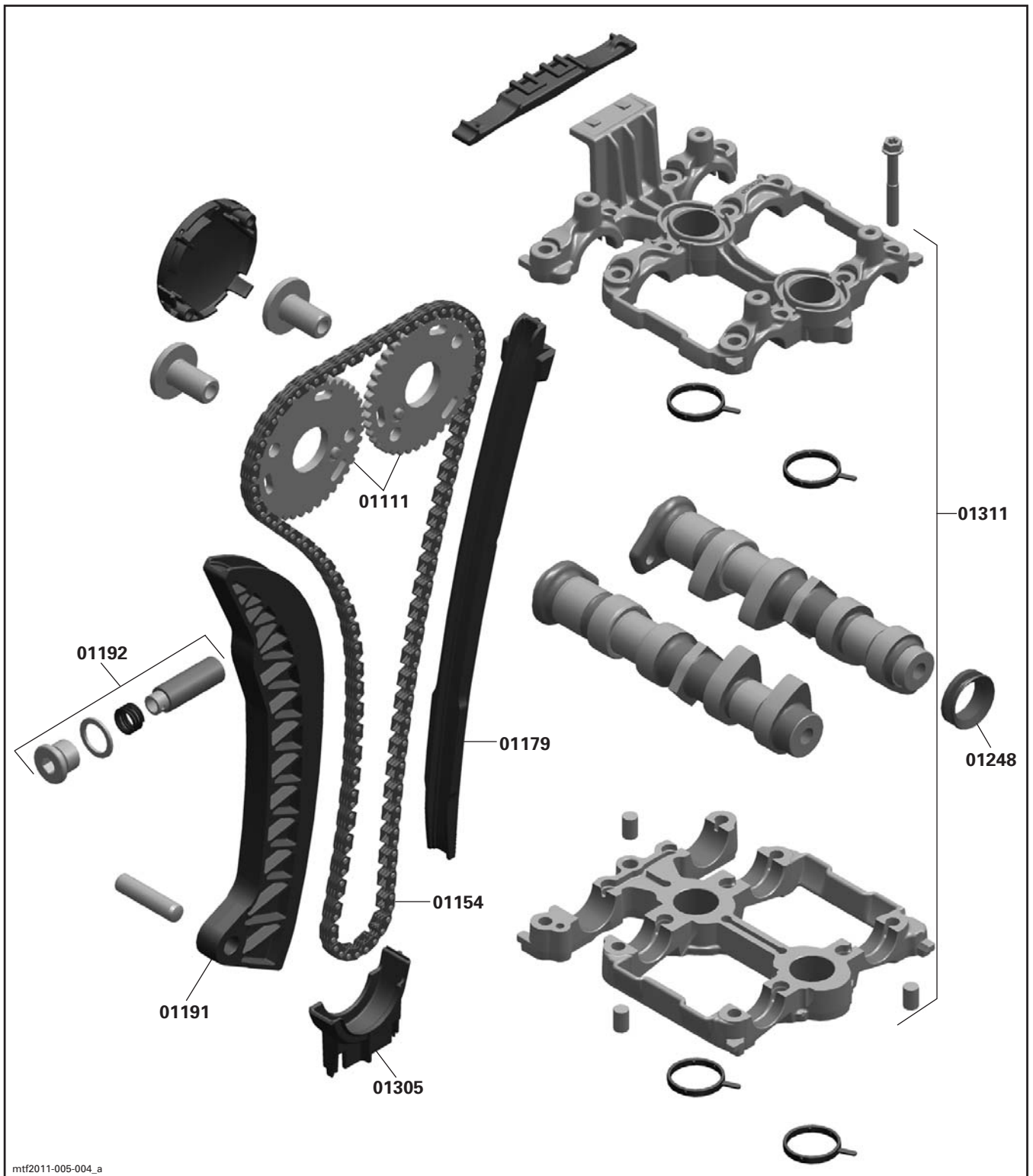


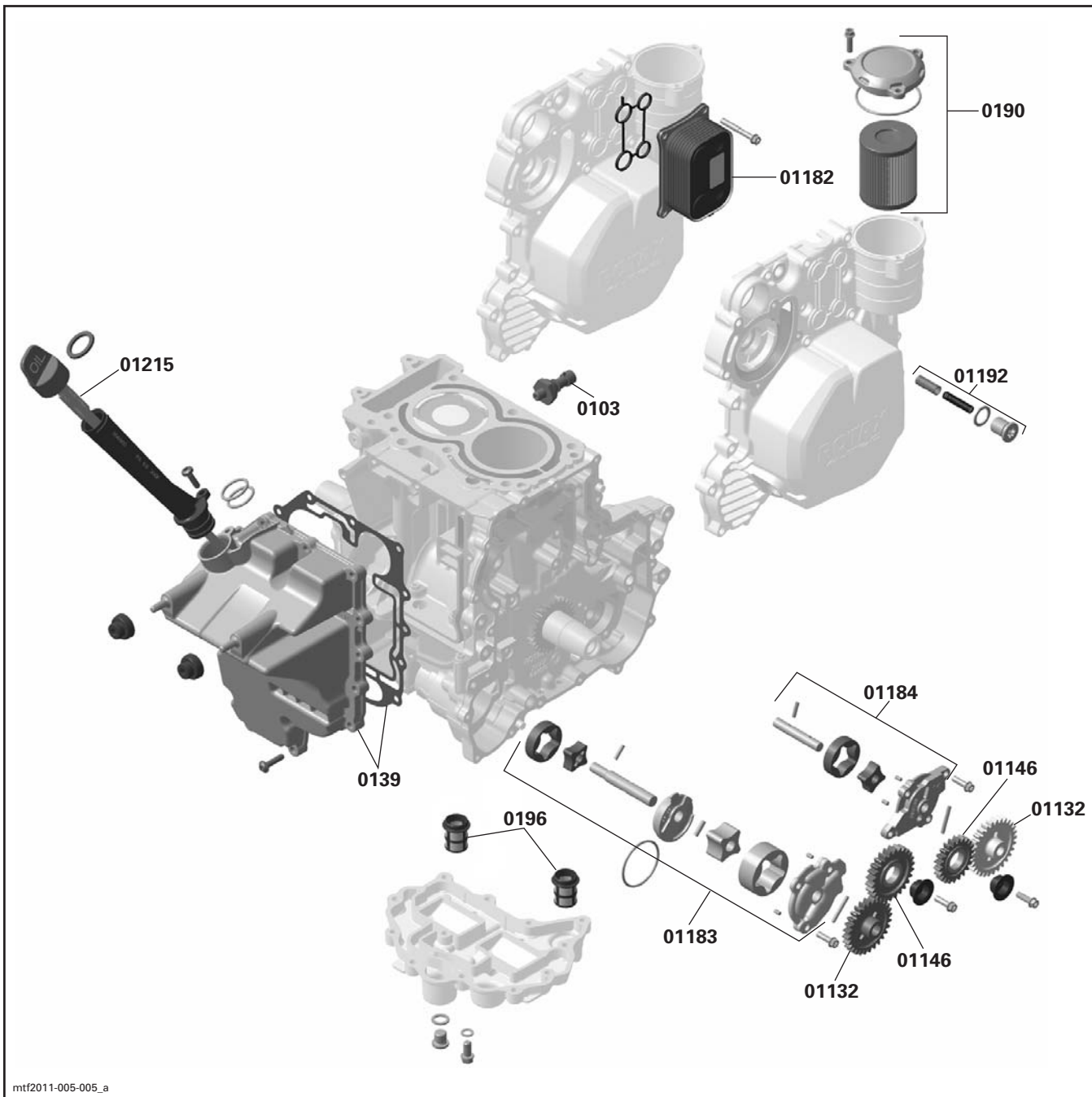
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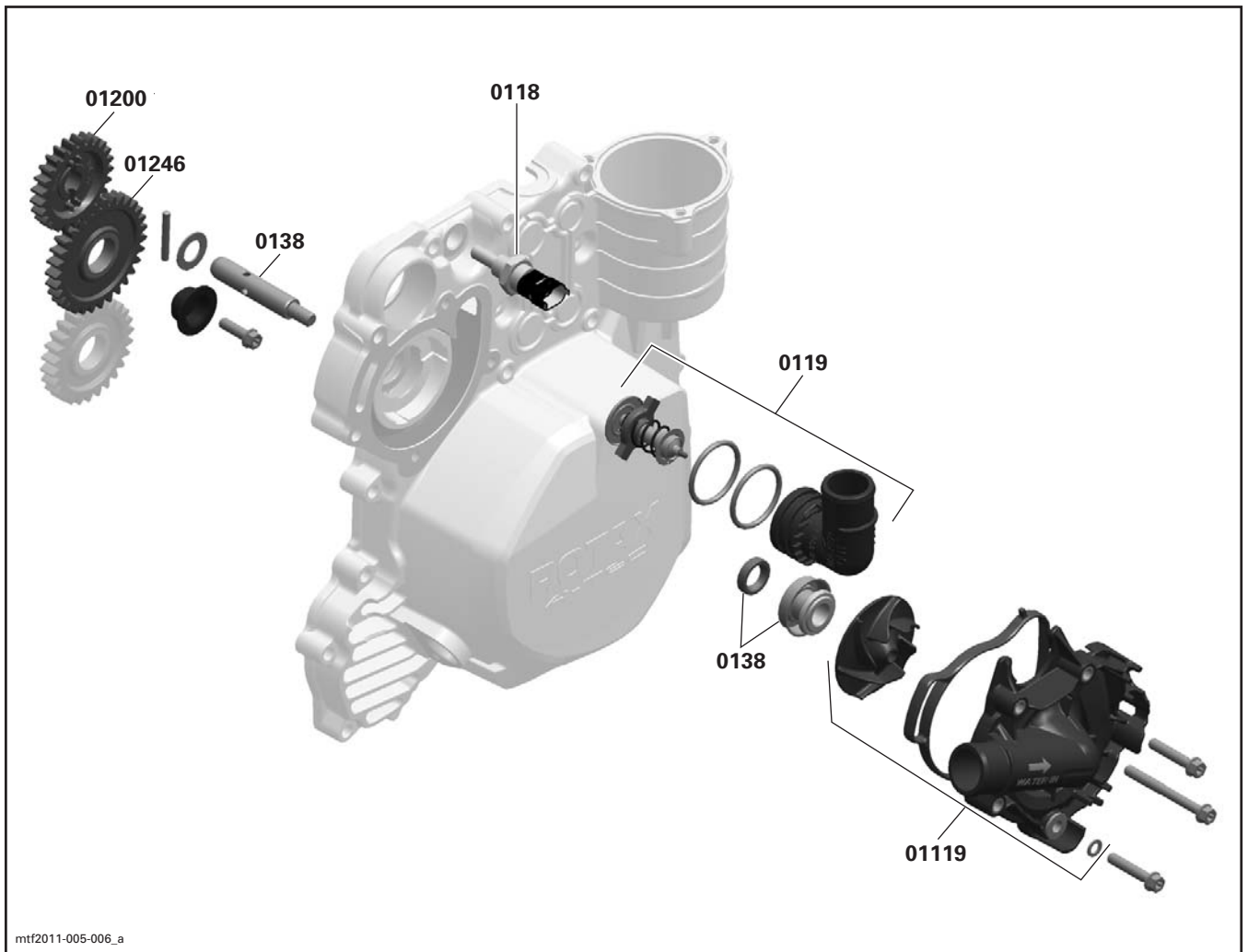


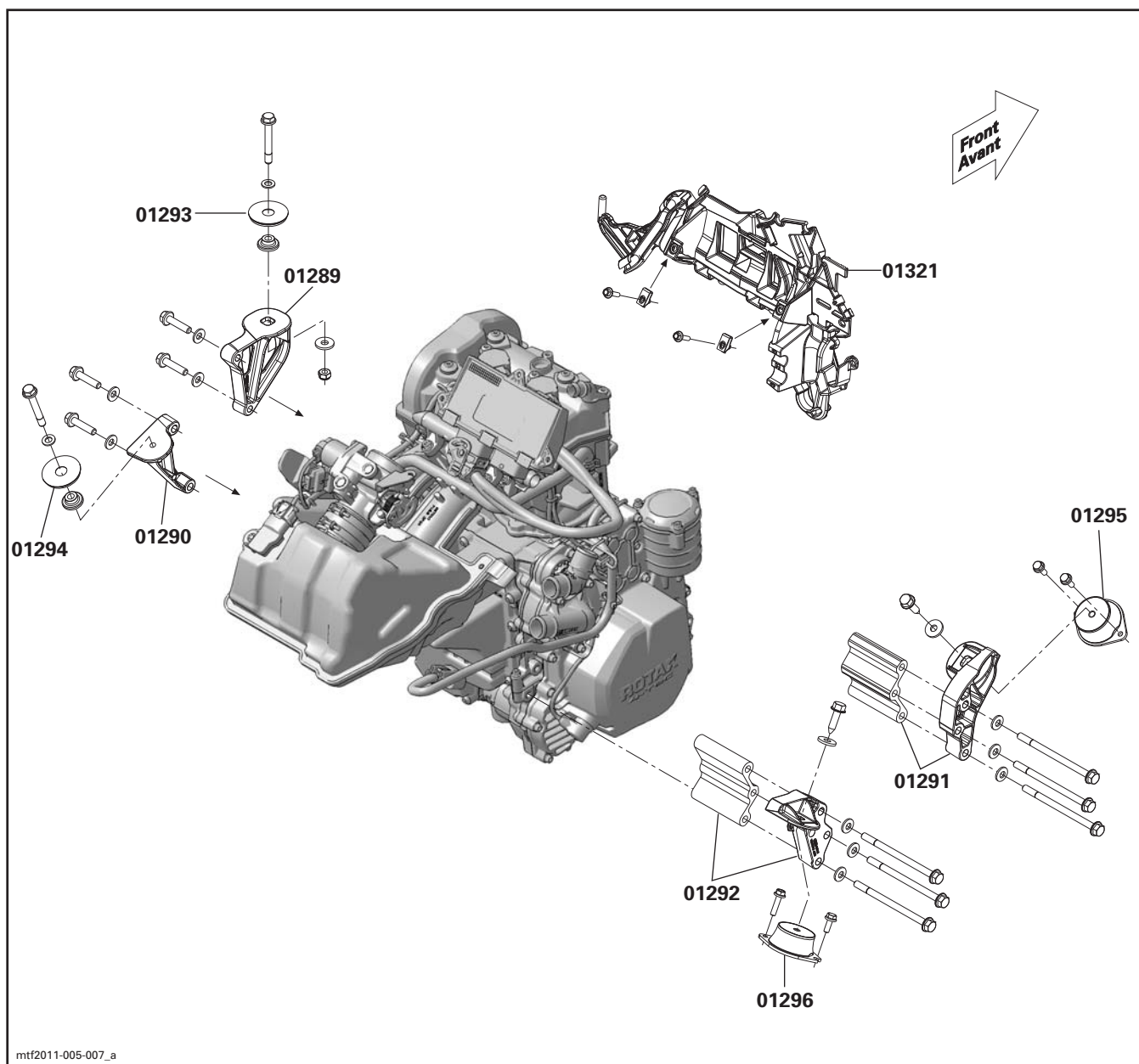
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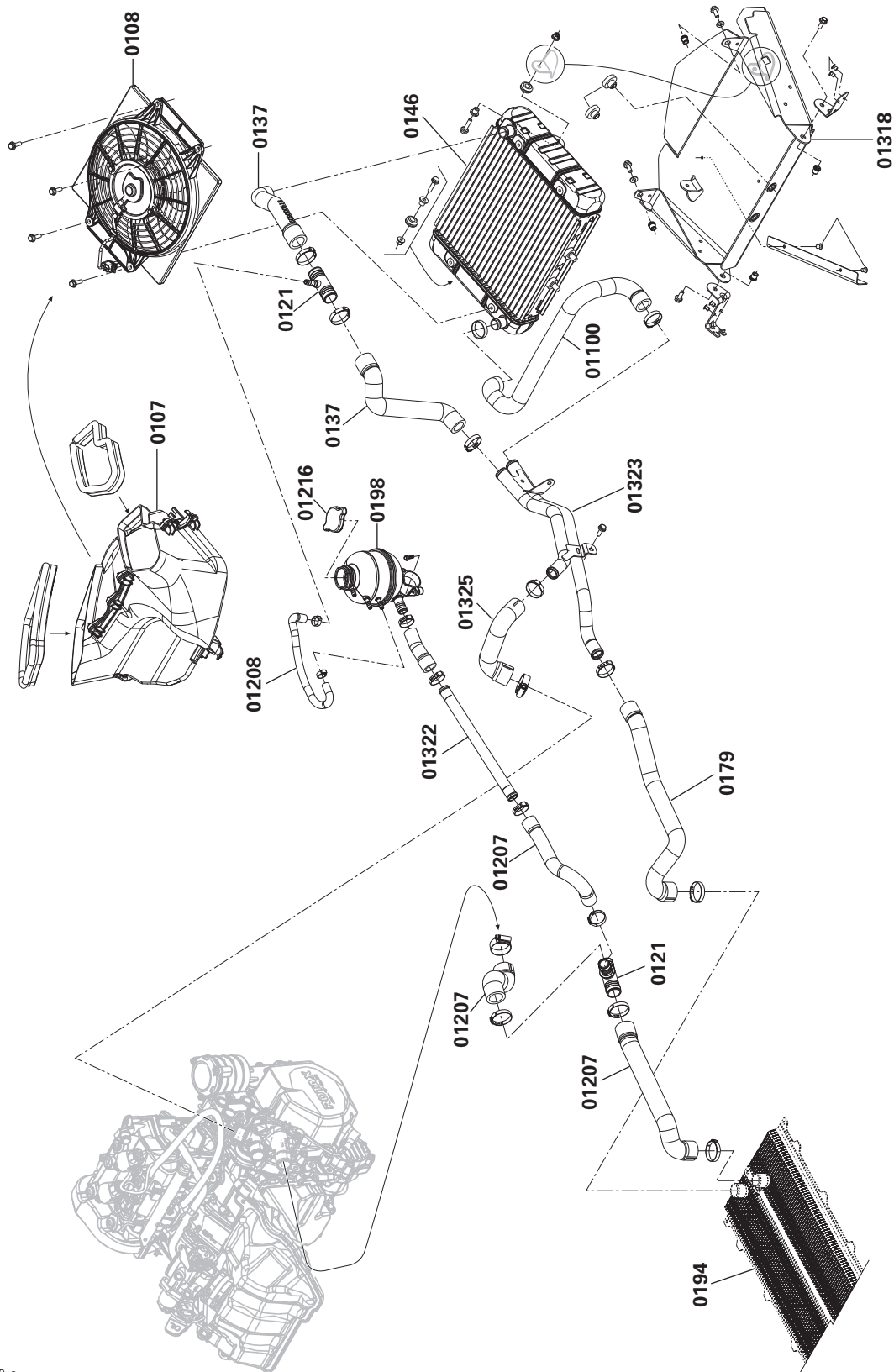


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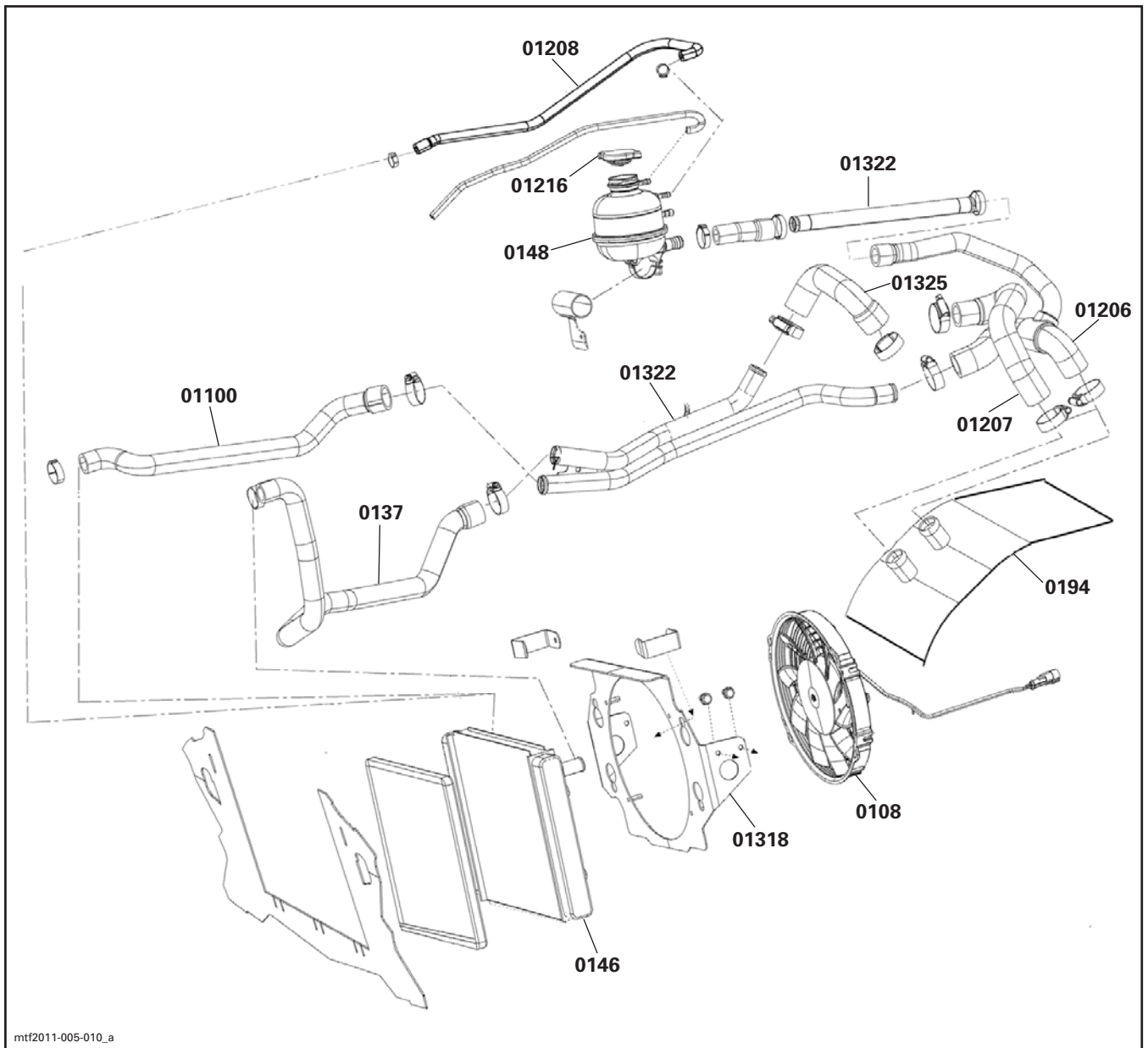


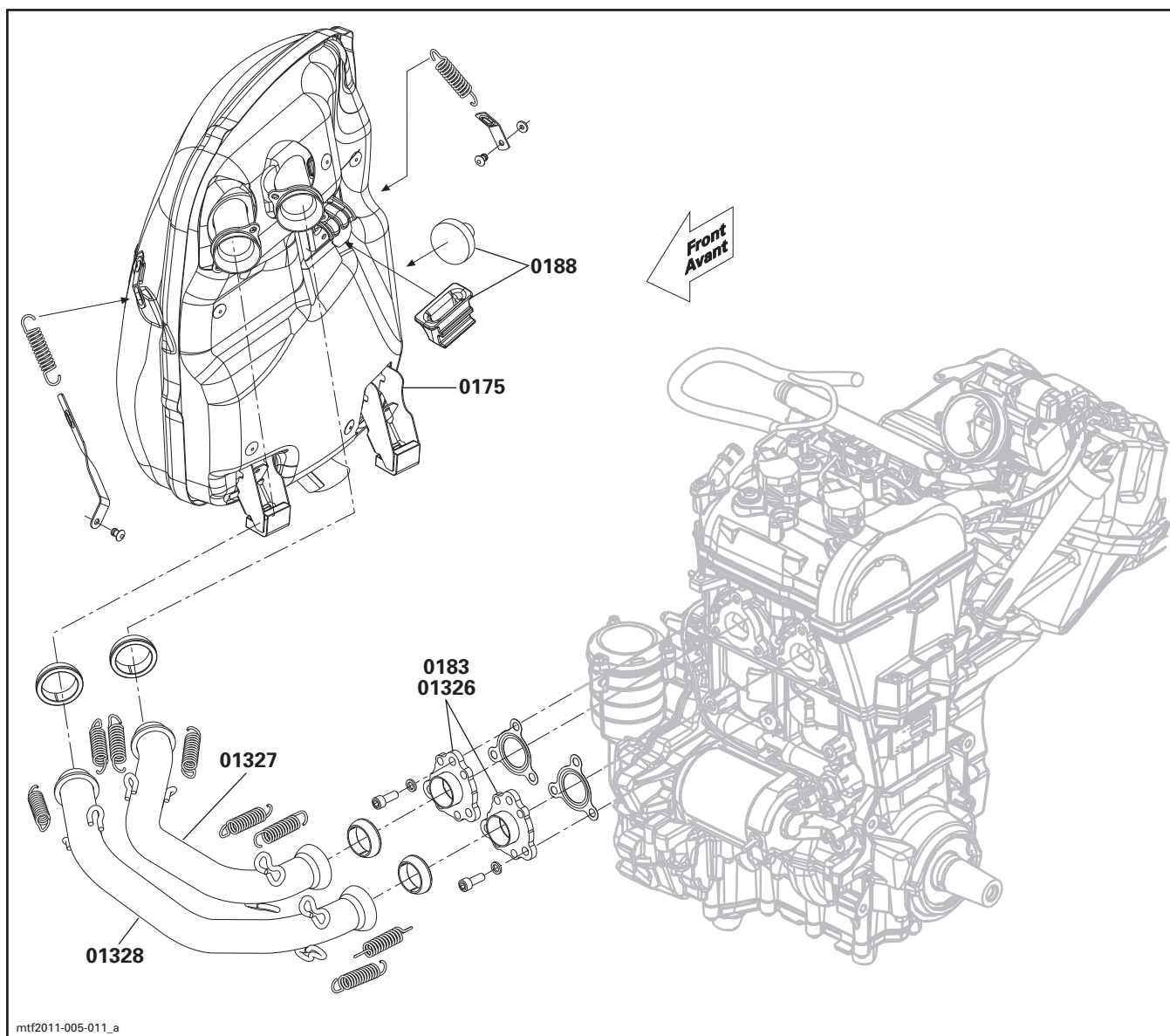




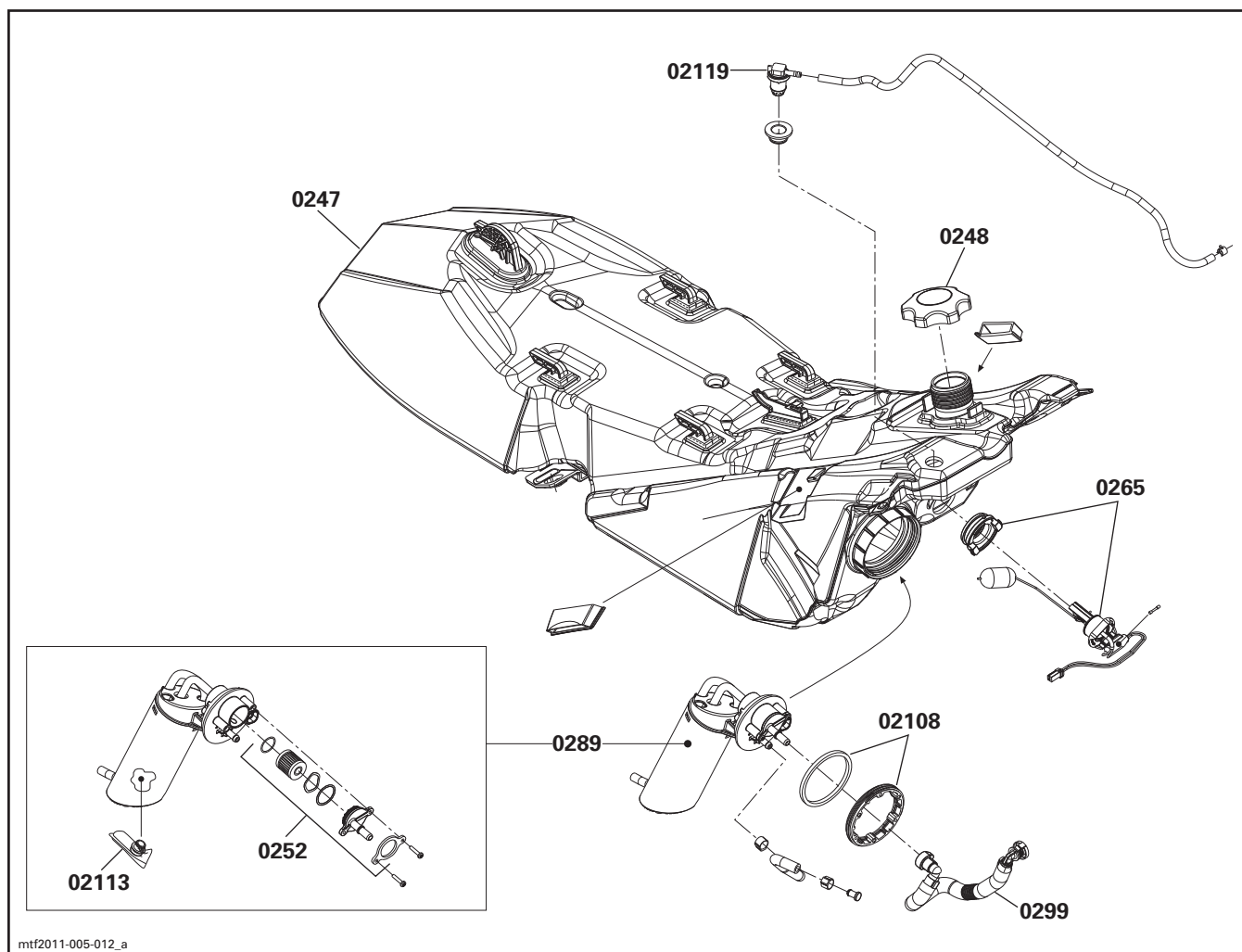


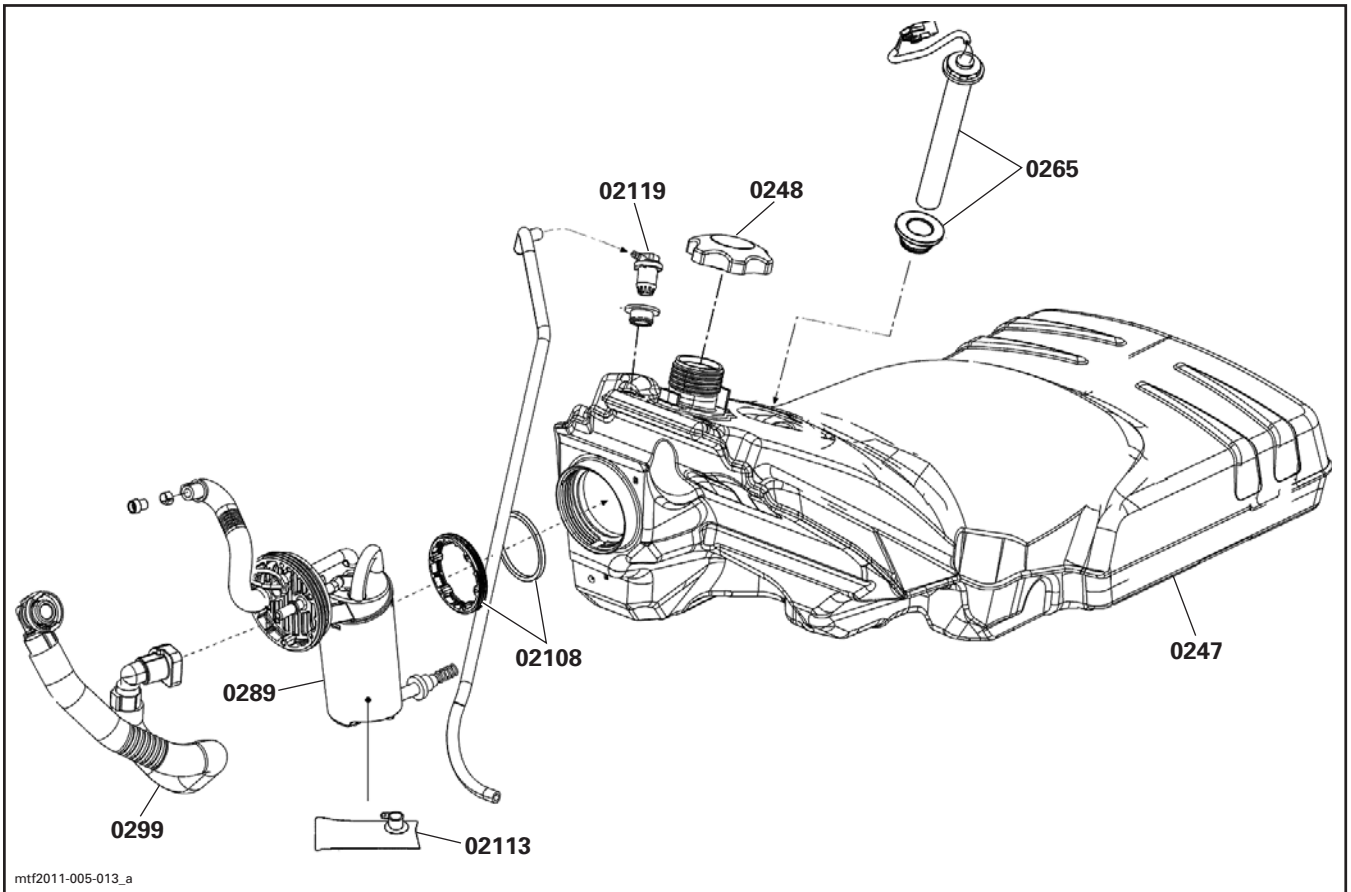
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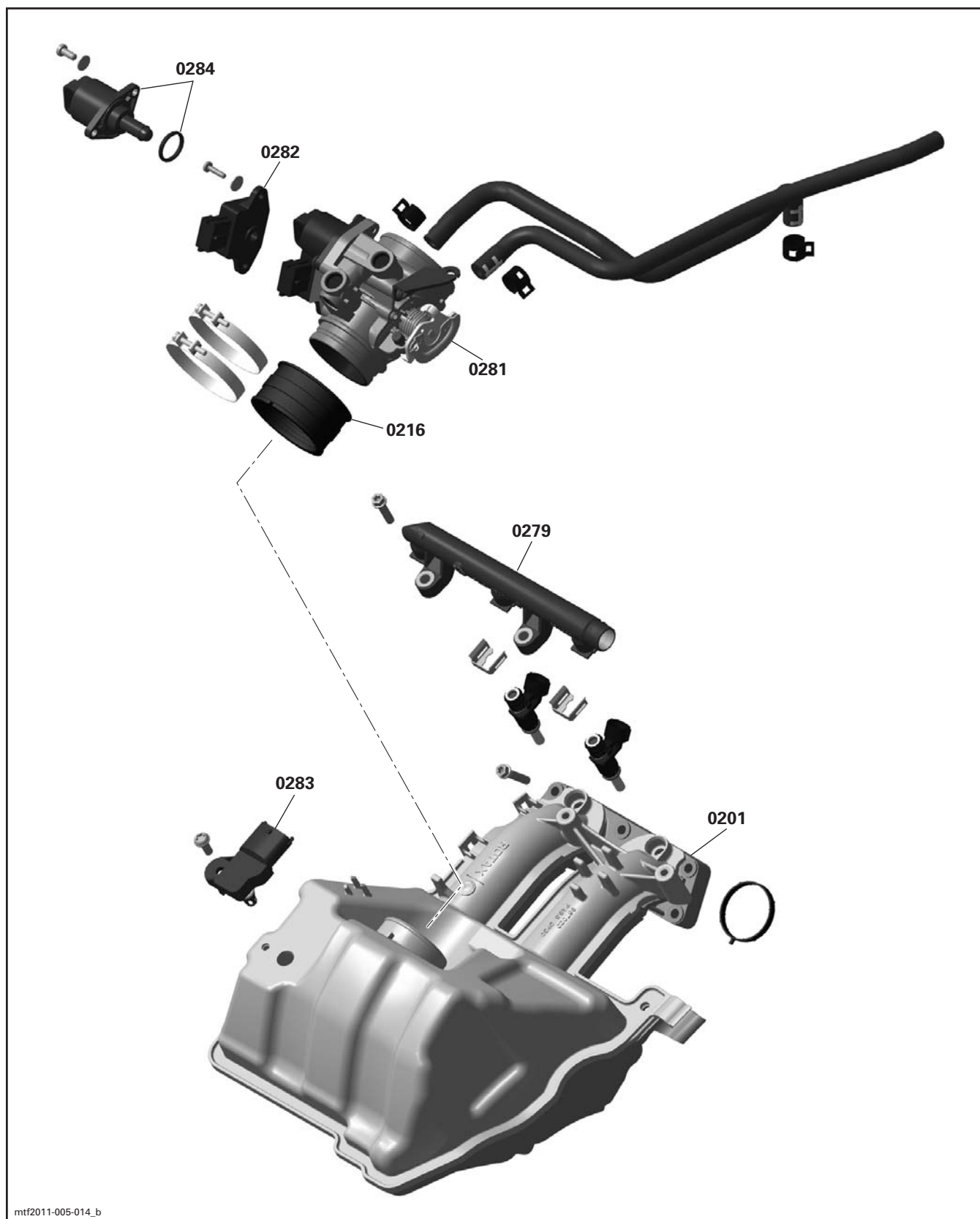




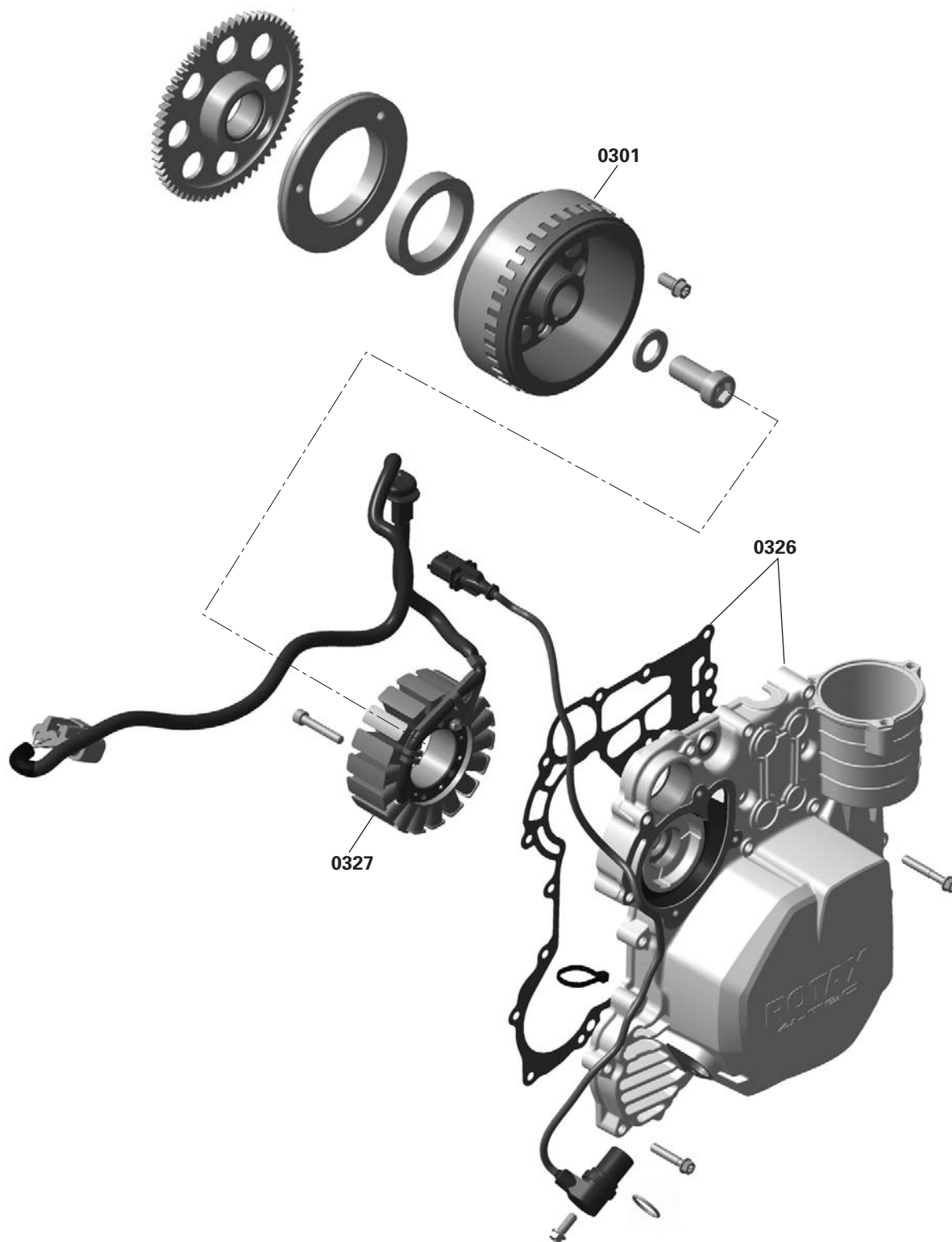
SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIC 600 ACE
			24	25	26	27	28
02	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0
02	01	AIR SILENCER (ASS'Y) (ALL PARTS) SILENCIEUX D'ADMISSION (COMPLET) (TOUTES LES PIÈCES)	1.5	1.5	1.5	1.5	1.5
02	06	THROTTLE CABLE CÂBLE D'ACCÉLÉRATEUR	0.8	0.8	0.8	0.8	0.8
02	16	INTAKE ADAPTOR ADAPTATEUR D'ADMISSION	0.4	0.4	0.4	0.4	0.4
02	19	AIR INTAKE TUBE TUYAU D'ADMISSION D'AIR	0.3	0.3	0.3	0.3	0.3
02	47	FUEL TANK RÉSERVOIR À ESSENCE	1.5	1.5	1.5	1.5	1.5
02	48	FUEL TANK CAP BOUCHON DU RÉSERVOIR À ESSENCE	0.3	0.3	0.3	0.3	0.3
02	50	THROTTLE HANDLE HOUSING LOGEMENT MANETTE ACCÉLÉRATEUR	0.3	0.3	0.3	0.3	0.3
02	52	FUEL FILTER FILTRE À ESSENCE	1.2	1.2	1.2	1.2	1.2
02	65	FUEL SENSOR (ASS'Y) CAPTEUR DE NIVEAU D'ESSENCE (COMPLET)	0.8	0.8	0.8	0.8	0.8
02	79	FUEL RAIL RAMPE D'ESSENCE	0.8	0.8	0.8	0.8	0.8
02	81	THROTTLE BODY (ASS'Y) CARTER ACCÉLÉRATEUR (COMPLET)	0.8	0.8	0.8	0.8	0.8
02	82	THROTTLE SENSOR CAPTEUR POSITION ACCÉLÉRATEUR	0.3	0.3	0.3	0.3	0.3
02	83	AIR PRESSURE SENSOR CAPTEUR PRESSION D'AIR	0.3	0.3	0.3	0.3	0.3
02	84	IDLE BY-PASS-VALVE VALVE DU RALENTI	0.3	0.3	0.3	0.3	0.3
02	89	FUEL PUMP MODULE MODULE POMPE À ESSENCE	1.5	1.5	1.5	1.5	1.5
02	99	FUEL INJECTION HOSE (ASS'Y) BOYAU D'ESSENCE À INJECTION (COMPLET)	1.0	1.0	1.0	1.0	1.0
02	105	SECONDARY CHAMBER (ASS'Y) CHAMBRE SECONDAIRE (COMPLET)	0.4	0.4	0.4	0.4	0.4
02	108	FUEL PUMP NUT AND/OR GASKET ÉCROU DE LA POMPE À ESSENCE ET/OU JOINT D'ÉTANCHÉITÉ	1.5	1.5	1.5	1.5	1.5
02	113	FUEL PUMP INLET FILTER FILTRE INTERNE DE LA POMPE À ESSENCE	1.5	1.5	1.5	1.5	1.5
02	119	CHECK VALVE SOUPAPE À ESSENCE	0.3	0.3	0.3	0.3	0.3







SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIC 600 ACE
			24	25	26	27	28
03	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0
03	01	FLYWHEEL VOLANT MOTEUR	3.0	3.0	3.0	3.0	3.0
03	08	IGNITION COIL BOBINE D'ALLUMAGE	0.3	0.3	0.3	0.3	0.3
03	26	MAGNETO COVER AND/OR GASKET COUVERCLE DU MAGNÉTO ET/OU JOINT D'ÉTANCHÉITÉ	2.7	2.7	2.7	2.7	2.7
03	27	STATOR (ASS'Y) STATOR (COMPLET)	2.7	2.7	2.7	2.7	2.7



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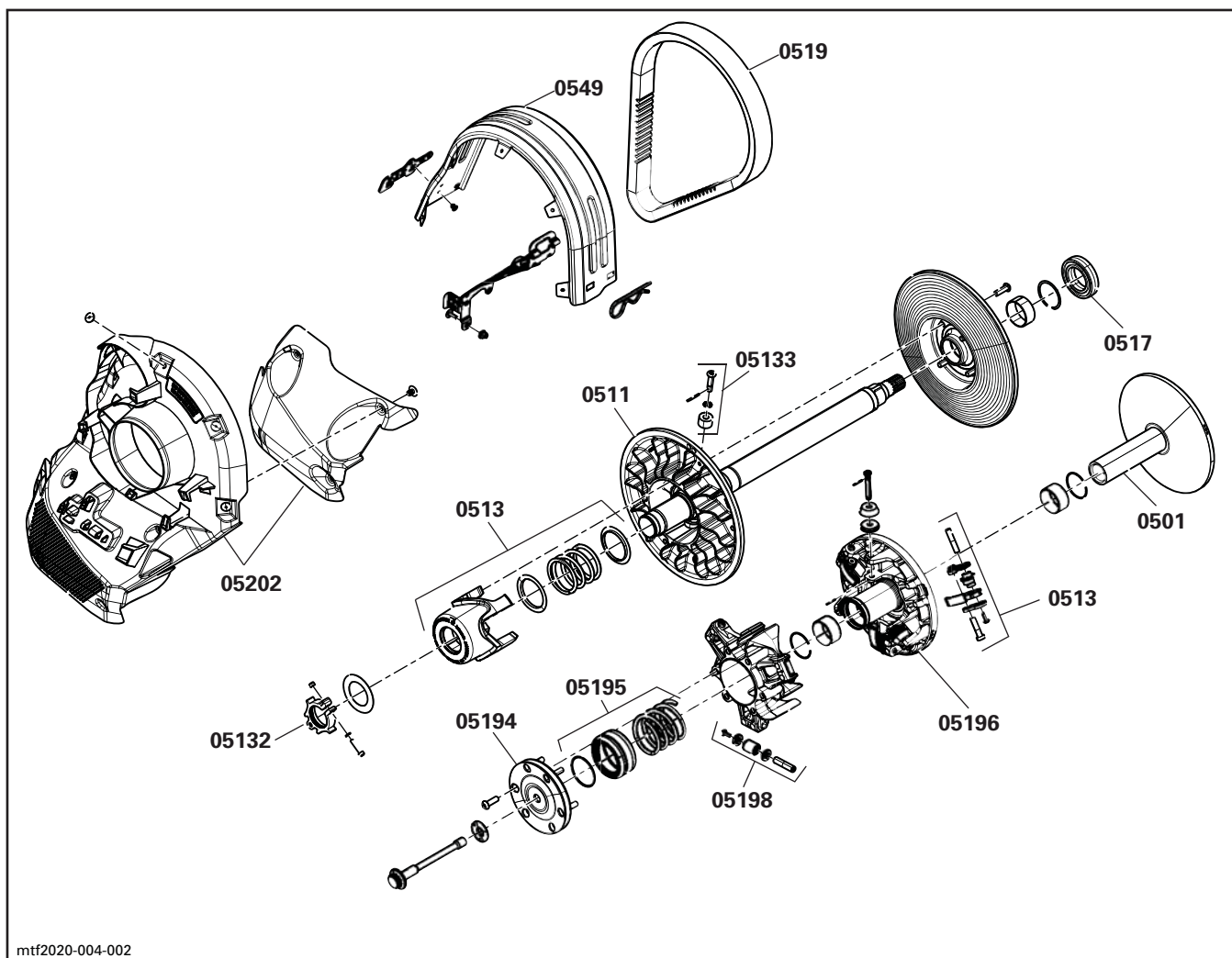
SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIC 600 ACE
			24	25	26	27	28
04	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0
04	02	ELECTRIC STARTER (ASS'Y) DÉMARREUR ÉLECTRIQUE (COMPLET)	0.3	0.3	0.3	0.4	0.3
04	03	STARTER RELAY SOLÉNOÏDE DE DÉMARREUR	0.3	0.3	0.3	0.3	0.3
04	19	STARTER DRIVE LANCEUR DÉMARREUR	3.0	3.0	3.0	3.0	3.0

SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIAC 600 ACE
			24	25	26	27	28
05	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0
05	01	DRIVE PULLEY (ASS'Y) OR SLIDING FLANGE POULIE MOTRICE (COMPLET) OU FLASQUE COULISSANTE	0.3	0.3	0.3	0.3	0.3
05	06	GOVERNOR CUP AND/OR FIXED HALF CUVETTE DE RÉGULATEUR ET/OU PARTIE FIXE	0.3	0.3	0.3	0.3	0.3
05	07	RAMPS AND/OR ADJUSTMENT SCREW RAMPES ET/OU VIS DE RÉGLAGE DE POULIE	0.5	0.5	0.5	0.5	0.5
05	08	SPRING COVER AND/OR SPRING AND/OR BUSHING COUVERCLE DU RESSORT ET/OU RESSORT ET/OU DOUILLE	0.5	0.5	0.5	0.5	0.5
05	09	SLIDER SHOES AND/OR SPRINGS GLISSIÈRE ET/OU RESSORTS	0.3	0.3	0.3	0.3	0.3
05	10	SLIDING HALF, BUSHING AND/OR LEVER (ASS'Y) DEMI-POULIE COULISSANTE, DOUILLE ET/OU LEVIER (COMPLET)	0.8	0.8	0.8	0.8	0.8
05	11	DRIVEN PULLEY FIXED HALF DEMI-POULIE MENÉE FIXE	0.7	0.7	0.7	0.7	0.7
05	12	DRIVEN PULLEY SLIDING HALF DEMI-POULIE MENÉE COULISSANTE	0.5	0.5	0.5	0.5	0.5
05	13	DRIVEN PULLEY CAM AND/OR SPRING CAME ET/OU RESSORT DE POULIE MENÉE	0.6	0.6	0.6	0.6	0.6
05	17	COUNTERSHAFT BALL BEARING AND/OR FLANGE ROULEMENT À BILLE DE L'ARBRE DE RENVOI ET/OU FLASQUE	1.0	1.0	1.0	1.0	1.0
05	18	COUNTERSHAFT ARBRE DE RENVOI	1.0	1.0	1.0	1.0	3.0
05	19	DRIVE BELT AND/OR BELT GUARD COURROIE D'ENTRAÎNEMENT ET/OU GARDE-COURROIE	0.1	0.1	0.1	0.1	0.1
05	20	CHAINCASE SEAL AND/OR BEARING ANNEAU D'ÉTANCHÉITÉ DE CARTER ET/OU ROULEMENT	1.3	1.3	1.3	1.3	
05	21	CHAINCASE CARTER DE CHAÎNE	3.9	3.9	3.9	3.9	
05	22	CHAINCASE COVER COUVERCLE DE CARTER DE CHAÎNE	1.3	1.3	1.3	1.3	
05	23	CHAINCASE UPPER SPROCKET AND/OR CENTRAL SPROCKET PIGNON SUPÉRIEUR DE CARTER ET/OU PIGNON CENTRAL	1.4	1.4	1.4	1.4	
05	24	CHAINCASE LOWER SPROCKET PIGNON INFÉRIEUR DE CARTER DE CHAÎNE	1.4	1.4	1.4	1.4	
05	25	CHAINCASE DRIVE CHAIN CHAÎNE D'ENTRAÎNEMENT DE CARTER DE CHAÎNE	1.4	1.4	1.4	1.4	
05	26	CHAINCASE TENSIONERS TENDEURS DE CARTER DE CHAÎNE	1.3	1.3	1.3	1.3	
05	27	TENSIONER ADJUSTING SCREW VIS DE RÉGLAGE DE TENDEUR	0.4	0.4	0.4	0.4	
05	34	SLIDING SLEEVE AND/OR FORK AND/OR FORK SHAFT CRABOT ET/OU FOURCHETTE ET /OU ARBRE DE FOURCHETTE	1.4	1.4	1.4	1.4	3.0
05	39	SHIFT LEVER AND/OR SHIFT ROD LEVIER DE TRANSMISSION ET/OU TIGE	0.4	0.4	0.4	0.4	
05	45	REVERSE GEAR WHEEL AND SHAFT ENGRENAGE ET ARBRE DE MARCHE ARRIÈRE	1.4	1.4	1.4	1.4	3.0

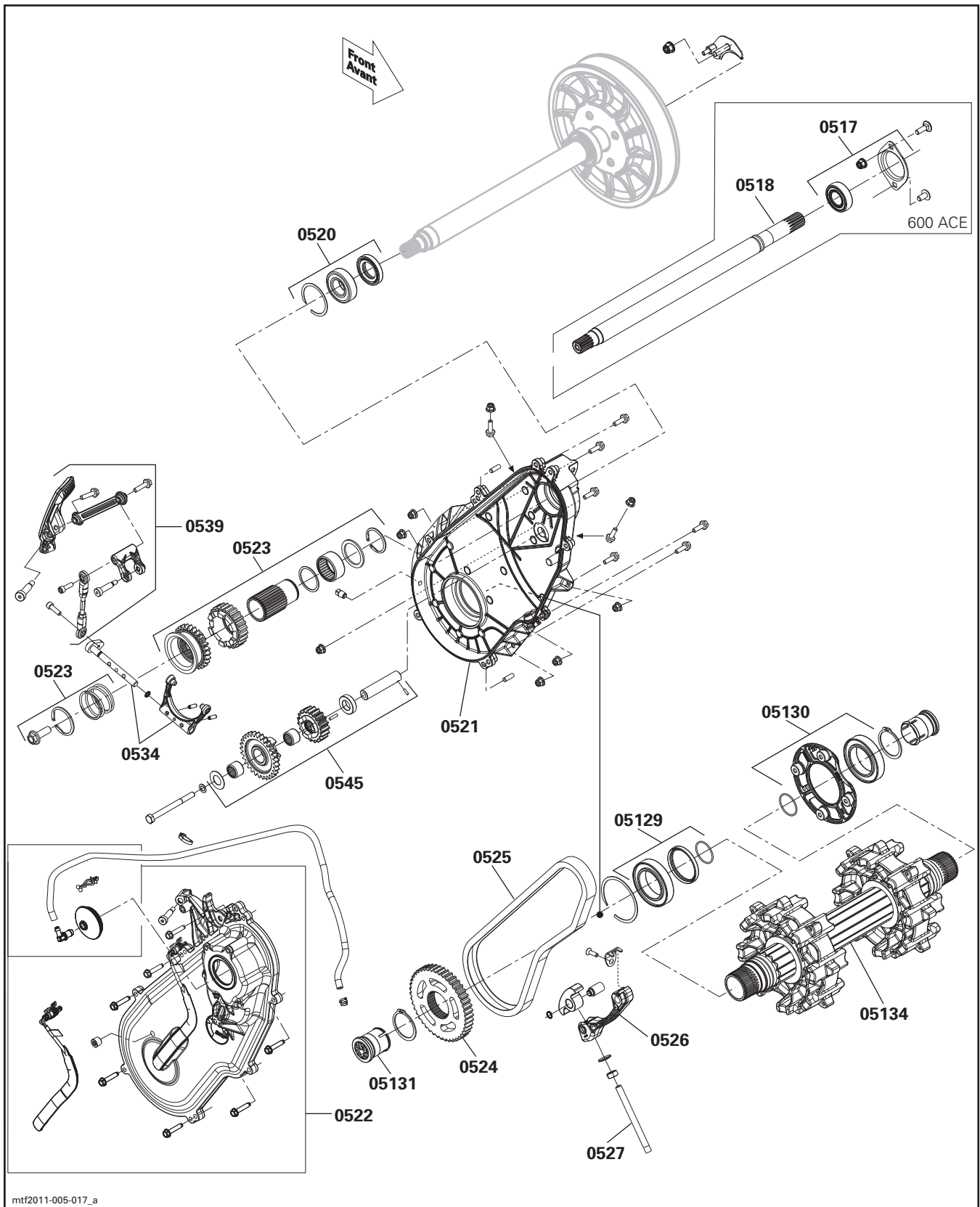
TRANSMISSION SYSTEM SYSTÈME DE TRANSMISSION

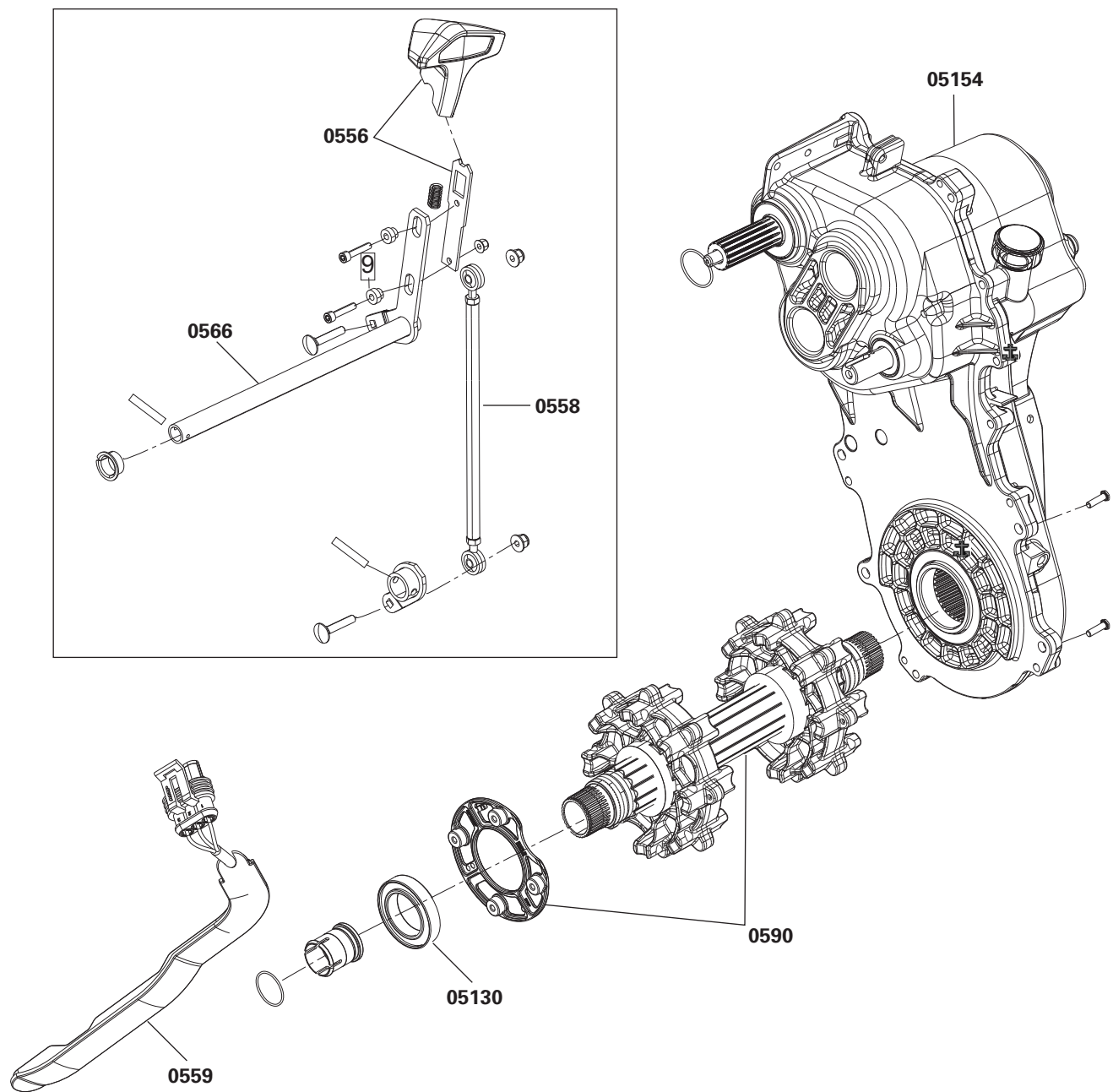
05
SYSTEM/SYSTÈME

SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIC 600 ACE
			24	25	26	27	28
05	49	DRIVE PULLEY GUARD GARDE DE POULIE MOTRICE	0.3	0.3	0.3	0.3	0.3
05	56	LEVER (ASS'Y) AND/OR LEVER SPRING LEVIER (COMPLET) ET/OU RESSORT DE LEVIER					0.3
05	58	TIE ROD AND/OR BALL JOINT BARRE D'ACCOMPAGNEMENT ET/OU JOINT ROTULE					0.6
05	59	SPEED SENSOR CAPTEUR DE VITESSE	1.3	1.3	1.3	1.3	0.9
05	66	GEARSHIFT LEVER LEVIER D'EMBRAYAGE					0.5
05	90	DRIVE AXLE (ASS'Y) AXE D'ENTRAÎNEMENT (COMPLET)					2.0
05	91	MAIN SHAFT (ASS'Y) ARBRE DE RENVOI (COMPLET)					3.0
05	103	SHIFT DRUM TAMBOUR D'EMBRAYAGE					3.0
05	114	SHIFT SHAFT SEAL ANNEAU D'ÉTANCHÉITÉ DE L'ARBRE D'EMBRAYAGE					1.0
05	129	CHAINCASE LOWER BEARING AND SEAL (MAG SIDE) ROULEMENT À BILLES INFÉRIEUR DU CARTER DE CHAÎNE ET ANNEAU ÉTANCHE (CÔTÉ MAG)	3.0	3.0	3.0	3.0	
05	130	BEARING HOUSING AND/OR BEARING (PTO SIDE) LOGEMENT DU ROULEMENT À BILLES ET/OU ROULEMENT À BILLES (CÔTÉ PTO)	2.4	2.4	2.4	2.4	2.4
05	131	MAGNETIC CAP CAPUCHON MAGNÉTIQUE	0.7	0.7	0.7	0.7	3.0
05	132	ADJUSTMENT RING (ASS'Y) ANNEAU DE RÉGLAGE (COMPLET)	0.3	0.3	0.3	0.3	0.3
05	133	STUDS AND/OR ROLLERS PIVOTS ET/OU ROULEAUX	0.8	0.8	0.8	0.8	0.8
05	134	DRIVE AXLE (ASS'Y) (WITH BATTERY) AXE D'ENTRAÎNEMENT (COMPLET) (AVEC BATTERIE)	2.4	2.4	2.4	2.4	
05	154	GEARBOX (ASS'Y) BOÎTE DE VITESSE (COMPLET)					0.6
05	155	BUSHINGS, SLIDERS AND ROLLERS (DRIVE PULLEY REPAIR) COUSSINETS, GLISSIÈRES ET ROULEAUX (RÉPARATION DE POULIE MOTRICE)	0.8	0.8	0.8	0.8	0.8
05	156	CAM, SLIDING FLANGE AND ROLLERS (DRIVEN PULLEY REPAIR) CAME, FLASQUE COULISSANTE ET ROULEAUX (RÉPARATION DE POULIE MENÉE)	0.8	0.8	0.8	0.8	0.8
05	158	TRANSMISSION BOTTOM SEAL JOINT D'ÉTANCHÉITÉ INFÉRIEUR DE LA TRANSMISSION					1.0
05	162	MIDDLE GEAR ENGRENAGE DU MILIEU					3.0
05	163	LOWER GEAR ENGRENAGE DU BAS					3.0
05	164	COUNTERSHAFT SEAL ANNEAU D'ÉTANCHÉITÉ DE L'ARBRE DE RENVOI					1.0

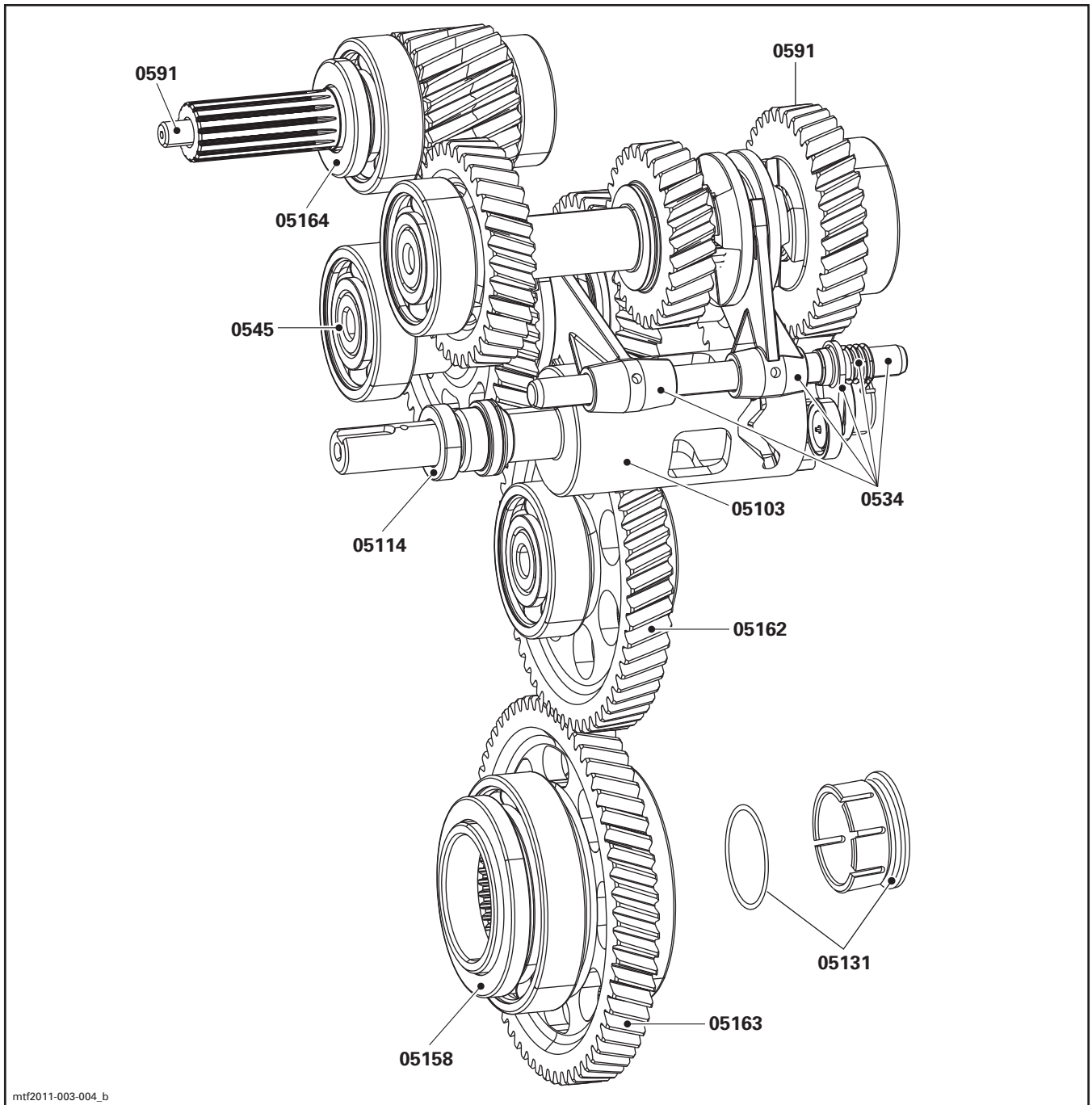


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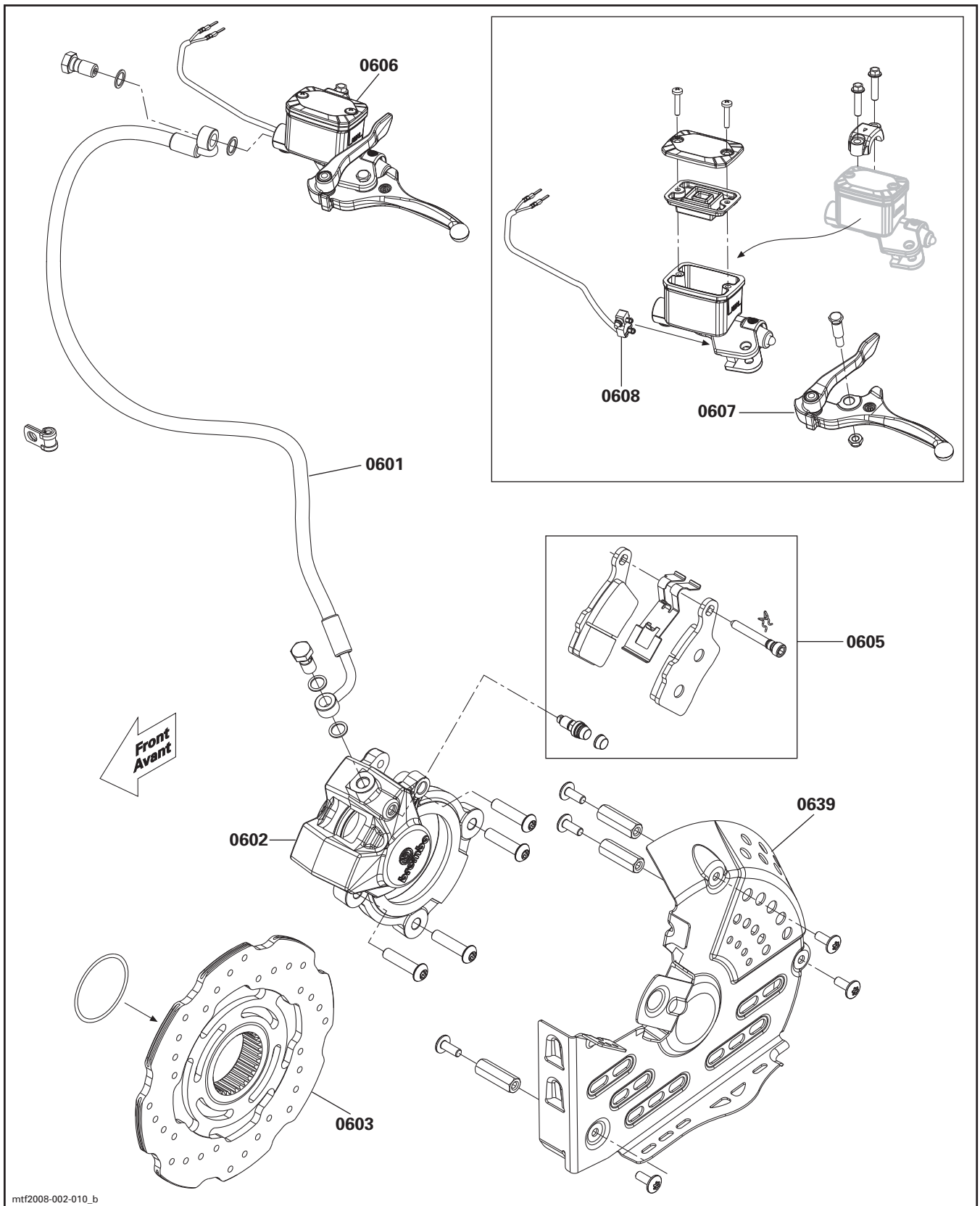




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SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIC 600 ACE
			24	25	26	27	28
06	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0
06	01	BRAKE OIL HOSE BOYAU À HUILE POUR FREIN	0.5	0.5	0.5	0.5	0.5
06	02	BRACKET, CALIPER, BRAKE PAD, RELEASE SPRING SUPPORT, ÉTRIER, PLAQUETTE DE FREIN, CLIQUET, LEVIER	0.8	0.8	0.8	0.8	0.8
06	03	DISC DISQUE	0.7	0.7	0.7	0.7	0.7
06	05	BRAKE PADS PLAQUETTES DE FREIN	0.4	0.4	0.4	0.4	0.4
06	06	MASTER CYLINDER MAÎTRE CYLINDRE	0.4	0.4	0.4	0.4	0.4
06	07	BRAKE LEVER (ASS'Y) LEVIER DE FREIN (COMPLET)	0.3	0.3	0.3	0.3	0.3
06	08	MICROSWITCH BRAKE (ASS'Y) INTERRUPTEUR MICRO-CONTACT DE FREIN (COMPLET)	0.3	0.3	0.3	0.3	0.3
06	39	DISC PROTECTOR PROTECTEUR DE DISQUE	0.3	0.3	0.3	0.3	0.3



STEERING SYSTEM AND FRONT SUSPENSION SYSTÈME DE DIRECTION ET SUSPENSION AVANT

SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIC 600 ACE
			24	25	26	27	28

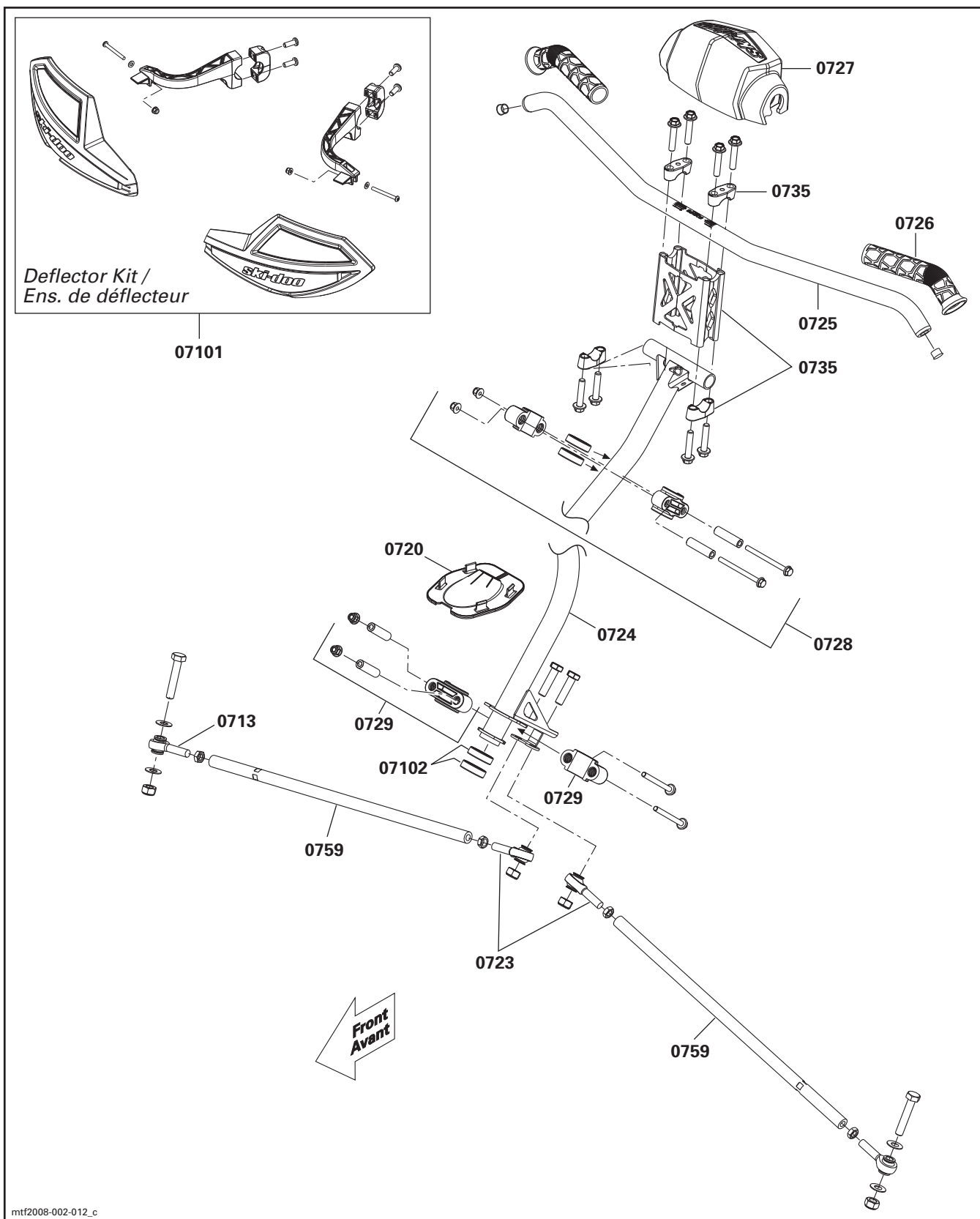
07	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0
07	01	SKI (1) SKI (1)	0.3	0.3	0.3	0.3	0.3
07	02	SKIS (2) SKIS (2)	0.4	0.4	0.4	0.4	0.4
07	03	SKI RUNNER LISSES	0.3	0.3	0.3	0.3	0.3
07	08	SKI LEG (RH) AND/OR BUSHING JAMBE DE SKI (DROITE) ET/OU DOUILLE	0.5	0.5	0.5	0.5	0.5
07	09	SKI LEG (LH) AND/OR BUSHING JAMBE DE SKI (GAUCHE) ET/OU DOUILLE	0.5	0.5	0.5	0.5	0.5
07	10	STEERING ARM (RH) BRAS DE DIRECTION (DROIT)				0.5	0.5
07	11	STEERING ARM (LH) BRAS DE DIRECTION (GAUCHE)				0.5	0.5
07	12	STEERING ARM BALL JOINT (RH) JOINT À ROTULE DE BRAS DE DIRECTION (DROIT)	0.3	0.3	0.3	0.3	0.3
07	13	STEERING ARM BALL JOINT (LH) JOINT À ROTULE DE BRAS DE DIRECTION (GAUCHE)	0.3	0.3	0.3	0.3	0.3
07	14	TELESCOPIC TUBE, SPRING, BUSHINGS TUBE TÉLESCOPIQUE, RESSORT, DOUILLES				0.6	0.6
07	17	TOP CAP CAPUCHON SUPÉRIEUR				0.3	0.3
07	20	TIE ROD COVER CAPUCHON DE TIMONERIE	0.3	0.3	0.3		
07	23	STEERING MAIN TUBE BALL JOINT JOINT À ROTULE DE COLONNE DE DIRECTION	0.6	0.6	0.6	0.6	0.6
07	24	STEERING MAIN TUBE COLONNE DE DIRECTION	1.4	1.4	1.4	1.4	1.4
07	25	HANDLE BAR GUIDON	1.1	1.1	1.1	1.1	1.1
07	26	HANDLE BAR GRIP (RIGHT AND/OR LEFT) GAINE DE GUIDON (DROITE ET/OU GAUCHE)	0.3	0.3	0.3	0.3	0.3
07	27	HANDLE BAR PADDING COUSSINET DE GUIDON	0.3	0.3	0.3	0.3	0.3
07	28	UPPER STEERING MAIN TUBE BUSHING DOUILLE SUPÉRIEURE DE COLONNE DE DIRECTION	0.5	0.5	0.5	0.5	0.5
07	29	LOWER STEERING MAIN TUBE BUSHING DOUILLE INFÉRIEURE DE COLONNE DE DIRECTION	0.5	0.5	0.5	0.5	0.5
07	32	LOWER ARM (LH OR RH) BRAS DE SUSPENSION INFÉRIEUR (GAUCHE OU DROIT)	0.6	0.6	0.6		

STEERING SYSTEM AND FRONT SUSPENSION SYSTÈME DE DIRECTION ET SUSPENSION AVANT

07
SYSTEM/SYSTÈME

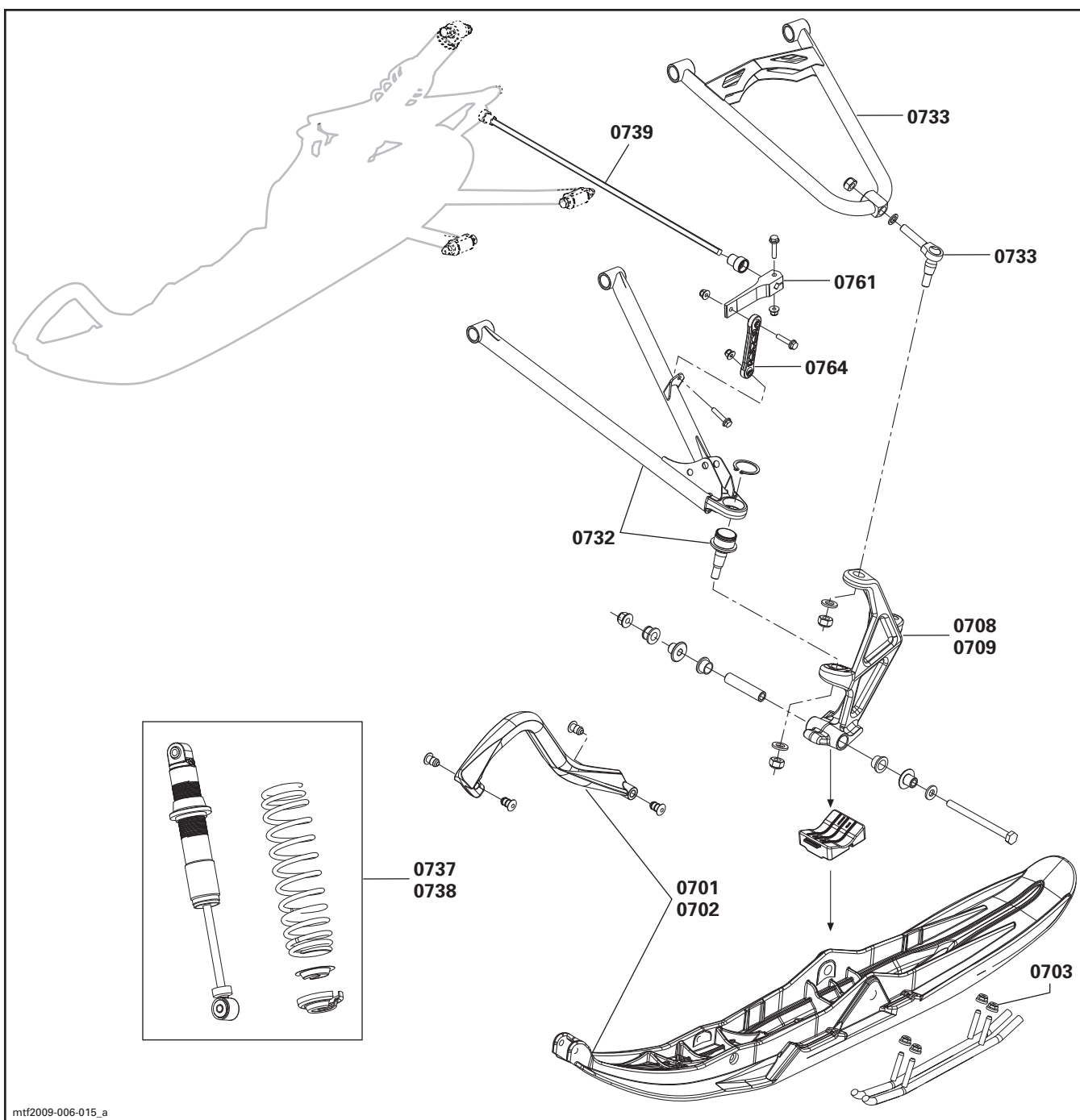
SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIC 600 ACE
			24	25	26	27	28
07	33	UPPER ARM (LH OR RH) BRAS DE SUSPENSION SUPÉRIEUR (GAUCHE OU DROIT)	0.5	0.5	0.5		
07	35	HANDLE BAR SUPPORT SUPPORT DE GUIDON	0.3	0.3	0.3	0.3	0.3
07	37	SHOCK AND/OR SPRING (1) AMORTISSEUR ET/OU RESSORT (1)	0.3	0.3	0.3	0.6	0.6
07	38	SHOCKS AND/OR SPRINGS (2) AMORTISSEURS ET/OU RESSORTS (2)	0.4	0.4	0.4	0.4	1.0
07	39	STABILIZER BAR BARRE STABILISATRICE	0.5	0.5	0.5		
07	51	STEERING MAIN TUBE BALL JOINT JOINT DE ROTULE DE LA COLONNE DE DIRECTION				0.5	0.5
07	59	TIE ROD (LH) BARRE D'ACCOUPLEMENT (GAUCHE)	0.3	0.3	0.3	0.3	0.3
07	60	TIE ROD (RH) BARRE D'ACCOUPLEMENT (DROITE)	0.3	0.3	0.3	0.3	0.3
07	61	LEVER STABILIZER LEVIER STABILISATEUR	0.3	0.3	0.3		
07	64	DOUBLE BALL JOINT JOINT À ROTULE DOUBLE	0.3	0.3	0.3		
07	102	LOWER DAMPER AMORTISSEUR VIBRATION INFÉRIEUR	0.5	0.5	0.5		
07	111	LTS MODULE MODULE LTS				3.5	3.5
07	124	STRAP SANGLE				0.3	0.3

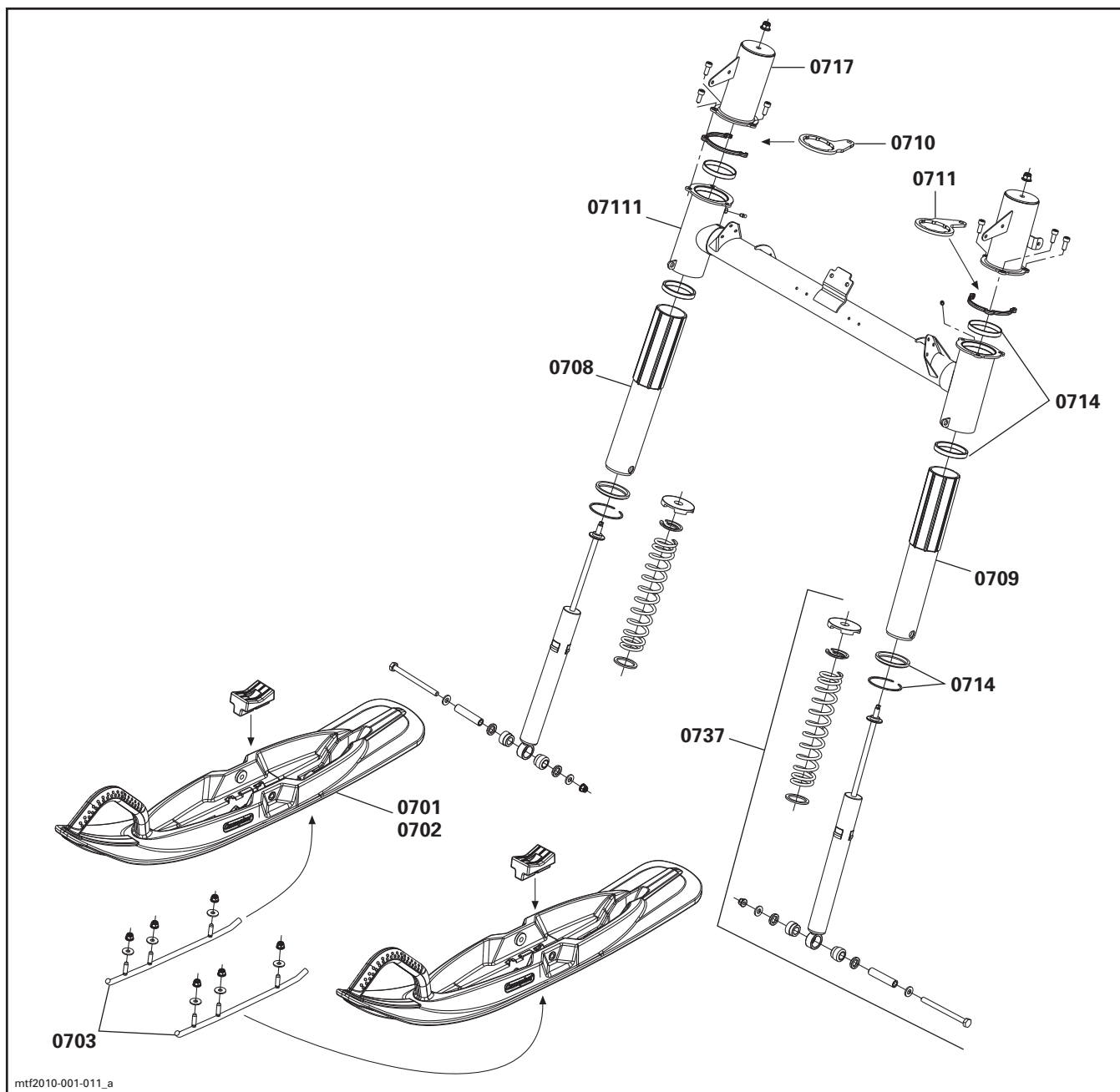
STEERING SYSTEM AND FRONT SUSPENSION SYSTÈME DE DIRECTION ET SUSPENSION AVANT



STEERING SYSTEM AND FRONT SUSPENSION SYSTÈME DE DIRECTION ET SUSPENSION AVANT

07
SYSTEM/SYSTÈME





REAR SUSPENSION SYSTEM AND TRACK SYSTÈME DE SUSPENSION ARRIÈRE ET CHENILLE

08
SYSTEM/SYSTÈME

SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIC 600 ACE
			24	25	26	27	28
08	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0
08	01	SLIDER SHOE (1) GLISSIÈRE (1)	0.5	0.5	0.5	0.5	0.5
08	02	SLIDER SHOES (2) GLISSIÈRES (2)	0.7	0.7	0.7	0.7	0.7
08	03	RUNNER (1) PORTE-GLISSIÈRE (1)	1.2	1.2	1.5	1.5	1.5
08	04	RUNNERS (2) PORTE-GLISSIÈRES (2)	1.5	1.5	1.9	1.9	1.9
08	09	FRONT IDLER WHEEL AND/OR BEARING (1) ROUE DE SUPPORT AVANT ET/OU ROULEMENT (1)	0.3	0.3	0.3	0.3	0.3
08	10	FRONT IDLER WHEELS AND/OR BEARINGS AND/OR SHAFTS (2) ROUES DE SUPPORT AVANT ET/OU ROULEMENTS ET/OU ARBRES (2)	0.4	0.4	0.4	0.4	0.4
08	11	FRONT IDLER WHEEL SUPPORT (1) SUPPORT DE ROUE AVANT (1)	0.3	0.3			
08	12	FRONT IDLER WHEELS SUPPORTS (2) SUPPORTS DE ROUE AVANT (2)	0.4	0.4			
08	13	CENTER IDLER WHEEL AND/OR BEARING (1) ROUE DE SUPPORT CENTRALE ET/OU ROULEMENT (1)	0.3	0.3	0.3	0.3	0.3
08	14	CENTER IDLER WHEELS AND/OR BEARINGS AND/OR SHAFTS (2) ROUES DE SUPPORT CENTRALES ET/OU ROULEMENTS ET/OU ARBRES (2)	0.4	0.4	0.4	0.4	0.4
08	15	CENTER IDLER WHEEL SUPPORT (1) SUPPORT DE ROUE CENTRALE (1)	0.3	0.3	0.3	0.3	0.3
08	17	REAR IDLER AND/OR BEARING (1) ROUE DE SUPPORT ARRIÈRE ET/OU ROULEMENT (1)	0.4	0.4	0.3	0.3	0.3
08	18	REAR IDLERS AND/OR BEARINGS (2) ROUES DE SUPPORT ARRIÈRE ET/OU ROULEMENTS (2)	0.5	0.5	0.4	0.4	0.4
08	19	REAR IDLER WHEELS AXLE ESSIEU DE ROUES DE SUPPORT ARRIÈRE	0.5	0.5	0.5	0.5	0.5
08	22	TAIL PIVOT IDLER WHEEL, INSIDE (1) ROUE SUPPORT DE PIVOT ARRIÈRE ET/OU ROULEMENT INTÉRIEUR (1)			0.3	0.3	0.3
08	23	TAIL PIVOT IDLER WHEELS OR AXLE (2) ROUES SUPPORT DE PIVOT ARRIÈRE/ROULEMENT OU ESSIEU (2)			0.3	0.3	0.3
08	29	AXEL (STOPPER STRAP) AXE (COURROIE D'ARRÊT)	0.3	0.3	0.3	0.3	0.3
08	31	TRACK TENSION ADJUSTER (1) PLAQUE DE RÉGLAGE TENSION CHENILLE (1)	0.4	0.4	0.4	0.4	0.4
08	32	TRACK TENSION ADJUSTERS (2) PLAQUES DE RÉGLAGE TENSION CHENILLE (2)	0.5	0.5	0.5	0.5	0.5
08	33	RUNNER RUBBER STOPPER (1) BUTÉE DE CAOUTCHOUC DE PORTE-GLISSIÈRE (1)	0.3	0.3	0.3	0.3	0.3
08	34	RUNNER RUBBER STOPPERS (2) BUTÉES DE CAOUTCHOUC DE PORTE-GLISSIÈRE (2)	0.4	0.4	0.4	0.4	0.4
08	35	FRONT ARM AND/OR AXLE BRAS AVANT ET/OU ESSIEU	0.8	0.8	0.8	0.8	0.8

