SAFETY NOTICE

This manual has been prepared as a guide to servicing and repair the 2017 Ski-Doo® snowmobile from the REV™ G4 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.

INTRODUCTION

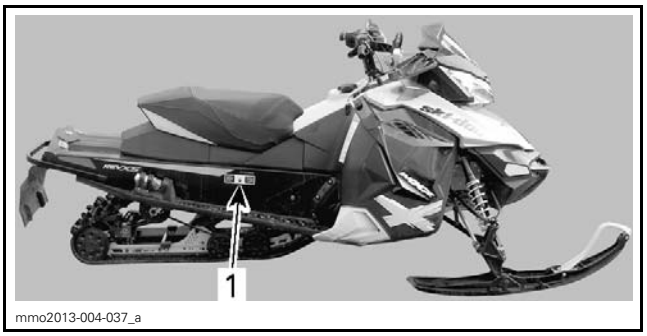
The information and component/system descriptions contained in this manual are correct at time of writing. BRP however, maintains a policy of continuous improvement of its products without imposing upon itself any obligation to install them on products previously manufactured.

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.

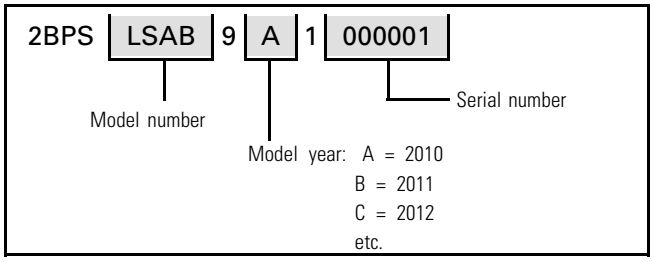
VEHICLE INFORMATION

VEHICLE IDENTIFICATION NUMBER (VIN)

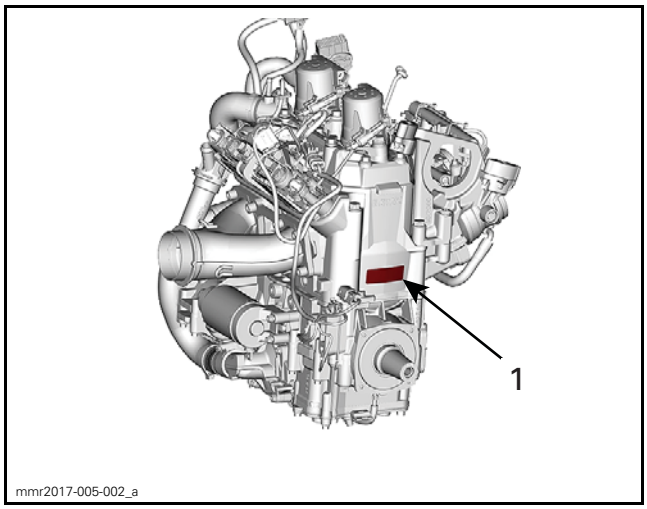


TYPICAL
1. Vehicle identification number

Identification Number Description



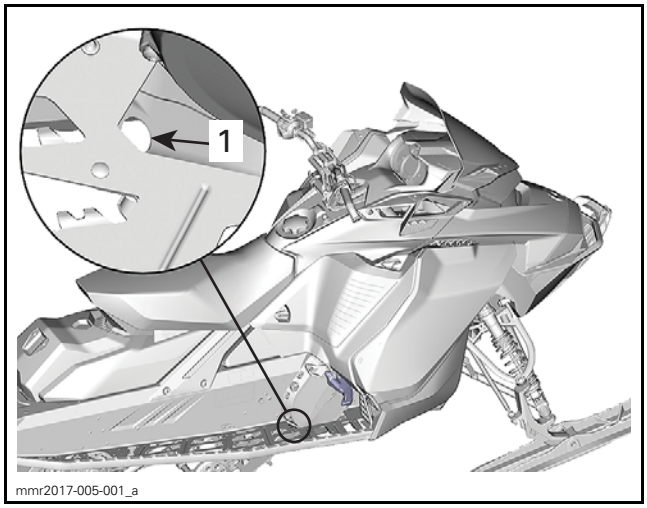
ENGINE IDENTIFICATION NUMBER (EIN)



850 E-TEC
1. Engine serial number

SNOWMOBILE LIFTING

To lift the snowmobile securely, it is important to place the hooks of the lifting tool into the reinforcement holes of the footrests.



1. Reinforced holes in footrest

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

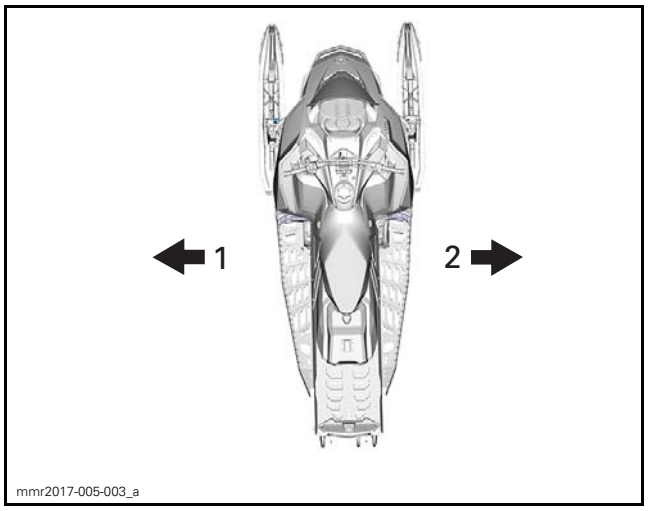
Many of the procedures in this manual are interrelated. Before undertaking any task, you should read and thoroughly understand the entire section or subsection in which the procedure is contained.

⚠ 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).



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.

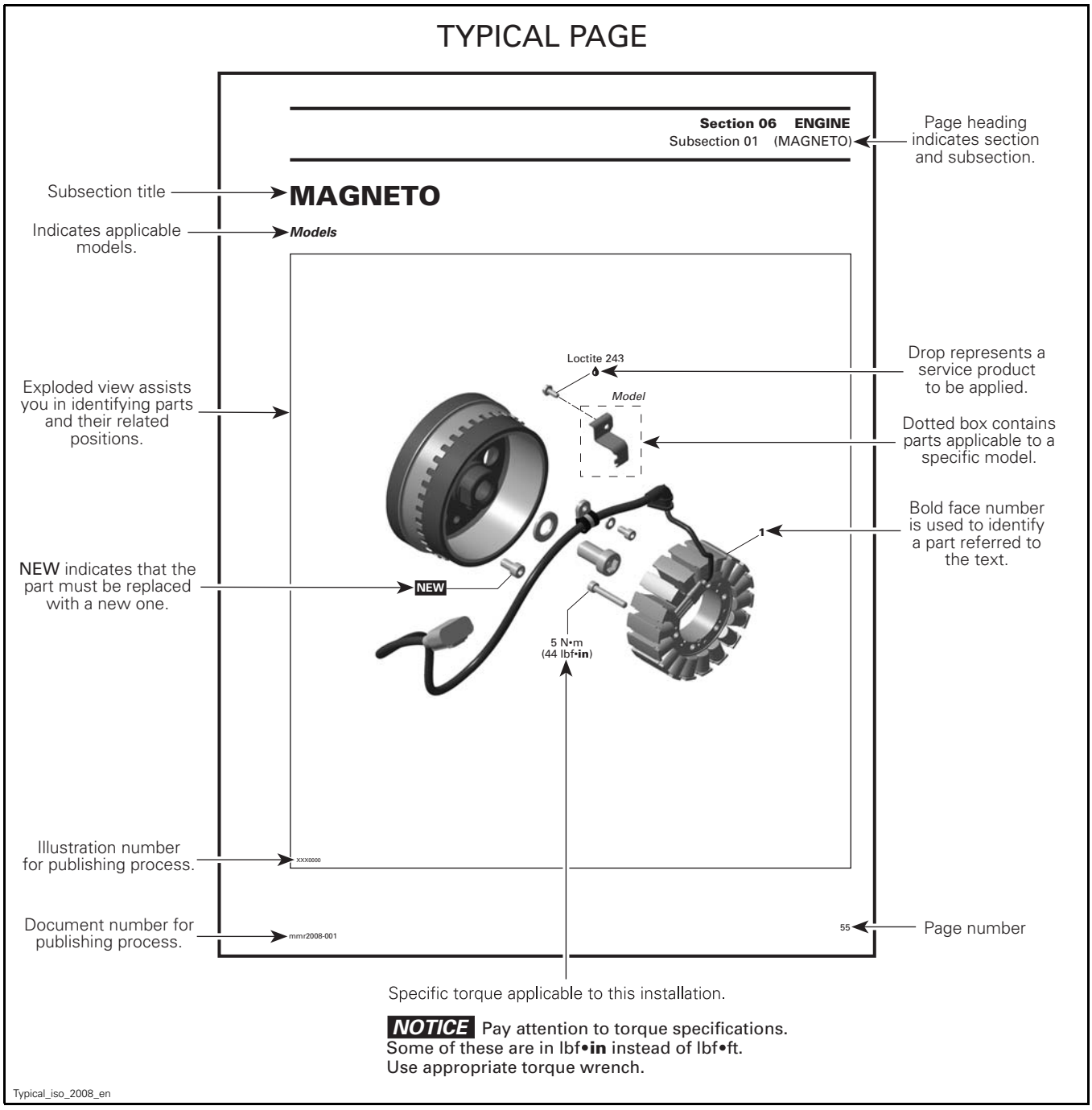
MANUAL LAYOUT

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



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TYPICAL PAGE

Tittle in bold indicates category of information 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.

Reference to a specific section or subsection.

Clean threads before applying a threadlocker. Refer to the *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

Indicates component procedures apply to.

MAGNETO FLYWHEEL

Magneto Flywheel Cleaning

Clean all metal components in a non-ferrous metal cleaner.

CAUTION: Clean magneto flywheel using only a clean cloth.

Indicates specific procedure to be carried out.

Magneto Flywheel Removal

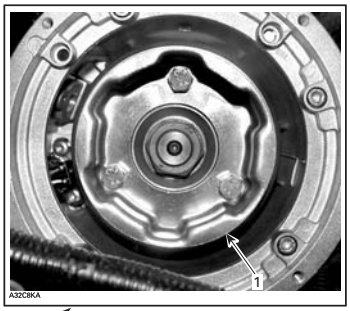
Remove muffler, refer to the *EXHAUST SYSTEM* section.

Remove acoustic panel.

Remove rewind starter.

Remove starting pulley **no. 2**.

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



TYPICAL
1. Starting pulley

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

Call-outs pertaining to above illustration.

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

TYPICAL

Illustration always follows text to which it applies.

Models

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

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

typical_txt_2008_en

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.

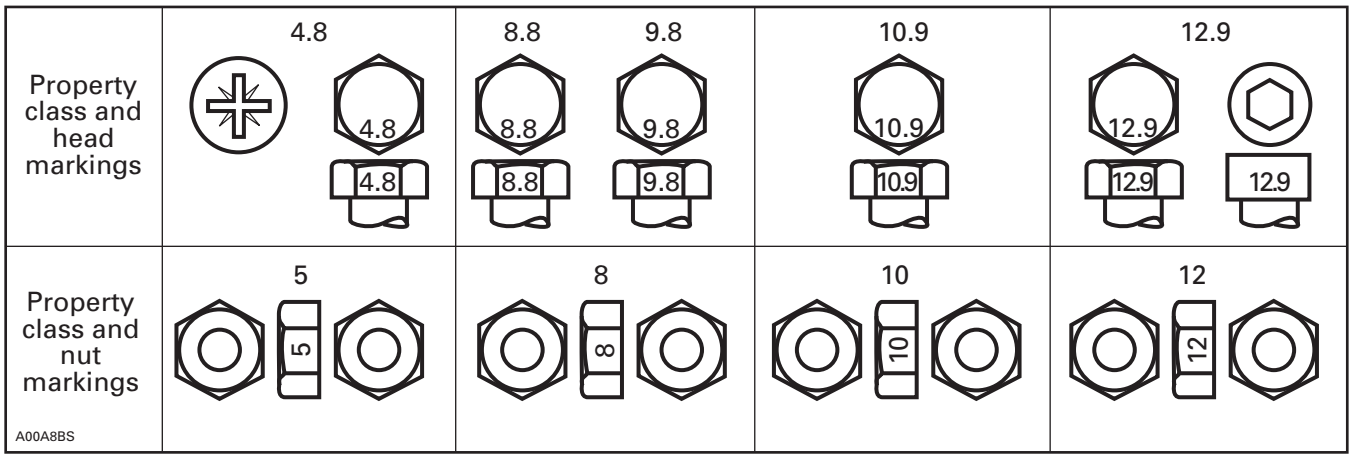
In order to avoid a poor assembly, tighten screws, bolts, or nuts in accordance with the following procedure:

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.

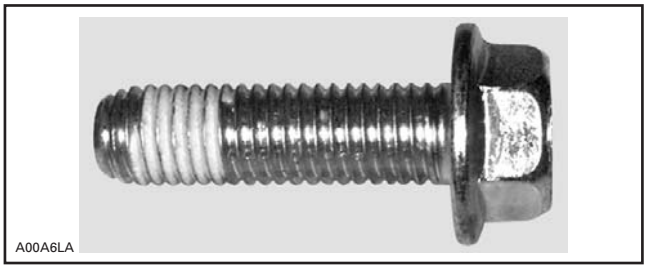


FASTENER SIZE	FASTENER GRADE/TORQUE			
	5.8 Grade	8.8 Grade	10.9 Grade	12.9 Grade
M4	1.5 – 2 N•m (13 – 18 lbf•**in**)	2.5 – 3 N•m (22 – 27 lbf•**in**)	3.5 N•m - 4 N•m (31 lbf•**in** - 35 lbf•**in**)	4 N•m - 5 N•m (35 lbf•**in** - 44 lbf•**in**)
M5	3 N•m - 3.5 N•m (27 lbf•**in** - 31 lbf•**in**)	4.5 N•m - 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)

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.

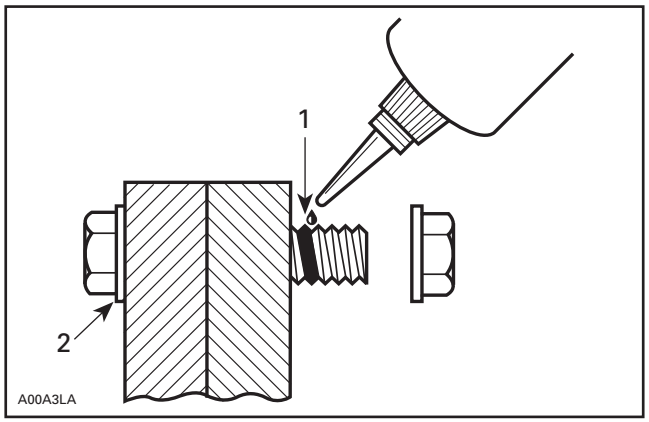
Use a metal brush or a tap to properly clean a threaded hole, then use a solvent. Allow the solvent time to act, approximately 30 minutes, then wipe off. Solvent utilization is to ensure proper adhesion of the product used for locking the fastener.

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.

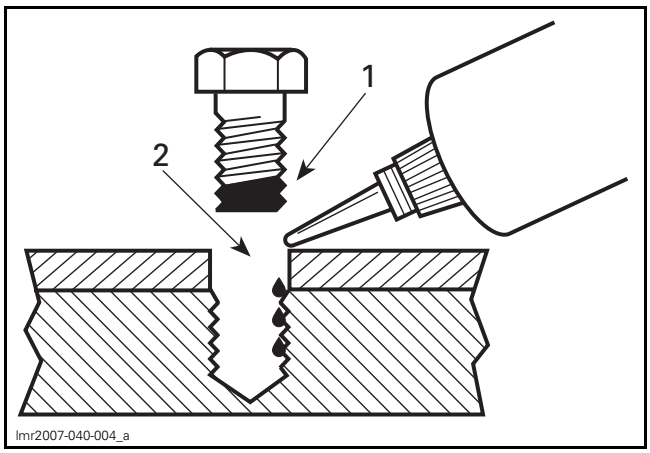
Threadlocker Application for Uncovered Holes (Bolts and Nuts)



1. Apply here
2. Do not apply

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

Threadlocker Application for Blind Holes

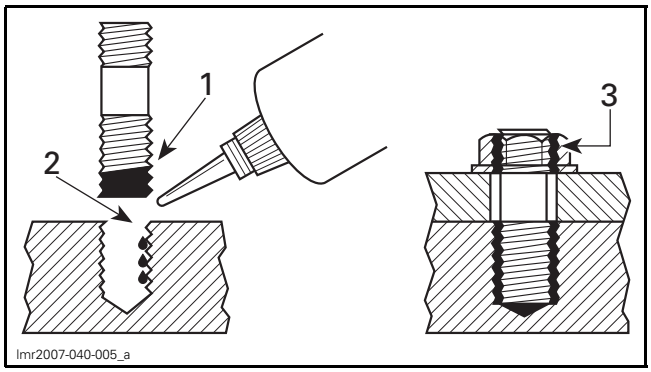


1. On fastener threads
2. On threads and at the bottom of hole

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

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

Threadlocker Application for Stud Installation in Blind Holes



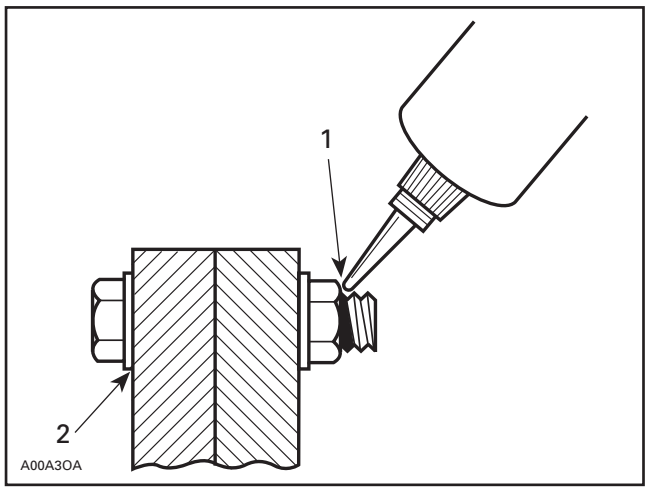
1. On stud threads
2. On threads and in the hole
3. On retaining nut threads

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

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

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

Threadlocker Application for Pre-Assembled Parts

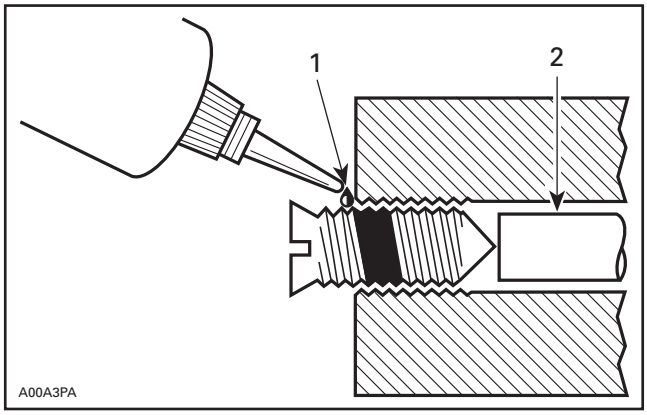


1. Apply here
2. Do not apply

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

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

Threadlocker Application for an Adjustment Screw

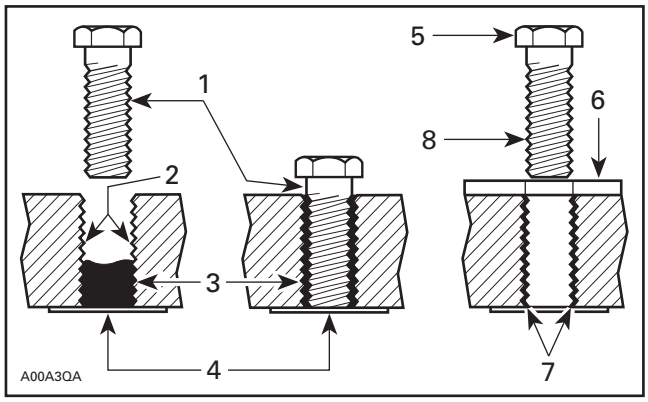


1. Apply here
2. Plunger

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

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

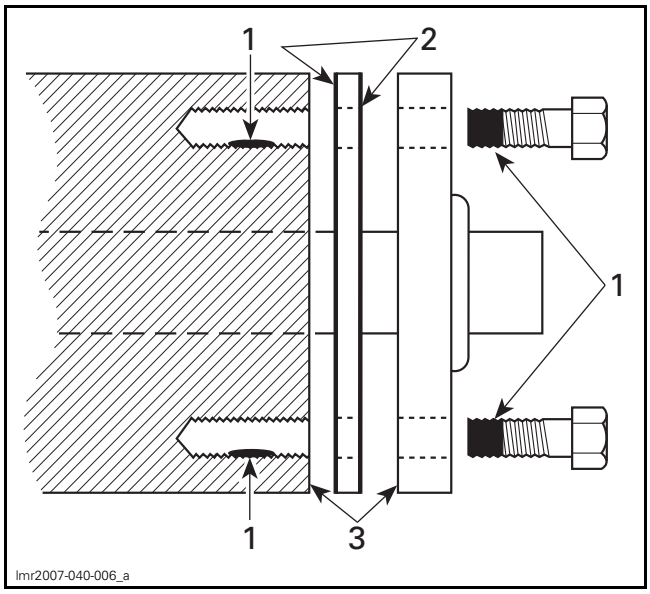
Option 1: Enlarge damaged hole, then follow *STANDARD THREAD REPAIR* procedure.

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) (P/N 413 708 500). Use a mechanical means only if necessary.

NOTE: Avoid grinding.

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

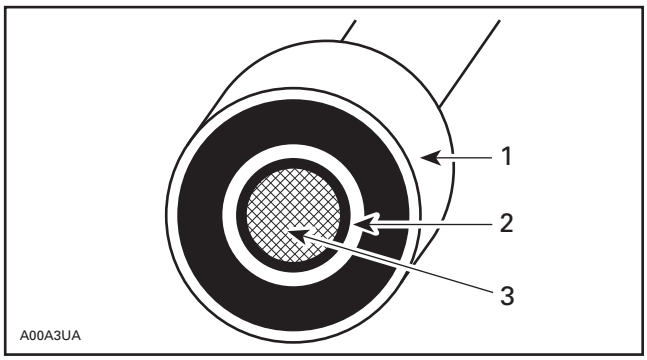
NOTE: If the cover is bolted to blind holes, apply proper strength Loctite in the hole and on threads. Tighten fastener.

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

6. Tighten as usual.

Threadlocker Application for Mounting on a Shaft

Mounting with a Press



1. Bearing
2. Proper strength Loctite
3. Shaft

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

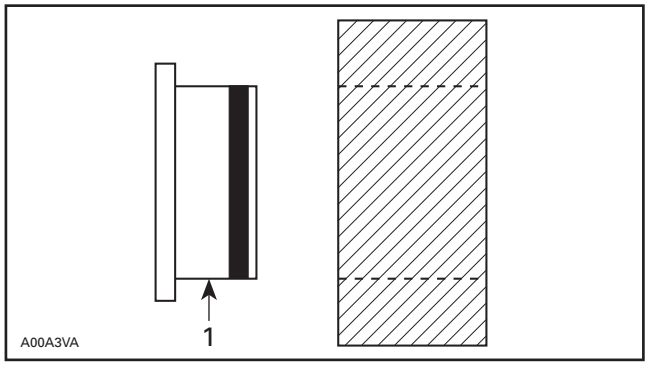
NOTE: Retaining compound is always forced out when applied on shaft.

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

Mounting in Tandem

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

Threadlocker Application for Case-In Components (Metallic Gaskets)



1. Proper strength Loctite

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

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

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

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

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

PERIODIC MAINTENANCE SCHEDULE (REV G4)

All Models

Procedures are detailed in *PERIODIC MAINTENANCE PROCEDURES* subsection.

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

Mountain Series Only

DURING THE FIRST 1500KM (1000MI)
Adjust and align track after first 75KM (50MI)
Inspect track tension every 500KM (300MI), adjust if necessary

Mountain Series Only

EVERY 1500KM (1000MI)
Adjust drive chain
Adjust and align track (if necessary)

Subsection XX (PERIODIC MAINTENANCE SCHEDULE (REV G4))

All Models

EVERY YEAR AT PRESEASON OR 3 000 KM (2,000MI) (WHICHEVER COMES FIRST)
Perform *PRE-RIDE INSPECTION*
Check fault codes
Charge battery (on applicable models)
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
Inspect and clean driven pulley
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 2 YEAR OR 6 000KM (4,000 MI) (WHICHEVER COMES FIRST)
Replace brake fluid
Inspect throttle cable
Clean and lubricate rewind starter (on applicable models)
Change chaincase oil
Inspect engine rubber mounts

EVERY 3 YEARS OR 10 000KM (6,000 MI) (WHICHEVER COMES FIRST)
Replace spark plugs
Inspect oil injection pump strainer and clean if needed
Clean 3D rave valves

EVERY 5 YEARS
Replace engine coolant
Replace in-line fuel filter

PERIODIC MAINTENANCE PROCEDURES

SERVICE TOOLS

Description	Part Number	Page
OETIKER PLIER	295 000 070	5
TENSIOMETER	414 348 200	9

SERVICE PRODUCTS

Description	Part Number	Page
BRAKE FLUID GTLMA DOT4	293 600 131	11
LONG LIFE ANTIFREEZE	219 702 685	3
MOLYKOTE PG 54	420 899 763	2
PULLEY FLANGE CLEANER	413 711 809	6, 8
SUSPENSION GREASE	293 550 033	13
XPS SYNTHETIC CHAINCASE OIL	413 803 300	8
XPS SYNTHETIC GREASE	293 550 010	13

GENERAL

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

PROCEDURES

ENGINE

Cleaning and Lubricating the Rewind Starter

Refer to *REWIND STARTER ASSEMBLY* in *REWIND STARTER* subsection.

NOTICE It is of the utmost importance that the rewind starter spring be lubricated periodically using MOLYKOTE PG 54 (P/N 420 899 763). The use of standard multipurpose grease could result in rewind starter malfunction under very cold temperatures and component life will be shortened.

Cleaning the 3D RAVE Valve

NOTICE It is very important to perform *3D RAVE VALVE SYNCHRONIZATION* whenever link bar is removed. Refer to *RAVE* subsection.

Clean carbon deposits as required.

Thoroughly clean all *RAVE VALVES* components and cylinder slots.

Use a clean rag when cleaning the valve.

NOTE: Do not use any solvents or cleaners for cleaning the cylinder slots. Fluids can cause corrosion of the cylinder bore which may result in severe engine damage.

Inspecting the Rubber Mount

Check rubber mounts for cracks or other damages.

Adjusting the Engine Stopper

Refer to *REMOVING AND INSTALLING THE ENGINE* subsection.

EXHAUST SYSTEM

Inspecting the Exhaust System

Check the following components for leaks, cracks, or other damages:
- Springs and retainers
- Exhaust system mounts
- Muffler
- Tuned pipe
- Donut gaskets
- Shields
- Manifold.

LUBRICATION SYSTEM

Inspecting and Cleaning the Oil Injection Pump Strainer

Refer to *OIL INJECTION PUMP* in *LUBRICATION SYSTEM* subsection.

Lubricating the Engine

Engine Storage Mode (Summerization Function)

Refer to applicable *GAUGE* subsection as procedure varies depending on the gauge.

COOLING SYSTEM

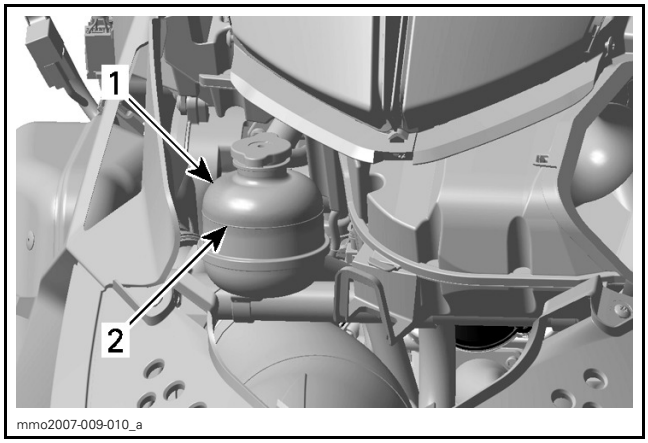
⚠ WARNING

Never open coolant tank cap when engine is hot.

Verifying the Engine Coolant Level

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

Remove pressure cap.

Use an antifreeze tester to test coolant strength.

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

Replacing the Engine Coolant

Recommended Engine Coolant

RECOMMENDED SERVICE PRODUCT	ACCEPTABLE
LONG LIFE ANTIFREEZE (P/N 219 702 685)	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.

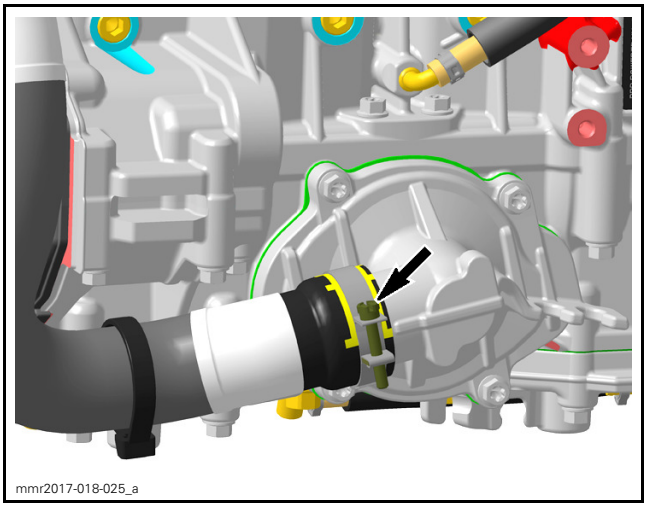
Remove RH side panel and hood. Refer to *BODY* subsection.

Remove muffler and tuned pipe. Refer to *EXHAUST SYSTEM* subsection.

Place a large drain pan under the vehicle bottom pan.

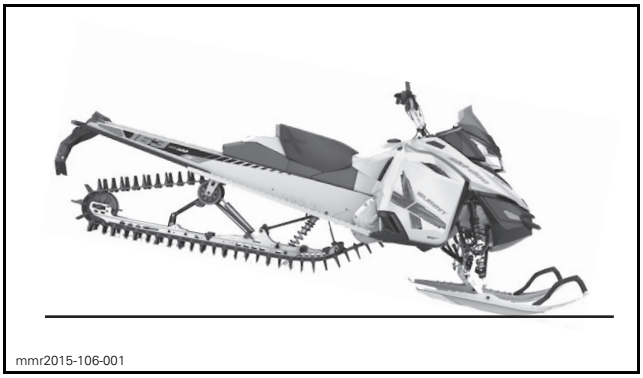
Remove clamp. Discard original installed gear clamp.

Unplug coolant hose from water pump to drain coolant.



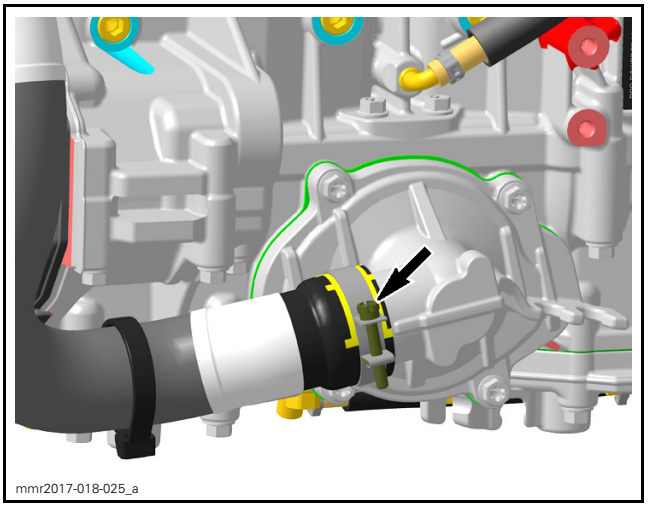
REMOVE CLAMP (DISCARD ORIGINAL INSTALLED 1–EAR CLAMP)

When coolant level is low enough, lift the rear of vehicle to drain the heat exchangers.



TYPICAL VIEW

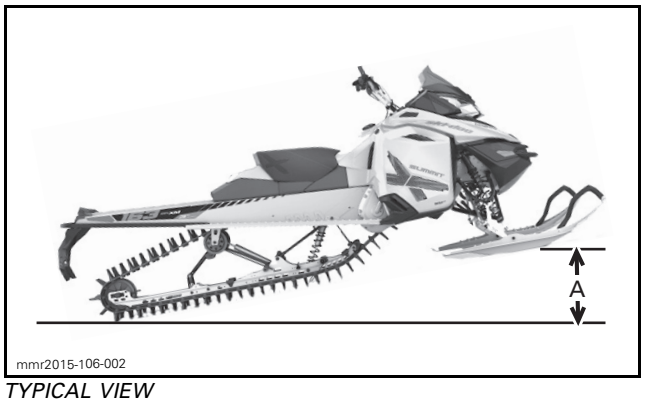
Install and tighten coolant hose clamp on water pump.



TIGHTENING TORQUE	
Coolant hose clamp	3 N•m ± 0.4 N•m (27 lbf•**in** ± 4 lbf•**in**)

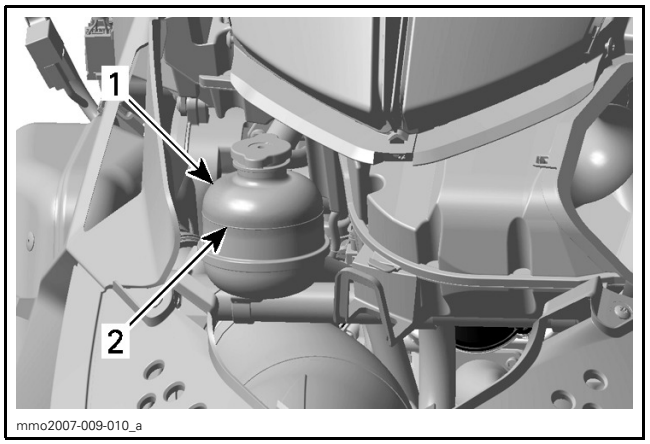
Refilling and Bleeding the Cooling System

1. Apply parking brake.
2. Lift front of vehicle as shown and support it safely.



TYPICAL VIEW
A. 25 cm ± 5 cm (10 in ± 2 in)

3. With engine cold, slowly fill coolant tank up to COLD LEVEL line allowing time for the air in the cooling system to seep out.

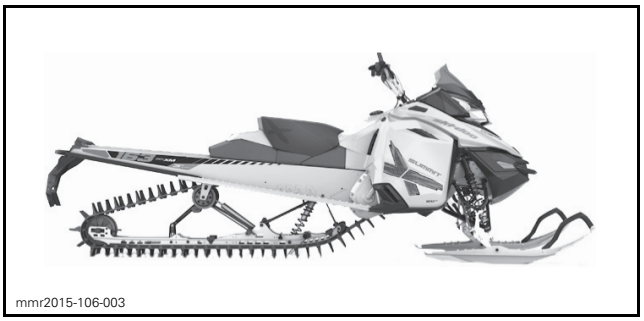


TYPICAL
1. Coolant tank
2. COLD LEVEL line

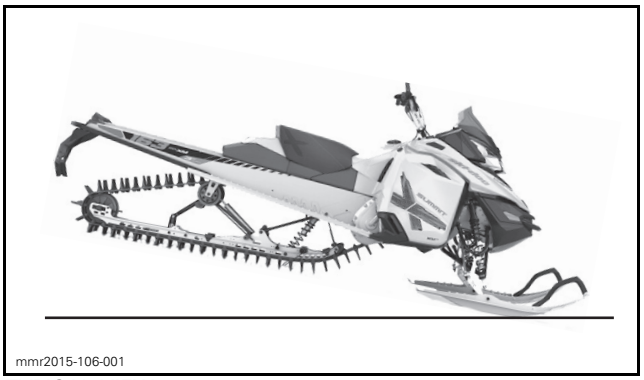
4. Start engine.
5. Refill coolant tank up to COLD LEVEL line while engine is idling until rear heat exchangers are warm to the touch (about 4 to 5 minutes).

NOTE: Always monitor coolant level while filling coolant tank to avoid emptying and thus allowing air to enter the system.

6. Install pressure cap.
7. Lower vehicle back to the ground.



8. Lift rear of vehicle and support it safely.

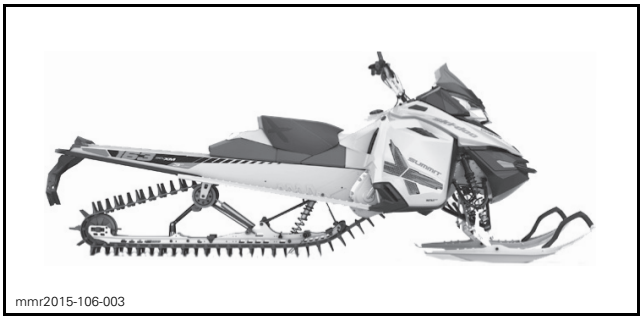


TYPICAL VIEW

⚠ 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.

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 to ground.
13. Stop engine.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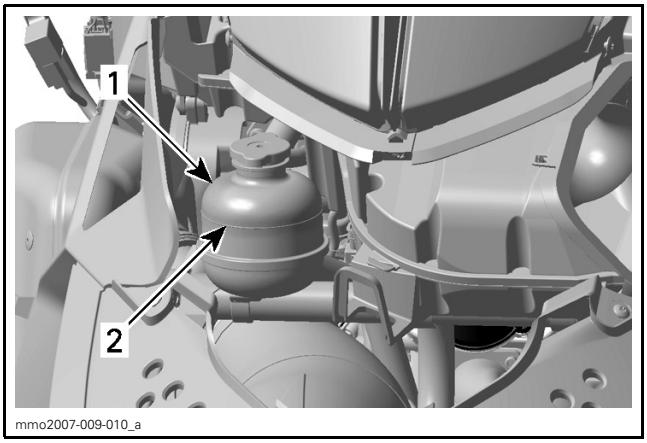
14. Add coolant up to 15 mm (1/2 in) above the COLD LEVEL line.



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TYPICAL
1. *Coolant tank*
2. *Coolant 15 mm (1/2 in) above COLD LEVEL line*

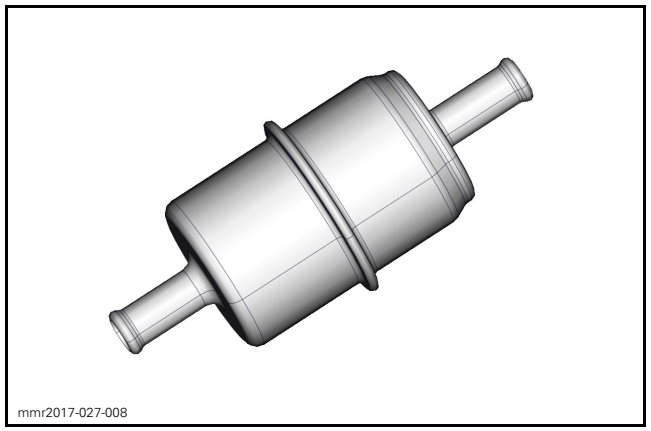
15. When engine has completely cooled down, recheck coolant level in coolant tank and refill up to line if needed.
16. Visual check for any leakages.
17. Perform *VERIFYING THE ENGINE COOLANT STRENGTH*. See procedure in this subsection.
18. Adjust mixture as necessary.
19. Reinstall removed parts.

FUEL SYSTEM

Inspecting the Fuel Lines and Connections

Visually inspect fuel lines and connections for cracks or leaks.

Replacing the In-Line Fuel Filter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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 *FUEL TANK AND FUEL PUMP* 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 ECM.

Using OETIKER PLIER (P/N 295 000 070), close Oetiker clamps to secure the fuel filter.

⚠ 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 *FUEL SYSTEM PRESSURIZATION* in *FUEL TANK AND FUEL PUMP* 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.

THROTTLE BODY CLEANING	
Service product	PULLEY FLANGE CLEANER (P/N 413 711 809)

Inspecting the Throttle Cable

Visually inspect cable sheath for kinks, wear or other damage.

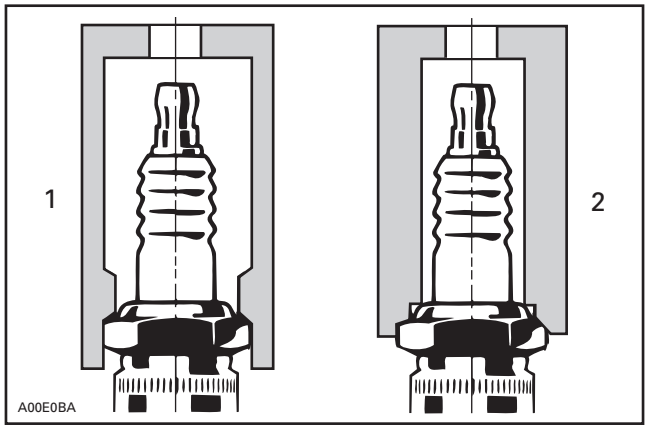
Visually inspect cable at throttle body/carburetor and at throttle lever for fraying or other damage.

Make sure the throttle cable operates smoothly.

SPARK PLUGS

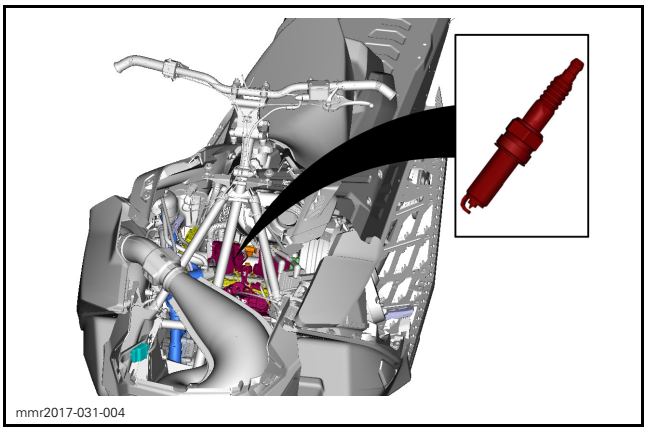
Replacing the Spark Plug

NOTE: Use only an approved spark plug socket for removal and installation. Extra care should be taken to avoid side stresses which could result in a broken spark plug.



TYPICAL
1. *Approved socket*
2. *Improper socket*

Removing the Spark Plugs

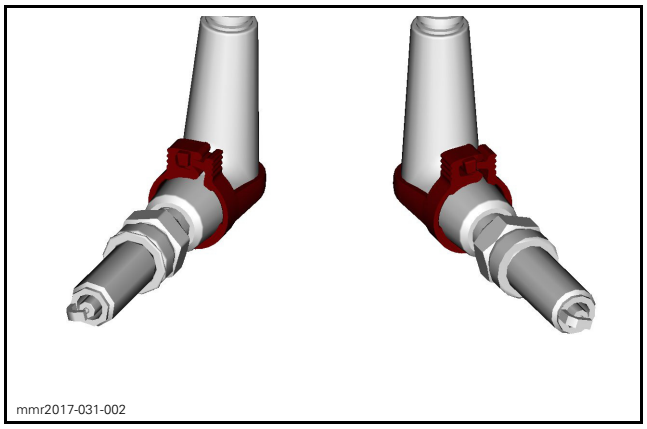


1. Disconnect the stator connector. Refer to *STATOR CONNECTOR ACCESS* in the *MAGNETO AND STARTER* subsection.
2. Remove the upper body module. For procedure, refer to *BODY* subsection.
3. Remove cover, refer to *TOP END* subsection.
4. Clean the spark plug and cylinder head with pressurized air.

⚠ WARNING

Whenever using compressed air, always wear protective eye wear.

5. Remove lock securing spark plug wire to spark plug.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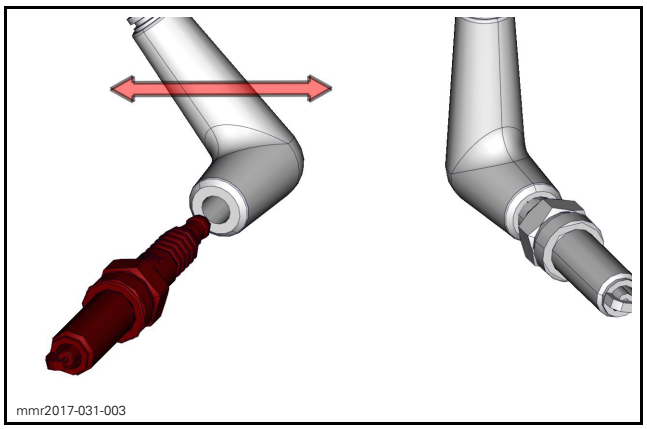
6. Remove spark plug cables by gently rotating the cap and pulling it off the plug.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7. Unscrew the spark plug sufficiently to break the applied torque using the appropriate tools.


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8. Remove spark plugs by hand.

Installing the Spark Plugs (OEM)

1. Prior to installation, ensure the contact surfaces of the cylinder head and spark plug are free of grime.
2. Using a wire gauge, confirm electrode gap is as specified. Refer to *TECHNICAL SPECIFICATIONS*.

NOTE: If spark plug gap is incorrect, use another spark plug.

3. Hand screw spark plug into cylinder head until it bottoms out.
4. Apply specific torque using a torque wrench and approved spark plug socket.

NOTE: Spark plug tightening torque is particularly important on this engine as it contributes to the proper positioning of the negative electrode.

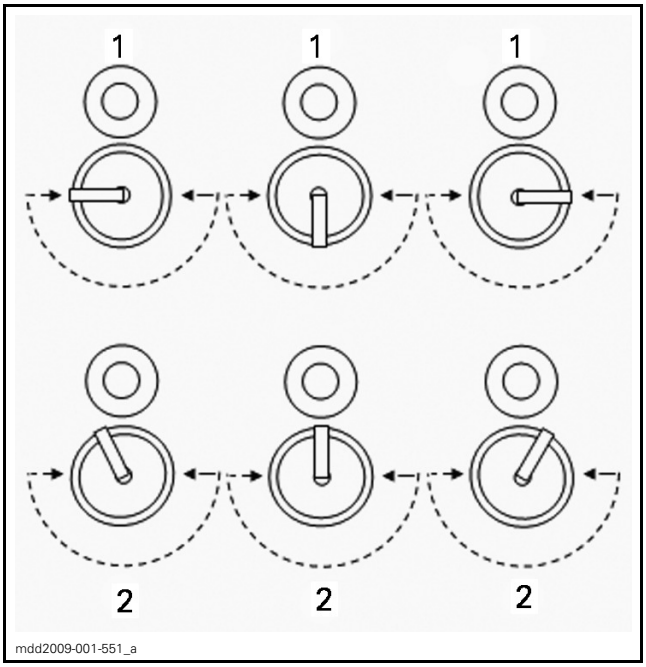
TIGHTENING TORQUE	
Spark plug	18 N•m ± 0.7 N•m (159 lbf•**in** ± 6 lbf•**in**)

Installing the Spark Plugs (Non-OEM)

NOTE: When using a non-OEM spark plug , it must be correctly indexed or engine may experience rough idling and higher emissions.

1. Using a marker, mark the open end of the negative electrode on the plug shell (above threads).
2. Ensure the contact surfaces of the cylinder head and spark plug are free of grime.
3. Install and torque the spark plug, refer to previous table for specific torque.
4. Visually check to ensure the open end of the negative electrode is facing the injector nozzle within 90° each side of nozzle.

NOTE: The following illustration uses the point of attachment of the negative electrode to depict the angle. The injector is illustrated above the spark plug.



SPARK PLUG INDEXING
1. *Acceptable installation*
2. *Unacceptable installation*

If the plug indexing angle is not within specification, repeat procedure with another spark plug until correct indexing is achieved.

LIGHTS

Adjusting the Headlights Beam Aiming

Refer to *LIGHTS* subsection.

DRIVE SYSTEM

Inspecting the Drive Belt

Refer to *DRIVE BELT* subsection.

Inspecting and Cleaning the Drive Pulley

Refer to *DRIVE PULLEY* subsection.

Drive Pulley Retaining Screw Tightening

Refer to appropriate *DRIVE PULLEY* subsection.

Replacing the Drive Pulley Wear Parts

Replace drive pulley wear parts as per *PERIODIC MAINTENANCE SCHEDULE*. Refer to *DRIVE PULLEY* subsection.

Inspection and Cleaning the Driven Pulley

Inspect pulley sheave for dirt, marks or scratches.

Test sliding sheave operation.

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

CHAINCASE

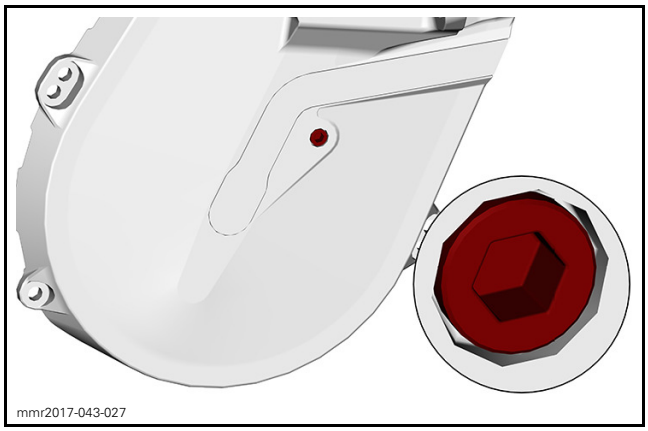
Recommended Chaincase Oil

RECOMMENDED SERVICE PRODUCT
XPS SYNTHETIC CHAINCASE OIL (P/N 413 803 300)

NOTICE **Use only the recommended type oil when servicing. Do not mix synthetic oil with other types of oil.**

Verifying the Chaincase Oil Level

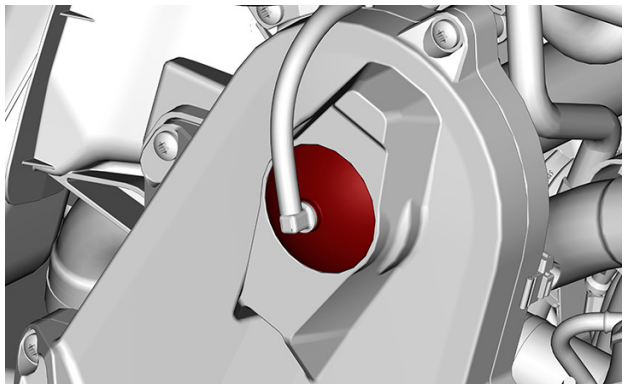
1. Place vehicle on a level surface.
2. Remove the check plug beside the speed sensor on the chaincase cover. Oil level must be equal with the lower edge.



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.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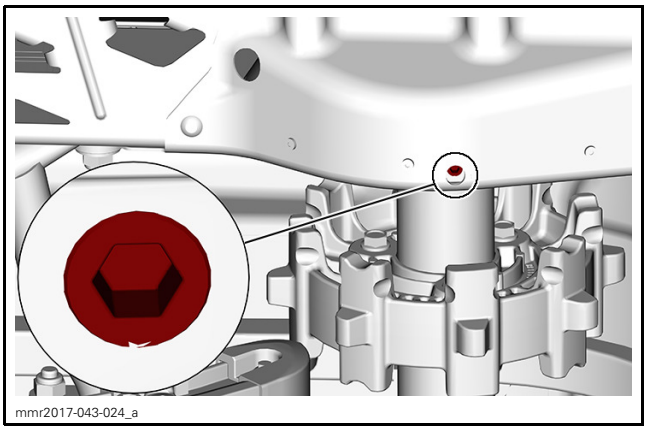
5. Pour recommended oil in chaincase by the filler hole until oil comes out by the magnetic check plug hole.
6. Reinstall magnetic check plug and torque to specification.

TIGHTENING TORQUE	
Magnetic check plug	6 N•m ± 1 N•m (53 lbf•**in** ± 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 drain plug on the bottom of the chaincase.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4. Reinstall the drain plug.

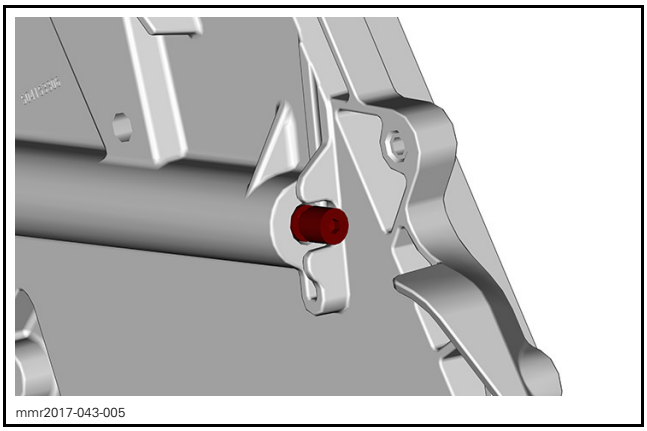
TIGHTENING TORQUE	
Drain plug	6 N•m ± 1 N•m (53 lbf•**in** ± 9 lbf•**in**)

5. Remove the magnetic check plug
6. Pour approximately 350 ml (12 U.S. oz) of recommended oil in chaincase through the filler hole until oil comes out by the magnetic check plug hole.
7. Clean the magnetic check plug. Refer to *CHAINCASE OIL LEVEL VERIFICATION*, see procedure in this subsection.

Adjusting the Drive Chain

1. Tighten tensioner adjustment screw **BY HAND**.

NOTE: Turn adjustment screw until resistance is strong enough that it can not be turned by hand.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TRACK

Adjusting and aligning the Track

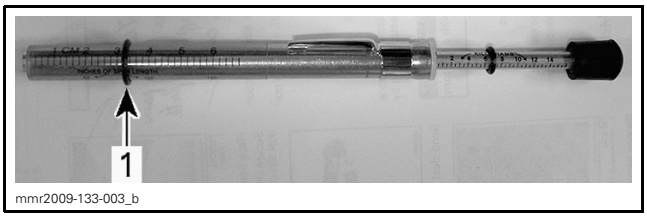
Track tension and alignment are interrelated. Do not adjust one without checking the other. Track tension procedure must be carried out prior to track alignment.

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.

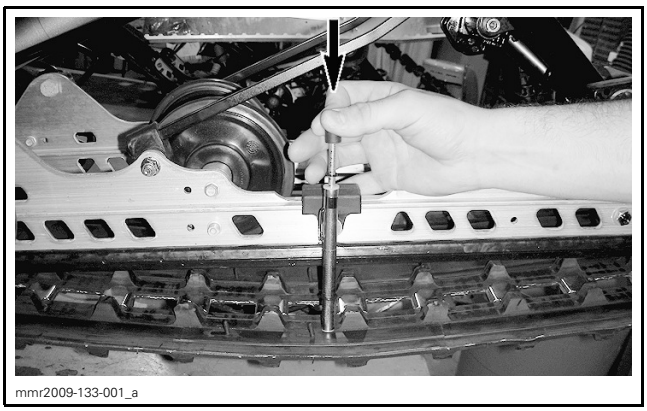
REQUIRED TOOL	
TENSIOMETER (P/N 414 348 200)	

4. Set deflection to 3.2 cm (1.26 in) using bottom O-ring.

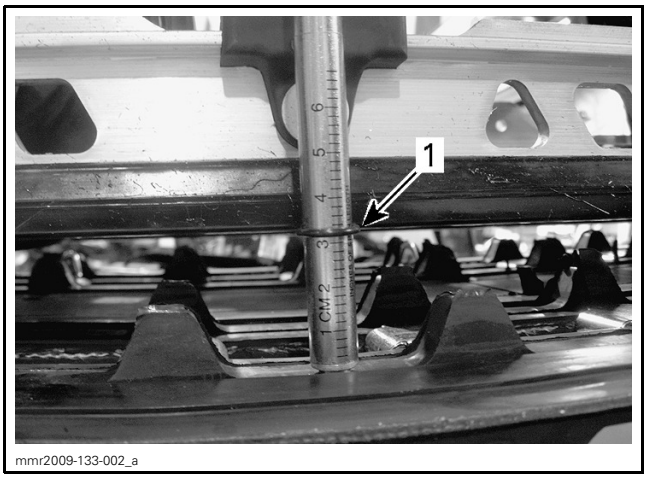


DEFLECTION SETTING
1. Bottom O-ring

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.

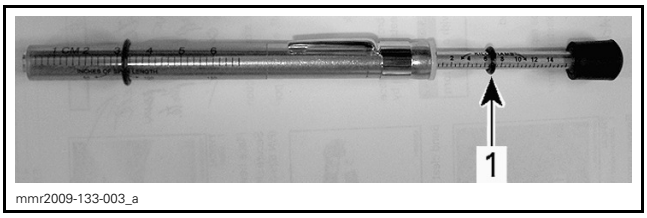


TYPICAL



1. Deflection O-ring aligned with slider shoe

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.

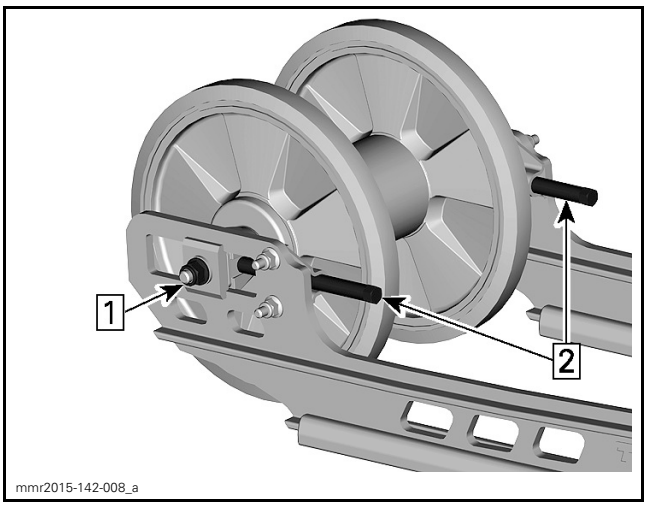
TRACK ADJUSTMENT SPECIFICATION	
Track deflection setting	3.2 cm (1.26 in)
Track load reading	6.0 kgf to 8.5 kgf (13 lbf to 19 lbf)

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.



Step 1: Loosen axle nut
Step 2: Tighten or loosen adjustment screws

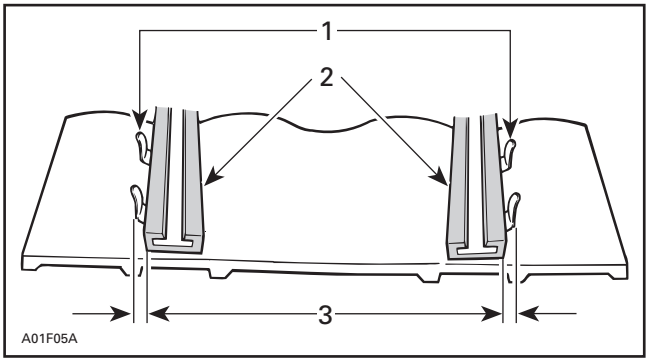
4. Verify track tension, refer to *VERIFYING THE TRACK TENSION*.
5. Ensure track is properly aligned, refer to *ALIGNING THE TRACK*.

Aligning the Track

⚠ WARNING

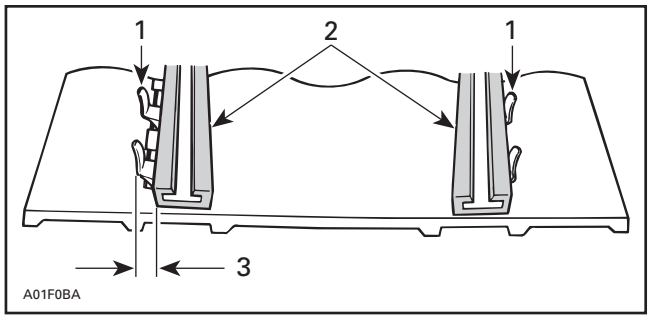
Before checking track alignment, ensure that the track is free of all particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure no one is standing in close proximity to the vehicle. Never rotate at high speed.

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)

BRAKE

Recommended Brake Fluid

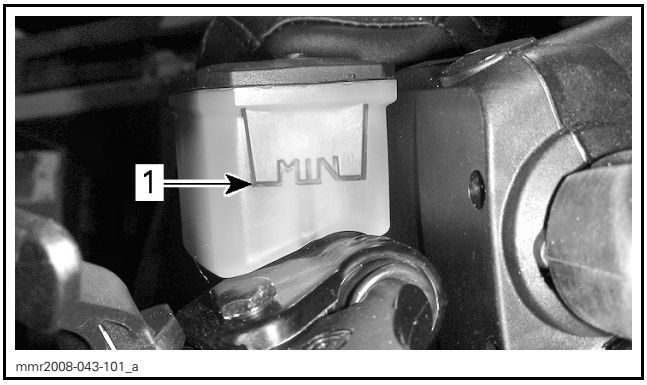
Always use brake fluid meeting the DOT 4 specification.

RECOMMENDED SERVICE PRODUCT
BRAKE FLUID GTLMA DOT4 (P/N 293 600 131) meeting DOT 4 specification

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

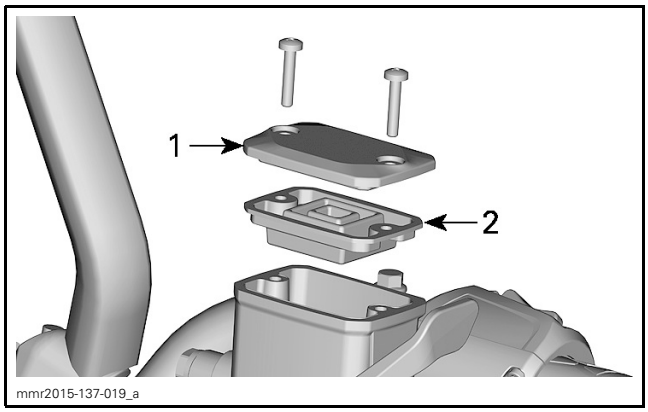
Add fluid as required. Do not overfill.

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

Replacing the Brake Fluid

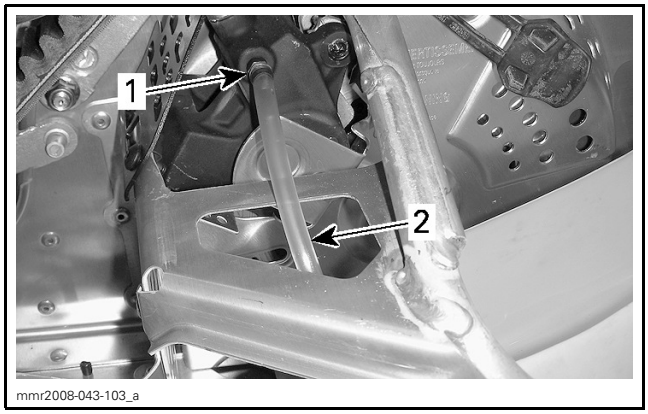
Draining the Brake Fluid

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.

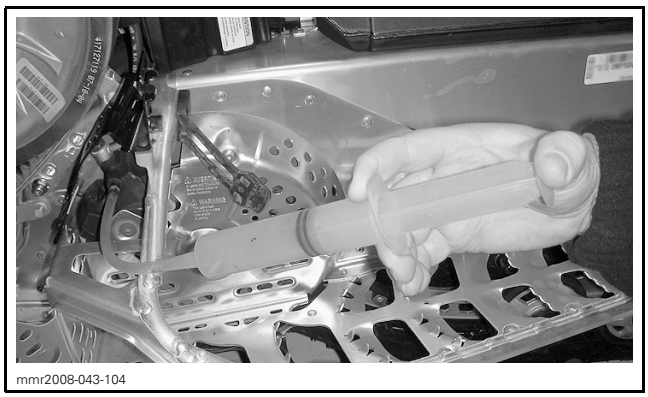


TYPICAL
1. Bleeder
2. Clear hose to catch used brake fluid

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

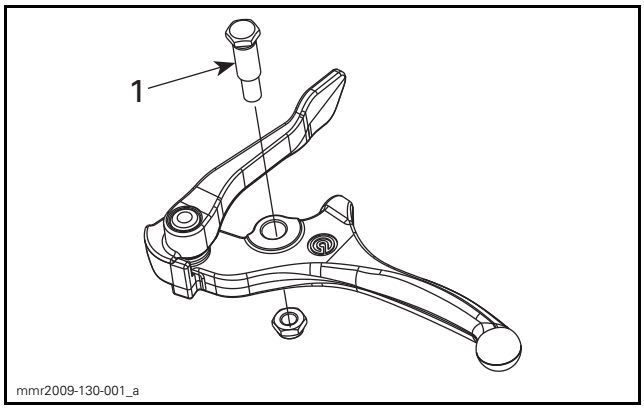
Visually inspect the brake hose for leaks or any damage.

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



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**)

SUSPENSION

Inspecting the Front Suspension

Visually inspect front suspension for tightness of components:
– Arms
– Stabilizer bar
– Shock absorbers
– Ball joints.

Rear Suspension, Stopper Strap and Slider Shoes

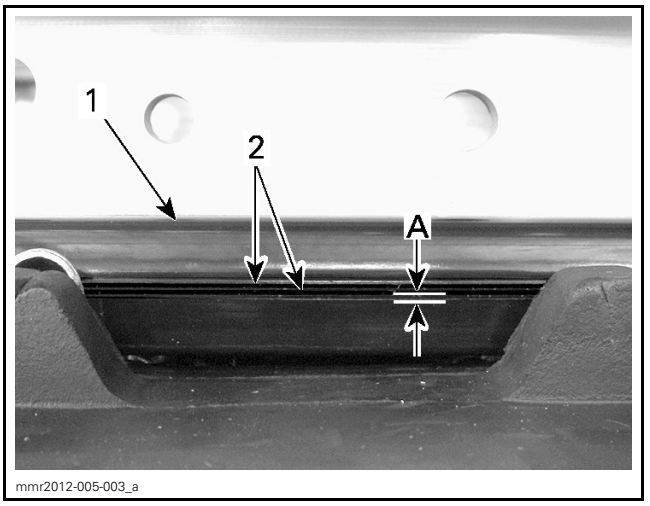
Inspecting the Rear Suspension Mechanism and Stopper Strap

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

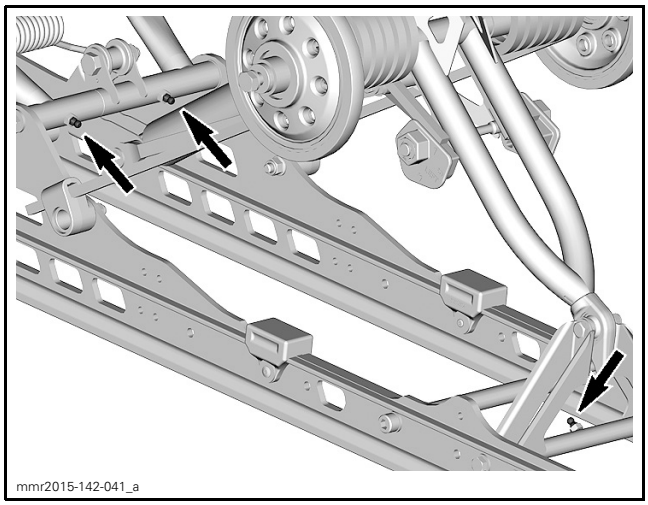


1. Slider shoe
2. Molding lines
A. Minimum thickness: 1 mm (.04 in)

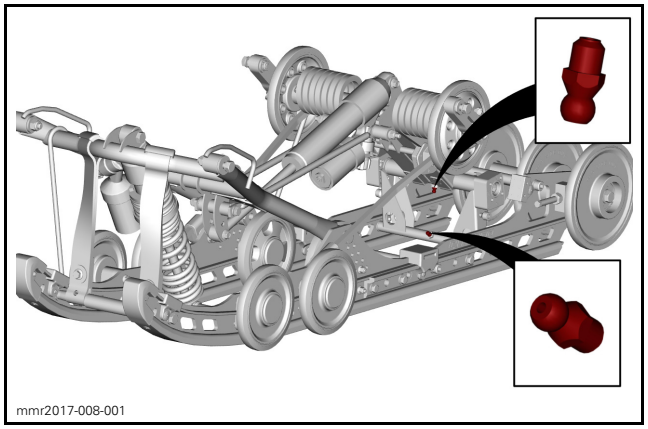
NOTICE **Slider shoes must always be replaced in pairs.**

Lubricating the Rear Suspension

Lubricate the following suspension pivots at grease fittings using SUSPENSION GREASE (P/N 293 550 033).



TYPICAL - tMOTION REAR SUSPENSION



TYPICAL - rMOTION REAR SUSPENSION

STEERING

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 *STEERING SYSTEM* 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.).

STORAGE PROCEDURE

During summer, or when a snowmobile is not in use for more than three months, proper storage is a necessity.

Procedures are detailed in *PERIODIC MAINTENANCE PROCEDURES* subsection.

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
Inspect and lubricate rear suspension
Charge battery monthly to keep it fully charge during storage (on applicable models)
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.

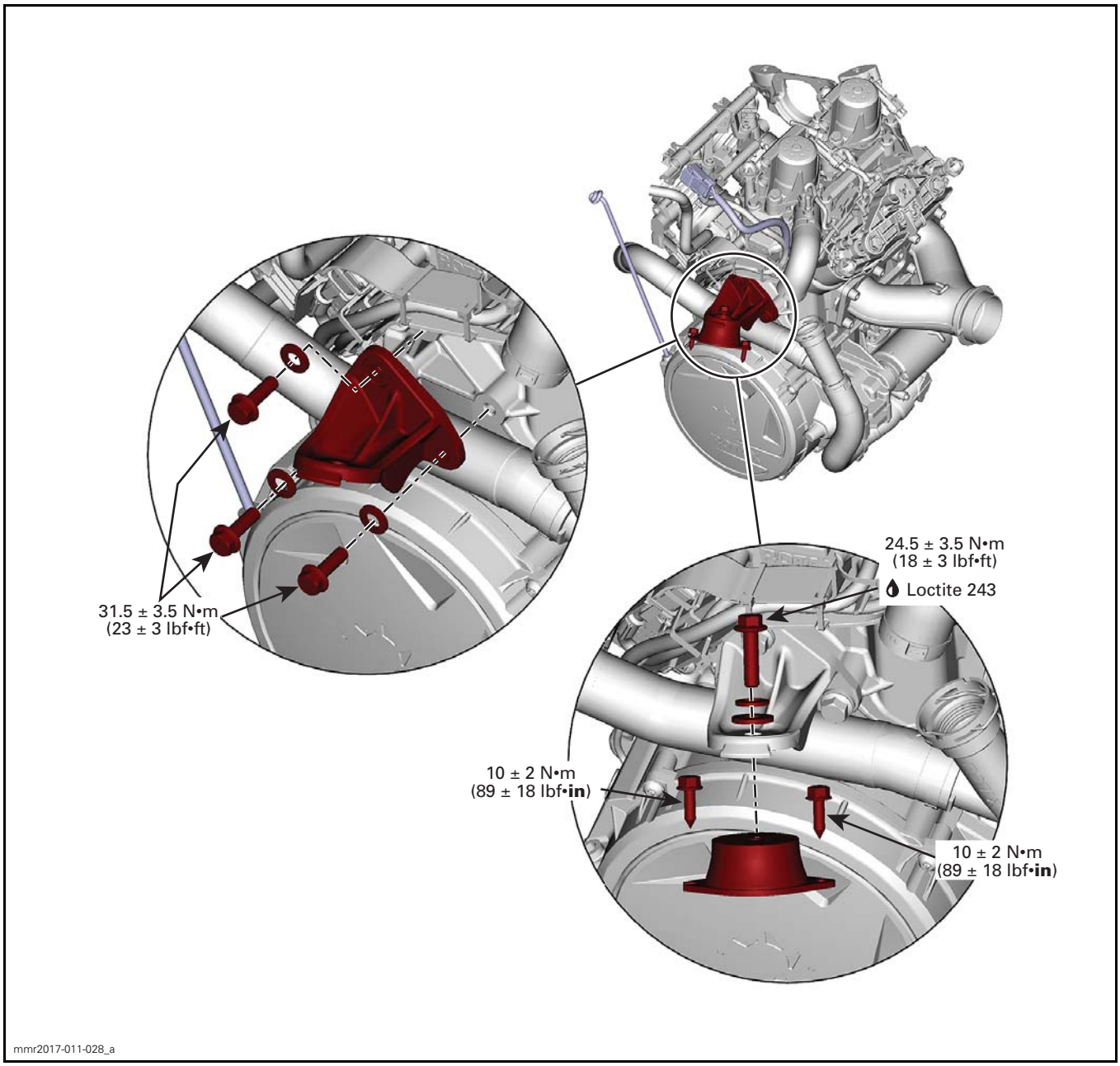
PRESEASON PREPARATION

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
ENGINE LIFTING HOOK	529 035 829	9
ENGINE LIFTING TOOL	529 036 402	9
UPPER GEAR RETAINING TOOL	529 036 110	7



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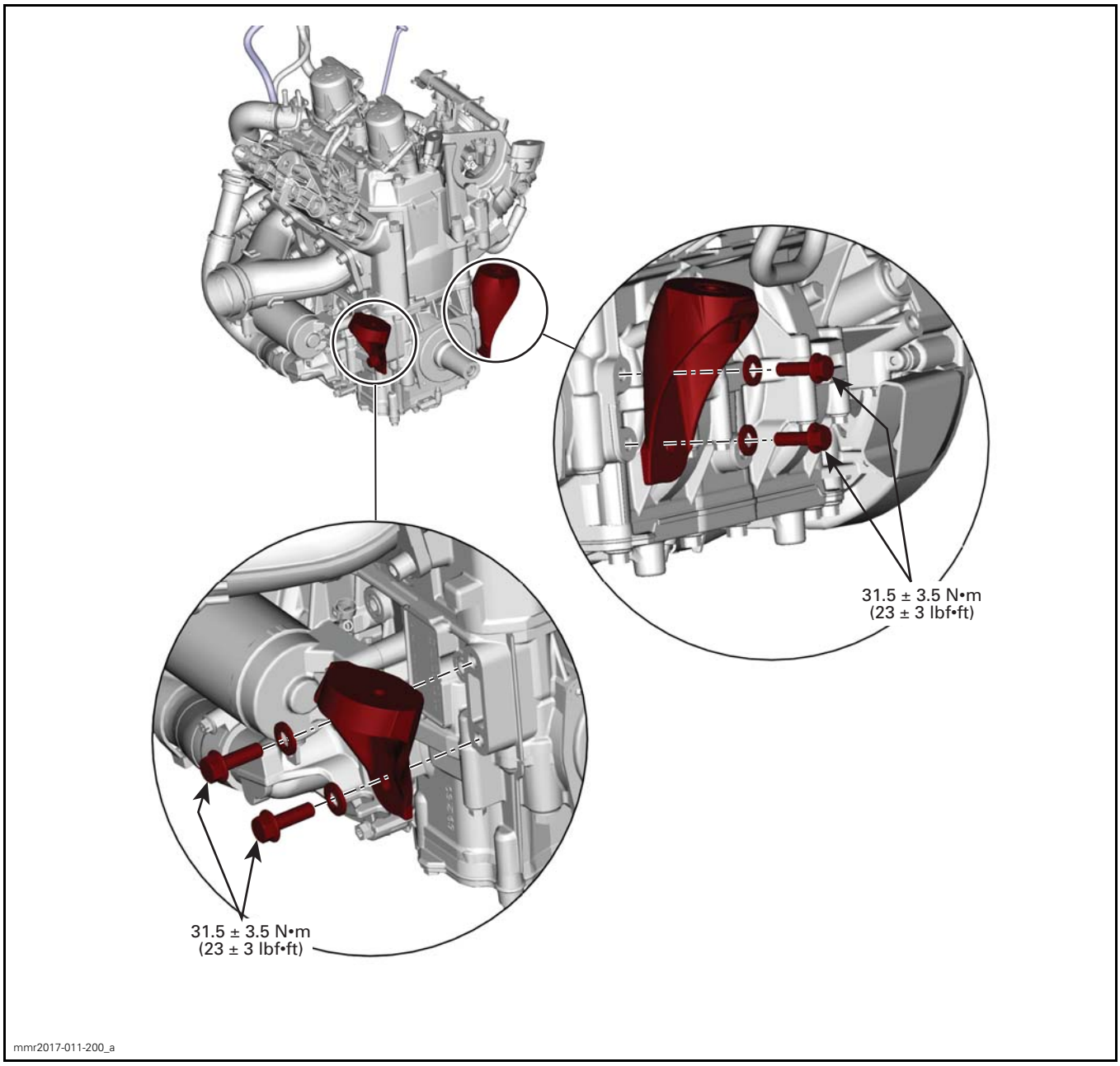

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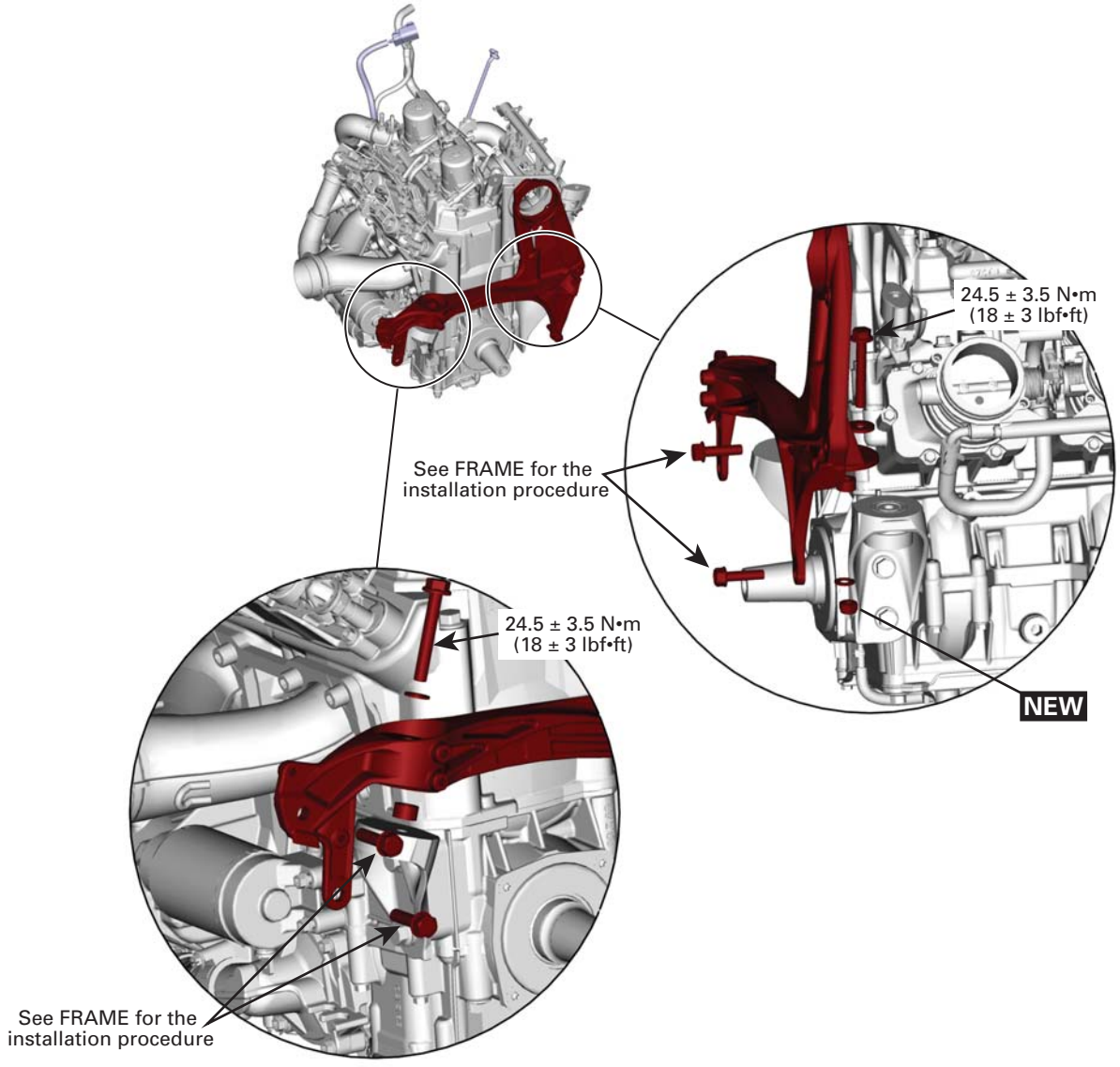

NEW = Component must be replaced when removed.

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GENERAL

During assembly/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 be strictly adhered to.
Locking devices when removed (e.g.: locking tabs, elastic stop nuts, cotter pin, etc.) must be replaced with new ones.

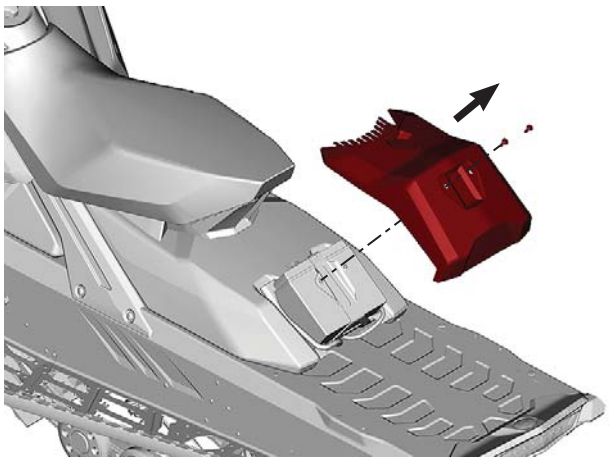
NOTICE **Hoses, cables and locking ties removed during a procedure must be reinstalled as per factory standards.**

PROCEDURES

ENGINE

Removing the Engine

1. Place vehicle at workstation that will have access to an engine-lifting hoist.
2. Remove fuel pressure. Refer to *ELECTRIC FUEL PUMP* in *FUEL TANK AND FUEL PUMP* subsection.
3. Disconnect the battery.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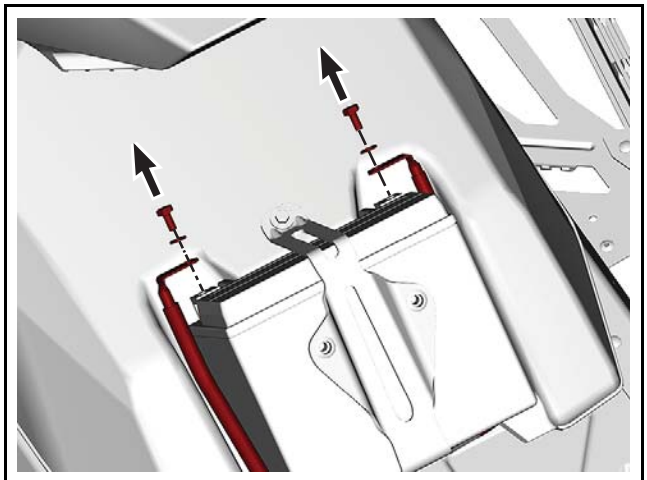
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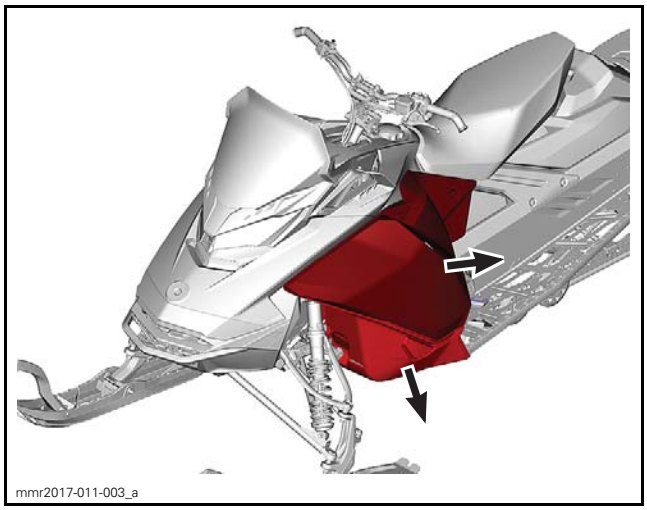
4. Remove the following parts. If required, refer to *BODY* subsection.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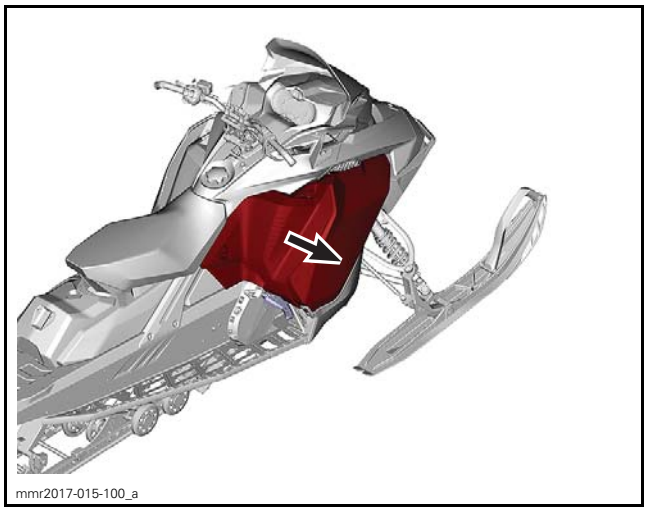
LH SIDE PANEL AND LH BOTTOM PAN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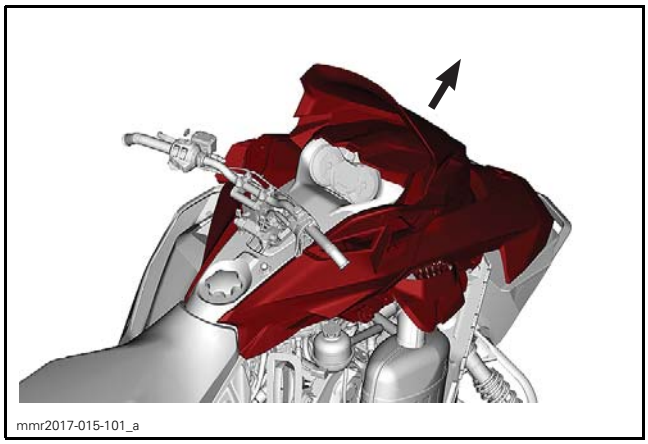
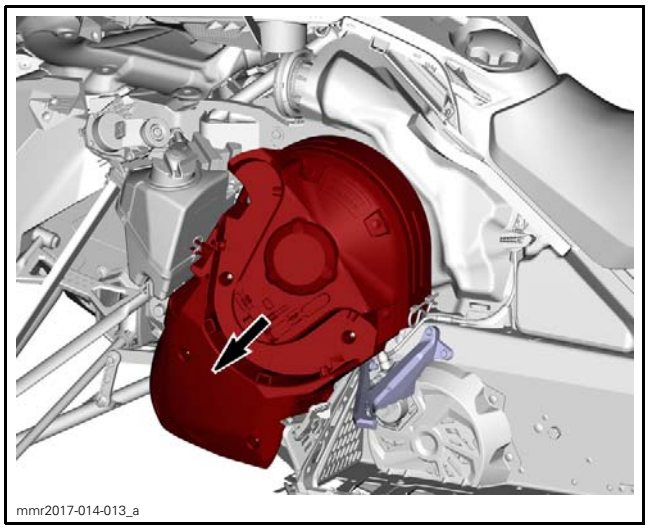
RH SIDE PANEL

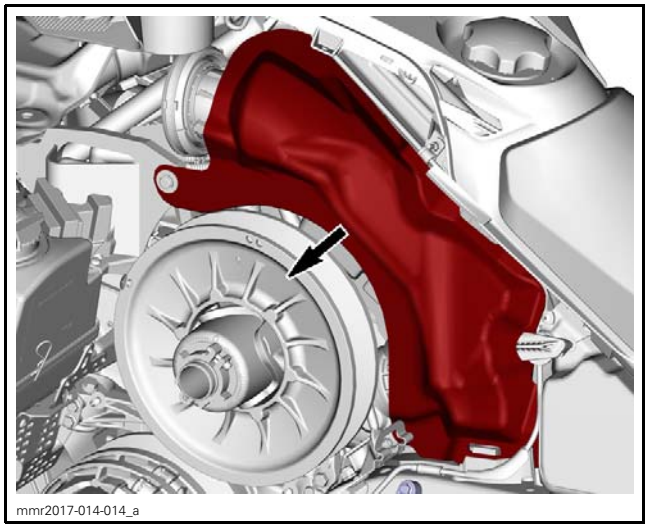


UPPER BODY MODULE

5. Remove the drive belt guard and acoustic panel.

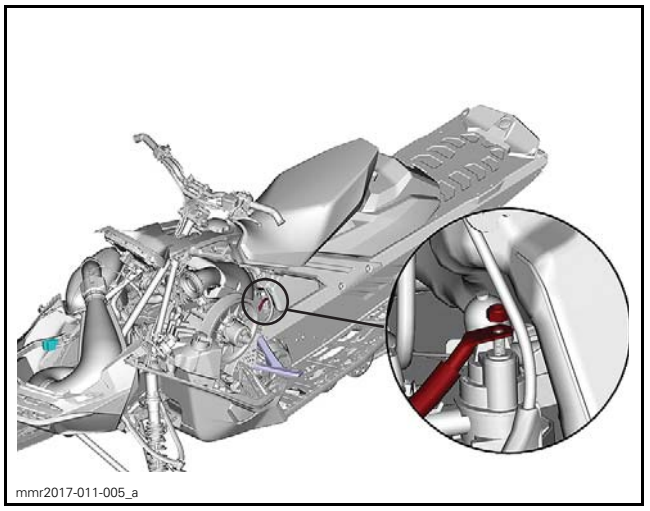


DRIVE BELT GUARD

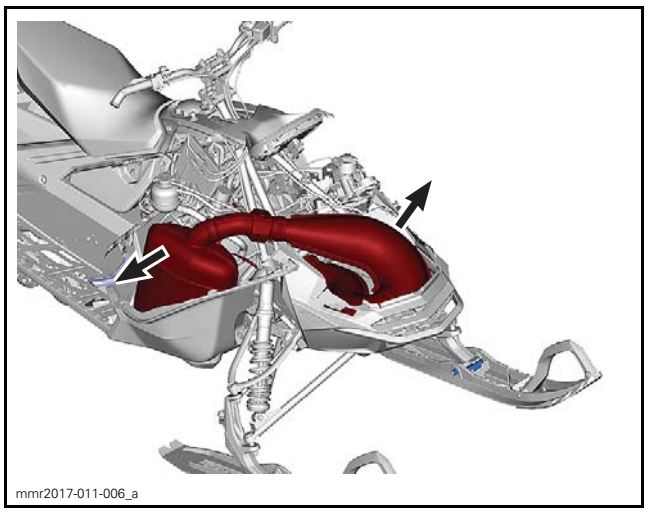


ACOUSTIC PANEL

6. Disconnect the BLACK wire from the starter solenoid.

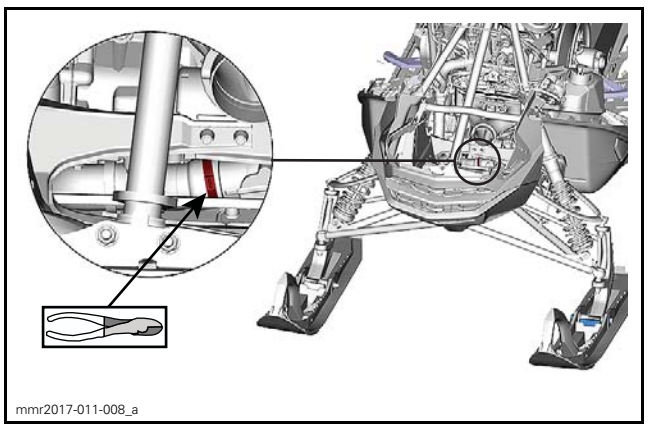


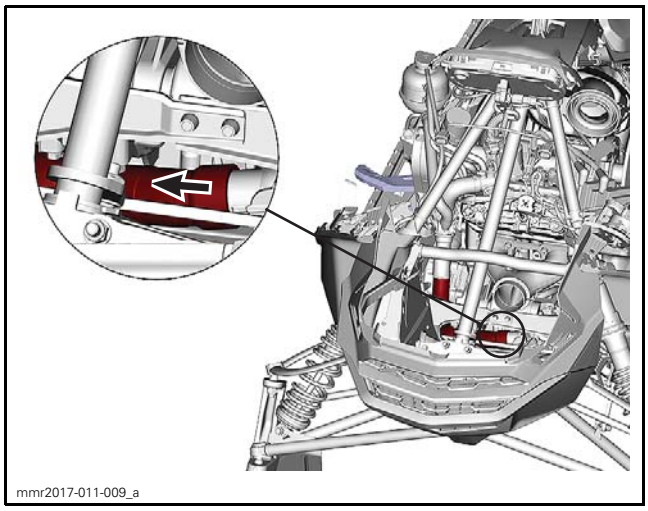
7. Remove the muffler and the tuned pipe. If required, refer to *EXHAUST SYSTEM* subsection.



8. Place a drain pan under the front of the vehicle.
9. Drain the coolant by detaching the front cooling hose from the engine then lift the rear of the vehicle

NOTE: At the installation, replace the ear clamp by an hose clamp.

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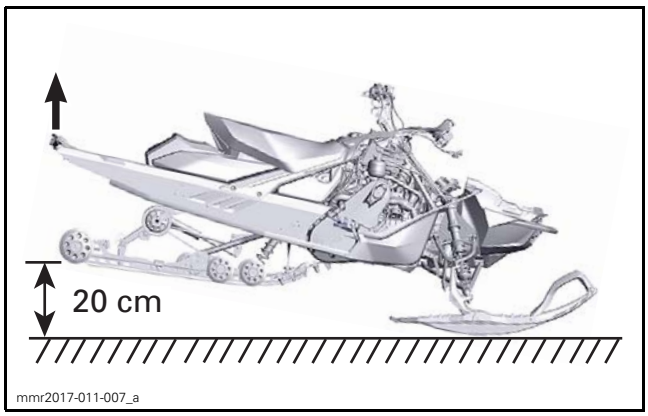

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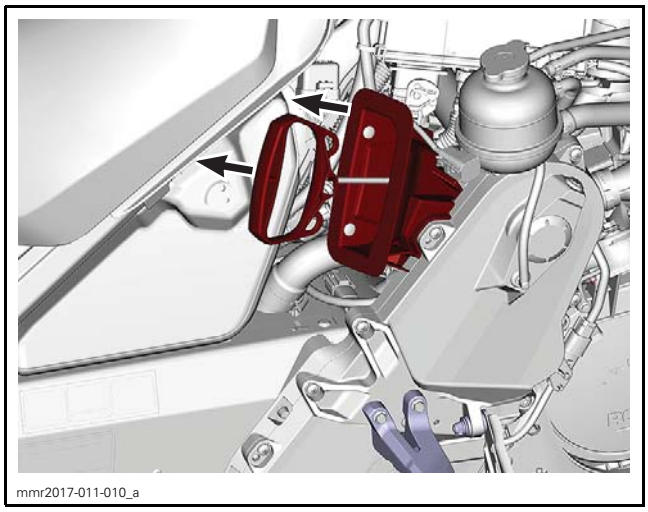
10. If equipped, remove the rewind starter handle and its housing.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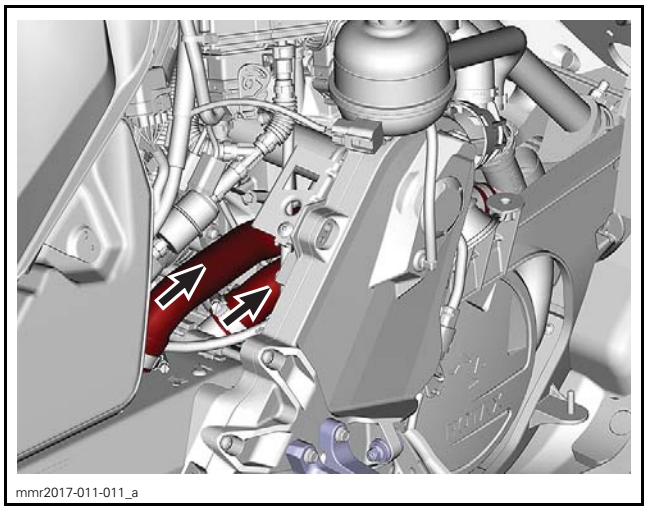
11. Unplug the inlet and outlet cooling hoses from the tunnel.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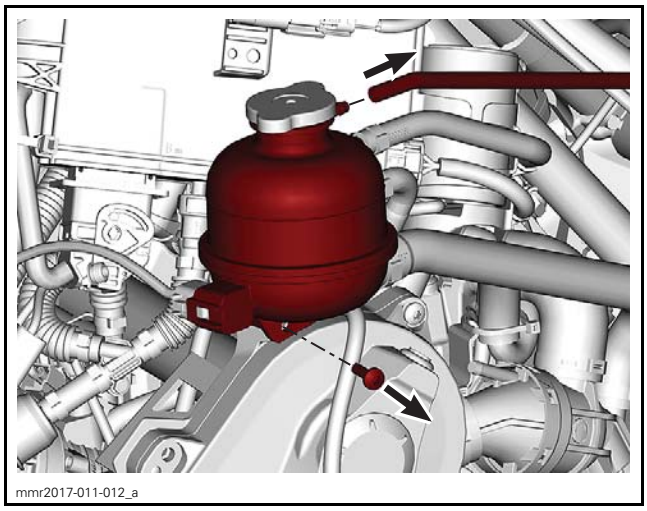
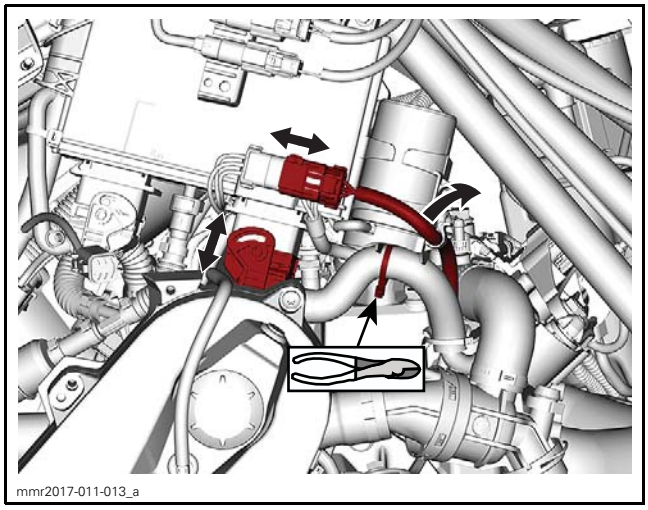
12. Detach the coolant tank from the top of the chaincase and unplug the vent hose from the tank.


mmr2017-011-012_a

13. Disconnect the ECM connector A and the magneto connector.
14. Cut the locking tie retaining the engine harness to the capacitor support.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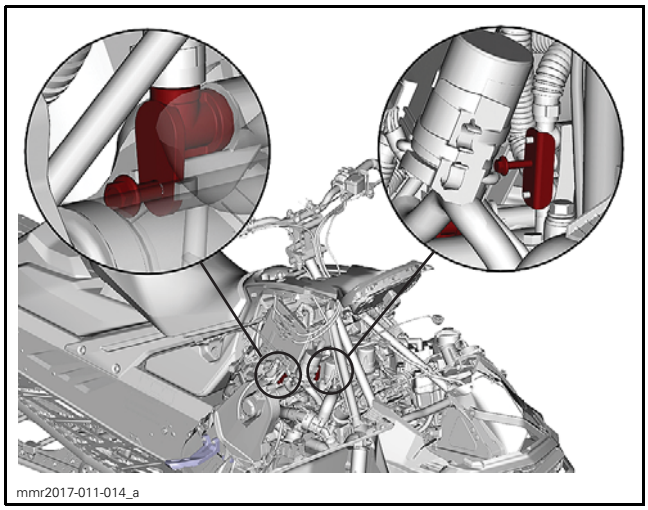
15. Unscrew fuel hoses from fuel rails.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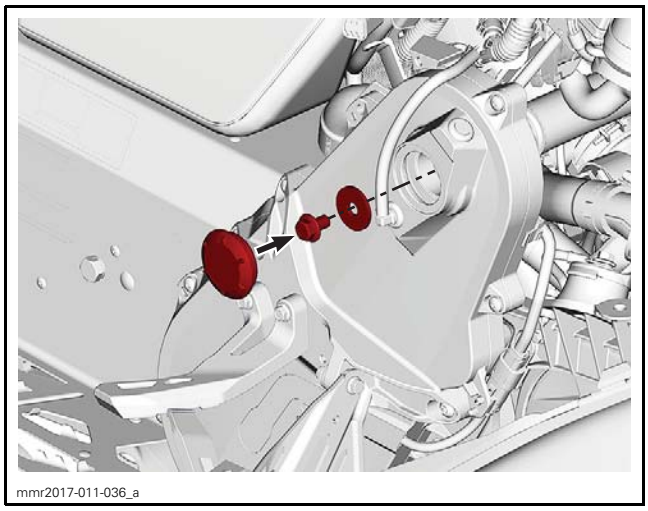
16. Apply parking brake and remove the upper gear screw and the conical spring washer.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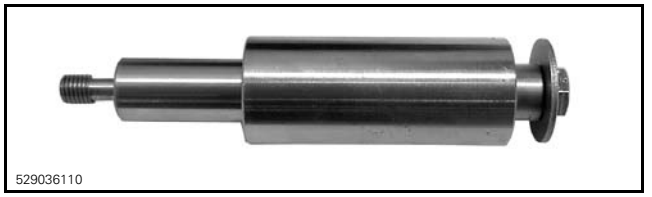
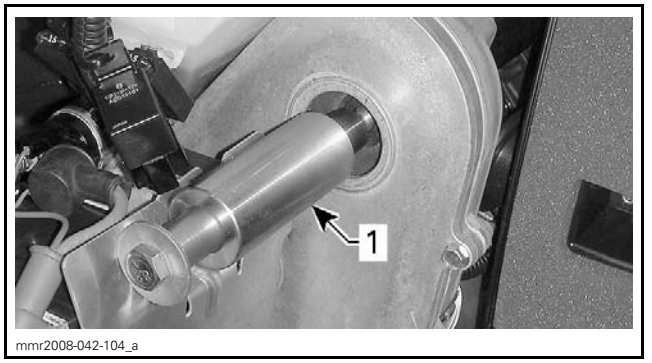
17. Install the UPPER GEAR RETAINING TOOL (P/N 529 036 110) on countershaft end.


529036110



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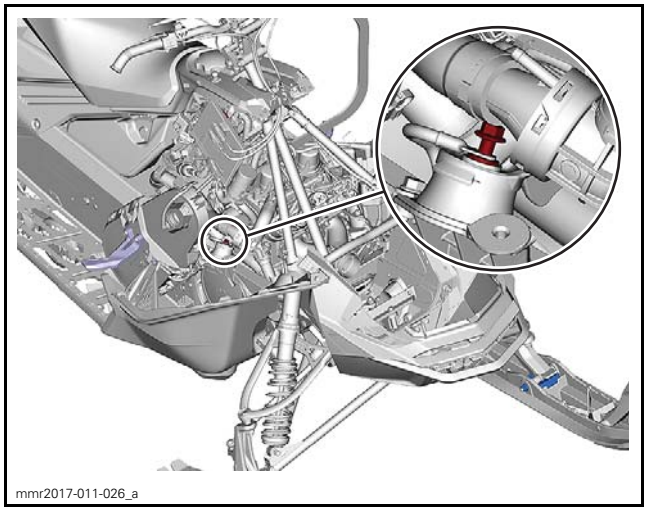
TYPICAL
1. Upper gear retaining tool

18. Remove the engine support screw.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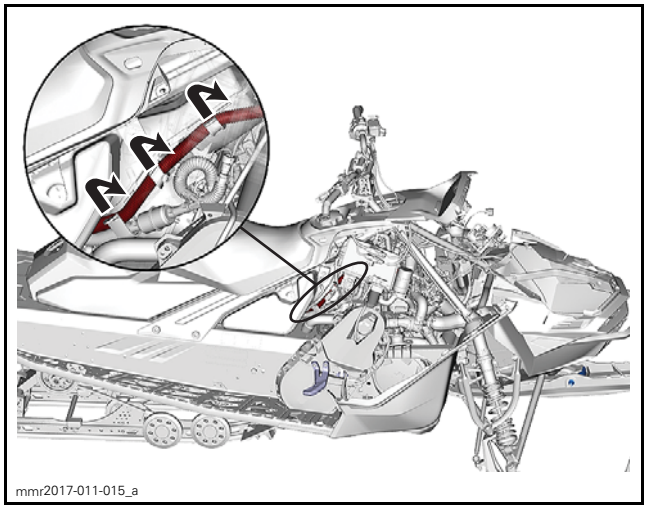
19. Unclip the fuel hose from the primary air silencer.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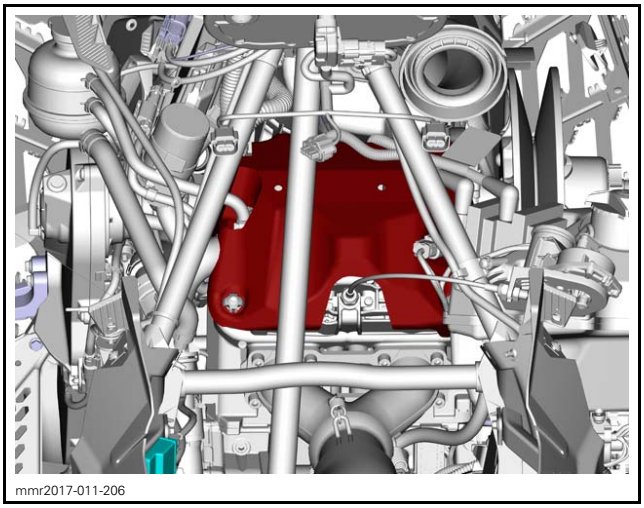
20. Remove engine cover.
    20.1 Remove the 3 screws.
    20.2 Pull on both halves of cover to remove.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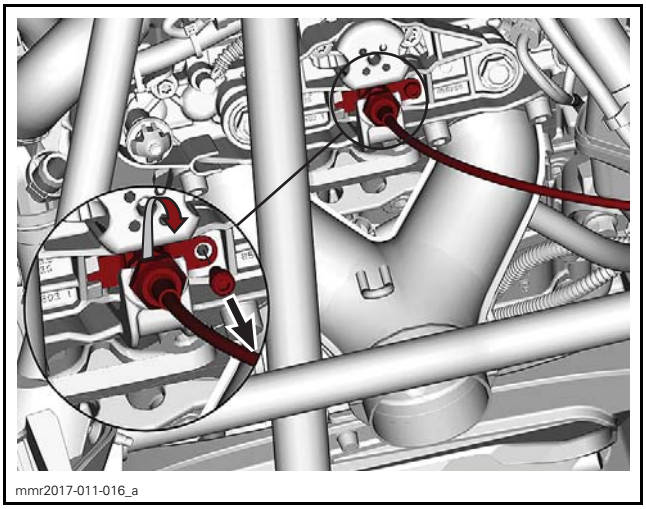
21. Detach the RAVE cable from the RAVE valve. Refer to *RAVE* subsection for proper procedure.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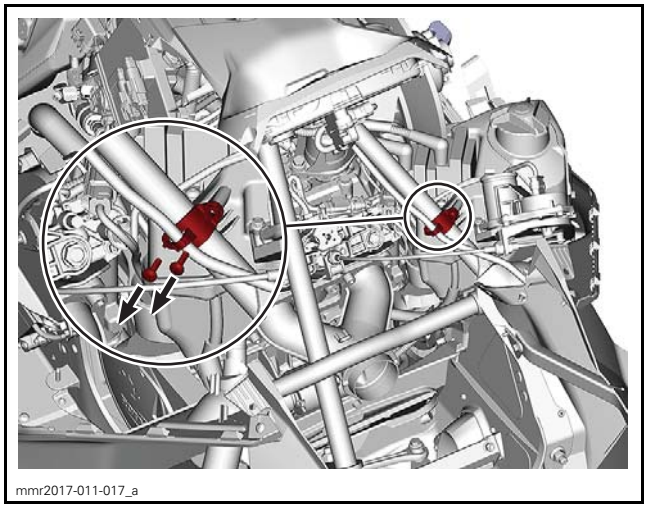
22. Unscrew the oil tank support.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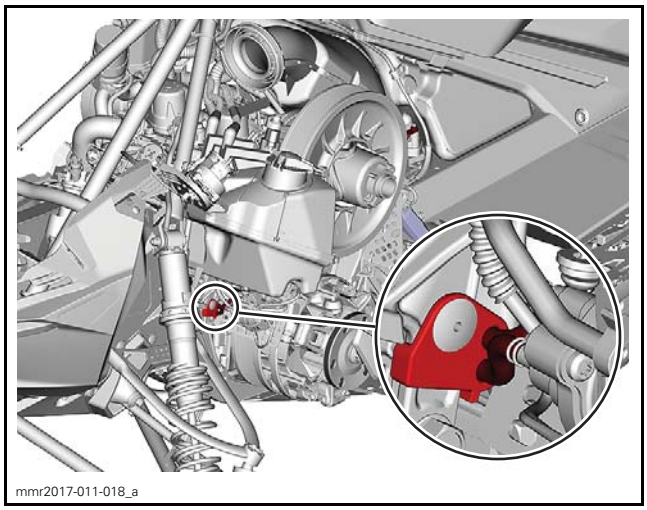
23. From underneath of the oil tank, detach both injection oil hoses from their support.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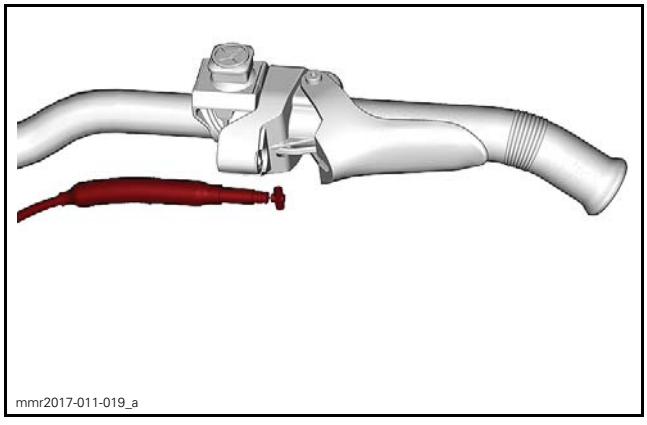
24. Detach the throttle cable from the throttle housing.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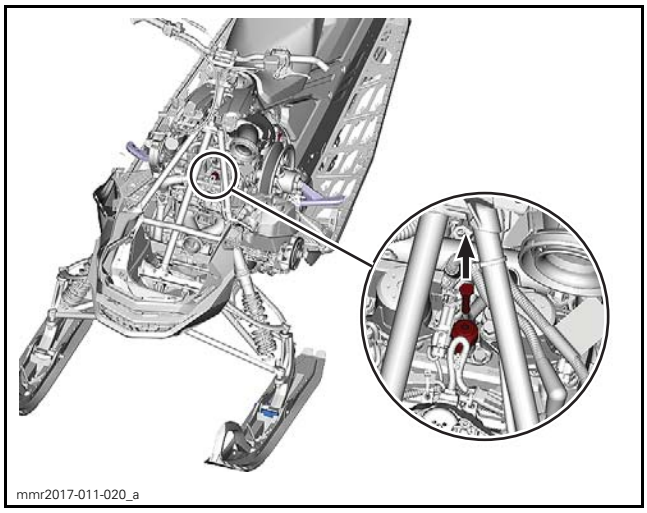
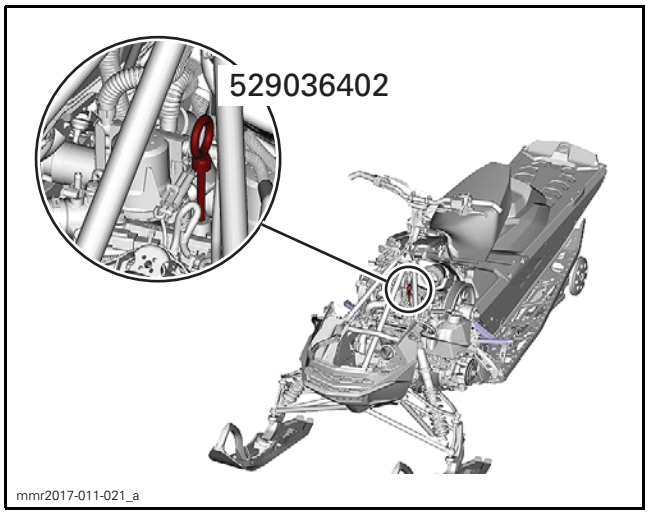
25. Remove the knock sensor from cylinder head cover.



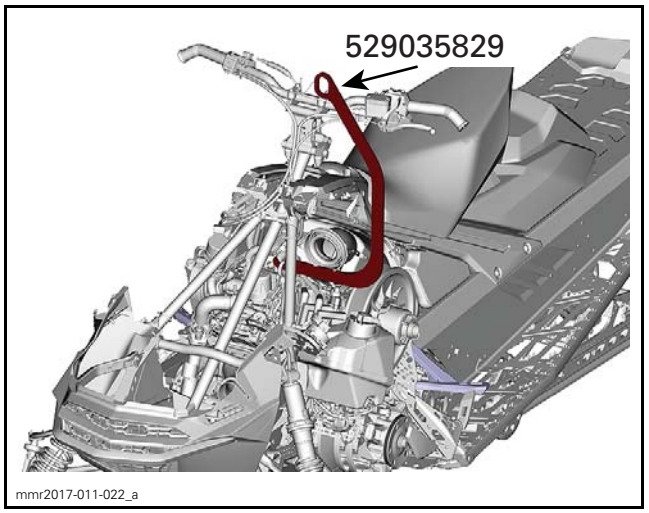
26. Install the engine lifting tool instead of knock sensor.

REQUIRED TOOL	
ENGINE LIFTING TOOL (P/N 529 036 402)	



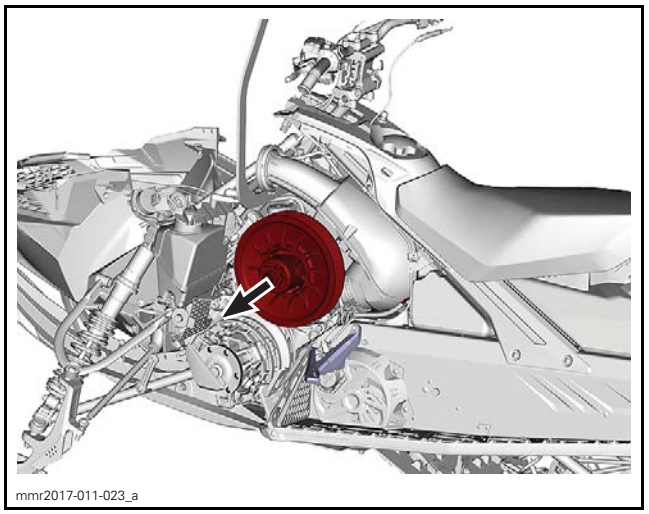
27. Install the engine lifting hook.

REQUIRED TOOL	
ENGINE LIFTING HOOK (P/N 529 035 829)	



28. Remove the driven pulley. Refer to appropriate *DRIVEN PULLEY AND COUNTERSHAFT* subsection.

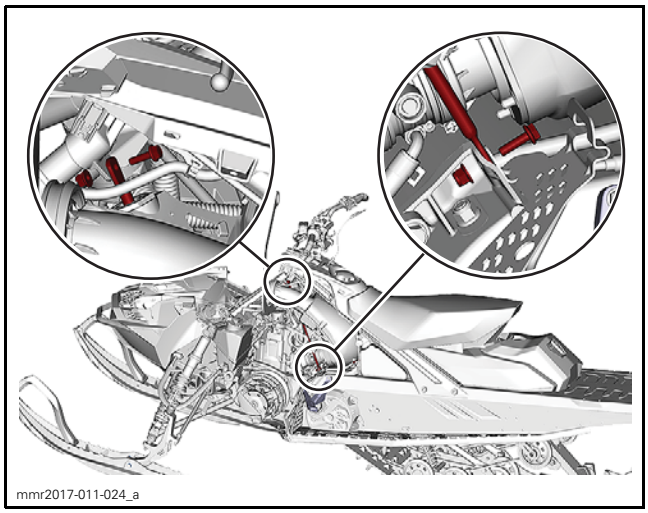
NOTE: If necessary, tap the upper gear retaining tool with a plastic hammer.



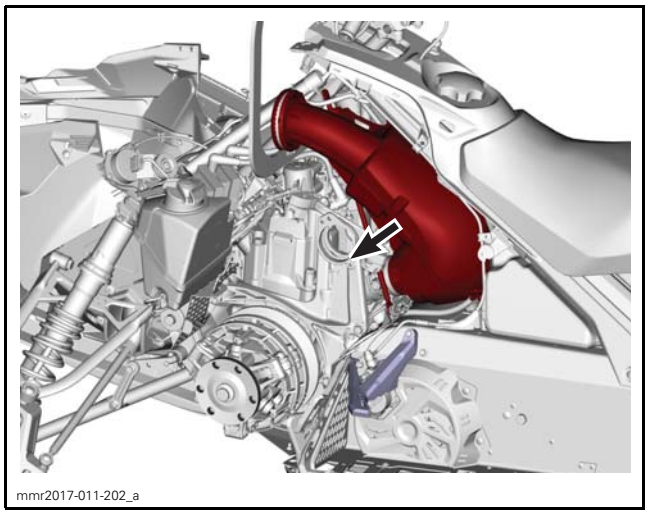
29. Unscrew countershaft from the upper gear retaining tool. **Do not** remove tool.

NOTE: While countershaft is removed from vehicle, the upper gear retaining tool maintains the drive chain and the upper gear in position inside chaincase.

30. On LH side, remove the steering brace.


mmr2017-011-024_a

31. Remove the primary air silencer. Refer to *AIR INTAKE SYSTEM* subsection.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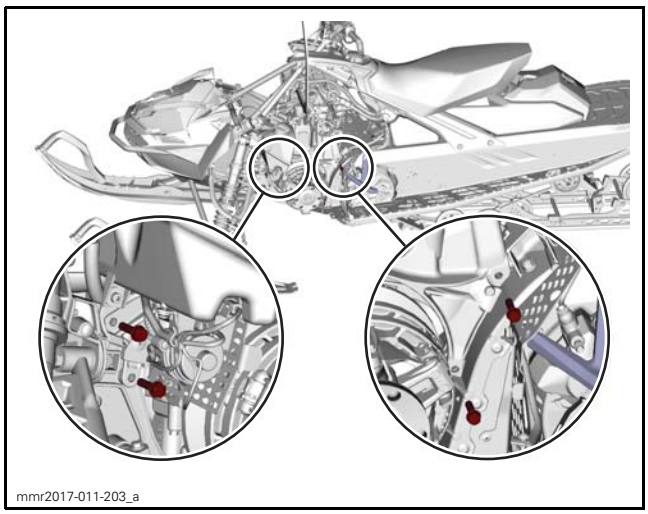
32. Remove engine support screws.


mmr2017-011-203_a

33. Lift engine and slide it out of vehicle.

Installing the Engine

To install engine, reverse the removal procedure. However, pay attention to the following.

- Install **NEW** self-locking fasteners (screw or nut) where required, refer to exploded views at the beginning of this subsection.
- When installing countershaft bearing support, refer to *FRAME* subsection for proper procedure.
- Install and tighten engine support bolts. Refer to *ENGINE SUPPORT INSTALLATION* in this subsection.
- If a new engine is installed or the engine was repaired, restart the break-in procedure using BUDS2.

ENGINE SUPPORT

Inspecting the Engine Support

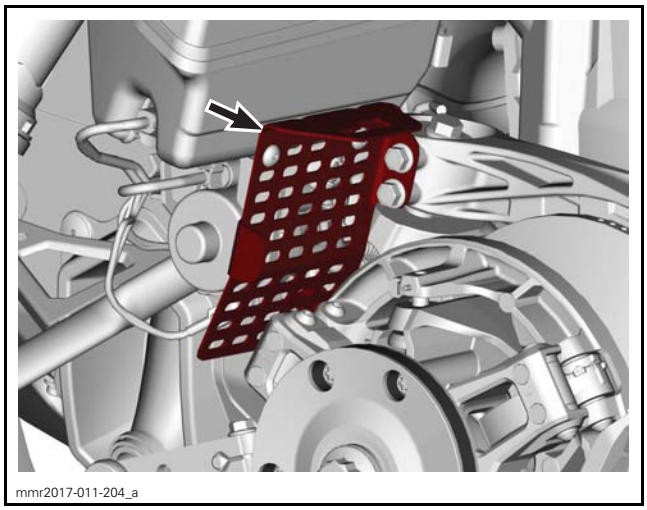
Check if engine supports are cracked, bent or damaged. Replace if necessary.

Replacing the PTO Side Engine Support

Remove the LH bottom pan. Refer to *BODY* subsection.

Remove driven pulley. Refer to appropriate *DRIVEN PULLEY AND COUNTERSHAFT* subsection.

Remove the injection oil tank support.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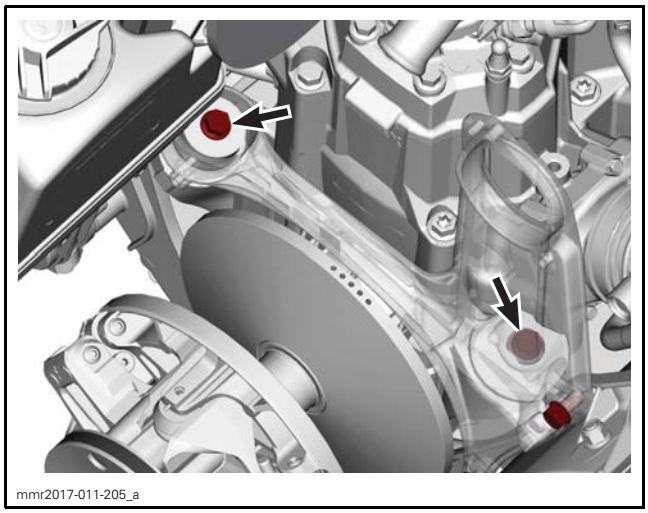
Place a piece of wood or any other appropriate tool under the engine to support it during engine support removal.

Remove screws securing engine support to rubber mount adapters.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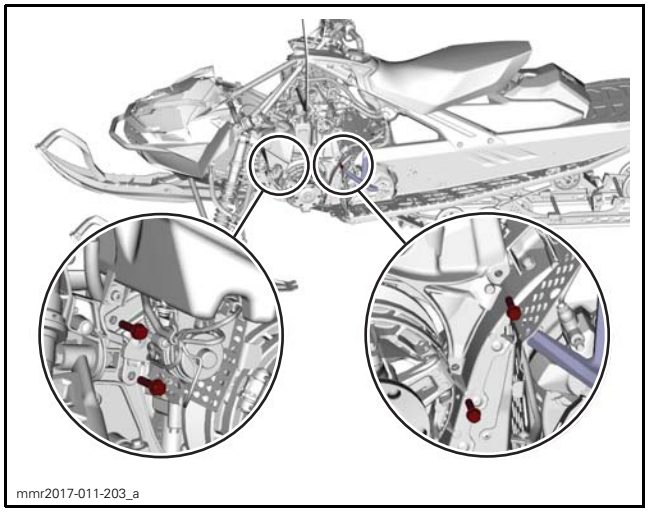
Remove engine support screws.


mmr2017-011-203_a

Remove engine support.

To install the engine support, reverse the removal procedure.

Tighten screws as per the specifications indicated in the exploded views.

Replacing the MAG Side Engine Support

Remove muffler and tuned pipe. Refer to *EXHAUST SYSTEM* subsection.

Place a piece of wood or any other appropriate tool under the engine to support it during engine support removal.

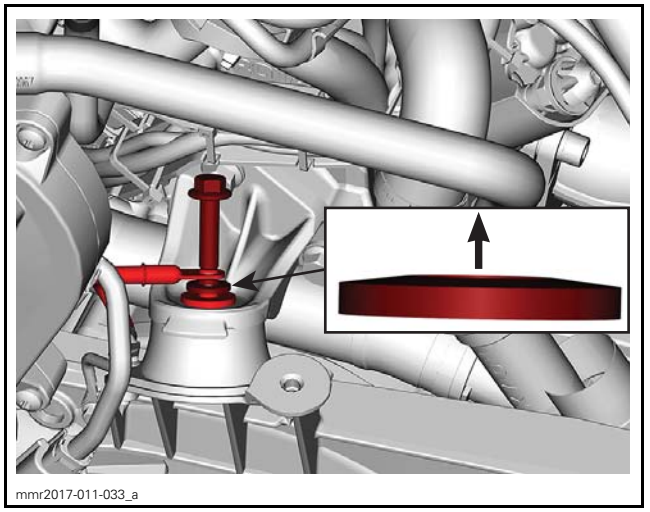
Remove screw securing engine support to rubber mount adapter.

Remove screw retaining engine support to engine.

Remove engine support.

To install the engine support, reverse the removal procedure.

Position the concave washer as shown.


mmr2017-011-033_a

SOME PARTS REMOVED FOR CLARITY

Tighten screws as per the specifications indicated in the exploded views.

ENGINE RUBBER MOUNTS

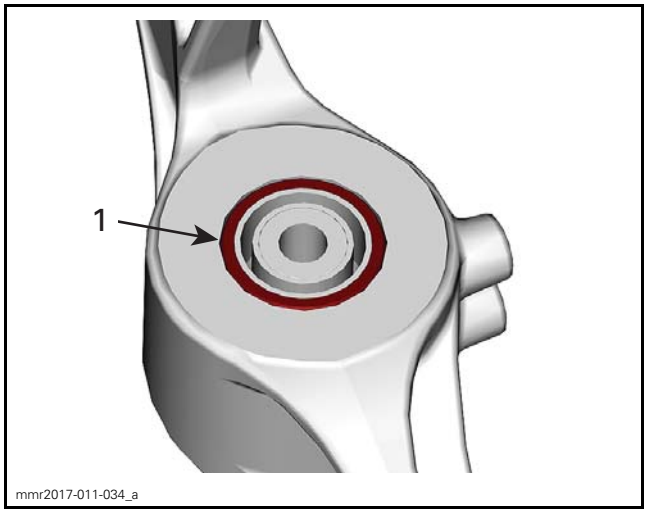
Inspecting the Engine Rubber Mount

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

Replacing the PTO Side Engine Rubber Mount

Remove the PTO side engine support. See procedure in this subsection.

Using a press, extract the engine rubber mount from the engine support.



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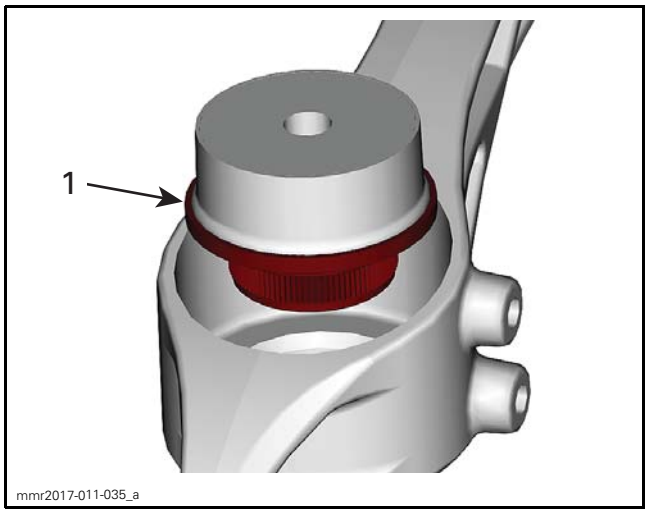
1. Press on this ring

Install the new engine rubber mount by pressing on the external metallic ring.



1. Press on this metallic ring

Replacing the MAG Side Engine Rubber Mount

Remove muffler and tuned pipe. Refer to *EXHAUST SYSTEM* subsection.

Place a piece of wood or any other appropriate tool under the engine to support it during engine support removal.

Remove screw securing engine support to rubber mount adapter.

Remove screw retaining rubber mount adapter to frame.

Remove rubber mount adapter.

To install the rubber mount adapter, reverse the removal procedure.

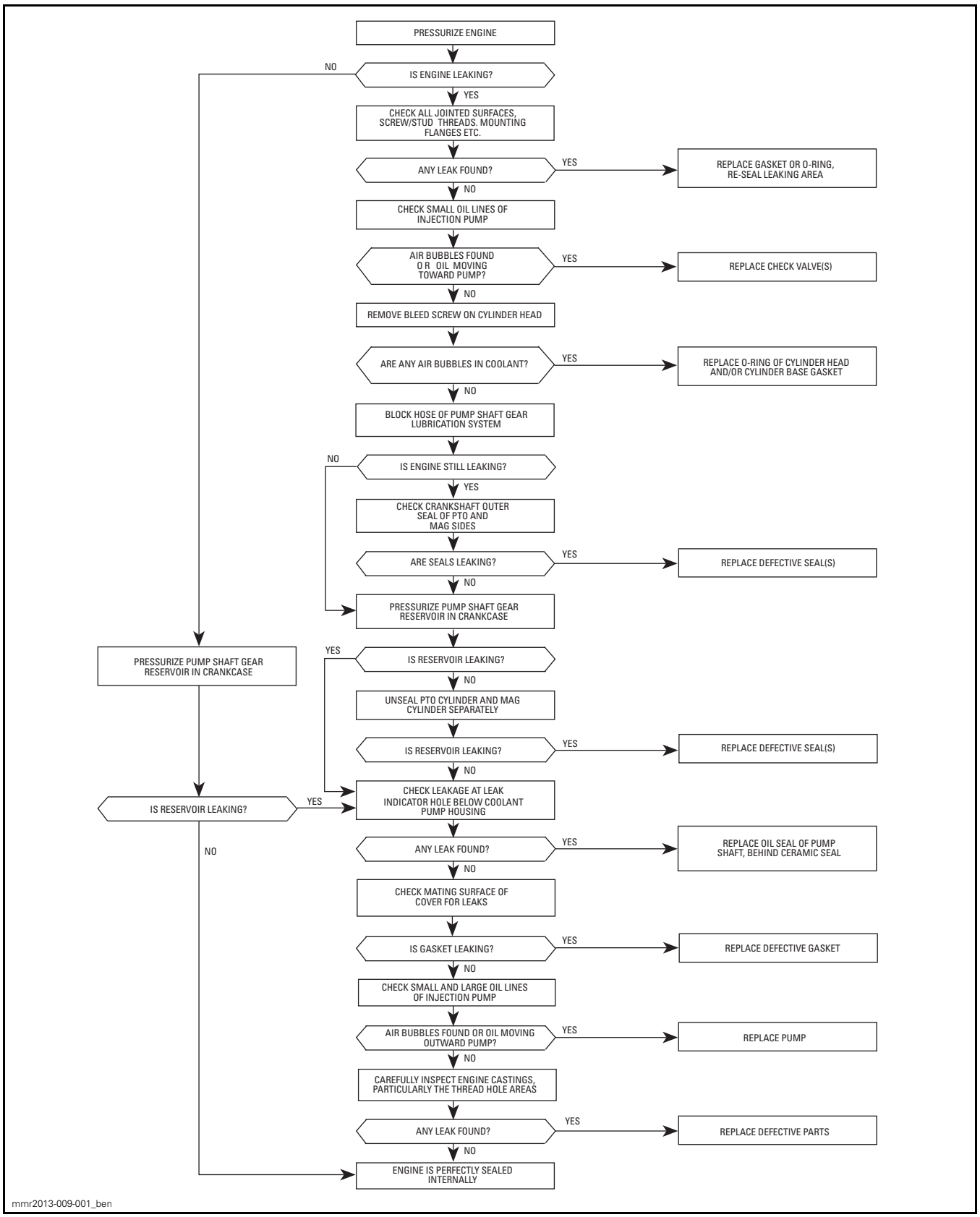
Tighten screws as per the specifications indicated in the exploded views.

ENGINE LEAK TEST

SERVICE TOOLS

PROCEDURES

NOTE: This flow chart must be used as a visual reference during the engine leak test procedure.

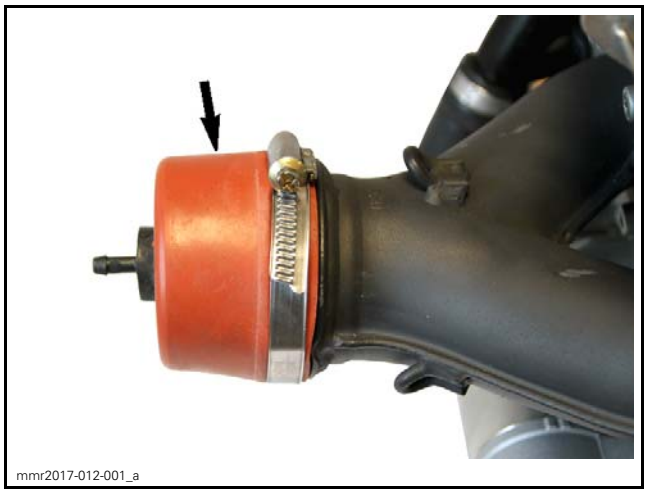


ENGINE LEAK TEST

Prior to take apart an engine, it is important to proceed with a leak test to diagnose engine problems. Whenever the engine is disassembled, a leak test should be performed after reassembly.

1. Remove engine. Do not remove the exhaust manifold. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
2. Remove throttle body, refer to *E-TEC DIRECT FUEL INJECTION* subsection.
3. Install appropriate plug over exhaust manifold and secure with a clamp.

REQUIRED TOOL	
MANIFOLD PLUG 63 MM (2-1/2") (P/N 529 035 961)	



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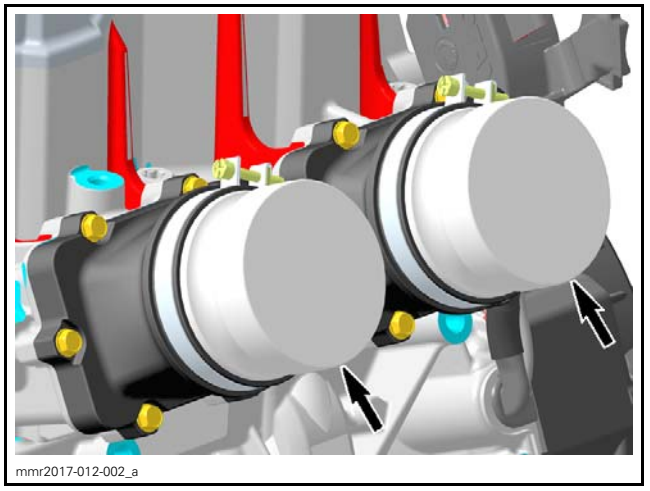
4. Insert an intake plug in each intake adapters.

REQUIRED TOOL	
INTAKE PLUGS (P/N 529 036 421)	

5. Tighten with existing clamps.



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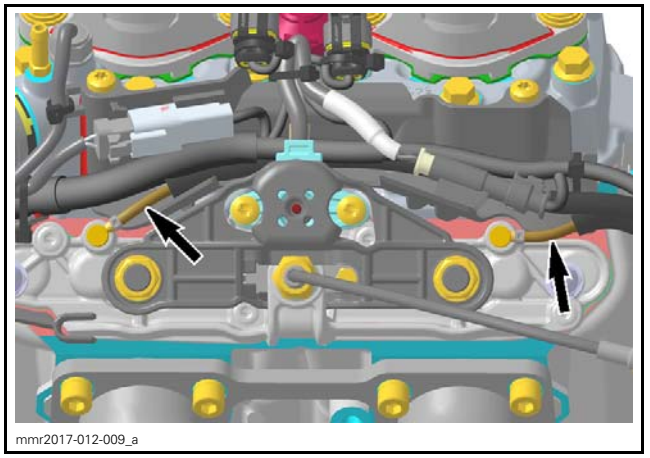
6. Block oil hoses connected to the oil pump:
   - 6.1 Partially remove corrugated tube from oil hoses.
   - 6.2 Install hose pincher right after check valve.

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



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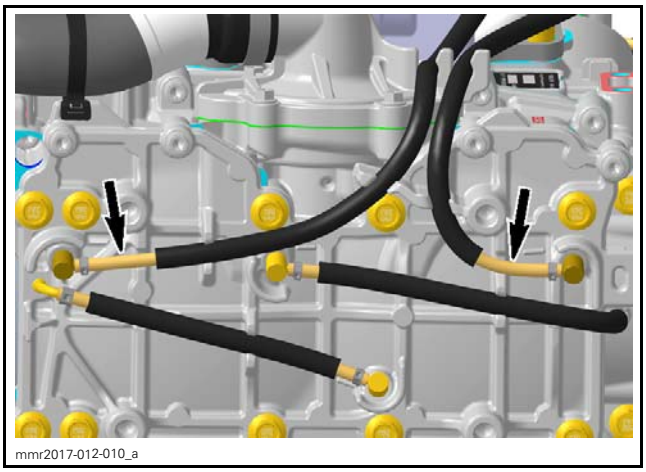
BLOCK OIL HOSES HERE

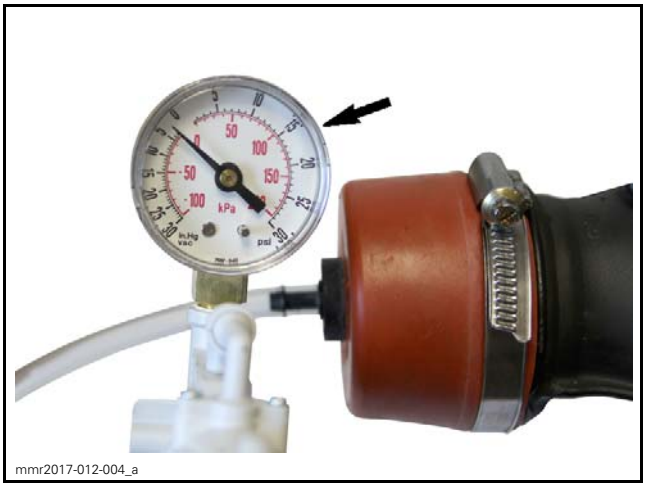

mmr2017-012-010_a

BLOCK OIL HOSES HERE

NOTICE Pay attention not to squeeze hose nipples.

7. Pressurize engine.

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


mmr2017-012-004_a

ENGINE LEAK TEST	
PRESSURE	TIME (WITHOUT PRESSURE DROP)
30 kPa (4.35 PSI)	3 minutes

NOTICE Do not exceed the specified pressure.

8. If pressure drops before 3 minutes, spray a soapy solution on tester kit (manifold and intake plugs, vacuum/pressure pump and its hose).
   - 8.1 If tester kit (manifold and intake plugs, hoses and pump) is leaking, bubbles will indicate where leak comes from.
   - 8.2 If tester kit is not leaking, check engine, see *ENGINE COMPONENTS TO BE VERIFIED*.

Engine Components to be Verified

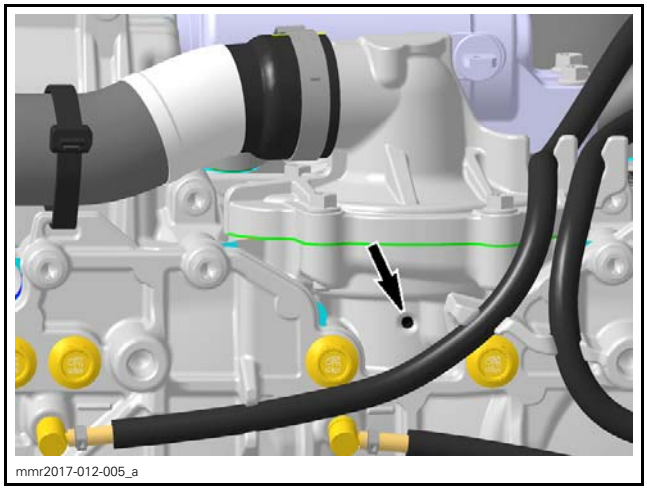
If air is escaping from engine check all jointed surfaces and screw or stud threads of engine:

- Spark plug base, insulator
- Cylinder head
- RAVE valve oil seals and housing
- Cylinder block
- Crankcase halves (joint)
- Crankshaft outer seals (PTO and MAG)
- Fuel injector gaskets
- Base plate gasket and base plate.

Troubleshooting Tips

Air bubbles in cooling system indicate a defective cylinder head O-ring or cylinder base gasket.

Check leak indicator hole for oil or coolant.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Leaking coolant indicates:

- A defective ceramic seal (on water pump side)
- Defective O-ring on bearing carrier, see *COOLING SYSTEM* subsection.

Leaking oil indicates:

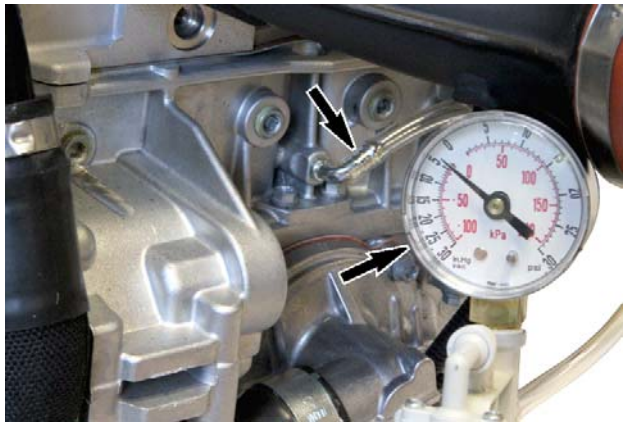
- A defective oil seal (behind ceramic seal)
- Defective O-ring on bearing carrier, see *COOLING SYSTEM* subsection.

PUMP SHAFT OIL GEAR RESERVOIR LEAK TEST

Install air pump on reservoir fitting and pressurize engine.

PUMP SHAFT OIL GEAR RESERVOIR LEAK TEST	
PRESSURE	TIME (WITHOUT PRESSURE DROP)
30 kPa (4.35 PSI)	3 minutes

NOTICE Do not exceed the specified pressure.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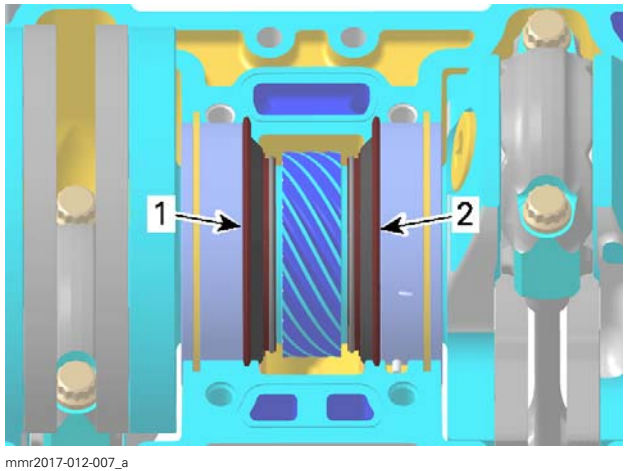
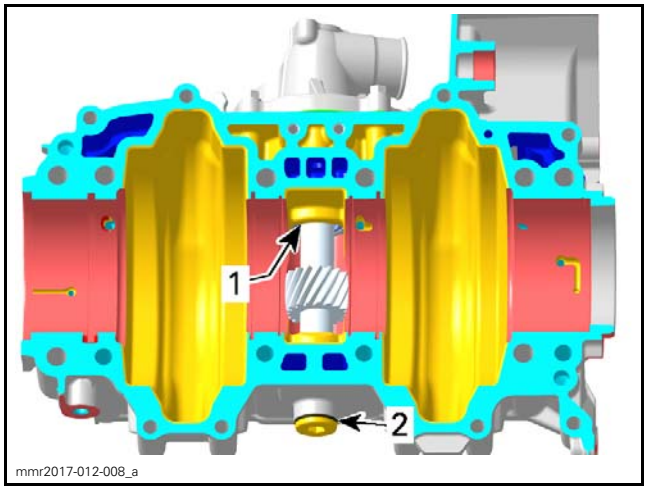
If pressure drops check for:
- Leaking plug screw gasket
- Defective O-ring on bearing carrier (see *COOLING SYSTEM* subsection)
- Defective oil seal on water pump side
- Defective crankshaft inner seal.



mmr2017-012-007_a

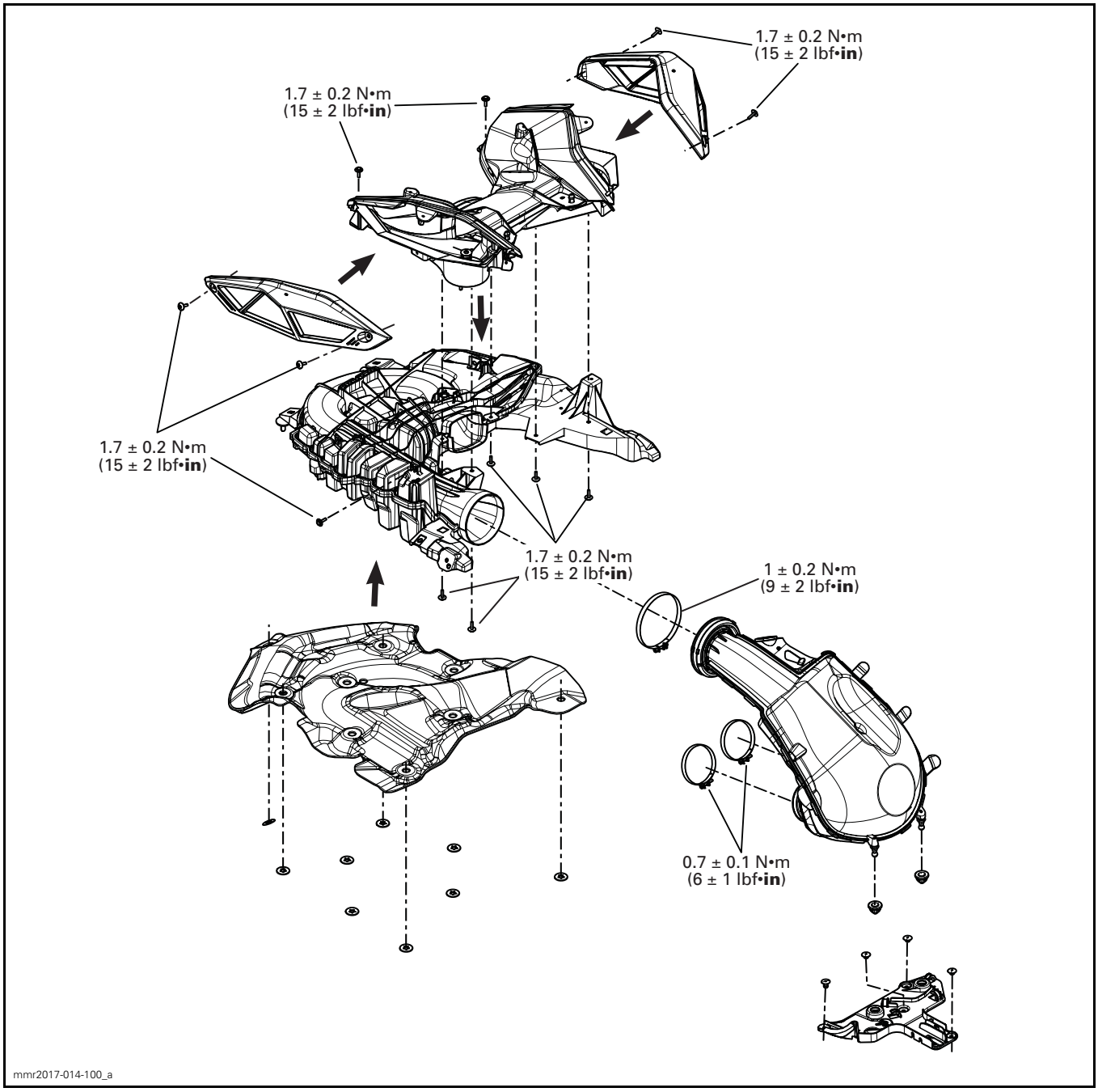
CRANKCASE INSIDE VIEW
1. *Leakage through inner seal on MAG side*
2. *Leakage through inner seal on PTO side*



mmr2017-012-008_a

CRANKCASE INSIDE VIEW
1. *Leakage through water pump oil seal (reservoir side)*
2. *Leakage on plug screw side (gasket)*

AIR INTAKE SYSTEM



GENERAL

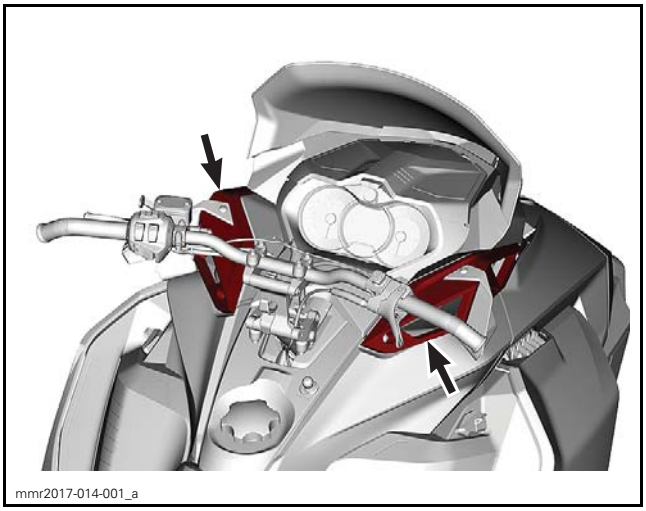
⚠ WARNING

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)



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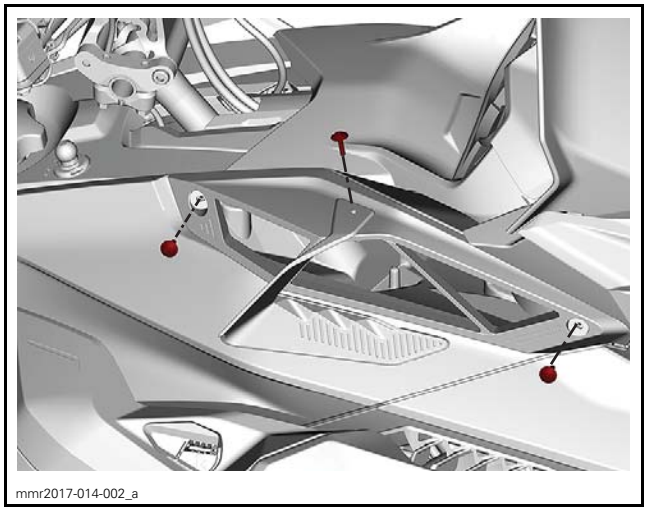
The same procedure applies for RH and LH side. Only one side is described in this procedure.

Removing the Air Filter

Remove screws from mesh filter housing.



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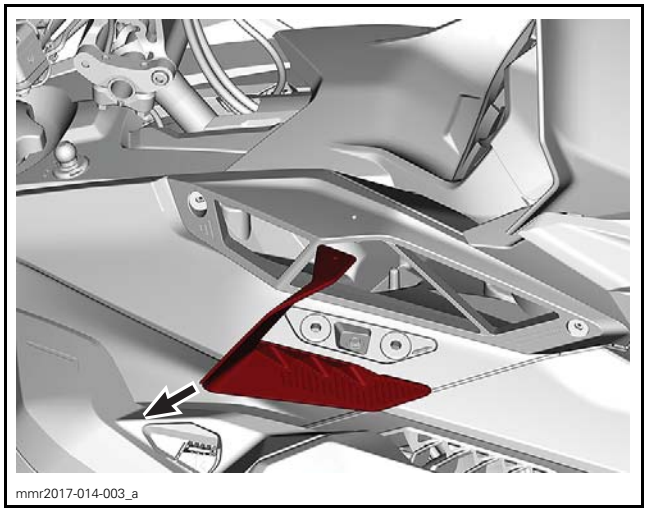
On some models, remove the air deflector.



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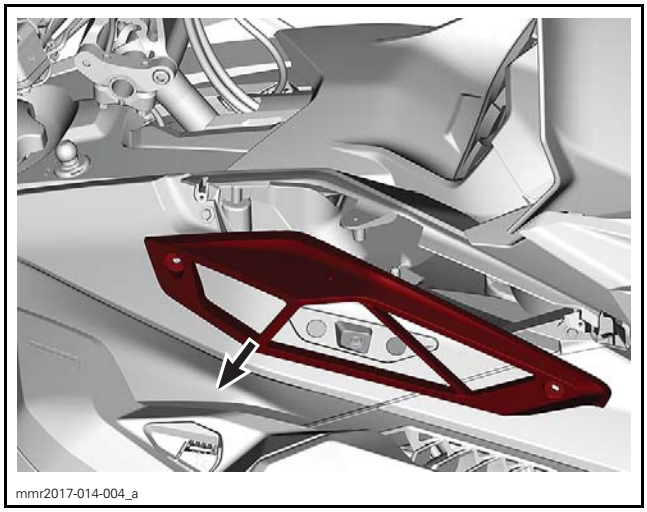
Remove the mesh filter housing from the upper body module.



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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.

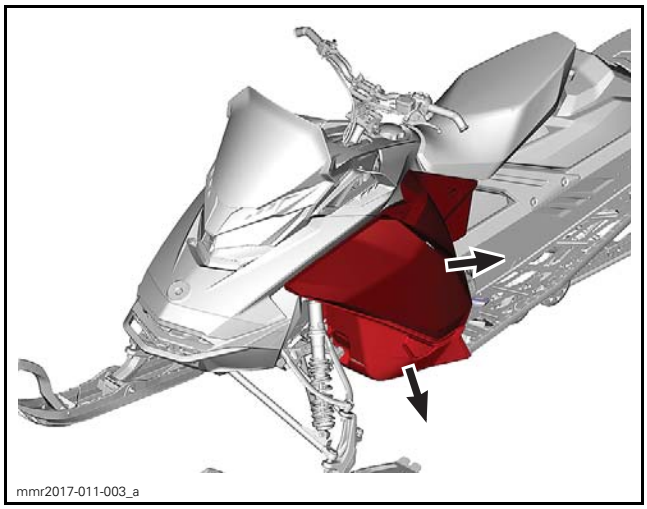
Installing the Air Filter

The installation is the reverse of the removal procedure.

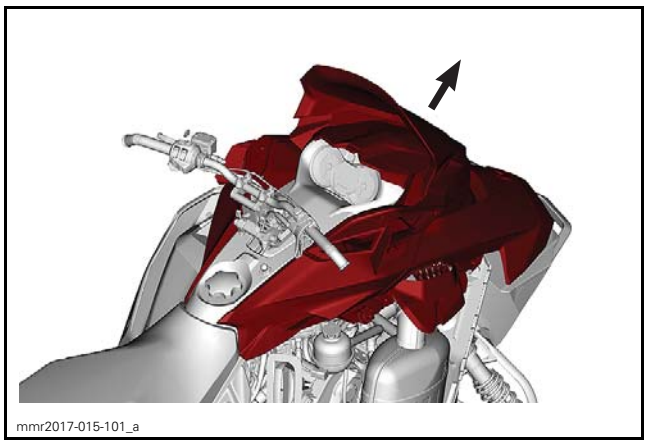
PRIMARY AIR INTAKE SILENCER

Removing the Primary Air Intake Silencer

1. Remove the following parts. If required, refer to *BODY* subsection.

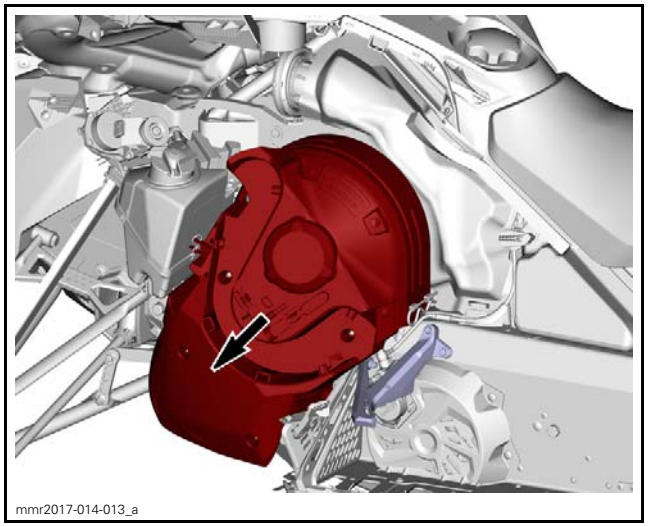


LH SIDE PANEL AND LH BOTTOM PAN

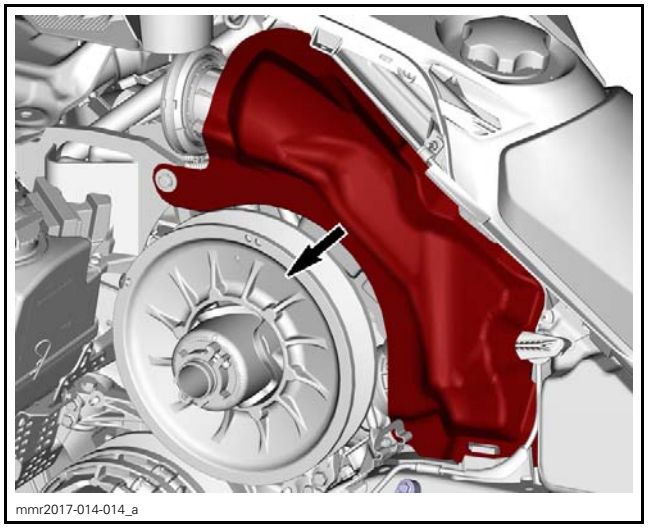


UPPER BODY MODULE

2. Remove the drive belt guard and acoustic panels.

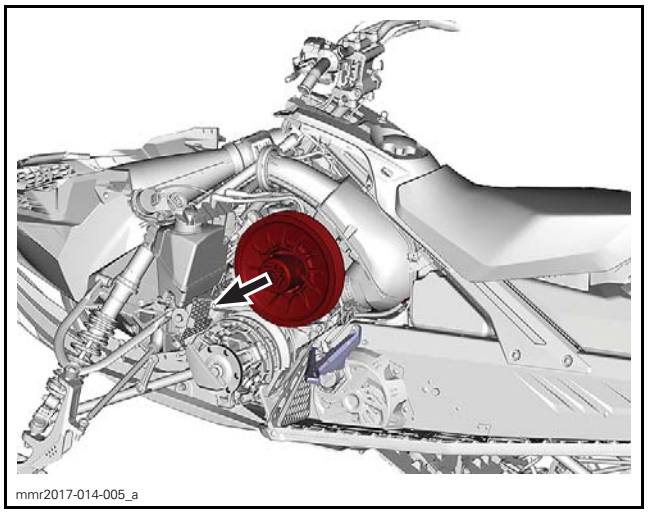


REMOVE DRIVE BELT GUARD

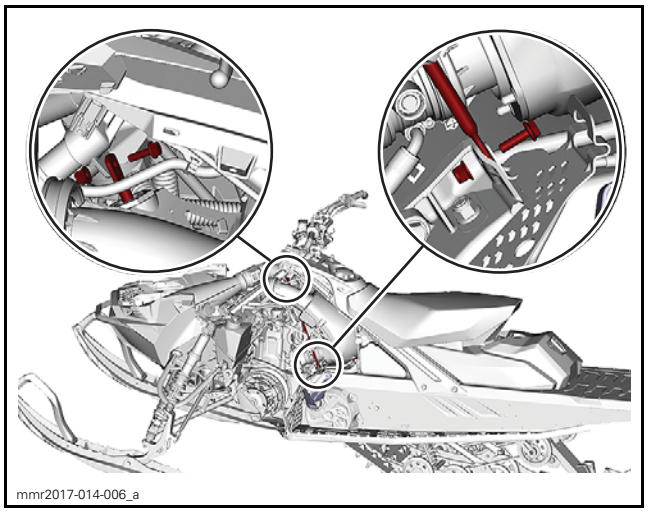


REMOVE ACOUSTIC PANEL

3. Remove the driven pulley. Refer to appropriate *DRIVEN PULLEY AND COUNTERSHAFT* subsection.



4. On LH side, remove the steering brace.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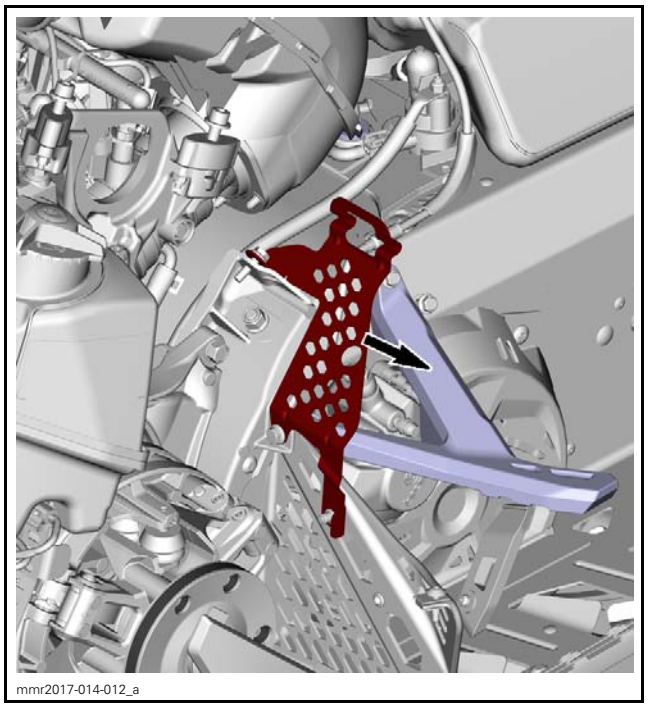
5. Remove the drive belt guard support.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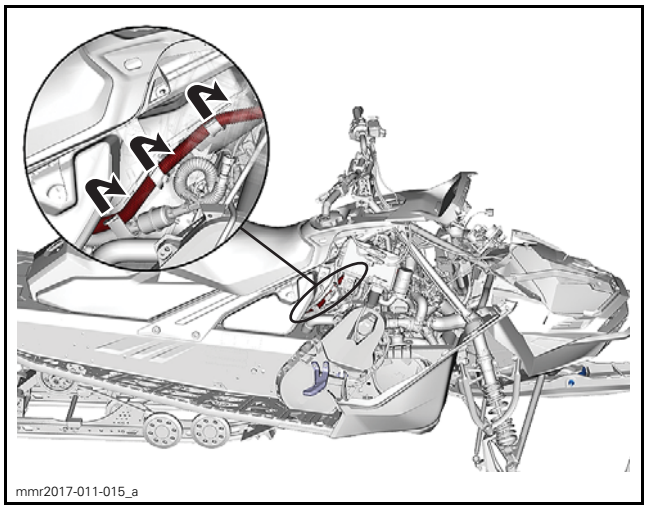
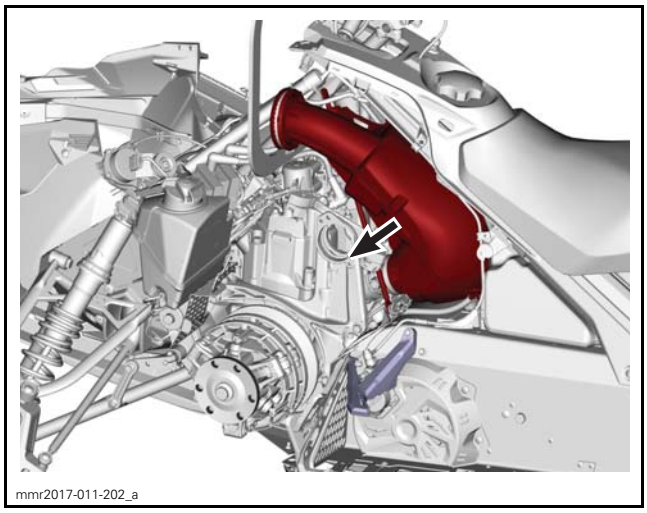
6. Unclip the fuel hose from the primary air silencer.


mmr2017-011-015_a

7. Remove the primary air silencer.
   - 7.1 Loosen clamps securing primary air silencer to intake adapters.
   - 7.2 Carefully pull out the primary air intake silencer with the steering brace.

NOTICE Make sure not touching the secondary injectors or their harnesses when removing the primary air intake silencer .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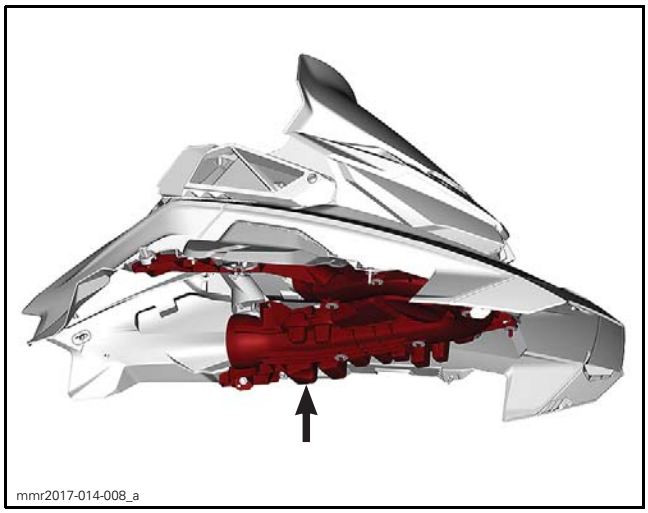
Installing the Primary Air Intake Silencer

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

Make sure primary air intake is properly insert in the intake adapters before applying the tightening torque.

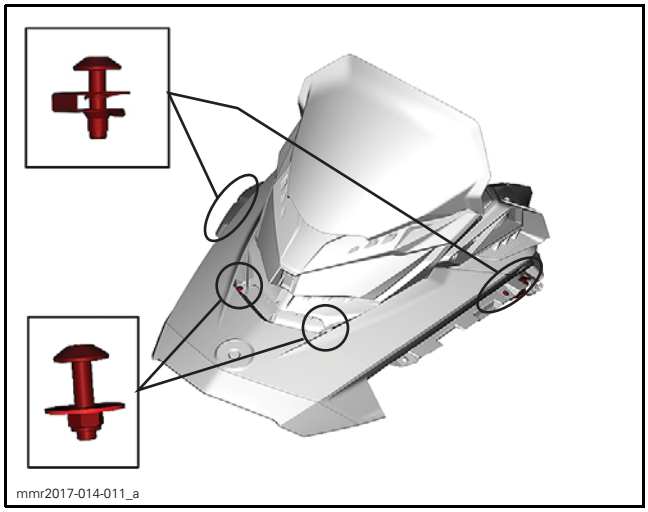
SECONDARY AIR INTAKE SILENCER



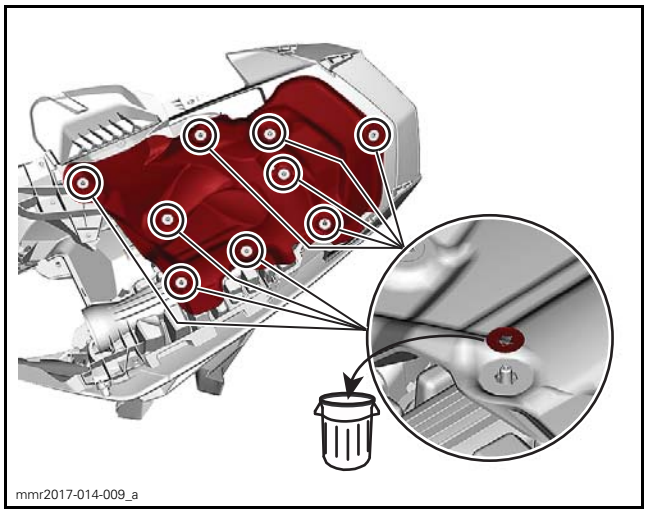
Removing the Secondary Air Intake Silencer

Referring to the *BODY* subsection, remove the upper body module.

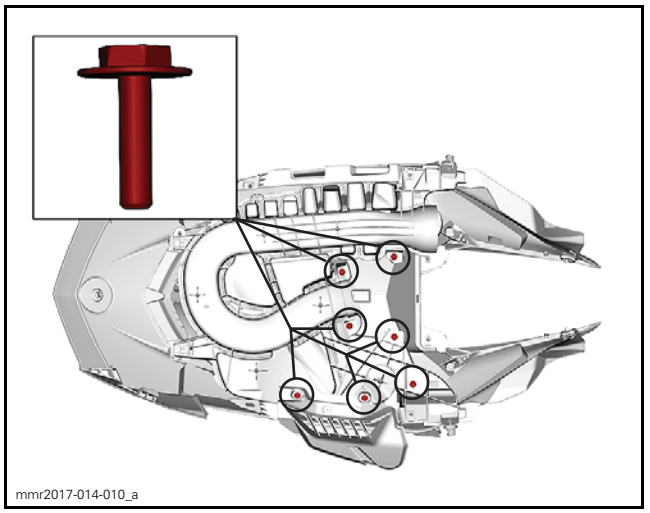
Remove the following screws.



Turn the upper body module upside down and remove the soundproofing panel.



Remove fasteners retaining secondary air intake silencer to upper body module.



Installing the Secondary Air Intake Silencer

The installation is the reverse of the removal procedure.

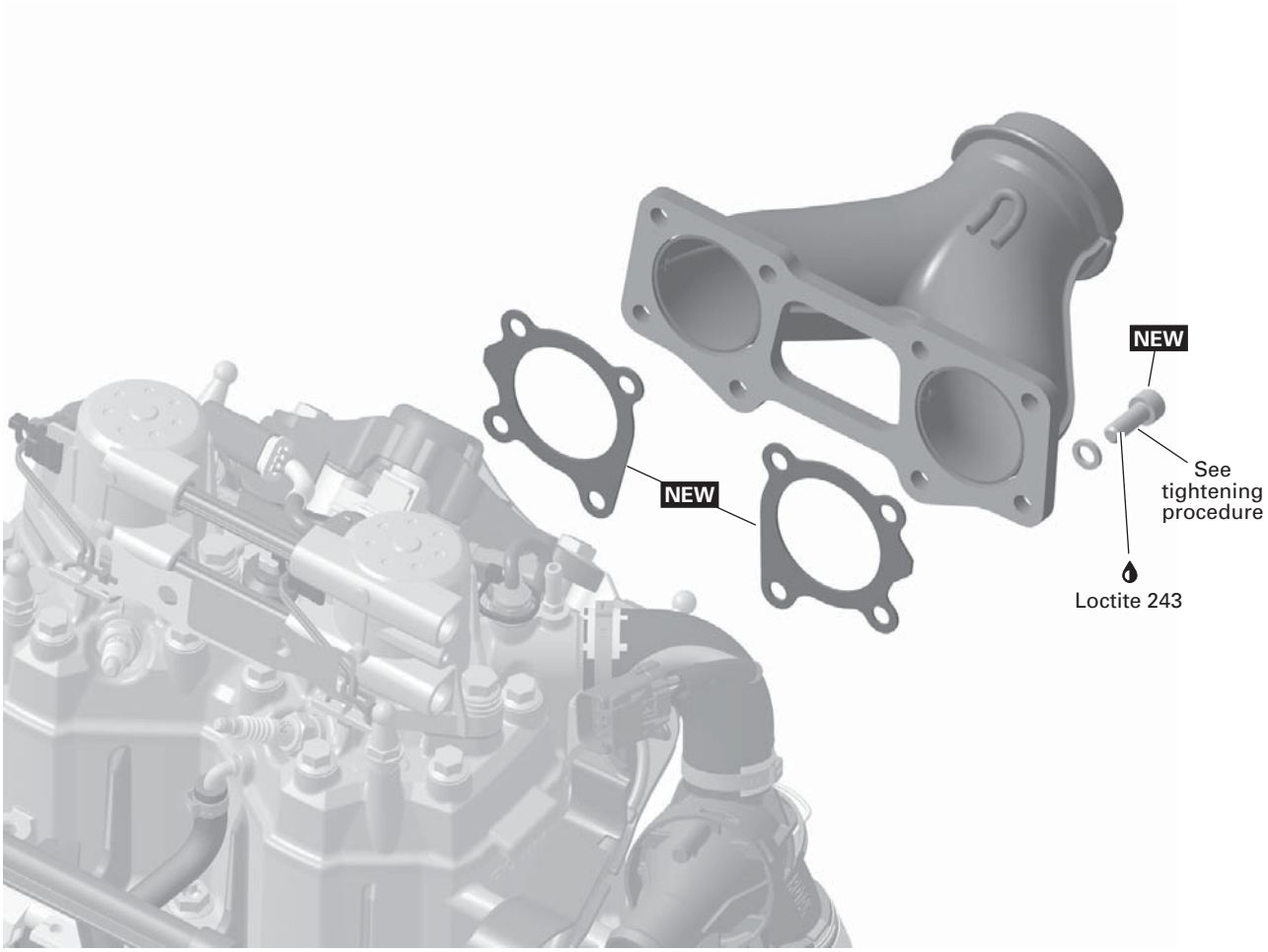
EXHAUST SYSTEM

SERVICE TOOLS

Description	Part Number	Page
SPRING INSTALLER/REMOVER	529 035 983	5, 7

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	9



NEW = Component must be replaced when removed.

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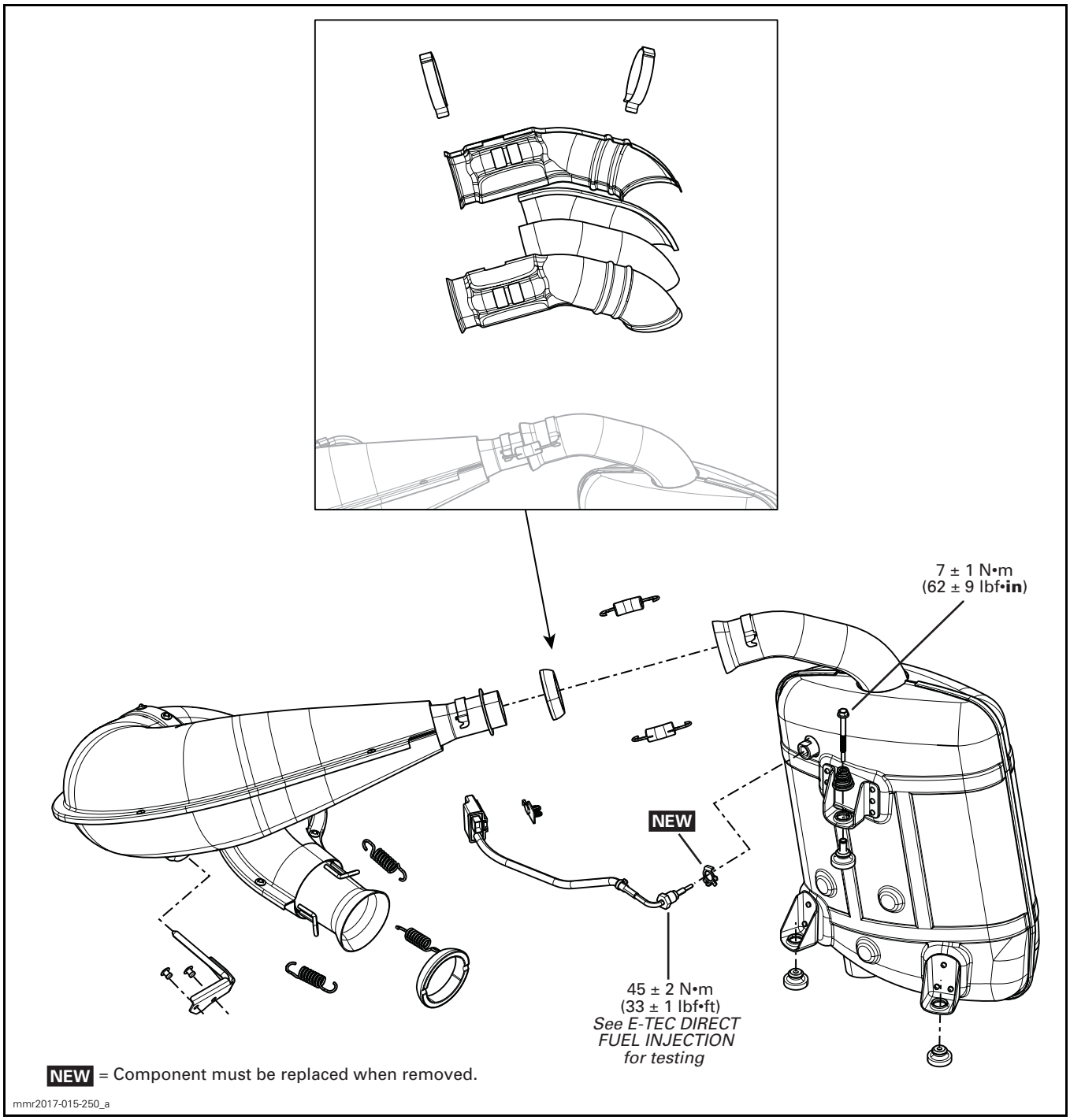
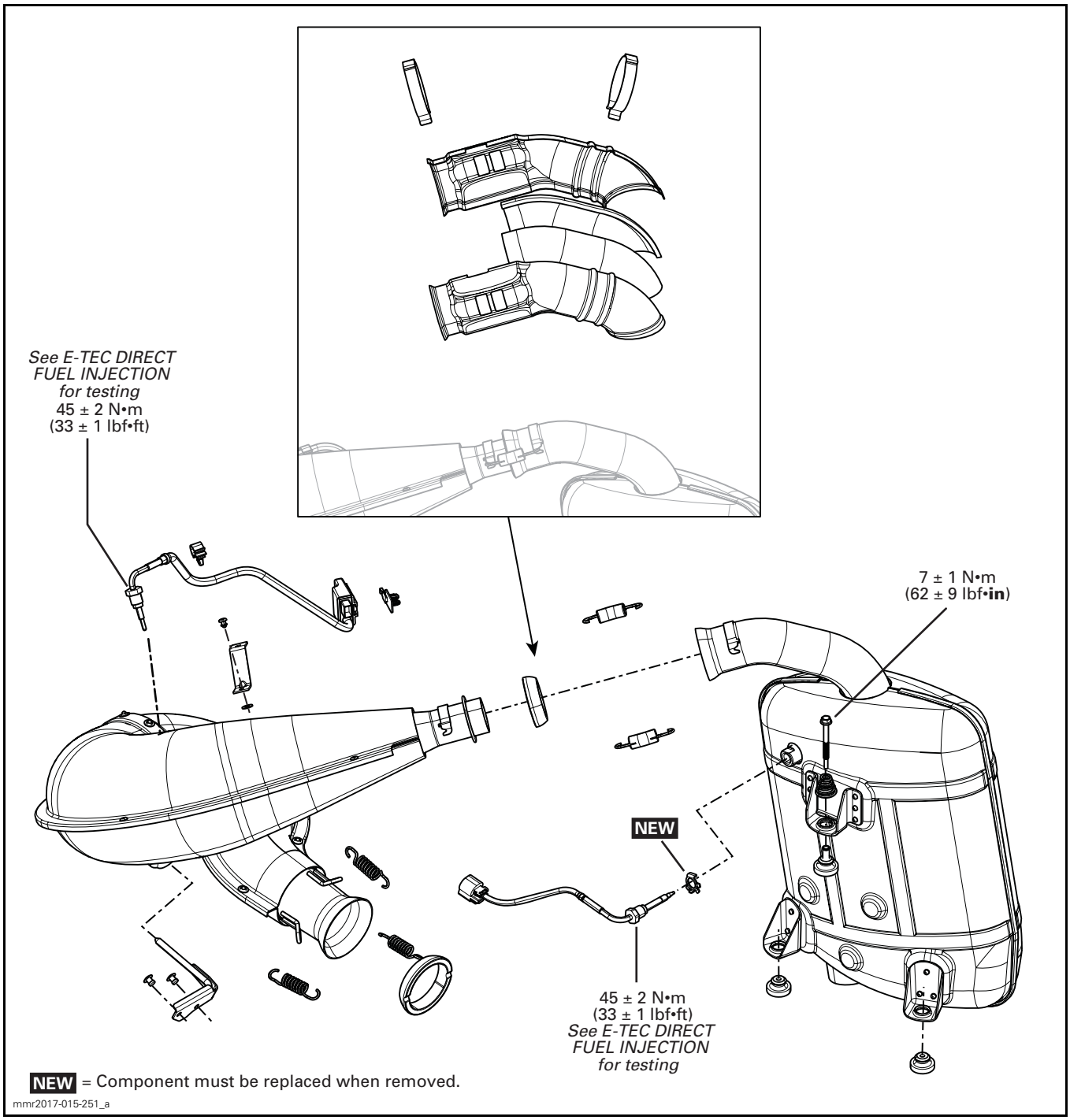
Models With One EGTS



Models With Two EGTS



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

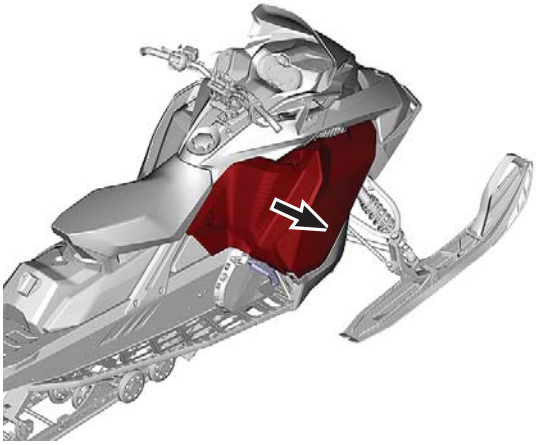
Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be replaced with new ones.

PROCEDURES

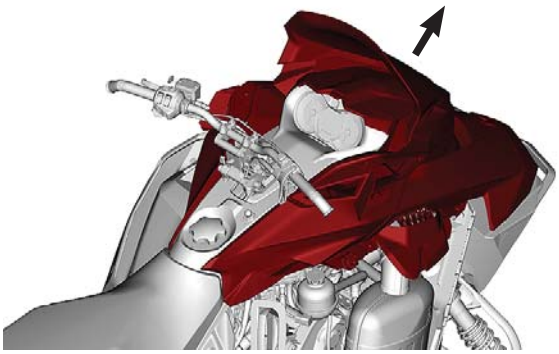
MUFFLER

Removing the Muffler

1. Refer to *BODY* subsection and remove the following parts.

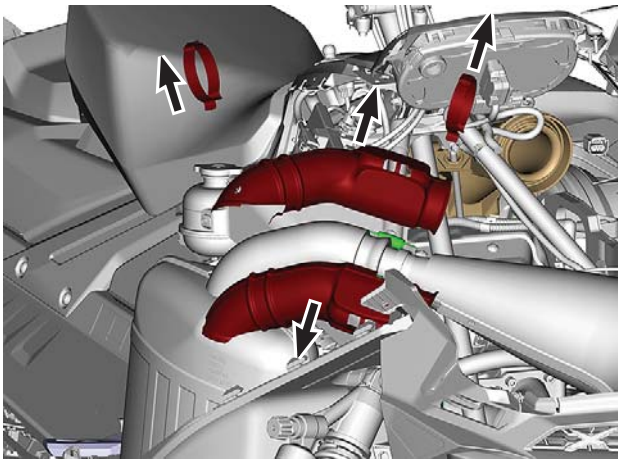


mmr2017-015-100_a



mmr2017-015-101_a

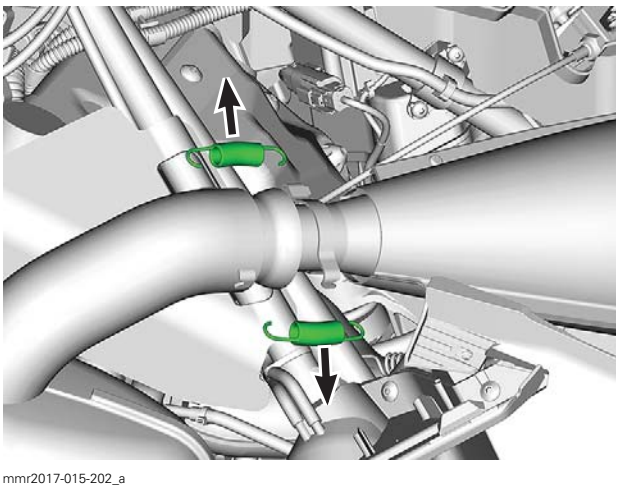
2. Remove heat shields from the muffler pipe.



mmr2017-015-201_a

3. Remove exhaust springs retaining the tuned pipe to the muffler.

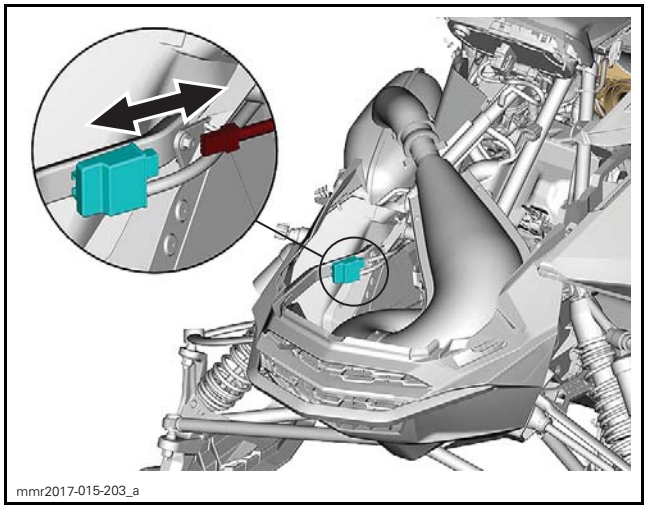
REQUIRED TOOL	
SPRING INSTALLER/REMOVER (P/N 529 035 983)	



mmr2017-015-202_a

Models With One EGTS

4. Disconnect the power harness from the thermocouple module (THCM)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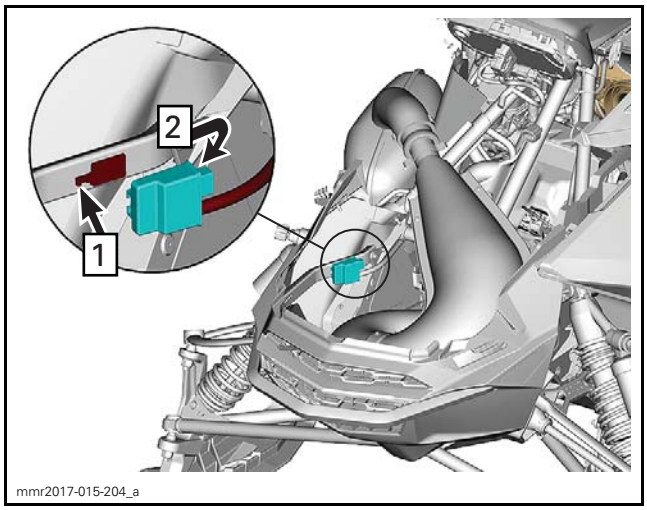
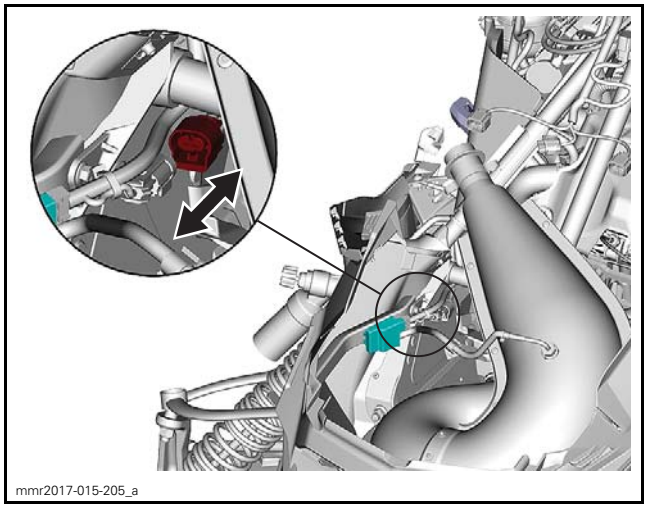
5. Detach the THCM module from the vehicle side member.



mmr2017-015-204_a

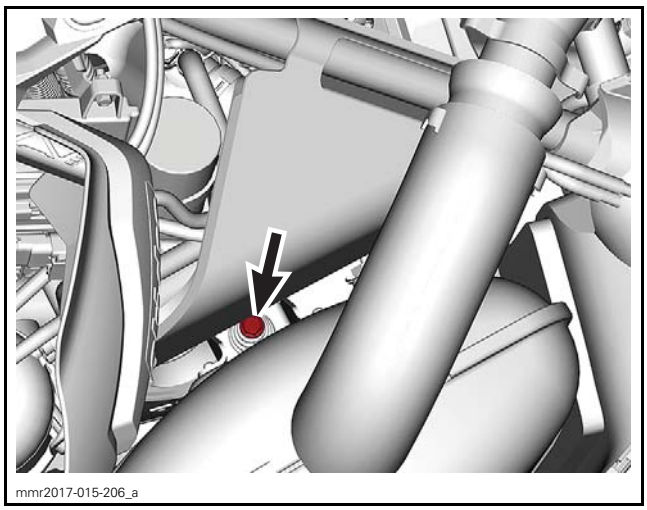
Models With Two EGTS

6. Disconnect the exhaust gas temperature sensor (EGTSm) from the THCM module harness.

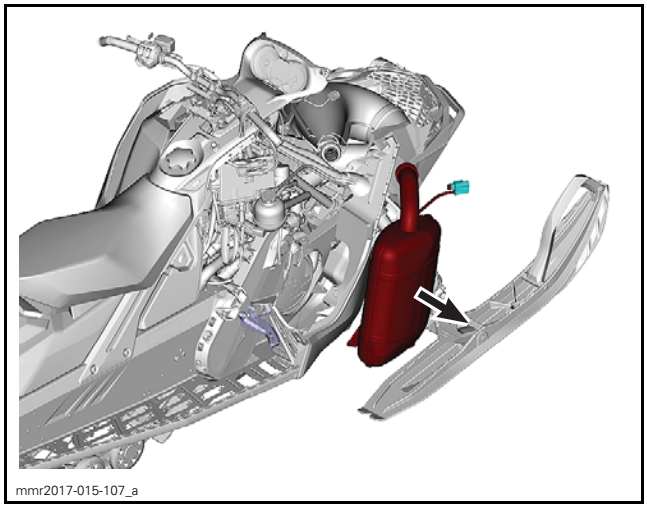

mmr2017-015-205_a

All Models

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


mmr2017-015-206_a

8. Remove the muffler.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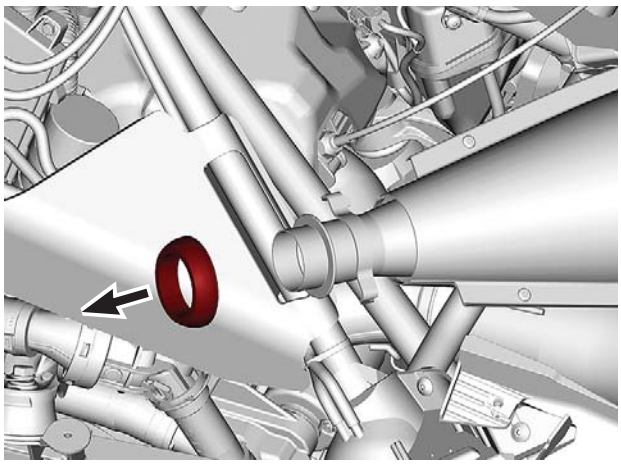
9. Remove exhaust gasket.


mmr2017-015-207_a

Inspecting the Muffler

Check the muffler for cracks or other damages.

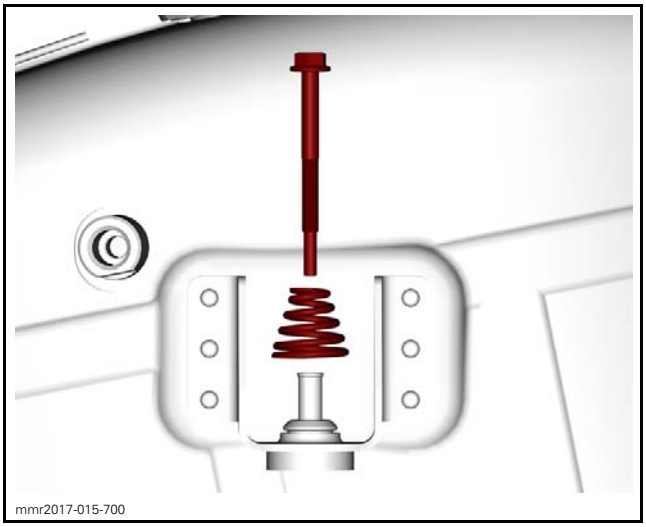
Check grommet condition.

Inspect exhaust gasket condition. Replace as required.

Installing the Muffler

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

Muffler Retaining Screw


mmr2017-015-700

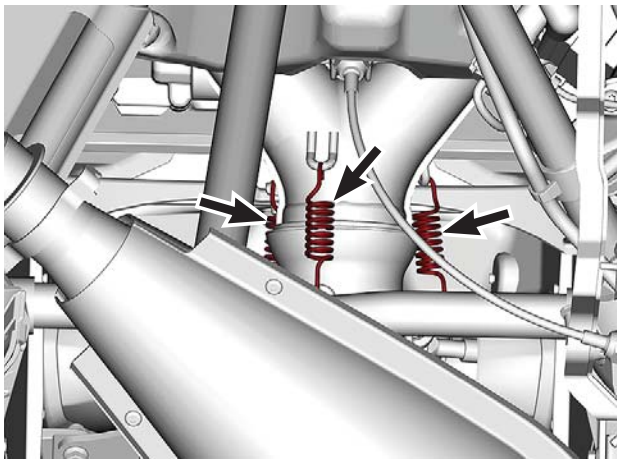
TIGHTENING TORQUE	
Muffler retaining screw	7 N•m ± 1 N•m (62 lbf•**in** ± 9 lbf•**in**)

TUNED PIPE

Removing the Tuned Pipe

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

REQUIRED TOOL	
SPRING INSTALLER/REMOVER (P/N 529 035 983)	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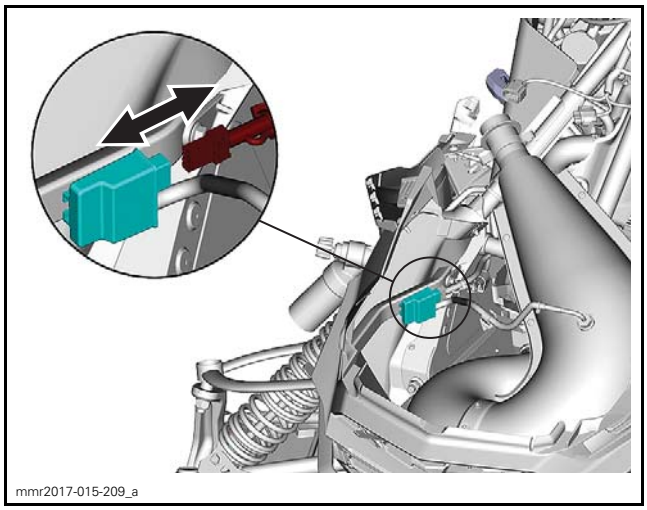
Models With 2 EGTS

3. Disconnect the THCM harness from the THCM module.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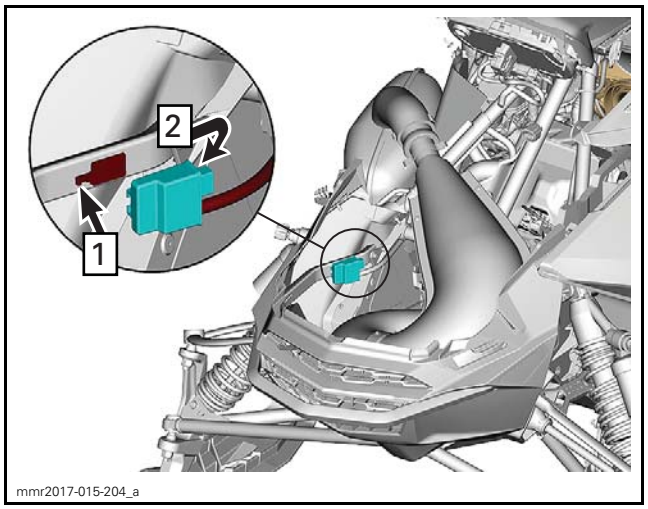
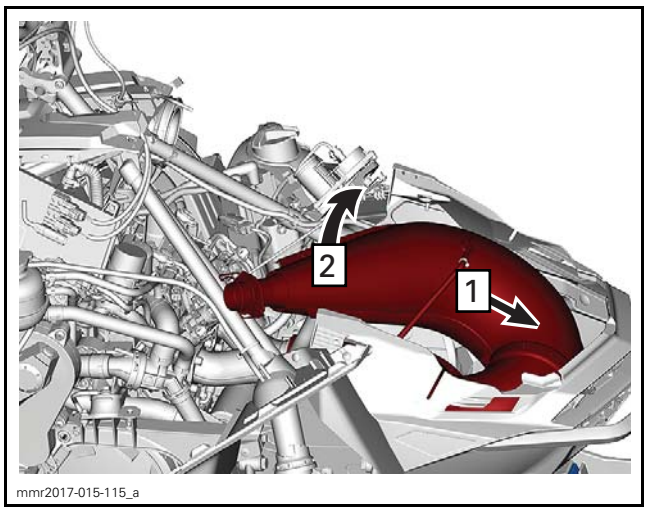
4. Detach the THCM module from the vehicle side member.

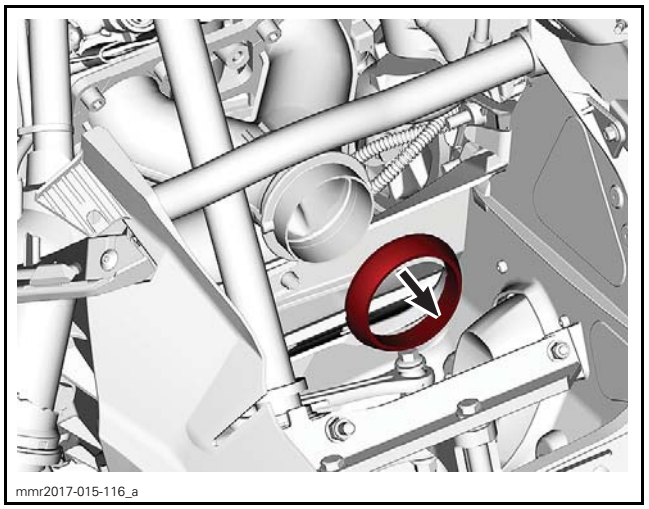


All Models

5. Remove tuned pipe.
   5.1 Move tuned pipe forwards until the hook gets out of the anti vibration rubber mount.
   5.2 Remove the tuned pipe by tilting it (engine side).



6. Remove exhaust gasket.



Inspecting the Tuned Pipe

Check exhaust pipe for:
– Damages
– Cracks.

Inspect exhaust gasket condition. Replace as required.

Installing the Tuned Pipe

For installation, reverse the removal procedure.

EXHAUST MANIFOLD

Removing the Exhaust Manifold

1. Remove tuned pipe. Refer to *REMOVING THE TUNED PIPE* in this subsection.
2. Remove:
   – Exhaust manifold screws (discard them)
   – Washers.

REQUIRED TOOL	
Allen spherical socket	

NOTICE Heat screws for 30 seconds before loosening to prevent screw breakage.

3. Remove:
   – Exhaust manifold
   – Gaskets (discard them).

Inspecting the Exhaust Manifold

Check if manifold is cracked or damaged. Replace if necessary.

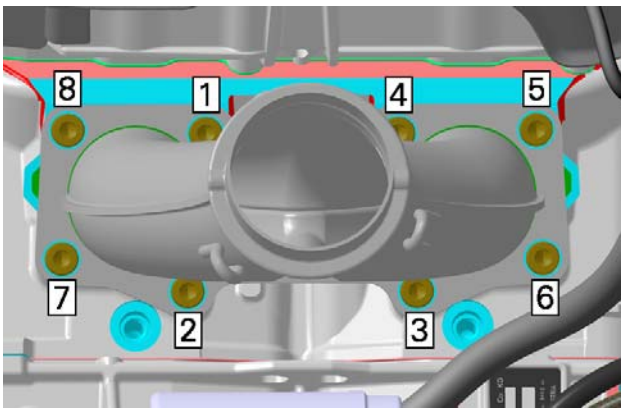
Installing the Exhaust Manifold

1. Install manifold with new gaskets.

2. Install new exhaust manifold screws with LOCTITE 243 (BLUE) (P/N 293 800 060) as per the following tightening sequence and procedure.
3. Tighten exhaust manifold screws to specification using the following pattern.

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

NOTE: Perform step A on all manifold screws before proceeding with step B.



TIGHTENING SEQUENCE

TIGHTENING PROCEDURE		
Exhaust manifold screws	Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
	Step A	7 N•m ± 0.5 N•m (62 lbf•**in** ± 4 lbf•**in**)
	Step B	34 N•m ± 4 N•m (25 lbf•ft ± 3 lbf•ft)

4. Install tuned pipe as the reverse of removal.

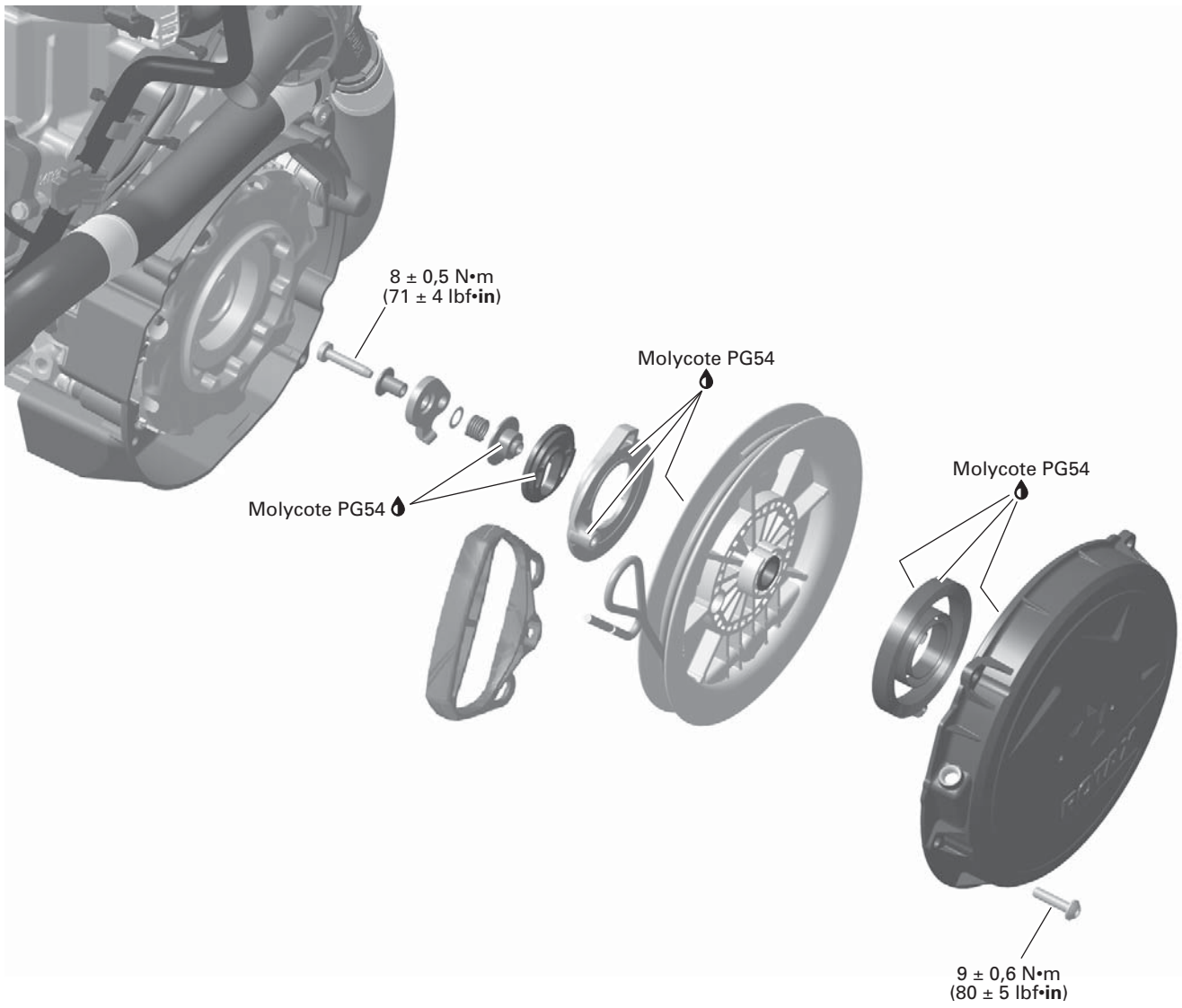
REWIND STARTER

SERVICE TOOLS

Description	Part Number	Page
SMALL HOSE PINCHER	295 000 076	3, 9

SERVICE PRODUCTS

Description	Part Number	Page
MOLYKOTE PG 54	420 899 763	6


8 ± 0,5 N•m
(71 ± 4 lbf•in)
Molycote PG54
Molycote PG54
Molycote PG54
9 ± 0,6 N•m
(80 ± 5 lbf•in)
mmr2017-016-001_a

INSPECTION

Due to dust accumulation, rewind starter must be periodically cleaned, inspected and lubricated. Refer to *MAINTENANCE* section.

NOTICE **It is of the utmost importance that the rewind starter spring is lubricated periodically using specific lubricant. Otherwise, rewind starter component life will be shortened and/or rewind starter will not operate properly under very cold temperatures.**

Check if starter rope is fraying, replace if necessary.

When pulling starter handle, starter mechanism must engage within 10 cm (3.94 in) of rope pull length. If not, disassemble rewind starter, clean and check for damaged plastic parts. Replace as required, lubricate, reassemble and recheck.

When releasing starter handle, it must return to its stopper and stay against it. If not, check for proper spring preload or damage. Readjust or replace as required.

When pulling starter handle 10 times in a row, it must return freely. If not, check for damaged parts or lack of lubrication. Replace parts or lubricate accordingly.

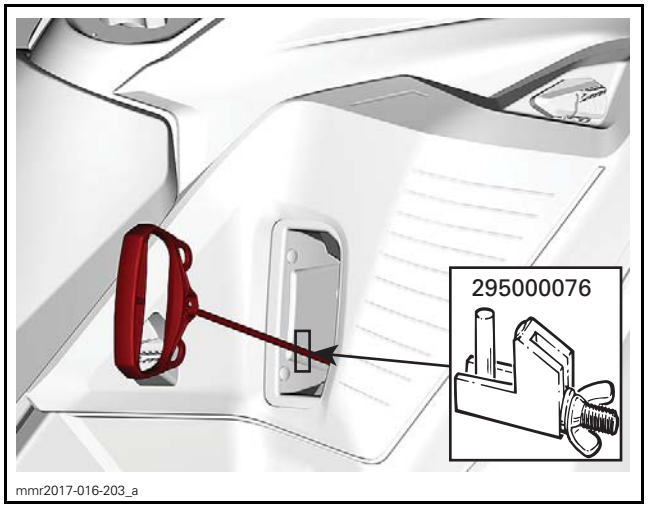
PROCEDURES

REWIND STARTER HANDLE

Removing the Rewind Starter Handle

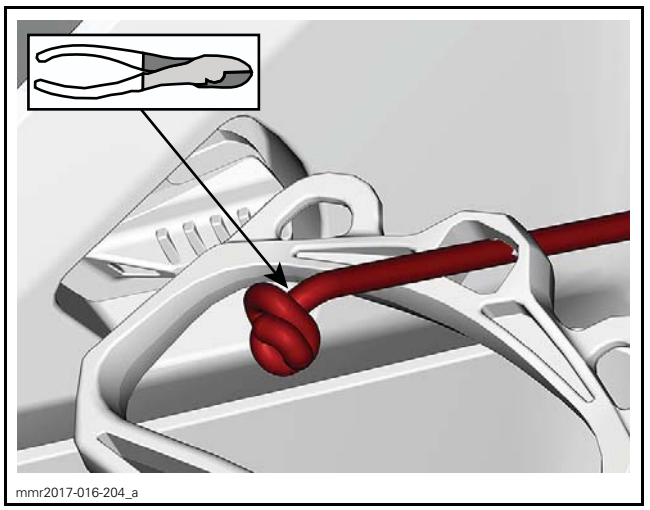
Pull out starter handle/rope for 50 cm (20 in) approximately and lock rope near rewind starter.

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



Using a small screwdriver, extract rope knot from stater handle.

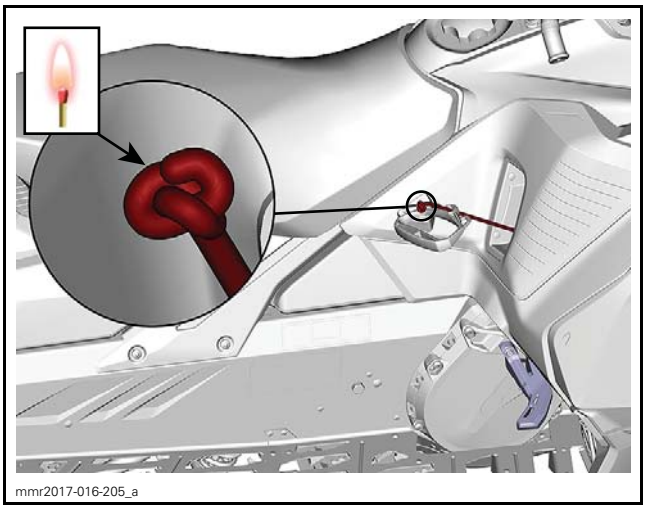
Cut rope close to knot.



Installing the Rewind Starter Handle

Before installing starter handle on the rope, it is necessary to fuse the rope end with a lit match. Pass rope through starter handle and tie a knot on the rope end.

Fuse the knot with a lit match then insert rope end down and pull the starter handle over the knot.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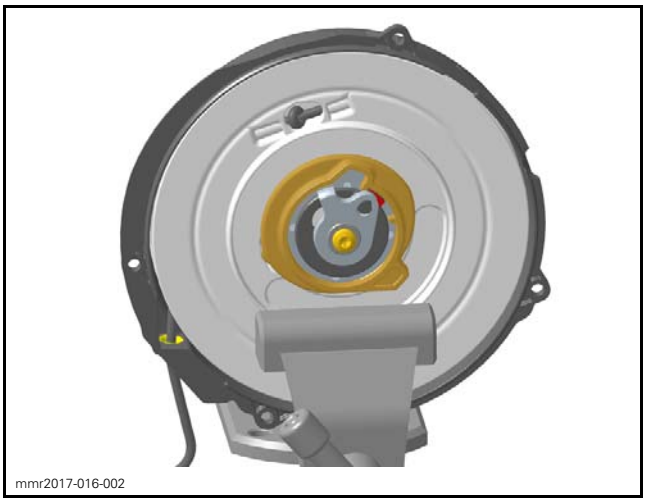
REWIND STARTER ROPE

Rewind Starter Rope Replacement

Remove rewind starter, refer to *REWIND STARTER* in this subsection.

Completely pull out rope. Hold rewind starter in a vise.


mmr2017-016-002

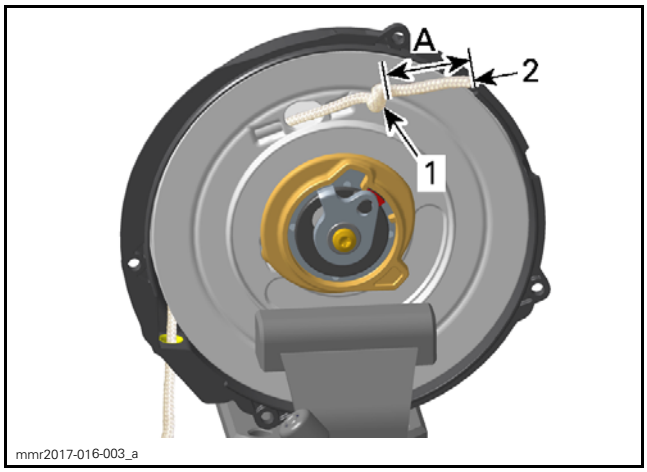
Slide rope and untie the knot.

Remove rope from rope sheave.

NOTE: A new rope must have a overall length of 200 cm (78.74 in).

Insert rope end in rope sheave orifice and lock it by making a knot, leaving behind a free portion of 30 mm to 35 mm (1.2 in to 1.4 in) in length.

Fuse rope end with a lit match



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A. 30 mm to 35 mm (1.2 in to 1.4 in)
1. Knot
2. Fused rope end

Insert rope end into rope sheave.


mmr2017-016-004_a

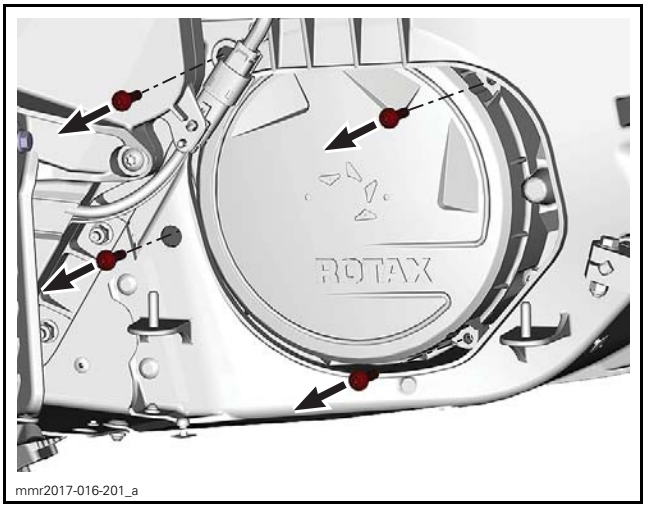
REWIND STARTER

Removing the Rewind Starter

Remove starter handle.

Remove:
– Retaining screws
– Rewind starter.

Engine Inside the Vehicle



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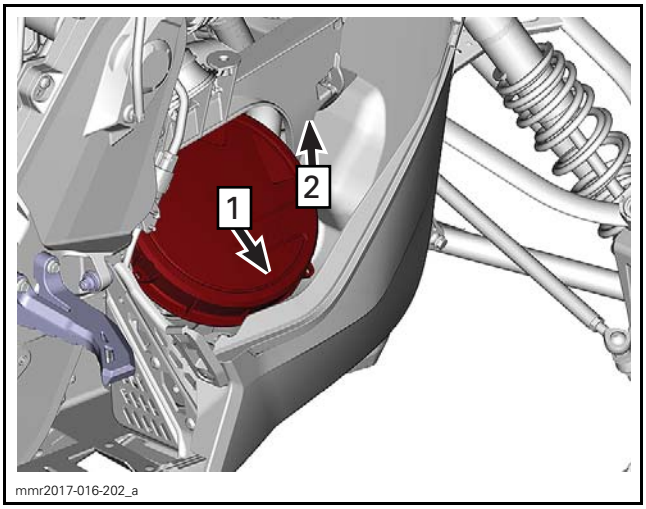

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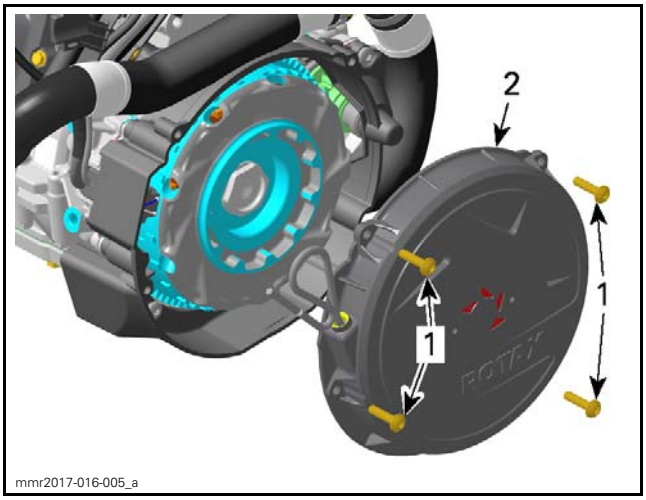
Step 1: Slide the bottom of the rewind starter out of frame
Step 2: Remove rewind starter from engine

Engine Out of the Vehicle



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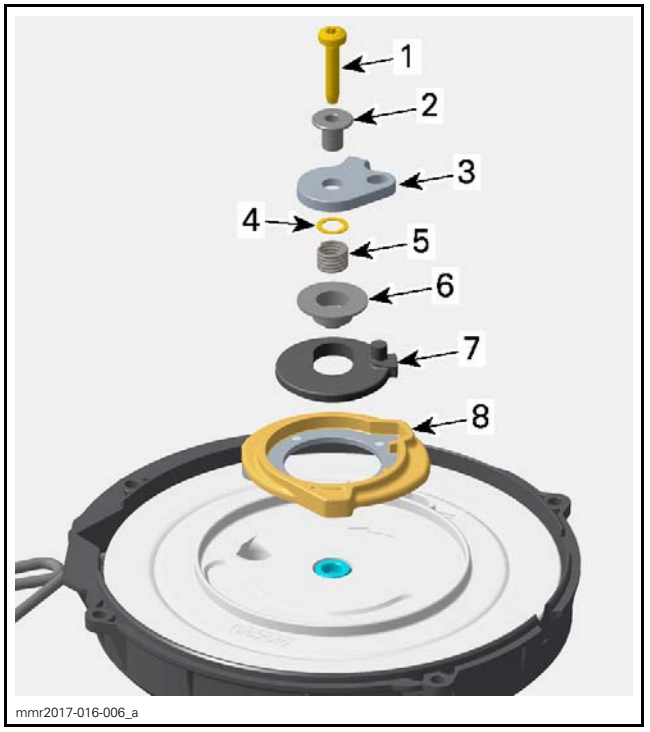
1. *Retaining screws*
2. *Rewind starter*

Disassembling the Rewind Starter

Remove the hose pincher previously installed on rope at rewind starter handle removal. Let rope sheave get free to release spring preload.

Remove the following parts:



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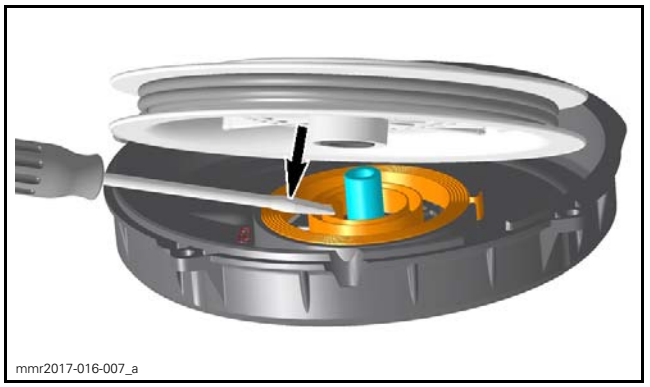
1. *Taptite screw*
2. *Flange bushing*
3. *Lock lever*
4. *Thrust washer*
5. *Compression spring*
6. *Step collar*
7. *Pawl lock*
8. *Pawl*

Remove rope sheave from starter housing. Hold spring in starter housing using a screwdriver.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⚠ WARNING

Since the spring is tightly wound inside the guide it may fly out when rewind is handled. Always handle with care.

For removing the spring, it is of best practice to take the starter housing with the spring showing to the floor and than let the starter housing fall plane to the ground.

Discard spring.

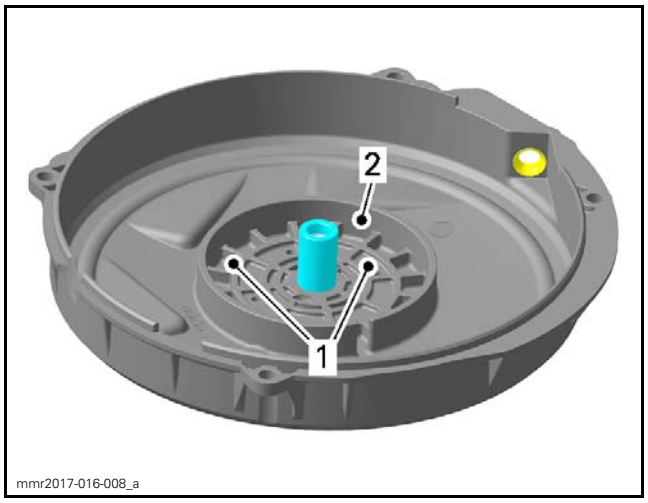
Check sleeve for wear or any other damage. Replace rope sheave if necessary.

Assembling the Rewind Starter

NOTICE For rewind starter parts lubrication use following specified service product. The use of standard multipurpose grease could result in rewind starter malfunction under very cold temperatures and component life will be shortened.

REWIND STARTER PARTS LUBRICATION	
Service product	MOLYKOTE PG 54 (P/N 420 899 763)

Apply the lubricant at these locations:

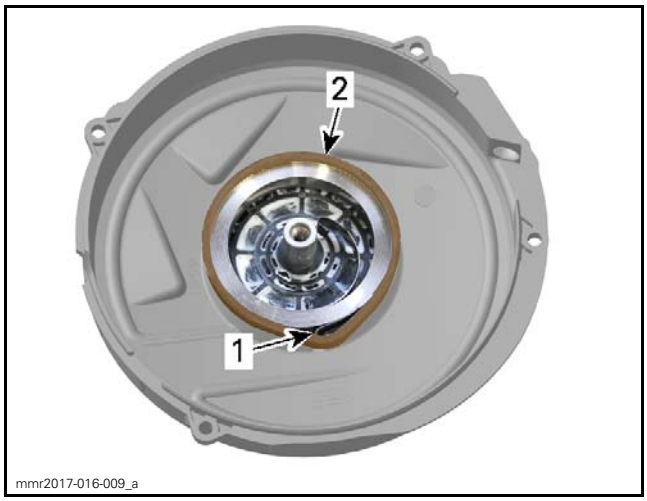


1. Spring contact area
2. Spring guide inside housing

Position spring outer end in spring guide notch with the opening of the spring clip pointing counterclockwise. Then push the spring evenly in the guide. Discard paper carrier.

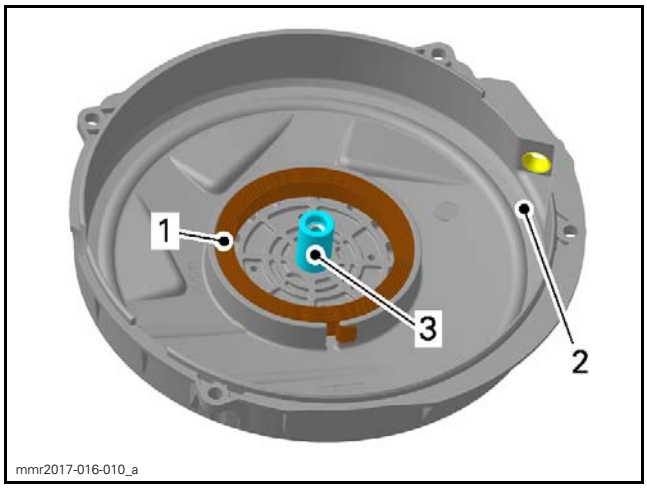
⚠ WARNING

Since the spring is tightly wound inside the guide it may fly out when rewind is handled. Always handle with care.



1. Outer spring end
2. Paper carrier (discard it)

Apply the lubricant at these locations:



1. Spring
2. 1 cm (1/2 in) wide on bottom of housing
3. Housing post

Wind rope on rope sheave

Place rope sheave in starter housing making sure the sheave hub notch engages in the rewind spring hook.

REWIND SPRING HOOK

SHEAVE HUB NOTCH

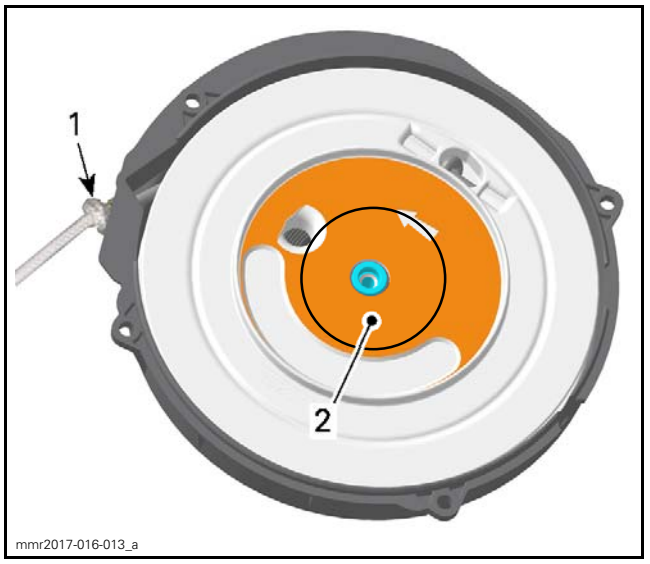
Rotate the rope sheave counterclockwise by about 1/2 turn until rope end is accessible through rope exit hole.

Pull rope out of starter housing.

Rotate the rope sheave counterclockwise 1 full turn.

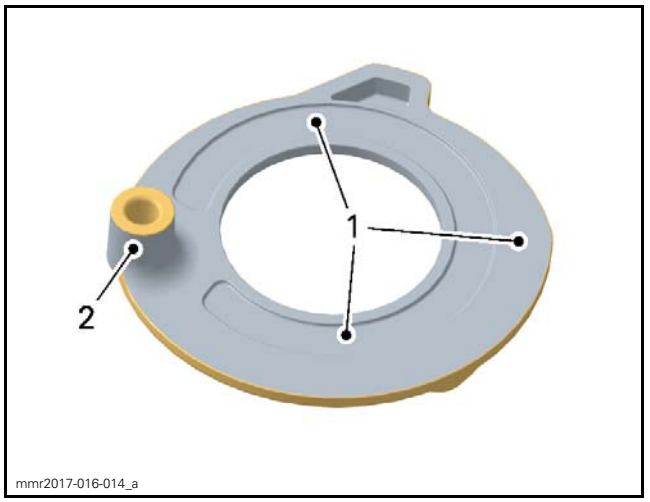
Temporarily make a knot to hold it.

Lubricate rope sheave at the contact surface of the pawl.



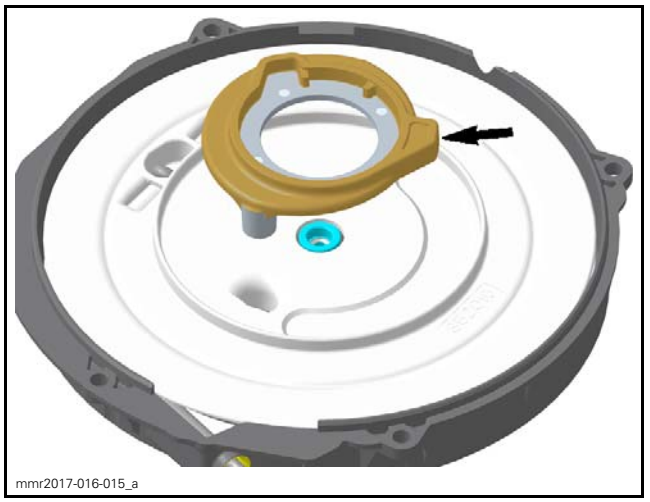
1. *Knot*
2. *Lubricate contact surface of the pawl*

Lubricate pawl at the contact surface and emboss.

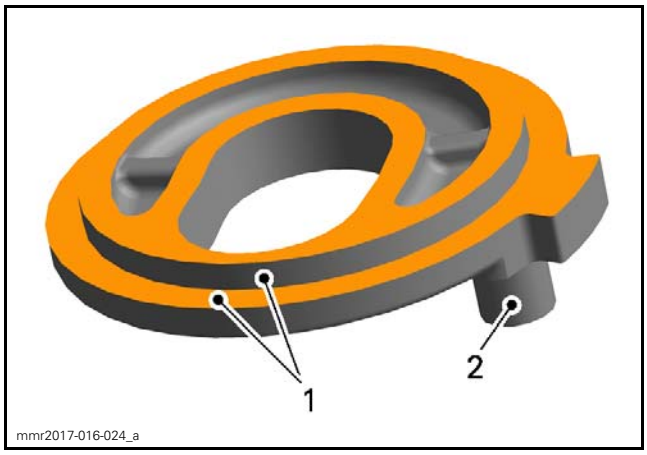


1. *Contact surface*
2. *Emboss*

Install pawl on rope sheave.



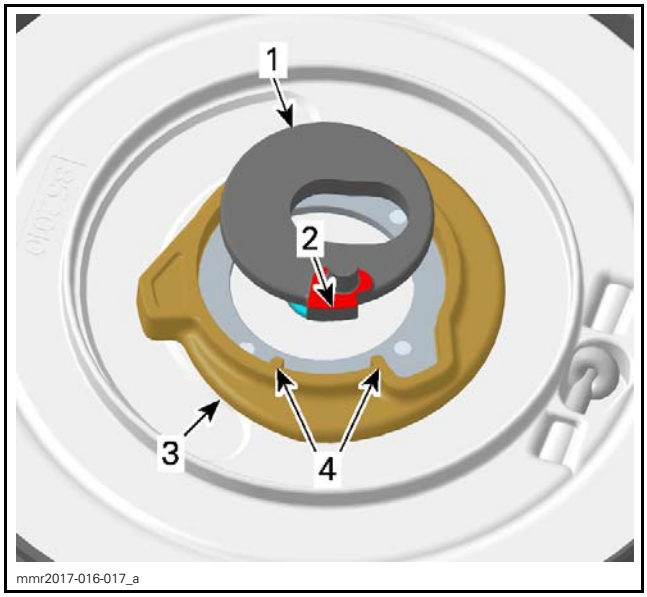
Lubricate pawl lock at the contact surfaces and emboss.



1. Contact surfaces
2. Emboss

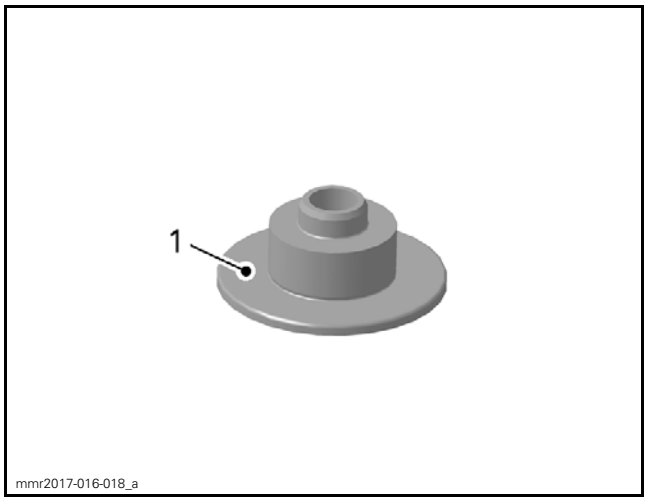
Install pawl lock on pawl.

NOTE: Pawl lock nose must engage between the pawl lock stoppers.



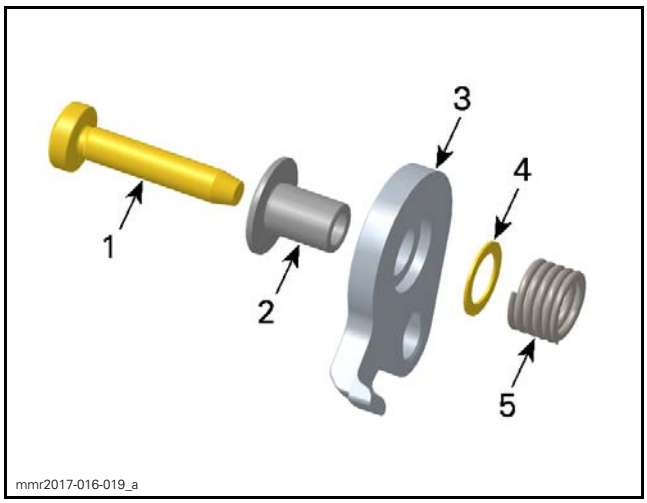
1. Pawl lock
2. Pawl lock nose
3. Pawl
4. Pawl lock stoppers

Lubricate step collar and install it on pawl lock.



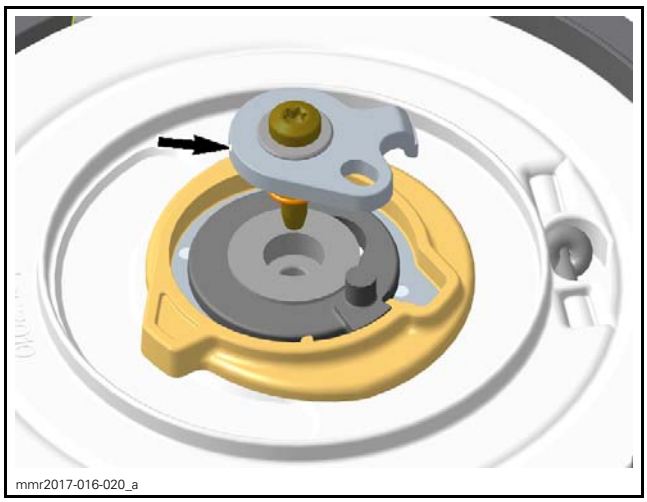
1. Contact surface

Preassemble as shown:



1. Taptite screw
2. Flange bushing
3. Lock lever
4. Thrust washer
5. Compression spring

Install preassembled unit on rewind starter.



Tighten Taptite screw to specification.

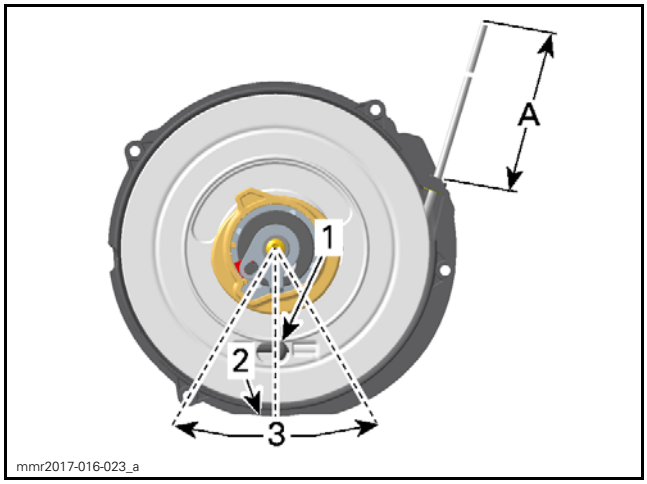
TIGHTENING TORQUE	
Taptite screw	8 N•m ± 0.5 N•m (71 lbf•**in** ± 4 lbf•**in**)

After completion, check if the pawl lock engages and the rope is pulled back completely after releasing the rope.

Installing the Rewind Starter

1. Loosen the temporary knot.
2. Check correct rope length:
   2.1 Pull out rope until recess for knot in the rope sheave is within the specified range.
   2.2 Measure rope length.

MINIMUM ROPE LENGTH
275 mm (10.8 in)

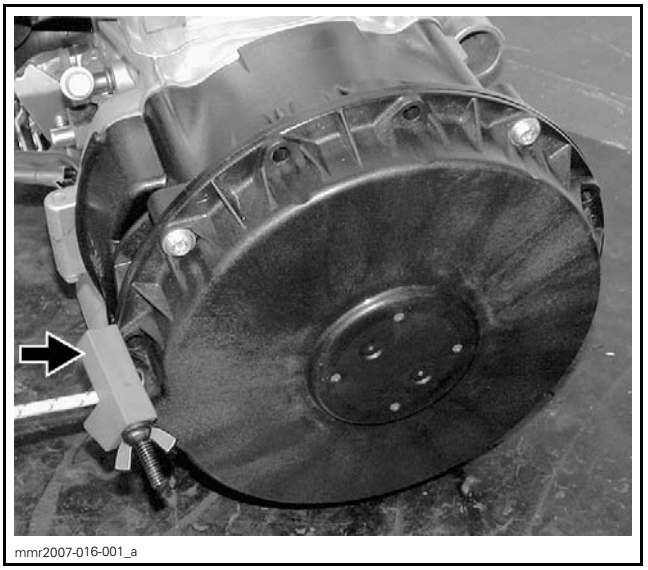


1. Knot
2. Bottom side of rewind starter
3. Range of ± 30°

If rope is too short replace rope, refer to *REWIND STARTER ROPE REPLACEMENT* in this subsection.

3. Lock rope near rewind starter housing.

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



4. Reinstall rewind starter assembly on engine.

TIGHTENING TORQUE	
Rewind starter retaining screws	9 N•m ± 0.6 N•m (80 lbf•**in** ± 5 lbf•**in**)

5. Thread starter rope through console.
6. Install handle, refer to *INSTALLING THE STARTER HANDLE* in this subsection.

LUBRICATION SYSTEM

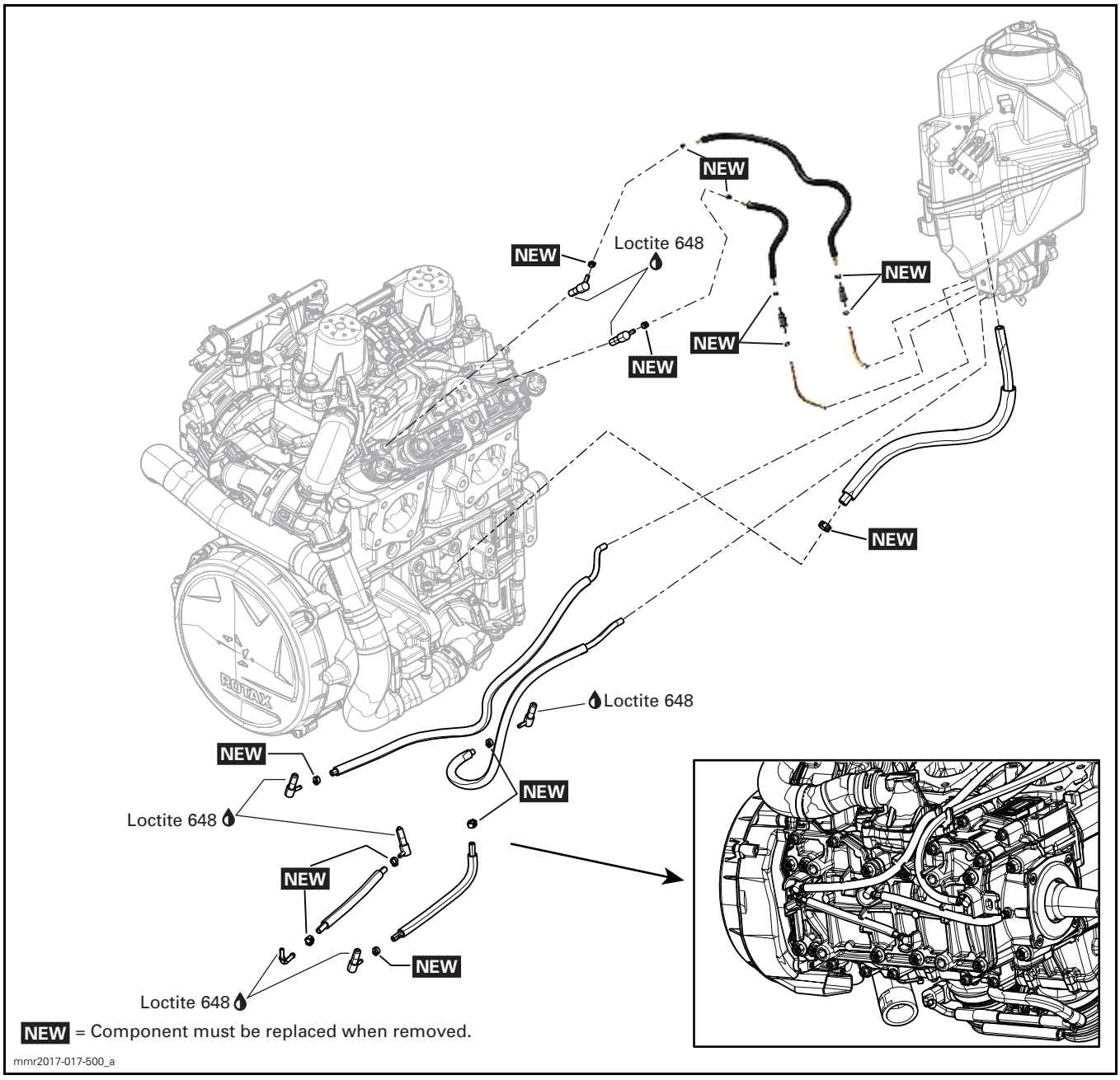
SERVICE TOOLS

Description	Part Number	Page
FLUKE 115 MULTIMETER	529 035 868	12
IMPULSE FITTING PUNCH (BIG)	529 036 412	16
IMPULSE FITTING PUNCH (SMALL)	529 036 413	16
LEAK TEST KIT	529 033 100	7
VACUUM/PRESSURE PUMP	529 021 800	7, 14, 16

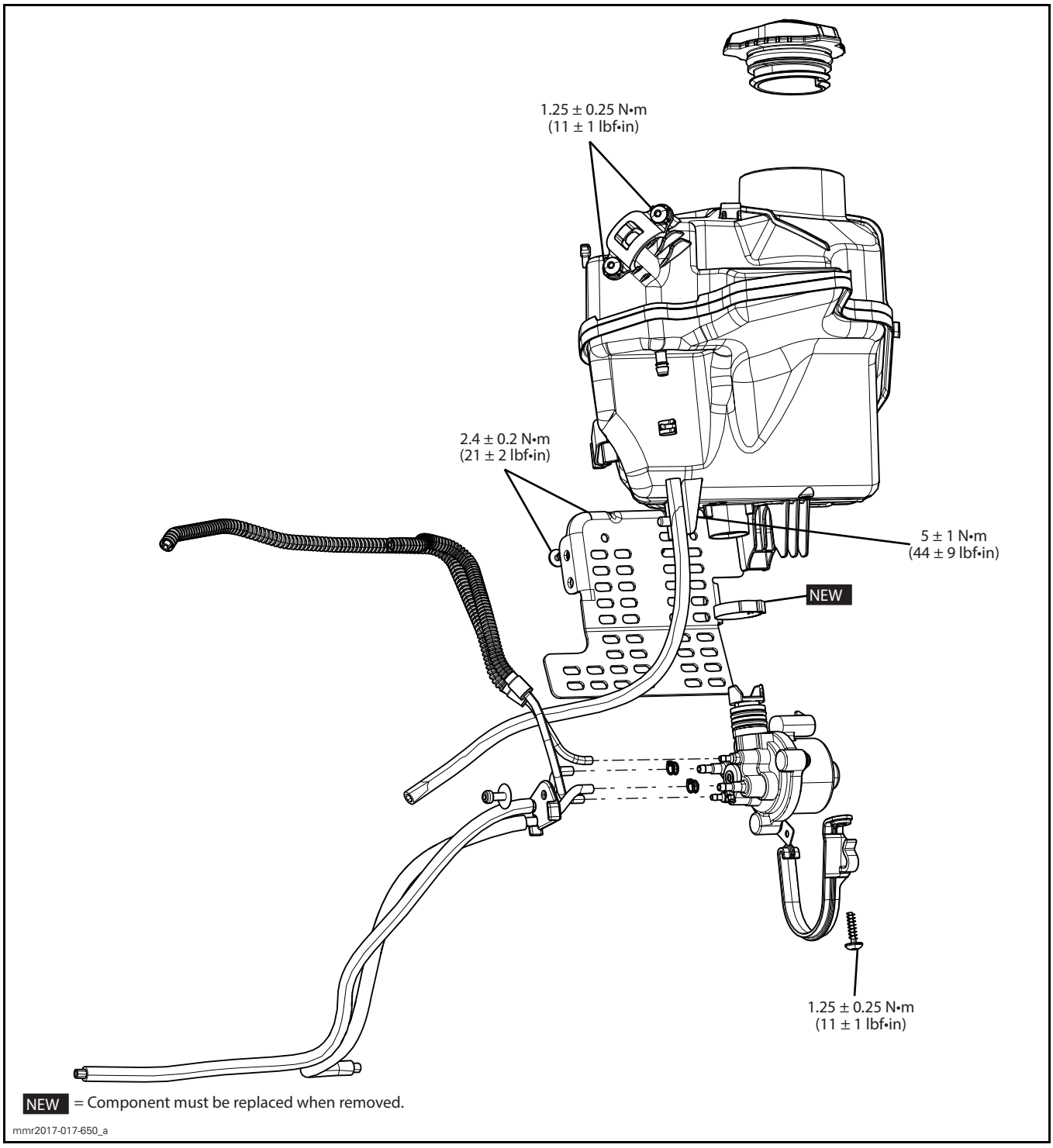
SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 648 (GREEN)	413 711 400	15
PULLEY FLANGE CLEANER	413 711 809	15
XPS INJECTION OIL	293 600 117	7
XPS SYNTHETIC 2-STROKE OIL	293 600 132	7

CHECK VALVES AND OIL HOSES



OIL INJECTION TANK AND OIL INJECTION PUMP



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

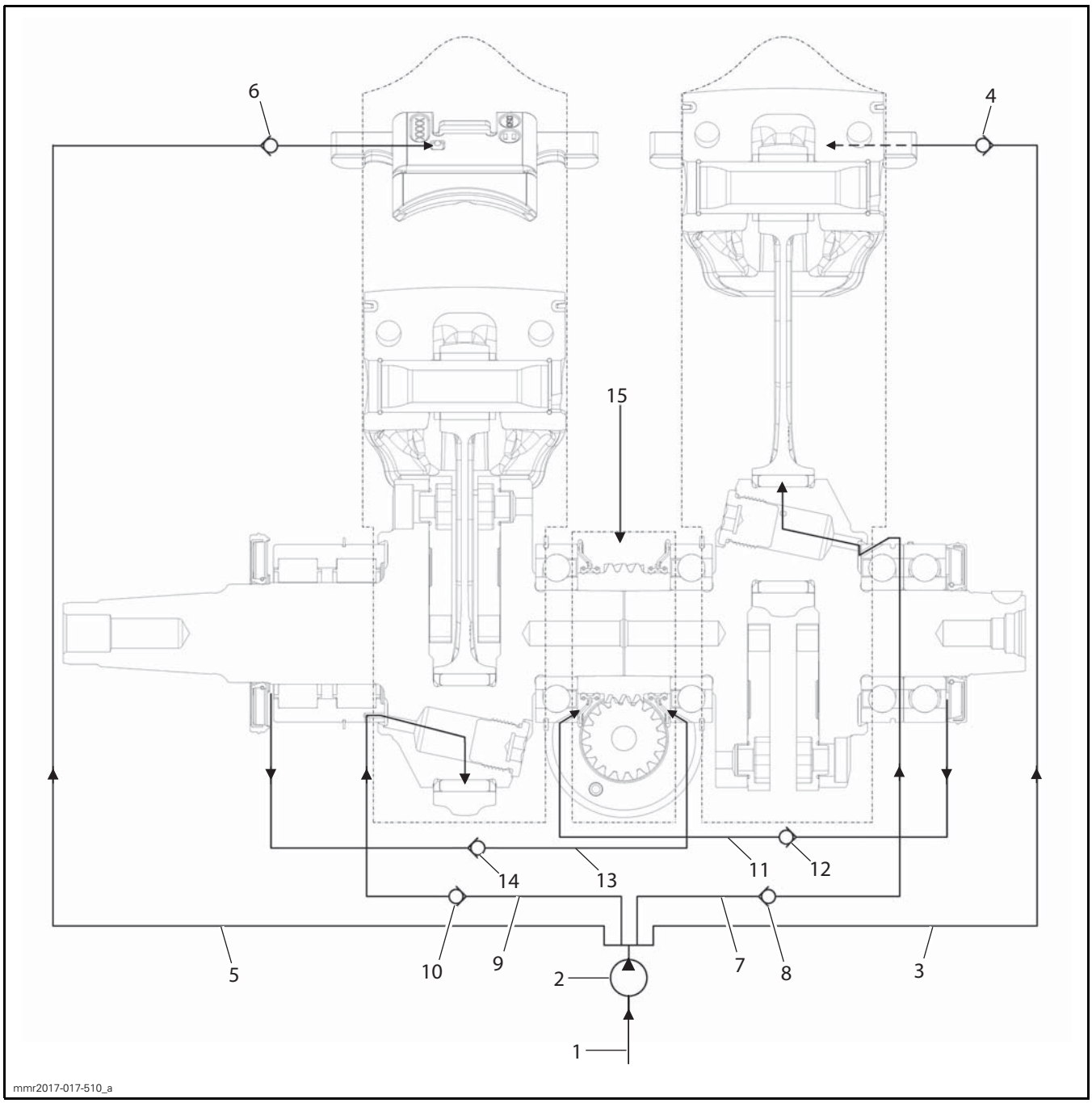
⚠ WARNING

Wipe off any oil spills. Oil is highly flammable.

