SAFETY NOTICE

This manual has been prepared as a guide to correctly service and repair 2013 Ski-Doo® snowmobiles described in the list in the *INTRODUCTION*.

This edition was primarily published to be used by technicians who are already familiar with service procedures relating to Bombardier Recreational Products Inc. (BRP) products. Mechanical technicians should attend continuous training courses given by BRPTI.

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

The content of this manual depicts parts and/or procedures applicable to a particular product at 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, wether 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 denoted by the 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 Denotes an instruction which, if not followed, could severely damage vehicle components.

NOTE: Indicates supplementary information needed 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 use common shop safety practice.

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.

Unless otherwise indicated, engine must be OFF and tether cord removed prior to perform any services.

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

INTRODUCTION

This Shop Manual covers the following BRP made 2013 snowmobiles:

CHASSIS	ENGINE
REV-XS	600 HO E-TEC
	800R E-TEC
REV-XM	600 HO E-TEC
	800R E-TEC

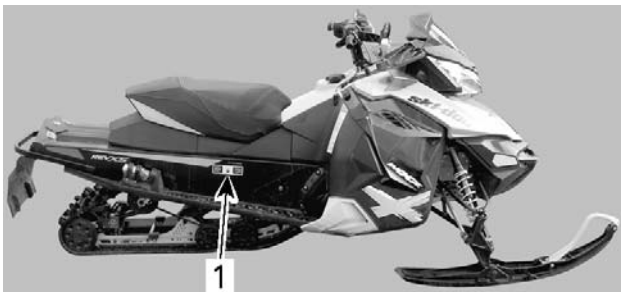
The information and component/system descriptions contained in this manual are correct at time of writing. BRP however, maintains a policy of continuous improvement of its products without imposing upon itself any obligation to install them on products previously manufactured.

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.

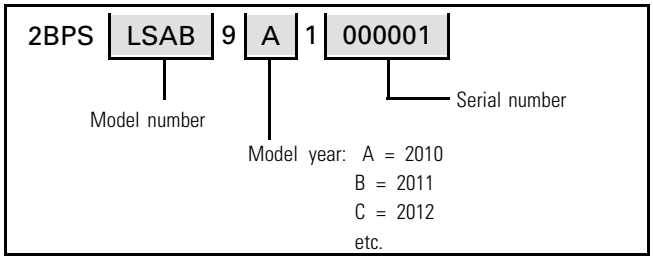
VEHICLE INFORMATION

VEHICLE IDENTIFICATION NUMBER (VIN)

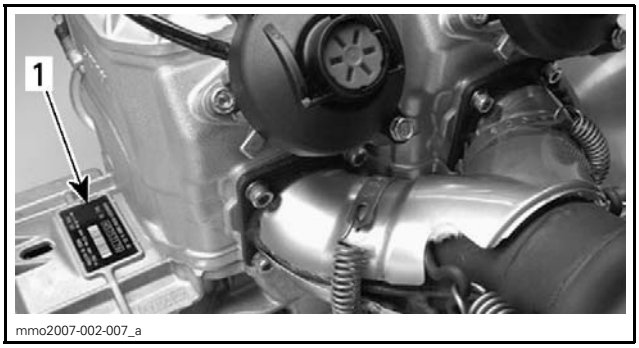


TYPICAL
1. Vehicle identification number

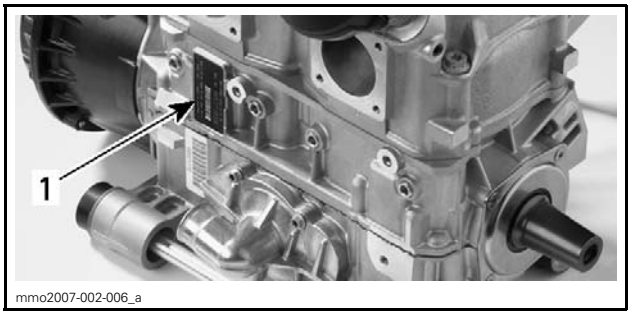
Identification Number Description



ENGINE SERIAL NUMBER



TYPICAL — 600 HO E-TEC
1. Engine serial number



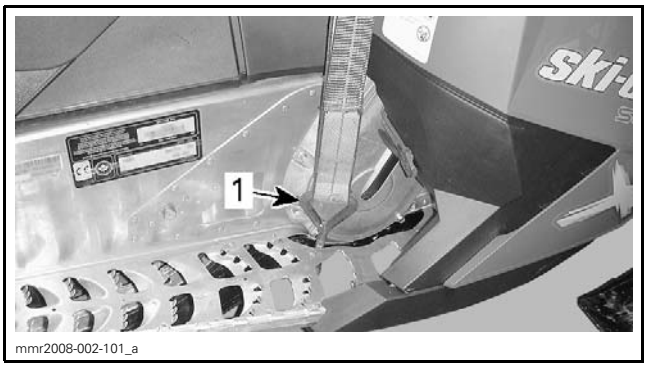
TYPICAL — 800R E-TEC
1. Engine serial number

SNOWMOBILE LIFTING

To lift the snowmobile securely, it is important to use the reinforced footrest holes.

1. Reinforced holes in footrest

Install lifting tool hooks in holes as shown.



1. Hook of lifting tool

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 snowmobile that carries 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 engine power or allow emission levels to exceed their predetermined factory specifications.

Exceptions include manufacturer's prescribed changes, such as altitude adjustments for example.

Owner Responsibility

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

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

EPA Emission Regulations

Snowmobiles manufactured by BRP are certified to the EPA standards as conforming to the requirements of the regulations for the control of air pollution emitted from new snowmobiles engines. This certification is contingent on certain adjustments being set to factory standards. For this reason, the factory procedure for servicing the product must be strictly followed and, whenever practicable, returned to the original intent of the design.

The responsibilities listed above are general and in no way a complete listing of the rules and regulations pertaining to the EPA requirements on exhaust emissions for snowmobiles products. For more detailed information on this subject, you may contact the following locations:

FOR ALL COURIER SERVICES:
U.S. Environmental Protection Agency
Office of Transportation and Air Quality
1310 L Street NW
Washington D.C. 20005

REGULAR US POSTAL MAIL:
1200 Pennsylvania Ave. NW
Mail Code 6403J
Washington D.C. 20460

INTERNET: http://www.epa.gov/otaq/

E-MAIL: otaqpublicweb@epa.gov

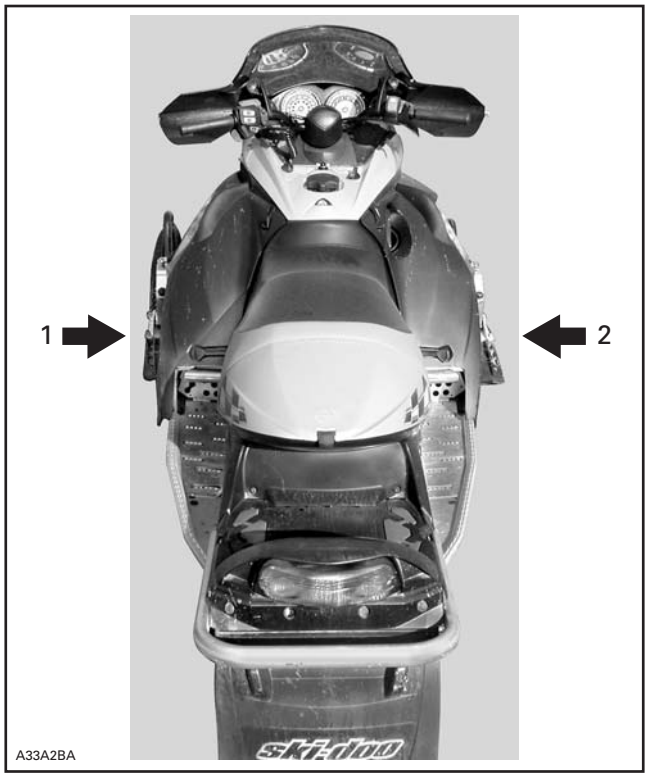
MANUAL INFORMATION

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.

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).



TYPICAL
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*.

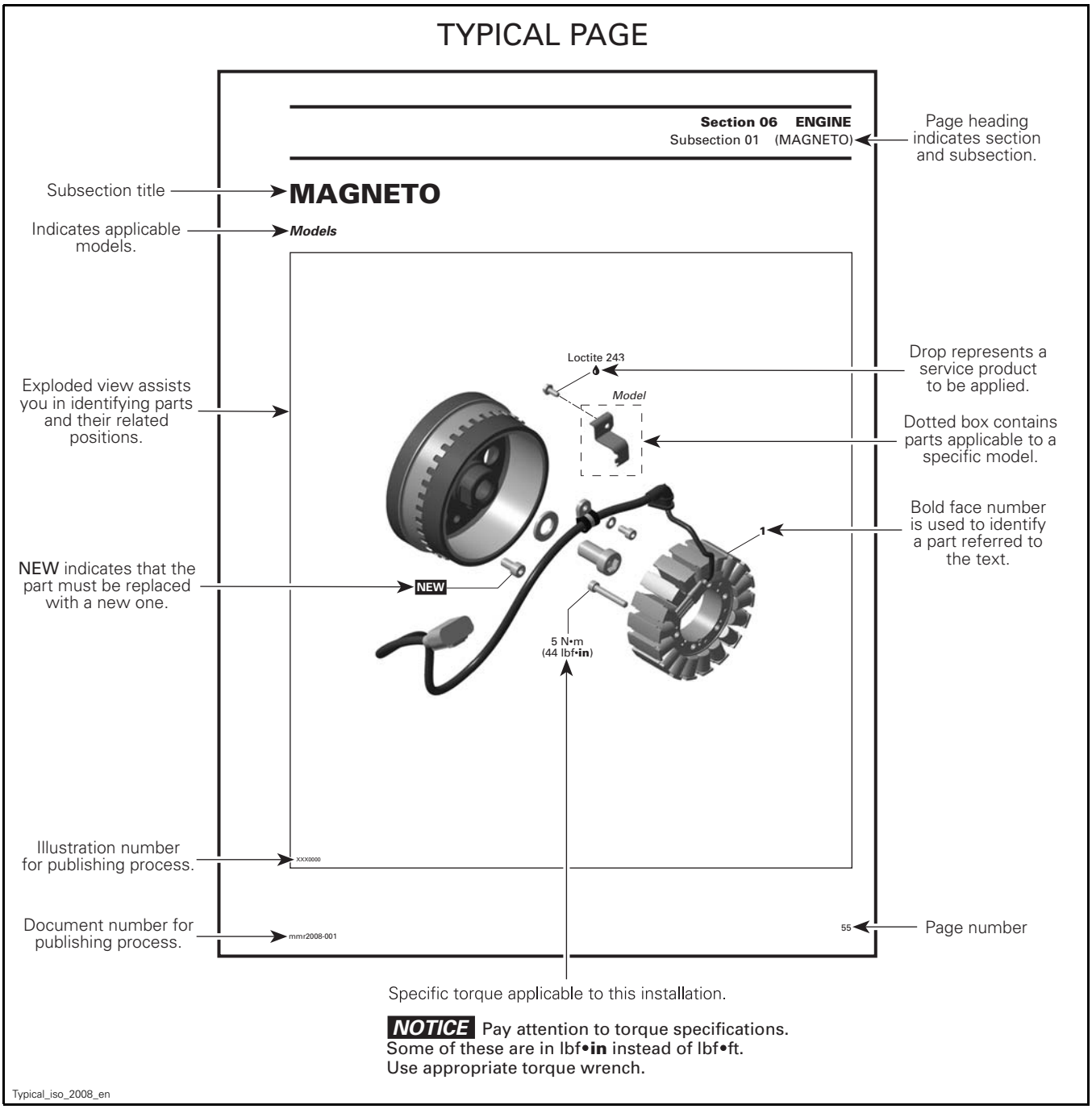
MANUAL LAYOUT

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.

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

Reference to a specific section or subsection.

⚠ 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.

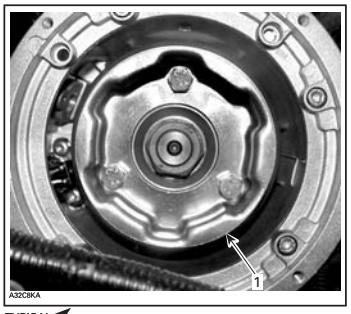
Magneto Flywheel Removal

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

Remove acoustic panel.

Remove rewind starter.

Remove starting pulley **no. 2**.



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).

mmr2008-001

57

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

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.

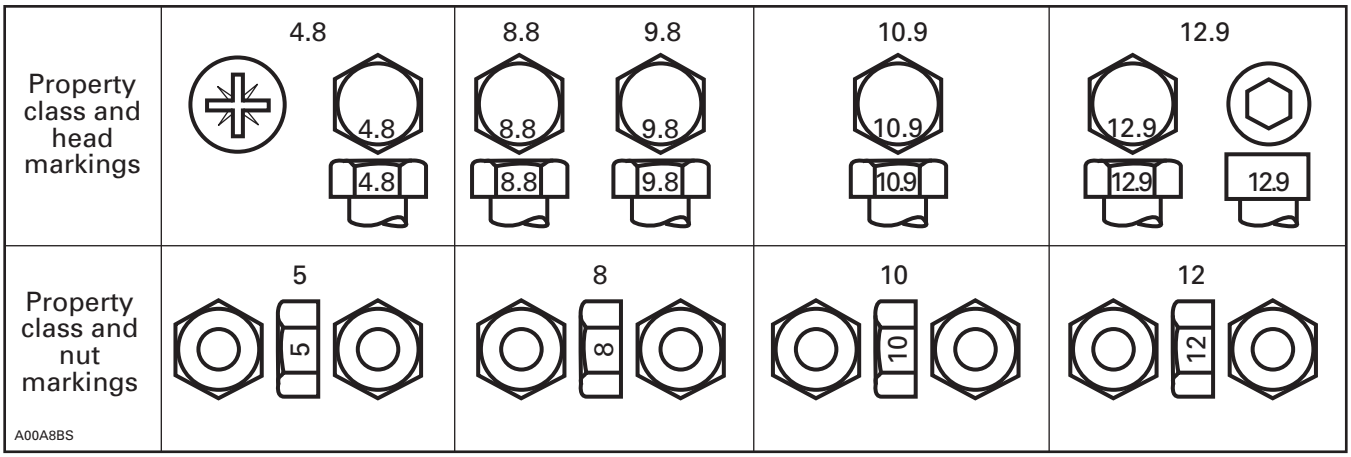
In order to avoid a poor assembly, tighten screws, bolts, or nuts in accordance with the following procedure:

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.

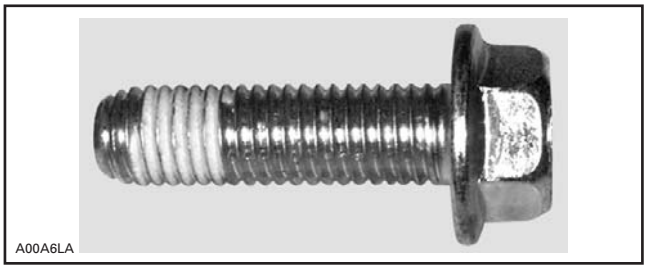


FASTENER SIZE	FASTENER GRADE/TORQUE			
	5.8 Grade	8.8 Grade	10.9 Grade	12.9 Grade
M4	1.5 – 2 N•m (13 – 18 lbf•**in**)	2.5 – 3 N•m (22 – 27 lbf•**in**)	3.5 – 4 N•m (31 – 35 lbf•ft)	4 – 5 N•m (35 – 44 lbf•ft)
M5	3 – 3.5 N•m (27 – 31 lbf•ft)	4.5 – 5.5 N•m (40 – 47 lbf•ft)	7 – 8.5 N•m (62 – 75 lbf•ft)	8 – 10 N•m (71 – 89 lbf•ft)
M6	6.5 – 8.5 N•m (58 – 75 lbf•ft)	8 – 12 N•m (71 – 106 lbf•ft)	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.

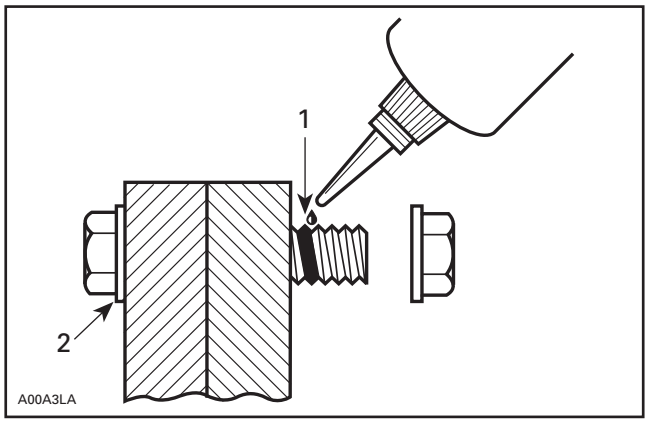
Use a metal brush or a tap to properly clean a threaded hole, then use a solvent. Allow the solvent time to act, approximately 30 minutes, then wipe off. Solvent utilization is to ensure proper adhesion of the product used for locking the fastener.

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.

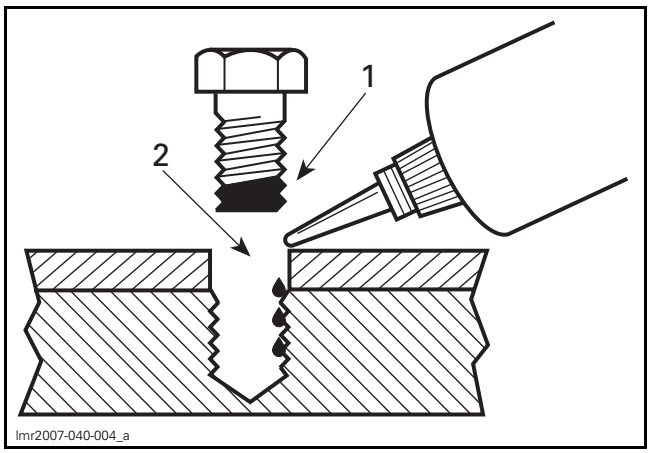
Threadlocker Application for Uncovered Holes (Bolts and Nuts)



1. Apply here
2. Do not apply

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

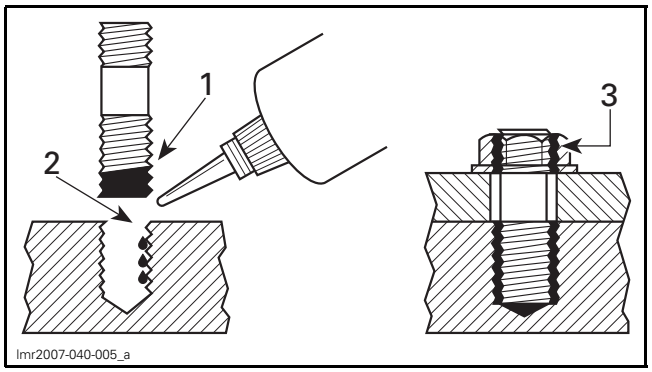


1. On fastener threads
2. On threads and at the bottom of hole

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



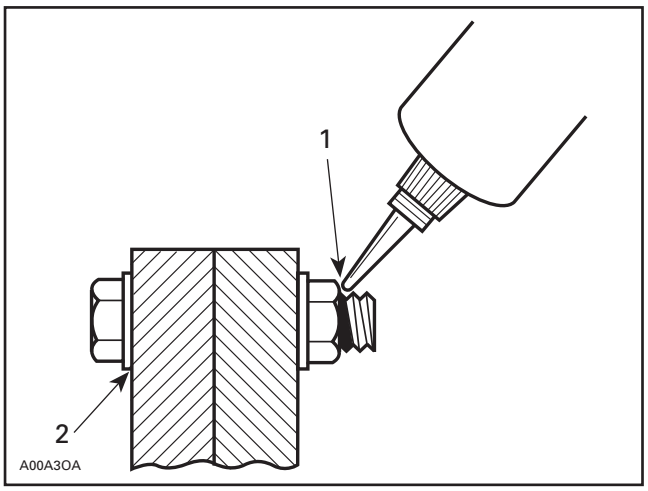
1. On stud threads
2. On threads and in the hole
3. On retaining nut threads

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

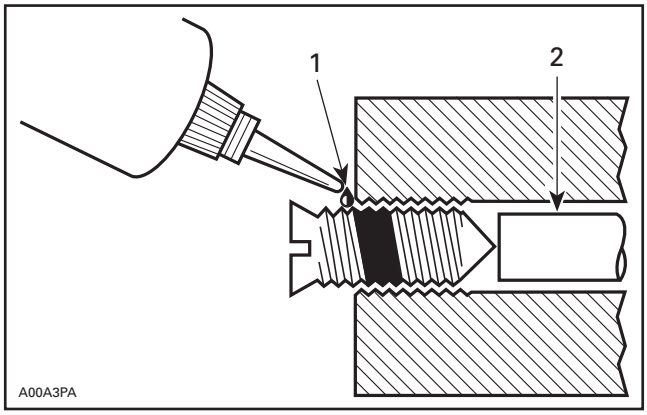


1. Apply here
2. Do not apply

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

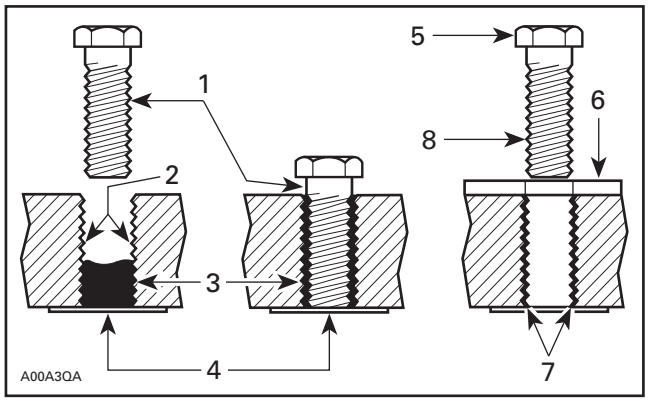


1. Apply here
2. Plunger

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

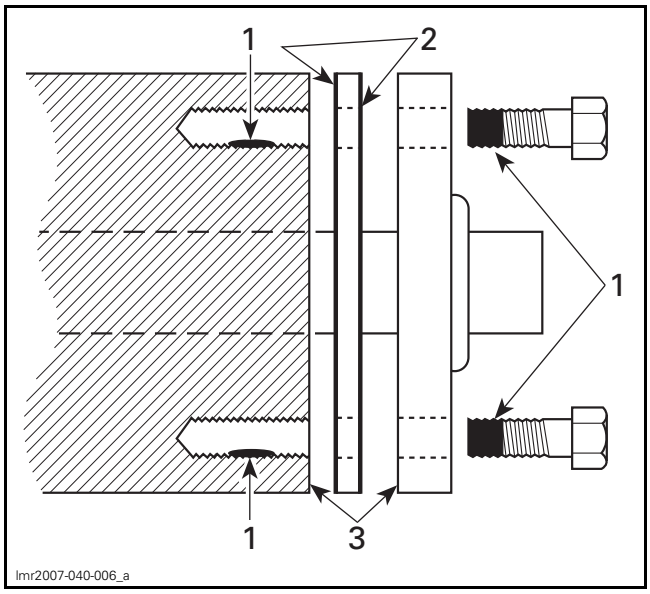
Option 1: Enlarge damaged hole, then follow *STANDARD THREAD REPAIR* procedure.

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.

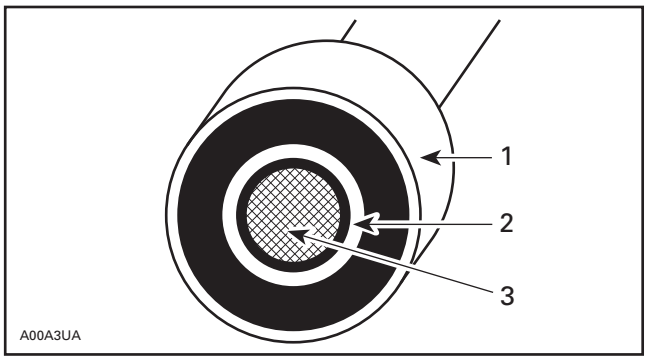
NOTE: If the cover is bolted to blind holes, apply proper strength Loctite in the hole and on threads. Tighten fastener.

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.

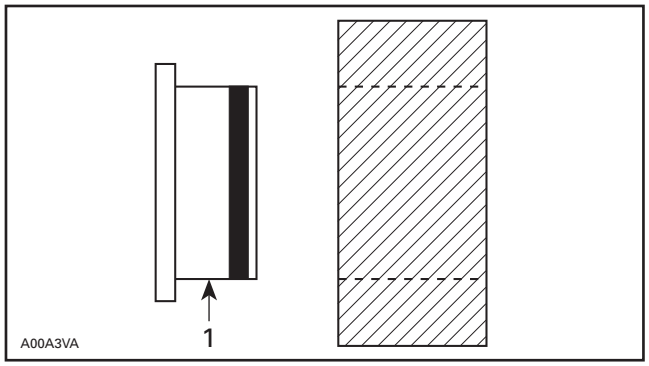
NOTE: Retaining compound is always forced out when applied on shaft.

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 PRIMER N (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.

SERVICE TOOLS INDEX

12 V BATTERY SUPPLY CABLE
(P/N 529 035 997)

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AMP DIE
(P/N 529 035 908)

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BALL JOINT EXTRACTOR
(P/N 529 035 827)

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BALL JOINT INSTALLER
(P/N 529 035 975)

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BALL JOINT REMOVER SUPPORT
(P/N 529 036 121)

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BEARING HEATER
(P/N 529 035 969)

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BEARING INSTALLER (PTO)
(P/N 529 035 990)

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BEARING PULLER/PUSHER
(P/N 529 036 111)

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BEARING PULLER/PUSHER
(P/N 529 036 112)

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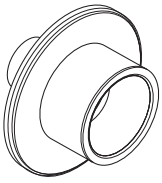
BUSHING PULLER/INSTALLER
(P/N 529 031 200)



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BUSHING REMOVER/INSTALLER
(P/N 529 035 931)

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CALIPER PULLER
(P/N 529 036 145)

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CERAMIC SEAL INSTALLER
(P/N 529 036 014)

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CONSOLE NUT WRENCH
(P/N 529 036 183)

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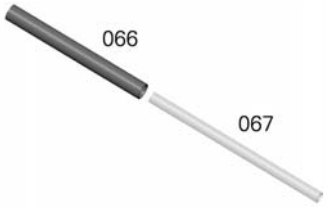
COUNTERSHAFT BEARING INSTALLER
(P/N 529 036 066)



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SERVICE TOOLS INDEX

COUNTERSHAFT BEARING REMOVER
(P/N 529 036 065)

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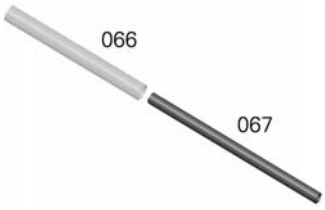
COUNTERSHAFT SUPPORT
(P/N 529 036 067)



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CRANKSHAFT BEARING PULLER
(P/N 529 036 004)

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CRANKSHAFT DISTANCE GAUGE
(P/N 529 035 968)

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CRANKSHAFT PROTECTOR (MAG)
(P/N 420 876 557)

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CRANKSHAFT PROTECTOR (PTO)
(P/N 420 876 552)

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CRIMPING TOOL (HEAVY GAUGE WIRE)
(P/N 529 035 730)

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CRIMPING TOOL (KOSTAL)
(P/N 529 035 909)

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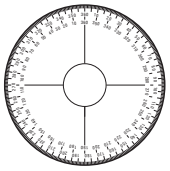
DEGREE WHEEL
(P/N 529 035 607)



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DIAL INDICATOR ADAPTER
(P/N 529 036 132)

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DISTANCE GAUGE
(P/N 529 036 060)

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DRIVE PULLEY HOLDER
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DRIVE PULLEY PULLER
(P/N 529 000 064)

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DRIVEN PULLEY SPRING COMPRESSOR
(P/N 529 036 182)

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ENGINE LIFTING HOOK
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ENGINE LIFTING TOOL
(P/N 529 036 131)

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EXTRACTOR ADAPTOR
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(P/N 529 035 868)

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FUEL HOSE ADAPTER
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FUEL PUMP NUT TOOL
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IGNITION TIMING TOOL
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INJECTOR RETAINER PLATE
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INTAKE PLUG
(P/N 529 036 203)

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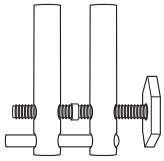
LARGE HOSE PINCHER
(P/N 529 032 500)



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MAGNETO PULLER RING
(P/N 420 876 081)

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MAGNETO PULLER
(P/N 529 035 547)

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

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MPI-2 INTERFACE CARD
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OETIKER PLIERS
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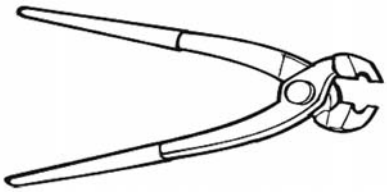

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RMOTION SUSPENSION TOOL
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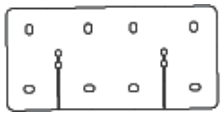
RUBBER PAD PROTECTOR
(P/N 529 023 400)



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SHOCK ABSORBER SUPPORTS
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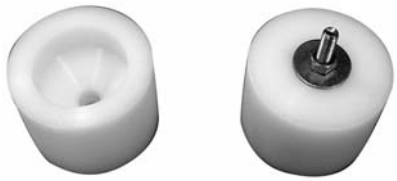

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SLIDER SHOE FORK
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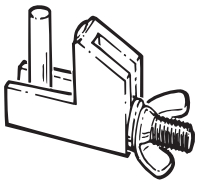
SMALL HOSE PINCHER
(P/N 295 000 076)



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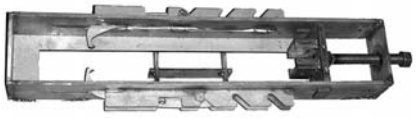
SPRING COMPRESSOR
(P/N 529 036 184)



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SPRING INSTALLER/REMOVER
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SUCTION PUMP
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SUPERTANIUM DRILL BIT 3/16"
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SUPPORT PLATE
(P/N 529 035 976)

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SUSPENSION ARM SUPPORT
(P/N 529 035 637)

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T-HARNESS
(P/N 529 035 869)

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TDC DIAL INDICATOR
(P/N 295 000 143)

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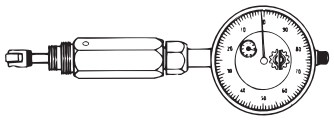
TDC DIAL INDICATOR
(P/N 414 104 700)



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TEMPERATURE INDICATOR STICK
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TEST CAP
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TRACK CLEAT INSTALLER
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UPPER GEAR RETAINING TOOL
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VACUUM/PRESSURE PUMP
(P/N 529 021 800)

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BREAK-IN INSPECTION

Procedures are detailed in *PERIODIC MAINTENANCE PROCEDURES* subsection.

BREAK-IN INSPECTION
Inspect exhaust system and check for leaks
Check coolant level
Inspect fuel lines and connections
Inspect throttle cable
Inspect drive belt
Visually inspect drive pulley
Tighten drive pulley retaining screw to specified torque
Inspect driven pulley
Adjust and align track
Change chaincase oil
Adjust drive chain
Check brake fluid level
Inspect brake hose, pads and disk
Inspect steering mechanism
Inspect skis and runners
Inspect front suspension
Inspect rear suspension and slider shoes

PERIODIC MAINTENANCE SCHEDULE

Procedures are detailed in *PERIODIC MAINTENANCE PROCEDURES* subsection.

EVERY 1 500 KM (1,000 MI)
Adjust drive chain
Check chaincase oil level

EVERY 3 000 KM (2,000 MI) OR 1 YEAR (WHICHEVER COMES FIRST)
Inspect engine rubber mounts
Inspect exhaust system and check for leaks
Adjust engine stopper
Visually inspect and clean drive pulley
Tighten drive pulley retaining screw to specified torque
Clean driven pulley
Adjust and align track
Inspect brake hose, pads and disc
Inspect steering mechanism
Inspect front suspension
Inspect rear suspension and stopper strap
Lubricate rear suspension (lubricate whenever the vehicle is used in wet conditions (rain, puddles)

EVERY 6 000 KM (4,000 MI) OR 2 YEARS (WHICHEVER COMES FIRST)
Inspect fuel pump strainer and replace if necessary
Replace brake fluid
Inspect throttle cable
Clean and lubricate rewind starter
Replace the following drive pulley wear parts: slider shoes, O-rings and sliding sheave bushing (800R E-TEC)

EVERY 10 000 KM (6,000 MI) OR 3 YEARS (WHICHEVER COMES FIRST)
Replace spark plugs
Inspect oil injection pump strainer and clean if needed
Replace the following drive pulley wear parts: spring cover bushing and ramps (800R E-TEC)
3D RAVE valves cleaning

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

PERIODIC MAINTENANCE PROCEDURES

SERVICE TOOLS

SERVICE PRODUCTS

GENERAL

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

PROCEDURES

ENGINE

Crankshaft PTO Seal Inspection

Break-In	Scheduled Maintenance	Storage	Preseason
			✔

Check PTO seal for cracks, leaks or other damages.

Rewind Starter Cleaning and Lubrication

Break-In	Scheduled Maintenance	Storage	Preseason
	✔		

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

3D RAVE Valve Cleaning

Break-In	Scheduled Maintenance	Storage	Preseason
	✔		

Clean carbon deposits as required.

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

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

ENGINE (SUPPORTS)

Engine Rubber Mount Inspection

Break-In	Scheduled Maintenance	Storage	Preseason
	✔		✔

Check rubber mounts for cracks or other damages.

Engine Stopper Adjustment

Break-In	Scheduled Maintenance	Storage	Preseason
	✔		

Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.

ENGINE (EXHAUST SYSTEM)

Exhaust System Inspection

Break-In	Scheduled Maintenance	Storage	Preseason
✔	✔		✔

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

– Springs and retainers
– Exhaust system mounts
– Muffler
– Tuned pipe
– Shields
– Manifold.

ENGINE (LUBRICATION SYSTEM)

Oil Injection Pump Strainer Inspection and Cleaning

Break-In	Scheduled Maintenance	Storage	Preseason
	✔		

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

Engine Lubrication

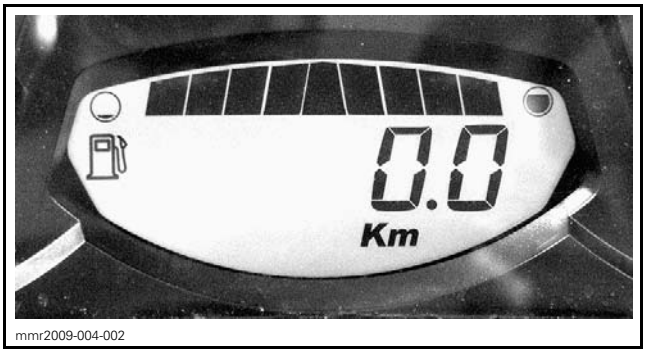
Break-In	Scheduled Maintenance	Storage	Preseason
		✔	

Engine Storage Mode

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.



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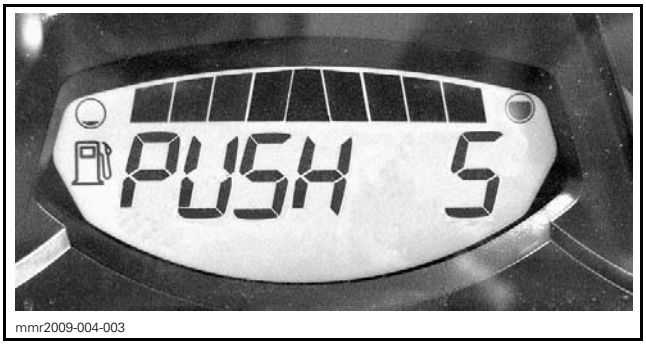
NOTE: The storage mode does not function in other modes (trip A, trip B and hr trip).

4. Repeatedly depress the HI/LOW beam switch rapidly, then, **while doing this**, press and hold the **SET button** until PUSH S appears on the display.



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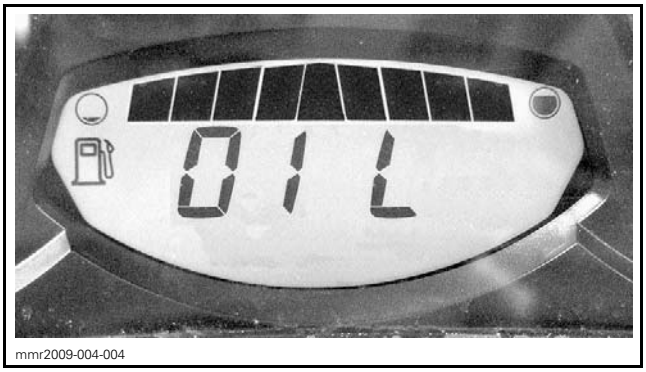
5. Release all buttons when gauge displays **PUSH "S"** appears.
6. Again, press and hold the SET (S) button for 2 - 3 seconds.

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.



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Do not touch anything during engine lubrication cycle.

The engine lubrication function takes approximately 1 minute. During this time, engine RPM will increase slightly to approximately 1600 RPM 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.**

ENGINE (COOLING SYSTEM)

⚠ WARNING

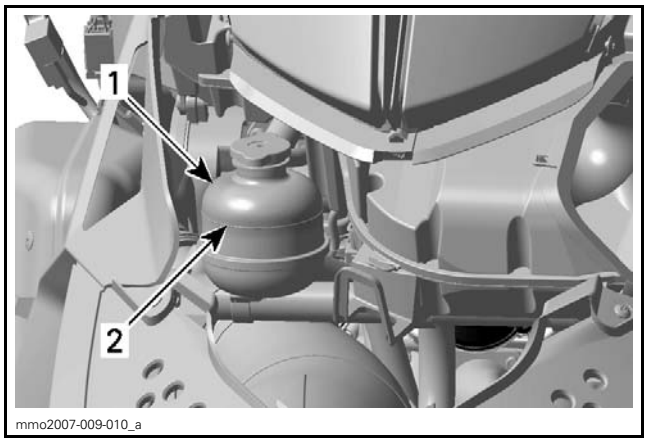
Never open coolant tank cap when engine is hot.

Engine Coolant Level Verification

Break-In	Scheduled Maintenance	Storage	Preseason
✔			

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.



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TYPICAL
1. Coolant tank
2. COLD LEVEL line

Engine Coolant Strength Verification

Break-In	Scheduled Maintenance	Storage	Preseason
			✔

Remove pressure cap.

Use an antifreeze tester to test coolant strength.

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

Engine Coolant Replacement

Break-In	Scheduled Maintenance	Storage	Preseason
	✔		

Recommended Engine Coolant

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

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

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

Cooling System Draining

⚠ WARNING

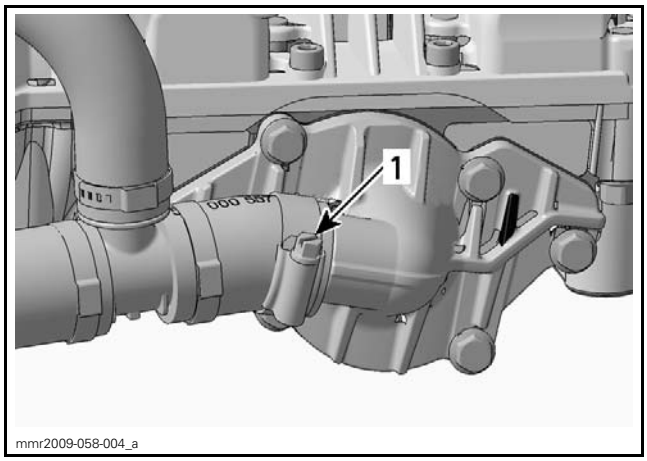
Never drain or refill the cooling system when engine is hot.

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

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

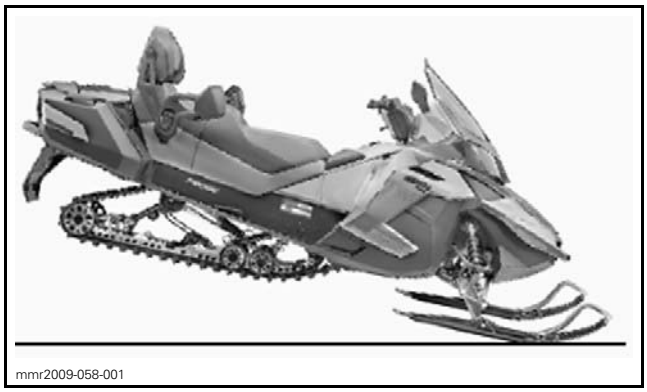
Place a large drain pan under the vehicle bottom pan.

Unplug coolant hose from water pump to drain coolant.



WATER PUMP
1. Unscrew clamp

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



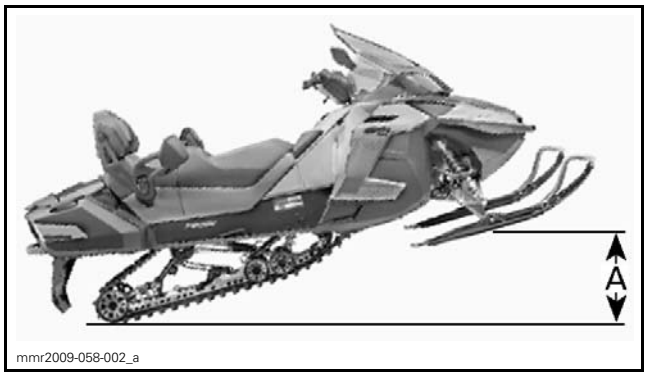
TYPICAL VIEW

Install and tighten coolant hose clamp on water pump.

TIGHTENING TORQUE	
Coolant hose clamp	5.5 N•m (49 lbf•**in**)

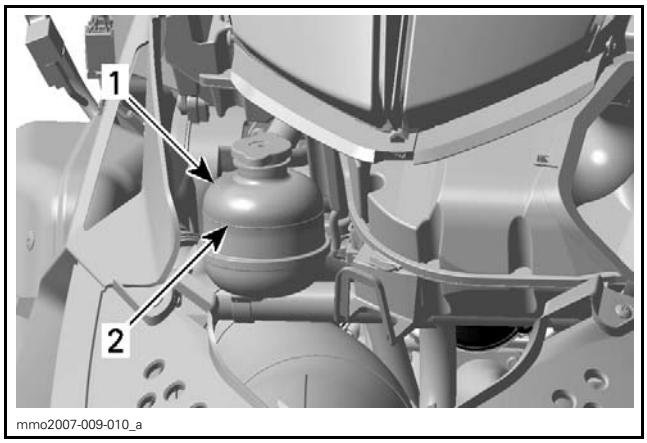
Cooling System Refill and Bleeding

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.



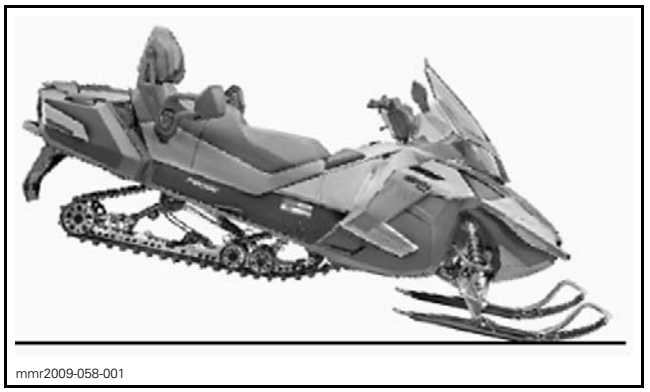
TYPICAL
1. Coolant tank
2. COLD LEVEL line

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.

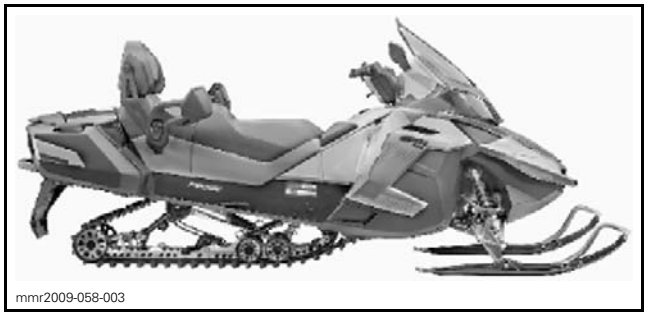


TYPICAL VIEW

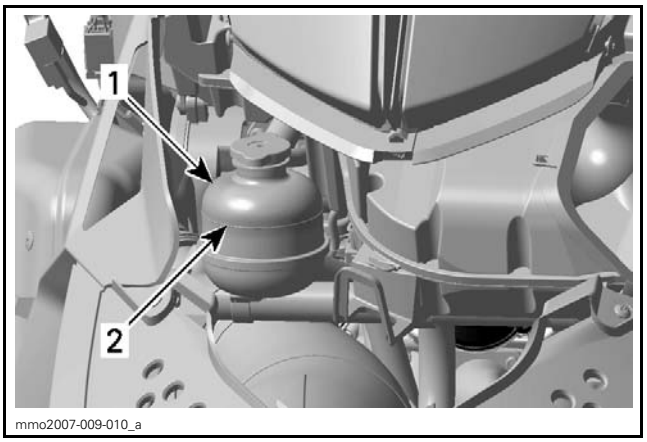
⚠ WARNING

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.



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



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

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

FUEL SYSTEM

Fuel Lines and Connection Inspection

Break-In	Scheduled Maintenance	Storage	Preseason
✔			✔

Visually inspect fuel lines and connections for cracks or leaks.

Fuel Pump Strainer Inspection

Break-In	Scheduled Maintenance	Storage	Preseason
	✔		

Remove fuel pump, refer to *FUEL TANK AND FUEL PUMP* subsection.

Inspect strainer for trapped foreign particles, clogging or damages. Replace if necessary.

In-Line Fuel Filter Replacement

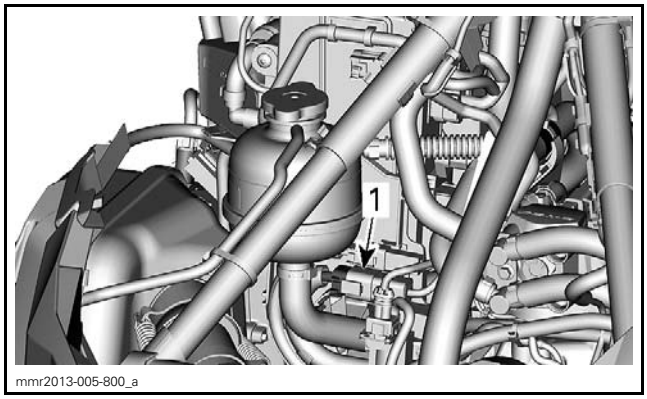
Break-In	Scheduled Maintenance	Storage	Preseason
	✔		

In-line Fuel Filter Removal

⚠ WARNING

Work in a well ventilated area. Wipe up all spilled fuel.

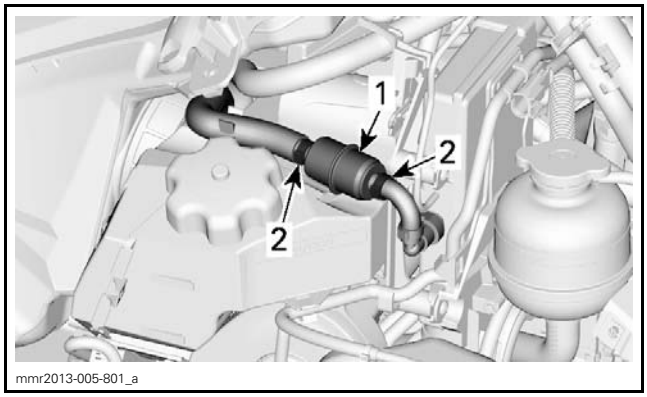
1. Release fuel pressure in the system. Refer to *FUEL TANK AND FUEL PUMP* subsection.
2. Remove the upper body module. Refer to *BODY* subsection.
3. Disconnect magneto connector.



⚠ 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.



1. *Fuel filter*
2. *Oetiker clamps*

6. Remove fuel filter from vehicle.

Dispose fuel filter as per your local environmental regulations.

In-Line Fuel Filter Installation

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 PLIERS (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.

Throttle Body Inspection and Cleaning

Break-In	Scheduled Maintenance	Storage	Preseason
			✔

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

Throttle Cable Inspection

Break-In	Scheduled Maintenance	Storage	Preseason
✔	✔		✔

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.

ELECTRICAL SYSTEM (CHARGING)

Battery Charging

Break-In	Scheduled Maintenance	Storage	Preseason
			✔

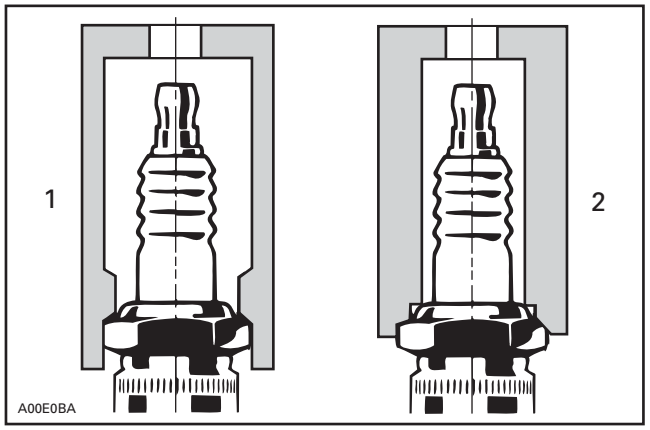
To charge battery, refer to *CHARGING SYSTEM* subsection.

ELECTRICAL SYSTEM (IGNITION)

Spark Plug Replacement

Break-In	Scheduled Maintenance	Storage	Preseason
	✔		

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.



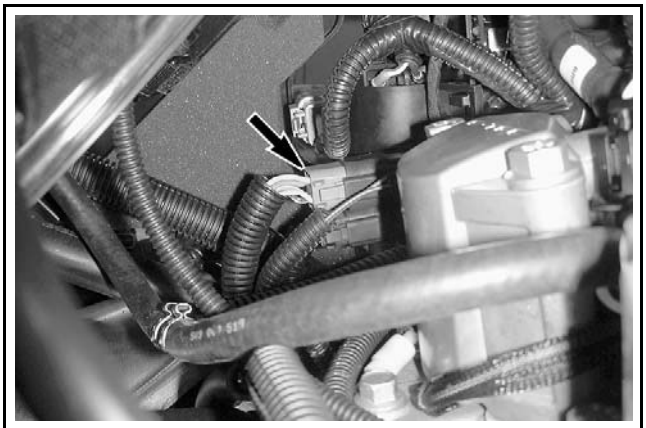
TYPICAL
1. *Approved socket*
2. *Improper socket*

Spark Plug Removal

1. Disconnect the magneto connector.

⚠ WARNING

Cranking engine with spark plug removed and without disconnecting the magneto connector may ignite fuel vapors creating a fire hazard.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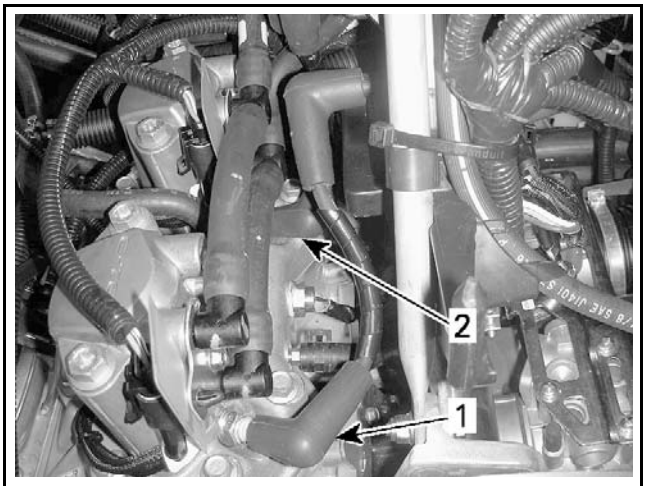
TYPICAL — MAGNETO CONNECTOR

2. Remove the primary air intake silencer.
3. Remove spark plug cables by gently rotating the cap and pulling it off the plug.



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TYPICAL
1. *PTO spark plug*
2. *MAGspark plug*

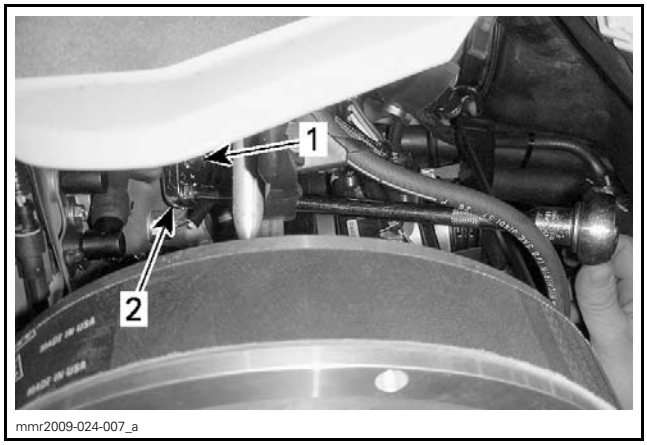
4. Clean the spark plug and cylinder head with pressurized air.

⚠ WARNING

Whenever using compressed air, always wear protective eye wear.

5. Unscrew the spark plug sufficiently to break the applied torque using the appropriate tools.

CYLINDER IDENTIFICATION	REQUIRED TOOLS
MAG side	– Spark plug socket (16 mm (5/8 in)) – Crowfoot (19 mm (3/4 in)) – Ratchet wrench – Extension
PTO side	– Spark plug socket (16 mm (5/8 in)) – Wrench (19 mm (3/4 in))



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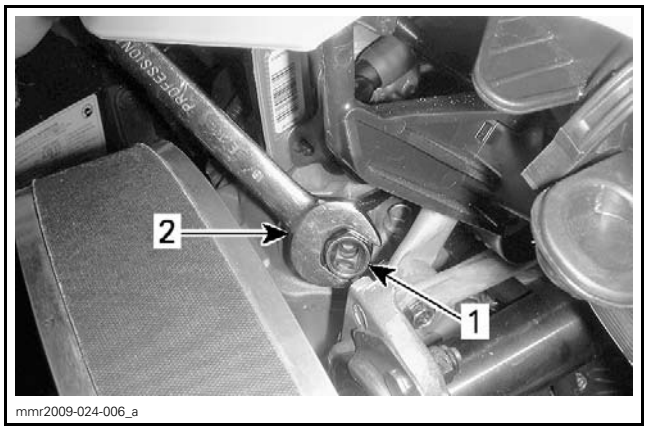
MAG SIDE
1. *Spark plug socket (16 mm (5/8 in))*
2. *Crowfoot (19 mm (3/4 in))*



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PTO SIDE
1. *Spark plug socket (16 mm (5/8 in))*
2. *Wrench (19 mm (3/4 in))*

6. Remove spark plugs by hand.

Spark Plug Installation (OEM)

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

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

REQUIRED SETTING	
Spark plug gap	0.7 mm to 0.8 mm (.028 in to .031 in)

3. Hand screw spark plug into cylinder head until it bottoms out.
4. Apply specific torque using a torque wrench, crow foot, 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.

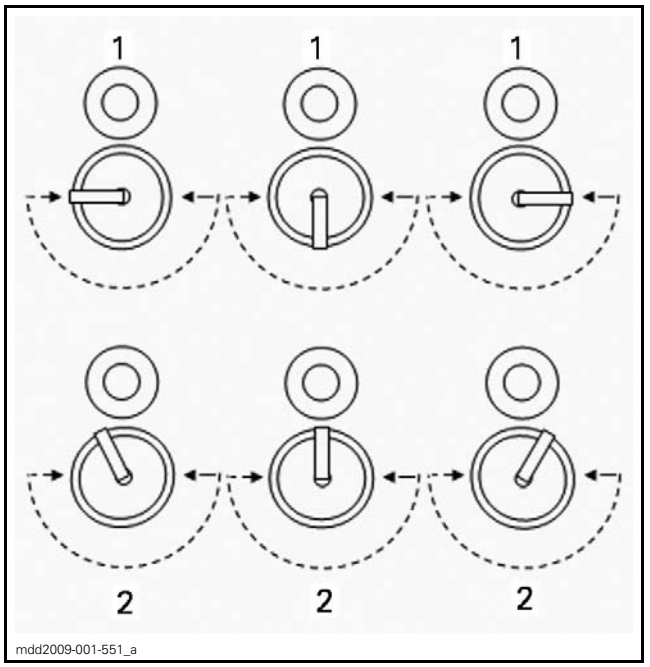
TIGHTENING TORQUE	
Spark plug	28 N•m (21 lbf•ft)

Spark Plug Installation (Non-OEM)

NOTE: When using a non-OEM spark plug on 800R E-TEC, 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.

ELECTRICAL SYSTEM (LIGHTS)

Headlights Beam Aiming Adjustment

Break-In	Scheduled Maintenance	Storage	Preseason
			✔

Refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.

DRIVE SYSTEM (CLUTCHES)

Drive Belt Inspection

Break-In	Scheduled Maintenance	Storage	Preseason
✔			✔

Refer to *DRIVE BELT* subsection.

Drive Pulley Inspection and Cleaning

Break-In	Scheduled Maintenance	Storage	Preseason
✔	✔		✔

Refer to *DRIVE PULLEY* subsection.

Drive Pulley Retaining Screw Tightening

Break-In	Scheduled Maintenance	Storage	Preseason
✔	✔		

TIGHTENING TORQUE	
Drive pulley screw	120 N•m (89 lbf•ft)

Drive Pulley Wear Parts Replacement

800R E-TEC Engines

Break-In	Scheduled Maintenance	Storage	Preseason
	✔		

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

Driven Pulley Inspection and Cleaning

Break-In	Scheduled Maintenance	Storage	Preseason
✔	✔		✔

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.

DRIVE SYSTEM (CHAINCASE)

Recommended Chaincase Oil

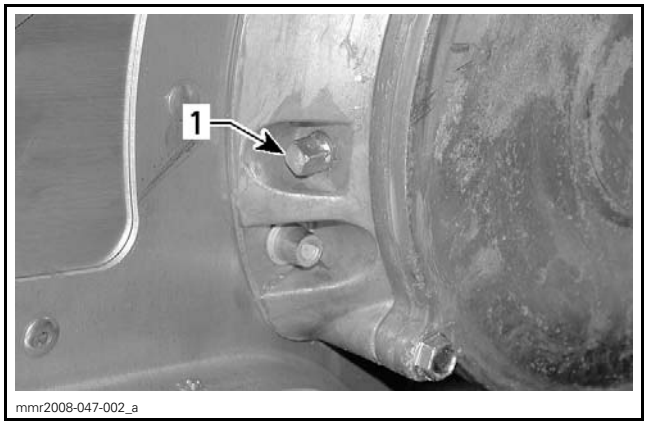
RECOMMENDED SERVICE PRODUCT
XPS SYNTHETIC CHAINCASE OIL (P/N 413 803 300)

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

Chaincase Oil Level Verification

Break-In	Scheduled Maintenance	Storage	Preseason
	✔		

1. Place vehicle on a level surface.
2. Remove magnetic check plug on the left side of chaincase. Oil level must be equal with the lower edge.

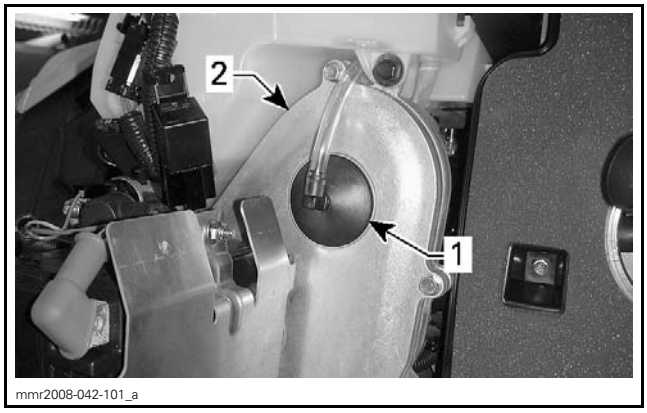


TYPICAL
1. Magnetic check plug

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.



TYPICAL
1. Filling plug
2. Chaincase cover

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

TIGHTENING TORQUE	
Magnetic check plug	6 N•m (53 lbf•**in**)

Chaincase Oil Replacement

Break-In	Scheduled Maintenance	Storage	Preseason
✔			✔

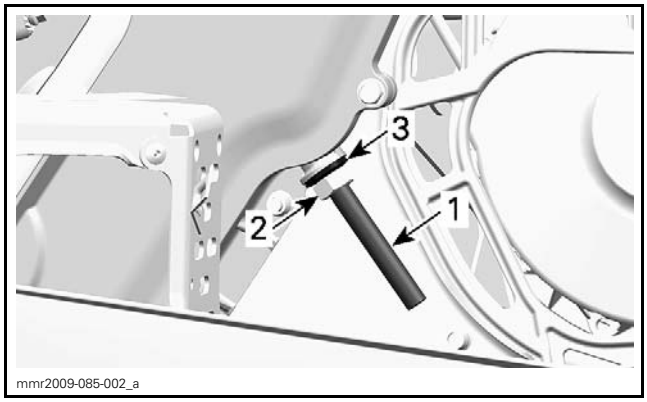
1. Place vehicle on a level surface.

2. Proceed with *CHAINCASE COVER REMOVAL* to allow oil to flow out of chaincase. See procedure in *CHAINCASE* subsection.
3. Proceed with *CHAINCASE COVER INSTALLATION*, see procedure in *CHAINCASE* subsection.
4. 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.
5. Proceed with *CHAINCASE OIL LEVEL VERIFICATION*, see procedure in this subsection.

Drive Chain Adjustment

Break-In	Scheduled Maintenance	Storage	Preseason
✔	✔		✔

1. Remove muffler. Refer to *EXHAUST SYSTEM* subsection.
2. Unscrew the lock nut on tensioner adjustment screw.



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1. Tensioner adjustment screw
2. Lock nut
3. Washer with rubber surface

3. Push back washer with rubber surface.
4. Tighten tensioner adjustment screw **BY HAND**.

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

5. Hold tensioner adjustment screw and tighten lock nut to specification.

TIGHTENING TORQUE	
Lock nut	36 N•m (27 lbf•ft)

DRIVE SYSTEM (TRACK)

Track Adjustment and Alignment

Break-In	Scheduled Maintenance	Storage	Preseason
✔	✔		✔

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

Track Tension Verification

1. Lift rear of vehicle and support it off the ground.
2. Allow rear suspension to fully extend.
3. 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.

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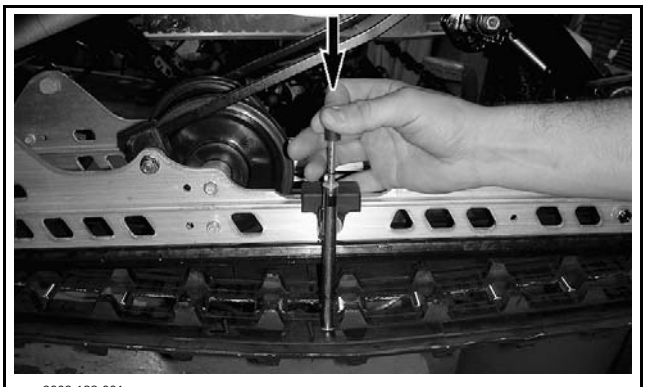
DEFLECTION SETTING
1. Bottom O-ring

5. Place upper O-ring to 0 kgf (0 lbf).
6. Position the tensiometer on track, halfway between front and rear idler wheels.
7. Push the tensiometer downwards until bottom O-ring (deflection) is aligned with the bottom of slider shoe.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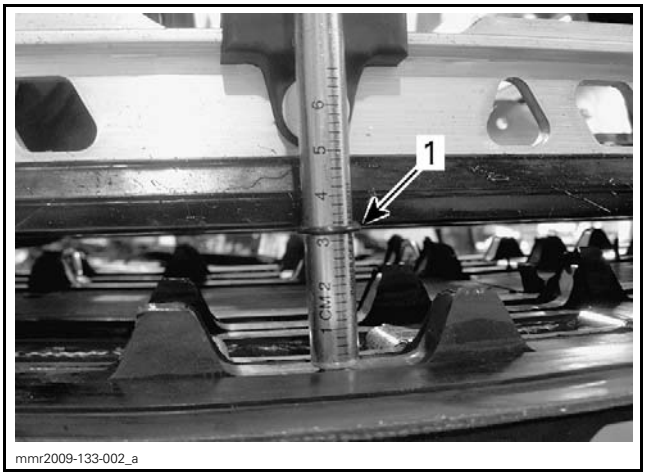


1. Deflection O-ring aligned with slider shoe

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)

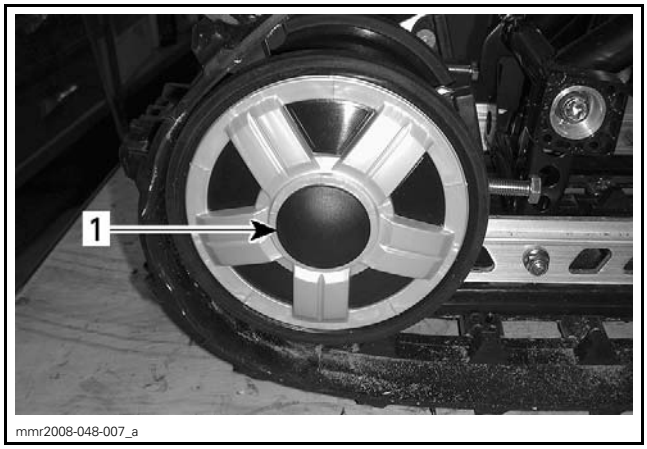
9. If load reading is not in accordance with the specification, adjust track tension. Refer to *TRACK TENSION ADJUSTMENT*.

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

Track Tension Adjustment

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

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

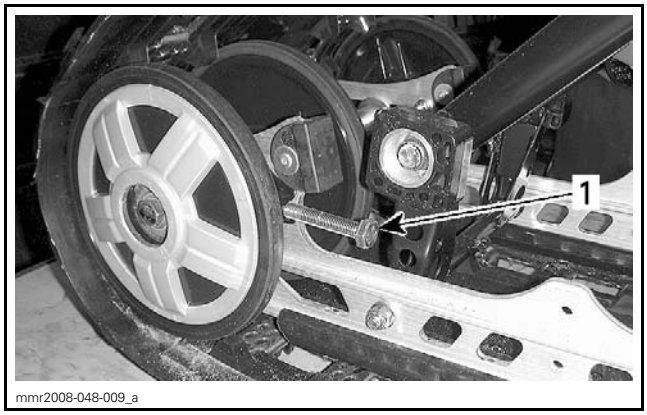


1. RH rear idler wheel cap

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

1. RH rear axle screw

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



1. RH adjustment screw

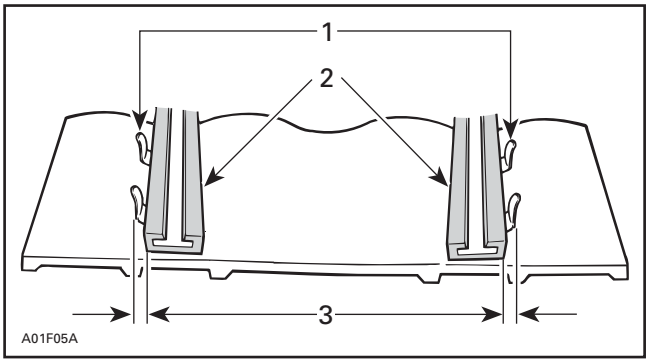
5. Verify track tension, refer to *TRACK TENSION VERIFICATION*.
6. Ensure track is properly aligned, refer to *TRACK ALIGNMENT*.

Track Alignment

⚠ WARNING

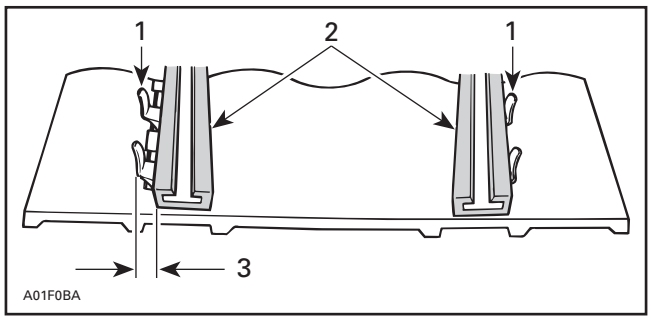
Before checking track alignment, ensure that the track is free of all particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure no one is standing in close proximity to the vehicle. Never rotate at high speed.

1. 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 (1 to 2 minutes).
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 screws.
   - 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:
   - 7.1 Torque idler wheel retaining screws to specification.

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

   - 7.2 Reinstall wheel caps.

BRAKE

Recommended Brake Fluid

Always use brake fluid meeting the DOT 4 specification.

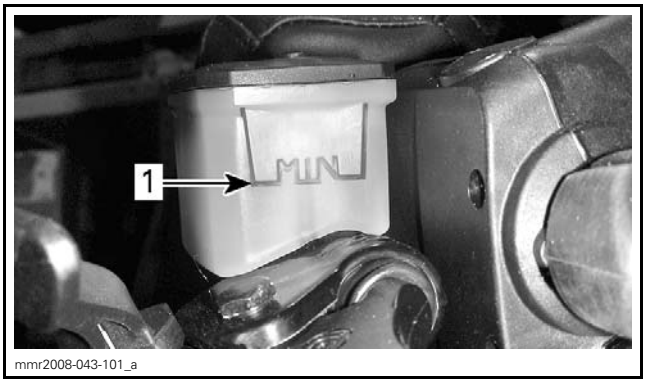
RECOMMENDED SERVICE PRODUCT
BRAKE FLUID (P/N 293 600 131) meeting DOT 4 specification

Brake Fluid Level Verification

Break-In	Scheduled Maintenance	Storage	Preseason
✔			✔

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.



1. MINIMUM line

Add fluid as required. Do not overfill.

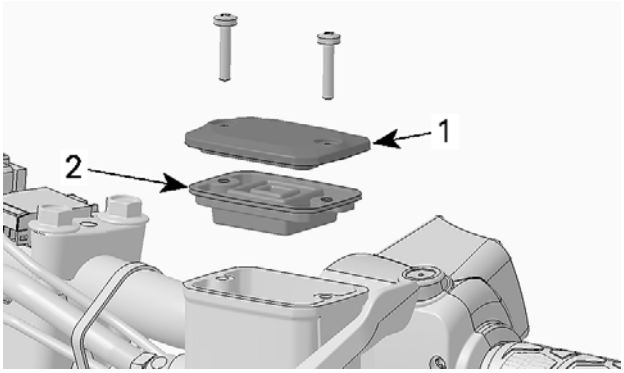
NOTE: A low level may indicate leaks or worn brake pads.

Brake Fluid Replacement

Break-In	Scheduled Maintenance	Storage	Preseason
	✔		

Brake Fluid Draining

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



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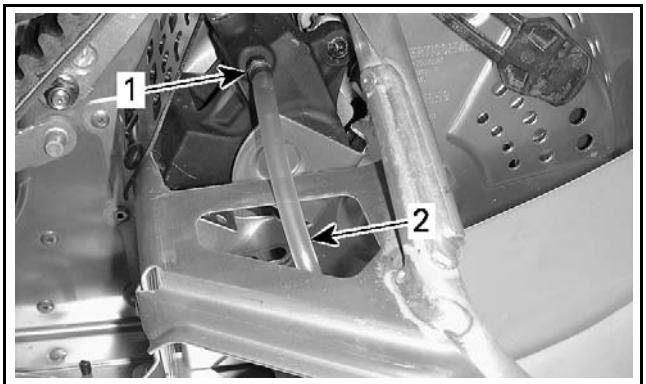
1. Reservoir cover
2. Diaphragm

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.



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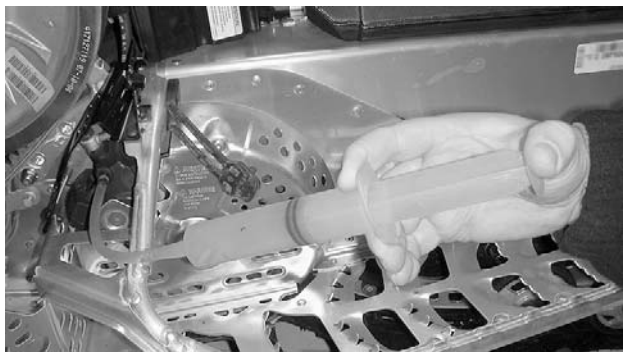
1. Bleeder
2. Clear hose to catch used brake fluid

Brake Fluid Filling

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.



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

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

   6.2 If brake lever is spongy, bleed brake system as per following procedure.

Brake System Bleeding

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

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

7. Install cover on reservoir.
8. Squeeze brake lever.
   8.1 If brake lever is firm, bleeding procedure is completed. Torque bleeder as specified.
   8.2 If brake lever is still spongy, go to step 9.
9. Push back brake pads with caliper in place and squeeze brake lever.
10. Repeat step 2 to step 5.

11. Torque bleeder as specified.

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

12. Refill reservoir.
13. Install diaphragm and cover on reservoir.

Brake Hose, Pads and Disc Inspection

Break-In	Scheduled Maintenance	Storage	Preseason
✔	✔		✔

Break-In Inspection

Visually inspect the brake hose for leaks or any damage.

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

Scheduled Maintenance and Preseason

Visually inspect the brake hose for leaks or any damage.

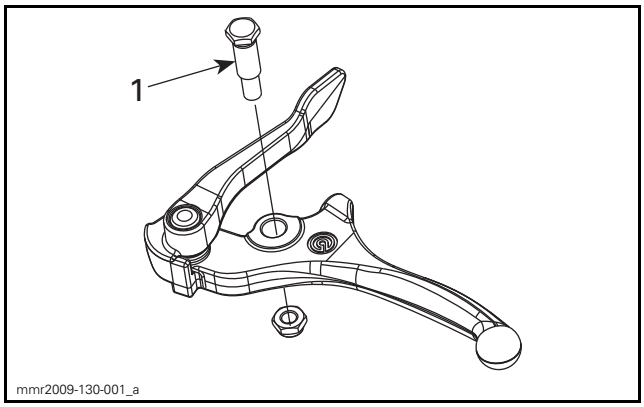
Refer to *BRAKE* subsection and carry out:
– *BRAKE PAD INSPECTION*
– *BRAKE DISC INSPECTION*.

Brake Lever Pivot Lubrication

Break-In	Scheduled Maintenance	Storage	Preseason
		✔	

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 (53 lbf•**in**)

CHASSIS (SUSPENSION)

Front Suspension Inspection

Break-In	Scheduled Maintenance	Storage	Preseason
✔	✔		✔

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

Rear Suspension, Stopper Strap and Slider Shoes Inspection

Break-In	Scheduled Maintenance	Storage	Preseason
✔	✔		✔

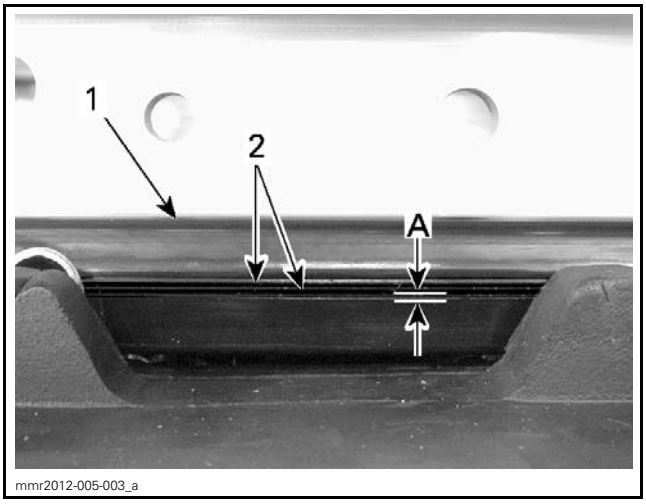
Rear Suspension Mechanism and Stopper Strap Inspection

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.

Slider Shoe Inspection

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)

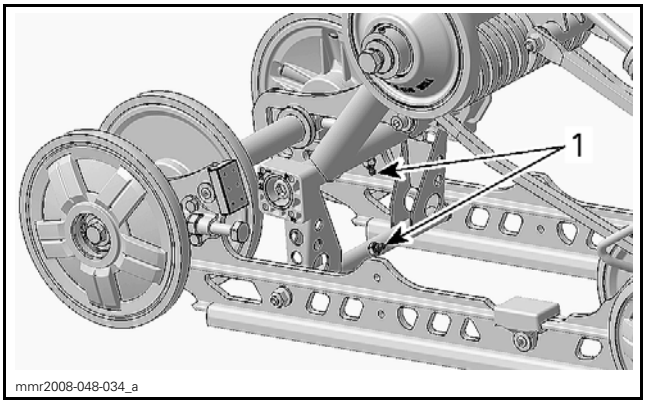
NOTICE Slider shoes must always be replaced in pairs.

Rear Suspension Lubrication

Break-In	Scheduled Maintenance	Storage	Preseason
	✔	✔	

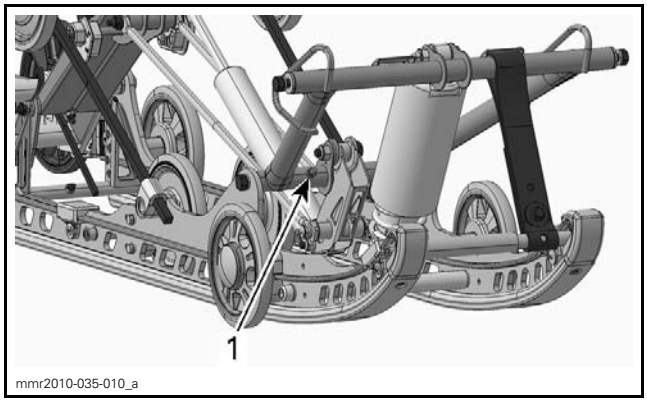
Lubricate the following suspension pivots at grease fittings using SUSPENSION GREASE (P/N 293 550 033).

Lubrication (SC-5)

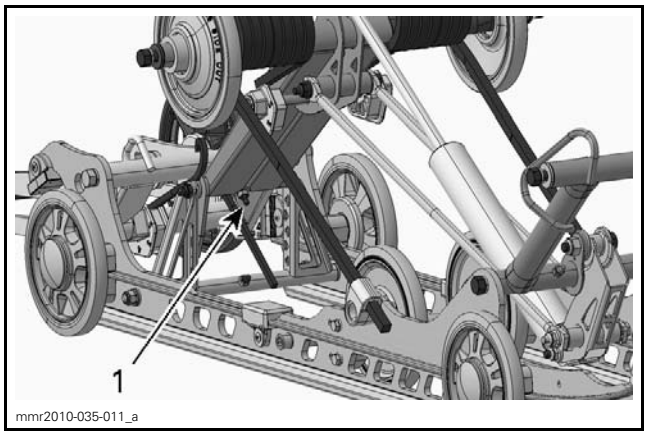


REAR ARM PIVOT AND PIVOT ARM
1. Grease fittings

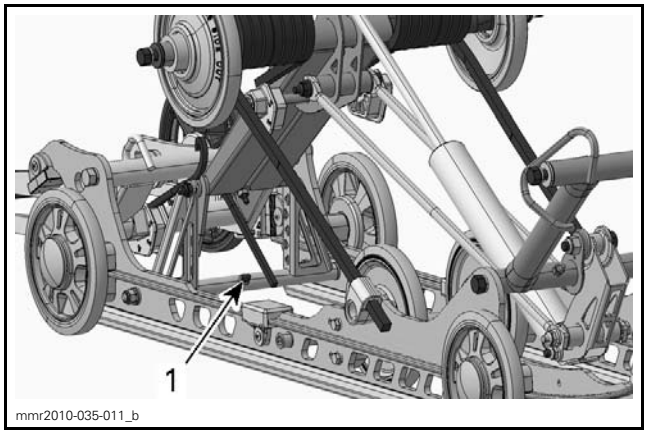
Lubrication (SC™-5M)



FRONT ARM PIVOT
1. Grease fitting

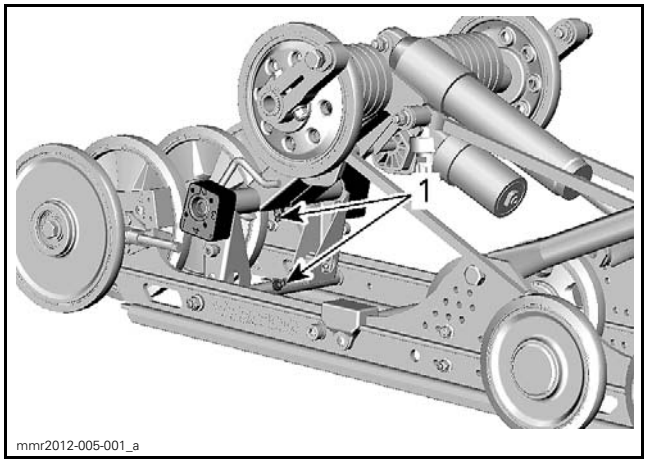


REAR ARM PIVOT
1. Grease fitting

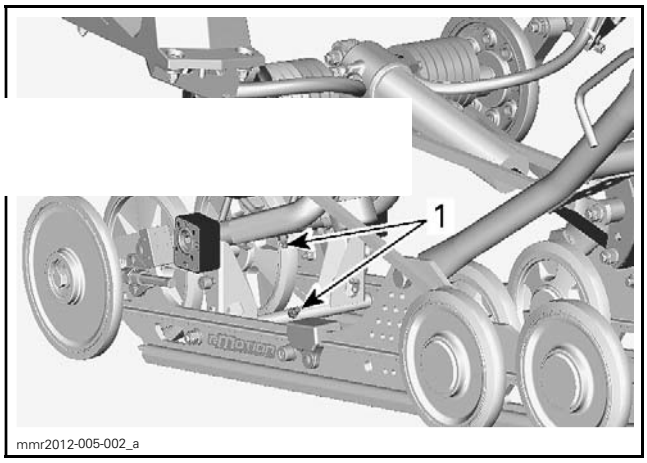


PIVOT ARM
1. Grease fitting

Lubrication (rMotion)



REAR ARM PIVOT AND PIVOT ARM (WITHOUT QUICK ADJUST)
1. Grease fittings



REAR ARM PIVOT AND PIVOT ARM (WITH QUICK ADJUST)
1. Grease fittings

CHASSIS (STEERING)

Ski and Runner Inspection

Break-In	Scheduled Maintenance	Storage	Preseason
✔			✔

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

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

Steering Mechanism Inspection

Break-In	Scheduled Maintenance	Storage	Preseason
✔	✔		✔

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 charged during storage
Block muffler outlet with rags
Lift rear of vehicle until track is clear of the ground. Do not release track tension

⚠ CAUTION Use appropriate lifting device or have assistance to share lifting stress. If a lifting device is not used, use proper lifting techniques, notably using your legs force. Do not attempt to lift the rear of vehicle if it is above your limits.