REAR SUSPENSION SYSTEM AND TRACK SYSTÈME DE SUSPENSION ARRIÈRE ET CHENILLE

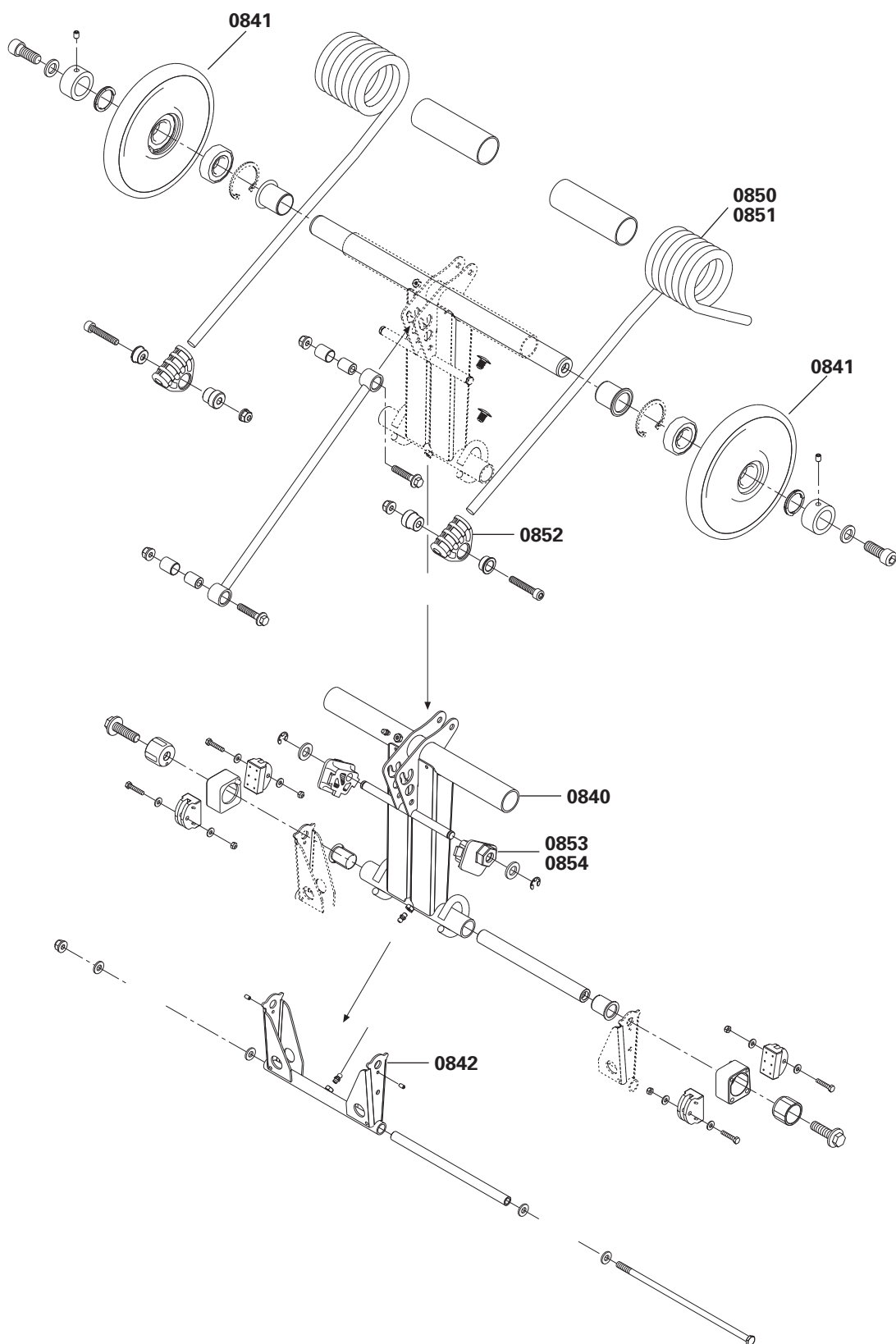
SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIC 600 ACE
			24	25	26	27	28
08	36	FRONT ARM STOPPER STRAP/STOPPER BOLT COURROIE D'ARRÊT BRAS AVANT/BOULON D'ARRÊT	0.3	0.3	0.3	0.3	0.3
08	37	FRONT ARM SUPPORT SUPPORT DE BRAS AVANT			0.6	0.6	0.6
08	40	REAR ARM AND/OR AXLE BRAS ARRIÈRE ET/OU ESSIEU	0.7	0.7	0.7	0.7	0.7
08	41	REAR ARM IDLER WHEELS (1-2) AND/OR SHAFT-CROSS ROUES DE SUPPORT BRAS ARRIÈRE (1-2) ET/OU AXE TRANSVERSALE	0.3	0.3	0.3	0.3	0.3
08	42	REAR ARM SHACKLE JUMELLE DE BRAS ARRIÈRE	0.3	0.3	0.3	0.3	0.3
08	44	REAR AND FRONT ARMS BRAS ARRIÈRE ET AVANT	1.5	1.5	1.5	1.5	1.5
08	50	REAR TORSION SPRING AND/OR WHEEL (1) RESSORT DE TORSION ARRIÈRE ET/OU ROUE (1)	0.3	0.3	0.3	0.3	0.3
08	51	REAR TORSION SPRINGS AND/OR WHEELS (2) RESSORTS DE TORSION ET/OU ROUES (2)	0.4	0.4	0.4	0.4	0.4
08	52	TORSION SPRING SUPPORT SUPPORT DE RESSORT DE TORSION	0.3	0.3	0.3	0.3	0.3
08	53	SPRING ADJUSTMENT CAM (1) CAME DE RÉGLAGE DE RESSORT (1)	0.3	0.3	0.3	0.3	0.3
08	54	SPRING ADJUSTMENT CAMS (2) CAMES DE RÉGLAGE DE RESSORT (2)	0.4	0.4	0.4	0.4	0.4
08	55	SHOCK AND/OR SPRING AND/OR BUSHING AMORTISSEUR ET/OU RESSORT ET/OU DOUILLE	0.5	0.5	0.5	0.5	0.5
08	69	TRACK (1) CHENILLE (1)	2.2	2.2	2.2	2.2	2.2
08	71	CLEATS AND/OR GUIDES (0-9) SEGMENTS GUIDE ET/OU GUIDES (0-9)	0.3	0.3	0.3	0.3	0.3
08	72	CLEATS AND/OR GUIDES (10-14) SEGMENTS GUIDE ET/OU GUIDES (10-14)	0.4	0.4	0.4	0.4	0.4
08	73	CLEATS AND/OR GUIDES (15-19) SEGMENTS GUIDE ET/OU GUIDES (15-19)	0.5	0.5	0.5	0.5	0.5
08	74	CLEATS AND/OR GUIDES (20-24) SEGMENTS GUIDE ET/OU GUIDES (20-24)	0.6	0.6	0.6	0.6	0.6
08	75	CLEATS AND/OR GUIDES (25-29) SEGMENTS GUIDE ET/OU GUIDES (25-29)	0.7	0.7	0.7	0.7	0.7
08	76	CLEATS AND/OR GUIDES (30-34) SEGMENTS GUIDE ET/OU GUIDES (30-34)	0.8	0.8	0.8	0.8	0.8
08	77	CLEATS AND/OR GUIDES (35-39) SEGMENTS GUIDE ET/OU GUIDES (35-39)	0.9	0.9	0.9	0.9	0.9
08	78	CLEATS AND/OR GUIDES (40-44) SEGMENTS GUIDE ET/OU GUIDES (40-44)	1.0	1.0	1.0	1.0	1.0
08	79	CLEATS AND/OR GUIDES (45-49) SEGMENTS GUIDE ET/OU GUIDES (45-49)	1.1	1.1	1.1	1.1	1.1
08	80	CLEATS AND/OR GUIDES (50-54) SEGMENTS GUIDE ET/OU GUIDES (50-54)			1.2	1.2	1.2

REAR SUSPENSION SYSTEM AND TRACK SYSTÈME DE SUSPENSION ARRIÈRE ET CHENILLE

08
SYSTEM/SYSTÈME

SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIC 600 ACE
			24	25	26	27	28
08	81	CLEATS AND/OR GUIDES (55-59) SEGMENTS GUIDE ET/OU GUIDES (55-59)			1.3	1.3	1.3
08	82	CLEATS AND/OR GUIDES (60-64) SEGMENTS GUIDE ET/OU GUIDES (60-64)			1.4	1.4	1.4
08	83	CLEATS AND/OR GUIDES (65-70) SEGMENTS GUIDE ET/OU GUIDES (65-70)			1.5	1.5	1.5
08	85	ADJUSTMENT SCREW (1) VIS D'AJUSTEMENT (1)	0.3	0.3	0.3	0.3	0.3
08	86	ADJUSTMENT SCREWS (2) VIS D'AJUSTEMENT (2)	0.4	0.4	0.4	0.4	0.4
08	87	SHOCK SUPPORT AND/OR AXLE SUPPORT D'AMORTISSEUR ET/OU AXE	0.4	0.4	0.4	0.4	0.4
08	88	FRONT SHOCK AND/OR SPRING AMORTISSEUR AVANT ET/OU RESSORT	0.5	0.5	0.5	0.5	0.5
08	89	FRONT WHEELS SUPPORT AND/OR BEARINGS (3) ROUES DE SUPPORT AVANT ET/OU ROULEMENTS À BILLE (3)	0.5	0.5	0.5	0.5	0.5
08	91	REAR PIVOT ARM BRAS DE PIVOT ARRIÈRE			0.7	0.7	0.7
08	144	CAM AXLE, SPRING, SHAFT AND CUSHIONS AXE DE CAME, RESSORT, ARBRE ET COUSSINETS			0.5	0.5	0.5
08	145	BLOCK, GUIDE, CAM AND PIVOT BLOC, GUIDE, CAME ET PIVOT			0.7	0.7	0.7

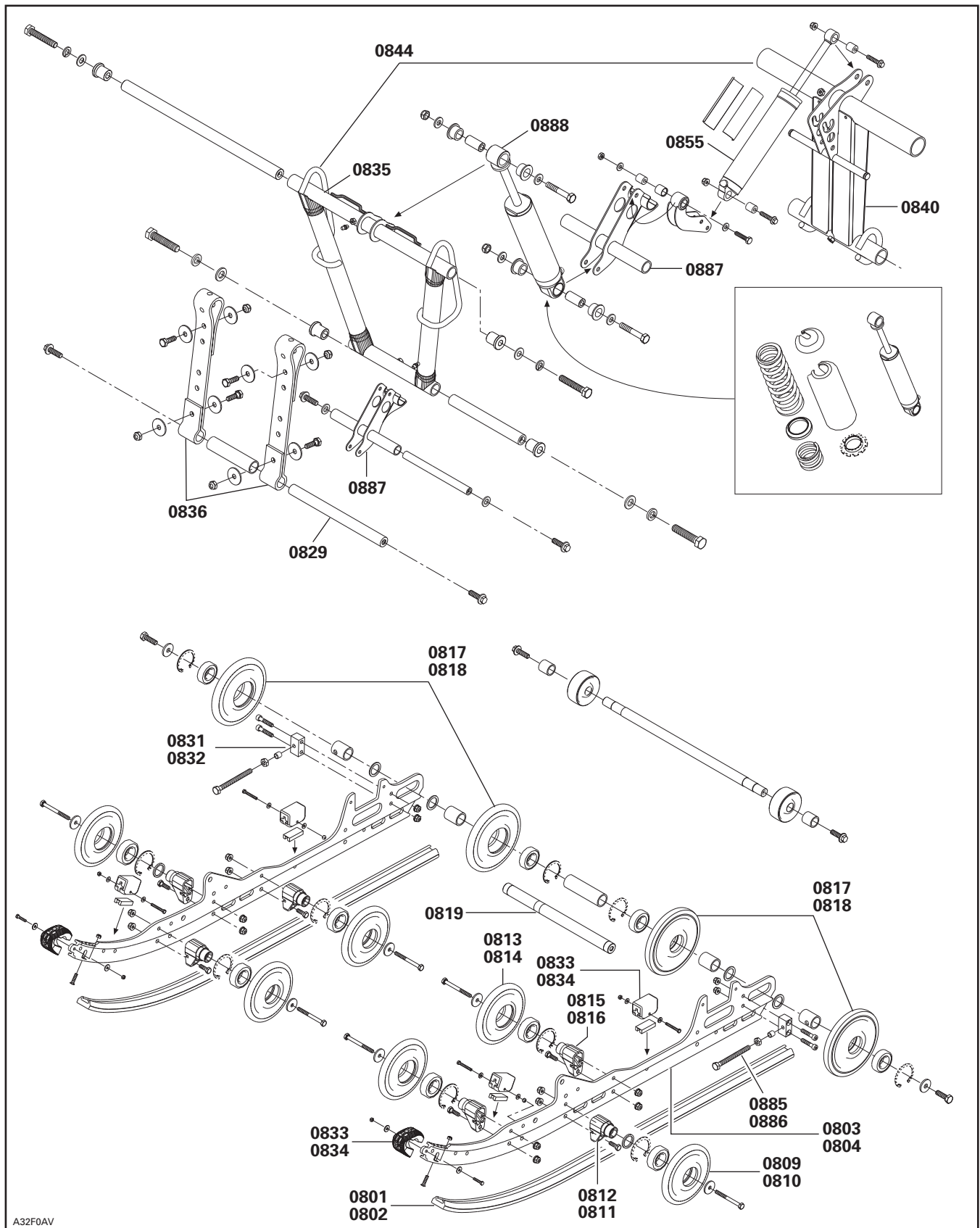
REAR SUSPENSION SYSTEM AND TRACK SYSTÈME DE SUSPENSION ARRIÈRE ET CHENILLE



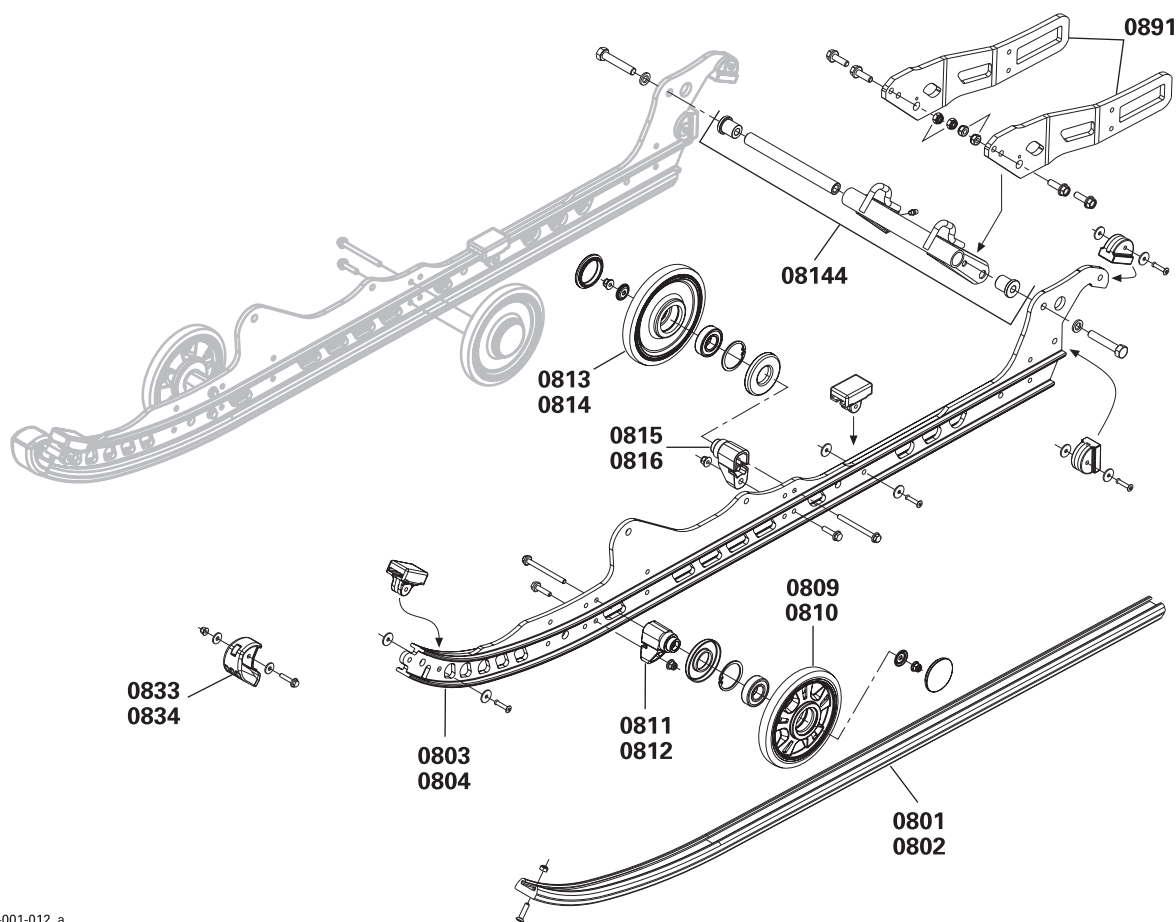
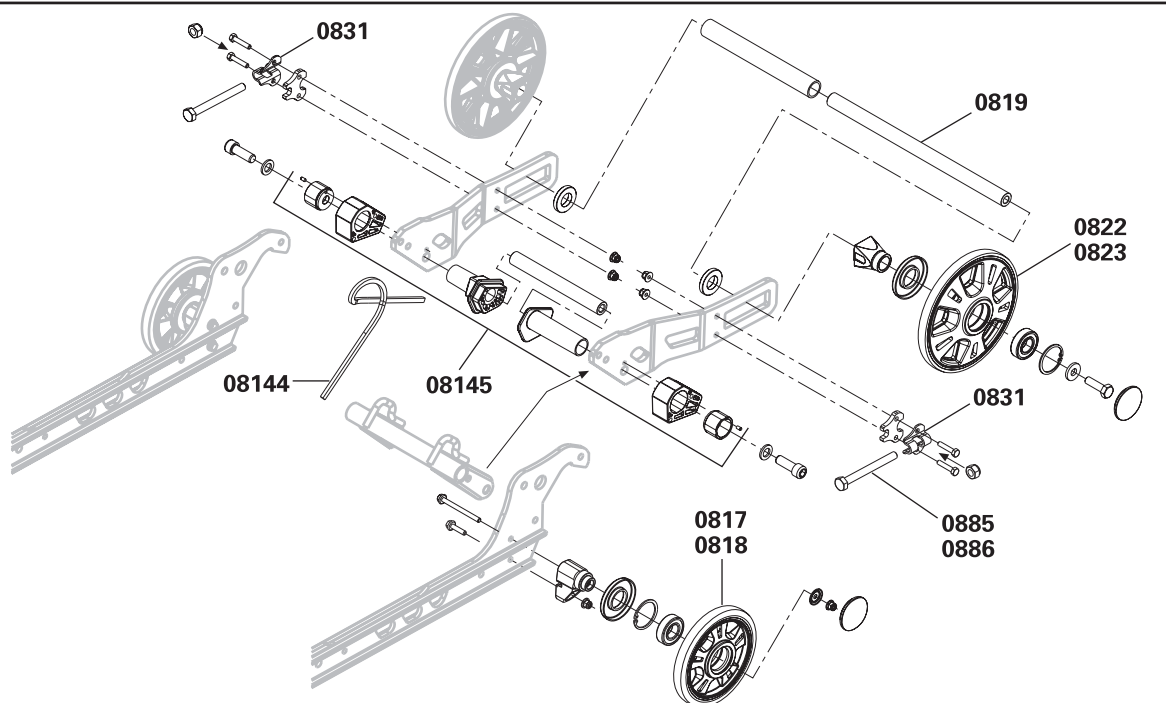
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REAR SUSPENSION SYSTEM AND TRACK SYSTÈME DE SUSPENSION ARRIÈRE ET CHENILLE

08
SYSTEM/SYSTÈME



REAR SUSPENSION SYSTEM AND TRACK SYSTÈME DE SUSPENSION ARRIÈRE ET CHENILLE



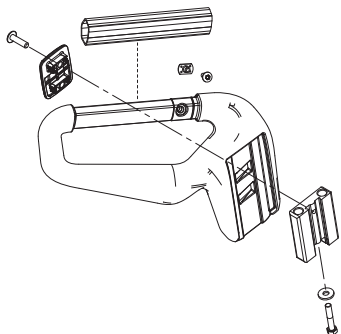
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SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIC 600 ACE
			24	25	26	27	28
09	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0
09	01	HOOD CAPOT	0.3	0.3	0.3	0.3	0.3
09	05	HOOD DECALS (LH OR RH) AUTOCOLLANTS DU CAPOT (GAUCHE OU DROIT)	0.3	0.3	0.3	0.3	0.3
09	06	HOOD DECALS (ALL) AUTOCOLLANTS DU CAPOT (TOUS)	0.5	0.5	0.5	0.5	0.5
09	09	WINDSHIELD PARE-BRISE	0.3	0.3	0.3	0.3	0.3
09	13	CARGO RACK SUPPORT À BAGAGES		0.4	0.4	0.4	
09	14	FRONT BUMPER PARE-CHOCES AVANT	0.4	0.4	0.4	0.4	0.4
09	17	CONSOLE CONSOLE	0.3	0.3	0.3	0.3	0.3
09	21	SEAT (ASS'Y) SIÈGE (COMPLET)	0.3	0.3	0.3	0.3	
09	22	SEAT COVER AND/OR FOAM HOUSSE DE SIÈGE ET/OU MOUSSE	1.0	1.0	1.0	1.0	0.7
09	23	SEAT FOAM CAOUTCHOUC MOUSSE DE SIÈGE	1.0	1.0	1.0	1.0	0.7
09	34	REAR BUMPER PARE-CHOCES ARRIÈRE	0.3	0.3	0.3	0.3	0.3
09	35	HITCH SUPPORT (ALL PARTS) SUPPORT D'ATTELAGE (TOUTES LES PIÈCES)			0.3	0.3	0.3
09	48	FRONT FOOTREST (LH OR RH) REPOSE-PIED AVANT (GAUCHE OU DROIT)		0.3	0.3		
09*	49	FRAME (ASS'Y) OR FRONT MEMBER CHÂSSIS (COMPLET) OU CADRE AVANT	13.5	13.8	13.8	13.8	14.5
09	51	REAR CAP PARTIE ARRIÈRE DU CHÂSSIS	0.8	0.8	0.8	0.8	
09	55	SNOW GUARD (1) GARDE-NEIGE (1)	0.3	0.3	0.3	0.3	0.3
09	58	BACKREST AND/OR COVER DOSSIER ET/OU HOUSSE		0.3	0.3		
09	65	MIRROR (1) RÉTROVISEUR (1)		0.3	0.3		0.3
09	66	MIRRORS (2) RÉTROVISEURS (2)		0.3	0.3		0.3
09	72	TUNNEL DECAL (1 OR 2) DÉCALQUE DE TUNNEL (1 OU 2)	0.3	0.3	0.3	0.3	0.3
09	77	BOTTOM PAN (RH) COQUE CÔTÉ (DROITE)	0.7	0.7	0.7	0.6	0.7

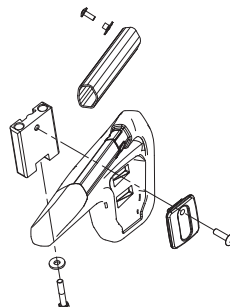
SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIC 600 ACE
			24	25	26	27	28
09	78	BOTTOM PAN (LH) COQUE CÔTÉ (GAUCHE)	0.7	0.7	0.7	0.6	0.7
09	79	BOTTOM PAN (CENTER) COQUE PARTIE (CENTRALE)	0.5	0.5	0.5	0.7	0.8
09	80	FRONT GRILL (LH AND/OR RH) GRILLE AVANT (GAUCHE ET/OU DROIT)				0.3	0.3
09	81	SIDE GRILL (LH AND/OR RH) GRILLE LATÉRALE (GAUCHE ET/OU DROIT)	0.3	0.3	0.3	0.3	0.3
09	82	CABLE RETAINER (LH AND/OR RH) CÂBLE DE RETENUE (GAUCHE ET/OU DROIT)					0.3
09	86	ROLLER ROULEAU	0.5	0.5	0.5	0.5	
09	87	BOTTOM PAN DOOR PORTE DE COQUE				0.3	0.3
09	96	FOOT PROTECTOR AND/OR SUPPORT (LH OR RH) PROTÈGE PIED ET/OU SUPPORT (GAUCHE OU DROIT)	1.0	1.0	1.0	1.0	1.0
09	149	ENGINE SIDE PANELS (2) PANNEAUX MOTEUR (2)	0.9	0.9	0.9	0.7	0.9
09	157	UPPER CONSOLE CONSOLE SUPÉRIEUR	0.3	0.3	0.3	0.3	0.4
09	163	MEMBER (LH OR RH) MEMBRURE (GAUCHE OU DROIT)	0.4	0.4	0.4	0.4	0.5
09	168	FRONT GRILL GRILLE AVANT					0.3
09	191	SIDE PANEL DECAL (LH OR RH) (1) DÉCALQUES DE PANNEAU (GAUCHE OU DROIT) (1)	0.3	0.3	0.3	0.3	0.3
09	192	SIDE PANEL DECALS (LH OR RH) (ALL) DÉCALQUES DE PANNEAU (GAUCHE OU DROIT) (TOUS)	0.6	0.6	0.6	0.6	0.6
09	194	ENGINE SIDE PANEL (LH OR RH) PANNEAU MOTEUR (GAUCHE OU DROIT)	0.5	0.5	0.5	0.4	0.5
09	195	FRONT PLATE PLAQUE AVANT	4.5	4.5	4.5		
09	196	REAR HANDLE AND/OR GRIP POIGNÉE ARRIÈRE ET/OU GAINÉ		0.5			0.3
09	197	REAR HANDLES AND/OR GRIPS (2) POIGNÉES ARRIÈRE ET/OU GAINES (2)		0.9			0.3
09	198	BACKREST PARTS PIÈCES DU DOSSIER		0.3	0.3		
09	199	REAR SEAT BASE AND/OR ALL PARTS BASE SIÈGE ARRIÈRE ET/OU TOUTES LES PIÈCES		1.9	1.9		1.9
09	203	REAR SEAT COVER OR FOAM HOUSSE OU MOUSSE DU SIÈGE ARRIÈRE		1.1	1.1		1.1
09	233	UPPER SIDE PANEL (LH OR RH) PANNEAU LATÉRAL SUPÉRIEUR (GAUCHE OU DROIT)					0.3

SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIC 600 ACE
			24	25	26	27	28
09	238	LOWER SIDE PANEL (LH OR RH) PANNEAU LATÉRAL INFÉRIEUR (GAUCHE OU DROIT)	0.3	0.3	0.3		
09	249	WINDSHIELD SUPPORT SUPPORT PARE-BRISE	0.3	0.3	0.3	0.3	0.3
09	250	AIR DEFLECTOR (LH OR RH) DÉFLECTEUR D'AIR (GAUCHE OU DROIT)	0.3	0.3	0.3	0.3	0.3
09	251	PANEL LATCHES (ALL) LOQUETS DE PANNEAU (TOUS)	0.3	0.3	0.3	0.3	0.3
09	252	FOOTREST REINFORCEMENT (LH OR RH) RENFORT DE MARCHE-PIED (GAUCHE OU DROIT)	1.1	1.1	1.1	1.1	0.6
09	261	FRONT MEMBER MEMBRURE AVANT	2.0	2.0	2.0	2.0	2.0
09	284	BOX DOOR PORTE DE COFFRE					0.4
09	293	PUSH LATCH LOQUET POUSSOIR					0.3
09	310	SEAT BOX BASE SIÈGE					1.3
09	311	E-MODULE MODULE E	5.8	5.8	5.8	6.0	6.0
09	312	S-MODULE MODULE S	3.5	3.5	3.5	3.5	3.5
09*	313	SEAT BOX FRAME CHÂSSIS BASE DE SIÈGE					0.4
09	367	LOCK VERROU					0.3
09	378	BRACE BRETELLE	1.0	1.0	1.0	1.0	1.0
09	379	BATTERY SUPPORT SUPPORT DE BATTERIE	0.5	0.5	0.5	0.5	
09	384	RADIATOR COVER COUVERCLE DE RADIATEUR	0.5	0.5			
09	403	HEADLAMP MOULDING ENJOLIVEUR DU PHARE	0.3	0.3	0.3		
09	439	MEMBER CAP CAPUCHON DE MEMBRURE	0.3		0.3	0.3	
09	469	REAR SUSPENSION BRACKET (RIGHT OR LEFT) ATTACHE DE SUSPENSION ARRIÈRE (DROIT OU GAUCHE)	0.8	0.8	0.8	0.8	

RH/DR



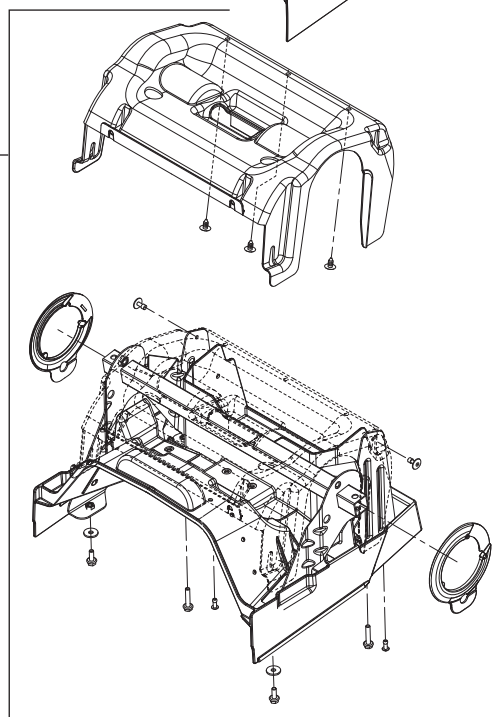
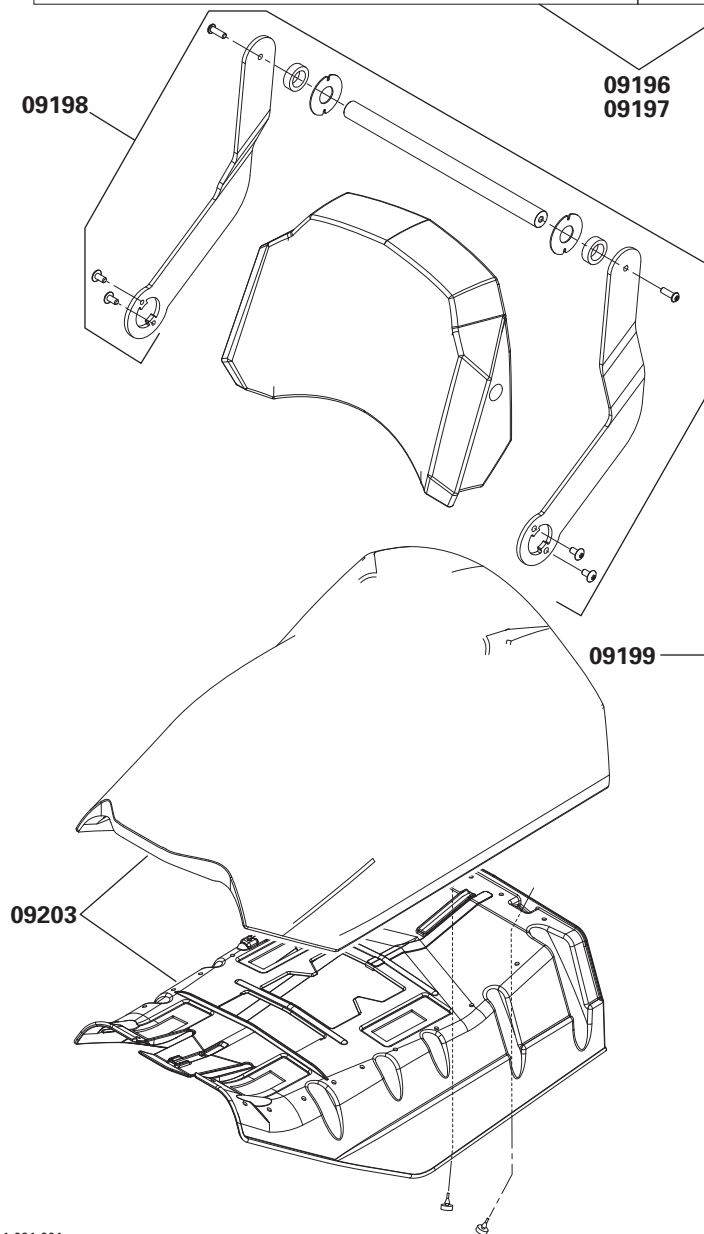
LH/GA



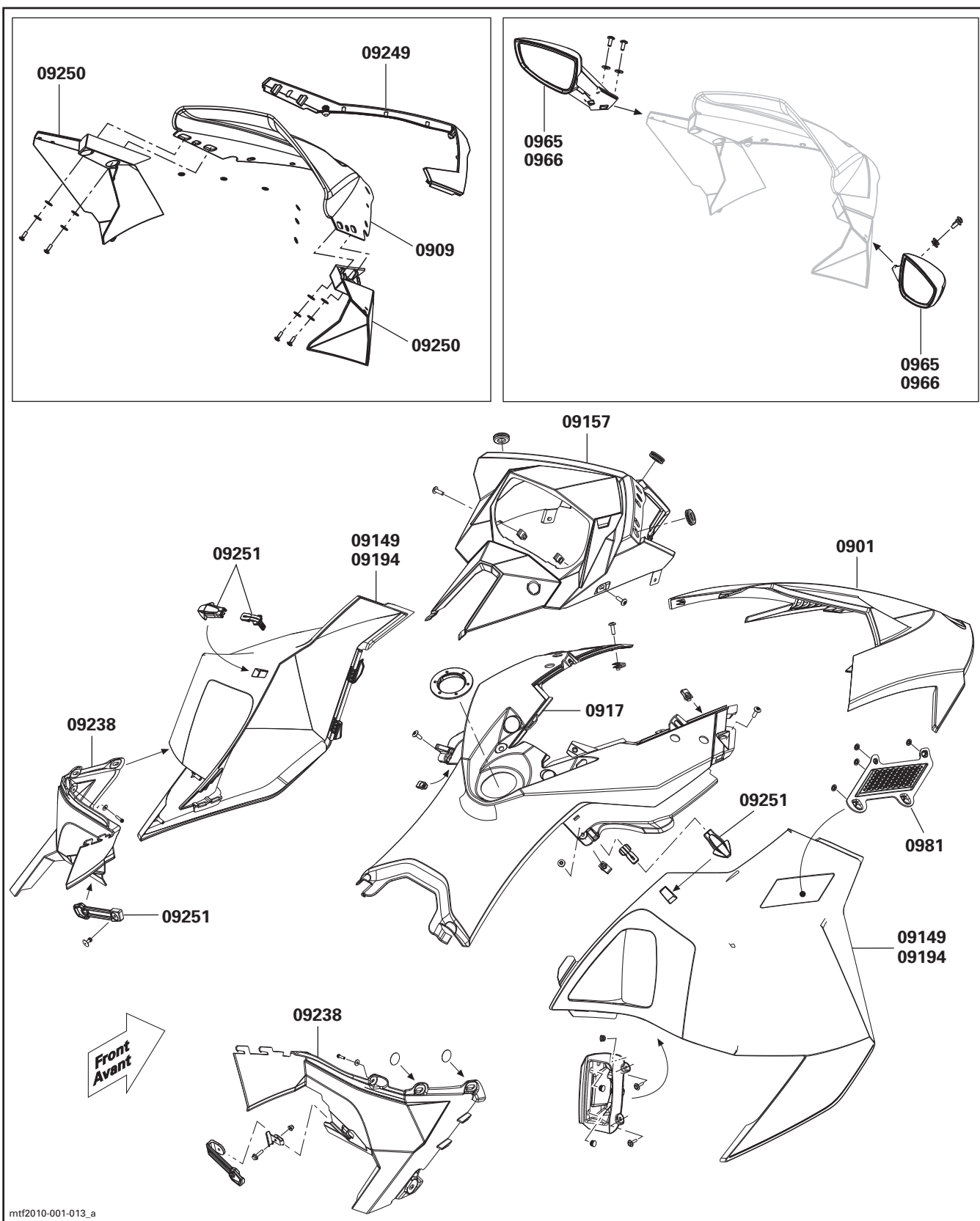
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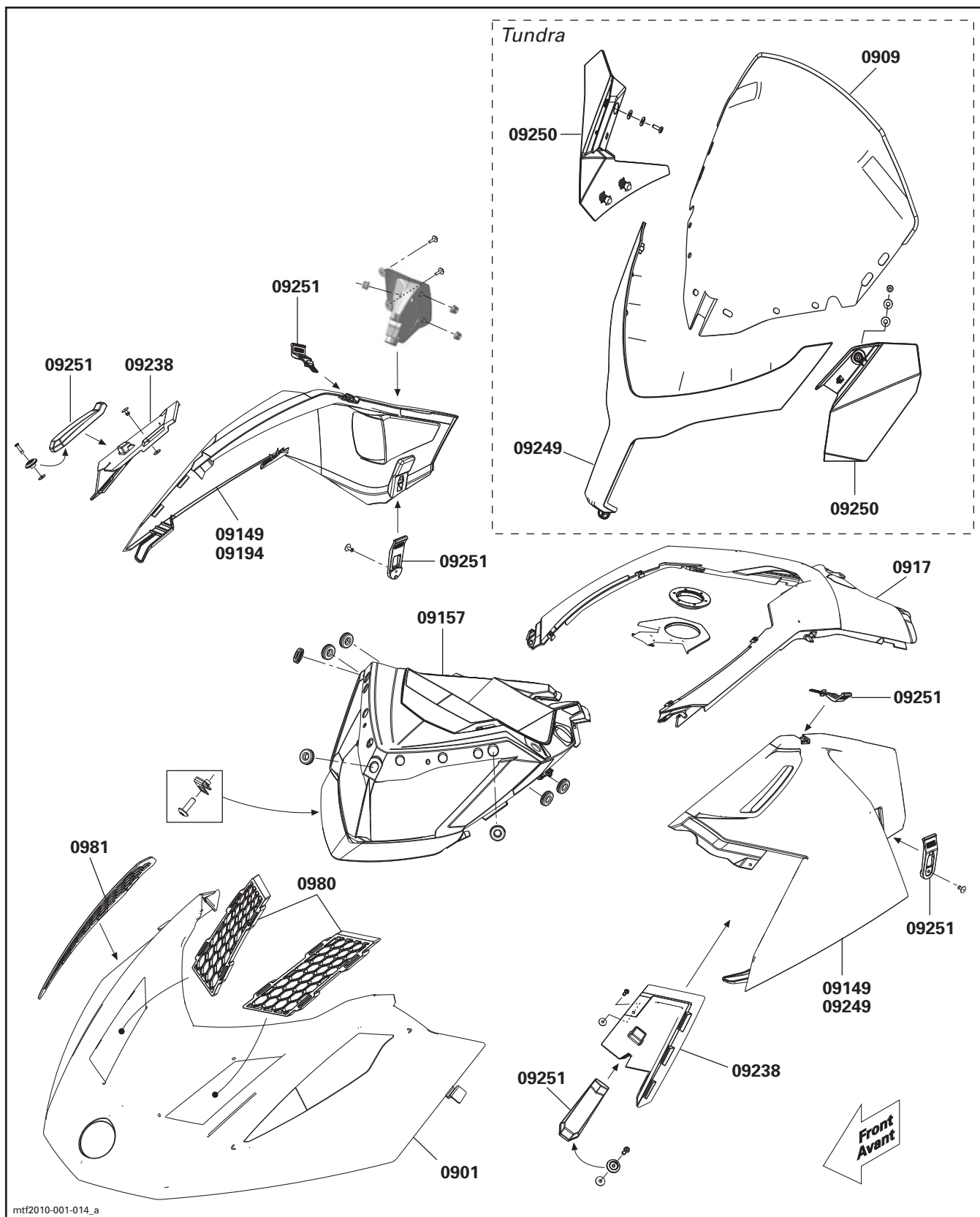
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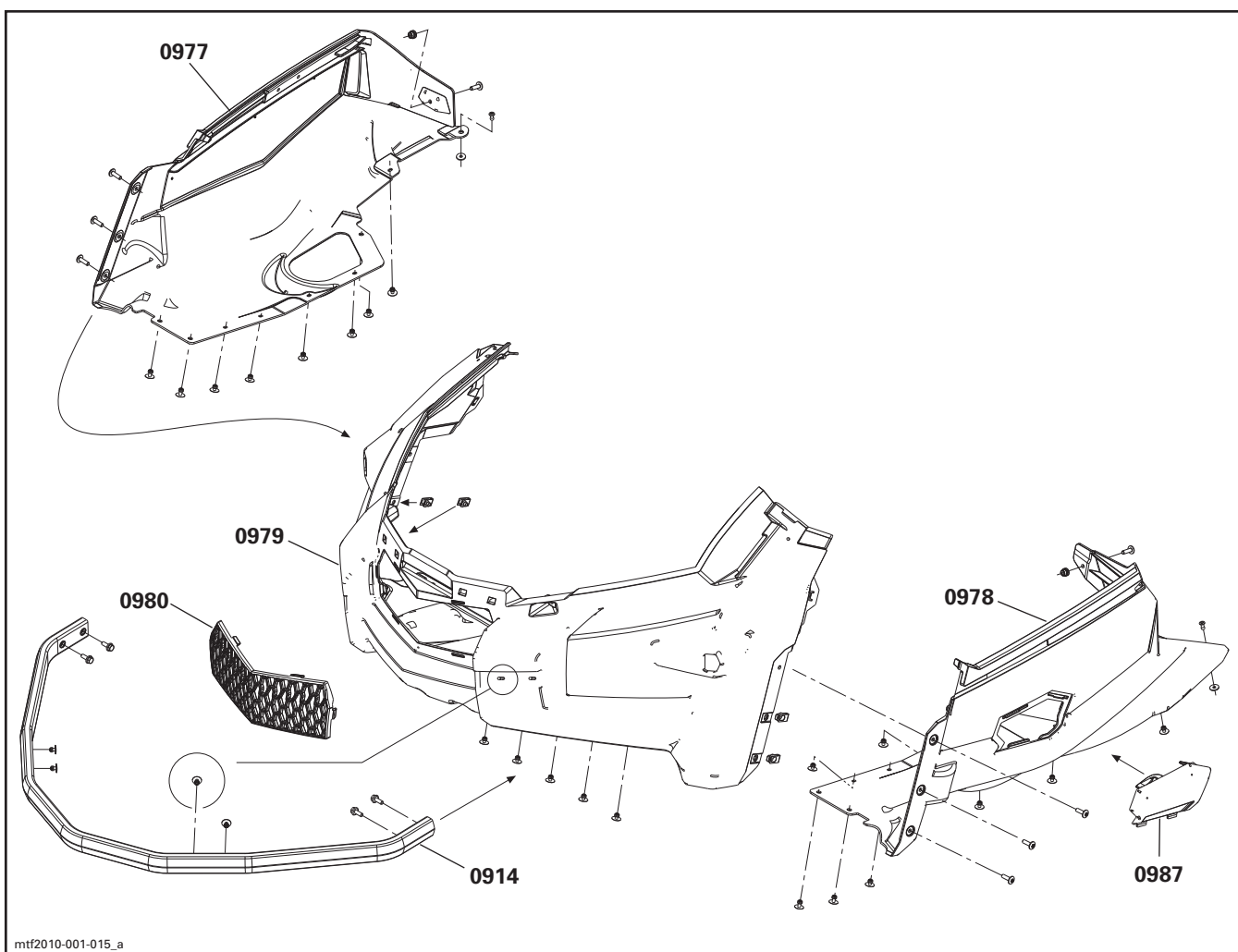
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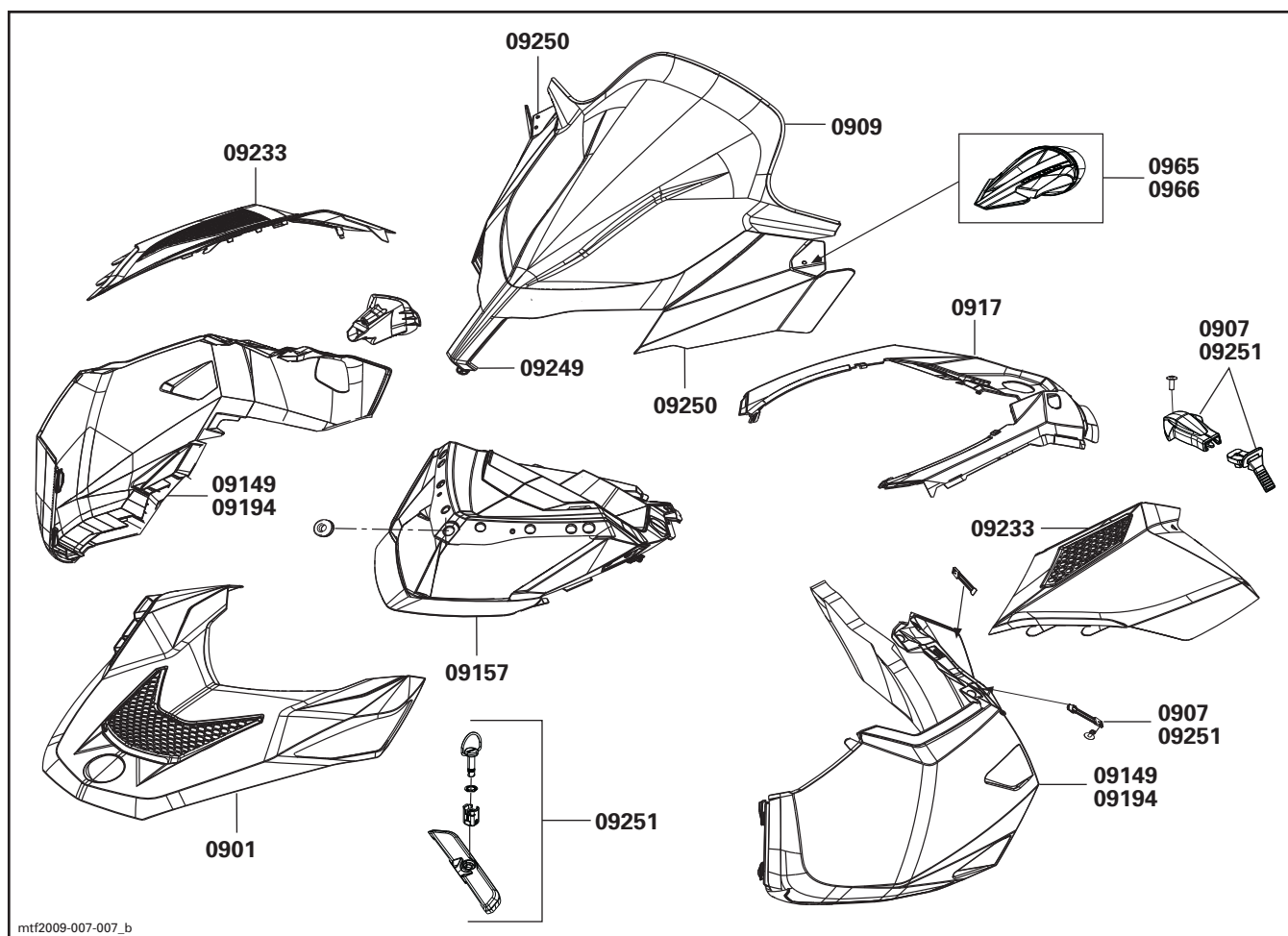


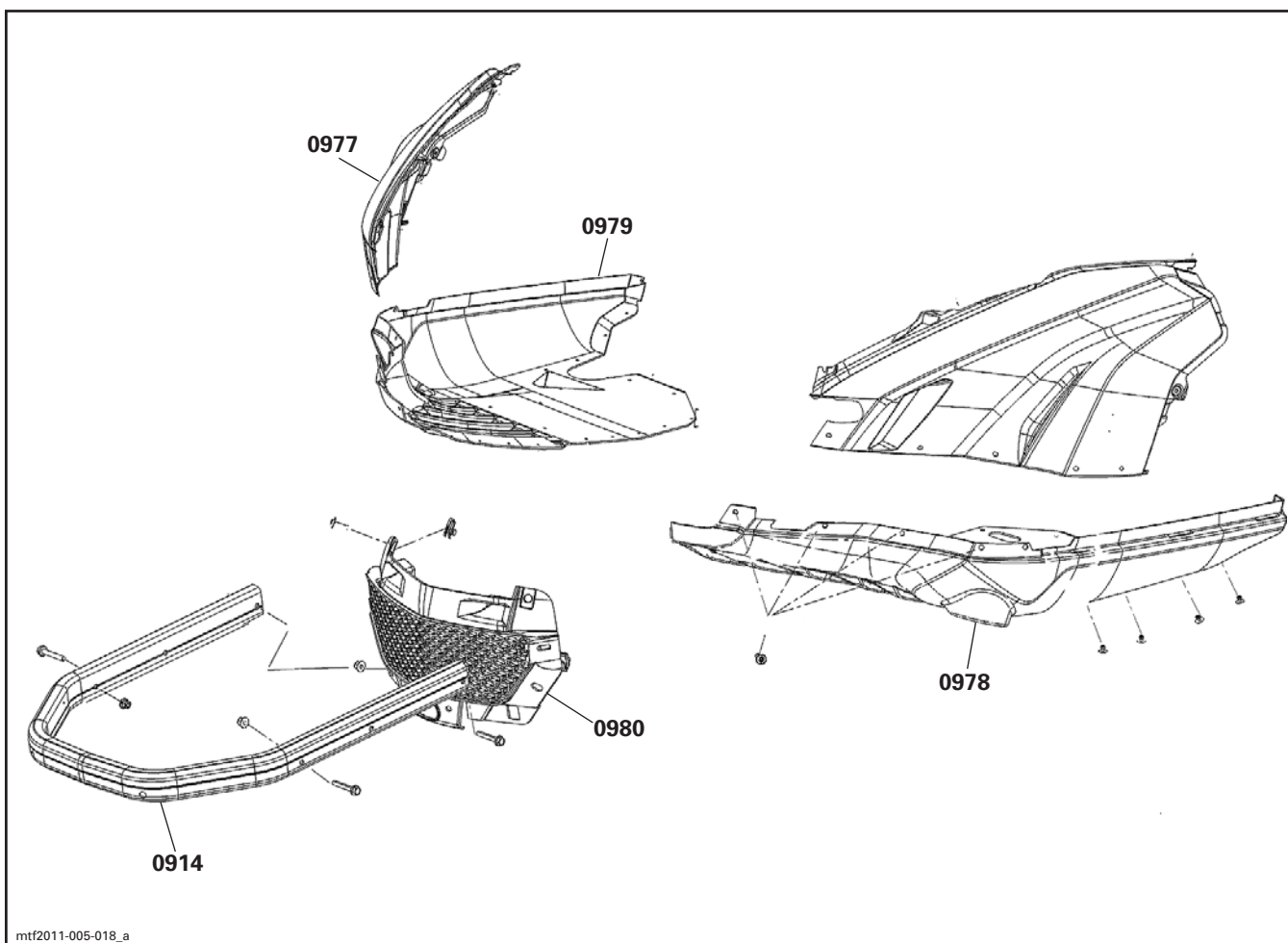
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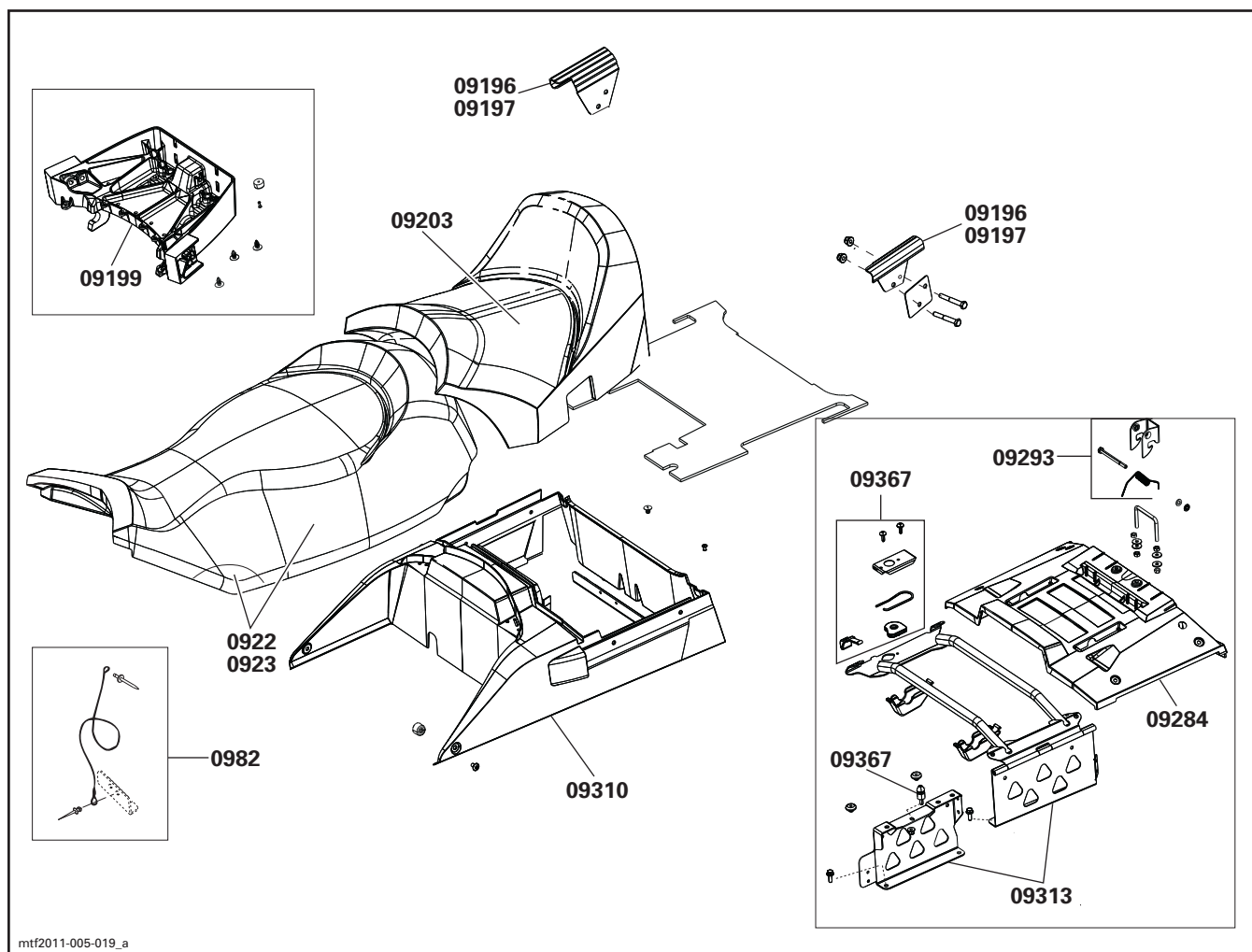


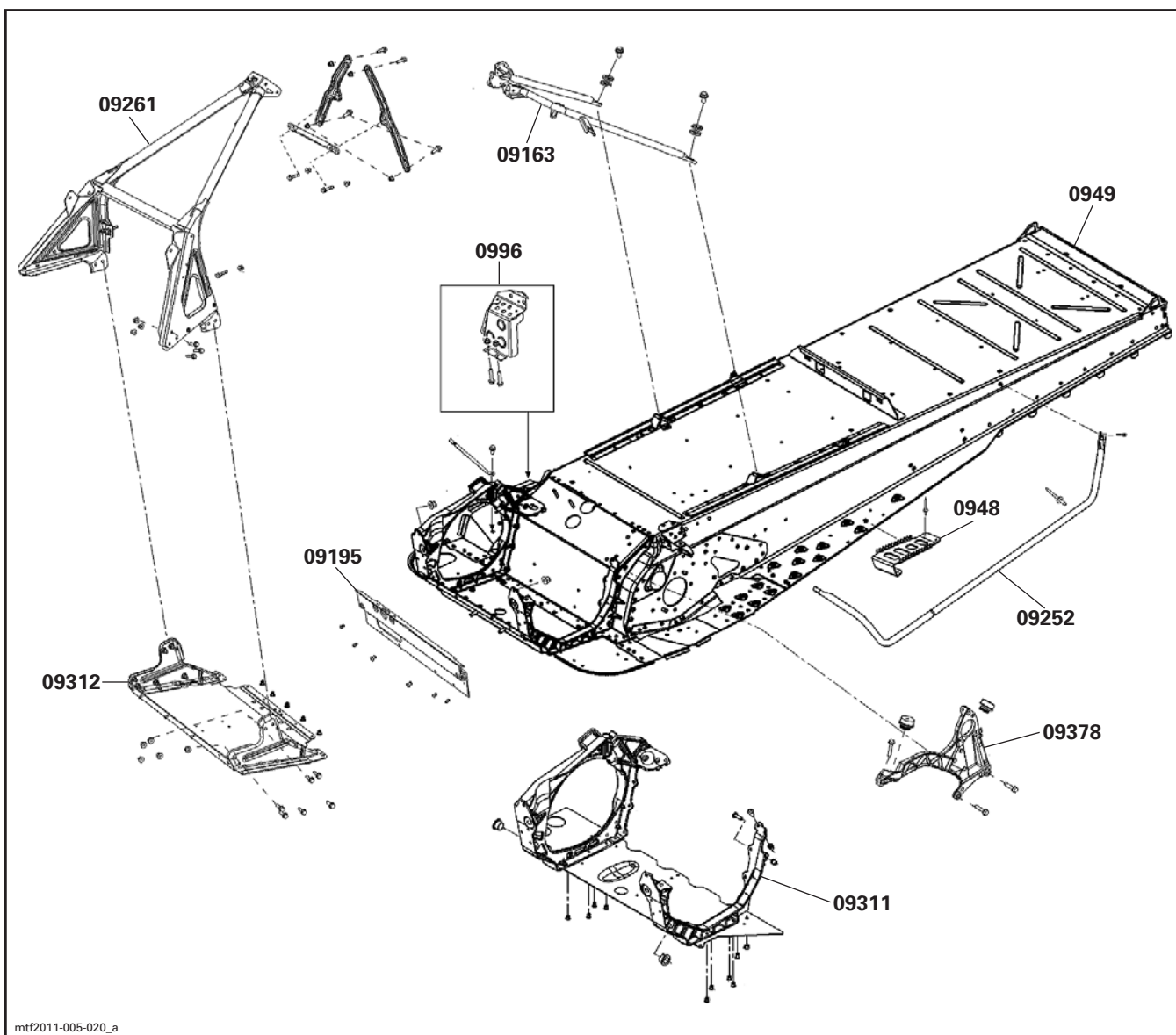


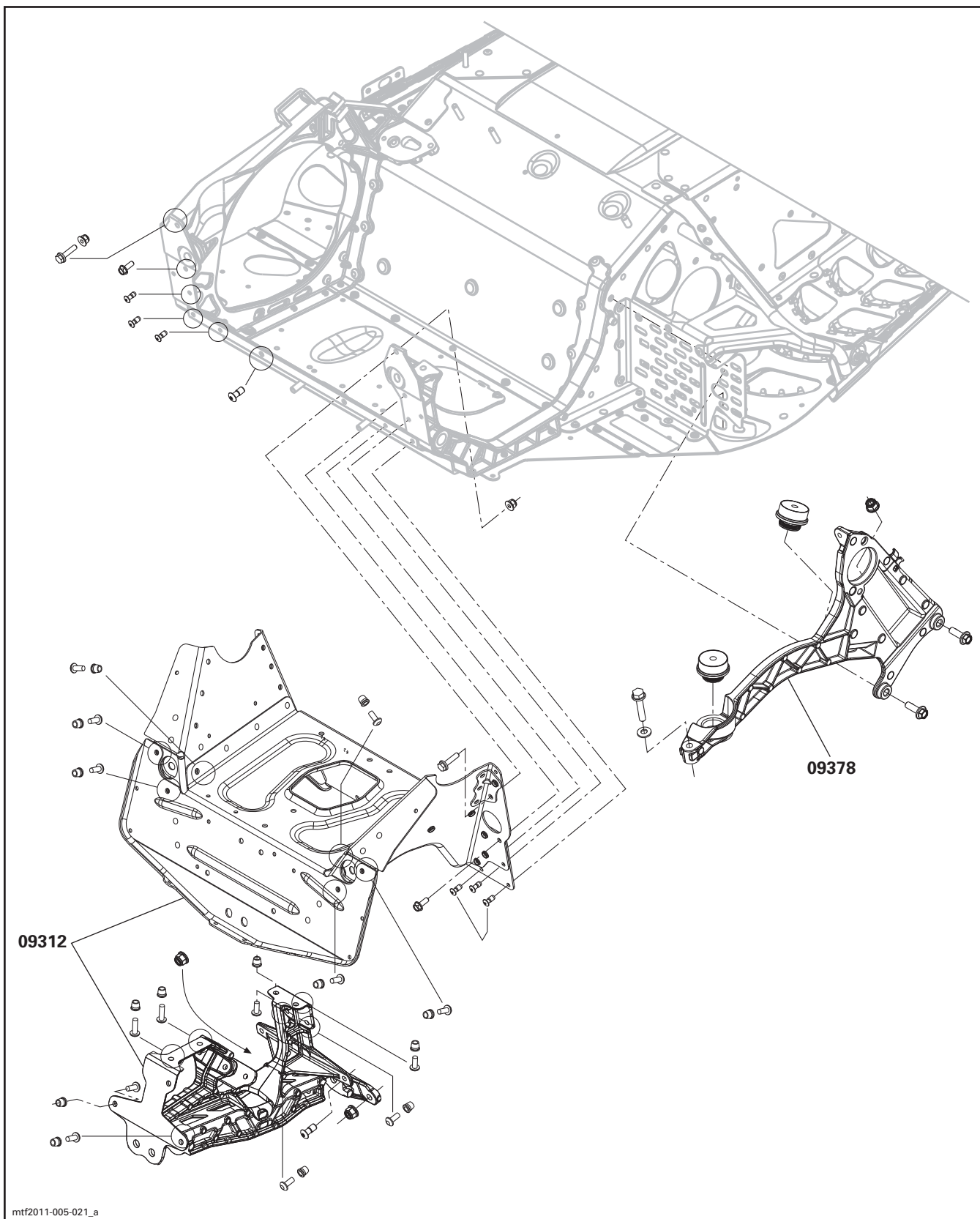


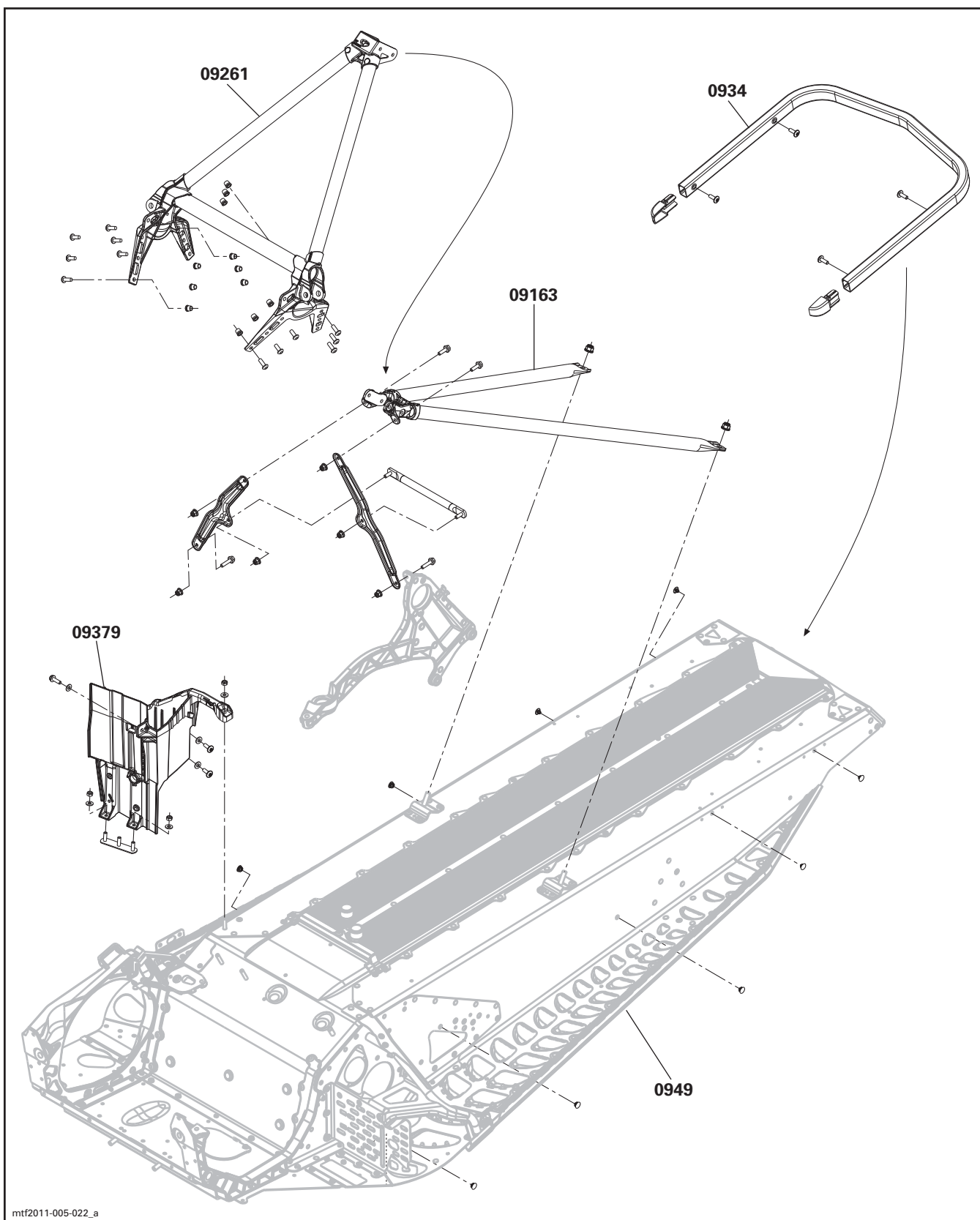






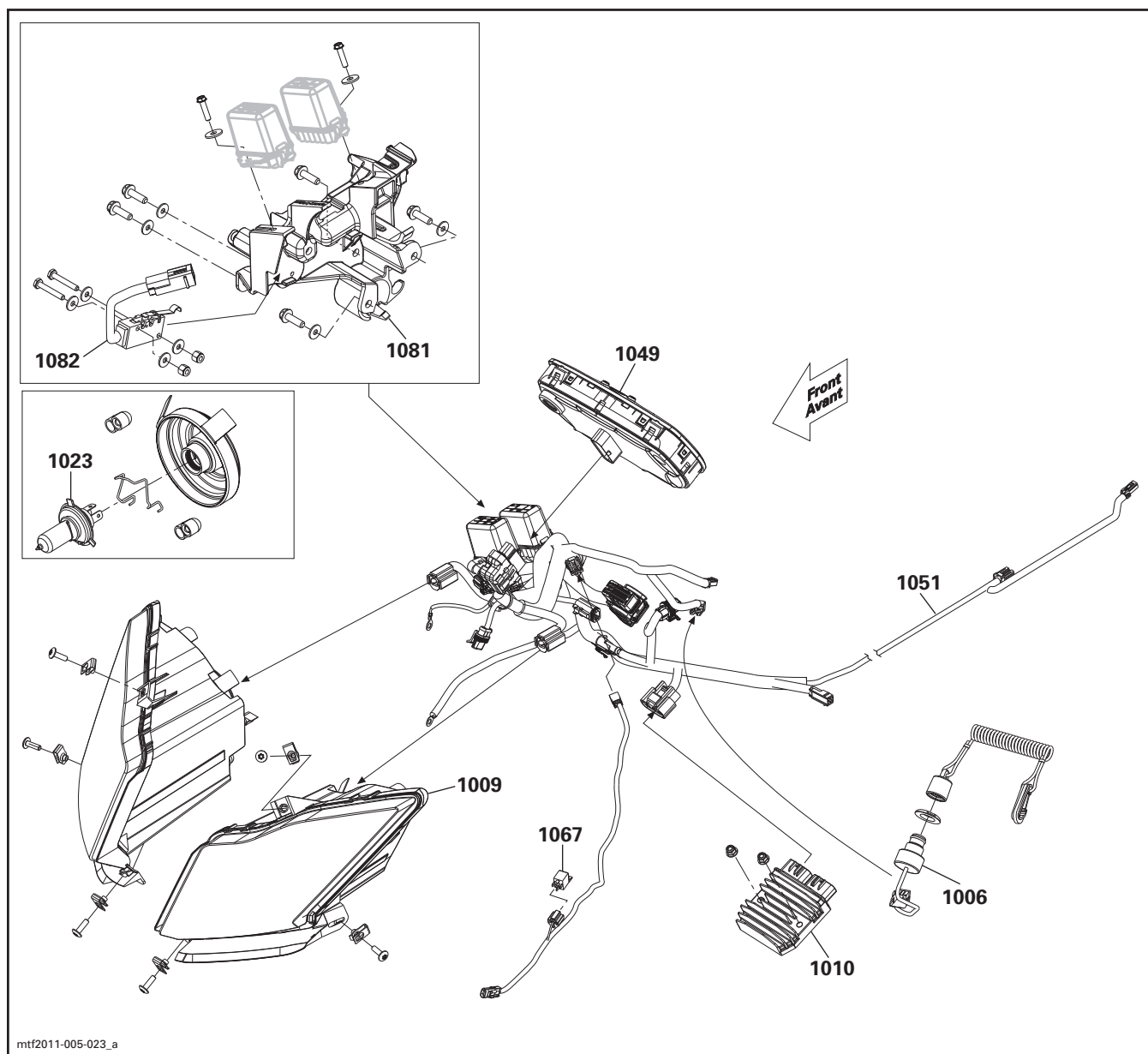


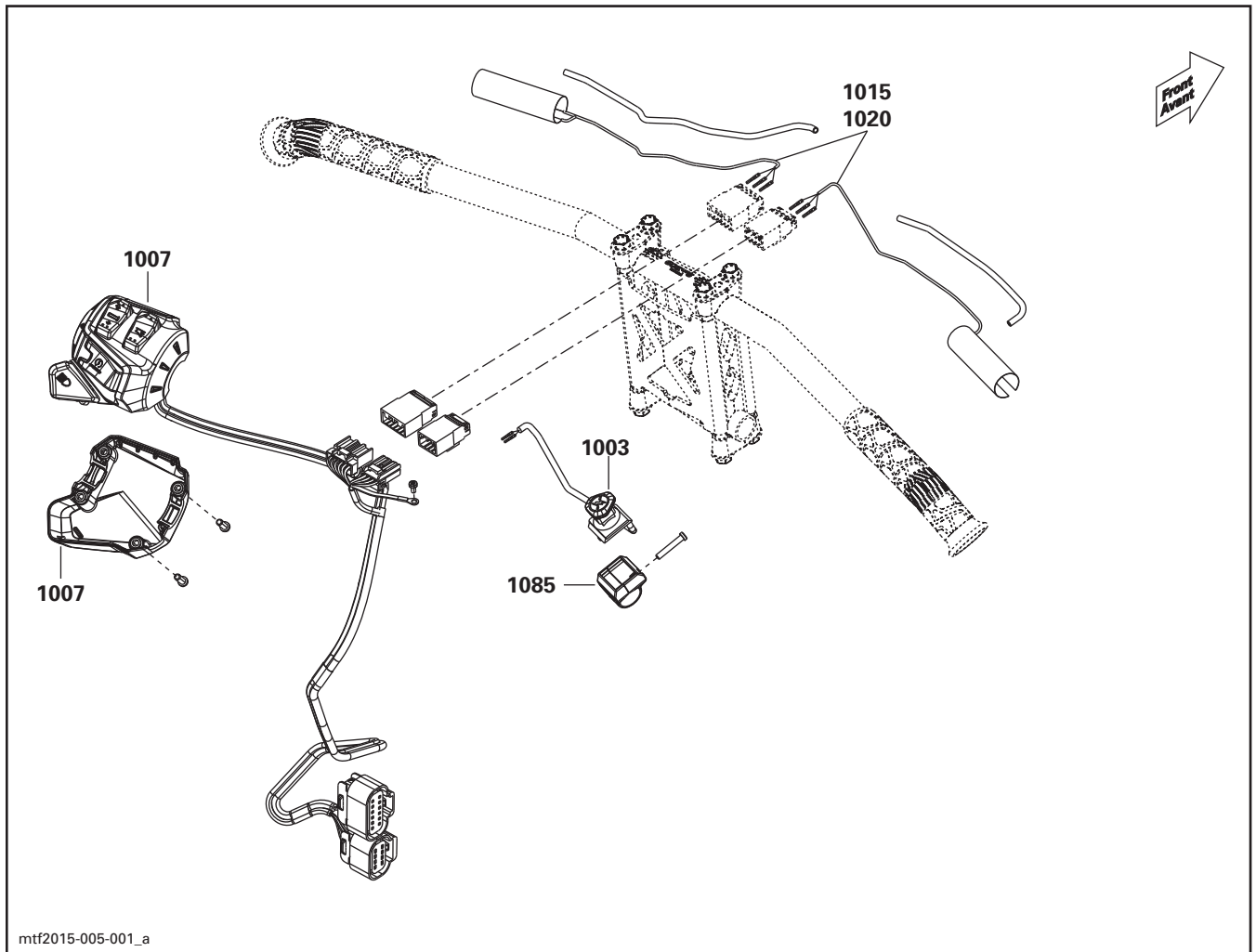


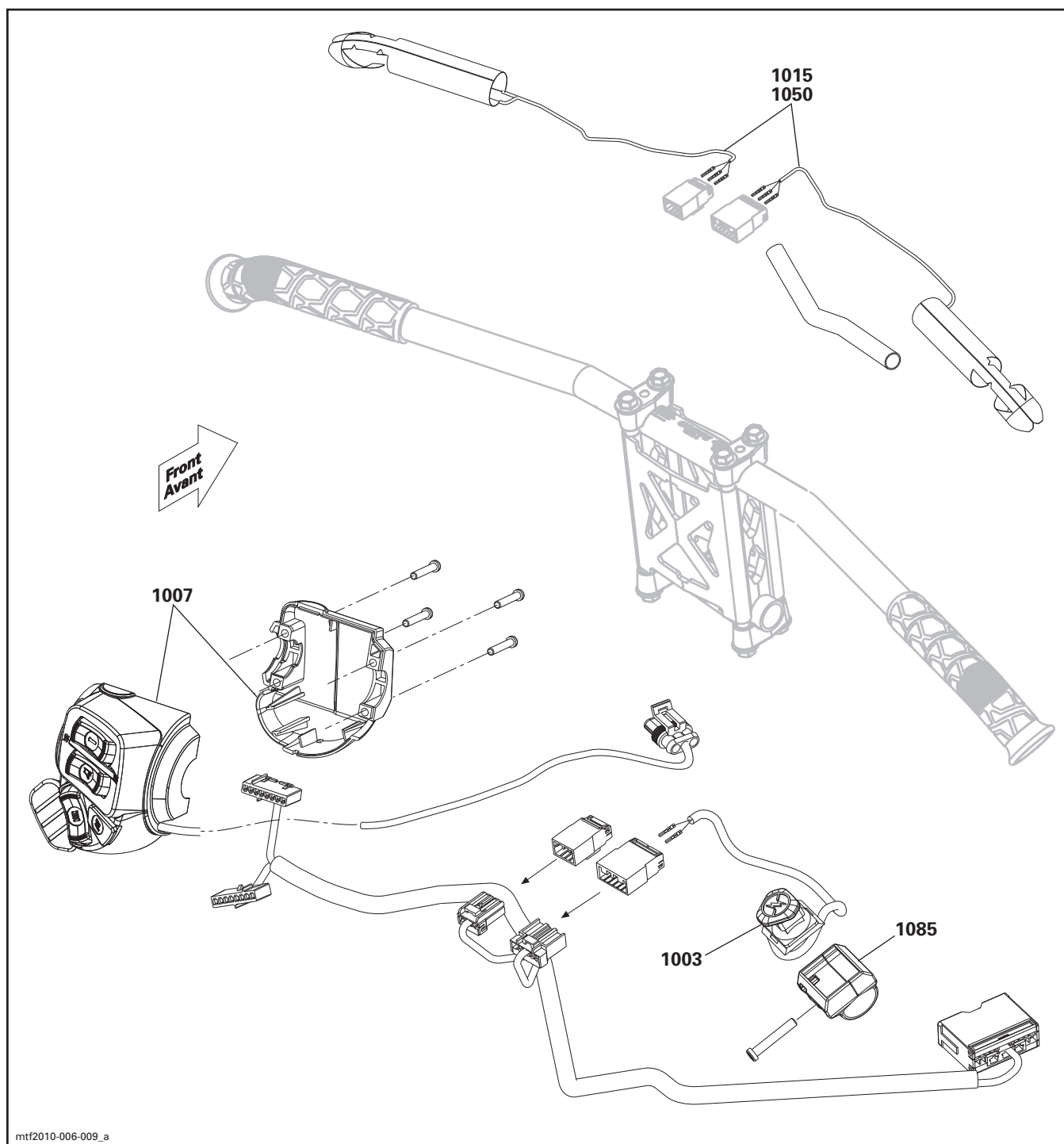


SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIC 600 ACE
			24	25	26	27	28
10	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0
10	01	IGNITION SWITCH INTERRUPTEUR D'ALLUMAGE	0.3	0.3	0.3	0.3	0.3
10	03	KILL SWITCH D'INTERRUPTEUR D'URGENCE	0.3	0.3	0.3	0.3	0.3
10	05	BRAKE LIGHT SWITCH INTERRUPTEUR DE FEU D'ARRÊT	0.3	0.3	0.3	0.3	0.3
10	06	TETHER CORD SWITCH OR D.E.S.S. CAPUCHON COUPE-CIRCUIT OU D.E.S.S.	0.3	0.3	0.3	0.3	0.3
10	07	IGNITION SWITCH BLOCK LOGEMENT DE RÉCEPTACLE (INTERRUPTEUR)	0.3	0.3	0.3	0.3	0.3
10	08	CURRENT OR GROUND WIRE FIL DE BATTERIE OU DE MASSE	0.3	0.3	0.3	0.3	0.3
10	09	HEADLAMP (ASS'Y) (ALL PARTS) PHARE (COMPLET) (TOUTES LES PIÈCES)	0.3	0.3	0.3	0.3	0.3
10	10	VOLTAGE REGULATOR RÉGULATEUR DE TENSION	0.7	0.7	0.7	0.7	0.7
10	12	TAIL LIGHT (ASS'Y) (ALL PARTS) FEU ARRIÈRE (COMPLET) (TOUTES LES PIÈCES)	0.3	0.3	0.3	0.3	0.3
10	13	BATTERY BATTERIE	0.3	0.3	0.3	0.3	0.3
10	15	HEATED GRIP (1) POIGNÉES CHAUFFANTE (1)	0.5	0.5	0.5	0.5	0.5
10	16	BULBS (ONE OR ALL) AMPOULES (UNE OU TOUTES)	0.3	0.3	0.3	0.3	0.3
10	17	HEATED THROTTLE LEVER MANETTE D'ACCÉLÉRATEUR CHAUFFANTE	0.3	0.3	0.3	0.3	0.3
10	23	HALOGEN BULB AMPOULE HALOGÈNE	0.3	0.3	0.3	0.3	0.3
10	31	DC OUTLET PLUG PRISE D'ACCESSOIRE DC			0.3		0.3
10	34	ELECTRONIC MODULE MODULE ÉLECTRONIQUE	0.7	0.7	0.7	0.7	0.7
10	41	ENGINE HARNESS CÂBLAGE DU MOTEUR	1.5	1.5	1.5	1.5	1.5
10	49	MULTIFUNCTION GAUGE CADRAN MULTIFONCTION	0.3	0.3	0.3	0.3	0.3
10	50	HEATED GRIPS (2) POIGNÉES CHAUFFANTES (2)	0.9	0.9	0.9	0.9	0.9
10	51	MAIN HARNESS CÂBLAGE PRINCIPAL	1.8	1.8	1.8	1.8	1.8
10	59	REAR HEATED GRIP (1) POIGNÉE CHAUFFANTE ARRIÈRE (1)		0.5			

SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 600 ACE	GRAND TOURING 600 ACE	EXPEDITION 600 ACE	TUNDRA 600 ACE	SKANDIC 600 ACE
			24	25	26	27	28
10	60	REAR HEATED GRIPS (2) POIGNÉES CHAUFFANTES ARRIÈRE (2)		0.9			
10	67	RELAY RELAIS	0.3	0.3	0.3	0.3	0.3
10	81	MULTIFUNCTION PLATE PLAQUE MULTIFONCTION	0.4	0.4	0.4	0.4	0.4
10	82	REVERSE SWITCH INTERRUPTEUR DE RENVERSE	0.3	0.3	0.3	0.3	0.3
10	85	KILL SWITCH SUPPORT SUPPORT D'INTERRUPTEUR D'URGENCE	0.3	0.3	0.3	0.3	0.3
10	118	STEERING HARNESS CÂBLAGE DU GUIDON	1.0	1.0	1.0	1.0	1.0
10	133	FAN HARNESS CABLAGÉ DU VENTILATEUR		0.3	0.3	0.3	
10	136	ECO HARNESS CABLAGÉ ECO	0.3	0.3	0.3	0.3	0.3
10	137	ECO SWITCH INTERRPTEUR ECO	0.3	0.3	0.3	0.3	0.3







Flat rate times are what the manufacturer pays the authorized dealer for warranty work, the times listed are usually unrealistic for even the most experienced mechanic and will take longer to actually complete.

Because of this dealers will usually charge more than the times posted.

I cannot be held responsible for any errors BRP has made in these service flat rate or parts manuals.

If you bought this manual from any other seller, they could be reselling my work.

Please leave them negative feedback & email me at bestshopmanuals@gmail.com.

Our goal is to be one of the BEST sellers on the internet by providing you with the BEST customer service and the BEST manuals on the market.

Thank you for choosing us.



INTRODUCTION

This publication governs all warranty labor allowances for 2020 BRP Snowmobiles.

1. HOW DOES IT WORK

We follow the procedures detailed in the BRP *Snowmobiles Shop Manual*. The flat rate time is the maximum time allowed for a repair involving any given part. **FLAT RATE TIME IS NOT CUMULATIVE.** You must use the flat rate time given for the longest lasting operation.

NOTE: The *Flat Rate Time Schedule* was prepared by skilled mechanics using the hand tool usually found in workshops and all the special tools mentioned in the *Shop Manual*.

2. COMPILATION

The *Flat Rate Time Schedule* is compiled as follows:

The actual required time to perform the repair plus (+) 30% correction factor up to 3.0 hours or (+) 15% over 3.0 hours time to take into account, among others:

- Vehicle handling
- Obtaining the parts
- Diagnosis
- Cleaning
- Special compensation (rusted bolts).

3. HOW TO USE IT

Refer to the system you need, locate part of series of parts replaced. List JOB CODE in the appropriate column on claim.

SYSTEM		PAGE
01	ENGINE	04
02	CARBURETOR AND FUEL SYSTEM	18
03	IGNITION SYSTEM	22
04	STARTER	24
05	TRANSMISSION SYSTEM	26
06	BRAKE SYSTEM	34
07	STEERING SYSTEM AND FRONT SUSPENSION	36
08	REAR SUSPENSION SYSTEM AND TRACK	41
09	BODY	48
10	ELECTRICAL SYSTEM	60

NOTE: Unless otherwise specified, dismantling order is: top to bottom, exterior to interior, front to rear.

All fractions of hours are in tenths:

0.1 = 6 minutes

0.2 = 12 minutes, and so on

LEGEND:

- * REQUIRES PRIOR AUTHORIZATION BY DISTRIBUTOR.
- ** INDICATE LABOUR TIME ON LINE "LABOUR ONLY" OF CLAIM.
- *** INDICATE \$\$\$ AMOUNT ON "SUB-CONTRACTED LABOUR" OF CLAIM.

IMPORTANT: Always use the longest flat rate time applicable to the repair performed.

4. JOB REQUIREMENTS

All the flat rate times mentioned in the following pages include the required operations such as: engine timing (rotary valve and ignition), connecting rod(s) alignment, cylinder head(s) torque or use of parallel bar, use of ignition tester, piston clearance/ring end gap measurement, crankshaft to crankcase measurement, cylinder honing, engine leak test.

5. ILLUSTRATIONS

The illustrations contained in this manual do not necessarily show every components of a given system as *Parts Catalog* do. Their purpose is to facilitate recognition of parts related to a flat rate time. **Item numbers on illustrations correspond to the four digit Job Code.**

6. FLAT RATE TIME SUGGESTION

SEND A WARRANTY CASE ON BOSSWeb INFO CENTER

In the case, you must provide the following information:

Section *Subject*:

- Flat rate time suggestion

Section *Your Question*:

- Model year;
- Model description;
- Description job code;
- Job code;
- Present flat rate;
- Suggested flat rate;
- Detailed repair procedure;

To ensure that your case will be promptly and efficiently processed please indicate the step by step repair procedure you performed.

INTRODUCTION

Cette publication détermine le temps de main-d'oeuvre couvert par la garantie pour les motoneiges BRP 2020.

1. UTILISATION DU MANUEL

En procédant de la façon indiquée dans le *Manuel de réparation motoneiges* BRP, chaque temps donné représente le maximum permis pour une réparation portant sur cette pièce. **LES TEMPS NE SONT PAS CUMULATIFS.** On doit inscrire le temps donné pour l'opération qui prend le plus de temps.

REMARQUE: Le *Barème de temps à taux fixe* a été préparé par des mécaniciens compétents utilisant les outils que l'on retrouve normalement dans les ateliers de réparation, en plus de tous les outils spéciaux mentionnés dans le *Manuel de réparation*.

2. COMPILATION

Le *Barème de temps à taux fixe* a été établi en compilant le temps nécessaire pour faire la réparation plus (+) un facteur de correction de 30% lorsqu'un travail dure 3.0 heures et moins, ou (+) 15% lorsqu'un travail dure plus de 3.0 heures. Cette compilation comprend, entre autres, les étapes suivantes:

- Manutention du véhicule
- Nettoyage
- Aller chercher les pièces, essais physiques
- Compensation spéciale (boulons rouillés)
- Diagnostic.

3. UTILISATION DU BARÈME

Se reporter à la section désirée, repérer la pièce ou l'ensemble de pièces remplacées et inscrire le CODE DE TRAVAIL dans la colonne appropriée sur la formule de réclamation.

SYSTÈME		PAGE
01	MOTEUR	04
02	CARBURATEUR ET SYSTÈME D'ALIMENTATION D'ESSENCE	18
03	SYSTÈME D'ALLUMAGE	22
04	DÉMARREUR	24
05	SYSTÈME DE TRANSMISSION	26
06	SYSTÈME DE FREIN	34
07	SYSTÈME DE DIRECTION ET SUSPENSION AVANT	36
08	SYSTÈME DE SUSPENSION ARRIÈRE ET CHENILLE	41
09	CARROSSERIE	48
10	SYSTÈME ÉLECTRIQUE	60

REMARQUE: Sauf indication contraire, le démontage doit s'effectuer de haut en bas, de l'extérieur vers l'intérieur, de l'avant vers l'arrière.

Toutes les fractions d'heures sont exprimées en dixièmes:

0.1 = 6 minutes

0.2 = 12 minutes, et ainsi de suite

LÉGENDE:

- * AUTORISATION REQUISE AVANT LE REMPLACEMENT.
- ** INSCRIRE LE TEMPS À LA LIGNE «MAIN-D'OEUVRE SEULEMENT».
- *** INSCRIRE LE MONTANT \$\$\$ À LA LIGNE «OUVRAGE SOUS-CONTRACTÉ».

IMPORTANT: Toujours utiliser le temps donné à l'opération qui nécessite le plus de temps.

4. TRAVAUX REQUIS

Tous les temps mentionnés dans les pages suivantes incluent les opérations telles que: réglage du moteur (valve rotative et allumage), alignement de la ou des bielles, couple de serrage de la ou des culasses ou l'utilisation de barres parallèles, utilisation du vérificateur d'allumage, mesure du jet des pistons/jeu en bout des segments, mesure de l'écart entre le vilebrequin et le carter, rectification du cylindre, vérification de fuite du moteur.

5. ILLUSTRATIONS

Contrairement aux *Catalogues de pièces*, les illustrations de ce manuel ne montrent pas nécessairement chacune des pièces qu'elles représentent, leur raison d'être étant plutôt de faciliter la reconnaissance des pièces reliées à un barème de temps à taux fixe. **Les numéros d'items sur les illustrations correspondent aux quatre derniers chiffres du code de travail.**

6. SUGGESTION DE BARÈME DE TEMPS À TAUX FIXE

ENVOYEZ UNE REQUÊTE GARANTIE BOSSWeb DEPUIS LA SECTION INFO CENTRE

Dans cette requête, vous devez fournir les informations suivantes:

Section *Objet*:

- Suggestion de barème de temps à taux fixe

Section *Votre Question*:

- L'année modèle;
- Description du modèle;
- Description du code de travail;
- Code de travail;
- Temps actuel;
- Temps suggéré;
- Détails de la marche à suivre;

Pour s'assurer que votre demande sera traitée dans les plus brefs délais et efficacement, s.v.p. nous fournir toutes les étapes de réparation dans les détails de la marche à suivre.