NOTICE Do not use a hose pincher on outlet hose. This would damage the spring inside hose.

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

ENGINE LUBRICATION SYSTEM DESCRIPTION



1. *Oil supply from oil tank*
2. *Oil pump*
3. *To 3D RAVE valve MAG side*
4. *Check valve RAVE MAG side*
5. *To 3D RAVE valve PTO side*
6. *Check valve RAVE PTO side*
7. *To engine MAG side*
8. *Check valve MAG side main bearing*
9. *To engine PTO side*
10. *Check valve PTO side main bearing*
11. *From MAG side outer main bearing to PTO inner main bearing*
12. *Check valve*
13. *From PTO side outer main bearing to MAG inner main bearing*
14. *Check valve*
15. *Oil supply from oil tank*

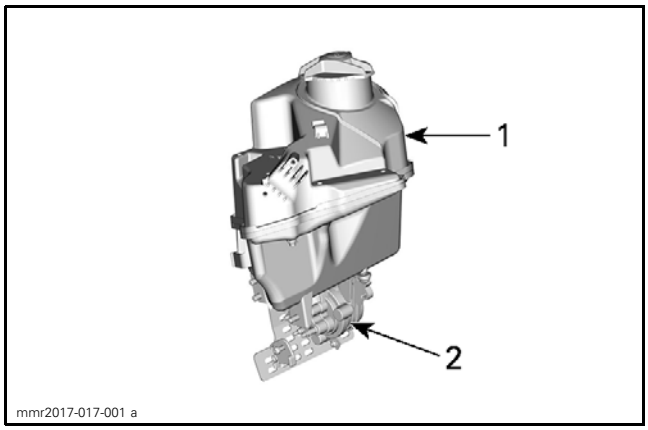
The engine oil supplied by the oil pump is going through check valves to the outer main bearings. Through oil collecting grooves in the outer crank webs, the main quantity of oil is going through the crank webs and by centrifugal force, the oil is directly transferred to the crank pins to lubricate the big end bearings. After this oil exits the big end bearings it lubricates the small ends, cylinder liners and pistons. A portion of the oil supplied to the outer main bearings is supplied to the opposite inner main bearings controlled by check valves. This oil supply happens by use of pressure difference between cylinder MAG and PTO.

RAVE valves are lubricated by the electronic oil injection pump.

SYSTEM DESCRIPTION

An electronic oil injection pump with a mechanical positive displacement type is used. An electronic pump is more accurate and injection rate can be changed according to engine requirements. This results in a greatly reduced oil consumption.

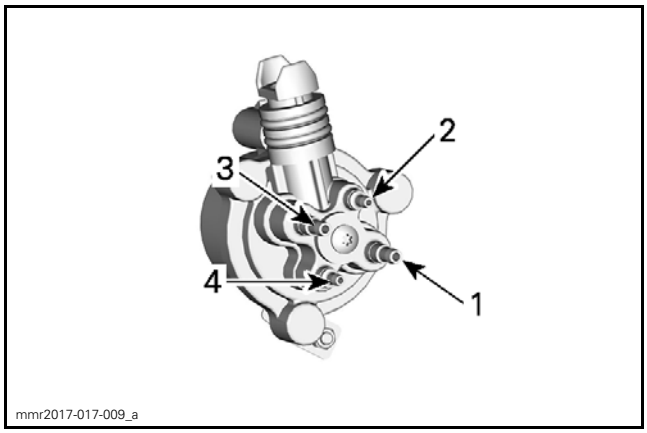
The electronic oil injection pump is directly attached under the oil injection tank.



1. Oil injection tank
2. Electronic oil injection pump

The E-TEC pump features a total of 4 outlets:

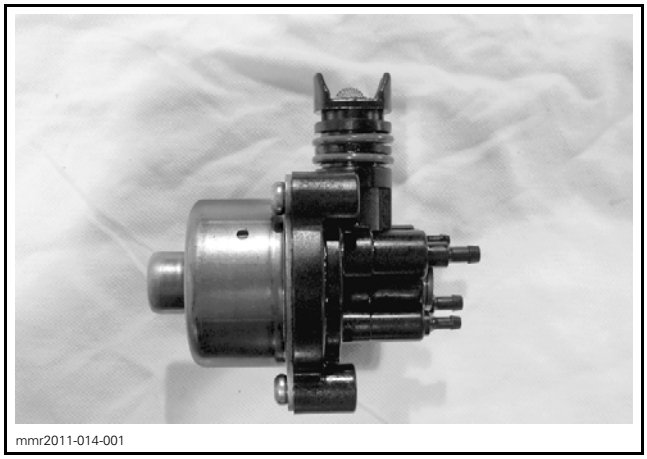
– 2 large outlets to the crankcase to lubricate engine internal parts.
– 2 small outlets to the 3D RAVE valves to lubricate valves to prevent carbon deposits.



1. To engine PTO side
2. To 3D RAVE valve PTO side
3. To engine MAG side
4. To 3D RAVE valve MAG side

NOTE: engine and 3D RAVE valve MAG side are interchangeable.

The 4 plungers in the pump work synchronized. They pump all at the same time.



TYPICAL

The ECM controls the pump to inject a variable amount of oil through the entire engine operating range and conditions.

Oil Injection Pump Operation

For the first 6 hours of engine break-in period, oil delivery is increased.

Oil/fuel ratio can go up to approximately 70:1 after the break-in period.

At idle, pump works at approximately less than 1 pulse per minute. A very low quantity of oil is injected to reduce engine smoke and to reduce engine emissions.

As engine speed increases, oil flow increases but not proportionally. It varies according to the specific engine requirements.

At 8000 RPM, pump works at approximately 180 pulses per minute.

When operating vehicle in high altitude area, oil flow is reduced proportionally as altitude increases.

Oil Warm-Up Mode

When injection oil is very cold and engine is above idle speed, the oil warm-up mode is active.

To warm-up the oil, the oil injection pump is kept ON after the oil delivery stroke, as long as possible, to then turn OFF for the return stroke. The extra time the pump is ON generates more heat that is dissipated through the oil.

NOTE: The premium gauge displays WARM UP whenever the oil warm-up or engine warm-up modes are active.

To determine if injection oil is cold, the ECM uses a feedback switch, located in oil injection pump, that closes at the end of the oil delivery stroke and opens when the oil injection pump coil is de-energized. Thus, the ECM can calculate the time it takes to deliver the oil which is related to the oil viscosity.

The ECM uses a complex algorithm to vary the warm-up time and the rev limiter according to oil pump requirements based on engine speed and TPS position. Therefore, the rev limiter is set dynamically as per the driver inputs.

NOTE: If a fault code related to the feedback switch is active (P1233, P1234), the oil injection warm-up mode uses data from the ATS but it uses the following parameter values. Engine lubrication does not change, only the warm-up time may be longer than usual.

OIL WARM-UP MODE STRATEGY WHEN FEEDBACK SWITCH IS FAULTY		
AIR TEMPERATURE	WARM-UP TIME	ENGINE SPEED LIMITATION
Warm-up starts below -20°C (-4°F)	Within approximately 8 and 11 minutes	Within approximately 4000 - 6000 RPM

Automated Engine Oil Fogging

An automated engine oil fogging has been implemented to automatically inject the required oil to protect the engine during vehicle storage. Engine speed will be increased to approximately 1600 RPM and excess oil will be injected for approximately 30 seconds then, the engine will automatically be stopped.

The storage mode can be activated either by using BUDS2 or the multifunction gauge on the vehicle. Refer to *STORAGE PROCEDURE* subsection.

RECOMMENDED INJECTION OIL

RECOMMENDED INJECTION OIL	
XPS INJECTION OIL (P/N 293 600 117)	XPS SYNTHETIC 2-STROKE OIL (P/N 293 600 132)

NOTICE **These engines have been developed and validated using the XPS™ 2-stroke oils. BRP strongly recommends the use of the applicable XPS 2-stroke oils at all times. Damages caused by oil which is not suitable for the engine will not be covered by the BRP limited warranty.**

INSPECTION

OIL SYSTEM LEAK TEST

1. Install the test cap on oil tank.

REQUIRED TOOL	
LEAK TEST KIT (P/N 529 033 100)	

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TYPICAL
1. Test cap on tank

2. Connect the pressure pump to test cap.

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

3. Pressurize oil system as follows.

PRESSURE	TIME TO HOLD PRESSURE
18 kPa (2.6 PSI)	3 minutes

If pressure drops, locate leak(s) and repair or replace leaking component(s).

If pressure does not drop, this validate the oil injection tank and the oil pump for leakage.

TROUBLESHOOTING

SYMPTOM	CAUSE	ACTION
	Damaged or disconnected oil injection pump.	Check oil injection pump wires and connectors on oil injection pump.
	Circuit wires, connectors or ECM output pins.	Check WHITE/RED wire on oil injection pump connector for 55 volts.
		Check system circuit to ECMA connector
		Repair or replace defective part(s).
Engine seizure (PTO or MAG side)	Damaged, kinked or obstructed inlet hose.	Repair or replace hose and test oil injection pump (oil outflow).
	Damaged oil injection pump inner piston.	Replace oil injection pump.
	Mechanical engine problem.	Repair or replace engine defective part(s).

PROCEDURES

OIL INJECTION PUMP

Oil Injection Pump Identification

Every pump is bench tested. Its electrical and flow characteristics are registered throughout all its operating range and are associated to a compensation number.

When a pump is replaced, the compensation number must be entered in BUDS2. so that the ECM properly controls the pump according to its optimized characteristics.

The compensation number is located on a label on the pump as shown.

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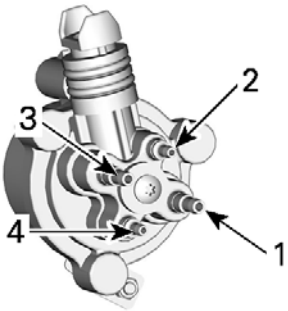
Oil injection pump bleeding is done with BUDS2Refer to *BLEEDING OIL INJECTION PUMP* in this subsection.

Oil Injection Pump Hoses Connection



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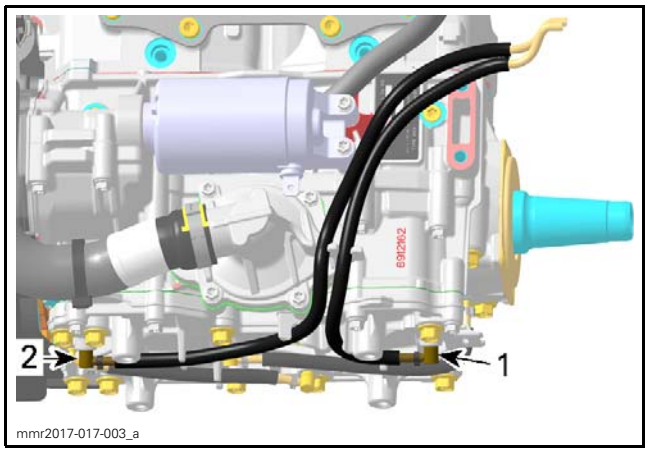
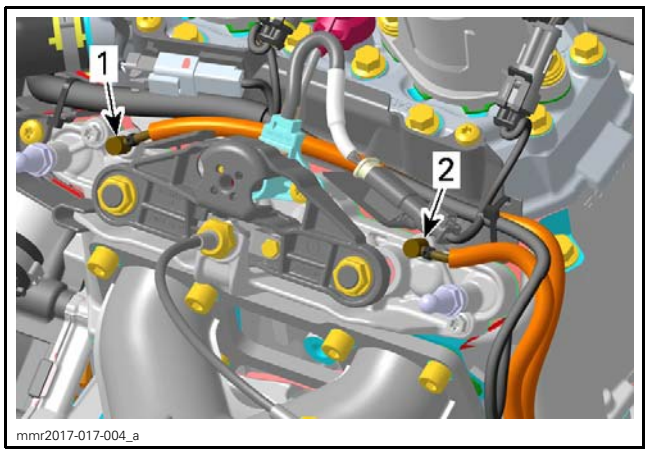
1. To engine PTO side
2. To 3D RAVE valve PTO side
3. To engine MAG side
4. To 3D RAVE valve MAG side

NOTE: engine and 3D RAVE valve MAG side are interchangeable.



1. *Oil inlet hose (PTO side)*
2. *Oil inlet hose (MAG side)*



1. *MAG 3D RAVE valve*
2. *PTO 3D RAVE valve*

Testing Oil Injection Pump with BUDS2

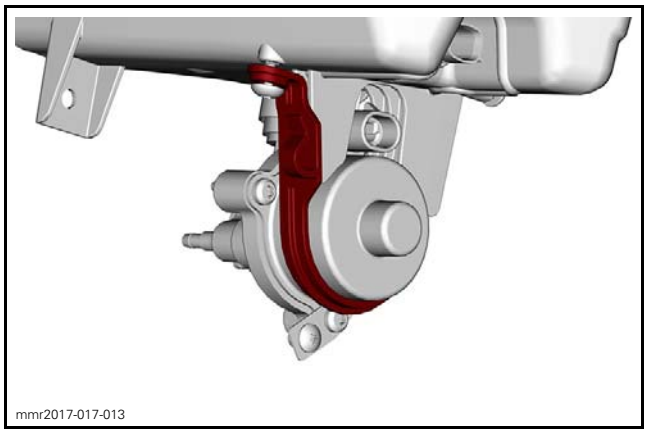
1. Connect BUDS2. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Navigate to the **functions page**.
3. Start engine.
4. Activate oil pump
5. Listen if oil injection pump is activated.

NOTE: Touching the oil injection pump may help to feel if pump is activated.

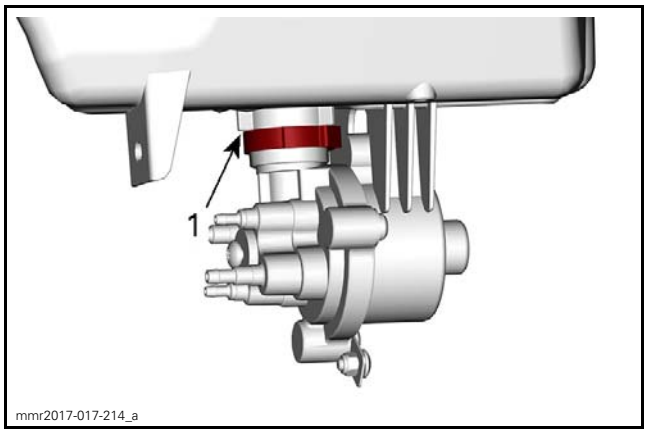
6. If test fails, check wires and connector.

Removing the Oil Injection Pump

1. Remove the pump bracket.

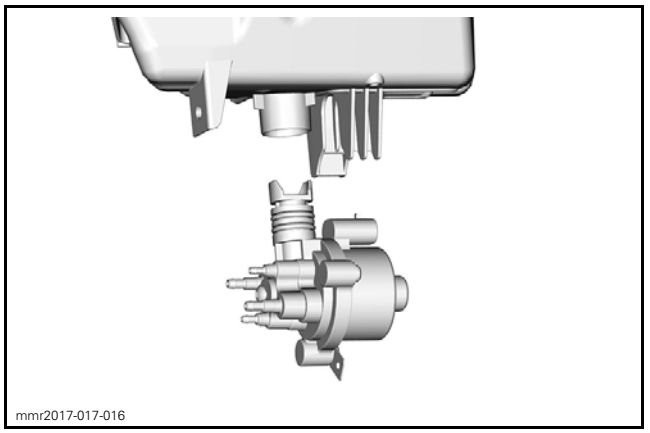


2. Remove and discard Oetiker clamp securing oil injection pump to oil tank.



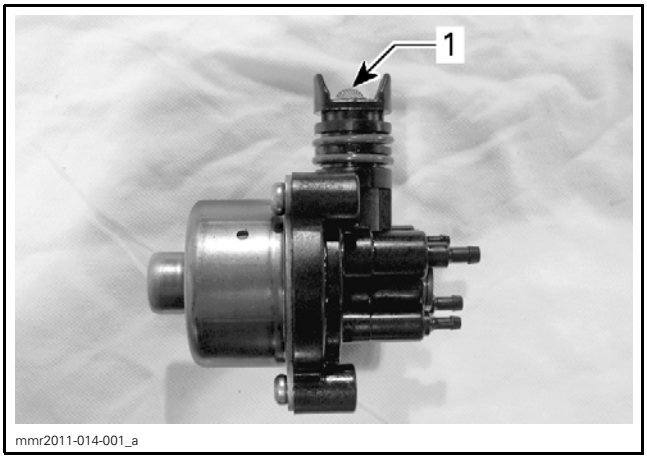
1. *Oetiker clamp*

3. Move oil injection pump downward to remove it from oil tank.



Inspecting the Oil Injection Pump

1. Check the strainer on the top of oil injection pump. Replace oil injection pump if the strainer is clogged.



1. Oil injection pump strainer

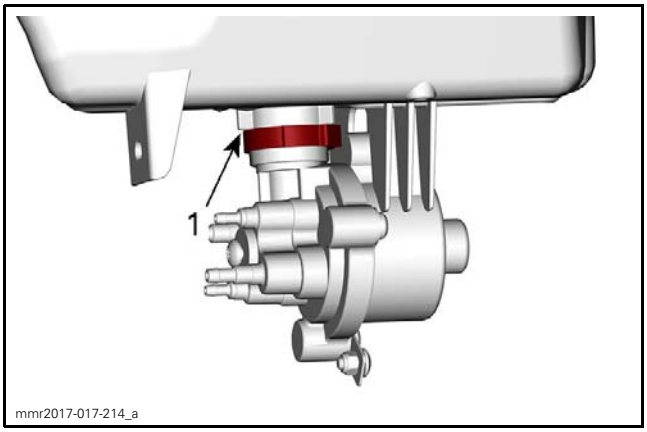
NOTE: Do not replace oil injection pump needlessly. If strainer is slightly dented, oil injection pump is still functional.

Installing the Oil Injection Pump

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

Install NEW Oetiker clamp to secure oil injection pump.

Ensure Oetiker clamp makes contact with oil tank ribs.



1. Oil tank rib

Refer to *INSTALLING THE OIL TANK* to properly reinstall oil tank.

Bleeding Oil Injection Pump

1. Connect BUDS2. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Navigate to the **settings page**.
3. Select **configuration** tab then the **ECM** tab.
4. Compare oil pump codes in B.U.D.S. and on oil injection pump sticker.

BACK OF OIL INJECTION PUMP
1. Oil injection pump code (0 to 9)

5. Correct oil injection pump code in BUDS2 if required.

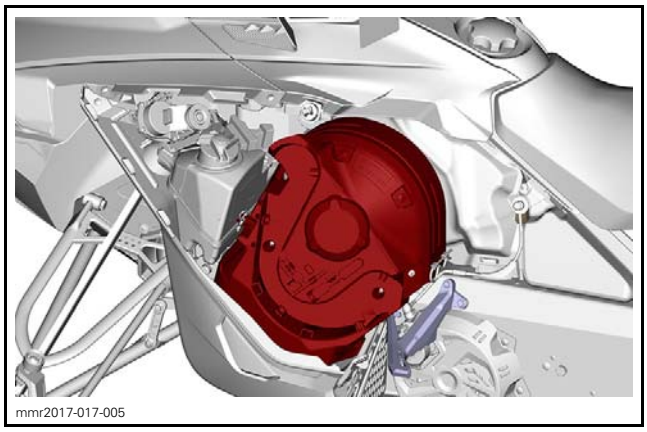
Write any changes.

6. Navigate to the **Functions** page.
7. Activate the oil pump.
8. Start engine.
9. Check for air into hoses. If so, the bleeding procedure must be repeated as often as needed until all air is pumped through entire system.

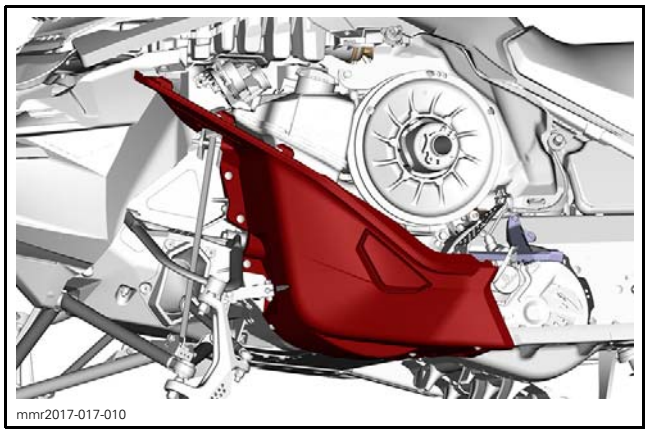
OIL INJECTION TANK

Removing the Oil Injection Tank

1. Remove upper body module. Refer to *BODY* subsection.
2. Remove side panel
3. Empty oil injection tank completely by siphoning injection oil.
4. Remove belt guard



5. Remove bottom pan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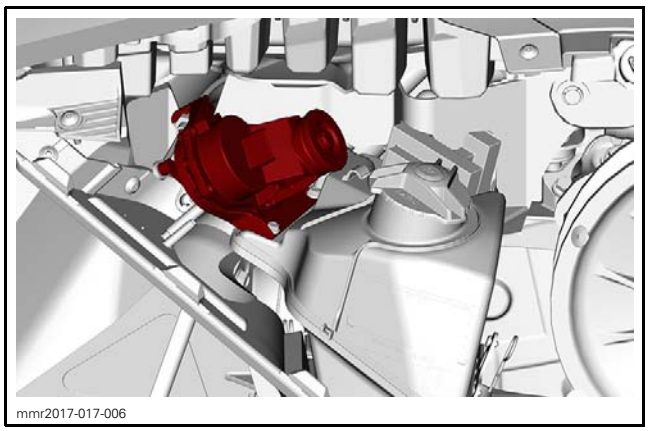
6. Unbolt Rave Valve actuator and set aside.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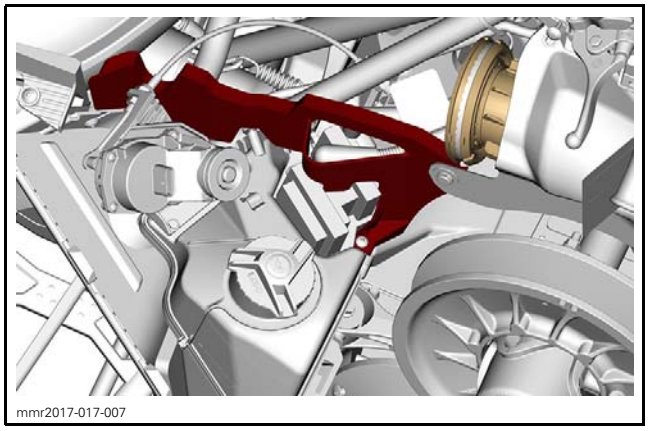
7. Remove acoustic panel.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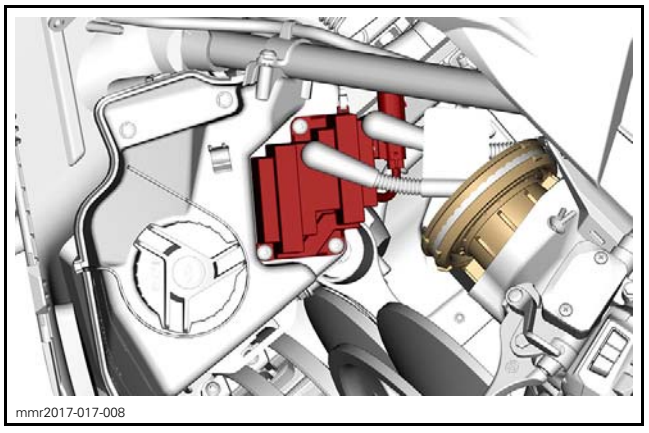
8. Remove Ignition coil.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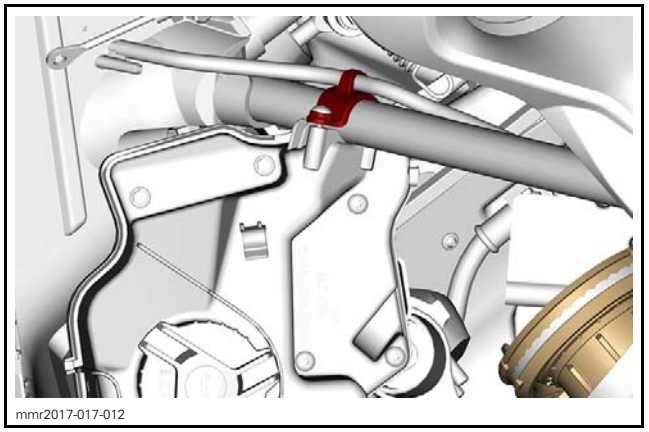
9. Remove bracket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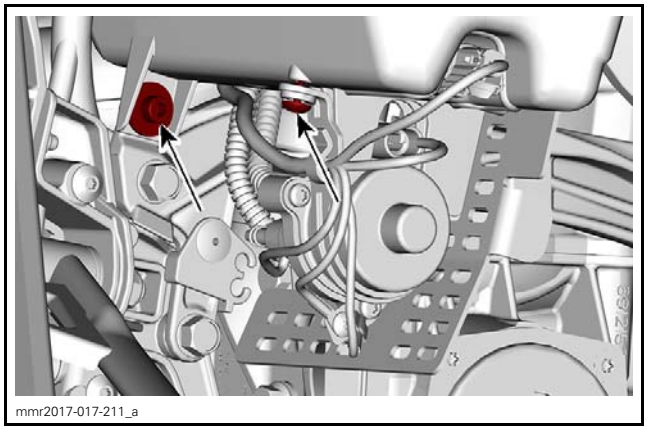
10. Remove screws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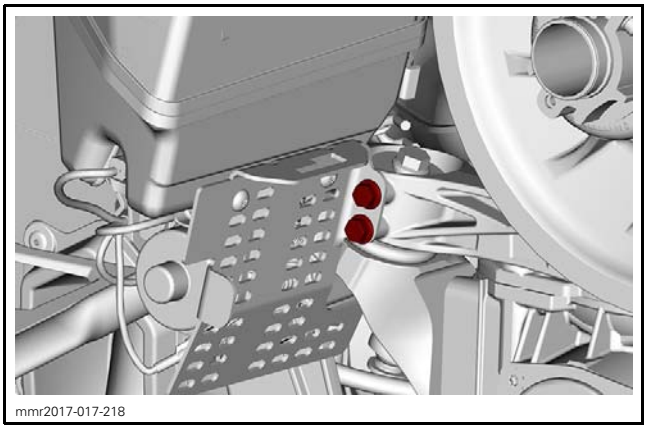
11. Remove Oil Tank support screw.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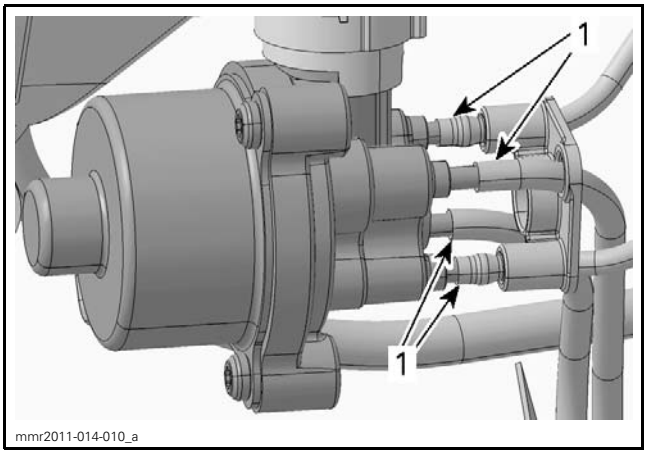
12. Disconnect crankcase vent hose on oil injection tank side.
13. Disconnect oil level sensor connector.
14. Place a rag under oil injection pump to catch oil spillage.
15. Carefully disconnect hoses from oil injection pump using a small screwdriver.



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SOME PARTS REMOVED FOR CLARITY PURPOSE
1. Oil hoses (4x)

NOTICE **Oil injection pump fittings are very fragile, care must be taken when removing hoses from oil injection pump.**

16. Disconnect oil injection pump electrical connectors.
17. Slide out oil tank.
18. Remove oil injection pump from oil injection tank. Refer to *OIL INJECTION PUMP REMOVAL* in this subsection.

Installing the Oil Injection Tank

Before tightening oil injection tank on vehicle, proceed as follows.

1. Install oil injection pump on oil injection tank. Refer to *OIL INJECTION PUMP INSTALLATION*.
2. Apply injection oil on oil injection pump hoses.
3. Properly route and connect oil hoses into oil injection pump. Refer to *OIL INJECTION PUMP HOSES CONNECTION* in this subsection.

NOTICE **Oil injection pump fittings are very fragile, care must be taken when installing hoses on oil injection pump.**

Position oil injection tank on vehicle.

Tighten oil injection tank screws to specification. Refer to exploded view.

Reinstall all remaining components as the reverse of removal procedure.

Fill up oil injection tank using recommended oil. See *RECOMMENDED INJECTION OIL* in this subsection.

Bleed oil injection system. Refer to *BLEEDING OIL INJECTION PUMP* in this subsection.

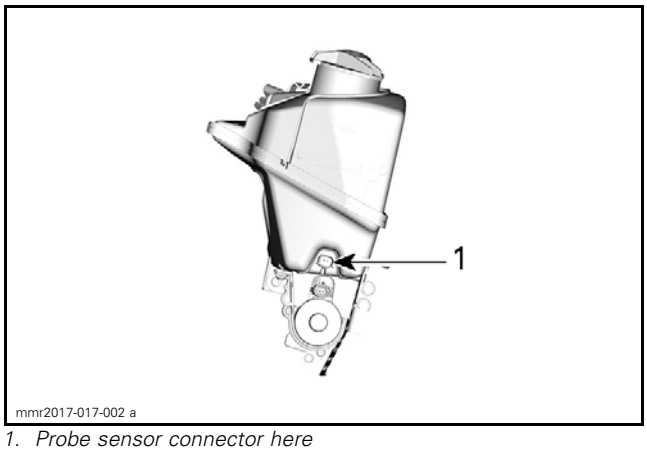
OIL LEVEL SENSOR

Testing the Oil Level Sensor

1. Measure resistance by probing sensor connector.

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

SENSOR TEST CONDITION		RESISTANCE
Empty oil tank	LOW float position	Closed circuit (close to 0 Ω)
	HIGH float position	Open circuit infinite (OL)



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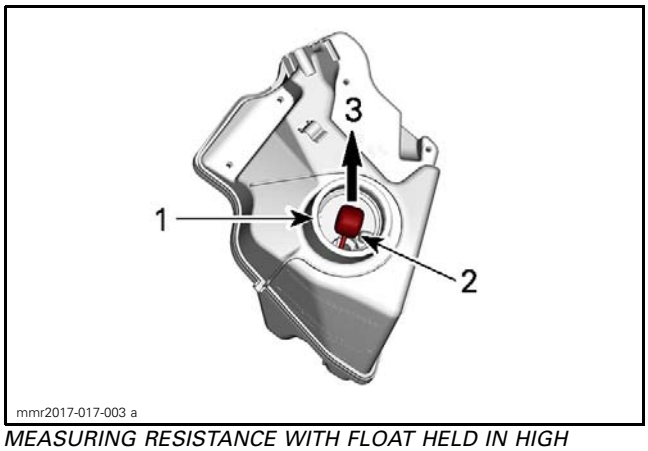
1. Probe sensor connector here



MEASURING RESISTANCE WITH FLOAT HELD IN HIGH POSITION
1. *Oil tank cap removed*
2. *Float*
3. *Use a locking tie to lift float*

If test fails, replace oil tank.

If test succeeds check float condition in oil tank.

Removing the Oil Level Sensor

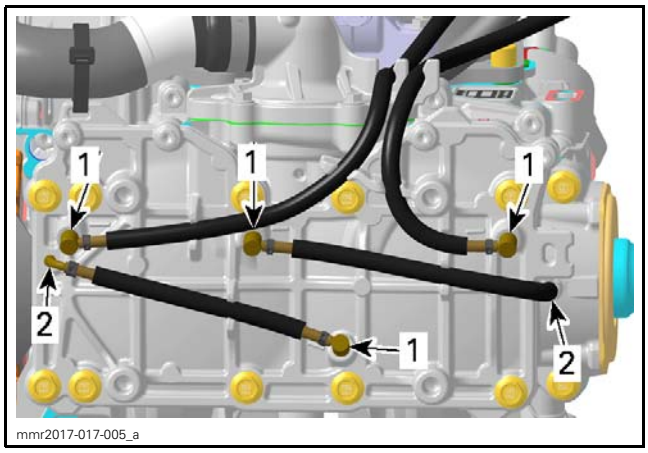
Oil level sensor is part of the oil tank and is not removable.

CHECK VALVES AND FITTINGS

Check Valves and Fittings Access

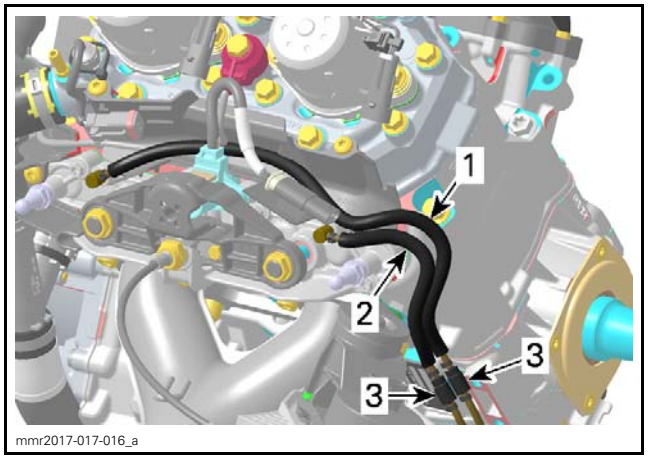
Check Valves and Fittings (Engine)

Lift engine to access the check valves and fittings at the bottom of the crankcase. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.



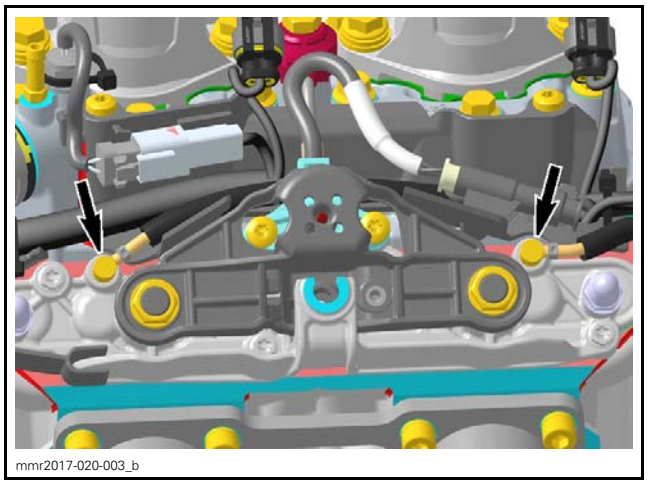
1. *Check valves*
2. *Fittings*

Check Valves and Fittings (RAVE)



RAVE CHECK VALVES
1. *Oil hose to MAG 3D RAVE valve*
2. *Oil hose to PTO 3D RAVE valve*
3. *RAVE check valves*

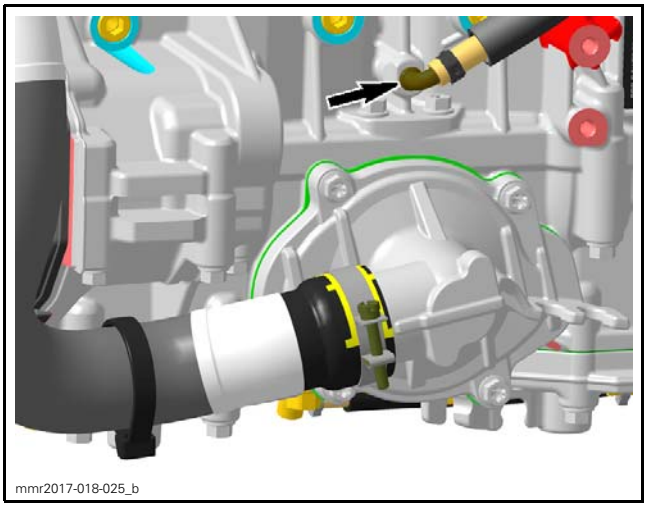
Remove cover, refer to *TOP END* subsection.



TYPICAL - RAVE FITTINGS

Fitting (Water Pump Drive)

Remove starter, refer to *MAGNETO AND STARTER* subsection.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Inspecting the Check Valves

Pressurize check valves at inlet side.

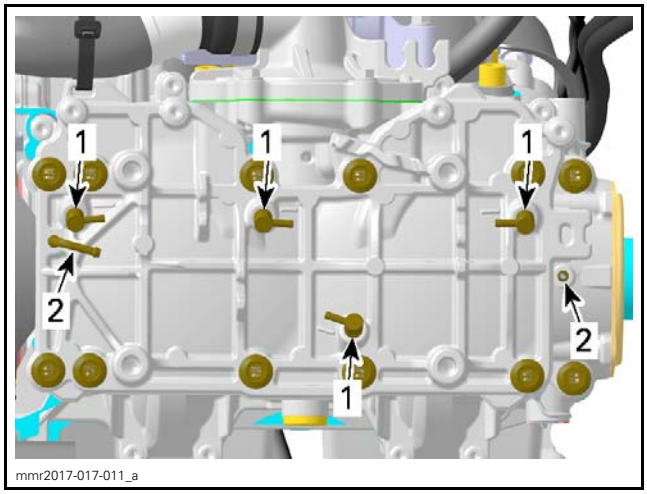
REQUIRED TOOL	
VACUUM/PRESSURE PUMP (P/N 529 021 800)	

PUMP SETTING	SET TO **VACUUM**	SET TO **PRESSURE**
TO DO	Activate pump several times	Slowly activate pump and listen to check valve
RESULT	Air must **NOT** flow through check valve	You should hear it release pressure at approximately 20.7 kPa (3 PSI)
ACTION	**Success:** Perform next test	**Success:** Check valve is good
	Failed: Replace check valve	**Failed:** Replace check valve

Removing the Check Valves and Fittings

NOTICE Do not remove check valve needlessly. It is likely to be damaged.

Check Valves and Fittings (Engine)



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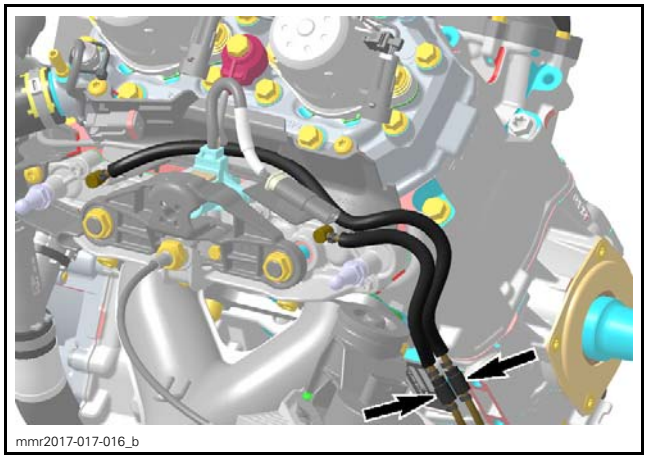
1. Check valves
2. Fittings

1. Clean area around check valve or fitting to remove oil or dirt.
2. Heat check valve or fitting then pull it out of crankcase.

Check Valves (RAVE)

1. Remove clamps and oil hoses from check valve.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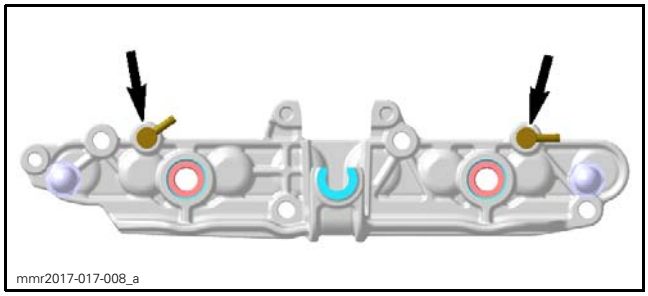
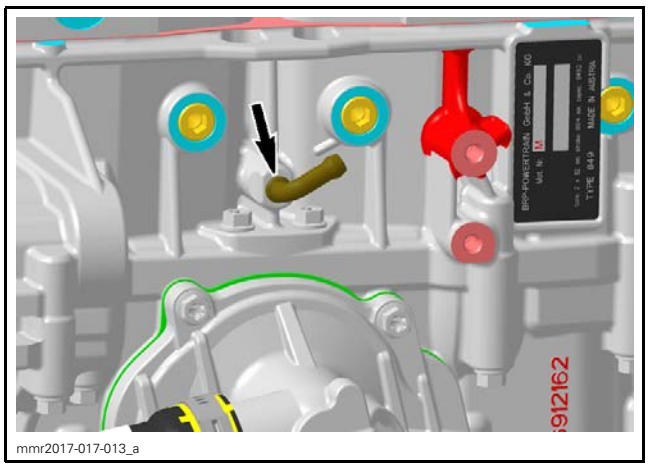
Fittings (RAVE)



TYPICAL - RAVE FITTINGS

1. Remove RAVE valve housing. Refer to *RAVE* subsection.
2. Clean area around fittings to remove oil or dirt.
3. Heat fitting then pull it out of RAVE valve housing.

Fitting (Water Pump Drive)



1. Clean area around fitting to remove oil or dirt.
2. Heat fitting then pull it out of crankcase.

Installing the Check Valves and Fittings

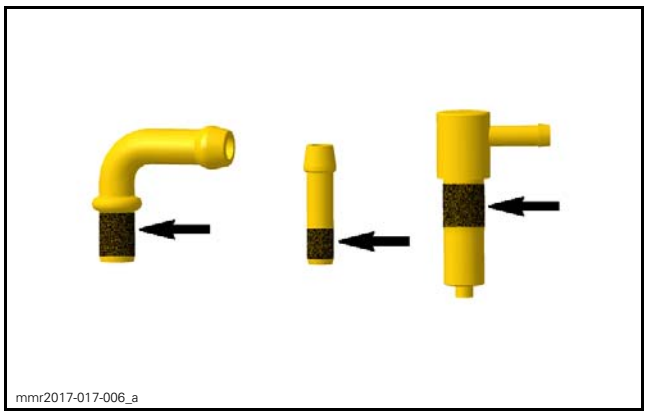
The installation is the reverse of the removal procedure. However pay attention to the following.

1. Ensure check valve bodies and fittings are clean from dirt or oil and dry.

CHECK VALVE CLEANING	
Service product	PULLEY FLANGE CLEANER (P/N 413 711 809)

2. Apply sealant on the outer diameter of the check valve (machined section) or fitting. Apply sealant ONLY in the specified area.

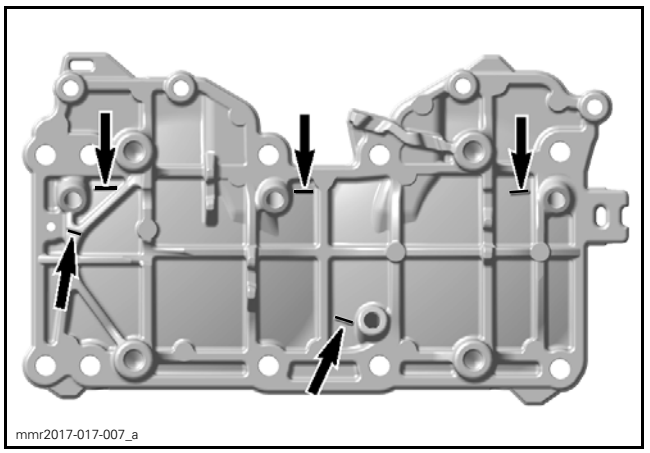
CHECK VALVE AND FITTING SEALANT	
Service product	LOCTITE 648 (GREEN) (P/N 413 711 400)



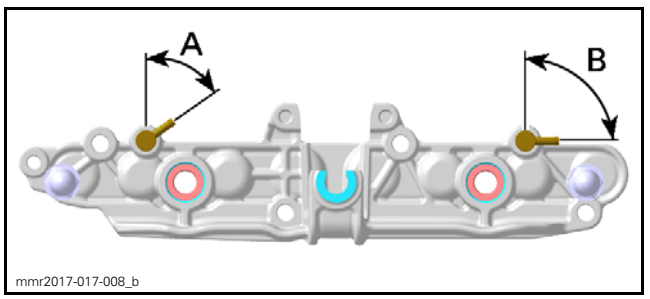
APPLY SEALANT ON INDICATED AREA ONLY

3. Punch in the check valves and fittings carefully with a plastic hammer by using a suitable punch.

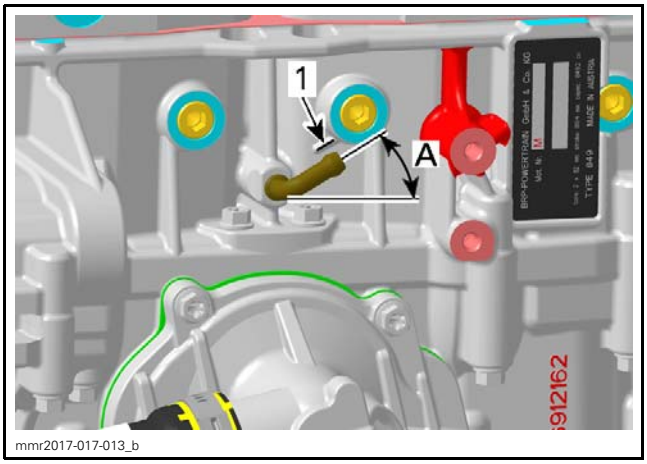
For correct orientation of the check valves and fitting refer to the next illustrations.



CAST MARKS FOR CHECK VALVES AND FITTING ORIENTATION



A. 55°
B. 90



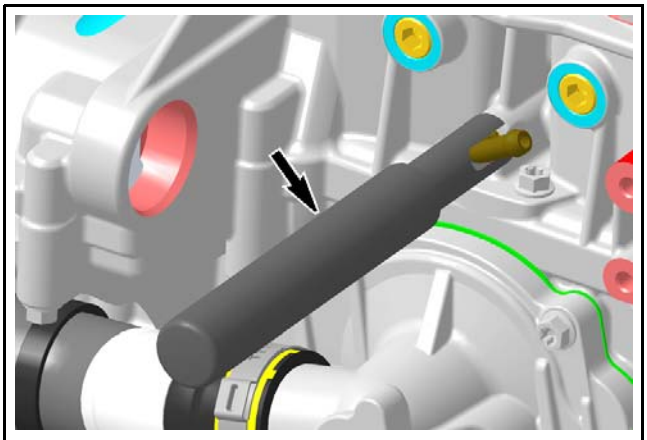
mmr2017-017-013_b

A. 30°

1. Cast mark for fitting orientation

For bent fitting use following service tool for installation:

REQUIRED TOOL	
IMPULSE FITTING PUNCH (BIG) (P/N 529 036 412)	
IMPULSE FITTING PUNCH (SMALL) (P/N 529 036 413)	



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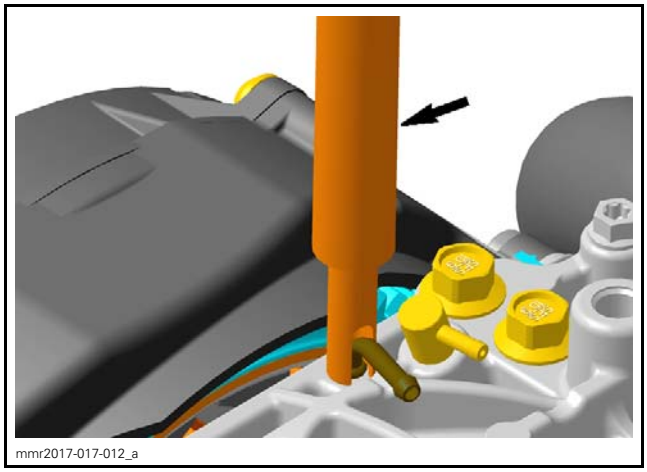
FITTING (WATER PUMP DRIVE) - IMPULSE FITTING PUNCH (BIG) (P/N 529 036 412)



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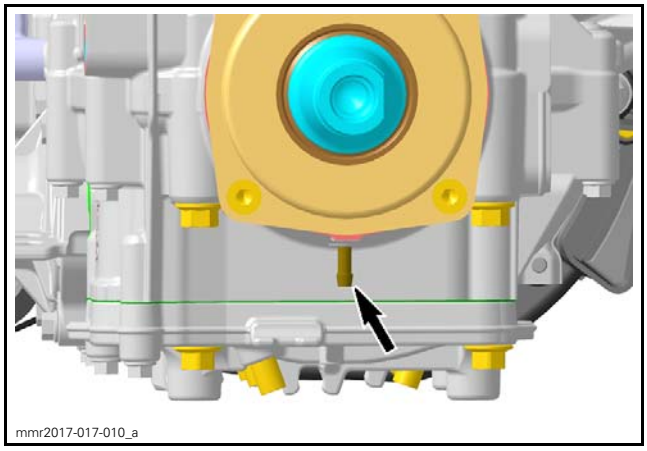
FITTING (ENGINE) - IMPULSE FITTING PUNCH (SMALL) (P/N 529 036 413)



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4. Clean area around check valve from surplus sealant with a rag.
5. Connect pressure pump and check if check valves and fittings are not blocked with glue after installation.

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

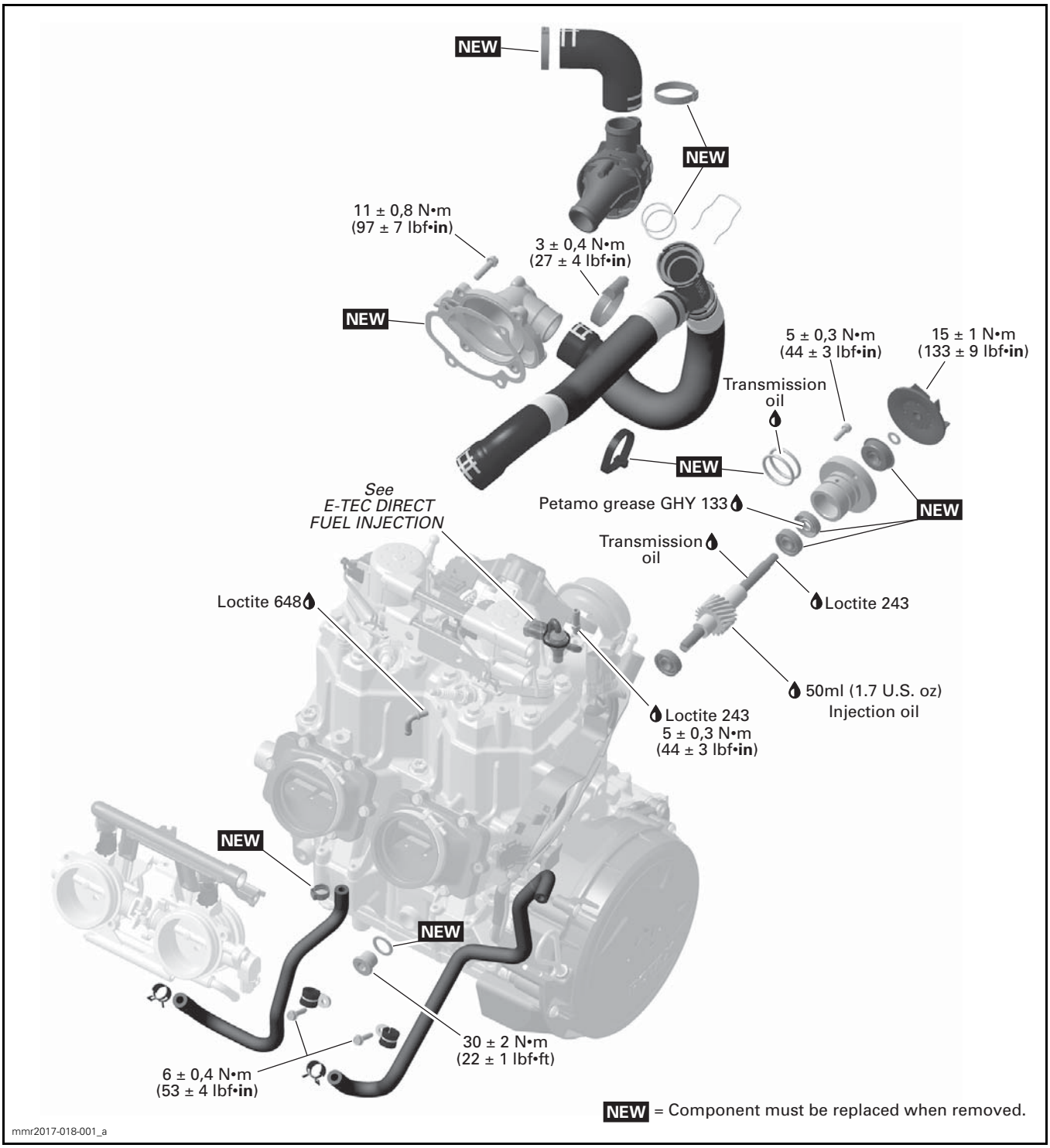
COOLING SYSTEM

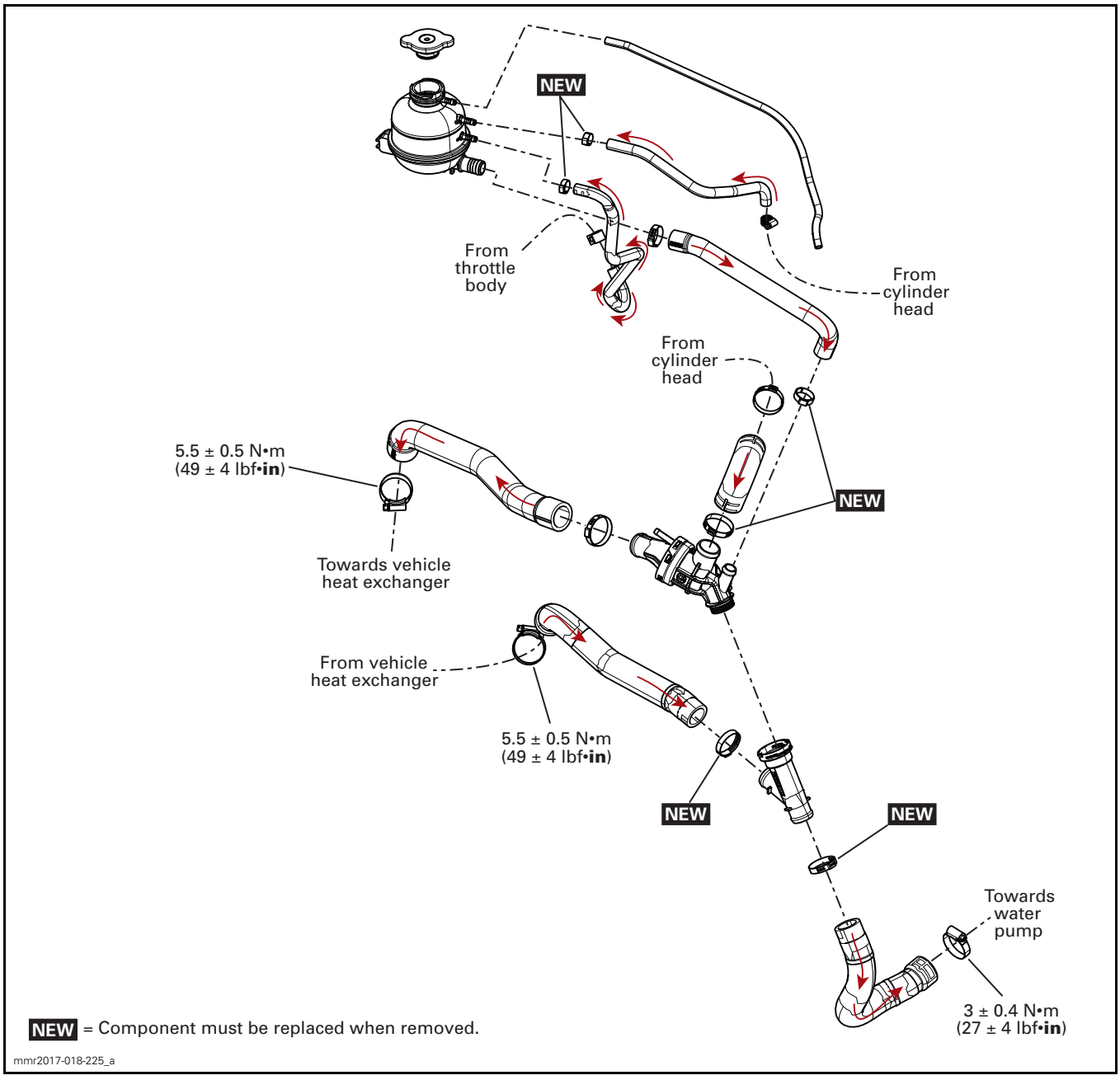
SERVICE TOOLS

Description	Part Number	Page
CERAMIC SEAL INSTALLER	529 036 014	10
HANDLE	420 877 650	9
IMPULSE FITTING PUNCH (BIG)	529 036 412	6
LARGE HOSE PINCHER	529 032 500	4–5
OIL SEAL PUSHER	529 035 757	9
PROTECTOR SLEEVE	529 036 406	10
SMALL HOSE PINCHER	295 000 076	5
TEST CAP	529 035 991	4
VACUUM/PRESSURE PUMP	529 021 800	4–5

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	7
LOCTITE 648 (GREEN)	413 711 400	5
PETAMO GREASE GHY 133N	420 899 271	10
PULLEY FLANGE CLEANER	413 711 809	5, 7, 11


NEW
NEW
11 ± 0,8 N•m
(97 ± 7 lbf•in)
3 ± 0,4 N•m
(27 ± 4 lbf•in)
NEW
5 ± 0,3 N•m
(44 ± 3 lbf•in)
15 ± 1 N•m
(133 ± 9 lbf•in)
Transmission
oil
NEW
See
E-TEC DIRECT
FUEL INJECTION
Petamo grease GHY 133
NEW
Transmission
oil
Loctite 648
Loctite 243
50ml (1.7 U.S. oz)
Injection oil
Loctite 243
5 ± 0,3 N•m
(44 ± 3 lbf•in)
NEW
NEW
30 ± 2 N•m
(22 ± 1 lbf•ft)
6 ± 0,4 N•m
(53 ± 4 lbf•in)
NEW = Component must be replaced when removed.
mmr2017-018-001_a


NEW
From throttle body
From cylinder head
From cylinder head
5.5 ± 0.5 N•m (49 ± 4 lbf•in)
NEW
Towards vehicle heat exchanger
From vehicle heat exchanger
5.5 ± 0.5 N•m (49 ± 4 lbf•in)
NEW
NEW
Towards water pump
3 ± 0.4 N•m (27 ± 4 lbf•in)
NEW = Component must be replaced when removed.
mmr2017-018-225_a

GENERAL

NOTE: It is a good practice to check for fault codes using BUDS2 software as a first troubleshooting step

During assembly/installation, use 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 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.).

INSPECTION

COOLING SYSTEM LEAK TEST

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

⚠ WARNING

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

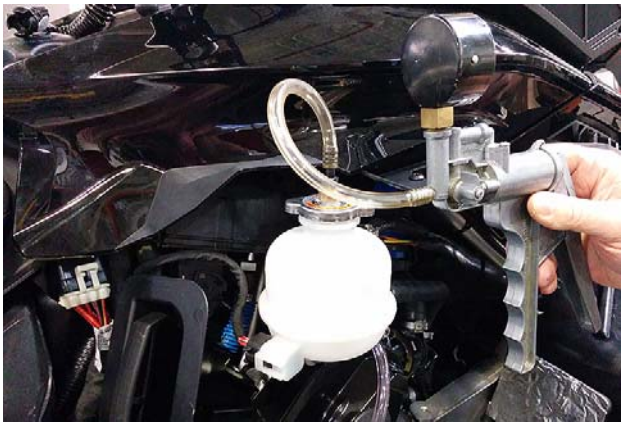
Remove the RH side panel.

Remove coolant tank cap.

Pressurize system through coolant tank.

REQUIRED TOOL	
TEST CAP (P/N 529 035 991)	
VACUUM/PRESSURE PUMP (P/N 529 021 800)	

TEST PRESSURE
100 kPa (15 PSI)



mmr2017-018-200

TYPICAL

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

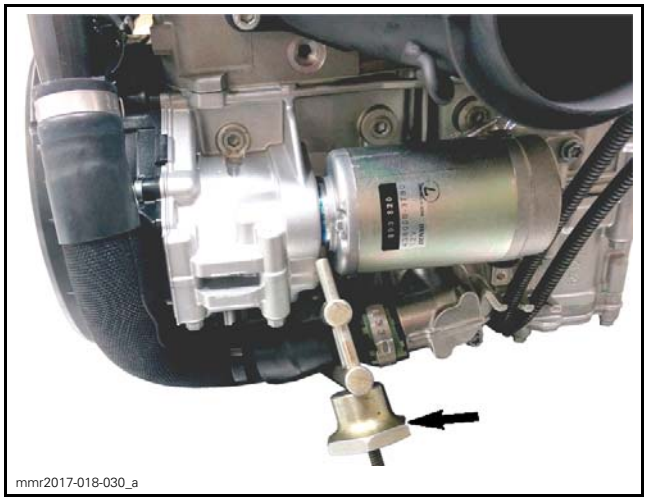
If no external leak is found and pressure drops, carry out the *ENGINE COOLING CIRCUIT LEAK TEST* to find a potential engine internal leak.

ENGINE COOLING CIRCUIT LEAK TEST

NOTE: An engine leak test should be performed prior to installing engine in vehicle each time the engine is disassembled.

Install a suitable hose on the water pump cover and block it.

REQUIRED TOOL	
LARGE HOSE PINCHER (P/N 529 032 500)	



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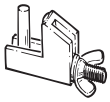
Install a suitable hose on the cylinder head and block it.

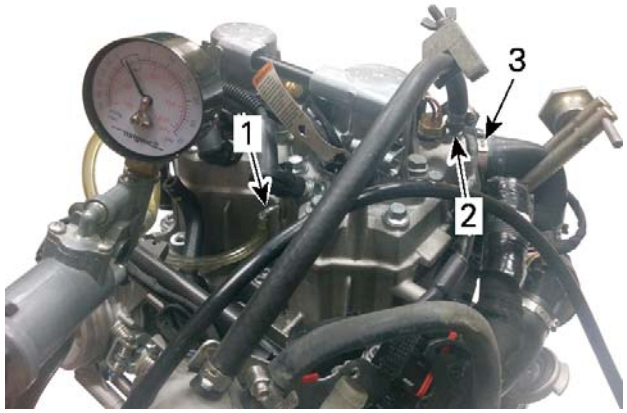
REQUIRED TOOL	
LARGE HOSE PINCHER (P/N 529 032 500)	

Install a suitable hose on the bleeder nipple and block it

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

Install the pressure pump on the bent fitting for throttle body heating.

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



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1. Bent fitting for throttle body heating
2. Bleeder nipple
3. Cylinder head hose

Pressurize the engine.

TEST PRESSURE
100 kPa (15 PSI)

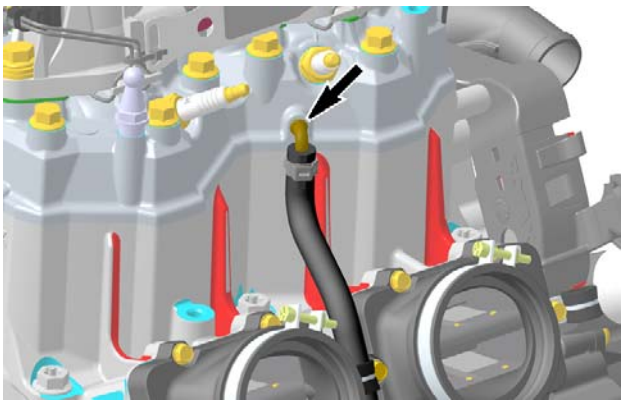
If pressure drops, spray a soap/water solution onto engine jointed surfaces and look for air bubbles.

PROCEDURES

FITTING (THROTTLE BODY HEATING)

Fitting Replacement

Remove throttle body from intake manifolds and put it aside.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TYPICAL - PARTS REMOVED FOR CLARITY

Clean area around fitting to remove oil or dirt.

Heat fitting then pull it out of cylinder head.

Ensure fitting is clean from dirt or oil and dry.

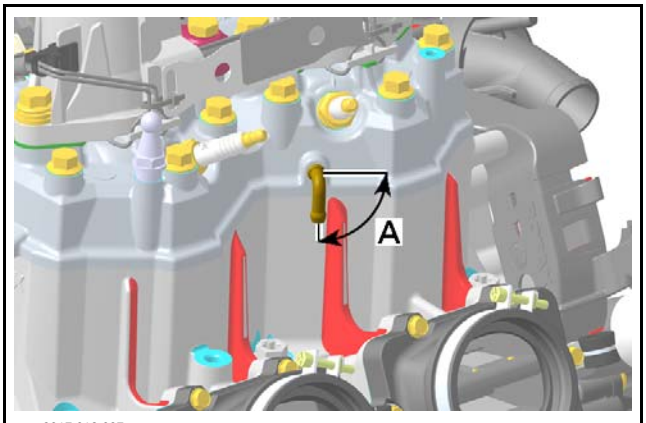
FITTING CLEANING	
Service product	PULLEY FLANGE CLEANER (P/N 413 711 809)

Apply sealant on the outer diameter of fitting.

CHECK VALVE AND FITTING SEALANT	
Service product	LOCTITE 648 (GREEN) (P/N 413 711 400)

Punch in the fitting carefully with a plastic hammer.

For correct orientation of the fitting refer to the next illustration.



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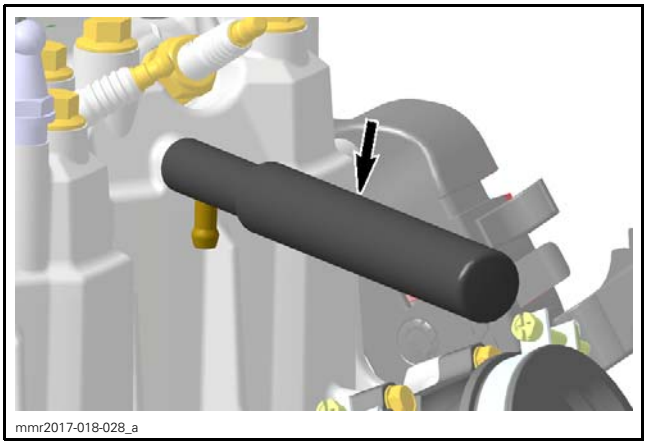
A. 90°

REQUIRED TOOL	
IMPULSE FITTING PUNCH (BIG) (P/N 529 036 412)	



FITTING - IMPULSE FITTING PUNCH (BIG) (P/N 529 036 412)

WATER PUMP

Water Pump Location

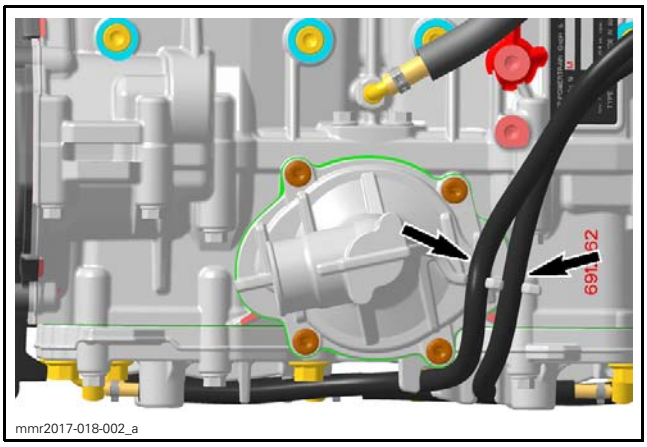
The water pump is located on the front of the engine, below the intake manifold.

Removing the Water Pump

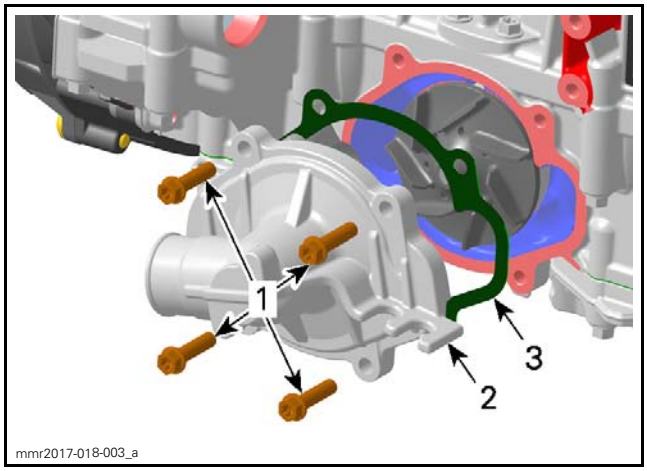
Drain cooling system, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

Remove starter, refer to *MAGNETO AND STARTER* subsection.

Remove oil lines.



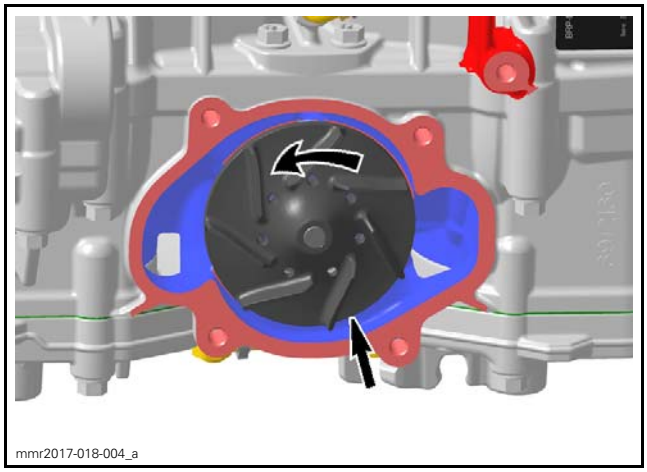
Remove the following parts.

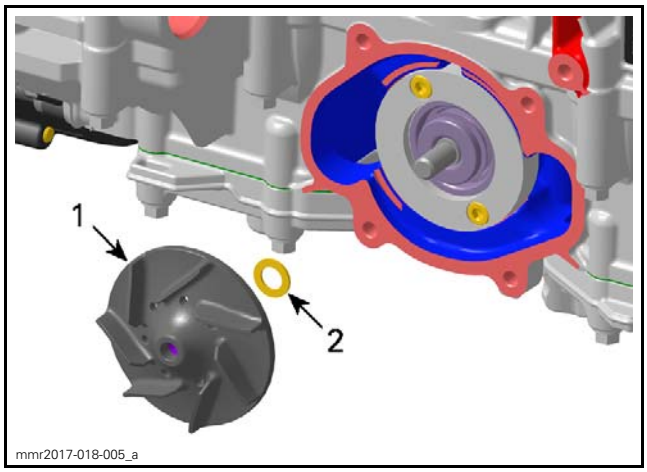


1. *Screws*
2. *Water pump cover*
3. *Gasket*

Remove impeller by turning it counterclockwise.

NOTICE Be careful not to damage impeller fins.





1. *Impeller*
2. *Washer, 1 mm (.039 in) thick*

Clean gasket surfaces of water pump cover and crankcase.

Installing the Water Pump

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

Clean water pump shaft thread using a part cleaner and compressed air.

WATER PUMP SHAFT THREAD CLEANING	
Service product	PULLEY FLANGE CLEANER (P/N 413 711 809)

Ensure to install the 1 mm (.039 in) thick washer.

Apply thread locker on water pump shaft thread.

WATER PUMP SHAFT THREAD	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)

Tighten impeller to specification.

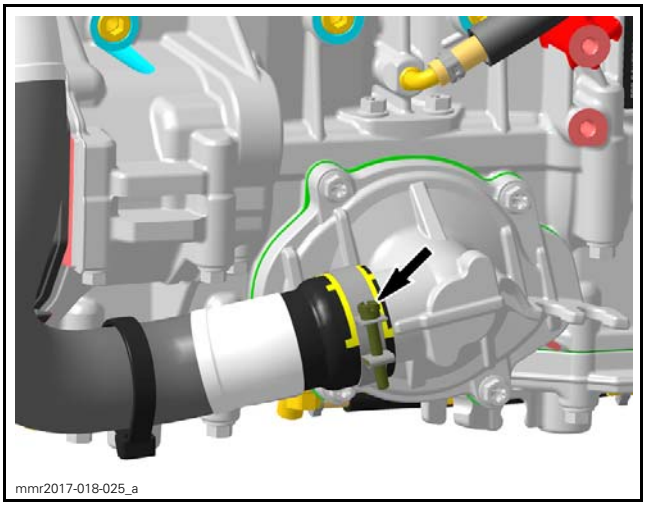
TIGHTENING TORQUE	
Impeller	15 N•m ± 1 N•m (133 lbf•**in** ± 9 lbf•**in**)

Install a NEW water pump cover gasket.

Tighten screws of water pump cover to specification in a crisscross sequence.

TIGHTENING TORQUE	
Water pump cover screws	11 N•m ± 0.8 N•m (97 lbf•**in** ± 7 lbf•**in**)

Install and tighten coolant hose clamp on water pump.

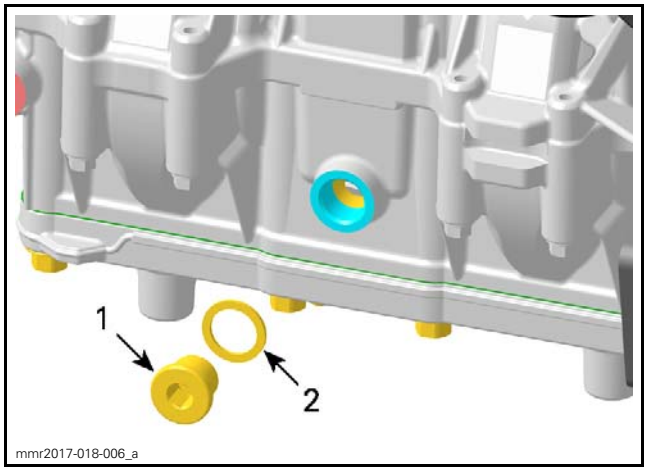


TIGHTENING TORQUE	
Coolant hose clamp	3 N•m ± 0.4 N•m (27 lbf•**in** ± 4 lbf•**in**)

BEARING CARRIER AND PUMP SHAFT

Removing the Bearing Carrier and Pump Shaft

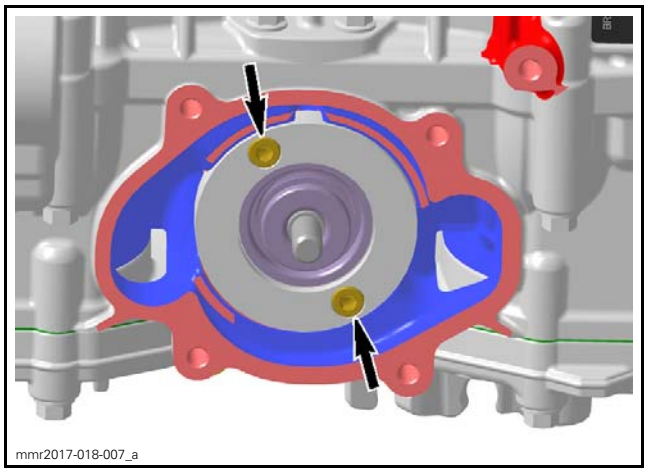
Remove plug screw and discard sealing ring.



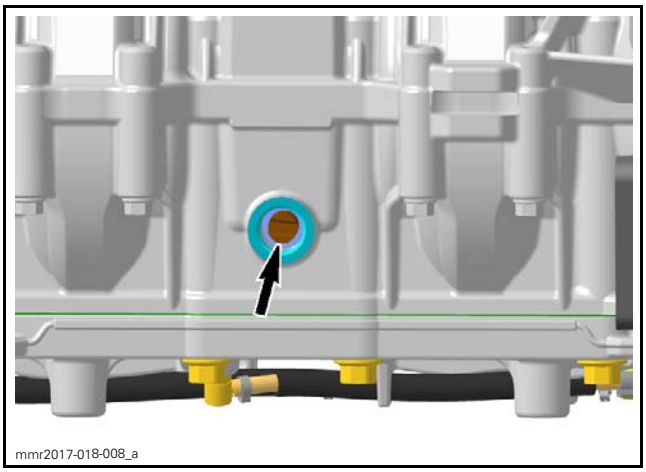
1. *Plug screw*
2. *Sealing ring*

Remove *WATER PUMP*. See procedure in this subsection.

Remove bearing carrier retaining screws.

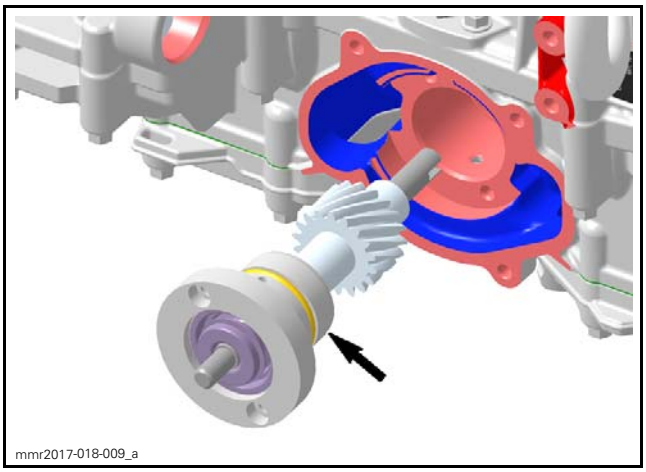


Push pump shaft out with a suitable drift punch and a hammer.

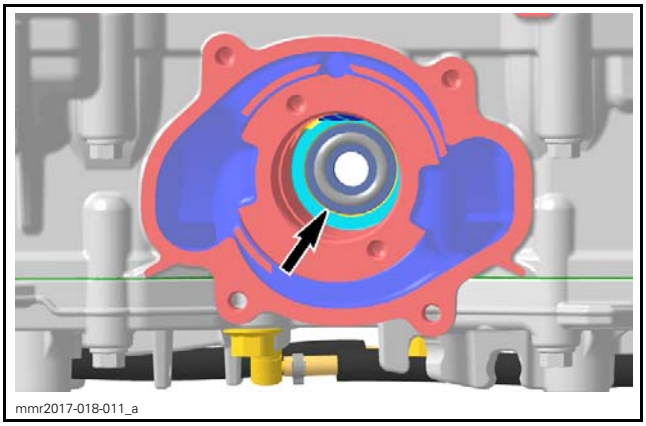


PUSH OUT SHAFT HERE

Extract bearing carrier and pump shaft.



For water pump shaft ball bearing replacement refer to *BOTTOM END* subsection.



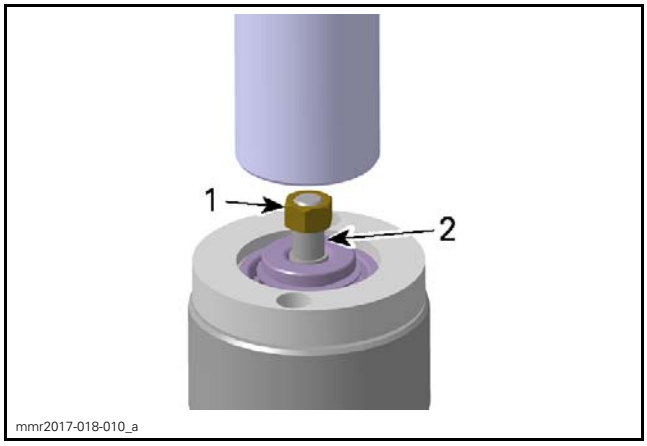
Disassembling the Bearing Carrier and Pump Shaft

NOTE: The pump shaft cannot be disassembled without damaging the ceramic seal and oil seal.

Protect the threads of shaft with a suitable M8 nut.

Properly support bearing carrier.

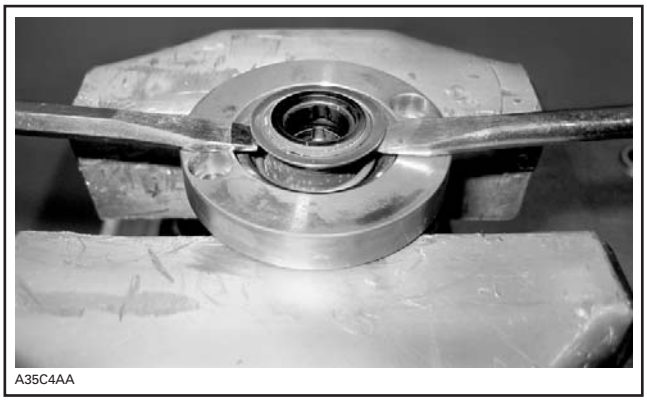
Push pump shaft out using a press.



1. *M8 nut*
2. *Shaft*

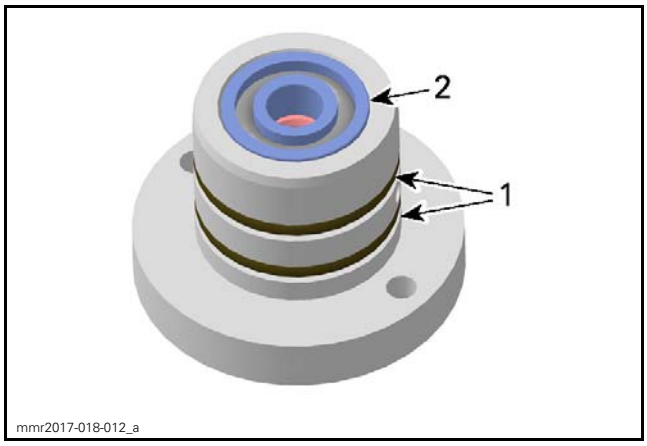
NOTICE Pay attention not to damage the bearing carrier during disassembly. Marks or other damages will lead to coolant or oil leakage.

Pry inner part of ceramic seal out.



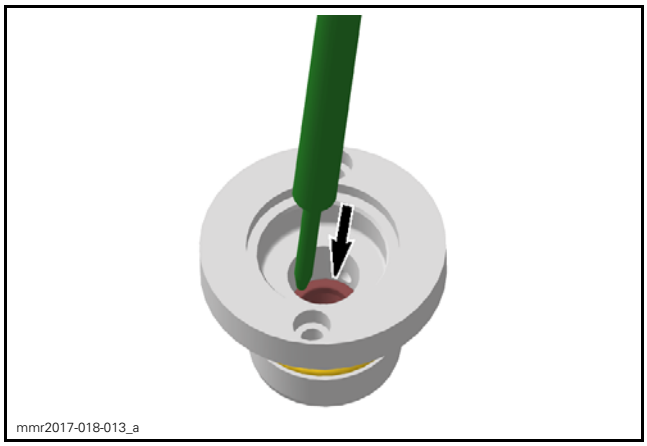
Remove O-rings and discard them.

Remove bearing using a blind hole bearing puller.



1. *O-rings*
2. *Ball bearing*

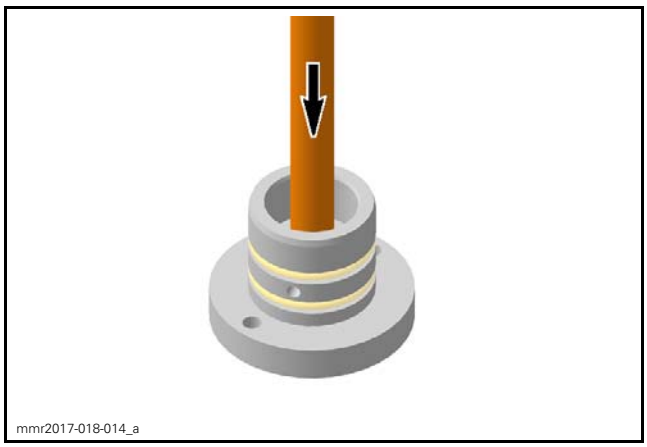
Remove oil seal using as appropriate punch.

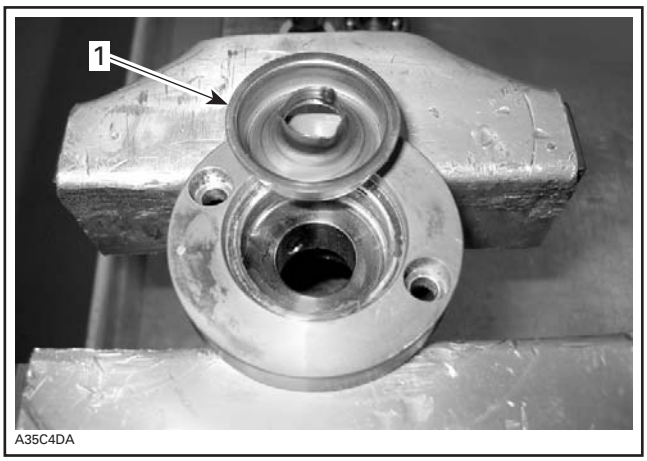


FOR CLARITY OUTER PART OF CERAMIC SEAL REMOVED

Carefully press the outer part of ceramic seal out.

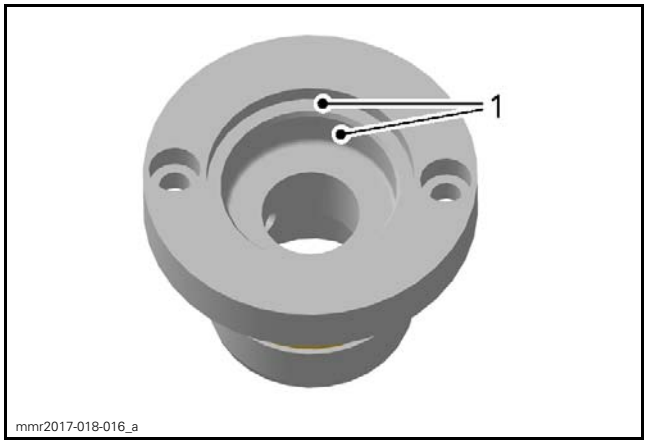
NOTE: Use a mandrel with a diameter of approximately 16 mm (.63 in).





1. *Outer part of ceramic seal*

Remove sealant from bearing carrier with sand paper no. 180.



1. *Remove sealant*

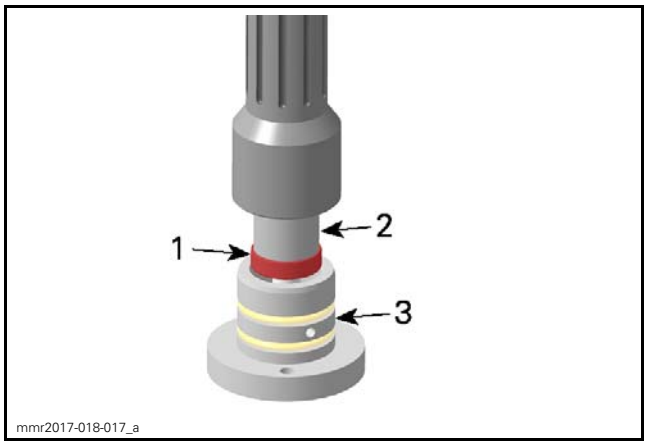
Reassembling the Bearing Carrier and Pump Shaft

Reverse disassembly procedure and pay attention to the following.

NOTE: Never put oil in the press fit area of the oil seal and ceramic seal.

Push the NEW oil seal in bearing carrier with the sealing lip facing to the ball bearing.

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

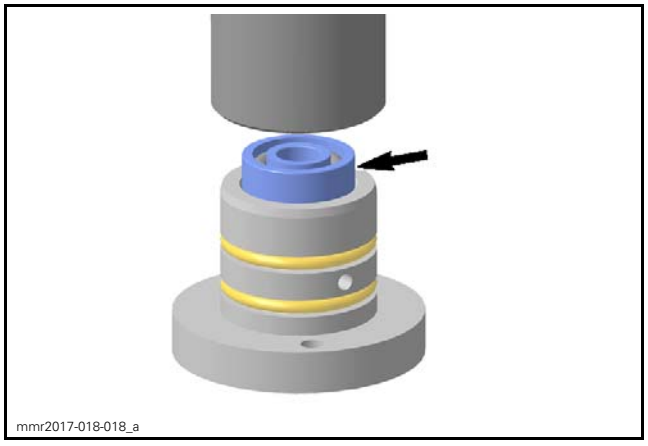


1. *Oil seal*
2. *Oil seal pusher*
3. *Bearing carrier*

Lubricate sealing lip of the oil seal.

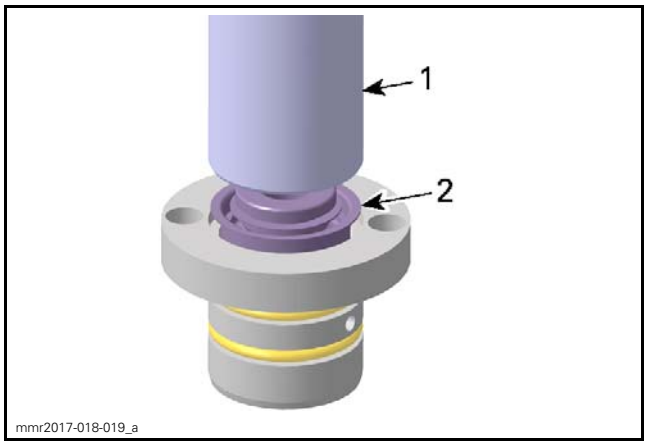
SEALING LIP OF OIL SEAL	
Service product	PETAMO GREASE GHY 133N (P/N 420 899 271)

Press bearing into bearing carrier.



Push the NEW ceramic seal in bearing carrier.

REQUIRED TOOL	
CERAMIC SEAL INSTALLER (P/N 529 036 014)	

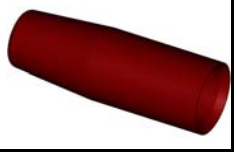


1. *Ceramic seal installer*
2. *Ceramic seal*

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

Install protector sleeve on pump shaft.

NOTE: Apply some grease inside the protector sleeve to prevent the protector sleeve fall off the pump shaft during installation.

REQUIRED TOOL	
PROTECTOR SLEEVE (P/N 529 036 406)	

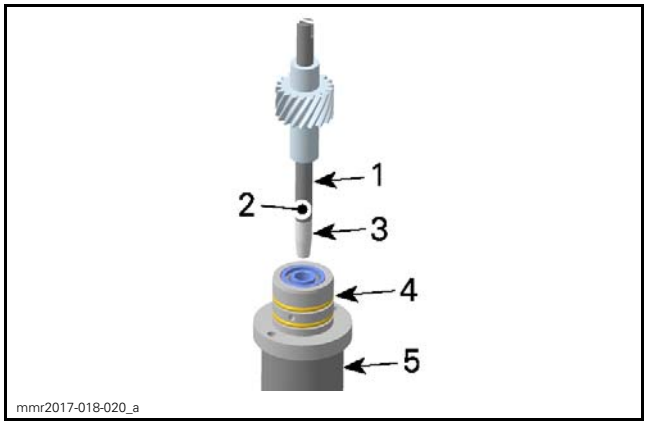
Apply injection oil on pump shaft.

Press pump shaft into the bearing carrier with the appropriate force.

NOTICE **Inadequate force will damage the oil seal and bearing.**

NOTE: During installation support the ceramic seal as shown on the following illustration.

REQUIRED TOOL	
CERAMIC SEAL INSTALLER (P/N 529 036 014)	



1. *Pump shaft*
2. *Apply injection oil*
3. *Potector sleeve*
4. *Bearing carrier*
5. *Ceramic seal installer*

Remove oil seal guide from pump shaft.

Clean water pump shaft thread using a part cleaner and compressed air.

WATER PUMP SHAFT THREAD CLEANING	
Service product	PULLEY FLANGE CLEANER (P/N 413 711 809)

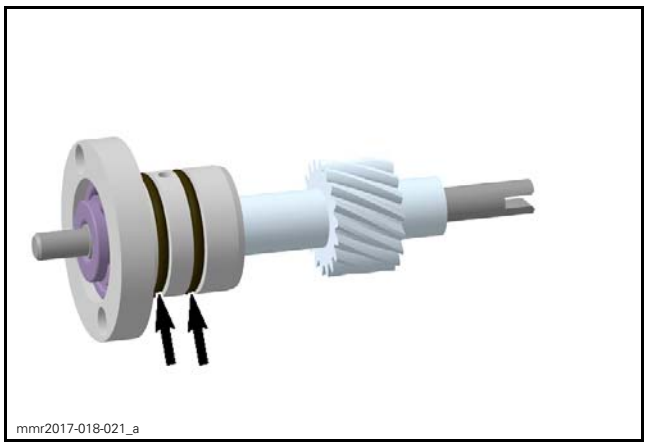
Installing the Bearing Carrier and Pump Shaft

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

Pour injection oil in the pan under crankshaft worm gear.

CRANKSHAFT WORM GEAR LUBRICATION	
Service product	Injection oil
Quantity	50 ml (1.7 U.S. oz)

Install **NEW** O-rings on bearing carrier and apply injection oil.



Install pump shaft and bearing carrier in crankcase while turning shaft to mesh gears.

Tighten bearing carrier retaining screws to specification.

TIGHTENING TORQUE	
Bearing carrier screws	5 N•m ± 0.3 N•m (44 lbf•**in** ± 3 lbf•**in**)

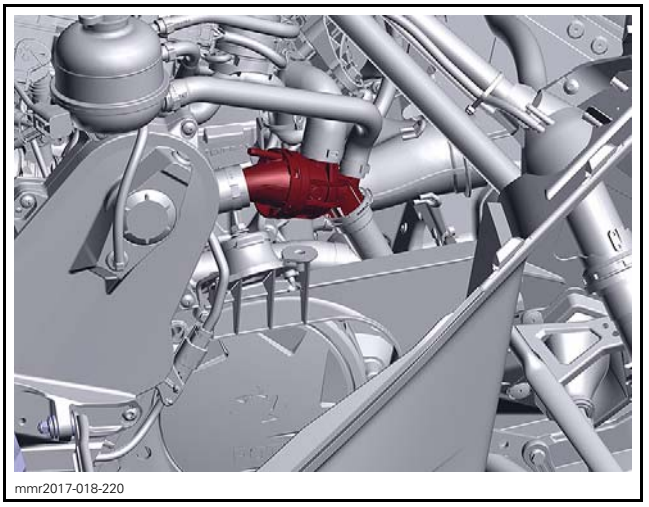
Install **NEW** sealing ring and tighten plug screw to specification.

TIGHTENING TORQUE	
Plug screw	30 N•m ± 2 N•m (22 lbf•ft ± 1 lbf•ft)

THERMOSTAT

Thermostat Location

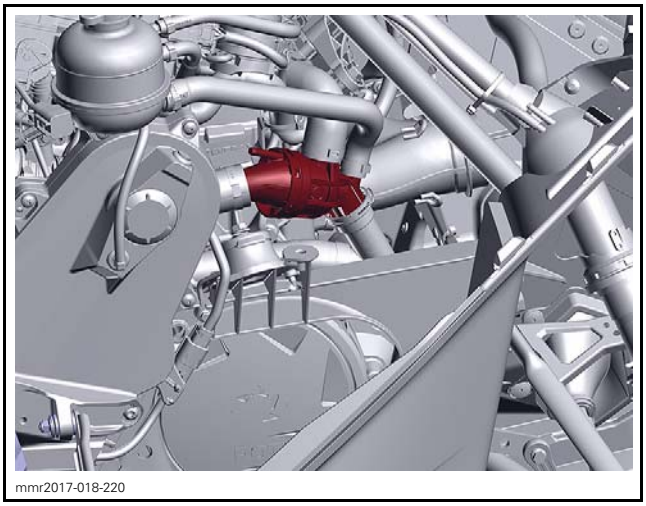
The thermostat is located on the RH side of the engine (PTO side), behind the muffler



Removing the Thermostat

To remove thermostat:

– Block all four thermostat hoses with hose pinchers **or**
– Drain cooling system.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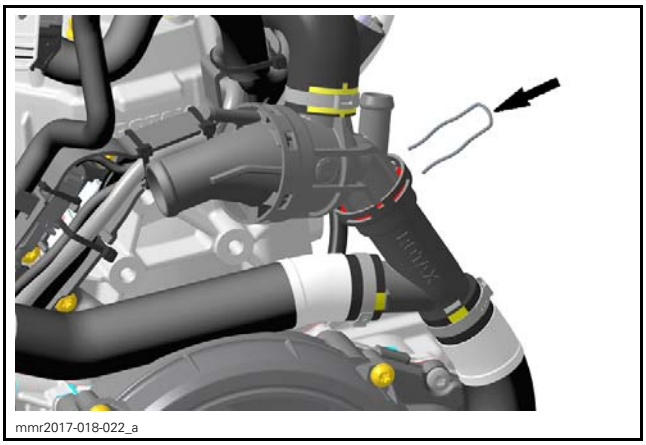
Remove spring clip from thermostat housing.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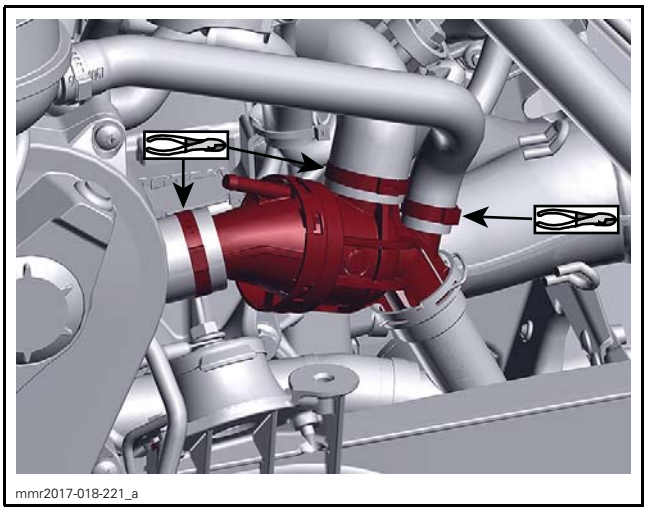
Cut Oetiker clamps (3x) then unplug hoses.

Remove thermostat housing from molded hose assembly.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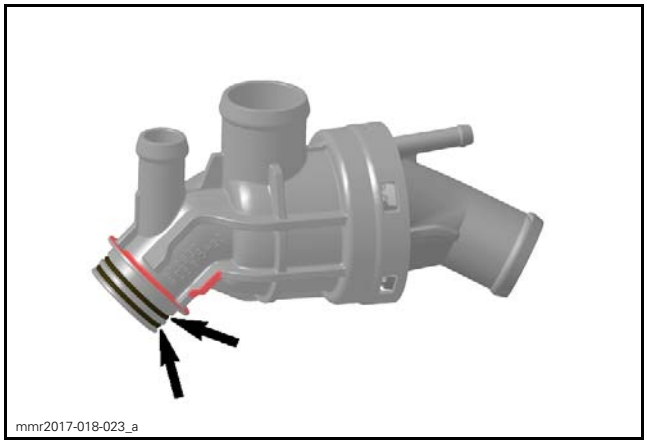
Remove O-rings and discard them.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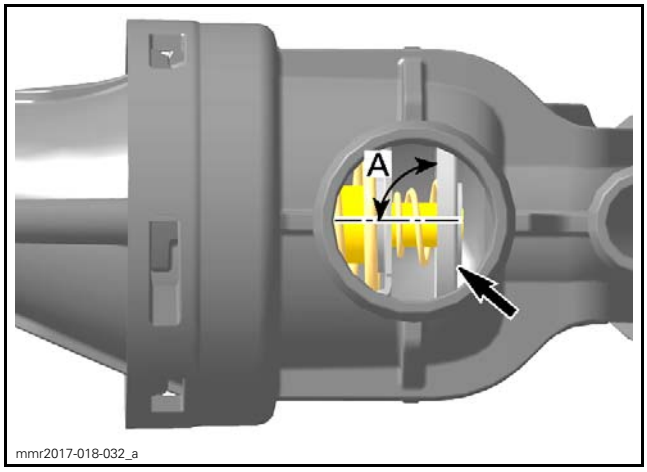
Testing the Thermostat

To check thermostat, put in water and heat water.

THERMOSTAT TEMPERATURE	
Starts to open	37°C (99°F)
Fully open	55°C (131°F)

Inspecting the Thermostat

Check for proper alignment of the thermostat plunger.



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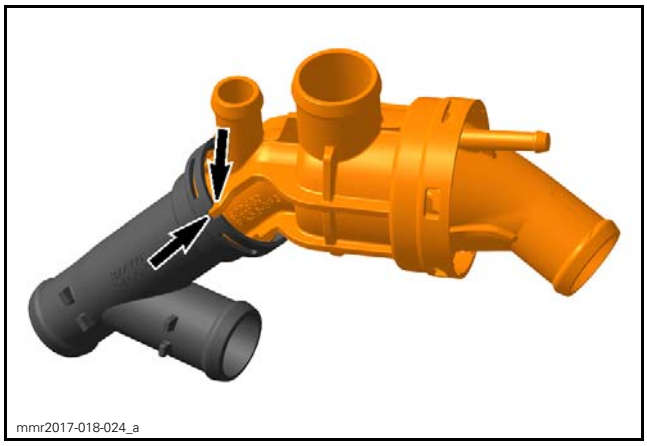
A. 90°

Installing the Thermostat

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

Install **NEW** O-rings and apply coolant.

Take care that the nose of the thermostat housing is properly positioned in the recess of the molded hose assembly.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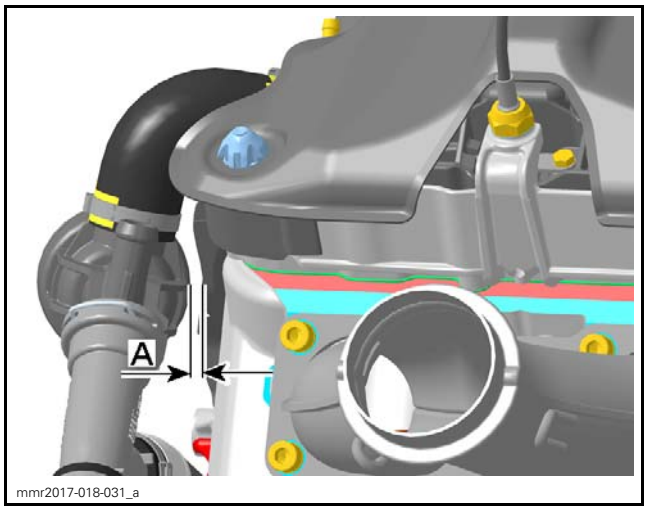
After installation ensure proper distance of thermostat housing to the cylinder block and exhaust manifold.



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A. 5 mm ± 2 mm (.2 in ± .08 in)

Properly refill cooling system. Refer to *COOLING SYSTEM REFILL AND BLEEDING* in *PERIODIC MAINTENANCE PROCEDURES* subsection.

COOLANT TANK CAP

Using a pressure cap tester, check the relief pressure of coolant tank cap.

If the test failed, install a new 110 kPa (16 PSI) cap.

NOTICE **Do not install a tank cap exceeding the recommended pressure.**

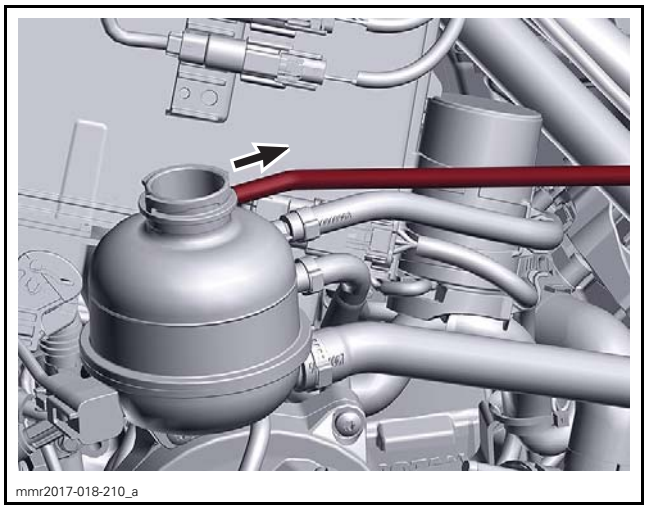
COOLANT TEMPERATURE SENSOR (CTS)

To test and replace the CTS, refer to *E-TEC DIRECT FUEL INJECTION* subsection.

COOLANT TANK

Removing the Coolant Tank

1. Remove the RH side panel.
2. Siphon the coolant tank.
3. Unplug the upper vent hose.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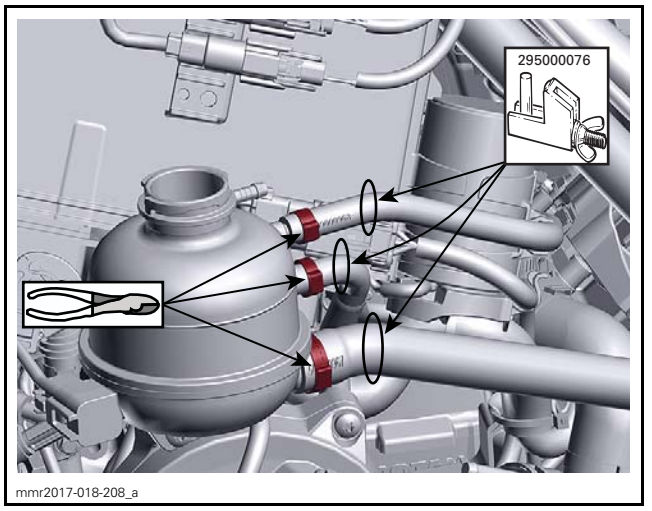
4. Block the three lower coolant hoses with pinchers.
5. Cut Oetiker clamps and remove coolant hoses from coolant tank.



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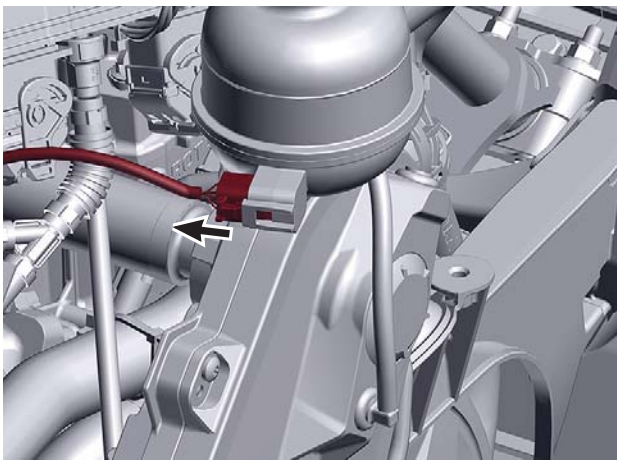
6. Disconnect the oil level sensor connector.



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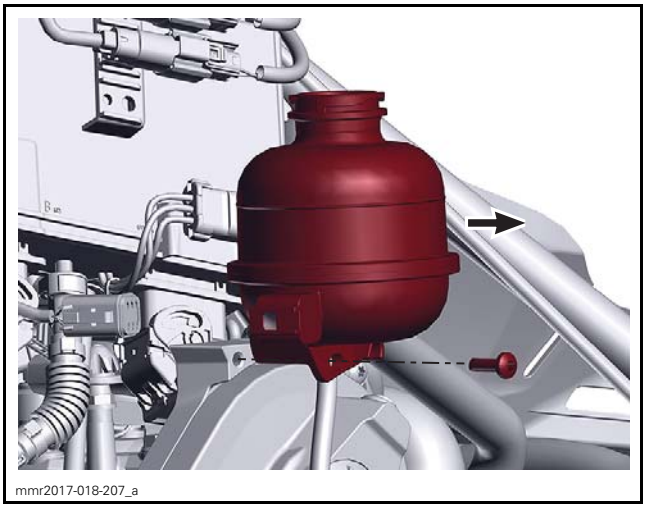
7. Detach the coolant tank from the top of the chaincase.



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Inspecting the Coolant Tank

Check if the tank is cracked or melted. Replace if necessary.

Installing the Coolant Tank

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

Properly refill cooling system. Refer to *COOLING SYSTEM REFILL AND BLEEDING* in *PERIODIC MAINTENANCE PROCEDURES* subsection.

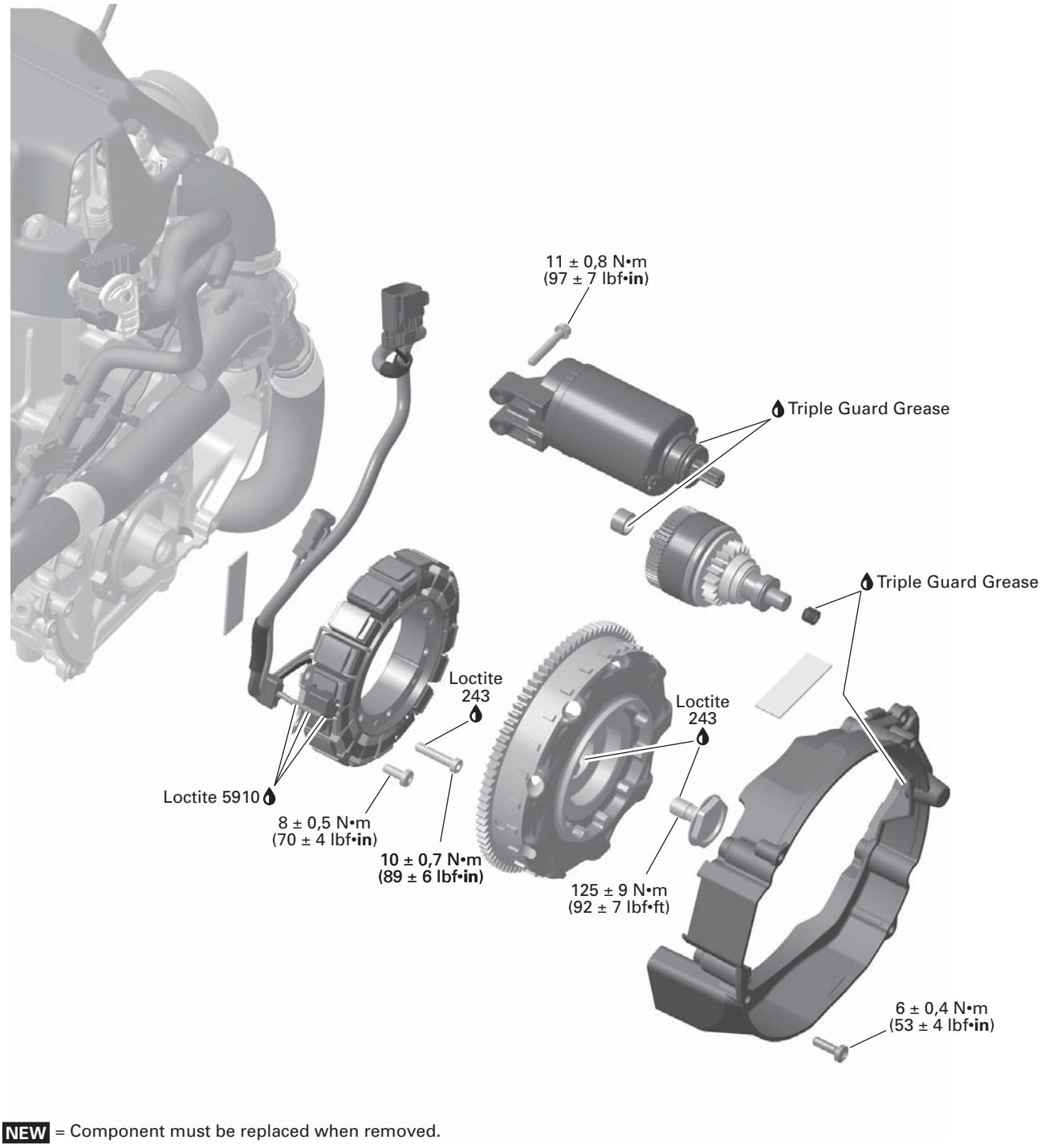
MAGNETO AND STARTER

SERVICE TOOLS

Description	Part Number	Page
ACG ADAPTER	529 036 410	10
CLUTCH HOLDER	529 036 369	3, 6
FLUKE 115 MULTIMETER	529 035 868	9–10
HANDLE	420 877 650	15
MAGNETO HOLDER	529 036 404	3–4, 6
MAGNETO PULLER	529 036 403	4, 6
STARTER DRIVE NEEDLE INSTALLER	529 035 934	15

SERVICE PRODUCTS

Description	Part Number	Page
DIELECTRIC GREASE	293 550 004	13
LOCTITE 243 (BLUE)	293 800 060	5, 7, 11
LOCTITE 5910	293 800 081	9
PULLEY FLANGE CLEANER	413 711 809	5
TRIPLE-GUARD GREASE	296 000 329	13, 15



NEW = Component must be replaced when removed.

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GENERAL

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

⚠ CAUTION Ensure tether cord is removed from D.E.S.S. post and engine shut-off switch is in the OFF position.

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

Clean threads before applying a threadlocker. Refer to the *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* subsections 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, self-locking fasteners, etc.).

PROCEDURES

MAGNETO FLYWHEEL

Magneto Flywheel Access

Remove the rewind starter, refer to *REWIND STARTER* subsection.

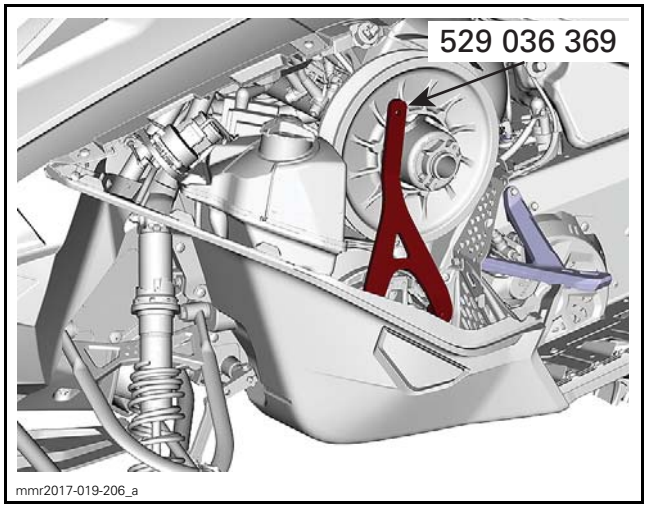
Removing the Magneto Flywheel

⚠ CAUTION Ensure tether cord is removed from D.E.S.S. post and engine shut-off switch is in the OFF position.

Engine In the Vehicle

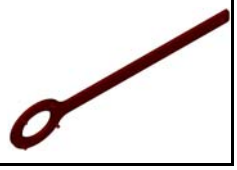
1. Block the drive pulley to avoid engine turning during the removal of the magneto retaining screw.

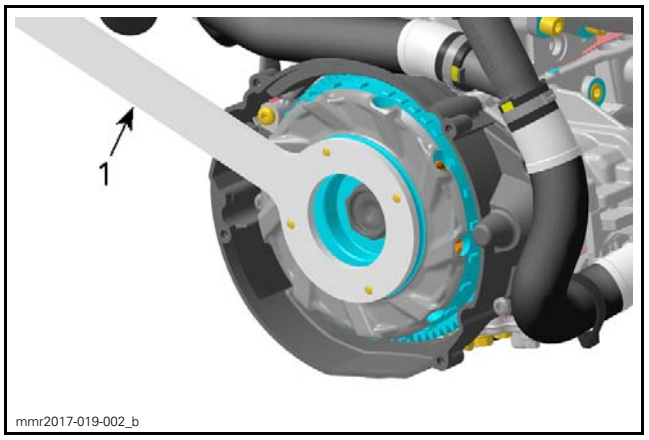
REQUIRED TOOL	
CLUTCH HOLDER (P/N 529 036 369)	



Engine Out of the Vehicle

2. Install the magneto holder.

REQUIRED TOOL	
MAGNETO HOLDER (P/N 529 036 404)	



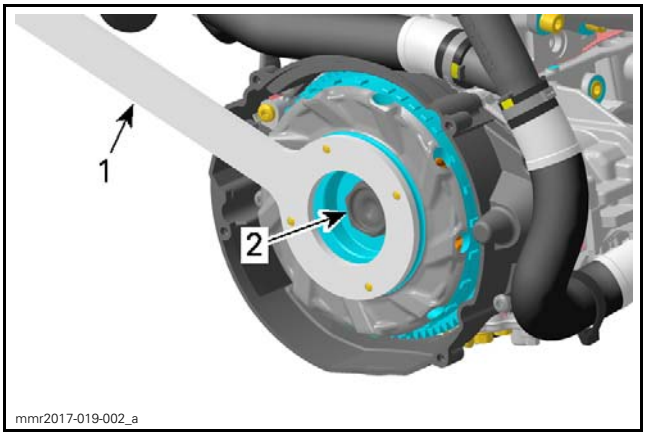
1. Magneto holder

Engine In or Out of the Vehicle

3. Remove magneto flywheel retaining screw.

NOTICE The hexagon head of the retaining screw is very flat. To avoid slipping off thoroughly hold socket against the screw head when loosening the retaining screw.

REQUIRED TOOL	
MAGNETO HOLDER (P/N 529 036 404)	
32 mm socket	



1. Magneto holder (engine out of vehicle)
2. Magneto flywheel retaining screw

Engine In the Vehicle

4. Remove the crankshaft position sensor (CPS). Refer to procedure in this subsection.

Engine Out of the Vehicle

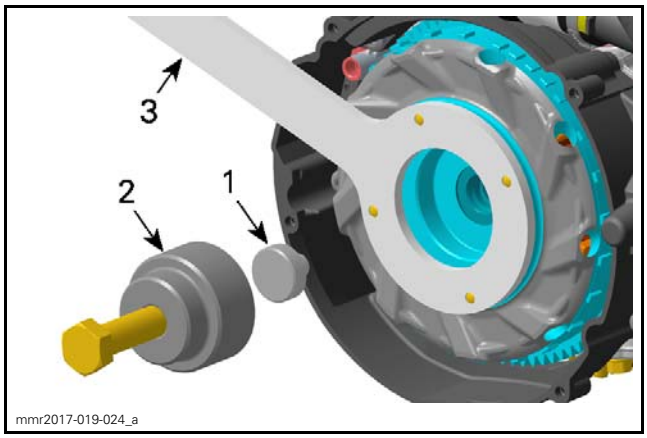
5. Unscrew crank position sensor (CPS). Refer to procedure in this subsection.
6. Slightly pull crank position sensor and cut silicone sealer between crank position sensor and crankcase.
7. Move CPS aside.

Engine In or Out of the Vehicle

8. Remove magneto flywheel.

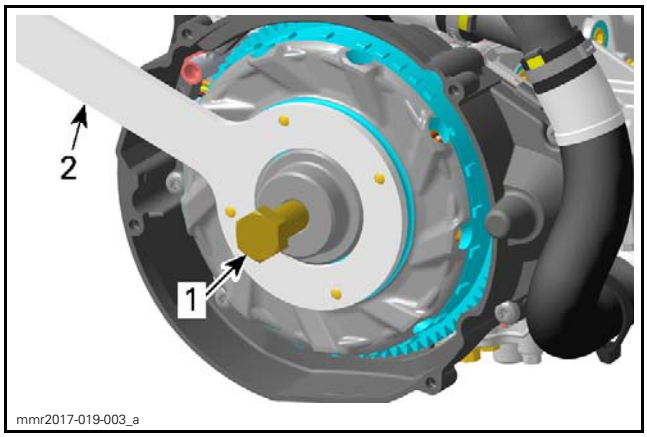
REQUIRED TOOL	
CRANKSHAFT PROTECTOR (P/N 529 036 434)	
MAGNETO PULLER (P/N 529 036 403)	
MAGNETO HOLDER (P/N 529 036 404)	
24mm socket	

Install service tools on engine.



1. Crankshaft protector
2. Magneto puller
3. Magneto holder (engine out of vehicle)

Tighten puller bolt, while holding the magneto flywheel in place until magneto flywheel releases from crankshaft.



1. *Puller bolt*
2. *Magneto holder (engine out of vehicle)*

Inspecting the Magneto Flywheel

Clean magneto flywheel using only a clean cloth.

Inspect magneto flywheel for abnormal coloration (brown or blue) that would indicate overheating condition.

If overheating condition is suspected, carry out the following:

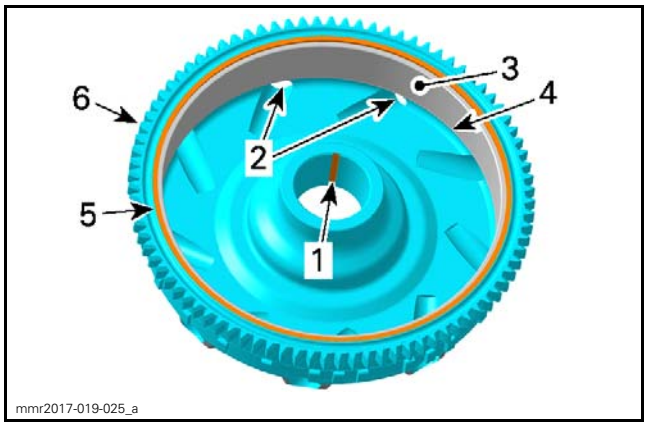
- Check flywheel magnetic field using a piece of metal. If magnetic field is not felt or weak, replace flywheel.
- Inspect flywheel for cracks, pay particular attention to the inside circumference (magnets), and the tapered center portion.
- Check if magneto flywheel ventilation holes are clean.
- Check if magneto housing ventilation holes are clean.
- Check stator for signs of overheating.
- Test stator, see procedures in this subsection.

Check INOX sheet metal ring on inside of magneto flywheel for proper position and fixation.

Check if bead of silicone is not damaged.

Check starter gear teeth for wear or any other damage.

Check keyway of the magneto flywheel for wear or damages.



1. *Keyway*
2. *Ventilation holes*
3. *INOX sheet metal ring (magnets underneath)*
4. *INOX sheet metal ring flush with flywheel (no gap)*
5. *Bead of silicone*
6. *Starter gear*

Installing the Magneto Flywheel

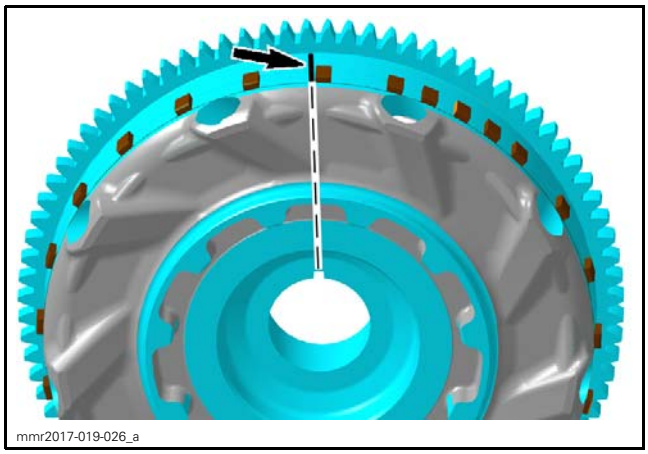
1. Clean:
   - Crankshaft taper
   - Thread in crankshaft
   - Magneto flywheel taper
   - Magneto flywheel retaining screw threads.

TAPER AND THREADS CLEANING	
Service product	PULLEY FLANGE CLEANER (P/N 413 711 809)

2. Apply thread locker on magneto flywheel taper.

MAGNETO FLYWHEEL TAPER	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)

3. Install woodruff key on crankshaft.
4. Turn crankshaft to position woodruff key in top position.
5. Mark keyway position on magneto flywheel.



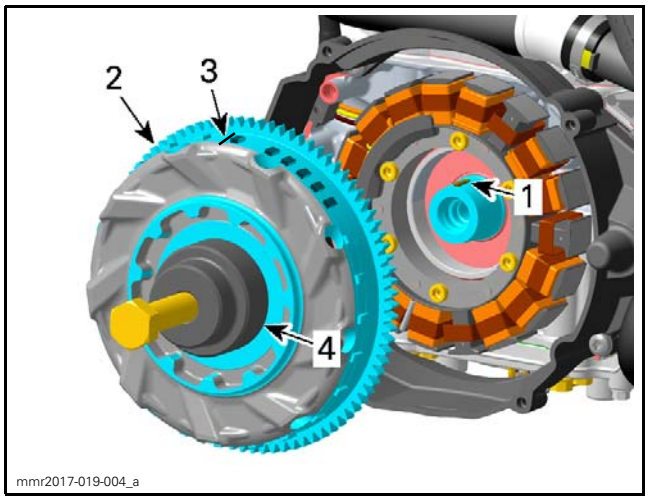
MARK KEYWAY POSITION

6. Install magneto flywheel.

⚠ CAUTION For installation use magneto puller to avoid injuries due to the high magnetic pull of the magneto flywheel.

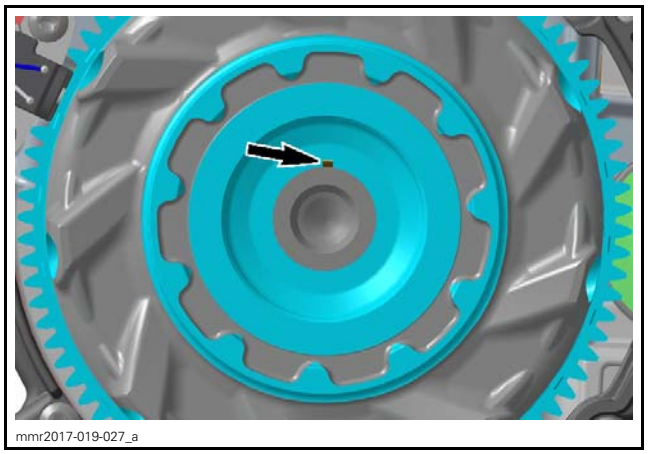
REQUIRED TOOL	
MAGNETO PULLER (P/N 529 036 403)	

Hold magneto flywheel with mark in top position.



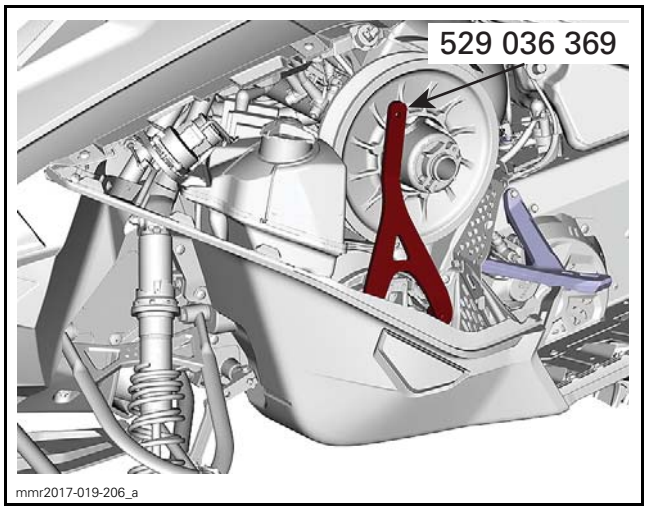
1. *Woodruff key in top position*
2. *Magneto flywheel*
3. *Mark on magneto flywheel*
4. *Magneto puller*

7. Check if woodruff key is in proper position.

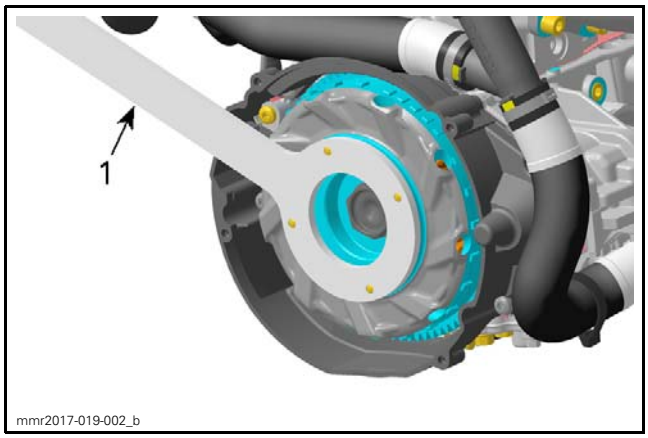


8. Block the drive pulley or the magneto flywheel using the appropriate tool.

REQUIRED TOOL	
CLUTCH HOLDER (P/N 529 036 369)	
MAGNETO HOLDER (P/N 529 036 404)	



IN VEHICLE

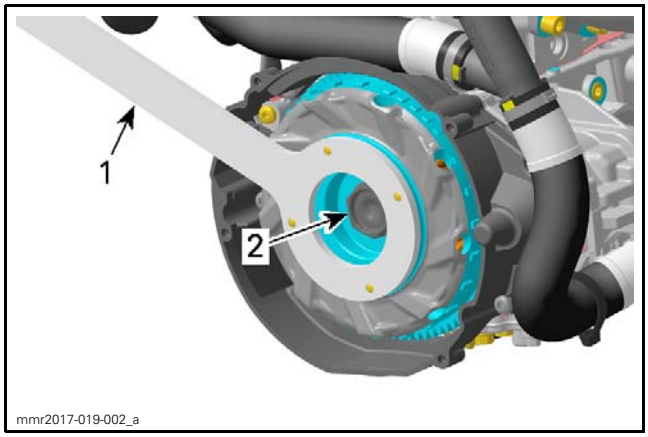


OUTSIDE VEHICLE
1. *Magneto holder*
2. *Magneto flywheel screw*

9. Install magneto flywheel retaining screw and tighten to specification.

NOTICE **The hexagon head of the retaining screw is very flat. To avoid slipping off thoroughly hold socket against the screw head when tightening the retaining screw.**

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Magneto flywheel retaining screw	125 N•m ± 9 N•m (92 lbf•ft ± 7 lbf•ft)



1. *Magneto holder*
2. *Magneto flywheel retaining screw*

MAGNETO HOUSING

Inspecting the Magneto Housing

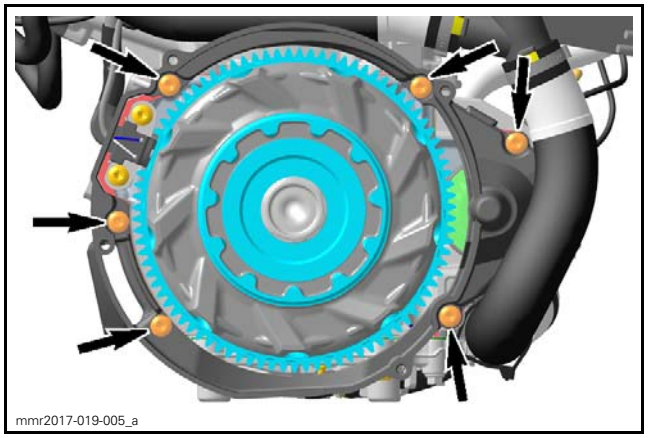
Inspect housing for cracks or other apparent damage. Replace if necessary.

Removing the Magneto Housing

NOTE: The engine removal is required to remove the magneto housing.

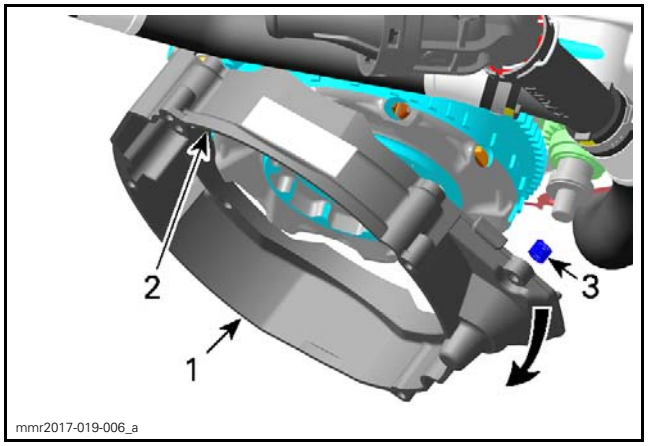
CAUTION **Ensure tether cord is removed from D.E.S.S. post and engine shut-off switch is in the OFF position.**

1. Remove magneto housing screws.



2. Slightly pull magneto housing and cut silicone sealer from between CPS and magneto housing.

NOTE: Do not lose starter drive spring during removal of magneto housing.



PULL MAGNETO COVER
1. *Magneto cover*
2. *CPS*
3. *Spring*

3. Remove magneto housing.

Installing the Magneto Housing

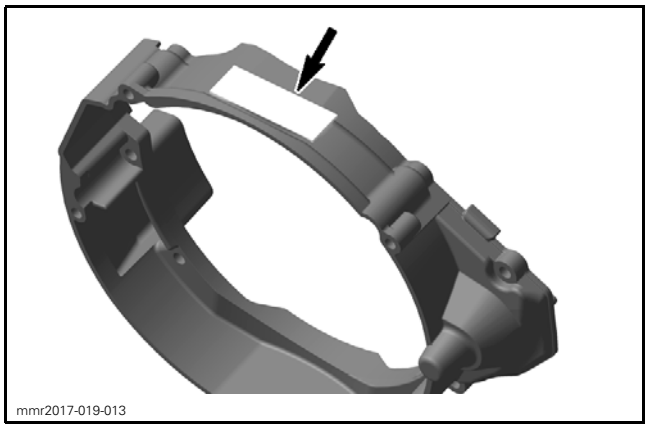
The installation is the reverse of the removal procedure, however pay attention to the following.

Remove the old silicon at CPS.

Tighten magneto housing screws to specification.

TIGHTENING TORQUE	
Magneto housing screws	6 N•m ± 0.4 N•m (53 lbf•**in** ± 4 lbf•**in**)

On a new magneto cover install adhesive pad.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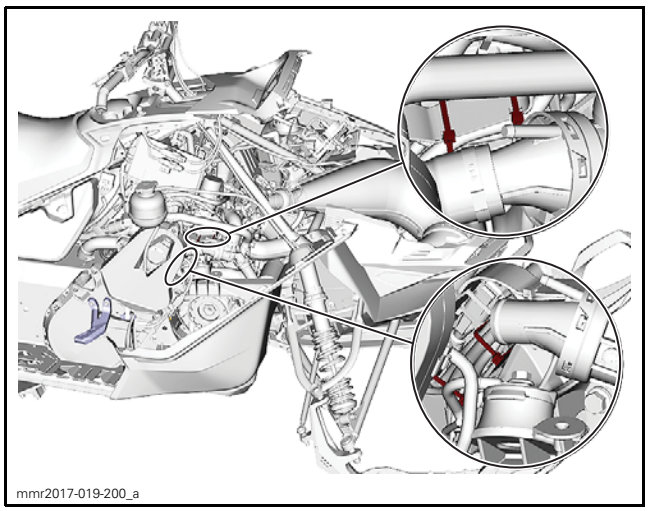
CRANKSHAFT POSITION SENSOR (CPS)

CPS Connector Access

1. Remove the muffler. Refer to *EXHAUST SYSTEM* subsection.
2. Cut locking ties securing the wiring harness to engine harness support.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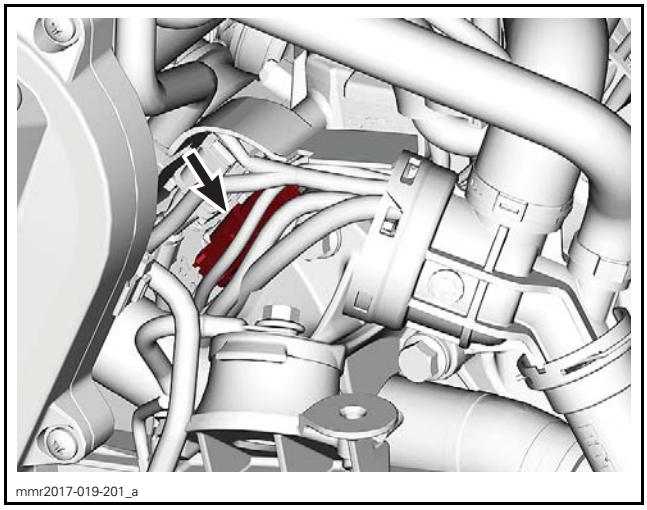
3. Move wirings aside and disconnect the CPS connector.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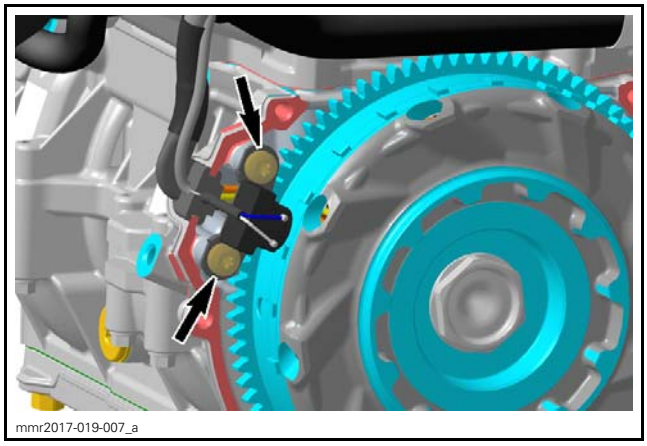
Testing the CPS

Refer to *E-TEC DIRECT INJECTION* subsection.

Removing the CPS

⚠ CAUTION **Ensure tether cord is removed from D.E.S.S. post and engine shut-off switch is in the OFF position.**

1. Remove magneto housing, refer to *MAGNETO HOUSING* in this subsection.
2. Remove CPS retaining screws.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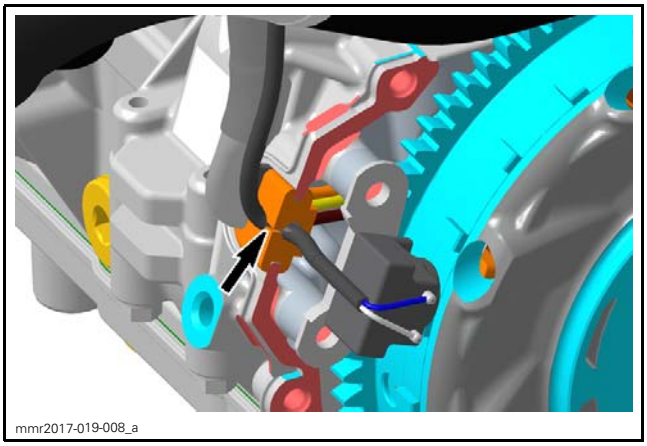
3. Disconnect CPS connector, refer to *CPS CONNECTOR ACCESS* in this subsection.
4. Remove CPS.
5. Remove the old silicon at CPS sensor location

Installing the CPS

NOTICE **Do not apply silicone dielectric grease or any other product on Deutsch waterproof housings as housing seal may be damaged.**

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

Insert CPS cable into stator cable grommet.



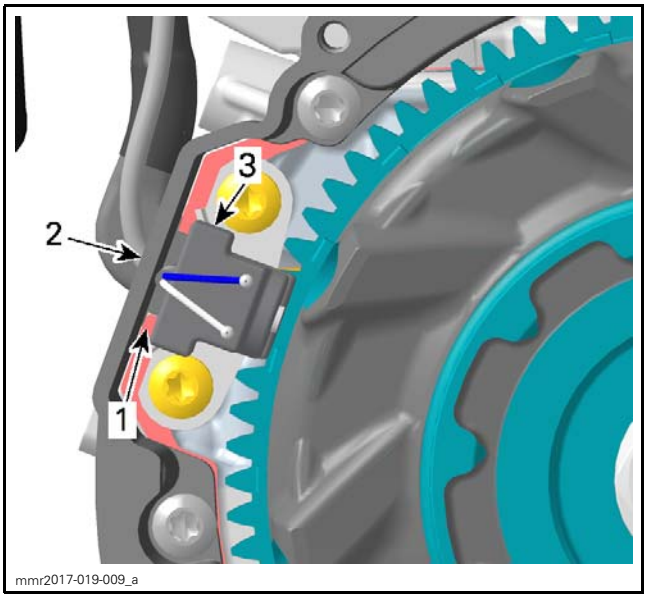
Tighten CPS retaining screws to specification.

TIGHTENING TORQUE	
CPS retaining screws	8 N•m ± 0.5 N•m (71 lbf•**in** ± 4 lbf•**in**)

NOTE: It is important to remove the old silicon at CPS location.

Fill out the gap between CPS and magneto housing with silicon.

CPS HARNESS	
Service product	LOCTITE 5910 (P/N 293 800 081)

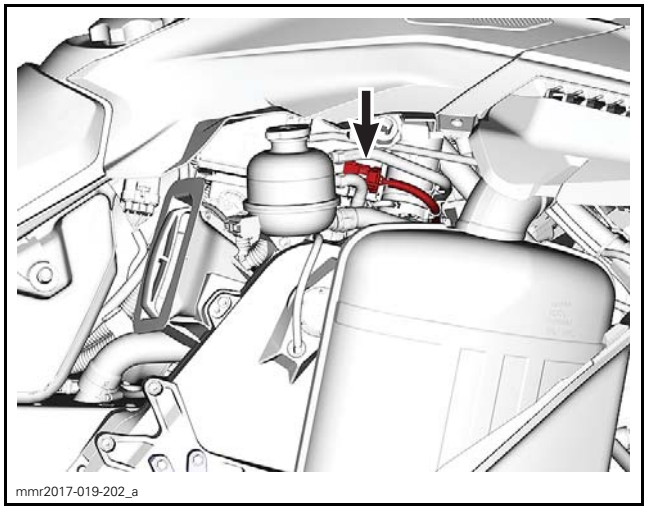


1. *Fill up with silicon.*
2. *Magneto housing*
3. *CPS*

STATOR

Stator Connector Access

1. Remove the RH side panel.
2. Disconnect stator connector (3-pin connector).



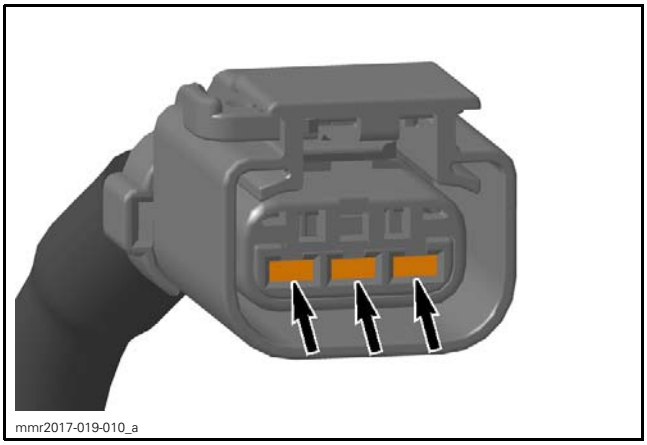
Testing the Stator Continuity

1. Disconnect stator connector.
2. Set multimeter to Ω.

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

3. Measure resistance of each stator coil as follows.

STATOR CONTINUITY TEST		
TEST PROBES		RESISTANCE @ 20°C (68°F)
Pin 1	Pin 2	0.63 ± 0.03 Ω
Pin 1	Pin 3	
Pin 2	Pin 3	



STATOR CONNECTOR PIN-OUT

NOTE: The stator resistance values mentioned in the table are manufacturers specifications under ideal conditions. If stator coil resistance is less than 1 Ω, consider stator to be in good working condition.

If resistance is out of specification, replace stator.

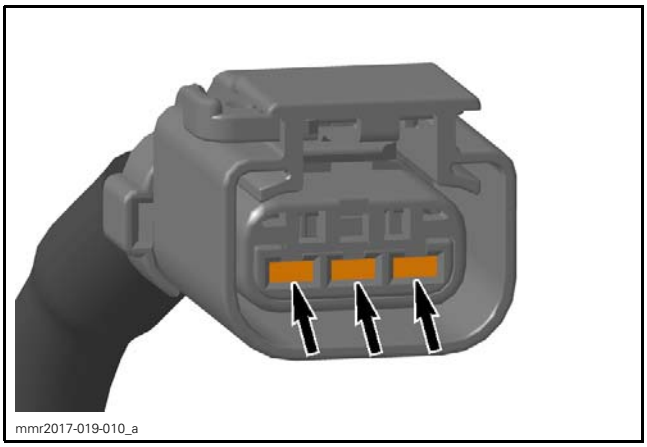
Testing the Stator Insulation

1. Disconnect stator connector.
2. Set multimeter to Ω.

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

3. Measure resistance as follows.

STATOR INSULATION TEST		
TEST PROBES		RESISTANCE @ 20°C (68°F)
Pin 1	Engine ground	OL (open circuit)
Pin 2		
Pin 3		



STATOR CONNECTOR PIN-OUT

If results are out of specification, the stator and/or the wiring need to be repaired/replaced.

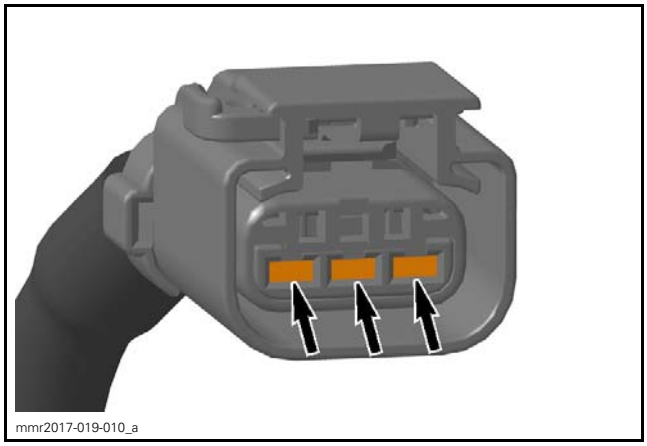
Testing the Stator Voltage Output

1. Disconnect stator connector.
2. Set multimeter to Vac and **manually set a scale** capable of reading at least 20 Vac.

REQUIRED TOOL	
FLUKE 115 MULTIMETER (P/N 529 035 868)	
ACG ADAPTER (P/N 529 036 410)	

3. Manually crank engine and read voltage from each winding as follows.
4. Repeat the test 3 times for each winding.

STATOR OUTPUT VOLTAGE TEST		
TEST PROBES		VOLTAGE
Pin 1	Pin 2	Approximately 15 - 20 Vac
Pin 1	Pin 3	
Pin 2	Pin 3	



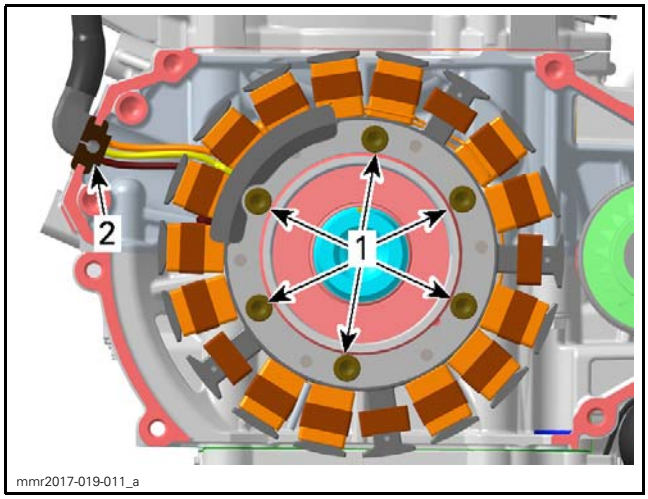
STATOR CONNECTOR PIN-OUT

5. If voltage is lower than specification, remove and inspect magneto flywheel and stator. Refer to *MAGNETO FLYWHEEL* in this subsection.
6. Replace magneto flywheel and/or stator if applicable.

Removing the Stator

1. Refer to procedures in this subsection and remove:
   - Magneto flywheel
   - Magneto housing
   - CPS.

2. Remove stator retaining screws.
3. Remove grommet from crankcase.



1. Stator retaining screws
2. Grommet

4. Disconnect stator connector. Refer to *STATOR CONNECTOR ACCESS* in this subsection.

NOTE: To ease harness routing at installation, tie a string on the connector and let the string follow through as you pull on the harnesses.

5. Remove stator.

Cleaning the Stator

NOTICE **Clean stator using only a clean cloth.**

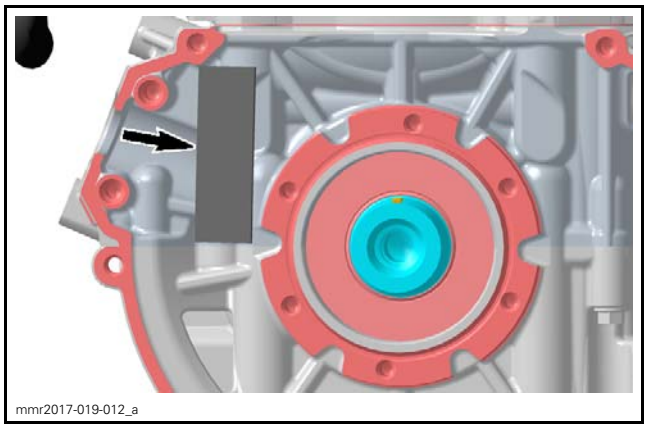
Inspecting the Stator

Refer to *MAGNETO FLYWHEEL INSPECTION* in this subsection.

Installing the Stator

NOTICE **Do not apply silicone dielectric grease or any other product on Deutsch waterproof housings as housing seal may be damaged.**

1. Install adhesive pad on crankcase.



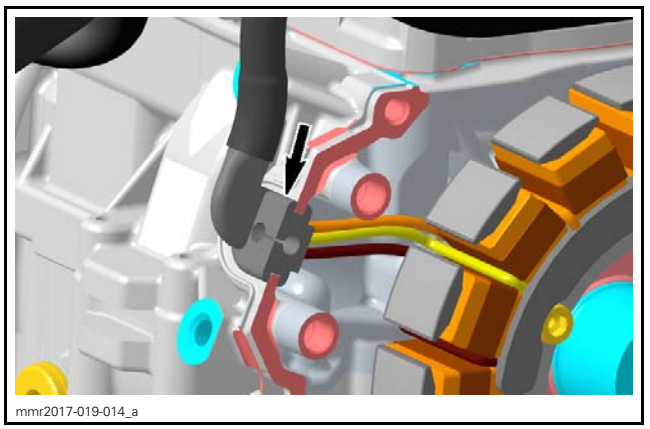
2. Install stator into crankcase.

NOTE: During installation, ensure stator harness is located on the left side.

3. Tighten stator retaining screws to specification.

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Stator retaining screws	10 N•m ± 0.7 N•m (89 lbf•**in** ± 6 lbf•**in**)

4. Position grommet into crankcase recess.



5. Tie the string on the connector used during removal of the stator connector, then pull on him to route the harness up to his original locations.
6. Reinstall all other removed parts.

STARTER

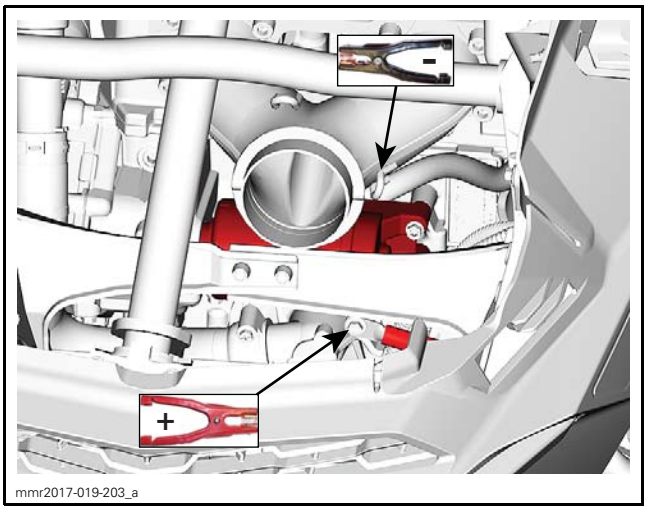
Starter Location

The starter is located at the front of the engine, below the exhaust manifold.

Testing the Starter Operation

Use booster cables and a booster battery to supply current directly to the starter.

1. Connect the RED jumper cable from the booster battery to the starter screw.
2. Momentarily connect the BLACK jumper cable to an ear of the exhaust manifold.



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If the starter turns, test other starting system components. Refer to *STARTING SYSTEM* subsection.

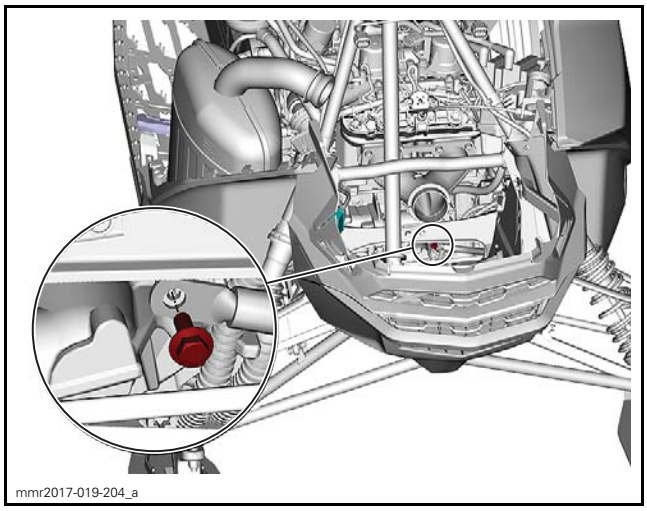
Removing the Starter

1. Disconnect the BLACK (-) battery cable from the battery.

⚠ WARNING

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

2. Remove the tuned pipe, refer to *EXHAUST SYSTEM* subsection.
3. Disconnect the RED (+) power cable from starter.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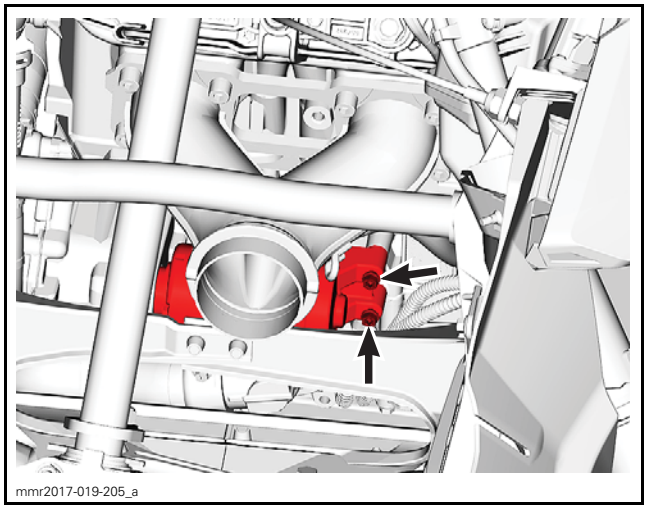
4. Clean starter and surrounding area.
5. Remove starter mounting screws.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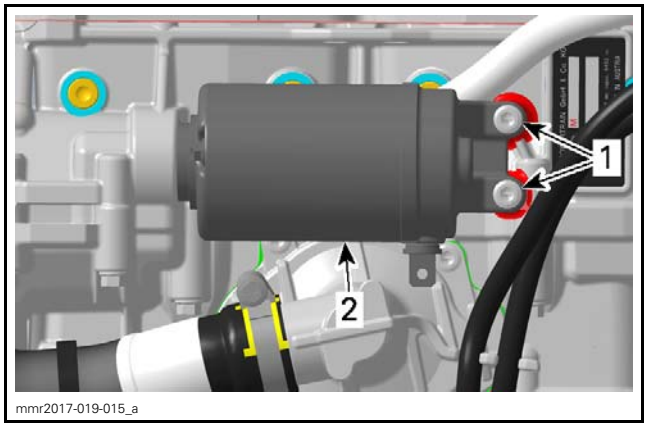

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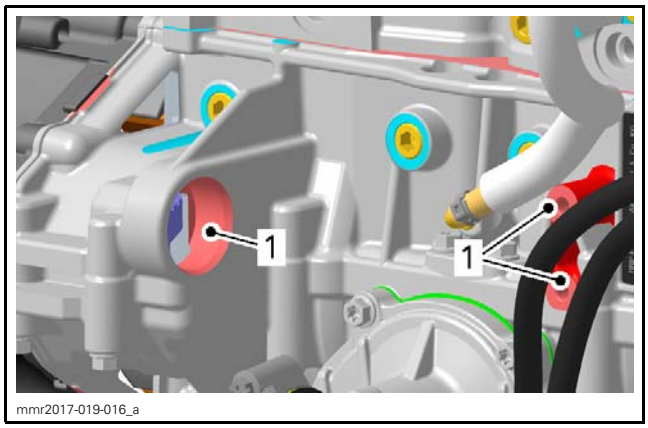
1. Starter mounting screws
2. Starter

6. Pull starter out of crankcase.

Installing the Starter

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

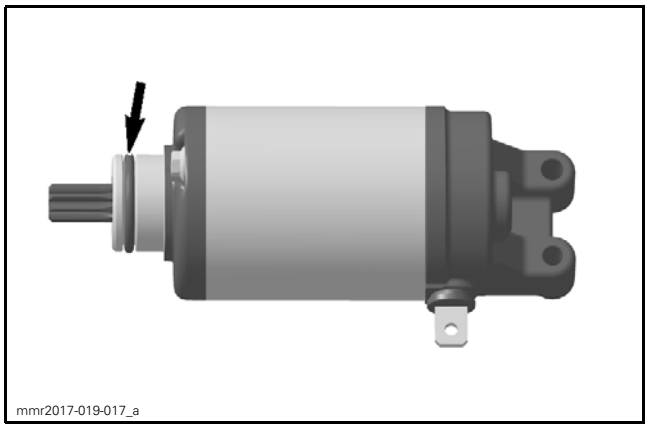
Make sure the starter and engine mating surfaces are free of debris. Serious problems may arise if the starter is not properly aligned.



1. Clean starter mating surfaces

Lubricate starter O-ring.

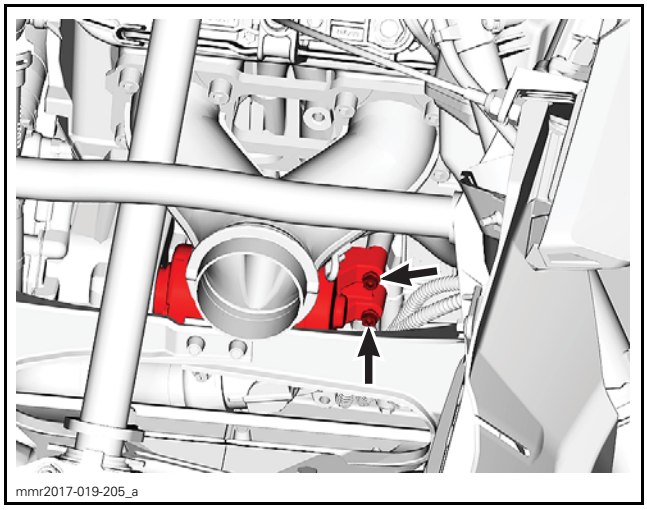
STARTER O-RING	
Service product	TRIPLE-GUARD GREASE (P/N 296 000 329)



LUBRICATE STARTER O-RING

Install starter and tighten mounting screws to specification

TIGHTENING TORQUE	
Starter mounting screws	11 N•m ± 0.8 N•m (97 lbf•**in** ± 7 lbf•**in**)



Connect the RED (+) cable to the starter and tighten screw to specification.

TIGHTENING TORQUE	
Service product	DIELECTRIC GREASE (P/N 293 550 004)
RED (+) power cable screw	2.7 N•m ± 0.7 N•m (24 lbf•**in** ± 6 lbf•**in**)

Connect the BLACK (-) battery cable last.

⚠ WARNING

Always connect the RED (+) starter cable first, then the 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.

Test starter operation.

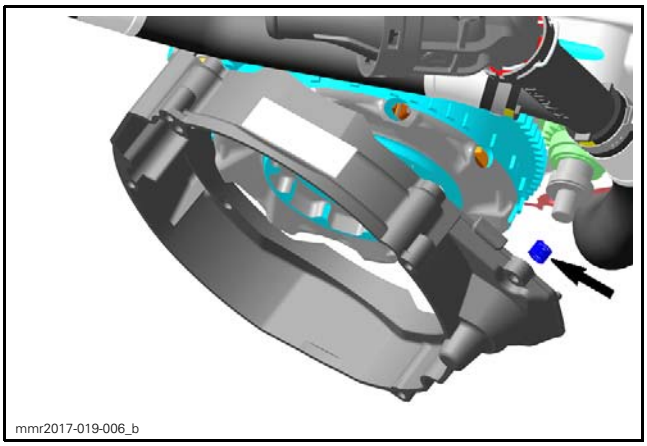
STARTER DRIVE

Removing the Starter Drive

Refer to procedures in this subsection to remove:

– Magneto flywheel
– Magneto housing.

NOTE: Do not lose starter drive spring during removal of magneto housing.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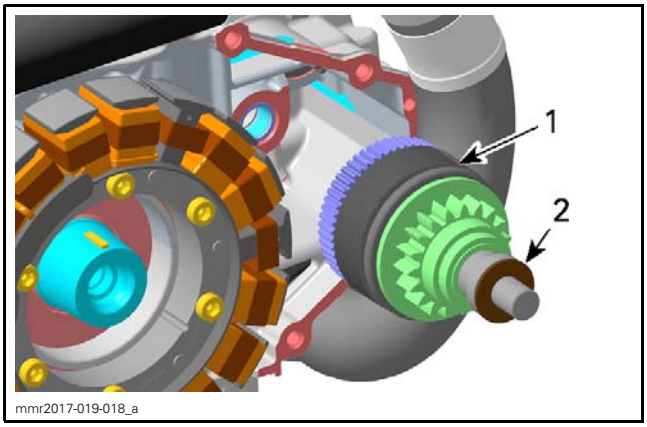
Pull out starter drive.

NOTE: Do not lose washer of starter drive gear during removal.



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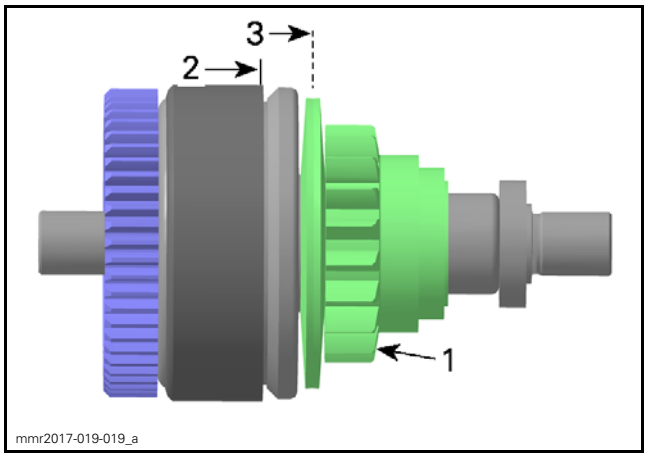
1. *Starter drive*
2. *Washer*

Inspecting the Starter Drive

Check if starter drive pinion is free of movement.

Ensure proper operation of the starter drive sprag clutch.

NOTE: Centrifugal weights avoid disengaging of the pinion while starting the engine.



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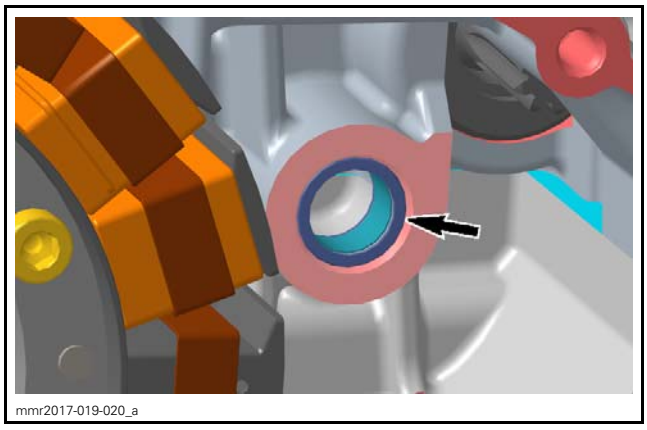
1. *Starter drive pinion*
2. *Starting position (spring released)*
3. *Gear is engaged drive pulley fixed half (spring loaded)*

Check needle bearing excessive play and smooth operation. If damaged see *STARTER DRIVE NEEDLE BEARING REPLACEMENT* in this subsection.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1. *Starter drive needle bearing*

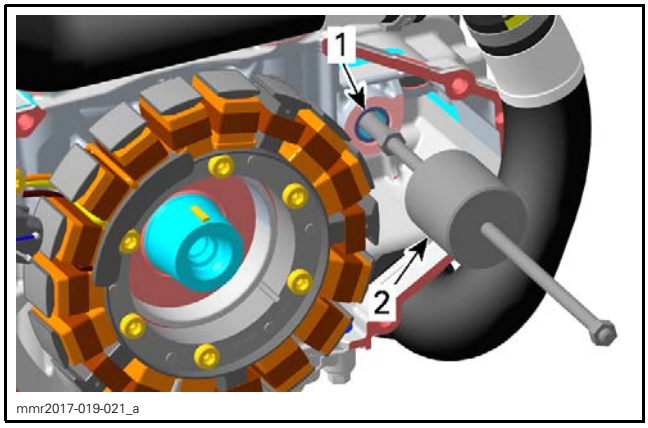
Check magneto housing:

– for cracks at the starter drive bore location
– if starter drive bore is worn or otherwise damaged.

Replace magneto housing if necessary.

Starter Drive Needle Bearing Replacement

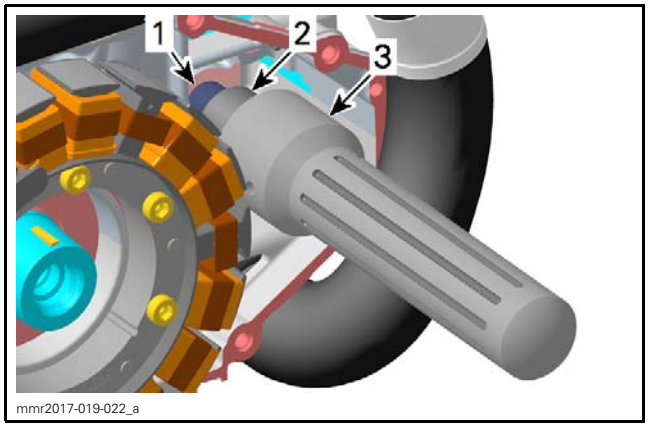
Remove needle bearing using a blind hole bearing puller.



1. *Needle bearing*
2. *Blind hole bearing puller*

Install needle bearing.

REQUIRED TOOL	
STARTER DRIVE NEEDLE INSTALLER (P/N 529 035 934)	
HANDLE (P/N 420 877 650)	



1. *Needle bearing*
2. *Starter drive needle bearing installer*
3. *Handle*

Installing the Starter Drive

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

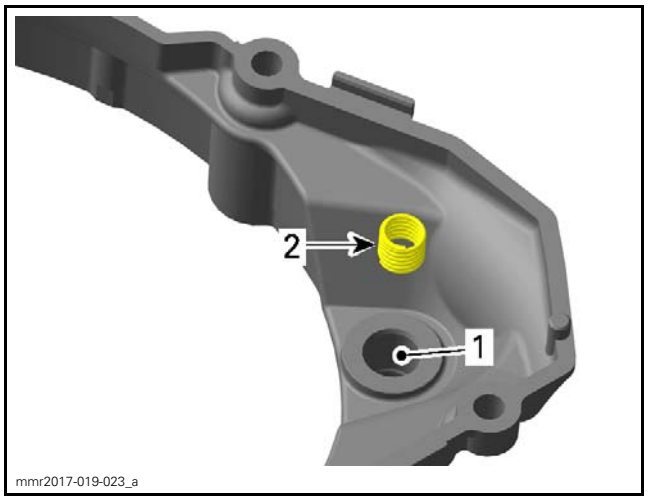
Clean out all residues of grease from:

– Needle bearing in the crankcase
– Starter drive journals
– Starter drive bore in magneto housing
– Spring.

Lubricate:

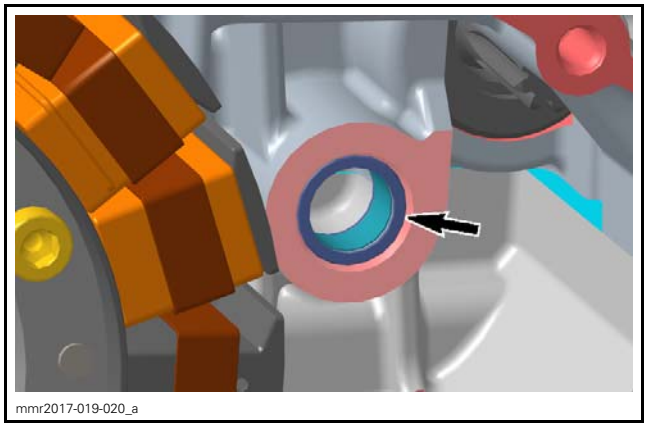
– Needle bearing in crankcase
– Starter drive bore in magneto housing
– Spring.

STARTER DRIVE LUBRICATION	
Service product	TRIPLE-GUARD GREASE (P/N 296 000 329)



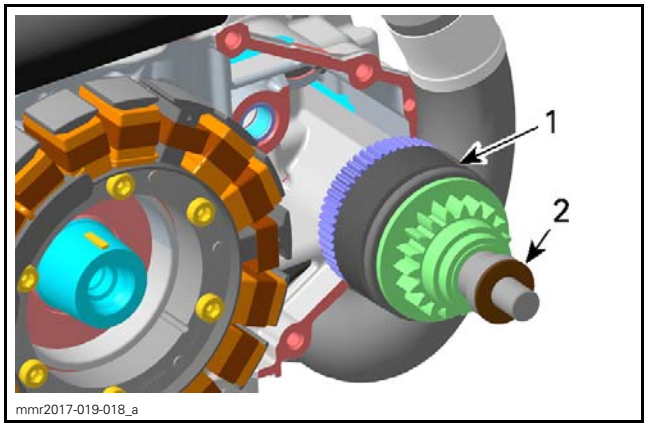
LUBRICATE

1. *Starter drive bore*
2. *Spring*



LUBRICATE NEEDLE BEARING IN CRANKCASE

Install starter drive with washer.



1. *Starter drive*
2. *Washer*

RAVE

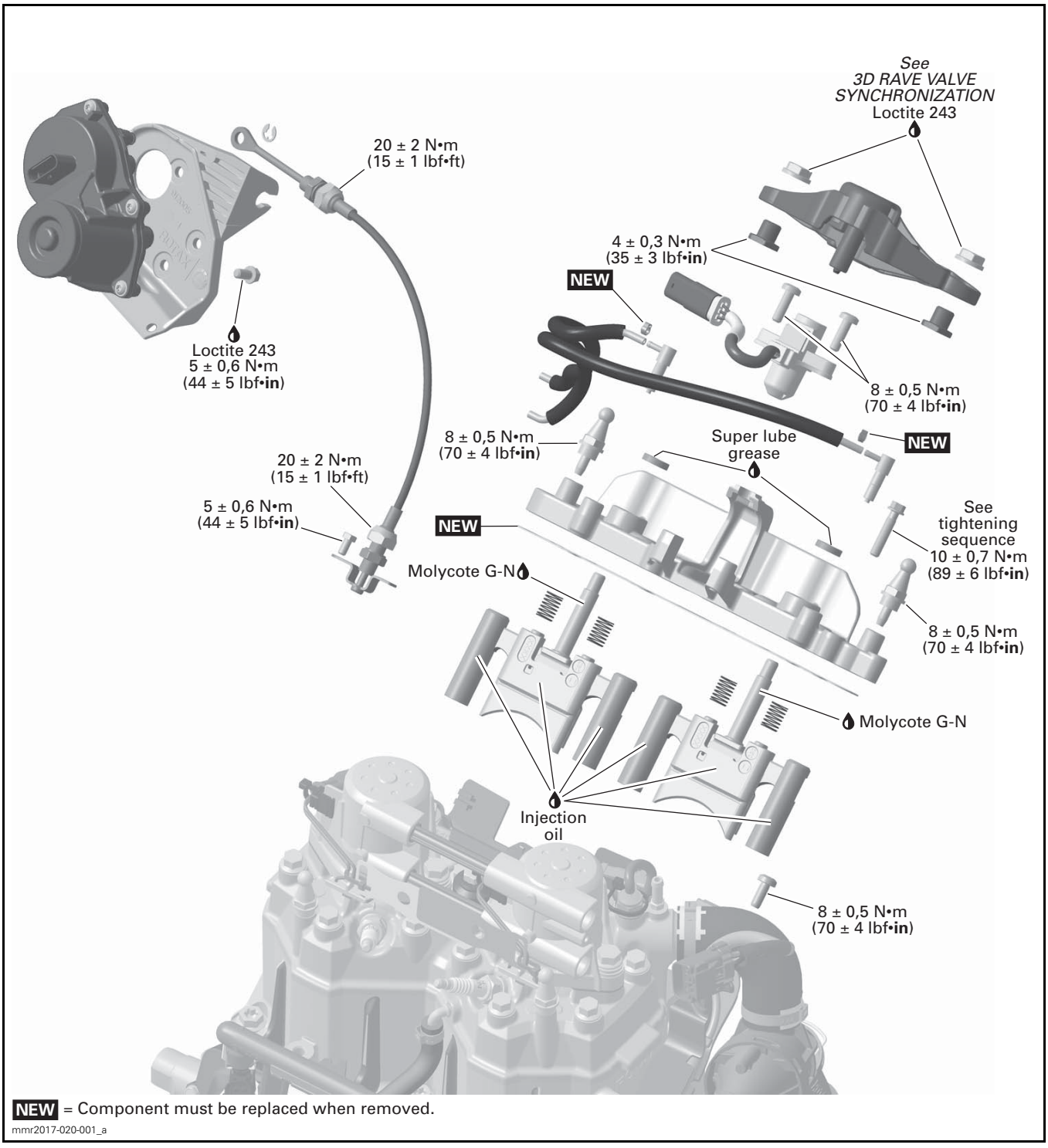
SERVICE TOOLS

Description	Part Number	Page
ECM ADAPTER TOOL	529 036 166	7, 16
FLUKE 115 MULTIMETER	529 035 868	6–7, 15–17
PROTECTOR SLEEVE	529 036 406	12

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	8–9, 18
MOLYKOTE G-N	420 297 433	12

RAVE VALVE



NEW = Component must be replaced when removed.

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GENERAL

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

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS PROCEDURE* and *LOCTITE APPLICATION PROCEDURE* 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 with new ones.

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

SYSTEM DESCRIPTION

3D RAVE Basic Operation

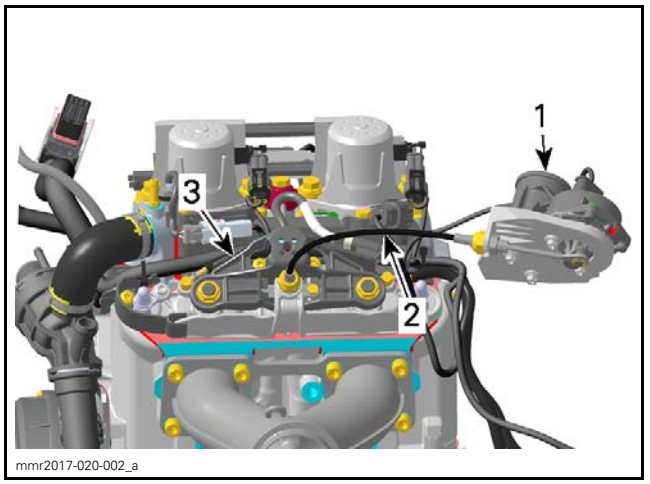
3-step RAVE valves are used. Their positions vary according to engine operating condition.

The RAVE valve steps are:
– Fully closed
– Partially opened
– Fully opened.

RAVE valves are moved to the desired position by a servomotor via a Rave cable that is controlled by the ECM through mappings.

Different mappings are used by the ECM to control the 3D RAVE valves. The mappings are based on current engine RPM and the following inputs: intake temperature, TPS, knock sensor, engine coolant temperature and APS.

NOTE: 3D RAVE valves may go through all 3 positions or skip the partially opened position and go directly to either the fully opened or closed positions depending on present engine load and how quickly the throttle is depressed.



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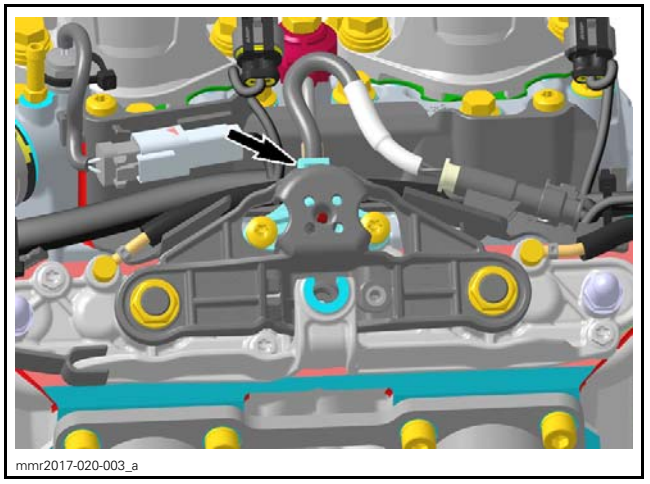
COVER REMOVED FOR CLARITY
1. *Servomotor*
2. *Rave cable*
3. *3D RAVE valve*

A hall-effect position sensor (RPS: RAVE position sensor) is used to provide RAVE valve position feedback to the ECM.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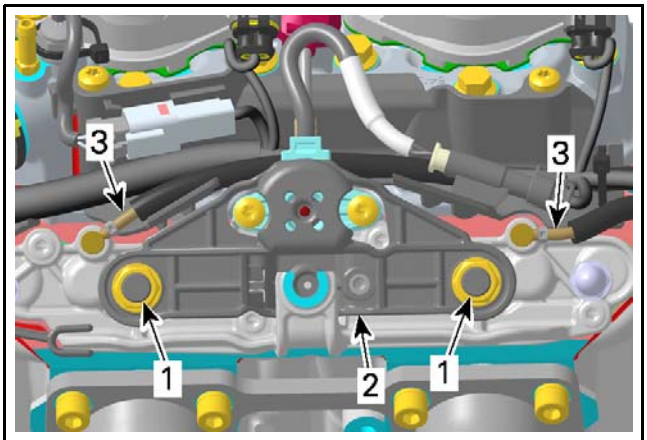
PARTS REMOVED FOR CLARITY

The RAVE position sensor (RPS) provides the ECM the actual position of the RAVE valves. Either closed, mid-position or opened. This informs the ECM that the RAVE valves are really at the expected position so that the proper amount of fuel is injected as well as other required operating parameters are applied.

RAVE valves are lubricated by the electronic oil injection pump.

RAVE valves are moved and monitored with a link bar.



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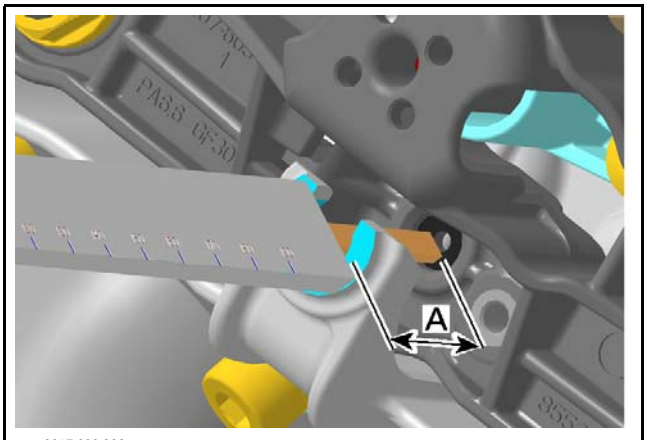
PARTS REMOVED FOR CLARITY
1. *Linked RAVE valves*
2. *Link bar*
3. *Oil lines to RAVE valves*

NOTICE It is very important to perform *3D RAVE VALVE SYNCHRONIZATION* and *RAVE VALVE POSITION SENSOR SETTING* whenever link bar is removed.

3D RAVE Position According to Engine Operation



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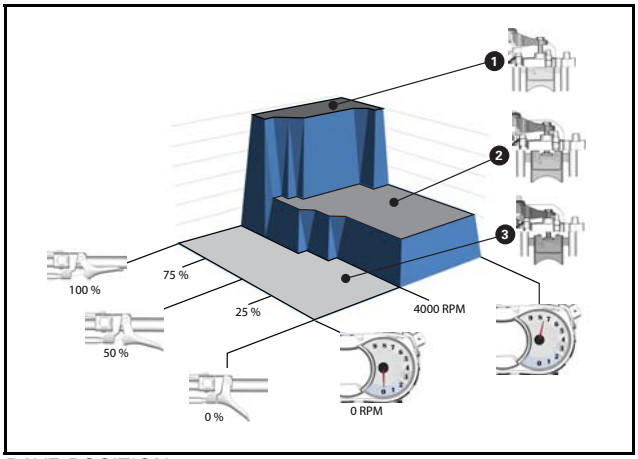
A. Measure from counter bearing to link bar

NOTICE For correct measurement the Rave cable must be removed.

Move both RAVE valves simultaneously to fully opened / mid / fully closed position by hand.

RAVE VALVE POSITION MEASURED FROM COUNTER BEARING OF THE RAVE CABLE TO THE LINK BAR	
Fully closed	1. Measure from counter bearing to link bar. 2. Set calliper to 0 mm (0 in).
Mid position	A: Approximately 6 mm (1/4 in) from 0 mm (0 in) (fully closed position)
Fully opened	A: Approximately17.5 mm (11/16 in) from 0 mm (0 in) (fully closed position)



RAVE POSITION
1. *Fully opened*
2. *Mid*
3. *Fully closed*

TROUBLESHOOTING

DIAGNOSTIC TIPS

As a first troubleshooting step, perform the following procedures to ensure RAVE system is properly adjusted.

1. *3D RAVE VALVE SYNCHRONIZATION*
2. *3D RAVE VALVES POSITION SENSOR SETTING*
3. *3D RAVE VALVES POSITION VALIDATION.*

TROUBLESHOOTING GUIDELINES

RAVE Valves Position Sensor Fault Code

The ECM may generate a **position sensor fault code** if the RAVE valve is not reaching the desired position.

If a position sensor fault code is generated by the ECM, check for the following:

Defective Position Sensor

– Test position sensor operation, perform *3D RAVE VALVES POSITION VALIDATION*, see procedure in this subsection.
– Check position sensor wiring, perform *INSPECTING THE 3D RAVE VALVES POSITION SENSOR*, see procedures in this subsection.
– Check movement of the RAVE manually.

Excessive Carbon Build-up in RAVE Valves

– Use the recommended oil quality, refer to *LUBRICATION SYSTEM* subsection.
– Check oil lines (installed incorrectly, air bubbles)
– Check for proper oil injection pump code in BUDS2, refer to *LUBRICATION SYSTEM* subsection.

NOTE: Insufficient oil delivery to RAVE valves may result in a carbon build-up.

PROCEDURES

3D RAVE VALVES POSITION SENSOR

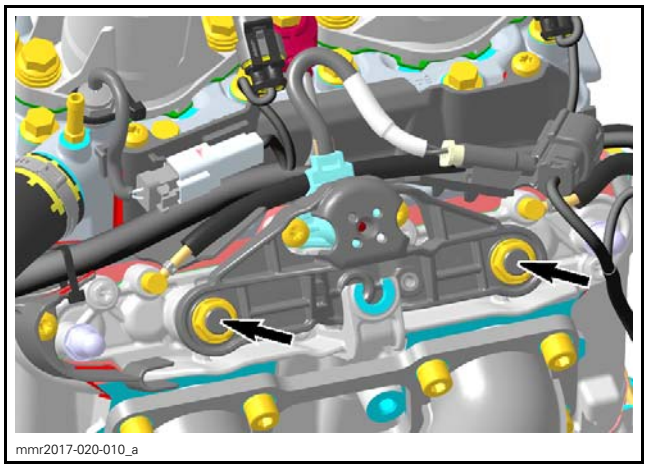
3D RAVE Valves Position Sensor Setting

1. Ensure RAVE valves are properly synchronized as per *3D RAVE VALVE SYNCHRONIZATION* procedure.

NOTICE It is very important to perform *3D RAVE VALVE SYNCHRONIZATION* and *RAVE VALVE POSITION SENSOR SETTING* whenever link bar is removed.

2. Remove upper body module. Refer to *BODY*.
3. Remove Rave cable from link bar. Refer to *REMOVING THE RAVE CABLE* in this subsection.
4. Connect vehicle to BUDS2, Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
5. Go to:
   – Settings / Initializations / RAVE Setting
6. Perform setting at **fully closed** position:
   6.1 Push both RAVE valves simultaneously to fully closed position by hand.

   NOTICE For a correct setting hold both RAVE stems simultaneously in its proper position. Never push or pull in the center of the link bar.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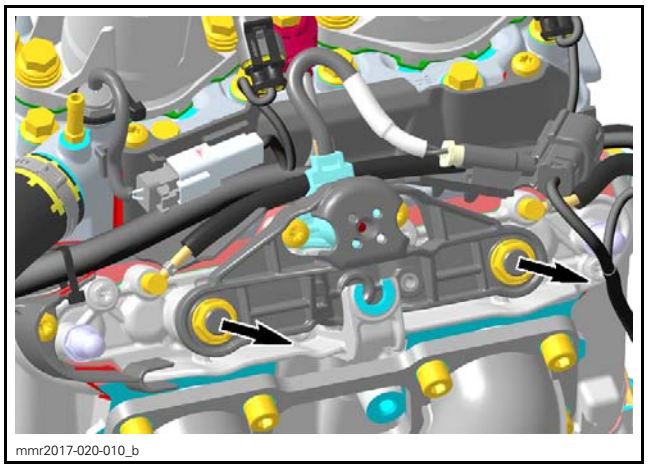
   6.2 Select "**Rave Closed Position Setting**" in the list.
   6.3 Confirm that **Rave Actual Position (V)** is within specification.
7. Perform setting at **fully opened** position:
   7.1 Pull both RAVE valves simultaneously to fully opened position by hand.

   NOTICE For a correct setting hold both RAVE stems simultaneously in its proper position. Never push or pull in the center of the link bar.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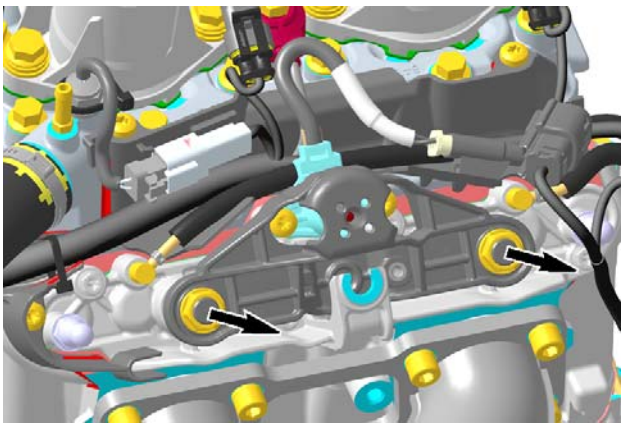
   7.2 Select "**Rave Fully Position Setting**" in the list.
   7.3 Confirm that **Rave Actual Position (V)** is within specification.
8. Perform setting at **middle** position:
   8.1 Move both RAVE valves simultaneously to mid position by hand.

   NOTICE For a correct setting hold both RAVE stems simultaneously in its proper position. Never push or pull in the center of the link bar.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8.2 Select "**Rave Middle Position Setting**" in the list.

8.3 Confirm that **Rave Actual Position (V)** is within specification.

9. Validate that position sensor is properly set. Refer to *3D RAVE VALVES POSITION VALIDATION* in this subsection.

10. Start engine.

At first engine start after RAVE position sensor setting is completed RAVE valves travel to fully opened position and than moving slowly to fully closed position

NOTICE **Do not push throttle lever during this initialization procedure, otherwise the ECM will discontinue the initialization and starts initialization from the beginning.**

Inspecting the 3D Rave Valves Position Sensor

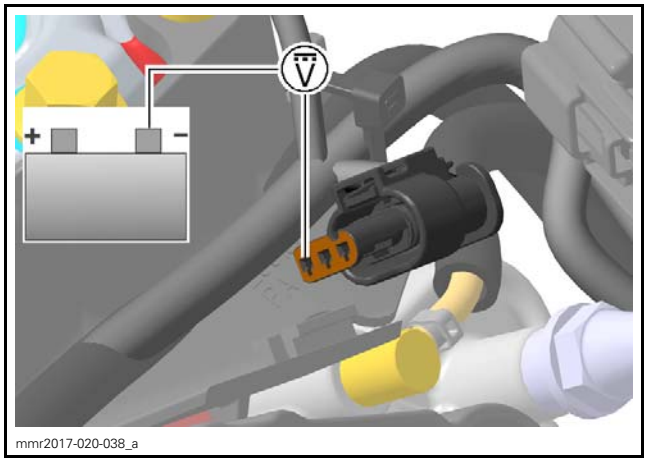
NOTE: As a first troubleshooting step, always check for applicable fault codes using BUDS2 software.

Testing the 3D Rave Valves Position Sensor Voltage Input

1. Disconnect position sensor connector.
2. Install D.E.S.S. key and press start/RER button to wake up ECM.
3. Set multimeter to Vdc and probe terminals as per following table.

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

3D RAVE VALVES POSITION SENSOR INPUT VOLTAGE		
Position Sensor Connector (harness side)	Battery ground	Measurement
Pin 3		5 ± 0.25 Vdc



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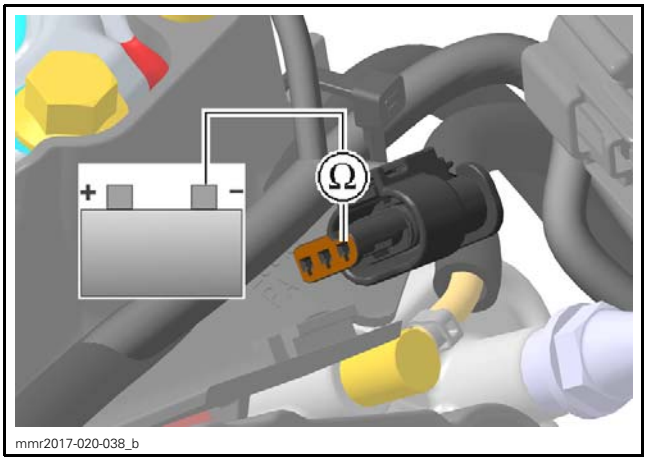
If voltage is exceeding the range check ECM power supply (fuses F1 and F3) and wiring harness.

Testing the Continuity of 3D Rave Valves Position Sensor Ground Circuit

1. Disconnect position sensor connector.
2. Set multimeter to Ω and probe terminals as per following table.

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

3D RAVE VALVES POSITION SENSOR RESISTANCE		
Position Sensor Connector (harness side)	Battery ground	RESISTANCE @ 20°C (68°F)
Pin 1		Close to 0 Ω



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If resistance is out of specifications check ECM grounding and wiring harness.

Testing the Continuity of 3D Rave Valves Position Sensor Circuit

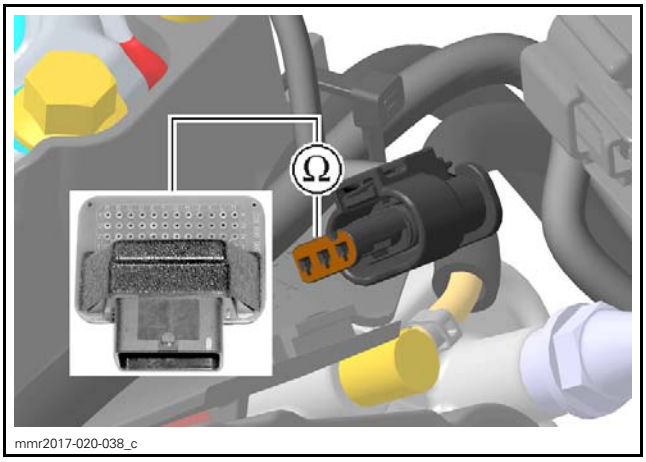
1. Disconnect:
   - ECM connector
   - Position sensor connector.
2. Connect ECM connector to ECM adapter tool.

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

3. Set multimeter to Ω and probe terminals as per following table.

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

3D RAVE VALVES POSITION SENSOR RESISTANCE		
Position Sensor Connector (harness side)	ECM-A	RESISTANCE @ 20°C (68°F)
Pin 1	E2	Close to 0 Ω
Pin 2	E3	
Pin 3	F3	



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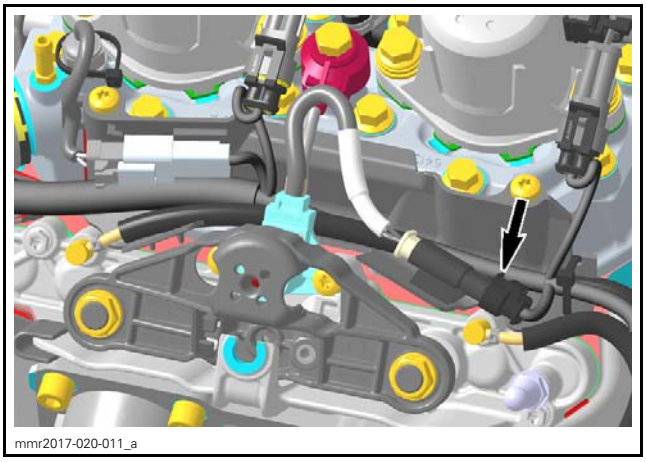
If resistance is not within specification, repair or replace the wiring harness.

Removing the 3D Rave Valves Position Sensor

1. Remove upper body module. Refer to *BODY*.
2. Remove cover, refer to *TOP END* subsection.
3. Remove Rave cable from link bar. Refer to *REMOVING THE RAVE CABLE* in this subsection.
4. Disconnect position sensor connector.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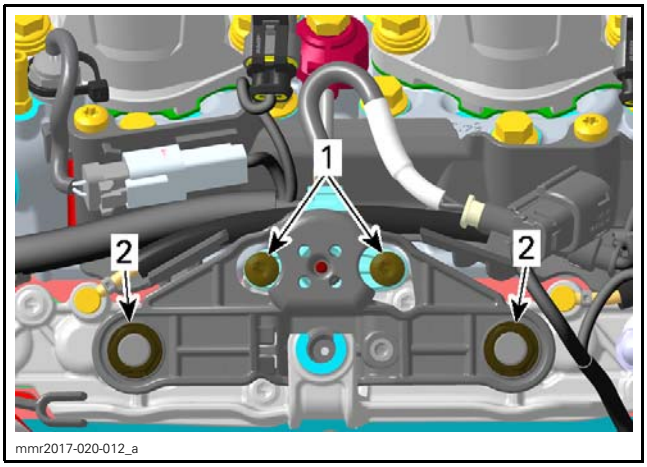
5. Unscrew:
   - RAVE valves position sensor retaining screws
   - Link bar retaining nuts.



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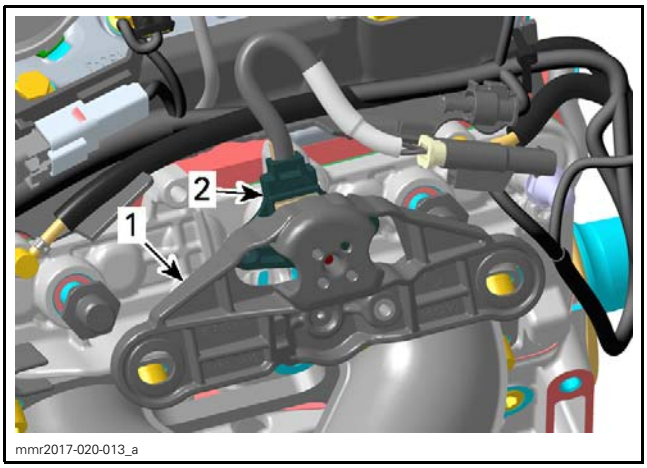
1. *RAVE valves position sensor retaining screws*
2. *Link bar collar nuts*

6. Remove link bar with RAVE valves position sensor.



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1. *Link bar*
2. *RAVE valves position sensor*

NOTICE It is very important to perform *3D RAVE VALVES SYNCHRONIZATION* whenever link bar is removed.

Installing the 3D Rave Valves Position Sensor

1. Position RAVE valves position sensor with link bar on RAVE valve housing.
2. Install position sensor retaining screws but do not tighten yet.
3. Perform *3D RAVE VALVE SYNCHRONIZATION* procedure in this subsection to complete link bar installation.

NOTICE It is very important to perform *3D RAVE VALVES SYNCHRONIZATION* and *RAVE VALVE POSITION SENSOR SETTING* whenever link bar is removed.

4. Install position sensor retaining screws.

TIGHTENING TORQUE	
Position sensor retaining screws	8 N•m ± 0.5 N•m (71 lbf•**in** ± 4 lbf•**in**)

5. Install connector.

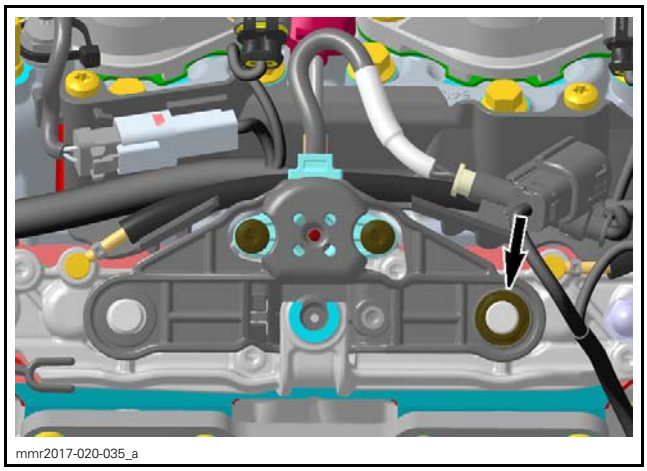
3D RAVE VALVES

3D RAVE Valve Synchronization

Synchronization Adjustment Procedure

1. Remove link bar retaining nuts and clean threads.
2. Install PTO link bar retaining nut and tighten by hand.

LINK BAR RETAINING NUTS	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)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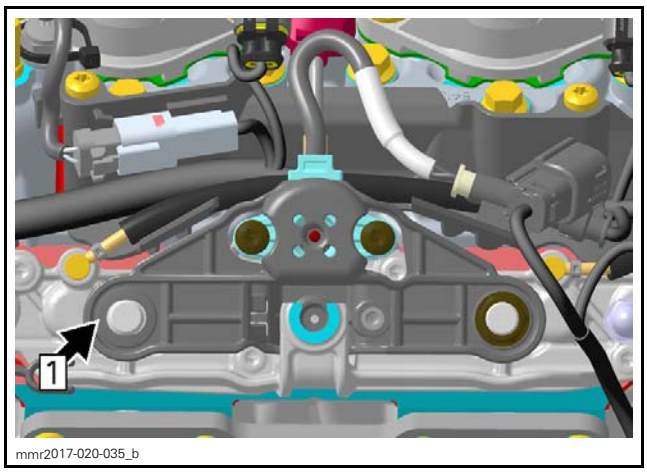
3. Check if the link bar rests flat on the retaining nut.

Tip on link bar at MAG side an listen if link bar rests on retaining nut.



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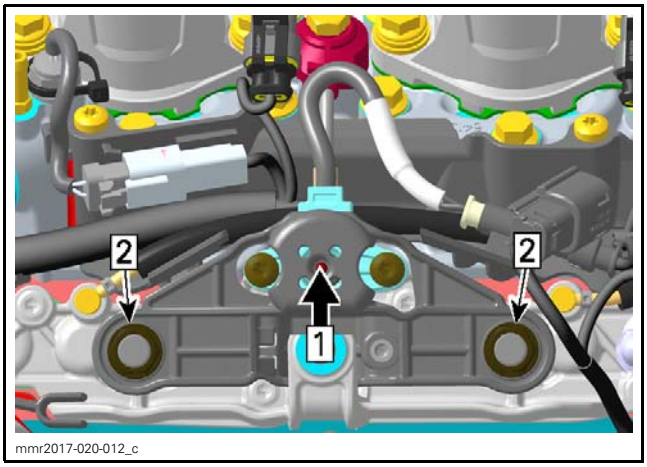
1. *Tip here*

4. If the link bar does not rest flat:
   4.1 Unscrew PTO nut then slightly move link bar.
   4.2 Tighten PTO nut by hand and recheck position.
   4.3 Repeat above sequence until the link bar rests flat.
5. Install MAG link bar retaining nut and tighten by hand.

LINK BAR RETAINING NUTS	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)

6. Push the center of link bar downwards in order to seat both RAVE valves on their fully closed position.
7. Firmly hold link bar downwards.
8. Tighten both retaining nuts.



Step 1: Push link bar
Step 2: Tighten retaining nuts

TIGHTENING TORQUE	
Link bar retaining nuts	4 N•m ± 0.3 N•m (35 lbf•**in** ± 3 lbf•**in**)

9. Adjust position sensor using BUDS2 Refer to *3D RAVE VALVES POSITION SENSOR SETTING*.
10. Push link bar down to fully closed position.
11. Install Rave cable, refer to *INSTALLING THE RAVE CABLE* in this subsection.

Synchronization Validation Procedure

1. Push and pull link bar to force RAVE valves to pass through their 3 positions.
   1.1 Ensure that only **one** step is felt at mid position.
   1.2 If out of specification, redo the *SYNCHRONIZATION ADJUSTMENT PROCEDURE*.

3D RAVE Valves Position Validation

1. Ensure RAVE valves are properly synchronized as per *3D RAVE VALVE SYNCHRONIZATION*.
2. Ensure position sensor is properly set as per *3D RAVE VALVES POSITION SENSOR SETTING*.
3. Remove upper body module. Refer to *BODY*.
4. Connect vehicle to BUDS2, Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
5. Go to:
   – Measurement/Custom/RAVE Actual Position (%)
   – Select the appropriate RAVE position in the list.

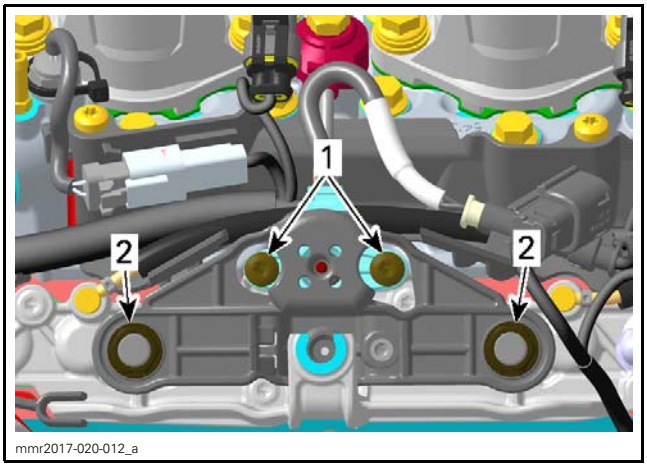
RAVE ACTUAL POSITION SPECIFICATION	
Closed	Below 2%
Middle	37 ± 2 %
Fully opened	Above 97%

TYPICAL

If RAVE valves actual position are out of specification, check the following:
– RAVE valve position sensor setting
– RAVE valve synchronization
– RAVE valves cleanliness.

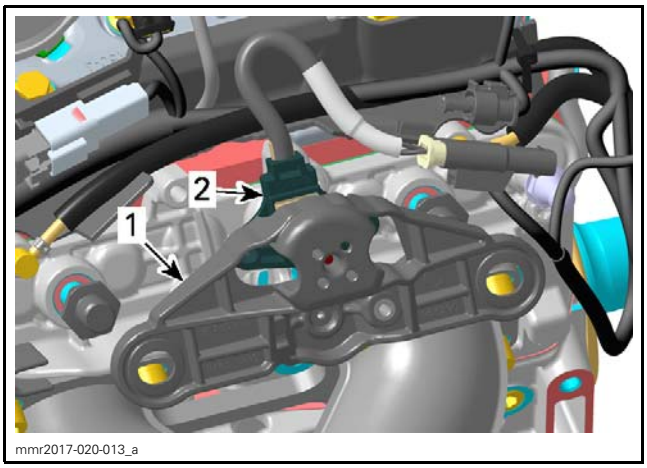
Removing the 3D RAVE Valves

1. Remove upper body module. Refer to *BODY*.
2. Remove cover, refer to *TOP END* subsection.
3. Remove Rave cable from link bar, refer to *REMOVING THE RAVE CABLE* in this subsection.
4. Disconnect Rave valve position sensor connector and put harness away.
5. Unscrew:
   – RAVE valves position sensor retaining screws
   – Link bar retaining nuts.



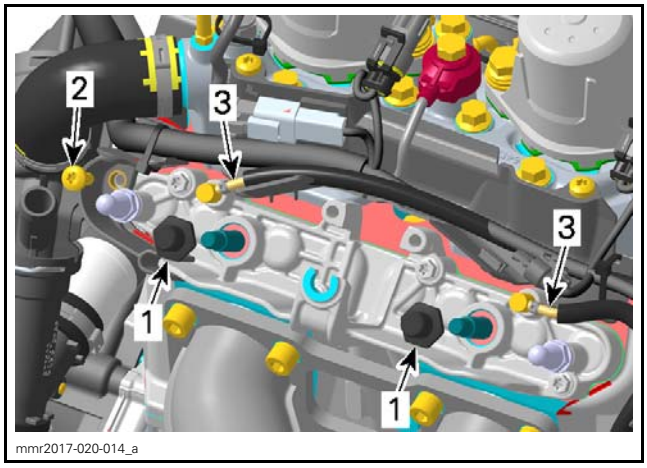
1. *RAVE valves position sensor retaining screws*
2. *Link bar retaining nuts*

6. Remove link bar with RAVE valves position sensor.



1. *Link bar*
2. *RAVE valves position sensor*

7. Remove:
   - Collar nuts
   - Screw from harness support
   - Disconnect lubrication hoses and discard Oetiker clamps.

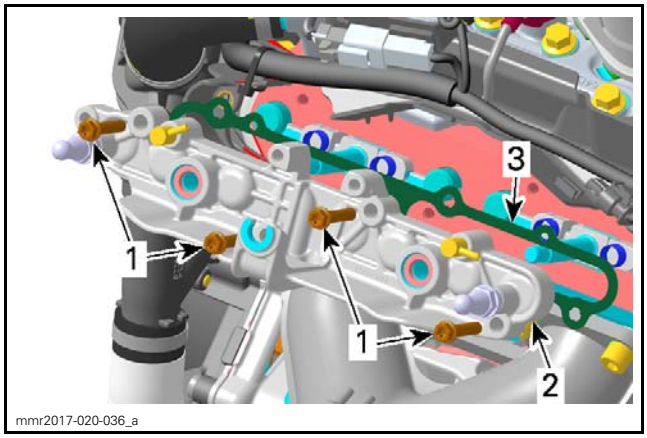


1. *Collar nuts*
2. *Harness support screw*
3. *Lubrication hoses*

8. Remove:
   - Retaining screws
   - RAVE valve housing
   - Gasket (discard it).

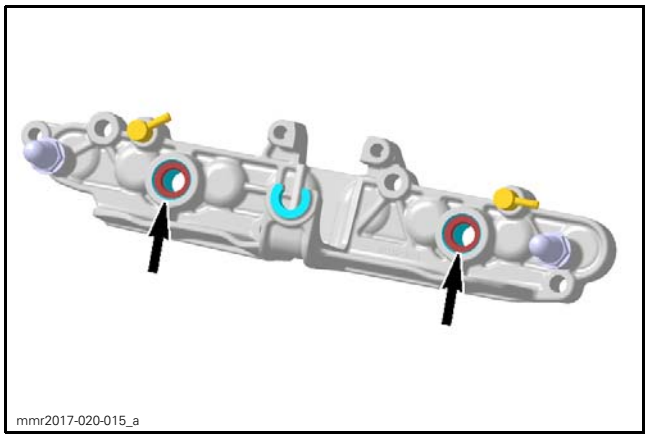
NOTE: Be careful not to loose springs underneath housing.

NOTICE **If signs of oil are found outside the housing, replace seals.**



1. *Retaining screws*
2. *RAVE valve housing*
3. *Gasket (discard it)*

9. Take note of seals orientation and carefully pry them out using a screwdriver.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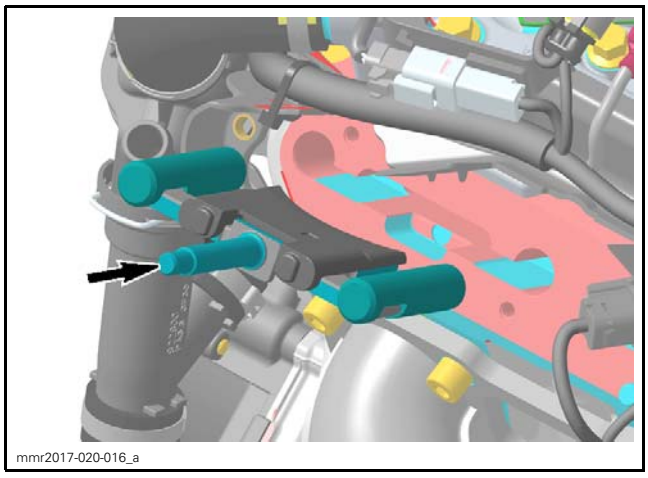
10. Pull RAVE valve assembly out.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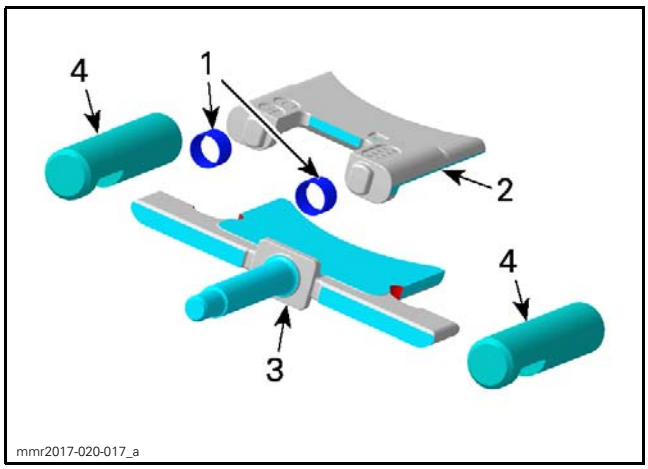
11. If necessary separate RAVE valve assembly.



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1. *Springs*
2. *Main valve upper part*
3. *Main valve lower part*
4. *Side valves*

Cleaning the 3D RAVE Valve

Thoroughly clean all RAVE VALVES components and cylinder slots.

No special solvents or cleaners are allowed when cleaning the valve.

RAVE Valves Frequently Gummed

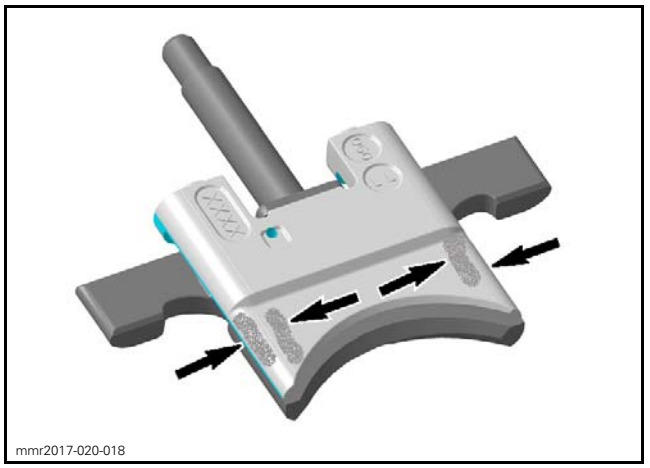
If the valves are getting gummed more frequently than usual, do the following:

– Check if the recommended injection oil is used.
– Check lubrication hoses for restriction.
– Check lubrication hoses for presence of air. Bleed system if needed.
– Check lubrication hose check valves as explained in this subsection.

Inspecting the 3D RAVE Valve

Check valves for:

– wear at sliding points
– straightness
– breakage.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SIGNS OF WEAR

Check spring condition and straightness.

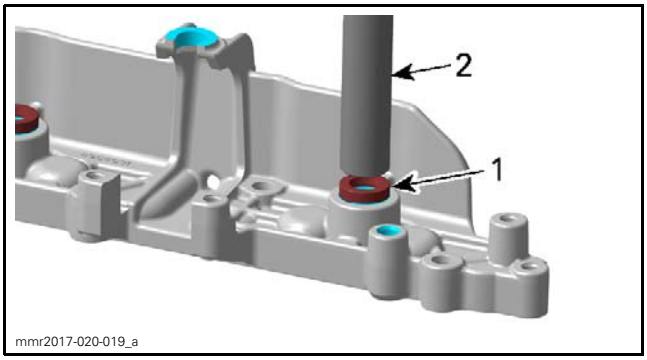
NOTE: Make sure hoses are not leaking, kinked or damaged.

Installing the 3D RAVE Valve

1. Use an appropriate pusher to reinstall seals.

Lubricate outer oil seal diameter.

OIL SEAL INSTALLATION	
Service product	Injection oil

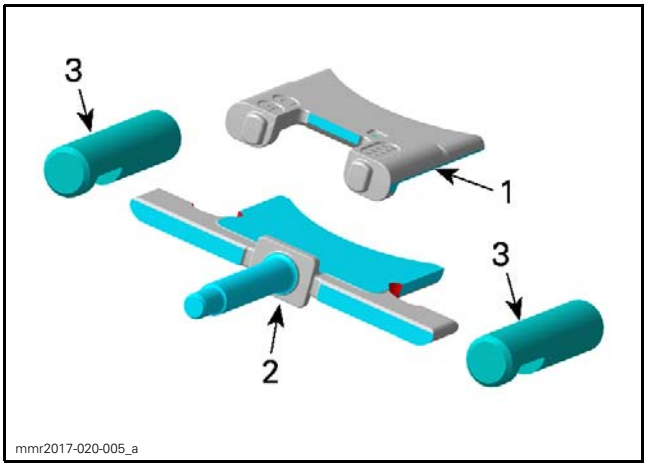


1. Oil seal
2. Pusher

2. Lubricate sealing lips of oil seals.

SEALING LIPS LUBRICATION	
Service product	Super lube grease

3. Preassemble the main and side valves.

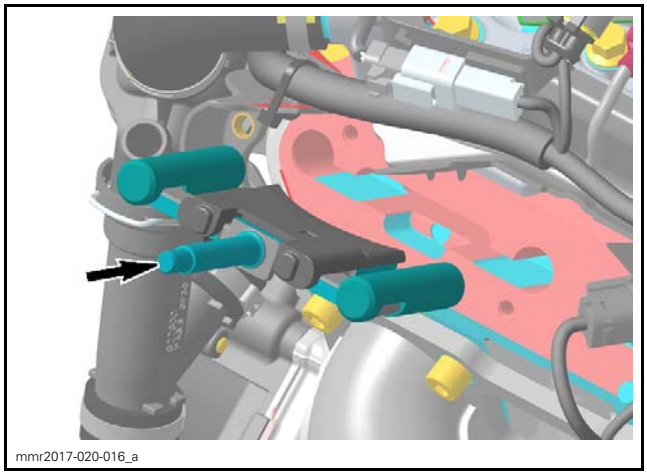


1. Main valve upper part
2. Main valve lower part
3. Side valves

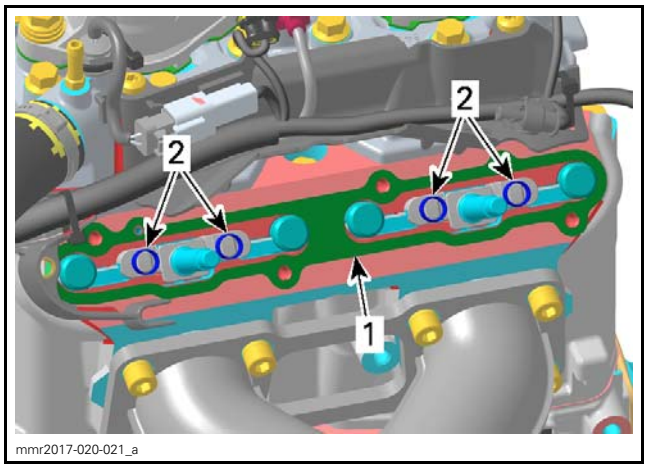
4. Lubricate:
   – RAVE chamber in cylinder block, main and side valves
   – Sliding surfaces of RAVE valves.

RAVE SLIDING SURFACES LUBRICATION	
Service product	Injection oil

5. Insert RAVE valves in cylinder.



6. Install NEW gasket.
7. Install springs on stud ends of valves.

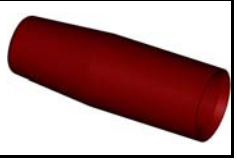


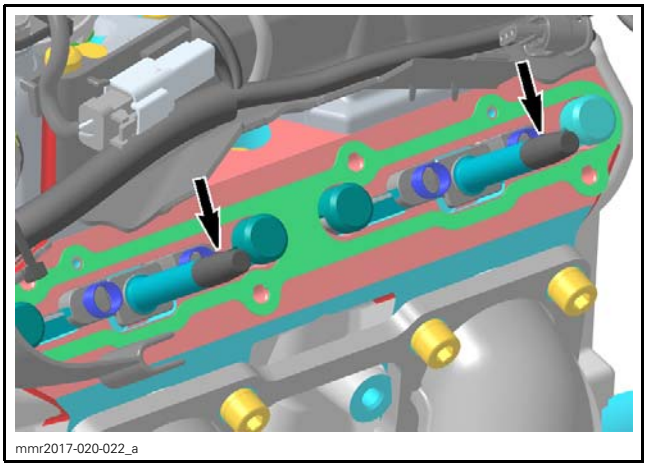
1. Gasket
2. Springs

8. Lubricate valve shaft.

VALVE SHAFT	
Service product	MOLYKOTE G-N (P/N 420 297 433)

9. Place protector sleeves on RAVE valve threads.

REQUIRED TOOL	
PROTECTOR SLEEVE (P/N 529 036 406)	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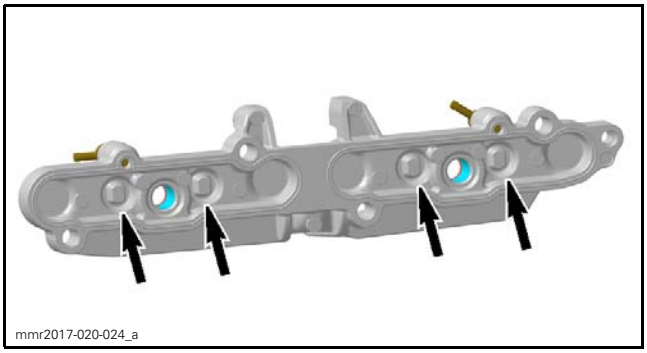
10. Install RAVE valve housing and carefully align springs in recess of RAVE valve housing.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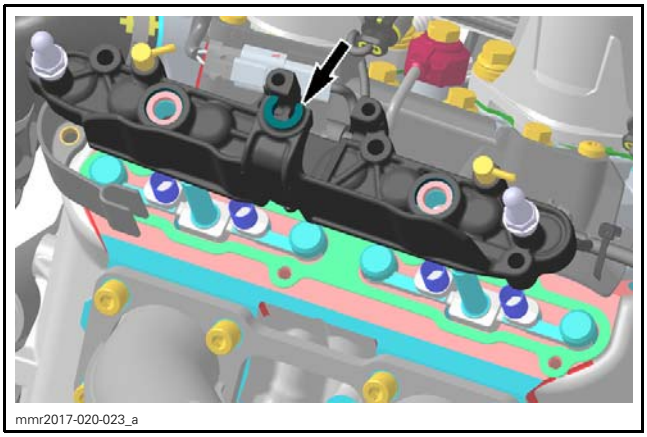
RECESS FOR RAVE SPRINGS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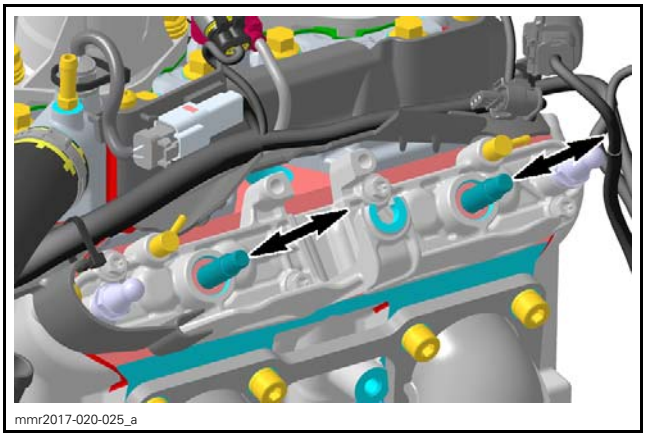
11. Remove protector sleeves.
12. Install and **hand tighten** screws.

Push and pull main valve stems to make sure they move freely.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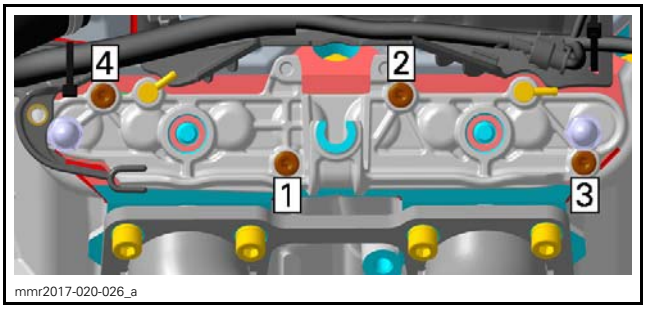
13. Tighten RAVE valve housing screws and check valve stem for free movement again. If some friction is felt, slightly loosen screws and readjust housing then retighten screws.

TIGHTENING TORQUE	
RAVE valve housing screw	10 N•m ± 0.7 N•m (89 lbf•**in** ± 6 lbf•**in**)



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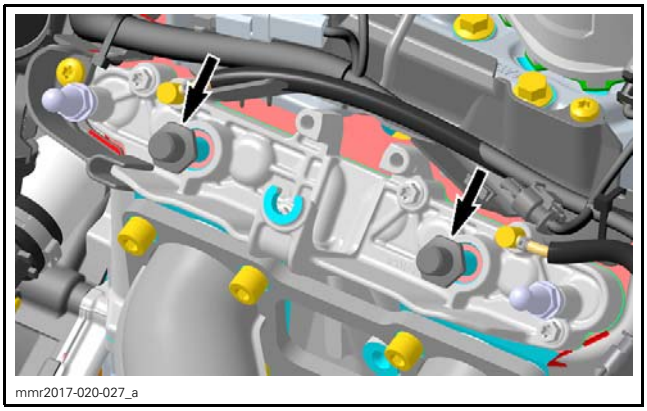
TIGHTENING SEQUENCE

14. Repeat the process until a free movement is obtained.
15. Install lubrication hoses using **NEW** Oetiker clamps.
16. Tighten collar nuts to specification.

TIGHTENING TORQUE	
Collar nuts	4 N•m ± 0.3 N•m (35 lbf•**in** ± 3 lbf•**in**)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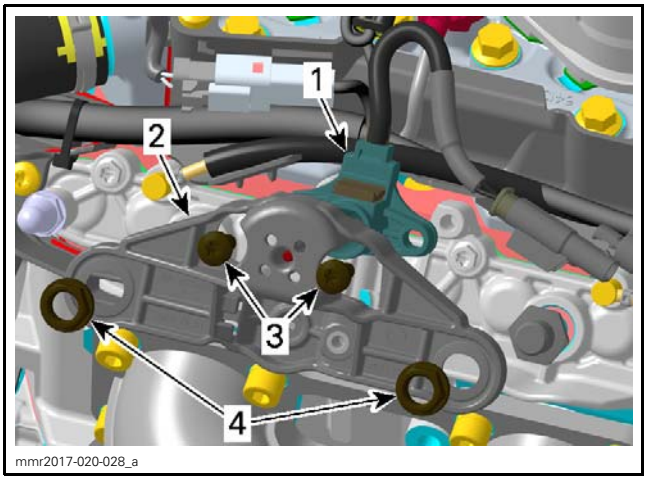
17. Position RAVE valves position sensor with link bar on RAVE valve housing.
18. Refer to *INSTALLING THE 3D RAVE VALVES POSITION SENSOR* in this subsection and install:
    – Position sensor retaining screws
    – Link bar retaining nuts.

NOTICE It is very important to perform *3D RAVE VALVES SYNCHRONIZATION* whenever link bar is removed.



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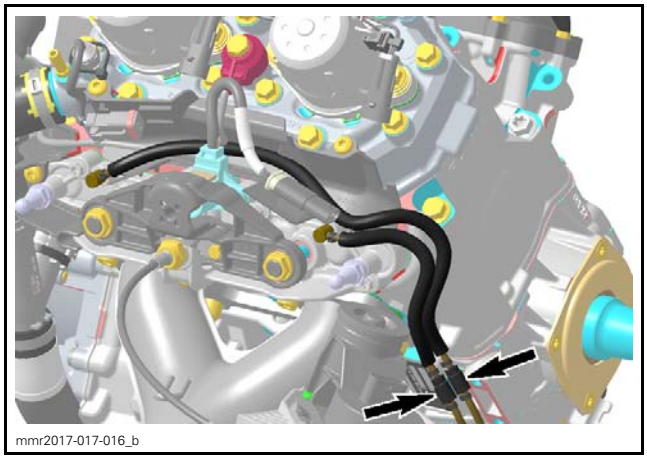
1. RAVE valves position sensor
2. Link bar
3. Position sensor retaining screws
4. Link bar retaining nuts

19. Connect the RAVE valves position sensor.
20. Install Rave cable. Refer to *INSTALLING THE RAVE CABLE* in this subsection
21. Bleed oil lines. Refer to *OIL INJECTION PUMP* in the *LUBRICATION SYSTEM* subsection.

CHECK VALVES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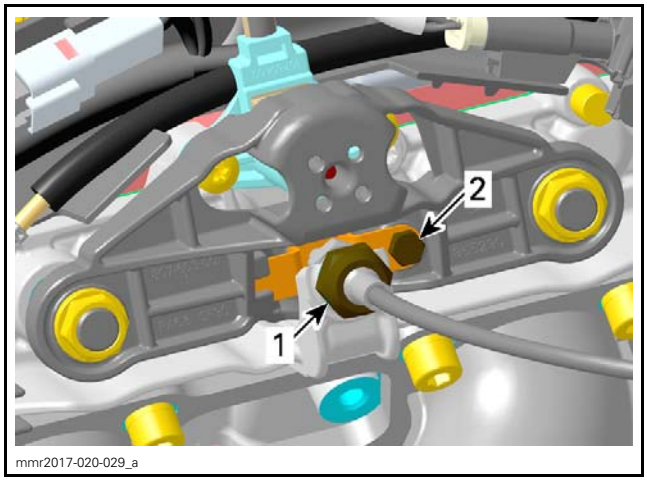
For testing and replacement refer to the *LUBRICATION SYSTEM* subsection.

RAVE CABLE

Removing the Rave Cable

NOTE: To avoid twisting the Rave cable, start with removal at the link bar.

1. Push RAVE valves to closed position.
2. Loosen Rave cable lock nut. Hold counter nut.
3. Remove retaining plate screw.



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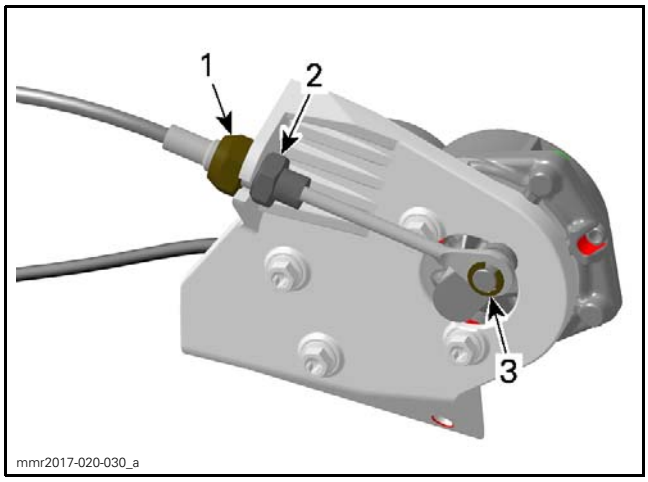
1. Rave cable lock nut
2. Retaining plate screw

4. Remove Rave cable.
5. Remove Rave cable lock nut at servomotor bracket. Hold counter nut.
6. Remove snap ring from servomotor lever.

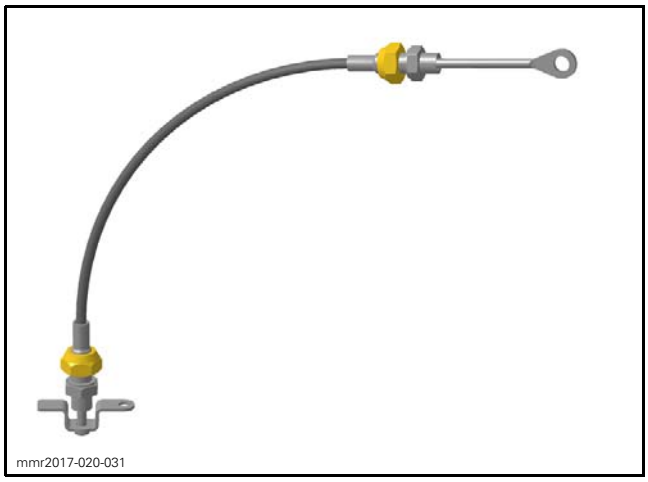


1. *Rave cable lock nut*
2. *Counter nut*
3. *Snap ring*

7. Remove Rave cable.

Inspecting the Rave Cable

Check Rave cable and retaining plate for wear or any other damage.



Check if cable moves freely.

If not, lubricate both ends of the Rave cable sleeve and check if the Rave cable is sliding without any resistance. Replace if necessary.

RAVE CABLE SLEEVE LUBRICATION	
Service product	O-ring chain lubricant

Installing the Rave Cable

1. Install Rave cable on the servomotor lever.
2. Install snap ring.
3. Install Rave cable lock nut at the Servomotor bracket.

TIGHTENING TORQUE	
Rave cable lock nut	20 N•m ± 2 N•m (15 lbf•ft ± 1 lbf•ft)

4. Install Rave cable on the link bar.
5. Install retaining plate screw but do not tighten yet.
6. Install Rave cable lock nut.

TIGHTENING TORQUE	
Rave cable lock nut	20 N•m ± 2 N•m (15 lbf•ft ± 1 lbf•ft)

7. Tighten retaining plate screw.

TIGHTENING TORQUE	
Retaining plate screw	5 N•m ± 0.6 N•m (44 lbf•**in** ± 5 lbf•**in**)

SERVOMOTOR

The servomotor consists of a brush DC motor (actuator) and a non-contacting angle sensor integrated in one housing.

Testing the Servomotor

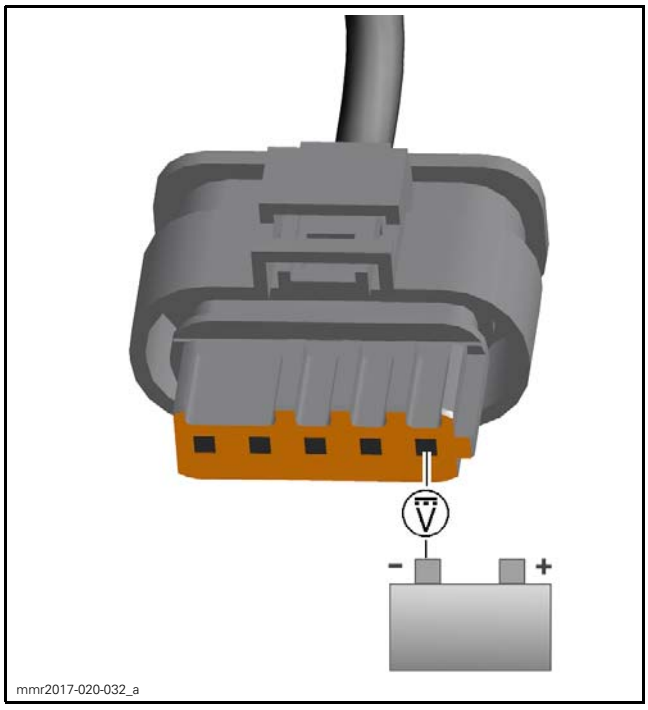
As a first troubleshooting step, always connect vehicle to the applicable BUDS2. software version to check for applicable fault codes. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

Testing the Sensor Input Voltage

1. Disconnect the servomotor connector.
2. Install D.E.S.S. key and press start/RER button to wake up ECM.
3. Set multimeter to Vdc and check voltage as per following table.

SENSOR INPUT VOLTAGE		
Servomotor connector (wiring harness side)	Battery ground	MEASUREMENT
Pin 1		5 ± 0.25 Vdc

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



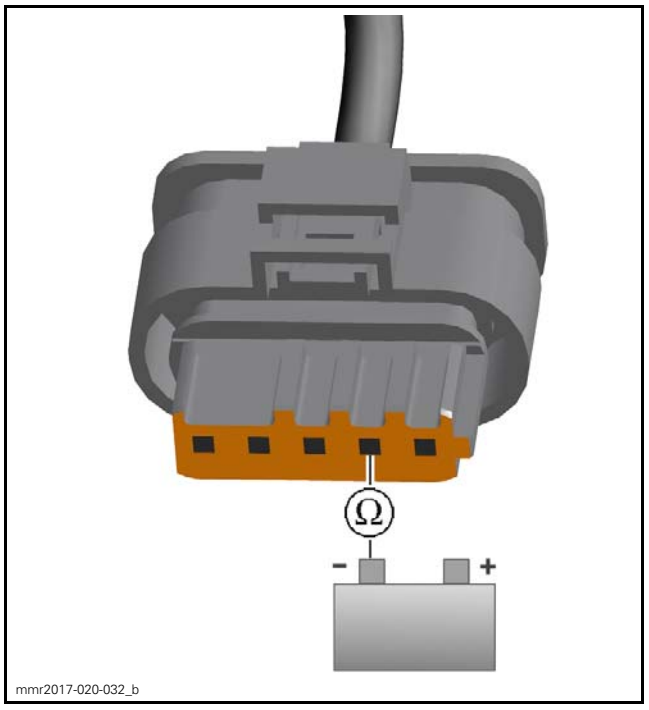
If voltage is exceeding the range check ECM power supply (Fuses F1 and F3) and servomotor wiring.

Testing the Sensor Ground

1. Disconnect the servomotor connector.
2. Set multimeter to Ω and probe terminals as per following table.

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

SENSOR GROUND		
Servomotor connector (wiring harness side)	Battery ground	MEASUREMENT
Pin 2		Close to 0 Ω



If resistance is incorrect check ECM grounding and servomotor wiring.

Testing the Servomotor Wiring

1. Disconnect ECM connector.
2. Connect ECM connector to ECM adapter tool.

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

3. Disconnect the servomotor connector.
4. Set multimeter to Ω and probe terminals as per following table.

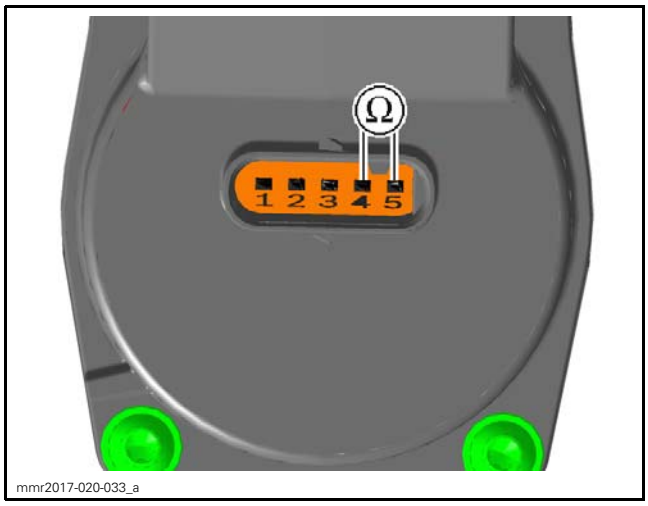
REQUIRED TOOL	
FLUKE 115 MULTIMETER (P/N 529 035 868)	

ECM ADAPTER	SERVOMOTOR CONNECTOR (WIRING HARNESS SIDE)	RESISTANCE
E4	1	Close to 0 Ω
F4	2	
D4	3	
H4	4	
G4	4	
J4	5	
K4	5	

Testing the Servomotor Resistance

1. Disconnect the servomotor connector.
2. Set multimeter to Ω and probe terminals as per following table.

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



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SERVOMOTOR RESISTANCE		
SERVOMOTOR CONNECTOR (SERVOMOTOR SIDE)	SERVOMOTOR CONNECTOR (SERVOMOTOR SIDE)	RESISTANCE @ 20°C (68°F)
4	5	Close to 0 Ω

Servomotor Location

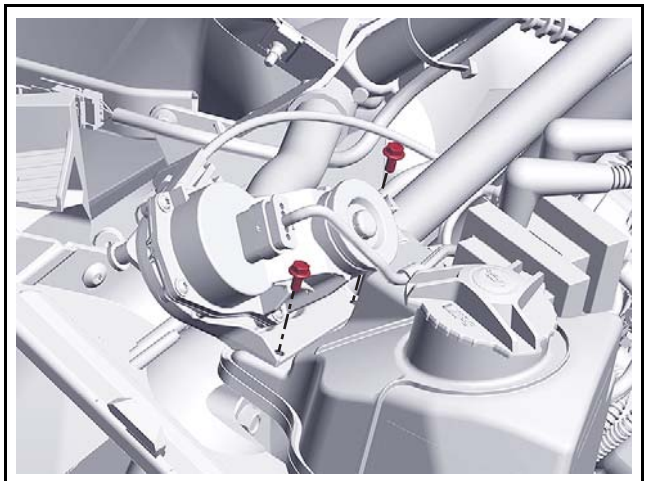
The servomotor is located on the top of the oil tank, on the LH side of the vehicle.

Remove the upper body module to work on the servomotor.

Removing the Servomotor

Remove Rave cable. Refer to *REMOVING THE RAVE CABLE* in this subsection.

Remove servomotor from the oil tank.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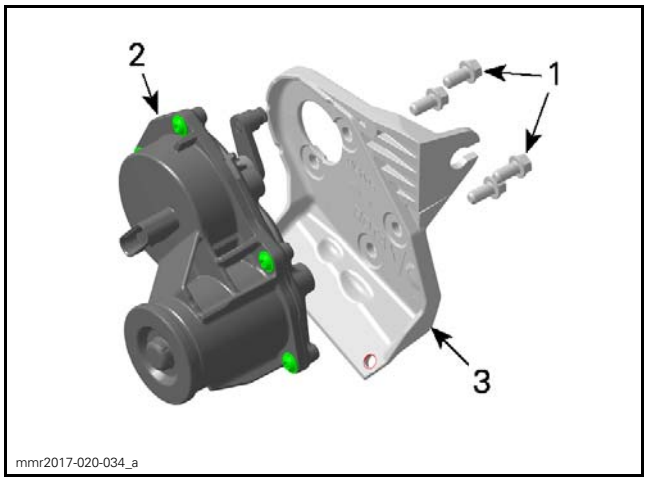
Remove:
- Bracket retaining screws
- Bracket.



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1. Retaining screws
2. Servomotor
3. Servomotor bracket

Inspecting the Servomotor

Check ease of movement of the servomotor lever.

Check mechanical end stop of servomotor lever.

If necessary replace servomotor.

Installing the Servomotor

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

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Bracket retaining screws	11 N•m ± 0.8 N•m (97 lbf•**in** ± 7 lbf•**in**)
Servomotor retaining screws	4 N•m ± 1 N•m (35 lbf•**in** ± 9 lbf•**in**)

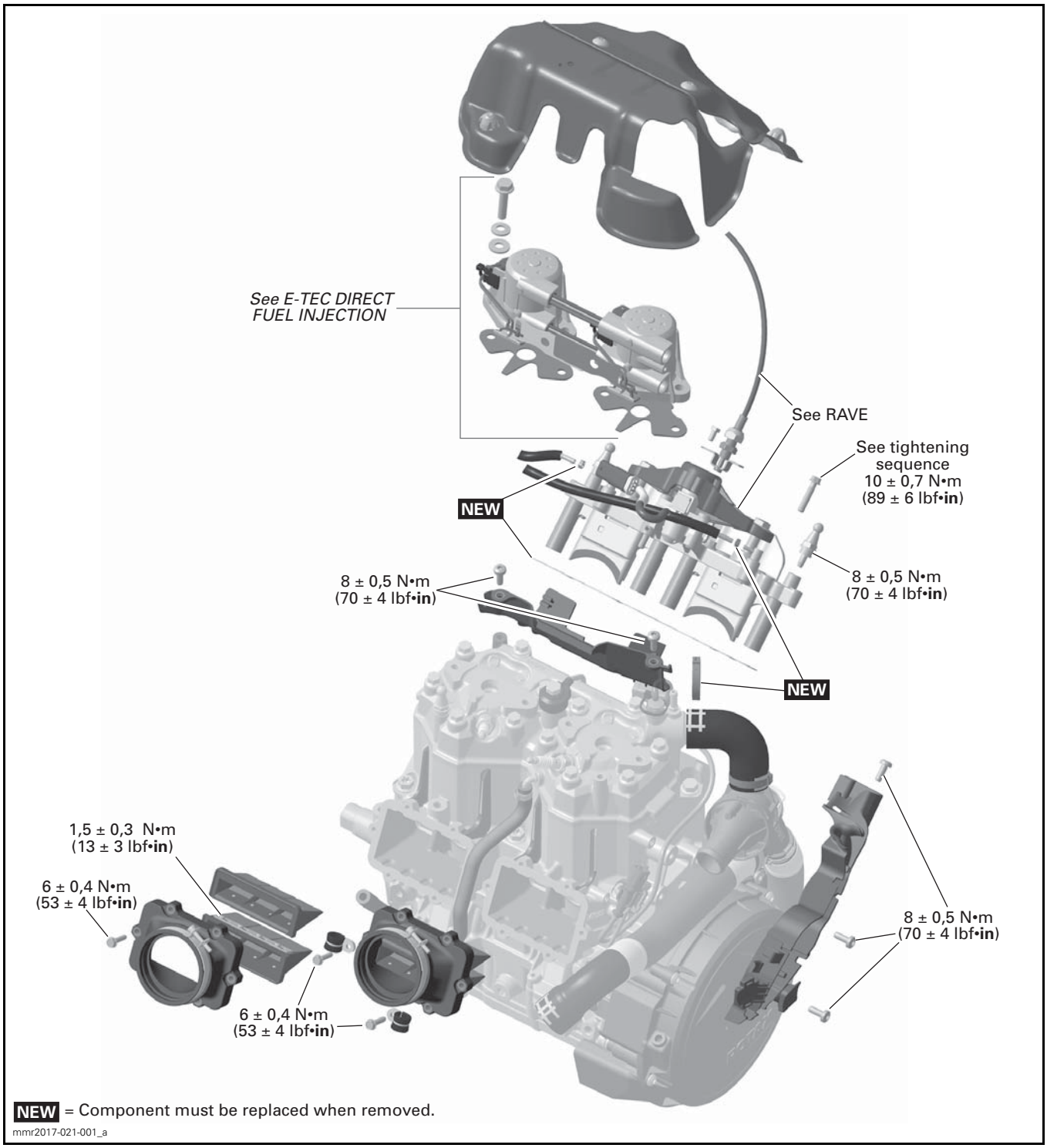
TOP END

SERVICE TOOLS

Description	Part Number	Page
PISTON CIRCLIP INSTALLER 21MM	529 036 138	16
PISTON PROJECTION	529 036 215	12
TDC DIAL INDICATOR	295 000 143	12

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	7, 10



NEW = Component must be replaced when removed.