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

PRESEASON PREPARATION

Proper vehicle preparation is necessary after the summer months or when a vehicle has not been used for more than three months.

Procedures are detailed in *PERIODIC MAINTENANCE PROCEDURES* subsection.

PRESEASON PREPARATION
Inspect engine rubber mounts
Check exhaust system condition and check for leaks
Tighten exhaust manifold screws or nuts to specified torque
Inspect cooling system cap, hoses and clamps
Check coolant density
Inspect crankshaft PTO seal
Inspect fuel lines and connections
Clean and inspect throttle body
Inspect throttle cable
Inspect drive belt (adjust at every drive belt replacement)
Clean and visually inspect drive pulley
Clean and inspect driven pulley
Inspect, adjust and align track
Adjust drive chain
Change chaincase oil
Check brake fluid level
Inspect brake hose, pads and disc
Inspect steering mechanism
Inspect skis and runners
Inspect front suspension
Inspect rear suspension stopper strap
Charge battery (**if so equipped**)
Adjust headlight beam aiming

ENGINE REMOVAL AND INSTALLATION

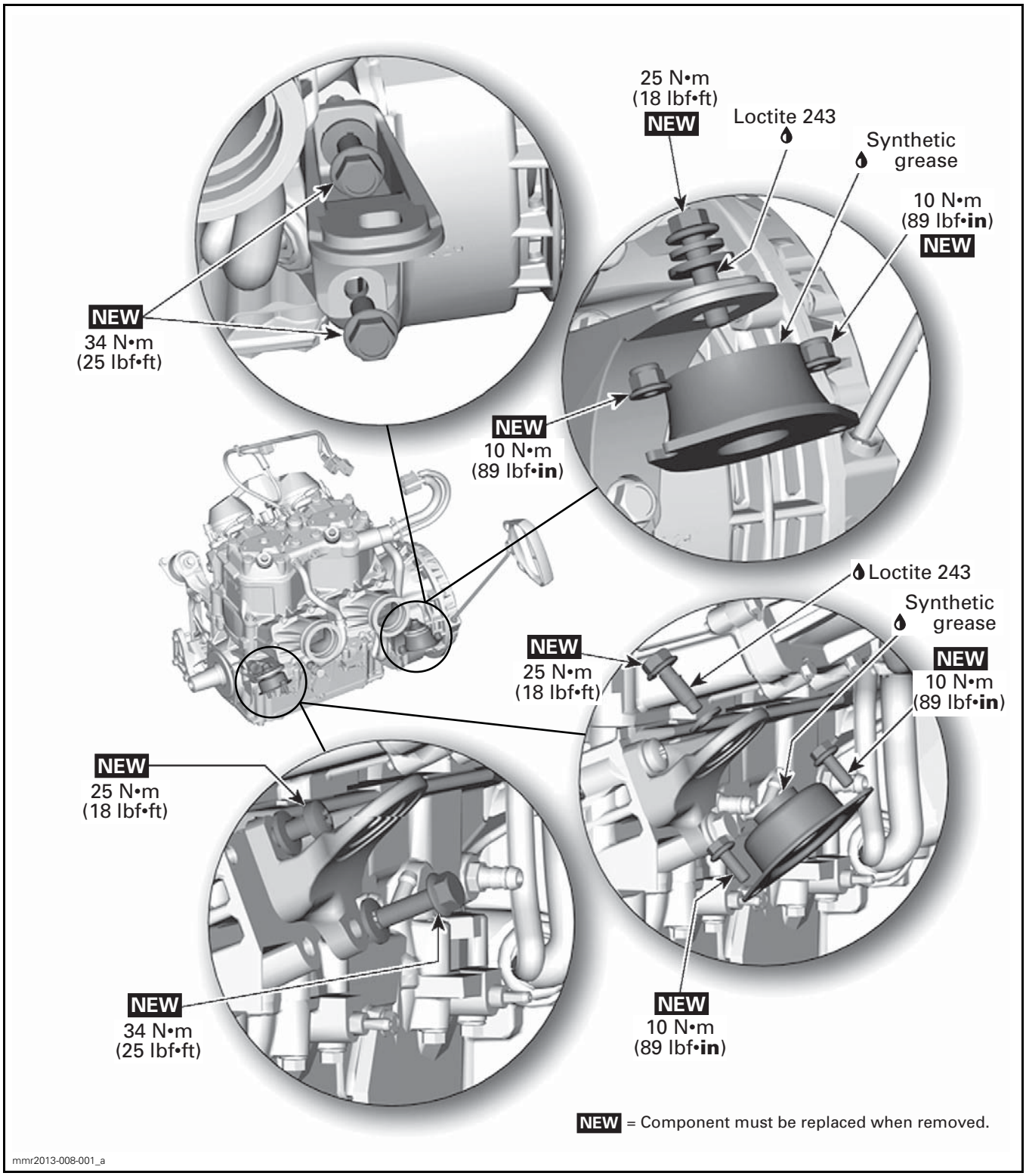
SERVICE TOOLS

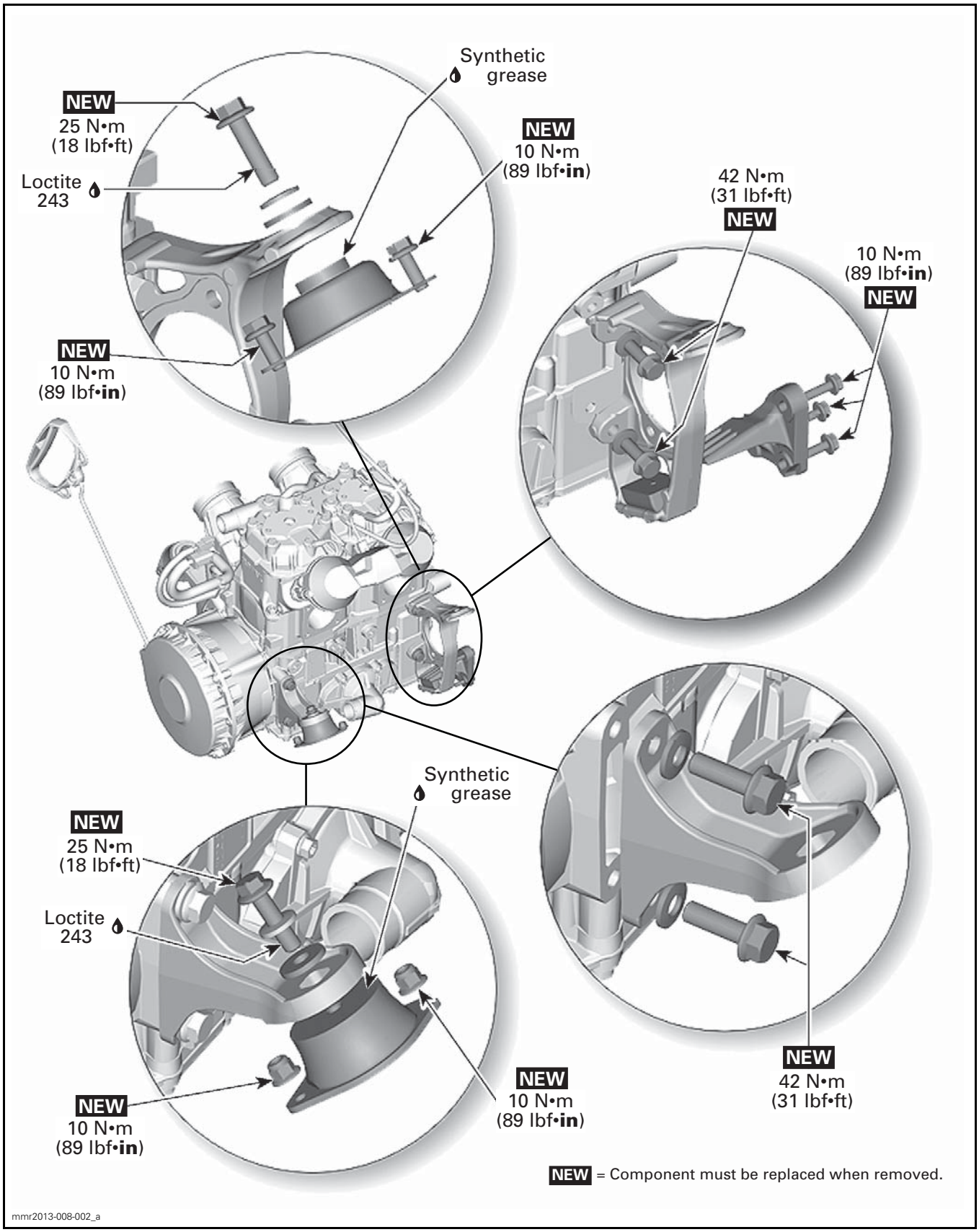
Description	Part Number	Page
ENGINE LIFTING HOOK	529 035 829	7, 10–11
ENGINE LIFTING TOOL	529 036 131	7, 10–11
SMALL HOSE PINCHER	295 000 076	7

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	10

600 HO E-TEC and 800R E-TEC




Synthetic grease
NEW
25 N•m
(18 lbf•ft)
Loctite 243
NEW
10 N•m
(89 lbf•in)
NEW
10 N•m
(89 lbf•in)
42 N•m
(31 lbf•ft)
NEW
10 N•m
(89 lbf•in)
NEW
Synthetic grease
NEW
25 N•m
(18 lbf•ft)
Loctite 243
NEW
10 N•m
(89 lbf•in)
NEW
10 N•m
(89 lbf•in)
NEW
42 N•m
(31 lbf•ft)
NEW = Component must be replaced when removed.
mmr2013-008-002_a

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.

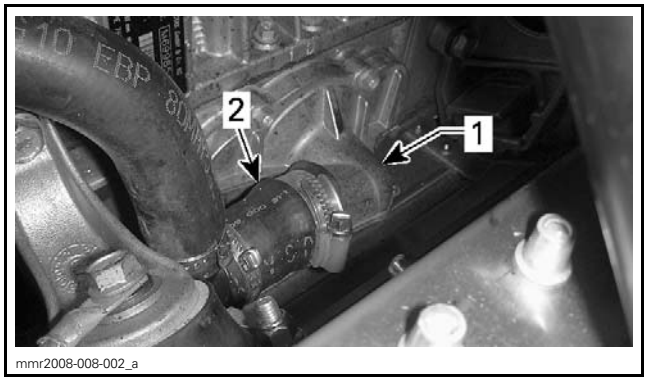
NOTICE **Hoses, cables and locking ties removed during a procedure must be reinstalled as per factory standards.**

PROCEDURES

ENGINE

Engine Removal

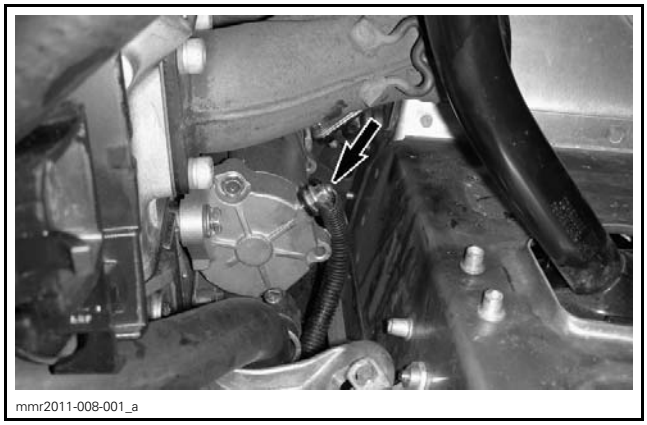
1. Place vehicle at workstation that will have access to an engine-lifting hoist.
2. Remove fuel pressure using B.U.D.S. software. Refer to *ELECTRIC FUEL PUMP* in *FUEL TANK AND FUEL PUMP* subsection.
3. Refer to *BODY* subsection and remove:
   – LH and RH side panels
   – Upper body module
   – Front bottom pan cover.
4. Refer to *AIR INTAKE SYSTEM* subsection and remove the primary air intake silencer.
5. Refer to *EXHAUST SYSTEM* subsection and remove:
   – Muffler
   – Tuned pipe.
6. Remove drive pulley. Refer to *DRIVE PULLEY* subsection.
7. Refer to *DRIVEN PULLEY AND COUNTERSHAFT* subsection and remove:
   – Driven pulley
   – Countershaft bearing support.
8. Place a drain pan under engine compartment.
9. Disconnect water pump hose to drain engine coolant.



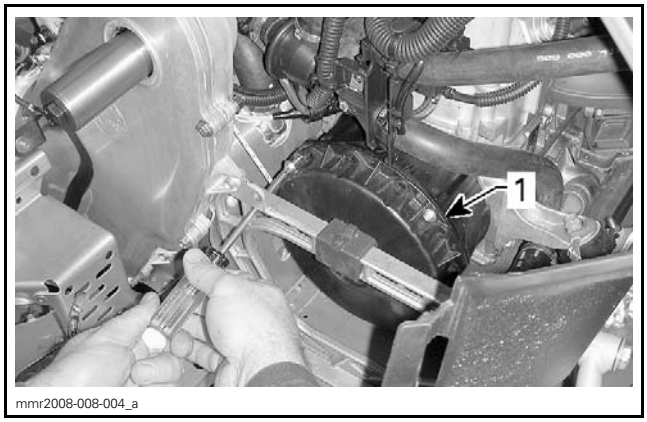
mmr2008-008-002_a

1. Water pump cover
2. Remove this hose

10. On **applicable models**, disconnect electric starter wire.


mmr2011-008-001_a

11. On **applicable models**, remove rewind starter cover screws and place rewind starter housing aside.



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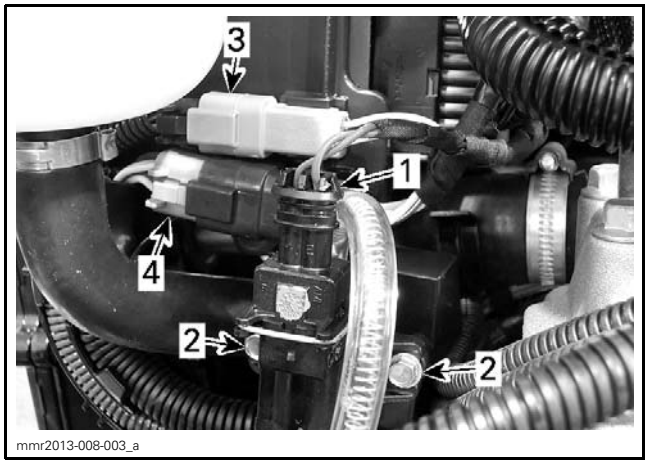
TYPICAL
1. Rewind starter cover

12. Disconnect 3D RAVE solenoid connector.
13. Remove screws securing 3D RAVE solenoid.
14. Disconnect CPS sensor and magneto connectors.



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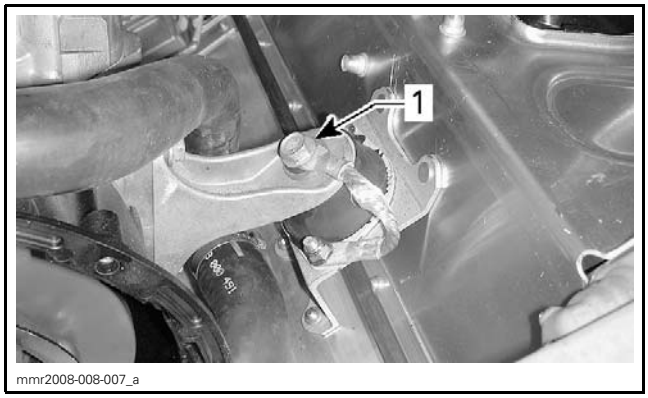
1. *3D RAVE solenoid connector*
2. *3D RAVE solenoid retaining screws*
3. *CPS sensor connector*
4. *Magneto connector*

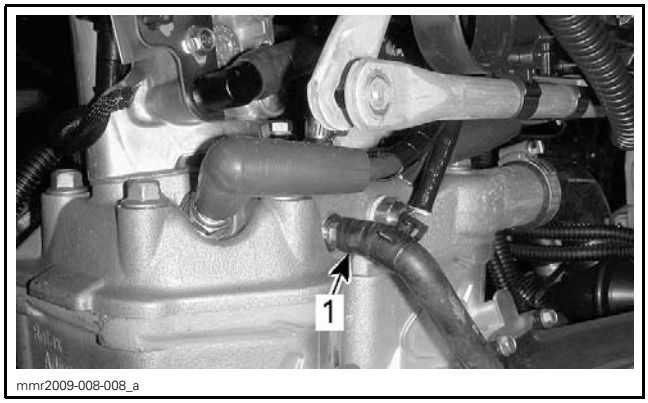
15. Remove and discard screw securing front MAG engine support to front rubber mount.



mmr2008-008-007_a

1. *Front engine support screw*

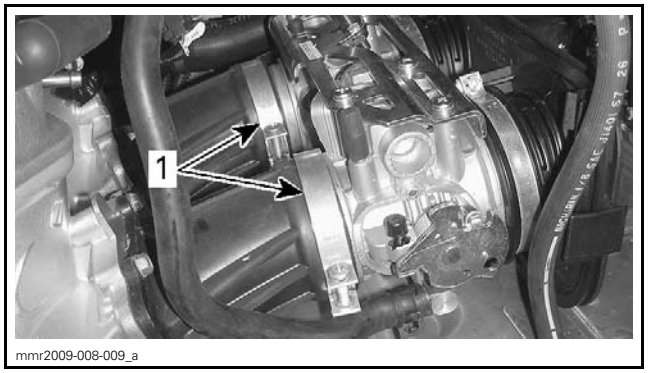
16. Remove throttle body heater hose from the cylinder head.



mmr2009-008-008_a

1. *Heater hose*

17. Unscrew clamps securing throttle body to intake adapters.



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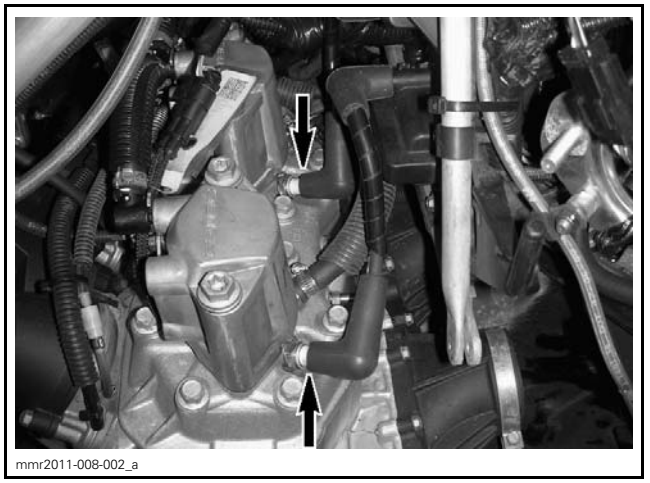
1. *Throttle body clamps*

18. Move and attach throttle body aside.
19. Disconnect spark plug cables.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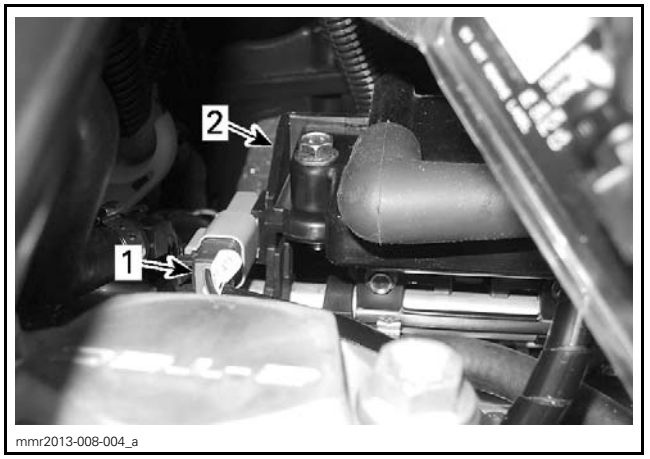
20. Disconnect coolant temperature sensor (CTS) connector (at the RH of ignition coil).



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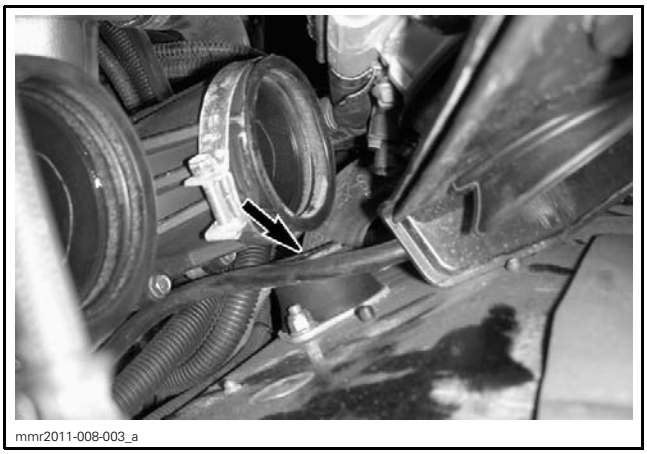
1. *CTS connector*
2. *Ignition coil*

21. Remove and discard screw securing rear MAG engine support to rear rubber mount.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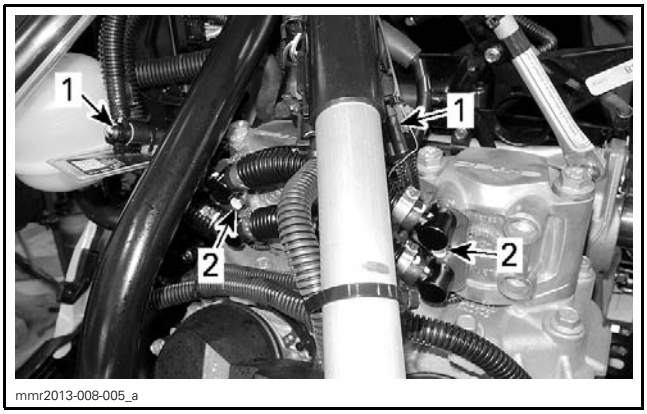
22. Disconnect coolant hose from cylinder head.

mmr2009-008-013_a

1. Coolant hose

23. Disconnect fuel injector connectors.
24. Remove screws that attach fuel injector hose retainers to fuel injectors.



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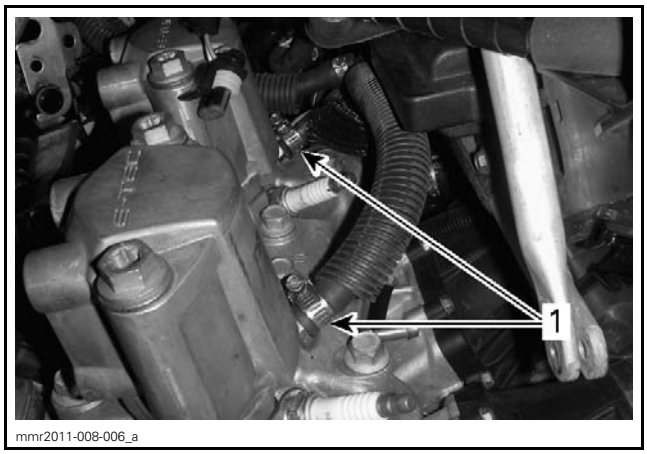
1. Fuel injector connectors
2. Fuel injector hose retainer screws

25. Place a rag at the bottom of fuel injectors and unplug fuel hoses from fuel injectors.
26. Disconnect coolant hoses on the top of cylinder head.



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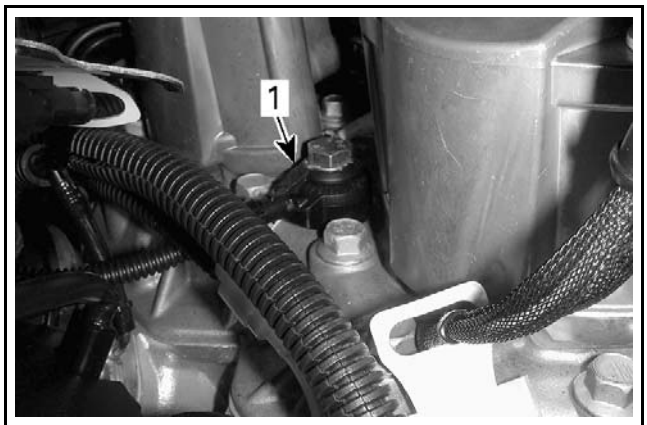
TYPICAL
1. Coolant hoses from coolant reservoir

27. Remove knock sensor from cylinder head.



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1. Knock sensor

28. Remove spark plugs from engine.
29. Disconnect 3D RAVE connector.


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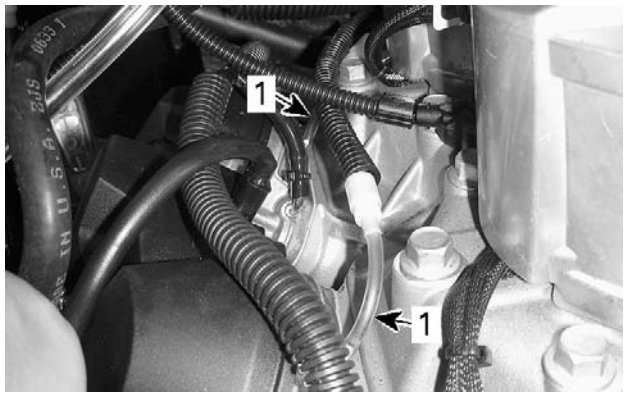
30. Disconnect oil hoses from 3D RAVE valves.



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TYPICAL

1. 3D RAVE valve oil hoses

31. Install engine lifting tool into knock sensor retaining hole.

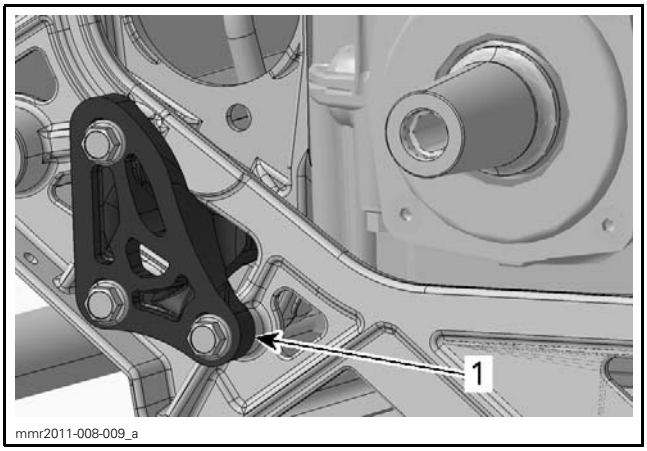
REQUIRED TOOL	
ENGINE LIFTING TOOL (P/N 529 036 131)	

NOTE: Use knock sensor screw to secure lifting tool on cylinder head.

32. Place engine lifting hook into lifting tool rings.

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

33. Remove engine stopper. Discard screws.



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1. Engine stopper

34. Remove and discard screws securing PTO engine supports to front and rear rubber mounts.

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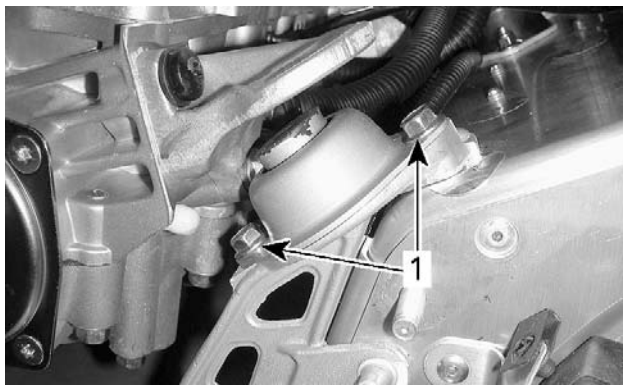
1. Front engine support screw
2. Rear engine support screw

35. Slightly lift the engine.

36. Remove PTO rear rubber mount.



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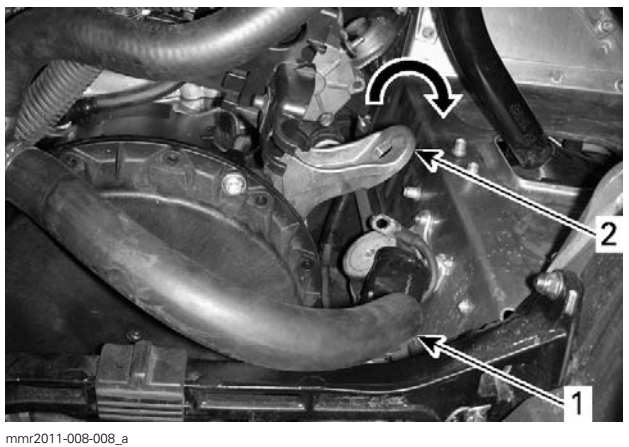
1. Rubber mount screws

37. Clear coolant hose from MAG front engine support.



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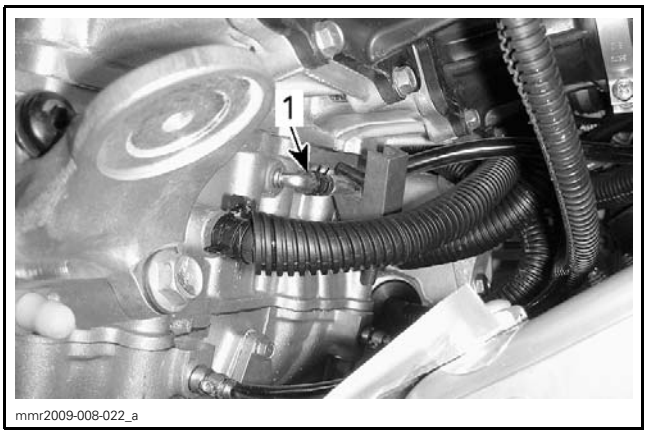
1. Coolant hose
2. Front MAG engine support

38. Block the oil return hose.

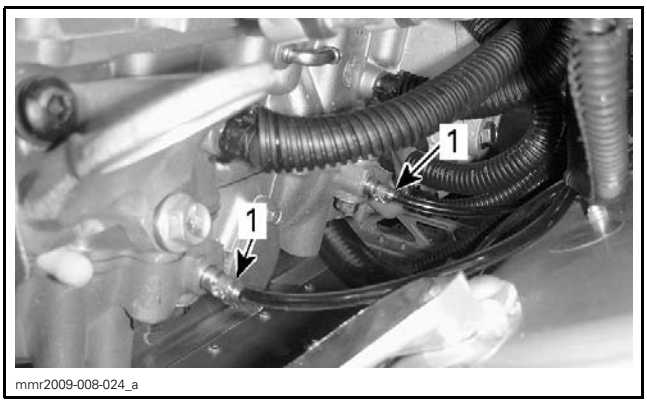
REQUIRED TOOL	
SMALL HOSE PINCHER (P/N 295 000 076)	

39. Disconnect oil return hose.



1. Oil return hose

40. Disconnect oil inlet hoses from crankcase. Discard Oetiker clamps.



1. Inlet hoses

41. Lift engine and slide it out of vehicle.

NOTICE Pay attention not to damage fuel hoses or adapters.

Engine Installation

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

– Install NEW self-locking screws where required, refer to exploded views at the beginning of this subsection.
– Install NEW Oetiker clamps when installing oil inlet hoses.
– Install and tighten engine support bolts. Refer to *ENGINE SUPPORT INSTALLATION* in this subsection.
– Install and adjust engine stopper. Refer to *ENGINE STOPPER ADJUSTMENT* in this subsection.
– Oil hoses must be routed correctly to avoid lubrication problems. To route hoses correctly, refer to *OIL INJECTION PUMP HOSES CONNECTION* in *LUBRICATION SYSTEM* subsection.
– When engine installation is completed, bleed oil system. Refer to *LUBRICATION SYSTEM* subsection.
– If a new engine is installed or the engine was repaired, restart the break-in procedure in B.U.D.S..

ENGINE STOPPER

Engine Stopper Adjustment

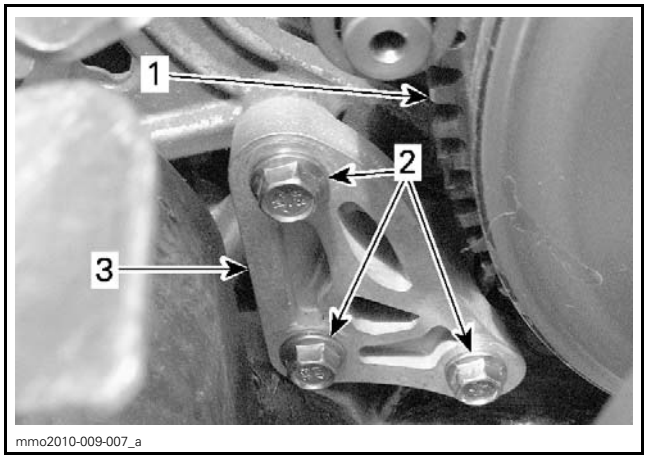
Summit Models

On these models, there is no play between engine stopper and rubber stop block (on engine).

All Other Models

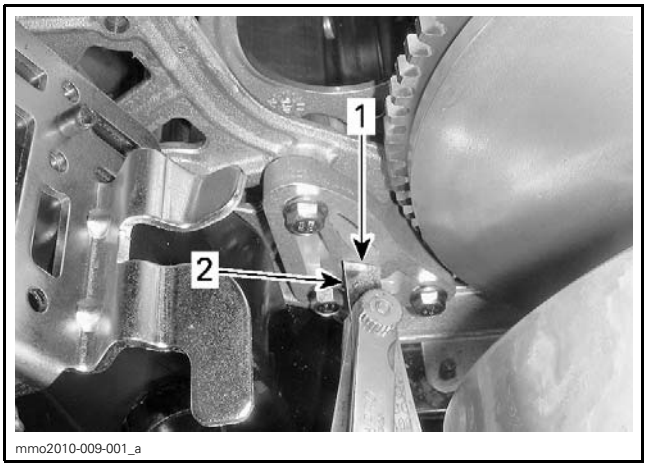
The engine stopper is located on the LH front engine support, in front of the drive pulley.

1. Remove LH side panel, refer to *BODY* subsection.
2. Remove drive belt guard, refer to *DRIVE BELT* subsection.
3. Loosen the three screws retaining engine stopper to engine support just enough to allow a vertical play (1/2 to one turn).



1. Drive pulley
2. Engine stopper screws
3. Engine stopper

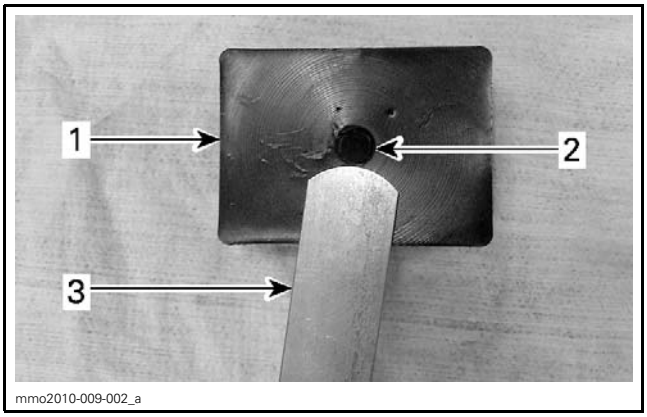
4. Insert a 0.5 mm (.02 in) feeler gauge in the engine stopper opening (see illustration).



1. Opening
2. Feeler gauge

5. Place feeler gauge between engine stopper and rubber stop block (on engine).

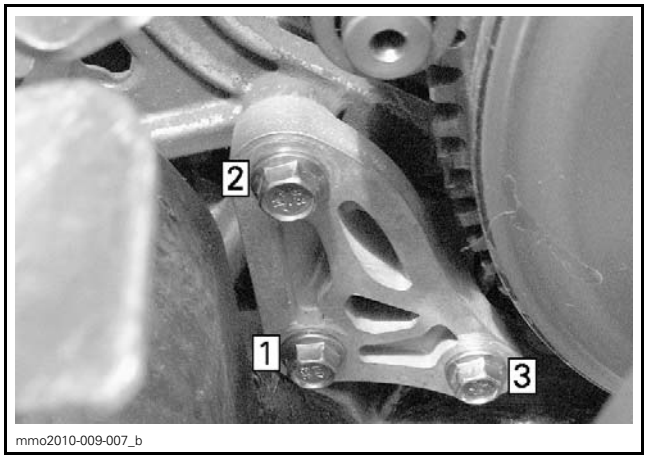
NOTE: Do not insert the feeler gauge too deep, as it will pass over the bump at the surface of the rubber stop block and alter adjustment. See illustration.



TYPICAL
1. Rubber stop block
2. Bump
3. Feeler gauge

6. Tighten engine stopper screws to specification following the illustrated sequence.

TIGHTENING TORQUE	
Engine stopper screws	10 N•m (89 lbf•**in**)



TIGHTENING SEQUENCE

NOTE: Take care not to pinch the feeler gauge.

NOTICE **Serious pulley damage can occur if the engine stopper and its screws are not properly installed.**

ENGINE SUPPORT

Engine Support Inspection

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

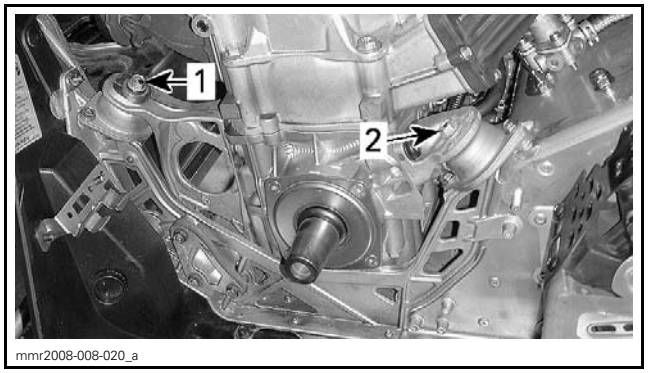
PTO Side Engine Support Removal (Engine not Removed)

NOTE: On **vehicle with electric starter**, remove the electric starter. Refer to *STARTING SYSTEM* subsection.

Remove drive and driven pulleys. Refer to *DRIVE PULLEY* and *DRIVEN PULLEY AND COUNTERSHAFT* subsections.

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

Remove and discard screws securing PTO engine supports to front and rear rubber mount adapters.



1. Front engine support screw
2. Rear engine support screw

Insert a pry bar over the LH frame member and gently raise the engine just enough to remove engine weight from support.

Remove and discard screws retaining engine support to engine.

Remove engine support.

MAG Side Engine Support Removal (Engine not Removed)

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

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

Remove primary air intake silencer. Refer to *AIR INTAKE SYSTEM* subsection.

Unscrew clamps retaining throttle body to intake adapters.

Move and attach throttle body aside.

Remove knock sensor.

Install the engine lifting tool into knock sensor retaining hole.

REQUIRED TOOL	
ENGINE LIFTING TOOL (P/N 529 036 131)	

NOTE: Use knock sensor screw to secure lifting tool on cylinder head.

Place the engine lifting hook into lifting tool rings.

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

Remove and discard screws securing engine supports to rubber mount adapters.

Lift engine.

Remove and discard screws retaining engine support to engine.

Remove engine support.

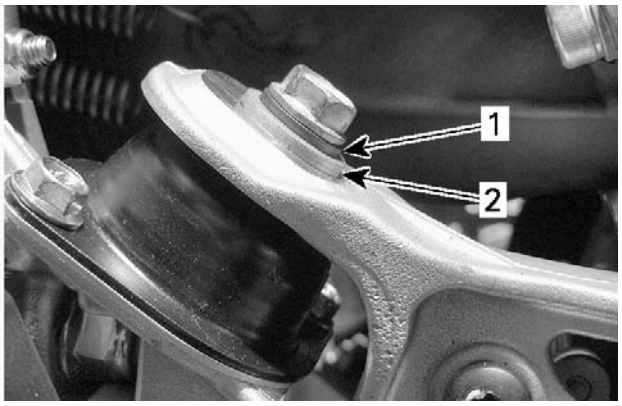
Engine Support Installation

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

NOTICE **Engine stopper must be adjusted after installing engine support.**

Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on the first two threads of the engine support screws.

Front engine supports (PTO and MAG sides) are secured using a conical washer and a flat washer.



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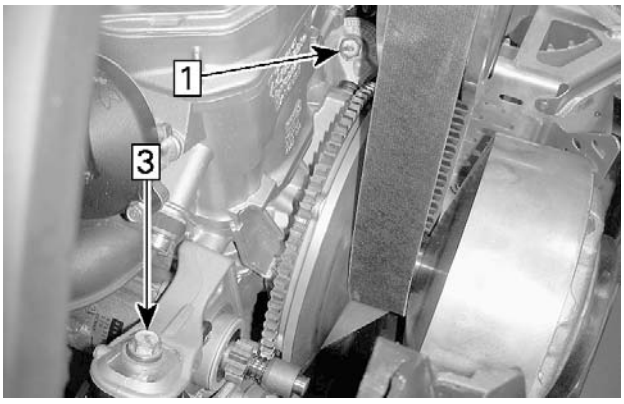
FRONT ENGINE MOUNT (PTO SIDE)
1. Conical washer
2. Flat washer

Tighten engine supports screws to specification.

ENGINE SUPPORT SCREWS	
Tightening Torque	25 N•m (18 lbf•ft)
Tightening Sequence	1 = Rear engine support (PTO side)
	2 = Front engine support (PTO side)
	3 = Rear engine support (MAG side)
	4 = Front engine support (MAG side)



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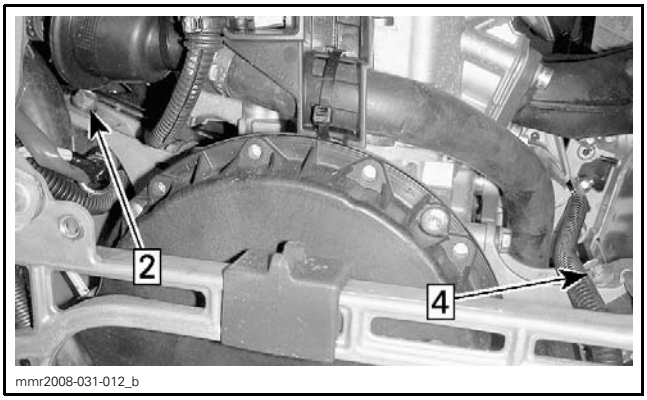
TYPICAL — PTO SIDE
Step 1: Rear engine support (PTO side)
Step 3: Front engine support (PTO side)



TYPICAL — MAG SIDE
Step 2: Rear engine support (MAG side)
Step 4: Front engine support (MAG side)

Adjust engine stopper, refer to *ENGINE STOPPER ADJUSTMENT* in this subsection.

ENGINE RUBBER MOUNTS

Engine Rubber Mount Inspection

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

Engine Rubber Mount Removal

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

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

Remove primary air intake silencer. Refer to *AIR INTAKE SYSTEM* subsection.

Unscrew clamps retaining throttle bodyto intake adapters.

Move and attach throttle body aside.

Remove knock sensor.

Install the engine lifting tool into knock sensor retaining hole.

REQUIRED TOOL	
ENGINE LIFTING TOOL (P/N 529 036 131)	

NOTE: Use knock sensor screw to secure lifting tool on cylinder head.

Place the engine lifting hook into lifting tool rings.

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

Remove and discard screws securing engine supports to rubber mount adapters.

Lift engine.

Unscrew screws or nuts securing engine rubber mounts to frame.

Engine Rubber Mount Installation

The installation is the reverse of the removal procedure.

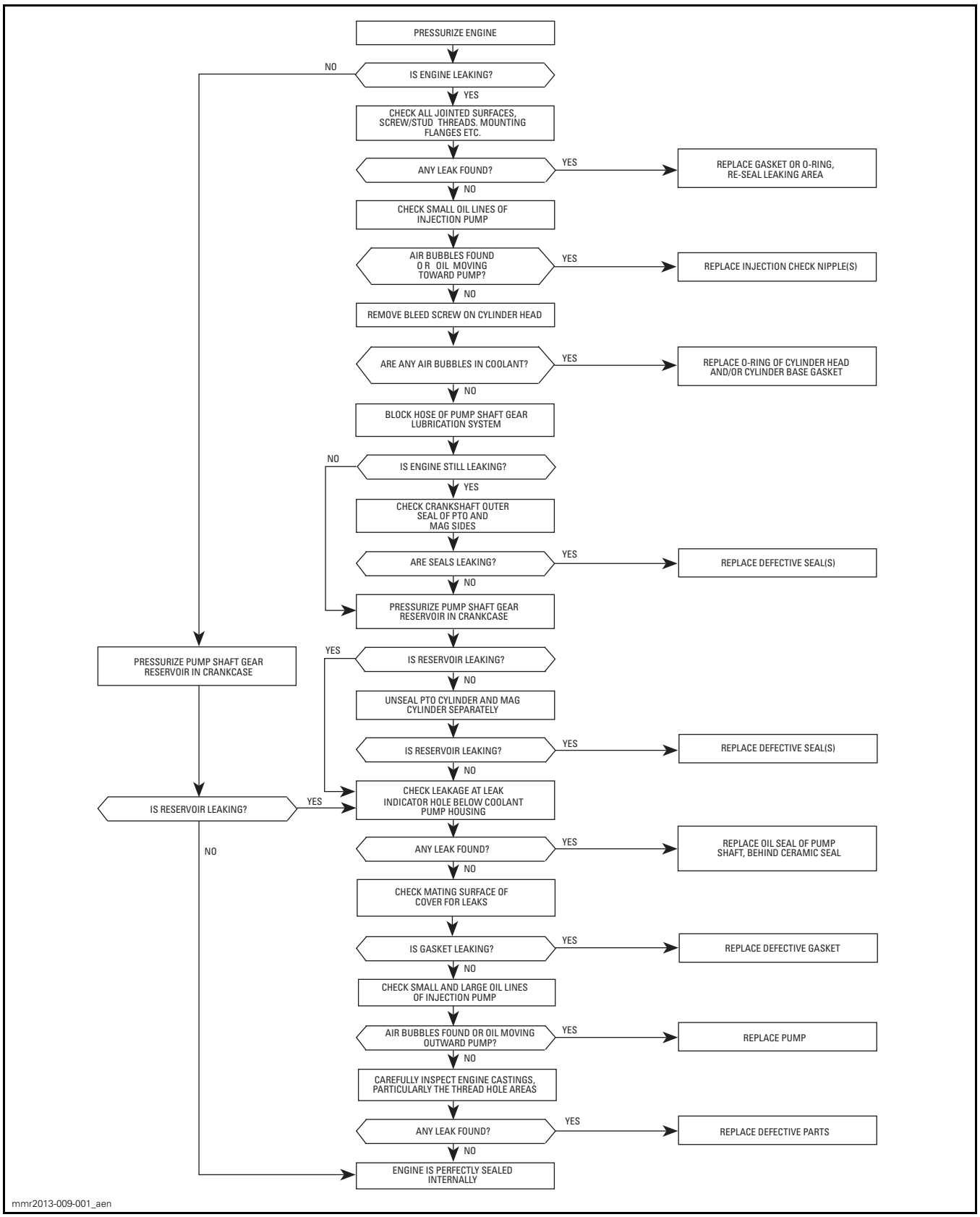
ENGINE LEAK TEST

SERVICE TOOLS

Description	Part Number	Page
INTAKE PLUG	529 036 203	3
MANIFOLD PLUG 63 MM (2-1/2")	529 035 961	3
SMALL HOSE PINCHER	295 000 076	3
VACUUM/PRESSURE PUMP	529 021 800	3

PROCEDURES

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

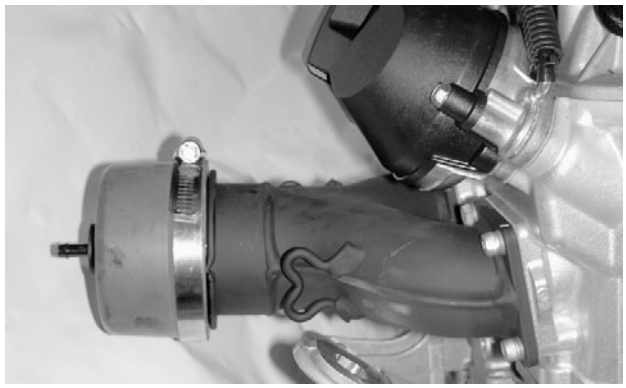


ENGINE LEAK TEST

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. 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)	

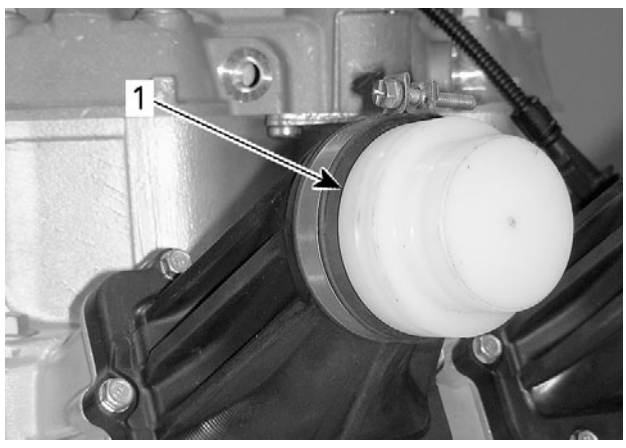

mmr2009-009-001

TYPICAL

3. Insert an intake plug in each intake adapters.

REQUIRED TOOL	
INTAKE PLUG (P/N 529 036 203)	

4. Tighten with existing clamps.

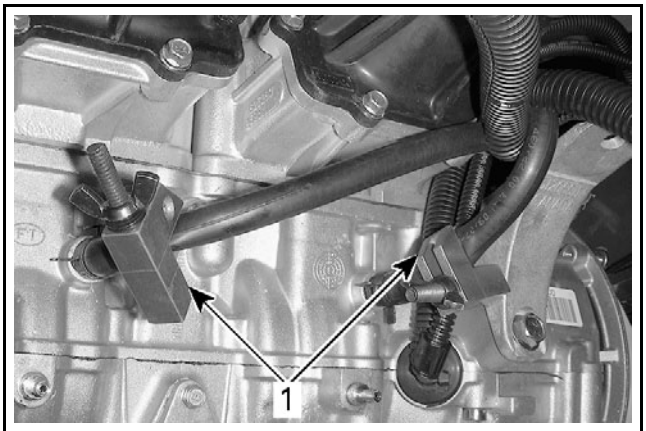


mmr2008-009-001_a

TYPICAL
1. Intake plug

5. Block each impulse hose as applicable.

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



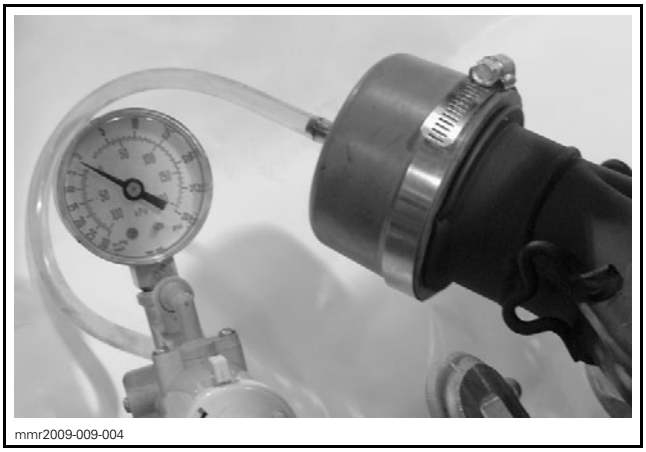
mmr2009-009-003_a

TYPICAL
1. Small hose pinchers

NOTICE Pay attention not to squeeze hose nipples.

6. Pressurize engine.

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


mmr2009-009-004

TYPICAL

ENGINE LEAK TEST	
PRESSURE	TIME (without pressure drop)
34 kPa (5 PSI)	3 minutes

NOTICE Do not exceed the specified pressure.

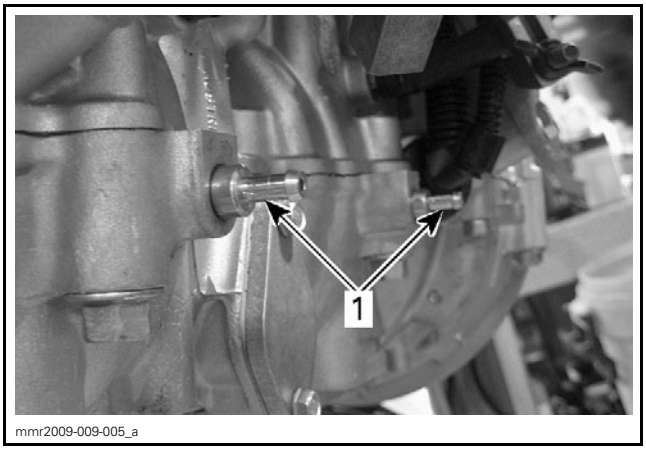
7. If pressure drops before 3 minutes, spray a soapy solution on tester kit (manifold and intake plugs, vacuum/pressure pump and its hose).
   7.1 If tester kit (manifold and intake plugs, hoses and pump) is leaking, bubbles will indicate where leak comes from.
   7.2 If tester kit is not leaking, check 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 bellows, piston and housing
- Cylinder
- Crankcase halves (joint)
- Crankshaft outer seals (PTO and MAG)
- Water pump cover.
- Coolant bleed nipples on cylinder head
- Fuel injector gaskets.

Troubleshooting Tips

Air bubbles or oil column going toward pump may indicates a defective check valve in injection nozzle.



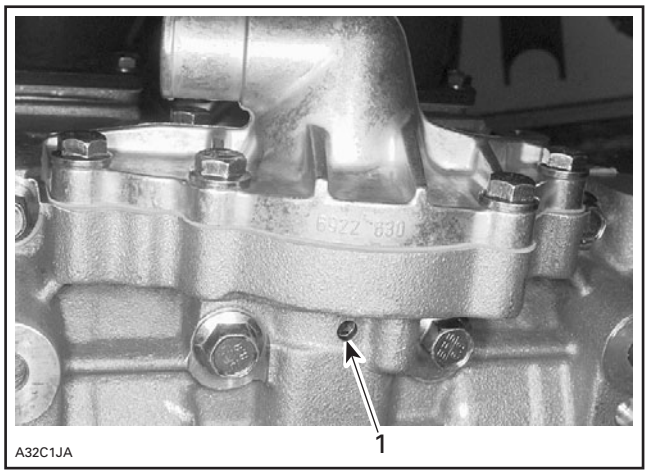
600 HO E-TEC ENGINE SHOWN
1. Injection nipples

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

Check leak indicator hole for oil or coolant. ,

Leaking coolant indicates:
- A defective ceramic seal (on water pump side)
- Defective O-ring on bearing carrier, see appropriate *BOTTOM END* subsection.

Leaking oil indicates:
- A defective oil seal (behind ceramic seal).
- Defective O-ring on bearing carrier, see appropriate *BOTTOM END* subsection.



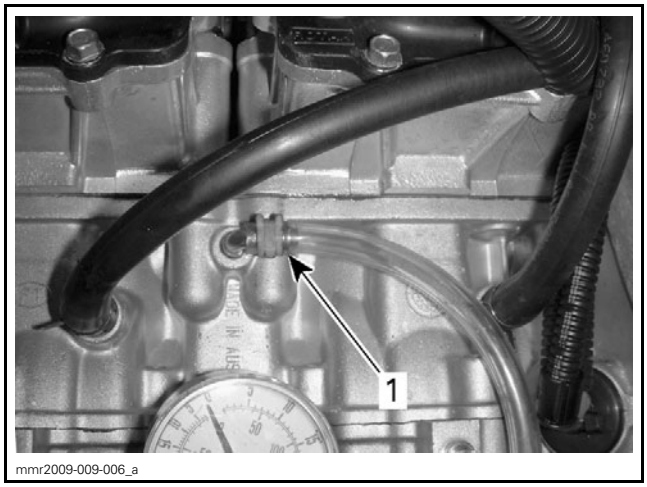
1. Leak indicator hole

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)
34 kPa (5 PSI)	3 minutes

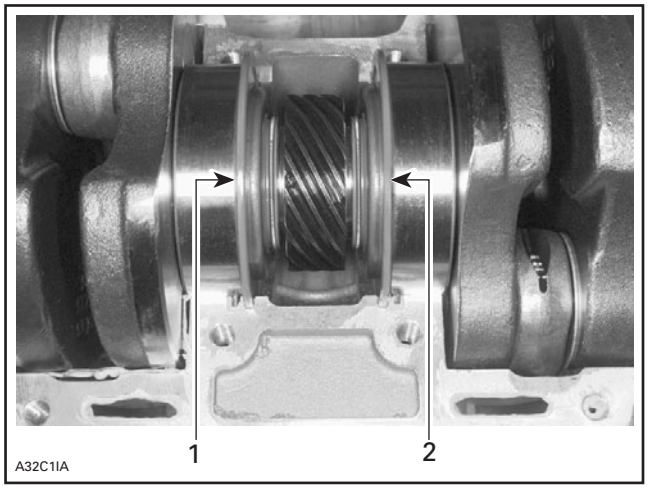
NOTICE Do not exceed the specified pressure.



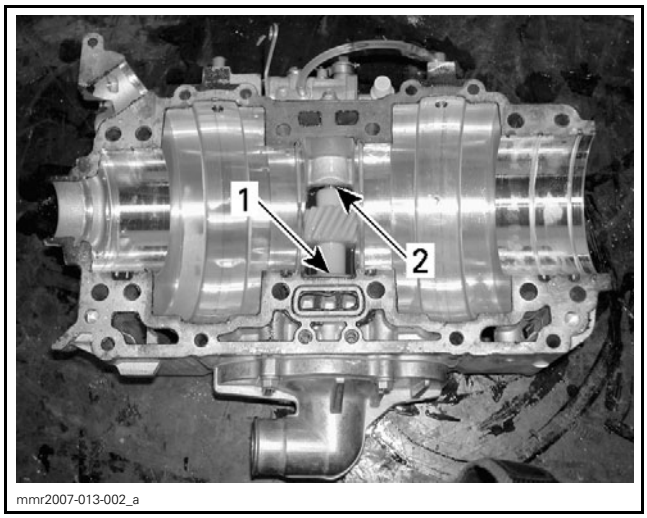
TYPICAL
1. Air pump hose on fitting

If pressure drops check for:
- Leaking cover plate gasket

– Defective O-ring on bearing carrier (see appropriate *BOTTOM END* subsection)
– Defective oil seal on water pump side
– Defective crankshaft inner seal.



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



TYPICAL — CRANKCASE INSIDE VIEW
1. Leakage through water pump oil seal (reservoir side)
2. Leakage on cover plate side (gasket)

ENGINE MEASUREMENT

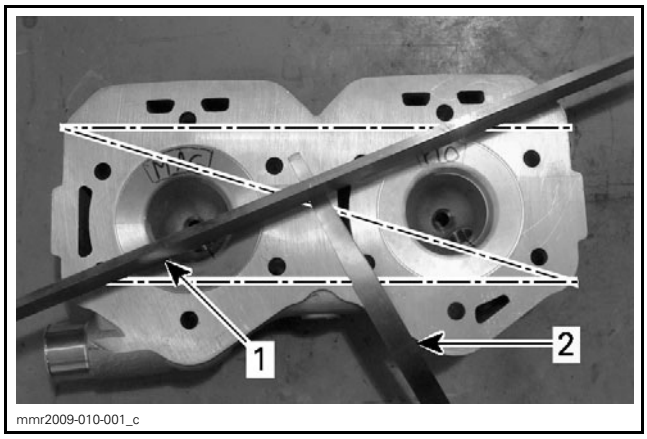
SERVICE TOOLS

PROCEDURES

NOTE: This subsection explains the procedures to correctly measure engine components. For the engine technical specifications, refer to *INSPECTION* in the appropriate *ENGINE* subsection.

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.

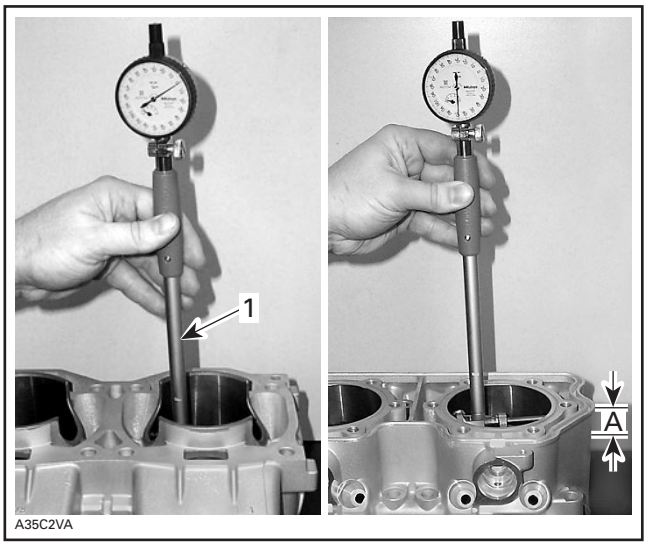


1. Straight edge
2. Feeler gauge

CYLINDER TAPER

1. Measure cylinder diameter in the following locations:
   – Above exhaust port
   – Below intake port.
2. Compare cylinder diameters.
3. If the difference exceeds the specified dimension, the cylinder should be rebored and honed or should be replaced. Nikasil cylinder can be honed using diamond hone but can not be rebored.

NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.

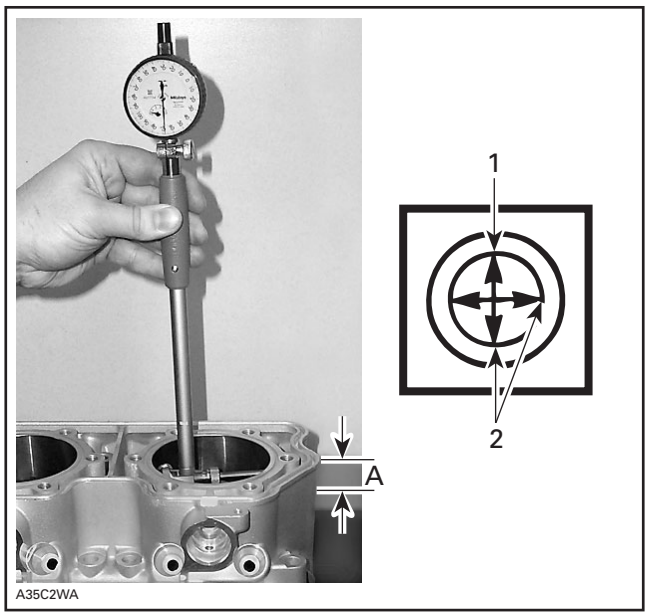


1. Below the intake port
A. Above exhaust port

CYLINDER OUT OF ROUND

1. Measuring above exhaust port with a cylinder gauge, check if the cylinder out of round is more than the specified dimension.
2. If larger, cylinder should be rebored and honed or should be replaced. Nikasil cylinder can be honed using diamond hone but cannot be rebored.

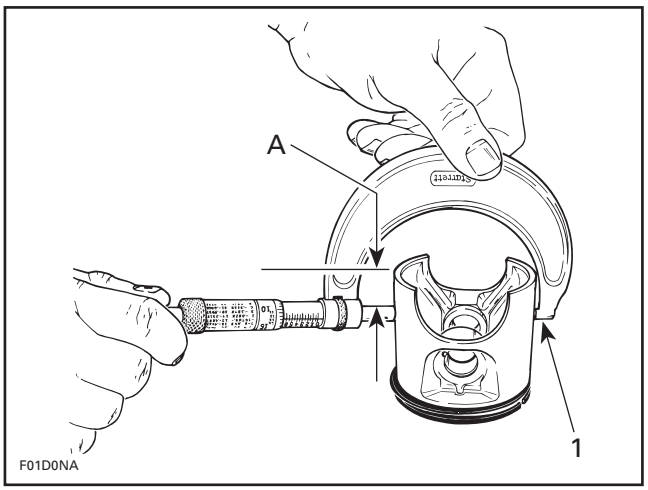
NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.



1. Piston pin position
2. Measures to be compared
A. Above exhaust port

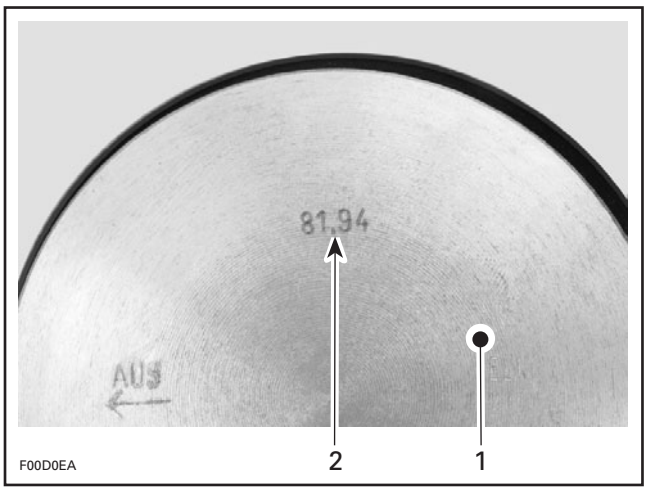
CYLINDER/PISTON CLEARANCE

1. Using a micrometer, measure piston diameter at "A" perpendicularly (90°) to piston pin.



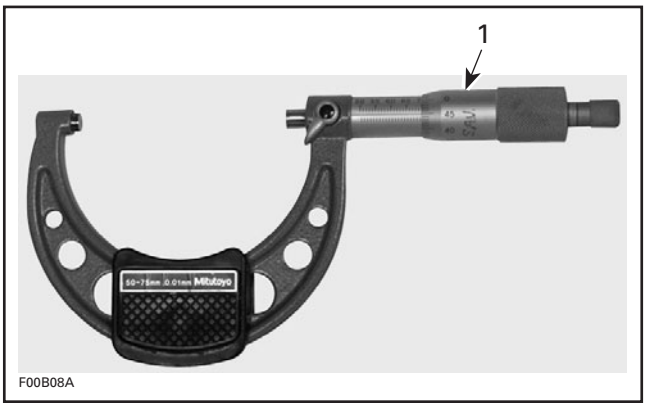
TYPICAL
1. Measuring diameter perpendicularly (90°) to piston pin axis
A. 15 mm (.591 in)

PISTON DIAMETER	
SERVICE LIMIT	Measured diameter must not be less than 0.15 mm (.006 in) of the diameter stamped on piston dome



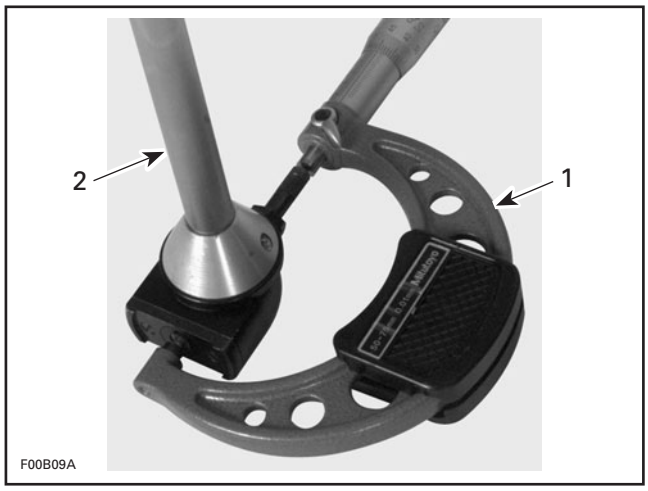
TYPICAL
1. Piston dome
2. Piston diameter marking

2. If piston is out of tolerance, install a new piston.
3. If piston is within tolerance, adjust and lock a micrometer to the piston diameter.

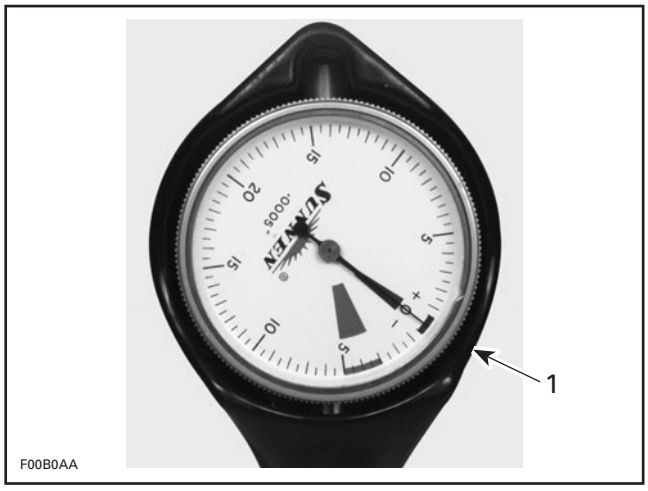


1. Micrometer set to the piston diameter

4. With the micrometer set to the piston diameter, adjust a cylinder bore gauge to the micrometer dimension and set the indicator to 0.



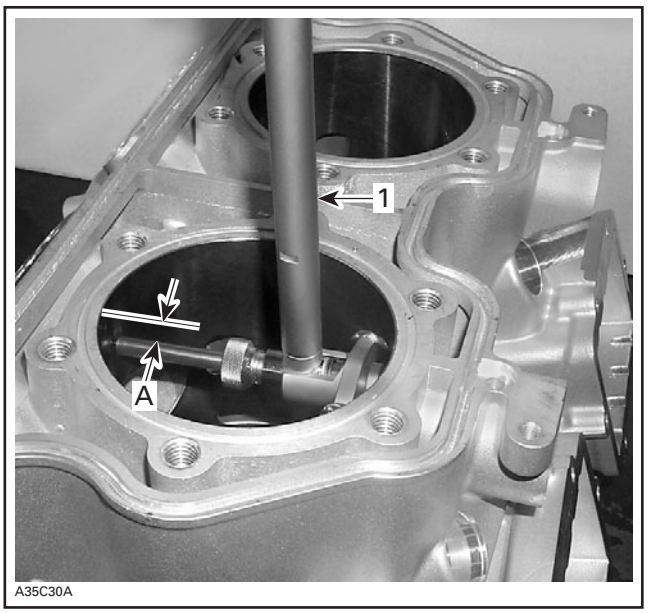
1. Use the micrometer to set the cylinder bore gauge
2. Dial bore gauge



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.

5. Position the dial bore gauge above the exhaust port.
6. IMPORTANT: Always remove cylinder-block from crankcase before measuring.



1. Measuring perpendicularly (90°) to piston pin axis
A. Above exhaust port

7. Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder wall clearance.
8. If clearance exceeds specified tolerance, replace cylinder and piston.

RING/PISTON GROOVE CLEARANCE

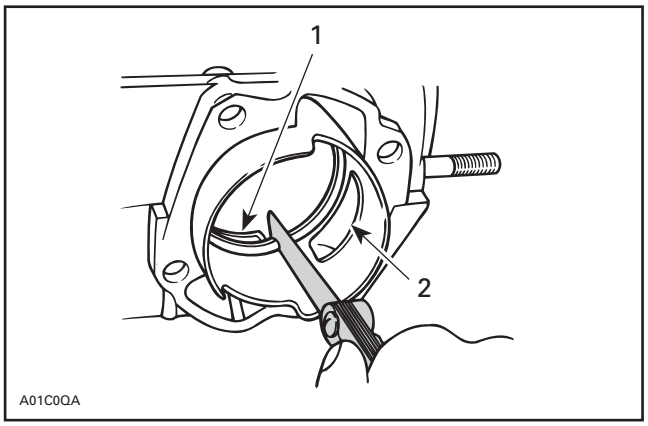
1. Using a feeler gauge check clearance between rectangular ring and groove.
2. Replace piston if clearance exceeds specified tolerance.

RING END GAP

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

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

2. Using a feeler gauge, check ring end gap. Replace ring if gap exceeds specified tolerance.

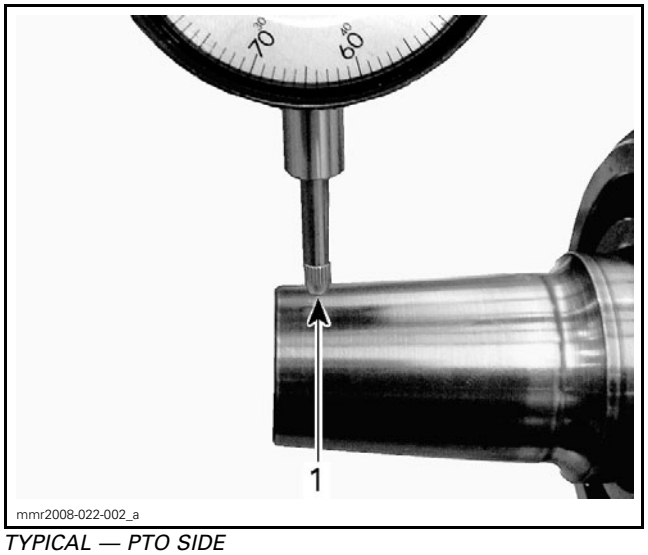


TYPICAL
1. *Transfer port*
2. *Intake port*

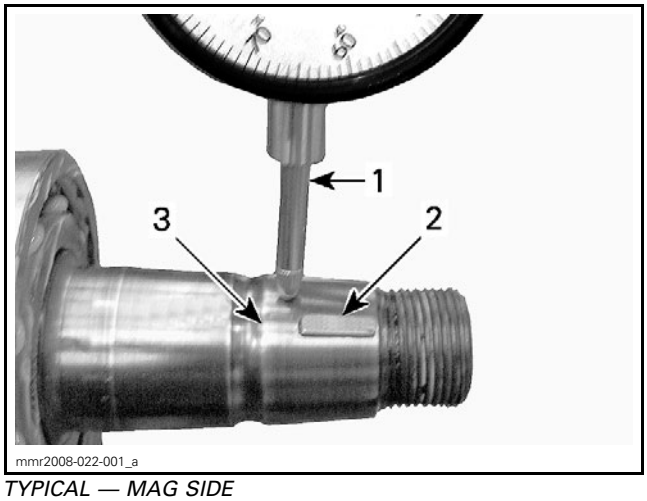
CRANKSHAFT DEFLECTION

Measuring in Crankcase

1. Using a dial indicator, check deflection with crankshaft in crankcase.



TYPICAL — PTO SIDE
1. *Measure deflection 3 mm (1/8 in) from crankshaft end*

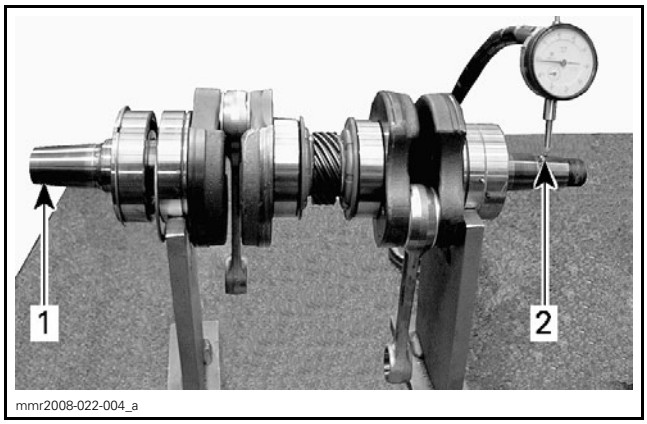


TYPICAL — MAG SIDE
1. *Measure deflection at mid point between key and groove*
2. *Key*
3. *Groove*

2. If deflection exceeds the specified tolerance, recheck deflection using V-shaped blocks to determine the defective part(s). See *MEASURING ON BENCH*.

Measuring on Bench

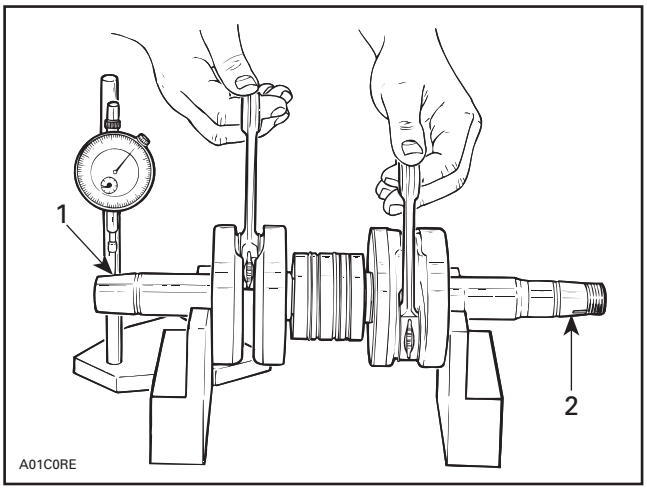
1. Once engine is disassembled, check crankshaft deflection on V-shaped blocks.



TYPICAL — V-SHAPED BLOCKS POSITION WITH BEARINGS
1. *Measure deflection 3 mm (1/8 in) from crankshaft end*
2. *Measure deflection at mid point between key and groove*

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).

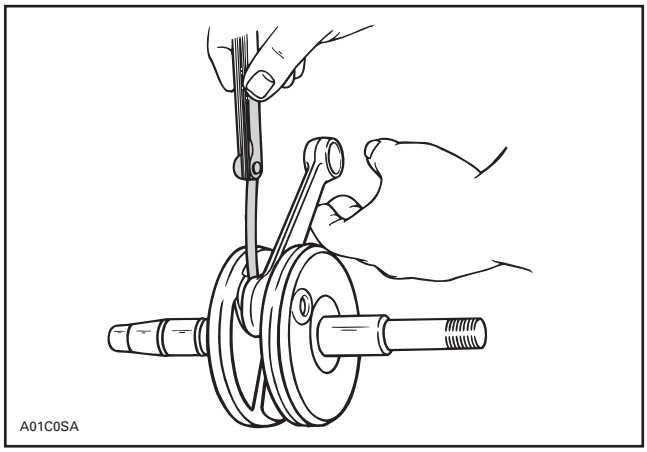


TYPICAL — V-SHAPED BLOCKS POSITION WITHOUT BEARINGS
1. *Measure deflection 3 mm (1/8 in) from crankshaft end*
2. *Measure deflection at mid point between key and groove*

4. If the deflection exceeds the specified tolerance, crankshaft should be repaired or replaced.

CONNECTING ROD BIG END AXIAL PLAY

1. Using a feeler gauge, measure distance between thrust washer and crankshaft counterweight.
2. If the distance exceeds specified tolerance, repair or replace the crankshaft.

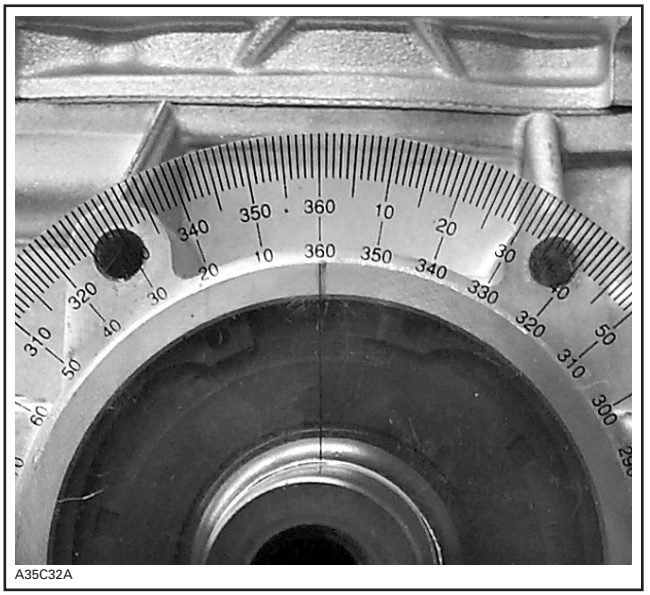


TYPICAL

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)	



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.

PISTON PROJECTION MEASUREMENT

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

Engine Preparation

NOTE: As a troubleshooting step, It is possible to measure piston projection without removing engine from vehicle.

1. Bring PTO piston to TDC.

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

2. Remove cylinder head from engine. Refer to *TOP END* 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.

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.