2020

LIQUID COOLED FOUR STROKES 4 TEMPS REFROIDIS PAR LIQUIDE

TABLE	DESCRIPTION	MODEL/ MODÈLE	ENGINE/ MOTEUR	CHASSIS TYPE/ TYPE DE CHÂSSIS	REAR SUSPENSION/ SUSPENSION ARRIÈRE
29	RENEGADE ENDURO 900 ACE	UNLA/UNLB	903 ACE	Gen4 137"	r-MOTION
	RENEGADE Adrenaline 900 ACE	MBLA/MBLB MBLC			
30	GT Sport 900 ACE	EALA	903 ACE	Gen4 137"	SC-5
	GT LTD 900 ACE	EBLA/EBLB			
31	EXPEDITION Sport 900 ACE	KDLA/KDLB	903 ACE	Gen4 154"	SC-5U
32	EXPEDITION LE 900 ACE	AALA/AALB	903 ACE	REV-XU 154"	SC-5U
	EXPEDITION SE 900 ACE	AELA/AELB AELC			
33	SKANDIC WT 900 ACE	FRLA/FRLB	903 ACE	REV-XU 154"	SC-5U
	SKANDIC SWT 900 ACE	LDLA/LDLB			
34	RENEGADE Adrenaline 900T ACE	DULA/DULB	903T ACE	Gen4 137"	r-Motion
	RENEGADE X 900T ACE	DSLA/DSLB DSLCL/DSLCLD DSLE/DSLFL DSLGL/DSLHL DSLJ/DSLML			
	RENEGADE XRS 900T ACE	DALA/DALB DALC/DALD DALE/DALF DALG/DALH DALJ/DALK DALL/DALM DALN/DALP DALR/DALS DALT/DALU DALV/DALW			
35	GT LTD 900T ACE	ERLA/ERLB	903T ACE	Gen4 137"	r-Motion
36	EXPEDITION LE 900T ACE	ACLA/ACLB	903t ACE	Gen4 154"	SC-5U
	EXPEDITION SE 900T ACE	AFLA/AFLB AFLC/AFLD			

SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900T
			29	30	31	32	33	34	35	36

01	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0	0	0	0
01*	01	REMOVE AND REPLACE ENGINE (ASS'Y) REPLACEMENT MOTEUR (COMPLET)	3.7	3.7	3.7	3.7	3.7	4.4	4.4	4.4
01	03	OIL PRESSURE SWITCH INTERRUPTEUR DE PRESSION D'HUILE	0.5	0.5	0.5	0.3	0.3	0.5	0.5	0.5
01	08	FAN VENTILATEUR			0.4	0.4	0.3		0.4	0.4
01	18	COOLANT TEMPERATURE SENDER CAPTEUR DE TEMPÉRATURE LIQUIDE DE REFROIDISSEMENT	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
01	19	THERMOSTAT THERMOSTAT	1.3	1.3	1.3	1.3	1.0	2.4	2.4	2.4
01	21	COOLANT HOSE T-FITTING BOYAU DE REFROIDISSEMENT DU RACCORD EN T	1.2	1.2	1.2	1.2		1.2	1.2	1.2
01	38	WATER PUMP SHAFT (ALL PARTS) ARBRE DE LA POMPE À EAU (TOUTES LES PIÈCES)	6.0	6.0	6.0	6.0	6.0	6.7	6.7	6.7
01	39	OIL TANK RÉSERVOIR D'HUILE	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
01	46	RADIATOR AND/OR GROMMET RADIATEUR ET/OU PASSE FILS			0.8	0.8	0.6		0.8	0.8
01	51	CYLINDER HEAD GASKET JOINT DE CULASSE	4.5	4.5	4.5	4.5	4.5	5.5	5.5	5.5
01	63	CRANKSHAFT BEARING PTO ROULEMENT DE VILEBREQUIN, COTE PDM	0.6	0.6	0.6	0.5	0.5	0.6	0.6	0.6
01	69	CRANKSHAFT VILEBREQUIN	7.5	7.5	7.5	7.5	7.5	8.2	8.2	8.2
01	71	EXHAUST MANIFOLD COLLECTEUR D'ÉCHAPPEMENT	0.5	0.5	0.5	0.5	0.5			
01	75	MUFFLER AND/OR EXHAUST GROMMET/SUPPORT SILENCIEUX ET/OU BAGUE D'ÉCHAPPEMENT/SUPPORT	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
01	79	COOLANT HOSE (TANK TO ENGINE) BOYAU SYSTÈME DE REFROIDISSEMENT (RÉSERVOIR AU MOTEUR)					1.0			
01	88	RUBBER MOUNT (MUFFLER) TAMPON D'ANCRAGE (SILENCIEUX)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
01	90	ENGINE OIL FILTER FILTRE À HUILE DU MOTEUR	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
01	94	REAR RADIATOR RADIATEUR ARRIÈRE					4.3			
01	96	OIL SIEVE CRIBLE D'HUILE	4.5	4.5	4.5	4.5	4.5	5.2	5.2	5.2
01	98	COOLING RESERVOIR RÉSERVOIR D'ANTIGEL	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4

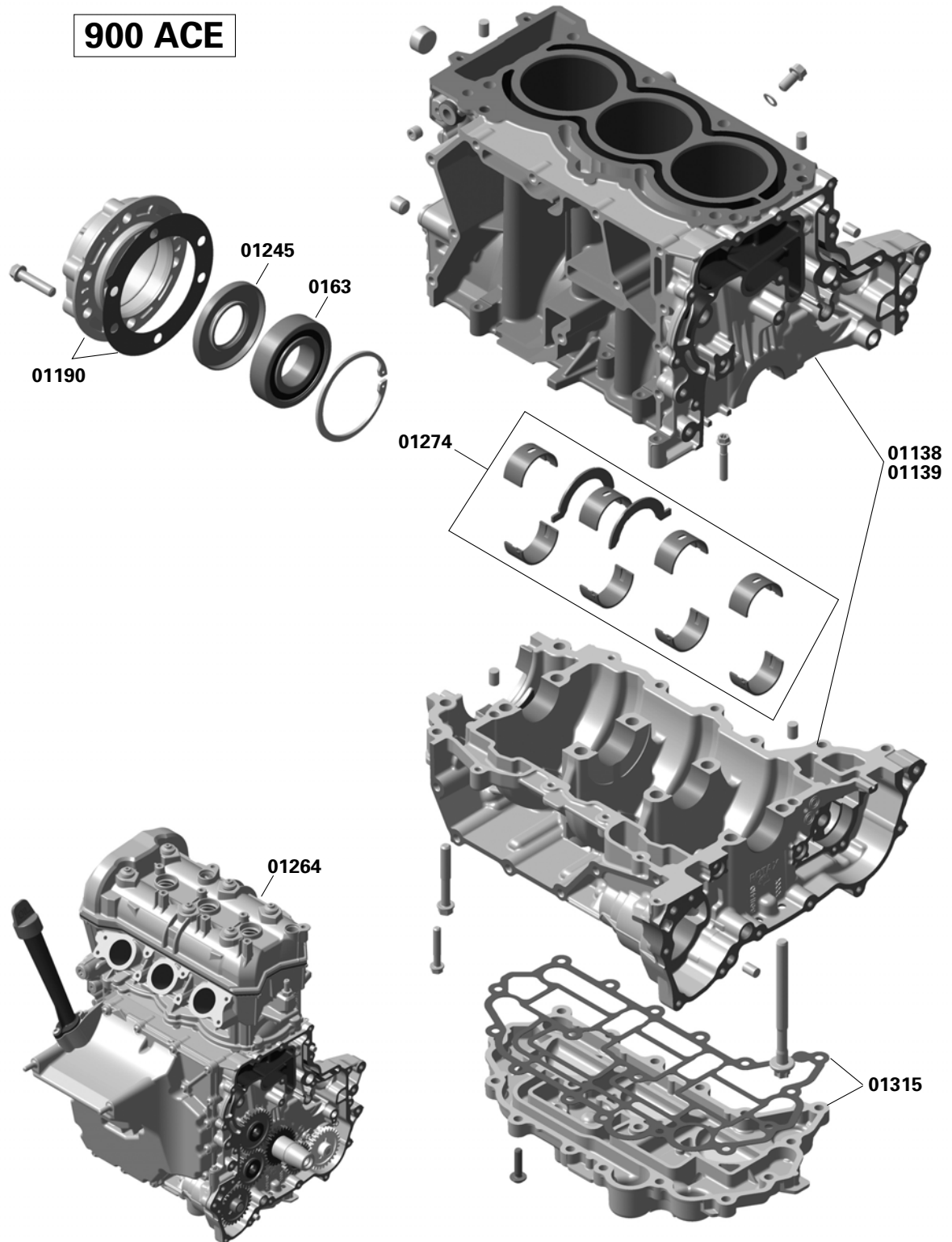
SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900T
			29	30	31	32	33	34	35	36
01	100	RADIATOR OUTLET HOSE BOYAU DE SORTIE DU RADIATEUR	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
01	101	PISTON, PIN, CIRCLIP, RING (1) PISTON, AXE, FREIN D'AXE, SEGMENT (1)	6.2	6.2	6.2	6.2	6.2	6.9	6.9	6.9
01	102	PISTONS, PINS, CIRCLIPS, RINGS (2) PISTONS, AXES, FREINS D'AXE, SEGMENTS (2)	6.3	6.3	6.3	6.3	6.3	7.0	7.0	7.0
01	103	PISTON, BEARING, PIN (3 PISTON) PISTON, ROULEMENT, AXE (3 PISTONS)	6.5	6.5	6.5	6.5	6.5	7.2	7.2	7.2
01	109	VALVE COVER AND/OR GASKET COUVERCLE DE SOUPAPE ET/OU JOINT D'ÉTANCHÉITÉ	1.5	1.5	1.5	1.5	0.7	3.0	3.0	3.0
01	111	TIMING GEARS ENGRENAGES DE LA DISTRIBUTION	2.5	2.5	2.5	2.5	1.6	3.1	3.1	3.1
01	114	CYLINDER HEAD AND/OR GASKET CULASSE ET/OU JOINT D'ÉTANCHÉITÉ	5.9	5.9	5.9	5.9	5.0	6.5	6.5	6.5
01	116	EXHAUST AND/OR INLET VALVE AND/OR SPRING AND/OR SEAL VALVE D'ADMISSION ET/OU D'ÉCHAPPEMENT ET/OU RESSORT ET/OU ANNEAU D'ÉTANCHÉITÉ	4.5	4.5	4.5	4.5	4.0	5.9	5.9	5.9
01	119	WATER PUMP HOUSING AND/OR IMPELLER CARTER DE POMPE À EAU ET/OU ROUE AILETTES	1.3	1.3	1.3	1.3	1.0	2.4	2.4	2.4
01	132	OIL PUMP GEAR ENGRENAGE DE LA POMPE À HUILE	4.7	4.7	4.7	4.7	4.2	5.4	5.4	5.4
01	133	OIL PIPE TUYAU À L'HUILE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
01	138	CRANKCASE RESEAL AND/OR GASKET RESCÈLEMENT CARTER ET/OU JOINT D'ÉTANCHÉITÉ	6.0	6.0	6.0	6.0	6.0	6.7	6.7	6.7
01	139	CRANKCASE REPLACEMENT REMPLACEMENT DU CARTER	8.0	8.0	8.0	8.0	7.5	8.7	8.7	8.7
01	146	OIL PUMP GEAR (2) ENGRENAGE POMPE À L'HUILE (2)	4.7	4.7	4.7	4.7	4.2	5.4	5.4	5.4
01	154	TIMING CHAIN (PTO SIDE) CHAÎNE D'ENGRENAGE (CÔTÉ PDM)	6.5	6.5	6.5	6.5	6.0	7.2	7.2	7.2
01	179	CHAIN GUIDE GUIDE DE CHAÎNE	2.2	2.2	2.2	2.2	1.5	2.9	2.9	2.9
01	182	OIL RADIATOR AND/OR O-RING RADIATEUR D'HUILE ET/OU JOINT	1.0	1.0	1.0	1.0	0.5	1.0	1.0	1.0
01	183	OIL PUMP COVER AND/OR SHAFT AND/OR ROTOR COUVERCLE POMPE ET/OU ARBRE ET/OU ROTOR	4.9	4.9	4.9	4.9	4.4	5.6	5.6	5.6
01	184	OIL PUMP HOUSING AND/OR ALL PARTS BOÎTIER POMPE HUILE ET/OU TOUTES LES PIÈCES	4.9	4.9	4.9	4.9	4.4	5.6	5.6	5.6
01	190	PTO HOUSING AND/OR GASKET BOÎTIER PDM ET/OU JOINT	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6
01	191	CHAIN TENSION GUIDE GUIDE DE TENSION DE CHAÎNE	6.1	6.1	6.1	6.1	5.2	6.7	6.7	6.7

SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900T
			29	30	31	32	33	34	35	36
01	192	CHAIN TENSIONER (ASS'Y) TENDEUR DE CHAÎNE (COMPLET)	0.5	0.5	0.5	0.5	0.4	0.5	0.5	0.5
01	200	WATER PUMP GEAR ENGRENAGE POMPE À EAU	4.7	4.7	4.7	4.7	4.2	5.4	5.4	5.4
01	206	COOLANT HOSE (REAR RADIATOR TO FRONT RADIATOR) BOYAU REFROIDISSEMENT (RADIATEUR ARRIÈRE AU RADIATEUR AVANT)	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2
01	207	COOLANT HOSE (ENGINE TO REAR RADIATOR) BOYAU DE REFROIDISSEMENT (MOTEUR AU RADIATEUR ARRIÈRE)				1.1	1.1			
01	215	OIL DIPSTICK JAUGE À L'HUILE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
01	216	PRESSURE CAP BOUCHON DU RADIATEUR	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
01	245	OUTPUT CRANKSHAFT SEAL (PTO SIDE) ANNEAU D'ÉTANCHÉITÉ SORTIE VILEBREQUIN (CÔTÉ PDM)	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6
01	246	WATER PUMP GEARS AND/OR SEAL ENGRENAGES POMPE À EAU ET/OU JOINT D'ÉTANCHÉITÉ	5.0	5.0	5.0	5.0	4.5	5.7	5.7	5.7
01	248	BREATHER GEAR AND/OR V-RING RENIFLARD ET/OU ANNEAU D'ÉTANCHÉITÉ EN V	1.0	1.0	1.0	1.0	1.0	1.7	1.7	1.7
01	250	CRANKSHAFT POSITION SENSOR (CPS) CAPTEUR POSITION DU VILEBREQUIN (CPV)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
01	255	EXHAUST/INLET VALVES AND/OR SPRINGS AND/OR SEALS (4) VALVES D'ADMISSION/D'ÉCHAPPEMENT ET/OU RESSORTS ET/OU ANNEAUX (4)	4.8	4.8	4.8	4.8	4.3	6.4	6.4	6.4
01	256	EXHAUST/INLET VALVES AND/OR SPRINGS AND/OR SEALS (8) VALVES D'ADMISSION/D'ÉCHAPPEMENT ET/OU RESSORTS ET/OU ANNEAUX (8)	5.0	5.0	5.0	5.0	4.5	6.6	6.6	6.6
01	257	EXHAUST/INLET VALVE A/O SPRINGS A/O SEALS (12) VALVES ADMISSION/ÉCHAPPEMENT E/O RESSORTS E/O ANNEAUX (12)	5.2	5.2	5.2	5.2	4.7	6.8	6.8	6.8
01	264	LONG BLOCK ENSEMBLE CARTER-CYLINDRE-CULASSE	5.9	5.9	5.9	5.9	5.4	7.6	7.6	7.6
01	274	CRANKSHAFT PLAIN BEARINGS PALIERS LISSE DU VILEBREQUIN	7.5	7.5	7.5	7.5	7.5	8.2	8.2	8.2
01	289	FRONT ENGINE SUPPORT (PTO SIDE) SUPPORT MOTEUR AVANT (CÔTÉ PDM)	1.3	1.3	1.3	1.3	0.6	1.3	1.3	1.3
01	290	REAR ENGINE SUPPORT (PTO SIDE) SUPPORT MOTEUR ARRIÈRE (CÔTÉ PDM)	2.0	2.0	2.0	2.0	0.6	2.0	2.0	2.0

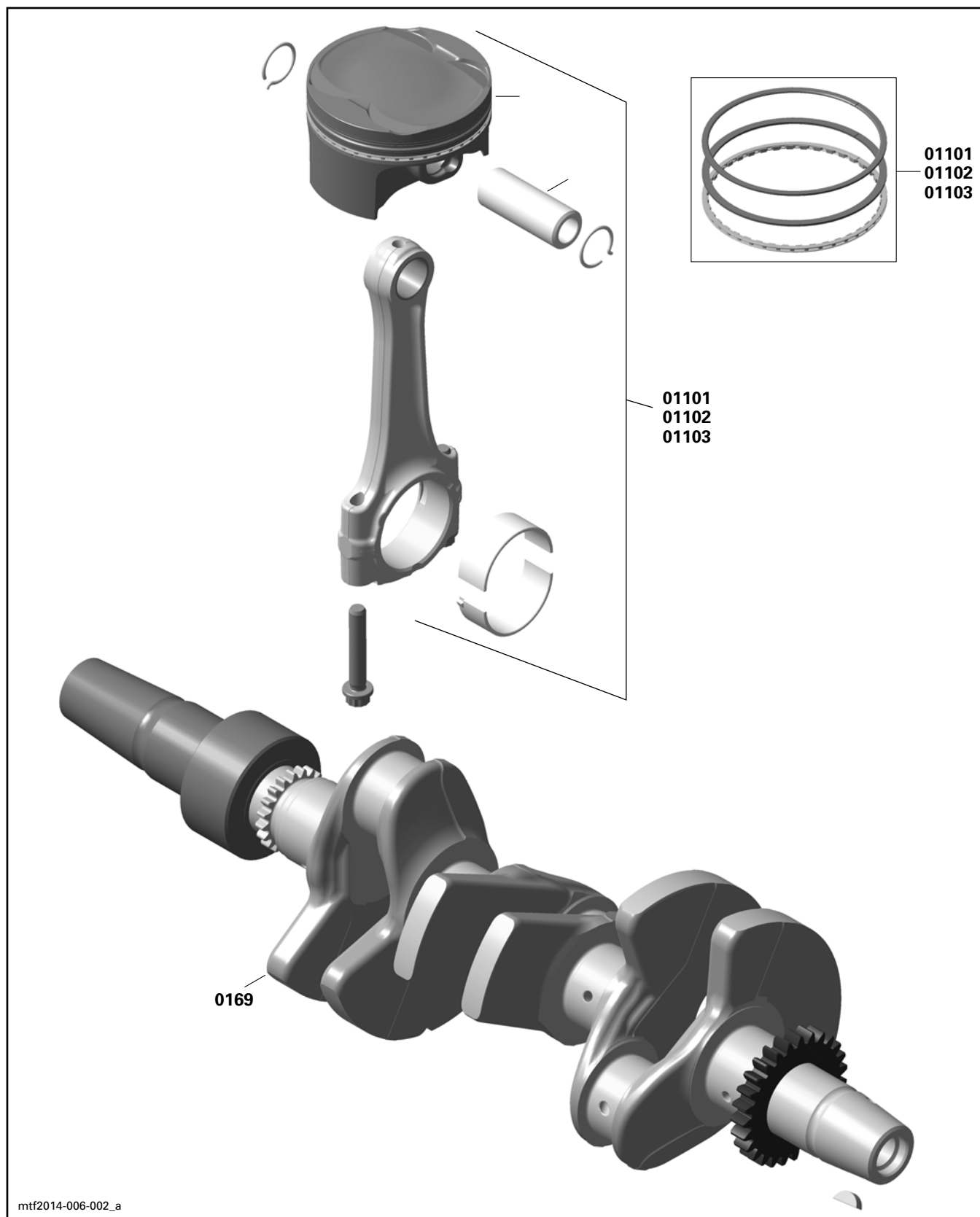
SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900T
			29	30	31	32	33	34	35	36
01	291	FRONT ENGINE SUPPORT (MAG SIDE) SUPPORT MOTEUR AVANT (CÔTÉ MAG)	1.2	1.2	1.2	1.2	0.6	1.2	1.2	1.2
01	292	REAR ENGINE SUPPORT (MAG SIDE) SUPPORT MOTEUR ARRIÈRE (CÔTÉ MAG)	3.0	3.0	3.0	3.0	1.0	3.0	3.0	3.0
01	293	FRONT RUBBER MOUNT (PTO SIDE) TAMPON D'ANCRAGE AVANT (CÔTÉ PDM)	0.8	0.8	0.8	0.8	0.6	0.8	0.8	0.8
01	294	REAR RUBBER MOUNT (PTO SIDE) TAMPON D'ANCRAGE ARRIÈRE (CÔTÉ PDM)	1.5	1.5	1.5	1.5	1.0	1.5	1.5	1.5
01	295	FRONT RUBBER MOUNT (MAG SIDE) TAMPON D'ANCRAGE AVANT (CÔTÉ MAG)	1.0	1.0	1.0	1.0	0.6	1.0	1.0	1.0
01	296	REAR RUBBER MOUNT (MAG SIDE) TAMPON D'ANCRAGE ARRIÈRE (CÔTÉ MAG)	3.0	3.0	3.0	3.0	1.2	3.0	3.0	3.0
01	311	CAMSHAFT INTAKE/EXHAUST AND/OR CAMSHAFT BRACKETS ARBRE À CAME D'ADMISSION/ÉCHAPPEMENT ET/OU SUPPORTS D'ARBRE À CAME	3.1	3.1	3.1	3.1	2.3	3.7	3.7	3.7
01	315	OIL SUMP COVER AND GASKET COUVERCLE DU CARTER D'HUILE ET JOINT D'ÉTANCHÉITÉ	4.2	4.2	4.2	4.2	4.2	4.9	4.9	4.9
01	318	RADIATOR SUPPORT SUPPORT DE RADIATEUR					0.3			
01	321	MODULE SUPPORT SUPPORT DU MODULE	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
01	322	WATER PIPE TUYAU D'EAU		0.6	0.6	0.6	0.6			
01	323	WATER PIPE DOUBLE TUYAU D'EAU DOUBLE	0.6	0.6	0.8	0.8	0.8	0.6	0.6	0.6
01	324	FAN SUPPORT SUPPORT DU VENTILATEUR			0.5	0.5	0.5		0.5	0.5
01	325	COOLANT HOSE (WATER PUMP HOUSING TO RADIATOR) BOYAU DE REFROIDISSEMENT (BOÎTIER DE LA POMPE À EAU AU RADIATEUR)	1.2	1.2	1.2	1.2	0.6	1.2	1.2	1.2
01	335	COOLANT HOSE (WATER PUMP) BOYAU DE REFROIDISSEMENT (POMPE A EAU)	1.2	1.2	1.2	1.2		1.2	1.2	1.2
01	353	INJECTORS (ALL) INJECTEUR (TOUS)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
01	369	TURBOCHARGER (ASS'Y) TURBOCOMPRESSEUR (COMPLET)						2.2	2.2	2.2
01	400	SOLENOID VALVE SOUPAPE SOLENOIDE						0.3	0.3	0.3
01	401	COOLANT TUBE (TURBO) TUYAU DE REFROIDISSEMENT (TURBO)						0.5	0.5	0.5
01	403	TURBO GASKET JOINT D'ETANCHEITE DU TURBO						2.2	2.2	2.2

SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900T
			29	30	31	32	33	34	35	36
01	414	WASTE GATE ACTUATOR ACTUATEUR SOUPAPE DE DÉCHARGE						1.0	1.0	1.0
01	415	EXHAUST FLANGE BRIDE D'ÉCHAPPEMENT						0.5	0.5	0.5

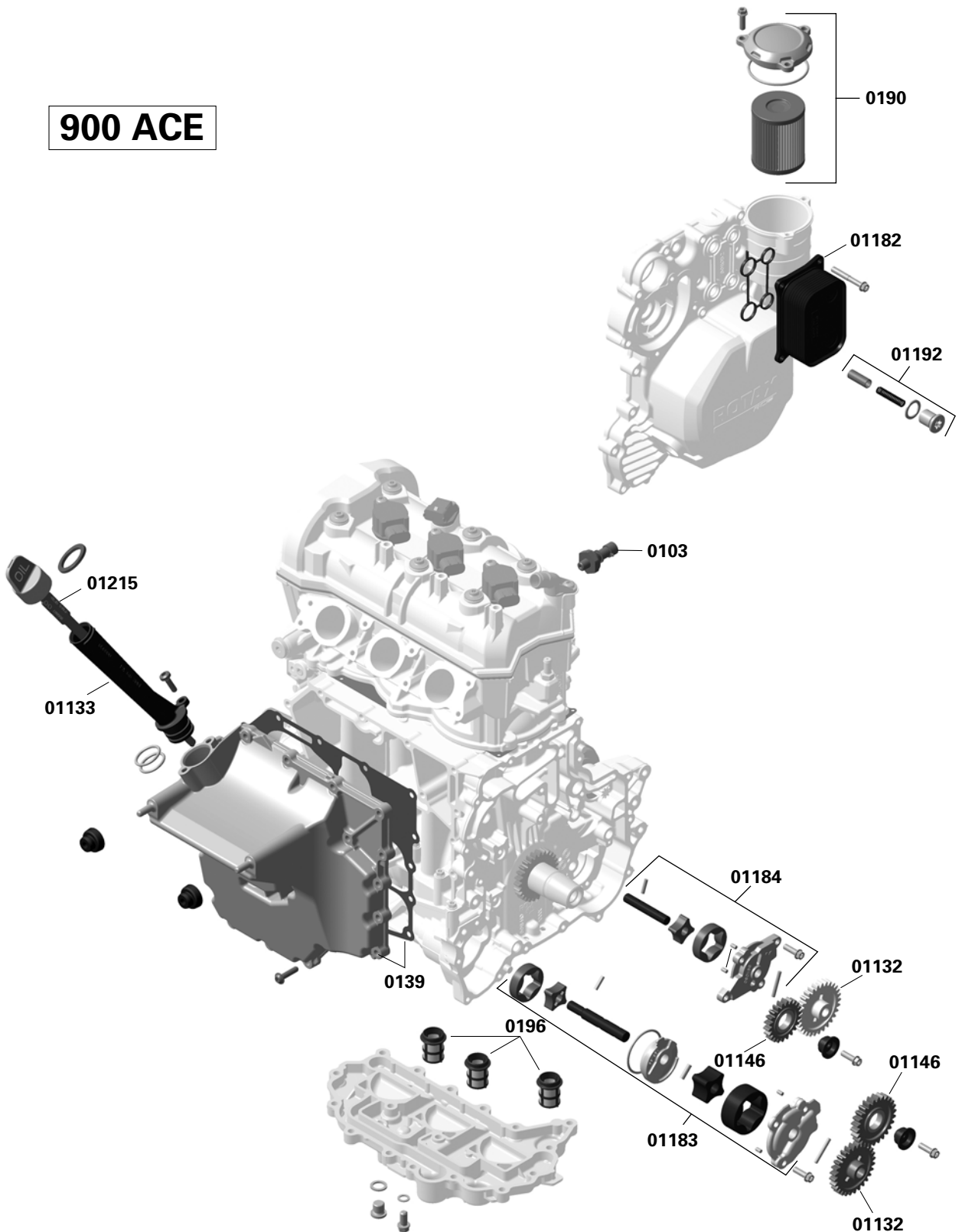
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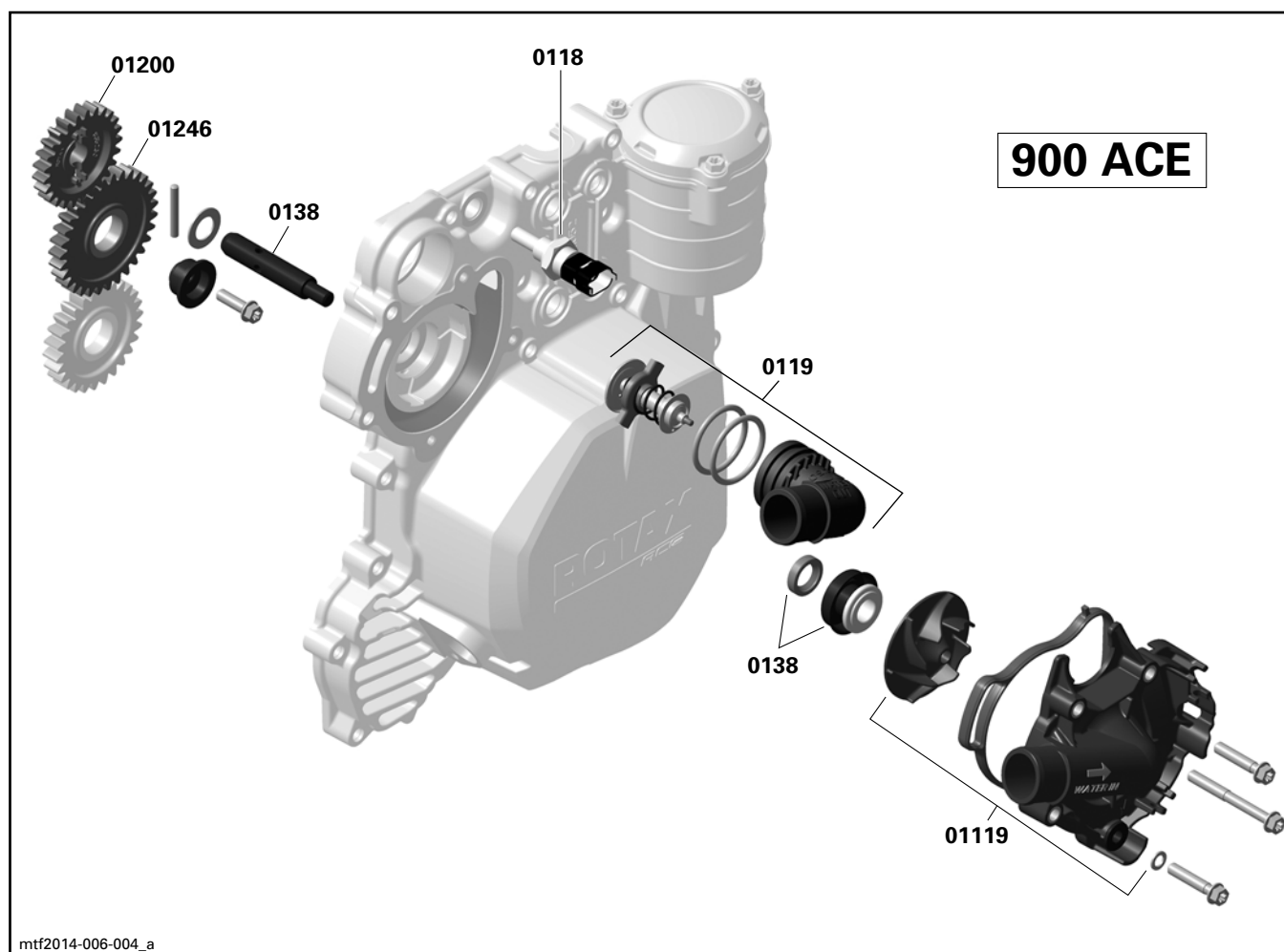
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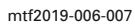


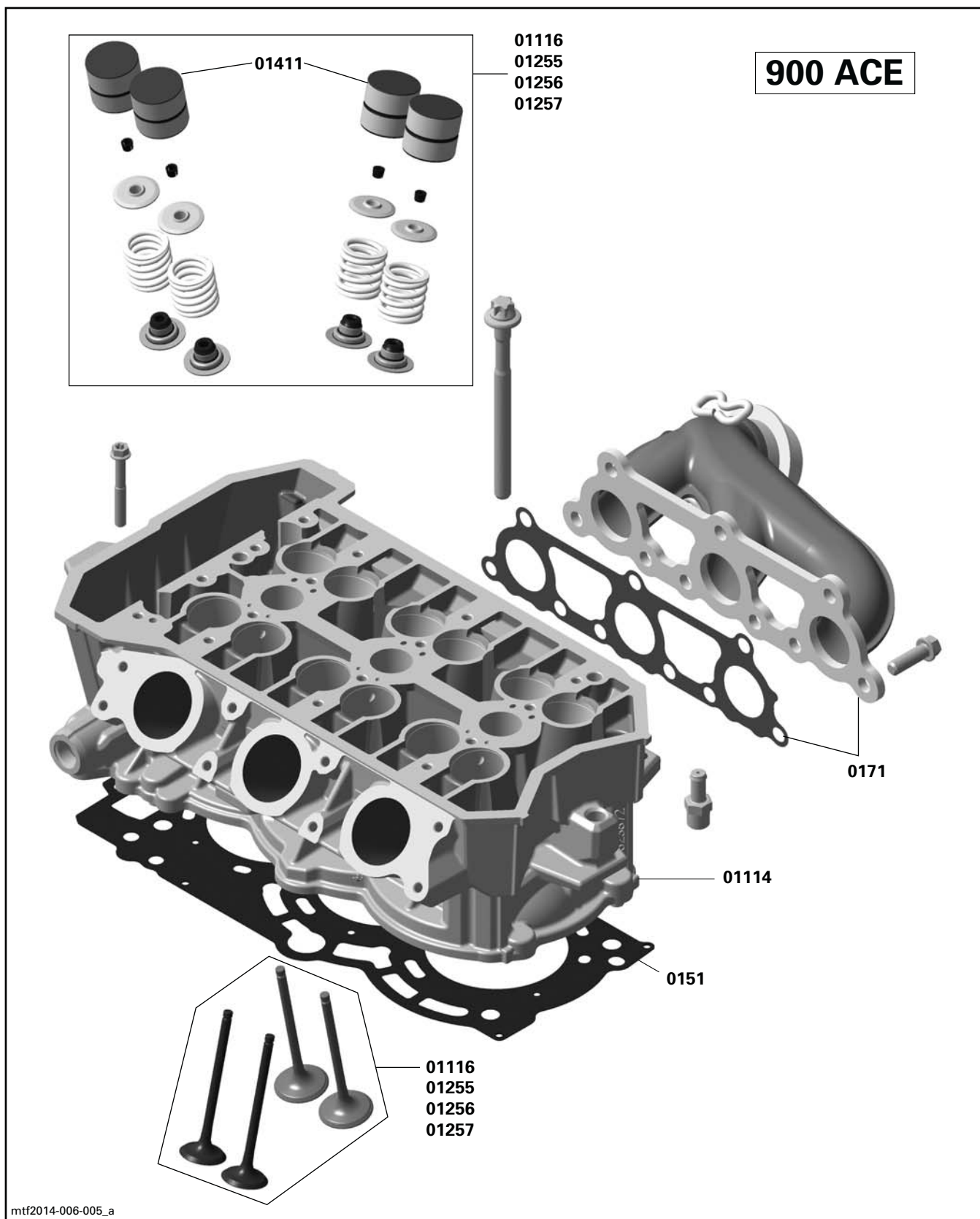
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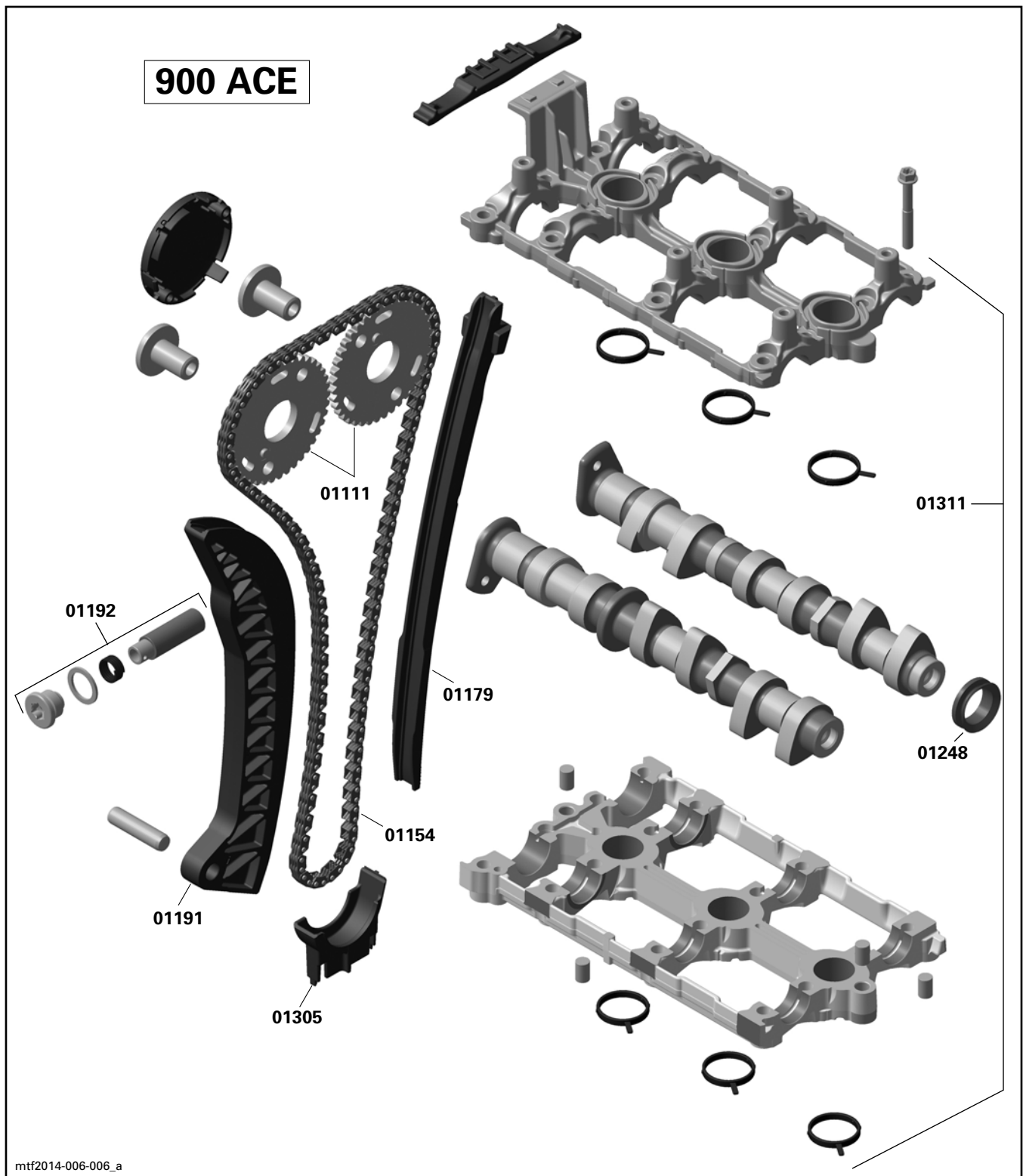


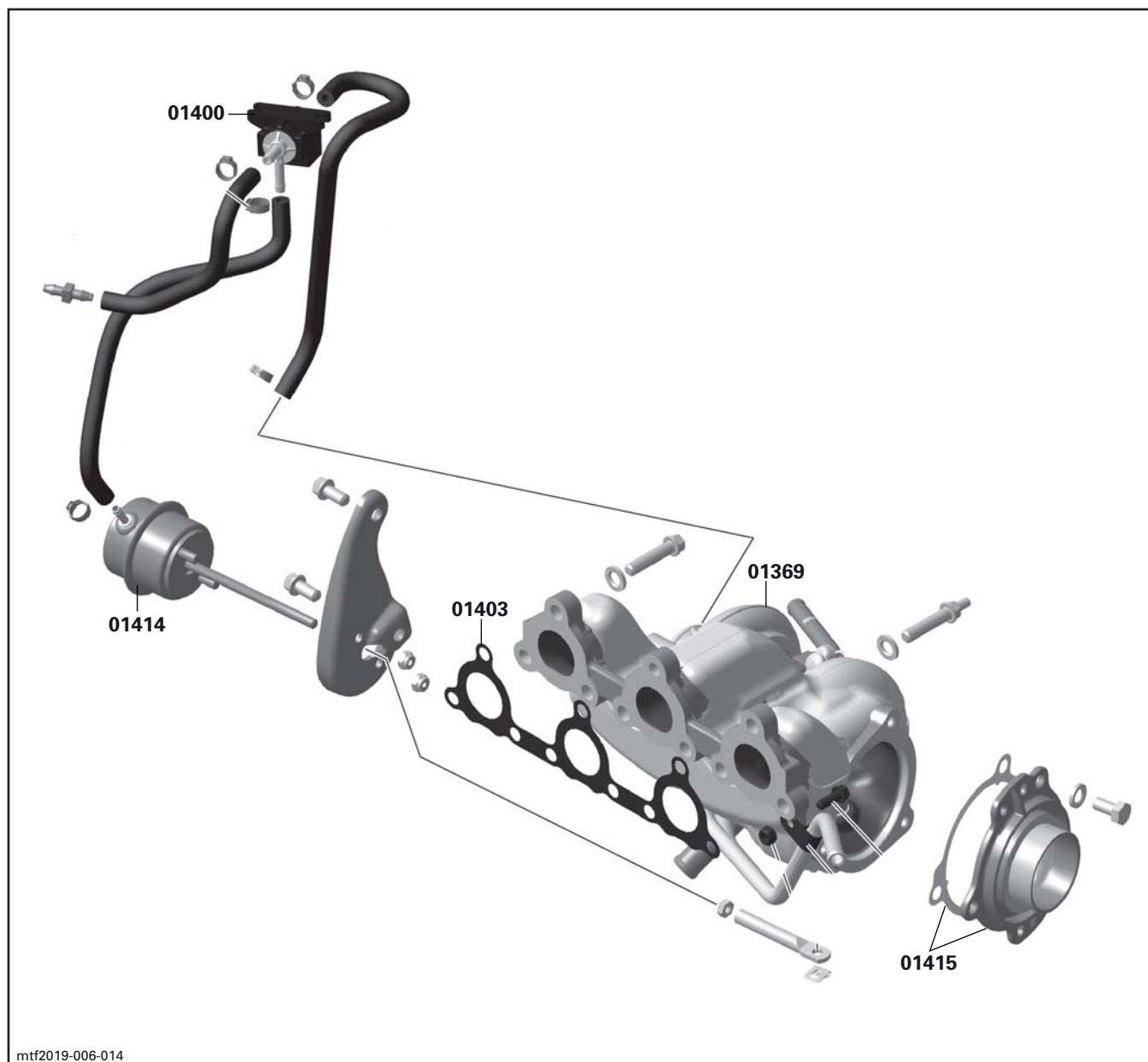
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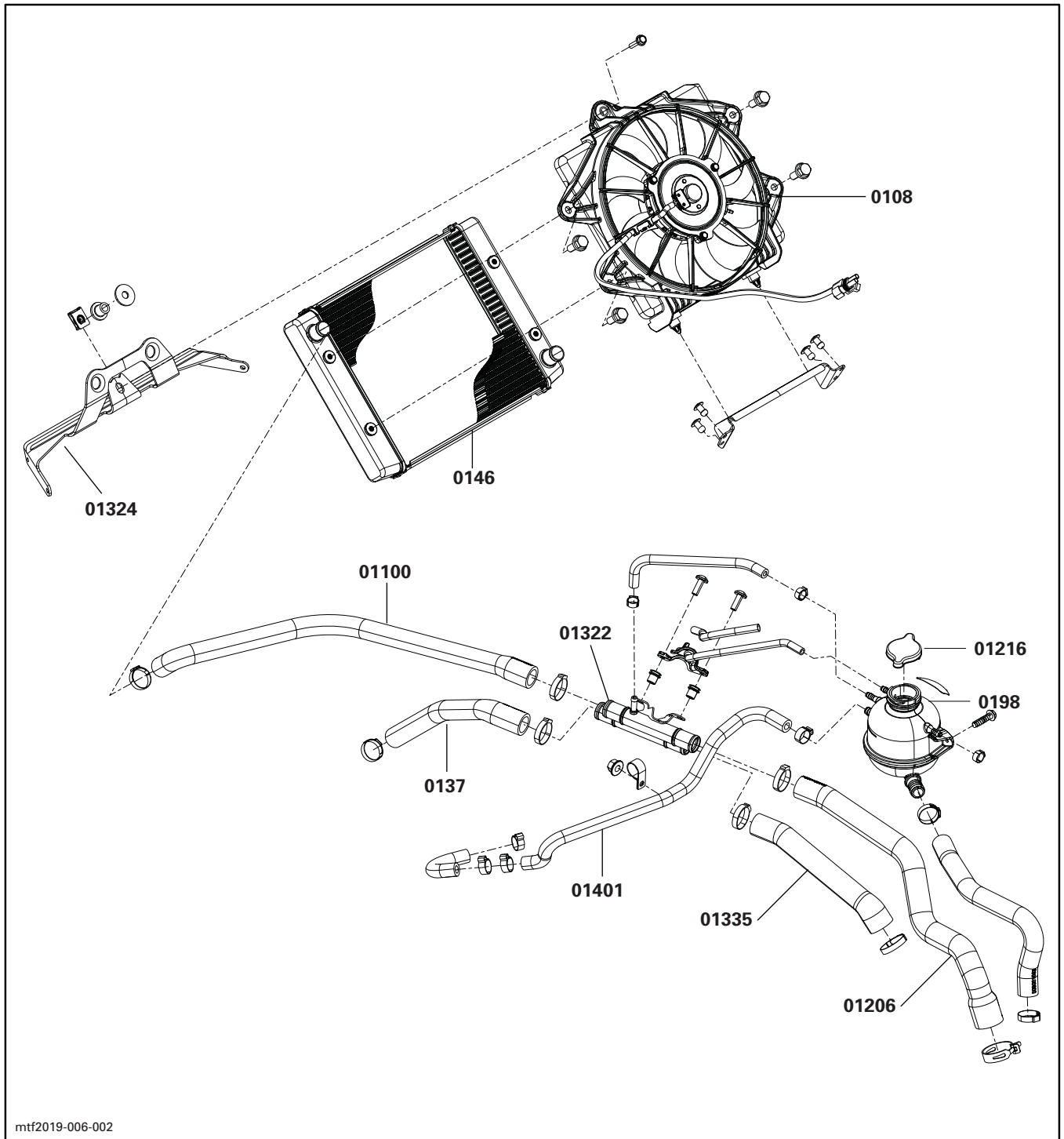






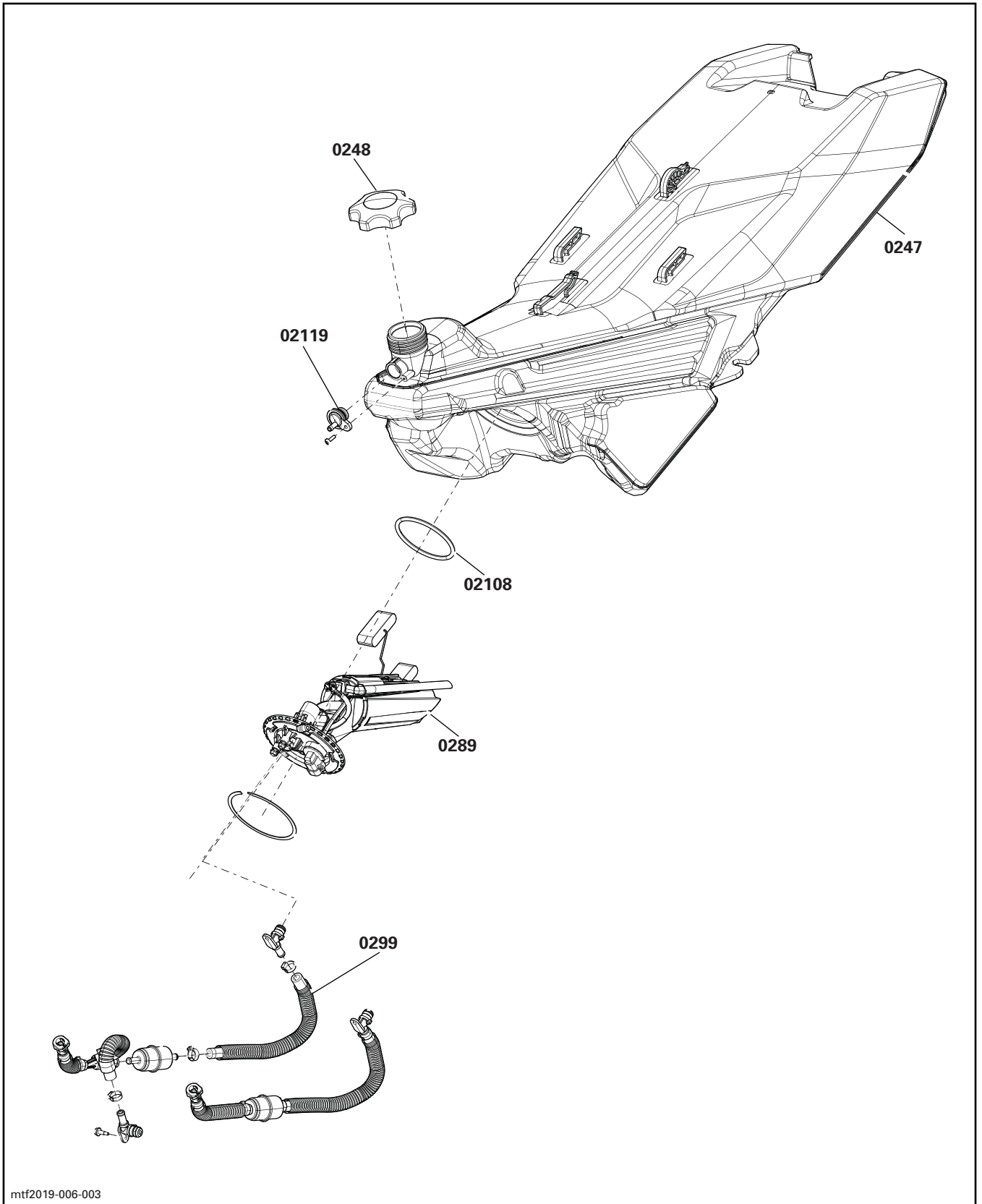


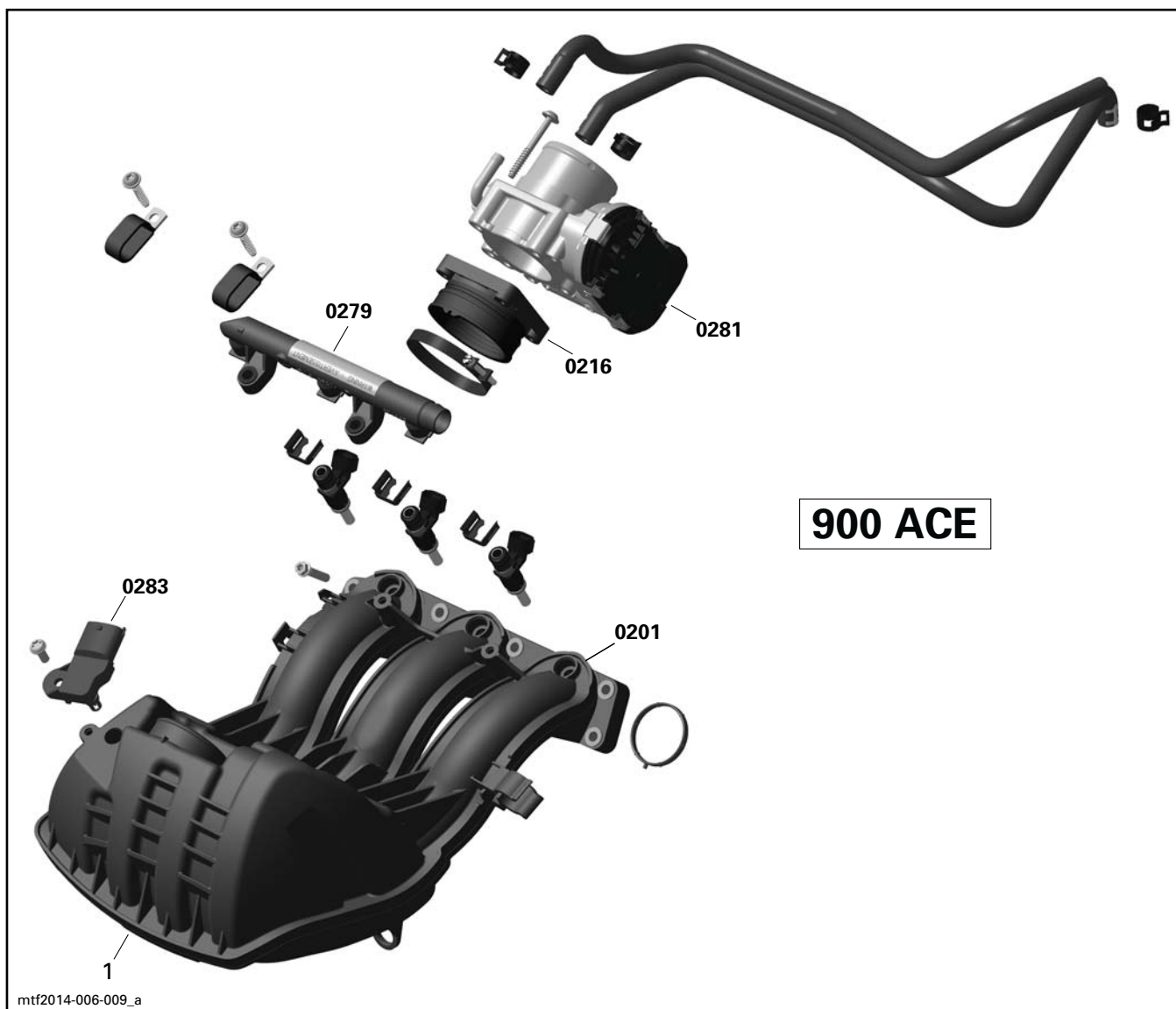


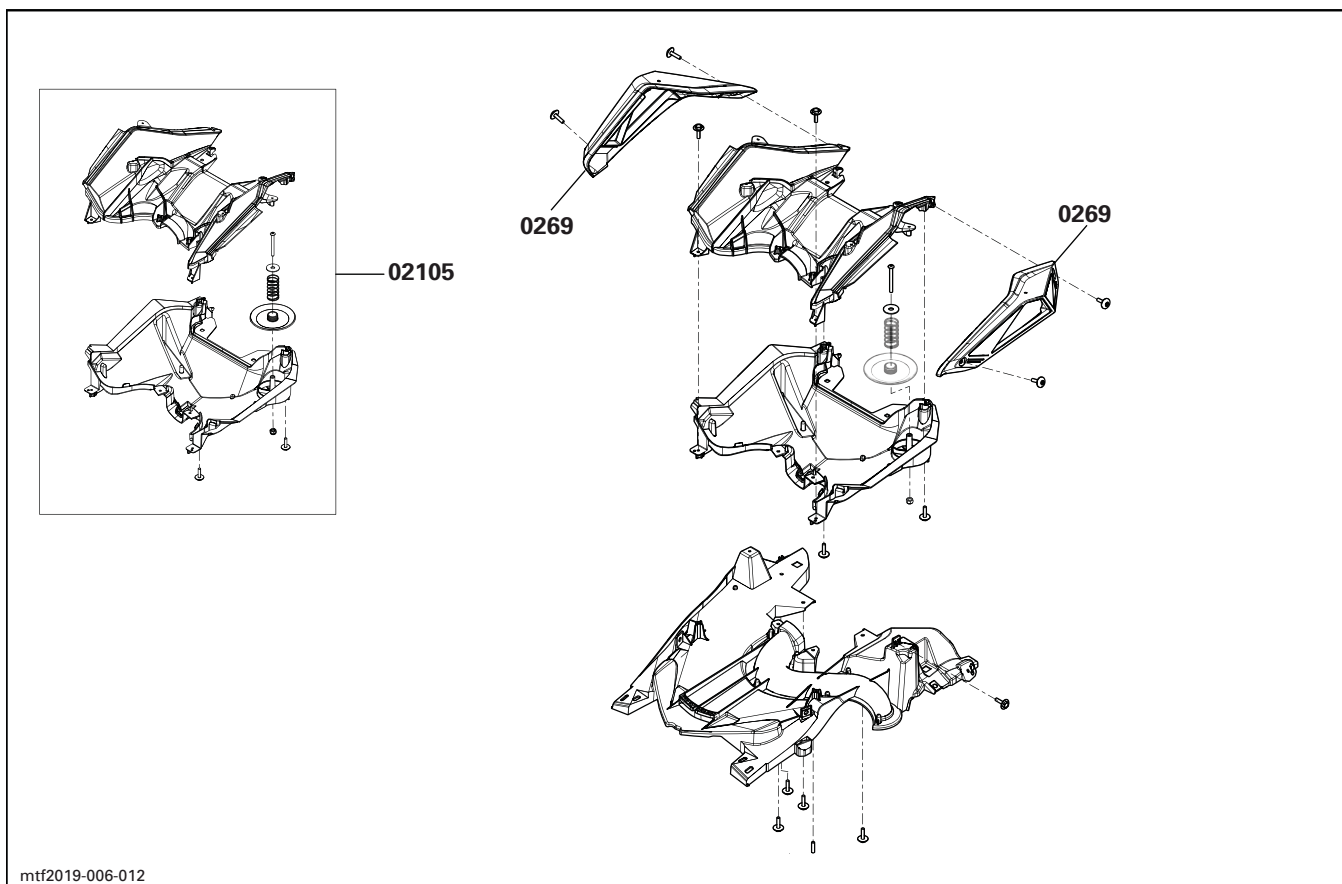


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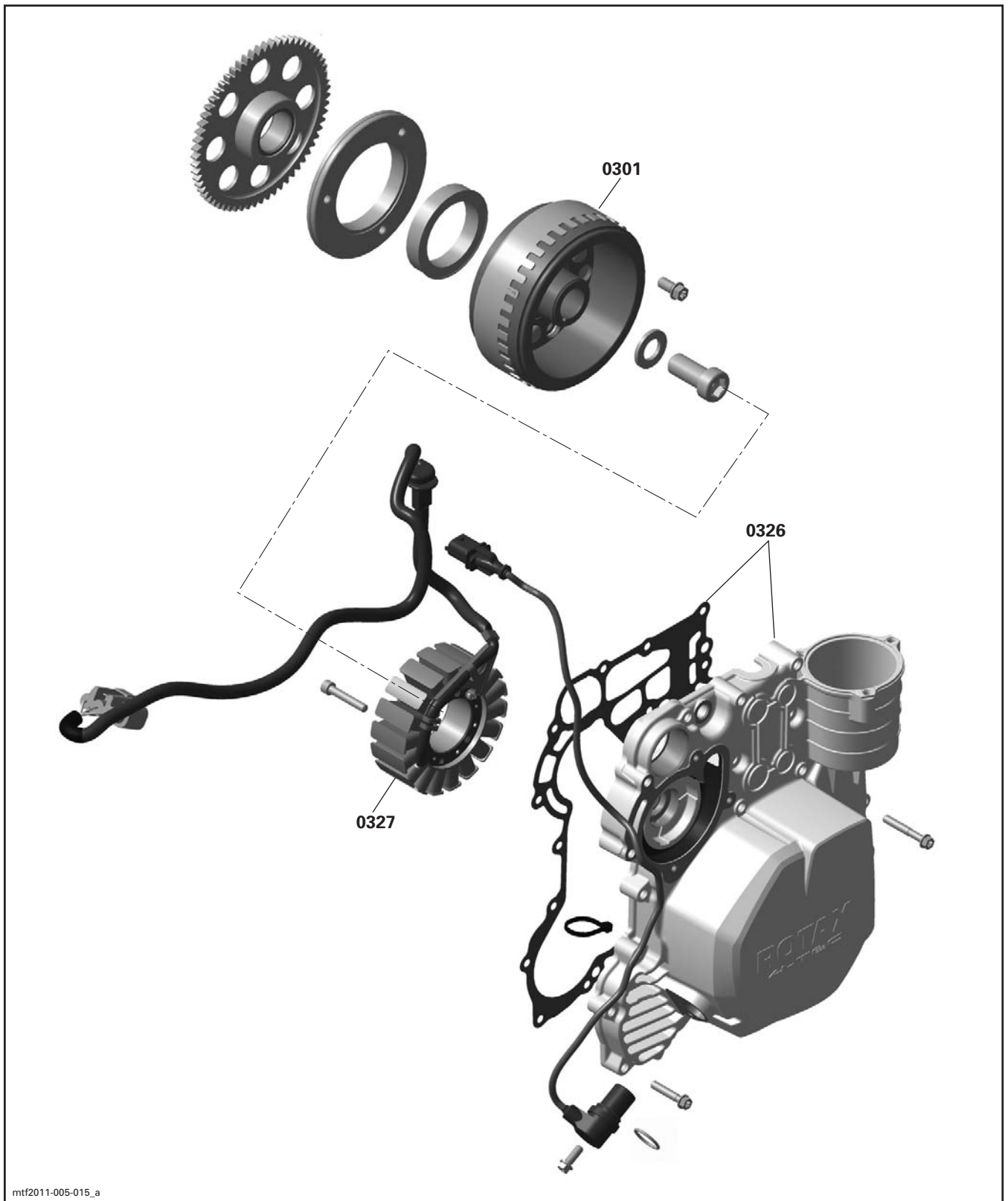
SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900 T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900 T
			29	30	31	32	33	34	35	36
02	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0	0	0	0
02	01	AIR SILENCER (ASS'Y) (ALL PARTS) SILENCIEUX D'ADMISSION (COMPLET) (TOUTES LES PIÈCES)	2.5	2.5	2.5	2.5	1.5	2.5	2.5	2.5
02	16	INTAKE ADAPTOR ADAPTATEUR D'ADMISSION	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
02	19	AIR INTAKE TUBE TUYAU D'ADMISSION D'AIR	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
02	47	FUEL TANK RÉSERVOIR À ESSENCE	1.2	1.2	1.2	1.2	1.5	1.2	1.2	1.2
02	48	FUEL TANK CAP BOUCHON DU RÉSERVOIR À ESSENCE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
02	50	THROTTLE HANDLE HOUSING LOGEMENT MANETTE ACCÉLÉRATEUR	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
02	52	FUEL FILTER FILTRE À ESSENCE	1.2	1.2	1.2	1.2	1.5	1.2	1.2	1.2
02	65	FUEL SENSOR (ASS'Y) CAPTEUR DE NIVEAU D'ESSENCE (COMPLET)	1.2	1.2	1.2	1.2	1.5	1.2	1.2	1.2
02	69	AIR FILTER FILTRE À AIR	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
02	79	FUEL RAIL RAMPE D'ESSENCE	1.2	1.2	1.2	1.2	1.0	1.2	1.2	1.2
02	81	THROTTLE BODY (ASS'Y) CARTER ACCÉLÉRATEUR (COMPLET)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
02	83	AIR PRESSURE SENSOR CAPTEUR PRESSION D'AIR	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
02	89	FUEL PUMP MODULE MODULE POMPE À ESSENCE	1.2	1.2	1.2	1.2	1.5	1.2	1.2	1.2
02	99	FUEL INJECTION HOSE (ASS'Y) BOYAU D'ESSENCE À INJECTION (COMPLET)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
02	105	SECONDARY CHAMBER (ASS'Y) CHAMBRE SECONDAIRE (COMPLET)	0.5	0.5	0.5	0.5	0.4	0.5	0.5	0.5
02	108	FUEL PUMP NUT AND/OR GASKET ÉCROU DE LA POMPE À ESSENCE ET/OU JOINT D'ÉTANCHÉITÉ	1.2	1.2	1.2	1.2	1.4	1.2	1.2	1.2
02	119	CHECK VALVE SOUPAPE À ESSENCE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
02	122	INTERCOOLER REFROIDISSEUR						0.4	0.4	0.4
02	124	INTERCOOLER HOSE BOYAU INTERCOOLER						0.4	0.4	0.4







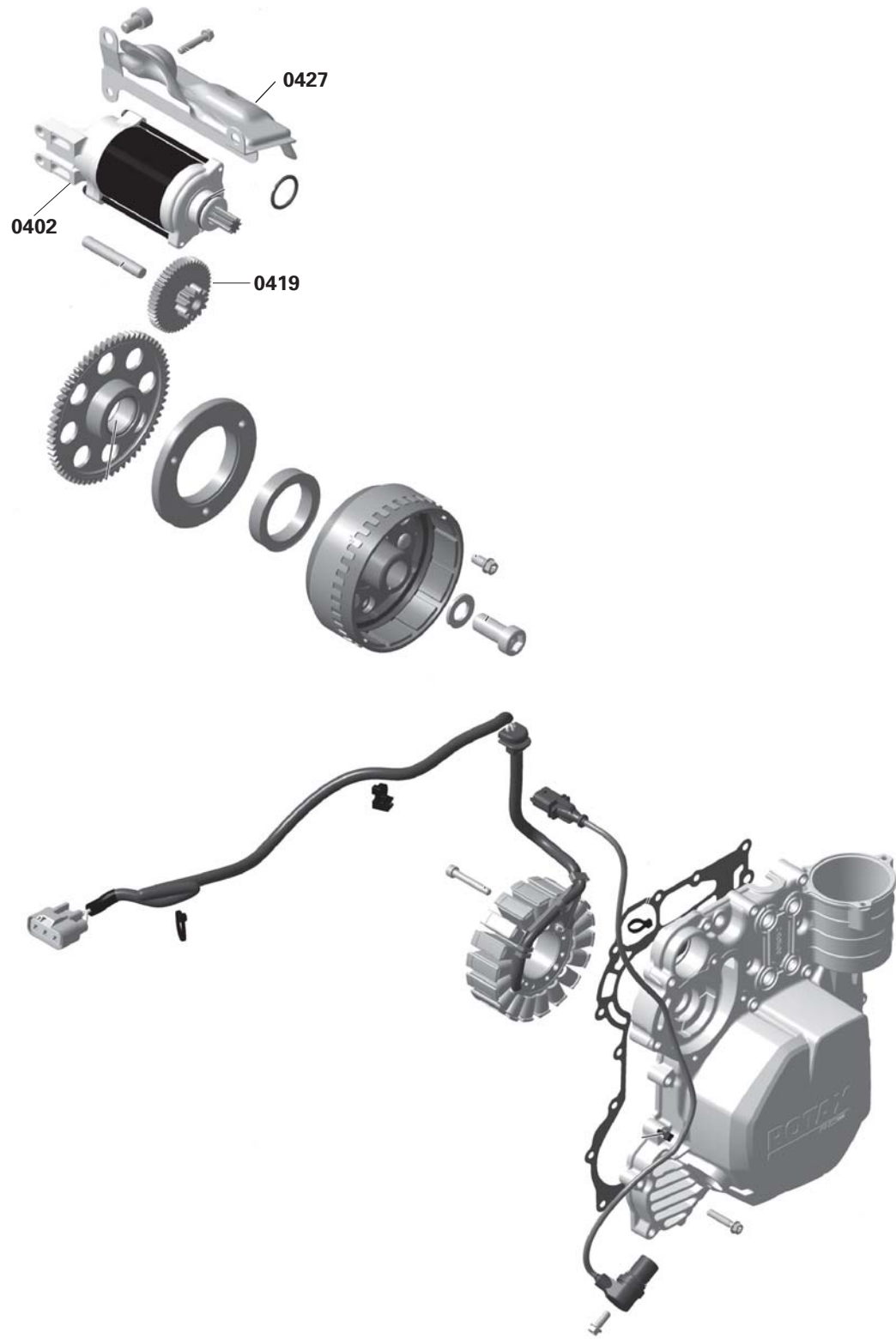
SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900T
			29	30	31	32	33	34	35	36
03	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0	0	0	0
03	01	FLYWHEEL VOLANT MOTEUR	4.7	4.7	4.7	4.7	4.2	5.4	5.4	5.4
03	08	IGNITION COIL BOBINE D'ALLUMAGE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
03	26	MAGNETO COVER AND/OR GASKET COUVERCLE DU MAGNÉTO ET/OU JOINT D'ÉTANCHÉITÉ	4.5	4.5	4.5	4.5	4.0	5.2	5.2	5.2
03	27	STATOR (ASS'Y) STATOR (COMPLET)	4.5	4.5	4.5	4.5	4.0	5.2	5.2	5.2



STARTER SYSTEM SYSTÈME DE DÉMARREUR

SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900T
			29	30	31	32	33	34	35	36

04	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0	0	0	0
04	02	ELECTRIC STARTER (ASS'Y) DÉMARREUR ÉLECTRIQUE (COMPLET)	0.5	0.5	0.5	0.5	0.4	1.6	1.6	1.6
04	03	STARTER RELAY SOLÉNOÏDE DE DÉMARREUR	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
04	19	STARTER DRIVE LANCEUR DÉMARREUR	4.7	4.7	4.7	4.7	4.2	5.4	5.4	5.4
04	27	HEAT SHEILD DÉFLECTEUR DE CHALEUR						1.5	1.5	1.5

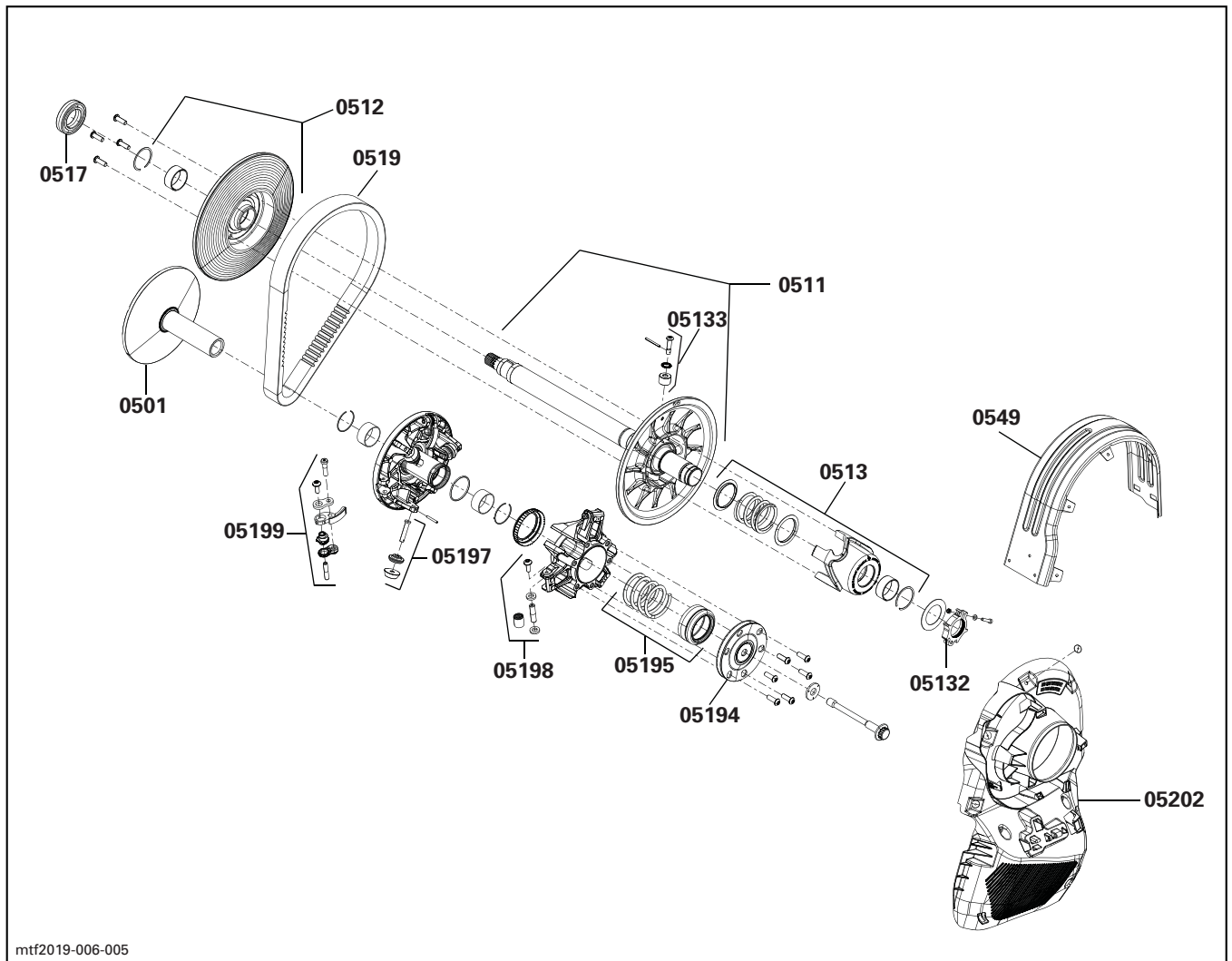


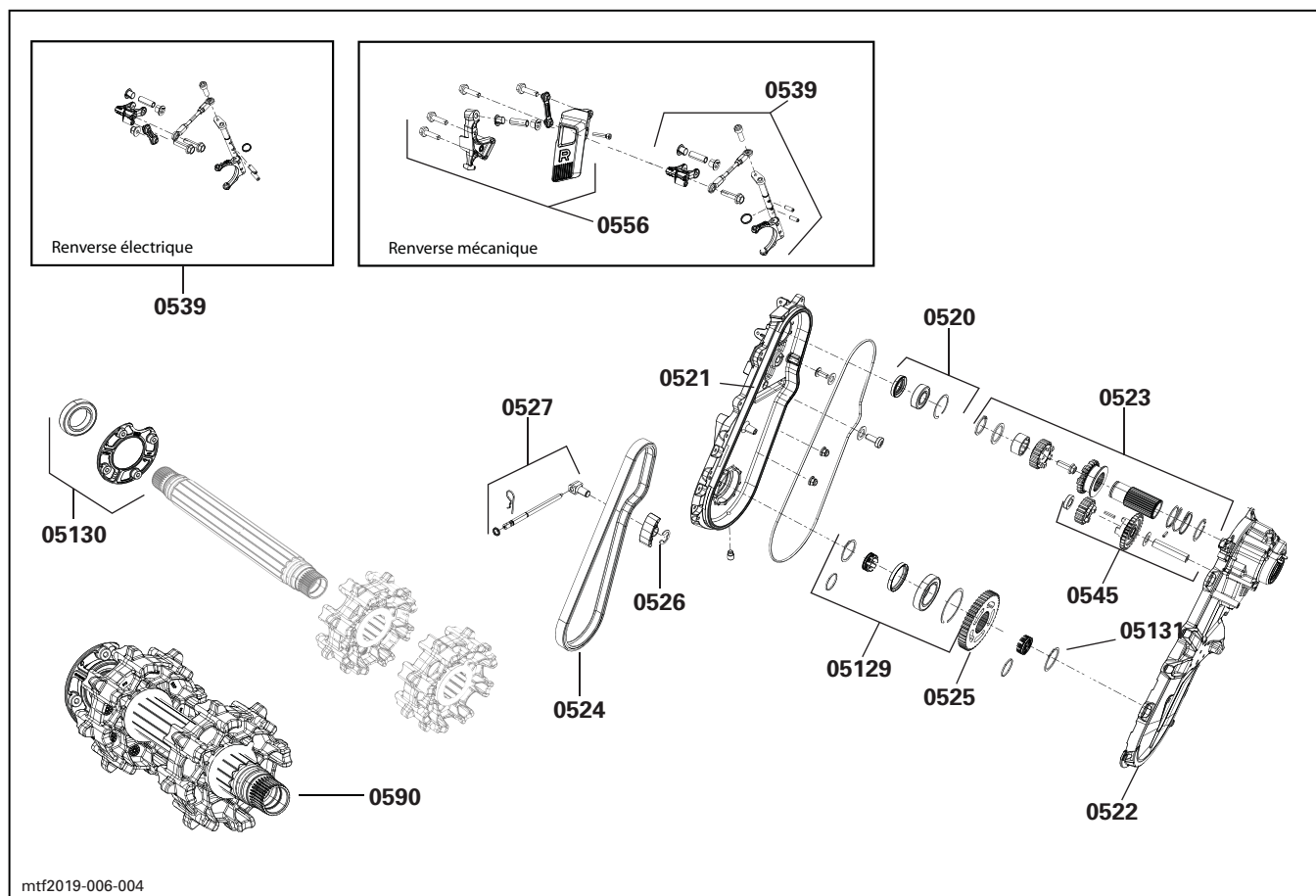
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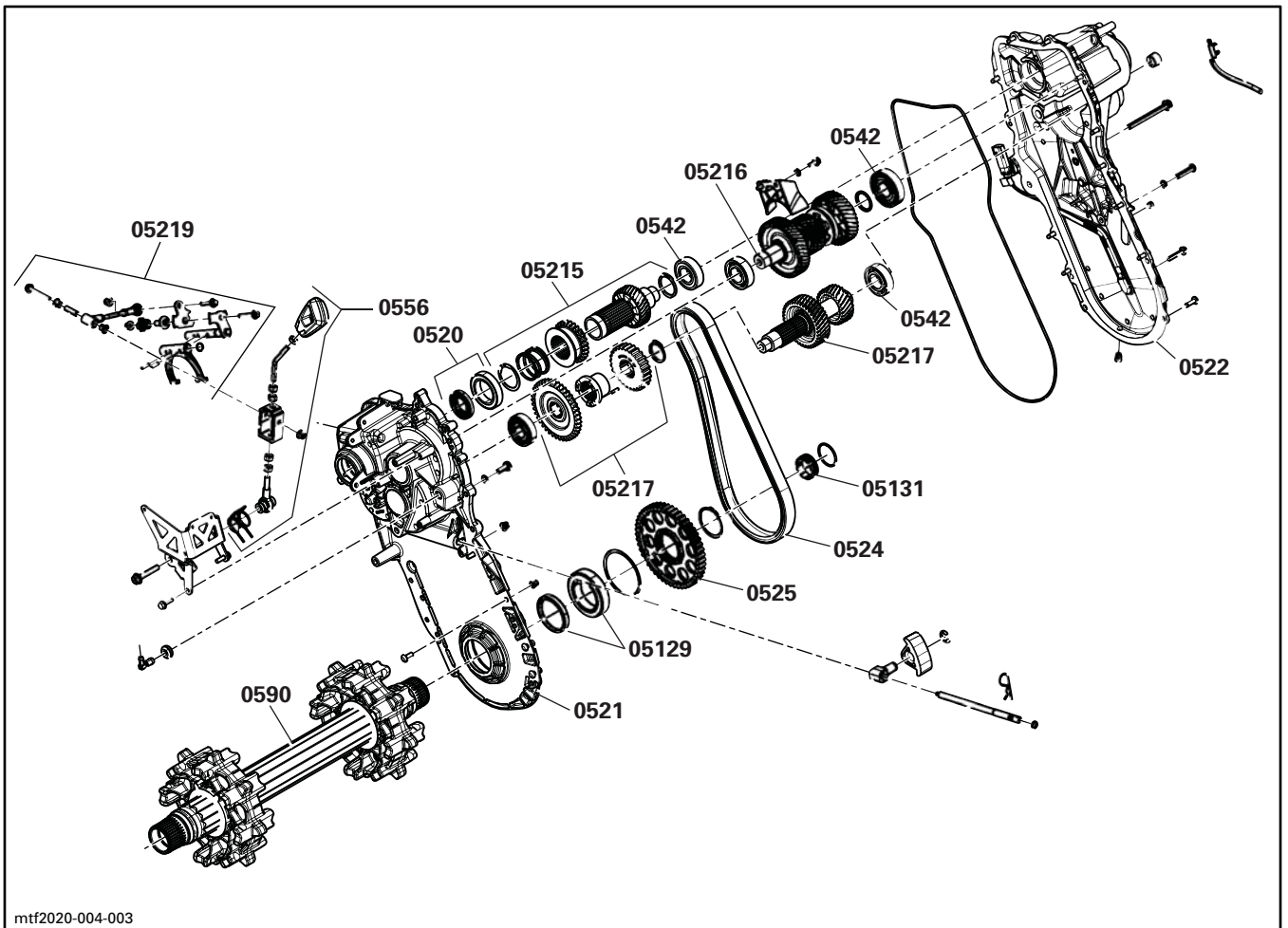
SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900T
			29	30	31	32	33	34	35	36
05	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0	0	0	0
05	01	DRIVE PULLEY (ASS'Y) OR SLIDING FLANGE POULIE MOTRICE (COMPLET) OU FLASQUE COULISSANTE	0.7	0.7	0.7	0.7	0.3	0.7	0.7	0.7
05	06	GOVERNOR CUP AND/OR FIXED HALF CUVETTE DE RÉGULATEUR ET/OU PARTIE FIXE					0.8			
05	07	RAMPS AND/OR ADJUSTMENT SCREW RAMPES ET/OU VIS DE RÉGLAGE DE POULIE					0.5			
05	08	SPRING COVER AND/OR SPRING AND/OR BUSHING COUVERCLE DU RESSORT ET/OU RESSORT ET/OU DOUILLE					0.5			
05	09	SLIDER SHOES AND/OR SPRINGS GLISSIÈRE ET/OU RESSORTS					0.8			
05	10	SLIDING HALF, BUSHING AND/OR LEVER (ASS'Y) DEMI-POULIE COULISSANTE, DOUILLE ET/OU LEVIER (COMPLET)					0.8			
05	11	DRIVEN PULLEY FIXED HALF DEMI-POULIE MENÉE FIXE	1.0	1.0	1.0	1.0	0.7	1.0	1.0	1.0
05	12	DRIVEN PULLEY SLIDING HALF DEMI-POULIE MENÉE COULISSANTE	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6
05	13	DRIVEN PULLEY CAM AND/OR SPRING CAME ET/OU RESSORT DE POULIE MENÉE	0.8	0.8	0.8	0.8	0.6	0.8	0.8	0.8
05	17	COUNTERSHAFT BALL BEARING AND/OR FLANGE ROULEMENT À BILLE DE L'ARBRE DE RENVOI ET/OU FLASQUE	0.6	0.6	0.6	0.6	1.0	0.6	0.6	0.6
05	18	COUNTERSHAFT ARBRE DE RENVOI					1.0			
05	19	DRIVE BELT AND/OR BELT GUARD COURROIE D'ENTRAÎNEMENT ET/OU GARDE-COURROIE	0.1	0.1	0.1	0.1	0.1			
05	20	CHAINCASE SEAL AND/OR BEARING ANNEAU D'ÉTANCHÉITÉ DE CARTER ET/OU ROULEMENT	0.7	0.7	0.7	1.4		0.7	0.7	1.4
05	21	CHAINCASE CARTER DE CHAÎNE	3.9	3.9	3.9	4.5		3.9	3.9	4.5
05	22	CHAINCASE COVER COUVERCLE DE CARTER DE CHAÎNE	0.8	1.0	0.8	1.4		1.0	1.0	1.4
05	23	CHAINCASE UPPER SPROCKET AND/OR CENTRAL SPROCKET PIGNON SUPÉRIEUR DE CARTER ET/OU PIGNON CENTRAL	0.9	1.1	0.9	1.5		1.1	1.1	1.5
05	24	CHAINCASE LOWER SPROCKET PIGNON INFÉRIEUR DE CARTER DE CHAÎNE	0.9	1.1	0.9	1.5		1.1	1.1	1.5
05	25	CHAINCASE DRIVE CHAIN CHAÎNE D'ENTRAÎNEMENT DE CARTER DE CHAÎNE	0.9	1.1	0.9	1.5		1.1	1.1	1.5
05	26	CHAINCASE TENSIONERS TENDEURS DE CARTER DE CHAÎNE	0.9	1.1	0.9	1.5		1.1	1.1	1.5
05	27	TENSIONER ADJUSTING SCREW VIS DE RÉGLAGE DE TENDEUR	0.4	0.4	0.4	1.4		0.4	0.4	1.4
05	34	SLIDING SLEEVE AND/OR FORK AND/OR FORK SHAFT CRABOT ET/OU FOURCHETTE ET /OU ARBRE DE FOURCHETTE					3.0			
05	39	SHIFT LEVER AND/OR SHIFT ROD LEVIER DE TRANSMISSION ET/OU TIGE	0.4	0.4	0.4	0.4		0.4	0.4	0.4
05	42	CHAINCASE COVER BEARING ROULEMENT DU COUVERCLE DE CARTER DE CHAÎNE				1.4				1.4

SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900T
			29	30	31	32	33	34	35	36
05	45	REVERSE GEAR WHEEL AND SHAFT ENGRENAGE ET ARBRE DE MARCHE ARRIÈRE	0.9	1.1	0.9		3.0	1.1	1.1	1.1
05	49	DRIVE PULLEY GUARD GARDE DE POULIE MOTRICE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
05	56	LEVER ASS'Y A/O LEVER SPRING LEVIER ASS E/O RESSORT DE LEVIER	0.3		0.3	0.3	0.3	0.3		
05	58	TIE ROD A/O BALL JOINT BARRE D'ACCOUPLEMENT E/O JOINT ROTUL				0.6	0.6			
05	59	SPEED SENSOR CAPTEUR DE VITESSE	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0
05	66	GEARSHIFT LEVER LEVIER D'EMBRAYAGE				0.5	0.5			
05	90	DRIVE AXLE ASS'Y AXE ENTRAÎNEMENT COMPLET	2.1	2.4	2.1	2.5	2.0	2.1	2.4	2.9
05	91	MAIN SHAFT ASS'Y ARBRE DE RENVOI COMPLET					3.0			
05	103	SHIFT DRUM TAMBOUR D'EMBRAYAGE					3.0			
05	114	SHIFT SHAFT SEAL ANNEAU ETANCHE DE L'ABRE D'EMBRAYAGE					1.0			
05	129	CHAINCASE LOWER BEARING AND SEAL (MAG SIDE) ROULEMENT À BILLES INFÉRIEUR DU CARTER DE CHAÎNE ET ANNEAU ÉTANCHE (CÔTÉ MAG)	2.4	2.7	2.4	3.1		2.4	2.7	3.1
05	130	BEARING HOUSING AND/OR BEARING (PTO SIDE) LOGEMENT DU ROULEMENT À BILLES ET/OU ROULEMENT À BILLES (CÔTÉ PTO)	2.1	2.4	2.1	2.9	2.4	2.1	2.4	2.9
05	131	MAGNETIC CAP CAPUCHON MAGNÉTIQUE	0.9	1.1	0.9	1.5	3.0	1.1	1.1	1.5
05	132	ADJUSTMENT RING (ASS'Y) ANNEAU DE RÉGLAGE (COMPLET)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	
05	133	STUDS AND/OR ROLLERS PIVOTS ET/OU ROULEAUX	0.6	0.6	0.6	0.6	0.8	0.6	0.6	
05	154	GEARBOX ASS'Y BOITE DE VITESSE (COMPLET)					0.6			
05	158	TRANSMISSION BOTTOM SEAL JOINT D'ÉTANCHEITE INFERIEUR DE LA TRANSMISSION					1.0			
05	162	MIDDLE GEAR ENGRENAGE DU MILIEU					3.0			
05	163	LOWER GEAR ENGRENAGE DU BAS					3.0			
05	164	COUNTERSHAFT SEAL ANNEAU D'ÉTANCHÉITÉ DE L'ABRE DE RENVOI					1.0			
05	193	SLIDING SHEAVE (PDRIVE) POULIE COULISSANTE (PDRIVE)	0.7	0.7	0.7	0.7		0.7	0.7	0.7
05	194	DAMPER (PDRIVE) AMORTISSEUR DE VIBRATIONS (PDRIVE)	0.4	0.4	0.4	0.4		0.4	0.4	0.4
05	195	SPRING SEAT AND SPRING (PDRIVE) SIEGE RESSORT ET RESSORT (PDRIVE)	0.5	0.5	0.5	0.5		0.5	0.5	0.5

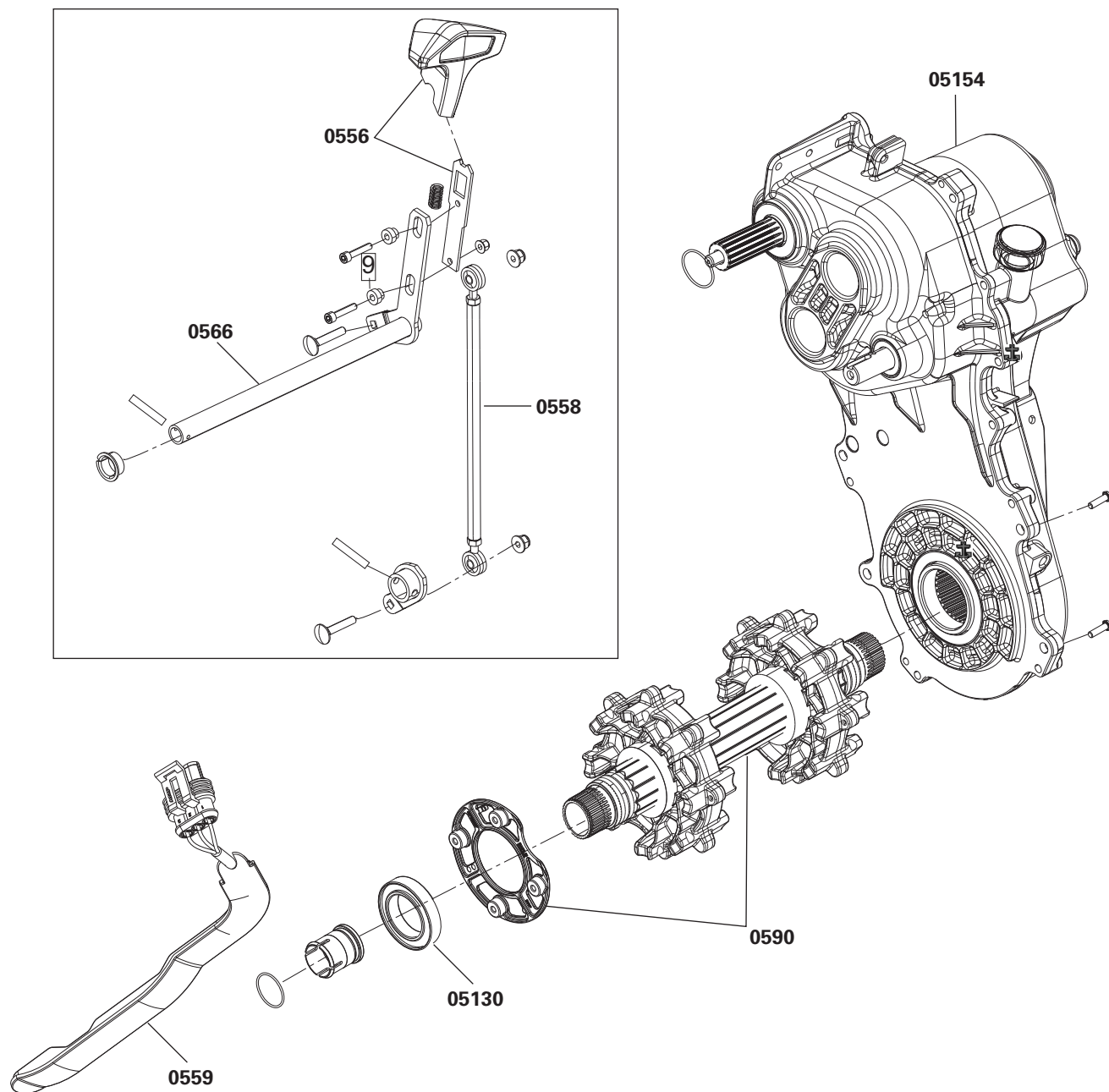
SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900T
			29	30	31	32	33	34	35	36
05	196	SPIDER (PDRIVE) ARAIGNEE (PDRIVE)	0.6	0.6	0.6	0.6		0.6	0.6	0.6
05	197	TORQUE ROLLERS (PDRIVE) ROULEAUX DE TRANSFERT (PDRIVE)	0.6	0.6	0.6	0.6		0.6	0.6	0.6
05	198	ROLLERS AND AXLE (PDRIVE) ROULEAUX ET AXE (PDRIVE)	0.5	0.5	0.5	0.5		0.5	0.5	0.5
05	199	CLICKER A/O LEVERS A/O RAMP (PDRIVE) CAME E/O LEVIERS E/O RAMPES (PDRIVE)	0.5	0.5	0.5	0.5		0.5	0.5	0.5
05	202	CVT AIR DUCT AND ACOUSTIC PANEL CONDUIT D'AIR DE POULIE ET PANNEAU ACOUSTIQUE	0.3	0.3	0.3	0.3		0.3	0.3	0.3
05	214	BRACE (ASS'Y) BRETELLE (COMPLET)	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
05	215	SHAFT GEARBOX IN (ASS'Y) ARBRE BOITE DE VITESSE ENTREE (COMPLET)				1.6				1.6
05	216	SHAFT GEARBOX SELECTION (ASS'Y) ARBRE BOITE DE VITESSE SELECTION (COMPLET)				1.6				1.6
05	217	SHAFT GEARBOX OUT (ASS'Y) ARBRE BOITE DE VITESSE SORTIE (COMPLET)				1.6				1.6
05	218	REVERSE AXLE, FORK AND BALL JOINT AXE RENVERSE, FOURCHETTE ET JOINT À ROTULE				0.4				0.4
05	219	ACTUATING ROD, AXLE AND FORK TIGE DE COMMANDE, AXE ET FOURCHETTE				0.4				0.4