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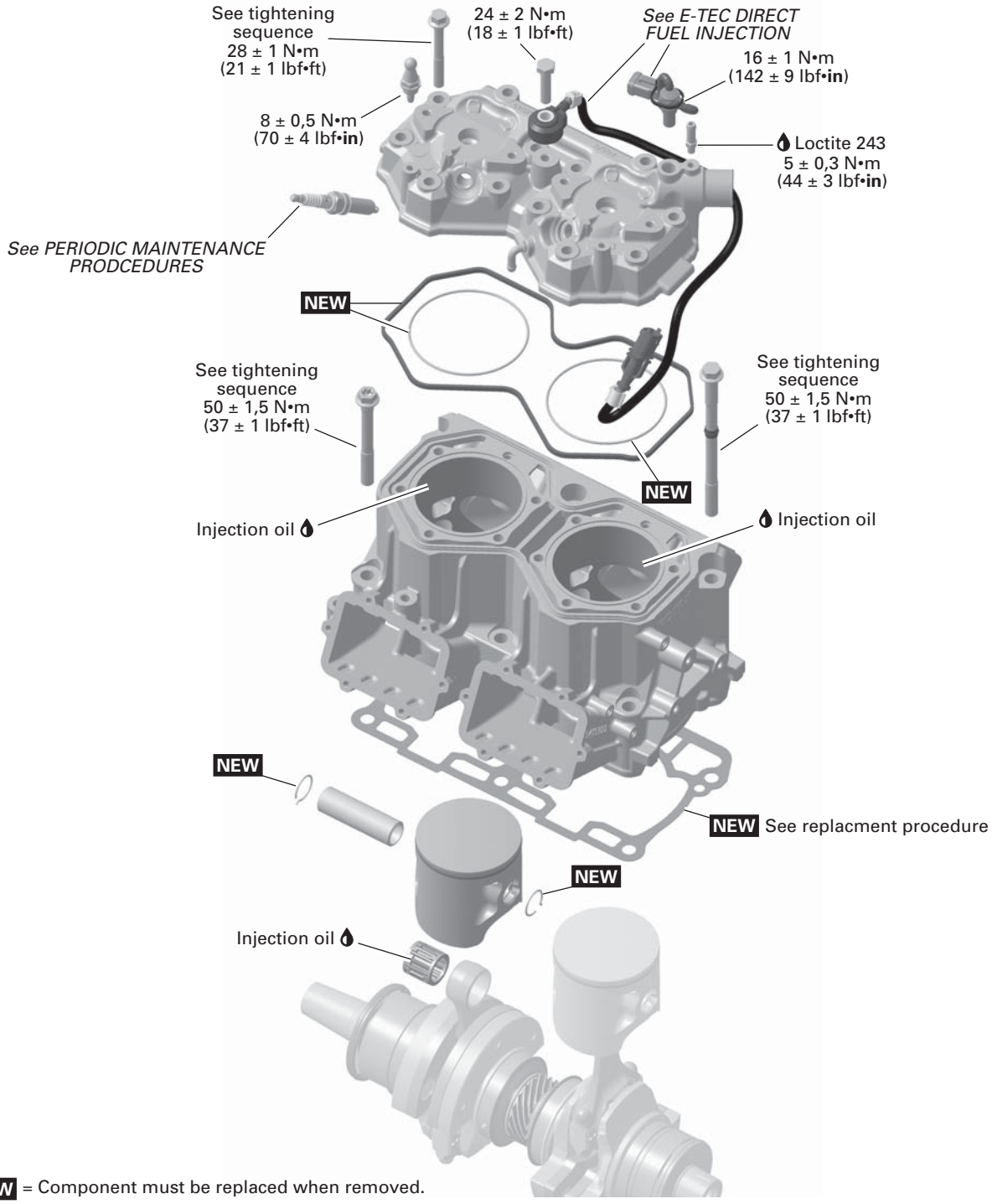

NEW = Component must be replaced when removed.

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GENERAL

Before completely disassembling the engine, check airtightness. Refer to *ENGINE LEAK TEST* subsection.

During assembly or installation:

– Use torque values and service products as shown in the exploded view.
– Clean threads before applying a threadlocker. Refer to the *INTRODUCTION* subsection.

⚠ 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 with new ones.

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

⚠ 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.

ENGINE BREAK-IN

NOTICE **After a repair involving major parts replacement, a break-in period must be observed. Follow *OPERATOR'S GUIDE* recommendation relating to break-in.**

To reactivate the break-in period, use the BUDS2 software.

Go to:

– Setting/Initialization/Restart Break-In

INSPECTION

ENGINE COMPRESSION TEST

1. Remove body parts as required to access to the spark plugs.
2. Lift rear of vehicle to clear track from the ground. Support it with a wide base stand.

⚠ WARNING

Prior to measuring engine compression, ensure vehicle is properly lifted with the track off the ground.

3. Safely warm up engine.
4. Remove a spark plug.
5. Install an appropriate ENGINE COMPRESSION TOOL on engine.

Place emergency engine stop switch to OFF position.

Crank engine several times:

– Pull rewind starter several times (if applicable) - or
– Press START/STOP button to crank engine.

Check if engine compression is according to specification.

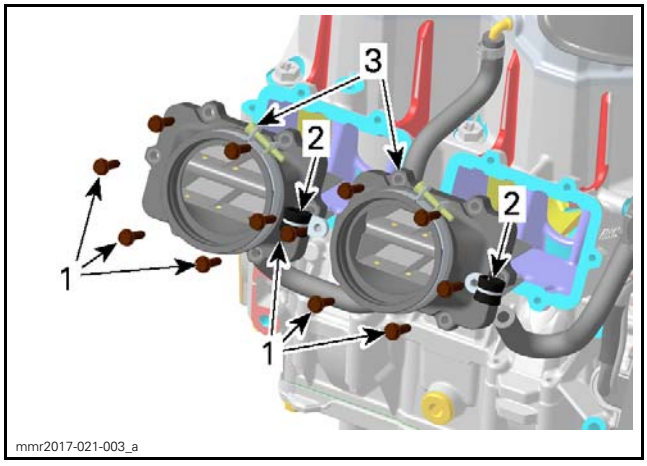
SERVICE LIMIT	
ENGINE COMPRESSION SPECIFICATION	7.5 bar (110 PSI)

PROCEDURES

REED VALVES

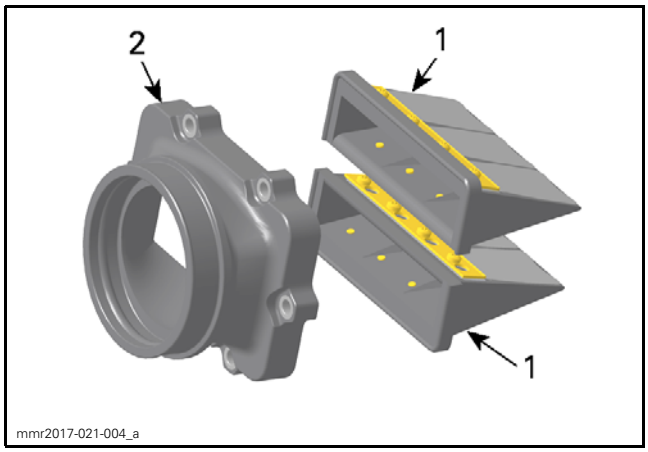
Removing the Reed Valve

1. Remove throttle body, refer to *E-TEC DIRECT FUEL INJECTION* subsection.
2. Remove the following parts.



1. Retaining screws (12x)
2. Clamps
3. Intake adapters with reed valves

3. Remove reed valves from intake adapter.



1. *Reed valves*
2. *Intake adapter*

Inspecting the Reed Valve

Check reed valve for proper tightness.

Check blades for breakouts at their end tips. In case of breakouts replace it.

There must not be any play between blade and valve body when exerting a finger pressure on blade at blade stopper location.

In case of a play, turn blade upside down and recheck.

TIGHTENING TORQUE	
Reed valve blade screws	1.5 N•m ± 0.3 N•m (13 lbf•**in** ± 3 lbf•**in**)

If there is still a play, replace blade and/or reed valve assembly.

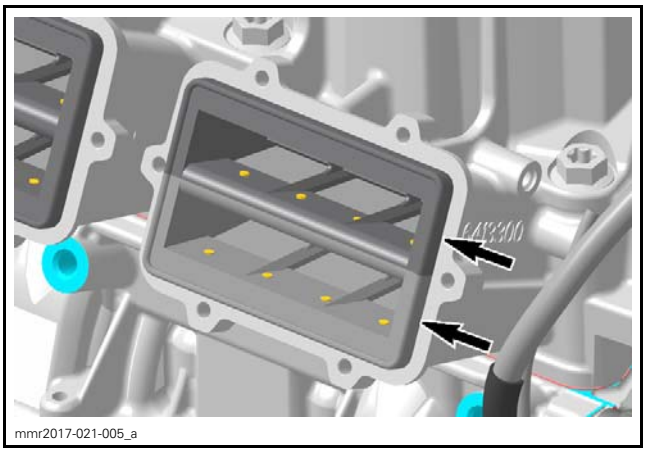
Installing the Reed Valve

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

Blades have a curved shape. Install with their curve facing reed block.

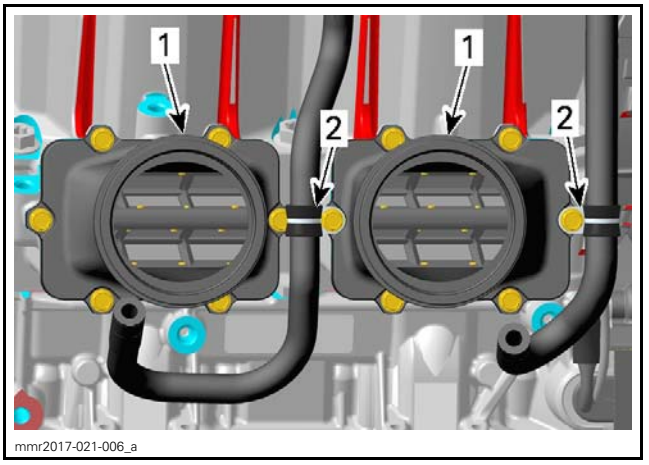
TIGHTENING TORQUE	
Reed valve blade screws	1.5 N•m ± 0.3 N•m (13 lbf•**in** ± 3 lbf•**in**)

Ensure to position reed valves so that they rest flat in intake opening.



Ensure to position intake adapter as shown.

Install clamps as shown in the illustration.



1. *Intake adapter*
2. *Clamps*

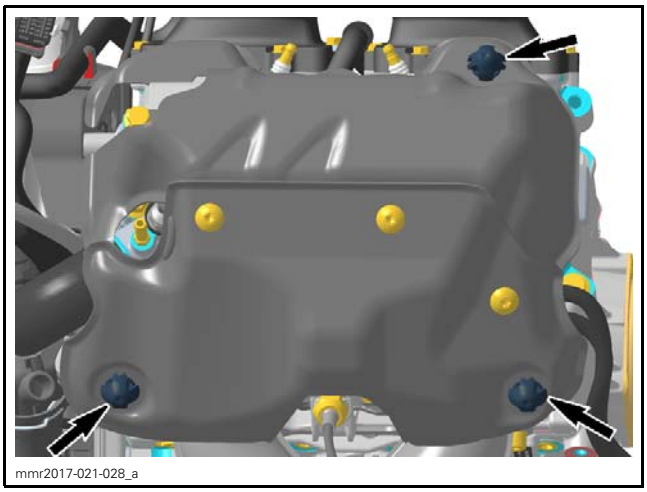
Tighten intake adapter retaining screws to specification.

TIGHTENING TORQUE	
Intake adapter retaining screws	6 N•m ± 0.4 N•m (53 lbf•**in** ± 4 lbf•**in**)

COVER

Removing the Cover

Carefully lift cover until rubber caps come off from distance screw.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Inspecting the Cover

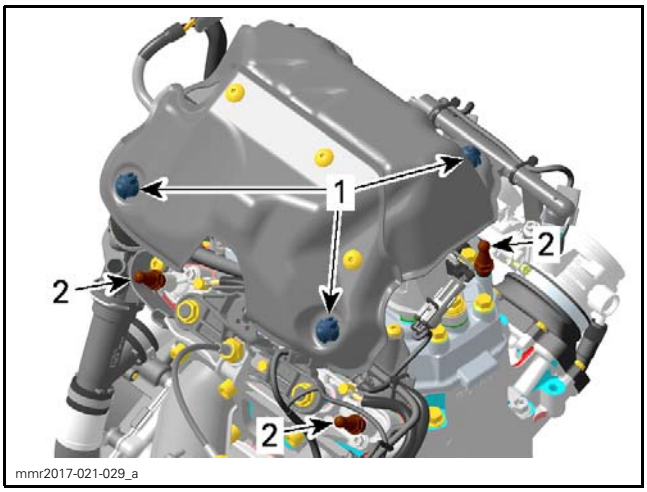
Check if heat protection mat inside cover is damaged. Replace cover if necessary.

Check rubber caps if they are brittle or otherwise damaged. Replace as required.

Installing the Cover

Position rubber caps onto the distance screw.

Push the cover until rubber caps snapping on the distance screw.



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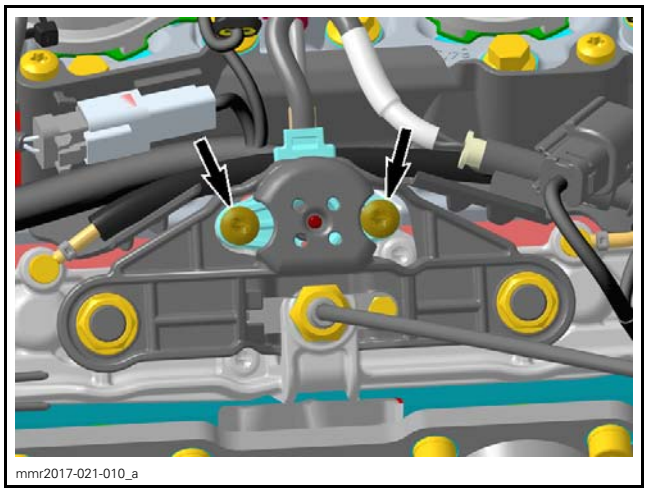
1. *Rubber caps*
2. *Distance screws*

CYLINDER HEAD

Removing the Cylinder Head

1. Remove cover, refer to procedure in this subsection.
2. Drain coolant, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
3. Remove RAVE position sensor screws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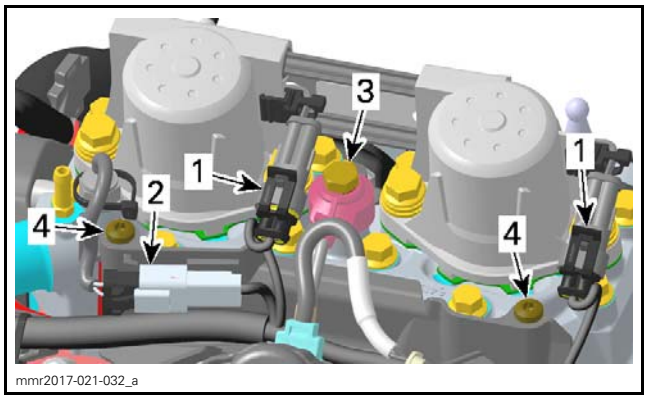
4. Pull RAVE valves to fully open position and lift RAVE position sensor.
5. Remove knock sensor retaining screw and move knock sensor aside.
6. Disconnect:
   - Fuel injector connectors
   - Coolant temperature sensor connector.
7. Remove retaining screws and move harness support towards RAVE valves.



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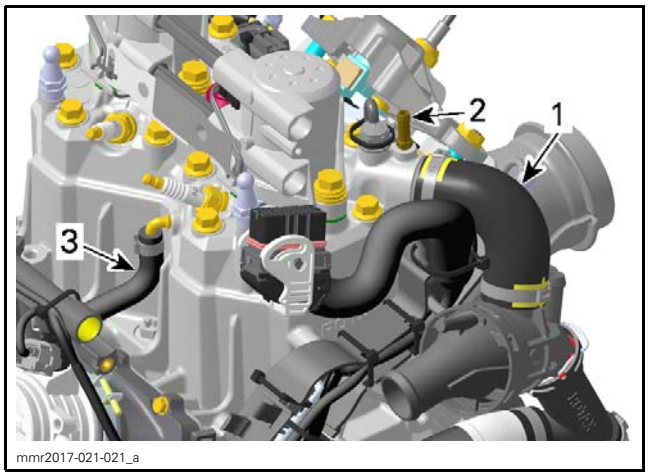
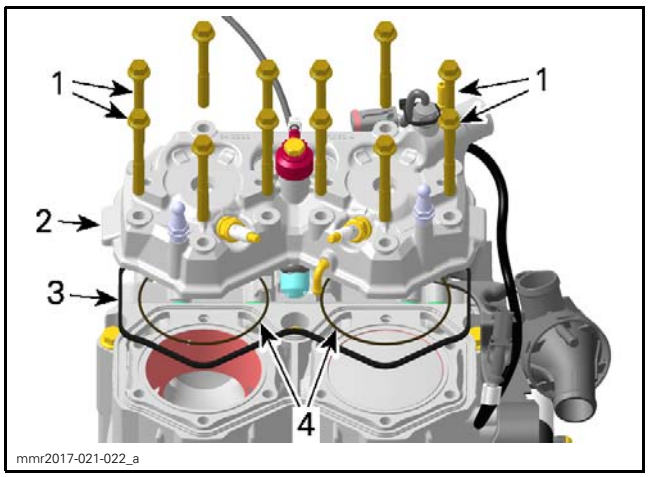
1. *Fuel injector connectors*
2. *Coolant temperature sensor connector*
3. *Knock sensor retaining screw*
4. *Harness support retaining screws*

8. Disconnect coolant hose at cylinder head.
9. Disconnect hose from bleeding nipple.
10. Disconnect throttle body heater inlet hose at cylinder head.



1. Coolant hose
2. Bleeder nipple
3. Throttle body heater inlet hose

11. Remove fuel injectors, refer to *E-TEC DIRECT FUEL INJECTION* subsection.
12. If necessary remove following parts from cylinder head:
    – Spark plugs
    – Knock sensor
    – Distance screws
    – Bleeder hose nipple.
13. Remove the following parts: .



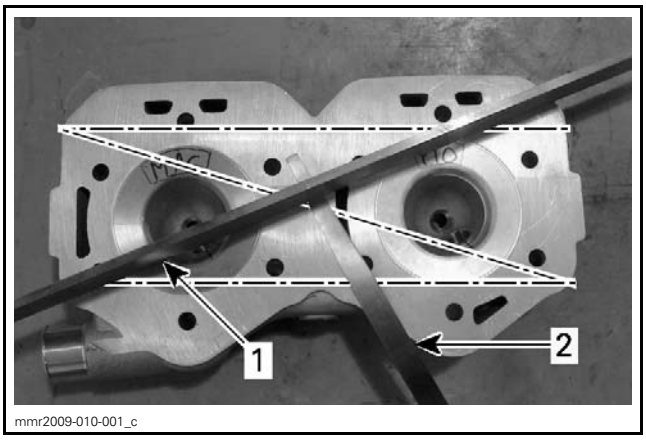
1. Cylinder head screws (12x)
2. Cylinder head
3. Cylinder rubber ring
4. O-rings

Inspecting the Cylinder Head

Check cylinder head for cracks or other damages. Replace if necessary.

Cylinder Head Warpage

1. Check gasket mating surface of the cylinder head with a straight edge and a feeler gauge. Make sure part is within the given specification.
2. If cylinder head is out of specification, replace it.



TYPICAL
1. Straight edge
2. Feeler gauge

SERVICE LIMIT	
CYLINDER HEAD WARPAGE	0.05 mm (.002 in) per 50 mm (2 in) of surface
	0.5 mm (.02 in) for total length of cylinder head

Cleaning the Cylinder Head

Scrape off any carbon deposits from cylinder head.

CYLINDER HEAD CLEANING	
Service product	LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500)

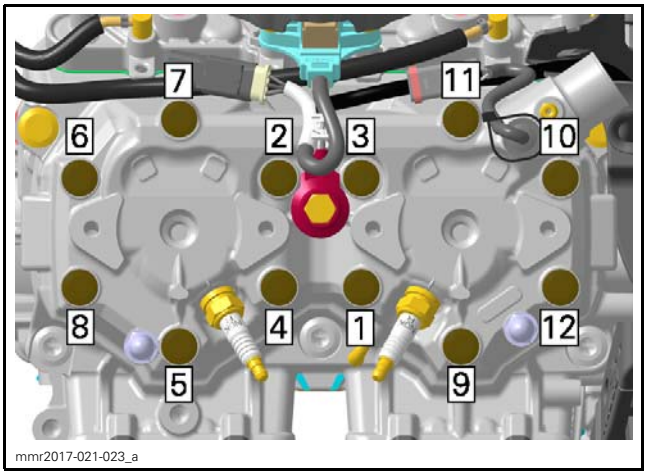
Installing the Cylinder Head

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

Install **NEW** rubber ring and round O-rings on cylinder block.

Tighten cylinder head screws to specification as per the following sequence.

TIGHTENING TORQUE	
Cylinder head screws	28 N•m ± 1 N•m (21 lbf•ft ± 1 lbf•ft)



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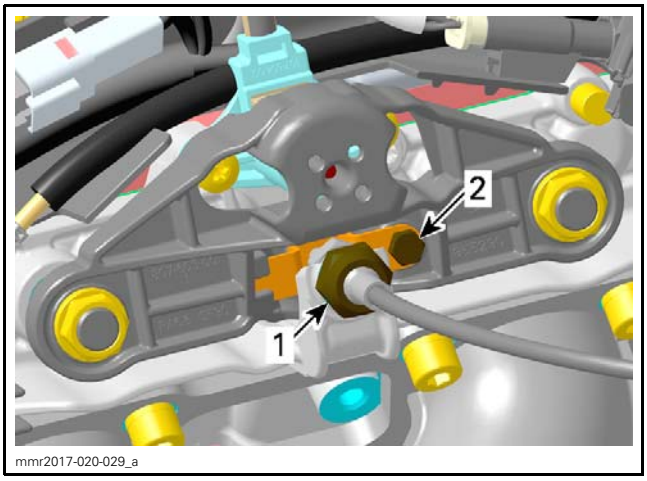
TIGHTENING SEQUENCE

CYLINDER BLOCK

Removing the Cylinder Block

1. Remove *CYLINDER HEAD*, see procedure in this subsection.
2. Disconnect throttle bodies from intake adapters and set aside.
3. Loosen bowden cable lock nut and remove retaining plate screw and put cable aside.



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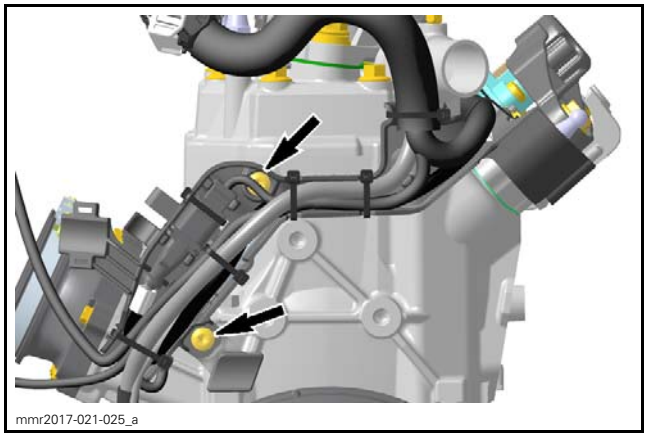
1. *Bowden cable lock nut*
2. *Retaining plate screw*

4. Disconnect RAVE valves oil lines.
5. Remove screws from harness support and put wiring harness with support aside.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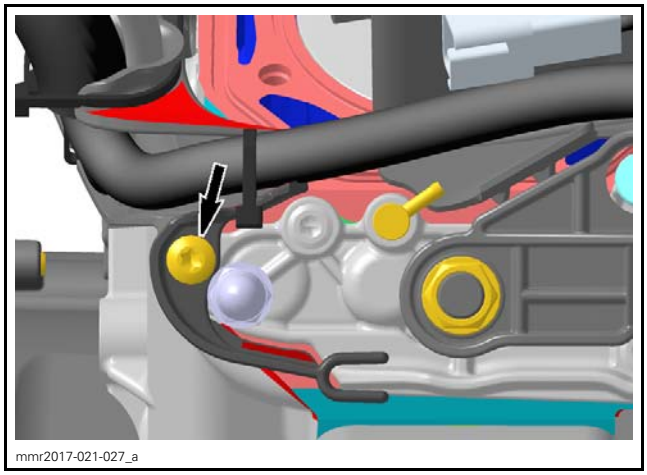
MAGNETO SIDE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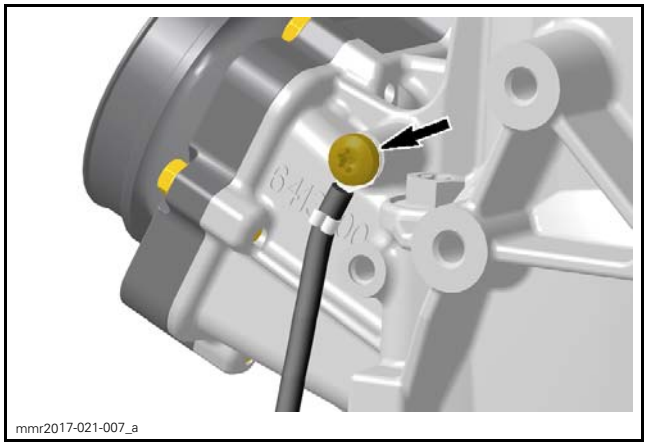
EXHAUST SIDE

6. Remove ground cable.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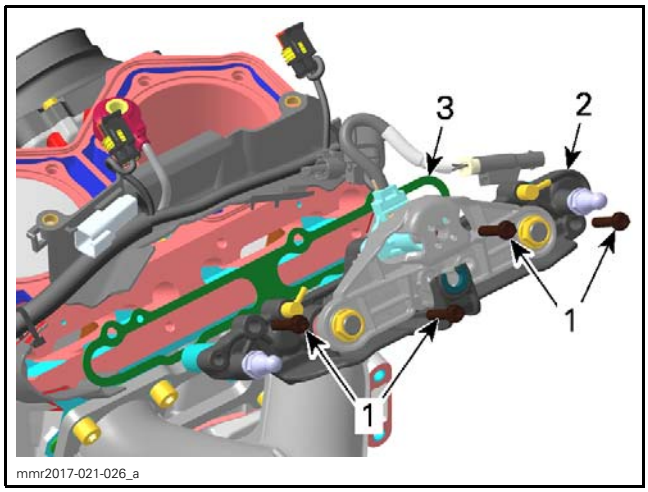
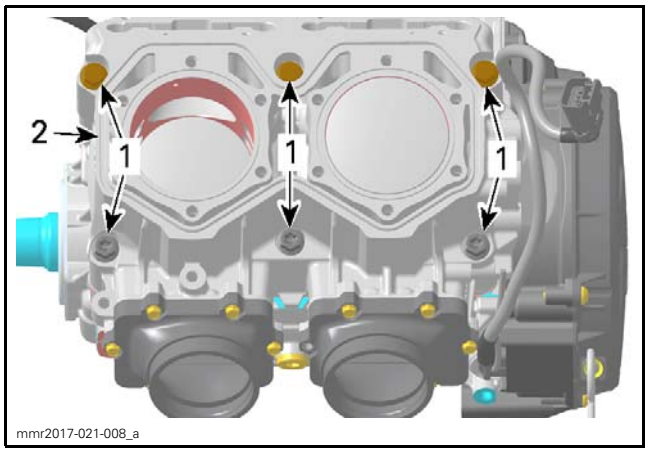
7. If necessary remove:
   - Retaining screws
   - RAVE assembly.



1. *Retaining screws*
2. *RAVE assembly*
3. *Gasket*

8. Remove:
   - Cylinder block screws
   - Cylinder block.



1. *Cylinder block screws*
2. *Cylinder block*

Inspecting the Cylinder Block

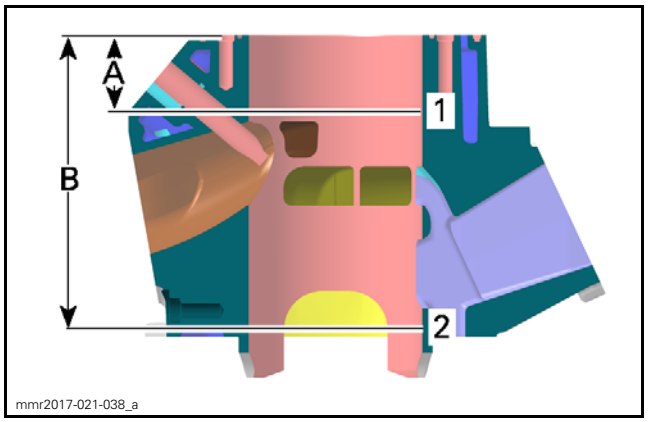
Remove RAVE valves, refer to *RAVE* subsection.

Remove reed valves, refer to *REMOVING THE REED VALVES* in this subsection.

Check cylinder bores for cracks and scoring on the top and bottom of cylinders. Replace if necessary.

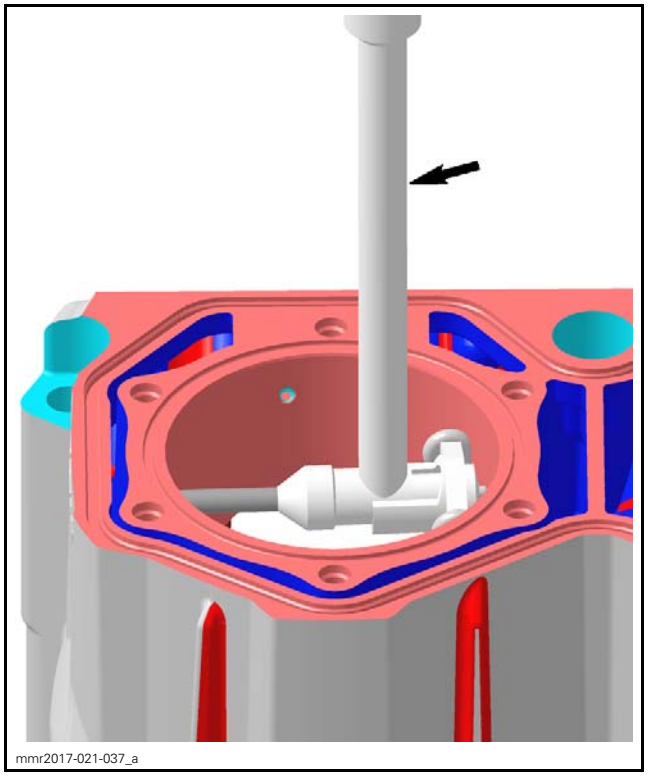
Cylinder Taper

1. Measure cylinder diameter at the following positions:
   - Above exhaust port
   - Below intake port.



CYLINDER TAPER MEASUREMENTS		
POSITION	MEASUREMENT	FROM TOP OF CYLINDER BLOCK
1	A	30 mm (1.18 in)
2	B	140 mm (5.51 in)

REQUIRED TOOL
Cylinder bore gauge



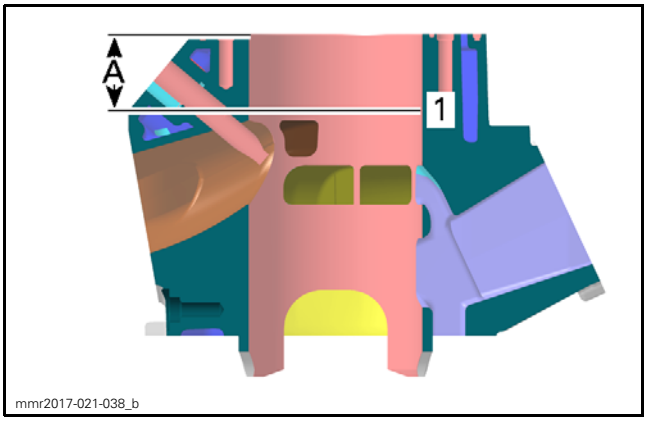
2. Compare cylinder diameters.
3. If the difference exceeds the specified dimension, replace the cylinder block.

CYLINDER BORE TAPER	
SERVICE LIMIT	0.10 mm (.0039 in)

Cylinder out of Round

1. Check if the cylinder out of round is more than the specified dimension.

Measure above exhaust port:
– in piston pin axis
– perpendicular to piston pin axis.



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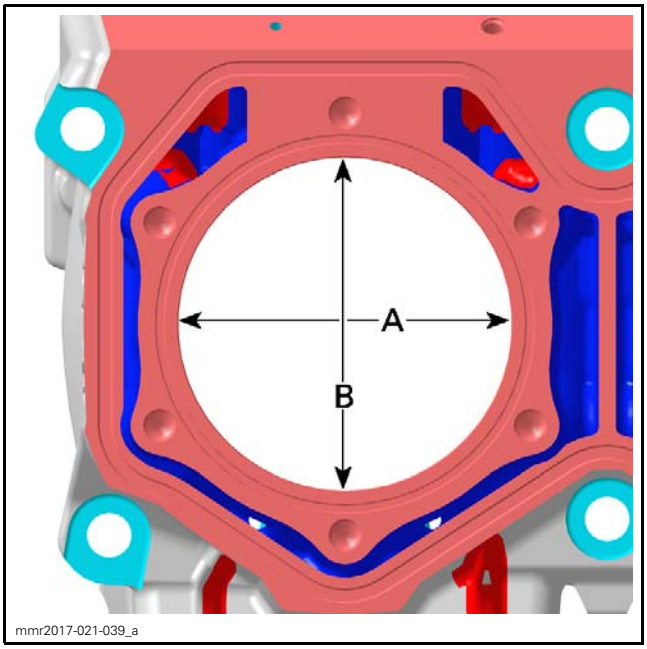
CYLINDER OUT OF ROUND MEASUREMENT		
POSITION	MEASUREMENT	FROM TOP OF CYLINDER BLOCK
1	A	30 mm (1.18 in)



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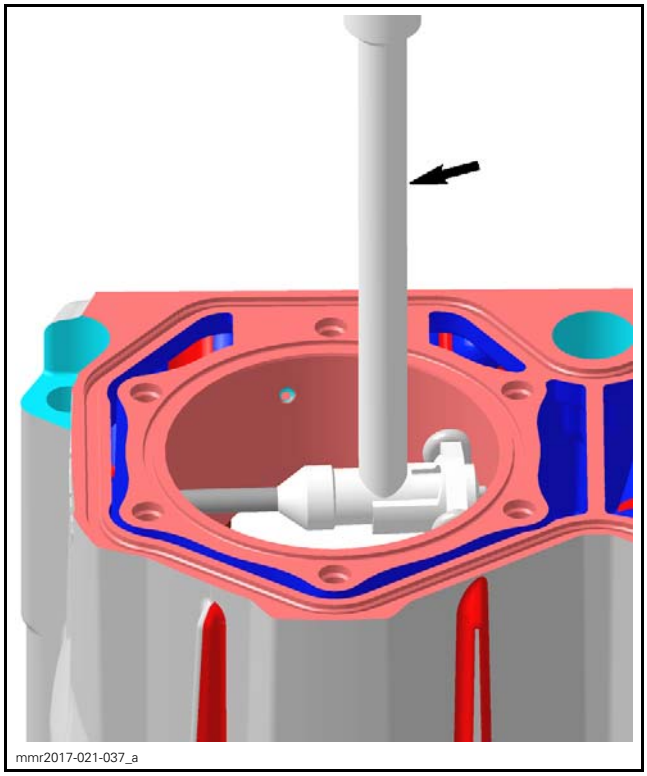
A. Measure in piston pin axis
B. Measure perpendicular to piston pin axis

REQUIRED TOOL
Cylinder bore gauge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2. If the measurement exceeds the specifications, replace the cylinder block.

CYLINDER BORE OUT OF ROUND	
SERVICE LIMIT	0.08 mm (.0031 in)

Cleaning the Cylinder Block

Scrape off any carbon deposits from exhaust ports.

Carefully clean cylinder block screws, specifically under screw head.

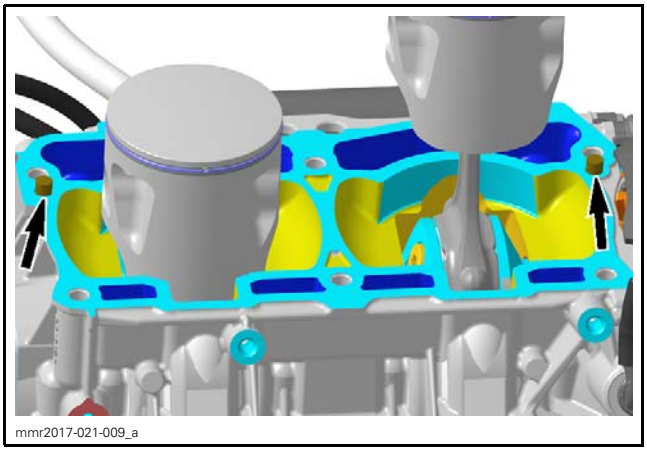
CYLINDER BLOCK AND SCREWS CLEANING	
Service product	LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500)

Installing the Cylinder Block

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

Ensure top surface of crankcase is clean.

Check if dowel pins are in crankcase holes.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Install a NEW cylinder block base gasket of the same thickness as the old one. Refer to *PISTON PROJECTION MEASUREMENT* in this subsection.

NOTE: If thickness of the factory-installed gasket is unknown, install a 7-holes gasket (0.7 mm (.028 in)) as a base line.

Lubricate cylinder bores.

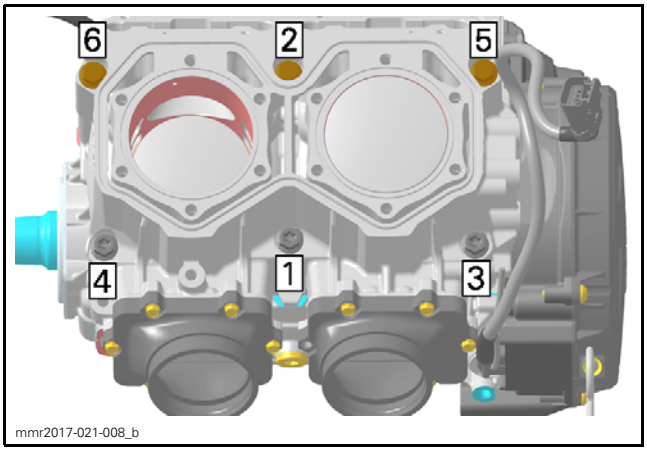
CYLINDER BORE LUBRICATION	
Service product	Injection oil

Carefully slide cylinder block down while squeezing piston rings to allow cylinder insertion.

Proceed one piston at a time, the help of an assistant may be required.

Tighten cylinder block screws to specification as per the following sequence.

TIGHTENING SEQUENCE	
Cylinder block screws	50 N•m ± 1.5 N•m (37 lbf•ft ± 1 lbf•ft)



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TIGHTENING SEQUENCE

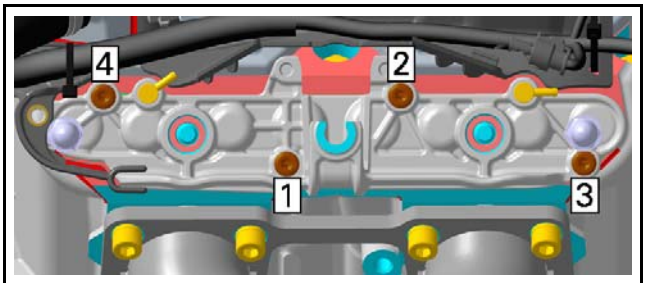
Measure piston projection as described in *PISTON PROJECTION MEASUREMENT* in this subsection.

NOTICE **Always install a cylinder block base gasket of the proper thickness. Failure to do so may cause detonation and severe engine damage.**

Install RAVE assembly with NEW gasket.

Tighten RAVE valve housing screws to specification following the illustrated sequence.

TIGHTENING TORQUE	
RAVE valve housing screws	10 N•m ± 0.7 N•m (89 lbf•**in** ± 6 lbf•**in**)



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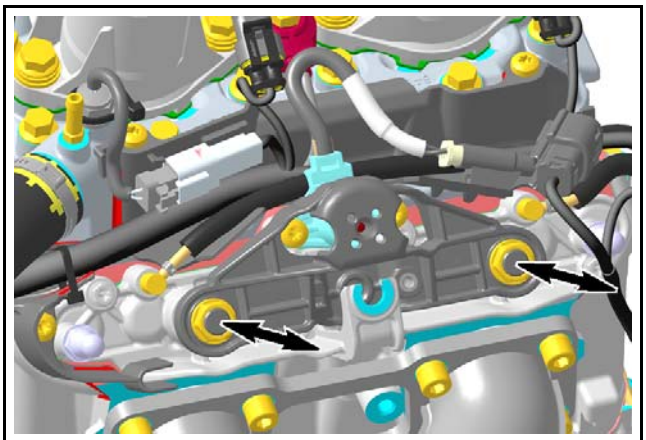
TIGHTENING SEQUENCE

Push and pull RAVE link bar to be sure that RAVE valves move freely.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PUSH AND PULL RAVE LINK BAR

Install bowden cable on the link bar, refer to *BOWDEN CABLE* in the *RAVE* subsection.

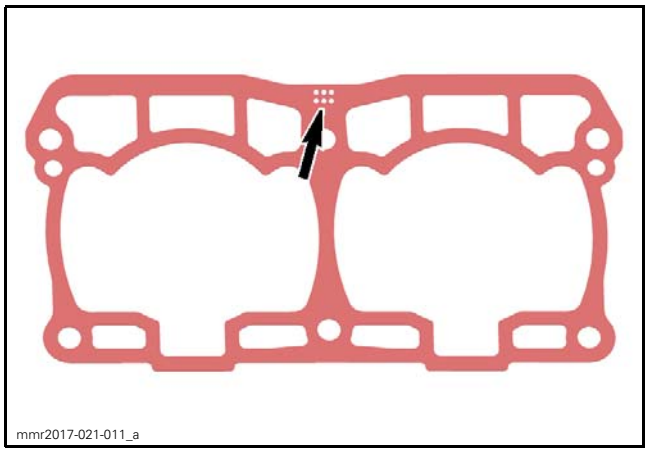
PISTON PROJECTION MEASUREMENT

NOTE: The piston projection measurement is used to determine the correct cylinder base gasket thickness when engine components are replaced.

Cylinder Block Base Gasket

The cylinder block base gasket is available in different thicknesses to adjust precisely the piston projection.

CYLINDER BLOCK BASE GASKET	
THICKNESS	HOLES QUANTITY
0.9	9
0.8	8
0.7	7
0.6	6
0.5	5



TYPICAL - GASKET THICKNESS IDENTIFICATION HOLES

NOTICE **Always install a cylinder block base gasket of the proper thickness. Failure to do so may cause detonation and severe engine damage.**

Engine Preparation

1. Bring PTO piston to TDC.

REQUIRED TOOL	
TDC DIAL INDICATOR (P/N 295 000 143)	

2. Remove cylinder head from engine. Refer to *CYLINDER HEAD* in this subsection.
3. Remove O-rings from cylinder block.
4. Clean top surface of cylinder block.
5. Ensure piston dome is clean and free of any carbon deposits.
6. Ensure cylinder block screws are properly tightened.

Piston Projection Measurement

1. Place piston projection tool on a flat steel surface.

REQUIRED TOOL	
PISTON PROJECTION (P/N 529 036 215)	
TDC DIAL INDICATOR (P/N 295 000 143)	

2. Rotate dial indicator face to position the **0** in line with needle.

SETTING THE ZERO

3. Install tool on PTO cylinder.
4. Center tool with cylinder to ensure that dial indicator reads piston dome.


mmr2011-010-003

TYPICAL - TOOL PROPERLY CENTERED

5. Ensure that PTO piston is set to TDC.
6. Read dial indicator then note measurement.


mmr2011-010-004

TYPICAL

NOTE: Convert dial indicator measurement to millimeter.

PISTON PROJECTION MEASUREMENT
1.75 mm to 1.82 mm (.069 in to .072 in)

7. If piston projection measurement is out of specification, change cylinder block base gasket thickness. Refer to *CYLINDER BLOCK* in this subsection.

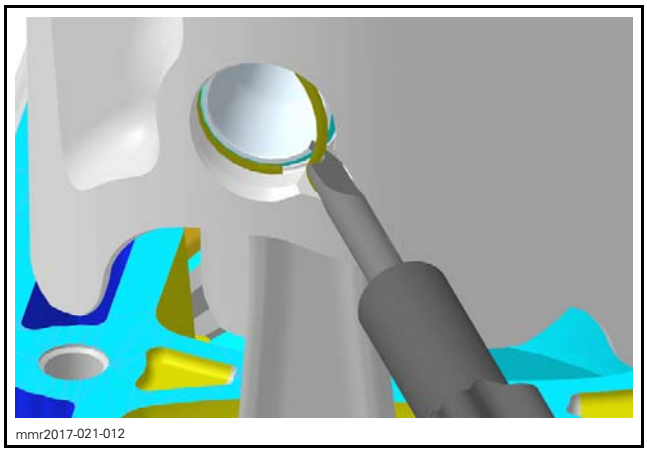
CYLINDER BLOCK BASE GASKET SELECTION GUIDELINE	
MEASURED PISTON PROJECTION	GASKET TO INSTALL
Below specification	Thinner
Above specification	Thicker

NOTICE Take care to use the proper specification according to the type of engine and the model of vehicle.

PISTONS

Removing the Piston

1. Remove *CYLINDER BLOCK*, see procedure in this subsection.
2. Place a clean cloth over crankcase.
3. Using a pointed tool inserted in piston notch, remove circlips from piston.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4. Push piston pin out of piston.
5. Remove piston.
6. Remove bearing.
7. Discard circlips.

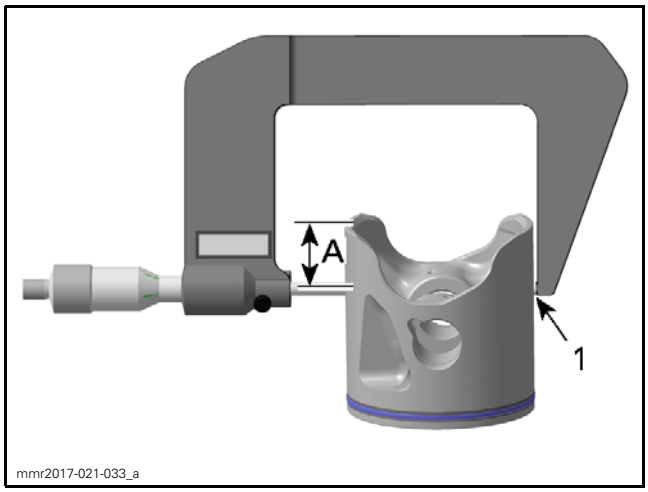
Inspecting the Piston

Inspect piston for scoring, cracking or other damage.

Cylinder/Piston Clearance

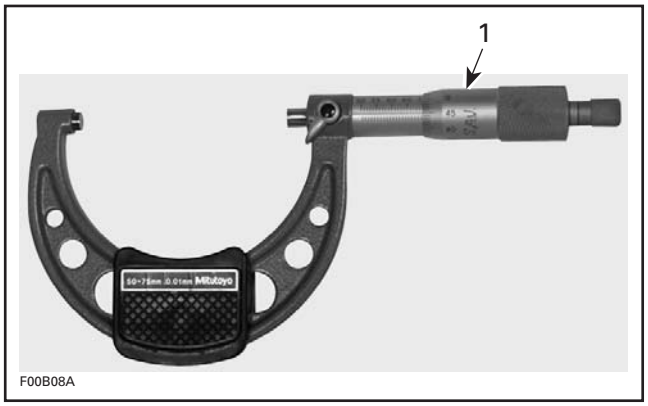
1. Measure piston diameter at "A" perpendicularly (90°) to piston pin.

REQUIRED TOOL
Micrometer



1. Measuring diameter perpendicularly (90°) to piston pin axis
A. 15 mm (.591 in)

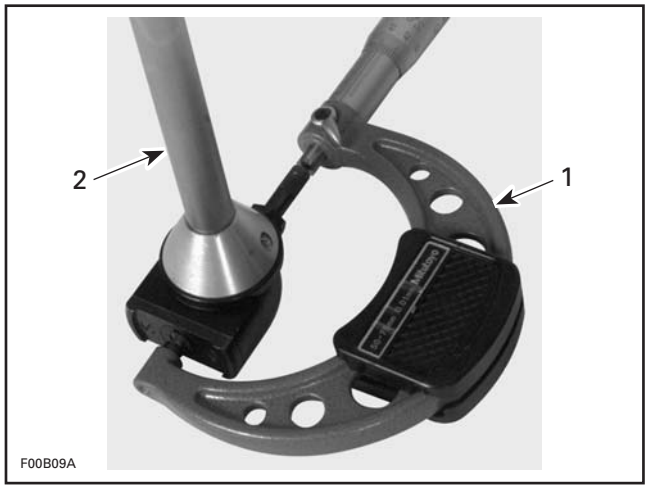
2. Adjust and **lock** a micrometer to the piston diameter.



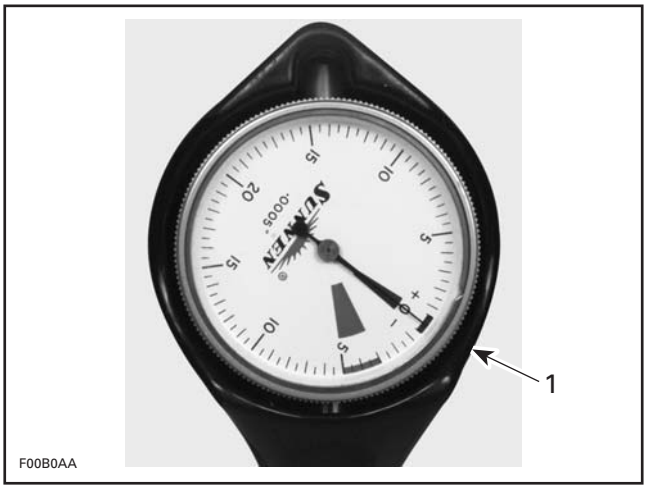
1. Micrometer set to the piston diameter

3. Adjust a cylinder bore gauge to the locked micrometer and set the indicator to 0.

REQUIRED TOOL
Cylinder bore gauge



1. Use the micrometer to set the cylinder bore gauge
2. Dial bore gauge

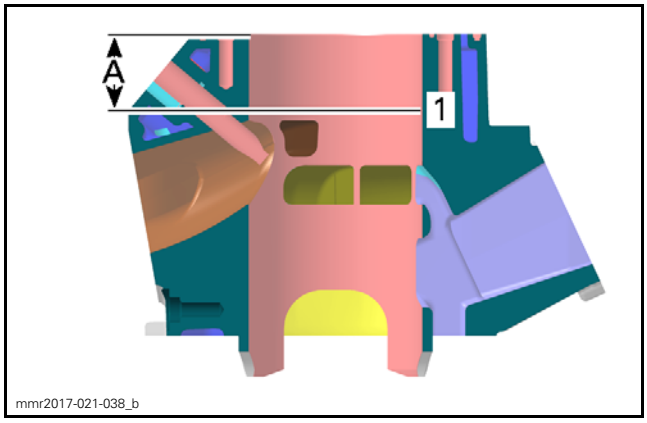


1. Indicator set to 0 (zero)

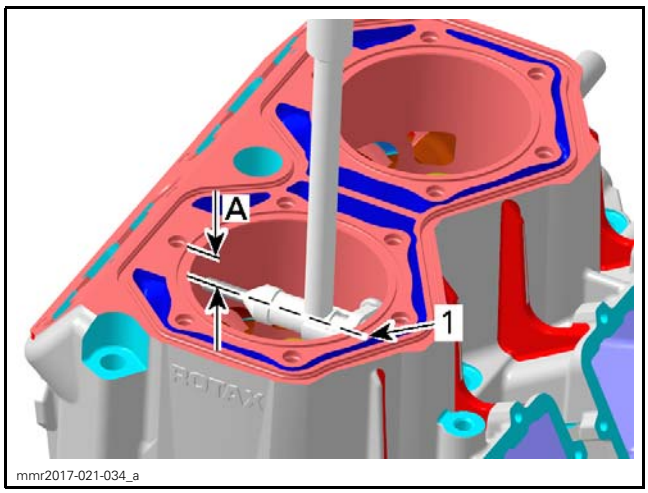
NOTE: Make sure the cylinder bore gauge indicator is set exactly at the same position as with the micrometer, otherwise the reading will be false.

4. Position the dial bore gauge above the exhaust port.

NOTICE **Always remove cylinder-block from crankcase before measuring.**



CYLINDER OUT OF ROUND MEASUREMENT		
POSITION	MEASUREMENT	FROM TOP OF CYLINDER BLOCK
1	A	30 mm (1.18 in)



1. Measuring perpendicularly (90°) to piston pin axis
A. 30 mm (1.18 in)

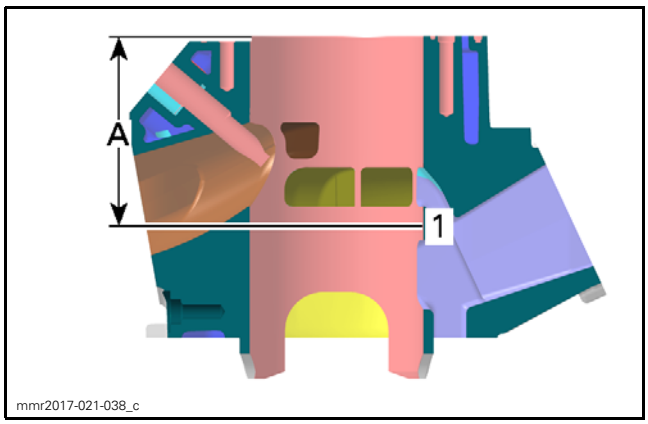
5. Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder wall clearance.

CYLINDER/PISTON CLEARANCE	
NEW	0.136 mm to 0.160 mm (.0054 in to .0063 in)
SERVICE LIMIT	0.200 mm (.0079 in)

6. If clearance exceeds specified tolerance, replace cylinder and piston.

Ring End Gap

1. Position ring halfway between transfer ports and intake port.



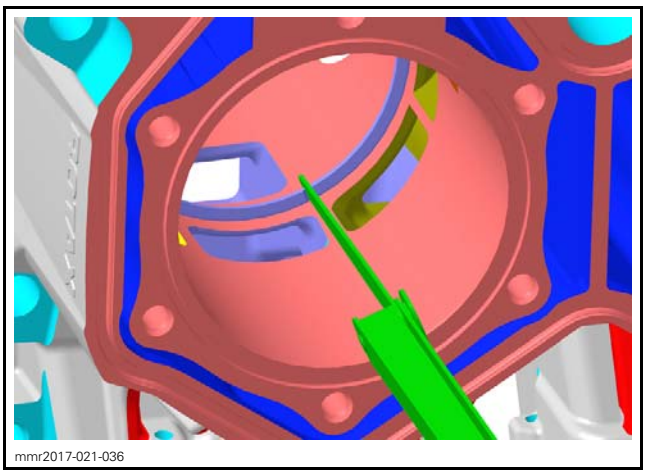
RING END GAP MEASUREMENT		
POSITION	MEASUREMENT	FROM TOP OF CYLINDER BLOCK
1	A	89 mm (3.5 in)

NOTE: In order to correctly position the ring in the cylinder, use piston as a pusher.

2. Check ring end gap. Replace ring if gap exceeds specified tolerance.

REQUIRED TOOL
Feeler gauge

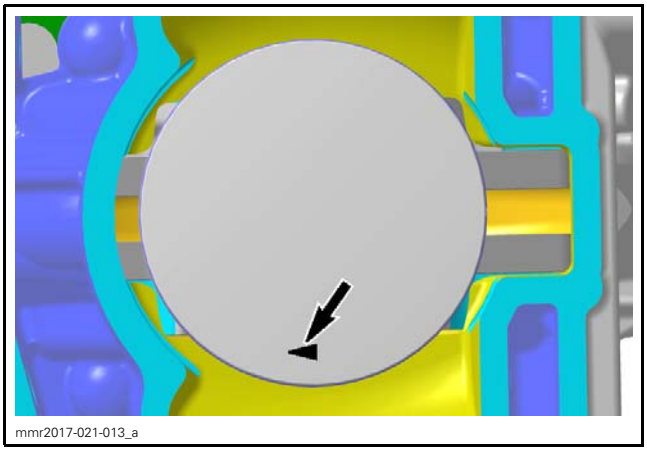
RING END GAP	
NEW	0.400 mm to 0.600 mm (.0157 in to .0236 in)
SERVICE LIMIT	1.000 mm (.0394 in)



Cleaning the Piston

1. Scrape off any carbon deposits from piston dome.

NOTE: The arrow on the piston dome must be visible after cleaning.



EXHAUST DIRECTION INDICATION

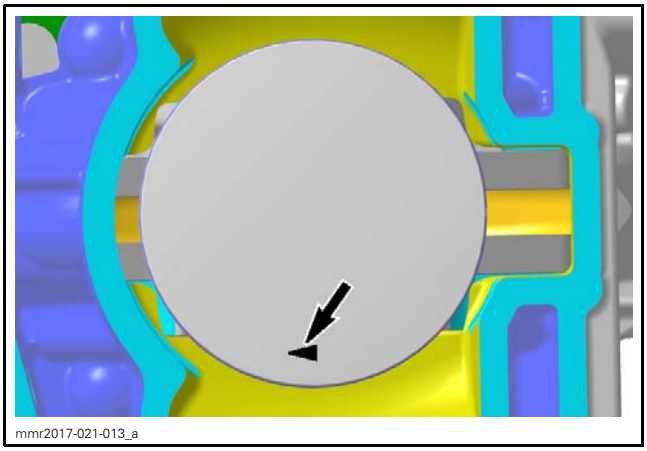
2. Clean the piston ring groove with a groove cleaner tool or with a piece of broken ring.

Installing the Piston

1. Lubricate needle bearing.

NEEDLE BEARING LUBRICATION	
Service product	Injection oil

2. Insert bearing into connecting rod.
3. Place pistons over connecting rods with the arrow on the piston dome facing towards exhaust port.



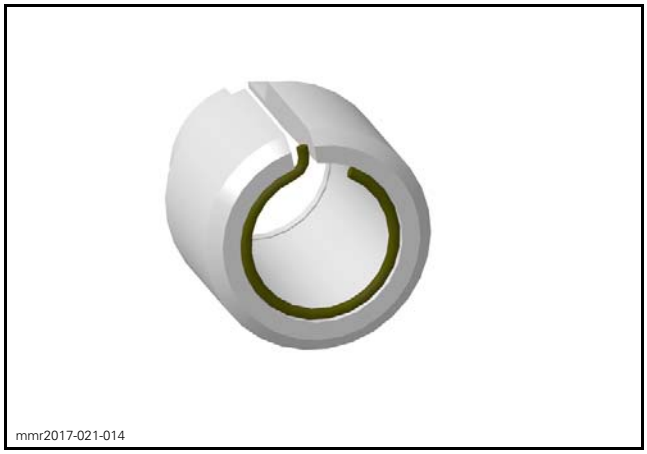
EXHAUST DIRECTION INDICATION

4. Install piston pin in piston.
5. Install **NEW** circlips.

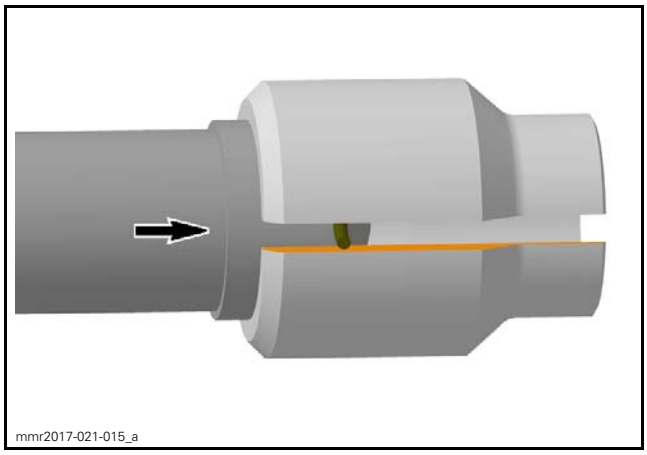
REQUIRED TOOL	
PISTON CIRCLIP INSTALLER 21MM (P/N 529 036 138)	

NOTICE **Always install NEW mono-hook circlips. If circlip installation fails at the first attempt, always retry with a new one.**

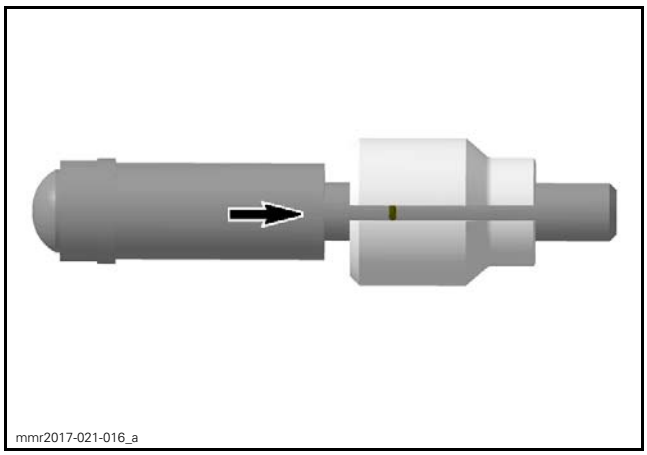
6. Use the following procedure to properly install circlip.
   6.1 Insert circlip into support so that, when installed in piston groove, the gap will be below the tab.

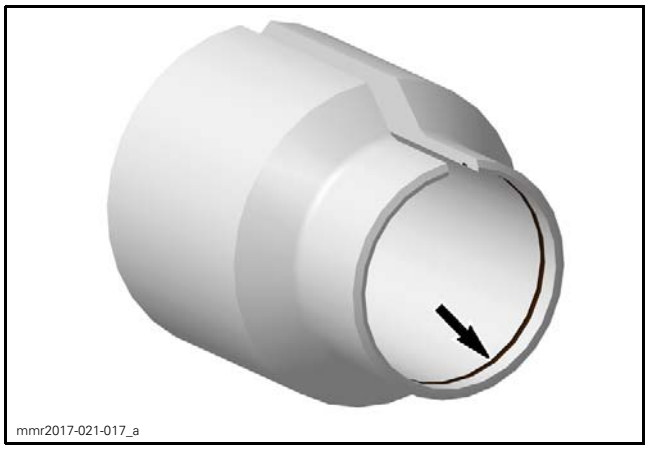


   6.2 With round end of pusher, position circlip perpendicularly to the support axis.

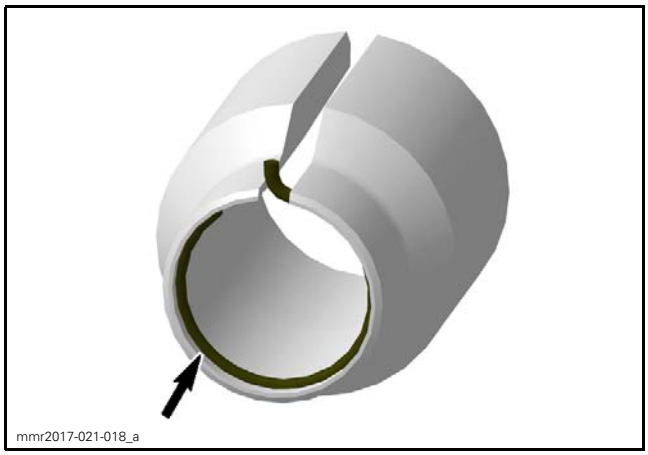


   6.3 With the other end of the pusher, push circlip into the support groove.

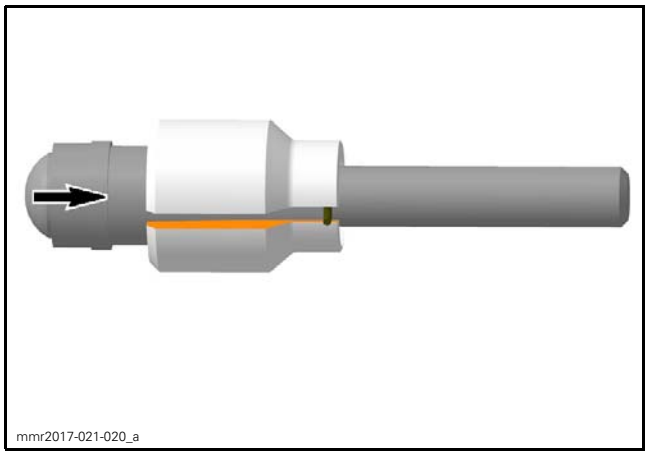




GROOVE

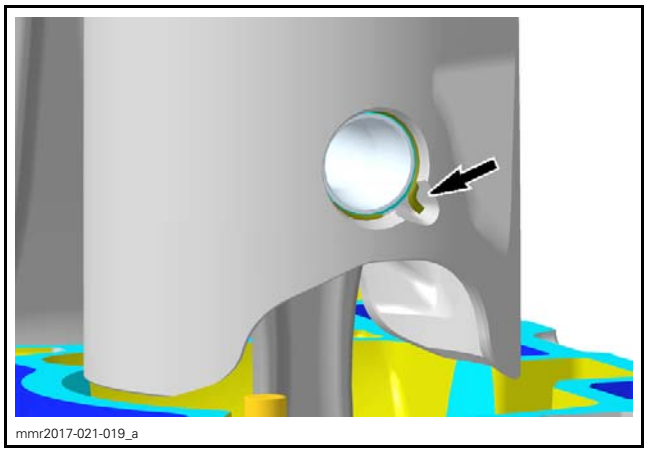


CIRCLIP READY TO BE INSTALLED ON PISTON



6.4 Using a plastic hammer, tap pusher to put the new circlip in place.

NOTE: Make sure to install new circlips with the gap below the tab exactly as shown on the following photo.



GAP BELOW THE TAB

NOTICE Circlips must not move freely after installation; if so, replace them.

7. Install all other removed parts as the reverse of removal procedure.

BOTTOM END

SERVICE TOOLS

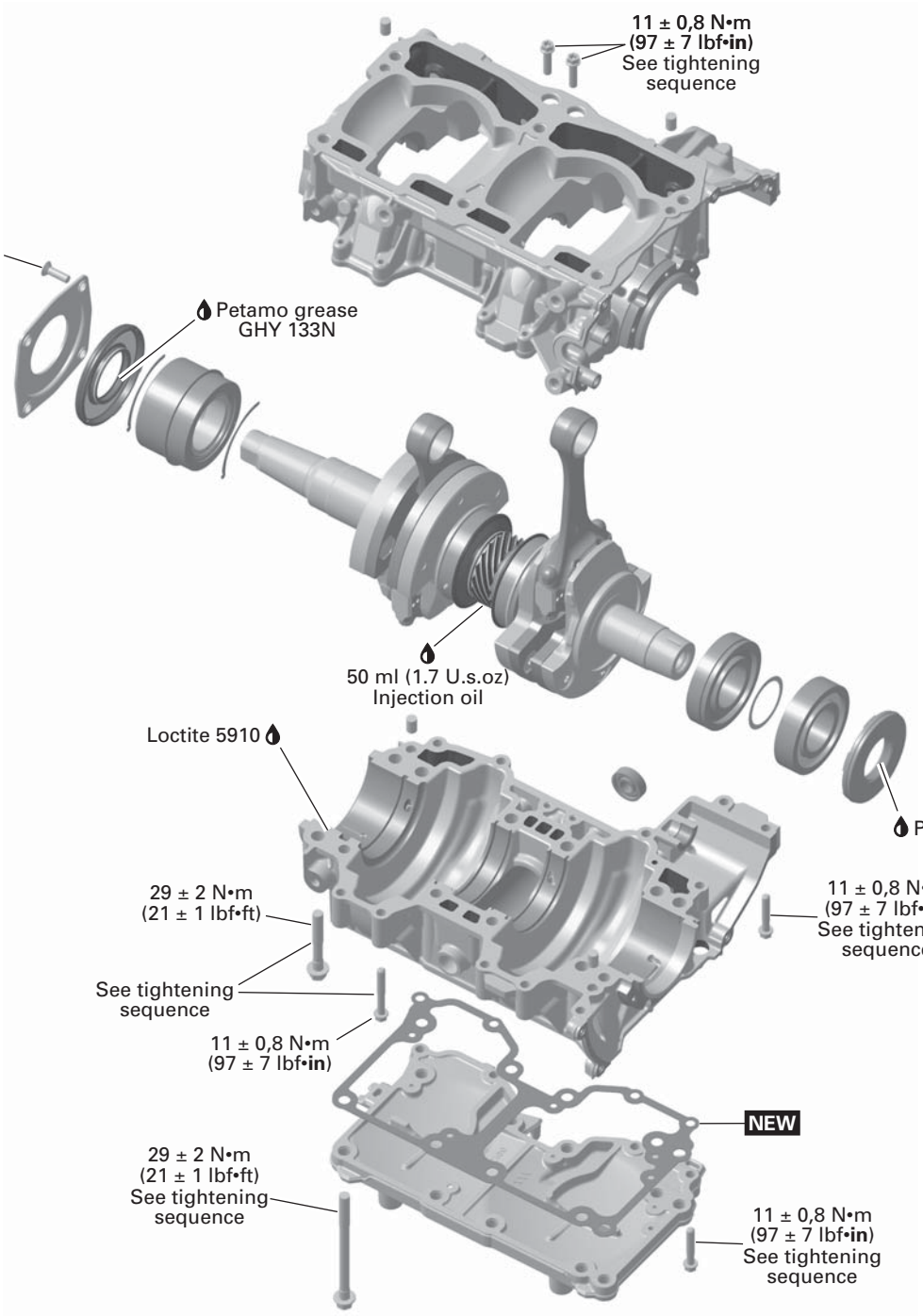
Description	Part Number	Page
BEARING HEATER	529 035 969	11
CRANKSHAFT BEARING PULLER	529 036 004	10
CRANKSHAFT PROTECTOR	529 036 405	10
DEGREE WHEEL	529 035 607	9
DISTANCE GAUGE	529 036 415	13
HALF-RING	529 036 414	10
PULLER RING	420 977 490	10
TEMPERATURE INDICATOR STICK	529 035 970	11
WATER PUMP BEARING PUNCH	529 036 417	6

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
SNAP-ON MANUAL IMPACT DRIVER	PIT120	3

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 5910	293 800 081	6
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	5
PETAMO GREASE GHY 133N	420 899 271	12
PULLEY FLANGE CLEANER	413 711 809	11
XPS LUBE	293 600 016	10



NEW = Component must be replaced when removed.

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GENERAL

Engine removal is required to repair bottom end.

All oil seals and gaskets must be discarded and replaced with new ones when crankcase is split.

Clean all metal components in a non-ferrous metal cleaner.

During assembly or installation:

– Use torque values and service products as shown in the exploded view.
– Clean threads before applying a threadlocker. Refer to the *INTRODUCTION* subsection.

⚠ 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 with new ones.

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

⚠ 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.

ENGINE BREAK-IN

NOTICE **After a repair involving major parts replacement, a break-in period must be observed. Follow *OPERATOR'S GUIDE* recommendation relating to break-in.**

To reactivate the break-in period, use the BUDS2 software.

Go to:

– Setting/Initialization/Restart Break-In

PROCEDURES

CRANKCASE

Disassembling the Crankcase

Remove engine from vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.

Refer to *TOP END* subsection to remove:

– Cylinder head
– Cylinder block
– Pistons.

Refer to *MAGNETO AND STARTER* subsection to remove:

– Stator
– Magneto housing
– Starter drive
– Starter.

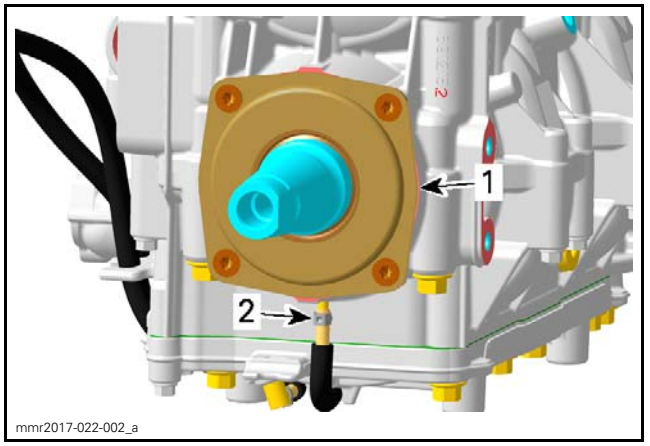
.

Remove drive pulley. Refer to *DRIVE PULLEY* subsection.

Remove PTO oil seal cover.

NOTE: Tap screw heads to break the Loctite bond or use a SNAP-ON MANUAL IMPACT DRIVER (P/N PIT120).

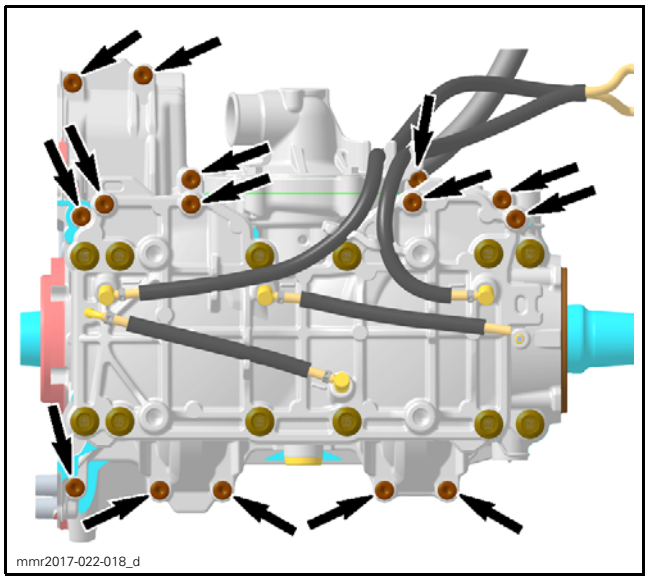
Remove oil line from crankcase. Discard 1-ear clamp.



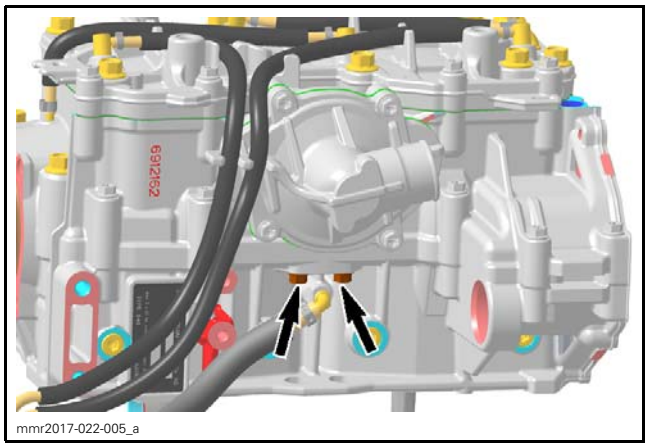
1. PTO oil seal cover
2. Oil line

Remove engine front supports.

Remove M6 crankcase screws.

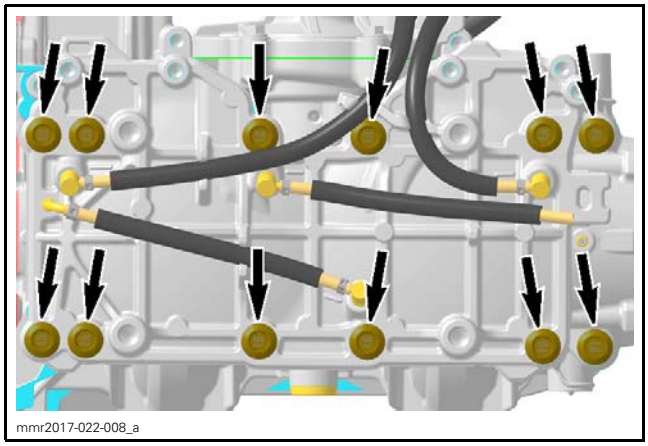


M6 CRANKCASE SCREWS - BOTTOM SIDE



M6 CRANKCASE SCREW - WATER PUMP SIDE

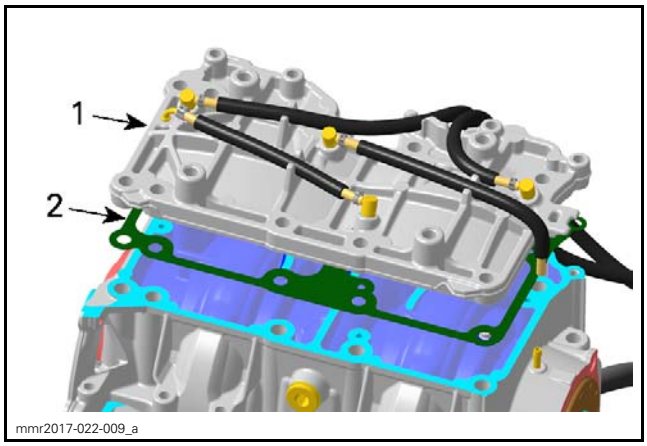
Remove M8 crankcase screws.



TYPICAL - BASE PLATE RETAINING SCREWS

Remove base plate and discard gasket.

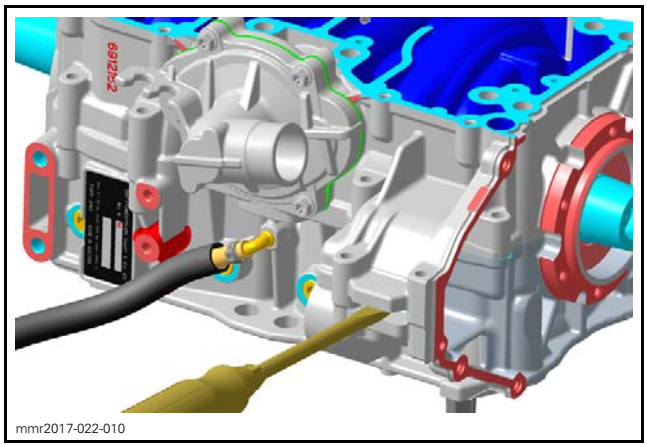
NOTICE **Whenever base plate is removed, crankcase must be opened, cleaned, and re-sealed.**



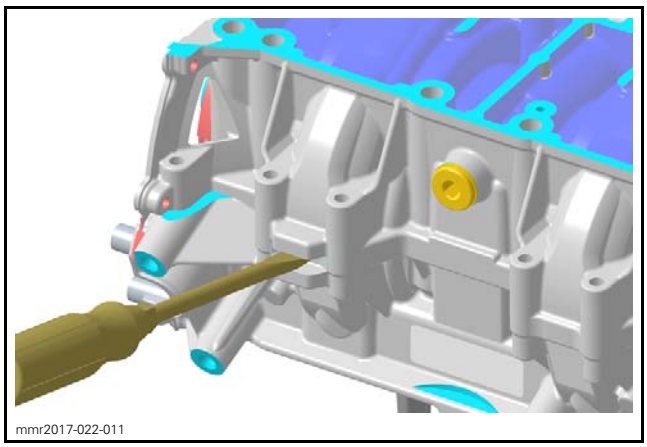
1. Base plate
2. Gasket (discard it)

Split crankcase.

NOTE: To prevent damage to crankcase mating surfaces, use prying lugs to "unstick" crankcase.

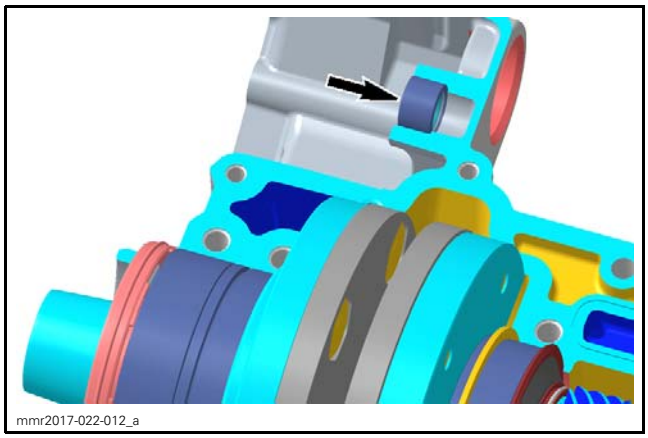


PRYING LUGS

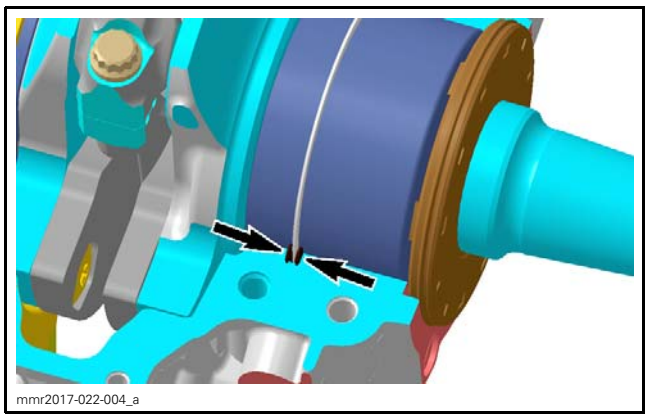


PRYING LUGS

Remove:
- Starter drive needle bearing
- Crankshaft assembly
- Shims.



STARTER DRIVE NEEDLE BEARING



SHIMS

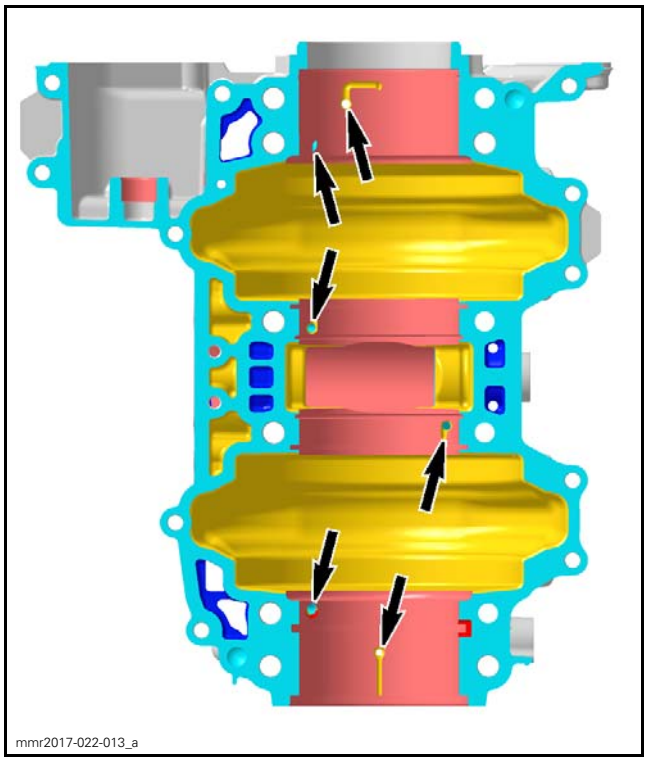
Cleaning the Crankcase and Base Plate

Clean all metal components in a non-ferrous metal cleaner.

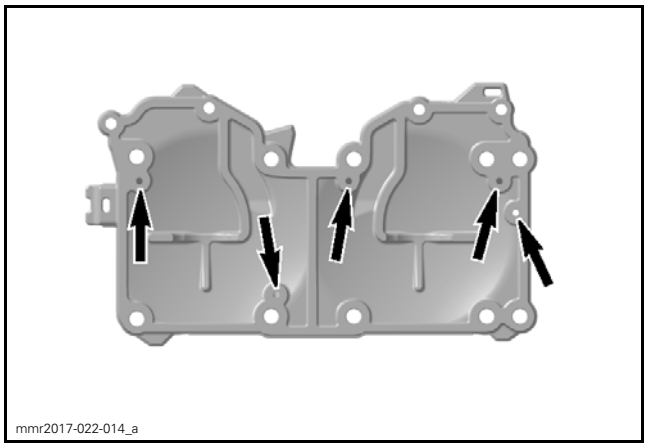
CRANKCASE CLEANING	
Service product	LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500)

NOTICE Never use a sharp object to remove sealant as score marks incurred are harmful to crankcase sealing.

Blow out the oil orifices using compressed air and make sure they are not clogged.



OIL BORES IN CRANKCASE LOWER PART



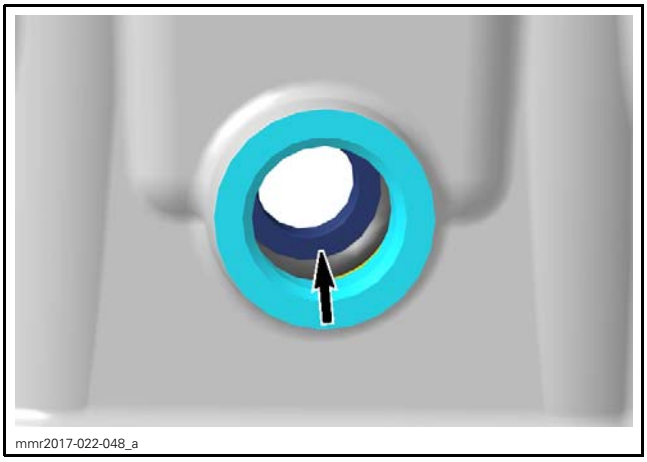
OIL BORES IN BASE PLATE

Inspecting the Crankcase and Base Plate

Check crankcase and base plate for cracks or other damages. Replace if necessary.

Water Pump Bearing Replacement

Use a suitable punch to push ball bearing out of crankcase.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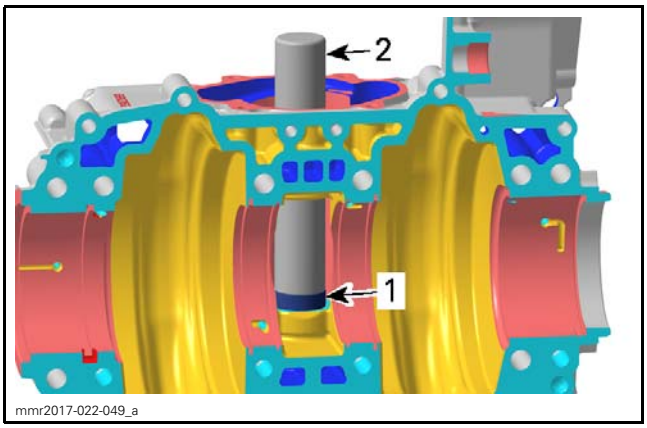
Install **NEW** ball bearing.

REQUIRED TOOL	
WATER PUMP BEARING PUNCH (P/N 529 036 417)	



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1. *Ball bearing*
2. *Water pump bearing punch*

Assembling the Crankcase

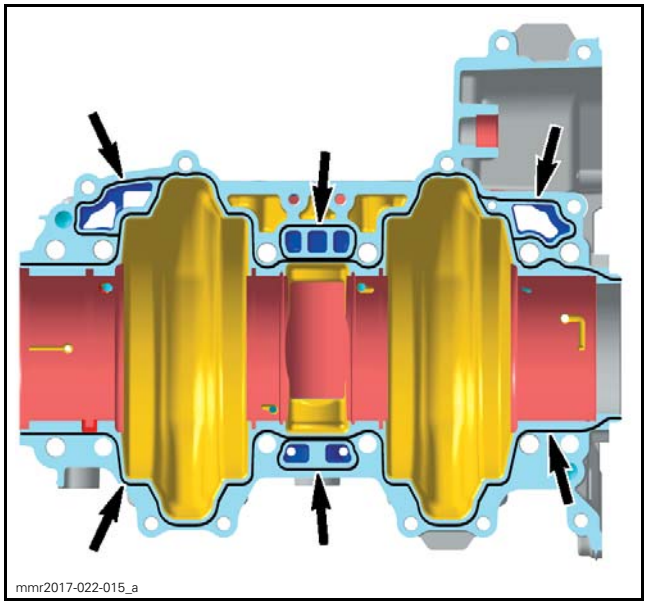
Install crankshaft in upper crankcase. See *CRANKSHAFT* for procedure.

Install needle bushing in crankcase upper with the writing showing to the outside.

Apply sealant on lower crankcase as per following procedure.

CRANKCASE SEALANT	
Service product	LOCTITE 5910 (P/N 293 800 081)

NOTE: The total assembly sequence, including sealing compound application and crankcase torquing, must be performed within 10 minutes.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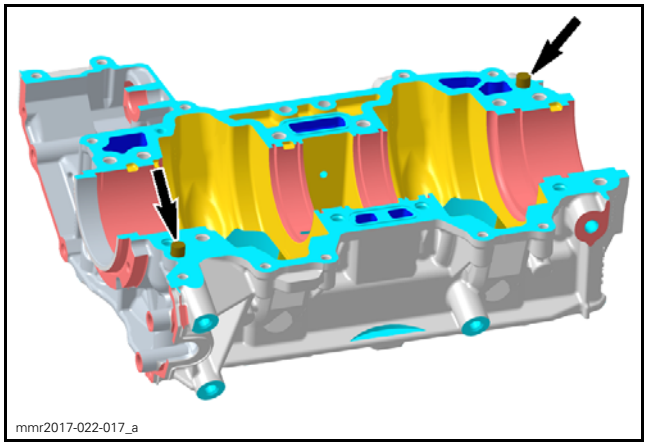
Ensure dowel pins are in their holes.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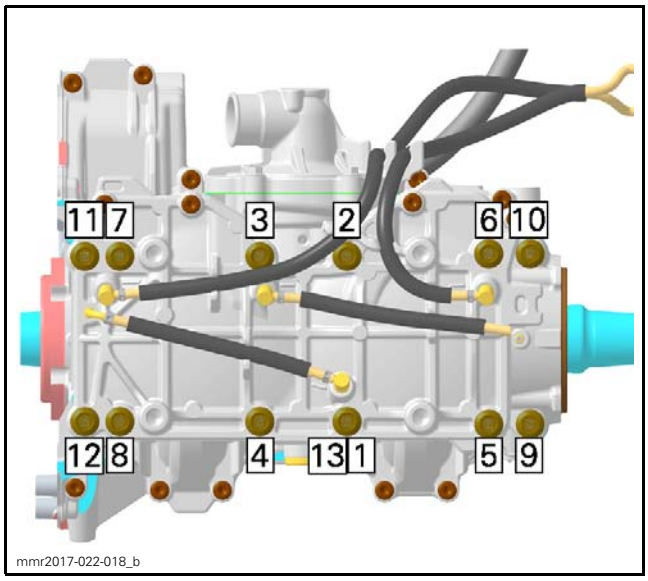
Assemble crankcase lower half.

Install base plate with **NEW** gasket.

Install crankcase screws.

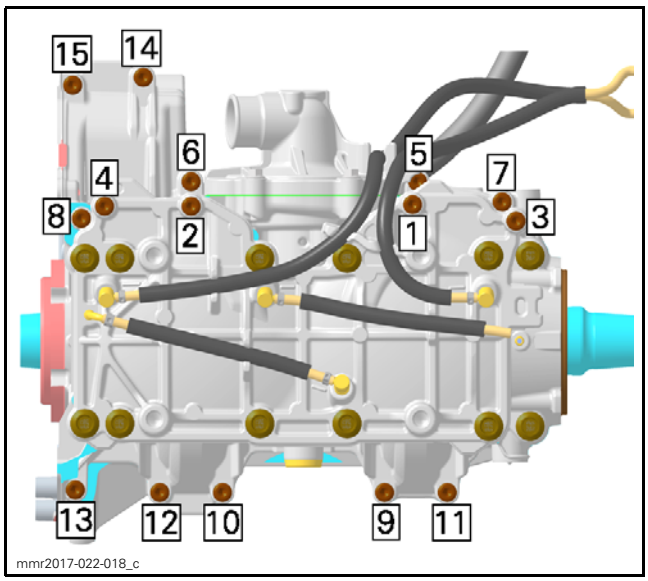
Tighten crankcase screws to specification as per illustrated sequence.

TIGHTENING TORQUE	
M8 Crankcase screws	29 N•m ± 2 N•m (21 lbf•ft ± 1 lbf•ft)

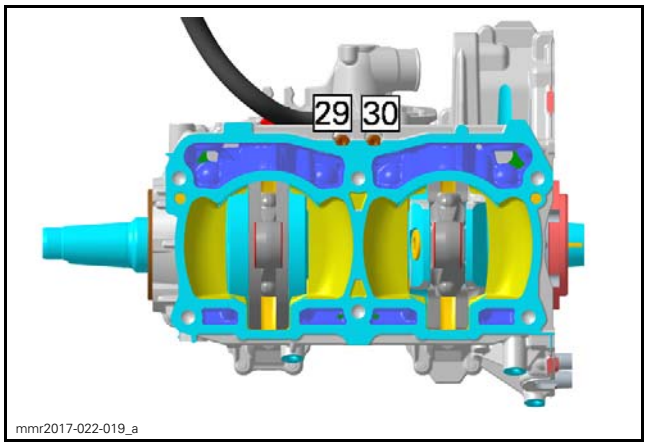


TIGHTENING SEQUENCE - M8 CRANKCASE SCREWS

TIGHTENING TORQUE	
M6 Crankcase screws	11 N•m ± 0.8 N•m (97 lbf•**in** ± 7 lbf•**in**)



TIGHTENING SEQUENCE - BOTTOM VIEW



TIGHTENING SEQUENCE- M6 CRANKCASE SCREWS - TOP VIEW

Install PTO oil seal cover.

Tighten oil seal cover to specification.

TIGHTENING TORQUE	
Oil seal cover screws	11 N•m ± 0.8 N•m (97 lbf•**in** ± 7 lbf•**in**)

NOTE: It is recommended to test engine cooling system for leaks after engine assembly, before installation in vehicle. Refer to *COOLING SYSTEM* subsection.

NOTE: It is recommended to always check the functionality of the check valves before installation in vehicle. Refer to *CHECK VALVES AND FITTINGS* in *LUBRICATION SYSTEM* subsection.

CRANKSHAFT

Removing the Crankshaft

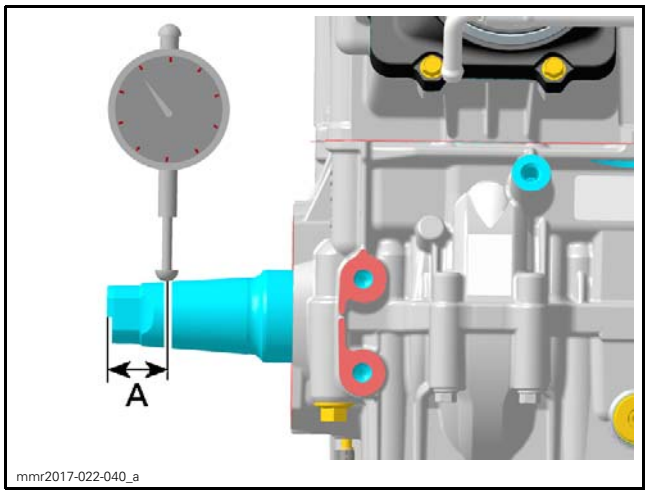
To remove crankshaft, use crankcase disassembly procedure.

Inspecting the Crankshaft

For crankshaft specifications refer to *TECHNICAL SPECIFICATIONS* subsection.

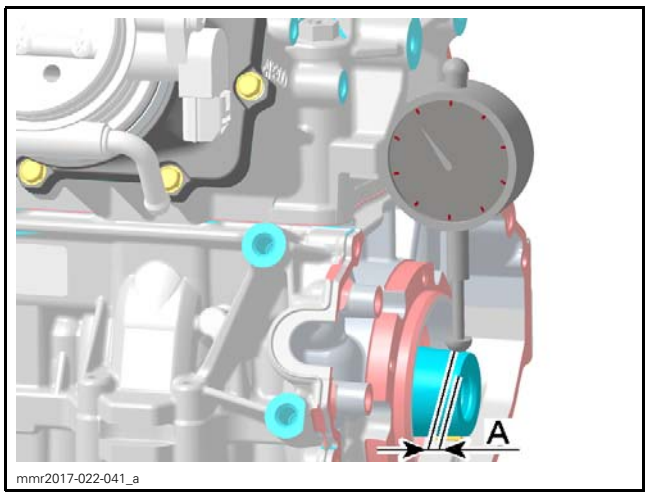
Crankshaft Deflection (Measuring in Crankcase)

1. Using a dial indicator, check deflection with crankshaft in crankcase.



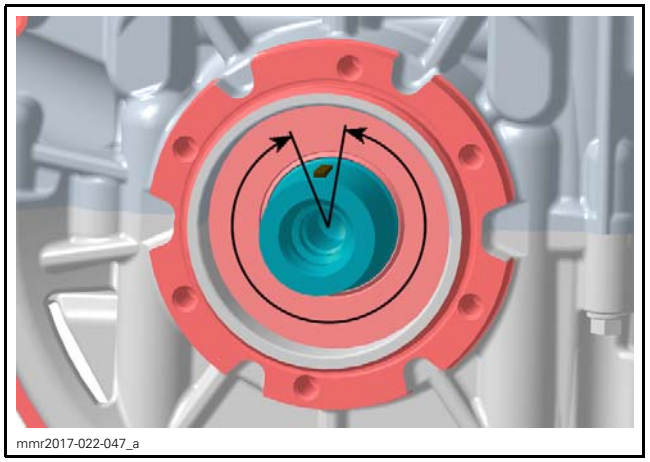
CRANKSHAFT PTO SIDE
A. 17 mm (.67 in)

CRANKSHAFT DEFLECTION PTO SIDE	
SERVICE LIMIT	0.060 mm (.0024 in)



CRANKSHAFT MAG SIDE
A. 3 mm (.12 in)

Measure deflection circumferential excluding the woodruff key.

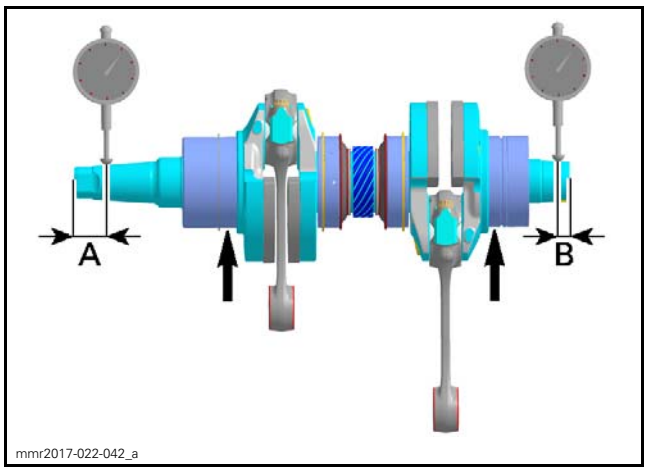


CRANKSHAFT DEFLECTION MAG SIDE	
SERVICE LIMIT	0.050 mm (.002 in)

2. If deflection exceeds the specified tolerance, recheck deflection using V-shaped blocks to determine the defective part(s). See *MEASURING ON BENCH*.

Crankshaft Deflection (Measuring on Bench)

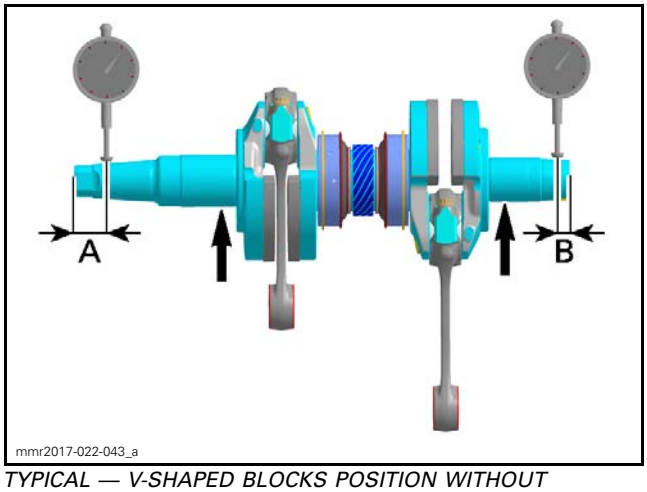
1. Once engine is disassembled, check crankshaft deflection on V-shaped blocks.



TYPICAL — V-SHAPED BLOCKS POSITION WITH BEARINGS
A. 17 mm (.67 in)
B. 3 mm (.12 in)

NOTE: Crankshaft deflection cannot be correctly measured between centers of a lathe.

2. If deflection exceeds the specified tolerance, it can be worn bearings or a bent crankshaft.
3. Remove crankshaft bearings and check deflection again on V-shaped blocks to determine the defective part(s).



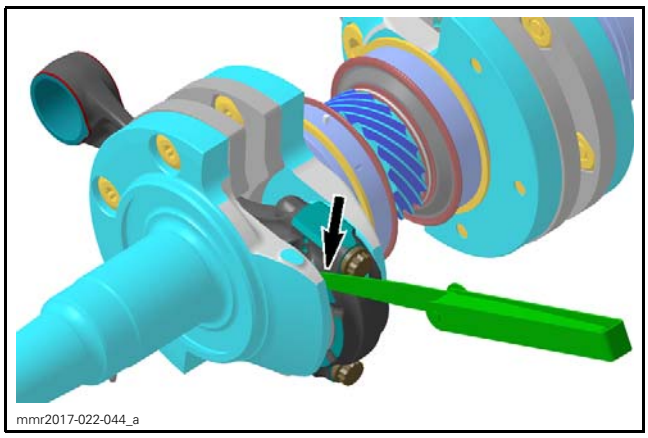
TYPICAL — V-SHAPED BLOCKS POSITION WITHOUT BEARINGS
A. 17 mm (.67 in)
B. 3 mm (.12 in)

4. If the deflection exceeds the specified tolerance, replace crankshaft.

Connecting Rod Big End Axial Play

1. Measure distance between connecting rod and crankshaft counterweight.

REQUIRED TOOL
Feeler gauge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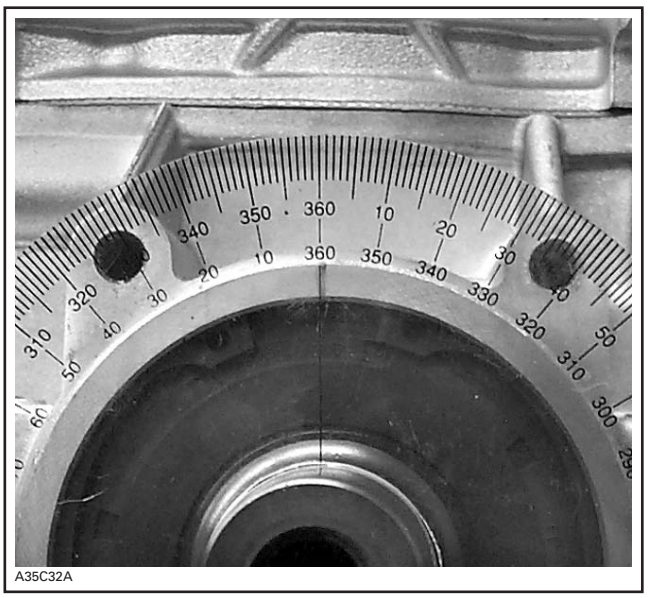
CONNECTING ROD BIG END AXIAL PLAY	
New	0.152 mm to 0.352 mm (.006 in to .0139 in)

2. If the distance exceeds specified tolerance, replace crankshaft.

Crankshaft Alignment

1. Remove injectors. Refer to *E-TEC DIRECT FUEL INJECTION* subsection.
2. Bring MAG piston at top dead center. Refer to *IGNITION SYSTEM* subsection.
3. Scribe a mark on crankcase (see illustration).
4. Install a degree wheel on crankshaft end so that 360° mark aligns with the mark on crankcase. Do not rotate crankshaft.

REQUIRED TOOL	
DEGREE WHEEL (P/N 529 035 607)	



A35C32A

5. Remove dial indicator and install it in spark plug hole on PTO side.
6. Bring PTO piston to top dead center. Degree wheel must rotate with crankshaft.
7. Interval between cylinders must be 180° ± 0.5.
8. Any other reading indicates a misaligned (twisted) crankshaft.

Removing the Crankshaft Bearing

NOTE: 10 minutes is required to heat up a new bearing for its installation, To save time, it is recommended to start the heating process prior to bearing removal operation. See procedure further.

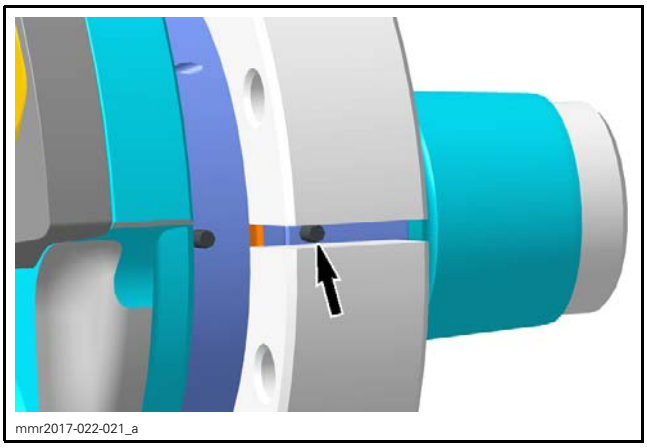
To remove MAG side bearings from crankshaft, install proper half rings and puller ring on the outer bearing race.

The roller bearing on PTO side has a sliding seat and can be removed without a tool.

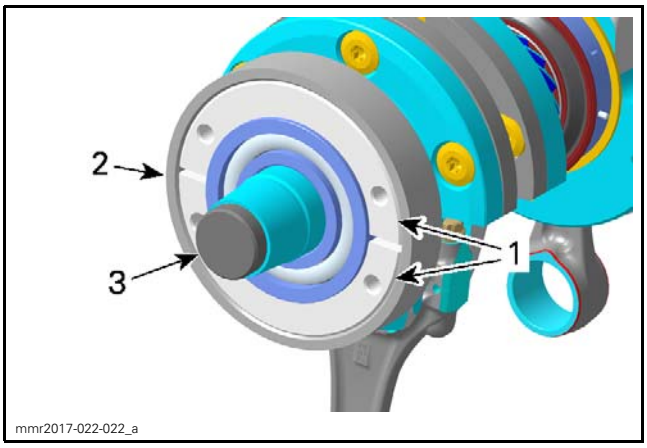
NOTE: Position tools in the groove of the inner bearing and pull out both bearings together.

REQUIRED TOOL	
HALF-RING (P/N 529 036 414)	
PULLER RING (P/N 420 977 490)	
CRANKSHAFT PROTECTOR (P/N 529 036 405)	

Ensure to position bearing pin between half ring gap.



MAG SIDE

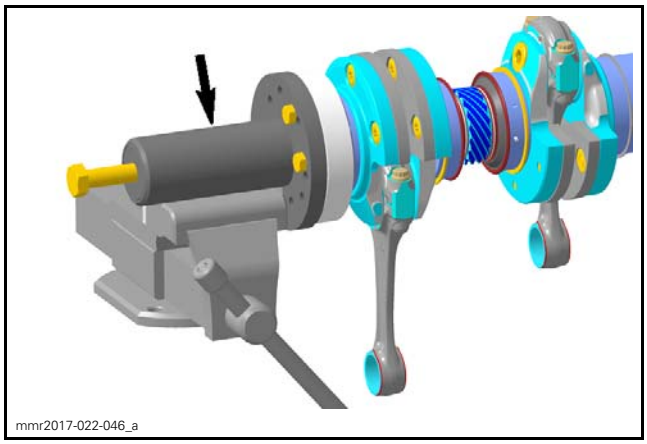


MAG SIDE
1. *Half rings*
2. *Puller ring*
3. *Crankshaft protector*

Install bearing puller on the half rings.

REQUIRED TOOL	
CRANKSHAFT BEARING PULLER (P/N 529 036 004)	

Secure the bearing puller in a vise at its rib.

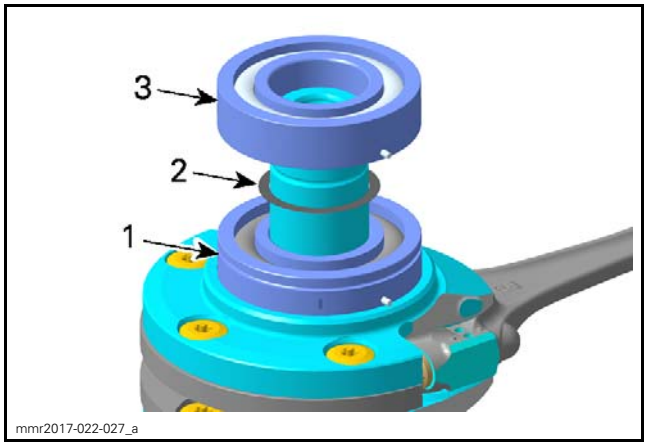


TYPICAL - BEARING PULLER SECURED IN THE VISE

NOTICE **Never use any air impact tool for tightening the puller bolt. Lubricate the bolt with XPS LUBE (P/N 293 600 016) to avoid damaging the threads.**

Screw in the puller bolt until the bearings come out.

During bearing removal take care not to lose the distane shim installed between inner and outer bearing.

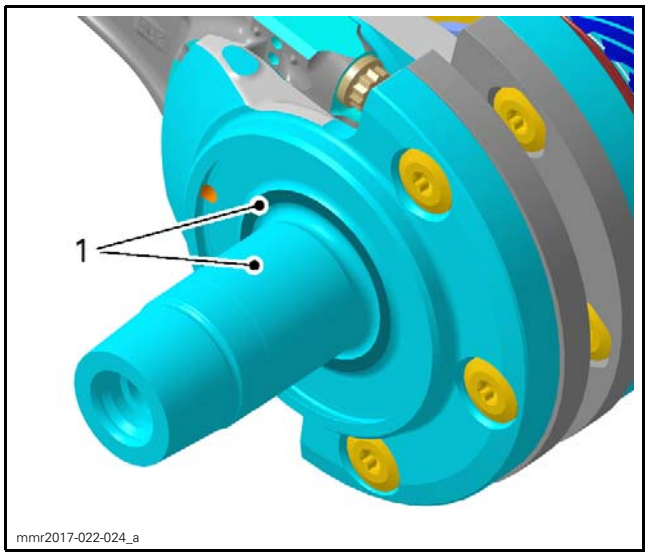


MAG SIDE
1. *Inner bearing*
2. *Distance shim*
3. *Outer bearing*

Installing the Crankshaft Bearing

Inspect crankshaft ends for damage.

Clean crankshaft ends with sand paper no. 400 to remove possible seal marks and debris.



Remove all residue.

CRANKSHAFT ENDS CLEANING	
Service product	PULLEY FLANGE CLEANER (P/N 413 711 809)

Heating the Bearing

Heat up the bearing(s) to ease installation.

REQUIRED TOOL	
BEARING HEATER (P/N 529 035 969)	

NOTICE Bearing(s) should not be heated to more than 80°C (176°F). Do not heat bearing(s) with direct flame, or with a heat gun or soaked in a heated oil bath. Inappropriate bearing(s) heating may result in cage failure.

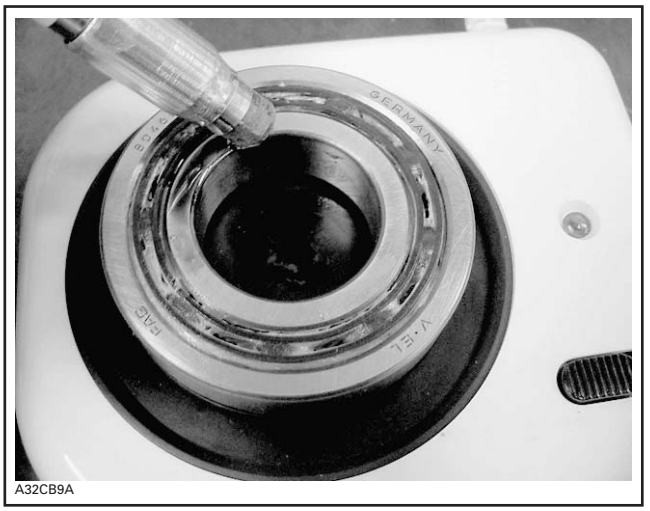
For even heat distribution, turn bearing several times during heating process.

NOTE: Two bearings can be heated at the same time on one bearing heater.

1. Bearings

Probe the side of the inner race of the bearing with a temperature indicator stick. Stick will liquefy when the bearing reaches the proper temperature.

REQUIRED TOOL	
TEMPERATURE INDICATOR STICK (P/N 529 035 970)	



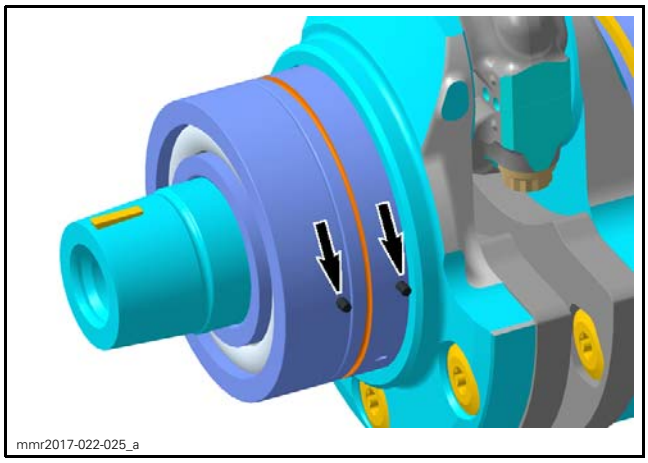
⚠ WARNING

Do not touch heated bearing with bare hands. Always wear heat resisting gloves before handling the heated bearing(s).

NOTICE Never reinstall a bearing that has been removed.

MAG Side Bearings

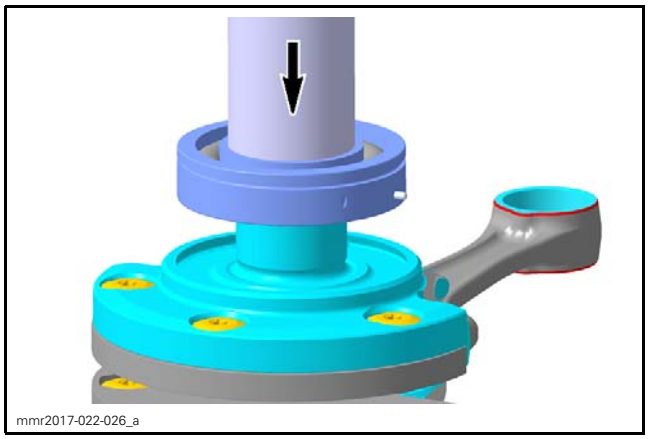
Install MAG bearings on crankshaft so that locating pins will be positioned as shown.



MAG SIDE

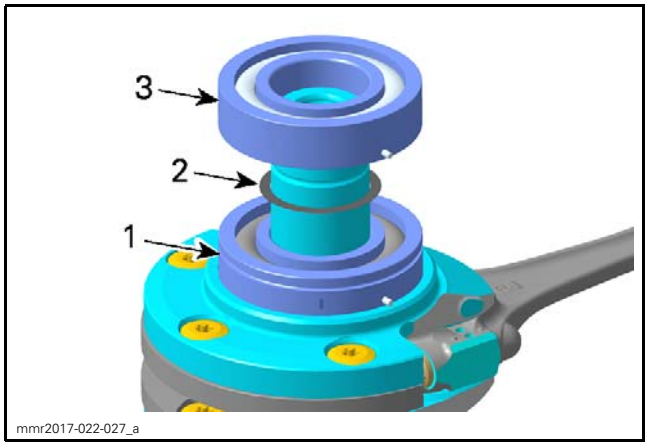
Slide the inner MAG bearing until it bottoms on crankshaft shoulder.

NOTE: Heated bearing should slide easily onto the crankshaft. If required, push with a steel tube on the inner race of the bearing.



Put distance shim on inner MAG bearing.

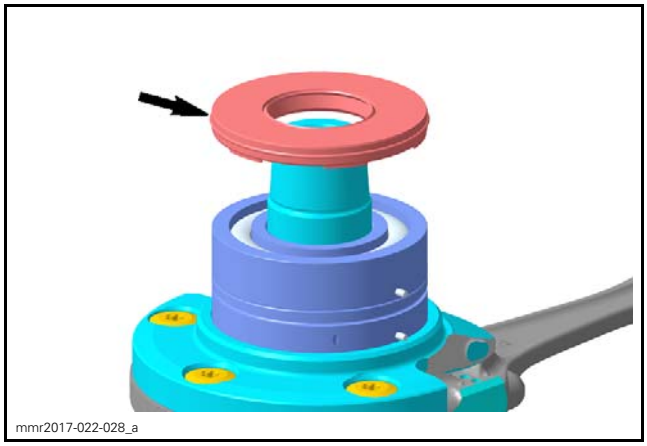
Slide the outer bearing until it sits on distance shim.



MAG SIDE
1. *Inner bearing*
2. *Distance shim*
3. *Outer bearing*

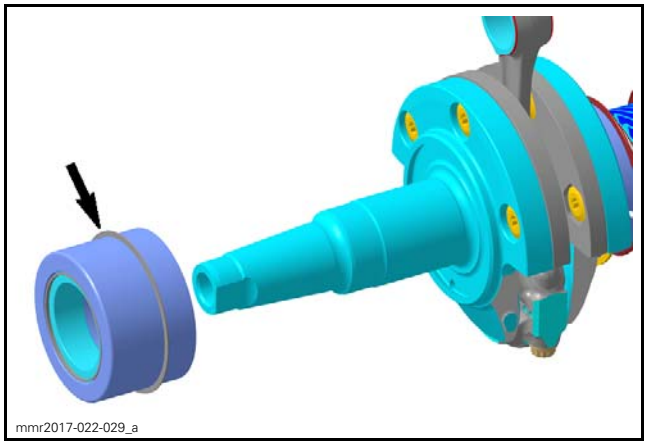
Lubricate oil seal sealing lip and slide it on crankshaft until it sits on outer bearing.

SEALING LIP LUBRICATION	
Service product	PETAMO GREASE GHY 133N (P/N 420 899 271)

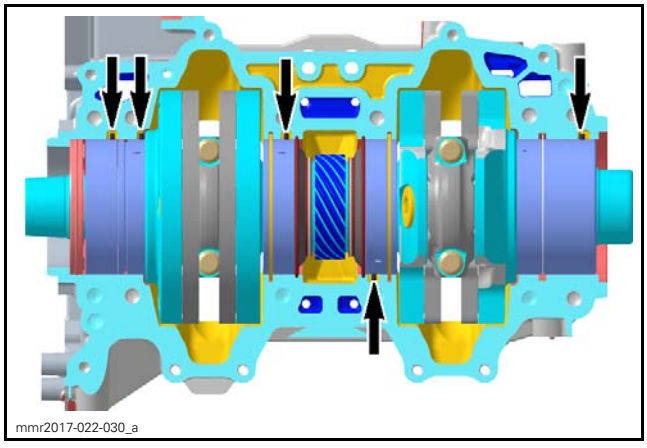


Installing the Crankshaft

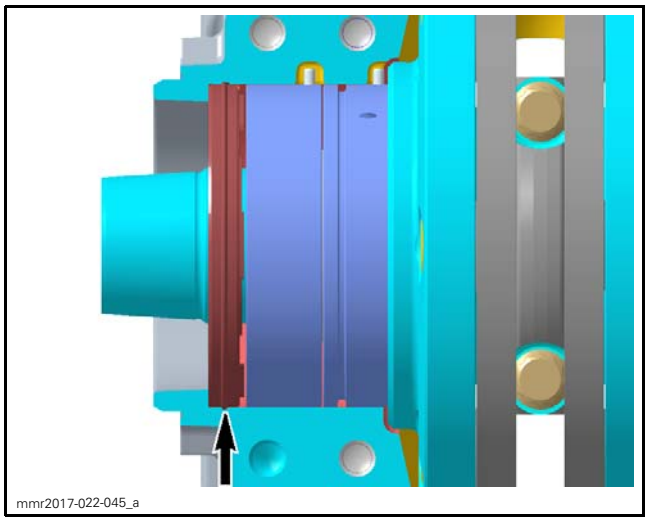
1. Slide cylinder roller bearing on crankshaft journal PTO side.



2. Position locating pins in their recess as illustrated.



3. Pay attention to properly locate MAG seal in its groove.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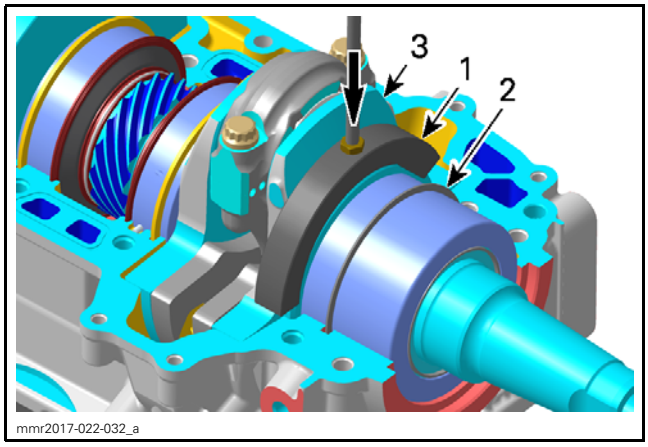
4. Place distance gauge between distance ring and crank web PTO.

REQUIRED TOOL	
DISTANCE GAUGE (P/N 529 036 415)	



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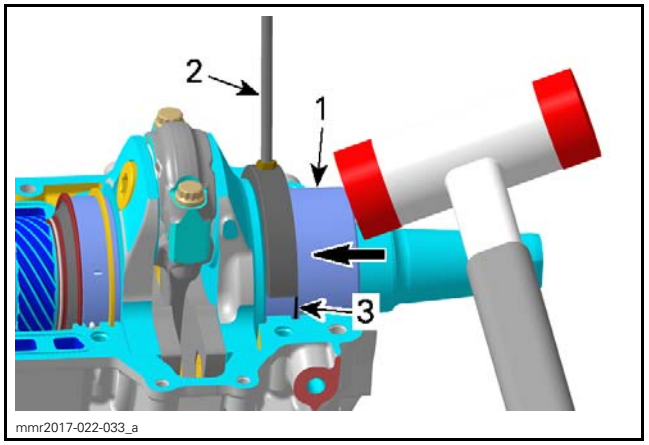
1. *Distance gauge*
2. *Distance ring*
3. *Crank web PTO*

5. Tap the cylinder roller bearing with a plastic hammer until the distance gauge is in contact with the distance ring and crank web.



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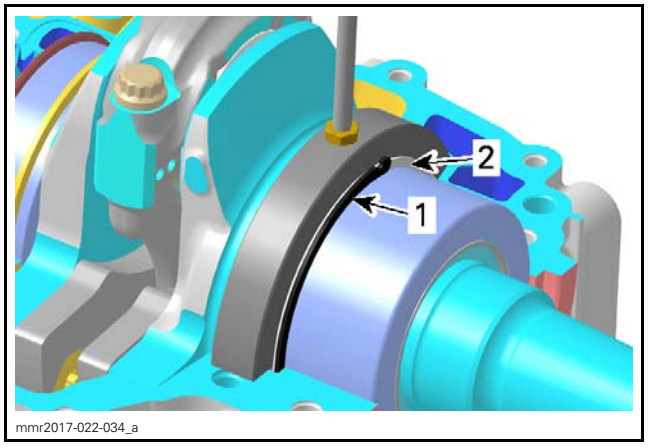
1. *Roller bearing*
2. *Distance gauge*
3. *Distance ring*

6. Put the biggest shim and try to install it in the groove right hand side of the distance ring

AVAILABLE SHIMS	
SHIM NUMBER	SHIM THICKNESS
50	0.50 mm (.02 in)
75	0.75 mm (.03 in)
100	1.00 mm (.039 in)
125	1.25 mm (.049 in)
150	1.50 mm (.059 in)
200	2.00 mm (.079 in)
250	2.50 mm (.098 in)



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1. *Shim (right hand)*
2. *Distance ring*

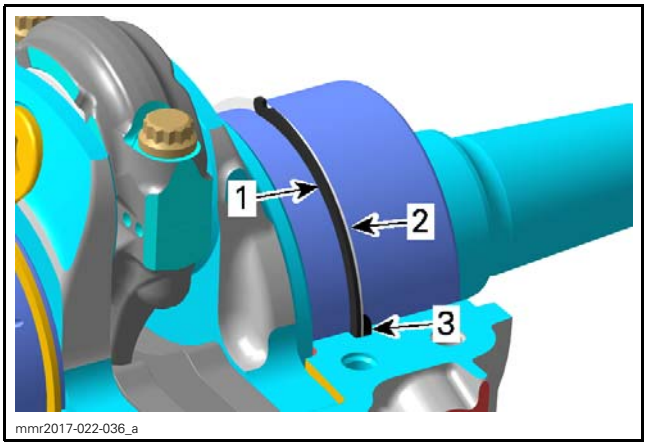
If the thickest shim does not fit, try to install the next thinner shim.

If the thickest shim fits, try to install a second shim until no gap is left.

NOTICE **Maximum 2 shims must be installed to achieve the proper adjustment.**

7. Remove the distance gauge carefully.
8. Put the biggest shim and try to install it in the groove left hand side of the distance ring

AVAILABLE SHIMS	
SHIM NUMBER	SHIM THICKNESS
50	0.50 mm (.02 in)
75	0.75 mm (.03 in)
100	1.00 mm (.039 in)
125	1.25 mm (.049 in)
150	1.50 mm (.059 in)
200	2.00 mm (.079 in)
250	2.50 mm (.098 in)



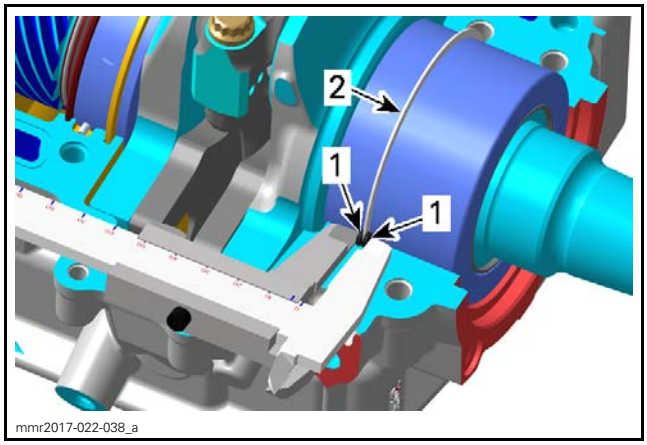
1. Shim (left hand)
2. Distance ring
3. Shim (right hand)

If the shim does not fit, try to install the next thinner shim.

If the shim fits, try to install another shim until no gap is left.

9. Measure the width of the complete package (shims + distance ring).

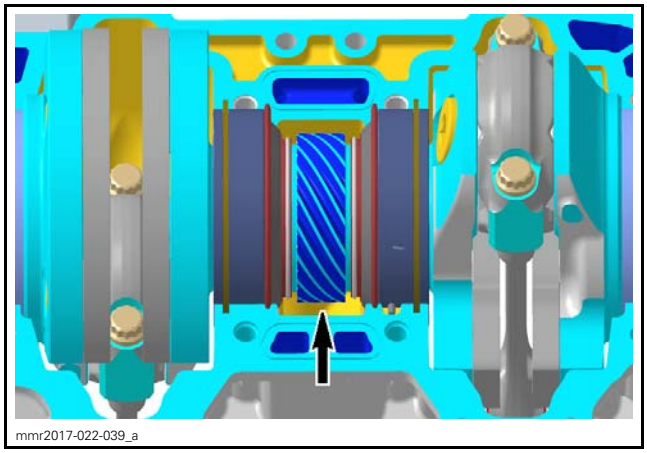
MINIMUM WIDTH OF THE PACKAGE (SHIMS + DISTANCE RING)
3.80 mm (.15 in)



1. Shims
2. Distance ring

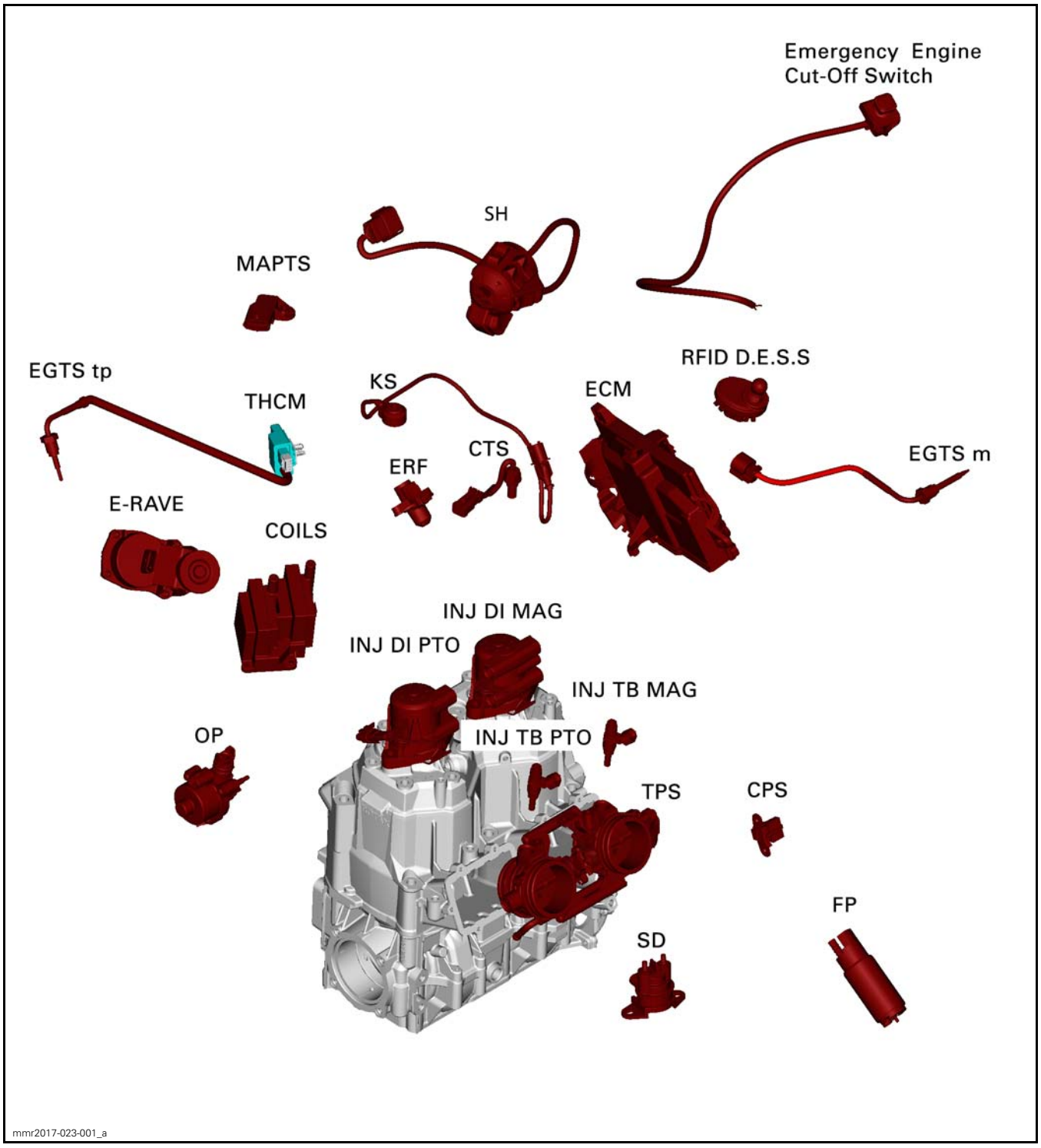
10. Pour injection oil in the oil bath under worm gear as shown.

CRANKSHAFT WORM GEAR LUBRICATION	
Service product	Injection oil
Quantity	50 ml (1.7 U.S. oz)



OIL BATH

ENGINE MANAGEMENT SYSTEM (EMS)



GENERAL

ACRONYM	DEFINITION
SH	Left hand multi-function switch
COILS	Ignition Coils
CPS	Crankshaft Position Sensor
CTS	Coolant Temperature Sensor
RFID DESS	Digitally Encoded Security System
ECM	Engine Control Module
EGTSm	Exhaust Gas Temperature Sensor muffler
EGTStp	Exhaust Gas Temperature Sensor tuned pipe
FP	Fuel Pump
INJ DI MAG	E-TEC Direct Injector (Mag Side)
INJ DI PTO	E-TEC Direct Injector (PTO Side)
INJ TB MAG	Throttle body Injector (Mag Side)
INJ TB PTO	Throttle body Injector (PTO Side)
KS	Knock Sensor
MAPTS	Manifold (intake) Air Pressure / Temperature Sensor
OP	Oil Pump
RER	Rotax Electronic Reverse
ERF	Rave Position Sensor
E-RAVE	Rave Actuator
SD	Starter Solenoid
TPS	Throttle Position Sensor
THCM	Thermocouple Module

SYSTEM DESCRIPTION

The Engine Control Module (ECM) ensures a high power output with a clean combustion with practically no exhaust smoke.

There are 8 main systems that are controlled by the ECM:

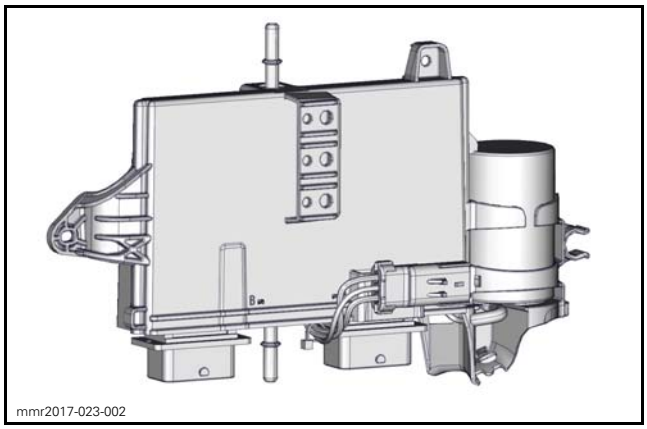
1. E-TEC Direct fuel injection
2. Throttle body injection
3. Ignition system
4. Starting system
5. Rotax electronic reverse (RER)
6. Digitally encoded security system (D.E.S.S.)
7. Lubrication system
8. 3D RAVE
9. Fuel pump
10. Electrical accessories.

The ECM features a monitoring system that self-diagnoses its electronic components. For more information, refer to *DIAGNOSTIC FAULT CODES* subsection.

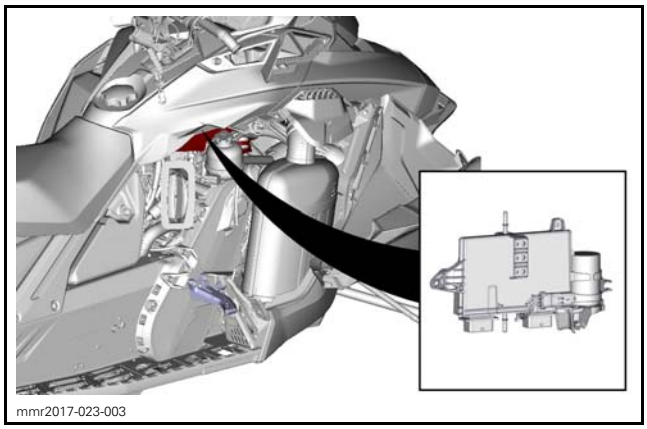
Electrical power distribution is also controlled by the ECM. Refer to *POWER DISTRIBUTION* subsection.

Engine Control Module (ECM)

The ECM reads the inputs and makes computations by comparing them to pre-determined parameters, and sends the required control signals to the outputs to ensure proper engine management.



ECM

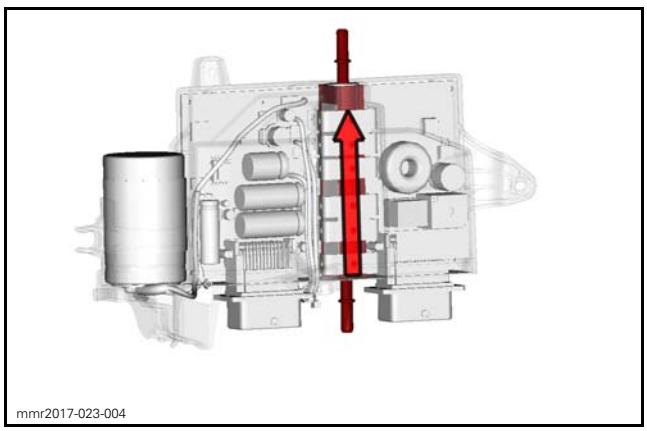


The ECM features a permanent memory that will store fault codes, customer information and other engine information when the engine is stopped.

ECM Cooling

Since the ECM manages all the vehicle's power needs as it incorporates the voltage regulator/ rectifier and other power components, a lot of heat needs to be dissipated.

To ensure adequate heat dissipation, a constant fresh fuel flow from the fuel pump is used to cool down the ECM.



ECM COOLING (FUEL FLOW DIRECTION)

SYSTEM FEATURES

Throttle Protection

If the throttle is not completely closed during engine startup, engine RPM will be limited to idle speed by the ECM.

To revert to normal operation, release the throttle completely and then depress it again.

Warm-Up Protection

The engine's RPM is limited until the desired engine and injection oil temperatures are obtained.

WARM-UP PROTECTION	ENGINE WARM-UP TEMPERATURE
850 E-TEC	20°C to 30°C (68°F to 86°F)

Engine Warm-Up

During the engine warm-up period, the RAVE valves will be limited to the MID position which, limits the engine to a maximum of 7500 ± 200 RPM.

Injection Oil Warm-Up

The injection oil warm-up period is based on oil viscosity.

This is accomplished by measuring the time it takes for the electric oil pump to complete a stroke (oil pump switch signal) from the time at which is was commanded. This provides an indication of the oil viscosity, and therefore temperature and flow capacity.

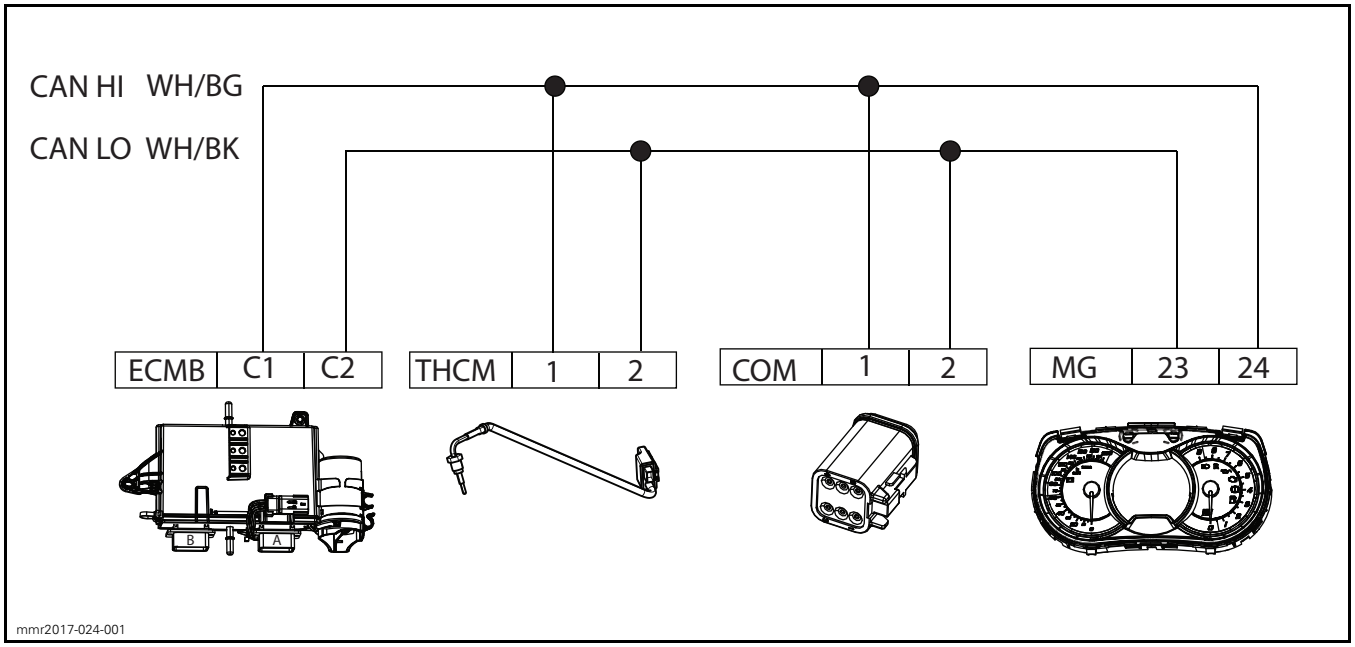
This function will limit engine speed to 5500 - 7500 RPM depending on detected oil viscosity.

This function may remain active for up to 10 - 15 minutes.

Automated Engine Oil Fogging (E-TEC)

An automated engine oil fogging has been implemented to automatically inject the required oil to protect the engine during vehicle storage. Refer to *STORAGE PROCEDURE* subsection for details.

COMMUNICATION PROTOCOLS



COM (Diagnostic connector)
ECM (Engine control module)
MG (Multifunction gauge)
THCM (Thermocouple module)
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.

NOTE: Disconnect THCM last.

CAN NETWORK RESISTANCE	
CONDITION	SPECIFICATION ± 10%
Good network or THCM fault	60 Ω
ECM or MG network fault	120 Ω
ECM and MG network fault	above 1 MΩ
ECM, MG, and THCM network fault	O.L.
1 MΩ = 1,000,000Ω	

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.

COMMUNICATION TOOLS AND B.U.D.S.

SERVICE TOOLS

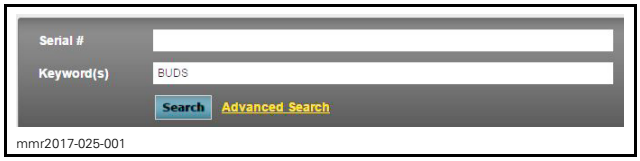
GENERAL

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".



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TROUBLESHOOTING

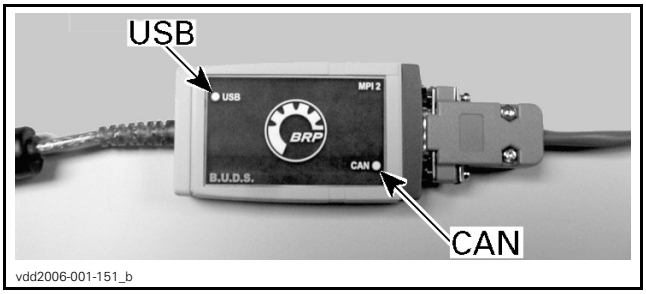
Refer to the BRP BUDS chart to ensure you are using the approriate hardware and tools.

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.



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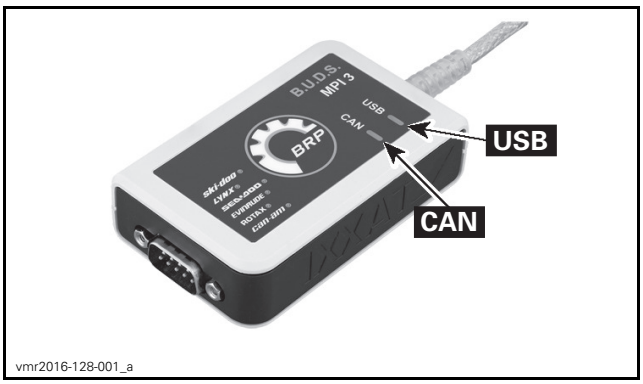
MPI-2 CARD



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MPI-3 CARD

Prerequisite for USB Communication:

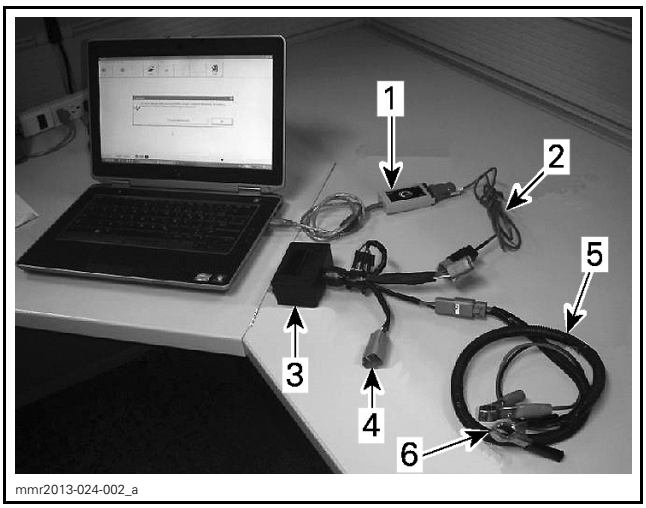
- PC Computer turned ON
- MPI connected to PC computer.

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 carn*
2. *DIAGNOSTIC CABLE (P/N 710 000 851)*
3. *POWER INTERFACE (P/N 515 177 223)*
4. *To vehicle diagnostic connector*
5. *12 V BATTERY SUPPLY CABLE (P/N 529 035 997)*
6. *To 12 V battery*

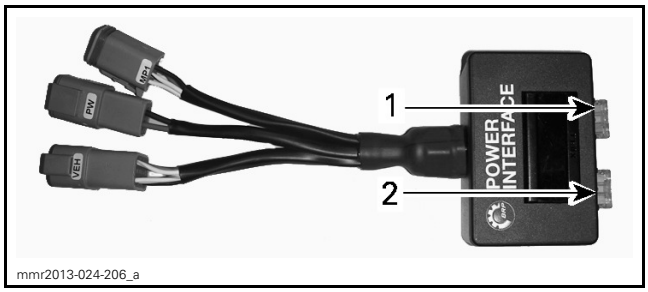
NOTE: The battery supply cable is only necessary on models without a battery.

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. looses 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.

Power Interface Test

When the POWER INTERFACE (P/N 515 177 223) is connected to the vehicle diagnostic connector and the emergency stop switch is pulled, the multifunction gauge and the headlight should turn on. Otherwise, check the following and repair or replace Power interface if any test failed.

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.

   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.

DIAGNOSTIC AND FAULT CODES

GENERAL

MONITORING SYSTEM

The ECM features a monitoring system that self-diagnose its electronic components.

When a predefined condition (engine overheat for example) or a fault occurs, the ECM sends a signal to the multifunction gauge and/or audible signals to a beeper to inform you of this particular condition.

The ECM monitors the following functions and components.

COMPONENT
ECM, TPS, CTS, CPS, KS, RAVE valve solenoids, MAPTS, RPS, ignition coils, fuel injectors and THCM (EGTSm and EGTStp)
12 volts under/over voltage 60 volts under/over voltage
D.E.S.S.
RER
Low oil level, electronic oil injection pump
Oil temperature (end of piston stroke feedback from electronic oil injection pump)
Engine RPM
CAN
Fuel pump

Limp Home Mode

The ECM may automatically set default parameters to ensure the adequate operation of the vehicle if a component of the engine management system is not operating properly.

NOTE: Sensor failures will not automatically result in limp home mode. The appropriate fault code will turn on and in some cases the beeper will sound.

The engine RPM may be limited if some critical components fail. In this case, releasing the throttle and letting the engine return to idle speed may allow normal operation to come back. If it does not, try removing and reinstalling the tether cord cap (D.E.S.S. key) on the engine cut-off switch.

These performance-reduced modes allow the rider to continue on to seek help, or return home, which would otherwise not be possible.

ECM ACTION	CAUSE
Engine is gradually stopped. Continuous fast short beeps and a shutdown message is displayed in multifunction gauge until shutdown.	Fuel pump wiring short circuit to ground or open circuit.
	Fuel pump current requirement is too high.
	Engine idle overheat protection: – Engine idled more than 5 seconds after engine temperature increased above 95°C (203°F). – Engine idled more than 5 minutes after engine temperature increased above 37°C (99°F).
Engine speed is limited to 2500 RPM.	D.E.S.S. key is not recognized by the ECM. The antitheft system is active. RAVE valves are kept at closed position.
Engine speed is limited to 5500 RPM (RAVE valves are kept closed).	Oil injection pump wiring shorted to ground or open circuit.
	Low voltage in the 55 Vdc system. Voltage dropped by 5 V.
	ECM overheat (85°C (185°F)). Engine overheat (100°C (212°F) and above).
	Exhaust gas temperature too high (800°C (1,472°F) and above).
	High engine detonation.
Engine speed is limited to 7000 RPM.	Max. RPM allowed to the engine in reverse. RAVE valves are kept closed.
Engine speed is limited (Variable limit)	Max. RPM allowed varies when engine is cold, according to oil viscosity
Engine speed is limited to 8600 RPM.	Maximum engine RPM allowed.

Pilot Lamps and Beep Codes

Warning lights in the multifunction gauge and/or a beeper provide signals as to a vehicle operation feedback, or to indicate a problem.

A pilot lamp can flash alone or in combination with another lamp.

Beeper codes will be heard and messages (depending on gauge model) will be displayed to attract your attention and inform you of the situation.

DIAGNOSTIC FAULT CODES (DTC)

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

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

The faults registered in the ECM are stored in memory.

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

How to Read Fault Codes Using BUDS2 Software

Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

For more information pertaining to the faults code status and report, refer to B.U.D.S. online help.

How to Read Fault Codes on the Multifunction Gauge

Same gauges can display fault codes.. Refer to the applicable *GAUGE* subsection.

How to Find Fault Code Descriptions

Connect BUDS2 to the vehicle. Refer to *COMMUNICATION TOOLS AND BUDS* subsection.

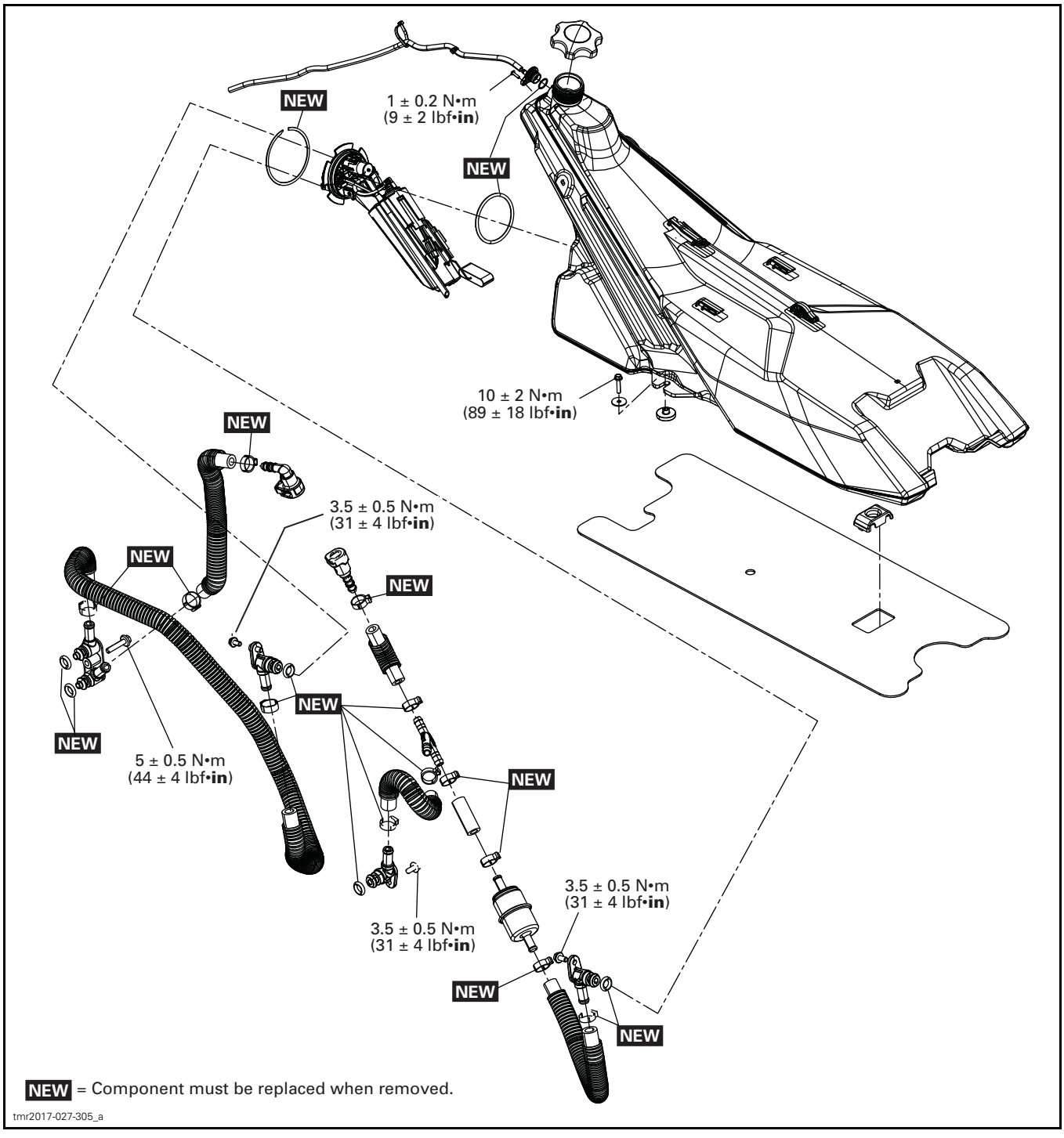
Navigate to the faults page in BUDS2.

Browse lists of active/occurred and inactive fault codes.

FUEL TANK AND FUEL PUMP

SERVICE TOOLS

Description	Part Number	Page
LEAK TEST KIT	529 033 100	6
OETIKER PLIER	295 000 070	9
PRESSURE GAUGE	529 036 395	7–8
SMALL HOSE PINCHER	295 000 076	6
VACUUM/PRESSURE PUMP	529 021 800	6–7


NEW
1 ± 0.2 N•m
(9 ± 2 lbf•in)
NEW
10 ± 2 N•m
(89 ± 18 lbf•in)
NEW
3.5 ± 0.5 N•m
(31 ± 4 lbf•in)
NEW
NEW
NEW
NEW
NEW
5 ± 0.5 N•m
(44 ± 4 lbf•in)
3.5 ± 0.5 N•m
(31 ± 4 lbf•in)
3.5 ± 0.5 N•m
(31 ± 4 lbf•in)
NEW
NEW
NEW = Component must be replaced when removed.
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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

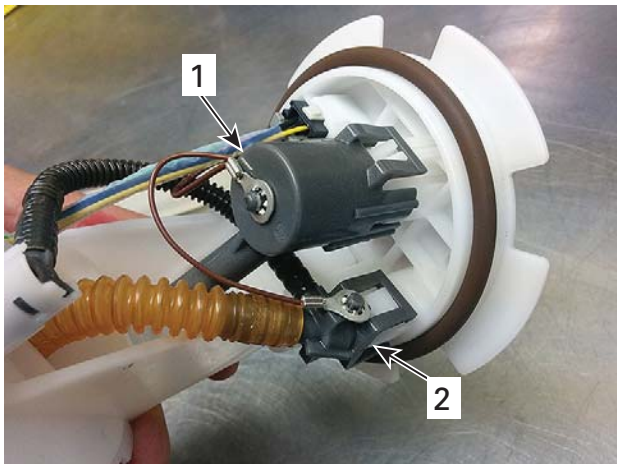
Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions.

⚠ 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.



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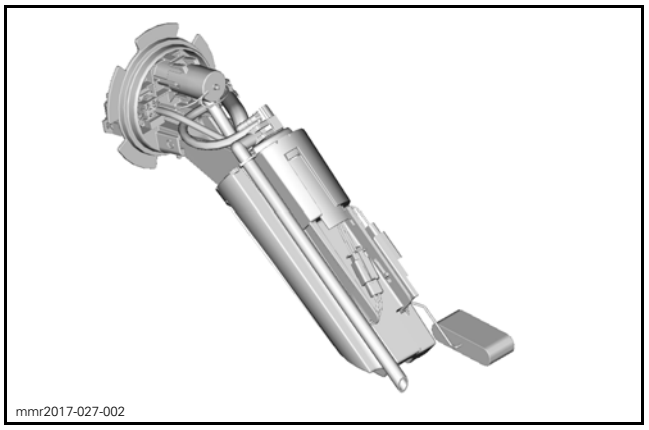
1. Fuel pressure regulator
2. Fuel hose connector

SYSTEM DESCRIPTION

Electric Fuel Pump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An electric fuel pump is mounted in the front center portion of the fuel tank.

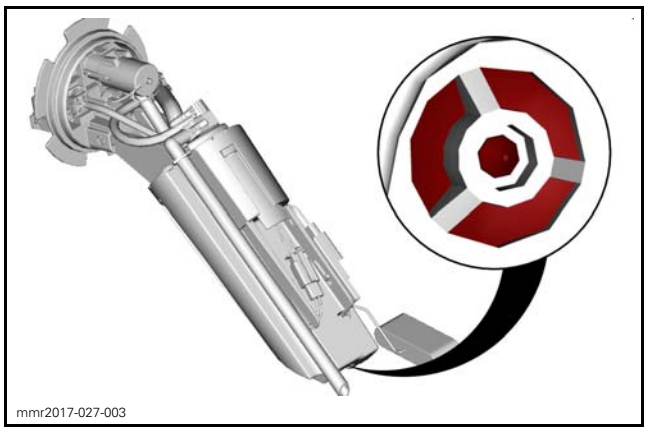
A 12 Vdc high pressure fuel pump with an integrated jet pump is used.

NOTE: Although the fuel pump is connected to the 55 Vdc system, the ECM modulates the voltage (Pulse Width Modulation) between 9 and 16 Vdc depending on the engine RPM. The fuel pump output will change as voltage changes.

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.

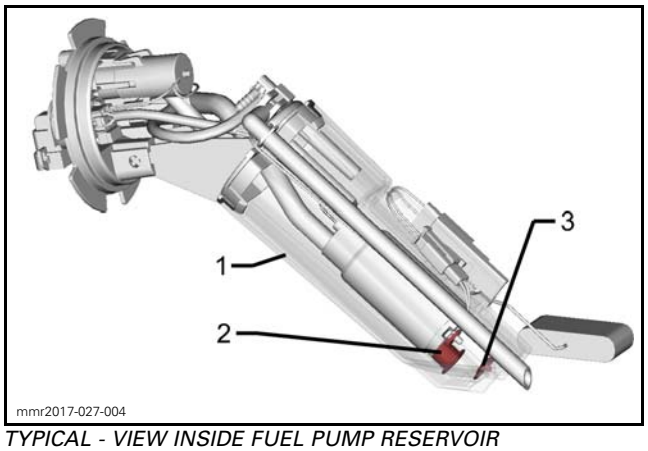
To ensure a constant delivery of fuel to the engine for all riding conditions when the fuel level is low, a rear pickup and a fuel pump reservoir is used.

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.



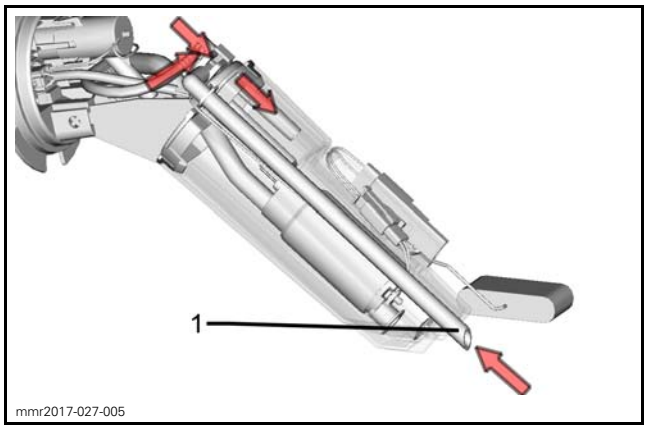
When the fuel pump runs, it draws the fuel from the fuel pump reservoir and feeds it to the injection system. This causes fuel in the tank to enter the fuel pump reservoir, by gravity, through its bottom inlet check valve.

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*

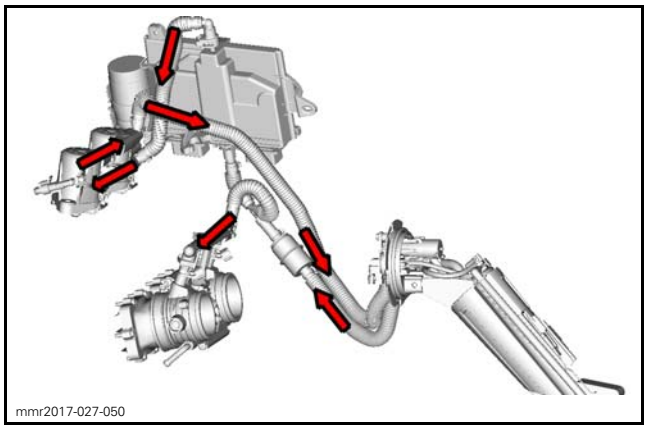
When riding the vehicle on a level surface, fuel enters into the fuel pump reservoir through its check valve and through the remote pickup simultaneously, as long as there is enough fuel in the tank to cover the remote pickup.

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.

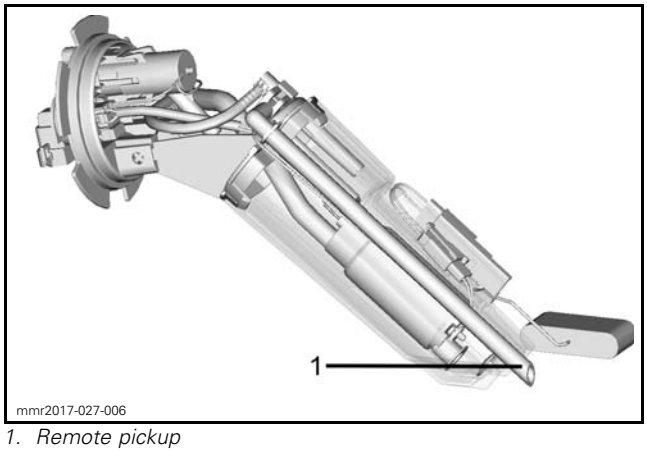
The continuous fuel flow cools down the fuel pump, the injectors and the ECM. To cool these components, the fuel circulates as follows:

– Out of fuel pump
– Through the ECM
– To the direct injectors (around the voice coils)
– Through the pressure regulator
– Back to fuel tank.



Fuel Pickup

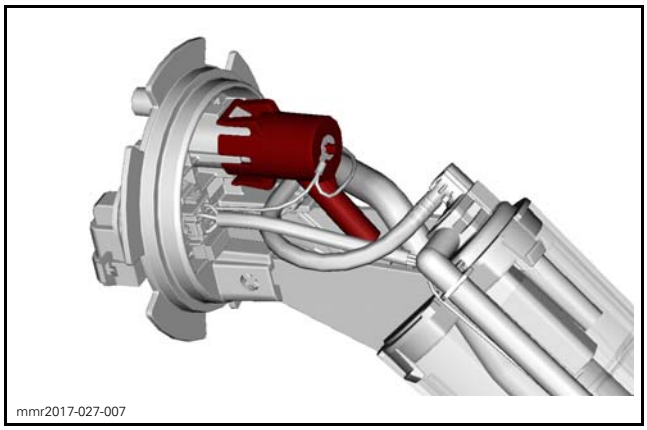
Fuel enters the fuel pump reservoir from either a check valve at the bottom of the fuel pump reservoir, or from a remote pickup in the rear portion of the fuel tank.



1. Remote pickup

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 303 kPa (44 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.

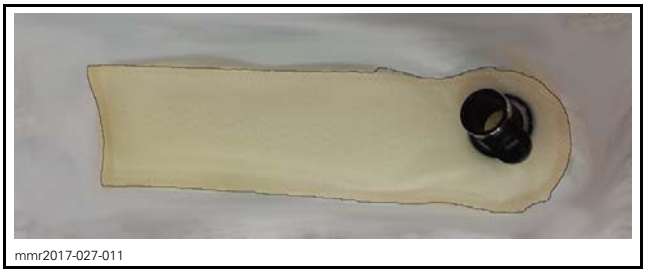
As fuel is consumed by the engine, a negative pressure would occur in the fuel tank. This could eventually prevent the fuel pump from drawing enough fuel. The **negative pressure relieve function** of the valve allows the higher outside air pressure in.

If pressure builds up and exceeds 2.0 kPa to 4.8 kPa (.3 PSI to .7 PSI) in the fuel tank, the check valve opens and lets the excess pressure vent out of the tank.

Fuel Filters

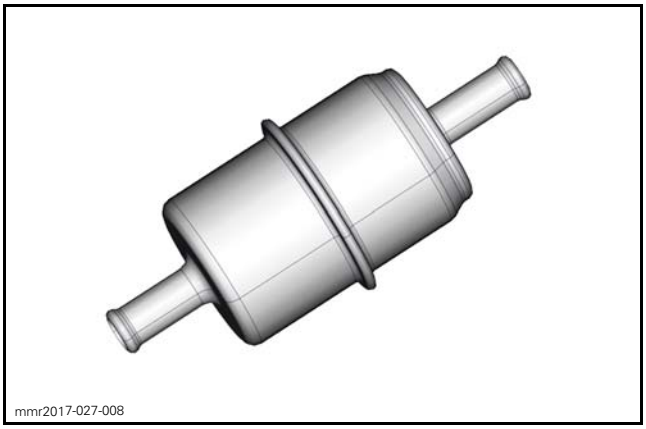
Fuel Pump Pre-Filter

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.

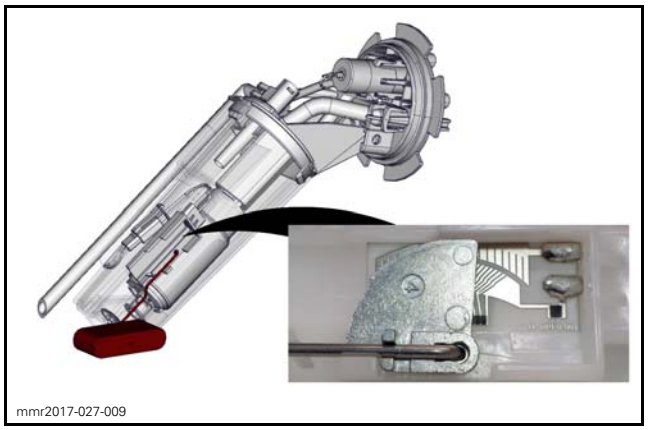
In-Line Fuel Filter



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


mmr2017-027-009

A float type fuel level sensor varies its resistance with fuel level thus providing a signal to the multifunction gauge for fuel level indication.

INSPECTION

TESTING FUEL SYSTEM FOR LEAKS

Activate the fuel pump from the **Functions** page in BUDS2.

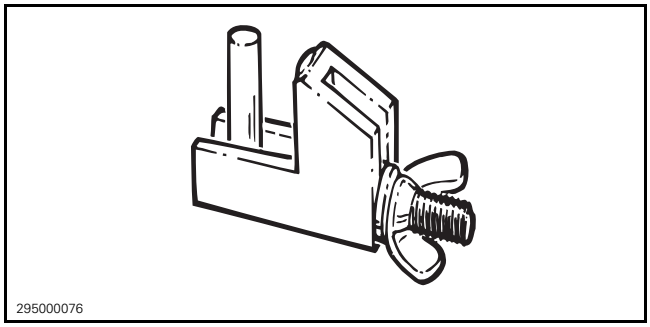
Check for fuel leaks.

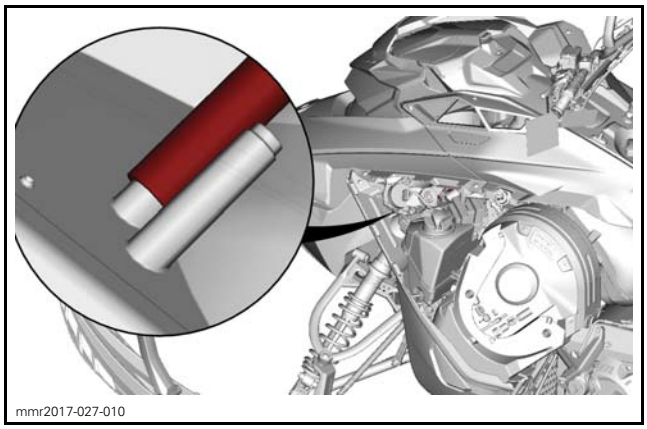
⚠ WARNING

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.

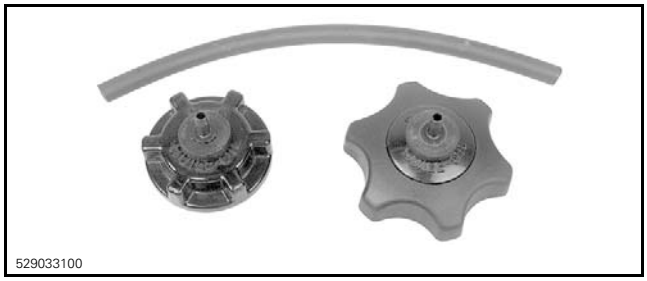
FUEL TANK LEAK TEST

1. Fill up fuel tank.
2. Open the left side panel to access the fuel vent tube.
3. Install a SMALL HOSE PINCHER (P/N 295 000 076) on the vent tube.


295000076

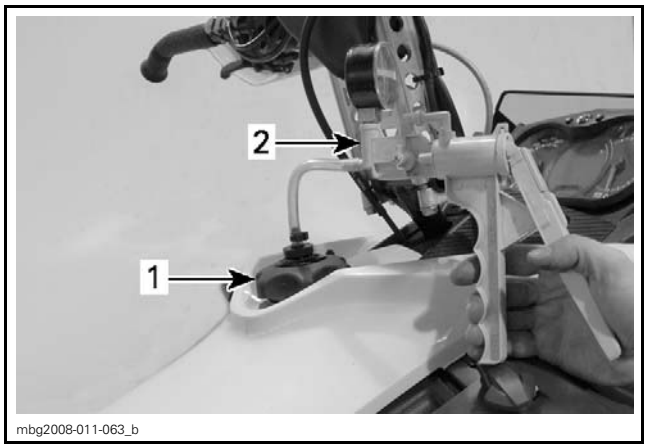

mmr2017-027-010

4. Install the appropriate test cap from the LEAK TEST KIT (P/N 529 033 100) on fuel tank inlet.


529033100

5. Install VACUUM/PRESSURE PUMP (P/N 529 021 800) on pressure test fuel cap.


529021800



TYPICAL
1. *Pressure test fuel cap*
2. *Vacuum/pressure pump*

6. Set pump selector to pressure.
7. Pressurize fuel tank as follows.

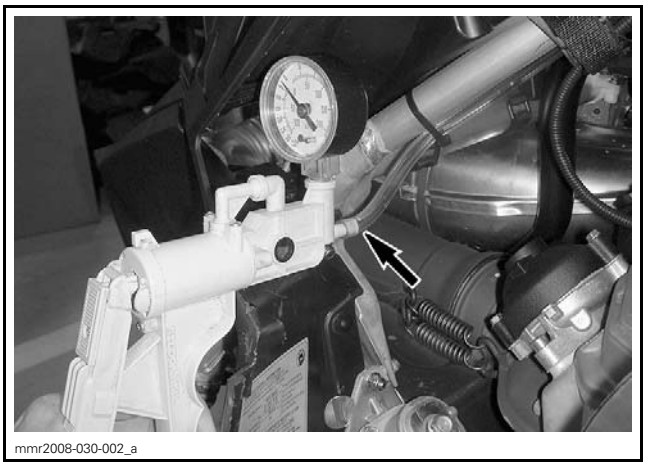
PRESSURE	TIME WITHOUT PRESSURE DROP
21 kPa (3 PSI)	3 minutes

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 (P/N 529 021 800) 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.

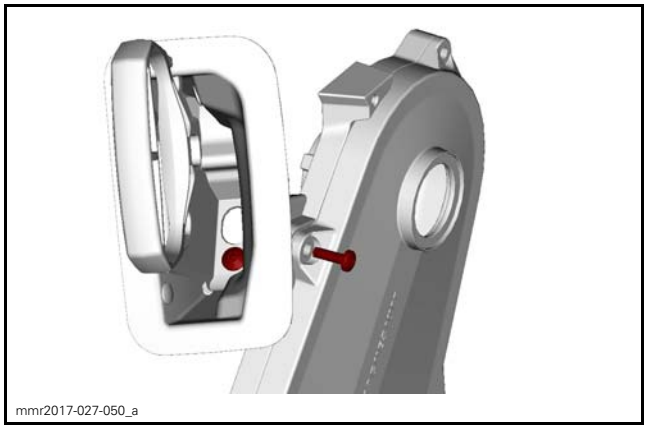
8. Remove vacuum/pressure pump.
9. Install vent tube on its fitting.
10. Install normal fuel tank cap.

TESTING FUEL PRESSURE

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

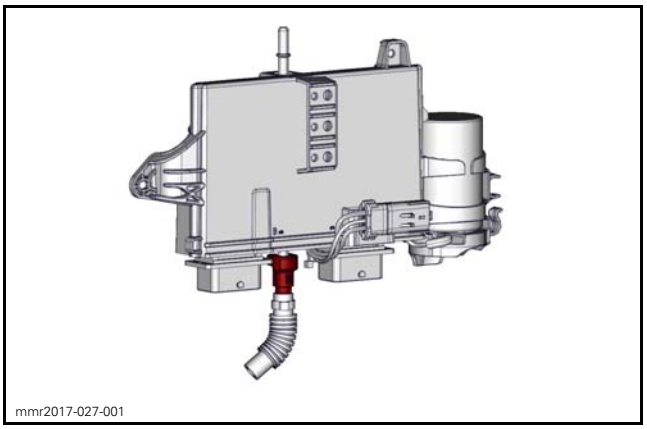
Open right hand side panel.

Move rewind starter handle assembly (applicable models).



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 ECM hose quick connect to catch fuel spillage.
3. Disconnect fuel pressure hose from ECM.


mmr2017-027-001

4. Install the PRESSURE GAUGE (P/N 529 036 395) between fuel pressure hose and ECM.

⚠ 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.

5. Start engine.
6. Run engine above 2000 RPM and observe the fuel pressure.

FUEL PRESSURE
303 kPa (44 PSI)

If pressure is lower than specified, momentarily block the return hose while monitoring the pressure gauge.

NOTICE **Do not block the fuel return for more than 2 seconds.**

If pressure rises to reach or exceed specification with the fuel return blocked, replace fuel regulator.

If pressure does not rise with the fuel return blocked, refer to *PRESSURE BELOW SPECIFICATIONS* in the following table.

FUEL PRESSURE TROUBLESHOOTING	
RESULT	POSSIBLE CAUSE
Pressure above specifications	Defective fuel regulator
Pressure below specifications	Clogged fuel filter
	Poor electrical connection
	Defective fuel regulator
	Defective fuel pump
	Leak in the fuel system circuit

7. Stop engine.

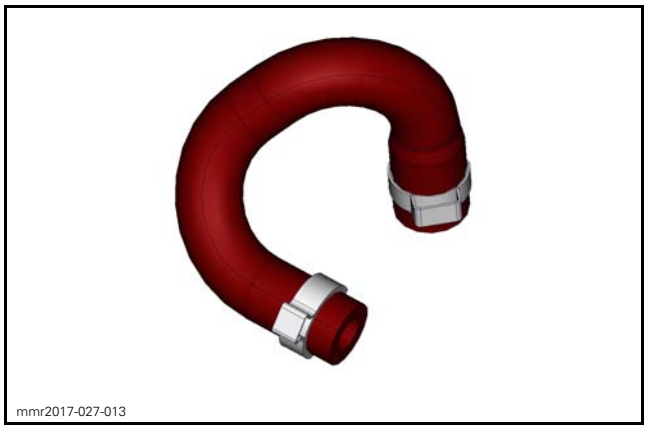
Fuel pressure should remain stable.

8. If fuel pressure drops, check the following for leaks:
   - Tools
   - Hoses
   - Fuel injectors
   - Fuel pressure regulator
   - Fuel pump.
9. Bleed away any remaining fuel in the pressure gauge and fuel hose adapter using the bleed valve on the fuel hose adapter.
10. Remove pressure gauge and fuel hose adapter.
11. Reinstall the fuel pressure hose on ECM and gently but firmly pull on hose to ensure quick disconnect fitting is properly locked and secure on the ECM.
12. 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.

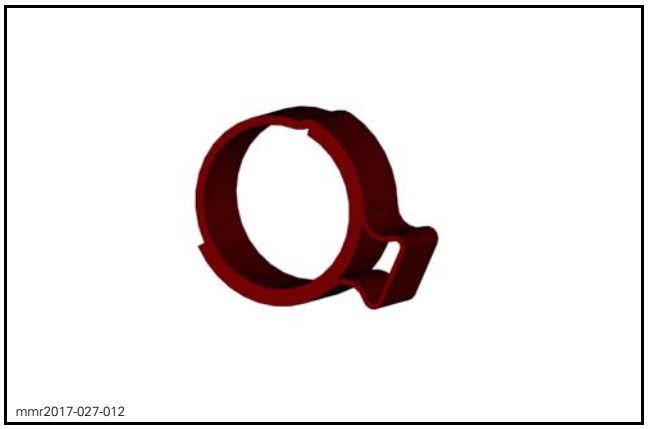
⚠ WARNING

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)	

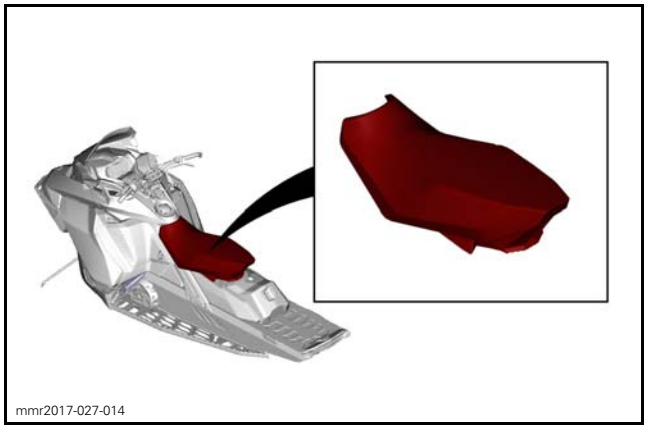
⚠ WARNING

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

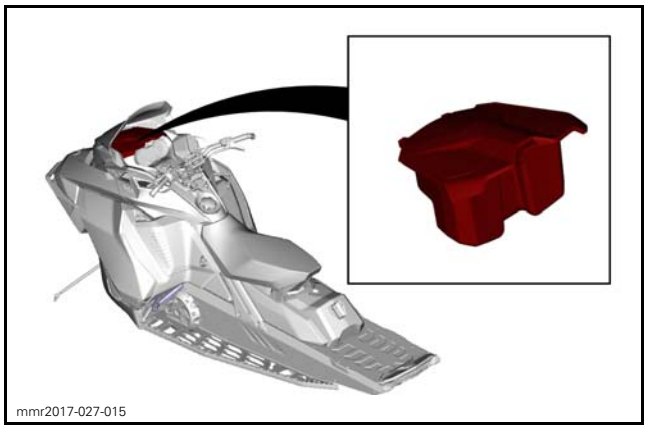
FUEL TANK

Removing the Fuel Tank

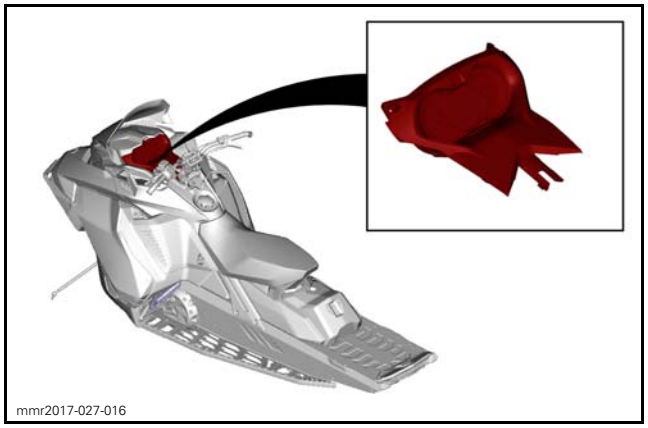
1. Remove seat.



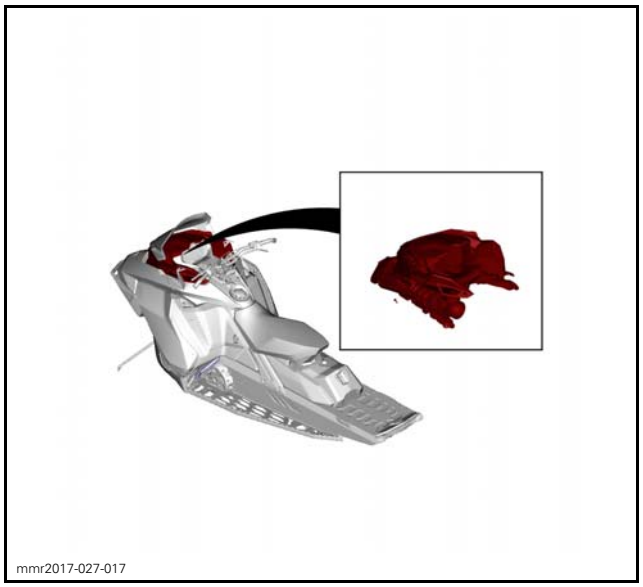
2. Remove glove box.



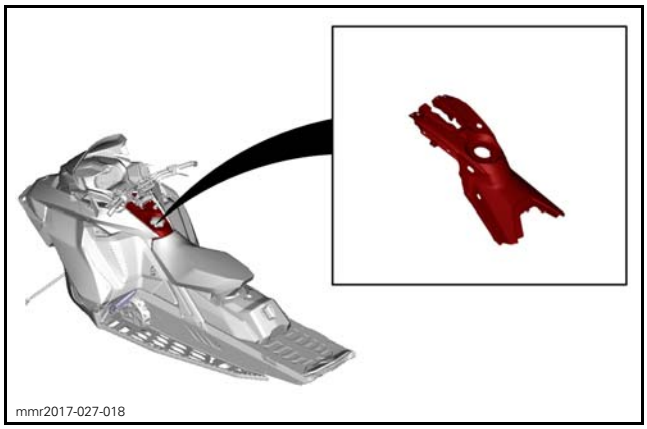
3. Remove cluster and trim.



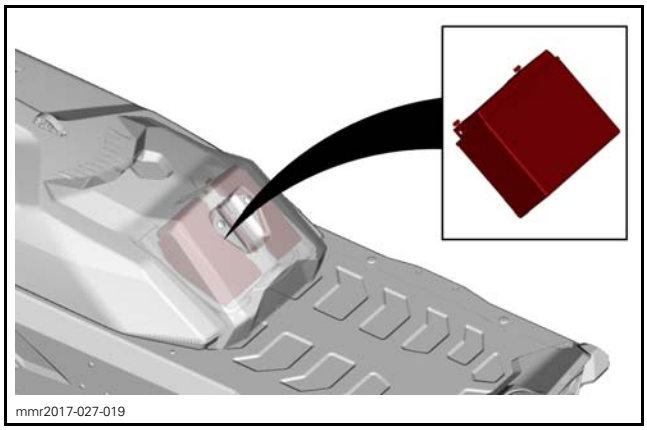
4. Remove console.



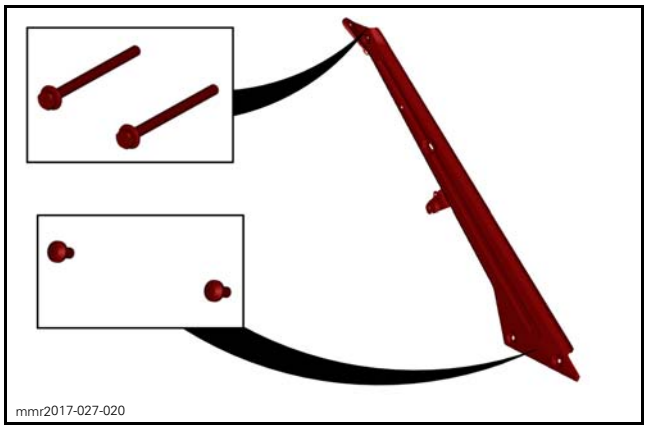
5. Remove tank cover.



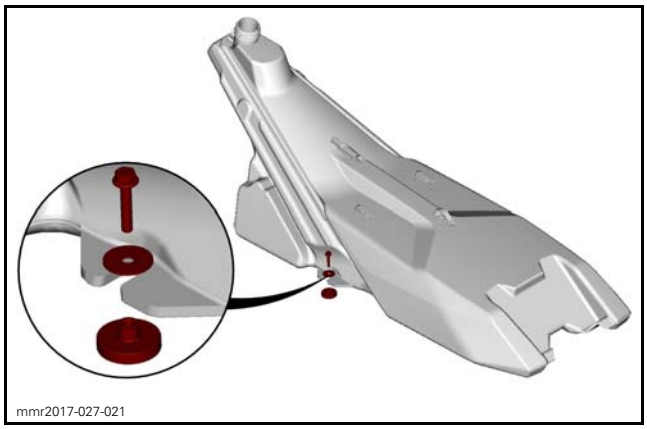
6. Remove battery cover and battery, if applicable.



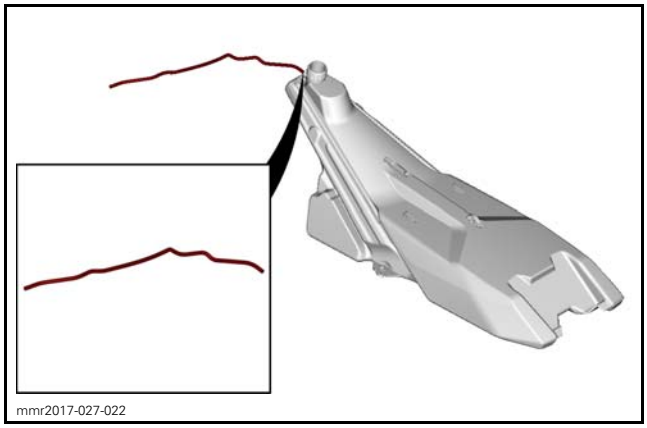
7. Remove pyramidal structure.



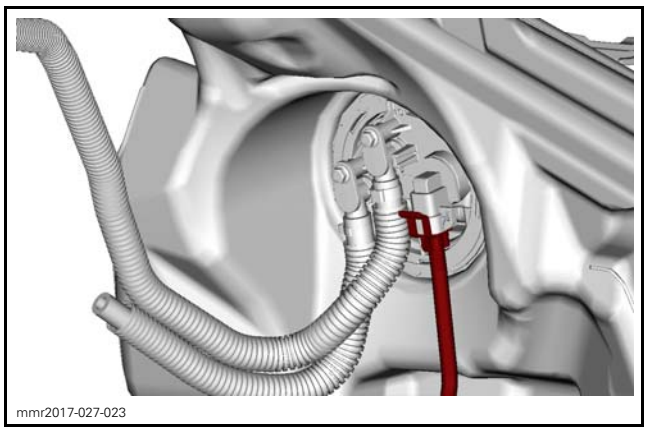
8. Remove fuel tank retaining screws.


mmr2017-027-021

9. Remove fuel tank vent.


mmr2017-027-022

10. Remove fuel pump electrical connector.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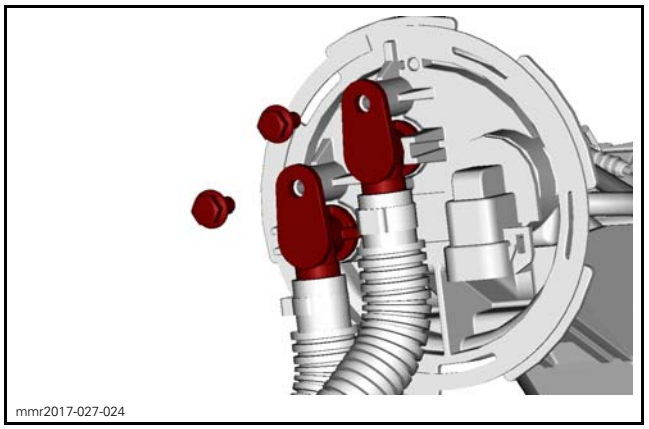
11. Remove fuel hoses from pump.


mmr2017-027-024

12. Remove fuel tank.

Installing the Fuel Tank

Reverse removal procedure.

Pressurize and test fuel system for leaks.

FUEL PUMP

Relieving Fuel Pressure

1. Connect vehicle to BUDS2, refer to the *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. From the **Functions** page, relieve fuel pressure.

Activating the Fuel Pump with B.U.D.S.

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 AND B.U.D.S.* 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.

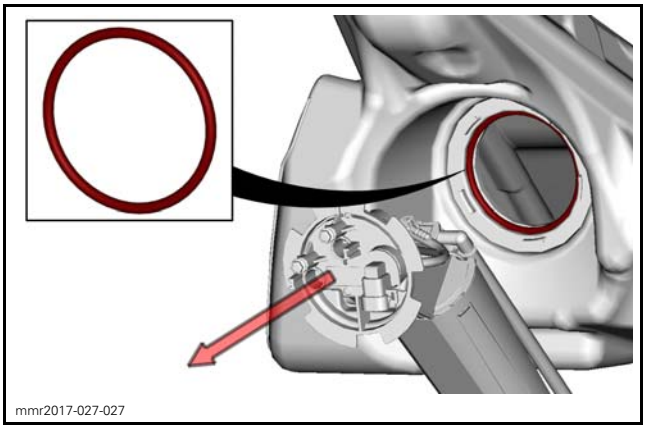
If the second fuel pump functions when connected to the vehicle harness, then replace the fuel pump installed in the vehicle.

Removing the Fuel Pump

1. Remove the fuel tank.
2. Remove fuel pump assembly snap ring from fuel tank.

mmr2017-027-026

3. Remove and discard fuel pump gasket.



mmr2017-027-027

4. Visually inspect for broken or damaged ground wires, if any issue are found, the module should be replaced.

Installing the Fuel Pump

For installation, reverse 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

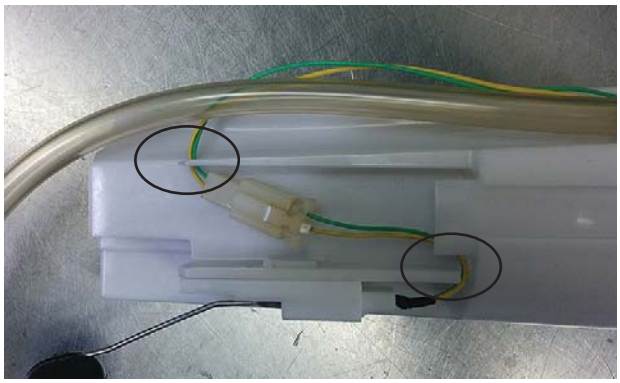
After working on the fuel system, carry out a fuel system pressurization test to check for leaks. Failure to carry out a fuel system leak test could result in severe injury or a life threatening situation should a leak occur.

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.

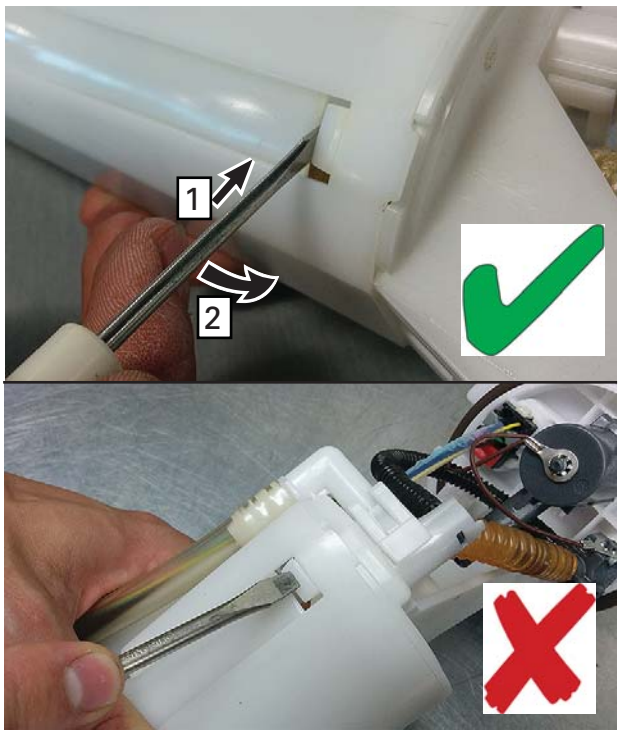
NOTICE **Do not pull / push on wires or metal terminals that connect the grounding wires to the plastic parts. Keep hands and tools away from this area.**



mmr2017-027-300_a

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.**



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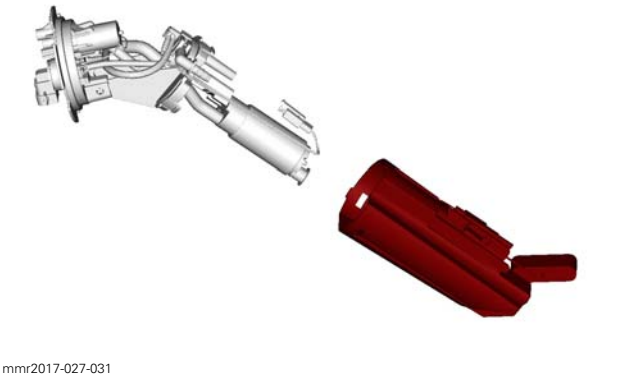
4. Completely remove fuel pump reservoir by pulling it carefully.


mmr2017-027-031

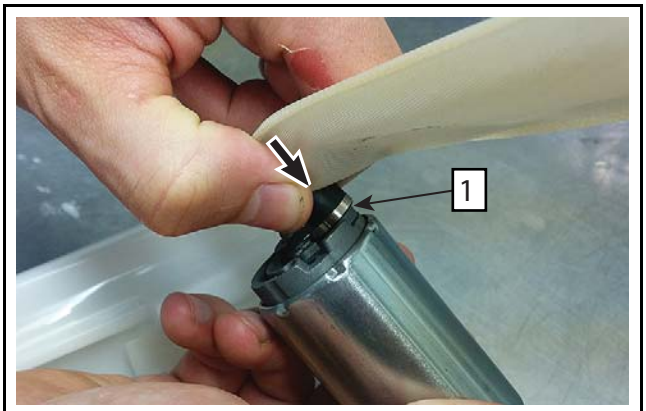
NOTICE To avoid damaging wires, Pull the reservoir carefully and do not let reservoir hang by wires.

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.


mmr2017-027-302_a

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.



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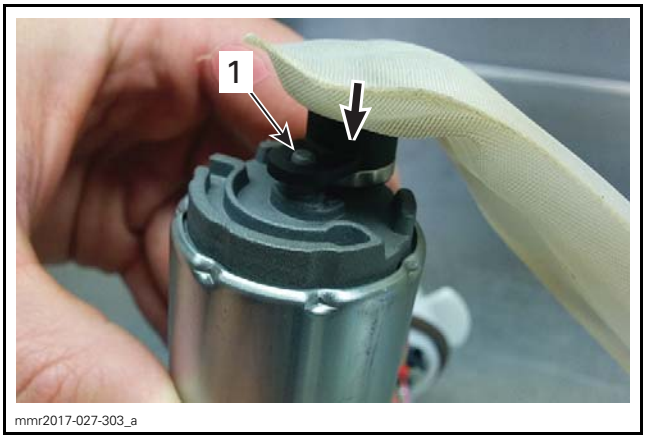
1. No gap here

   - 7.3 Ensure that the filter hole is properly positioned into the pin.



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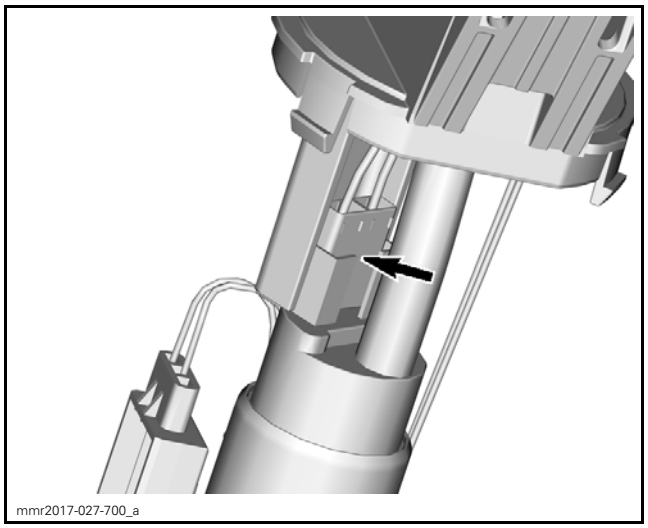
1. Pin

8. Install fuel pump reservoir carefully and ensure that all parts are properly positioned.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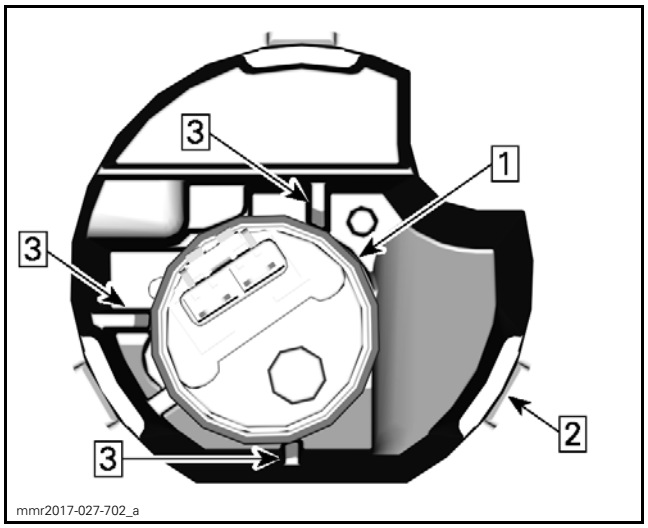
ELECTRICAL CONNECTOR MUST BE IN THIS POSITION

NOTE: Make sure the pump motor is positioned between the molded ribs in the reservoir.



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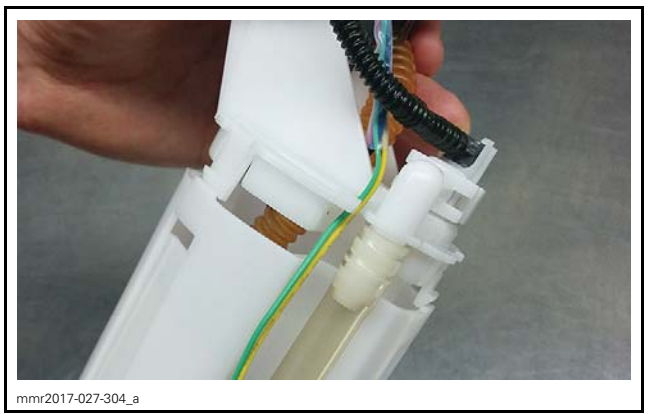
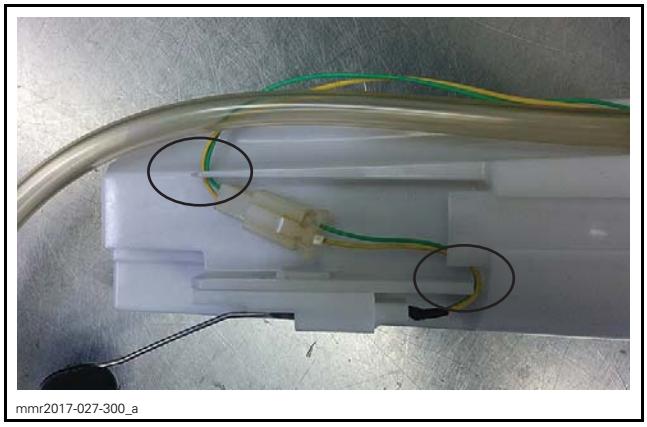
1. *Fuel pump motor*
2. *Reservoir*
3. *Ribs*


mmr2017-027-304_a

9. Ensure that fuel tank reservoir tabs are properly locked.
10. Route the fuel level sensor wires properly.


mmr2017-027-300_a

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.

Measuring Fuel Level Sensor Resistance with BUDS2

1. Connect vehicle to BUDS2.
2. Select the **Measurements** page.
3. Monitor the fuel level sensor resistance under **Fuel Level** and compare to the table below.

FUEL LEVEL SENSOR RESISTANCE TABLE	
Full level resistance value	9 Ω ± 2 Ω
Empty level resistance value	95 Ω ± 5 Ω

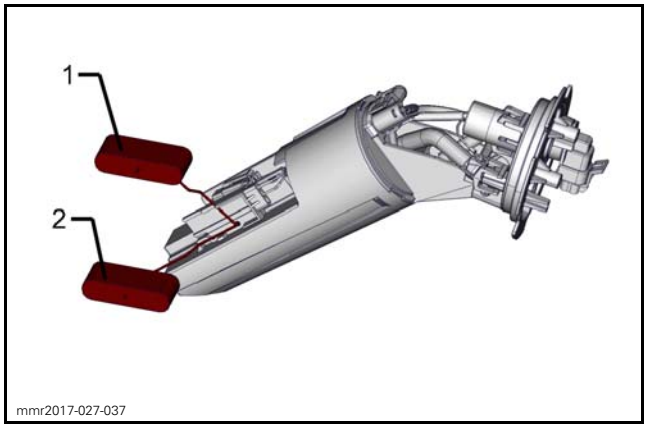
If resistance is within specifications, the fuel level sensor, and wiring are ok.

If resistance is not within specifications, measure resistance at the fuel pump connector **(FP)**. Refer to *TESTING FUEL LEVEL SENSOR RESISTANCE*

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 ± 5 Ω
	Full	9 Ω ± 2 Ω



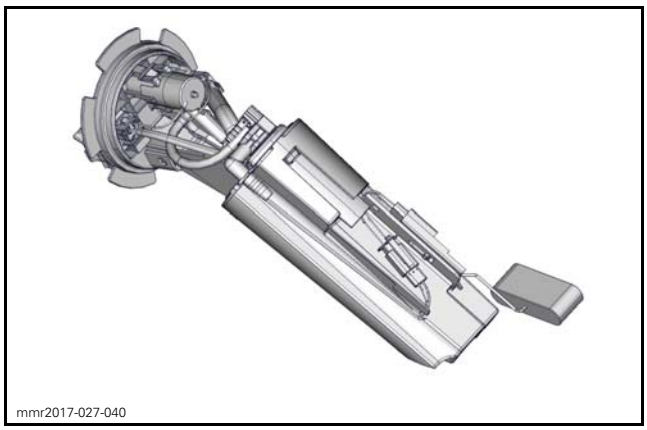
TYPICAL FUEL PUMP FLOAT
1. *Full position*
2. *Empty position*

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.

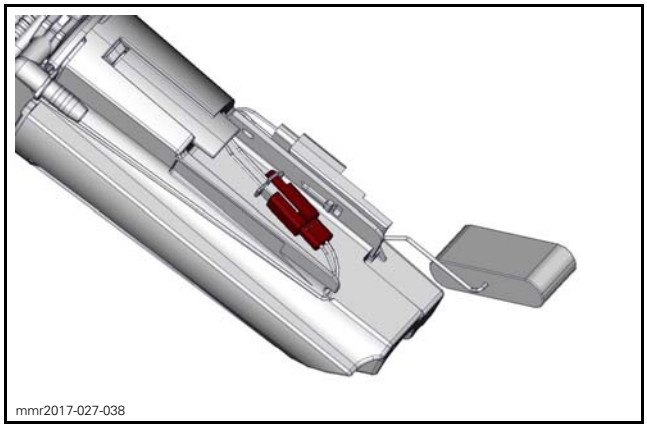
If fuel level sensor fails bench test, replace the fuel level sensor.

Replacing the Fuel Level Sensor

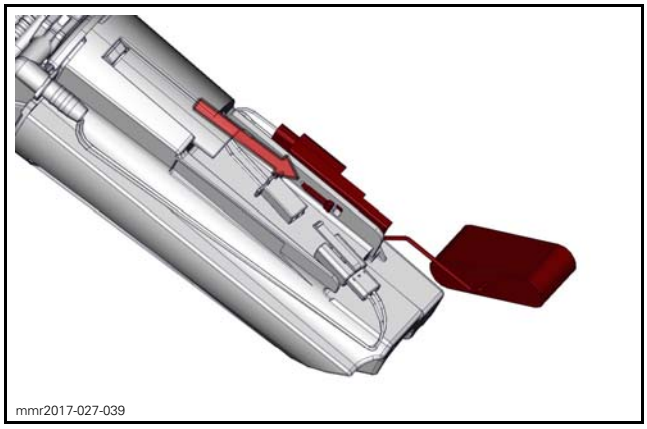
1. Remove the fuel pump.



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.

E-TEC DIRECT FUEL INJECTION

SERVICE TOOLS

Description	Part Number	Page
ECM ADAPTER TOOL	529 036 166	20, 30–33, 36–37
EXTRACTOR ADAPTOR	529 036 136	14
FLUKE 115 MULTIMETER	529 035 868	12, 20, 32–34, 36
OETIKER PLIER	295 000 070	6
SMALL HOSE PINCHER	295 000 076	27

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
SNAP-ON HAMMER	CJ125-6	14
SNAP-ON SCREW	CJ93-1	14

SERVICE PRODUCTS

Description	Part Number	Page
DIELECTRIC GREASE	293 550 004	18, 34
PULLEY FLANGE CLEANER	413 711 809	28

GENERAL

When testing electrical systems, the emergency stop switch must always be in the RUN position unless otherwise mentioned, or test is performed while cranking engine.

⚠ 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, fuel vapors may ignite in presence of a spark creating a fire hazard.

⚠ WARNING

The fuel system is under high pressure. Proceed with care when working on the fuel system. Wear safety glasses and work in a well ventilated area.

Release fuel system pressure prior to removing fuel system components. Refer to *FUEL TANK REMOVAL* in *FUEL TANK AND FUEL PUMP* subsection.

⚠ WARNING

Perform a fuel pressure test each time a component from the fuel system is removed. Prior to starting the engine when a fuel hose was disconnected or a fuel injector removed:
- Ensure all fuel lines are properly connected.
- Inspect engine compartment to detect any fuel leakage or an abnormally strong fuel odor which may be an indication of a fuel leak that is not readily visible.

SYSTEM DESCRIPTION

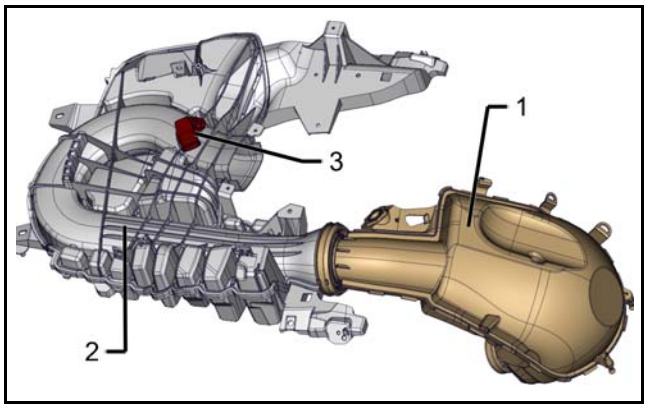
The ECM reads the input signals from different sensors which indicate engine operating conditions at micro-second intervals.

The ECM calculates the proper air/fuel ratio and activates the output to fuel injectors.

Signals from sensors are used by the ECM to determine the injection parameters (fuel maps required for optimum air-fuel ratio).

The crankshaft position sensor (CPS), the throttle position sensor (TPS) are the primary sensors used to control the injection. Other sensors (like temperature sensors, etc.) are used as secondary input.

Air Induction



1. *Primary air intake silencer*
2. *Secondary air intake silencer*
3. *MAPTS*

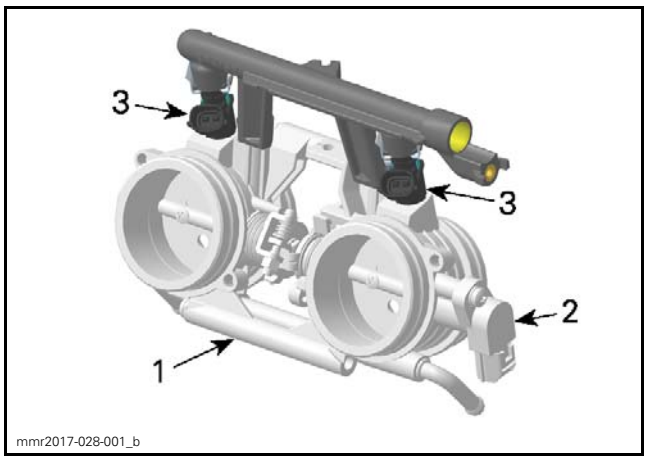
Air flows through a mesh filter in the secondary air intake silencer mounted on top of engine. The mesh filter prevents snow from being drawn into the engine.

Air pressure and temperature is measured in the secondary air intake silencer by the Manifold Absolute Air and Temperature Sensor (MAPTS).

Air then flows through the primary air intake silencer.

Air is then drawn in through a dual throttle body mounted on the engine intake side.

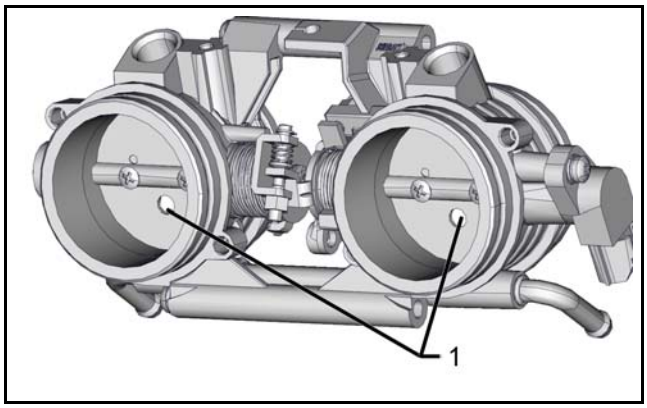
Throttle Body



1. *Throttle body*
2. *TPS (Throttle Position Sensor)*
3. *Throttle body injectors*

A dual throttle body assembly is directly mounted on the intake flange of each cylinder (52 mm (2.05 in)).

The air flow is controlled by two throttle plates. Each throttle plate has a 6.8 mm (.268 in) idle port in it.

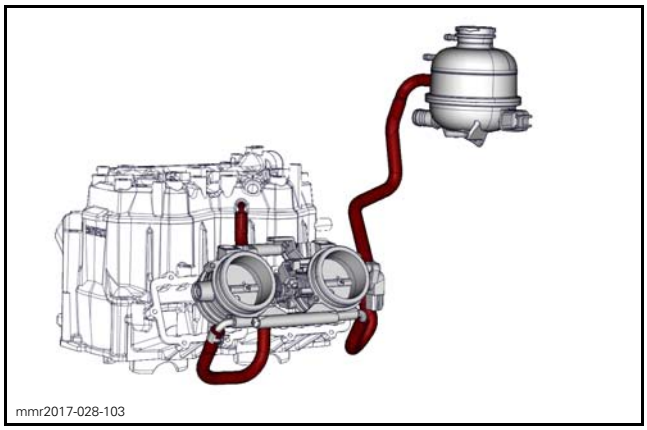


1. *Idle ports*

Since there is a constant airflow through the idle ports of the throttle plates, the idle speed is controlled by the ECM by varying the amount of fuel injected in the combustion chamber and by controlling the injection timing.

The TPS (Throttle Position Sensor) is fitted on the throttle body. The TPS sends throttle angle position to the ECM.

Engine coolant flows through the throttle body to prevent potential freezing of throttle plates due to the temperature drop naturally created by the venturi.

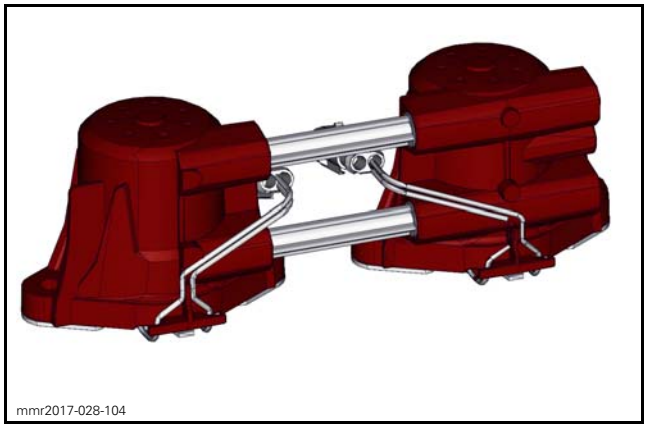


The air then continues through the reed valves into the cylinder base then into the crankcase.

Fuel Injectors

Each cylinder is supplied with fuel by a fuel injector on the top of the cylinder (high pressure direct ETEC injectors) and a fuel injector on the throttle body (throttle body injectors).

High Pressure Direct E-TEC Injectors

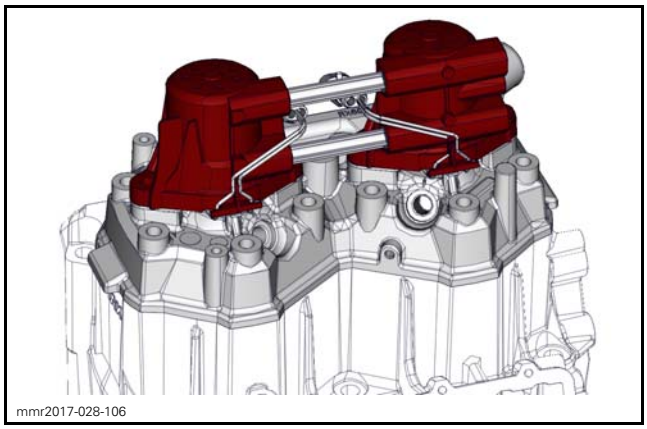


DIRECT INJECTORS

The fuel injectors are powered from the 55 Vdc system.

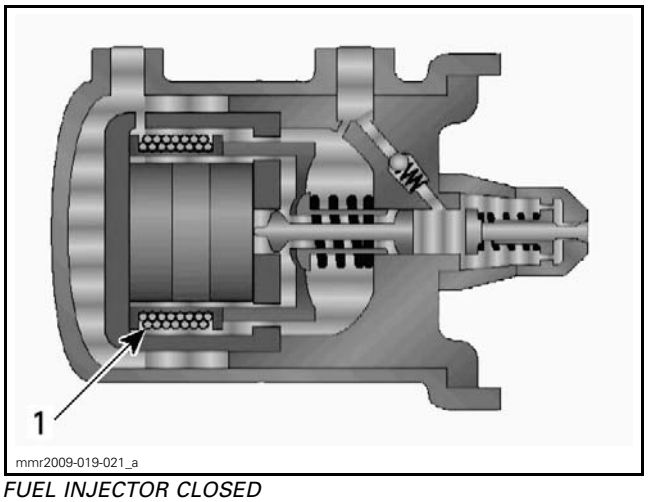
One fuel injector per cylinder is used.

The E-TEC fuel injector is mounted directly on top of the cylinder head.



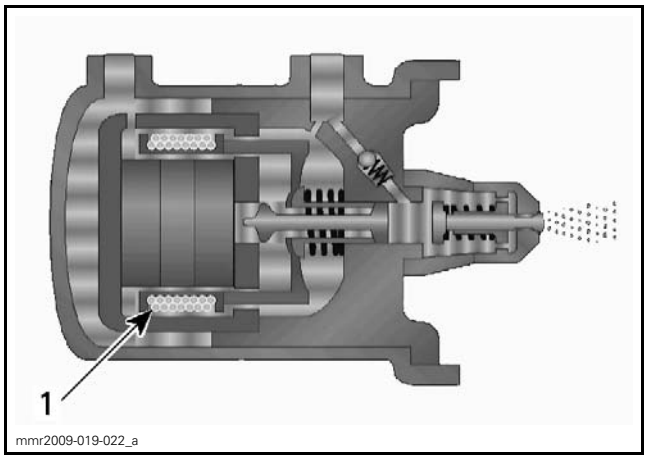
The fuel injector achieves a direct injection right into the combustion chamber. This keeps the piston cooler with less fuel.

A voice coil type is used to open and close the fuel injector nozzle. This allows for quick operation of the fuel injector; opening stage as well as the closing stage. This results in the ability to operate the engine at a higher RPM and lowers unburned fuel to the exhaust port.



FUEL INJECTOR CLOSED
1. Voice coil

When a positive current is supplied to the coil by the ECM, the fuel injector plunger moves towards the spring loaded injector needle. As the injector plunger moves, this builds up a pressure in the fuel injector chamber. When the pressure reaches approximately 1724 kPa (250 PSI), the injector needle spring is overcome and the needle opens. Fuel injection then takes place while the pressure peaks at 3103 kPa (450 PSI).



FUEL INJECTOR OPENED
1. Voice coil

Swirl channels are used in the fuel injector to better atomize the fuel charge.

The quantity of injected fuel is controlled by varying the injector plunger stroke.

To bring the injector plunger backward to its rest position, the current is reversed and the return springs close the injector needle and plunger. Near the end of the return stroke, a brief positive current is applied to "brake" the injector plunger. This results in a quieter operation of the fuel injectors.

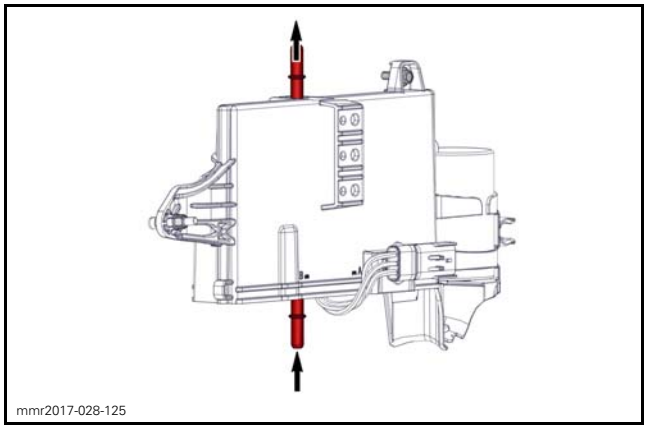
The fuel injectors provide a stratified fuel charge to the combustion chamber up to clutch engagement speed. Beyond this RPM, the fuel charge becomes homogeneous.

The stratified fuel charge provides a cleaner combustion, better idling and less smoke.

Fuel is used to maintain proper fuel injector operating temperature.

The flow starts from the fuel pump, through the ECM, then around the voice coil inside the fuel injector housings to cool down the fuel injector components.

Fuel enters the inlet port located at the bottom of the fuel injector housing and exits through the outlet port on top of the fuel injector.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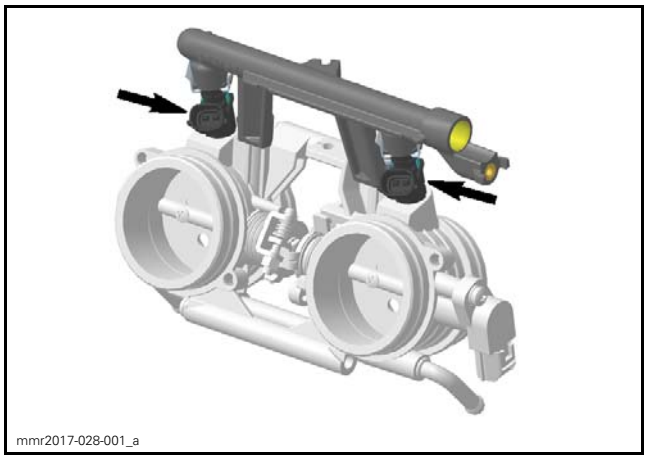
Throttle Body Injectors

The fuel injectors are mounted directly on top of the throttle body.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Fuel injectors are used to inject fuel into the transfer port of the cylinder. One injector is used per cylinder.

The fuel injectors are supplied with fuel by the fuel rail. The fuel rail ensures all times that enough fuel at the right pressure can be delivered to the fuel injectors. The fuel rail is fed by the fuel pump module.

ADJUSTMENT

IDLE SPEED

Idle speed is controlled by the ECM and is not adjustable with an idle screw.

If idle speed is not as per specification (refer to *TECHNICAL SPECIFICATIONS*), perform the *CLOSED THROTTLE RESET (TPS)*.

RESETTING CLOSED THROTTLE VALUE (TPS)

General Information

This operation performs a reset of the TPS (throttle position sensor) values in the ECM when the throttle is closed. This reset is very important as the setting of the TPS will determine the basic parameters for all fuel mapping and several ECM calculations for idle speed control of the engine.

NOTICE **An improperly set TPS may lead to poor engine performance.**

Verifying TPS Closed Throttle Value

1. Connect vehicle to BUDS2. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. In BUDS2, navigate to the Measurements page.
3. Ensure throttle cable is properly adjusted, refer to *ADJUSTING THROTTLE CABLE* in this subsection.
4. Look for the throttle opening value .

NOTE: The Throttle Opening indication must be within the following specification.

THROTTLE OPENING SPECIFICATION	TEMPERATURE
(0 % ± 0.2)	Above 5°C (41°F)

If the throttle opening is within the % specification, DO NOT reset the closed throttle value unless the following parts were replaced:

– Engine control module (ECM)
– Throttle body
– Throttle position sensor (TPS).

If TPS is not within specification, reset the closed throttle value.

Resetting the Closed Throttle Value

NOTICE Proper throttle cable adjustment must be verified before proceeding.

1. In BUDS2, navigate to the Settings page.
2. Confirm the Actual TPS Voltage is within specification.

ACTUAL TPS VOLTAGE SPECIFICATION
0.3 to 0.7 Volts

NOTE: If the Actual TPS Voltage is out of specification, the TPS cannot be reset. The cause must be found. See *TROUBLESHOOTING ACTUAL TPS VOLTAGE OUT OF RANGE*.

3. Press on the Reset button.
4. Confirm Throttle Opening value indicates 0.0%.

NOTE: A throttle opening of 0.0% after reset indicates the operation is successful.

Troubleshooting Actual TPS Voltage Out of Range

If the Actual TPS Voltage is out of specification, check the following.
- Fault codes related to TPS
- Throttle cable adjustment
- TPS properly installed
- TPS connector and terminal condition.

TROUBLESHOOTING

DIAGNOSTIC TIPS

Engine problems are not necessarily related to the injection system.

It is important to ensure the mechanical integrity of the engine is present.

Spark Plugs

Improper spark plug indexing may lead to engine misfiring. Check if BRP spark plugs are installed or if spark plugs are properly indexed. Refer to *REPLACING SPARK PLUGS* in the *PERIODIC MAINTENANCE PROCEDURES* subsection.

3D RAVE Valves

Improper position of RAVE valves may lead to engine misfiring. Check RAVE valves. Refer to *RAVE* subsection.

Crankshaft Position Sensor (CPS)

Confirm that ECM receives the CPS signal. Refer to *CRANKSHAFT POSITION SENSOR (CPS)* in this subsection.

Electrical System

It is important to check that the electrical system is functioning properly:
- 55V system voltage
- Capacitor (refer to *CHARGING SYSTEM*)
- Ground connections
- Wiring and connectors.

Ensure that all electronic components are original BRP recommended components.

Any modification to the wiring harness may lead to fault codes or bad operation.

Always refer to the wiring diagram when diagnosing an electrical problem.

⚠ WARNING

The EMS operates on high voltage (55 Vdc), be careful to avoid electrical shocks.

⚠ WARNING

All electrical actuators (example: fuel injectors, fuel pump, ignition coils and electronic oil injection pump) are powered as soon as engine is cranked when the emergency engine stop switch is at the RUN position.

Electrical Connections

Pay particular attention to ensure that pins are not out of their connectors or out of shape.

Make sure that connections are very tight, make good contact, are corrosion-free, and show no signs of moisture. Particularly check ECM ground connections.

NOTE: Do not apply dielectric grease or other lubricant in the ECM connectors.

Check if wiring harness shows any signs of scoring.

Resistance Measurement

When measuring the resistance with an ohmmeter, all values are given for a temperature of 20°C (68°F). The value of a resistor varies with the temperature. The value for common resistor or windings (such as solenoid) increases as the temperature increases. However, our temperature sensors are NTC types (Negative Temperature Coefficient) except for the EGTS, which means

that the value decreases as the temperature increases. Use the provided tables for sensor resistive values at given temperature.

The resistive value of a temperature sensor may test good at a certain temperature but may be defective at other temperatures.

A good test is to put the sensor in a container filled with ice and water and measure resistance. Then, heat the water and read the resistance at different temperatures.

PROCEDURES

FUEL HOSES AND OETIKER CLAMPS

Removing and Installing Oetiker Clamps

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

Always use a shop rag when disconnecting a fuel hose.

⚠ CAUTION Fuel system is under high pressure.

⚠ WARNING

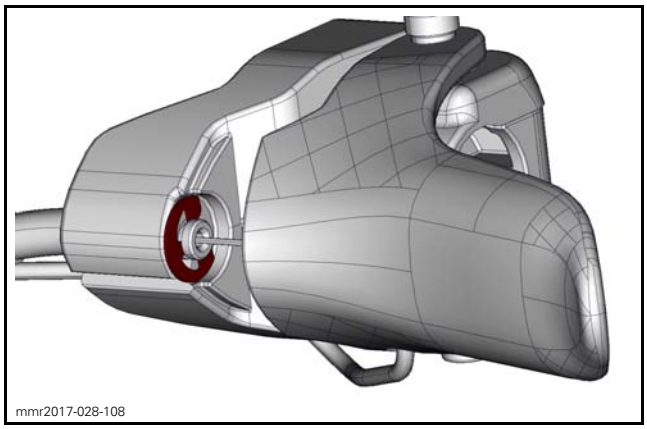
- Never use a hose pincher on high pressure hoses.
- Never change the routing of a fuel hose.
- Always reinstall the corrugated protective tubing on fuel hoses.
- Secure fuel hoses using the appropriate locking tie or fastener to prevent contact with sharp edges or hot, rotating and moving parts.
- After connecting a hose or a quick connect fitting, pull on the hose near the fitting to make sure it is securely locked.

Use of improper fuel lines could compromise fuel system integrity.

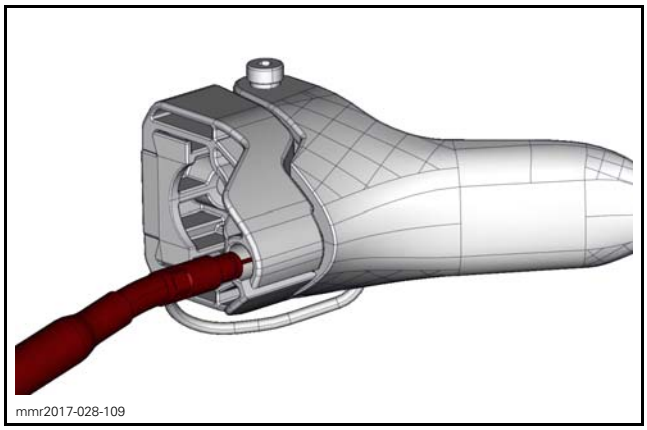
THROTTLE CABLE

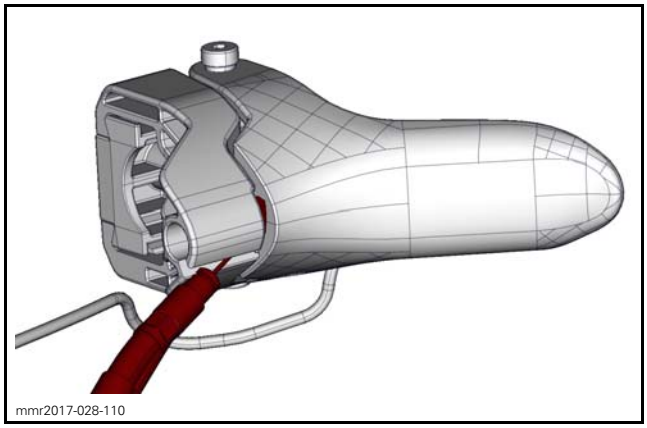
Removing the Throttle Cable

1. Depress and hold throttle lever.
2. Pull out circlip using long nose pliers. Keep circlip for re-use.

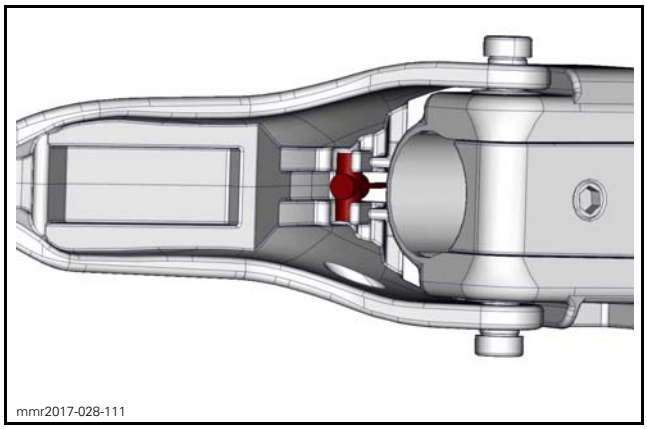


3. Pull throttle cable out of the throttle lever housing.



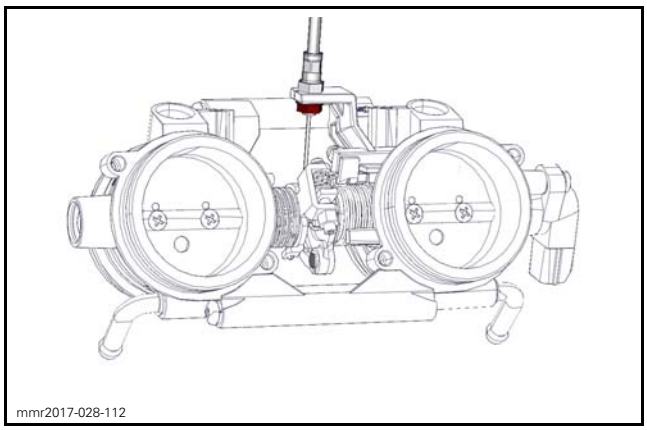


4. Unhook cable end barrel from throttle lever and remove cable.



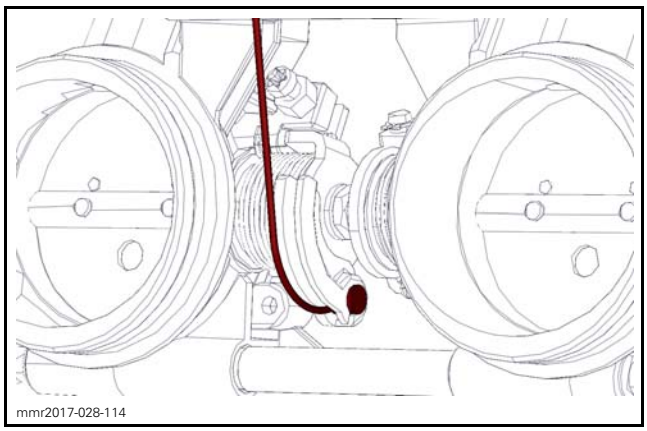
NOTE: Take note of cable routing before removal.

5. At throttle body, fully unscrew cable lock nut.



THROTTLE CABLE LOCK NUT

6. Unhook throttle cable end.



7. Remove throttle cable.

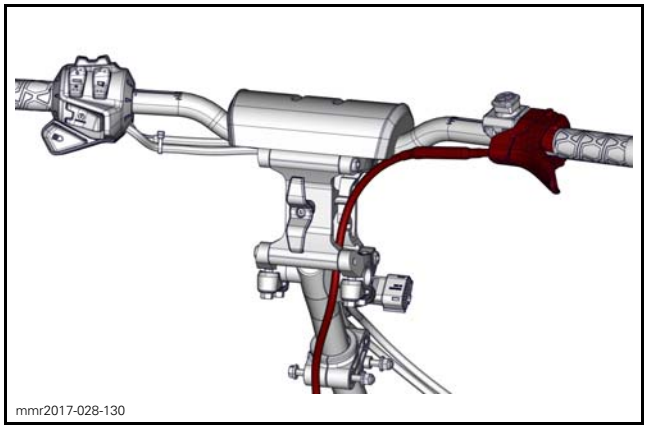
Installing the Throttle Cable

Reverse removal procedure however, pay attention to the following.

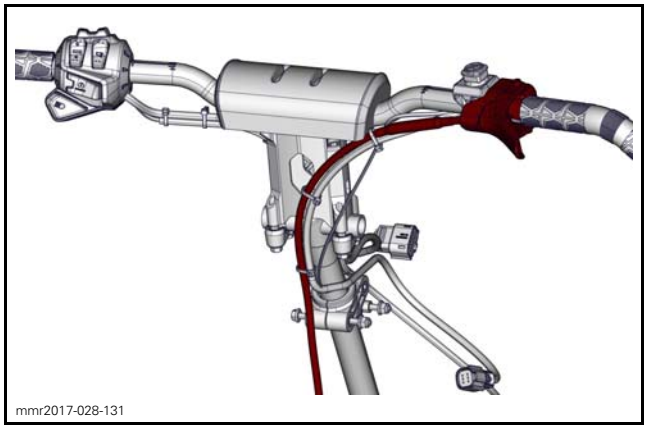
Route cable as noted prior to removal.

⚠ WARNING

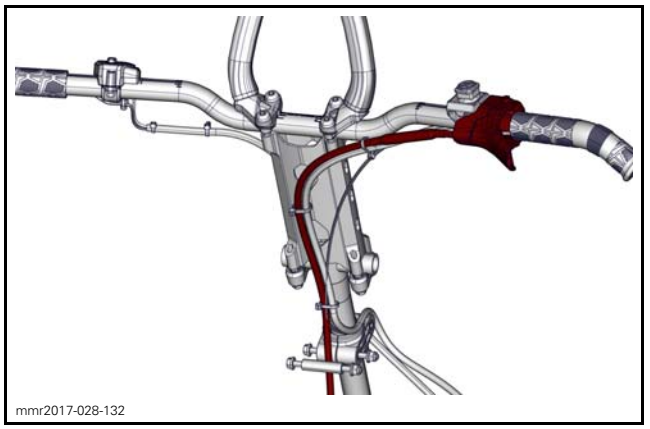
Ensure proper routing of throttle cable as per following illustrations.



CROSS-COUNTRY WITH ADJUSTABLE RISER



CROSS COUNTRY WITH FIXED RISER



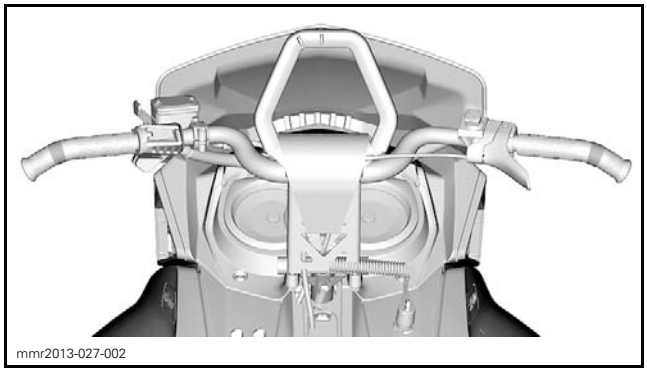
MOUNTAIN WITH FIXED RISER

Ensure that cable ends are properly secured in their levers.

Proceed with throttle cable adjustment.

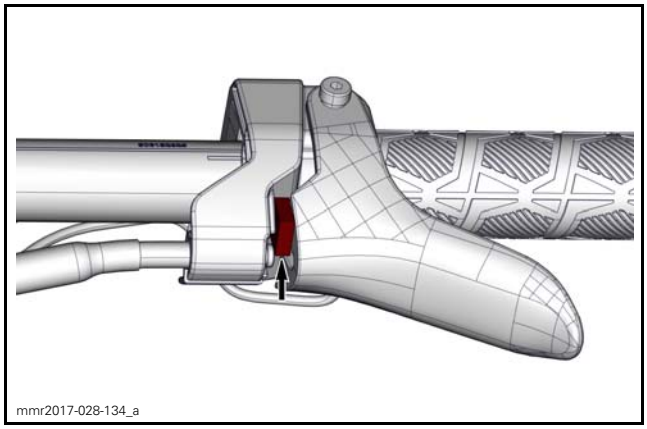
Adjusting the Throttle Cable

1. Connect BUDS2. Refer to *COMMUNICATION TOOLS AND BUDS* subsection.
2. Navigate to the measurements page and monitor TPS opening % in BUDS2.
3. Position handlebar straight and level.

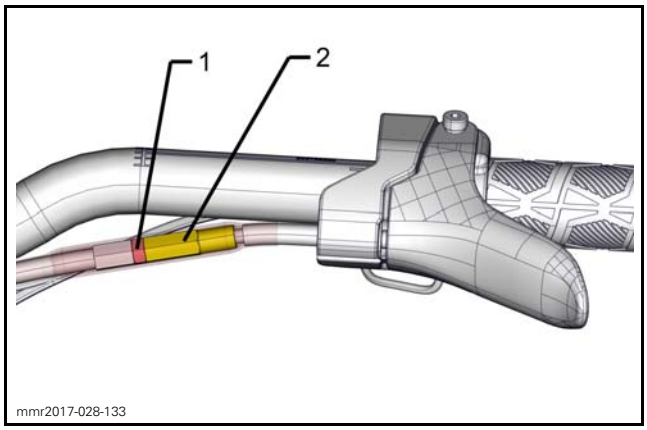


TYPICAL - HANDLEBAR IN STRAIGHT AHEAD POSITION

4. Insert a 4 mm (.157 in) spacer between throttle lever and throttle lever housing.



5. Unlock throttle cable adjuster lock nut.
6. Adjust throttle cable until the TPS value (%) is between 3 and 5% in BUDS2.

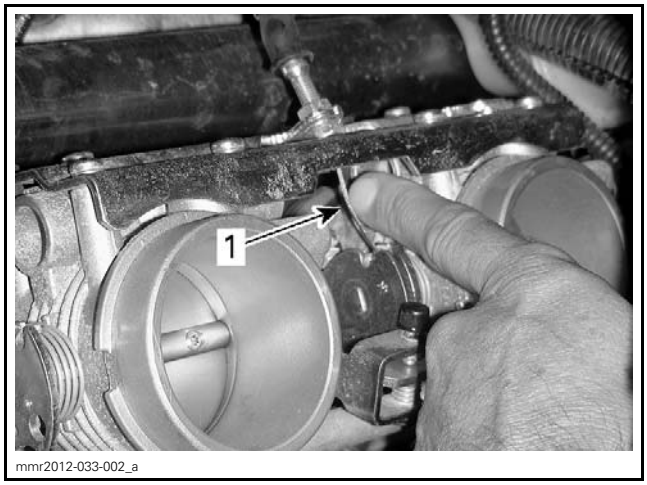


1. Throttle cable adjuster lock nut
2. Throttle cable adjuster

7. Lock throttle cable adjuster lock nut.
8. Remove the 4 mm (.157 in) spacer.
9. Fully depress the throttle lever and ensure the opening value is more than 95 % in BUDS2.
10. Ensure there is free play in the cable with the throttle lever at rest.

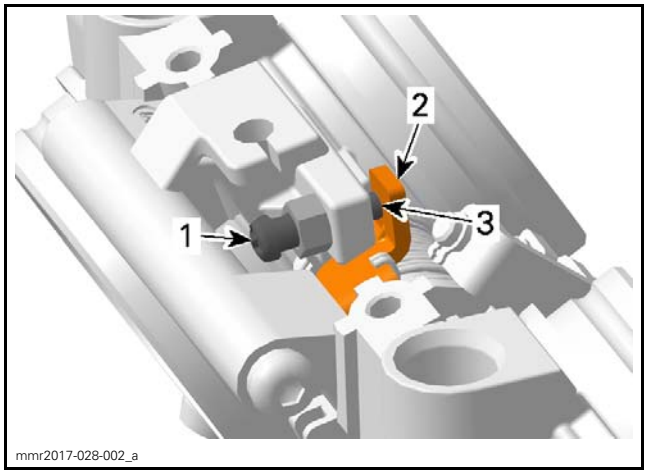
NOTICE **Do not tamper with any throttle body adjustment screws. Otherwise, throttle body must be replaced.**

NOTE: To ensure cable free play, lightly press on throttle cable as in following illustration.



THROTTLE CABLE FREE PLAY
1. Cable slightly loose here

11. Activate and release throttle lever 2 - 3 times to settle throttle plate.
12. Confirm throttle plate stopper is STILL in contact with master zero position screw.



THROTTLE BODY MASTER ZERO POSITION
1. Master zero position screw
2. Throttle plate stopper
3. Contact here

13. Readjust throttle cable if necessary.

14. Inspect the throttle cable operating range with BUDS2
15. Reset the Closed Throttle Value, refer to procedure in this subsection.

Inspecting the Throttle Cable Operating Range BUDS2

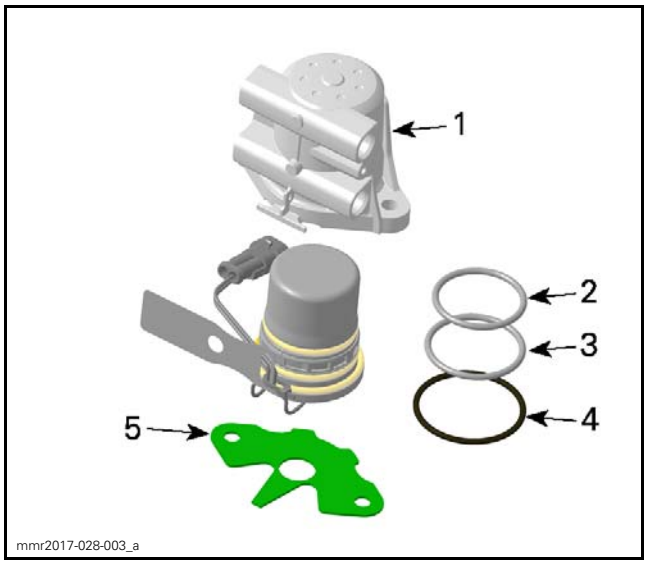
1. In BUDS2, navigate to the Measurements page.
2. Fully depress throttle lever and hold.
   2.1 Confirm throttle opening is within specification.

THROTTLE OPENING SPECIFICATION (WIDE OPEN THROTTLE)
More than 95%

3. If throttle opening is out of specification, readjust as follows.

THROTTLE OPENING OUT OF SPECIFICATION	
Above specification	Loosen throttle cable
Below specification	Tighten throttle cable

E-TEC DIRECT INJECTORS



1. *Fuel injector housing*
2. *Top O-ring*
3. *Bottom O-ring*
4. *Crush ring*
5. *Gasket*

Every fuel injector is bench tested. Its electrical and flow characteristics are registered throughout all its operating range in a calibration file.

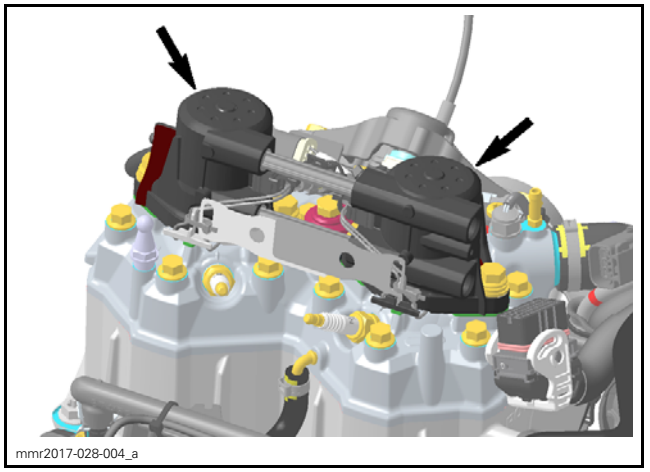
NOTICE When a fuel injector is replaced, the matching calibrated file must be loaded in the ECM using BUDS2 so that the ECM properly controls the fuel injector.

Fuel Injectors Access

1. Remove upper body module.
2. Remove engine cover.

Visually Inspecting Fuel Injectors

1. Visually inspect the fuel injector area.



FUEL INJECTORS

If a fuel leak is noticed in the hoses area, inspect hoses and connections.

If a fuel leak is noticed in fuel injector base area, it indicates a leak of the lower O-ring of fuel injector.

If a dark carbon sooted area is noticed in fuel injector base area, it indicates a leak between the fuel injector nozzle and the cylinder head. The fuel injector retaining screws may not be tight enough.

Fuel Injector Troubleshooting Tips

Usually, a faulty fuel injector will lead to poor engine idling and a low RPM (around 800 RPM and below). It may also lead to engine misfiring.

Ensure the correct fuel injector is installed on the proper cylinder. Refer to *FUEL INJECTOR POSITION VALIDATION*.

While engine is running, try disconnecting a fuel injector connector:

⚠ WARNING

Be careful while working close to rotating parts.

– If engine RPM does not change, the fuel injector could be faulty.
– If engine RPM decreases, the other fuel injector could be faulty.

If one injector is thought to be faulty, proceed with the injector tests.

Testing for Fuel Injector Leaks

Test Preparation

1. First make sure fuel pressure is within specifications. Refer to *FUEL TANK AND FUEL PUMP* subsection.

NOTE: Keep the pressure gauge installed for the leak test.

2. Disconnect magneto connector. Refer to *WIRING HARNESS AND CONNECTORS* subsection.

⚠ WARNING

The magneto connector must be disconnected to prevent any spark in the engine compartment should the engine be cranked. Fuel vapors may ignite in presence of a spark creating a fire hazard.