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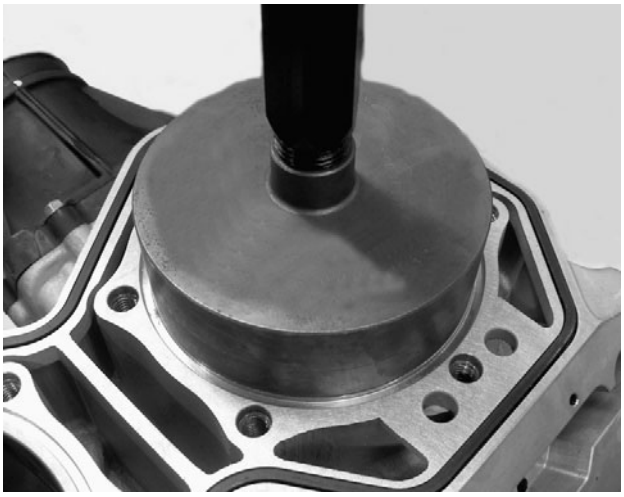
SETTING THE ZERO

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



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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.

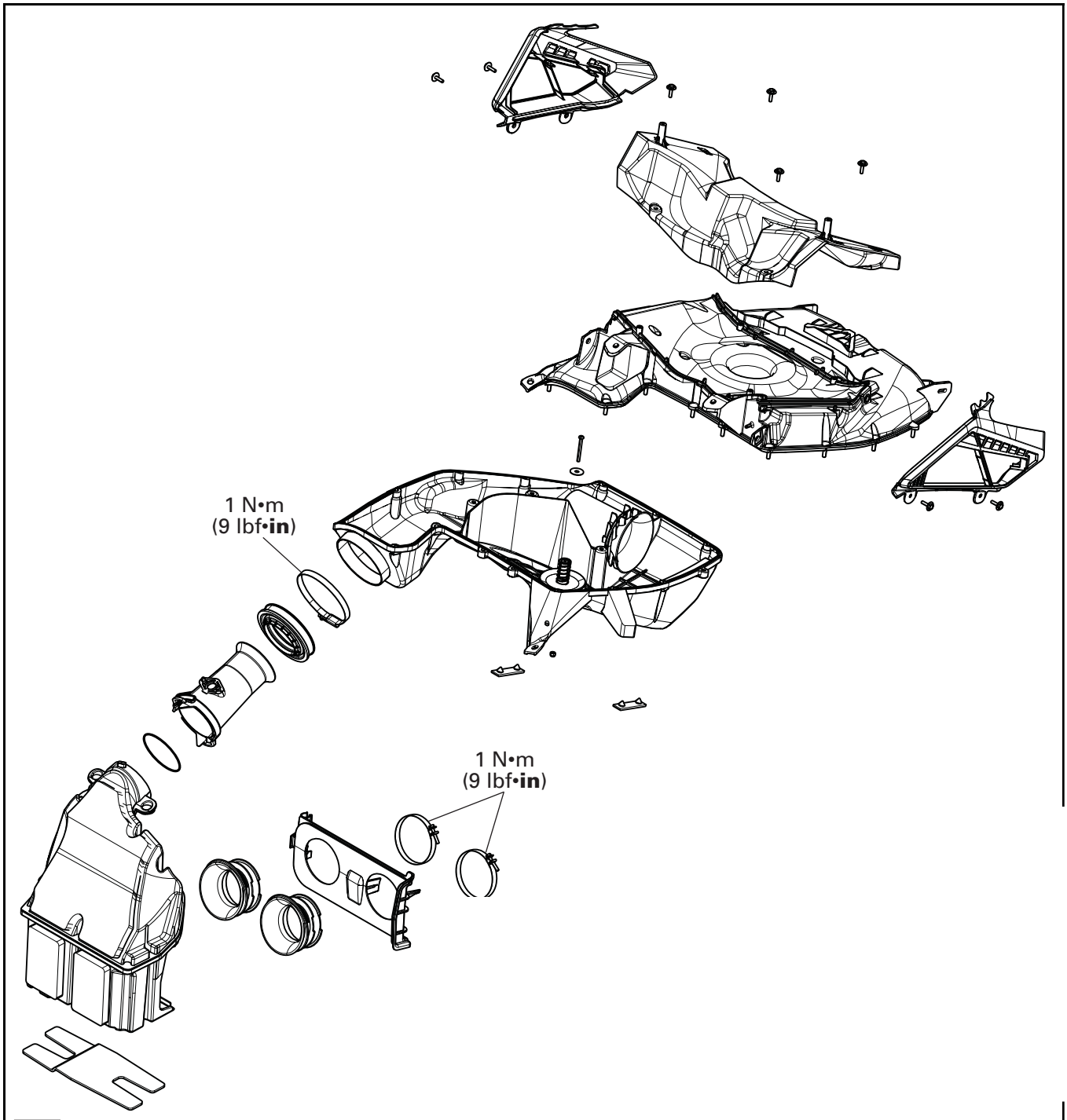
7. Check if piston projection is according to specification. Refer to *TOP END* subsection.

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

8. Repeat procedure for MAG cylinder.
9. If piston projection is out of specification, replace base gasket.

NOTE: A thicker base gasket will lower the piston projection measurement.

AIR INTAKE SYSTEM



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.

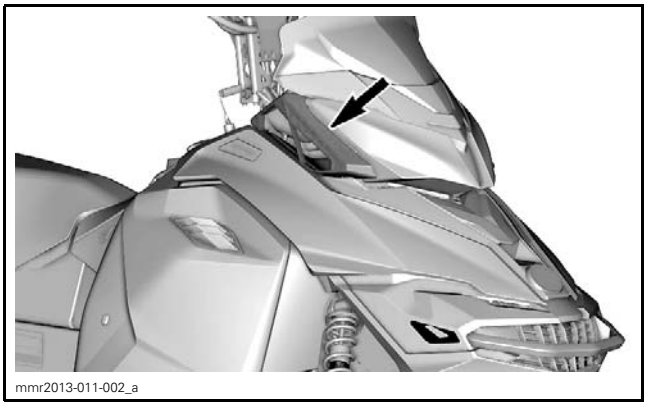
⚠ WARNING

Torque wrench tightening specifications must be strictly adhered to.
Locking devices 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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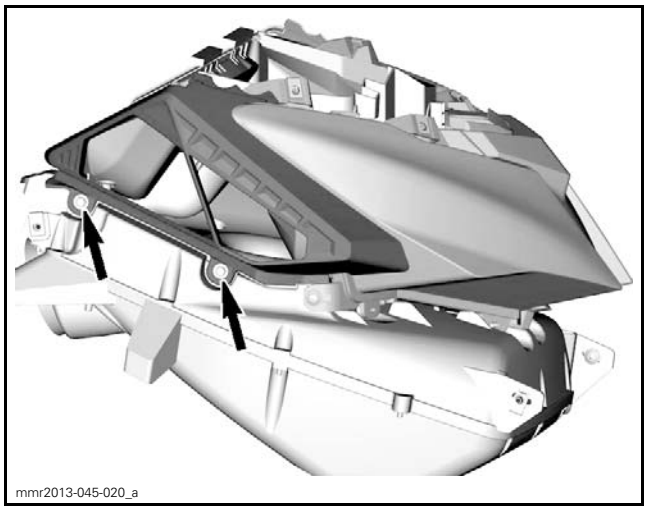
Air Filter Removal

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

1. Refer to *BODY* subsection and remove:
   – Upper body module
   – Hood
   – Gauge support
2. Remove screws from mesh filter housing.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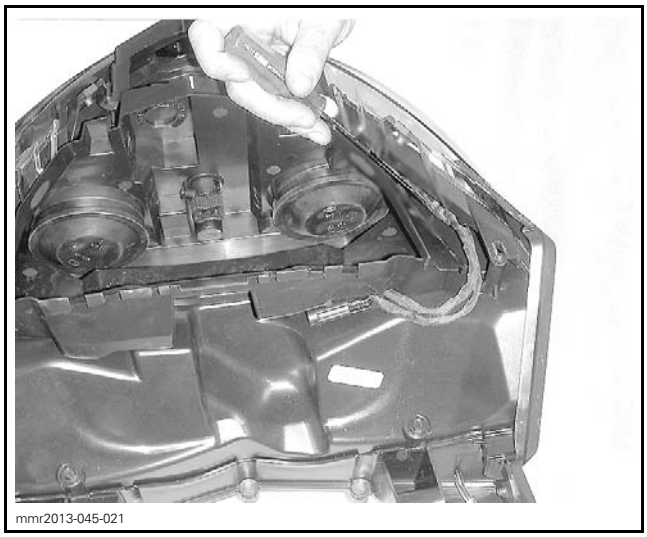
RH SIDE SHOWN

3. From top of upper body module, carefully release mesh filter housing tabs.
4. Detach connector from air intake silencer.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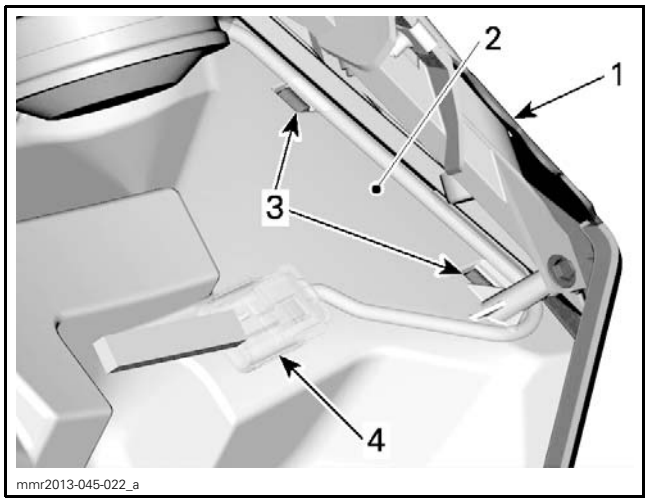
TOP OF UPPER BODY MODULE — RH SIDE TABS SHOWN



RH SIDE TABS SHOWN — RELEASE AND PUSH OUT BOTH TABS
1. *Headlight housing*
2. *Air intake silencer*
3. *Mesh filter housing tabs*
4. *Connector*

Air Filter Cleaning

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.

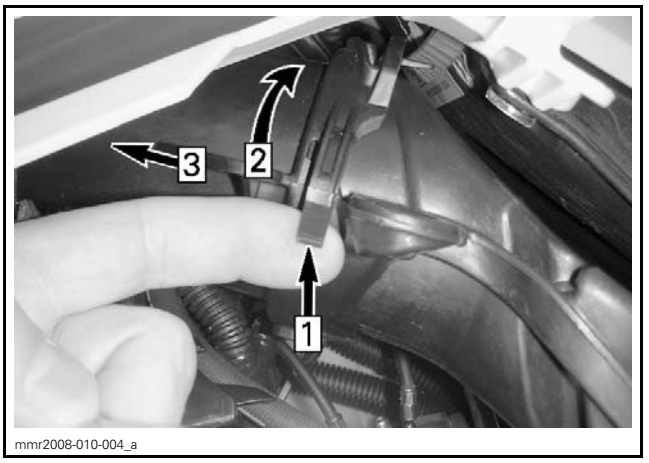
Air Filter Installation

The installation is the reverse of the removal procedure.

PRIMARY AIR INTAKE SILENCER

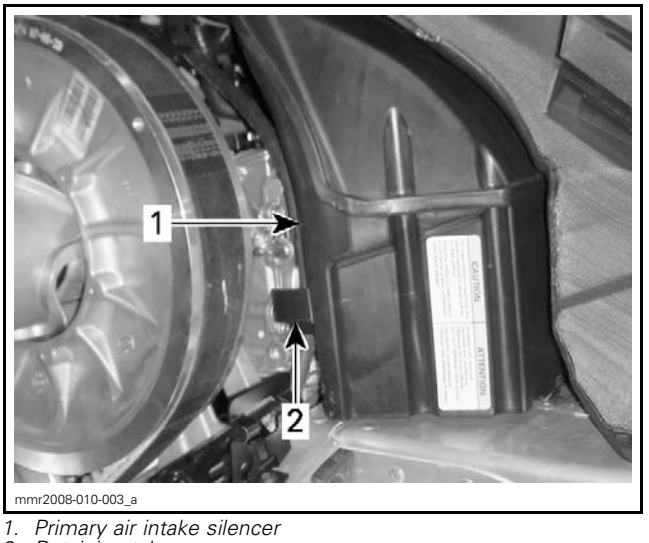
Primary Air Intake Silencer Removal

1. Remove LH side panel.
2. Remove drive belt guard. Refer to *DRIVE BELT* subsection.
3. Unlock connector tube as follows:
   - 3.1 Lift tab on rear section of connector tube.
   - 3.2 Twist tube counter clockwise and pull slightly forward.



Step 1: Lift tab
Step 2: Twist tube
Step 3: Pull forward

4. Push retaining tab of primary air intake silencer forward and pull silencer out of adapter plate.



1. *Primary air intake silencer*
2. *Retaining tab*

Primary Air Intake Silencer Installation

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

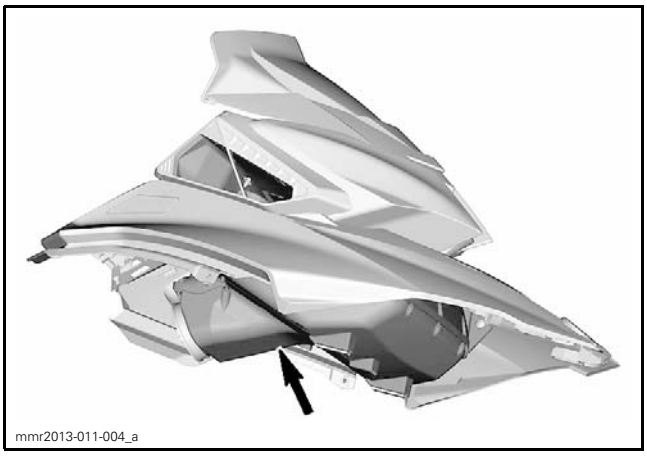
Guide primary air intake silencer into the adapter plate groove.

Ensure primary air silencer is pushed to the end of adapter plate.

Ensure retaining tab is fully engaged.

NOTICE Be careful not to damage foam during installation.

SECONDARY AIR INTAKE SILENCER



Secondary Air Intake Silencer Removal

1. Remove multifunction gauge. Refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.
2. Refer to *BODY* subsection and remove:
   - Upper body module
   - Hood
   - Gauge support
   - Air filters (mesh)
   - Headlight housing

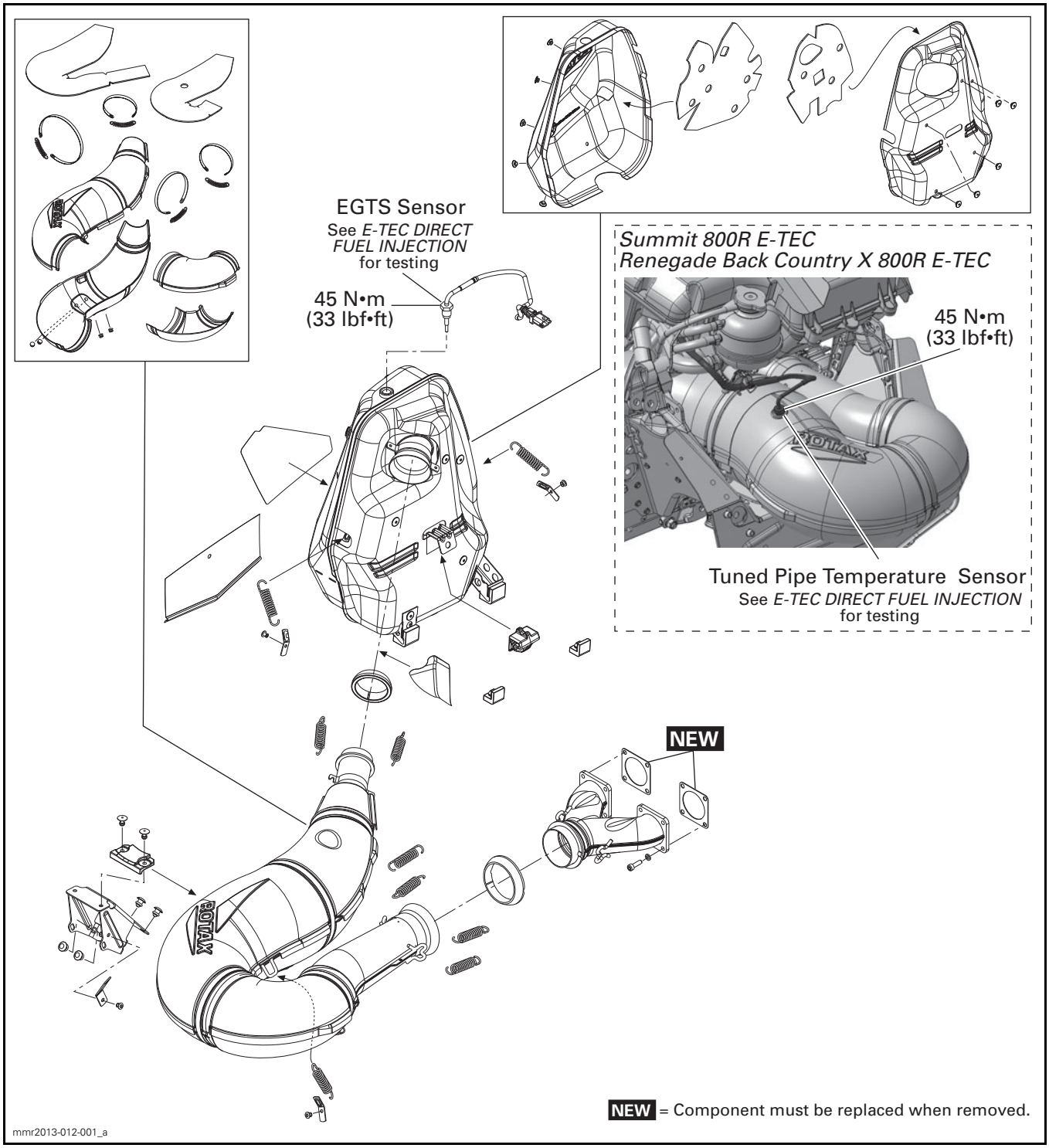
Secondary Air Intake Silencer Installation

The installation is the reverse of the removal procedure.

EXHAUST SYSTEM

SERVICE TOOLS

Description	Part Number	Page
SPRING INSTALLER/REMOVER	529 035 983	2, 4



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 shown in the exploded view.

⚠ 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.

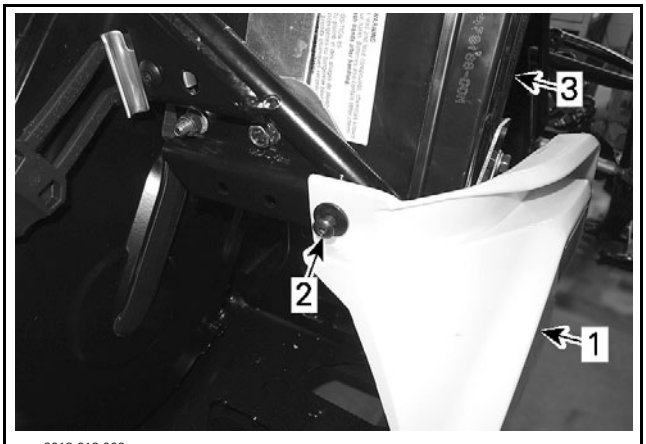
NOTICE Hoses, cables and locking ties removed during a procedure must be reinstalled as per factory standards.

PROCEDURES

MUFFLER

Muffler Removal

1. Remove RH side panel.
2. Remove screw securing the lower panel.



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1. Lower panel
2. Retaining screw
3. Battery

3. Remove all springs retaining the muffler.

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

For vehicle servicing:
- 600 HO E-TEC: Unplug EGTS connector and remove muffler.
- 800R E-TEC: Unscrew the EGTS from the muffler.

For muffler replacement: unscrew the EGTS from the muffler.

Muffler Inspection

Check muffler for cracks or other damages.

Muffler Installation

For installation, reverse the removal procedure.

EGTS SENSOR

EGTS Sensor Test

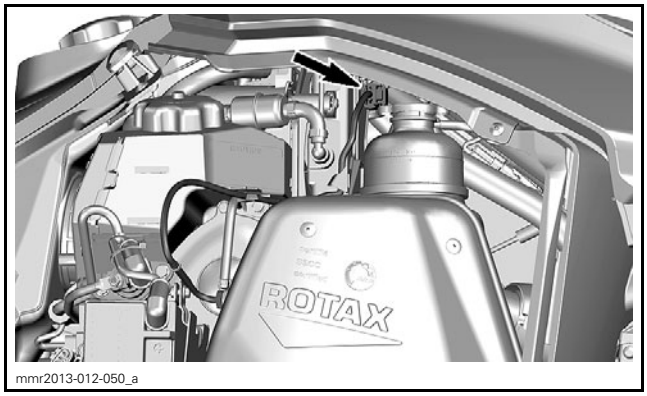
Refer to *E-TEC DIRECT FUEL INJECTION* subsection for EGTS sensor (Exhaust Gas Temperature Sensor) testing.

EGTS Sensor Replacement

NOTE: New EGTS sensors have paraffin wax on their tip to protect the sensor during shipping. Paraffin will melt at first engine operation.

600 HO E-TEC

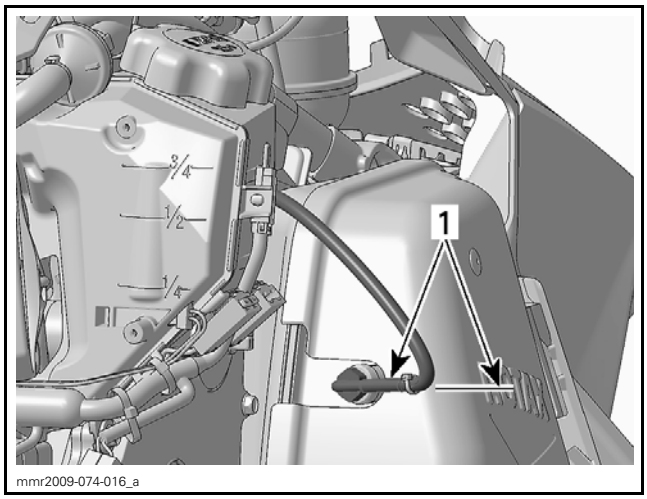
1. Remove RH side panel.
2. Disconnect EGTS sensor connector.



mmr2013-012-050_a

3. Remove *MUFFLER*. See procedure in this subsection.
4. Remove EGTS sensor from muffler.
5. Install NEW EGTS sensor in the following specific position for optimum efficiency.

NOTICE Do not use the sensor if it was dropped and never use an impact wrench to install it.



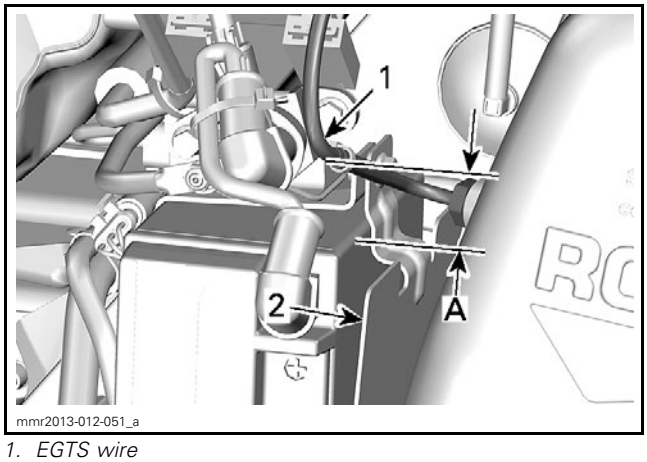
1. EGTS sensor positioned horizontally

6. Tighten EGTS sensor to specification while holding sensor to prevent turning.

EGTS SENSOR TORQUE
45 N•m (33 lbf•ft)

7. Install muffler as the reverse of removal.

NOTICE Make sure the positive battery cable is not in contact with the EGTS wire.



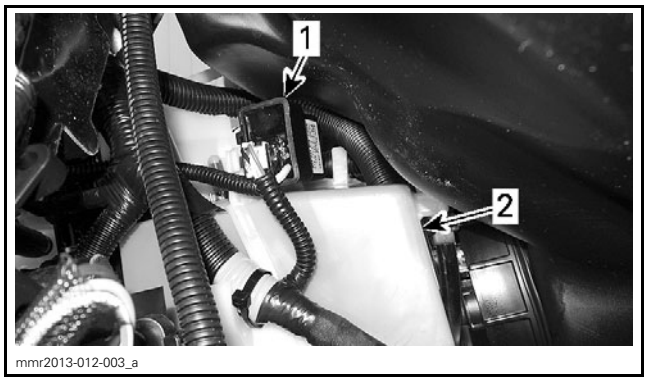
1. EGTS wire
2. Battery support
A. 30 mm (1-3/16 in)

8. Connect EGTS sensor connector.
9. Install RH side panel.

800R E-TEC

NOTE: EGTS sensor, tuned pipe temperature sensor (if so equipped) and THCM module must be replaced as an assembly.

1. Remove the primary air intake silencer, refer to *AIR INTAKE SYSTEM*.
2. Unclip THCM module from oil injection tank.



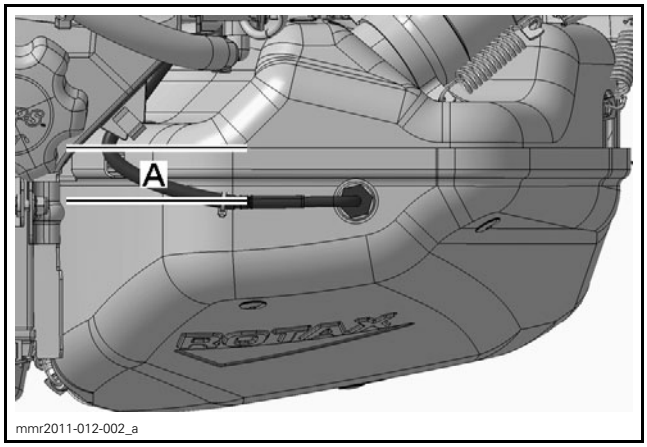
1. THCM module
2. Oil injection tank

3. Remove EGTS sensor from muffler.

NOTE: On **Renegade Back Country X and Summit**, unscrew the tuned pipe temperature sensor from the tuned pipe. Both sensors must be replaced at the same time with the THCM module.

4. Install **NEW** EGTS sensor in the following specific position for optimum efficiency.

NOTICE Do not use an impact wrench for installation or if it was dropped.



A. EGTS sensor positioned parallel with muffler seam

5. Tighten EGTS sensor to specification while holding sensor to prevent turning.

TIGHTENING TORQUE	
EGTS sensor	45 N•m (33 lbf•ft)

6. Install muffler as the reverse of removal.

7. Clip the THCM module to oil injection tank.
8. Install RH side panel.

TUNED PIPE

Tuned Pipe Removal

1. Refer to *BODY* subsection and remove:
   – Upper body module
   – Bottom pan cover.
2. On **Renegade Back Country X and Summit**, unscrew the tuned pipe temperature sensor from the tuned pipe.
3. Detach exhaust retaining springs.

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

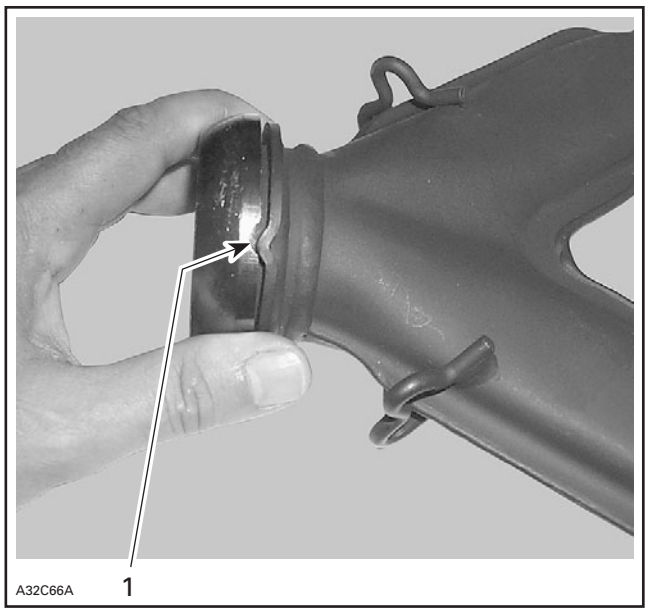
4. Remove muffler. Refer to *MUFFLER REMOVAL* in this subsection.
5. Remove tuned pipe.
6. Remove doughnut-shaped exhaust gaskets.

Tuned Pipe Inspection

1. Check tuned pipe and shields for:
   – Damages
   – Cracks.
2. Inspect gaskets condition. Replace if required.

Tuned Pipe Installation

1. Install doughnut shaped exhaust gasket with both of its notches aligned with Y-manifold protrusions.



TYPICAL
1. Align notches

2. Install exhaust on vehicle.
3. Install exhaust springs.
4. Install all other removed parts as the reverse of removal.

TUNED PIPE TEMPERATURE SENSOR

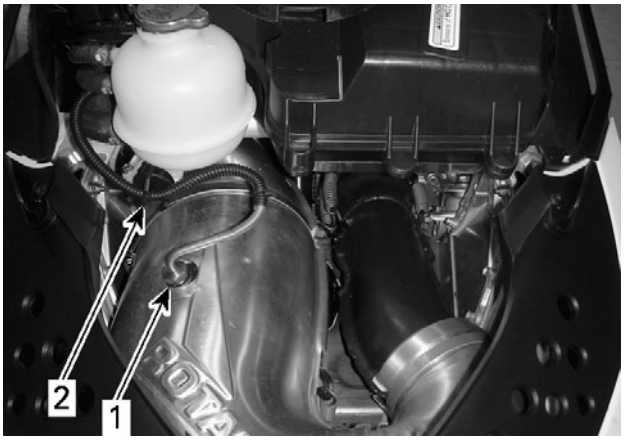
Tuned Pipe temperature Sensor Test

Refer to *E-TEC DIRECT FUEL INJECTION* for tuned pipe temperature sensor testing.

Tuned Pipe Temperature Sensor Replacement

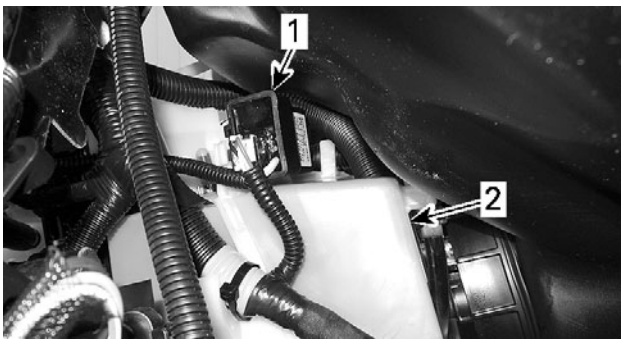
NOTE: EGTS sensor, tuned pipe temperature sensor and THCM module must be replaced as an assembly.

1. Remove tuned pipe temperature sensor from tuned pipe.
2. Detach tuned pipe temperature sensor wires from coolant tank support.



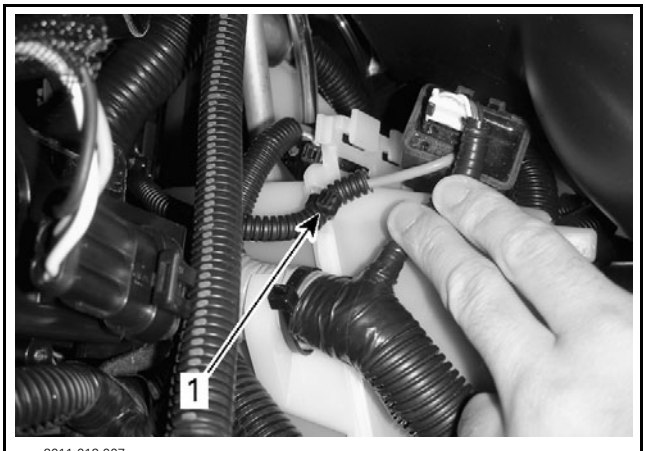
1. Tuned pipe temperature sensor
2. Coolant tank support

3. Remove the primary air intake silencer, refer to *AIR INTAKE SYSTEM*.
4. Unclip THCM module from oil injection tank.



1. THCM module
2. Oil injection tank

5. Cut locking tie that secure tuned pipe temperature sensor wires to oil injection tank.



1. Locking tie

6. Remove THCM module and sensors (EGTS and tuned pipe temperature sensor) as an assembly by carefully moving them towards LH side.
7. Install NEW THCM module and sensors as the reverse of removal.

NOTICE Do not use an impact wrench for installation.

8. Tighten tuned pipe temperature sensor to specification while holding sensor to prevent turning.

TIGHTENING TORQUE	
Tuned pipe temperature sensor	45 N•m (33 lbf•ft)

9. Install body panels as the reverse of removal.

NOTE: Ensure that tuned pipe temperature sensor is properly configured using B.U.D.S. Refer to *E-TEC DIRECT FUEL INJECTION* subsection.

MANIFOLD

Manifold Removal

1. Remove tuned pipe. Refer to *TUNED PIPE REMOVAL* in this subsection.
2. Remove and discard manifold screws.

REQUIRED TOOL	
ALLEN SPHERICAL SOCKET	

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

3. Remove manifold.
4. Remove and discard gaskets.

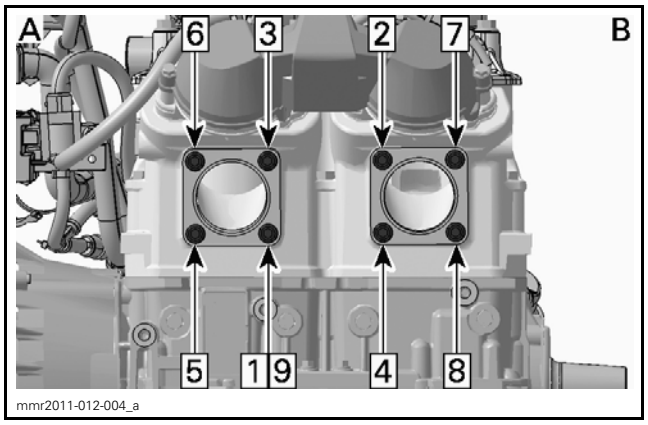
Manifold Inspection

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

Manifold Installation

1. Install manifold with NEW gaskets.
2. Install NEW manifold screws.
3. Tighten manifold screws to specification using the following pattern.

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



A. MAG side
B. PTO side

MANIFOLD SCREWS	
ENGINE	**TIGHTENING TORQUE**
600 HO E-TEC	17 N•m (150 lbf•**in**)
800R E-TEC	34 N•m (25 lbf•ft)

4. Install tuned pipe as the reverse of removal.

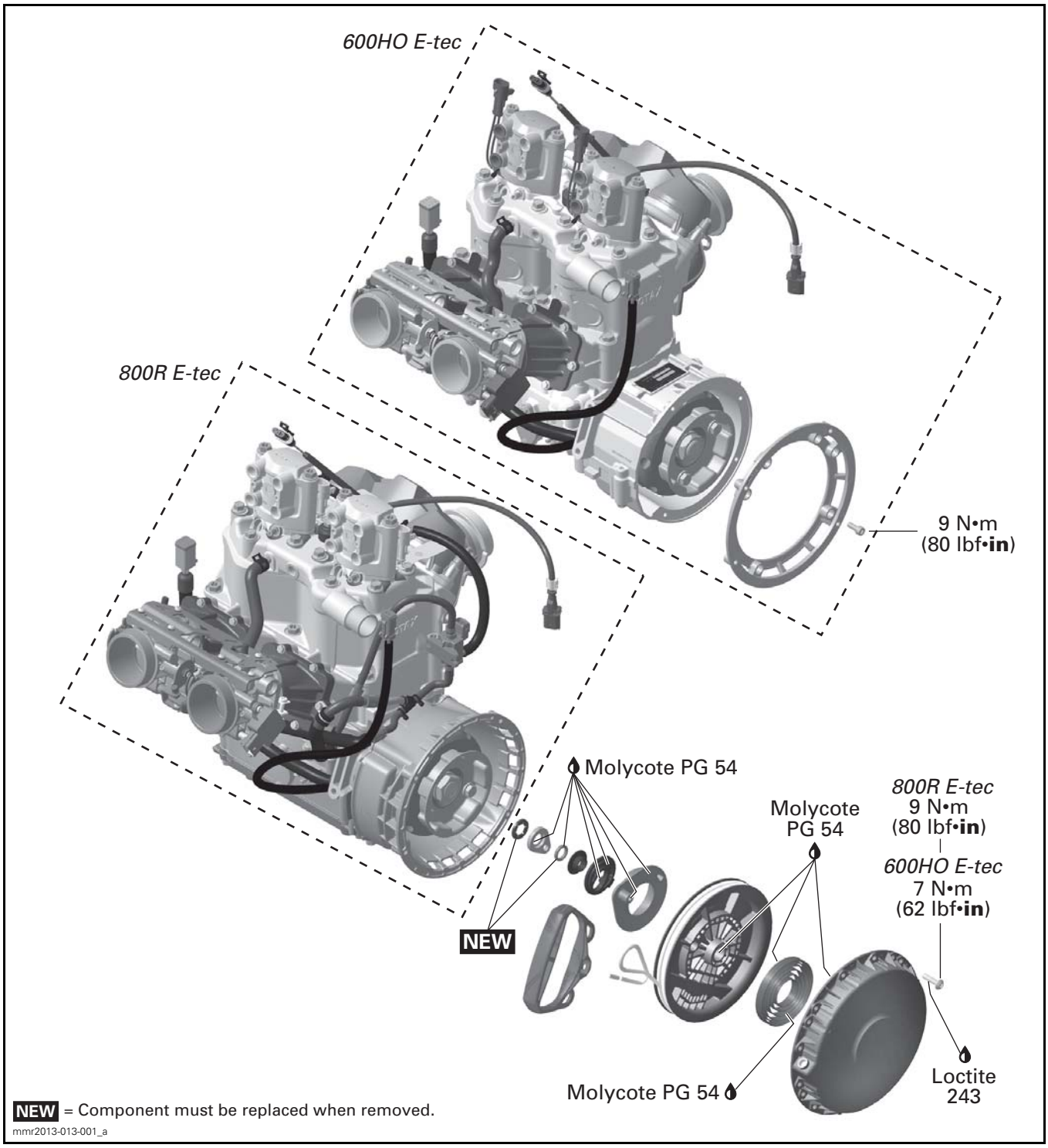
REWIND STARTER

SERVICE TOOLS

Description	Part Number	Page
SMALL HOSE PINCHER	295 000 076	3

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	7
MOLYKOTE PG 54	420 899 763	5–7


600HO E-tec
800R E-tec
9 N•m
(80 lbf•in)
Molycote PG 54
Molycote
PG 54
800R E-tec
9 N•m
(80 lbf•in)
600HO E-tec
7 N•m
(62 lbf•in)
NEW
Molycote PG 54
Loctite
243
NEW = Component must be replaced when removed.
mmr2013-013-001_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 be 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 30 cm (1 ft) 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.

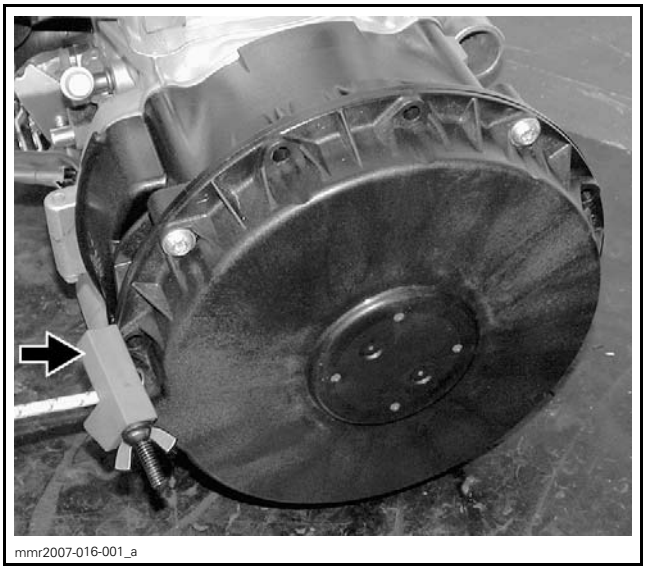
PROCEDURES

REWIND STARTER HANDLE

Rewind Starter Handle Removal

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)	

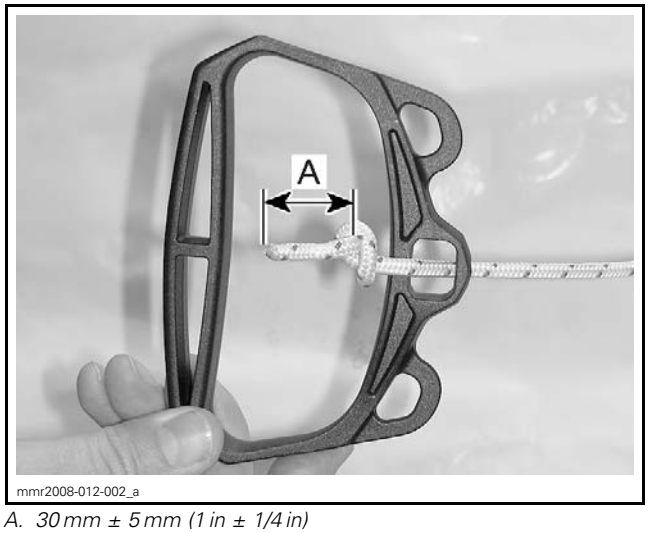


mmr2007-016-001_a

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

Rewind Starter Handle Installation

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, see picture.



mmr2008-012-002_a

A. 30 mm ± 5 mm (1 in ± 1/4 in)

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

Rewind Starter Access

Remove the following parts:
– RH side panel
– Muffler

Rewind Starter Removal

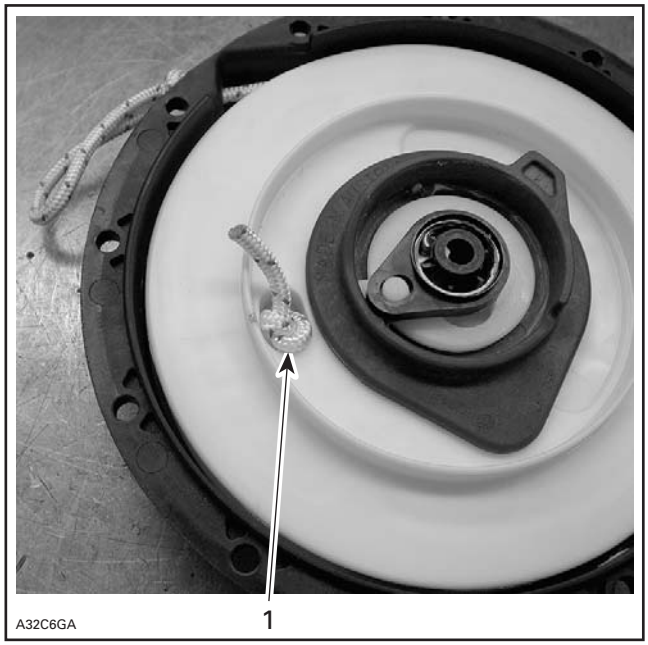
Remove starter handle.

Remove:
– Rewind starter retaining screws
– Rewind starter.

Rewind Starter Rope Replacement

Remove rewind starter.

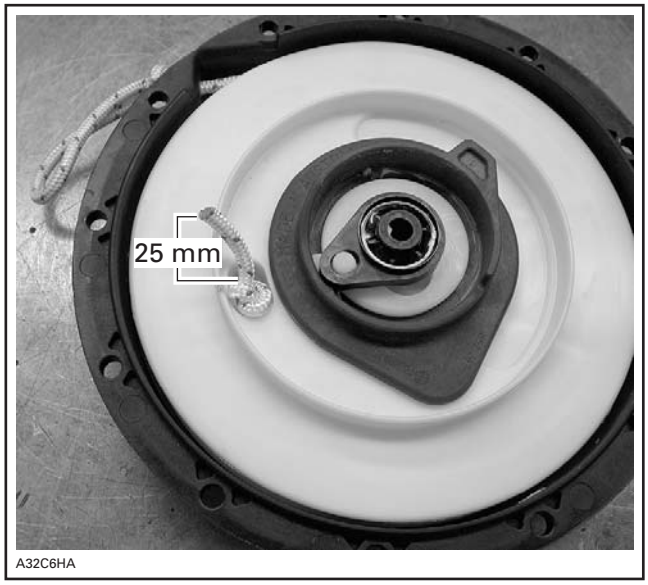
Completely pull out rope. Hold rewind starter in a vise. Slide rope and untie the knot. Remove rope from starter sheave.



A32C6GA

1. Knot to be untied

Insert rope in starter sheave orifice and lock it by making a knot, leaving behind a free portion of about 25 mm (1 in) in length.



A32C6HA

FREE PORTION

Fuse rope end with a lit match and insert it into sheave.


A32C6IA

FREE PORTION INSERTED INTO SHEAVE

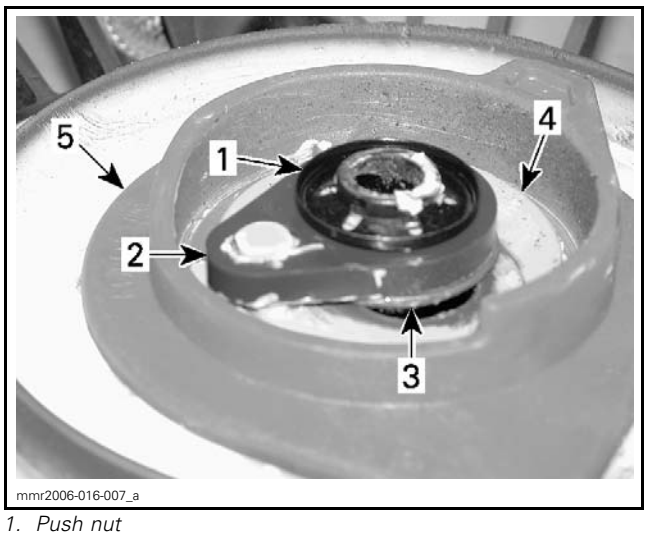
NOTE: When rope is completely pulled out, spring preload is 4-1/2 turns.

Rewind Starter Disassembly

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

Cut push nut and discard.

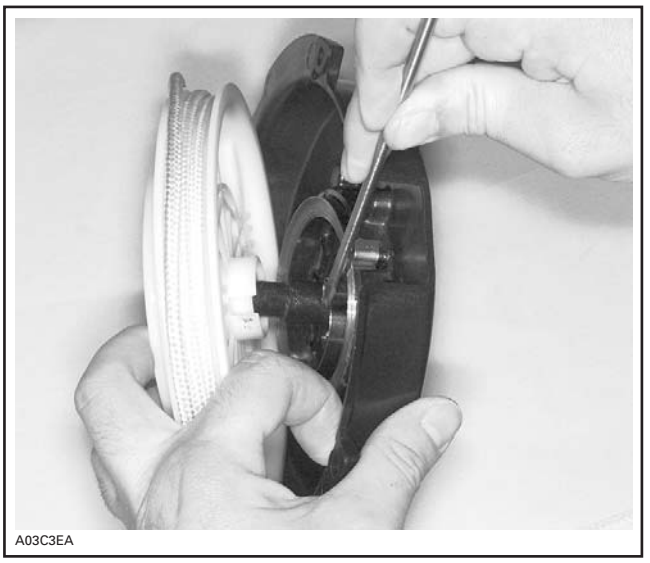
Remove:
- Lock lever
- O-ring
- Collar sleeve
- Pawl lock
- Pawl.



mmr2006-016-007_a

1. *Push nut*
2. *Lock lever*
3. *Collar sleeve*
4. *Pawl lock*
5. *Pawl*

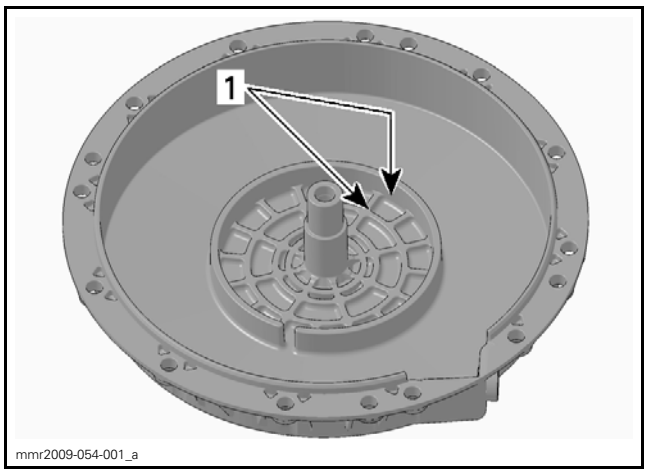
Remove sheave with rope from starter housing. Hold spring in starter housing using a screwdriver.


A03C3EA

Take out the knot and then rope.

Rewind Starter Assembly

Lubricate spring contact area and spring guide inside housing with MOLYKOTE PG 54 (P/N 420 899 763).



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1. *Molykote PG 54*

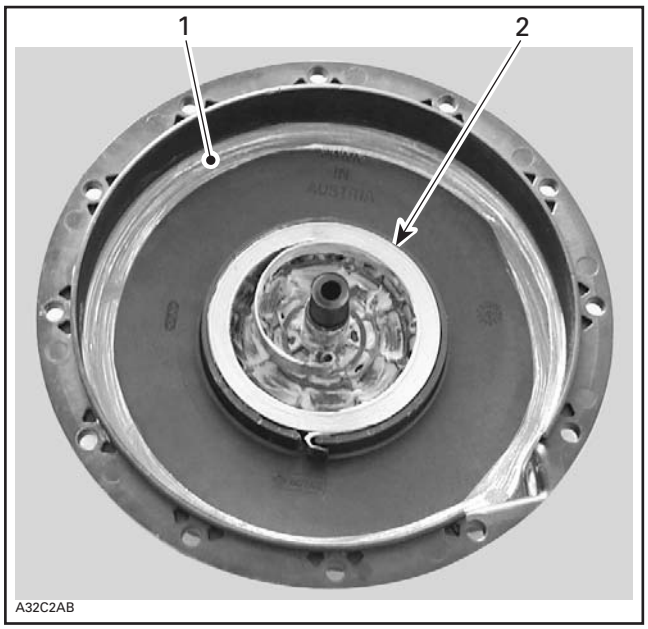
At assembly, position spring outer end in spring guide notch then wind the spring counterclockwise in the guide.

⚠ WARNING

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

TYPICAL
1. Outer end into guide notch

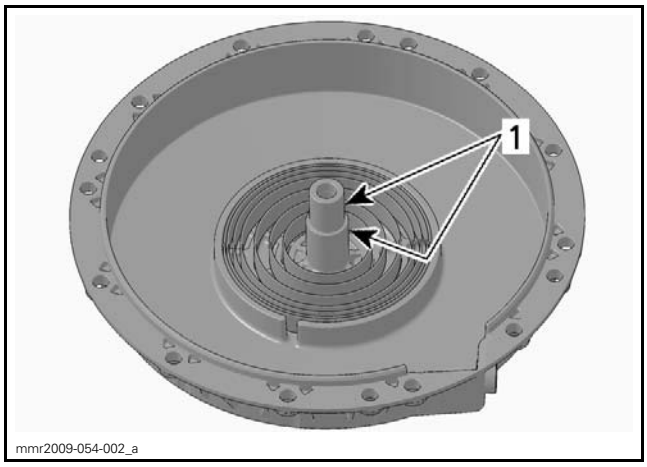
Lubricate spring assembly and 1 cm (1/2 in) wide on bottom of housing with MOLYKOTE PG 54 (P/N 420 899 763).



1. Molykote PG 54 applied 1 cm (1/2 in) wide on bottom of housing
2. Molykote PG 54 ion spring

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.

Lubricate housing post with MOLYKOTE PG 54 (P/N 420 899 763). Install sheave.



1. Molykote PG 54

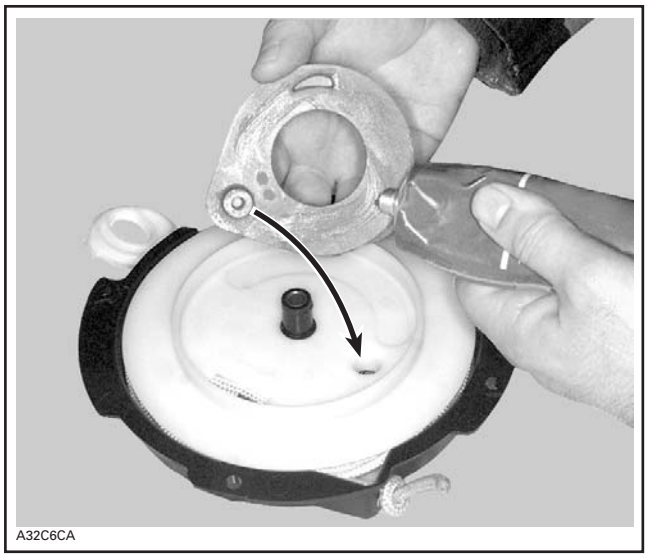
To adjust spring tension:

Wind rope on sheave and place rope sheave in starter housing making sure the sheave hub notch engages in the rewind spring hook.

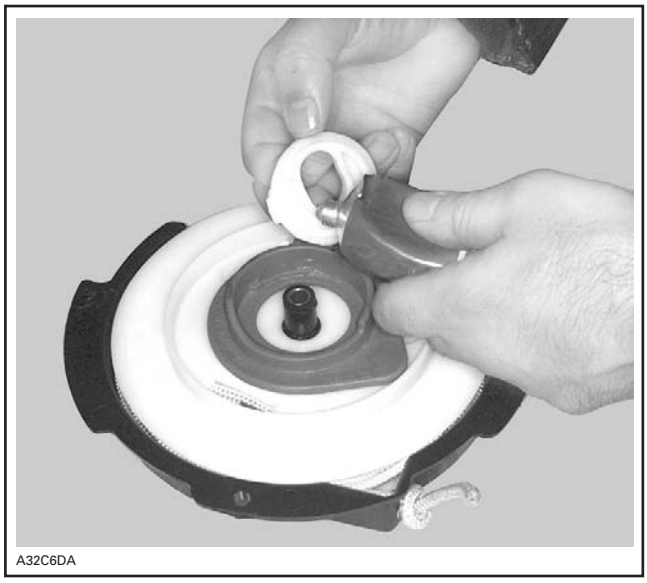
Rotate the sheave counterclockwise until rope end is accessible through rope exit hole. This will provide 1/2 turn of preload.

Pull rope out of starter housing and temporarily make a knot to hold it.

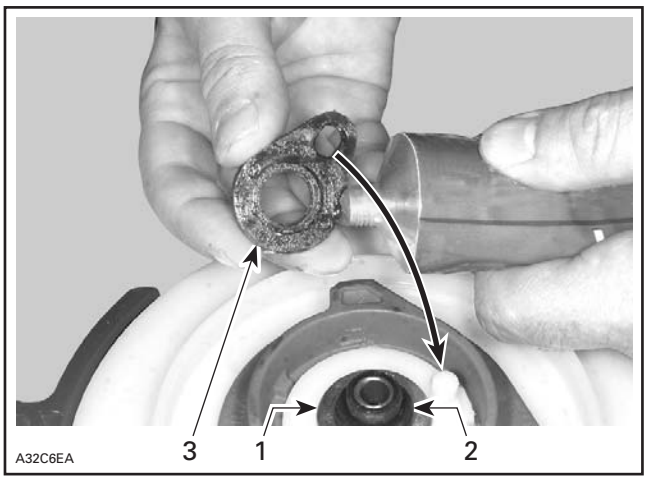
Lubricate pawl with MOLYKOTE PG 54 (P/N 420 899 763) then install over rope sheave.


A32C6CA

Lubricate pawl lock with MOLYKOTE PG 54 (P/N 420 899 763). Install over pawl.


A32C6DA

Install collar sleeve with its collar first. Lubricate a **NEW** O-ring and lock lever with MOLYKOTE PG 54 (P/N 420 899 763). Install over pawl lock.



A32C6EA

1. *Collar sleeve*
2. *O-ring*
3. *Lock lever*

Secure lock lever with a **NEW** push nut.

Rewind Starter Installation

Thread starter rope through console.

Install handle, refer to *STARTER HANDLE INSTALLATION*.

Reinstall rewind starter assembly on engine.

SERVICE PRODUCT	
Rewind starter retaining screws	LOCTITE 243 (BLUE) (P/N 293 800 060)

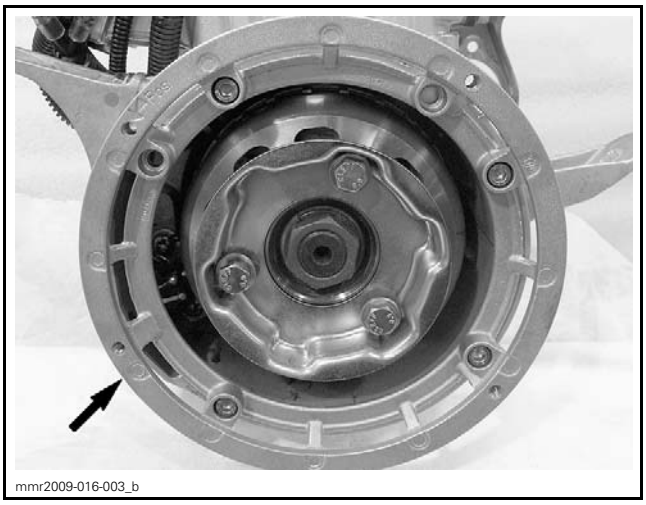
TIGHTENING TORQUE	
600HO E-Tec	7 N•m (62 lbf•**in**)
800R E-Tec	9 N•m (80 lbf•**in**)

CONNECTING FLANGE (600HO E-TEC)

Connecting Flange Removal

Remove rewind starter housing (magneto cover on electric start models).

Remove connecting flange retaining screws.



TYPICAL - CONNECTING FLANGE

Connecting Flange Installation

When reinstalling the connecting flange, torque screws as specified.

TIGHTENING TORQUE	
Connecting flange retaining screws	9 N•m (80 lbf•**in**)

LUBRICATION SYSTEM

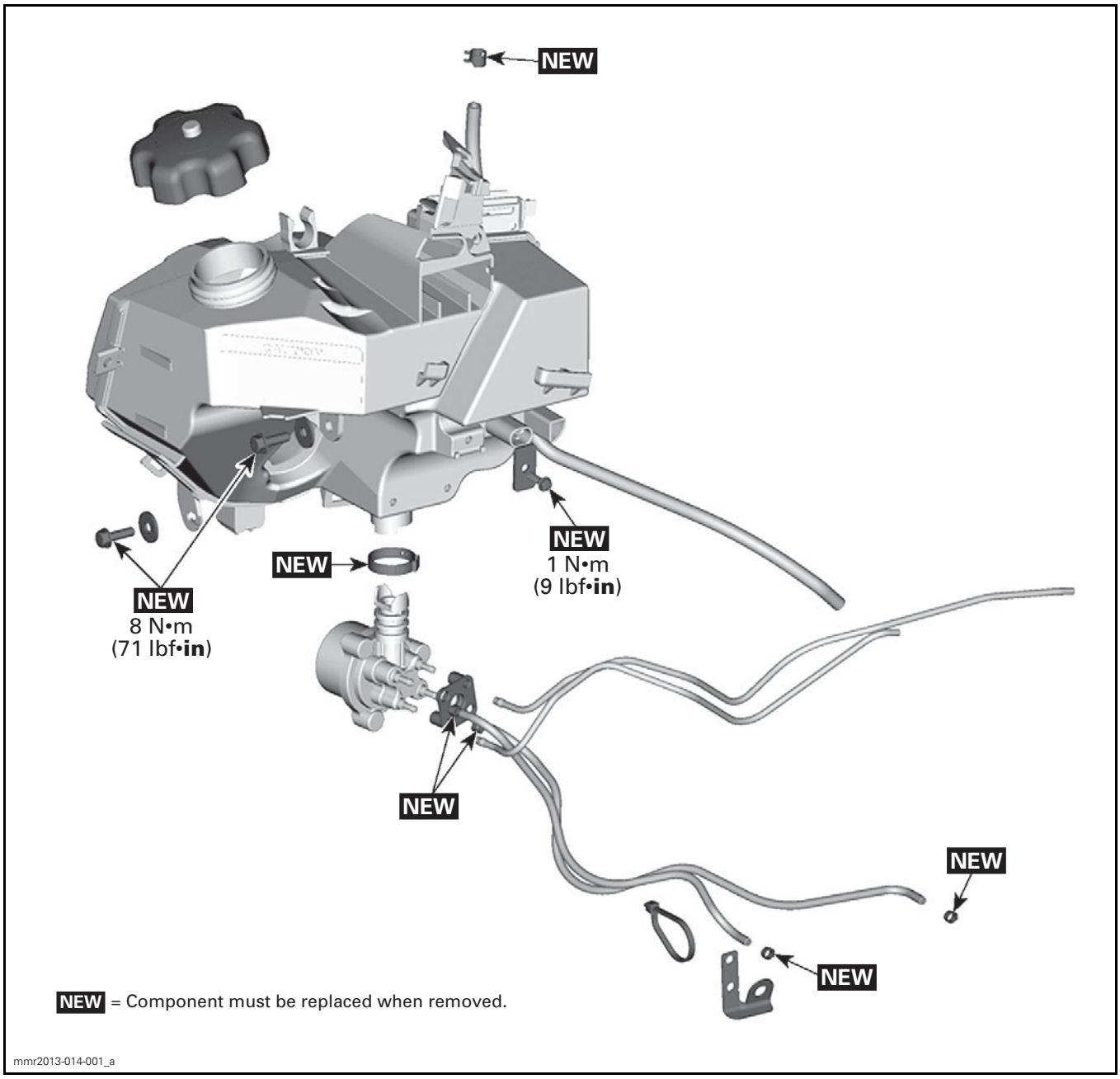
SERVICE TOOLS

Description	Part Number	Page
FLUKE 115 MULTIMETER	529 035 868	11
LEAK TEST KIT	529 033 100	4
VACUUM/PRESSURE PUMP	529 021 800	5, 12

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 648 (GREEN)	413 711 400	12
PULLEY FLANGE CLEANER	413 711 809	12
XPS INJECTION OIL	293 600 117	4
XPS SYNTHETIC 2-STROKE OIL	293 600 132	4
XPS SYNTHETIC BLEND 2-STROKE OIL	293 600 100	4

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.

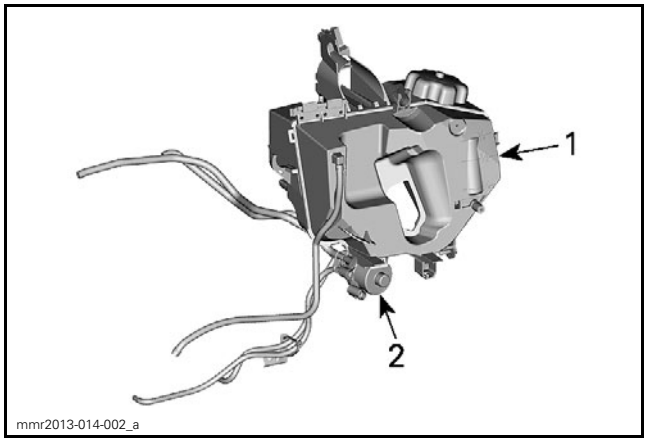
NOTICE **Do not use a hose pincher on outlet hose. This would damage the spring inside hose.**

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

SYSTEM DESCRIPTION

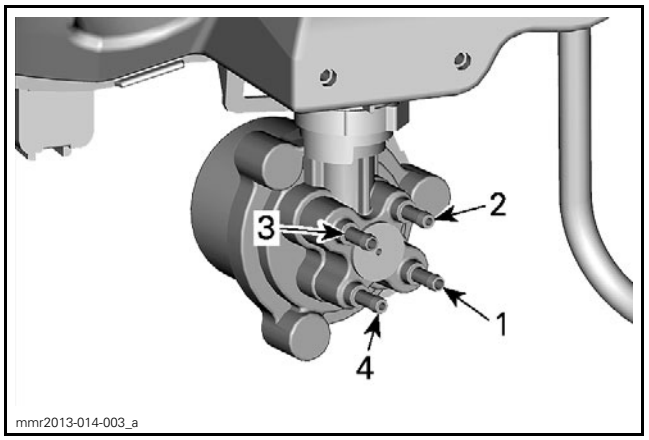
An electronic oil injection pump with a mechanical positive displacement type is used. An electronic pump is more accurate and injection rate can be changed according to engine requirements. This results in a greatly reduced oil consumption.

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



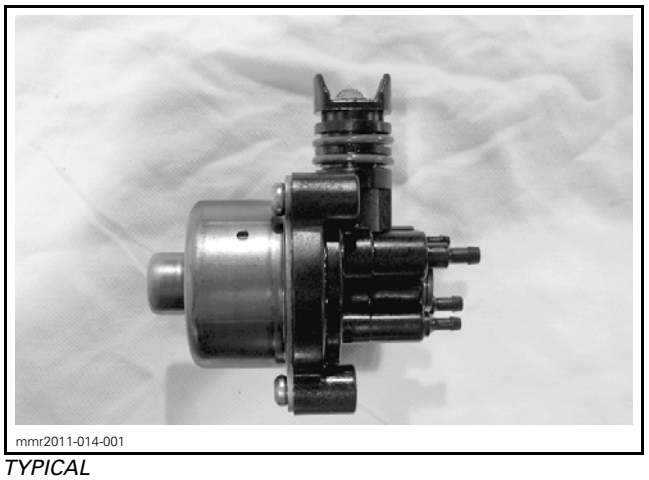
1. Oil injection tank
2. Electronic oil injection pump

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

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 120 pulses per minute for 600 HO E-TEC engine and approximately 180 pulses per minute for 800R E-TEC engine.

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 B.U.D.S. or the multifunction gauge on the vehicle. Refer to *STORAGE PROCEDURE* subsection.

RECOMMENDED INJECTION OIL

RECOMMENDED INJECTION OIL			
ENGINES	XPS INJECTION OIL (P/N 293 600 117)	XPS SYNTHETIC BLEND 2-STROKE OIL (P/N 293 600 100)	XPS SYNTHETIC 2-STROKE OIL (P/N 293 600 132)
600 HO E-TEC	-	✓	✓
800R E-TEC	-	✓	✓

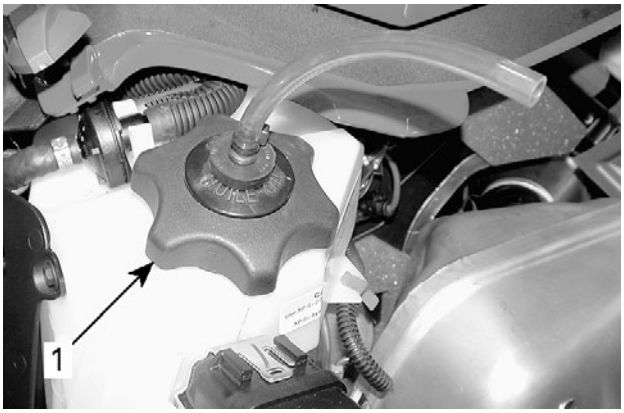
NOTICE These engines have been developed and validated using the XPS™ 2-stroke oils. BRP strongly recommends the use of the applicable XPS 2-stroke oils at all times. Damages caused by oil which is not suitable for the engine will not be covered by the BRP limited warranty.

INSPECTION

OIL SYSTEM LEAK TEST

1. Install the test cap on oil tank.

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



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 55/60 volts.
		Check system circuit J1B-23.
		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

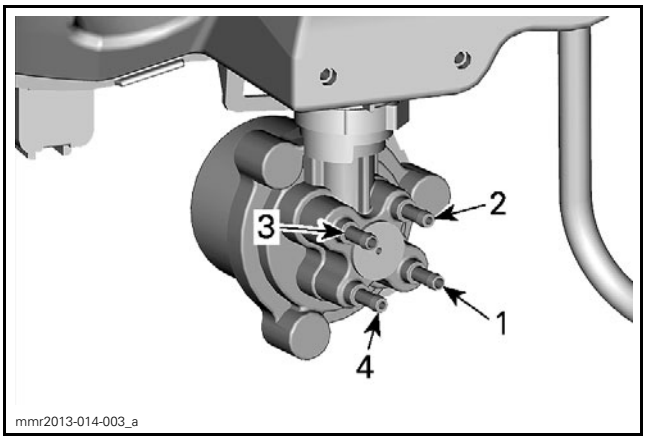
Every pump is bench tested. Its electrical and flow characteristics are registered throughout all its operating range and are associated to a compensation number.

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

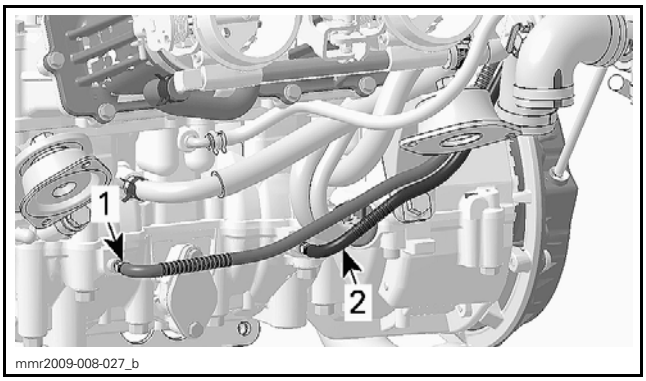
The compensation number is located on a label on the pump as shown.

Oil injection pump bleeding is done with B.U.D.S. Refer to *OIL INJECTION PUMP BLEEDING* in this subsection.

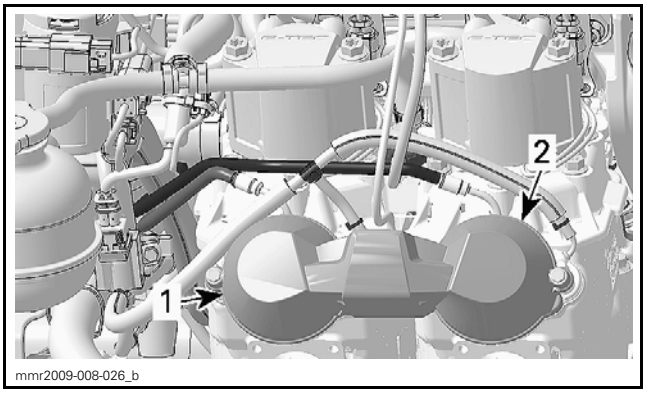
Oil Injection Pump Hoses Connection



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



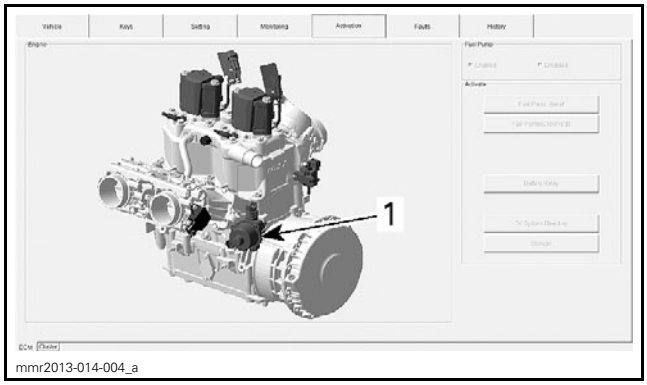
TYPICAL
1. *Oil inlet hose (PTO side)*
2. *Oil inlet hose (MAG side)*



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

Oil Injection Pump Test with B.U.D.S.

1. Connect B.U.D.S. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. In B.U.D.S., press **Read Data**.
3. Select **Activation** tab then the **ECM** tab.
4. Start engine.
5. Press on oil pump.



1. *Press here to activate oil pump*

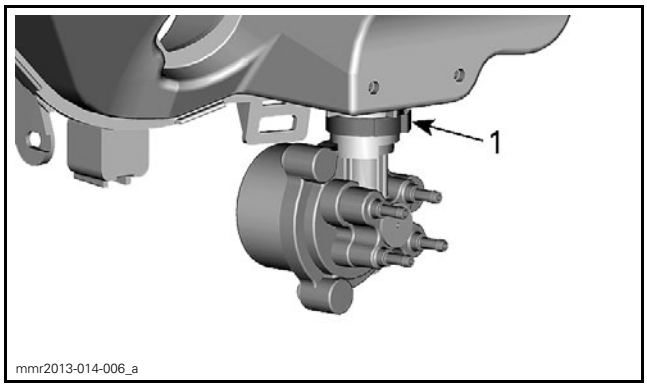
6. Listen if oil injection pump is activated.

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

7. If test fails, check wires and connector.

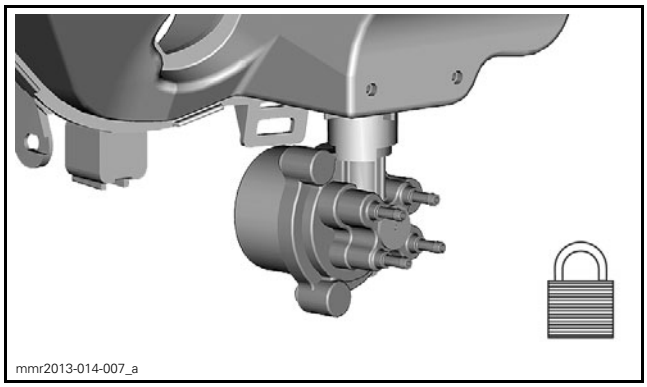
Oil Injection Pump Removal

1. Remove oil tank from vehicle. Refer to *OIL TANK* in this subsection.
2. Remove and discard Oetiker clamp securing oil injection pump to oil tank.

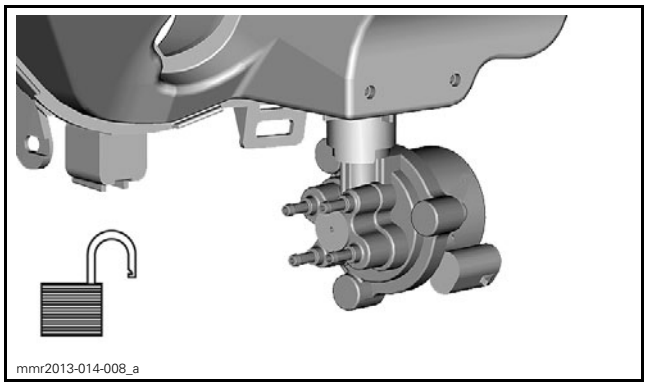


1. *Oetiker clamp*

3. Rotate oil injection pump from 90 degrees as illustrated.



PUMP LOCKED INTO OIL TANK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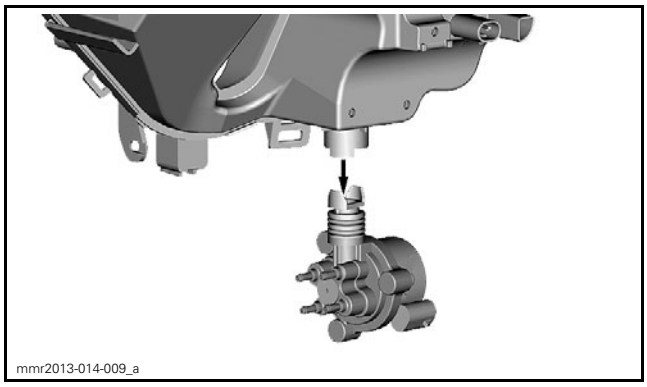
PUMP RELEASED FROM OIL TANK

4. Move oil injection pump downward to remove it from oil tank.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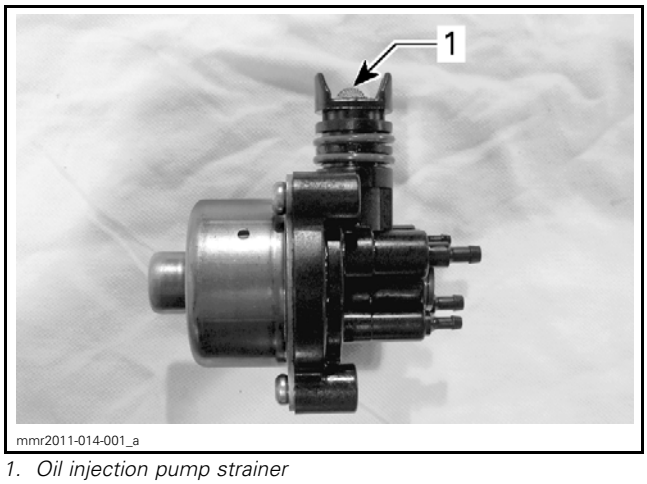
Oil Injection Pump Inspection

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



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1. Oil injection pump strainer

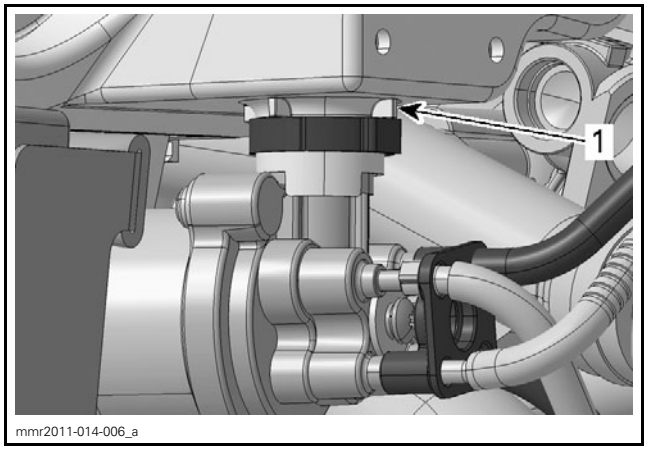
NOTE: Do not replace oil injection pump needlessly. If strainer is slightly dented, oil injection pump is still functional.

Oil Injection Pump Installation

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.



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1. Oil tank rib

Refer to *OIL TANK INSTALLATION* to properly re-install oil tank.

Oil Injection Pump Bleeding

1. Connect B.U.D.S. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. In B.U.D.S., press **Read Data**.
3. Select **Setting** tab then the **ECM** tab.
4. Compare oil pump codes in B.U.D.S. and on oil injection pump sticker.

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1. B.U.D.S. oil pump code

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

5. Correct oil injection pump code in B.U.D.S. if required.
6. Select **Activation** tab then **ECM** tab.

7. Press Oil System Bleeding button.
8. Start engine.
9. Check for air into hoses. If so, the bleeding procedure must be repeated once more.

OIL INJECTION TANK

Oil Injection Tank Removal

1. Remove fuel tank. Refer to *FUEL TANK AND FUEL PUMP* subsection.
2. Remove driven pulley. Refer to *DRIVEN PULLEY AND COUNTERSHAFT* subsection.
3. Remove primary air intake silencer. Refer to *AIR INTAKE SYSTEM* subsection.
4. Remove housing of rewind starter handle (if applicable). Refer to *BODY* subsection.
5. On 800R E-TEC, detach THCM module from oil injection tank. Refer to *EXHAUST SYSTEM* subsection.
6. Remove the 25 A fuse.
7. Detach fuse holders from oil injection tank.

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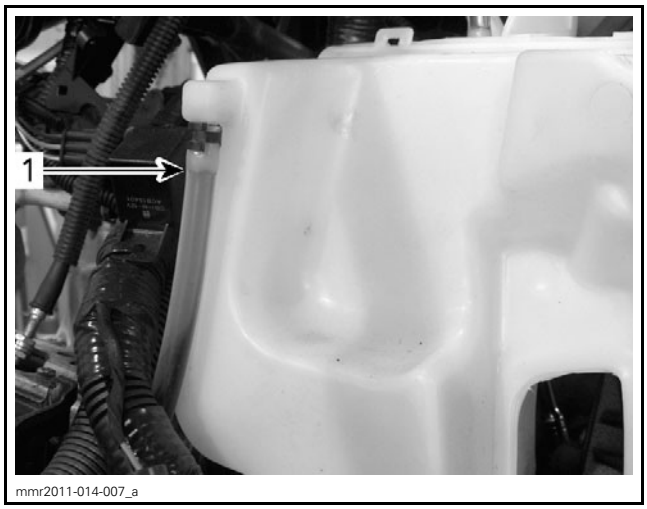
1. 25 A fuse location

8. Empty oil injection tank completely by siphoning injection oil.
9. Disconnect crankcase vent hose on oil injection tank side.



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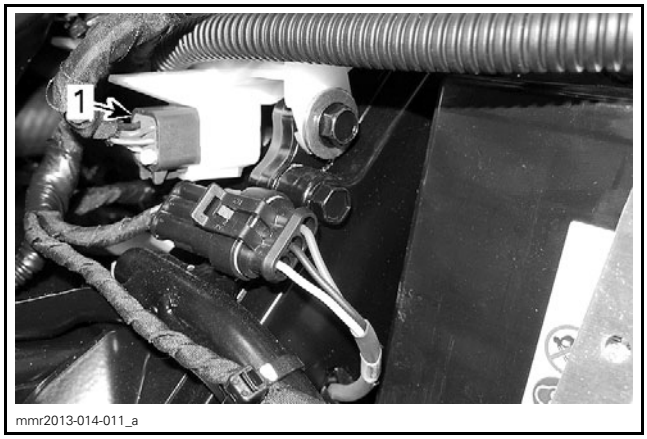
TYPICAL
1. Crankcase vent hose

10. Cut locking tie retaining wires as necessary.
11. Disconnect oil level sensor connector.
12. Detach diagnostic connector from oil injection tank.