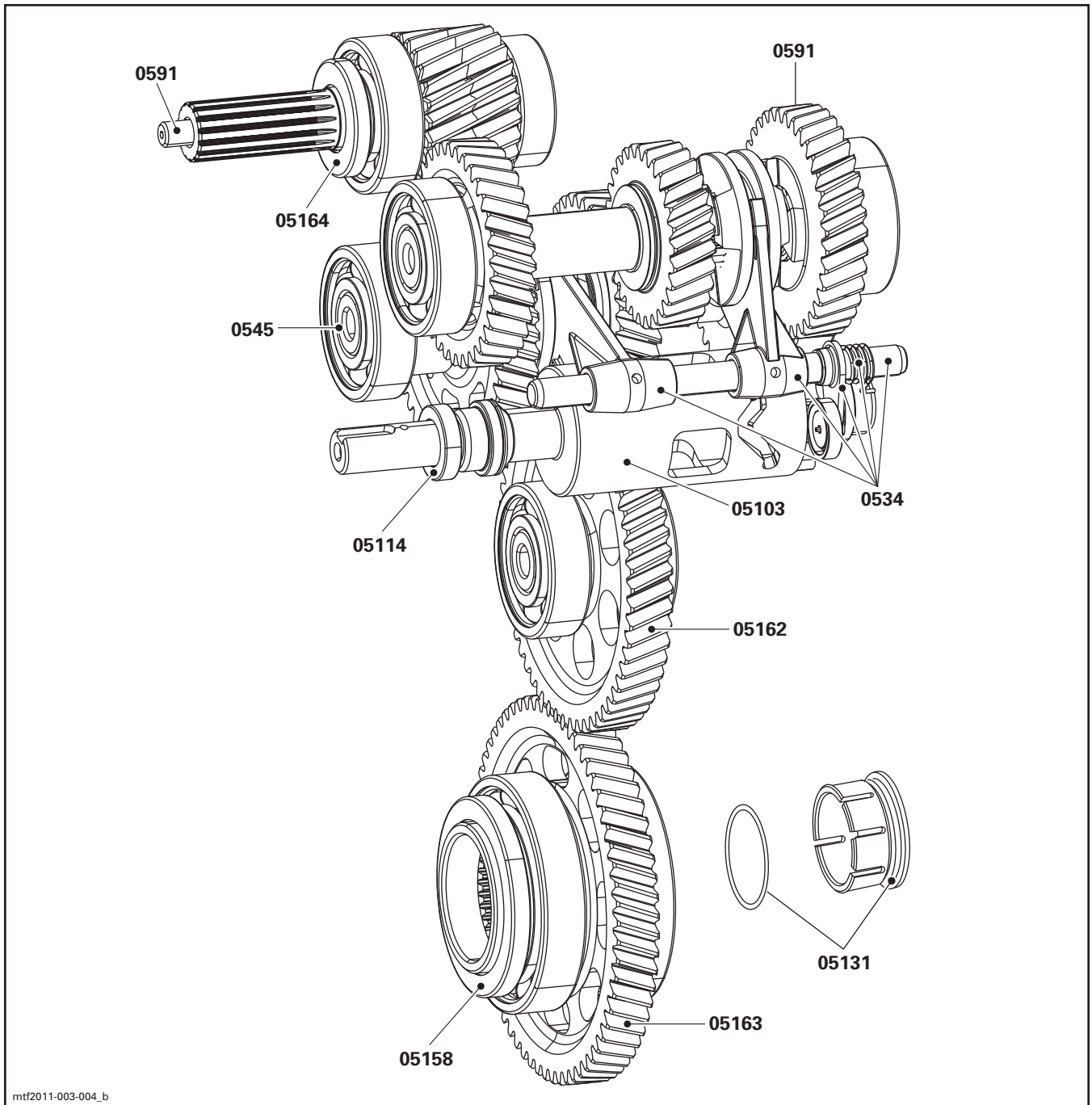




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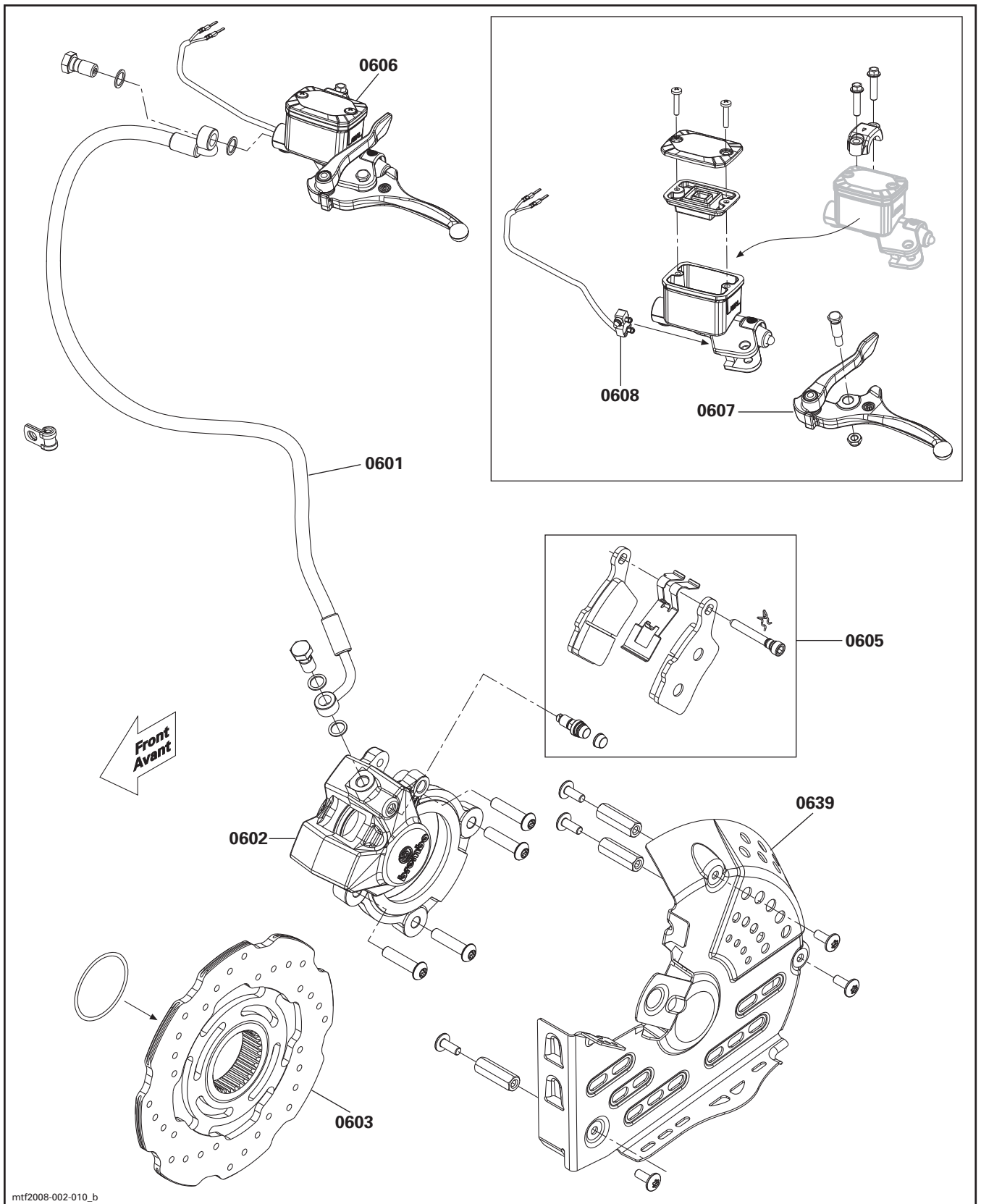


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SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900T
			29	30	31	32	33	34	35	36

06	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0	0	0	0
06	01	BRAKE OIL HOSE BOYAU À HUILE POUR FREIN	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
06	02	BRACKET, CALIPER, BRAKE PAD, RELEASE SPRING SUPPORT, ÉTRIER, PLAQUETTE DE FREIN, CLIQUET, LEVIER	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
06	03	DISC DISQUE	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
06	05	BRAKE PADS PLAQUETTES DE FREIN	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
06	06	MASTER CYLINDER MAÎTRE CYLINDRE	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
06	07	BRAKE LEVER (ASS'Y) LEVIER DE FREIN (COMPLET)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
06	08	MICROSWITCH BRAKE (ASS'Y) INTERRUPTEUR MICRO-CONTACT DE FREIN (COMPLET)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
06	39	DISC PROTECTOR PROTECTEUR DE DISQUE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3



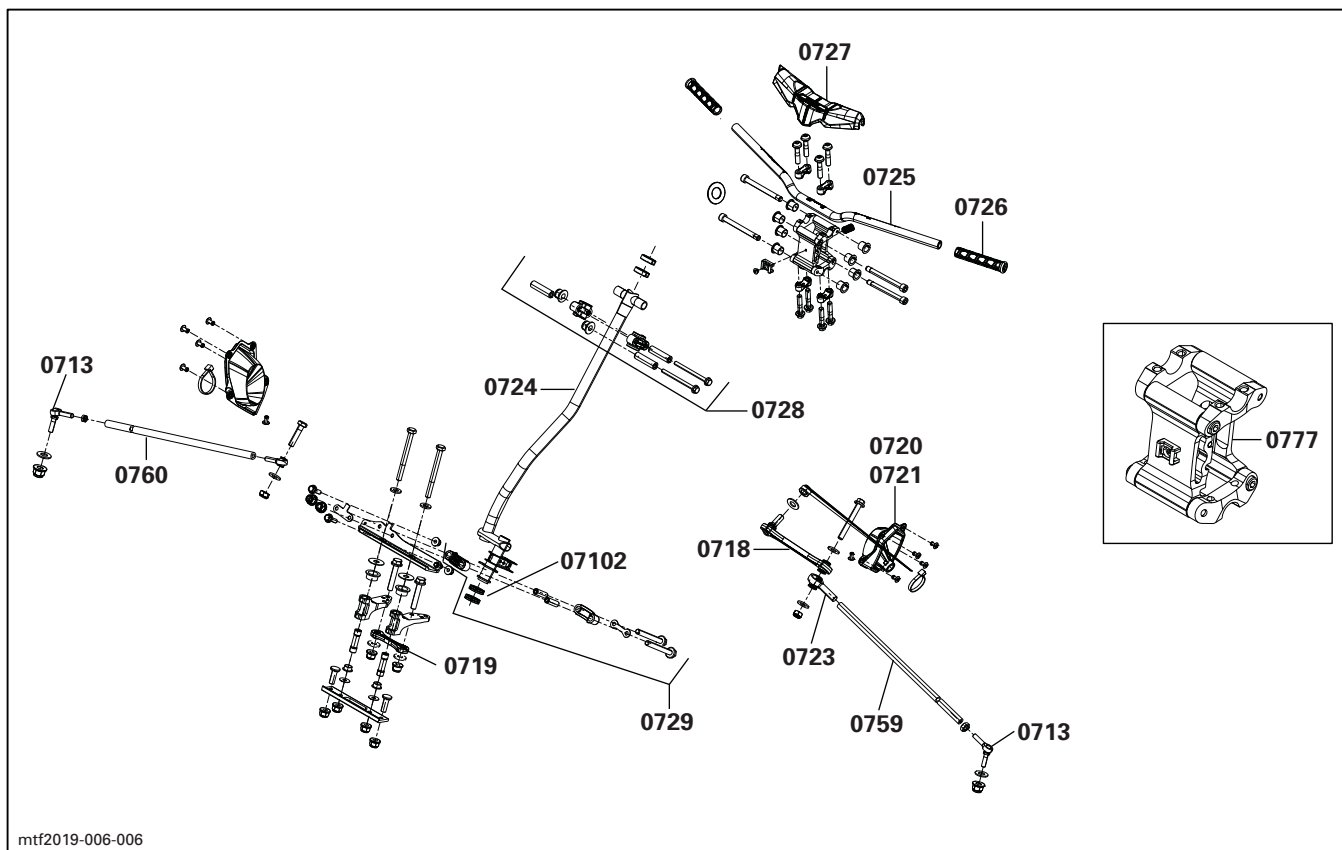
STEERING SYSTEM AND FRONT SUSPENSION SYSTÈME DE DIRECTION ET SUSPENSION AVANT

SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900T
			29	30	31	32	33	34	35	36
07	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0	0	0	0
07	01	SKI (1) SKI (1)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
07	02	SKIS (2) SKIS (2)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
07	03	SKI RUNNER LISSES	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
07	08	SKI LEG (RH) AND/OR BUSHING JAMBE DE SKI (DROITE) ET/OU DOUILLE	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
07	09	SKI LEG (LH) AND/OR BUSHING JAMBE DE SKI (GAUCHE) ET/OU DOUILLE	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
07	10	STEERING ARM (R.H.) BRAS DE DIRECTION (DROIT)					0.5			
07	11	STEERING ARM (L.H.) BRAS DE DIRECTION (GAUCHE)					0.5			
07	12	STEERING ARM BALL JOINT (RH) JOINT À ROTULE DE BRAS DE DIRECTION (DROIT)				0.3	0.3			
07	13	STEERING ARM BALL JOINT (LH) JOINT À ROTULE DE BRAS DE DIRECTION (GAUCHE)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
07	14	TELESC TUBE/SPRING/BUSHING/SAUCER TUBE TELESC/RESS/DOUILLES/SOUPAPE					0.6			
07	17	TOP CAP CAPUCHON SUPERIEUR					0.3			
07	20	TIE ROD COVER CAPUCHON DE TIMONERIE	0.4	0.4	0.4	0.4		0.4	0.4	0.4
07	21	TIE ROD COVERS (2) CAPUCHON DE TIMONERIE (2)	0.8	0.8	0.8	0.8		0.8	0.8	0.8
07	23	STEERING MAIN TUBE BALL JOINT JOINT À ROTULE DE COLONNE DE DIRECTION	0.6	0.6	0.6	0.6	0.6	0.4	0.6	0.6
07	24	STEERING MAIN TUBE COLONNE DE DIRECTION	1.0	1.0	1.0	1.0	1.4	1.0	1.0	1.0
07	25	HANDLE BAR GUIDON	1.1	1.1	1.1	1.1	1.1	1.0	1.1	1.1
07	26	HANDLE BAR GRIP (RIGHT AND/OR LEFT) GAINE DE GUIDON (DROITE ET/OU GAUCHE)	0.3	0.3	0.3	0.3	0.3			
07	27	HANDLE BAR PADDING COUSSINET DE GUIDON	0.3	0.3	0.3	0.3	0.3			
07	28	UPPER STEERING MAIN TUBE BUSHING DOUILLE SUPÉRIEURE DE COLONNE DE DIRECTION	0.5	0.5	0.5	0.5	0.5			
07	29	LOWER STEERING MAIN TUBE BUSHING DOUILLE INFÉRIEURE DE COLONNE DE DIRECTION	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6

STEERING SYSTEM AND FRONT SUSPENSION SYSTÈME DE DIRECTION ET SUSPENSION AVANT

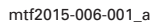
07
SYSTEM/SYSTÈME

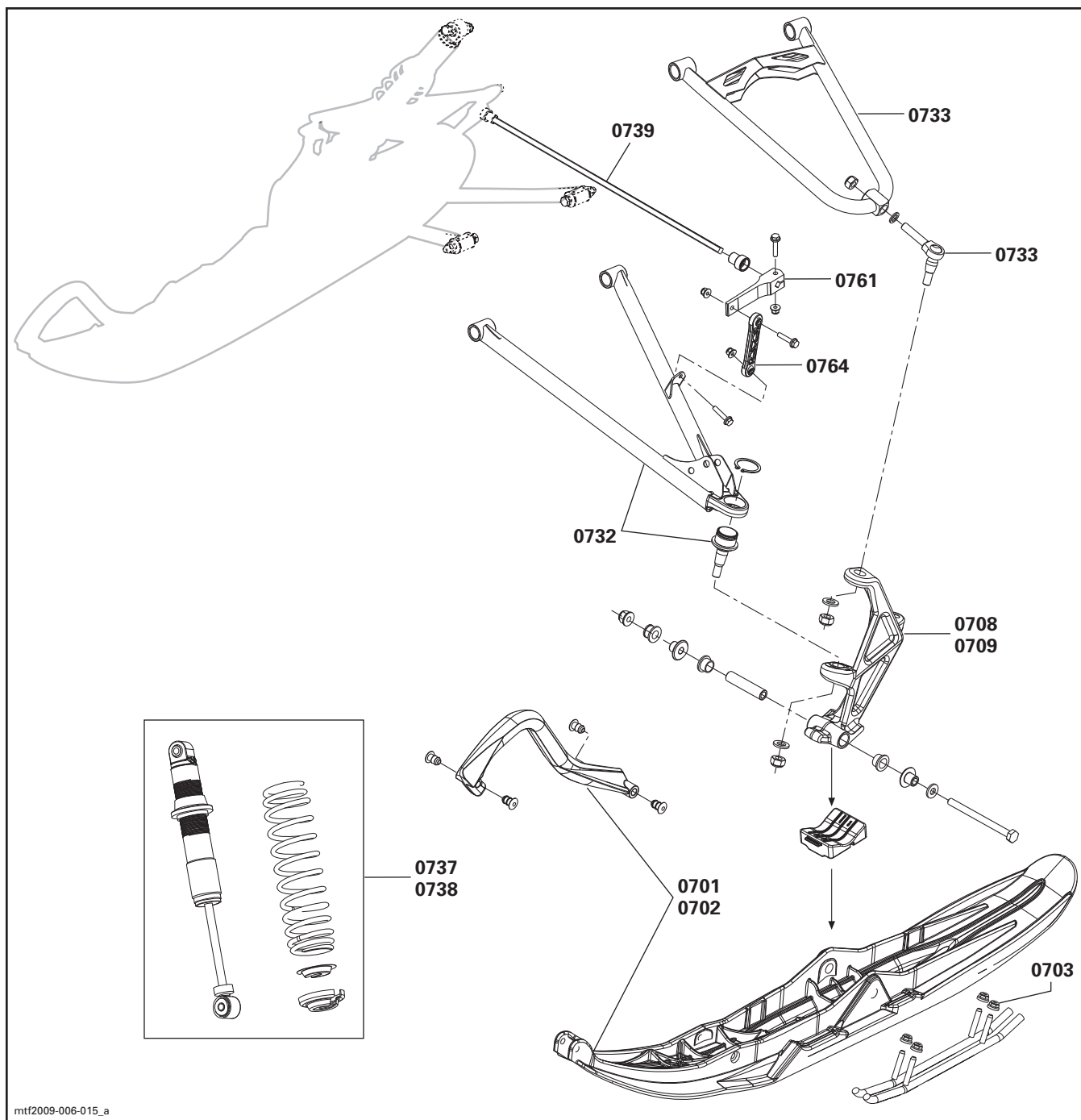
SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900T
			29	30	31	32	33	34	35	36
07	32	LOWER ARM (LH OR RH) BRAS DE SUSPENSION INFÉRIEUR (GAUCHE OU DROIT)	0.6	0.6	0.6	0.6		0.6	0.6	0.6
07	33	UPPER ARM (LH OR RH) BRAS DE SUSPENSION SUPÉRIEUR (GAUCHE OU DROIT)	0.5	0.5	0.5	0.5		0.5	0.5	0.5
07	35	HANDLE BAR SUPPORT SUPPORT DE GUIDON	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
07	37	SHOCK AND/OR SPRING (1) AMORTISSEUR ET/OU RESSORT (1)	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.4
07	38	SHOCKS AND/OR SPRINGS (2) AMORTISSEURS ET/OU RESSORTS (2)	0.8	0.8	0.8	0.8	1.0	0.8	0.8	0.8
07	39	STABILIZER BAR BARRE STABILISATRICE	0.5	0.5	0.5	0.5		0.5	0.5	0.5
07	51	STEERING MAIN TUBE BALL JOINT JOINT ROTULE DE COLONNE DIRECTION					0.5			
07	59	TIE ROD (LH) BARRE D'ACCOUPLEMENT (GAUCHE)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
07	60	TIE ROD (RH) BARRE D'ACCOUPLEMENT (DROITE)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
07	61	LEVER STABILIZER LEVIER STABILISATEUR	0.3	0.3	0.3	0.3		0.3	0.3	0.3
07	64	DOUBLE BALL JOINT JOINT À ROTULE DOUBLE	0.3	0.3	0.3	0.3		0.3	0.3	0.3
07	77	ADJUST STEERING SYSTEM AJUSTEMENT SYSTEME CONDUITE	0.3	0.3		0.3		0.3	0.3	0.3
07	101	DEFLECTOR LH OR RH DEFLECTEUR GA OU DR	0.3					0.3		
07	102	LOWER DAMPER AMORTISSEUR VIBRATION INFÉRIEUR	0.8	0.8	0.8	0.8		0.8	0.8	0.8
07	111	LTS MODULE MODULE LTS					3.5			
07	124	STRAP SANGLE					0.3			



07

SYSTEM/SYSTEME





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REAR SUSPENSION SYSTEM AND TRACK SYSTÈME DE SUSPENSION ARRIÈRE ET CHENILLE

08
SYSTEM/SYSTÈME

SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900 T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900 T
			29	30	31	32	33	34	35	36

08	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0	0	0	0
08	01	SLIDER SHOE (1) GLISSIÈRE (1)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
08	02	SLIDER SHOES (2) GLISSIÈRES (2)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
08	03	RUNNER (1) PORTE-GLISSIÈRE (1)	1.2	1.2	1.5	1.5	1.5	1.2	1.2	1.5
08	04	RUNNERS (2) PORTE-GLISSIÈRES (2)	1.5	1.5	1.9	1.9	1.9	1.5	1.5	1.9
08	09	FRONT IDLER WHEEL AND/OR BEARING (1) ROUE DE SUPPORT AVANT ET/OU ROULEMENT (1)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
08	10	FRONT IDLER WHEELS AND/OR BEARINGS AND/OR SHAFTS (2) ROUES DE SUPPORT AVANT ET/OU ROULEMENTS ET/OU ARBRES (2)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
08	11	FRONT IDLER WHEEL SUPPORT (1) SUPPORT DE ROUE AVANT (1)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
08	12	FRONT IDLER WHEELS SUPPORTS (2) SUPPORTS DE ROUE AVANT (2)	0.4	0.4	0.3	0.3	0.3	0.4	0.4	0.3
08	13	CENTER IDLER WHEEL AND/OR BEARING (1) ROUE DE SUPPORT CENTRALE ET/OU ROULEMENT (1)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
08	14	CENTER IDLER WHEELS AND/OR BEARINGS AND/OR SHAFTS (2) ROUES DE SUPPORT CENTRALES ET/OU ROULEMENTS ET/OU ARBRES (2)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
08	15	CENTER IDLER WHEEL SUPPORT (1) SUPPORT DE ROUE CENTRALE (1)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
08	17	REAR IDLER AND/OR BEARING (1) ROUE DE SUPPORT ARRIÈRE ET/OU ROULEMENT (1)	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.4
08	18	REAR IDLERS AND/OR BEARINGS (2) ROUES DE SUPPORT ARRIÈRE ET/OU ROULEMENTS (2)	0.5	0.5	0.5	0.5	0.3	0.5	0.5	0.5
08	19	REAR IDLER WHEELS AXLE ESSIEU DE ROUES DE SUPPORT ARRIÈRE	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
08	21	COMPRESSOR COMPRESSEUR	0.3	0.3		0.3		0.3	0.3	0.3
08	22	TAIL PIVOT IDLER WHEEL, INSIDE (1) ROUE SUPPORT DE PIVOT ARRIÈRE ET/OU ROULEMENT INTÉRIEUR (1)			0.3	0.3	0.3			0.3
08	23	TAIL PIVOT IDLER WHEELS OR AXLE (2) ROUES SUPPORT DE PIVOT ARRIÈRE/ROULEMENT OU ESSIEU (2)			0.3	0.3	0.3			0.3
08	24	PNEUMATIC HOSE BOYAU PNEUMATIQUE	0.3	0.3		0.3		0.3	0.3	0.3
08	29	AXEL (STOPPER STRAP) AXE (COURROIE D'ARRÊT)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
08	31	TRACK TENSION ADJUSTER (1) PLAQUE DE RÉGLAGE TENSION CHENILLE (1)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
08	32	TRACK TENSION ADJUSTERS (2) PLAQUES DE RÉGLAGE TENSION CHENILLE (2)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

REAR SUSPENSION SYSTEM AND TRACK SYSTÈME DE SUSPENSION ARRIÈRE ET CHENILLE

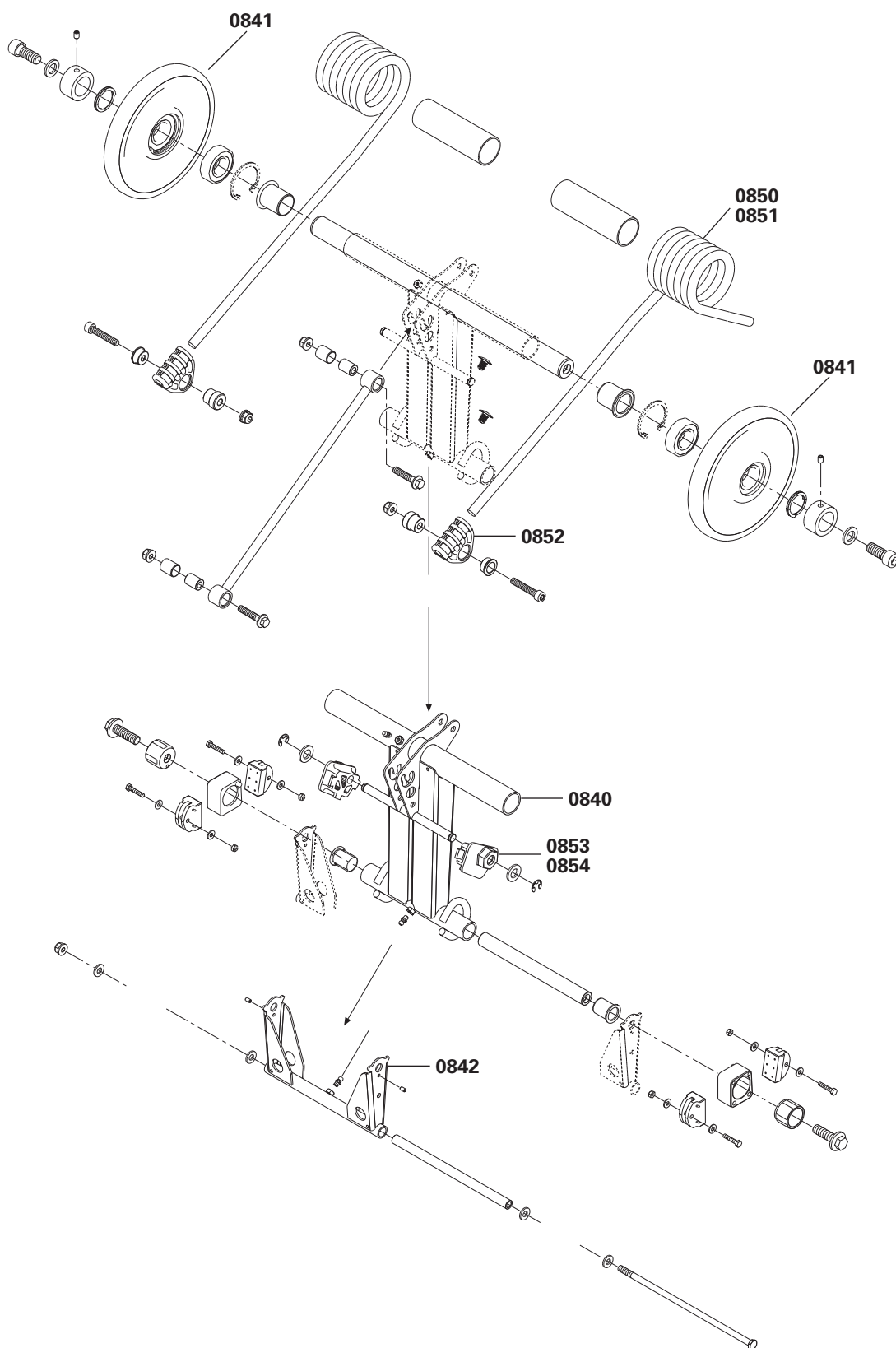
SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900 T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900T
			29	30	31	32	33	34	35	36
08	33	RUNNER RUBBER STOPPER (1) BUTÉE DE CAOUTCHOUC DE PORTE-GLISSIÈRE (1)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
08	34	RUNNER RUBBER STOPPERS (2) BUTÉES DE CAOUTCHOUC DE PORTE-GLISSIÈRE (2)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
08	35	FRONT ARM AND/OR AXLE BRAS AVANT ET/OU ESSIEU	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
08	36	FRONT ARM STOPPER STRAP/STOPPER BOLT COURROIE D'ARRÊT BRAS AVANT/BOULON D'ARRÊT	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
08	37	FRONT ARM SUPPORT SUPPORT DE BRAS AVANT			0.6	0.6	0.6			0.6
08	40	REAR ARM AND/OR AXLE BRAS ARRIÈRE ET/OU ESSIEU	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
08	41	REAR ARM IDLER WHEELS (1-2) AND/OR SHAFT-CROSS ROUES DE SUPPORT BRAS ARRIÈRE (1-2) ET/OU AXE TRANSVERSALE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
08	42	REAR ARM SHACKLE JUMELLE DE BRAS ARRIÈRE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
08	44	REAR AND FRONT ARMS BRAS ARRIÈRE ET AVANT	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
08	50	REAR TORSION SPRING AND/OR WHEEL (1) RESSORT DE TORSION ARRIÈRE ET/OU ROUE (1)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
08	51	REAR TORSION SPRINGS AND/OR WHEELS (2) RESSORTS DE TORSION ET/OU ROUES (2)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
08	52	TORSION SPRING SUPPORT SUPPORT DE RESSORT DE TORSION	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
08	53	SPRING ADJUSTMENT CAM (1) CAME DE RÉGLAGE DE RESSORT (1)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
08	54	SPRING ADJUSTMENT CAMS (2) CAMES DE RÉGLAGE DE RESSORT (2)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
08	55	SHOCK AND/OR SPRING AND/OR BUSHING AMORTISSEUR ET/OU RESSORT ET/OU DOUILLE	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
08	69	TRACK (1) CHENILLE (1)	2.2	2.2	2.2	2.6	2.2	2.2	2.2	2.6
08	71	CLEATS AND/OR GUIDES (0-9) SEGMENTS GUIDE ET/OU GUIDES (0-9)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
08	72	CLEATS AND/OR GUIDES (10-14) SEGMENTS GUIDE ET/OU GUIDES (10-14)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
08	73	CLEATS AND/OR GUIDES (15-19) SEGMENTS GUIDE ET/OU GUIDES (15-19)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
08	74	CLEATS AND/OR GUIDES (20-24) SEGMENTS GUIDE ET/OU GUIDES (20-24)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
08	75	CLEATS AND/OR GUIDES (25-29) SEGMENTS GUIDE ET/OU GUIDES (25-29)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
08	76	CLEATS AND/OR GUIDES (30-34) SEGMENTS GUIDE ET/OU GUIDES (30-34)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8

REAR SUSPENSION SYSTEM AND TRACK SYSTÈME DE SUSPENSION ARRIÈRE ET CHENILLE

08
SYSTEM/SYSTÈME

SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900 T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900T
			29	30	31	32	33	34	35	36
08	77	CLEATS AND/OR GUIDES (35-39) SEGMENTS GUIDE ET/OU GUIDES (35-39)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
08	78	CLEATS AND/OR GUIDES (40-44) SEGMENTS GUIDE ET/OU GUIDES (40-44)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
08	79	CLEATS AND/OR GUIDES (45-49) SEGMENTS GUIDE ET/OU GUIDES (45-49)	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
08	80	CLEATS AND/OR GUIDES (50-54) SEGMENTS GUIDE ET/OU GUIDES (50-54)			1.2	1.2	1.2			1.2
08	81	CLEATS AND/OR GUIDES (55-59) SEGMENTS GUIDE ET/OU GUIDES (55-59)			1.3	1.3	1.3			1.3
08	82	CLEATS AND/OR GUIDES (60-64) SEGMENTS GUIDE ET/OU GUIDES (60-64)			1.4	1.4	1.4			1.4
08	83	CLEATS AND/OR GUIDES (65-70) SEGMENTS GUIDE ET/OU GUIDES (65-70)			1.5	1.5	1.5			1.5
08	85	ADJUSTMENT SCREW (1) VIS D'AJUSTEMENT (1)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
08	86	ADJUSTMENT SCREWS (2) VIS D'AJUSTEMENT (2)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
08	87	SHOCK SUPPORT AND/OR AXLE SUPPORT D'AMORTISSEUR ET/OU AXE	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
08	88	FRONT SHOCK AND/OR SPRING AMORTISSEUR AVANT ET/OU RESSORT	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
08	89	FRONT WHEELS SUPPORT AND/OR BEARINGS (3) ROUES DE SUPPORT AVANT ET/OU ROULEMENTS À BILLE (3)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
08	91	REAR PIVOT ARM BRAS DE PIVOT ARRIÈRE			0.7	0.7	0.7			0.7
08	137	PRESSURE COLLECTOR ASS'Y COLLECTEUR DE PRESSION COMPLET	0.3	0.3				0.3	0.3	
08	141	AIR DAMPER AMORTISSEUR PNEUMATIQUE	0.6	0.6				0.6	0.6	
08	143	AIR VALVE AND/OR CONNECTOR SOUPAPE PNEUMATIQUE ET/OU CONNECTEUR	0.3	0.3				0.3	0.3	
08	144	CAM AXLE, SPRING, SHAFT AND CUSHIONS AXE DE CAME, RESSORT, ARBRE ET COUSSINETS			0.5	0.5	0.5			0.5
08	145	BLOCK, GUIDE, CAM AND PIVOT BLOC, GUIDE, CAME ET PIVOT			0.7	0.7	0.7			0.7

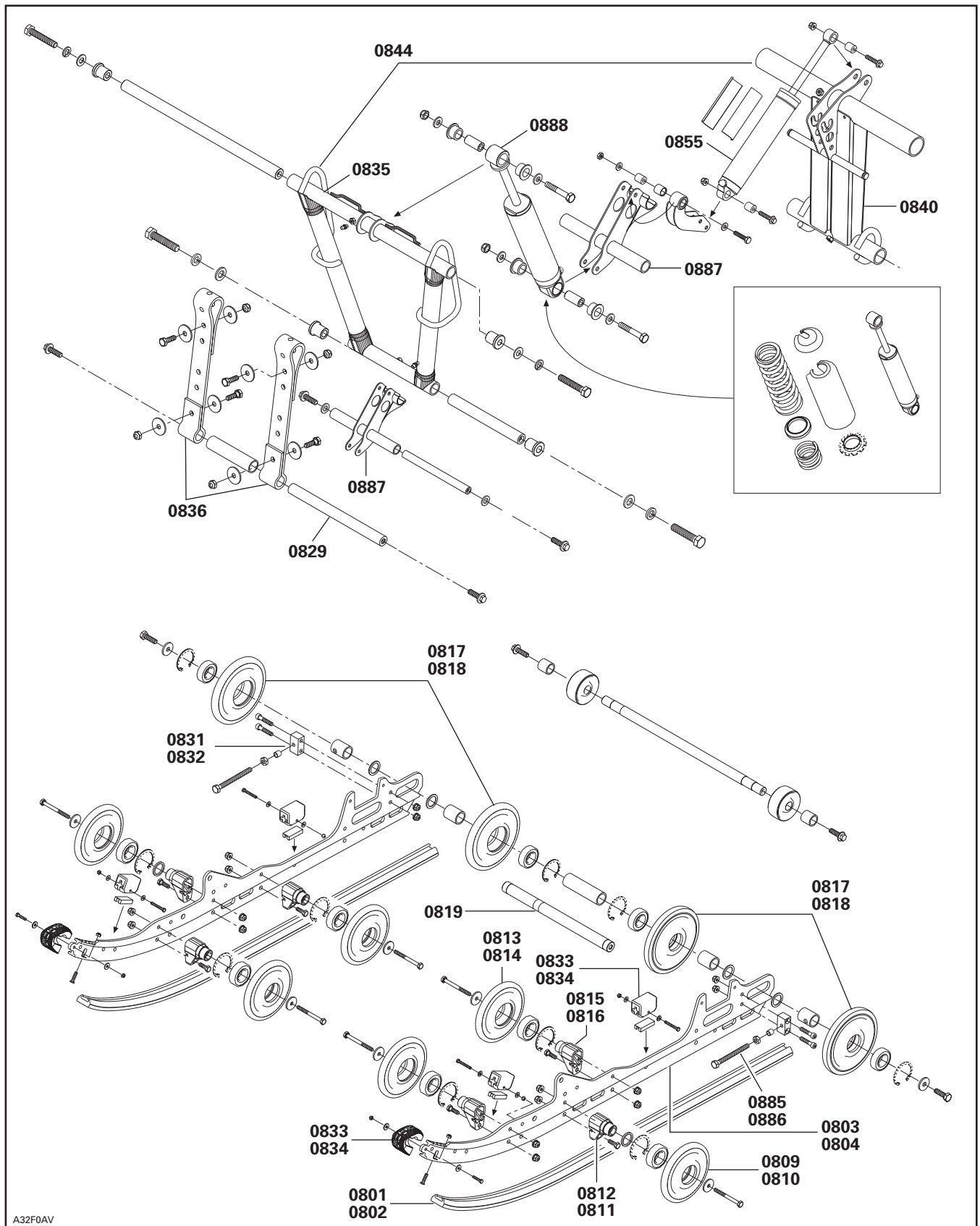
REAR SUSPENSION SYSTEM AND TRACK SYSTÈME DE SUSPENSION ARRIÈRE ET CHENILLE



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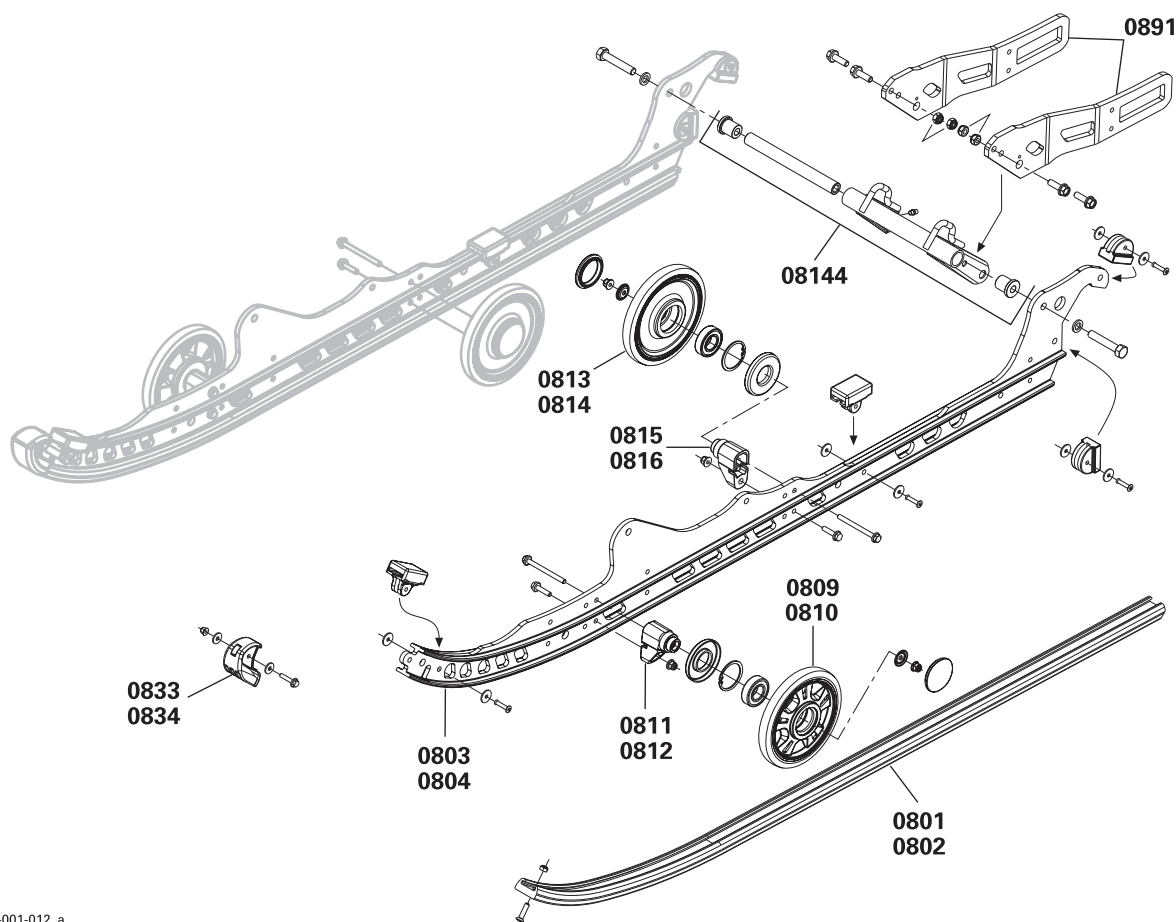
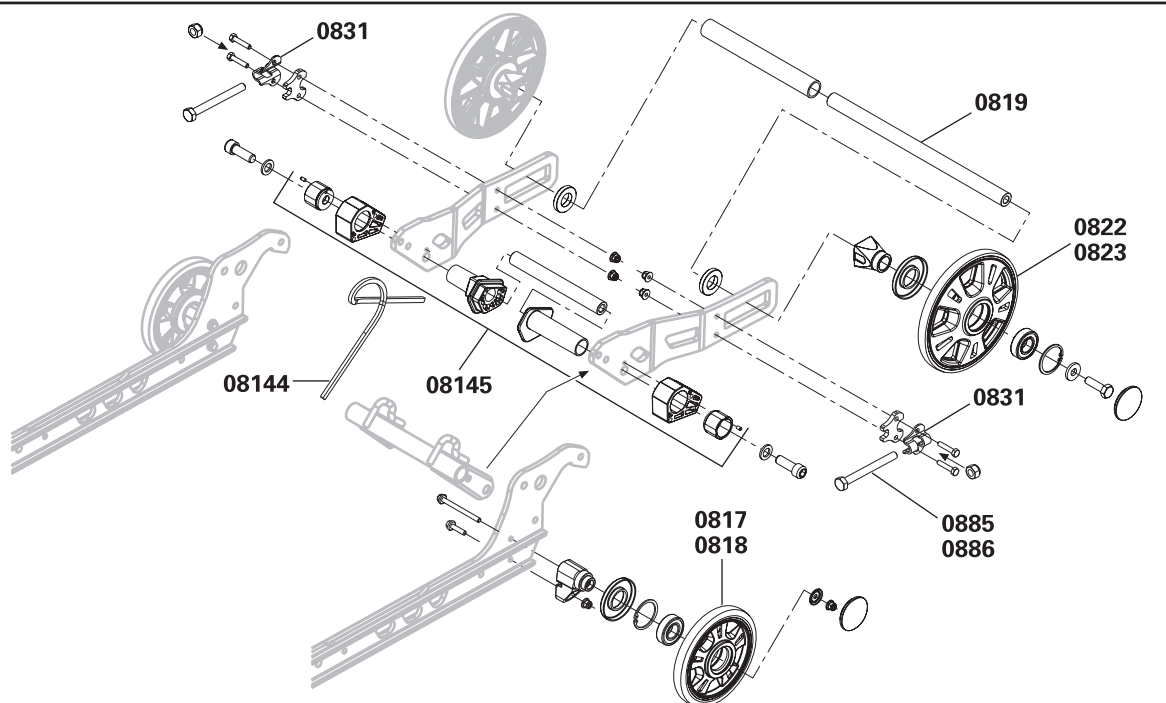
REAR SUSPENSION SYSTEM AND TRACK **SYSTÈME DE SUSPENSION ARRIÈRE ET CHENILLE**

08
 SYSTEM/SYSTÈME



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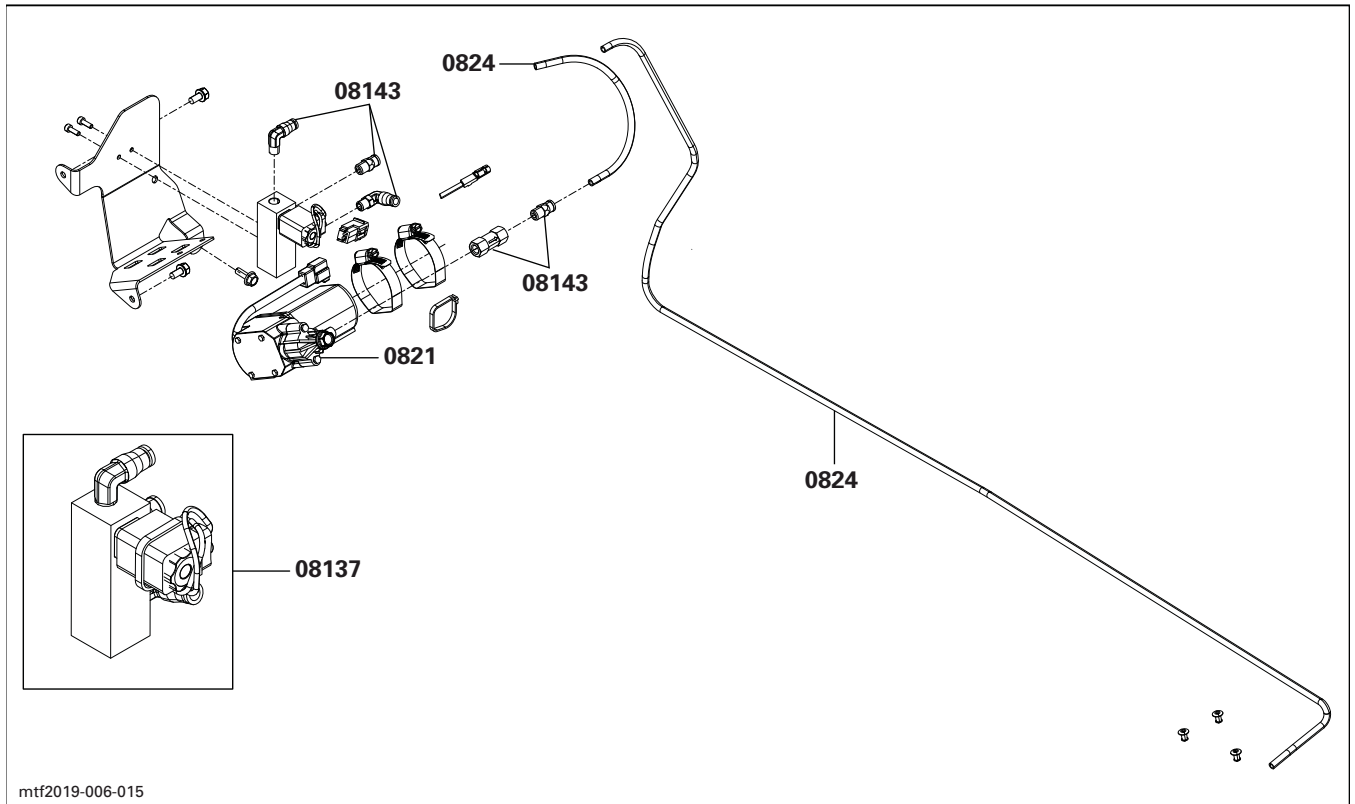
REAR SUSPENSION SYSTEM AND TRACK SYSTÈME DE SUSPENSION ARRIÈRE ET CHENILLE



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REAR SUSPENSION SYSTEM AND TRACK SYSTÈME DE SUSPENSION ARRIÈRE ET CHENILLE

08
SYSTEM/SYSTÈME

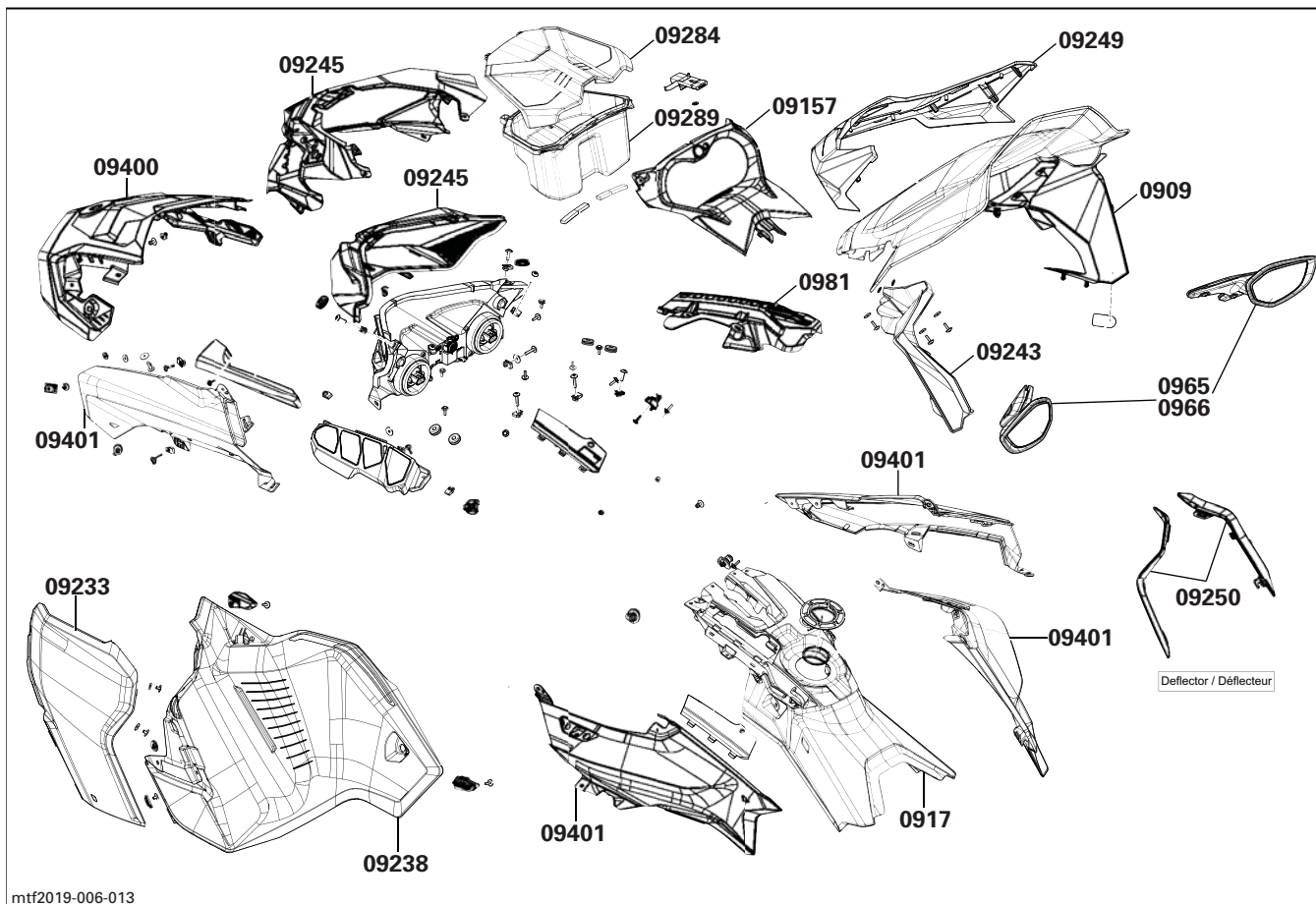


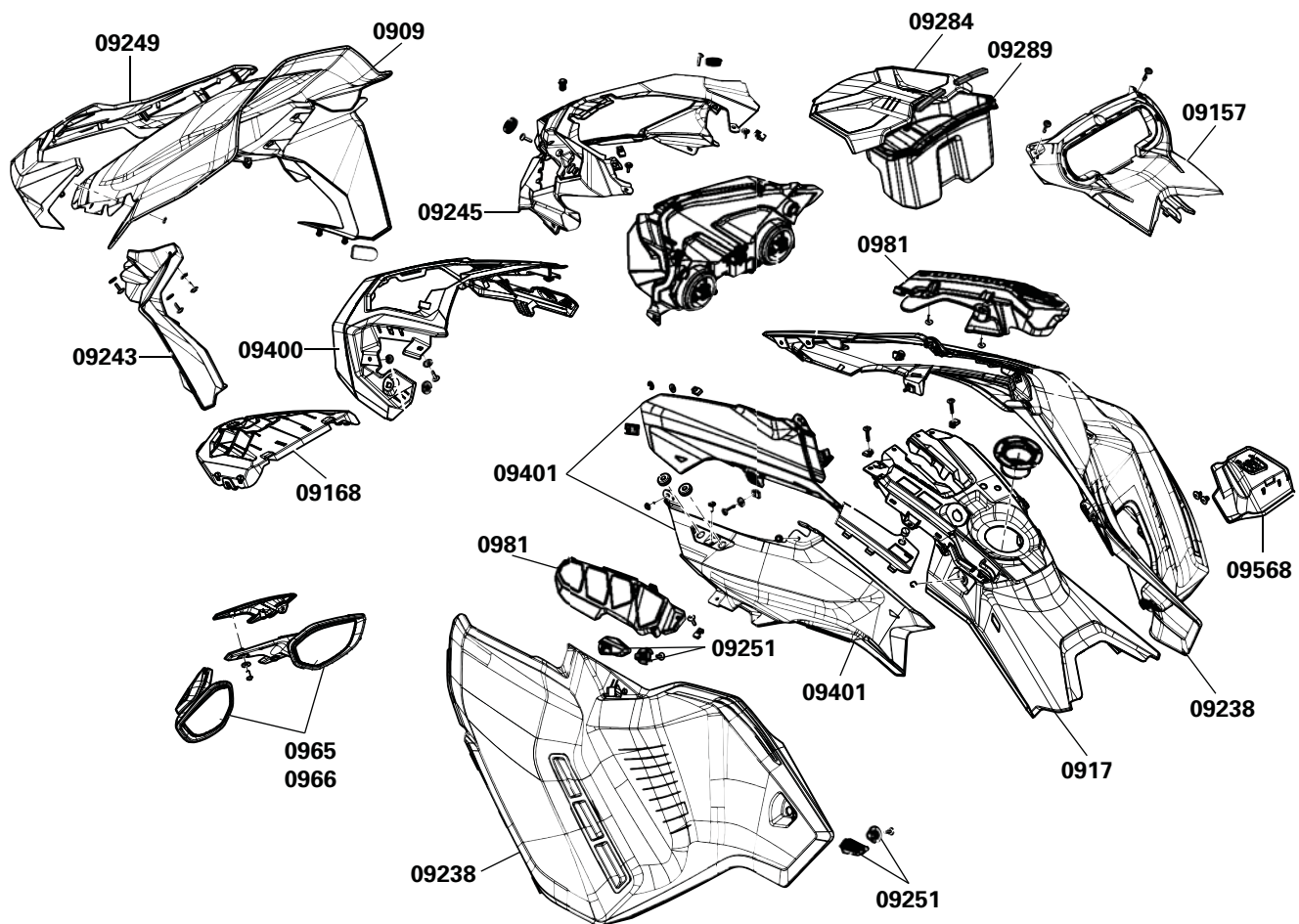
SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900 T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900 T
			29	30	31	32	33	34	35	36

09	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0	0	0	0
09	01	HOOD CAPOT					0.3			
09	05	HOOD DECALS (LH OR RH) AUTOCOLLANTS DU CAPOT (GAUCHE OU DROIT)	0.3	0.3	0.3	0.3	0.5	0.3	0.3	0.3
09	06	HOOD DECALS (ALL) AUTOCOLLANTS DU CAPOT (TOUS)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
09	09	WINDSHIELD PARE-BRISE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
09	14	FRONT BUMPER PARE-CHOCES AVANT	0.5	0.5	0.5	0.6	0.4	0.6	0.6	0.6
09	17	CONSOLE CONSOLE	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.4
09	21	SEAT (ASS'Y) SIÈGE (COMPLET)	0.3	0.3	0.3			0.3	0.3	0.3
09	22	SEAT COVER AND/OR FOAM HOUSSE DE SIÈGE ET/OU MOUSSE	1.0	1.0	1.0	1.0	0.7	1.0	1.0	1.0
09	23	SEAT FOAM CAOUTCHOUC MOUSSE DE SIÈGE	1.0	1.0	1.0	1.0	0.7	1.0	1.0	1.0
09	33	HEAT EXCHANGER RADIATEUR	9.7	10.0	10.0	11.0		9.7	10.0	11.0
09	34	REAR BUMPER PARE-CHOCES ARRIÈRE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
09	35	HITCH SUPPORT (ALL PARTS) SUPPORT D'ATTELAGE (TOUTES LES PIÈCES)			0.3	0.3	0.3			
09*	49	FRAME (ASS'Y) OR FRONT MEMBER CHÂSSIS (COMPLET) OU CADRE AVANT	14.5	15.0	14.5	16.0	14.7	15.0	15.5	17.0
09	51	REAR CAP PARTIE ARRIÈRE DU CHÂSSIS	0.7	0.7	0.7	0.7		0.7	0.7	0.7
09	52	SIDE BRACKET (RIGHT OR LEFT) SUPPORT LATERAL (GAUCHE OU DROITE)	0.4	0.4	0.4	0.4		0.4	0.4	0.4
09	55	SNOW GUARD (1) GARDE-NEIGE (1)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
09	58	BACKREST AND/OR COVER DOSSIER ET/OU HOUSSE		0.3	0.3	0.3			0.3	0.3
09	65	MIRROR (1) RÉTROVISEUR (1)		0.3		0.3	0.3		0.3	0.3
09	66	MIRRORS (2) RÉTROVISEURS (2)		0.3		0.3	0.3		0.3	0.3
09	77	BOTTOM PAN (RH) COQUE CÔTÉ (DROITE)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
09	78	BOTTOM PAN (LH) COQUE CÔTÉ (GAUCHE)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7

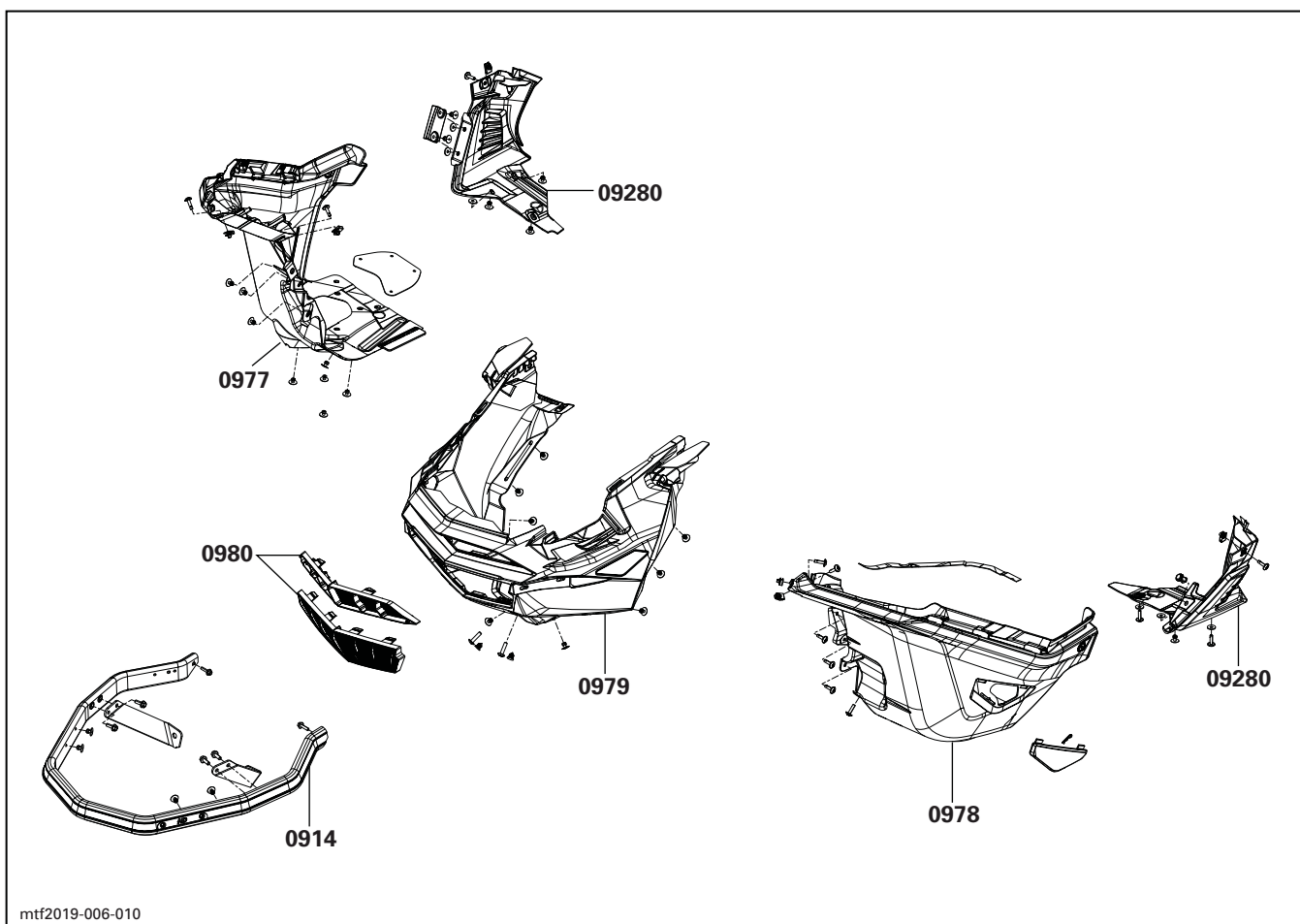
SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900T
			29	30	31	32	33	34	35	36
09	79	BOTTOM PAN (CENTER) COQUE PARTIE (CENTRALE)	0.7	0.7	0.7	0.8	0.8	0.7	0.7	0.7
09	80	FRONT GRILL GRILLE AVANT	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
09	81	SIDE GRILL (LH AND/OR RH) GRILLE LATÉRALE (GAUCHE ET/OU DROIT)				0.3	0.3	0.3	0.3	0.3
09	86	ROLLER ROULEAU	1.2	1.2	1.2	1.5	1.5	1.2	1.2	1.2
09	87	BOTTOM PAN DOOR PORTE DE COQUE					0.3			
09	96	FOOT PROTECTOR AND/OR SUPPORT (LH OR RH) PROTÈGE PIED ET/OU SUPPORT (GAUCHE OU DROIT)	1.4	1.4	1.4	1.4	1.0	1.4	1.4	1.4
09	149	ENGINE SIDE PANELS (2) PANNEAUX MOTEUR (2)					0.9			
09	157	UPPER CONSOLE CONSOLE SUPERIEUR					0.4			
09	163	MEMBER (LH OR RH) MEMBRURE (GAUCHE OU DROIT)	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4
09	168	FRONT GRILL GRILLE FRONTALE						0.3	0.3	0.3
09	191	SIDE PANEL DECAL (LH OR RH) (1) DÉCALQUES DE PANNEAU (GAUCHE OU DROIT) (1)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
09	192	SIDE PANEL DECALS (LH OR RH) (ALL) DÉCALQUES DE PANNEAU (GAUCHE OU DROIT) (TOUS)	0.8	0.8	0.8	0.8	0.6	0.8	0.8	0.8
09	194	ENGINE SIDE PANEL (LH OR RH) PANNEAU MOTEUR (GAUCHE OU DROIT)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
09	196	REAR HANDLE AND/OR GRIP POIGNÉE ARRIÈRE ET/OU GAINÉ		0.5		0.5	0.3		0.5	0.5
09	197	REAR HANDLES AND/OR GRIPS (2) POIGNÉES ARRIÈRE ET/OU GAINES (2)		0.9		0.9	0.3		0.9	0.9
09	198	BACKREST PARTS PIÈCES DU DOSSIER		0.3	0.3	0.3			0.3	0.3
09	199	REAR SEAT BASE AND/OR ALL PARTS BASE SIÈGE ARRIÈRE ET/OU TOUTES LES PIÈCES					1.9			
09	203	REAR SEAT COVER OR FOAM HOUSSE OU MOUSSE DU SIÈGE ARRIÈRE					1.0			
09	233	UPPER SIDE PANEL (LH OR RH) PANNEAU LATÉRAL SUPÉRIEUR (GAUCHE OU DROIT)	0.6	0.6	0.6			0.6	0.6	0.6
09	238	LOWER SIDE PANEL (LH OR RH) PANNEAU LATÉRAL INFÉRIEUR (GAUCHE OU DROIT)	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6
09	243	DEFLECTOR PANEL (RIGHT OR LEFT) PANNEAU DEFLECTEUR (DROITE OU GAUCHE)	0.3	0.3		0.3		0.3	0.3	0.3
09	245	HEADLAMP SUPPORT SUPPORT DE PHARE	0.8	0.8	0.8	0.8		0.8	0.8	0.8

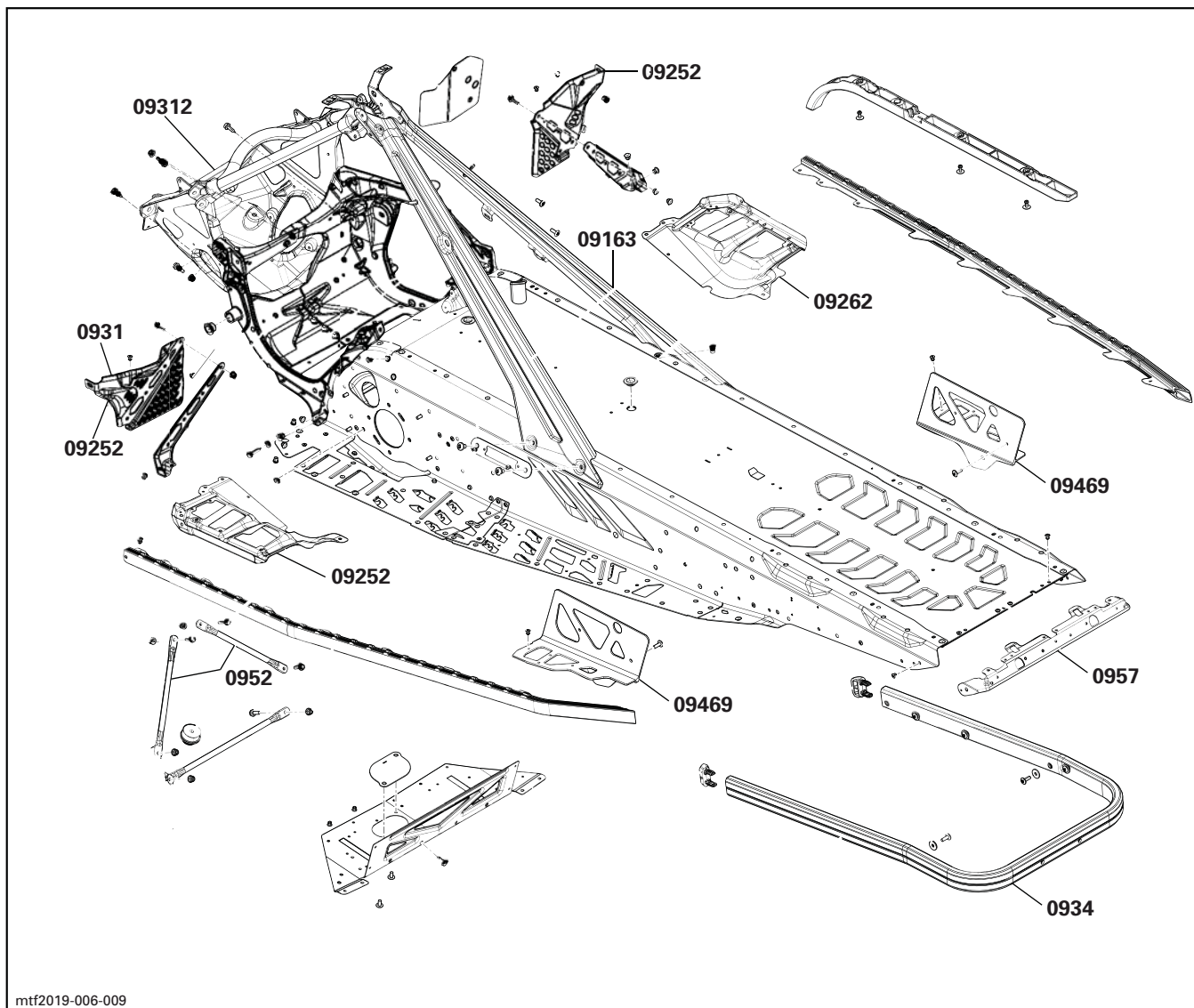
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			29	30	31	32	33	34	35	36
09	249	WINDSHIELD SUPPORT SUPPORT PARE-BRISE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
09	250	AIR DEFLECTOR (LH OR RH) DÉFLECTEUR D'AIR (GAUCHE OU DROIT)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
09	251	PANEL LATCHES (ALL) LOQUETS DE PANNEAU (TOUS)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
09	252	FOOTREST REINFORCEMENT (LH OR RH) RENFORT DE MARCHE-PIED (GAUCHE OU DROIT)	1.1	1.1	1.1	1.1	0.6	1.1	1.1	1.1
09	284	BOX DOOR PORTE DE COFFRE	0.3	0.3	0.3	0.3		0.3	0.3	0.3
09	289	GLOVES BOX BOITE À GANTS	0.3	0.3	0.3	0.3		0.3	0.3	0.3
09	310	SEAT BOX BASE SIEGE					1.3			
09	311	E-MODULE MODULE E	6.0	6.0	6.0	6.4	6.4	6.0	6.5	6.5
09	312	S-MODULE MODULE S	4.3	4.3	4.3	4.3		4.3	4.3	4.3
09	313	SEAT BOX FRAME CHASSIS BASE DE SIEGE					0.4			
09	384	RADIATOR COVER COUVERCLE DE RADIATEUR	0.5	0.5	0.6	0.6		0.5	0.5	0.5
09	400	CENTER HOOD CAPOT CENTRAL	0.8	0.8	0.8	0.8		0.8	0.8	0.8
09	401	HOOD (RH OR LH) CAPOT (DROIT OU GAUCHE)	0.7	0.7	0.7	0.7		0.7	0.7	0.7
09	403	HEADLAMP MOULDING ENJOLIVEUR DE PHARE	0.3	0.3	0.3	0.3		0.3	0.3	0.3
09	469	REAR SUSPENSION BRACKET (RIGHT OR LEFT) ATTACHE DE SUSPENSION ARRIÈRE (DROITE OU GAUCHE)	0.8	0.8	0.8	0.8		0.8	0.8	0.8
09	520	REAR PROTECTOR PROTECTEUR ARRIERE	2.0					2.0		
09	567	MULTI PURPOSE PLAT PLAQUE MULTI USAGE				0.5				0.5
09	568	SHIFT LEVER GRILL GRILLE LEVIER DE VITESSE				0.3				0.3

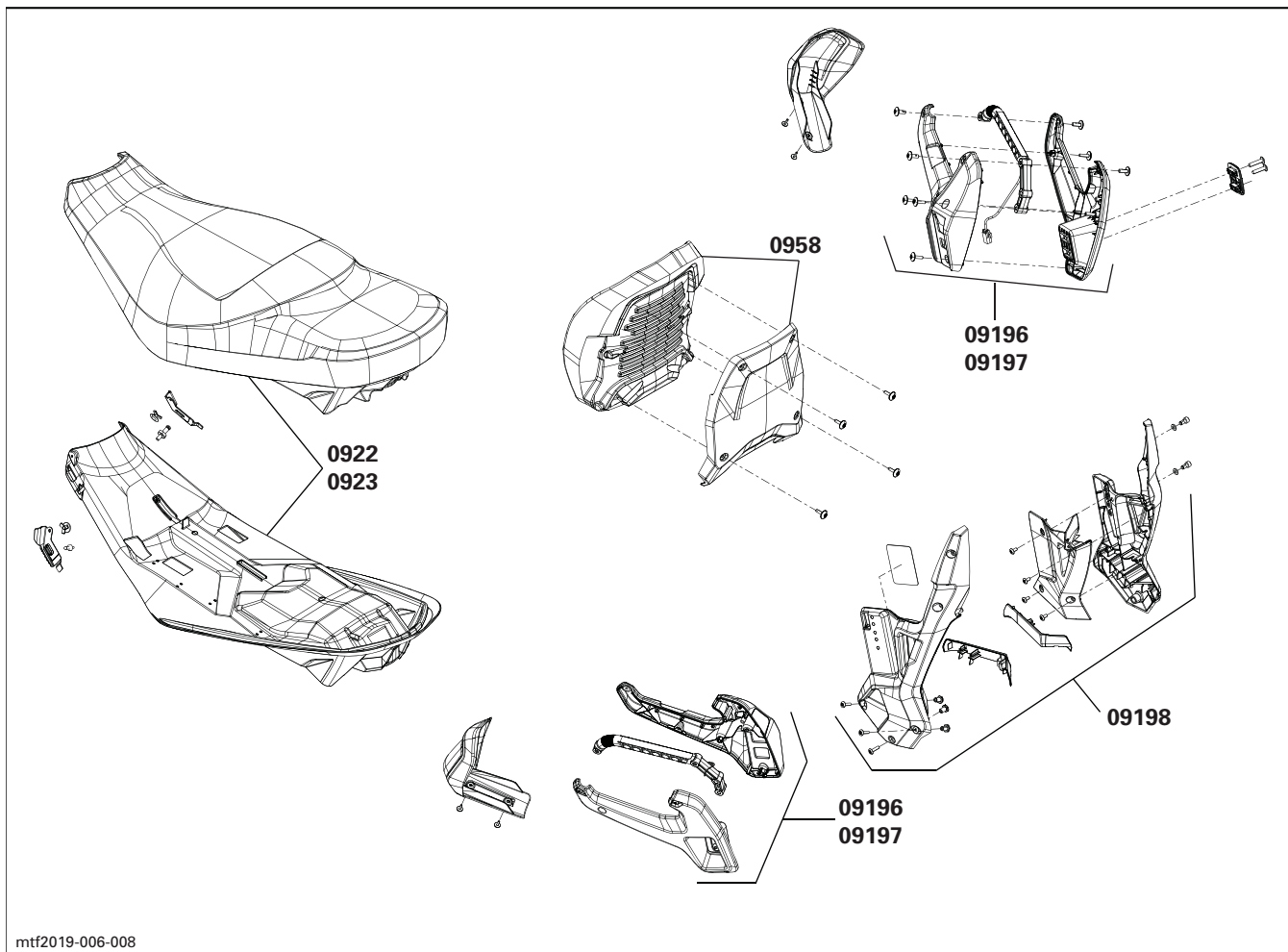


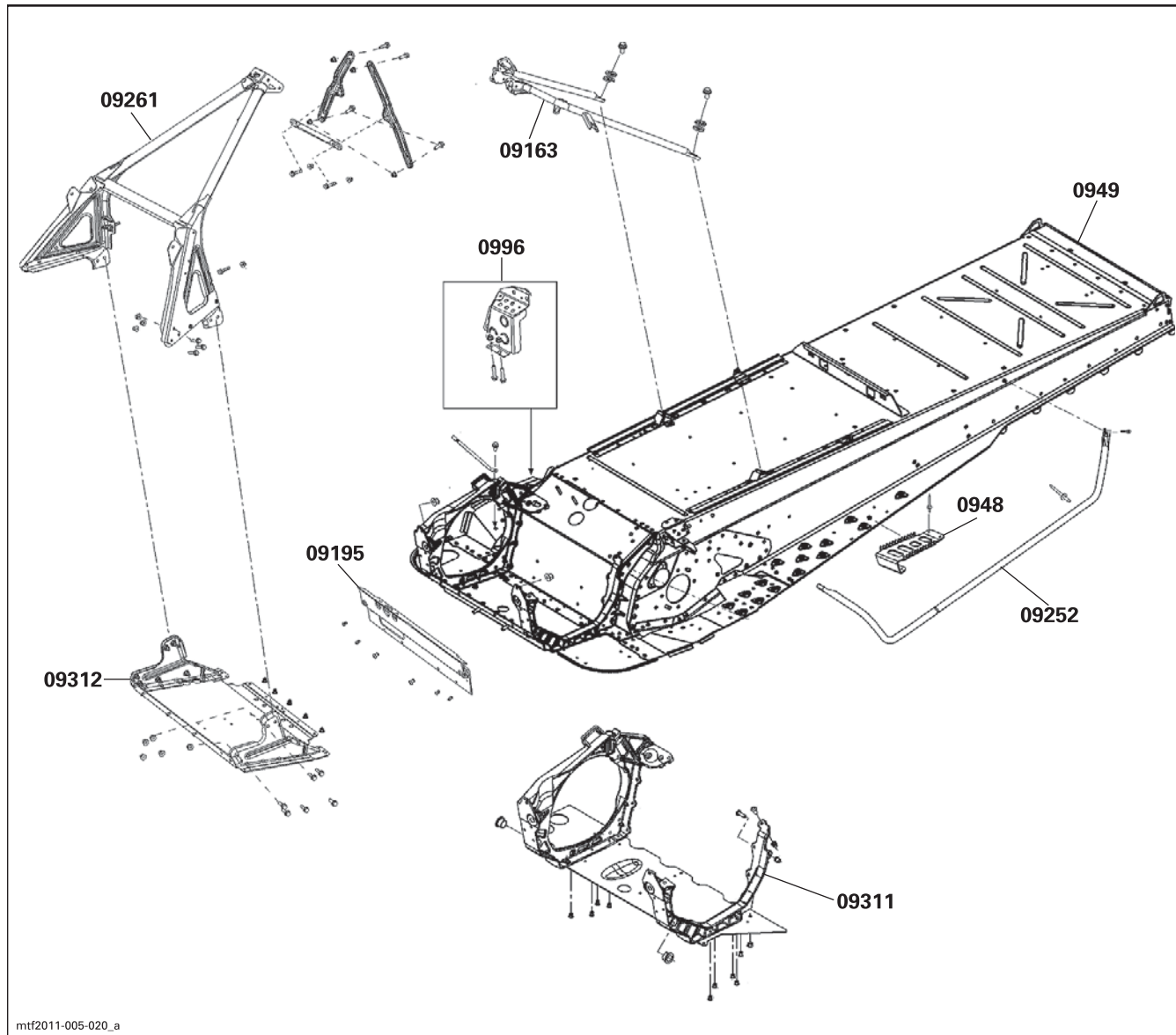


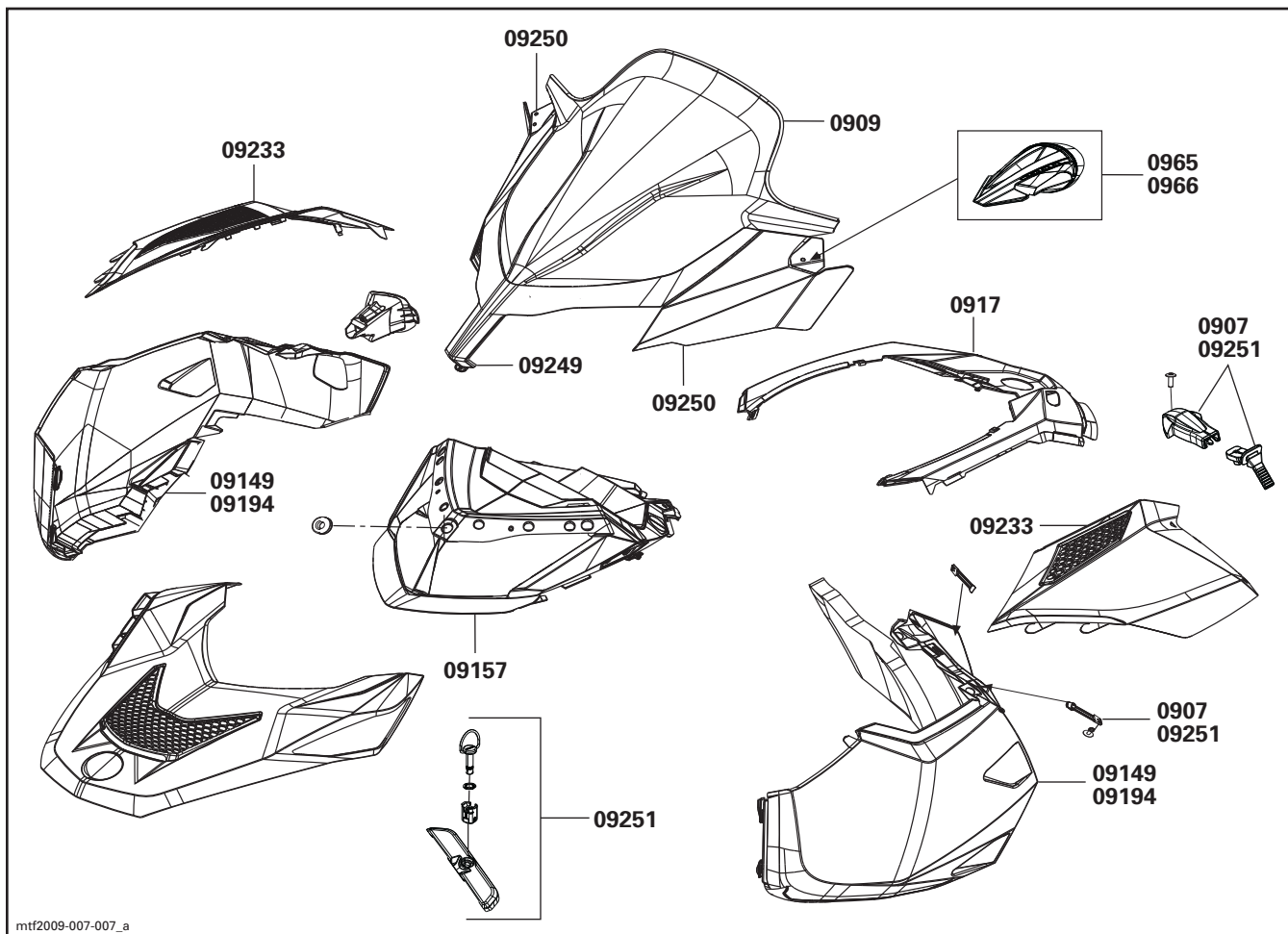
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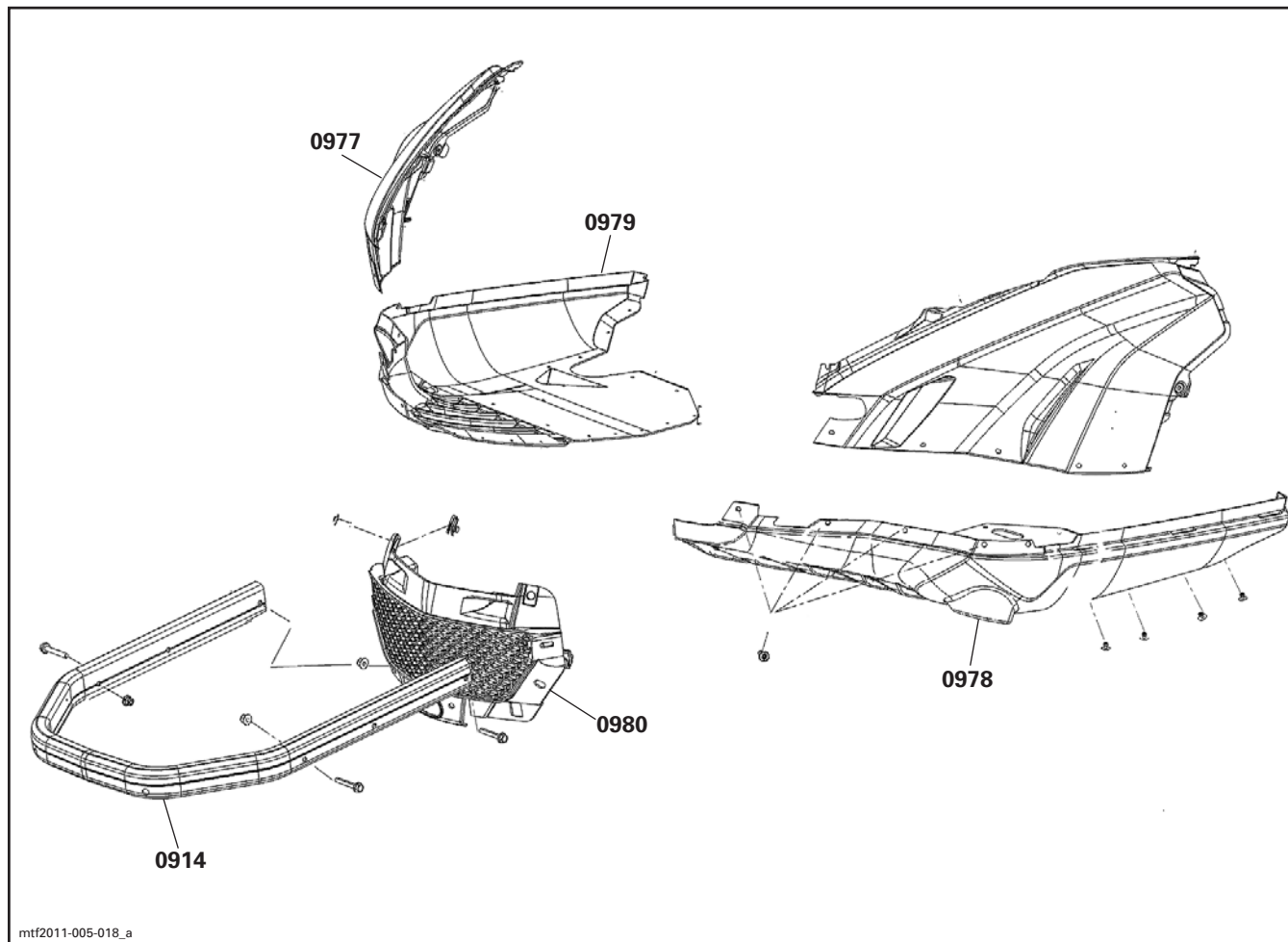


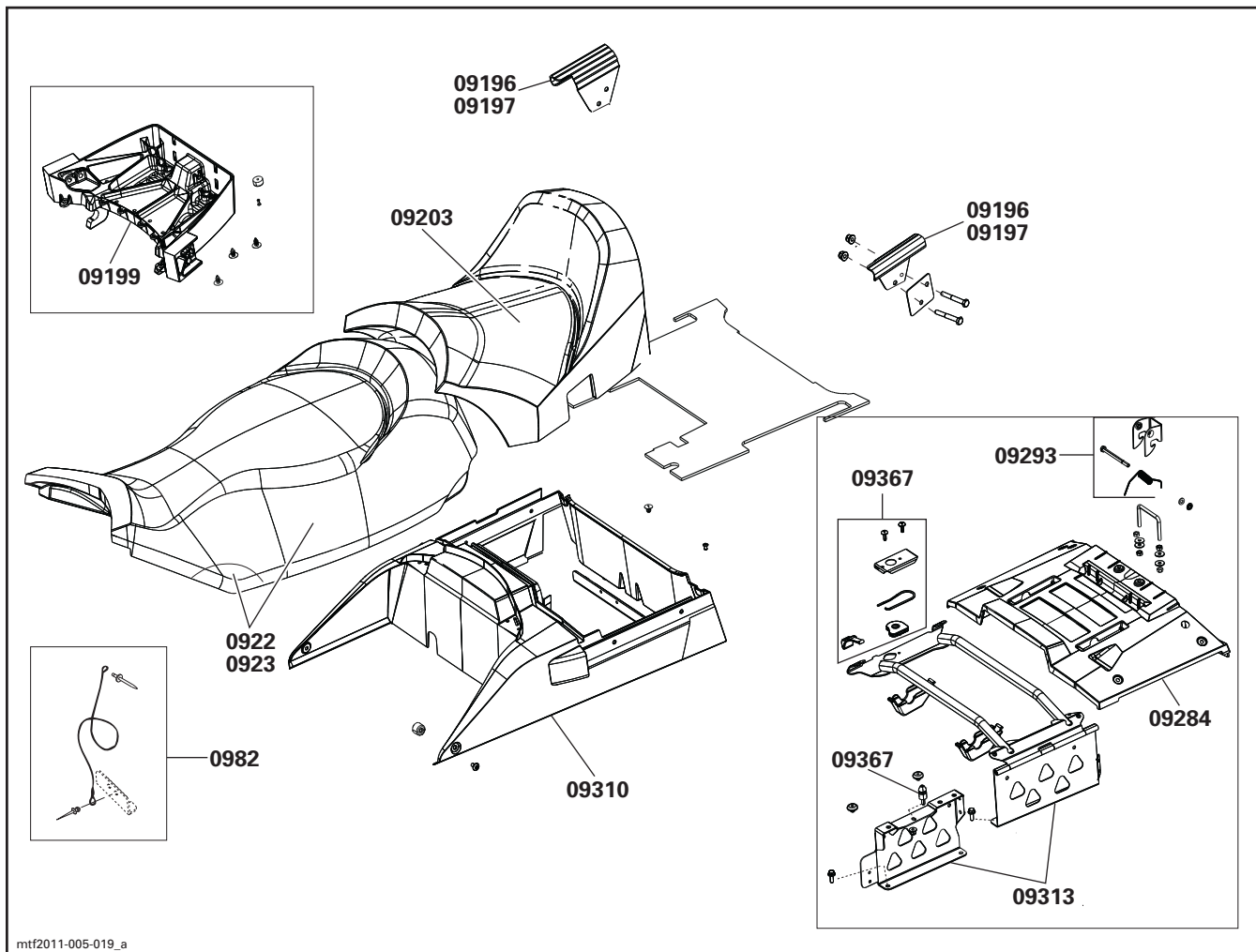








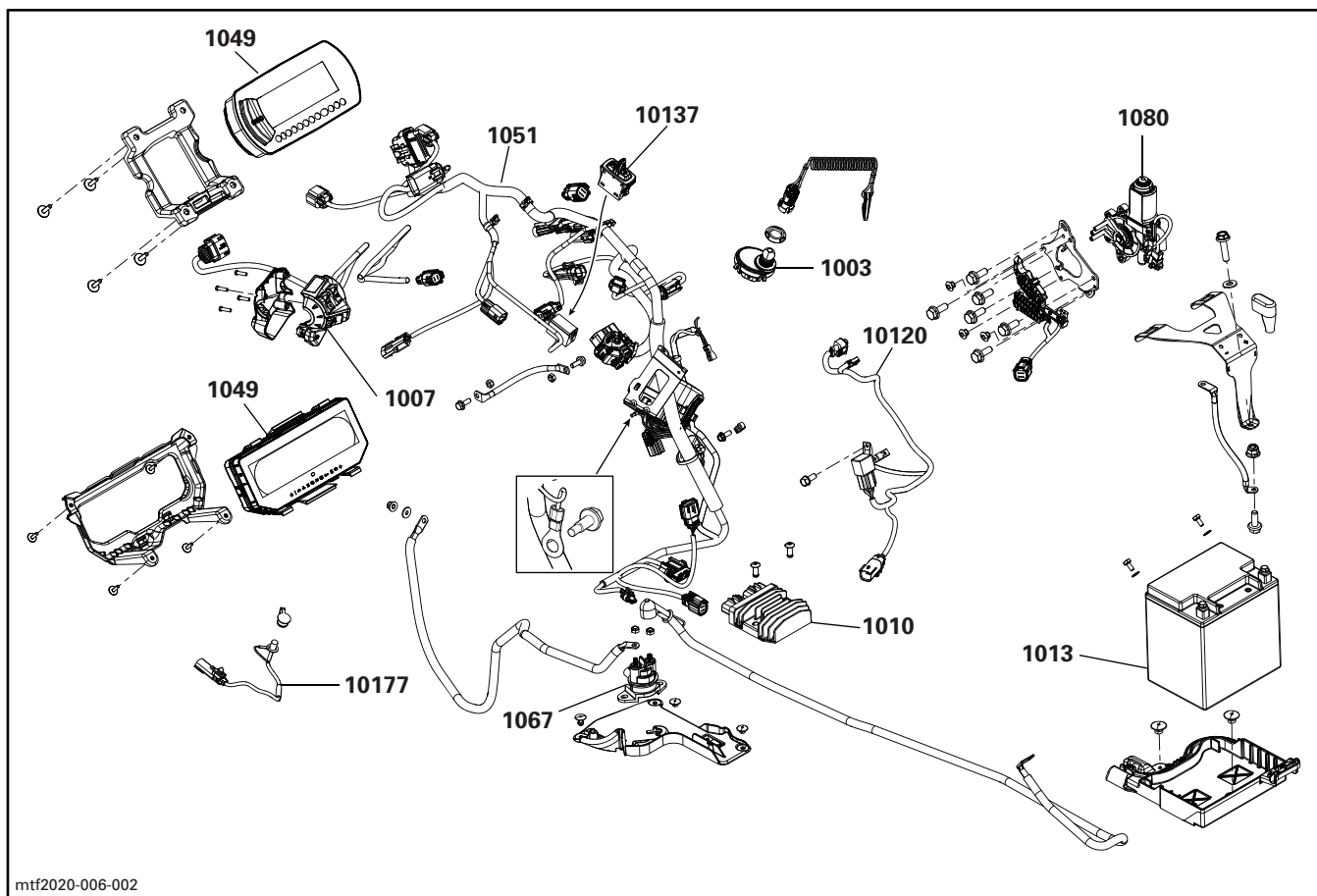


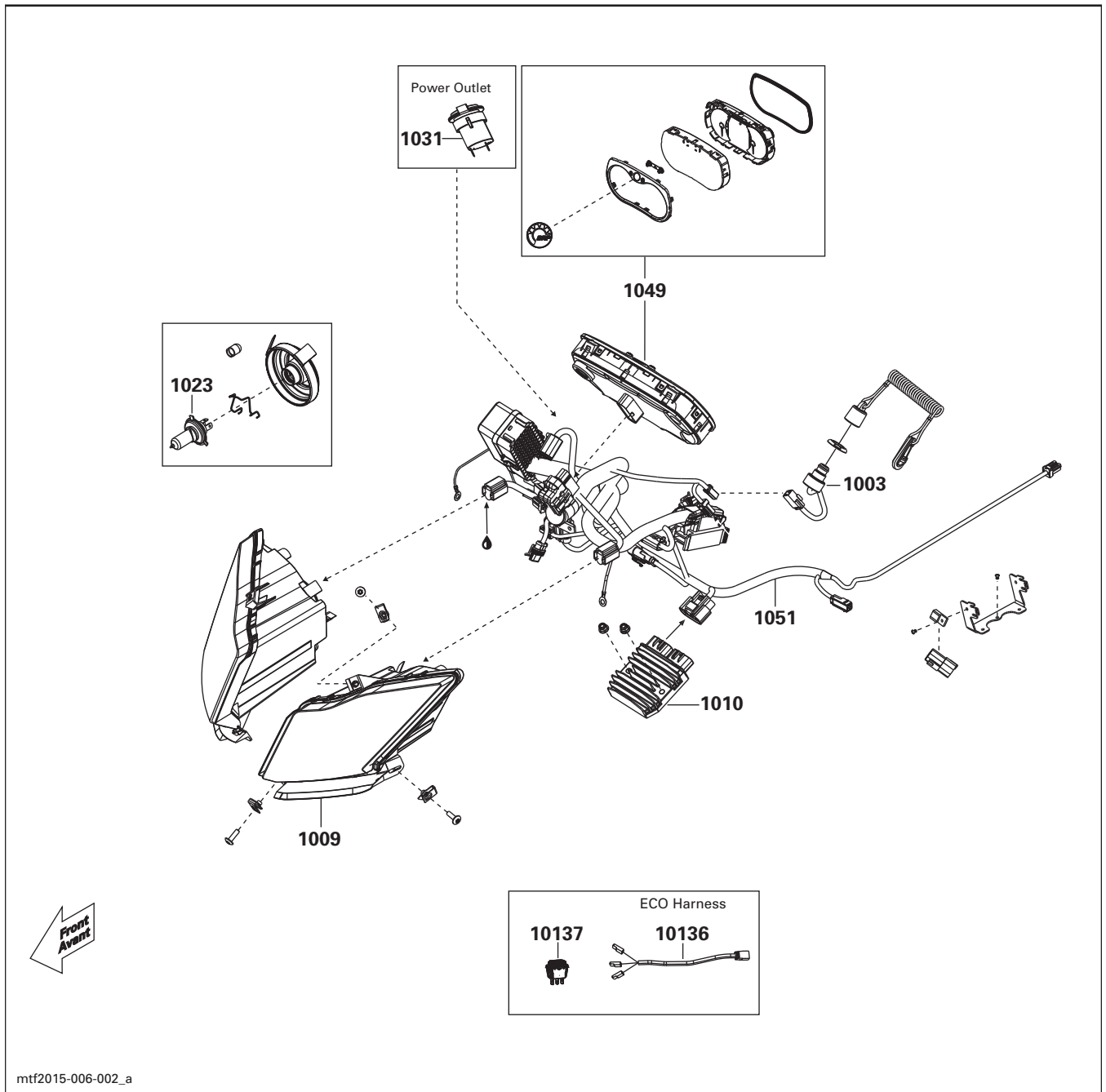


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			29	30	31	32	33	34	35	36

10	00	NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE	0	0	0	0	0			
10	01	IGNITION SWITCH INTERRUPTEUR D'ALLUMAGE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
10	03	KILL SWITCH D'INTERRUPTEUR D'URGENCE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
10	05	BRAKE LIGHT SWITCH INTERRUPTEUR DE FEU D'ARRÊT	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
10	06	TETHER CORD SWITCH OR D.E.S.S. CAPUCHON COUPE-CIRCUIT OU D.E.S.S.	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
10	07	IGNITION SWITCH BLOCK LOGEMENT DE RÉCEPTACLE (INTERRUPTEUR)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
10	08	CURRENT OR GROUND WIRE FIL DE BATTERIE OU DE MASSE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
10	09	HEADLAMP (ASS'Y) (ALL PARTS) PHARE (COMPLET) (TOUTES LES PIÈCES)	0.6	0.6	0.6	0.3	0.3	0.6	0.6	0.6
10	10	VOLTAGE REGULATOR RÉGULATEUR DE TENSION	1.2	1.2	1.2	1.2	0.7	1.2	1.2	1.2
10	12	TAIL LIGHT (ASS'Y) (ALL PARTS) FEU ARRIÈRE (COMPLET) (TOUTES LES PIÈCES)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
10	13	BATTERY BATTERIE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
10	15	HEATED GRIP (1) POIGNÉES CHAUFFANTE (1)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
10	16	BULBS (ONE OR ALL) AMPOULES (UNE OU TOUTES)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
10	17	HEATED THROTTLE LEVER MANETTE D'ACCÉLÉRATEUR CHAUFFANTE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
10	23	HALOGEN BULB AMPOULE HALOGÈNE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
10	31	DC OUTLET PLUG PRISE D'ACCESSOIRE DC			0.3	0.3	0.3			
10	34	ELECTRONIC MODULE MODULE ÉLECTRONIQUE	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
10	41	ENGINE HARNESS CÂBLAGE DU MOTEUR	2.0	2.0	2.0	2.0	1.5	2.0	2.0	2.0
10	49	MULTIFUNCTION GAUGE CADRAN MULTIFONCTION	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
10	50	HEATED GRIPS (2) POIGNÉES CHAUFFANTES (2)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
10	51	MAIN HARNESS CÂBLAGE PRINCIPAL	2.4	2.4	2.4	2.4	1.8	2.4	2.4	2.4
10	59	REAR HEATED GRIP (1) POIGNÉE CHAUFFANTE ARRIÈRE (1)		0.5		0.5			0.5	0.5

SYSTEM SYSTÈME	CODE	DESCRIPTION	RENEGADE 900 ACE	GRAND TOURING 900 ACE	EXPEDITION 900 ACE SPORT	EXPEDITION LE/SE 900 ACE	SKANDIC 900 ACE	RENEGADE 900T ACE	GRAND TOURING 900 T ACE	EXPEDITION 900T
			29	30	31	32	33	34	35	36
10	60	REAR HEATED GRIPS (2) POIGNÉES CHAUFFANTES ARRIÈRE (2)		0.9		0.9			0.9	0.9
10	67	RELAY RELAIS	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
10	79	COMPRESSOR MODULE MODULE DU COMPRESSEUR		0.3					0.3	
10	80	ELECTRONIC REVERSE MOTOR MOTEUR DE LA RENVERSE ÉLECTRONIQUE		0.4					0.4	
10	82	REVERSE SWITCH INTERRUPTEUR DE RENVERSE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
10	85	KILL SWITCH SUPPORT SUPPORT D'INTERRUPTEUR D'URGENCE	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
10	117	SEAT HARNESS CABLAGE DE SIEGE		0.3					0.3	
10	118	STEERING HARNESS CÂBLAGE DU GUIDON	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
10	120	AIR COMPRESSOR HARNESS CABLAGE COMPRESSEUR D'AIR	0.3	0.3		0.3		0.3	0.3	0.3
10	121	HEATED SEAT SWITCH INTERRUPTEUR DU SIEGE CHAUFFANT		0.3					0.3	
10	136	ECO HARNESS CABLAGE ECO					0.3			0.3
10	137	ECO SWITCH INTERRUPTEUR ECO	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
10	177	HEATED VISOR HARNESS HARNAIS VISIERE CHAUFFANTE		0.3		0.3			0.3	0.3







ski-doo®

REV™ G4

Utility ACE™ Series

Operator's Guide 2020

**Includes
Safety, Vehicle
and Maintenance Information**



⚠ WARNING

Read this guide thoroughly.
It contains important safety information.
Minimum recommended operator's age: 16 years old.
Keep this Operator's Guide in the vehicle.