3. Using BUDS2, release fuel pressure. Refer to *FUEL TANK AND FUEL PUMP* subsection

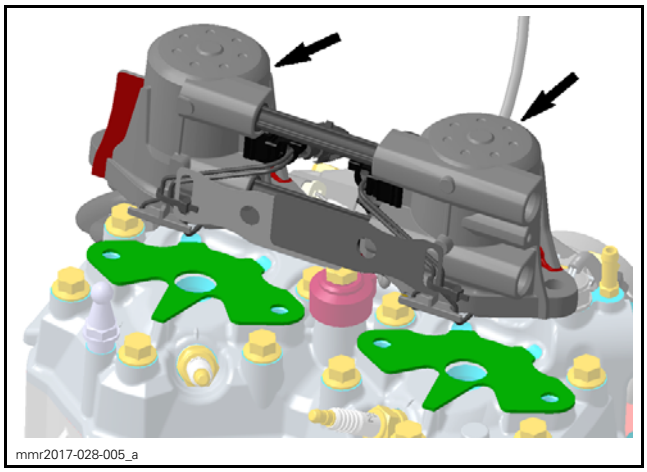
NOTICE **If the fuel pressure is not released, the pressure will push the fuel injector out of its housing when removing the fuel injector from the engine. This could damage the fuel injector and lead to an important fuel spill.**

4. Remove upper body module. Refer to *BODY* subsection.

NOTE: Fuel injector leak test can only be done on both injectors simultaneously.

5. Unscrew both E-TEC direct fuel injectors. Refer to *REMOVING THE FUEL INJECTOR* in this subsection.
6. Carefully lift both fuel injectors. Be careful not to pry hoses against their plastic fittings.

⚠ CAUTION **If both fuel injectors are not lifted carefully from the engine together, the strain on the injector fuel fittings may cause them to crack and leak fuel when pressurized, resulting in a fire hazard.**



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NOTE: Do not install the gaskets against fuel injectors.

NOTE: Use a new crush ring. If a new crush ring is not installed, it will be difficult to determine if the E-TEC direct injector is leaking.

7. Secure the injectors on a cylinder head (either remove it from engine or order a spare one as a tool).

NOTICE **Test injectors when removed from the engine, while attached to the cylinder head.**

⚠ WARNING

Fuel injector must be secured during the leak test to avoid the fuel injector to be projected.

8. Place an appropriate container under the fuel injectors.
9. Ensure spark plug caps are installed on spark plugs.
10. Ensure there is enough fuel in fuel tank.
11. Connect vehicle to BUDS2. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

Leak Test

1. UsingBUDS2, activate the fuel pump.

NOTE: Fuel pump will operate until deactivated in BUDS2.

2. Check for fuel leakage from the fuel injector nozzle.

3. Monitor fuel pressure at fuel pressure gauge. If pressure drops below 275 kPa (40 PSI) during the test, re-activate fuel pump as necessary.

FUEL INJECTOR LEAKAGE	
TEST DURATION	SPECIFICATION
2 minutes	2 drops per minute maximum

4. If test is not within specification, replace the faulty fuel injector.
5. Properly reinstall fuel injectors. Refer to *INSTALLING FUEL INJECTORS* in this subsection.
6. Reinstall remaining removed components.
7. Connect magneto connector.

⚠ WARNING

Wipe up any spilled fuel.

Testing the Fuel Injector

1. Connect vehicle to BUDS2. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Activate each fuel injector.

With each activation a sound coming from the targeted injector should be heard.

If the fuel injector does not work, possible causes are:

– Injector
– Harness
– ECM.

If the fuel injector does not work, connect it to the opposite fuel injector connector, then test again.

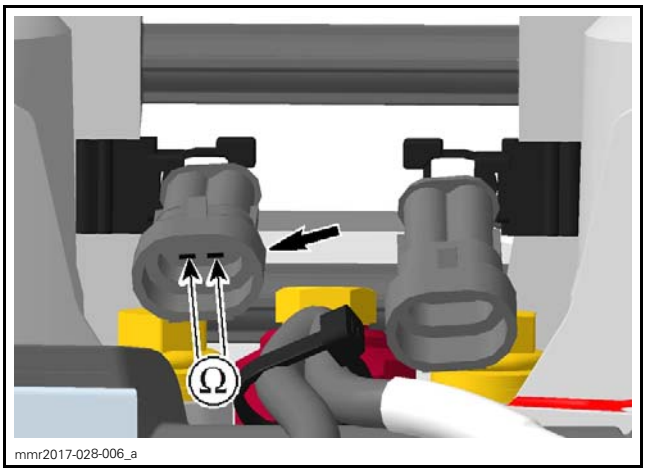
If the suspected fuel injector works normally with the opposite fuel injector connector, carry out the *TESTING THE FUEL INJECTOR INPUT VOLTAGE* in this subsection.

If the fuel injector still does not work, carry out the *TESTING THE FUEL INJECTOR RESISTANCE*.

Measuring E-TEC Direct Fuel Injector Resistance

1. Disconnect the fuel injector connector.
2. Measure fuel injector resistance directly on its terminals.

E-TEC DIRECT FUEL INJECTORS		MEASUREMENT @ 22°C (72°F)
Pin 1	Pin 2	Below 2.7 Ω



FUEL INJECTOR CONNECTOR

If measurement is out of specification, replace fuel injector.

Testing the Fuel Injector Input Voltage

1. Connect vehicle to BUDS2. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Read the voltage on the 55 V System Circuit meter in BUDS2.

55 V SYSTEM CIRCUIT VALUE
30 Vdc minimun

3. Measure voltage at E-TEC direct fuel injector connector with a multimeter.

PROBE		SPECIFICATION
INJ_DI_MAG-1	Chassis Ground	30 Vdc minimun
INJ_DI_PTO-1	Chassis Ground	30 Vdc minimun

If voltage test is as per specification, carry out *TESTING THE FUEL INJECTOR CONTROL CIRCUIT SIGNAL*.

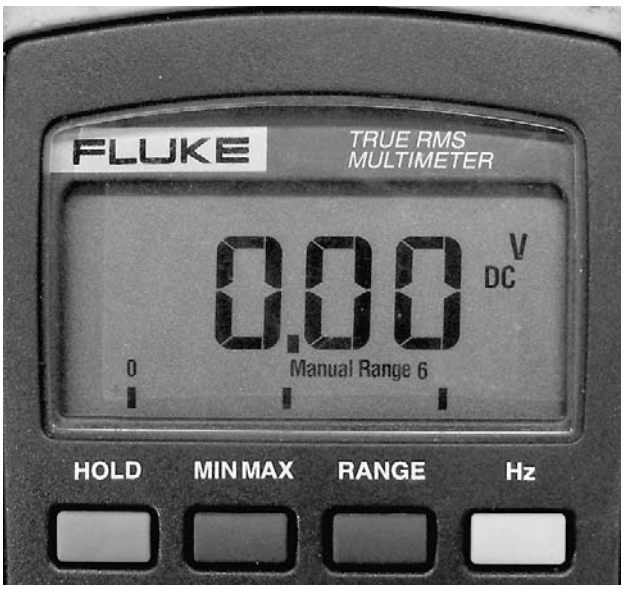
If voltage test is not as per specification, check wire continuity between ECM and fuel injector connector.

Testing the Fuel Injector Control Circuit Signal

1. Connect vehicle to BUDS2. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Backprobe injector connector, do not disconnect injector connector.
3. Set multimeter to Vdc (Hz).

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

4. Repeatedly press the RANGE button until the display shows Manual Range 6.



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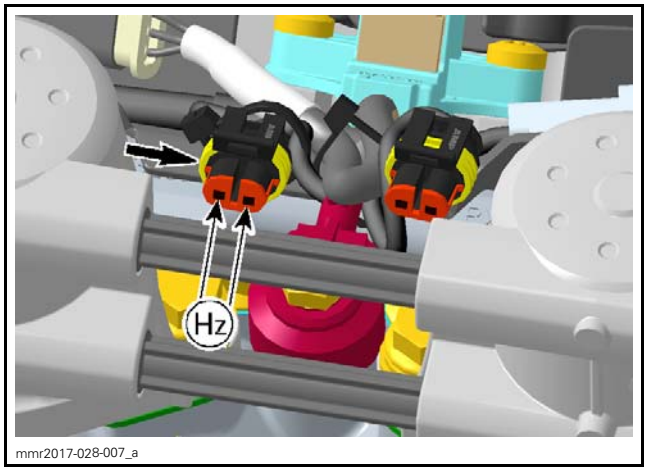
DC VOLTS AND MANUAL RANGE 6 SELECTED

5. Press the Hz button so that the display shows Hz.
6. Activate fuel injector and read the frequency on the multimeter.

NOTE: The multimeter counts the pulses per second (Hertz) of current the ECM sends to the fuel injector.

FUEL INJECTOR CONNECTOR		MEASUREMENT
Pin 1	Pin 2	Approximately 2 Hz



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FUEL INJECTOR WIRING HARNESS CONNECTOR

If there is no reading, check continuity of wiring between ECM and fuel injector connector.

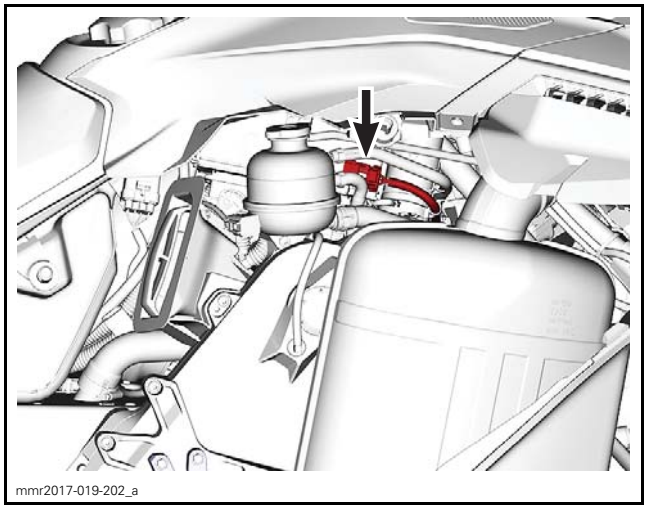
If you hear the injector click, control circuit is good.

If reading is good, the control circuit is functional.

Removing the Fuel Injector

IMPORTANT: NEW O-rings, retaining screws, and crush ring must be installed if fuel injector is removed (fuel injector disassembly required). Otherwise, leakage or damage to fuel injector/cylinder head might occur.

1. Release the fuel pressure in the system. Refer to *FUEL TANK AND FUEL PUMP* subsection.
2. Disconnect magneto connector (3-pin connector). Refer to *Stator Connector Access* in *MAGNETO AND STARTER* subsection.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3. Remove upper body module.
4. Remove engine cover.

⚠ WARNING

The magneto connector must be disconnected to prevent any spark in the engine compartment should the engine be cranked. Fuel vapors may ignite in presence of a spark creating a fire hazard.

5. Clean fuel injector area.

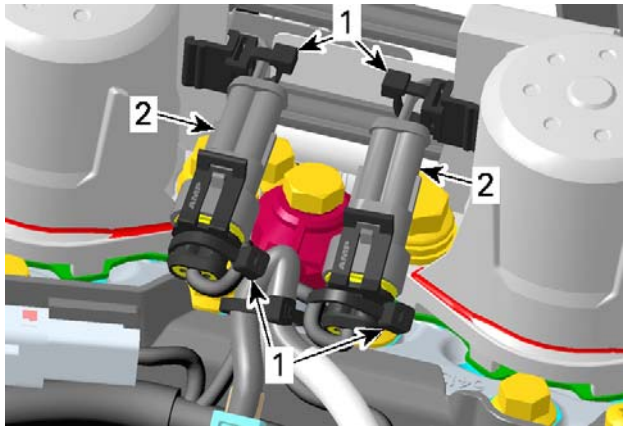
NOTICE If fuel pressure is not released, the pressure will push the fuel injector out of its housing when removing the fuel injector. This could damage the fuel injector and lead to an important fuel spill.

⚠ WARNING

Fuel vapors in the engine compartment could be lit by a spark. This might create a fire.

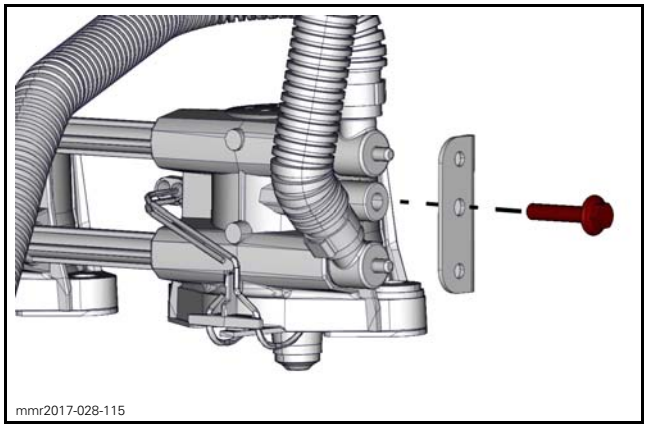
6. Disconnect fuel injector connectors.

NOTE: Locking ties must not be removed.

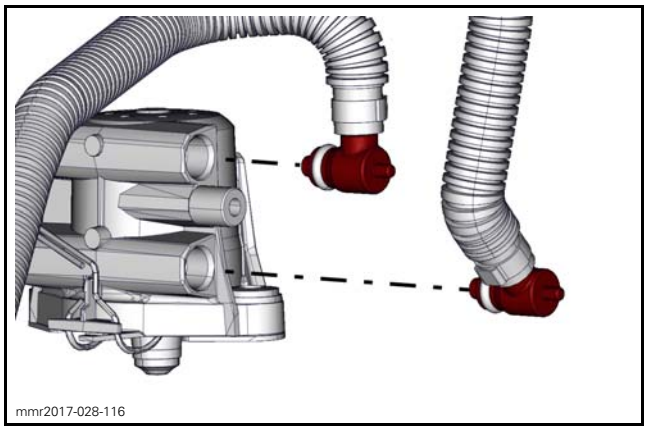


1. Locking ties
2. Fuel injector connectors

7. Install a rag under the hose ends to catch fuel spillage.
8. Remove fuel hose retainer screw and retainer.



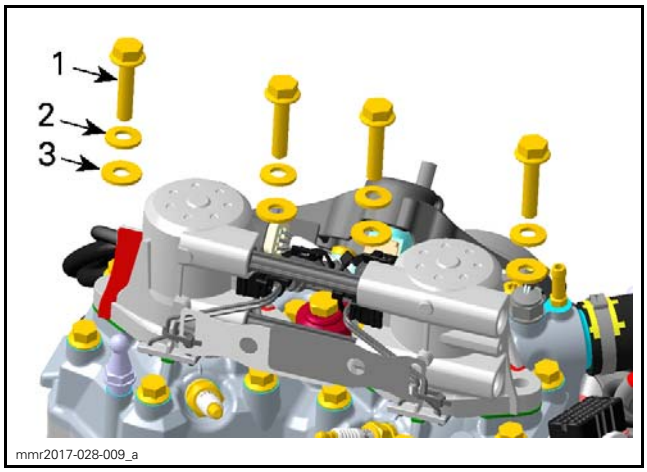
9. Disconnect fuel hoses from fuel injector.



⚠ WARNING

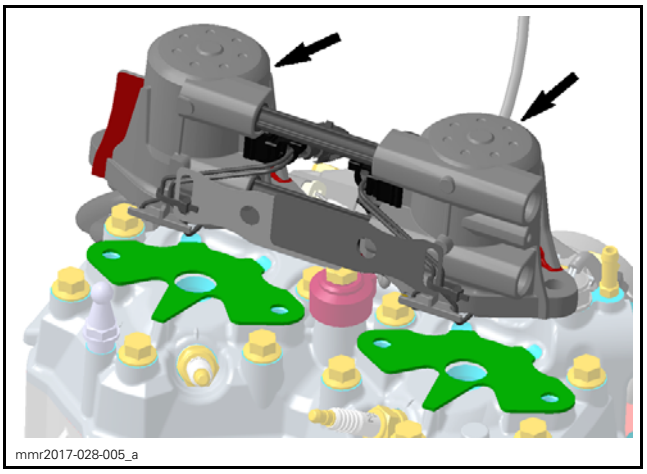
More fuel than usual will flow out of the fuel injectors. Work in a well ventilated area and wipe up spilled fuel.

10. Remove and discard:
    - Fuel injector screws
    - Spring washers
    - Washers.



1. Fuel injector screw
2. Spring washer
3. Washer

11. Gently pull up on the fuel injectors to remove them.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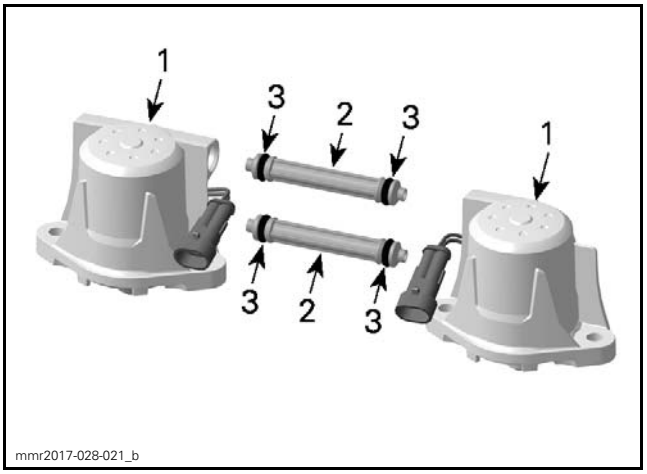
NOTICE Use caution when handling fuel injector. Never hold injector by its electrical wires. Prevent dirt and debris from entering fuel inlet and outlet ports of fuel injectors or fuel hoses. Cover the fuel injector nozzle port in cylinder head to prevent contamination of combustion chamber.

12. Separate fuel injectors and connecting tubes. Remove and discard O-rings.



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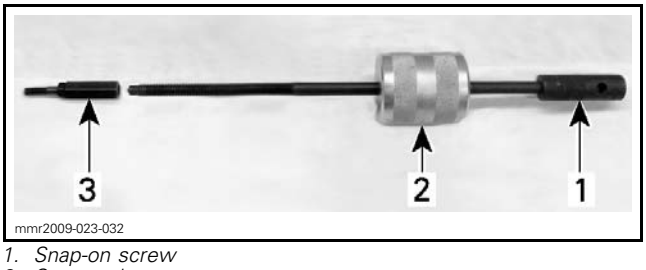
1. *Fuel injectors*
2. *Connecting tubes*
3. *O-rings*

Disassembling the Fuel Injector

REQUIRED TOOL	
SNAP-ON SCREW (P/N CJ93-1)	
SNAP-ON HAMMER (P/N CJ125-6)	
EXTRACTOR ADAPTOR (P/N 529 036 136)	

1. Install the extractor adapter on the Snap-on screw.



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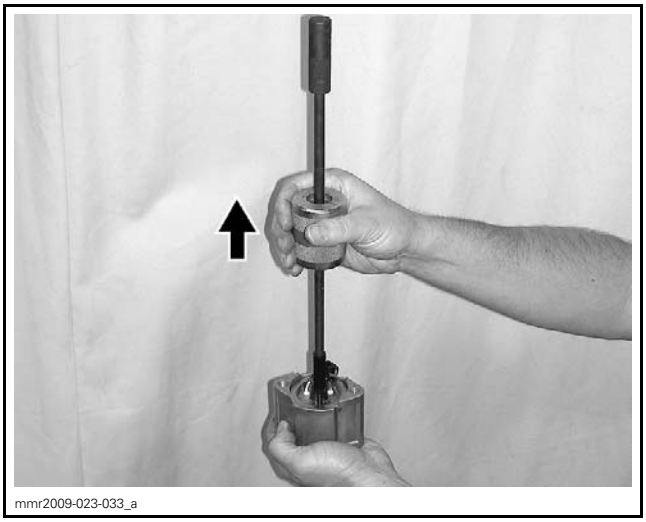
1. *Snap-on screw*
2. *Snap-on hammer*
3. *Extractor adapter (P/N 529 036 136)*

2. Thread the extractor adapter into the fuel injector.
3. Securely hold the fuel injector housing upside down to avoid dropping it.
4. Work slide hammer to pull the fuel injector out.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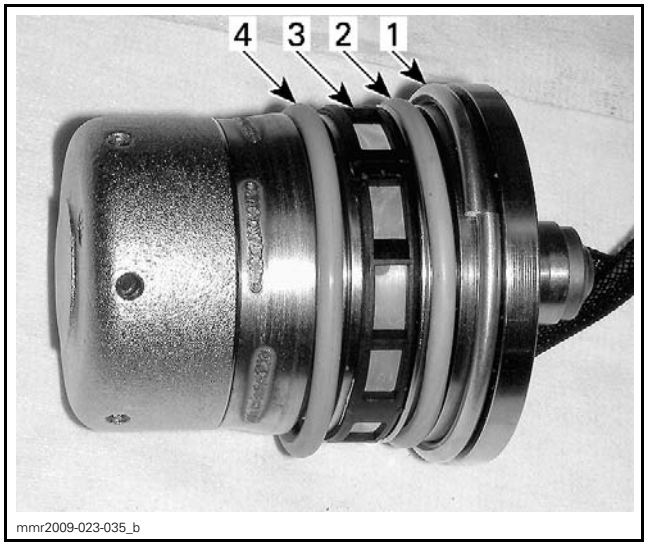
5. Remove the extractor adaptor from the fuel injector.
6. Remove O-rings, crush ring and filter from the fuel injector.



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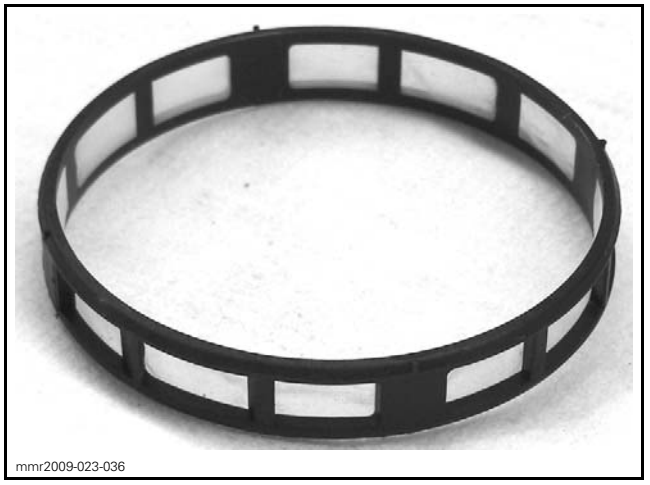
1. Crush ring
2. ORANGE O-ring
3. Filter
4. BLUE O-ring

7. Inspect and clean fuel injector filter.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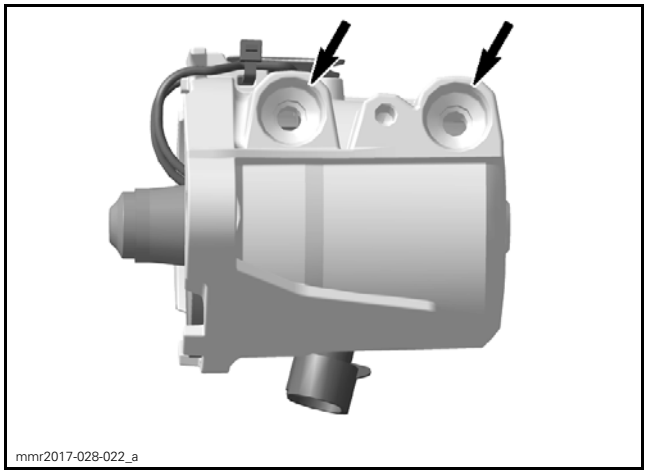
8. Clean connecting tube bores in injector housing.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Assembling the Fuel Injector

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

Lubricate O-rings.

O-RINGS LUBRICATION	
Service product	Injection oil

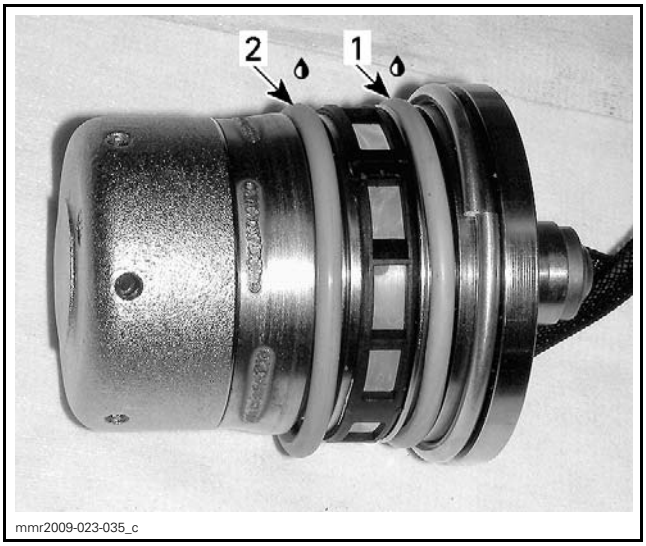
Install a NEW crush ring.

Install a NEW orange O-ring on top.

NOTICE **Always use the O-rings specifically designed for these fuel injectors.**

Install filter. Ensure filter is retained firmly on fuel injector. Otherwise, remove it, invert it half a turn, then reinstall. If it still not retained securely, install a new one.

Install a NEW blue O-ring at bottom.

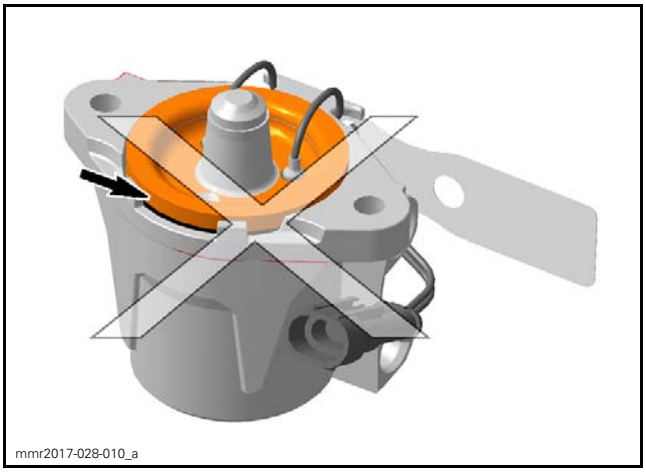


OIL INJECTION ON O-RINGS
1. *ORANGE*
2. *BLUE*

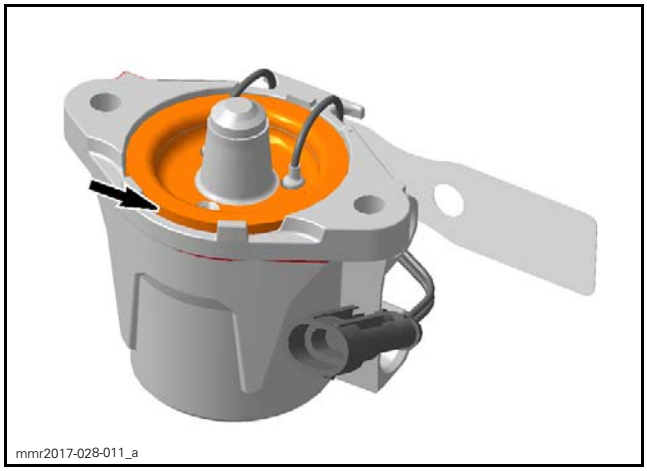
Reinstall fuel injector in its housing.

NOTE: Be sure to fully insert fuel injector in the housing with the wire outlets towards the fuel ports.

NOTICE Never press or tap the fuel injector tip.

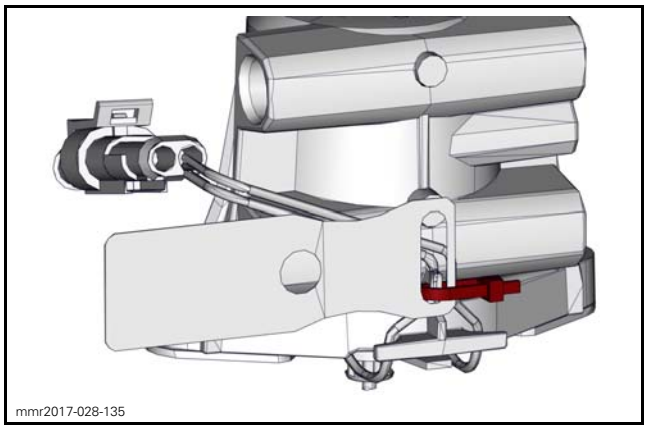


WRONG INSTALLATION



CORRECT INSTALLATION

Reinstall locking tie.



Installing the Fuel Injector

The following items and their mating surfaces must be cleaned and inspected prior to assembly:

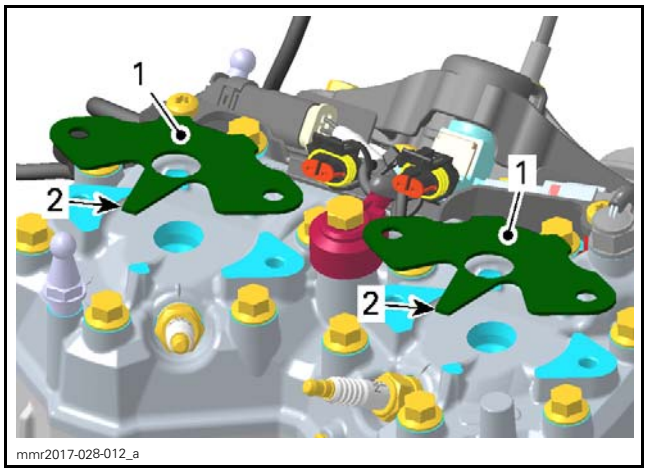
– Fuel Injector
– Cylinder head: fuel injector housing and fuel injector tip contact surfaces
– Fuel injector screw threads and cylinder head threads (must be dry).

NOTICE All fuel injector components must be clean to ensure correct torque tightening specifications and to avoid leakage. Carefully follow the installation instructions.

NOTE: When installing a used fuel injector, reinstall the fuel injector in the same location. If it was not marked at removal, verify the correct fuel injector-cylinder match using BUDS2 Refer to *FUEL INJECTOR POSITION VALIDATION*.

1. Position the NEW gaskets on cylinder head.

NOTICE Smooth surface of gasket must face toward injector housing.



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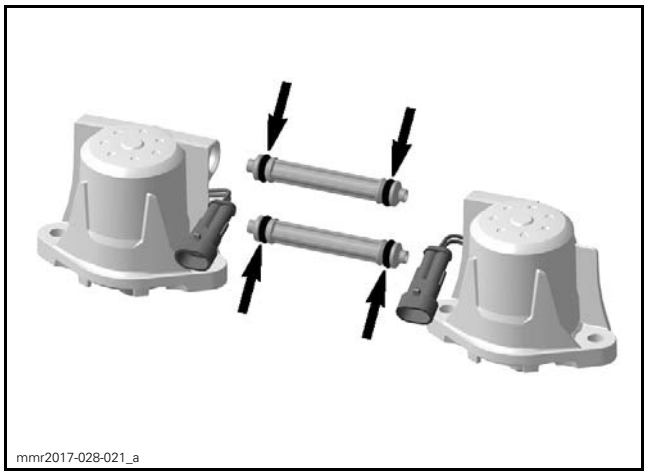
1. *Smooth surface of gasket*
2. *Tab facing towards intake side*

2. Install NEW O-rings on connecting tubes.
3. Lubricate O-rings and pre-assemble fuel injectors and connecting tubes.

O-RINGS LUBRICATION	
Service product	Injection oil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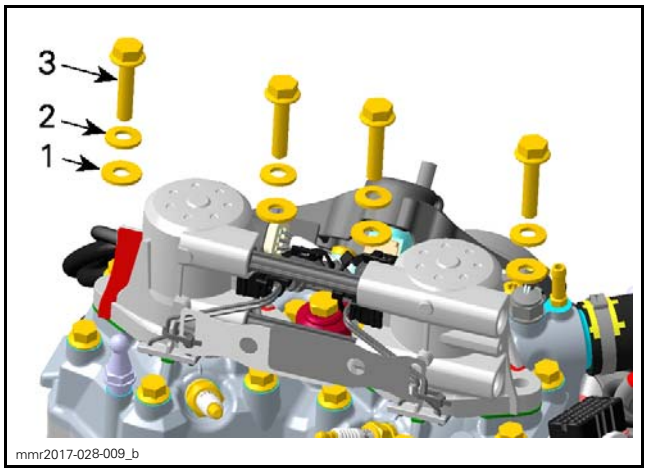
LUBRICATE O-RINGS

4. Place the fuel injectors on the cylinder head, then thread in NEW screws with NEW washers.



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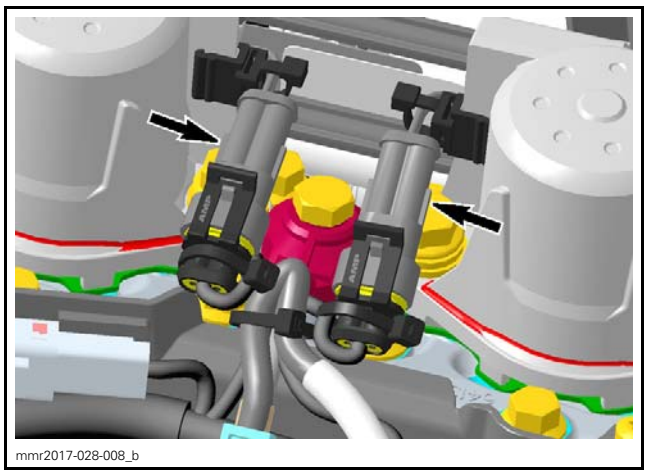
1. *Washer*
2. *Spring washer*
3. *Fuel injector screw*

5. Tighten fuel injector retaining screws alternately in the following procedure:

TIGHTENING PROCEDURE		
Fuel injector retaining screws	Step A	7 N•m ± 0.5 N•m (62 lbf•**in** ± 4 lbf•**in**)
	Step B	20 N•m ± 0.6 N•m (15 lbf•ft ± 0 lbf•ft)
	Step C	35 N•m ± 1 N•m (26 lbf•ft ± 1 lbf•ft)

6. Install both fuel injector connectors between the fuel injectors.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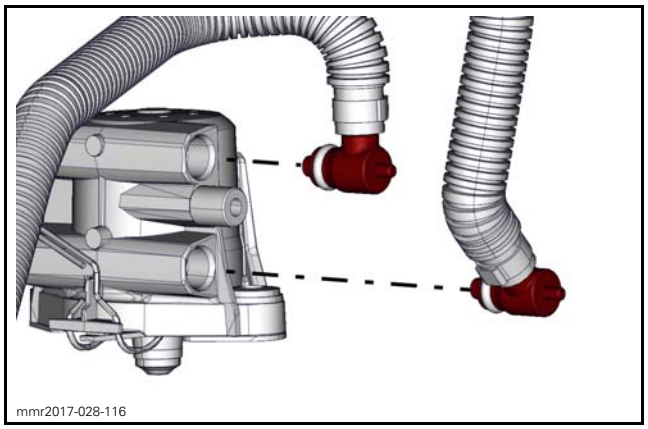
7. Check condition of fuel hose O-rings and plastic flange on hose fittings.
8. Apply injection oil on O-rings.
9. Insert fuel hoses in fuel injector housing.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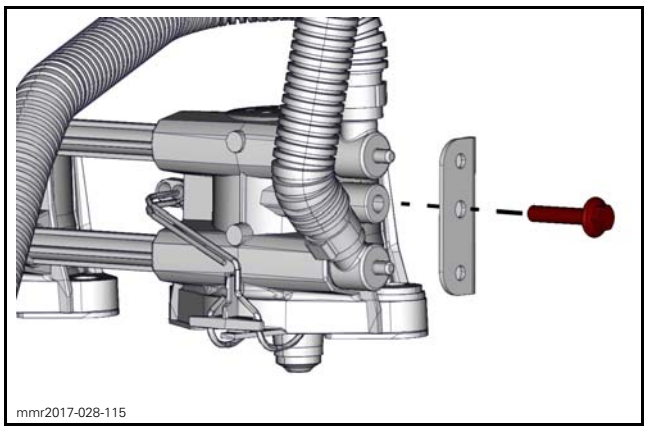
NOTE: Both hose fittings must be fully seated in the fuel injector housing.

10. Insert the hose retainer so that it engages the groove in the fuel injector fittings.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NOTE: Ensure open end of retainer that locks in the fuel hoses faces inboard. The hole in the hose retainer used to secure the injector wiring must be on top for the PTO injector, and on the bottom for the MAG injector.

11. Install a NEW screw to secure hose retainer.

NOTICE **The screw features a scotch grip threadlocker coating that is destroyed when loosening screw. Always replace screw with a new one each time it is loosened.**

TIGHTENING TORQUE	
fuel hose retainer screw	5 N•m (44 lbf•**in**)

12. Secure fuel injector wiring using a NEW locking tie.
13. Grease fuel injector connector.

FUEL INJECTOR CONNECTOR LUBRICATION	
Service product	DIELECTRIC GREASE (P/N 293 550 004)

14. Reconnect fuel injector connector.

NOTICE **Never fasten the electrical connector to the fuel injector. The connector must be "free floating".**

15. If installing a NEW fuel injector, use BUDS2 to configure it in the ECM. Refer to *SETTING A FUEL INJECTOR TO A CYLINDER*.

NOTE: The engine will be able to run with an improperly matched fuel injector. However, the engine may misfire, run rough at idle, have poor fuel economy or run lean.

⚠ WARNING

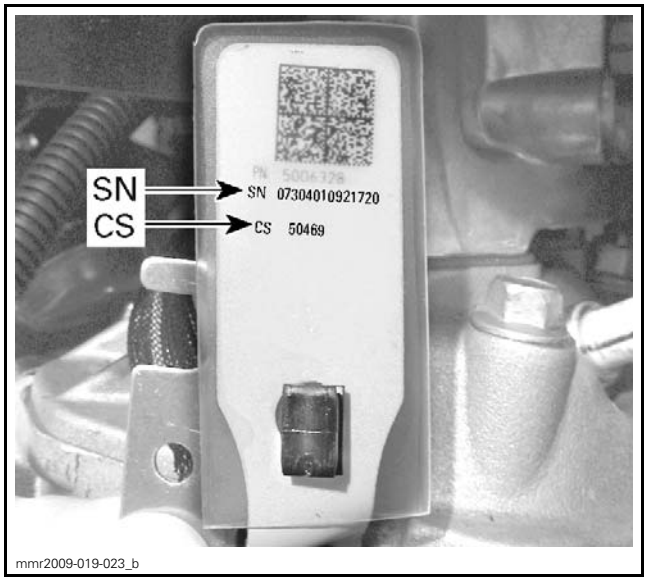
Perform a fuel pressure test and make sure there is no leak.

Fuel Injector Position Validation

When troubleshooting or reinstalling a fuel injector, the correct matching of the fuel injector and cylinder must be confirmed using BUDS2 An incorrect match between the fuel injector and cylinder may lead to engine misfiring, improper idling or poor fuel economy.

NOTE: To configure a new fuel injector at installation, refer to *SETTING A FUEL INJECTOR TO A CYLINDER.*

1. Look for the fuel injector identification tag.
2. Note the fuel injector serial number (SN) on the tag of the fuel injector you want to validate.



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SN: Serial number
CS: Checksum number

3. In BUDS2, navigate to the Settings page.
4. In the Injector Coefficient box, look for the fuel injector serial numbers (S/N) that are registered in the ECM.

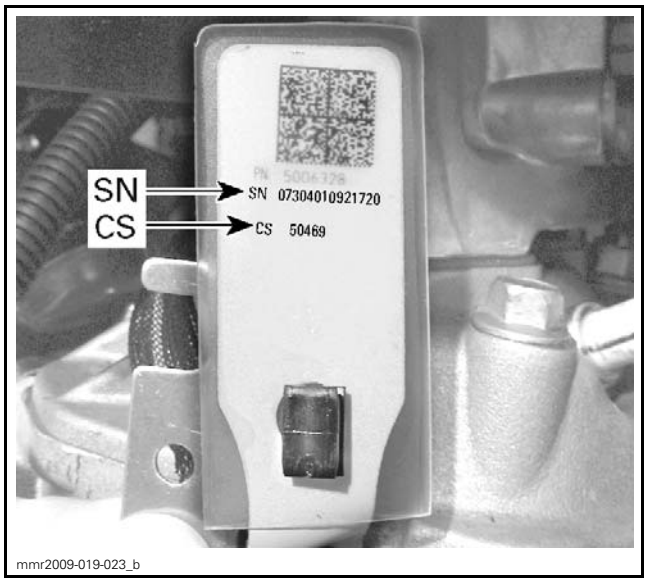
5. Compare the MAG or PTO Injector S/N that is configured in the ECM with the fuel injector SN installed on the engine.

NOTICE The actual fuel injector number (SN) must match the number in BUDS2 (Injector S/N).

If numbers do not match, configure the fuel injector in BUDS2 Refer to *SETTING A FUEL INJECTOR TO A CYLINDER.*

Setting a Fuel Injector to a Cylinder

1. Note the serial number (SN) and the checksum number (CS) on the fuel injector tag.



SN: Serial number
CS: Checksum number

2. Download the E-TEC injector coefficient file from the *COMCENTER* tab in *BOSSWEB.*.

DOWNLOAD INJECTOR COEFFICIENT FILE
Log in to BOSSWeb
Under the COMCENTER tab , click on E-TEC injector coefficient link

3. Start BUDS2 and click on the Scan button.
4. Navigate to the Settings page and Injector Coefficient tabs.
5. In the Injector Coefficient box, click on the New button of the fuel injector you want to replace (MAG or PTO).

NOTE: Every time the New button is clicked, BUDS2 will automatically open the Injector Coefficients folder.

6. Select and open the fuel injector serial number file that matches the fuel injector installed on the engine.
7. Enter the checksum number noted earlier and select Write.

NOTE: The file will be loaded in BUDS2

8. Click the OK button when the confirmation box appears.
9. Click on the Write Data button to save the changes to the ECM.

IMPORTANT: To ensure the proper file has been saved in the ECM, do the following:

10. Click on the Scan button again in BUDS2
11. Look in the Injector Coefficient area in the ECM Setting page.
12. Ensure the S/N in BUDS2 matches the SN of the fuel injector installed on the engine and the PTO/MAG numbers are not inverted.
13. If there is a mismatch, reload the proper configuration file. Write data and read it again to recheck.

FUEL RAIL AND THROTTLE BODY INJECTORS

Testing the Fuel Injector Operation Using BUDS2 (Dynamic)

NOTE: As a first troubleshooting step, always check for applicable fault codes using BUDS2

1. Connect vehicle to BUDS2. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Start engine.
3. Using the BUDS2, shut down fuel injection to each engine cylinder one at a time by clicking on the button under the applicable cylinder.

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 engine and prevent a potential backfire due to fuel accumulation in engine.

1. Set emergency stop switch to RUN.
2. Install a fuel pressure gauge as described in *FUEL TANK AND FUEL PUMP* subsection.
3. Connect vehicle to BUDS2. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
4. In BUDS2, activate fuel pump.
5. Fuel pressure must be within specification. Refer to *FUEL TANK AND FUEL PUMP* subsection. Re-activate fuel pump as necessary.
6. In BUDS2, energize fuel injector no. 1.
7. Record the fuel pressure drop for injector no. 1.
8. In BUDS2, ctivate fuel pump.
9. Repeat the procedure for fuel injector no. 2 and record the pressure drop.
10. The maximum fuel pressure drop between injectors should not exceed the following specification:

MAXIMUM FUEL PRESSURE DROP ALLOWED BETWEEN FUEL INJECTORS
10 kPa (1.5 PSI)

If pressure drop of any fuel injector is greater than the specification, replace that injector then repeat the test.

11. Using the valve on the fuel pressure gauge, release the pressure in the system (if so equipped).
12. Remove fuel pressure gauge and reinstall removed parts.

Testing for Fuel Injector Leaks

Carry out the *TESTING THE FUEL PUMP PRESSURE* as detailed in the *FUEL TANK AND FUEL PUMP* subsection.

Testing the Fuel Injector Activation Using BUDS2

Connect vehicle to BUDS2. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

On the Functions page of BUDS2, energize the fuel injector to be tested.

You should hear or feel the injector functioning. This will validate the injector mechanical and electrical operation.

If the injector does not function, carry out the *TESTING THE FUEL INJECTOR RESISTANCE*.

Testing the Fuel Injector Resistance

Disconnect connector "A" from the ECM. Refer to *WIRING HARNESS AND CONNECTORS*

Check resistance value between terminals as follows.

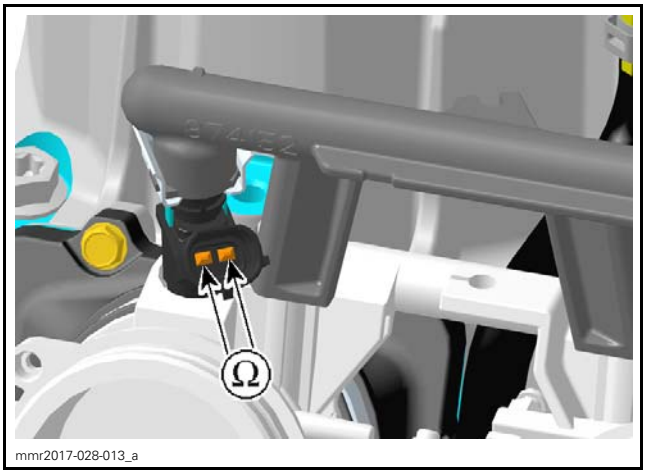
REQUIRED TOOL	
FLUKE 115 MULTIMETER (P/N 529 035 868)	
ECM ADAPTER TOOL (P/N 529 036 166)	

FUEL INJECTOR RESISTANCE TEST AT ECMA CONNECTOR			
INJECTOR	**ECM CONNECTOR "A"**		**RESISTANCE @ 20°C (68°F)**
MAG	ECMA-A3	ECMa_A4	11.4 - 12.6 Ω
PTO	ECMA-A2	ECMA-A1	

If resistance value is as specified, the injector and its circuits are good. Refer to *TESTING FOR FUEL INJECTOR INPUT VOLTAGE* in this subsection.

If resistance value is NOT as specified, remove injector connector and check resistance value between injector pins.

FUEL INJECTOR RESISTANCE TEST AT INJECTOR CONNECTOR			
INJECTOR	**INJECTOR PIN**		**RESISTANCE @ 20°C (68°F)**
MAG	1	2	11.4 - 12.6 Ω
PTO			



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If readings are out of specifications, replace injector.

If readings are good, carry out *TESTING THE FUEL INJECTOR CIRCUIT RESISTANCE*.

Testing the Fuel Injector Input Voltage

Disconnect the fuel injector connector.

NOTE: If the connector is hard to unlock, gently use a screwdriver to release connector.


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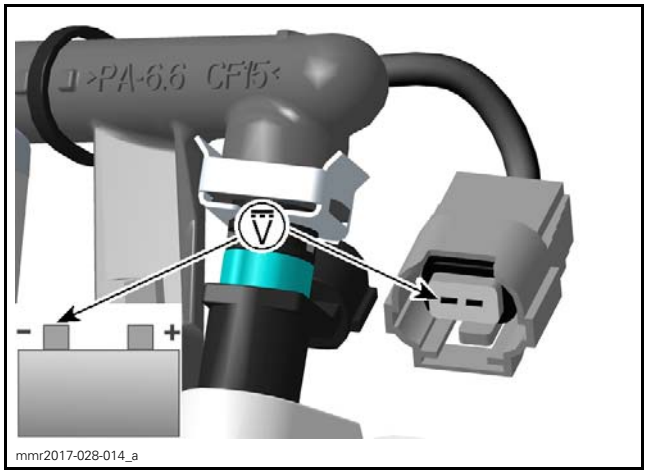
TYPICAL

NOTE: It is not necessary to activate the injector since it is continuously powered when the emergency stop switch is set to RUN and BUDS2 is connected.

Use a multimeter and set it to Vdc. Read voltage.

CYLINDER	INJECTOR CONNECTOR		MEASUREMENT
	INJECTOR PIN		
MAG	Pin 2	Battery ground	Battery voltage
PTO	Pin 2		



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If supply voltage is good:

1. Check if ground circuit is faulty, repair/replace wiring and connectors. Refer to *TESTING THE FUEL INJECTOR CIRCUIT RESISTANCE*.
2. If the ground circuit is good, the injector problem may be mechanical. Replace injector.
3. If injector is good the problem may be in the power distribution system in the ECM (does not provide a ground signal) refer to *PROGRAMMING A NEW ECM*.

If the injector input voltage is good, the injector problem may be mechanical.

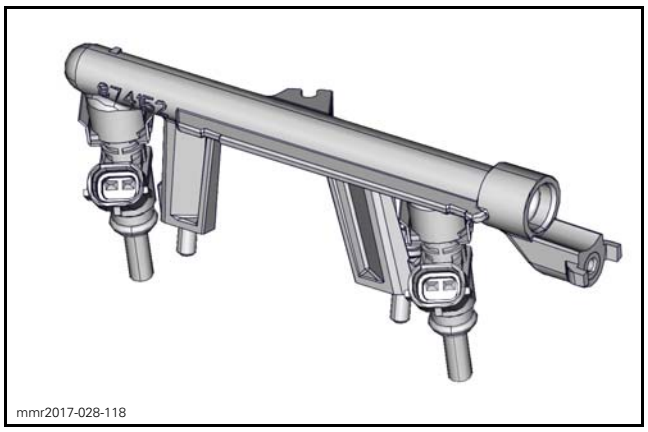
Fuel Rail with Fuel Injectors Access

Remove upper body module. Refer to *BODY* subsection.

Remove engine cover.

Remove primary air intake silencer.

Removing the Fuel Rail with Fuel Injectors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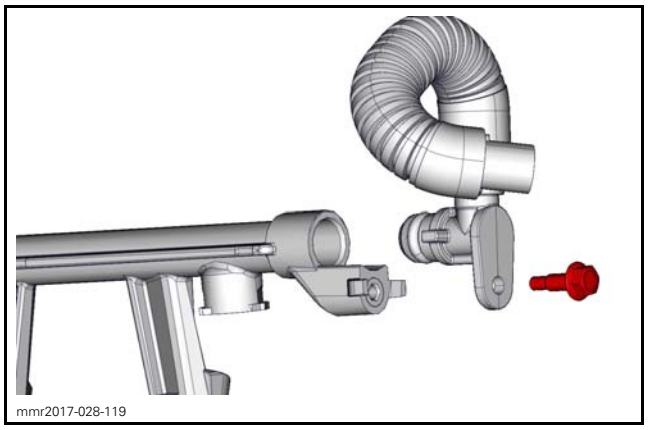
Release fuel pressure from fuel system, refer to *FUEL TANK AND FUEL PUMP* subsection.

Place an absorbent shop rag around the fuel supply hose fitting at the fuel rail to catch any fuel leakage.

Disconnect fuel hose from fuel rail.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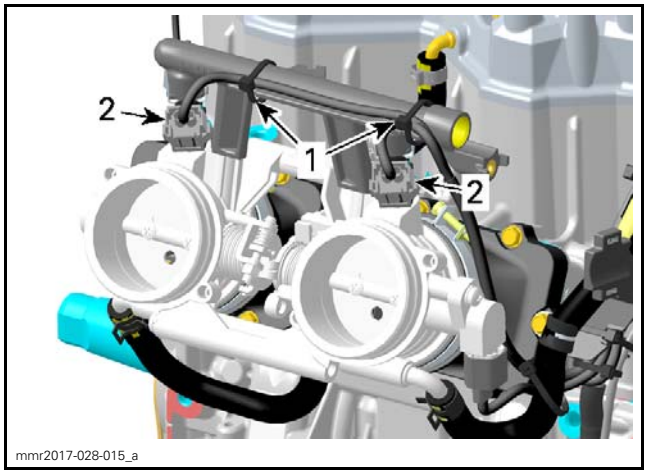
Cut locking ties securing engine harness to fuel rail.

Disconnect fuel injector connectors.



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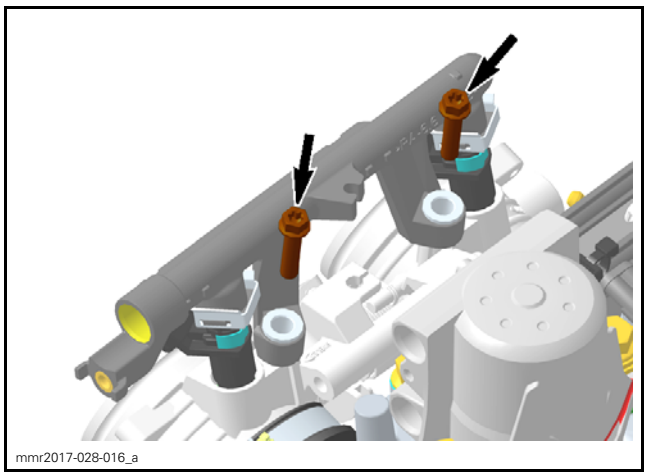
1. *Locking ties*
2. *Injector connectors*

Remove fuel rail retaining screws .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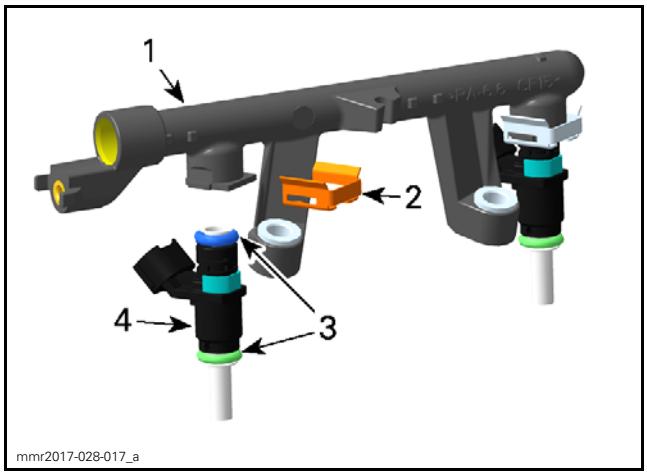
Gently wiggle fuel rail side to side as you pull the fuel rail out with fuel injectors.

Remove the injector retaining clip.

Pull the fuel injector out of the fuel rail and discard the O-rings.



1. *Fuel rail*
2. *Retaining clip*
3. *Fuel injector*
4. *O-rings*

Installing the Fuel Rail and Fuel Injectors

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

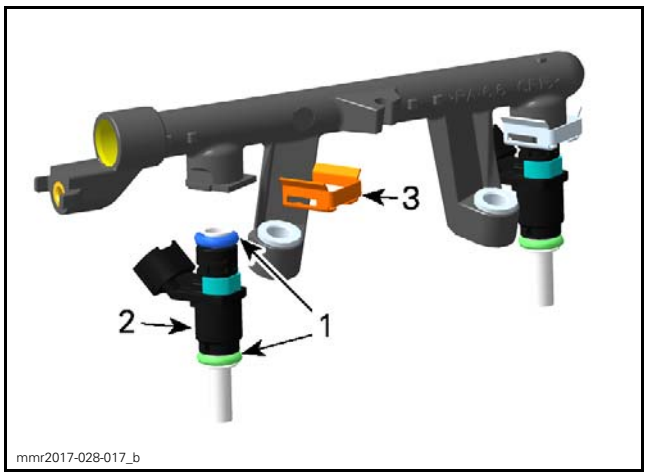
NOTICE **If installing the removed injector(s), always install NEW O-rings.**

Lubricate NEW O-rings to ease insertion in rail.

FUEL INJECTOR O-RINGS	
Service product	Injection oil

Install fuel injector with your hand. Do not use any tool.

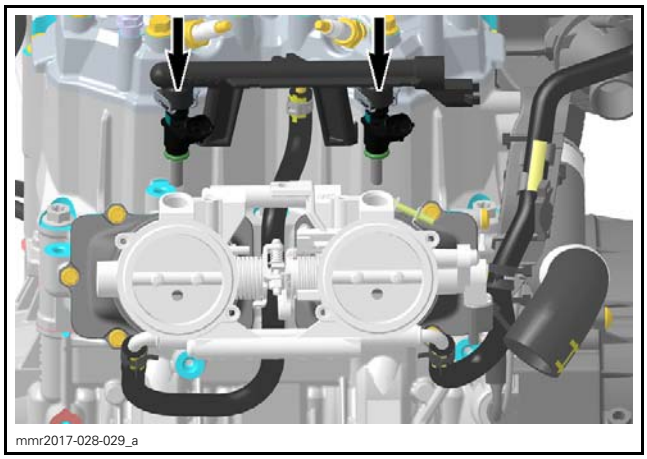
Carefully insert fuel injectors in fuel rail and install injector retaining clips..



1. *O-rings*
2. *Fuel injector*
3. *Retaining clip*

Gently push the fuel rail together with injectors in the throttle body.

NOTICE Pay attention to not damage the O-rings.



Tighten fuel rail retaining screws.

TIGHTENING TORQUE	
Fuel rail retaining screws	8 N•m ± 0.5 N•m (71 lbf•**in** ± 4 lbf•**in**)

Connect fuel pressure hose to fuel rail.

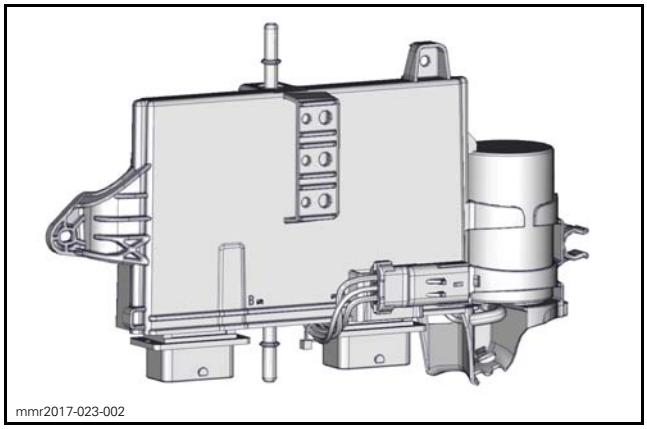
Pressurize the fuel system and check for fuel leaks. Refer to *FUEL TANK AND FUEL PUMP* subsection.

⚠ 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.

Reinstall all remaining removed parts.

ECM (ENGINE CONTROL MODULE)



ECM

NOTE: Prior to replacing an ECM, carry out all testing procedures.

Troubleshooting ECM Power Supply

Verifying System Voltage

Set emergency stop switch to RUN.

Connect vehicle to BUDS2. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

In BUDS2, navigate to the Measurements screen

View high voltage system circuit voltage.

Start or crank engine while viewing System Voltage.

TEST CONDITION	VOLTAGE
Manual crank speed	30 Vdc min.
Engine running	55 Vdc

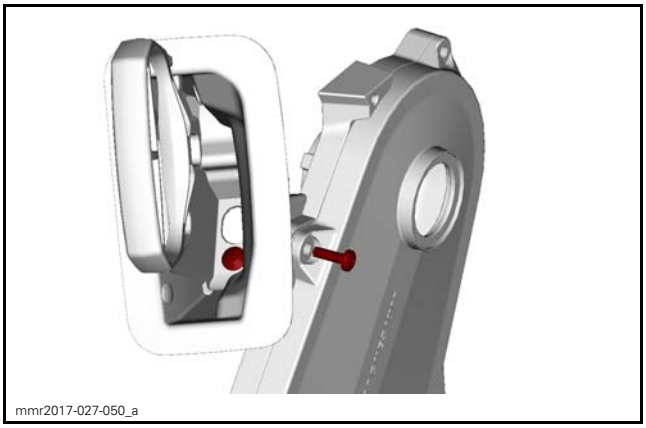
If voltage is as per specification, ECM is properly powered.

If voltage is out of specification, refer to *CHARGING SYSTEM*.

Removing the ECM

Save a BUDS2 File.

1. Set emergency engine stop switch to STOP.
2. Remove upper body module. Refer to *BODY* subsection.
3. Move rewind starter handle assembly (applicable models).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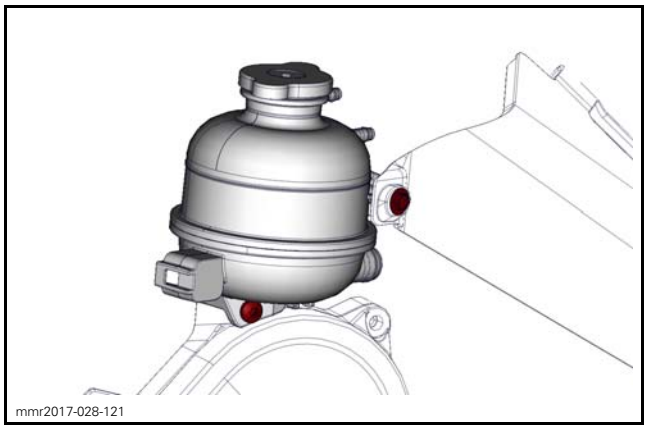
4. Detach coolant tank from its support.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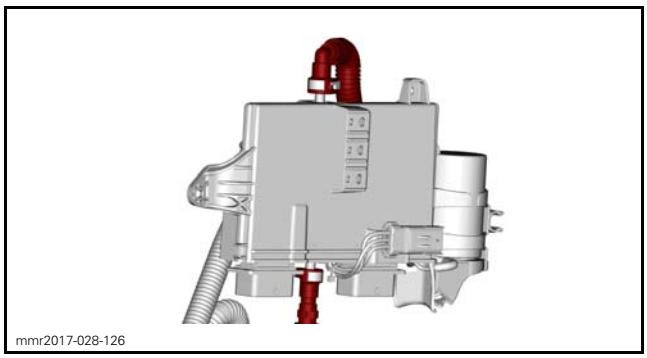
5. Install a rag under the ECM fuel hose quick connect to catch fuel spillage.
6. Place a container under the hose connector to recover fuel.
7. Slowly disconnect fuel both hoses from ECM and drain fuel.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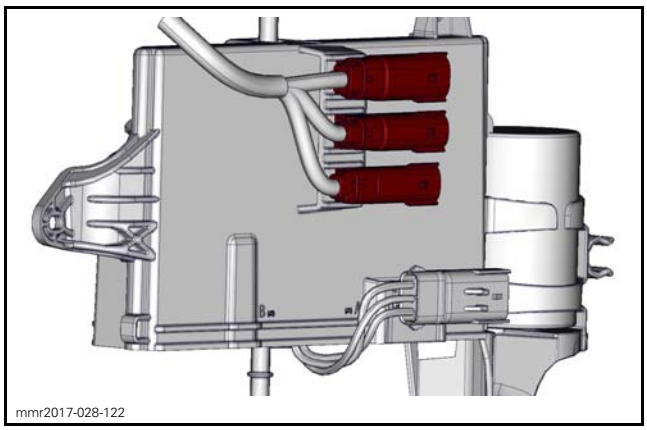
8. Disconnect magneto, ECMA, and ECMB connectors. Refer to *WIRING HARNESS AND CONNECTORS*.
9. Remove connectors from ECM housing.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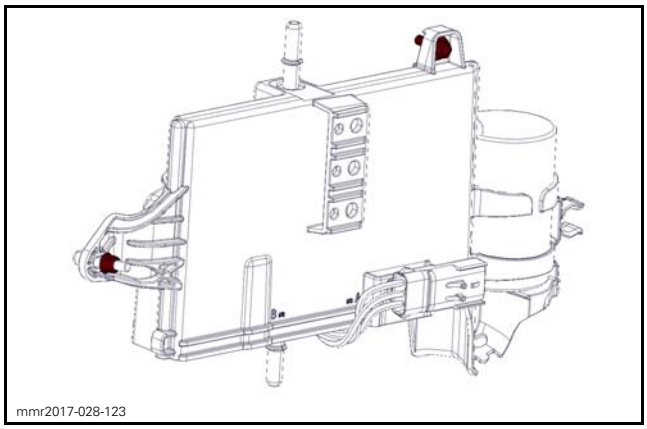
10. Remove ECM retaining screw and nut.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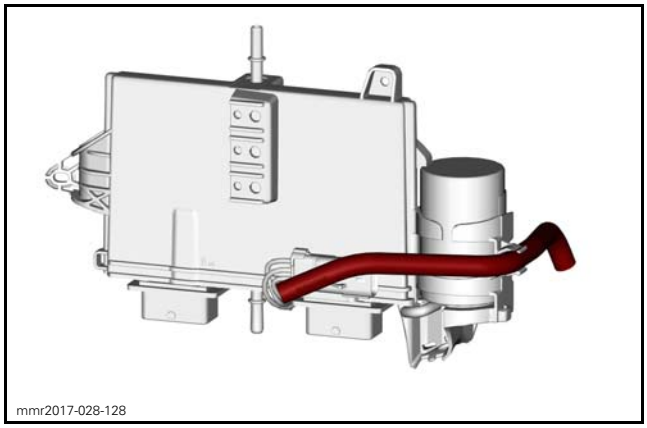
11. Move coolant hose.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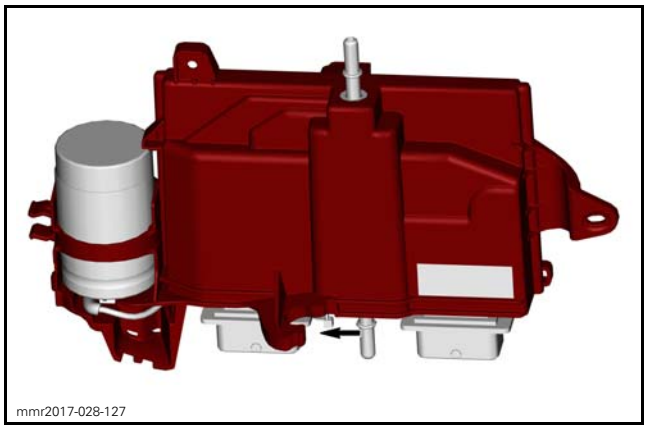
12. Carefully slide ECM forwards to unhook clip behind ECM.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13.

14. Remove. Cut locking ties as applicable.

Installing ECM

Reverse removal procedure however, pay attention to the following.

⚠ WARNING

Wipe up all spilled fuel.

Set engine stop switch to RUN.

Install tether cord cap on engine cut-off switch.

Transfer or enter data in new ECM. Refer to *PROGRAMMING A NEW ECM* in this subsection.

Programming a New ECM

There are 2 possible methods to manually collect the required information. The 1st being the easiest.

– Use BUDS2 software and obtain the data from a saved file on your PC computer.
– Collect the information from the vehicle and obtain the fuel injector coefficient files from Knowledge Center.

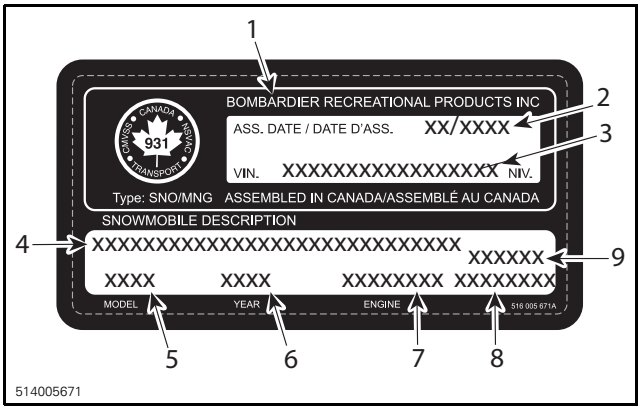
1. Remove the faulty ECM, refer to *REMOVING ECM* in this subsection.
2. Install and connect the new ECM, refer to *INSTALLING ECM* in this subsection.
3. Connect vehicle to BUDS2 version and log on. Refer to *COMMUNICATION TOOLS AND BUDS2* subsection.
4. Click on the Scan button.
5. Navigate to the Summary page and Healthtab.
6. Initiate the new ECM and perform any required updates
   6.1 Enter vehicle model number
   6.2 Follow instructions in BUDS2.

NOTE: If you were not able to save a BUDS2 file, refer to *COLLECT THE INFORMATION FROM THE VEHICLE* to get the required information.

7. Refer to the saved BUDS2 file and write the following information to the Settings page
   7.1 Keys
   7.2 Oil pump offset
   7.3 Ignition timing offset. Refer to *IGNITION SYSTEM*
   7.4 Injector coefficient. Refer to *SETTING A FUEL INJECTOR TO A CYLINDER*
   7.5 RAVE setting
   into the new ECM.
8. Check the Settings page and Options tab to ensure options and any accessories are entered.
9. Perform the *CLOSED THROTTLE RESET (TPS)* procedure in this subsection.

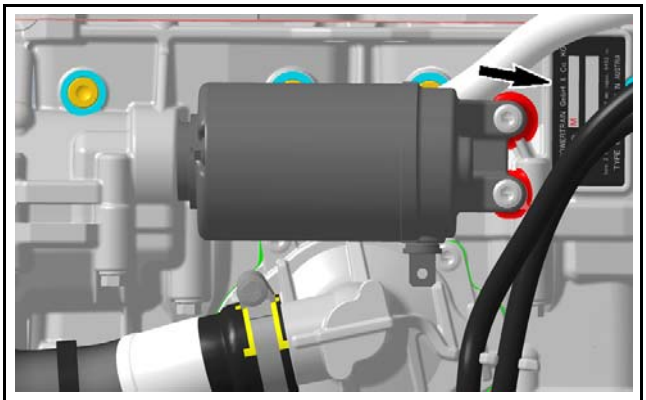
Collect the Information from the Vehicle

1. Record model number.



VEHICLE DESCRIPTION DECAL
1. *Manufacturer name*
2. *Manufacturing date*
3. *Vehicle identification number (VIN)*
4. *Model and package name*
5. *Model number*
6. *Model year*
7. *Engine type*
8. *Vehicle weight (European models)*
9. *Vehicle engine power (European models)*

NOTE: If prompted to enter engine serial number, it can be found on the cylinder block.



CYLINDER BLOCK, EXHAUST SIDE

2. Record oil injection pump code.

BACK OF OIL INJECTION PUMP
1. *Oil pump code (0 to 9)*

3. Record MAG/PTO injector S/N and Checksum numbers.

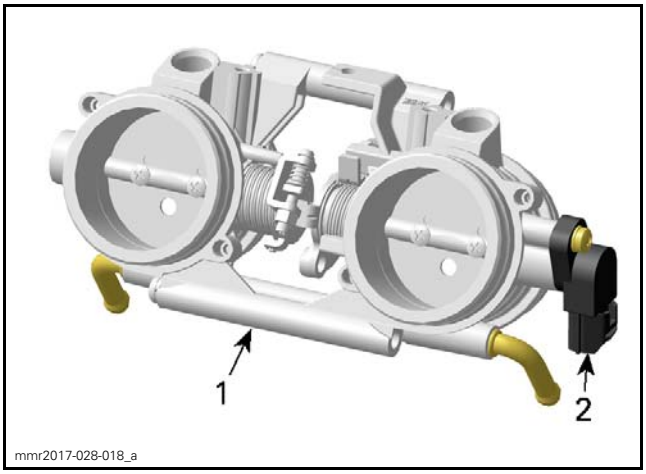
Record the serial number (SN) and the checksum (CS) on the fuel injector tag.

SN: Serial number
CS: Checksum number

Use the BOSSWeb Com Center tab to download the matching injector coefficient file.

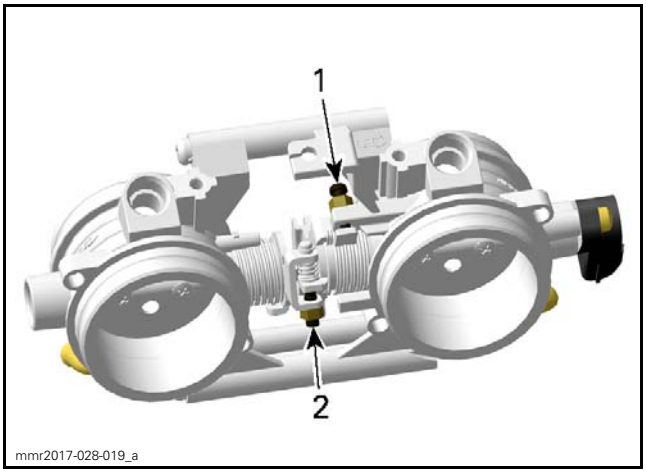
Save the calibration file to your PC computer in the folder:

THROTTLE BODY



1. *Throttle body*
2. *TPS (Throttle position sensor)*

Throttle Body Screw Identification



1. *Master zero position screw (capped)*
2. *Synchronizing screw (capped)*

NOTICE Do not tamper with any capped screw. Otherwise, throttle body may have to be replaced.

Inspecting the Throttle

- Ensure throttle plates move freely and smoothly when depressing throttle lever.
- Ensure throttle body master zero position screw is NOT loose. If so, replace throttle body.
- Ensure that the master zero position screw stops the throttle plate.
- Ensure TPS is NOT loose.
- Check for corroded or damaged wiring or connectors.

Throttle Body Access

⚠ WARNING

Always remove tether cord cap (D.E.S.S. key) before removing the throttle body.

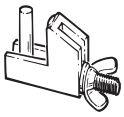
1. Remove upper body module. Refer to *BODY* subsection.
2. Remove engine cover.
3. Remove primary intake silencer. Refer to *AIR INTAKE SILENCER* subsection.

Removing the Throttle Body

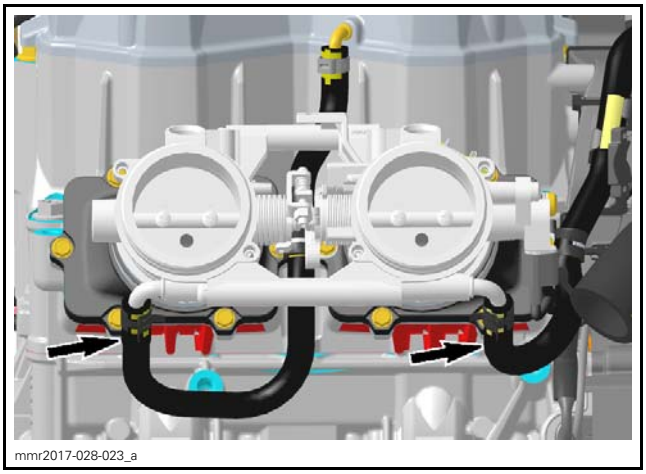
⚠ WARNING

Always remove tether cord cap (D.E.S.S. key) before removing the throttle body.

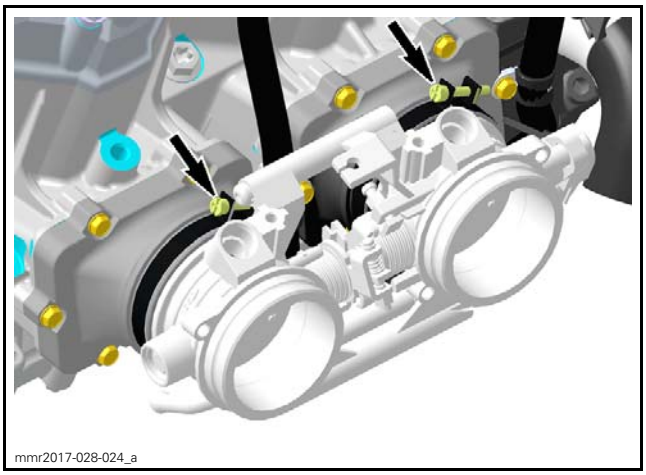
1. Remove fuel rail with fuel injectors and put it aside, refer to *FUEL RAIL AND THROTTLE BODY INJECTORS* in this subsection.
2. Block coolant hoses of throttle body heating.

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

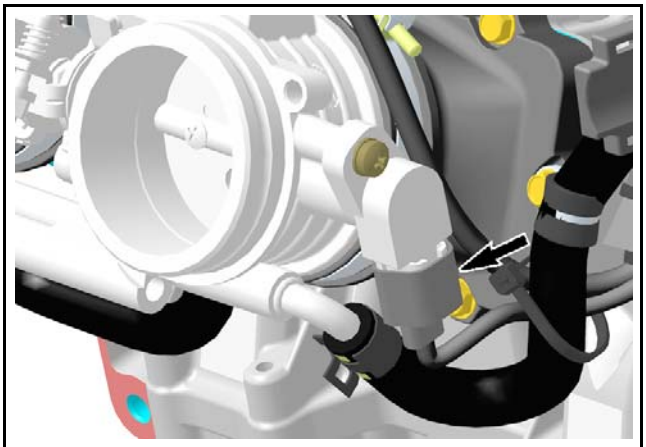
3. Remove coolant hoses from throttle body.



4. Loosen clamps retaining throttle body.



5. Disconnect TPS connector.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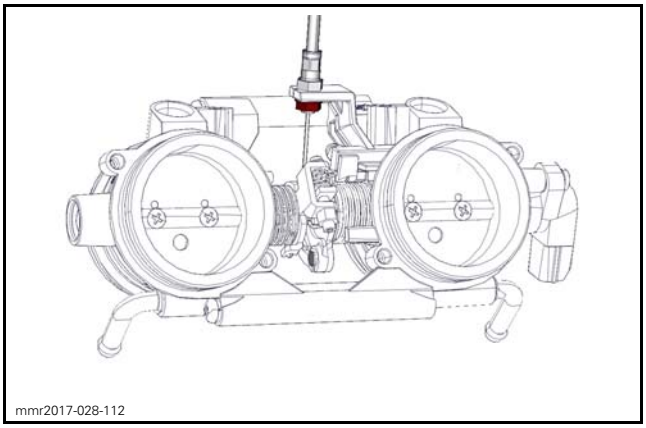
6. Disconnect throttle cable.
7. At throttle body, fully unscrew cable lock nut.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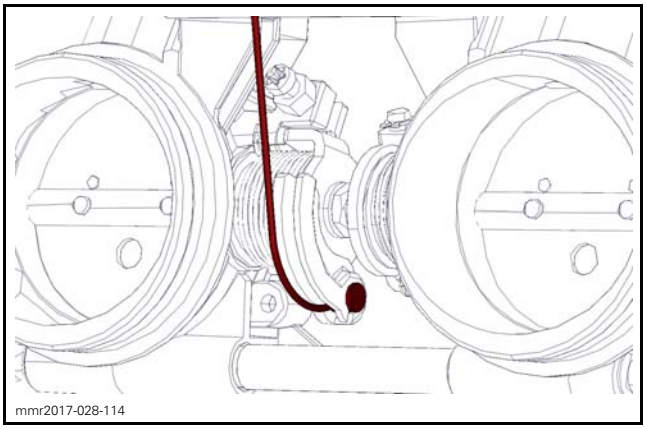
THROTTLE CABLE LOCK NUT

8. Unhook throttle cable end.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9. Remove throttle cable.
10. Remove throttle body from vehicle.

Installing the Throttle Body

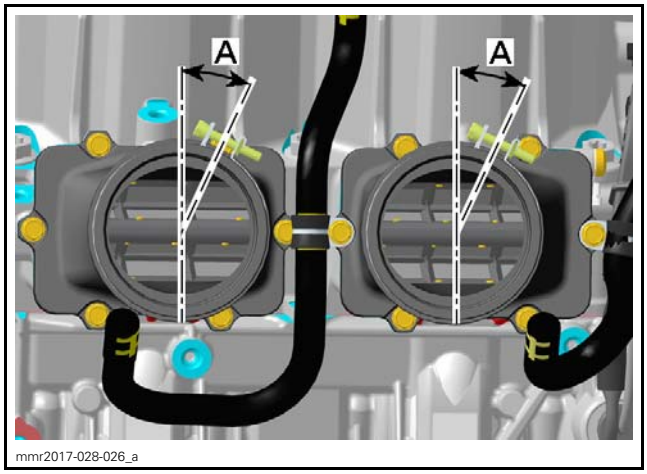
1. If installing the removed throttle body, clean throttle plates and bores before installation.

THROTTLE BODY CLEANING	
Service product	PULLEY FLANGE CLEANER (P/N 413 711 809)

2. Install cooling hoses on throttle body.
3. Remove hose pinchers.
4. Connect TPS connector.

NOTICE **Ensure TPS connector tab is properly locked.**

5. Install throttle body on intake adapters.
6. Position throttle body clamps and tighten to specification.



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A. 25°

TIGHTENING TORQUE	
Throttle body clamps	1.5 N•m ± 0.2 N•m (13 lbf•**in** ± 2 lbf•**in**)

7. Install throttle cable loosely.
8. Carry out the *ADJUSTING THROTTLE CABLE* procedure as detailed in this subsection.
9. Install fuel rail with fuel injectors and put it aside, refer to *FUEL RAIL AND THROTTLE BODY INJECTORS* in this subsection.
10. If a new throttle body or TPS is installed, carry out the *CLOSED THROTTLE RESET (TPS)* as detailed in this subsection.
11. Refill and bleed cooling system, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
12. Install adapter plate (primary air intake silencer) on throttle body.

TIGHTENING TORQUE	
Adapter plate clamps	0.7 N•m ± 0.1 N•m (6 lbf•**in** ± 1 lbf•**in**)

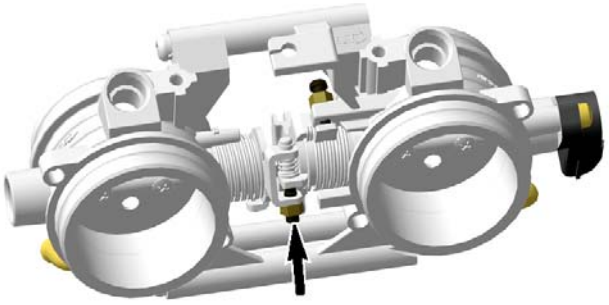
13. Install primary air intake silencer, refer to *AIR INTAKE SYSTEM* subsection.
14. Install all remaining removed parts.

NOTICE **Make sure the TPS wire does not touch the frame. Install locking tie as found from factory.**

Throttle Body Synchronization

No synchronization is required as it has already been done at the factory.

NOTICE **Do not alter synchronization screw setting. Otherwise throttle body must be replaced.**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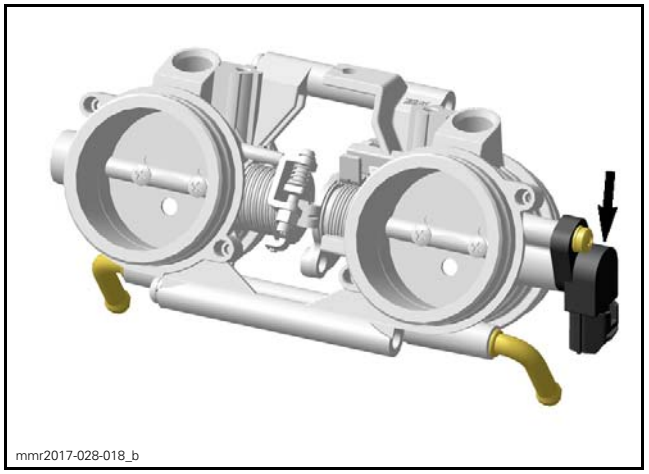
TPS (THROTTLE POSITION SENSOR)

Description

The throttle position sensor (TPS) is a potentiometer that sends a signal to the ECM which is proportional to the throttle shaft angle.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THROTTLE POSITION SENSOR (TPS)

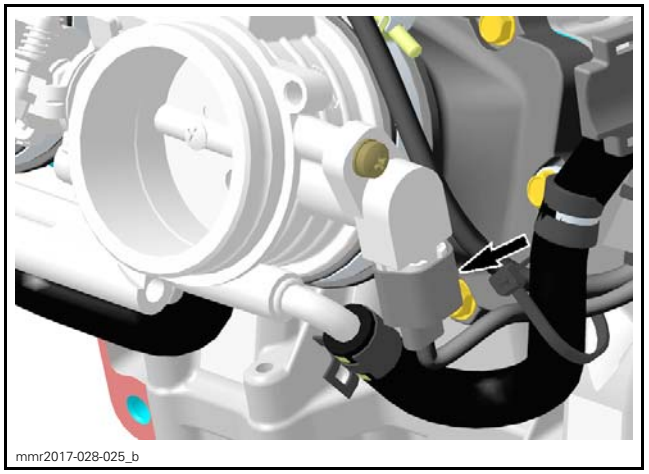
TPS Connector Access

1. Remove upper body module. Refer to *BODY* subsection.

⚠ WARNING

Always remove tether cord cap (D.E.S.S. key) before removing the throttle body.

2. Disconnect TPS connector.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Testing the TPS Wear using BUDS2

1. Ensure TPS connector is properly connected.
2. While engine is not running, activate throttle and pay attention for smooth operation without physical stops of the cable.
3. Use BUDS2 software.
4. Select the Measurements and ECM tabs. Monitor the TPS voltage.and percentage
5. Slowly and regularly depress the throttle.

The values must change gradually and regularly as the throttle is activated. If the values "stick", bounce, suddenly drops off or if any discrepancy

between the throttle movement and the needle movement is noticed, it indicates a worn TPS that needs to be replaced.

Reset TPS (Closed Throttle)

Refer to *RESETTING THE CLOSED THROTTLE VALUE* in the *ADJUSTMENT* topic of this subsection.

Testing the TPS Input Voltage

1. Remove parts required to access TPS connector, refer to *TPS CONNECTOR ACCESS* in this subsection.
2. Connect BUDS2 to power 12 Vdc and 5 Vdc system.
3. Disconnect TPS connector.
4. Read voltage at TPS harness connector as follows.

TPS HARNESS CONNECTOR		VOLTAGE
Pin 3	Pin 2	5.0 Vdc

If voltage is good, carry out *TESTING THE TPS SIGNAL WIRE*.

Testing the TPS Circuit Continuity

Disconnect connector A from ECM, refer to *CONNECTOR INFORMATION* subsection.

Check the wiring continuity as follows.

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

TPS HARNESS CONNECTOR	ECMA CONNECTOR	RESISTANCE
Pin 1	D3	Close to 0 Ω (continuity)
Pin 2	C2	
Pin 3	D2	

If tests are good, replace the TPS.

If tests are not good, continue to check the resistance of the remainder of the TPS circuit.

Testing the TPS Resistance

1. Reconnect the TPS.
2. Disconnect ECMA connector .

ECMA CONNECTOR		THROTTLE IDLE POSITION	WIDE OPEN THROTTLE POSITION
PIN		RESISTANCE Ω	
D3	C2	1140±300	5140±1900
D3	D2	5140±1900	540±300
C2	D2	5000±2000	5000±2000

NOTE: The resistive value should change smoothly and proportionally to the throttle movement. Otherwise, replace TPS.

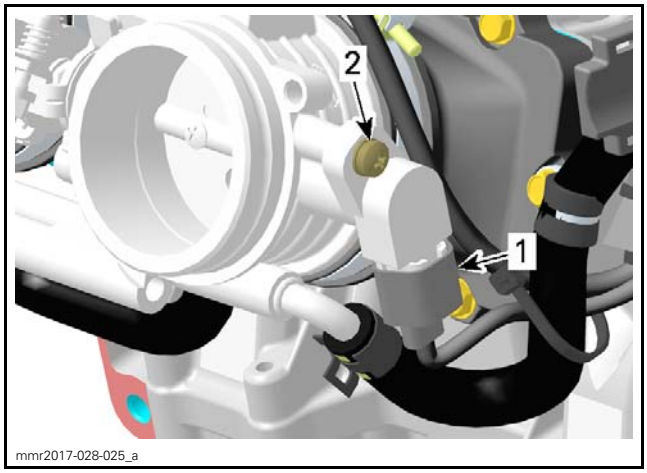
If resistive values are correct, try a new ECM. Refer to *ENGINE CONTROL MODULE (ECM)* elsewhere in this subsection.

If resistive values are incorrect:

– Repair/replace wiring/connectors.
– Replace TPS.

Replacing the TPS

1. Remove the throttle body, refer to *REMOVING THE THROTTLE BODY* in this subsection.
2. Disconnect TPS connector.
3. Remove TPS retaining screw.



1. TPS connector
2. Screw

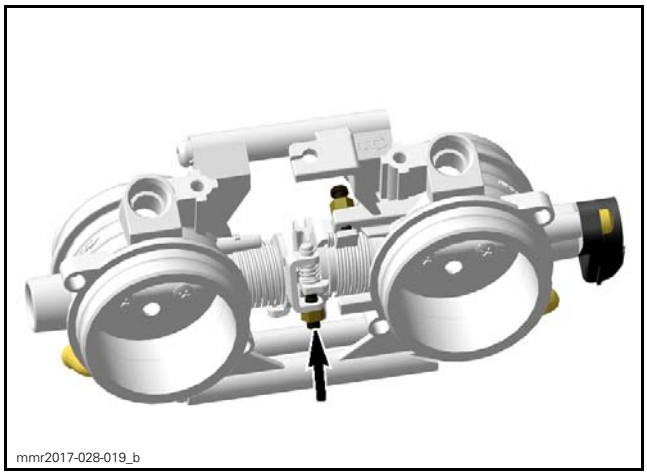
4. Remove TPS.
5. Install new TPS and secure wire with a locking tie.

NOTICE **Make sure the TPS wire does not touch the frame. Install locking tie as found from factory.**

6. Tighten TPS retaining screw to specification.

TIGHTENING TORQUE	
TPS retaining screw	4 N•m ± 0.5 N•m (35 lbf•**in** ± 4 lbf•**in**)

7. Open and quickly release throttle plates 6 times (throttle plates must snap shut).



PUSH TO OPEN THROTTLE PLATES

8. Reinstall remaining removed parts.
9. Reset TPS, refer to *CLOSED THROTTLE RESET (TPS)* in this subsection.

CRANKSHAFT POSITION SENSOR (CPS)

Testing the CPS with BUDS2

1. Connect vehicle to BUDS2. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. In BUDS2, navigate to the Measurements screen
3. Monitor the Engine Speed (RPM) indicator while cranking engine.

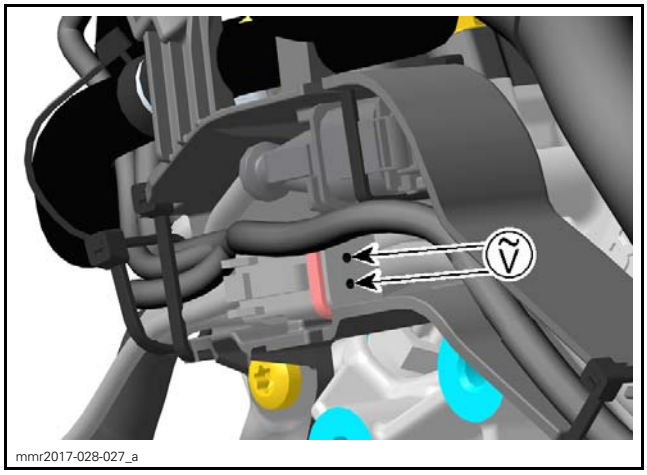
The value should move proportionally to the cranking RPM. If no value movement is observed, test the *CPS OUTPUT VOLTAGE*.

NOTE: A loose CPS or CPS connector can send an intermittent signal that can prevent the engine from starting.

Testing the CPS Output Voltage

1. Disconnect CPS connector (2-pin connector). Refer to *WIRING HARNESS AND CONNECTORS* for connector location.
2. Probe terminals coming from CPS while cranking engine.

CPS CONNECTOR		VOLTAGE
Pin 1	Pin 2	1 - 2 Vac min.



If voltage is out of specification, inspect wiring/connectors. Replace CPS if wiring is good.

Testing the CPS Resistance

1. Disconnect connector ECMA from ECM.
2. Measure the resistance of the sensor through its wiring.

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

ECMA CONNECTOR		RESISTANCE @ 20°C (68°F)
K1	K2	190 - 290 Ω

If measurement is out of specification, check wiring continuity between ECM and CPS.

3. Also check for a shorted connection to ground as per table.

ECMA CONNECTOR		RESISTANCE @ 20°C (68°F)
K1	Engine ground	Open circuit (OL)
K2	Engine ground	

If the previous tests were good, replace CPS.

CPS Replacement

Refer to *MAGNETO AND STARTER* subsection.

3D RAVE VALVES POSITION SENSOR

Refer to *RAVE* subsection.

MANIFOLD ABSOLUTE PRESSURE AND TEMPERATURE SENSOR (MAPTS)

NOTE: This sensor is a multifunction device. It measures ambient absolute pressure and intake air temperature for air flow calculations.

MAPTS Location

The MAPTS is on the secondary air intake silencer.

MAPTS Pressure Function

The sensor measures the ambient atmospheric air pressure. The ambient air pressure is at that moment stored in the ECM.

The sensor must be correctly installed on the secondary air intake silencer. Otherwise, the MAPTS could generate a fault code for an unexpected sensor range at idle when it reads an erroneous 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.

MAPTS Quick Test (Pressure Function)

1. Connect vehicle to BUDS2 Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Navigate to the Measurements page in BUDS2 to view the manifold pressure value.
3. Look for and take note of the MAPTS pressure reading while the engine is stopped.

NOTE: The indicated intake air pressure in BUDS2 must be within 3.4 kPa (.5 PSI) of local atmospheric pressure when the engine is stopped.

MAPTS PRESSURE FUNCTION QUICK TEST			
RESULT	Service action		
NO READING	Circuit Continuity Test of MAPTS Pressure Function	MAPTS Input Voltage Test	Repair or replace wiring
VALUE IS OUT OF RANGE	Replace MAPTS		

4. Perform the same test with a new MAPTS and compare both readings.

MAPTS Input Voltage Test

1. Connect BUDS2. Refer to *COMMUNICATION TOOLS AND BUDS*.
2. Remove electrical connector from MAPTS.
3. Install tether cord cap on engine shut-off switch.
4. Using a FLUKE 115 MULTIMETER (P/N 529 035 868) set to Vdc, measure for MAPTS input voltage as per following table.

MAPTS CONNECTOR		MEASUREMENT
PIN		VOLTAGE
1	3	5 Vdc

If voltage test is good, replace the MAPTS.

If voltage test is not good, carry out the *MAPTS CIRCUIT CONTINUITY TEST (PRESSURE FUNCTION)*.

MAPTS Circuit Continuity Test (Pressure Function)

1. Remove parts required to access ECM connectors, refer to *ECM CONNECTOR ACCESS* in this subsection.
2. Disconnect the ECM-B connector from the ECM and connect it to the ECM adapter tool.

ECM ADAPTER TOOL (P/N 529 036 166)	

3. Using the FLUKE 115 MULTIMETER (P/N 529 035 868) set to Ω and check continuity of the following circuits.

MAPTS CIRCUIT CONTINUITY TEST (PRESSURE FUNCTION)		
ECM-B	MAPTS CONNECTOR	RESISTANCE VALUE
Pin E4	Pin 3	Close to 0 Ω
Pin F3	Pin 4	
Pin F4	Pin 1	

If resistance is not within specification, repair or replace the wiring harness between ECM connector and the MAPTS. Refer to *WIRING DIAGRAM.*

If value is not correct, try a new ECM.

MAPTS Temperature Function

The MAPTS also monitors the temperature of the air in the intake manifold.

MAPTS Quick Test (Temperature Function)

1. Connect vehicle to BUDS2 Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Navigate to the measurements page.
3. Look for the Intake Air temperature reading while the engine is stopped.

NOTE: If the complete vehicle is at room temperature, BUDS2 should display the ambient air temperature at the intake manifold.

4. Perform the same test with a new MAPTS and compare both readings.

If the engine's MAPTS temperature reading is significantly different than the new MAPTS, replace it.

NOTE: Both sensors must feel same ambient air temperature.

If there is no reading, carry out a *TESTING MAPTS RESISTANCE (TEMPERATURE FUNCTION).*

MAPTS Resistance Test (Temperature Function)

1. Disconnect the MAPTS connector.
2. Using the FLUKE 115 MULTIMETER (P/N 529 035 868) set to Ω, test MAPTS resistance at the sensor as per following tables.

MAPTS		MEASUREMENT
PIN		Refer to MAPTS TEMPERATURE SENSOR TABLE
1	2	

MAPTS TEMPERATURE SENSOR TABLE		
TEMPERATURE		RESISTANCE (ohms)
°C	°F	MAPTS
- 40	- 40	40528 TO 56935
- 10	- 14	8103 to 10919
20	68	2193 to 2863
80	176	294 to 368
120	248	98 to 122

If resistance is not within specification, replace the MAPTS.

If resistance tests good, reconnect the MAPTS and proceed with the following steps.

3. Disconnect the ECM-B connector.
4. Install ECM-B connector on the ECM adapter tool.

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

5. Using a multimeter, recheck resistance value as per following table.

ECM ADAPTER		MEASUREMENT
PIN		Refer to MAPTS TEMPERATURE SENSOR TABLE
B2	F4	

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		

MAPTS Circuit Continuity Test (Temperature Function)

MAPTS CIRCUIT CONTINUITY TEST (TEMPERATURE FUNCTION)		
ECM ADAPTER	MAPTS CONNECTOR	RESISTANCE VALUE
Pin F4	Pin 1	Close to 0 Ω
Pin B2	Pin 2	
Pin E4	Pin 3	

Repair or replace wiring as required.

Replacing MAPTS

1. Disconnect MAPTS connector and remove the MAPTS from the intake manifold.
2. Install new MAPTS as per following table.

MAPTS INSTALLATION	
Retaining screw	TORQUE
	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)
Connector	Service PRODUCT
	DIELECTRIC GREASE (P/N 293 550 004)

COOLANT TEMPERATURE SENSOR (CTS)

Testing the CTS with BUDS2

1. Connect vehicle to BUDS2. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. In BUDS2, navigate to the Measurements screen
3. Monitor the Engine temperature indicator. It should show the coolant temperature. Otherwise, perform *TESTING THE CTS RESISTANCE*.

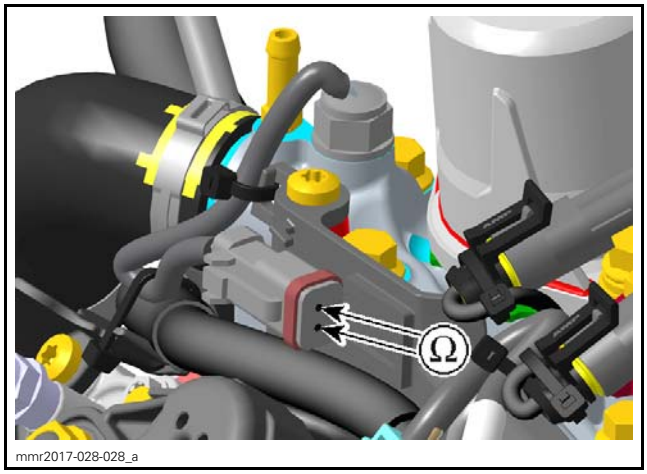
Testing the CTS Resistance

1. Disconnect CTS sensor connector. Refer to *WIRING HARNESS AND CONNECTORS* for connector location.
2. Set multimeter to Ω.

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

3. Measure resistance between sensor terminals.

CTS		MEASUREMENT
Pin 1	Pin 2	Refer to *CTS SENSOR TEMPERATURE TABLE*
Pin 1 or 2	Engine ground	Open circuit (OL)



CTS RESISTANCE CHECK

CTS SENSOR TEMPERATURE TABLE	
TEMPERATURE	**RESISTANCE**
25°C (77°F)	2138 - 2570 Ω
38°C (100°F)	1284 - 1514 Ω
104°C (219°F)	156 - 174 Ω
121°C (250°F)	103 - 115 Ω

If resistance is out of specifications, replace CTS.

If resistance tests good, carry out the following steps.

4. Reconnect the CTS.
5. Disconnect the ECMA connector from ECM.
6. Measure CTS circuit resistance as follows.

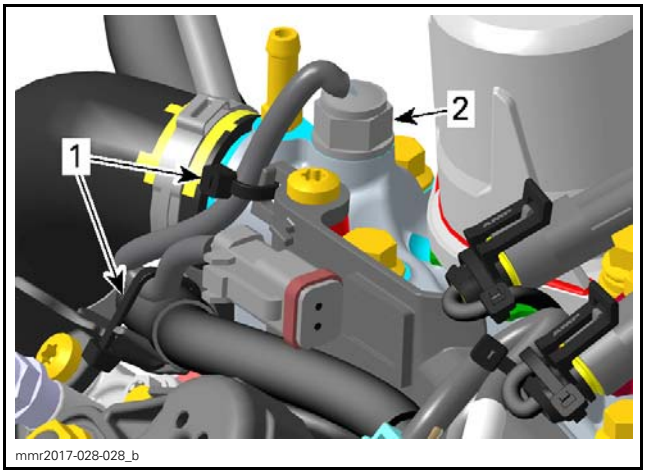
ECMA CONNECTOR		MEASUREMENT
B1	C1	Refer to *CTS SENSOR TEMPERATURE TABLE (E-TEC)*

If resistance value is correct, sensor and wiring/connectors are good.

If resistance value is incorrect, repair/replace wiring/connectors between ECM and CTS.

Replacing the CTS

1. Disconnect CTS connector.
2. Cut locking ties and remove CTS.



1. *Locking ties*
2. *CTS*

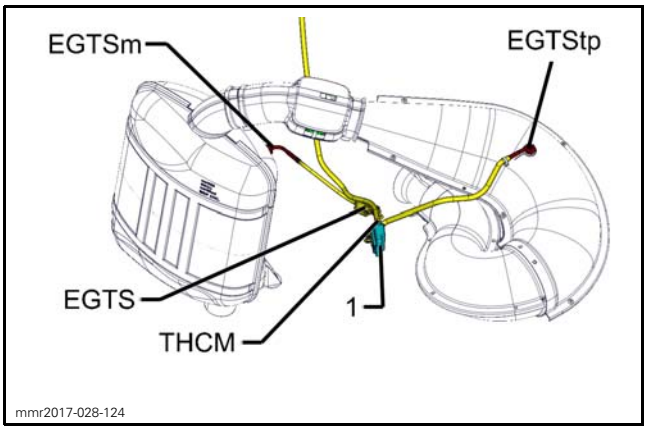
3. Install new CTS.

TIGHTENING TORQUE	
CTS	16 N•m ± 1 N•m (142 lbf•**in** ± 9 lbf•**in**)

4. Reinstall removed parts.
5. Refill engine coolant. If an important quantity of coolant spilled from the engine, bleed cooling system. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

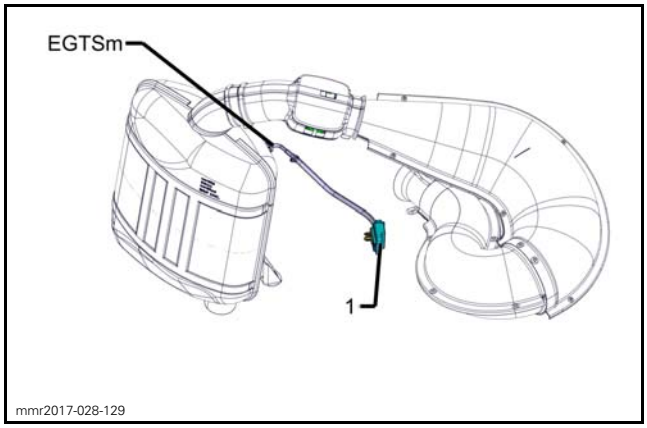
THCM (THERMOCOUPLE MODULE)

On models with an exhaust gas temperature sensor on the tuned pipe and the muffler, the THCM monitors the sensor on the tuned pipe.



MODELS WITH SENSOR ON TUNED PIPE AND MUFFLER
1. *THCM Module*

On models with an exhaust gas temperature sensor on the muffler only, the THCM monitors the sensor on the muffler.



MODELS WITH SENSOR ON MUFFLER
1. *THCM Module*

THCM Test with BUDS2

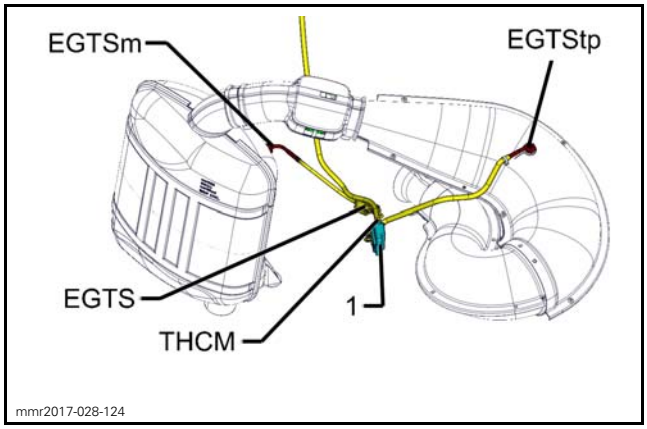
1. Connect vehicle to BUDS2. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. In BUDS2, navigate to the Measurements screen
3. In BUDS2, monitor the Exhaust (Muffler) and Tuned Pipe temperature indicators (as applicable).

If sensor temperature continuously read(s), 1 500°C (2,732°F) then the sensor is defective (open circuit). Replace THCM.

If sensor temperature is(are) read, THCM operates normally.

If BUDS2 cannot communicate with the THCM, check the power, ground, and CAN wires. Refer to *WIRING DIAGRAM*.

EXHAUST GAS TEMPERATURE SENSOR (EGTSM AND EGTSTP)



MODELS WITH SENSOR ON TUNED PIPE AND MUFFLER
1. *THCM Module*

EGTS Test with BUDS2

Connect vehicle to BUDS2. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

In BUDS2, navigate to the Measurements screen

Monitor the Exhaust temperature indicators. They should show the exhaust temperature.

Use an infrared thermometer and measure the sensor's temperature.

The measured temperature should be close to the temperature displayed in BUDS2.

If temperature is not the same, replace EGTS.

NOTE: If engine runs with the EGTS connected but not installed in the muffler, the reading will be 710°C (1,310°F) steady.

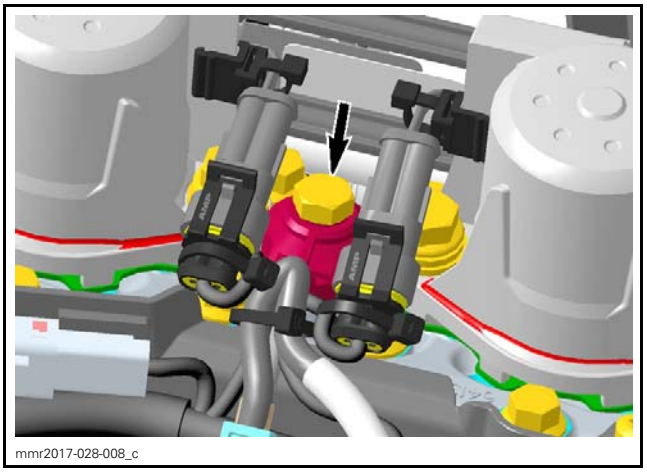
EGTS Replacement

Refer to *EXHAUST SYSTEM* subsection.

KNOCK SENSOR (KS)

Knock Sensor Location

The knock sensor is located on top of the cylinder head, between the fuel injectors.



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Testing the KS with BUDS2

1. Lift rear of vehicle off the ground and support it with a wide-base mechanical stand.
2. Connect BUDS2 and navigate to the measurements page.
3. Use the latest applicable BUDS2 version.
4. Monitor the knock sensor value .
5. Start the engine.
6. Bring engine speed above 5200 RPM and vary engine RPM above 5200 RPM.

NOTE: Use the custom screen and graph the knock sensor signal.

The Knock Sensor Signal value should move between 0 and 100. The movement pattern is of no importance as long as it moves indicating the knock sensor senses the engine vibrations.

If the value changes as described, the knock sensor should be good.

If the value sticks either at 0 or 100, there is a problem.

NOTE: Ensure ignition coil cables are not close to knock sensor harness. If so, this might generate a false fault code.

Perform *TESTING THE KS RESISTANCE*.

Testing the KS Resistance

Disconnect ECMA connector and install it on the ECM adapter tool. Refer to *WIRING HARNESS AND CONNECTORS* subsection.

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

Measure the knock sensor circuit resistance as per following table.

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

ECMA CONNECTOR		RESISTANCE @ 20°C (68°F)
ECMA-H1	ECMA-G1	3.92 - 5.88 MΩ

If resistance measured at ECMA connector is not close to specification, measure resistance at KS connector.

If resistance measured at KS connector is not as specified, replace knock sensor.

If resistance test at KS connector is good perform *TESTING THE KS CIRCUIT CONTINUITY*.

NOTE: Although the knock sensor resistance is as specified, it may still be at fault as it may not be producing a signal within its design specification.

Testing the KS Circuit Continuity

1. Ensure sensor and cylinder head contact surfaces are clean and mounting bolt is properly torqued.

2. Disconnect knock sensor connector. Refer to *REPLACING THE KS*.
3. Disconnect ECMA connector from ECM.
4. Check wire continuity of circuit as per following table.

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

ECMA CONNECTOR	KS CONNECTOR	MEASUREMENT
ECMA-H1	Pin 1	Close to 0 Ω (continuity)
ECMA-G1	Pin 2	

If test is not good, repair/replace wiring/connectors between ECM and knock sensor.

If test is good, try a new knock sensor.

Replacing the KS

1. Remove upper body module. Refer to *BODY* subsection
2. Remove engine cover.
3. Disconnect knock sensor connector. Refer to *WIRING HARNESS AND CONNECTORS* subsection for connector location.
4. Unscrew and remove knock sensor from cylinder head.
5. Clean contact surfaces on cylinder head, then install the new knock sensor.
6. Tighten knock sensor screw.

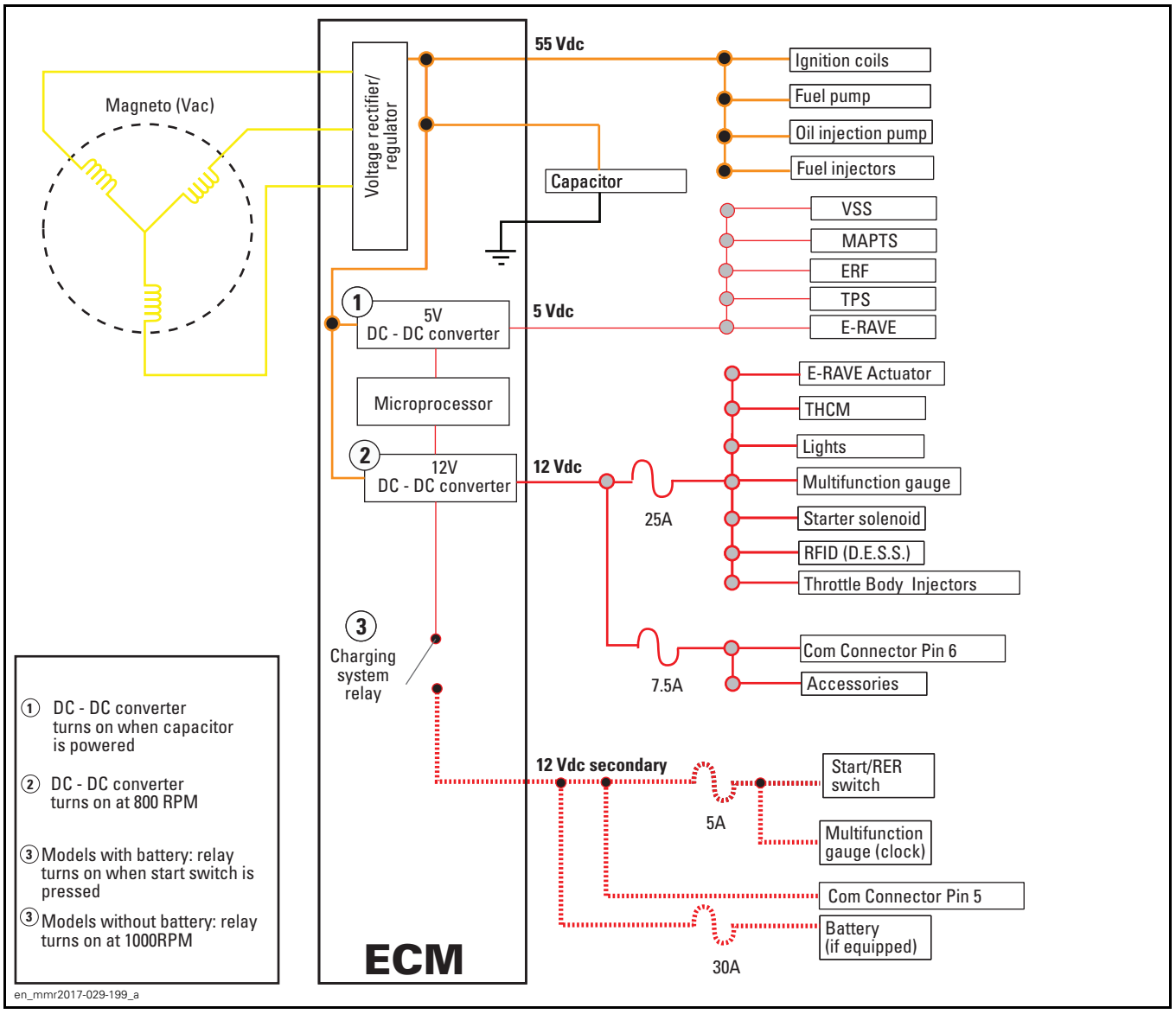
TIGHTENING TORQUE	
Knock sensor screw	24 N•m ± 1 N•m (18 lbf•ft ± 1 lbf•ft)

NOTICE **Improper torque may prevent sensor from functioning properly possibly leading to severe internal engine component damage.**

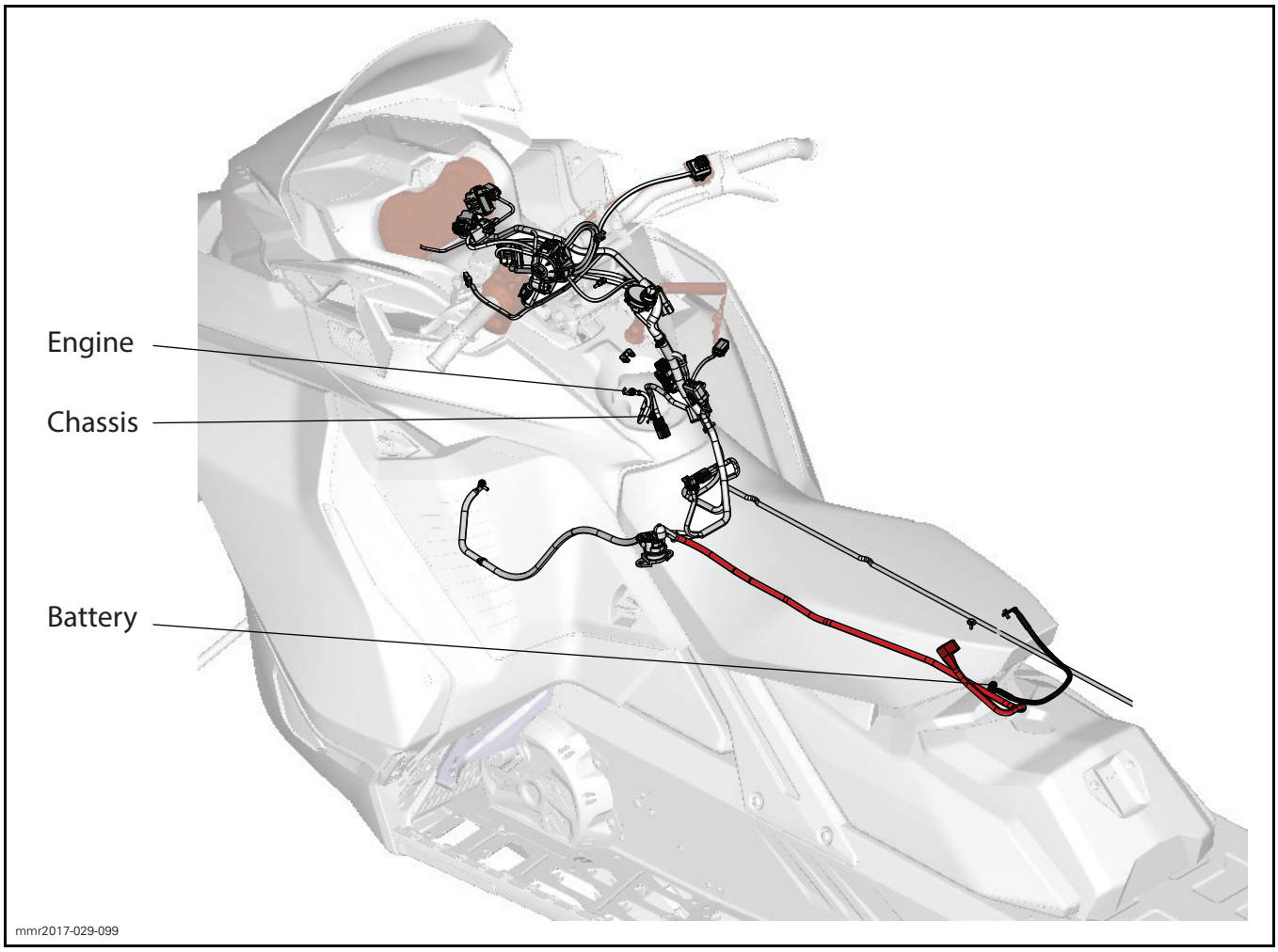
7. Reconnect connector.
8. Reinstall remaining parts.

POWER DISTRIBUTION

POWER DISTRIBUTION



GROUNDS



GENERAL

OVERVIEW

Power distribution is shown in red on the wiring diagram. Refer to *KNOWLEDGE CENTER*.

The magneto stator is wired with a 3 phase star configuration winding.

At high RPM if the magneto power is greater than the loads, the ECM will shunt the stator windings to regulate its power as necessary.

The voltage regulator/rectifier is part of the ECM.

The ECM receives the energy produced by the magneto, rectifies the alternating current (AC) to direct current (DC) and regulates the voltage.

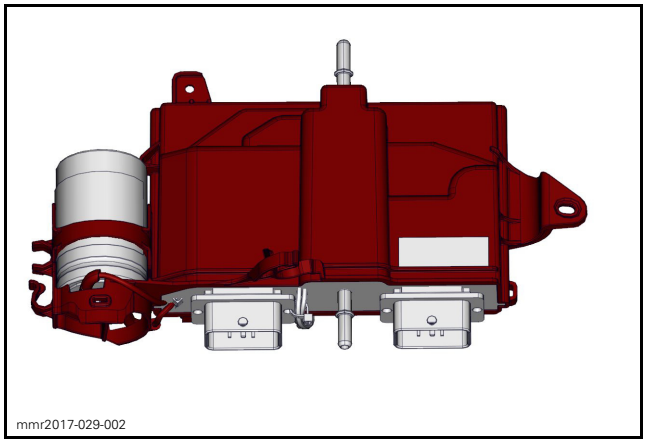
SYSTEM VOLTAGE (55 VDC)

Since the available power is low when cranking, the ECM first supplies 55 Vdc to the illustrated components that need voltage for the starting and the basic operation of the engine.

NOTE: When starting, voltage may be closer to 40Vdc until RPM increases.

ECM

For more information, refer to *ENGINE MANAGEMENT SYSTEM* subsection.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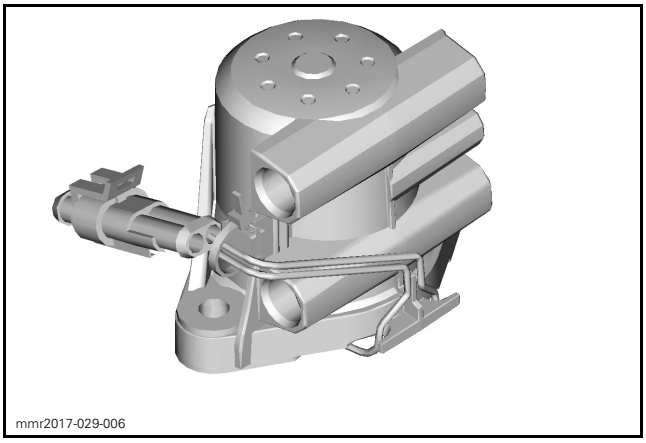
Fuel Injector

For more information, refer to *E-TEC DIRECT FUEL INJECTION* subsection.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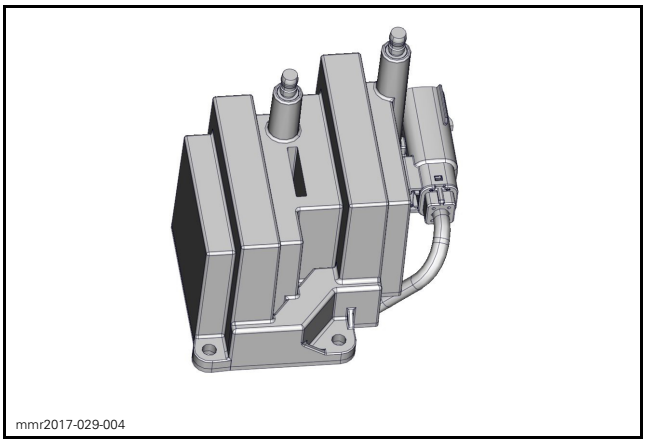
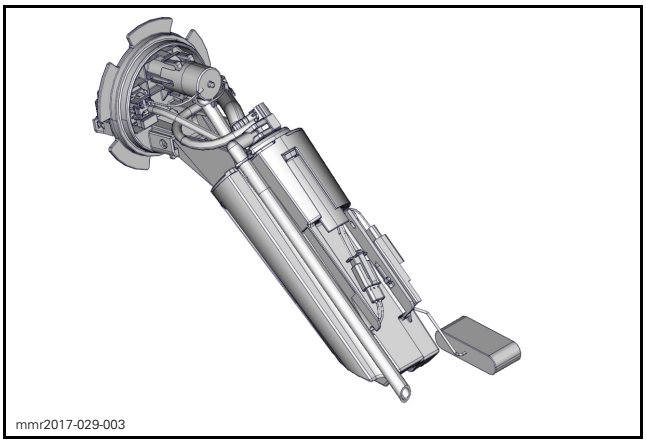
Ignition Coil

For more information, refer to *IGNITION SYSTEM* subsection.


mmr2017-029-004

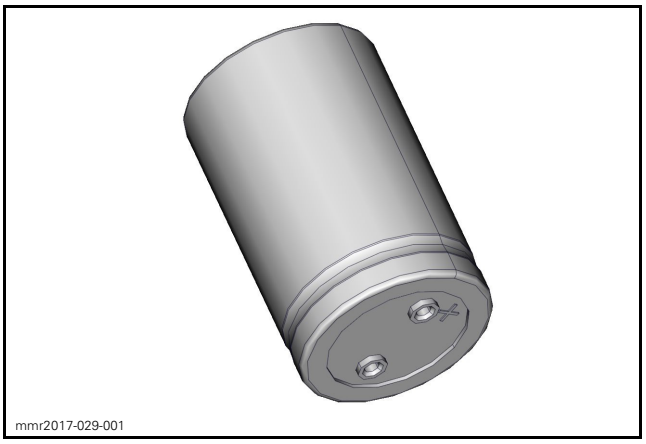
Fuel Pump

For more information, refer to *FUEL TANK AND FUEL PUMP* subsection.


mmr2017-029-003

Capacitor

For more information, refer to *CHARGING SYSTEM* subsection.


mmr2017-029-001

SYSTEM VOLTAGE (12 VDC)

A DC-DC converter, in the ECM, steps down the 55 DC voltage to 12 Vdc when the engine reaches 800 RPM.

Since the available power is not at its maximum at the early stage of engine starting, the ECM supplies 12 Vdc to the following components when engine reaches 800 RPM.

- THCM (thermocouple module)
- E-RAVE actuator
- Communication connector
- Lighting system
- Multifunction gauge
- Heaters
- Heated visor
- Auxiliary lights
- 12 V power outlet
- Other accessories.

Approximately 25 A are available at idle (1200 RPM). Refer to *CHARGING SYSTEM* for more information.

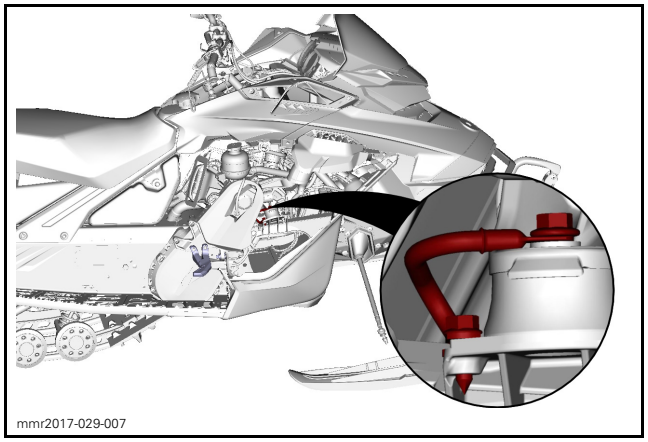
Below 2000 RPM, the total available current is limited to reduce the load on the system voltage.

Above 2000 RPM, the 12 Vdc system has a maximum of 30 A available.

If electrical system load is increased, or the RPM is decreased, the 12 Vdc system output is reduced in order to maintain 55 Vdc for engine operation.

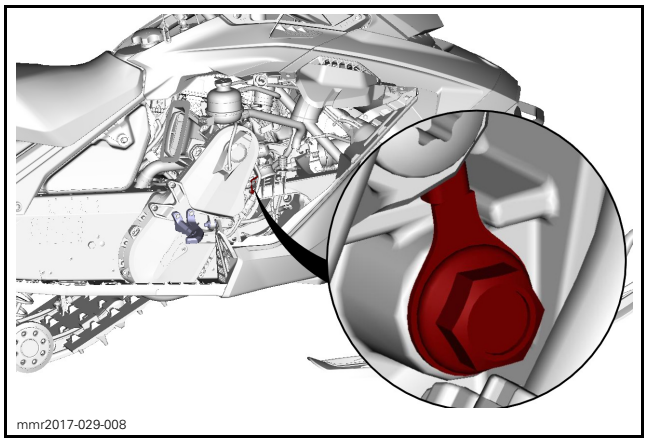
GROUNDS

Engine


mmr2017-029-007

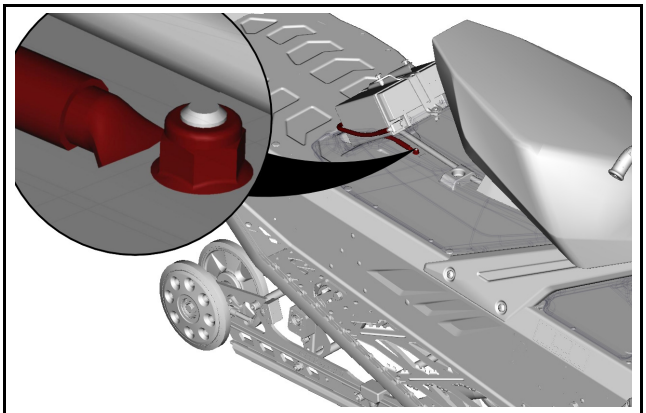
TIGHTENING TORQUE	
M6 screw on chassis	10 N•m ± 2 N•m (89 lbf•**in** ± 18 lbf•**in**)

Chassis


mmr2017-029-008

TIGHTENING TORQUE	
M5 screw on chassis	5 N•m ± 0.5 N•m (44 lbf•**in** ± 4 lbf•**in**)

Battery


mmr2017-029-005

TIGHTENING TORQUE	
M6 shoulder nut	10 N•m ± 2 N•m (89 lbf•**in** ± 18 lbf•**in**)

WIRING HARNESS AND CONNECTORS

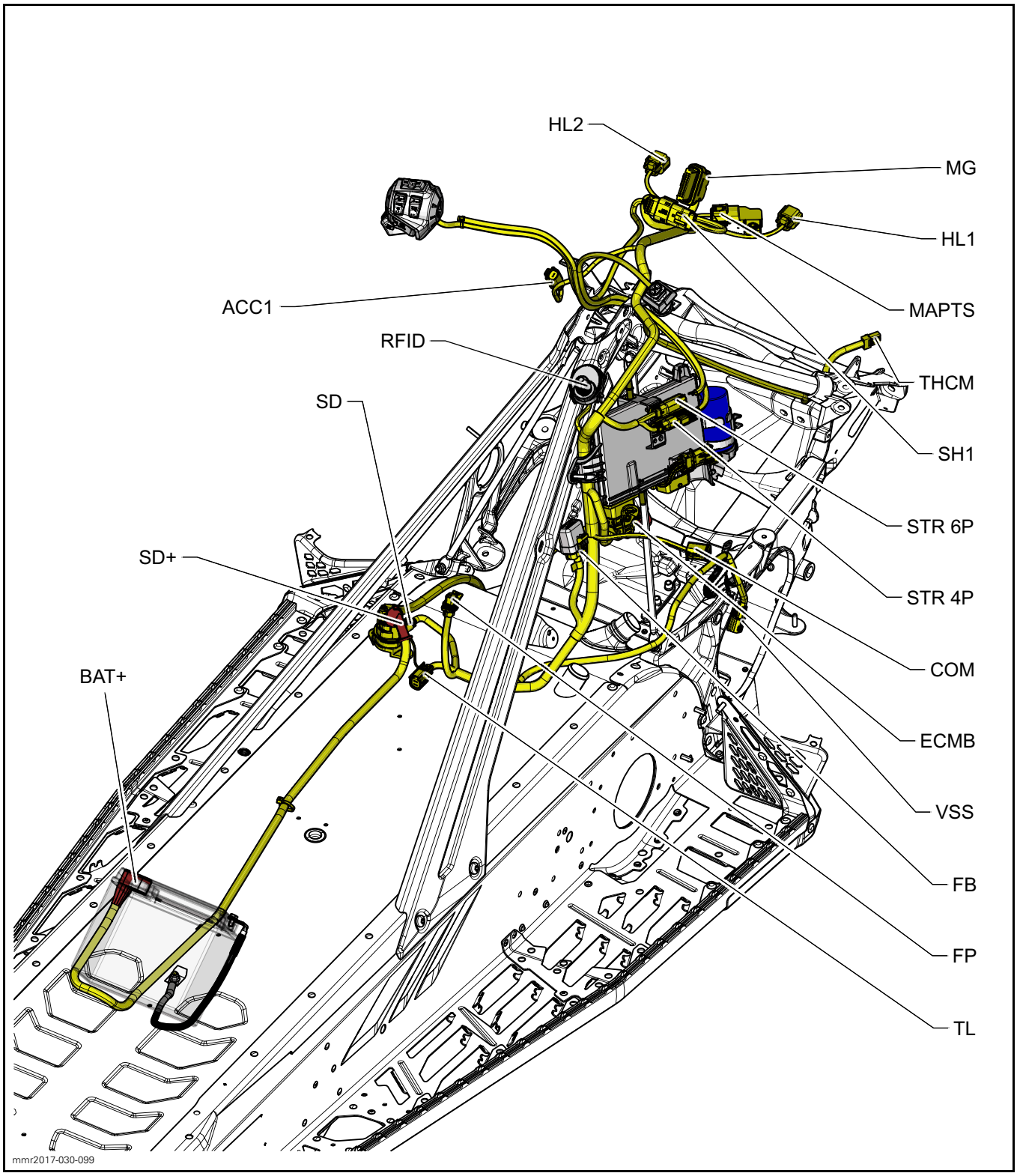
SERVICE TOOLS

Description	Part Number	Page
CRIMPING TOOL (HEAVY GAUGE WIRE)	529 035 730	13
ECM ADAPTER TOOL	529 036 166	9
ECM TERMINAL REMOVER 2.25	529 036 175	9
ECM TERMINAL REMOVER 3.36	529 036 174	9

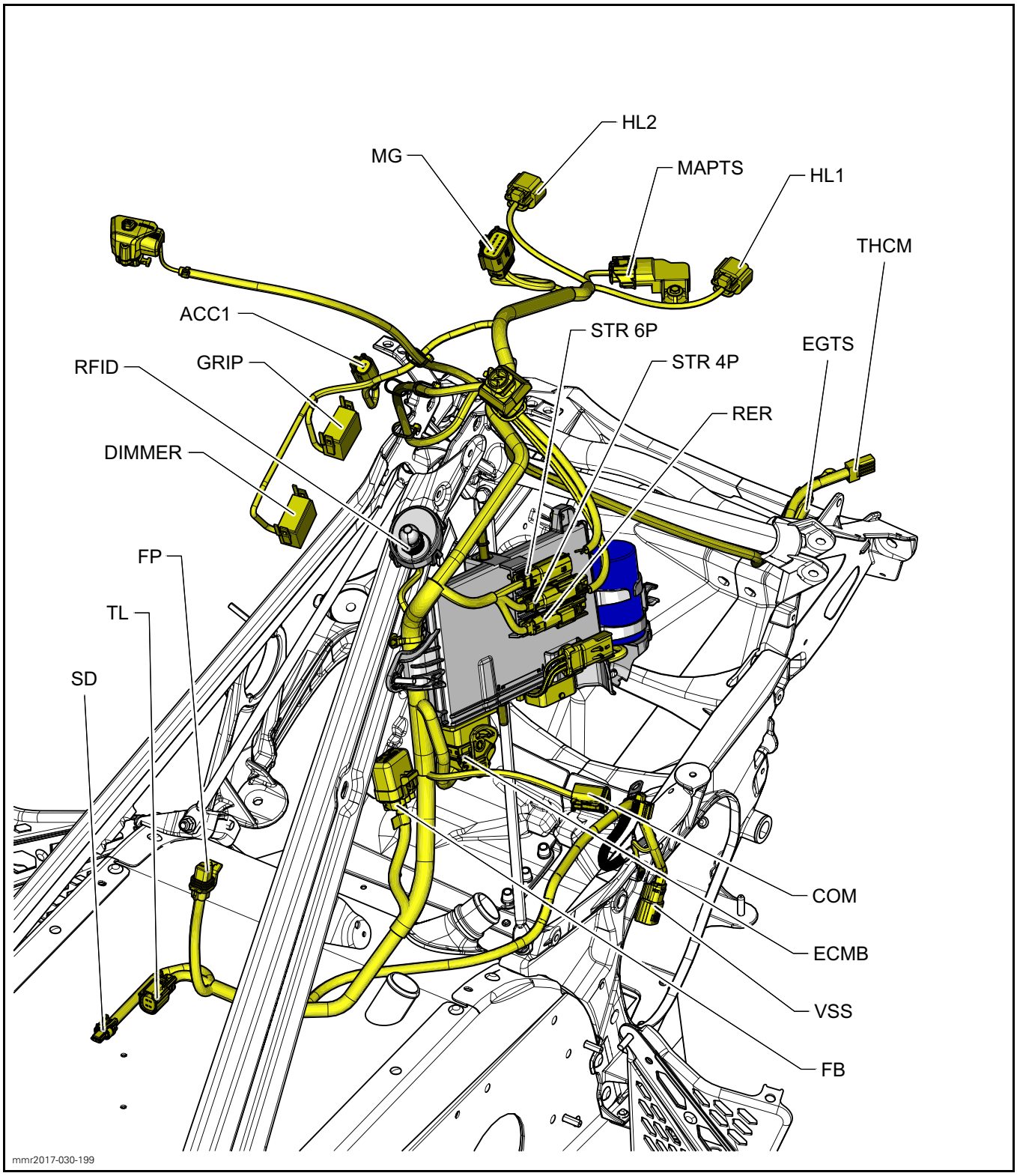
SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
DELPHI TERMINAL EXTRACTOR	12094429	11–12
FCI TERMINAL EXTRACTOR TOOL	54241678	10–11
MOLEX 150 TERMINAL EXTRACTOR TOOL	63813 - 1500	10–11

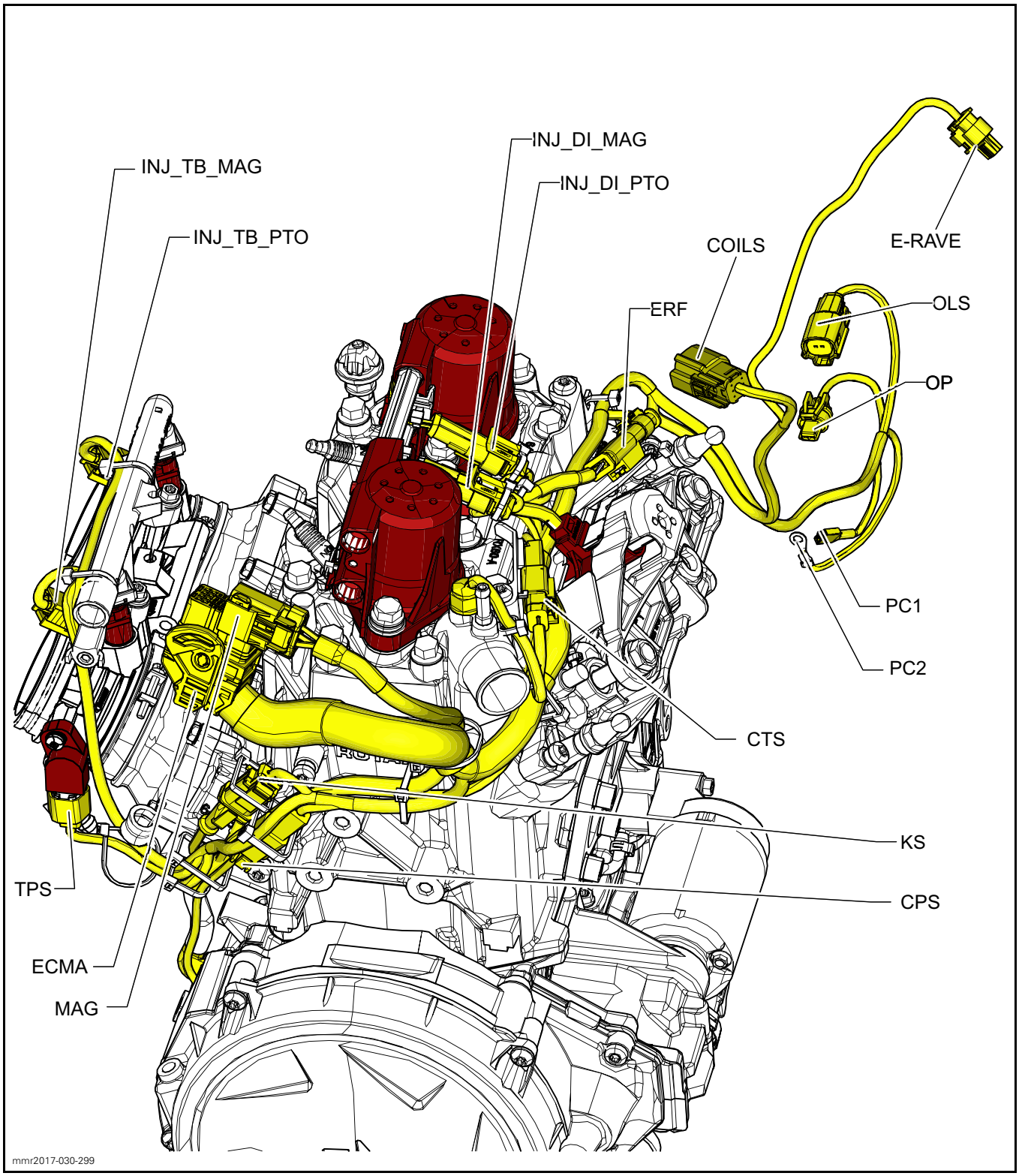
REV G4 CROSS-COUNTRY (WITH BATTERY) CHASSIS HARNESS



REV G4 MOUNTAIN (WITHOUT BATTERY) CHASSIS HARNESS



850 E-TEC ENGINE HARNESS



GENERAL

ACRONYMS

ACRONYM	DESCRIPTION
ACC	Accessory
BAT+	Battery +
CAN	Controller Area Network
CAPS	Camshaft Position Sensor
COM	Communication
CPS	Crankshaft Position Sensor
CTS	Coolant Temperature Sensor
CYL	Cylinder
DESS	Digitally Encoded Security System
ECMA	ECM connector A (Engine)
ECMB	ECM connector B (Chassis)
EGTS	Engine Gas Temperature Sensor
E-RAVE	E-Rave
ERF	E-Rave Feedback (position sensor)
ETC	Electronic Throttle Control
FB	Fusebox
FP	Fuel Pump
GND	Ground Engine
HL	HeadLamp
COILS	Ignition Coil Pack
INJ_DI_MAG	Direct Injector Magneto
INJ_DI_PTO	Direct Injector PTO
INJ_TB_MAG	Throttle Body Injector Magneto
INJ_TB_PTO	Throttle Body Injector PTO
KS	Knock Sensor
MAG	Magneto
MAPTS	Manifold Air Pressure & Temperature Sensor
MG	Multifunction Gauge
OLS	Oil Level Sensor
OP	Oil Pump
OLS	Oil Level Sensor
OPS	Oil Pressure Switch
RFID	Radio Frequency Identification
SD	Starter Solenoid
SH1	Switch Housing 1
THCM	Thermocouple Module
TL	Tail Light
TPS	Throttle Position Sensor
VSS	Vehicle Speed Sensor
DIMMER	Dimmer switch
GRIP	Heater switch
FLS	Fuel level sensor

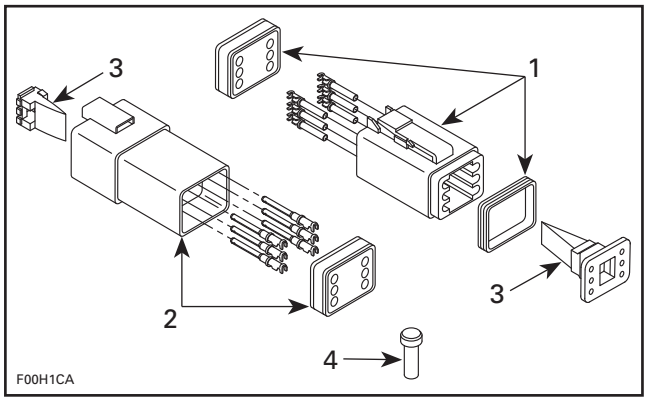
PROCEDURES

⚠ WARNING

When disassembling any connector for repair or replacement on the vehicle, always disconnect the battery to ensure all electrical power is removed and prevent any possibility of a short circuit. Refer to *CHARGING SYSTEM* subsection.

DIAGNOSTIC CONNECTOR (DEUTSCH)

Connector Disassembly and Reassembly

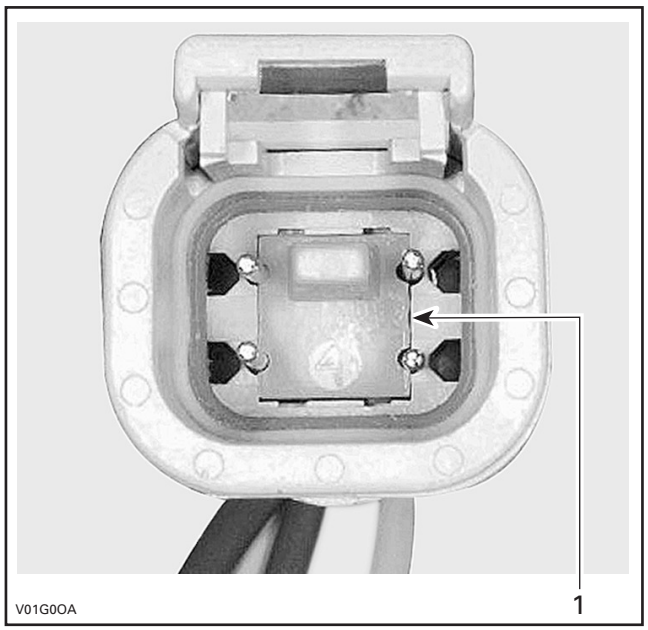


TYPICAL - DEUTSCH CONNECTOR
1. *Male connector*
2. *Female connector*
3. *Secondary lock*
4. *Sealing cap*

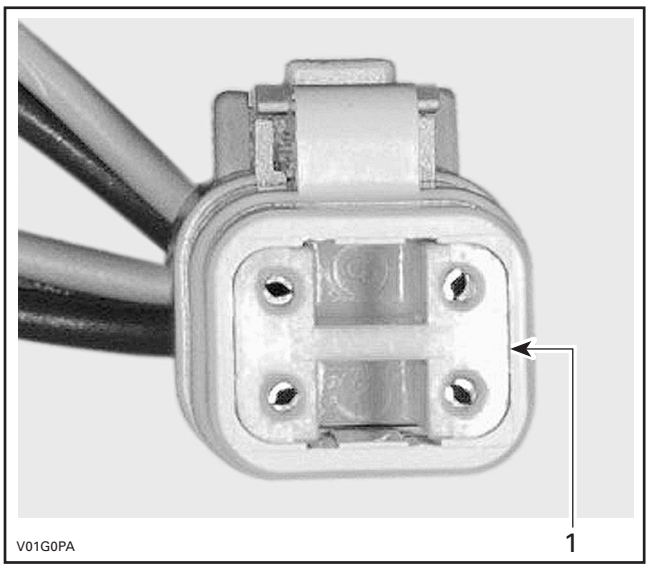
NOTICE Do not apply dielectric grease on terminal inside connector.

To remove terminals from connector, proceed as follows:

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



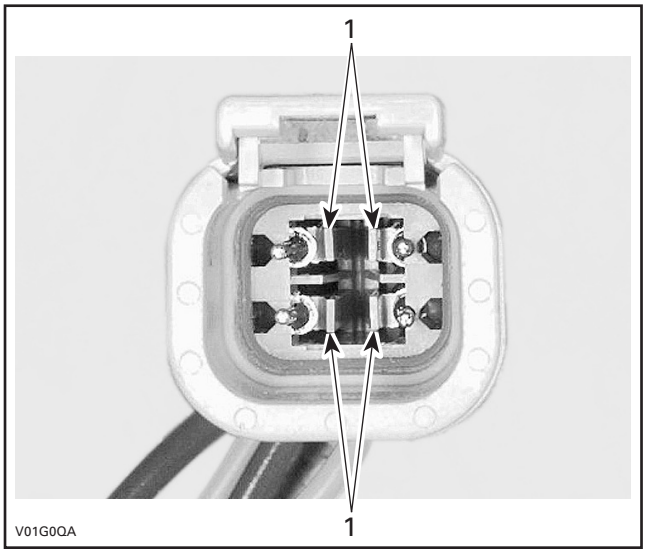
TYPICAL - FEMALE CONNECTOR
1. *Female lock*



TYPICAL - MALE CONNECTOR
1. *Male lock*

NOTE: Before pin extraction, push wire forward to relieve pressure on retaining tab.

2. Insert a 4.8 mm (.189 in) wide screwdriver blade inside the front of the terminal cavity.
3. Pry the retaining tab away from the terminal while gently pulling the wire and terminal out of the back of the connector.

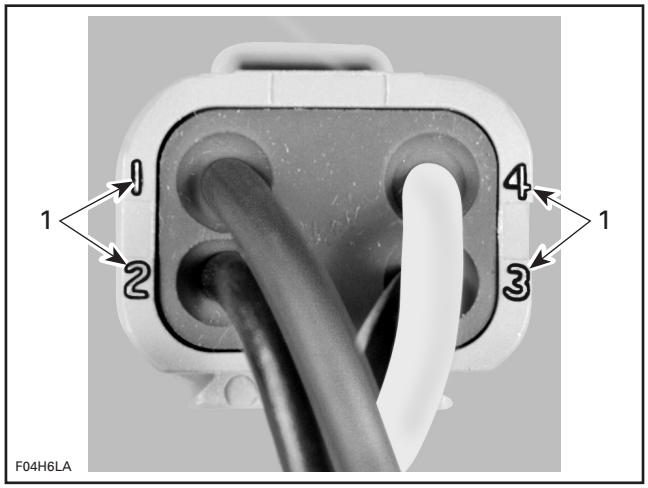


TYPICAL - FEMALE CONNECTOR
1. *Retaining tabs*

To install:

1. For insertion of a terminal, ensure the plastic lock is removed.
2. Insert terminal through the back of the connector in the appropriate position, and push it in as far as it will go. You should feel or hear the terminal lock engage.

3. Pull back on the terminal wire to ensure the retention fingers are holding the terminal.
4. After all required terminals have been inserted, the lock must be installed.



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

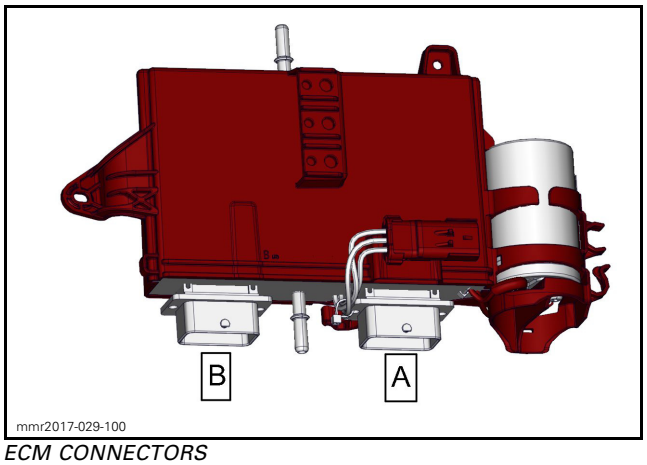
ECM CONNECTOR (MOLEX)

There are 2 connectors on the ECM.

The engine wiring harness connector is connected to ECM connector "A". The vehicle wiring harness connector is connected to ECM connector "B".

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

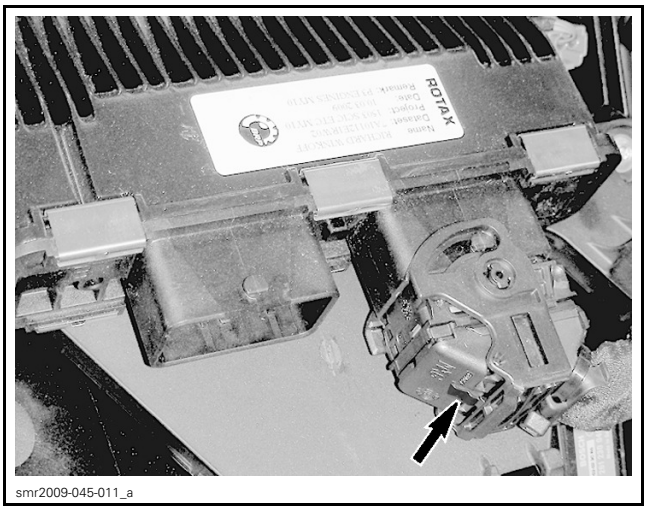
NOTE: If you need to remove the connector, be sure to not disconnect fuel quick-connector at ECM. If you need to remove the ECM or fuel quick connector, insure the ECM electrical connectors are securely in place and avoid fuel intrusion into connector/seal.



ECM CONNECTORS

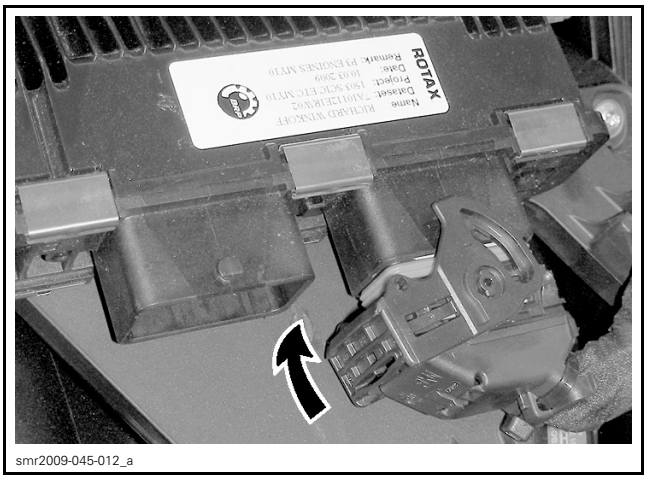
Connector Removal

1. To access the ECM, refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.
2. Press **and hold** the locking tab on the connector to be disconnected.



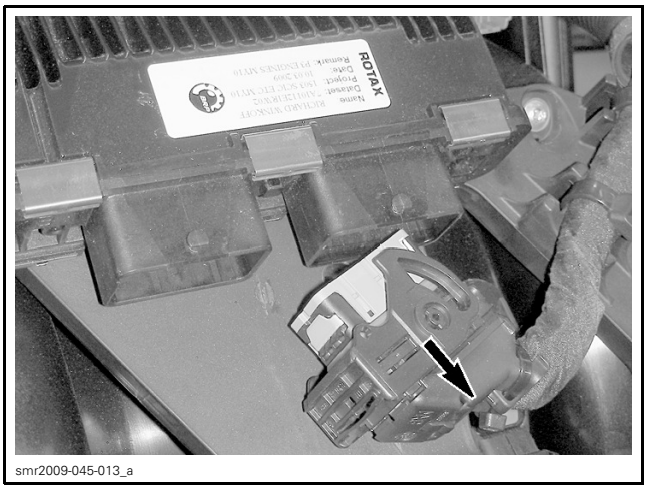
LOCKING TAB TO PRESS AND HOLD

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



CONNECTOR LOCKING CAM ROTATION TO RELEASE

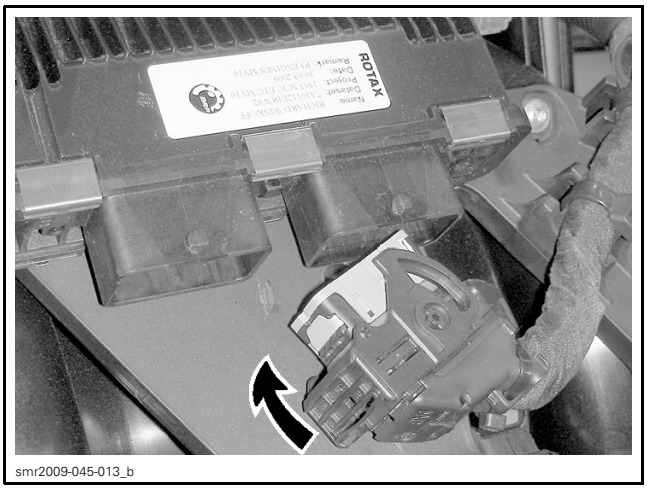
4. Pull connector off ECM.



smr2009-045-013_a

Connector Installation

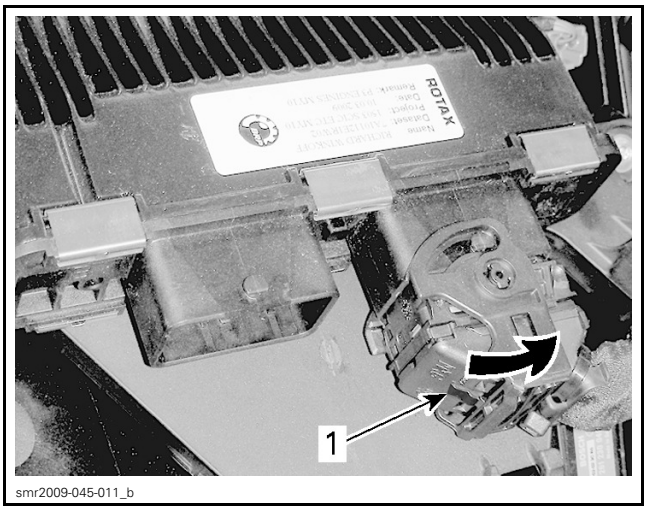
1. Fully open connector locking cam.



smr2009-045-013_b

CONNECTOR LOCKING CAM IN RELEASE POSITION

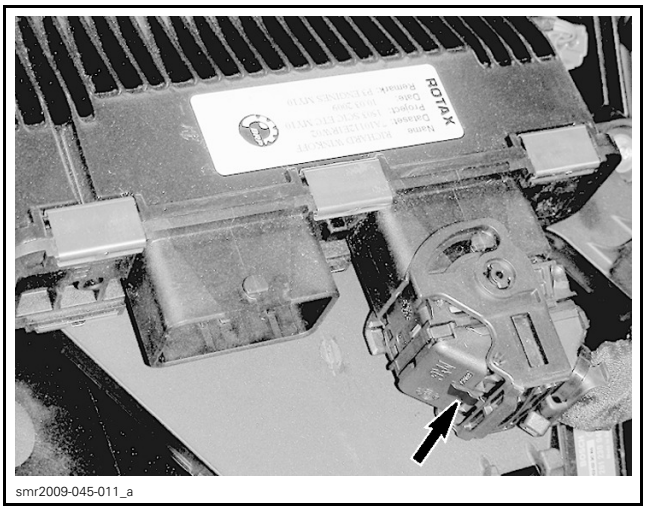
2. Insert connector on ECM.
3. As you push the connector onto the ECM, rotate the connector locking cam until it snaps locked.



smr2009-045-011_b

1. Locked here

4. Ensure the locking tab is fully out.



smr2009-045-011_a

LOCKING TAB FULLY OUT

Connector Inspection

Before replacing an ECM, always check electrical connections.

1. Ensure connector locking mechanism is functioning properly.
2. Ensure all wire terminals (pins) are properly locked in the connector.
3. Ensure they are very tight, make good contact with the pins in the ECM.
4. Ensure the pins in the harness connector and the ECM connector are clean, shiny and corrosion-free.

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

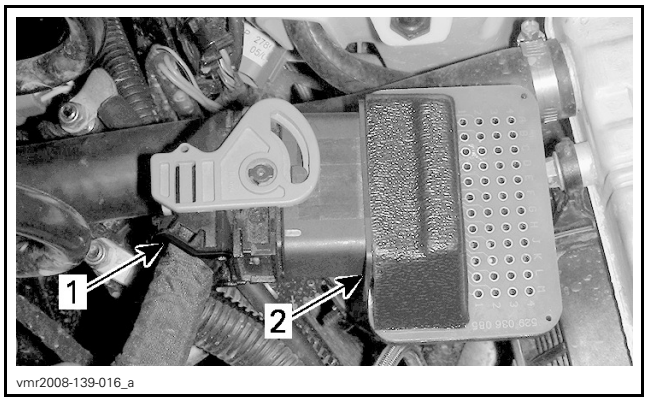
NOTICE **Do not apply any lubricant product to the pins of the ECM connector.**

Connector Probing

The most recommended and safest method to probe the MOLEX (ECM) connector terminals is to use the ECM ADAPTER TOOL (P/N 529 036 166). This tool will prevent deforming or enlarging of the terminals, which would lead to bad ECM terminal contact creating intermittent or permanent problems.


529036166

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.



vmr2008-139-016_a

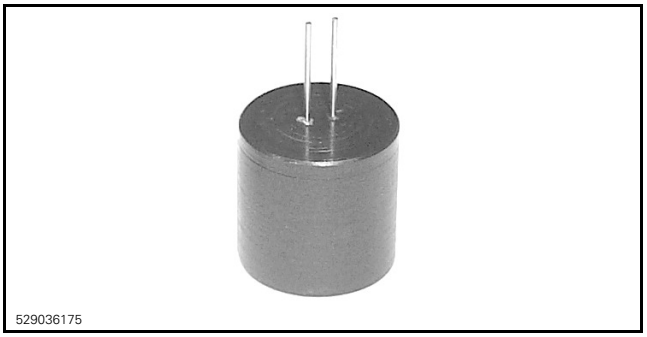
TYPICAL
1. ECM connector
2. ECM adapter

NOTICE **Never probe directly on the ECM harness connector. This could change the shape or enlarge the terminals and create intermittent or permanent contact problems.**

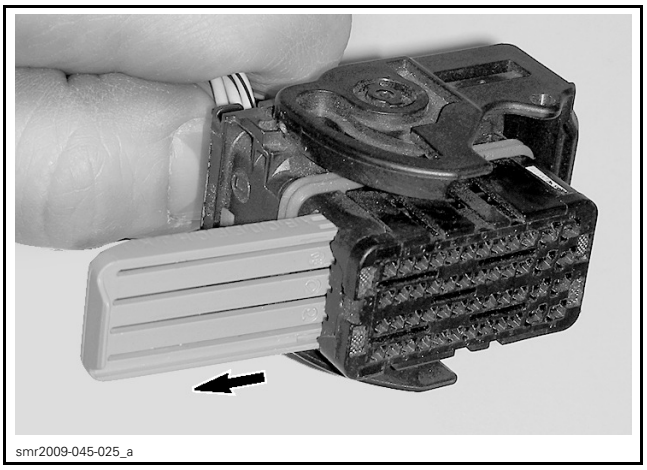
Connector Terminal Removal (Harness Connector)

To remove a signal terminal from the ECM harness connector, use the ECM TERMINAL REMOVER 2.25 (P/N 529 036 175).

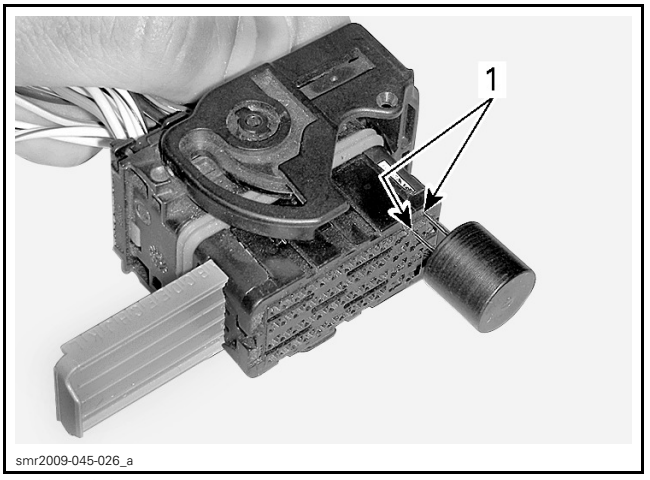
To remove a power terminal, use the ECM TERMINAL REMOVER 3.36 (P/N 529 036 174).


529036175

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


smr2009-045-025_a

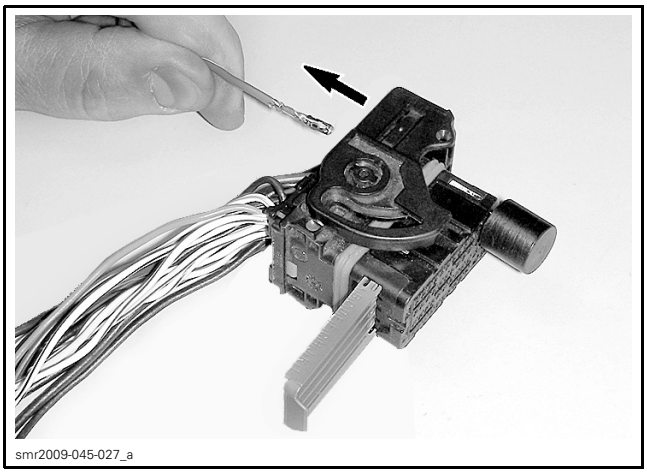
3. Insert tool to unlock terminal.



smr2009-045-026_a

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)

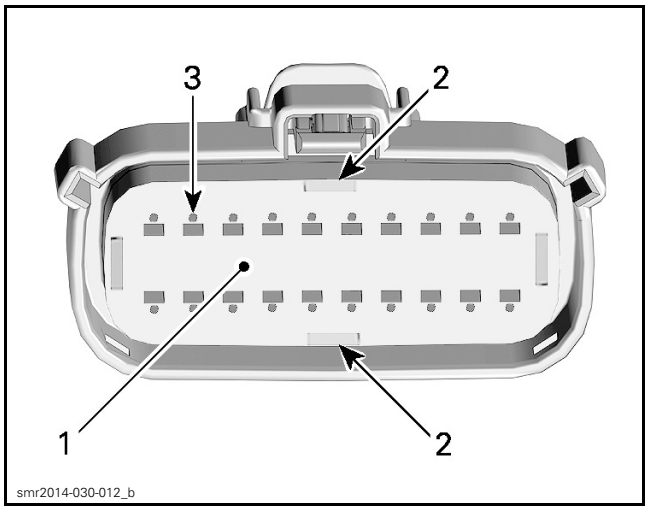
Connector Probing

1. Disconnect the steering connector in the vehicle and connect it to the Diagnostic Harness (P/N 284560054).
2. Probe the applicable circuit using the test connector on the diagnostic harness.

NOTICE Attempting to probe the connector without using the diagnostic connector may damage the connector pins, or even cause a short circuit if testing an energized circuit.

Socket Extraction (Female Connector)

1. Insert a small flat screwdriver in the pry holes of the socket locator, on the socket side of the connector.



smr2014-030-012_b

1. Socket locator
2. Pry holes
3. Holes for inserting terminal extractor tool

2. Carefully pull out the socket locator out to the detent position (approximately 5 mm).

NOTE: Do not remove the socket locator from the connector housing.

3. Insert the extractor tool in the small hole adjacent to the socket.

NOTE: Push the extractor tool in only as far as required to release the lock from the socket. The tool should slide along the socket and be inserted between the socket and the lock.

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

smr2010-052-002

FCI TERMINAL EXTRACTOR TOOL (P/N 54241678)

smr2014-045-001

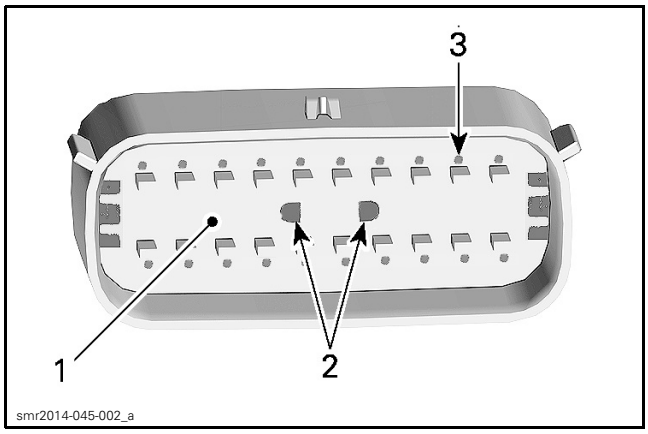
MOLEX 150 TERMINAL EXTRACTOR TOOL 6(P/N 3813 - 1500)

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

Pin Extraction (Male Connector)

1. Using a pair of thin long nose pliers, pull the pin locator out to the detent position (approximately 5 mm). This will allow unlocking of the pins.

NOTICE Do not attempt to remove the pin locator or damage will occur. Be careful not to bend the pins when using the pliers.



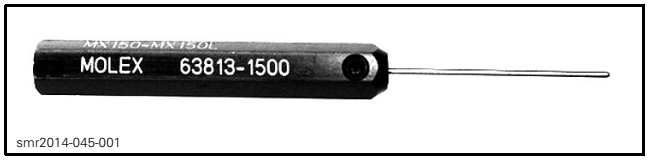
1. Pin locator
2. Insert long nose pliers here
3. Holes for inserting terminal extractor tool

2. Insert the extractor tool in the small hole adjacent to the pin.

NOTE: Push the extractor tool in only as far as required to release the lock from the pin. The tool should slide along the pin and be inserted between the pin and the lock.

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

FCI TERMINAL EXTRACTOR TOOL (P/N 54241678)



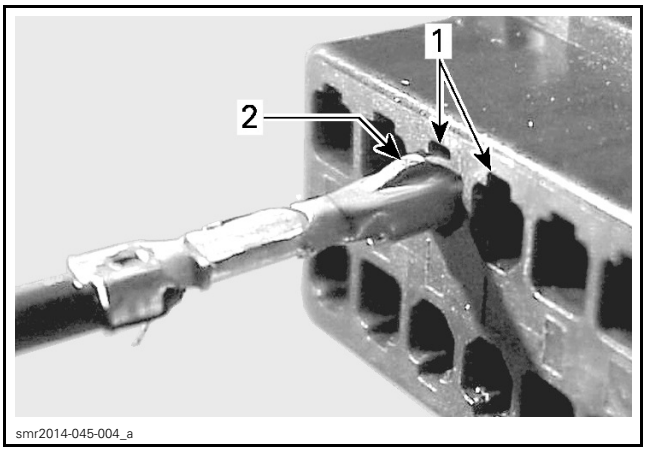
MOLEX 150 TERMINAL EXTRACTOR TOOL 6(P/N 3813 - 1500)

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

Pin Insertion

1. Ensure the terminal (pin) is properly crimped onto the wire.
2. Ensure the pin locator (the white plastic insert in the connector) is out in the detent position.
3. Insert the pin in through the back of the connector.

NOTE: When inserting the pin, insert the stepped portion facing the notch in the connector pin hole.



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

4. Push the pin in until the pin lock engages the pin.
5. Gently pull on the pin to ensure it is properly locked.
6. Repeat previous steps for each pin to be inserted.
7. Push the pin locator into the connector to the locked position.

DELPHI/PACKARD CONNECTORS

Connector Terminal Removal

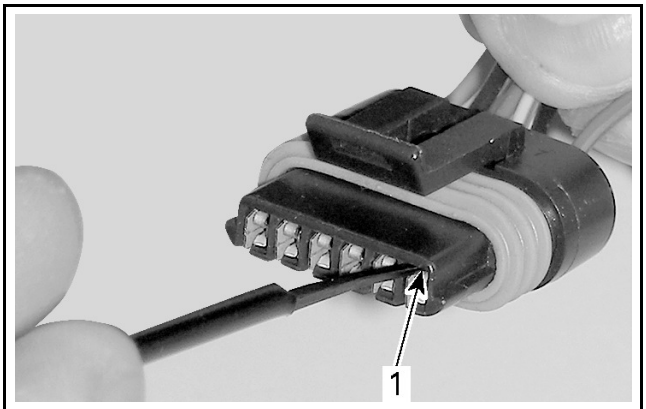
To remove a terminal (pin) from the connector, use a special tool such as the DELPHI TERMINAL EXTRACTOR (P/N 12094429).

DELPHI TERMINAL EXTRACTOR (P/N 12094429)

NOTE: Grinding the tool end to a taper is required.

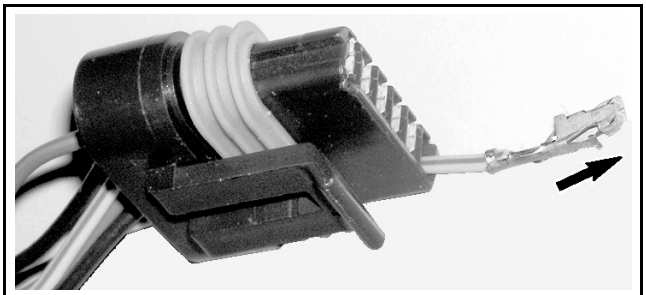
1. Carefully insert the tool in the space provided to release the pin lock.

2. Push the pin out the front of the connector by pushing on the wire.



smr2009-045-014_a

1. Unlock terminal here



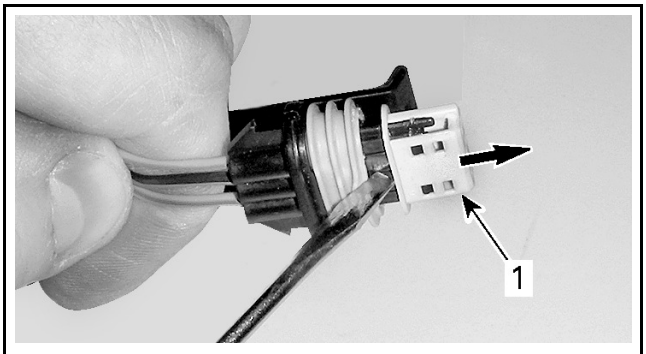
smr2009-045-015_a

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

Terminal Removal

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



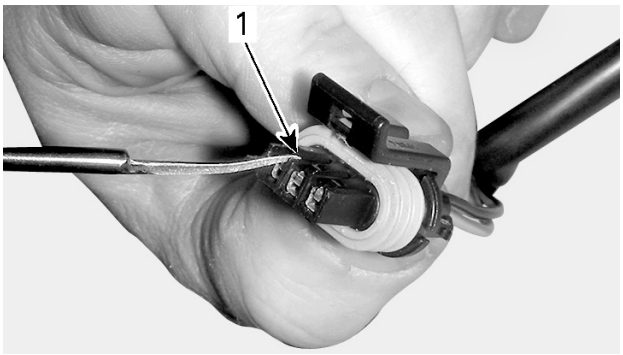
smr2009-045-023_a

1. Pry out locking cap

2. Carefully insert the DELPHI TERMINAL EXTRACTOR (P/N 12094429) in the space provided to release the pin lock.

smr2010-052-001

DELPHI TERMINAL EXTRACTOR (P/N 12094429)



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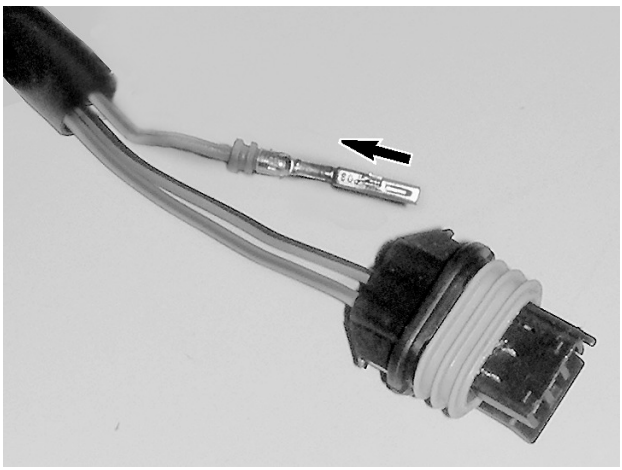
1. Unlock here

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



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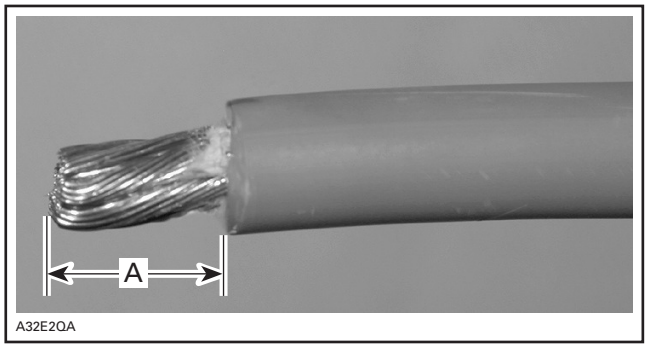
NOTICE Before installing terminals in the connectors, ensure all terminals are properly crimped on the wires. After installation of the wire terminals in the connectors, ensure they are properly locked by gently pushing on them as if to extract them.

BATTERY CABLES

Battery Cable Crimping

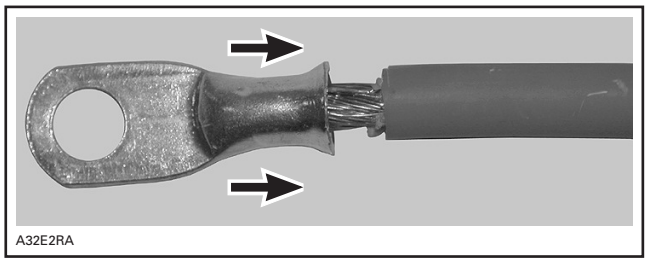
Carefully strip the wire approximately to 10 mm (3/8 in) in length, using a wire stripping tool or sharp blade/knife.



A. 10 mm (3/8 in)

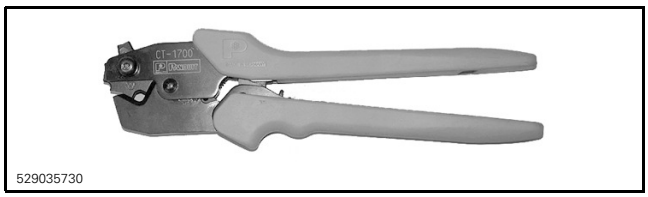
NOTE: Make sure not to cut wire strands while stripping the wire.

Install the appropriate terminal on the wire according to the requirement. Refer to appropriate *PARTS CATALOG*.

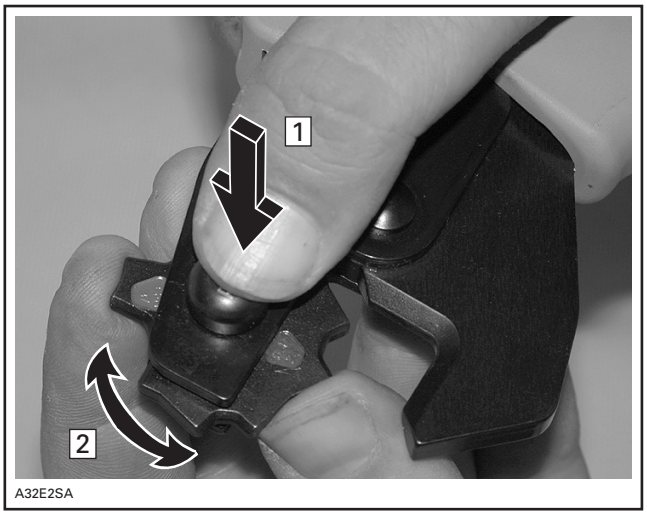


INSTALLATION OF TERMINAL

Follow the instructions provided with the CRIMPING TOOL (HEAVY GAUGE WIRE) (P/N 529 035 730) to select the proper position of the tool.

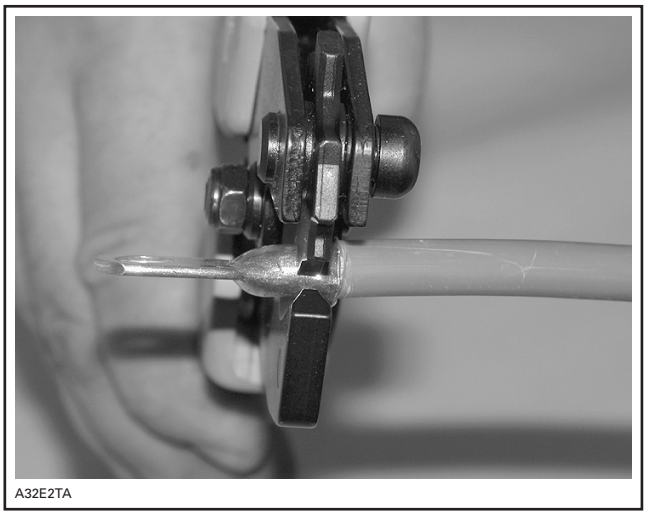


NOTE: Different wires require different crimping pliers settings, so make sure to follow the instruction supplied with the tool.

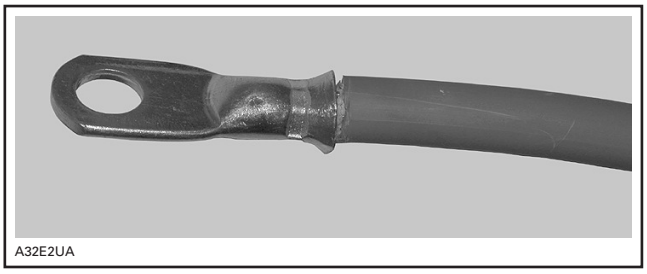


POSITIONING THE CRIMPING PLIERS
Step 1: Press
Step 2: Rotate

After positioning the crimping pliers, crimp the terminal already installed on wire.



CRIMPING OF WIRE



PROPERLY CRIMPED WIRE

To verify, if the wire is properly crimped, apply some pulling force on wire and the terminal at the same time from both directions.

NOTICE Never weld the wire to the terminal. Welding can change the property of the wire and it can become brittle and break.

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

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

IGNITION SYSTEM

SERVICE TOOLS

GENERAL

⚠ WARNING

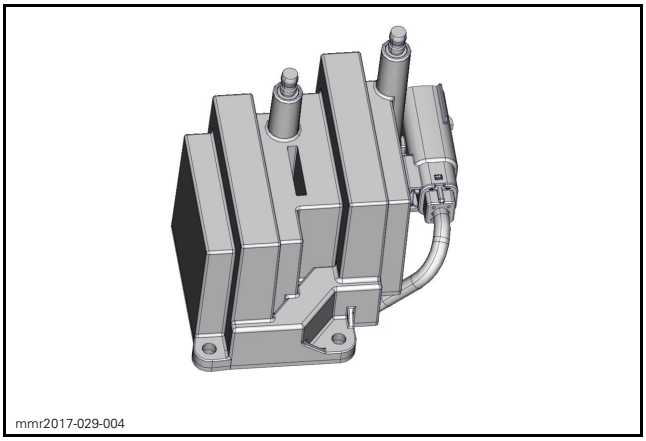
Always electrically disconnect both fuel injectors prior to testing for ignition spark. Otherwise, fuel vapors may ignite in presence of a spark creating a fire hazard.

SYSTEM DESCRIPTION

This ignition system is an inductive type specifically designed for the E-TEC engine with a rapid rise time to prevent spark plug fouling. It provides a quick spark with a long duration.

The ignition system is fully managed by the ECM which controls the ignition system parameters such as spark timing, dwell time, and firing order.

The system uses two separate ignition coils which induce high voltage in their secondary winding to produce a spark at each spark plug independently.



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The ignition coils receive power from the 55 Vdc system. Their operating voltage varies from 20 to 55 Vdc.

Ignition System Basic Operation

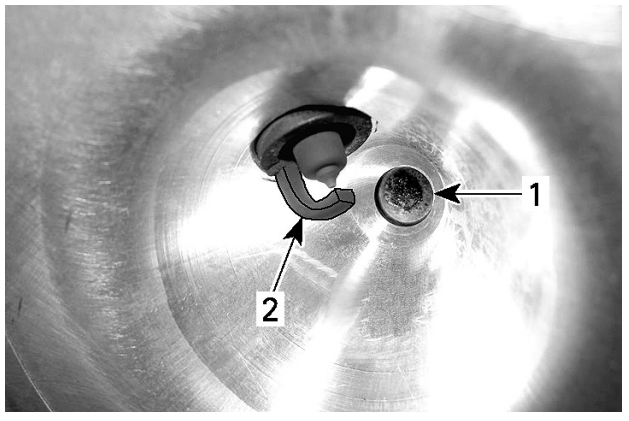
Each ignition coil uses an active circuitry to energize the primary winding when it receive a pulse from the ECM. The pulse has an amplitude of approximately 10 volts. At the end of the dwell time, the power is released from the primary winding which induces a current that produces a high voltage in the secondary winding. This high voltage is then fed to the spark plug.

A resistive core spark plug cable is used to prevent the RFI (Radio Frequency Interference). There is no resistor in the spark plug cap.

Spark Plugs

The OEM spark plug used is specially indexed for optimum engine operation and efficiency.

The threads on the spark plug and in the cylinder head are indexed so that when the plug is installed, the open end of the negative electrode will be facing the injection spray, within ± 90°. This ensures the negative electrode does not deviate the injection spray and ensures proper ignition.



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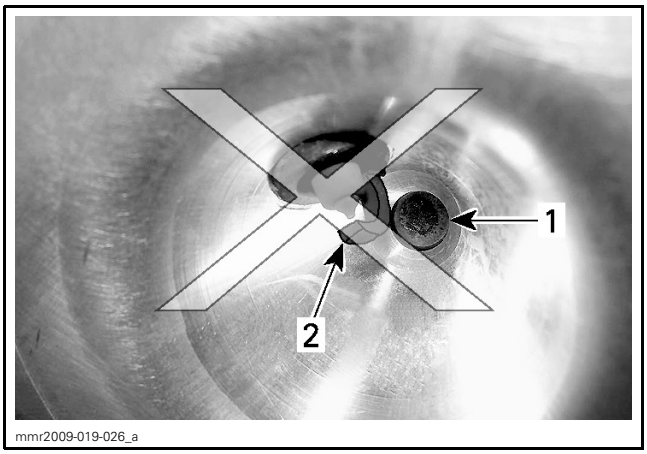
CORRECTLY INDEXED
1. *Injector nozzle*
2. *Ground electrode*

NOTE: Using an incorrectly indexed spark plug will result in poor idle and increased emissions.



INCORRECTLY INDEXED
1. *Injector nozzle*
2. *Ground electrode*

If using a non OEM spark plug, a specific installation procedure must be followed. Refer to *PERIODIC MAINTENANCE PROCEDURE* subsection.

Ignition Timing

The crankshaft position sensor (CPS), the air pressure sensor (MAPTS) and the throttle position sensor (TPS) are the primary sensors used to control the ignition timing.

The ECM is programmed with data (ignition mappings). Using feedback provided by the sensors, the ECM controls the ignition timing for optimum engine operation under all operating conditions.

Ignition timing can be adjusted using BUDS2

Knock Detection

The knock sensor detects specific vibration that would be typically generated by engine detonation.

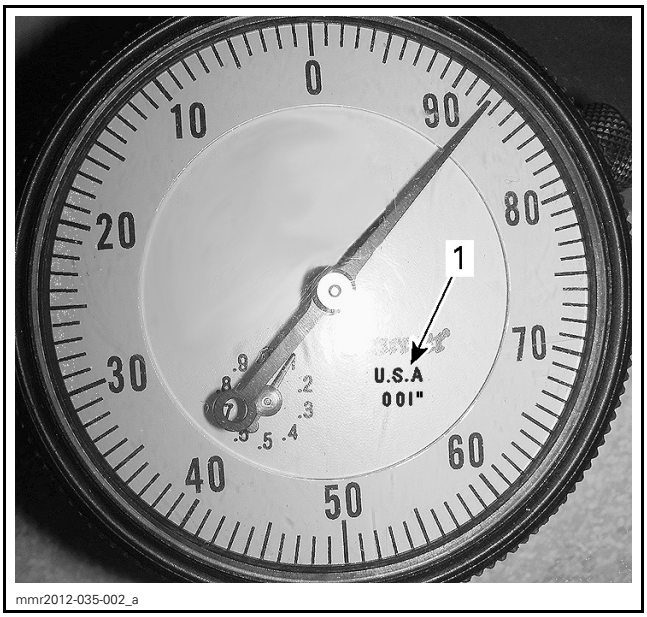
If detonation occurs, the ECMs retards the ignition and increases the fuel injected temporarily (it goes into a specific operating mode) until detonation stops.

ADJUSTMENT

UNDERSTANDING THE TDC GAUGE

Dial gauges can be either in imperial or metric units. It is crucial to identify gauge units and graduation.

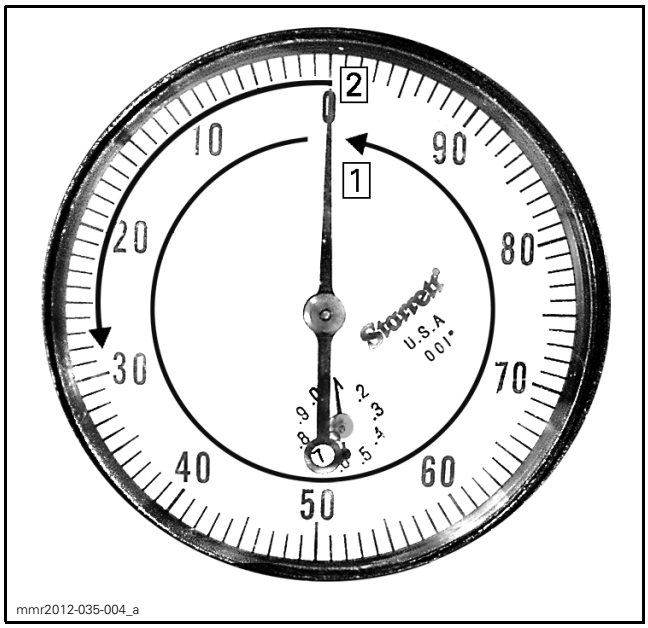
Imperial Dial Gauge



IMPERIAL GAUGE EXAMPLE
1. 001 inch means it is graduated each 1/1000 inch

TYPICAL IMPERIAL DIAL GAUGE		
GRADUATION	MEASURE PER NEEDLE TURN	MEASURE EXAMPLE: .128 INCH
1/1000 inch (.001) per graduation line	1 turn = .100 inch	1 complete turn + 28 graduation lines

NOTE: The small dial indicates the number of turns the long needle traveled around the main dial.



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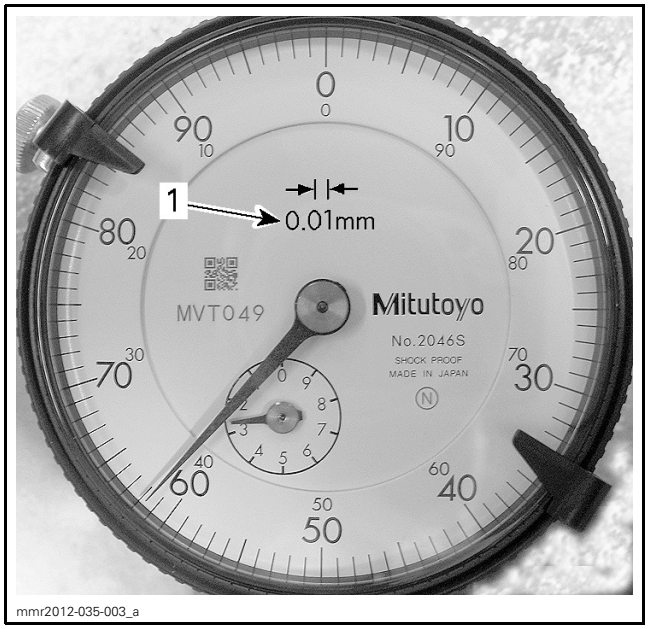
.128 INCH AS AN EXAMPLE
Step 1: 1 complete turn
Step 2: 28 lines

Metric Dial Gauge



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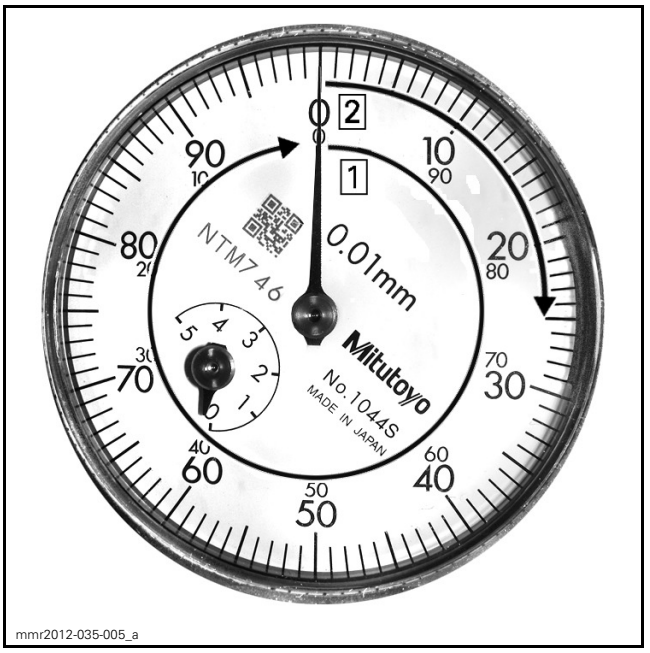
METRIC GAUGE EXAMPLE
1. 0.01mm means its graduated each 1/100 millimeter

METRIC DIAL GAUGE EXAMPLE		
GRADUATION	MEASURE PER NEEDLE TURN	MEASURE EXAMPLE: 3.25 mm
1/100 millimeter (.01) per graduation line	1 turn = 1 millimeter	3 complete turns + 25 graduation lines

NOTE: The small dial indicates the number of turns the long needle traveled around the main dial.



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3.25 mm AS AN EXAMPLE
Step 1: Complete turns (3 X)
Step 2: 25 lines

IGNITION TIMING

Normally, ignition timing adjustments should not be required. It has been set at the factory and should remain correctly adjusted as every component is fixed and non adjustable.

The only time the ignition timing may require adjustment is when replacing the:
- Crankshaft
- Magneto flywheel
- CPS
- ECM.

Adjustment procedure summary:
- Ignition Timing Tool Installation
- TDC Gauge Installation
- Locating Piston TDC
- Scribing the Timing Mark
- Checking Ignition Timing
- Adjusting Timing.

If the ignition timing is incorrect, first check for proper crankshaft alignment. This might be an indication of a twisted crankshaft. Refer to *ENGINE MEASUREMENT* subsection.

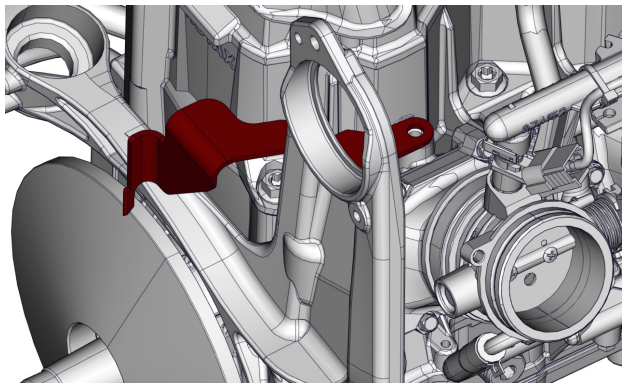
Installing the Ignition Timing Tool

REQUIRED TOOL	
IGNITION TIMING TOOL (P/N 529 036 419)	
Ignition timing tool retaining screw (diameter X thread pitch)	M8 X 1.25

⚠ WARNING

Ensure tether cord is removed from engine cut-off switch and emergency engine stop switch is in the STOP position.

1. Install the ignition timing tool on the engine.



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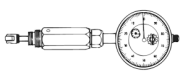
Installing the TDC Gauge

⚠ WARNING

Ensure tether cord is removed from engine cut-off switch and emergency engine stop switch is in the STOP position.

Two TDC gauges can be used:

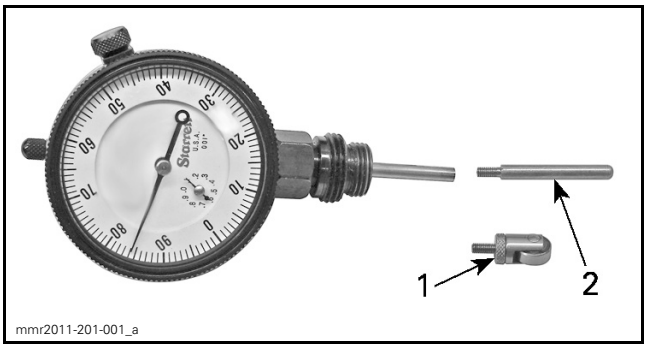
TDC GAUGES	
Preferred Gauge TDC DIAL INDICATOR (P/N 295 000 143) **(short reach)**	
TDC DIAL INDICATOR (P/N 414 104 700) **(long reach)**	

Preparing the Short Reach Gauge (Preferred Gauge)

1. Remove the roller tip from the gauge.

REQUIRED TOOL	
DIAL INDICATOR ADAPTER (P/N 529 036 418)	

2. Use the rounded tip from the DIAL INDICATOR ADAPTER (P/N 529 036 132).



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1. Roller tip removed
2. Rounded tip to install

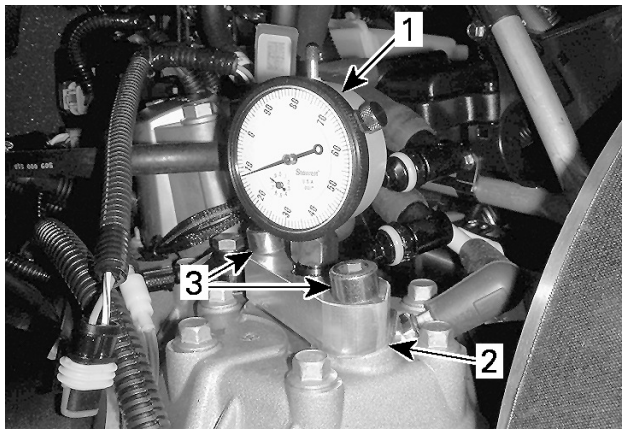
3. Install the rounded tip on the gauge.

Preparing the Long Reach Gauge

1. Replace the roller tip by the rounded tip as described in the *PREPARING THE SHORT REACH GAUGE*.

Installing Gauge (both gauges)

1. Remove the PTO injector, refer to *E-TEC DIRECT FUEL INJECTION* subsection.
2. Install the DIAL INDICATOR ADAPTER (P/N 529 036 418) over the PTO injector hole.
3. Use two screws M10 x 1.5 x 35 to secure the adaptor.
4. Carefully insert the TDC gauge through the dial indicator adapter hole.



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TYPICAL
1. *TDC gauge*
2. *Dial indicator adaptor*
3. *Screws*

5. Screw the gauge into the adapter plate with the dial face towards the PTO and tighten it sufficiently to prevent movement.

Locating Piston TDC

NOTE: Normal engine rotation as seen from the PTO side is counterclockwise.

1. With a firm hold on the drive pulley, slowly rotate the drive pulley counterclockwise while observing the TDC gauge needle.

NOTE: Note that the needle stops moving only as the piston is changing direction at the top of its stroke.

2. Rotate the dial face so the "0" is in line with the needle when it stops moving.
3. Resume rotating the engine in the same direction (counterclockwise) until the gauge needle has rotated approximately 1/4 turn past TDC.
4. Then slowly rotate the engine in a clockwise direction until needle stops moving.

NOTE: The needle should stop on the "0". If not, reset the dial "0" to the needle.

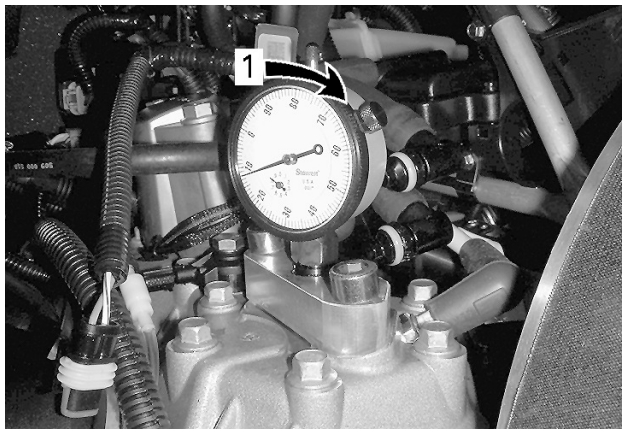
5. Again, slowly rotate the drive pulley back and forth across TDC and confirm the needle always stops exactly at "0" before changing direction. "0" now indicates exact TDC.
6. Lock the dial face with the dial lock screw.

NOTE: If a difference in "0" setting the dial in each direction of rotation is easily noticeable, the engine components may suffer from excessive wear. The engine may require further inspection and maintenance.

Scribing the Timing Mark

IMPORTANT: Make sure to understand the TDC gauge functioning. Refer to *UNDERSTANDING THE TDC GAUGE* in this subsection.

1. From the "0" (TDC), rotate the drive pulley clockwise (backwards engine rotation) until the dial needle rotates past the BTDC specification (see table below).



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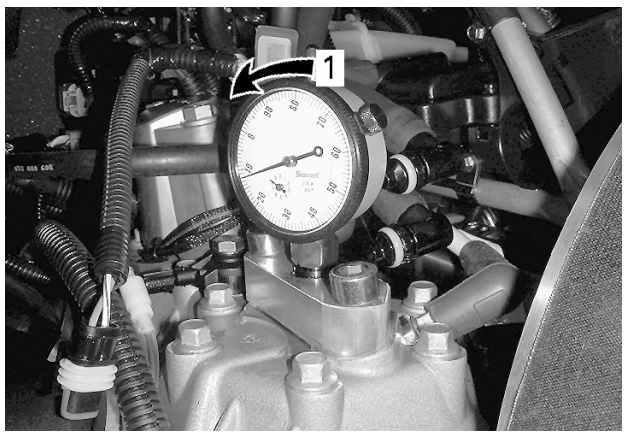
TYPICAL
1. *Pass the BTDC specification*

2. Then carefully rotate engine forward until needle precisely points the measurement specified in the table.



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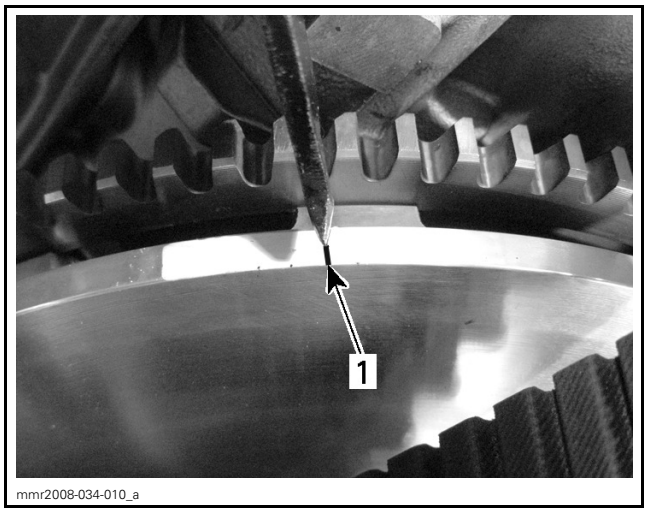
TYPICAL
1. *Bring dial needle to the BTDC specification*

NOTE: Final setting must always be made in the normal engine rotation.

IGNITION TIMING BTDC		
ENGINE	BTDC SPECIFICATION	DEGREE SETTING BTDC
850 E-TEC	6 mm (.236 in)	28°

3. With the TDC gauge indicating specified timing, use a permanent marker to draw a line on the drive pulley fixed sheave directly in line with pointer end.



TYPICAL
1. Timing mark in line with pointer end

4. Repeat the procedure to ascertain the mark is exactly in line with the pointer.
5. Remove the TDC gauge and dial indicator adapter.
6. Reinstall the fuel injector. Refer to *E-TEC DIRECT INJECTION* subsection.
7. Reconnect magneto connector.
8. Check ignition timing as per applicable procedure in this subsection.

Checking Ignition Timing

The ignition timing can be checked with either the engine hot or cold at the specified RPM.

ENGINE SPEED FOR IGNITION TIMING CHECK
ENGINE RPM
2500 to 4000 (1)
(1) In this range, the spark advance does not change during the procedure.

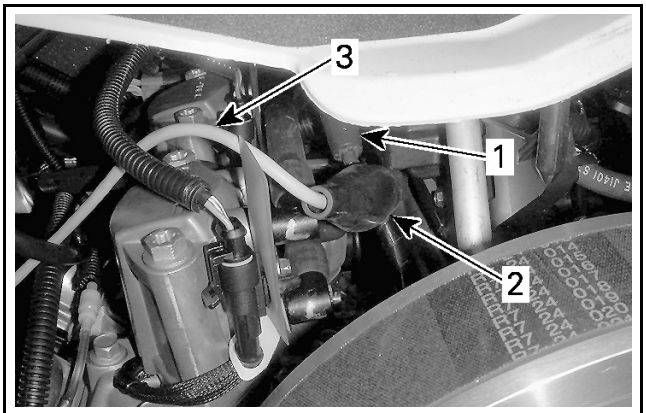
To check the ignition timing proceed as follows:

⚠ WARNING

Place ski tips against a wall, raise rear of vehicle on a stand, so that track does not contact the ground. Do not allow anyone in front of or behind the vehicle while engine is running. Keep clear of track and do not wear loose clothing which can get caught in moving parts.

1. Connect the timing light pick-up to the **PTO** spark plug cable.

NOTE: Be careful to route timing light cable away from drive belt and pulleys.



TYPICAL — TIMING LIGHT CONNECTION
1. PTO spark plug cable
2. Timing light connection to PTO plug cable
3. Timing light wire routing

2. Connect the vehicle to BUDS2, refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
3. Start engine and let idle.
4. In BUDS2, navigate to the **Settings**page.
5. Select the **Ignition/Injection Timing** field.

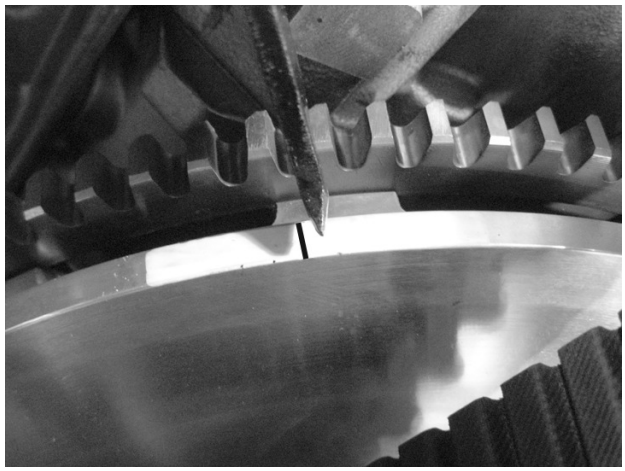
NOTE: Timing will be frozen on the PTO cylinder only for RPM stability. RPM will be limited to 4000 RPM.

6. Point the timing light on the timing mark and increase engine to **3500 RPM** for a brief instant.
7. The timing mark must be aligned with the pointer end within the specified tolerance.

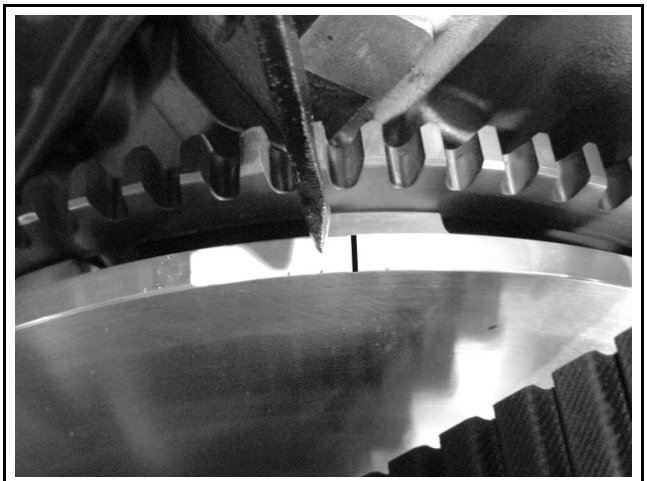
TOLERANCE
± 0.5°

If timing mark and pointer are aligned, no adjustment is required.

If they are not aligned, note if timing is retarded or advanced, see following illustrations. Then, adjust timing as described in *ADJUSTING TIMING* further in this subsection.



TYPICAL — TIMING RETARDED BY ABOUT 1°



TYPICAL — TIMING ADVANCED BY ABOUT 2°

Adjusting Timing

1. In the **Ignition/Injection Timing** area on the **Settings** page, select **Advance** or **Retard** to change the ignition timing.

NOTE: Timing will be changed in 0.5° increments.

2. Adjust the timing using the appropriate button until the timing mark is in line with the pointer, within 0.5°.
3. Unfreeze ignition timing.
4. Click **Close** button to store the ignition timing correction.
5. Shut down engine.
6. Restart engine and **Scan** in BUDS2.
7. Recheck timing to ensure ignition timing adjustment was properly stored in the ECM.
8. Increase engine RPM past 4000 RPM to ascertain the **Freeze Timing** function is no longer active.

NOTE: The **Freeze Timing** function automatically disengages when the engine is stopped.

9. Remove all tools.

MAINTENANCE

For maintenance, including replacing spark plugs, refer to *PERIODIC MAINTENANCE PROCEDURES*.

TROUBLESHOOTING

IGNITION SYSTEM TESTING SEQUENCE

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

In the case of ignition problems, check the following in the prescribed order until the problem can be solved:

1. Spark plugs
2. Spark plug cables
3. Wiring harness/electrical connectors
4. Emergency engine stop switch
5. Ignition cut-off switch
6. Ignition coil(s)
7. CPS
8. ECM (Engine Control Module).

If engine idles roughly or shows signs of increased emissions, the spark plugs may be incorrectly indexed. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

PROCEDURES

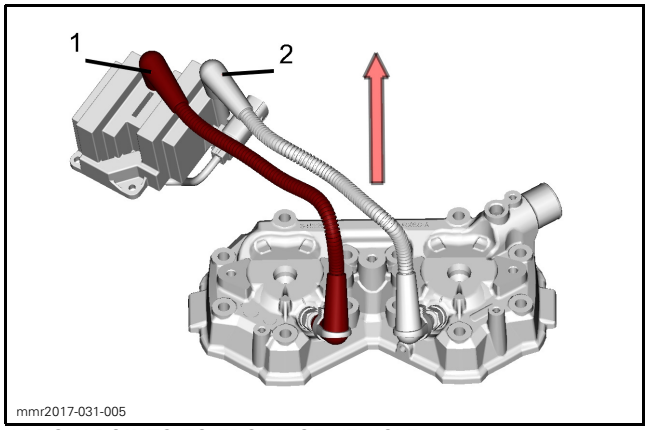
SPARK PLUGS

For spark plug type, refer to *TECHNICAL SPECIFICATIONS*.

For procedure to replace spark plugs, refer to *PERIODIC MAINTENANCE PROCEDURES.*

SPARK PLUG CABLES

NOTICE Do not interchange spark plug cables. The lower LH coil must be matched to the PTO spark plug.



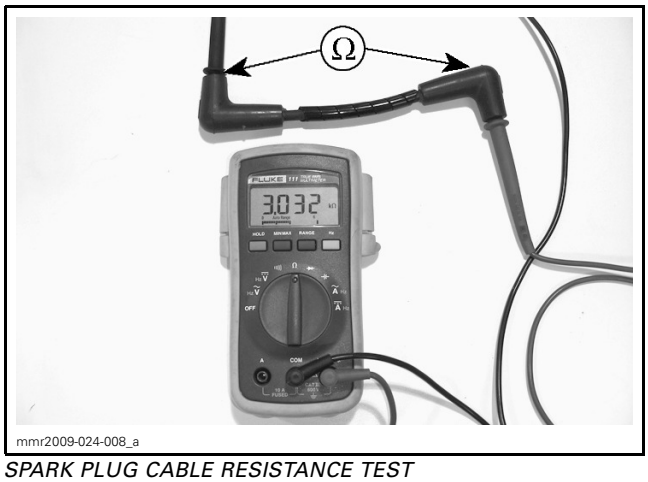
ARROW POINTS TO FRONT OF VEHICLE
1. *PTO side*
2. *MAG side*

Measuring Spark Plug Cable Resistance

If the spark plug cables are in good condition, carry out the following resistance test.

1. Remove each spark plug cable from its ignition coil and spark plug.
2. Insert a probe in each cable end and measure the resistance.

SPARK PLUG CABLE RESISTANCE
2160 – 6870 Ω



SPARK PLUG CABLE RESISTANCE TEST

If resistance is not as specified, replace spark plug cable.

EMERGENCY ENGINE STOP SWITCH

Emergency Engine Stop Switch Operation

The emergency engine stop switch provides a ground signal to the ECM when STOP is selected.

Refer to applicable *WIRING DIAGRAM* for details.

Testing Emergency Engine Stop Switch

1. Disconnect *STR 6P* connector. For connector location, refer to *WIRING HARNESS AND CONNECTORS*.
2. Measure resistance as per following table.

STR 6P CONNECTOR	EMERGENCY ENGINE STOP SWITCH POSITION	SPECIFICATION
Pin 3 to pin 6	RUN	O.L.
	STOP	Continuity

NOTE: If emergency engine stop switch is unplugged, engine will start and run. If emergency engine stop switch is jumped, engine will stop.

IGNITION COILS

Testing for Spark

NOTE: Ensure emergency stop switch is set to *RUN*.

NOTE: Use ONLY an approved inductive spark plug tester or a new spark plug to test for ignition spark. In-line (series connected) spark testers must not be used. Radio frequency interference (RFI) generated by the arcing current may cause erratic behavior in the ECM.

⚠ WARNING

Always electrically disconnect both fuel injectors prior to testing for ignition spark. Otherwise, fuel vapors may ignite in presence of a spark, creating a fire hazard.

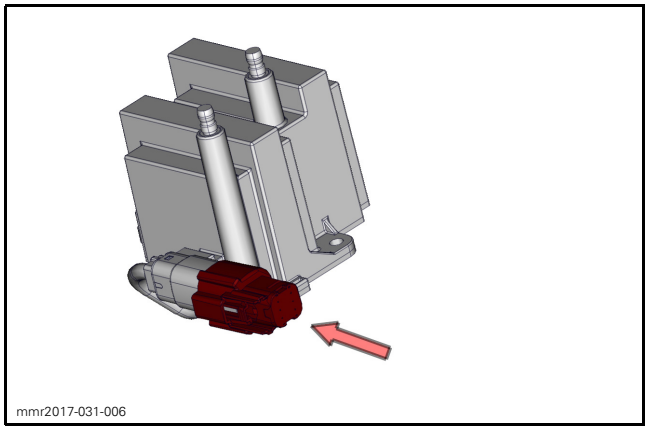
1. Install the inductive spark tester (or a new spark plug) on the spark plug cable **(Do not remove spark plugs installed on engine)**.
2. Activate ignition coil with BUDS2
3. If no spark is produced, test ignition coil.

4. If a spark is produced, install new spark plugs in the engine and repeat the test to assure the new spark plugs are in good condition and functioning correctly.

Testing Ignition Coils

NOTE: Ensure emergency stop switch is set to *RUN*.

1. Backprobe the ignition coil connector and measure voltage as per following table.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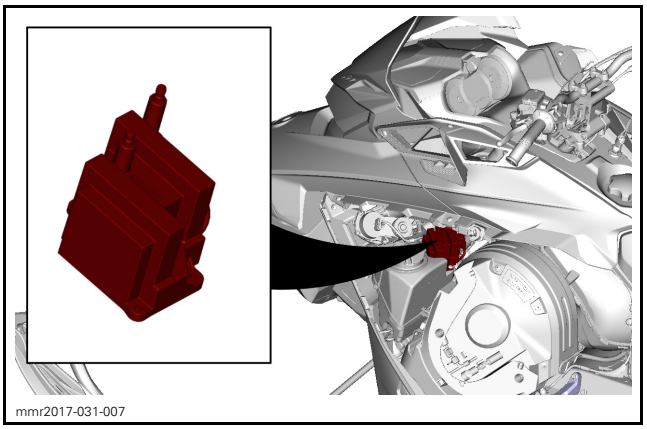
2. Use BUDS2 to activate ignition coil and measure the control signal.

IGNITION COIL CONNECTOR	DESCRIPTION	SPECIFICATION
Pin 1	Ground	Battery ground
Pin 2	Control MAG	Vary when activated 0.015V-0.222V[1]
Pin 3	55 Volts	40V engine off 55V engine running
Pin 4	Ground	Battery ground
Pin 5	Control PTO	Vary when activated 0.015V-0.222V[1]
Pin 6	55 Volts	40V engine off 55V engine running

[1] Control signal actually varies between 13 - 15 volts for 800 micro-seconds (DWELL time) but most multimeters cannot read it, it happens so fast.

3. If all inputs are as per specifications and there is no spark, replace ignition coil.
4. If a pin does not test as per specification, troubleshoot the affected wire continuity to ground or ECM. Refer to *WIRING DIAGRAM*.

Removing Ignition Coil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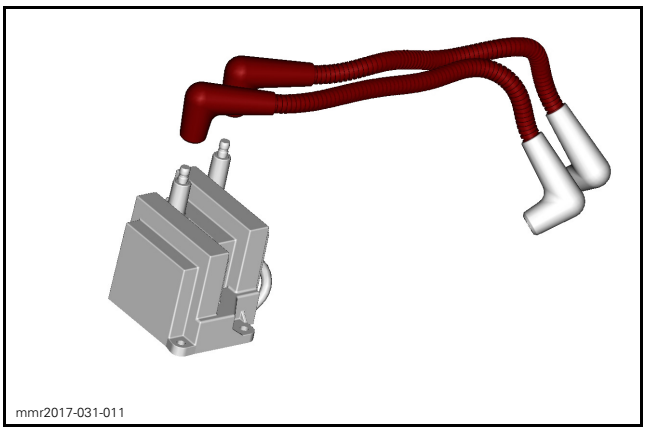
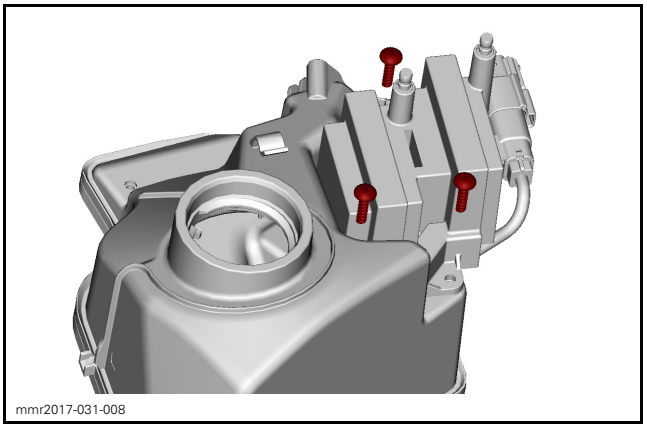
1. Remove the left hand side panel.
2. Note position of spark plug cables and remove them from the spark plugs.


mmr2017-031-011

3. Remove retaining screws.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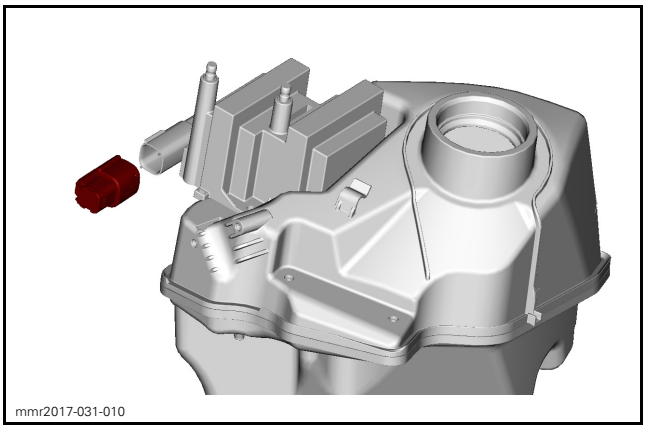
4. Unplug ignition coil connector.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5. Remove ignition coil.

Installing Ignition Coil

Reverse the removal procedures but pay attention to the following:

TIGHTENING TORQUE	
Ignition coil retaining screws	2.4 N•m ± 0.2 N•m (21 lbf•**in** ± 2 lbf•**in**)

CHARGING SYSTEM

SERVICE TOOLS

SERVICE TOOLS – OTHER SUPPLIER

GENERAL

⚠ WARNING

Unless otherwise specified, always disconnect the magneto connector and ensure spark plugs are installed on the engine before carrying out electrical system checks. Should the engine be made to rotate with magneto connected, a spark may occur resulting in electrical shock, a fire, or an explosion.

SYSTEM DESCRIPTION

12V System Capacity

12V SYSTEM CAPACITY	
Over 2000 RPM	30 A
1200 RPM (Idle)	25 A

Magneto

A magneto provides the primary source of electrical energy. It transforms a magnetic field into an alternating current (AC).

The magneto stator is wired with a 3 phase star configuration winding.

AC current is rectified and regulated by a voltage regulator/rectifier circuit within the ECM to provide 55 volts for engine component operation. It is then converted into 14.5 volts by a DC to DC converter for vehicle operation.

TROUBLESHOOTING

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

TROUBLESHOOTING GUIDELINES

Low or No System Voltage (Engine May Not Start)

The vehicle cannot start without having a minimum voltage to the 55 V power circuit. If the engine does not start, see *VOLTAGE REGULATOR/RECTIFIER* in this subsection and test the Vdc Output using BUDS2

If voltage is not as specified, check the following items in the recommended order until you find the fault:

– Stator (refer to *MAGNETO* subsection)
– Capacitor (see procedure in this subsection).

NOTE: The 55 Vdc may be unstable or unobtainable if the capacitor is faulty, not connected, or incorrectly connected.

If the above mentioned checks were good, isolate each of the following components by disconnecting them individually, and repeating the voltage test after each one.

– Each injector
– Each ignition coil
– Fuel pump
– Oil injection pump.

NOTE: When the 55 Vdc test good after a component is disconnected, replace that component and repeat the test.

PROCEDURES

Ensure battery is fully charged (if applicable).

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

Charging Battery

Initial Charging

Sealed VRLA batteries require an initial charge before being used in the vehicle.

NOTE: Since batteries state of charge need to be checked 3 months after their manufacturing date or their last charge, it is highly recommended to check the batteries of all newly arrived vehicles. Consult the "Identification of reminder sticker" section and battery chart on last page.

If you are using a constant current charger, refer to the standard (STD) charging method printed on the battery.

For YTX20HL batteries (18.9 AH), the initial charge must be 1.8 A for 5 - 10 hours.

YTX20HL CHARGING METHOD

If you are using an automatic type taper charger, check to make sure that the charger current (amps) is equal to or greater than the standard charging method listed on the battery.

If the battery gets very hot to the touch, cease charging and allow battery to cool down for 6 to 12 hours. Check voltage using a voltmeter. A fully charged, battery should be 12.8 volts or higher after the battery has been off the charger 1-2 hours. If less, it needs additional charge.

Routine Charging

NOTICE **Overcharging can harm the battery beyond recovery.**

The single most important thing to maintaining a VRLA battery is to not let it sit discharged: keep it fully charged for peak performance.

Use the following guidelines for charging. Always verify battery state of charge before charging, and 30 minutes after charging.

It is not recommended to overcharge sealed VRLA batteries. Because of their characteristics, too much charging will decrease the volume of electrolyte. The longer the overcharge time, the greater the drop in electrolyte – and starting power.

Refer to the following tables for charging routine.

Note that charging times can vary depending on type of charger. Follow the manufacturer's instructions for details.

STATE OF CHARGE : 100%		
VOLTAGE	ACTION	CHARGE TIME
12.8 – 13.0	Check in 3 months or when vehicle is sold***	None required
*** Identify battery as being checked on "date" or needs to be rechecked at "date"		

STATE OF CHARGE : 75% - 100%		
VOLTAGE	ACTION	CHARGE TIME *
12.5 – 12.8	May need slight charge. If no charge given, check in 3 months or when vehicle is sold***	3 – 6 hours
* Using a constant current charger at standard amps specified on the battery		
*** Identify battery as being checked on "date" or needs to be rechecked at "date"		

STATE OF CHARGE : 50% - 75%		
VOLTAGE	ACTION	CHARGE TIME *
12.0 – 12.5	Need charge. Check in 3 months or when vehicle is sold***	5 – 11 hours
* Using a constant current charger at standard amps specified on the battery		
*** Identify battery as being checked on "date" or needs to be rechecked at "date"		

STATE OF CHARGE : 25% - 50%		
VOLTAGE	ACTION	CHARGE TIME *
11.5 – 12.0	Need charge. Check in 3 months or when vehicle is sold***	At least 13 hours verify state of charge
* Using a constant current charger at standard amps specified on the battery		
*** Identify battery as being checked on "date" or needs to be rechecked at "date"		

STATE OF CHARGE : 0% - 25%		
VOLTAGE	ACTION	CHARGE TIME *
11.5 or less (see instructions below)	Need charge. Check in 3 months or when vehicle is sold***	20 hours
* Using a constant current charger at standard amps specified on the battery		
*** Identify battery as being checked on "date" or needs to be rechecked at "date"		

Charging for Voltage of 11.5 V or Less

Batteries with voltage below 11.5 V may require special equipment and procedures to recharge.

In charging an over discharged battery having a terminal voltage of 11.5 V or lower, its internal resistance may be too high to charge at a normal charge voltage.

Therefore, it may be necessary to raise the voltage of the battery initially (20 V as a maximum), and charge for approximately 5 minutes. If the ammeter shows no change in current after 5 minutes, you need a new battery.

Current flowing into the battery at high voltage can become excessive. Monitor amperage and adjust voltage as necessary to keep current at the battery's standard amp rating. Charge for approximately 20 hours.

Testing Battery

Battery Load Test

1. Connect a battery load tester such as the NAPA ULTRA PRO BATTERY LOAD TESTER (P/N 95260).
2. Ensure proper test conditions.

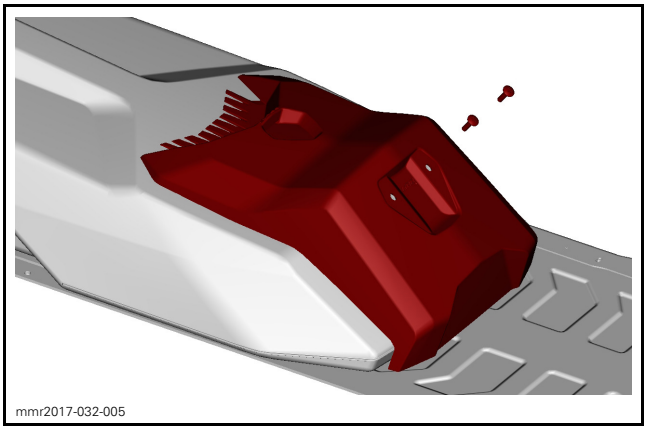
TEST CONDITIONS	
Initial battery voltage‡	Above 12.5 Vdc
Engine	OFF
Load	3 times the amp-hour (AH) rating
Time	15 seconds
‡ Required for accurate testing	

SPECIFICATION	
Battery	Above 9.6 Vdc

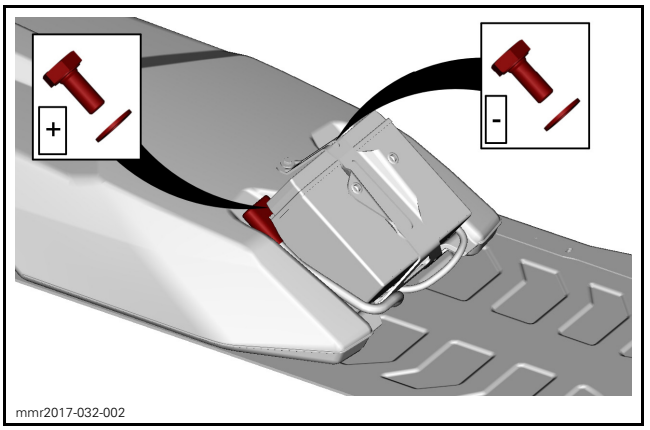
If battery voltage drops below specification during test, replace battery and test charging system.

Removing Battery

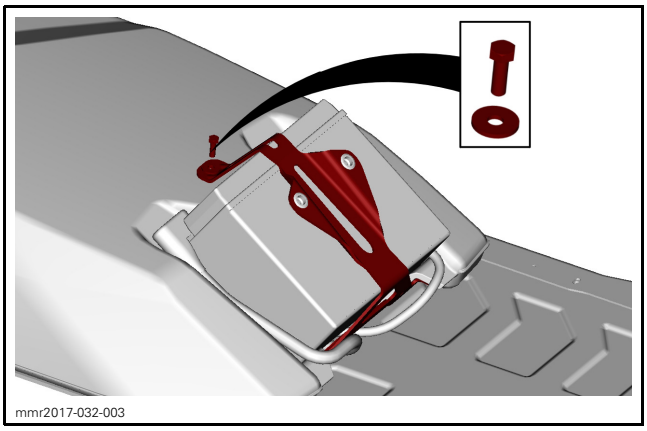
1. Remove seat.
2. Remove battery cover.



3. Disconnect negative before positive terminal.



4. Remove battery hold down bracket.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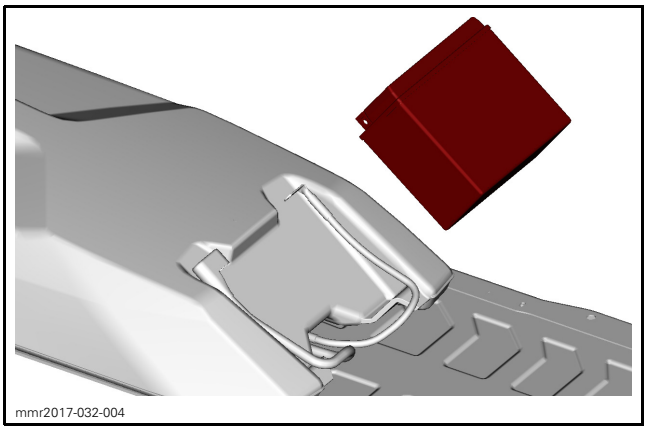
5. Remove battery.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Installing Battery

TIGHTENING TORQUE	
Battery terminals (positive and negative)	10 N•m ± 2 N•m (89 lbf•**in** ± 18 lbf•**in**)
Battery hold down bracket	5 N•m ± 0.5 N•m (44 lbf•**in** ± 4 lbf•**in**)
Battery cover retaining screws	7 N•m ± 1 N•m (62 lbf•**in** ± 9 lbf•**in**)

VOLTAGE REGULATOR/ RECTIFIER

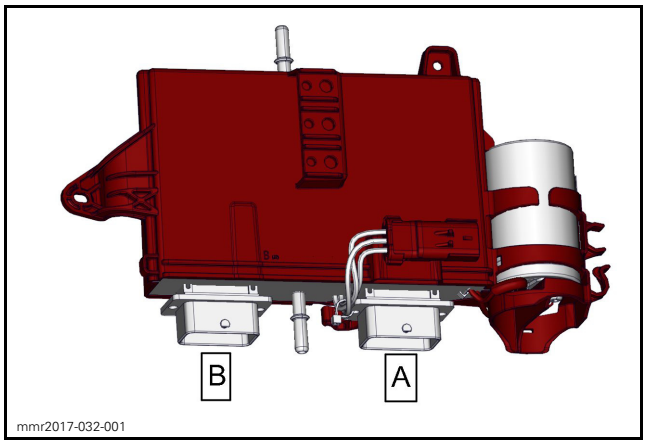
Description

The voltage regulator/rectifier is integrated within the ECM. It receives alternating current (AC) from the magneto which it rectifies and regulates to 55 Vdc.

On a single pull start with the engine between 250 and 500 RPM, the magneto, is capable of producing 30-40 Vdc.

55 Vdc Output

ECMB CONNECTOR
pins M1, M2, M4



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Testing Continuity (Voltage Regulator/Rectifier)

Due to internal circuitry, there is no static test available to check continuity.

Testing 55 Vdc Voltage Output with B.U.D.S. (Voltage Regulator/Rectifier)

1. Raise vehicle so that the track is off the ground and can turn freely.

⚠ WARNING

Ensure vehicle track is completely raised off ground. If the track should come into contact with the ground when the engine is at 5000 RPM, equipment damage and severe injury may result.

2. Remove RH side panel, refer to *BODY* subsection.

Procedure When Engine Cannot be Started

1. Install the following tools to supply power to the 12 Vdc circuits for this test. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection for proper connections.
   - POWER INTERFACE (P/N 515 177 223)
   - 12 V BATTERY SUPPLY CABLE (P/N 529 035 997)
   - 12 volts battery.
2. Select the **Measurements** page.
3. Read the voltage on the **55V System Circuit** meter in B.U.D.S. as the engine is turning over.

55 VDC VOLTAGE OUTPUT TEST	
TEST ENGINE SPEED	VOLTAGE
Pull start (engine not running)	At least 30 Vdc

If you cannot obtain the specified voltage, refer to *TROUBLESHOOTING* in this subsection and carry out the required tests.

Also carry *TESTING VOLTAGE REGULATOR/RECTIFIER GROUND CIRCUIT* in this subsection.

Procedure with Engine Running

1. Connect vehicle to the applicable B.U.D.S. software version, refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Start engine.
3. Select the **Measurements** page.
4. Read the voltage on the **55 V System Circuit** meter in B.U.D.S.

55 VDC VOLTAGE OUTPUT TEST (ENGINE RUNNING)	
TEST ENGINE SPEED	VOLTAGE
Any RPM from idle and above	55 Vdc ± 2

If voltage is below or above specification, refer to *TROUBLESHOOTING* in this subsection and carry out the required tests.

Also test the ECM ground circuit.

Testing ECM Ground Circuit

1. Disconnect the ECMA connector.
2. Test ground circuit continuity as follows.

ECM GROUND CIRCUIT		
Black wire of capacitor	ECMA Connector Pins L3, L4, M3, M4	Continuity
Black wire of capacitor	Chassis ground	Continuity

DC-DC CONVERTER

System voltage (12 Vdc) is explained in *POWER DISTRIBUTION AND GROUNDS* subsection.

12 Vdc Output Voltage Tests (DC-DC Converter)

12 VDC OUTPUT VOLTAGE	
OUTPUT	CONNECTOR - -PIN
Primary 12 Vdc	COM - 6
Secondary 12 Vdc	COM - 5

Testing Primary 12 Vdc Circuit with B.U.D.S.

1. Start engine.
2. Turn off any accessories.
3. Disconnect any external batteries.
4. Select the **Measurements** page.
5. Read the voltage on the **Primary 12 V Circuit** meter in B.U.D.S.

PRIMARY 12 VDC CIRCUIT TEST WITH B.U.D.S.	
TEST ENGINE SPEED	VOLTAGE
Any RPM from idle and above	14.5 ± 0.5 Vdc

If voltage is above specification, replace ECM.

If voltage is below specification, check the *PRIMARY 12 VDC CIRCUIT*

Also test the ECM ground circuit (voltage regulator/rectifier).

Install all removed parts and connectors.

Secondary 12 Vdc Circuit Test

The secondary 12 Vdc system is not monitored in B.U.D.S.

To test it, carry out the following procedure.

1. Remove RH side panel to expose the fuse(s). Refer to *BODY*.
2. Set FLUKE 115 MULTIMETER (P/N 529 035 868) to Vdc scale.
3. Start the engine.
4. Unplug battery (if applicable)
5. Probe the COM connector as follows.

12 VDC OUTPUT VOLTAGE	
OUTPUT	CONNECTOR - -PIN
Secondary 12 Vdc	COM - 5

SECONDARY 12 VDC CIRCUIT TEST	
TEST ENGINE SPEED	VOLTAGE
Any RPM from idle and above	14.5 ± 0.5 Vdc

If voltage cannot be measured, test continuity of wire from COM-5 to ECMB pins L1, L2, and L3.

If the wire continuity is good and other voltages from ECM tested good, ECM may not output secondary 12 Vdc.

Test the *VOLTAGE REGULATOR/RECTIFIER GROUND CIRCUIT*. If the ground circuit tests good, the ECM will need to be replaced.

NOTE: Before replacing ECM, all ECM grounds, power output circuits, and input circuits from the magneto must be tested.

Repair or replace as applicable.

CAPACITOR

The fuel injectors, which require a stable 55 Vdc for their operation, are particularly sensitive to voltage variations. A capacitor is connected to the 55 Vdc electrical system to stabilize the system voltage.

The capacitor is located next to the ECM on the RH side of the vehicle.

Quick Troubleshooting

A faulty capacitor will lead to the following symptoms:

– Unstable, low, or no system voltage (55 V).
– Engine will not start
– Engine hard to start
– Poor idling
– Engine misfiring.

NOTE: A defective capacitor is likely to give off a burning like odor.

Discharging Capacitor

⚠ WARNING

The capacitor remains charged approximately 10 seconds after engine is stopped. A high energy could suddenly be discharged if capacitor terminals were shorted. Always discharge capacitor before servicing.

To properly discharge capacitor, leave it connected for at least 5 minutes after engine has been stopped, or after engine was last cranked before carrying out any maintenance procedure on the capacitor or 55 volt electrical system.

Testing Capacitor Charge Hold

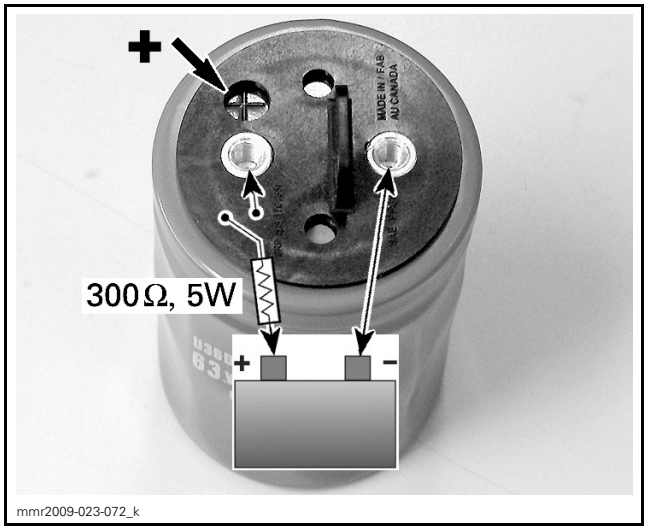
Procedure Setup

1. Remove capacitor from vehicle. Refer to *REMOVING CAPACITOR* in this subsection
2. Work on a non metallic workbench.
3. Connect the following items to the capacitor. See following illustration.
   – A switch
   – Resistor (300 Ω/5 W)
   – 12 V battery (fully charged).

NOTICE **Ensure the test switch is in the OFF position when connecting the battery to the capacitor to prevent sparking or electrical shock.**

⚠ WARNING

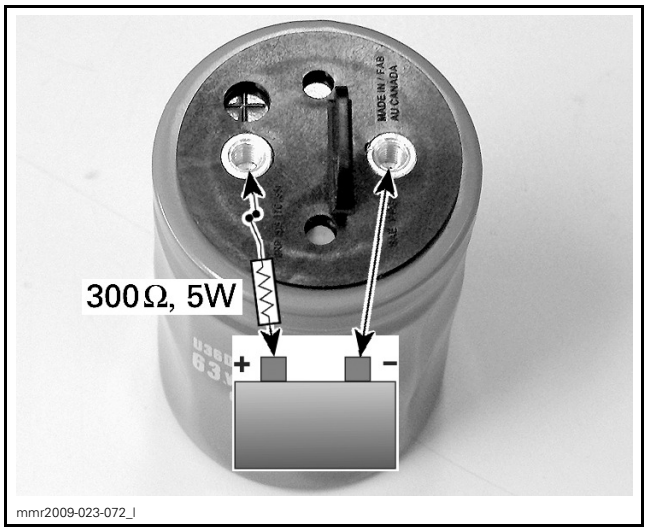
Connect the battery POSITIVE post to the capacitor POSITIVE terminal.



SWITCH AT OFF

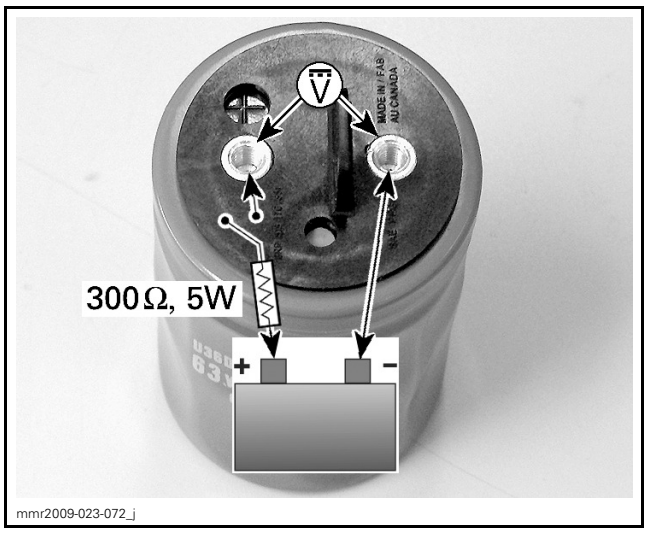
Test Procedure

1. Turn switch to **ON** and read capacitor voltage. Wait until voltage reaches 12 V.



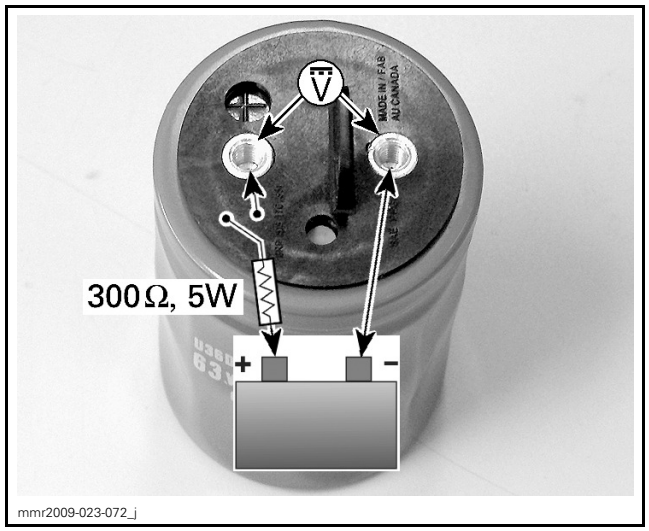
SWITCH AT ON

2. Turn test switch to **OFF**.
3. Use the FLUKE 115 MULTIMETER (P/N 529 035 868) set to Vdc.
4. Read capacitor voltage.



SWITCH AT OFF

5. Wait 5 minutes.
6. Read capacitor voltage again.



SWITCH AT OFF

7. The difference between the readings should not exceed the specification.

ALLOWED VOLTAGE DIFFERENCE BETWEEN READINGS
0.5 Vdc

If readings are out of specification, replace capacitor.

Reinstall capacitor. Refer to *INSTALLING CAPACITOR* in this subsection.

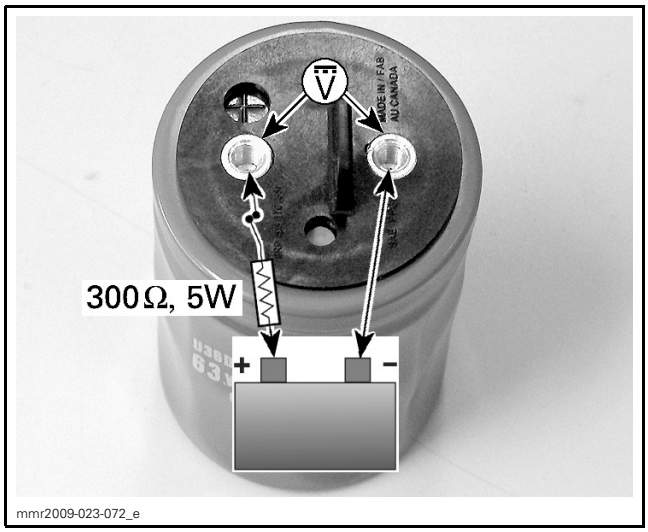
Testing Capacitor Residual Voltage

Procedure Setup

Follow the same steps as described in Procedure Setup of *TESTING CAPACITOR CHARGE HOLD*.

Test Procedure

1. Turn switch to **ON** and read capacitor voltage. Wait until voltage reaches 12 V to ensure the capacitor is fully charged.

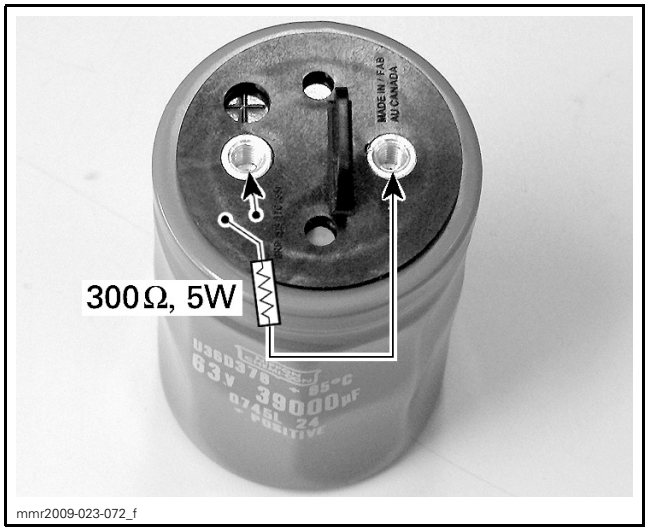


2. Turn test switch to OFF.

NOTE: Carry out the following steps **within one minute** to ensure the capacitor does not begin to discharge before the test.

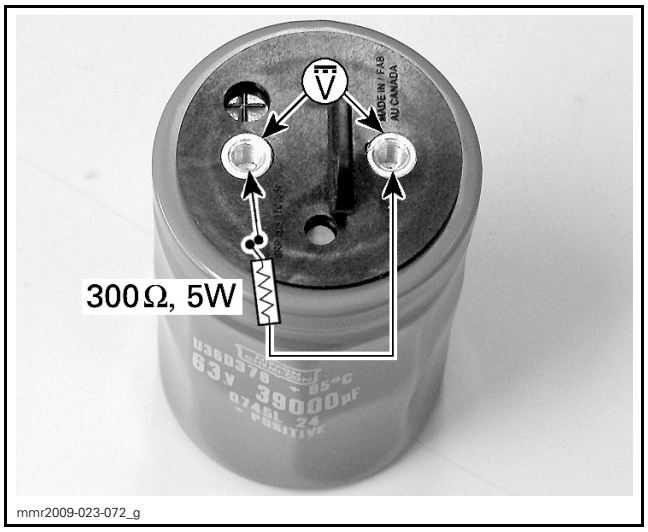
3. Remove battery from circuit and connect the resistor and switch across capacitor terminals.

NOTICE **Ensure test switch is in the OFF position during the circuit configuration change.**



SWITCH AT OFF

4. Turn test switch to the ON position for 12 seconds ± 1 second to slowly discharge capacitor.
5. Read capacitor voltage.



SWITCH AT ON

CAPACITOR RESIDUAL VOLTAGE
Must be above 2.6 Vdc

If voltage is out of specification, replace capacitor.

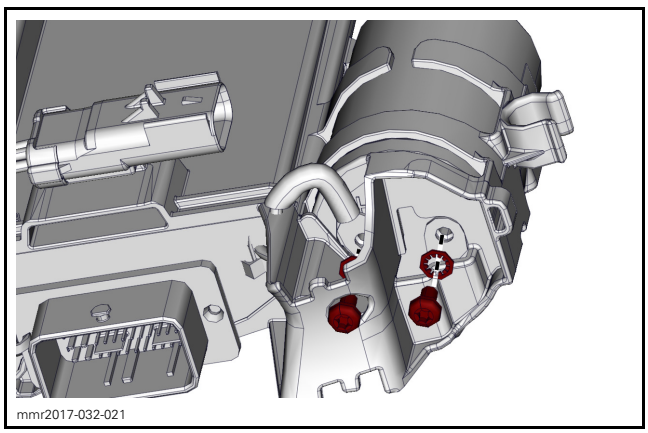
Removing Capacitor

1. Remove upper body module. Refer to *BODY* subsection.
2. Disconnect magneto connector.
3. Remove muffler.

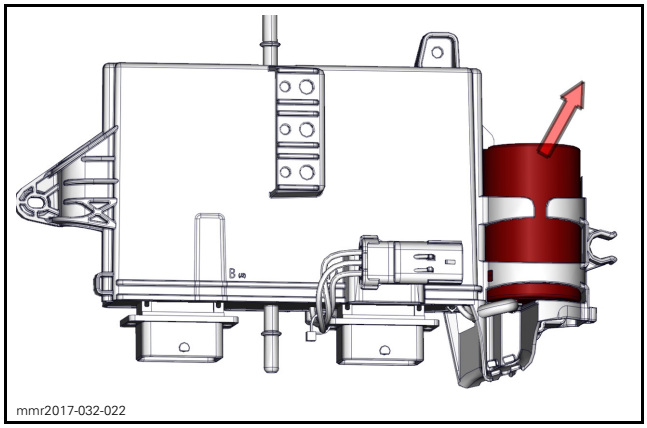
⚠ WARNING

Disconnect the magneto connector. Should the engine be made to rotate with magneto connected, a spark may occur resulting in electrical shock, a fire or an explosion.

4. Ensure capacitor remains connected for at least 1 minute after engine shut down, or after engine was last cranked. This ensures capacitor is fully discharged.
5. Disconnect wire terminals from capacitor.