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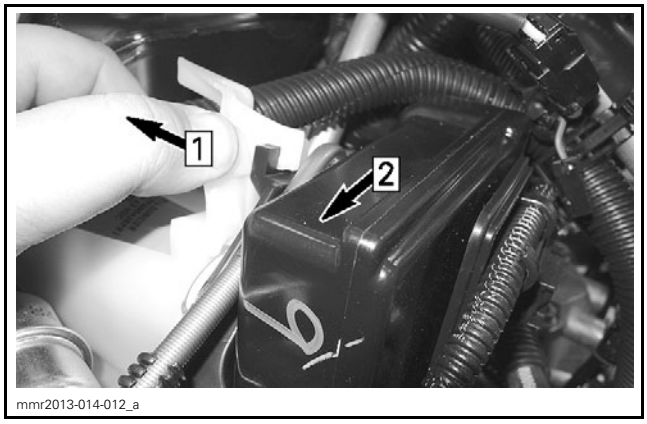
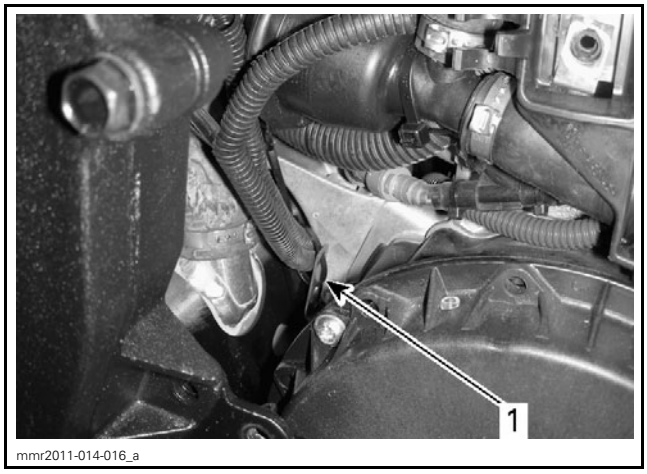
TYPICAL
1. Diagnostic connector

13. Detach ECM support from oil injection tank by pressing upper tab and sliding support outwards.



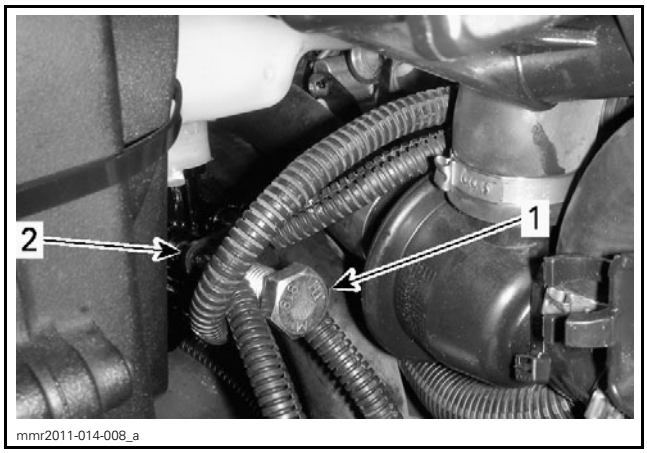
Step 1: Press tab rearwards
Step 2: Slide the ECM out of its support

14. Detach wires from capacitor.
15. Cut locking tie that secure oil hoses to engine.



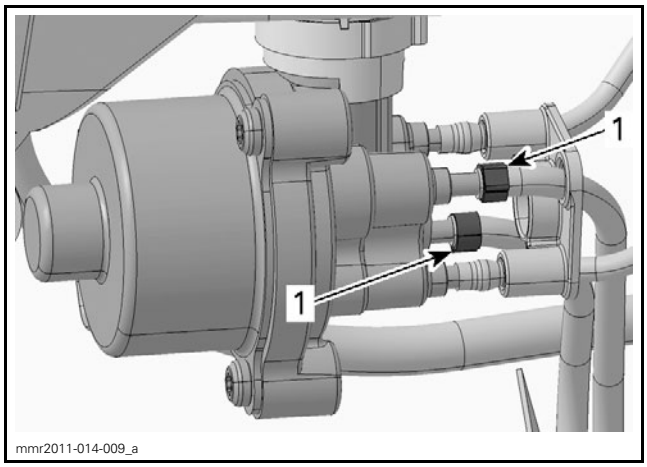
1. Locking tie

16. Pull pump hoses manifold by threading a M12 x 1.75 bolt.



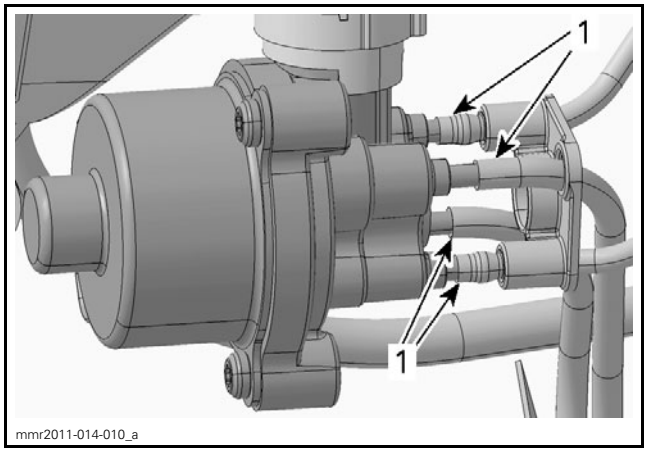
1. M12 x 1.75 bolt
2. Hoses manifold

17. Place a rag under oil injection pump to catch oil spillage.
18. Using metal scissors, remove and discard Oetiker clamps securing oil hoses to oil injection pump fittings.



SOME PARTS REMOVED FOR CLARITY PURPOSE
1. Oetiker clamps (2x)

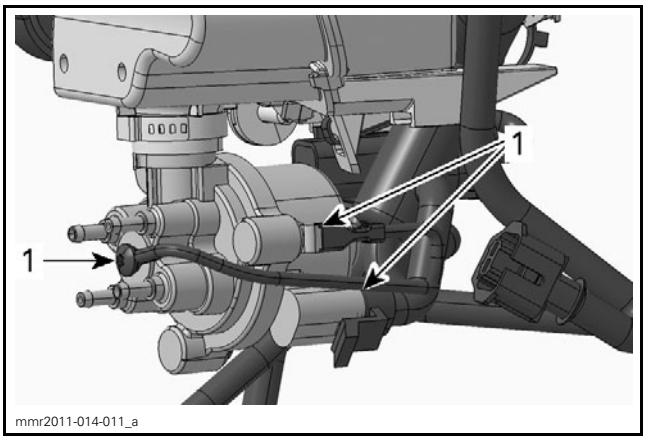
19. Carefully disconnect hoses from oil injection pump using a small screwdriver.



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.**

20. Disconnect oil injection pump connectors.



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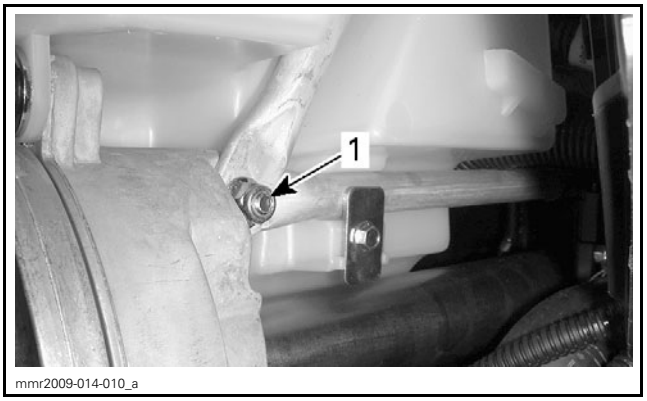
SOME PARTS REMOVED FOR CLARITY PURPOSE
1. Oil injection pump connectors

21. Remove RH side frame member.



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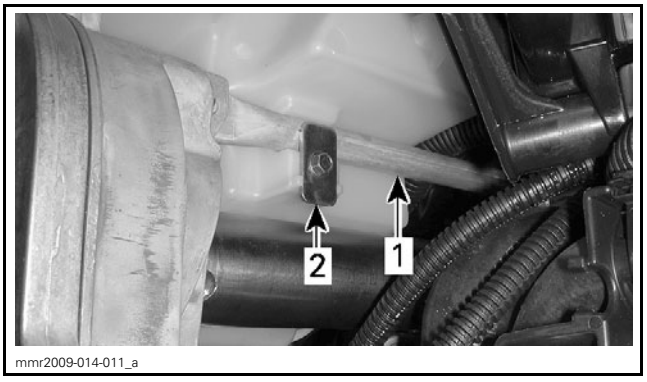
BEHIND THE TOP OF CHAINCASE
1. Lower bolt on side frame member

22. Remove holder retaining oil tank to side frame member brace.



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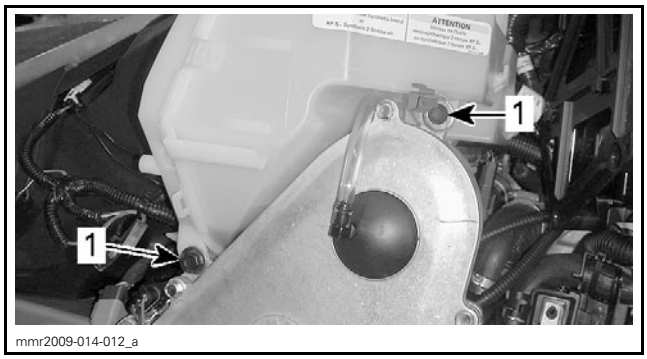
TYPICAL
1. Side frame member brace
2. Oil tank holder

23. Remove screws securing oil tank to chaincase.



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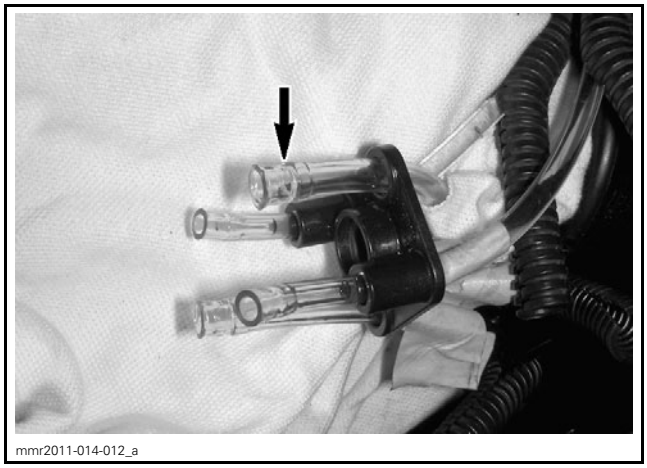
TYPICAL
1. Oil tank screws

24. Remove oil tank from vehicle.
25. Remove oil injection pump from oil injection tank. Refer to *OIL INJECTION PUMP REMOVAL* in this subsection.

Oil Injection Tank Installation

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.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APPLY INJECTION OIL

3. Install manifold sleeves onto both hoses routed towards 3D RAVE valves.
4. Properly route and connect oil hoses into oil injection pump. Refer to *OIL INJECTION PUMP HOSES CONNECTION* in this subsection.
5. Install **NEW** Oetiker clamp to secure hose routed towards PTO and MAG oil inlet.

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

6. Manually push hoses manifold against oil injection pump.
7. Use a large jaws locking pliers then **carefully** push manifold until it clips onto oil injection pump.

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MANIFOLD INSTALLATION


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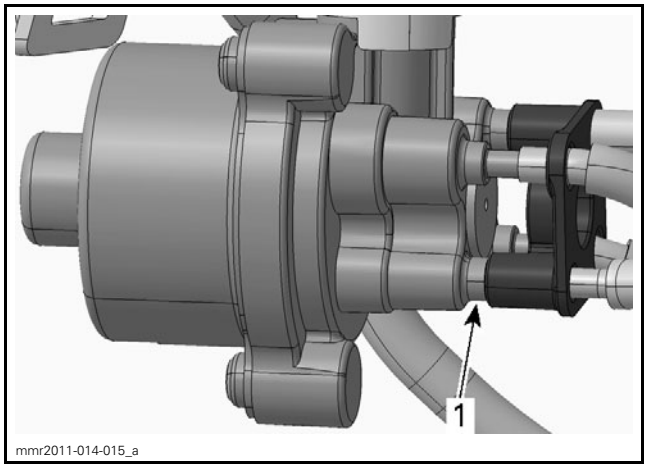
MANIFOLD INSTALLATION

8. Ensure hoses manifold is properly clipped onto oil injection pump.



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MANIFOLD PROPERLY CLIPPED
1. Normal gap

NOTE: A slight gap is normal between oil injection pump and hoses manifold.

Position oil injection tank on vehicle.

Tighten oil injection tank screws to specification.

TIGHTENING TORQUE	
Oil tank **SIDE** screws	8 N•m (71 lbf•**in**)
Oil tank **FRONT** screw	1 N•m (9 lbf•**in**)

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 *OIL INJECTION PUMP BLEEDING* in this subsection.

⚠ WARNING

Make sure fitting of the fuel inlet hose at ECM is not leaking.

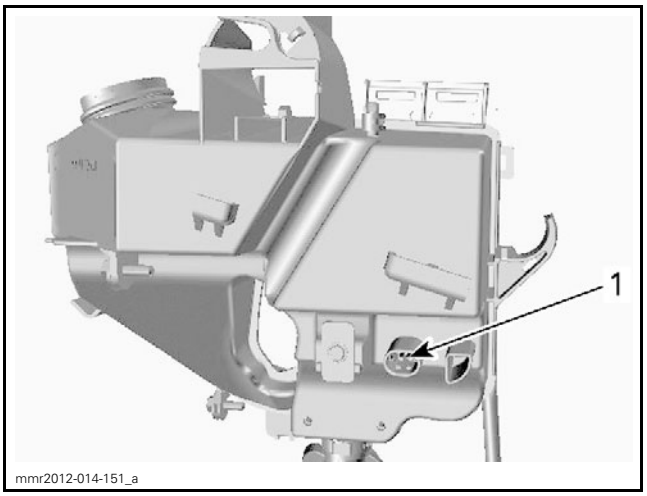
OIL LEVEL SENSOR

Oil Level Sensor Test

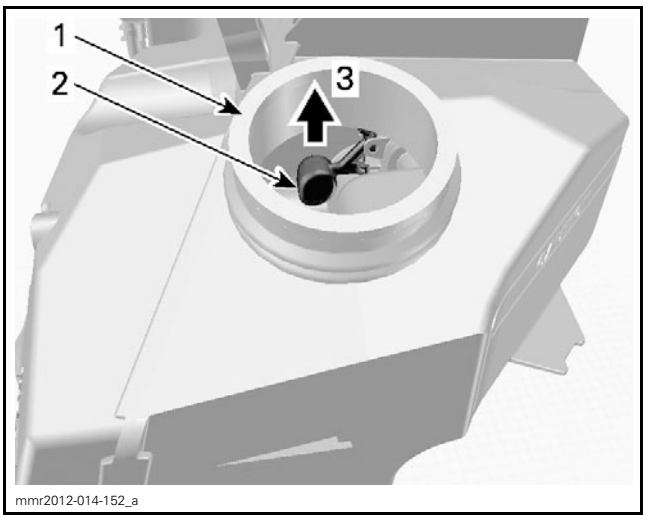
1. Measure resistance by probing sensor connector.

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)



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.

Oil Level Sensor Removal

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

INJECTION NOZZLE

Injection Nozzle Inspection

Lift engine to access the injector nozzles.

Test check valve of injection nozzle as follows.

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 injection nozzle	**Failed:** Replace injection nozzle

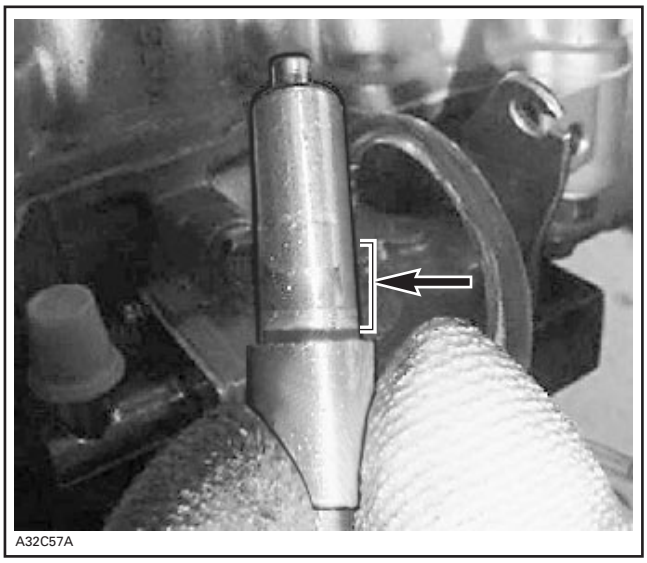
Injection Nozzle Removal

NOTICE **Do not remove injection nozzle needlessly. It is likely to be damaged.**

1. To gain access to the injector nozzles, engine must be lifted. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
2. Clean injection nozzle area to remove oil or dirt.
3. Heat injection nozzle then pull it out of crankcase.

Injection Nozzle Installation

1. Prior to coating it with Loctite, make sure check valve body is clean and dry. If necessary, clean from dirt or oil, with PULLEY FLANGE CLEANER (P/N 413 711 809).
2. Apply LOCTITE 648 (GREEN) (P/N 413 711 400) on the outer diameter of the check valve (machined section). Take care that Loctite is ONLY in this area.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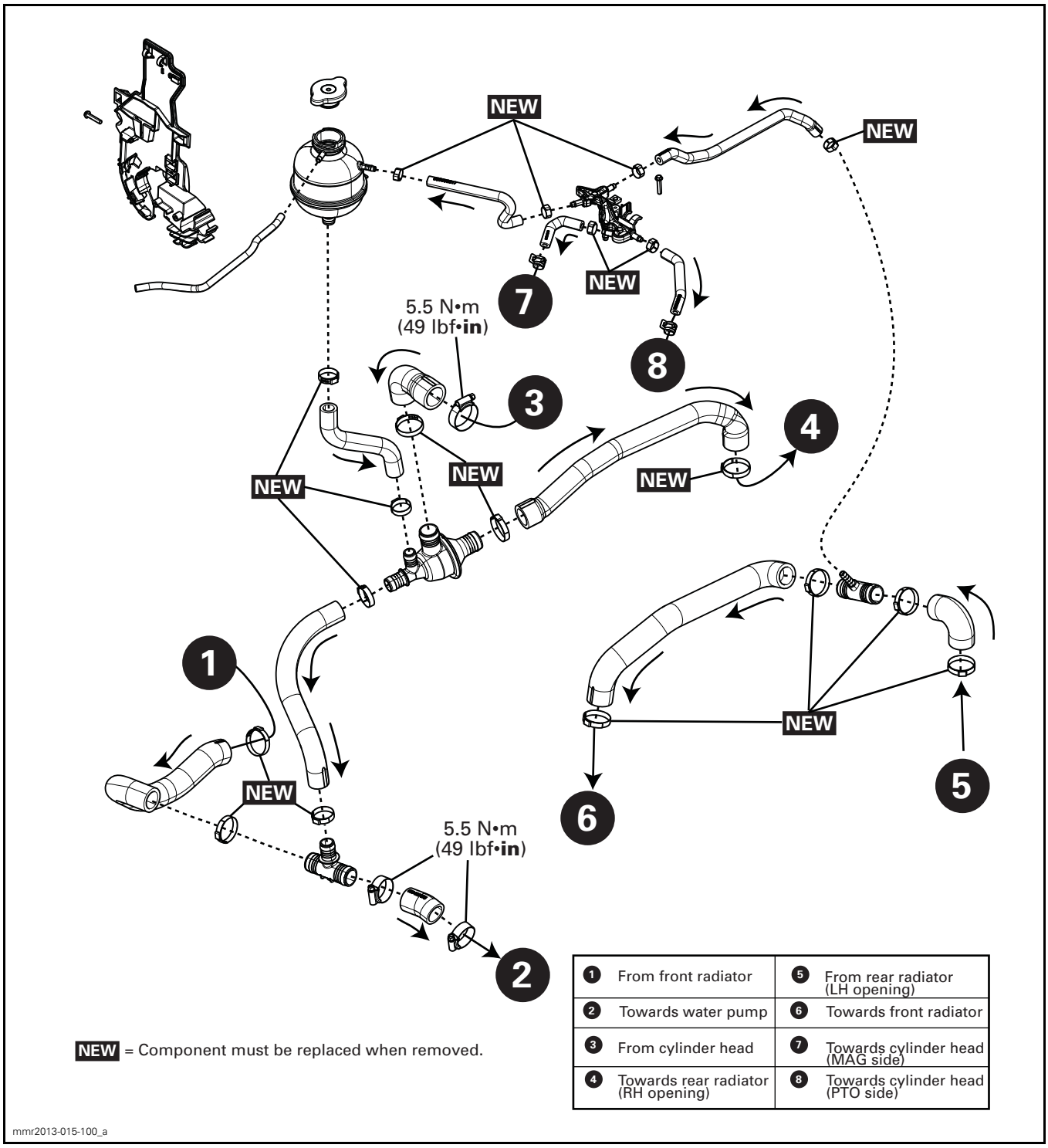
APPLY LOCTITE ON THIS AREA ONLY

3. Punch in the injection nozzle carefully with a plastic hammer.
4. Clean crankcase from surplus of Loctite 648 with a rag.
5. Reinstall engine into vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.

COOLING SYSTEM

SERVICE TOOLS



1	From front radiator	5	From rear radiator (LH opening)
2	Towards water pump	6	Towards front radiator
3	From cylinder head	7	Towards cylinder head (MAG side)
4	Towards rear radiator (RH opening)	8	Towards cylinder head (PTO side)

NEW = Component must be replaced when removed.

mmr2013-015-100_a

GENERAL

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

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 upper body module.

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)

mmr2008-014-005

TYPICAL

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

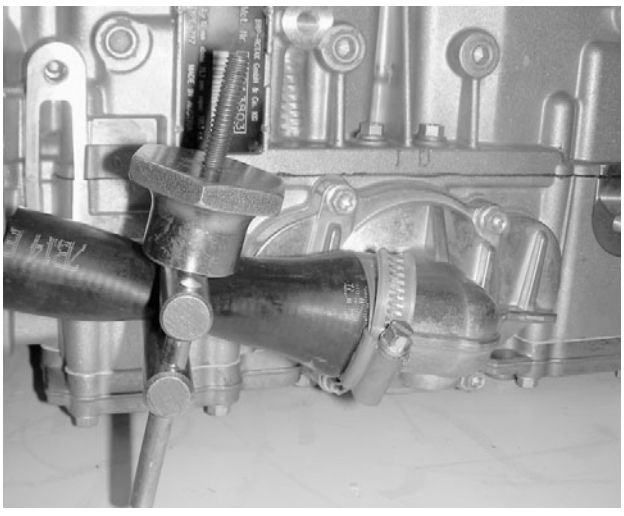
If no external leak is found and pressure drops, carry out the *ENGINE COOLING CIRCUIT LEAK TEST* to find a potential engine internal leak.

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)	

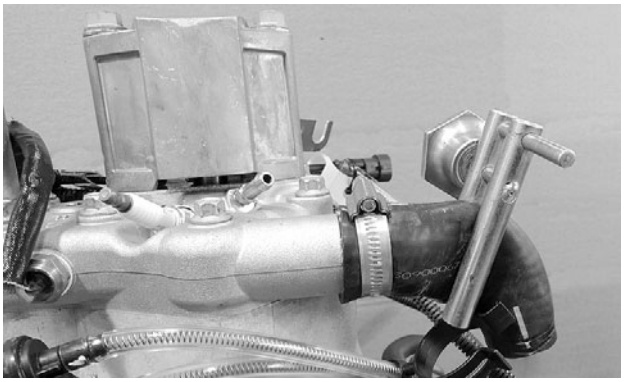


mmr2008-014-004

TYPICAL

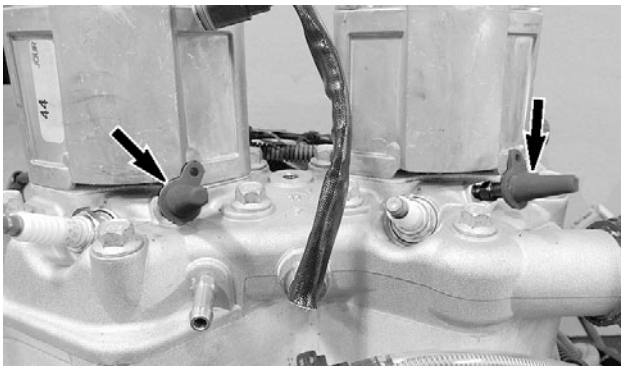
Install a suitable hose on the water pump cover and block it.

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



mmr2013-015-002

Block coolant fittings on cylinder head using plugs from vacuum/pressure pump kit.



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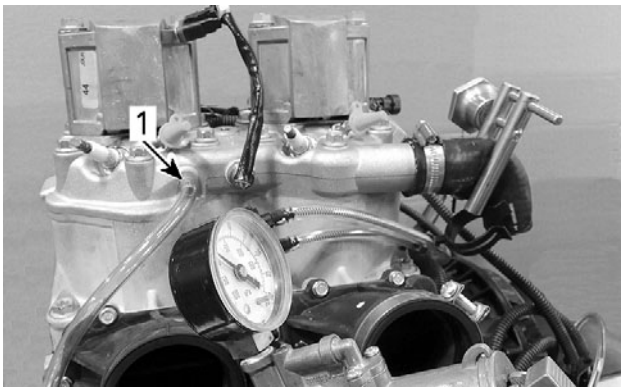
Install the pressure pump on the straight fitting for throttle body heating.

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



mmr2013-015-004_a

1. Straight fitting for throttle body heating

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

WATER PUMP

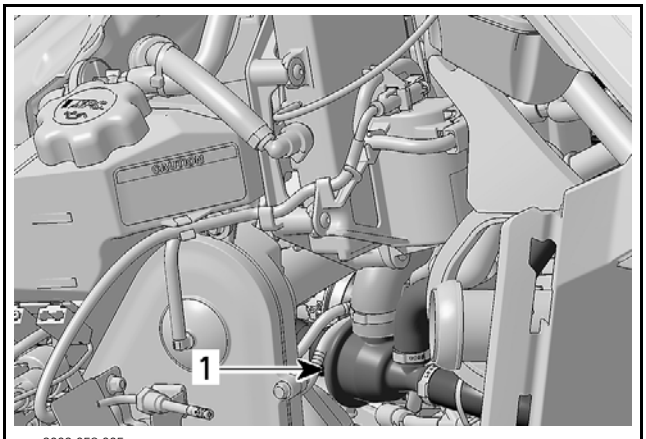
Refer to appropriate *BOTTOM END* subsection.

THERMOSTAT

Thermostat Removal

To remove thermostat:

– Block all four thermostat hoses with hose pinchers **or**
– Drain cooling system.



mmr2009-058-005_a

TYPICAL
1. Thermostat

Remove LH and RH panels. Refer to *BODY* subsection.

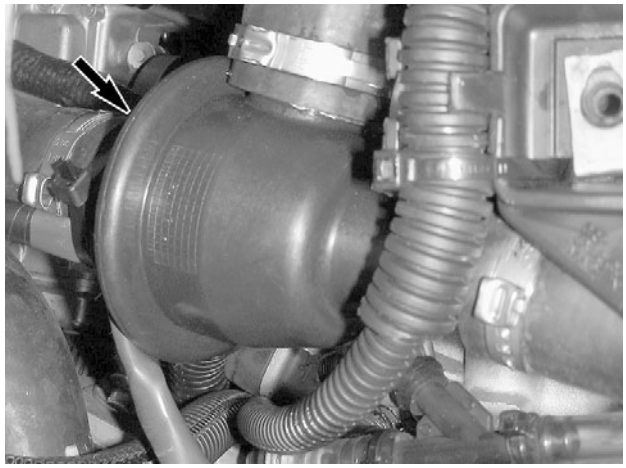
Remove drive belt guard. Refer to *DRIVE BELT* subsection.

Remove primary air intake silencer. Refer to *AIR INTAKE SYSTEM* subsection.

Remove muffler. Refer to *EXHAUST SYSTEM* subsection.

Cut Oetiker clamps then unplug hoses.

Remove thermostat housing.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TYPICAL - THERMOSTAT HOUSING

Thermostat Test

To check thermostat, put in water and heat water.

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

Thermostat Installation

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.

COOLANT TANK CAP

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

If the test failed, install a new 90 kPa (13 PSI) cap.

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

COOLANT TANK

Coolant Tank Removal

1. Remove upper body module, refer to *BODY* subsection.
2. Siphon coolant tank and block the three lower hoses with pinchers.
3. Cut Oetiker clamps and remove all hoses from coolant tank.
4. Remove retaining screws to disengage coolant tank from frame.

Coolant Tank Inspection

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

Coolant Tank Installation

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.

COOLANT TEMPERATURE SENSOR (CTS)

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

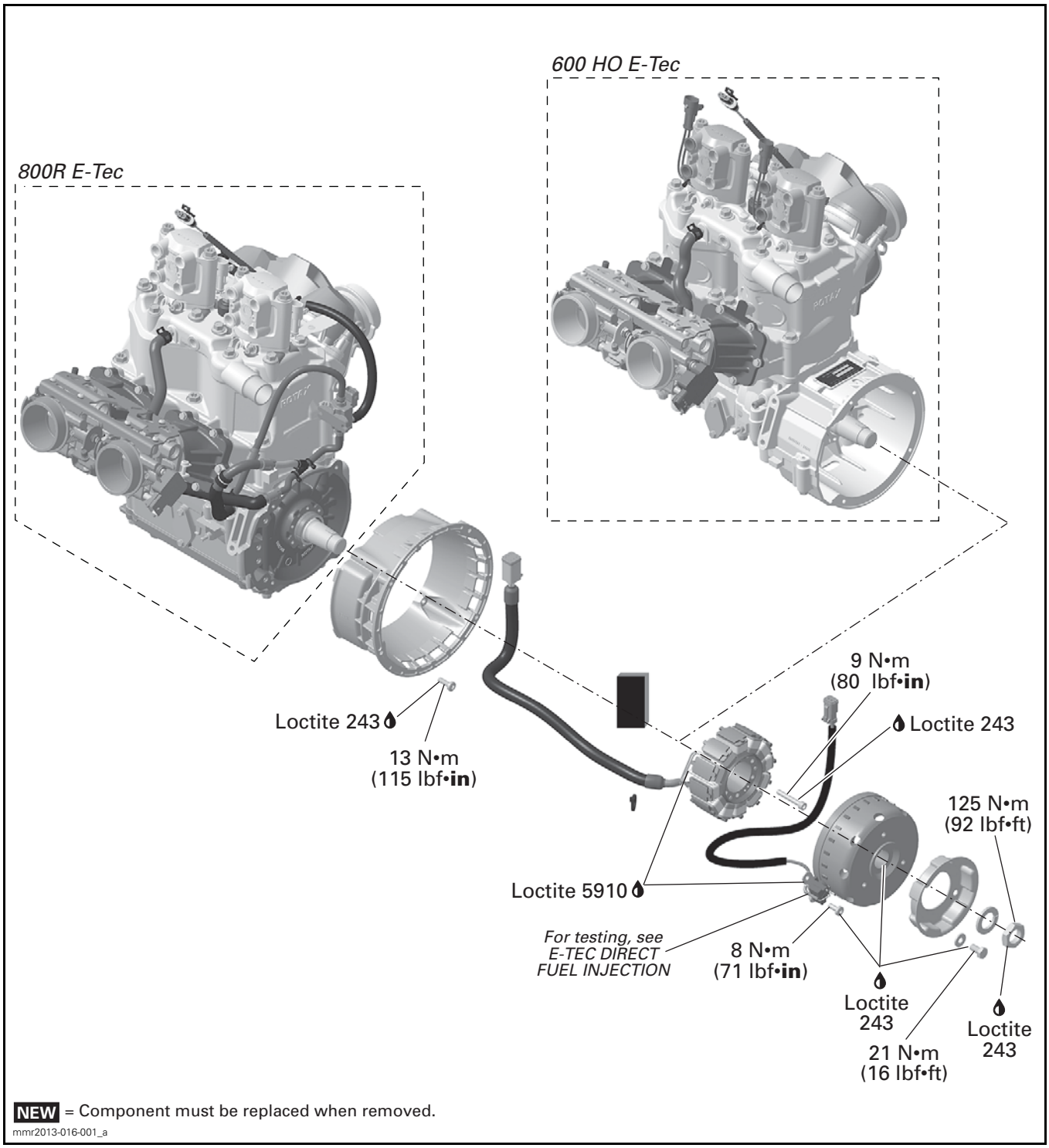
MAGNETO SYSTEM

SERVICE TOOLS

Description	Part Number	Page
CRANKSHAFT PROTECTOR (MAG)	420 876 557	4
FLUKE 115 MULTIMETER	529 035 868	6
MAGNETO PULLER RING	420 876 081	3
MAGNETO PULLER	529 035 547	4

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	5, 8–9
LOCTITE 5910	293 800 081	7–8


600 HO E-Tec
800R E-Tec
Loctite 243
13 N•m
(115 lbf•in)
9 N•m
(80 lbf•in)
Loctite 243
125 N•m
(92 lbf•ft)
Loctite 5910
For testing, see
E-TEC DIRECT
FUEL INJECTION
8 N•m
(71 lbf•in)
Loctite
243
21 N•m
(16 lbf•ft)
Loctite
243
NEW = Component must be replaced when removed.
mmr2013-016-001_a

GENERAL

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

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

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

1. Remove muffler. Refer to *EXHAUST SYSTEM* subsection.

Magneto Flywheel Removal

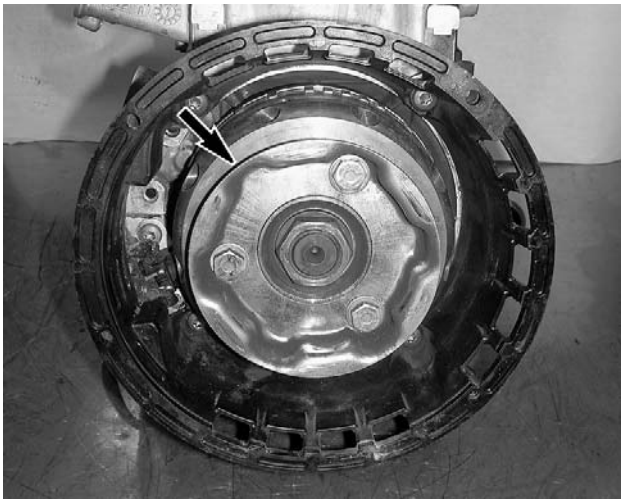
1. Remove rewind starter assembly (or magneto cover for electric start models). Refer to *REWIND STARTER* subsection.

600 HO E-TEC Models

2. Remove rewind starter connecting flange. Refer to *REWIND STARTER* subsection.

All Models

3. Hold magneto flywheel with a socket then remove starting pulley retaining screws.



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TYPICAL - STARTING PULLEY (800R E-TEC ILLUSTRATED)

mmr2012-016-002

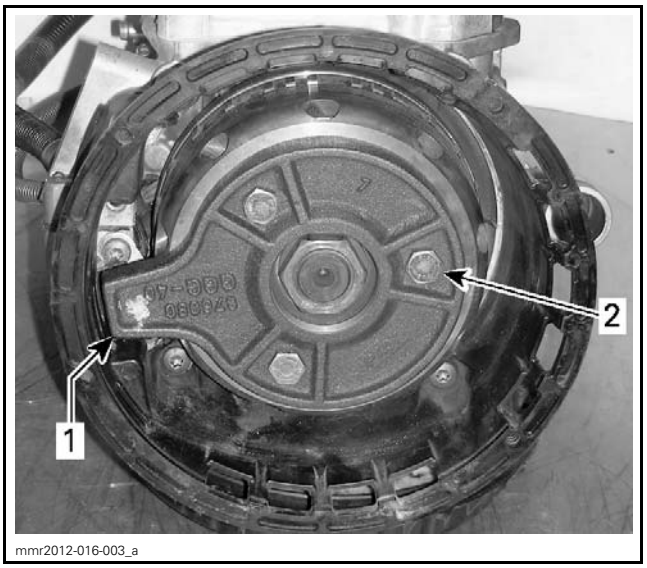
TYPICAL - STARTING PULLEY SCREWS REMOVAL

4. Remove magneto flywheel retaining nut, using an appropriate socket.

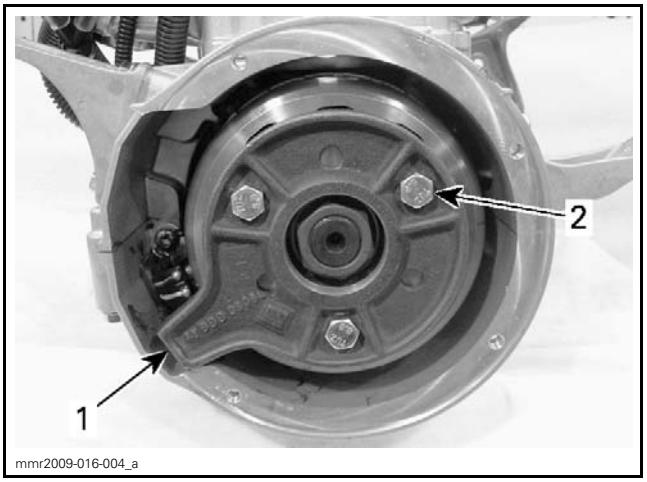
REQUIRED TOOL	
MAGNETO PULLER RING (P/N 420 876 081)	
30 mm socket with the outside diameter machined to 40 mm (1.575 in)	

NOTICE **Use only the following screw lengths to fasten puller ring to magneto flywheel. If other screw lengths are used, the stator behind the magneto flywheel may be damaged.**

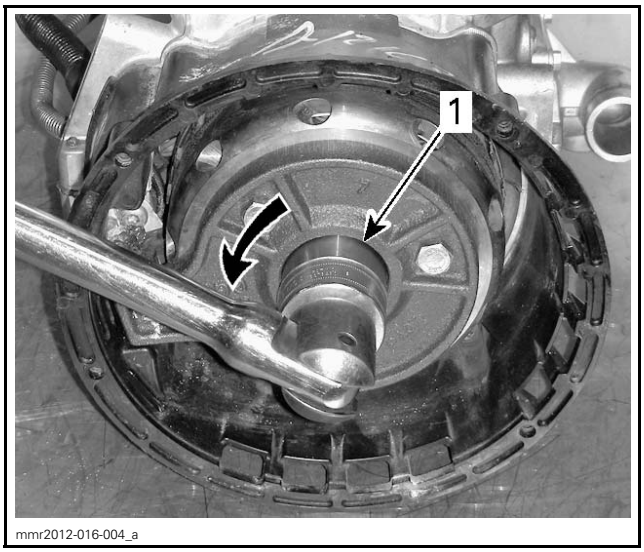
ENGINE	SCREW LENGTH
600 HO E-TEC, 800R E-TEC	M8 x 25 mm



TYPICAL - 800R ENGINES
1. *Tab in magneto housing opening*
2. *M8 screws of appropriate length (x3)*



TYPICAL 600 HO E-TEC
1. *Tab in magneto housing opening*
2. *M8 screws of appropriate length*



TYPICAL
1. *Machined 30 mm socket*

NOTE: To correctly remove a fastener with threadlocker, first tap on the fastener to break threadlocker bond. This will prevent the thread from breaking.

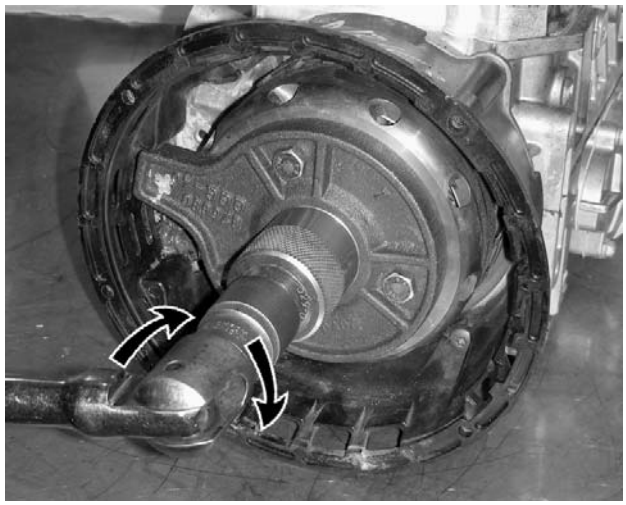
5. Remove magneto flywheel.

REQUIRED TOOL	
CRANKSHAFT PROTECTOR (MAG) (P/N 420 876 557)	
MAGNETO PULLER (P/N 529 035 547)	

NOTE: Apply a small amount of grease on the end of the crankshaft to hold crankshaft protector in place.

Install the magneto puller into the magneto puller ring.

Tighten puller bolt, while tapping on puller bolt head with a hammer to release magneto flywheel from crankshaft.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TYPICAL

Magneto Flywheel Cleaning

NOTICE Clean magneto flywheel using only a clean cloth.

Magneto Flywheel Inspection

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 housing ventilation holes are clean.
– Check stator for signs of overheating.
– Test stator, see procedures further in this subsection.

Magneto Flywheel Installation

1. Clean crankshaft extension (taper) and apply LOCTITE 243 (BLUE) (P/N 293 800 060) on tapered surface.
2. Position Woodruff key, magneto flywheel and lock washer on crankshaft.
3. Clean threads in magneto flywheel nut.
4. Install nut on crankshaft and tighten to specification.

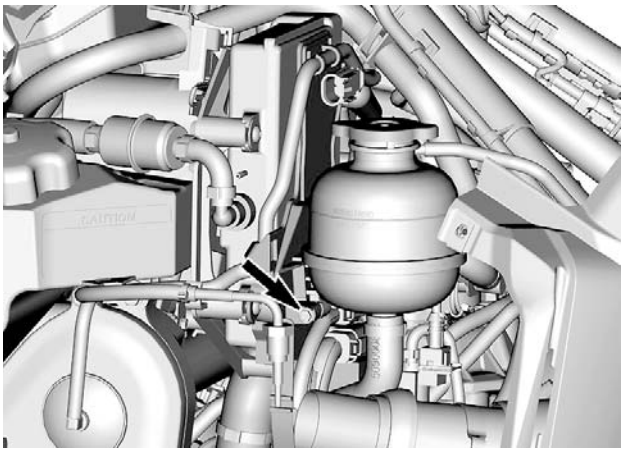
MAGNETO FLYWHEEL NUT	
Service Product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening Torque	125 N•m (92 lbf•ft)

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

STATOR

Stator Connector Access

1. Remove upper body module. Refer to *BODY* subsection.
2. Remove muffler. Refer to *EXHAUST SYSTEM* subsection.
3. Detach coolant tank from its support.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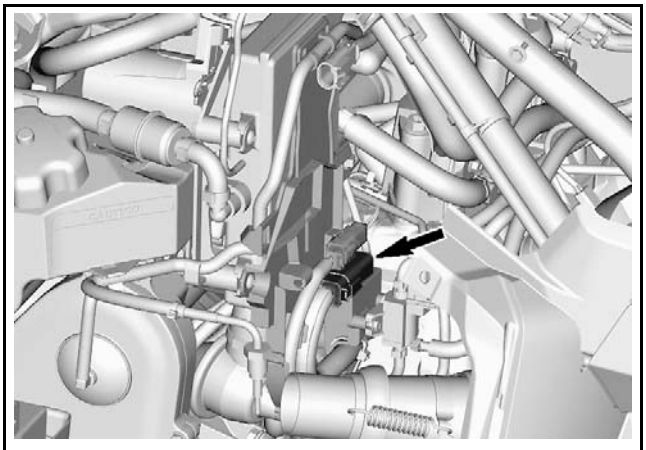
4. Disconnect stator connector (6-pin connector).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Stator Continuity Test

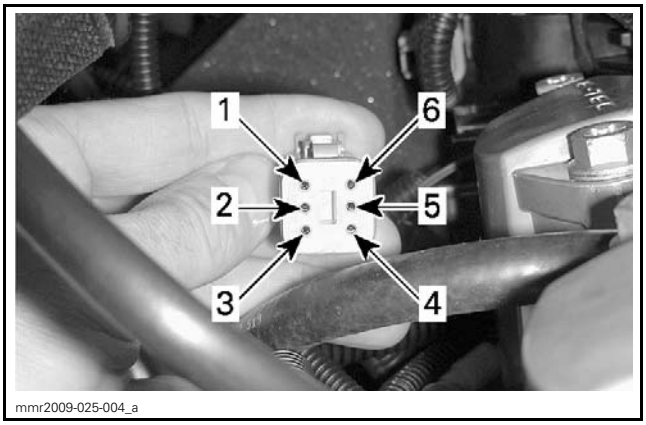
1. Disconnect stator connector.

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 6	0.63 ± 0.03 Ω
Pin 2	Pin 5	
Pin 3	Pin 4	



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.

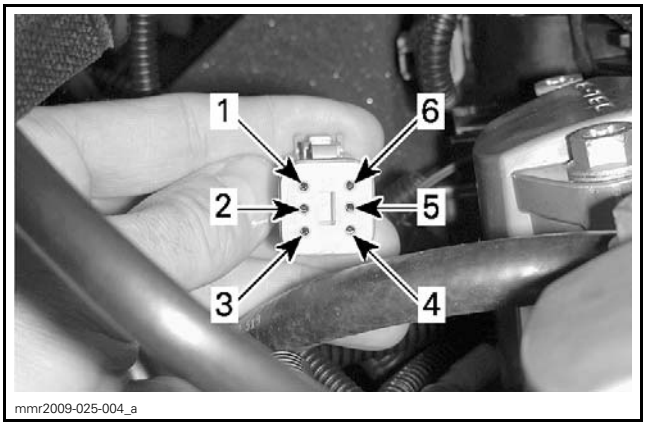
Stator Insulation Test

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		
Pin 1	Pin 4	
Pin 1	Pin 5	
Pin 2	Pin 4	



STATOR CONNECTOR PIN-OUT

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

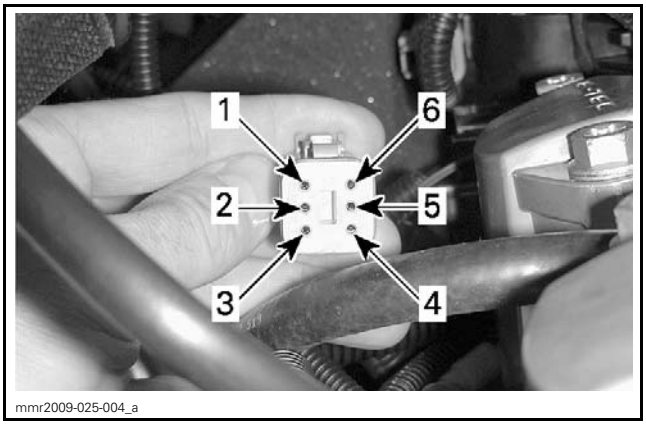
Stator Voltage Output Test

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)	

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 6	Approximately 15 - 20 Vac
Pin 2	Pin 5	
Pin 3	Pin 4	



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.

Stator Removal

1. Lift engine for access to stator harness. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
2. Remove *MAGNETO FLYWHEEL*, see procedure in this subsection.
3. Remove Allen socket screws retaining stator to magneto housing.
4. Remove grommet from crankcase where CPS sensor and stator wires exit magneto housing.
5. 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.

6. Remove stator and carefully pull wires through the grommet.

NOTE: It will be necessary to break the silicone sealant behind the left side of the stator. Proceed carefully to avoid wire damage.

Stator Cleaning

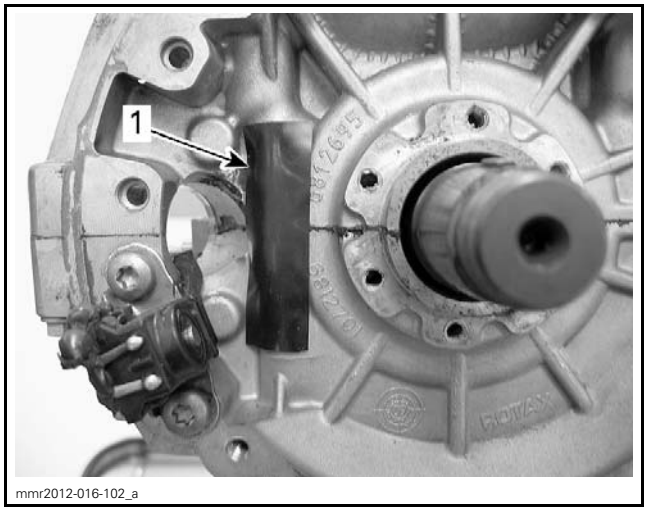
NOTICE Clean stator using only a clean cloth.

Stator Inspection

Refer to *MAGNETO FLYWHEEL INSPECTION* in this subsection.

Stator Installation

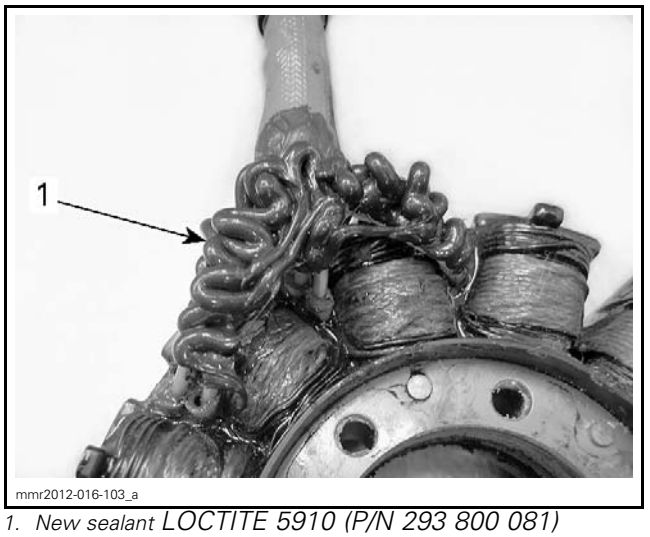
1. Install adhesive pad on crankcase as illustrated.



TYPICAL - 800R E-TEC SHOWN
MAGNETO HOUSING REMOVED FOR CLEARNESS PURPOSE
1. Adhesive pad to install

NOTE: It is important to remove the old sealant behind the LH side of the stator then apply new sealant specified on stator wires.

STATOR WIRES	
Service Product	LOCTITE 5910 (P/N 293 800 081)



1. New sealant LOCTITE 5910 (P/N 293 800 081)

2. Insert stator connector through the crankcase and grommet.
3. Install grommet on crankcase.

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

4. Tighten stator retaining screws to specification.

STATOR RETAINING SCREWS	
Service Product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening Torque	9 N•m (80 lbf•**in**)

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.

CRANKSHAFT POSITION SENSOR (CPS)

CPS Test

Refer to *E-TEC DIRECT INJECTION* subsection.

CPS Removal

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

1. Lift engine for access to CPS harness. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
2. Remove magneto flywheel, refer to *MAGNETO FLYWHEEL REMOVAL* in this subsection.

800R E-TEC Models

3. Remove magneto housing, refer to *MAGNETO HOUSING* in this subsection.

All Models

4. Remove CPS retaining screws.
5. Remove grommet from crankcase where CPS harness exits magneto housing.
6. Disconnect CPS connector, refer to *STATOR CONNECTOR ACCESS* in this subsection.

NOTE: To ease harness routing at installation, tie a string to the CPS connector and guide it through as you pull on the CPS harness.

7. Remove CPS and carefully pull harness through from crankcase.
8. Remove the old silicon at CPS sensor location

CPS Installation

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

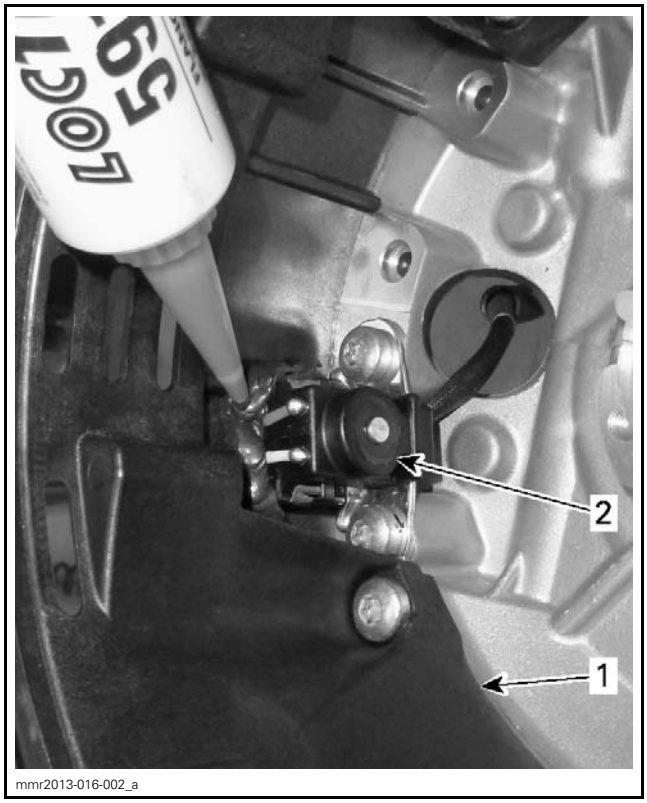
Tie the string used during removal on the CPS connector, then pull on it to route the harness to its original location.

Tighten CPS retaining screws to specification.

CPS RETAINING SCREWS	
Service Product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening Torque	8 N•m (71 lbf•**in**)

NOTE: It is important to remove the old silicon at CPS location then apply new silicon. Screw CPS then stick the CPS harness.

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



TYPICAL - 800R E-TEC SHOWN
1. Magneto housing
2. CPS

MAGNETO HOUSING (800R E-TEC)

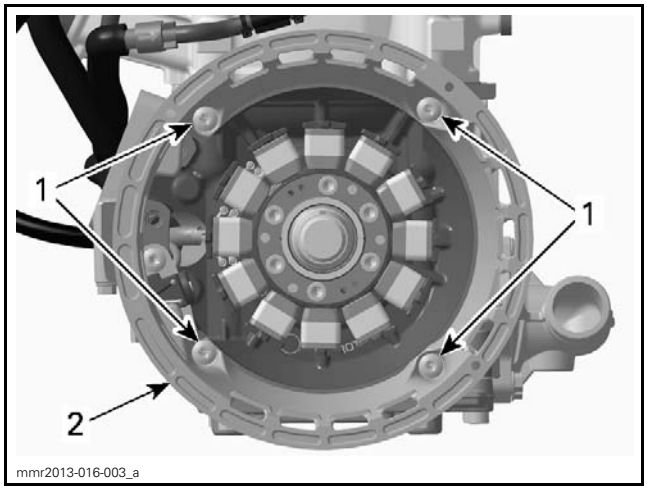
Magneto Housing Inspection

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

Magneto Housing Removal

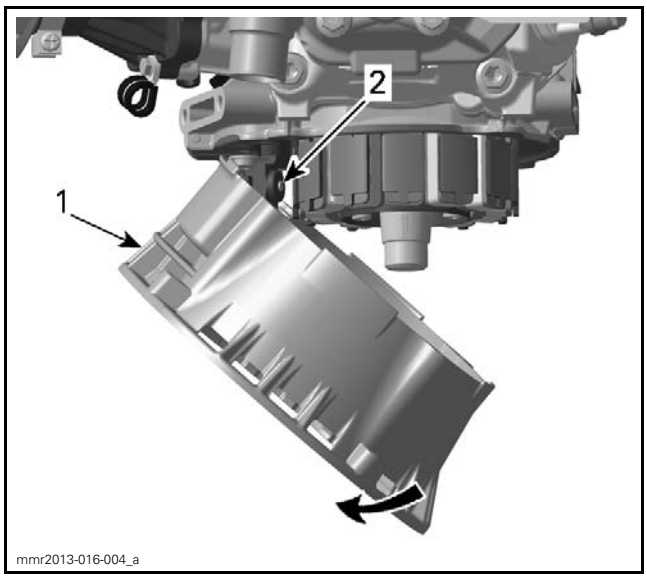
⚠ CAUTION Ensure tether cord is removed from D.E.S.S. post and engine shut-off switch is in the OFF position.

1. Remove magneto flywheel, refer to *MAGNETO FLYWHEEL REMOVAL* in this subsection.
2. Remove magneto housing screws.



1. Magneto housing screws
2. Magneto housing

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



PULL MAGNETO COVER
1. Magneto cover
2. CPS

4. Remove magneto housing.

Magneto Housing Installation

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

Remove the old silicon at CPS location then apply new silicon. Refer to *CPS INSTALLATION* in this subsection.

Tighten magneto housing screws to specification.

MAGNETO HOUSING SCREWS	
Service Product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening Torque	13 N•m (115 lbf•**in**)

RAVE

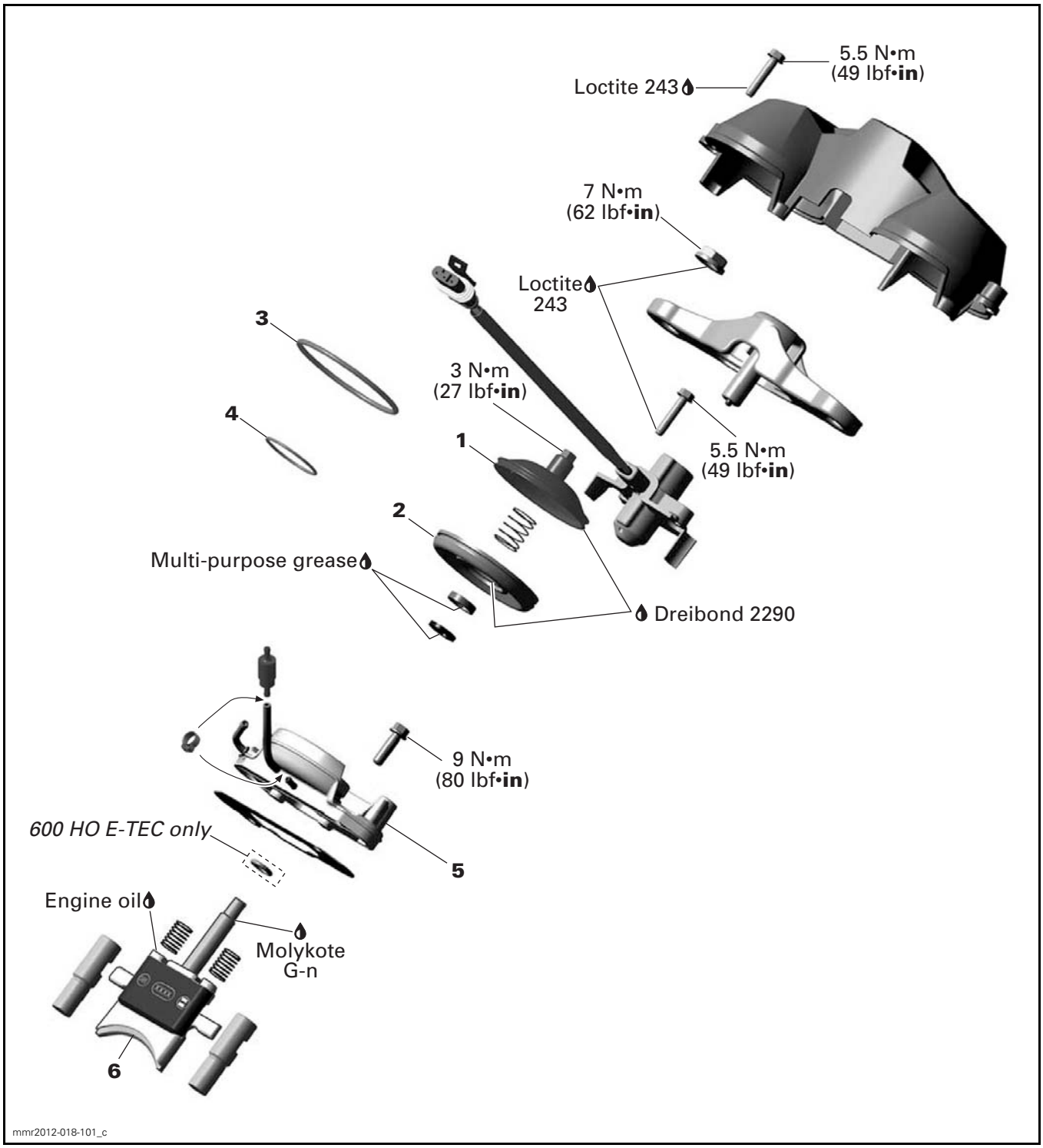
SERVICE TOOLS

Description	Part Number	Page
SMALL HOSE PINCHER	295 000 076	18
T-HARNESS	529 035 869	20
VACUUM/PRESSURE PUMP	529 021 800	8, 11–12, 18–19, 21

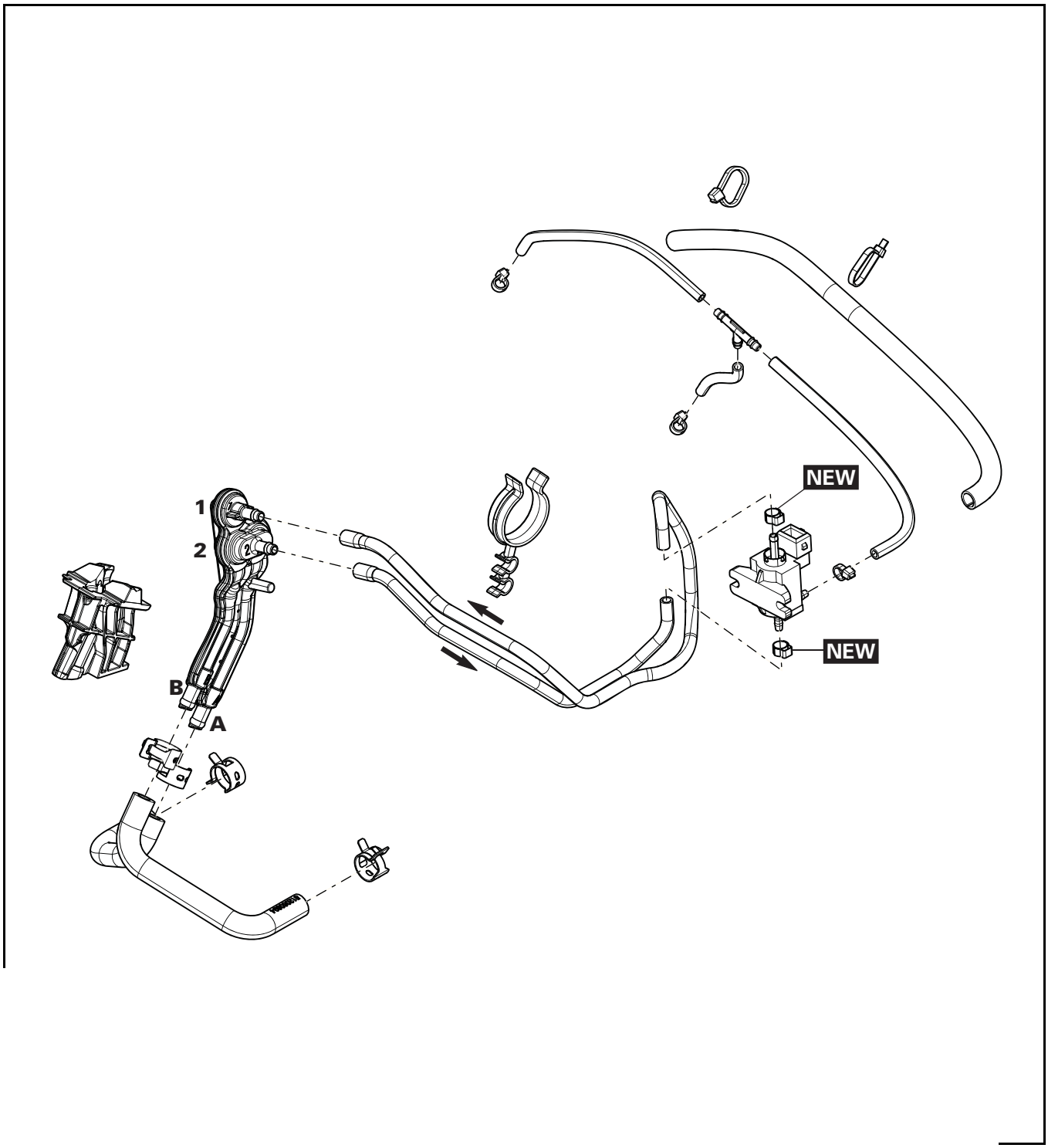
SERVICE PRODUCTS

Description	Part Number	Page
DREI BOND SEALING COMPOUND	420 297 906	16
LOCTITE 243 (BLUE)	293 800 060	9, 18
MOLYKOTE G-N	420 297 433	16
XPS SYNTHETIC BLEND 2-STROKE OIL	293 600 100	14

RAVE VALVE


5.5 N•m
(49 lbf•in)
Loctite 243
7 N•m
(62 lbf•in)
Loctite
243
3
3 N•m
(27 lbf•in)
4
1
5.5 N•m
(49 lbf•in)
2
Multi-purpose grease
Dreibond 2290
9 N•m
(80 lbf•in)
600 HO E-TEC only
5
Engine oil
Molykote
G-n
6
mmr2012-018-101_c

SOLENOID AND CHECK VALVES



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.

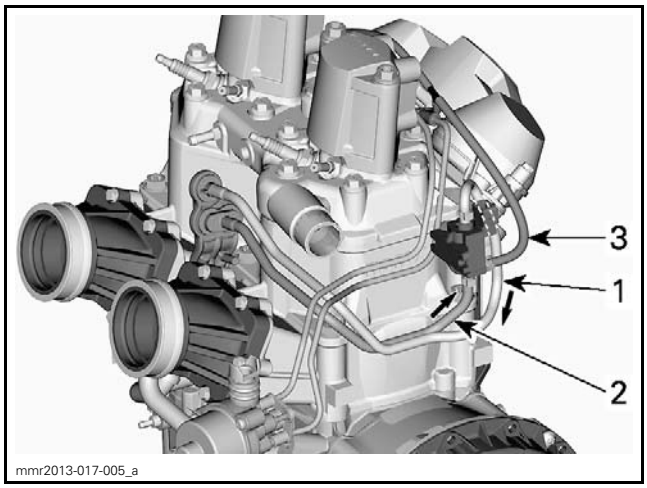
The RAVE valve steps are:
– Fully closed
– Partially opened
– Fully opened.

RAVE valves are moved to the desired position by using vacuum or pressure via a solenoid that is controlled by the ECM through mappings.

Many different mappings are used by the ECM to control the 3D RAVE valves. The mappings are based on current engine RPM, crankshaft rate of acceleration or deceleration and the following inputs: intake temperature, TPS, knock sensor, engine coolant temperature and APS.

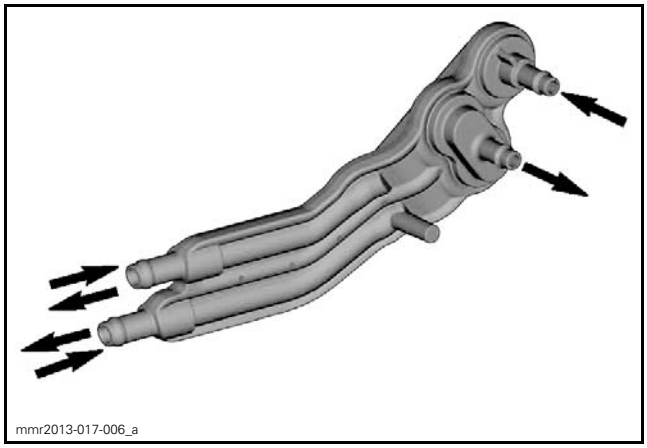
NOTE: 3D RAVE valves may go through all 3 positions or skip the partially open position and go directly to either the fully open or closed positions depending how quickly the throttle is depressed and the engine load.

The solenoid directs pressure and/or vacuum towards the RAVE valves to open or close them.

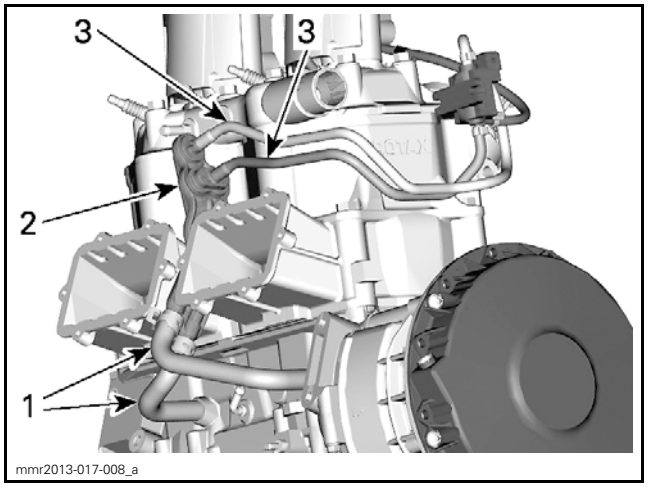


1. *Vacuum hose*
2. *Pressure hose*
3. *Hose towards RAVE valves*

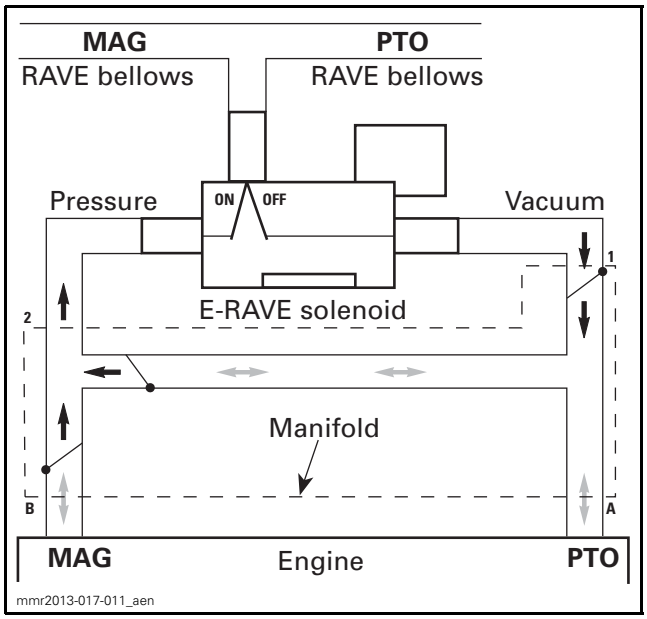
An arrangement of check valves within the check valve manifold allows to separate the crankcase vacuum pulses from the pressure pulses.



CHECK VALVE MANIFOLD



1. *Crankcase hoses*
2. *Check valve manifold*
3. *Hoses to solenoid*

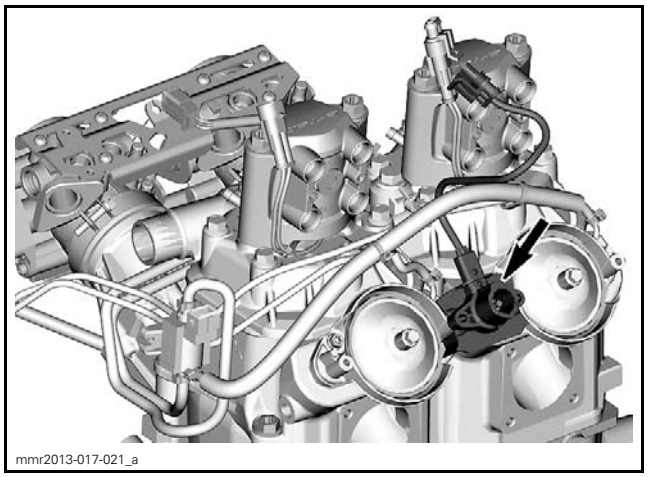


SOLENOID VACUUM/PRESSURE SEPARATION

The ECM controls the solenoid as follows.

RAVE VALVES POSITION	SOLENOID STATE	SOLENOID VALVE OPERATION
FULLY OPENED	ON	Pressure
MIDDLE	Switched between ON and OFF repeatedly by the ECM (pulse width modulation with a variable DC) (duty cycle from 10 to near 50%).	Near atmospheric pressure (floating position). A constant switching between pressure and vacuum to keep the RAVE in the mid position as set in the ECM.
CLOSED	OFF	Vacuum

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

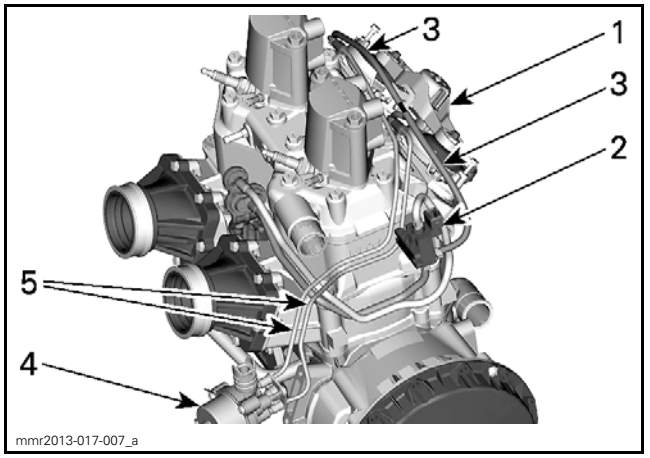


PARTS REMOVED FOR CLARITY

The RAVE position sensor (RPS) provides the ECM its actual position. Either closed, mid-position or open. 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.

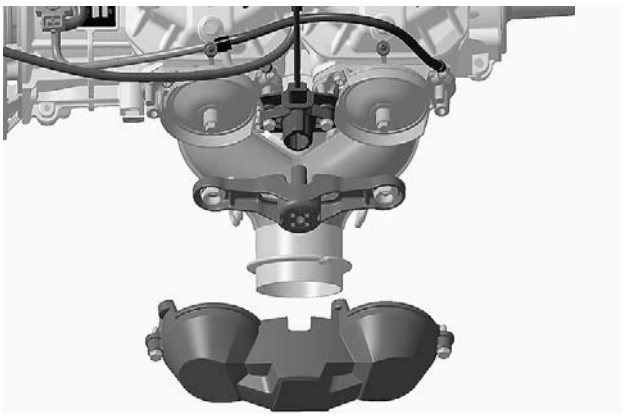
RAVE valves are lubricated by the electronic oil injection pump.

RAVE valves movement is synchronized and monitored with a link bar.



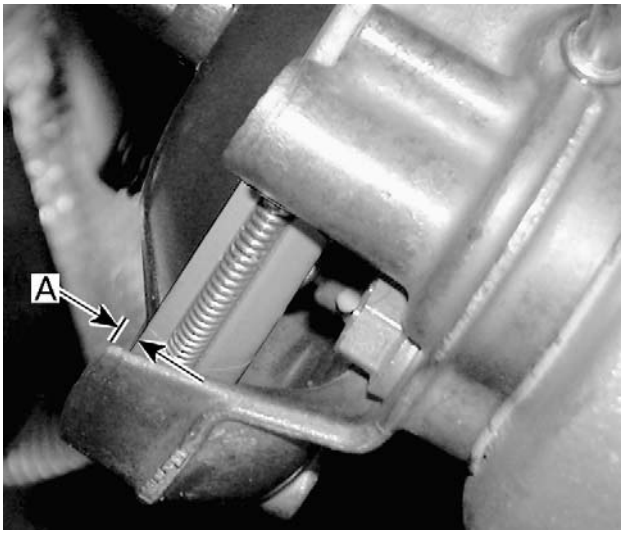
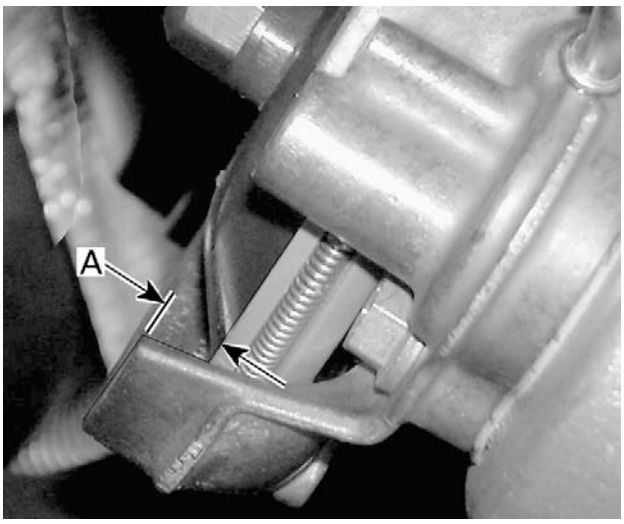
LINK BAR COVER REMOVED
1. *Linked RAVE valves*
2. *RAVE solenoid*
3. *Inlet hoses (vacuum and pressure to RAVE valves)*
4. *Electronic oil injection pump*
5. *Oil lines to RAVE valves*

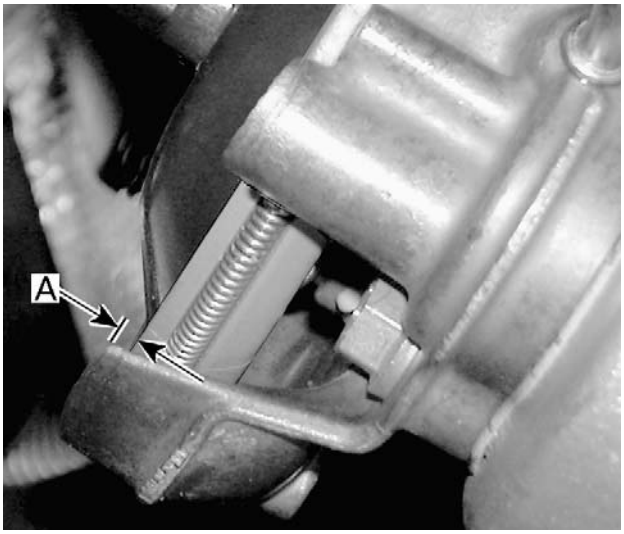
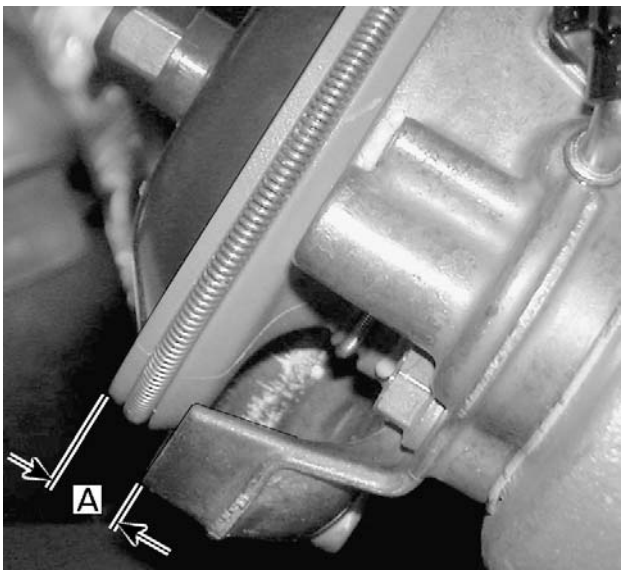
The link bar is used to keep RAVE valves opening and closing synchronized one with each other. This provides a more consistent engine operation.


mmr2009-019-033

If link bar is removed, a particular adjustment is required at the assembly. Also, B.U.D.S. needs to be used to set the RAVE positions.

3D RAVE Position According to Engine Operation

ENGINE OPERATION	RAVE VALVE POSITION MEASURED FROM TOP OF GREEN BELLOW TO EDGE OF RAVE HOUSING	
Engine stopped	Partially open	 mbs2007-015-002_a A: Approximately 1 mm (1/32 in) down
Idle to approximately 6200 RPM	Fully closed	 mbs2007-015-001_a A: Approximately 6 mm (1/4 in) down

ENGINE OPERATION	RAVE VALVE POSITION MEASURED FROM TOP OF GREEN BELLOW TO EDGE OF RAVE HOUSING	
Approximately 6200 to 7900 RPM (typical trail riding)	Partially opened	NOTE: Same as engine stopped position.  mbs2007-015-002_a A: Approximately 1 mm (1/32 in) down
Approximately 7900 RPM to top RPM	Fully opened	 mbs2007-015-003_a A: Approximately 8 mm (5/16 in) up

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.
– Check position sensor wiring.

Excessive Carbon Build-up in RAVE Valves

– Use the recommended oil quality, refer to *LUBRICATION*.
– Check for damaged, kinked or obstructed inlet hoses (vacuum and pressure).
– Check for proper oil injection pump code in B.U.D.S., refer to *LUBRICATION*.

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

RAVE System Leaking

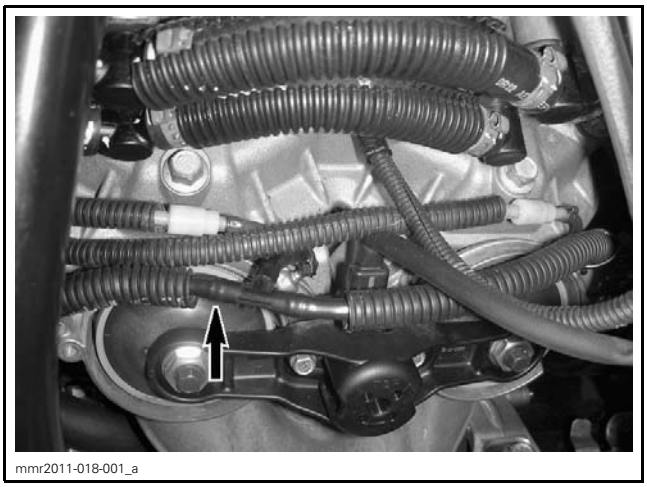
– Perform a *3D RAVE VALVE LEAK TEST*.
– Check for damaged or loose Oetiker clamp.
– Check for damaged hose or fitting.
– Check for a faulty check valve, refer to *CHECK VALVES*.
– Check for a faulty solenoid, refer to *SOLENOID*.