5 2 0 0 0 2 1 3 1

Original Instructions

WARNING

Disregarding any of the safety precautions and instructions contained in this Operator's Guide, *SAFETY VIDEO* and on-product safety labels could cause injury including the possibility of death!

WARNING

This vehicle may exceed the performance of other vehicles you may have ridden. Take time to familiarize yourself with your new vehicle.

CALIFORNIA PROPOSITION 65 WARNING



WARNING: Operating, servicing

and maintaining an off-road vehicle can expose you to chemicals including engine exhaust, carbon monoxide, phthalates, and lead, which are known to the State of California to cause cancer and birth defects or other reproductive harm. To minimize exposure, avoid breathing exhaust, do not idle the engine except as necessary, service your vehicle in a well-ventilated area and wear gloves or wash your hands frequently when servicing your vehicle. For more information go to www.p65warnings.ca.gov/products/passenger-vehicle.



FOREWORD

The following are trademarks of Bombardier Recreational Products Inc. or its subsidiaries.

ACE™	HPG™	QUICK ADJUST™	Ski-Doo®
D.E.S.S.™	iTC™	RER™	XPS™
EXPEDITION®	pDrive™	REV®	
G4™	Pilot™	ROTAX™	

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OPERATOR'S GUIDE 2020
Expedition Sport 600 ACE
Expedition Sport 900 ACE
Expedition LE 900 ACE
Expedition LE 900 ACE Turbo
Expedition SE 900 ACE
Expedition SE 900 ACE Turbo

Deutsch	Dieses Handbuch ist möglicherweise in Ihrer Landessprache verfügbar. Bitte wenden Sie sich an Ihren Händler oder besuchen Sie: www.operatorsguides.brp.com
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Español	Es posible que este manual esté disponible en su idioma. Consulte a su distribuidor o visite: www.operatorsguides.brp.com
Français	Ce guide peut être disponible dans votre langue. Vérifier avec votre concessionnaire ou aller à: www.operatorsguides.brp.com
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Norsk	Denne boken kan finnes tilgjengelig på ditt eget språk. Kontakt din forhandler eller gå til: www.operatorsguides.brp.com
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Suomi	Käyttöohjekirja voi olla saatavissa omalla kielelläsi. Tarkista jälleenmyyjältä tai käy osoitteessa: www.operatorsguides.brp.com
Svenska	Denna bok kan finnas tillgänglig på ditt språk. Kontakta din återförsäljare eller gå till: www.operatorsguides.brp.com

Congratulations on your purchase of a new Ski-Doo® snowmobile. Whatever model you have chosen, it is backed by the Bombardier Recreational Products Inc. (BRP) warranty and a network of authorized Ski-Doo snowmobile dealers ready to provide the parts, service or accessories you may require.

Your dealer is committed to your satisfaction. He has taken training to perform the initial set-up and inspection of your snowmobile as well as completed the final adjustment required to suit your specific weight and riding environment before you took possession.

At delivery, you were informed of the warranty coverage and signed the *PREDELIVERY CHECK LIST* to ensure your new vehicle was prepared to your entire satisfaction.

Know Before you Go

To learn how to reduce the risk for you, your passenger or bystanders being injured or killed, read the following sections before you operate the vehicle:

- *SAFETY INFORMATION*
- *VEHICLE INFORMATION.*

Also read all safety labels on your snowmobile and watch attentively your *SAFETY VIDEO* located at www.ski-doo.com/safety.



We highly recommend that you take a safety riding course. Please check with your dealer or local authorities for availability in your area.

Failure to follow the warnings contained in this Operator's Guide can result in **SERIOUS INJURY** or **DEATH**.

The proper functioning of a snowmobile depends in part on the surface on which it is driven.

Driving on very hard or snow-free surfaces compromises the cooling of the engine and the lubrication of rear suspension components. Avoid prolonged driving on such surfaces.

Safety Messages

The types of safety messages, what they look like and how they are used in this guide are explained as follows:

The safety alert symbol  indicates a potential injury hazard.

WARNING

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

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

NOTICE Indicates an instruction which, if not followed, could severely damage vehicle components or other property.

About this Operator's Guide

This Operator's Guide has been prepared to acquaint the owner/operator and passenger with this snowmobile and its various controls, safe riding and maintenance instructions.

The following terminology in regards to operator, passenger and vehicle configuration is used as follows throughout this guide:

- **Operator:** refers to the person being behind the controls and driving the snowmobile.
- **Passenger:** refers to a person sitting behind the operator.
- **1-UP:** refers to a model designed for an operator only.
- **2-UP:** refers to a model designed to accommodate **one** passenger.

Keep this Operator's Guide in the vehicle as you can refer to it for things such as maintenance, troubleshooting and instructing others.

Note that this guide is available in several languages. In the event of any discrepancy, the English version shall prevail.

If you want to view and/or print an extra copy of your Operator's Guide, simply visit the following website www.operatorsguides.brp.com.

The information contained in this document is correct at the time of publication. BRP, however, maintains a policy of continuous improvement of its products without imposing upon itself any obligation to install them on products previously manufactured. Due to late changes, some differences between the manufactured product and the descriptions and/or specifications in this guide may occur. BRP reserves the right at any time to discontinue or change specifications, designs, features, models or equipment without incurring any obligation upon itself.

This Operator's Guide should remain with the vehicle when it's sold.

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SAFETY INFORMATION

GENERAL PRECAUTIONS

Avoid Carbon Monoxide Poisoning

All engine exhaust contains carbon monoxide, a deadly gas. Breathing carbon monoxide can cause headaches, dizziness, drowsiness, nausea, confusion and eventually death.

Carbon monoxide is a colorless, odorless, tasteless gas that may be present even if you do not see or smell any engine exhaust. Deadly levels of carbon monoxide can collect rapidly, and you can quickly be overcome and unable to save yourself. Also, deadly levels of carbon monoxide can linger for hours or days in enclosed or poorly ventilated areas. If you experience any symptoms of carbon monoxide poisoning, leave the area immediately, get fresh air and seek medical treatment.

To prevent serious injury or death from carbon monoxide:

- Never run the vehicle in poorly ventilated or partially enclosed areas such as garages, carports or barns. Even if you try to ventilate engine exhaust with fans or open windows and doors, carbon monoxide can rapidly reach dangerous levels.
- Never run the vehicle outdoors where engine exhaust can be drawn into a building through openings such as windows and doors.

Avoid Gasoline Fires and Other Hazards

Gasoline is extremely flammable and highly explosive. Fuel vapors can spread and be ignited by a spark or flame many feet away from the engine. To reduce the risk of fire or explosion, follow these instructions:

- Use only an approved gasoline container to store fuel.
- Strictly adhere to instructions in *VEHICLE FUELING PROCEDURE*.
- Never start or operate the engine if the fuel cap is not properly installed.

Gasoline is poisonous and can cause injury or death.

- Never siphon gasoline by mouth.
- If you swallow gasoline, get any in your eye or inhale gasoline vapor, see your doctor immediately.

If gasoline spills on you, wash with soap and water and change your clothes.

Avoid Burns from Hot Parts

The exhaust system and engine become hot during operation. Avoid contact during and shortly after operation to avoid burns.

Accessories and Modifications

Do not make unauthorized modifications, or use attachments or accessories that are not approved by BRP. Since these changes have not been tested by BRP, they may increase the risk of crashes or injuries, and they can make the vehicle illegal.

Tunnel accessories must be loaded onto vehicle as per instructions provided for each accessories.

Accessory passenger seats approved by BRP and conforming to SSCC standards may be available for certain models. If such a seat is used, you must follow the guidelines and recommendations in regards to a passenger in this guide.

WARNING

Passenger seat must have a strap or handholds and must meet SSCC standards.

See your authorized Ski-Doo dealer for available accessories for your vehicle.

SPECIAL SAFETY MESSAGES

SEVERE INJURY OR DEATH can result if you do not follow these instructions:

- Always make a pre-ride inspection **BEFORE** you start the engine.
- Throttle mechanism should be checked for free movement and return to idle position before starting engine.
- Always attach tether cord eyelet to clothing before starting the engine.
- Never operate the engine without belt guard and brake disk guard securely installed or, with hood or side panels opened or removed. Never run the engine without drive belt installed. Running an unloaded engine such as without drive belt or with track raised, can be dangerous.
- Always engage parking brake before starting the engine.
- Everyone is a beginner the first time he sits behind the controls of a snowmobile regardless of previous experience in driving any other type of vehicle. The safe use of your snowmobile depends on many conditions such as visibility, speed, weather, environment, traffic, vehicle condition and the condition of the operator.
- Basic training is required for the safe operation of any snowmobile. Study your operator's guide paying particular attention to cautions and warnings. Join your local snowmobile club: its social activities and trail systems are planned for both fun and safety. Obtain basic instructions from your snowmobile dealer, friend, fellow club member or enroll in your state or provincial safety training program.
- Any new operator must read and understand all safety labels on the snowmobile, the Operator's Guide and watch the *SAFETY VIDEO* at www.ski-doo.com/safety before operating the snowmobile. Only allow a new operator to operate the snowmobile in a restricted flat area, at least until he is completely familiar with its operation. If snowmobile operator's training course is offered in your area, have him enroll.
- The performance of some snowmobiles may significantly exceed that of other snowmobiles you have operated. Therefore, use by novice or inexperienced operators is not recommended.
- Snowmobiles are used in many areas and in many snow conditions. Not all models perform the same in similar conditions. Always consult your snowmobile dealer when selecting the snowmobile model for your particular needs and uses.

- Injury or death may result to the snowmobile operator, passenger or bystander if the snowmobile is used in risky conditions which are beyond the operator's, passenger's or snowmobile's capabilities or intended use.
- BRP recommends the operator has at least 16 years old of age. Verify also your local laws for age and training requirements.
- It is very important to inform any operator, regardless of his experience, of the handling characteristics of this snowmobile. The snowmobile configuration, such as ski stance, ski type, suspension type, track length, width and type vary from a model to another. The snowmobile handling is greatly influenced by these characteristics.
- The novice operator should become familiar with the snowmobile through practice on a level area at slow speeds before venturing far afield.
- Know your local laws. Federal, state, provincial and local government agencies have enacted laws and regulations pertaining to the safe use and operation of snowmobiles. It is your responsibility as a snowmobiler to learn and obey these laws and regulations. Respect and observance will result in safer snowmobiling for all. Be aware of the liability property damages and insurance laws regarding your equipment.
- Speeding can be fatal. In many cases, you cannot react or respond quickly enough to the unexpected. Always ride at a speed which is suitable to the trail, weather conditions and your own ability. Know your local rules. Speed limit may be in effect and meant to be observed.
- Always keep right hand side of the trail.
- Always keep a safe distance from other snowmobiles and bystanders.
- Remember, promotional material may show risky maneuvers performed by professional riders under ideal and/or controlled conditions. You should never attempt any such risky maneuvers if they are beyond your level of riding ability.
- Never use this vehicle with drugs or alcohol. They slow reaction time and impair judgement.
- Your snowmobile is not designed to be operated on public streets, roads or highways.

- Avoid road traveling. If you must do so, and it is permitted, reduce speed. The snowmobile is not designed to operate or turn on paving. When crossing a road, make a full stop, then look carefully in both directions before crossing at a 90° angle. Be wary of parked vehicles.
- Snowmobiling at night can be a delightful experience but because of reduced visibility, be extra cautious. Avoid unfamiliar terrain and be sure your lights are working. Always carry a flashlight and spare light bulbs.
- Never remove any original equipment from your snowmobile. Each vehicle has many built in safety features. Such features include various guards and consoles, plus reflective materials and safety labels.
- Nature is wonderful but don't let it distract your attention from driving. If you want to truly appreciate winter's scenery, stop your snowmobile on the side of the trail so that you don't become a hazard to others.
- Fences represent a very serious threat for both you and your snowmobile. Give a wide berth to telephone poles or posts.
- Hidden wires unseen from a distance can cause serious accidents.
- Always wear an approved safety helmet, eye protection and a face shield. This also applies to your passenger.
- Be aware of inherent risks associated with riding off trails, such as avalanche and other natural or man made hazards or obstacles.
- Tailgating another snowmobile should be avoided. If the snowmobile in front of you slows for any reason, its operator and passenger could be harmed through your neglect. Maintain a safe stopping distance between you and the snowmobile in front of you. Depending on the terrain condition, stopping may require a little more space than you think. Play it safe. Be prepared to use evasive driving.
- Venturing out alone with your snowmobile could also be hazardous. You could run out of fuel, have an accident, or damage your snowmobile. Remember, your snowmobile is capable of traveling further in half an hour than you may be able to walk in a day. Use the "buddy system". Always ride with a friend or member of your snowmobile club. Even then, tell someone where you are going and the approximate time you plan to return.

- Meadows sometimes have low areas where water accumulate and freezes over in winter. This ice is usually glare ice. Attempting to turn or brake on this surface could cause your vehicle to spin out of control. Never brake or attempt speeding or turning on glare ice. If you do happen to travel over such a condition, reduce speed by carefully releasing the throttle.
- Never "jump" with your snowmobile.
- While on safari, do not "gun" the throttle. Snow and ice can be thrown back into the path of a following snowmobile. In addition, when "gunning" the throttle, the vehicle digs into and leaves an irregular snow surface for others.
- Safaris are both fun and enjoyable but don't show off or overtake others in the group. A less experienced operator might try to do the same as you and fail. When riding with others, limit your abilities to the experience of others.
- In an emergency, the snowmobile engine can be stopped by pressing down on the emergency engine stop switch or by pulling the tether cord cap from the engine cut-off switch, while applying brake.
- Always engage parking brake when vehicle is not in use.
- Never run the engine in a non-ventilated area and/or if vehicle is left unattended.
- **Electric start models only:** Never charge or boost a battery while installed on snowmobile.
- Never attempt any fuel system or electrical system maintenance or repair. Any maintenance or repair of these systems must be performed by an authorized Ski-Doo dealer.
- Ensure the path behind is clear of obstacles or bystanders before proceeding in reverse.
- Always remove the tether cord cap from engine cut-off switch when vehicle is not in operation in order to prevent accidental engine starting, to avoid unauthorized use by children or others or theft.
- NEVER stand behind or near a rotating track. Debris could be projected causing severe injuries. To remove packed snow or ice, stop engine, tilt and hold vehicle on its side and use wrench tool on the belt guard.
- Do not stud the track unless it has been approved for studs. At speed, a studded track that has not been approved for studs could tear and separate from vehicle. See an authorized Ski-Doo dealer for current specific studding availability and applications.

- You may stud the track on this vehicle model. However, you **MUST** only use the BRP approved type stud for use on Ski-Doo snowmobiles. **DO NOT EVER** use conventional studs because the track thickness is thinner than our standard tracks. The stud could tear off of track and separate from vehicle.
- Always wear an approved helmet and follow the same dressing guidelines as those recommended for the operator and described in this guide.
- Make sure that you are able to achieve a stable stance, both feet resting positively on the footboards of footrests with good grip, and that you are able to hold on firmly to the handholds.
- Do not forget, with 2-UP models, the operator is responsible for the safety of the passenger. Always remember that the snowmobile handling, stability and braking distance may be affected when riding with a passenger.
- Before riding the vehicle, ask your passenger to inform you to slowdown or stop immediately if he feels uncomfortable or insecure during the ride. Keep a watchful eye on your passenger while riding.

ACTIVE TECHNOLOGIES (iTC)

Introduction

NOTE: Some functions or features described in this section may not apply to every model, or may be available as an option.

The throttle is electronic and provides a command signal to an electronic module whose function is to assure proper operation of its system within set parameters.

It is extremely important for operators to read all information contained in this operator's guide so as to become familiar with this snowmobile, its systems, controls, capabilities and limitations.

iTC (intelligent Throttle Control)

The system uses an electronic throttle control (ETC) that provides command signals to the ECM (Engine Control Module). With this system, there is no need for a traditional throttle cable.

The iTC allows the following operating modes:

- ECO mode
- Standard mode
- Sport mode.

ECO Mode

When ECO mode is selected (fuel economy mode), vehicle torque and speed are limited whereby an optimal cruising speed is maintained in order to reduce fuel consumption.

Refer to *OPERATING MODES* subsection for detailed instructions.

Standard Mode

In standard mode, acceleration is reduced when accelerating from a complete stop and when operating in the low vehicle speed range under certain conditions.

Sport Mode

In sport mode, maximum engine power is available throughout the engine operational range.

Refer to *OPERATING MODES* subsection for detailed instructions.

RIDING THE VEHICLE

Each operator has a responsibility to ensure the safety of other recreationists or bystanders.

You are responsible for proper operation of your vehicle as well as training those whom you allow to ride or drive. There may be noticeable handling and performance differences from one snowmobile to the other.

A snowmobile is relatively simple to operate but like any other vehicle or mechanical equipment, it can be hazardous if you or a passenger are reckless, thoughtless or inattentive. We encourage you to have an Annual Safety Inspection of your snowmobile. Please contact an authorized Ski-Doo dealer for further details. Though not required, it is recommended that an authorized Ski-Doo dealer performs the preseason preparation of your snowmobile. Each visit to your authorized Ski-Doo dealer is a great opportunity for your dealer to verify if your snowmobile is included in any safety campaign. We also urge you to visit your authorized Ski-Doo dealer in a timely manner if you become aware of any safety related campaigns.

See an authorized Ski-Doo dealer for available accessories you may require.

Before venturing on the trails, operate the snowmobile in a restricted flat area until you are completely familiar with its operation and feel comfortable that you can safely tackle a more demanding task. Have an enjoyable and safe ride.

Pre-Ride Inspection



WARNING

The pre-operation check is very important prior to operating the vehicle. Always check the proper operation of critical controls, safety features and mechanical components before starting.

Before Starting the Engine

1. Remove snow and ice from body including lights, seat, footrests, controls and instruments.
2. Verify that air silencer prefilter is free of snow.
3. Verify that skis and steering operate freely. Check corresponding action of skis versus handlebar.

4. Check fuel and oil levels and look for leaks. Replenish if necessary and in case of any leaks; you should seek service from an authorized Ski-Doo dealer, repair shop, or person of your own choosing for maintenance, repair, or replacement. Please refer to the *US EPA EMISSION-RELATED WARRANTY* contained herein for information about warranty claims.
5. All storage compartments must be properly latched and they must not contain any heavy or breakable objects. Hood and side panels must be also properly latched.
6. Activate the throttle control lever several times to check that it operates easily and smoothly. It must return to idle position when released.
7. Activate the brake lever and make sure the brake fully applies before the brake control lever touches the handlebar grip. It must fully return when released.
8. Apply parking brake and check if it operates properly. Leave parking brake applied.
9. Inspect drive belt condition and height, refer to *DRIVE BELT in MAINTENANCE PROCEDURES*.

After Engine is Started

For proper engine starting procedure, refer to *ENGINE STARTING PROCEDURE*.

1. Check headlights high beam and low beam, taillight, stop light and pilot lamps operation.

NOTE: You may need to detach tether cord from your clothes to check lights. In such a case, attach cord as soon as you get back at the controls of the snowmobile.

2. Check the engine cut-off switch (by pulling tether cord cap) and emergency engine stop switch operation.
3. Release parking brake.
4. Refer to *VEHICLE WARM UP* and follow instructions.

Pre-Ride Check List

ITEM	OPERATION	✓
BODY INCLUDING SEAT, FOOTRESTS, LIGHTS, AIR FILTER, CONTROLS AND INSTRUMENTS	Check condition and remove snow or ice.	
SKIS AND STEERING ACTION	Check for free movement and proper operation.	
FUEL AND OIL	Check for proper level and no leaks.	
COOLANT	Check for proper level and no leaks.	
BRAKE FLUID	Check for proper level and no leaks.	
STORAGE COMPARTMENT	Check for proper latching and no heavy or breakable objects.	
TRACK	Check condition and remove snow or ice. For studded tracks, refer to <i>TRACTION ENHANCING PRODUCTS</i> .	
THROTTLE LEVER	Check for proper operation.	
BRAKE LEVER	Check for proper operation.	
PARKING BRAKE, BRAKE	Check for proper operation.	
EMERGENCY ENGINE STOP SWITCH AND ENGINE CUT-OFF SWITCH (TETHER CORD CAP)	Check for proper action. Tether cord must be attached to operator clothing eyelet.	
LIGHTS	Check for proper operation.	
SKI RUNNERS	Check for proper operation.	
SLIDER SHOES	Check for proper operation.	
DRIVE BELT	Check for cracks, fraying or abnormal wear and proper height.	

How to Ride

Riding Gear

Proper snowmobile clothing should be worn. It should be comfortable and not too tight. Always check the weather forecast before going on a ride. Dress for the coldest weather expected. Thermal underwear next to the skin also provides a good insulation.

Wear an approved helmet at all times for safety and comfort. They provide both warmth and reduce injury. A stocking type cap, balaclava and face mask should always be carried or worn. Goggles or a face shield that attach to the helmet are indispensable.

Hands should be protected by a pair of snowmobile gloves or mitts which have sufficient insulation and allow use of thumbs and fingers for operation of controls.

Rubber bottom boots with either a nylon or a leather top, with removable felt liners are best suited for snowmobiling.

You should keep yourself as dry as possible when snowmobiling. When you come indoors, take your snowmobile suit and boots off and make certain they dry properly.

Do not wear a long scarf or loose apparels that could get caught in moving parts.

Carry colored lens goggles.

What to Bring

First aid kit	Provided tool kit
Mobile phone	Knife
Spare spark plugs	Flashlight
Friction tape	Trail map
Spare drive belt	Snack

Rider Position (Forward Operation)

Your riding position and balance are the two basic principles of making your snowmobile go where you want it to. When turning on the side of a hill, you and your passenger must be ready to shift body weight to help it turn in the desired direction. Operator and passenger must never attempt this maneuvering by placing feet

outside of the vehicle. Experience will teach you how much lean to put into turns at different speeds and how much you will have to lean into a slope to maintain proper balance.

Generally, the riding position for best balance and control is sitting. However, the posting, kneeling or standing positions are also used under certain conditions.

WARNING

Do not attempt any maneuvers if they are beyond your abilities.

Sitting

Feet on the running boards, body midway back on seat is an ideal position when operating the snowmobile over familiar, smooth terrain. Knees and hips should remain flexible to absorb shocks.



Posting

A semi-sitting position with the body off the seat and the feet under the body in a sort of squatting posture, thus allowing the legs to absorb the shocks when traveling over uneven terrain. Avoid abrupt stops.



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Kneeling

This position is achieved by placing one foot firmly on the running board and the opposite knee on the seat. Avoid abrupt stops.



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Standing

Place both feet on the running boards. Knees should be flexed to absorb the shock from surface bumps. This is an effective position to see better and to shift weight as conditions dictate. Avoid abrupt stop.



Rider Position (Reverse Operation)

We recommend sitting on your snowmobile when operating in reverse.

Avoid standing up. Your weight could shift forward against throttle lever while operating in reverse, causing an unexpected acceleration.

WARNING

Unexpected acceleration when snowmobile operates in reverse can cause a loss of control.

Carrying a Passenger

Certain snowmobiles are designed for an operator only (1-UP), and others can allow one passenger (2-UP). Make sure to identify and respect the warnings according to your specific models.

Even when a passenger is allowed, this person must be physically fit for snowmobiling.

WARNING

Any passenger must be able to firmly lay his feet on the footrests and keep his hands on the handholds or seat strap at all times when seated. Respecting those physical criteria is important to ensure that the passenger is stable and to reduce the risks of ejection.

The operator has a responsibility to ensure the safety of his passenger and should inform the passenger about snowmobiling basics.

WARNING

- Passenger must only sit on designated passenger seat. Never allow anyone to sit between the handlebar and the operator.
- Passenger and operator must always wear an approved helmet and warm clothing appropriate for snowmobiling. Make sure that no skin is exposed.
- If the passenger feels uncomfortable or insecure for any reason, he must right away inform the operator to slow-down or stop.

Riding with a passenger on board is different than riding alone. The operator has the benefit of knowing what will be the next maneuver and is able to prepare himself accordingly. The operator also benefits from the support of his grip on the handlebar. In contrast, the passenger has to rely on the operator's careful and safe operation of the vehicle. In addition, "body english" is limited with a passenger, and the operator can sometimes see more of the trail ahead than the passenger. Therefore, smooth starting and stopping are required with a passenger, and the operator must slow down. The operator must also warn the passenger about side hills, bumps, branches, etc. An unforeseen bump can leave you passenger-less. Remind your passenger to lean into the turn with you, without causing the vehicle to topple. Be extremely careful, go more slowly and check the passenger frequently.

WARNING

When riding with a passenger:

- Braking ability and steering control are reduced. Decrease speed and allow extra space to maneuver.
- Adjust suspension according to weight.

For complete information on how to adjust the suspension, please refer to *TUNE YOUR RIDE*.

Riding with a Child

On snowmobiles allowing two passengers (with optional seat), if you have an adult and a child for passenger, BRP recommends that the child sits in the center location. This allows an adult sitting in the rear seat to keep a visual contact with the child and hold him if necessary. In addition, the child is best protected against the wind and cold temperature if seated in the center location.

Use extra caution and go even more slowly with a young passenger. Check frequently to make certain the child has a firm grip and is properly positioned with his feet on the running boards.

Terrain/Riding Variations

Groomed Trail

On a maintained trail, sitting is the most preferred riding position. Do not race and, above all, keep to the right hand side of the trail. Be prepared for the unexpected. Observe all trail signs. Do not zigzag from one side of the trail to the other.

Ungroomed Trail

Unless there has been a fresh snowfall you can expect “washboard” and snowdrift conditions. Taken at excessive speeds, such conditions can be physically harmful. Slow down. Hold on the handlebar and assume a posting position. Feet should be under the body assuming a crouched position to absorb any jarring effect. On longer stretches of “washboard” trails, the kneeling position of one knee on the seat can be adopted. This provides a certain amount of comfort, while at the same time keeps the body loose and capable of vehicle control. Beware of hidden rocks or tree stumps partially hidden by a recent snowfall.

Deep Snow

In deep “powder” snow, your vehicle could begin to “bog” down. If this occurs, turn in as wide an arc as possible and look for a firmer base. If you do get “bogged”, and it happens to everyone, do not spin your track as this makes the vehicle sink deeper. Instead, turn the engine off, get off and move the back of the vehicle onto new snow. Then tramp a clear path ahead of the vehicle. A few feet will generally suffice. Restart the engine. Assume the standing position and rock the vehicle gently as you steadily and slowly apply the throttle. Depending on whether the front or rear end of the vehicle is sinking, your feet should be placed on the opposing end of the running boards. Never place foreign material beneath the track for support. Do not allow anyone to stand in front of, or to the rear of, the snowmobile with the engine running. Stay away from the track. Personal injury will result if contact is made with the revolving track.

Frozen Water

Traveling frozen lakes and rivers can be fatal. Avoid waterways. If you are in an unfamiliar area, ask the local authorities or residents about the ice condition, inlets, outlets, springs, fast moving currents or other hazards. Never attempt to operate your snowmobile on ice that may be too weak to support you and the vehicle. Operating a snowmobile on ice or icy surfaces can be very dangerous if you do not observe certain precautions. The very nature of ice is foreign to good control of a snowmobile or any vehicle. Traction for starting, turning or stopping is much less than that on snow. Thus, these distances can be multiplied manyfold. Steering is minimal, and uncontrolled spins are an ever present danger. When operating on ice, drive slowly with caution. Allow yourself plenty of room for stopping and turning. This is especially true at night.

Hard Packed Snow

Don't underestimate hard packed snow. It can be difficult to negotiate as both skis and track do not have as much traction. Best advice is to slow down and avoid rapid acceleration, turning or braking.

Uphill

There are two types of hills you can encounter — the open hill on which there are few trees, cliffs or other obstacles, and a hill that can only be climbed directly. On an open hill, the approach is to climb it by side hilling or slalomming. Approach at an angle. Adopt a kneeling

position. Keep your weight on the uphill side at all times. Maintain a steady, safe speed. Continue as far as you can in this direction, then switch to an opposite hill angle and riding position.

A direct climb could present problems. Choose the standing position, accelerate before you start the climb and then reduce throttle pressure to prevent track slippage.

In either case, vehicle speed should be as fast as the incline demands. Always slow down as you reach the crest. If you cannot proceed further, don't spin your track. Turn the engine off, free the skis by pulling them out and downhill, place the rear of the snowmobile uphill restart the engine and ease it out with slow even throttle pressure. Position yourself to avoid tipping over, then descend.

Downhill

Downhill driving requires that you have full control of your vehicle at all times. On steeper hills, keep your center of gravity low and both hands on the handlebar. Maintain slight throttle pressure and allow the machine to run downhill with the engine operating. If a higher than safe speed is reached, slow down by braking but apply the brake with frequent light pressure. Never jam the brake and lock the track.

Side Hill

When crossing a side hill or traversing up or downhill, certain procedures must be followed. All riders should lean towards the slope as required for stability. The preferred operating positions are the kneeling position, with the knee of the down hill leg on the seat and the foot of the uphill leg on the running board, or the posting position. Be prepared to shift your weight quickly as needed. Side hills and steep slopes are not recommended for a beginner or a novice snowmobiler.

Avalanche Hazard

When riding on mountainous terrain, you should be aware of the risk of avalanches. Avalanches vary in size and shapes and generally occur in steep terrain and on unstable snow.

New snow, animals, people, wind and snowmobiles can all trigger an avalanche. Avoid high marking or traversing steep terrain when avalanche conditions are possible. When in unstable snow conditions, travel should be restricted to lower angle slopes. Wind formed cornices should be avoided. Staying off unstable conditions is the key to safe mountain riding. Probably most important is to be

aware of the conditions and dangers on a daily basis when in the mountains. Check local avalanche forecasts and threats each day before heading out to ride and heed forecasters advice.

You should always carry a snow shovel, probe and avalanche beacon while riding on mountains. We recommend that all mountain riders take a local avalanche safety training course to become more familiar with snow conditions and learn how to properly use their equipment.

Here are some web sites that can help you finding important information:

- US: www.avalanche.org
- Europe: www.avalanches.org
- Canada: www.avalanche.ca

Slush

Slush should be avoided at all times. Always check for slush before starting across any lake or river. If dark spots appear in your tracks, get off the ice immediately. Ice and water can be thrown rearward into the path of a following snowmobile. Getting a vehicle out of a slush area is strenuous and in some cases, impossible.

Fog or Whiteout Conditions

On land or water, fog or visibility-limiting snow can form. If you have to proceed into the fog or heavy snow, do so slowly with your lights on and watch intently for hazards. If you are not sure of your way, do not proceed. Keep a safe distance behind other snowmobilers to improve visibility and reaction time.

Unfamiliar Territory

Whenever you enter an area that is new to you, drive with extreme caution. Go slow enough to recognize potential hazards such as fences or fence posts, brooks crossing your path, rocks, sudden dips, guy wires and countless other obstacles which could result in a termination of your snowmobile ride. Even when following existing tracks, be cautious. Travel at a speed so you can see what is around the next bend or over the top of the hill.

Bright Sunshine

Bright sunny days can considerably reduce your vision. The glare from sun and snow may blind you to the extent that you cannot easily distinguish ravines, ditches or other obstacles. Goggles with colored lenses should always be worn under these conditions.

Unseen Obstruction

There may be obstructions hidden beneath the snow. Driving off established trails and in the woods requires reduced speed and increased vigilance. Driving too fast in an area can make even minor obstacles very hazardous. Even hitting a small rock or stump could throw your snowmobile out of control and cause injury to its riders. Stay on established trails to reduce your exposure to hazards. Be safe, slow down and enjoy the scenery.

Hidden Wires

Always be on the lookout for hidden wires, especially in areas that may have been farmed at one time or another. Too many accidents have been caused by running into wires in the fields, guy wires next to poles and roads, and into chains and wires used as road closures. Slow speeds are a must.

Obstacles and Jumping

Unplanned jumps of snowdrifts, snowplow ridges, culverts or indistinguishable objects can be dangerous. You can avoid them by wearing the proper color lenses or face shields and by operating at a lower speed.

Jumping can be a hazardous situation. Be prepared before landing to absorb the shock and brace yourself for the impact. Knees must be flexed to act as shock absorbers. If the trail does suddenly drop away from you, crouch (stand) towards the rear of the vehicle and keep the skis up and straight ahead. Apply partial throttle and brace yourself for the impact. Knees must be flexed to act as shock absorbers.

Turning

Depending on terrain conditions, there are two preferred ways to turn or corner a snowmobile. For most snow surfaces, "body english" is the key to turning. Leaning towards the inside of the turn and positioning body weight on the inside foot will create a

“banking” condition beneath the track. By adopting this position and positioning yourself as far forward as possible, weight will be transferred to the inside ski.

On occasion, you will find that the only way to turn the vehicle about in deep snow is to pull the snowmobile around. Do not over-exert yourself. Get assistance. Remember to always lift using your legs as opposed to your back.



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Road Crossing

In some cases, you will be approaching the road from a ditch or snowbank. Choose a place where you know you can climb without difficulty. Use the standing position and proceed with only as much speed needed to crest the bank. Stop completely at the top of the bank and wait for all traffic to clear. Judge the drop to the roadway. Cross the road at a 90° angle. If you encounter another snowbank on the opposite side, position your feet near the rear of the vehicle. Remember, your snowmobile is not designed to operate on bare pavement and steering on this type of surface is more difficult.

Railroad Crossing

Never ride on railroad tracks. It is illegal. Railroad tracks and railroad rights-of-way are private property. A snowmobile is no match for a train. Before crossing a railroad track, stop, look and listen.

Night Rides

The amount of natural and artificial light at a given time can effect your ability to see or to be seen. Nighttime snowmobiling is delightful. It can be a unique experience if you acknowledge your reduced visibility. Before you start, make certain your lights are clean and work properly. Drive at speeds that will allow you to stop in time when you see an unknown or dangerous object ahead. Stay on established trails and never operate in unfamiliar territory. Avoid rivers and lakes. Guy wires, barbed wire fences, cabled road entrances and other objects such as tree limbs are difficult to see at night. Never drive alone. Always carry a flashlight. Keep away from residential areas and respect the right of others to sleep.

Riding in a Group

Before starting out, designate a "trail boss" to lead the party and another person to follow-up at the end of the party. Ensure that all members of the party are aware of the proposed route and destination. Make certain that you are carrying all necessary tools and equipment and that you have sufficient fuel to complete the trip. Never overtake the trail boss or, for that matter, any other snowmobile. Use down-the-line hand signals to indicate hazards or intent of direction change. Assist others whenever necessary.

It is always IMPORTANT to keep a safe distance between each snowmobile. Always maintain a safe interval and allow sufficient stopping distance. Don't be a tailgater. Know the position of the machine ahead.

Signals

If you intend to stop, raise either hand straight above your head. A left turn is indicated by extending your left hand straight out in the proper direction. For right turns, extend the left arm and raise the hand to a vertical position so it forms a right angle at the elbow. Every snowmobiler should relay any signal to the ones behind.

Trail Stops

Whenever possible, pull off the trail when you stop. This will reduce the hazard to other snowmobilers using the trail.

Trails and Signs

Trail signs are used to control, direct or regulate the use of snowmobiles on trails. Become familiar with all signs used in the area where you are snowmobiling.

Environment

Wildlife compliments your snowmobiling day. Snowmobile tracks provide firm ground over which animals can travel from area to area. Do not violate this privilege by chasing or harassing wildlife. Fatigue and exhaustion can lead to animal's death. Avoid areas posted for the protection or feeding of wildlife.

If you happen to be fortunate enough to see an animal, stop your snowmobile and observe quietly.

The guidelines that we support are not designed to limit your snowmobiling fun, but to preserve the beautiful freedom that you can experience only on a snowmobile! These guidelines will keep snowmobilers healthy, happy and able to introduce others to what they know and enjoy about their favorite winter pastime. So, the next time you hit the trails on a cool, crisp and clear winter day, we ask you to remember that you are paving the way for the future of our sport. Help us lead it down the right path! From all of us at BRP, thank you for doing your share.

There is nothing more exhilarating than snowmobiling. Venturing onto snowmobile trails that cross wild areas is an exciting and healthy winter sport. However, as the number of people using these recreational parks increases, so does the potential for damage to the environment. Abuse of land, facilities and resources inevitably leads to restrictions and closures of both private and public land.

In essence, the greatest threat to our sport, is all around us. Which leaves us with one logical choice. When we snowmobile, we must always ride responsibly.

The vast majority respect the law and the environment. Each of us must set an example for those who are new to the sport, young and old alike.

It is in every one's best interest to tread lightly into our recreational areas. Because, in the long run, to protect the sport we must preserve the environment.

Recognizing the importance of this issue and the need for snowmobilers to do their share in preserving areas that make it possible to enjoy our sport, BRP has developed the "Light Treading Is Smart Sledging" campaign for snowmobilers.

Light Treading refers to more than the tread of our tracks. It's a statement of concern, respect and willingness to take the lead and take action. It applies to the environment in general, its proper care and maintenance, its natural inhabitants and all enthusiasts and the public at large who enjoy the great outdoors. With this theme, we invite all snowmobilers to remember that respecting the environment is not only critical to the future of our industry but to future generations.

Light Treading in no way suggests you should curb your appetite for snowmobiling fun! It simply means tread with respect!

The fundamental objective of Light Treading is one of respect for where and how you ride a snowmobile. You're a light treader when you follow the principles below.

Become informed. Obtain maps, regulations and other information from the Forest Service or from other public land agencies. Learn the rules and follow them and that goes for speed limits, too!

Avoid running over young trees, shrubs, and grasses and don't cut wood. On flatlands or areas where trail riding is popular, it's important to ride only where authorized. Remember, there is a link between protecting your environment and your own safety.

Respect wildlife and be particularly sensitive of animals that are rearing young or suffering from food shortage. Stress can sap scarce energy reserves. Refrain from riding in areas where only animals are intended to tread!

Obey gate closures and regulatory signs and remember, light treaders don't litter!

Stay out of wilderness areas. They're closed to all vehicles. Know where the boundaries are.

Obtain permission to travel across private land. Respect the rights of landowners and other people's privacy. Remember, snowmobile technology has lowered the noise factor considerably, but you still shouldn't rev your engines where quiet "is the order of the day".

Snowmobilers know all too well the efforts that have been made throughout the sport's history to enjoy access to areas where people can snowmobile safely and responsibly. This effort continues today, as strong as ever.

Respecting the areas where we ride... wherever they may be... is the only way to ensure their future enjoyment. That's one major reason why we know you'll agree that Light Treading is smart sledding! And there are more.

Enjoying the opportunity to see winter and all its natural majestic wonders, is an experience cherished by snowmobilers. Light Treading will preserve this opportunity and will make it possible for us to expose others to the beauty of winter and the unique thrill of our sport! Light Treading will help our sport to grow!

Finally, Light Treading is the sign of a smart snowmobiler. You don't have to leave big tracks or careen through a virgin forest to show you can ride. So whether you're driving a high performance Ski-Doo, a sporty snowmobile or any other make or model, show you know what you're doing. Show you know how to send snow flying and make tracks with a light touch!

TRACTION ENHANCING PRODUCTS

NOTE: This section is applicable to snowmobiles equipped with a factory installed track that has been approved by BRP for special studs installation.

WARNING

Never stud a track that has not been approved for studs. Installing studs on an unapproved track could increase the risk of the track tearing or severing.

WARNING

You may stud the track on this vehicle model. However, you **MUST** only use the BRP approved type stud for use on these Ski-Doo snowmobiles. **DO NOT EVER** use conventional studs as the track thickness is thinner than other standard tracks. The stud could tear off of track and separate from vehicle. See an authorized Ski-Doo dealer for current specific studding availability and applications.

Using traction enhancing products such as, adjustable or more aggressive ski carbide runners and/or studs on your snowmobile will change its behavior, particularly in terms of manoeuvrability, acceleration, and braking.

Using traction enhancing products gives a better grip on packed snow and ice, but has no noticeable effect on soft snow. For this reason, driving a snowmobile equipped with traction enhancing products requires a certain adaptation period. If your snowmobile is equipped with traction enhancing products, be sure to take plenty of time to get used to the way it handles when turning, accelerating, and braking.

Also, always check local regulations concerning the use of traction enhancing products on snowmobiles. Always drive your snowmobile in a responsible manner, respecting the environment and other people's property.

Manoeuvrability

Using traction enhancing products such as, more aggressive ski carbide runners and/or studs makes the snowmobile grip the ground better at both the front and at the rear. The use of carbide runners is therefore required to give the skis a better grip, so that the front and rear of the snowmobile are in balance. While off-the-shelf carbide

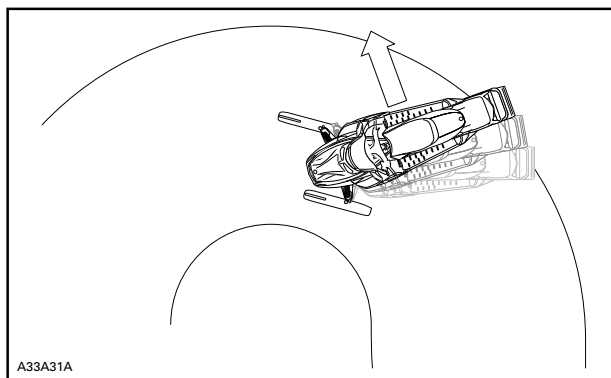
ski runners are adequate, they don't necessarily give you optimal control, since that depends on your personal preferences, your riding style, and how your suspension is adjusted.

WARNING

If the front and rear of the snowmobile are out of balance due to an incorrect combination of traction enhancing products, the snowmobile may tend to oversteer or understeer, which could lead to a loss of control.

Oversteering

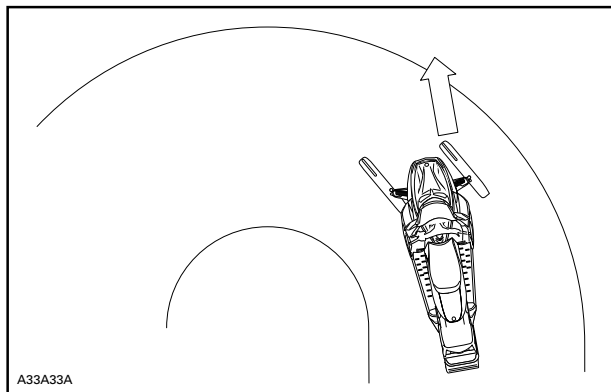
In certain conditions, using more aggressive ski carbide runners without studs on the rear track could make the snowmobile prone to oversteering, see illustration.



OVERSTEERING

Understeering

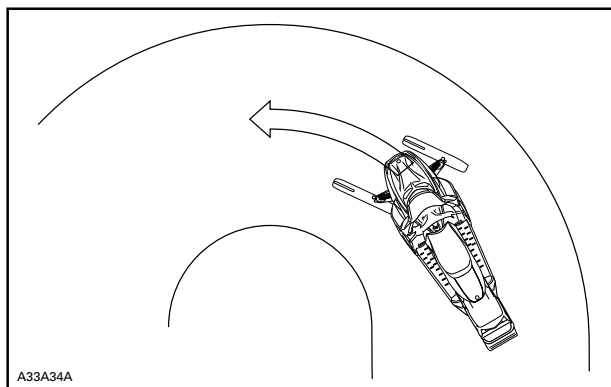
In certain conditions, the use of studs on the track could make the snowmobile prone to understeering if the skis are not equipped with more aggressive ski carbide runners, see illustration.



UNDERSTEERING

Controlled Driving

A balanced combination of carbide ski runners and studs on the track ensures adequate control and better handling, see illustration.



CONTROLLED DRIVING

Acceleration

Using studs on the track will allow your sled to accelerate better on packed snow and ice but will have no noticeable effect on soft snow. This can cause sudden variations in traction under certain conditions.



WARNING

To prevent surprises that could lead to a loss of control of the snowmobile:

- Always go easy on the throttle.
- NEVER try to spin the track to make the rear of the snowmobile skid.

This could cause debris or ice to be thrown violently backwards, possibly injuring others nearby or on snowmobiles behind you.

Braking

As in the case of acceleration, using studs on the track will give you better braking capacity on packed snow or ice but will have no noticeable effect on soft snow. Braking may thus vary suddenly under certain conditions. Be sure to use restraint in braking to keep from blocking the track in order to avoid surprises that could lead to a loss of control.

Important Safety Rules



WARNING

To prevent serious injury to individuals near the snowmobile:

- NEVER stand behind or near a moving track.
- Always use a wide-base snowmobile stand with a rear deflector panel if it is necessary to rotate track.
- When the track is raised off the ground, only run it at the lowest possible speed.

Centrifugal force could cause debris, damaged or loose studs, pieces of torn track, or an entire severed track to be violently thrown backwards out of the tunnel with tremendous force.

Effects of Having a Studded Track on the Life of the Snowmobile

The use of traction enhancing products can increase the load and the stress on certain snowmobile components, as well as the vibration level. This can cause premature wear on parts such as belts, brake linings, bearings, chain, chaincase sprocket, and on approved studded tracks, shorten track life. Always proceed with a visual inspection of your track before each use. For more information, refer to *TRACK* in *MAINTENANCE*.

Studs on the track can also cause serious damage to your snowmobile if it is not equipped with the tunnel protectors designed for your particular model. Damage to the electrical wiring or perforation of the heat exchangers are potential hazards, that could cause the engine to overheat and be severely damaged.

WARNING

If tunnel protectors are excessively worn or not installed, the gas tank could be punctured, causing a fire.

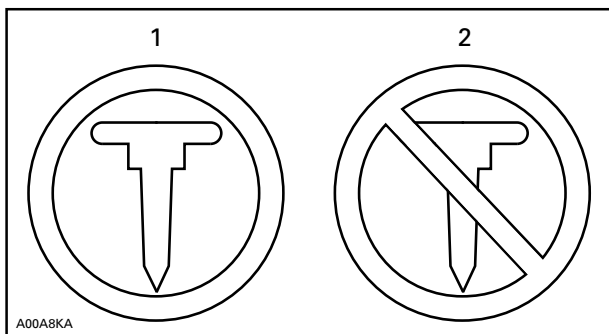
NOTICE Ask your dealer for the appropriate tunnel protectors model and kit number required for your snowmobile.

NOTE: Consult the BRP limited warranty to find out what warranty limitations are related to the use of studs.

Installation of Studs on BRP Approved Tracks

WARNING

Never stud a track that has not been approved for studs. Approved tracks can be identified by a stud symbol (see illustration below) molded into the track surface. Installing studs on an unapproved track could increase the risk of the track tearing or severing.

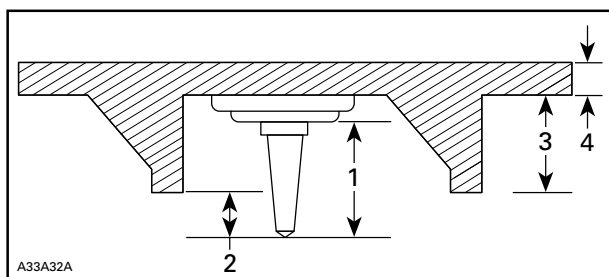


TRACK SYMBOLS

1. *Approved*
2. *NOT Approved*

To ensure safe and proper installation, BRP recommends to have the studs installed by your dealer.

- Use only the BRP approved special studs.
- Never use studs that exceed the height of your snowmobile's track profile by more than 9.5 mm (3/8 in).



INSTALLATION OF STUDS

1. *Stud size*
2. *Penetration range 6.4 mm to 9.5 mm (1/4 in to 3/8 in)*
3. *Track lug height*
4. *Track belt thickness*

WARNING

- See an authorized Ski-Doo dealer for current specific studding availability and applications.
- DO NOT EVER use conventional stud because, the track thickness is thinner than our standard tracks and the stud could tear off of track and separate from vehicle.
- Studs should only be installed in the locations indicated by molded bulges in the track surface. Some track models have two types of molded bulges; triangles and circles. See the warning molded into the track surface to know which one to use.
- Never stud a track with a profile of 35 mm (1-3/8 in) or more.
- The number of studs installed must always perfectly match the pattern of molded bulges in the track.
- Always consult the traction product manufacturer's installation instructions and recommendations before having your dealer install studs and runners. It is very important to follow the tightening torque specifications for the stud bolts.

INSTALLING AN INCORRECT NUMBER OF STUDS OR AN IMPROPER INSTALLATION CAN INCREASE THE RISK OF THE TRACK TEARING OR SEVERING.

Maintenance/Replacement

PROCEED WITH A VISUAL INSPECTION OF YOUR TRACK BEFORE EACH USE.

Look for any defects, such as:

- Perforations in the track
- Tears in the track (particularly around traction holes on studded tracks)
- Lugs that are broken or torn off, exposing portions of rods
- Delamination of the rubber
- Broken rods
- Broken studs (studded tracks)
- Bent studs (studded tracks)
- Missing studs
- Studs that are torn off the track
- Missing track guide(s)
- Also, ensure that studs nut are tighten to the recommended tightening torque.

On approved studded tracks, replace broken or damaged studs immediately. If your track shows signs of deterioration, it must be replaced immediately. When in doubt, ask your dealer. Always proceed with a visual inspection of your track before each use.



WARNING

Riding with a damaged track or studs could lead to loss of control.

MOVING LOADS AND DOING WORK

Working with your Vehicle

Your vehicle can help you perform a number of different LIGHT tasks ranging from pulling a load to carrying cargo. A variety of accessories are available from your authorized Ski-Doo dealer. To prevent possible injury, follow the instructions and warnings that accompany the accessory. Always respect the load limits of the vehicle. Overloading the vehicle can overstress the components and cause failure. Avoid overexerting yourself if you lift or pull heavy loads or manually push the vehicle.

Carrying Loads

WARNING

Always reduce your speed when carrying load or a cargo carrier.

Any load carried on the vehicle including a passenger and/or the carrying rack will affect the handling, stability and braking distance of the vehicle. Do not exceed the total load allowed for this vehicle, including the weight of the occupant(s), cargo, accessories and cargo carrier tongue weight. Refer to *SPECIFICATIONS*. Always make sure the cargo is secured and cannot interfere with controls lights. Always be aware that the cargo may slide or fall off and cause an accident. Avoid loads that may protrude sideways and get snagged or caught in bushes or other obstacles.

WARNING

The vehicle handling, stability and braking distance are affected when loading rear cargo area and using the vehicle. Correct loading and weight distribution are therefore important. Never overload, tow or carry cargo improperly. Always ensure the cargo is safely secured before operating the vehicle. Safely reduce speed according to terrain conditions when carrying cargo or pulling a cargo carrier, and avoid hills and rough terrain. Allow greater distance for braking, especially on inclined surfaces and when a passenger is on board. Be careful not to skid or slide. Always secure cargo as low as possible to reduce the effect of a higher center of gravity. Failure to follow the recommendations here could cause changes in vehicle handling which could lead to an accident.

MAXIMUM LOAD TABLE			
TOTAL LOAD ALLOWED	Expedition Sport	198 kg (435 lb)	Includes weight of operator, passenger, cargo, accessories and cargo carrier tongue weight.
	Expedition LE Expedition SE	238 kg (525 lb)	
CARGO LOAD	Expedition Sport	15.8 kg (35 lb)	Evenly distributed. Includes rear rack, rear storage compartment and tongue load.
	Expedition LE Expedition SE	56 kg (125 lb)	

Hauling a Load

Never pull a load by attaching it directly to the bumper. Use only the hitch to pull a load.

When hauling a load, respect the maximum hauling capacity. See *PULLING A CARGO CARRIER* in this section.



WARNING

Never tow an accessory with a rope. Always use a rigid tow bar. Using a rope would result in a collision between the object and the snowmobile and possibly in a tip over in case of a rapid deceleration or on a downward slope.



WARNING

A slack in the chain or cable can cause it to break and snap back.

When pulling another vehicle, be sure that someone is controlling the pulled vehicle. They must brake and steer to prevent the vehicle from going out of control.

Reduce your speed when hauling a load and turn gradually. Avoid hills and rough terrain. Never attempt steep hills. Allow more distance for braking, especially on inclined surfaces and when a passenger is on board. Be careful not to skid or slide.

Pulling a Cargo Carrier

Riding this vehicle with a cargo carrier substantially increases the risk of toppling, especially on inclined slopes. If a cargo carrier is used behind the vehicle make sure that its hitch is compatible with the one on the vehicle. Make sure the cargo carrier is horizontal with the vehicle. (In some instances a special extension may have to be installed on the vehicle hitch). Use security chains or cables to secure the cargo carrier with the vehicle.

Reduce your speed when pulling a cargo carrier and turn gradually. Avoid hills and rough terrain. Never attempt steep hills. Allow more distance for braking, especially on inclined surfaces and when a passenger is on board. Be careful not to skid or slide.

Improperly loading a cargo carrier may cause a loss of control.

Do not exceed the towing capacity or tongue capacity. Refer to *SPECIFICATIONS*.

Make sure there is at least some weight on the tongue.

Always make sure load is evenly distributed and safely secured on the cargo carrier; an evenly balanced cargo carrier is easier to control.

On vehicle equipped with a gearbox, always put the shift lever to L (low range) for hauling a cargo carrier – in addition to providing more torque, operating in low range helps account for the increased load.

Use caution when disconnecting a loaded cargo carrier; it or its load may topple on you or others.

When hauling a cargo carrier, respect the maximum hauling capacity indicated on the label on the rear of the tunnel.

IMPORTANT ON-PRODUCT LABELS

Hang Tag(s)

VEHICLE ENGINE DESCRIPTION:

XXXXXX

EPA CERTIFIED

NER (NORMALIZED EMISSION RATE) =

ON A 0 TO 10 SCALE, 0 BEING THE CLEANEST

***NOT TO BE REMOVED PRIOR TO SALE**



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TYPICAL

 **WARNING.** Operating, servicing and maintaining an off-road vehicle can expose you to chemicals including engine exhaust, carbon monoxide, phthalates, and lead, which are known to the State of California to cause cancer and birth defects or other reproductive harm.

To minimize exposure, avoid breathing exhaust, do not idle the engine except as necessary, service your vehicle in a well-ventilated area and wear gloves or wash your hands frequently when servicing your vehicle.

For more information go to
[www.P65Warnings.ca.gov/products/
passenger-vehicle](http://www.P65Warnings.ca.gov/products/passenger-vehicle)



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Have you asked your dealer to adjust your suspension to **YOUR** riding style?

- **Limiter strap length**
- **Spring preload**

for more details.

See the operator's guide

-Tune your ride section

***This hangtag may ONLY be removed by the customer.**



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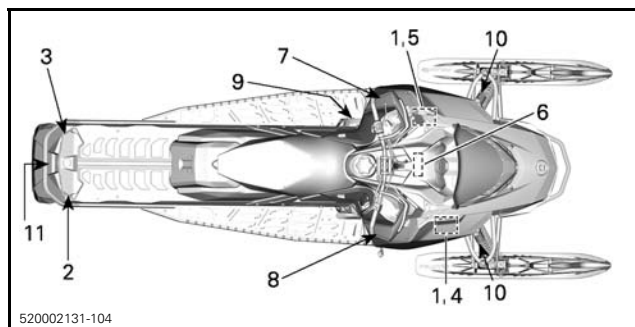
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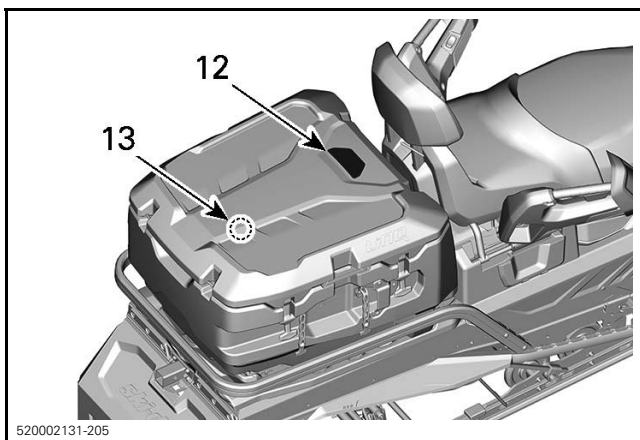
Vehicle Safety Labels

These labels are affixed to the vehicle for the safety of the operator, passenger or bystanders.

The following labels are on your vehicle and they should be considered permanent parts of the vehicle. If missing or damaged, the decals can be replaced free of charge. See an authorized Ski-Doo dealer.

NOTE: In the event of any discrepancy between this guide and the vehicle, the safety labels on the vehicle have precedence over the labels in this guide.



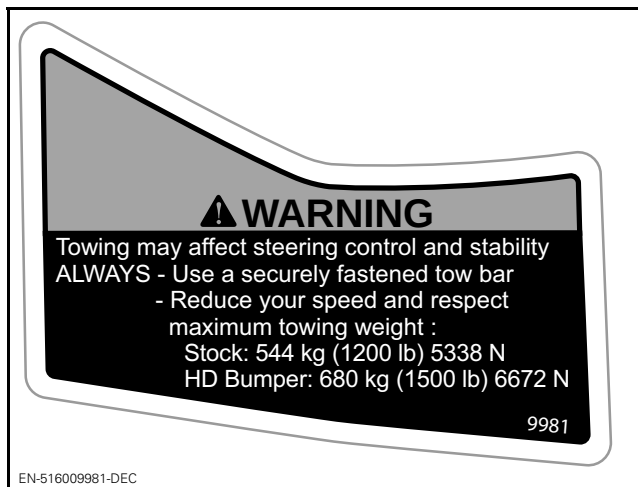


Label 1



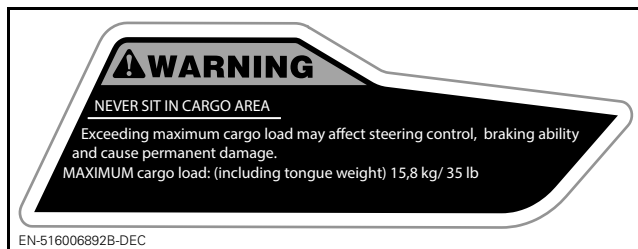
LABEL 1

Label 2 - Expedition LE and SE



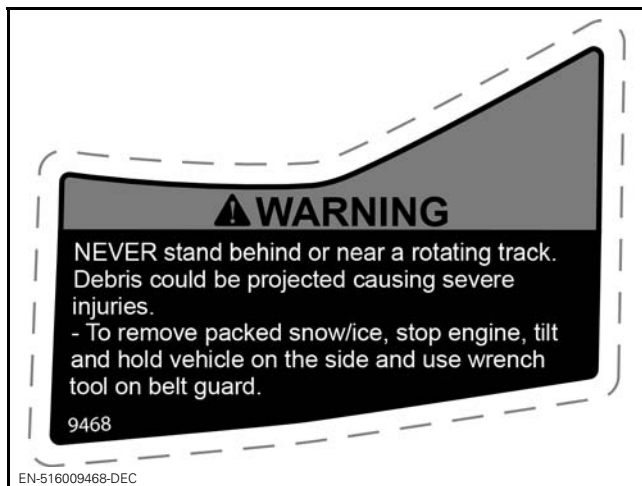
LABEL 2

Label 2 - Expedition Sport



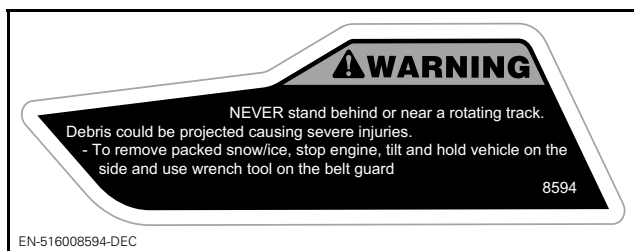
LABEL 2

Label 3 - Expedition LE and SE



LABEL 3

Label 3 - Expedition Sport



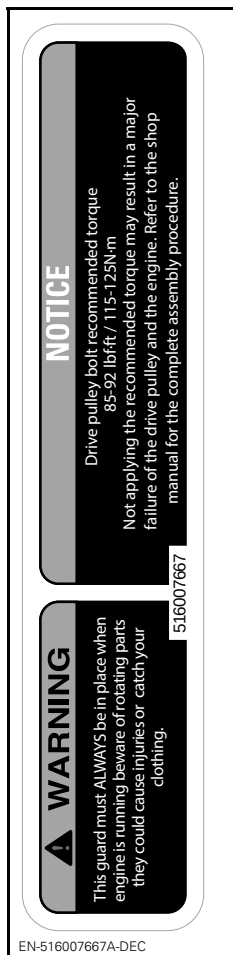
LABEL 3

Label 4



LABEL 4

Label 5



LABEL 5

Label 6

 **CAUTION**

ENGINE OIL AND CERTAIN COMPONENTS IN THE ENGINE COMPARTMENT MAY BE HOT. DIRECT CONTACT MAY RESULT IN SKIN BURN.

CHECKING ENGINE OIL LEVEL

- Make sure engine is at operating temperature.
- Vehicle must be level to perform verification.
- Let engine running at idle for at least 30 seconds.
- Stop engine and wait at least 30 seconds.
- Check oil level using the dipstick.
- The engine of this snowmobile has been developed and validated using the BRP XPS™ Synthetic 4-stroke oil (293 600 112). BRP recommends the use of its XPS™ approved lubricant or equivalent.

Damages caused by oil which is not suitable for this engine may not be covered by the BRP limited warranty. See operator's guide.

EN-51607500-DEC

LABEL 6

Label 7 - Expedition LE and SE



EN-516009492-DEC

LABEL 7

Label 7 - Expedition Sport



LABEL 7

Label 8 - Expedition LE and SE

⚠ WARNING

This vehicle is designed for one (1) operator and as many passengers as there are seats with straps or handgrips installed on the vehicle conforming to SSCC standards.

Ce véhicule a été conçu pour un (1) conducteur et autant de passagers qu'il y a de siège avec courroies ou poignées installés sur le véhicule et rencontrant la norme SSCC.

When riding with a passenger:

- Braking ability and steering control are reduced. Decrease speed and allow extra space to manoeuvre.
- Adjust suspension according to weight

REMEMBER : YOU ARE RESPONSIBLE FOR THE SAFETY OF YOUR PASSENGER!

ALL DRIVERS AND PASSENGERS MUST READ THE FOLLOWING :

Avoid surprises!

BE ON THE LOOK-OUT for the unexpected.
Operate defensively.

- Scan constantly for people, objects, conditions and upcoming vehicles.
- Avoid thin ice / open water.
- Use extra caution whenever off-trail.

ALWAYS wear a DOT approved HELMET and clothing appropriate for snowmobiling.

NEVER ride under the influence of alcohol or drugs even as a passenger.

Patent: www.brp.com/en/about-brp/patents.html
516009493

EN-516009493-DEC

LABEL 8

Label 8 - Expedition Sport

WARNING

This vehicle is designed for one (1) operator and as many passengers as there are seats with straps or handgrips installed on the vehicle conforming to SSCC standards.

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Decrease speed and allow extra space to manoeuvre.

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- Avoid thin ice / open water.
- Use extra caution whenever off-trail.



ALWAYS wear a DOT approved **HELMET** and clothing appropriate for snowmobiling.



NEVER ride under the influence of alcohol or drugs even as a passenger.



516009483

EN-516009483-DEC

[Page 11: www.bep.com/en/about-bep/passents.html](http://www.bep.com/en/about-bep/passents.html)

LABEL 8

Label 9



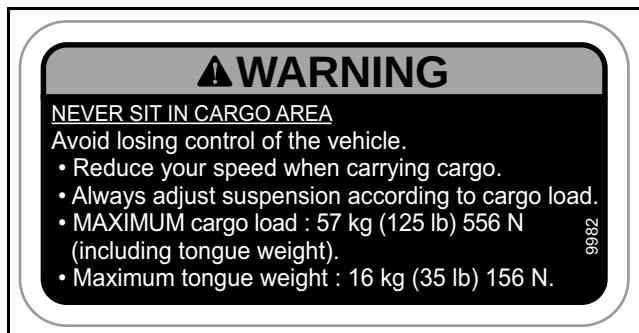
LABEL 9

Label 10



LABEL 10 - ON SHOCK GAS CHARGED ABSORBERS

Label 11 - Expedition LE and SE



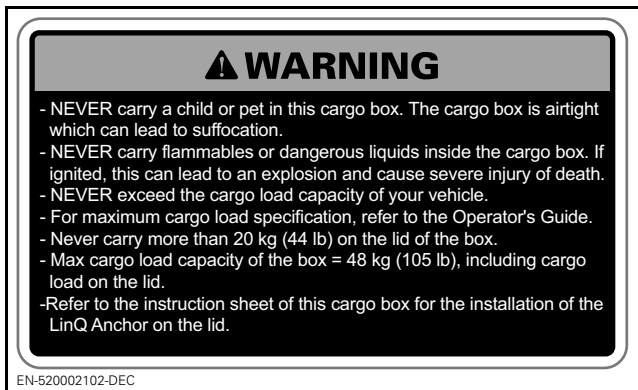
LABEL 11

Label 12 - Expedition SE



LABEL 12 - ON COVER OF CARGO BOX

Label 13 - Expedition SE



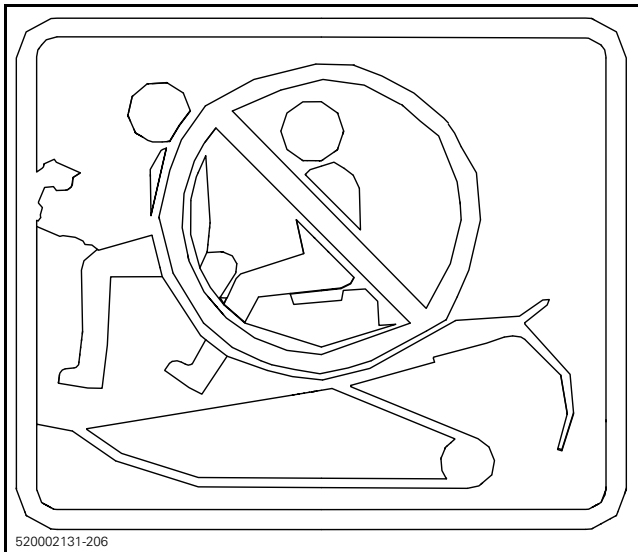
LABEL 13 - INSIDE CARGO BOX COVER

Molded Safety Pictogram

Located on rear storage compartment of Expedition LE and SE.

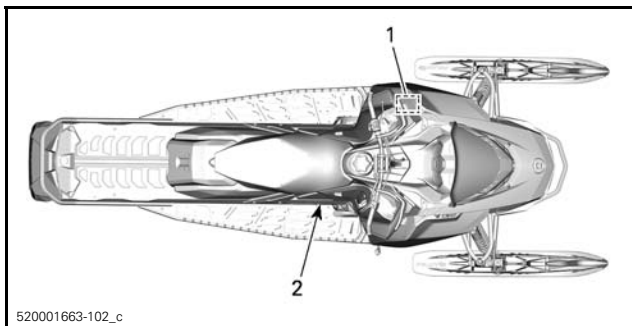


Never carry passengers on cargo box.



520002131-206

Compliance Labels

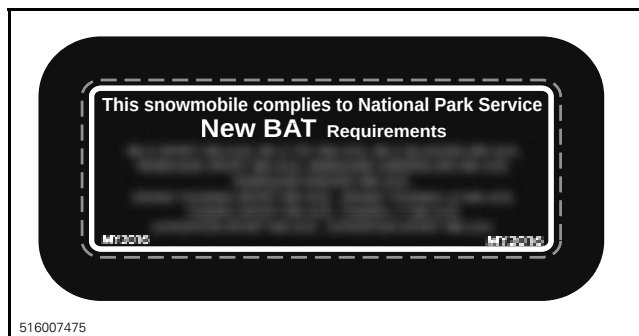


EPA Compliance Label

EMISSION CONTROL INFORMATION		EC 121
THIS VEHICLE IS CERTIFIED TO OPERATE ON UNLEADED GASOLINE AND MEETS [XXXX] U.S. EPA REGULATIONS FOR SNOWMOBILE SI ENGINES.		
ENGINE FAMILY	XXXXXXXXXXXXX	FAMILLE DE MOTEUR
PERMEATION FAMILY	XXXXXXXXXXXXX	FAMILLE DE PERMÉATION
FEL	XX g/kW-hr HC XXX g/kW-hr CO X.X g/ m2 / day	LIMITE DES ÉMISSIONS DES FAMILLES
ENGINE DISPLACEMENT	XXX cm ³	CYLINDRÉE
EXHAUST EMISSION CONTROL SYSTEM	XXXX	SYSTÈME DE CONTRÔLE DES ÉMISSIONS
RENSEIGNEMENTS SUR LE DISPOSITIF ANTIPOLLUTION CE VÉHICULE EST CERTIFIÉ POUR FONCTIONNER À L'ESSENCE SANS PLOMB ET IL RÉPOND AUX NORMES [XXXX] DE L'EPA DES É.-U. POUR LES MOTONEIGES À MOTEUR SI. SEE OPERATOR'S GUIDE FOR MAINTENANCE SPECIFICATIONS VOIR GUIDE DU CONDUCTEUR POUR LES SPÉCIFICATIONS D'ENTRETIENS BOMBARDIER RECREATIONAL PRODUCTS INC. 6865		

516006865

TYPICAL: COMPLIANCE LABEL 1 - IN ENGINE COMPARTMENT

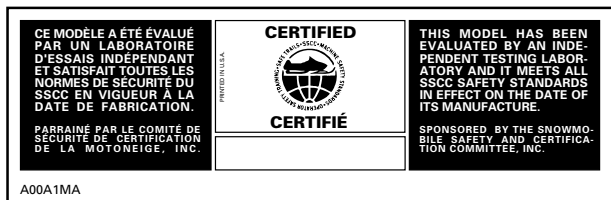


516007475
TYPICAL - COMPLIANCE LABEL 2

SSCC Label

Safety standards for snowmobiles have been adopted by the Snowmobile Safety and Certification Committee (SSCC) of which BRP is a proud participating member. Assurance that your snowmobile meets these standards is easily checked by locating the Certification Label on a right vertical portion of the vehicle.

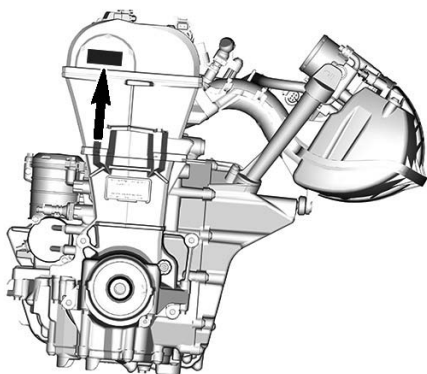
The following label shows that an independent testing laboratory has verified compliance with the SSCC safety standards.



LABEL 2

Regulation (EU) 2016/1628 applicable for Non-Road Mobile Machineries

Vehicles who comply to Regulation (EU) 2016/1628 (NRMM) are identified on the engine valve cover.



NRMM_ACE_MY20

TYPICAL

Rotax



#

M#####

Prod. date:

MM-YYYY

Family type:

#####

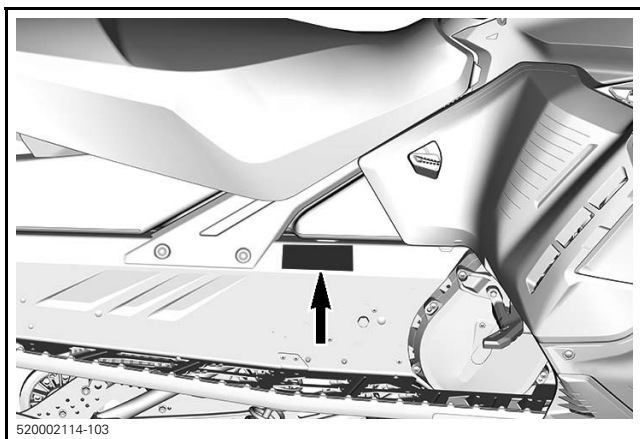
e13

SMB/P V-####

EN-516009861-DEC

TYPICAL NRMM IDENTIFICATION ON ENGINE

Depending on your particular vehicle configuration, an additional NRMM identification decal may be installed on the tunnel, near the chaincase.



520002114-103

TYPICAL - ON RH SIDE OF TUNNEL

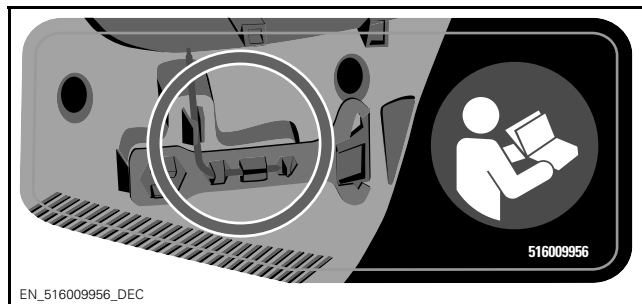


EN-516009917-DEC

TYPICAL NRMM IDENTIFICATION ON VEHICLE

Technical Information Labels

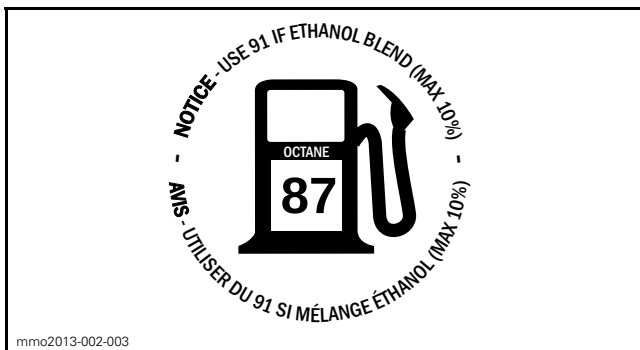
- Install Suspension adjustment tool 1st. (Illustrated Red on label)
- Install Pulley Expander and Headlight adjustment tool 2nd. (Illustrated Blue on label)
- Refer to your operator's guide.



LOCATED ON BELT GUARD



LOCATED ON FUEL CAP - ON 600 ACE AND 900 ACE ENGINE (IN COUNTRIES USING RON OCTANE RATINGS)



LOCATED ON FUEL CAP - ON 600 ACE AND 900 ACE ENGINE (IN COUNTRIES USING PUMP POSTED AKI (RON+MON)/2 OCTANE RATINGS)



ON FUEL CAP - ON TURBO ENGINES (IN COUNTRIES USING PUMP POSTED AKI (RON+MON)/2 OCTANE RATINGS)



DEC 513033943 EN-FR

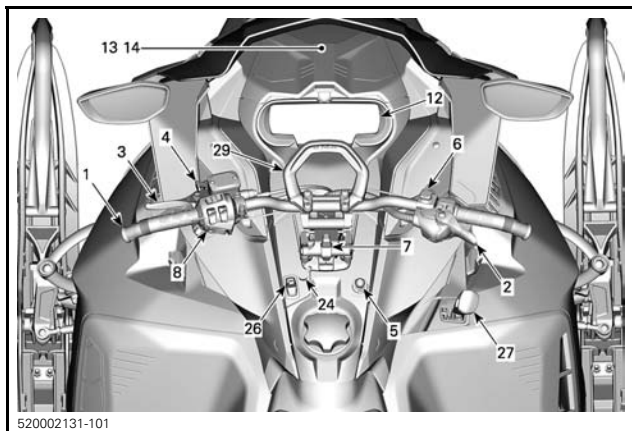
ON FUEL CAP - ON TURBO ENGINES (IN COUNTRIES USING RON OCTANE RATINGS)

VEHICLE INFORMATION

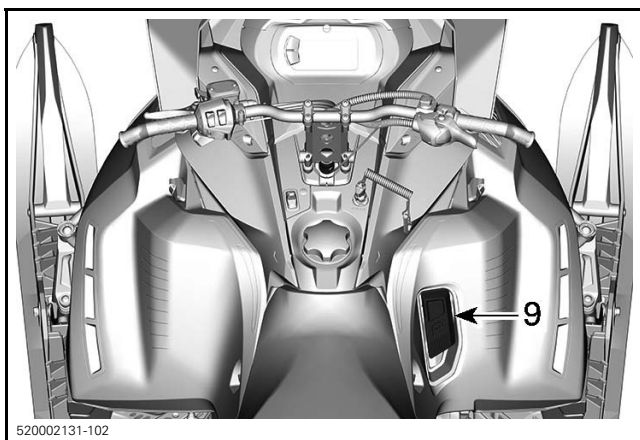
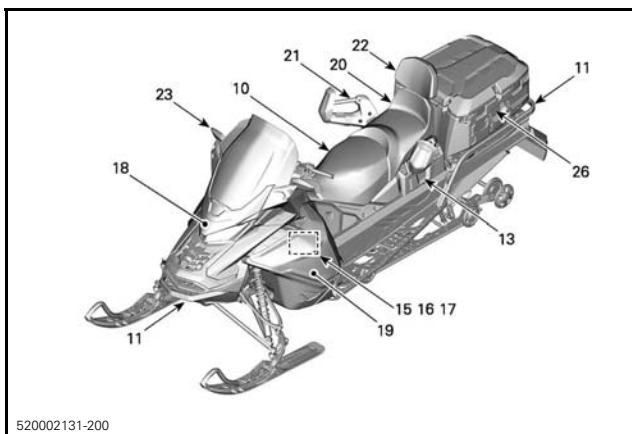
CONTROLS, INSTRUMENTS AND EQUIPMENT

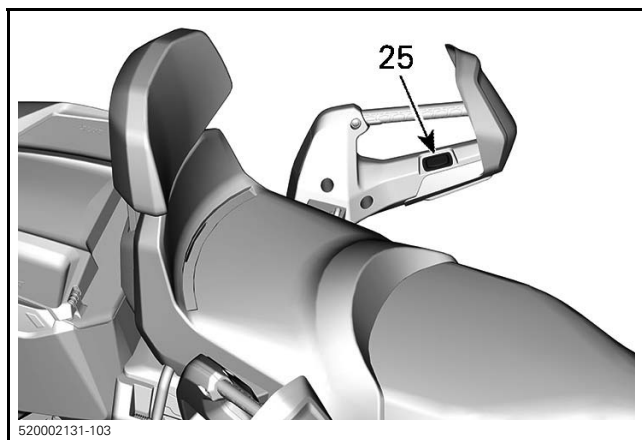
NOTE: Some features may not apply to your model or could be optional.

NOTE: Some vehicle safety labels are not shown on illustrations. For information on vehicle safety labels, refer to *IMPORTANT ON-PRODUCT LABELS*.



TYPICAL





1) Handlebar

The handlebar controls the steering of the snowmobile. As the handlebar is rotated to right or left, the skis are turned right or left to steer the snowmobile.

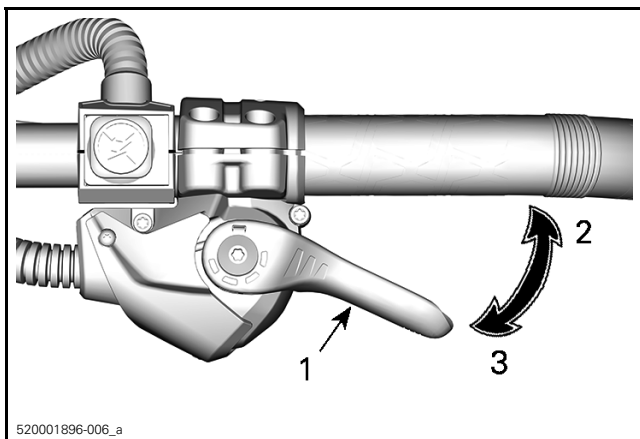
WARNING

Fast reverse while turning, could result in loss of stability and control.

2) Throttle Lever

Throttle lever is located on the RH side of handlebar.

Designed to be either thumb activated or finger activated. When squeezed, it increases the engine speed. When released, engine speed returns automatically to idle.



520001896-006_a

TYPICAL

1. Throttle lever
2. To accelerate
3. To decelerate

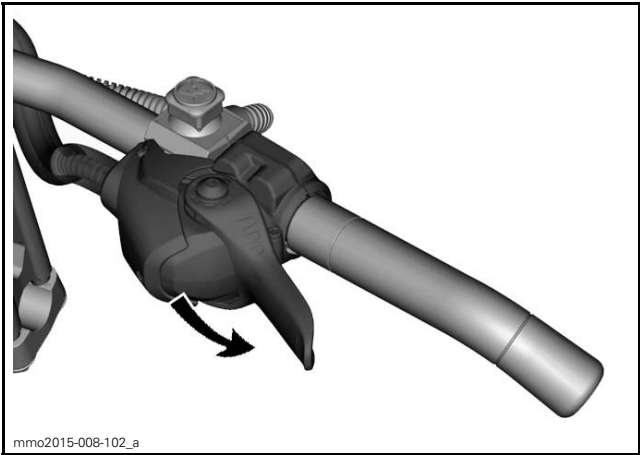
⚠ WARNING

Test the throttle lever operation each time before starting the engine. The lever must return to the rest position once released. Otherwise, do not start engine.

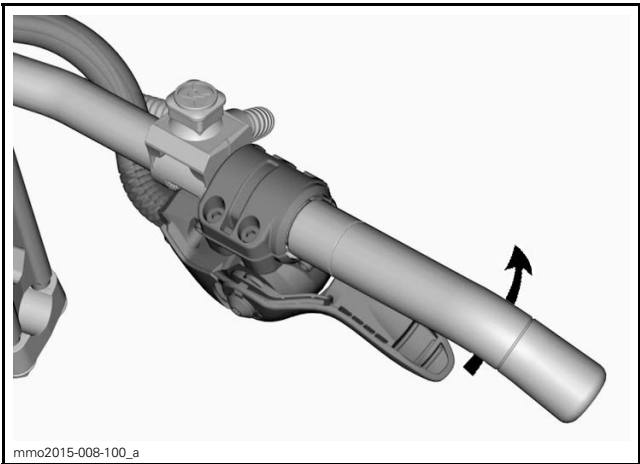
Switching from Thumb to Finger Throttle Position

⚠ CAUTION It is highly recommended to immobilize the snowmobile before attempting any modification to the throttle position as it could lead to a hazardous situation.