6. Remove capacitor from bracket.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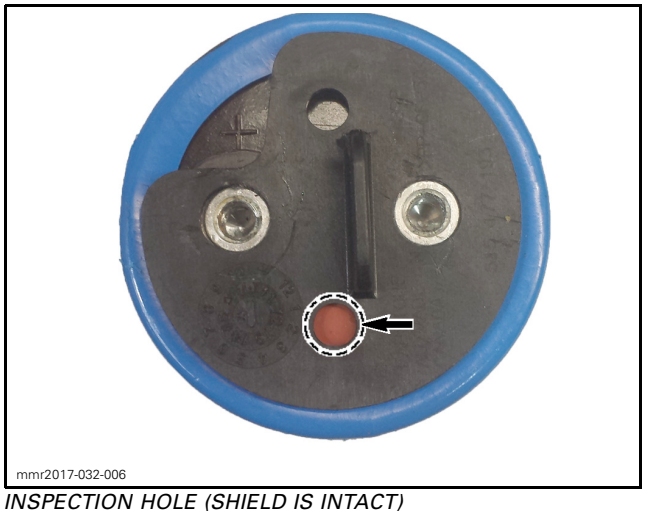
⚠ WARNING

Do not remove plastic protector from top of capacitor unless the capacitor is to be replaced. The cover prevents the two capacitor contacts from being easily shorted together which may cause a spark, possibly resulting in a fire.

7. Check inspection hole on top of capacitor.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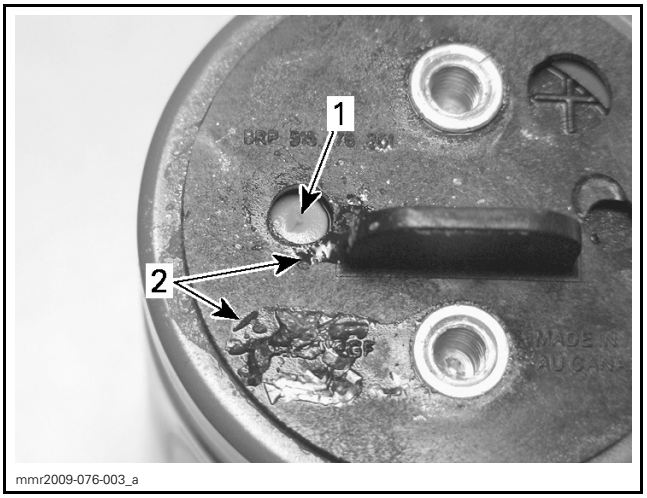
INSPECTION HOLE (SHIELD IS INTACT)

If the top shield is open (pierced), replace capacitor.

NOTE: The following illustration shows a perforated shield with capacitor fluid leakage. This capacitor was connected in reverse polarity.



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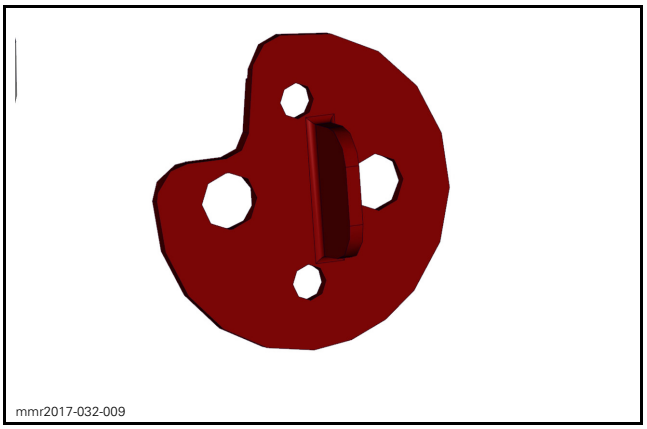
1. Perforated shield
2. Capacitor fluid leakage

Installing Capacitor

1. If capacitor was replaced, install a plastic protector cap on new capacitor.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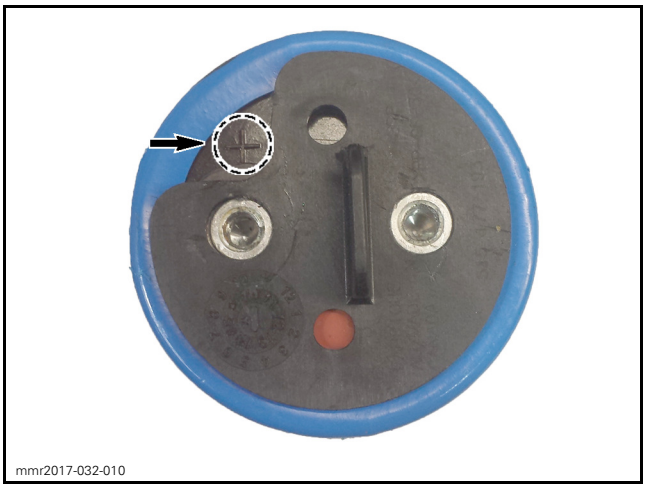
NOTE: When reinstalling plastic protector, ensure the **+** sign on top of capacitor is visible through the hole in protector.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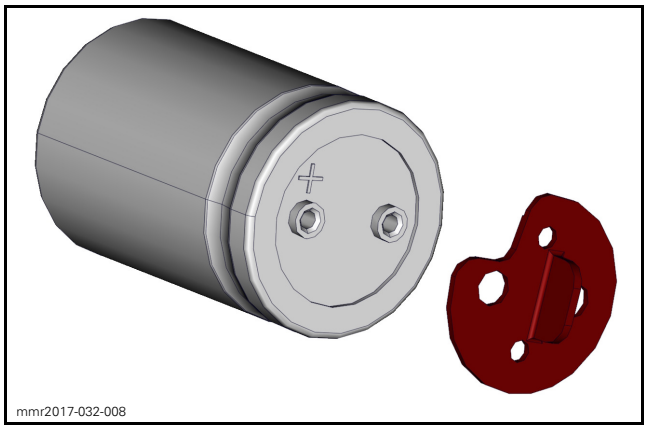
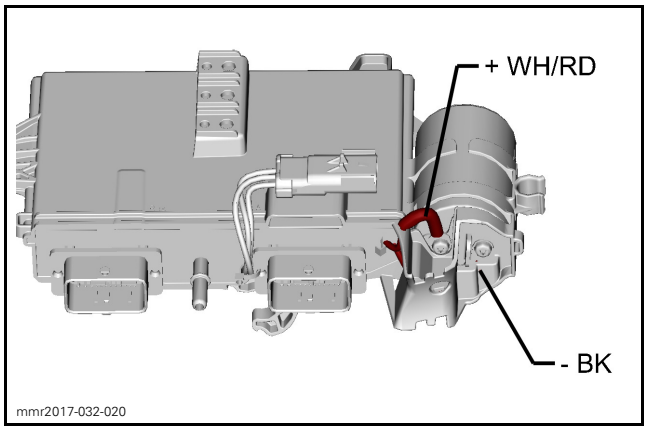
Otherwise, pull off protector, rotate it one half turn, then reinstall it.



2. Route capacitor wires as per illustration and connect wire terminals to capacitor. Connect the WH/RD wire to the **+** terminal.

NOTICE Improper polarity could destroy the capacitor while in operation.



NOTICE Be careful not to damage threads when tightening capacitor screws.

3. Torque screws to 2 N•m (18 lbf•**in**).
4. Complete assembly of remaining parts in the reverse order of removal.

STARTING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
ECM ADAPTER TOOL	529 036 166	3–4
FLUKE 115 MULTIMETER	529 035 868	3

SERVICE PRODUCTS

Description	Part Number	Page
DIELECTRIC GREASE	293 550 004	5

GENERAL

STARTING SYSTEM BASICS (WITHOUT BATTERY)

Conditions for Engine Starting

– Emergency engine stop switch set to RUN;
– D.E.S.S. key on the D.E.S.S. post.

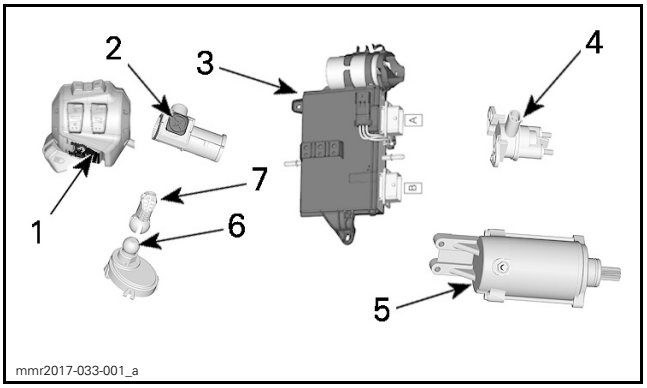
Starting System Operation

Refer to *REWIND STARTER* subsection for starting system operation.

STARTING SYSTEM BASICS (WITH BATTERY)

Basic Starting System Operation (With Battery)

When the START button is pressed, 12 Vdc is applied to the ECM. The ECM activates the internal ECM 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/RER 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 (WITH BATTERY)

DIAGNOSTIC TIPS

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

Starting system failures are not necessarily related to the starter but may be due to one the following:

– Crankshaft position sensor (CPS)
– Starter solenoid fuse and start fuse
– Battery, refer to *CHARGING SYSTEM*
– START/RER button
– Starter solenoid
– Emergency engine cut-off switch
– ECM
– Wiring/connections.

Check these components before removing the starter.

NOTE: This subsection assumes the problem is related to an electrical component of the starting system. If the starting system tests good, ensure engine is in good condition. Refer to applicable subsection.

DIAGNOSTIC GUIDELINES

NOTHING HAPPENS WHEN START/RER BUTTON PRESSED

1. Battery not connected
   - *Connect battery.*
2. Burnt fuse
   - *Check fuses*
3. Defective internal ECM relay or related circuits
   - *Test power and ground circuits to starter solenoid.*
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 CONTINUITY TEST OF START/RER SWITCH CONTROL CIRCUIT 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 (WITH BATTERY)

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

⚠ WARNING

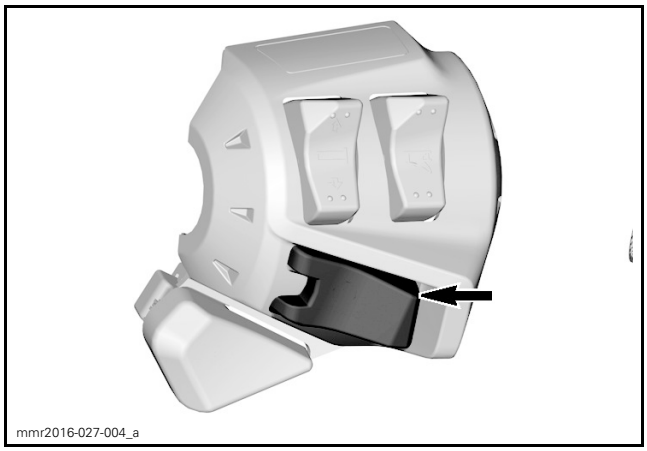
Ensure vehicle cannot move when performing starting system tests.

START/RER SWITCH

Pressing the start/RER switch sends a start signal (battery voltage) to the ECM. If the *ENGINE CRANKING CONDITIONS* are met, the ECM will ground the starter solenoid.

In B.U.D.S., select the **Measurements** page and press the start/RER button to see if the ECM receives the start signal.

START/RER Switch Continuity Test



1. Disconnect the steering connector SH2. Refer to *WIRING HARNESS AND CONNECTORS* subsection.
2. Measure resistance through switch as per following table.

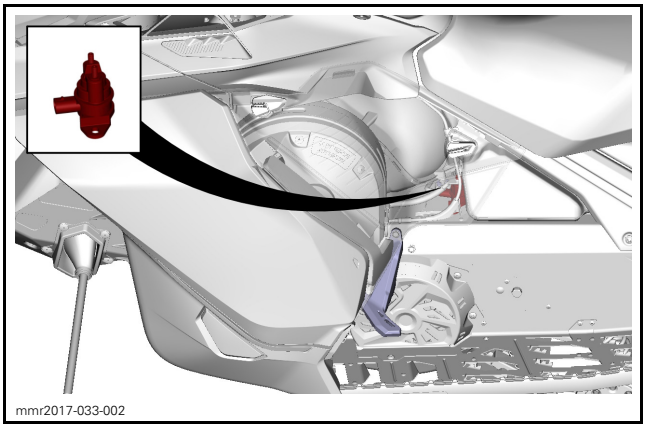
CONTINUITY TEST OF START/RER SWITCH CIRCUIT		
SWITCH POSITION	SH	RESISTANCE
Released	Pins 1 and 2	Close to 0 Ω
Pressed and held	Pins 2 and 8	Close to 0 Ω

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.

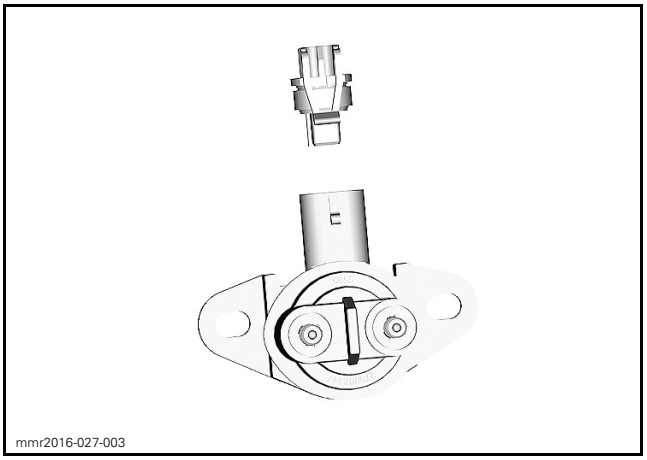
STARTER SOLENOID

Starter Solenoid Location



Testing Solenoid Input Voltage

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.

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

If test succeeded, carry out a *SOLENOID CONTROL CIRCUIT TEST*.

If test failed, carry out a *START/RER SWITCH CIRCUIT CONTINUITY TEST*.

Testing Solenoid Control Circuit

1. Set the multimeter to Ω.
2. Disconnect connector "B" from ECM, refer to *WIRING HARNESS AND CONNECTORS* subsection.
3. Install the ECM ADAPTER TOOL (P/N 529 036 166) on ECM harness connector.
4. Test continuity of wiring from solenoid to ECM as per following table.

SOLENOID CONTROL CIRCUIT TEST		
SOLENOID CONNECTOR	ECM CONNECTOR B	RESISTANCE
Pin B	ECMB-A1	Close to 0 Ω (continuity)

If test failed, repair or replace wiring/connectors.

If test succeeded, carry out a *SOLENOID COIL RESISTANCE TEST*.

Testing Solenoid Coil Resistance

1. Set multimeter to Ω.
2. Disconnect solenoid connector.
3. Measure solenoid coil resistance as per following table.

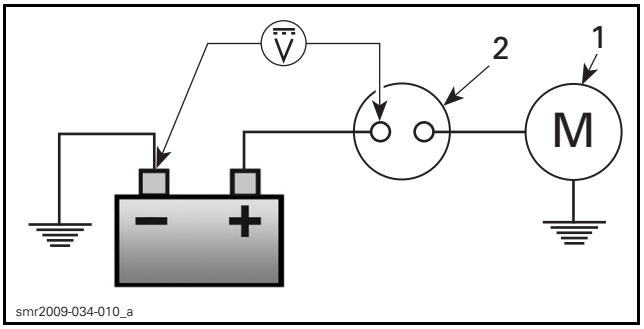
SOLENOID COIL RESISTANCE TEST		
SOLENOID CONNECTOR		RESISTANCE
Pin A	Pin B	4.5 to 5.5 Ω

If test fails, replace solenoid.

Testing Solenoid (Dynamic)

1. 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.

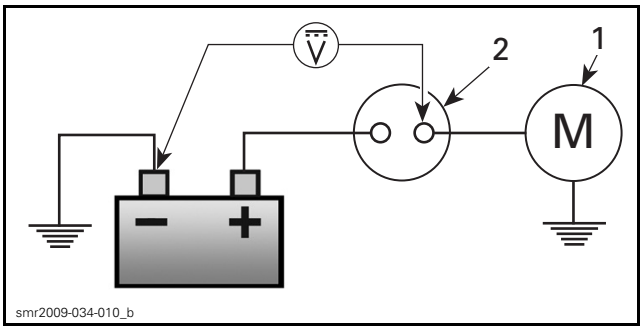
SOLENOID DYNAMIC TEST (ENGINE CRANKING)		
TEST PROBES		SPECIFICATION
Solenoid battery post	Battery ground	Battery voltage



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.

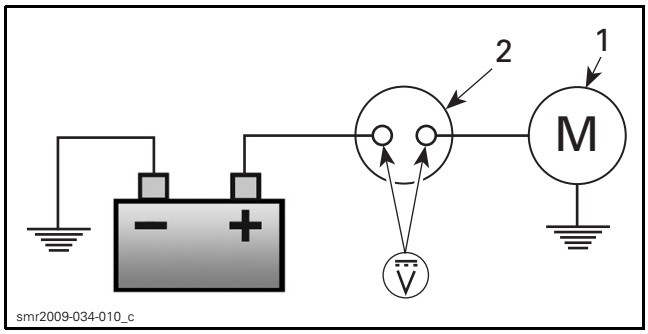
SOLENOID DYNAMIC TEST (ENGINE CRANKING)		
TEST PROBES		SPECIFICATION
Solenoid starter post	Battery ground	Battery voltage



1. Starter motor
2. Starter solenoid

7. If test failed, test *SOLENOID INPUT VOLTAGE*.
8. If test succeeded, continue with next step.

SOLENOID DYNAMIC TEST (ENGINE CRANKING)		
TEST PROBES		SPECIFICATION
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.

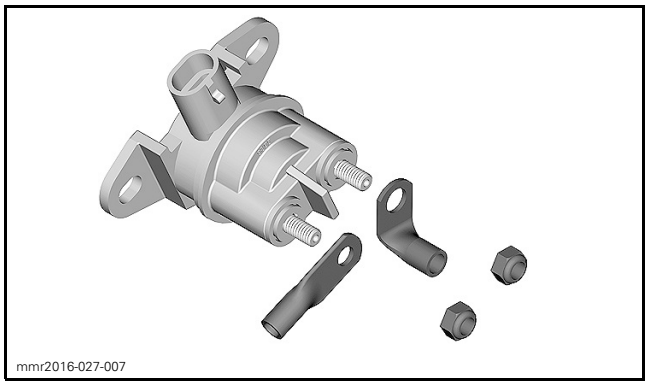
Removing Solenoid

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

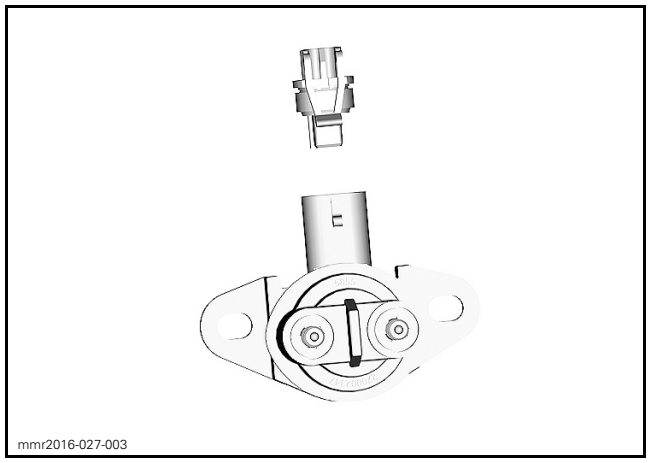
⚠ WARNING

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

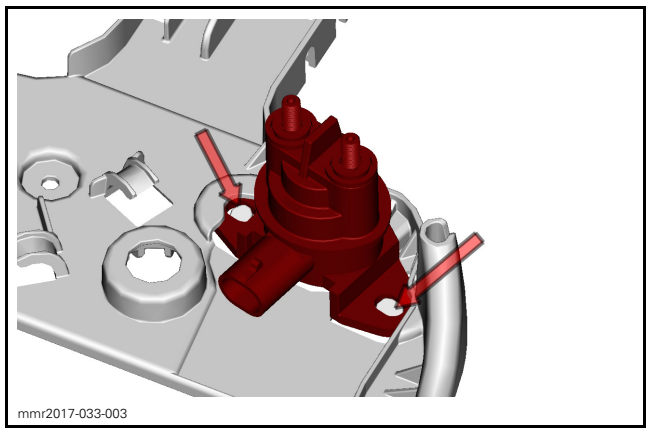
2. Disconnect solenoid cables.



3. Disconnect starter solenoid connector.



4. Press down on the tabs and release the solenoid.



Installing Solenoid

Reverse the removal procedure and pay attention to the following.

1. Secure solenoid on its support, ensure the tabs lock.

NOTE: Apply DIELECTRIC GREASE (P/N 293 550 004) under and over each connections and make sure each nut are well covered.

TIGHTENING TORQUE	
Solenoid cable retaining nuts	4 N•m ± 0.5 N•m (35 lbf•**in** ± 4 lbf•**in**)

2. Close or slide protective caps.

3. 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

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

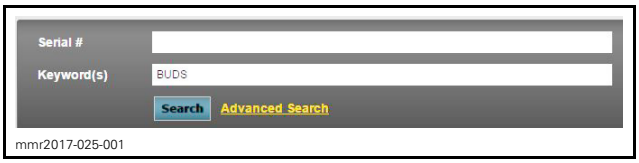
D.E.S.S. Key Programming

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".



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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*.

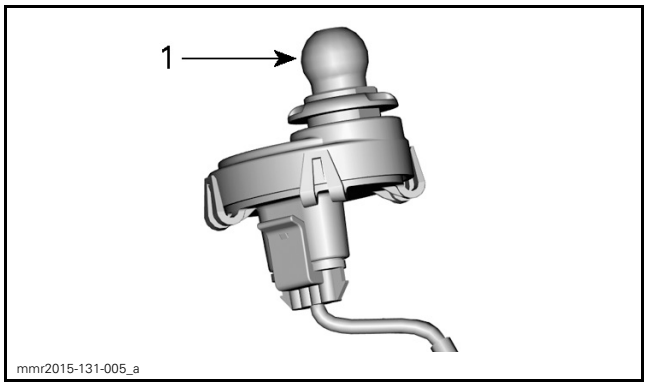
RFID CONNECTOR PIN	SPECIFICATIONS with POWER INTERFACE (P/N 515 177 223) installed
A	ECM ground
B	12 - 15 Vdc
C	5 Vdc
D	12 Vdc

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.



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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.

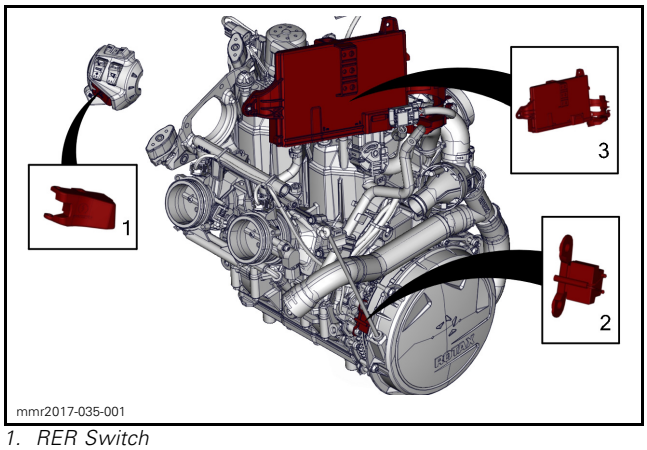
ROTAX ELECTRONIC REVERSE (RER)

SERVICE TOOLS

SERVICE TOOLS – OTHER SUPPLIER

GENERAL

The main components of the RER system are:



1. *RER Switch*
2. *Crankshaft position sensor (CPS)*
3. *ECM*

The ECM receives signals from the CPS for forward and reverse engine rotation.

The ECM recognizes a signal sent by the RER switch.

When the RER switch is activated and the engine is running at or near idle speed, the ECM cuts off ignition, therefore causing the engine RPM to drop off gradually.

When the engine reaches a predetermined low RPM (approximately 450 RPM), the ECM initiates an ignition spark that is greatly advanced in timing, creating a thrust which reverses engine rotation.

If the following condition are not meet, the RER function is disabled and nothing takes place when the RER button is pressed.

– RPM between 1000 and 4300 RPM
– Throttle lever released (TPS opening below 2%)
– Vehicle speed below 25 km/h (16 MPH).

NOTE: Refer to *E-TEC DIRECT FUEL INJECTION* subsection for crankshaft position sensor (CPS) testing.

TROUBLESHOOTING

DIAGNOSTIC TIPS

RER Does Not Respond When Depressing RER Button

Check the following:

– RER fuse condition
– Check if the vehicle is properly configured in B.U.D.S. (with Mechanical Reverse check box not selected)
– *TESTING RER SWITCH SIGNAL WITH B.U.D.S.*

Engine Stops after Pressing RER Button

This confirms that RER control circuits function normally. Check the following:

– CPS
– Engine compression, refer to *TOP END* subsection.
– Reed valves leaking, refer to applicable *TOP END* subsection

– RAVE valve adjustment or sticking, refer to *RAVE* subsection
– Drive belt adjustment, refer to *DRIVE SYSTEM AND BRAKE* subsection
– ECM
– Stator, refer to *MAGNETO SYSTEM* subsection
– Capacitor, refer to *CHARGING SYSTEM* subsection.

Ensure 55V system is in good condition at idle.

RER Functions Erratically

1. Check engine compression.

NOTE: A low compression resulting in loss of engine power may cause the RER to function erratically, leading you to believe the problem is in the electronic control system.

2. Low compression may be due to the following items:
   – REED valves leaking or broken
   – RAVE valves sticking
   – Worn engine parts.
3. Check piston condition through the intake and exhaust ports.

NOTE: Look for scoring on piston skirts. Scored piston skirts or other mechanical problems resulting in excessive friction which may cause the RER to function erratically.

4. Also check the following:
   – RER switch for intermittent operation, refer to *TESTING RER SWITCH CONTINUITY* in this subsection
   – Loose (intermittent) electrical connections
   – Drive belt adjustment, refer to *DRIVE SYSTEM AND BRAKE* subsection
   – ECM.

PROCEDURES

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

RER SWITCH

Testing RER Switch Signal with BUDS2

1. Connect vehicle to BUSD2.Download from *KNOWLEDGE CENTER*. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection for proper connection instructions.

REQUIRED TOOLS	
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 MALE-FEMALE EXTENSION SERIAL CABLE (P/N (DB9))	

NOTE: A 12 volt battery is required to activate the electrical system.

2. In BUDS2, select the **Scan** button.
3. Select the **Measurements** tab.
4. Raise track and start the engine.
5. Press vehicle RER button and look for the **START/RER Button** status to change.

If the **START/RER Button** status changes, it indicates the RER switch, ECM and wiring are functioning properly. Test CPS. Refer to *E-TEC DIRECT FUEL INJECTION* subsection.

If the**START/RER Button** status does not change, carry out the RER switch tests that follow.

NOTE: When the B.U.D.S. RER test is carried out with engine running and reverse engages, the RER light on the **ECM Monitoring** page and the reverse light on the **Cluster Monitoring** page should both turn ON.

Testing RER Switch Continuity

1. Measure continuity of RER switch as per following table.

Models with multifunction switch on handlebar

2. Disconnect the RER switch (SH) connector.

SWITCH POSITION	SH CONNECTOR		RESISTANCE
Released	SH-1	SH-2	Continuity (0.4 Ω max.)
Press and held	SH-8	SH-2	Continuity (0.4 Ω max.)

Models with console switches

3. Disconnect the RER connector.

SWITCH POSITION	RER CONNECTOR		RESISTANCE
Release	RER-1	RER-2	O.L.
Press and hold	RER-1	RER-2	Continuity (0.4 Ω max.)

If continuity test fails, replace switch.

If continuity tests were good, measure voltage as per *TESTING RER SWITCH CIRCUIT*.

Testing RER Switch Circuit

Models with multifunction switch on handlebar

1. Backprobe SH2 connector pins as per table.
2. Lift track and idle vehicle.

(SH) CONNECTOR		SPECIFICATION
SH-1	Chassis ground	0Ω
SH-2	START / RER SIGNAL	Chassis ground when switch is released
		12 volts when switch is pressed and held
SH-8	Chassis ground	Unswitched 12 Vdc

If chassis ground SH-1 and 12 volts SH-8 measurements are good **but** START / RER SIGNAL SH-2 measurements are incorrect, replace switch.

If chassis ground is not measured, repair the wire between chassis ground and SH connector.

If 12 votls is not measured, repair the wire between RER fuse and SH connector.

Testing RER Switch Circuit

Models with console switches

1. Set multimeter to Vdc.
2. Backprobe RER connector pins as per table.
3. Lift track and idle vehicle.

(RER) CONNECTOR		SPECIFICATION
RER-2	Chassis ground	12 Vdc
RER-1	Chassis ground	No voltage when switch is released
		12 volts when switch is pressed and held

If no voltage is present at RER-1 when switch is pressed and held, replace switch.

If no voltage is present at RER-2, repair the wire between RER fuse and RER-2 connector.

Testing RER Switch Signal to ECM

Models with electric starter

1. If applicable, ensure the (SD) starter solenoid connector is disconnected.

All models

2. Disconnect ECMB connector and install the ECM ADAPTER TOOL (P/N 529 036 166).
3. Test wire continuity between the RER fuse and the ECMB connector as follows.

RER FUSE (F1)	ECMB CONNECTOR	RESISTANCE
FB-H	ECMB-A3	RER switch pressed and held Continuity (0.2 Ω max.)
FB-H	ECMB-A3	RER switch released Infinite (OL)

If continuity test is good, try a new ECM.

If test fails, repair or replace wiring.

BEEPER (REVERSE ALARM)

The reverse alarm (beeper) is integrated in the gauge cluster and is also used for emitting the vehicle beep codes. Refer to applicable *GAUGE* subsection for the testing procedure.

LIGHTS

SERVICE TOOLS

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.

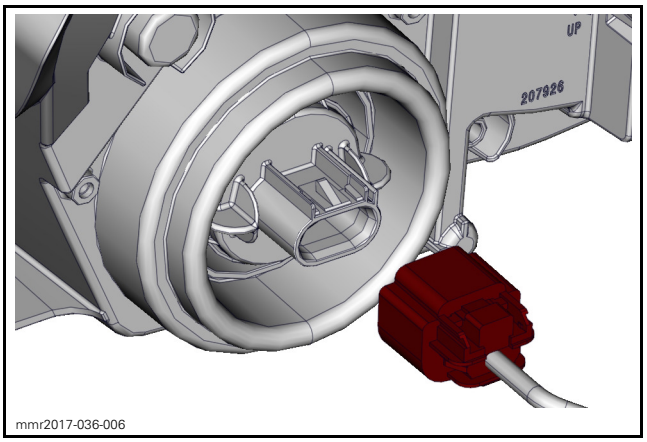
REQUIRED TOOLS
– POWER INTERFACE (P/N 515 177 223) – 12 V BATTERY SUPPLY CABLE (P/N 529 035 997) – 12-volt battery

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.



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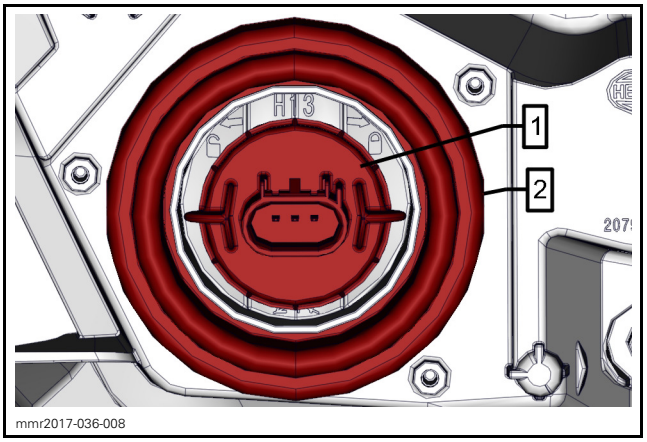
4. Turn bulb socket to unlock and remove bulb.

NOTE: Ensure bulb seal stays in place.



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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.

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.

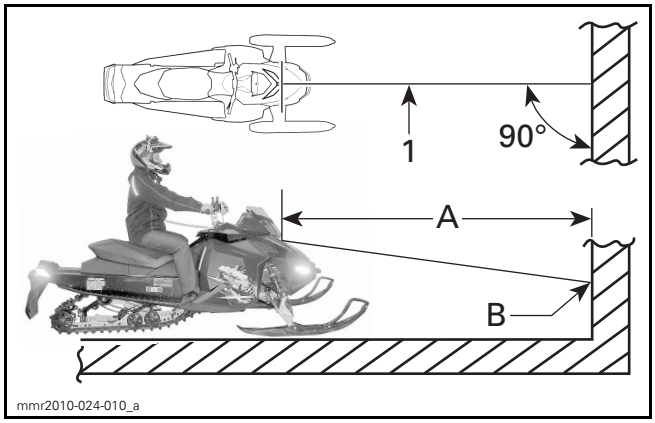
If any test failed, check wiring and connections going to switch.

If test of wiring and connections was good, replace switch.

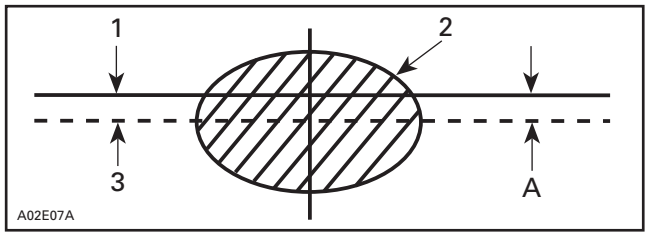
Aiming Headlight Beam

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



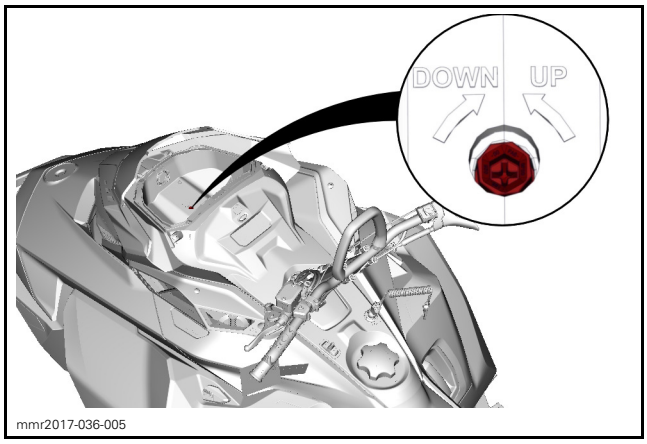
1. Headlight horizontal
2. Light beam (high beam) (projected on the wall)
3. Light beam center
A. 25 mm (1 in)

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.



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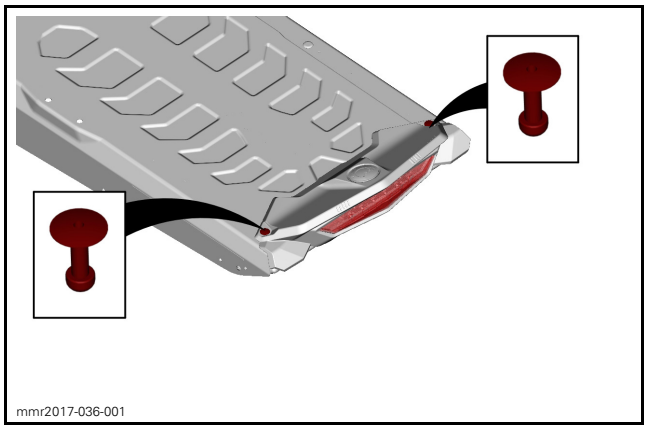
TAILLIGHT / BRAKE LIGHT

Replacing Taillight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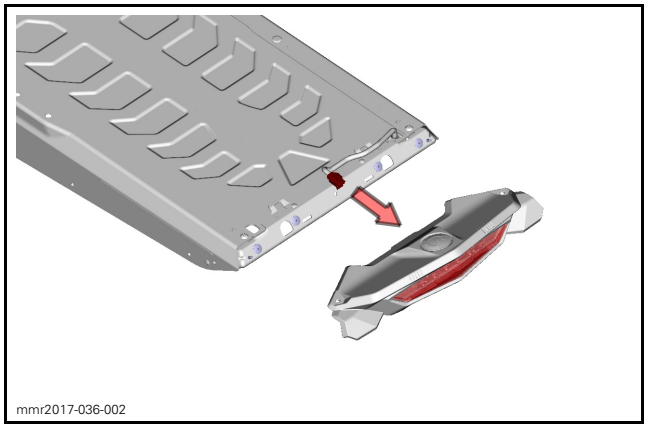
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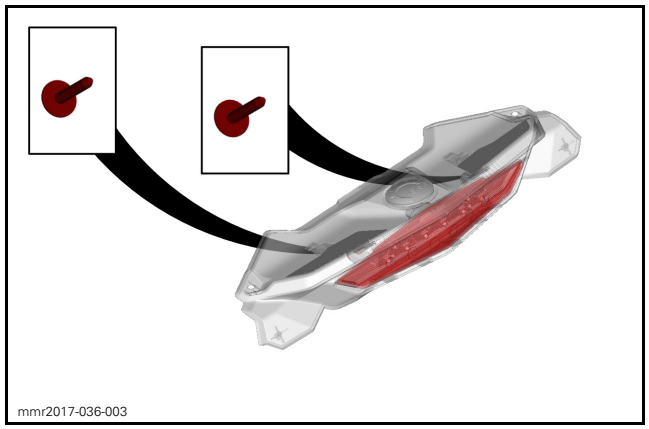
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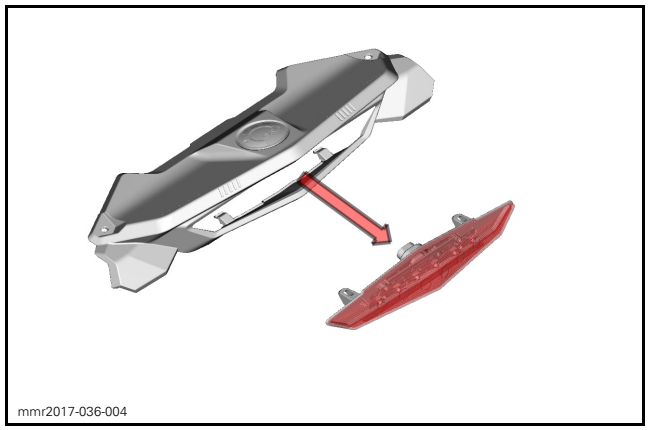
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Replace taillight.

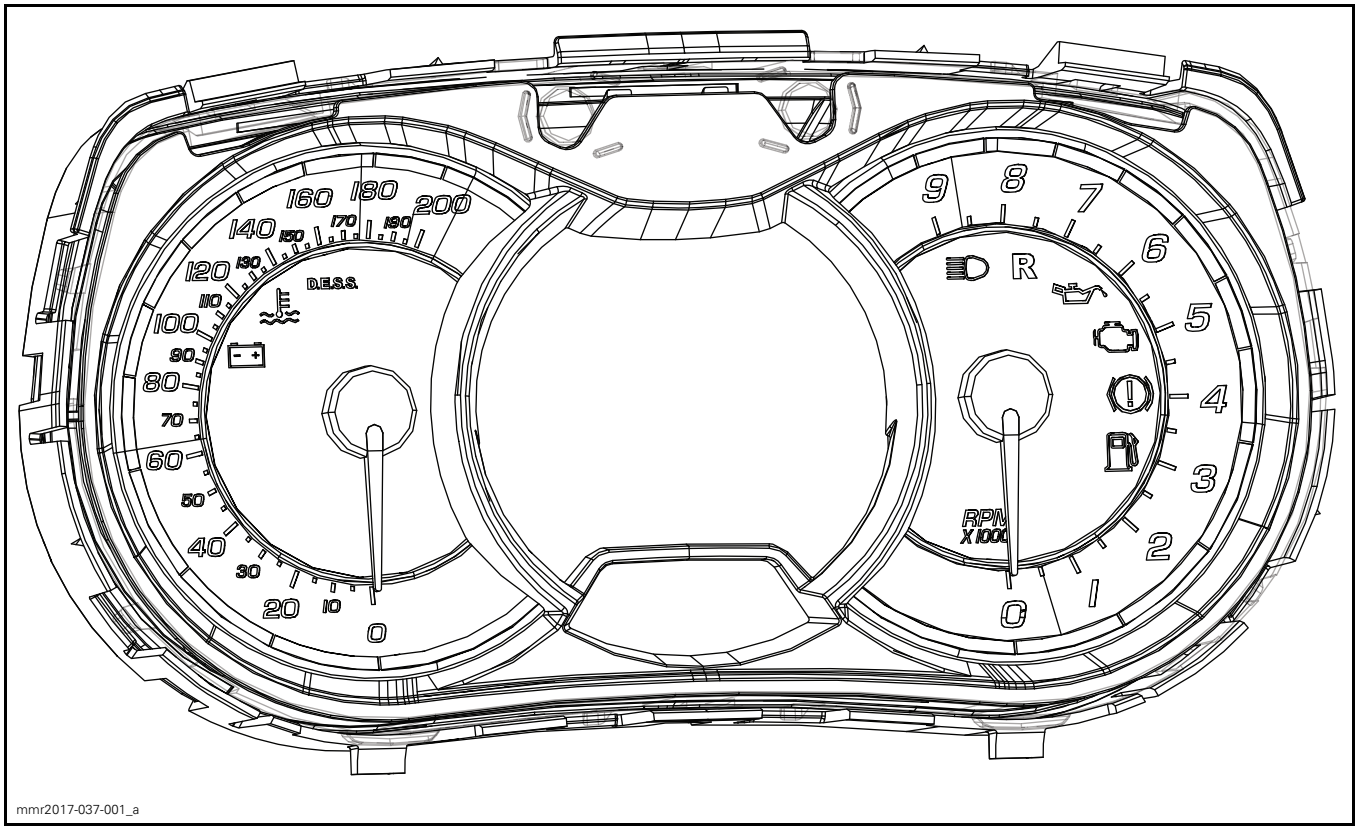
Installation is the reverse of removal. However pay attention to the following.

TIGHTENING TORQUE	
Taillight retaining screw	0.4 N•m (4 lbf•**in**)

GAUGE (ANALOG/DIGITAL)

SERVICE TOOLS

Description	Part Number	Page
12 V BATTERY SUPPLY CABLE	529 035 997	2, 4
POWER INTERFACE	515 177 223	2, 4



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GENERAL

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

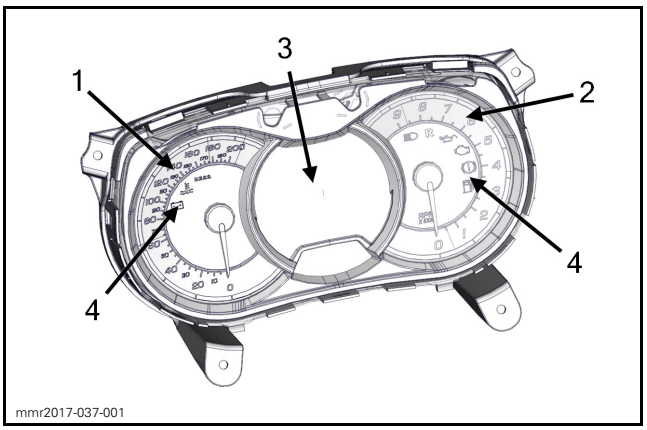
Torque wrench tightening specifications must be strictly adhered to. Locking devices must be replaced with new ones when removed (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.).

SYSTEM TESTING

For models without a battery, connect the following tools in order to provide electrical power to the vehicle.

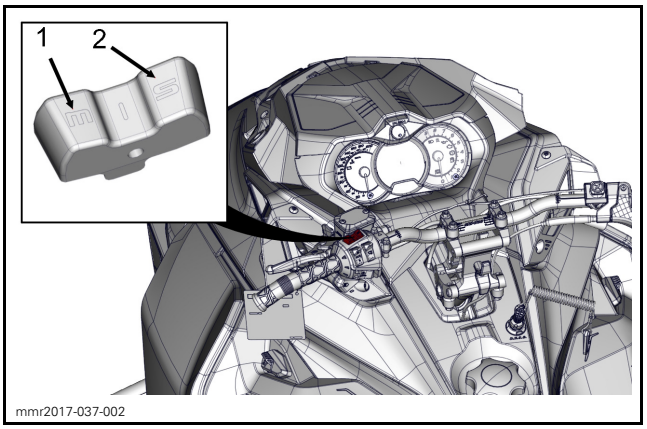
REQUIRED TOOLS
– POWER INTERFACE (P/N 515 177 223) – 12 V BATTERY SUPPLY CABLE (P/N 529 035 997) – 12-volt battery

GAUGE DESCRIPTION



MULTIFUNCTION ANALOG/DIGITAL GAUGE (PREMIUM)
1. *Speedometer*
2. *Tachometer (RPM)*
3. *Gauge Multifunction Digital Display*
4. *Gauge Pilot Lamps*

Mode and Set Buttons



1. *MODE button*
2. *SET button*

The mode and set buttons allow you to toggle through the different gauge functions and settings.

INDICATOR LAMPS

INDICATOR LAMP(S)	STATE	DESCRIPTION
All indicator lamps	On	All indicator lamps are activated during *WOW TEST*
	Steady on	Parking brake engaged.
	Blnking slowly	Unit in reverse position.
	On	Headlights in the HIGH beam position.

INDICATOR LAMP(S)	STATE	DESCRIPTION
	On	Charging system fault
	Blink 4 times then steady on	Engine management system fault
	Blink 4 times then steady on	Engine overheat 85°C (185°F)????
	Blinking	Major engine overheat100°C (212°F)????
	On	Engine temperature displayed
	On	Heated grip temperature displayed
	On	Heated throttle lever temperature displayed
	On	Fuel level displayed
	On (red indicator lamp)	Low fuel
	On	Low Engine Oil Pressure Indicator
D.E.S.S.	Blink 2 times	Good key
	Blinking slowly	Not able to read the key
	Blinking rapidly	Wrong key read / key not programmed to vehicle

INDICATOR LAMP DESCRIPTION

Charging System Fault

There is a charging system fault. Refer to *CHARGING SYSTEM* subsection.

Overheat Indicator Lamp

Overheat indicator lamp may come on for three different reasons: engine overheat, muffler overheat or ECM overheat. The multifunction gauge will display the active problem.

Engine Overheat

The indicator lamp comes on at 85°C (185°F) and power limitation will occur at 95°C (203°F). Major engine overheat condition occurs when engine temperature reaches 100°C (212°F), the overheat indicator light will begin to blink.

Muffler Overheat

The indicator lamp comes on at 750°C (1,382°F) and power limitation will happen at 800°C (1,472°F). Major muffler overheat condition occurs when the muffler temperature reaches 800°C (1,472°F).

ECM Overheat

The indicator lamp comes on at 80°C (176°F) and power limitation will occur at 85°C (185°F).

Fuel Level Indication

A bar gauge located in the RH side of the display indicates the amount of fuel in the fuel tank.

When there is approximately 12 L (3.2 U.S. gal.), the indicator lamp will come ON to advise you that a low fuel condition exists.

Check Engine Light

The check engine light comes ON when a fault is detected by the engine management system.

The check engine light may be accompanied by the applicable scrolling fault message in the multifunction display.

To scroll through active fault codes, refer to *DISPLAYING "P" CODES* in this subsection .

Low Injection Oil Level Indicator

When this indicator is ON, it indicates a low injection oil level condition. Look for a message in the multifunction display. Add oil to oil tank.

TROUBLESHOOTING

SYSTEM TESTING

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

GAUGE

Gauge Self Test Function

Gauge self test only runs if the gauge has been off for more than 30 seconds.

On **ECM wake-up**, the gauge will perform a self-test. All indications should come ON and gauge pointers will cycle once. You will have a few seconds to ensure the indications (**LEDs** and **LCDs**) are functioning correctly.

NOTE: This test only validates the gauge operation of the **LEDs**, **LCDs** in the gauge digital display and the pointers. It does not test the actual circuit functions related to each indication.

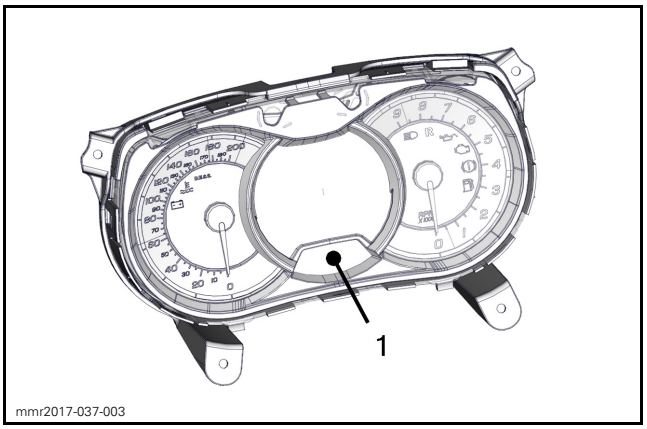
If the self test does not take place, test gauge input power.

Gauge Setup

Activating Clock

The gauge has an internal clock that can display the time of day in the lower digital display (when selected).

NOTE: The internal clock is only available if the vehicle is equipped with a battery, such as an electric starter kit.



1. Clock displayed

1. In BUDS2, select the **Settings** page.
2. Activate the clock (models with battery).

Changing Gauge Units of Measurement

The gauges are factory preset to indicate in imperial units and can be changed using the BUDS2 software.

To change the gauge units of measurement in BUDS2:

1. Provide electrical power to the gauge.
2. In BUDS2, select the **Setting** page.
3. Select **Imperial** or **Metric** in the **Cluster Units** field.

NOTE: Speedometer, odometer and trip meter will have their units (kilometer or miles) changed simultaneously.

Adjusting Speedometer and Tachometer Pointer

1. In BUDS2, select the **Settings** page.
2. Click on **Clockwise** or **Counterclockwise** button to align gauge pointer with the zero (0).

NOTE: Because of the fine tuning of the pointer, the button must be pressed several times before perceiving pointer movement.

Displaying "P" Codes

1. To activate **P CODE** mode, push and hold the "M" button for 2 seconds.
2. As you hold the "**M**" button, quickly turn ON and OFF the high beams a few times. The gauge will enter **P CODE** mode.
3. While in **P CODE** mode, use the "**M**" or "**S**" button to scroll over available failure codes.
4. Push and hold the "**M**" button to exit **P CODE** mode.

A NO ACTIVE P CODE message is displayed if there are no P CODES in memory.

Testing Gauge With BUDS2

The *GAUGE SELF TEST* can be duplicated using BUDS2

1. Connect vehicle to BUDS2 Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. In BUDS2,choose the **Functions** page.
3. Select **WOW Test**.

Testing Gauge Power(Main 12 Vdc)

If the gauge does not come on when the engine is started, carry out the following test.

1. Remove multifunction gauge.
2. Disconnect the gauge connector.
3. Set multimeter to Vdc.
4. Start engine.
5. Measure voltage with the chassis ground as per following table.

GAUGE CONNECTOR	VOLTAGE
Pin 8	Approximately 14.75 Vdc

6. If gauge main power input test was as specified, test the gauge ground circuit.
7. If no voltage was read, test wiring continuity. Refer to *WIRING DIAGRAM* for details.

Testing Gauge Ground

1. Set multimeter to Ω selection.
2. Measure for continuity of gauge ground wire to chassis ground as per following table.

GAUGE CONNECTOR	RESISTANCE
Pin 11	Close to 0 Ω

If ground test failed, check vehicle ground. Refer to *POWER DISTRIBUTION* subsection.

If gauge power input test and ground circuit continuity tests are good, replace gauge.

Testing Clock 12 Vdc Input (If electric starter kit is installed)

If the clock function in the premium gauge does not hold the proper time of day when the engine is not running, carry out the following test.

1. Remove multifunction gauge.
2. Disconnect the gauge connector.
3. Set multimeter to Vdc.
4. Measure voltage as per following table.

GAUGE CONNECTOR	VOLTAGE
Pin 9	Battery voltage

5. If there is no voltage read, test input wire continuity. Refer to *WIRING DIAGRAM* for circuit details.

Testing Gauge Beeper

To test beeper, perform the following test with BUDS2

1. Connect vehicle to BUDS2 Refer to *COMMUNICATION TOOLS AND B.U.D.S.*
2. In BUDS2, choose the **Functions** page.
3. Activate the **Cluster Buzzer Test**.

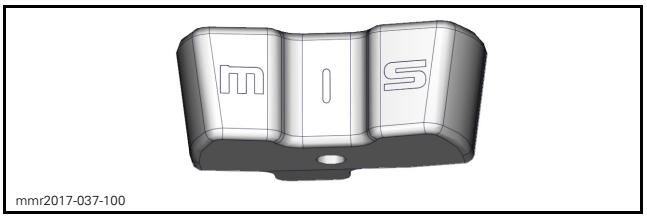
You should hear a few beeps.

– If you do not hear the beeper, replace gauge.

Testing Gauge Buttons with BUDS2

Using the BUDS2 software, select the **Measurements** page.

Press the **'m'** and **'s'** buttons on the left multifunction switch.



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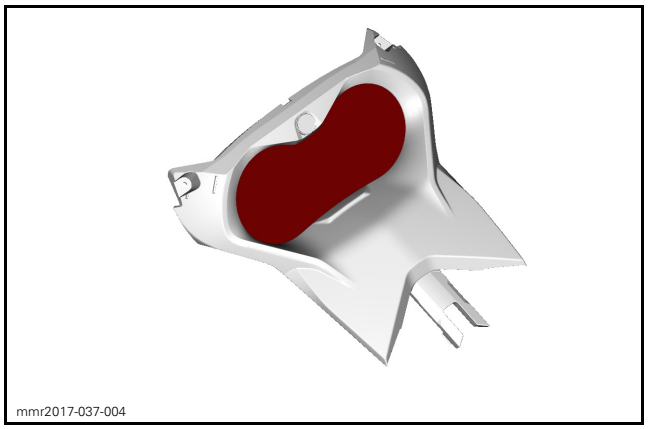
If the indicator light(s) come ON in BUDS2, the gauge button(s) is(are) functioning correctly.

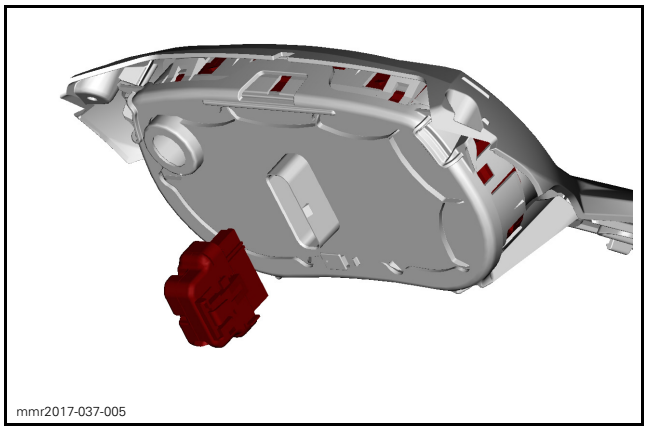
If the indicator light(s) do not come ON, check button(s) and wiring continuity, refer to *WIRING DIAGRAM*. If they are in good condition, replace gauge.

Removing Gauge

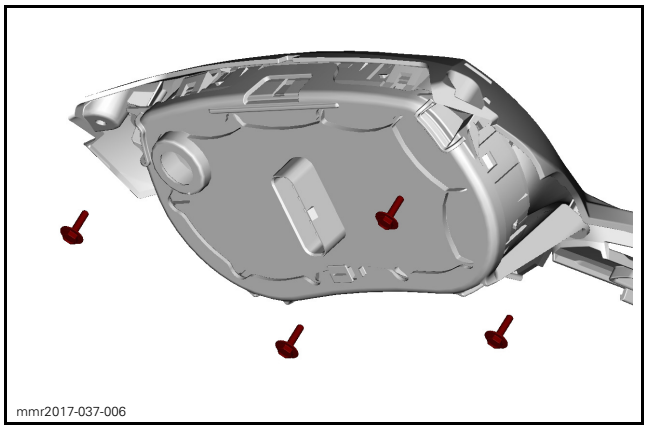
1. Remove glove box.
2. Remove gauge trim.



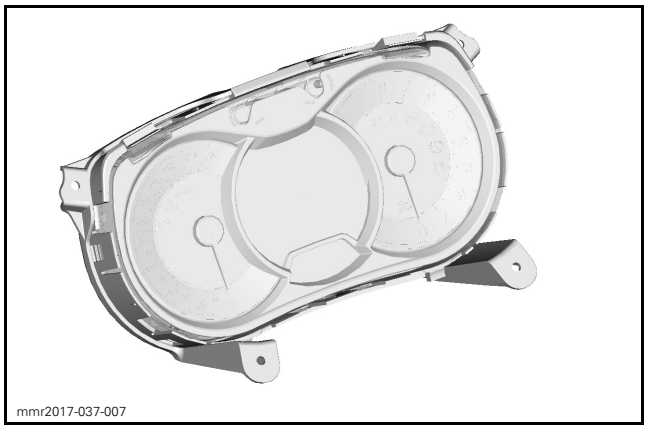
3. Unplug gauge connector.



4. Remove retaining screws.



5. Remove gauge.



Installing Gauge

Reverse removal procedure.

TIGHTENING TORQUE	
Gauge retaining screws	1 N•m ± 0.2 N•m (9 lbf•**in** ± 2 lbf•**in**)

Configuring Gauge

Using BUDS2, configure gauge options as per customer preferences

– Language
– Units

Summerization Function

Like other engines, the E-TEC has to be properly lubricated at storage for internal parts protection. The E-TEC system offers a built-in engine storage lubrication function (summerization) that can be initiated by the operator.

To engage procedure, do the following:

1. Place the vehicle in a well ventilated area.
2. Start the engine and let it run at idle speed until it reaches its operating temperature (watch the coolant temperature on the display or verify that the rear heat exchanger becomes warm).
3. Push the SET (S) button to select odometer mode.

NOTE: The storage mode does not function in other modes (trip A, trip B and hr trip).

4. Hold the **SET button** while repeatedly pressing the HI/LOW beam switch until **PRESS/HOLD _S_ FOR OIL INJECTION** appears on the display.
5. Release all buttons when gauge displays **PRESS/HOLD _S_ FOR OIL INJECTION** appears.
6. Again, press and hold the SET (S) button for 2 - 3 seconds.

NOTE: The gauge will display oil injection when the storage procedure is initiated.

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7. When gauge displays **oil injection**, release button and wait for the lubrication function to end.

Do not touch anything during engine lubrication cycle.

The engine lubrication function takes approximately 1 minute. During this time, engine RPM may increase slightly and the oil pump will "oil flood" the engine.

At the end of engine lubrication function, the ECM will stop the engine.

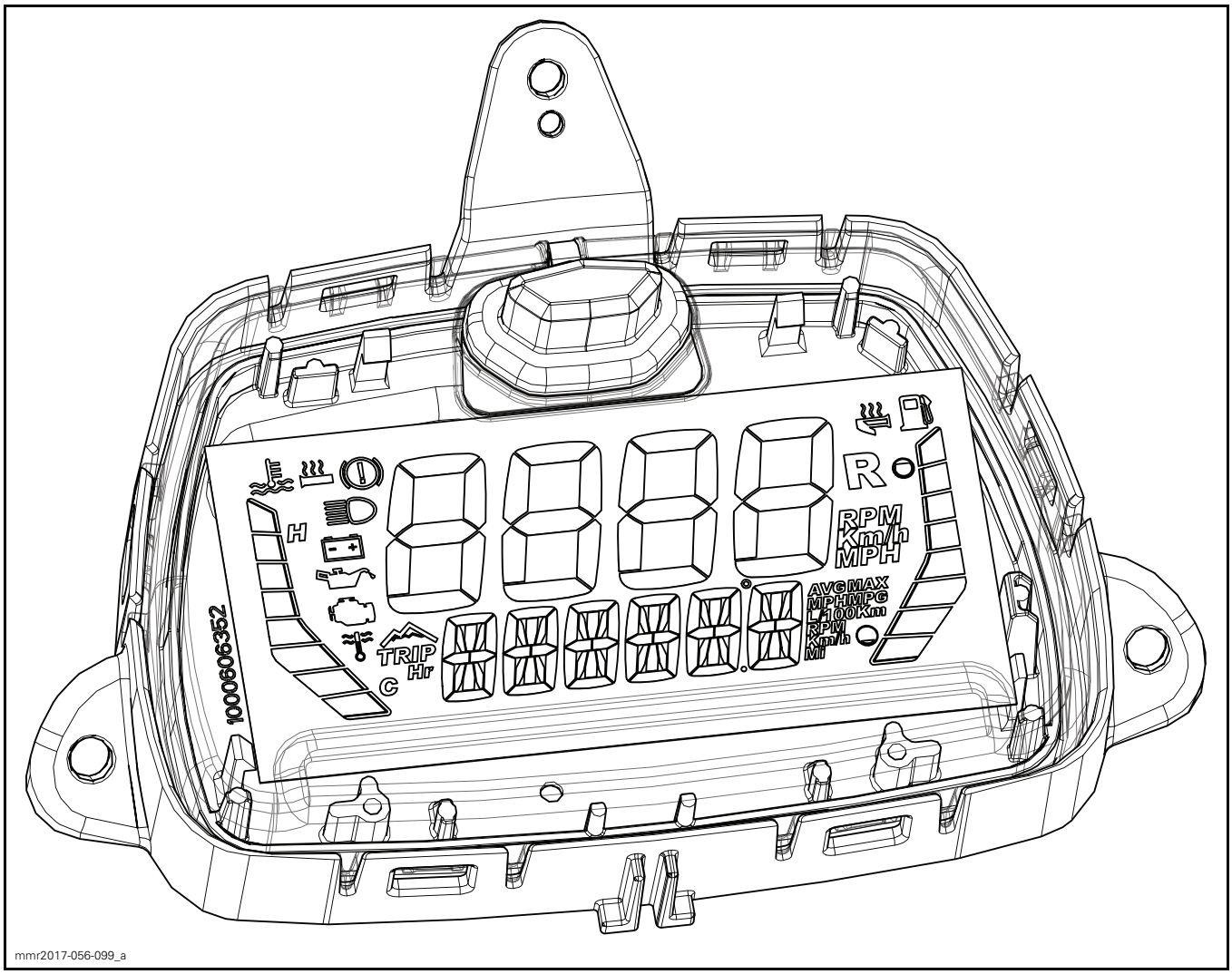
8. Remove tether cord cap from engine cut-off switch.

NOTICE **Do not start the engine during storage period.**

GAUGE COMPACT DIGITAL

SERVICE TOOLS

Description	Part Number	Page
12 V BATTERY SUPPLY CABLE	529 035 997	2
POWER INTERFACE	515 177 223	2



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GENERAL

The compact digital gauges is a heated, backlit LCD gauge.

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

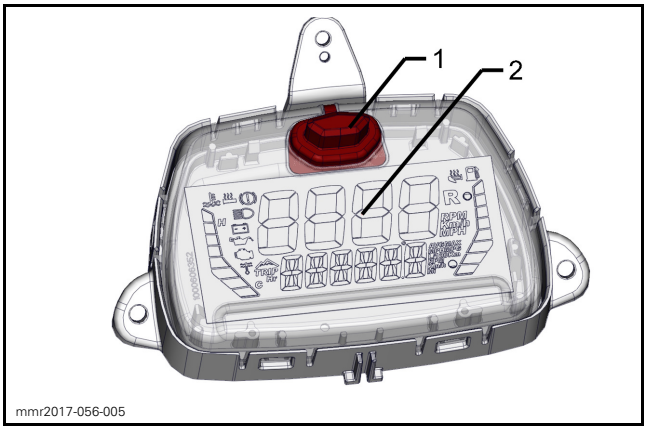
Torque wrench tightening specifications must be strictly adhered to. Locking devices must be replaced with new ones when removed (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.).

SYSTEM TESTING

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

GAUGE DESCRIPTION



COMPACT DIGITAL GAUGE
1. Gauge button
2. Gauge Digital Display

The button allow you to toggle through the different gauge functions and settings.

INDICATOR LAMPS

INDICATOR LAMP(S)	STATE	DESCRIPTION
All indicator lamps	On	All indicator lamps are activated during *WOW TEST*
	Flashing 4 Beeps	Parking brake engaged Brake applied while throttle lever depressed
	Flashing slowly Beeping slowly	Unit in reverse position.
	On 4 beeps	Headlights in the HIGH beam position.
	On 4 Beeps	Charging system fault
	On	Engine management system fault
	On	Temperature: cold
	On	Level: empty

INDICATOR LAMP(S)	STATE	DESCRIPTION
	On 4 Beeps	Overheat condition
	Flashing Beeping rapidly	Major overheat condition
	On	Engine temperature displayed
	On	Level: full
	On	Heated grip temperature displayed
	On	Heated throttle lever temperature displayed
	On	Temperature: hot
	On	Fuel level displayed
	Flashing Long beep	Low fuel
	On	Low oil indicator
Rev Limit	Scrolling	Limp home mode active

INDICATOR LAMP DESCRIPTION

Charging System Fault

There is a charging system fault. Refer to *CHARGING SYSTEM* subsection.

Overheat Indicator Lamp

Overheat indicator lamp may come on for three different reasons: engine overheat, muffler overheat or ECM overheat. The multifunction gauge will display the active problem.

Engine Overheat

The indicator lamp comes on at 85°C (185°F) and power limitation will occur at 95°C (203°F). Major engine overheat condition occurs when engine temperature reaches 100°C (212°F), the overheat indicator light will begin to blink.

Muffler Overheat

The indicator lamp comes on at 750°C (1,382°F) and power limitation will happen at 800°C (1,472°F). Major muffler overheat condition occurs when the muffler temperature reaches 800°C (1,472°F).

ECM Overheat

The indicator lamp comes on at 80°C (176°F) and power limitation will occur at 85°C (185°F).

Fuel Level Indication

A bar gauge located in the RH side of the display indicates the amount of fuel in the fuel tank.

When there is approximately 6 L (1.6 U.S. gal.), the indicator lamp will come ON to advise you that a low fuel condition exists.

Check Engine Light

The check engine light comes ON when a fault is detected by the engine management system.

The check engine light may be accompanied by the applicable scrolling fault message in the multifunction display.

To scroll through active fault codes, refer to *DISPLAYING "P" CODES* in this subsection .

Low Injection Oil Level Indicator

When this indicator is ON, it indicates a low injection oil level condition. Look for a message in the multifunction display. Add oil to oil tank.

PROCEDURES

GAUGE

Gauge Self Test Function

On **ECM wake-up**, the gauge will perform a self-test. All indications should come ON and cycle once. You will have a few seconds to ensure the indicator (lights are functioning correctly.

NOTE: This test only validates the gauge operation of the gauge digital display. It does not test the actual circuit functions related to each indication.

If the self test does not take place, proceed with the *TESTING GAUGE POWER*.

Gauge Setup

Changing Gauge Units of Measurement

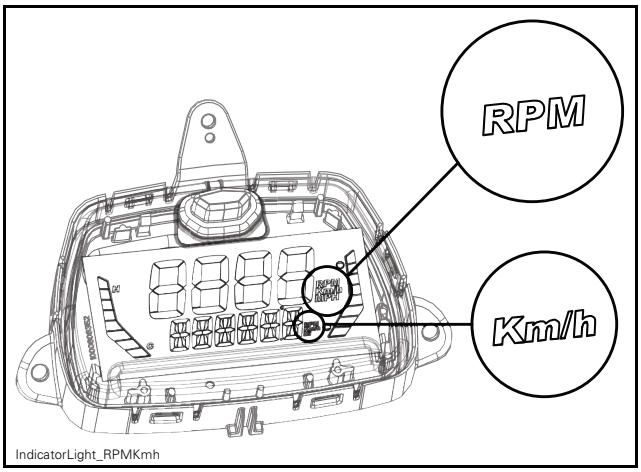
The gauges are factory preset to indicate in imperial units and can be changed using the BUDS2 software.

1. Provide electrical power to the gauge.
2. In BUDS2, navigate to the **Settings** page.
3. Change the units of measurement as per owner preferences.

NOTE: Speedometer, odometer and trip meter will have their units (kilometer or miles) changed simultaneously.

Displaying "P" Codes

1. Provide electrical power to the gauge.
2. Cycle through the gauge displays until both RPM and speed are displayed.



TYPICAL RPM AND SPEED DISPLAYED

3. Press and hold the button on the gauge while cycling high beams on and off 5 times.

Active fault codes will scroll across gauge display.

4. Press the button to scroll multiple fault codes.
5. Hold the button to exit the function.

Testing Gauge With BUDS2

The *GAUGE SELF TEST* can be duplicated using BUDS2

1. Connect vehicle to BUDS2 Refer to *COMMUNICATION TOOLS AND BUDS2* subsection.
2. In BUDS2,choose the **Functions** page.
3. Select **WOW Test**.

Testing Gauge Power (Main 12 Vdc)

If the gauge does not come on when the engine is started, carry out the following test.

1. Remove multifunction gauge.
2. Disconnect the gauge connector.
3. Set multimeter to Vdc.
4. Start engine.
5. Measure voltage with the chassis ground as per following table.

GAUGE CONNECTOR	VOLTAGE
Pin 2	Approximately 14.75 Vdc

6. If gauge main power input test was as specified, carry out the gauge *GROUND CIRCUIT CONTINUITY TEST*.
7. If no voltage was read, test wiring continuity. Refer to *WIRING DIAGRAM* for details.

Testing Gauge Ground

1. Set multimeter to Ω selection.
2. Measure for continuity of gauge ground wire to chassis ground as per following table.

GAUGE CONNECTOR	RESISTANCE
Pin 8	Close to 0 Ω

If ground test failed, check vehicle ground. Refer to *POWER DISTRIBUTION* subsection.

If gauge power input test and ground circuit continuity tests are good, replace gauge.

Testing Gauge Beeper

To test beeper, perform the following test with BUDS2

1. Connect vehicle to BUDS2 Refer to *COMMUNICATION TOOLS AND BUDS2*
2. In BUDS2, choose the **Functions** page.
3. Activate the **Cluster Buzzer Test**.

You should hear 4 short beeps.

– If you do not hear the beeper, replace gauge.

Testing Gauge Button

Using the BUDS2 software, select the **Measurements** page.

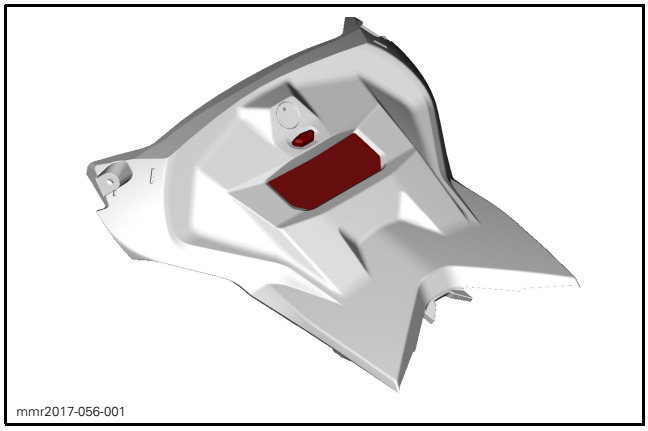
Press button on the gauge and activate the heater and hi/lo beam buttons on the console.

If the indicator light(s) come ON in BUDS2, the gauge button(s) is(are) functioning correctly.

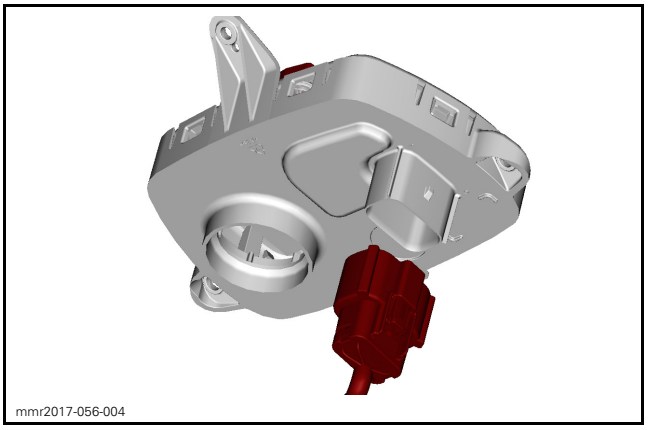
If the indicator light(s) do not come ON, check button(s) and wiring continuity. Refer to *WIRING DIAGRAM* for details. If they are in good condition, replace gauge.

Removing Gauge

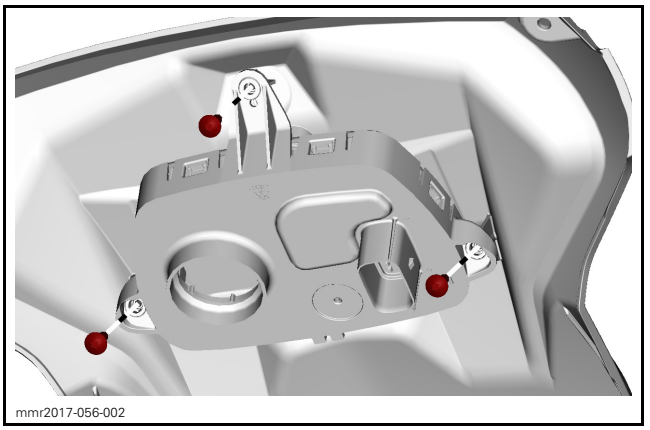
1. Remove glove box.
2. Remove gauge trim.



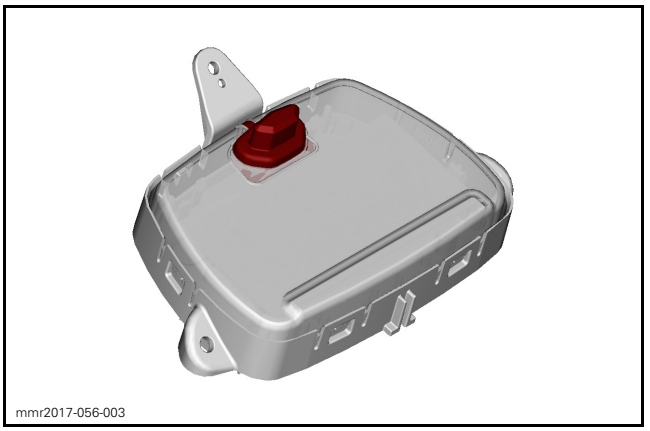
3. Unplug gauge connector.



4. Remove retaining screws.



5. Remove gauge.



Installing Gauge

Reverse removal procedure.

TIGHTENING TORQUE	
Gauge retaining screws	1 N•m ± 0.2 N•m (9 lbf•**in** ± 2 lbf•**in**)

Configuring Gauge

Using BUDS2, configure gauge options as per owner preferences

– Language
– Units
– Throttle lever heating ratio. Refer to *ACCESSORIES* subsection for more information.

Summerization Function

Like other engines, the E-TEC has to be properly lubricated at storage for internal parts protection. The E-TEC system offers a built-in engine storage lubrication function (summerization) that can be initiated by the operator.

To engage procedure, do the following:

1. Place the vehicle in a well ventilated area.
2. Start the engine and let it run at idle speed until it reaches its operating temperature (watch the coolant temperature on the display or verify that the rear heat exchanger becomes warm).
3. Push the gauge button to select odometer mode.

NOTE: The storage mode does not function in other modes (trip A, trip B and hr trip).

4. Hold the**gauge button** while repeatedly pressing the HI/LOW beam switch until PRESS/HOLD BUTTON FOR OIL INJECTION appears on the display.
5. Release all buttons when gauge displays PRESS/HOLD BUTTON FOR OIL INJECTION appears.
6. Again, press and hold the gauge button for 2 - 3 seconds.

NOTE: The gauge will display oil when the storage procedure is initiated.

7. When gauge displays OIL, release button and wait for the lubrication function to end.

Do not touch anything during engine lubrication cycle.

The engine lubrication function takes approximately 1 minute. During this time, engine RPM may increase slightly and the oil pump will "oil flood" the engine.

At the end of engine lubrication function, the ECM will stop the engine.

8. Remove tether cord cap from engine cut-off switch.

NOTICE **Do not start the engine during storage period.**

ACCESSORIES

SERVICE TOOLS

GENERAL

On multifunction analog/digital gauge, heated grips and heated throttle lever are limited at 50% output 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

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

SYSTEM DESCRIPTION (HEATED THROTTLE LEVER)

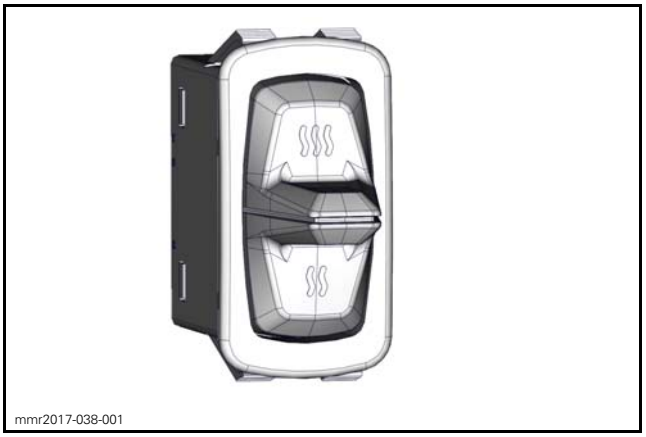
Power to the heated throttle lever is controlled through the gauge.

A three position switch allows the selection various heat levels, which are displayed in the gauge.

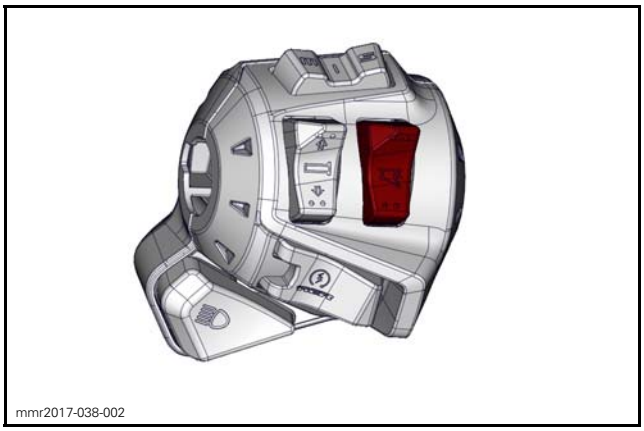
NOTE: The heated handlebar grips and the heated throttle lever are controlled by the same 3 position switch when used with the console switch. Refer to *SETTING THE HEATED THROTTLE LEVER RATIO*.

NOTE: The heating intensity is displayed via the gauge with the activation of the heated throttle lever switch.

The switch selection sends a signal to the gauge to increase or decrease heat.



HEATER SWITCH - MODELS WITH CONSOLE SWITCH



HEATER SWITCH - MODELS WITH MULTIFUNCTION 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.

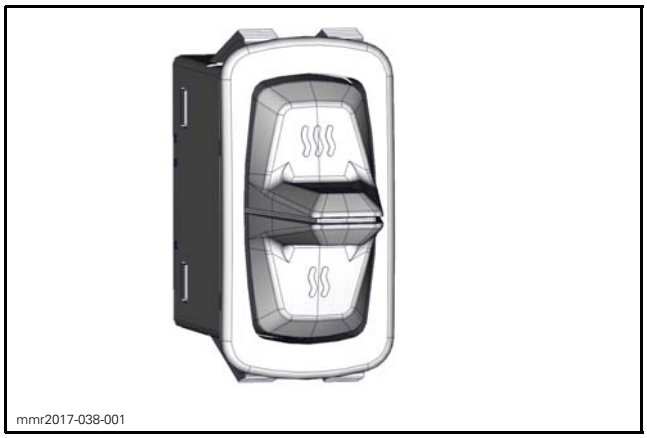
When released, the 3 position switch springs back to the center neutral position.

SYSTEM DESCRIPTION (HEATED HANDLEBAR GRIPS)

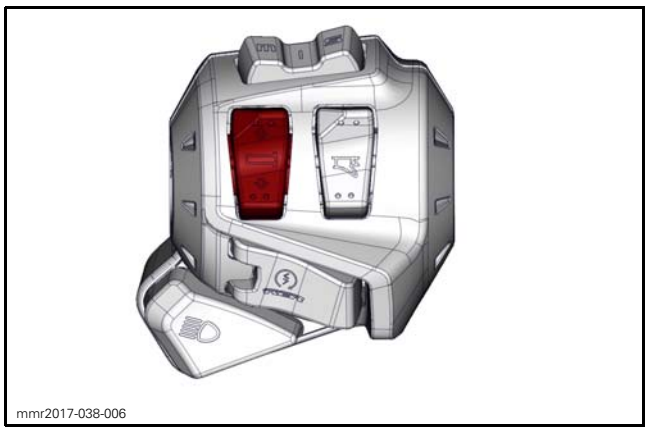
The grip heat is controlled through the gauge.

A three position switch allows the selection of various heat levels, which are displayed in the gauge.

NOTE: The heated handlebar grips and the heated throttle lever are controlled by the same 3 position switch when used with the console switch. Refer to *SETTING THE HEATED THROTTLE LEVER RATIO*.



HEATER SWITCH - MODELS WITH CONSOLE SWITCHES



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.

SETTING THE HEATED THROTTLE LEVER RATIO

On models where one switch simultaneously controls the heated grip temperature and the throttle lever, use BUDS2 to set the heated throttle grip ratio.

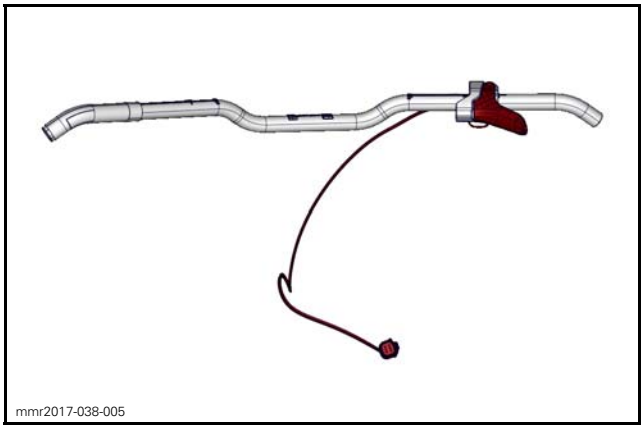
A higher ratio will increase the heated throttle temperature compared to the heated grips.

A lower ratio will lower the heated throttle temperature compared to the heated grips.

1. Connect BUDS2. Refer to *COMMUNICATION TOOLS AND BUDS* subsection.
2. Navigate to the settings page.
3. Change the **Heated Throttle Lever Ratio**.
4. Write the changes to the cluster.

PROCEDURES

HEATED THROTTLE LEVER



On multifunction analog/digital gauge heaters are limited to 50% under 2000 RPM.

For troubleshooting:

– Start engine and rev above 800 RPM for at least 2 seconds
– Use BUDS2 to activate the applicable heater.

NOTE: On models with console switches, there is only one switch that controls both the heated grips and heated throttle lever. Refer to *SYSTEM DESCRIPTION* and *SETTING THE HEATED THROTTLE LEVER RATIO*.

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 COMPACT DIGITAL GAUGE	
TERMINAL	SPECIFICATION
MG-7	2.7 to 14.5 Vdc depending on heated throttle lever ratio

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.

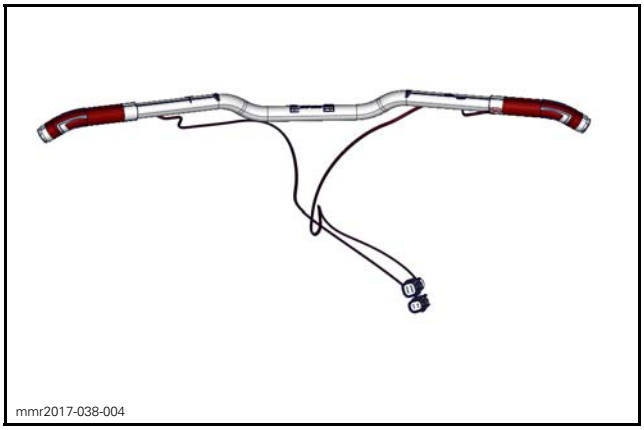
Testing Throttle Lever Heating Element

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.
2. Using the BUDS2, navigate to the **Functions** page.
3. In BUDS2, turn the heated grips on.

MODELS WITH COMPACT DIGITAL GAUGE	
TERMINAL	SPECIFICATION
MG-1	12 Vdc

MODELS WITH ANALOG/DIGITAL GAUGE	
TERMINAL	SPECIFICATION
MG-5	12 Vdc

4. If test is good, the gauge heater to handlebar grip heater is good. Proceed with *TESTING HANDLEBAR GRIP HEATING ELEMENT* in this subsection.
5. 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.

1. Disconnect heated grip connector.
2. 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 6P-3	STR 6P-1	5.3 - 6.6 Ω

3. If readings are out of specifications, replace applicable handle grip heating element.
4. If heating element readings are within specifications, check wiring and connections.
5. 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.

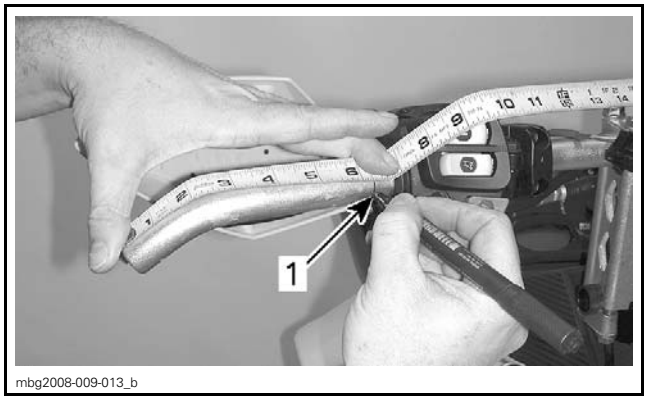
1. Disconnect the connector, Refer to *WIRING DIAGRAM AND CONNECTORS* subsection for connector location.
   1.1 STR 4P for left hand handlebar heater
   1.2 STR 6P for right hand handlebar heater

Use procedures for *MOLEX* connectors in the *WIRING DIAGRAM AND CONNECTORS* subsection.

2. Cut locking ties securing heater wires to handlebars.
3. Pull wires from harness protective sheath, multifunction switch housing or throttle lever housing.
4. Cut and remove black electrical tape from heater element and remove heater from cork insulator.
5. If damaged, remove cork insulator from handlebar and clean all adhesive residue from the handlebar.

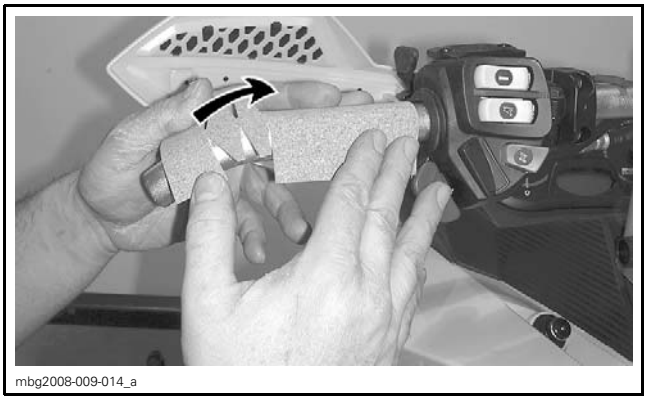
Installing Heated Grips Heater Element

1. 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

2. Align the edge of the cork insulator with the reference line centered with the handlebar folding axis as illustrated.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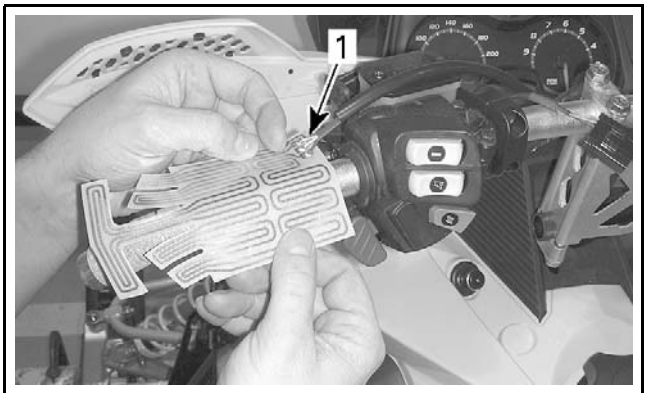
TYPICAL — CORK INSULATOR ALIGNMENT

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.



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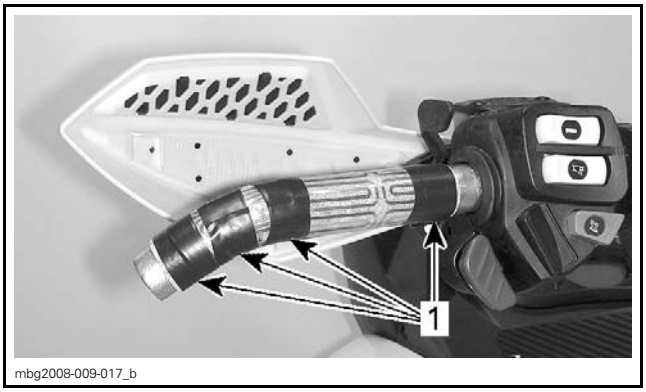
TYPICAL — HEATER ALIGNMENT
1. Heater wire position (LH front, RH rear)

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.



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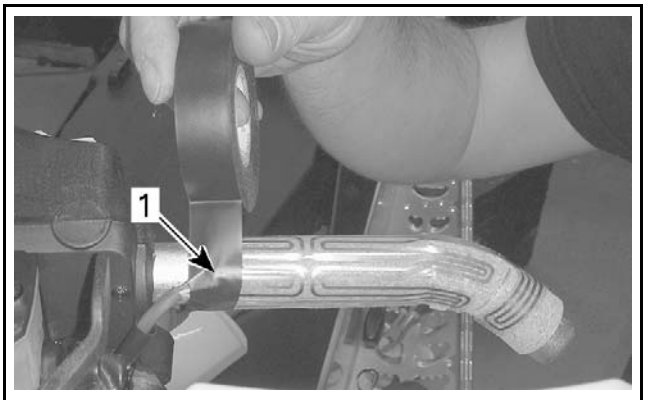
TYPICAL
1. Electrical tape application (4x)

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.



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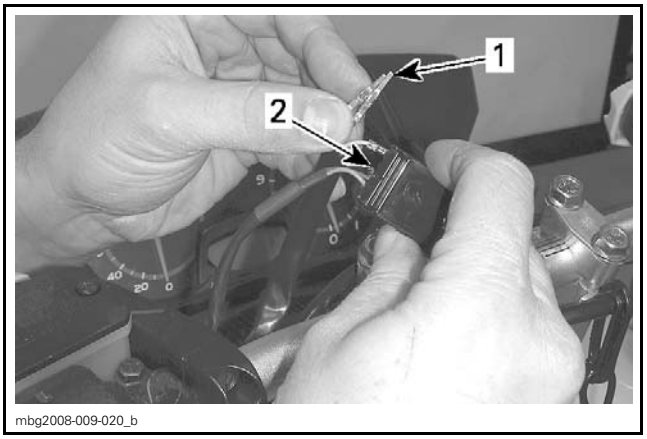
TYPICAL — IMPORTANT
1. Tape application over wire connections

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.

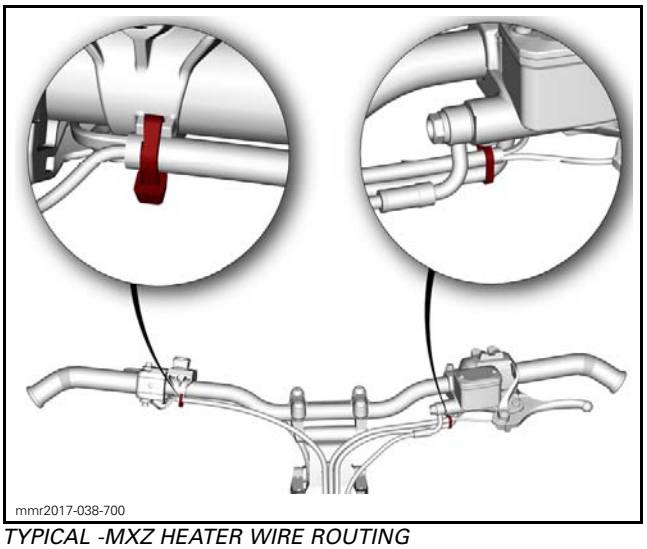


TYPICAL
1. *Heater wire terminals*
2. *Insertion through back of connector*

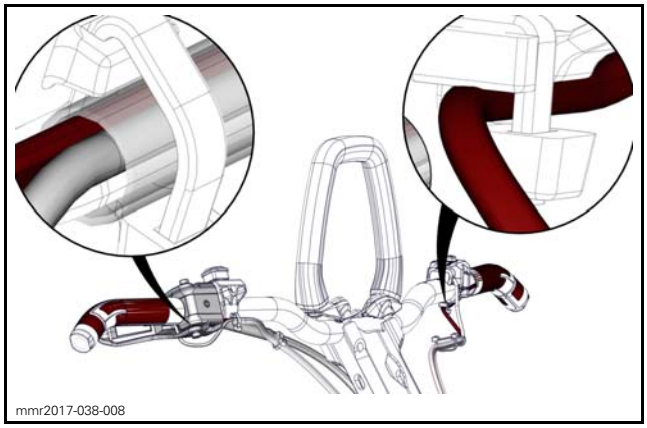
10. Install locking ties to secure the heater wire as it was routed originally..

⚠ WARNING

To ensure RH heater wires does not prevent smooth operation of throttle lever, it must be passed straight through the housing without any slack, and secured with a locking tie on the emergency engine cut-off switch housing.



TYPICAL -MXZ HEATER WIRE ROUTING



TYPICAL - SUMMIT HEATER WIRE ROUTING

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.**

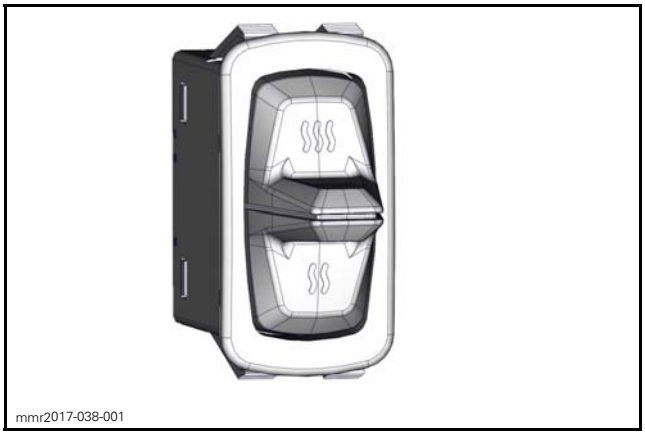
11. Provide electrical power to the heaters for testing.
12. Using the hand grip heat switch, turn on the hand grip heaters and ensure they are functioning correctly.

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.

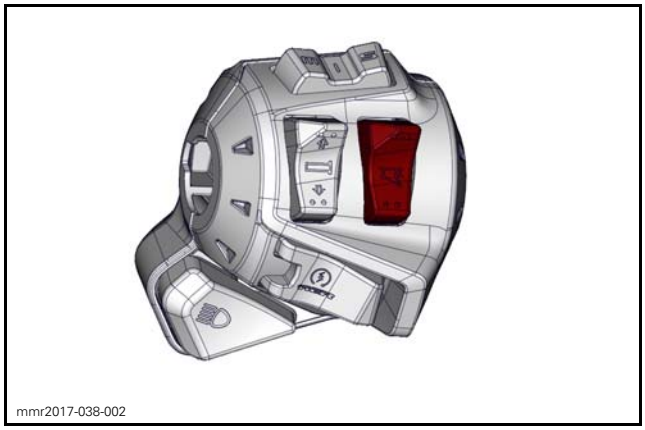
1. Using the FLUKE 115 MULTIMETER (P/N 529 035 868), select the Ω position.
2. Test throttle lever heat switch and circuits as per table.

Models with console switches



THROTTLE LEVER HEAT SWITCH TEST			
SWITCH SELECTION	TERMINAL		RESISTANCE
UP	GRIP-6	GRIP-8	Close to 0 Ω
	GRIP-6	GRIP-5	Infinite (OL)
DOWN	GRIP-6	GRIP-8	Infinite (OL)
	GRIP-6	GRIP-5	Close to 0 Ω

Models with multifunction switches



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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.

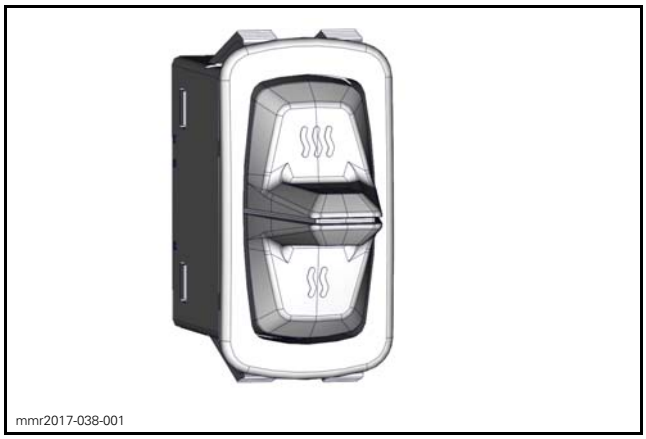
If continuity test is out of specification, check switch circuit as per wiring diagram. If good, replace switch.

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.

Models with console switches



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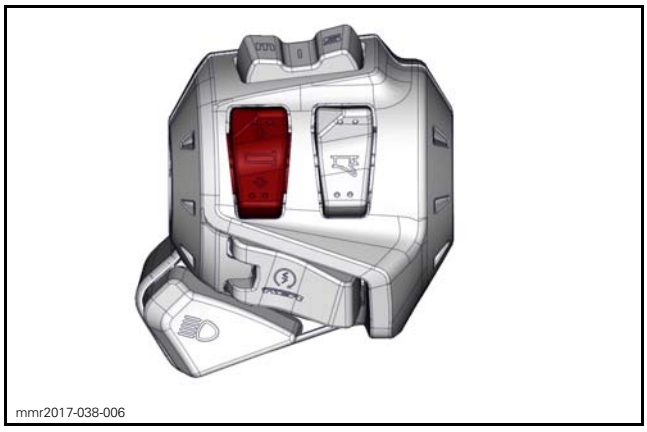
HEATED GRIP HEAT SWITCH TEST			
SWITCH SELECTION	TERMINAL		RESISTANCE
UP	GRIP-6	GRIP-8	Close to 0 Ω
	GRIP-6	GRIP-5	Infinite (OL)
DOWN	GRIP-6	GRIP-8	Infinite (OL)
	GRIP-6	GRIP-5	Close to 0 Ω

Models with multifunction switches



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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

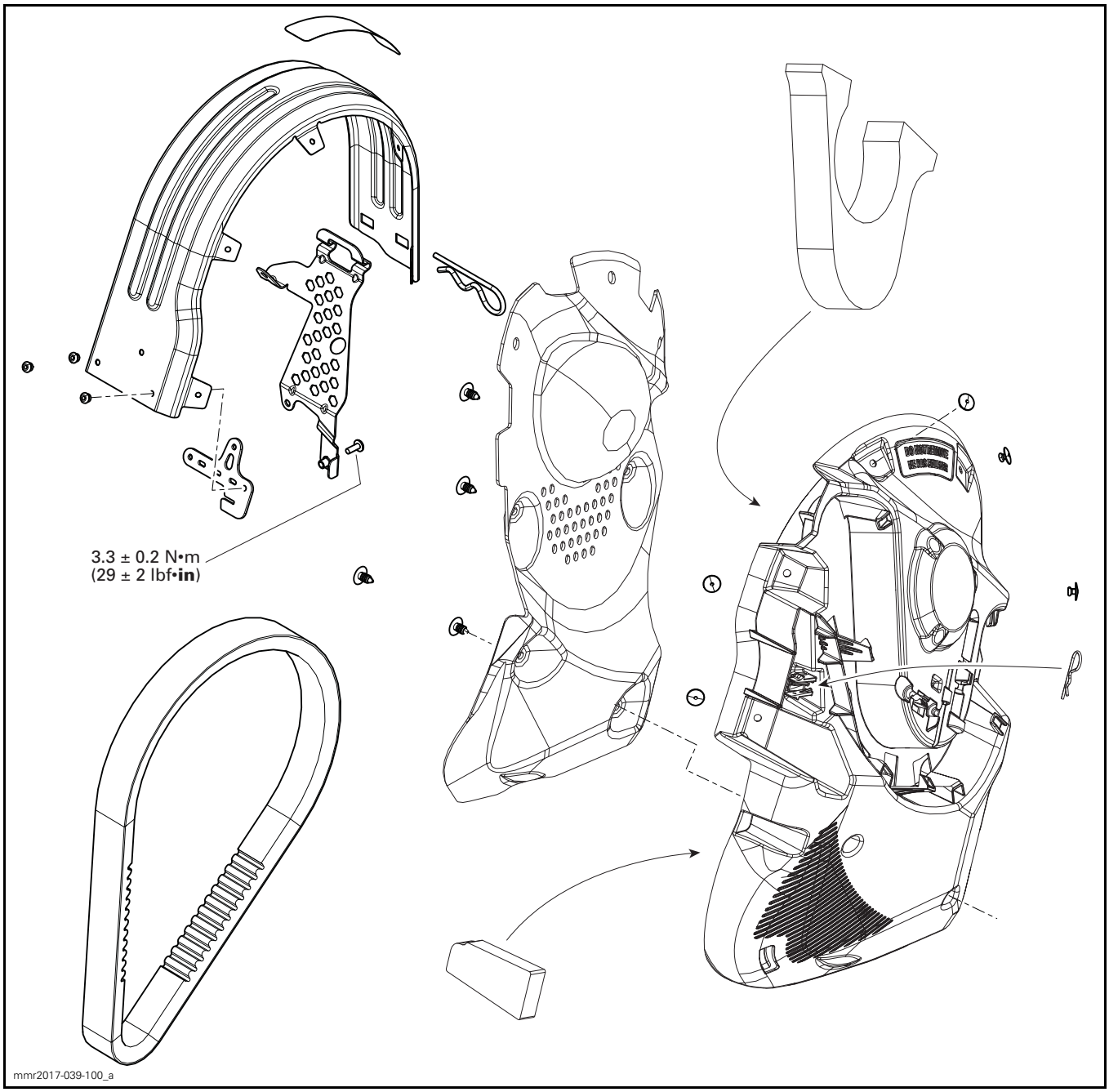
If continuity test is as per specification, check wiring to gauge connector.

If continuity test is out of specification, check switch circuit as per wiring diagram. If good, replace switch.

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.*

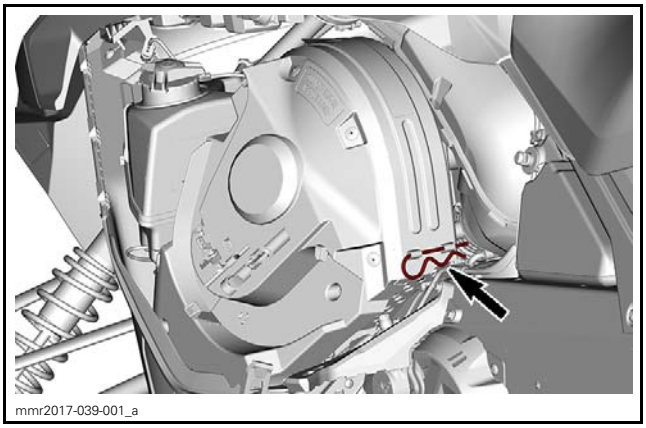
PROCEDURES

DRIVE BELT GUARD

NOTE: Belt guard is purposely made slightly oversize 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.



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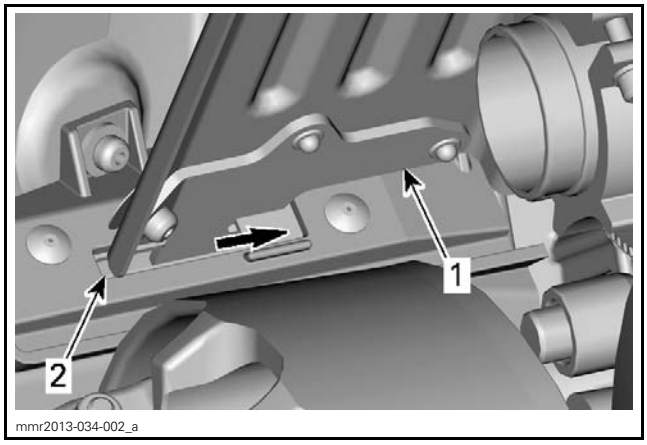
3. Lift rear portion of guard then release from front tabs.

Installing the Drive Belt Guard

1. Insert belt guard tab in front support slot.



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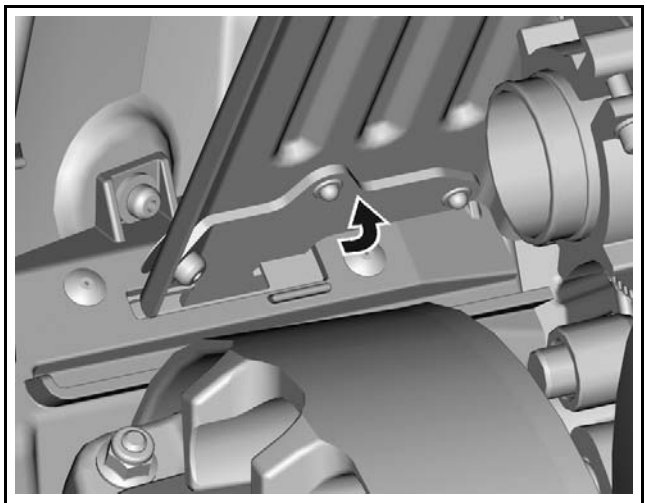
1. Belt guard tab
2. Front support slot

2. Push drive belt guard toward engine then toward front of vehicle.



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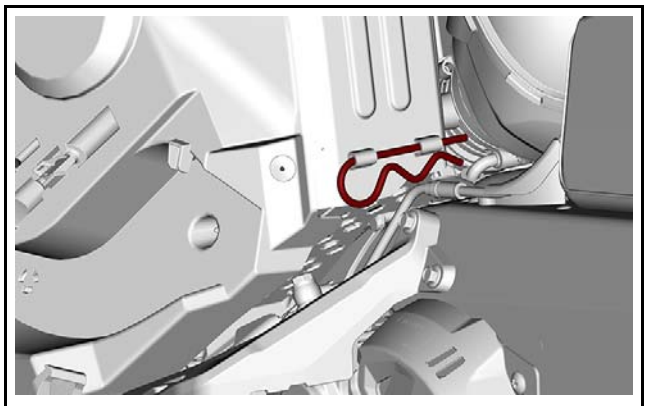
3. Position rear portion of the drive belt guard over the retainer and secure it using the retaining pin.



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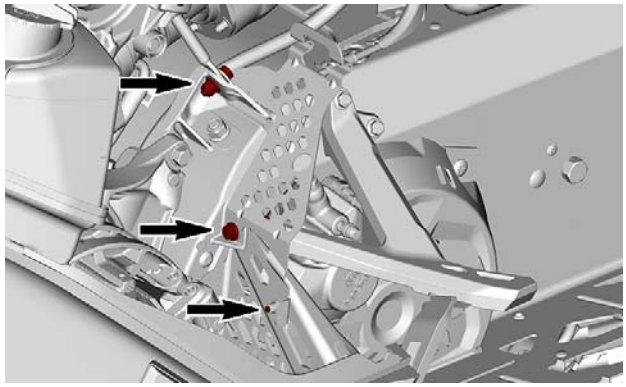
DRIVE BELT GUARD SUPPORT

Removing the Drive Belt Guard Support

1. Remove the drive belt guard.
2. Remove screws securing the support to vehicle.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Installing the Drive Belt Guard Support

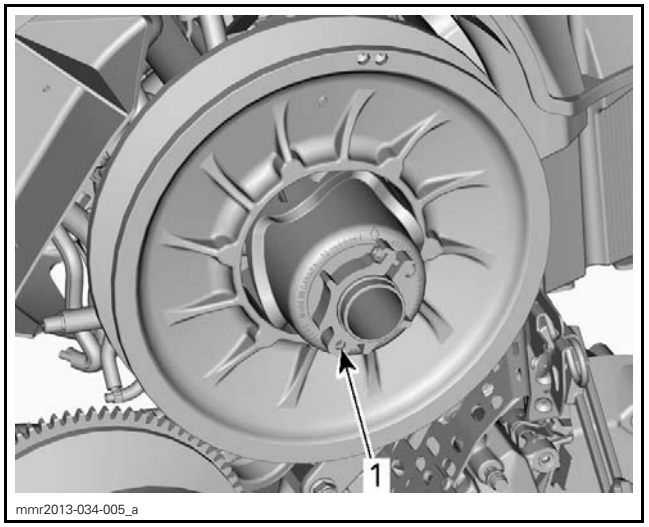
The installation is the reverse of the removal procedure. However pay attention to the following.

TIGHTENING TORQUE	
Drive belt guard support Torx screw	3.3 N•m ± 0.2 N•m (29 lbf•**in** ± 2 lbf•**in**)
Hexagonal flange elastic nut	10 N•m ± 2 N•m (89 lbf•**in** ± 18 lbf•**in**)

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.



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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.

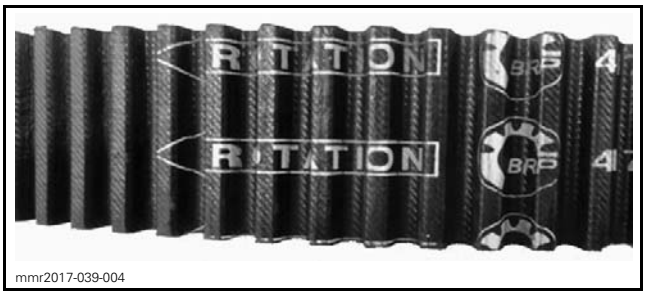
DRIVE BELT WIDTH	
NEW	WEAR LIMIT
38.3 mm (1.508 in)	35.9 mm (1.413 in)

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.



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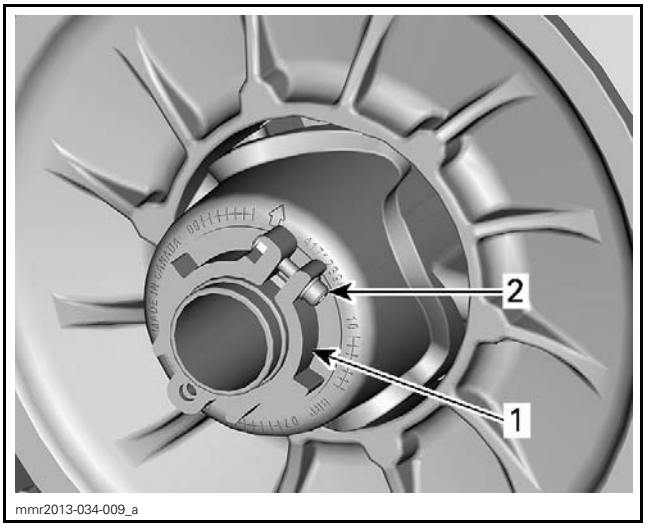
3. Unscrew and remove the driven pulley expander from the driven pulley.
4. Rotate the driven pulley several times to properly set the belt between the sheaves.
5. Adjust drive belt height. Refer to *ADJUSTING THE DRIVE BELT HEIGHT* procedure.
6. Install drive belt guard, refer to *INSTALLING THE DRIVE 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.



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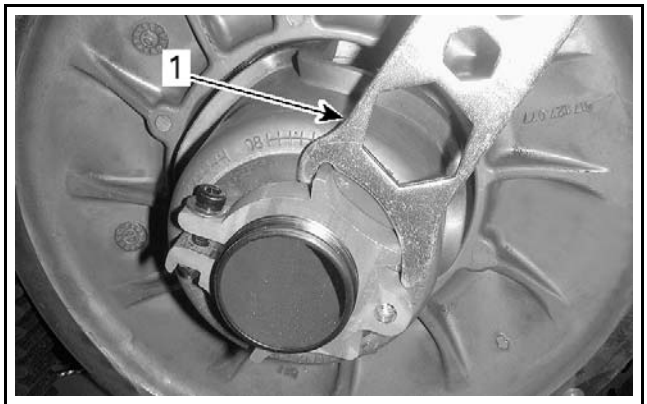
1. Adjustment ring
2. Clamping screw

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.



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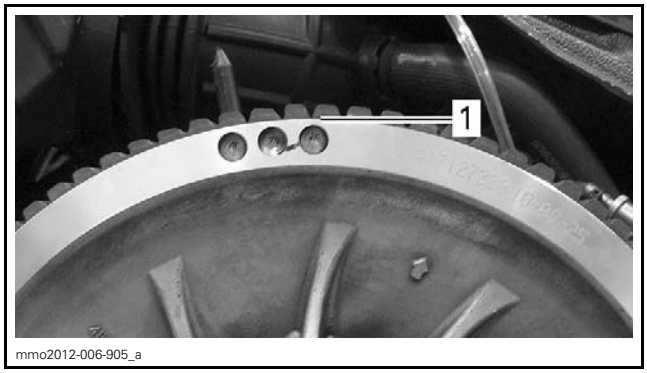
1. Suspension adjustment tool

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.



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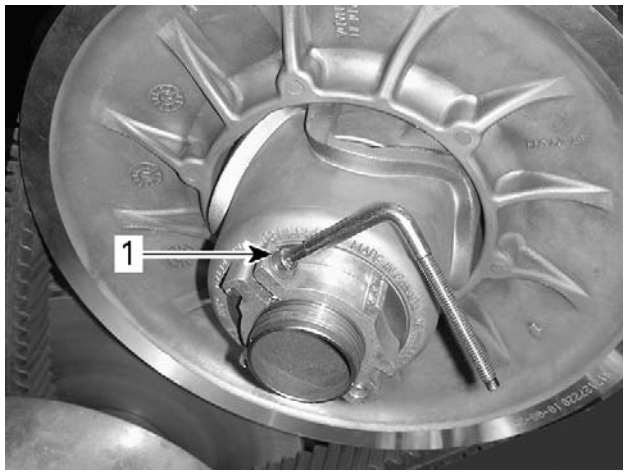
PRELIMINARY SETTING
1. Lowest portion of cogs even with external surface of drive belt

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

1. Make sure drive belt height is adjusted (preliminary setting).
2. Position a reference rule on drive belt.
3. Use the TENSIOMETER (P/N 414 348 200) as explained below.
4. Set deflection as per following table using bottom O-ring.

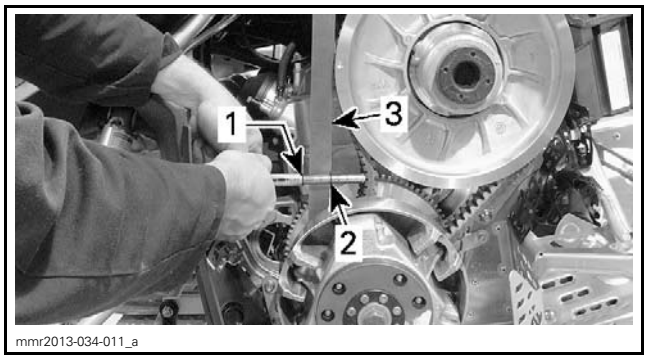
DRIVE BELT DEFLECTION	
DRIVE BELT DEFLECTION SETTING	32 mm ± 5 mm (1.26 in ± .2 in)

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.
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.

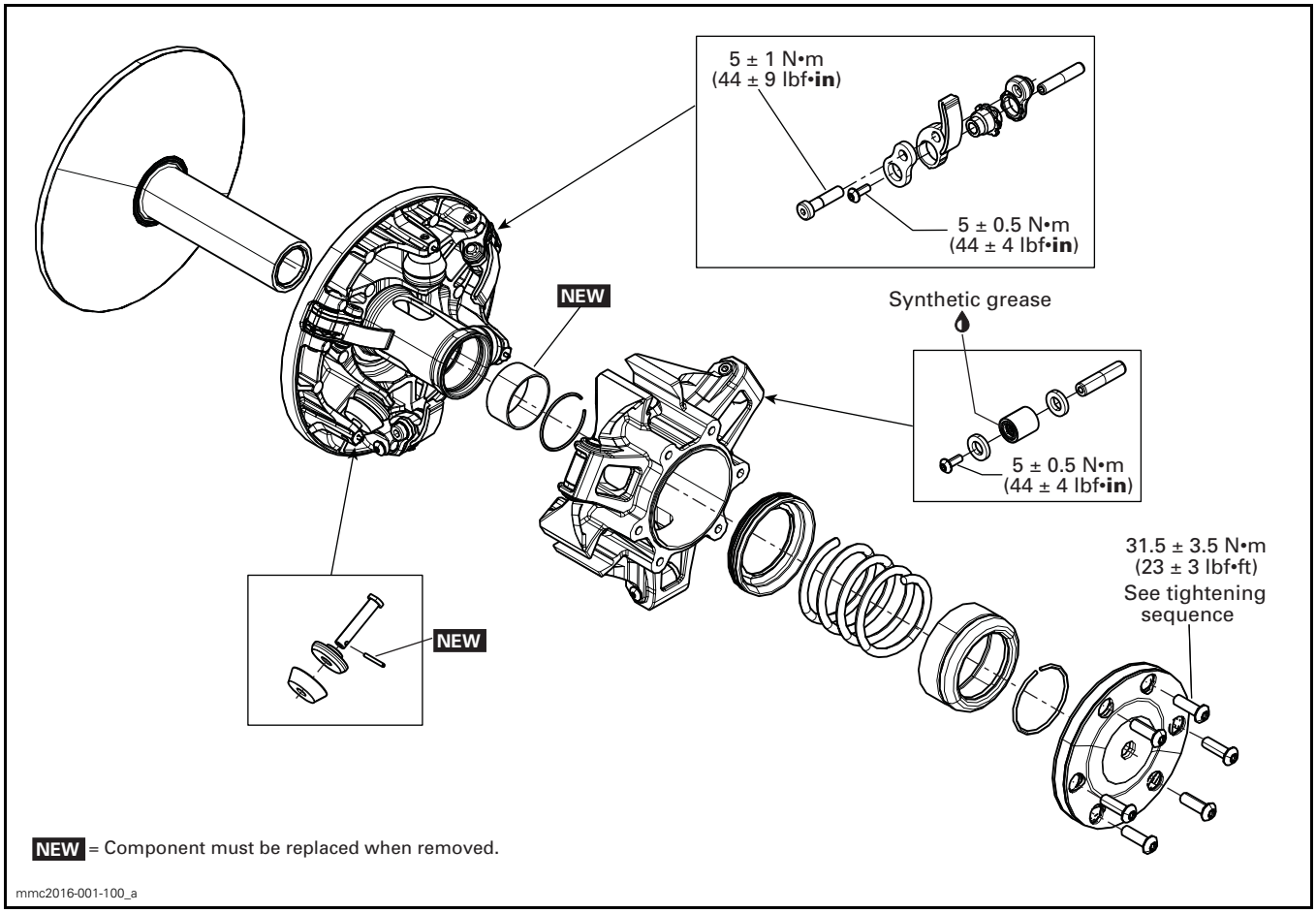
pDRIVE PULLEY WITH CLICKER

SERVICE TOOLS

Description	Part Number	Page
CIRCLIP INSTALLER/REMOVER	529 036 375	4–5
CLUTCH HOLDER	529 036 369	3, 12
DRIVE PULLEY OPENING TOOL	529 036 378	4, 8
DRIVE PULLEY SUPPORT	529 036 371	4–5, 7
GREASE INJECTOR	529 036 376	10
PDRIVE PULLER	529 036 370	3–4
PULLEY SPRING COMPRESSOR TOOL	529 036 373	4–5, 7–8
REMOVING AXLE TOOL	529 036 372	4, 6–8

SERVICE PRODUCTS

Description	Part Number	Page
ISOFLEX GREASE TOPAS NB 52	293 550 021	10
PULLEY FLANGE CLEANER	413 711 809	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.).

ADJUSTMENT

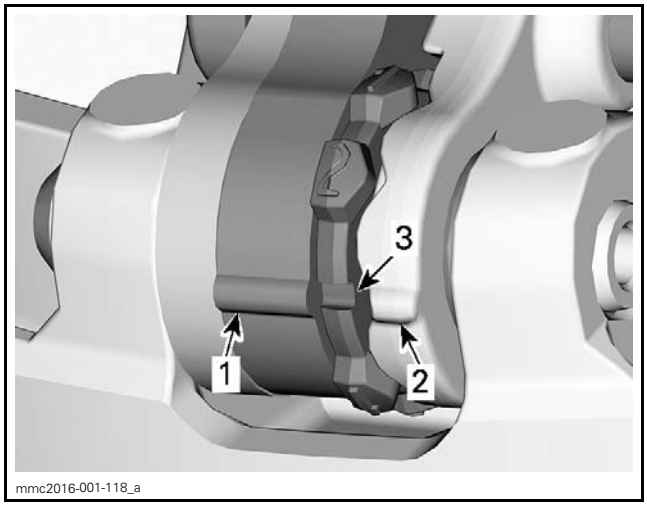
The drive pulley is factory calibrated to transmit maximum engine power at a predefined RPM. Factors such as ambient temperature, altitude or surface condition may vary this critical engine RPM thus affecting snowmobile efficiency.

This adjustable drive pulley allows setting maximum engine RPM in the vehicle to maintain maximum power. The adjustment has an effect on high RPM only.

Ramp cam should be adjusted so that actual maximum engine RPM in vehicle matches the maximum horsepower RPM given in *TECHNICAL SPECIFICATIONS*.

To adjust, modify ramp end position by turning ramp cams (3x).

The ramp and the right lever have a notch while ramp cam has 5 positions numbered 1 to 5.



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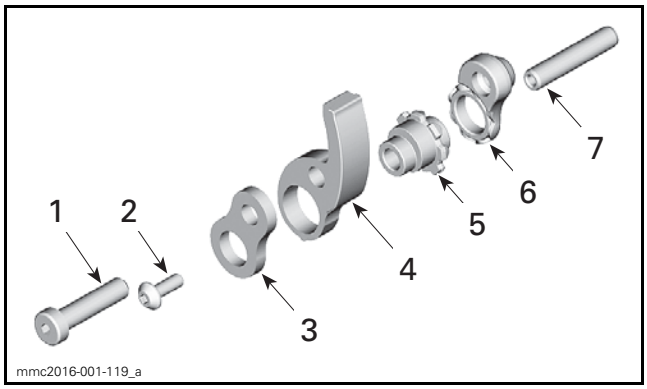
1. *Ramp notch*
2. *Right lever notch*
3. *Cam position (here #3 - factory setting, no number)*

Each number modifies maximum engine RPM by about 200 RPM.

Lower numbers decrease engine RPM in steps of 200 RPM and higher numbers increase it in steps of 200 RPM.

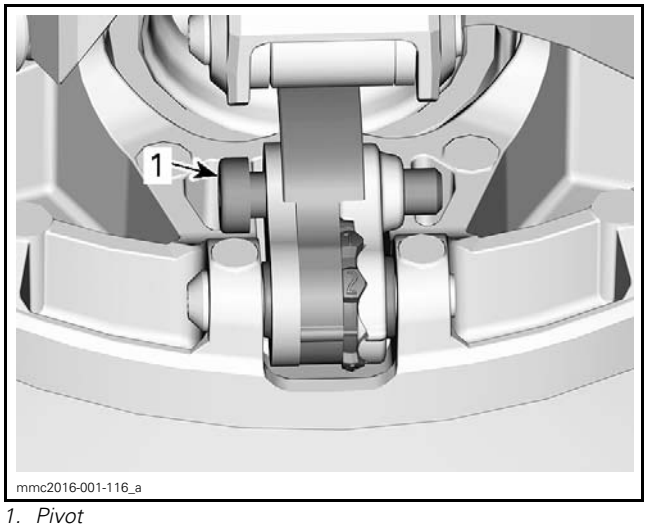
For example: Ramp cam is set at position 3 and is changed to position 5. So maximum engine RPM is increased by about 400 RPM.

MODIFYING THE RAMP CAM SETTING



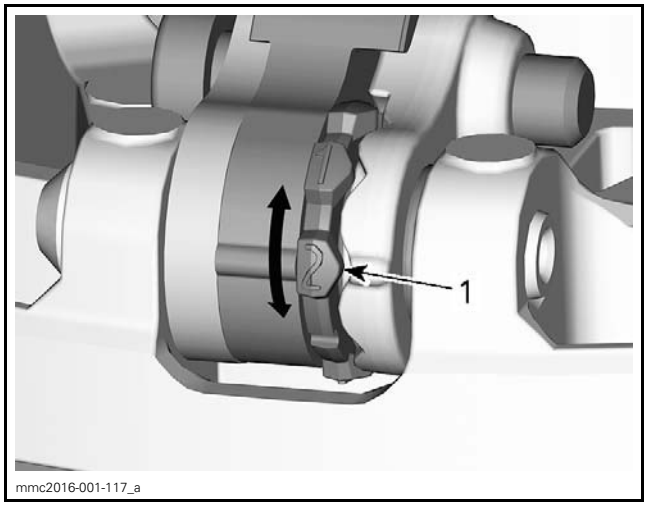
1. *Pivot*
2. *Axle retaining screw*
3. *Left lever*
4. *Ramp*
5. *Cam*
6. *Right lever*
7. *Axle*

1. Loosen the pivot.



1. *Pivot*

2. Move right lever aside to be able to turn the cam.
3. Turn cam to the desired position.



1. *Desired cam position (here #2)*

TIGHTENING TORQUE	
Pivot	5 N•m ± 1 N•m (44 lbf•**in** ± 18 lbf•**in**)

NOTICE Always adjust all 3 cams and make sure they are all set at the same number.

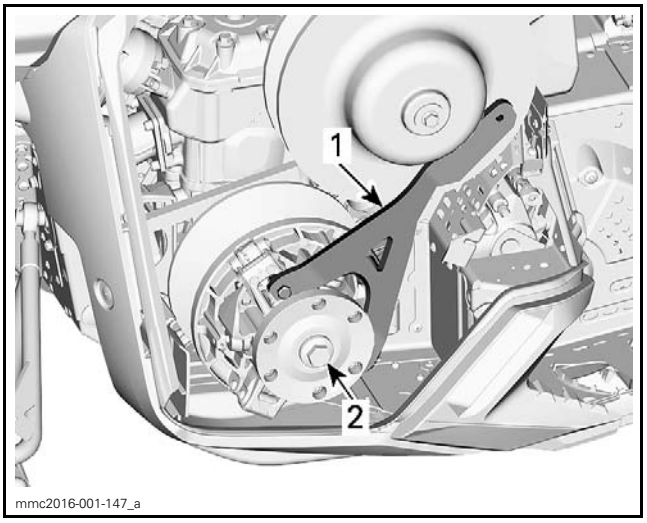
PROCEDURES

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* subsection.
2. Remove the drive pulley bolt.
   2.1 Secure the drive pulley with the clutch holder.
   2.2 Using a breaker bar, remove the drive pulley bolt and its conical spring washer.



1. Clutches holder
2. Drive pulley bolt

3. Remove the drive pulley from engine.
   3.1 Make sure the clutches holder is properly installed.
   3.2 Screw the pDrive puller in place of the drive pulley bolt.
   3.3 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)	

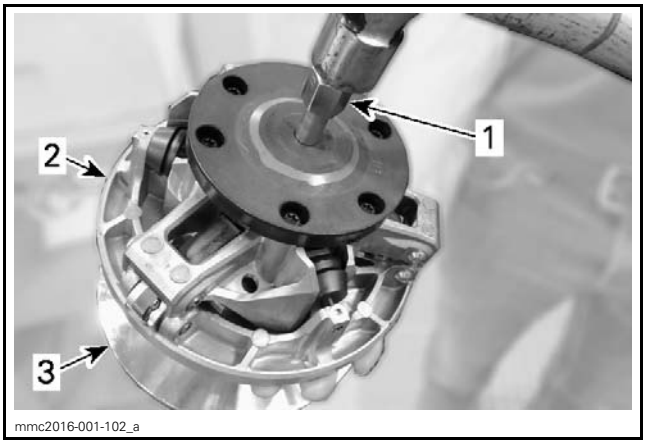
REQUIRED TOOLS	
CIRCLIP INSTALLER/REMOVER (P/N 529 036 375)	
REMOVING AXLE TOOL (P/N 529 036 372)	
DRIVE PULLEY OPENING TOOL (P/N 529 036 378)	

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.



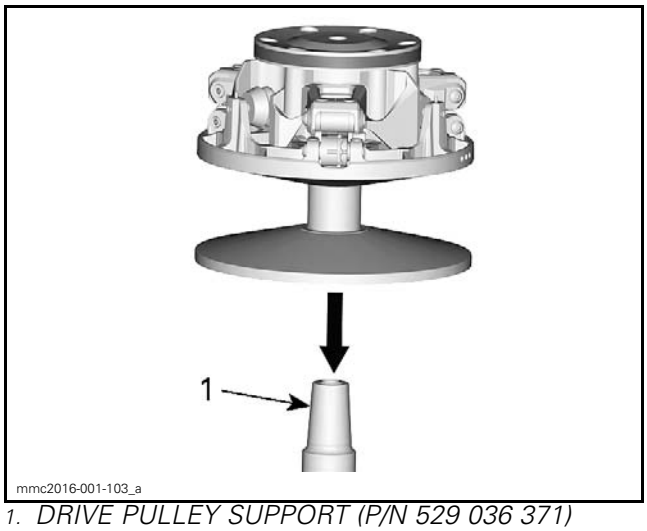
1. Puller screwed 13 mm (1/2 in) in fixed sheave
2. Sliding sheave
3. Fixed sheave

NOTE: No component marking is required before disassembly. This drive pulley features factory apposed index marks as references.

NOTICE Never use any type of torch to heat spider.

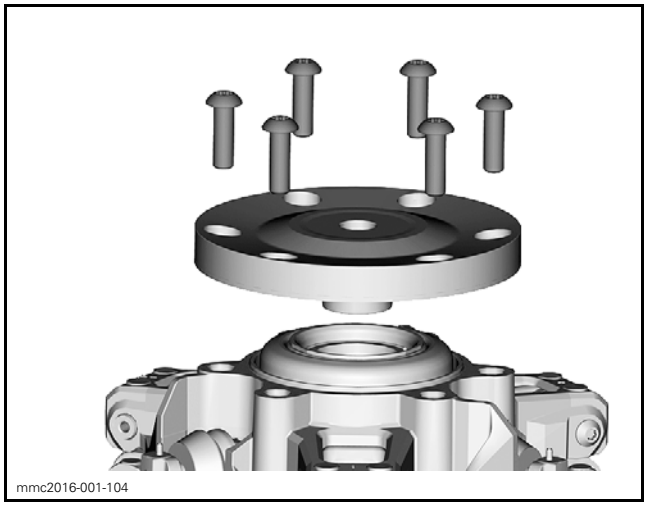
Removing the Damper

1. Secure the drive pulley support in a vice.
2. Install the drive pulley over the support.

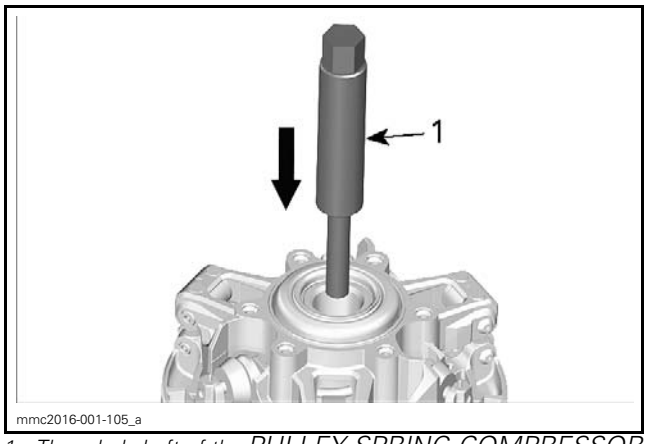


1. *DRIVE PULLEY SUPPORT (P/N 529 036 371)*

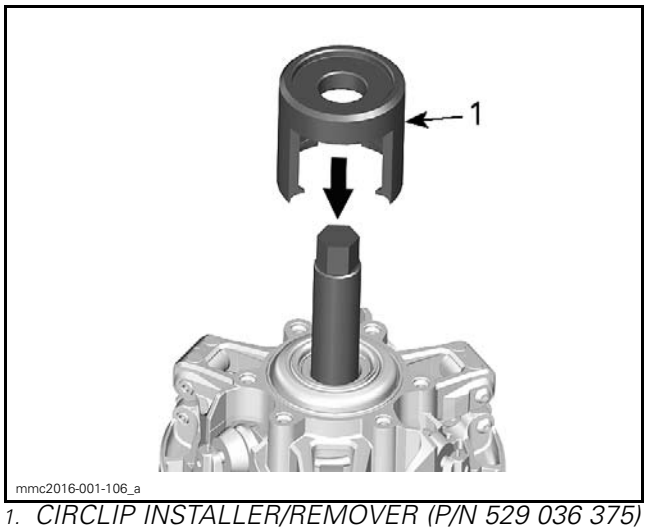
3. Remove the damper.



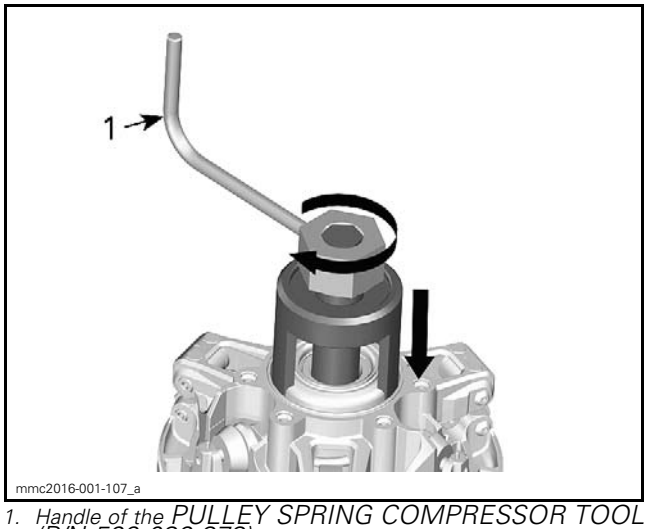
Removing the Spring



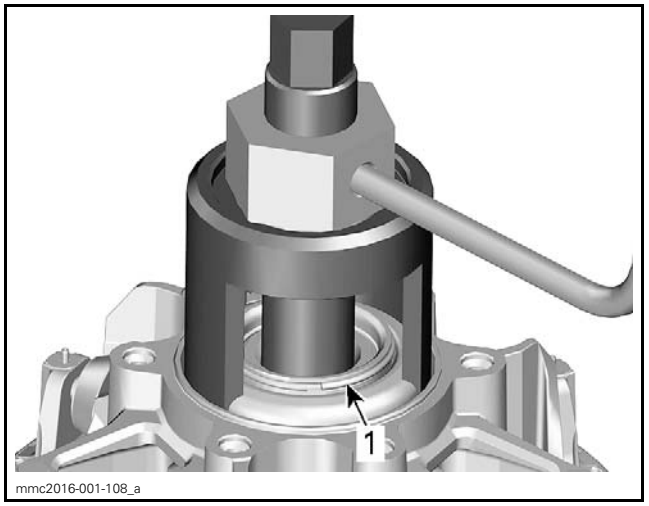
1. *Threaded shaft of the PULLEY SPRING COMPRESSOR TOOL (P/N 529 036 373)*



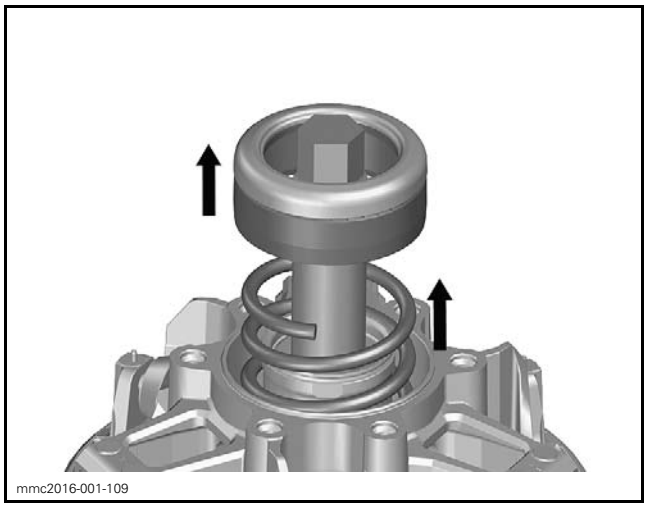
1. *CIRCLIP INSTALLER/REMOVER (P/N 529 036 375)*



1. *Handle of the PULLEY SPRING COMPRESSOR TOOL (P/N 529 036 373)*



1. *Remove the circlip*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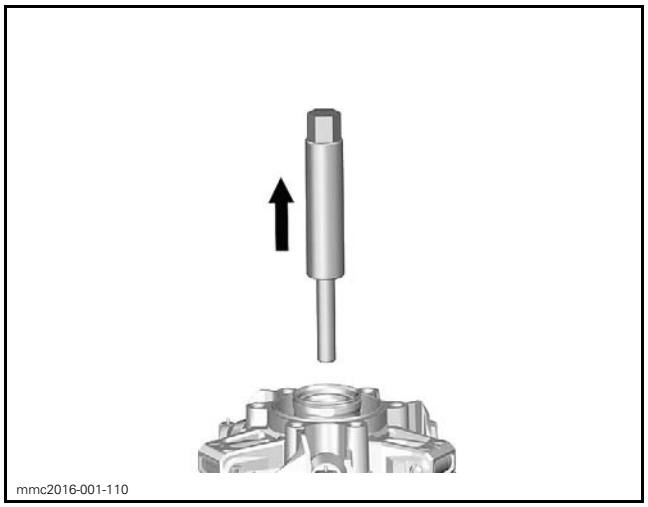
Removing the Spider

1. Remove the threaded shaft.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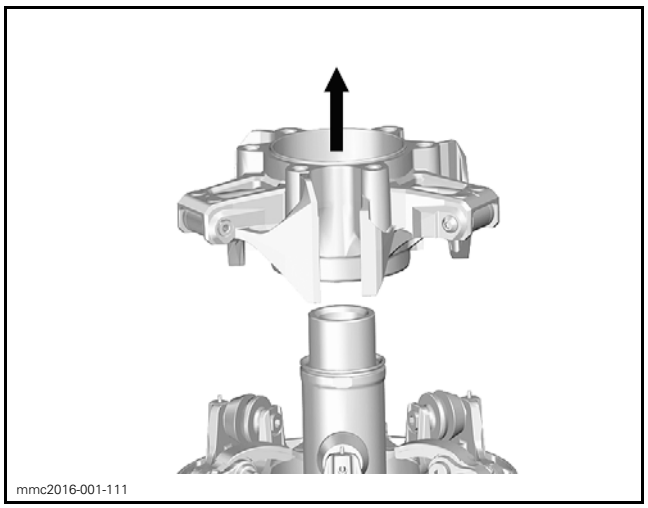
NOTICE Remove the threaded shaft to avoid damaging the bushings inside the spider.

2. Remove the spider.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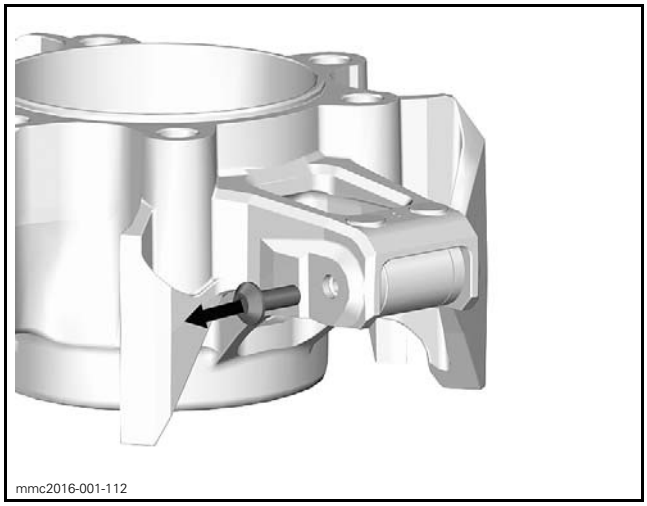
Removing the Roller

1. Remove axle retaining screw.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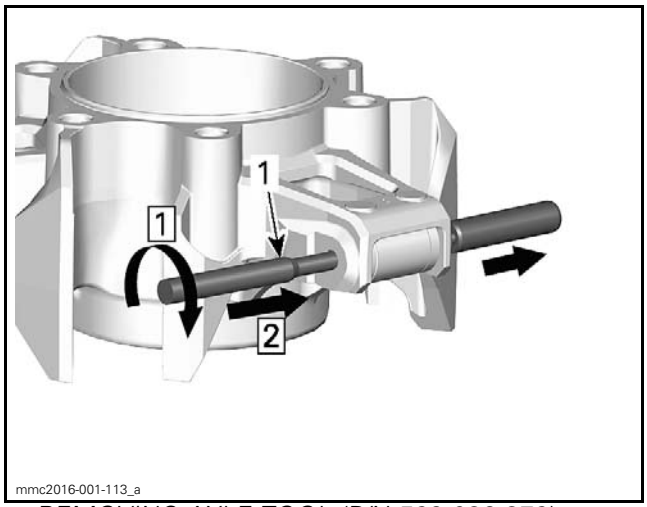
2. Remove the axle.



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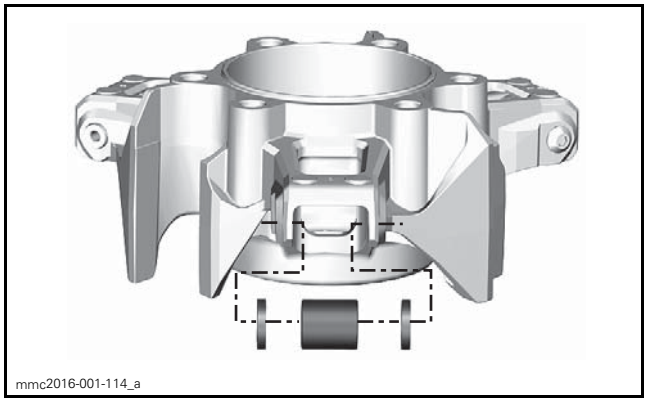
1. REMOVING AXLE TOOL (P/N 529 036 372)
Step 1: Screw the tool into the axle
Step 2: Push axle to the right side

3. Remove the roller and its thrust washers.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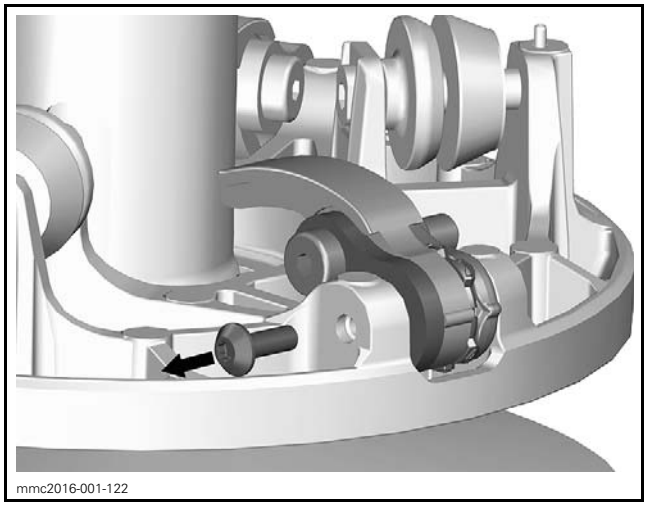
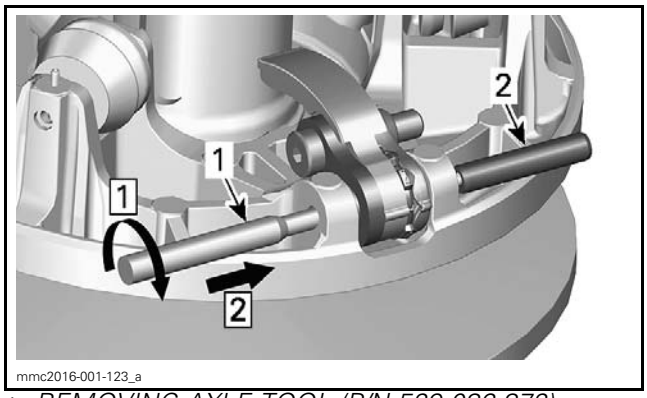
Removing the Ramp (without Spider)

1. Remove axle retaining screw.



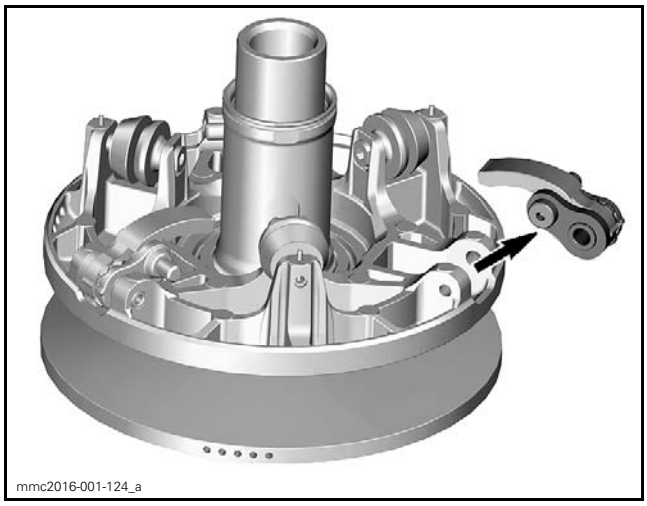
2. Remove the axle.



1. REMOVING AXLE TOOL (P/N 529 036 372)
2. Axle

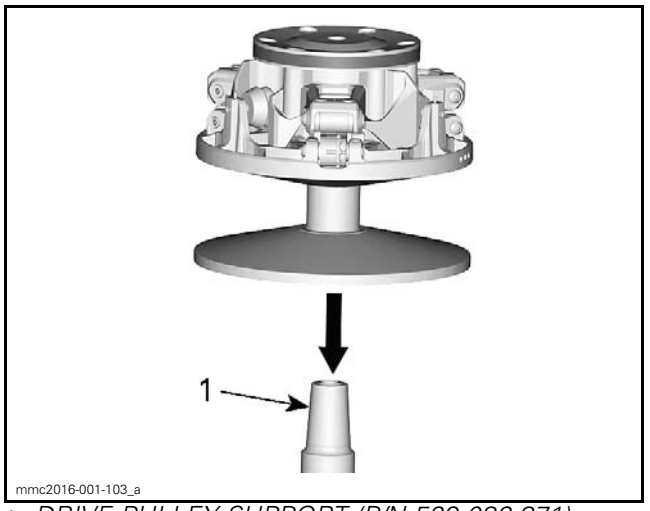
Step 1: Screw the tool into the axle
Step 2: Push axle to the right side

3. Remove ramp assembly.

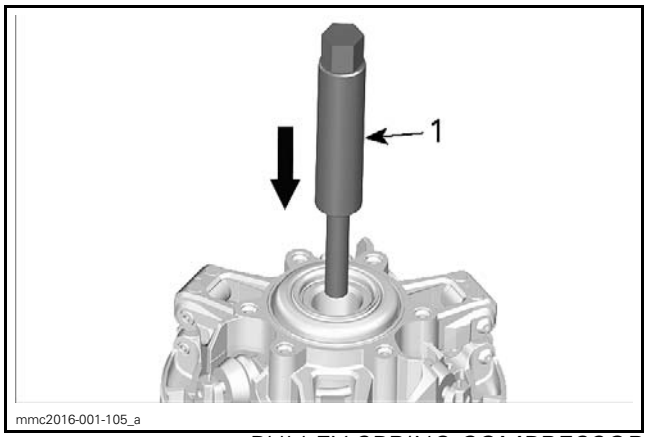


Removing the Ramp (Spider Installed)

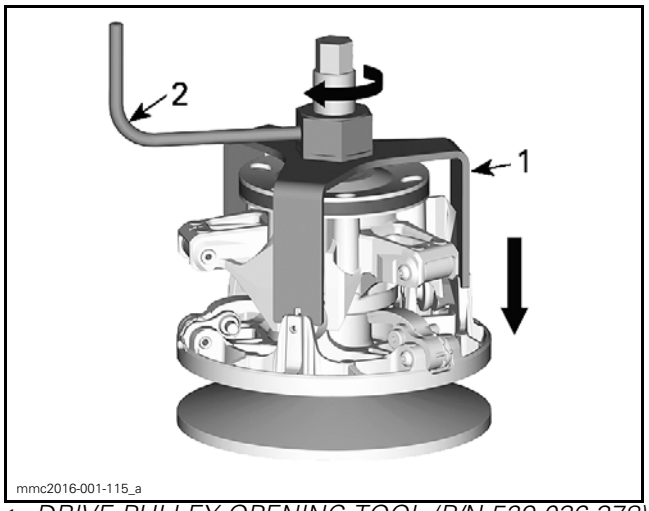
1. Lower the sliding sheave.
   1.1 Secure the drive pulley support in a vice.
   1.2 Install the drive pulley over the support.
   1.3 Install the drive pulley opening tool.



1. DRIVE PULLEY SUPPORT (P/N 529 036 371)

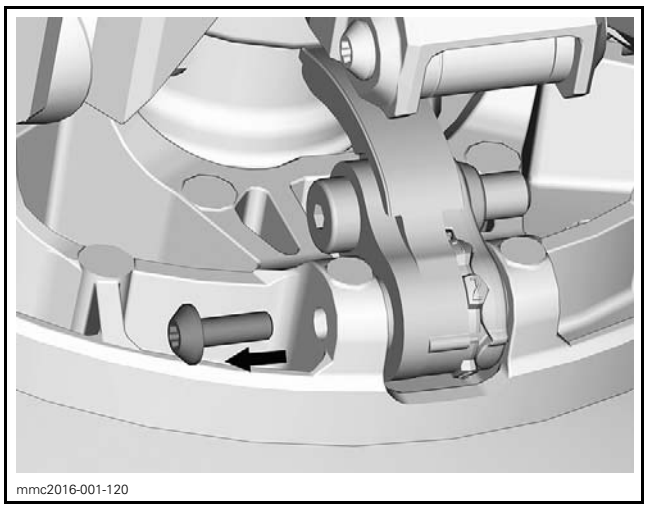


1. Threaded shaft of the PULLEY SPRING COMPRESSOR TOOL (P/N 529 036 373)

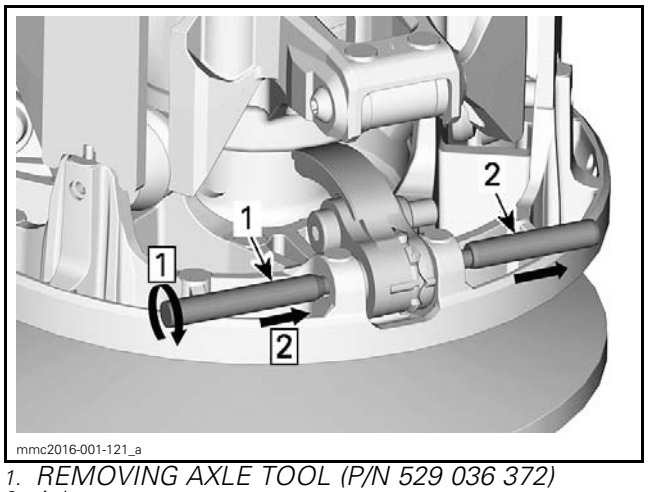


1. DRIVE PULLEY OPENING TOOL (P/N 529 036 378)
2. Handle of the PULLEY SPRING COMPRESSOR TOOL (P/N 529 036 373)

2. Remove axle retaining screw.



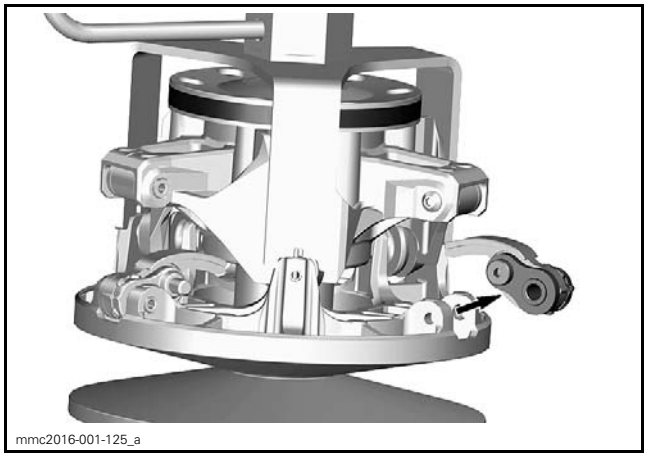
3. Remove the axle.



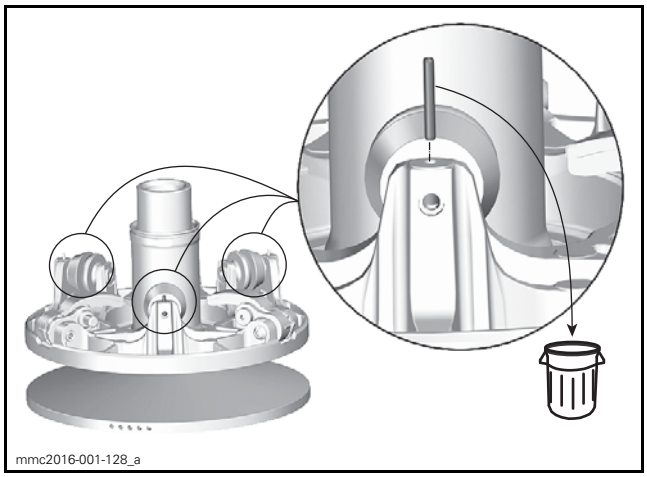
1. REMOVING AXLE TOOL (P/N 529 036 372)
2. Axle

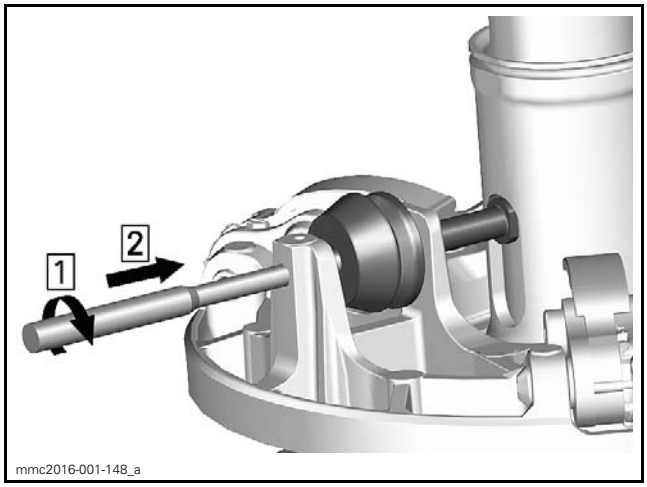
Step 1: Screw the tool into the axle
Step 2: Push axle to the right side

4. Remove ramp assembly.

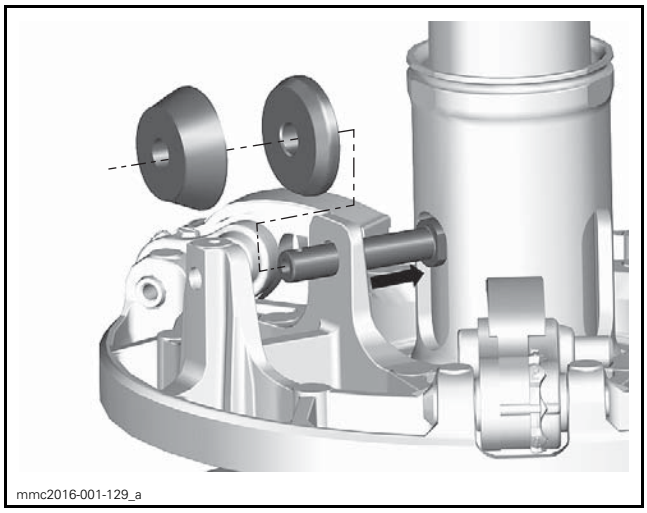


Removing the Torque Rollers





Step 1: Screw the tool into the axle
Step 2: Push axle towards the center of the pulley


mmc2016-001-129_a

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 with PULLEY FLANGE CLEANER (P/N 413 711 809), clean the following components.

- Crankshaft tapered end
- Taper inside fixed sheave of drive pulley
- Crankshaft threads
- Retaining screw threads.

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.

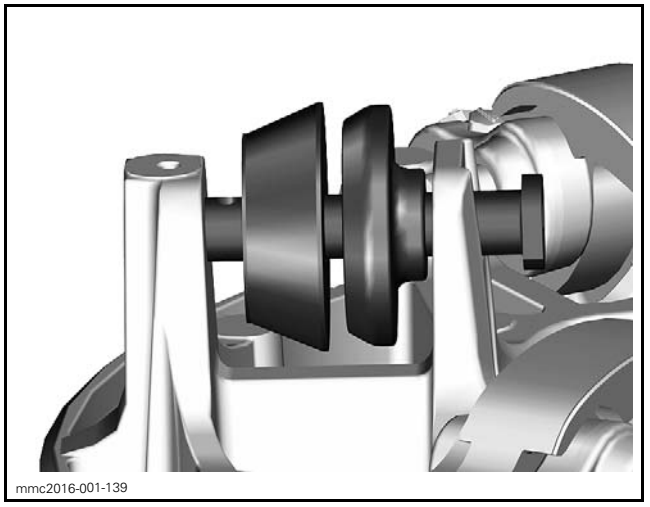
Wipe off the mounting surfaces with a clean, dry paper towel.

NOTICE Mounting surfaces must be free of any oil, cleaner or towel residue.

Assembling the Drive Pulley

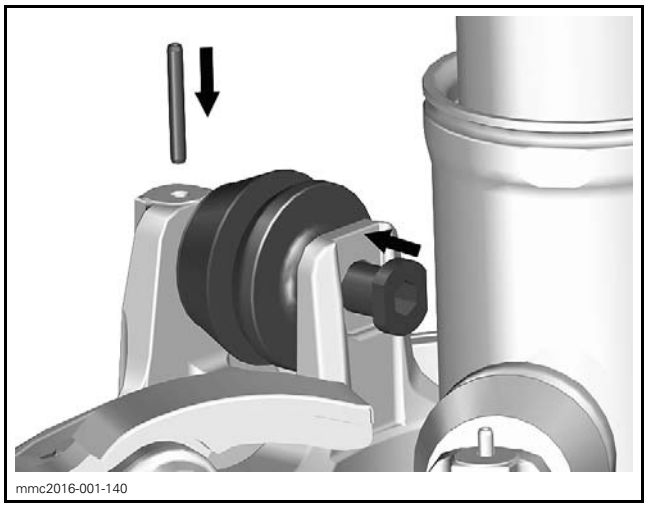
Torque Rollers

Position torque rollers as illustrated.


mmc2016-001-139

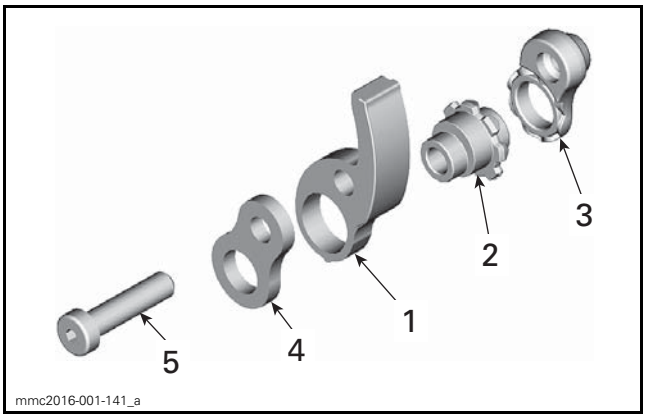
Position the flat sides of the axle head inside the slot of the mounting lug.

Install a new spring pin.


mmc2016-001-140

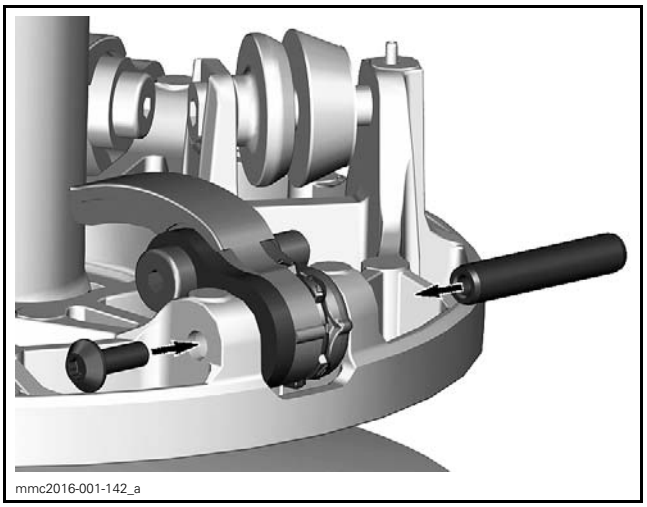
Ramp

Assemble the ramp as illustrated. Do not torque the pivot yet.



1. *Ramp*
2. *Cam*
3. *Right lever*
4. *Left lever*
5. *Pivot*

Install the ramp assembly on the sliding sheave.



TIGHTENING TORQUE	
Axle screw	5 N•m ± 0.5 N•m (44 lbf•**in** ± 4 lbf•**in**)

Position the cam to factory setting or to the desired position.

NOTICE **Make sure all cams are set at the same number.**

FACTORY SETTING	
Cam number	3 (position without number)

TIGHTENING TORQUE	
Pivot	8 N•m ± 2 N•m (71 lbf•**in** ± 18 lbf•**in**)

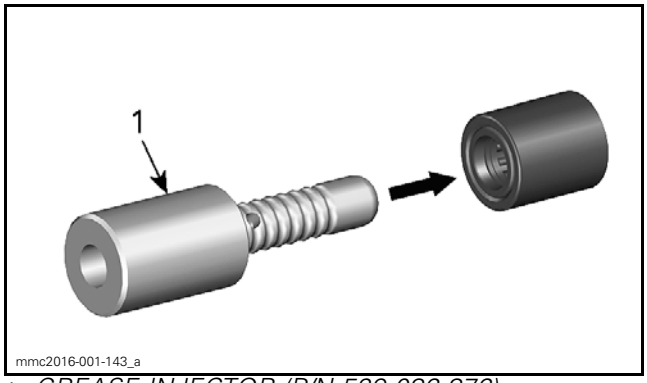
Roller

Lubricate the roller bearing.

REQUIRED SERVICE PRODUCT
ISOFLEX GREASE TOPAS NB 52 (P/N 293 550 021)

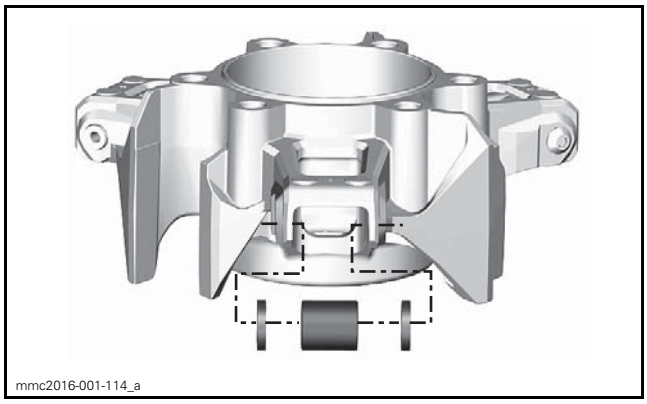
REQUIRED TOOL	
GREASE INJECTOR (P/N 529 036 376)	

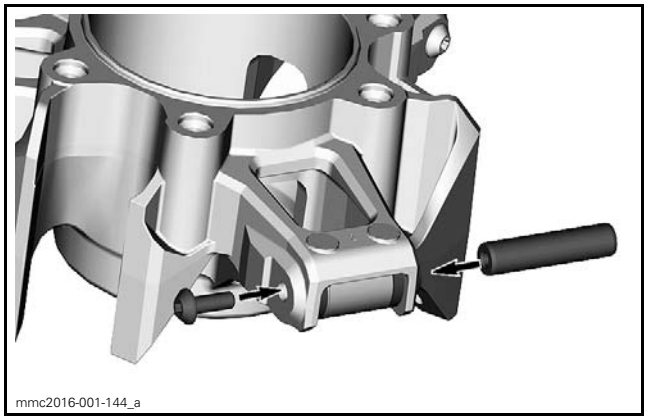
NOTE: A threaded end is required on the grease gun for using the grease injector.



1. *GREASE INJECTOR (P/N 529 036 376)*

Install roller.



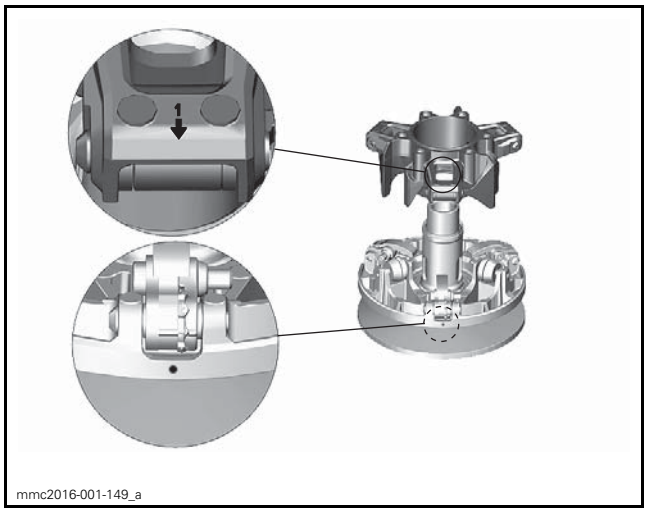


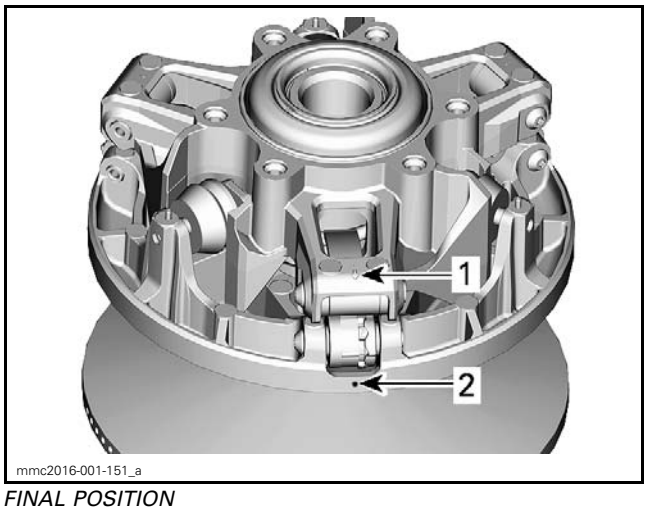
TIGHTENING TORQUE	
Roller axle screw	5 N•m ± 0.5 N•m (44 lbf•**in** ± 4 lbf•**in**)

Spider

Install the spider on the sliding sheave by aligning the indexing marks.

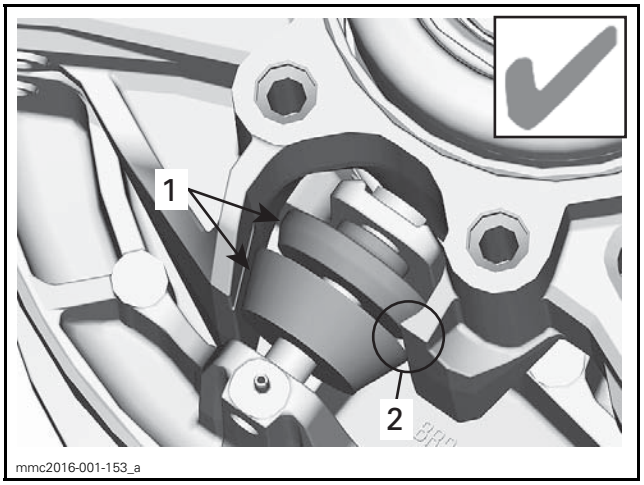
– Spider - the arrow on the arms #1, just above the roller.
– Sliding sheave - the dot on the external side of the sheave.



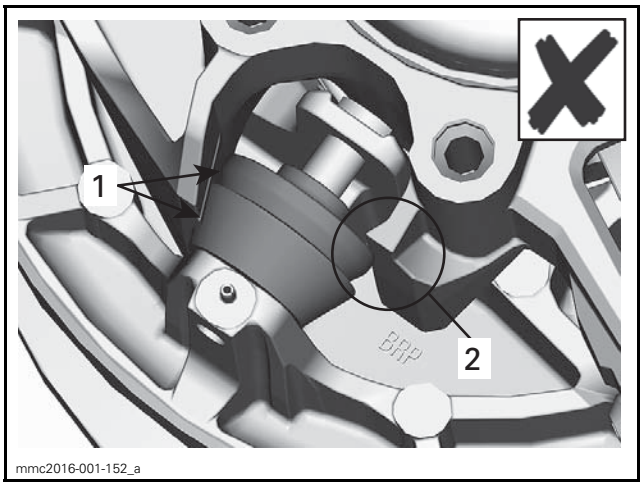


FINAL POSITION
1. Arrow - spider arm
2. Dot - sliding sheave

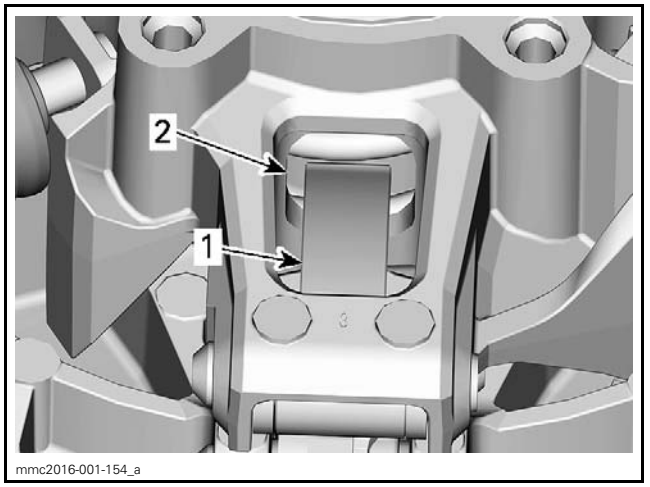
NOTICE During installation of the spider, make sure to position the three spurs of spider legs between torque rollers and ensure that ramps are positioned inside the openings of the spider.



ROLLER - GOOD INSTALLATION
1. Torque rollers
2. Spur of the spider leg



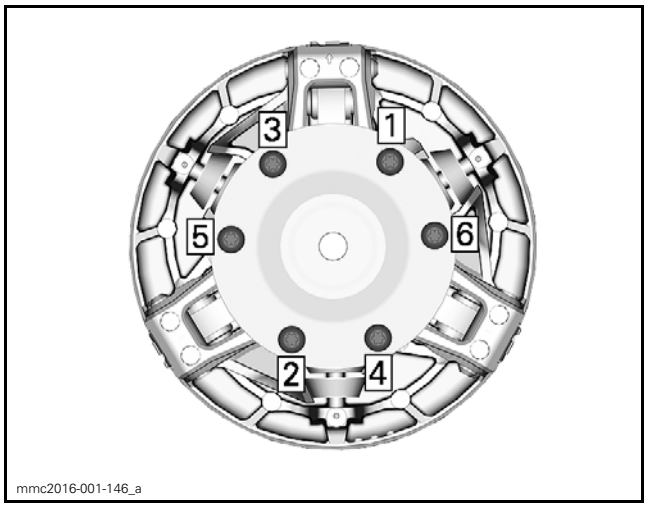
ROLLER - WRONG INSTALLATION
1. Torque rollers
2. Spur of the spider leg



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)

Sliding Sheave and Fixed Sheave Assembly

Index sliding sheave with fixed sheave by aligning index marks.

– Sliding sheave - the arrow on the spider arms #1, just above the roller.
– Fixed sheave- the dot on the external side of the sheave.

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 (89 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 (89 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.

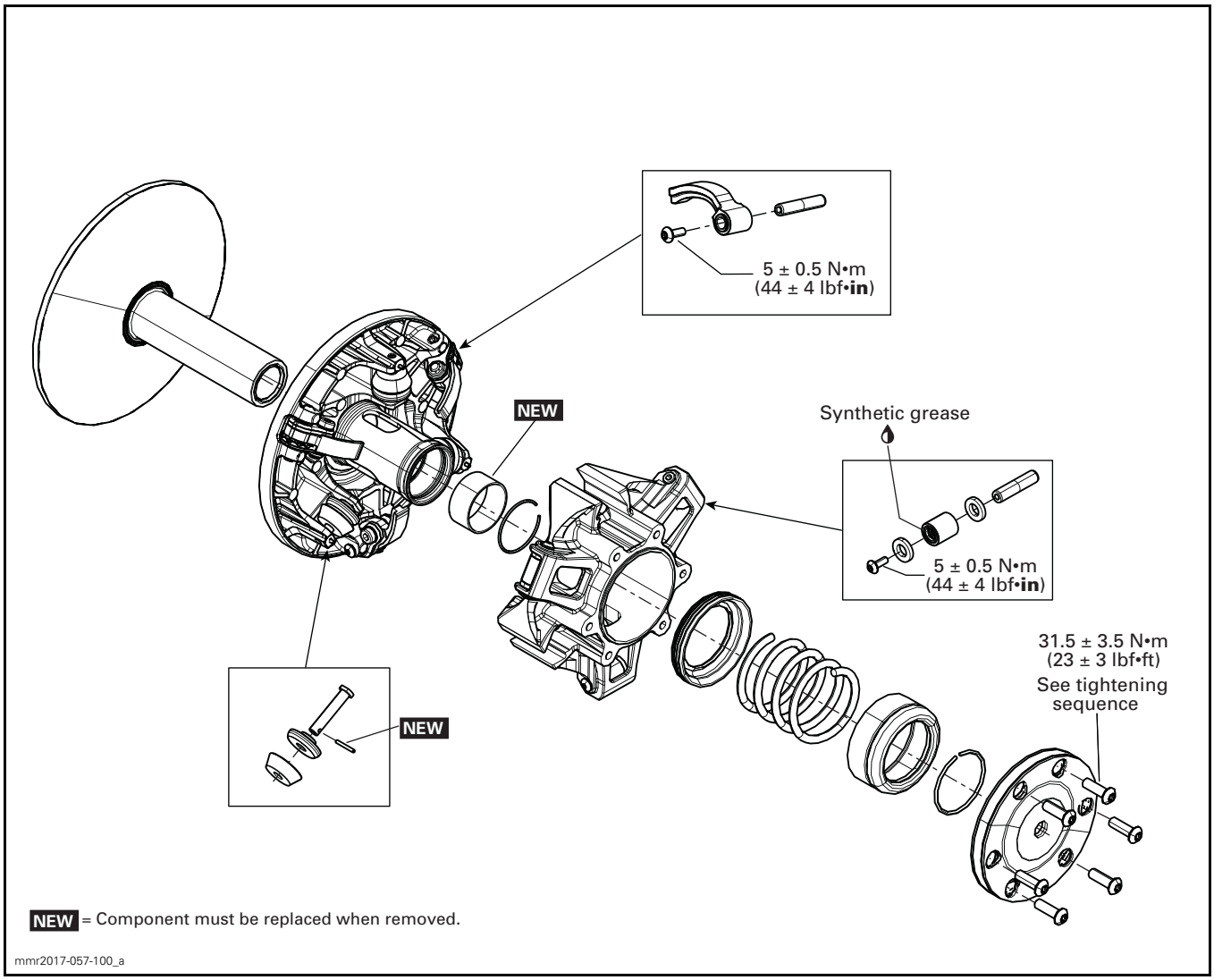
pDRIVE PULLEY WITHOUT CLICKER

SERVICE TOOLS

Description	Part Number	Page
CIRCLIP INSTALLER/REMOVER	529 036 375	4–5
CLUTCH HOLDER	529 036 369	3, 12
DRIVE PULLEY OPENING TOOL	529 036 378	4, 8
DRIVE PULLEY SUPPORT	529 036 371	4, 7
GREASE INJECTOR	529 036 376	10
PDRIVE PULLER	529 036 370	3–4
PULLEY SPRING COMPRESSOR TOOL	529 036 373	4–5, 7–8
REMOVING AXLE TOOL	529 036 372	4, 6–8

SERVICE PRODUCTS

Description	Part Number	Page
ISOFLEX GREASE TOPAS NB 52	293 550 021	10
PULLEY FLANGE CLEANER	413 711 809	9


5 ± 0.5 N•m
(44 ± 4 lbf•in)
NEW
Synthetic grease
5 ± 0.5 N•m
(44 ± 4 lbf•in)
31.5 ± 3.5 N•m
(23 ± 3 lbf•ft)
See tightening sequence
NEW
NEW = Component must be replaced when removed.
mmr2017-057-100_a

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.).

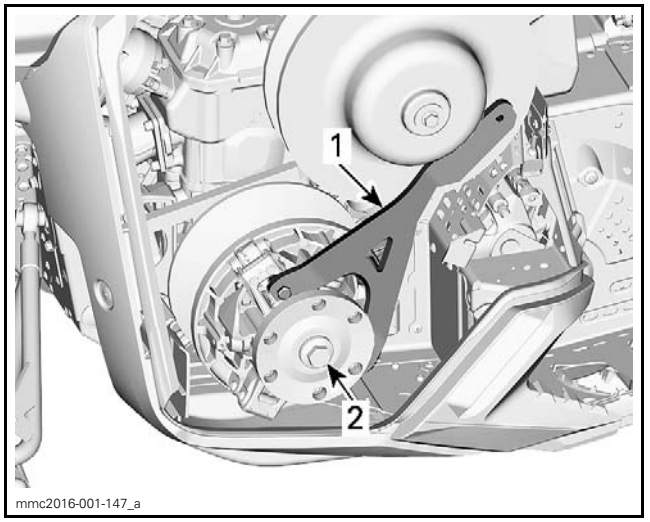
PROCEDURES

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* subsection.
2. Remove the drive pulley bolt.
   2.1 Secure the drive pulley with the clutch holder.
   2.2 Using a breaker bar, remove the drive pulley bolt and its conical spring washer.



1. Clutches holder
2. Drive pulley bolt

3. Remove the drive pulley from engine.
   3.1 Make sure the clutches holder is properly installed.
   3.2 Screw the pDrive puller in place of the drive pulley bolt.
   3.3 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

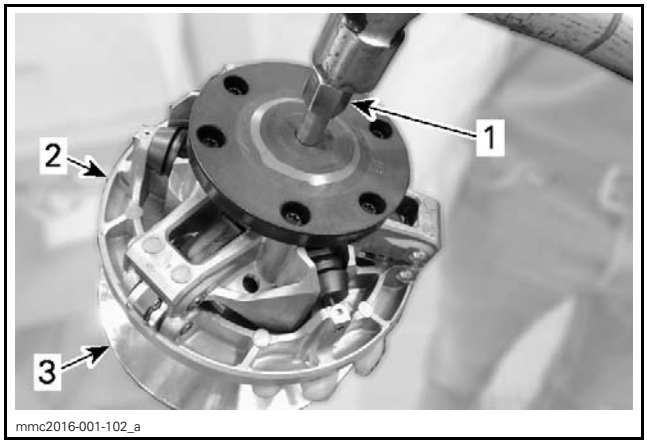
REQUIRED TOOLS	
PDRIVE PULLER (P/N 529 036 370)	
DRIVE PULLEY SUPPORT (P/N 529 036 371)	
PULLEY SPRING COMPRESSOR TOOL (P/N 529 036 373)	
CIRCLIP INSTALLER/REMOVER (P/N 529 036 375)	
REMOVING AXLE TOOL (P/N 529 036 372)	
DRIVE PULLEY OPENING TOOL (P/N 529 036 378)	

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.



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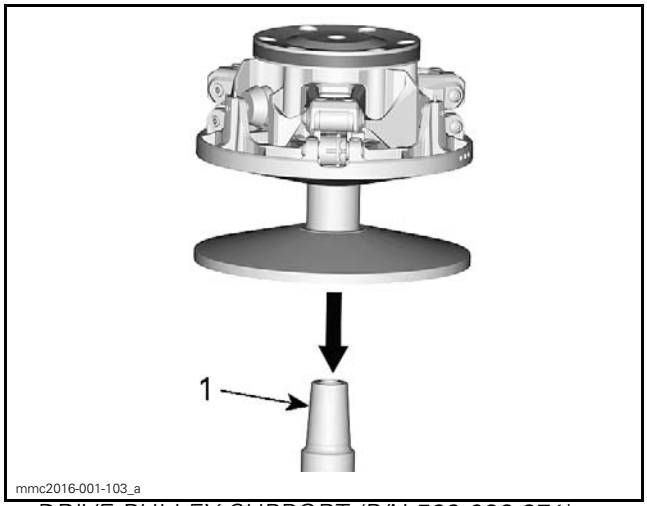
1. Puller screwed 13 mm (1/2 in) in fixed sheave
2. Sliding sheave
3. Fixed sheave

NOTE: No component marking is required before disassembly. This drive pulley features factory apposed 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.

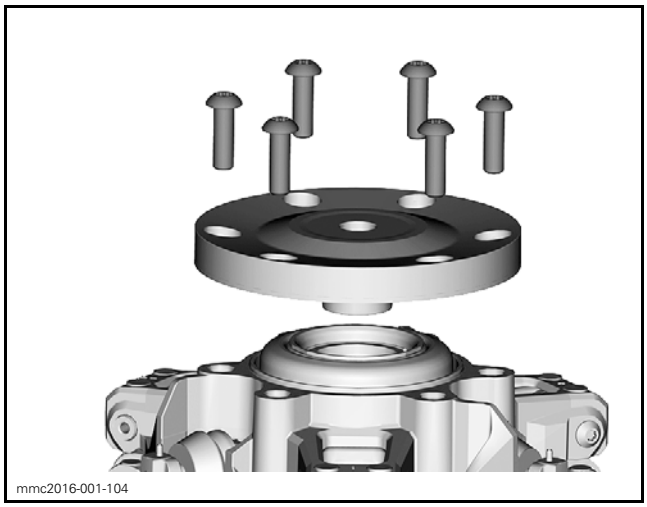


mmc2016-001-103_a

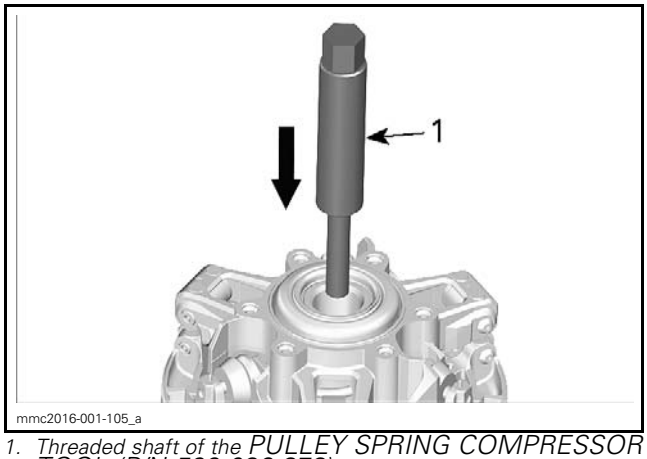
1. DRIVE PULLEY SUPPORT (P/N 529 036 371)

3. Remove the damper.

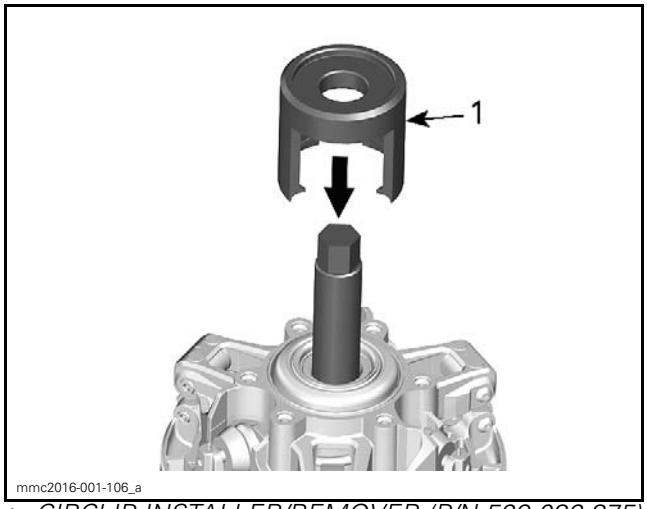
NOTE: To racing purpose only: Some dampers might be installed with shims for initial opening setup of the pulley.



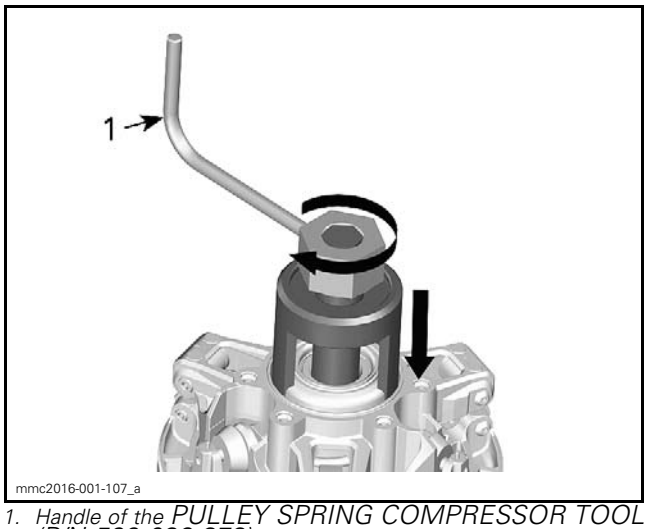
Removing the Spring



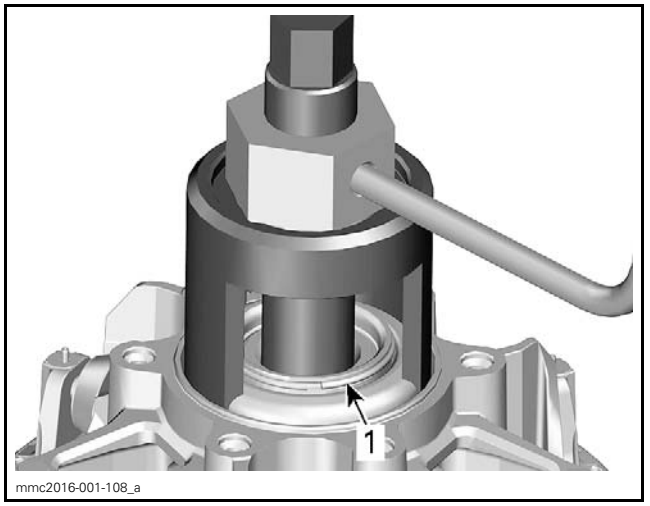
1. Threaded shaft of the PULLEY SPRING COMPRESSOR TOOL (P/N 529 036 373)



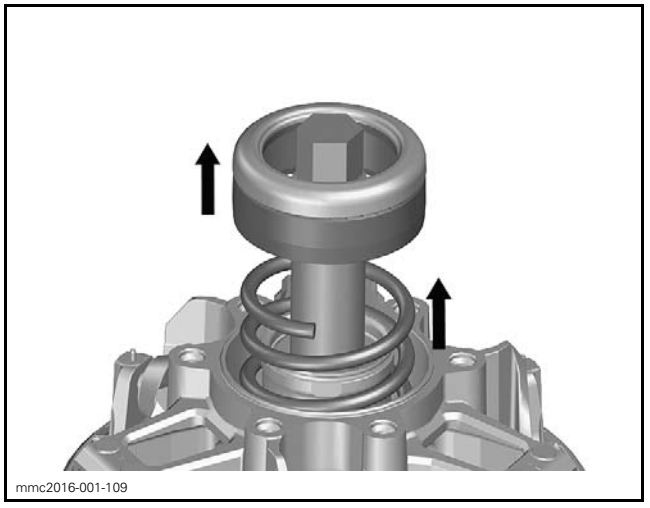
1. CIRCLIP INSTALLER/REMOVER (P/N 529 036 375)



1. Handle of the PULLEY SPRING COMPRESSOR TOOL (P/N 529 036 373)



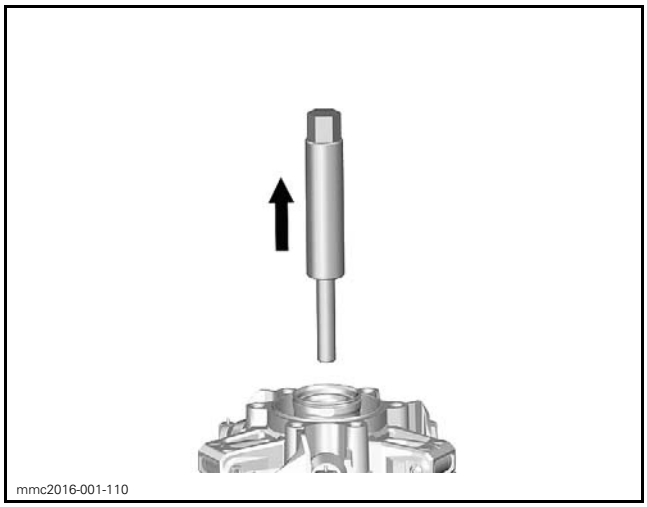
1. Remove the circlip



NOTE: To racing purpose only: A shim may be added between the spring and the cover to modify the compression of the spring. Refer to the chart in the *CALIBRATION SECTION*.

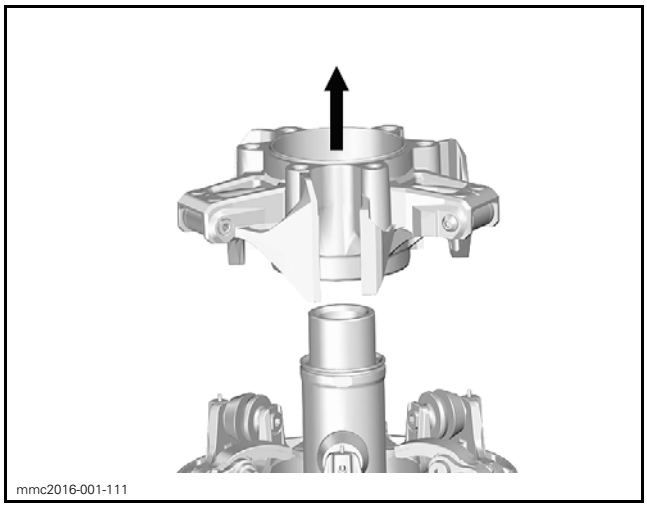
Removing the Spider

1. Remove the threaded shaft.



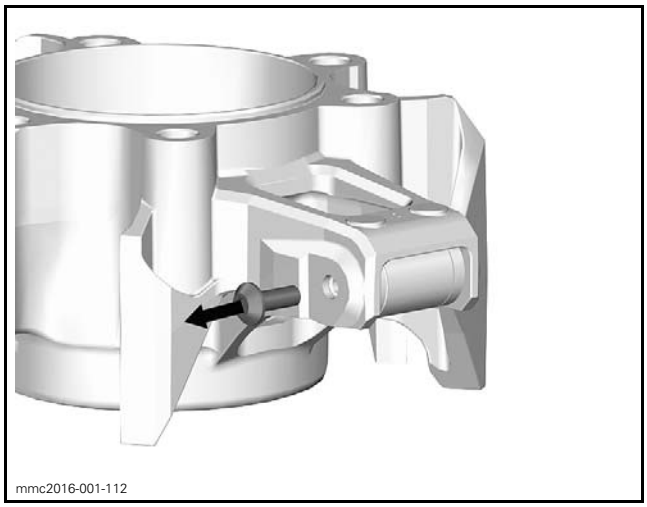
NOTICE Remove the threaded shaft to avoid damaging the bushings inside the spider.

2. Remove the spider.

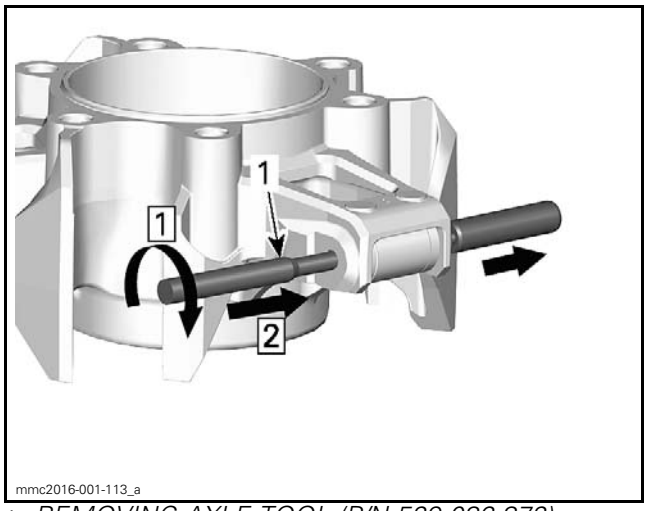


Removing the Roller

1. Remove axle retaining screw.

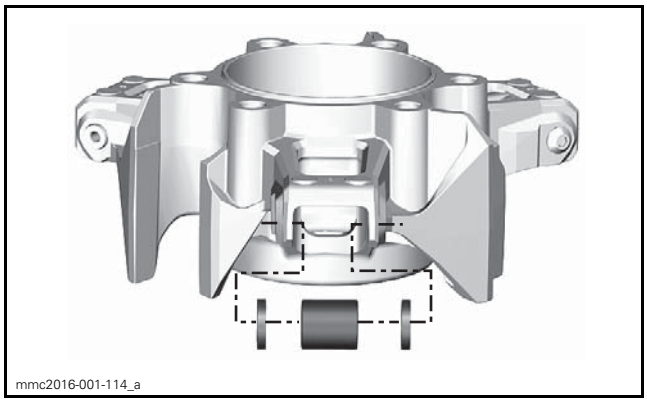


2. Remove the axle.



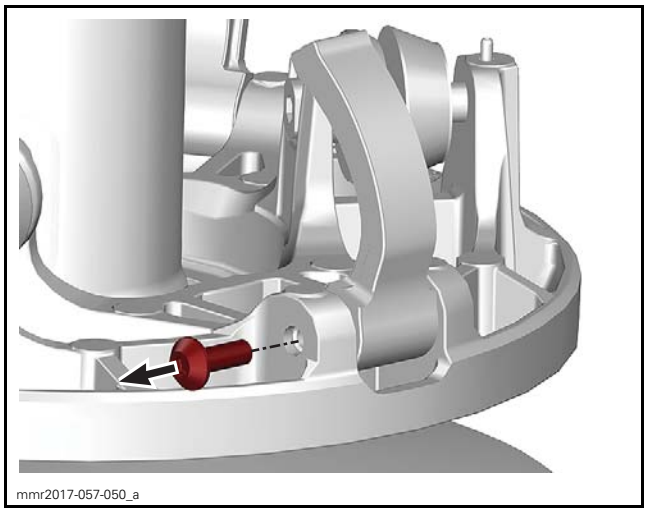
1. REMOVING AXLE TOOL (P/N 529 036 372)
Step 1: Screw the tool into the axle
Step 2: Push axle to the right side

3. Remove the roller and its thrust washers.

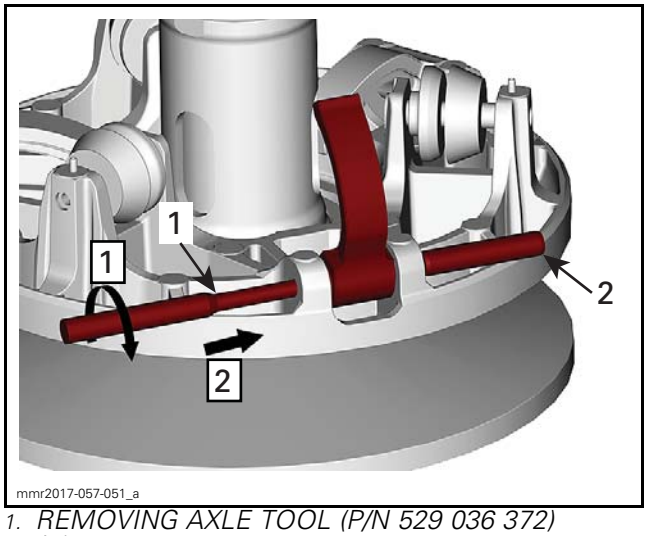


Removing the Ramp (without Spider)

1. Remove axle retaining screw.



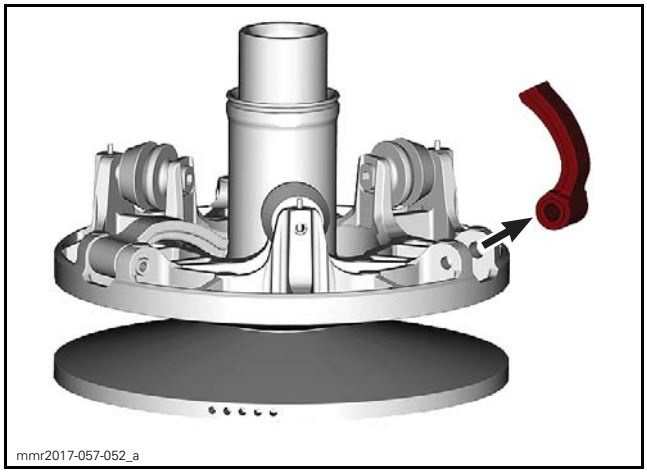
2. Remove the axle.



1. REMOVING AXLE TOOL (P/N 529 036 372)
2. Axle

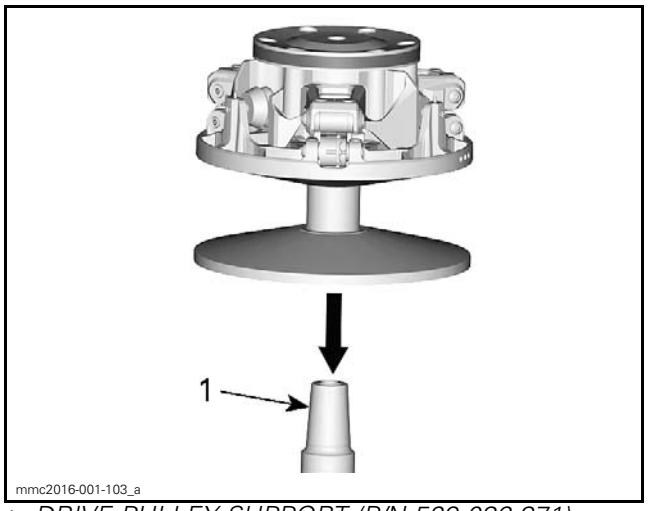
Step 1: Screw the tool into the axle
Step 2: Push axle to the right side

3. Remove ramp assembly.

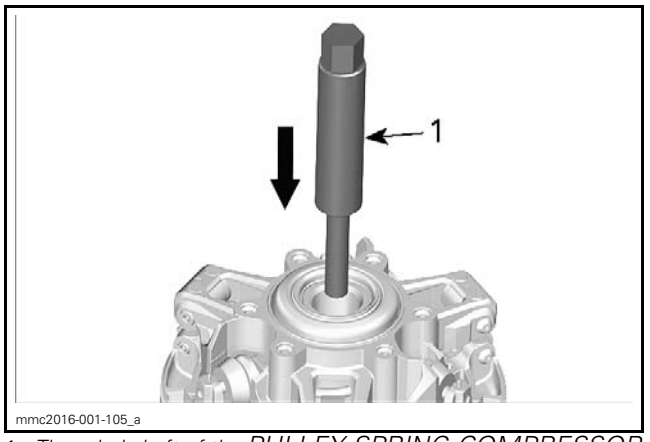


Removing the Ramp (Spider Installed)

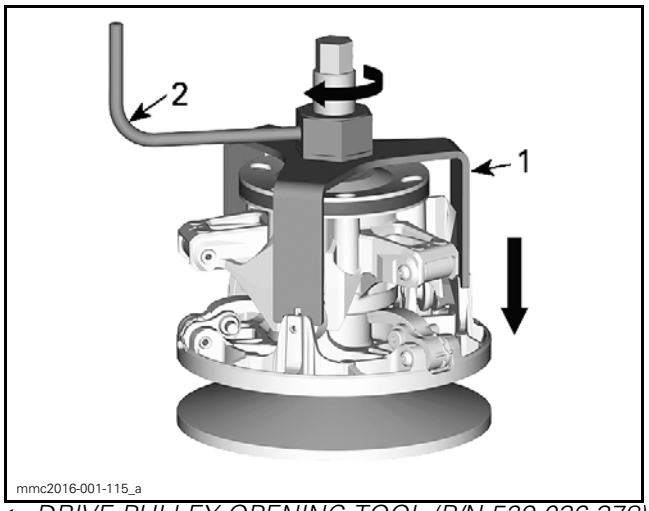
1. Lower the sliding sheave.
   1.1 Secure the drive pulley support in a vice.
   1.2 Install the drive pulley over the support.
   1.3 Install the drive pulley opening tool.



1. DRIVE PULLEY SUPPORT (P/N 529 036 371)

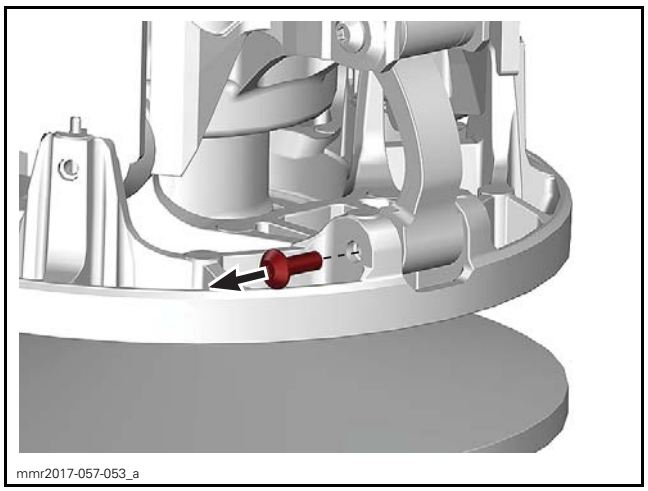


1. Threaded shaft of the PULLEY SPRING COMPRESSOR TOOL (P/N 529 036 373)

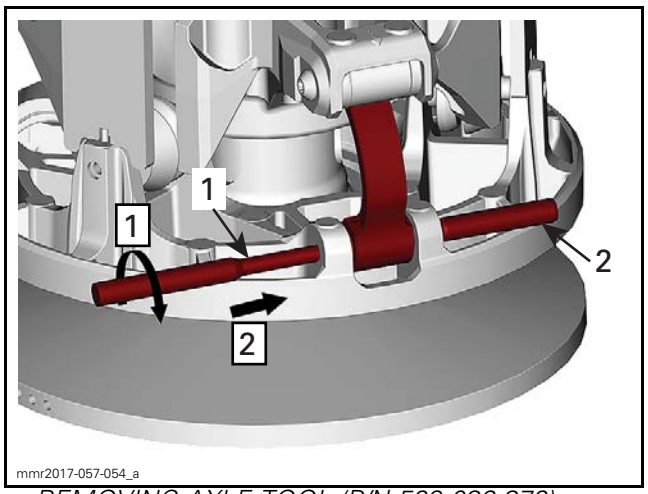


1. *DRIVE PULLEY OPENING TOOL (P/N 529 036 378)*
2. *Handle of the PULLEY SPRING COMPRESSOR TOOL (P/N 529 036 373)*

2. Remove axle retaining screw.



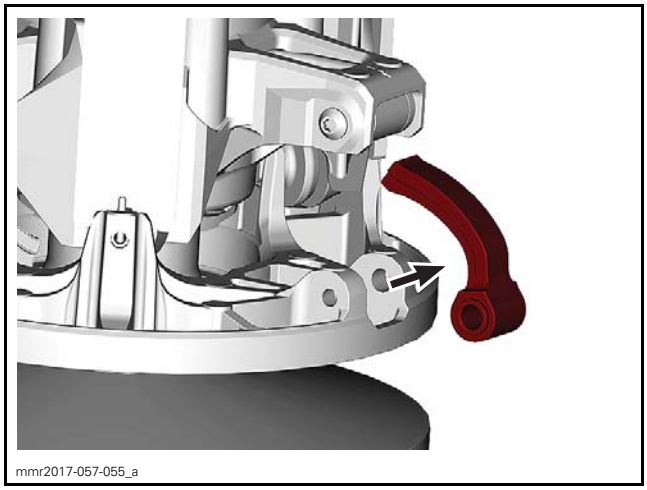
3. Remove the axle.



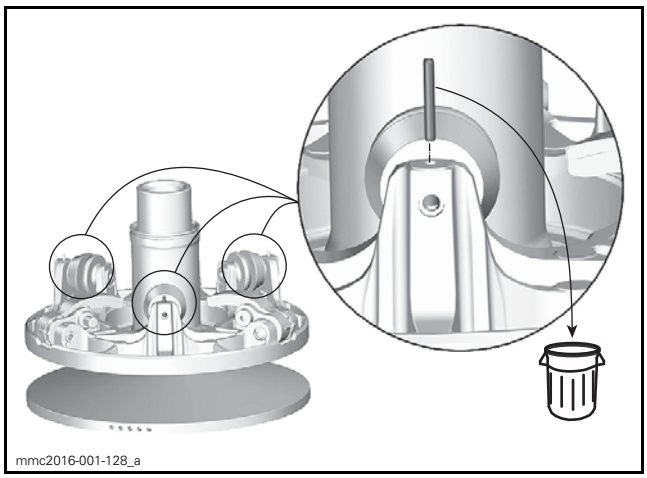
1. *REMOVING AXLE TOOL (P/N 529 036 372)*
2. *Axle*

Step 1: Screw the tool into the axle
Step 2: Push axle to the right side

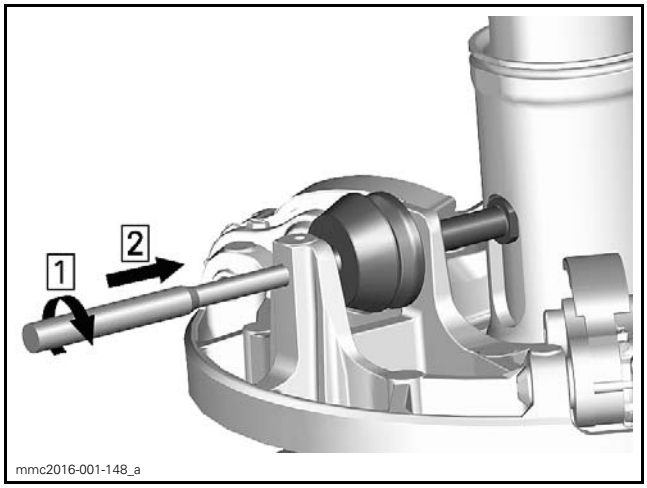
4. Remove ramp assembly.



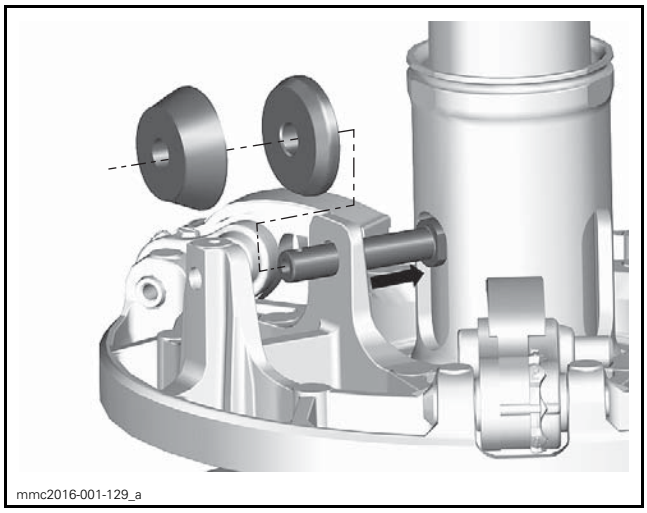
Removing the Torque Rollers



TYPICAL



TYPICAL
Step 1: Screw the tool into the axle
Step 2: Push axle towards the center of the pulley



TYPICAL

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 with PULLEY FLANGE CLEANER (P/N 413 711 809), clean the following components.

- Crankshaft tapered end
- Taper inside fixed sheave of drive pulley
- Crankshaft threads
- Retaining screw threads.

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.

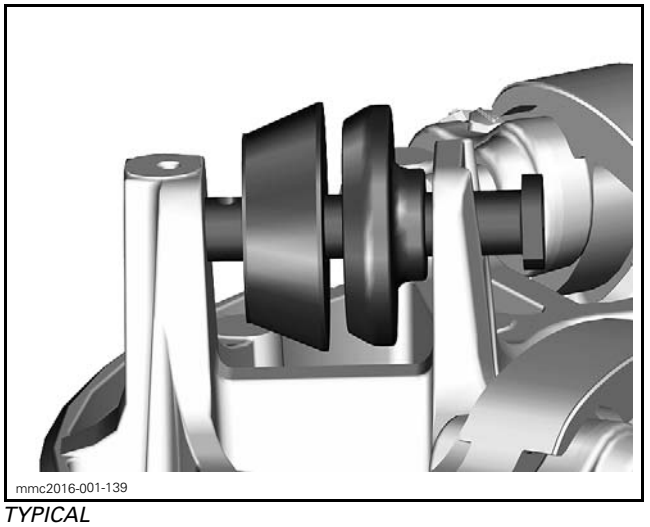
Wipe off the mounting surfaces with a clean, dry paper towel.

NOTICE Mounting surfaces must be free of any oil, cleaner or towel residue.

Assembling the Drive Pulley

Torque Rollers

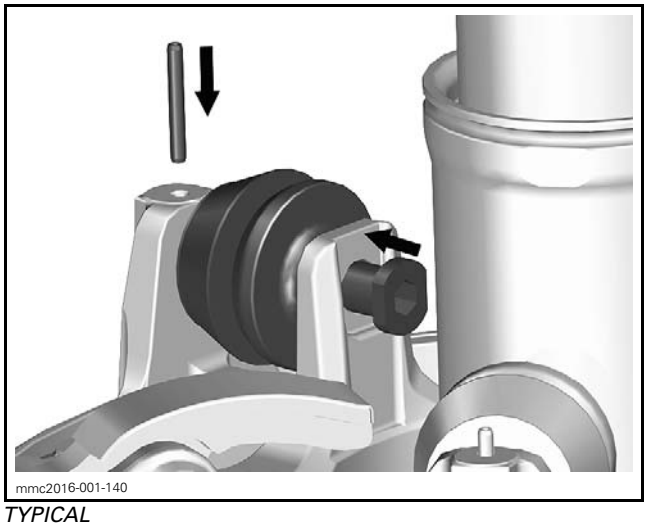
Position torque rollers as illustrated.



TYPICAL

Position the flat sides of the axle head inside the slot of the mounting lug.

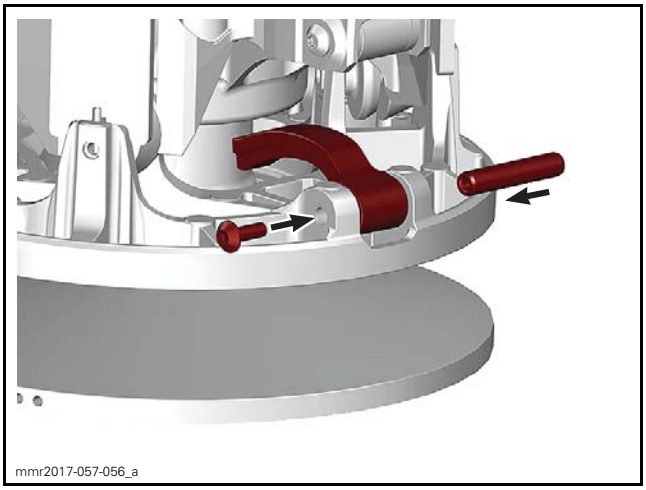
Install a new spring pin.



TYPICAL

Ramp

Install the ramp on the sliding sheave.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TIGHTENING TORQUE	
Axle screw	5 N•m ± 0.5 N•m (44 lbf•**in** ± 4 lbf•**in**)

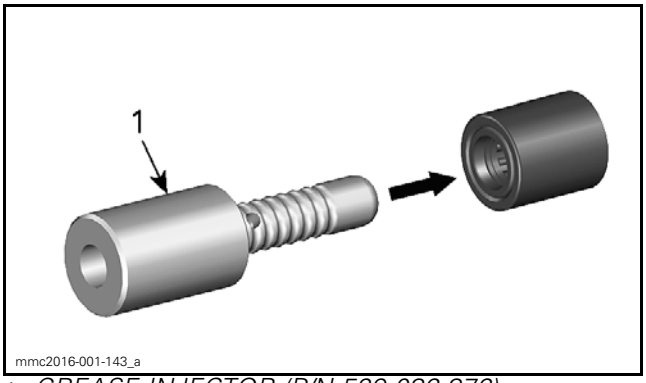
Roller

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.



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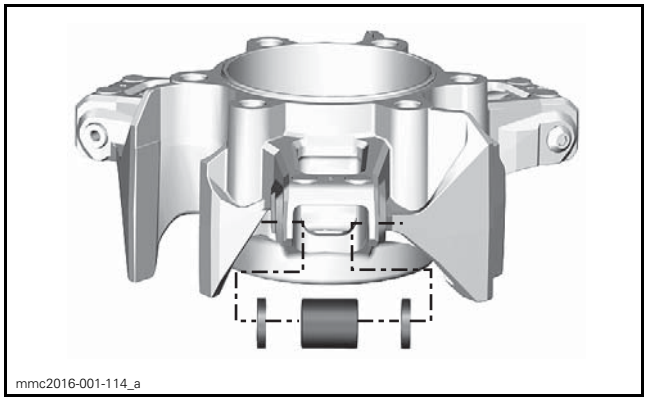
1. GREASE INJECTOR (P/N 529 036 376)

Install roller.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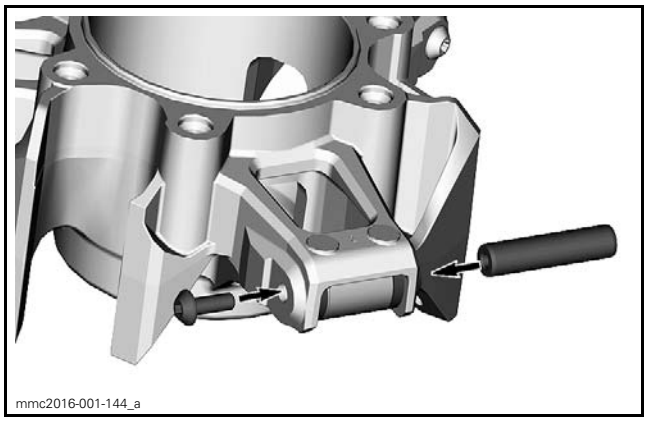
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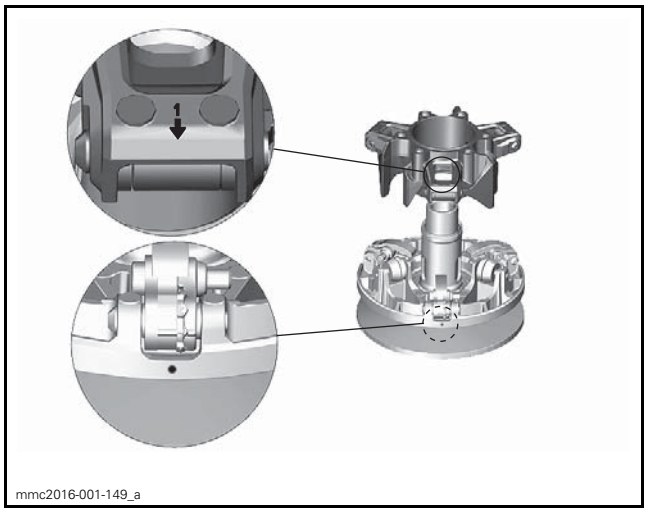
TIGHTENING TORQUE	
Roller axle screw	5 N•m ± 0.5 N•m (44 lbf•**in** ± 4 lbf•**in**)

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.



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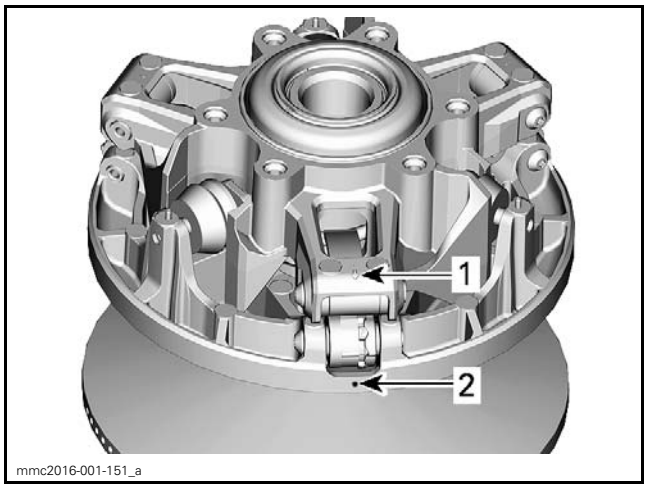
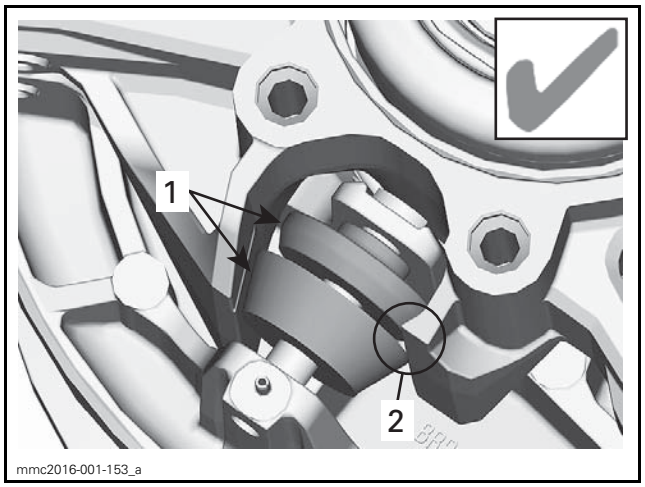
TYPICAL

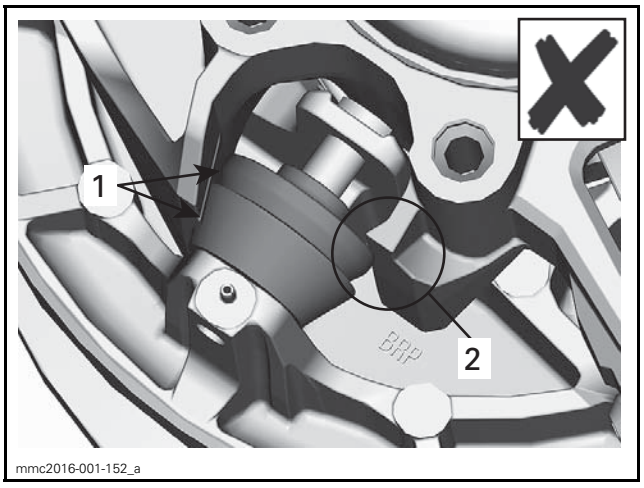


TYPICAL - FINAL POSITION
1. *Arrow - spider arm*
2. *Dot - sliding sheave*

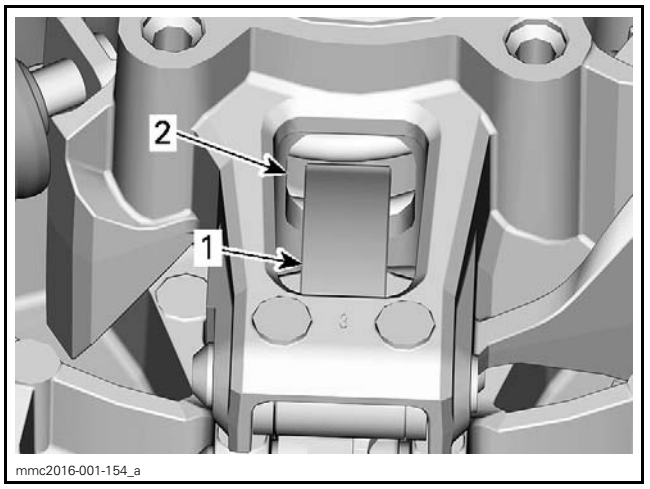
NOTICE During installation of the spider, make sure to position the three spurs of spider legs between torque rollers and ensure that ramps are positioned inside the openings of the spider.



ROLLER - GOOD INSTALLATION
1. *Torque rollers*
2. *Spur of the spider leg*



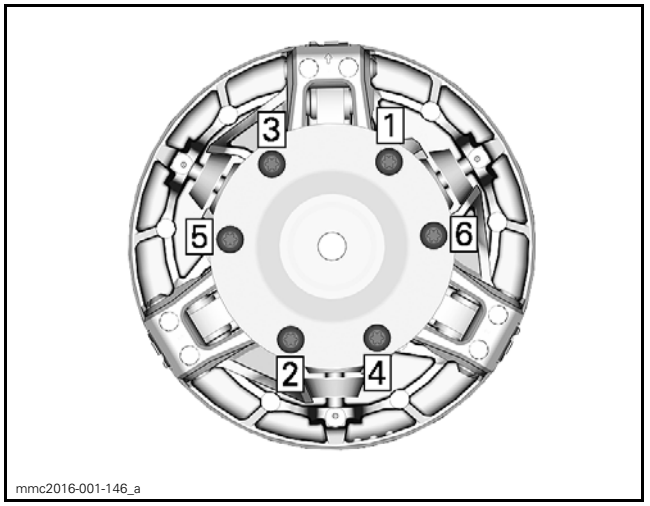
ROLLER - WRONG INSTALLATION
1. *Torque rollers*
2. *Spur of the spider leg*



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)

Sliding Sheave and Fixed Sheave Assembly

Index sliding sheave with fixed sheave by aligning index marks.

– Sliding sheave - the arrow on the spider arms #1, just above the roller.
– Fixed sheave- the dot on the external side of the sheave.

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 (89 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 (89 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.

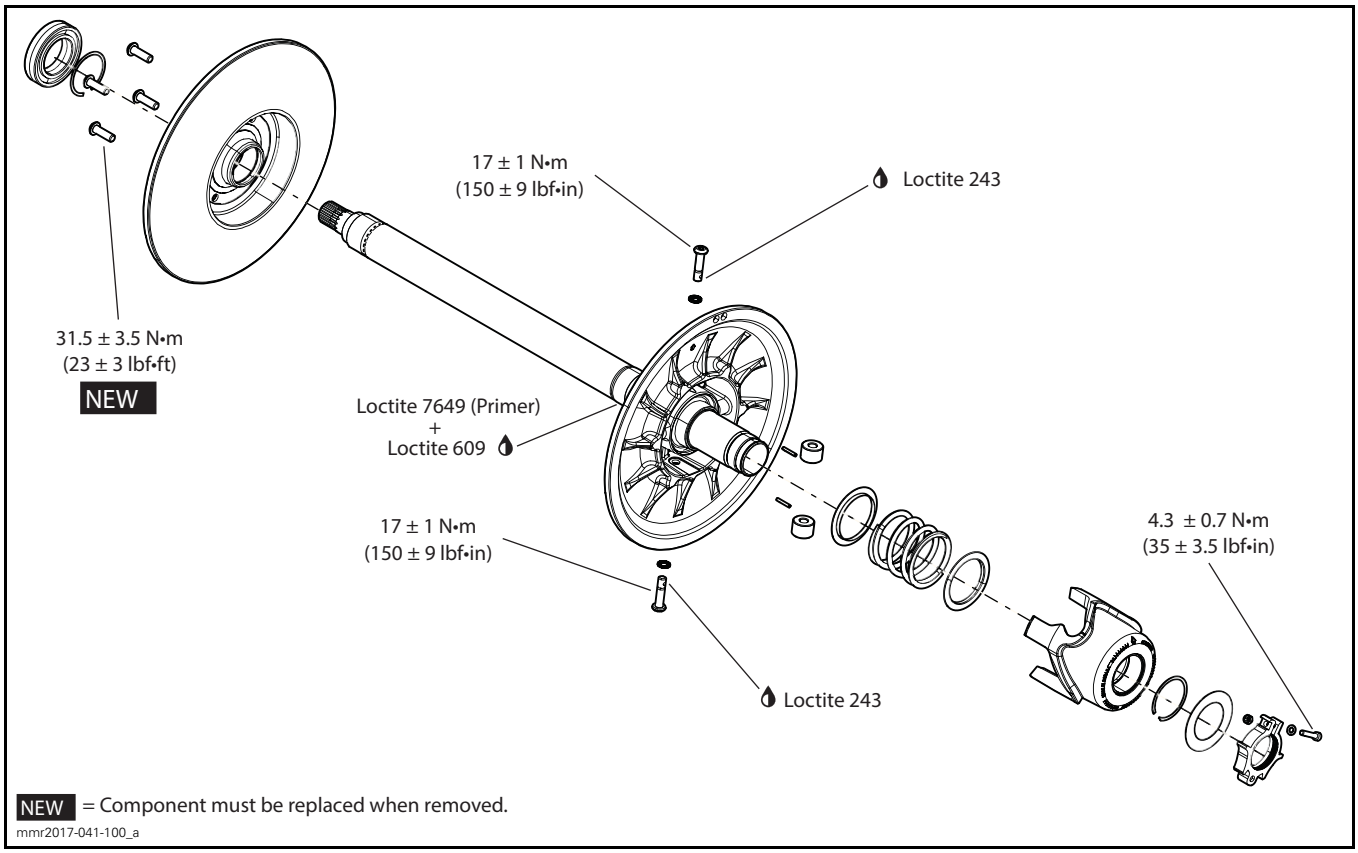
DRIVEN PULLEY AND COUNTERSHAFT

SERVICE TOOLS

Description	Part Number	Page
COUNTERSHAFT ADAPTER	529 036 424	9
COUNTERSHAFT BEARING INSTALLER	529 036 066	10
COUNTERSHAFT BEARING REMOVER	529 036 065	9
COUNTERSHAFT SUPPORT	529 036 067	9
DRIVEN PULLEY SPRING COMPRESSOR	529 036 182	3
UPPER GEAR RETAINING TOOL	529 036 110	2

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	7
LOCTITE 609	413 703 100	10
LOCTITE 7649 (PRIMER)	293 800 041	10
LOCTITE 767 (ANTISEIZE LUBRICANT)	293 800 070	8
PULLEY FLANGE CLEANER	413 711 809	6, 9



GENERAL

During assembly/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.

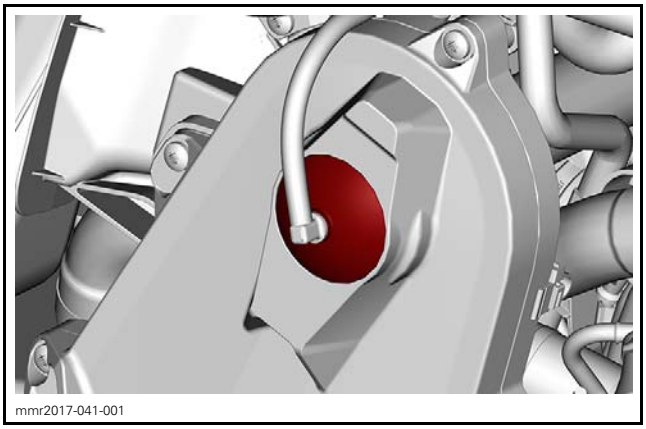
PROCEDURES

DRIVEN PULLEY

Removing the Driven Pulley

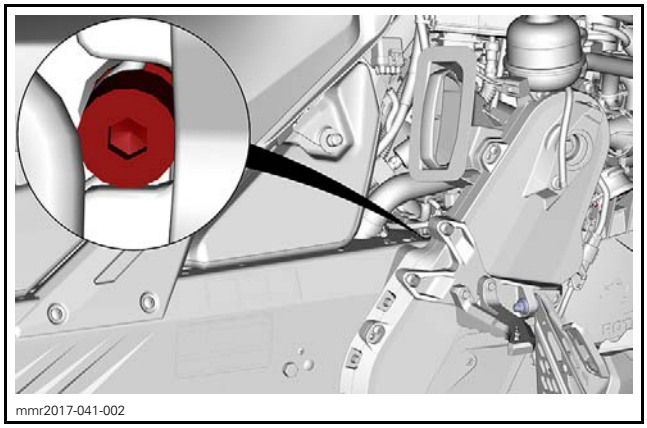
NOTE: The driven pulley is removed with the countershaft.

1. Remove the muffler. Refer to *EXHAUST SYSTEM* subsection.
2. Remove the filling plug on the chaincase cover.



mmr2017-041-001

3. Release drive chain tension by unscrewing tensioner adjustment screw.



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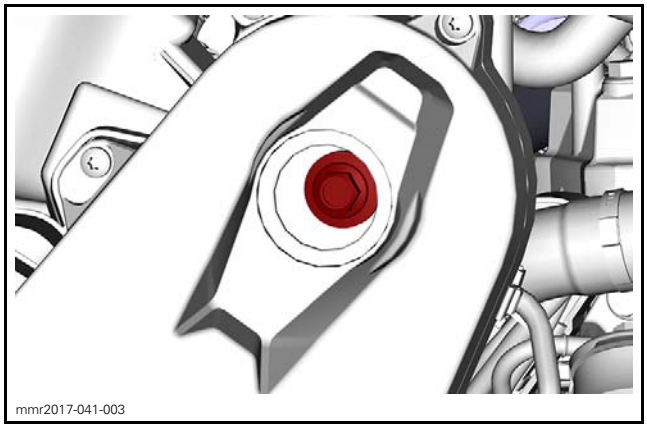
4. Remove the upper gear screw and the conical spring washer.

NOTE: Slightly tilt the bolt to avoid dropping washer inside chaincase.



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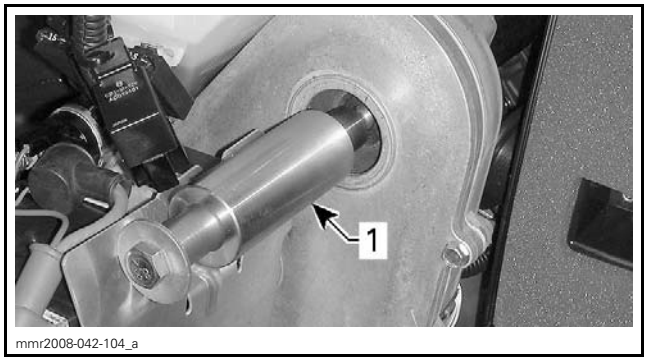
5. Install the gear retaining tool on countershaft end.

REQUIRED TOOL	
UPPER GEAR RETAINING TOOL (P/N 529 036 110)	



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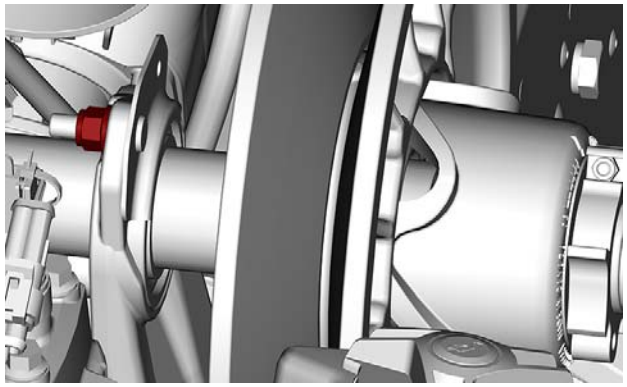
TYPICAL
1. Upper gear retaining tool

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

7. Behind driven pulley, remove nut securing the countershaft bearing flange.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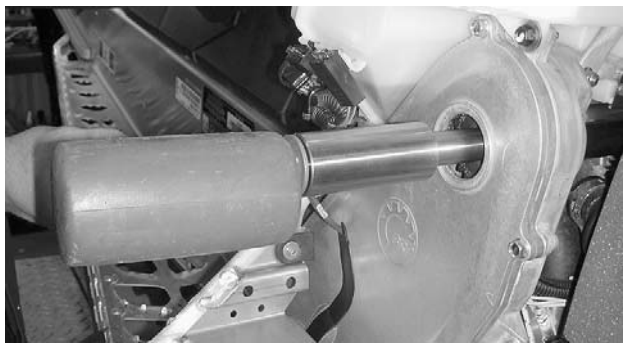
8. Pull out bearing flange.
9. Pull the driven pulley to disengage countershaft and upper gear.

NOTE: If necessary, tap the upper gear retaining tool with a plastic hammer.


mmr2008-042-106

TYPICAL

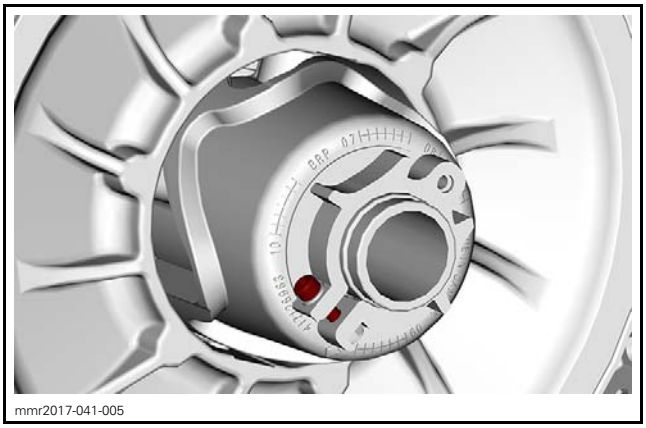
10. Unscrew countershaft from the upper gear retaining tool. **Do not** remove tool.

NOTE: While countershaft is removed from vehicle, the upper gear retaining tool maintains the drive chain and the upper gear in position inside chaincase.

Driven Pulley Disassembly

Removing Cam and Spring

1. Loosen the clamping screw.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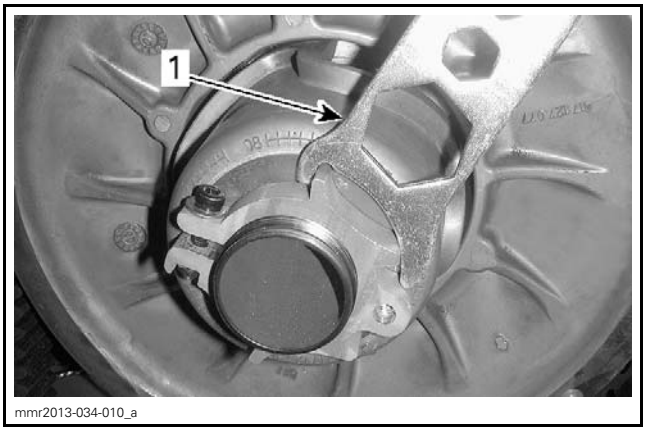
2. Unscrew the adjuster hub **clockwise** using the suspension adjustment tool provided in the vehicle tool kit.

NOTE: The adjuster hub has LH treads.



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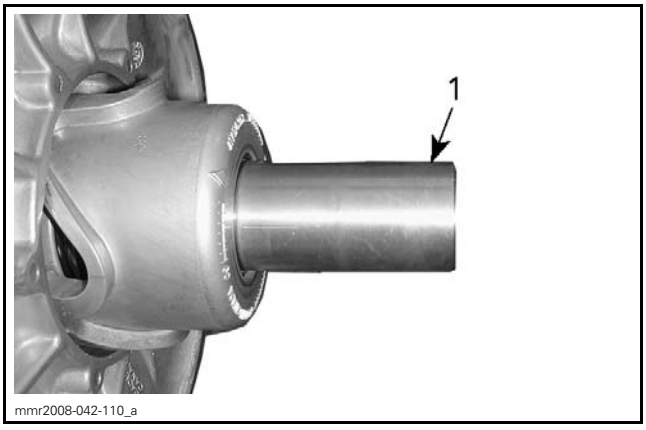
1. Suspension adjustment tool shown

REQUIRED TOOL	
DRIVEN PULLEY SPRING COMPRESSOR (P/N 529 036 182)	

3. Install the threaded adapter of the spring compressor on the countershaft.



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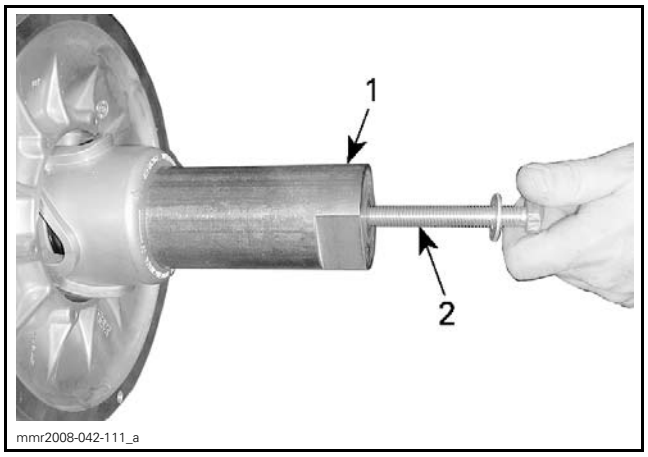
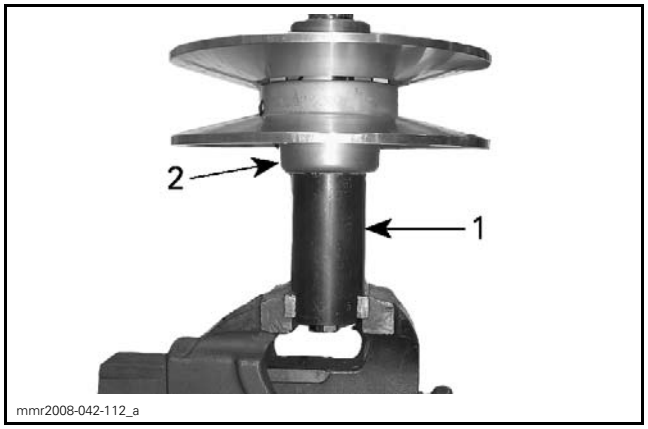
1. Threaded adapter

4. Install the external sleeve over the threaded adapter and secure sleeve with the tool screw.



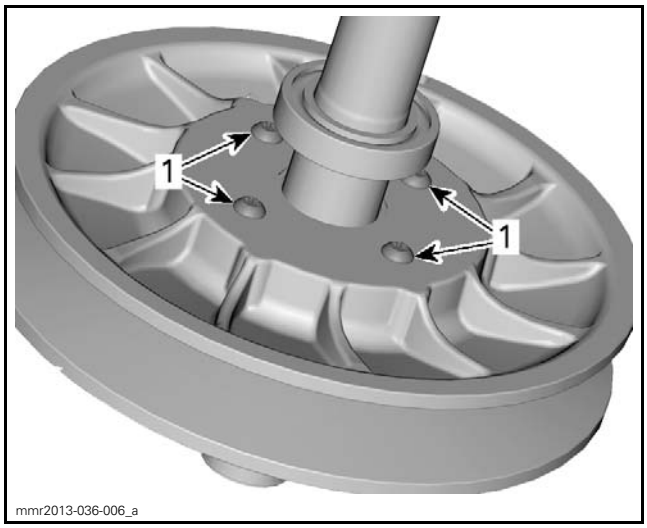
1. External sleeve
2. Driven pulley spring compressor screw

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.

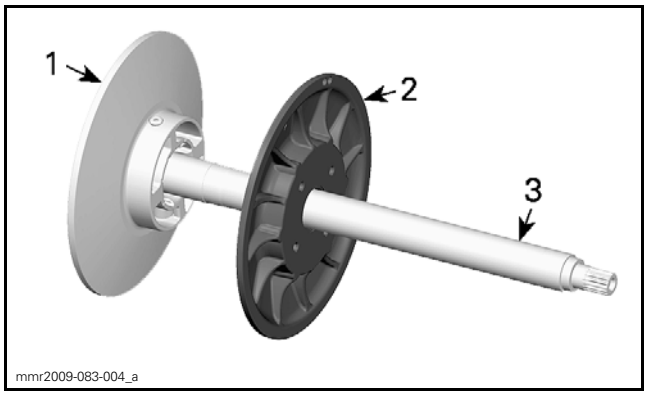


1. Heat cam screws

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

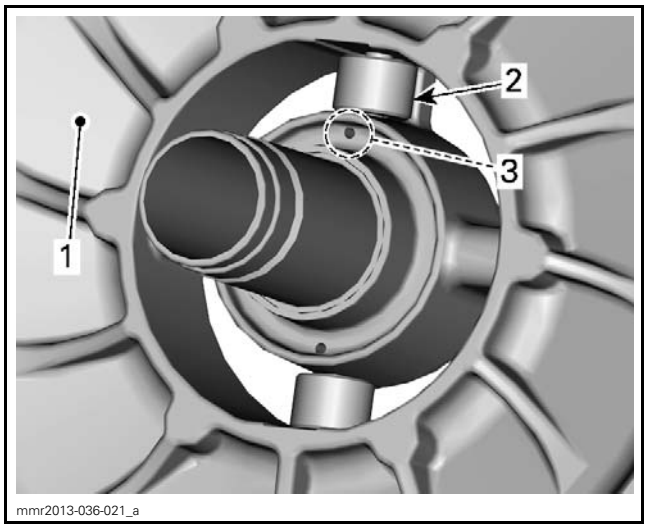
Removing the Fixed Sheave

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.

2.2 Once spring pin is accessible to pliers, pull pin out using pliers.



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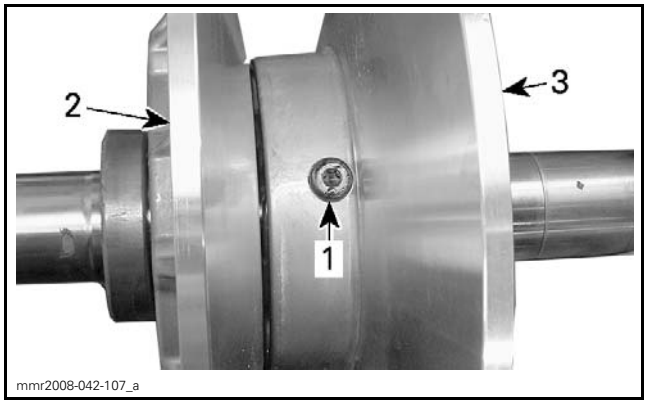
1. Fixed sheave outer face
2. Roller
3. Spring pin location

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.**



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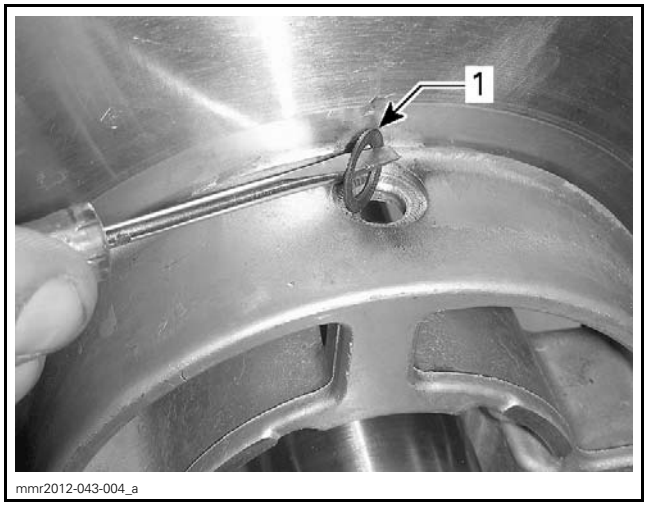
1. Pivot screw
2. Sliding sheave
3. Fixed sheave


mmr2012-043-003

PIVOT SCREW REMOVAL



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1. Ribbed lock washer

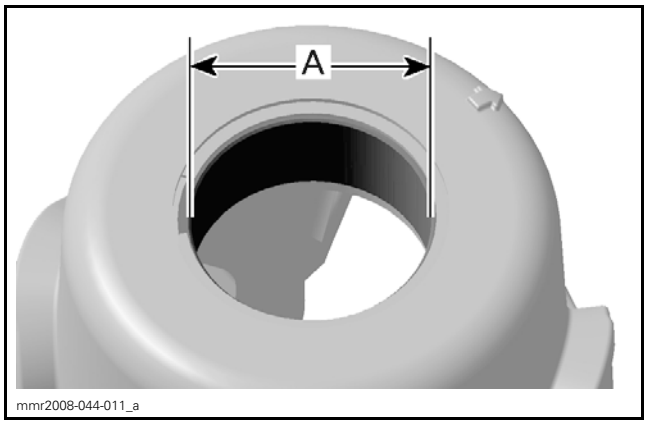
5. Remove roller.
6. Proceed with removal of other roller.

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.



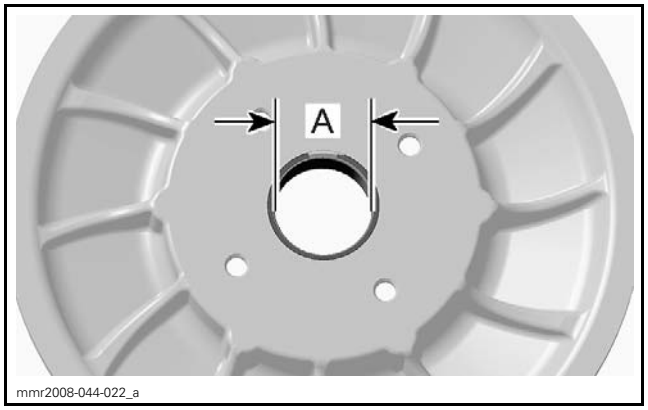
A. Inner diameter of cam bushing

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

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.