PROCEDURES

3D RAVE VALVES POSITION SENSOR

3D RAVE Valves Position Sensor Setting

1. Ensure RAVE valve are properly synchronized as per *3D RAVE VALVE SYNCHRONIZATION* procedure.
2. Remove upper body module. Refer to *BODY*.
3. Disconnect inlet hoses (vacuum/pressure) at the T-fitting.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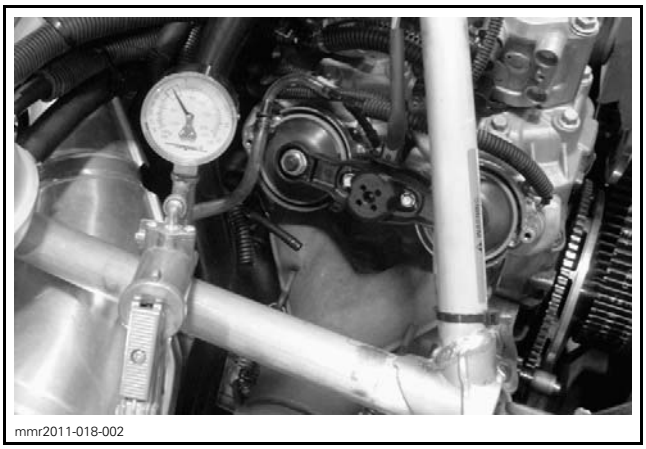
INLET HOSE AT T-FITTING

4. Connect pressure pump onto T-fitting.

REQUIRED TOOL	
VACUUM/PRESSURE PUMP (P/N 529 021 800)	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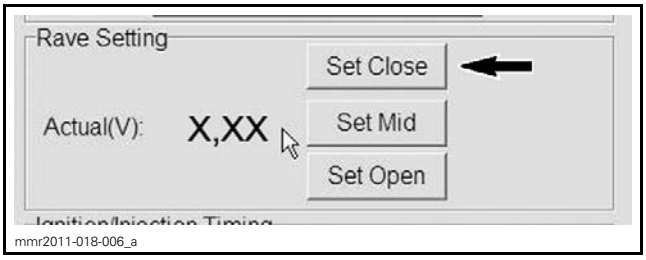
5. Connect vehicle to B.U.D.S., Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
6. In B.U.D.S.:
   6.1 Select **Setting** tab.
   6.2 Select **ECM** tab.
7. Apply -34 kPa (10 in Hg) of vacuum.
   7.1 Press **Set Close** button in **Rave Setting** area.
   7.2 Confirm that **Actual (V)** is within B.U.D.S. specification.



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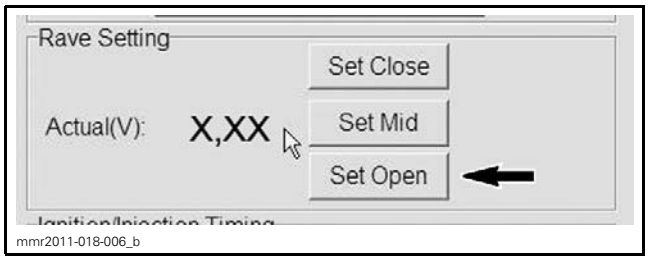
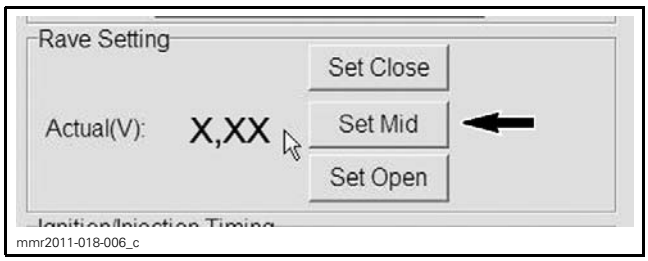
TYPICAL

8. Apply 69 kPa (10 PSI) of pressure.
   8.1 Press **Set Open** button in **Rave Setting** area.
   8.2 Confirm that **Actual (V)** is within B.U.D.S. specification.



TYPICAL

9. Disconnect vacuum/pressure pump from T-fitting.
   9.1 Press **Set Mid** button in **Rave Setting** area.
   9.2 Confirm that **Actual (V)** is within B.U.D.S. specification.

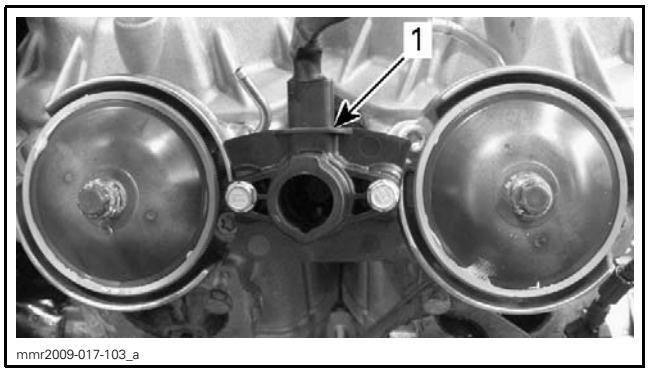


TYPICAL

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

3D Rave Valves Position Sensor Removal

1. Remove upper body module. Refer to *BODY*.
2. Disconnect position sensor connector.
3. Remove RAVE valves cover and link bar, see *3D RAVE VALVES REMOVAL* in this subsection.
4. Remove RAVE valves position sensor.



1. Position sensor

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

3D Rave Valves Position Sensor Installation

1. Install position sensor with wiring upwards.

POSITION SENSOR RETAINING SCREWS	
Service Product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening Torque	5.5 N•m (49 lbf•**in**)

2. Install connector.
3. Position link bar on RAVE valve pistons.
4. Install nuts on piston threads but do not tighten yet.
5. Perform *3D RAVE VALVE SYNCHRONIZATION* procedure in this subsection to complete link bar installation.

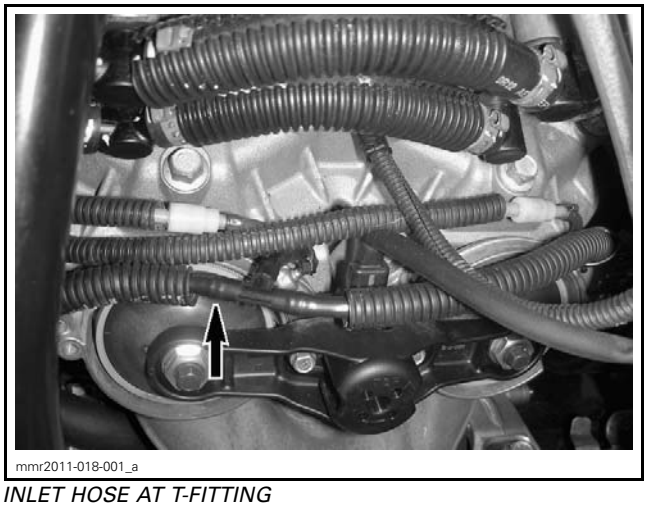
NOTICE It is very important to perform *3D RAVE VALVES SYNCHRONIZATION* whenever link bar is removed.

3D RAVE VALVES

3D RAVE Valve Synchronization

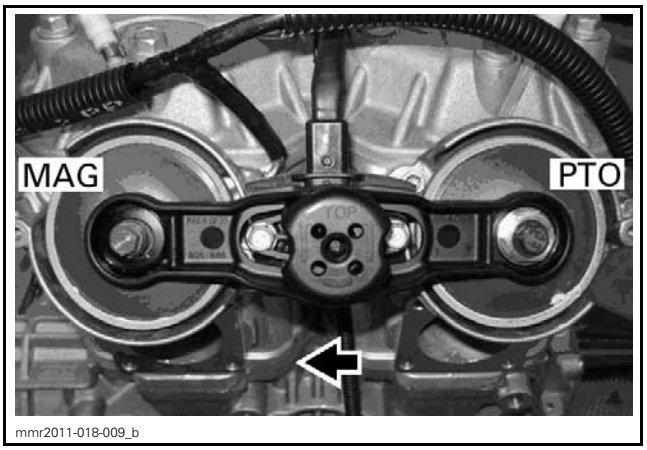
Synchronization Adjustment Procedure

1. Disconnect inlet hose (vacuum/pressure) at the T-fitting.



INLET HOSE AT T-FITTING

2. Ensure that retaining nuts are loosened.
3. Move link bar toward MAG side.
4. Tighten PTO nut by hand.



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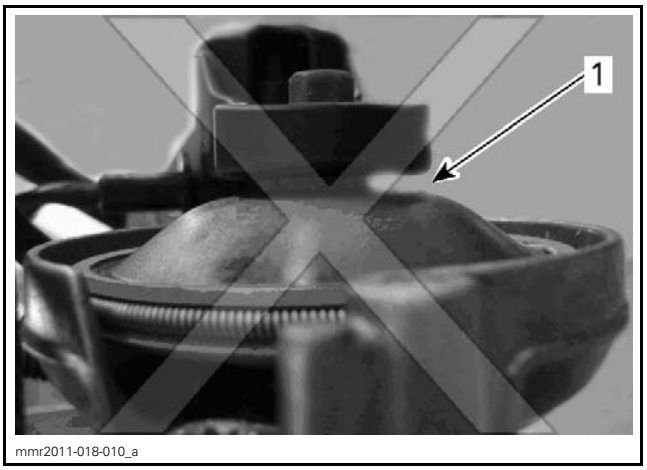
5. Check if a gap is visible between MAG valve piston and link bar.



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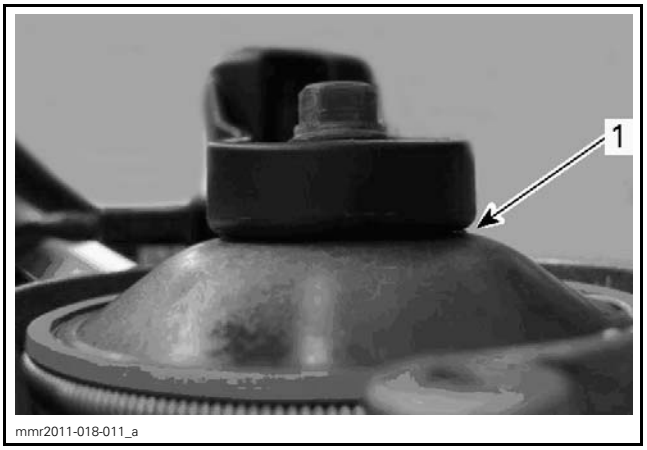
WRONG ADJUSTMENT
1. Gap on MAG side



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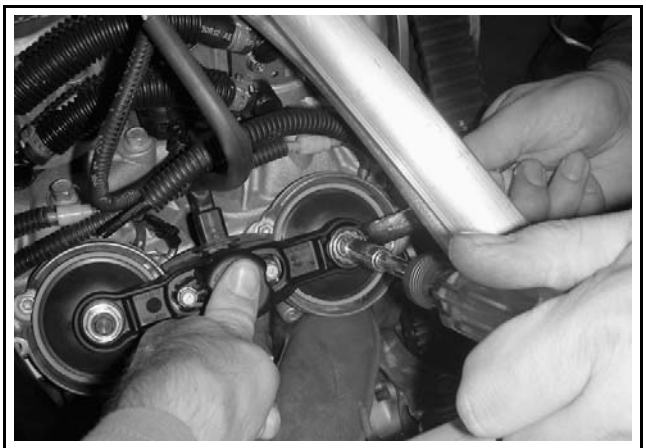
CORRECT ADJUSTMENT
1. No gap on MAG side

6. If a gap is visible:
   - 6.1 Unscrew PTO nut then slightly move link bar toward PTO side.
   - 6.2 Tighten PTO nut by hand and recheck gap.
   - 6.3 Repeat above sequence until no gap is visible.
7. Push the center of link bar downwards in order to seat both RAVE valves on their fully closed position.
8. Firmly hold link bar downwards.
9. Tighten both retaining nuts while holding RAVE valve pistons with a wrench.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NOTICE To prevent RAVE valve piston breakage, proceed with care and make sure piston does not turn to avoid inducing torsional force to piston rods.

10. Adjust position sensor using B.U.D.S. Refer to *3D RAVE VALVES POSITION SENSOR SETTING*.

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, repeat the *ADJUSTMENT PROCEDURE*.
2. With B.U.D.S., check position sensor voltage as follows:
   - 2.1 Difference from fully opened to mid position.
   - 2.2 Difference from closed to mid position.
   - 2.3 Confirm that voltage is within **0.15 volts**.
   - 2.4 If out of specification, repeat the *ADJUSTMENT PROCEDURE*.

3. Start engine and check RAVE valves operation.
   – Pistons should move freely.
   – If not, look for excessive friction due to torsional force applied on the piston rods during installation.

⚠ WARNING

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

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. Disconnect inlet hoses (vacuum/pressure) at the T-fitting.

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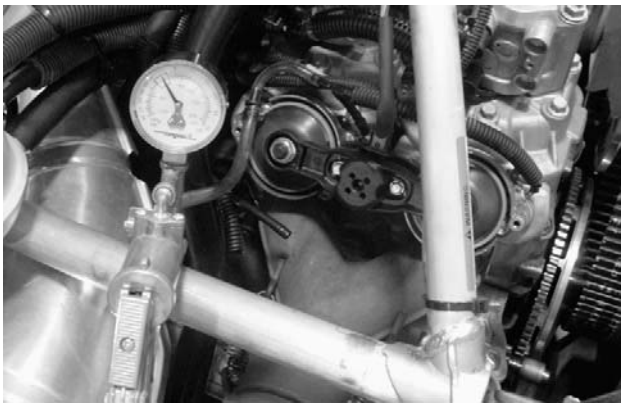
INLET HOSE AT T-FITTING

5. Connect pressure pump onto T-fitting.

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



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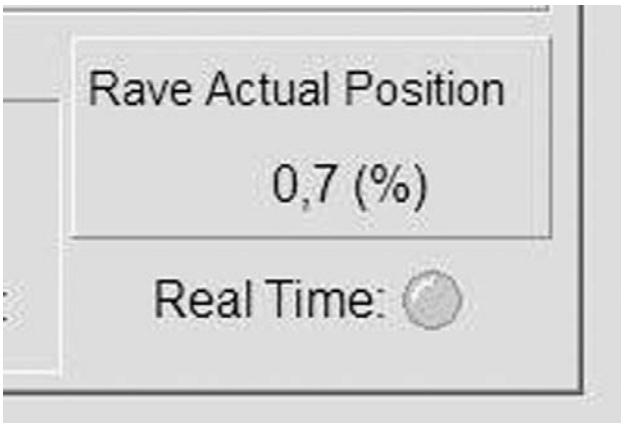
6. Connect vehicle to B.U.D.S., Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
7. In B.U.D.S.:
   7.1 Select **Monitoring** tab.
   7.2 Select **ECM** tab.
8. Apply -34 kPa (10 in Hg) of vacuum.
   8.1 Check **Rave Actual Position** value.
   8.2 Confirm that actual position is within specification.

RAVE ACTUAL POSITION SPECIFICATION	
Closed	Below 2%



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TYPICAL

9. Apply 69 kPa (10 PSI) of pressure.
   9.1 Check **Rave Actual Position** value.
   9.2 Confirm that actual position is within specification.

RAVE ACTUAL POSITION SPECIFICATION	
Fully opened	Above 98%

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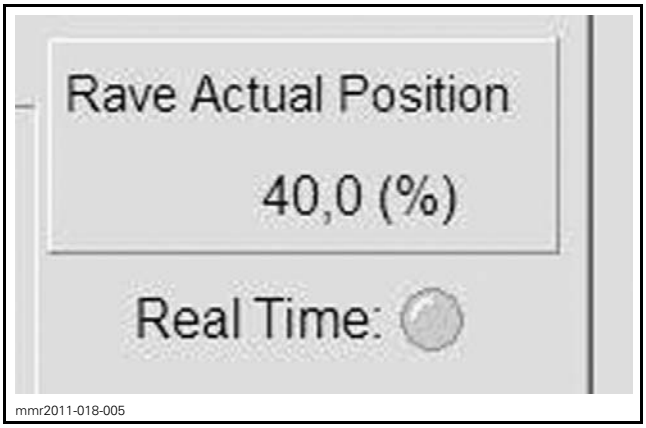
TYPICAL

10. Disconnect vacuum/pressure pump from T-fitting.
11. Manually locate RAVE valves at the middle position to overcome friction.
    11.1 Check **Rave Actual Position** value.
    11.2 Confirm that actual position is within specification.

RAVE ACTUAL POSITION SPECIFICATION		
600 HO E-TEC	Middle	48 ± 2 %
800R E-TEC	Middle	40 ± 2 %



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TYPICAL - 800R E-TEC

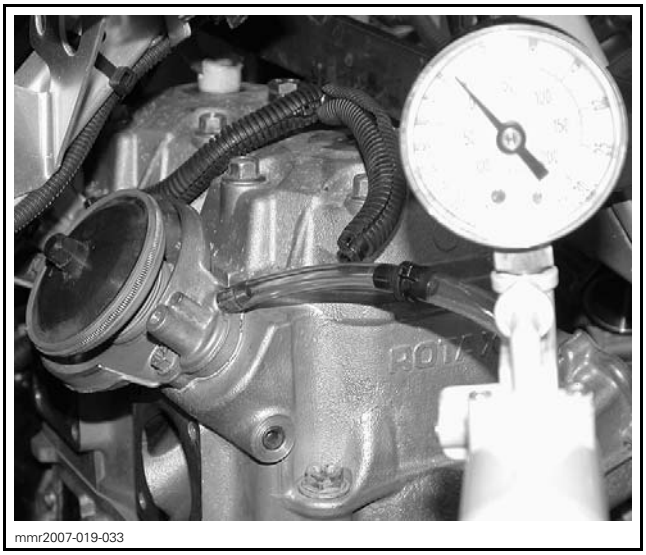
If RAVE valves actual position are out of specification, check the following:
– RAVE valves cleanliness
– RAVE valves for leaks. Refer to *3D RAVE VALVE LEAK TEST* in this subsection.

3D RAVE Valve Leak Test

NOTE: Test each RAVE individually.

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

1. Refer to *3D RAVE VALVES REMOVAL* in this subsection and remove.
– Valves cover
– Link bar
2. Disconnect RAVE inlet hose (vacuum/pressure).
3. Install test pump on nipple and apply pressure.
4. Check if piston fully rises.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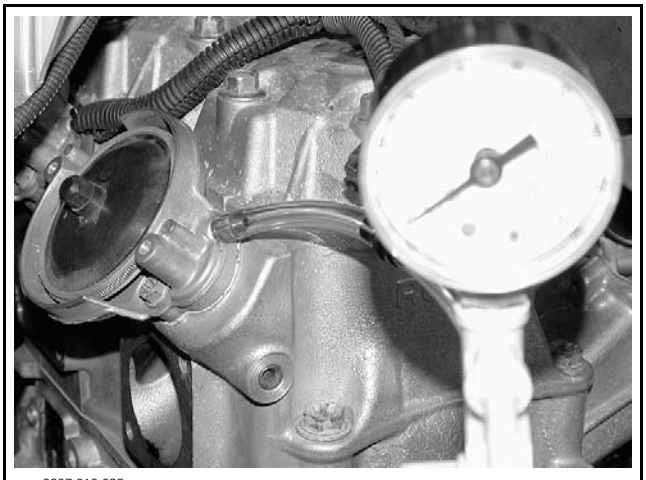
TYPICAL

5. Apply vacuum.
6. Check if piston fully lowers.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TYPICAL

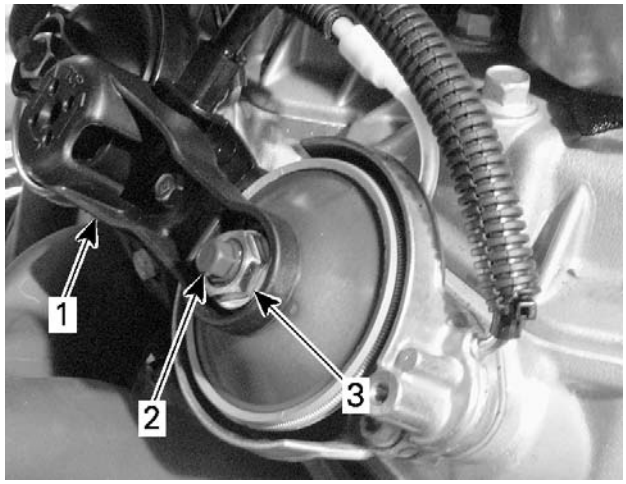
7. If a leak is detected, check the following:
   – Cracked or damaged bellows
   – Damaged seal inside RAVE valve.
8. Install RAVE valve link bar and cover.

NOTICE To prevent RAVE valve piston breakage, proceed with care and make sure piston does not turn.

NOTICE It is very important to perform *3D RAVE VALVES SYNCHRONIZATION* whenever link bar is removed. See procedure in this subsection.

3D RAVE Valves Removal

1. Remove upper body module. Refer to *BODY*.
2. Remove RAVE valves cover.
3. Remove RAVE valves link bar as follows.
   3.1 Hold RAVE valve pistons with a wrench then remove the retaining nuts.



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1. *Link bar*
2. *RAVE valve piston*
3. *Retaining nut*


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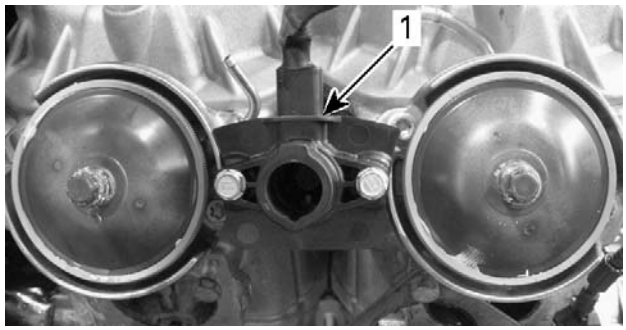
NOTICE To prevent RAVE valve piston breakage, proceed with care and make sure piston does not turn.

4. Remove RAVE valves position sensor.



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1. *Position sensor*

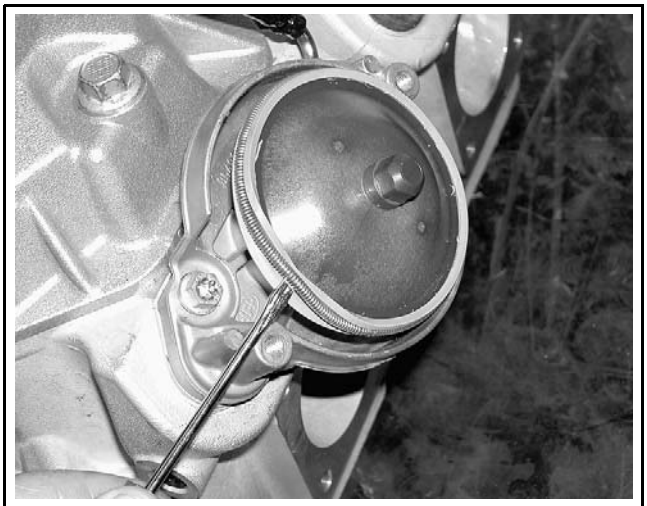
5. Disconnect RAVE valve oil lines and inlet hoses (vacuum/pressure).
6. Remove screws retaining RAVE valve housing **no. 5** to the cylinder.
7. Pull RAVE valve assembly out.


mmr2007-019-015

NOTE: Be careful not to loose springs underneath housing.

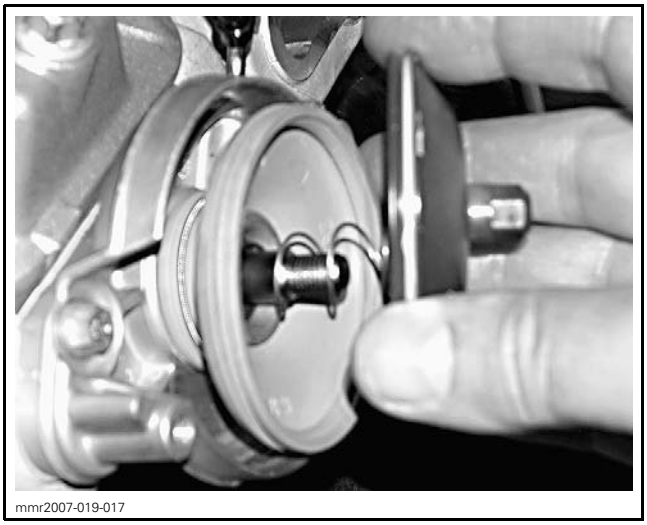
3D RAVE Valve Disassembly

1. Carefully remove spring **no. 3** retaining bellow **no. 2** to RAVE valve piston **no. 1**.


mmr2007-019-026
TYPICAL

2. Free bellow from RAVE valve piston.
3. Carefully unscrew RAVE valve piston then remove compression spring.

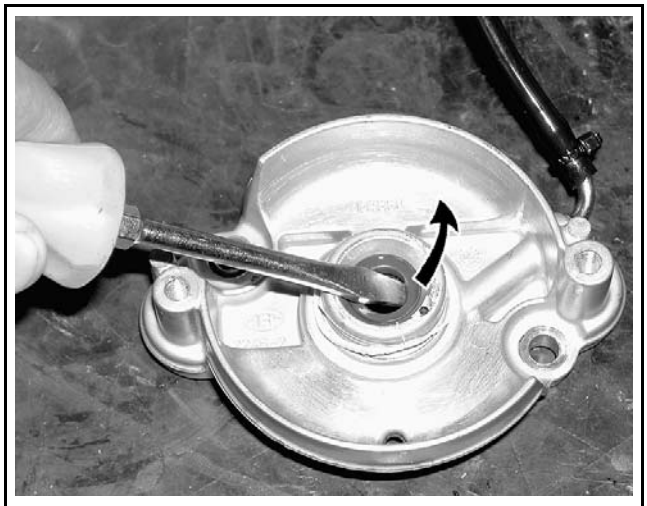
⚠ CAUTION Firmly hold RAVE valve piston. The compression spring inside the valve applies pressure against the piston.


mmr2007-019-017
TYPICAL

4. Carefully remove bellow **no. 2** from RAVE valve housing **no. 5**.

NOTE: If oil is found in housing area, replace seals.

5. Extract RAVE valve from housing.
6. Take note of seals orientation and carefully pry them out.


mmr2007-019-020_a
TYPICAL

3D RAVE Valve Cleaning

Thoroughly clean all RAVE VALVES components and cylinder slots.

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

RAVE Valves Frequently Gummed

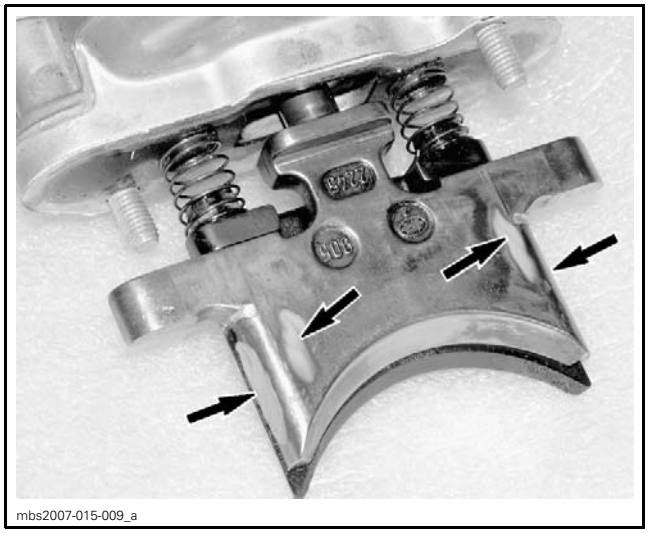
If the valves are getting gummed more frequently than usual, do the following:

– Check if XPS SYNTHETIC BLEND 2-STROKE OIL (P/N 293 600 100) 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 section.

3D RAVE Valve Inspection

Check valves **no. 6** for breakage.

Check valves for wear at sliding points and straightness.


mbs2007-015-009_a

SIGNS OF WEAR

Check spring condition and straightness.

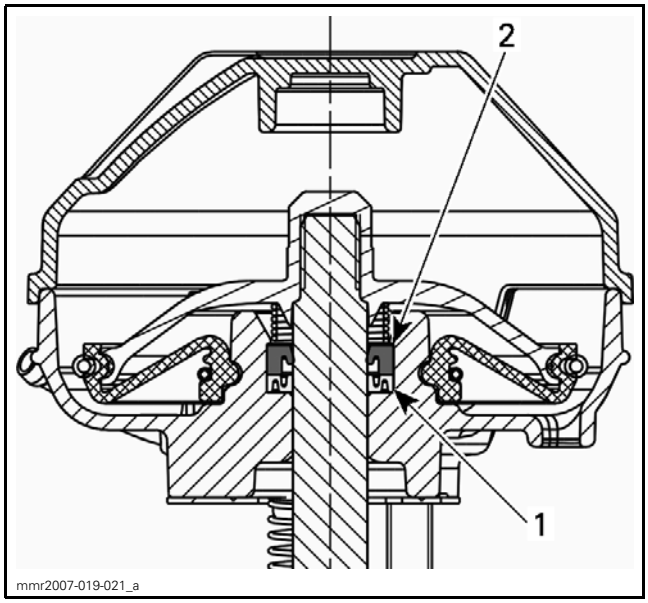
NOTE: Oil dripping from draining hole indicates a defective seal and a loosen retaining spring or damaged bellows.

Check for cracked, dried or perforated bellows no. 2.

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

3D RAVE Valve Assembly

Position parts as per illustrations.



mmr2007-019-021_a

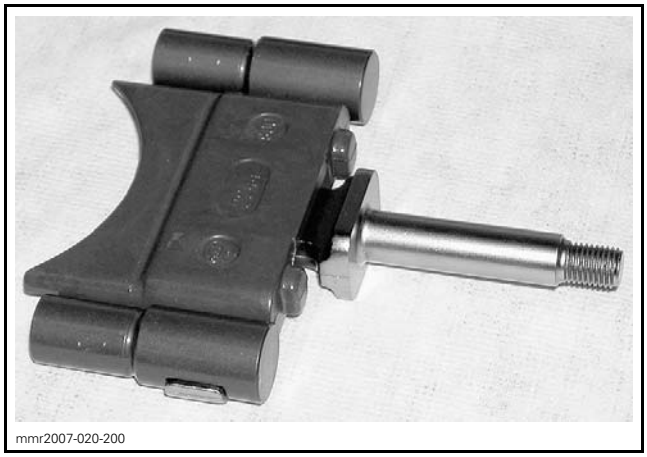
1. Oil seal
2. Gasket ring

Use an appropriate pusher to reinstall seals.

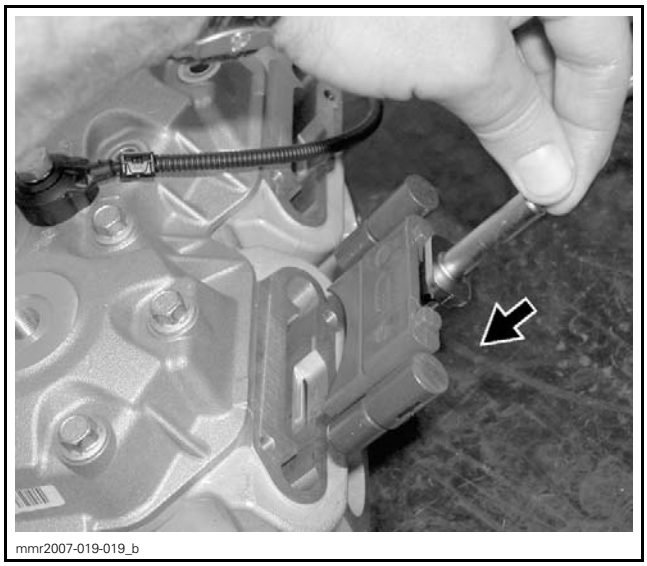

mmr2007-019-022

TYPICAL

1. Assemble together the main and side valves.

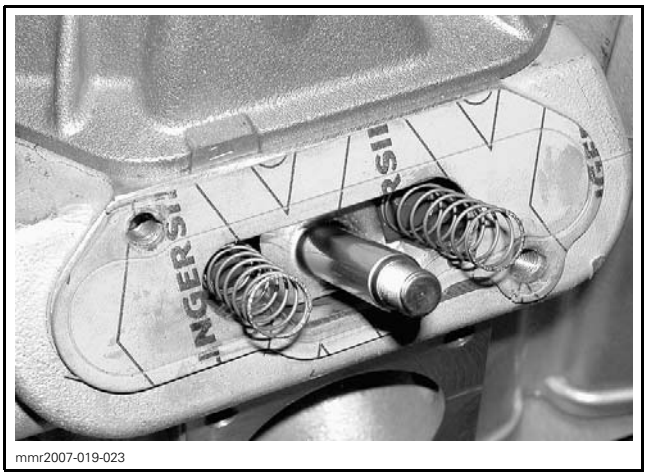

mmr2007-020-200

2. Insert valves together in cylinder. Install gasket.


mmr2007-019-019_b

TYPICAL

3. Align springs on stud ends of valves.

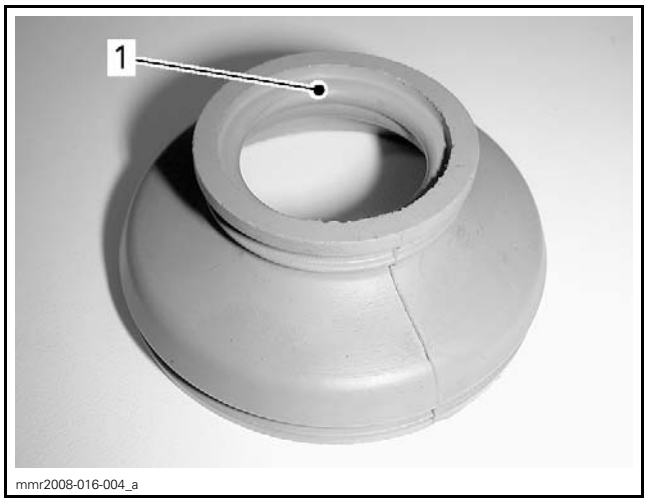

mmr2007-019-023

4. Apply MOLYKOTE G-N (P/N 420 297 433) to valve shaft and on seals in housing.
5. Install housing and carefully align springs on stud ends of housing.


mmr2007-019-024

TYPICAL

6. Install lower spring **no. 4** on bellow.
7. Apply DREI BOND SEALING COMPOUND (P/N 420 297 906) on bellow lower rib, then install bellow and spring.



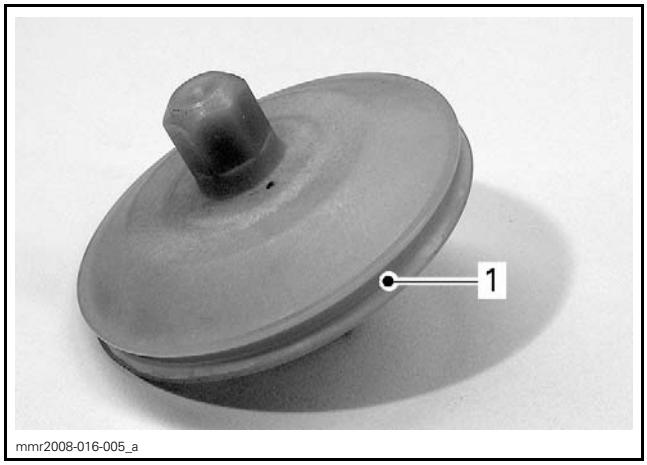
mmr2008-016-004_a

1. Apply Drei Bond here

8. Install compression spring then tighten valve piston.

VALVE PISTON	
Tightening Torque	3 N•m (27 lbf•**in**)

9. Apply DREI BOND SEALING COMPOUND (P/N 420 297 906) on valve piston groove.

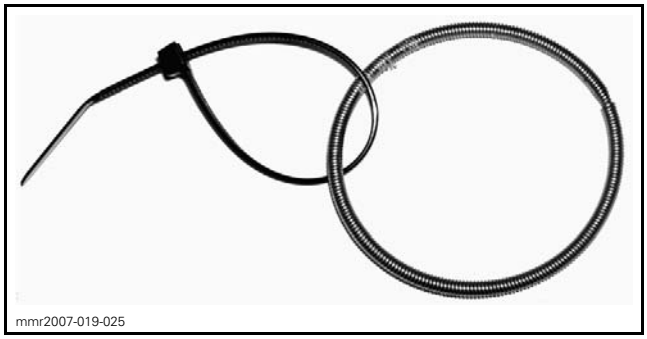


mmr2008-016-005_a

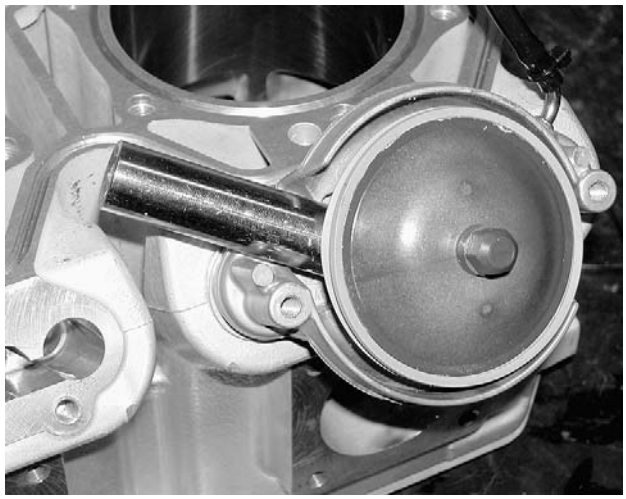
1. Apply Drei Bond here

10. Position bellow on valve piston then secure top retaining spring **no. 3** as follows.

    10.1 Attach a locking tie to spring.


mmr2007-019-025

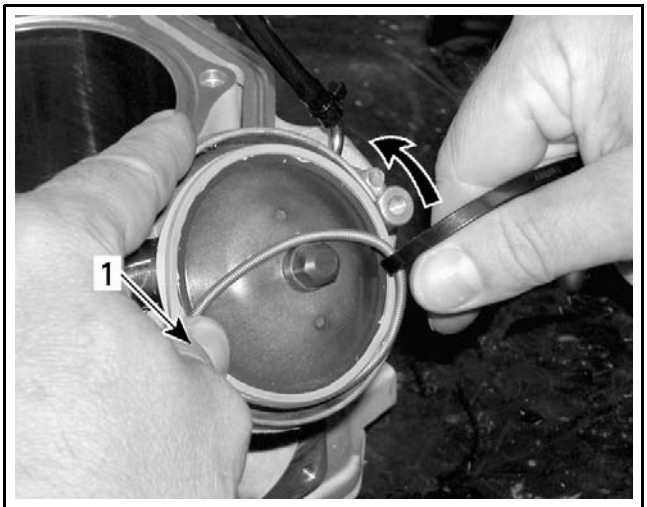
10.2 Block valve piston in the open position with a suitable socket.



mmr2007-019-027

10.3 Position joint of spring under your thumb.

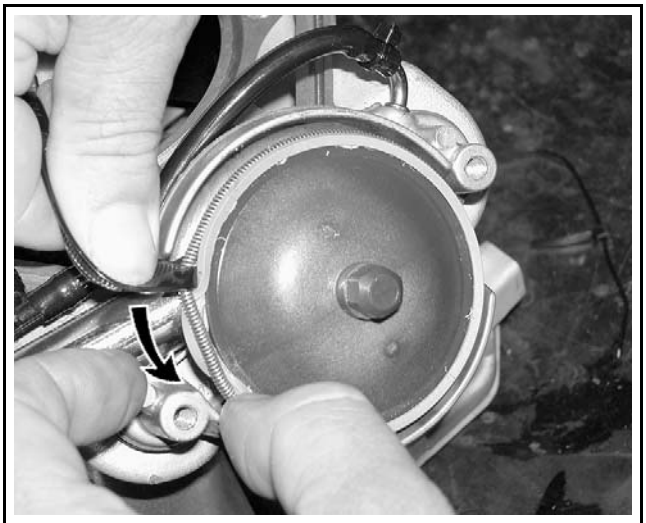
10.4 Hold spring with your thumb while sliding spring on the other side using the locking tie.



mmr2007-019-028_a

1. Joint of spring under thumb

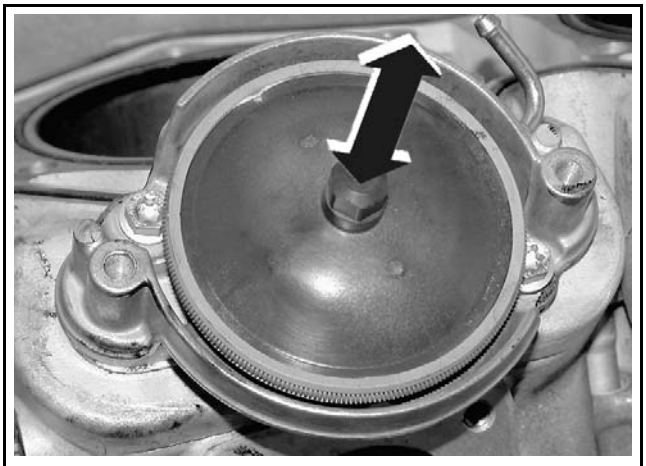
10.5 Continue sliding locking tie all around the edge of valve piston.



mmr2007-019-029_a

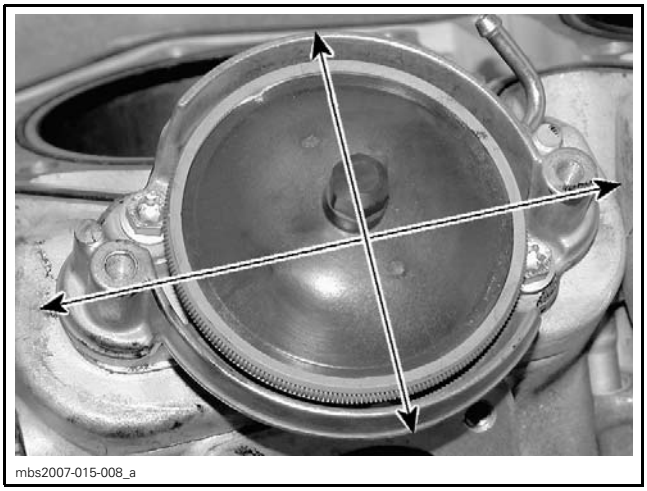
NOTE: Take care there is no strain in the bellow that could apply some bending force or torsion to the 3D RAVE valve. That may contribute to a RAVE valve jam.

11. Push and pull valve piston to make sure it moves freely.



mbs2007-015-008_b

12. When installing valve assembly in its housing, center valve horizontally and longitudinally then hand tighten screws.


mbs2007-015-008_a

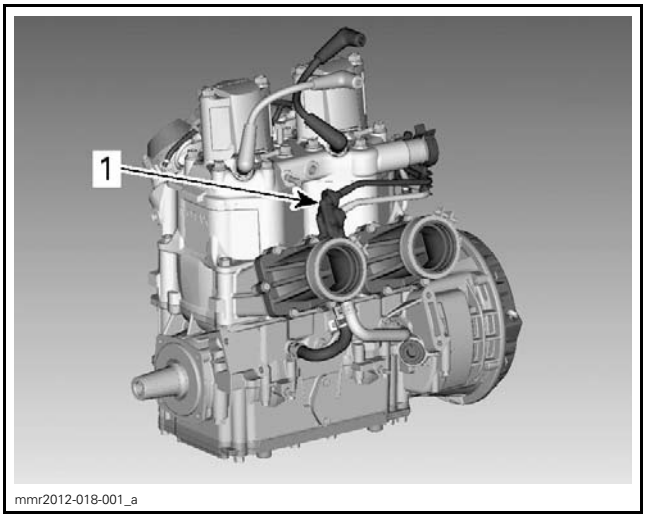
13. Tighten screws and check valve for free movement again. If some friction is felt, slightly loosen screws and readjust housing then retighten screws.
14. Repeat the process until a free movement is obtained.
15. Install position sensor.
16. Position link bar on valve pistons.
17. Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on valve piston threads.
18. Install retaining nuts but do not tighten yet.
19. Install lubrication and inlet hoses (vacuum/pressure).
20. Perform *3D RAVE VALVE SYNCHRONIZATION*. See procedure in this subsection.

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

21. Bleed oil lines. Refer to *OIL INJECTION PUMP* in the *LUBRICATION SYSTEM* subsection.

CHECK VALVE MANIFOLD (ACTUATOR CIRCUIT)

Check Valve Manifold Location (Actuator Circuit)



mmr2012-018-001_a

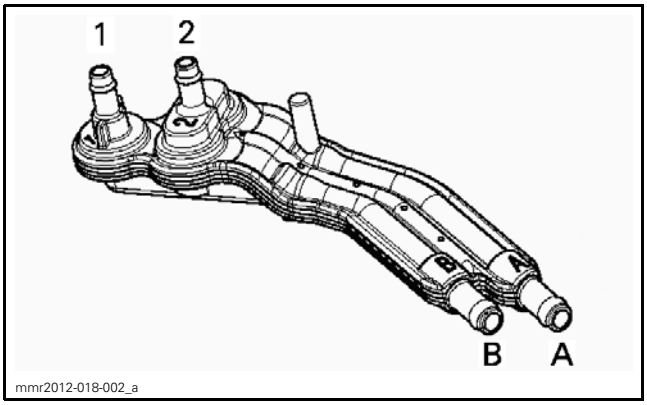
TYPICAL - 800R E-TEC
1. Check valve manifold

Check Valve Manifold Leak Test (Actuator Circuit)

1. Test check valve according to tables and illustration.

REQUIRED TOOL	
VACUUM/PRESSURE PUMP (P/N 529 021 800)	
SMALL HOSE PINCHER (P/N 295 000 076)	

CHECK VALVE MANIFOLD LEAK TEST					
Test no	INLET/OUTLET IDENTIFICATION				RESULT
	A	B	1	2	
1	Apply 34 kPa (5 PSI)	Pinch hose	Pinch hose	Pinch hose	Check valve must stand pressure
2	Pinch hose	Apply 34 kPa (5 PSI)	Pinch hose	Pinch hose	Check valve must stand pressure
3	Pinch hose	Apply 34 kPa (5 PSI)	Disconnect hose	Pinch hose	Check valve must stand pressure
4	Disconnect hose	Disconnect hose	Disconnect hose	Apply 34 kPa (5 PSI)	Check valve must stand pressure

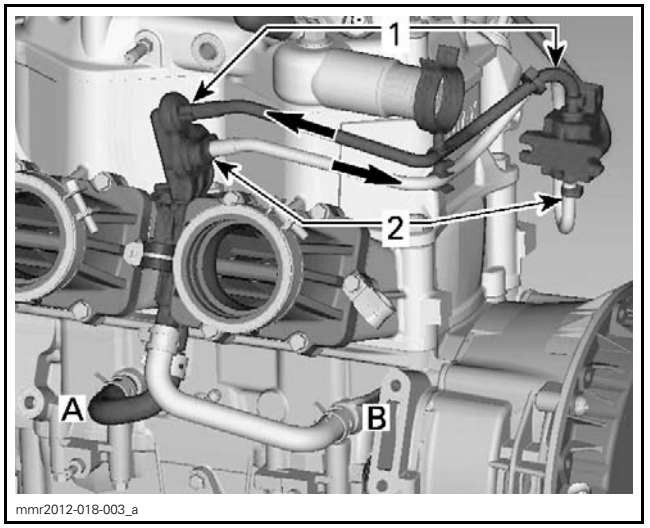


CHECK VALVE MANIFOLD
1. To RAVE solenoid port 1 (Vacuum)
2. To RAVE solenoid port 2 (Pressure)
A. To crankcase (PTO)
B. To crankcase (MAG)

2. Replace check valve manifold if any test failed.

Check Valve Manifold Installation (Actuator Circuit)

Install hoses to check valve manifold as per following illustration.



CHECK VALVE MANIFOLD
1. To RAVE solenoid port 1 (Vacuum)
2. To RAVE solenoid port 2 (Pressure)
A. To crankcase (PTO)
B. To crankcase (MAG)

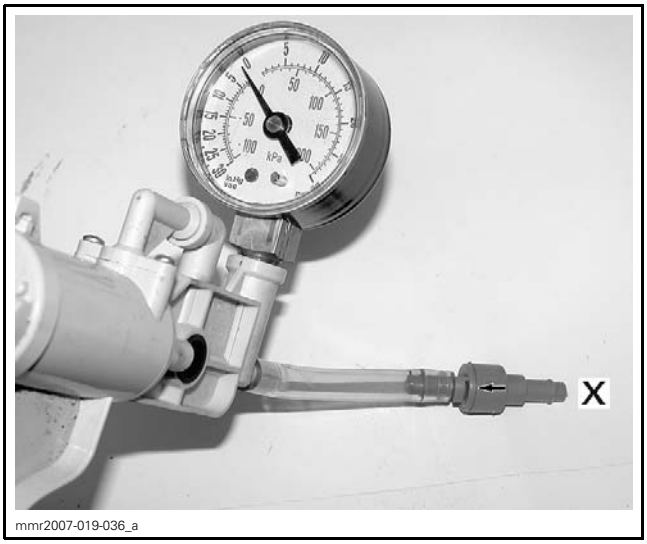
CHECK VALVES (LUBRICATION CIRCUIT)

Check Valve Test (Lubrication Circuit)

1. Disconnect check valve.
2. Pressurize check valve to specification.

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

CHECK VALVE LEAK TEST (LUBRICATION CIRCUIT)	
10 kPa (1.5 PSI)	Valve must stand pressure



TYPICAL

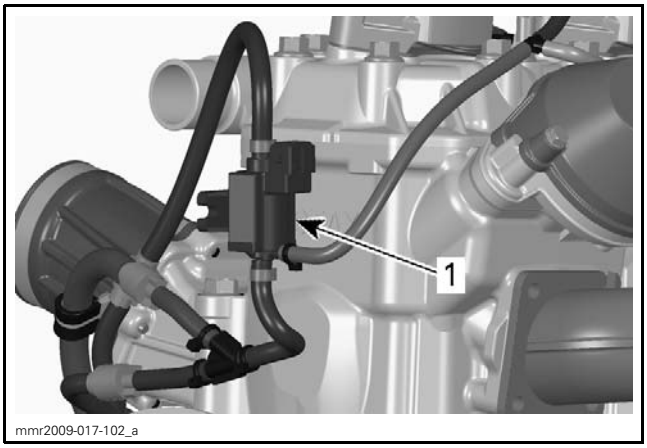
3. Install test pump on the opposite side.
4. Check that air starts to flow between 14 kPa and 24 kPa (2 PSI and 3 PSI).

Replace valve if any test failed.

SOLENOID

Solenoid Location

The solenoid is located on the RH side of the vehicle.

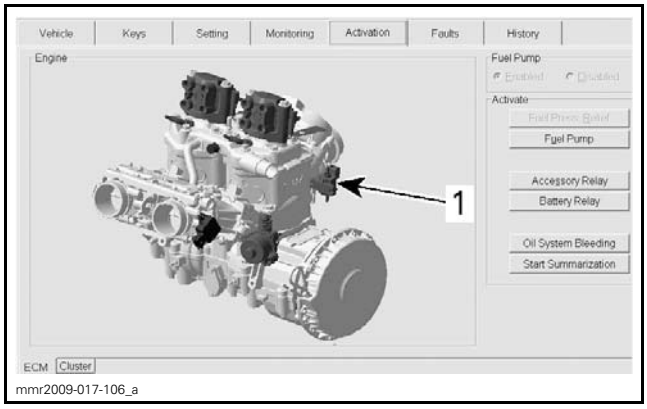


TYPICAL - 600 HO E-TEC SHOWN
1. RAVE solenoid

Solenoid Test with B.U.D.S.

Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection for proper connection to vehicle.

Using B.U.D.S. software (E-TEC version), energize RAVE solenoid from **Activation** tab.

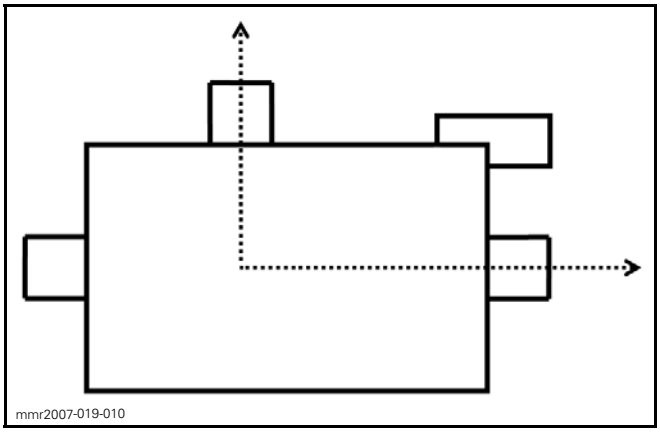


1. Activate here

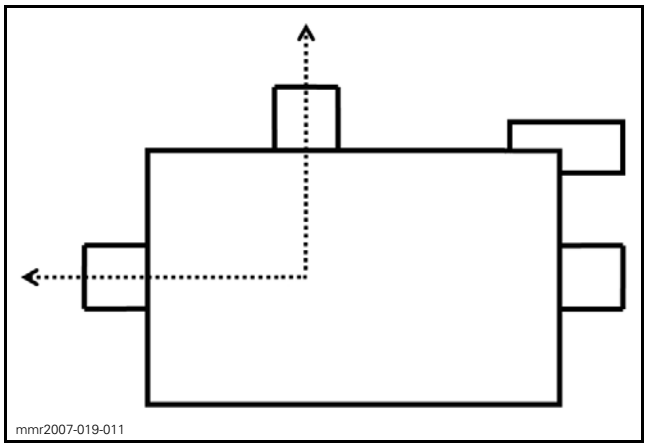
This will validate the RAVE solenoid mechanical and electrical operation.

If the solenoid does not work or works only when T-HARNESS (P/N 529 035 869) is connected, proceed with *SOLENOID INPUT VOLTAGE TEST* in this subsection.

Solenoid Leak Test



SOLENOID OPERATION (OFF)



SOLENOID OPERATION (ON)

NOTE: B.U.D.S. may be used to activate solenoid when performing the following tests but the activation lasts less than one second.

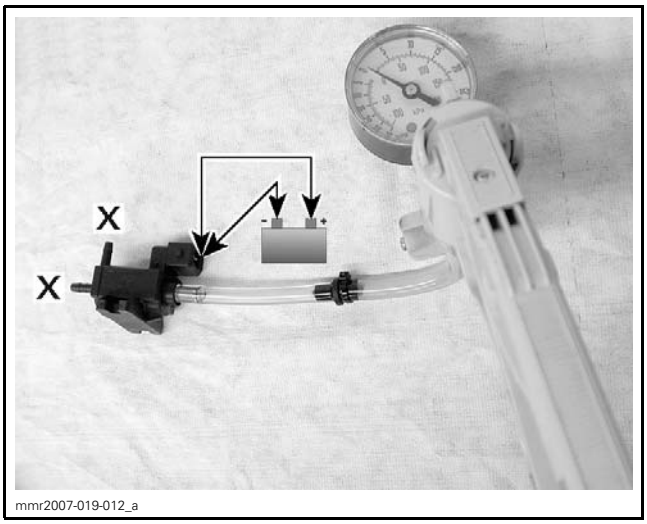
Supply Hose

1. Disconnect supply hose from solenoid.
2. Install pressure pump on solenoid nipple.

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

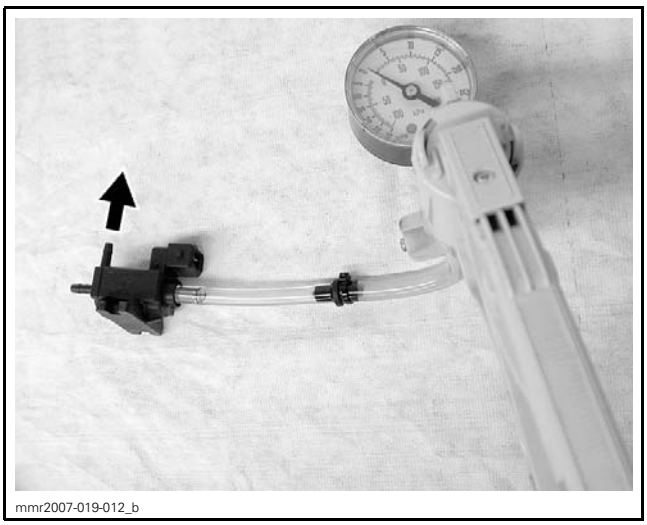
3. Supply 12 Vdc to solenoid terminals. Ensure to respect polarity.
4. Pressurize solenoid to specification.

SOLENOID LEAK TEST (SUPPLY)	
69 kPa - 103 kPa (10 PSI - 15 PSI)	Solenoid must stand pressure



SUPPLY HOSE TESTING

5. Disconnect 12 Vdc supply from solenoid.
6. Check that solenoid evacuates pressure.



SUPPLY HOSE TESTING

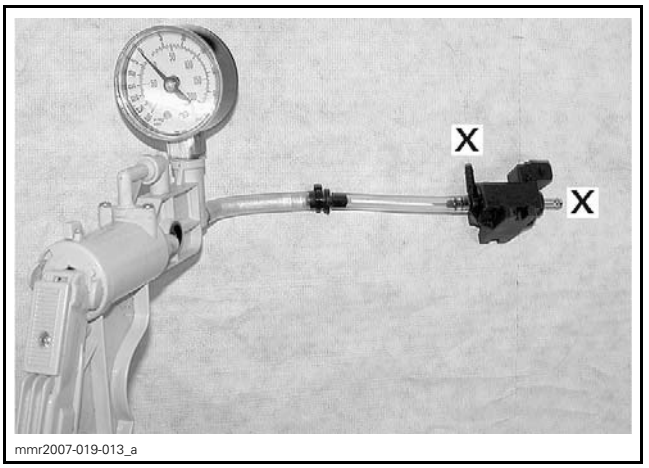
If any test failed, replace solenoid.

Outlet Hose

1. Disconnect outlet hose from solenoid.
2. Pressurize solenoid to specification.

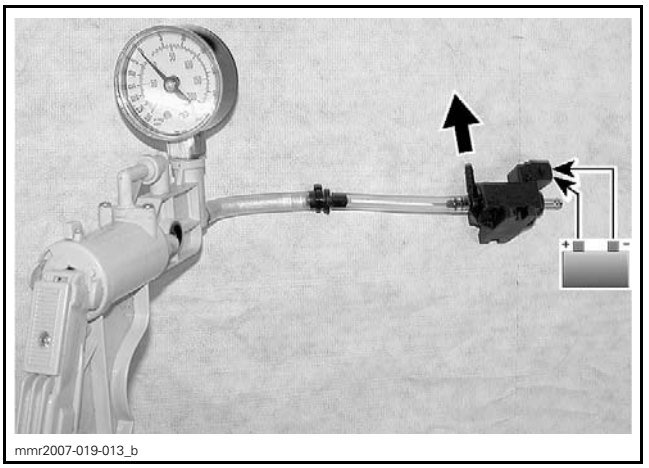
REQUIRED TOOL	
VACUUM/PRESSURE PUMP (P/N 529 021 800)	

SOLENOID LEAK TEST (OUTLET)	
69 kPa - 103 kPa (10 PSI - 15 PSI)	Solenoid must stand pressure



OUTLET HOSE TESTING

3. Supply 12 Vdc to solenoid terminals. Ensure to respect polarity.
4. Check that solenoid evacuates pressure.

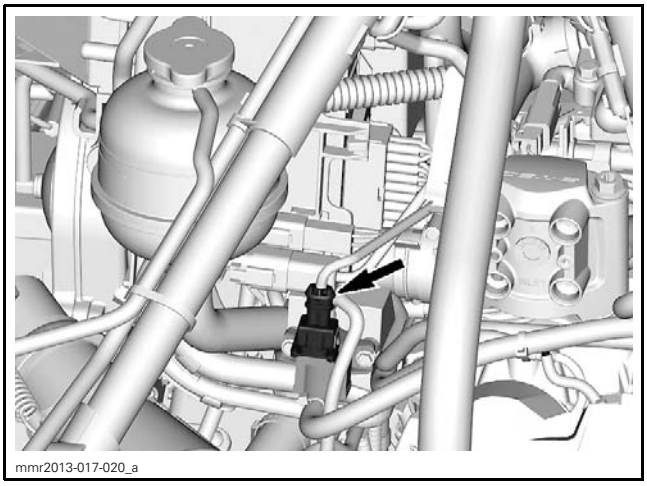


OUTLET HOSE TESTING

If any test failed, replace solenoid.

Solenoid Input Voltage Test

1. Remove upper body module. Refer to *BODY.* subsection.
2. Disconnect the connector from the solenoid.


mmr2013-017-020_a

3. Install a suitable jumper wire on pin 2 (harness side) taking care not to damage terminal.
4. Start engine and measure voltage on jumper wire as follows.

TEST PROBE		MEASUREMENT
Pin 2 (extended with jumper wire)	Engine ground	Battery voltage

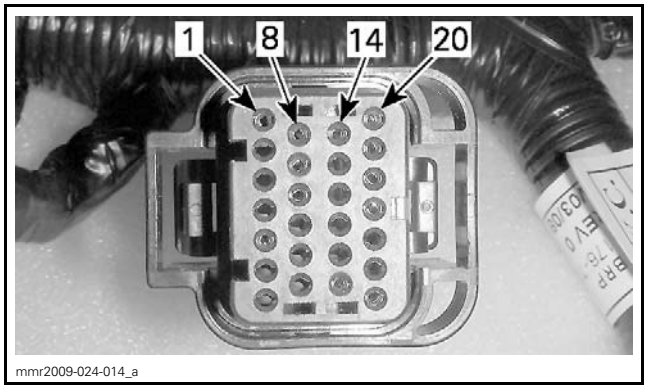
If reading is not as per specification repair/replace wiring/connector.

If solenoid does not work but the voltage supply is good, perform *SOLENOID CIRCUIT TEST*.

Solenoid Circuit Test

1. Disconnect ECM connector.
2. Measure wiring resistance between solenoid connector and ECM connector as follows.

SOLENOID CONNECTOR PIN	ECM CONNECTOR PIN	RESISTANCE
1	Connector J1B pin 22	Close to 0 Ω



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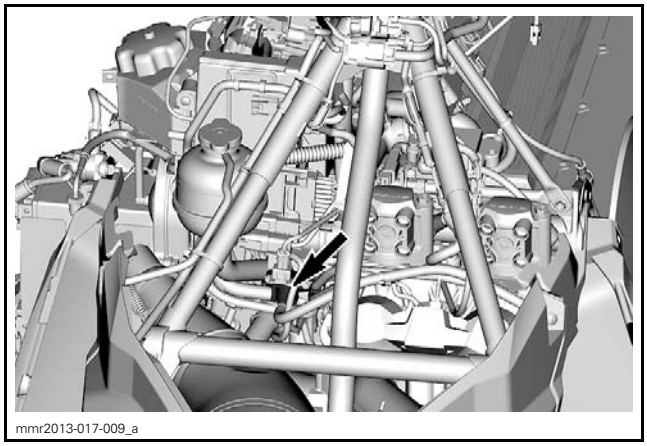
ECM J1B CONNECTOR PIN OUT

If the solenoid circuit test failed, repair/replace wiring/connector.

Solenoid Replacement


mmr2013-017-009_a

1. Remove upper body module. Refer to *BODY* subsection.

NOTE: Mark hose locations of RAVE solenoid for reinstallation.

2. Disconnect solenoid.
3. Remove solenoid screws.
4. Cut the small Oetiker clamps securing the hoses to the solenoid.

For installation, reverse the removal procedure.

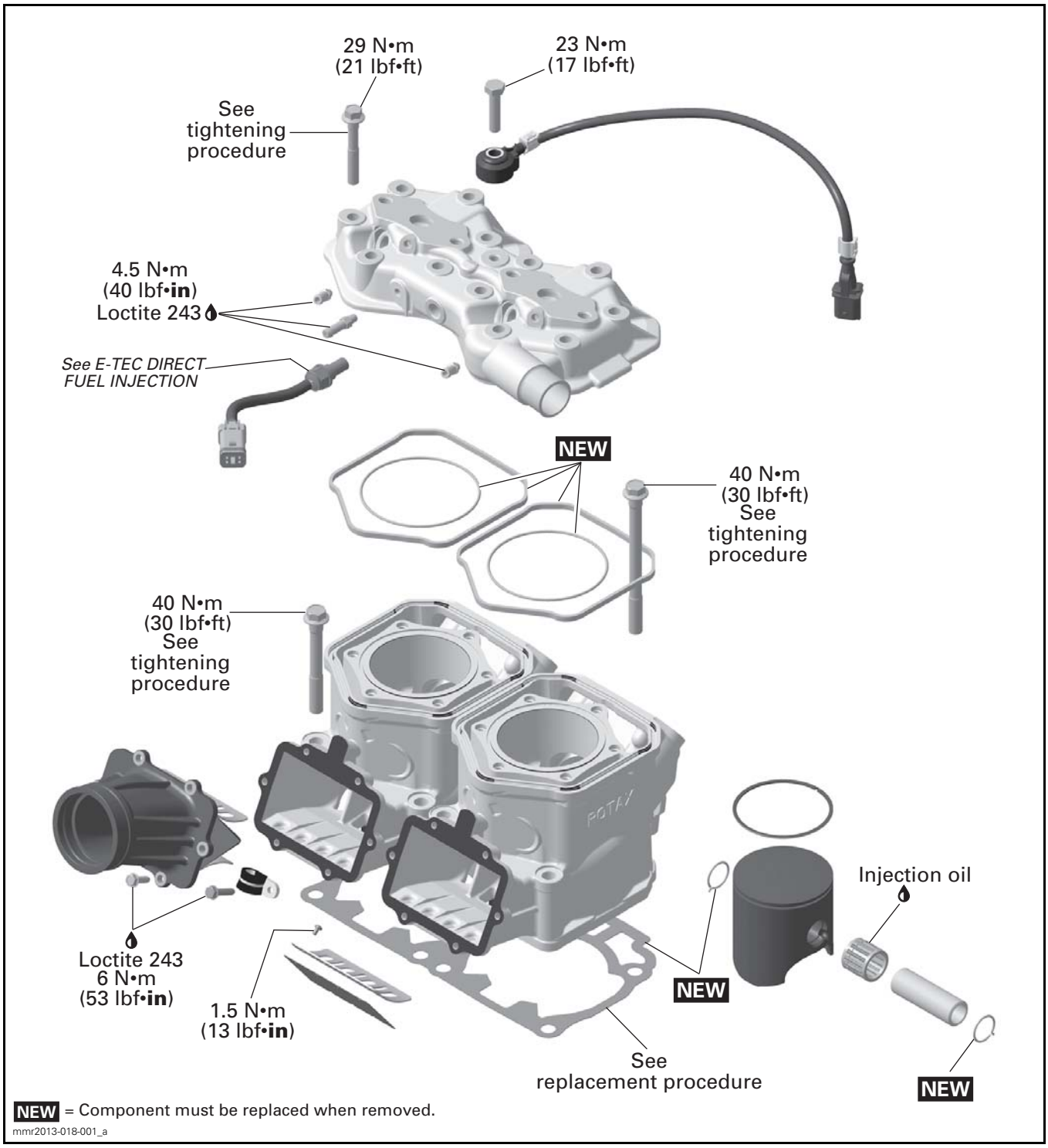
TOP END (600 HO E-TEC)

SERVICE TOOLS

Description	Part Number	Page
PISTON CIRCLIP INSTALLER	529 035 686	8
RUBBER PAD PROTECTOR	529 023 400	6

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	5


29 N•m
(21 lbf•ft)
See
tightening
procedure
23 N•m
(17 lbf•ft)
4.5 N•m
(40 lbf•**in**)
Loctite 243
See E-TEC DIRECT FUEL INJECTION
NEW
40 N•m
(30 lbf•ft)
See
tightening
procedure
40 N•m
(30 lbf•ft)
See
tightening
procedure
Injection oil
Loctite 243
6 N•m
(53 lbf•**in**)
1.5 N•m
(13 lbf•**in**)
NEW
See
replacement procedure
NEW
NEW = Component must be replaced when removed.
mmr2013-018-001_a

GENERAL

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

To measure internal parts, refer to *ENGINE MEASUREMENT* 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.**

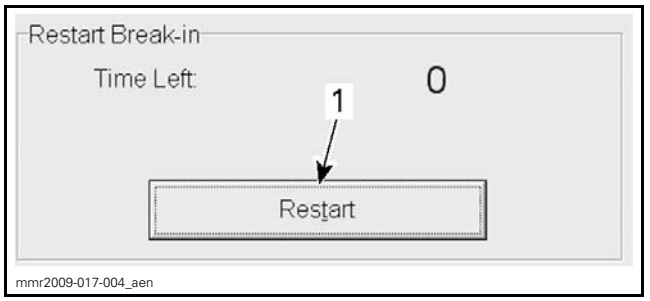
⚠ WARNING

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.**

1. Follow *OPERATOR'S GUIDE* recommendation relating to break-in.
2. Restart break-in period in B.U.D.S. as follows:
   2.1 Ensure to use the latest B.U.D.S. software specific to the E-TEC engine.
   2.2 Select **Setting** tab.
   2.3 Click on **Restart** button in **Restart Break-in** box.



1. Click on Restart

INSPECTION

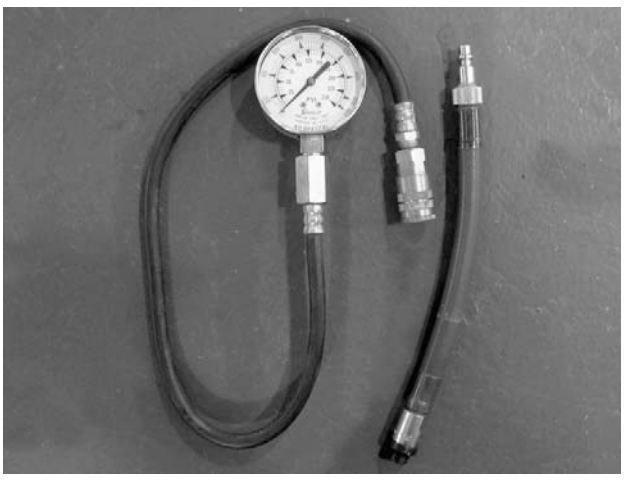
ENGINE COMPRESSION TEST

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. Disconnect RAVE inlet hoses.
6. Install an appropriate ENGINE COMPRESSION TOOL on engine.



ENGINE COMPRESSION TOOL

Manual Start Models

Place emergency engine stop switch to OFF position.

Pull rewind starter several times.

Electric Start Models

Depress throttle lever to wide open position.

Press start button for a few seconds.

All Models

Check if engine compression is according to specification.

SERVICE LIMIT	
ENGINE COMPRESSION SPECIFICATION	7.5 bar (110 PSI)

PROCEDURES

REED VALVES

Reed Valve Removal

1. Remove throttle bodies, refer to *FUEL SYSTEM* subsection.
2. Remove screws retaining intake adapters.
3. Remove reed valves.

Reed Valve Inspection

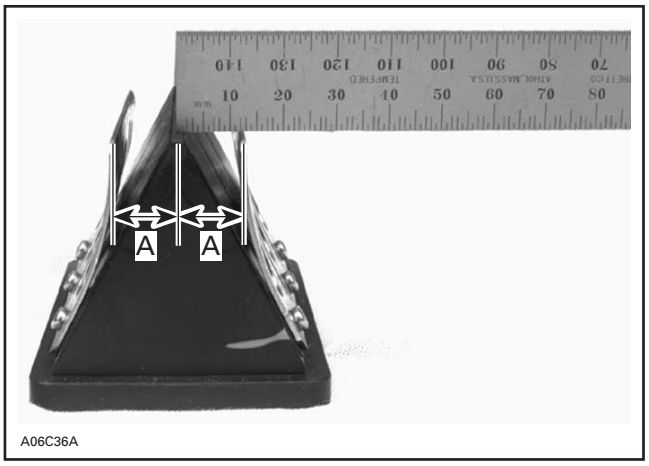
Check reed valve for proper tightness.

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

If there is play, turn blade upside down and recheck.

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

Check distance from blade stopper outer edge to center of reed valve block.



TYPICAL
A. Blade stopper distance

SERVICE LIMIT	
BLADE STOPPER DISTANCE	17.5 mm to 18.25 mm (.689 in to .719 in)

NOTE: Bend the blade stopper as required to obtain the proper distance.

Reed Valve Installation

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.

NOTE: Blade stoppers may slightly interfere with cylinder during installation. Adjusted distance will be reduced automatically upon installation.

CYLINDER HEAD

Cylinder Head Removal

1. Release fuel pressure using B.U.D.S. software. Refer to *ELECTRIC FUEL PUMP (E-TEC)* in *FUEL TANK AND FUEL PUMP* subsection.
2. Remove upper body module, refer to *BODY* subsection.
3. Remove drive belt guard. Refer to *DRIVE BELT* subsection.
4. Drain coolant, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
5. Disconnect fuel lines. Refer to *FUEL SYSTEM* subsection.
6. Disconnect injectors electrical connectors.
7. Remove spark plugs.
8. Remove knock sensor.
9. Disconnect temperature sensor connector.
10. Disconnect coolant hoses at cylinder head.
11. Disconnect throttle body heater inlet hose at cylinder head.
12. Remove cylinder head screws.
13. Remove cylinder head from cylinders.

Cylinder Head Inspection

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

NOTE: Refer to *ENGINE MEASUREMENT* for the measurement procedures.

Cylinder Head Warpage

SERVICE LIMIT	
CYLINDER HEAD WARPAGE	0.5 mm (.02 in) for total length of cylinder head

Cylinder Head Cleaning

Scrape off any carbon deposits from cylinder head.

Use LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500).

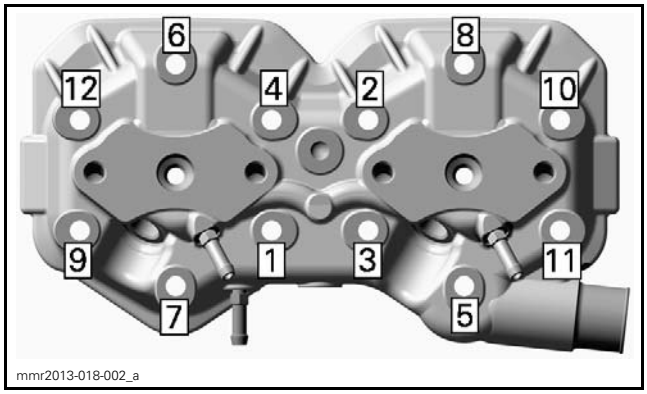
Cylinder Head Installation

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

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

Tighten cylinder head screws to specification following the illustrated sequence.

CYLINDER HEAD SCREW TIGHTENING SEQUENCE	
FIRST STEP	15 N•m (133 lbf•**in**)
SECOND STEP	29 N•m (21 lbf•ft)



TIGHTENING SEQUENCE

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

Tighten knock sensor retaining screw to specification.

TIGHTENING TORQUE	
KNOCK SENSOR SCREW	23 N•m (17 lbf•ft)

CYLINDERS

Cylinder Removal

1. Remove *CYLINDER HEAD* as explained in this subsection.
2. Refer to *EXHAUST SYSTEM* subsection and remove:
   – Muffler
   – Tune pipe
   – Exhaust manifold.
3. Remove acoustic panel.
4. Refer to *DRIVEN PULLEY AND COUNTERSHAFT* subsection and remove:
   – Driven pulley
   – Countershaft bearing support.
5. Disconnect throttle bodies from intake adapters and set aside.
6. Refer to *RAVE* subsection and remove:
   – RAVE valves cover
   – RAVE valves link bar.
7. Disconnect RAVE valves oil lines and vacuum/pressure hoses.
8. Remove cylinder screws.
9. Remove cylinders from crankcase.

Cylinder Inspection

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

NOTE: Refer to *ENGINE MEASUREMENT* for the measurement procedures.

SERVICE LIMIT	
CYLINDER TAPER	0.10 mm (.004 in)
CYLINDER OUT OF ROUND	0.08 mm (.003 in)

Cylinder Cleaning

Scrape off any carbon deposits from cylinder exhaust port.

Carefully clean cylinder screws, specifically under screw head.

Use LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500).

Cylinder Installation

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

Install a **NEW** base gasket of the same thickness as the old one. Refer to *CYLINDER BASE GASKET*.

Lubricate cylinder wall with new injection oil or equivalent.

Tighten cylinder screws to specification in a criss-cross sequence.

CYLINDER SCREW TIGHTENING SEQUENCE	
M8	29 N•m (21 lbf•ft)
M10	40 N•m (30 lbf•ft)

Measure piston projection as described in *ENGINE MEASUREMENT* subsection.

SERVICE LIMIT	
PISTON PROJECTION	0.90 mm to 1.10 mm (.035 in to .043 in)

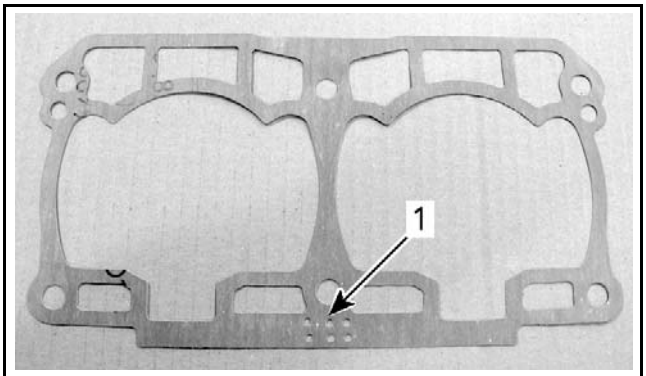
If piston projection measurement is out of specification, change cylinder base gasket thickness. Refer to *CYLINDER BASE GASKET* in this subsection.

CYLINDER BASE GASKET

Cylinder Base Gasket Replacement

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

CYLINDER BASE GASKET	
THICKNESS	HOLE QUANTITY
1.2	2
1.1	1
1.0	No hole
0.9	9
0.8	8
0.7	7
0.6	6
0.5	5



TYPICAL
1. Gasket thickness identification holes

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

1. Ensure top surface of crankcase is clean.
2. Install a NEW cylinder base gasket of the same thickness as the one that was installed at factory.

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

3. Install cylinders and measure piston projection. Refer to *CYLINDER* in this subsection.
4. If piston projection is out of specification, follow this guideline:

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

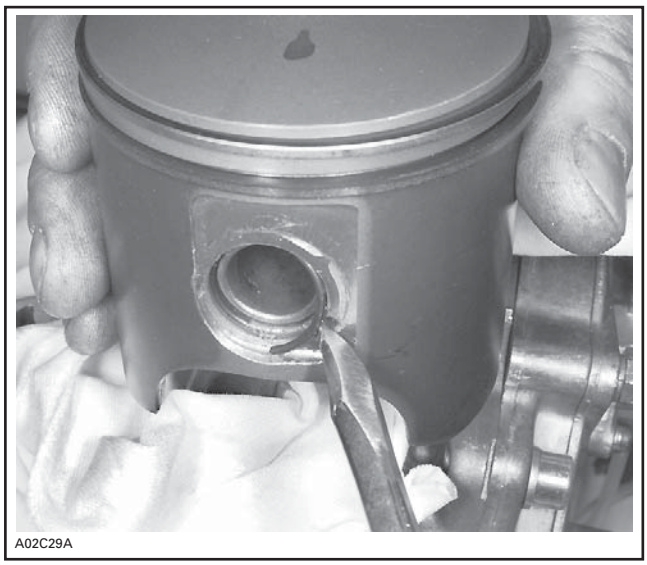
PISTONS

Piston Removal

1. Remove *CYLINDERS*, as explained in this subsection.
2. Place a clean cloth or a rubber pad over crankcase.

REQUIRED TOOL	
RUBBER PAD PROTECTOR (P/N 529 023 400)	

3. Using a pointed tool inserted in piston notch, remove both circlips from piston.
4. Discard circlips.



TYPICAL

5. Push piston pin out of piston.
6. Remove piston.
7. Remove bearing.

Piston Inspection

Inspect piston for scoring, cracking or other damage.

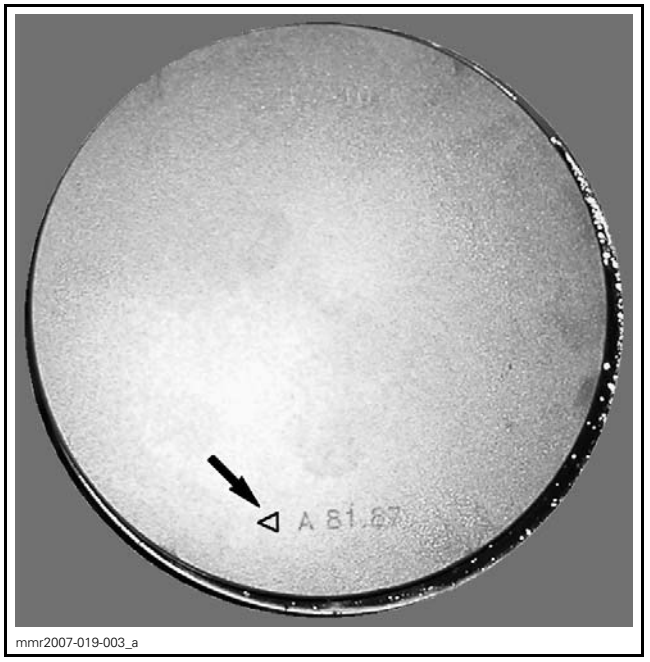
NOTE: Refer to *ENGINE MEASUREMENT* for the measurement procedures.