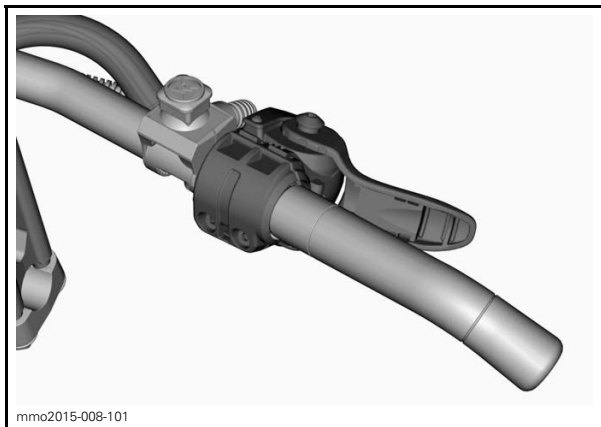
There are mainly three positions to choose from when going from the thumb to the finger throttle position and the best one will be to the rider's preference and in direct relation with the riding style and conditions.



THUMB THROTTLE POSITION : PUSH DOWNWARD TO ROTATE THROTTLE HOUSING



IF WANTED, CONTINUE TO ROTATE THE THROTTLE HOUSING



FINGER THROTTLE POSITION

⚠ CAUTION

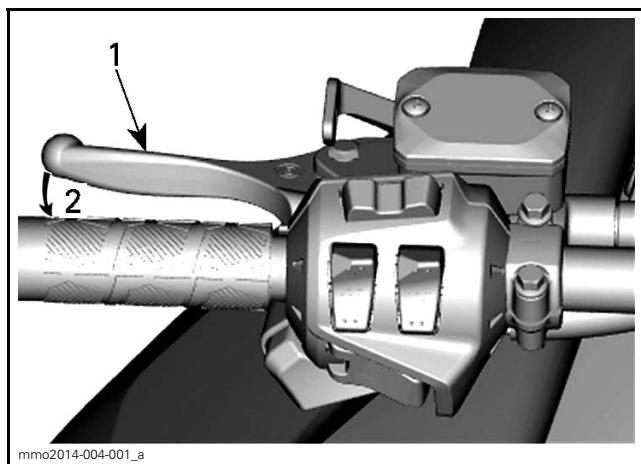
- It is **HIGHLY** recommended to use gloves and **NOT** mitts when using the finger throttle position.
- It is not recommended to use the finger throttle position while riding in dense off trail areas.

The procedure to go back to the thumb throttle position is the reverse of the one shown above.

3) Brake Lever

Brake lever is located on the LH side of handlebar.

When squeezed, brake is applied. When released, it automatically returns to the rest. Braking effect is proportional to the pressure applied on the lever and to the type of terrain and its snow coverage.



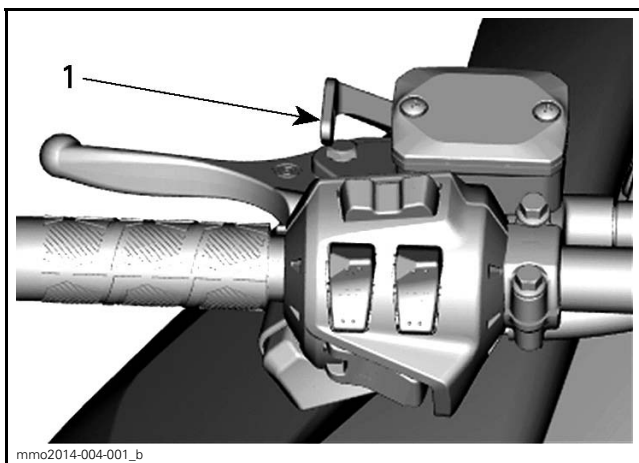
TYPICAL

1. Brake lever
2. To apply brake

4) Parking Brake Lever

Parking brake lever is located on the LH side of handlebar.

Parking brake should be used whenever snowmobile is parked.

**TYPICAL**

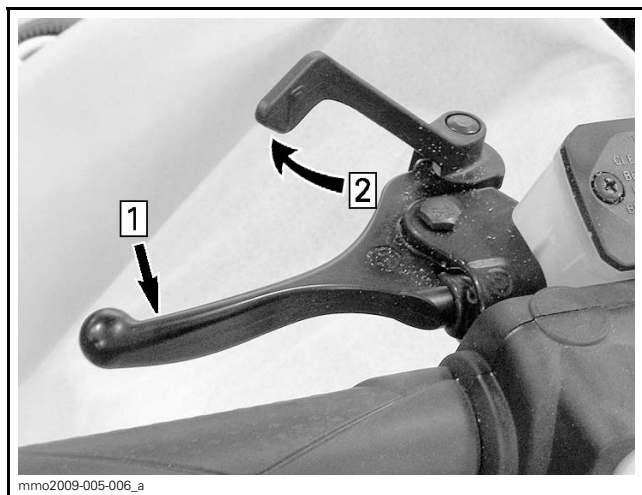
1. Parking brake lever

⚠ WARNING

Make sure parking brake is fully disengaged before operating the snowmobile. When you ride the vehicle, brake pads that are caused to drag by a continuous pressure on the lever may cause damage to the brake system and cause loss of braking capacity and/or fire.

To Engage Parking Brake

Apply and hold brake, then lock brake lever using the parking brake lever as shown.



TYPICAL — ENGAGE MECHANISM

Step 1: Apply and hold brake

Step 2: Lock brake lever using parking brake lever

To Release Parking Brake

Squeeze brake lever. Parking brake lever will automatically return to its original position. Always release parking brake before riding.

5) Engine Cut-off Switch

The engine cut-off switch (tether cord) is located on the console.

The tether cord cap must be securely snapped on the engine cut-off switch to allow vehicle operation.

NOTE: After engine starting, 2 short beeps should be heard if a programmed D.E.S.S. key (tether cord cap) is correctly snapped on engine cut-off switch. If another beep code is heard, refer to *MONITORING SYSTEM* for D.E.S.S. malfunction codes information.

Pulling the tether cord cap from the switch shuts the engine off.

! WARNING

Always attach the tether cord eyelet to clothing before starting the engine.

D.E.S.S. (Digitally Encoded Security System)

The tether cord cap has an integrated D.E.S.S. key to provide you and your snowmobile with the equivalent security of a conventional lock key.

The D.E.S.S. key contains an electronic chip which features a unique permanently memorized digital code.

Your authorized Ski-Doo dealer has programmed the D.E.S.S. of your snowmobile to recognize the D.E.S.S. key in the tether cord cap to allow vehicle operation.

If another tether cord is used without programming the D.E.S.S., the engine will start but will not reach drive pulley engagement speed to move vehicle.

Make sure the tether cord cap is free of dirt or snow.

D.E.S.S. Flexibility

The D.E.S.S. of your snowmobile can be programmed by your authorized Ski-Doo dealer to accept up to 8 different keys.

We recommend the purchase of additional tether cords from your authorized Ski-Doo dealer. If you have more than one D.E.S.S. equipped Ski-Doo snowmobile, each can be programmed by your authorized Ski-Doo dealer to accept the other vehicles D.E.S.S. keys.

6) Emergency Engine Stop Switch

The emergency engine stop switch is located on the RH side of handlebar.

Push-pull type switch.

To stop the engine in an emergency, select OFF position (down) and simultaneously apply the brake. To restart, button must be at the ON position (up).



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OFF POSITION

To allow engine starting, the switch must be in the ON position (UP).



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ON POSITION

All operators of the snowmobile should familiarize themselves with the function of the emergency engine stop switch by using it several times on first outing and whenever stopping the engine thereafter. This engine stopping procedure will become a reflex and will prepare operators for emergency situations requiring its use.

⚠ WARNING

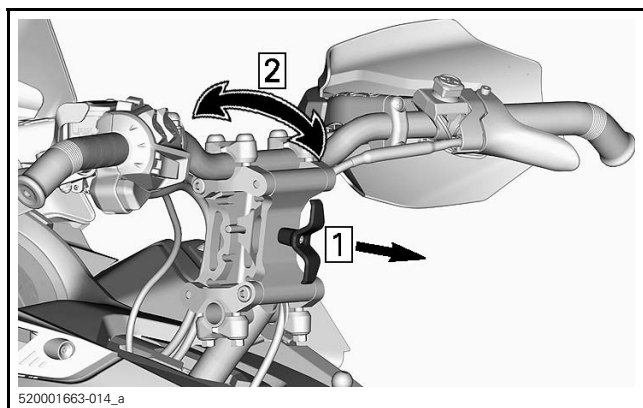
If the switch has been used in an emergency caused by a suspected malfunction, the source of the malfunction should be determined and corrected before restarting engine. See an authorized Ski-Doo dealer for servicing.

7) Adjustable Handlebar Riser (If Equipped)**⚠ WARNING**

Always stop engine before adjusting handlebar.

The handlebar can be set in four different positions.

To change handlebar position, pull lever and position handlebar as desired.

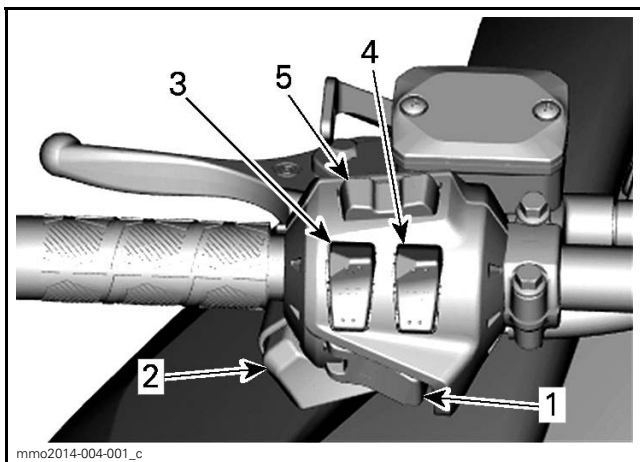


TYPICAL

Move the handlebar back and forth to make sure mechanism is securely engaged.

8) Handlebar Multifunction Switch

Multifunction switch is located on the LH side of handlebar.

**TYPICAL**

1. Start/Electronic Reverse button
2. Headlights dimmer switch
3. Heated grips switch
4. Heated throttle lever switch
5. Mode/set button (If equipped)

Start/Electronic Reverse Button

Press to start engine. Refer to *ENGINE STARTING PROCEDURE* in *BASIC PROCEDURES*.

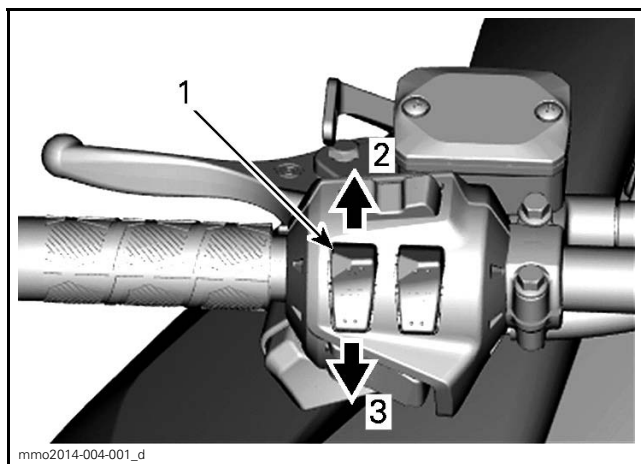
Once engine is started, press to engage the electronic reverse. Refer to *REVERSE (RER)* in *BASIC PROCEDURES* for procedure.

Headlights Dimmer Switch

Press to select HI or LOW beam. Lights are automatically ON when the engine is running.

Heated Grips Switch

Depress switch as required to select heating intensity to keep your hands at a comfortable temperature.

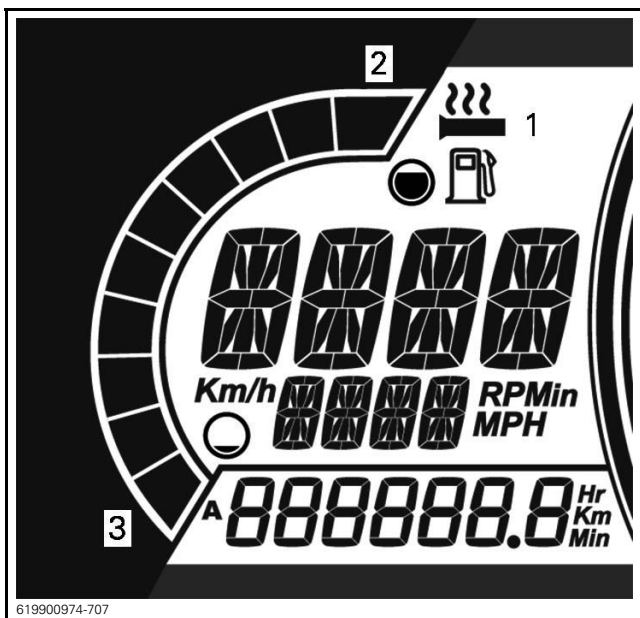


VARIABLE INTENSITY

1. *Heated grip switch*
2. *Increase heat*
3. *Decrease heat*

The heating intensity is displayed via the digital display.

NOTE: There are ten intensity settings. When released, display will return to fuel level.

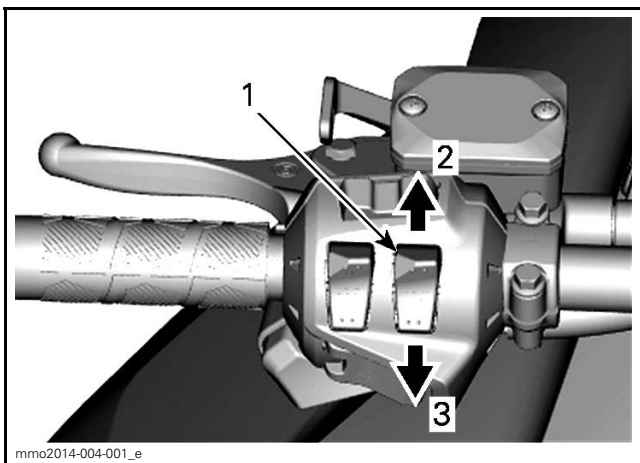
**TYPICAL**

1. Heated grip icon
2. More heat
3. Less heat

Heated grips will be in OFF position when there are no bars displayed on the gauge.

Heated Throttle Lever Switch

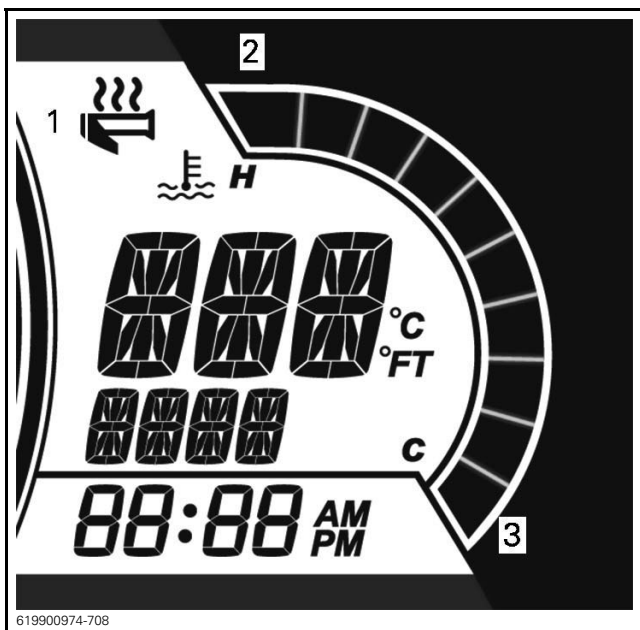
Depress switch as required to select heating intensity to keep your thumb at a comfortable temperature.



VARIABLE INTENSITY

1. Heated throttle lever switch
2. Increase heat
3. Decrease heat

NOTE: There are ten intensity settings. When released, display will return to engine temperature.

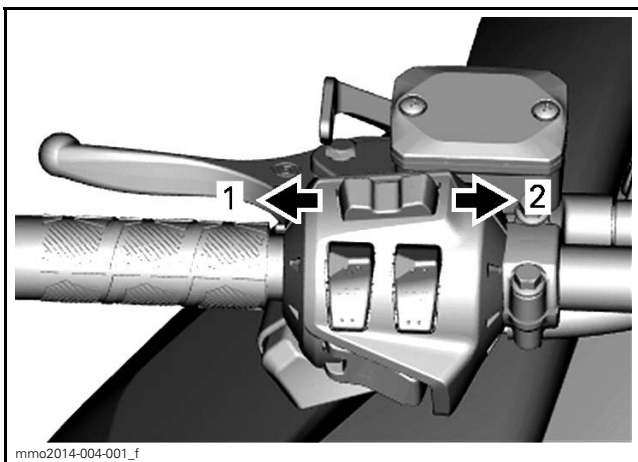
**TYPICAL**

1. Heated grip icon
2. More heat
3. Less heat

Heated throttle lever will be in OFF position when there are no bars displayed on the gauge.

Menu/Set Button (If equipped)

This button is used to manage the information displayed on the multifunction gauge.



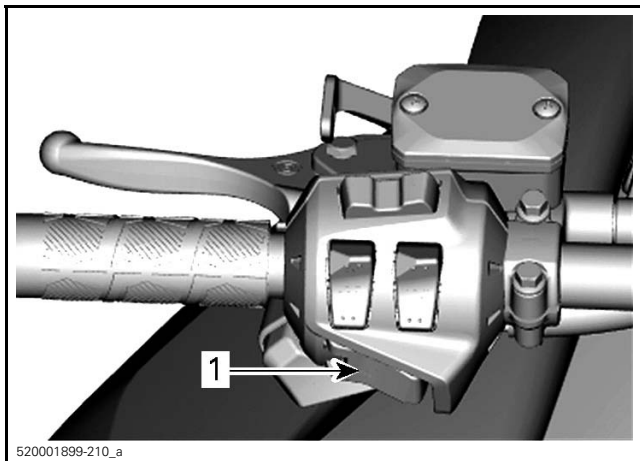
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MENU/SET BUTTON

1. Menu function
2. SET function

Refer to *GAUGE* for complete informations.

Start/Electronic Reverse (RER) Button



1. Start / RER button

On electric start models, press to start engine. Refer to *ENGINE STARTING PROCEDURE* in *BASIC PROCEDURES*.

Once engine is started, press to engage the electronic reverse. Refer to *REVERSE (RER)* in *BASIC PROCEDURES* for procedure.

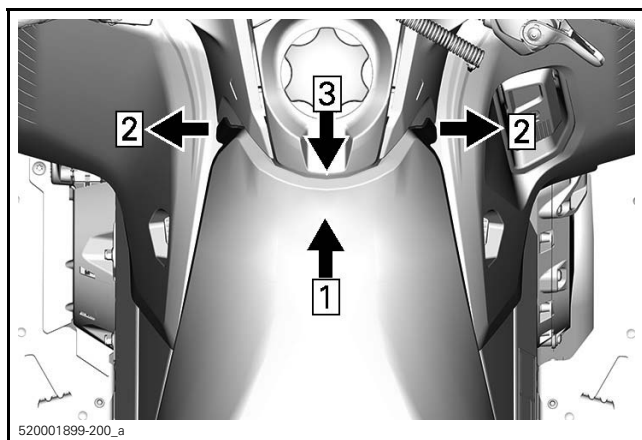
9) Reverse (Mechanical) (if equipped)

Refer to *BASIC PROCEDURES* for proper operation.

10) Seat

Seat Removal

While pushing in the center of the seat towards front, pull on both sides. Insert hand between seat and body to lift up and backward to unlock.



Step 1: Push

Step 2: Pull

Step 3: Lift up and backward to unlock seat

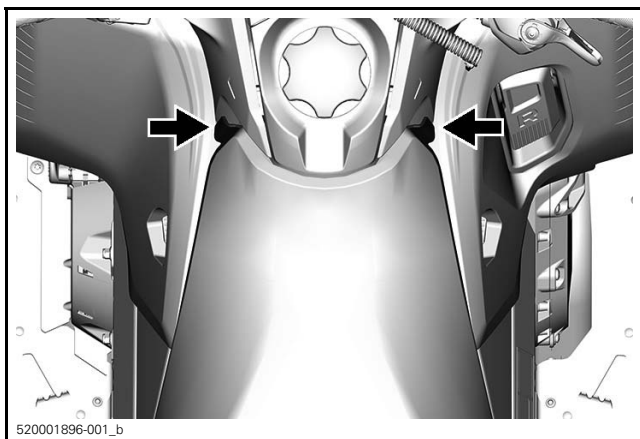
Slide seat rearwards to remove it.

Seat Installation

NOTICE Riding the vehicle with any objects between the seat and the fuel tank could damage the fuel tank. NEVER place any objects between seat and fuel tank.

Place seat over the hooks, then slide it forward.

Securely engage both ball studs at front.



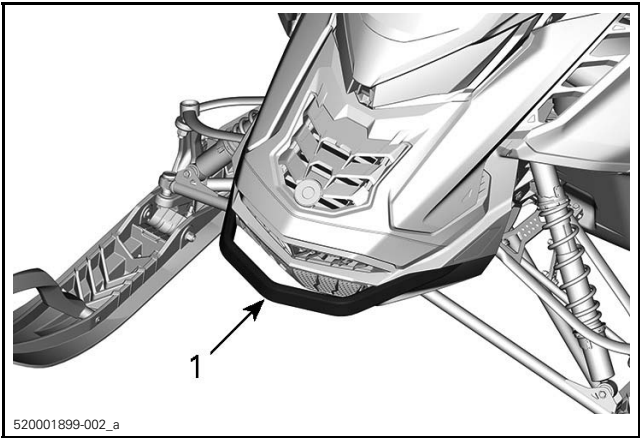
⚠ WARNING

Make sure seat is securely latched before riding.

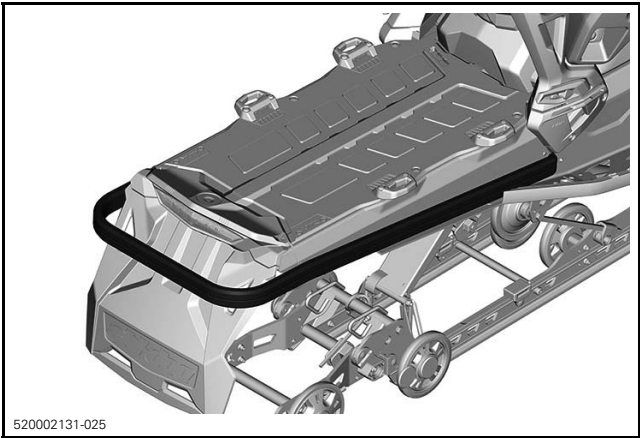
11) Front and Rear Bumpers

To be used whenever snowmobile requires manual lifting.

⚠ CAUTION Beware of injuries by using proper lifting techniques, notably using your legs force. Do not attempt to lift the rear of vehicle if it is above your limits. Use appropriate lifting device or have assistance to share lifting stress if possible.



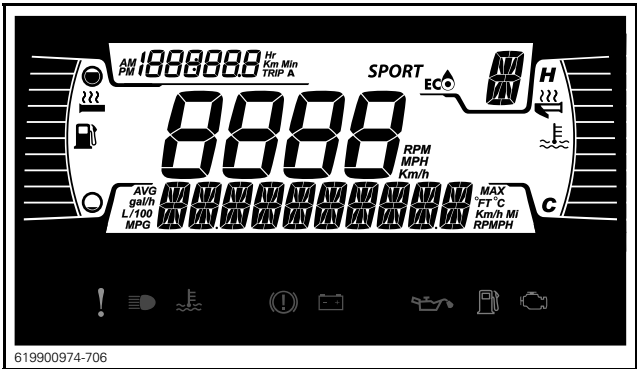
1. Front bumper



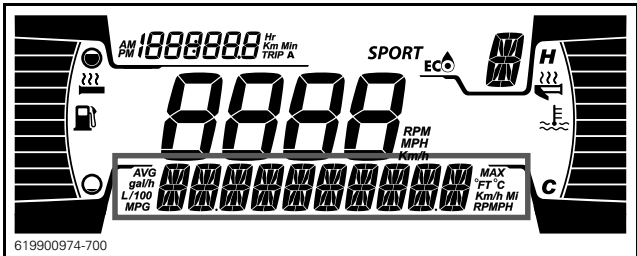
TYPICAL - STD BUMPER

12) Gauge

4.5" Digital display.



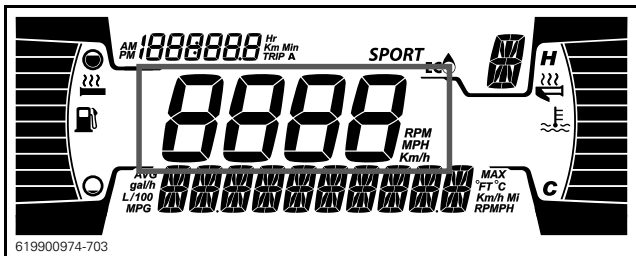
Lower Display



May display the following:

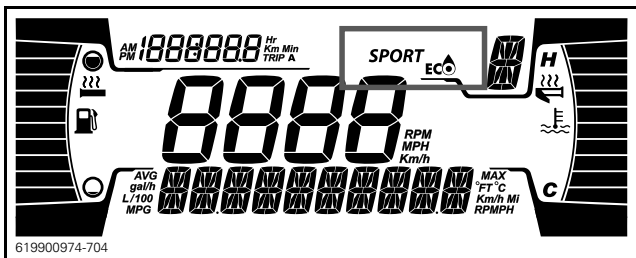
- RPM
- Speed
- Engine Temperature
- Fuel Statistics
- Settings
- Messages
- Outside temperature (if equipped)

Central Display



Display the RPM of engine or vehicle speed in Km/h or MPH.

MODE Display (if equipped)



The MODE display indicates the selected mode of operation:

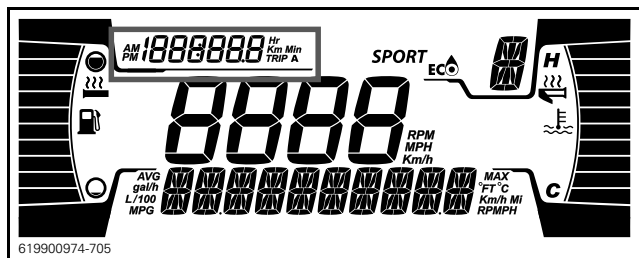
- SPORT
- ECO
- NORMAL

NOTE: When in NORMAL mode, no information is displayed.

A message of the selected mode will be displayed on the lower display at activation and deactivation as follow:

DRIVE MODE	MESSAGE AT ACTIVATION	MESSAGE AT DEACTIVATION
Sport	Sport	Sport OFF
Eco	Eco	Eco OFF

Trip Display



This display shows trip informations:

- Cumulative distance odometer
- Trip A hours
- Trip A distance (Km or mph)
- Vehicle hour meter
- Clock (If battery equipped)

Use UPPER button to change the displayed information.

Warning Lamps and Indicators

The following indicator lamps will alert you to a vehicle condition that may become serious. Some lamps will illuminate when starting the vehicle to make sure they work. If any lamps remain on after starting the vehicle, refer to the respective system warning lamp for further information.

NOTE: Some warning indicators appear in the display of the multi-function gauge and function the same as an indicator lamp but do not display when starting the vehicle.

Telltale Lights - Lower Bar

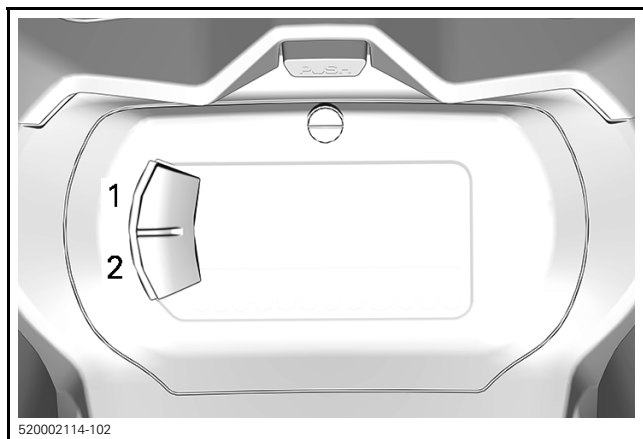


LIGHTS	DESCRIPTION
	ORANGE - Vehicle malfunction
	BLUE - The high beams are selected
	RED - The engine temperature is too high.
	RED - Parking brake is engaged or malfunction of the brake system
	RED - The battery voltage too low or problem with the electrical system
	RED - Low engine oil pressure (if applicable)
	ORANGE - Low fuel level
	ORANGE Turn on: Malfunction of the vehicle emissions control system Blink: Engine problems, the limp home mode is activated. Have the vehicle serviced immediately.

Icons and Indicators - Multifunction Display

ICONS AND INDICATORS	
SPORT	Denotes SPORT mode is selected.
ECO 	Denotes ECO mode is selected.

Setup



1. Upper button (S)
2. Lower button (M)

Using LOWER button, Select **SETTINGS** and hold to enter setting menu.

Reset Stats

Using LOWER button, select **RESET STAT** and hold to reset.

Unit Selection

This multifunction gauge is factory preset in Imperial units but it is possible to change it to Metric units.

Using LOWER button, Select **UNITS** and hold button to change units.

Setting Clock

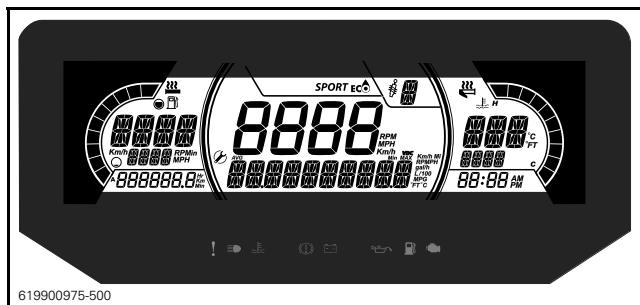
Using LOWER button, Select **CLOCK** to change the clock.

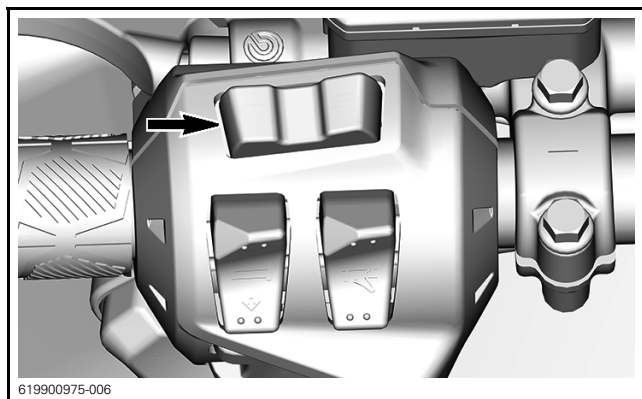
1. Press LOWER button to select clock display.
2. Push and hold LOWER button for 1 second.
3. Press LOWER button to select 12:00 AM PM or 24:00 time base.
4. Push and hold LOWER button to acknowledge selection.
5. Press LOWER button to change hours (hours flash).
6. Push and hold LOWER button to acknowledge hour selection.
7. Press LOWER button to switch to minutes (minutes flash).
8. Push and hold LOWER button to acknowledge minutes selection.

Setting Language

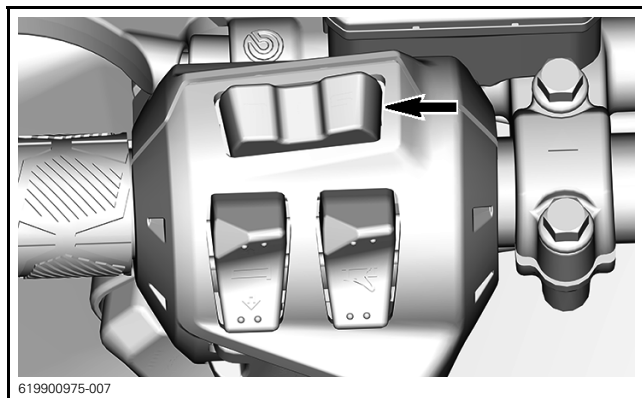
The gauge display language can be changed. Refer to an authorized Ski-Doo dealer for language availability and to setup the gauge to your preference.

7.2" Digital Display



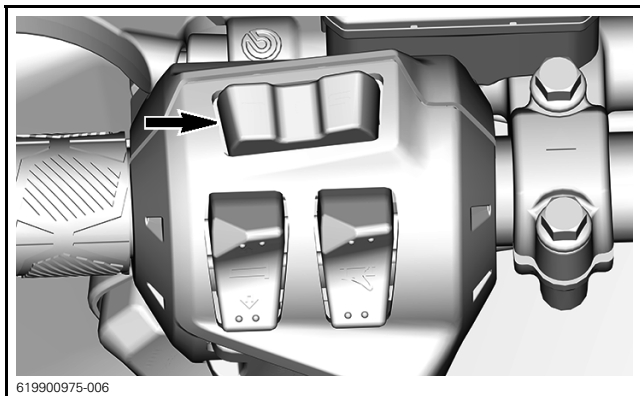


MENU (M) BUTTON



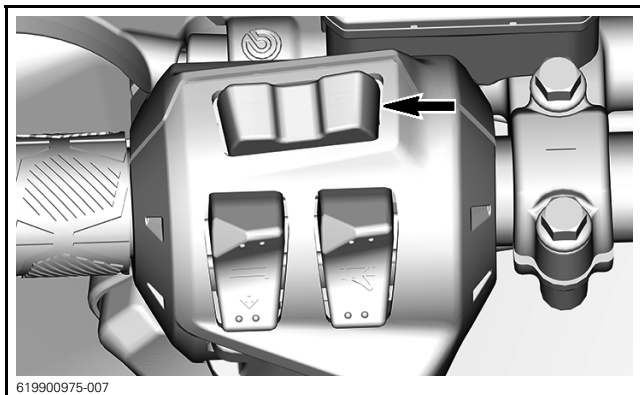
SET (S) BUTTON

1. Select the upper or center display by using the MENU (M) button on the multifunction switch.



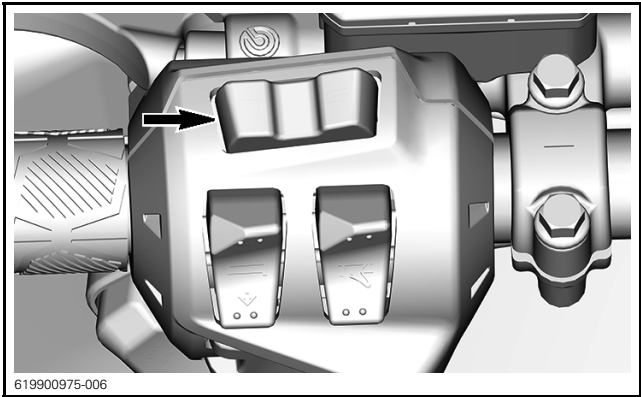
MENU (M) BUTTON

2. While the desired display is flashing, navigate through the display, by using the SET (S) button on the multifunction switch.



SET (S) BUTTON

Once the desired information is displayed, press the MENU (M) button or wait 5 seconds to confirm.



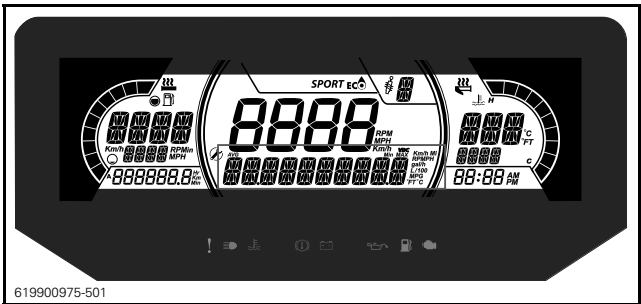
MENU (M) BUTTON

To reset

- Average speed
- Top speed
- Total fuel consumption

Press and hold the SET (S) button while display is flashing.

Lower Display

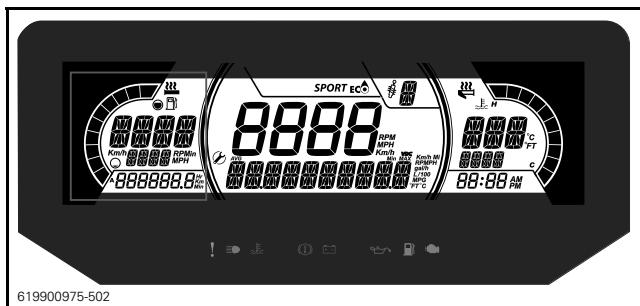


May display the following:

- Settings
- Messages

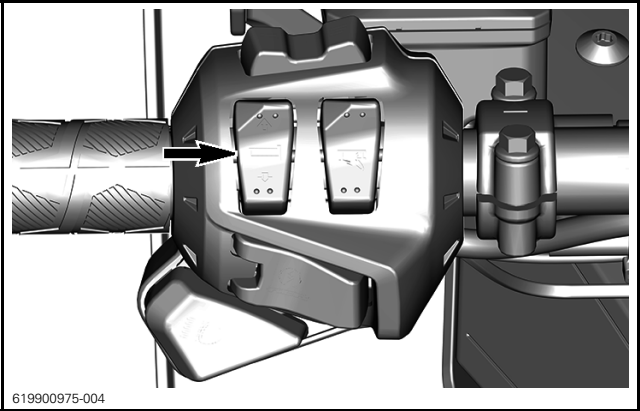
The SPEED display shows the Maximum and the averaged speed. Hold MENU button for 3 seconds to reset.

Left Lateral Display

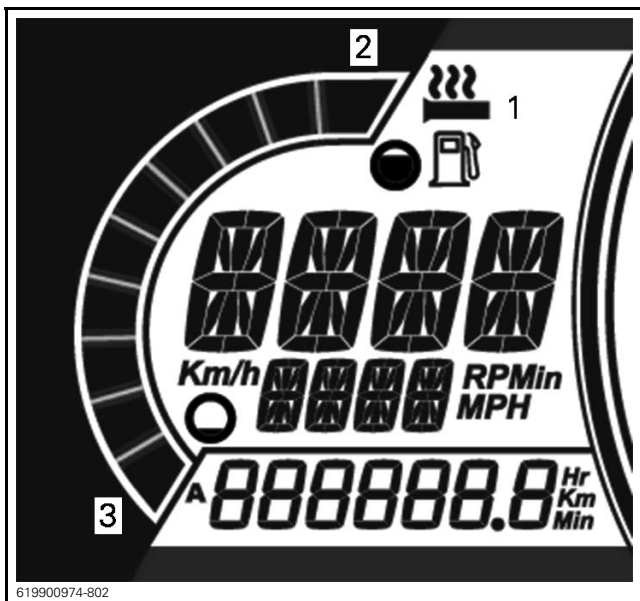


The left lateral display includes:

- RPM
- Speed
- Fuel level indicator
- Heated Grip level
- Trip A Hrs and KM
- Cumulative hours
- Odometer



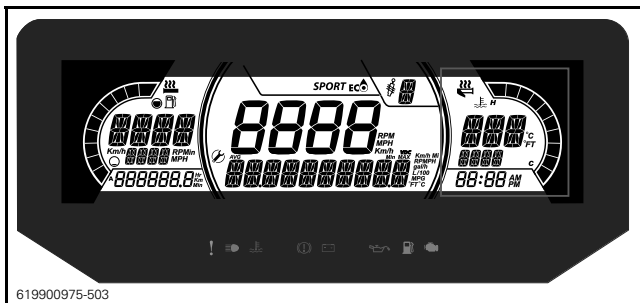
619900975-004



HEATING INTENSITY DISPLAY

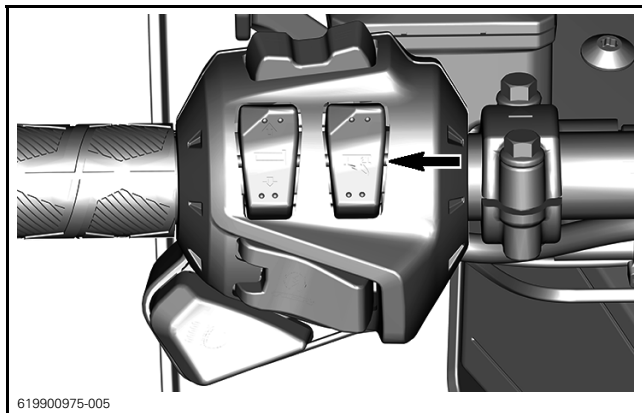
1. Heated Grip icon
2. More heat
3. Less heat

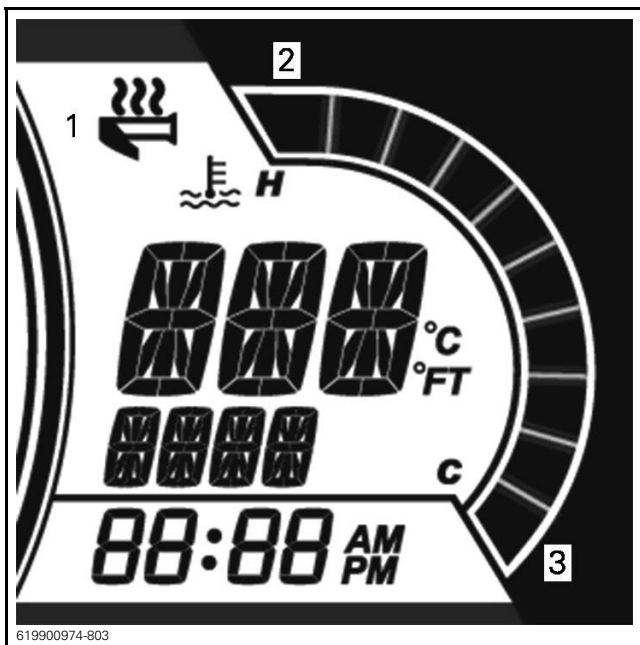
Right Lateral Display



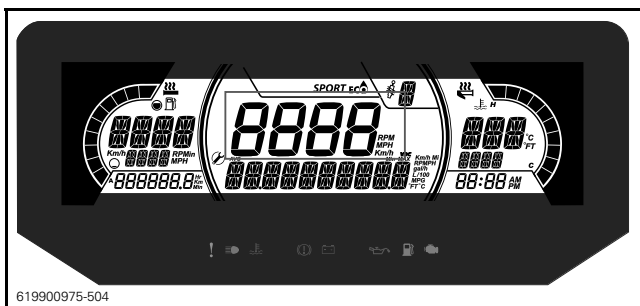
The right lateral display includes:

- Engine Temperature
- Heated throttle indicator
- Clock

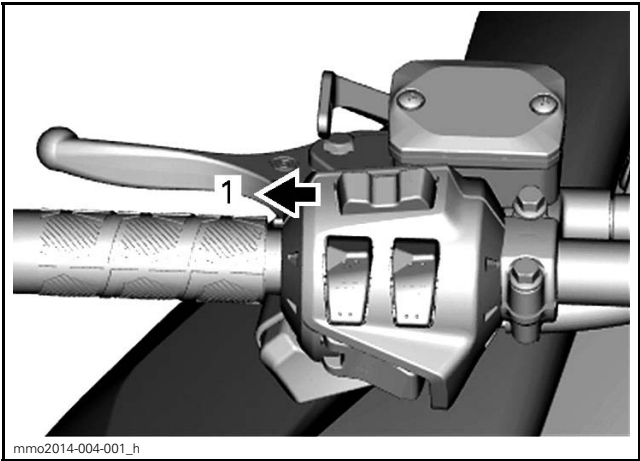




Central Display



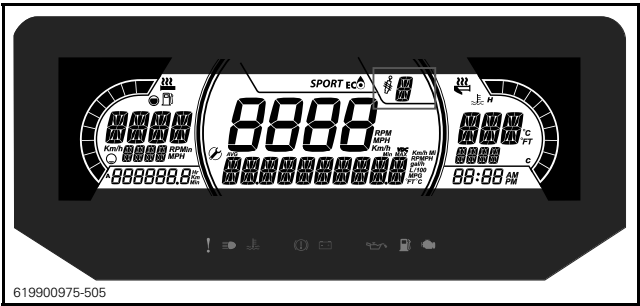
Display the vehicle speed in Km/h (or MPH) or the RPMs. Refer to *SETTINGS*.



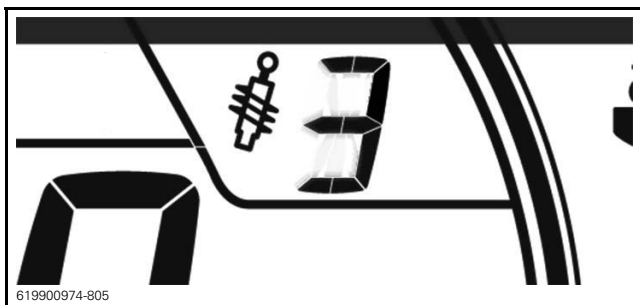
TYPICAL

- 1. MENU (M) button

ACS Suspension Position Display (if equipped)



This display shows suspension setting.
The suspension is calibrated from 1 to 5, 1 being the softest setting.



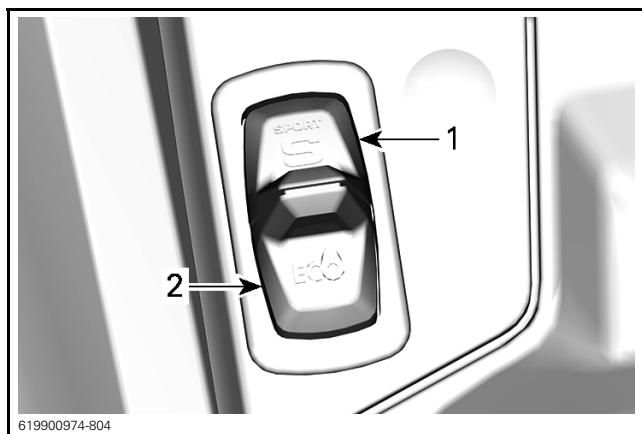
Refer to *TUNE YOUR RIDE* section for proper adjustment procedure.

MODE Display (if equipped)



The MODE display indicates the selected mode of operation:

- SPORT
- ECO
- NORMAL



619900974-804

1. *SPORT* position
2. *ECO* position

NOTE: When in **NORMAL** mode, no information is displayed.

A message of the selected mode will be displayed on the lower display at activation and deactivation as follow:

DRIVE MODE	MESSAGE AT ACTIVATION	MESSAGE AT DEACTIVATION
Sport	Sport	Sport OFF
Eco	Eco	Eco OFF

Warning Lamps and Indicators

The following indicator lamps will alert you to a vehicle condition that may become serious. Some lamps will illuminate when starting the vehicle to make sure they work. If any lamps remain on after starting the vehicle, refer to the respective system warning lamp for further information.

NOTE: Some warning indicators appear in the display of the multi-function gauge and function the same as an indicator lamp but do not display when starting the vehicle.

Telltale Lights - Lower Bar



LIGHTS	DESCRIPTION
	ORANGE - Vehicle malfunction
	BLUE - The high beam are selected
	RED - The engine temperature is too high.
	RED - Parking brake is engaged or malfunction of the brake system
	RED - The battery voltage too low or problem with the electrical system
	RED - Low engine oil pressure (if applicable)
	ORANGE - Low fuel level
	ORANGE Turn on: Malfunction of the vehicle emissions control system Blink: Engine problems, the limp home mode is activated. Have the vehicle serviced immediately.

Icons and Indicators - Multifunction Display

ICONS AND INDICATORS	
SPORT	Denotes SPORT mode is selected.
	Denotes ECO mode is selected.

Setup

Using MENU button, Select **SETTINGS** and hold to enter setting menu. Various options are available such as swapping the SPEED and RPM in the Central Display.

Maintenance Reset

NOTE: Only when the maintenance icon is displayed.

Using MENU button, Select **RES MAINT** and hold to reset maintenance.

Unit Selection

This multifunction gauge is factory preset in Imperial units but it is possible to change it to Metric units.

Using MENU button, Select **UNITS** and hold button to change units.

Setting Clock

Using MENU button, Select **CLOCK** and hold to change units.

1. Press MENU button to select clock display.
2. Push and hold MENU button for three seconds.
3. Press MENU button to select 12:00 AM PM or 24:00 time base.
4. Press MENU button to change hours.
5. Press MENU button to switch to minutes (minutes flash).
6. Press MENU button to change minutes.
7. Press MENU button.

Setting Language

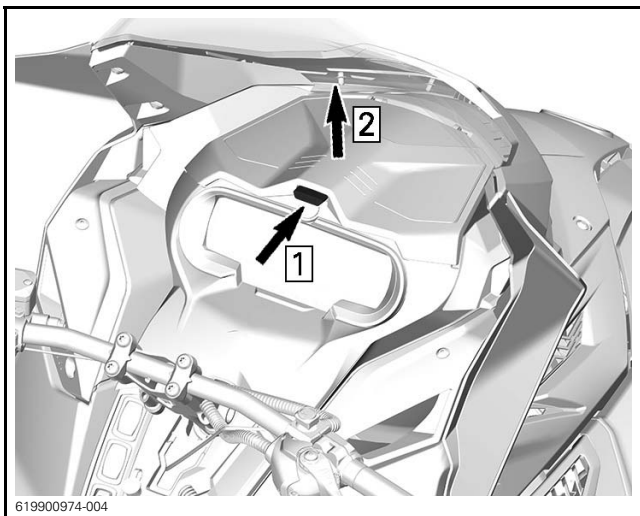
The gauge display language can be changed. Refer to an authorized Ski-Doo dealer for language availability and to setup the gauge to your preference.

13) Storage Compartment

A storage compartment is located at the front of the vehicle, above the gauge.

The Operator's Guide and the emergency starter rope are in the front storage compartment.

To open, push the button and lift the cover.

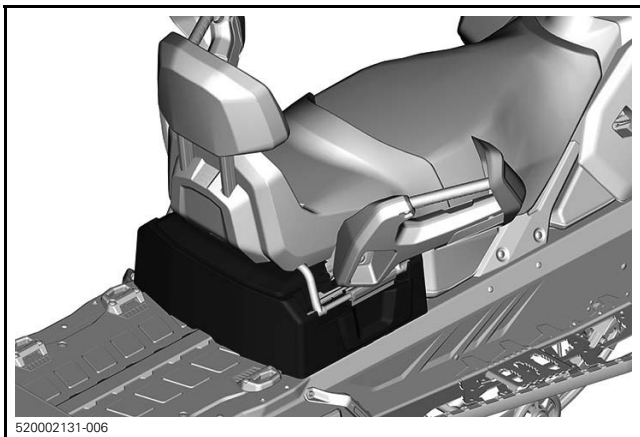


619900974-004

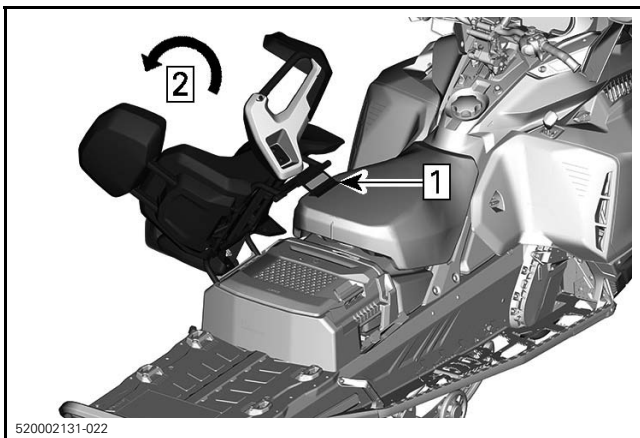
TYPICAL

NOTE: When closing, make sure cover is secured properly. You will hear a "clik".

On select models, a storage compartment is located at the rear of the seat, above the battery cover.



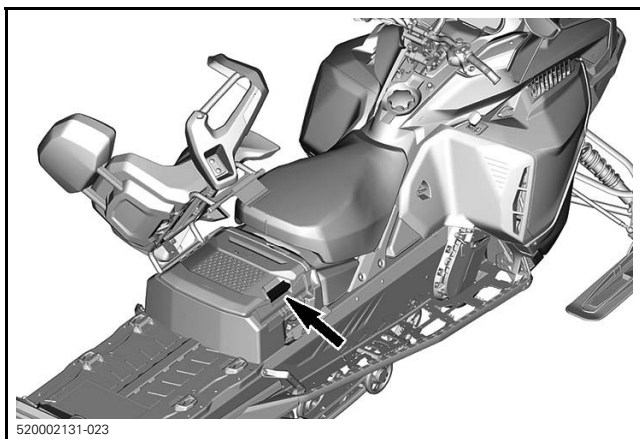
To open, tilt passenger seat.



Step 1: Unlock seat latch

Step 2: Tilt passenger seat

Lift handle.



520002131-023

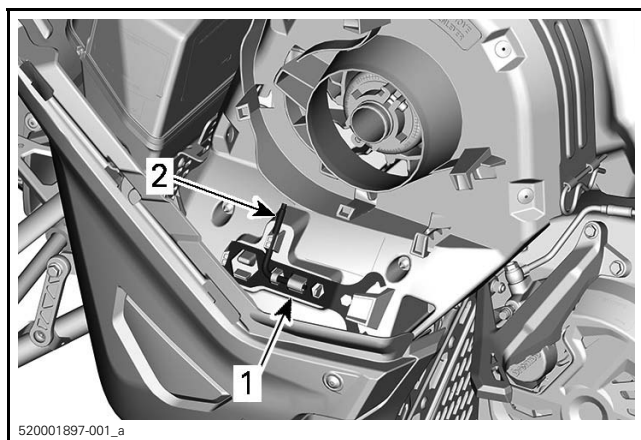
14) Operator's Guide

The Operator's Guide should be stored in the *STORAGE COMPARTMENT*.

15) Tools

A part of the drive belt guard is designed to hold the tools allowing for basic maintenance.

The tools are supplied with the vehicle. They should always be installed in their proper location and orientation.



520001897-001_a

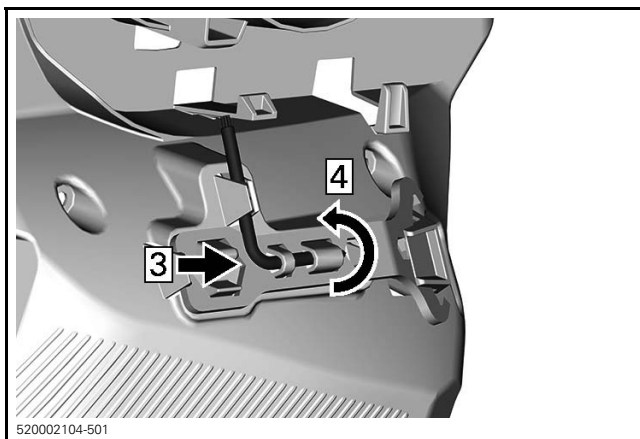
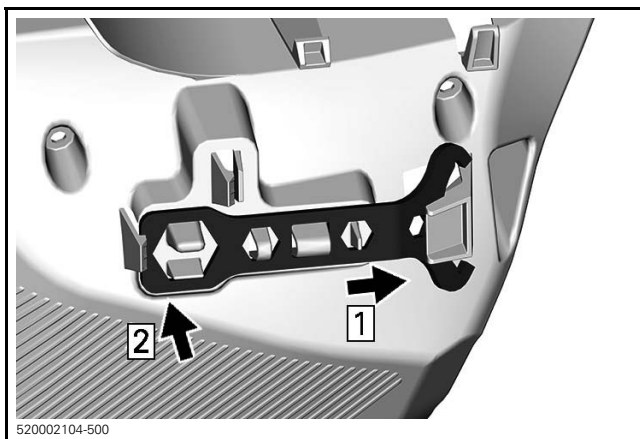
TYPICAL - DRIVE BELT GUARD TOOLS LOCATION

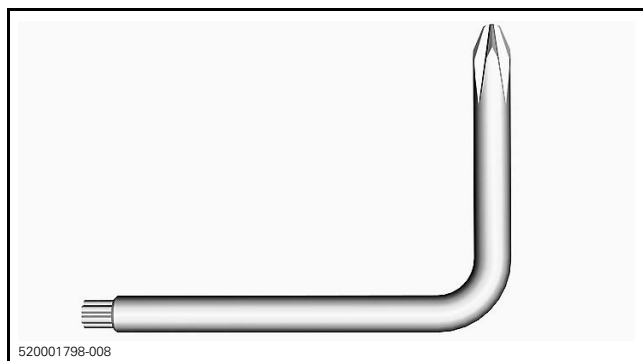
1. *Suspension adjustment tool*
2. *Pulley expander*

Install in the following sequence:

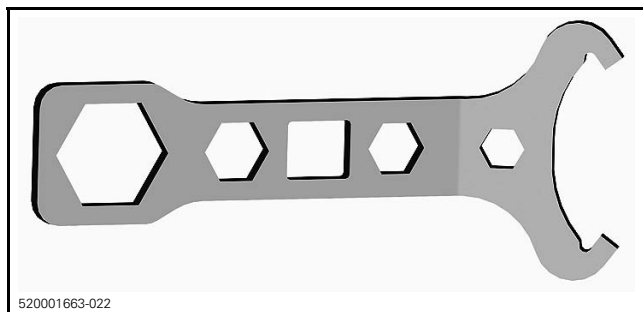
1. Slide the suspension adjustment tool open end under retaining tab.
2. Press the closed end on the retaining tabs.
3. Slide the Pulley expander and headlight adjustment tool short end into hole.
4. Rotate and clip long end in place.

⚠ CAUTION Make sure tools are secured properly. Tools may detach and cause damage to rotating parts.





PULLEY EXPANDER



SUSPENSION ADJUSTMENT TOOL

16) Drive Belt Guard

Drive Belt Guard Removal

WARNING

NEVER operate engine:

- Without shields and belt guard securely installed.
- With hood and/or side panels opened or removed.

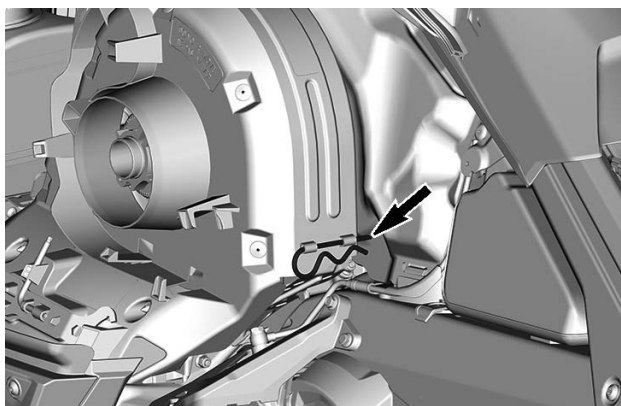
NEVER attempt to make adjustments to moving parts while engine is running.

NOTE: Belt guard is purposely made slightly oversize to maintain tension on its pins and retainers preventing undue noise and vibration. It is important that this tension be maintained when reinstalling.

Remove tether cord cap from engine cut-off switch.

Open the LH side panel. See procedure in this section.

Remove retaining pin.

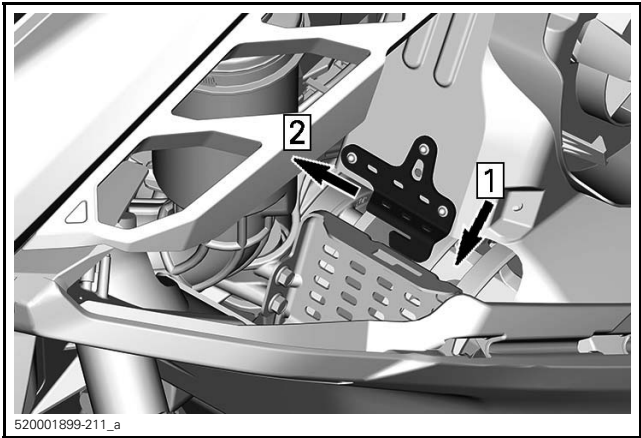


520001897-003_a

Lift rear portion of guard then release from front tab.

Drive Belt Guard Installation

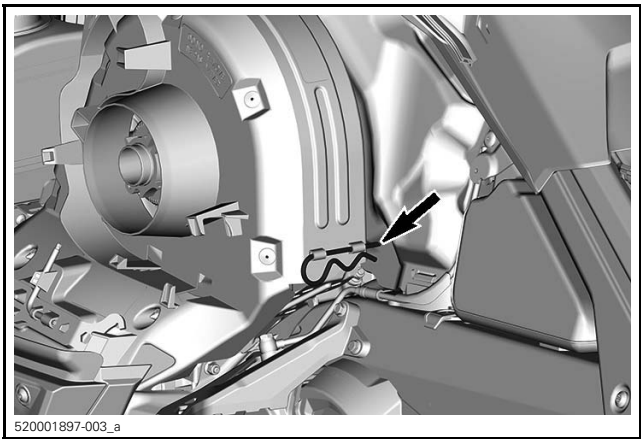
Insert the tab into the slot and push belt guard toward engine into place.



Step 1: Lower belt guard

Step 2: Slide belt guard

Position the rear portion of the belt guard over the retainer and secure it using the retaining pin.

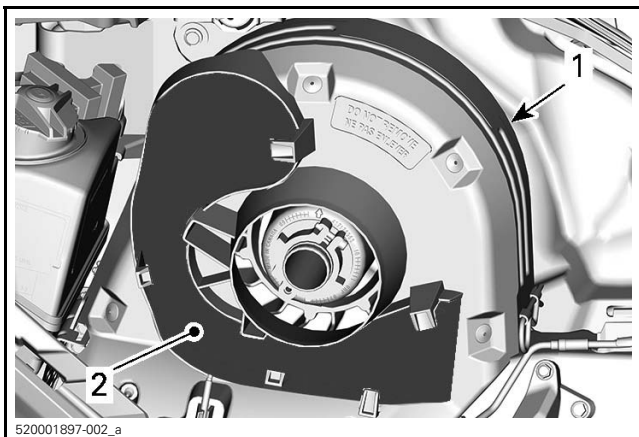


17) Spare Drive Belt Holder

A spare drive belt can be stored in a holder located on the drive belt guard.

NOTE: The spare drive belt is not supplied with the snowmobile.

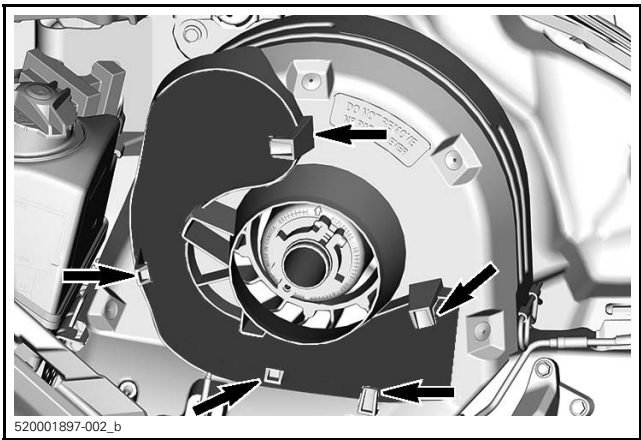
Position spare drive belt into drive belt guard slot.



TYPICAL

1. Drive belt guard
2. Slot

Secure in place by sliding it behind the tabs.

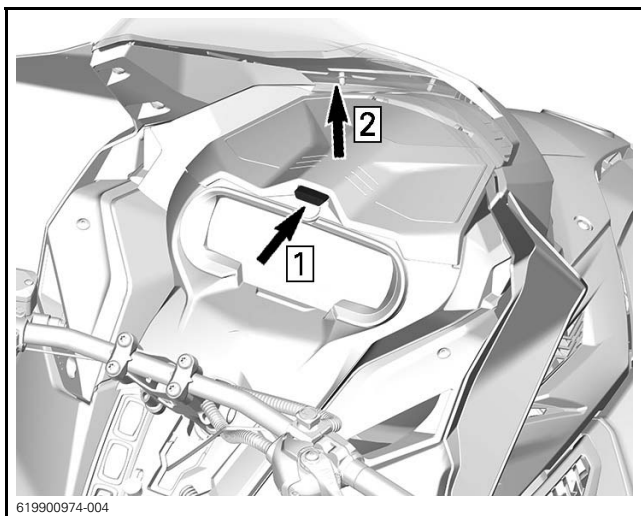


TYPICAL

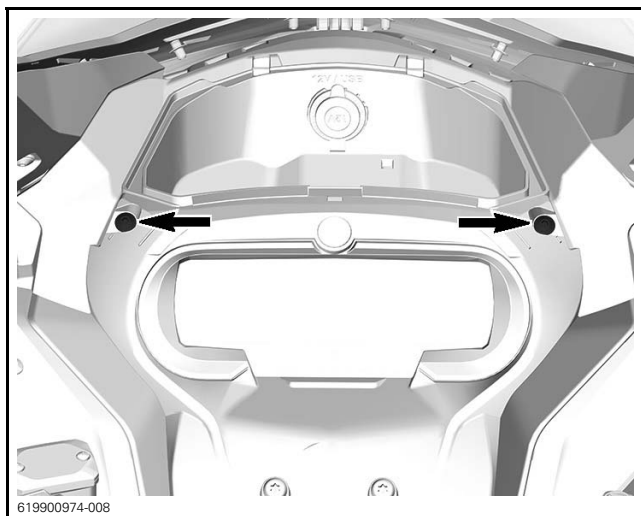
18) Upper Body Module (Hood)

Upper Body Module Removal

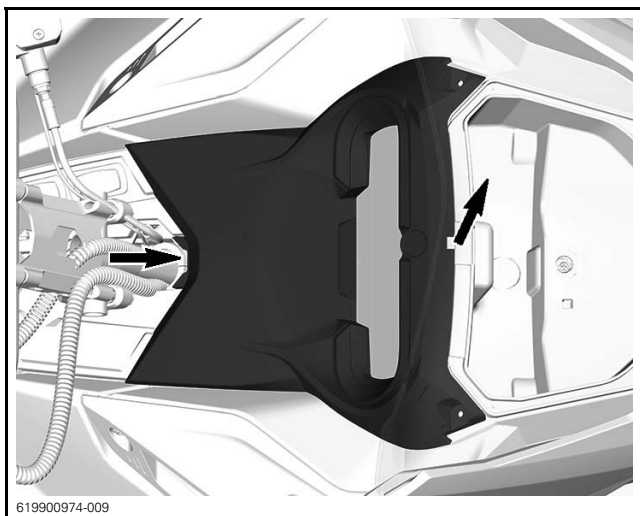
1. Open the storage compartment.



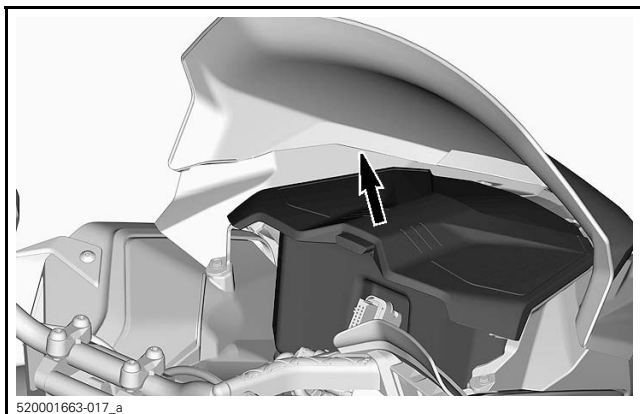
2. Remove the gauge retaining screws.



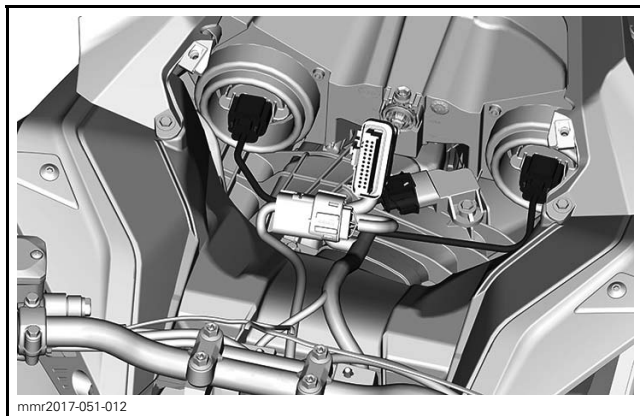
3. Lift the front of the gauge support, then slide it forward to remove it.



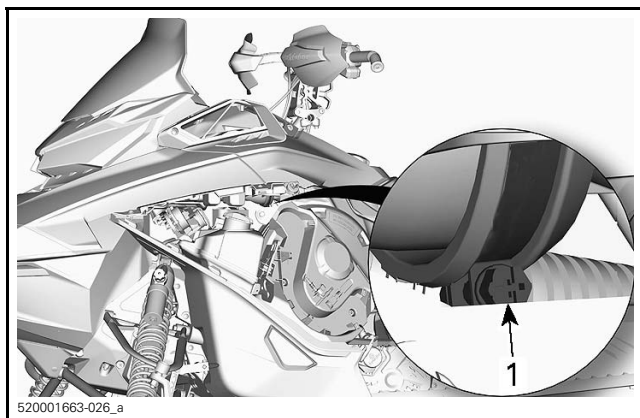
4. Set gauge support aside.
5. Remove the storage compartment.



6. Disconnect the MAPTS and headlight connectors.

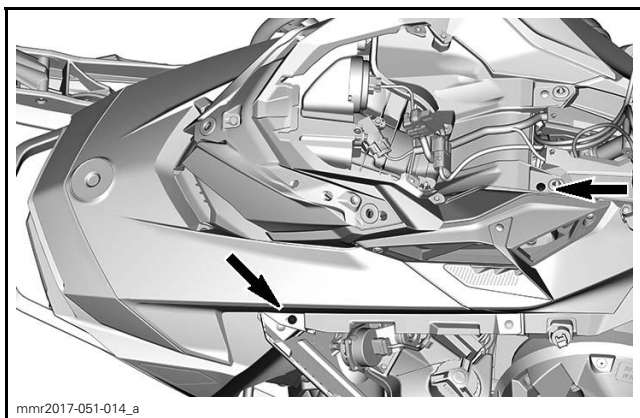


7. Loosen the air intake duct clamp.

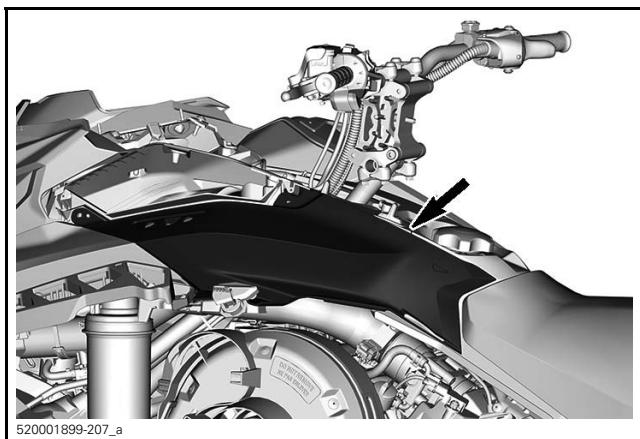


1. *Clamp*

8. Remove the upper body module retaining screws on both sides.



9. Free the rear end hooks of the upper body module from the slots in the console.

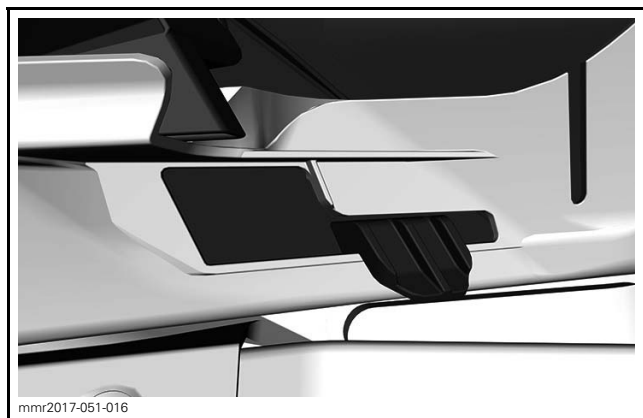


10. Remove the upper body module.
 - 10.1 Grab the upper body module in the gauge support area.
 - 10.2 Pull the module forward.

- 10.3 Remove the module from the vehicle.

Upper Body Module Installation

1. At front, insert the upper body module tabs into the bottom pan openings.



2. Lower the rear end of the upper body module.
3. Insert the rear end hooks of the upper body module into the slots in the console.

NOTE: Make sure the air intake duct is positioned properly connected.

4. Tighten air intake duct clamp.
5. On both sides, install the upper body module retaining screws.

TIGHTENING TORQUE	
Upper body screws	$2.3 \text{ N}\cdot\text{m} \pm 0.2 \text{ N}\cdot\text{m}$ ($20 \text{ lbf}\cdot\text{in} \pm 2 \text{ lbf}\cdot\text{in}$)

6. Connect the manifold air pressure and temperature sensor (MAPTS) connector.
7. Connect the headlight connectors.
8. Install the storage compartment but leave the cover open.

9. Install gauge, secure with the screws.

TIGHTENING TORQUE	
Gauge screws	$2.3 \text{ N}\cdot\text{m} \pm 0.2 \text{ N}\cdot\text{m}$ ($20 \text{ lbf}\cdot\text{in} \pm 2 \text{ lbf}\cdot\text{in}$)

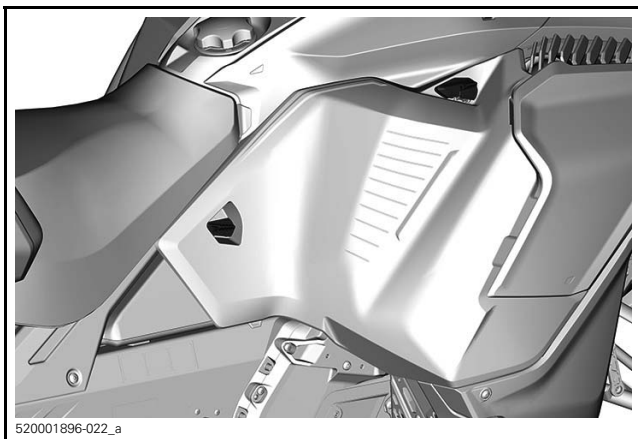
19) Side Panels

WARNING

Never operate engine with side panels opened or removed from vehicle.

Side Panels Opening and Closing

Unlock all latches, then open panel.

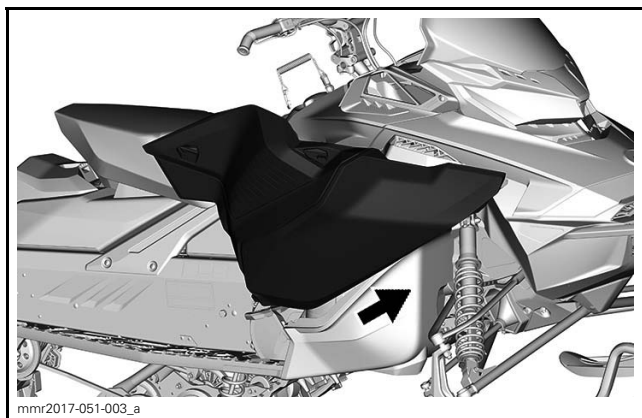


When closing panel, make sure latches are locked securely.

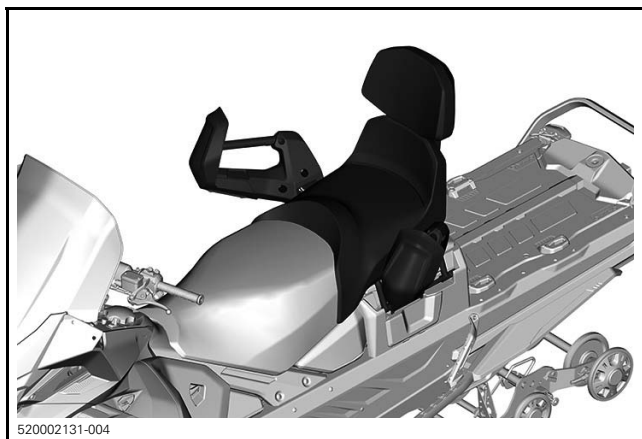
Side Panels Removal

Open side panel.

Pull the hinges off the bottom pan.



20) Passenger Seat (LE and SE models)

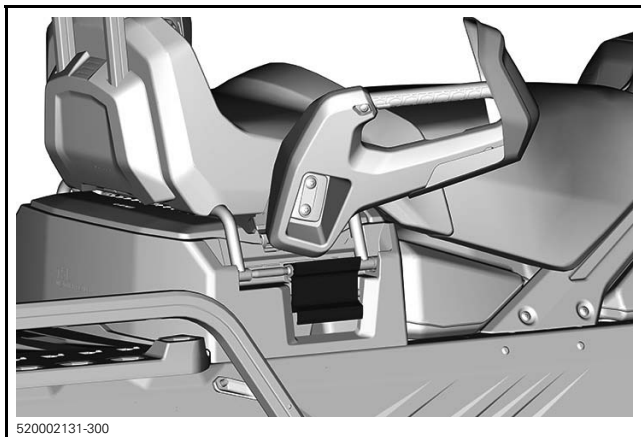


⚠ WARNING

Any passenger must be able to firmly lay his feet on the footrests and keep his hands on the handholds at all times when seated. Respecting those physical criteria is important to ensure that the passenger is stable and to reduce the risks of ejection.

Removing the Passenger Seat

1. Unlock seat latch on both sides.

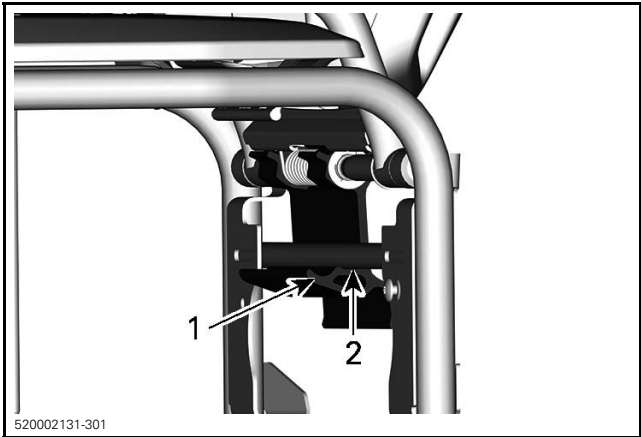


2. Lift the seat to disconnect the electrical connector.
3. Remove passenger seat.

Installing the Passenger Seat

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

Ensure to reach the second step when latching.

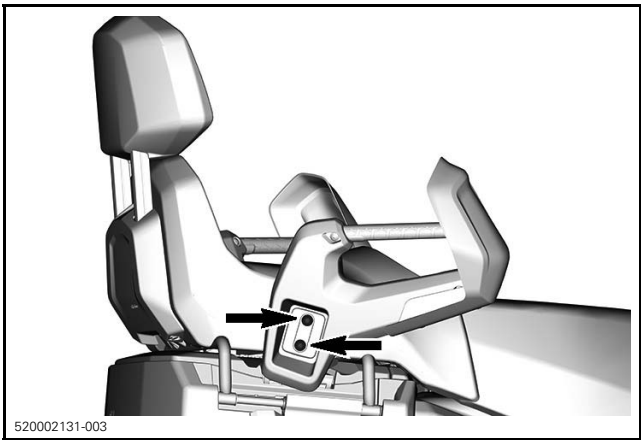


- 1. First step
- 2. Second step

21) Passenger Handhold

Removing the Passenger Handhold (LE and SE models)

Remove the handhold retaining screws.



Disconnect electrical connector.

Installing the Passenger Handhold (LE and SE models)

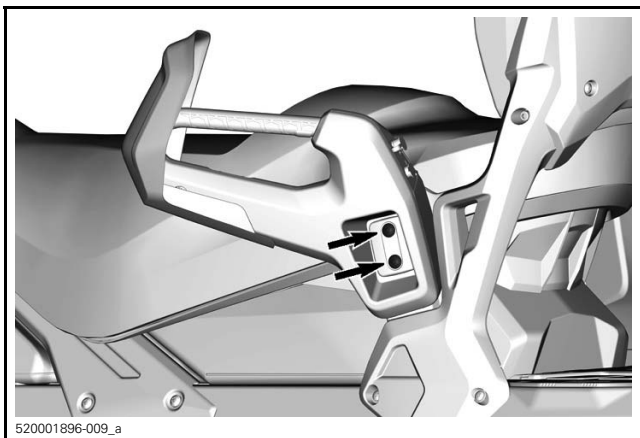
The installation is the reverse of removal procedure.

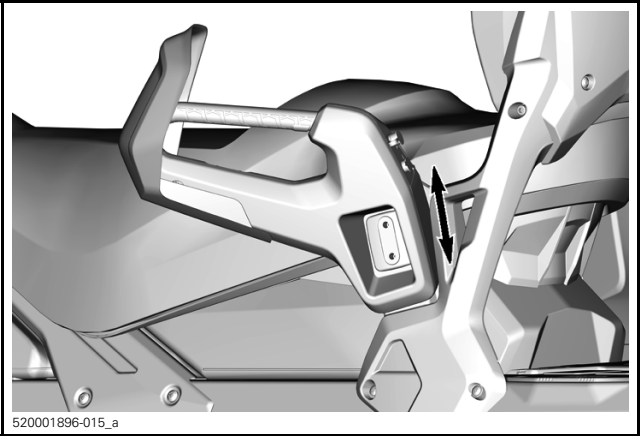
TIGHTENING TORQUE	
Screws	$12.8 \text{ N}\cdot\text{m} \pm 2.2 \text{ N}\cdot\text{m}$ ($113 \text{ lbf}\cdot\text{in} \pm 19 \text{ lbf}\cdot\text{in}$)

Adjusting Passenger Handhold (Sport Models)

To adjust the handhold height, proceed as follows:

1. Remove screws.





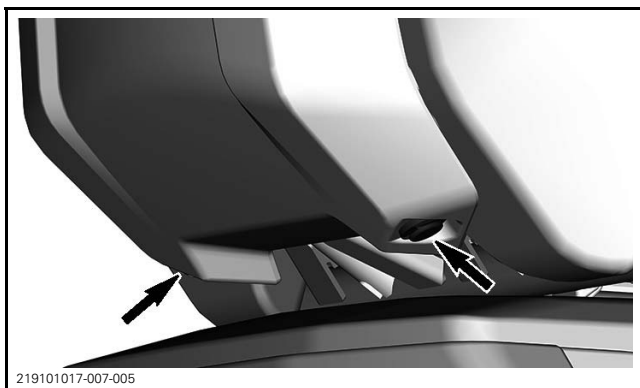
- 2. Raise or lower the handhold to suit passenger's comfort.
- 3. Reinstall screws. Tighten to specification.

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

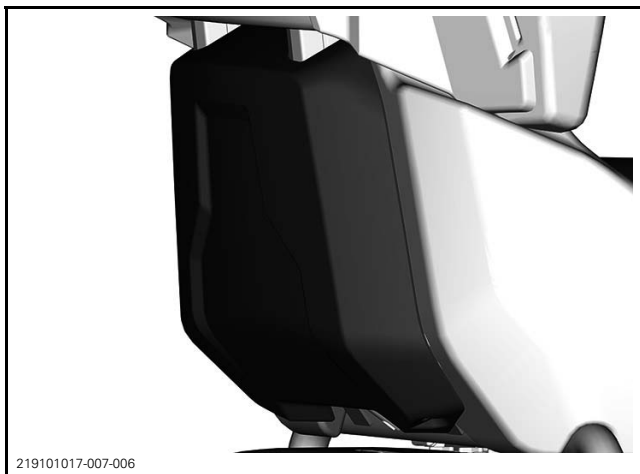
22) Backrest

Removing the Passenger Backrest (LE and SE models)

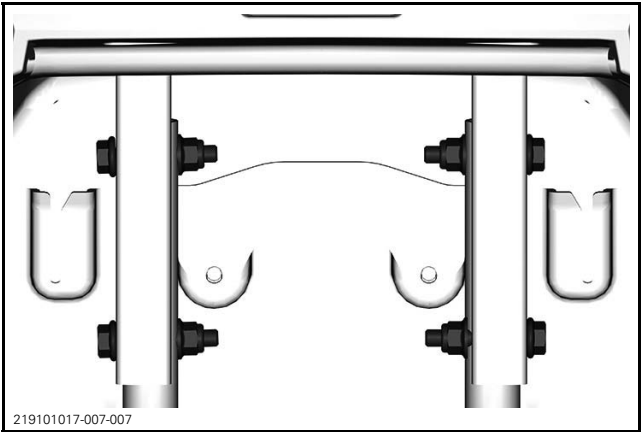
- 1. Remove the following fasteners.



2. Remove the seat trim by sliding it upwards.



3. Remove the following fasteners.



4. Remove the passenger backrest.

Installing the Passenger Backrest

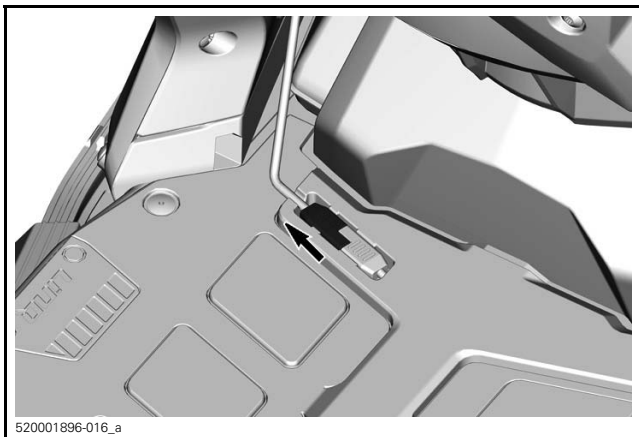
The installation is the reverse of removal procedure.

TIGHTENING TORQUE	
Backrest nuts	12.8N•m ± 2.2 N•m (113lbf•in ± 19lbf•in)

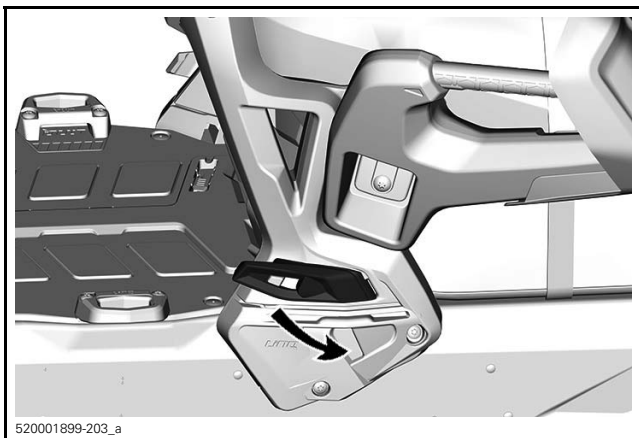
Backrest Removal (Sport Models)

To remove the backrest, proceed as follows:

1. Disconnect seat electrical connector located behind the seat.



2. Remove LinQ on the backrest arms on both side.

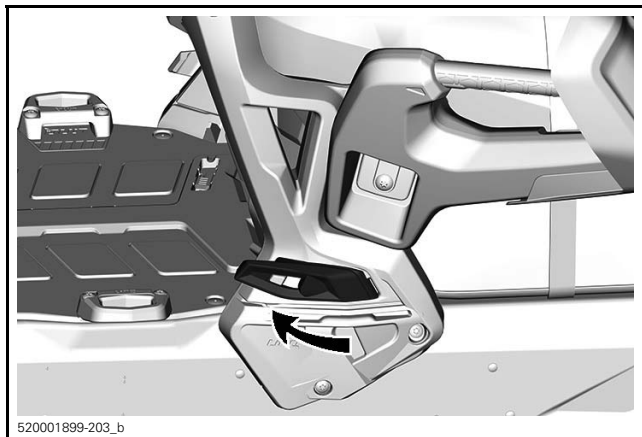


3. Remove backrest from vehicle.

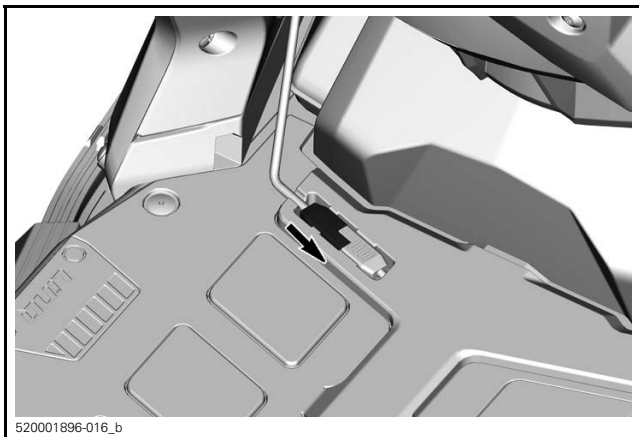
Backrest Installation

To install the backrest, proceed as follows:

1. Install backrest on vehicle.
2. Install LinQ on the backrest arms on both side.



3. Connect seat electrical connector located behind the seat.



23) Adjustable Mirrors (On Applicable Models)

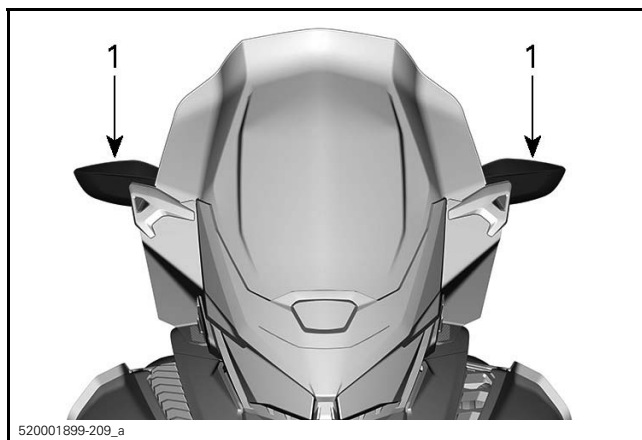
Each mirror can be adjusted to suit operator's preference.



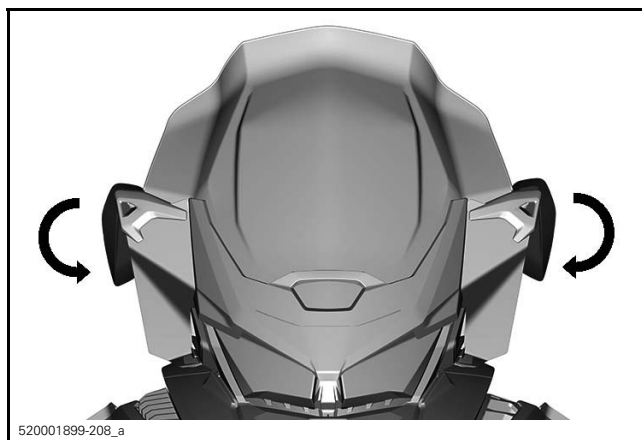
WARNING

Adjust with vehicle at rest in a safe place.

When installing a cover, the mirrors can be tilted downward to ease installation.