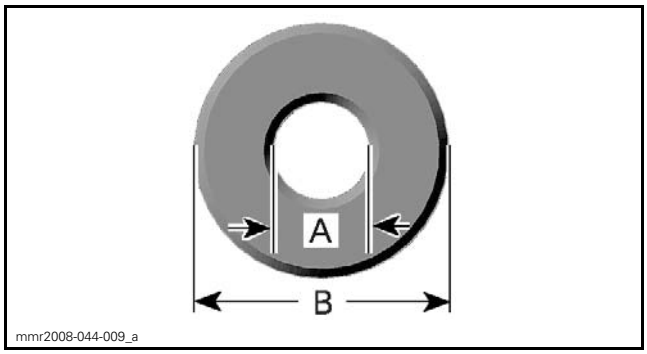
Inspecting the Fixed Sheave

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

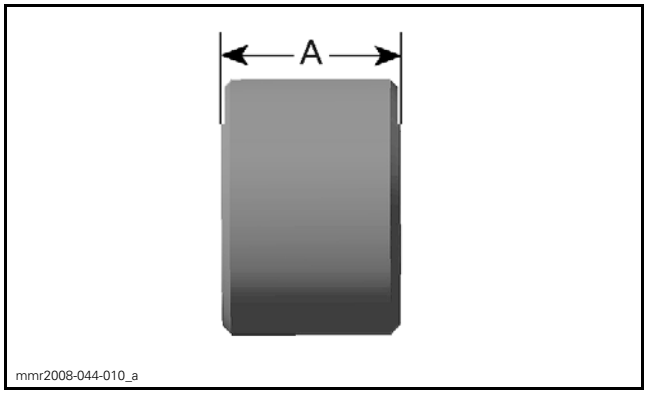
1. Check the rollers for flat spots, cracks or other visible damages. Replace if necessary (as a set).
2. Measure inner and outer diameter of rollers.



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

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.

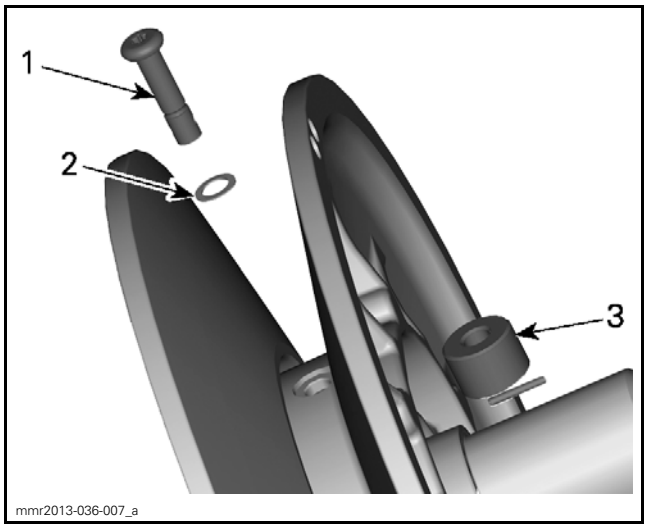
NOTE: Pivot screw and ribbed lock washer must be reused if in good condition. If damaged, replace fixed sheave assembly.

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 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

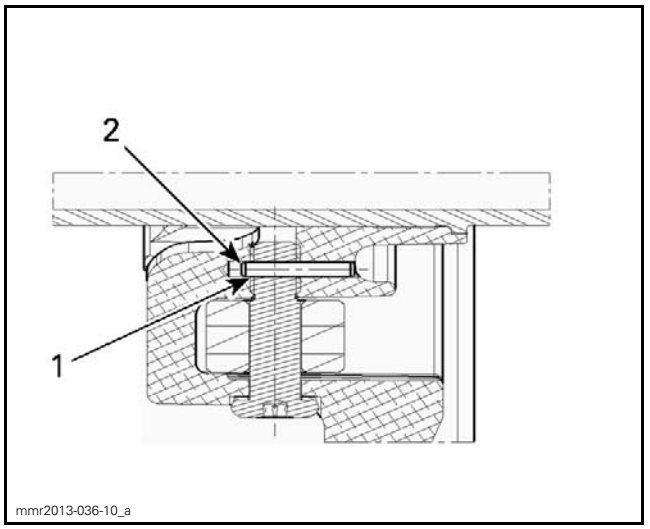
IMPORTANT: For proper fit, each pivot screw must be reinstalled where originally mounted in the fixed sheave.

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.**

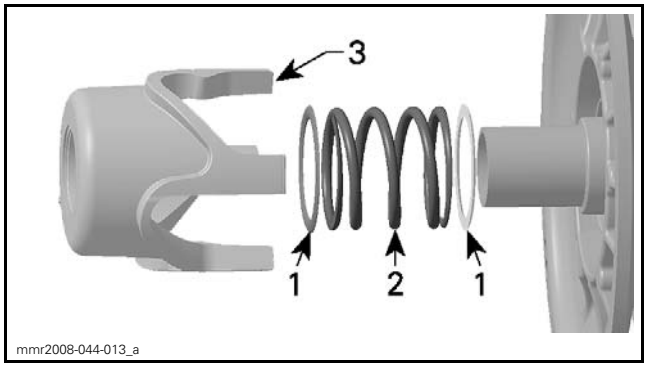


1. Hole in pivot screw
2. Spring pin

5. Install spring pin.

Installing Cam and Spring

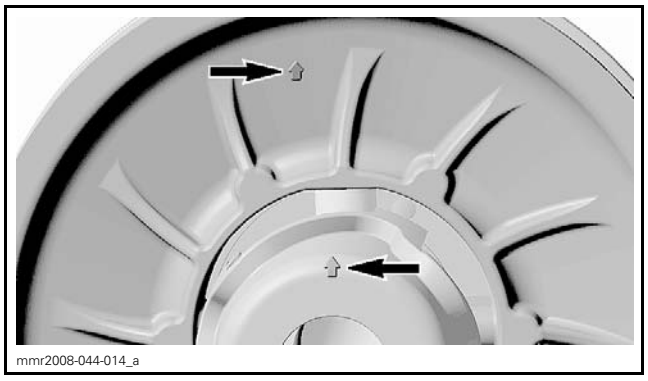
1. Install a spring stopper, the spring, the other spring stopper and the cam.



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. From the back of the sliding sheave, install 4 new cam screws.
5. Torque cam screws as specified.

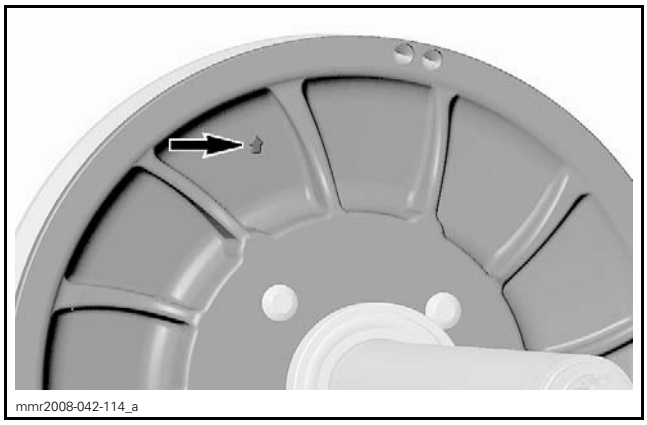
TIGHTENING TORQUE	
Cam screw	31.5 N•m ± 3.5 N•m (23 lbf•ft ± 3 lbf•ft)

6. Remove the tool.

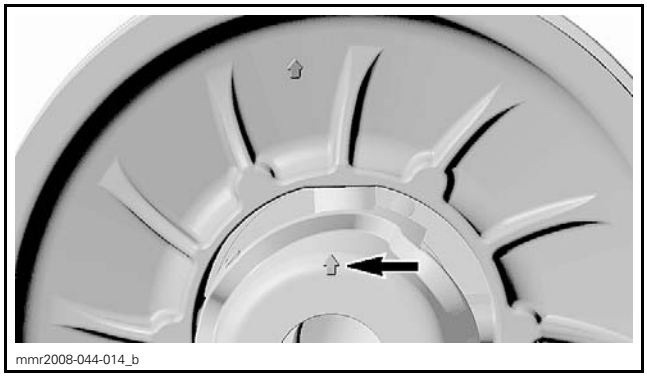
Installing the Sliding Sheave

The assembly of 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.



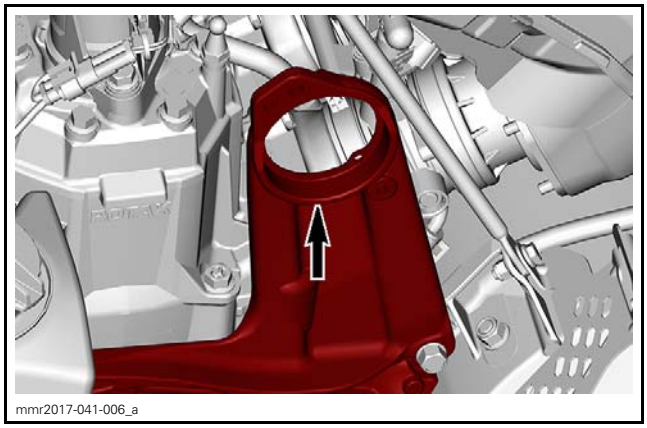
SLIDING SHEAVE ARROW



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 LOCTITE 767 (ANTISEIZE LUBRICANT) (P/N 293 800 070) on bearing shoulder.
3. Insert countershaft through countershaft bearing support.

4. Fasten the end of countershaft to upper gear retaining tool.
5. Align countershaft splines with upper gear splines.
6. Using the upper gear retaining tool as a puller, Engage countershaft splines in upper gear splines. Ensure countershaft bearing is installed properly in countershaft bearing support.
7. Remove the upper gear retaining tool.
8. Install the upper gear screw and the conical spring washer.

NOTE: The conical spring washer must be installed with its concave side towards upper gear.

9. Torque upper gear screw.
10. Install chaincase filler plug.
11. On LH side, install the bearing flange. Torque nut as specified.

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 for the procedures.

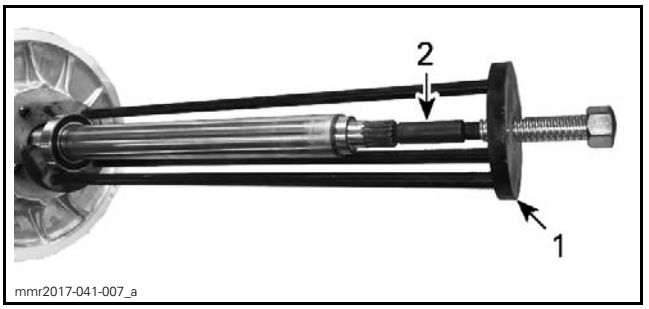
COUNTERSHAFT BEARING

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)	
COUNTERSHAFT ADAPTER (P/N 529 036 424)	



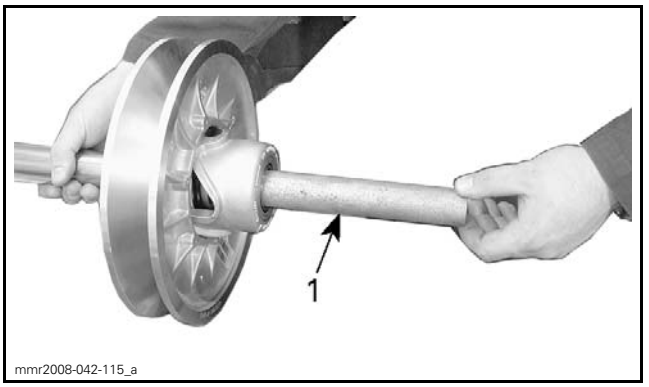
1. Countershaft adapter
2. Countershaft bearing remover

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)

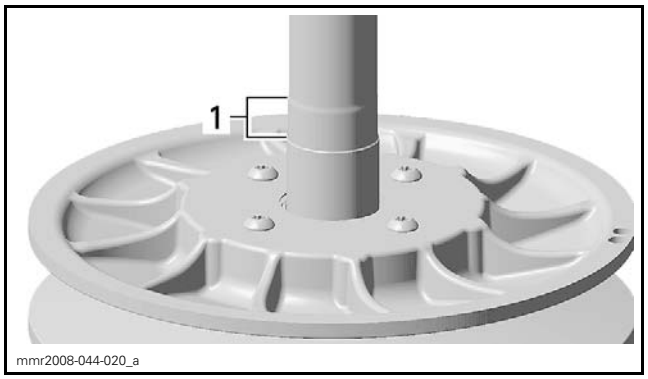


1. Countershaft support

NOTICE **The countershaft support is mandatory to avoid damaging the countershaft threaded end and the cam during bearing installation.**

3. Using PULLEY FLANGE CLEANER (P/N 413 711 809), clean residues on countershaft bearing surface.
4. Check countershaft bearing surface for wear.

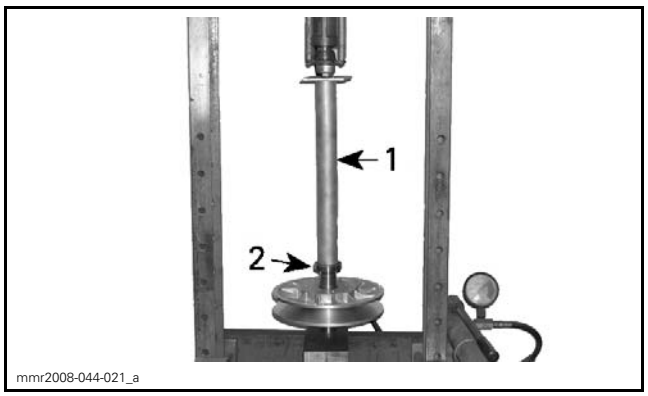
5. Apply LOCTITE 7649 (PRIMER) (P/N 293 800 041) on countershaft bearing surface and let dry 5 minutes.
6. Apply LOCTITE 609 (P/N 413 703 100) on primer.



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.

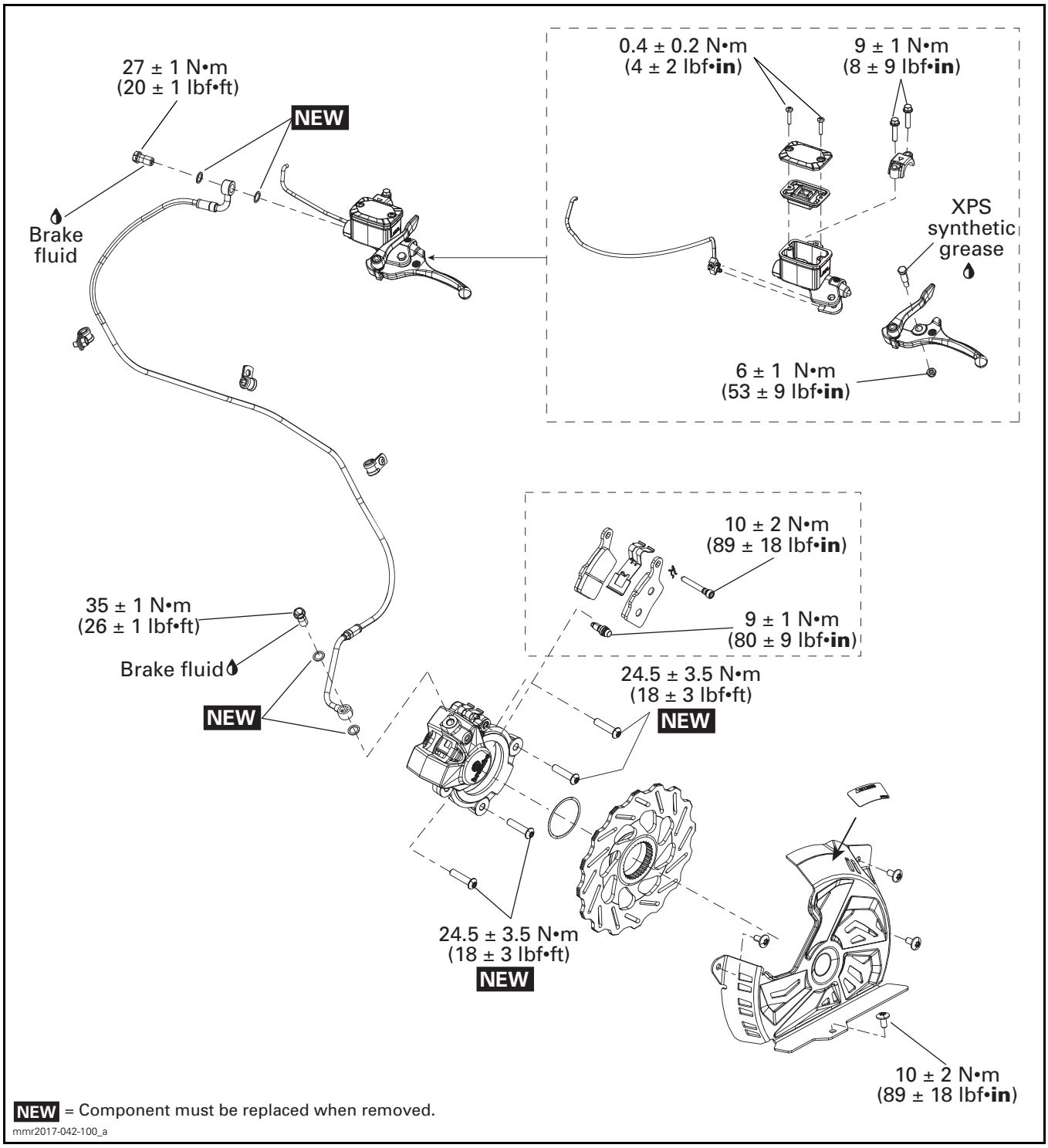
COUNTERSHAFT BEARING SUPPORT

For countershaft bearing support removal and installation, refer to *COUNTERSHAFT BEARING SUPPORT* in *FRAME*.

BRAKE

SERVICE TOOLS

SERVICE PRODUCTS


27 ± 1 N•m
(20 ± 1 lbf•ft)
NEW
Brake
fluid
0.4 ± 0.2 N•m
(4 ± 2 lbf•in)
9 ± 1 N•m
(8 ± 9 lbf•in)
XPS
synthetic
grease
6 ± 1 N•m
(53 ± 9 lbf•in)
10 ± 2 N•m
(89 ± 18 lbf•in)
9 ± 1 N•m
(80 ± 9 lbf•in)
35 ± 1 N•m
(26 ± 1 lbf•ft)
Brake fluid
NEW
24.5 ± 3.5 N•m
(18 ± 3 lbf•ft)
NEW
24.5 ± 3.5 N•m
(18 ± 3 lbf•ft)
NEW
10 ± 2 N•m
(89 ± 18 lbf•in)
NEW = Component must be replaced when removed.
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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.

PROCEDURES

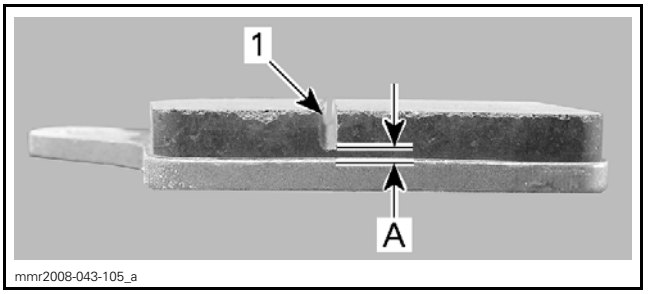
BRAKE PADS

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.



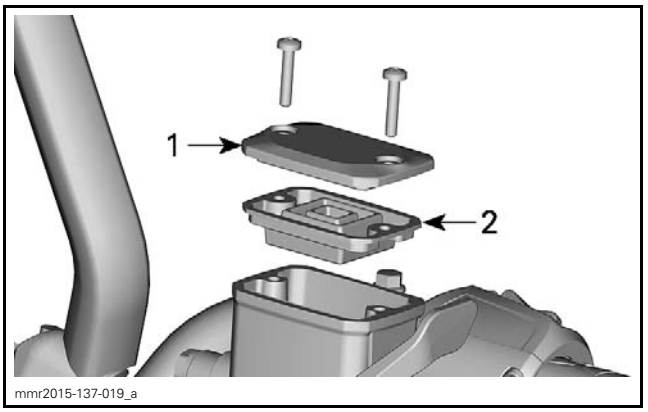
1. Groove on pad lining

2. Also inspect the brake disc, refer to *INSPECTING THE BRAKE DISC* in this subsection.

Replacing the Brake Pads

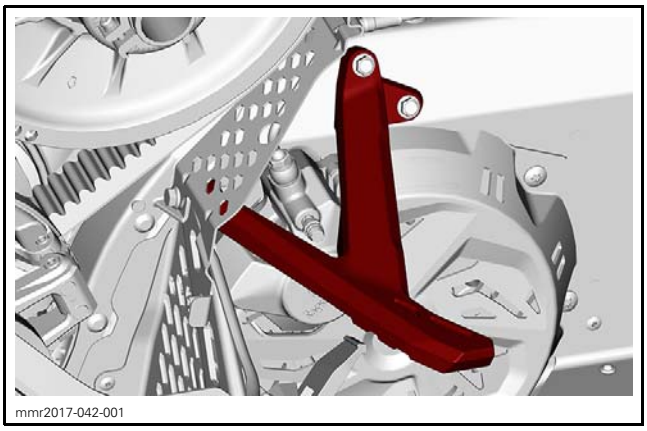
Removing the Brake Pads

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

4. Open the LH side panel.
5. Remove the LH toe hook.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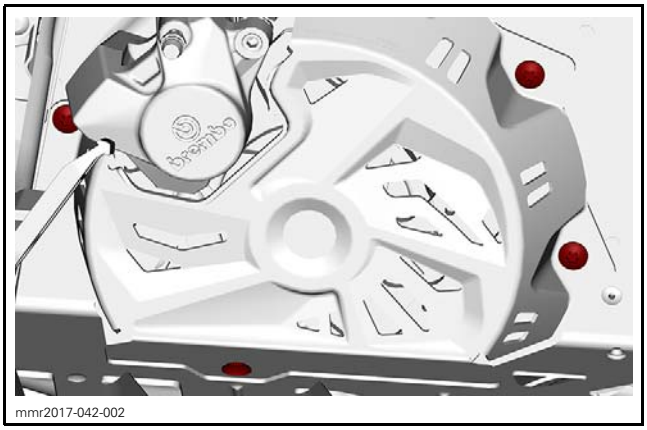
6. Remove the disc brake protective cover.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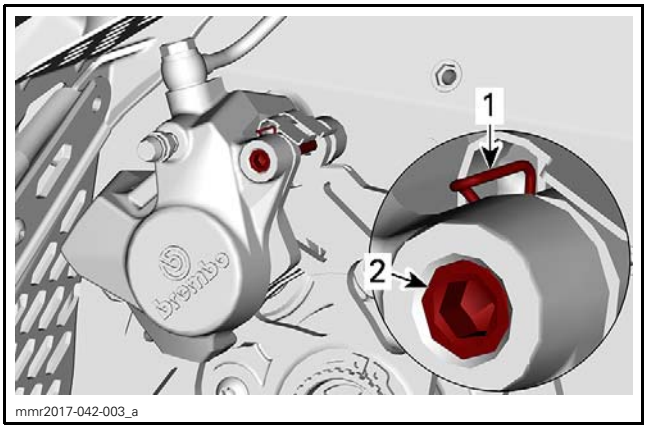
7. Remove the clip securing brake pad pin.
8. Unscrew and remove the brake pad pin.



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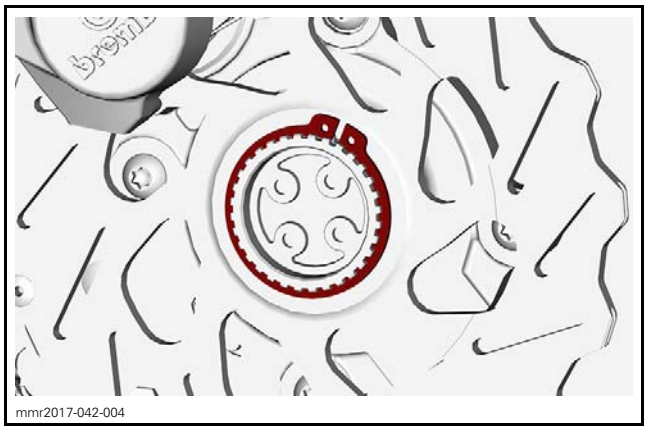
1. Clip
2. Brake pad pin

9. Using a flat screwdriver, depress caliper pistons into their bores.

NOTICE **Pay attention to avoid scratching brake disc.**

10. Remove the circlip securing brake disc to drive axle.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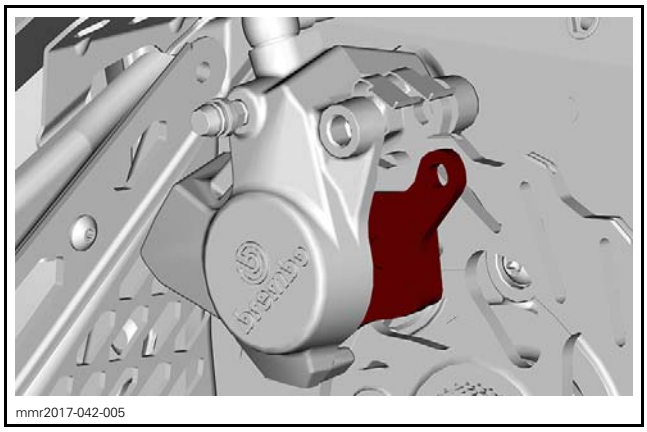
11. Remove brake pads.
    11.1 Remove the external pad first.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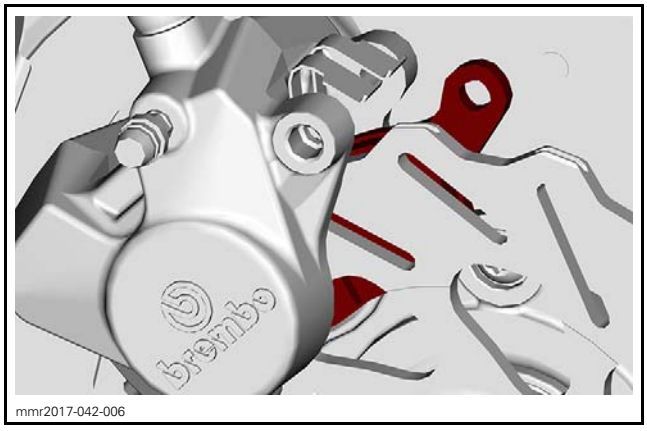
    11.2 Pull the brake disc outward and remove the internal pad.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Installing the Brake Pads

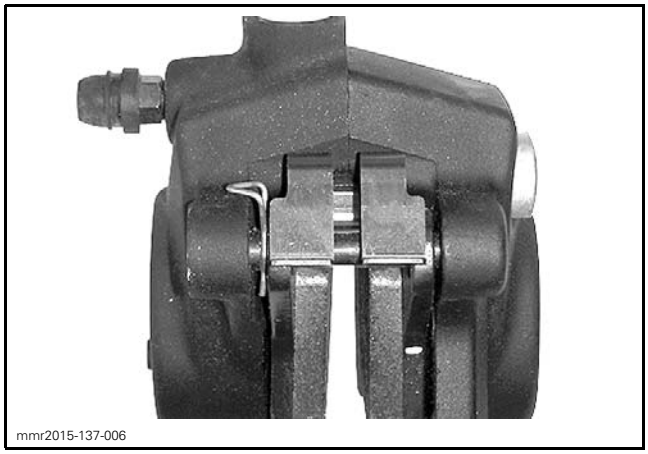
The installation is the reverse of the removal. However, pay attention to the following.

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.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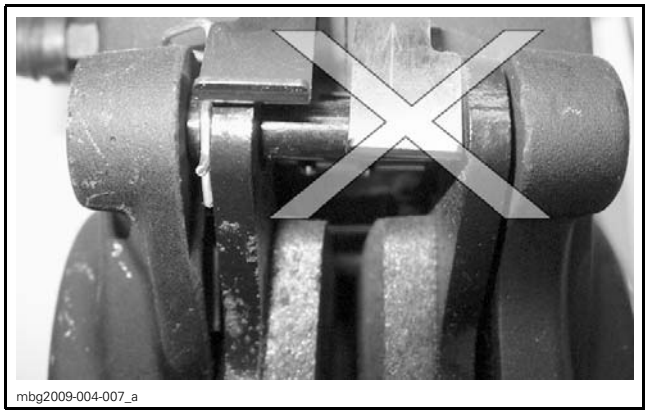
CORRECT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INCORRECT (RIGHT SIDE SPRING CLIP)

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.

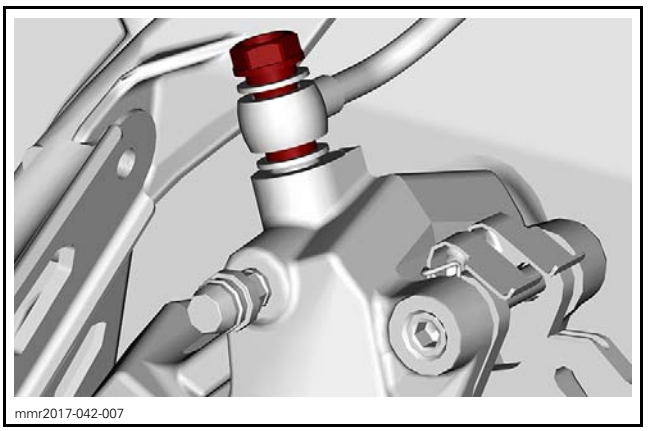
CALIPER

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. Drain the brake system, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
7. Remove the Banjo fitting and discard the sealing washers.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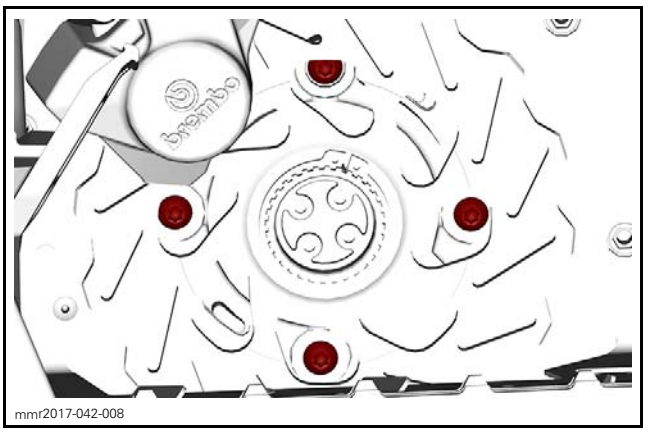
8. Remove the brake pads., Refer to procedure in this subsection.
9. Lift the rear of vehicle and release track tension completely.
10. Turn track to align brake disc slots with caliper bracket screws.
11. Remove caliper screws (4) behind brake disc.



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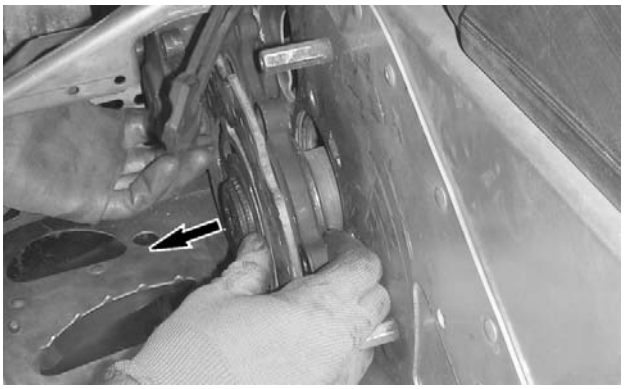
12. Pull the assembly (brake disc, caliper, bearing, and drive axle) from LH side in order to make room for the caliper puller.



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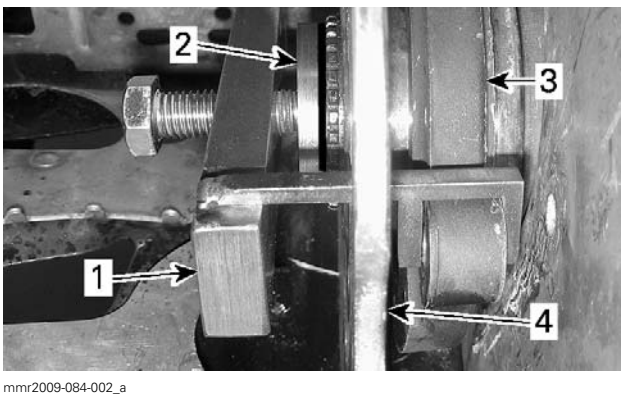
TYPICAL

REQUIRED TOOL	
CALIPER PULLER (P/N 529 036 145)	
PROTECTIVE CAP (P/N 529 036 150)	

13. Install the caliper puller on the brake caliper through brake disc slots.

NOTE: Make sure puller tabs are correctly engaged on caliper.

14. Install the protective cap between caliper puller bolt and plastic cap in drive axle end.



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TYPICAL
1. *Caliper puller*
2. *Protective cap*
3. *Caliper bracket*
4. *Brake disc*

15. 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.

16. When brake disc is out of splines, remove it.
17. Remove caliper.

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

Inspecting the Caliper

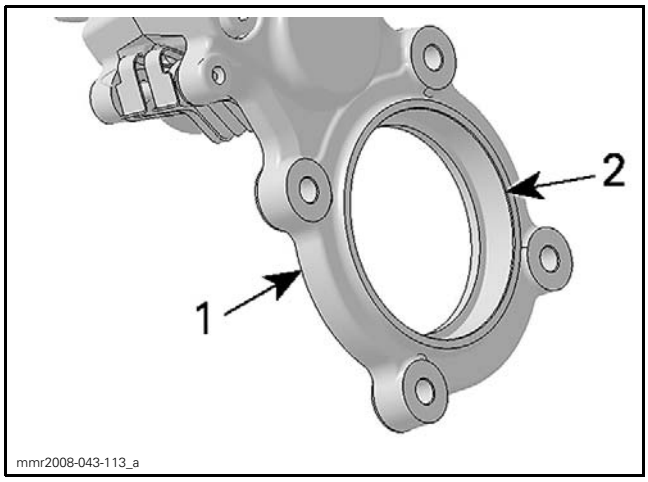
1. Check caliper pistons for:
   - Proper operation
   - Rust
   - Scratches
   - Leaks.
2. Check caliper bracket for:
   - Cracks
   - Rust on bearing shoulder (clean with a steel wood).
3. Replace caliper if required.

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 LOCTITE 767 (ANTISEIZE LUBRICANT) (P/N 293 800 070) on drive axle splines and on bearing shoulder of caliper bracket.

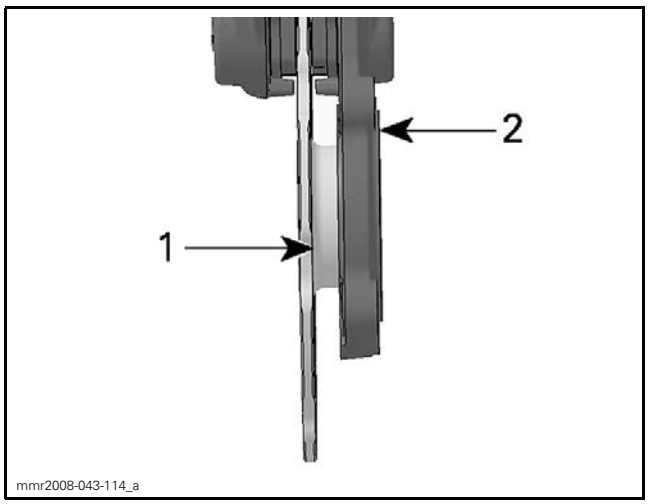
mmr2017-042-009

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.

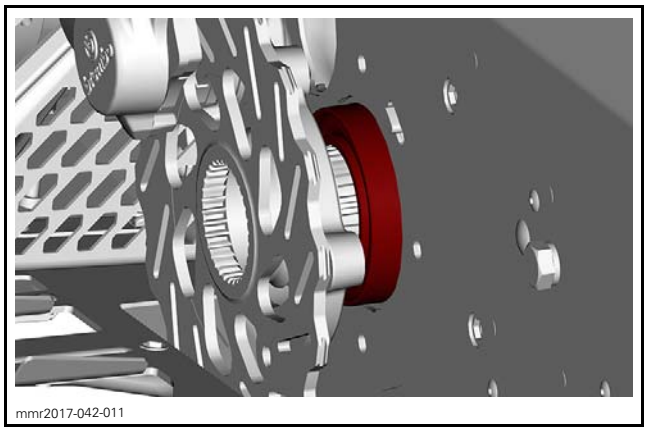


1. Brake disc collar
2. Caliper bracket

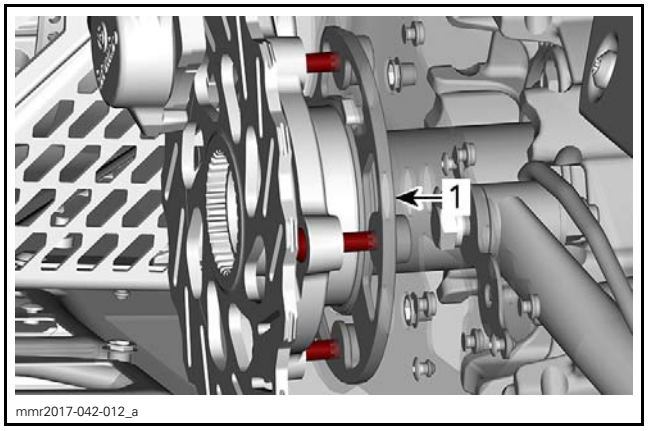
5. Ensure bearing flange is properly locked in the frame. Tabs must be properly inserted in frame slots.

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.



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.

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 *PERIODIC MAINTENANCE PROCEDURES* 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

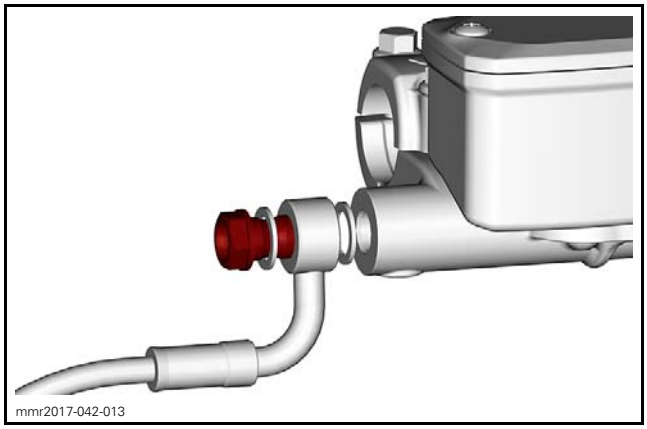
Follow procedures for caliper removal and installation.

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 *PERIODIC MAINTENANCE PROCEDURES* subsection.
2. Remove the Banjo fitting and discard the sealing washers.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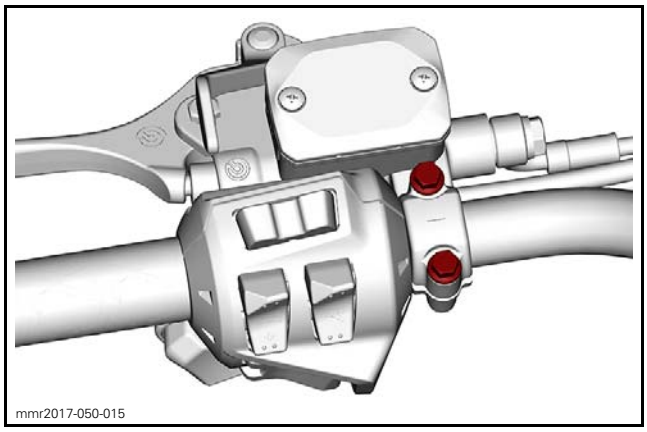
3. Remove screws and clamp securing master cylinder to handlebar.


mmr2017-050-015

4. Remove master cylinder.

NOTICE **Do not let master cylinder hang by the hose and do not stretch or twist the hose.**

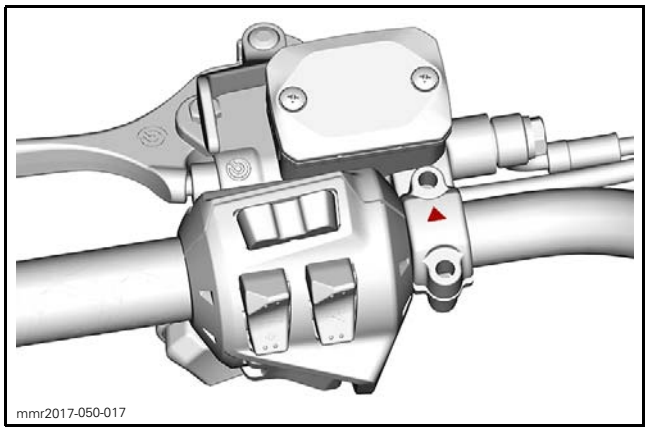
Inspecting the Master Cylinder

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 *PERIODIC MAINTENANCE PROCEDURES* subsection.
9. Install brake light switch.
10. Install steering cover.

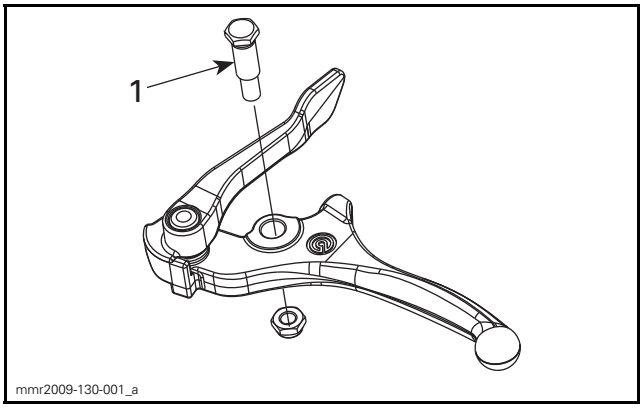
BRAKE LEVER

Lubricating the Brake Lever

After using brake cleaner in the brake lever area or after adding brake oil in reservoir, check brake lever pivot lubrication. Add XPS SYNTHETIC GREASE (P/N 293 550 010) on brake lever pivot as necessary.

Replacing the Brake Lever

Lubricate brake lever pivot using XPS SYNTHETIC GREASE (P/N 293 550 010).



TYPICAL
1. Lubricate brake lever pivot

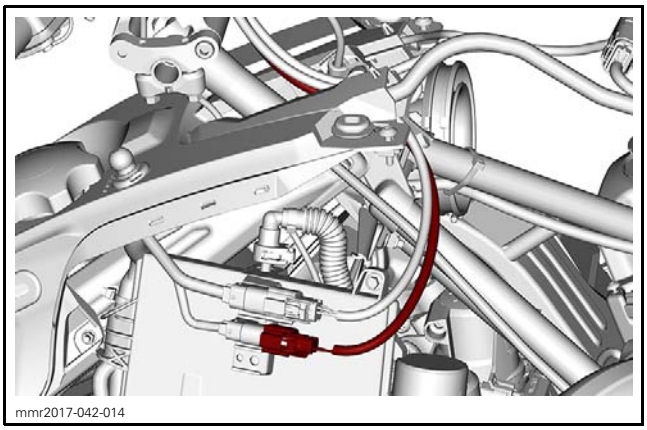
Tighten the pivot nut of brake lever to specification.

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.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3. Validate switch operation with an ohmmeter as follows.

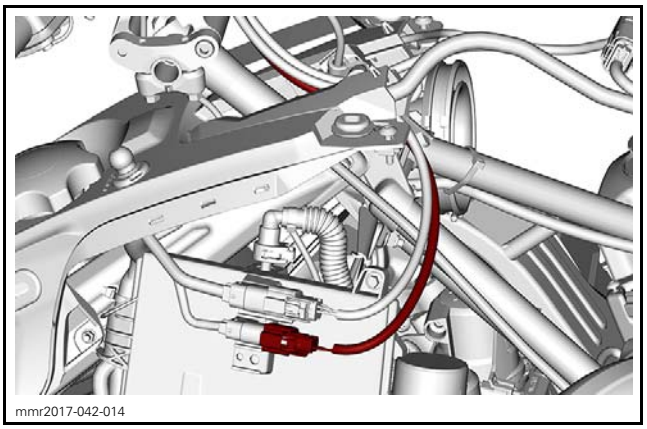
LH HANDLEBAR CONNECTOR (4-PIN)		
SWITCH	WIRE	RESISTANCE
Released	Pin 2 and pin 4	Infinite (OL)
Squeezed and held		Close to 0 Ω

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.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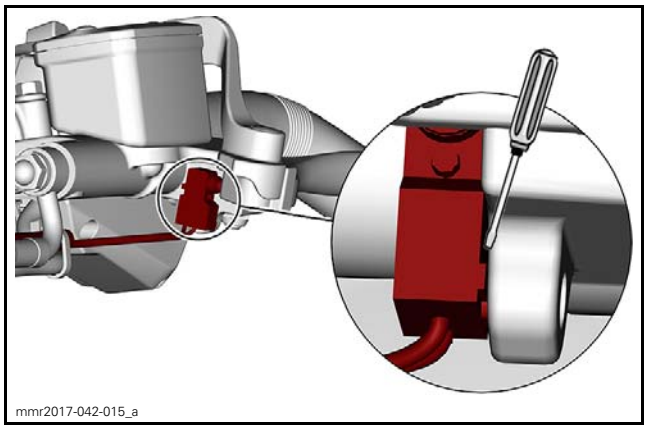
3. Slip a small screwdriver between brake light switch and master cylinder housing and separate them.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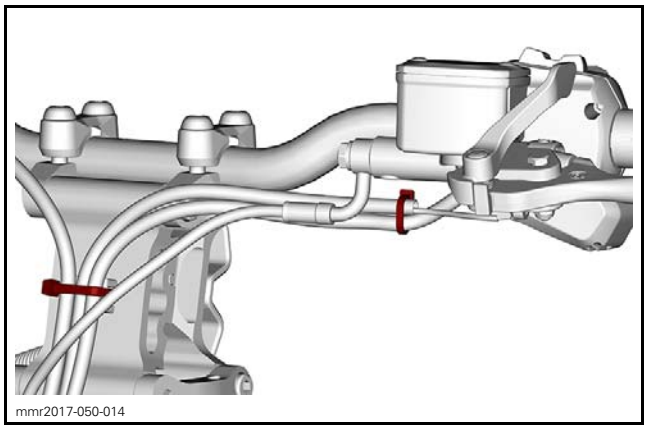
4. Cut all locking ties securing switch wires.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5. Remove switch wires from connector. Refer to *WIRING HARNESS AND CONNECTORS*.

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 *PERIODIC MAINTENANCE PROCEDURES* 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

SERVICE TOOLS

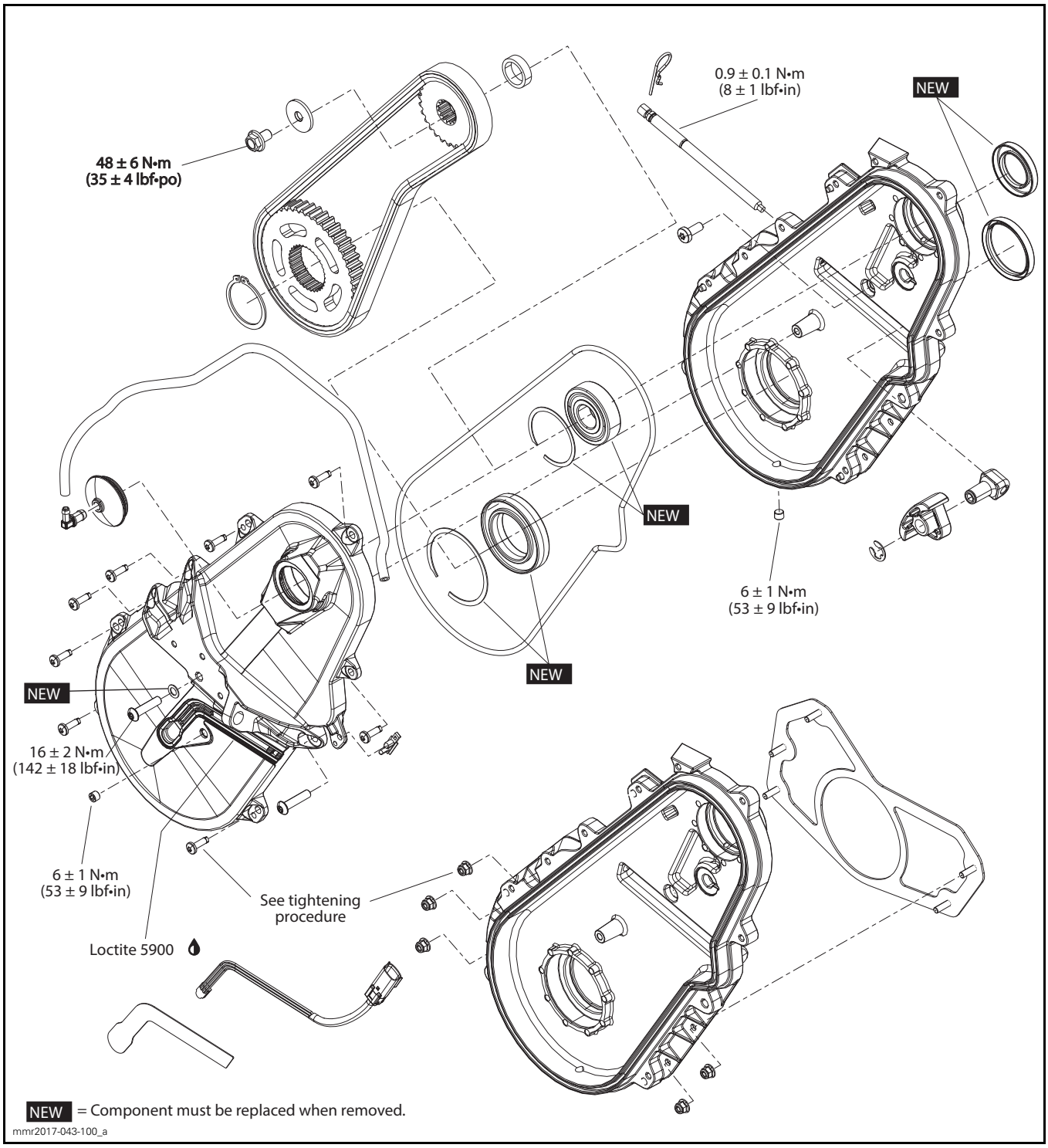
Description	Part Number	Page
BEARING PULLER/PUSHER	529 036 111	5
BEARING PULLER/PUSHER	529 036 112	5

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
SNAP-ON SEAL PULLER	YA105	6

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 5900	293 800 066	11


48 ± 6 N•m
(35 ± 4 lbf•po)
0.9 ± 0.1 N•m
(8 ± 1 lbf•in)
NEW
NEW
6 ± 1 N•m
(53 ± 9 lbf•in)
NEW
NEW
16 ± 2 N•m
(142 ± 18 lbf•in)
6 ± 1 N•m
(53 ± 9 lbf•in)
See tightening
procedure
Loctite 5900
NEW = Component must be replaced when removed.
mmr2017-043-100_a

GENERAL

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

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

⚠ WARNING

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

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

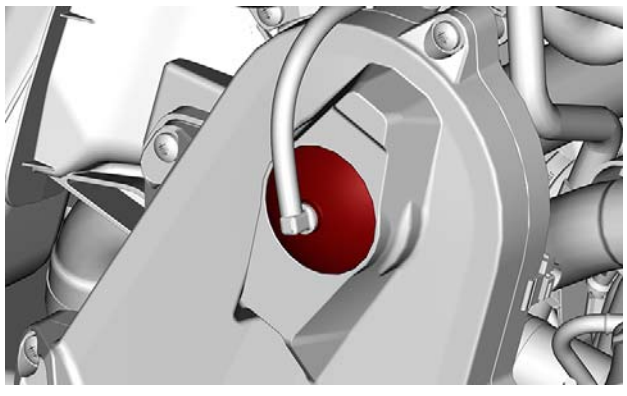
PROCEDURES

CHAINCASE

Chaincase Disassembly

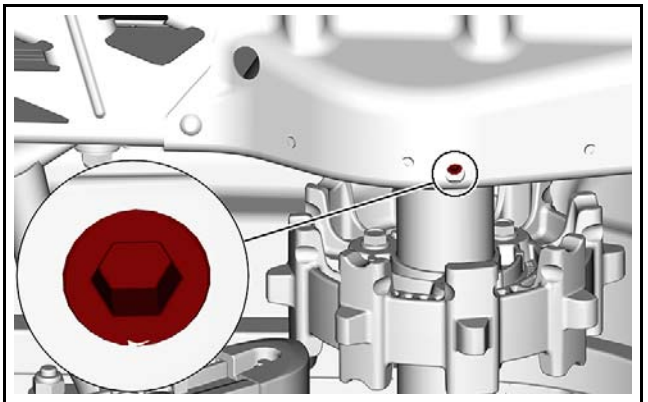
Removing the Chaincase Cover

1. Apply parking brake.
2. Remove the muffler. Refer to *EXHAUST SYSTEM* subsection.
3. Remove the filler plug on the chaincase cover.



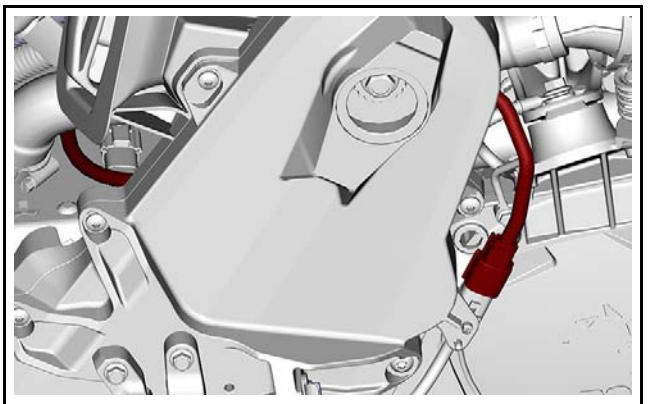
mmr2017-041-001

4. Place a container under vehicle in line with chaincase to catch chaincase oil.
5. Remove the drain plug on the bottom of the chaincase.



mmr2017-043-024_a

6. Disconnect speed sensor connector.



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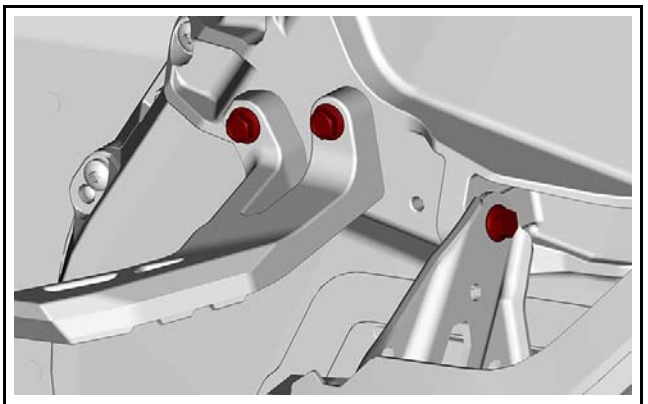
7. Remove the RH side toe hook and the screw securing the cover to the footrest.



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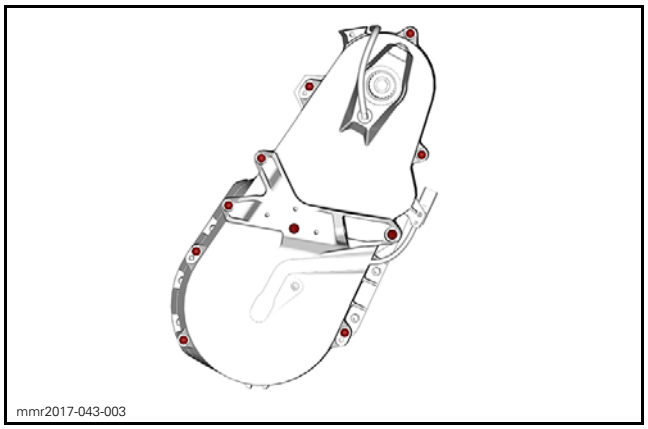
8. Remove chaincase cover screws.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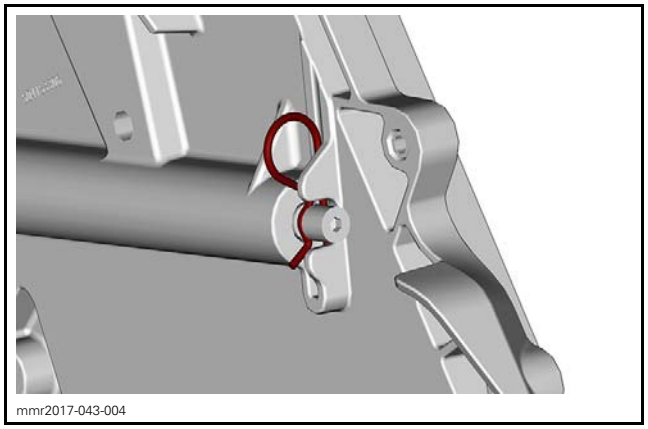
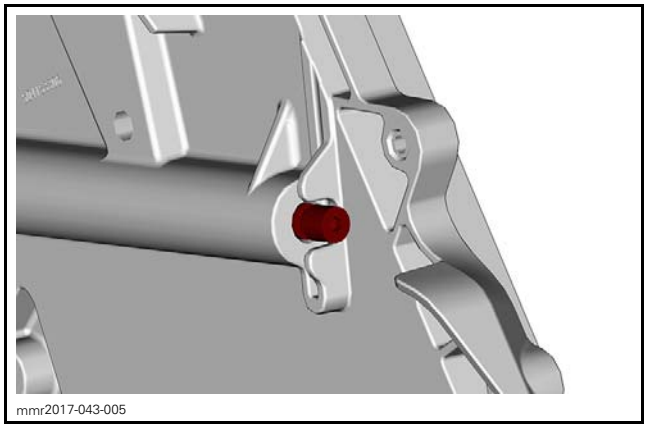
9. Pull on bottom of chaincase cover to drain oil.
10. Wait a moment then remove the cover completely.

Removing the Chain Tensioner

1. Remove the hair pin from behind the chaincase.


mmr2017-043-004

2. Remove the tensioner adjustment screw.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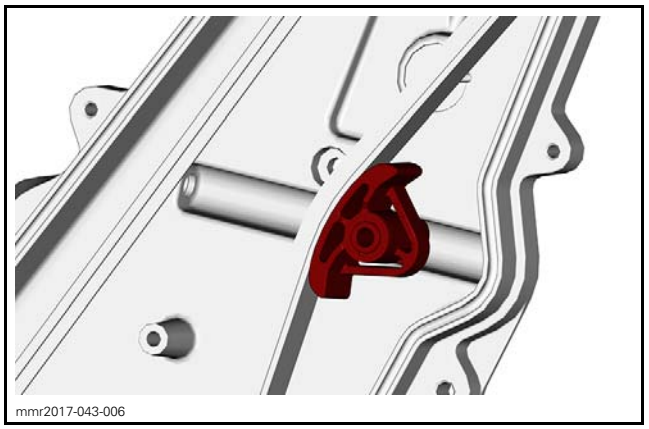
3. Remove tensioner.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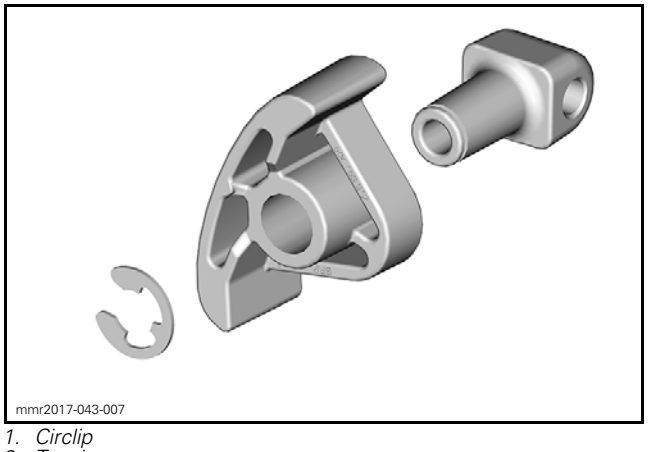
NOTE: The following steps are required only if the tensioner or the slider is defective.

4. Remove the circlip securing the slider to tensioner.

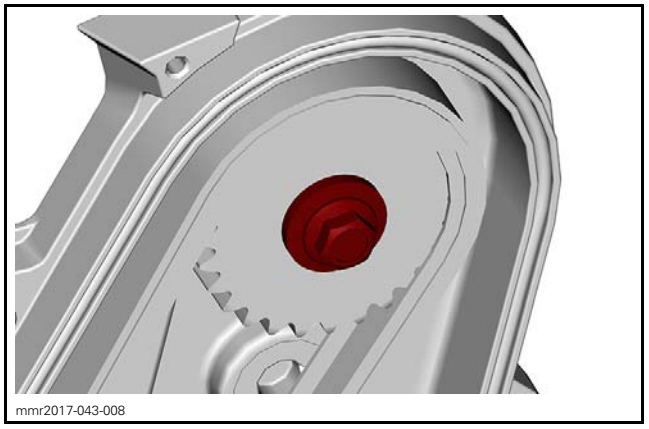

mmr2017-043-007

1. Circlip
2. Tensioner
3. Slider

Removing the Drive Chain and Sprocket

NOTE: Prior to removing the drive chain, check the drive chain deflection.

1. Remove the upper sprocket screw and its conical spring washer.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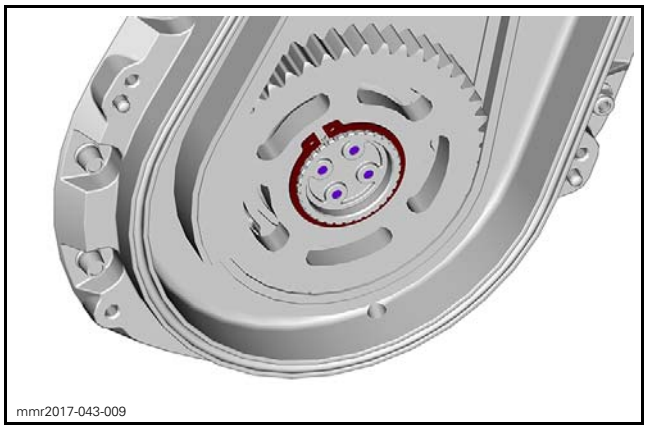
2. Remove the lower sprocket circlip.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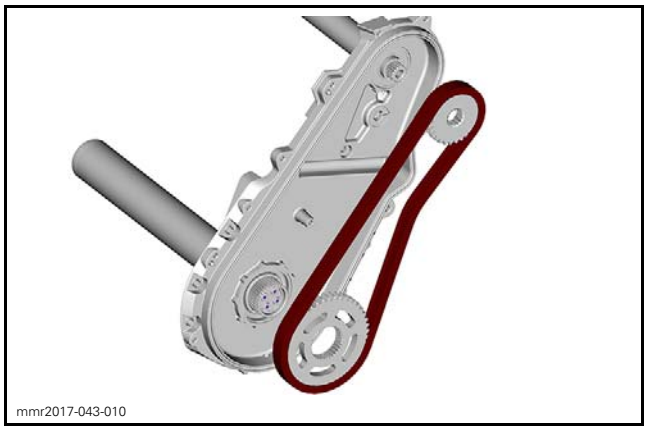
3. Remove the upper sprocket, lower sprocket and drive chain simultaneously.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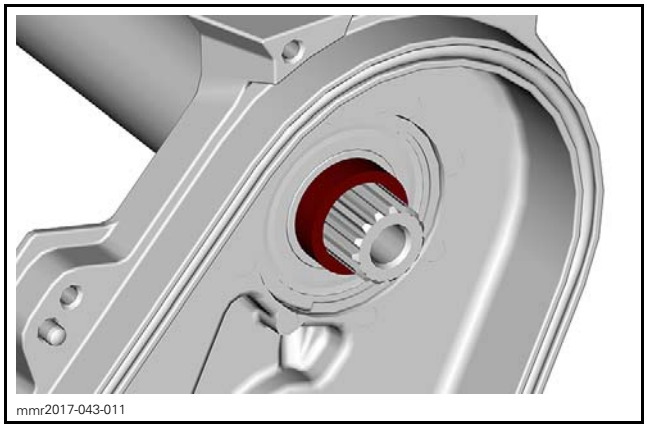
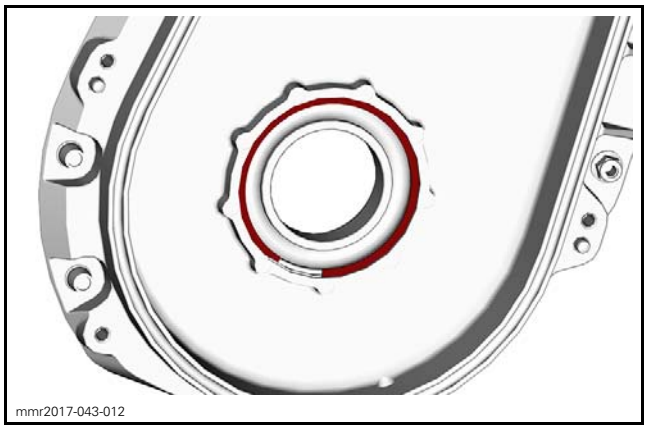
4. Remove the countershaft spacer.


mmr2017-043-011

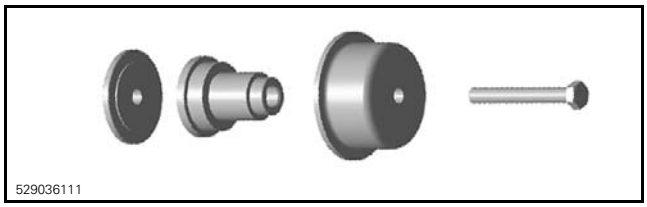
Removing the Chaincase Bearing

1. Remove countershaft or drive axle, depending which bearing is replaced. Refer to the appropriate subsection, *DRIVEN PULLEY AND COUNTERSHAFT* or *DRIVE AXLE*.
2. Remove snap ring securing bearing into chaincase.

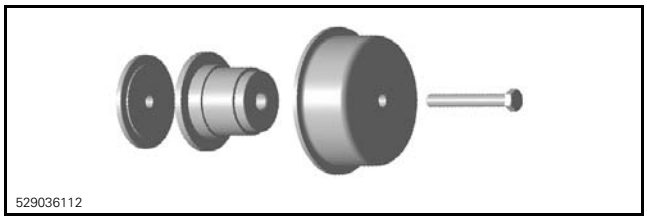

mmr2017-043-012

3. Install the appropriate bearing extractor:

BEARING	REQUIRED TOOL
Countershaft	BEARING PULLER/PUSHER (P/N 529 036 111)
Drive axle	BEARING PULLER/PUSHER (P/N 529 036 112)

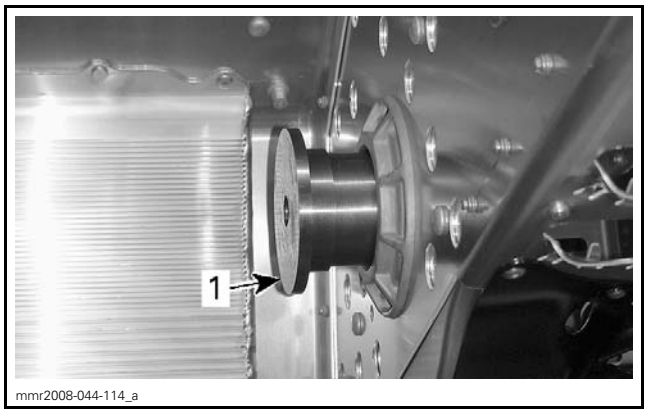

529036111

COUNTERSHAFT


529036112

DRIVE AXLE

4. Install the extractor/installer tool behind the bearing.



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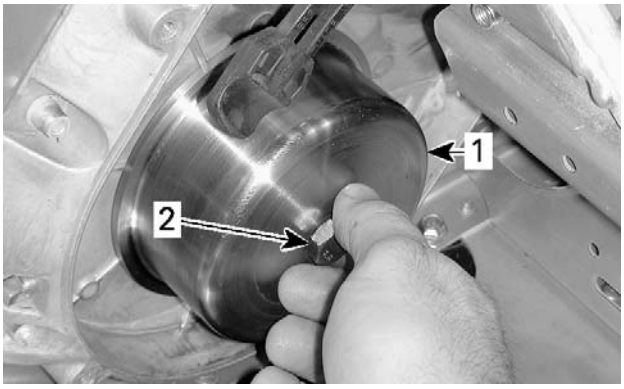
TYPICAL
1. Extractor/installer tool

5. Install the extractor cup over bearing.

6. Tighten the extractor/installer tool screw to remove the bearing.



mmr2008-044-115_a

TYPICAL
1. *Extractor cup*
2. *Tighten to remove bearing*

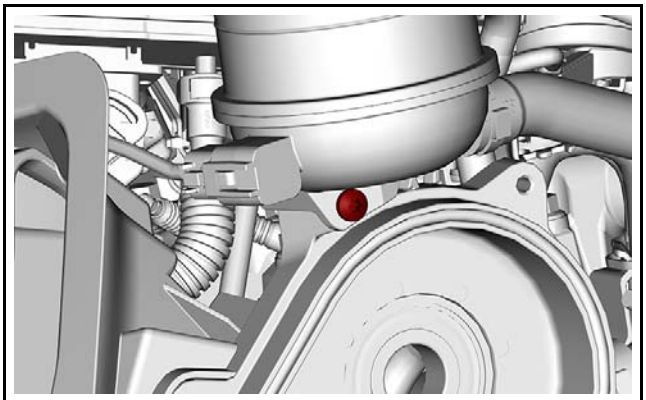
7. Using a seal puller such as the SNAP-ON SEAL PULLER (P/N YA105), remove and discard the oil seal.


mmr2008-044-116

TYPICAL

Removing the Chaincase Housing

1. Remove the drive axle. Refer to *DRIVE AXLE* subsection.
2. Remove the countershaft. Refer to *DRIVEN PULLEY AND COUNTERSHAFT* subsection.
3. Remove the screw securing the coolant reservoir.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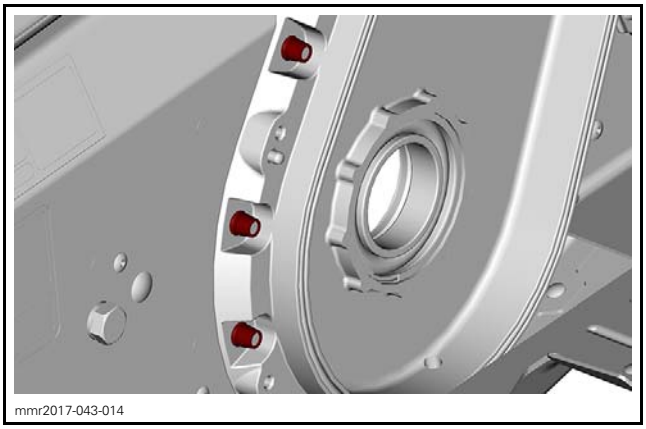
4. Remove the Huck rivets. Refer to *FRAME* subsection for proper removal procedure.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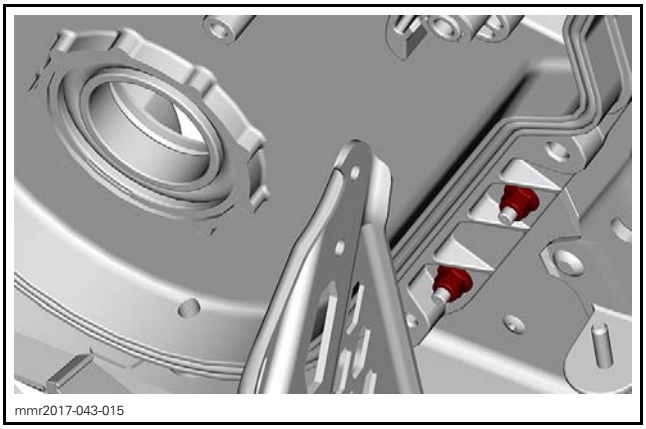
5. Remove nuts beside the footrest.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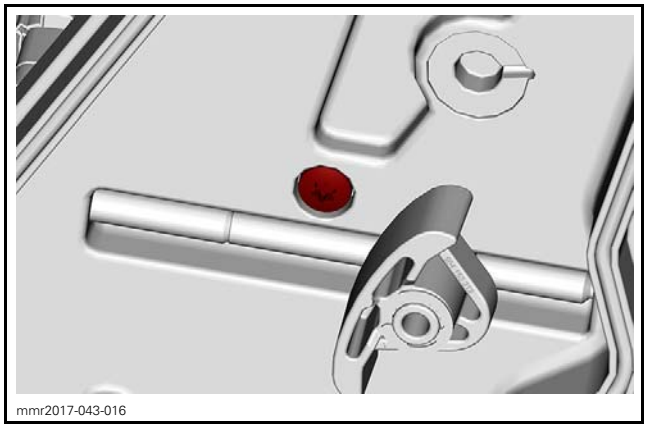
6. Remove the screw above the tensioner.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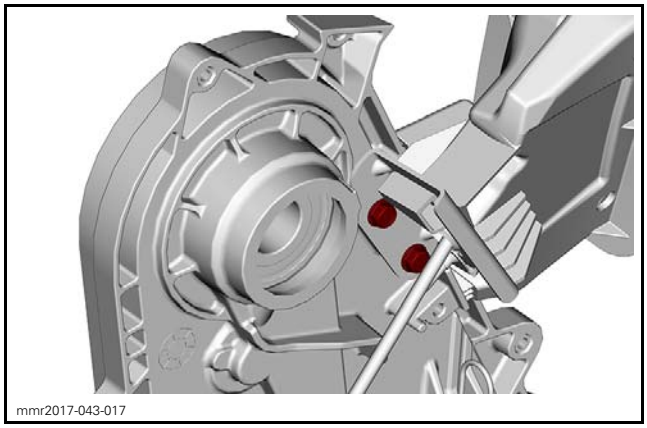
7. Using 2 large pry bars inserted between chaincase and frame, pry chaincase out of vehicle.
8. Remove the rewind starter rope guide screws.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Inspecting the Chaincase

Inspecting the Chaincase Cover

Check the cover for cracks or other damages. Replace it if necessary.

Check if O-ring inside cover is brittle, hard or damaged. Replace it if necessary.

Inspecting the Chain Tensioner

Check chain tensioner slider for wear or other damages. Replace if necessary.

Check threads of tensioner adjustment screw for damages or wear.

Replace screw if necessary and check chaincase for damages.

Inspecting the Drive Chain and Sprockets

Visually inspect the drive chain and sprockets for:
- Wear
- Cracks
- Damages teeth
- Missing links.

If a problem is detected, replace drive chain and sprockets 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.

Inspecting the Chaincase Bearing

Check for worn or defective bearings.

Chaincase Assembly

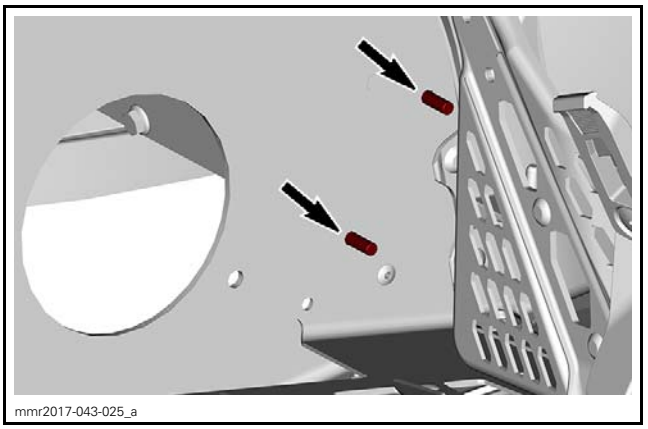
Installing the Chaincase Housing

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

Have the following parts in hands:

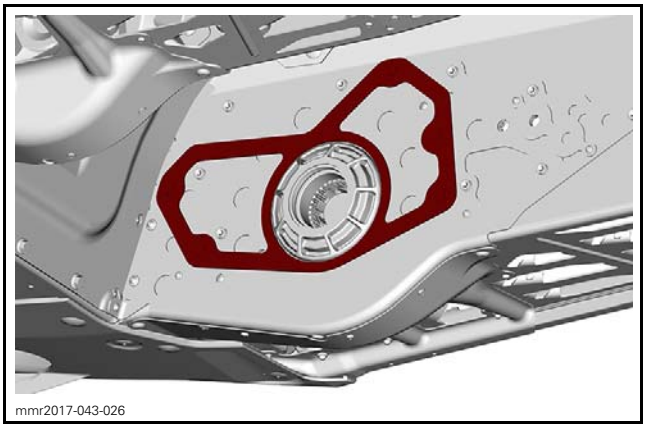
PARTS TO INSTALL CHAINCASE		
QTY	FASTENERS	PART NUMBER
1	Mounting plate kit	861805514
5	M6 elastic flanged nut	233261434

Remove the clinch studs from the frame.


mmr2017-043-025_a

Use a suitable box to support the frame around the stud head and hit the stud from the outside with a hammer.

Install the mounting plate underneath the frame.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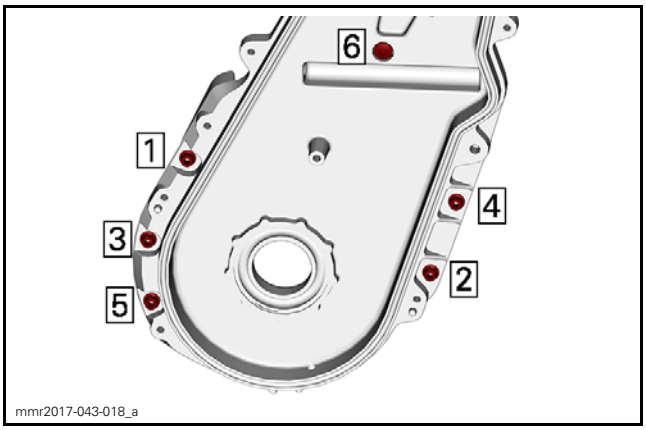
UNDERNEATH FRAME

Install 5 elastic flanged nuts to secure chaincase on mounting plate.

Tighten fasteners as per the following sequence.



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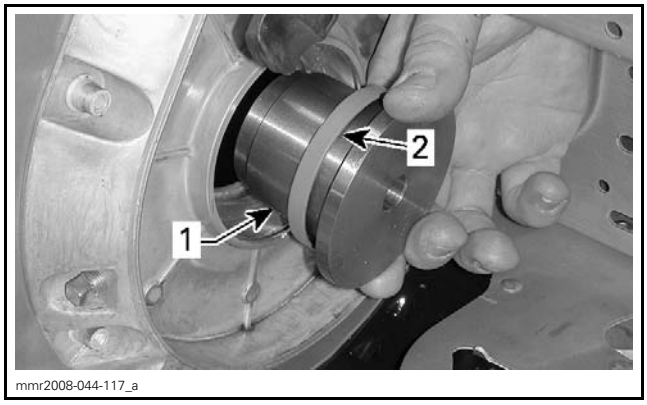
Proceed with drive chain adjustment. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

Refill chaincase with recommended oil. Refer to *REPLACING THE CHAINCASE OIL* in *PERIODIC MAINTENANCE PROCEDURES* subsection.

Installing Chaincase Bearing

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

Install the new oil seal on the extractor/installer tool. Position the lips toward bearing.



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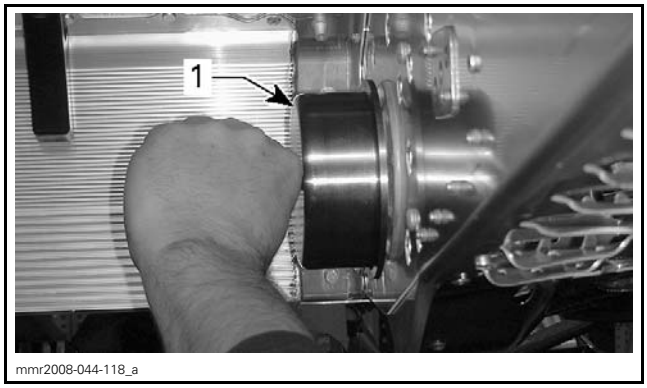
TYPICAL
1. *Extractor/installer tool*
2. *Oil seal lips on this side*

Install the extractor cup inside frame.



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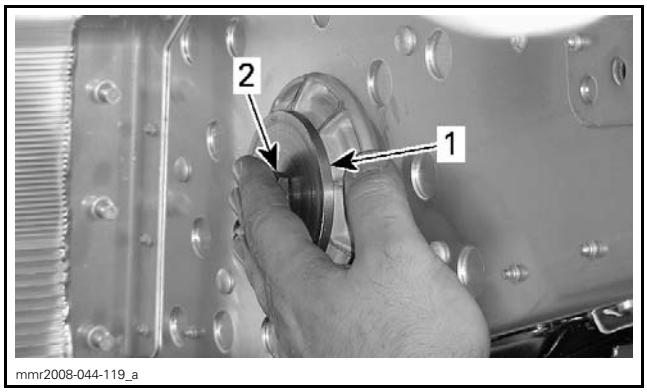
TYPICAL
1. *Extractor cup*

Tighten the extractor/installer tool screw to install the oil seal.

Install the large washer and the extractor/installer tool screw inside frame.



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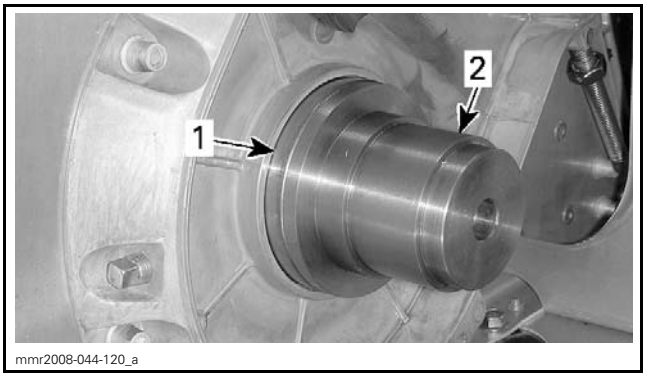
TYPICAL
1. *Large washer*
2. *Extractor/installer tool screw*

In chaincase, install new bearing and the extractor/installer tool.



TYPICAL
1. Bearing
2. Extractor/installer tool

Tighten the extractor/installer tool screw to install the bearing.

Install new snap ring.

Installing the Drive Chain and Sprockets

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

Make sure to install sprockets with their inscriptions outward.

Install the conical spring washer on the upper sprocket with its concave side toward sprocket.

Installing the Chain Tensioner

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

If the tensioner has been disassembled, make sure circlip turns freely and slider moves easily.

Proceed with drive chain adjustment. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

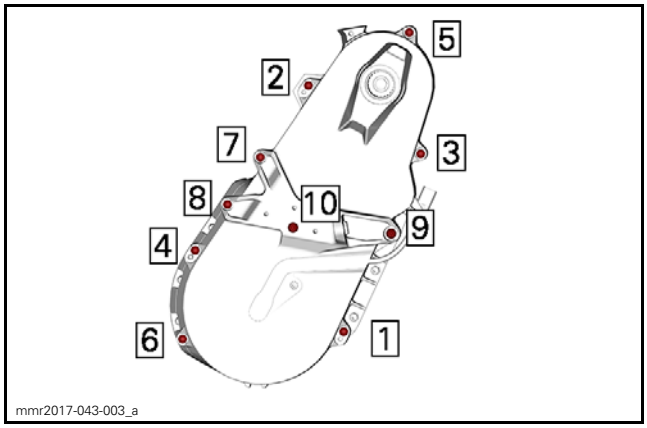
Installing the Chaincase Cover

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

Ensure cover seal is positioned correctly in its groove.

Install new sealing washer with screw no.10. See next illustration.

Tighten chaincase cover screws in accordance with the following sequence.



TIGHTENING TORQUE		
Screws 1 to 8	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**)

Refill chaincase with recommended oil. Refer to *CHAINCASE OIL REPLACEMENT* in *PERIODIC MAINTENANCE PROCEDURES* subsection.

Reinstall all other removed parts.

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.

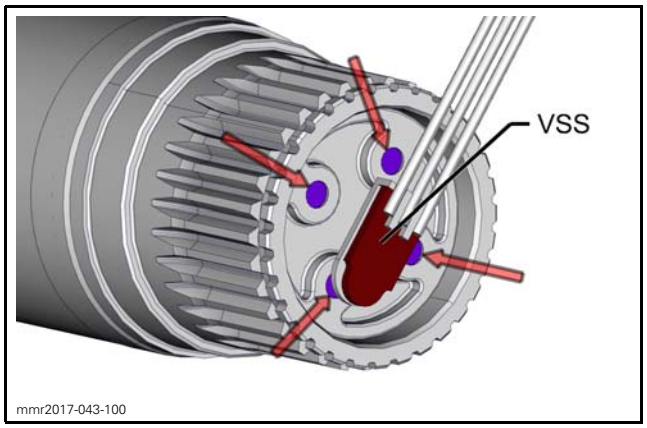
4. Lift and support rear of vehicle.

5. Back-probe VSS connector as per table and test for proper specification.
6. Rotate track/driven pulley.

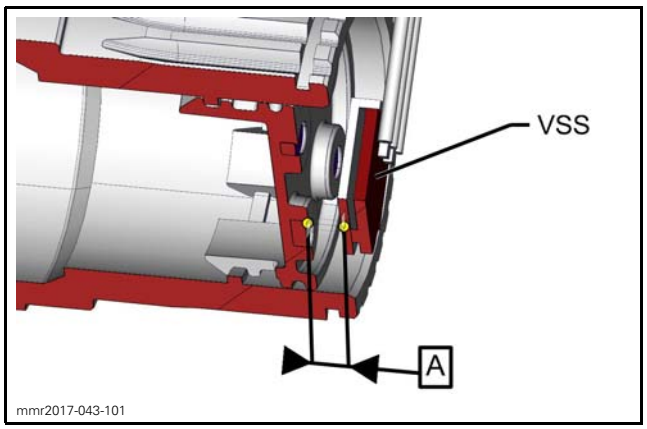
SPEED SENSOR SIGNAL TEST			
ROTATE DRIVEN PULLEY	SPEED SENSOR CONNECTOR (SENSOR SIDE)		VOLTAGE
	Pin 1	Pin 2	Alternate 7 Vdc and 0 Vdc

If reference voltage and ground are available at sensor, but no signal, replace sensor.

NOTE: During chaincase disassembly, ensure magnets are intact on shaft.



Air gap between magnets and sensor must be as specified.



A. VSS Air gap

AIR GAP SPECIFICATION	
no. A Measure between magnet and sensor	3 mm (.118 in)

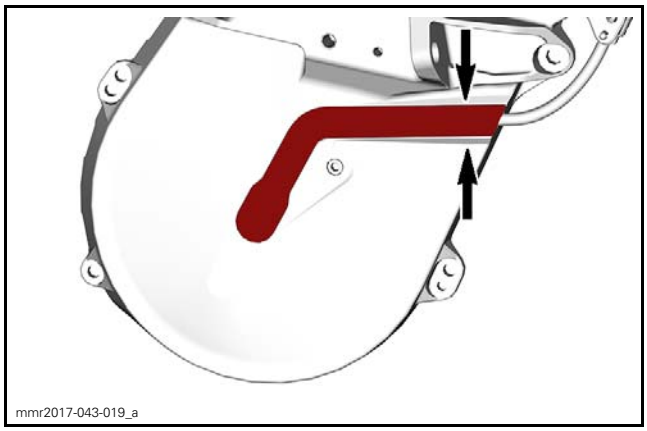
Replacing the Speed Sensor

The sensor can be replaced with the chaincase cover as an assembly. In such a case, refer to *CHAINCASE* subsection.

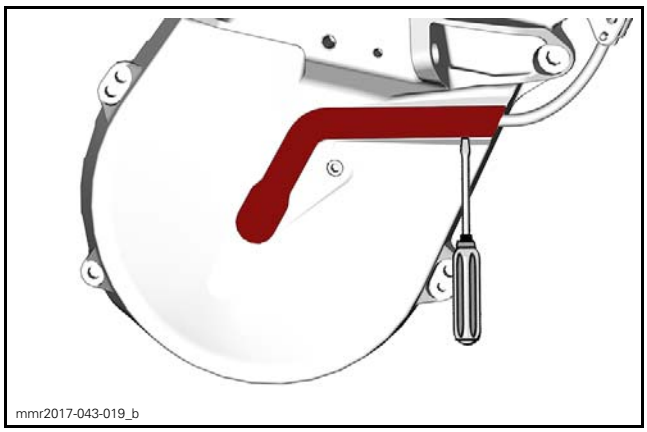
To replace sensor only, proceed as follows.

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.

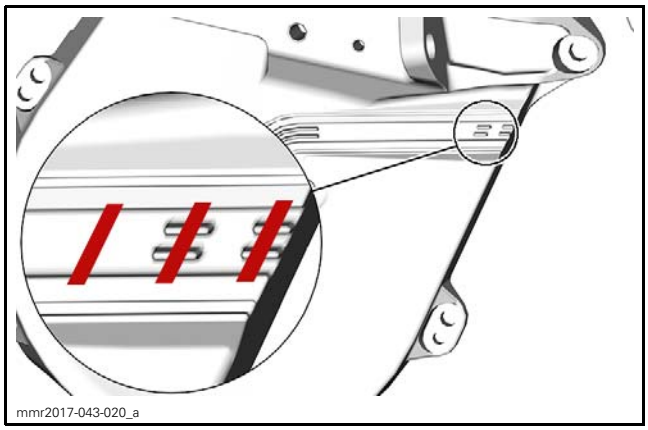
Installing the Speed Sensor

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.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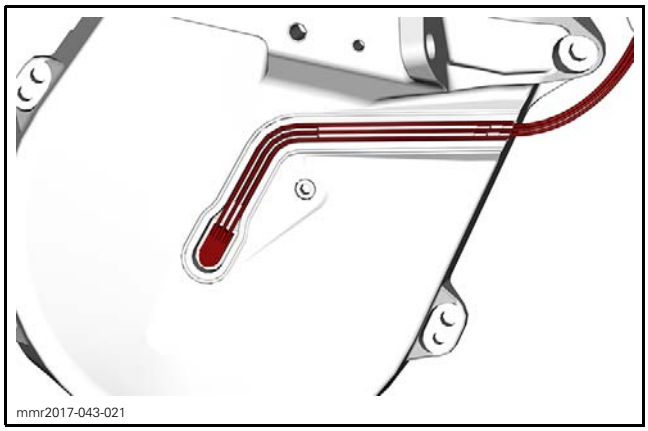
2. Install the speed sensor in the chaincase cover.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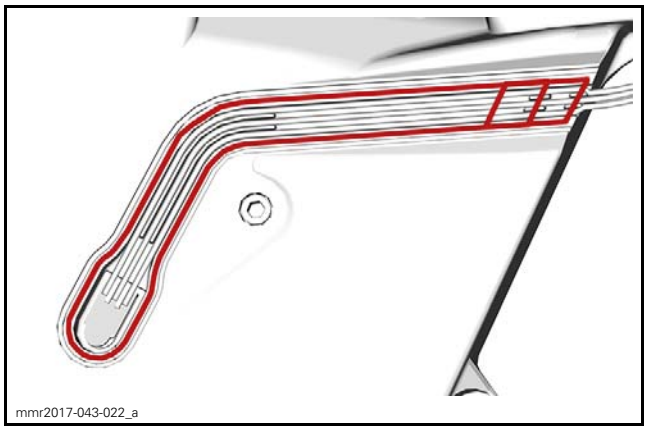
3. Apply sealant all around the protective plate bed on the chaincase cover.

Follow the pattern shown on the next picture.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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.

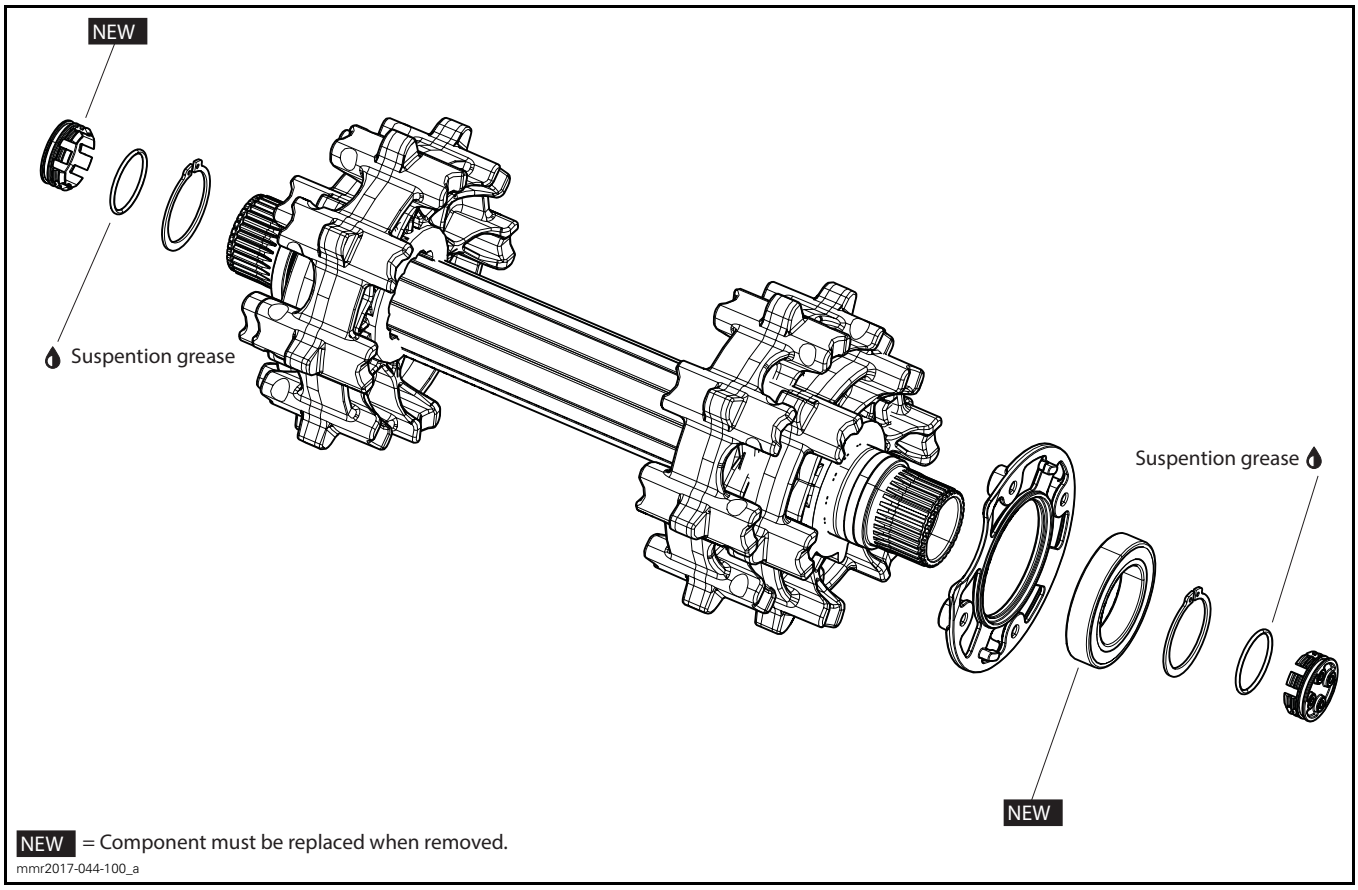
NOTE: Wait for at least 1 hour before exposing vehicle to cold temperature.

8. Reinstall chaincase cover. Refer to procedure in this subsection.

DRIVE AXLE

SERVICE PRODUCTS

Description	Part Number	Page
SUSPENSION GREASE	293 550 033	3



NEW = Component must be replaced when removed.

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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

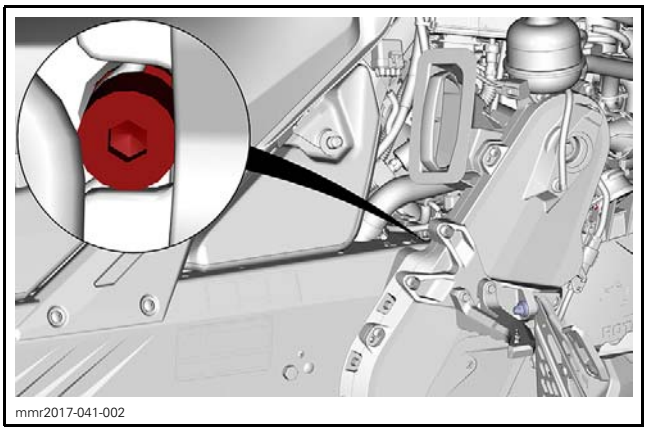
Torque wrench tightening specifications must be strictly adhered to.
Locking devices must be replaced with new ones when removed (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.).

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.



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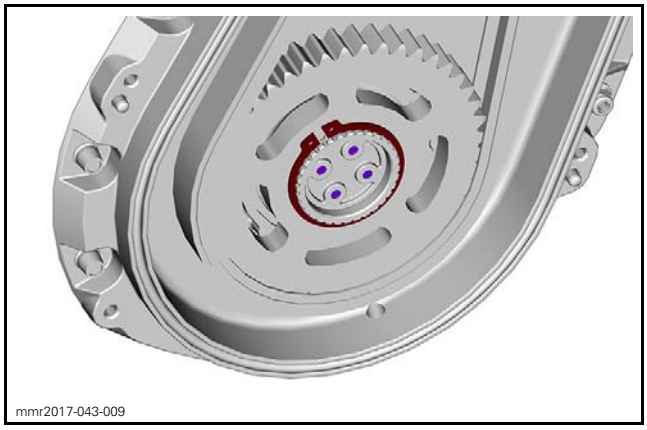
4. Remove the lower sprocket circlip.



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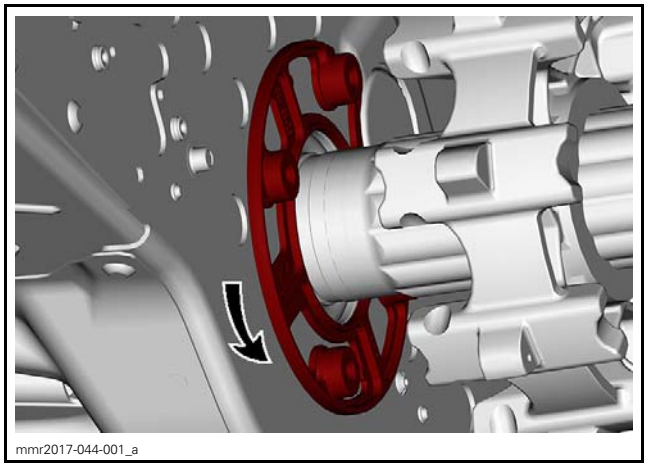
5. Remove lower gear and drive chain.
6. Remove the caliper. Refer to *BRAKE* subsection.
7. From underneath of vehicle, turn the LH bearing flange counterclockwise to unlock it from frame.



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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.

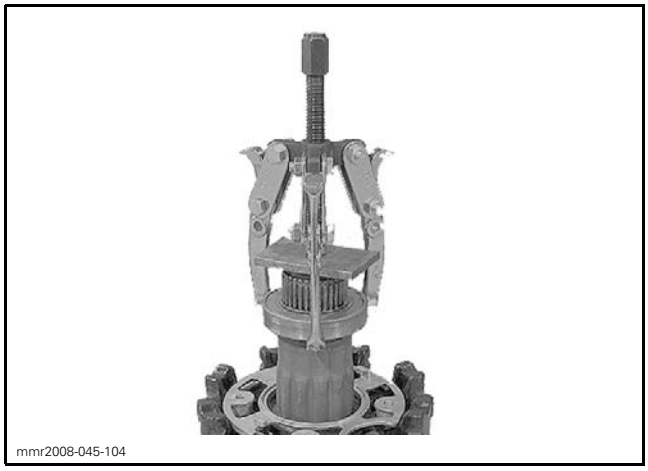
Replace drive axle if one of the following situations is detected:

– 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 pullerto remove the drive axle bearing.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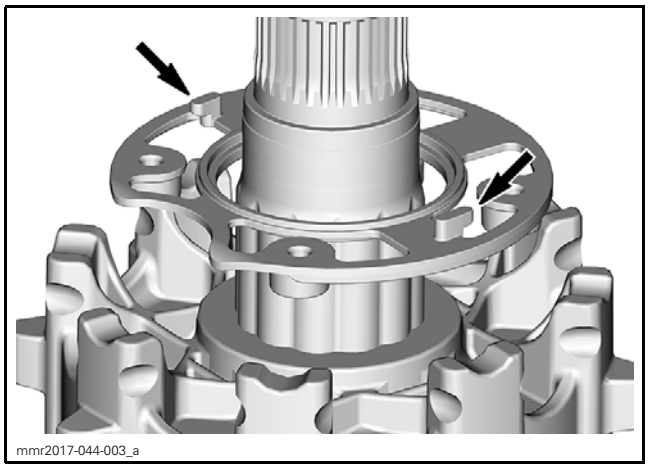
2. Remove the bearing flange.

Installing the Drive Axle Bearing

1. Install bearing flange on drive axle with locking tabs outwards.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2. Using a press and a suitable pipe, push the bearing onto drive axel.

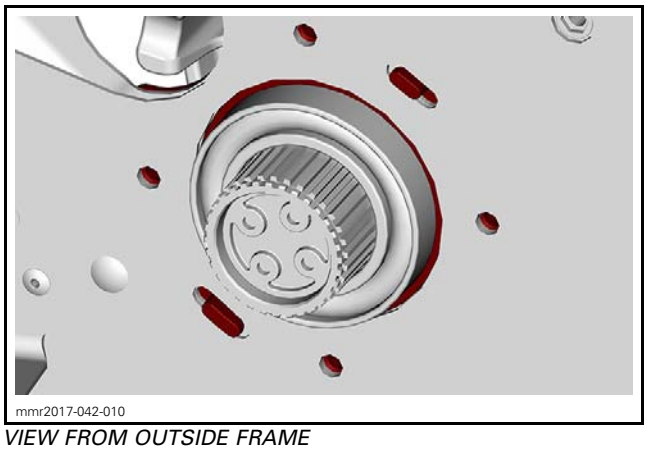
NOTICE **Always push the bearing by inner race.**

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.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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

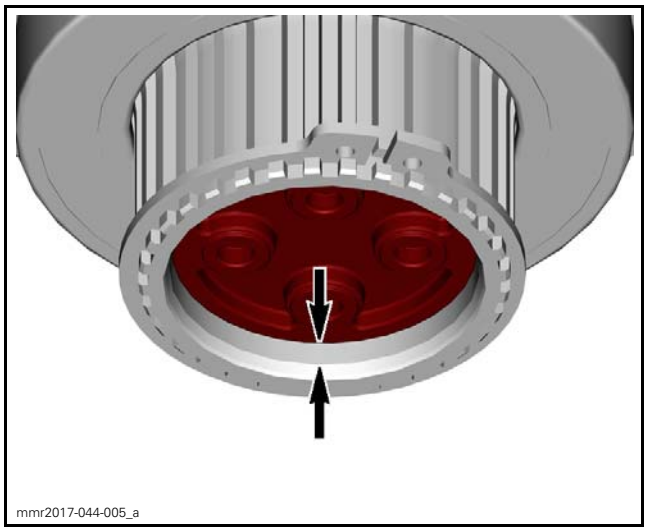
Removing the Magnetic Cap

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 SUSPENSION GREASE (P/N 293 550 033) on O-ring.
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.



5 MM (.197IN) INWARDS

3. Install all other removed parts.

TRACK

SERVICE TOOLS

PROCEDURES

TRACK

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.

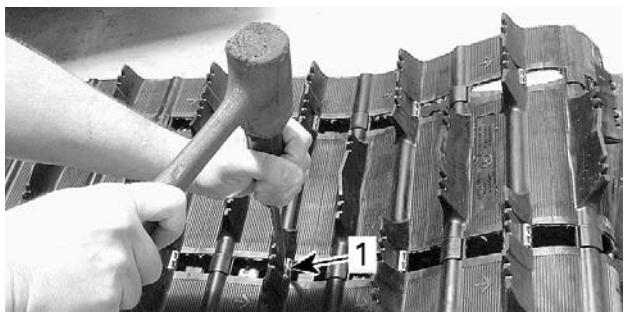
Replacing a Track Cleat

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.



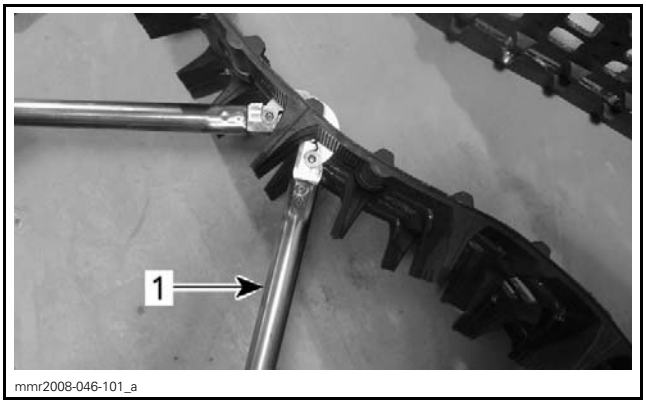
TYPICAL
1. Cleat

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-cleat installer

Reopen narrow-cleat 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*.

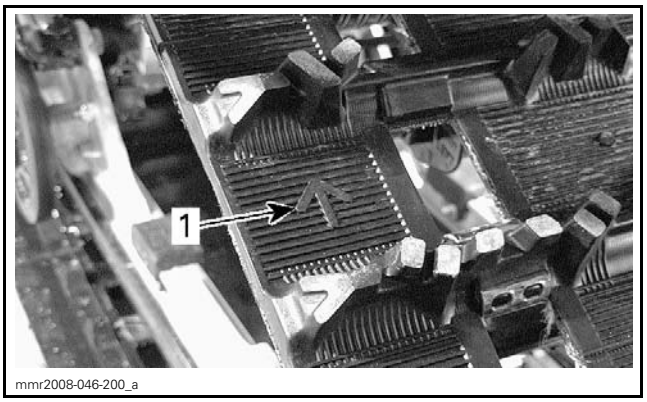
Remove drive axle. Refer to *DRIVE AXLE* subsection.

Remove track.

Installing the Track

Reverse the removal procedure.

NOTE: When installing the track, respect rotation direction indicated by an arrow on track thread.



1. Arrow pointing forwards

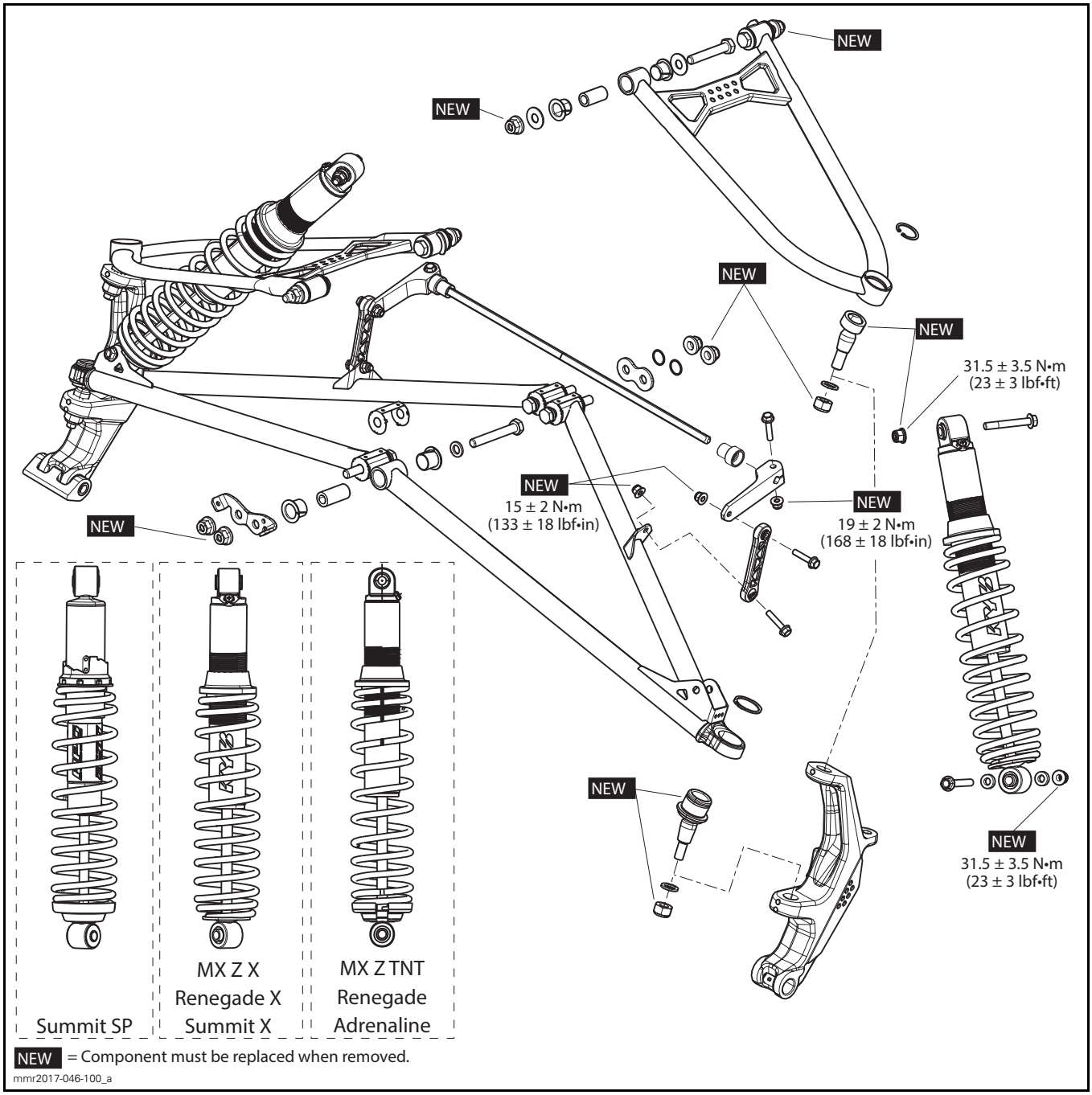
Adjusting and aligning the Track

Refer to *PERIODIC MAINTENANCE PROCEDURE* subsection to adjust and align the track.

FRONT SUSPENSION

SERVICE TOOLS

Description	Part Number	Page
BALL JOINT EXTRACTOR	529 035 827	4
BALL JOINT INSTALLER SUPPORT	529 036 398	7
BALL JOINT INSTALLER	529 036 399	7
BALL JOINT REMOVER SUPPORT	529 036 400	7
SPRING COMPRESSOR	529 036 184	3
SUSPENSION ARM SUPPORT	529 035 637	5



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

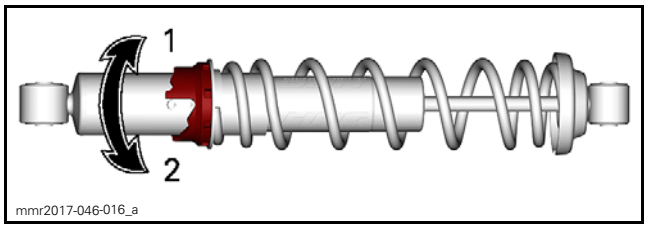
⚠ WARNING

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

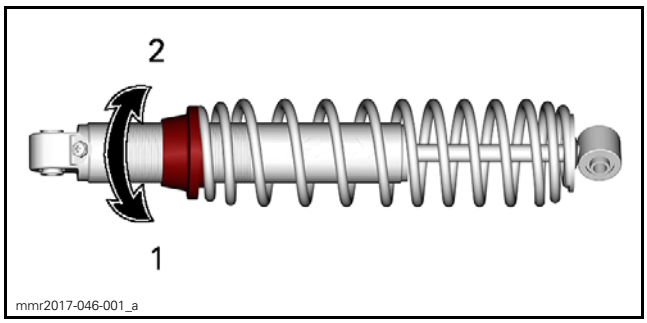
Using the suspension adjustment tool (included in the vehicle tool kit), turn the cam to increase or decrease spring preload.



1. Increase preload
2. Decrease preload

Ring Type Adjustment

Grab and turn the spring to increase or decrease spring preload.



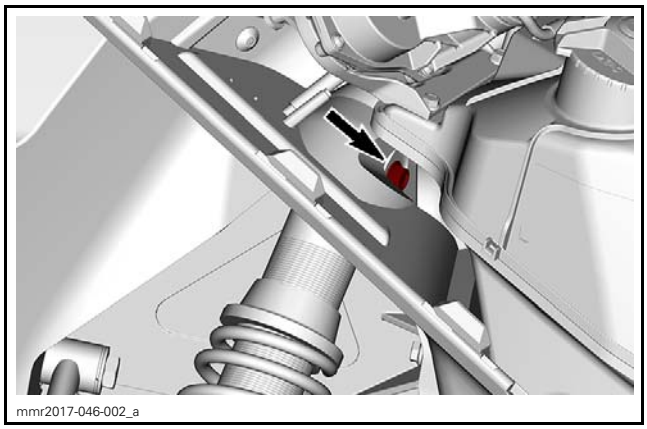
1. Increase preload
2. Decrease preload

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.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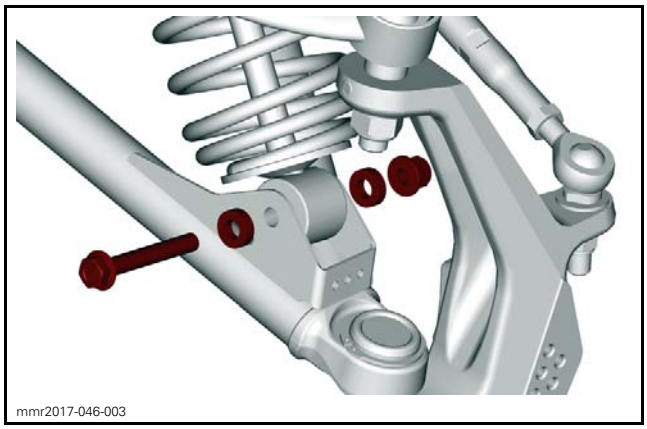
4. Remove the shock absorber lower bolt, nut, and spacers.


mmr2017-046-003

5. Remove the shock absorber.

Inspecting the Shock Absorber

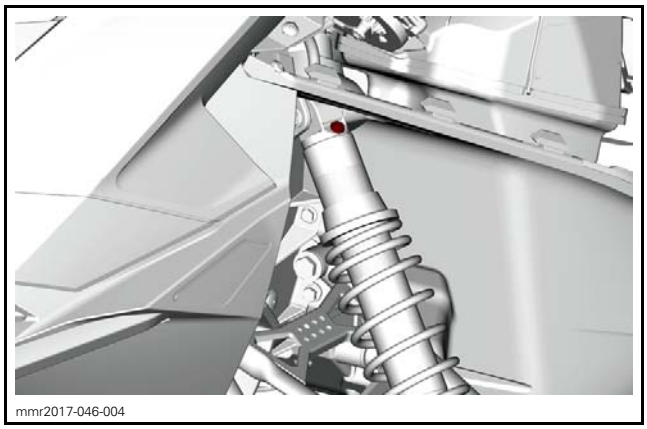
Refer to *REAR SUSPENSION (RMOTION)* subsection.

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.

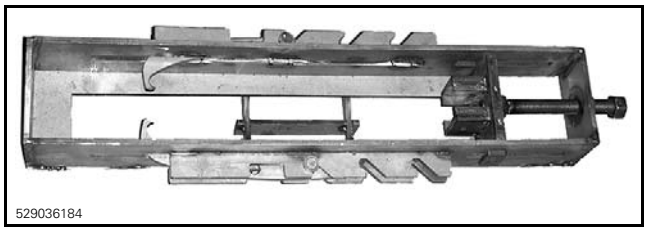

mmr2017-046-004

TIGHTENING TORQUE	
Front shock absorber retaining nuts	31.5 N•m ± 3.5 N•m (23 lbf•ft ± 3 lbf•ft)

SPRING

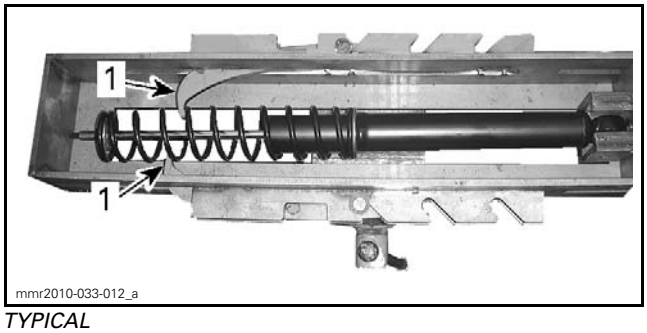
Removing the Spring

1. Secure the SPRING COMPRESSOR (P/N 529 036 184) in a vise.


529036184

SPRING COMPRESSOR

2. Position the shock absorber in the tool and install the spring compressor hooks.



mmr2010-033-012_a

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.

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

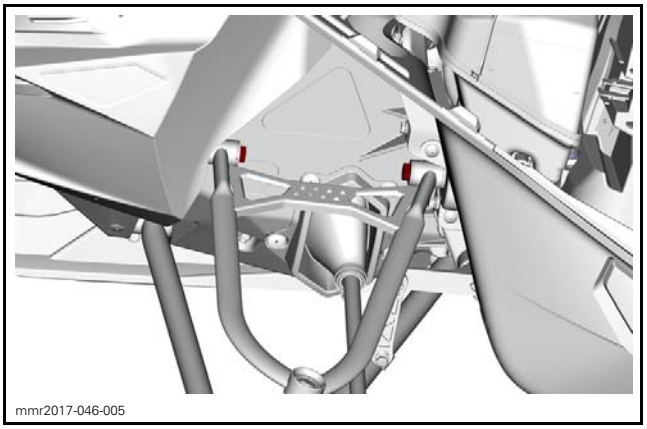
1. Check suspension arm for distortion or damage. Replace if necessary.
2. Lift the front of vehicle until skis are off the ground.
3. Move suspension arm from side to side.
4. Lower vehicle to the ground.
5. Move suspension up and down.
6. There should be no noticeable looseness. Replace bushings and/or sleeves if necessary.

NOTE: A play of 2 mm (.079 in) is acceptable when the suspension arm is moved forward and backward.

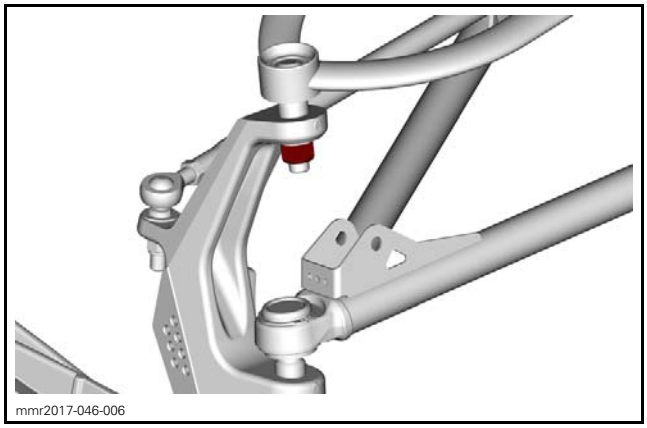
7. Check sleeves inside suspension arm attachments for wear or damage.

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.


mmr2017-046-005

5. Detach ball joint from ski leg as follows.
   5.1 Remove nut securing ball joint to ski leg.


mmr2017-046-006

   5.2 Use the extractor to detach ball joint from ski leg.

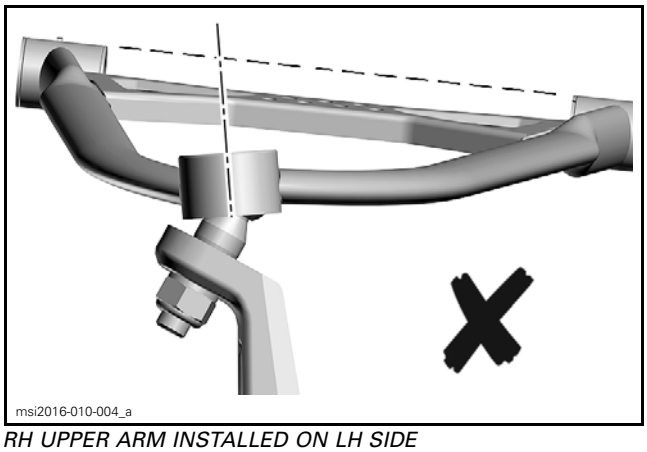
REQUIRED TOOL	
BALL JOINT EXTRACTOR (P/N 529 035 827)	

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.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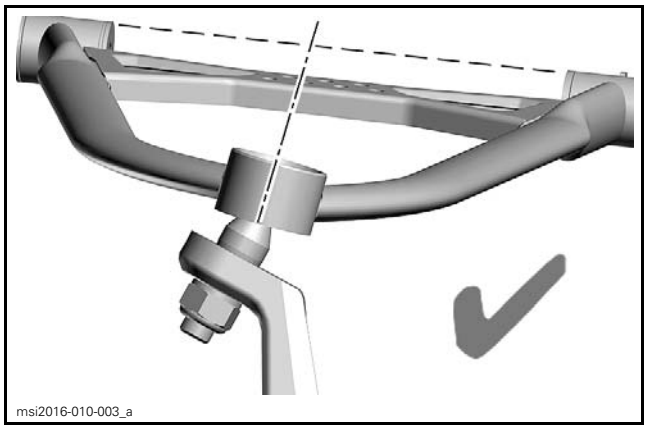
RH UPPER ARM INSTALLED ON LH SIDE



LH UPPER ARM INSTALLED ON LH SIDE

UPPER BALL JOINT

Inspecting the Upper Ball Joint

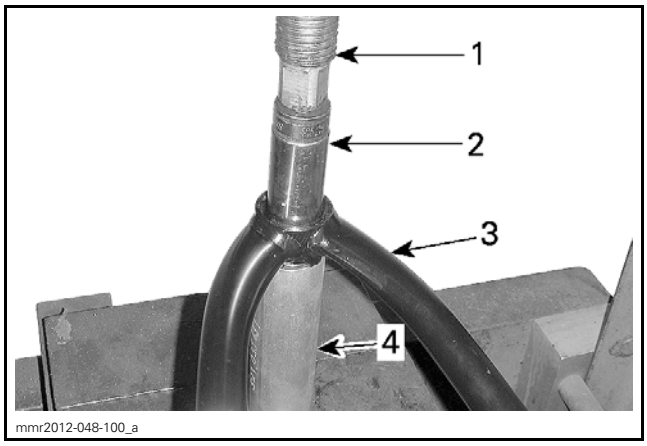
Check both upper ball joints for damage, pitting, looseness and roughness. If so, replace with a new one.

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	



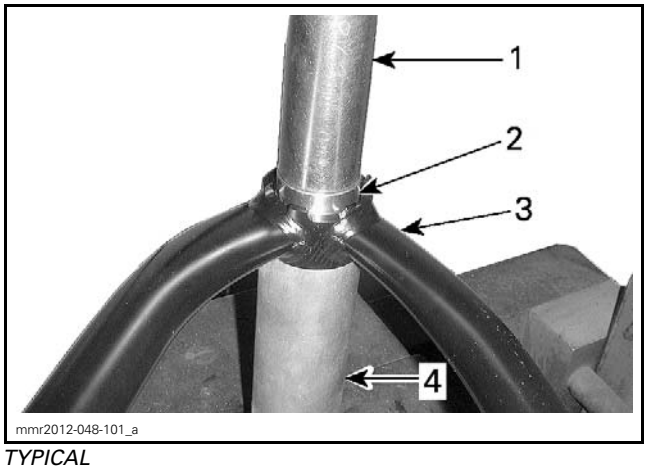
TYPICAL
1. *Press rod*
2. *Socket*
3. *Suspension arm*
4. *Suspension arm support*

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

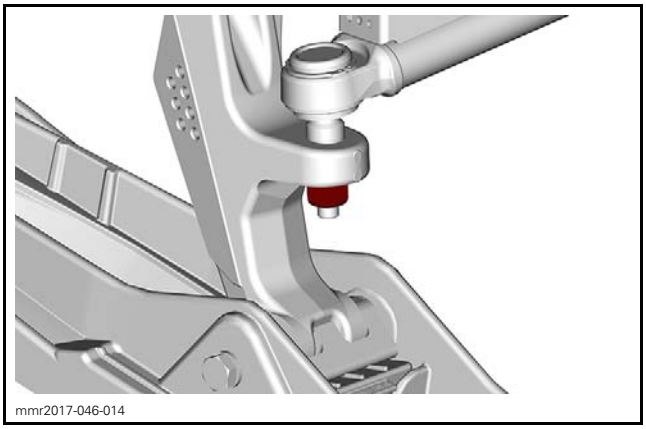
1. Check suspension arm for distortion or damage. Replace if necessary.
2. Lift the front of vehicle until skis are off the ground.
3. Detach shock absorber and stabilizer bar link from lower suspension arm.
4. Move suspension arm from side to side.
5. Lower vehicle to the ground.
6. Move suspension up and down.
7. There should be no noticeable loose. Replace bushings and/or sleeves if necessary.

NOTE: A play of 2 mm (.079 in) is acceptable when the suspension arm is moved forward and backward.

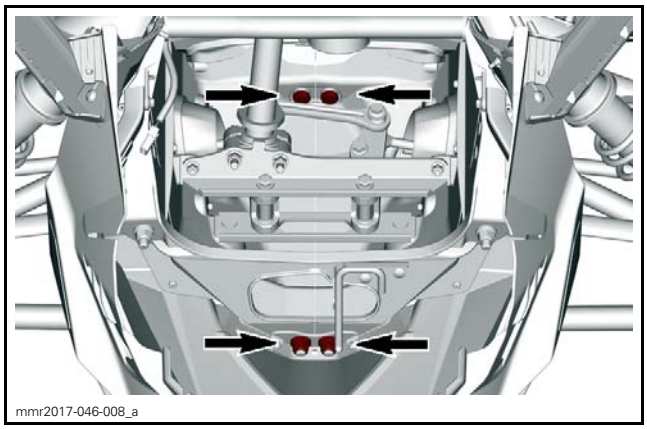
8. Check sleeves inside suspension arm attachments for wear or damage.

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.


mmr2017-046-014

6. Using a suitable ball joint remover, detach lower ball joint from ski leg.
7. Remove suspension arm screws from inside the vehicle.

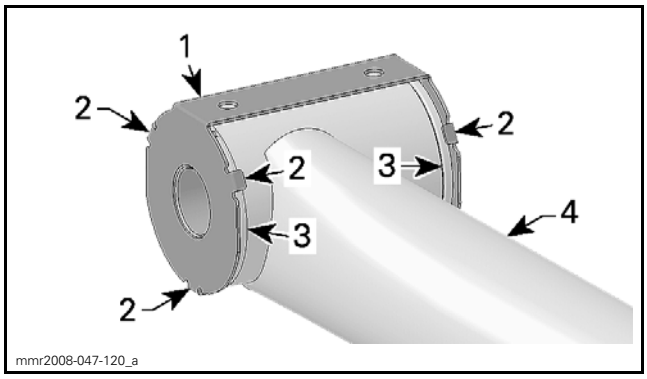

mmr2017-046-008_a

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.



mmr2008-047-120_a

1. *Wear plate*
2. *Wear plate tabs*
3. *Bushings*
4. *Lower suspension arm*

Install all other removed parts.

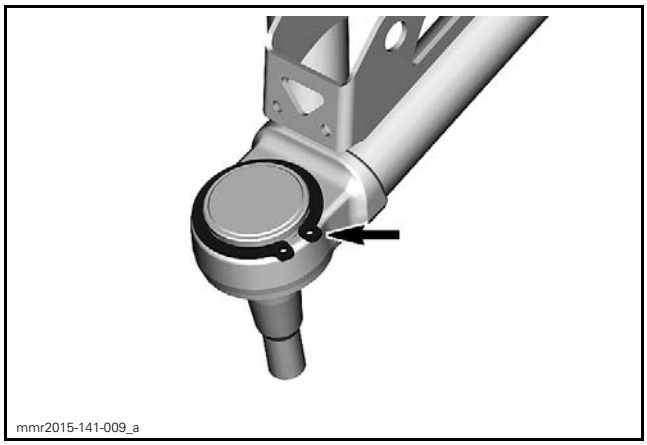
LOWER BALL JOINT

Inspecting the Lower Ball Joint

Inspect ball joint end for damage. Ensure it's moving freely, a 0.3 mm (.012 in) axial play is acceptable. Replace ball joints as required.

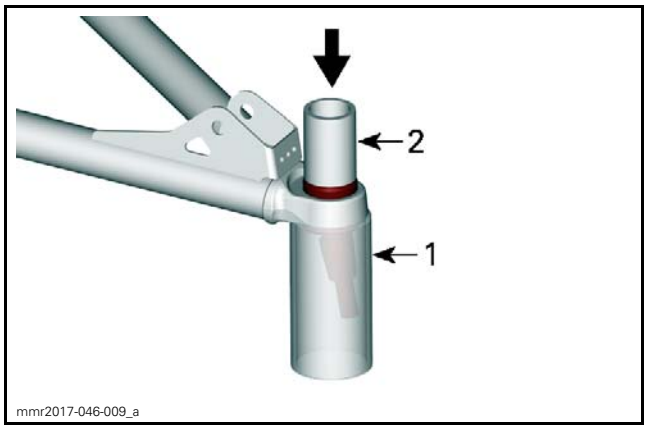
Removing the Lower Ball Joint

1. Remove the *LOWER SUSPENSION ARM*, see procedure in this subsection.
2. Remove circlip securing ball joint to suspension arm.


mmr2015-141-009_a

3. Use a shop press and the specified tools to press the ball joint out of the lower suspension arm.

REQUIRED TOOLS	
BALL JOINT REMOVER SUPPORT (P/N 529 036 400)	
Suitable box	



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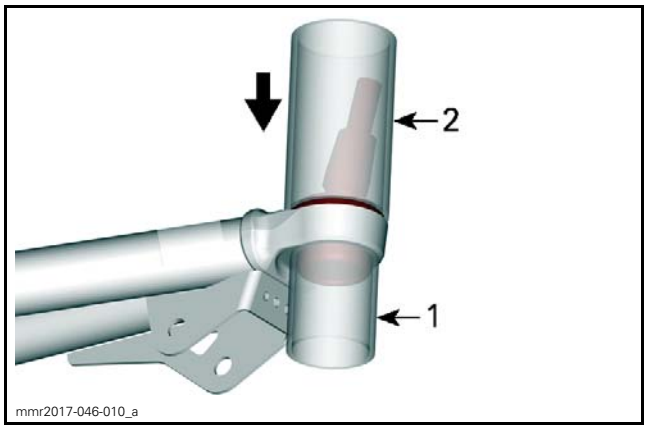
1. Ball joint remover support
2. Suitable box

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)	



mmr2017-046-010_a

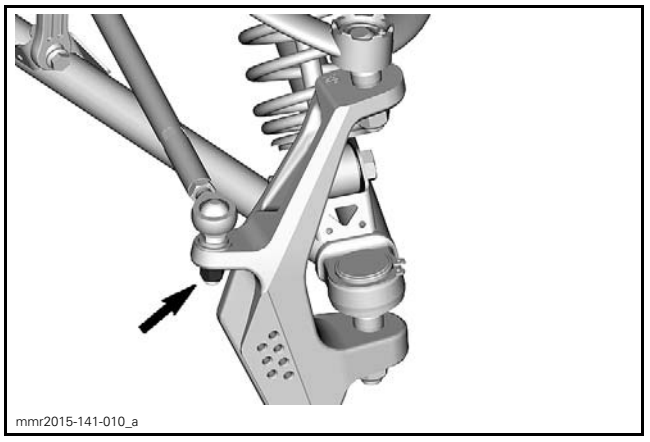
1. Ball joint installer support
2. Ball joint installer

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.


mmr2015-141-010_a

3. Remove upper and lower ball joints from ski leg. Refer to *UPPER BALL JOINT* and *LOWER BALL JOINT* in this subsection.

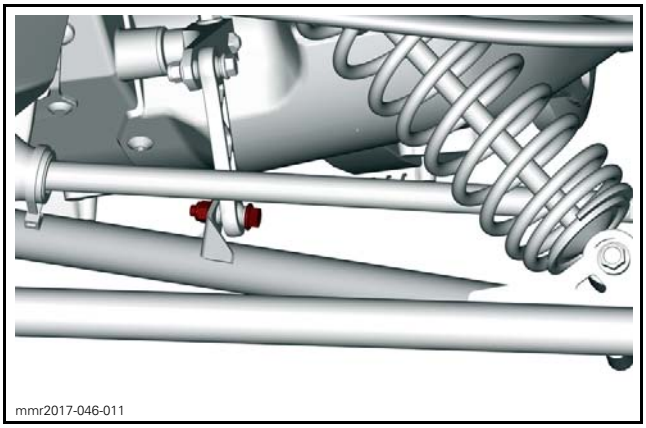
Installing the Ski Leg

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.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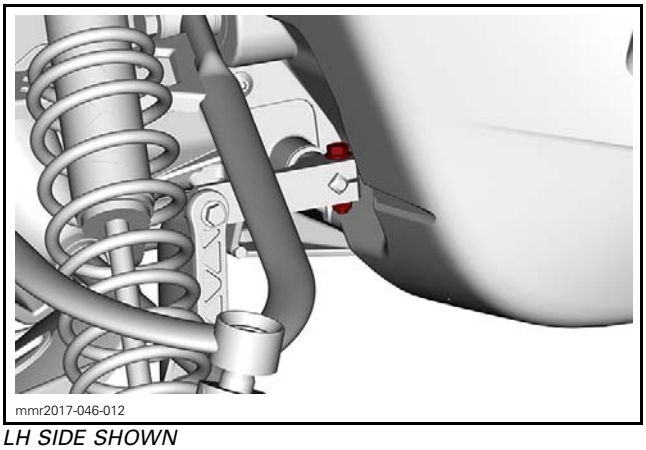
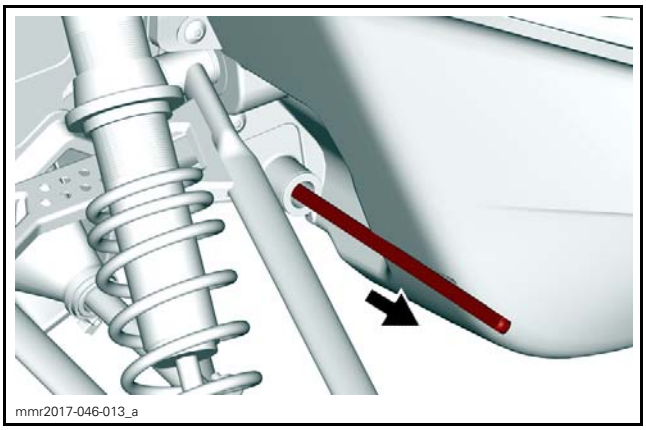
LH SIDE SHOWN

2. Remove stabilizer lever bolts and nuts.


mmr2017-046-012

LH SIDE SHOWN

3. Remove stabilizer levers and plastic bushings from stabilizer bar.
4. Slide stabilizer bar out of vehicle from the LH side.


mmr2017-046-013_a

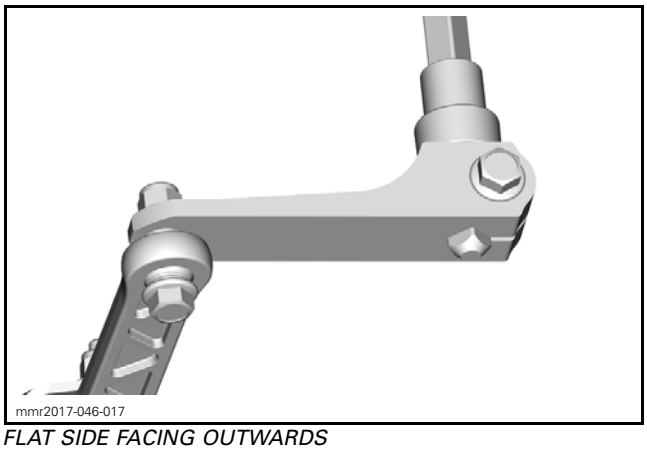
Installing the Stabilizer Bar

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 (168 lbf•**in** ± 18 lbf•**in**)


mmr2017-046-017

FLAT SIDE FACING OUTWARDS

REAR SUSPENSION (rMOTION)

SERVICE TOOLS

Description	Part Number	Page
RMOTION MASTER CYLINDER KEY	529 036 254	19
RMOTION SOCKET	529 036 255	19
RMOTION SUSPENSION TOOL	529 036 234	14, 27
SHOCK ABSORBER SUPPORTS	529 036 186	25

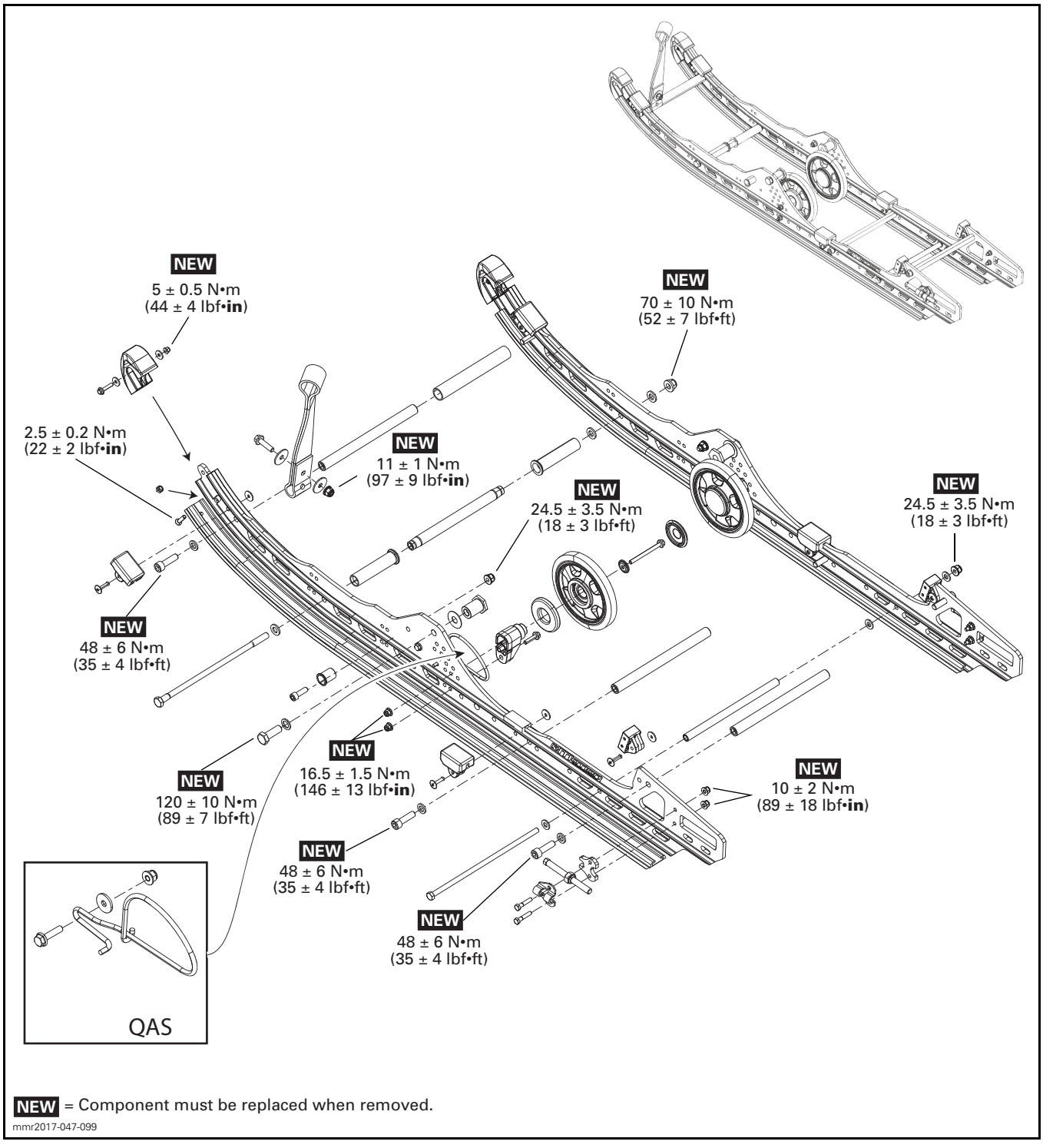
SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
BENCH SCALE	Salter Brecknell PS 400	25

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	17

RAILS



NEW = Component must be replaced when removed.

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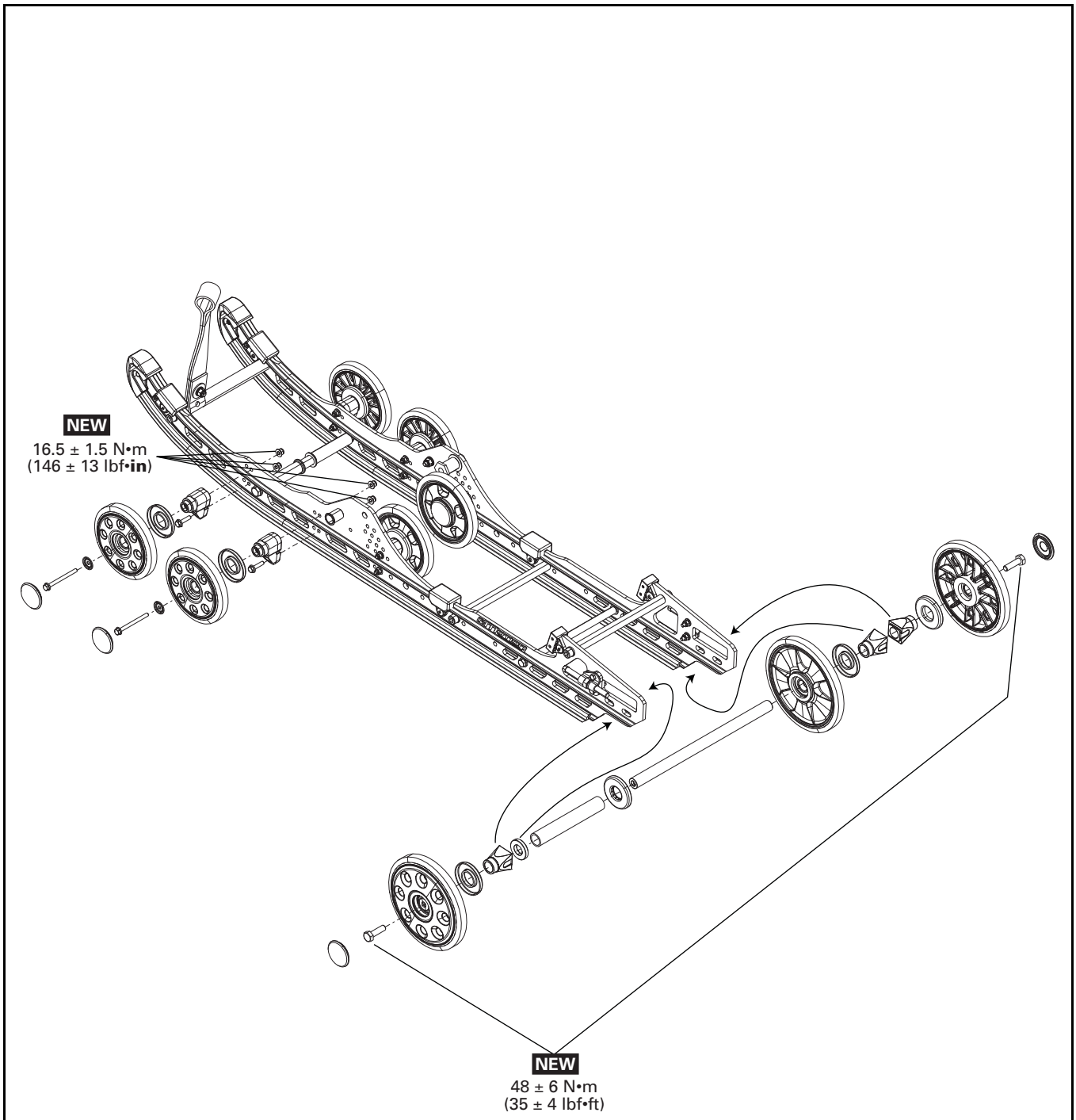
WHEELS (3 IDLER WHEELS LAYOUT)



NEW = Component must be replaced when removed.

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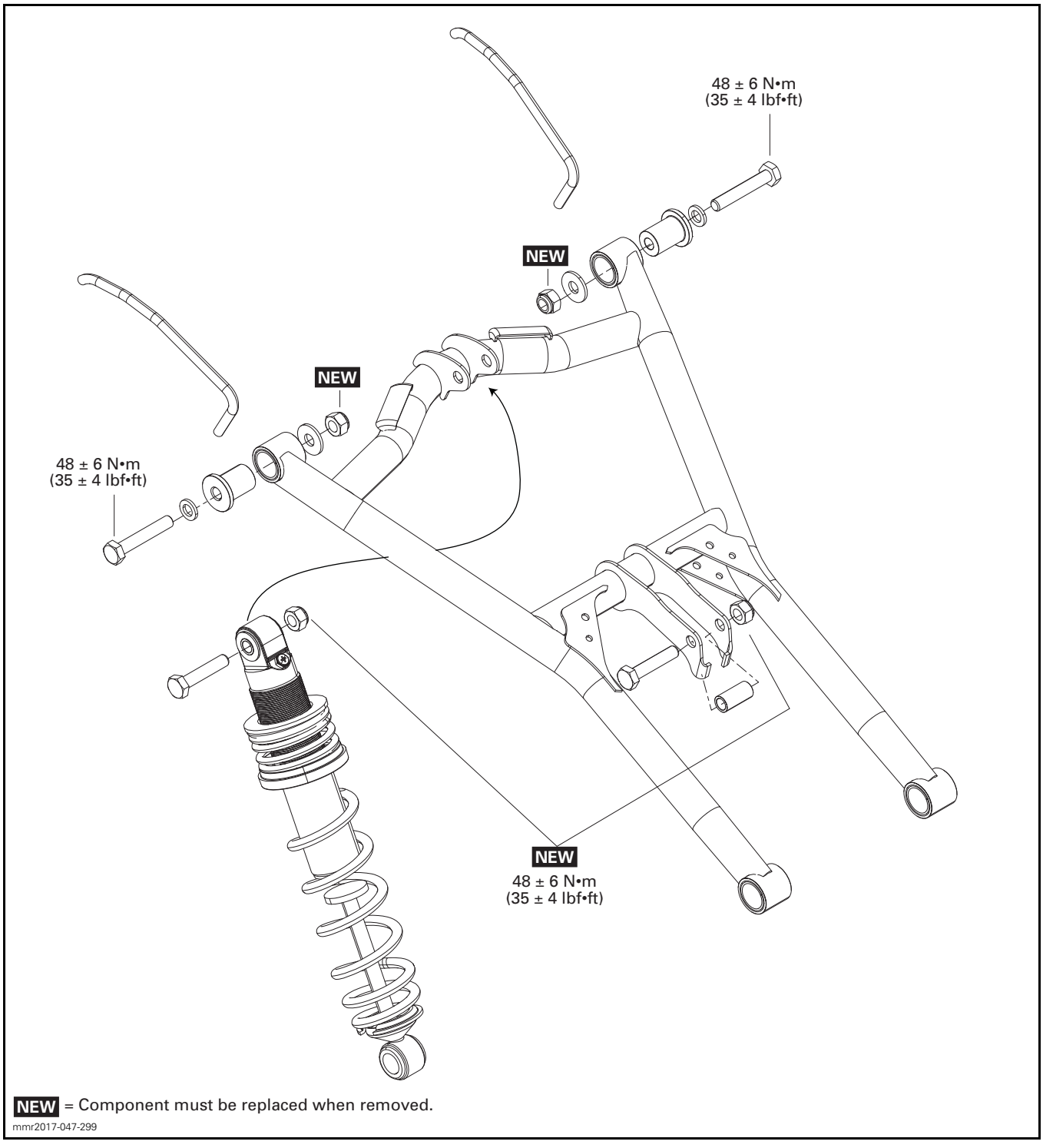
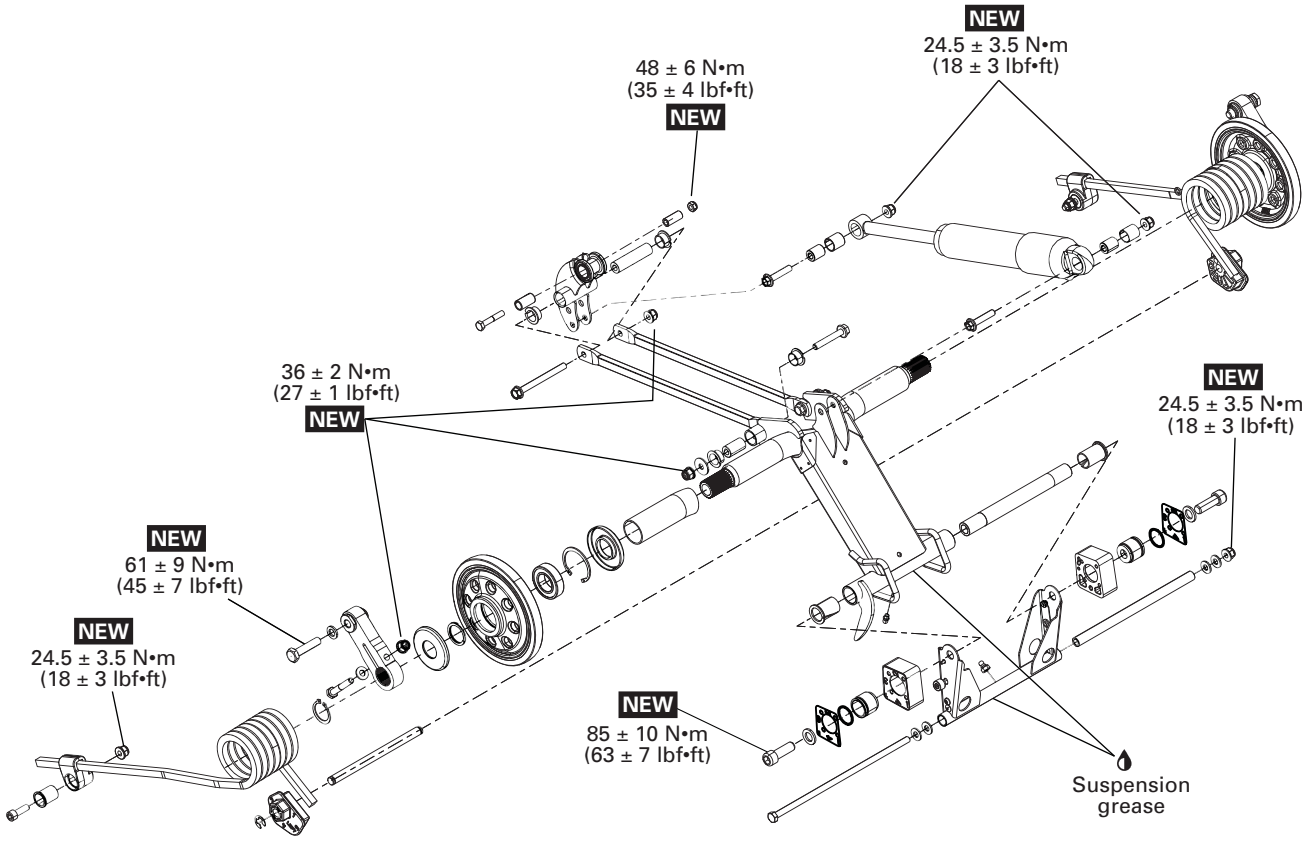
FRONT ARM



NEW = Component must be replaced when removed.

mmr2017-047-299

REAR ARM (MODELS WITHOUT ADJUSTABLE REAR SHOCK)



NEW = Component must be replaced when removed.

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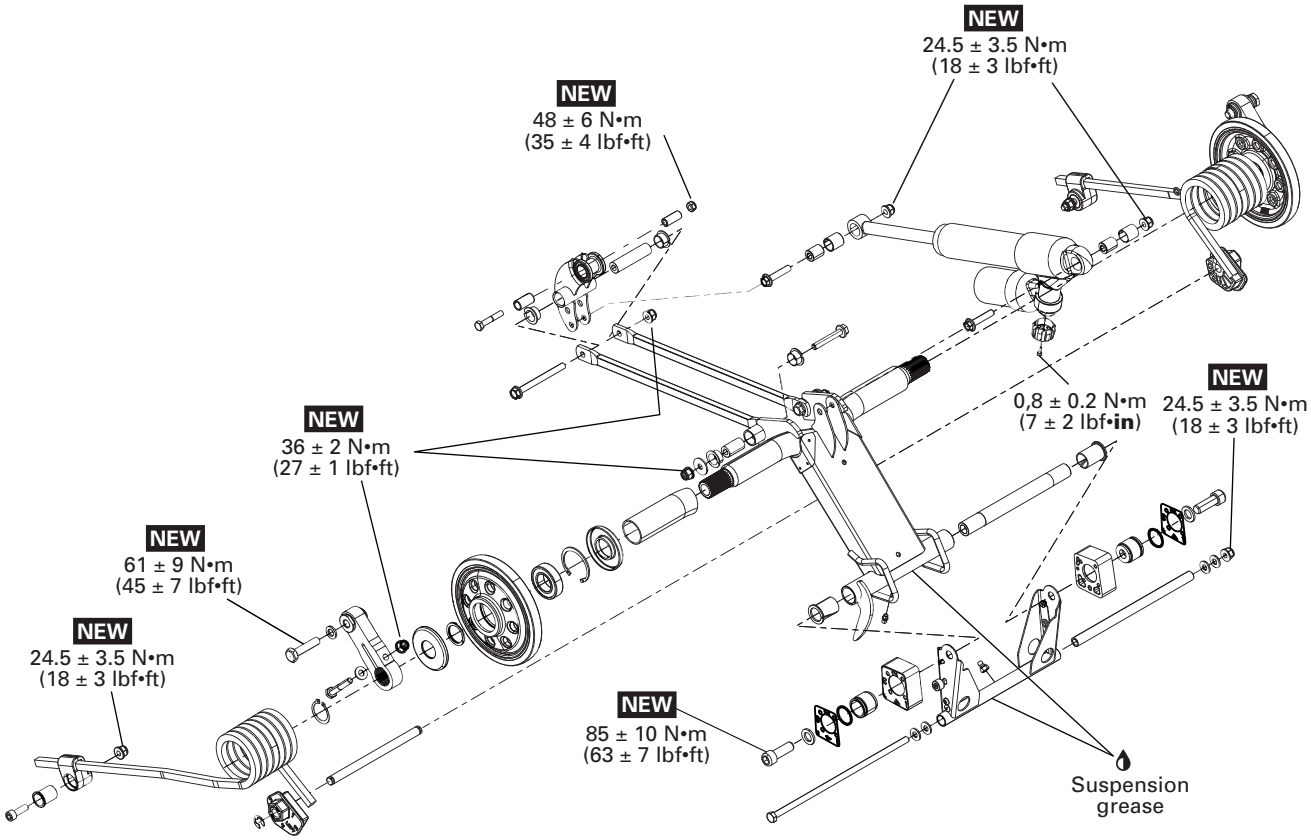
REAR ARM (MODELS WITHOUT QUICK ADJUST SYSTEM)



NEW = Component must be replaced when removed.

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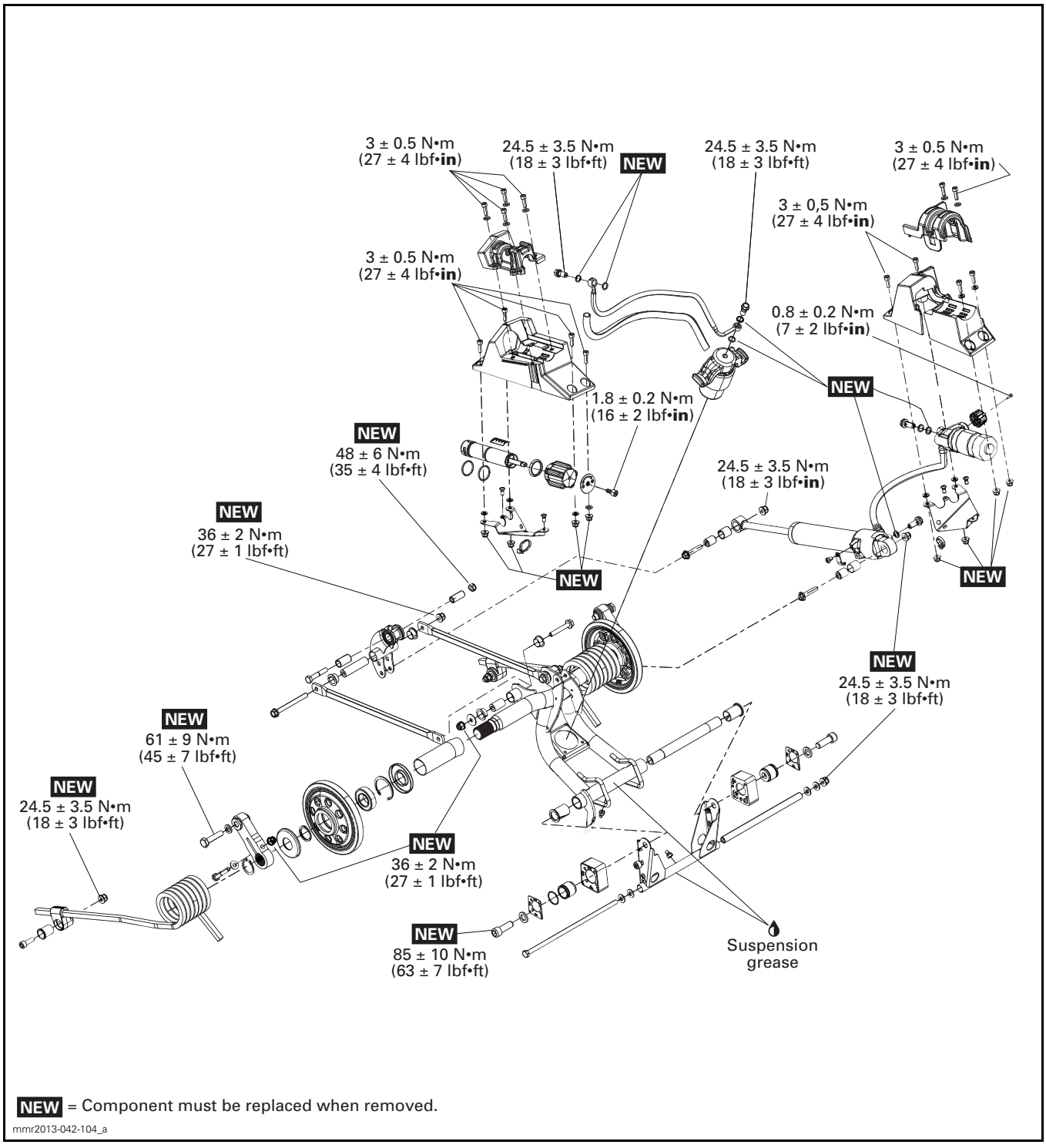
REAR ARM (MODELS WITH QUICK ADJUST SYSTEM)



NEW = Component must be replaced when removed.

mmr2013-042-104_a

GENERAL

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.

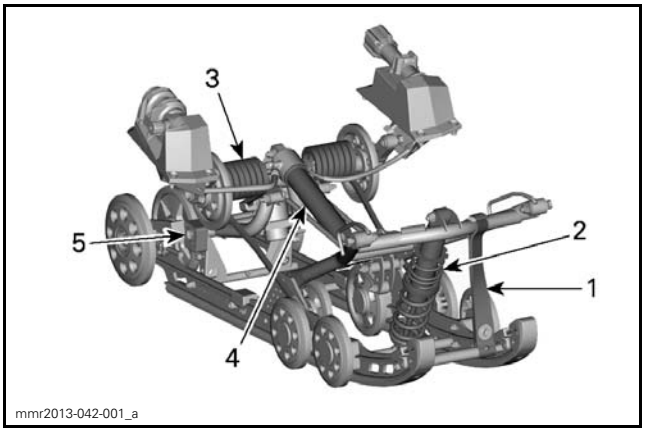
⚠ WARNING

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

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

ADJUSTMENT

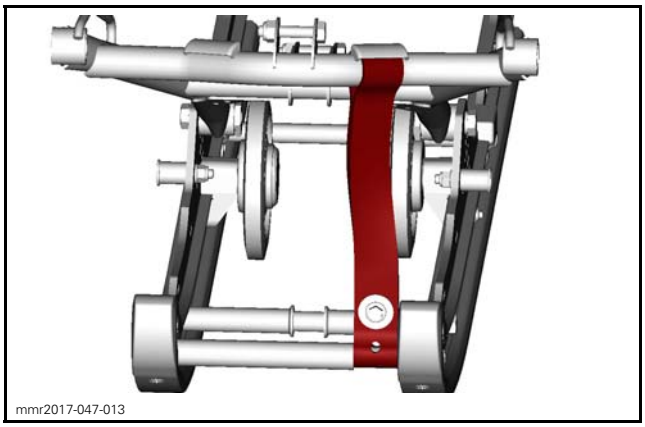
REAR SUSPENSION ADJUSTMENTS



ADJUSTABLE COMPONENTS
1. *Stopper strap*
2. *Center spring*
3. *Rear spring*
4. *Rear shock absorber*
5. *Coupling blocks (RH side shown)*

NOTICE **Whenever adjusting rear suspension, check track tension and adjust if necessary.**

Stopper Strap



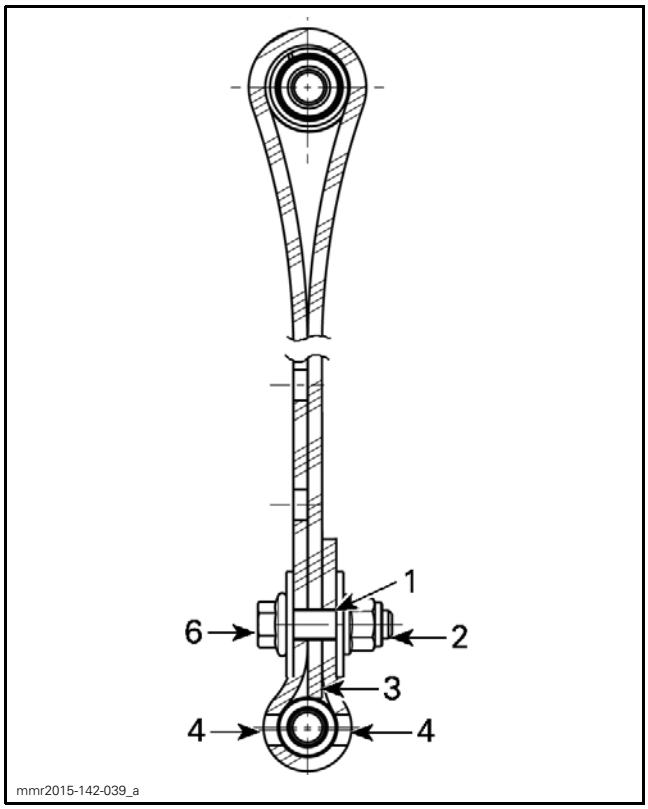
Stopper strap length has an effect on the amount of weight the center spring has to carry especially during acceleration, therefore on the front end uplift.

Stopper strap length also has an effect on center spring travel.

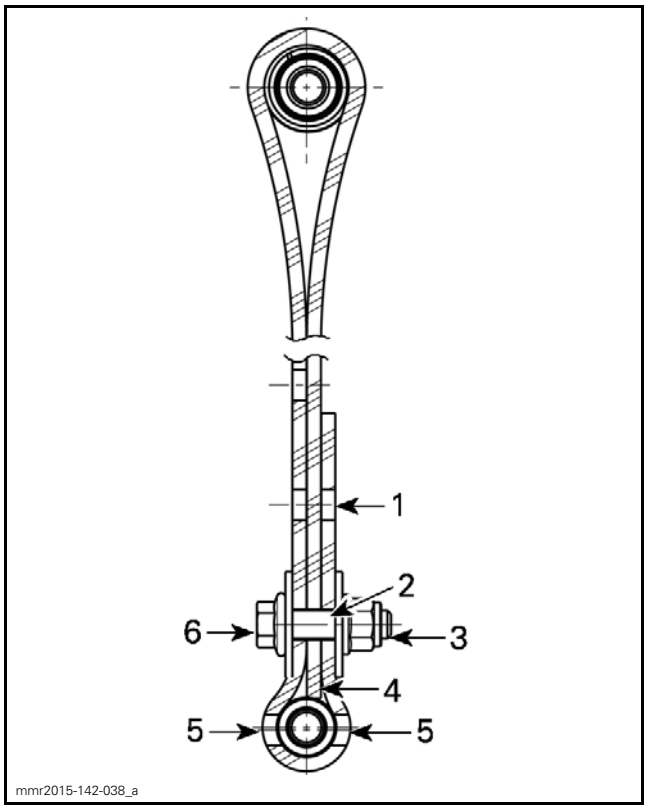
NOTICE **Whenever stopper strap length is changed, track tension must be checked.**

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

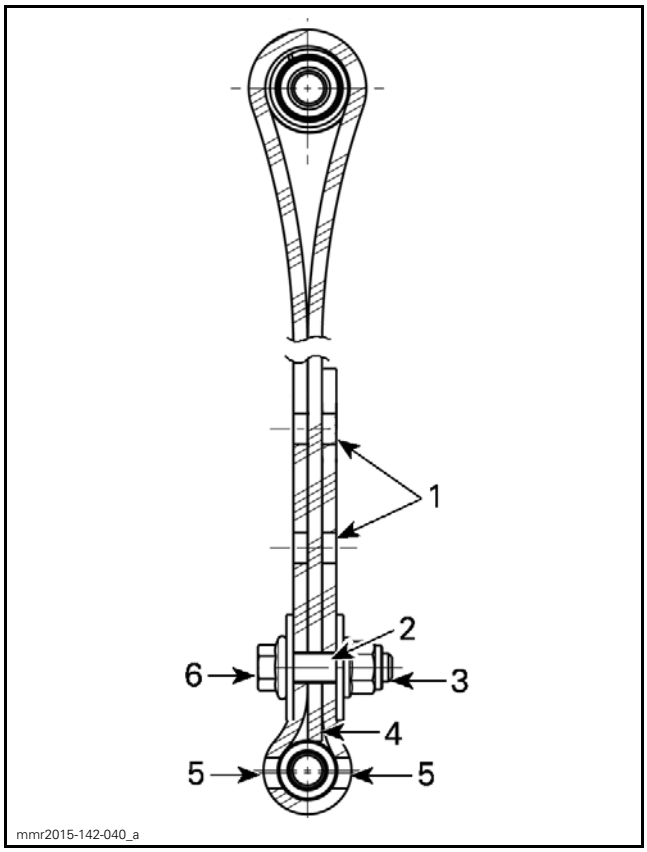
Stopper strap could be set to position 1, 2, 3, 4 and 5. Below are illustrations for position 1, 2, 3. Smaller numbers correspond to a longer strap setting.



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*

Always install stopper strap bolt as close as possible to the lower shaft.

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.

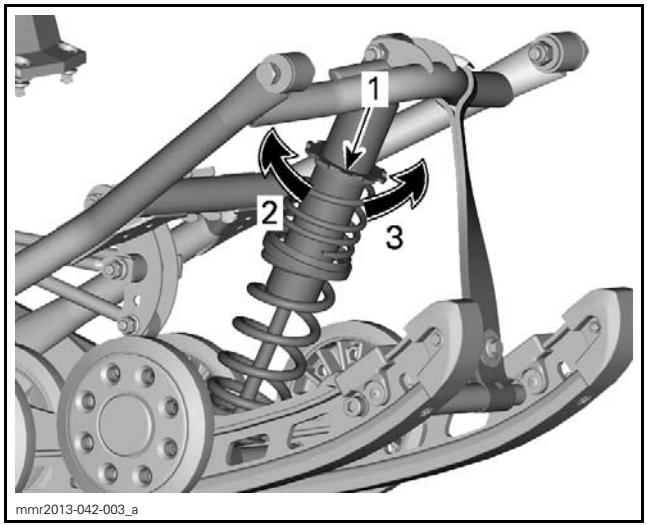
Generally, a longer stopper strap setting gives better performance in deep snow on a flat landscape.

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



TYPICAL- RING TYPE SHOWN
1. *Spring preload adjustment ring*
2. *Increase preload*
3. *Decrease preload*

Rear Spring

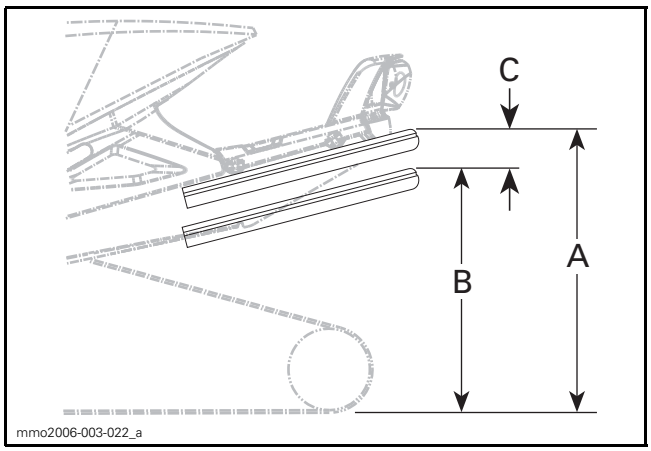
Rear spring preload has an effect on comfort, ride height and load compensation.

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.

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

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

If the specification is unattainable with the original springs, refer to the applicable *SPRING CHART* bulletin for other available springs.

rMotion Without Quick Adjust System

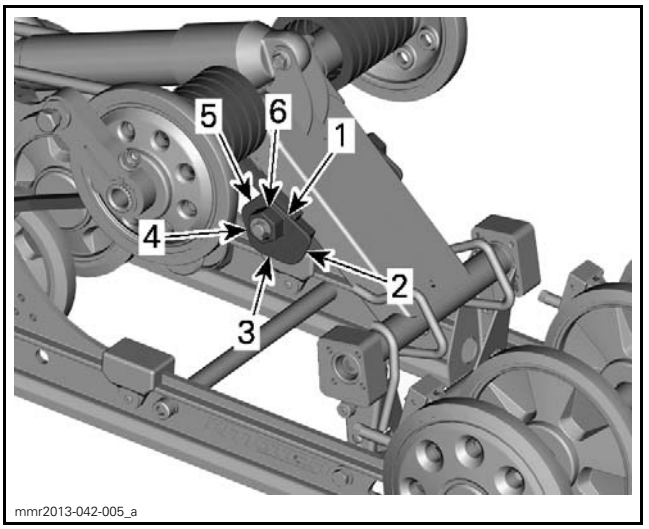
To increase spring preload using tool, always turn the left side adjustment cam in a clockwise direction, and the right side cam in a counterclockwise direction.

⚠ CAUTION Never set preload cams directly from position 5 to 1 or directly from position 1 to 5.

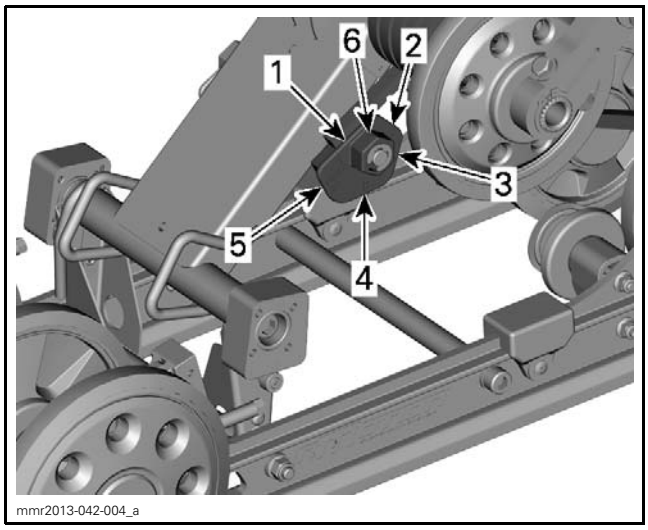
⚠ WARNING

Both rear spring preload must be set at the same position. Otherwise vehicle behavior may be unpredictable and suspension may become warped.

The adjustment cams have 5 different settings, 1 being the softest.



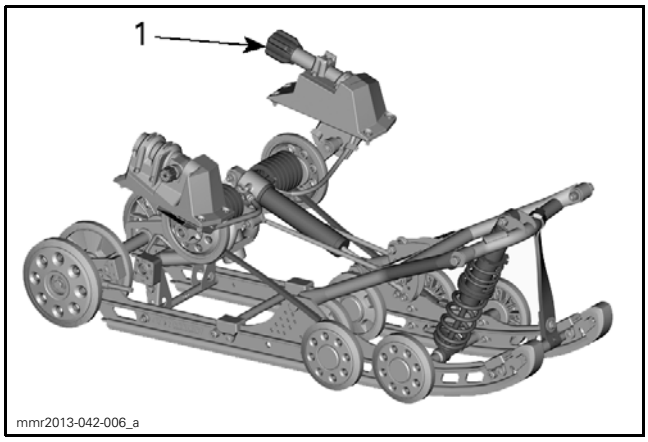
rMOTION WITHOUT QUICK ADJUST SYSTEM — LH SIDE
1. Position 1
2. Position 2
3. Position 3
4. Position 4
5. Position 5
6. Adjustment nut



rMOTION WITHOUT QUICK ADJUST SYSTEM— RH SIDE
1. *Position 1*
2. *Position 2*
3. *Position 3*
4. *Position 4*
5. *Position 5*
6. *Adjustment nut*

rMotion with Quick Adjust System

Turn the LH side knob to adjust preload accordingly.



TYPICAL — rMOTION WITH QUICK ADJUST SYSTEM
1. *LH side knob to adjust spring preload*

Rear Shock Absorber

Rear Shock Compression Damping

NOTE: Both low and high speed compression damping are adjusted simultaneously.

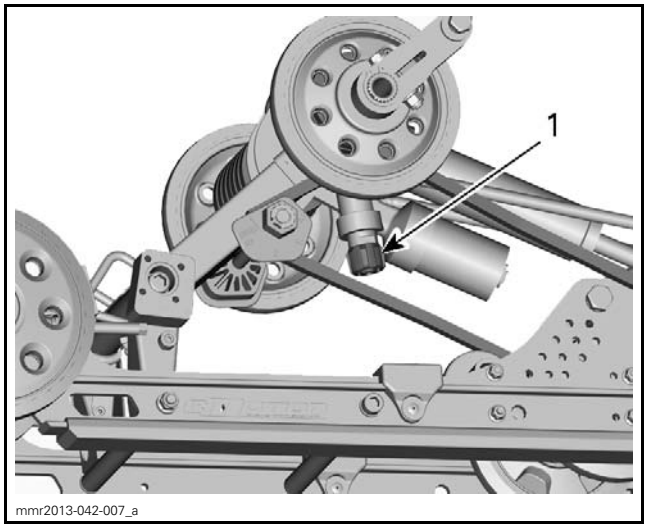
Low speed compression damping controls how the shock absorber reacts to a low suspension velocity (slow compression strokes, in most cases when riding at lower speeds).

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).

TURNING	ACTION	RESULT ON BIG AND SMALL BUMPS
Clockwise	Increasing compression damping force	Firmer compression damping
Counter Clockwise	Decreasing compression damping force	Softer compression damping

rMotion Without Quick Adjust System

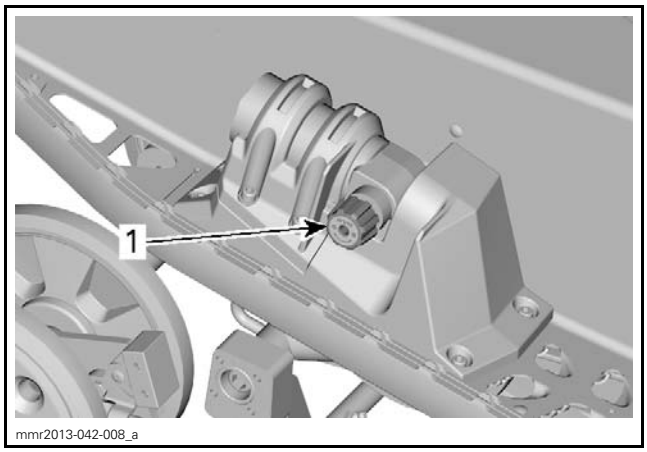
To adjust, turn the adjuster button located on the oil reservoir on shock clockwise to increase compression damping force and counterclockwise to decrease compression damping force.



TYPICAL — rMOTION WITHOUT QUICK ADJUST SYSTEM
1. *Compression damping adjustment button*

rMotion with Quick Adjust System

Turn the RH side knob to adjust the shock compression speed.

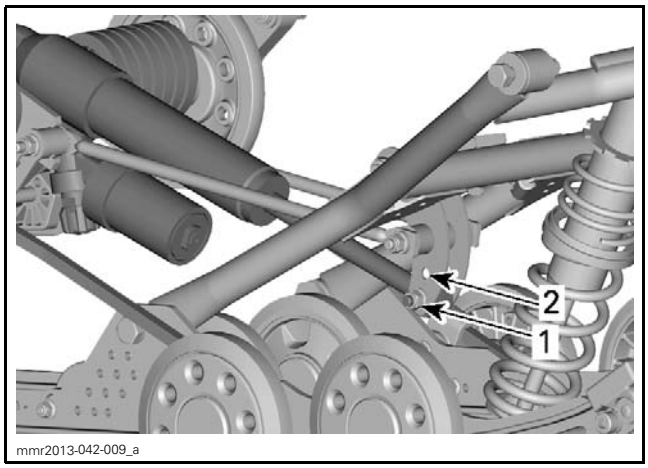


TYPICAL — rMOTION WITH QUICK ADJUST SYSTEM
1. *Knob to adjust low/high speed compression damping*

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.



REAR SHOCK MOUNTING POSITION
1. *High performance position*
2. *Sport position*

Coupling Blocks

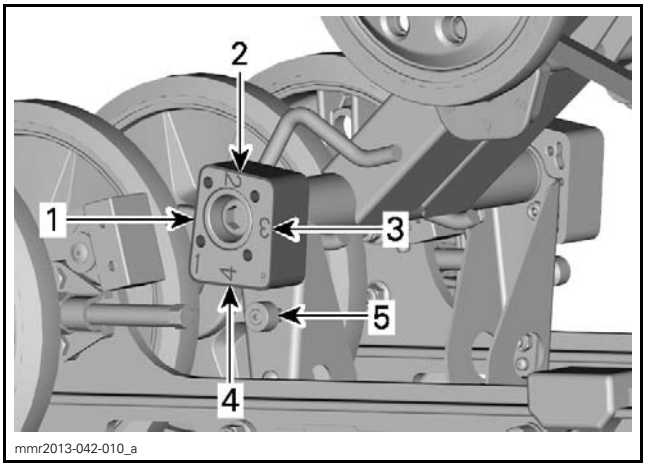
Coupling blocks adjustment has an effect on vehicle handling during acceleration only.

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.



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

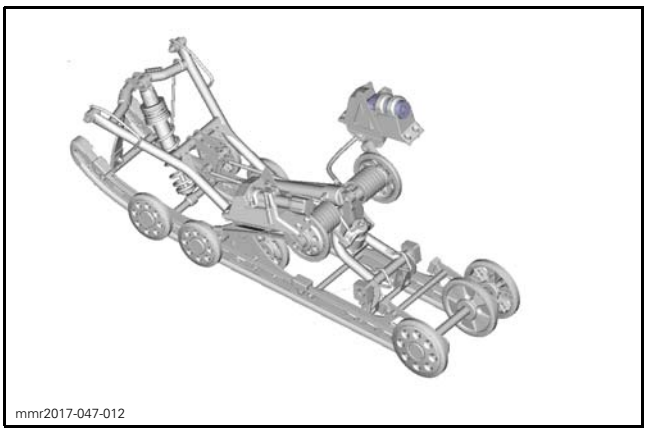
MAINTENANCE

For rear suspension lubrication, mechanism and stopper strap inspection, refer to *PERIODIC MAINTENANCE PROCEDURES*.

PROCEDURES

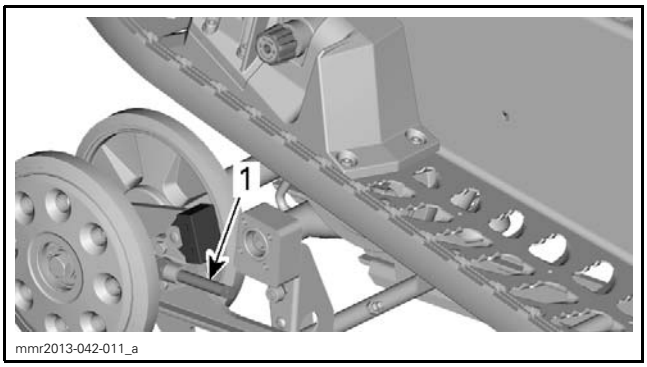
NOTE: Parts can be replaced without suspension removal, unless otherwise noted.

SUSPENSION ASSEMBLY


mmr2017-047-012

Removing Suspension Assembly

1. Lift rear of vehicle and support it off the ground.
2. Completely loosen track tension by unscrewing both adjustment screws.



mmr2013-042-011_a

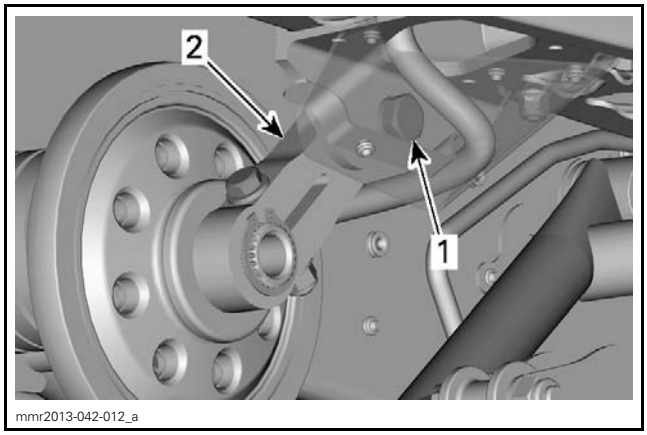
1. Adjustment screw

rMotion with Quick Adjust System

3. Remove quick adjuster control modules, refer to:
   - *SHOCK DAMPING QUICK ADJUSTER SYSTEM*
   - *SPRING PRELOAD QUICK ADJUSTER SYSTEM*.

All Models

4. Lower the rear of vehicle just enough to support suspension.
5. Remove rear arm connecting rods retaining screws.



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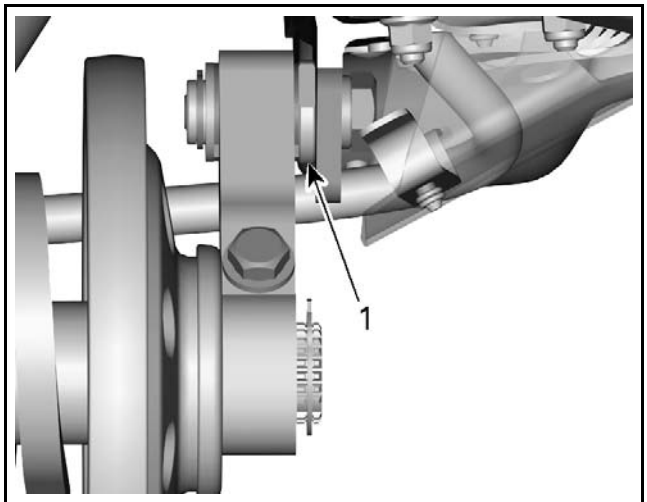
1. Retaining screw
2. Connecting rod

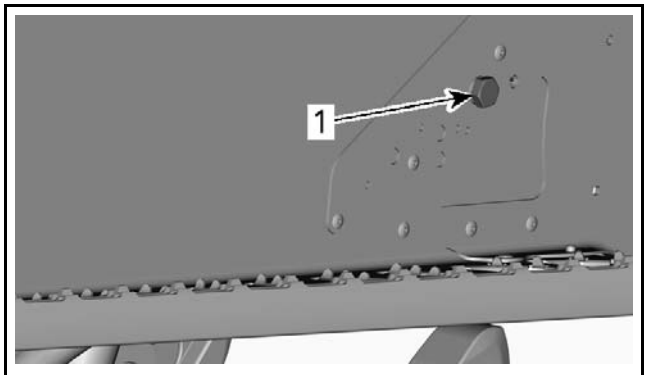
REQUIRED TOOL	
RMOTION SUSPENSION TOOL (P/N 529 036 234)	



mmr2013-042-013_a

1. rMotion suspension tool to be installed here

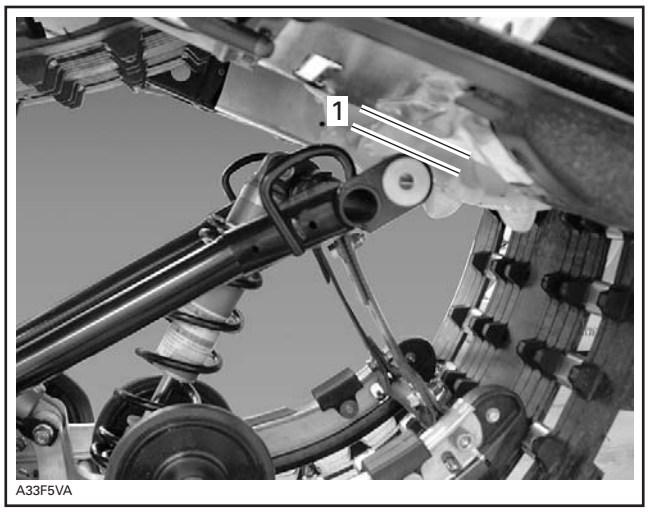
6. Remove front arm retaining bolts.



mmr2013-042-020_a

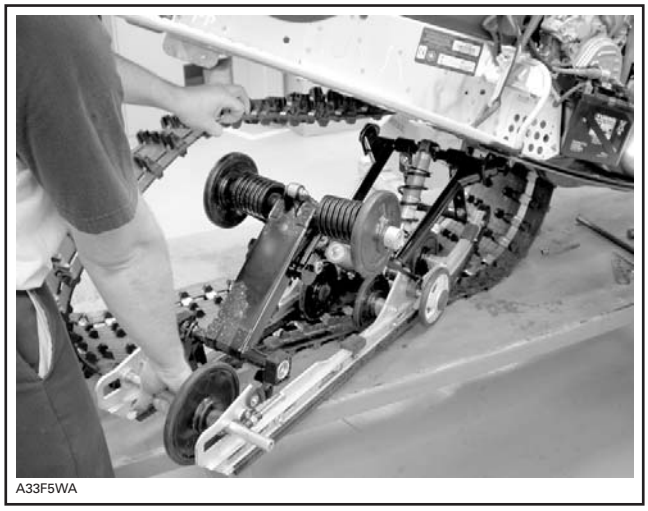
TYPICAL
1. Front arm bolt
2. Chaincase

7. Lift rear of vehicle until front arm as enough clearance to pass underneath tunnel.



TYPICAL
1. Enough clearance

8. Remove suspension assembly from vehicle.



TYPICAL — REMOVE SUSPENSION

Installing Suspension Assembly

Installation is the reverse of removal procedure. Pay attention to the following.

Install suspension into track with front portion first.

Tighten new screws to specification.

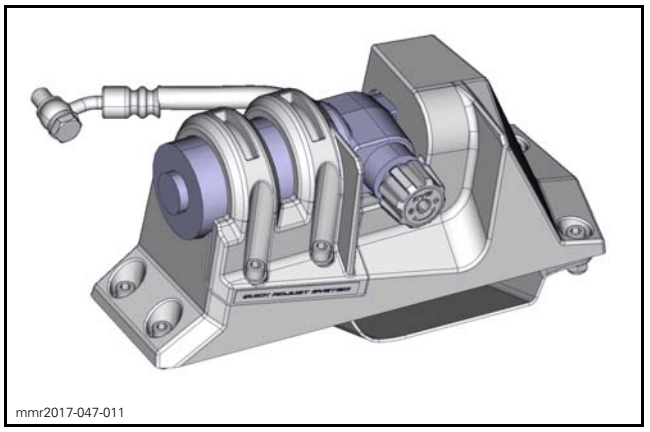
UPPER SUSPENSION ARM FASTENERS TIGHTENING TORQUE	
Front arm bolts	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)
Rear arm connecting rod screws	61 N•m ± 9 N•m (45 lbf•ft ± 7 lbf•ft)

Adjust track tension, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

rMotion with Quick Adjust System

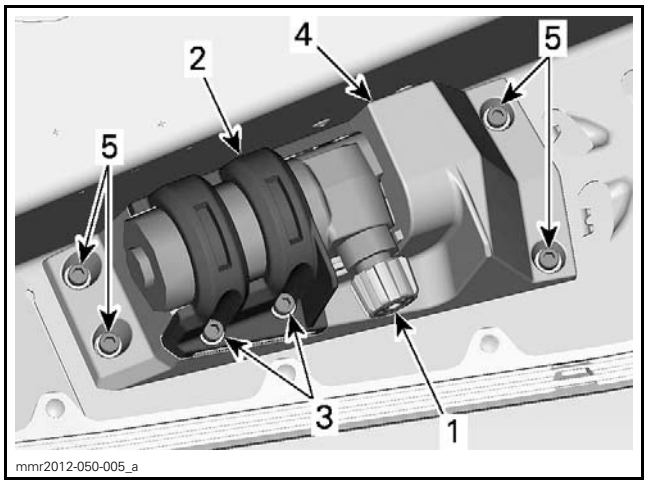
Install quick adjuster control modules, refer to:
– *SHOCK DAMPING QUICK ADJUSTER SYSTEM*
– *SPRING PRELOAD QUICK ADJUSTER SYSTEM*.

SHOCK DAMPING QUICK ADJUSTER SYSTEM



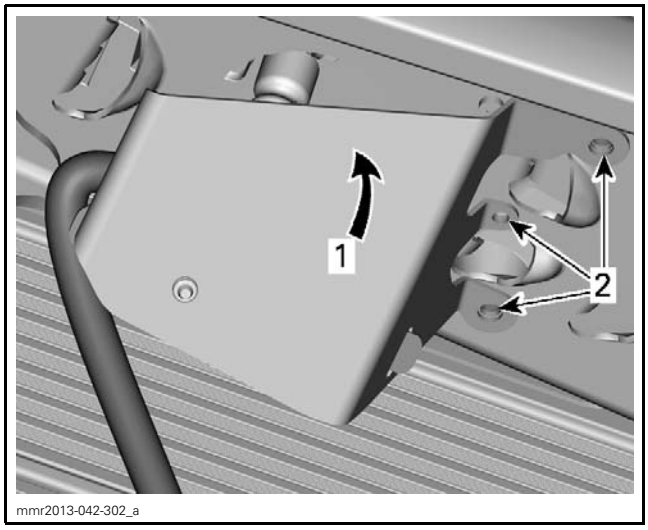
Removing Shock Damping Quick Adjuster Control Module

1. Remove the following parts:
   – Knob
   – Retaining clamp
   – Support.



CONTROL MODULE
1. Knob screw
2. Clamp
3. Clamp screws
4. Support
5. Support screws

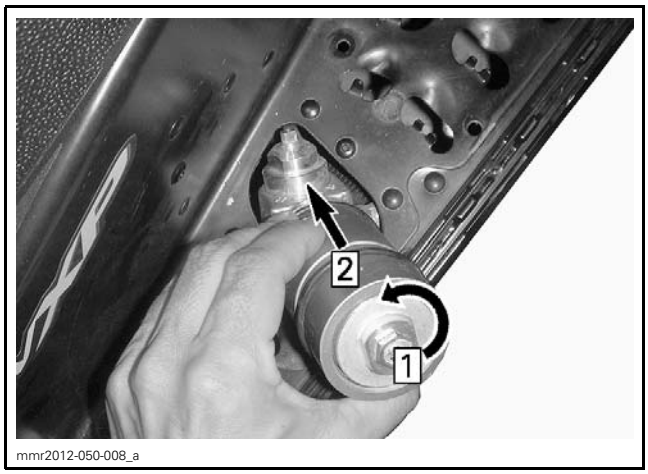
2. Remove front fasteners from hose guard.
3. Remove hose from its retainer tab and rotate hose guard outwards around rear rivet.



mmr2013-042-302_a

1. Pivot outwards
2. Front fasteners

4. Remove shock remote reservoir as follows:
   – Rotate.
   – Pass through tunnel opening.



mmr2012-050-008_a

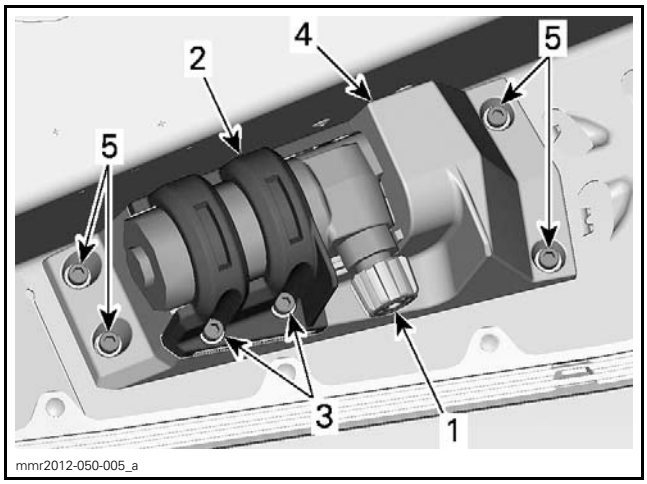
Step 1: Rotate
Step 2: Pass through tunnel opening

Installing Shock Damping Quick Adjuster Control Module

1. Align the hose guard front holes with the support front holes.

NOTE: No rivet needed at front of hose guard.

2. Install parts as follows:

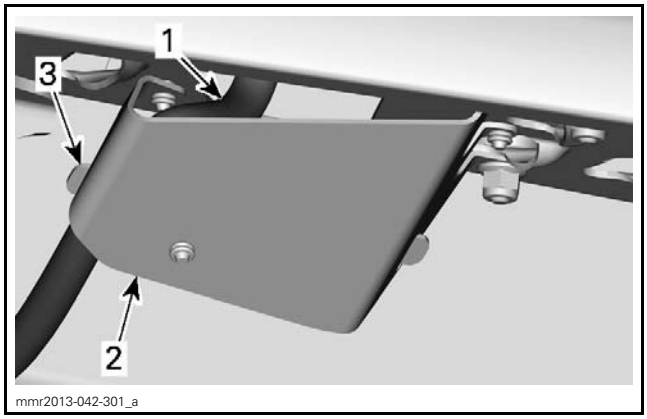


mmr2012-050-005_a

CONTROL MODULE
1. Knob screw
2. Clamp
3. Clamp screws
4. Support
5. Support screws

TIGHTENING TORQUE	
Support screws	5 N•m ± 1 N•m (44 lbf•**in** ± 9 lbf•**in**)
Clamp screws	2.5 N•m ± 0.5 N•m (22 lbf•**in** ± 4 lbf•**in**)
Knob screw	0.4 N•m ± 0.1 N•m (4 lbf•**in** ± 1 lbf•**in**)

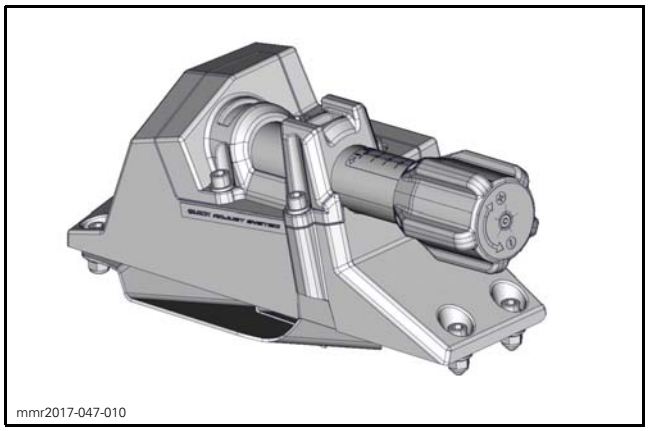
3. Secure rear shock hose to hose guard bracket.



mmr2013-042-301_a

1. Hose
2. Hose guard
3. Hose guard bracket

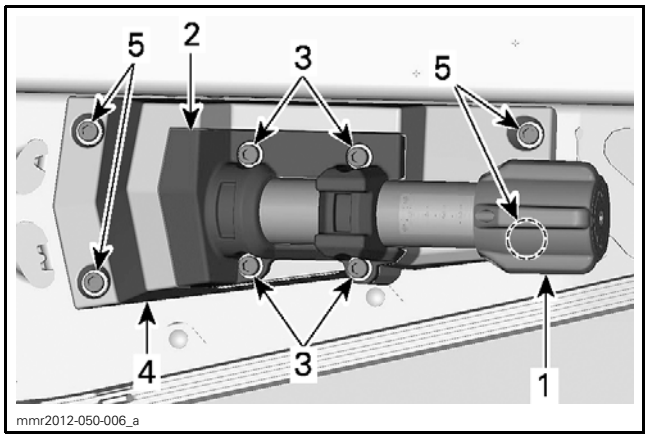
SPRING PRELOAD QUICK ADJUSTER SYSTEM


mmr2017-047-010

Removing Spring Preload Quick Adjuster Control Module

This procedure removes only the control module from the tunnel, without disconnecting the hose and will not necessitate bleeding the system.

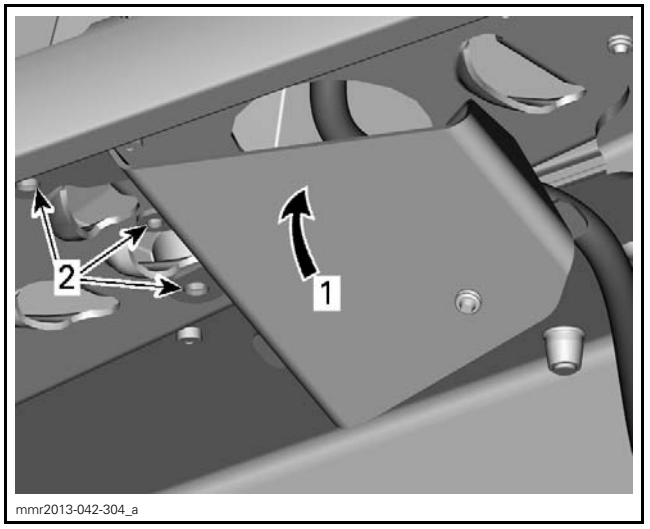
1. Remove the following parts:
   – Knob
   – Retaining clamp
   – Support.



mmr2012-050-006_a

SPRING PRELOAD QUICK ADJUSTER CONTROL MODULE
1. *Knob*
2. *Clamp*
3. *Clamp screws*
4. *Support*
5. *Support screws*

2. Remove front fasteners from hose guard.
3. Remove hose from its retainer tab and rotate hose guard outwards around rear rivet.



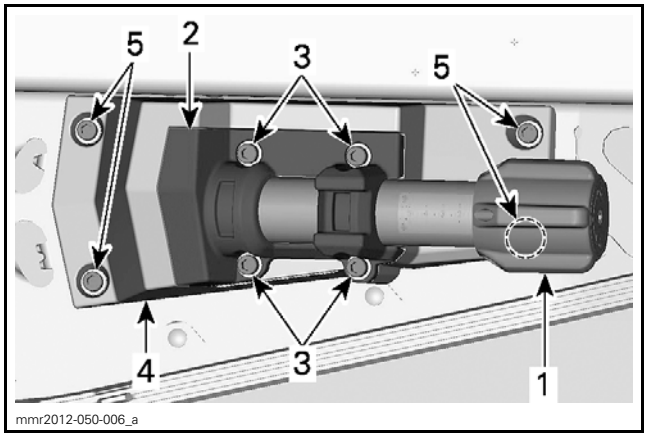
mmr2013-042-304_a

1. *Pivot outwards*
2. *Front fasteners*

4. Pass control cylinder through the opening in the tunnel.

Installing Spring Preload Quick Adjuster Control Module

1. Align the hose guard front holes with the support front holes.
2. Install parts as follows:

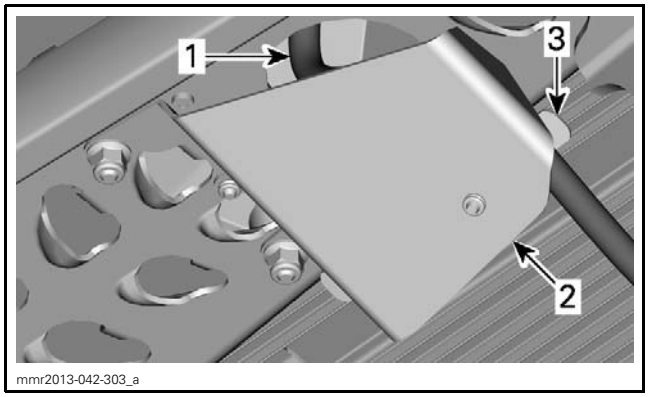


mmr2012-050-006_a

SPRING PRELOAD QUICK ADJUSTER CONTROL MODULE
1. *Knob*
2. *Clamp*
3. *Clamp screws*
4. *Support*
5. *Support screws*

TIGHTENING TORQUE	
Support screws	5 N•m ± 1 N•m (44 lbf•**in** ± 9 lbf•**in**)
Clamp screws	2.5 N•m ± 0.5 N•m (22 lbf•**in** ± 4 lbf•**in**)
Knob screw (apply LOCTITE 243 (BLUE) (P/N 293 800 060)	1.5 N•m ± 0.5 N•m (13 lbf•**in** ± 4 lbf•**in**)

3. Secure rear shock hose to hose guard bracket.



mmr2013-042-303_a

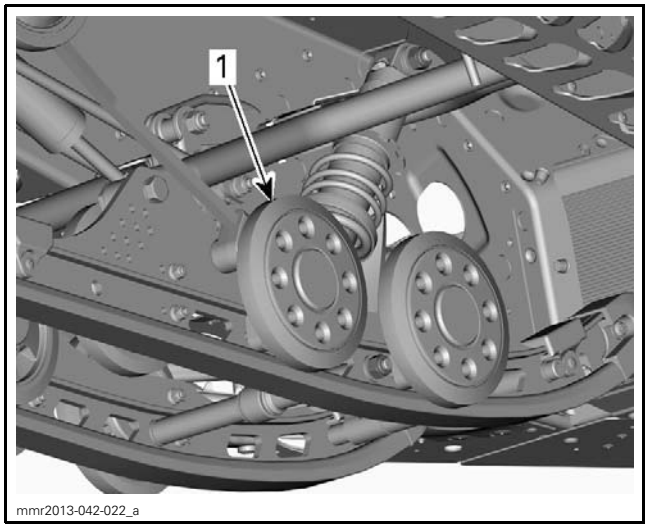
1. Hose
2. Hose guard
3. Hose guard bracket

Removing Spring Preload Quick Adjuster System

This procedure removes the following parts as an assembly and does not necessitate bleeding the system:

– Control module
– Hose
– Actuator.

1. Support the rear of vehicle just enough to remove load on the rear suspension.
2. Remove control module, refer to *SPRING PRELOAD QUICK ADJUSTER SYSTEM*.
3. Remove idler wheels to access spring support screws.



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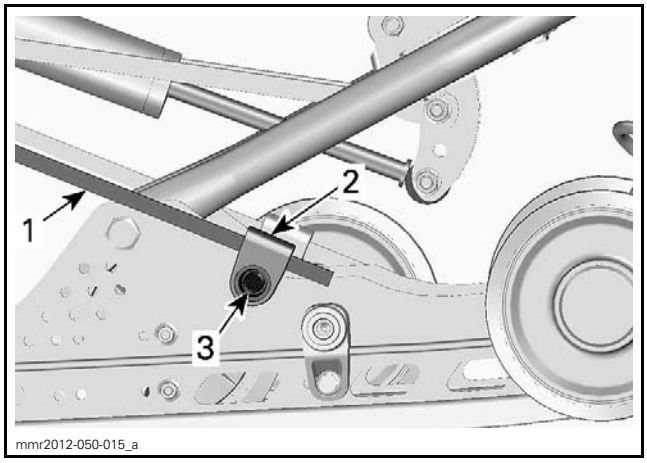
1. Idler wheel to be removed (on each side)

4. Firmly hold the spring supports and remove spring support bolts.

⚠ CAUTION Spring support are spring loaded.



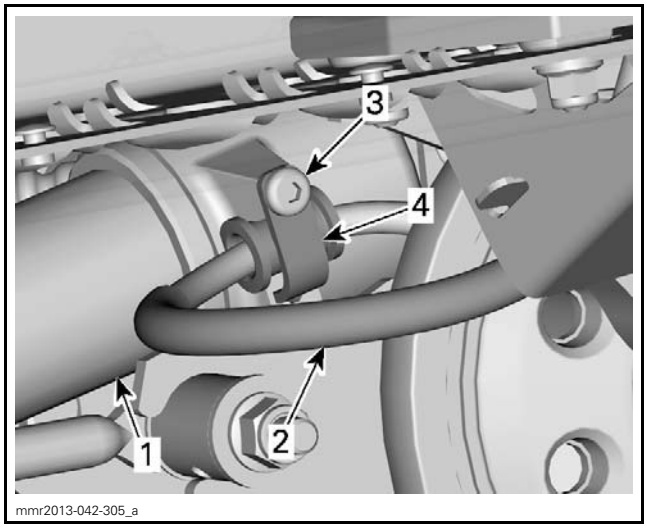
mmr2012-050-015_a

1. Spring
2. Spring support
3. Spring support bolt

5. Move spring supports with spring ends over the idler wheel supports and let them sit on the track.

NOTE: If the springs are still loaded, completely loosen track tension in order to make room to unload springs.

6. Move the other end of the springs off the spring adjuster actuator.
7. Remove hose retainer from shock assembly.



mmr2013-042-305_a

1. Shock
2. Hose
3. Retaining screw
4. Hose retainer

8. Remove actuator from rear arm.
9. Remove spring adjuster assembly.

Disassembling Spring Preload Quick Adjuster System

NOTE: System bleeding is required whenever the hose is disconnected.

NOTICE Thoroughly clean parts before disassembly. Work on a clean surface.

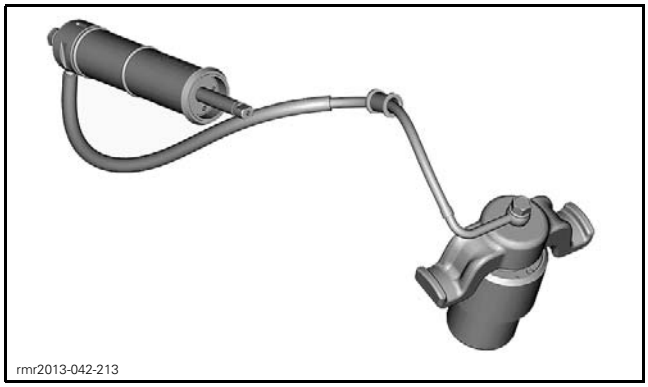
1. Set controller to the minimum preload.
2. Remove the banjo bolt(s) retaining the hose.
3. Drain fluid.

Replacing Spring Preload Quick Adjuster System Seals

NOTE: System bleeding is required whenever the hose is disconnected.

NOTICE Thoroughly clean parts before disassembly. Work on a clean surface.

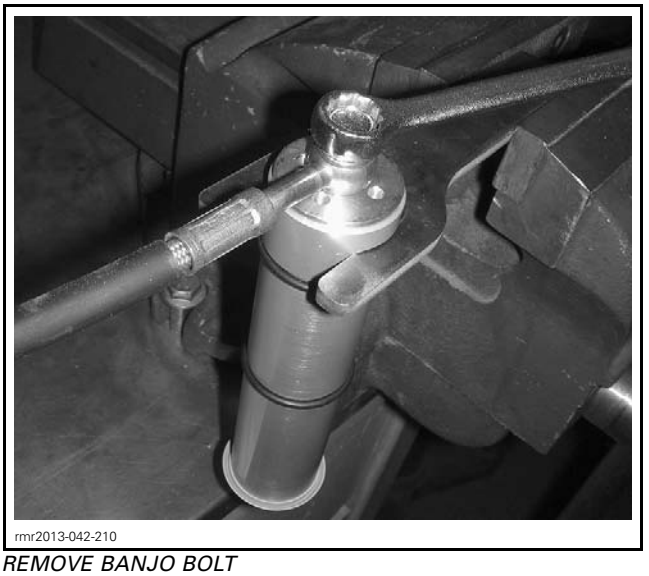
1. Remove quick adjuster assembly from vehicle. Refer to *REMOVING THE SPRING PRELOAD QUICK ADJUSTER CONTROL MODULE*.



QUICK ADJUSTER ASSEMBLY

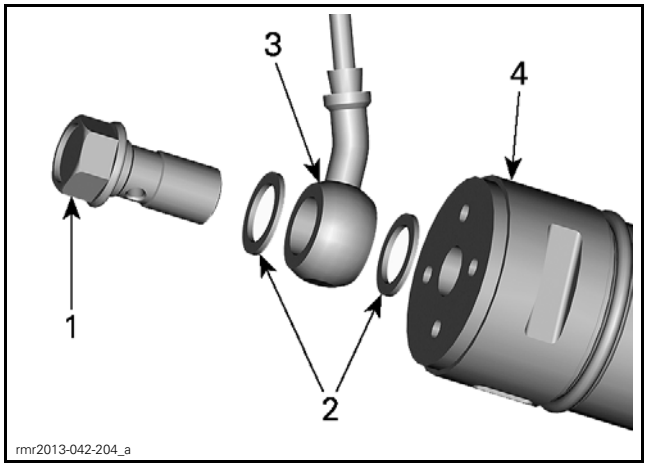
REQUIRED TOOL	
RMOTION MASTER CYLINDER KEY (P/N 529 036 254)	

2. Use retainer tool to hold cylinder while removing banjo bolt.



REMOVE BANJO BOLT

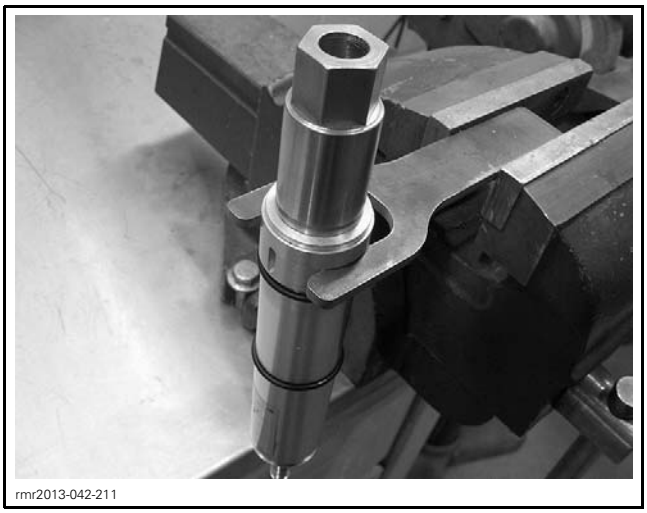
3. Remove banjo bolt, washers and hose from cylinder.



1. *Banjo bolt*
2. *Washer*
3. *Hose fitting*
4. *Cylinder body*

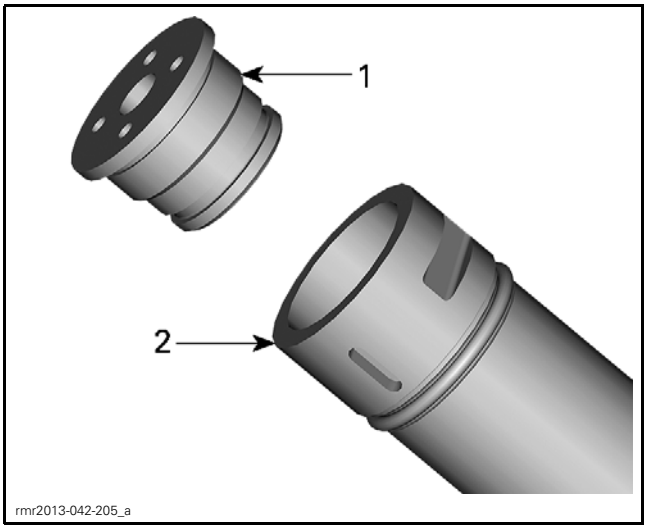
REQUIRED TOOL	
RMOTION MASTER CYLINDER KEY (P/N 529 036 254)	
RMOTION SOCKET (P/N 529 036 255)	

4. Hold cylinder body with tool and unscrew end cap using the rMotion socket.



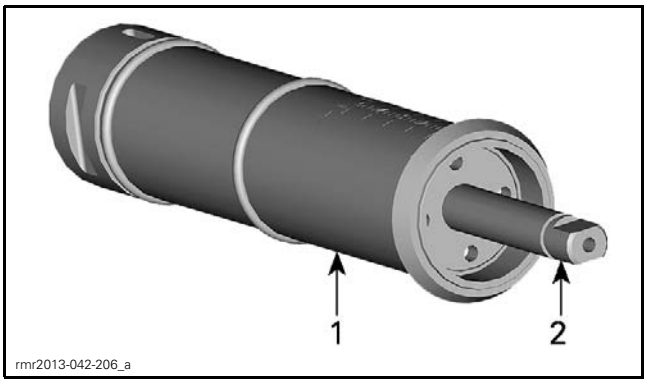
REMOVE END CAP

5. Remove end cap.



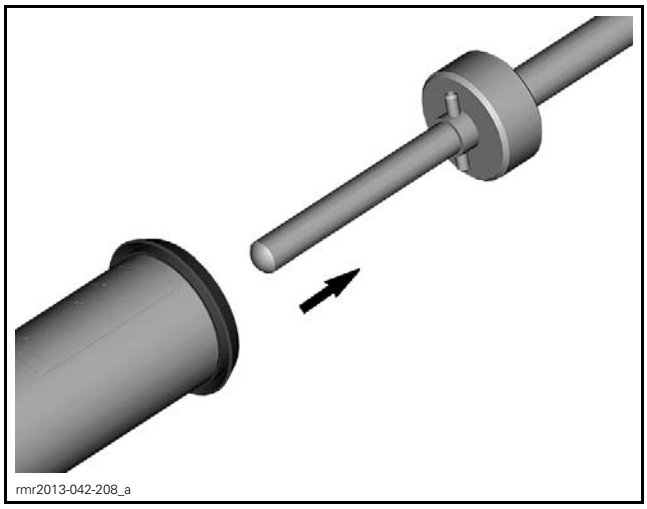
1. *End cap*
2. *Cylinder body*

6. At other end of cylinder, unscrew piston rod using same tools.



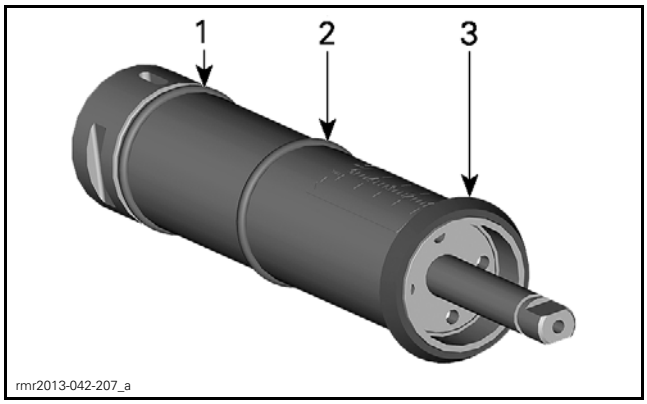
1. *Cylinder body*
2. *Piston rod*

7. Remove piston rod.



REMOVE PISTON ROD

8. Replace external seals if worn out or damaged.



1. *Cylinder Body front seal*
2. *Cylinder body rear seal*
3. *Knob seal*

9. Installation is the reverse of removal.

Bleeding and Reassembling Spring Preload Quick Adjuster System

NOTE: Actuator, control module and hose have to be separated from each other before carrying out bleeding procedure.

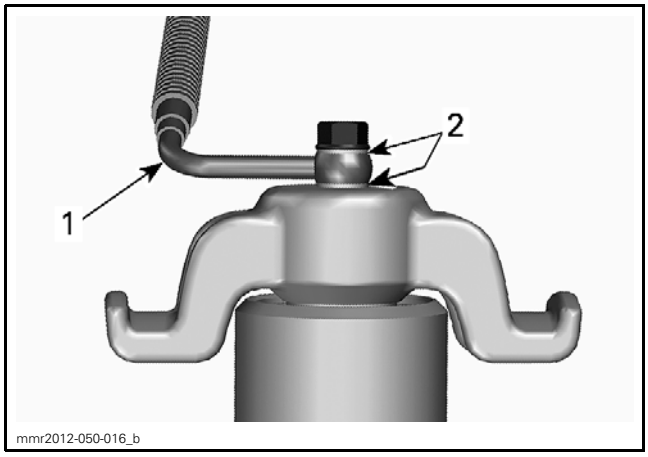
1. Fully extend the actuator by hand.
2. Add fluid in the actuator, see table.

ACTUATOR FILLING	
FLUID TYPE	QUANTITY
ATF Dexron III	Approximately 40 ml (1.35 U.S. oz)

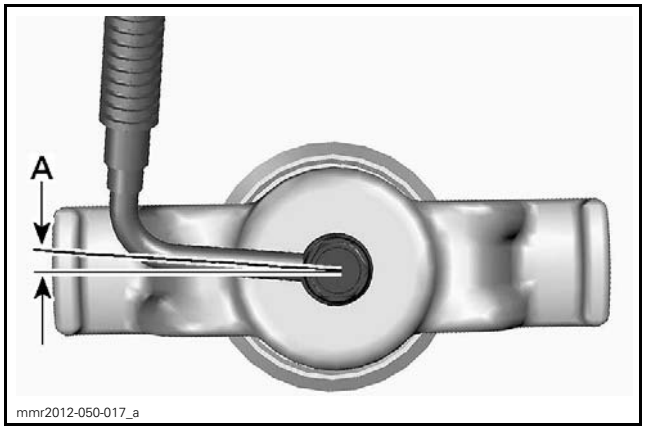
3. Maintain actuator with threaded hole upwards and:
   3.1 Compress the actuator by precisely 15 mm (19/32 in).

3.2 Fill until fluid reaches the top of the threads.

3.3 Install hose with new sealing washers as shown.



1. Hose
2. Sealing washers



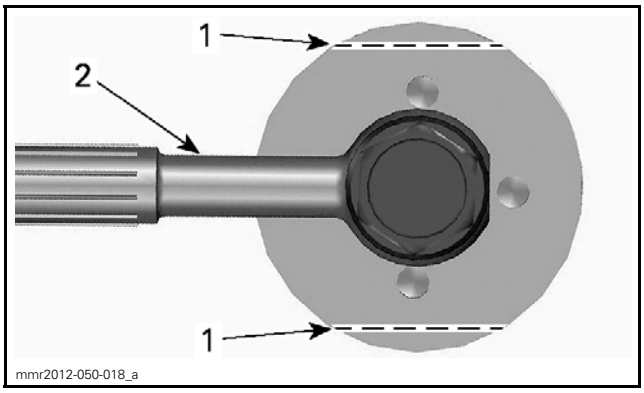
A. 5°

TIGHTENING TORQUE	
Banjo bolt	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

4. With the hose open end up, compress the actuator by precisely 8 mm (5/16 in).

NOTE: Fluid should reach the open end of the hose.

5. Unscrew the control cylinder adjustment rod until it stops.
6. Using a small diameter punch through the M10 threaded hole, push the control cylinder piston all the way back.
7. With the threaded hole up, fill control cylinder until fluid reaches the top of the threads.
8. Install the hose on the control cylinder as shown.



1. Notches
2. Hose

NOTE: The hose must on be the opposite side of the decal on the control cylinder.

TIGHTENING TORQUE	
Banjo bolt	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

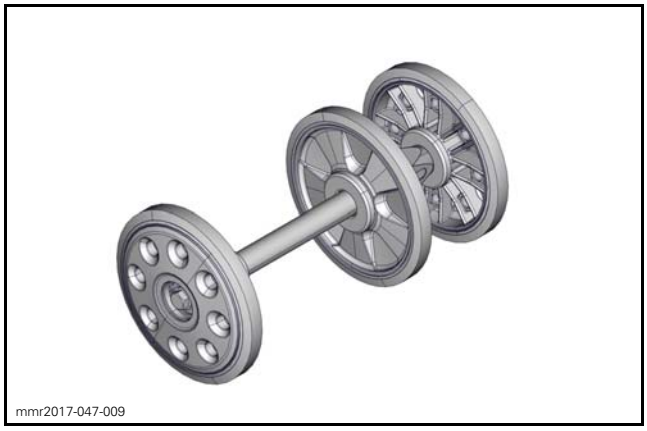
9. Verify system operation. The actuator full stroke should be 22 mm (7/8 in).

Installing Spring Preload Quick Adjuster System

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

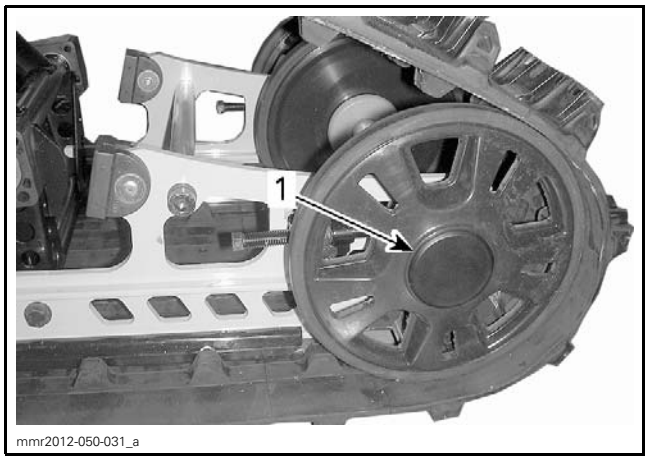
Set the preload to the minimum using the control cylinder adjustment rod first.

REAR AXLE



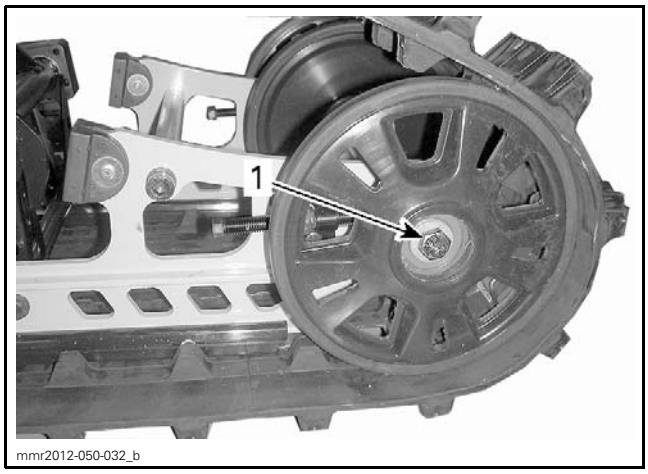
Removing Rear Axle

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



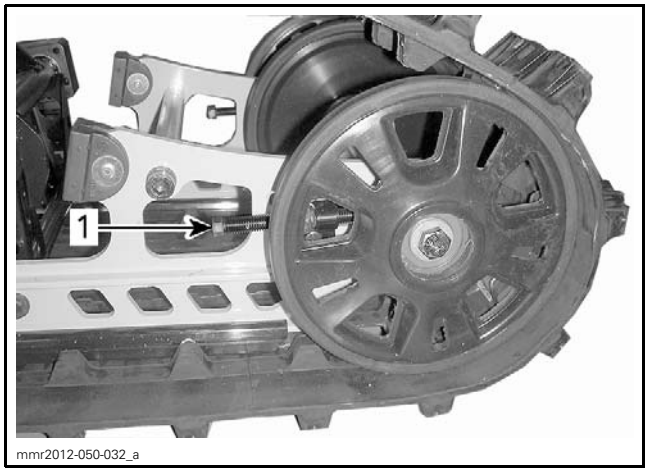
1. RH rear idler wheel cap

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



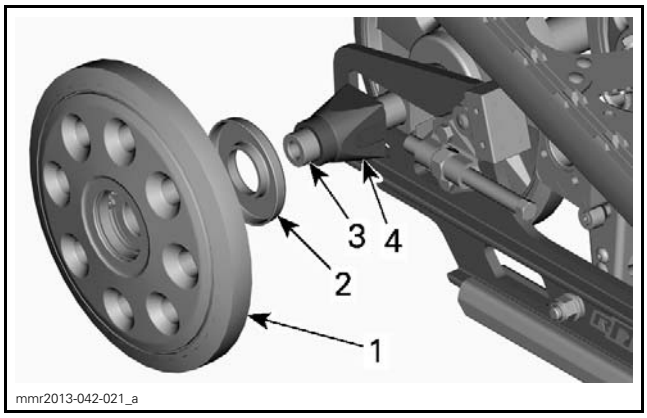
1. RH rear axle screw

4. Completely loosen track tension by unscrewing both adjustment screws.



1. RH adjustment screw

5. Remove both rear axle screws.
6. Remove rear idler wheels, seals and wheel spacers.



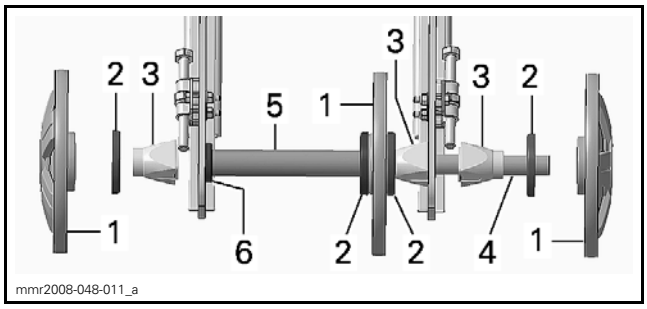
TYPICAL - RH SIDE SHOWN
1. Rear idler wheel
2. Seal
3. Rear axle
4. Wheel spacer

7. Pull out the rear axle.

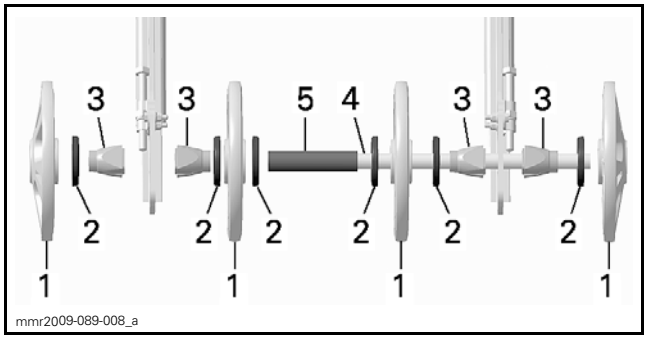
Installing Rear Axle

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

Make sure to position all parts correctly.

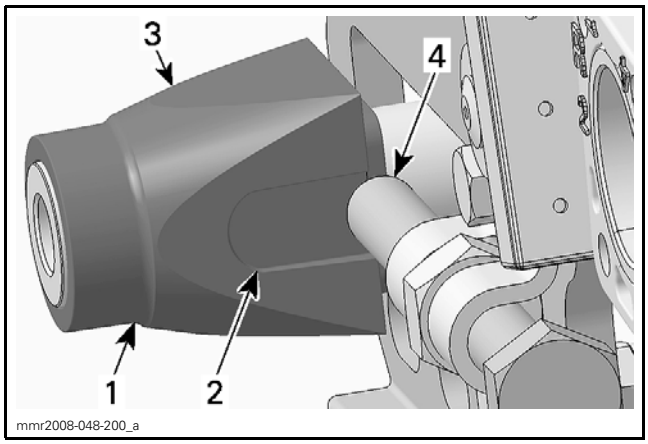


TYPICAL - 3 IDLER WHEELS LAYOUT
1. Idler wheels
2. Seals
3. Wheel spacers
4. Rear axle
5. Rear axle spacer
6. Washer



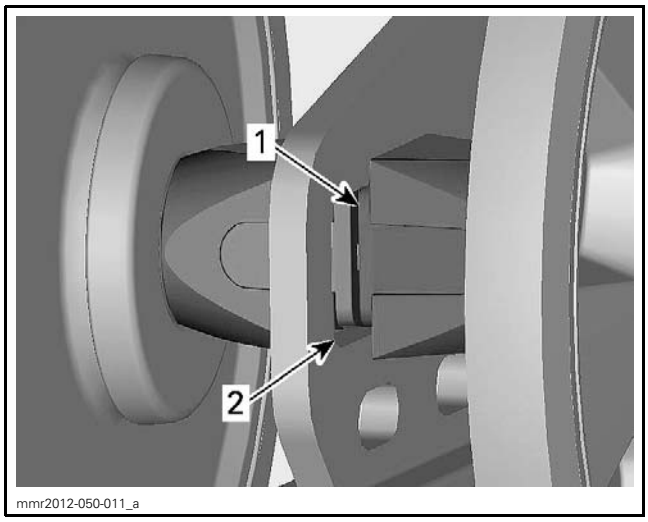
TYPICAL - 4 IDLER WHEELS LAYOUT
1. Idler wheels
2. Seals
3. Wheel spacers
4. Rear axle
5. Rear axle spacer

Position wheel spacers with a flat side up and a groove facing tensioner screw.



TYPICAL
1. *Wheel spacer*
2. *Groove*
3. *Flat side*
4. *Tensioner screw*

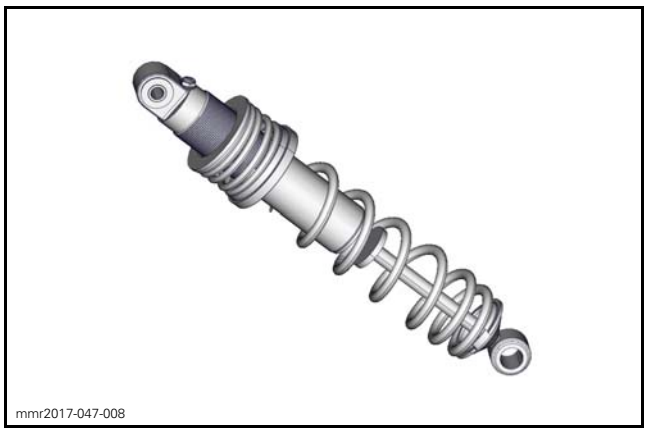
When tightening rear axle, make sure each wheel spacer protuberance is engaged into rail slot.



1. *Wheel spacer protuberance*
2. *Rail slot*

Adjust track tension. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

SHOCK ABSORBERS



Removing Rear Shock Absorber

1. Lift rear of vehicle and support it off the ground.

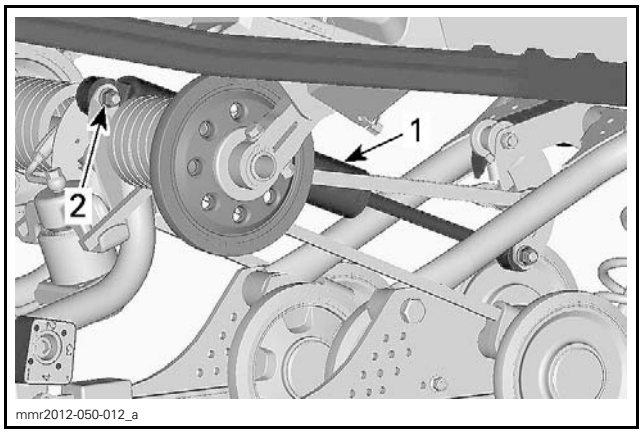
rMotion with Quick Adjust System

2. Carry out *REMOVING THE SHOCK DAMPING QUICK ADJUSTER CONTROL MODULE*, Refer to procedure in this subsection.

All Models

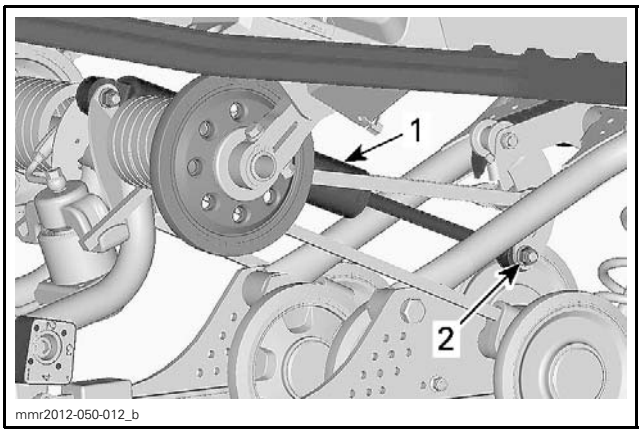
3. Remove the upper bolt.

NOTE: It may be necessary to lower the vehicle and slightly compress suspension to remove load.



TYPICAL
1. *Rear shock absorber*
2. *Upper bolt*

4. Remove the lower bolt.



TYPICAL
1. *Rear shock absorber*
2. *Lower bolt*

5. Remove rear shock absorber from the vehicle.

Installing Rear Shock Absorber

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

REAR SHOCK ABSORBER POSITIONING	
rMotion quick with adjust system	Body up hose on RH side
rMotion quick without adjust system	Body up reservoir downwards

Install new shock absorber retaining nuts and tighten to specified torque.

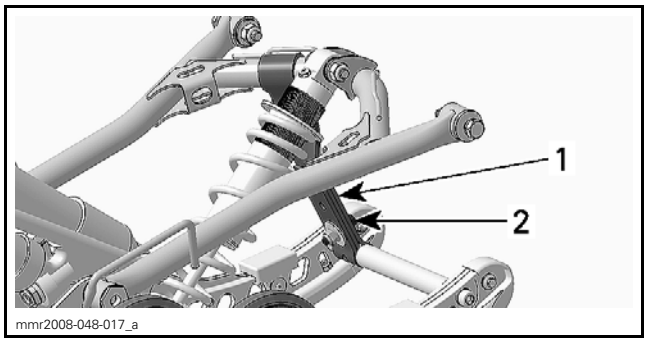
TIGHTENING TORQUE	
Shock absorber retaining bolts	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

rMotion with Quick Adjust System

Carry out *INSTALLING THE SHOCK DAMPING QUICK ADJUSTER CONTROL MODULE*.

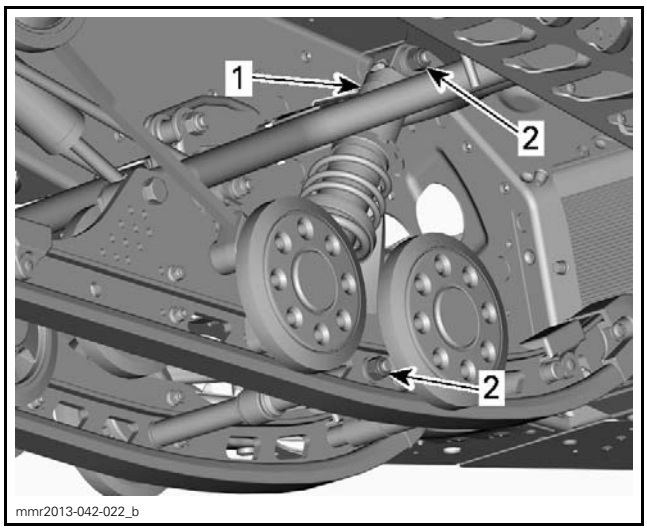
Removing Center Shock Absorber

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 idler wheels to access lower retaining bolt.
4. Remove shock retaining bolts.



TYPICAL
1. *Center shock absorber*
2. *Retaining bolts*

5. Remove shock absorber from vehicle.

Inspecting Shock Absorber

NOTE: All types of shock absorbers are covered in this topic, refer to *TECHNICAL SPECIFICATIONS* to identify the shock absorber relating to the vehicle model.

NOTE: Unless otherwise noted, shock absorber must be at normal room temperature (21°C ± 2°C (70°F ± 36°F)) during inspection.

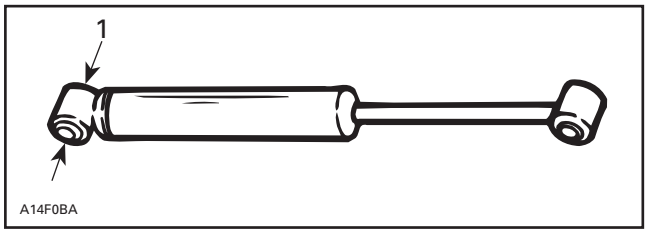
MC Hydraulic Shock

1. Perform a visual inspection of the shock:
   - The shock must be exempt of any dent or scratch, especially on the rod.
   - Small dent on the shock body may not affect any performance or reliability of this shock.

– Any defect on the rod, as small as it is, can lead to seal failure and oil leak.
– If such defect (on rod) is detected, the shock must be replaced, and this will not be cover under warranty.

2. Secure the shock body end in a vise, clamping on eyelet, with its rod upward.

NOTICE **Do not clamp directly on shock body.**



1. Shock body eyelet

3. Examine shock for leaks. Extend and compress the piston at least 5 complete strokes with its rod upward.
4. Check that shock moves smoothly and with uniform resistance over its entire stroke.

NOTE: For the first 5 complete strokes, it could be normal to note uneven resistance.

5. Check the following conditions that will denote a defective shock:
   – A skip or a hang back when reversing stroke at mid travel.
   – Seizing or binding condition except at extreme end of either stroke.
   – Oil leakage.
   – A gurgling noise, after completing one full compression and extension strokes.
6. If suspecting a shock is freezing, place shock in a freezer (temperature below 0°C (32°F)) for 4 hours.
7. Push down on rod and note its resistance. If shock is frozen it will be much more difficult to compress than one in normal condition.
8. If any faults are present, replace shock.

All HPG™ Shock (Including KYB PRO Series)

1. Perform a visual inspection of the shock:
   – The shock must be exempt of any dent or scratch, especially on the rod.
   – Any defect on the rod, as small as it is, can lead to seal failure and oil leak.
   – If such defect is detected, the shock must be replaced and this will not be covered under warranty.
2. Completely push down shock rod into the body and check result as per table.

HPG SHOCK	RESULT
All except 551 mm (21-11/16 in) rear shock	The rod should completely get in the shock body
551 mm (21-11/16 in) rear shock	The stroke must be at least 138 mm (5-7/16 in)

NOTE: For the **HPG Variable Rate Shock**, it should be stiff for approximately the first 25 mm (1 in), then softer for about 50 mm (2 in), and stiffer again. This stiff/soft/stiff phenomenon shows the normal operation of VR shock.

3. Release shock from completely collapsed position and check result as per table.

HPG SHOCK EXCEPT VARIABLE RATE
– The shock should extend unassisted. – The rod must come out at a steady speed.

HPG VARIABLE RATE SHOCK
– The shock should extend unassisted. – Rod must come out slowly first, than faster and finally slow again for the last 25 mm (1 in).

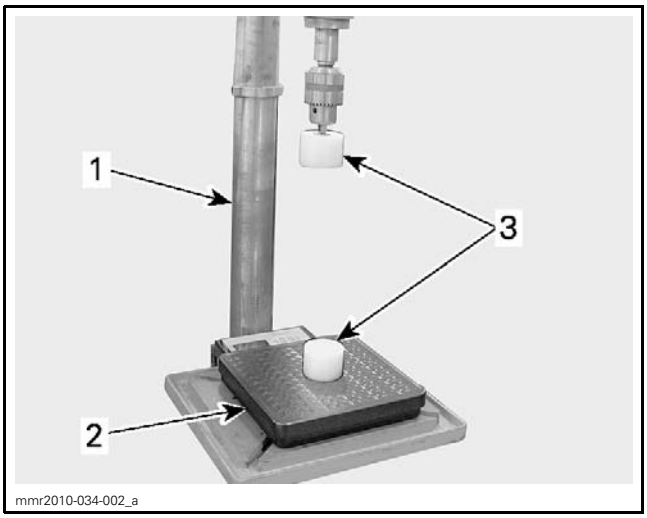
4. Proceed with *TESTING SHOCK ABSORBER COMPRESSION*. See procedure in this subsection.
5. If any faults are present, replace shock.

Testing Shock Absorber Compression

1. Ensure shock absorber is at normal room temperature (21°C ± 2°C (69.8°F ± 35.6°F).
2. Remove spring from shock absorber (if applicable).
3. Place a BENCH SCALE (P/N SALTER BRECKNELL PS 400) (or an equivalent) on a suitable drill press.

REQUIRED TOOL	
SHOCK ABSORBER SUPPORTS (P/N 529 036 186)	

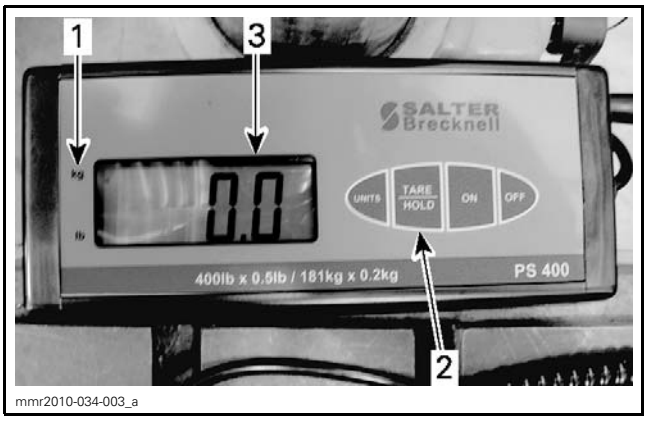
4. Install the shock absorber support onto drill press.
5. Set bench scale units to **kg**.



mmr2010-034-002_a

1. *Drill press*
2. *Bench scale*
3. *Shock absorber supports*

6. Press TARE to reset digits (must indicate zero).



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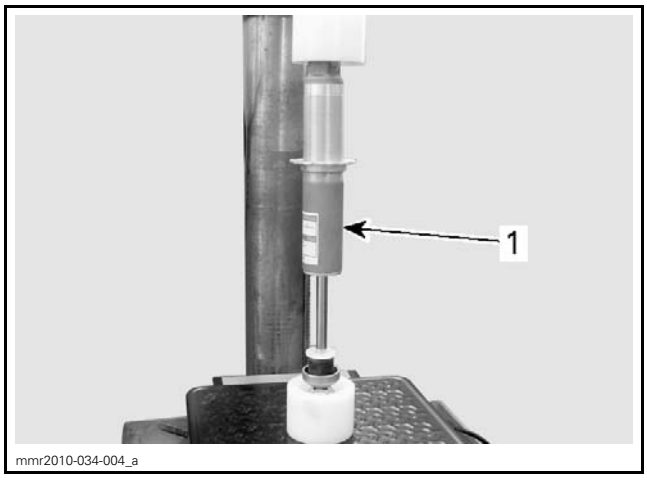
1. *Units indicator lamp*
2. *TARE button*
3. *Digits*

7. Install shock absorber into support with shock body upwards.
8. Adjust drill press table height in order to set the upper shock support flush with the shock body end.
9. Ensure shock absorber is aligned with drill press axis.



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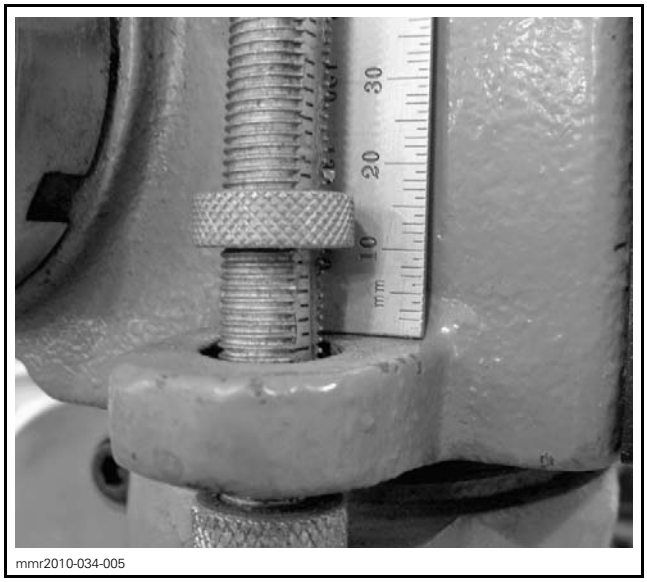
1. *Shock body upwards*

10. Set the drill press displacement to 10 mm (.394 in) using locking nut.



mmr2010-034-005

11. Compress shock absorber by 10 mm (.394 in) and hold it in position.
12. Read load recorded on the bench scale.

mmr2010-034-006

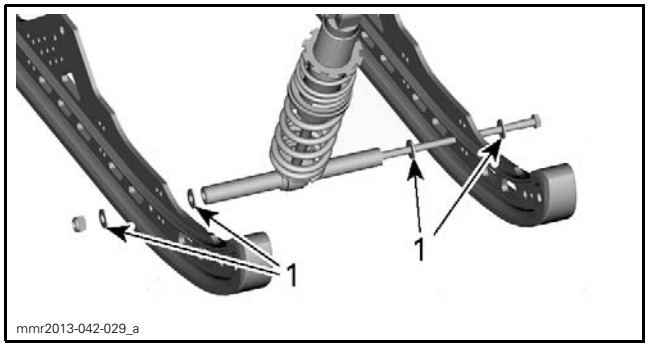
13. Load reading must be as per the following table.

MODEL	ROD DIAMETER	SERVICE RANGE
Every HPG (Plus/Plus R)	12.5 mm (1/2 in)	24 kgf ± 4 kgf (53 lbf ± 9 lbf)
All KYB PRO Series	16 mm (5/8 in)	39 kgf ± 5 kgf (86 lbf ± 11 lbf)

Installing Center Shock Absorbers

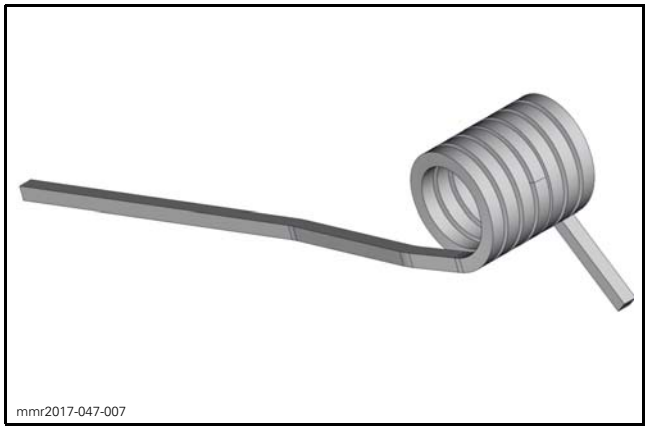
Installation is reverse of removal procedure. However, pay attention to the following.