SERVICE LIMITS	
RING/PISTON GROOVE CLEARANCE	0.20 mm (.0079 in)
RING END GAP	1.0 mm (.039 in)
PISTON/CYLINDER CLEARANCE	0.20 mm (.008 in)

Piston Cleaning

Scrape off any carbon deposits from piston dome.

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



EXHAUST DIRECTION INDICATION

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

Piston Installation

1. Lubricate needle bearing with injection oil.
2. Insert bearing into connecting rod.
3. Place piston over connecting rod with the arrow on the piston dome facing towards exhaust port.

1. Exhaust

4. Push piston pin trough piston.

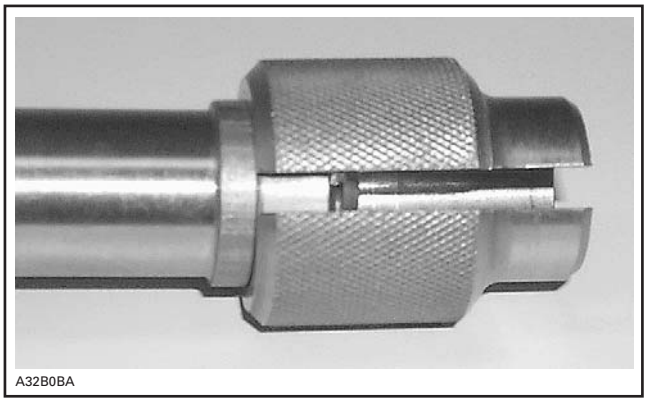
5. Install NEW mono-hook circlips.

REQUIRED TOOL	
PISTON CIRCLIP INSTALLER (P/N 529 035 686)	

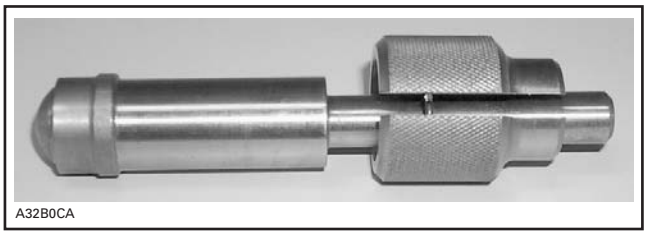
NOTICE Always install NEW mono-hook circlip(s). If circlip installation fails at the first attempt, always retry with a new one.

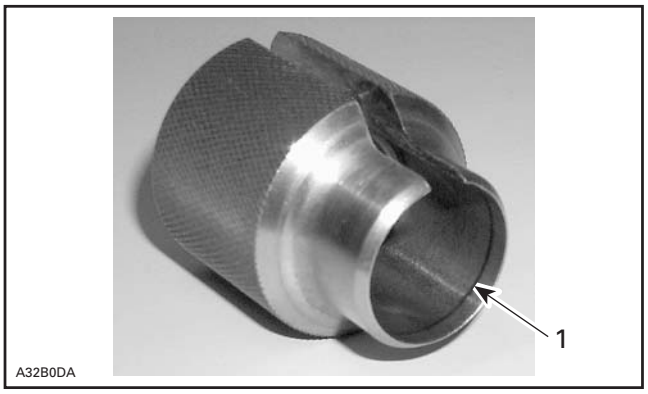
6. Insert circlip into support so that, when installed in piston groove, the gap will be below the tab.

7. With round end of pusher, position circlip perpendicular to the support axis.



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



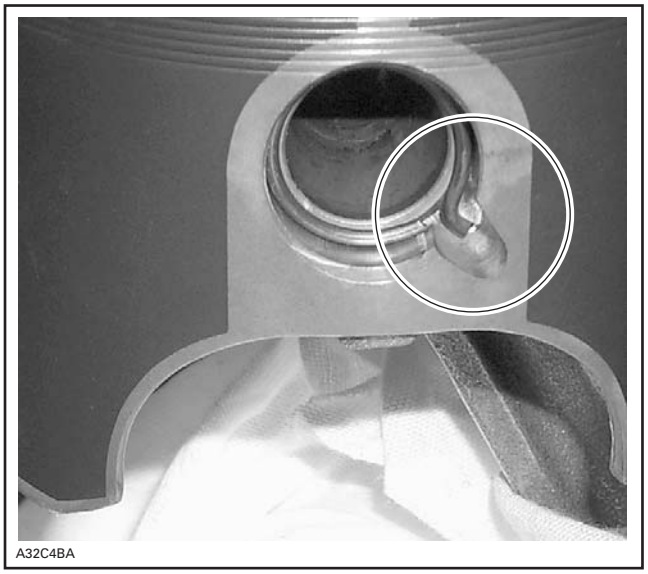


1. Groove

CIRCLIP READY TO BE INSTALLED ON PISTON

9. Using a plastic hammer, tap pusher to put 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

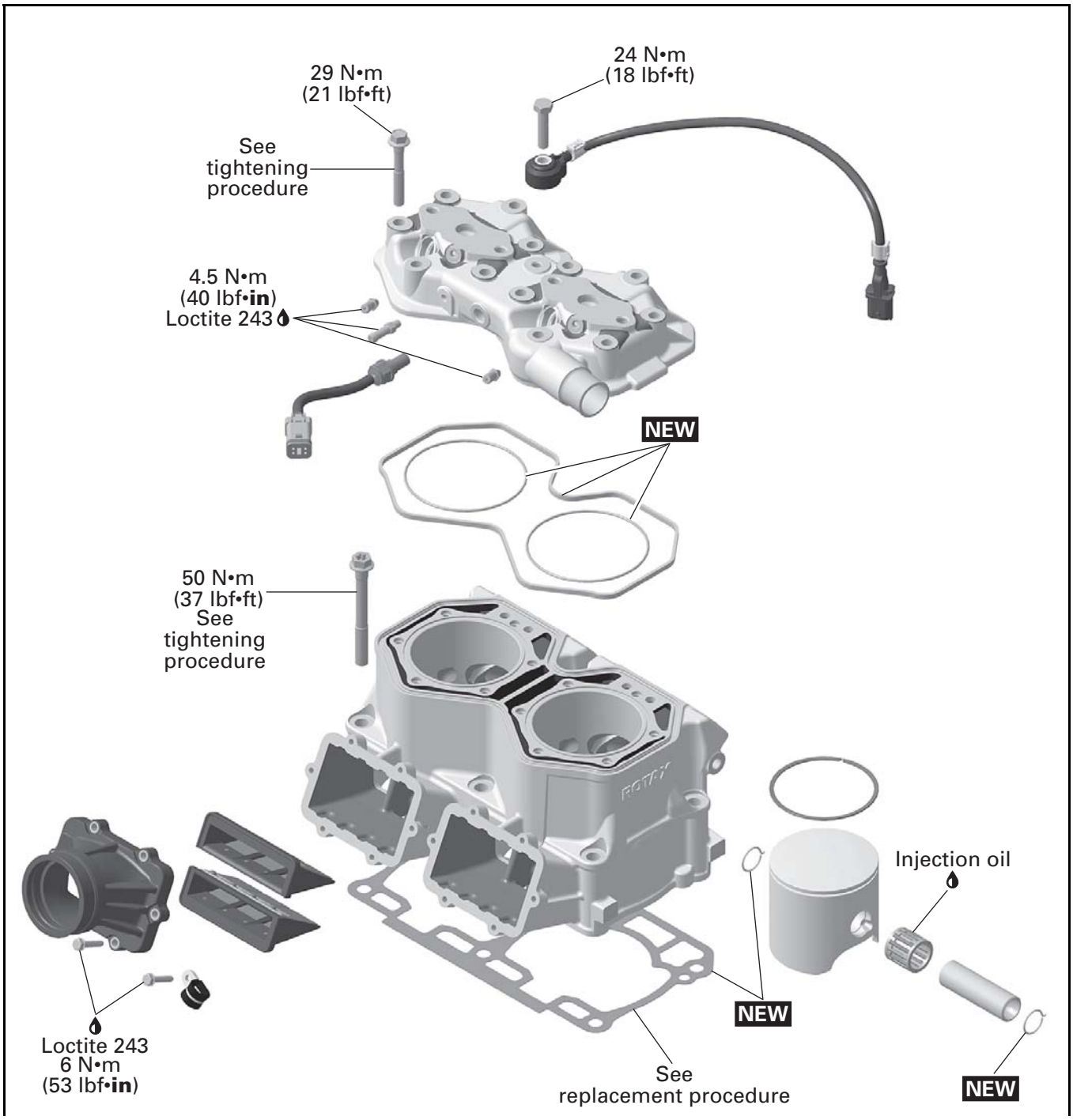
NOTICE Circlips must not move freely after installation; if so, replace them.

10. Install all other removed parts as the reverse of removal procedure.

TOP END (800R E-TEC)

SERVICE TOOLS

SERVICE PRODUCTS


29 N•m
(21 lbf•ft)
See
tightening
procedure
24 N•m
(18 lbf•ft)
4.5 N•m
(40 lbf•in)
Loctite 243
NEW
50 N•m
(37 lbf•ft)
See
tightening
procedure
Injection oil
Loctite 243
6 N•m
(53 lbf•in)
NEW
See
replacement procedure
NEW

GENERAL

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

To measure internal parts, refer to *ENGINE MEASUREMENT* 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.

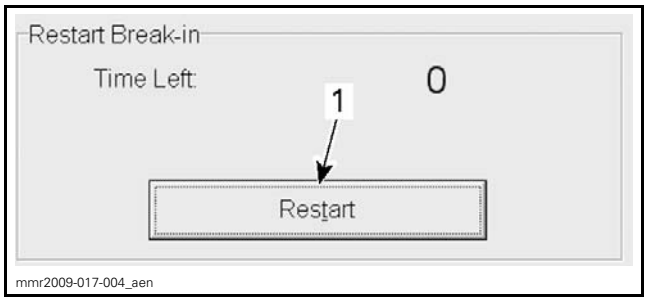
NOTICE **Hoses, cables and locking ties removed during a procedure must be reinstalled as per factory standards.**

⚠ 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

1. Follow *OPERATOR'S GUIDE* recommendation relating to break-in.
2. Restart break-in period in B.U.D.S. as follows:
   2.1 Ensure to use the latest B.U.D.S. software specific to the E-TEC engine.
   2.2 Select **Setting** tab.
   2.3 Click on **Restart** button in **Restart Break-in** box.



1. Click on Restart

INSPECTION

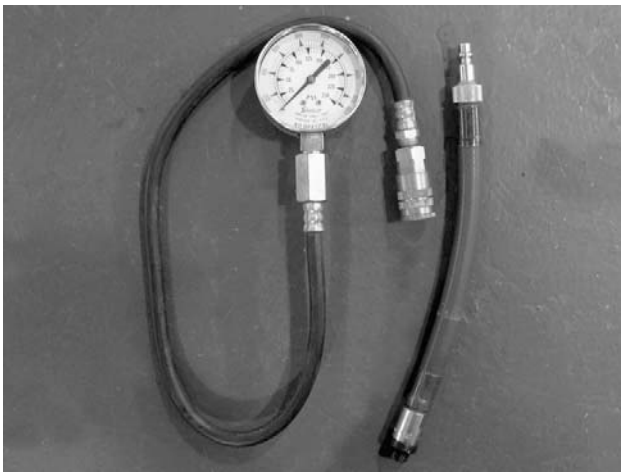
ENGINE COMPRESSION TEST

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. Disconnect RAVE inlet hoses.
6. Install an appropriate ENGINE COMPRESSION TOOL on engine.



ENGINE COMPRESSION TOOL

Manual Start Models

Place emergency engine stop switch to OFF position.

Pull rewind starter several times.

Electric Start Models

Depress throttle lever to wide open position.

Press start button for a few seconds.

All Models

Check if engine compression is according to specification.

SERVICE LIMIT	
ENGINE COMPRESSION SPECIFICATION	7.5 bar (110 PSI)

PROCEDURES

REED VALVES

Reed Valve Removal

1. Remove throttle bodies, refer to *FUEL SYSTEM* subsection.
2. Remove screws retaining intake adapters.
3. Remove reed valves.

Reed Valve Inspection

Check reed valve for proper tightness.

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.

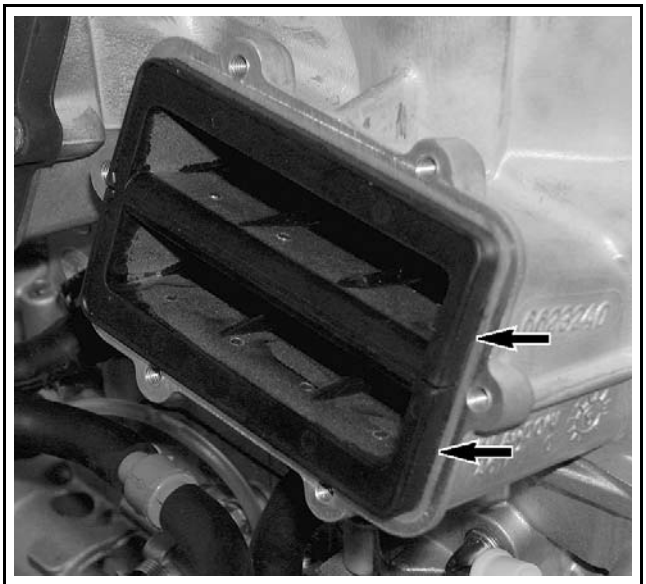
If there is still a play, replace blade and/or valve body.

Reed Valve Installation

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.

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



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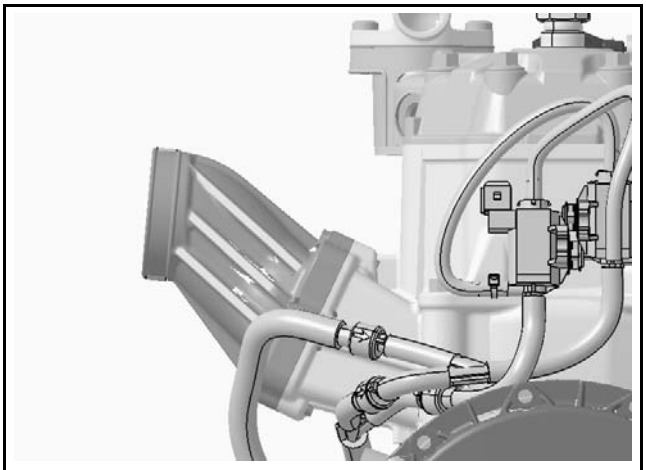
Ensure to position intake adapter as shown.



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CYLINDER HEAD

Cylinder Head Removal

1. Release fuel pressure using B.U.D.S. software. Refer to *ELECTRIC FUEL PUMP (E-TEC)* in *FUEL TANK AND FUEL PUMP* subsection.
2. Remove upper body module, refer to *BODY* subsection.
3. Remove drive belt guard. refer to *DRIVE BELT* subsection.
4. Drain coolant, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
5. Disconnect fuel lines. Refer to *FUEL SYSTEM* subsection.
6. Disconnect injectors electrical connectors.
7. Remove spark plugs.

8. Remove knock sensor.
9. Disconnect temperature sensor connector.
10. Disconnect coolant hoses at cylinder head.
11. Disconnect throttle body heater inlet hose at cylinder head.
12. Remove cylinder head screws.
13. Remove cylinder head from cylinder.

Cylinder Head Inspection

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

NOTE: Refer to *ENGINE MEASUREMENT* for the measurement procedures.

Cylinder Head Warpage

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

Cylinder Head Cleaning

Scrape off any carbon deposits from cylinder head.

Use LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500).

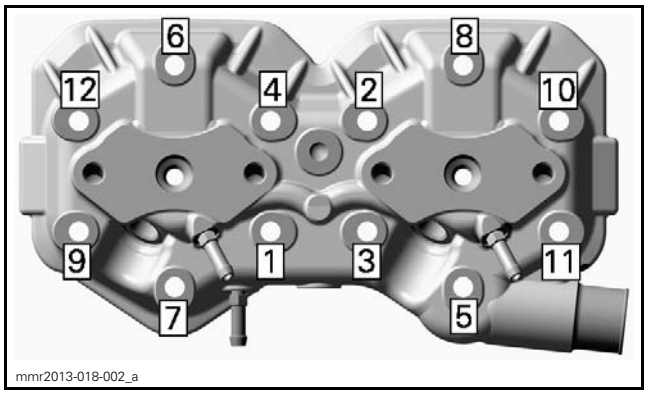
Cylinder Head Installation

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

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

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

CYLINDER HEAD SCREW TIGHTENING SEQUENCE	
FIRST STEP	15 N•m (133 lbf•**in**)
SECOND STEP	29 N•m (21 lbf•ft)



TIGHTENING SEQUENCE

Tighten knock sensor retaining screw to specification.

TIGHTENING TORQUE	
KNOCK SENSOR SCREW	24 N•m (18 lbf•ft)

CYLINDERS

Cylinder Removal

1. Remove *CYLINDER HEAD* as explained in this subsection.
2. Refer to *EXHAUST SYSTEM* subsection and remove:
   – Muffler
   – Tune pipe
   – Exhaust manifold.
3. Remove acoustic panel.
4. Refer to *DRIVEN PULLEY AND COUNTERSHAFT* subsection and remove:
   – Driven pulley
   – Countershaft bearing support.
5. Disconnect throttle bodies from intake adapters and set aside.
6. Refer to *RAVE* subsection and remove:
   – RAVE valves cover
   – RAVE valves link bar.
7. Disconnect RAVE valves oil lines and vacuum/pressure hoses.
8. Remove cylinder screws.
9. Remove cylinder from crankcase.

Cylinder Inspection

Remove RAVE valves, refer to *RAVE* subsection.

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

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

NOTE: Refer to *ENGINE MEASUREMENT* for the measurement procedures.

SERVICE LIMITS	
CYLINDER TAPER	0.1 mm (.004 in)
CYLINDER OUT OF ROUND	0.08 mm (.003 in)

Cylinder Cleaning

Scrape off any carbon deposits from exhaust ports.

Carefully clean cylinder screws, specifically under screw head.

Use LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500).

Cylinder Installation

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

Install a NEW cylinder base gasket of the same thickness as the old one. Refer to *CYLINDER BASE GASKET*.

Check if dowel pins are in crankcase holes.

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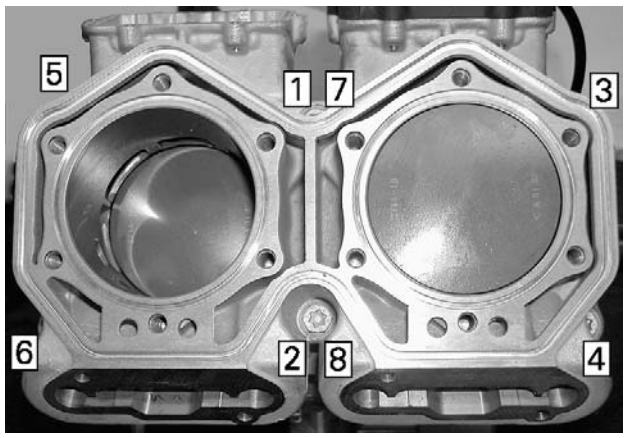
Lubricate cylinder with new injection oil or equivalent.

Carefully slide cylinder 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 screws to specification as per the following sequence.

CYLINDER SCREW TIGHTENING SEQUENCE	
FIRST STEP	25 N•m (18 lbf•ft)
SECOND STEP	50 N•m (37 lbf•ft)



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TIGHTENING SEQUENCE

Measure piston projection as described in *ENGINE MEASUREMENT* subsection.

SERVICE LIMIT	
PISTON PROJECTION	1.82 mm to 1.92 mm (.072 in to .076 in)

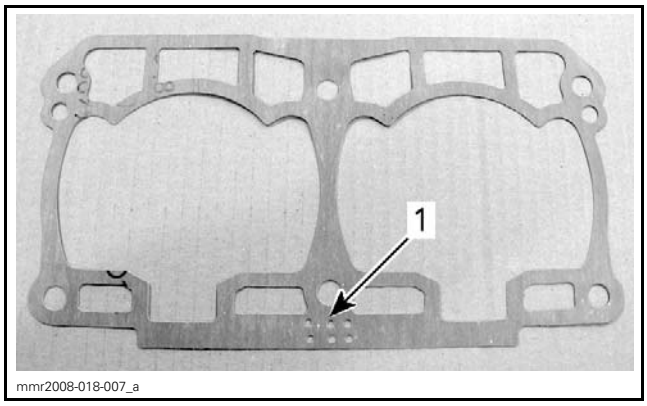
If piston projection measurement is out of specification, change cylinder base gasket thickness. Refer to *CYLINDER BASE GASKET* in this subsection.

CYLINDER BASE GASKET

Cylinder Base Gasket Replacement

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

CYLINDER BASE GASKET	
THICKNESS	HOLES QUANTITY
1.2	2
1.1	1
1.0	No hole
0.9	9
0.8	8
0.7	7
0.6	6
0.5	5



TYPICAL
1. Gasket thickness identification holes

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

1. Ensure top surface of crankcase is clean.
2. Install a NEW cylinder base gasket of the same thickness as the one that was installed at factory.

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

3. Install cylinder and measure piston projection. Refer to *CYLINDER* in this subsection.
4. If piston projection is out of specification, follow this guideline:

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

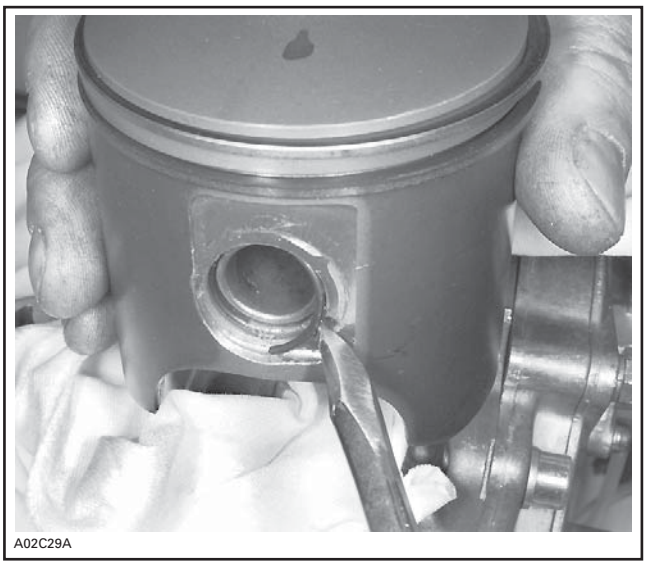
PISTONS

Piston Removal

1. Remove *CYLINDER*, as explained in this subsection.
2. Place a clean cloth or a rubber pad over crankcase.

REQUIRED TOOL	
RUBBER PAD PROTECTOR (P/N 529 023 400)	

3. Using a pointed tool inserted in piston notch, remove one circlip from piston.



TYPICAL

4. Push piston pin out of piston.
5. Remove piston.
6. Remove bearing.
7. Discard circlips.

Piston Inspection

Inspect piston for scoring, cracking or other damage.

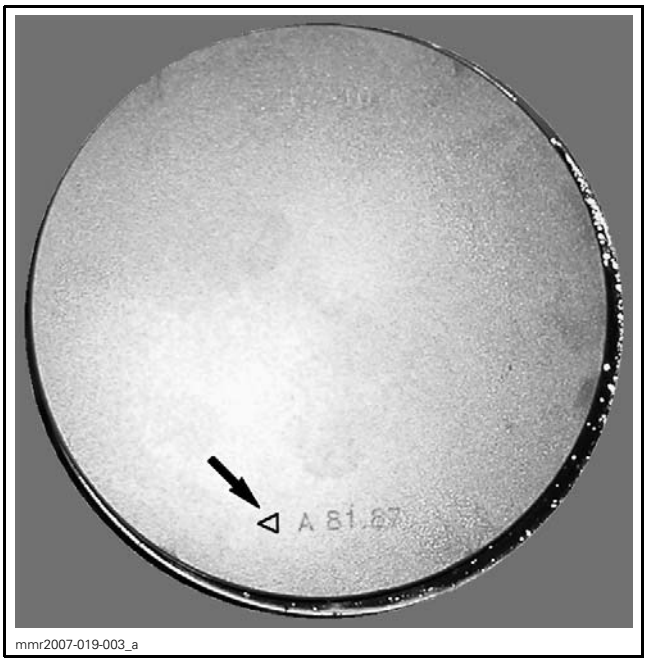
NOTE: Refer to *ENGINE MEASUREMENT* for the measurement procedures.

SERVICE LIMIT	
CYLINDER/PISTON CLEARANCE	0.2 mm (.0079 in)
RING/PISTON GROOVE CLEARANCE	0.2 mm (.0079 in)
RING END GAP	1 mm (.039 in)

Piston Cleaning

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.

Piston Installation

1. Lubricate needle bearing with 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.

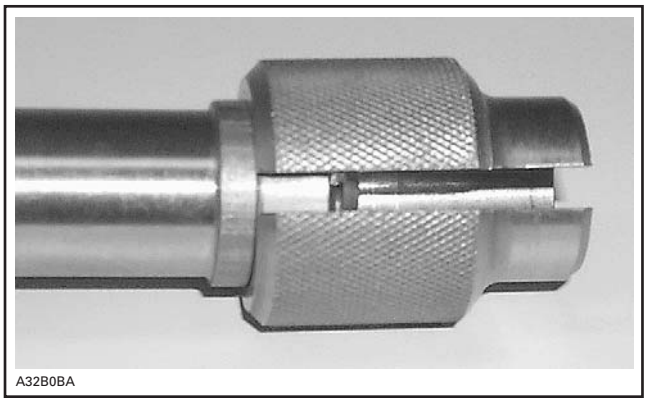
REQUIRED TOOL	
PISTON CIRCLIP INSTALLER 21MM (P/N 529 036 138)	

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

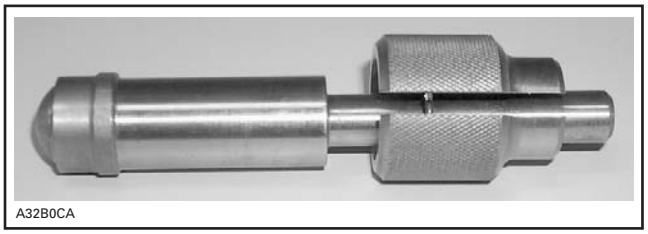
6. Use the following procedure to properly install circlip.

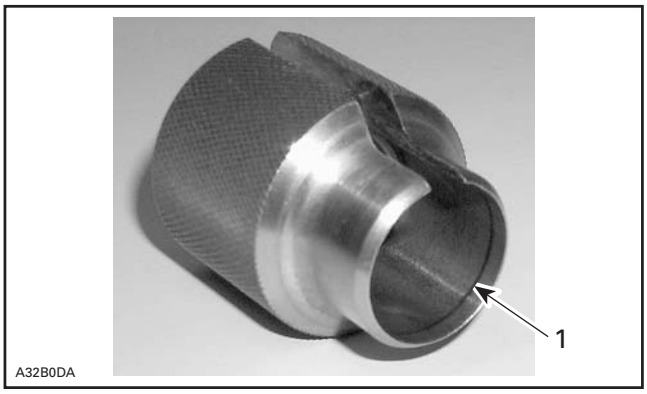
   6.1 Insert circlip into support so that, when installed in piston groove, the gap will be below the tab.

   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.



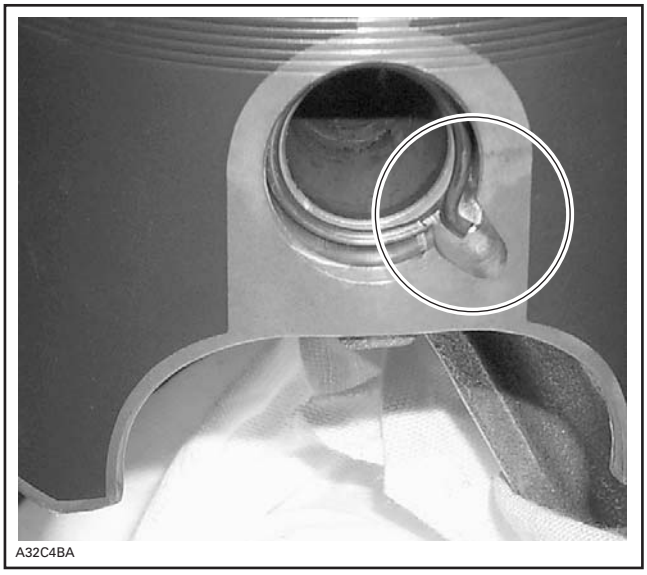


1. Groove

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 circlip(s) 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 (600 HO E-TEC)

SERVICE TOOLS

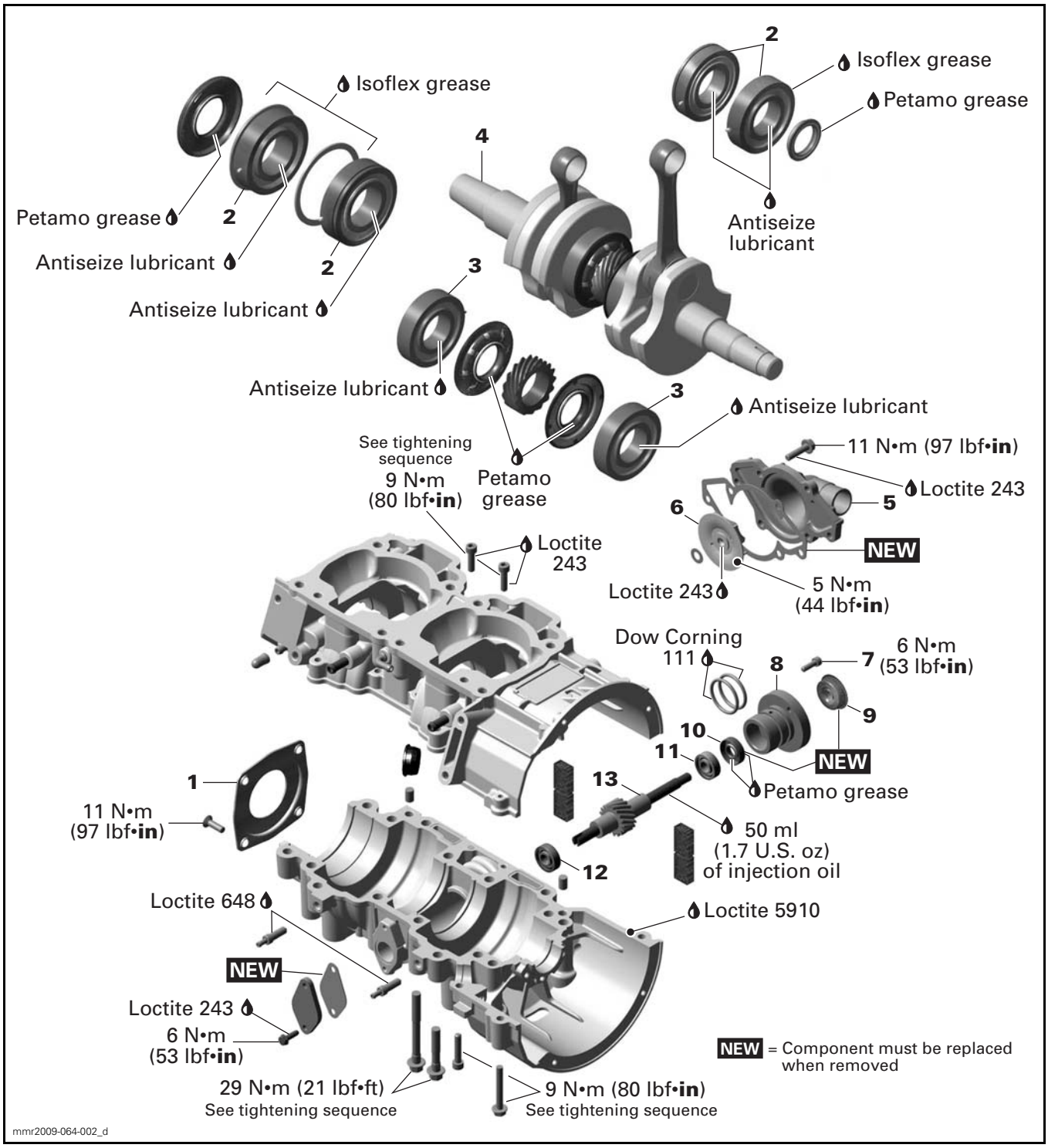
Description	Part Number	Page
BEARING HEATER	529 035 969	12
BEARING INSTALLER (PTO)	529 035 990	13–14
CERAMIC SEAL INSTALLER	529 036 014	7–8
CRANKSHAFT BEARING PULLER	529 036 004	11
CRANKSHAFT DISTANCE GAUGE	529 035 968	13
CRANKSHAFT PROTECTOR (MAG)	420 876 557	11
CRANKSHAFT PROTECTOR (PTO)	420 876 552	11
HALF-RINGS	420 977 479	11
HANDLE	420 877 650	7
OIL SEAL GUIDE	529 035 822	7
OIL SEAL PUSHER	529 035 757	7
PULLER RING	420 977 494	11
SUPPORT PLATE	529 035 976	13
TEMPERATURE INDICATOR STICK	529 035 970	13

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
SNAP-ON BEARING SEPARATOR	CJ 951	11
SNAP-ON MANUAL IMPACT DRIVER	PIT120	8
SPX/OTC BEARING SEPARATOR	1124	11

SERVICE PRODUCTS

Description	Part Number	Page
ISOFLEX GREASE TOPAS NB 52	293 550 021	15
LOCTITE 243 (BLUE)	293 800 060	4, 8
LOCTITE 5910	293 800 081	9
LOCTITE 767 (ANTISEIZE LUBRICANT)	293 800 070	12
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	9
PULLEY FLANGE CLEANER	413 711 809	12
XPS INJECTION OIL	293 600 117	8–9, 15
XPS LUBE	293 600 016	11


2
Isoflex grease
Petamo grease
Isoflex grease
4
Petamo grease
2
Antiseize lubricant
Antiseize lubricant
2
Antiseize lubricant
3
Antiseize lubricant
3
Antiseize lubricant
See tightening sequence
9 N•m (80 lbf•in)
Petamo grease
11 N•m (97 lbf•in)
Loctite 243
5
6
NEW
Loctite 243
Loctite 243
5 N•m (44 lbf•in)
Dow Corning 111
8
7
6 N•m (53 lbf•in)
9
10
11
NEW
Petamo grease
1
13
11 N•m (97 lbf•in)
50 ml (1.7 U.S. oz) of injection oil
12
Loctite 648
Loctite 5910
NEW
Loctite 243
6 N•m (53 lbf•in)
NEW = Component must be replaced when removed
29 N•m (21 lbf•ft)
See tightening sequence
9 N•m (80 lbf•in)
See tightening sequence
mmr2009-064-002_d

GENERAL

Engine removal is required to repair bottom end except for the water pump impeller.

All oil seals and gaskets must be discarded and replaced with new ones when crankcase halves are separated.

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

To measure internal parts, refer to *ENGINE MEASUREMENT* 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.

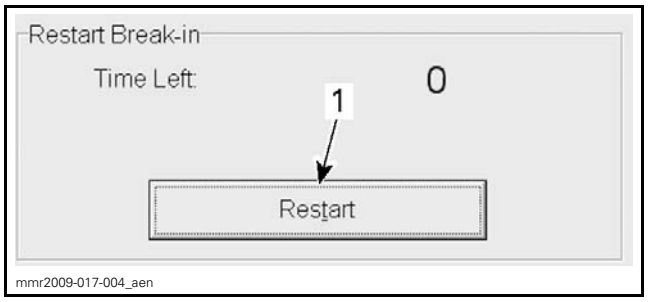
NOTICE **Hoses, cables and locking ties removed during a procedure must be reinstalled as per factory standards.**

⚠ 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

1. Follow *OPERATOR'S GUIDE* recommendation relating to break-in.
2. Restart break-in period in B.U.D.S. as follows:
   2.1 Ensure to use the latest B.U.D.S. software specific to the E-TEC engine.
   2.2 Select **Setting** tab.
   2.3 Click on **Restart** button in **Restart Break-in** box.



1. Click on Restart

PROCEDURES

WATER PUMP

Water Pump Access

Refer to *BODY* subsection and remove:

– Upper body module
– Bottom pan cover.

Refer to *EXHAUST SYSTEM* subsection and remove:

– Tune pipe
– Muffler
– Exhaust manifold.

Remove acoustic panel.

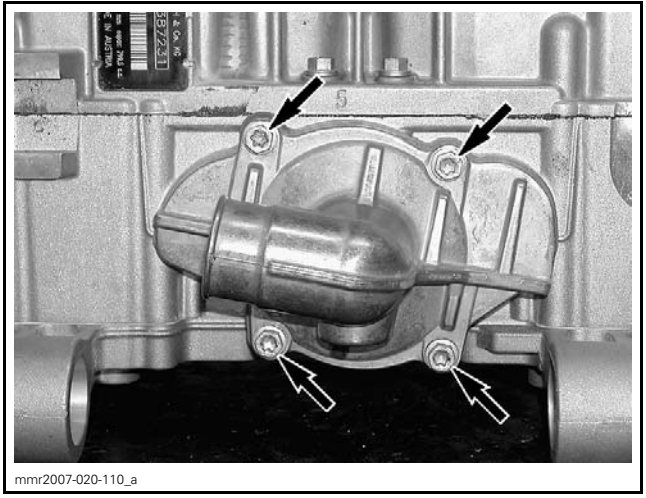
Remove starter as necessary. Refer to *STARTING SYSTEM* subsection.

Water Pump Removal

Put a large drain pan under vehicle bottom pan.

Remove water pump inlet hose from pump cover.

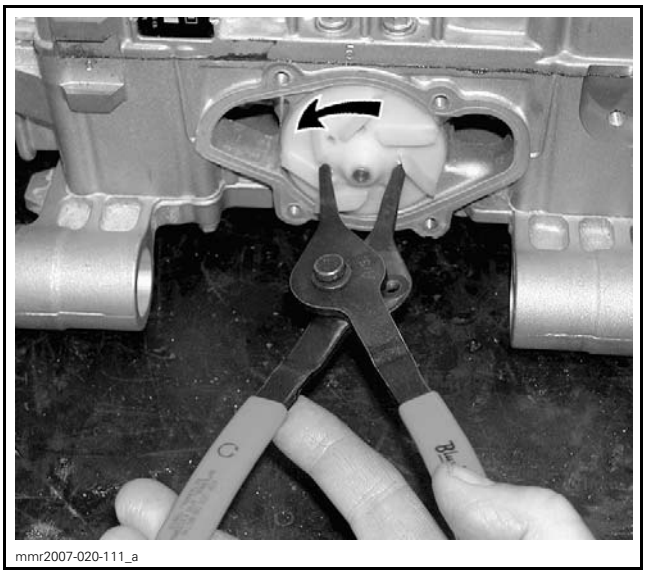
Remove water pump cover **no. 5**.



TYPICAL

Remove impeller **no. 6** by turning it counterclockwise.

NOTICE Be careful not to damage impeller fins.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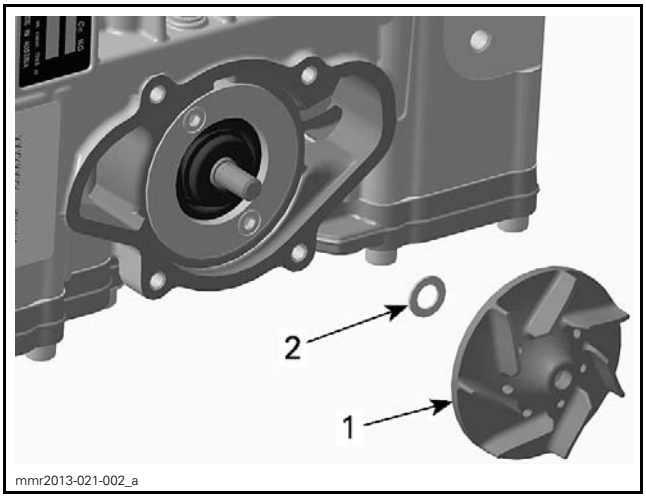
TYPICAL



mmr2013-021-002_a

1. *Impeller*
2. *Washer, 0.5 mm (.02 in) thick*

Clean gasket surfaces of water pump cover and crankcase.

Water Pump Installation

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

Ensure to install the 0.5 mm (.02 in) thick washer.

Tighten impeller to specification.

IMPELLER	
Service Product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening Torque	5 N•m (44 lbf•**in**)

Install a **NEW** pump cover gasket.

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

WATER PUMP COVER SCREWS	
Tightening Torque	11 N•m (97 lbf•**in**)

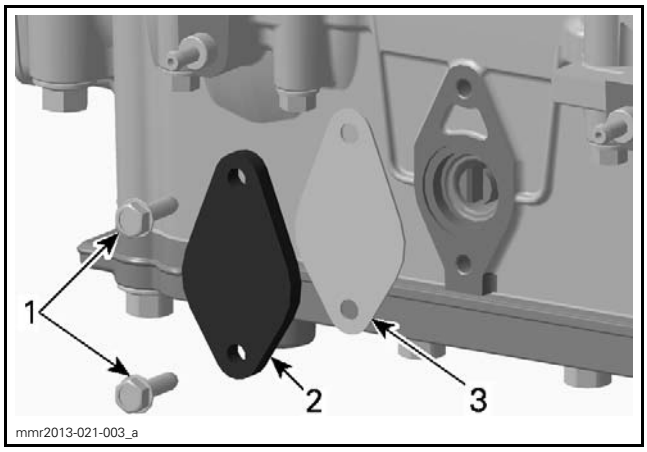
BEARING CARRIER AND PUMP SHAFT

Bearing Carrier and Pump Shaft Access

The bearing carrier and pump shaft is located on the lower rear portion of the engine. Remove engine from vehicle, refer to *ENGINE REMOVAL (600 HO E-TEC)* subsection.

Bearing Carrier and Pump Shaft Removal

Remove cover plate and discard gasket.



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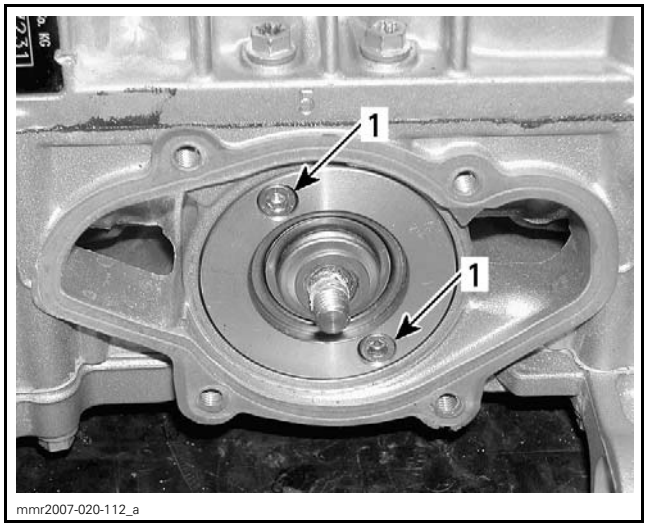
1. *Screws*
2. *Cover plate*
3. *Gasket*

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

Remove bearing carrier retaining screws **no. 7**.



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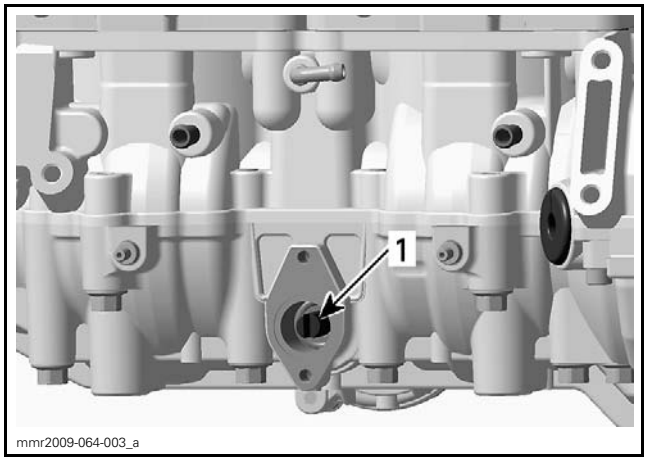
TYPICAL
1. Screws

Push pump shaft out while turning shaft to release it from crankshaft worm gear.



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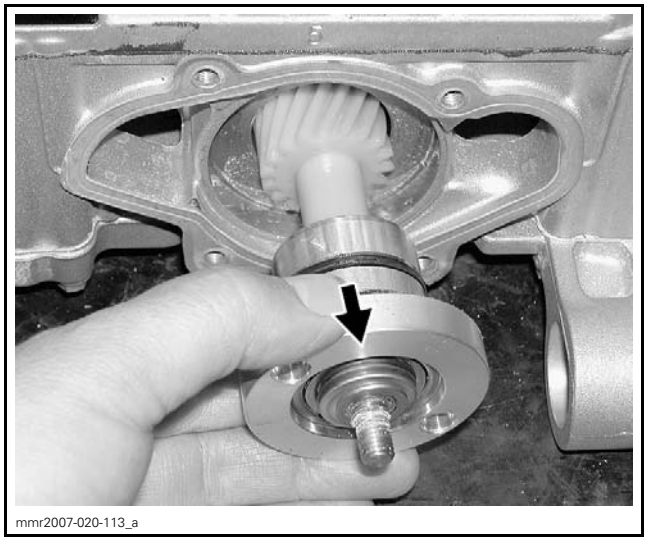
TYPICAL
1. Push out shaft here

Extract bearing carrier and pump shaft.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TYPICAL

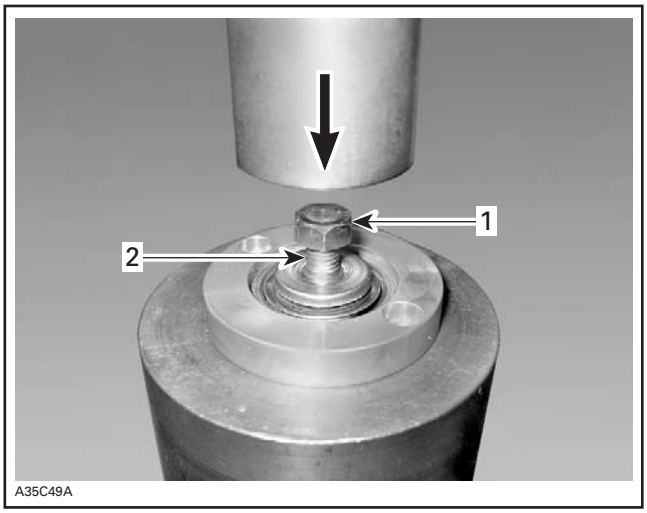
Bearing Carrier and Pump Shaft Disassembly

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

Protect the threads of the pump shaft with a suitable M8 nut.

Properly support bearing carrier.

Push pump shaft out using a press.

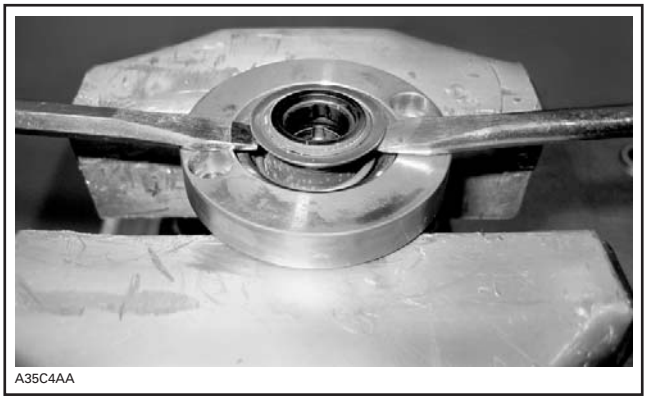


A35C49A

TYPICAL
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.**

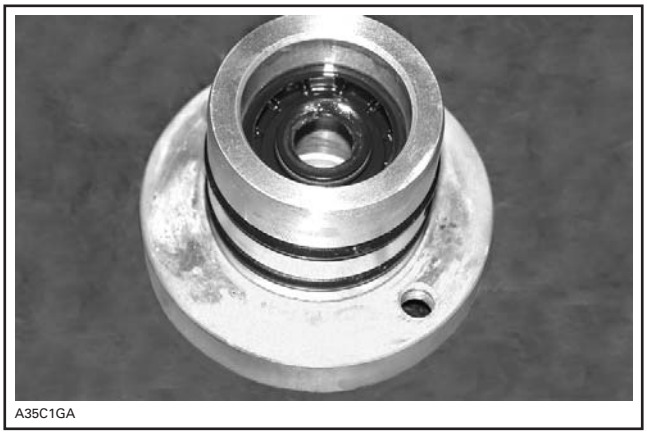
Pry inner part of ceramic seal **no. 9** out.


A35C4AA

Push out bearing **no. 11** from bearing carrier using an appropriate pusher.

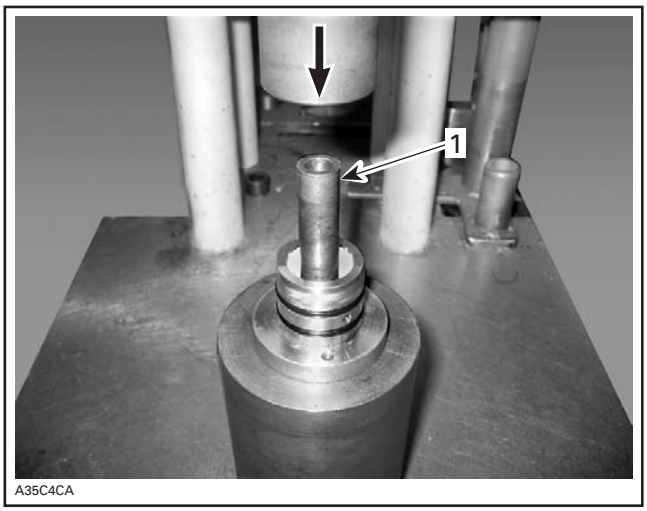

A35C4BA

Push oil seal **no. 10** out.


A35C1GA

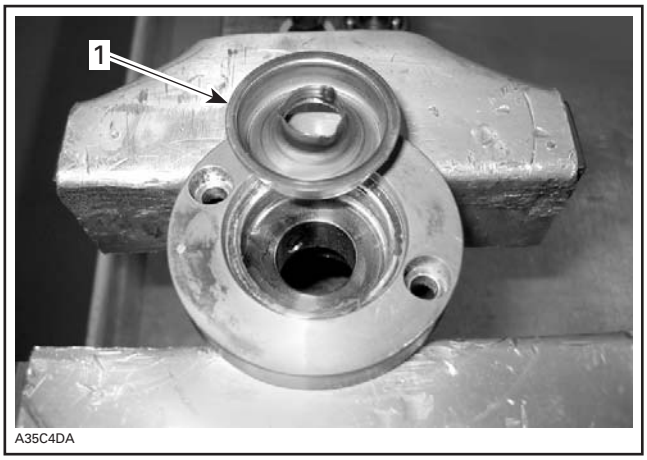
Carefully press out outer part of ceramic seal.

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



A35C4CA

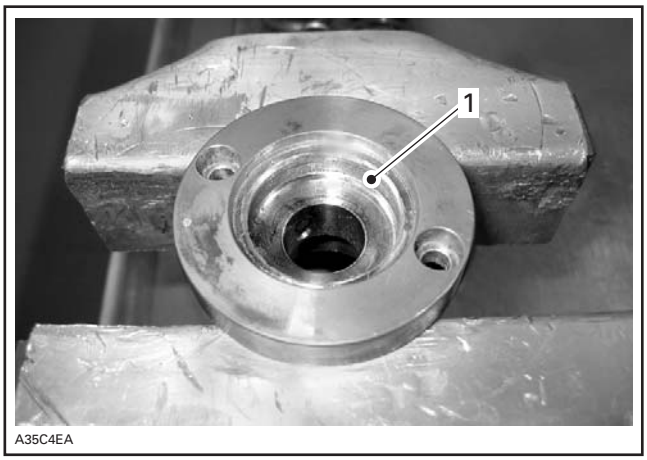
1. 16 mm (.63 in) mandrel



A35C4DA

1. Outer part of ceramic seal

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



A35C4EA

1. Remove sealant

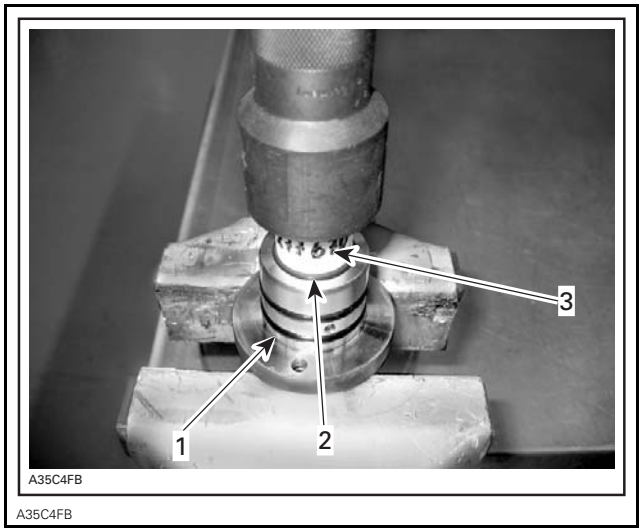
Bearing Carrier and Pump Shaft Reassembly

Reverse disassembly procedure and pay attention to the following.

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

Push NEW oil seal no. 10 in bearing carrier.

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



A35C4FB

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

Press bearing no. 11 in bearing carrier no. 8.

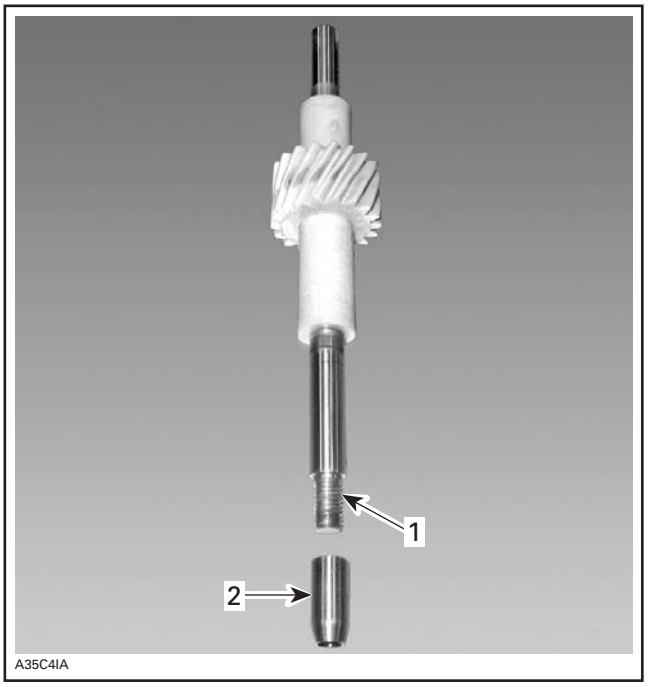
Push NEW ceramic seal no. 9 in bearing carrier no. 8.

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

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

Install oil seal protector on pump shaft no. 13.

REQUIRED TOOL	
OIL SEAL GUIDE (P/N 529 035 822)	



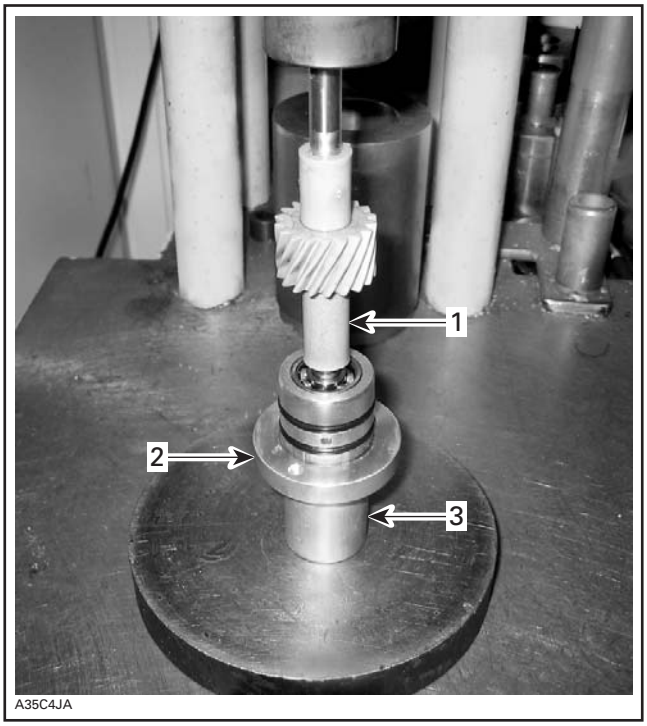
1. *Pump shaft*
2. *Oil seal protector*

Press pump shaft **no. 13** in bearing carrier **no. 8** with appropriate force.

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

NOTE: During installation, support ceramic seal as shown in following illustration.

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



A35C4JA

1. Pump shaft
2. Bearing carrier
3. Ceramic seal installer

Remove oil seal protector from pump shaft.

Bearing Carrier and Pump Shaft Installation

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

Pour 50 ml (1.7 U.S. oz) of injection oil in the cavity under crankshaft worm gear.

SERVICE PRODUCT
XPS INJECTION OIL (P/N 293 600 117)

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

Tighten bearing carrier retaining screws **no. 7** to specification.

BEARING CARRIER SCREWS	
Tightening Torque	6 N•m (53 lbf•**in**)

Install cover plate and **NEW** gasket.

Tighten cover plate screws to specification.

COVER PLATE SCREWS	
Service Product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening Torque	6 N•m (53 lbf•**in**)

CRANKCASE

Crankcase Disassembly

Remove engine from vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.

Remove cylinder head and cylinders. Refer to *TOP END (600 HO-ETEC)* subsection.

Remove rewind starter. Refer to *REWIND STARTER* subsection.

Refer to *MAGNETO SYSTEM* subsection and remove:
– Crankshaft position sensor
– Magneto flywheel
– Stator.

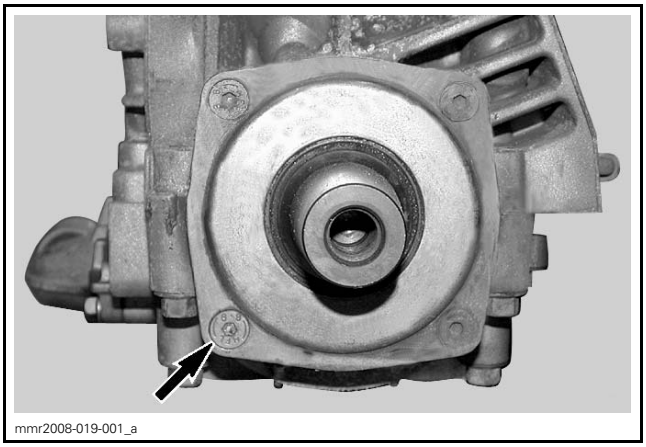
Remove front engine supports.

Remove drive pulley. Refer to *DRIVE PULLEY* subsection.

Remove PTO oil seal cover **no. 1**.

NOTE: Tap on screw heads to break Loctite bond or use following tool.

SUGGESTED TOOL
SNAP-ON MANUAL IMPACT DRIVER (P/N PIT120)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TYPICAL - 600 HO E-TEC

Remove all screws retaining crankcase halves together.

Separate crankcase halves and remove crankshaft.

Crankcase Cleaning

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

Use LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500) accordingly.

NOTICE **Never use a sharp object to remove sealant as score marks incurred are harmful to crankcase sealing.**

Crankcase Inspection

Check crankcase for cracks or other damages. Replace if necessary.

Crankcase Assembly

Install crankshaft in lower crankcase. See *CRANKSHAFT* for procedure.

Pour 50 ml (1.7 U.S. oz) of injection oil in the cavity under crankshaft worm gear.

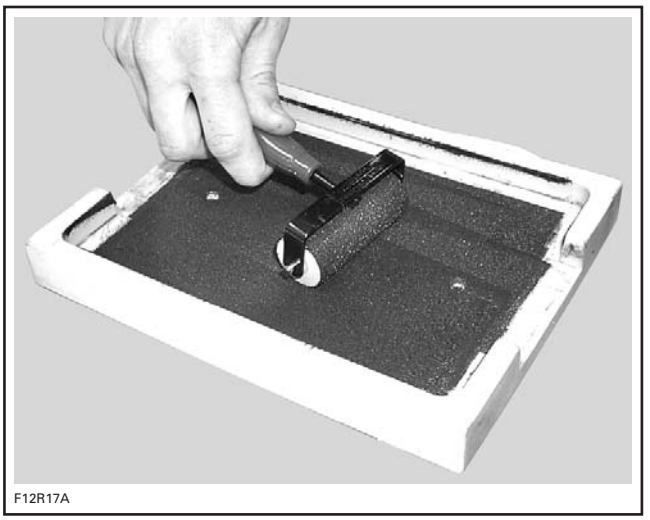
SERVICE PRODUCT
XPS INJECTION OIL (P/N 293 600 117)

Apply LOCTITE 5910 (P/N 293 800 081) on crankcase halves. Proceed as follows.

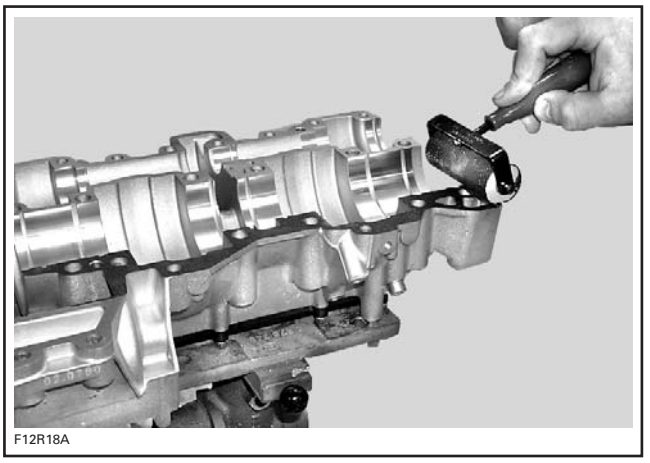
NOTE: IMPORTANT: The total assembly sequence, including sealing compound application and crankcase torquing, must be performed within 10 minutes.

Use a plexiglass plate and apply some sealant on it. Use a 50 mm - 75 mm (2 in - 3 in) soft rubber roller and spread the sealant to get a thin uniform coat on the plate (spread as necessary).

When ready, apply the sealant on crankcase mating surfaces.


F12R17A

TYPICAL


F12R18A

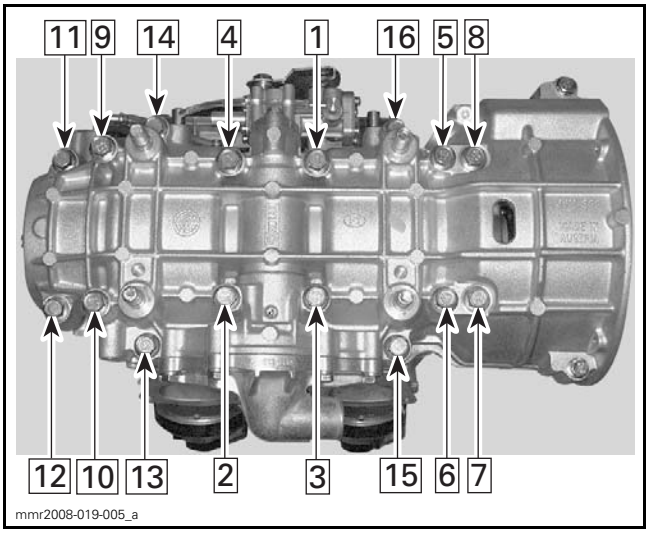
TYPICAL - CRANKCASE SEALANT APPLICATION

NOTE: If you do not use the roller method, you may use your finger to uniformly distribute the sealant.

Assemble both crankcase halves.

Install M8 screws (16x) in crankcase and tighten to specification as per illustrated sequence.

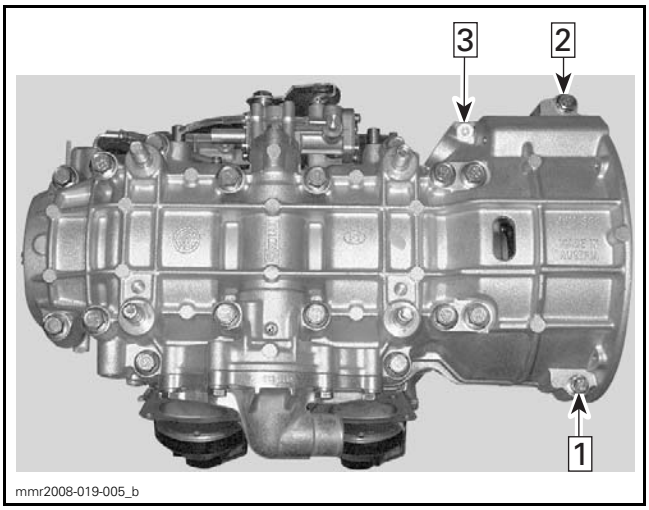
CRANKCASE M8 SCREWS TIGHTENING SEQUENCE	
FIRST STEP	18 N•m (159 lbf•**in**)
FINAL STEP	29 N•m (21 lbf•ft)



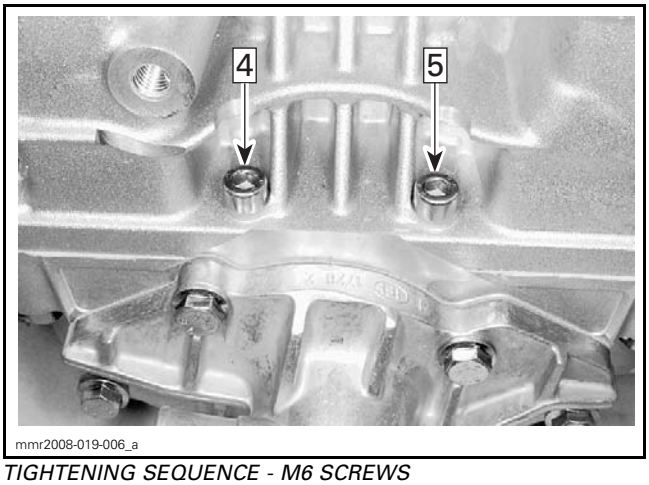
TYPICAL - TIGHTENING SEQUENCE - M8 SCREWS

Install M6 screws (5x) in crankcase and tighten to specification as per illustrated sequence.

CRANKCASE M6 SCREWS	
Tightening Torque	9 N•m (80 lbf•**in**)



TYPICAL - TIGHTENING SEQUENCE - M6 SCREWS



TIGHTENING SEQUENCE - M6 SCREWS

Install PTO oil seal cover **no. 1** and tighten screws to specification.

OIL SEAL COVER SCREWS	
Tightening Torque	11 N•m (97 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.

CRANKSHAFT

Crankshaft Removal

To remove crankshaft, use crankcase disassembly procedure.

Crankshaft Inspection

Check crankshaft bearings. They must turn smoothly and without noise. Replace as required.

Refer to table below to find crankshaft dimension specifications. For dimension measurement procedures, refer to *ENGINE MEASUREMENT*.

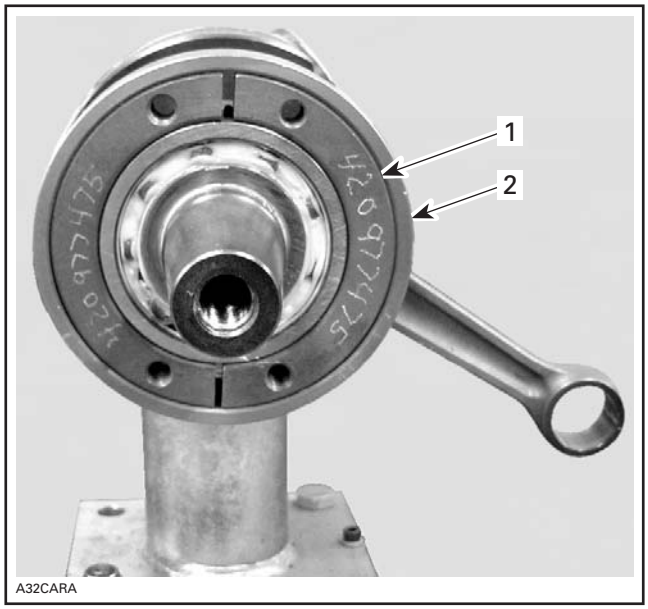
ENGINE MEASUREMENT	**TOLERANCES**		
	NEW PARTS (min.)	(max.)	WEAR LIMIT
Crankshaft deflection on PTO side	N.A.	0.06 mm (.002 in)	N.A.
Crankshaft deflection on MAG side	N.A.	0.05 mm (.002 in)	N.A.
Crankshaft deflection in center of crankshaft	N.A.	0.08 mm (.003 in)	N.A.
Connecting rod big end axial play	0.28 mm (.011 in)	0.68 mm (.027 in)	1.20 mm (.047 in)
Crankshaft end-play	0.10 mm (.004 in)	0.30 mm (.012 in)	N.A.
N.A.: Not Applicable			

Crankshaft Bearing Removal

NOTE: Normally, it takes approximately 10 minutes to heat up a bearing. If replacing bearing, it's recommended to start the bearing heating process prior to removal operation. See *BEARING HEATING* procedure further.

To remove bearings **no. 2** and **no. 3** from crankshaft **no. 4**, install half rings and puller ring on the outer bearing race.

REQUIRED TOOL	
HALF-RINGS (P/N 420 977 479)	
PULLER RING (P/N 420 977 494)	



1. *Half ring*
2. *Puller ring*

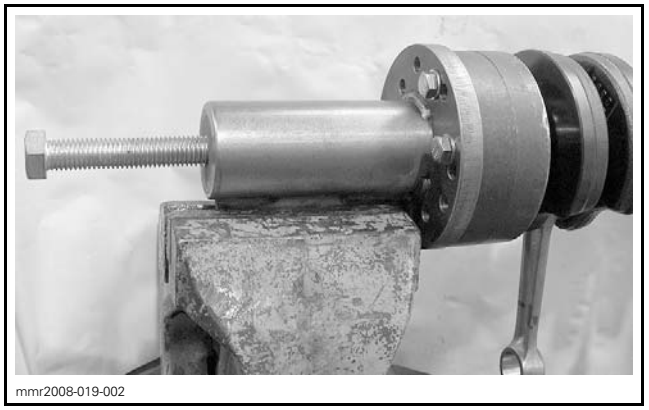
NOTE: Apply some grease on crankshaft end to hold proper crankshaft protector in place.

REQUIRED TOOL	
PTO side	
CRANKSHAFT PROTECTOR (PTO) (P/N 420 876 552)	
MAG side	
CRANKSHAFT PROTECTOR (MAG) (P/N 420 876 557)	

Install bearing puller on the half rings.

REQUIRED TOOL	
CRANKSHAFT BEARING PULLER (P/N 529 036 004)	

Secure bearing puller in a vise by one of its ribs.



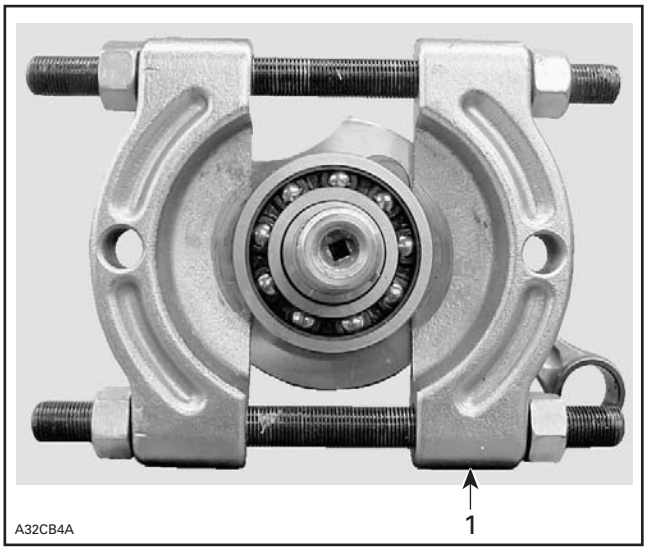
BEARING PULLER SECURED IN THE VISE

NOTICE **Never use an air impact tool for tightening the puller bolt. Lubricate bolt with XPS LUBE (P/N 293 600 016) to avoid damaging the threads.**

Screw in puller bolt until bearing comes out.

Follow same procedure for inner bearing.

NOTE: In the case of a damaged bearing or reduced clearance between crankshaft counterbalance and bearing, or on the MAG side bearing, use SNAP-ON BEARING SEPARATOR (P/N CJ 951) or SPX/OTC BEARING SEPARATOR (P/N 1124) to facilitate removal.



1. *Bearing separator*

Crankshaft Bearing Installation

Inspect crankshaft ends for damage.

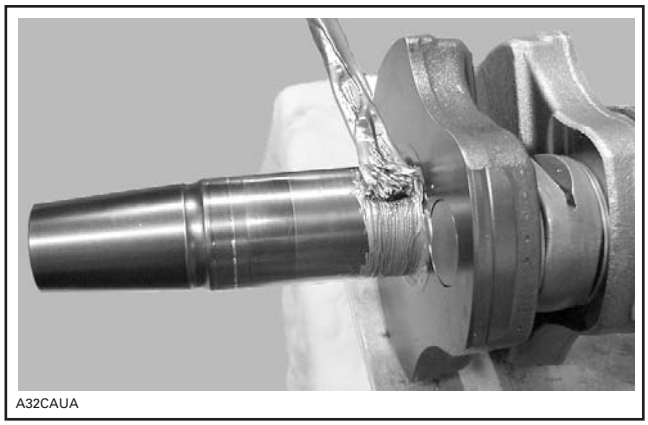
Clean crankshaft ends with sand paper no. 180 to remove possible seal marks and debris.

A32CB5A

A32CBWB

Remove all residue using PULLEY FLANGE CLEANER (P/N 413 711 809).

Apply LOCTITE 767 (ANTISEIZE LUBRICANT) (P/N 293 800 070) on crankshaft bearing mounting area.



A32CAUA

ANTISEIZE LUBRICANT APPLICATION

Bearing Heating

Heat bearing(s) as per following instructions to ease installation. If required, put a suitable plate or shim between integrated seal and heating surface to avoid direct contact.

REQUIRED TOOL	
BEARING HEATER (P/N 529 035 969)	

A32CB7A

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 inner seals or cage failure.

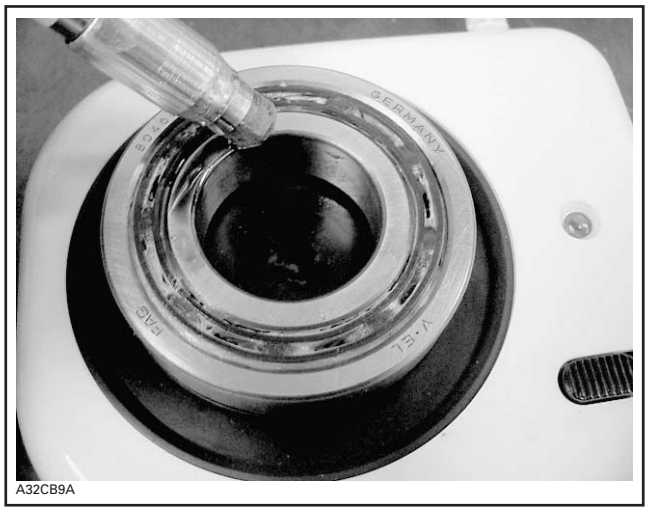
For even heat distribution, turn bearing several times during heating process.

NOTE: Two bearings can be heated at the same time on one bearing heater.

1. Bearings

Probe side of bearing inner race with temperature indicator stick. Temperature stick will liquefy when bearing reaches proper temperature.

REQUIRED TOOL	
TEMPERATURE INDICATOR STICK (P/N 529 035 970)	



⚠ WARNING

Do not touch heated bearing with bare hands. Always wear heat resistant gloves before handling heated bearing(s).

NOTICE Never reinstall a bearing that has been removed.

PTO Side Bearing Installation

Slide inner PTO bearing onto crankshaft with the **integrated seal facing crankshaft**. Push bearing to end position.

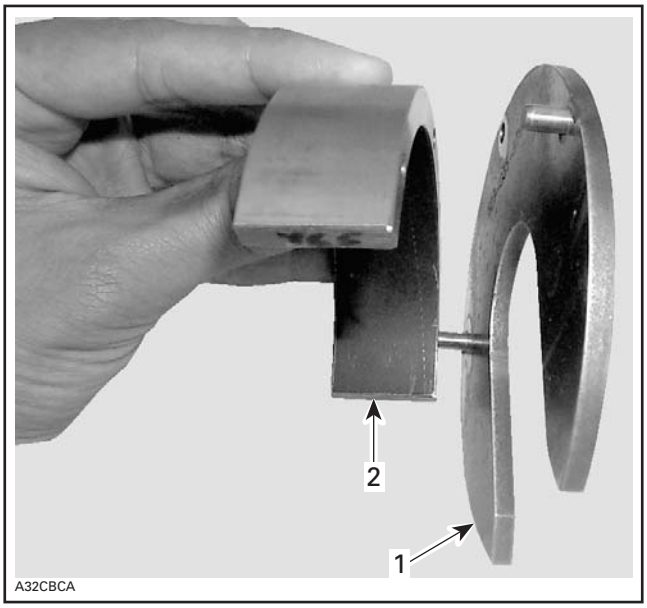
NOTE: Heated bearing should slide easily onto crankshaft. If required, push on the bearing inner race. **Pay special attention to correct positioning of the locating pins and/or retaining discs.**

REQUIRED TOOL	
BEARING INSTALLER (PTO) (P/N 529 035 990)	

Install retaining discs.

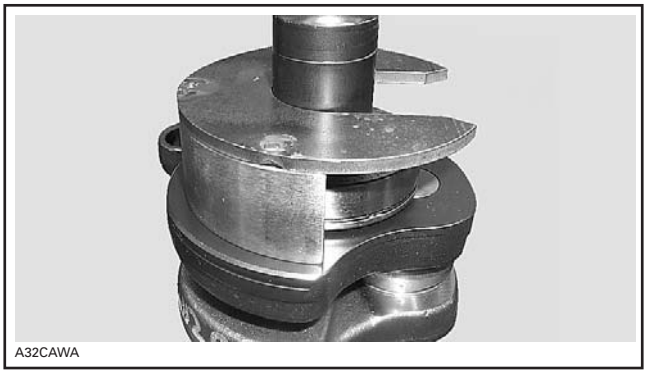
Install support plate with distance gauge.

REQUIRED TOOL	
SUPPORT PLATE (P/N 529 035 976)	
CRANKSHAFT DISTANCE GAUGE (P/N 529 035 968)	



1. Support plate
2. Distance gauge

Install bearing locator tool.



Slide heated outer PTO bearing onto crankshaft until it contacts the distance gauge.

MAG Side Bearing Installation

Slide first MAG bearing onto crankshaft with the **integrated seal facing crankshaft** until it bottoms on crankshaft shoulder.

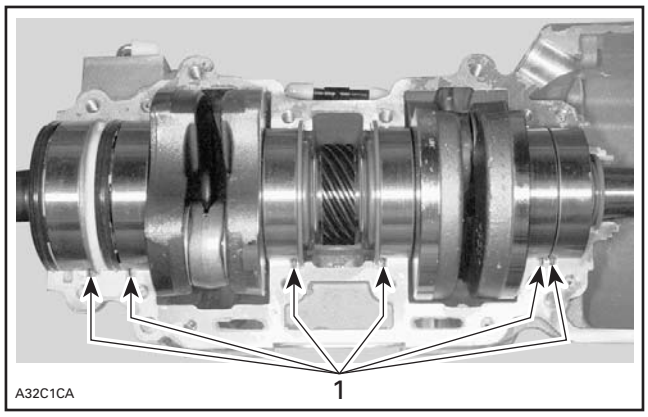
NOTE: Heated bearing should slide easily onto crankshaft. If required, push on the bearing inner race using appropriate tool.

REQUIRED TOOL	
BEARING INSTALLER (PTO) (P/N 529 035 990)	

Slide second bearing onto crankshaft until it contacts the first one.

Crankshaft Installation

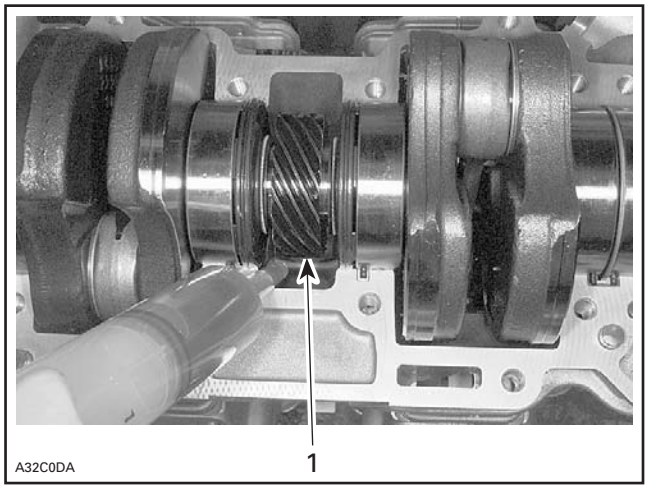
At crankshaft installation, position location pins as illustrated.



TYPICAL
1. Position pins

Pour 50 ml (1.7 U.S. oz) of injection oil in the pan under worm gear as per illustration.