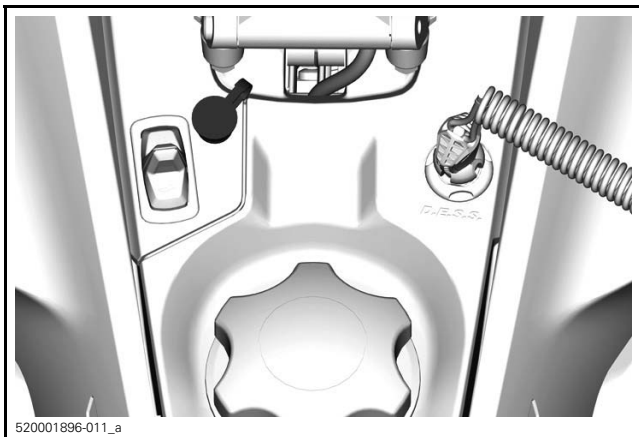


1. Mirrors

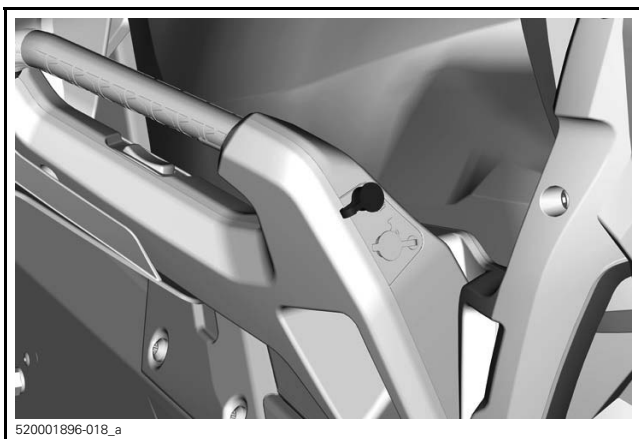


24) Electric Visor Jack Connector (On Applicable Models)

An electric visor can be connected to the jack connector. A stress relief extension is supplied with the vehicle.



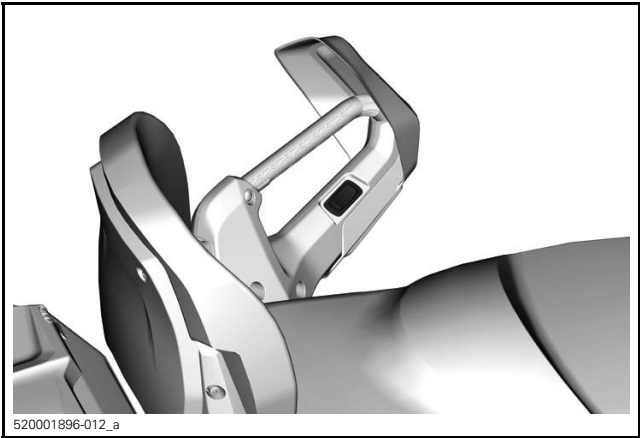
DRIVER - ELECTRIC VISOR JACK CONNECTOR LOCATION



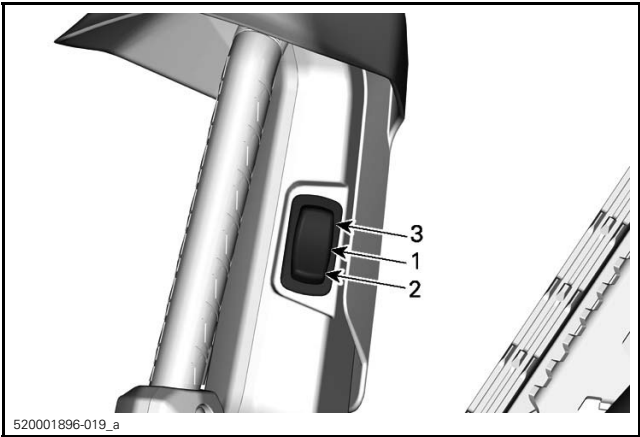
PASSENGER - ELECTRIC VISOR JACK CONNECTOR LOCATION

25) Passenger Heated Grip Switch (On Applicable Models)

The switch is located on the LH passenger handhold.



Adjust heating intensity as shown.

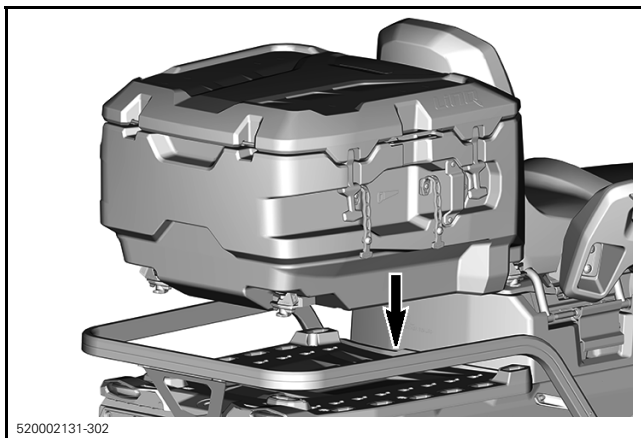


- 1. Off
- 2. Warm
- 3. Hot

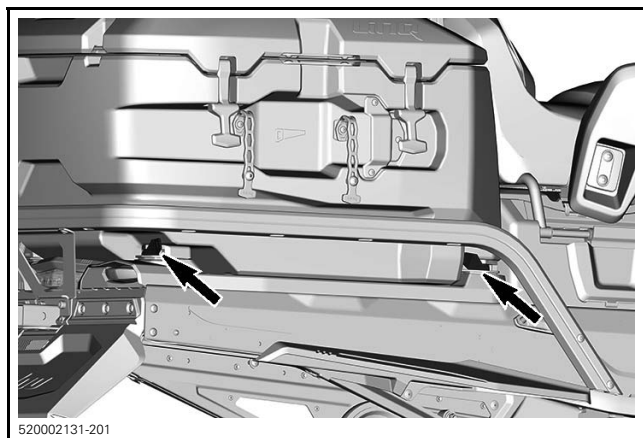
26) Cargo Box (On Applicable Models)

The cargo box can contain up to 22 kg (44 lb) on the cover and a total of 48 kg (105 lb) (including weight on cover).

The cargo box is secured by LinQ attachment. To Install, lower box in cargo area.



Turn LinQ levers to lock.



RH SIDE SHOWN, REPEAT ON LH SIDE

27) Gearshift Lever (On Applicable Models)

Use this lever to select gears. The gearbox has two forward gears and a neutral.

Shifting from one position to another is possible at speeds lower than 30 km/h (19 MPH)

NOTE: Do not shift when vehicle is moving faster than 30 km/h (19 MPH).

⚠ CAUTION Shifting at a speed faster than 30 km/h (19 MPH) may cause serious damage to the gearbox.

Neutral

The neutral position disengages the gearbox.

High Range (Forward)

This position selects the high speed range of the gearbox. It is the normal driving speed range. It allows the vehicle to reach its maximum speed.

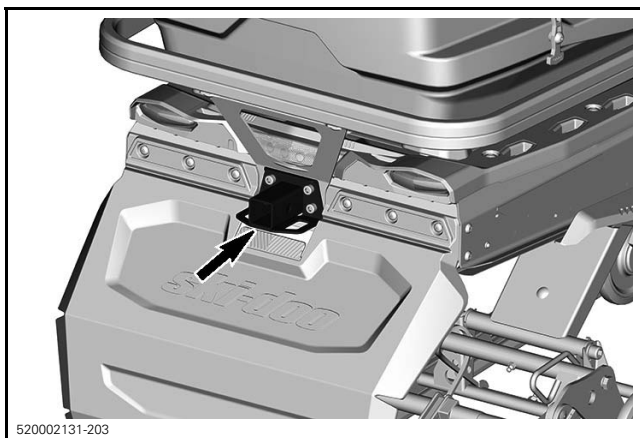
Low Range (Forward)

This position selects the low speed range of the gearbox. It allows the vehicle to move slowly with maximum torque.

NOTICE Use the low speed range to pull a cargo carrier, carry heavy cargo, go over obstacles or drive uphill and downhill.

28) Hitch

LE and SE Models



Use the hitch in conjunction with a tow bar to tow an accessory.

When attaching any accessory, always refer to the manufacturer's recommendations.

NOTE: Refer to decal on vehicle for towing weight capacities.

WARNING

Never tow an accessory with a rope. Always use a rigid tow bar. Using a rope would result in a collision between the object and the snowmobile and possibly in a tip over in case of a rapid deceleration or on a downward slope.

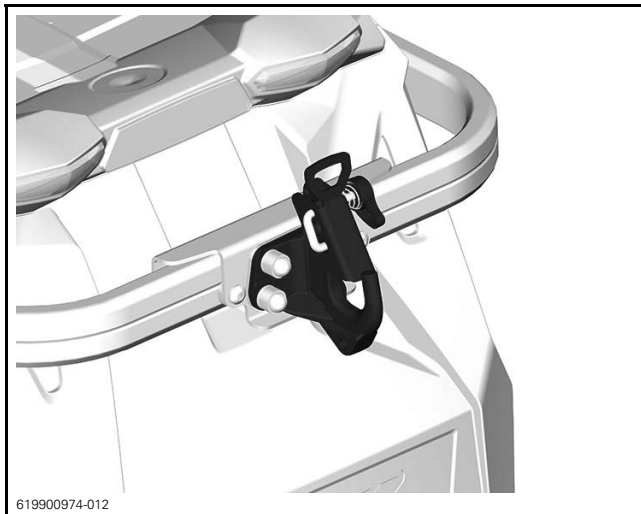
Tongue Type Hitch (North American Sport Models)

To attach an equipment to the hitch, secure the accessory tow bar to the hitch tongue using a lockable pin.

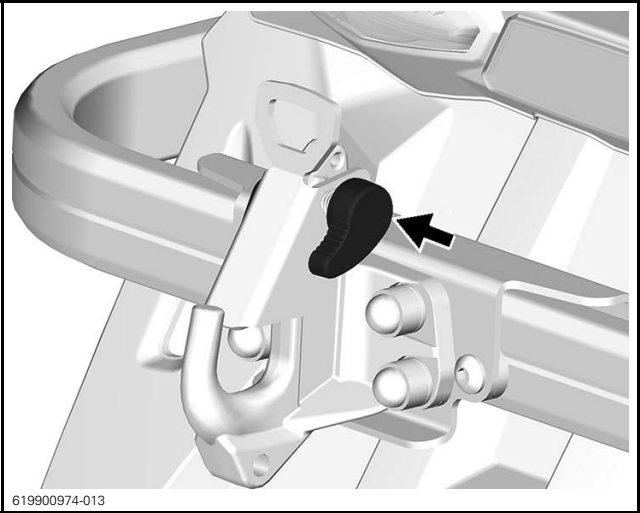


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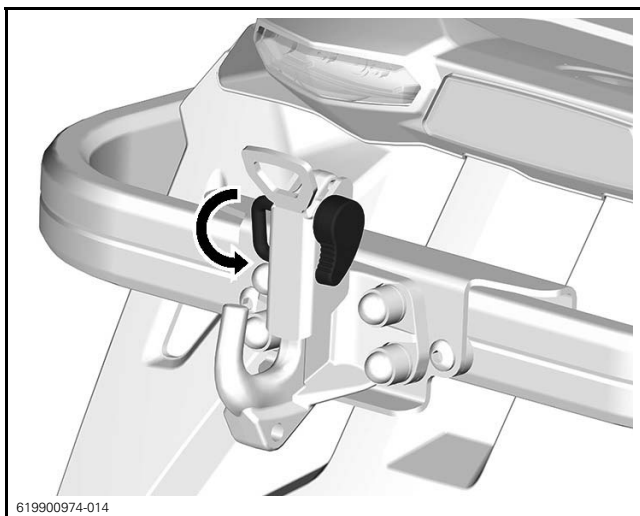
J-Type Hitch (European Sport Models)



The J-Hook is located on the rear bumper. It can be used to tow. To use the hook, push and turn the handle to lower locking plate.

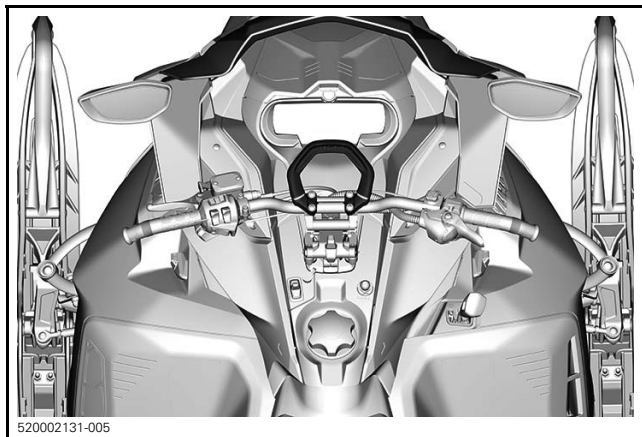


PUSH

**TURN**

29) Mountain Strap (If Equipped)

This handlebar strap shall be used only to provide additional pulling force when snowmobile is stuck in a slanted position. On an exceptional basis it can be used at very slow speed only, when standing on the right running board to bring the vehicle back on its desired path. When riding, both hands should remain on the handlebar grips to provide braking capability, as well proper steering and directional control. Do not use handlebar strap for towing, lifting or side hilling.



TYPICAL

WARNING

Do not use while riding at speed. Steering control is highly reduced and brake control is not possible.

FUEL AND OIL

Fuel Requirements

NOTICE Always use fresh gasoline. Gasoline will oxidize; the result is loss of octane, volatile compounds, and the production of gum and varnish deposits which can damage the fuel system.

Alcohol fuel blending varies by country and region. Your vehicle has been designed to operate using the recommended fuels, however, be aware of the following:

- Use of fuel containing alcohol above the percentage specified by government regulations is not recommended and can result in the following problems in the fuel system components:
 - Starting and operating difficulties.
 - Deterioration of rubber or plastic parts.
 - Corrosion of metal parts.
 - Damage to internal engine parts.
- Inspect frequently for the presence of fuel leaks or other fuel system abnormalities if you suspect the presence of alcohol in gasoline exceeds the current government regulations.
- Alcohol blended fuels attract and hold moisture which may lead to fuel phase separation and can result in engine performance problems or engine damage.

Recommended Fuel

Use unleaded gasoline containing MAXIMUM 10% ethanol. The gasoline must have the following minimum octane requirements:

FUEL TYPE	ENGINE	MINIMUM OCTANE RATING
Fuel with NO ethanol	600 ACE 900 ACE	87 AKI (RON+MON)/2 92 RON
	900 ACE Turbo	91 AKI (RON+MON)/2 95 RON
Fuel which may contain up to 10% MAX ethanol	600 ACE 900 ACE 900 ACE Turbo	91 AKI (RON+MON)/2 95 RON 

NOTICE Never experiment with other fuels. Engine or fuel system damages may occur with the use of an inadequate fuel.

NOTICE Do NOT use fuel from fuel pumps labeled E85.

Use of fuel labeled E15 is prohibited by U.S. EPA Regulations.

Fuel Antifreeze Additives

When using oxygenated fuel, additional gas line antifreeze or water absorbing additives are not required and should not be used. When using non oxygenated fuel, isopropyl base gas line antifreeze can be used in a proportion of 150 ml (5 U.S. oz) of gas line antifreeze added to 40 L (10.6 U.S. gal.) of gas.

This precaution is in order to reduce the risk of frost buildup in carburetors or other fuel system components which may lead, in certain cases, to severe damage to engine.

NOTE: Use only methyl hydrate free gas line antifreeze.

Fueling Procedure



WARNING

Always stop engine before refueling.



WARNING

- Do not allow anyone seated on the vehicle while fueling.
- Fuel is flammable and explosive under certain conditions.
- Never use an open flame to check fuel level.
- Never smoke or allow flame or spark in vicinity.
- Always work in a well-ventilated area.

NOTE: Do not sit or lean on seat when fuel tank cap is not properly installed.

1. Stop engine.
2. Have operator and passenger get off vehicle.

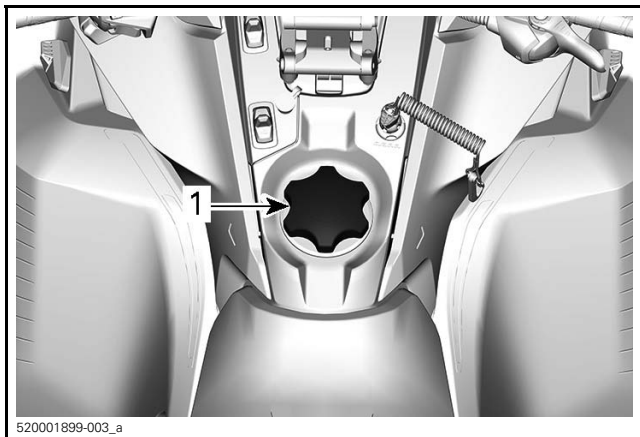


WARNING

Do not allow anyone seated on the vehicle while fueling.

3. Unscrew slowly the fuel reservoir cap counterclockwise to stabilize pressure before removing it.

NOTE: A short whistling sound is normal.



TYPICAL

1. Fuel tank cap
4. Insert the spout into the filler neck.
 5. Pour fuel slowly so that air can escape from the tank and prevent fuel flow back. Be careful not to spill fuel.
 6. Stop filling when the fuel reaches the bottom of filler neck. Do not overfill.

⚠ WARNING

Never top up the fuel tank before placing the vehicle in a warm area. As temperature increases, fuel expands and may overflow.

7. Fully tighten fuel reservoir cap clockwise.

 WARNING

Always wipe off any small fuel spillage from the vehicle. If a major spillage occurs, remove side panels to remove fuel vapors from engine compartment before starting.

NOTE: Do not sit or lean on seat when fuel tank cap is not properly installed.

Recommended Oil

Rotax® engines were developed and validated using the XPS™ oil. BRP recommends the use of its XPS engine oil or an equivalent at all time. Do not add any oil additives to the recommended engine oil. Damages caused by the use of an oil not suitable for the engine or by adding of an oil additives may not be covered by the BRP Limited Warranty.

XPS RECOMMENDED ENGINE OIL	
Scandinavia	4T 0W40 SYNTHETIC OIL (EUR) (P/N 779286)
Other Countries	4T 0W40 SYNTHETIC OIL (P/N 779139)
IF THE RECOMMENDED XPS ENGINE OIL IS NOT AVAILABLE	
Use a 0W40 4-stroke SAE synthetic engine oil meeting or exceeding the following lubricant industry specifications. Always check the API service label certification on the oil container, it must contain at least the indicated standard. – API service classification SM or SN	

BREAK-IN PERIOD

Operation During Break-In

Engine

During the break-in period:

- Avoid prolonged full throttle operation.
- Avoid sustained accelerations.
- Avoid prolonged cruising speeds.
- Avoid engine overheating.

However, brief accelerations and speed variations contribute to a good break-in.

During a predetermined period, the engine management system controls some engine parameters.

The duration is based on fuel volume. It will take approximately two fuel tanks to complete the break-in.

During this period:

- The engine performance and behavior will not be optimal.
- The fuel and oil consumption will be higher.

Drive Belt

A new drive belt requires a break in period of 50 km (30 mi).

During the break-in period:

- Avoid strong acceleration and deceleration.
- Avoid pulling a load.
- Avoid high speed cruising.

OPERATING MODES

WARNING

Whenever changing operating mode, make sure to maintain situational awareness while riding.

ECO Mode **(Fuel Economy Mode)**

When ECO mode is selected (fuel economy mode), vehicle torque and speed are limited whereby an optimal cruising speed is maintained in order to reduce fuel consumption.

Once activated, ECO mode will remain active until it is deactivated by the operator.

Standard Mode

When in Standard mode, no indicator is in the multifunction gauge.

Sport Mode

WARNING

Ensure passenger is advised to hold on tightly before activating Sport mode. Sport mode provides increased acceleration.

When selected, Sport mode provides for instant throttle response and more rapid accelerations than Standard or ECO mode.

Once activated, Sport mode will remain active until it is deactivated by the operator.

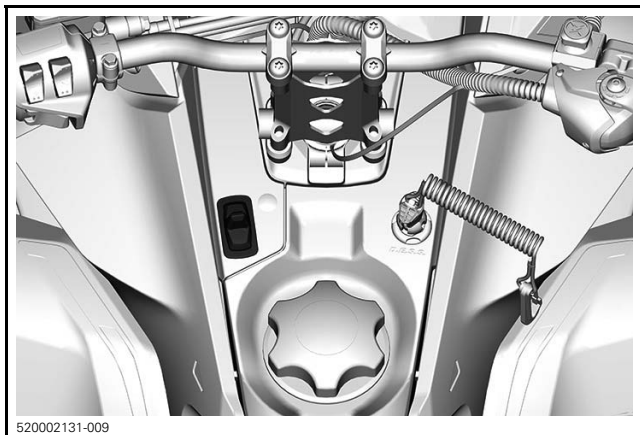
A message of the selected mode will be displayed at activation and deactivation as follow:

OPERATING MODE	MESSAGE AT ACTIVATION
Sport	SPORT MODE
Normal	NORMAL MODE
Eco	ECO MODE

Navigating Operating Modes

Use ECO/Standard/Sport Mode switch to navigate between power levels, from ECO (reduced power) to Standard (full power) to Sport (increased response).

To increase power, press the switch upwards. To decrease power, press the switch downwards.



To activate Standard mode when in Sport mode, press bottom end of switch once.

To activate ECO mode when in Sport mode, press bottom end of switch twice.

To activate ECO mode when in Standard mode, press bottom end of switch once.

WARNING

Ensure passenger is advised to hold on tightly before activating Sport mode. Sport mode provides increased acceleration.

To activate Sport mode when in Standard mode, press top end of switch once.

To activate Sport mode when in ECO mode, press top end of switch twice.

To activate Standard mode when in ECO mode, press top end of switch once.



WARNING

When adjusting modes, be sure to maintain situational awareness of other snowmobiles, obstacles, or persons.

BASIC PROCEDURES

Engine Starting Procedure

Procedure

1. Apply parking brake.
2. Recheck throttle control lever operation.
3. Put your helmet on.
4. Ensure that the tether cord cap is installed on the engine cut-off switch and that the cord is attached to your clothing eyelet.
5. Ensure that the emergency engine stop switch is in the ON position (up).



WARNING

Never depress throttle while starting engine.

6. Release parking brake.

NOTE: For an initial cold start, do not release parking brake. Perform the *VEHICLE WARM-UP* procedure as explained below.

7. Depress the START button to engage the electric starter and start the engine. Release button immediately when engine has started.

NOTICE Do not engage electric starter for more than 10 seconds at a time. A rest period should be observed between the cranking cycles to allow electric starter to cool down.

Emergency Starting

Do not attempt any emergency starting procedure. Have the battery charged or replaced.

Vehicle Warm-Up

Before every ride, vehicle has to be warmed up as follows.

1. Start engine as explained in *ENGINE STARTING PROCEDURE* above.
2. Allow engine to warm up one or two minutes at idle speed.

NOTE: Engine will shut down after approximately 12 minutes of idling.

3. Disengage parking brake.

4. Apply throttle until drive pulley engages. Drive at low speed the first two or three minutes.

NOTICE If vehicle does not move when throttle is applied, stop engine, remove tether cord cap from the engine cut-off switch, then do the following.

- Check if skis are stuck on the ground. Lift one ski at a time by the handle, then put it down.
- Check if track is stuck on the ground. Lift rear of snowmobile enough to clear track from the ground, then drop.
- Check rear suspension for hard snow or ice accumulation that could interfere with track rotation. Clean the area.
- Validate that transmission is engaged (not in neutral).

CAUTION Beware of injuries by using proper lifting techniques, notably using your legs force. Do not attempt to lift the rear of vehicle if it is above your limits.

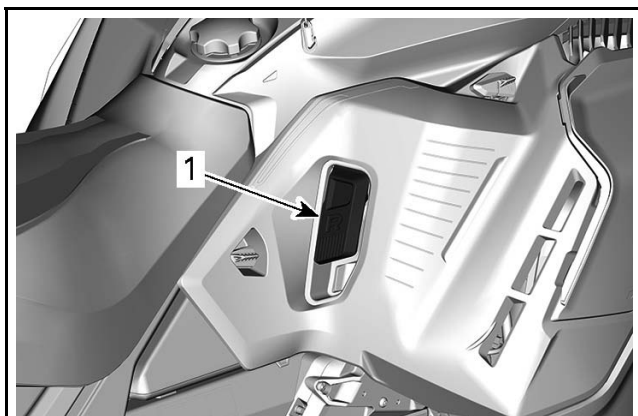
WARNING

Make sure tether cord cap is removed before standing in front the vehicle, getting close to the track or rear suspension components.

NOTE: Warm-up is electronically controlled. During this period (up to 10 minutes depending on ambient temperature), engine RPM is limited.

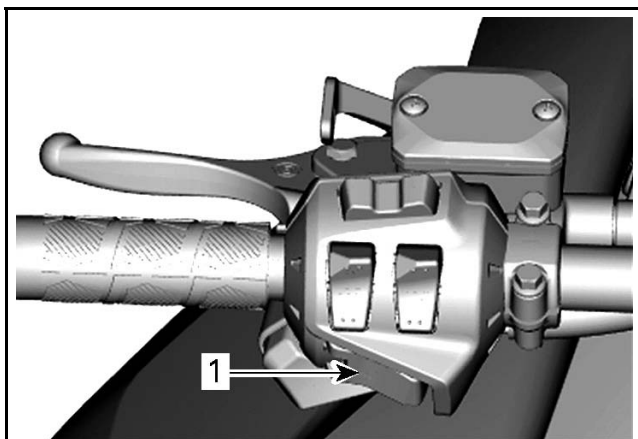
Shifting in Reverse

1. Bring vehicle to a complete stop.
2. Apply and hold brake. Remain seated, refer to *RIDER POSITION (REVERSE OPERATION)* in *RIDING THE VEHICLE* for posture information.
3. With engine at idle speed, select reverse (R) gear using the reverse lever or Start / RER button.



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1. Reverse lever



520001899-210_a

1. Start / RER button

WARNING

Engaging the reverse mode is done by depressing the RER button when the engine is running. Wait until the reverse alarm sounds and the RER pilot lamp comes on in the analog/digital gauge before operating throttle to proceed in reverse. The reverse speed is not limited. Always proceed with caution as fast reverse could result in loss of vehicle stability. Come to complete stop before depressing RER button. Always remain seated and apply the brake before shifting. Ensure the path behind is clear of obstacles or bystanders before proceeding.

Shifting in Forward from Reverse

1. Bring vehicle to a complete stop.
2. Apply and hold brake.
3. Press and release the RER button or reverse lever.
4. Apply throttle slowly and evenly. Allow drive pulley to engage then accelerate carefully.

Shifting in High or Low range

This transmission is designed to accept shifting while moving. However, shifting while the engine is under heavy load is not recommended.

NOTE: Do not shift when vehicle is moving faster than 30 km/h (19 MPH).

 **CAUTION** Shifting at a speed faster than 30 km/h (19 MPH) may cause serious damage to the gearbox.

High Range

This position selects the high speed range of the gearbox. It is the normal driving speed range. It allows the vehicle to reach its maximum speed.

Low Range

This position selects the low speed range of the gearbox. It allows the vehicle to move slowly with maximum engine torque.

Low range should be used whenever:

- Pulling a cargo carrier or accessory

- Hauling a load
- Crossing obstacles
- Climbing onto trailer
- Hill climbing

It is also recommended to use low range if driving for prolonged periods at speeds under 24 km/h (15 MPH).

NOTICE Use the low speed range to pull a cargo carrier, carry heavy cargo, go over obstacles or drive uphill and downhill.

Shutting Off the Engine

Release throttle lever and wait until engine has returned to idle speed.

Shut off the engine using either the emergency engine stop switch or by pulling off the tether cord cap from the engine cut-off switch.



WARNING

Always remove the tether cord cap from engine cut-off switch when vehicle is not in operation in order to prevent accidental engine starting or to avoid unauthorized use by children or others or theft.

RIDING CONDITIONS AND YOUR SNOWMOBILE

Altitude

At factory, your snowmobile was calibrated to be used within an altitude range (height above the sea level). For your model's factory calibration, refer to the following table.

MODELS	FACTORY CALIBRATION
All models (North America)	Sea level up to 600 m (2,000 ft)

MODELS	FACTORY CALIBRATION
All models (Europe)	Sea level up to 600 m (2,000 ft)

If your snowmobile is to be used at an altitude outside the specified range, have it calibrated accordingly by an authorized Ski-Doo dealer.

NOTICE An inappropriate altitude calibration would decrease performance and may cause serious damage to the snowmobile.

Temperature

The engine management of these engines provides the optimum air/fuel ratio for all temperatures.

SPECIAL OPERATION

Towing an Accessory

Always use a rigid tow bar to tow an accessory. Any towed accessory should have reflectors on both sides and at the rear. Check local laws for brake light(s) requirements.



WARNING

Never tow an accessory with a rope. Always use a rigid tow bar. Using a rope would result in a collision between the object and the snowmobile and possibly in a tip over in case of a rapid deceleration or on a downward slope.

Towing Another Snowmobile

If a snowmobile is disabled and must be towed use a rigid tow bar. Remove the drive belt from disabled snowmobile, refer to *DRIVE BELT* in *MAINTENANCE PROCEDURES* and tow at moderate speed.

NOTICE

Always remove the drive belt of the snowmobile that is to be towed to prevent damage to its belt and drive system.

In an emergency situation only, if a rigid tow bar is not available, a rope can be used. Proceed with extra caution. In some areas, it may be illegal to do so. Check with state or local authorities.

Remove the drive belt, attach the rope to the ski legs (spindles), have someone sit on the towed snowmobile to activate the brake, and tow at low speed.

NOTICE

In order to prevent damage to the steering system, never attach the tow rope to the ski handles.



WARNING

Never ride at high speed when towing a disabled snowmobile. Proceed slowly with extra caution.

TUNE YOUR RIDE

Snowmobile handling and comfort depend upon multiple adjustments.

WARNING

Suspension adjustment could affect vehicle handling. Always take time to familiarize yourself with the vehicle's behavior after any suspension adjustment have been made. Always adjust LH and RH suspension components to the same setting.

Choice of suspension adjustments vary with carrying load, operator's weight, personal preference, riding speed and field condition.

NOTE: Some adjustments may not apply to your snowmobile.

WARNING

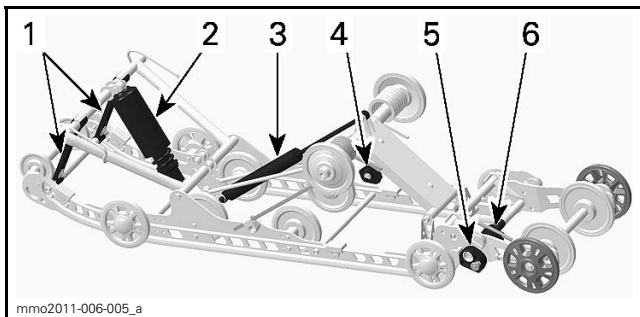
Before proceeding with any suspension adjustment, remember:

- Park in a safe place.
- Remove the tether cord cap from the engine cut-off switch.
- Use appropriate lifting device or have assistance to share lifting stress. If a lifting device is not used, use proper lifting techniques, notably using your legs force.
- Do not attempt to lift the front or rear of vehicle if it is above your limits.
- Support front of vehicle off the ground with a suitable device before adjusting suspension.
- Support rear of vehicle off the ground with a wide-base snowmobile stand with a rear deflector panel.
- Make sure support device is stable and secure.

The best way to set up the suspension is to customize each adjustment one at a time. Various adjustments are interrelated. It may be necessary to readjust center spring after adjusting front springs for instance. Test run the snowmobile under the same conditions; trail, speed, snow, operator riding position, etc. Proceed methodically until you are satisfied.

Following are guidelines to fine-tune suspension. Use suspension adjustment tool provided in the tool kit.

Rear Suspension Adjustments



SC5-U ADJUSTABLE COMPONENTS

1. Stopper straps
2. Center spring
3. Rear shock absorber
4. Rear springs
5. Extension stabilizer cam
6. Extension spring cam

NOTICE Whenever adjusting rear suspension, check track tension and adjust if necessary.

Stopper Strap

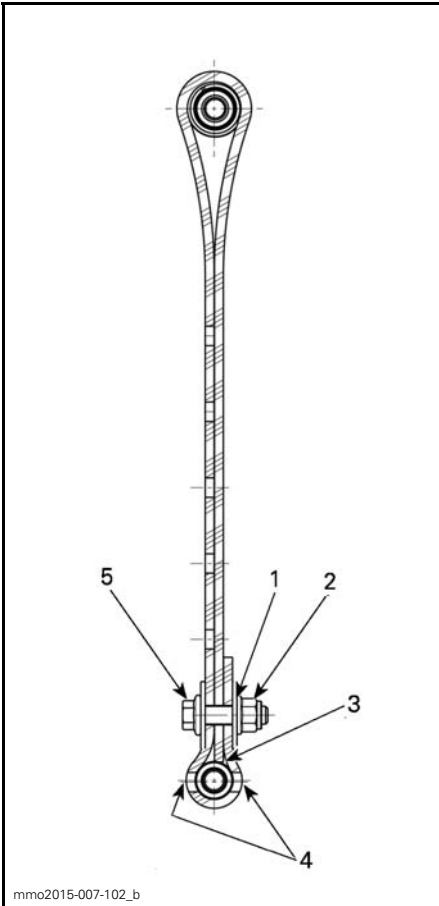
Stopper strap length has an effect on the amount of weight the center spring has to carry especially during acceleration, therefore on the front end uplift.

Stopper straps length also has an effect on center spring travel.

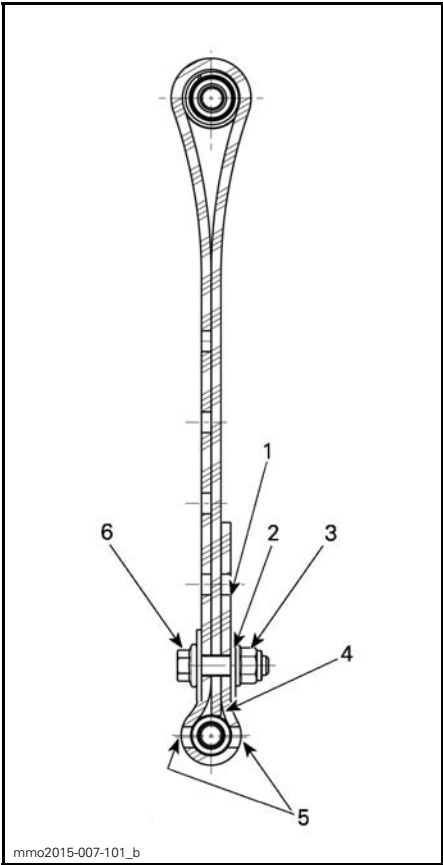
NOTICE Whenever stopper strap length is changed, track tension must be checked.

ACTION	RESULT
Increasing stopper strap length	Lighter ski pressure under acceleration
	More center spring travel
	More bump absorption capability
Decreasing stopper strap length	Heavier ski pressure under acceleration
	Less center spring travel
	Less bump absorption capability

NOTE: Stopper strap could be set to position 1, 2, 3, 4 and 5. Below are illustrations for position 1, 2, 3. Smaller numbers correspond to a longer strap setting.

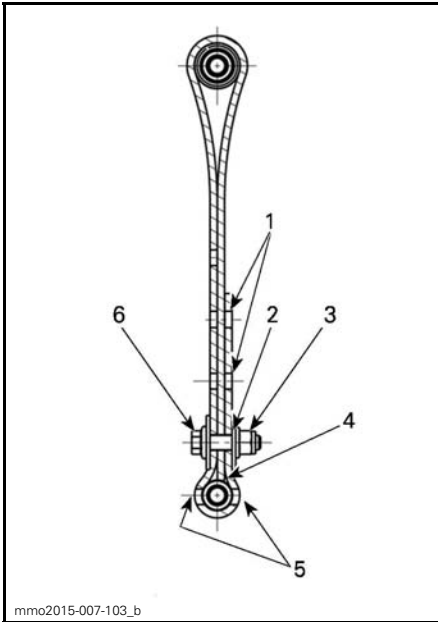
**STOPPER STRAP POSITION 1 (1ST HOLE, LONGEST)**

1. 1st hole from end
2. Towards rear
3. Tip of strap touching strap axis
4. Two holes left open between screw head and nut
5. Towards front



STOPPER STRAP POSITION 2 (2ND HOLE)

- 1. Free hole
- 2. 2nd hole from end
- 3. Towards rear
- 4. Tip of strap touching strap axis
- 5. Two holes left open between screw head and nut
- 6. Towards front

**STOPPER STRAP POSITION 3 (3RD HOLE)**

1. Free holes
2. 3rd hole from end
3. Towards rear
4. Tip of strap touching strap axis
5. Two holes left open between screw head and nut
6. Towards front

NOTE: Decreasing the stopper strap length may reduce comfort. If too much weight transfer is felt, try to correct it by adjusting the coupling blocks first. Always install stopper strap bolt as close as possible to the lower shaft.

When operating the snowmobile in deep snow, it may be necessary to vary stopper strap length and/or riding position, to change the angle at which the track rides on the snow. Operator's familiarity with the various adjustments as well as snow conditions will dictate the most efficient combination.

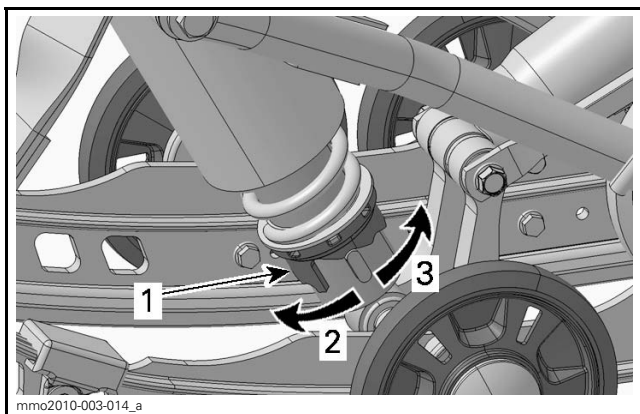
Generally, a longer stopper strap setting gives better performance in deep snow on a flat landscape.

Center Spring

Center spring preload has an effect on steering effort, handling and bump absorption.

Also, since center spring preload adjustment puts more or less pressure on the front of the track, it has an effect on the performance in deep snow.

ACTION	RESULT
Increasing preload	Lighter steering
	More bump absorption capability
	Better deep snow starts
	Better deep snow performance and handling
Decreasing preload	Heavier steering
	Less bump absorption capability
	Better trail handling

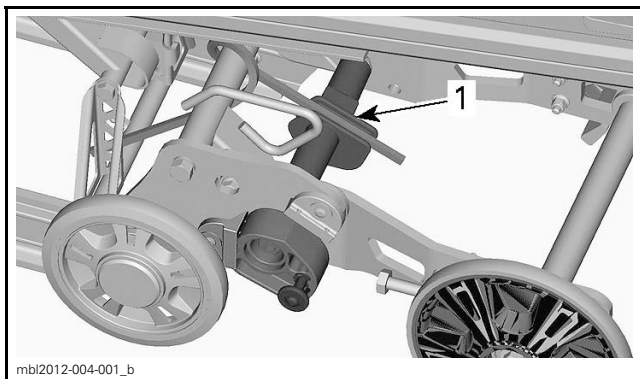
**CAM TYPE - MOTION CONTROL SHOCK ABSORBER**

1. Spring preload adjustment cam
2. Increase preload
3. Decrease preload

NOTE: For cam type preload adjuster, use the suspension adjustment tool provided in the tool kit.

Rear Suspension Extension Spring Preload (SC-5U)

Adjust by turning the preload cam.



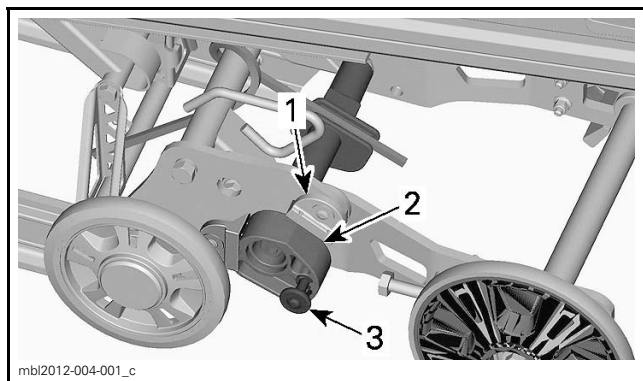
1. Preload cam

ACTION	RESULT
Increasing preload	More track surface on the ground
	Less extension lift
Decreasing preload	Better reverse capability especially in deep snow
	More extension lift

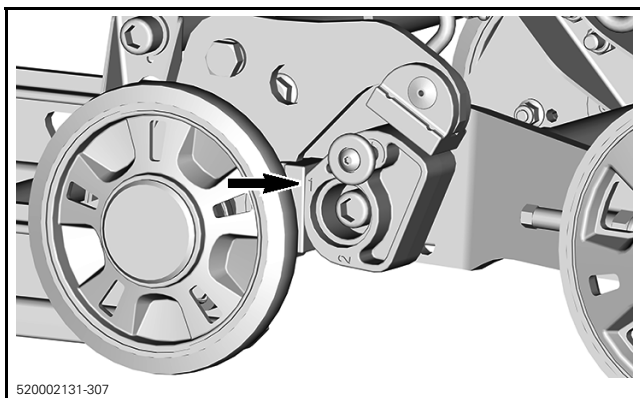
Rear Suspension Extension Stabilizer Cam

SC-5U Only

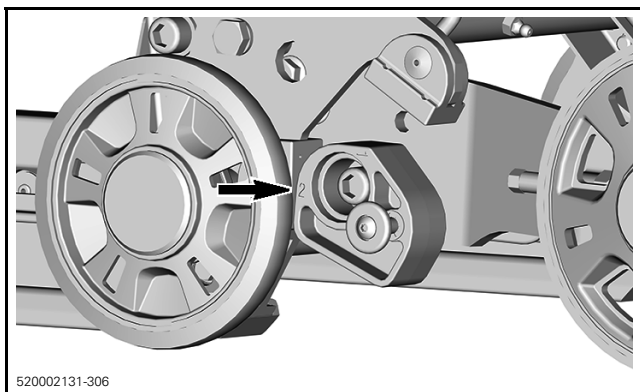
To change stabilizer cam setting, pull lock off, then turn cam.
Ensure the lock is fully pushed-in when locked.



1. Stop block
2. Stabilizer cam
3. Lock



POSITION 1



POSITION 2

CAM SETTING	RESULT
Away from upper stop block (Position 1)	Allows free movement of the suspension extension on its entire stroke
	General use
	Good reverse capability
Leaning on both stop blocks (Position 2)	Locks the suspension extension in line with the suspension rails
	Better traction, full track contact surface
	Better towing capability

Rear Spring

Rear spring preload has an effect on comfort, ride height and load compensation.

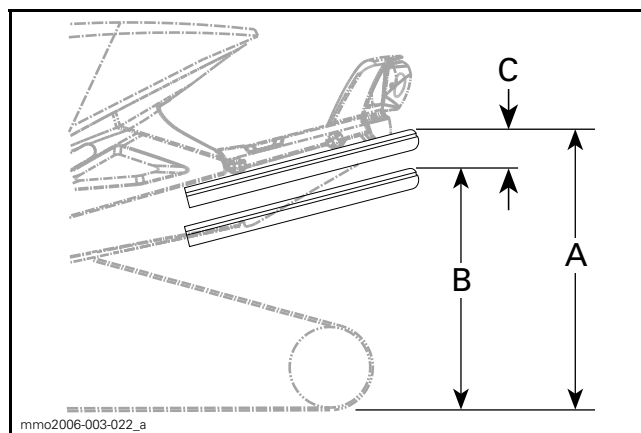
Also, adjusting rear spring preload shifts more or less weight to the snowmobile front end. As a result, more or less weight is applied to the skis. This has an effect on performance in deep snow, steering effort and handling.

Slight suspension bottoming occurring under the worst riding conditions indicates a good choice of spring preload.

NOTE: Ensure to adjust suspension when hauling cargo.

ACTION	RESULT
Increasing preload	Firmer rear suspension
	Higher rear end
	More bump absorption capability
	Heavier steering
Decreasing preload	Softer rear suspension
	Lower rear end
	Less bump absorption capability
	Lighter steering
	Better performance and handling in deep snow

Refer to the following to determine if preload is correct.



TYPICAL - PROPER ADJUSTMENT

- A. Suspension fully extended
- B. Suspension has collapsed with operator, passenger(s) and load added
- C. Distance between dimension "A" and "B", see table below

TUNE YOUR RIDE

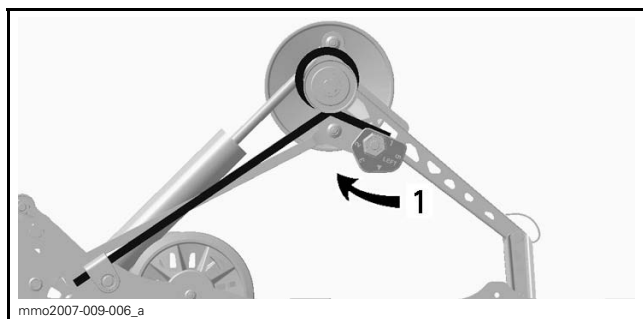
C	WHAT TO DO
50 mm to 75 mm (2 in to 3 in)	No adjustment required
More than 75 mm (3 in)	Adjusted too soft. Increase preload
Less than 50 mm (2 in)	Adjusted too firm. Decrease preload

NOTE: If the specification is unattainable with the original springs, see an authorized Ski-Doo dealer for other available springs.

NOTICE To increase spring preload, always turn the left side adjustment cam in a clockwise direction, and the right side cam in a counterclockwise direction.

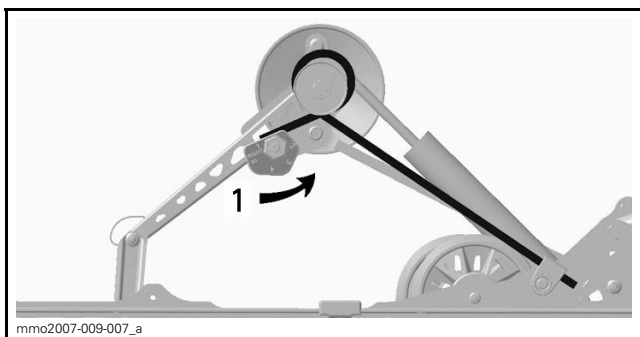
CAUTION Never set preload cams directly from position 5 to 1 or directly from position 1 to 5.

The adjustment cams have 5 different settings, 1 being the softest.



TYPICAL — LH SIDE

1. Adjust spring preload

**TYPICAL — RH SIDE**

1. Adjust spring preload

ACTION	RESULT
Increasing preload	Firmer rear suspension
	Higher rear end
	More bump absorption capability
	Heavier steering
Decreasing preload	Softer rear suspension
	Lower rear end
	Less bump absorption capability
	Lighter steering
	Better performance and handling in deep snow

Rear Shock Absorber (ACS)

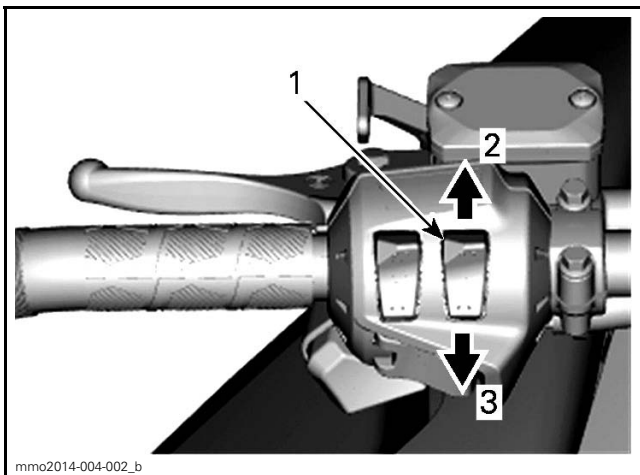
The operator can adjust the comfort and ride height by adjusting the air pressure inside the air shock absorber.

To adjust, proceed as follows:

1. Start engine.
2. Press the MENU (M) button to select suspension mode.

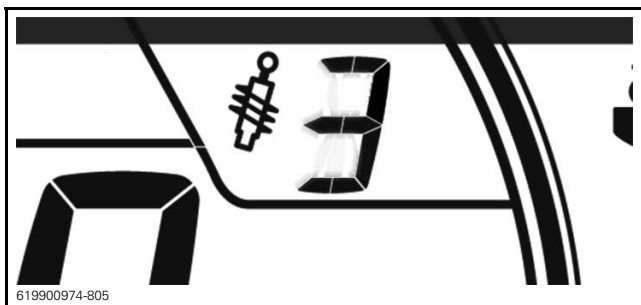
When the air suspension mode is selected, AIR_SUSP is displayed. The display also shows the actual suspension setting (a number from 1 to 5, 1 being the softest setting).

3. Depress the heated throttle lever switch as shown to increase or decrease air pressure.



TYPICAL

1. Heated throttle lever switch
 2. Increase pressure
 3. Decrease pressure
4. The desired set point appears on the display. To confirm, press the MENU (M) button or wait 5 seconds.



ACS SETTING 3

Front Suspension Adjustments

Ski Stance (Applicable Models)

Ski stance can be set to two different width.

For the narrow setting, install the spacer inside the ski leg.

For the wide setting, install the spacer outside the ski leg.

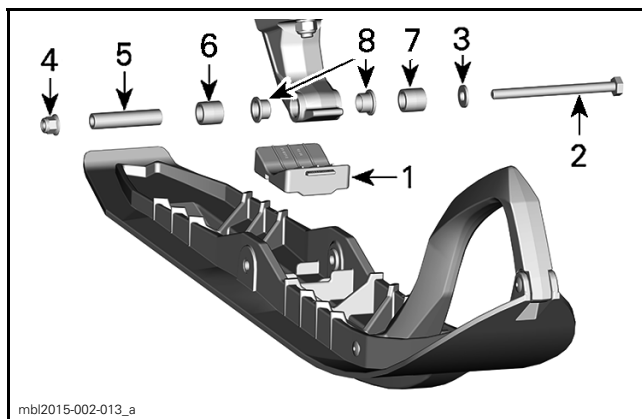
Proceed as follows to change the stance setting:

1. Lift the front of vehicle.
2. Remove the ski bolt.
3. Place the spacer according to the desired stance see illustration.



WARNING

Proceed to the same setting for both skis.



LH SIDE SHOWN

1. Ski stopper
2. M10 x 130 screw
3. M10 flat washer
4. M10 flanged nut
5. Ski axle
6. Narrow adjustment
7. Wide adjustment

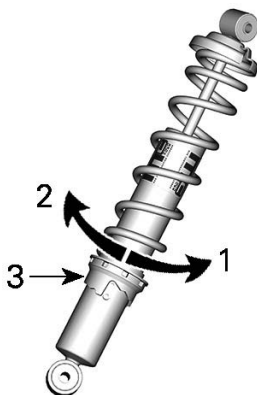
4. Tighten nut to the specified torque.

TIGHTENING TORQUE	
Ski nut	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)

Front Springs

Front spring preload has an effect on front suspension firmness.
Front spring preload also has an effect on the steering behavior.

ACTION	RESULT
Increasing preload	Firmer front suspension
	Higher front end
	More precise steering
	More bump absorption capability
Decreasing preload	Softer front suspension
	Lower front end
	Lighter steering
	Less bump absorption capability



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CAM TYPE

1. Decrease preload
2. Increase preload
3. Spring preload adjustment cam

Adjustment Tips According to Vehicle Behavior

PROBLEM	CORRECTIVE MEASURES
Front suspension darting	Check ski alignment. – Reduce front suspension spring preload. – Increase center spring preload. – Reduce rear spring preload.
Steering feels too heavy at steady speeds	– Reduce front suspension spring preload. – Increase center spring preload.
Steering feels too heavy during acceleration	– Set coupling blocks to a lower position. – Reduce rear spring preload. – Lengthen limiter strap.
Too much ski lift during cornering or acceleration	– Set coupling blocks to a higher position. – Shorten limiter strap. – Increase rear spring preload.
Rear of snowmobile seems too stiff	– Reduce rear spring preload. – Reduce compression damping adjustment if equipped
Rear of snowmobile seems too soft	– Increase rear spring preload.
Rear suspension is frequently bottoming	– Increase compression damping adjustment if equipped. – Increase rear spring preload. – Increase center spring preload. – Lengthen limiter strap. – Increase compression damping adjustment if equipped.

PROBLEM	CORRECTIVE MEASURES
Snowmobile seems to pivot around its center	– Reduce center spring preload. – Increase rear spring preload. – Increase front suspension spring preload. – Shorten limiter strap.
Track spins too much at start	– Set coupling blocks to a lower position. – Lengthen limiter strap.
Ski diving in deep snow	– Install ski tip enlarger.

VEHICLE TRANSPORTATION

Make sure that oil reservoir and fuel tank caps are properly installed.

Tilt bed trailers can easily be equipped with a winch mechanism to afford maximum safety in loading. Simple as it may seem, never drive your snowmobile onto a tilt bed trailer or any other kind of trailer or vehicle. Many serious accidents have resulted from driving up and over a trailer. Anchor your vehicle securely, front and rear, even on short hauls. Be certain all equipment is securely fastened. Cover your snowmobile when trailering to prevent road grime from causing damage.

Be certain your trailer meets state or provincial requirements. Ensure the hitch and safety chains are secure and the brake, turn indicators and clearance lights all function.



WARNING

Do not tow the vehicle facing backwards. If the vehicle is towed facing backwards, the wind may cause damage to the windshield or even loss of the windshield.

MAINTENANCE

MAINTENANCE SCHEDULE

Maintenance is very important for keeping your vehicle in safe operating condition.

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

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 Ski-Doo dealers.

Although an authorized Ski-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 Ski-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.

For emission-related warranty claims, BRP is limiting the diagnosis and repair of emission-related parts to the authorized Ski-Doo dealers. For more information, please refer to the *US EPA EMISSION-RELATED WARRANTY* contained in the *WARRANTY* section.

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

FIRST INSPECTION AFTER THE FIRST 1 500 KM (1,000 MI)

Adjust drive chain

Check chaincase oil level (if equipped)

Check gearbox oil level (if equipped)

Adjust and align track

**EVERY YEAR AT PRESEASON OR 3 000 KM (2,000 MI)
(WHICHEVER COMES FIRST)**

Perform pre-ride inspection

Check fault codes

Charge battery

Adjust drive chain

Inspect track tension, adjust and align (if necessary)

Inspect brake hose, pads and disk

Check coolant density

Inspect drive belt

Inspect and clean drive pulley

Tighten drive pulley retaining screw to specified torque

Inspect and clean driven pulley

Inspect engine seals and gaskets for leaks

Lubricate rear suspension. Lubricate whenever the vehicle is used in wet conditions (rain, puddles)

Inspect exhaust system and check for leaks

Tighten exhaust manifold screws to specified torque

Inspect fuel lines and connections

Inspect front suspension

MAINTENANCE SCHEDULE

EVERY YEAR AT PRESEASON OR 3 000 KM (2,000 MI) (WHICHEVER COMES FIRST)

Inspect rear suspension (including stopper straps and slider shoes)

Inspect tie-rod ends and ski alignment
--

Adjust headlight beam aiming

Change gearbox oil (if equipped)

EVERY 6 000 KM (4,000 MI) OR AT PRE-SEASON (WHICHEVER COMES FIRST)

Change engine oil and filter

EVERY 2 YEARS OR 6 000 KM (4,000 MI) (WHICHEVER COMES FIRST)

Replace brake fluid

Clean and lubricate rewind starter (on applicable models)

Replace chaincase oil (if equipped)

EVERY 3 YEARS OR 10 000 KM (6,000 MI) (WHICHEVER COMES FIRST)
--

Replace spark plugs

Replace turbo exhaust gasket (on applicable models)

EVERY 5 YEARS

Replace engine coolant

Replace fuel pump outlet filter

MAINTENANCE PROCEDURES

This section includes instructions for basic maintenance procedures.

WARNING

Turn off the engine, remove tether cord cap and follow these maintenance procedures when performing maintenance. If you do not follow proper maintenance procedures you can be injured by hot parts, moving parts, electricity, chemicals or other hazards.

WARNING

Should removal of a locking device be required (e.g. lock tabs, self-locking fasteners, etc.) when undergoing disassembly/assembly, always replace with a new one.

Engine Coolant

WARNING

Never open coolant tank cap when engine is hot.

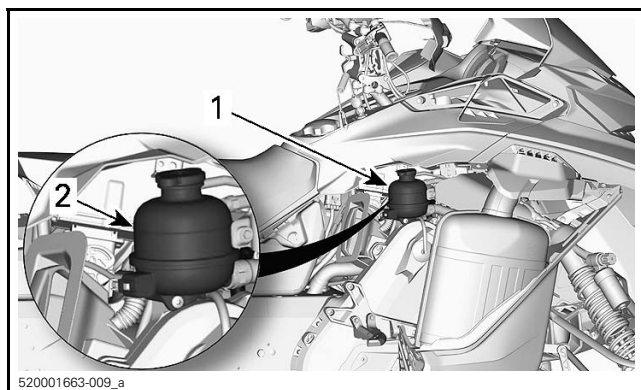
Engine Coolant level Verification

Open the RH side panel, see *CONTROLS, INSTRUMENTS AND EQUIPMENT*.

Check coolant level at room temperature. Liquid should be at cold level line of coolant tank.

NOTE: When checking level at low temperature it may be slightly lower then the mark.

If additional coolant is necessary or if entire system has to be refilled, refer to an authorized Ski-Doo dealer, repair shop or person of your own choosing.



1. Coolant reservoir
2. COLD line

Recommended Engine Coolant

COUNTRY	RECOMMENDED 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)

NOTICE Always use ethylene-glycol antifreeze containing corrosion inhibitors specifically for internal combustion aluminum engines.

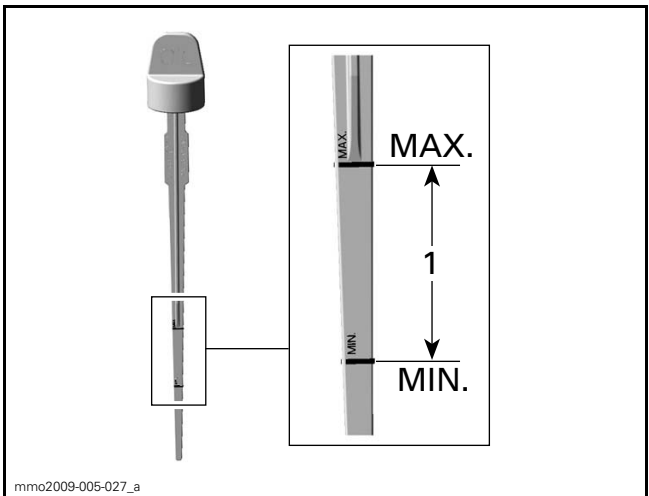
Engine Oil

Engine Oil Level Verification

NOTICE Check level before each ride and refill if necessary. Do not overfill. Operating the engine with an improper level may severely damage engine. Wipe off any spillage.

Place vehicle on a level surface and proceed as follows to check oil level:

1. Start engine and let it reach its normal operating temperature. Engine is at normal temperature when rear radiator gets warm, indicating that the thermostat is open.
2. Let engine run at idle for 30 more seconds.
3. Stop engine.
4. Open the LH side panel, refer to *CONTROLS, INSTRUMENTS AND EQUIPMENT*.
5. Remove the drive belt guard, refer to *DRIVE BELT GUARD*.
6. Remove dipstick from the filler tube, then wipe it clean.
7. Completely insert dipstick in the filler tube.
8. Remove dipstick and check the oil level. Oil level should be between the MIN and MAX marks as shown, add if necessary.



1. Oil level between MIN. and MAX.

CAUTION Engine oil can be very hot.

WARNING

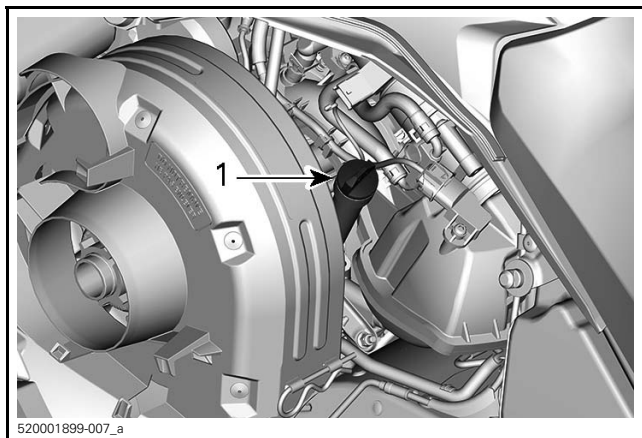
Wipe off any oil spills. Oil is highly flammable when heated.

Engine Oil Replacement

 **CAUTION** The engine oil can be very hot. Wait until engine oil is warm.

NOTICE Engine oil and oil filter must be replaced at the same time.

1. Bring engine to its normal operating temperature.
2. Place vehicle on a level surface.
3. Remove the LH side panel.
4. Remove dipstick.

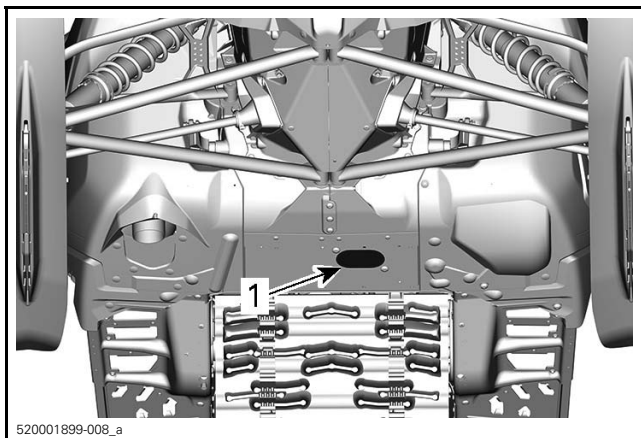


LH SIDE OF VEHICLE

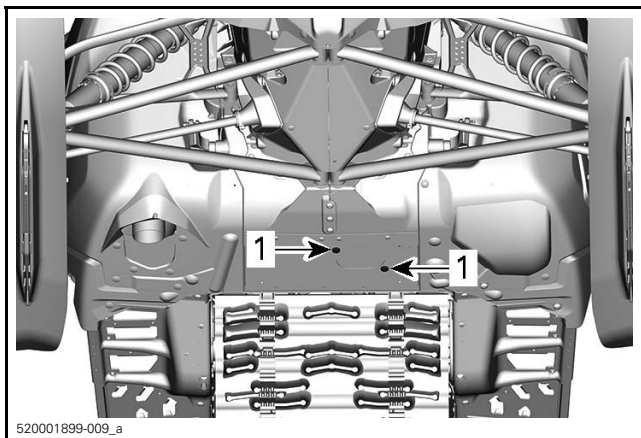
1. Oil tank dipstick

5. Remove *OIL FILTER*, see procedure in this subsection.
6. From underneath the vehicle, access the drain plug:
 - 6.1 Remove one access cover retaining screw and loosen the other.

- 6.2 Pivot the access cover to clear the bottom pan opening.



1. Drain plugs access cover



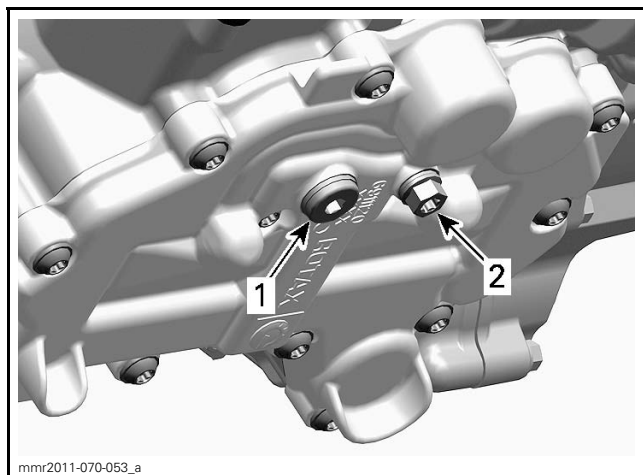
PIVOT THE ACCESS COVER

1. Retaining screws

7. Clean drain plug area.

MAINTENANCE PROCEDURES

8. Place a drain pan under the bottom pan opening.
9. Remove engine drain plugs in the following order.
 - 9.1 Main drain plug.
 - 9.2 Secondary drain plug.

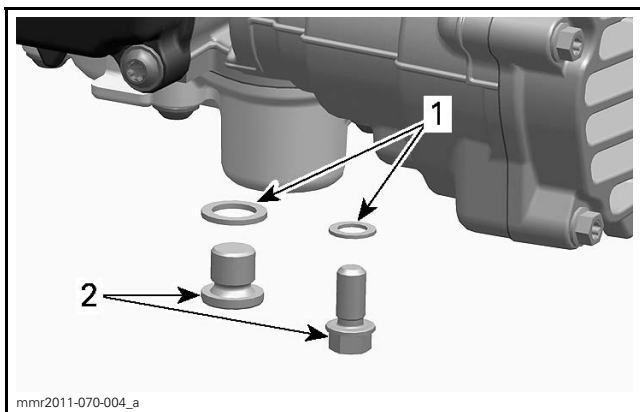


UNDERNEATH THE ENGINE

1. Main drain plug
2. Secondary drain plug

10. Allow oil to drain completely.
11. Install **NEW** sealing washers on oil drain plugs.

NOTICE Never use a sealing washer a second time. Always replace with a new one.



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1. Sealing washer
2. Oil drain plug

12. Install drain plugs and tighten to specification.

TIGHTENING TORQUE	
Drain plugs	20 N•m ± 2 N•m (15 lbf•ft ± 1.5 lbf•ft)

13. Install a new *OIL FILTER*, see procedure in this subsection.
14. Refill oil tank at the proper level with the recommended oil.

APPROXIMATE ENGINE OIL CAPACITY (WITH FILTER)	
600 ACE	2.1 L (2.22 qt (U.S. liq.))
900 ACE 900 ACE Turbo	3.3 L (3.5 qt (U.S. liq.))

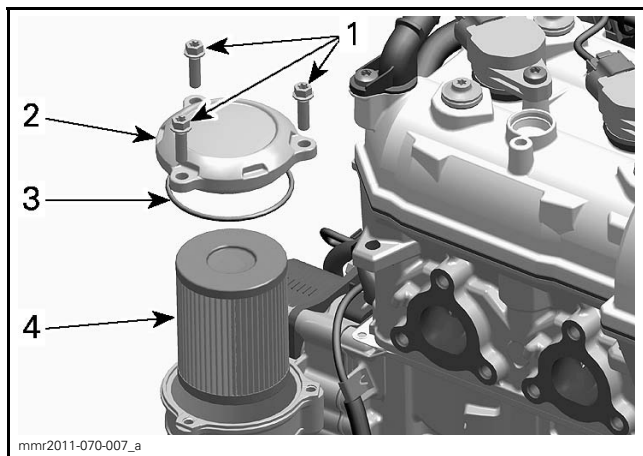
15. Reinstall dipstick in oil tank and properly tighten it.
16. Start engine and let it idle for a few minutes.
17. Ensure there are no leaks.
18. Stop engine and check oil level as explained in this subsection. Refill if necessary.
19. Dispose oil and filter as per your local environmental regulations.

Engine Oil Filter

Engine Oil Filter Replacement

Oil Filter Removal

1. Remove the RH side panel.
2. Clean oil filter area.
3. Remove:
 - Oil filter cover screws
 - Oil filter cover with O-ring
 - Oil filter.

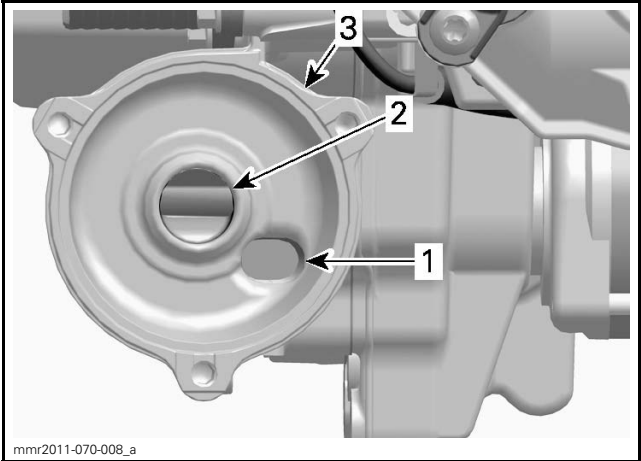


1. Oil filter cover screws
2. Oil filter cover
3. O-ring
4. Oil filter

4. Dispose filter as per your local environmental regulations.

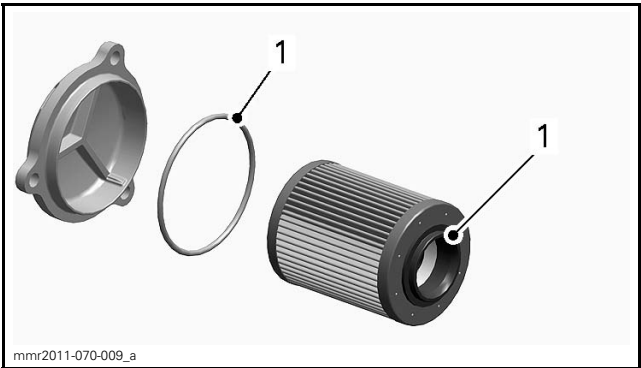
Oil Filter Installation

1. Check the oil filter inlet and outlet orifices inside oil filter receptacle (integrated part of magneto cover) for dirt and contaminations.



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1. Oil inlet orifice from the oil pressure pump
 2. Oil outlet orifice to the engine lubrication system
 3. Oil filter receptacle
2. Install a **NEW** O-ring on oil filter cover.
 3. Install the new filter into the cover.
 4. Lubricate filter seal and cover O-ring with engine oil.



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1. Lubricate with engine oil

NOTICE Pay attention to avoid pinching the O-ring during filter and cover installation.

5. Install the oil filter cover.
6. Tighten oil filter cover screws to specification.

TIGHTENING TORQUE	
Oil filter cover screws	10 N•m ± 1 N•m (89 lbf•in ± 9 lbf•in)

7. Wipe off any oil spillage on engine.

Exhaust System

Exhaust System Verification

The muffler tail pipe should be centered with the exit hole in the bottom pan. Exhaust system must be free of rust or leaks. Make sure that all parts are securely in place.

Check retaining springs and heat shields condition and replace if necessary.

The exhaust system is designed to reduce noise and to improve the total performance of the engine. Modification may be in violation of local laws.

NOTICE If any exhaust system component is removed, modified or damaged, severe engine damage may result.

Spark Plugs

Spark plugs inspection or replacement may be performed by an authorized Ski-Doo dealer, repair shop, or person of your own choosing. Spark plugs inspection or replacement requires an in-depth technical knowledge. Though not required, it is recommended that an authorized Ski-Doo dealer performs spark plugs inspection or replacement.

Brake Fluid

Recommended Fluid

Use only DOT 4 brake fluid from a sealed container. An opened container may be contaminated or may have absorbed moisture from the air.

⚠ WARNING

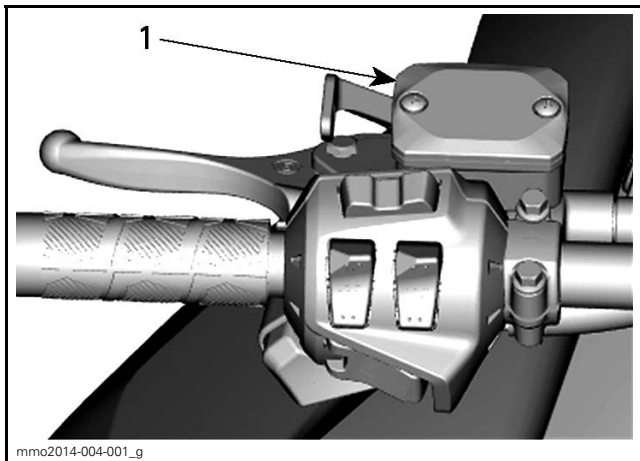
Use only DOT 4 brake fluid from a sealed container. To avoid serious damage to the braking system, do not use fluids other than the recommended one, nor mix different fluids for topping up.

NOTICE Brake fluid can damage painted and plastic parts. Handle with care. Rinse thoroughly in case of spillage.

Brake Fluid Level Verification

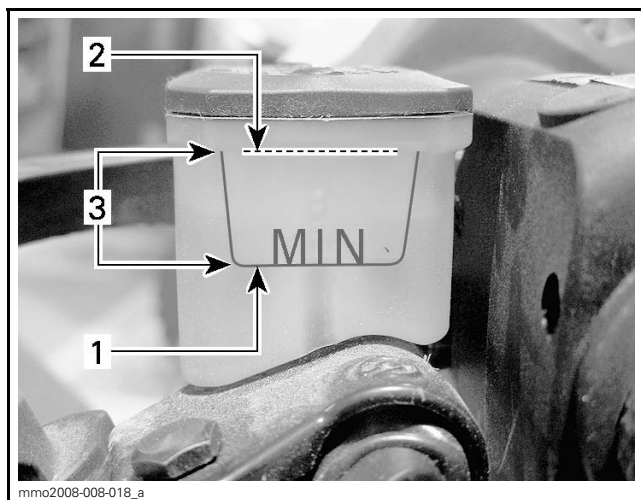
NOTICE Vehicle must be on a level surface before checking any fluid levels.

Check brake fluid (DOT 4) in reservoir for proper level. Add fluid (DOT 4) as required.



TYPICAL

1. Brake fluid reservoir



TYPICAL

1. Minimum
2. Maximum
3. Operating range

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

Chaincase Oil (if equipped)

Recommended Chaincase Oil

RECOMMENDED CHAINCASE OIL	
Scandinavia	SYNTHETIC CHAINCASE OIL (EUR) (P/N 779185)
All other countries	SYNTHETIC CHAINCASE OIL (P/N 779156)

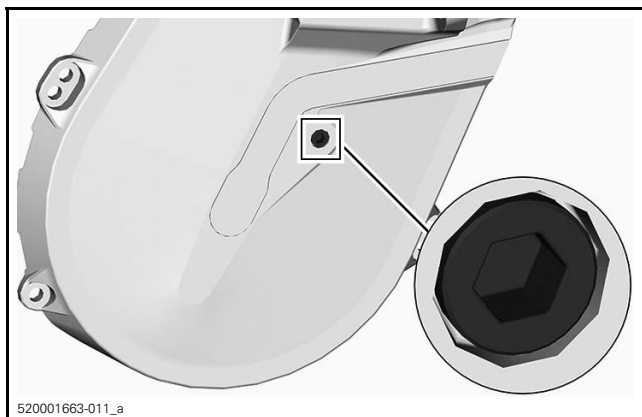
NOTICE If the recommended XPS chaincase oil is not available, use a 75W140 gear oil that meets the API GL-5 specification. The chaincase of this snowmobile has been developed and validated using the XPS™ Synthetic chaincase oil. BRP strongly recommends the use of its XPS Synthetic chaincase oil at all times. Damages caused by oil which is not suitable for the chaincase will not be covered by the BRP limited warranty.

Access to Chaincase

Open RH side panel, refer to *CONTROLS, INSTRUMENTS AND EQUIPMENT*.

Chaincase Oil Level Verification

With the vehicle on a level surface, check the oil level by removing the check plug.



CHECK PLUG

Oil level must reach the threaded hole.

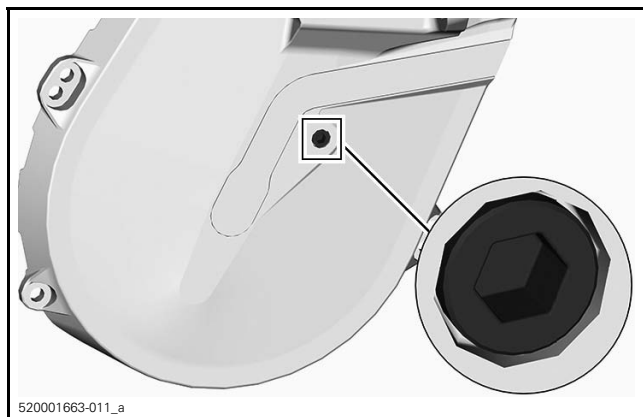
If level is correct, reinstall check plug and tighten to the specified torque.

TIGHTENING TORQUE	
Check plug	$6 \text{ N}\cdot\text{m} \pm 1 \text{ N}\cdot\text{m}$ ($53 \text{ lbf}\cdot\text{in} \pm 9 \text{ lbf}\cdot\text{in}$)

If level is insufficient, See *CHAINCASE FILLING PROCEDURE*.

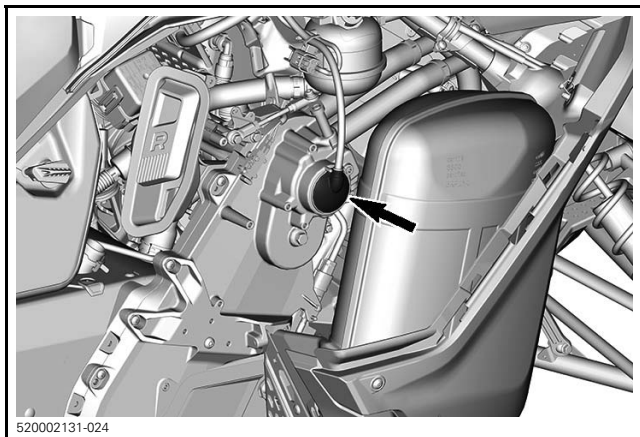
Chaincase Filling Procedure

Remove the check plug.



CHECK PLUG

Remove the filler cap.



520002131-024

TYPICAL - TOP OF CHAINCASE

1. Filler cap

Pour recommended oil in the filler hole until oil comes out by the check plug hole.

Reinstall check plug and tighten to the specified torque.

TIGHTENING TORQUE	
Check plug	$6 \text{ N}\cdot\text{m} \pm 1 \text{ N}\cdot\text{m}$ $(53 \text{ lbf}\cdot\text{in} \pm 9 \text{ lbf}\cdot\text{in})$

Reinstall the filler cap.

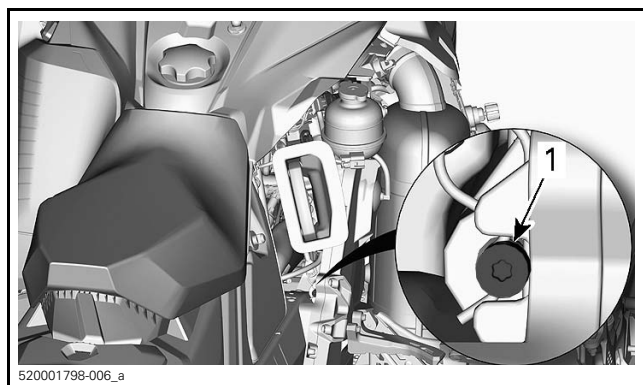
Drive Chain

Access to Chaincase

Open RH side panel, refer to *CONTROLS, INSTRUMENTS AND EQUIPMENT*.

Drive Chain Adjustment

Using the Torx end of the driven pulley expander, GENTLY turn tensioner adjustment screw clockwise to eliminate the play.



TYPICAL

1. Adjustment screw

Do not force the tensioner in.

NOTE: Do not remove the hair cotter pin.

NOTICE Overtightening the drive chain could result in severe damage to the chaincase components.

Gearbox Oil (if equipped)

Recommended Gearbox Oil

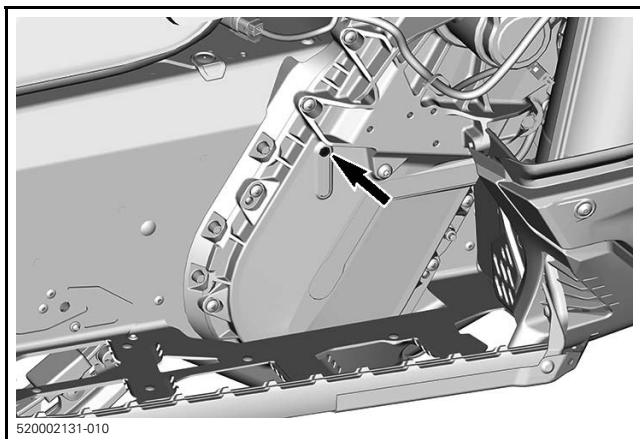
RECOMMENDED GEARBOX OIL	
Scandinavia	SYNCHROMESH TRANSMISSION SYNTHETIC OIL (EUR) (P/N 779211)
All other countries	SYNCHROMESH TRANSMISSION SYNTHETIC OIL (P/N 779170)

NOTICE If the recommended XPS gearbox oil is not available, use a 75W140 gear oil that meets the API GL-5 specification. The gearbox of this snowmobile has been developed and validated using the XPS™ Synthetic gearbox oil. BRP strongly recommends the use of its XPS Synthetic gearbox oil at all times. Damages caused by oil which is not suitable for the gearbox will not be covered by the BRP limited warranty.

Gearbox Oil Level

With the vehicle on a level surface, check the oil level by removing the check plug on the left side of gearbox.

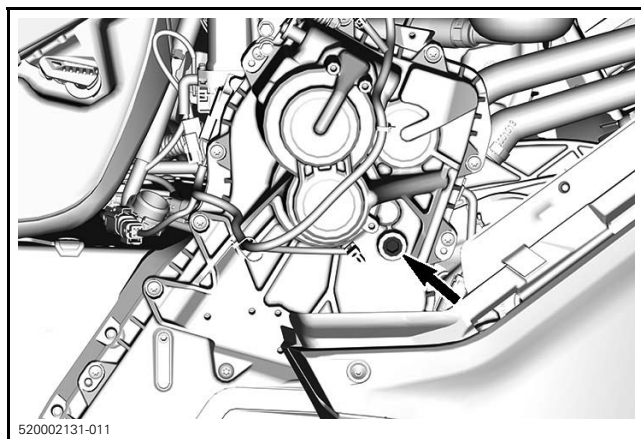
Oil level must reach the threaded hole's lower edge.



CHECK PLUG

To add oil, proceed as follows:

1. Remove the filler plug.



520002131-011

FILLER PLUG

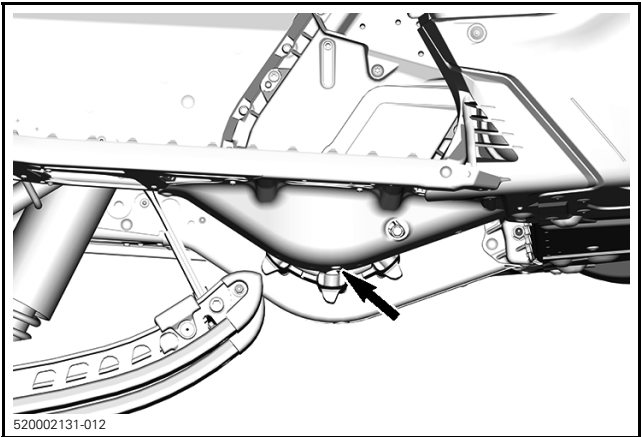
2. Pour recommended oil in gearbox by the filler hole until oil comes out by the check plug hole.
3. Reinstall check and filler plug and tighten to specifications.

TIGHTENING TORQUE	
Check plug	6 N•m ± 1 N•m (53 lbf•in ± 9 lbf•in)
Filler plug	8 N•m ± 1 N•m (71 lbf•in ± 9 lbf•in)

Gearbox Oil Replacement

Gearbox Oil Draining

1. Place the vehicle on a level surface.
2. Place a drain pan under gearbox drain plug area.
3. Remove filler cap.
4. Remove the drain plug located at the bottom of gearbox.



520002131-012

1. *Drain plug access hole*

5. Wait a while to allow all oil to drain out of gearbox.
6. Install drain plug and tighten to specification.

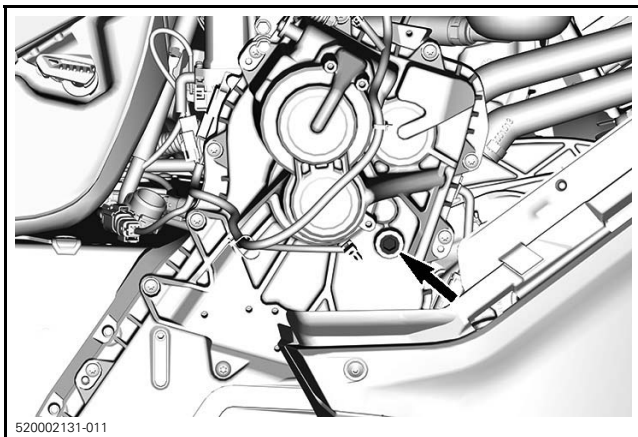
TIGHTENING TORQUE

Gearbox drain plug	$6 \text{ N}\cdot\text{m} \pm 1 \text{ N}\cdot\text{m}$ $(53 \text{ lbf}\cdot\text{in} \pm 9 \text{ lbf}\cdot\text{in})$
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Gearbox Oil Filling

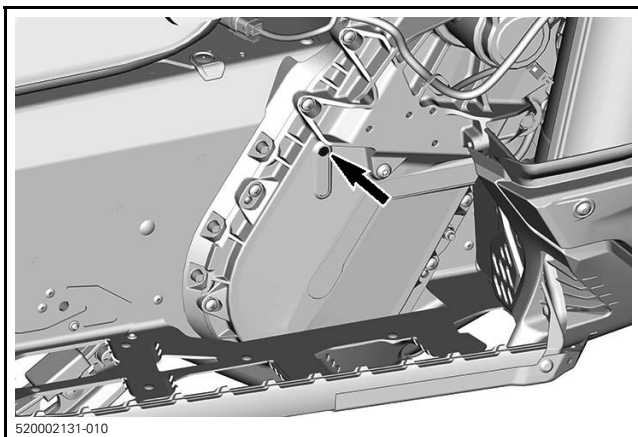
NOTE: Vehicle must be on a level surface.

1. Remove the filler plug.
2. Remove oil level check plug.



520002131-011

FILLER PLUG



520002131-010

CHECK PLUG

3. Pour recommended oil into gearbox through the filler hole.

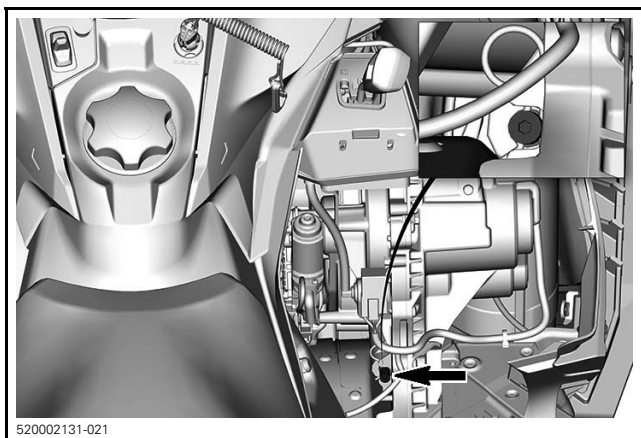
NOTE: Oil level is correct when it just begins to come out of the check plug orifice.

4. Reinstall check plug and tighten to specification.

TIGHTENING TORQUE	
Oil level check plug	$6 \text{ N}\cdot\text{m} \pm 1 \text{ N}\cdot\text{m}$ (53 lbf•in $\pm$ 9 lbf•in)

Drive Chain Adjustment

Using the Torx end of the driven pulley expander, GENTLY turn tensioner adjustment screw clockwise to eliminate the play.



ADJUSTMENT SCREW

Do not force the tensioner in.

NOTE: Do not remove the hair cotter pin.

NOTICE Overtightening the drive chain could result in severe damage to the gearbox components.

Drive Belt

Drive Belt Inspection

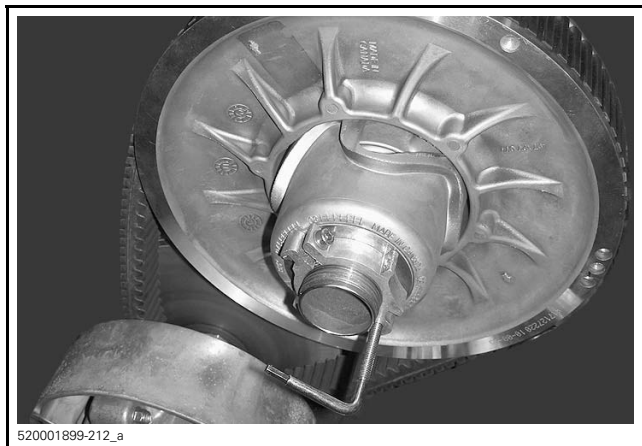
Inspect belt for cracks, fraying or abnormal wear (uneven wear, wear on one side, missing cogs, cracked fabric). If abnormal wear is noted, probable cause could be pulley misalignment, excessive RPM

with frozen track, fast starts without warm-up period, burred or rusty sheave, oil on belt or distorted spare belt. Contact an authorized Ski-Doo dealer.

Drive Belt Replacement

Drive Belt Removal

1. Remove tether cord cap from engine cut-off switch.
2. Remove drive belt guard, refer to *CONTROLS, INSTRUMENTS AND EQUIPMENT*.
3. Insert the driven pulley expander provided in the threaded hole on the adjuster hub as shown.



TYPICAL - PULLEY EXPANDER INSTALLED ON ADJUSTER HUB

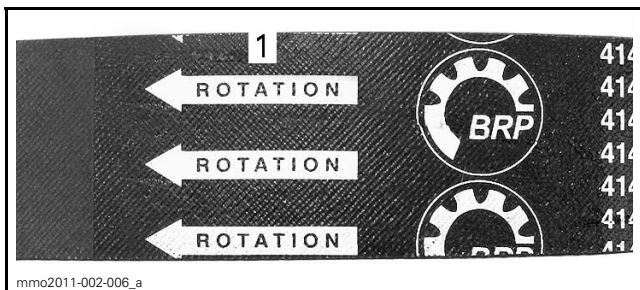
4. Open the driven pulley by screwing the tool in.
5. Remove the drive belt by slipping it over the top of the driven pulley, then over the drive pulley.

Drive Belt Installation

1. If necessary, open the driven pulley, refer to *DRIVE BELT REMOVAL* above.
2. Slip the belt over the drive pulley, then over the driven pulley.

NOTICE Do not force or use tools to pry the belt into place, as this could cut or break the cords in the belt.

NOTE: The maximum drive belt life span is obtained when belt is installed with arrows in the direction of rotation.



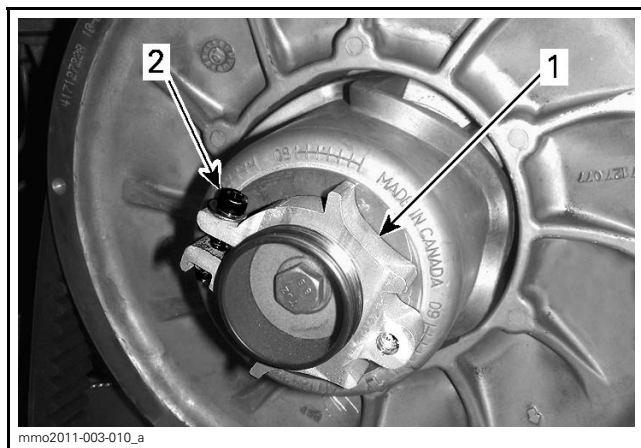
1. To be pointed in the direction of rotation
3. Unscrew and remove the driven pulley expander from the pulley.
4. Rotate the driven pulley several times to properly set the belt between the sheaves.
5. If a new belt was installed, an adjustment will be required for the proper belt height. Refer to *DRIVE BELT HEIGHT ADJUSTMENT* below.
6. Install belt guard, refer to *CONTROLS, INSTRUMENTS AND EQUIPMENT*.
7. Close side panel, refer to *CONTROLS, INSTRUMENTS AND EQUIPMENT*.

Drive Belt Height Adjustment

The drive belt height must be checked every time a new drive belt is installed and as part of the pre-ride inspection.