CENTER SHOCK ABSORBER POSITIONING	
HPG Plus	Body up Valve upwards
KYB PRO	Body up Reservoir on the RH side



BOTTOM OF SHOCK ABSORBER
1. Washers location

REAR SPRINGS



Removing Rear Springs

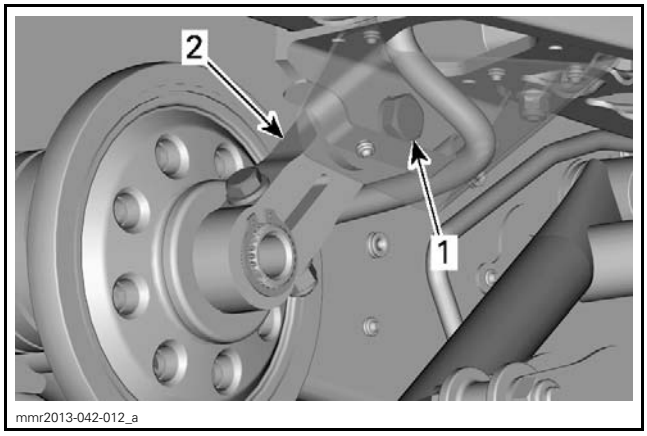
1. Support the rear of vehicle just enough to remove load on the rear suspension.
2. Set rear spring preload to the minimum.

rMotion with Quick Adjust System

3. Remove quick adjuster control modules, refer to:
   - *SHOCK DAMPING QUICK ADJUSTER SYSTEM*
   - *SPRING PRELOAD QUICK ADJUSTER SYSTEM*.

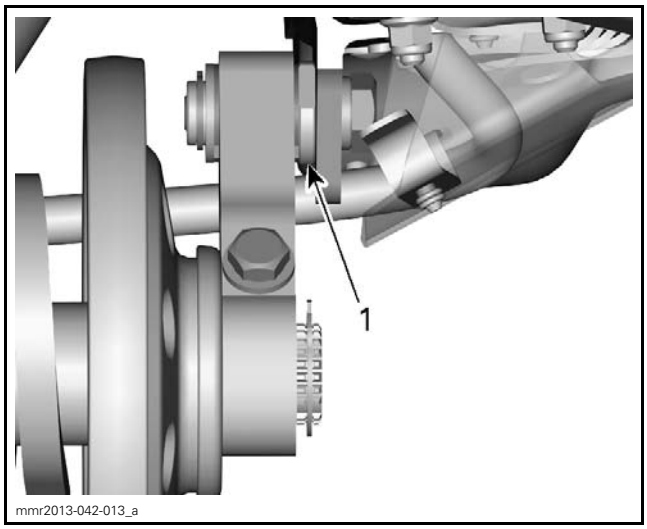
All Models

4. Remove rear arm connecting rod retaining screws.



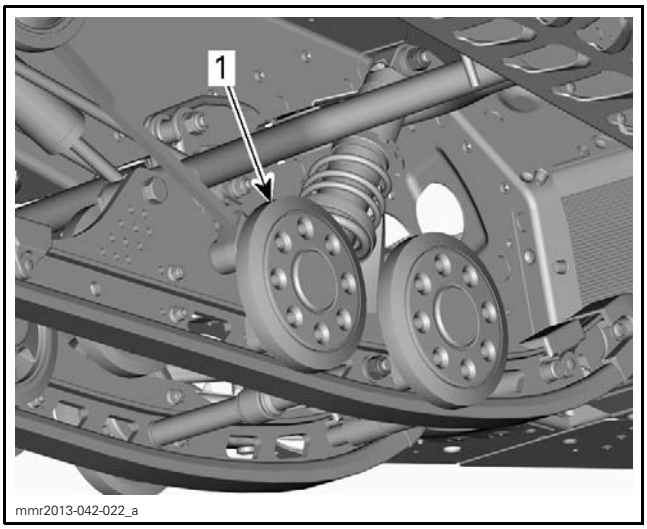
1. Connecting rod retaining screw
2. Connecting rod

REQUIRED TOOL	
RMOTION SUSPENSION TOOL (P/N 529 036 234)	



1. rMotion suspension tool to be installed here

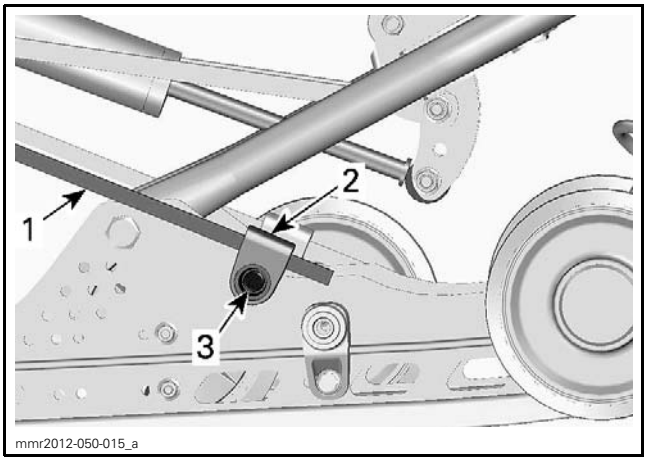
5. Remove idler wheels to have access to spring support screws.



1. Idler wheel to be removed (on each side)

6. Firmly hold the spring supports and remove spring support bolts.

⚠ CAUTION Spring support are spring loaded.



1. Spring
2. Spring support
3. Spring support bolt

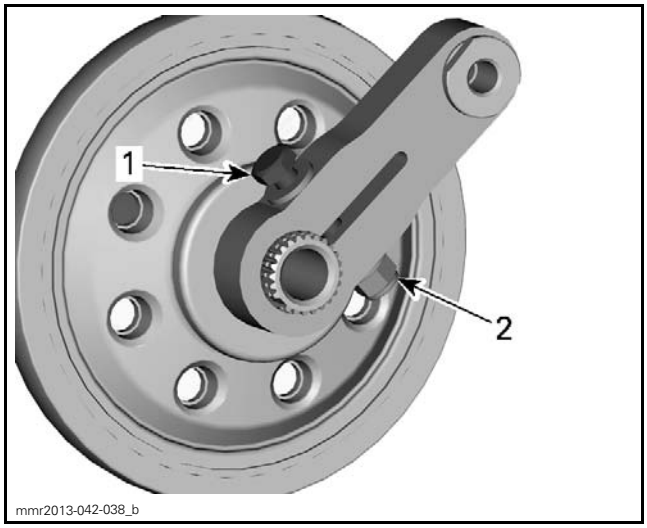
7. Move spring supports with spring ends over the idler wheel supports and let them sits on the track.

NOTE: If the springs are still loaded, completely loosen track tension in order to make room to unload springs.

8. Raise and support the rear of vehicle just enough to clear the rear arm connecting rods.

NOTICE rMotion with Quick Adjust system: Avoid stretching the hoses.

9. Remove connecting rods from the rear arm.
   9.1 Loosen bolt.
   9.2 Remove circlip.
   9.3 Pull connecting rod off the rear arm.



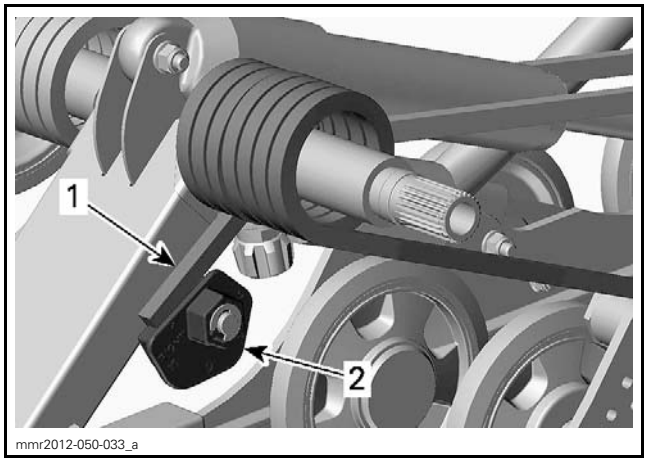
1. Retaining screw
2. Bolt

10. Remove upper idler wheels and hardware.
11. Remove rear spring from suspension.

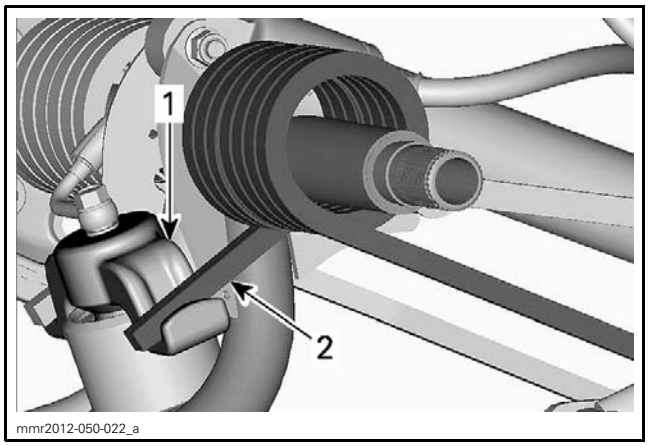
Installing Rear Springs

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

Make sure that spring end is in cam adjuster or actuator spring support.

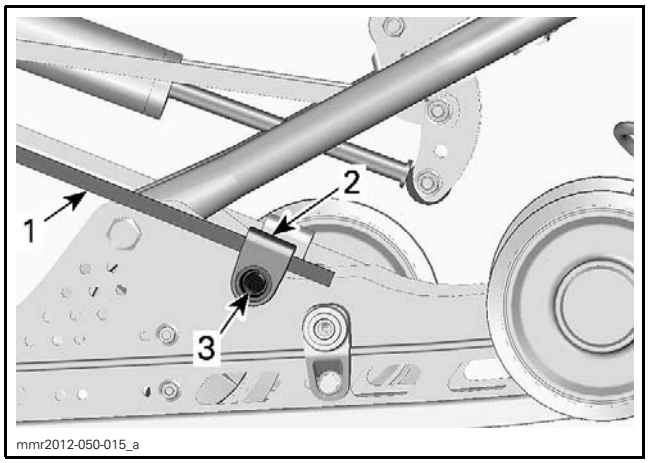


MODELS WITHOUT QUICK-ADJUST
1. Rear spring
2. Cams



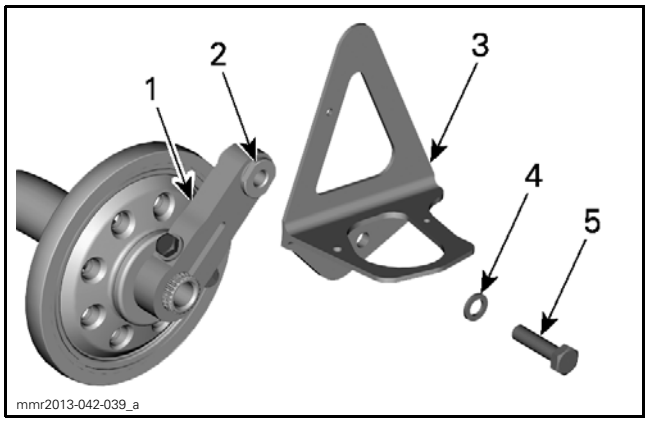
QUICK-ADJUST MODELS
1. *Actuator spring support*
2. *Rear spring*

Install spring supports upwards.



1. *Spring*
2. *Spring support*
3. *Spring support bolt*

Install rear arm connecting rod inserts with the shoulder outwards.

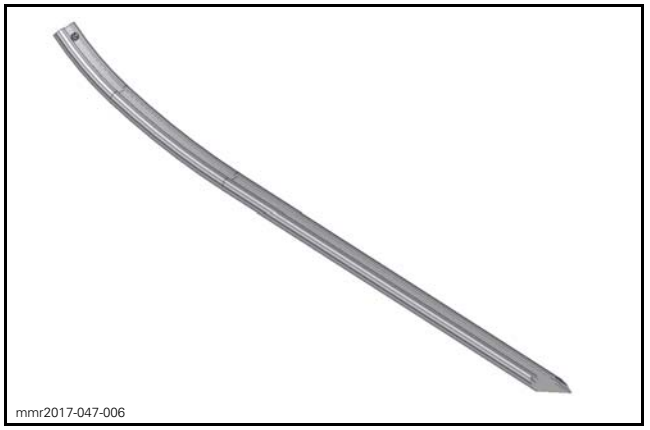


1. *Connecting rod*
2. *Insert with the shoulder outwards*
3. *Support*
4. *Washer*
5. *Retaining screw*

rMotion with Quick Adjust System

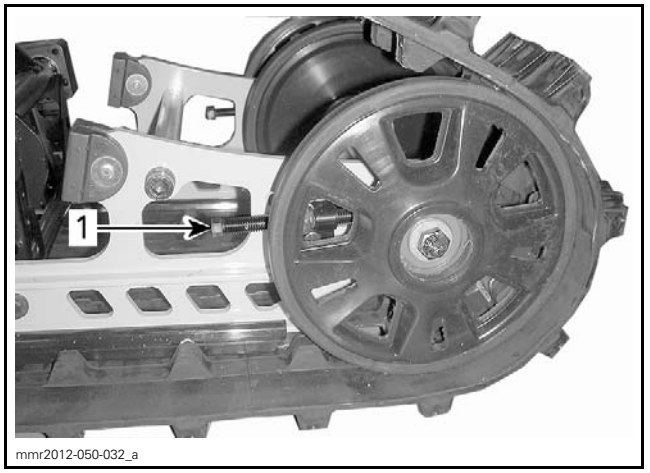
Install quick adjuster control modules, refer to:
– *SHOCK DAMPING QUICK ADJUSTER SYSTEM*
– *SPRING PRELOAD QUICK ADJUSTER SYSTEM*.

SLIDER SHOES



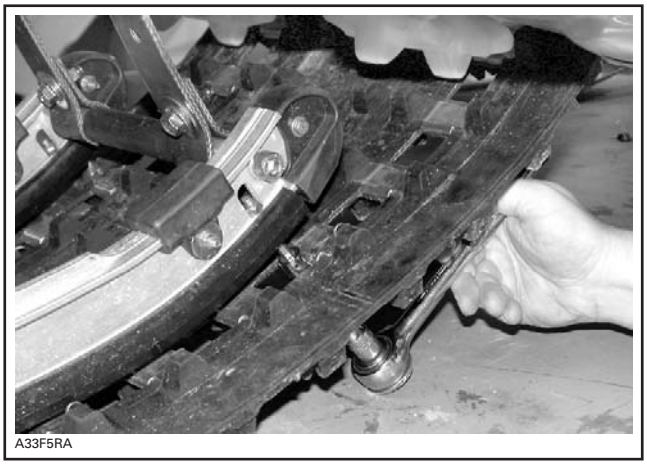
Removing Slider Shoes

1. Lift rear of vehicle and support it off the ground.
2. Completely loosen track tension by unscrewing both adjustment screws.



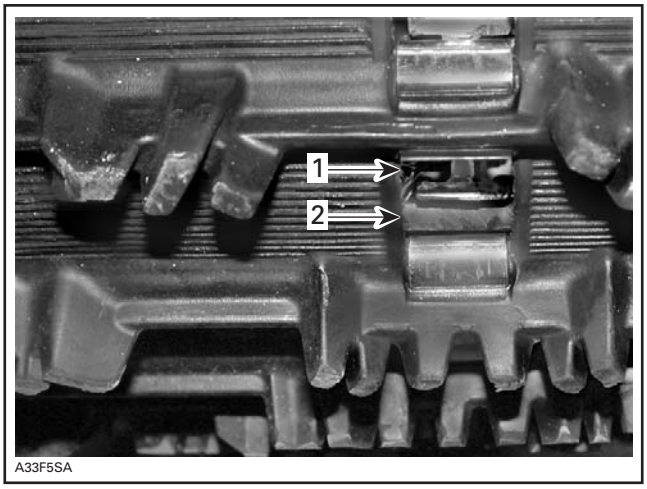
1. *RH adjustment screw*

3. Remove nut and screw of each runner.


A33F5RA

TYPICAL - REMOVE NUT AND SCREW OF EACH RUNNER

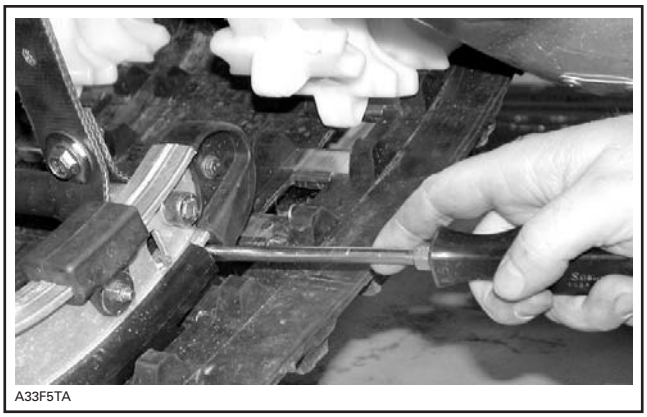
4. At the rear of vehicle, align a track window with slider shoe.



A33F5SA

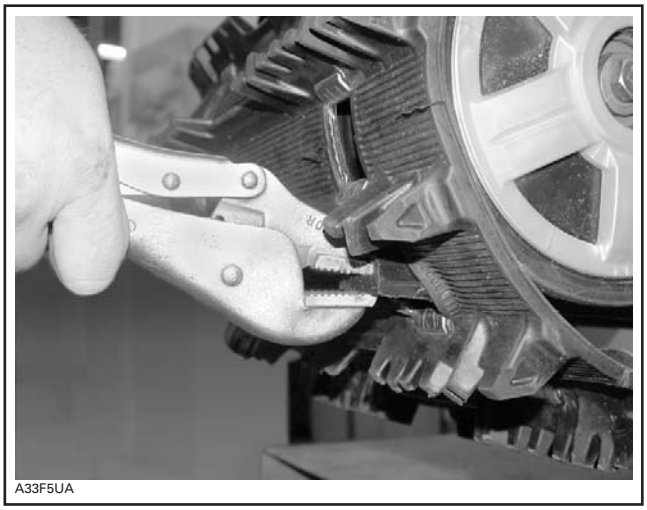
TYPICAL
1. Track window
2. Slider shoe

5. Lubricate widow edges.
6. Using a pry bar or a screwdriver, push slider shoe rearward until it comes in contact with track.


A33F5TA

TYPICAL - PUSH ON SLIDER SHOE

7. Using locking pliers, pull slider shoe through track window to remove.


A33F5UA

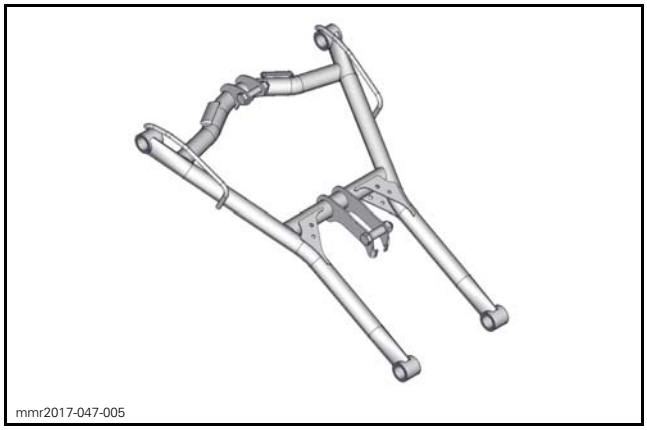
TYPICAL - PULL ON SLIDER SHOE TO REMOVE

Installing Slider Shoes

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

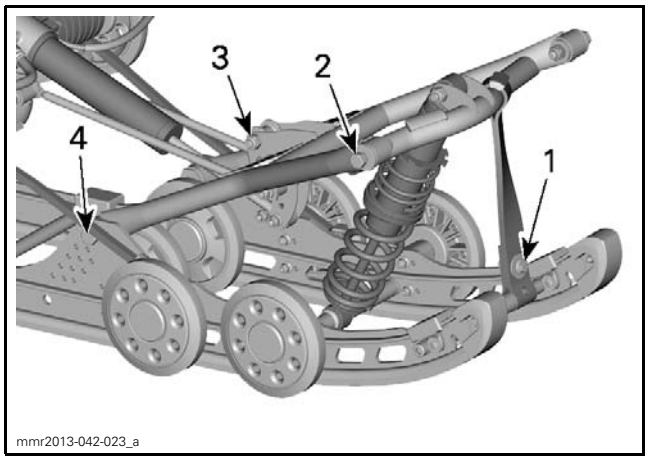
Make sure to insert slider shoe end with hole first.

FRONT ARM


mmr2017-047-005

Removing Front Arm

1. Proceed with *REMOVING THE SUSPENSION ASSEMBLY*. Refer to procedure in this subsection.
2. Unfasten stopper strap.
3. Remove the following fasteners:
   – Center shock to front arm
   – Front arm to rocker
   – Front arm to rail.



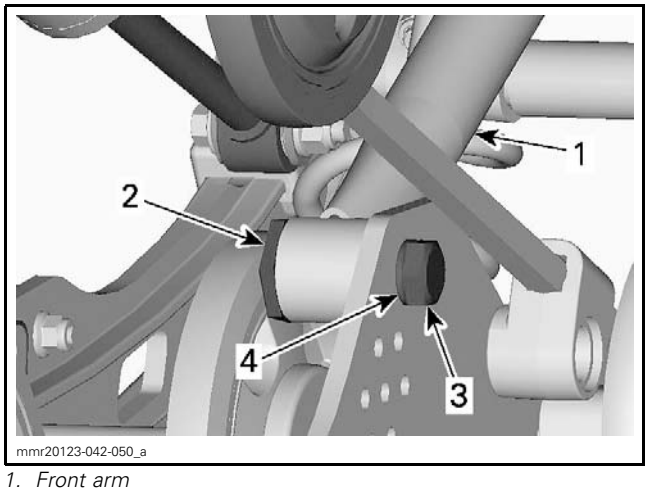
TYPICAL
1. *Stopper strap bolt*
2. *Center shock to front arm bolt*
3. *Front arm to rocker bolt*
4. *Front arm to rail screw*

4. Remove front arm from suspension assembly.

Installing Front Arm

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

Install front arm to rail fasteners as shown.

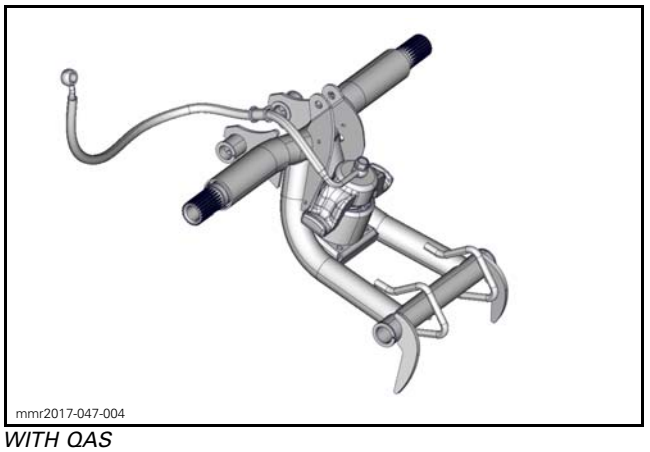


1. *Front arm*
2. *Insert (shoulder inward)*
3. *Front arm to rail screw*
4. *Washer*

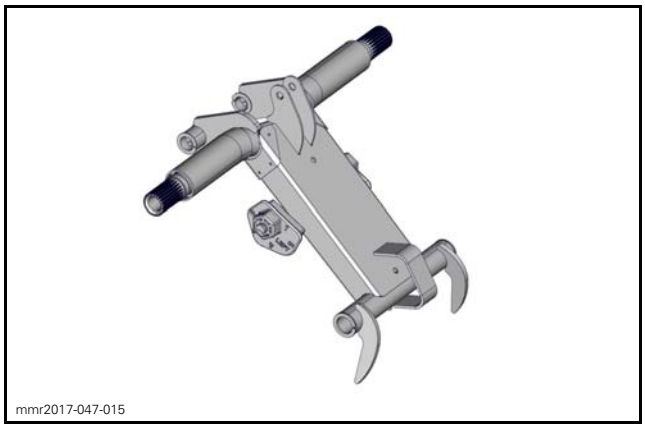
Install stopper strap on the LH side of the vehicle.

NOTICE Incorrect stopper strap installation would cause suspension parts interference.

REAR ARM



WITH QAS



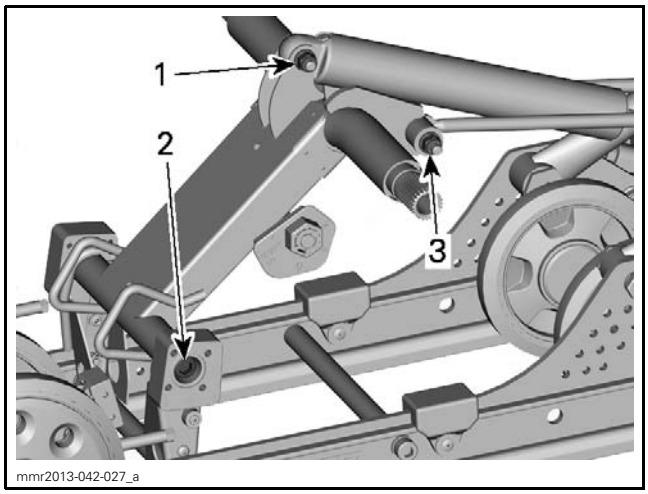
WITHOUT QAS

Removing Rear Arm

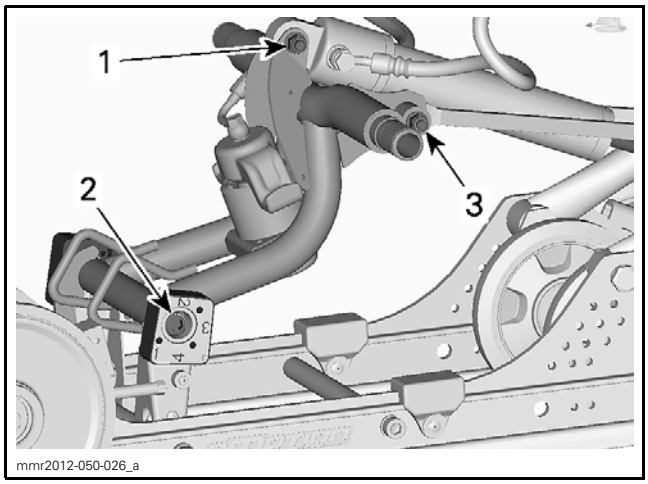
1. Remove rear springs, refer to *REMOVING REAR SPRINGS* in this subsection.

NOTE: On Quick Adjust models, set the spring preload actuator aside.

2. Remove the following fasteners:
   - Rear shock to rear arm
   - Rear arm to throttle rods
   - Coupling blocks retaining screws.



MODELS WITHOUT QUICK ADJUST SYSTEM
1. *Rear shock to rear arm bolt*
2. *Coupling blocks retaining screw*
3. *Rear arm to throttle rods bolt*



QUICK ADJUST SYSTEM
1. *Rear shock to rear arm bolt*
2. *Coupling blocks retaining screw*
3. *Rear arm to throttle rods bolt*

3. Remove rear arm from the vehicle.

Installing Rear Arm

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

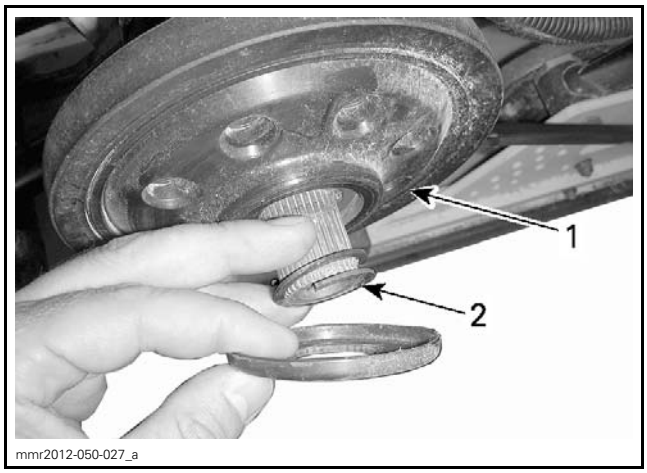
rMotion Without Quick Adjust System

Place rear arm grease fitting towards the front of the vehicle.

All Models

Install coupling block with new socket screws.

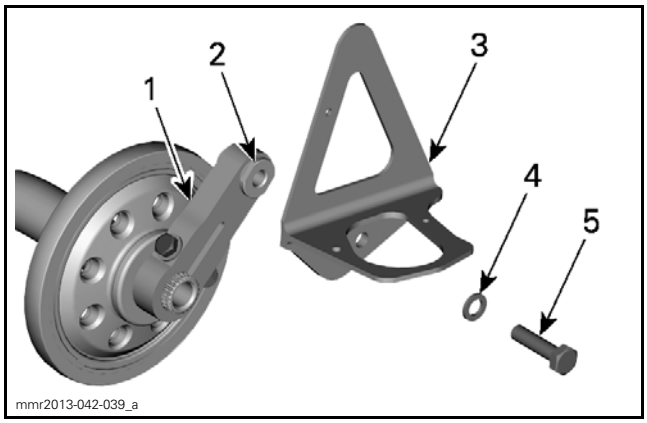
Install upper idler wheels as shown.



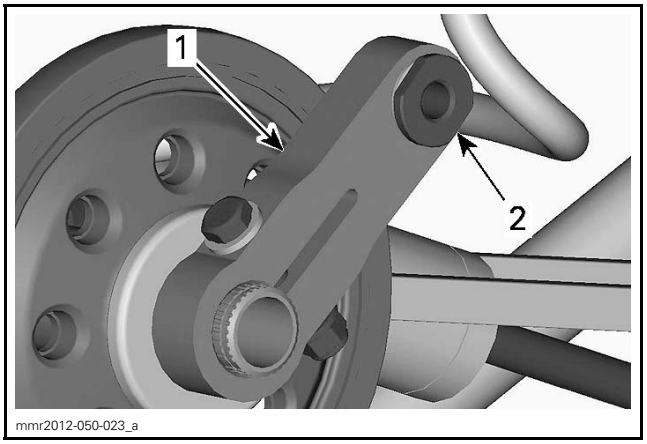
1. *Convex side out*
2. *Spring between wheel and plastic cover*

Install rear arm connecting rod inserts with the shoulder outwards.

Install circlip.



1. *Connecting rod*
2. *Shoulder outwards*
3. *Support*
4. *Washer*
5. *Retaining screw*

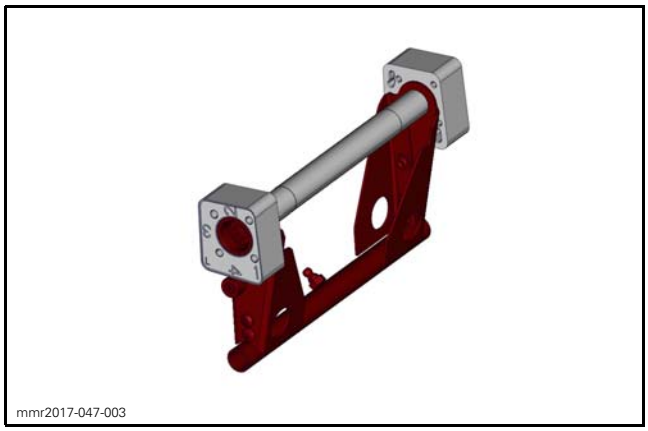


1. *Connecting rod*
2. *Shoulder outwards*

Install new connecting rod retaining screws.

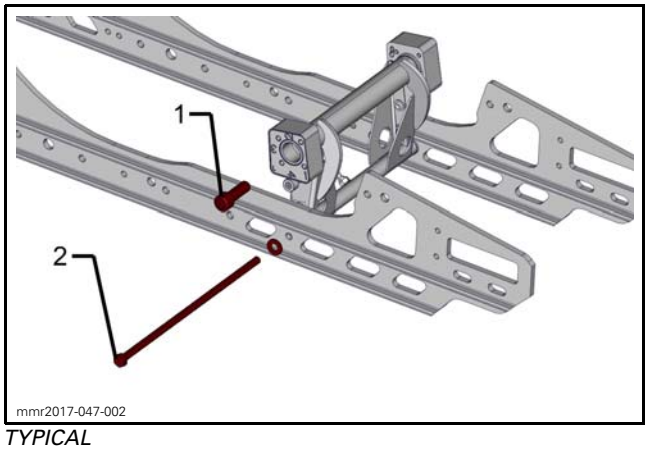
Lubricate rear arm pivot. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

PIVOT ARM



Removing Pivot Arm

1. Lift rear of vehicle and support it off the ground.
2. Completely loosen track tension by unscrewing both adjustment screws.
3. Set the rear springs preload to the minimum.
4. Remove rear spring supports.
5. Remove the following fasteners:
   – Coupling blocks retaining screws
   – Pivot arm to rails bolt.



TYPICAL
1. Coupling block screw
2. Pivot arm to rails bolt

6. Carefully remove pivot arm from rear arm.

Installing Pivot Arm

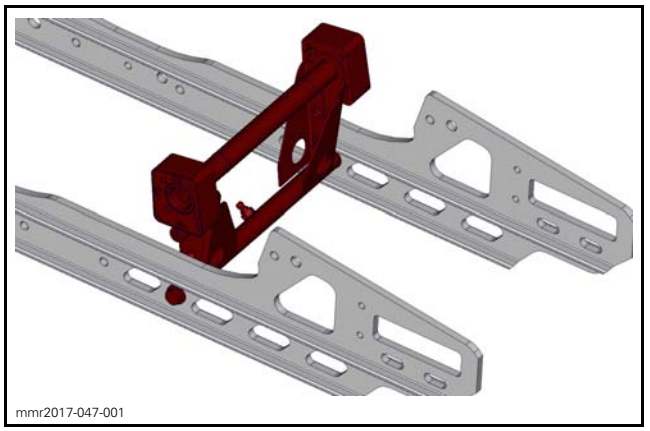
The installation is the reverse of the removal procedure. However, pay attention to the following.

Install new coupling block screws.

Install pivot arm with the grease fitting towards front of the vehicle.

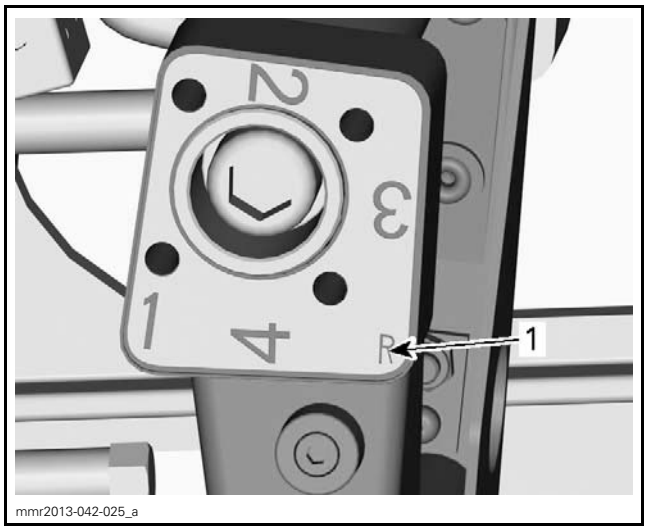
Lubricate pivot arm. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

COUPLING BLOCKS



Replacing Coupling Blocks

LH and RH coupling blocks are different. There is a molded "R" (RH side) or "L" (LH side) on the back face of the coupling blocks.



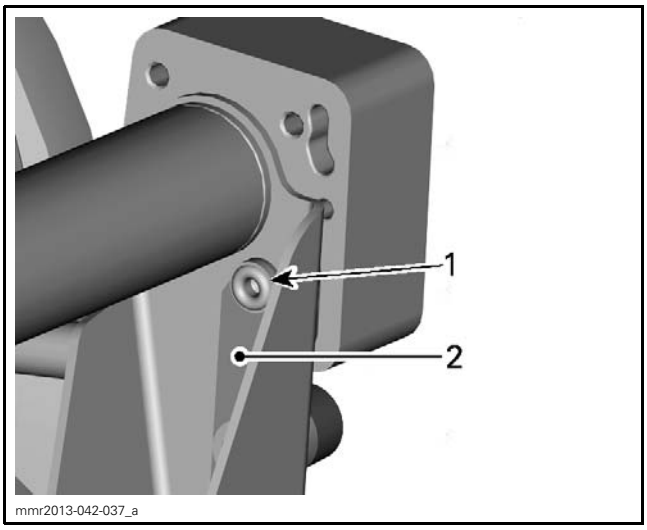
1. Side identification

Install new coupling block screws.

Set the coupling blocks to the same position on both sides.

MODELS	FACTORY BLOCK POSITION
All models	1

Fit riveted pin through coupling block.



TYPICAL
1. Riveted pin
2. Spring pin

IDLER WHEELS AND SUPPORTS

Replacing Idler Wheels

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.

NOTICE **Incorrect stopper strap installation would cause suspension parts interference.**

REAR SUSPENSION (tMOTION)

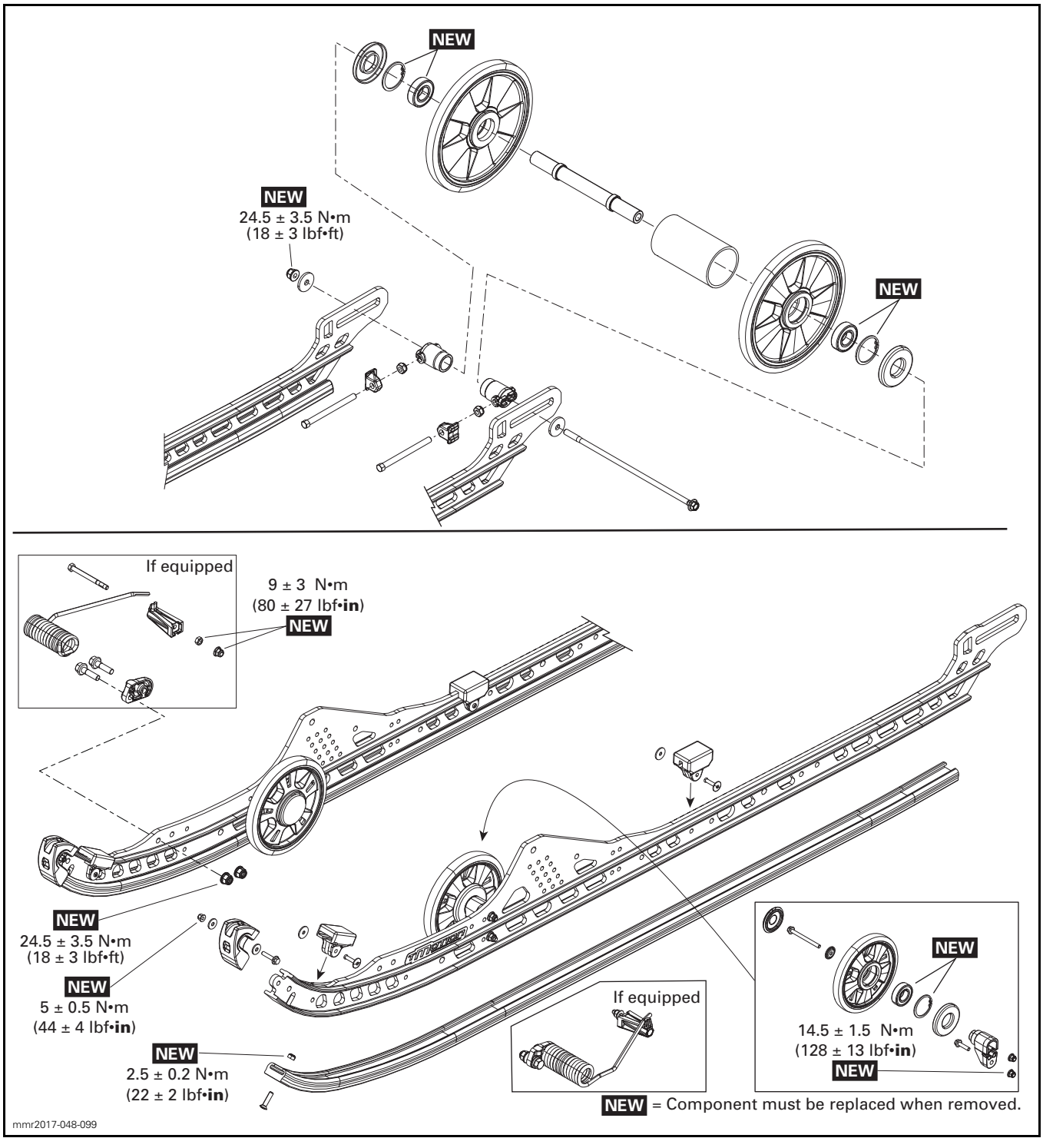
SERVICE TOOLS

Description	Part Number	Page
SHOCK ABSORBER SUPPORTS	529 036 186	12

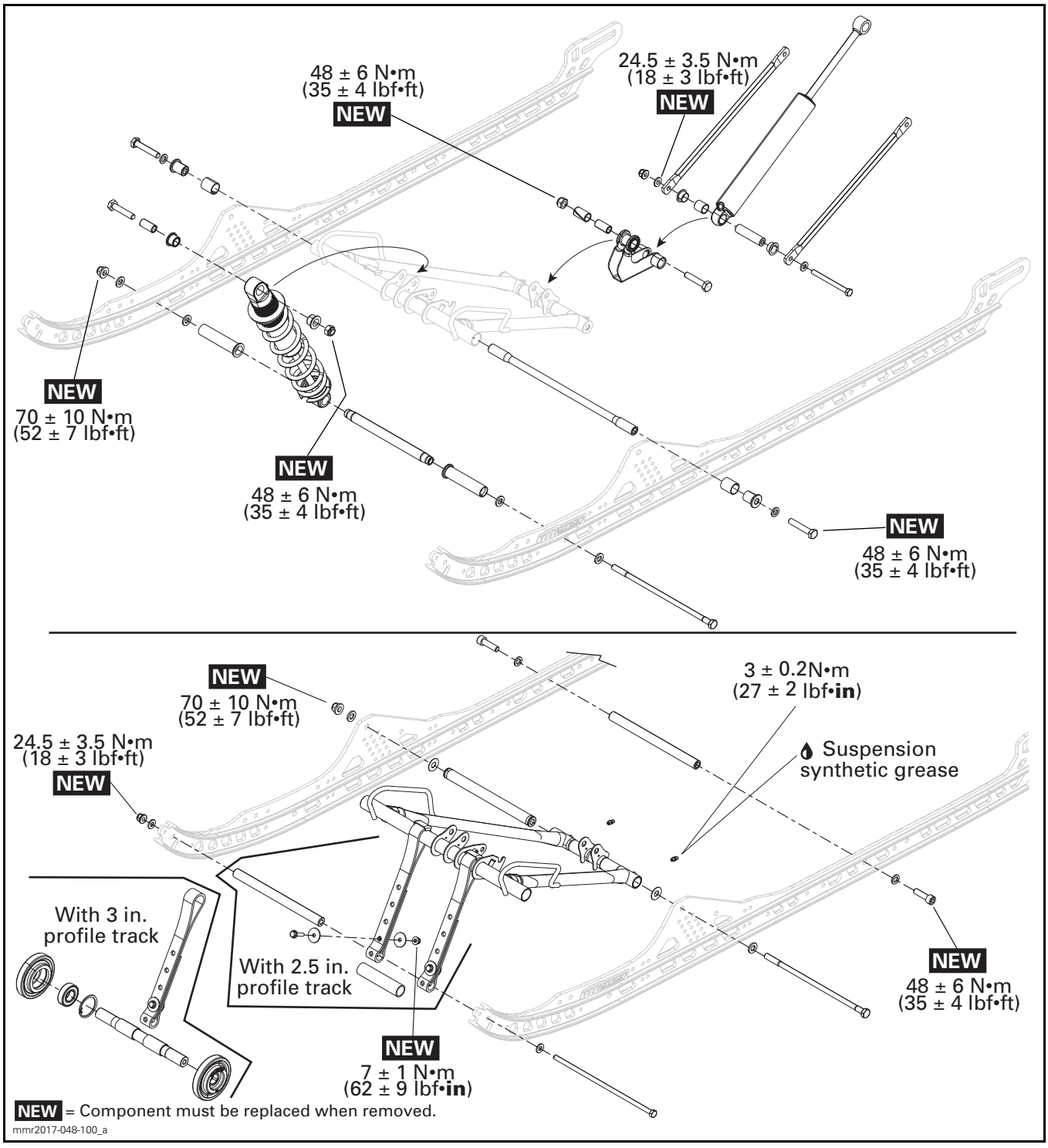
SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
BENCH SCALE SUCH AS SALTER BRECKNELL	PS 400	12

RAILS AND IDLER WHEELS



FRONT ARM


48 ± 6 N•m
(35 ± 4 lbf•ft)
NEW
24.5 ± 3.5 N•m
(18 ± 3 lbf•ft)
NEW
NEW
70 ± 10 N•m
(52 ± 7 lbf•ft)
NEW
48 ± 6 N•m
(35 ± 4 lbf•ft)
NEW
48 ± 6 N•m
(35 ± 4 lbf•ft)
NEW
70 ± 10 N•m
(52 ± 7 lbf•ft)
3 ± 0.2N•m
(27 ± 2 lbf•in)
24.5 ± 3.5 N•m
(18 ± 3 lbf•ft)
NEW
Suspension
synthetic grease
With 3 in.
profile track
With 2.5 in.
profile track
NEW
48 ± 6 N•m
(35 ± 4 lbf•ft)
NEW
7 ± 1 N•m
(62 ± 9 lbf•in)
NEW = Component must be replaced when removed.
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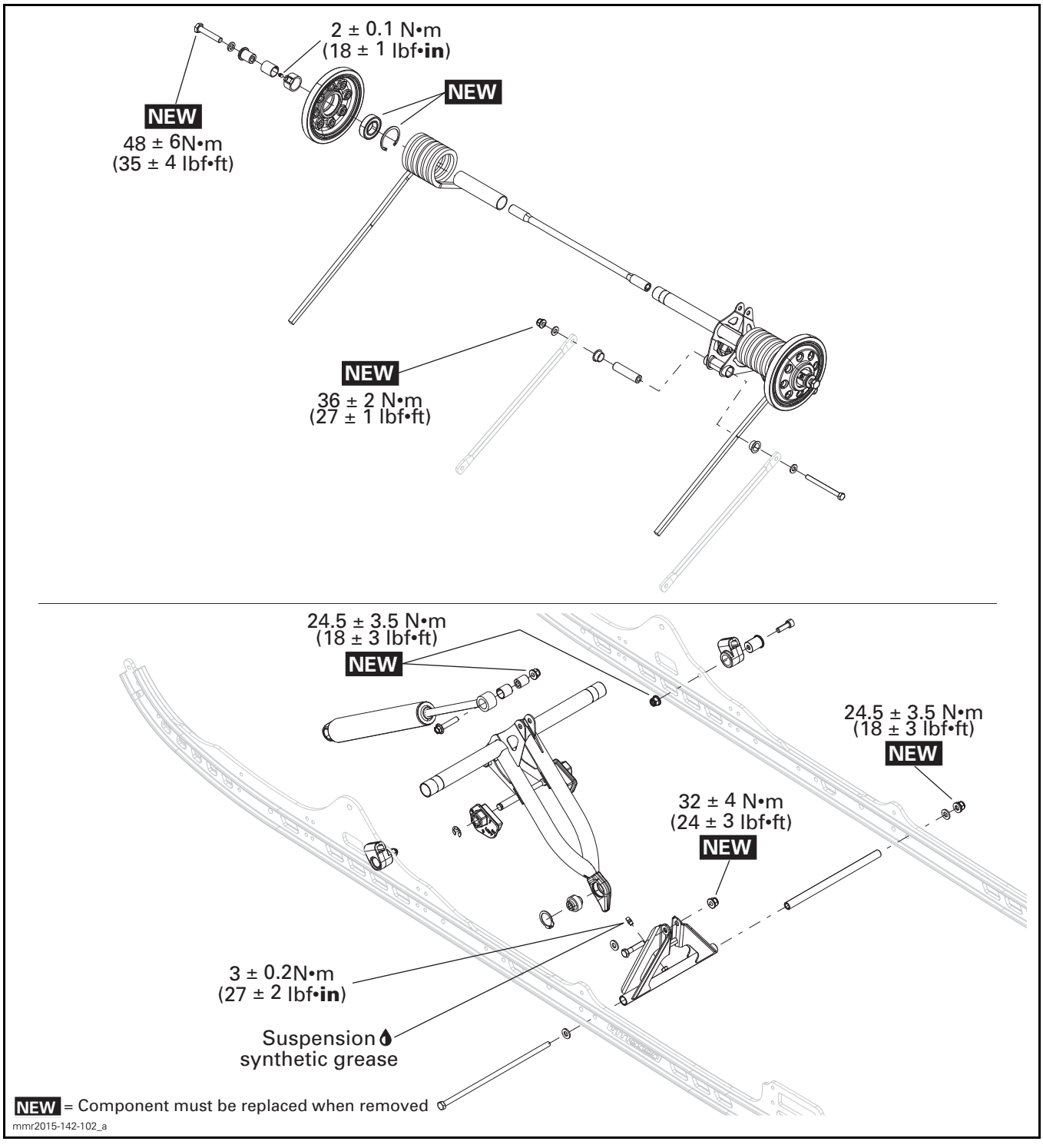
REAR ARM


2 ± 0.1 N•m
(18 ± 1 lbf•**in**)
NEW
NEW
48 ± 6N•m
(35 ± 4 lbf•ft)
NEW
36 ± 2 N•m
(27 ± 1 lbf•ft)
24.5 ± 3.5 N•m
(18 ± 3 lbf•ft)
NEW
24.5 ± 3.5 N•m
(18 ± 3 lbf•ft)
NEW
32 ± 4 N•m
(24 ± 3 lbf•ft)
NEW
3 ± 0.2N•m
(27 ± 2 lbf•**in**)
Suspension
synthetic grease
NEW = Component must be replaced when removed
mmr2015-142-102_a

GENERAL

NOTE: Refer to *TECHNICAL SPECIFICATIONS* to identify the snowmobile suspension type.

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

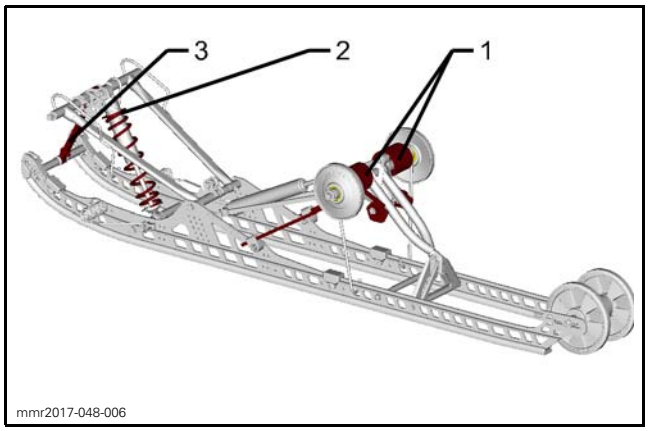
Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ WARNING

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

ADJUSTMENT

REAR SUSPENSION ADJUSTMENTS



ADJUSTABLE COMPONENTS
1. *Rear springs*
2. *Center spring*
3. *Stopper strap*

NOTICE Whenever adjusting rear suspension, check track tension and adjust if necessary.

Stopper Strap

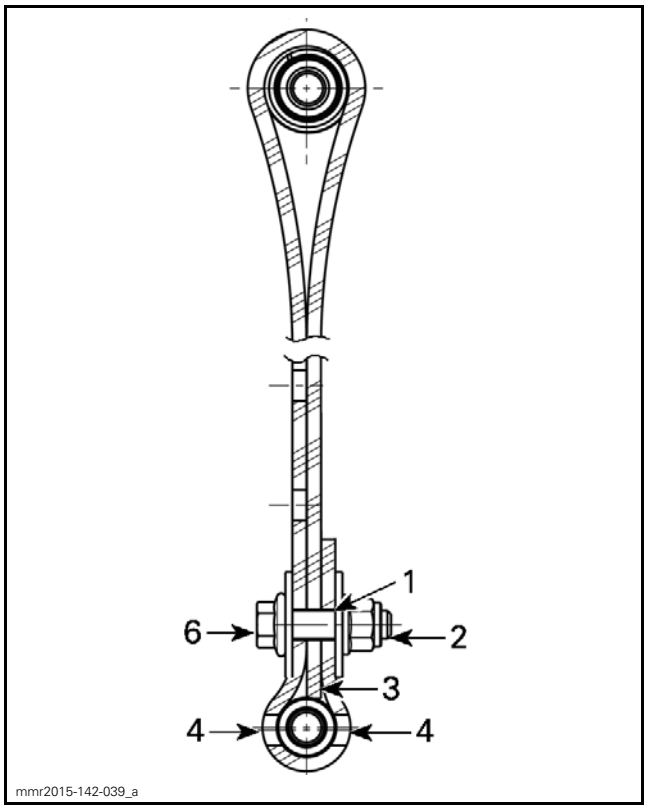
Stopper strap length has an effect on the amount of weight the center spring has to carry especially during acceleration, therefore on the front end uplift.

Stopper strap length also has an effect on center spring travel.

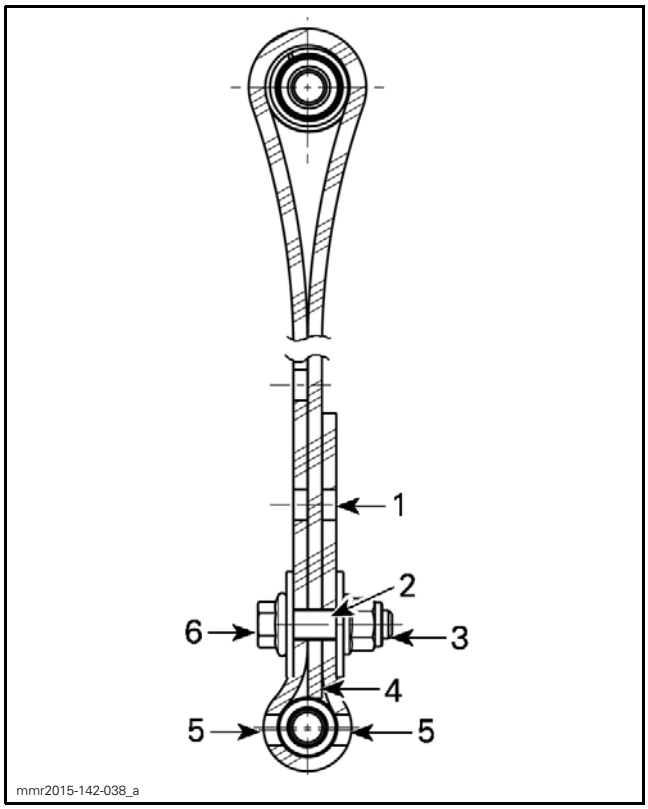
NOTICE Whenever stopper strap length is changed, track tension must be checked.

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

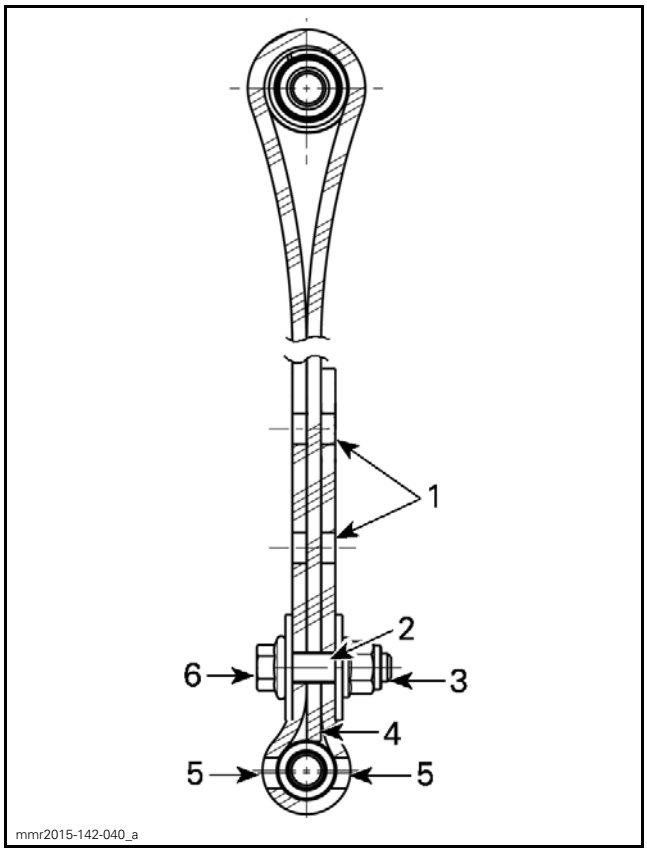
NOTE: Stopper strap could be set to position 1, 2, 3, 4 and 5. Below are illustrations for position 1, 2, 3. Smaller numbers correspond to a longer strap setting.



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: 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)

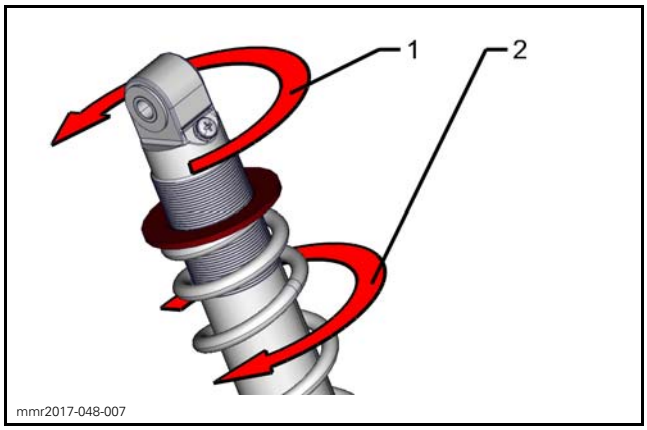
STOPPER STRAP SETTING	
POSITION	USE
3	Factory setting: Best overall setting (General use)
4	Hill climb: – Better track attack angle for hill climbing
5	Steep hill climb: – Better track attack angle for hill climbing – Less transfer – Lower ride height

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



1. Decrease preload
2. Increase preload

Rear Springs

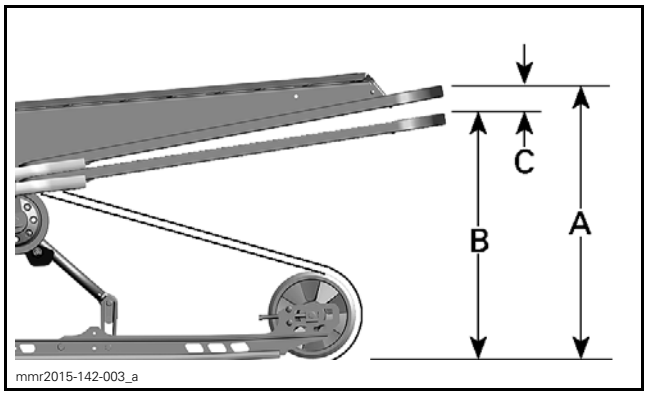
Rear spring preload has an effect on comfort, ride height and load compensation.

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

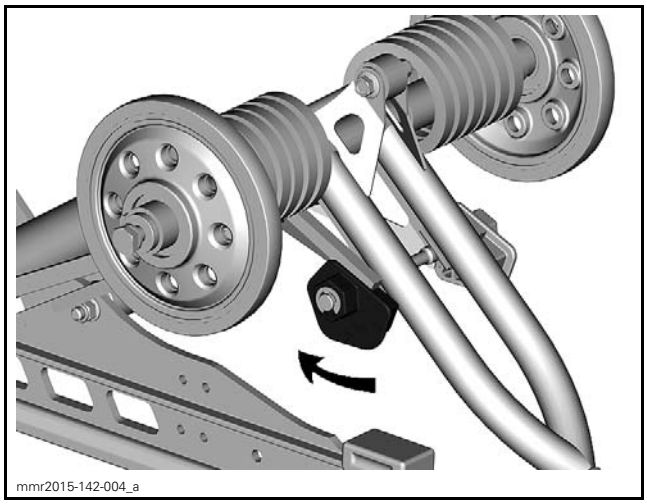
"C"	WHAT TO DO
65 mm to 100 mm (2.5 in to 4 in)	No adjustment required
More than 100 mm (4 in)	Adjusted too soft. Increase preload
Less than 65 mm (2.5 in)	Adjusted too firm. Decrease preload

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.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MAINTENANCE

For rear suspension lubrication, mechanism and stopper strap inspection, refer to *PERIODIC MAINTENANCE PROCEDURES*.

For shock absorbers inspection, refer to *SHOCK ABSORBERS* in this subsection.

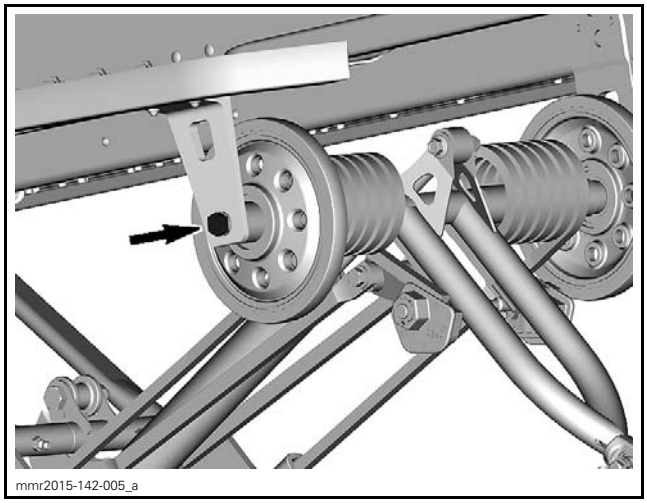
PROCEDURES

NOTE: Many parts can be changed with rear suspension in place. When specified, refer to *SUSPENSION ASSEMBLY* to remove rear suspension from vehicle.

SUSPENSION ASSEMBLY

Removing Suspension Assembly

1. Lift rear of vehicle and support it off the ground.
2. Completely loosen track tension.
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.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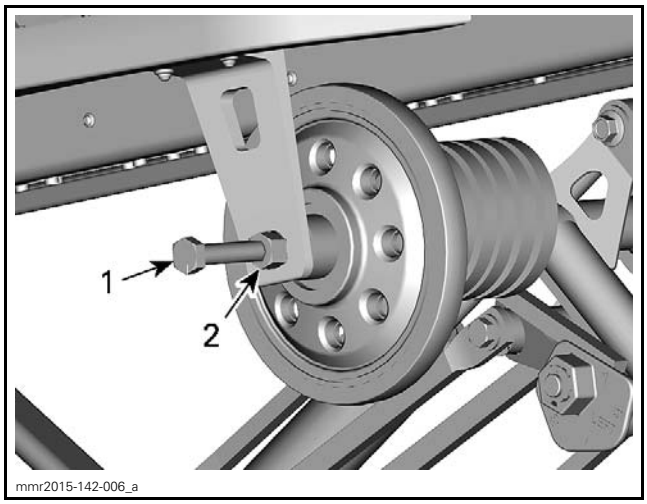
   - 3.2 Replace this bolt with a longer one and a nut.
   - 3.3 Screw in by approximately 7 turns.
   - 3.4 Hold the bolt and tighten locking nut.



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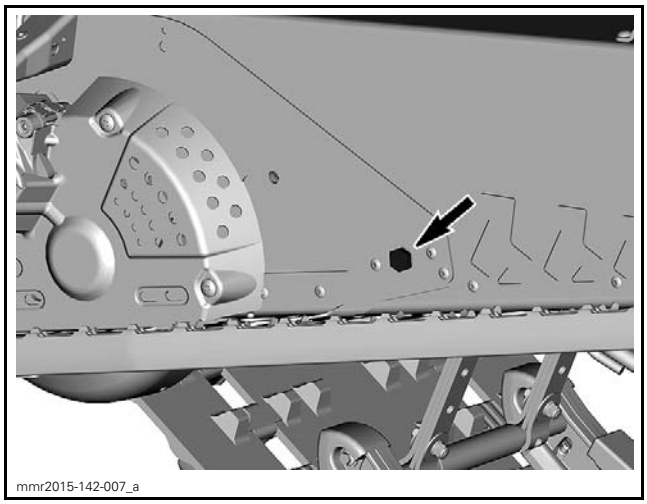
1. Long bolt
2. Locking nut

   - 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.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5. Lift rear of vehicle until front arm as enough clearance to pass underneath tunnel.
6. Remove suspension.

Installing Suspension Assembly

Installation is the reverse of removal procedure. Pay attention to the following.

Inspect track thoroughly before reinstalling suspension. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

Install suspension into track with front portion first.

Install new front and rear arm bolts.

Tighten bolts to specified torque.

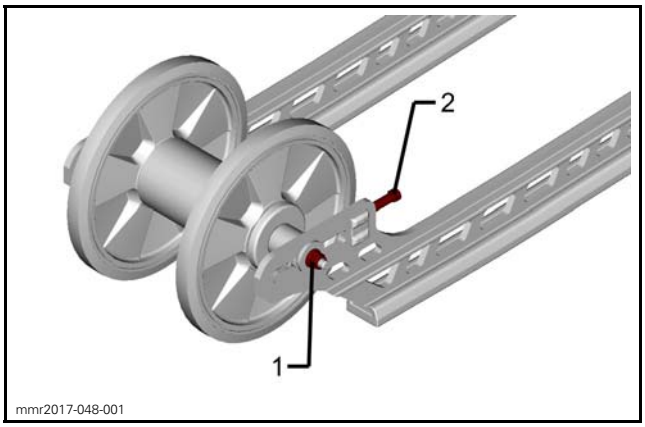
TIGHTENING TORQUE	
Front and rear arm upper bolts	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)

Adjust track tension, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

REAR AXLE

Removing Rear Axle

1. Lift rear of vehicle and support it off the ground.
2. Loosen rear axle nut.
3. Completely loosen track tension by unscrewing both adjustment screws.



mmr2017-048-001

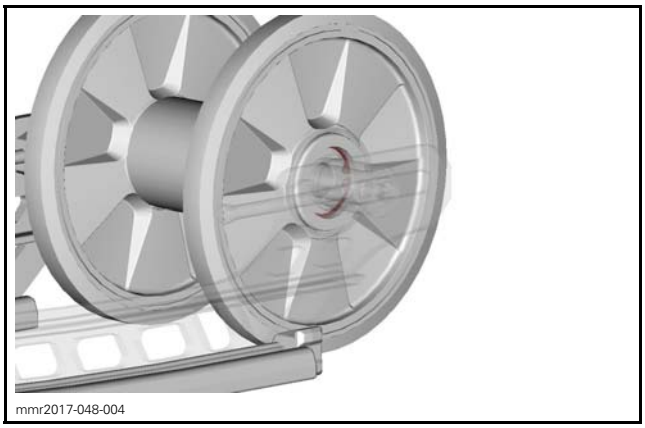
Step 1: Loosen axle nut
Step 2: Unscrew adjustment screws

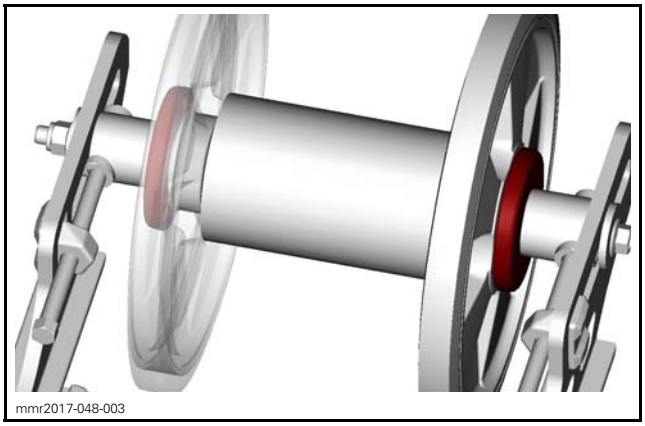
4. Remove rear axle nut, screw, washers and sliders.
5. Pull out the rear axle.

Installing Rear Axle

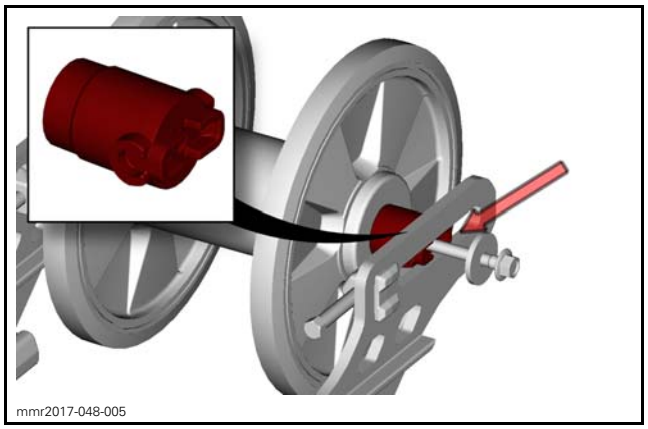
The installation is the reverse of the removal procedure. However, pay attention to the following.

Bearing circlip faces outward.


mmr2017-048-004


mmr2017-048-003

When tightening rear axle, make sure each wheel spacer protuberance is engaged into runner slot.

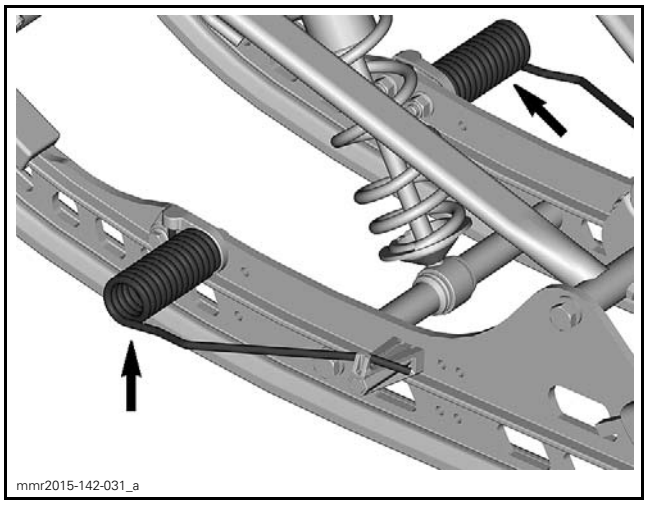


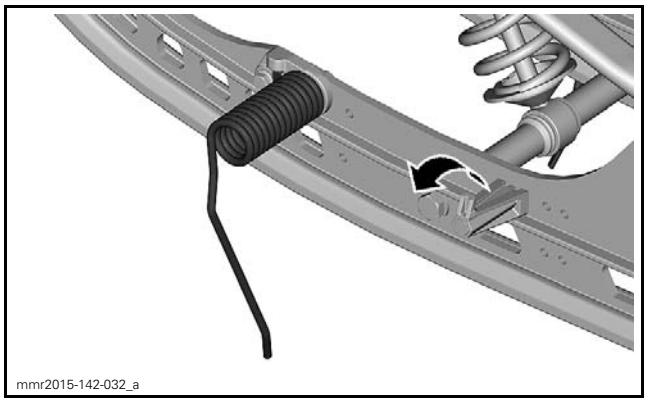
Adjust track tension. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

ICE SCRATCHERS

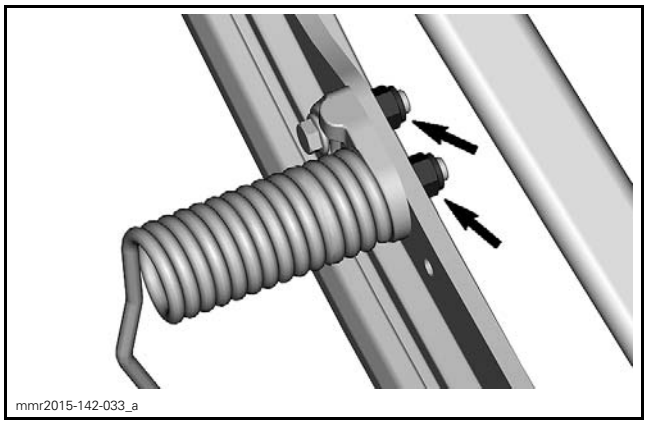
Removing Ice Scratchers

⚠ CAUTION Always remove ice scratchers from hooks before working on rear suspension.





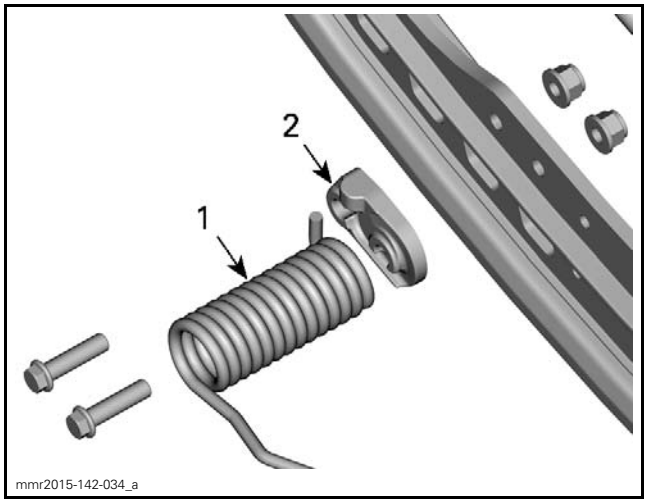
Remove spring holder nuts.



Installing Ice Scratchers

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

Make sure spring end is well inserted in holder.



1. Ice scratcher spring
2. Spring holder

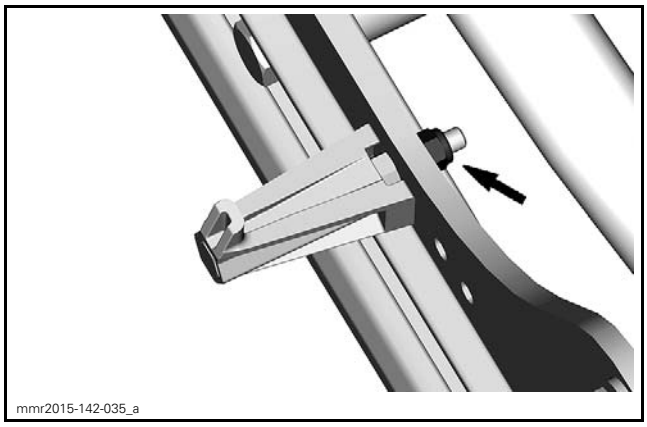
Tighten retaining nuts to specification.

TIGHTENING TORQUE	
Spring retaining nuts	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

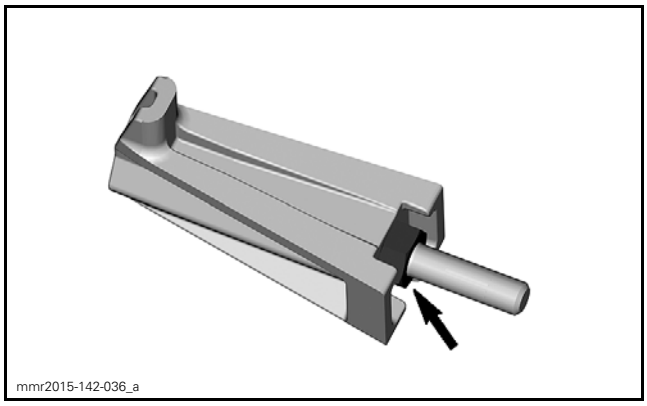
Removing Ice Scratcher Hooks

⚠ CAUTION Always remove ice scratchers from hooks before working on rear suspension.

1. Remove hook retaining nut.


mmr2015-142-035_a

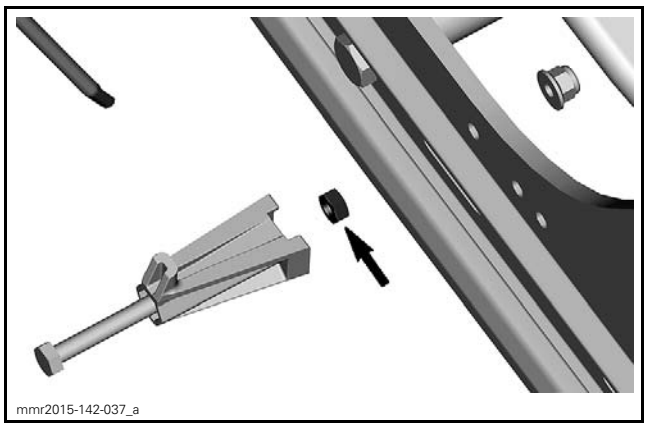
2. Remove hook counter nut.


mmr2015-142-036_a

Installing Ice Scratcher Hooks

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

Hand tighten counter nut first.


mmr2015-142-037_a

Tighten hook retaining nut to specification.

TIGHTENING TORQUE	
Hook retaining nut	9 N•m ± 3 N•m (80 lbf•**in** ± 27 lbf•**in**)

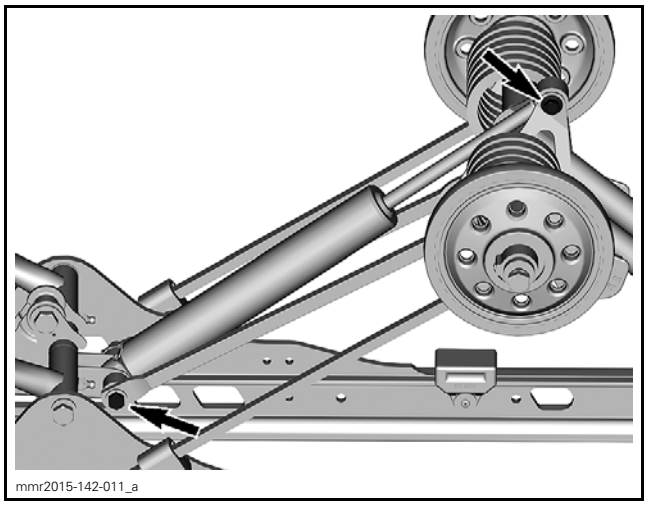
SHOCK ABSORBERS

Removing 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.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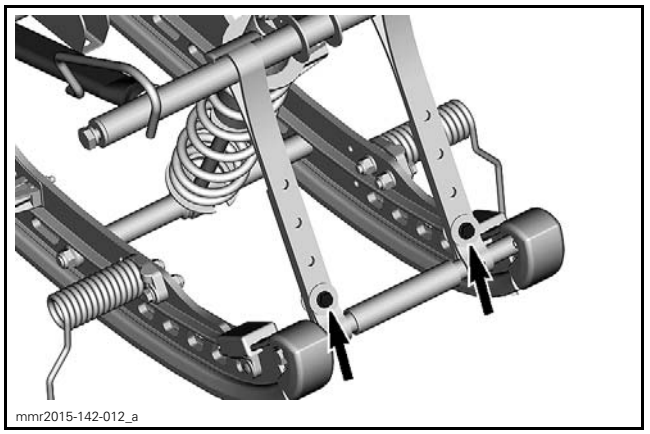
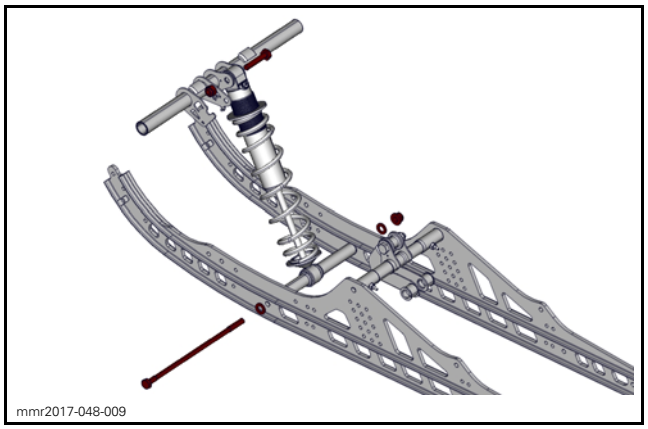
Removing Center Shock Absorber

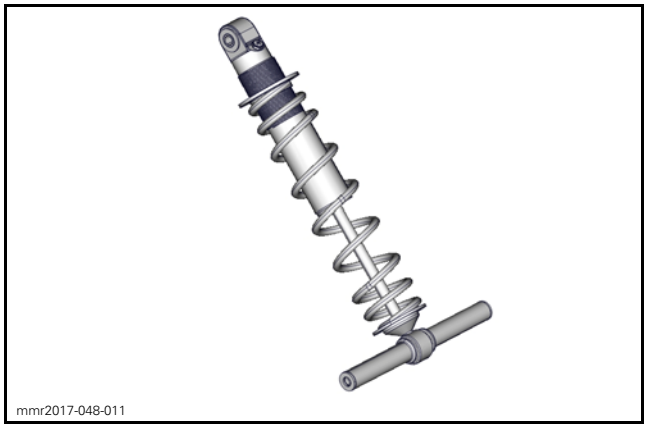
1. Lift the rear of vehicle and support it off the ground.
2. Unfasten stopper strap(s).


mmr2015-142-012_a

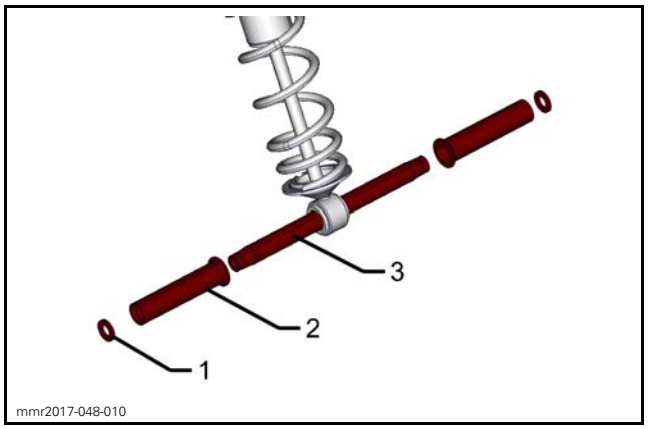
3. Remove lower and upper shock absorber nuts and bolts.


mmr2017-048-009

4. Remove shock absorber from vehicle.


mmr2017-048-011

5. Remove bushings and shock shaft from shock absorber.



mmr2017-048-010

Inspecting Shock Absorbers

NOTE: Unless otherwise noted, shock absorber must be at normal room temperature (21°C ± 2°C (70°F ± 36°F)) during inspection.

1. Perform a visual inspection of the shock:
   – The shock must be exempt of any dent or scratch, especially on the rod.
   – Any defect on the rod, as small as it is, can lead to seal failure and oil leak.
   – If such defect is detected, the shock must be replaced and this will not be covered under warranty.
2. Completely push down shock rod into the body and check result as per table.

HPG SHOCK	RESULT
All except 551 mm (21-11/16 in) rear shock	The rod should completely get in the shock body
551 mm (21-11/16 in) rear shock	The stroke must be at least 138 mm (5-7/16 in)

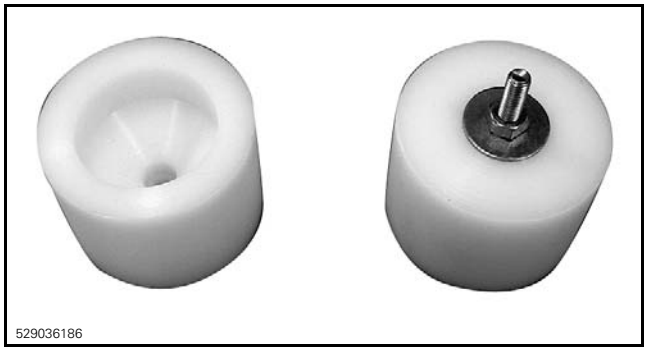
3. Release shock from completely collapsed position and check result as per table.

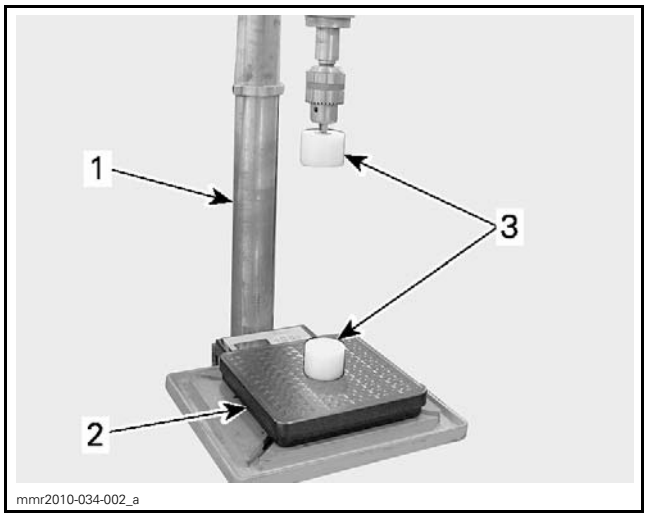
HPG SHOCK
– The shock should extend unassisted. – The rod must come out at a steady speed.

4. Proceed with *COMPRESSION TESTING SHOCK ABSORBERS*. See procedure in this subsection.
5. If any faults are present, replace shock.

Compression Testing Shock Absorbers

1. Ensure shock absorber is at normal room temperature (21°C ± 2°C (70°F ± 36°F)).
2. Remove spring from shock absorber (if applicable).
3. Place a BENCH SCALE SUCH AS SALTER BRECKNELL (P/N PS 400) (or an equivalent) on a suitable drill press.
4. Install SHOCK ABSORBER SUPPORTS (P/N 529 036 186) onto drill press.

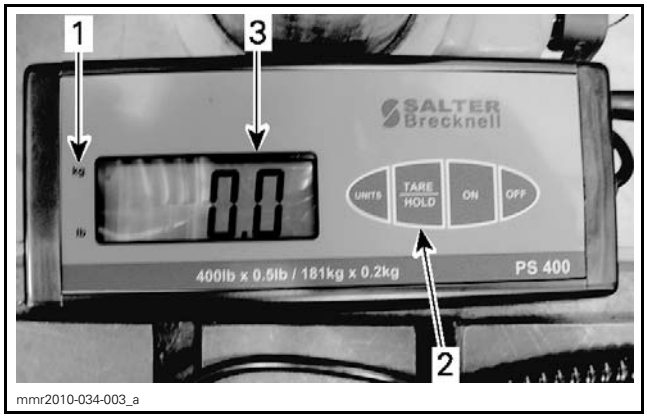

529036186



mmr2010-034-002_a

1. *Drill press*
2. *Bench scale*
3. *Shock absorber supports*

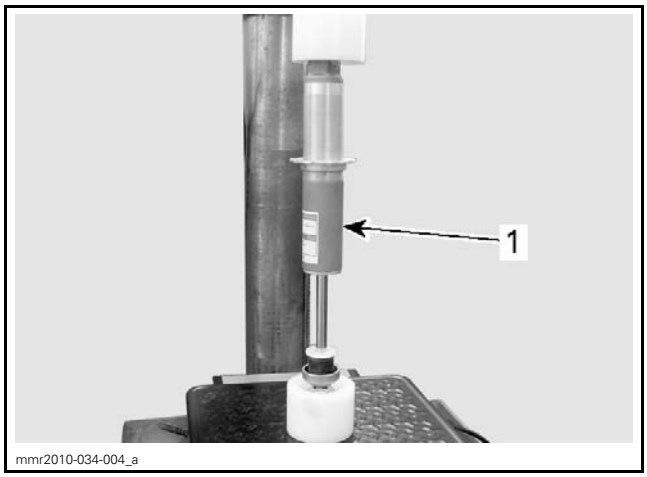
5. Set bench scale units to **kg** (or lb).
6. Press **TARE** to reset digits (must indicate (0) zero).



mmr2010-034-003_a

1. *Units indicator lamp*
2. *TARE button*
3. *Digits*

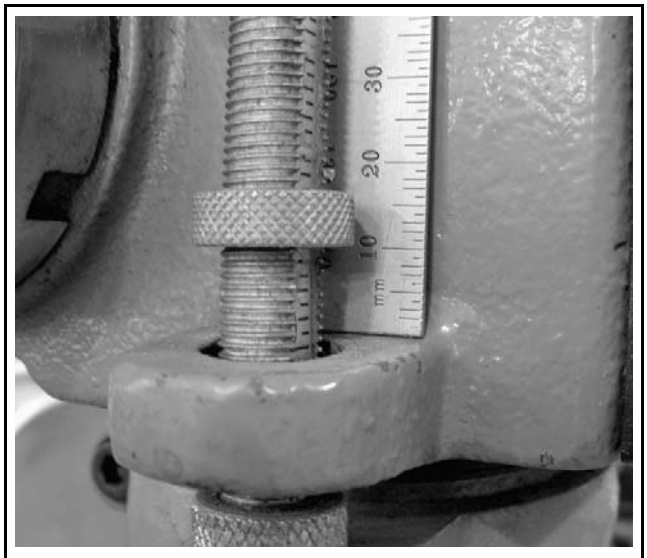
7. Install shock absorber into support with shock body upwards.
8. Adjust drill press table height in order to set the upper shock support flush with the shock body end.
9. Ensure shock absorber is aligned with drill press axis.



mmr2010-034-004_a

1. *Shock body upwards*

10. Set the drill press displacement to 10 mm (.394 in) using locking nut.



mmr2010-034-005

11. Compress shock absorber by 10 mm (.394 in) and hold it in position.
12. Read load recorded on the bench scale.

mmr2010-034-006

13. Load reading must be as per the following table.

ROD DIAMETER	SERVICE RANGE
12.5 mm (1/2 in)	24 kgf ± 4 kgf (53 lbf ± 9 lbf)

Installing Rear Shock Absorber

Installation is the reverse of removal procedure. Pay attention to the following.

To ease shock installation, secure upper side of shock first.

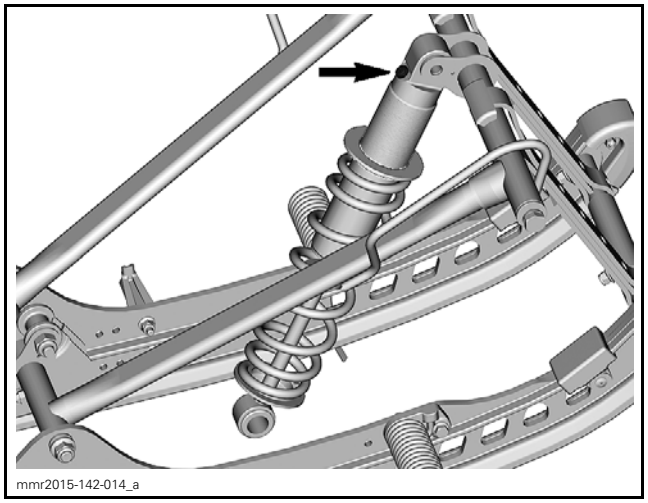
Install new shock absorber retaining nuts and tighten to specification.

TIGHTENING TORQUE	
Rear shock absorber fasteners	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

Installing Center Shock Absorber

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

1. Position the adjustment ring upwards and the valve towards the tunnel.



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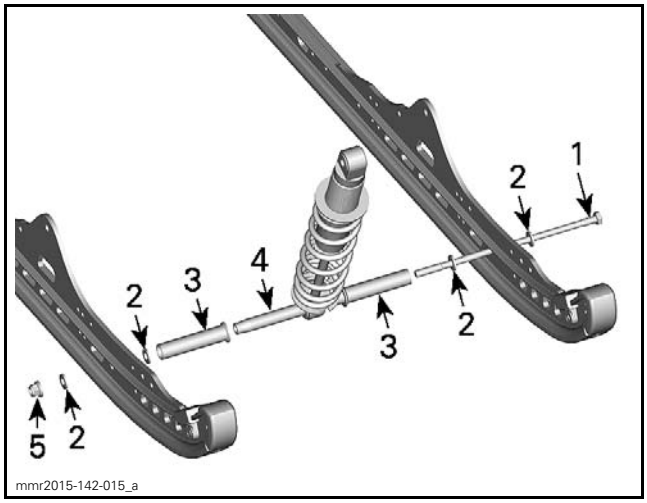
2. Using new nut, install shock shaft to runners.
3. Position washers in proper position.



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BOTTOM OF SHOCK ABSORBER
1. *Lower screw*
2. *Washers location*
3. *Spacers*
4. *Shock shaft*
5. *Nut*

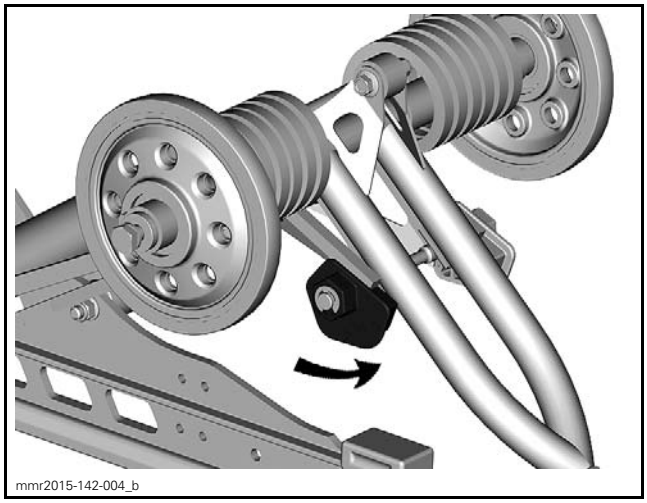
Tighten nut to the specification.

TIGHTENING TORQUE	
Center shock absorber lower nut	70 N•m ± 10 N•m (52 lbf•ft ± 7 lbf•ft)

REAR SPRINGS

Removing Rear Springs

1. Lift rear of vehicle and support it off the ground.
2. Completely loosen track tension by unscrewing both adjustment screws.
3. Decrease springs preload by turning cams accordingly.



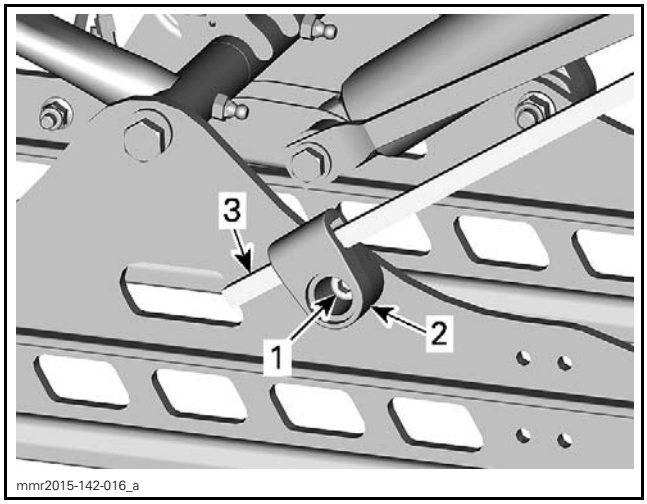
mmr2015-142-004_b

LH SIDE SHOWN

4. Firmly hold the spring support and unscrew its retaining bolt (one each side).

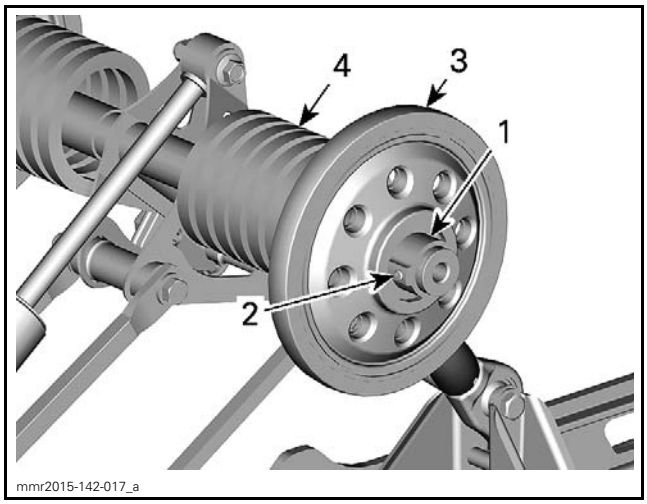
⚠ WARNING

Supports are spring loaded.



1. *Spring support bolt*
2. *Spring support*
3. *Spring*

5. Remove screws and washers from rear arm top axle. Refer to *REMOVING SUSPENSION ASSEMBLY* for procedure to remove the bolts.
6. Loosen set screw from locking rings.
7. Remove locking rings.
8. Remove upper idler wheels.
9. Remove springs.



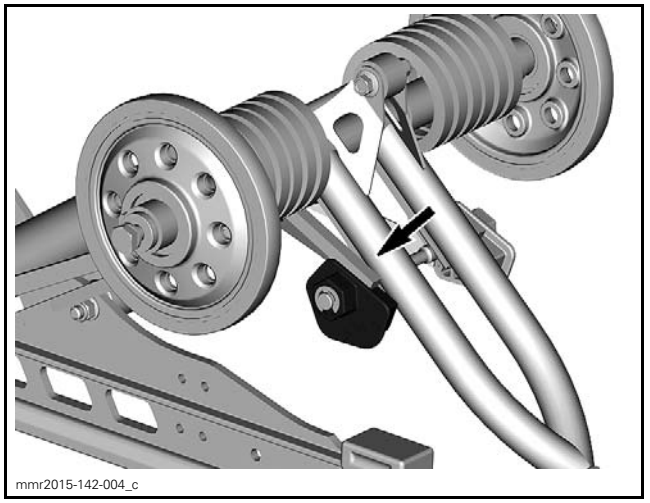
LH SIDE SHOWN

1. *Locking ring*
2. *Set screw*
3. *Upper idler wheel*
4. *Rear spring*

Installing Rear Springs

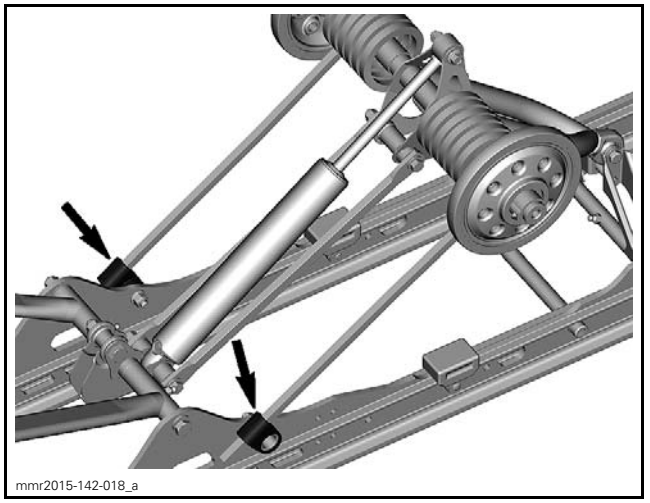
Installation is the reverse of removal procedure. Pay attention to the following.

1. Respect THIS SIDE OUT inscription on top idler wheels.
2. Make sure that spring end is in cam adjuster.



LH SIDE SHOWN

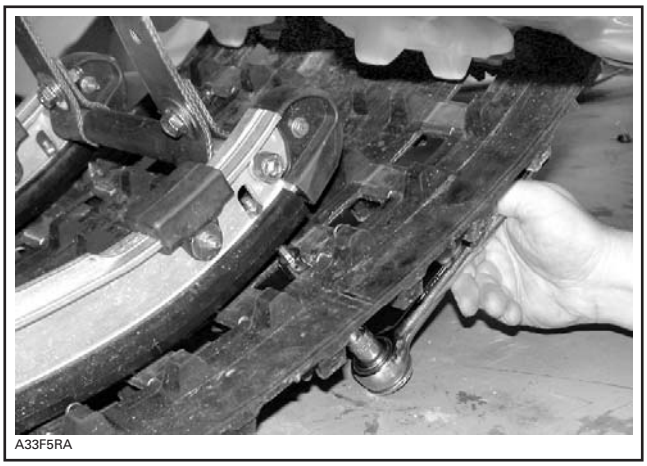
3. Install spring supports upwards.



SLIDER SHOES

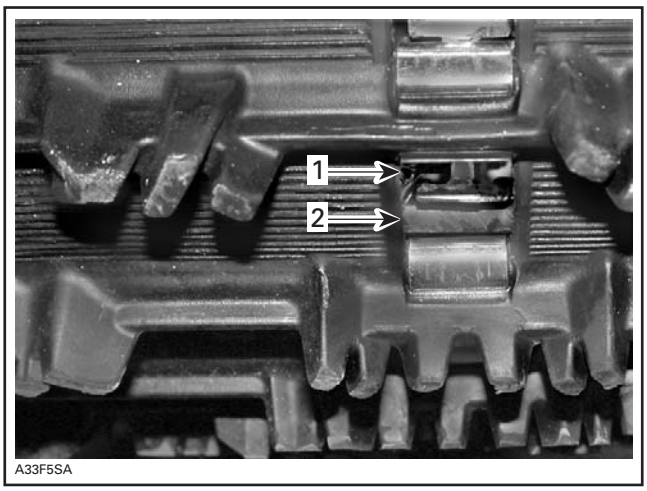
Removing Slider Shoes

1. Lift rear of vehicle and support it off the ground.
2. Completely loosen track tension.
3. Remove nut and screw of each runner.


A33F5RA

TYPICAL

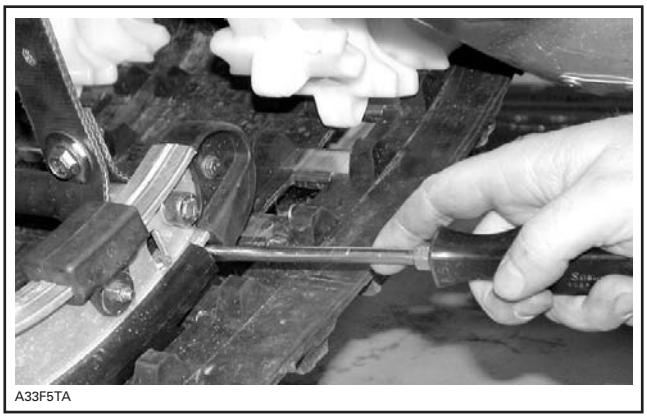
4. At the rear of vehicle, align a track window with slider shoe.



A33F5SA

TYPICAL
1. Track window
2. Slider shoe

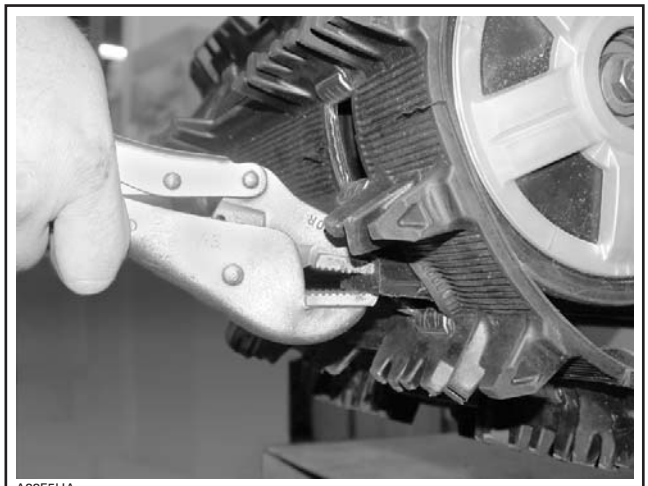
5. Using a pry bar or a screwdriver, push slider shoe rearward until it comes in contact with track.


A33F5TA

TYPICAL - 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.


A33F5UA

TYPICAL - PULL ON SLIDER SHOE TO REMOVE

Installing Slider Shoes

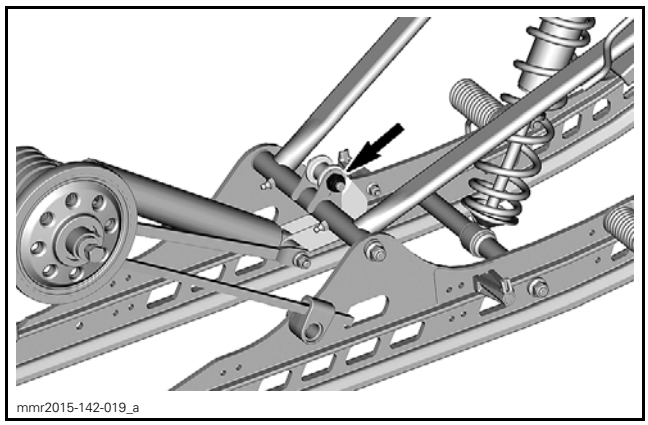
The installation is the reverse of the removal procedure. However, pay attention to the following.

Make sure to insert slider shoe end with hole first.

FRONT ARM

Removing Front Arm

1. Proceed with *REMOVING SUSPENSION ASSEMBLY*, see procedure in this subsection.
2. Remove nut and bolt securing rocker to front arm.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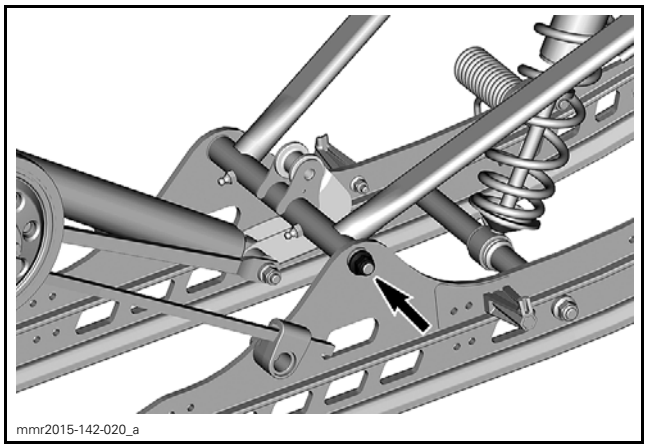
3. Remove the front arm lower bolt, nut and washers. Discard retaining nut.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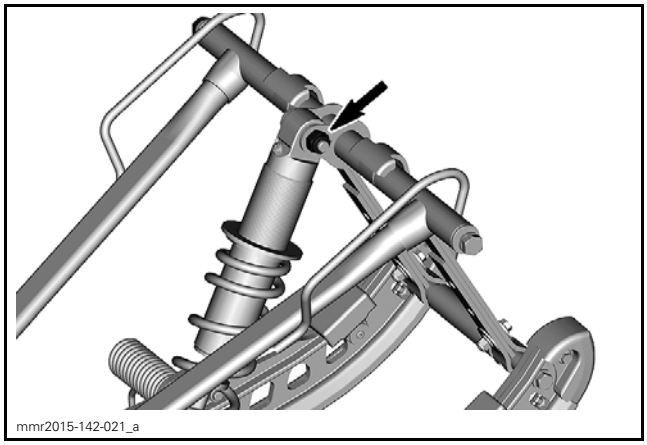
4. Remove the shock absorber upper nut and bolt.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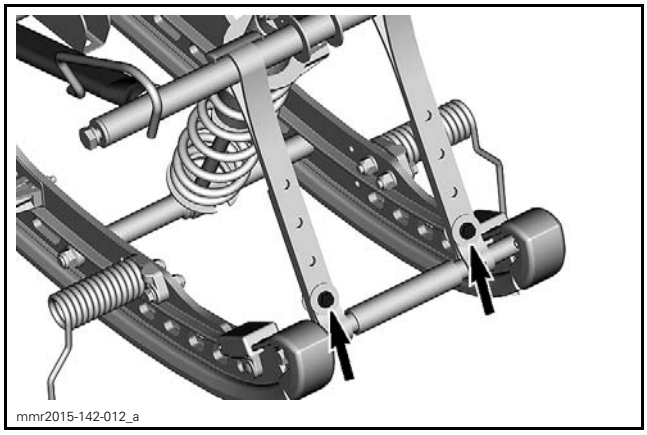
5. Unfasten stopper strap(s).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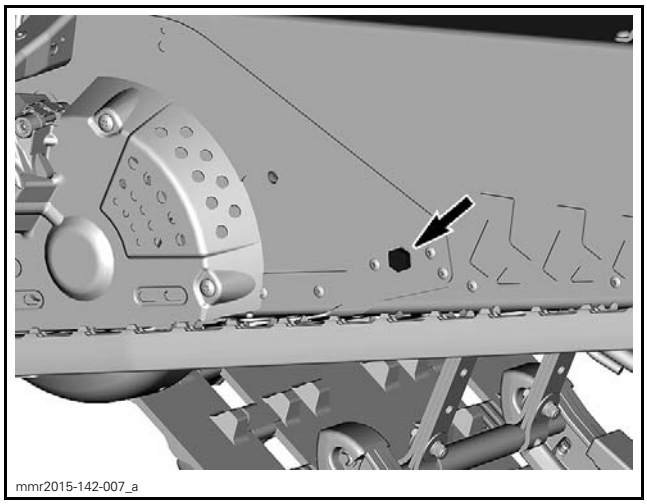
6. Remove and discard front arm upper bolts.

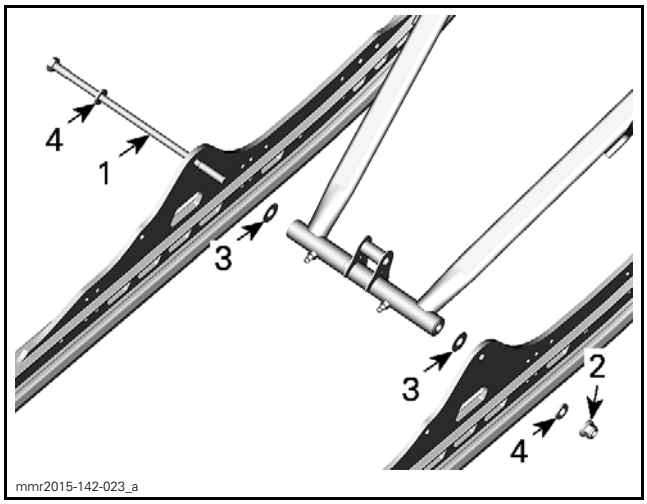

mmr2015-142-007_a

7. Remove front arm.

Installing Front Arm

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

1. Install new nuts.
2. Install new front arm upper bolts.



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1. *Front arm lower bolt*
2. *Nut*
3. *Spacer washers*
4. *Washers*

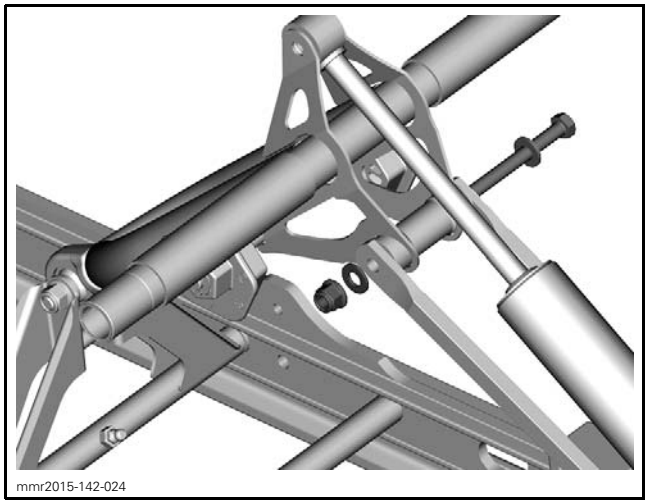
3. See front arm exploded view for proper tightening torque.

REAR ARM

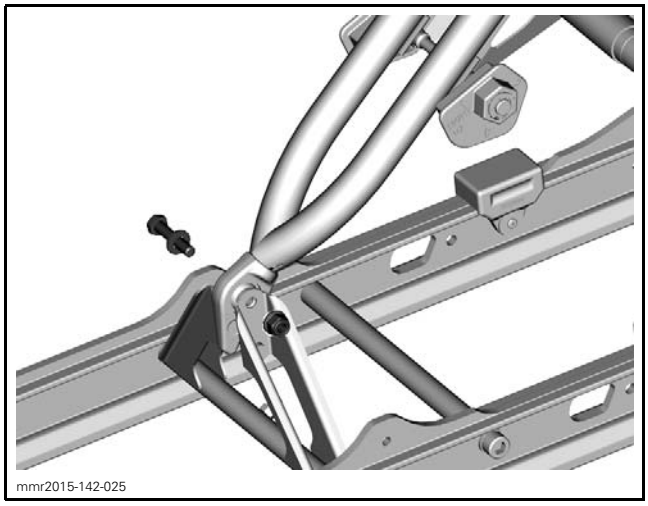
Removing Rear Arm

1. Lift rear of vehicle and support it off the ground.
2. Completely loosen track tension.
3. Proceed with *REMOVING REAR SPRINGS*, see procedure in this subsection.

4. Remove the rear shock absorber upper bolt and nut.
5. Remove nut and bolt securing throttle rods to rear arm.


mmr2015-142-024

6. Remove bolt, nut and washer holding rear arm to pivot arm.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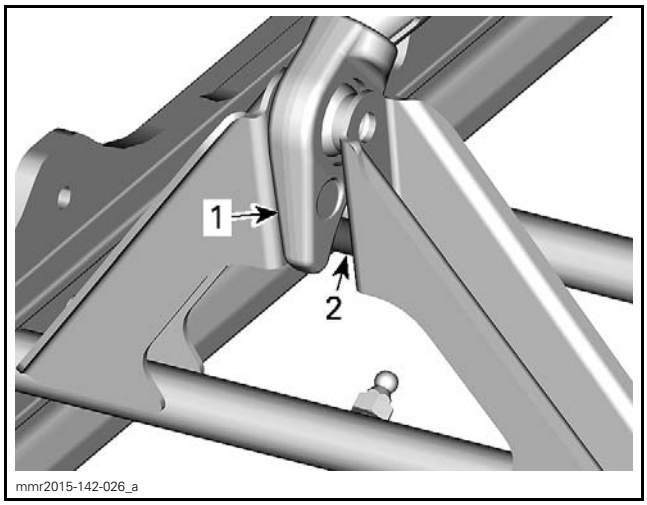
Installing Rear Arm

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

1. At installation, rear arm stroke limiter must be at rear.

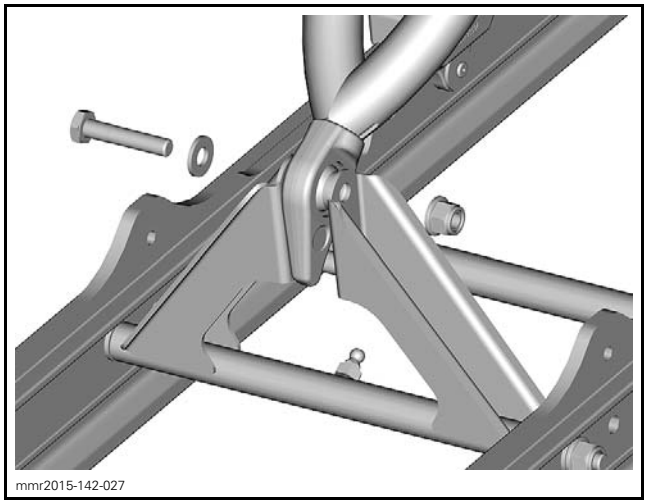


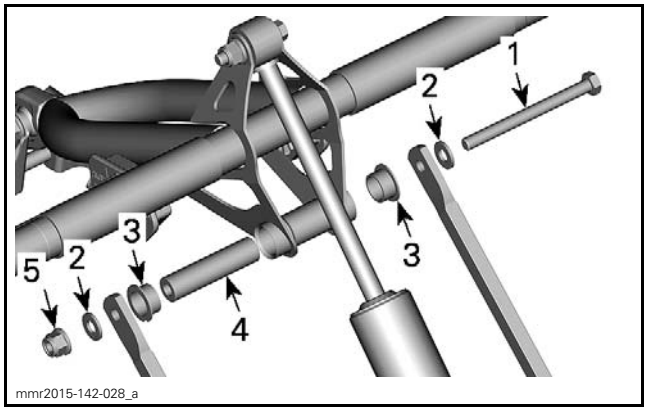
mmr2015-142-026_a

1. Rear arm stroke limiter
2. Pivot arm stroke limiter

2. Install new nuts and tighten to specification.

Assemble rear arm fasteners as per following illustrations.


mmr2015-142-027



mmr2015-142-028_a

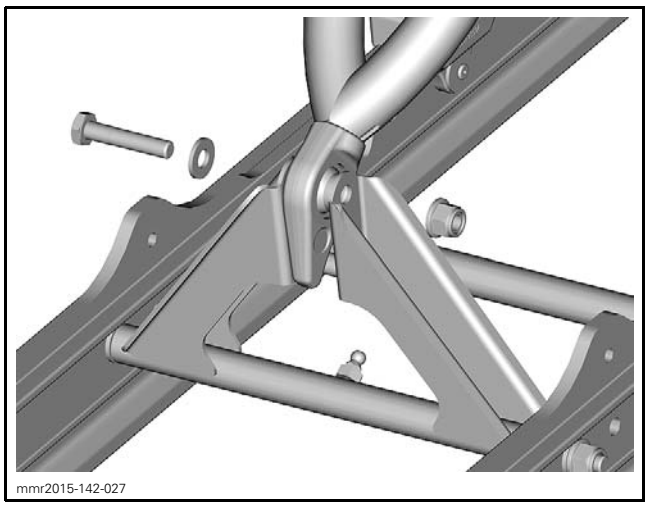
SOME PARTS REMOVED FOR CLARITY PURPOSES
1. Throttle rod upper bolt
2. Washers
3. Bushings
4. Axle
5. Throttle rod upper nut

TIGHTENING TORQUE	
Rear arm throttle rod nut	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)
Rear arm to pivot arm nut	32 N•m ± 4 N•m (24 lbf•ft ± 3 lbf•ft)

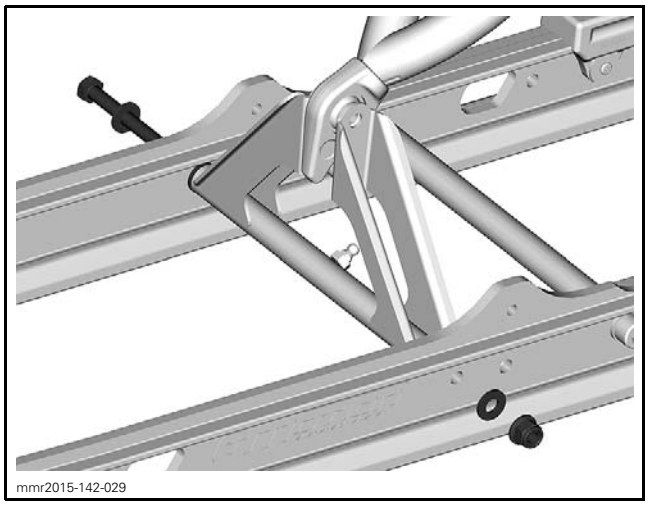
PIVOT ARM

Removing Pivot Arm

1. Lift rear of vehicle and support it off the ground.
2. Completely loosen track tension by unscrewing both adjustment screws.
3. Remove bolt, nut and washer retaining rear arm to pivot arm.


mmr2015-142-027

4. Remove bolt, nut and 4 washers retaining pivot arm to runners.


mmr2015-142-029

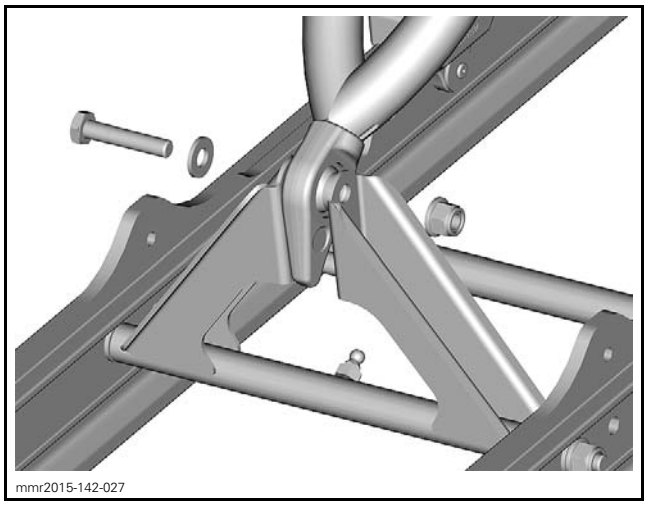
NOTE: Make sure inner washers are properly removed from assembly to avoid losing them.

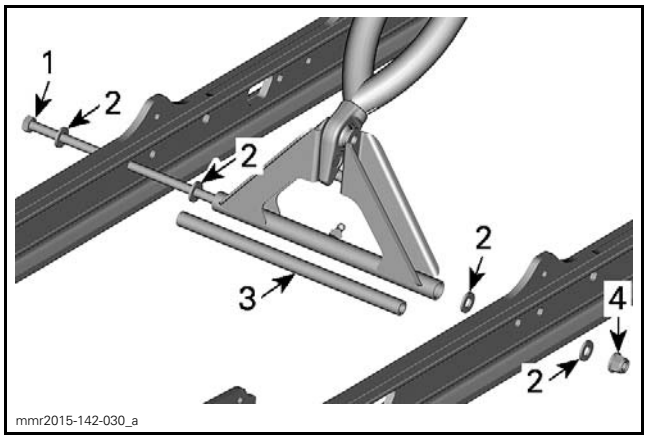
5. Carefully remove pivot arm from rear arm.

Installing Pivot Arm

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

Assemble pivot arm fasteners as per following illustrations, with grease fitting towards front of vehicle.


mmr2015-142-027



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PARTS REMOVED FOR CLARITY PURPOSE
1. *Pivot arm lower screw*
2. *Washers*
3. *Axle*
4. *Pivot arm nut*

Tighten pivot arm nuts to specification.

TIGHTENING TORQUE	
Pivot arm lower nut	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)
Pivot arm upper nut	32 N•m ± 4 N•m (24 lbf•ft ± 3 lbf•ft)

Lubricate pivot arm. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

STOPPER STRAP

Refer to the exploded views at the beginning of this subsection for parts layout and fasteners tightening torque.

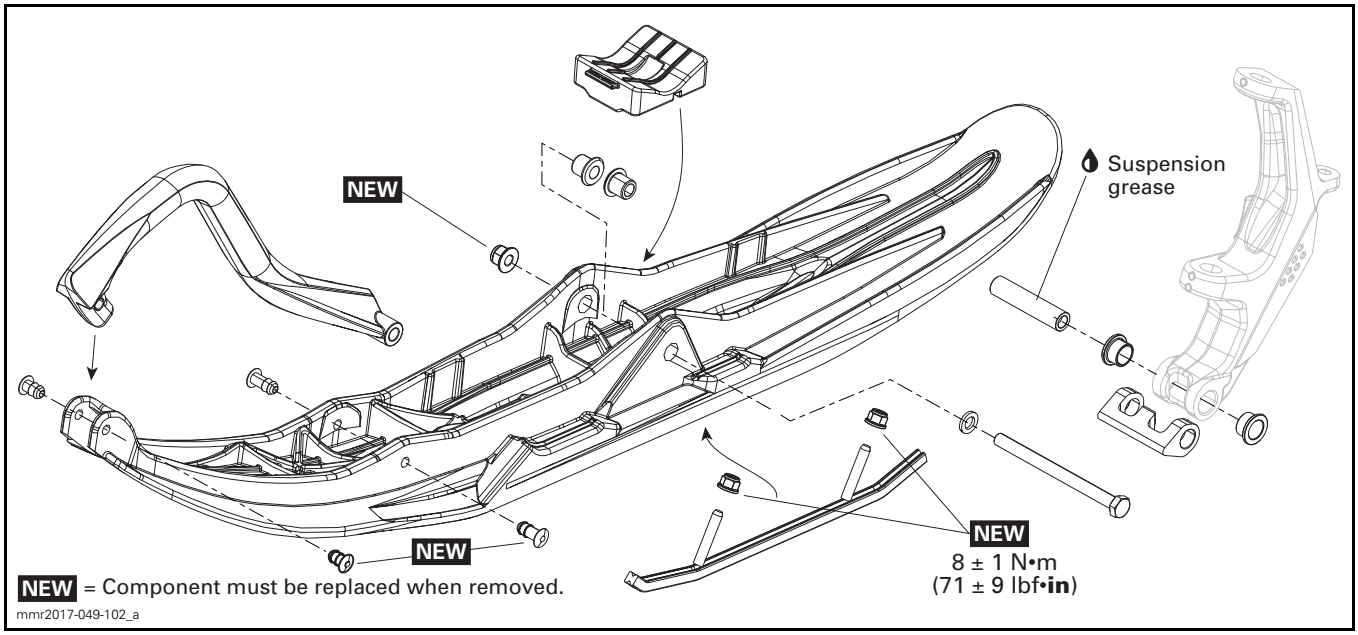
STEERING SYSTEM (PITMAN ARM)

SERVICE PRODUCTS

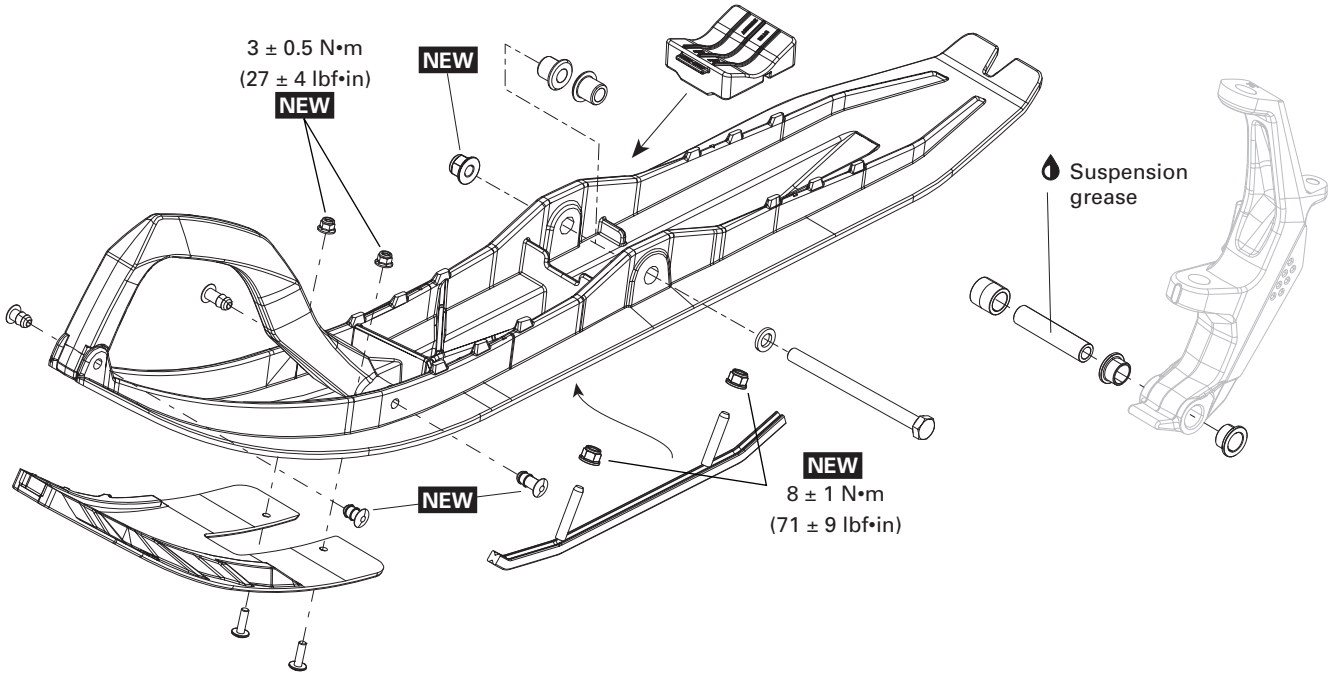
Description	Part Number	Page
SUSPENSION GREASE	293 550 033	18

SKIS

Trail and Crossover Models



Mountain Models



NEW = Component must be replaced when removed.

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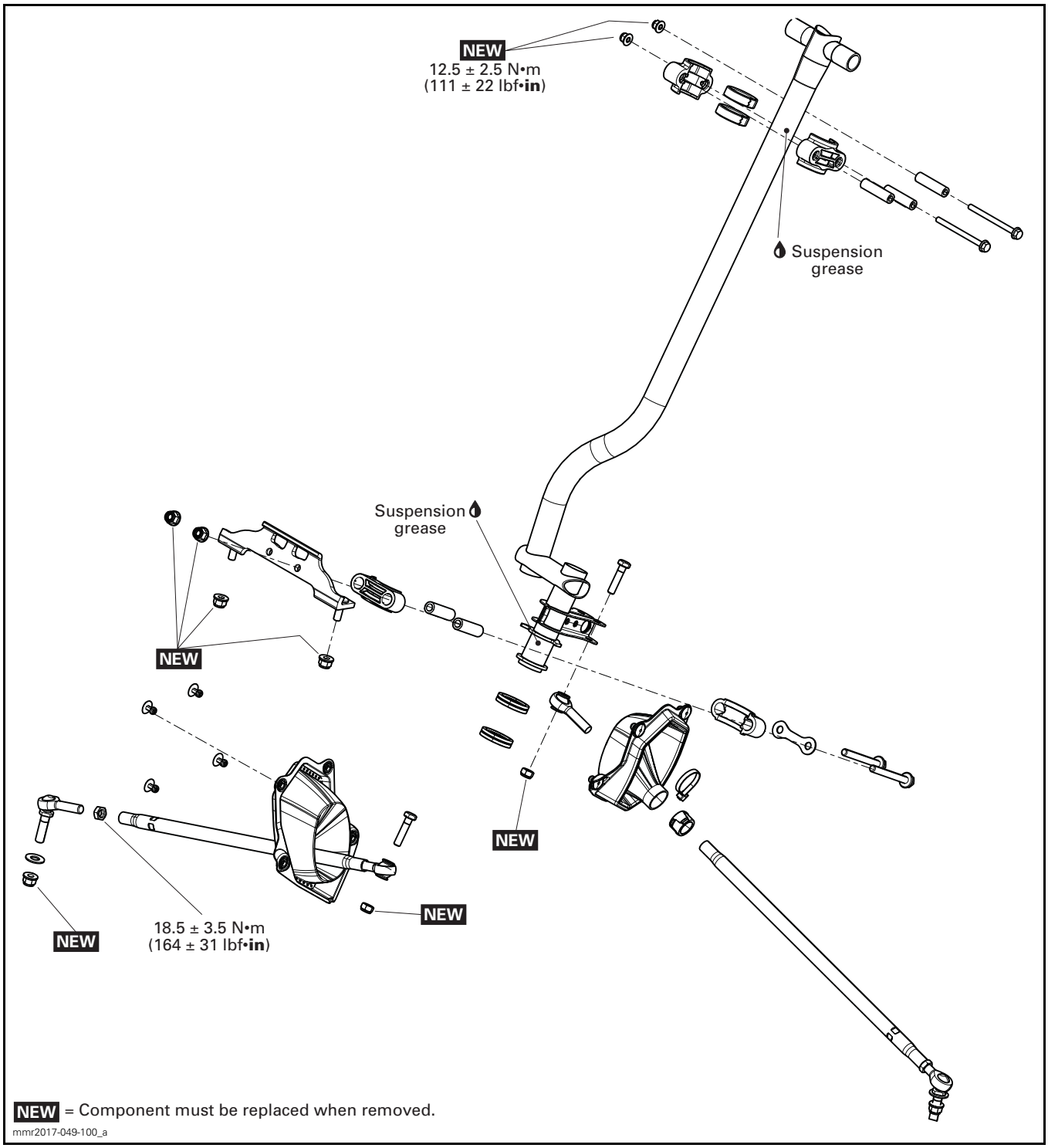
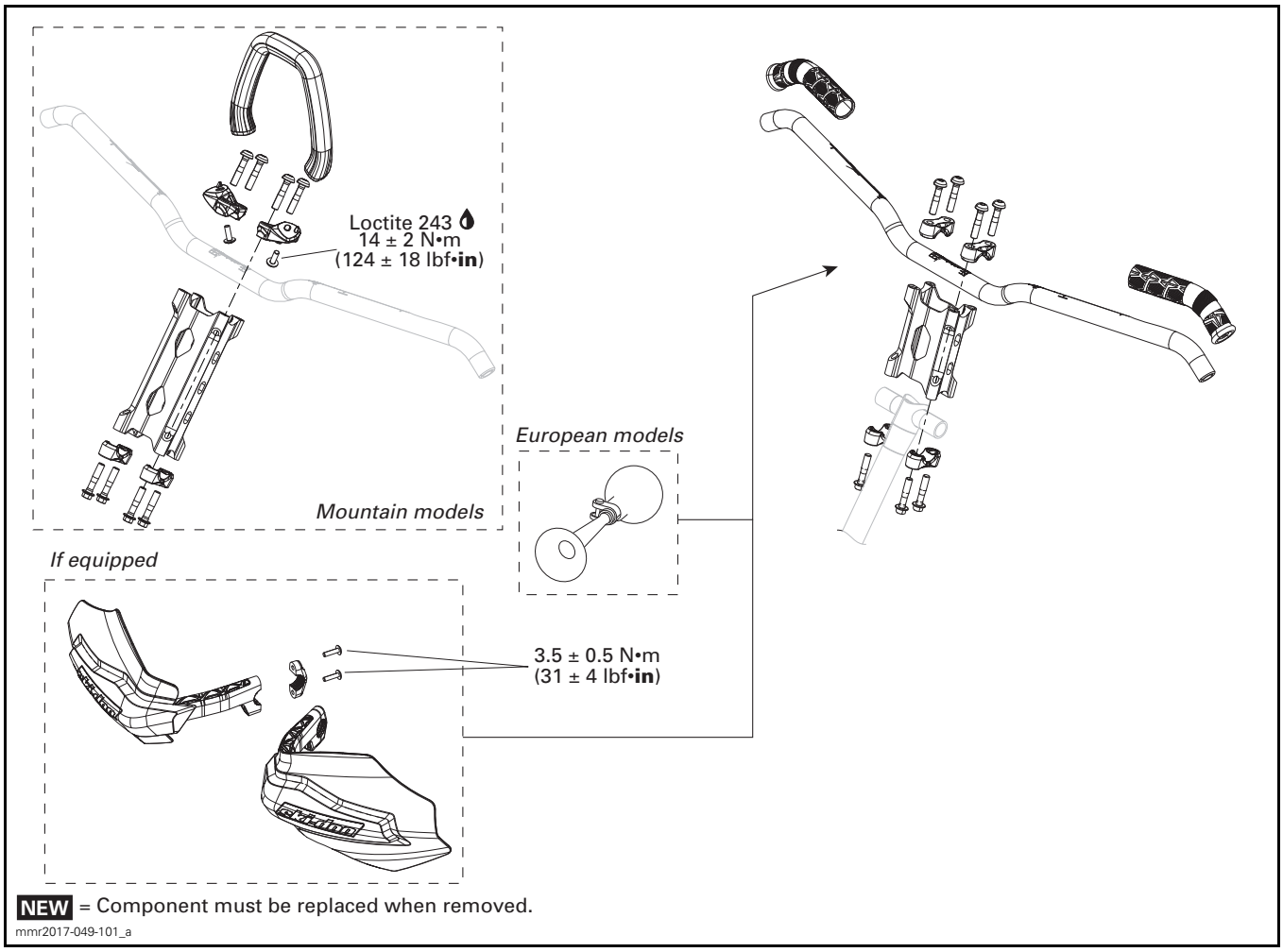
STEERING COLUMN AND TIE-RODS



HANDLEBAR



NEW = Component must be replaced when removed.

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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.

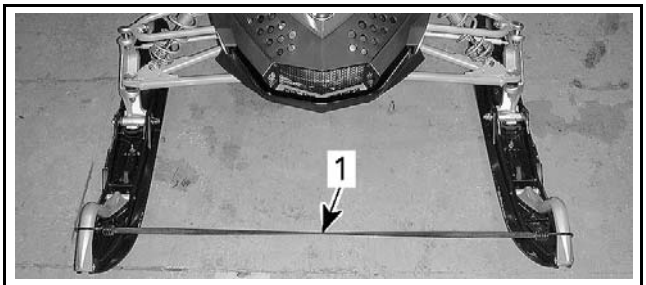
NOTICE **Hoses, cables and locking ties removed during a procedure must be reinstalled at the same location.**

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.



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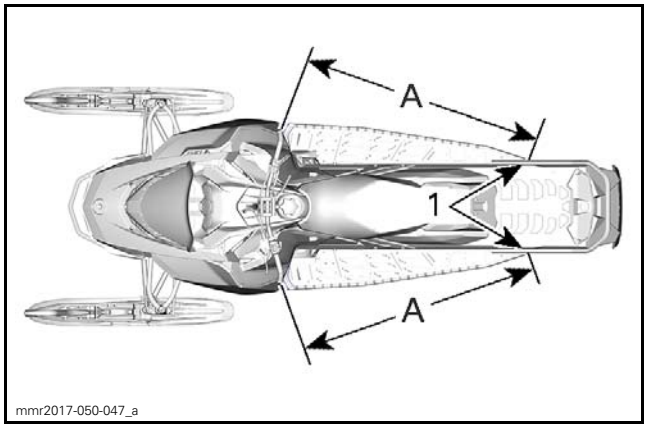
TYPICAL
1. Bungee cord

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.



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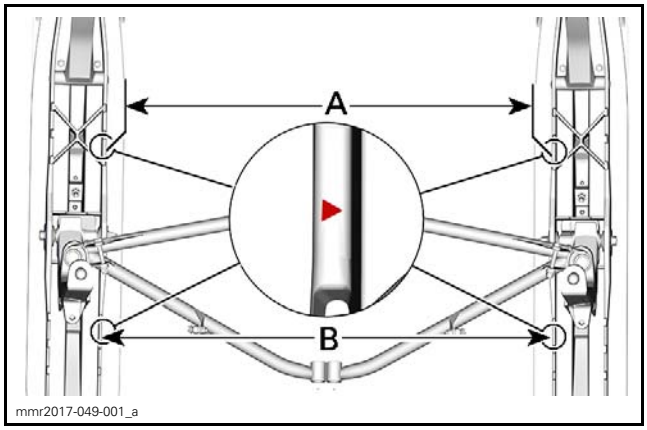
TYPICAL
1. Same reference point
A. Equal distance on each side

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.



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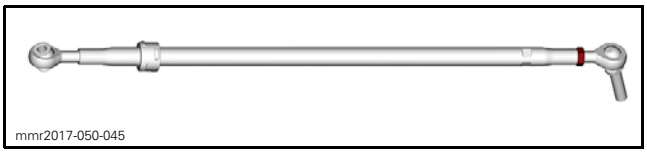
STEERING ALIGNMENT	
Toe-out	A – B = 5 mm (.197 in)

9. If adjustment is needed, loosen tie-rod jam nuts then turn tie-rods to change their length.

NOTE: There is no jam nut on the inner tie-rods.

10. Tighten jam nuts to specification.

TIGHTENING TORQUE	
Jam nut	18.5 N•m ± 3.5 N•m (164 lbf•**in** ± 31 lbf•**in**)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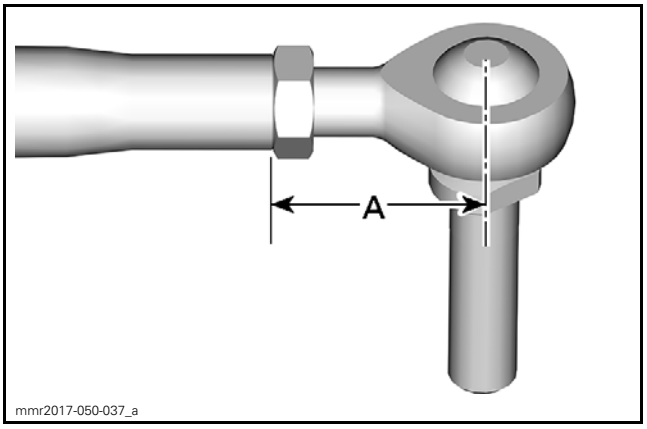
⚠ WARNING

The maximum tie-rod end length (A) not engaged in the tie rod must not exceed 34 mm (1.339 in).



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PROCEDURES

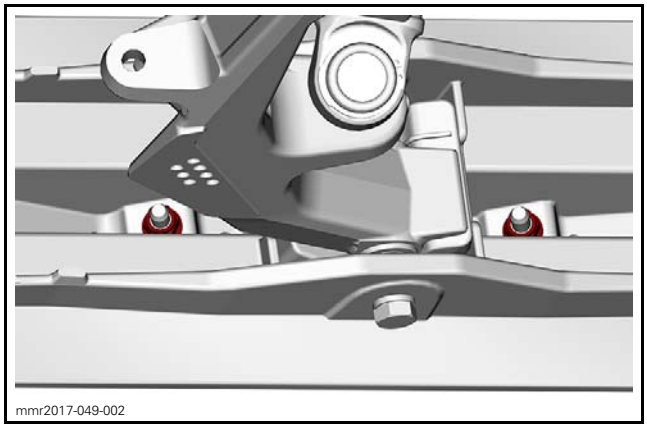
SKI RUNNER

Inspecting the Ski Runner

Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

Removing the Ski Runner

1. Lift the front of vehicle and support it off the ground.
2. Unscrew the ski runner nuts then remove ski runners.


mmr2017-049-002

Installing the Ski Runner

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

tighten ski runner nuts to specification.

TIGHTENING TORQUE	
Runner nut	8 N•m ± 1 N•m (71 lbf•**in** ± 9 lbf•**in**)

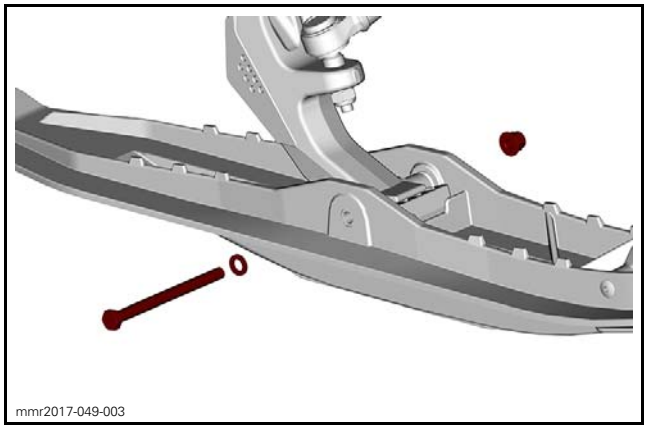
SKIS

Inspecting the Ski

Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

Removing the Ski

1. Lift front of vehicle and support it off ground.
2. Unscrew nut then pull ski bolt out.

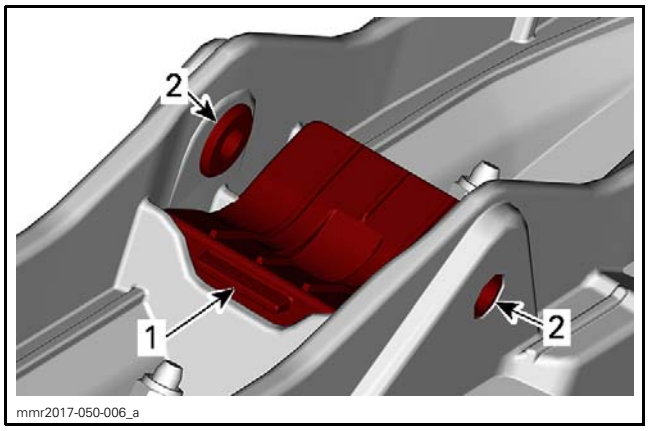

mmr2017-049-003

3. Remove ski from vehicle.

Installing the Ski

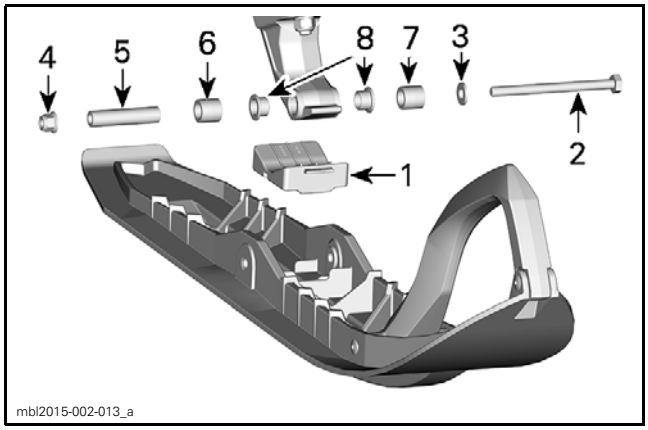
Make sure bushings are installed in ski holes.

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*

Mountain Models



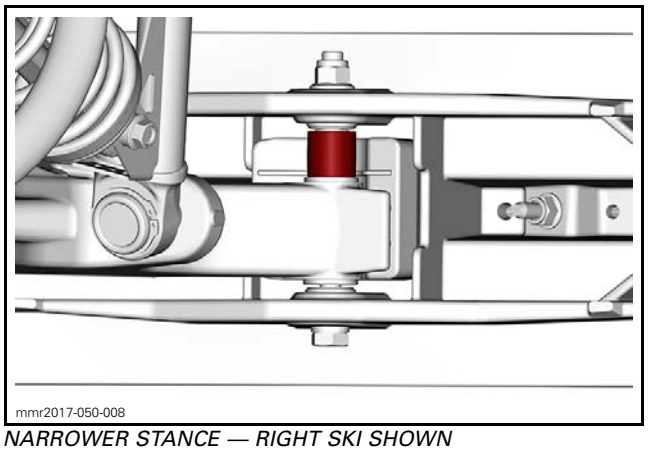
LH SIDE SHOWN

1. *Ski stopper*
2. *M10 x 130 screw*
3. *M10 flat washer*
4. *M10 flanged nut*
5. *Ski axel*
6. *Narrow adjustment*
7. *Wide adjustment*

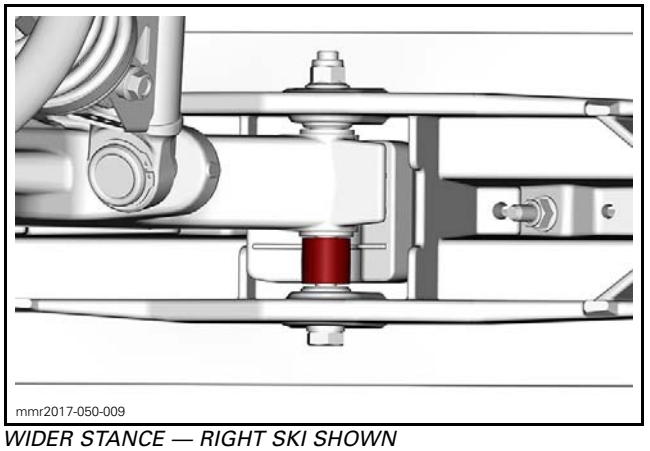
Install the spacer inside for the narrower stance and outside for the wider stance.

⚠ WARNING

Proceed to the same setting for both skis.



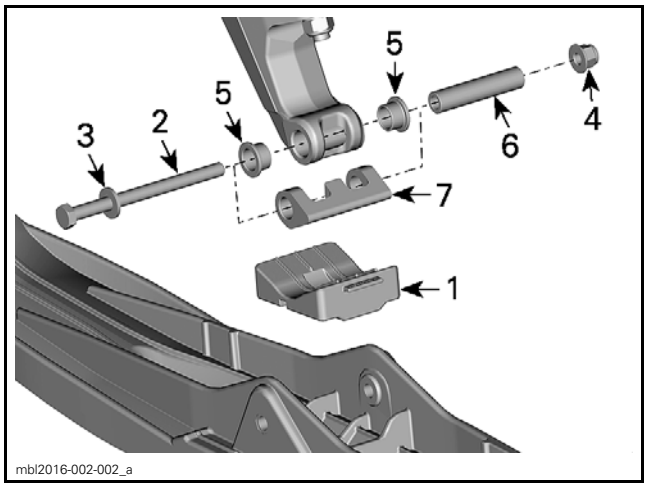
NARROWER STANCE — RIGHT SKI SHOWN



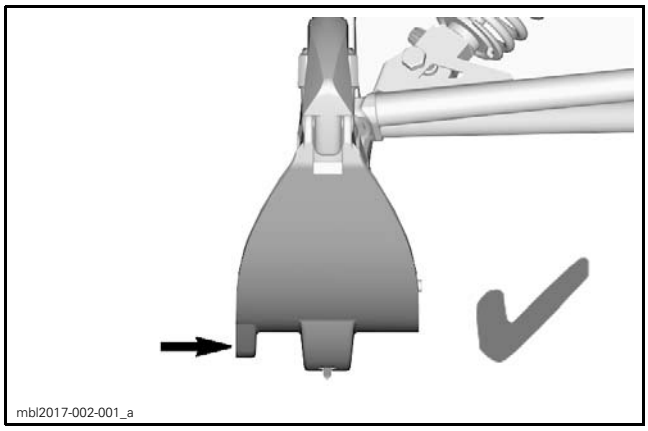
WIDER STANCE — RIGHT SKI SHOWN

Trail and Crossover Models

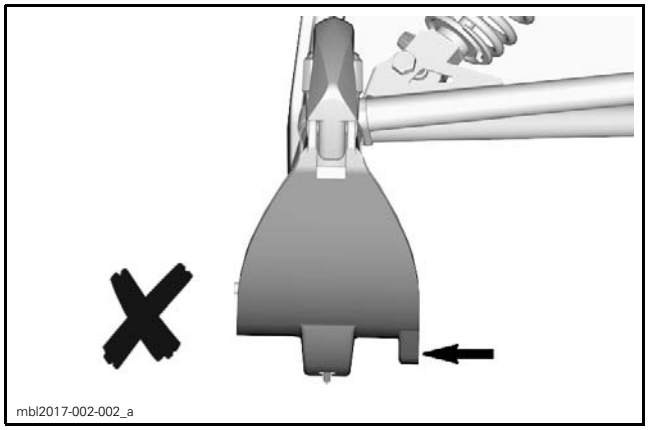
Install ski on ski leg as per the following illustrations.



1. *Ski stopper*
2. *M10 x 130 screw*
3. *M10 flat washer*
4. *M10 flanged nut*
5. *Ski leg bushings*
6. *Ski leg sleeve*
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)

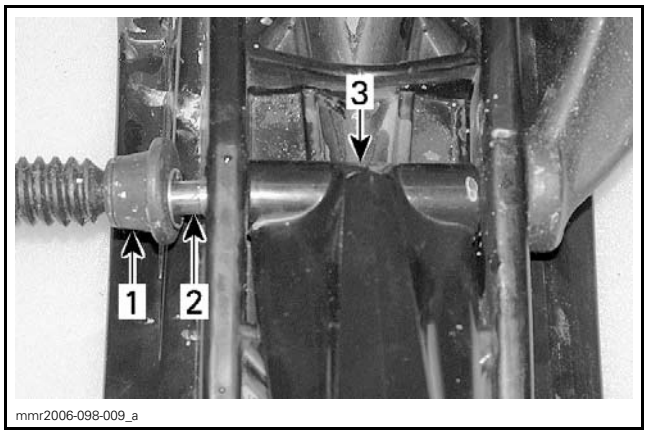
SKI HANDLES

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.

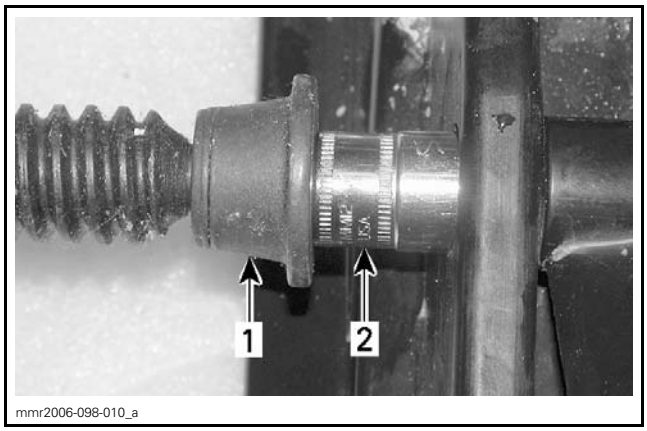
Installing the Ski Handle

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 FLOTATION EXTENSION (MOUNTAIN MODELS)

Condition Utilization

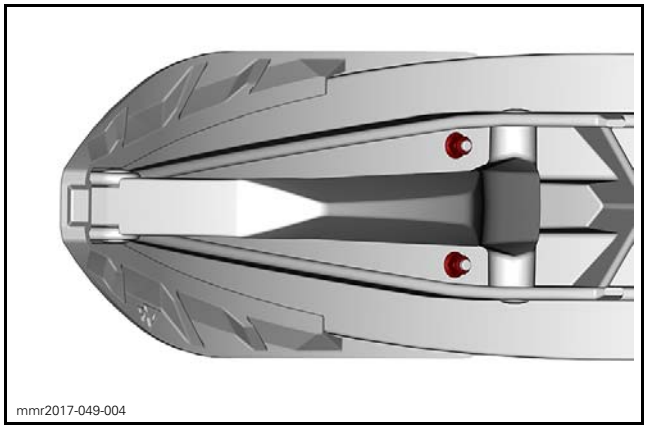
The key to the adjustable nose is to reduce the tip-hop that can slow down the vehicle.

In snow conditions with less than 41 cm (16 in) of fresh powder, specially when there is a crust, the narrow tip stays in the snow - which helps to maintain a carve. Also, when side hilling, and crossing a snowmobile rut, the narrow shape moves the impact point - where a change in snow density acts to tip-up the ski - more towards the spindle. This reduces kick back by 50% compared to the wider configuration, minimizing its impact on the attitude of the snowmobile holding a side hill.

In snow conditions with more than 41 cm (16 in) of fresh powder, the wider tip configuration is desirable, as it increases flotation and will bring the nose of the snowmobile up.

Removing the Ski Flotation Extension

1. Remove nuts and screws securing the extension to ski.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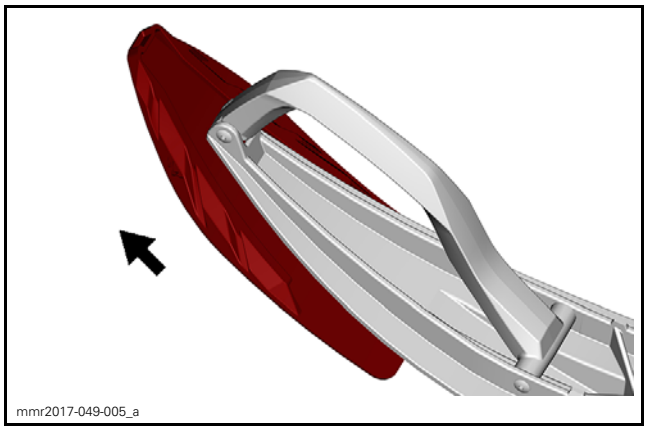
2. Slide the extension off the ski.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Installing the Ski Flotation Extension

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

1. Install extension nuts towards up and tighten to specification.

TIGHTENING TORQUE	
Extension nuts	3 N•m ± 0.5 N•m (27 lbf•**in** ± 4 lbf•**in**)

SKI LEG

To replace a ski leg, refer to *FRONT SUSPENSION* subsection.

HANDLEBAR GRIP

NOTE: 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.


mmr2015-143-007

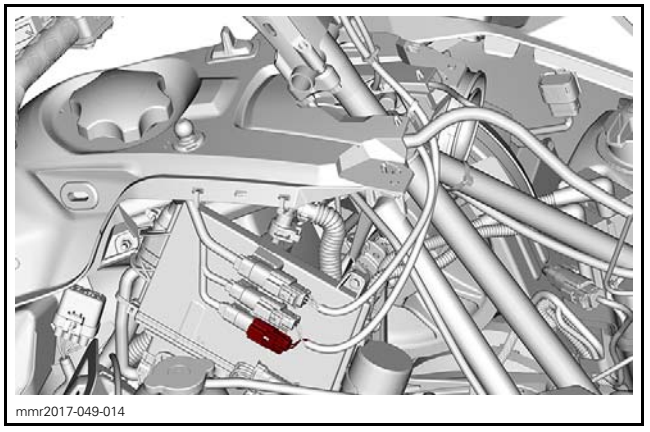
Installing the Handlebar Grip

Insert the handlebar grip on handlebar while blowing compressed air to inflate or loosen the fit between grip and handlebar.

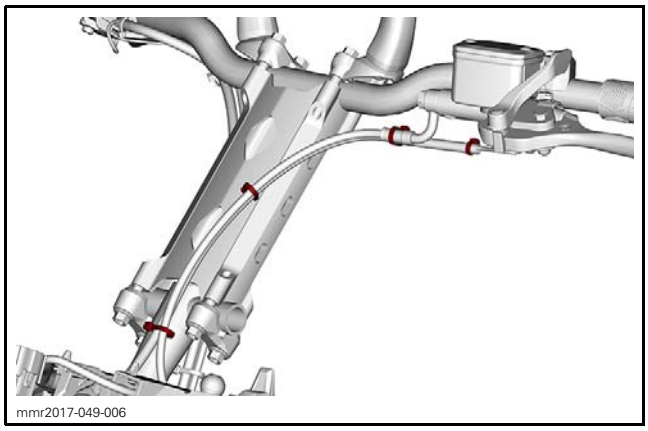
MULTIFUNCTION SWITCH

Removing the Multifunction Switch (Mountain models)

1. Remove the upper body module. Refer to *BODY* subsection.
2. Disconnect the multifunction switch connector (2-pin connector).


mmr2017-049-014

3. Cut locking ties securing multifunction switch harness.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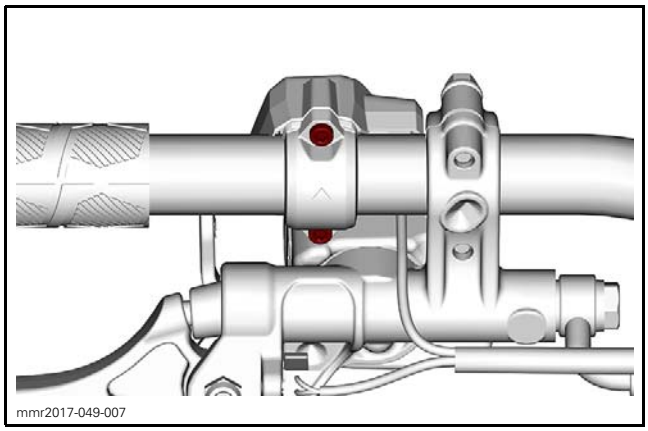
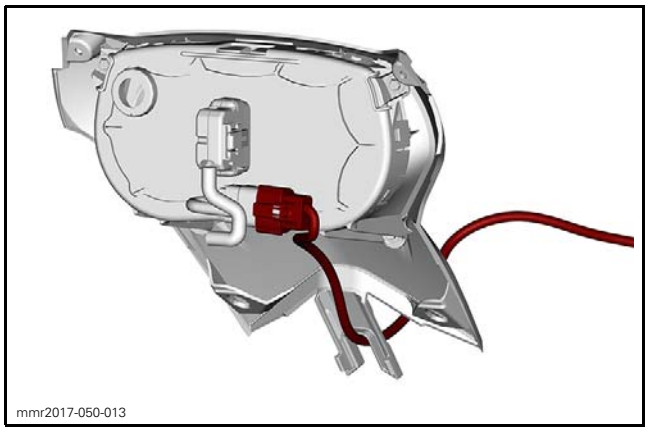
4. Remove multifunction switch screws.


mmr2017-049-007

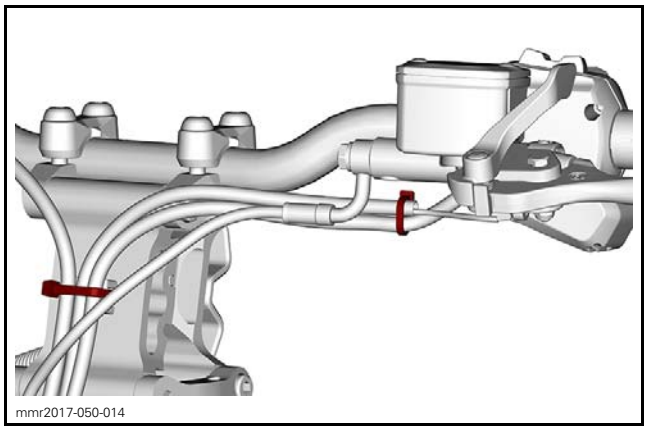
5. Remove multifunction switch from vehicle.

Removing the Multifunction Switch (Trail and Crossover models)

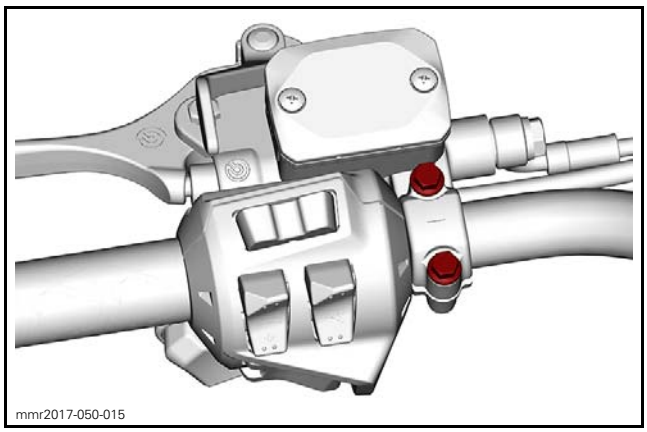
1. Remove the gauge support. Refer to *BODY* subsection.
2. Disconnect the multifunction switch connector.


mmr2017-050-013

3. Cut locking ties securing multifunction switch harness.


mmr2017-050-014

4. Unscrew master cylinder from handlebar.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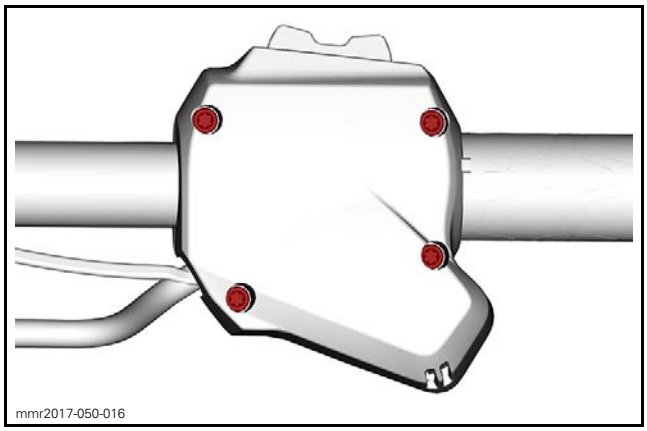
5. Remove master cylinder.

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

6. Remove multifunction switch screws.


mmr2017-050-016

7. Remove multifunction switch from vehicle.

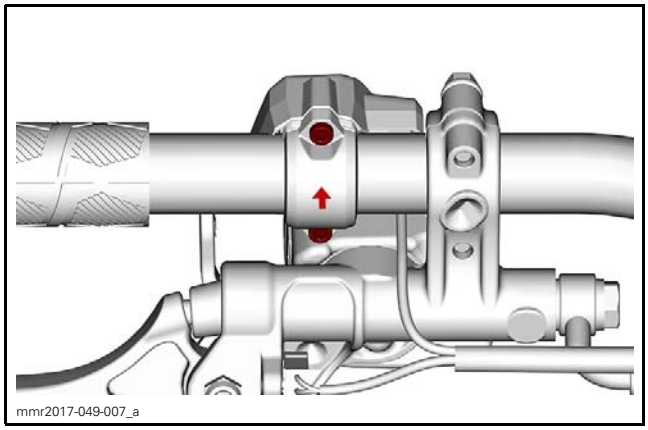
Installing the Multifunction Switch (Mountain models)

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

Install the multifunction switch clamp with the arrow towards rear.

Tighten multifunction switch screws to specification as per the following sequence.

TIGHTENING TORQUE	
Multifunction switch screws	2.4 N•m ± 0.2 N•m (21 lbf•**in** ± 2 lbf•**in**)



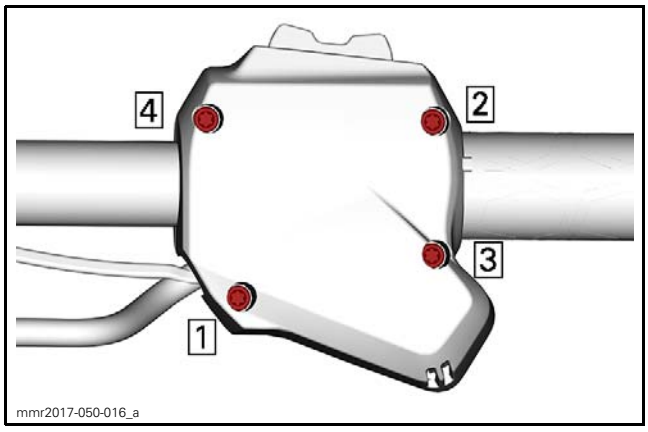
Turn handlebar completely from side to side making sure it does not exert unwanted tension on handlebar wires.

Installing the Multifunction Switch (Trail and Crossover Models)

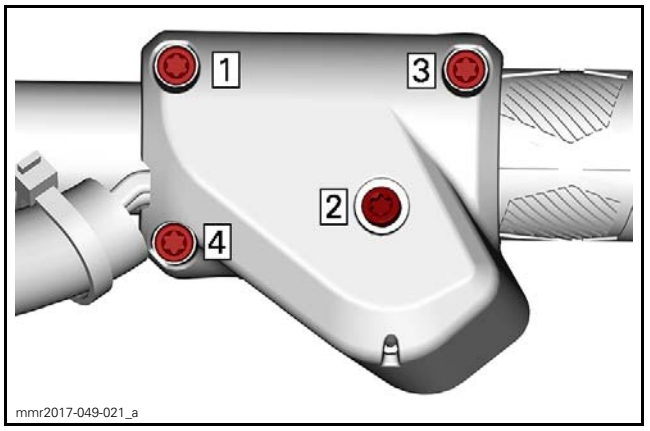
The installation is the reverse of the removal procedure. However, pay attention to the following.

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**)



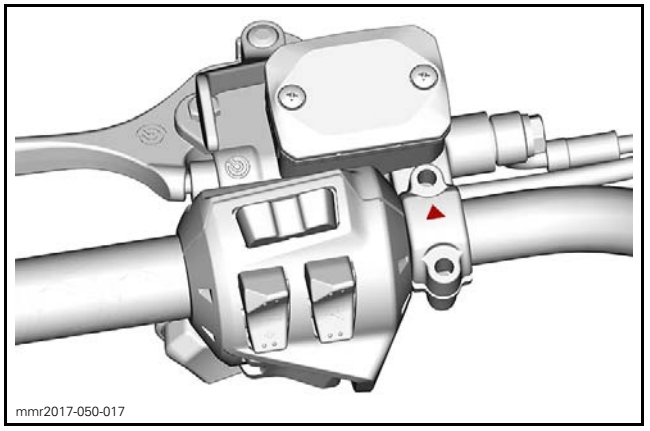
TRAIL AND CROSSOVER MODELS



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.

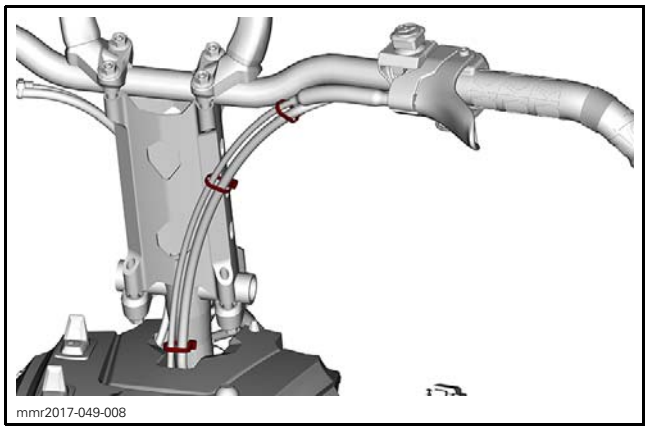
TIGHTENING TORQUE	
Master cylinder clamp screws	9 N•m ± 1 N•m (80 lbf•**in** ± 9 lbf•**in**)

Turn handlebar completely from side to side making sure it does not exert unwanted tension on handlebar wires.

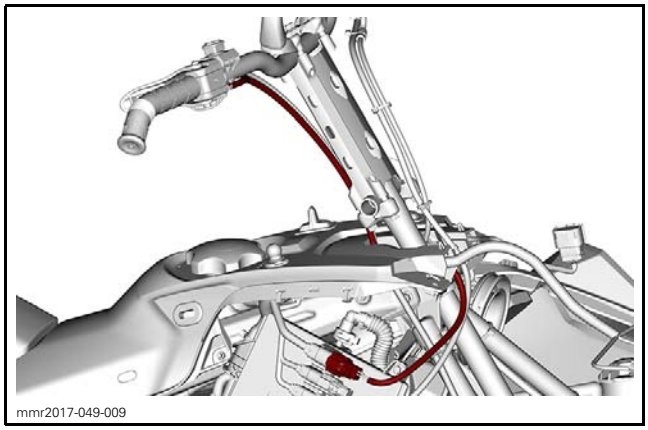
THROTTLE LEVER HOUSING

Removing the Throttle Lever Housing

1. Remove the upper body module. Refer to *BODY* subsection.
2. Cut the harness locking ties.


mmr2017-049-008

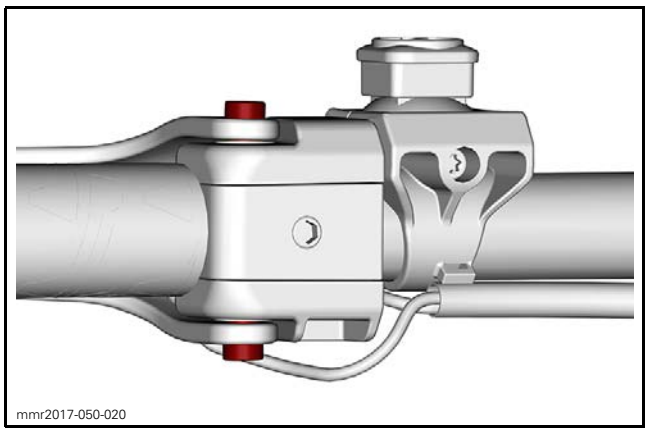
3. Disconnect the LH heater element connector (6-pin connector).


mmr2017-049-009

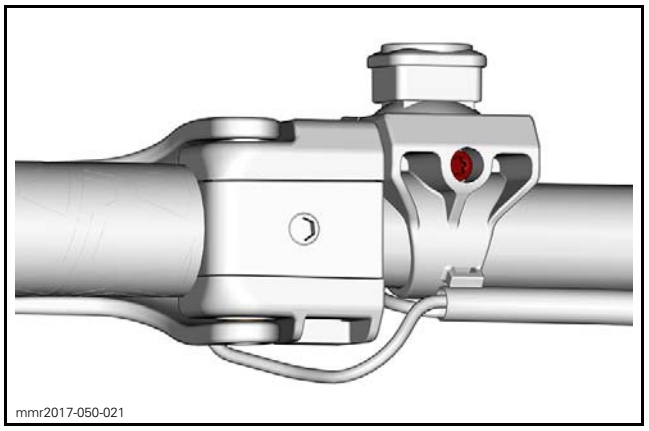
4. Remove the heater element wire terminals from connector. Refer to *WIRING HARNESS AND CONNECTORS* subsection.

NOTICE **Take note of exact positioning of multifunction wire before removing it from the connector.**

5. Disconnect throttle cable from throttle lever.
6. Remove both throttle lever pivot screws.


mmr2017-050-020

7. Loosen the emergency stop switch screw and slide the switch towards center of handlebar.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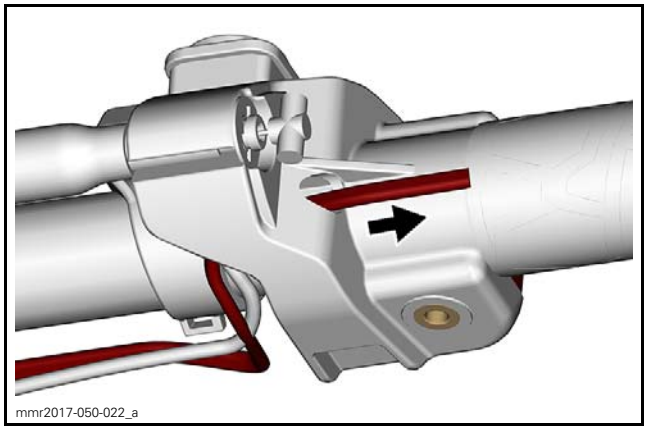
8. Pull the heater element wire out of the throttle lever housing.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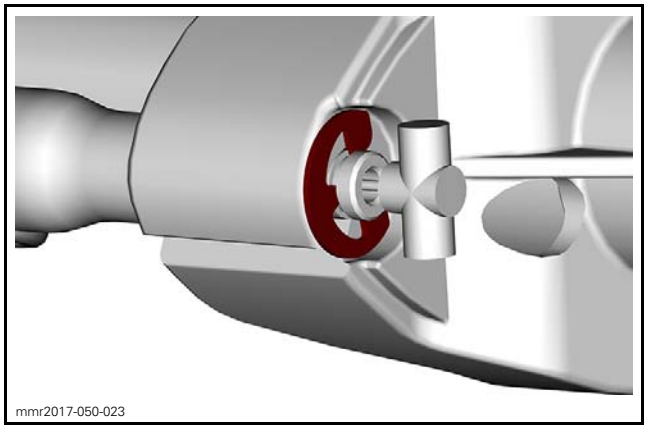
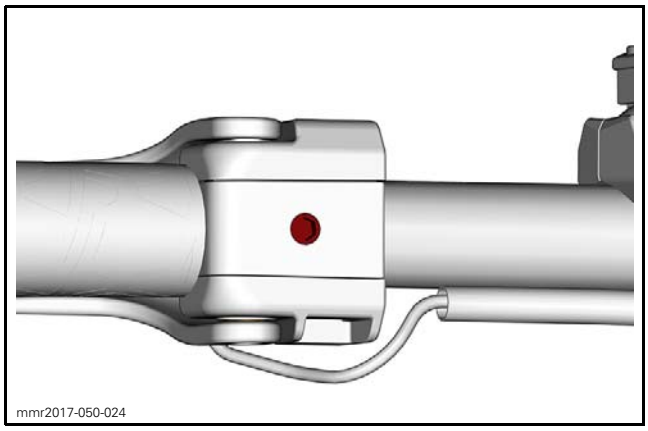
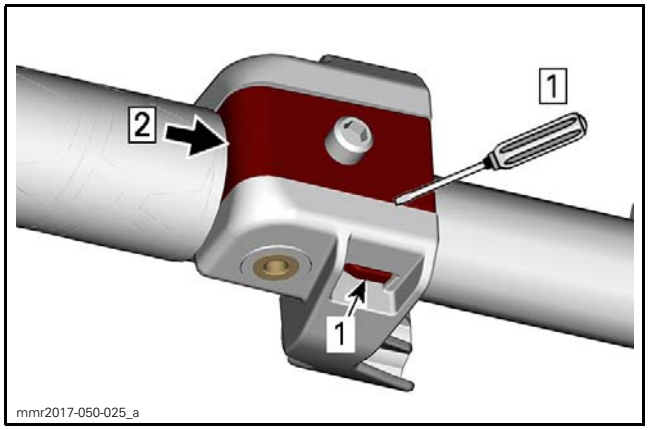
9. Remove throttle cable circlip.


mmr2017-050-023

10. Remove the throttle cable from the housing.
11. Loosen throttle lever housing retaining screw.

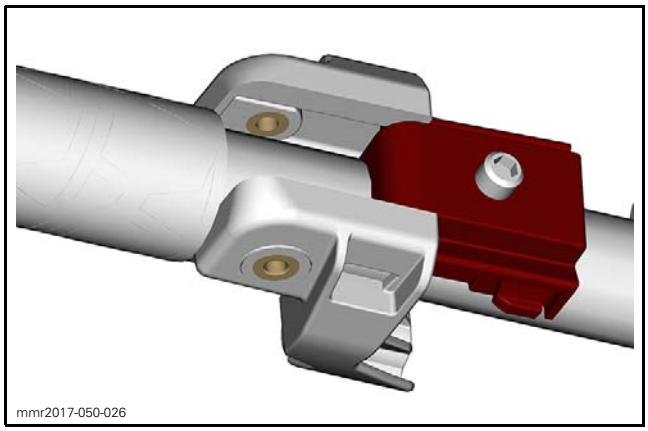


12. Insert a flat screwdriver between the housing and the clamp to release the tab.

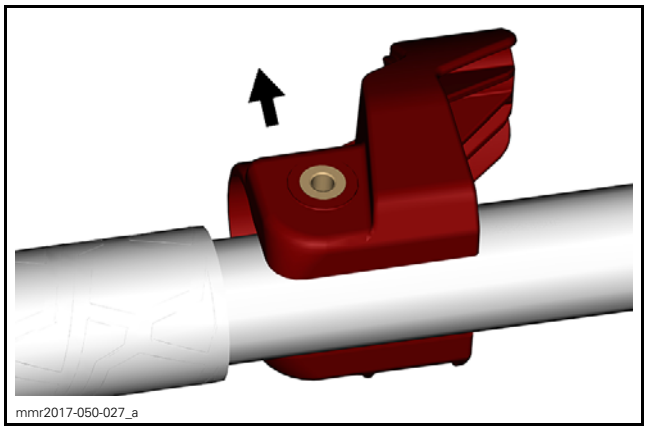


1. Tab

13. Slide the clamp out of the housing



14. Remove throttle lever housing from handlebar.



Installing the Throttle Lever Housing

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

Tighten throttle lever pivot screws to specification.

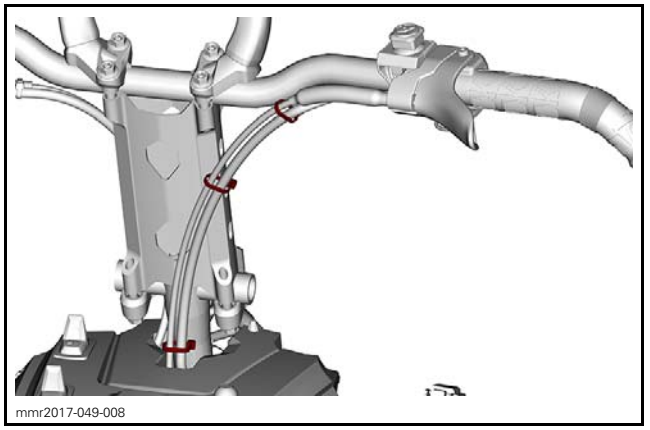
TIGHTENING TORQUE	
Throttle lever retaining screws	1.5 N•m ± 0.2 N•m (13 lbf•**in** ± 2 lbf•**in**)

Turn handlebar completely from side to side making sure it does not exert unwanted tension on handlebar wires.

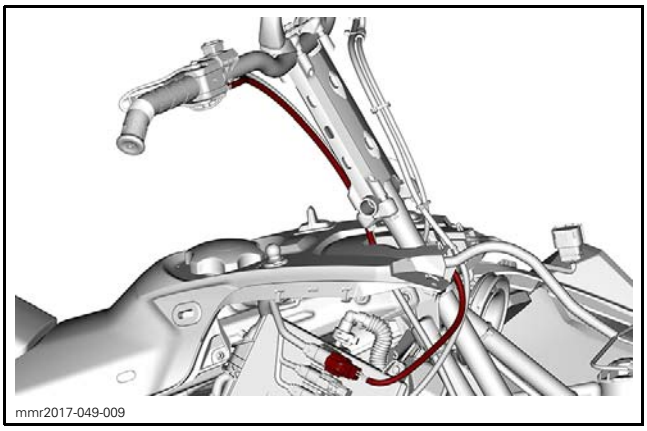
THROTTLE LEVER

Removing the Throttle Lever

1. Remove the upper body module. Refer to *BODY* subsection.
2. Cut the harness locking ties.



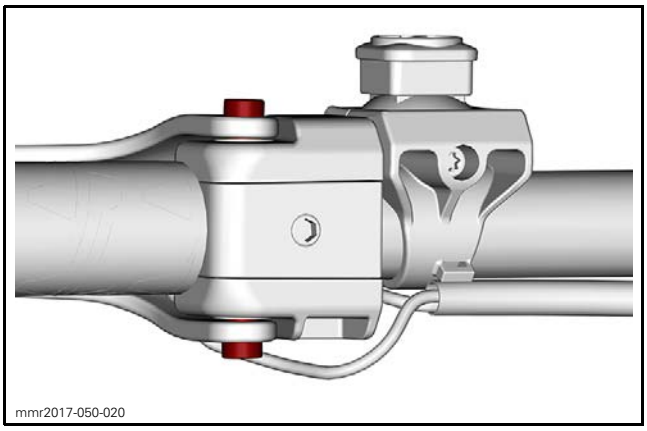
3. Disconnect the LH heater element connector.


mmr2017-049-009

4. Remove throttle lever heater wire terminals from connector. Refer to *CONNECTOR INFORMATION* subsection.

NOTICE **Take note of exact positioning of throttle lever heater before removing it from the connector.**

5. Disconnect throttle cable from throttle lever.
6. Remove throttle lever pivot screws.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7. Remove throttle lever and heater wires.

Installing the Throttle Lever

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

Tighten throttle lever pivot screws to specification.

TIGHTENING TORQUE	
Throttle lever pivot screws	1.5 N•m ± 0.2 N•m (13 lbf•**in** ± 2 lbf•**in**)

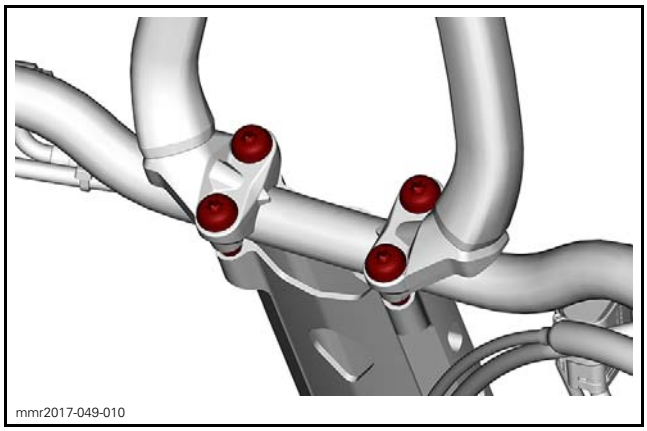
Turn handlebar completely from side to side making sure it does not exert unwanted tension on handlebar wires.

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.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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.

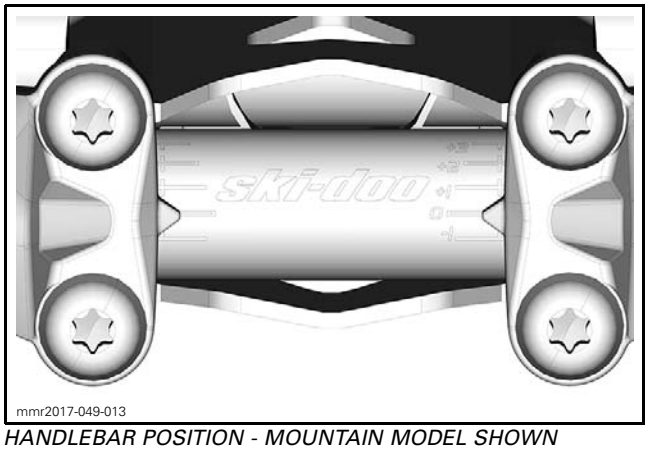
3. Check handlebar clamps for cracks or distortion, replace if necessary.

Installing the Handlebar

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

Position the handlebar with clamps, as per the following table.

MODEL	HANDLEBAR POSITION
Mountain	0
Trail and crossover	+1

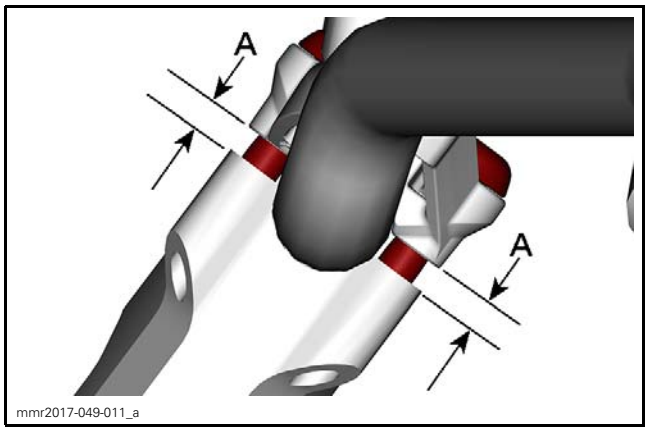


HANDLEBAR POSITION - MOUNTAIN MODEL SHOWN

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.



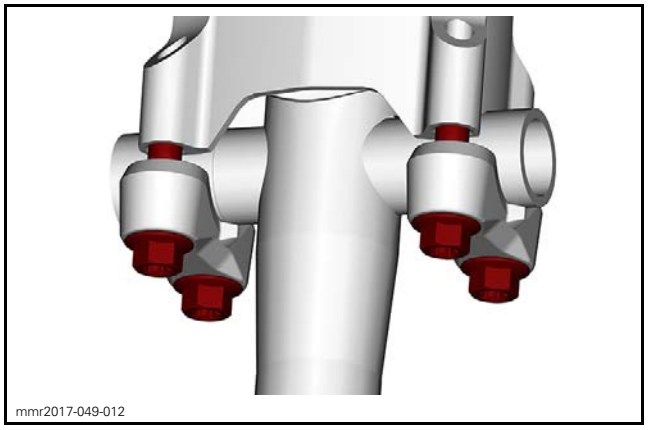
A. Must be equal on each side

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

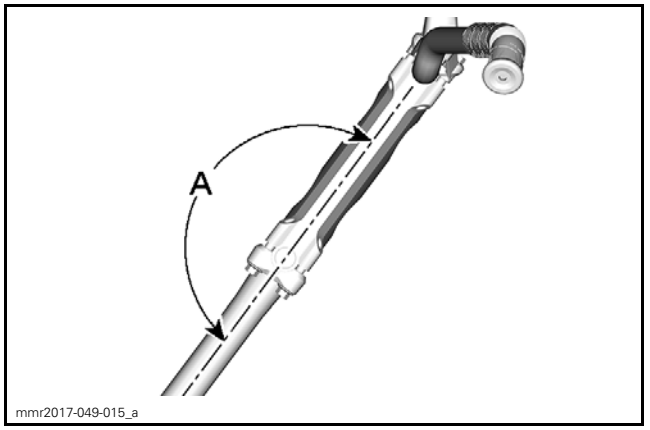
Do not try to repair a defective handlebar extension.

Installing the Handlebar Extension

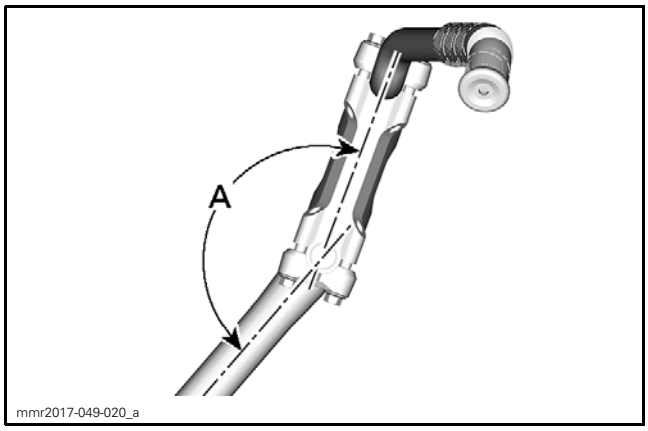
The installation is the reverse of the removal procedure. However, pay attention to the following.

Position the extension with the steering column, as per the following table.

MODEL	HANDLEBAR EXTENSION POSITION ANGLE
Mountain	180°
Trail and crossover	159°

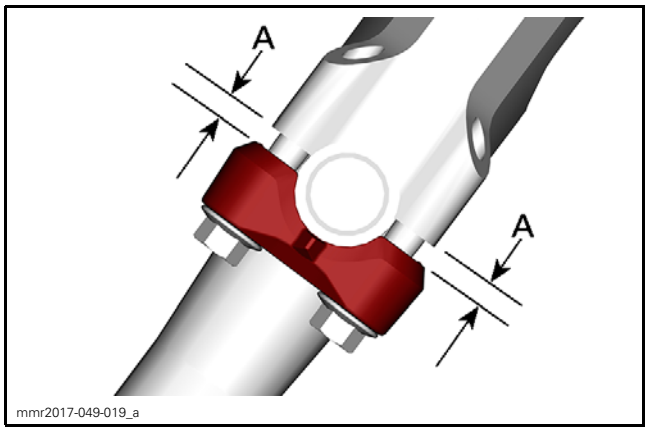


MOUNTAIN MODELS



TRAIL AND CROSSOVER MODELS

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.

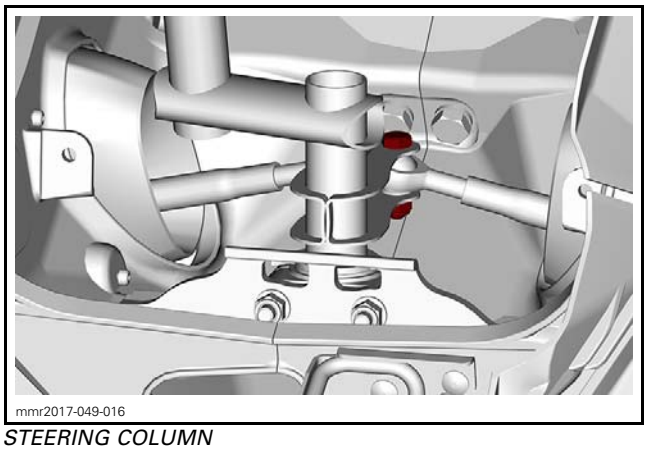
Inspecting the Tie-Rod

Check tie-rod ends for looseness. If play is excessive, replace tie-rod.

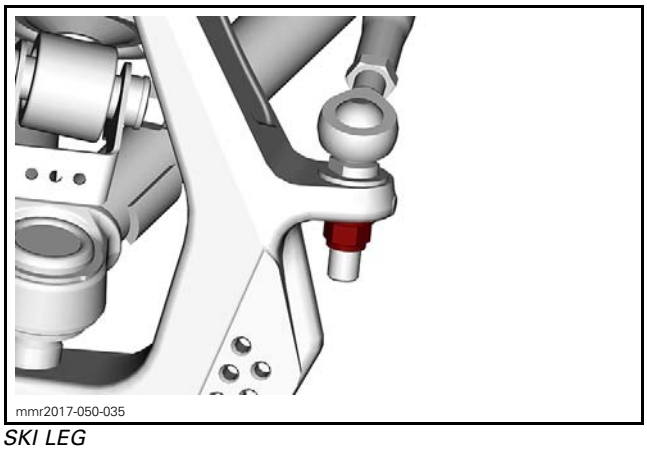
Check if the tie-rod is bent, cracked or otherwise damaged. Replace if necessary.

Removing the Tie-Rod

1. Remove the tuned pipe. Refer to *EXHAUST SYSTEM* subsection.
2. Remove the tie-rod end nuts and screws from the steering column and ski leg.

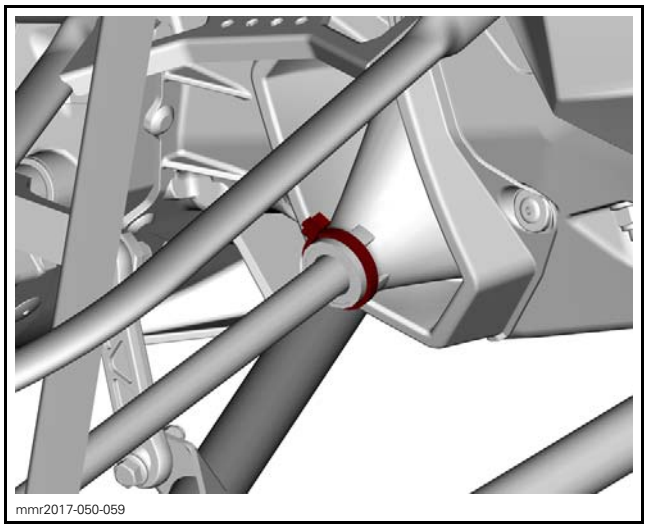


STEERING COLUMN

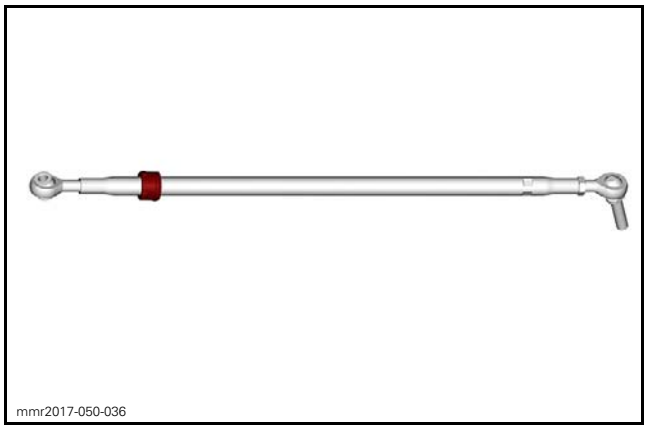


SKI LEG

3. Cut the locking tie on the steering boot.



4. Remove tie-rod with ring from vehicle.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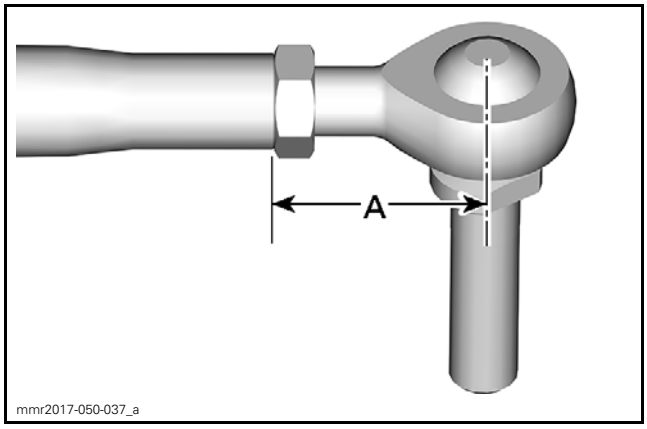
Installing the Tie-Rod

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.



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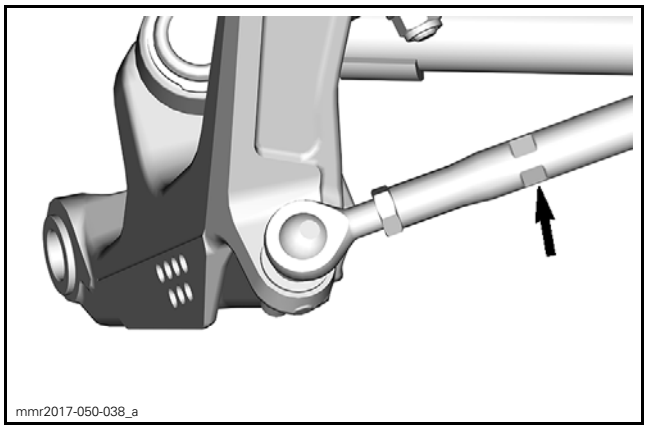
TIE-ROD LENGTH (A)
30 mm (1.181 in)

⚠ 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.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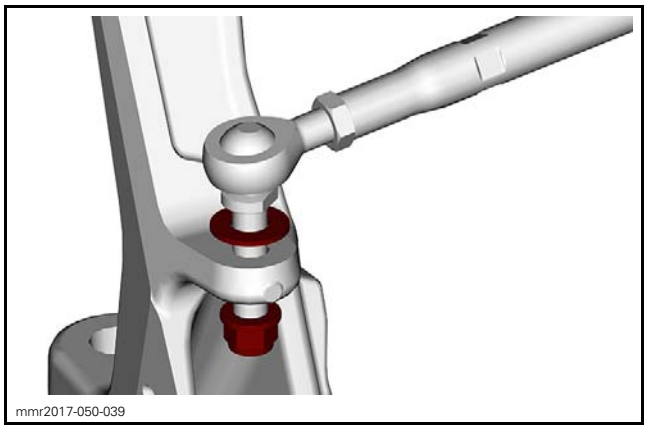
Install the washer and the nut, and tighten to specification.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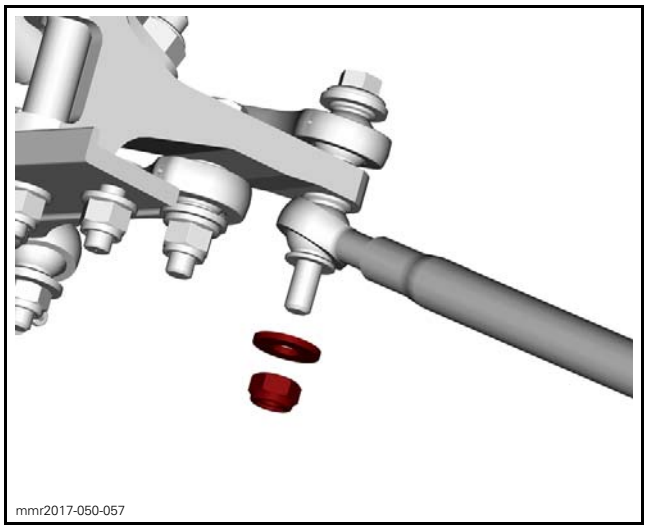
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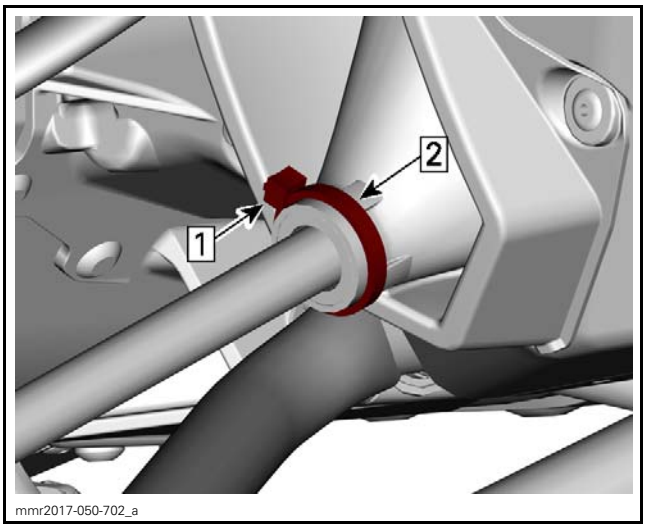
TIGHTENING TORQUE	
Outer tie-rod end nut	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)
Inner tie-rod end nut	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

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.



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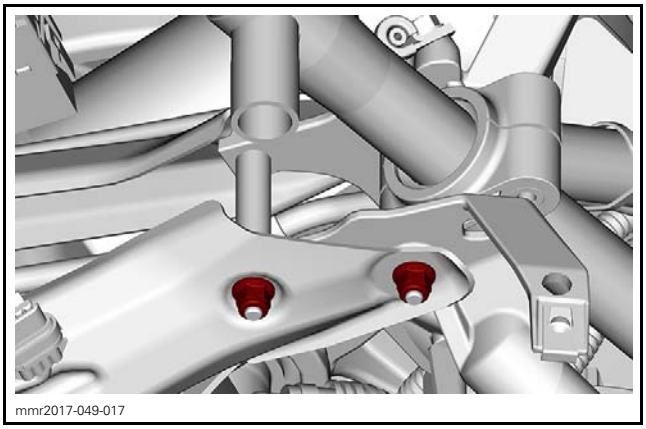
1. Head up
2. Fully seated

Perform the steering alignment, refer to *ALIGNING THE STEERING* in this section.

STEERING COLUMN

Removing the Steering Column

1. Remove the tuned pipe. Refer to *EXHAUST SYSTEM* subsection.
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.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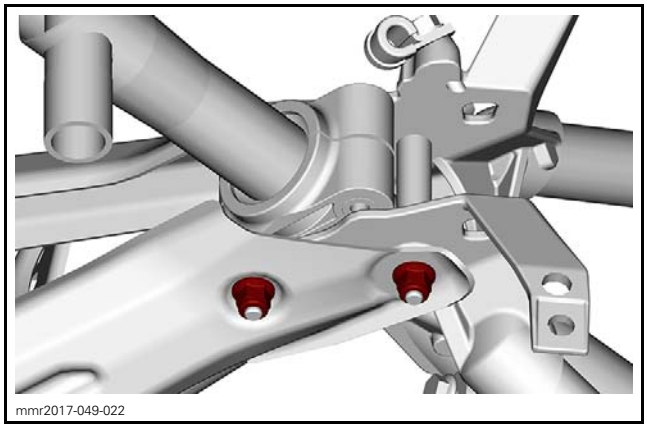
FRONTWARD POSITION COLUMN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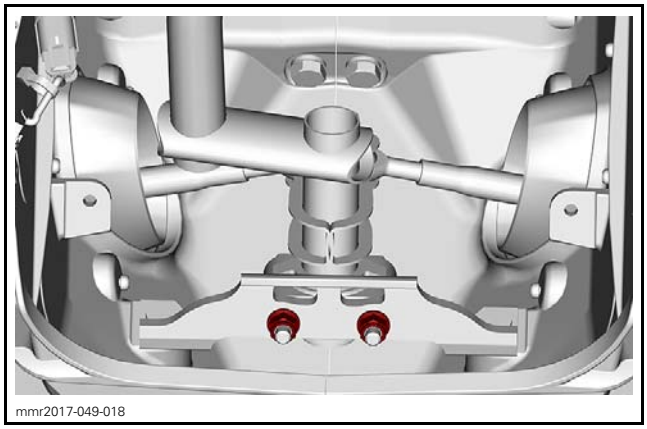
REARWARD POSITION COLUMN

6. Remove nuts and screws securing the steering column lower support.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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 SUSPENSION GREASE (P/N 293 550 033) on vibration dampers before installing upper and lower supports.
2. Install new elastic nuts on the steering column retaining screws.

3. Tighten nuts to specification.

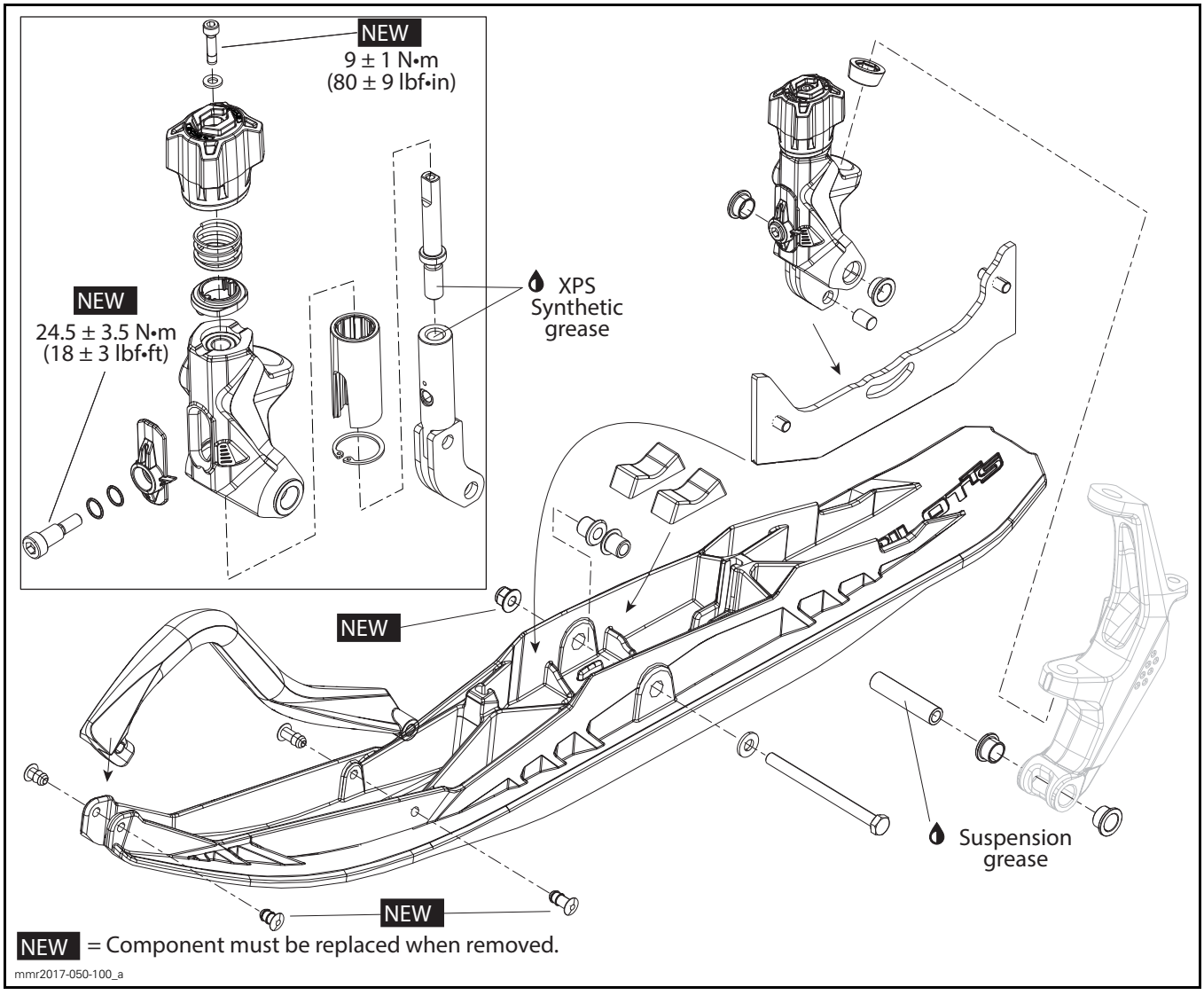
TIGHTENING TORQUE	
Upper steering column support nut	12.5 N•m ± 2.5 N•m (111 lbf•**in** ± 22 lbf•**in**)
Lower steering column support nut	23.5 N•m ± 3.5 N•m (17 lbf•ft ± 3 lbf•ft)

STEERING SYSTEM (RACK)

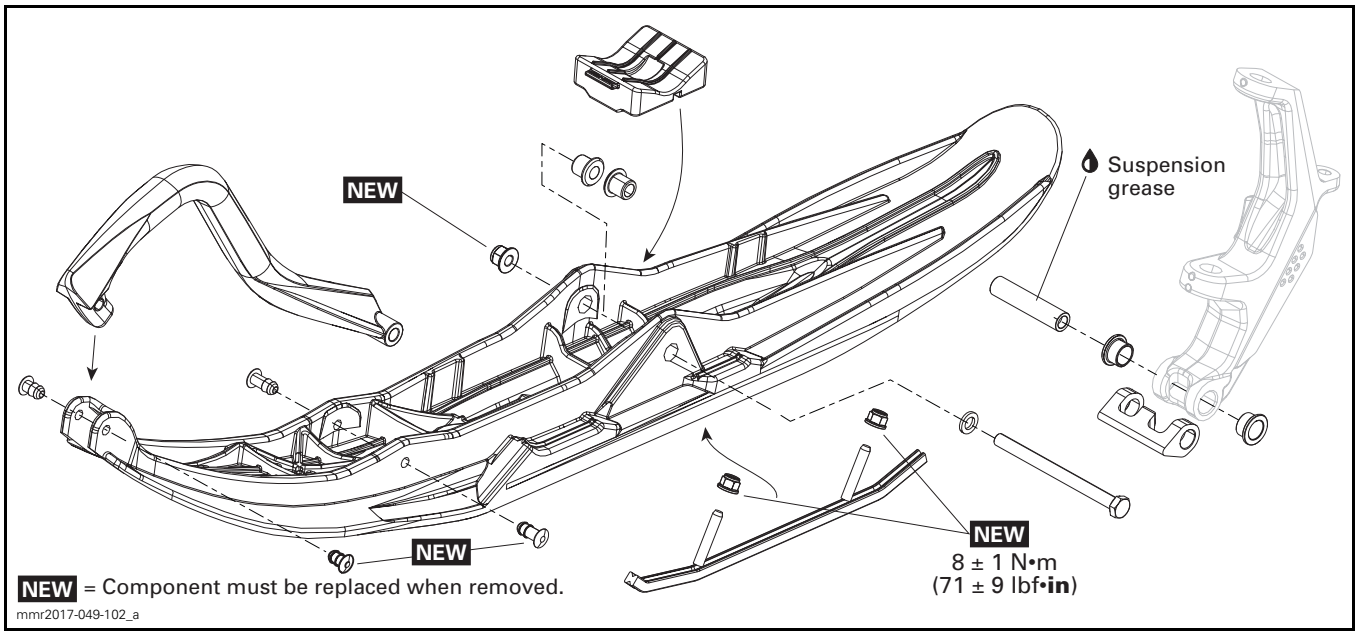
SERVICE PRODUCTS

Description	Part Number	Page
SUSPENSION GREASE	293 550 033	18
XPS BRAKES AND PARTS CLEANER (USA)	219 701 705	8
XPS BRAKES AND PARTS CLEANER	219 701 776	8
XPS SYNTHETIC GREASE	293 550 010	8

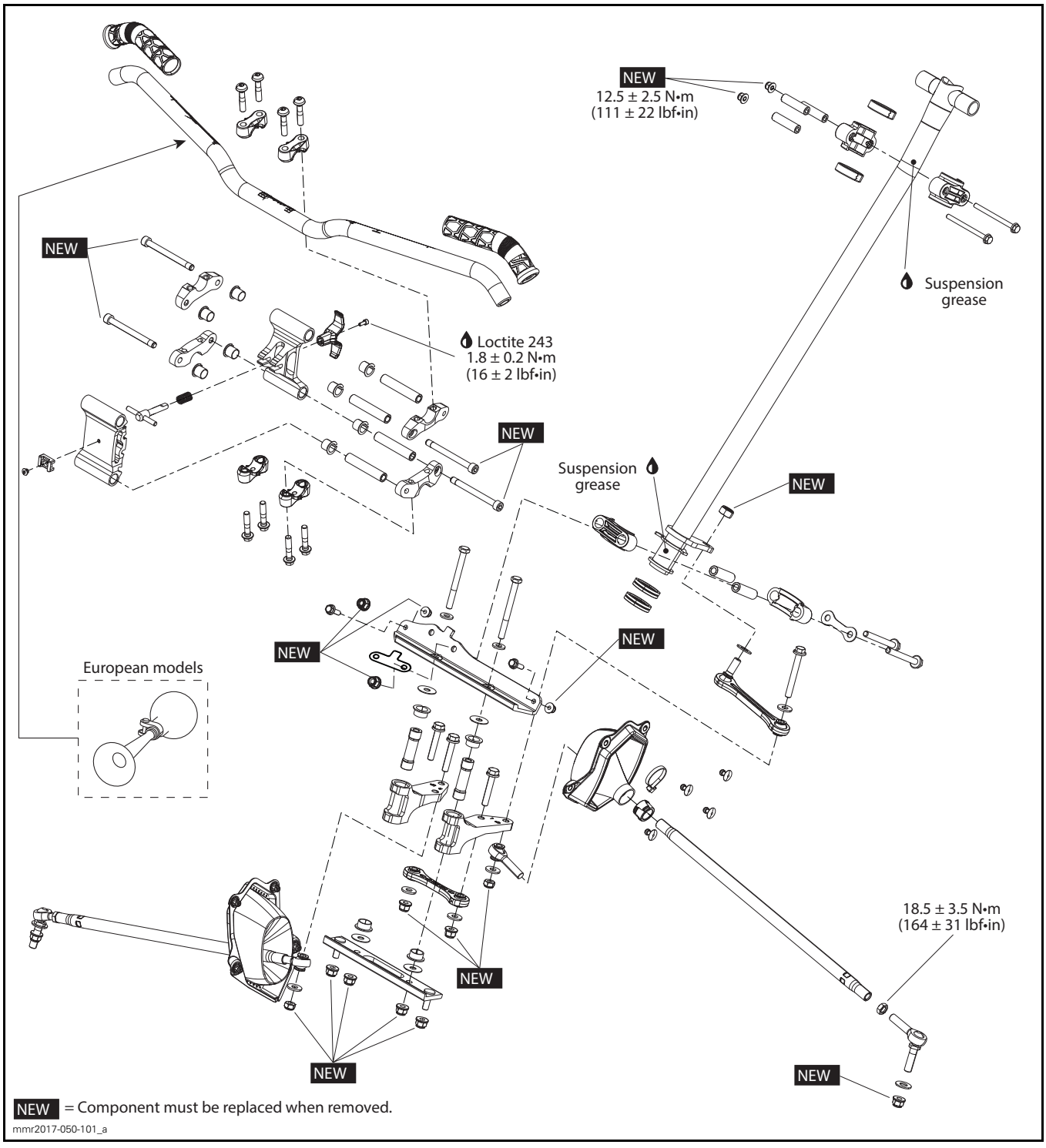
SKIS (WITH ADJUSTABLE RUNNER)



SKIS (WITHOUT ADJUSTABLE RUNNER)



STEERING COLUMN AND TIE-RODS



GENERAL

When removing or replacing a part of the steering mechanism, perform the steering alignment, refer to *STEERING ALIGNMENT* 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.

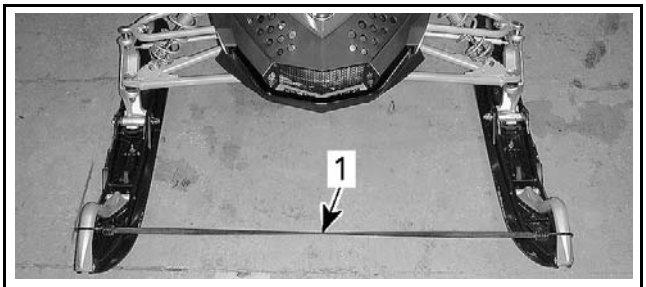
NOTICE **Hoses, cables and locking ties removed during a procedure must be reinstalled at the same location.**

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.



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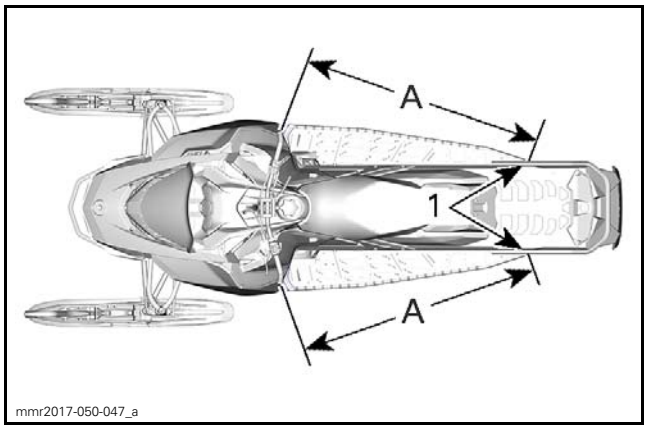
1. Bungee cord

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.

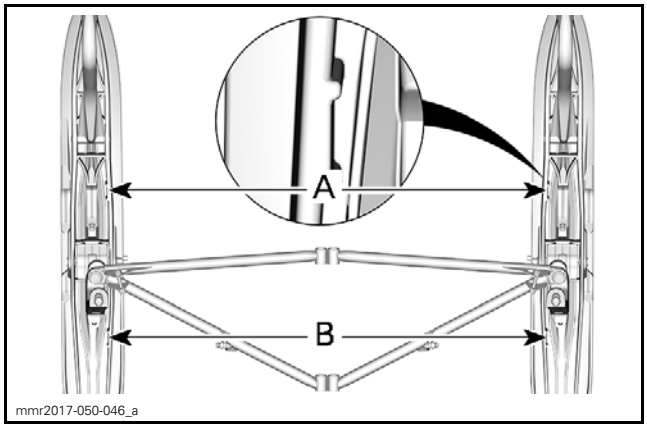
NOTE: The reference point must be the same to each side.



mmr2017-050-047_a

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. Adjust the steering alignment as per the following illustration and specification.



mmr2017-050-046_a

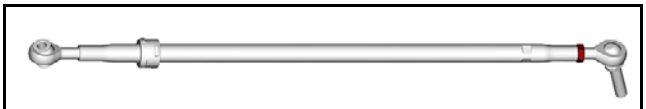
STEERING ALIGNMENT	
Toe-out	A - B = 5 mm (.197 in)

9. If adjustment is needed, loosen tie-rod jam nuts then turn tie-rods to change their length.

NOTE: There is no jam nut on the inner tie-rods.

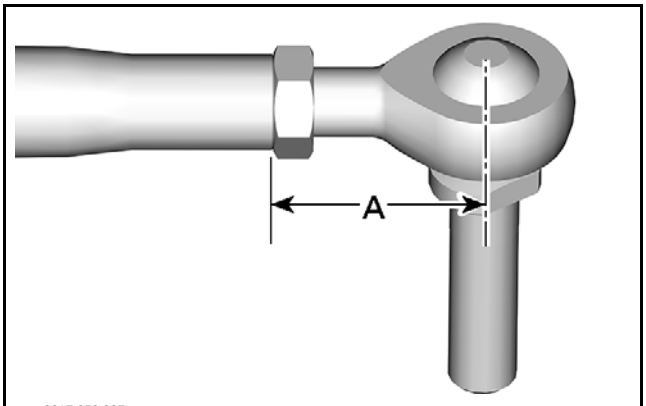
10. Tighten jam nuts to specification.

TIGHTENING TORQUE	
Jam nut	18.5 N•m ± 3.5 N•m (164 lbf•**in** ± 31 lbf•**in**)


mmr2017-050-045

⚠ WARNING

The maximum tie-rod end length (A) not engaged in the tie rod must not exceed 34 mm (1.339 in).



mmr2017-050-037_a

PROCEDURES

SKI RUNNER

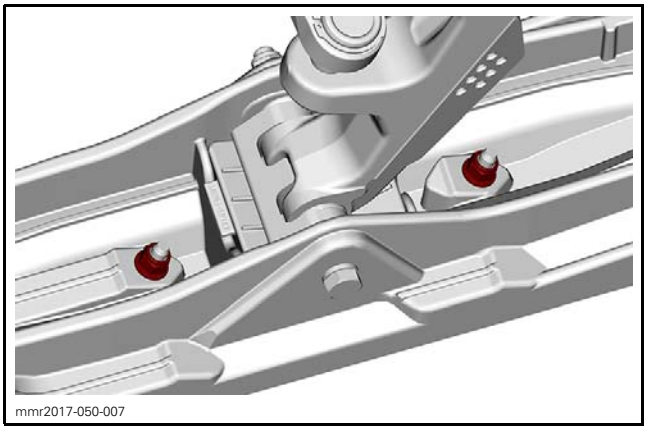
Inspecting the Ski Runner

Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

Removing the Ski Runner

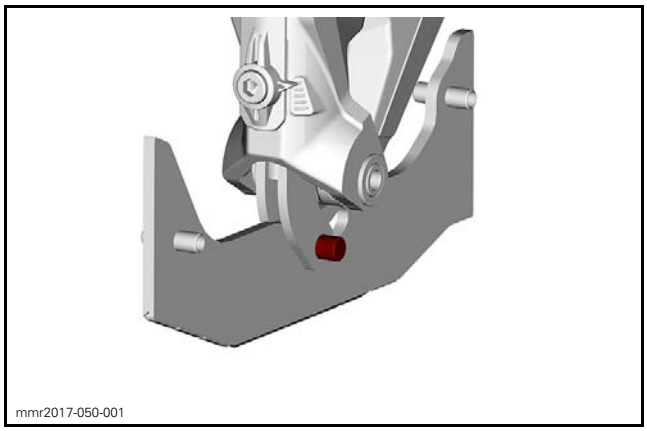
Without Adjustable Ski (Pilot TS)

1. Lift the front of vehicle and support it off the ground.
2. Unscrew the ski runner nuts, then remove the ski runner.


mmr2017-050-007

With Adjustable Ski (Pilot TS)

1. Remove the ski.
2. Remove the pin.


mmr2017-050-001

Installing the Ski Runner

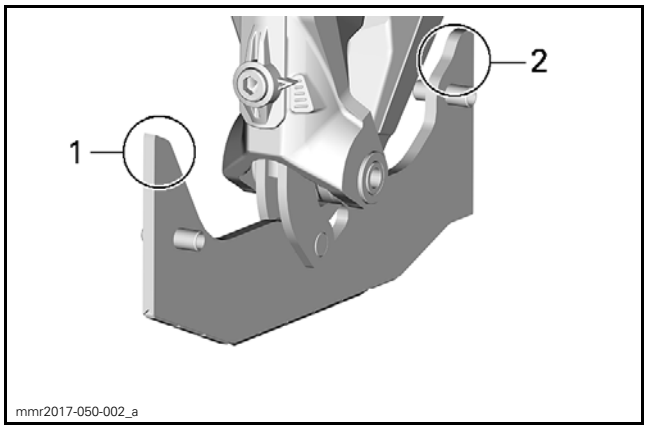
The installation is the reverse of the removal procedure. Pay attention to the following.

Without Adjustable Ski (Pilot TS)

Tighten ski runner nuts to specification.

TIGHTENING TORQUE	
Runner nut	8 N•m ± 1 N•m (71 lbf•**in** ± 9 lbf•**in**)

With Adjustable Ski (Pilot TS)



mmr2017-050-002_a

1. Towards front
2. Towards rear

SKIS

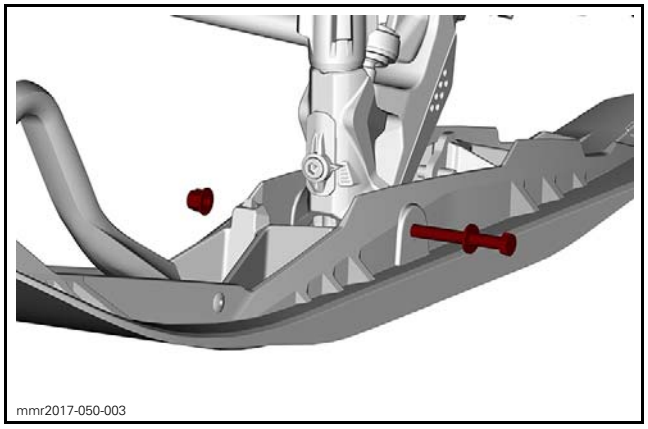
Inspecting the Ski

Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

Removing the Ski

1. Lift front of vehicle and support it off ground.

2. Unscrew nut then pull ski bolt out.

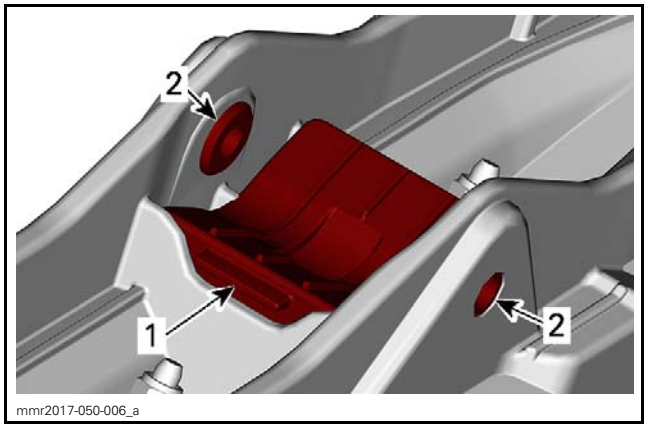


3. Remove ski from vehicle.

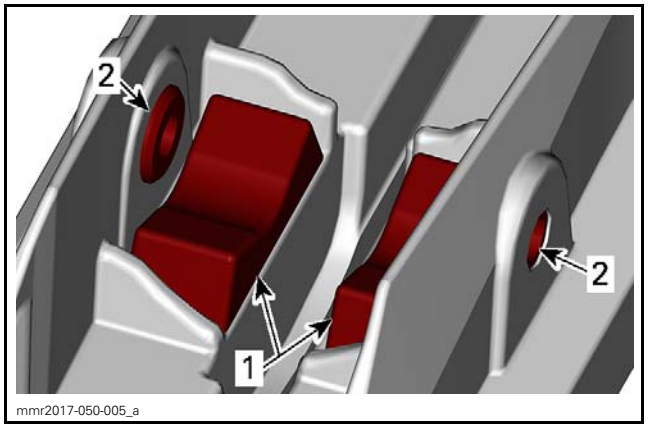
Installing the Ski

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.

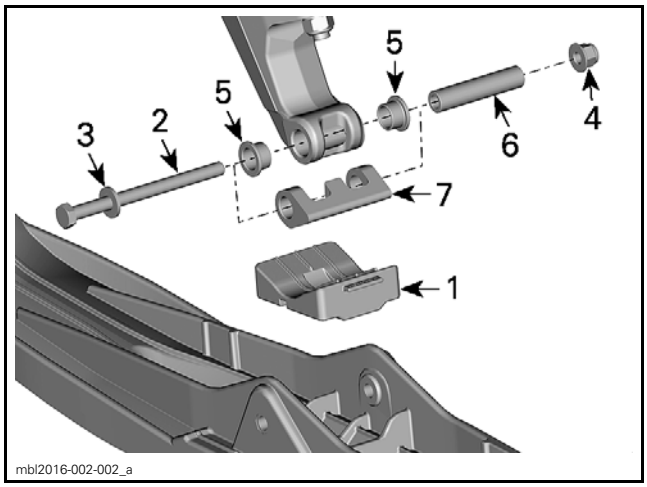


WITHOUT ADJUSTABLE SKI (PILOT TS)
1. *Ski stopper*
2. *Bushings*

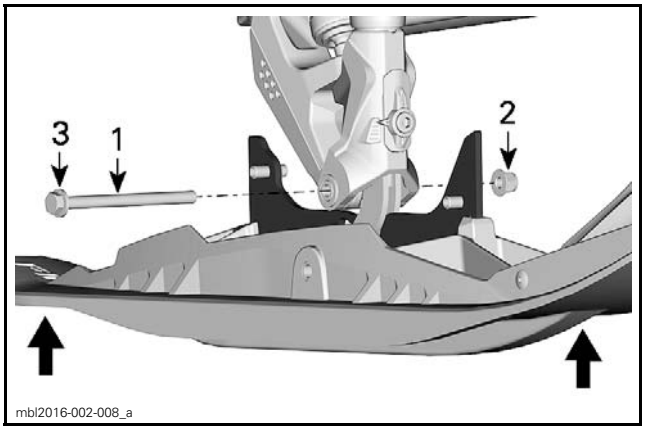


WITH ADJUSTABLE SKI (PILOT TS)
1. *Ski stopper*
2. *Bushings*

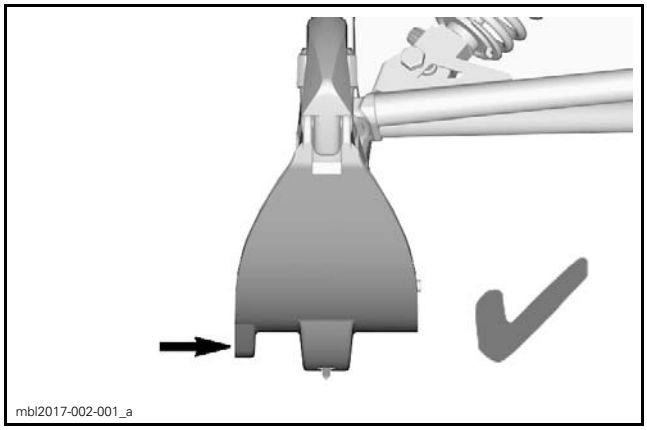
Install ski on ski leg as per the following illustrations.



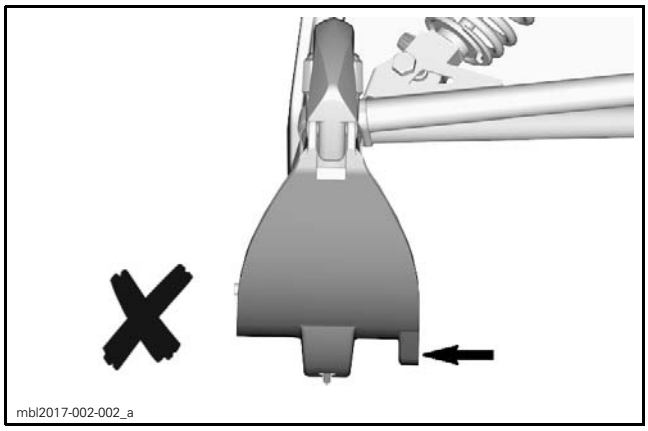
WITHOUT ADJUSTABLE SKI (PILOT TS)
1. *Ski stopper*
2. *M10 x 130 screw*
3. *M10 flat washer*
4. *M10 flanged nut*
5. *Ski leg bushings*
6. *Ski leg sleeve*
7. *Ski leg stopper*



WITH ADJUSTABLE SKI (PILOT TS)
1. *Ski screw*
2. *Nut*
3. *Washer*



LATERAL SKI KEEL TOWARDS OUTSIDE (IF EQUIPPED) - CORRECT



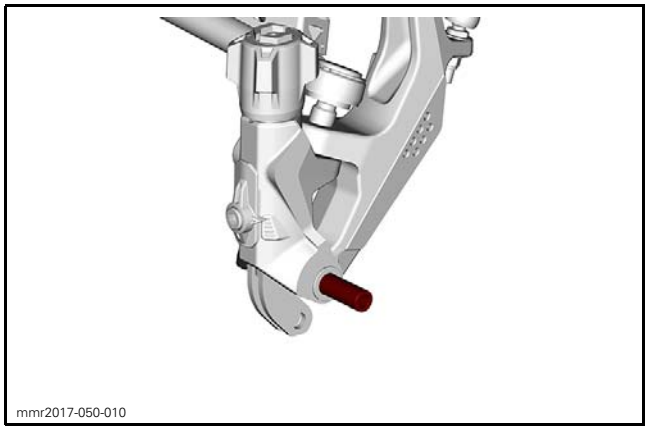
LATERAL SKI KEEL TOWARDS INSIDE (IF EQUIPPED) - NOT CORRECT

TIGHTENING TORQUE	
Ski nut	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)

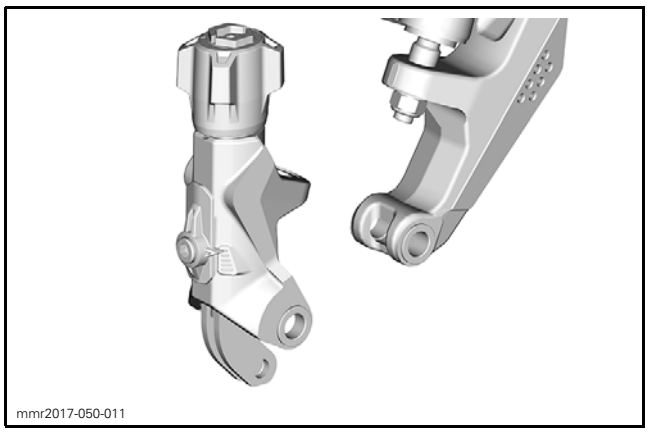
ADJUSTABLE SKI MECHANISM

Removing the Adjustable Ski Mechanism

1. Remove the ski and the runner.
2. Slide the sleeve out of the ski leg.



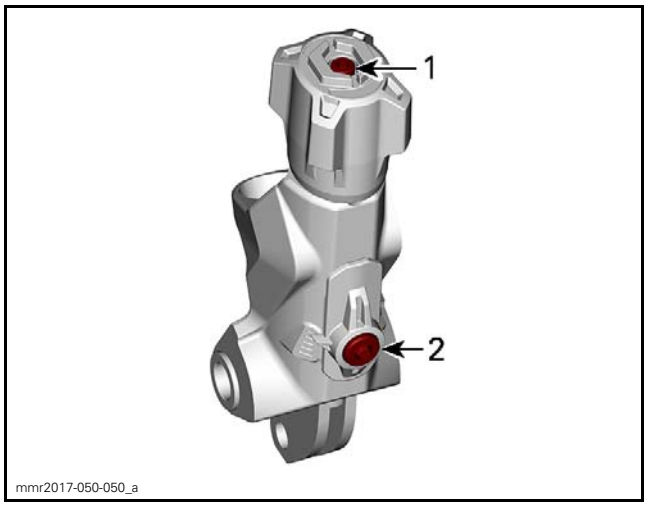
3. Remove the mechanism from the ski leg.



Disassembling the Adjustable Ski Mechanism

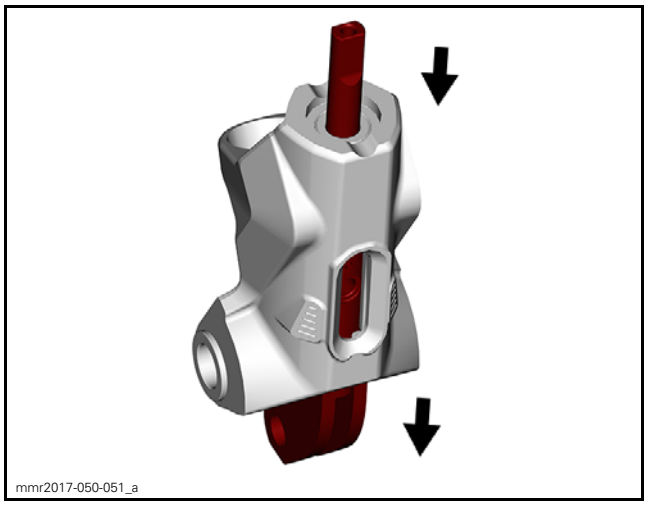
1. Remove the adjusting knob and the indicator screws.

NOTE: There are two O-rings on the indicator screw.

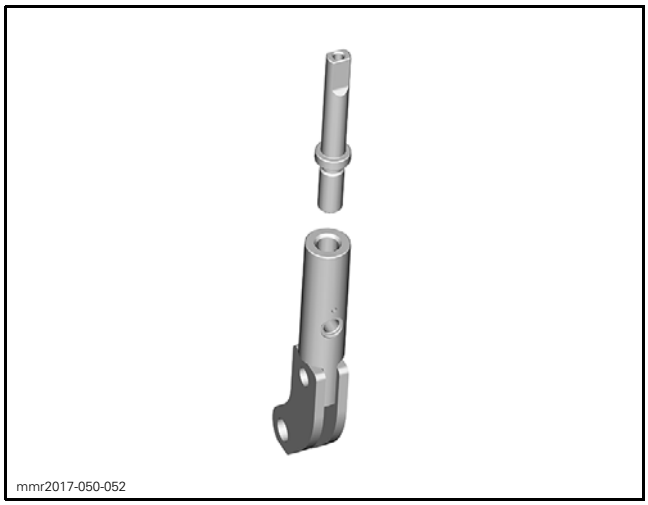


1. *Adjusting knob screw*
2. *Indicator screw*

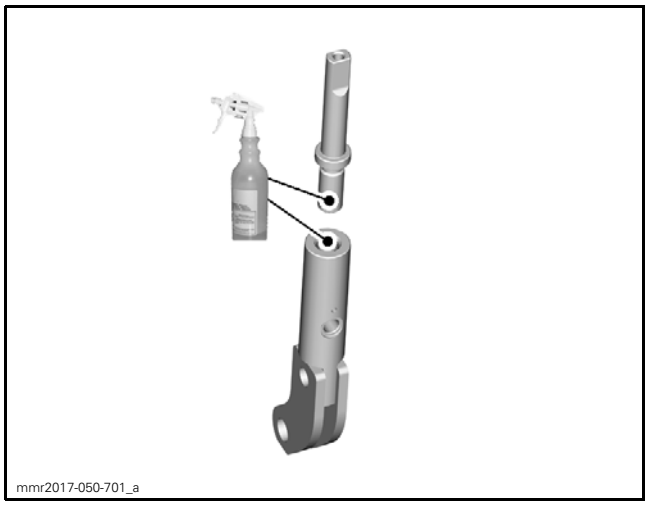
2. Slide the adjusting screw and the adjusting shaft out of the body.



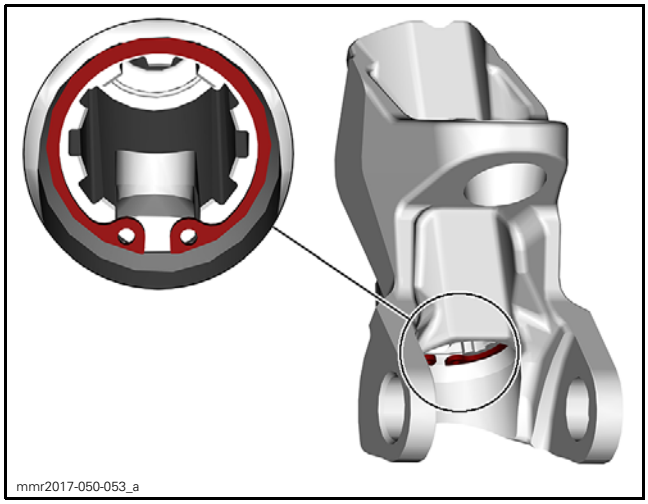
3. Remove the screw from the shaft.


mmr2017-050-052

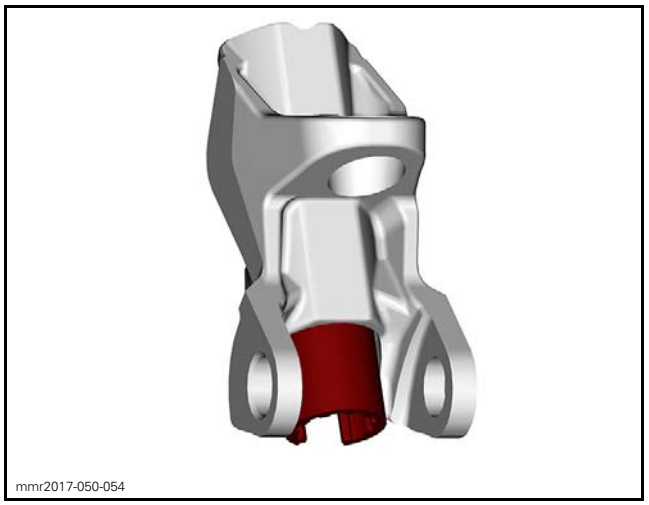
4. Clean the screw and the shaft inner threads with XPS BRAKES AND PARTS CLEANER (USA) (P/N 219 701 705) or XPS BRAKES AND PARTS CLEANER (P/N 219 701 776) and a small brush.


mmr2017-050-701_a

5. Remove the snap ring.


mmr2017-050-053_a

6. Slide the sleeve out of the body.


mmr2017-050-054

Inspecting the Adjustable Ski 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

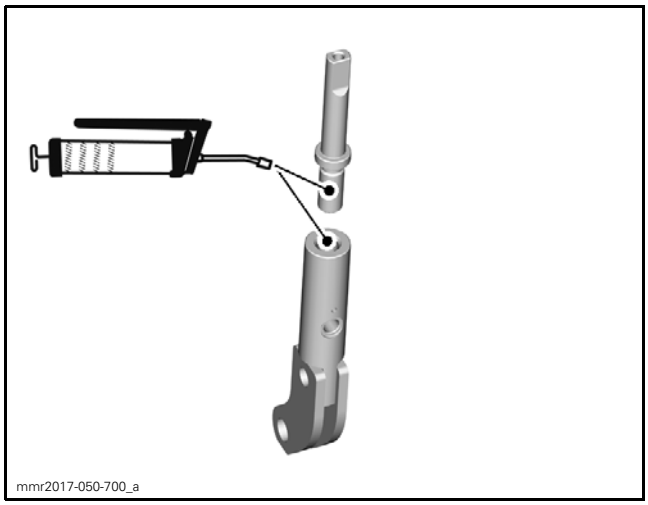
Replace if required.

Inspect the ball bearing. It should turn freely and smoothly. If bearing needs to be replaced, replace the mechanism assembly.

Assembling the Adjustable Ski Mechanism

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

Apply XPS SYNTHETIC GREASE (P/N 293 550 010) on screw thread and shaft inner thread.


mmr2017-050-700_a

Install a new knob screw.

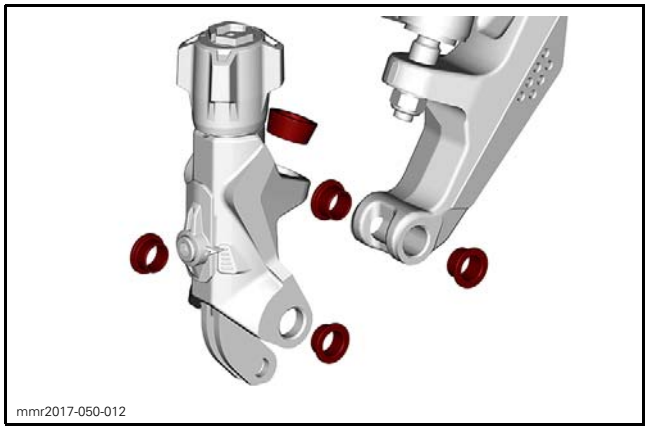
TIGHTENING TORQUE	
Adjusting knob screw	9 N•m ± 1 N•m (80 lbf•**in** ± 9 lbf•**in**)
Indicator screw	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

Installing the Adjustable Ski 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.


mmr2017-050-012

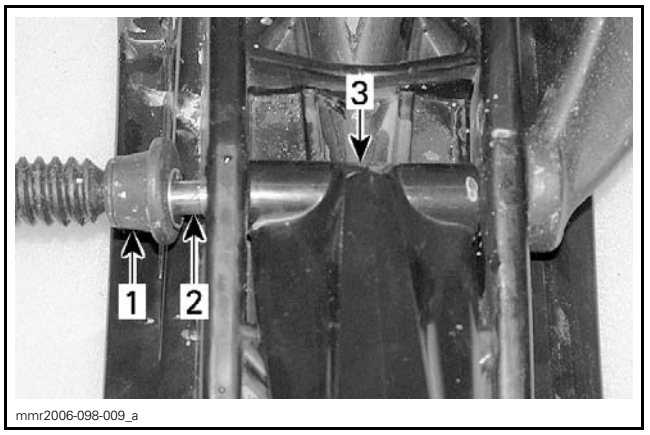
SKI HANDLES

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

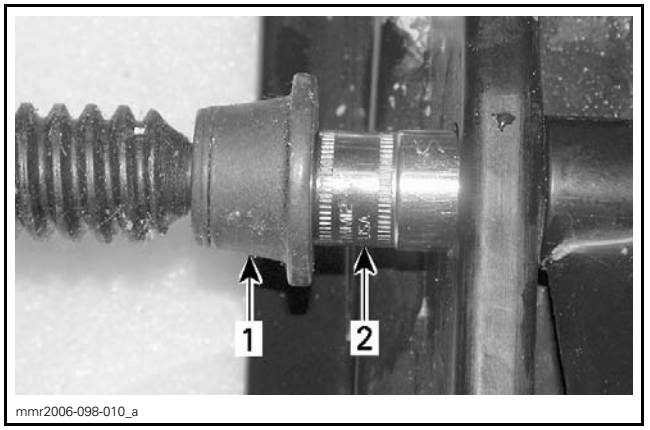
1. To install rivets, use a C-clamp and a short 10 mm socket.
2. Place a rivet in position and insert it into ski and ski handle. Repeat the procedure for the other side.



mmr2006-098-009_a

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.



mmr2006-098-010_a

1. C-clamp
2. 10 mm socket

SKI LEG

To replace a ski leg, refer to *FRONT SUSPENSION* subsection.

HANDLEBAR GRIP

NOTE: To verify or replace heating elements, refer to *LIGHTS, GAUGE AND 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.


mmr2015-143-007

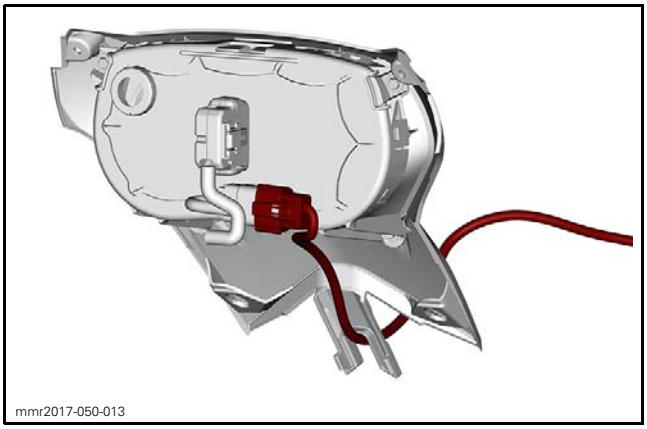
Installing the Handlebar Grip

Insert the handlebar grip on handlebar while blowing compressed air to inflate or loosen the fit between grip and handlebar.