SERVICE PRODUCT
XPS INJECTION OIL (P/N 293 600 117)



1. Worm gear oil bath

Apply recommended service product as per following procedure:

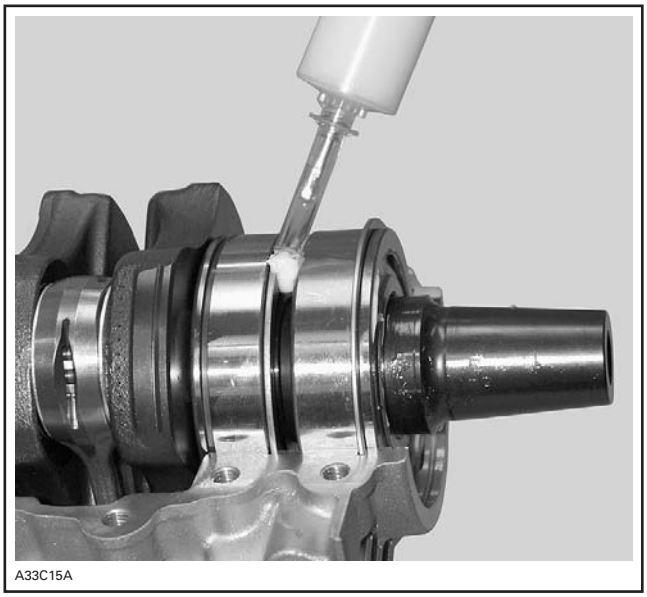
NOTICE **Use only the recommended service product. Make sure not to push grease between the outer bearing race and crankcase half.**

SERVICE PRODUCT	
30 ml ± 5 ml (1 U.S. oz ± .2 U.S. oz)	ISOFLEX GREASE TOPAS NB 52 (P/N 293 550 021)

NOTE: The 50 g tube corresponds to 50 ml of grease.

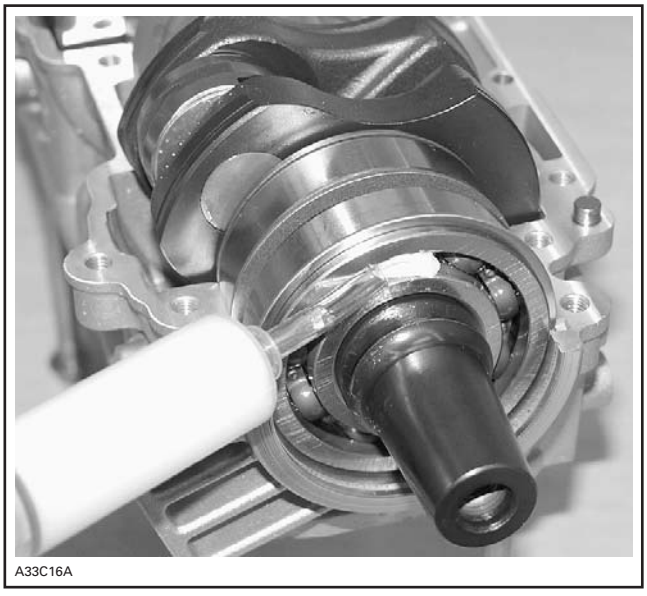
NOTICE **Do not exceed the recommended amount of grease.**

Fill inner side of PTO side bearing with grease (about 10 ml (.3 U.S. oz).

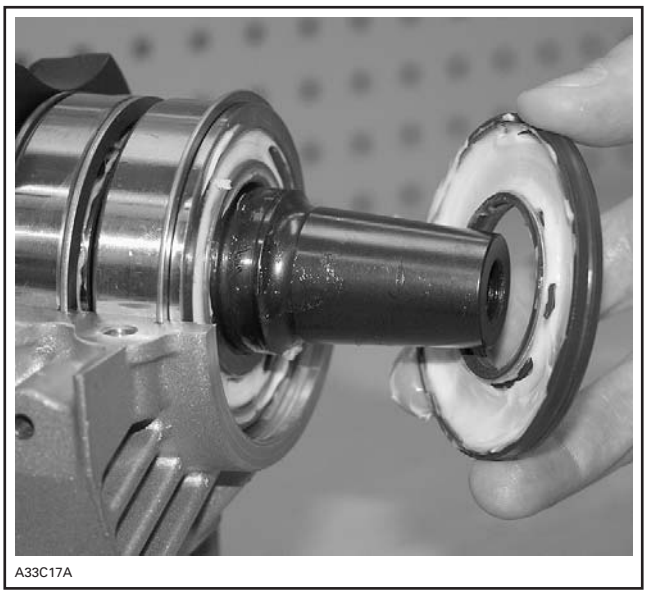


PTO SIDE BEARING FILLED WITH GREASE

With the syringe, fill the outer ball bearing and inner side of outer seal with the remaining grease.



BALLS COATED WITH A SEAM OF GREASE


A33C17A

TYPICAL — FILL WITH GREASE AND SET IN PLACE

Apply 6 ml (.2 U.S. oz) of same grease to MAG side outer bearing.

NOTE: If replaced with new bearing, do not apply grease as new bearings come with grease already applied.

Proceed with crankcase assembly. Refer to *CRANKCASE* subsection.

BOTTOM END (800R E-TEC)

SERVICE TOOLS

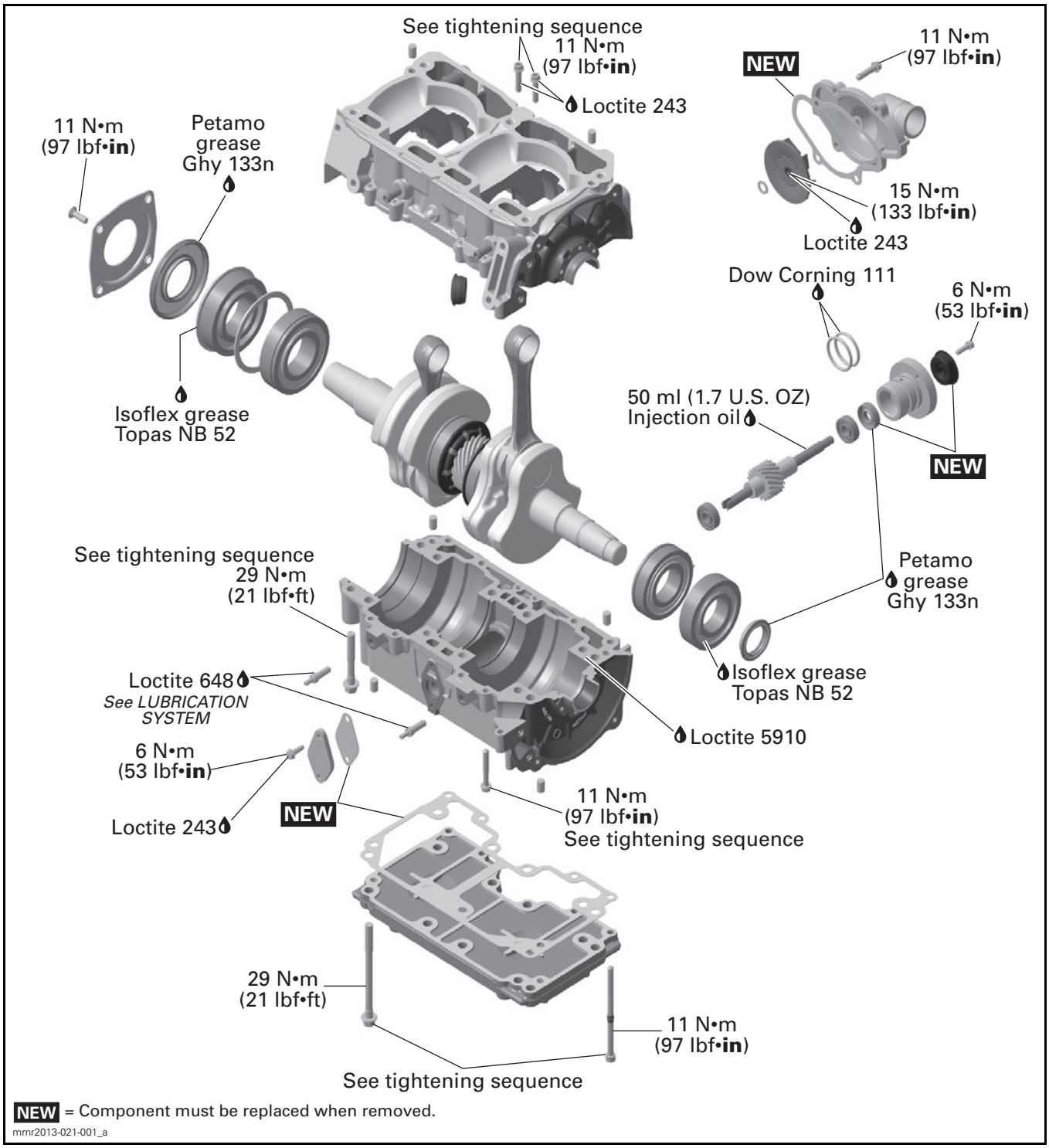
Description	Part Number	Page
BEARING HEATER	529 035 969	13
CERAMIC SEAL INSTALLER	529 036 014	7–8
CRANKSHAFT BEARING PULLER	529 036 004	12
DISTANCE GAUGE	529 036 060	15
HANDLE	420 877 650	6
OIL SEAL GUIDE	529 035 822	7
OIL SEAL PUSHER	529 035 757	6
TEMPERATURE INDICATOR STICK	529 035 970	14

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
SNAP-ON BEARING SEPARATOR	CJ 951	13
SNAP-ON MANUAL IMPACT DRIVER	PIT120	8
SPX/OTC BEARING SEPARATOR	1124	13

SERVICE PRODUCTS

Description	Part Number	Page
ISOFLEX GREASE TOPAS NB 52	293 550 021	16
LOCTITE 243 (BLUE)	293 800 060	4, 8
LOCTITE 5910	293 800 081	9
LOCTITE 767 (ANTISEIZE LUBRICANT)	293 800 070	13
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	9
PULLEY FLANGE CLEANER	413 711 809	13
XPS LUBE	293 600 016	12



NEW = Component must be replaced when removed.

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GENERAL

Engine removal is required to repair bottom end except for the water pump impeller.

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.

To measure internal parts, refer to *ENGINE MEASUREMENT* 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.**

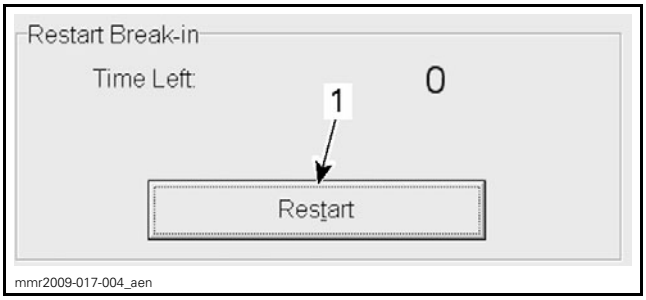
⚠ WARNING

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.**

1. Follow *OPERATOR'S GUIDE* recommendation relating to break-in.
2. Restart break-in period in B.U.D.S. as follows:
   2.1 Ensure to use the latest B.U.D.S. software specific to the E-TEC engine.
   2.2 Select **Setting** tab.
   2.3 Click on **Restart** button in **Restart Break-in** box.



1. Click on Restart

PROCEDURES

WATER PUMP

Water Pump Access

Refer to *BODY* subsection and remove:

– Both side panel
– Upper body module.

Refer to *EXHAUST SYSTEM* subsection and remove:

– Tune pipe
– Muffler.

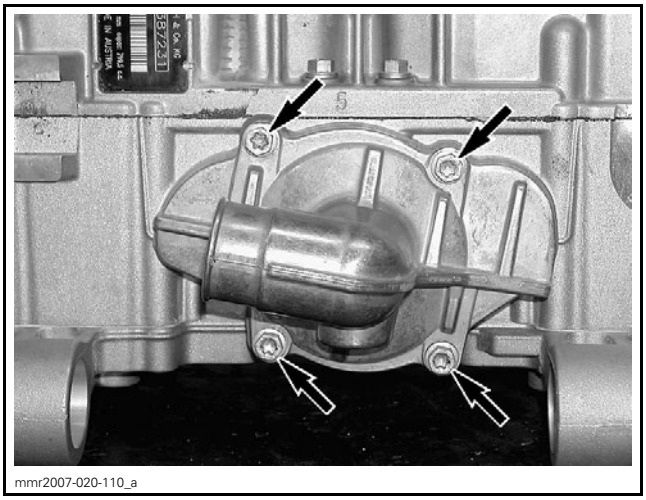
Remove acoustic panel.

Put a large drain pan under vehicle bottom pan.

Remove starter, refer to *STARTING SYSTEM* subsection.

Water Pump Removal

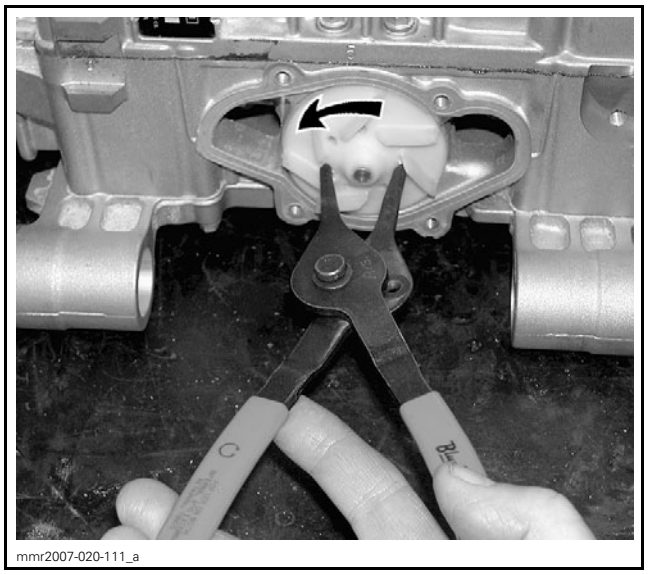
Remove water pump cover.



TYPICAL

Remove impeller by turning it counterclockwise.

NOTICE Be careful not to damage impeller fins.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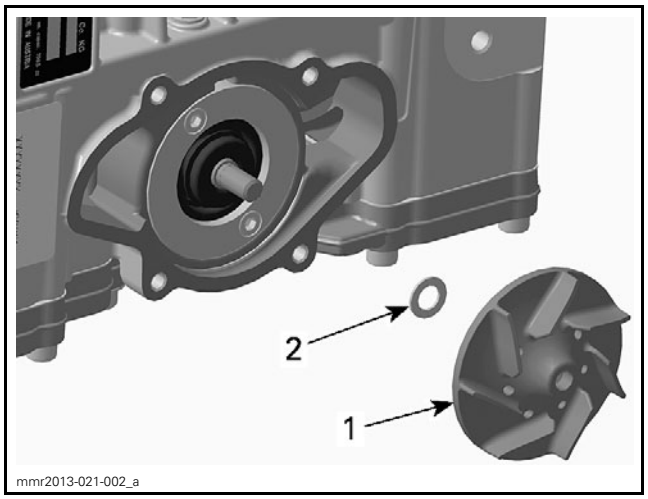
TYPICAL



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

Clean gasket surfaces of water pump cover and crankcase.

Water Pump Installation

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

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

Tighten impeller to specification.

TIGHTENING TORQUE	
Impeller	15 N•m (133 lbf•**in**) + LOCTITE 243 (BLUE) (P/N 293 800 060)

Install a NEW water pump cover gasket.

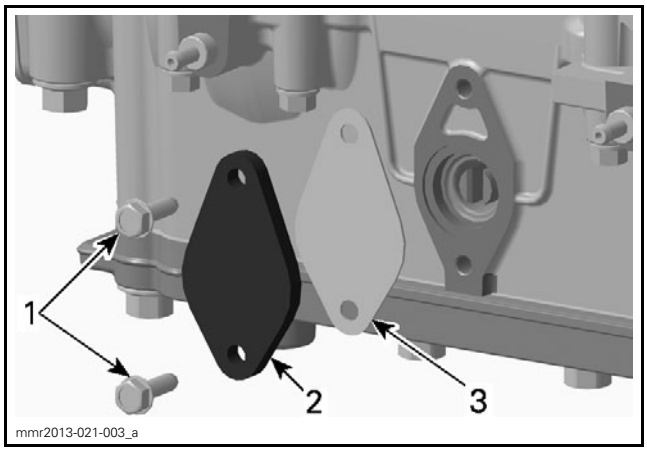
Tighten screws of water pump cover to specification in a crisscross sequence.

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

BEARING CARRIER AND PUMP SHAFT

Bearing Carrier and Pump Shaft Removal

Remove cover plate and discard gasket.



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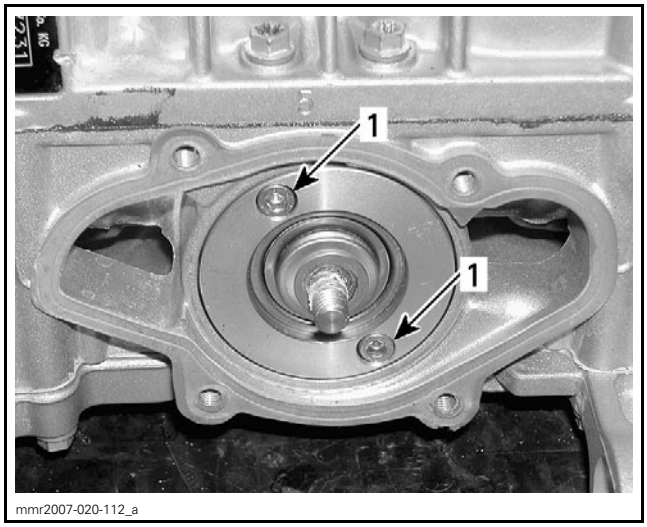
1. *Screws*
2. *Cover plate*
3. *Gasket*

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

Remove bearing carrier retaining screws.



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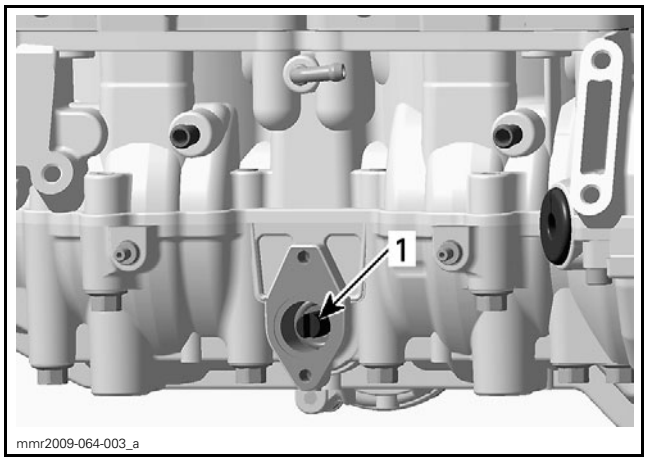
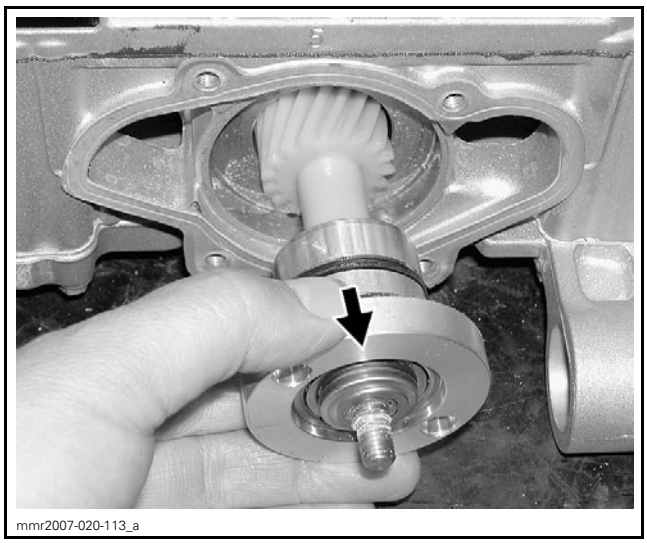
TYPICAL
1. *Screws*

Push pump shaft out while turning shaft to release it from crankshaft worm gear.



TYPICAL
1. Push out shaft here

Extract bearing carrier and pump shaft.



TYPICAL

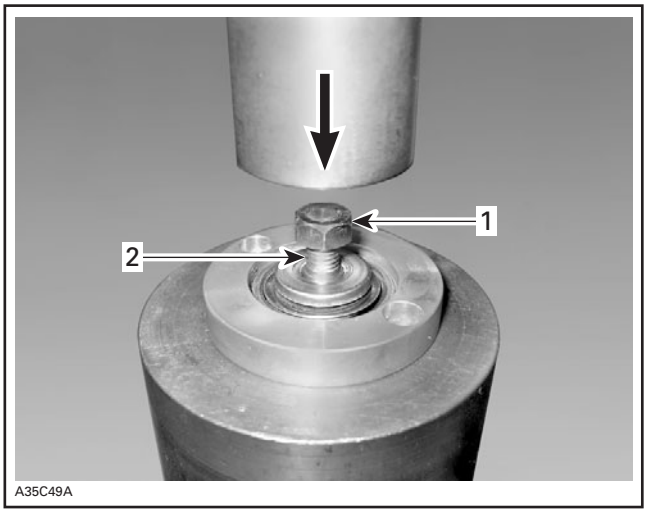
Bearing Carrier and Pump Shaft Disassembly

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.

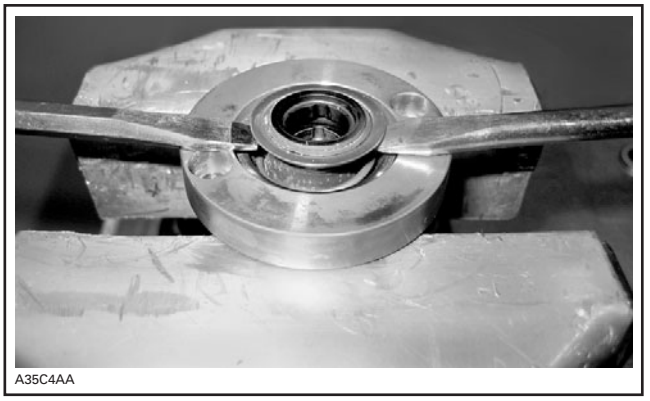
Push pump shaft out using a press.



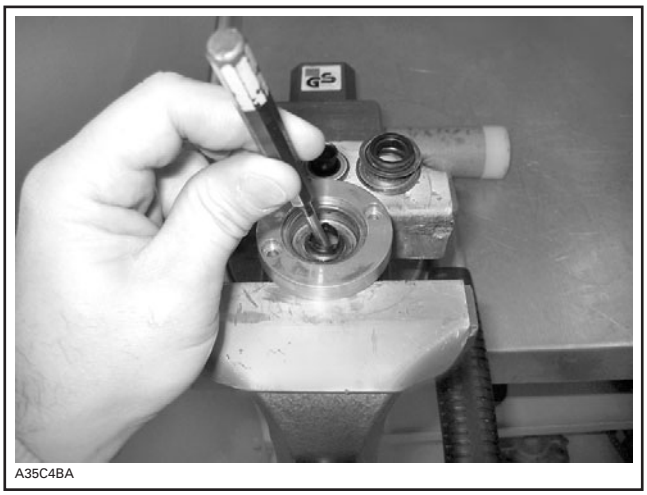
TYPICAL
1. M8 nut
2. Shaft

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.

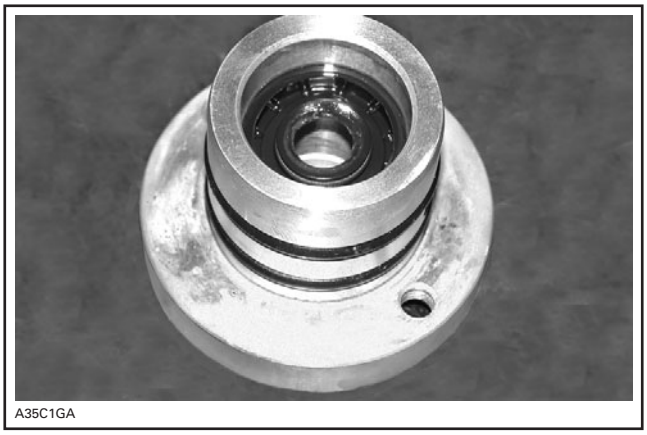


Push out bearing from the bearing carrier using an appropriate pusher.


A35C4BA

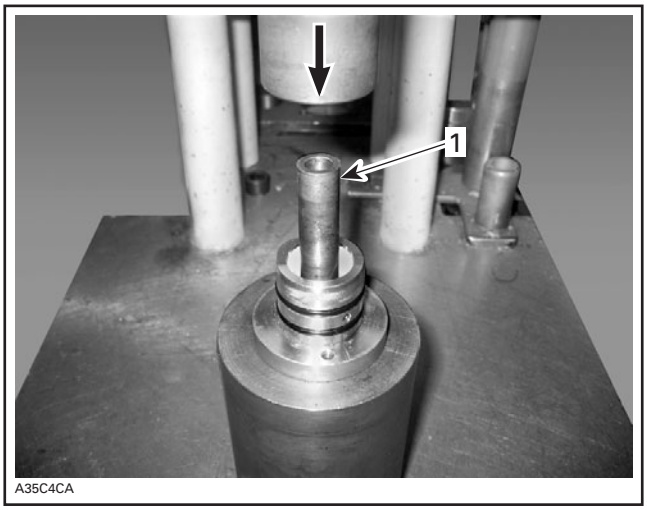
BEARING UNDERNEATH OUTER PART OF ROTARY SEAL

Push oil seal out.


A35C1GA

Carefully press the outer part of ceramic seal out.

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



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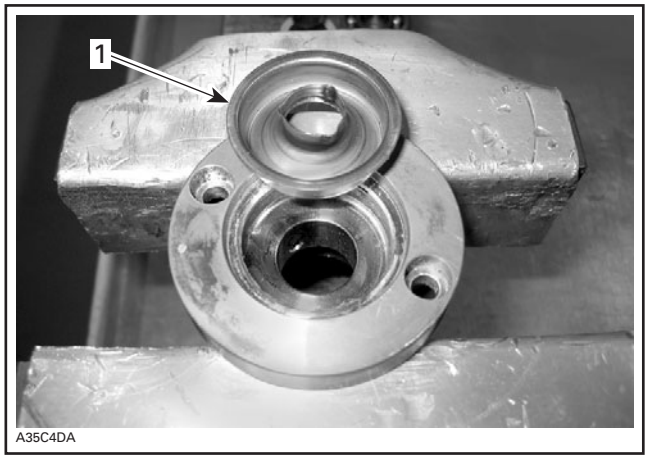
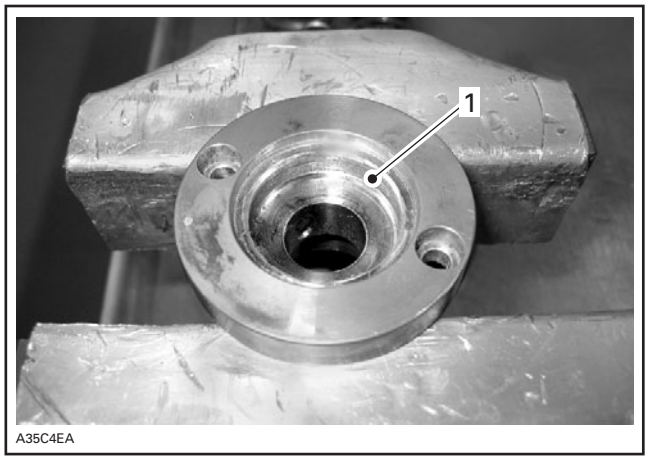
1. 16 mm (.63 in) mandrel



A35C4DA

1. Outer part of ceramic seal

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



A35C4EA

1. Remove sealant

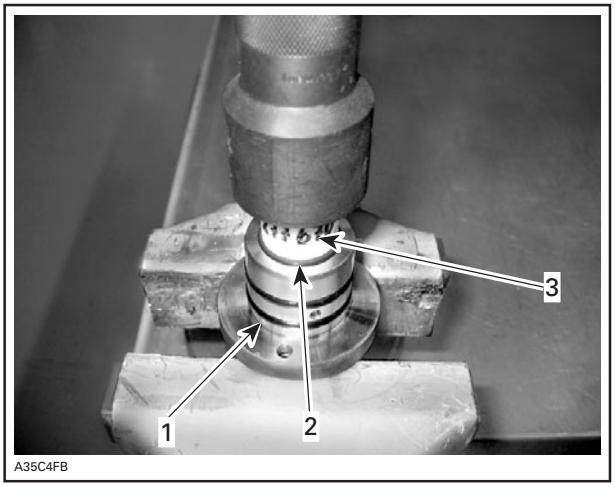
Bearing Carrier and Pump Shaft Reassembly

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.

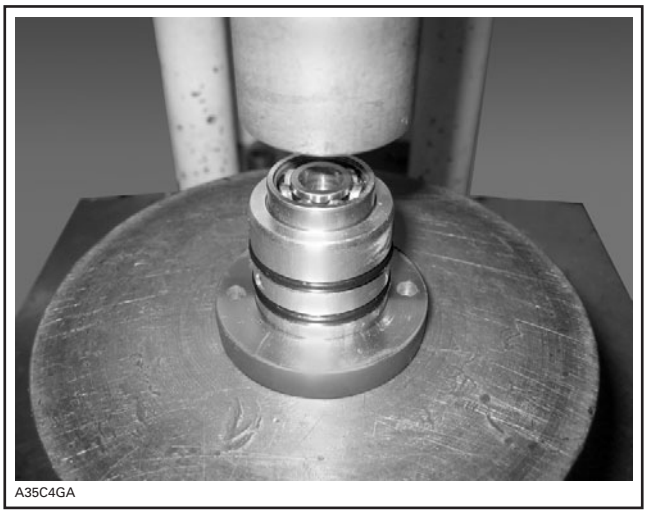
Push the NEW oil seal in bearing carrier.

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



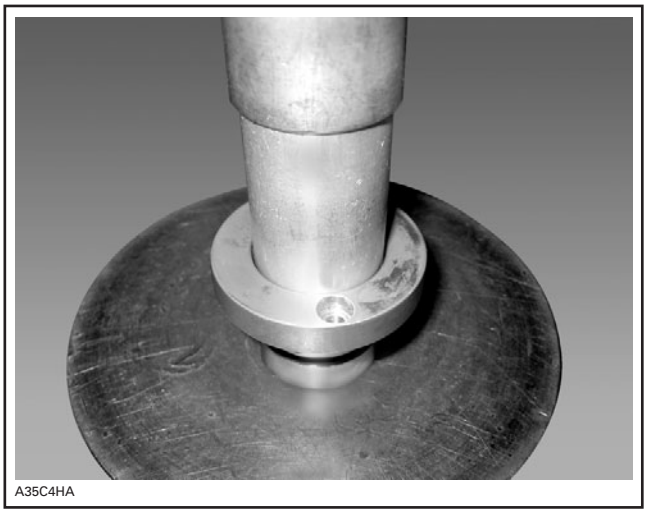
1. Bearing carrier
2. Oil seal
3. Oil seal pusher

Press bearing into bearing carrier.



Push the NEW ceramic seal in bearing carrier.

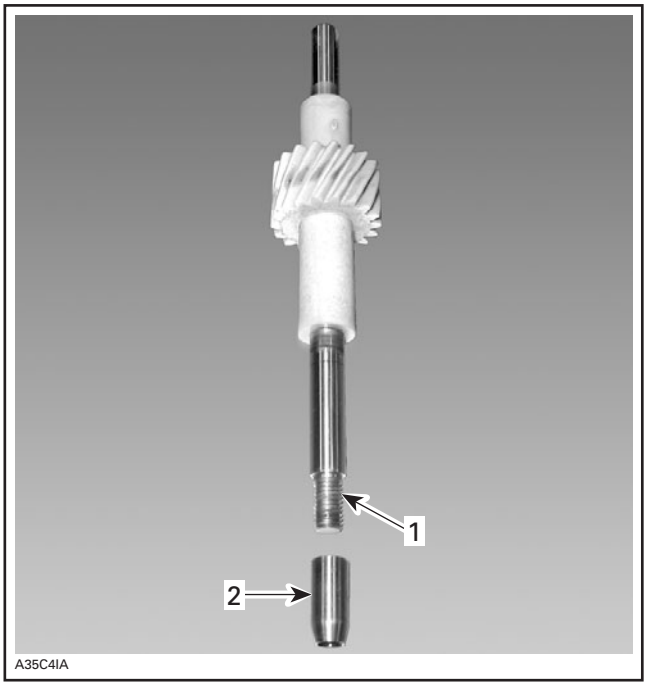
REQUIRED TOOL	
CERAMIC SEAL INSTALLER (P/N 529 036 014)	



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

Install oil seal guide on pump shaft.

REQUIRED TOOL	
OIL SEAL GUIDE (P/N 529 035 822)	



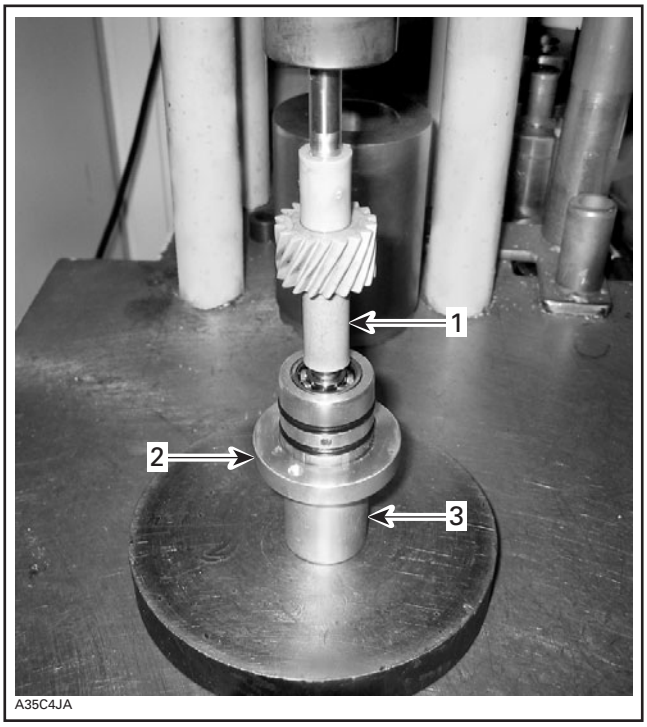
1. Pump shaft
2. Oil seal guide

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. *Bearing carrier*
3. *Ceramic seal installer*

Remove oil seal guide from pump shaft.

Bearing Carrier and Pump Shaft Installation

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

Pour 50 ml (1.7 U.S. oz) of injection oil in the pan under crankshaft worm gear.

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	6 N•m (53 lbf•**in**)

Install cover plate and NEW gasket.

Tighten cover plate screws to specification.

TIGHTENING TORQUE	
Cover plate screws	6 N•m (53 lbf•**in**) + LOCTITE 243 (BLUE) (P/N 293 800 060)

CRANKCASE

Crankcase Disassembly

Remove engine from vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.

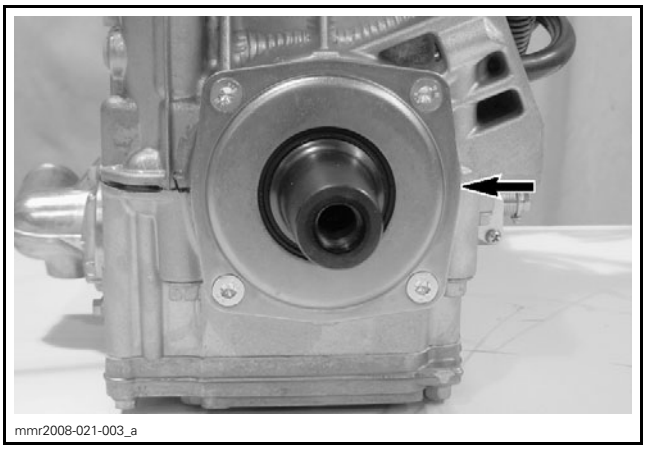
Remove cylinder head and cylinder-block. Refer to *TOP END (800R E-TEC ENGINES)* subsection.

Remove magneto housing. Refer to *MAGNETO SYSTEM* subsection.

Remove drive pulley. Refer to *DRIVE PULLEY* subsection.

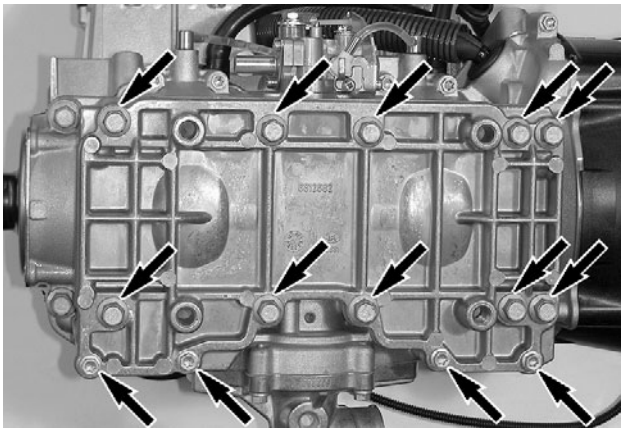
Remove PTO oil seal cover.

NOTE: Tap screw heads to break the Loctite bond or use a SNAP-ON MANUAL IMPACT DRIVER (P/N PIT120).



TYPICAL - PTO OIL SEAL COVER

Remove base plate.

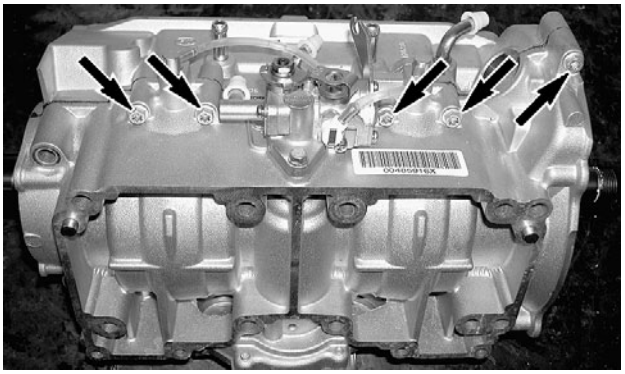

mmr2008-021-002_a

TYPICAL - BASE PLATE RETAINING SCREWS

NOTICE Whenever base plate is removed, crankcase must be opened, cleaned, and re-sealed.

Remove engine front supports.

Remove crankcase screws.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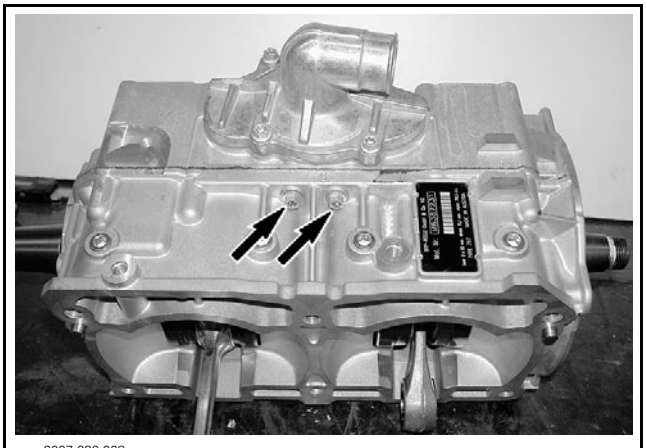
CRANKCASE SCREWS - OIL INJECTION PUMP SIDE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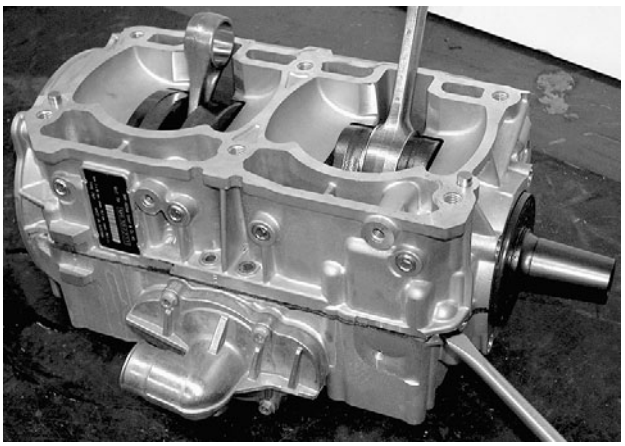
TYPICAL - CRANKCASE SCREWS - WATER PUMP SIDE

Split crankcase.

NOTE: To prevent damage to crankcase mating surfaces, use prying lugs to "unstick" crankcase.


mmr2007-020-004

PRYING LUGS


mmr2007-020-005

PRYING LUGS

Remove crankshaft assembly.

Crankcase Cleaning

Clean all metal components in a non-ferrous metal cleaner. Use LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500) accordingly.

NOTICE Never use a sharp object to remove sealant as score marks incurred are harmful to crankcase sealing.

Crankcase Inspection

Check crankcase for cracks or other damages. Replace if necessary.

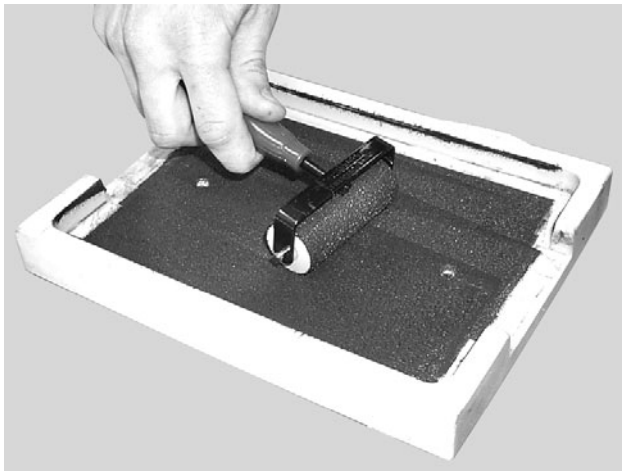
Crankcase Assembly

Install crankshaft in lower crankcase. See *CRANKSHAFT* for procedure.

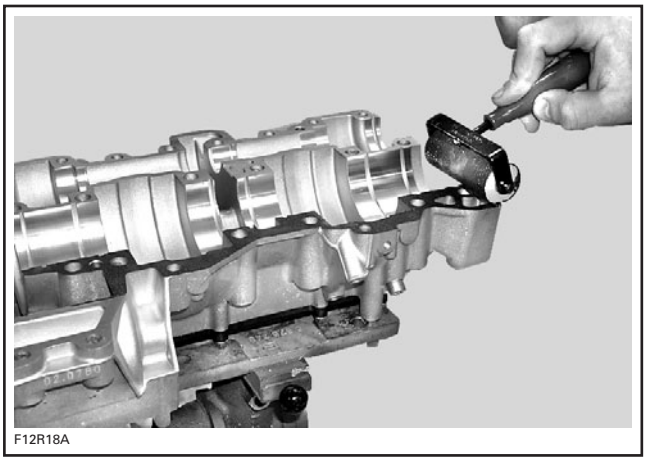
Apply LOCTITE 5910 (P/N 293 800 081) on crankcase halves as per following procedure.

NOTE: The total assembly sequence, including sealing compound application and crankcase torquing, must be performed within 10 minutes.

Use a plexiglass plate and apply some sealant on it. Use a 50 mm - 75 mm (2 in - 3 in) soft rubber roller and spread the sealant to get a thin uniform coat on the plate (spread as necessary). When ready, apply the sealant on crankcase mating surfaces.



F12R17A



F12R18A

TYPICAL

NOTE: If you do not use the roller method, you may use your finger to uniformly distribute the sealant.

Spread a small bead of sealant around the water passage groove as illustrated.

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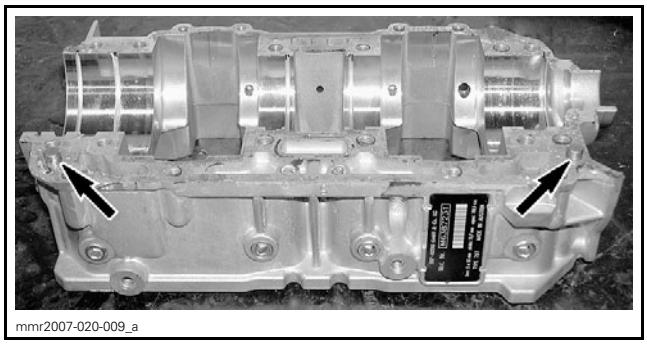
Ensure dowel pins are in their holes.



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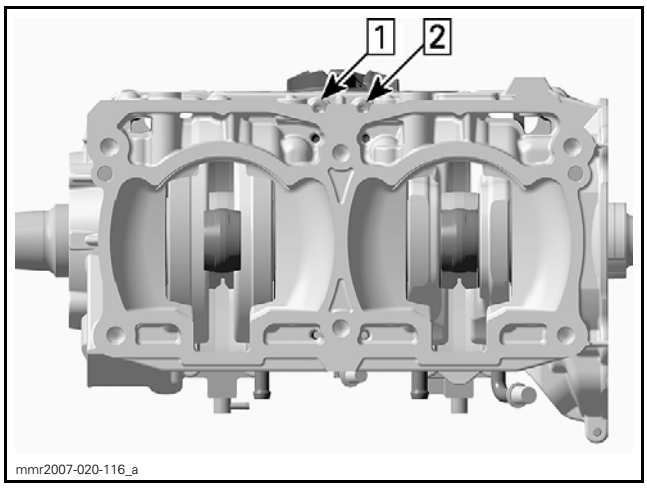
Assemble both crankcase halves.

Install M6 screws (7x) in crankcase.

Tighten M6 screws to specification as per illustrated sequence.

TIGHTENING TORQUE	
Crankcase M6 screws	11 N•m (97 lbf•**in**)



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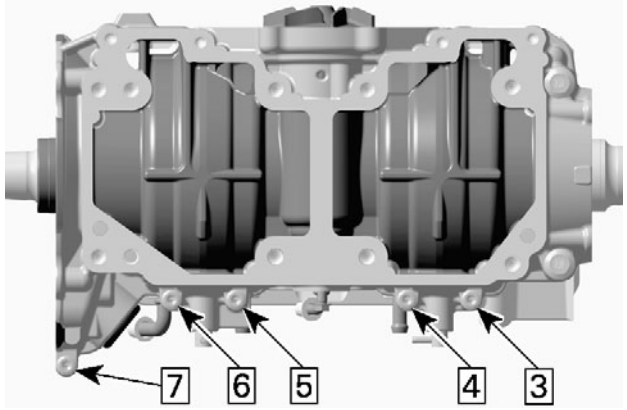
TIGHTENING SEQUENCE - TOP VIEW



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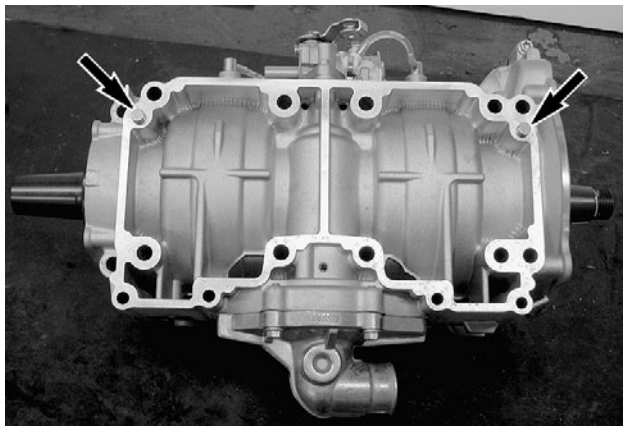
TIGHTENING SEQUENCE - BOTTOM VIEW

Ensure dowel pins are in their holes.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TYPICAL - BOTTOM VIEW

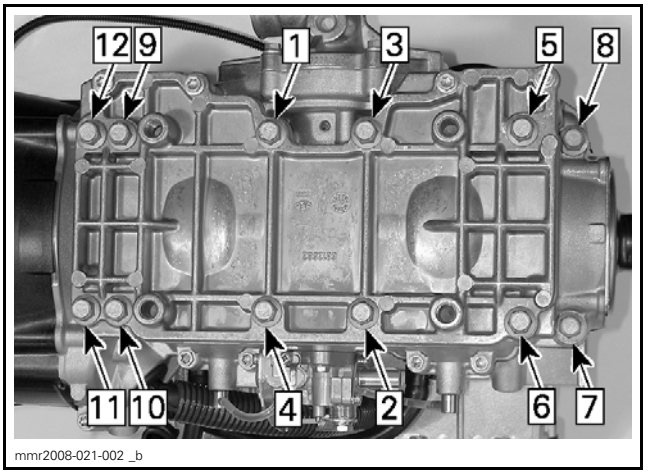
Install engine support.

Install a NEW base plate gasket.

Install M8 screws (12x) in base plate.

Tighten M8 screws to specification as per illustrated sequence.

TIGHTENING TORQUE (SEQUENCE)		
Base plate M8 screws	First step	14 N•m (124 lbf•**in**)
	Final step	29 N•m (21 lbf•ft)



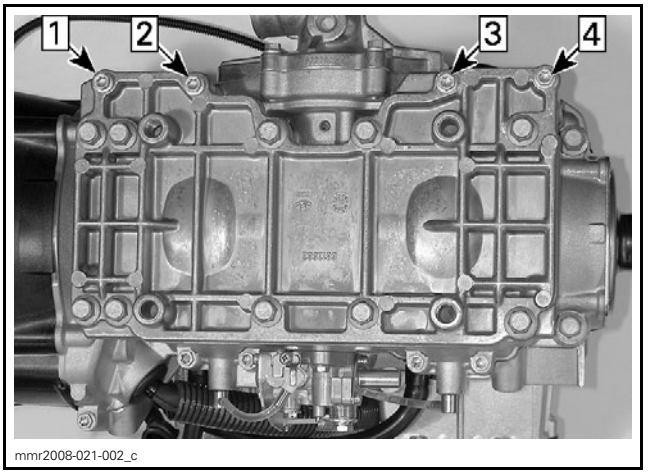
mmr2008-021-002 _b

TYPICAL - TIGHTENING SEQUENCE (M8 SCREWS)

Install M6 screws (4x) in base plate.

Tighten M6 screws to specification as per illustrated sequence.

TIGHTENING TORQUE	
Base plate M6 screws	11 N•m (97 lbf•**in**)



mmr2008-021-002_c

TYPICAL - TIGHTENING SEQUENCE (M6 SCREWS)

Install PTO oil seal cover.

Tighten oil seal cover to specification.

TIGHTENING TORQUE	
Oil seal cover screws	11 N•m (97 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.

CRANKSHAFT

Crankshaft Removal

To remove crankshaft, use crankcase disassembly procedure.

Crankshaft Inspection

For crankshaft specifications refer to *800R E-TEC MODELS* subsection in *TECHNICAL SPECIFICATIONS* section.

For dimension measurement procedures, refer to *ENGINE MEASUREMENT* subsection.

Crankshaft Bearing Removal

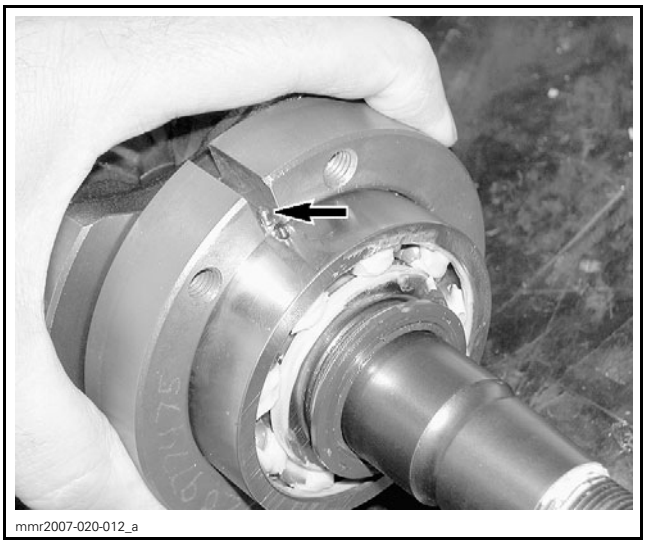
NOTE: 10 minutes is required to heat up a new bearing for its installation, To save time, it is recommended to start the heating process prior to bearing removal operation. See procedure further.

To remove MAG and PTO side bearings from crankshaft, install proper half rings and puller ring on the outer bearing race.

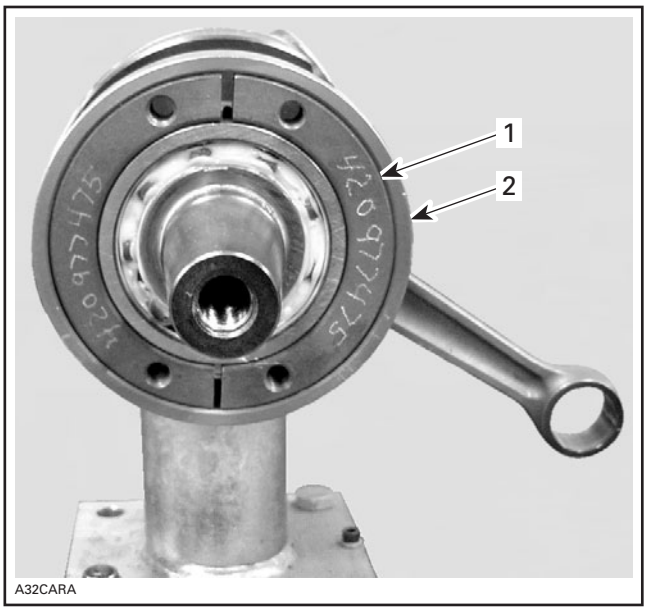
NOTE: On MAG side, position tools on inner bearing and pull out both bearings together.

REQUIRED TOOL		
Part	MAG side	PTO side
Half rings	420 977 475	420 977 479
Puller ring	420 977 490	420 977 494
Crankshaft protector	420 876 557	420 877 414

Ensure to position bearing pin between half ring gap.



MAG SIDE



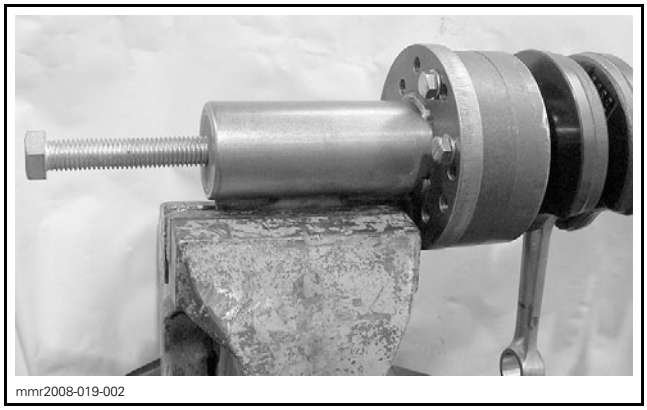
PTO SIDE
1. *Half ring*
2. *Puller ring*

NOTE: Apply some grease on crankshaft end to hold in place the proper 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 by one of its rib.



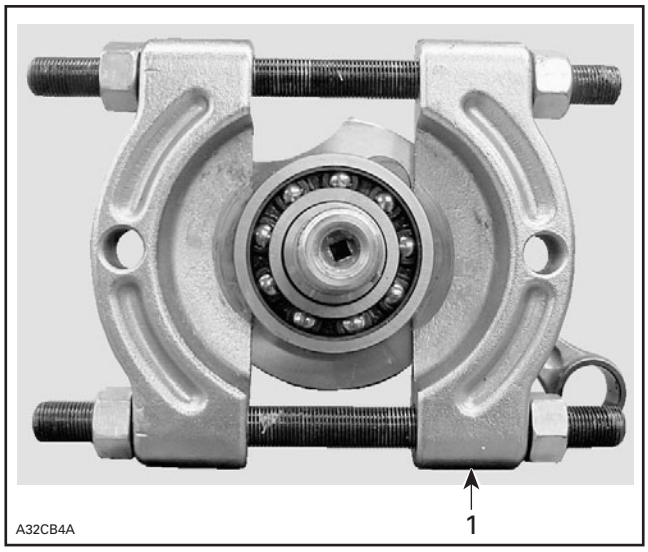
BEARING PULLER SECURED IN THE VISE

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 bearing comes out.

Follow the same procedure for the inner bearing (PTO side).

NOTE: As an alternate method to remove bearings, use SNAP-ON BEARING SEPARATOR (P/N CJ 951) or SPX/OTC BEARING SEPARATOR (P/N 1124). Use a press to remove bearings.



1. Bearing separator

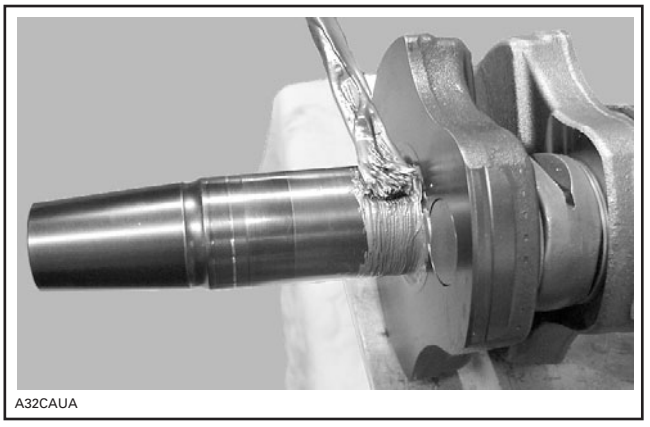
Crankshaft Bearing Installation

Inspect crankshaft ends for damage.

Clean crankshaft ends with sand paper no. 180 to remove possible seal marks and debris.

Remove all residue using PULLEY FLANGE CLEANER (P/N 413 711 809).

Apply LOCTITE 767 (ANTISEIZE LUBRICANT) (P/N 293 800 070) on crankshaft bearing mounting area.



Bearing Heating

Heat up the bearing(s) to ease installation. If required, put a suitable plate or shim to avoid the direct contact between the integrated seal with the heating surface.

REQUIRED TOOL	
BEARING HEATER (P/N 529 035 969)	


A32CB7A

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 inner seals or cage failure.

For even heat distribution, turn bearing several times during heating process.

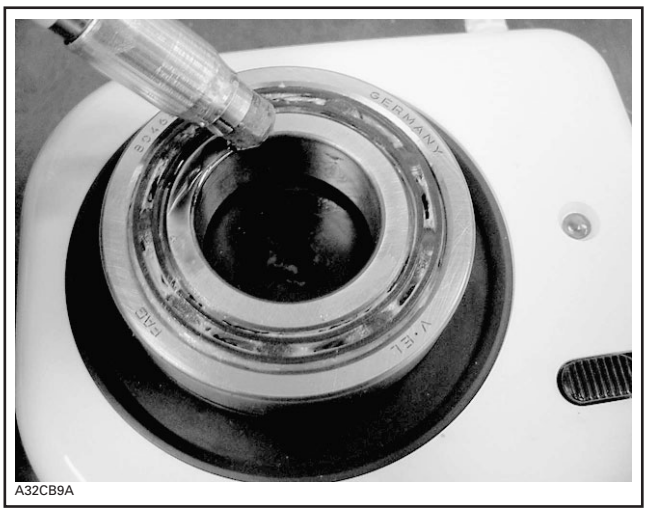
NOTE: Two bearings can be heated at the same time on one bearing heater.

A32CB8A

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)	


A32CB9A

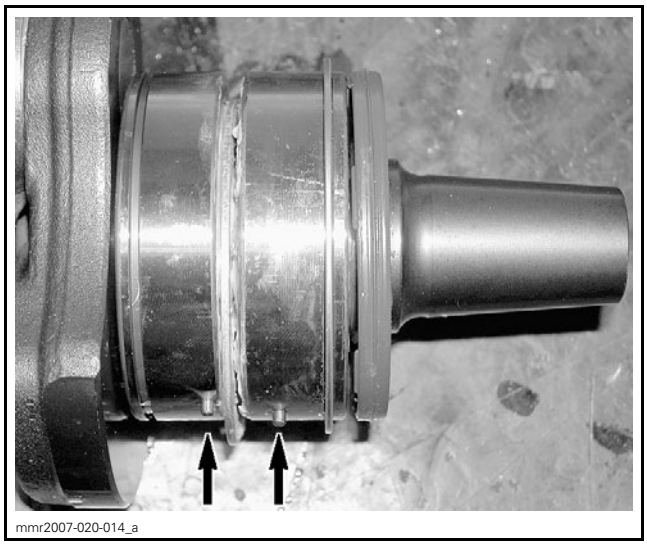
⚠ WARNING

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.

PTO Side Bearings

Install PTO bearings on crankshaft so that locating pins will be positioned as shown.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PTO SIDE

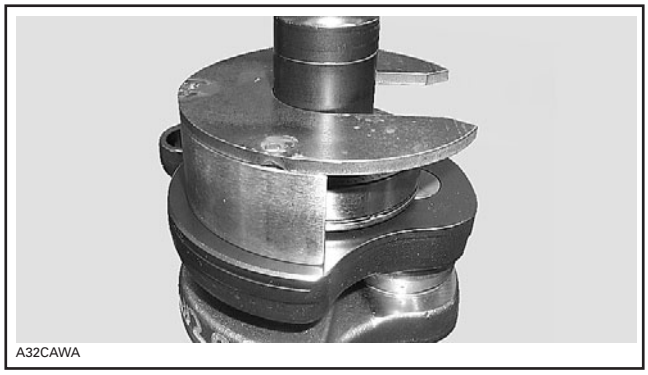
Slide the heated inner PTO bearing on crankshaft until it bottoms on crankshaft shoulder.

NOTE: Heated bearing should slide easily onto the crankshaft. If required, push with a steel tube on the inner race of the bearing.

Install retaining disc.

Install distance gauge.

REQUIRED TOOL	
DISTANCE GAUGE (P/N 529 036 060)	

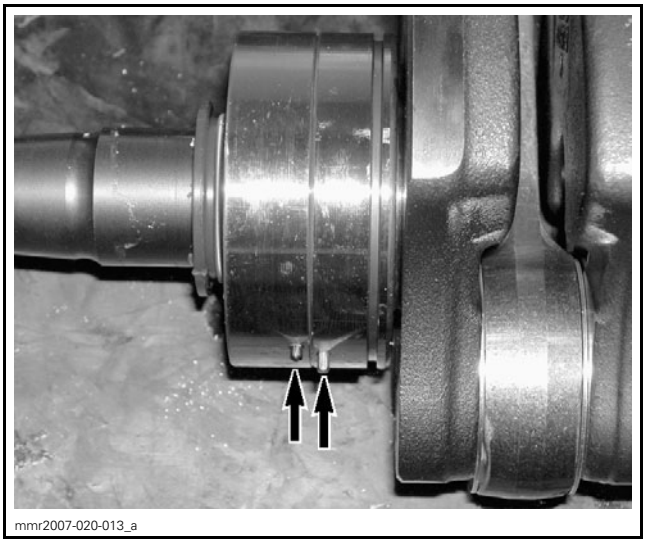


TYPICAL

Slide the heated outer PTO bearing onto the crankshaft until it contacts the distance gauge.

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.

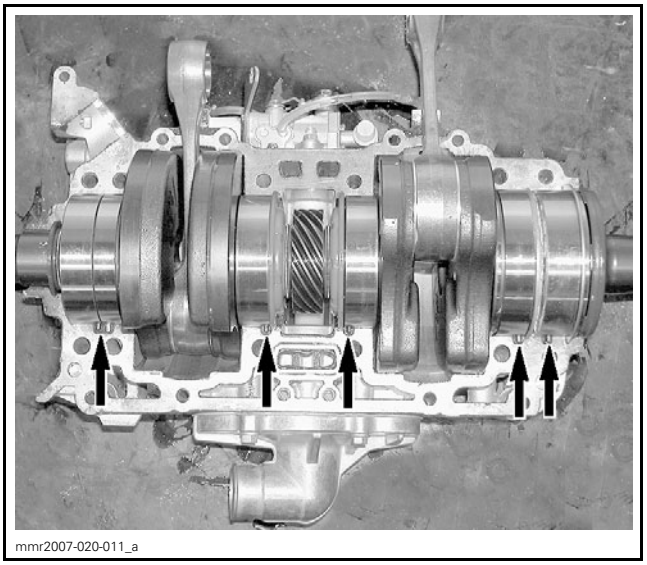
NOTE: Heated bearing should slide easily onto the crankshaft. If required, push with a steel tube on the inner race of the bearing.

Slide the outer bearing until it sits on inner bearing.


A32CC5B

Crankshaft Installation

1. Position locating pins in their recess as illustrated.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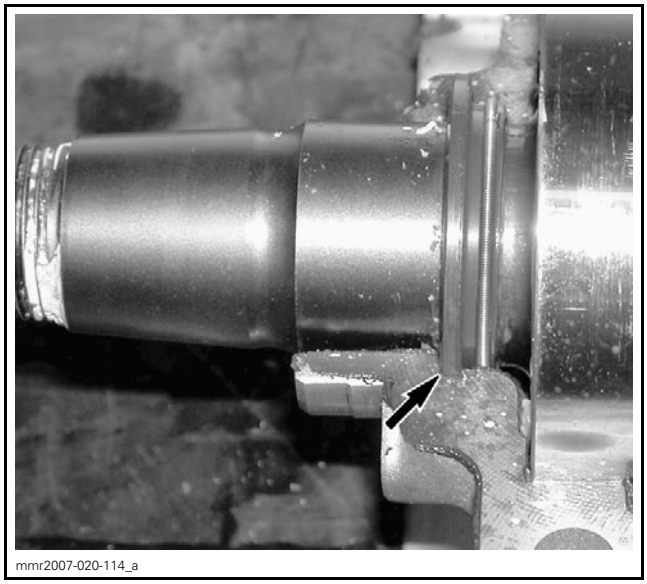
2. Pay attention to properly locate MAG seal in its groove.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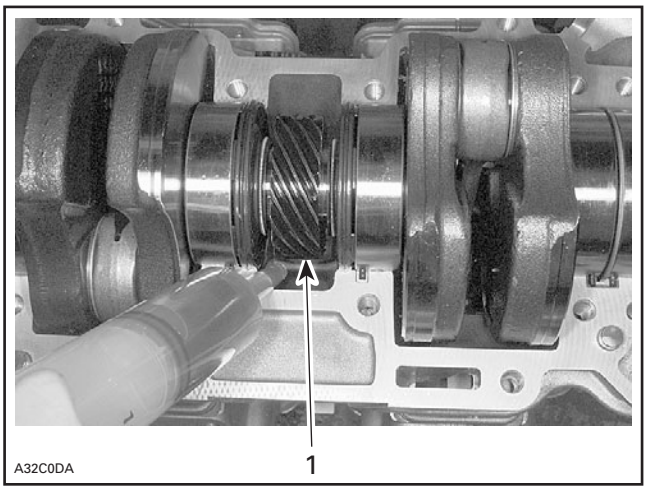
3. Pour 50 ml (1.7 U.S. oz) of injection oil in the oil bath under worm gear as shown.



TYPICAL
1. Oil bath

4. Apply ISOFLEX GREASE TOPAS NB 52 (P/N 293 550 021) as follows:

NOTICE

– Use only the recommended grease.
– Make sure not to push grease between the outside bearing race and the crankcase half.
– Do not exceed the recommended amount of grease.

4.1 Put approximately 25 ml (.8 U.S. oz) of grease in a syringe.

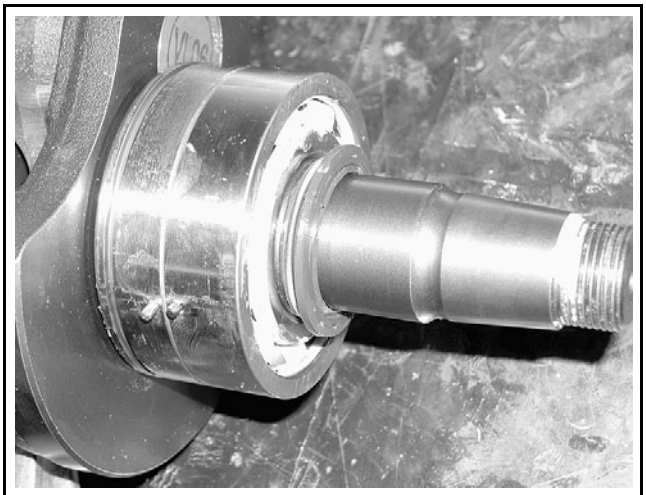
NOTE: The 50 g tube corresponds to 50 ml of grease.

4.2 With the syringe, fill the PTO side outer bearing with 19 ml (.6 U.S. oz) of grease.


A33C16A

NOTE: Inner PTO bearing is already filled with grease (about 8 ml (.3 U.S. oz).

4.3 Apply 5 ml (.2 U.S. oz) of grease to MAG side outer bearing.

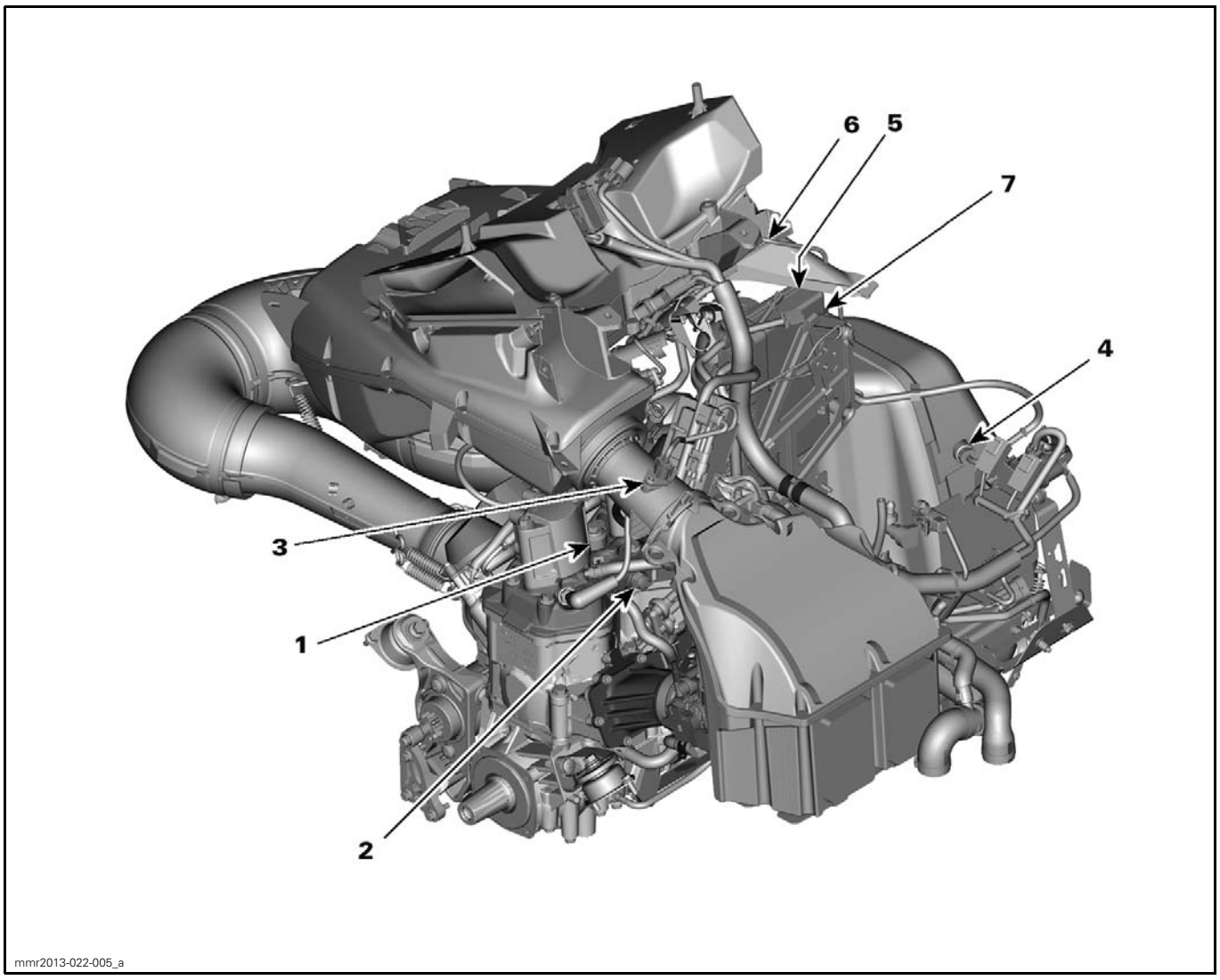

mmr2007-020-010

NOTE: Inner MAG bearing is already filled with grease (about 5 ml (.2 U.S. oz)).