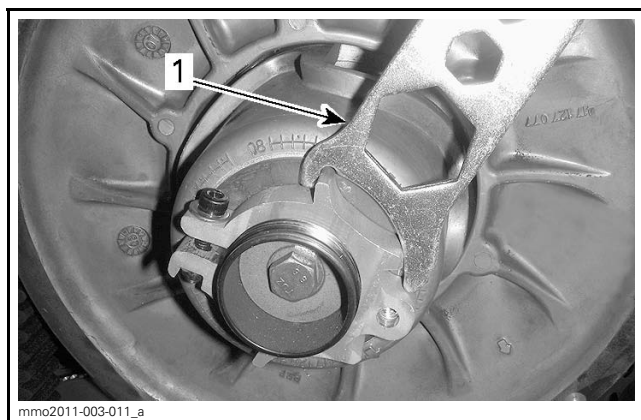
To adjust the drive belt height, proceed as follows:

1. Remove tether cord cap from engine cut-off switch.
2. Remove drive belt guard.
3. Loosen the clamping bolt.



1. Adjuster hub
2. Clamping bolt

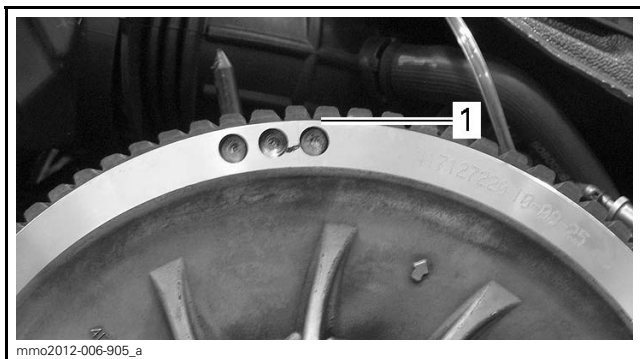
4. Using the suspension adjustment tool provided, turn the ring 1/4 turn at a time then rotate the driven pulley to properly set the drive belt between the pulley sheaves.



1. Suspension adjustment tool

NOTE: The adjustment ring has left hand treads.

Repeat step 4 until the lowest portion of the cogs on the external surface of drive belt is even with the driven pulley edge.



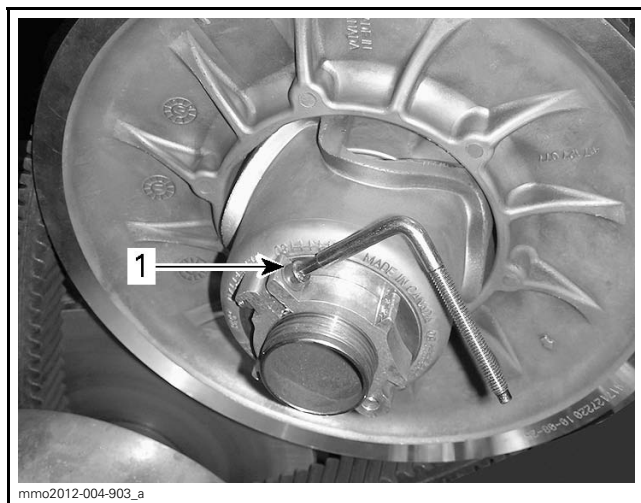
TYPICAL - PRELIMINARY SETTING

1. Lowest portion of cogs even with external surface of drive belt

NOTE: Turning the ring counterclockwise lowers the drive belt in the pulley. Turning the ring clockwise raises the drive belt in the pulley.

5. Firmly tighten the clamping bolt. If possible, tighten to specified torque using a torque wrench.

TIGHTENING TORQUE	
Clamping bolt	5.5 N•m ± 0.5 N•m (49 lbf•in ± 4 lbf•in)



TYPICAL

1. Clamping bolt

6. Install drive belt guard.

7. Install side panel.

NOTE: These settings are correct as a preliminary adjustment for most models. In some cases, when starting the engine, the vehicle could creep, indicating that the drive belt is too tight.

If the vehicle creeps, lower the drive belt height from the preliminary setting. Repeat procedure until creeping stops.

Reverse Activation

NOTE: The reverse may not activate if the belt is positioned too high in the driven pulley. If reverse activation does not work properly, ensure the drive belt is properly adjusted. Adjust the drive belt lower in the driven pulley if needed.

Track

Track Condition

WARNING

Remove tether cord cap from engine cut-off switch before performing any maintenance or adjustment, unless otherwise specified. Vehicle must be parked in a safe place, away from the trail.

Remove tether cord cap from engine cut-off switch.

Lift the rear of the snowmobile and support it with a wide-base snowmobile mechanical stand with a rear deflector panel. With the engine off, rotate the track by hand, and inspect condition. If worn or cut, or if track fibers are exposed, or if missing or defective inserts or guides are noted; contact an authorized Ski-Doo dealer.

Snowmobiles Equipped with Traction Enhancing Products

If your snowmobile is equipped with a BRP approved studded track, PROCEED WITH A VISUAL INSPECTION OF YOUR TRACK BEFORE EACH USE.

Look for any defects, such as:

- Perforations in the track
- Tears in the track (particularly around traction holes on studded tracks)
- Lugs that are broken or torn off, exposing portions of rods
- Delamination of the rubber
- Broken rods
- Broken studs (studded tracks)
- Bent studs (studded tracks)
- Missing studs
- Studs that are torn off the track
- Missing track guide(s)
- Also, ensure that studs nut are tighten to the recommended torque.

On approved studded tracks, replace broken or damaged studs immediately. If your track shows signs of deterioration, it must be replaced immediately. When in doubt, ask your dealer.

WARNING

Riding with a damaged track or studs could lead to a loss of control.

For complete information on traction enhancing products, refer to *TRACTION ENHANCING PRODUCTS* in *SAFETY INFORMATION* at the beginning of this Operator's Guide.

Track Tension and Alignment

NOTE: Track tension and alignment are interrelated. Do not adjust one without the other.

WARNING

To prevent serious injury to individuals near the snowmobile:

- NEVER stand behind or near a moving track.
- Always use a wide-base snowmobile stand with a rear deflector panel if it is necessary to rotate track.
- When the track is raised off the ground, only run it at the lowest possible speed.

Centrifugal force could cause debris, damaged or loose studs, pieces of torn track, or an entire severed track to be violently thrown backwards out of the tunnel with tremendous force, possibly resulting in the loss of a leg or other serious injury.

Track Tension Verification

NOTE: Ride the snowmobile in snow about 15 to 20 minutes prior to adjusting track tension.

1. Remove tether cord cap from engine cut-off switch.
2. Lift rear of vehicle and support it off the ground.

 **CAUTION** Use proper lifting techniques, notably using your legs force. Do not attempt to lift the rear of vehicle if it is above your limits.

3. Allow rear suspension to fully extend.
4. Use the TENSIO METER (P/N 414 348 200).

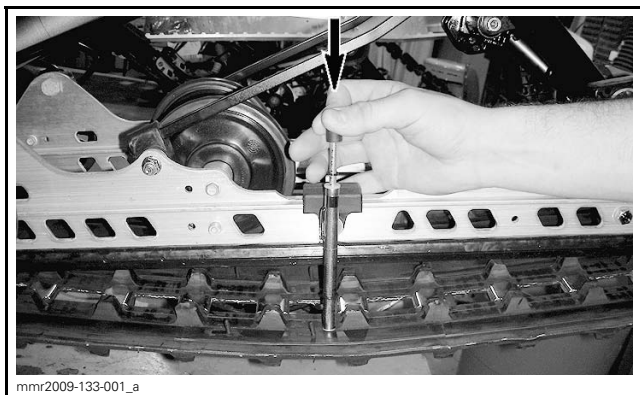


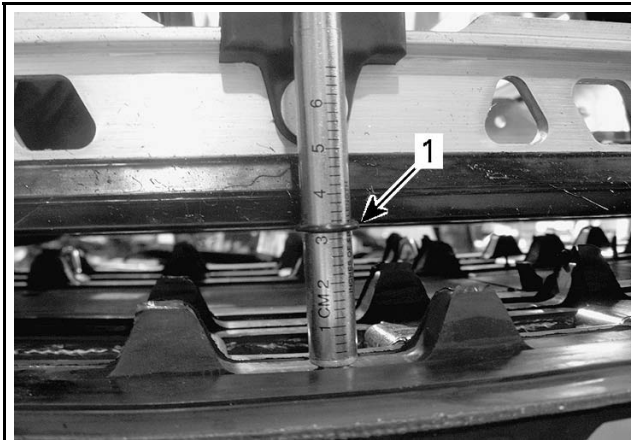
5. Set deflection between 40 mm to 50 mm (1.575 in to 1.969 in) using bottom O-ring.



DEFLECTION SETTING

1. *Bottom O-ring set to specification*
6. Place upper O-ring to 0 kgf (0 lbf).
7. Position the tensiometer on track, halfway between front and rear idler wheels.
8. Push the tensiometer downwards until bottom O-ring (deflection set earlier) be aligned with the bottom of slider shoe.





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1. Deflection O-ring aligned with slider shoe

9. Read load recorded by the upper O-ring on the tensiometer.



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LOAD READING

1. Upper O-ring

10. Load reading must be as per the following table.

TRACK ADJUSTMENT SPECIFICATION	
TRACK DEFLECTION SETTING	40 mm to 50 mm (1.5 in to 2 in)
TRACK LOAD READING	7.3 kgf (16 lbf)

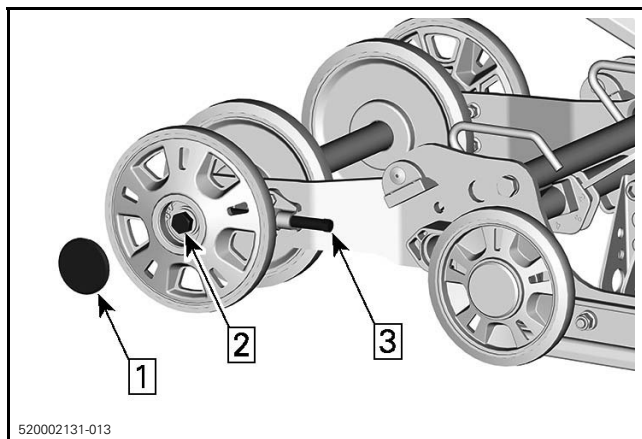
11. If load reading is not in accordance with the specification, adjust track tension. Refer to *TRACK TENSION ADJUSTMENT*.

Track Tension Adjustment

1. Remove tether cord cap from engine cut-off switch.

⚠ CAUTION Use proper lifting techniques, notably using your legs force. Do not attempt to lift the rear of vehicle if it is above your limits.

2. Remove wheel caps.
3. Loosen the rear axle screws on both sides or, on 2 idler wheel models, the rear axel nut.
4. Tighten or loosen both adjustment screws (equally) to increase or decrease track tension.



Step 1: Remove cap

Step 2: Loosen the axle screw or nut

Step 3: Tighten or loosen adjustment screws

5. If correct tension is unattainable, contact an authorized Ski-Doo dealer.
6. Retighten the rear axle fasteners to specification.

TIGHTENING TORQUE	
Rear idler wheel retaining screws (3 wheels and 4 wheels models)	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)

7. Check track alignment as described below.

Track Alignment

WARNING

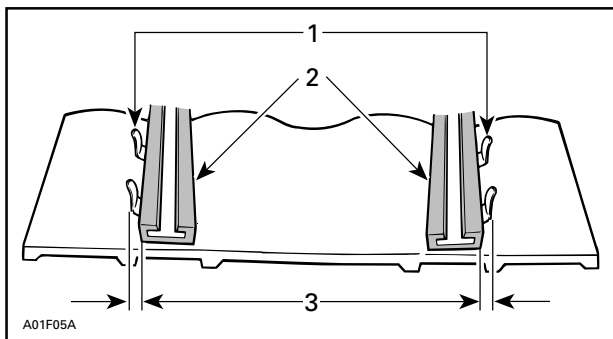
Before checking track alignment, ensure that the track is free of all particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Always lift the snowmobile on a wide-base stand with a rear deflector panel. Ensure no one is standing in close proximity to the snowmobile, especially at the rear of the track. Never rotate track at high speed.

Centrifugal force could cause debris, damaged or loose studs, pieces of torn track, or an entire severed track to be violently thrown backwards out of the tunnel with tremendous force.

1. Lift rear of vehicle and support it off the ground.

 **CAUTION** Use proper lifting techniques, notably using your legs force. Do not attempt to lift the rear of vehicle if it is above your limits.

2. Start engine and accelerate slightly so that track slowly turns. This must be done in a short period of time (15 to 20 seconds).
3. Check that the track is well centered; equal distance on both sides between edges of track guides and slider shoes.



1. Guides
2. Slider shoes
3. Equal distance

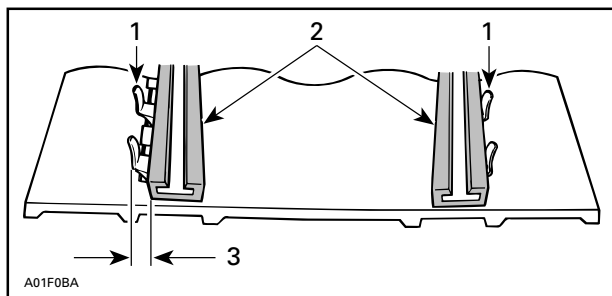
4. To correct track alignment:

- 4.1 Stop engine.
- 4.2 Remove tether cord cap from engine cut-off switch.

! WARNING

Remove tether cord cap from engine cut-off switch before performing any maintenance or adjustment, unless otherwise specified. Vehicle must be parked in a safe place, away from the trail.

- 4.3 Loosen the rear axle nut.
- 4.4 Tighten adjustment screw on side where the slider shoe is the farthest from the track insert guides.



1. Guides
2. Slider shoes
3. Tighten on this side

5. Tighten the rear axle nut.

! WARNING

Properly tighten wheel retaining bolt, otherwise wheel may come off and cause track to "lock".

6. Restart engine and rotate track slowly to recheck alignment.
7. Tighten the rear axle nut to specified torque.

TIGHTENING TORQUE	
Rear idler wheel retaining screws (3 and 4 idler wheels system)	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)

8. Reposition snowmobile on the ground.

Suspension

Rear Suspension Condition

Visually inspect all suspension components including slider shoes, springs, wheels, etc.

NOTE: During normal driving, snow will act as a lubricant and coolant for the slider shoes. Extensive riding on ice or sanded snow, will create excessive heat build-up and cause premature slider shoe wear.

Suspension Stopper Strap Condition

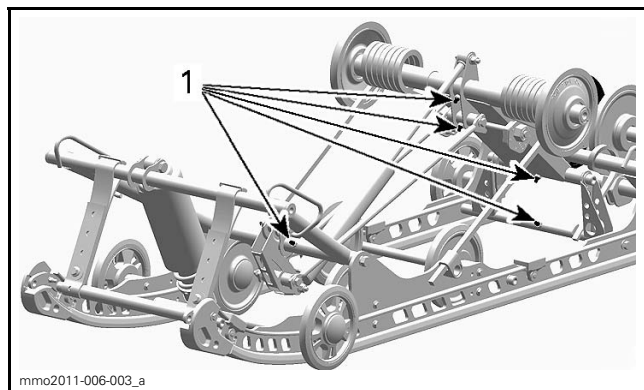
Inspect stopper straps for wear and cracks, bolt and nut for tightness. If loose inspect holes for deformation. Replace as required. Tighten nut to specification.

TIGHTENING TORQUE	
Stopper strap nut	10 N•m ± 1 N•m (89 lbf•in ± 9 lbf•in)

Suspension Lubrication

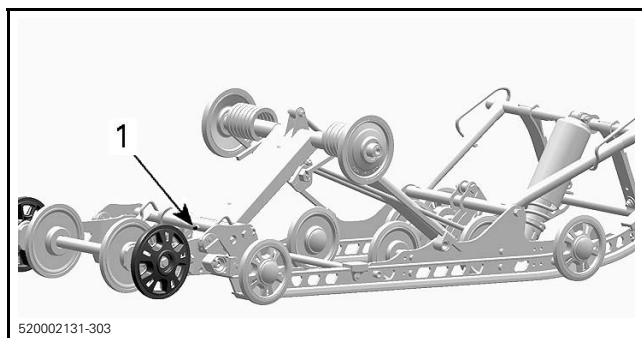
Lubricate the following suspension pivots at grease fittings. Refer to *MAINTENANCE SCHEDULE* for maintenance frequency.

SUSPENSION GREASE	
Scandinavia	SYNTHETIC SUSPENSION GREASE (EUR) (P/N 779226)
All other countries	SYNTHETIC SUSPENSION GREASE (P/N 779163)



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1. Grease fittings



1. Grease fittings

Steering and Front Suspension Condition

Visually inspect steering and front suspension for tightness of components (steering arms, control arms and links, tie rods, ball joints, ski bolts, ski legs, etc.). If necessary, contact an authorized Ski-Doo dealer.

Skis

Wear and Condition of Skis and Runners

Check the condition of the skis and ski runner carbides. If worn, contact an authorized Ski-Doo dealer.

WARNING

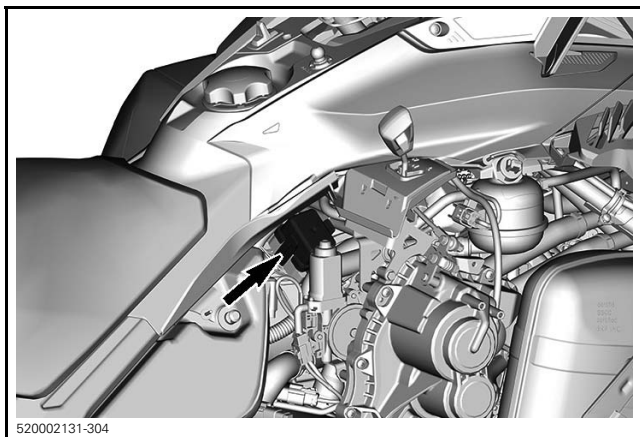
Excessively worn skis and/or ski runners will adversely affect snowmobile control.

Fuses

Access to Fuse Block

Open RH side panel, refer to *CONTROLS, INSTRUMENTS AND EQUIPMENT*.

Fuses Location



TYPICAL - FUSE BLOCK

Unlock fuse block from its cover.

Expedition LE and SE

FUSE IDENTIFICATION		AMPERAGE RATING
F1	Clock/Start/Relays	5 A
F2	Headlamps	20 A
F3	Taillight/Brake/PAC	10 A
F4	ECM/RFID/O2 Sensor/CAPS	10 A
F5	Fuel Pump/Starter	10 A
F6	Fan	15 A
F7	Accessory	15 A

FUSE IDENTIFICATION		AMPERAGE RATING
F8	Cluster	15 A
F9	ACS	15 A
F10	RER	30 A

RELAY IDENTIFICATION	
RY1	Main Relay
RY2	Headlamps/Forward Relay
RY3	Fan
RY4	Reverse
RY5	Accessory
RY6	Lighting

Expedition Sport

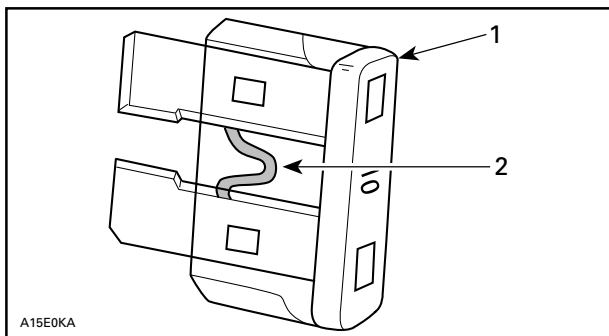
FUSE IDENTIFICATION		AMPERAGE RATING
F1	Start/Relays	5 A
F2	Accessory	15 A
F3	Taillight/Brake/PAC	10 A
F4	ECM/RFID/O2 Sensor/CAPS	10 A
F7	Fuel Pump/Engine	10 A
F8	Cluster	15 A
F9	Fan	15 A
F10	Headlamp	20 A
RY1	Main Relay	-

FUSE IDENTIFICATION		AMPERAGE RATING
RY2	Accessory Relay	-
RY3	Fan Relay	-
RY4	Lighting Relay	-

Fuse Inspection

Check fuse condition and replace it if necessary.

To remove fuse from holder, pull fuse out. Check if filament is melted.



1. Fuse
2. Check if melted

WARNING

Do not use a higher rated fuse.

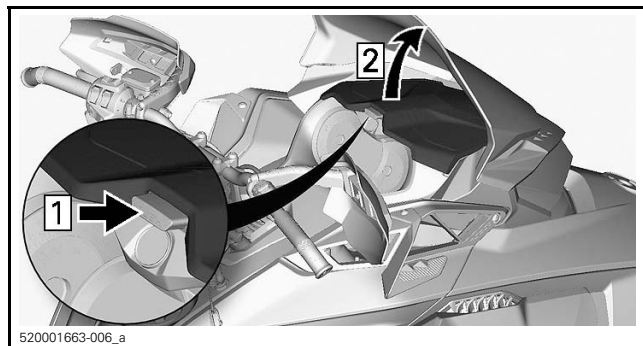
WARNING

If fuse has burnt out, source of malfunction should be determined and corrected before restarting. See an authorized Ski-Doo dealer for servicing.

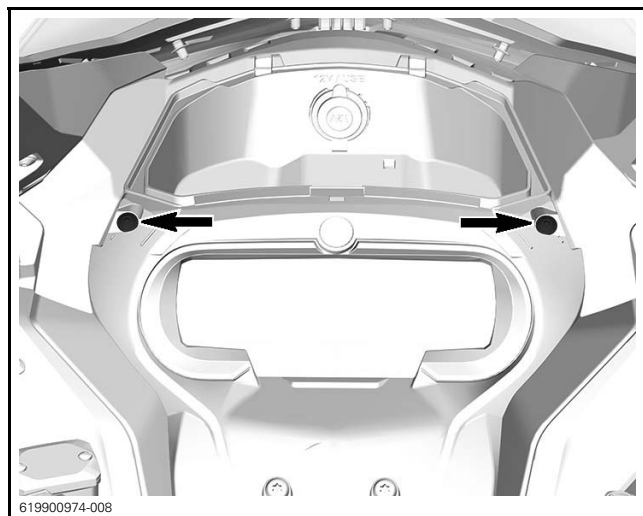
Headlights

Headlights Bulb Replacement

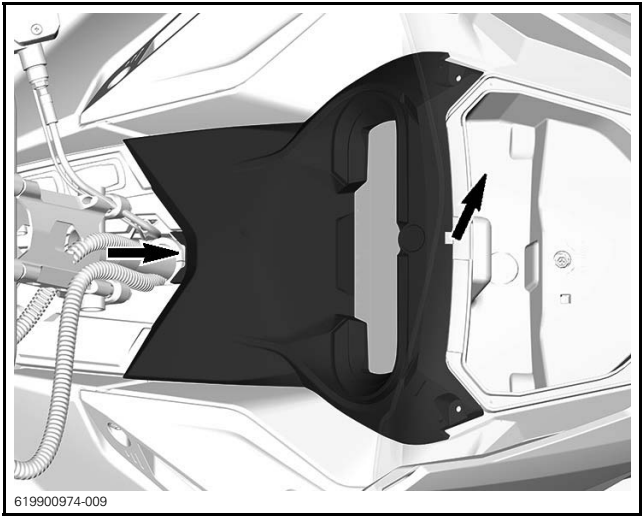
1. Open the storage compartment.



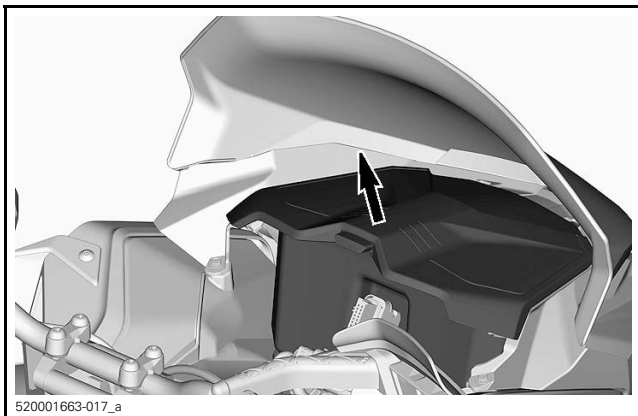
2. Remove the gauge support retaining screws.



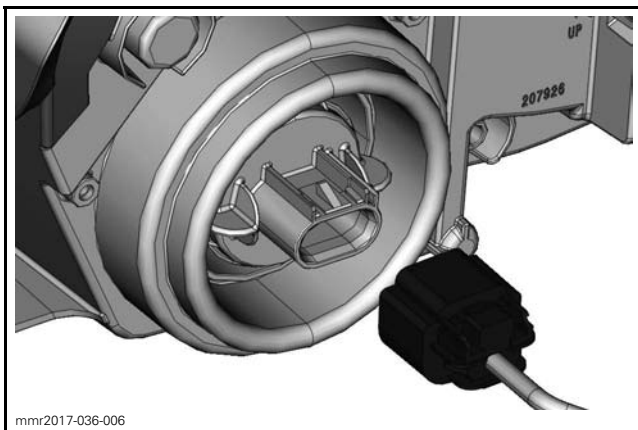
3. Lift the front of the gauge support , then slide it forward to remove it.



4. Set gauge support aside.
5. Remove the storage compartment.



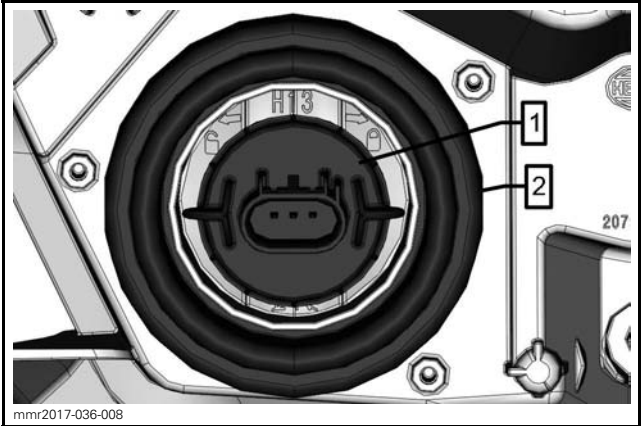
6. Disconnect MAPTS and bulb connector.



7. Unlock bulb by turning it counterclockwise.

8. Pull bulb out.

NOTE: Ensure bulb seal stays in place.



1. Bulb
2. Bulb seal

Install a new bulb using the reverse of the removal procedure.

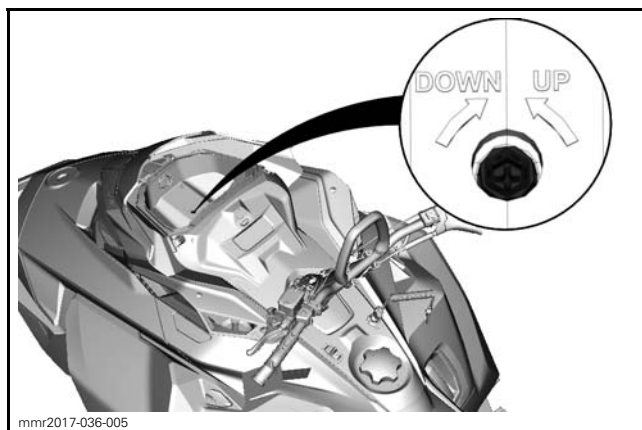
NOTICE Never touch glass portion of an halogen bulb with bare fingers, it shortens its operating life. If glass is touched, clean it with isopropyl alcohol which will not leave a film on the bulb.

Check headlights operation.

Headlights Beam Aiming

Open the storage compartment, see *FRONT STORAGE COMPARTMENT*.

Turn the adjustment screw with appropriate screwdriver to reach desired beam height.



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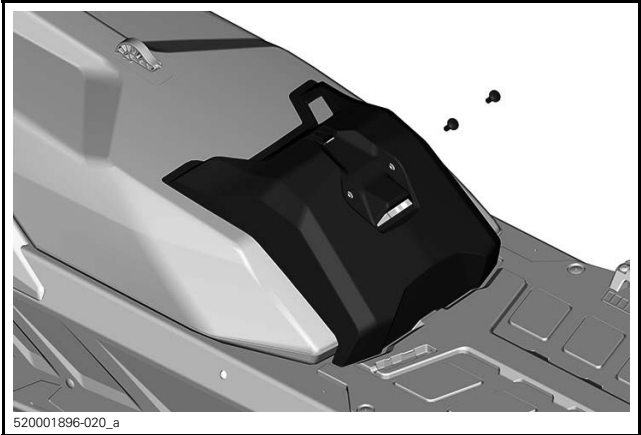
Removing Battery

WARNING

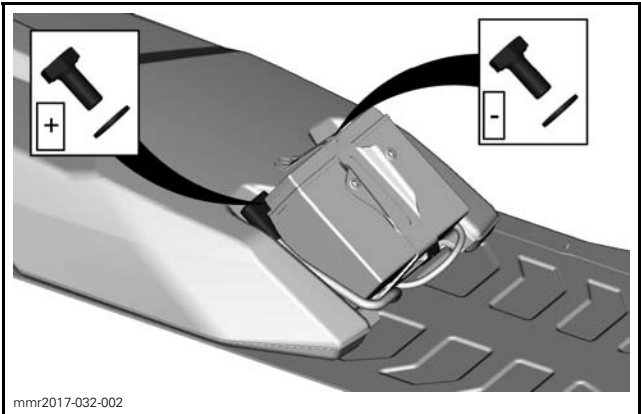
Battery BLACK (-) cable must always be disconnected first and connected last. Never charge or boost battery while installed on vehicle.

Expedition Sport

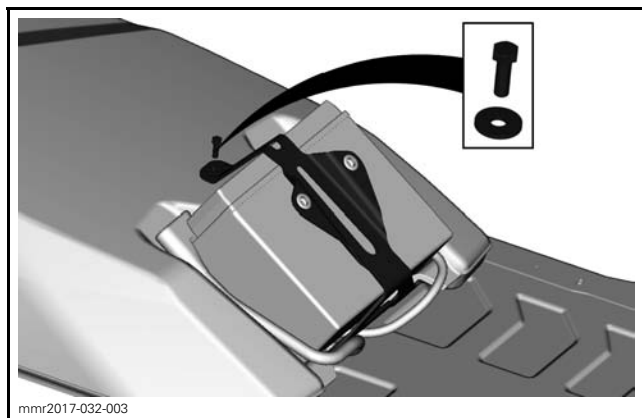
1. Disconnect passenger heated grips.
2. Remove seat and backrest.
3. Remove battery cover.



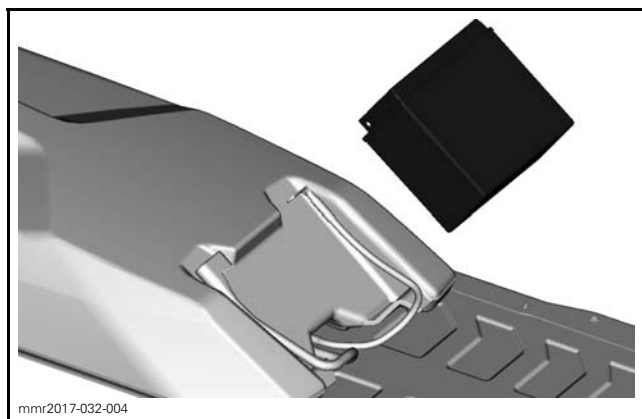
4. Disconnect negative before positive terminal.



5. Remove battery hold down bracket.

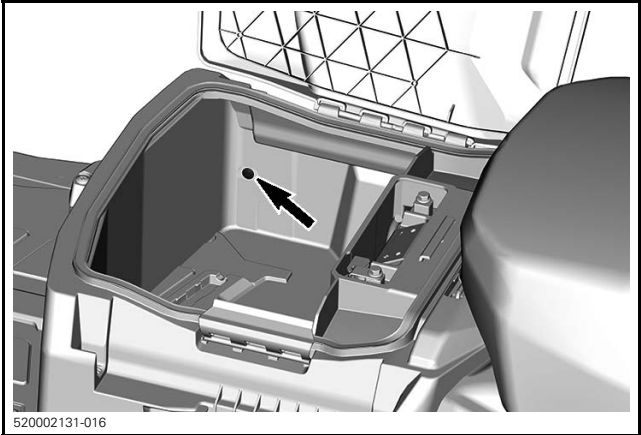


6. Remove battery.



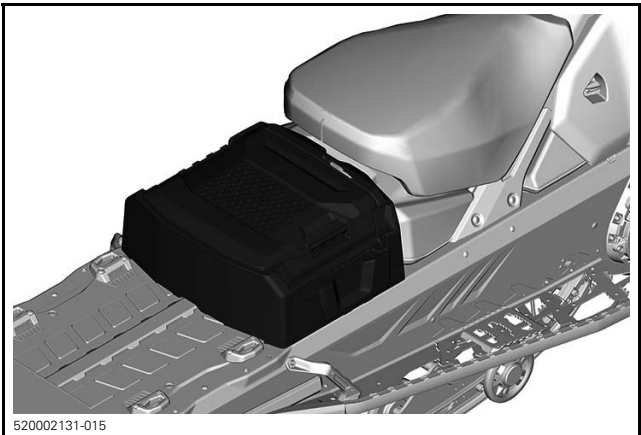
Expedition LE and SE

1. Remove passenger seat and backrest.
2. Open cargo box, remove battery cover and all mounting screws.

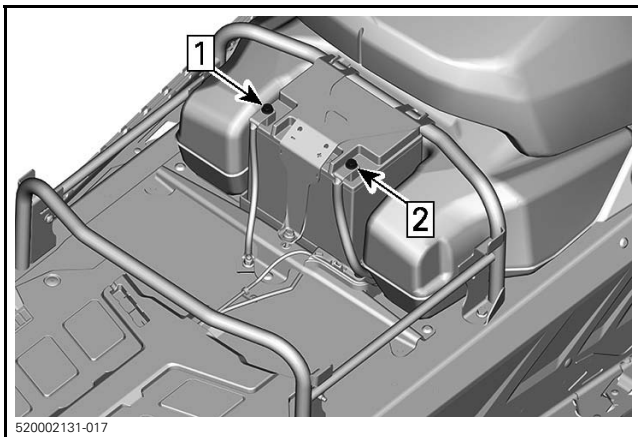


LH SIDE SCREW SHOWN

3. Remove cargo box.



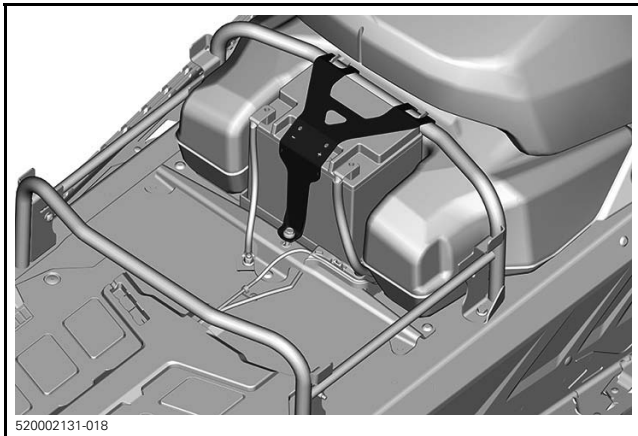
4. Disconnect negative before positive terminal.



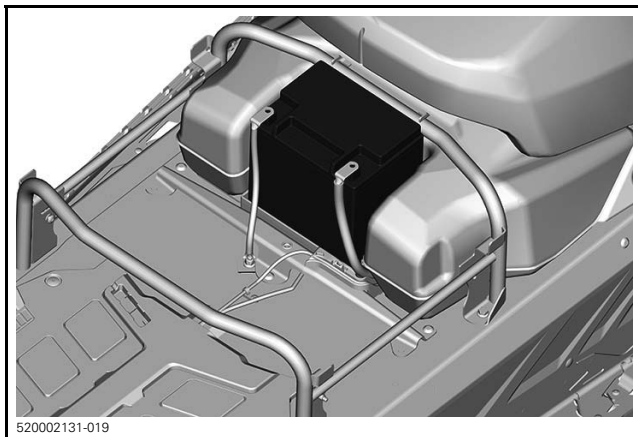
Step 1: Disconnect negative

Step 2: Disconnect positive

5. Remove battery hold down bracket.



6. Remove battery.



Installing Battery

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

TIGHTENING TORQUE	
Battery terminals (positive and negative)	$10 \text{ N}\bullet\text{m} \pm 2 \text{ N}\bullet\text{m}$ (89 lbf•in $\pm$ 18 lbf•in)
Battery hold down bracket	$7 \text{ N}\bullet\text{m} \pm 1 \text{ N}\bullet\text{m}$ (62 lbf•in $\pm$ 9 lbf•in)
Battery cover retaining screws	$7 \text{ N}\bullet\text{m} \pm 1 \text{ N}\bullet\text{m}$ (62 lbf•in $\pm$ 9 lbf•in)

Reinstall the seat, backrest and cargo box if applicable.

VEHICLE CARE

Post-Operation Care

Remove snow and ice from rear suspension, track, front suspension, steering mechanism and skis.

WARNING

Make sure tether cord cap is away from engine cut-off switch before standing in front the vehicle, getting close to the track or rear suspension components.

Always cover your snowmobile when leaving it outside overnight or during extended periods of inactivity. This will protect it from frost and snow as well as help retain its appearance.

Vehicle Cleaning and Protection

Wash snowmobile with water mixed with a mild detergent. Use only microfiber cloths or an equivalent.

NOTICE Never use a high pressure washer to clean the vehicle. **USE LOW PRESSURE ONLY** (like a garden hose).

NOTICE Never use XPS Brake and Parts Cleaner or any petroleum based cleaners on plastic parts.

Non Compatible Cleaning Products

MATERIAL TYPE	NON-COMPATIBLE CLEANING PRODUCTS
All plastics, vinyls, painted steel and aluminium.	BRAKE AND PARTS CLEANER OR ANY PETROLEUM BASE CLEANING PRODUCTS

Compatible Cleaning Products

MATERIAL TYPE	CLEANING PRODUCT
All plastics, vinyls, painted steel and aluminium.	Soapy water XPS Spray Cleaner and Polish XPS All Purpose Cleaner

For more information and products, Visit the XPS Products website at www.xpslubricants.com

STORAGE

During summer, or when a snowmobile is not in use for more than three months, proper storage is necessary.

STORAGE
Clean the vehicle
Add fuel stabilizer to fuel following the product manufacturer recommendations. Run the engine after adding the product to the fuel
Lubricate engine
Lubricate brake lever pivot
Lubricate rear suspension
Charge battery monthly to keep it fully charged during storage
Block muffler outlet with rags
Lift rear of vehicle until track is clear of the ground. Do not release track tension

⚠ CAUTION Use appropriate lifting device or have assistance to share lifting stress. If a lifting device is not used, use proper lifting techniques, notably using your legs force. Do not attempt to lift the rear of vehicle if it is above your limits.

NOTICE The snowmobile has to be stored in a cool and dry place and covered with an opaque but ventilated tarpaulin. This will prevent sun rays and grime from affecting plastic components and vehicle finish.

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

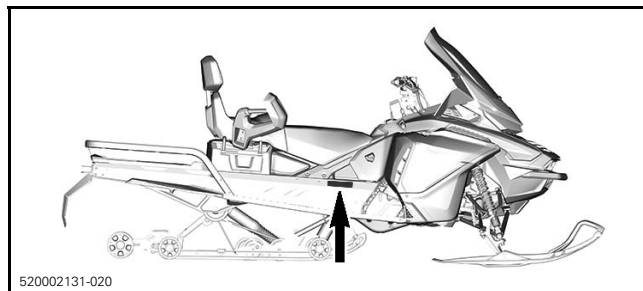
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TECHNICAL INFORMATION

VEHICLE IDENTIFICATION

Vehicle Description Decal

Vehicle description decal is located on right hand side of tunnel.



TYPICAL

1. Vehicle description decal

BOMBARDIER RECREATIONAL PRODUCTS Inc. Date	
VIN. / NIV.	
Description	Type: SNO/MNG
ASSEMBLED IN CANADA / ASSEMBLÉ AU CANADA	

EN-516009003-DEC

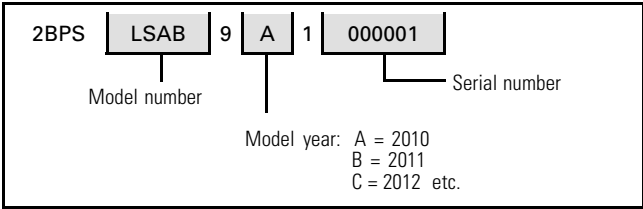
Identification Numbers

The main components of your snowmobile (engine and frame) are identified by different identification numbers. It may sometimes become necessary to locate these numbers for warranty purposes or to trace your snowmobile in the event of loss. These numbers are required by the authorized Ski-Doo dealer to complete warranty claims properly. We strongly recommend that you take note of all the identification numbers on your snowmobile and supply them to your insurance company.

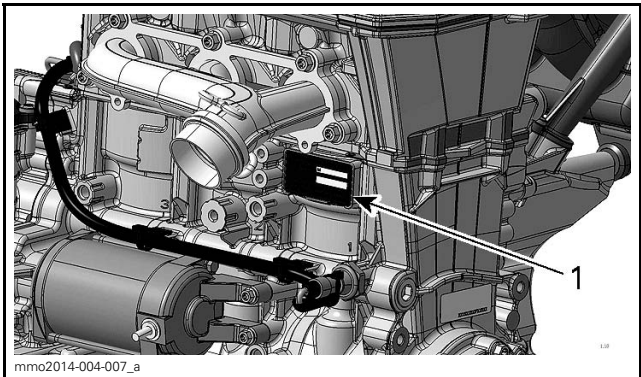
Vehicle Identification Number (VIN)

VIN is scribed on vehicle description decal. See above. It is also engraved on tunnel near vehicle description decal.

Model number and model year are part of the information found in the VIN. See illustration.



Engine Identification Number Location



1. Engine identification number

NOISE EMISSION AND VIBRATION VALUES (ALL COUNTRIES EXCEPT CANADA/UNITED STATES)

MODEL		600 ACE	900 ACE	900ACE Turbo
NOISE EMISSION AND VIBRATION VALUES ¹				
Noise	Sound power level (L_{WA})	90,4 dB @ 3625 RPM (Uncertainty (K_{wa}) 3 dB)	91,2 dB @ 3625 RPM (Uncertainty (K_{wa}) 3 dB)	98,4 dB @ 3625 RPM (Uncertainty (K_{wa}) 3 dB)
Vibration	Hand-arm system	<2.5 m/s ² @ 3625 RPM	3.15 m/s ² @ 3625 RPM	<2.5 m/s ² @ 3625 RPM
	Whole body at seat	<0.5 m/s ² @ 3625 RPM	<0.5m/s ² @ 3625 RPM	<0.5m/s ² @ 3625 RPM
¹ : Noise emission and Vibration values are measured in accordance with Standard ISMA 1:2014 on a paved surface, at neutral or without belt.				

EC DECLARATION OF CONFORMITY

The EC-Declaration of Conformity does not appear in this version of the Operator's Guide.

Please refer to the printed version that was delivered with your vehicle.

***Left blank for Eurasian Conformity
mark where applicable***

EPA CERTIFIED ENGINES

Engine Emissions Information

Manufacturer's Responsibility

Beginning with **2007 model year engines**, snowmobile manufacturers of snowmobile engines need to 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's Responsibility

When performing service on a certified Ski-Doo snowmobiles 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 manufacturer's prescribed changes, such as altitude adjustments for example.

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 to modify the engine in any manner that would alter the horsepower or allow emissions levels to exceed their predetermined factory specifications.

EPA Emission Regulations

All Ski-Doo snowmobiles manufactured by BRP are certified to the EPA as conforming to the requirements of the regulations for the control of air pollution from new snowmobile engines. This certification is contingent on certain adjustments being set to factory standards. For this reason, the factory procedure for servicing the product must be strictly followed and, whenever practicable, returned to the original intent of the design.

The responsibilities listed above are general and in no way a complete listing of the rules and regulations pertaining to the EPA requirements on exhaust emissions for snowmobile products. For more detailed information on this subject, you may contact the following locations:

MAIL:

U.S. Environmental Protection Agency
Certification Division
Gasoline Engine Compliance Center
2000 Traverwood Drive
Ann Arbor MI 48105
USA

INTERNET WEB SITE:

www.epa.gov/otaq/

RADIO FREQUENCY DIGITALLY ENCODED SECURITY SYSTEM (RF D.E.S.S. KEY)

This device complies with FCC Part 15 and Industry Canada license exempt RSS standard(s).

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

IC Registration Number: 12006A-M01456

FCC ID: 2ACERM01456

We, the party responsible for compliance, declare under our sole responsibility that the device is in conformity with the provisions of the following Council Directive: 2014/53/EU. To which this declaration relates is in conformity with the essential requirements and other relevant requirements. The product is in conformity with the following directives, harmonized standards and regulations:

Radio Equipment Directive (RED) 2014/53/EU and Harmonized Standards:

EN 300 330-2, EN 60950-1

SPECIFICATIONS (ENGINE)

ENGINE	600 ACE
Engine type	Rotax 600, liquid cooled, 4-stroke, D.O.H.C., dry sump.
Number of cylinder	2
Bore	74 mm (2.91 in)
Stroke	69.7 mm (2.74 in)
Displacement	600 cm ³ (36.6 in ³)
Maximum power engine speed	7250 RPM

ENGINE	900 ACE
Engine type	Rotax 903, liquid cooled, 4-stroke, D.O.H.C., dry sump
Number of cylinder	3
Bore	74 mm (2.9 in)
Stroke	69.7 mm (2.74 in)
Displacement	899 cm ³ (54.9 in ³)
Maximum power engine speed	7250 RPM

ENGINE	900 ACE TURBO
Engine type	Rotax 903, liquid cooled, 4-stroke, D.O.H.C., dry sump, turbo with intercooler
Number of cylinder	3
Bore	74 mm (2.9 in)

ENGINE	900 ACE TURBO
Stroke	69.7 mm (2.74 in)
Displacement	899 cm ³ (54.9 in ³)
Maximum power engine speed	7750 RPM

FUEL SYSTEM	
Fuel delivery	Multi point EFI, 46 mm heated throttle body
Idle speed (not adjustable)	1200 ± 200 RPM

ELECTRICAL SYSTEM			
Total system output		30 A @ 14.5 V 420 W or 650 W @ 6000 RPM	
Spark plug	600 ACE	Type	NGK MR7BI or equivalent
		Gap	0.8 mm (.031 in)
	900 ACE	Type	NGK MR8BI or equivalent
		Gap	Not adjustable 0.6 mm to 0.7 mm (.024 in to .028 in)
	900 ACE Turbo	Type	NGK LMAR9AI-8 or equivalent
		Gap	Not adjustable 0.7 mm to 0.8 mm (.028 in to .031 in)

LUBRICATION SYSTEM			
Engine oil	Type ⁽²⁾	Scandinavia	4T 0W40 Synthetic oil (Eur) (P/N 779286)
		All other countries	4T 0W40 Synthetic oil (P/N 779139)
	Quantity	600 ACE	Oil change, 2.1 L (2.22 qt (U.S. liq.))
		900 ACE / 900 ACE Turbo	Oil change with filter: 3.5 L (3.7 qt (U.S. liq.))

SPECIFICATIONS (VEHICLE)

COOLING SYSTEM		
Coolant type	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	Ethyl glycol and distilled water (50%/50%) or coolant specifically formulated for aluminum engines

FUEL SYSTEM			
Fuel pump			In-tank electrical
Fuel	600 ACE 900 ACE	Type	Regular unleaded Refer to <i>FUEL REQUIREMENTS</i>
		Octane rating	87 Pump Posted AKI (R+M)/2 92 RON
	900 ACE Turbo	Type	Premium unleaded gasoline Refer to <i>FUEL REQUIREMENTS</i>
		Octane rating	91 Pump Posted AKI (RON+MON)/2 95 RON
Fuel tank capacity			36 L (9.5 U.S. gal.)

SPECIFICATIONS (VEHICLE)

ELECTRICAL SYSTEM		
Battery	Expedition Sport	12 V, 18 A•h
	Expedition LE Expedition SE	12 V, 30 A•h
Headlamp		2 x 60/55 W (H-13)
Taillight and stoplight		2.6 W / 139m W LED
Fuses		Refer to <i>FUSES</i> in <i>MAINTENANCE</i>

DRIVE SYSTEM		
Chaincase oil (if equipped)	Type	Scandinavia: Synthetic chaincase oil (Eur) (P/N 779185) All other countries: Synthetic chaincase oil (P/N 779156)
	Capacity	500 ml (16.9 U.S. oz)
Chain drive ratio	600 ACE	21/51
	900 ACE	24/49

DRIVE SYSTEM			
Gearbox oil (if equipped)	Type		Scandinavia: Synchromesh Transmission Synthetic Oil (eur)(P/N 779211) All other countries: Synchromesh Transmission Synthetic Oil(P/N 779170) or equivalent.
	Capacity		900 ml (30.4 U.S. oz)
Gearbox ratio	900 ACE	Low	4.24:1
		High	2.36:1
	900 ACE Turbo	Low	3.59::1
		High	2.0:1
Drive pulley	Type	600 ACE	eDrive II
		900 ACE 900 ACE Turbo	pDrive
	Engagement RPM	600 ACE 900 ACE	2200 ± 100 RPM
		900 ACE Turbo	2000 ± 100 RPM
Driven pulley	Type	600 ACE 900 ACE	QRS-4S
		900 ACE Turbo	QRS-4S Vent
Drive sprocket number of teeth		All	8

SPECIFICATIONS (VEHICLE)

DRIVE SYSTEM			
Track	Width	Expedition LE Expedition SE	50 cm (20 in)
		Expedition Sport	40.6 cm (16 in)
	Length	All	391.2 cm (154 in)
	Profile height	All	38.1 mm (1.5 in)
Track adjustment		Deflection	40 mm to 50 mm (1.575 in to 1.969 in)
		Force	7.3 kgf (16 lbf)

BRAKE SYSTEM		
Brake fluid	Type	DOT 4
	Quantity	65 ml (2.2 U.S. oz)

FRONT SUSPENSION	
Suspension type	RAS 3
Suspension maximum travel	210 mm (8.3 in)
Shock absorber type	Motion Control

REAR SUSPENSION			
Suspension type			SC-5U
Suspension maximum travel Measured at rear arm			239 mm (9.4 in)
Shock absorber type	Center	All	Motion control
	Rear	Expedition Sport Expedition LE	HPG
		Expedition SE	ACS (Air Controlled Suspension)

WEIGHT AND DIMENSIONS		
Mass (dry)	Expedition Sport 600 ACE	241 kg (531 lb)
	Expedition Sport 900 ACE	251 kg (553 lb)
	Expedition LE 900 ACE	288 kg (634 lb)
	Expedition LE 900 ACE Turbo	302 kg (663 lb)
	Expedition SE 900 ACE	301 kg (663 lb)
	Expedition SE 900 ACE Turbo	315 kg (693 lb)
Overall length	Expedition Sport	335 cm (131.9 in)
	Expedition LE Expedition SE	333.6 cm (131.3 in)
Overall width	All	114 cm (44.9 in) to 118 cm (46.5 in)
Overall height	All	140.5 cm (55.3 in)
Ski stance	All	97.5 cm (38.4 in) to 102 cm (40.2 in)
Rear rack capacity (including tongue weight)	Expedition Sport	16 kg (35 lb)
	Expedition LE Expedition SE	56 kg (125 lb)
Rear under seat storage compartment loading capacity	Expedition LE Expedition SE	15 L (4 U.S. gal.) or 10 kg (22 lb)
Cargo box capacity	Expedition SE	135 L (35.7 U.S. gal.) or 48 kg (105 lb)

SPECIFICATIONS (VEHICLE)

WEIGHT AND DIMENSIONS		
Total vehicle load allowed (including occupant(s), all other loads and added accessories)	Expedition Sport	198 kg (435 lb)
	Expedition LE Expedition SE	238 kg (525 lb)
Towing capacity	All with HD bumper	680 kg (1,500 lb)
	All with STD bumper	545 kg (1,200 lb)
Tongue capacity	All	15.8 kg (35 lb)

TROUBLE- SHOOTING

TROUBLESHOOTING GUIDELINES

ELECTRIC STARTER DOES NOT WORK

- 1. Emergency engine stop switch in OFF position or tether cord cap not installed on engine cut-off switch.**
 - *Place the emergency engine stop switch in the ON position and install tether cord cap (on engine cut-off switch).*
- 2. Throttle applied while attempting an engine start.**
 - *Release throttle while cranking.*

ENGINE IS CRANKED BUT FAILS TO START

- 1. No fuel to the engine.**
 - *Check fuel tank level, add fuel if necessary.*
- 2. System voltage too low.**
 - *Contact an authorized Ski-Doo dealer.*

ENGINE RPM DOES NOT REACH CLUTCH ENGAGEMENT POINT

- 1. D.E.S.S. did not read D.E.S.S. key code in the tether cord cap. D.E.S.S. pilot lamp blinks (slow short beeps/repetitive).**
 - *Properly install tether cord cap.*
- 2. D.E.S.S. has read a different code than the one programmed. D.E.S.S. pilot lamp blinks rapidly (fast short beeps/repetitive).**
 - *Install a tether cord cap for which this snowmobile was programmed.*
- 3. ECM does not recognize the D.E.S.S. key.**
 - *Refer to an authorized Ski-Doo dealer.*

ENGINE LACKS ACCELERATION OR POWER

- 1. Engine warm-up in progress.**
 - *Drive vehicle at low speeds for a few minutes.*
- 2. Engine break-in period not completed.**
 - *Complete break-in period.*
- 3. Drive and driven pulleys require servicing.**
 - *Contact an authorized SKI-DOO dealer.*

ENGINE LACKS ACCELERATION OR POWER (cont'd)

4. Engine overheats.

- Check coolant level, see MAINTENANCE PROCEDURES.
- Check heat exchangers cleanliness. Clean if necessary.

5. Drive belt worn too thin.

- If the drive belt has lost more than 3 mm (1/8 in) of its original width, it will affect vehicle performance.
- Replace drive belt.

6. Incorrect track adjustment.

- See MAINTENANCE PROCEDURES and/or an authorized SKI-DOO dealer for proper alignment and tension adjustments.

7. Fuel pressure too low.

- Seek service from an authorized Ski-Doo dealer, repair shop, or person of your own choosing for maintenance, repair, or replacement. Please refer to the US EPA EMISSIONS-RELATED WARRANTY contained herein for information about warranty claims.

ENGINE BACKFIRES

1. Engine is running too hot.

- See item 4 of ENGINE LACKS POWER.

2. Ignition timing is incorrect or there is an ignition system failure.

- Seek service from an authorized Ski-Doo dealer, repair shop, or person of your own choosing for maintenance, repair, or replacement. Please refer to the US EPA EMISSIONS-RELATED WARRANTY contained herein for information about warranty claims.

3. Exhaust system leak.

- Seek service from an authorized Ski-Doo dealer, repair shop, or person of your own choosing for maintenance, repair, or replacement. Please refer to the US EPA EMISSIONS-RELATED WARRANTY contained herein for information about warranty claims.

ENGINE BACKFIRES (cont'd)

4. Fuel pressure too low.

- *Seek service from an authorized Ski-Doo dealer, repair shop, or person of your own choosing for maintenance, repair, or replacement. Please refer to the US EPA EMISSIONS-RELATED WARRANTY contained herein for information about warranty claims.*

ENGINE MISFIRES

1. Water in fuel.

- *Drain fuel system and refill with fresh fuel.*

HEATED GRIPS/THUMB WARMERS ARE NOT WORKING

1. Engine RPM is too low.

- *Make sure engine RPM is above 2000.*

ENGINE HAS SHUT DOWN

1. The engine shuts down after long periods of idling.

- *Do not let engine idle too long. Refer to VEHICLE WARM-UP in OPERATING INSTRUCTION.*

MONITORING SYSTEM

Pilot Lamps, Messages and Beeper Codes

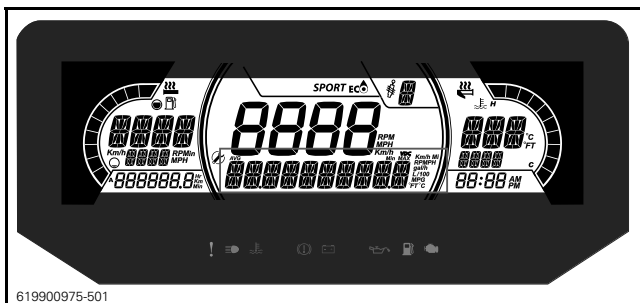
Gauge pilot lamp(s) will inform you if an anomaly occurs or to inform you of a particular condition.



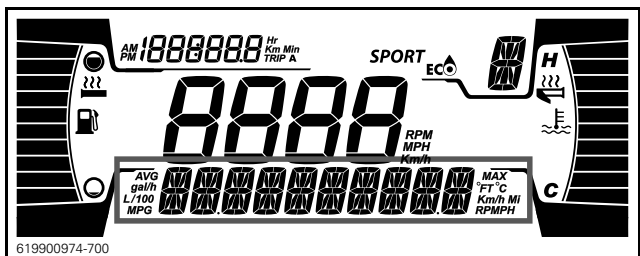
TYPICAL — PILOT LAMPS

Pilot lamp can flash alone or in combination with another lamp.

On the multifunction analog/digital gauge, the center display is used as a complement of the pilot lamps to give you a brief description if an anomaly occurs or to inform you of a particular condition.



7.2" DIGITAL LOWER DISPLAY



4.5" DIGITAL LOWER DISPLAY

Messages will be displayed with a beep code and pilot lamp(s).

MONITORING SYSTEM

Beeper codes will be heard and messages will be displayed to catch your attention.

See table below for details.

NOTE: Some of the listed pilot lamps and messages do not apply to all models. The message display is available only on the multifunction analog/digital gauge.

PILOT LAMP ON	BEEPER	MESSAGE DISPLAY	DESCRIPTION
	1 Long beep repeating	HIGH ENGINE TEMPERATURE	Engine is overheating, reduce snowmobile speed and run in loose snow or stop engine immediately and let engine cool down. Check coolant level, refer to <i>MAINTENANCE</i> . If coolant level is correct and overheating persists, contact an authorized Ski-Doo dealer. Do not run the engine if condition persists.
		MUFFLER OVERHEAT	Reduce speed or stop engine. Let engine cool down and restart. If overheating persists, contact an authorized Ski-Doo dealer. Do not run the engine if condition persists.

PILOT LAMP ON	BEEPER	MESSAGE DISPLAY	DESCRIPTION
	1 Long beep repeating	HIGH ENGINE TEMPERATURE	Critical overheat. Stop engine immediately and let engine cool down. Check coolant level, refer to <i>MAINTENANCE</i> . If coolant level is correct and overheating persists, contact an authorized Ski-Doo dealer. Do not run the engine if condition persists.
		MUFFLER OVERHEAT	Critical overheat. Stop engine immediately and let engine cool down. If overheating persists, contact an authorized Ski-Doo dealer. Do not run the engine if condition persists.
		ECM OVERHEAT	Critical overheat. Stop engine immediately and let engine cool down. If overheating persists, contact an authorized Ski-Doo dealer. Do not run the engine if condition persists.
	—	BATT VOLT	Indicate a low or high battery voltage condition. See an authorized Ski-Doo dealer as soon as possible.
	1 Long beep repeating	CHECK ENGINE	Engine fault, see an authorized Ski-Doo dealer, repair shop or person of your own choosing as soon as possible.
	—	—	Displayed when brake is applied for more than 15 seconds while throttle lever is squeezed and vehicle is moving at more than 5 km/h (3 MPH).
—	Short beeps repeating rapidly	SHUTDOWN	Shutdown procedure in force due to engine overheating or fuel pump problem.

PILOT LAMP ON	BEEPER	MESSAGE DISPLAY	DESCRIPTION
DESS	—	—	Good key, vehicle ready to operate.
	—	WRONG KEY	Unable to read key (bad connection). Make sure the key is clean and correctly snapped on post.
	—	CHECK KEY	Invalid key or key not programmed. Use the proper key for the vehicle or have the programmed.
 (blinking)	—	—	Fuel level sensor problem.

Fault Codes

On the multifunction analog/digital gauge, fault codes can be displayed on the center display.

To read any active fault code, press and hold MODE (M) Button and simultaneously depress the HI/LOW beam switch repeatedly several times.

If two or more codes are registered, use SET (S) or MODE (M) to scroll.

To exit the fault codes mode, press and hold MODE (M) button.

Contact an authorized Ski-Doo dealer for code signification.

WARRANTY

BRP LIMITED WARRANTY USA AND CANADA: 2020 SKI-DOO® SNOWMOBILES

1) SCOPE OF THE LIMITED WARRANTY

Bombardier Recreational Products Inc. ("BRP")* warrants its 2020 Ski-Doo snowmobiles sold by authorized BRP dealers (as defined below) in the United States of America ("USA") and in Canada from defects in material or workmanship for the period and under the conditions described below. This limited warranty will become null and void if: (1) the snowmobile was used for racing or any other competitive activity, at any point, even by a previous owner; or (2) the snowmobile has been altered or modified in such a way so as to adversely affect its operation, performance or durability, or has been altered or modified to change its intended use.

Non-factory installed parts and accessories are not covered under this limited warranty. Please refer to the applicable parts and accessories limited warranty text.

2) LIMITATIONS OF LIABILITY

THIS WARRANTY IS EXPRESSLY GIVEN AND ACCEPTED IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TO THE EXTENT THAT THEY CANNOT BE DISCLAIMED, THE IMPLIED WARRANTIES ARE LIMITED IN DURATION TO THE LIFE OF THE EXPRESS WARRANTY. INCIDENTAL AND CONSEQUENTIAL DAMAGES ARE EXCLUDED FROM COVERAGE UNDER THIS WARRANTY. SOME STATES/PROVINCES DO NOT ALLOW FOR THE DISCLAIMERS, LIMITATIONS AND EXCLUSIONS IDENTIFIED ABOVE, AS A RESULT, THEY MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIC RIGHTS, AND YOU MAY ALSO HAVE OTHER LEGAL RIGHTS WHICH MAY VARY FROM STATE TO STATE, OR PROVINCE TO PROVINCE.

Neither the distributor, any BRP dealer nor any other person has been authorized to make any affirmation, representation or warranty regarding the product, other than those contained in this limited warranty, and if made, shall not be enforceable against BRP. BRP reserves the right to modify this limited warranty at any time, being understood that such modification will not alter the warranty conditions applicable to the products sold while this warranty is in effect.

3) EXCLUSIONS – ARE NOT WARRANTED

The following are not warranted under any circumstances:

- Normal wear and tear;
- Routine maintenance items, tune ups, adjustments;
- Damage caused by failure to provide proper maintenance and/or storage, as described in the Operator's Guide;
- Damage resulting from removal of parts, improper repairs, service, maintenance, modifications or use of parts or accessories not manufactured or approved by BRP or resulting from repairs done by a person that is not an authorized servicing BRP dealer;
- Damage caused by abuse, abnormal use, neglect, use of the product on surfaces other than snow, or operation of the product in a manner inconsistent with the recommended operation described in the Operator's Guide;
- Damage resulting from accident, submersion, fire, theft, vandalism or any act of God;
- Operation with fuels, oils or lubricants which are not suitable for use with the product (see the Operator's Guide);
- Snow or water ingestion;
- Incidental or consequential damages, or damages of any kind including without limitation towing, storage, telephone, rental, taxi, inconvenience, insurance coverage, loan payments, loss of time, loss of income; and
- Damage resulting from studs installed on tracks if the installation does not conform to BRP's instructions.

4) WARRANTY COVERAGE PERIOD

This limited warranty will be in effect from the date of delivery to the first retail consumer or the date the product is first put into use, whichever occurs first and for the following period:

TWELVE (12) CONSECUTIVE MONTHS, for private or commercial use owners. However, the warranty coverage period on a snowmobile delivered between June 1st and December 1st of a given year will expire November 30th of the following year.

For emission-related components; please also refer to the *US EPA EMISSION-RELATED WARRANTY* contained herein.

The repair or replacement of parts or the performance of service under this warranty does not extend the life of this warranty beyond its original expiration date.

5) CONDITIONS REQUIRED FOR WARRANTY COVERAGE

This warranty coverage is available **only** if each of the following conditions has been fulfilled:

- The 2020 Ski-Doo snowmobile must be purchased as new and unused by its first owner from a BRP dealer authorized to distribute Ski-Doo snowmobiles in the country in which the sale occurred ("**BRP dealer**");
- The BRP specified pre-delivery inspection process must be completed and documented and signed by the purchaser;
- The 2020 Ski-Doo snowmobile must have undergone proper registration by an authorized BRP dealer;
- The 2020 Ski-Doo snowmobile must be purchased in the country in which the purchaser resides; and
- Routine maintenance outlined in the Operator's Guide must be timely performed in order to maintain warranty coverage. BRP reserves the right to make warranty coverage contingent upon proof of proper maintenance.

BRP will not honor this limited warranty to any private use owner or commercial use owner if one of the preceding conditions has not been met. Such limitations are necessary in order to allow BRP to preserve both the safety of its products, and also that of its consumers and the general public.

6) WHAT TO DO TO OBTAIN WARRANTY COVERAGE

The customer must cease using the snowmobile upon the appearance of an anomaly. The customer must notify a servicing BRP dealer within three (3) days of the appearance of a defect, and provide it with reasonable access to the product and reasonable opportunity to repair it. The customer must also present to the authorized BRP dealer, proof of purchase of the product and must sign the repair/work order prior to starting the repair in order to validate the warranty repair. All parts replaced under this limited warranty become the property of BRP.

7) WHAT BRP WILL DO

BRP's obligations under this warranty are limited to, at its sole discretion, repairing parts found defective under normal use, maintenance and service, or replacing such parts with new genuine Ski-Doo parts without charge for parts and labor, at any authorized BRP dealer during the warranty coverage period under the conditions described herein. No claim of breach of warranty shall be cause for cancellation or rescission of the sale of the snowmobile to the owner.

In the event that service is required outside of the country of original sale, the owner will bear responsibility for any additional charges due to local practices and conditions, such as, but not limited to, freight, insurance, taxes, license fees, import duties, and any and all other financial charges, including those levied by governments, states, territories and their respective agencies.

BRP reserves the right to improve or modify products from time to time without assuming any obligation to modify products previously manufactured.

8) TRANSFER

If the ownership of a product is transferred during the warranty coverage period, this limited warranty, subject to its terms and conditions, shall also be transferred and be valid for the remaining coverage period provided BRP or an authorized Ski-Doo Distributor/Dealer receives a proof that the former owner agreed to the transfer of ownership, in addition to the co-ordinates of the new owner.

9) CONSUMER ASSISTANCE

In the event of a controversy or a dispute in connection with this limited warranty, BRP suggests that you try to resolve the issue at the dealership level. We recommend discussing the issue with the authorized dealer's service manager or owner.

If the matter still remains unresolved, contact BRP by filling out the customer contact form at www.brp.com or contact BRP by mail at one of the addresses listed under the *CONTACT US* section of this guide.

* In the USA, products are distributed and serviced by BRP US Inc.
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US EPA EMISSION-RELATED WARRANTY

Bombardier Recreational Products Inc. ("BRP")* warrants to the ultimate purchaser and each subsequent purchaser that this new engine, including all parts of its exhaust emission-control system and its evaporative emission-control system, meets two conditions:

1. It is designed, built, and equipped so it conforms at the time of sale to the ultimate purchaser with the requirements of 40 CFR 1051 and 40 CFR 1060.
2. It is free from defects in materials and workmanship that may keep it from meeting the requirements of 40 CFR 1051 and 40 CFR 1060.

Where a warrantable condition exists, BRP will repair or replace, as it elects, any part or component with a defect in materials or workmanship that would increase the engine's emissions of any regulated pollutant within the stated warranty period at no cost to the owner, including expenses related to diagnosing and repairing or replacing emission-related parts. All defective parts replaced under this warranty become the property of BRP.

For all emission-related warranty claims, BRP is limiting the diagnosis and repair of emission-related parts to the authorized Ski-Doo dealers, unless for emergency repairs as required by item 2 of the following list.

As a certifying manufacturer, BRP will not deny emission-related warranty claims based on any of the following:

1. Maintenance or other service BRP or BRP's authorized facilities performed.
2. Engine/equipment repair work that an operator performed to correct an unsafe, emergency condition attributable to BRP as long as the operator tries to restore the engine/equipment to its proper configuration as soon as possible.
3. Any action or inaction by the operator unrelated to the warranty claim.
4. Maintenance that was performed more frequently than BRP specify.
5. Anything that is BRP fault or responsibility.
6. The use of any fuel that is commonly available where the equipment operates unless BRP written maintenance instructions state that this fuel would harm the equipment's emission control system and operators can readily find the proper fuel. See maintenance information section and fuel requirements of fueling section.

Emission-Related Warranty Period

The emission-related warranty is valid for the following period whichever comes first:

	HOURS	MONTHS	KILO METERS
Exhaust emission-related components	200	30	4000
Evaporative emission-related components	N/A	24	N/A

Components Covered

The emission-related warranty covers all components whose failure would increase an engine's emissions of any regulated pollutant, including the following listed components:

1. For exhaust emissions, emission-related components include any engine parts related to the following systems:
 - Air-induction system
 - Fuel system
 - Ignition system
 - Exhaust gas recirculation systems
2. The following parts are also considered emission-related components for exhaust emissions:
 - Aftertreatment devices
 - Crankcase ventilation valves
 - Sensors
 - Electronic control units
3. The following parts are considered emission-related components for evaporative emissions:
 - Fuel tank
 - Fuel cap
 - Fuel line
 - Fuel line fittings
 - Clamps*
 - Pressure relief valves*
 - Control valves*

- Control solenoids*
 - Electronic controls*
 - Vacuum control diaphragms*
 - Control cables*
 - Control linkages*
 - Purge valves
 - Vapor hoses
 - Liquid/vapor separator
 - Carbon canister
 - Canister mounting brackets
 - Carburetor purge port connector
4. Emission-related components also include any other part whose only purpose is to reduce emissions or whose failure will increase emissions without significantly degrading engine/equipment performance.

Limited Applicability

As a certifying manufacturer, BRP may deny emission-related warranty claims for failures that have been caused by the owner's or operator's improper maintenance or use, by accidents for which the manufacturer has no responsibility, or by acts of God. For example, an emission-related warranty claim need not be honored for failures that have been directly caused by the operator's abuse of the engine/equipment or the operator's use of the engine/equipment in a manner for which it was not designed and are not attributable to the manufacturer in any way.

If you have any question regarding your warranty rights and responsibility, you should contact Bombardier Recreational Products at 1-888-272-9222.

*As related to the evaporative emission control system

* In the USA, products are distributed and serviced by BRP US Inc.

BRP INTERNATIONAL LIMITED WARRANTY: 2020 SKI-DOO® SNOWMOBILES

1) SCOPE OF THE LIMITED WARRANTY

Bombardier Recreational Products Inc. ("BRP")* warrants its 2020 Ski-Doo snowmobiles sold by distributors or dealers authorized by BRP to distribute SKI-Doo snowmobiles ("Ski-Doo Distributor/Dealer") outside of the fifty United States, Canada, members of the European Economic Area (which is comprised of the member states of the European Union plus Norway, Iceland and Liechtenstein) ("EEA"), members states of the Commonwealth of the Independent States (including Ukraine and Turkmenistan) ("CIS") and Turkey, from defects in material or workmanship for the period and under the conditions described below.

Non-factory installed parts and accessories are not covered under this limited warranty. Please refer to the applicable parts and accessories limited warranty text.

This limited warranty will become null and void if: (1) the snowmobile was used for racing or any other competitive activity, at any point, even by a previous owner; or (2) the snowmobile has been altered or modified in such a way so as to adversely affect its operation, performance or durability, or has been altered or modified to change its intended use.

2) LIMITATIONS OF LIABILITY

TO THE EXTENT PERMITTED BY LAW, THIS WARRANTY IS EXPRESSLY GIVEN AND ACCEPTED IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TO THE EXTENT THAT THEY CANNOT BE DISCLAIMED, THE IMPLIED WARRANTIES ARE LIMITED IN DURATION TO THE LIFE OF THE EXPRESS WARRANTY. INCIDENTAL AND CONSEQUENTIAL DAMAGES ARE EXCLUDED FROM COVERAGE UNDER THIS WARRANTY. SOME JURISDICTIONS DO NOT ALLOW FOR THE DISCLAIMERS, LIMITATIONS AND EXCLUSIONS IDENTIFIED ABOVE, AS A RESULT, THEY MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIC RIGHTS, AND YOU MAY ALSO HAVE OTHER LEGAL RIGHTS WHICH MAY VARY FROM COUNTRY TO COUNTRY. (FOR PRODUCTS PURCHASED IN AUSTRALIA SEE CLAUSE 4 BELOW).

Neither the Ski-Doo Distributor/Dealer nor any other person has been authorized to make any affirmation, representation or warranty regarding the product, other than those contained in this limited warranty, and if made, shall not be enforceable against BRP.

BRP reserves the right to modify this warranty at any time, being understood that such modification will not alter the warranty conditions applicable to the products sold while this warranty is in effect.

3) EXCLUSIONS – ARE NOT WARRANTED

The following are not warranted under this limited warranty under any circumstances:

- Normal wear and tear;
- Routine maintenance items, tune ups, adjustments;
- Damage caused by negligence or failure to provide proper maintenance and/or storage, as described in the Operator's Guide;
- Damage resulting from removal of parts, improper repairs, service, maintenance, modifications or use of parts or accessories not manufactured or approved by BRP which in its reasonable judgement are either incompatible with the product or adversely affect its operation, performance and durability, or resulting from repairs done by a person that is not an authorized servicing Ski-Doo Distributor/Dealer;
- Damage caused by abuse, abnormal use, neglect, racing or operation of the product on surfaces other than snow, or operation of the product in a manner inconsistent with the recommended operation described in the Operator's Guide;
- Damage resulting from accident, submersion, fire, snow or water ingestion, theft, vandalism or any act of God;
- Operation with fuels, oils or lubricants which are not suitable for use with the product (see the Operator's Guide);
- Damage resulting from rust, corrosion or exposure to the elements;
- Incidental or consequential damages, or damages of any kind including without limitation towing, storage, transportation expenses, telephone, rental, taxi, inconvenience, insurance coverage, loan payments, loss of time, loss of income; or time missed for downtime experience due to service work.
- And damage resulting from studs installed on tracks if the installation does not conform to BRP's instructions.

4) WARRANTY COVERAGE PERIOD

This warranty will be in effect from (1) the date of delivery to the first retail consumer or (2) the date the product is first put into use, whichever occurs first and for a period of:

TWELVE (12) CONSECUTIVE MONTHS, for private or commercial use owners. However, the warranty coverage period on a snowmobile delivered between June 1st and December 1st of a given year will expire November 30th of the following year.

The repair or replacement of parts or the performance of service under this warranty does not extend the life of this warranty beyond its original expiration date.

Note that the duration and any other modalities of the warranty coverage are subject to the applicable national or local legislation in the customer's country.

FOR PRODUCTS SOLD IN AUSTRALIA ONLY

Nothing in these Warranty terms and conditions should be taken to exclude, restrict or modify the application of any condition, warranty, guarantee, right or remedy conferred or implied under the Competition and Consumer Act 2010 (Cth), including the Australian Consumer Law or any other law, where to do so would contravene that law, or cause any part of these terms and conditions to be void. The benefits given to you under this limited warranty are in addition to other rights and remedies that you have under Australian law.

Our goods come with guarantees that cannot be excluded under the Australian Consumer Law. You are entitled to a replacement or refund for a major failure and for compensation for any other reasonably foreseeable loss or damage. You are also entitled to have the goods repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure.

5) CONDITIONS TO HAVE WARRANTY COVERAGE

This warranty coverage is available **only** if each of the following conditions has been fulfilled:

- The 2020 Ski-Doo snowmobile must be purchased as new and unused by its first owner from a Ski-Doo Distributor/Dealer authorized to distribute Ski-Doo snowmobiles in the country in which the sale occurred;

- The BRP specified pre-delivery inspection process must be completed and documented;
- The product must have undergone proper registration by an authorized Ski-Doo Distributor/Dealer;
- The 2020 Ski-Doo snowmobile must be purchased in the country or union of countries in which the purchaser resides.
- Routine maintenance outlined in the Operator's Guide must be timely performed in order to maintain warranty coverage. BRP reserves the right to make warranty coverage contingent upon proof of proper maintenance.

BRP will not honour this limited warranty to any private use owner or commercial use owner if one of the preceding conditions has not been met. Such limitations are necessary in order to allow BRP to preserve both the safety of its products, and also that of its consumers and the general public.

6) WHAT TO DO TO OBTAIN WARRANTY COVERAGE

The customer must cease using the snowmobile upon the appearance of an anomaly. The customer must notify a servicing Ski-Doo Distributor/Dealer within two (2) days of the appearance of a defect, and provide it with reasonable access to the product and reasonable opportunity to repair it. The customer must also present to the authorized Ski-Doo Distributor/Dealer, proof of purchase of the product and must sign the repair/work order prior to starting the repair in order to validate the warranty repair. All parts replaced under this limited warranty become the property of BRP.

Note that the notification period is subject to the applicable national or local legislation in customer's country.

7) WHAT BRP WILL DO

To the extent permitted by law, BRP's obligations under this warranty are limited to, at its sole discretion, repairing parts found defective under normal use, maintenance and service, or replacing such parts with new genuine Ski-Doo parts without charge for parts and labour, at any authorized Ski-Doo Distributor/Dealer during the warranty coverage period under the conditions described herein. BRP's responsibility is limited to making the required repairs or replacements of parts. No claim of breach of warranty shall be cause

for cancellation or rescission of the sale of the snowmobile to the owner. You may have other legal rights which may vary from country to country.

In the event that service is required outside of the country of original sale, the owner will bear responsibility for any additional charges due to local practices and conditions, such as, but not limited to, freight, insurance, taxes, license fees, import duties, and any and all other financial charges, including those levied by governments, states, territories and their respective agencies.

BRP reserves the right to improve or modify products from time to time without assuming any obligation to modify products previously manufactured.

8) TRANSFER

If the ownership of a product is transferred during the warranty coverage period, this limited warranty, subject to its terms and conditions, shall also be transferred and be valid for the remaining coverage period provided BRP or an authorized Ski-Doo Distributor/Dealer receives a proof that the former owner agreed to the transfer of ownership, in addition to the co-ordinates of the new owner.

9) CONSUMER ASSISTANCE

In the event of a controversy or a dispute in connection with this limited warranty, BRP suggests that you try to resolve the issue at the Ski-Doo Distributor/Dealer level. We recommend discussing the issue with the authorized Ski-Doo Distributor/Dealer's service manager or owner.

If the matter still remains unresolved, contact BRP by filling out the customer contact form at www.brp.com or contact BRP by mail at one of the addresses listed under the *CONTACT US* section of this guide.

* For the territory covered by this limited warranty, products are distributed and serviced by Bombardier Recreational Products Inc. or its affiliates.

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BRP LIMITED WARRANTY FOR THE EUROPEAN AND THE COMMONWEALTH OF THE INDEPENDENT STATES (CIS) AREAS AND TURKEY: 2020 SKI-DOO® SNOWMOBILES

1) SCOPE OF THE LIMITED WARRANTY

Bombardier Recreational Products Inc. ("BRP")* warrants its 2020 Ski-Doo snowmobiles sold by distributors or dealers authorized by BRP to distribute Ski-Doo snowmobiles ("**Ski-Doo Distributor/Dealer**") in member states of the European Economic Area (which is comprised of the member states of the European Union plus Norway, Iceland and Liechtenstein) ("**EEA**"), in member states of the Commonwealth of the Independent States (including Ukraine and Turkmenistan) ("**CIS**") and Turkey from defects in material or workmanship for the period and under the conditions described below.

Non-factory installed parts and accessories are not covered under this limited warranty. Please refer to the applicable parts and accessories limited warranty text.

This limited warranty will become null and void if: (1) the snowmobile was used for racing or any other competitive activity, at any point, even by a previous owner; or (2) the snowmobile has been altered or modified in such a way so as to adversely affect its operation, performance or durability, or has been altered or modified to change its intended use.

2) LIMITATIONS OF LIABILITY

TO THE EXTENT PERMITTED BY LAW, THIS WARRANTY IS EXPRESSLY GIVEN AND ACCEPTED IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TO THE EXTENT THAT THEY CANNOT BE DISCLAIMED, THE IMPLIED WARRANTIES ARE LIMITED IN DURATION TO THE LIFE OF THE EXPRESS WARRANTIES. INCIDENTAL AND CONSEQUENTIAL DAMAGES ARE EXCLUDED FROM COVERAGE UNDER THIS WARRANTY. SOME JURISDICTIONS DO NOT ALLOW FOR THE DISCLAIMERS, LIMITATIONS AND EXCLUSIONS IDENTIFIED ABOVE, AS A RESULT, THEY MAY NOT APPLY TO YOU. THIS

WARRANTY GIVES YOU SPECIFIC RIGHTS, AND YOU MAY ALSO HAVE OTHER LEGAL RIGHTS WHICH MAY VARY FROM COUNTRY TO COUNTRY.

Neither the Ski-Doo Distributor/Dealer nor any other person has been authorized to make any affirmation, representation or warranty regarding the product, other than those contained in this limited warranty, and if made, shall not be enforceable against BRP.

BRP reserves the right to modify this warranty at any time, being understood that such modification will not alter the warranty conditions applicable to the products sold while this warranty is in effect.

3) EXCLUSIONS – ARE NOT WARRANTED

The following are not warranted under this limited warranty under any circumstances:

- Normal wear and tear;
- Routine maintenance items, tune ups, adjustments;
- Damage caused by negligence or failure to provide proper maintenance and/or storage, as described in the Operator's Guide;
- Damage resulting from removal of parts, improper repairs, service, maintenance, modifications or use of parts or accessories not manufactured or approved by BRP which in its reasonable judgement are either incompatible with the product or adversely affect its operation, performance and durability, or resulting from repairs done by a person that is not an authorized servicing Ski-Doo Distributor/Dealer;
- Damage caused by abuse, abnormal use, neglect, racing or operation of the product on surfaces other than snow, or operation of the product in a manner inconsistent with the recommended operation described in the Operator's Guide;
- Damage resulting from accident, submersion, fire, snow or water ingestion, theft, vandalism or any act of God;
- Operation with fuels, oils or lubricants which are not suitable for use with the product (see the Operator's Guide);
- Damage resulting from rust, corrosion or exposure to the elements;

- Incidental or consequential damages, or damages of any kind including without limitation towing, transportation expenses, storage, telephone, rental, taxi, inconvenience, insurance coverage, loan payments, loss of time, loss of income or time missed for downtime experience due to service work;
- and damage resulting from studs installed on tracks if the installation does not conform to BRP's instructions.

4) WARRANTY COVERAGE PERIOD

This warranty will be in effect from (1) the date of delivery to the first retail consumer or (2) the date the product is first put into use, whichever occurs first and for a period of:

TWENTY-FOUR (24) CONSECUTIVE MONTHS, for private use owners and TWELVE (12) CONSECUTIVE MONTHS for commercial use owners. However, the warranty coverage period on a snowmobile delivered between June 1st and December 1st of a given year will expire November 30th of the applicable year. A snowmobile is used commercially when it is used in connection with generating income or any work or employment during any part of the warranty period. A snowmobile is also used commercially when, at any point during the warranty period, it has commercial tags or is licensed for commercial use.

The repair or replacement of parts or the performance of service under this warranty does not extend the life of this warranty beyond its original expiration date.

Note that the duration and any other modalities of the warranty coverage are subject to the applicable national or local legislation in the customer's country.

5) CONDITIONS TO HAVE WARRANTY COVERAGE

This warranty coverage is available **only** if each of the following conditions has been fulfilled:

- The 2020 Ski-Doo snowmobile must be purchased as new and unused by its first owner from a Ski-Doo Distributor/Dealer authorized to distribute Ski-Doo products in the country in which the sale occurred;
- The BRP specified pre-delivery inspection process must be completed and documented;

- The product must have undergone proper registration by an authorized Ski-Doo Distributor/Dealer;
- The 2020 Ski-Doo snowmobile must be purchased within the EEA by an EEA resident, in the CIS for residents of the countries comprised in such area and in Turkey for residents of Turkey; and
- Routine maintenance outlined in the Operator's Guide must be timely performed in order to maintain warranty coverage. BRP reserves the right to make warranty coverage contingent upon proof of proper maintenance.

BRP will not honour this limited warranty to any private use owner or commercial use owner if one of the preceding conditions has not been met. Such limitations are necessary in order to allow BRP to preserve both the safety of its products, and also that of its consumers and the general public.

6) WHAT TO DO TO OBTAIN WARRANTY COVERAGE

The customer must cease using the snowmobile upon the appearance of an anomaly. The customer must notify a servicing Ski-Doo Distributor/Dealer within two (2) months of the appearance of a defect, and provide it with reasonable access to the product and reasonable opportunity to repair it. The customer must also present to the authorized Ski-Doo Distributor/Dealer, proof of purchase of the product and must sign the repair/work order prior to starting the repair in order to validate the warranty repair. All parts replaced under this limited warranty become the property of BRP.

Note that the notification period is subject to the applicable national or local legislation in customer's country.

7) WHAT BRP WILL DO

To the extent permitted by law, BRP's obligations under this warranty are limited to, at its sole discretion, repairing parts found defective under normal use, maintenance and service, or replacing such parts with new genuine Ski-Doo parts without charge for parts and labour, at any authorized Ski-Doo Distributor/Dealer during the warranty coverage period under the conditions described herein. BRP's responsibility is limited to making the required repairs or replacements of parts. No claim of breach of warranty shall be cause for cancellation or rescission of the sale of the snowmobile to the owner. You may have other legal rights which may vary from country to country.

In the event that service is required outside of the EEA, CIS or Turkey, the owner will bear responsibility for any additional charges due to local practices and conditions, such as, but not limited to, freight, insurance, taxes, license fees, import duties, and any and all other financial charges, including those levied by governments, states, territories and their respective agencies.

BRP reserves the right to improve or modify products from time to time without assuming any obligation to modify products previously manufactured.

8) TRANSFER

If the ownership of a product is transferred during the warranty coverage period, this limited warranty, subject to its terms and conditions, shall also be transferred and be valid for the remaining coverage period provided BRP or an authorized Ski-Doo Distributor/Dealer receives a proof that the former owner agreed to the transfer of ownership, in addition to the co-ordinates of the new owner.

9) CONSUMER ASSISTANCE

In the event of a controversy or a dispute in connection with this limited warranty, BRP suggests that you try to resolve the issue at the Ski-Doo Distributor/Dealer level. We recommend discussing the issue with the authorized Ski-Doo Distributor/Dealer's service manager or owner.

If the matter still remains unresolved, contact BRP by filling out the customer contact form at www.brp.com or contact BRP.

ADDITIONAL TERMS AND CONDITIONS FOR FRANCE ONLY

The following terms and conditions are applicable to products sold in France only:

The seller shall deliver goods that are complying with the contract and shall be responsible for defects existing upon delivery. The seller shall also be responsible for defects resulting from packaging, assembling instructions or the installation when it is its responsibility per the contract or if accomplished under its responsibility. To be compliant with the contract, the good shall:

1. Be fit for normal use for goods similar thereto and, if applicable:
 - Correspond to the description provided by the seller and have the qualities presented to the buyer through sample or model;
 - Have the qualities that a buyer may legitimately expect considering the public declarations of the seller, the manufacturer of its representative, including in advertising or labeling; or
2. Have the characteristics mutually agreed upon as between the parties or be fit for the specific use intended by the buyer and brought to the attention of the seller and which accepted

The action for failure to comply is prescribed after two years after delivery of the goods. The seller is responsible for the warranty for hidden defects of the good sold if such hidden defects are rendering the good unfit for the intended use, or if they diminish its use in such a way that the buyer would not have acquired the good or would have given a lesser price, had he known. The action for such hidden defects shall be taken by the buyer within 2 years of the discovery of the defect.

CUSTOMER INFORMATION

PRIVACY INFORMATION

BRP wishes to inform you that your coordinates will be used for safety and warranty related purposes. Furthermore, BRP and its affiliates may use its customer list to distribute marketing and promotional information about BRP and related products.

To exercise your right to consult or correct your data, or to be removed from the addressee-list for direct marketing, please contact BRP.

CHANGE OF ADDRESS/OWNERSHIP

If your address has changed or if you are the new owner of the Snow-mobile, be sure to notify BRP.

In case of change of ownership, please join a proof that the former owner agreed to the transfer.

Notifying BRP, even after the expiration of the limited warranty, is very important as it enables BRP to reach the Snowmobile owner if necessary, like when safety recalls are initiated. It is the owner's responsibility to notify BRP.

STOLEN UNITS: If your personal Snowmobile is stolen, you should notify BRP or an authorized Ski-Doo dealer. We will ask you to provide your name, address, phone number, the vehicle identification number and the date it was stolen.

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CHANGE OF ADDRESS ☐		CHANGE OF OWNERSHIP ☐		✂
VEHICLE IDENTIFICATION NUMBER				
Model Number		Vehicle Identification Number (V.I.N.)		
OLD ADDRESS OR PREVIOUS OWNER:		NAME		
		NO.	STREET	APT
		CITY	STATE/PROVINCE	ZIP/POSTAL CODE
		COUNTRY	TELEPHONE	
NEW ADDRESS OR NEW OWNER:		NAME		
		NO.	STREET	APT
		CITY	STATE/PROVINCE	ZIP/POSTAL CODE
		COUNTRY	TELEPHONE	
		E-MAIL ADDRESS		

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CHANGE OF ADDRESS ☐		CHANGE OF OWNERSHIP ☐		✂
VEHICLE IDENTIFICATION NUMBER				
Model Number		Vehicle Identification Number (V.I.N.)		
OLD ADDRESS OR PREVIOUS OWNER:		NAME		
		NO.	STREET	APT
		CITY	STATE/PROVINCE	ZIP/POSTAL CODE
		COUNTRY	TELEPHONE	
NEW ADDRESS OR NEW OWNER:		NAME		
		NO.	STREET	APT
		CITY	STATE/PROVINCE	ZIP/POSTAL CODE
		COUNTRY	TELEPHONE	
		E-MAIL ADDRESS		

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CHANGE OF ADDRESS										CHANGE OF OWNERSHIP																			
VEHICLE IDENTIFICATION NUMBER																													
Model Number					Vehicle Identification Number (V.I.N.)																								
OLD ADDRESS OR PREVIOUS OWNER:										NAME																			
NO.										STREET										APT.									
CITY										STATE/PROVINCE										ZIP/POSTAL CODE									
COUNTRY										TELEPHONE																			
NEW ADDRESS OR NEW OWNER:										NAME																			
NO.										STREET										APT.									
CITY										STATE/PROVINCE										ZIP/POSTAL CODE									
COUNTRY										TELEPHONE																			
E-MAIL ADDRESS																													

CHANGE OF ADDRESS										CHANGE OF OWNERSHIP									
VEHICLE IDENTIFICATION NUMBER																			
Model Number					Vehicle Identification Number (V.I.N.)														
OLD ADDRESS OR PREVIOUS OWNER:										NAME									
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										CITY STATE/PROVINCE ZIP/POSTAL CODE									
										COUNTRY TELEPHONE									
NEW ADDRESS OR NEW OWNER:										NAME									
										NO. STREET APT									
										CITY STATE/PROVINCE ZIP/POSTAL CODE									
										COUNTRY TELEPHONE									
E-MAIL ADDRESS																			



WARNING

**BEFORE YOU OPERATE THIS VEHICLE, READ THIS
OPERATOR'S GUIDE, ALL ON-PRODUCT SAFETY
LABELS AND WATCH THE SAFETY VIDEO.**



ski-doo LYNX SEA-DOO EVINRUDE ROTAX can-am