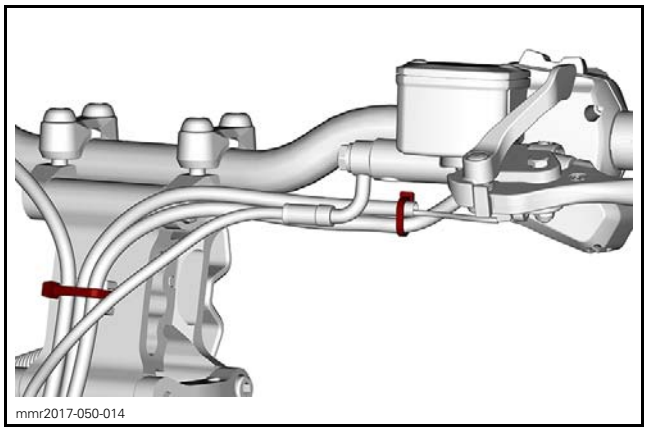
MULTIFUNCTION SWITCH

Removing the Multifunction Switch

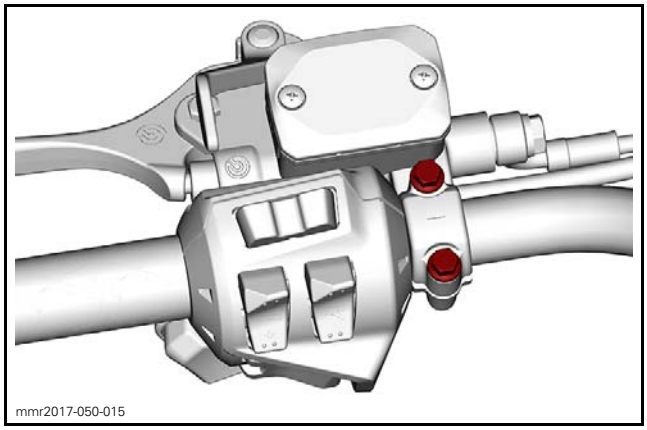
1. Remove the gauge support. Refer to *BODY* subsection.
2. Disconnect the multifunction switch connector.


mmr2017-050-013

3. Cut locking ties securing multifunction switch harness.


mmr2017-050-014

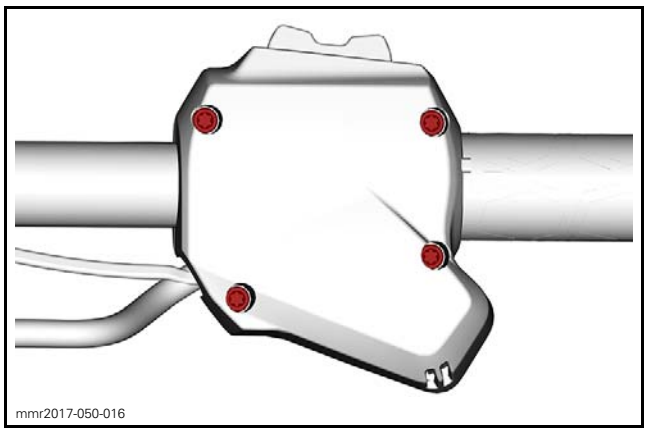
4. Unscrew master cylinder from handlebar.


mmr2017-050-015

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.


mmr2017-050-016

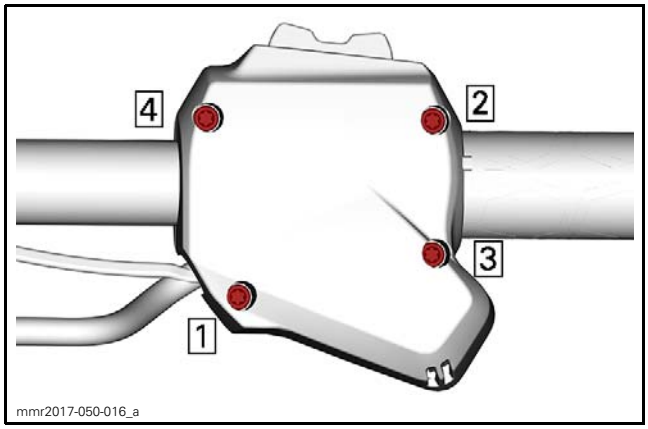
7. Remove multifunction switch from vehicle.

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.

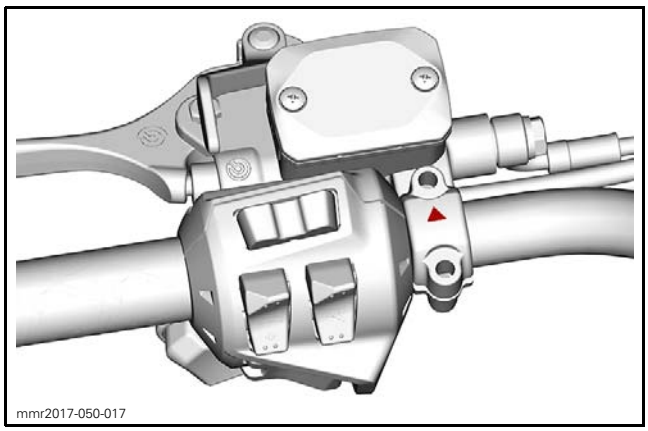
TIGHTENING TORQUE	
Multifunction switch screw	2.4 N•m ± 0.2 N•m (21 lbf•**in** ± 2 lbf•**in**)



mmr2017-050-016_a

Place the master cylinder on the handlebar.

Install master cylinder retaining clamp with its arrow pointing toward the front of vehicle.


mmr2017-050-017

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.

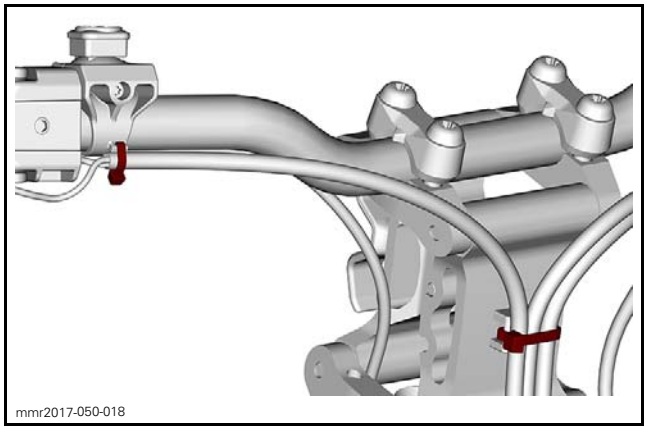
TIGHTENING TORQUE	
Master cylinder clamp screw	9 N•m ± 1 N•m (80 lbf•**in** ± 9 lbf•**in**)

Turn handlebar completely from side to side making sure it does not exert unwanted tension on handlebar wires.

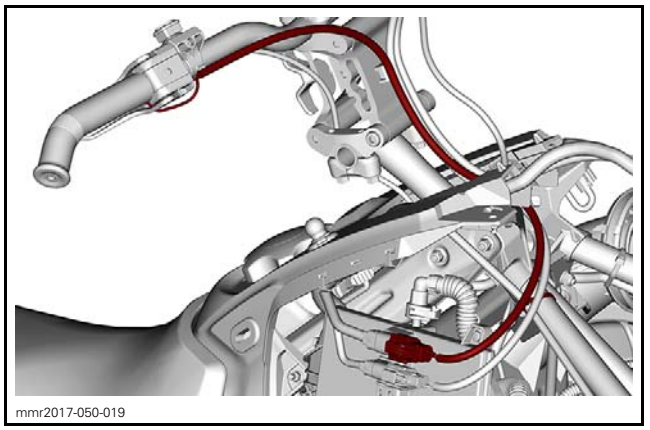
THROTTLE LEVER HOUSING

Removing the Throttle Lever Housing

1. Remove the upper body module. Refer to *BODY* subsection.
2. Cut the harness locking ties.


mmr2017-050-018

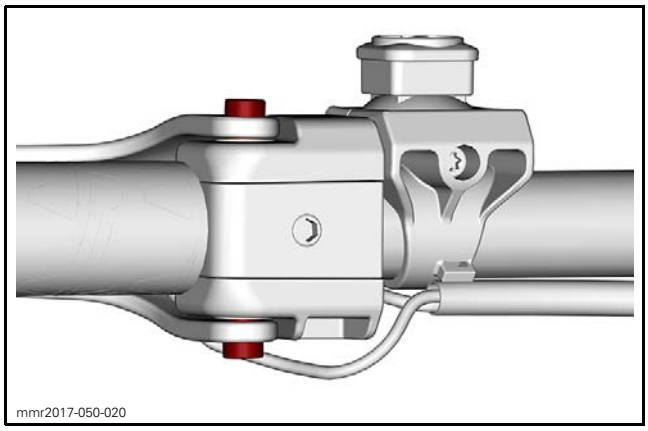
3. Disconnect the RH heater element connector.


mmr2017-050-019

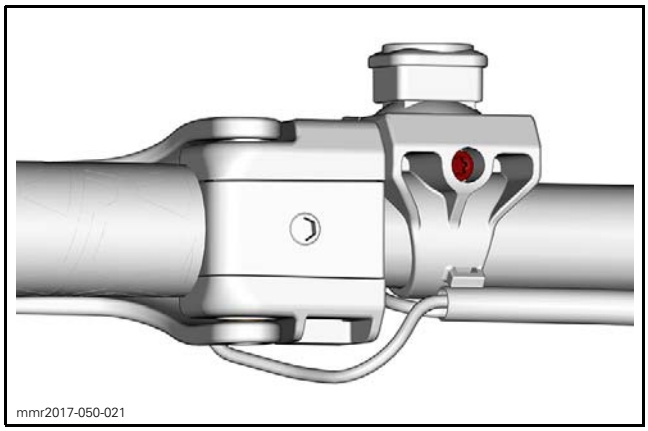
4. Remove the heater element wire terminals from connector. Refer to *WIRING HARNESS AND CONNECTORS* subsection.

NOTICE **Take note of exact positioning of multifunction wire before removing it from the connector.**

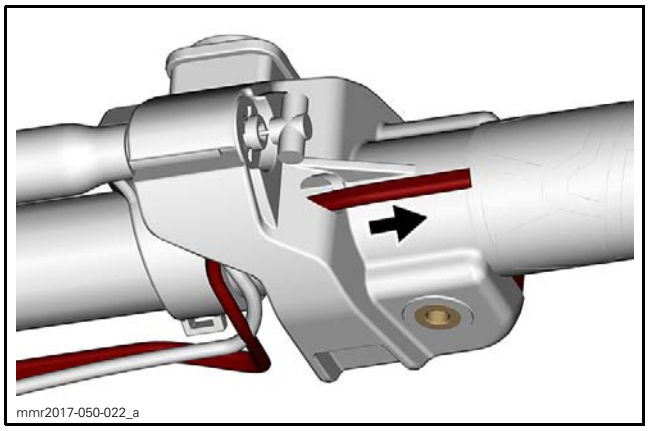
5. Disconnect throttle cable from throttle lever.
6. Remove both throttle lever pivot screws.



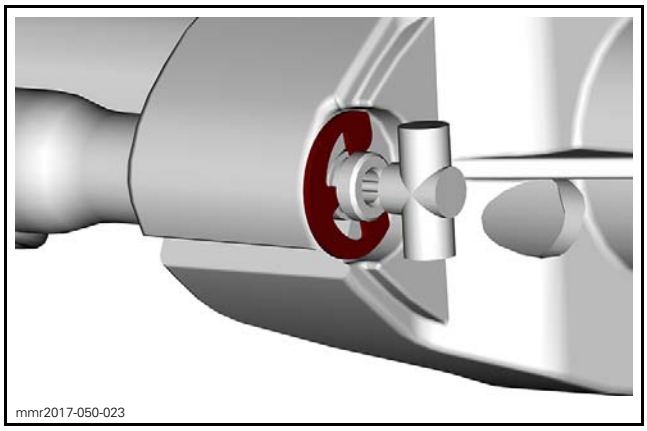
7. Loosen the emergency stop switch screw and slide the switch towards center of handlebar.



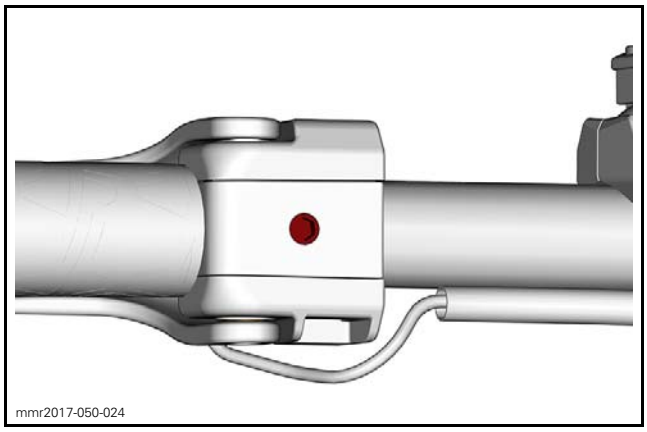
8. Pull the heater element wire out of the throttle lever housing.



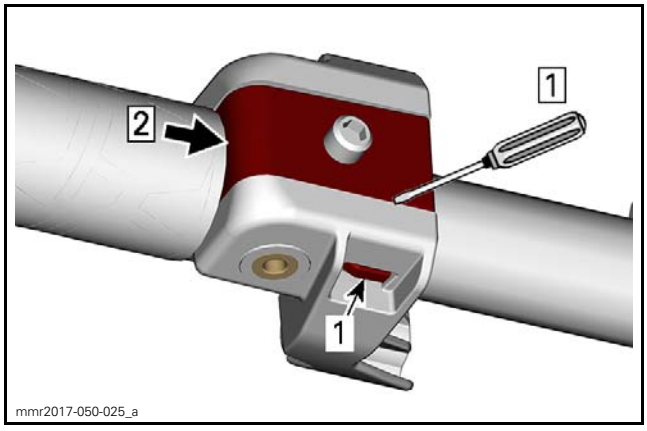
9. Remove throttle cable circlip.



10. Remove the throttle cable from the housing.
11. Loosen throttle lever housing retaining screw.

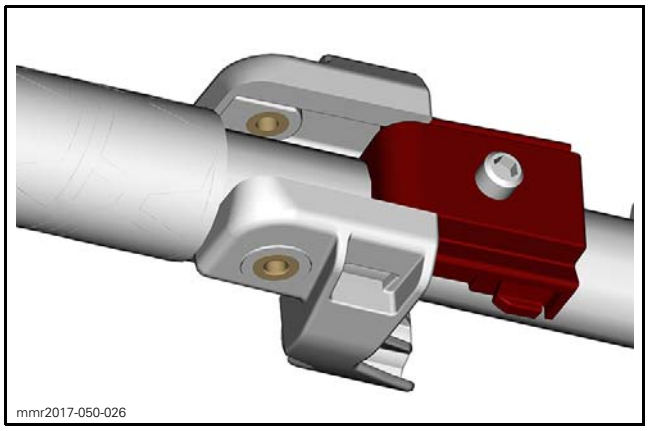


12. Insert a flat screwdriver between the housing and the clamp to release the tab.

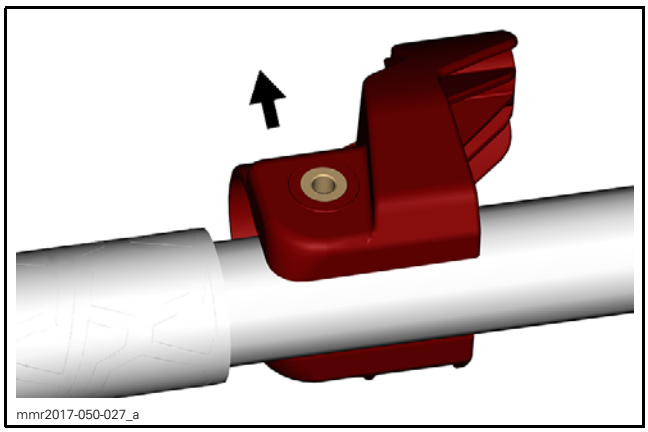


1. Tab

13. Slide the clamp out of the housing


mmr2017-050-026

14. Remove throttle lever housing from handlebar.


mmr2017-050-027_a

Installing the Throttle Lever Housing

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

Tighten throttle lever pivot screws to specification.

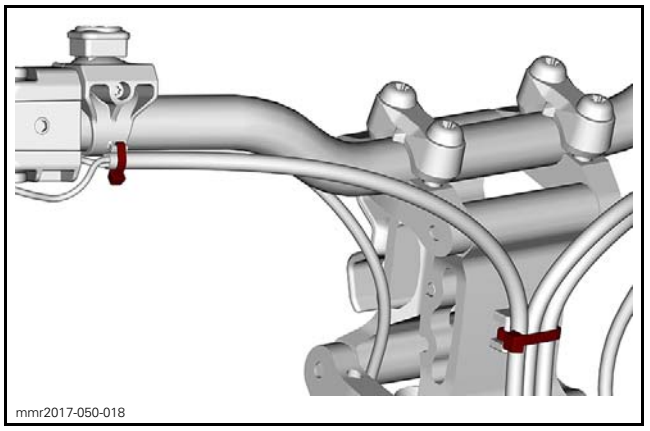
TIGHTENING TORQUE	
Throttle lever retaining screw	1.5 N•m ± 0.2 N•m (13 lbf•**in** ± 2 lbf•**in**)

Turn handlebar completely from side to side making sure it does not exert unwanted tension on handlebar wires.

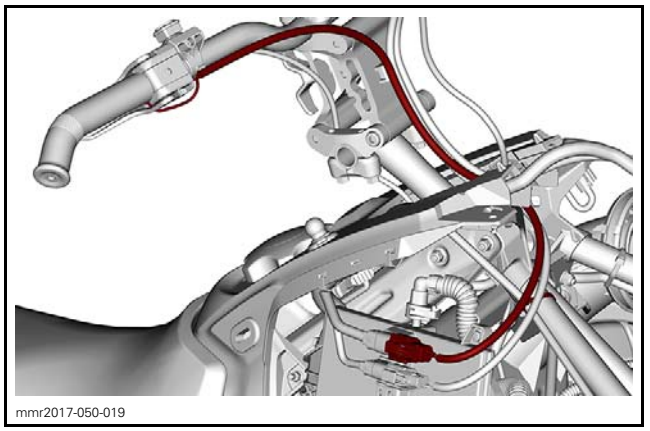
THROTTLE LEVER

Removing the Throttle Lever

1. Remove the upper body module. Refer to *BODY* subsection.
2. Cut the harness locking ties.


mmr2017-050-018

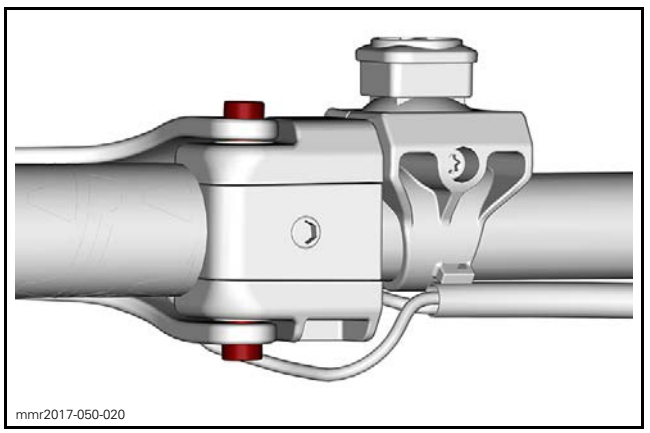
3. Disconnect the LH heater element connector.


mmr2017-050-019

4. Remove throttle lever heater wire terminals from connector. Refer to *CONNECTOR INFORMATION* subsection.

NOTICE **Take note of exact positioning of throttle lever heater before removing it from the connector.**

5. Disconnect throttle cable from throttle lever.
6. Remove throttle lever pivot screws.


mmr2017-050-020

7. Remove throttle lever and heater wires.

Installing the Throttle Lever

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

Tighten throttle lever pivot screws to specification.

TIGHTENING TORQUE	
Throttle lever pivot screw	1.5 N•m ± 0.2 N•m (13 lbf•**in** ± 2 lbf•**in**)

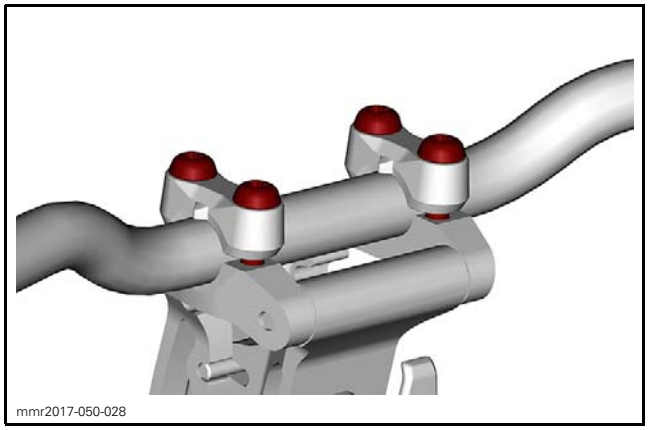
Turn handlebar completely from side to side making sure it does not exert unwanted tension on handlebar wires.

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

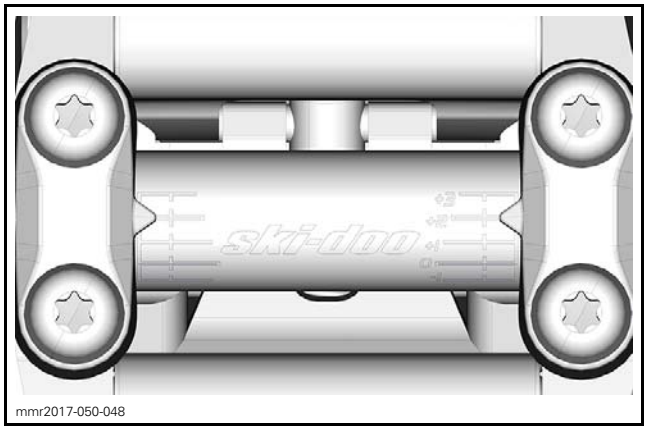
Do not try to repair a defective handlebar.

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.

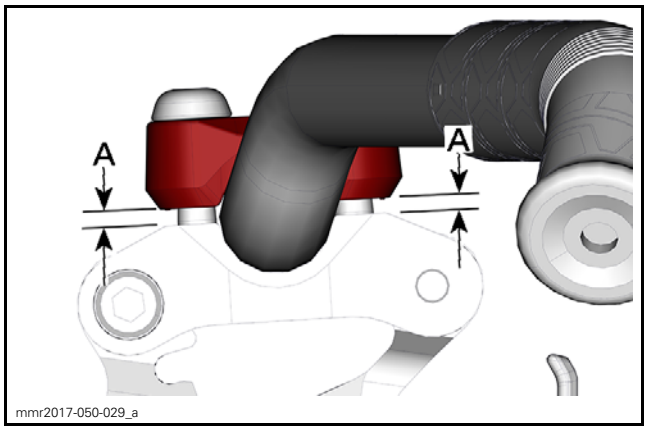
Position the handlebar at +2 with clamps.



Tighten handlebar clamps screws to specification.

TIGHTENING TORQUE	
Clamp screw	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

Ensure handlebar clamps are parallel with handlebar extension.



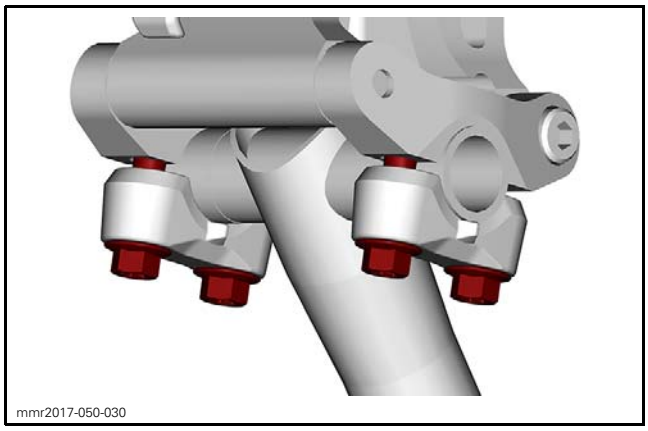
A. Must be equal on each side

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.


mmr2017-050-030

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.

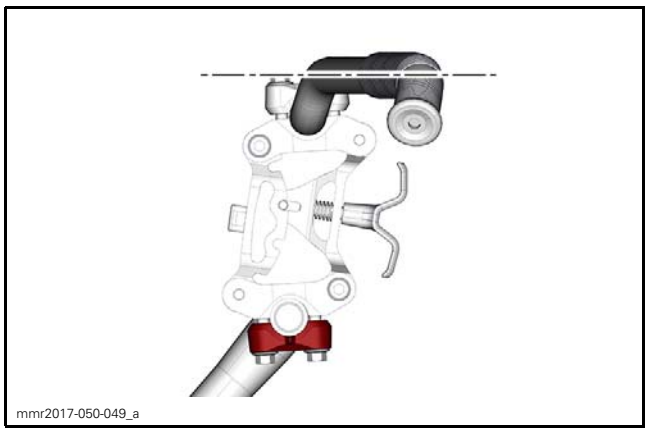
⚠ WARNING

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.

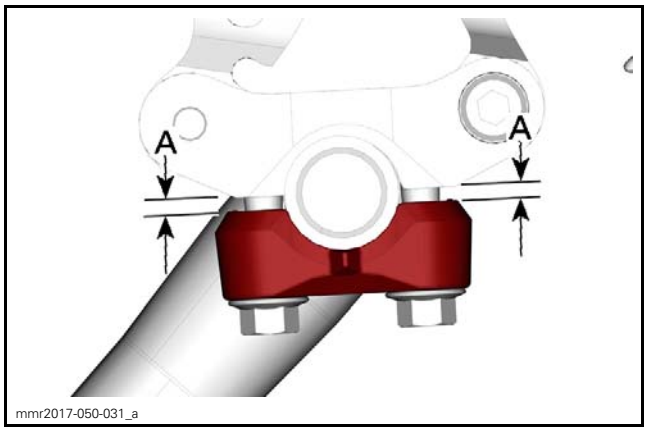
Position the extension in order to have the handlebar horizontal.


mmr2017-050-049_a

Torque handlebar extension retaining screws to specification.

TIGHTENING TORQUE	
Clamp screw	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

Ensure extension clamps are parallel with handlebar extension.



mmr2017-050-031_a

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.

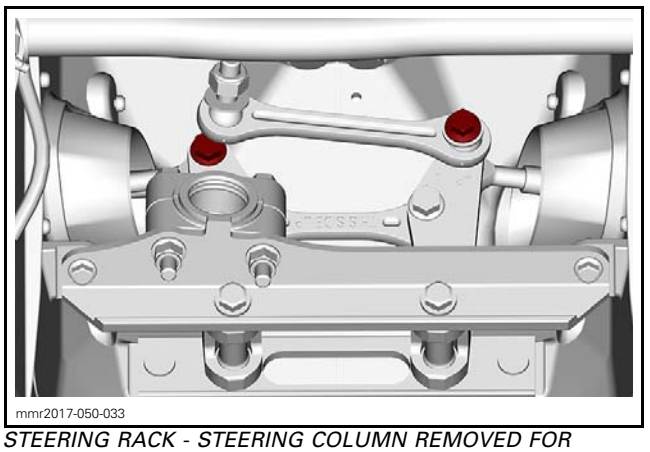
Inspecting the Tie-Rod

Check tie-rod ends for looseness. If play is excessive, replace tie-rod.

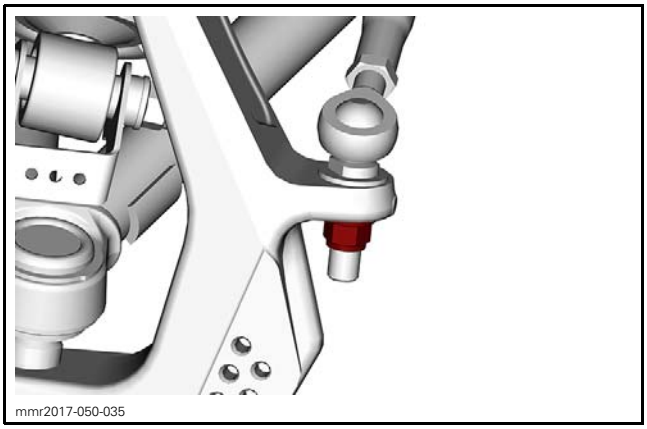
Check if the tie-rod is bent, cracked or otherwise damaged. Replace if necessary.

Removing the Tie-Rod

1. Remove the tuned pipe. Refer to *EXHAUST SYSTEM* subsection.
2. Remove the tie-rod end nuts and screws from the steering rack and ski leg.

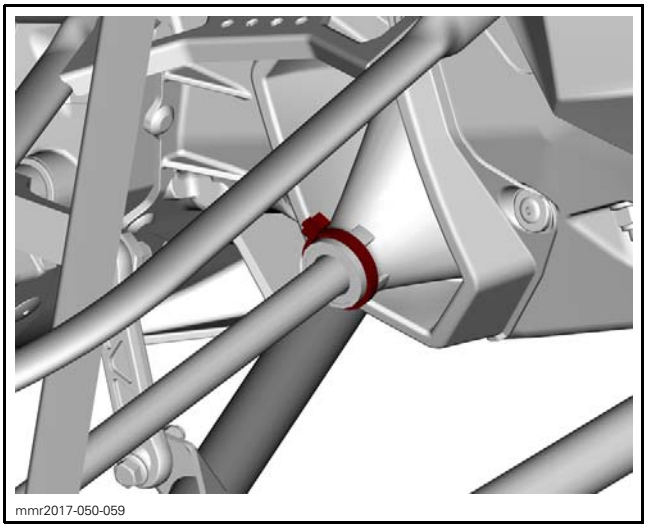

mmr2017-050-033

STEERING RACK - STEERING COLUMN REMOVED FOR CLARITY

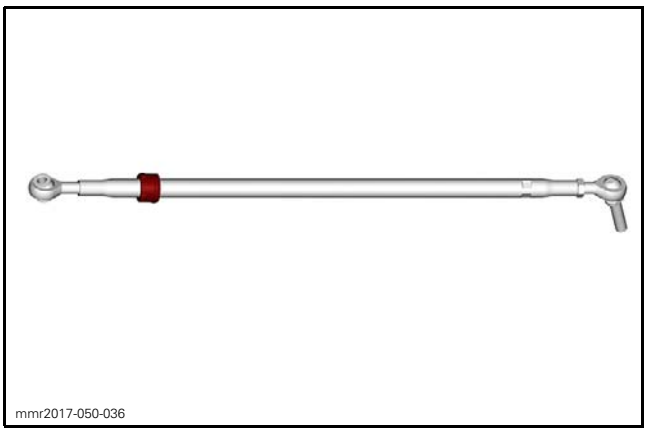

mmr2017-050-035

SKI LEG

3. Cut the locking tie on the steering boot.


mmr2017-050-059

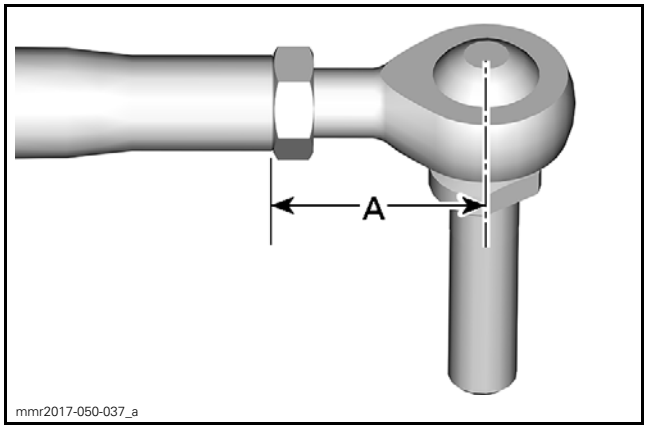
4. Remove tie-rod with ring from vehicle.


mmr2017-050-036

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.



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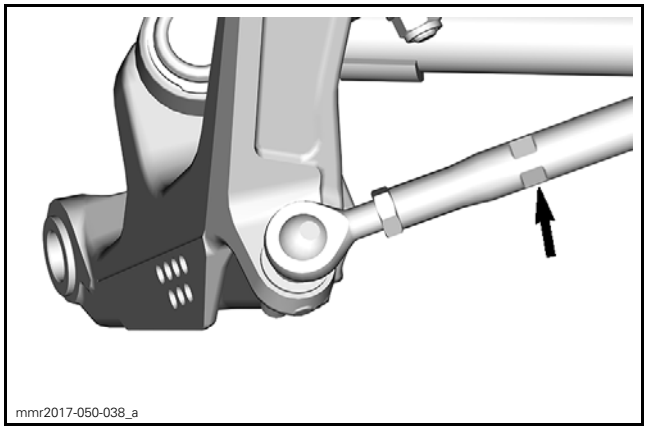
TIE-ROD LENGTH (A)
30 mm (1.181 in)

⚠ 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.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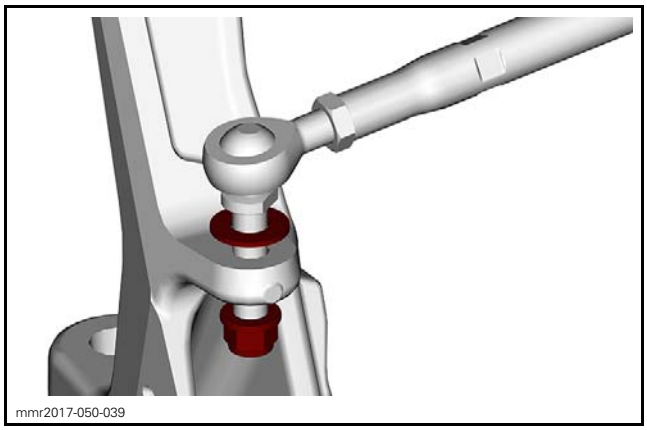
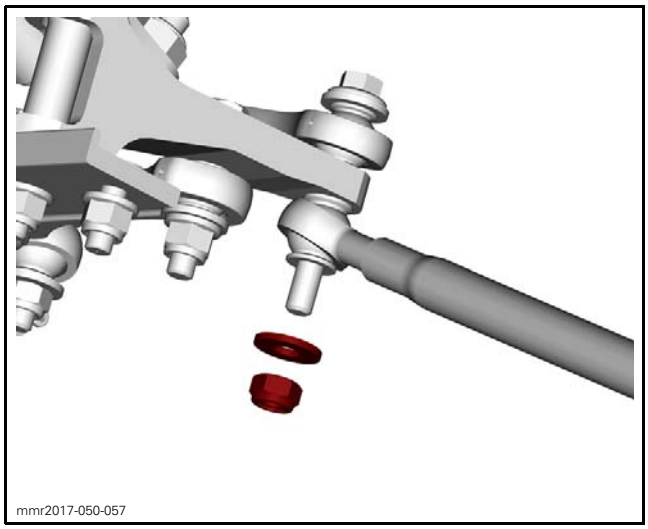
Install the washer and the nut, and tighten to specification.

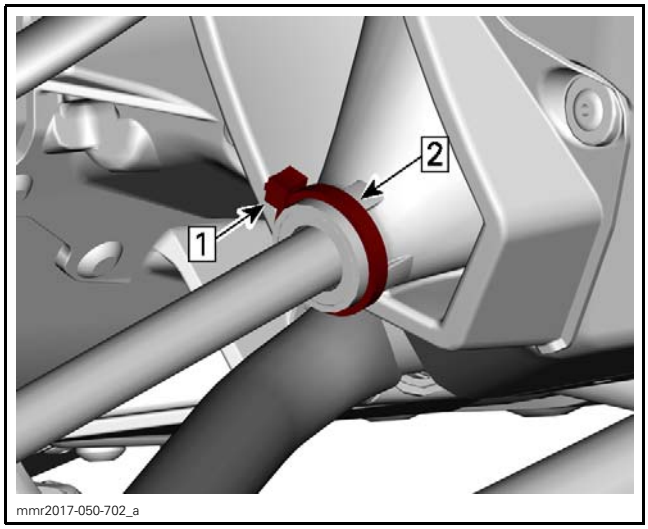

mmr2017-050-039


mmr2017-050-057

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.



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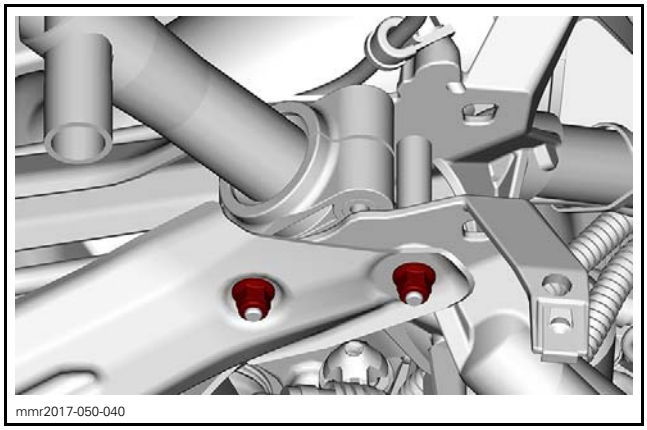
1. Head up
2. Fully seated

Perform the steering alignment, refer to *ALIGNING THE STEERING* in this section.

STEERING COLUMN

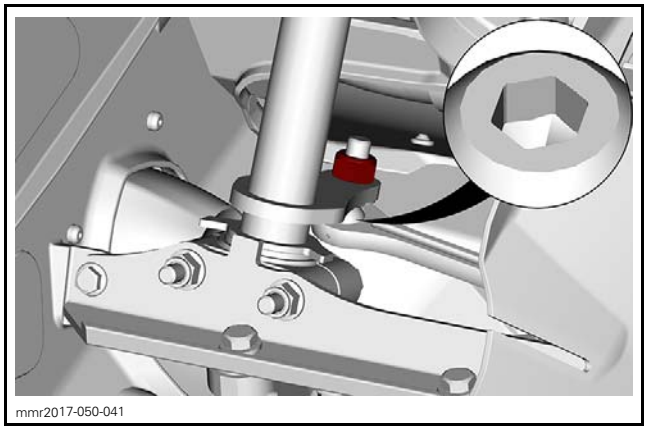
Removing the Steering Column

1. Remove the tuned pipe. Refer to *EXHAUST SYSTEM* subsection.
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 nuts and screws securing steering column upper support.


mmr2017-050-040

5. From inside engine compartment, remove the steering column pitman arm nut.

NOTE: Use an Allen key to lock the ball joint.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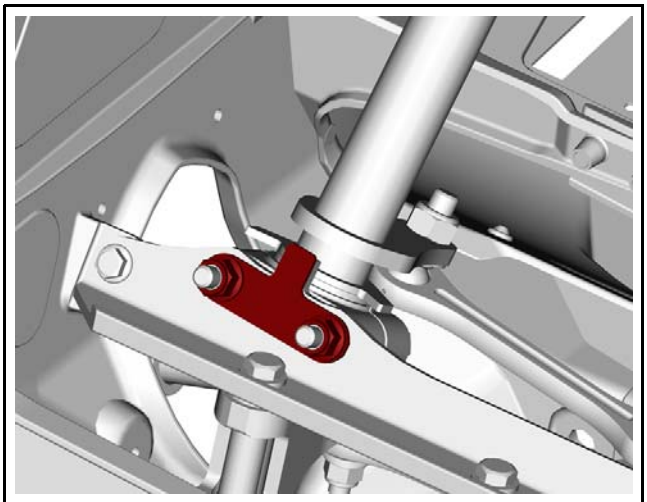
6. Remove nuts, stopper plate and screws securing the steering column lower support.


mmr2017-050-058

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.

Check if stopper plate is deformed or otherwise damaged.

Replace stopper plate as necessary.

Installing the Steering Column

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

1. Apply SUSPENSION GREASE (P/N 293 550 033) on vibration dampers before installing upper and lower supports.
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

Remove the tuned pipe. Refer to *EXHAUST SYSTEM* subsection.

Check if steering rack component are:
– Cracked
– Bent
– Twisted
– Otherwise damaged.

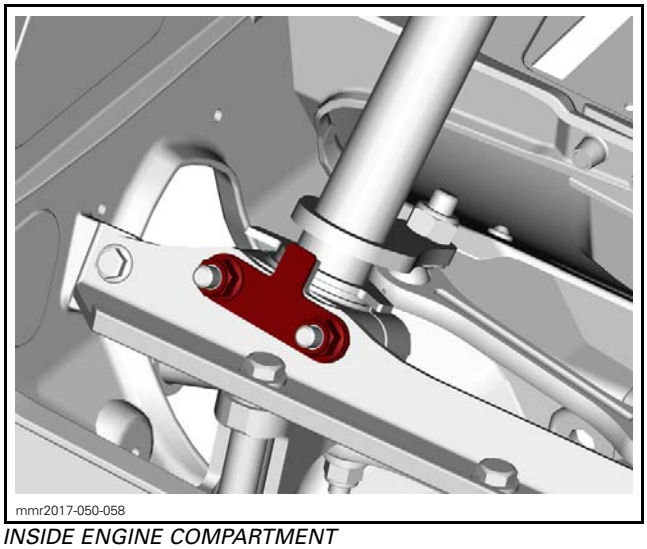
Check steering rack for looseness.

Check if stopper plate is deformed or otherwise damaged.

Replace component if necessary.

Removing the Steering Rack

1. Remove the tuned pipe. Refer to *EXHAUST SYSTEM* subsection.
2. Remove inner tie-rod end nuts and screws.
3. Remove the nuts, stopper plate and screws as per the following illustrations.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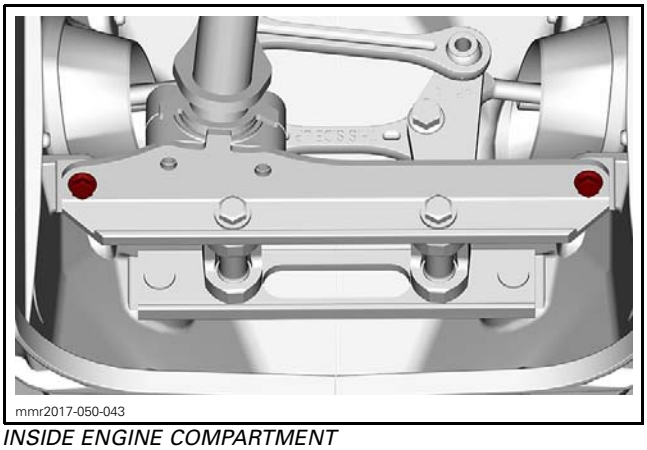
INSIDE ENGINE COMPARTMENT



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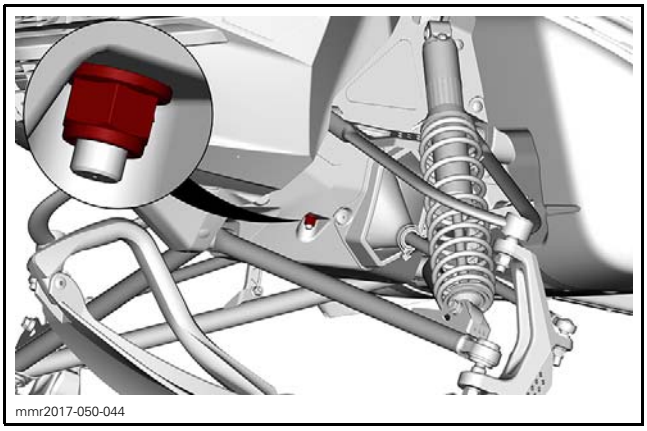
INSIDE ENGINE COMPARTMENT



mmr2017-050-044

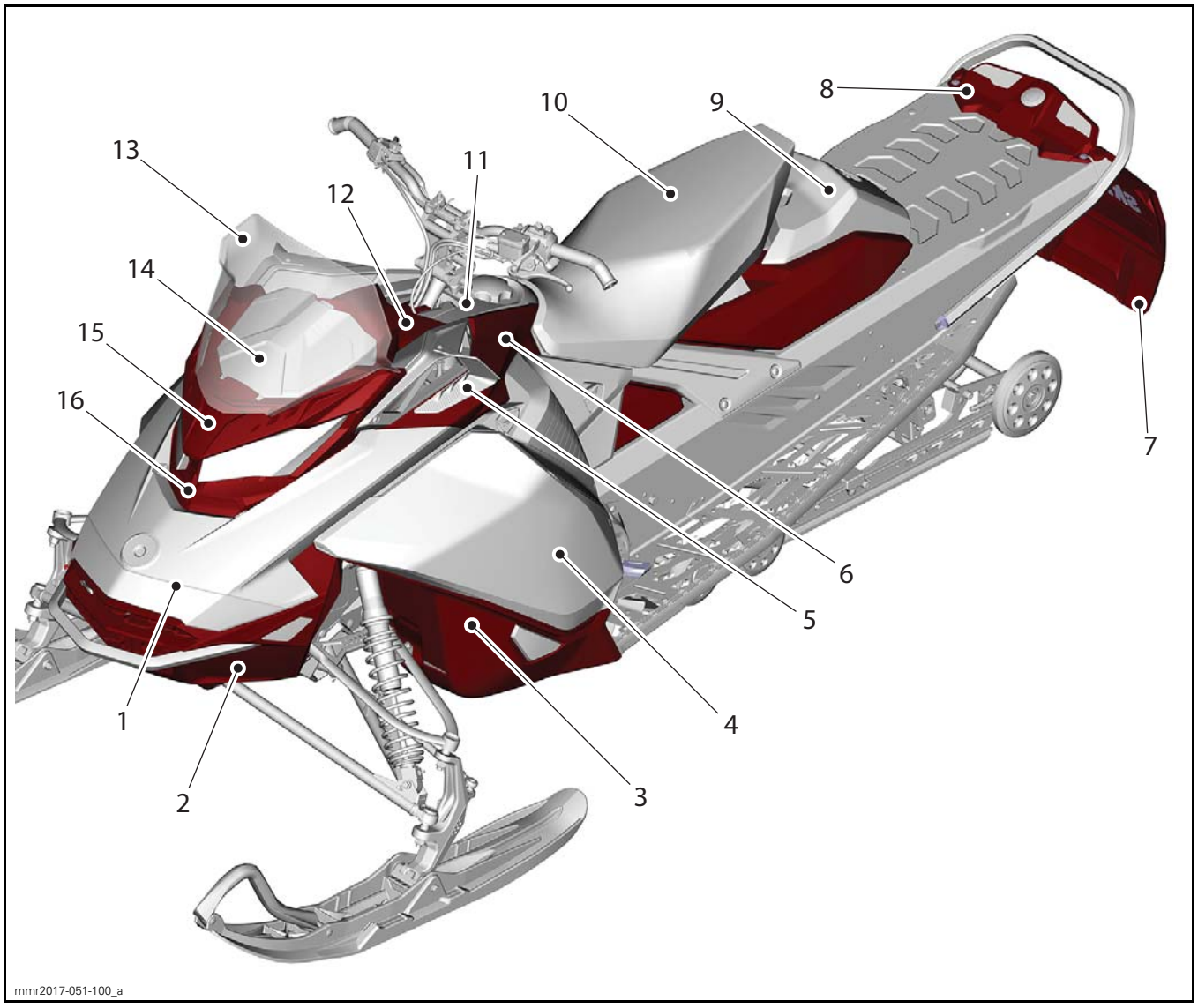
Installing the Steering Rack

The installation is the reverse of the removal procedure.

BODY

SERVICE TOOLS

Description	Part Number	Page
SUPERTANIUM DRILL BIT 3/16"	529 031 800	9



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1. *Hood*
2. *Bottom pan*
3. *Side bottom pan*
4. *Side panel*
5. *Side wind deflector*
6. *Lateral hood*
7. *Snow guard*
8. *Taillight cover*
9. *Battery cover*
10. *Seat*
11. *Console*
12. *Gauge support*
13. *Windshield*
14. *Storage compartment cover*
15. *Windshield support*
16. *Headlight trim*

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
	XP-S ATV Finishing Spray (P/N 219 701 704)
	XP-S ATV Cleaning Kit (P/N 219 701 713) (it contains the above XP-S ATV Finishing Spray)

vbs2012-006-002_a

DO NOT USE ON POLYPROPYLENE

Compatible Cleaning Products

MATERIAL TYPE	COMPATIBLE CLEANING PRODUCT
Polypropylene	XPS ATV Wash (P/N 219 701 702)
	Soapy water

vbs2012-006-001

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.

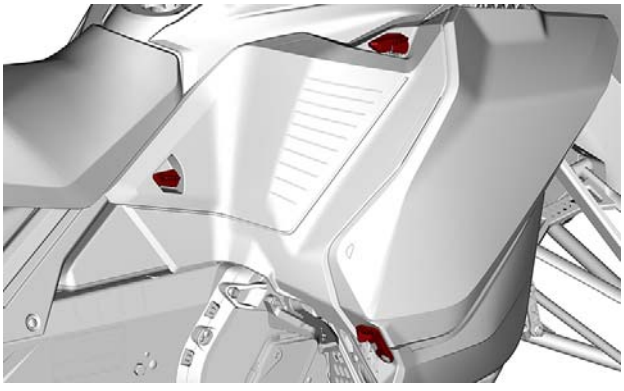
NOTICE Do not remove the pre-mask yet.

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.



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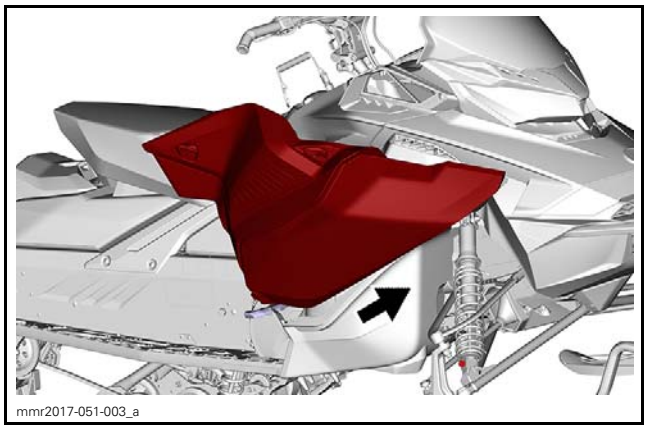
2. Open side panel.
3. Lift the side panel up and towards front.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NOTICE Make sure to place panels in a safe place to avoid scratching.

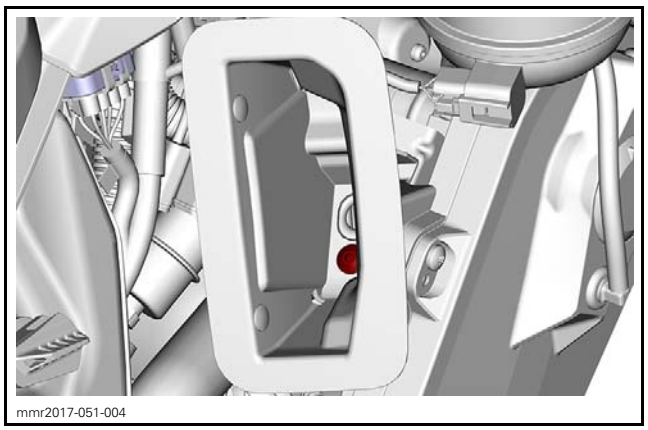
Installing the Side Panel

The installation is the reverse of the removal procedure.

REWIND STARTER HANDLE HOUSING

Removing the Rewind Starter Handle Housing

1. Open RH side panel.
2. Remove screw retaining housing to bracket.


mmr2017-051-004

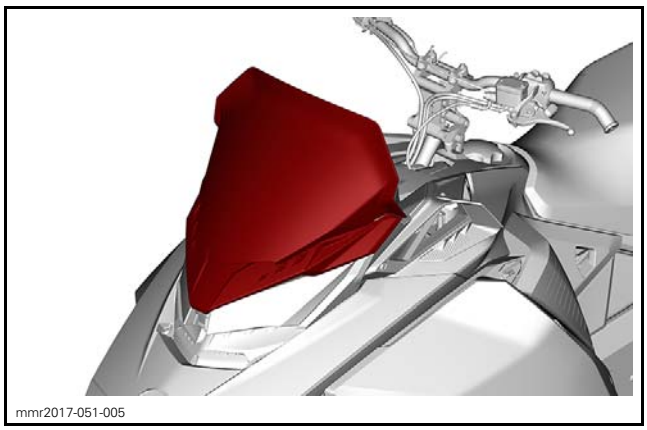
3. Remove rewind starter handle. Refer to *REWIND STARTER* subsection.

Installing the Rewind Starter Handle Housing

Installation is the reverse of removal procedure. Pay attention to the following.

TIGHTENING TORQUE	
Rewind starter handle housing screw	2.3 N•m ± 0.2 N•m (20 lbf•**in** ± 2 lbf•**in**)

WINDSHIELD


mmr2017-051-005

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

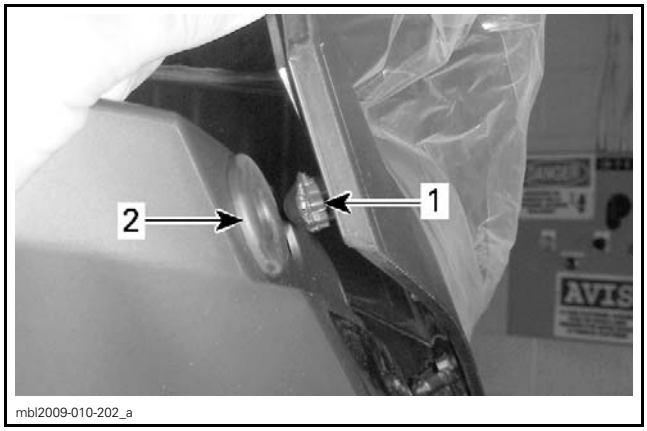
The installation is the reverse of removal procedure.

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.



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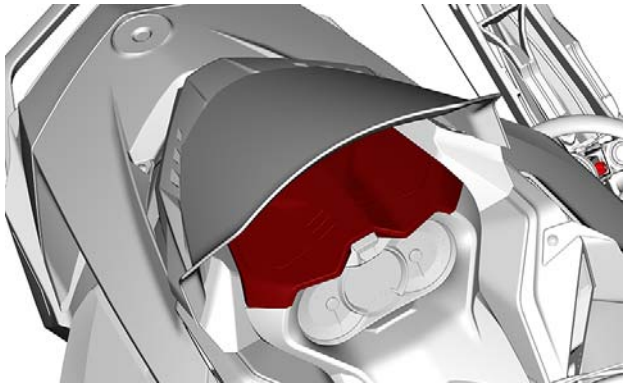
TYPICAL
1. Windshield tab
2. Gauge support front grommet

⚠ 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



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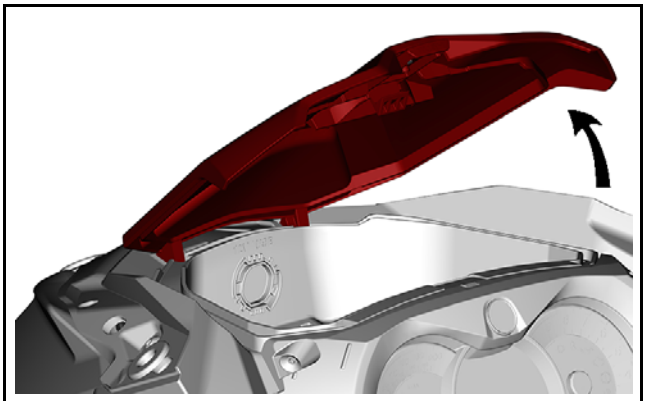
Removing the Storage Compartment Cover

1. Remove windshield.
2. Open storage cover until it is almost vertical.



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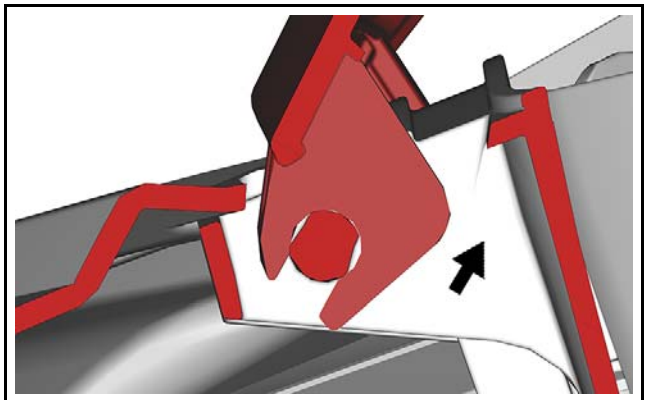
3. Pull out storage cover.



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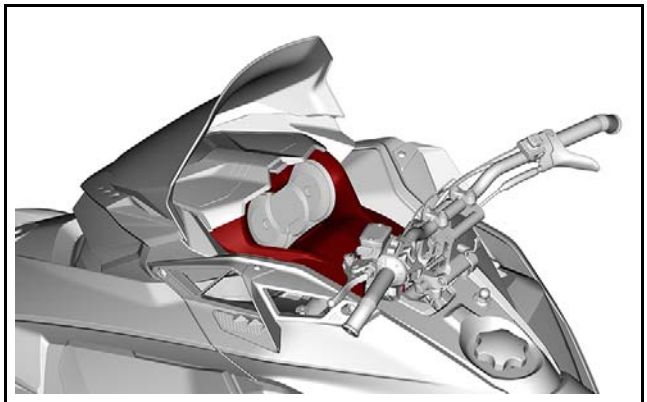
Installing the Storage Compartment Cover

The installation is the reverse of the removal procedure.

NOTICE **Ensure windshield is NOT installed. Otherwise, the storage cover could be damaged during installation.**

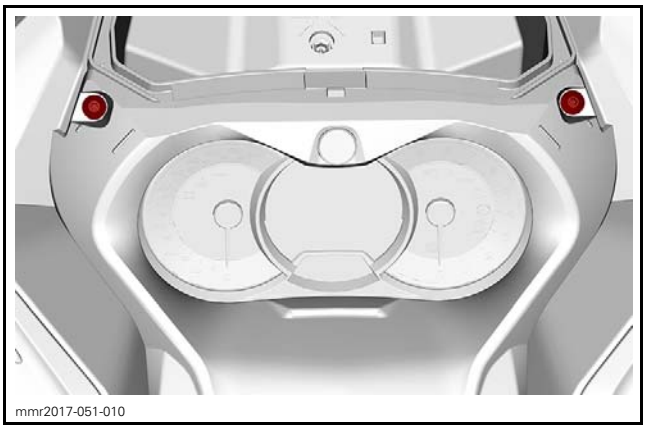
GAUGE SUPPORT



mmr2017-051-009

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.


mmr2017-051-010

TRAIL AND CROSSOVER MODELS SHOWN

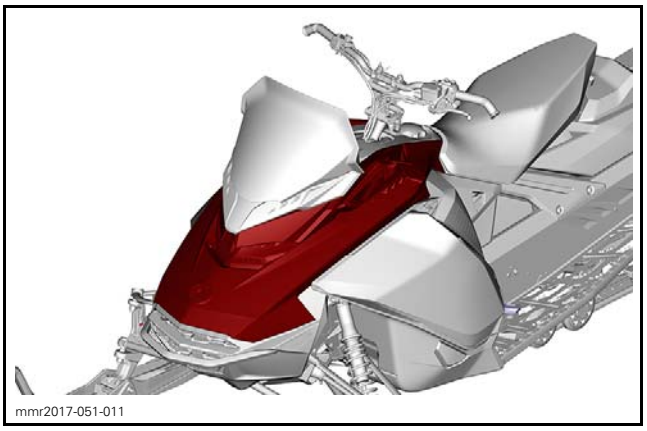
4. Pull out gauge support from bottom grommets.
5. Remove the multifunction gauge from support. Refer to *GAUGE* subsection.

Installing the Gauge Support

The installation is the reverse of removal procedure.

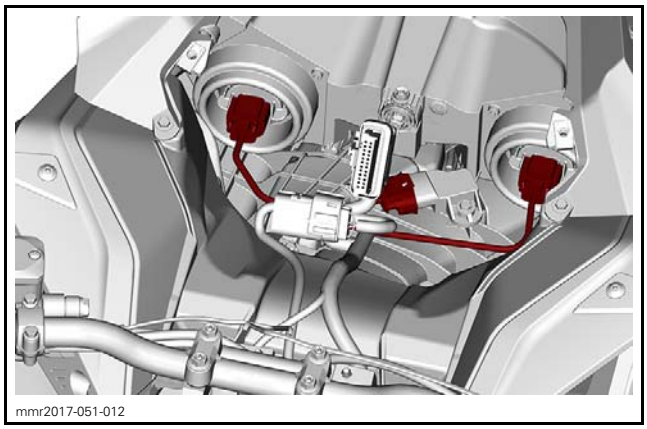
TIGHTENING TORQUE	
Gauge support screw	2.3 N•m ± 0.2 N•m (20 lbf•**in** ± 2 lbf•**in**)

UPPER BODY MODULE

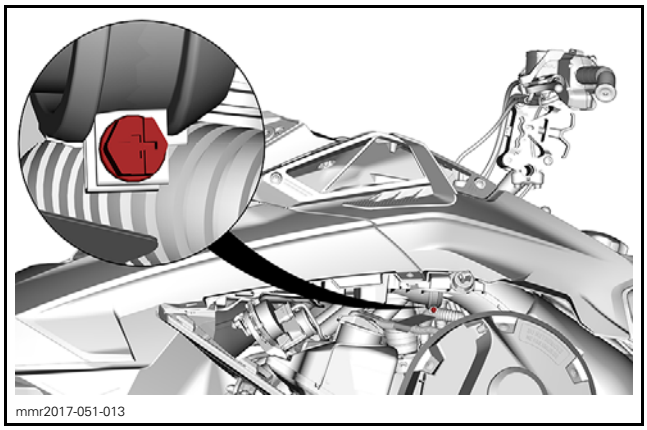

mmr2017-051-011

Removing the Upper Body Module

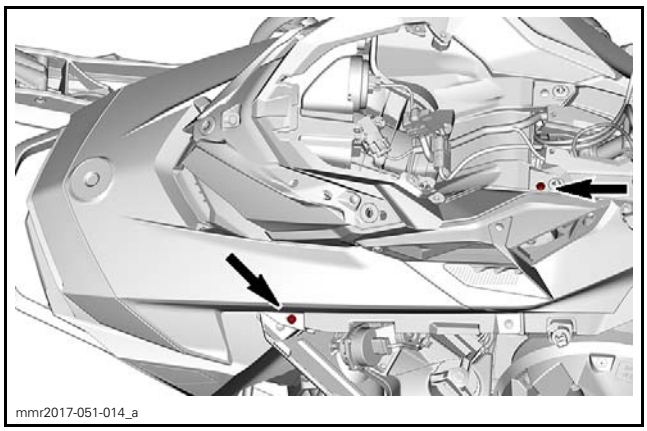
1. Refer to procedures in this subsection and remove:
   - Side panels
   - Gauge support
   - Storage compartment and its cover.
2. Disconnect the MAPTS and headlight connectors.


mmr2017-051-012

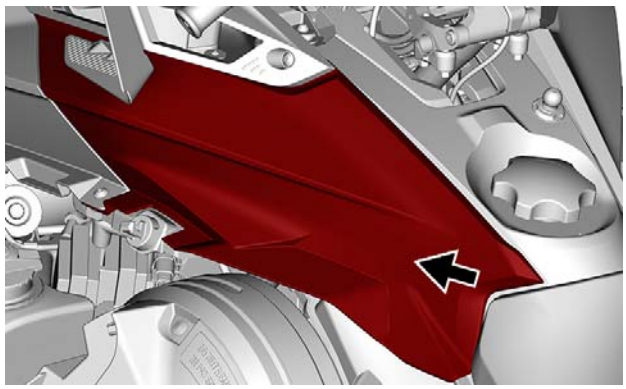
3. Loosen the air intake hose clamp.


mmr2017-051-013

4. Remove the upper body module retaining screws.


mmr2017-051-014_a

5. Pull on the rear end of both lateral hood until their tabs come out of the rear console.


mmr2017-051-015_a

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.

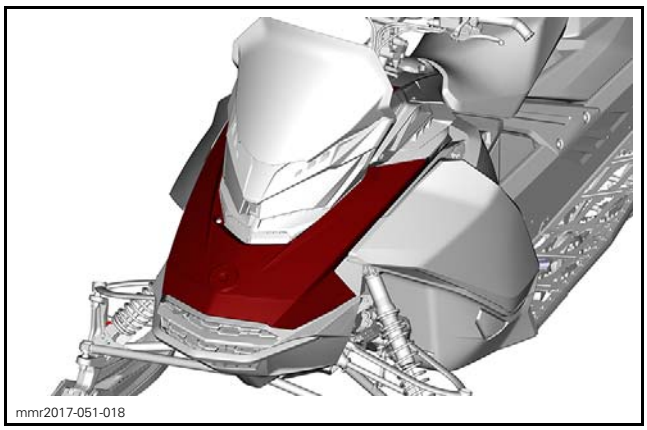
Ensure to engage rear hood tabs in rear console.


mmr2017-051-016

Ensure to connect the air intake hose.

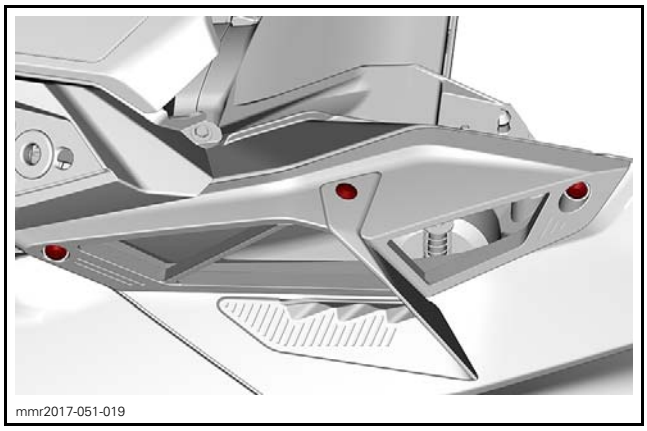
TIGHTENING TORQUE	
Upper body module screw	2.3 N•m ± 0.2 N•m (20 lbf•**in** ± 2 lbf•**in**)

HOOD

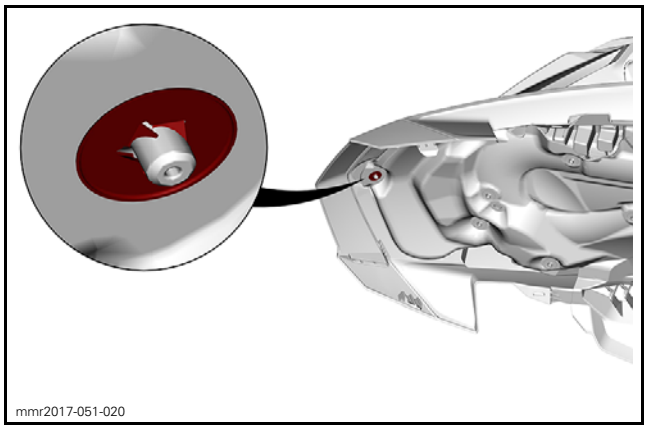

mmr2017-051-018

Removing the Hood

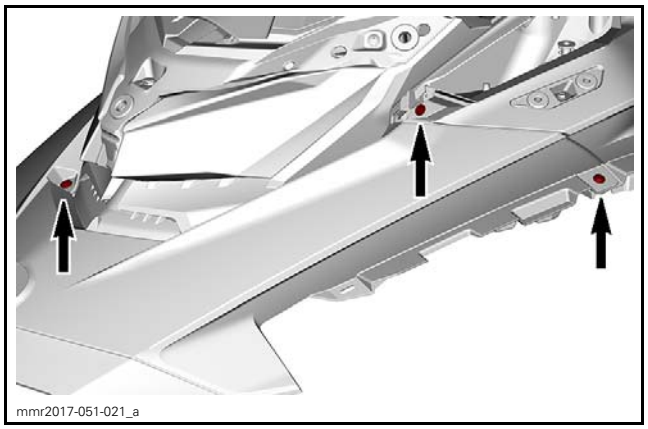
1. Remove the upper body module. Refer to procedure in this subsection.
2. Remove both sides air deflector and air intake filter.


mmr2017-051-019

3. Remove the front push nut under the hood.


mmr2017-051-020

4. Remove hood screws.


mmr2017-051-021_a

5. Pull out hood.

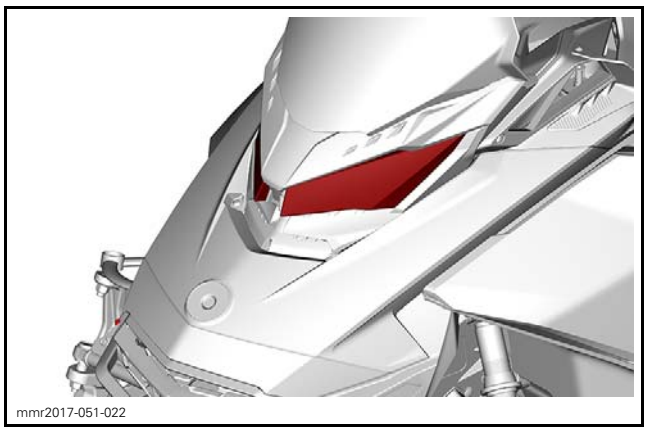
Installing the Hood

The installation is the reverse of removal procedure.

Install a new push nut.

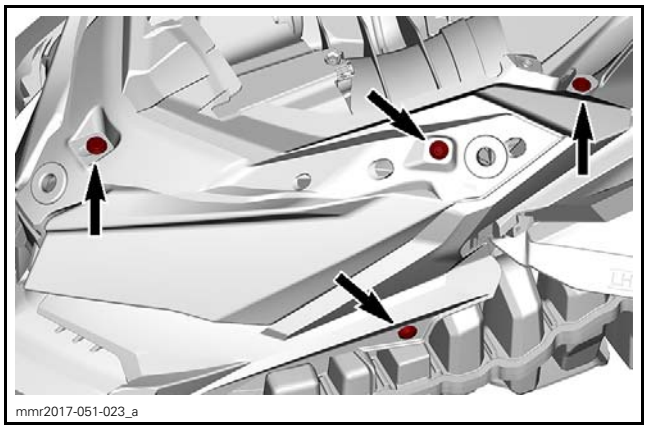
TIGHTENING TORQUE	
Hood hexagonal screw	1.8 N•m ± 0.2 N•m (16 lbf•**in** ± 2 lbf•**in**)
Hood Torx screw	2.3 N•m ± 0.2 N•m (20 lbf•**in** ± 2 lbf•**in**)

HEADLIGHT MODULE


mmr2017-051-022

Removing the Headlight Module

1. Remove the hood. Refer to procedure in this subsection.
2. Remove the headlight trim fasteners.


mmr2017-051-023_a

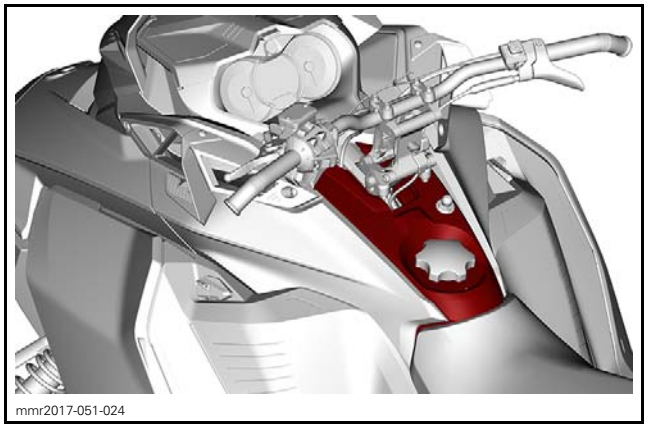
3. Pull out headlight housing and trim.

Installing the Headlight Module

The installation is the reverse of removal procedure.

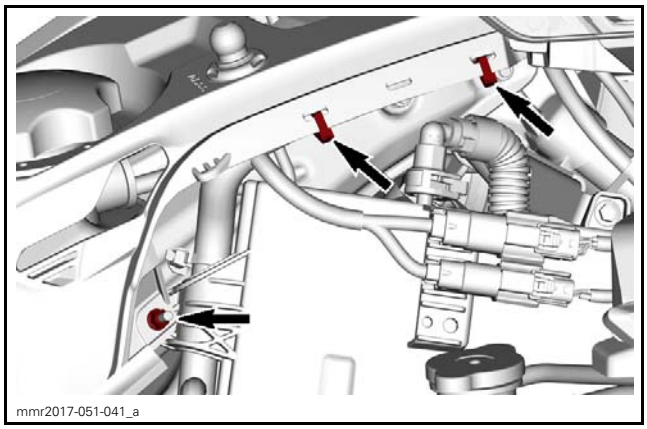
TIGHTENING TORQUE	
Headlight hexagonal screw	1.8 N•m ± 0.2 N•m (16 lbf•**in** ± 2 lbf•**in**)
Headlight Torx screw	2.3 N•m ± 0.2 N•m (20 lbf•**in** ± 2 lbf•**in**)

CONSOLE


mmr2017-051-024

Removing the Console

1. Remove *UPPER BODY MODULE*. Refer to procedure in this subsection.
2. Remove the seat. Refer to *SEAT* subsection.
3. Cut harness locking ties.
4. Remove console nuts.


mmr2017-051-041_a

5. Remove fuel tank cap.
6. Lift up the console and unplug all connectors.
7. Install fuel tank cap.

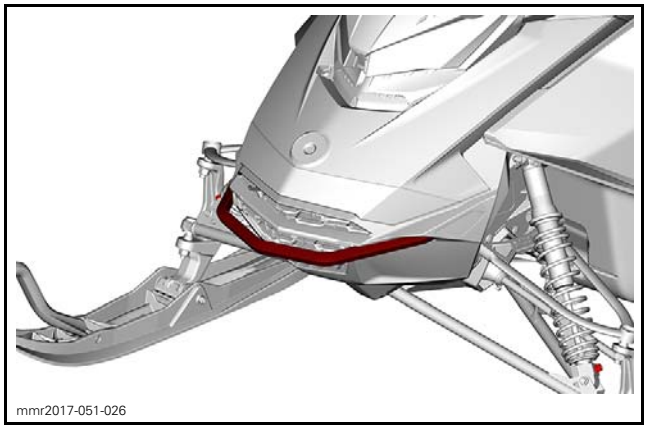
Installing the Console

The installation is the reverse of the removal procedure.

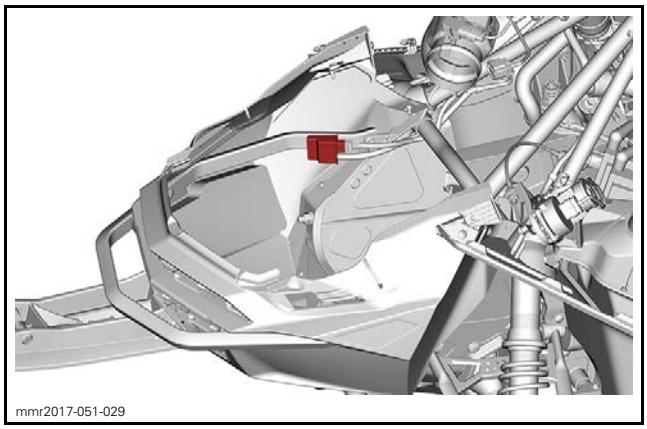
TIGHTENING TORQUE	
Console nut	2.3 N•m ± 0.2 N•m (20 lbf•**in** ± 2 lbf•**in**)

FRONT BUMPER

Removing the Front Bumper


mmr2017-051-026

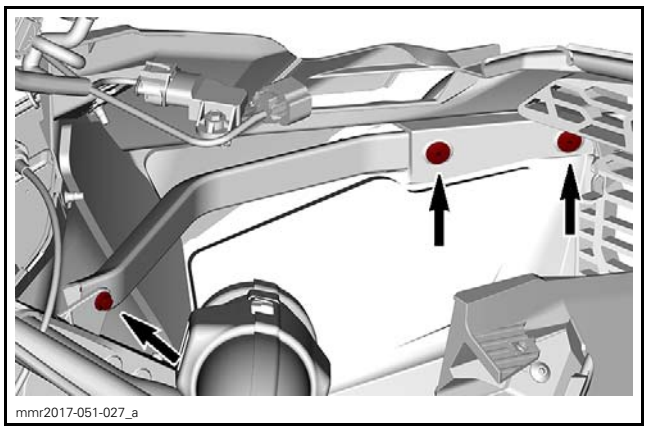
1. Remove tuned pipe. Refer to *EXHAUST SYSTEM* subsection.
2. Detach TCM from bumper.


mmr2017-051-029

3. Drill out rivets from front bumper.

REQUIRED TOOL
SUPERTANIUM DRILL BIT 3/16" (P/N 529 031 800)

4. Remove front bumper screws.

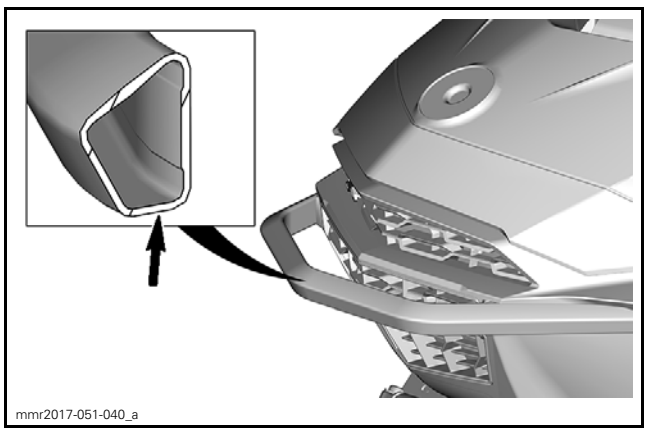

mmr2017-051-027_a

5. Pull out bumper towards front.

Installing the Front Bumper

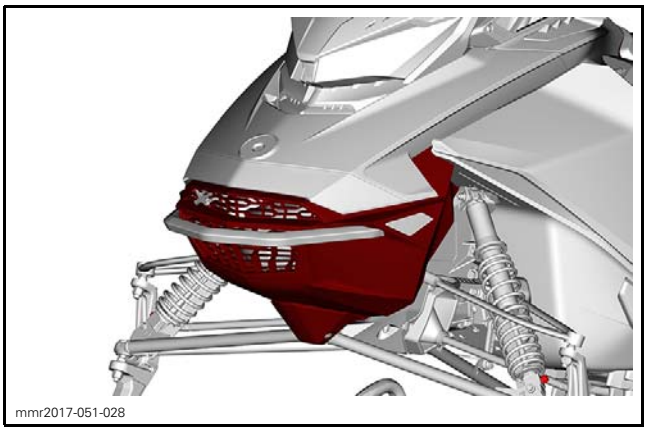
The installation is the reverse of the removal procedure.

Ensure the small surface of the bumper extrusion is facing downwards.


mmr2017-051-040_a

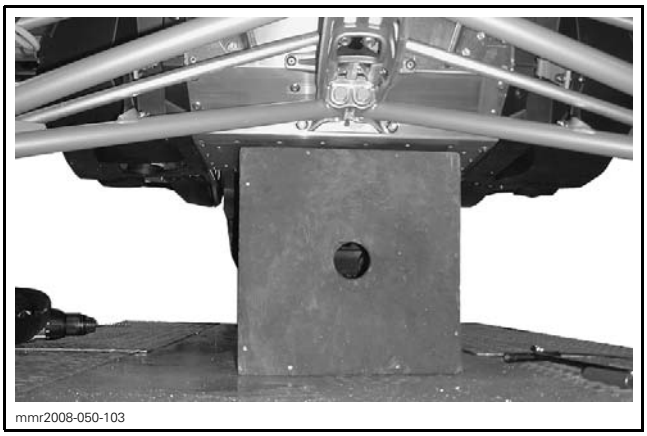
TIGHTENING TORQUE	
Front bumper nut	5 N•m ± 0.5 N•m (44 lbf•**in** ± 4 lbf•**in**)

FRONT BOTTOM PAN

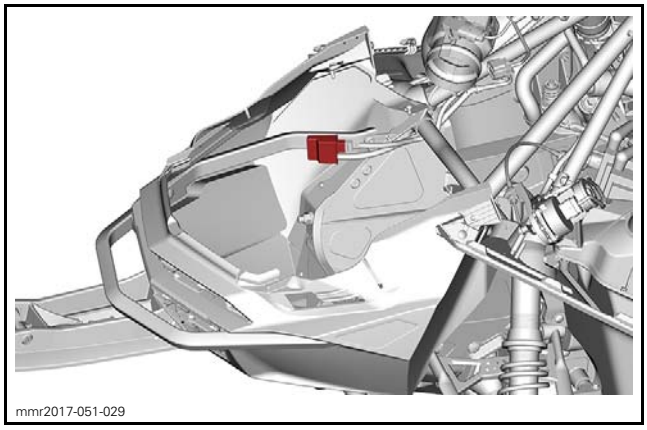

mmr2017-051-028

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.


mmr2008-050-103

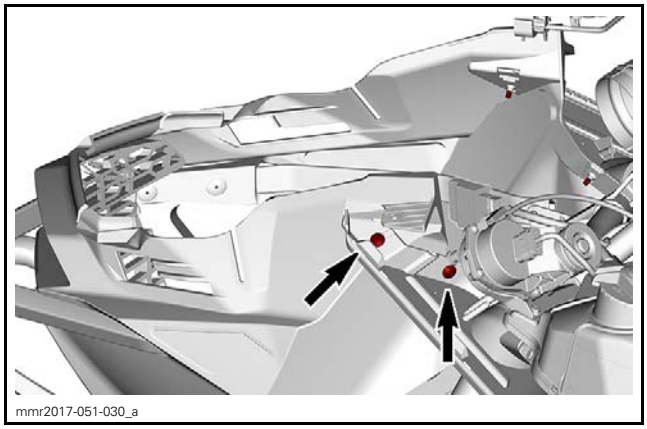
3. Remove the upper body module. Refer to procedure in this subsection.
4. Remove tuned pipe. Refer to *EXHAUST SYSTEM* subsection.
5. Detach TCM from bumper.


mmr2017-051-029

6. Remove *FRONT BUMPER*. See procedure in this subsection.

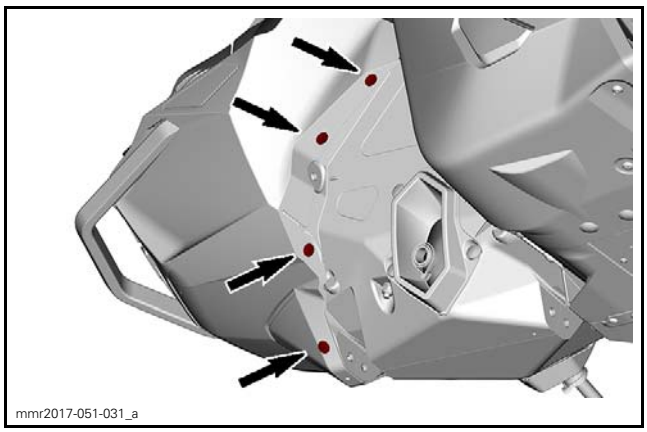
If the front bottom pan does not need to be replaced, the bumper may remain attached to bottom pan.

7. Remove bottom pan screws.


mmr2017-051-030_a

8. Remove front shock absorbers. Refer to *FRONT SUSPENSION* subsection.
9. Drill out all rivets retaining bottom pan.

NOTE: Refer to *FRAME* for proper procedure when drilling rivets retaining plastic parts.


mmr2017-051-031_a

LH SIDE SHOWN — SOME PARTS REMOVED FOR CLARITY PURPOSE

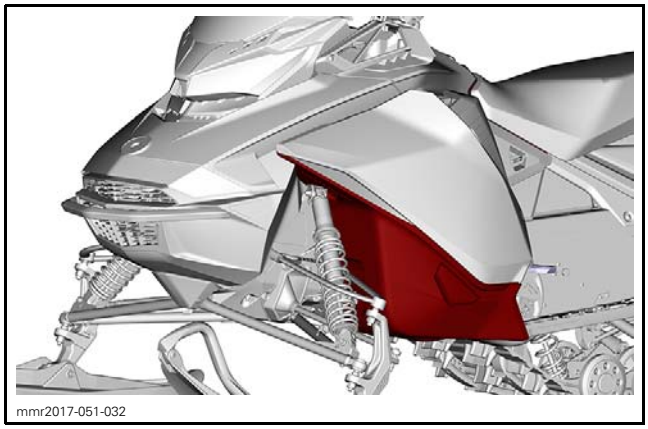
10. Remove bottom pan.

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**)

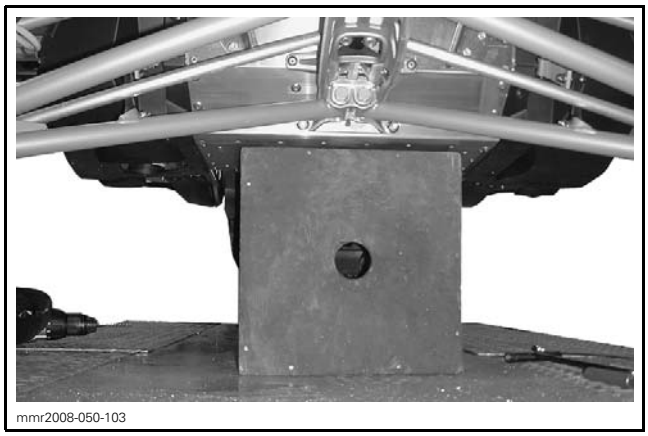
SIDE BOTTOM PAN


mmr2017-051-032

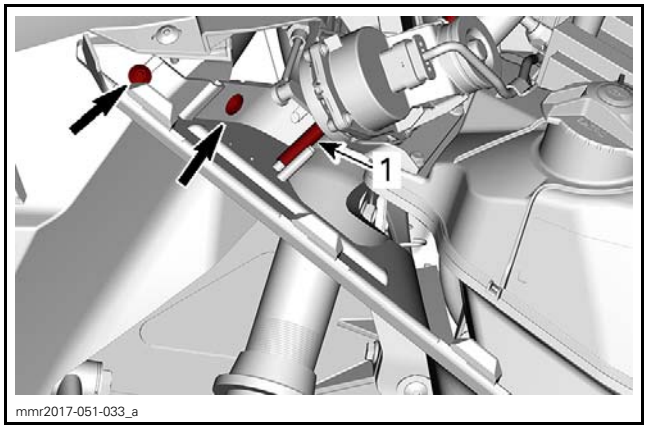
Removing the Side Bottom Pan

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.

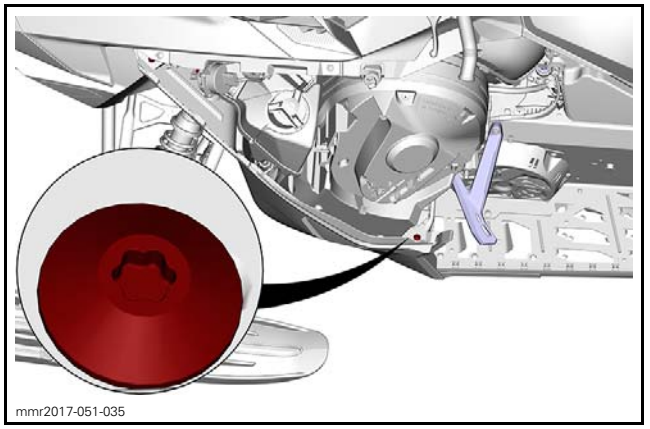

mmr2008-050-103

4. Disconnect vent tube from side bottom pan, and remove the screws.

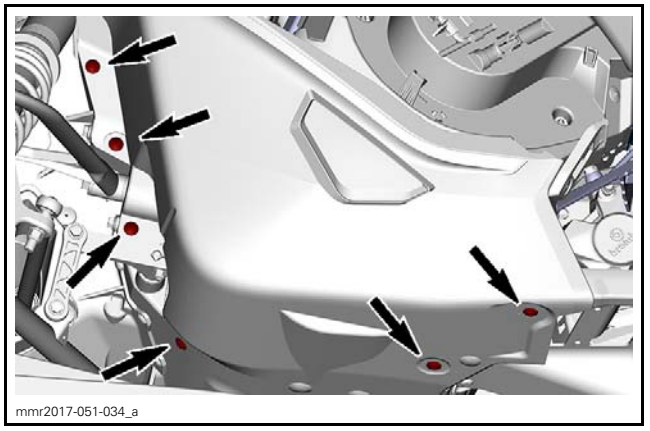


mmr2017-051-033_a

1. Vent tube


mmr2017-051-035

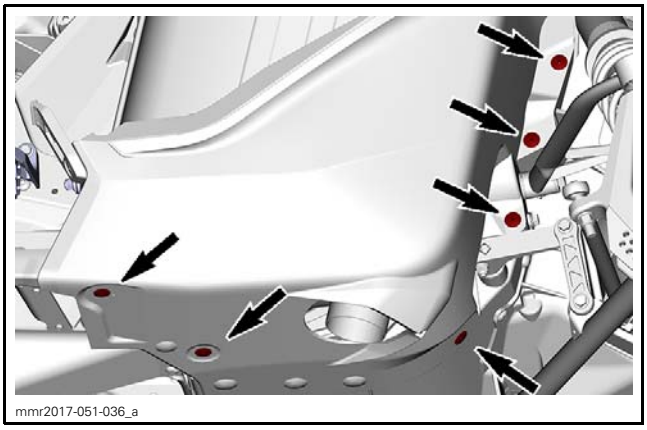
5. To remove the LH side bottom pan, remove the screws.


mmr2017-051-034_a

6. To remove the RH side bottom pan, drill out all rivets

NOTE: Refer to *FRAME* for proper procedure when drilling rivets retaining plastic parts.

NOTICE **Be careful not to drill through muffler.**


mmr2017-051-036_a

RH SIDE SHOWN

Installing the Side Bottom Pan

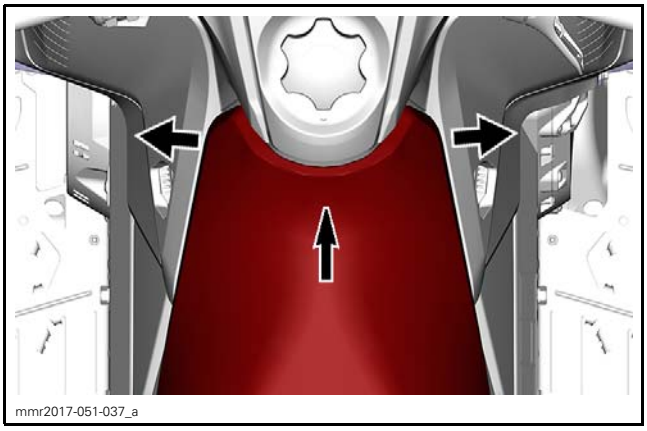
The installation is the reverse of the removal procedure.

TIGHTENING TORQUE	
Side bottom pan screw	2.8 N•m ± 0.2 N•m (25 lbf•**in** ± 2 lbf•**in**)

SEAT

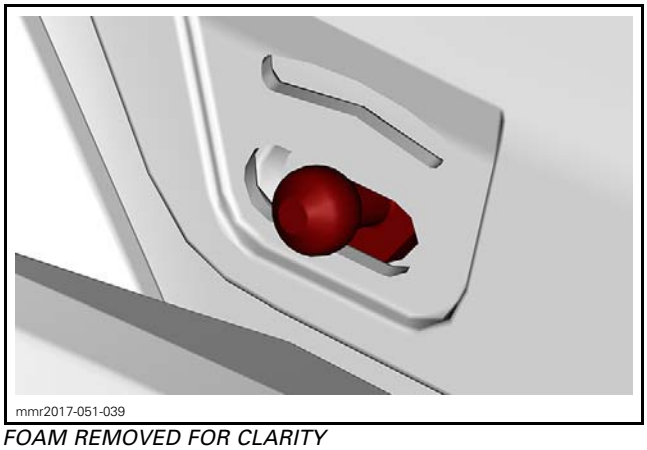
Removing and Installing the Seat

1. While pushing in the center of the seat towards front, pull on both sides, to unlock, and slide rearwards.


mmr2017-051-037_a

The Installation is the reverse of the removal procedure.

Ensure the seat is locked.


mmr2017-051-039

FOAM REMOVED FOR CLARITY

Replacing the Seat Cover

Remove seat.

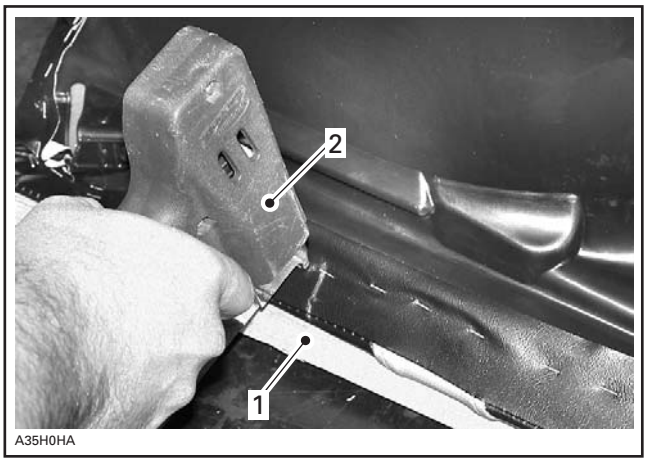
Remove the old seat cover. Check the foam and replace it if necessary.

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 tacker.

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.



A35H0HA

TYPICAL
1. Piece of wood
2. Tacker

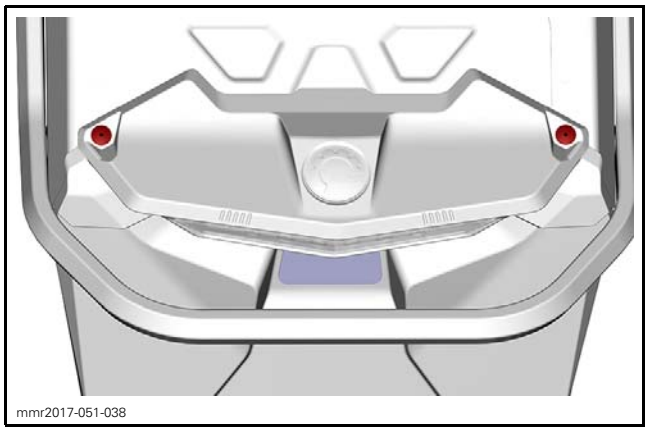
After seat cover installation, cut all around the excess of material.

REAR BUMPER

TIGHTENING TORQUE	
Rear bumper screws	16 N•m ± 2 N•m (142 lbf•**in** ± 18 lbf•**in**)

TAIL LIGHT HOUSING

Drill out the rivets.


mmr2017-051-038

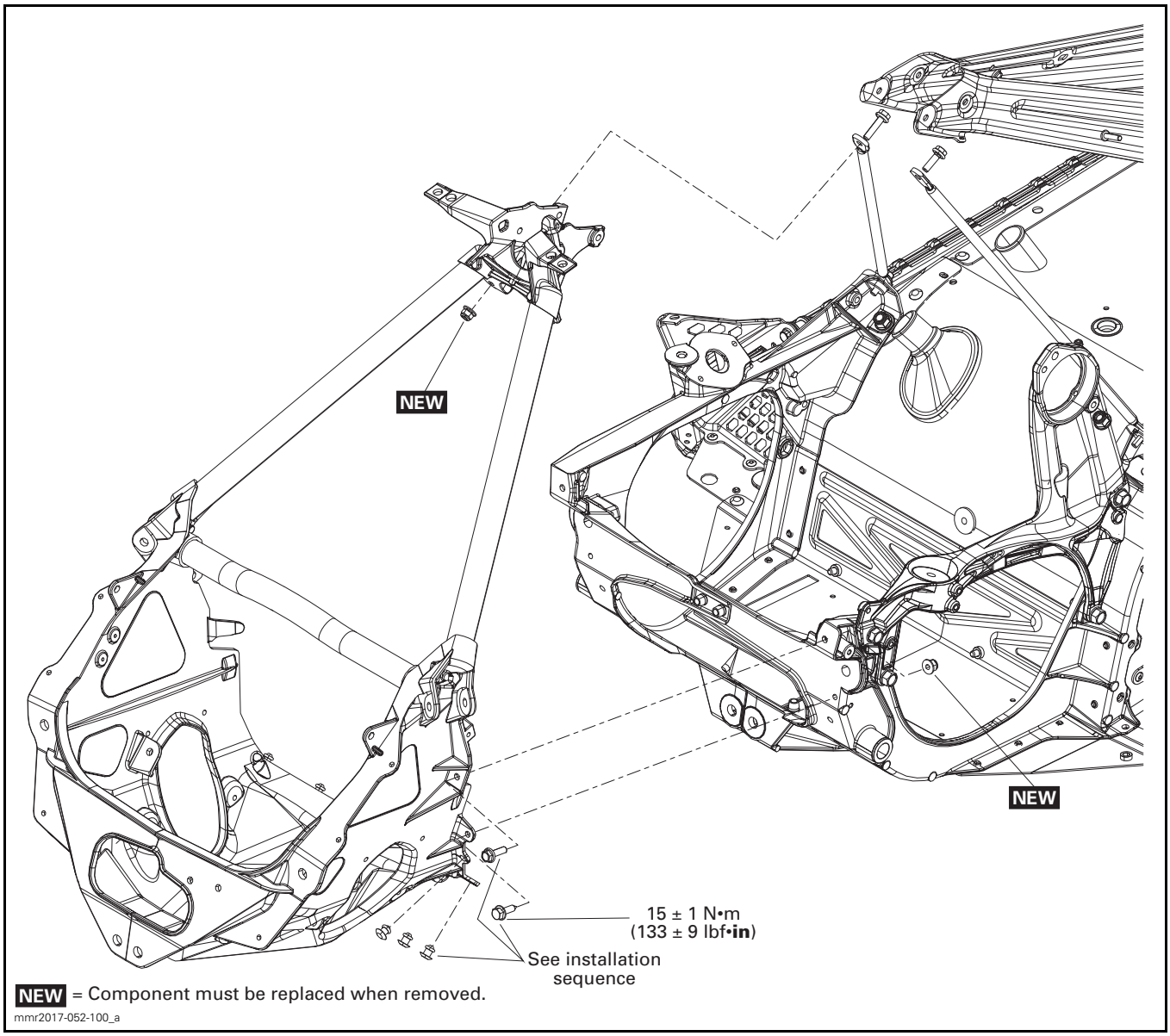
Pull housing towards rear.

FRAME

SERVICE TOOLS

Description	Part Number	Page
RADIATOR INSTALLATION GAUGES	529 036 422	13
SUPERTANIUM DRILL BIT 3/16"	529 031 800	4

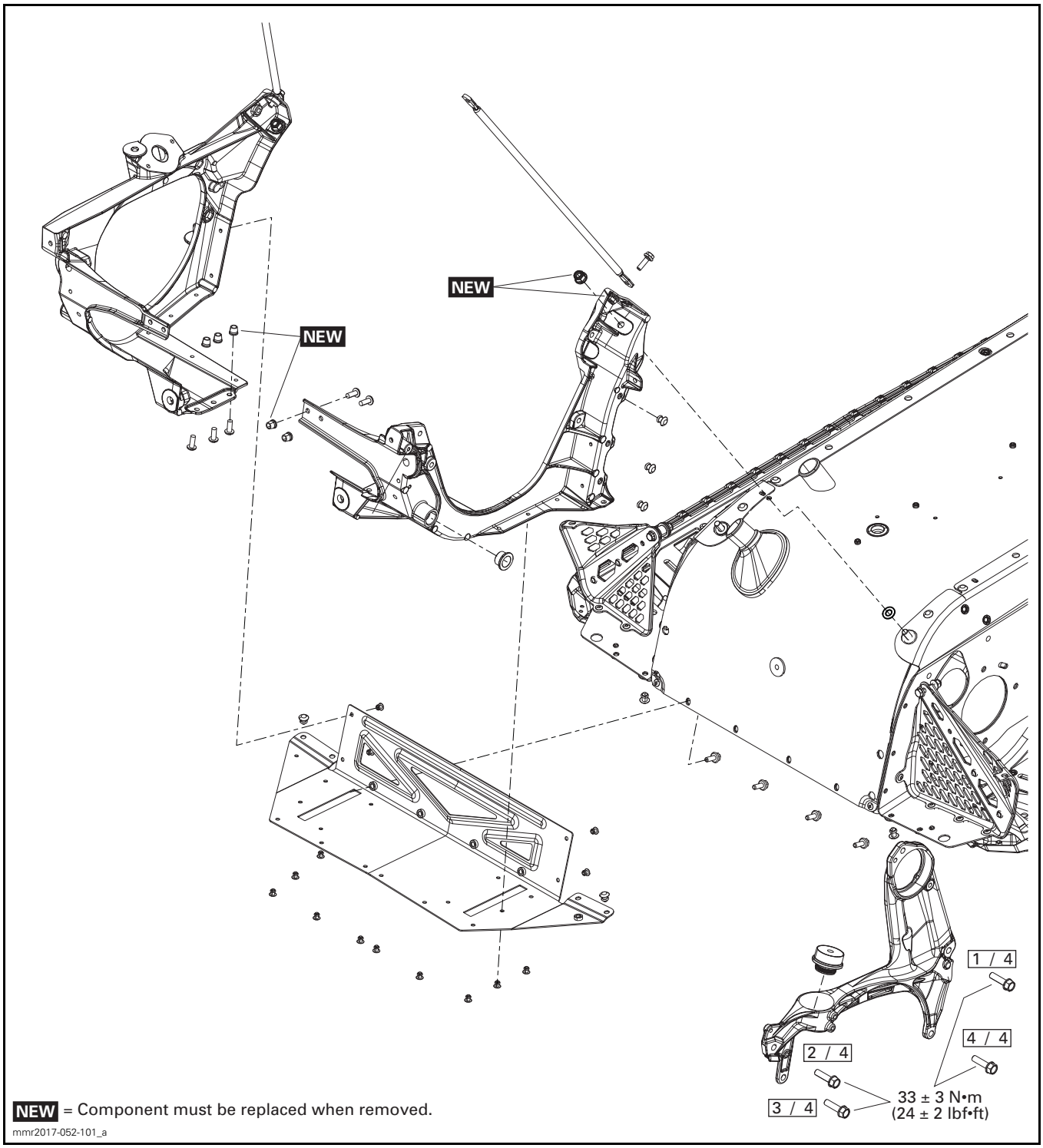
SUSPENSION MODULE



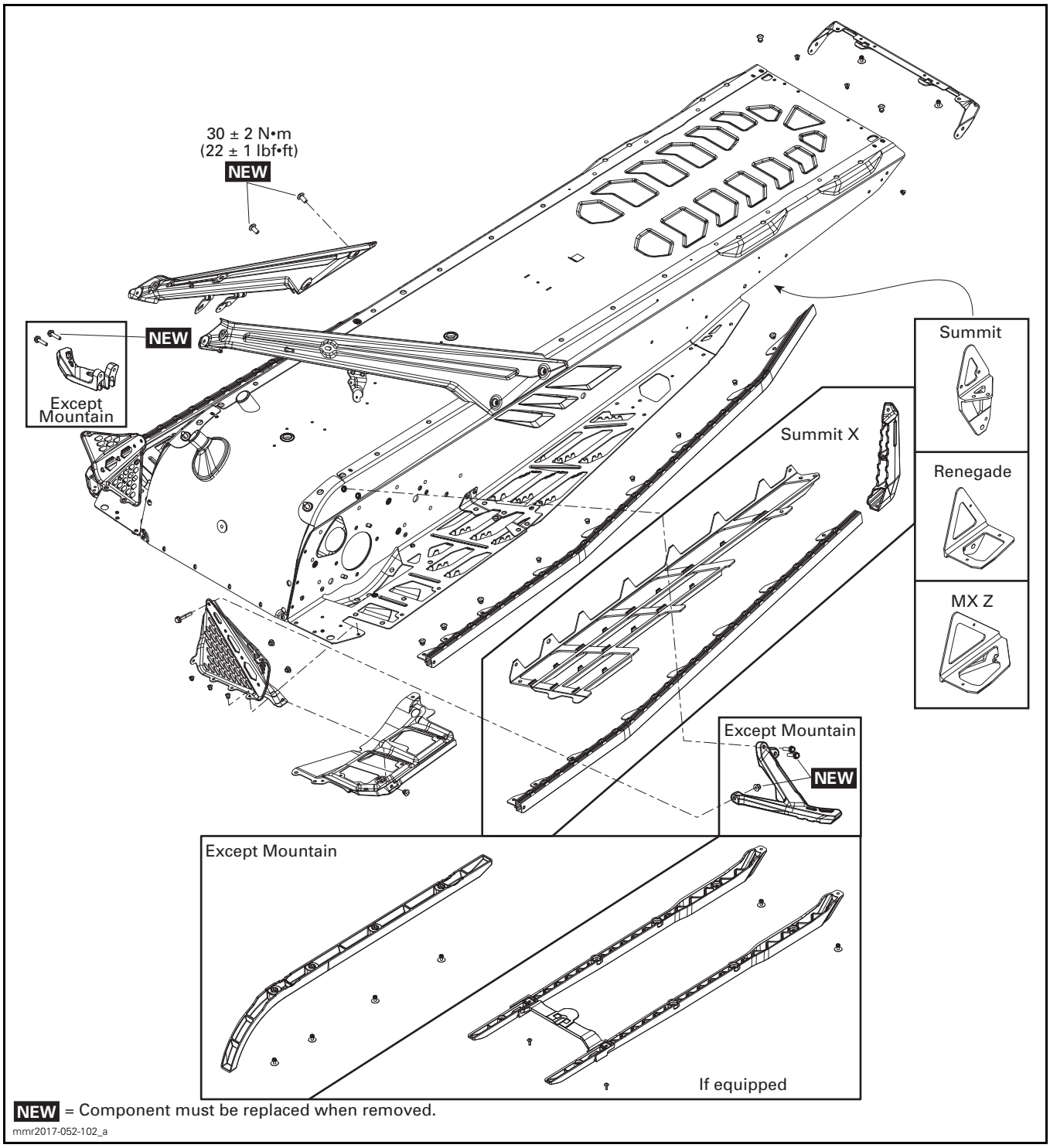
NEW = Component must be replaced when removed.

mmr2017-052-100_a

ENGINE MODULE



TUNNEL MODULE



NEW = Component must be replaced when removed.

mmr2017-052-102_a

GENERAL

During assembly/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

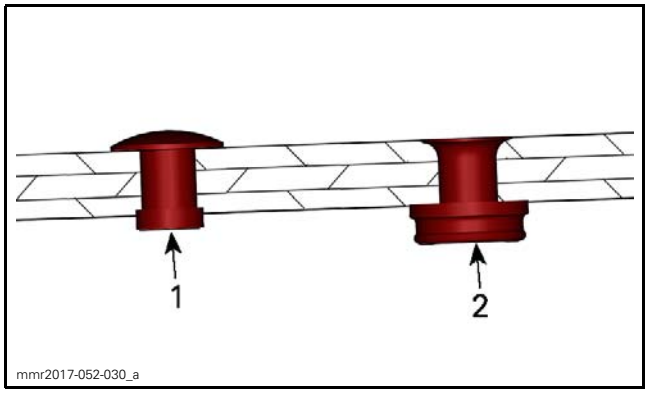
For proper drilling instructions and to prevent premature wear, follow the procedures as detailed.

NOTICE **When removing rivets, do not enlarge or deform the rivet holes in the frame.**

Removing a Self-Percing Rivet

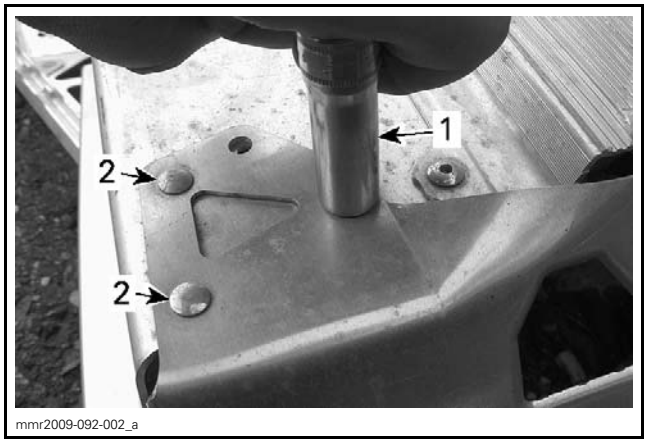
Henrob and Thomson rivets are self-piercing rivets. They are installed with specific robotized equipment.

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.

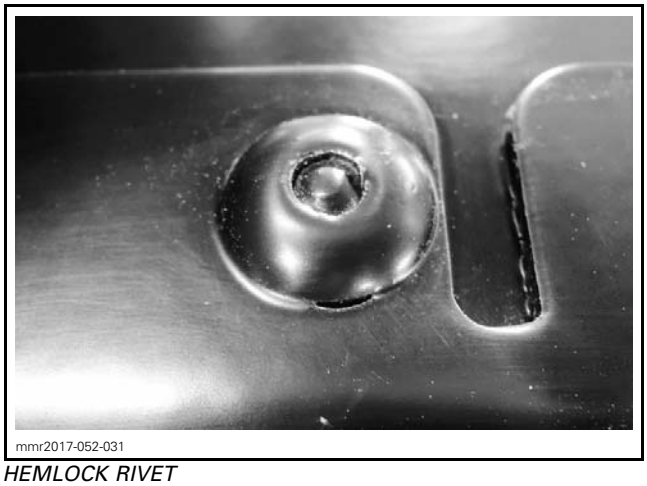
Removing a Pop Rivet

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.

Important: 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)

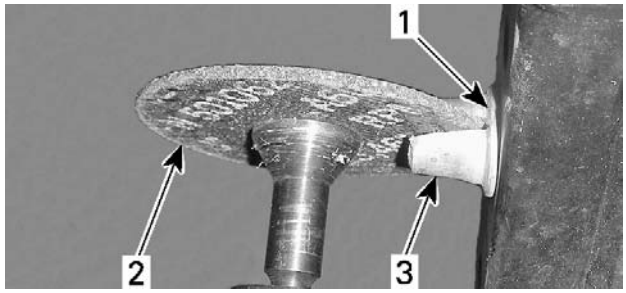
NOTICE **Drill only sufficiently to cut rivet head. Do not drill into frame material, or part secured using the rivet. When rivet is used to secure a plastic part, use pliers to avoid rotation of rivet with drill bit and heating or melting of the plastic part.**

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.



mmr2008-051-125_a

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.

Repairing the Frame

NOTE: 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.

NOTE: Immediately after the clear coat application, apply a thin coat of HR50 blending solvent **around** the painted area.

6. Allow clear coat to dry.

NOTE: Clear coat takes approximately 2 hours to dry following application.

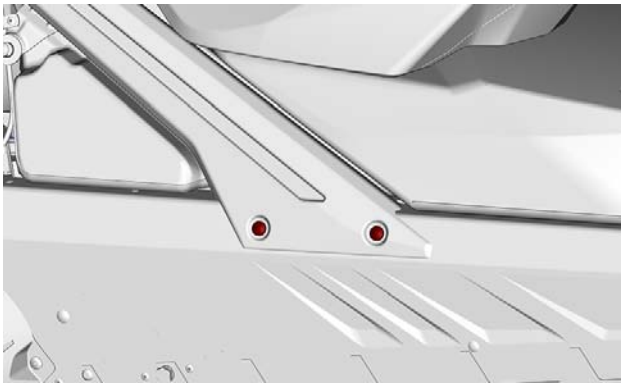
REAR BUMPER

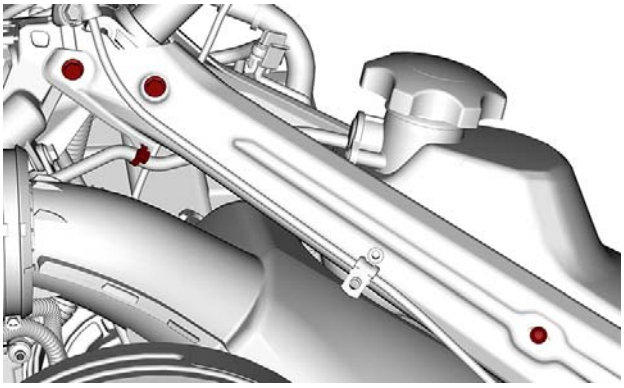
Refer to *BODY* subsection for rear bumper removal and installation procedure.

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.


mmr2017-052-001


mmr2017-052-002

3. Remove rear frame member.

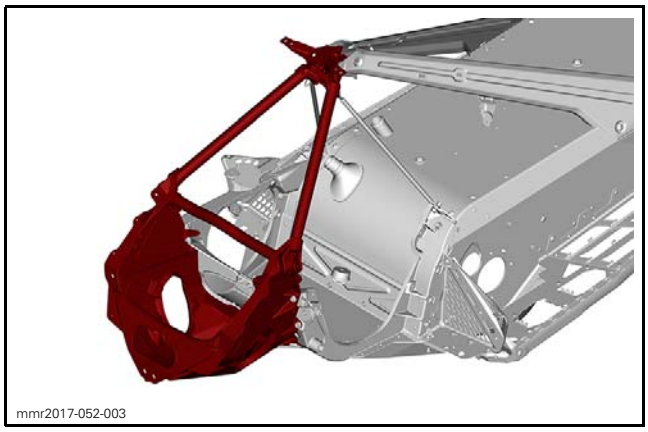
Installing the Rear Frame Member

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

NOTE: Install all screws and nuts before tightening them.

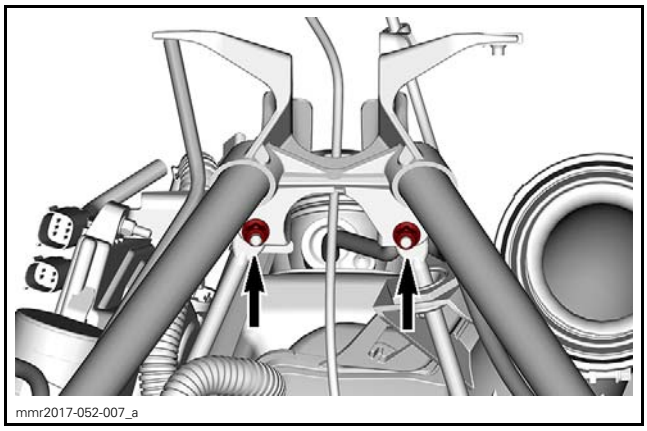
Refer to exploded view for proper tightening torque.

FRONT SUSPENSION MODULE

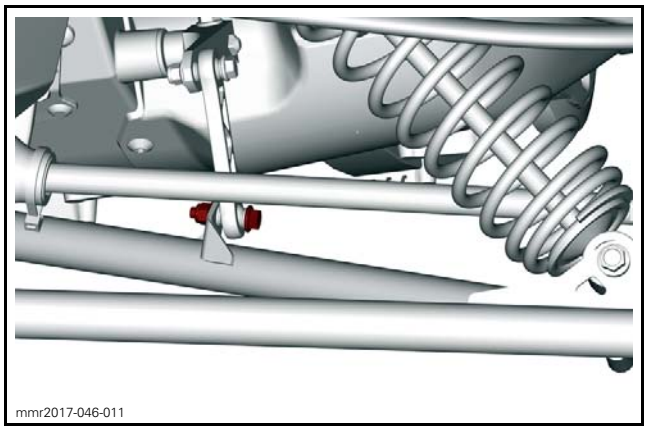

mmr2017-052-003

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.


mmr2017-052-007_a

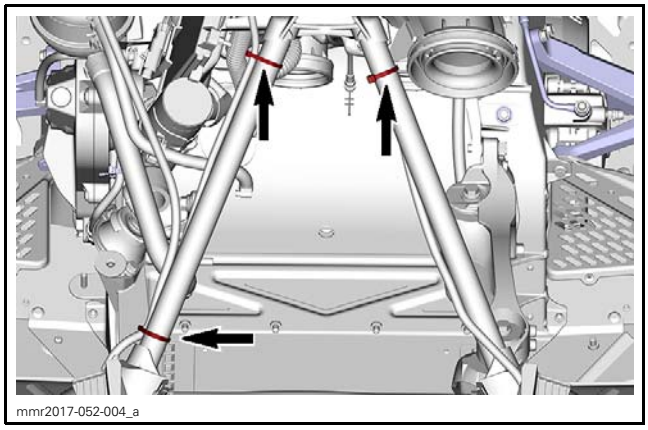
6. Remove the front suspension assembly in the following manner:
   6.1 Detach tie-rod ends from steering column.
   6.2 Remove upper shock absorber screws.
   6.3 Remove screw that secures stabilizer link to lower arm.


mmr2017-046-011

   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.

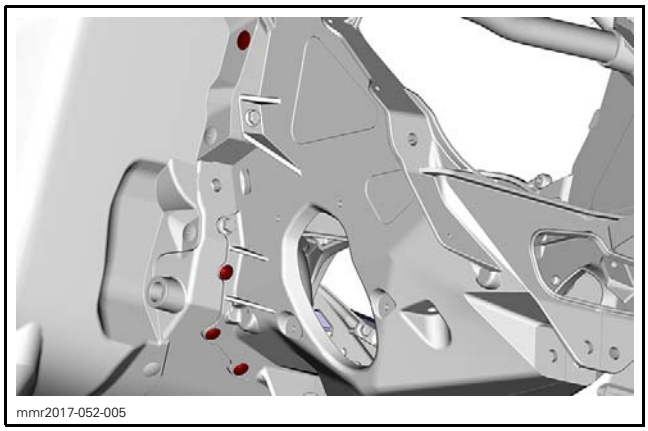
NOTE: Keep the front bumper installed on front bottom pan.

9. Cut locking ties that secure vents and electrical harness to module tubes.


mmr2017-052-004_a

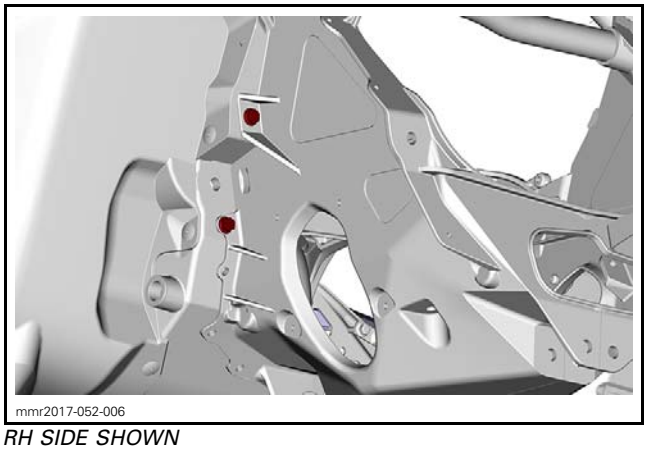
10. If the suspension module needs to be replaced, remove:
    – Steering rack / lower steering column support
    – Tie rod boots.
    Refer to *STEERING SYSTEM* subsection.
11. Remove the following pop rivets. Refer to *REMOVING A POP RIVET* at the beginning of this subsection.

Important: It is highly recommended to support the frame locally around a Hemlock rivet when punching its nail out.


mmr2017-052-005

RH SIDE SHOWN

12. Remove screws securing front suspension module to frame.


mmr2017-052-006

RH SIDE SHOWN

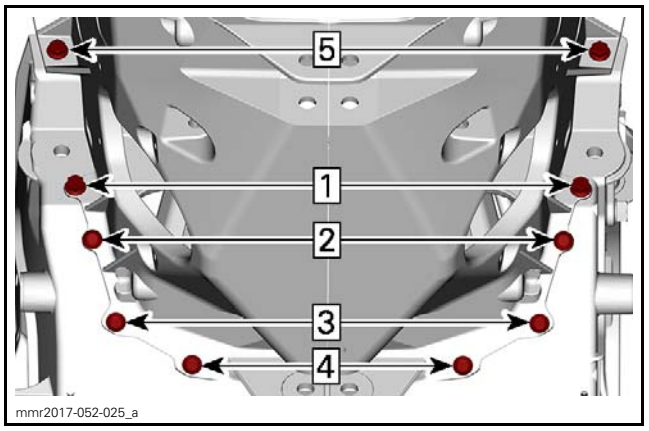
13. Remove the front suspension module.

Installing the Front Suspension Module

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

Refer to exploded view for proper tightening torque.

Install fasteners as per the following sequence.



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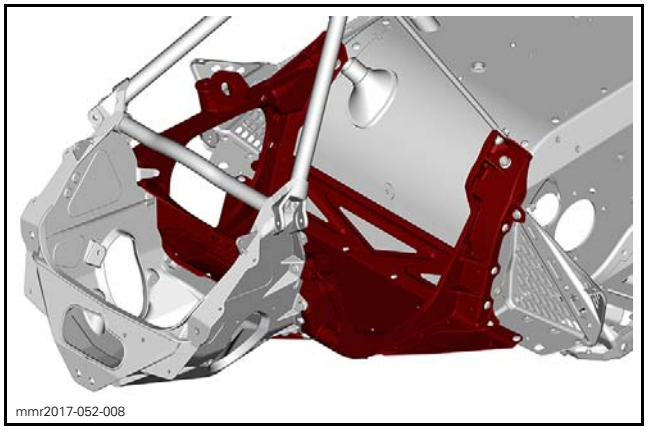
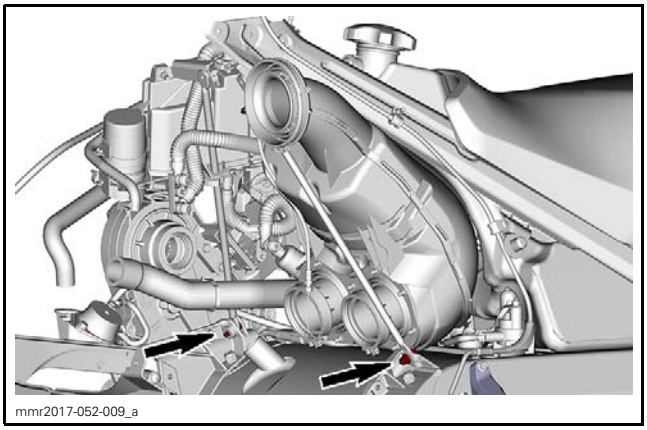
ENGINE MODULE


mmr2017-052-008

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*.subsection.
4. Detach side frame members from engine module.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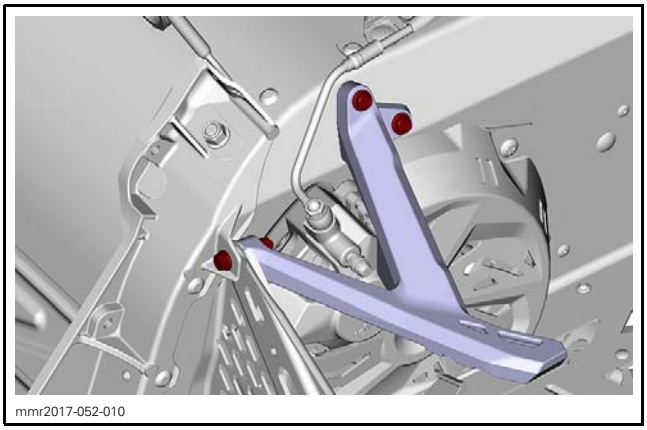
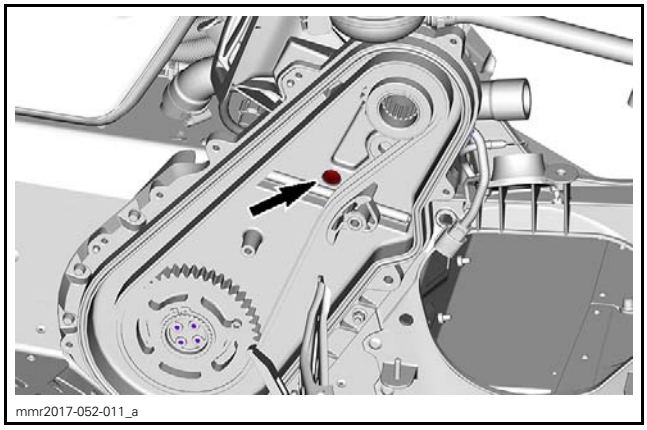
5. Remove toe hook fasteners, if equipped.


mmr2017-052-010

6. Remove the chaincase cover. Refer to *CHAINCASE* subsection.
7. Remove the screw that secure the chaincase to the engine module.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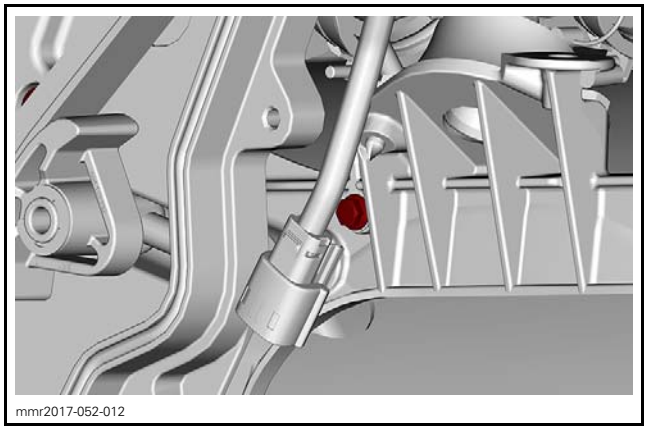
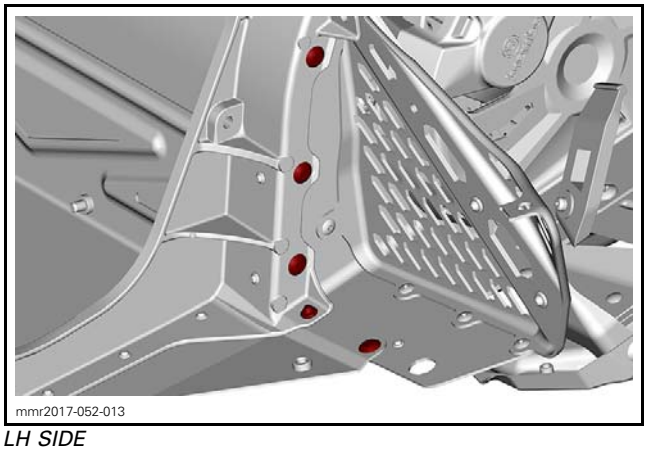
8. Remove the electrical ground screw located between the chaincase and the engine mount.

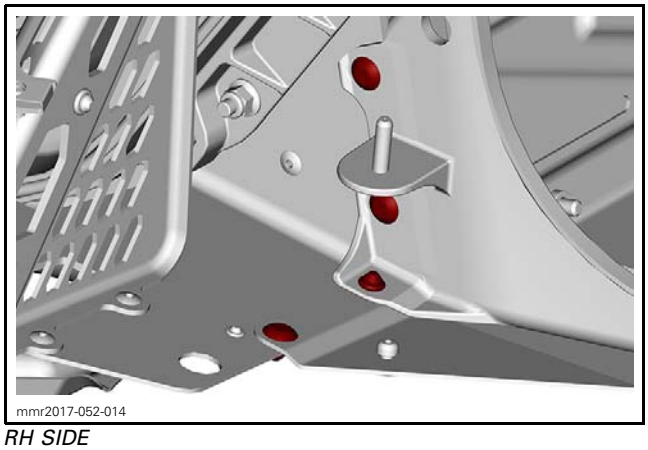

mmr2017-052-012

9. Remove rivets as per the following illustrations. Refer to *REMOVING A POP RIVET* in this subsection.

Important: It is highly recommended to support the frame locally around a Hemlock rivet when punching its nail out.

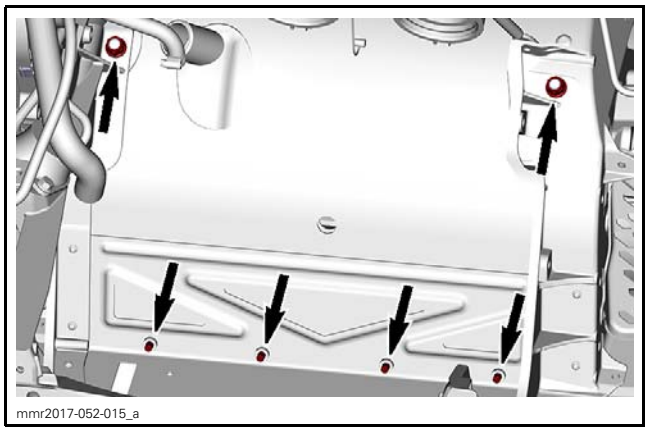

mmr2017-052-013

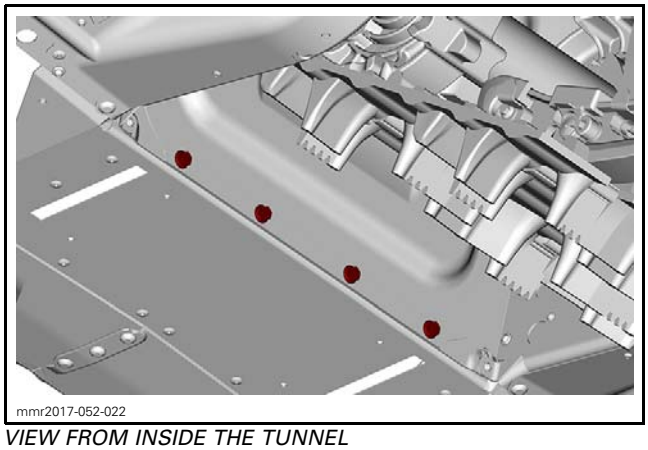
LH SIDE



RH SIDE

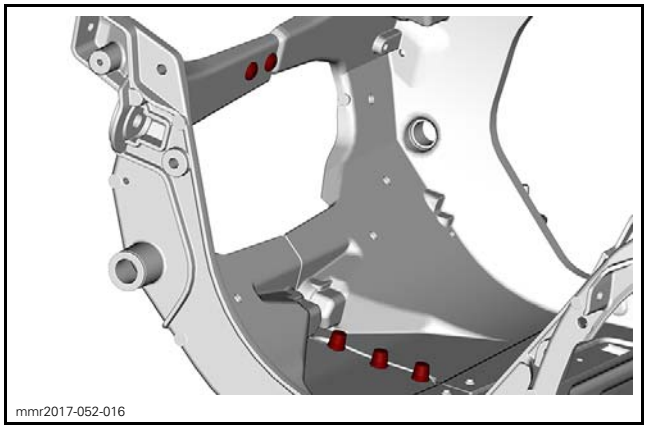
10. Remove nuts and screws securing the engine module to the tunnel.





VIEW FROM INSIDE THE TUNNEL

11. Remove the engine module.
12. If only one of the two side members is replaced, remove HUCK rivets as per the procedure in this subsection.



Engine Module Installation

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.

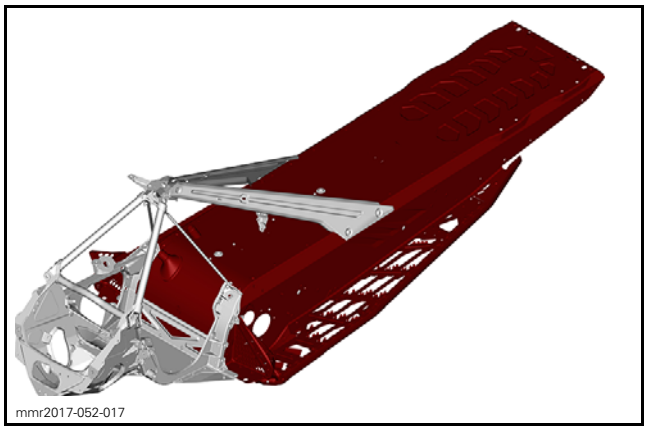
NEW FASTENERS	
Torx screw M6 x 20	(P/N 250000712)
Hexagonal flanged elastic stop nut M6	(P/N 233261414)

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 before tightening and riveting.

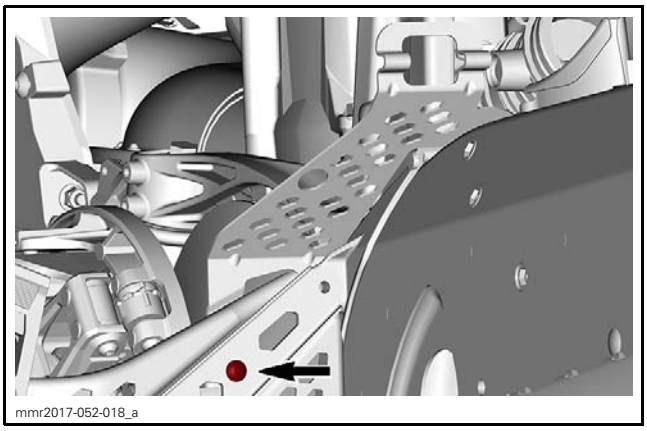
Refer to exploded view for proper tightening torque. Use standard tightening torque when not specified.

TUNNEL MODULE



Removing the Tunnel Module

1. Drain cooling system, Refer to *COOLING SYSTEM DRAINING* in *PERIODIC MAINTENANCE PROCEDURES* 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.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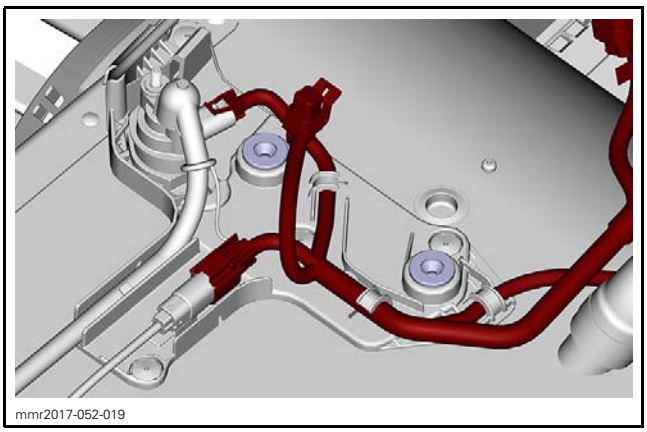
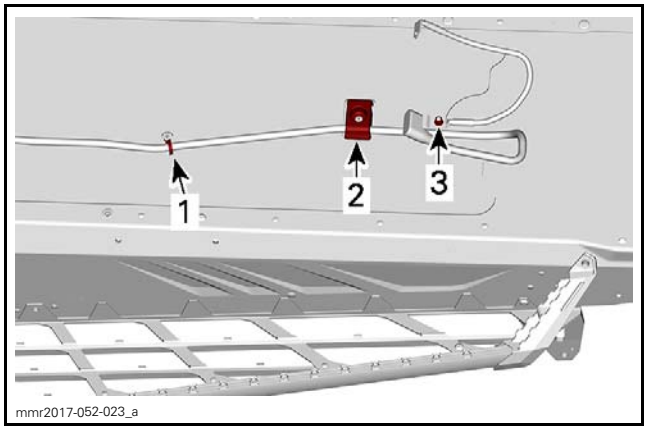
5. Disconnect the starter cable from the solenoid, if equipped.
6. Disconnect and remove the electric harness from the plastic bracket.


mmr2017-052-019

7. If the tunnel is replaced, remove:
   - Chaincase
   - The plastic bracket
   - Devices that retain the battery cable, if equipped
   - Rear bumper
   - Taillight
   - Snowguard.



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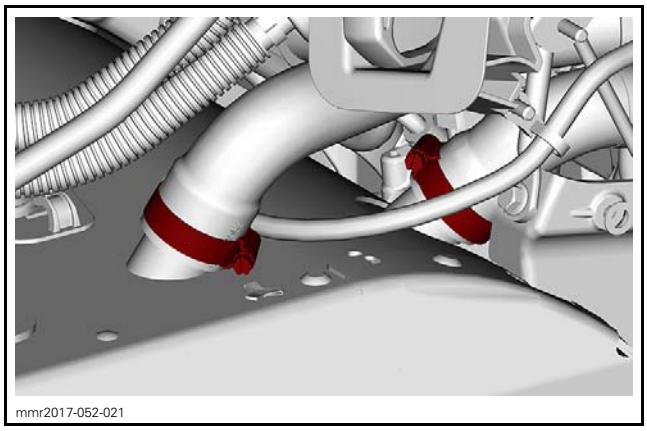
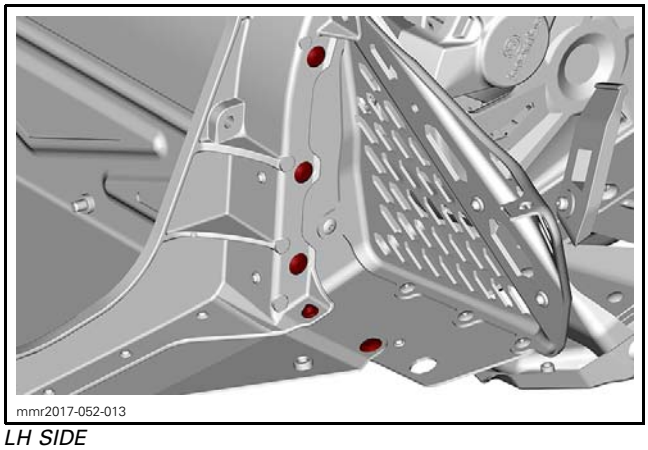
8. Move the plastic bracket, electrical harness, and fuel hoses aside to clear the tunnel.
9. Loosen the coolant hose clamps and disconnect hoses.

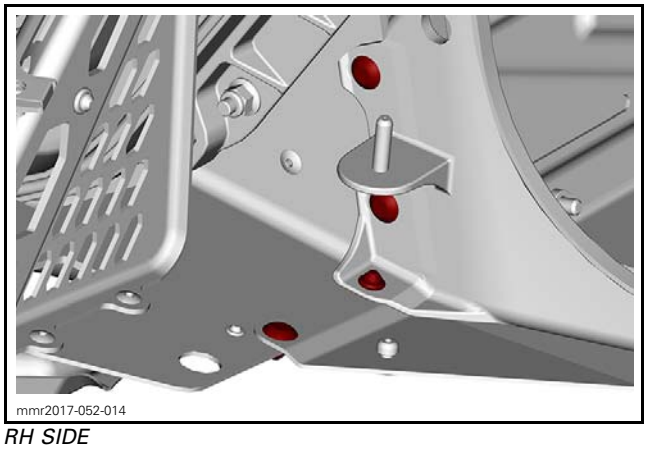

mmr2017-052-021

10. Remove rivets as per the following illustrations. Refer to *REMOVING A POP RIVET* in this subsection.

Important: It is highly recommended to support the frame locally around a Hemlock rivet when punching its nail out.

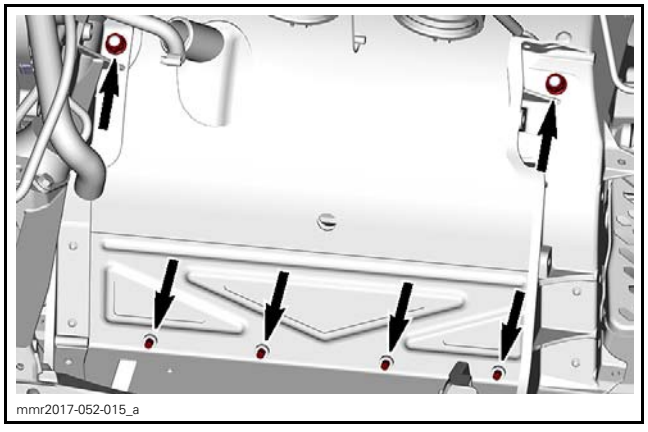


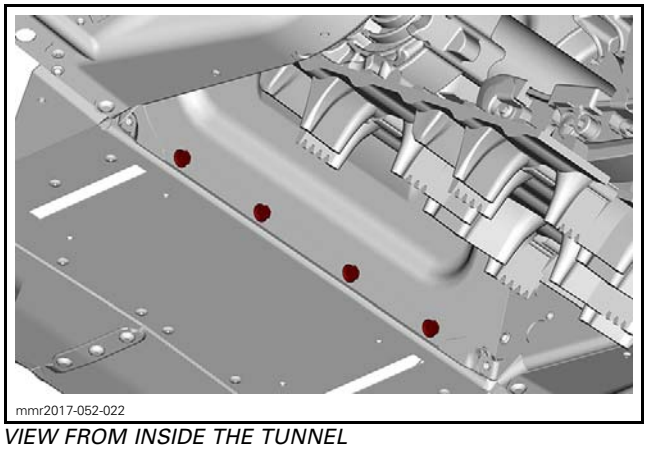
LH SIDE



RH SIDE

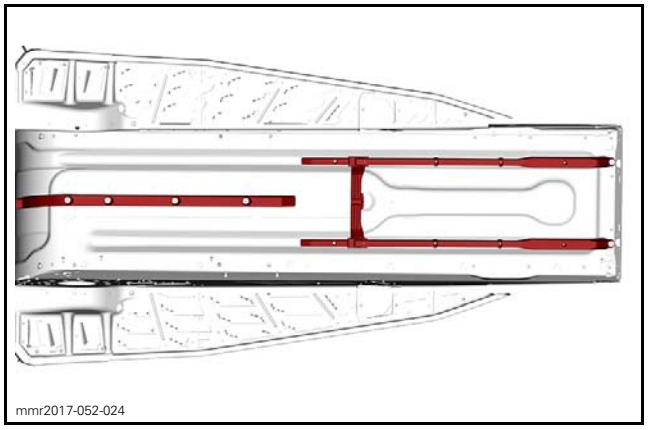
11. Remove nuts and screws securing the engine module to the tunnel.





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.



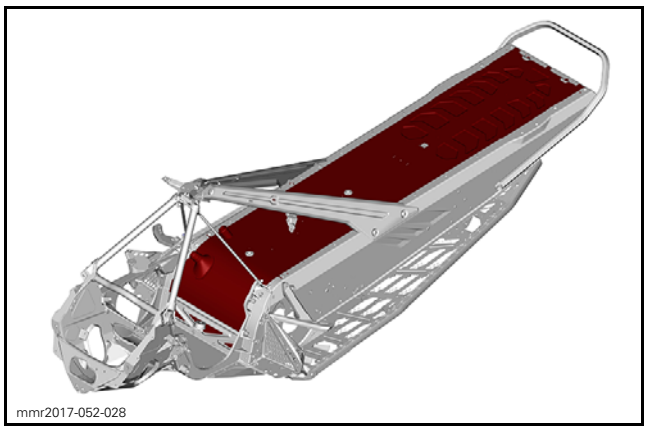
Installing the Tunnel Module

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 REFILL AND BLEEDING* in *PERIODIC MAINTENANCE PROCEDURES* subsection.

HEAT EXCHANGER


mmr2017-052-028

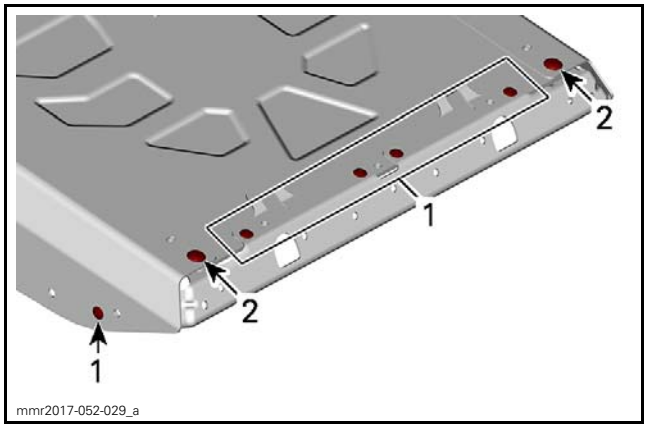
Replacing the Heat Exchanger

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.

Important: It is highly recommended to support the frame locally around a Hemlock rivet when punching its nail out.



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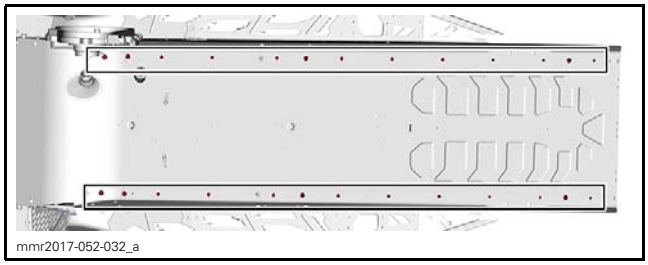
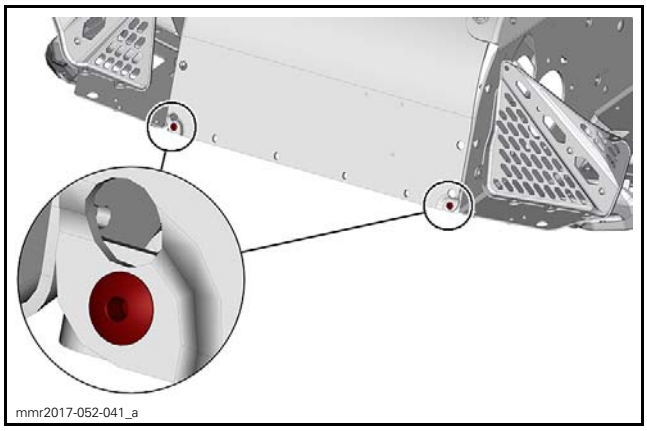
1. Avibulb rivets (pop rivets)
2. Hemlock rivets (pop rivets)

3. Remove the following rivets.


mmr2017-052-032_a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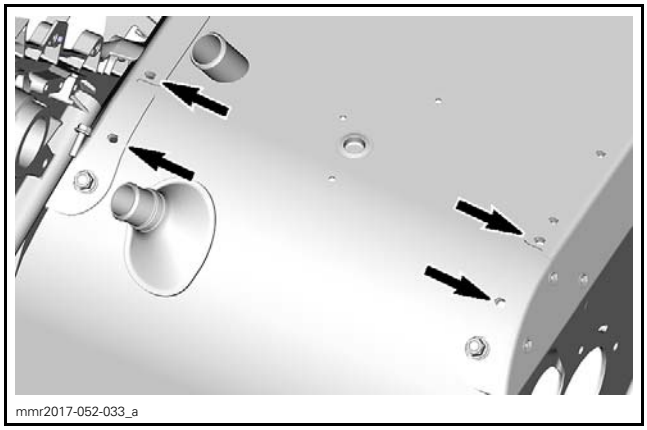
4. Position the new heat exchanger.
5. Install M6 screws and nuts loosely in the Hemlock rivet holes.

NOTE: M6 screws will not fit in self-piercing rivet holes.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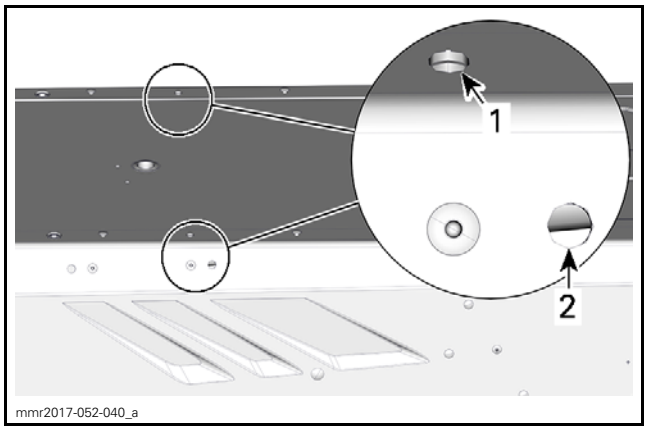
FRONT RIVET HOLES



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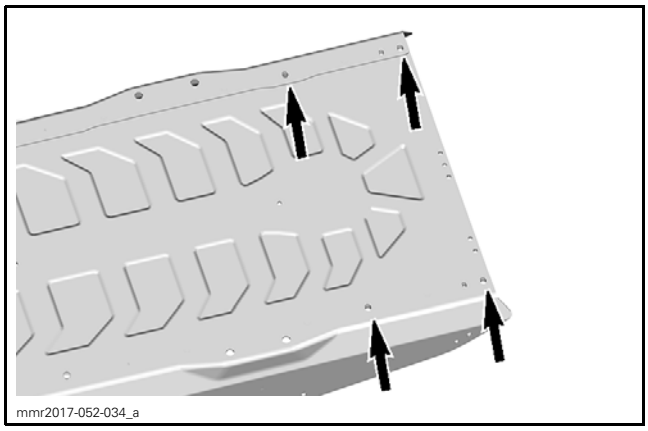
MID-LENTGH RIVET HOLES
1. Install M6 screws and nuts here
2. Rear mounting hole for rear frame member



REAR RIVET HOLES

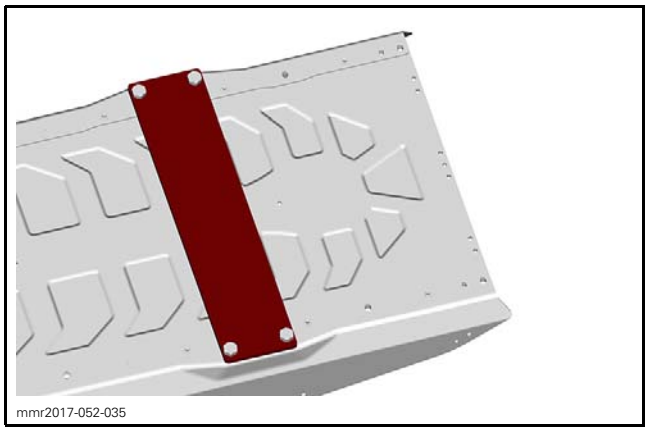
6. Install the gauge kit loosely with the appropriate screws, as per the following illustrations.

NOTICE **It is imperative to use the gauge kit and to follow each steps of this procedure to avoid drive axle misalignment.**

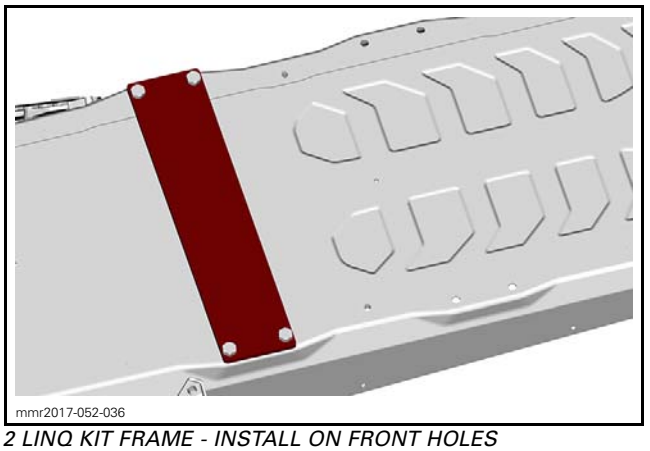
REQUIRED TOOL	
RADIATOR INSTALLATION GAUGES (P/N 529 036 422)	

CYLINDRICAL GAUGES LENGHT	
Rear suspension hole gauges	419.2 mm (16-1/2 in)
Tail gauge	426.4 mm (16-25/32 in)

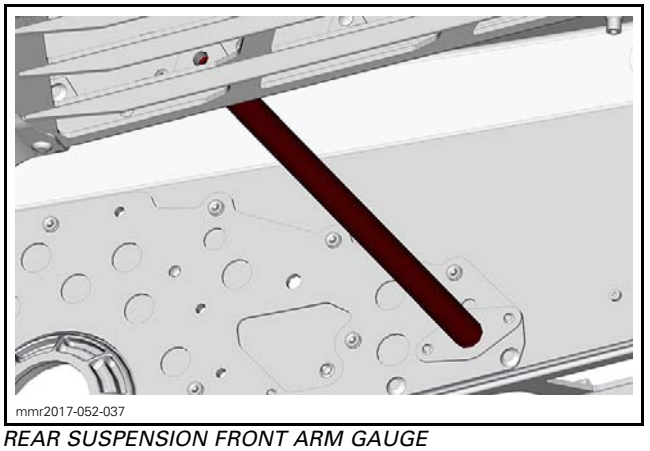
The gauge kit fits all tunnel sizes.



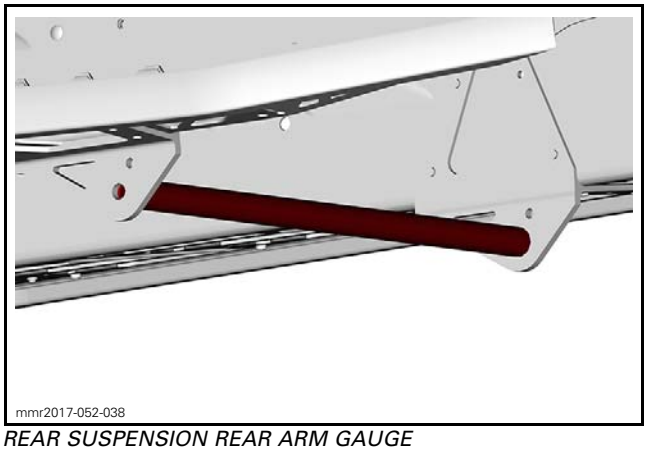
1 LINQ KIT FRAME



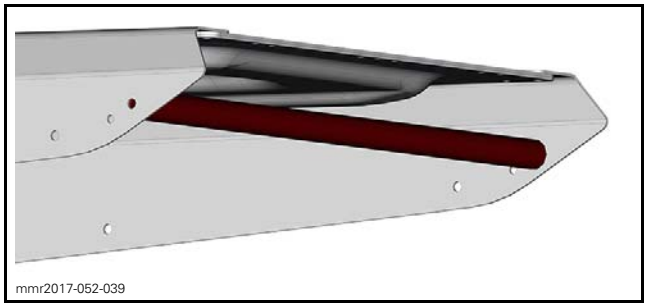
2 LINQ KIT FRAME - INSTALL ON FRONT HOLES



REAR SUSPENSION FRONT ARM GAUGE



REAR SUSPENSION REAR ARM GAUGE



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.

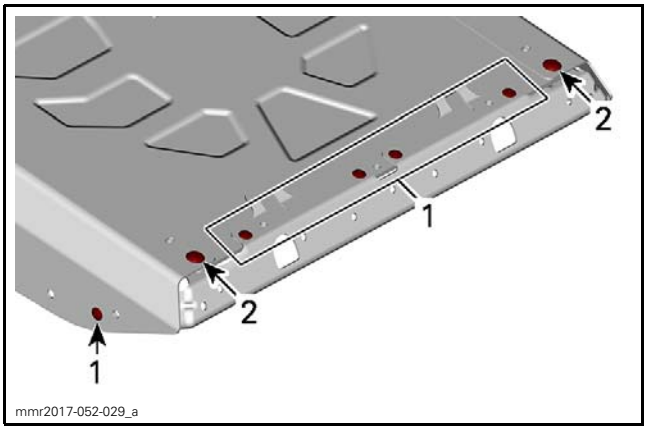
8. Tighten gauges and M6 screws with standard torque.
9. Enlarge self-piercing rivet holes.

REQUIRED TOOL
Drill bit6.35 mm (1/4 in)

10. Install Hemlock rivets in enlarged holes.

REQUIRED PARTS	
Hemlock rivets	293150119

11. Install the tunnel rear cap.



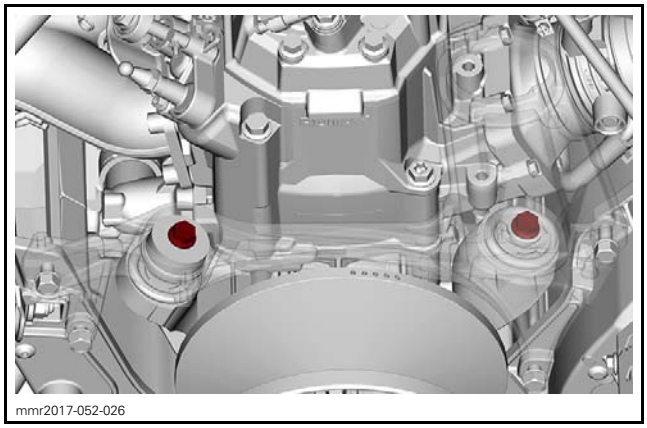
1. Avibulb 4.76 mm (3/16 in) rivets
2. Hemlock 6.4 mm (1/4 in) rivets

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

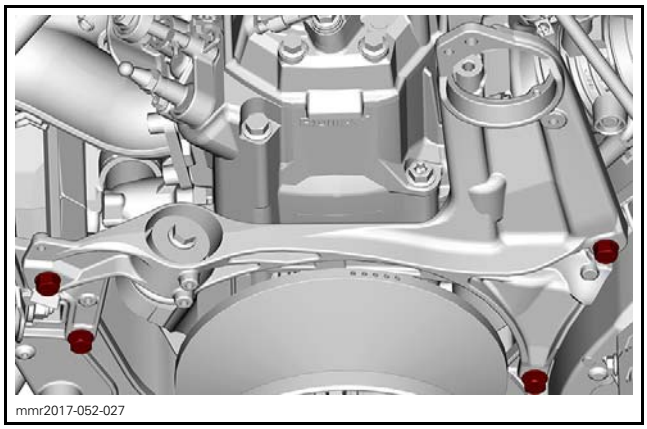
Removing the Countershaft Bearing Support

1. Refer to the appropriate subsection and remove:
   – Driven pulley and countershaft
   – LH side bottom pan.
2. Disconnect the Rave valve cable. Refer to *RAVE* subsection in *ENGINE*.
3. Install a shim between the engine bottom end and the engine module.
4. Remove both engine mount screws.



FRAME MEMBER IS TRANSPARENT FOR CLARITY

5. Remove countershaft bearing support screws.



6. 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	207683044
IF INSTALLED ON A NEW FRAME MEMBER	
M8 Hexagonal flange self-tapping screw	210283040

Refer to exploded view for tightening torque and sequence.

ENGINE

ENGINE			
Engine type			Rotax 850 E-TEC
Number of cylinder			2
Bore			82 mm (3.228 in)
Stroke			80.4 mm (3.165 in)
Displacement			849 cm^3 (51.81 in^3)
Compression ratio			12.50 ± 0.3
Combustion chamber volume			37.00 cc ± 0.93
Maximum power engine speed			7900 ± 100 RPM
3D RAVE spring	Valve springs	Color	Yellow
		Wire diameter	0.7 mm (.0276 in)
		Minimum free length	35 mm (1.378 in)
Piston ring type			Semi-trapezoidal
Ring end gap		New	0.4 mm to 0.6 mm (.016 in to .024 in)
		Service limit	1 mm (.039 in)
Engine compression specification		Service limit	7.5 bar (109 PSI)
Piston/cylinder wall clearance		New	0.135 mm to 0.161 mm (.0053 in to .0063 in)
		Service limit	0.200 mm (.0079 in)
Piston projection			1.75 mm to 1.82 mm (.069 in to .072 in)
Cylinder head warpage		Service limit	0.5 mm (.0197 in)
Cylinder taper		New (max.)	0.03 mm (.0012 in)
		Service limit	0.1 mm (.0039 in)
Cylinder out of round		New (max.)	0.010 mm (.0004 in)
		Service limit	0.080 mm (.0031 in)
Crankshaft deflection		Max.	MAG: 0.05 mm (.002 in) PTO: 0.06 mm (.0024 in)
Connecting rod big end axial play		New	0.152 mm to 0.352 mm (.006 in to .0139 in)

COOLING SYSTEM		
Coolant	Type	Ethyl glycol and distilled water (50%/50%). Use BRP LONG LIFE ANTIFREEZE (P/N 219 702 685) or coolant specifically formulated for aluminum engines
Thermostat opening temperature		37°C (99°F)

FUEL SYSTEM		
Fuel delivery		E-TEC direct injection with integrated auxiliary injection system
Throttle body		2x 52 mm
Idle speed (not adjustable)		1200 ± 200 RPM

ELECTRICAL SYSTEM		
Lighting system output		1340 W @ 6000 RPM
Ignition type		Inductive
Spark plug	Make and type	NGK ILKR8Q7 (engine and spark plug threads are indexed)
	Gap	Not adjustable 0.6 mm to 0.7 mm (.024 in to .028 in)
Ignition timing BTDC @ 3500 RPM		28°
		5.98 mm (.235 in)

VEHICLES

COOLING SYSTEM			
Coolant	Type		Ethyl glycol and distilled water (50%/50%). Use BRP LONG LIFE ANTIFREEZE or coolant specifically formulated for aluminum engines
	Quantity	MX Z	6.8 L (7.2 qt (U.S. liq.))
		Renegade	7.1 L (7.5 qt (U.S. liq.))
		Summit	7.5 L (7.9 qt (U.S. liq.))
Radiator cap opening pressure			110 kPa (16 PSI)

LUBRICATION SYSTEM		
Oil injection pump type		Electronic oil injection pump
Injection oil	Type	XPS synthetic 2-stroke oil
	Quantity	3.4 L (3.6 qt (U.S. liq.))

FUEL SYSTEM			
Fuel pump			In-tank electrical fuel pump
Fuel	Type		Premium unleaded gasoline (fuel which may contain up to 10% MAX ethanol
	Octane rating	Inside North America	91 Pump Posted AKI (R+M)/2)
		Outside North America	95 (RON)
Fuel tank capacity			36 L (9.5 U.S. gal.)

ELECTRICAL SYSTEM		
Battery		12 V, 18 A•h
Headlamp		2 x 60/55 W (H-13)
Taillight and stoplight		2.6 W / 139m W LED
Fuses	START/RER/CLOCK (F1)	5 A
	LOADS (F2)	25 A
	BATTERY (F3)	30 A
	ACCESSORIES (F4)	7.5 A

DRIVE SYSTEM		
Chaincase oil	Type	XPS synthetic chaincase oil
	Quantity	350 ml (12 U.S. oz)

DRIVE SYSTEM			
Chain drive ratio		MX Z	27/45
		Renegade	25/45
		Summit (154")	19/45
		Summit (165")	21/51
Chain	Pitch		9.530 mm (.375 in)
	Type		Silent
	Links qty/ plate qty	MX Z	110/13
		Renegade	108/13
		Summit (154")	112/13
		Summit (165")	116/13
Drive pulley type			pDrive
Drive pulley calibration	Clutch engagement	MX Z Renegade	3600 ± 100 RPM
		Summit (High Altitude Calibration)	3800 ± 100 RPM
		Summit (Sea Level Calibration)	3600 ± 100 RPM
	Spring color code	MX Z	Blue/Violet
		Renegade	Blue/Blue
		Summit (High Altitude Calibration)	Violet/Violet
		Summit (Sea Level Calibration)	Blue/Yellow
	Spring length	Blue/Blue	108 mm (4.252 in)
		Blue/Violet	100.3 mm (3.949 in)
		Blue/Yellow	123 mm (4.843 in)
		Violet/Violet	106.7 mm (4.201 in)
Drive pulley calibration	Screw length		14 mm (.551 in)
	Ramp	MX Z Renegade	868
		Summit	967 adjustable
Drive pulley calibration	Clicker position	Summit	3

DRIVE SYSTEM			
Driven pulley type	Type		QRS
	Spring color code	MX Z Renegade	Green/Green
		Summit (High Altitude Calibration)	Blue/Blue
		Summit (Sea Level Calibration)	Not applicable
	Spring length	Blue/Blue	124.3 mm (4.894 in)
		Green/Green	98.5 mm (3.878 in)
		Summit (Sea Level Calibration)	88.8 mm (3.496 in)
	Spring preload		0
	Cam angle	MX Z	47°/44°
		Renegade	44°/42°
		Summit	40° - XTIs
Pulley distance	Z		Not adjustable 20.9 mm (.823 in)
	X		Not adjustable 41.1 mm ± 1.8 mm (1.618 in ± .071 in)
Offset	Y - X	New	Not adjustable 3 mm (.118 in)
		After break-in	Not adjustable 2 mm ± .5 mm (.079 in ± .02 in)
Drive belt	Width		38.3 mm (1.508 in)
	Wear limit		35.9 mm (1.413 in)
Drive sprocket number of teeth		MX Z Renegade	8
		Summit	6
Drive sprocket diameter		MX Z Renegade	183 mm (7.2 in)
		Summit	166 mm (6.5 in)

DRIVE SYSTEM			
Track	Width	MX Z Renegade	381 mm (15 in)
		Summit	406.4 mm (16 in)
	Length	MX Z	326.9 cm (129 in)
		Renegade	348.7 cm (137 in)
		Summit	3 923 mm (154 in)
			4 178 mm (165 in)
	Profile height	MX Z Renegade	31.75 mm (1.25 in)
		Summit	63.5 mm (2.5 in) or 76.2 mm (3 in)
Track adjustment	Deflection		3.2 cm (1.26 in)
	Force		6.0 kgf to 8.5 kgf (13 lbf to 19 lbf)

BRAKE SYSTEM		
Brake lining minimum thickness		1 mm (.039 in)
Brake disk minimum thickness		4.5 mm (.177 in)
Brake fluid	Type	DOT 4
	Quantity	65 ml (2.2 U.S. oz)

SUSPENSION		
FRONT		
Suspension type		RAS 3
Suspension maximum travel	MX Z Renegade	233 mm (9.17 in)
	Summit	214 mm (8.4 in)
Shock absorber type	Summit SP	HPG
	All other	HPG Plus
Stabilizer bar type		Link
REAR		
Suspension type	MX Z Renegade	rMotion
	Summit	tMotion
Suspension maximum travel	MX Z TNT MX Z X	27.2 cm (10.7 in)
	Renegade	27 cm (10.6 in)
	Summit	239 mm (9.4 in)

SUSPENSION			
Shock absorber type	Center	MX Z TNT MX Z X Renegade X Summit X	HPG Plus
		Renegade Adrenaline Summit SP	HPG
	Rear	MX Z TNT Summit X	HPG Plus
		MX Z X Renegade X	KYB PRO 36 EA
		Renegade Adrenaline Summit SP	HPG
Stroke limiter standard position			3

STEERING SYSTEM		
Handlebar	MX Z Renegade	Aluminum with J-Hooks
	Summit	Aluminum with J-Hooks and Grab handle
Riser block height	MX Z TNT Renegade Adrenaline	120 mm (4.7 in)
	MX Z X Renegade X	Adjustable - 120 mm (4.7 in)
	Summit	190 mm (7.5 in)
Ski type	MX Z TNT Renegade Adrenaline	Pilot 5.7
	MX Z X Renegade X	Pilot 5.7 Pilot TS (optional)
	Summit	Pilot DS3
Toe-out		5 mm (.197 in)

WEIGHT AND DIMENSIONS		
Mass (dry)	MX Z TNT	214 kg (471 lb)
	MX Z X	215 kg (475 lb)
	Renegade	220 kg (486 lb)
	Summit SP (154")	200 kg (441 lb)
	Summit SP (165")	203 kg (448 lb)
	Summit X (154")	197 kg (434 lb)
	Summit X (165")	200 kg (441 lb)
Overall length	MX Z	301 cm (118.5 in)
	Renegade	311 cm (122.4 in)
	Summit (154")	3 422 mm (134.7 in)
	Summit (165")	3 555 mm (140 in)

WEIGHT AND DIMENSIONS		
Overall width	MX Z Renegade	121.7 cm (47.9 in)
	Summit	1 057 mm (41.6 in)
Overall height	MX Z Renegade	122.2 cm (48.1 in)
	Summit	1 379 mm (54.3 in)
Ski stance	MX Z Renegade	106 cm (41.7 in)
	Summit	89.5 cm (35.2 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

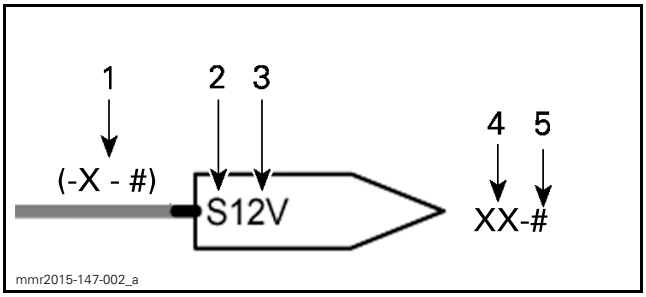
NOTE: To find the color of the wire on the vehicle skip to *WIRE COLORS AND SIZES* in this subsection.

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

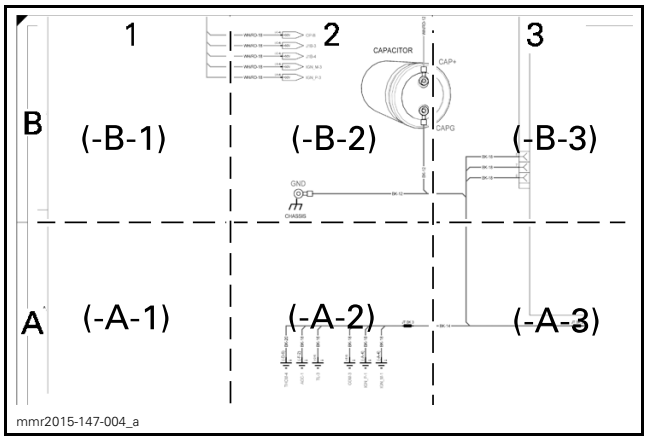
The wiring diagrams use the following codes.



1. *Wiring diagram index*
2. *Power condition*
3. *Voltage of a powered circuit*
4. *Connector code*
5. *Connector pin*

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.

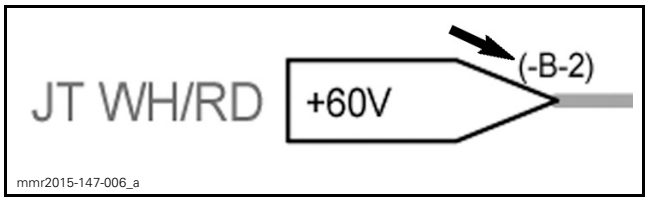
NOTE: Could be identified by either a number or by a letter depending on the type of connector used.

FOLLOWING A CIRCUIT

To follow a circuit, search the in section of the wiring diagram shown in the wiring diagram index.

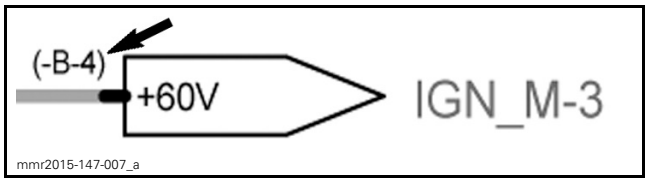
In this example, the 60V comes **from** JT WH/RD in section (-B-2).

NOTE: The arrow indicates the direction of the power in the circuit.



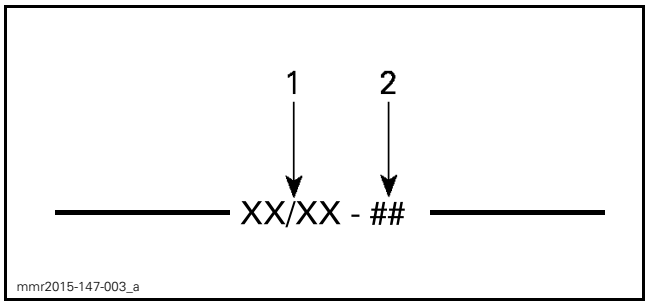
FROM JT WH/RD (-B-2)

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.

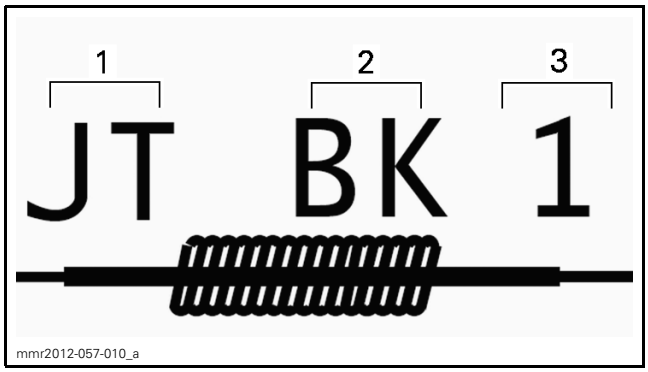
Example: YE/BK is a YELLOW wire with a BLACK stripe.

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.

2017 550 FAN COOLED

REGULATOR
REG
RD/WH-14
(B-6)
REGULATOR
JT RD/YE
BK-14
YE
YE
MAGNETO
GENERATOR
GEN
RD
BK
RD-18
BK-18
(H-2)
JT BK 3
(H-1)
JT BK 3
JT RD/WH

ACCESSORY
ACC
RD/WH-18
BK-18
(H-2)
JT BK 2

STARTER SWITCH
OFF
RUN
START
STARTER
RD/WH-18
RD-18
RD/BN-18
RD/GN-18

STARTER SOLENOID
SD
RD/GN-18
BK-18
(H-1)
JT BK 3

ENGINE
RD-6
CHASSIS

BATTERY FUSE
FA 30A
FA
RD-14
RD/WH-14

TRIGGER COIL 9 O'CLOCK
TRIGGER COIL 11 O'CLOCK

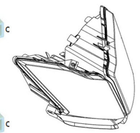
ECM-3W
BK/YE-18
RD/BN-18
BK-18
(H-2)
JT BK 2
ECM-2W
ECM-4W
BG/BK-20
BG-20
BUZZER
RER

TETHER SWITCH
TETHER
BK/YE-18
BK-18
(H-2)
JT BK 2

MULTIFUNCTION GAUGE
MG
MG
BG-20
BG/BK-20
FUEL LEVEL SENSOR
FLS
SIGNAL
GROUND
BU-20
BK/GN-20
SPEED SENSOR
VSS
12 VOLTS
GROUND
SIGNAL
RD/BK-20
BK/RD-20
GN/WH-20
OIL LEVEL SENSOR
OLS
LT BU-20
BK-20
(H-2)
JT BK 2
(H-2)
JT BK 1
BK/YE-20
GY-20
BG/RD-20
RD/YE-20

JT BK/YE
COMMUNICATION
COM
RD/YE-18
BK-18
WH/BK-20
WH/BG-20
(H-2)
JT BK 3

HEADLAMP 1
HL1
LOW BEAM
GROUND
HIGH BEAM
GY/VT-16
BK-16
GY-16
(H-2)
JT BK 1



HEADLAMP 2
HL2
LOW BEAM
GROUND
HIGH BEAM
GY/VT-16
BK-16
GY-16
(H-2)
JT BK 1

JT BK/WH
JT GY/VT
REG-4
(B-2)
REGULATOR
RD/YE-14

TAILLIGHT
TL
12 VOLTS
BRAKE LAMP
GROUND
RD/YE-16
WH-18
BK-16
(H-2)
JT BK 3

STEERING HARNESS
SH3
RD/YE-18
GY/VT-16
RD/YE-16
GY-16
BK-18
BK/YE-20
BG/RD-20
RD/YE-18
WH-18
BK-18
BK-18
RD/YE-20
GY/VT-16
RD/OG-16
GY-16
BG-20
BK/YE-20
RD/GY-20
RD/OG-16
WH-20
BK-20
BK-20
(H-2)
JT BK 1
(H-2)
JT BK 1
(H-2)
JT BK 1

LB
BG-20
RD/GY-20
GY/VT-16
RD/OG-16
BN-20
BN/YE-20
START/RER SWITCH
HEATING LEVER SWITCH
LA
RD/YE-20
OG/VT-20
OG/VT-20
OG-20
OG-20
GY-16
HEATING GRIP SWITCH
DIMMER SWITCH

GD
BN-20
BN/YE-20
BK-20
BK-20
OG/VT-20
OG-20
BK/YE-20
BK-20
BN
BN/YE
YE/BK
BK
OG/VT
OG
BK
BK
THROTTLE LEVER WARMER
RIGHT GRIP WARMER
EMERGENCY ENGINE CUT OFF SWITCH
HANDLEBAR GROUND
BK-20
GG
OG-20
OG/VT-20
BK-20
RD/OG-16
WH-20
OG
OG/VT
BK
BN
GY
LEFT GRIP WARMER
BRAKE SWITCH
JT BK

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	

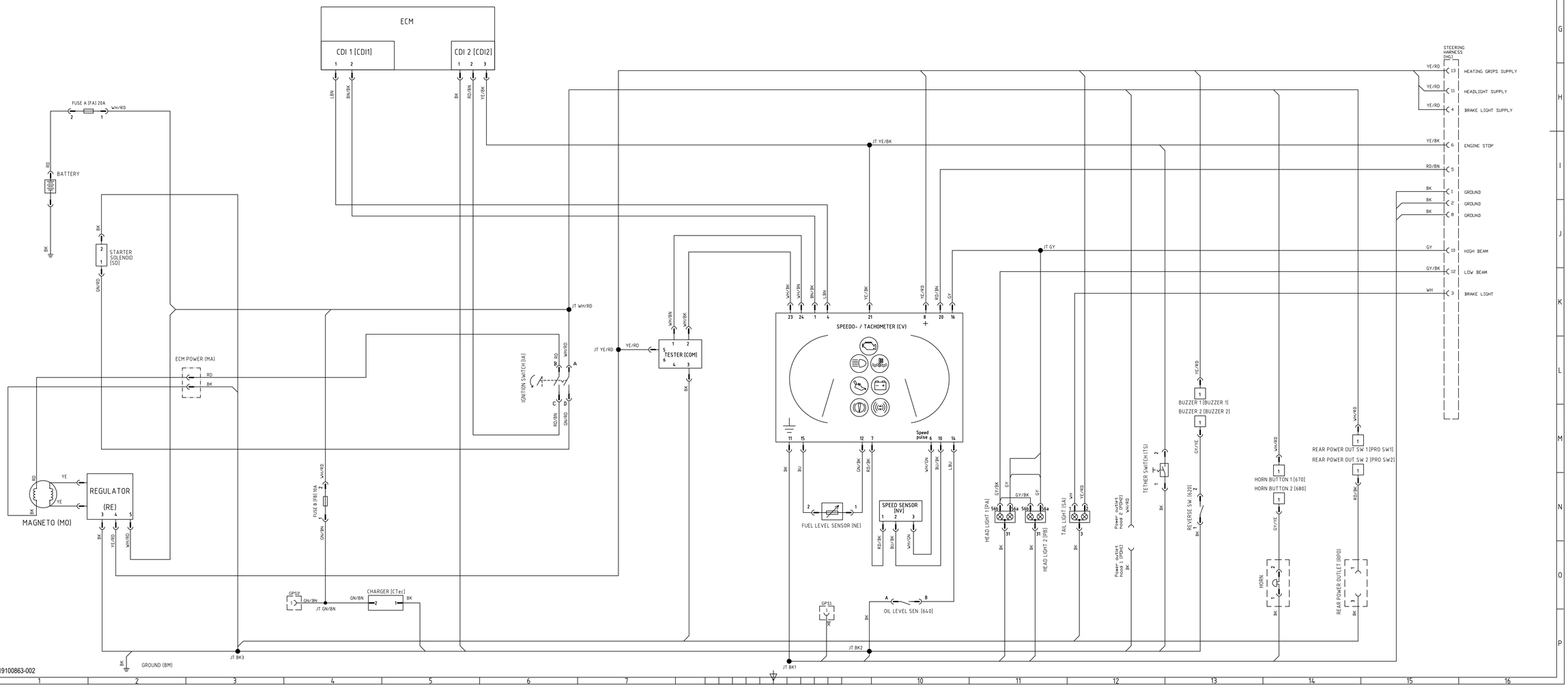
CHASSIS
BK-14
JT BK 3
(C-2)
REG-3
(A-2)
SO-B
BK-14
(E-9)
GEN-1
(C-6)
COM-3
(E-9)
TL-1
BK-14
JT BK 2
(C-6)
OLS-A
(E-9)
ACC-1
(C-6)
TETHER-2
(C-6)
ECM-SW-1
BK-14
JT BK 1
(C-6)
MG-11
(E-8)
HL2-B
(A-8)
HL1-B
(E-7)
SH3-1
(E-7)
SH3-2
(E-7)
SH0-B

REF: 515177979 REV:

2017 550F SKANDIC WT

COLOR	CODE
BLACK	BK
BLUE	BU,BL
GREEN	GN
ORANGE	OG, OR
PINK, ROSA	PK, RS
WHITE	WH
RED	RD
YELLOW	YE, YL
GRAY	GY, GR
BROWN	BN, BR
VIOLET	VT, VI
DARK BLUE	DBU, DBL
DARK GREEN	DGN
LIGHT BROWN	LBN, LBR, BE
LIGHT GREEN	LGN
LIGHT BLUE	LBU, LBL

515177505



219100863-002

2017 REV-XS 600 ACE iTC
2017 REV-XS 900 ACE iTC
2017 REV-XS 1200 iTC

WITH :

RCM : REVERSE CONTROL MODULE

CFM : COOLING FAN MODULE

ACS : AIR CONTROLED SUSPENSION

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	

STARTER SOLENOID SD

CONTROL BY ECM

12 VOLTS

SD+

ENGINE

BAT+

CHASSIS

MAIN FUSE FA

FA: 40A

FUSEBOX FB

IF01 : ACCESSORY RELAY

ACCESSORY F1: 20A

IF03 : LIGHTING RELAY

HEADLAMP BRAKE LIGHT F3: 20A

START BUTTON / ECU F4: 10A

IF01 : MAIN RELAY

IGNITION COILS / FUEL INJECTORS / FUEL PUMP / STARTER SOLENOID F5: 30A

ECM MULTIFUNCTION GAUGE F6: 10A

E-REVERSE F7: 20A

RY2 F4 F3 RY3 F2 F6 RY1 F1 F5

15 10 20

RECTIFIER/REGULATOR REG

GND

CHASSIS

DRIVER ACCESSORY ACC1

PASSENGER ACCESSORY ACC2

12 VOLTS

GROUND

HARNESS INTER CONNECTION HIC

12 VOLTS FOR CAPS

12 VOLTS FOR REVERSE RELAYS

12 VOLTS FOR INJECTORS

12 VOLTS FOR IGNITION COILS

ECMB

RF IDENTIFICATION KEY RFID

12 VOLTS

DATA

CONTACT

GROUND

COMMUNICATION CONNECTOR COM

12 VOLTS

12 VOLTS

ECM POWER IN

GROUND

CAN LO

CAN HI

TAIL LIGHT TL

12 VOLTS

BRAKE

GROUND

HEADLAMP HL

LAMP A

LAMP B

GROUND

LOW BEAM

HIGH BEAM

AUXILIARY LIGHT

FUEL PUMP FP

FUEL LEVEL GROUND

12 VOLTS

FUEL LEVEL SIGNAL

CONTROL

COOLING FAN MODULE CFM

FAN

SWITCHED 12 VOLTS

GROUND

THROTTLE ACCELERATOR SENSOR TAS

5 VOLTS

GROUND

SIGNAL 2

5 VOLTS

GROUND

SIGNAL 1

ECO MODE SWITCH ECO

UP

GROUND

DOWN

REVERSE RELAY

FORWARD RELAY

REVERSE CONTROL MODULE RCM

REVERSE MOTOR RV

REVERSE POSITION SWITCH RPS

MULTIFUNCTION GAUGE MG

CAN HI

CAN LO

HIGH BEAM

HEATED LEVER OUTPUT

HEATED GRIPS OUTPUT

S12V

CLOCK (U12V)

FUEL LEVEL SIGNAL

12 VOLTS

GROUND

SPEED SIGNAL INPUT

ACS

SET

GRIP UP

GRIP DOWN

LEVER UP

LEVER DOWN

MODE

VEHICULE SPEED SENSOR VSS

12 VOLTS

GROUND

SIGNAL

AIR CONTROLLED SUSPENSION MODULE ACS

12 VOLTS

DATA

GROUND

STEERING HARNESS CONNECTOR 1 SH1

STEERING HARNESS CONNECTOR 2 SH2

BRAKE SWITCH

LEFT GRIP WARMER

HANDLEBAR GROUND

RIGHT GRIP WARMER

THROTTLE LEVER WARMER

EMERGENCY ENGINE CUT OFF SWITCH

DIMMER SWITCH

START / MER SWITCH

BACK LIGHT

SET

MODE

GRIP UP

GRIP DOWN

LEVER UP

LEVER DOWN

219100863-003

REF: 515177990 REV:

2017 TUNDRA 600 ACE

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

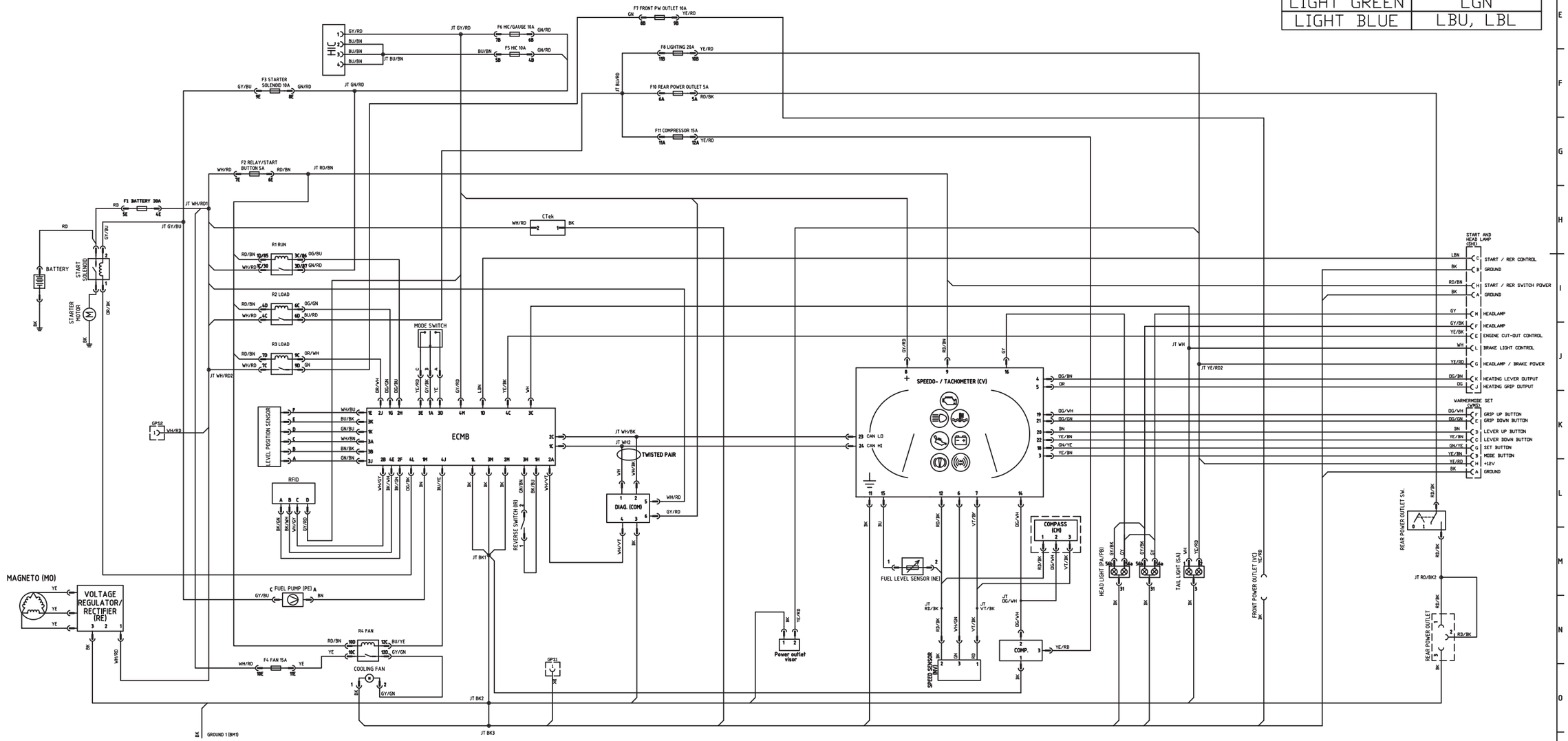
STARTER SOLENOID
SD
CONTROL BY ECM
12 VOLTS
SD+
ENGINE
CHASSIS
BAT+
MAIN FUSE
FA
FA: 40A
FUSEBOX
FB
RY2
RY3
RY1
F1
F2
F3
F4
F5
F6
15
10
20
DRIVER ACCESSORY
ACC1
12 VOLTS
GROUND
HARNESS INTER CONNECTION
HIC
12 VOLTS FOR CAPS
12 VOLTS FOR INJECTORS
12 VOLTS FOR IGNITION COILS
RECTIFIER/REGULATOR
REG
GND
CHASSIS
ECMB
RF IDENTIFICATION KEY
RFID
12 VOLTS
DATA
CONTACT
GROUND
COMMUNICATION CONNECTOR
COM
12 VOLTS
12 VOLTS
ECM POWER IN
GROUND
CAN LO
CAN HI
TAIL LIGHT
TL
12 VOLTS
BRAKE
GROUND
HL1
HL2
LOW BEAM
GROUND
HIGH BEAM
FUEL PUMP
FP
FUEL LEVEL GROUND
12 VOLTS
FUEL LEVEL SIGNAL
CONTROL
COOLING FAN MODULE
CFM
FAN
SWITCHED 12 VOLTS
GROUND
THROTTLE ACCELERATOR SENSOR
TAS
5 VOLTS
GROUND
SIGNAL 2
5 VOLTS
GROUND
SIGNAL 1
ECO MODE SWITCH
ECO
UP
GROUND
DOWN
REVERSE POSITION SWITCH
RPS2-
RPS1-
MULTIFUNCTION GAUGE
MG
CAN HI
CAN LO
HIGH BEAM
HEATED LEVER OUTPUT
HEATED GRIPS OUTPUT
S12V
CLOCK (U12V)
FUEL LEVEL SIGNAL
12 VOLTS
GROUND
SPEED SIGNAL INPUT
SET
GRIP UP
GRIP DOWN
LEVER UP
LEVER DOWN
MODE
VEHICULE SPEED SENSOR
VSS
12 VOLTS
GROUND
SIGNAL
STEERING HARNESS CONNECTOR 1
SH1
STEERING HARNESS CONNECTOR 2
SH2
BRAKE SWITCH
LEFT GRIP WARMER
HANDLEBAR GROUND
RIGHT GRIP WARMER
THROTTLE LEVER WARMER
EMERGENCY ENGINE CUT OFF SWITCH
DIMMER SWITCH
START / RER SWITCH
BACK LIGHT
GRIP UP
GRIP DOWN
LEVER UP
LEVER DOWN
MODE
SET
4 MICROSWITCH

219100863-004

REF: 515177991 REV:

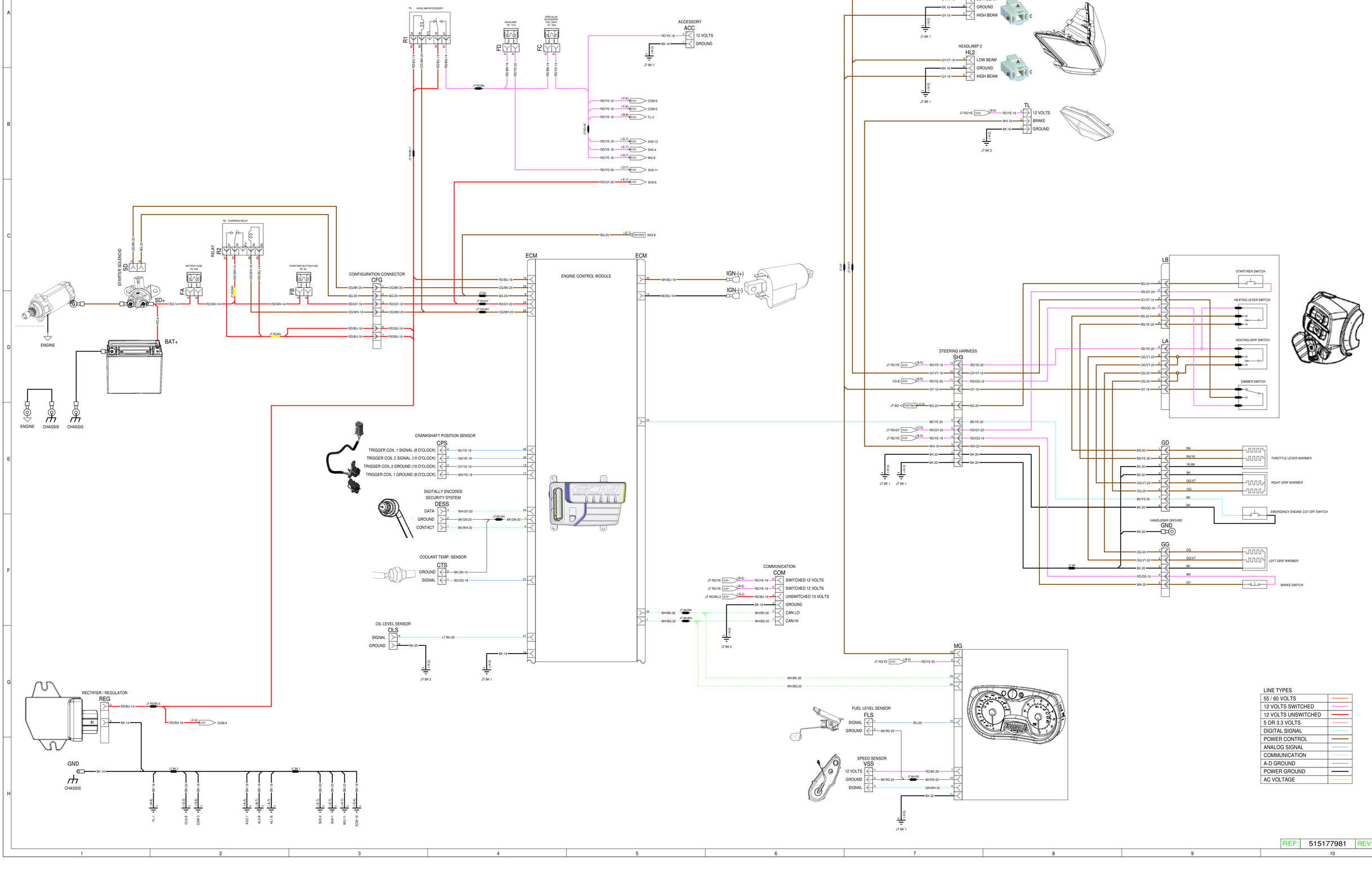
2017 Expedition LE 900 ACE
2017 Expedition SE 900 ACE
2017 Skandic SWT 600 ACE
2017 Skandic SWT 900 ACE
2017 Skandic WT 900 ACE

COLOR	CODE
BLACK	BK
BLUE	BU, BL
GREEN	GN
ORANGE	OG, OR
PINK, ROSA	PK, RS
WHITE	WH
RED	RD
YELLOW	YE, YL
GRAY	GY, GR
BROWN	BN, BR
VIOLET	VT, VI
DARK BLUE	DBU, DBL
DARK GREEN	DGN
LIGHT BROWN	LBN, LBR, BE
LIGHT GREEN	LGN
LIGHT BLUE	LBU, LBL



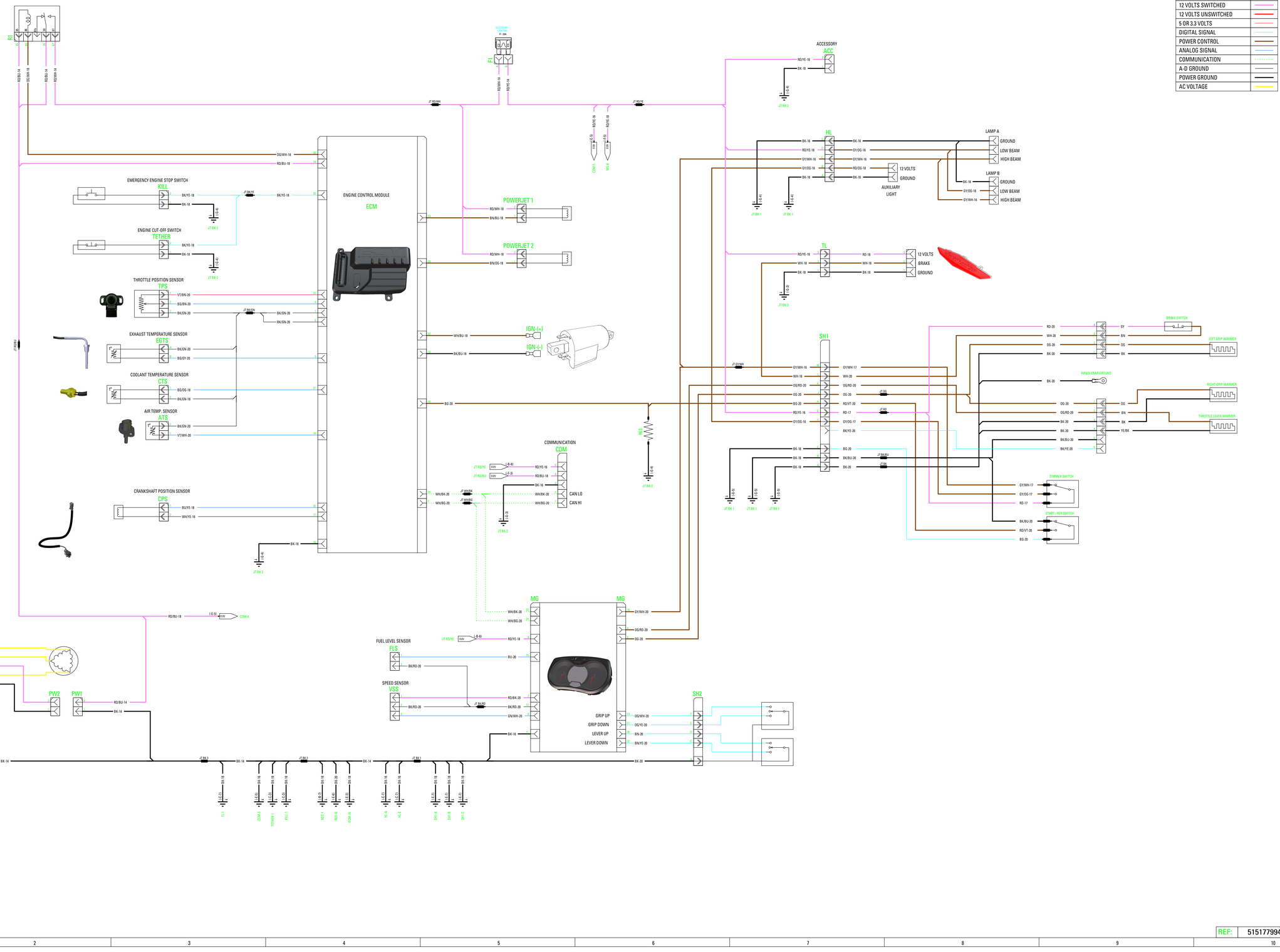
219001869-005

2017 600 CARB.



REF: 515177981 REV:

2017 600RS



219100863-007

REF: 515177994 REV:

2017 REV-XS, REV-XM 600 HO E-TEC

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	

ACCESSORY
ACC 1
12 volts
Ground
RD/OG-18
BK-18
JT BK 3

RF IDENTIFICATION KEY
RFID
12 VOLTS
DATA
CONTACT
GROUND
RD/OG-20
WH/GY-20
BK/WH-20
BK/GN-20

CRANK POSITION SENSOR
CPS
GROUND
SIGNAL
WH/YE-18
BU/YE-18

COMMUNICATION CONNECTOR
COM
12 VOLTS
12 VOLTS
ECM POWER IN
GROUND
CAN LO
CAN HI
JT RD/OG 2
RD/OG-16
RD/BU-18
BK-16
WH/BK-20
WH/BG-20
JT BK 3

KNOCK SENSOR
KS
SIGNAL
GROUND
YE/BU-20
BQ/BU-20

THROTTLE POSITION SENSOR
TPS
SIGNAL
GROUND
5 VOLTS
WH/BN-20
BK/OG-20
VT/BN-20

3D-RAVE POSITION SENSOR
ERF
5 VOLTS
SIGNAL
GROUND
VT/BN-20
BK/OG-20
WH/BU-20

AIR TEMPERATURE SENSOR
ATS
SIGNAL
GROUND
VT/WH-20
BK/OG-20

COOLANT TEMPERATURE SENSOR
CTS
GROUND
SIGNAL
BK/OG-18
BQ/OG-18

EXHAUST TEMPERATURE SENSOR
EGTS
SIGNAL
GROUND
BQ/GY-20
BK/OG-20

OIL LEVEL SENSOR
OLS
CONTACT
GROUND
LT BU-20
BK/OG-20

MULTIFUNCTION GAUGE
MG
WH/BG-20
WH/BK-20
RD/OG-18
RD/VT-20
GY/WH-20
BK/OG-18
BQ/GY-20
BQ/BK-18
BU-20
BK/RD-20
BK-18

VEHICLE SPEED SENSOR
VSS
12 VOLTS
GROUND
SIGNAL
RD/BK-20
BK/RD-20
GN/WH-20

AIR CONTROLLED SUSPENSION
ACS
12 VOLTS
DATA
GROUND
RD/YE-16
WH/OG-20
BK-16

HEADLAMP
HL
12 VOLTS
GROUND
AUXILIARY LIGHT
LAMP A
GROUND
LOW BEAM
HIGH BEAM
LAMP B
GROUND
LOW BEAM
HIGH BEAM
BK-16
GY/OG-16
GY/WH-16
RD/OG-18

TAIL LIGHT
TL
12 VOLTS
BRAKE
GROUND
RD/OG-16
WH-18
BK-16
RD-18

STEERING HARNESS CONNECTOR 1
SH1
GY/WH-16
WH-18
OG/RD-20
OG-20
RD/VT-20
RD/OG-16
GY/OG-16
BK/YE-20
RD-16
BK/YE-20
BG-20
BK/BU-20
BK/YE-20
BK-18
BK-18

BRAKE SWITCH
LEFT GRIP WARMER
HANDLEBAR GROUND
RIGHT GRIP WARMER
THROTTLE LEVER WARMER
EMERGENCY ENGINE CUT OFF SWITCH
DIMMER SWITCH
START / RER SWITCH
BACK LIGHT
SET
MODE

STEERING HARNESS CONNECTOR 2
SH2
RD/OG-20
YE/GN-20
OG/WH-20
OG/VT-20
BN-20
BN/YE-20
YE/BN-20
BK-20
GRIP UP
GRIP DOWN
LEVER UP
LEVER DOWN
BACK LIGHT
SET
MODE

STARTER RELAY
SD
CONTROL BY ECM
12 VOLTS FROM START BUTTON
BATTERY CHARGING
FA
STARTER CLOCK
FB
FC
ENGINE
CHASSIS

MAGNETO
MO
1200W
YE-16
OG-16
BN-16
BN/WH-16
OG/WH-16
YE/WH-16

FUEL PUMP
FP
PUMP CONTROL
FUEL LEVEL SIGNAL
55 VOLTS
FUEL LEVEL GROUND
BN/PK-18
BU-20
WH/RD-18
BK/RD-20

3D RAVE VALVE
ER
12 VOLTS
CONTROL
JT RD/OG 2
BN/GN-20

INJECTOR (MAG)
INJ_M
INJECTOR CONTROL
55 VOLTS
BU-18
WH/RD-18

INJECTOR (PTO)
INJ_P
INJECTOR CONTROL
55 VOLTS
GN-18
WH/RD-18

IGNITION COIL (MAG)
IGN_M
55 VOLTS
IGNITION CONTROL
GROUND
OG/BU-18
BK-18

IGNITION COIL (PTO)
IGN_P
55 VOLTS
IGNITION CONTROL
GROUND
WH/RD-18
OR/GN-18
BK-18

CAPACITOR
CAP+
GND
CHASSIS

J1A
J1B
J2
J1
J2

ACC1-1 ACC2-1 TL-1 COM3 IGN_P-1 IGN_M-1 ACS-1 MG-11 SHO-A HL-A HL-E SHH-A SHH-B

2017 TUNDRA 600 HO E-TEC

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	

ACCESSORY
ACC1
12 volts
Ground
BK-18
JT BK 3

RF IDENTIFICATION KEY
RFID
12 VOLTS
DATA
CONTACT
GROUND
ID

CRANK POSITION SENSOR
CPS
GROUND
SIGNAL

COMMUNICATION CONNECTOR
COM
12 VOLTS
12 VOLTS
ECM POWER IN
GROUND
CAN LO
CAN HI

KNOCK SENSOR
KS
SIGNAL
GROUND

THROTTLE POSITION SENSOR
TPS
SIGNAL
GROUND
5 VOLTS

3D-RAVE POSITION SENSOR
ERF
5 VOLTS
SIGNAL
GROUND

AIR TEMPERATURE SENSOR
ATS
SIGNAL
GROUND

COOLANT TEMPERATURE SENSOR
CTS
GROUND
SIGNAL

EXHAUST TEMPERATURE SENSOR
EGTS
SIGNAL
GROUND

OIL LEVEL SENSOR
OLS
CONTACT
GROUND

OIL PUMP
OP
55 VOLTS
CONTROL

MULTIFUNCTION GAUGE
MG

3D RAVE VALVE
ER
12 VOLTS
CONTROL

INJECTOR (MAG)
INJ_M
INJECTOR CONTROL
55 VOLTS

INJECTOR (PTO)
INJ_P
INJECTOR CONTROL
55 VOLTS

IGNITION COIL (MAG)
IGN_M
55 VOLTS
IGNITION CONTROL
GROUND

IGNITION COIL (PTO)
IGN_P
55 VOLTS
IGNITION CONTROL
GROUND

VEHICLE SPEED SENSOR
VSS
12 VOLTS
GROUND
SIGNAL

HEADLAMP 1
HL1
HEADLAMP LOW
GROUND
HEADLAMP HIGH

HEADLAMP 2
HL2
HEADLAMP LOW
GROUND
HEADLAMP HIGH

TAIL LIGHT
TL
12 VOLTS
BRAKE
GROUND

STEERING HARNESS CONNECTOR 1
SH1

STEERING HARNESS CONNECTOR 2
SH2

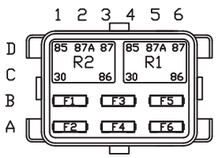
BRAKE SWITCH
LEFT GRIP WARMER
HANDLEBAR GROUND
RIGHT GRIP WARMER
THROTTLE LEVER WARMER
EMERGENCY ENGINE CUT OFF SWITCH
DIMMER SWITCH
START / RER SWITCH
BACK LIGHT
GRIP UP
GRIP DOWN
LEVER UP
LEVER DOWN
SET
MODE

STARTER RELAY
SD
CONTROL BY ECM
12 VOLTS FROM START BUTTON
BATTERY CHARGING
FA
(STARTER CLOCK)
FB
ENGINE
CHASSIS
MAGNETO
MO
1200W
FUEL PUMP
FP
PUMP CONTROL
FUEL LEVEL SIGNAL
55 VOLTS
FUEL LEVEL GROUND
CAPACITOR
CAP+
GND
CHASSIS

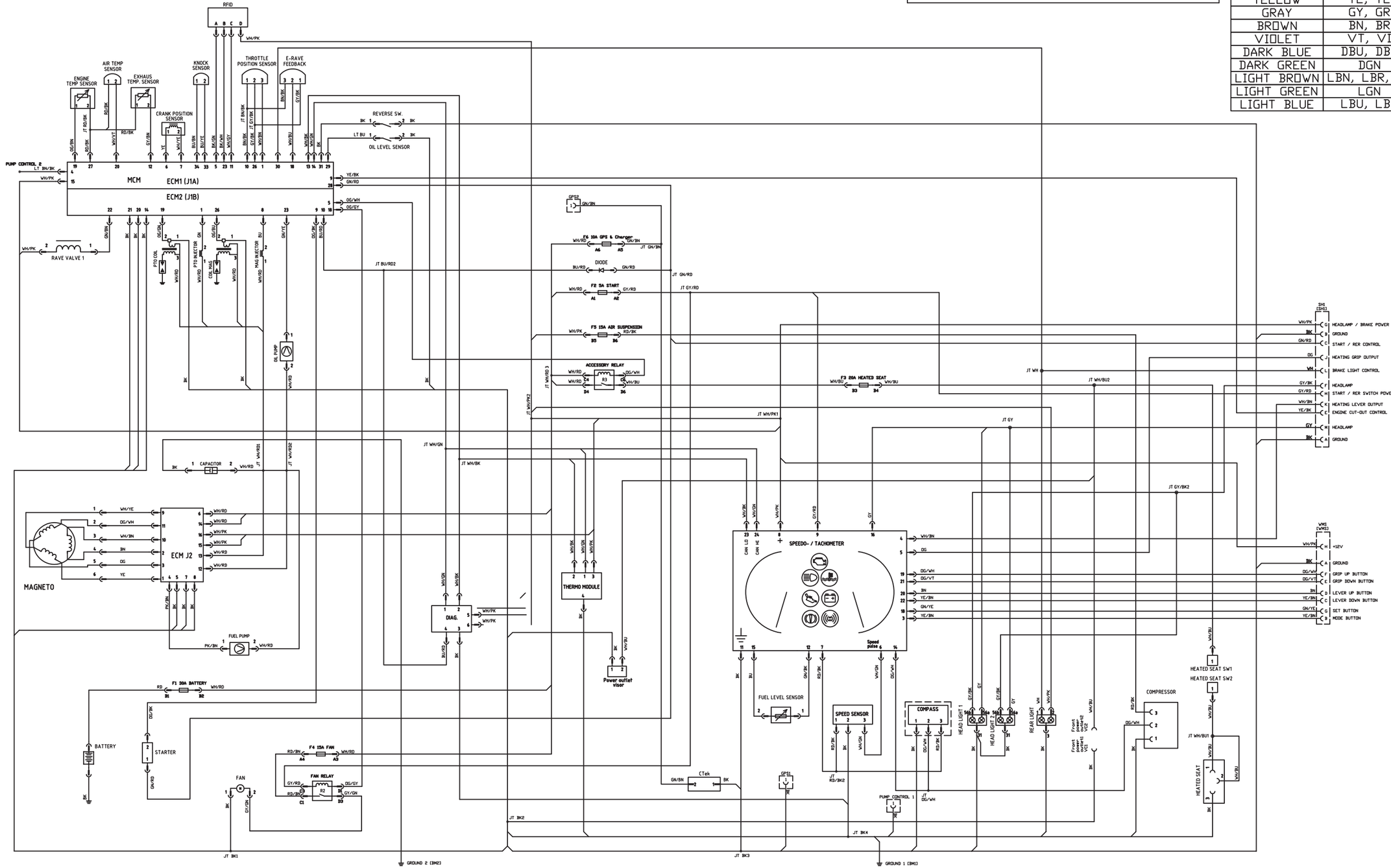
J1A
J1B
J2

2017 Expedition LE 600 HO E-TEC
2017 Expedition SE 600 HO E-TEC
2017 Skandic SWT 600 HO E-TEC
2017 Skandic WT 600 HO E-TEC

R1 ACCESSORY RELAY
R2 FAN RELAY
F1 BATTERY 30A
F2 START 5A
F3 HEATED SEAT 20A
F4 FAN 15A
F5 AIR SUSPENSION 15A
F6 GPS & Charger 10A



COLOR	CODE
BLACK	BK
BLUE	BU, BL
GREEN	GN
ORANGE	OG, OR
PINK, ROSA	PK, RS
WHITE	WH
RED	RD
YELLOW	YE, YL
GRAY	GY, GR
BROWN	BN, BR
VIOLET	VT, VI
DARK BLUE	DBU, DBL
DARK GREEN	DGN
LIGHT BROWN	LBN, LBR, BE
LIGHT GREEN	LGN
LIGHT BLUE	LBU, LBL



219100863-010

2017 800R E-TEC

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	

ACCESSORY
ACC 1
12 volts
Ground

RF IDENTIFICATION KEY
RFID
12 VOLTS
DATA
CONTACT
GROUND

CRANK POSITION SENSOR
CPS
GROUND
SIGNAL

COMMUNICATION CONNECTOR
COM
12 VOLTS
12 VOLTS
ECM POWER IN
GROUND
CAN LO
CAN HI

KNOCK SENSOR
KS
SIGNAL
GROUND

THERMOCOUPLE MODULE
THCM
CAN HI
CAN LO
12 VOLTS
GROUND

THROTTLE POSITION SENSOR
TPS
SIGNAL
GROUND
5 VOLTS

3D-RAVE POSITION SENSOR
ERF
5 VOLTS
SIGNAL
GROUND

AIR TEMPERATURE SENSOR
ATS
SIGNAL
GROUND

COOLANT TEMPERATURE SENSOR
CTS
GROUND
SIGNAL

OIL LEVEL SENSOR
OLS
CONTACT
GROUND

OIL PUMP
OP
60 VOLTS
CONTROL

MULTIFUNCTION GAUGE
MG

VEHICLE SPEED SENSOR
VSS
12 VOLTS
GROUND
SIGNAL

AIR CONTROLLED SUSPENSION
ACS
12 VOLTS
DATA
GROUND

3D RAVE VALVE
ER
12 VOLTS
CONTROL

INJECTOR (MAG)
INJ_M
INJECTOR CONTROL
INJECTOR CONTROL

INJECTOR (PTO)
INJ_P
INJECTOR CONTROL
INJECTOR CONTROL

IGNITION COIL (MAG)
IGN_M
60 VOLTS
IGNITION CONTROL
GROUND

IGNITION COIL (PTO)
IGN_P
60 VOLTS
IGNITION CONTROL
GROUND

STARTER RELAY
SD
CONTROL BY ECM
12 VOLTS FROM START BUTTON

BATTERY CHARGING
FA 20A
FA

STARTER CLOCK
FB 5A
FB

FC 15 A
FC

ENGINE

CHASSIS

MAGNETO
MO
1200W

FUEL PUMP
FP
PUMP CONTROL
FUEL LEVEL SIGNAL
60 VOLTS
FUEL LEVEL GROUND

CAPACITOR
CAP+

J1A
J1B
J2

HEADLAMP
HL
GROUND
LOW BEAM
HIGH BEAM
12 VOLTS
GROUND
AUXILIARY LIGHT

LAMP A
GROUND
LOW BEAM
HIGH BEAM

LAMP B
GROUND
LOW BEAM
HIGH BEAM

TAIL LIGHT
TL
12 VOLTS
BRAKE
GROUND

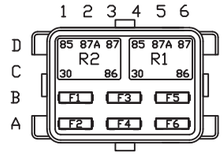
STEERING HARNESS CONNECTOR 1
SH1

STEERING HARNESS CONNECTOR 2
SH2

BRAKE SWITCH
LEFT GRIP WARMER
HANDLEBAR GROUND
RIGHT GRIP WARMER
THROTTLE LEVER WARMER
EMERGENCY ENGINE CUT OFF SWITCH
DIMMER SWITCH
START / RER SWITCH
BACK LIGHT
GRIP UP
GRIP DOWN
LEVER UP
LEVER DOWN
SET
MODE

REF: 515177986 REV: 1

2017 Expedition Extreme 800R E-TEC



R1 ACCESSORY RELAY
R2 FAN RELAY
F1 BATTERY 30A
F2 START 5A
F3 HEATED SEAT 20A
F4 FAN 15A
F5 AIR SUSPENSION 15A
F6 GPS & Charger 10A

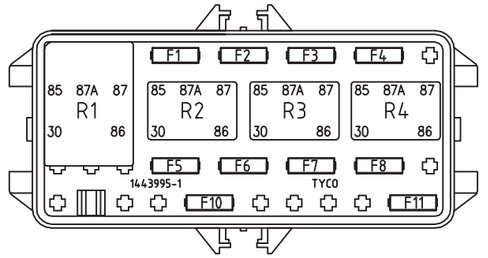
COLOR	CODE
BLACK	BK
BLUE	BU,BL
GREEN	GN
ORANGE	OG, OR
PINK, ROSA	PK, RS
WHITE	WH
RED	RD
YELLOW	YE, YL
GRAY	GY, GR
BROWN	BN, BR
VIOLET	VT, VI
DARK BLUE	DBU, DBL
DARK GREEN	DGN
LIGHT BROWN	LBN, LBR, BE
LIGHT GREEN	LGN
LIGHT BLUE	LBU, LBL

RFID
ENGINE TEMP SENSOR
AIR TEMP SENSOR
KNOCK SENSOR
CRANK POSITION SENSOR
THROTTLE POSITION SENSOR
E-RAVE FEEDBACK
REVERSE SW.
OIL LEVEL SENSOR
MCM
ECM1 (J1A)
ECM2 (J1B)
RAVE VALVE 1
PTO COIL
PTO INJECTOR
COIL MAG
MAG INJECTOR
OIL PUMP
ECM J2
MAGNETO
CAPACITOR
FUEL PUMP
DIAG.
THERMO MODULE
Power outlet visor
SPEEDO- / TACHOMETER
SPEED SENSOR
COMPASS
FUEL LEVEL SENSOR
CTek
F1 30A BATTERY
BATTERY
START SOLENOID
F4 15A FAN
FAN RELAY
COOLING FAN
ACCESSORY RELAY
F6 10A GPS & Charger
F2 5A START
F5 15A AIR SUSPENSION
F3 20A HEATED SEAT
GPS1
PUMP CONTROL 1
START AND HEAD LAMP (SHL)
HEAD LIGHT 1
HEAD LIGHT 2
REAR LIGHT
Front passenger vent 1
Front passenger vent 2
COMPRESSOR
HEATED SEAT SW1
HEATED SEAT SW2
HEATED SEAT
WARMER MODE SET (WMS)

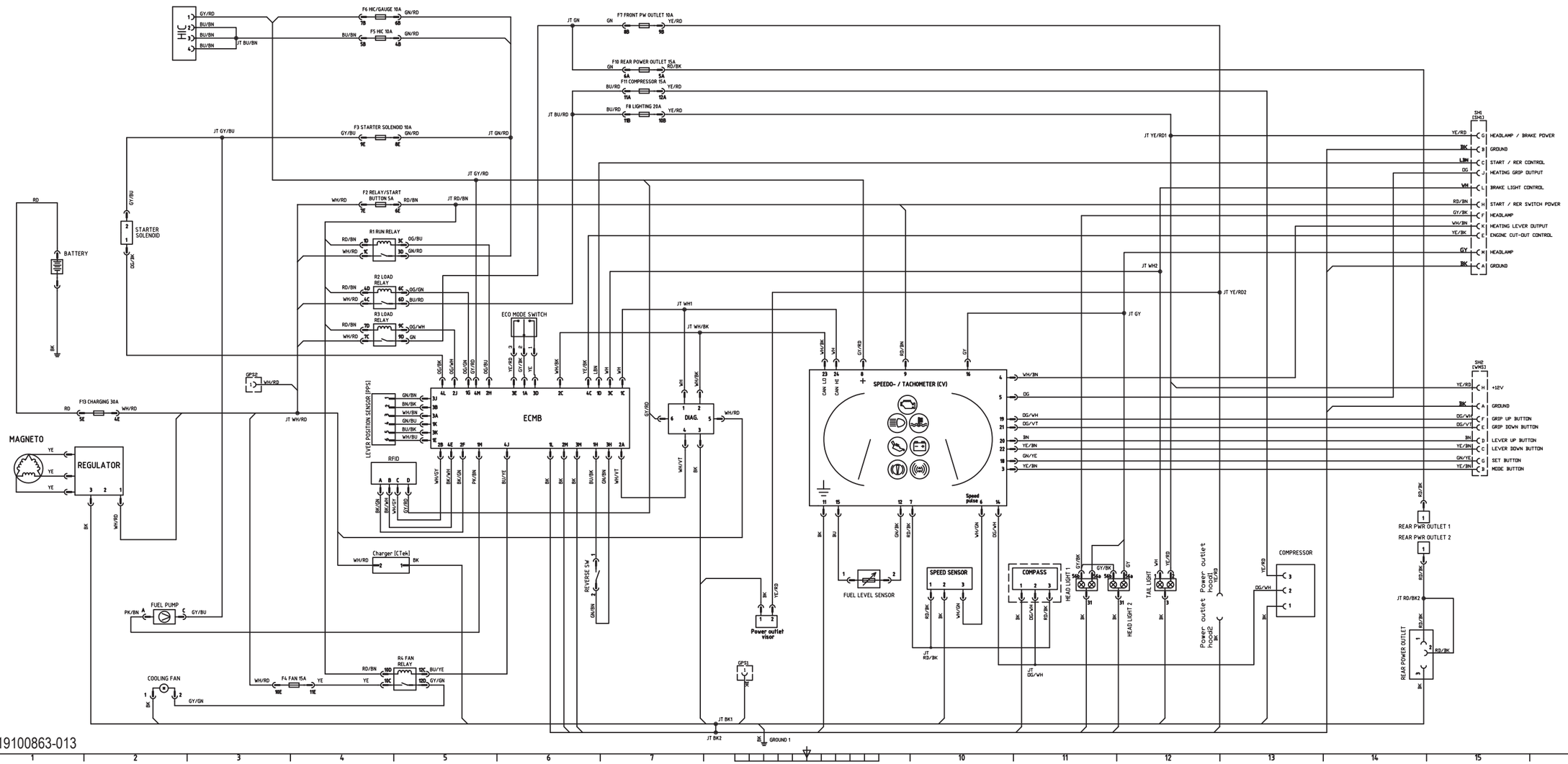
219100863-012

2017 Expedition LE 1200 4-TEC
2017 Expedition SE 1200 4-TEC

R1 RUN RELAY
R2 LOAD RELAY
R3 LOAD RELAY
R4 FAN RELAY
F1 BATTERY 30A
F2 RELAY/START BUTTON 5A
F3 STARTER SOLENOID 10A
F4 FAN 15A
F5 HIC 10A
F6 HIC/GAUGE 10A
F7 FRONT PW OUTLET AND HEATERS 10A
F8 LIGHTING 20A
F10 REAR POWER OUTLET 15A
F11 COMPRESSOR 15A



COLOR	CODE
BLACK	BK
BLUE	BU, BL
GREEN	GN
ORANGE	OG, OR
PINK, ROSA	PK, RS
WHITE	WH
RED	RD
YELLOW	YE, YL
GRAY	GY, GR
BROWN	BN, BR
VIOLET	VT, VI
DARK BLUE	DBU, DBL
DARK GREEN	DGN
LIGHT BROWN	LBN, LBR, BE
LIGHT GREEN	LGN
LIGHT BLUE	LBU, LBL



219100863-013

2017 SUMMIT 850 E-TEC

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

ENGINE CONTROL MODULE
ECMB

BATTERY CHARGING
VEHICULE LOADS
RER CONTROL
DATA
CONTACT
GROUND
ECM POWER INPUT
ENGINE CUT OFF SIGNAL INPUT
FUEL PUMP PWM CONTROL
55 V FOR FUEL PUMP
BRAKE SIGNAL INPUT
CAN LO
CAN HI
EGTS SIGNAL
GROUND
5 VOLTS
GROUND
SPEED SIGNAL INPUT
INTAKE MANIFOLD PRESSURE SIGNAL
5 VOLTS
INTAKE MANIFOLD TEMP. SIGNAL
GROUND

FUSEBOX
FB
RER F1: 5A
BATTERY F3: 30A
ACCESSORY F4: 7.5A
LOADS F2: 20A

BAT+
CHASSIS
STARTER SOLENOID
SD+
CHASSIS
ENGINE
SD
CONTROL
12 VOLTS

RF IDENTIFICATION KEY
RFID
12 VOLTS
DATA
CONTACT
GROUND

FUEL PUMP
FP
PWM CONTROL
FUEL LEVEL SIGNAL
55 VOLTS
FUEL LEVEL GROUND

COMMUNICATION CONNECTOR
COM
+12V
+12V
ECM POWER IN
GROUND
CAN LO
CAN HI

THCM
CAN HI
CAN LO
S12V
GND

REVERSE BUTTON
RER
12 VOLTS

ACC 1
12 VOLTS
GROUND

TL
12 VOLTS
BRAKE
GROUND

STR 4P
BRAKE SWITCH
LEFT GRIP WARMER

EMERGENCY ENGINE CUT OFF SWITCH
STR 6P
THROTTLE LEVER WARMER
RIGHT GRIP WARMER

GAUGE SUMMIT
MG
12 VOLTS
FUEL LEVEL SIGNAL
CAN LO
CAN HI
GROUND
HEATED LEVER OUTPUT
HEATED GRIPS OUTPUT
HEATER UP
HEATER DOWN
HIGH BEAM

GRIP
GRIP AND LEVER HEATER CONTROL SWITCH
UP
DOWN

DIMMER
HEADLAMP DIMMER SWITCH
HI
LO

HEADLAMP 1
HL1
HIGH BEAM
GROUND
LOW BEAM

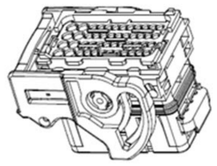
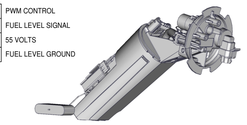
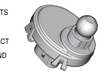
HEADLAMP 2
HL2
HIGH BEAM
GROUND
LOW BEAM

MUFFLER TEMP. SENSOR
EGTS
SIGNAL
GROUND

VEHICLE SPEED SENSOR
VSS
5 VOLTS
GROUND
SPEED SIGNAL

MANIFOLD AIR PRESSURE TEMP SENSOR
MAPTS
PRESSURE SIGNAL
5 VOLTS
TEMPERATURE SIGNAL
GROUND

GND
CHASSIS





REF: 515178206 REV: 1

2017 MXZ, RENEGADE 850 E-TEC

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

FUSEBOX FB
ENGINE START CLOCK F1-5A
BATTERY F3-30A
ACCESSORY F4-7.5A
LOADS F2-20A
RD-12
RD-6
BAT+
CHASSIS
SD+
STARTER SOLENOID
SD
CONTROL
12 VOLTS
CHASSIS
ENGINE
ECMB
BATTERY CHARGING
STARTER SOLENOID
VEHICULE LOADS
DIAGNOSTIC POWER
JT RD/WH
JT RD/GN
JT RD/OG 2
JT RD/YE
JT RD/OG 1
JT RD/VT
RD/OG-12
ACC 1
12 VOLTS
GROUND
JT BK 1
COMMUNICATION CONNECTOR
COM
12 VOLTS
12 VOLTS
ECM POWER IN
GROUND
CAN LO
CAN HI
JT BK 2
ACC2
12 VOLTS
GROUND
TL
TAIL LIGHT
12 VOLTS
BRAKE
GROUND
RF IDENTIFICATION KEY
RFID
DATA
CONTACT
GROUND
THCM
CAN HI
CAN LO
12 VOLTS
GROUND
STR 4P
BRAKE SWITCH
LEFT GRIP WARMER
BRAKE SIGNAL INPUT
FUEL PUMP PWM CONTROL
55 V FOR FUEL PUMP
FUEL PUMP
FP
PWM CONTROL
FUEL LEVEL SIGNAL
55 VOLTS
FUEL LEVEL GROUND
ENGINE CUT OFF CONTROL INPUT
ENGINE CUT OFF CONTROL GROUND
GAUGE
MG
HEATED LEVER OUTPUT
HEATED GRIPS OUTPUT
EMERGENCY ENGINE CUT OFF SWITCH
STR 6P
THROTTLE LEVER WARMER
RIGHT GRIP WARMER
CAN LO
CAN HI
START/RER CONTROL
FUEL LEVEL GROUND
FUEL LEVEL SIGNAL
CAN LO
CAN HI
S12V
CLOCK (U12V)
GROUND
LEVER DOWN
GRIP DOWN
SET
LEVER UP
GRIP UP
MODE
HIGH BEAM
START / RER SWITCH
SH
LEVER DOWN
GRIP DOWN
SET
LEVER UP
GRIP UP
MODE
DIMMER SWITCH
VEHICLE SPEED SENSOR
VSS
5 VOLTS
GROUND
SPEED SIGNAL
MANIFOLD AIR PRESSURE TEMP SENSOR
MAPTS
INTAKE MANIFOLD PRESSURE SIGNAL
5 VOLTS
INTAKE MANIFOLD TEMP. SIGNAL
GROUND
PRESSURE SIGNAL
5 VOLTS
TEMPERATURE SIGNAL
GROUND
HEADLAMP 1
HL1
HIGH BEAM
GROUND
LOW BEAM
HEADLAMP 2
HL2
HIGH BEAM
GROUND
LOW BEAM
GND
CHASSIS
JT BK 2
JT BK 1
BK-12
BK-12

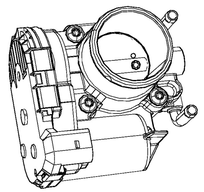
REF: 515178205 REV:

2017 ENGINE HARNESS 600 ACE iTC

ECMA

ECMA

ELECTRONIC THROTTLE CONTROL
ETC

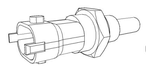


3.3 VOLTS	6	BG/YE-18	K4
MOTOR (+)	5	BG/RD-18	L1
SIGNAL 2	4	BG/GN-18	K3
MOTOR (-)	3	BG/BK-18	L2
GROUND	2	BG/GY-18	A2
SIGNAL 1	1	BG/WH-18	F3

MANIFOLD ABSOLUTE PRESSURE
AND TEMPERATURE SENSOR
MAPTS

PRESSURE SIGNAL	4	WH/BU-18	G4
5 VOLTS	3	PK/BU-18	B4
TEMP. SIGNAL	2	WH/GY-18	H3
GROUND	1	BK/BU-18	H2

COOLANT TEMPERATURE SENSOR
CTS



SIGNAL	1	BK/OG-18	J2
GROUND	2	BG/OG-18	A1

CRANKSHAFT POSITION SENSOR
CPS

SIGNAL	1	BU/YE-18	H1
SIGNAL	2	YE/WH-18	K2

OIL PRESSURE SWITCH
OPS

SIGNAL		LT BU-18	E3

CAMSHAFT POSITION SENSOR
CAPS

D4		BK/GN-18	1 GROUND
E2		YE/GN-18	2 SIGNAL
		OR/GN-18	3 12 VOLTS

HARNESS INTER CONNECTOR
HIC

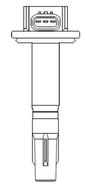
		OR/GN-18	4 12 VOLTS
C1		OG/BU-18	3 REVERSE ENABLE
		VT/GN-16	2 12 VOLTS
		VT/BU-16	1 12 VOLTS

INJECTOR CYLINDER 1
INJ_1

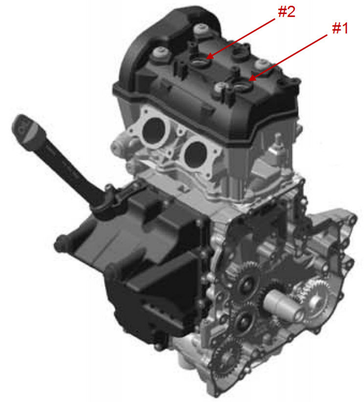
		VT/BU-18	1 12 VOLTS
J1		BN/RD-18	2 CONTROL

JT VT/BU

IGNITION COIL
CYLINDER 1
COIL_1



		VT/BU-16	1 12 VOLTS
M1		BN/BK-16	3 CONTROL

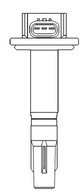


INJECTOR CYLINDER 2
INJ_2

		VT/GN-18	1 12 VOLTS
K1		BN/BU-18	2 CONTROL

JT VT/GN

IGNITION COIL
CYLINDER 2
COIL_2



		VT/GN-16	1 12 VOLTS
M2		BN/OG-16	3 CONTROL

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	

219100863-016

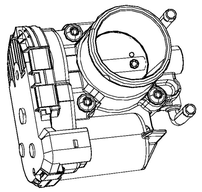
REF 864 340 REV

2017 ENGINE HARNESS 900 ACE iTC

ECMA

ECMA

ELECTRONIC THROTTLE CONTROL
ETC

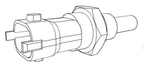


3.3 VOLTS	6	BG/YE-18	K4
MOTOR (+)	5	BG/RD-18	L1
SIGNAL 2	4	BG/GN-18	K3
MOTOR (-)	3	BG/BK-18	L2
GROUND	2	BG/GY-18	A2
SIGNAL 1	1	BG/WH-18	F3

MANIFOLD ABSOLUTE PRESSURE
AND TEMPERATURE SENSOR
MAPTS

PRESSURE SIGNAL	4	WH/BU-18	G4
5 VOLTS	3	PK/BU-18	B4
TEMP. SIGNAL	2	WH/GY-18	H3
GROUND	1	BK/BU-18	H2

COOLANT TEMPERATURE SENSOR
CTS



SIGNAL	1	BK/OG-18	J2
GROUND	2	BG/OG-18	A1

CRANKSHAFT POSITION SENSOR
CPS

SIGNAL	1	BU/YE-18	H1
SIGNAL	2	YE/WH-18	K2

OIL PRESSURE SWITCH
OPS

SIGNAL		LT BU-18	E3

CAMSHAFT POSITION SENSOR
CAPS

D4	BK/GN-18	1	GROUND
E2	YE/GN-18	2	SIGNAL
	OR/GN-18	3	12 VOLTS

HARNESS INTER CONNECTOR
HIC

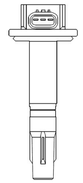
	OR/GN-18	4	12 VOLTS
C1	OG/BU-18	3	REVERSE ENABLE
	VT/GN-16	2	12 VOLTS
	VT/BU-16	1	12 VOLTS

INJECTOR CYLINDER 1
INJ_1

	VT/BU-18	1	12 VOLTS
B3	BN/RD-18	2	CONTROL

JT VT/BU

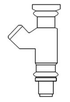
IGNITION COIL
CYLINDER 1
COIL_1



	VT/GN-16	1	12 VOLTS
M4	BN/BK-16	3	CONTROL

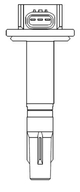
JT VT/GN

INJECTOR CYLINDER 2
INJ_2



	VT/BU-18	1	12 VOLTS
K1	BN/BU-18	2	CONTROL

IGNITION COIL
CYLINDER 2
COIL_2

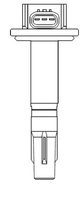


	VT/GN-16	1	12 VOLTS
M2	BN/OG-16	3	CONTROL

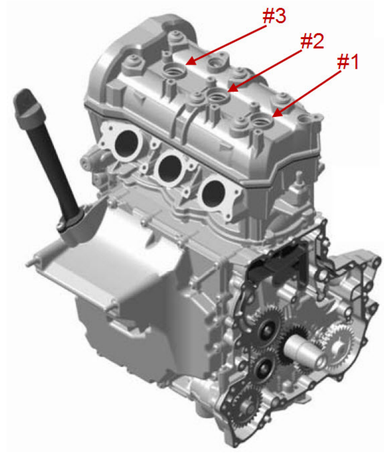
INJECTOR CYLINDER 3
INJ_3

	VT/BU-18	1	12 VOLTS
J1	BN/GY-18	2	CONTROL

IGNITION COIL 3
COIL_3



	VT/GN-16	1	12 VOLTS
M1	BN/YE-16	3	CONTROL



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	

219100863-017

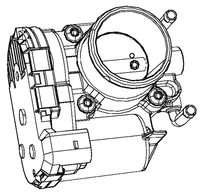
REF 666 096 REV

2017 ENGINE HARNESS 1200 iTC

ECMA

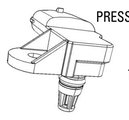
ECMA

ELECTRONIC THROTTLE CONTROL
ETC



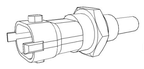
3.3 VOLTS	6	BG/YE-18	K4
MOTOR (+)	5	BG/RD-18	L1
SIGNAL 2	4	BG/GN-18	K3
MOTOR (-)	3	BG/BK-18	L2
GROUND	2	BG/GY-18	A2
SIGNAL 1	1	BG/WH-18	F3

MANIFOLD ABSOLUTE PRESSURE
AND TEMPERATURE SENSOR
MAPTS



PRESSURE SIGNAL	4	WH/BU-18	G4
5 VOLTS	3	PK/BU-18	B4
TEMP. SIGNAL	2	WH/GY-18	H3
GROUND	1	BK/BU-18	H2

COOLANT TEMPERATURE SENSOR
CTS



SIGNAL	1	BK/OG-18	J2
GROUND	2	BG/OG-18	A1

CRANKSHAFT POSITION SENSOR
CPS

SIGNAL	1	BU/YE-18	H1
SIGNAL	2	YE/WH-18	K2

OIL PRESSURE SWITCH
OPS

SIGNAL		LT BU-18	E3

D4	BK/GN-18	1	GROUND
E2	YE/GN-18	2	SIGNAL
	OR/GN-18	3	12 VOLTS

CAMSHAFT POSITION SENSOR
CAPS

HARNESS INTER CONNECTOR
HIC

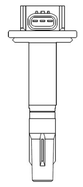
	OR/GN-18	4	12 VOLTS
C1	VT/OG-18	3	REVERSE ENABLE
	VT/GN-16	2	12 VOLTS
	VT/BU-16	1	12 VOLTS

INJECTOR CYLINDER 1
INJ_1

	VT/BU-18	2	12 VOLTS
B3	BN/RD-18	1	CONTROL

JT VT/BU

IGNITION COIL
CYLINDER 1
COIL_1



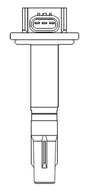
	VT/GN-16	1	12 VOLTS
M4	BN/BK-16	3	CONTROL

JT VT/GN

INJECTOR CYLINDER 2
INJ_2

	VT/BU-18	2	12 VOLTS
K1	BN/BU-18	1	CONTROL

IGNITION COIL
CYLINDER 2
COIL_2

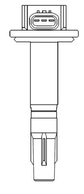


	VT/GN-16	1	12 VOLTS
M2	BN/OG-16	3	CONTROL

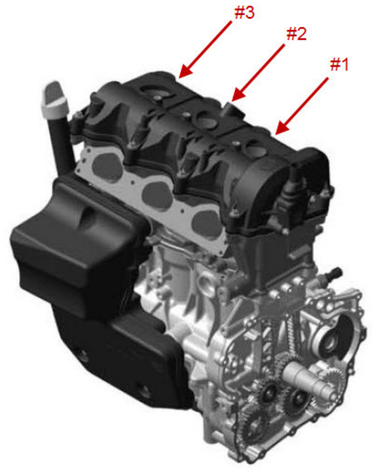
INJECTOR CYLINDER 3
INJ_3

	VT/BU-18	2	12 VOLTS
J1	BN/GY-18	1	CONTROL

IGNITION COIL 3
COIL_3



	VT/GN-16	1	12 VOLTS
M1	BN/YE-16	3	CONTROL



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	

219100863-018

REF 666 690 REV

2017 ENGINE HARNESS 850 E-TEC

RAVE POSITION SENSOR
ERF
5 VOLTS — 3 — PK/VT-18 — F3
SIGNAL — 2 — WH/VT-18 — E3
GROUND — 1 — BK/VT-18 — E2

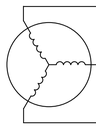
THROTTLE POSITION SENSOR
TPS
5 VOLTS — 3 — PK/BR-18 — D2
GROUND — 2 — BK/BN-18 — C2
SIGNAL — 1 — WH/BN-18 — D3

KNOCK SENSOR
KS
SIGNAL — 2 — YE/BU-18 — G1
GROUND — 1 — BG/BU-18 — H1

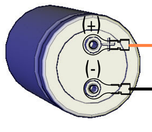
COOLANT TEMPERATURE SENSOR
CTS
SIGNAL — 2 — BK/OG-18 — B1
GROUND — 1 — BG/OG-18 — C1

CRANKSHAFT POSITION SENSOR
CPS
SIGNAL — 1 — BU/YE-18 — K2
GROUND — 2 — WH/YE-18 — K1

OIL LEVEL SENSOR
OLS
SIGNAL — 1 — LT BU-18 — F2
GROUND — 2 — BK/BU-18 — G3

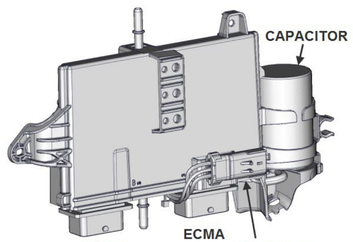


MAGNETO
MAG
YE-12
YE-12
YE-12

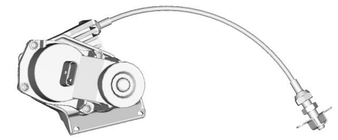


CAPACITOR
WH/RD-12
BK-12

ECMA
ECMA



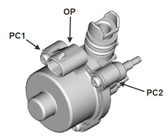
RAVE ACTUATOR
E-RAVE
E4 — PK/BG-18 — 1 — SENSOR 5 VOLTS
F4 — BK/BG-18 — 2 — SENSOR GROUND
D4 — WH/BG-18 — 3 — SENSOR SIGNAL
G4 — BG/RD-18 — JT BG/RD — BG/RD-18 — 4 — ACTUATOR (+/-)
H4 — BG/RD-18 — JT BG/BN — BG/BN-18 — 5 — ACTUATOR (-/+)
J4 — BG/BN-18
K4 — BG/BN-18



THROTTLE BODY INJECTOR MAG
INJ TB MAG
A3 — BN/BU-18 — 1 — CONTROL
A4 — VT/BU-18 — 2 — 12 VOLTS

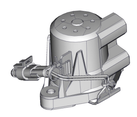
THROTTLE BODY INJECTOR PTO
INJ TB PTO
A2 — BN/GN-18 — 1 — CONTROL
A1 — VT/GN-18 — 2 — 12 VOLTS

OIL PUMP FEEDBACK SWITCH
E1 — BK/WH-18 — PC1
F1 — BG/BK-18 — PC2

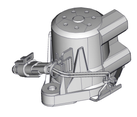


OIL PUMP
OP
B4 — GN/YE-18 — 1 — CONTROL
WH/RD-18 — 2 — 55 VOLTS

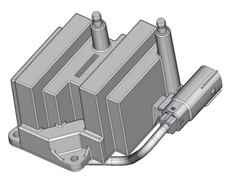
DIRECT INJECTOR MAG.
INJ DI MAG
L1 — WH/RD-14 — JT WH/RD
M1
BU-16 — 2 — CONTROL
WH/RD-16 — 1 — 55 VOLTS



DIRECT INJECTOR PTO
INJ DI PTO
M2
GN-16 — 2 — CONTROL
WH/RD-16 — 1 — 55 VOLTS



IGNITION COILS
COILS
L3 — BK-16 — JT B K 1
J3
BK-16 — 1 — GROUND
OG/BU-18 — 2 — CONTROL MAG
WH/RD-16 — 3 — 55 VOLTS
M3 — BK-16 — JR BK 2
K3
BK-16 — 4 — GROUND
OR/GN-18 — 5 — CONTROL PTO
WH/RD-16 — 6 — 55 VOLTS



BK-16
BK-16

GROUND
ENGINE
L4 — BK-16
M4 — BK-16

LINE TYPES

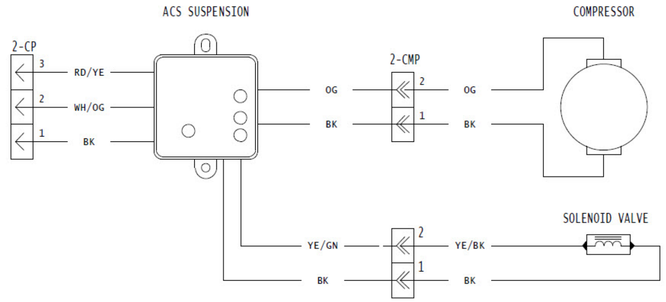
55 / 60 VOLTS	
12 VOLTS SWITCHED	
12 VOLTS UNSWITCHED	
5 OR 3.3 VOLTS	
DIGITAL SIGNAL	
POWER CONTROL	
ANALOG SIGNAL	
COMMUNICATION	
A-D GROUND	
POWER GROUND	
AC VOLTAGE	

219100863-019

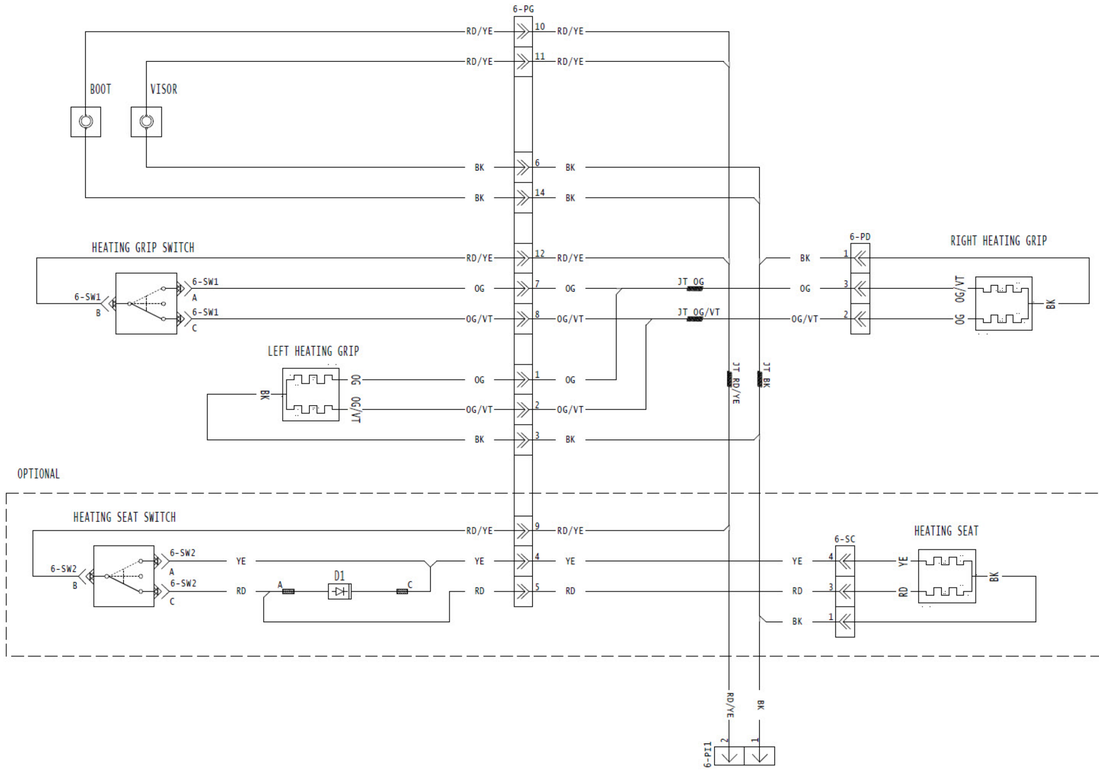
REF	864 440	REV	1

2017 SECONDARY HARNESSES

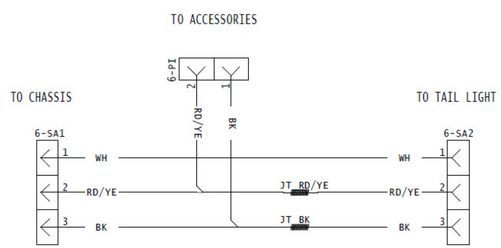
ACS SUSPENSION



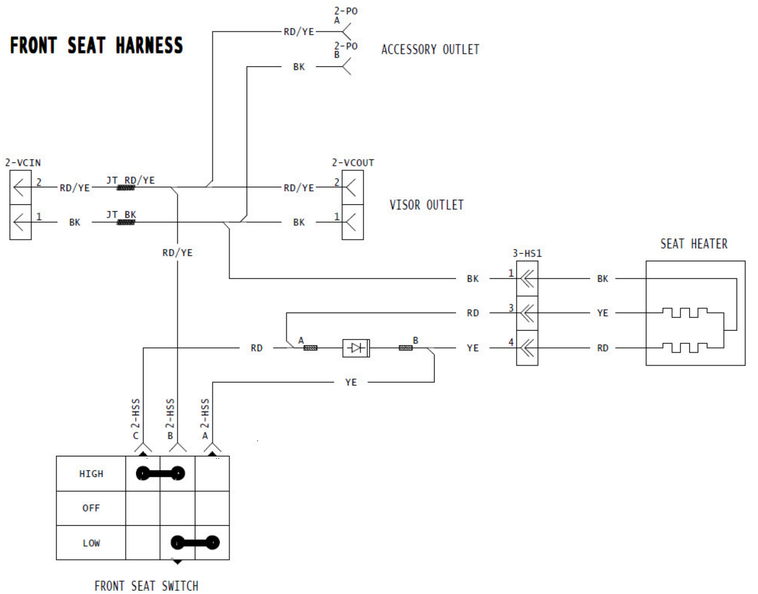
REAR SEAT HARNESS



REAR ACCESORIES T HARNESS



FRONT SEAT HARNESS



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