5. Install MAG seal.
6. Proceed with crankcase assembly. Refer to *CRANKCASE* in this subsection.

ENGINE MANAGEMENT SYSTEM

600 HO E-TEC



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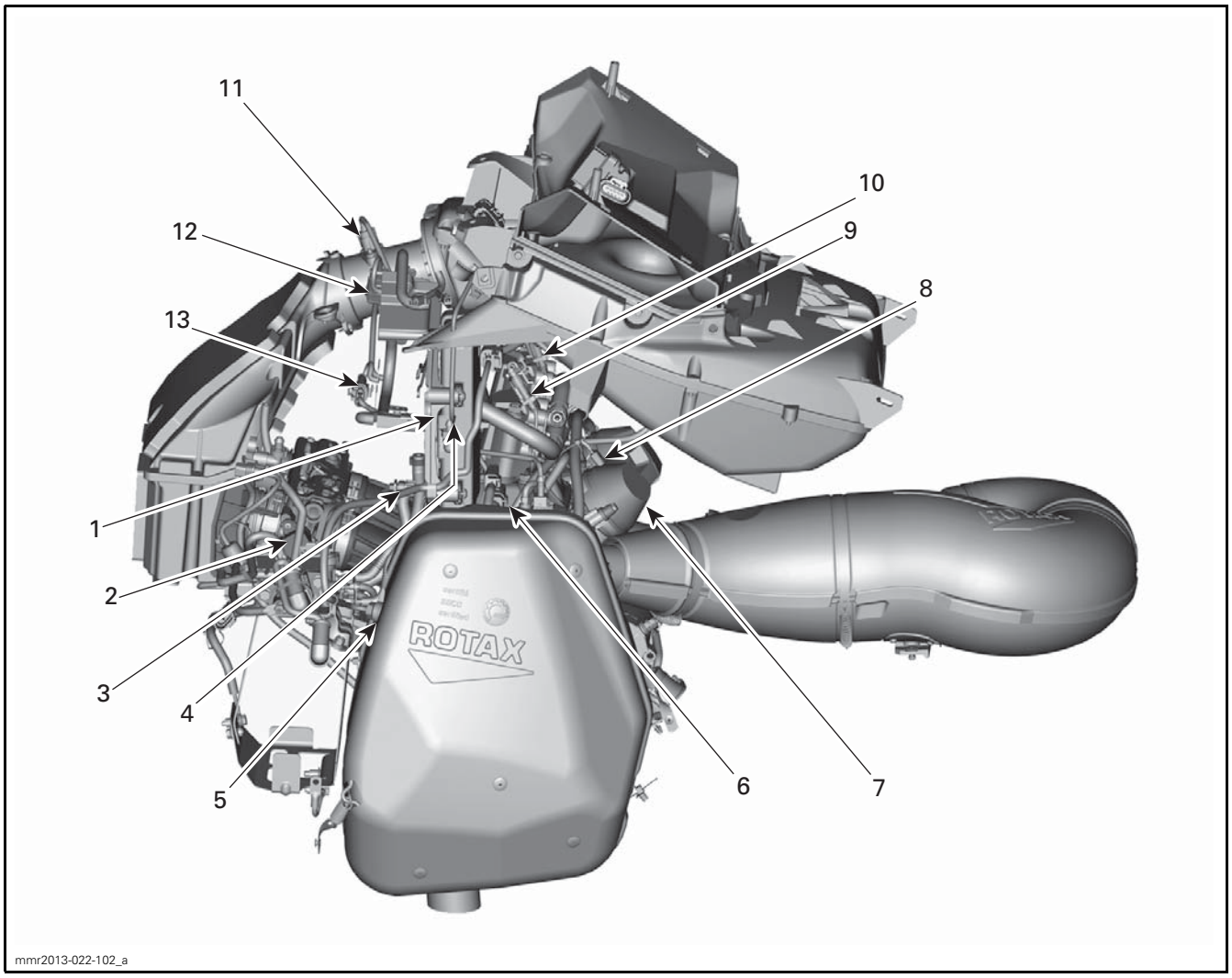
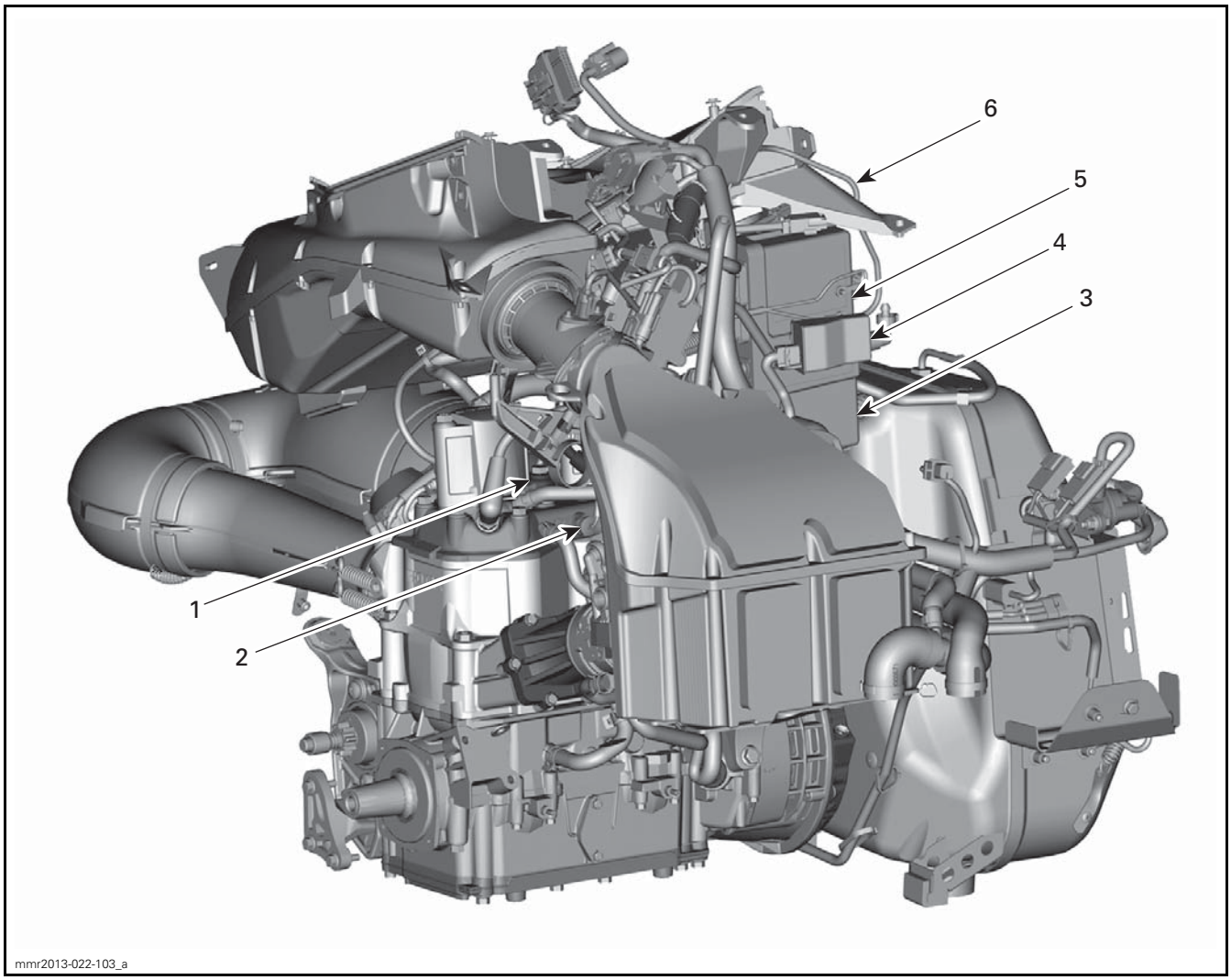
1. *Knock sensor (KS)*
2. *Coolant temperature sensor (CTS)*
3. *Air temperature sensor (ATS)*
4. *Exhaust gas temperature sensor EGTS)*
5. *Engine control module (ECM)*
6. *Air pressure sense line*
7. *Air pressure sensor (inside ECM)*

600 HO E-TEC



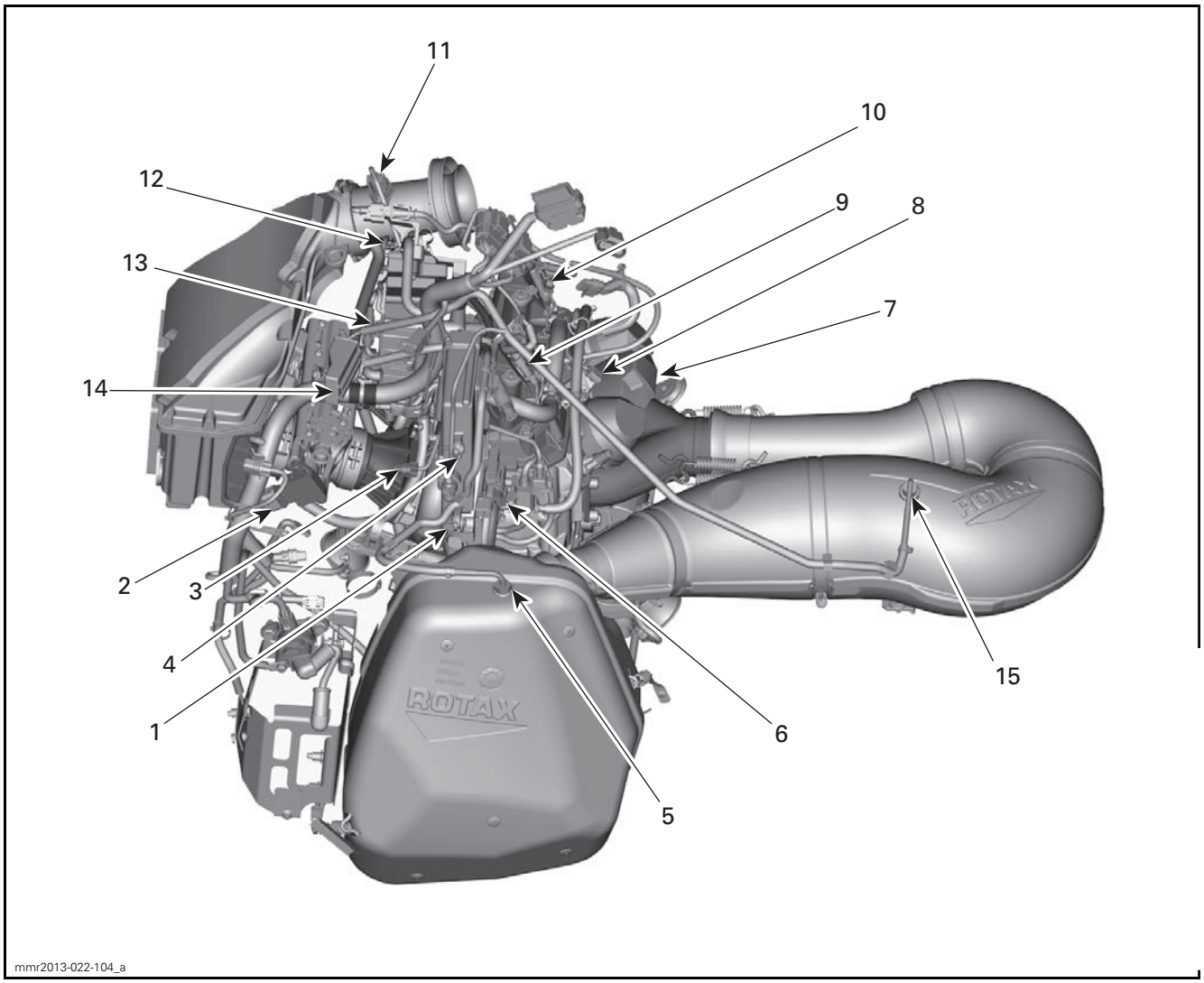
1. *Engine control module (ECM)*
2. *Throttle position sensor (TPS)*
3. *Oil level sensor connector (OLS)*
4. *Air pressure sensor (APS, inside ECM)*
5. *Exhaust gas temperature sensor (EGTS)*
6. *Crankshaft position sensor connector (CPS)*
7. *RAVE valve*
8. *RAVE valve position sensor (RPS)*
9. *MAG injector*
10. *PTO injector*
11. *Air temperature sensor (ATS)*
12. *MAG ignition coil*
13. *PTO ignition coil*

800R E-TEC



1. *Knock sensor (KS)*
2. *Coolant temperature sensor (CTS)*
3. *Engine control module (ECM)*
4. *Thermocouple module (THCM)*
5. *Air pressure sensor (APS, inside ECM)*
6. *Air pressure sense line*

800R E-TEC



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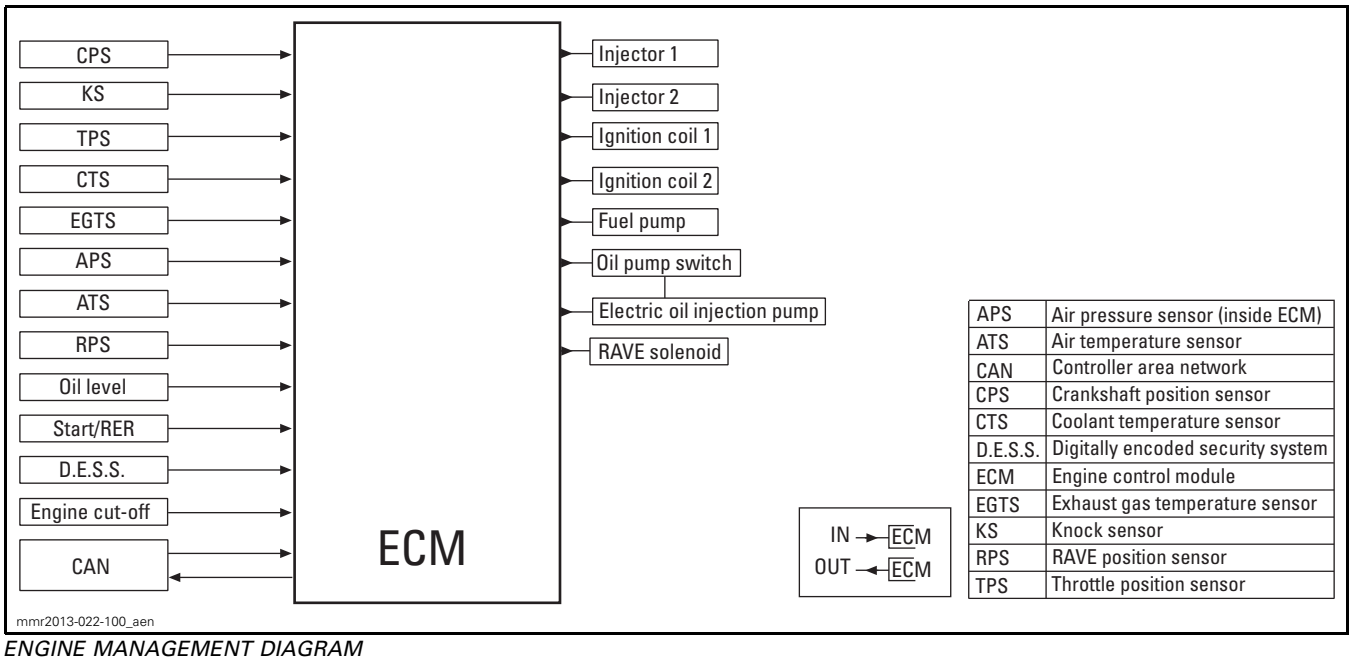
1. *Engine control module (ECM)*
2. *Throttle position sensor (TPS)*
3. *Oil level sensor connector (OLS)*
4. *Air pressure sensor (APS, inside ECM)*
5. *Exhaust gas temperature sensor muffler (EGTSm)*
6. *Crankshaft position sensor connector (CPS)*
7. *RAVE valves*
8. *RAVE valve position sensor (RPS)*
9. *MAG injector*
10. *PTO injector*
11. *Air temperature sensor (ATS)*
12. *MAG ignition coil*
13. *PTO ignition coil*
14. *Thermocouple module (THCM)*
15. *Exhaust gas temperature sensor tuned pipe (EGTStp, Summit and Backcountry)*

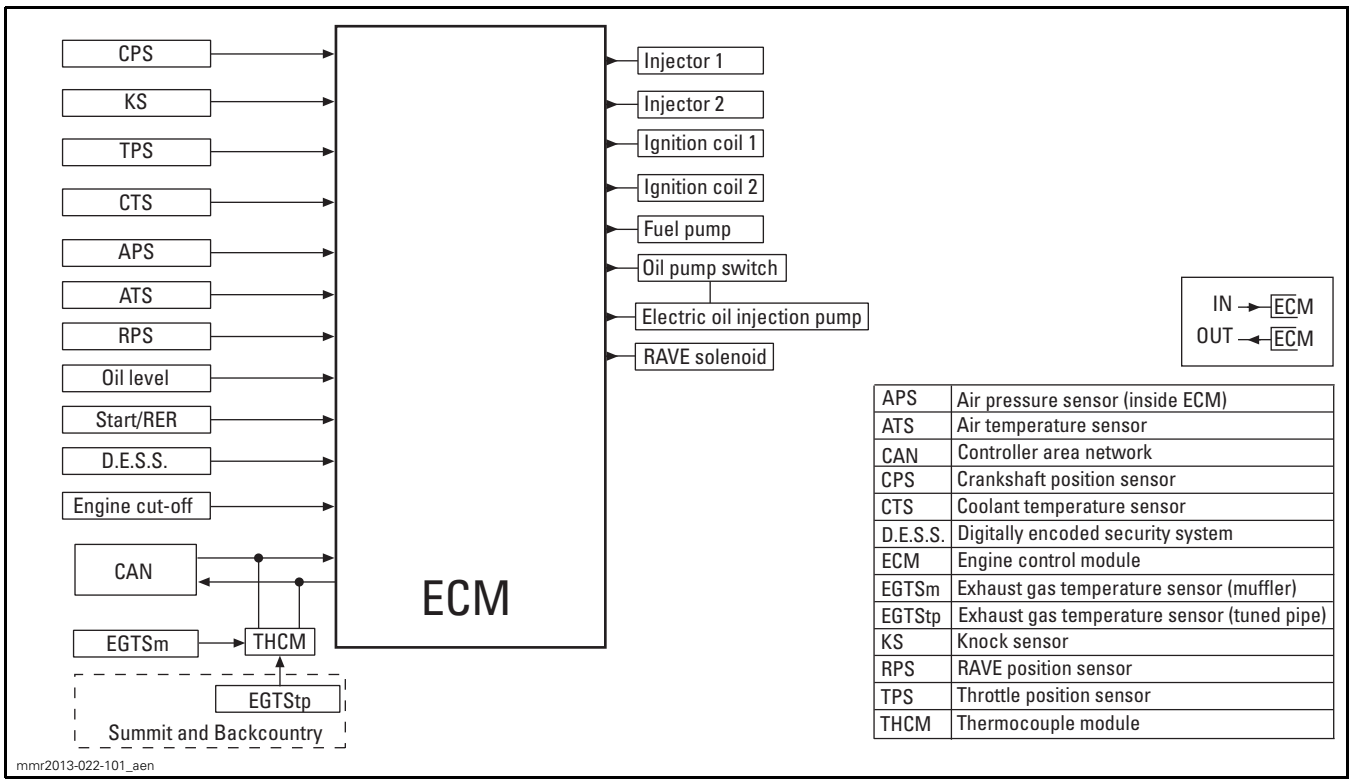
600 HO E-TEC Models



APS	Air pressure sensor (inside ECM)
ATS	Air temperature sensor
CAN	Controller area network
CPS	Crankshaft position sensor
CTS	Coolant temperature sensor
D.E.S.S.	Digitally encoded security system
ECM	Engine control module
EGTS	Exhaust gas temperature sensor
KS	Knock sensor
RPS	RAVE position sensor
TPS	Throttle position sensor

ENGINE MANAGEMENT DIAGRAM

800R E-TEC Models



APS	Air pressure sensor (inside ECM)
ATS	Air temperature sensor
CAN	Controller area network
CPS	Crankshaft position sensor
CTS	Coolant temperature sensor
D.E.S.S.	Digitally encoded security system
ECM	Engine control module
EGTSm	Exhaust gas temperature sensor (muffler)
EGTStp	Exhaust gas temperature sensor (tuned pipe)
KS	Knock sensor
RPS	RAVE position sensor
TPS	Throttle position sensor
THCM	Thermocouple module

ENGINE MANAGEMENT DIAGRAM

GENERAL

SYSTEM DESCRIPTION

A highly advanced engine management system (EMS) has been used on this 2-stroke engine to ensure a high power output with a clean combustion with practically no exhaust smoke.

There are 8 main systems that are controlled by the engine management system (EMS):

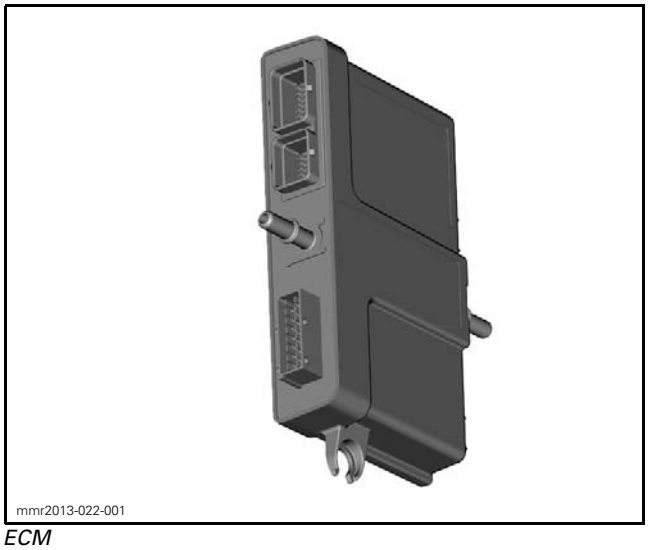
1. E-TEC Direct fuel injection
2. Ignition system
3. Starting system
4. Rotax electronic reverse (RER)
5. Digitally encoded security system (D.E.S.S.)
6. Lubrication system
7. 3D RAVE
8. Electrical accessories.

The engine management system 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 engine management system. Refer to *POWER DISTRIBUTION* subsection.

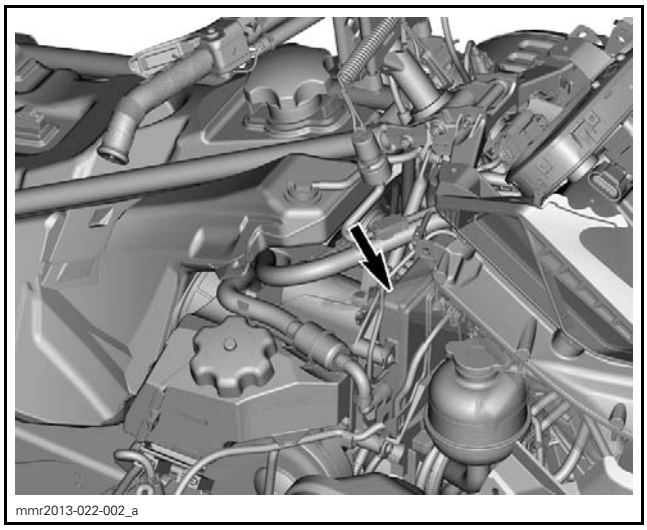
Engine Control Module (ECM)

The ECM is the central point of the engine management system. It 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 is located near the oil injection reservoir.



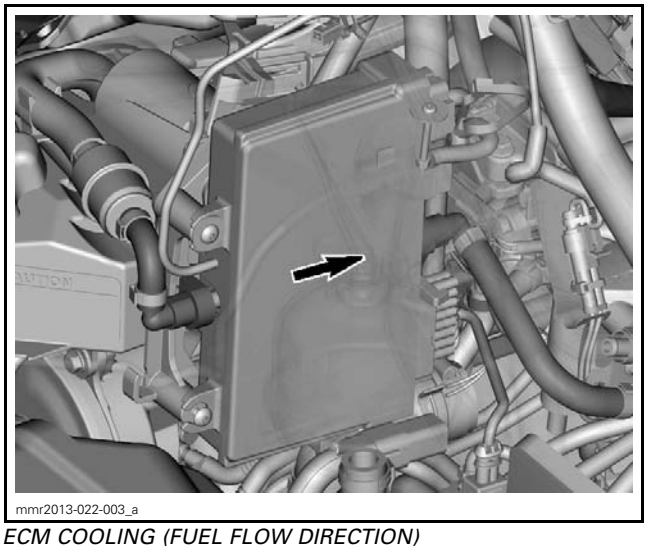
ECM LOCATION

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	INJECTION OIL WARM-UP
600 HO E-TEC	20°C (68°F)	Oil viscosity
800R E-TEC	30°C (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.

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

GENERAL

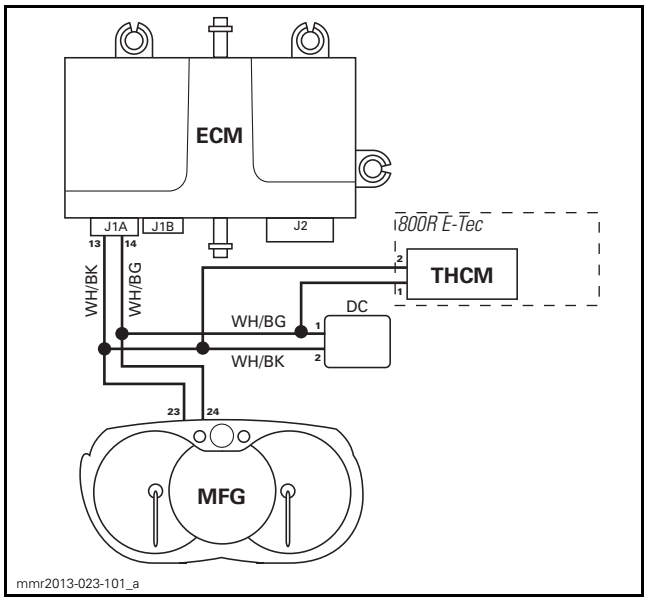
CONTROLLER AREA NETWORK (CAN)

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.

The network is comprised of the:
- ECM
- Multifunction gauge
- Diagnostic connector
- THCM (thermocouple module) on 800R E-TEC
- CAN bus.



600 HO E-TEC AND 800R E-TEC
DC (Diagnostic connector)
ECM (Engine control module)
MFG (Multifunction gauge)
THCM (Thermocouple module)
WH/BG (White/beige)
WH/BK (White/black)

NOTE: Fault codes are broadcasted through the CAN bus.

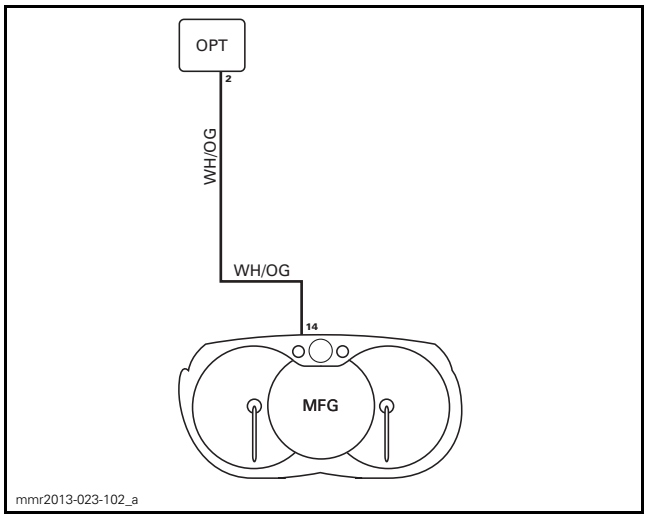
LOCAL INTERCONNECT NETWORK (LIN)

The LIN bus is a simple broadcast serial network comprising one master and up to 16 slaves. It is used as a complement to the CAN network to integrate the following devices.

MASTER	SLAVES
Multifunction gauge	Optional premium module (engine temperature, lap recorder)
	Optional engine temperature module

The master communicates to one slave at a time which supplies the requested information. The gauge can then display the related data (engine temperature for example).

One wire connects each component. The LIN line consists of a WHITE/ORANGE wire.



MFG (multifunction gauge)
OPT (optional modules: engine temperature, lap recorder)
WH/OG: WHITE/ORANGE

COMMUNICATION TOOLS AND B.U.D.S.

SERVICE TOOLS

SERVICE TOOLS – OTHER SUPPLIER

GENERAL

Refer to *PROCEDURES* in this subsection for instructions on the communication tools.

If communication problems occur, refer to *TROUBLESHOOTING*.

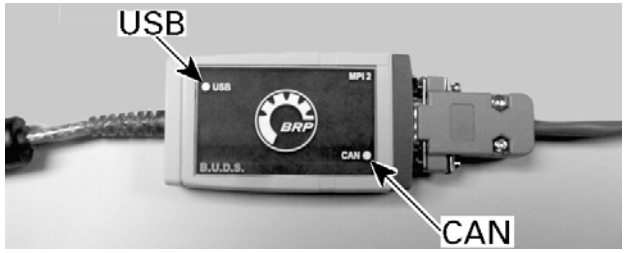
TROUBLESHOOTING

COMMUNICATION PROBLEMS

MPI-2 Connection Troubleshooting

MPI-2 Status Lights

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



vdd2006-001-151_b

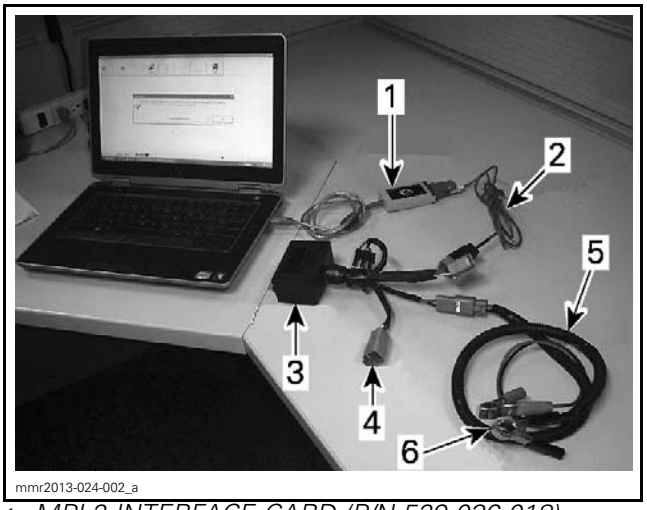
Prerequisite for USB Communication:

– PC Computer turned ON
– MPI-2 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-2 connected to diagnostic connector.
2. The tether cord cap (D.E.S.S. key) is installed on the engine cut-off switch.
3. B.U.D.S. started and logged.
4. ECM is powered.



mmr2013-024-002_a

1. MPI-2 INTERFACE CARD (P/N 529 036 018)
2. MPI-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

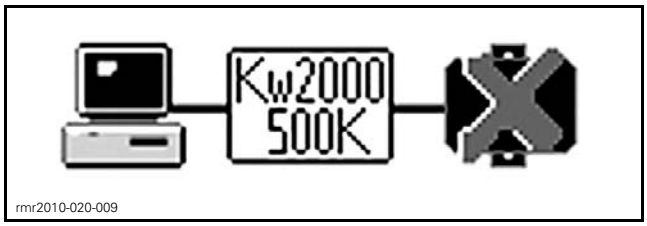
COMMUNICATION PROBLEM (CAN)	
STATUS	WHAT TO DO
CAN Light is OFF	– BUDS does not communicate with the vehicle. – Check connections from computer to vehicle. – Check if BUDS is started. – Check if vehicle is powered: is cluster turned ON. If it is not ON, install the tether cord cap (D.E.S.S. key) on the engine cut-off switch.
CAN Light is RED	This occurs when BUDS 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.
CAN Light is GREEN	– Connections are GOOD. BUDS communicates normally with the vehicle.

Communication Problems with B.U.D.S.

Vehicle not Detected in B.U.D.S.

Make sure both USB and CAN lights on the MPI-2 are GREEN.

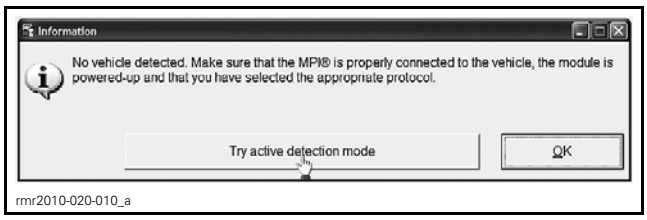
If an "X" is shown in the status bar and the protocol indication is blinking between Kw2000 500K and KW2000, it means that no ECU is communicating with the MPI-2.



rmr2010-020-009

Check the following:
– Connections between the PC computer and the vehicle.
– The multifunction gauge is powered up.

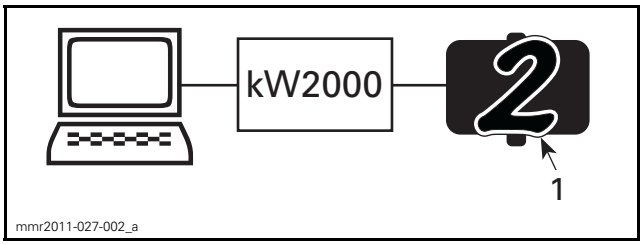
If B.U.D.S. does not automatically exit the following message box, click the **Try active detection mode** button. This will manually establish the communication with the vehicle.



rmr2010-020-010_a

One or More ECU is not Communicating with the MPI-2

Ensure the status bar shows the Kw2000 and the appropriate number of modules to its right according to the vehicle model.

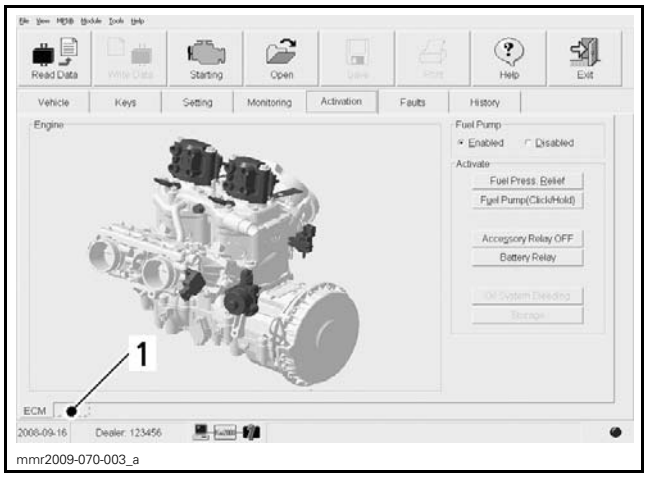


mmr2011-027-002_a

TYPICAL — CONNECTION SUCCESSFUL
1. Number of modules

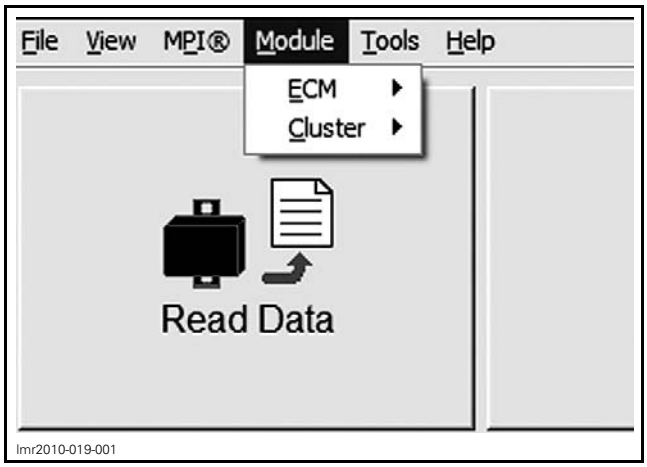
VEHICLE MODEL	PROTOCOL	NUMBER OF MODULES
600 HO E-TEC	Kw2000	2 (ECM and gauge)
800R E-TEC	Kw2000	3 (ECM, gauge and THCM)

If one or more "ECU" is (are) not communicating with the MPI-2, a module may not be properly connected, powered, or is defective. To check which module is missing in B.U.D.S., look for its page tab at the bottom of the B.U.D.S. window. It will not be visible. Then check the wiring and power supply to that module.



TYPICAL
1. Cluster tab not visible meaning this ECU is not communicating

NOTE: The module submenu will also provide a list of modules that are communicating with B.U.D.S.

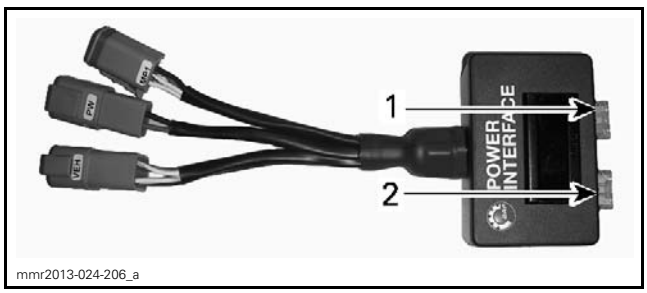


TYPICAL - MODULE SUBMENU LIST

Power Interface Test

When the POWER INTERFACE (P/N 515 177 223) is connected to the vehicle diagnostic connector, the multifunction gauge and the headlight should turn on. Otherwise, check the following and repair or replace Power interface if any test failed.

1. Power interface fuses.



1. Fuse 1
2. Fuse 2

2. Vehicle battery voltage should be displayed on Power interface.
   2.1 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 it prior to updating software.

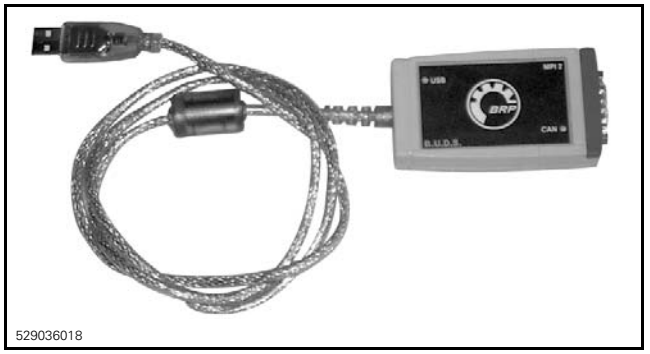
PROCEDURES

MULTI-PURPOSE INTERFACE-2 (MPI-2)

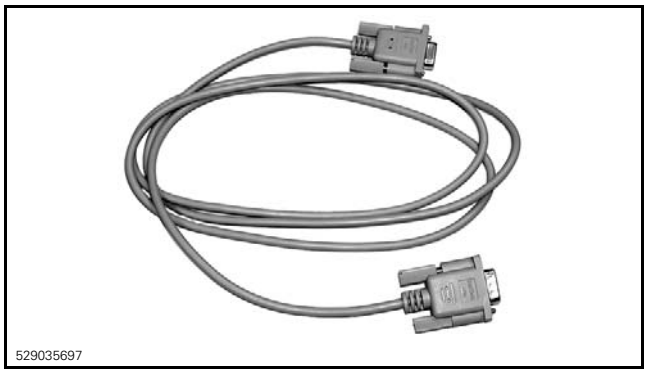
The MPI-2 (Multi-Purpose Interface-2) is used with B.U.D.S. to communicate with vehicle electronic module.

Parts Required for Connecting the PC to the Vehicle

MPI-2 INTERFACE CARD (P/N 529 036 018)

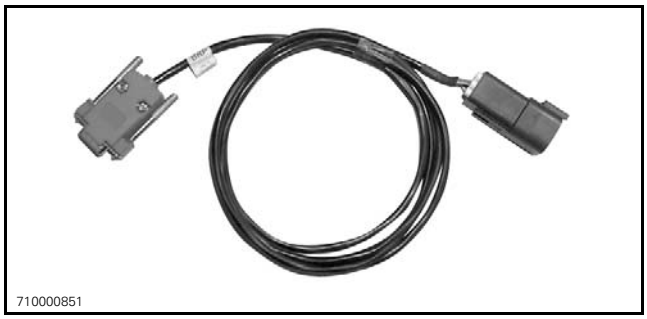


OPTIONAL MALE-FEMALE EXTENSION SERIAL CABLE (P/N (DB9))



NOTE: The extension cable is available at electronic retail outlets. Do not exceed 7.6 m (25 ft).

MPI-2 DIAGNOSTIC CABLE (P/N 710 000 851)


710000851

POWER INTERFACE (P/N 515 177 223)

515177223

12 V BATTERY SUPPLY CABLE (P/N 529 035 997)


529035997

MPI-2 Power

The MPI-2 uses the PC computer USB port for its power supply.

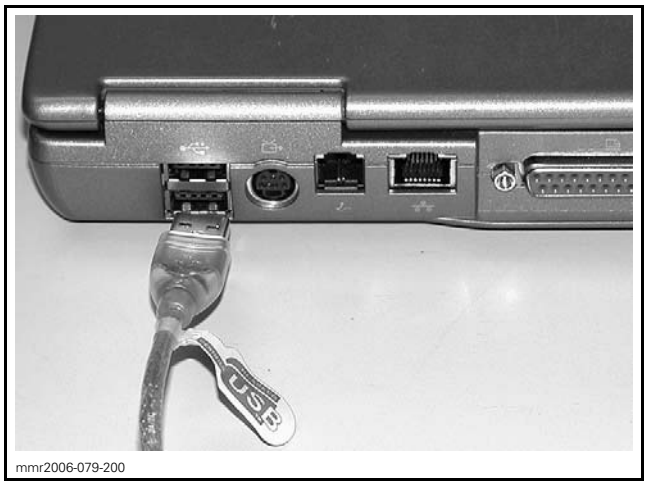
Connecting the PC to the Vehicle

⚠ WARNING

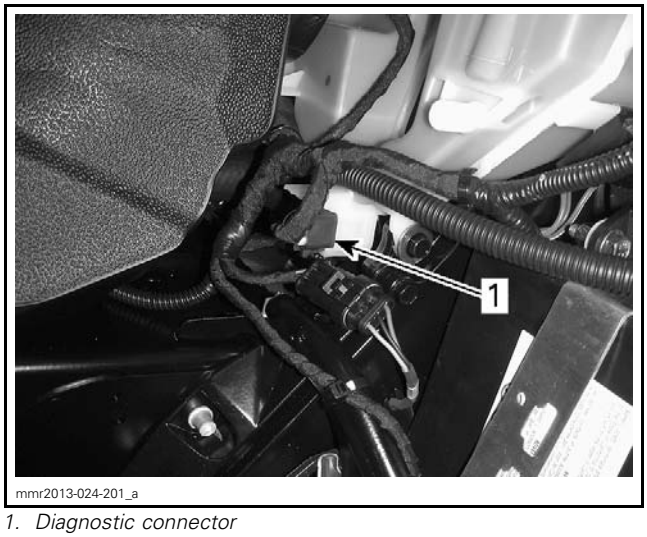
If the computer you are using is connected to a power outlet, there is a potential risk of electrocution when working in contact with water. Be careful not to touch water while working with the computer.

NOTE: Some components will generate heat when leaving vehicle in diagnostic mode for a long period. Always disconnect MPI-2 supply harness and supply cable from vehicle/battery when not working on vehicle.

1. Connect MPI-2 connector to the USB port of a PC (personal computer).


mmr2006-079-200

2. Remove the diagnostic connector from the protective cap on the right side of the vehicle.



mmr2013-024-201_a

1. Diagnostic connector

3. Connect the POWER INTERFACE (P/N 515 177 223) to the diagnostic connector.

mmr2013-024-205_a

1. Diagnostic Connector

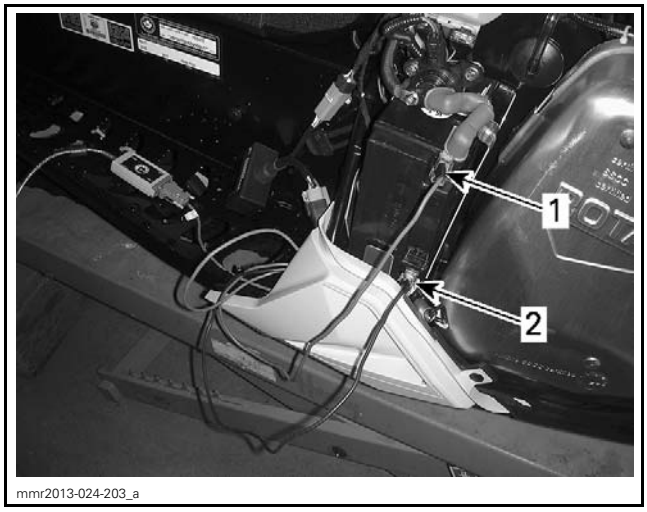
4. Connect the MPI-2 DIAGNOSTIC CABLE (P/N 710 000 851) to the Power interface connector.

1. MPI-2 connector

NOTICE Connecting MPI-2 directly to diagnostic connector (without Power interface) may prevent proper communication. Always use the Power interface.

5. Connect the battery supply cable to a 12 V battery.

NOTE: Connect cable clips to vehicle battery **if so equipped**.

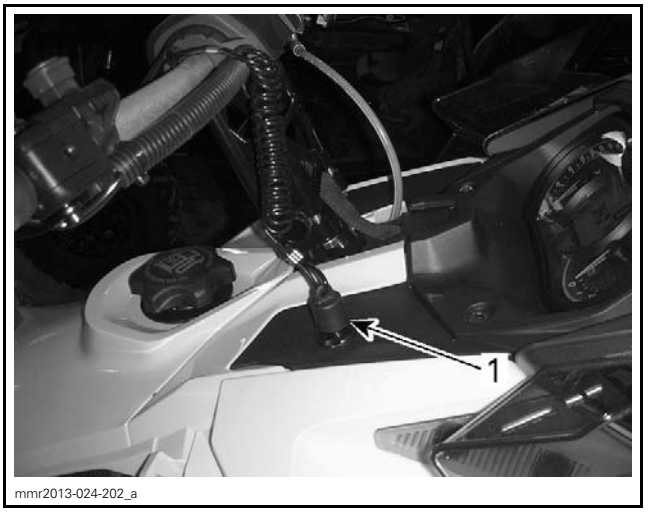


1. Red cable to battery "+" terminal
2. Black cable to battery "-" terminal

6. Connect the 12 V BATTERY SUPPLY CABLE (P/N 529 035 997) to the Power interface.

NOTICE Always use the proper supply harness and cables. Make sure to respect polarity when connecting cable clips to battery. Match RED cables together.

7. Set headlights to low beam to reduce battery discharge rate.
8. Connect DESS key.



1. DESS key

9. Use B.U.D.S. as described further in *B.U.D.S.*

B.U.D.S.

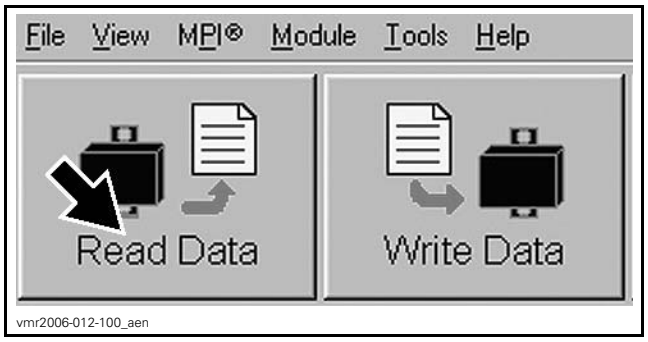
B.U.D.S. (BRP Utility and Diagnostic Software) is designed to allow:
- Electrical and electronic component monitoring
- Making setting changes (such as the Closed throttle reset)
- Diagnostics
- Update electronic module software
- Reading fault codes.

Use the latest applicable B.U.D.S. version available on BOSSWeb.

IMPORTANT: Make sure all connections have been made **before starting B.U.D.S.** to allow proper communication initialization and operation.

Reading Data from a Vehicle using the B.U.D.S. Software

1. Install the tether cord cap (D.E.S.S. key) on the engine cut-off switch.
2. Start B.U.D.S. and logon.
3. Read ECM by clicking the **Read Data** button.

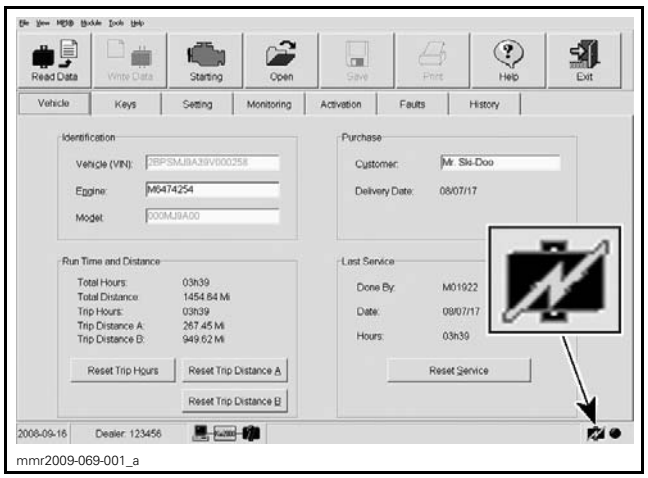


vmr2006-012-100_aen

Electronic Modules (ECU) Update

NOTICE Failure to strictly follow a procedure when updating a module may permanently damage the module.

Whenever B.U.D.S. is started, check for an update icon in the B.U.D.S. status bar.



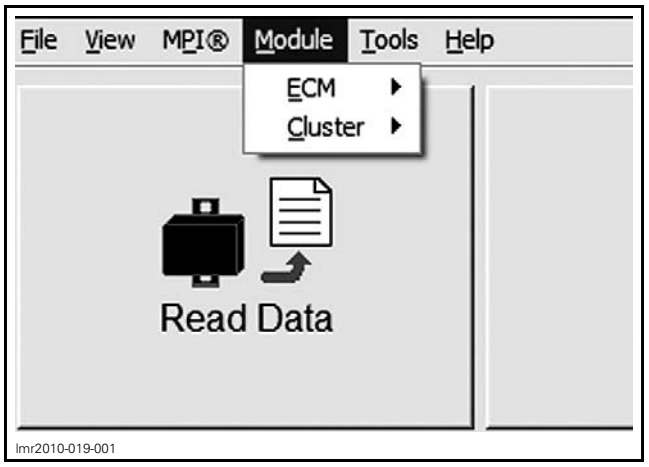
mmr2009-069-001_a

TYPICAL

The icon indicates that a file is available in B.U.D.S. to update any of the electronic modules.

NOTE: If an update file is available on BOSSWeb but the B.U.D.S. software being used is not up to date, the update icon will not appear. Refer to the *SERVICE BULLETINS* to see if there is an update available.

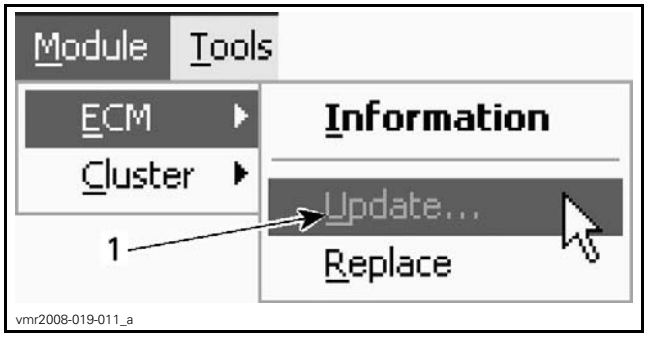
Use the **Module** submenu and check all modules one at a time to see which module(s) can be updated.



lmr2010-019-001

TYPICAL - MODULE SUBMENU LIST

1. If the **Update** option is **greyed out**, no update file is available for this module.
2. If the **Update** option is **black**, an update file is available for this module. Select the update option and load the proper file.



vmr2008-019-011_a

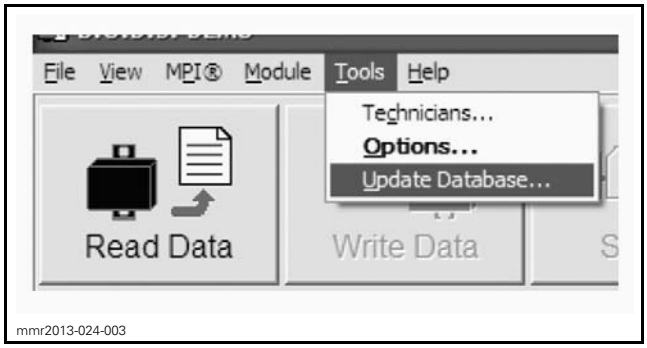
TYPICAL
1. Greyed out: No update to perform
Black: Update file available

Before applying an update, log onto BOSSWeb and look in the **Service** menu for the **Unit history** to find out if any information or publication related to the vehicle is available. If so, carefully follow the given instructions.

mmr2009-118-011

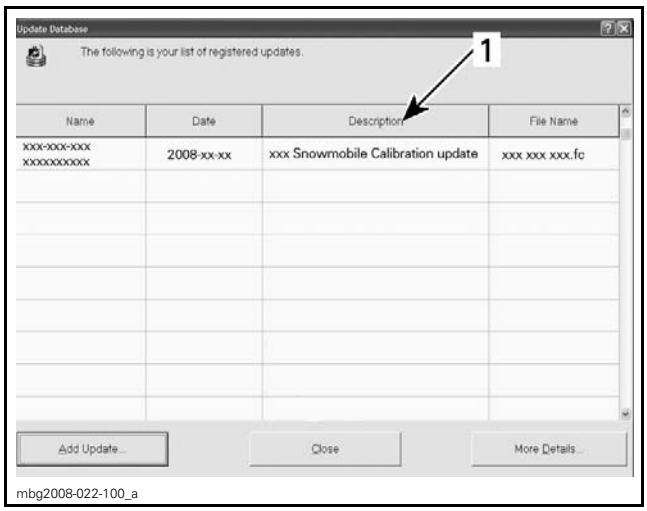
SERVICE, UNIT HISTORY

NOTE: When selecting the update database in B.U.D.S. (menu Tools - >Update Database), a dialog box will appear and the update file description may provide some clue to finding the vehicle-related information in BOSSWeb.



mmr2013-024-003

TOOLS, UPDATE DATABASE

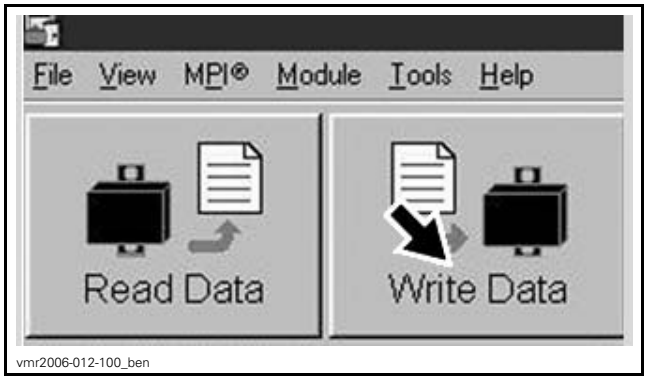


mbg2008-022-100_a

TYPICAL
1. File description

Writing Changes (Saving) in a Module

When making a data or setting change in a module using B.U.D.S., save the new data (or setting) in the module by clicking the **Write Data** button.



vmr2006-012-100_ben

If the word **Modified** appears in the vehicle file identification number at the top of the B.U.D.S. page, then a change has been made that requires selecting the **Write Data** to save the change.

rmr2010-020-008_a

TYPICAL
1. Indicate setting or data modified; Write Data to save

If a message box appears on the PC screen after clicking the **Write Data** button, follow the on screen instructions.

Exiting B.U.D.S and Disconnecting Computer from Vehicle

Once the maintenance is completed, press the EXIT button and disconnect MPI-2 connections. Reconnect the 6-pin connector in its protective cap.

NOTICE **Failure to secure the diagnostic connector in its protective cap would allow corrosion and damage to the terminals.**

DIAGNOSTIC AND FAULT CODES

GENERAL

MONITORING SYSTEM

The EMS 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
EMS (ECM, TPS, CTS, CPS, knock sensor, RAVE valve solenoids, APS, ATS, EGTS, RPS, ignition coils, fuel injectors and THCM for **800R E-TEC models**
12 V overload and 55/60 V 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
Coolant temperature
CAN
CTS
Starter solenoid (**electric start models**)
Fuel pump
Charging system relay (**electric start models**)

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 LED 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 not be possible without this advanced system.

EMS 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 55/60 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.

NOTE: Message displayed is not available on all gauges.

PILOT LAMP(S)	BEEPER OR PILOT LAMP STATUS	MESSAGE DISPLAY	DESCRIPTION
	4 short beeps every 30 seconds	ENGINE OVERHEAT	Engine is overheating, reduce snowmobile speed and run in loose snow or stop engine immediately and let engine cool down. Check coolant level, refer to *MAINTENANCE*. If coolant level is correct and overheating persists, contact an authorized Ski-Doo dealer. Do not run the engine if condition persists.
		MUFFLER	Reduce speed or stop engine. Let engine cool down and restart. If overheating persists, contact an authorized Ski-Doo dealer. Do not run the engine if condition persists.
	Short beeps repeating rapidly	ENGINE OVERHEAT	Critical overheat. Stop engine immediately and let engine cool down. Check coolant level, refer to *MAINTENANCE*. If coolant level is correct and overheating persists, contact an authorized Ski-Doo dealer. Do not run the engine if condition persists.
		MUFFLER OVERHEAT	Critical overheat. Stop engine immediately and let engine cool down. If overheating persists, contact an authorized Ski-Doo dealer. Do not run the engine if condition persists.
		ECM OVERHEAT	
	4 short beeps every 5 minutes	LOW BAT	Indicate a low or high battery voltage condition. See an authorized Ski-Doo dealer as soon as possible.
		HIGH BAT	
	4 short beeps	CHECK ENGINE	Engine fault, see an authorized Ski-Doo dealer as soon as possible.
	—	PARK BRAKE	If brakes are engaged for more than 15 seconds while vehicle is in movement, parking brake light will come on Make sure to release the brake completely while vehicle is in movement.
—	4 short beeps every 5 minutes	KNOCK	Engine detonation (RPM is limited when this condition occurs). – Ensure recommended fuel is used. – Check fuel quality, replace if necessary. – If fault still occurs, contact an authorized Ski-Doo dealer.
—	4 short beeps every 5 minutes	REV LIMIT	Engine RPM limited for protection when certain faults occur or engine went above 8400 RPM.
—	Short beeps repeating rapidly	SHUTDOWN	Shutdown procedure in force due to engine overheating or fuel pump problem, remove tether cord cap from engine cut-off switch and contact an authorized Ski-Doo dealer.

PILOT LAMP(S)	BEEPER OR PILOT LAMP STATUS	MESSAGE DISPLAY	DESCRIPTION
—	—	COMMUNICATION	Communication problem between ECM and gauge. Stop engine, remove tether cord cap. Wait a few minutes, then start engine. If problem persists, contact an authorized Ski-Doo dealer.
DESS	2 short beeps	—	Good key, vehicle ready to operate.
	2 short beeps, repeating slowly	CHECK KEY	Unable to read key (bad connection). Make sure the key is clean and correctly snapped on post.
	Short beeps repeating rapidly	BAD KEY	Invalid key or key not programmed. Use the proper key for the vehicle or have the key programmed.
	(Blinking)	—	Fuel level sender problem.
—	—	THROTTLE OPEN	Throttle applied while attempting an engine start (engine cranks but won't run). Release throttle while starting.
—	—	DROWN MODE	Throttle wide open while attempting an engine start (engine cranks but won't run). Release throttle while starting.

FAULT CODES

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

When there is a problem, the EMS (engine management system) can provide fault codes to ease troubleshooting.

The faults registered in the ECM (engine control module) are stored in memory even when the battery is disconnected.

Many simultaneous fault codes are likely caused by a burnt fuse(s), a faulty relay or a problem with the vehicle wiring harness.

When troubleshooting using the service actions suggested in the **Fault** section of B.U.D.S., a system circuit referred to as DA-26 or J1A-26 refers to pin 26 of ECM connector "A".

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

How to Read Fault Codes Using B.U.D.S. 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 or to the EMS fault code tables.

How to Read Fault Codes on the Premium Multifunction Gauge

Fault codes can also be displayed in the premium multifunction gauge. Refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.

How to Find Fault Code Descriptions

For the latest fault code table, use the **Knowledge Center** tab under the **Info Center** menu in BOSS-Web and enter the following search criterias:

– Enclose the search within quotes " "
– Enter: "2013 Ski-Doo DTC Table"

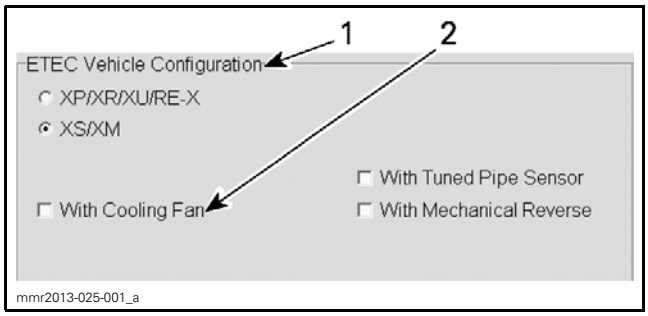
SPECIFIC FAULT CODES

The following provides additional information related to specific fault codes.

Fault Code P0480 or P0484 (Cooling Fan Relay Open Circuit, Shorted to Ground or Shorted to Battery)

This code occurs if the wrong option was selected in B.U.D.S.

If there is no cooling fan installed on the vehicle, connect and start B.U.D.S. to uncheck **With Cooling Fan** in **ECM** page under **Setting** tab and vehicle configuration thumbnail.



SETTING AND VEHICLE CONFIGURATION TABS
1. *Vehicle configuration area*
2. *Uncheck*

NOTE: If the option is not checked when a cooling fan is installed, the fan relay and its circuits will not be monitored by the EMS (Engine Management System). The fan operation will not be altered.

Fault Code P1233 Oil Pump Feedback Switch does not Close

This code occurs if the ECM does not receive a signal from the switch (end of piston stroke) in the electric injection oil pump.

When this occurs, the oil pump will function normally but the injection oil warm-up period will be time based (approximately 7.5 minutes) instead of being dependent on how long it takes for the oil pump to complete a stroke which, is dependent on oil viscosity and therefore oil temperature.

Check wiring continuity between the injection oil pump switch, the ECM and ground.

If the problem is not related to the electrical wiring or ground, refer to *LUBRICATION SYSTEM* subsection.

Fault Code P1427 (Temperature Module Not Detected)

800R E-TEC Models

This code occurs if:
– The thermocouple module (THCM) is not connected to the vehicle
– The THCM does not function

Ensure vehicle is equipped with a THCM and that it is properly connected to the vehicle wiring harness.

If the fault code persists, refer to *E-TEC DIRECT FUEL INJECTION* subsection.

All Except Summit and Backcountry X Models

The **With Tuned Pipe Sensor** box in B.U.D.S. should be unchecked and saved to the ECM, otherwise, the fault code will appear.

Fault Code P0428 and P1428

Exhaust muffler temperature sensor open circuit or Tuned pipe temperature sensor open circuit

Those codes occur if:
– The thermocouple probes are damage (wires or probe itself)
– The THCM does not operate correctly
– The wrong THCM is used on the vehicle
– The vehicle is not properly configured.

To check if the vehicle is properly configured, connect vehicle to applicable B.U.D.S. version and ensure that the "With Tuned Pipe Sensor" box in the Vehicle Configuration field is set as following:

MODELS	"WITH TUNED PIPE SENSOR" BOX
Summit and Renegade Backcountry X	Checked
All other models	Unchecked

DIAGNOSTIC AND FAULT CODES

FAULT CODE TABLE

P-CODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0079	ECM	E-RAVE® solenoid open circuit or shorted to ground	Disconnected E-RAVE solenoid. Damaged E-RAVE solenoid, wires or terminals.	Check for approximately 12 volts between E-RAVE solenoid RD/OR wire and chassis. Check for approximately 30 ohms between E-RAVE solenoid terminals. Check system circuit J1B-22.
P0106	ECM	Intake air pressure sensor functional problem	Damaged air pressure sensor inside in the ECM.	Replace the ECM.
P0107	ECM	Intake air pressure sensor voltage too low	Damaged air pressure sensor inside in the ECM.	Replace the ECM.
P0108	ECM	Intake air pressure sensor voltage too high	Damaged air pressure sensor inside in the ECM.	Replace the ECM.
P0111	ECM	Air temperature sensor functional problem	Intermittent air temperature sensor reading or circuit wires shorted to ground.	Check system circuits J1A-20 for continuity to terminal 2 of the ATS connector and J1A-27 for continuity to terminal 1 of the ATS connector. Check circuits J1A-20 and J1A-27 for resistivity to ground. Sensor can have an intermittent reading, replace the sensor if necessary.
P0112	ECM	Air temperature sensor voltage too low	Air temperature sensor or circuit wires shorted to ground.	Disconnect the sensor and check for a change in the fault code. If the fault code stays the same, look for a short circuit on the harness. If the fault code is different, replace the sensor. Check system circuits J1A-20 for continuity to terminal 2 of the ATS connector. Check system circuits J1A-20 for resistivity to ground.
P0113	ECM	Air temperature sensor voltage too high	Disconnected sensor or sensor's resistance too high.	Check for disconnected air temperature sensor on the airbox. Check the air temperature sensor for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F). Replace the sensor if necessary. Check system circuits J1A-20 for continuity to terminal 2 of the ATS connector and J1A-27 for continuity to terminal 1 of the ATS connector.

P0116	ECM	Coolant temperature sensor functional problem	Intermittent coolant temperature sensor reading or circuit wires shorted to ground.	Check system circuit J1A-19 for continuity to terminal 1 of the CTS connector and J1A-27 for continuity to terminal 2 of the CTS connector. Check circuit J1A-19 and J1A-27 for resistivity to ground. Replace the sensor if necessary.
P0117	ECM	Coolant temperature sensor voltage too low	Coolant temperature sensor or circuit wires shorted to ground.	Disconnect the sensor and check for a change in the fault code. If the fault code stays the same, look for a short circuit on the harness. If the fault code is different, replace the sensor. Check for leakage between sensor's connection and ground. Check system circuit J1A-19 for continuity to terminal 1 of the CTS connector and J1A-27 for continuity to terminal 2 of the CTS connector. Check circuit J1A-19 and J1A-27 for resistivity to ground.
P0118	ECM	Coolant temperature sensor voltage too high	Disconnected sensor or sensor's resistance too high.	Check for disconnected coolant temperature sensor. Check the engine temperature sensor for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F). Replace the sensor if necessary. Check system circuit J1A-19 for continuity to terminal 1 of the CTS connector and J1A-27 for continuity to terminal 2 of the CTS connector.
P0121	ECM	Throttle position sensor functional problem	Damaged circuit wires or connector, damaged throttle position sensor.	Check throttle position sensor connector for 5 volts between pin 1 and 2. Check system circuits J1A-10 for continuity to terminal 1 of the TPS connector, J1A-26 for continuity to terminal 2 of the TPS connector and J1A-1 for continuity to terminal 3 of the TPS connector. Refer to the Shop Manual for complete throttle position sensor testing procedure.
P0122	ECM	Throttle position sensor voltage too low	Damaged circuit wires, damaged throttle position sensor or damaged ECM pins.	Check throttle position sensor connector for 5 volts between pin 1 and 2. Check system circuits J1A-10 for continuity to terminal 1 of the TPS connector, J1A-26 for continuity to terminal 2 of the TPS connector and J1A-1 for continuity to terminal 3 of the TPS connector. Refer to the Shop Manual for complete throttle position sensor testing procedure.

P0123	ECM	Throttle position sensor voltage too high	Damaged circuit wires, damaged throttle position sensor or damaged ECM pins.	Check throttle position sensor connector for 5 volts between pin 1 and 2. Check system circuits J1A-10 for continuity to terminal 1 of the TPS connector, J1A-26 for continuity to terminal 2 of the TPS connector and J1A-1 for continuity to terminal 3 of the TPS connector. Refer to the Shop Manual for complete throttle position sensor testing procedure.
P0217	ECM	High coolant temperature detected	Poor cooling conditions. Engine may have been idling for too long. Low coolant level. Problem with cooling system.	Check coolant level. Check condition list to find out how it happened. Check cooling system.
P0230	ECM	Fuel pump over current	Damaged circuit wires, damaged fuel pump.	Check system circuit J2-4 for continuity to terminal 1 of the fuel pump connector. Check system circuit J2-4 for resistivity to ground. Replace the fuel pump if necessary.
P0231	ECM	Fuel pump open circuit or shorted to ground	Disconnected fuel pump. Damaged fuel pump, damaged circuit wires or connectors.	Check system circuit J2-4 for continuity to terminal 1 of the fuel pump connector. Check system circuit J2-12 for continuity to terminal 2 of the fuel pump connector. Check circuit J2-4 and J2-12 for resistivity to ground.
P0261	ECM	MAG injector open circuit or shorted to ground	Damaged or disconnected injector, circuit wires or ECM output pins. Damaged ECM output stage.	Check system circuit J1B-8 for continuity to terminal 2 of the MAG injector. Check system circuit J2-13 for continuity to terminal 1 of the MAG injector. Check circuit J1B-8 for resistivity to ground. Check for approximately 2.4 ohms on injector. Replace ECM.
P0262	ECM	MAG injector shorted to system voltage (over current)	Damaged injector, circuit wires or ECM output pins. Damaged ECM output stage.	Check for approximately 2.4 ohms on injector. Check if system circuit J1B-8 is shorted to system voltage (55V). Replace ECM.

P0264	ECM	PTO injector open circuit or shorted to ground	Damaged or disconnected injector, circuit wires or ECM output pins. Damaged ECM output stage.	Check system circuit J1B-1 for continuity to terminal 2 of the PTO injector. Check system circuit J2-13 for continuity to terminal 1 of the PTO injector. Check circuit J1B-1 for resistivity to ground. Check for approximately 2.4 ohms on injector. Replace ECM.
P0265	ECM	PTO injector shorted to system voltage (over current)	Damaged injector, circuit wires or ECM output pins. Damaged ECM output stage.	Check for approximately 2.4 ohms on injector. Check if system circuit J1B-1 is shorted to system voltage (55V). Replace ECM.
P0326	ECM	Knock sensor below minimum noise	Damaged or disconnected knock sensor, damaged circuit wires or damaged connector.	Check system circuits J1A-33 for continuity to terminal 2 of knock sensor connector and J1A-34 for continuity to terminal 1 of knock sensor connector. Check sensor mounting surface and torque.
P0339	ECM	Crankshaft signal fault (lost of sync)	CPS signal not plausible, damaged circuit wires, damaged connector or damaged tooth wheel.	Check for 190 to 290 ohms between terminals J1A-6 and J1A-7 of ECM connector. Check for 2 volts AC between terminals J1A-6 and J1A-7 of ECM connector while crancking the engine.
P0351	ECM	MAG ignition coil open circuit or shorted to ground	Damaged circuit wires or connector, damaged or disconnected ignition coil.	Check system circuit J1B-26 for continuity to terminal 2 of the ignition coil connector. Check for 55 volts on terminal 3 of ignition coil connector. Check for continuity between terminal 1 of ignition coil connector and chassis.
P0352	ECM	PTO ignition coil open circuit or shorted to ground	Damaged circuit wires or connector, damaged or disconnected ignition coil.	Check system circuit J1B-19 for continuity to terminal 2 of the ignition coil connector. Check for 55 volts on terminal 3 of ignition coil connector. Check for continuity between terminal 1 of ignition coil connector and chassis.
P0426	ECM	Exhaust muffler temperature sensor functional problem	Intermittent exhaust muffler temperature sensor reading or circuit wires shorted to ground.	Check system circuits J1A-12 for continuity to terminal 2 of the EGTS connector and J1A-27 for continuity to terminal 1 of the EGTS connector. Check circuits J1A-12 for continuity to ground. Replace the sensor if necessary.

P0428	ECM	Exhaust muffler temperature sensor voltage too high	Disconnected sensor or sensor's resistance too high.	Check for disconnected exhaust muffler temperature sensor. Check the exhaust muffler temperature sensor for 215 to 225 ohms at 19 to 21°C (66 to 70°F). Replace the sensor if necessary. Check system circuits J1A-12 for continuity to terminal 2 of the exhaust muffler temperature sensor connector and J1A-27 for continuity to terminal 1 of the muffler temperature sensor connector. Check circuits J1A-27 for continuity to ground.
P0480	ECM	Cooling fan relay open circuit or shorted to ground	Damaged or disconnected relay, damaged circuit wires or terminals.	Check for disconnected relay, damaged circuit wires. Check system circuit J1B-18 for continuity to relay connector.
P0484	ECM	Cooling fan relay shorted to battery	Damaged relay or damaged circuit wires.	Check for damaged relay or damaged circuit wires going to J1B-18.
P0562	ECM	12 V primary circuit voltage too low	Battery failure, damaged circuit wires or connection, too much load on electrical system.	Check battery condition, check if additional accessories are connected in the circuit.
P0563	ECM	12 V primary circuit voltage too high	An external battery charger may have been used, damaged ECM.	Measure 12 V primary circuit voltage on diagnostic connector pin 3 and 5 for approximately 14 volts while engine is running. If it's higher than 15.5 volts you may have a damaged ECM. Make sure no external power is connected to the primary 12 volt circuit.
P0601	ECM	ECM memory checksum error	Damaged ECM.	Replace ECM.
P0608	ECM	Sensor's power supply voltage too low	Damaged circuit wires, shorted TPS or E-RAVE position sensor.	Disconnect TPS and E-RAVE position sensor. Check E-RAVE positions sensor connector for 5 volts between pin 1 and 3. Check system circuit J1A-10 for resistivity to ground.
P0667	ECM	ECM temperature sensor functional problem	Damaged temperature sensor inside in the ECM.	Replace the ECM.
P0668	ECM	ECM temperature sensor voltage too low	Damaged temperature sensor inside in the ECM.	Replace the ECM.

P0669	ECM	ECM temperature sensor voltage too high	Damaged temperature sensor inside in the ECM.	Replace the ECM.
P1217	ECM	Engine shutdown at idle because overheat occured	Engine coolant temperature reached a high value at idle and the engine was stopped for protection.	Avoid keeping the engine idling for too long. Inspect cooling system for leaks.
P1218	ECM	Major Engine overheat occurred	Poor cooling conditions. Engine may have been idling for too long. Low coolant level. Problem with cooling system.	Check coolant level. Check condition list to find out how it happened. Check cooling system.
P1231	ECM	Oil pump open circuit or shorted to ground	Damaged or disconnected oil pump, circuit wires or ECM output pins.	Check connetion on oil pump, check system circuit J1B-23. Check WHITE/RED wire on oil pump connector for 55 volts.
P1233	ECM	Oil pump feedback switch do not close	Damaged or disconnected oil pump feedback switch circuit wires or ECM input pin.	Check connetion on oil pump feedback switch, check system circuit J1A-4. Check black wire on oil pump feedback switch connector for resistivity to ground.
P1326	ECM	High engine detonation detected on MAG side	Poor fuel quality, low fuel pressure, wrong timing offset, damaged spark plug, engine temperature too high, worn piston/ring.	Measure fuel pressure, check timing offset, check spark plug, check coolant system, check for evidence of piston erosion.
P1327	ECM	High engine detonation detected on PTO side	Poor fuel quality, low fuel pressure, wrong timing offset, damaged spark plug, engine temperature too high, worn piston/ring.	Measure fuel pressure, check timing offset, check spark plug, check coolant system, check for evidence of piston erosion.
P1351	ECM	MAG ignition shorted to system voltage	Damaged circuit wires or connector, damaged ignition coil.	Check system circuit J1B-26, check WHITE/RED wire on ignition coil connector for 55 volts.
P1352	ECM	PTO ignition shorted to system voltage	Damaged circuit wires or connector, damaged ignition coil.	Check system circuit J1B-19, check WHITE/RED wire on injector connector for 55 volts.
P1426	ECM	High exhaust muffler temperature detected	Damaged sensor, low fuel pump pressure, air leak in exhaust system, poor fuel quality.	Check fuel pump pressure, check sensor and replace if necessary, check components in exhaust system.
P1471	ECM	E-RAVE® position sensor functional problem	Damaged circuit wires or connector, damaged E-RAVE position sensor.	Check E-RAVE position sensor connector for 5 volts between pin 1 and 3. Check system circuit J1A-18.

P1472	ECM	E-RAVE® position sensor voltage too low	Damaged circuit wires or connector, damaged E-RAVE position sensor.	Check E-RAVE position sensor connector for 5 volts between pin 1 and 3. Check system circuit J1A-18.
P1473	ECM	E-RAVE® position sensor voltage too high	Damaged circuit wires or connector, damaged E-RAVE position sensor.	Check E-RAVE position sensor connector for 5 volts between pin 1 and 3. Check system circuit J1A-18.
P1476	ECM	RAVE valve middle position not reached	Damaged bellows. Damaged or dicconnected hoses. Damaged E-RAVE solenoid valve. Adjustment of the link between the two E-RAVE valves. Carbon deposit around E-RAVE parts.	Check for damaged bellows. Check for damaged or disconnected vacuum hoses. Check for damaged or disconnected pressure hoses. Check if the E-RAVE valves move freely. Clean and make the necessary adjustment if necessary.
P1477	ECM	RAVE valve close position not reached	Damaged bellows. Damaged or dicconnected hoses. Damaged E-RAVE solenoid valve. Adjustment of the link between the two E-RAVE valves. Carbon deposit around E-RAVE parts.	Check for damaged bellows. Check for damaged or disconnected vacuum hoses. Check for damaged or disconnected pressure hoses. Check if the E-RAVE valves move freely. Clean and make the necessary adjustment if necessary.
P1478	ECM	RAVE valve open position not reached	Damaged bellows. Damaged or dicconnected hoses. Damaged E-RAVE solenoid valve. Adjustment of the link between the two E-RAVE valves. Carbon deposit around E-RAVE parts.	Check for damaged bellows. Check for damaged or disconnected vacuum hoses. Check for damaged or disconnected pressure hoses. Check if the E-RAVE valves move freely. Clean and make the necessary adjustment if necessary.
P1532	ECM	High ECM temperature detected	Poor fuel flow in ECM. Damaged ECM.	Check fuel system for clogged filter, damaged regulator or damaged fuel pump.
P1533	ECM	Major ECM overheat occurred	Low fuel pressure, low fuel circulation in ECM.	Check fuel pump pressure, check fuel line for pinched hose.
P1549	ECM	Major exhaust muffler overheat occurred	Damaged sensor, low fuel pump pressure, air leak in exhaust system, poor fuel quality.	Check fuel pump pressure, check sensor and replace if necessary, check components in exhaust system.
P1562	ECM	Low voltage on system voltage circuit	Damaged circuit wires, connector, injector, ignition coil, oil pump, capacitor or ECM.	Check for inverted wires on magneto connector, loose connection on capacitor. Check for defective component as describe in Possible Causes.

P1563	ECM	High voltage on system voltage circuit	Damaged circuit wires, connector or ECM.	Check for inverted wires on magneto connector, loose connection on capacitor.
P1621	ECM	Overload on 12 V primary circuit	Damaged circuit wires or connector.	Check RED/ORANGE circuit for damaged or shorted wires. Check tail light, headlamp or diagnostic connector.
P1622	ECM	Overload on 12 V secondary circuit	Damaged circuit wires or connector.	Check RED/YELLOW circuit for damaged or shorted wire. Check connections on visor outlet, check heated grips if equipped with standard gauge.
P1623	ECM	Overload on 12 V battery circuit	Damaged circuit wires, connector or battery.	Check RED/WHITE circuit for damaged or shorted wire. Check battery condition. A blown 30 amp fuse is a good indication of a problem with the wires or the battery.
P1656	ECM	D.E.S.S.® line shorted to ground	Damaged circuit wires or mixed up connections.	Check system circuits J1A-23 for continuity to terminal 1 of D.E.S.S. post connector, J1A-11 for continuity to terminal 3 of D.E.S.S. post connector and J1A-5 for continuity to terminal 2 of D.E.S.S. post connector. Check system circuit J1A-23 for continuity to circuit J1A-5 when D.E.S.S. key is installed on D.E.S.S. post. Check system circuit J1A-11 for continuity to the center contact of the D.E.S.S. post connector and circuit J1A-5 for continuity to the outer ring of the D.E.S.S. post. Check system circuits J1A-5, J1A-11 and J1A-23 for continuity to ground.
P1676	ECM	Battery relay open circuit or shorted to ground	Damaged or disconnected relay, circuit wires or terminals.	Check for disconnected relay, damaged circuit wires.
P1679	ECM	Accessory relay open circuit or shorted to ground	Damaged or disconnected relay, circuit wires or terminals.	Check for disconnected relay, damaged circuit wires.
P2299	ECM	Incompatibility between brake lever position and engine/vehicle speed	Brake lever was left in Park position. The pilot kept a constant pressure applied on the brake lever while running. Defective or stuck brake switch. Brake circuit is shorted to 12 volts.	Check if the brake switch operate properly. Check if brake switch is secured on the master cylinder. Check for 12 volts at ECM connector J1A_30 when brake is applied. Check for 0 volt at ECM connector J1A-30 when brake is not applied. Check for a faulty ground on the brake light.

DIAGNOSTIC AND FAULT CODES

FAULT CODE TABLE

P-CODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0079	ECM	E-RAVE® solenoid open circuit or shorted to ground	Disconnected E-RAVE solenoid. Damaged E-RAVE solenoid, wires or terminals.	Check for approximately 12 volts between E-RAVE solenoid RD/OR wire and chassis. Check for approximately 30 ohms between E-RAVE solenoid terminals. Check system circuit J1B-22.
P0106	ECM	Intake air pressure sensor functional problem	Damaged air pressure sensor inside in the ECM.	Replace the ECM.
P0107	ECM	Intake air pressure sensor voltage too low	Damaged air pressure sensor inside in the ECM.	Replace the ECM.
P0108	ECM	Intake air pressure sensor voltage too high	Damaged air pressure sensor inside in the ECM.	Replace the ECM.
P0111	ECM	Air temperature sensor functional problem	Intermittent air temperature sensor reading or circuit wires shorted to ground.	Check system circuits J1A-20 for continuity to terminal 2 of the ATS connector and J1A-27 for continuity to terminal 1 of the ATS connector. Check circuits J1A-20 and J1A-27 for resistivity to ground. Sensor can have an intermittent reading, replace the sensor if necessary.
P0112	ECM	Air temperature sensor voltage too low	Air temperature sensor or circuit wires shorted to ground.	Disconnect the sensor and check for a change in the fault code. If the fault code stays the same, look for a short circuit on the harness. If the fault code is different, replace the sensor. Check system circuits J1A-20 for continuity to terminal 2 of the ATS connector. Check system circuits J1A-20 for resistivity to ground.
P0113	ECM	Air temperature sensor voltage too high	Disconnected sensor or sensor's resistance too high.	Check for disconnected air temperature sensor on the airbox. Check the air temperature sensor for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F). Replace the sensor if necessary. Check system circuits J1A-20 for continuity to terminal 2 of the ATS connector and J1A-27 for continuity to terminal 1 of the ATS connector.

P0116	ECM	Coolant temperature sensor functional problem	Intermittent coolant temperature sensor reading or circuit wires shorted to ground.	Check system circuit J1A-19 for continuity to terminal 1 of the CTS connector and J1A-27 for continuity to terminal 2 of the CTS connector. Check circuit J1A-19 and J1A-27 for resistivity to ground. Replace the sensor if necessary.
P0117	ECM	Coolant temperature sensor voltage too low	Coolant temperature sensor or circuit wires shorted to ground.	Disconnect the sensor and check for a change in the fault code. If the fault code stays the same, look for a short circuit on the harness. If the fault code is different, replace the sensor. Check for leakage between sensor's connection and ground. Check system circuit J1A-19 for continuity to terminal 1 of the CTS connector and J1A-27 for continuity to terminal 2 of the CTS connector. Check circuit J1A-19 and J1A-27 for resistivity to ground.
P0118	ECM	Coolant temperature sensor voltage too high	Disconnected sensor or sensor's resistance too high.	Check for disconnected coolant temperature sensor. Check the engine temperature sensor for approximately 2280 to 2736 ohms at 19 to 21°C (66 to 70°F). Replace the sensor if necessary. Check system circuit J1A-19 for continuity to terminal 1 of the CTS connector and J1A-27 for continuity to terminal 2 of the CTS connector.
P0121	ECM	Throttle position sensor functional problem	Damaged circuit wires or connector, damaged throttle position sensor.	Check throttle position sensor connector for 5 volts between pin 1 and 2. Check system circuits J1A-10 for continuity to terminal 1 of the TPS connector, J1A-26 for continuity to terminal 2 of the TPS connector and J1A-1 for continuity to terminal 3 of the TPS connector. Refer to the Shop Manual for complete throttle position sensor testing procedure.
P0122	ECM	Throttle position sensor voltage too low	Damaged circuit wires, damaged throttle position sensor or damaged ECM pins.	Check throttle position sensor connector for 5 volts between pin 1 and 2. Check system circuits J1A-10 for continuity to terminal 1 of the TPS connector, J1A-26 for continuity to terminal 2 of the TPS connector and J1A-1 for continuity to terminal 3 of the TPS connector. Refer to the Shop Manual for complete throttle position sensor testing procedure.

P0123	ECM	Throttle position sensor voltage too high	Damaged circuit wires, damaged throttle position sensor or damaged ECM pins.	Check throttle position sensor connector for 5 volts between pin 1 and 2. Check system circuits J1A-10 for continuity to terminal 1 of the TPS connector, J1A-26 for continuity to terminal 2 of the TPS connector and J1A-1 for continuity to terminal 3 of the TPS connector. Refer to the Shop Manual for complete throttle position sensor testing procedure.
P0217	ECM	High coolant temperature detected	Poor cooling conditions. Engine may have been idling for too long. Low coolant level. Problem with cooling system.	Check coolant level. Check condition list to find out how it happened. Check cooling system.
P0230	ECM	Fuel pump over current	Damaged circuit wires, damaged fuel pump.	Check system circuit J2-4 for continuity to terminal 1 of the fuel pump connector. Check system circuit J2-4 for resistivity to ground. Replace the fuel pump if necessary.
P0231	ECM	Fuel pump open circuit or shorted to ground	Disconnected fuel pump. Damaged fuel pump, damaged circuit wires or connectors.	Check system circuit J2-4 for continuity to terminal 1 of the fuel pump connector. Check system circuit J2-12 for continuity to terminal 2 of the fuel pump connector. Check circuit J2-4 and J2-12 for resistivity to ground.
P0261	ECM	MAG injector open circuit or shorted to ground	Damaged or disconnected injector, circuit wires or ECM output pins. Damaged ECM output stage.	Check system circuit J1B-8 for continuity to terminal 1 of the MAG injector. Check system circuit J1B-1 for continuity to terminal 2 of the MAG injector. Check circuit J1B-8 and J1B-1 for resistivity to ground. Check for approximately 2.4 ohms on injector. Replace ECM.
P0262	ECM	MAG injector shorted to system voltage (over current)	Damaged injector, circuit wires or ECM output pins. Damaged ECM output stage.	Check for approximately 2.4 ohms on injector. Check if system circuit J1B-1 and J1B-8 are shorted to system voltage (60 V). Replace ECM.

P0264	ECM	PTO injector open circuit or shorted to ground	Damaged or disconnected injector, circuit wires or ECM output pins. Damaged ECM output stage.	Check system circuit J1B-7 for continuity to terminal 2 of the PTO injector. Check system circuit J1B-2 for continuity to terminal 1 of the PTO injector. Check circuit J1B-7 and J1B-2 for resistivity to ground. Check for approximately 2.4 ohms on injector. Replace ECM.
P0265	ECM	PTO injector shorted to system voltage (over current)	Damaged injector, circuit wires or ECM output pins. Damaged ECM output stage.	Check for approximately 2.4 ohms on injector. Check if system circuit J1B-2 and J1B-7 are shorted to system voltage (60 V). Replace ECM.
P0326	ECM	Knock sensor below minimum noise	Damaged or disconnected knock sensor, damaged circuit wires or damaged connector.	Check system circuits J1A-33 for continuity to terminal 2 of knock sensor connector and J1A-34 for continuity to terminal 1 of knock sensor connector. Check sensor mounting surface and torque.
P0339	ECM	Crankshaft signal fault (lost of sync)	CPS signal not plausible, damaged circuit wires, damaged connector or damaged tooth wheel.	Check for 190 to 290 ohms between terminals J1A-6 and J1A-7 of ECM connector. Check for 2 volts AC between terminals J1A-6 and J1A-7 of ECM connector while crancking the engine.
P0351	ECM	MAG ignition coil open circuit or shorted to ground	Damaged circuit wires or connector, damaged or disconnected ignition coil.	Check system circuit J1B-26 for continuity to terminal 2 of the ignition coil connector. Check for 60 volts on terminal 3 of ignition coil connector. Check for continuity between terminal 1 of ignition coil connector and chassis.
P0352	ECM	PTO ignition coil open circuit or shorted to ground	Damaged circuit wires or connector, damaged or disconnected ignition coil.	Check system circuit J1B-19 for continuity to terminal 2 of the ignition coil connector. Check for 60 volts on terminal 3 of ignition coil connector. Check for continuity between terminal 1 of ignition coil connector and chassis.
P0426	ECM	Exhaust muffler temperature sensor functional problem	Intermittent exhaust muffler temperature sensor reading or circuit wires shorted to ground. Exhaust muffler temperature sensor disconnected from muffler.	Check for damaged sensor wire. Check for disconnected or unscrewed sensor.

P0428	ECM	Exhaust muffler temperature sensor open circuit	Thermocouple sensor wire is open circuit.	Thermocouple sensor wire is open, replace with available kit.
P0480	ECM	Cooling fan relay open circuit or shorted to ground	Damaged or disconnected relay, damaged circuit wires or terminals.	Check for disconnected relay, damaged circuit wires. Check system circuit J1B-18 for continuity to relay connector.
P0484	ECM	Cooling fan relay shorted to battery	Damaged relay or damaged circuit wires.	Check for damaged relay or damaged circuit wires going to J1B-18.
P0562	ECM	12 V primary circuit voltage too low	Battery failure, damaged circuit wires or connection, too much load on electrical system.	Check battery condition, check if additional accessories are connected in the circuit.
P0563	ECM	12 V primary circuit voltage too high	An external battery charger may have been used, damaged ECM.	Measure 12 V primary circuit voltage on diagnostic connector pin 3 and 5 for approximately 14 volts while engine is running. If it's higher than 15.5 volts you may have a damaged ECM. Make sure no external power is connected to the primary 12 volt circuit.
P0601	ECM	ECM memory checksum error	Damaged ECM.	Replace ECM.
P0608	ECM	Sensor's power supply voltage too low	Damaged circuit wires, shorted TPS or E-RAVE position sensor.	Disconnect TPS and E-RAVE position sensor. Check E-RAVE positions sensor connector for 5 volts between pin 1 and 3. Check system circuit J1A-10 for resistivity to ground.
P1217	ECM	Engine shutdown at idle because overheat occured	Engine coolant temperature reached a high value at idle and the engine was stopped for protection.	Avoid keeping the engine idling for too long. Inspect cooling system for leaks.
P1218	ECM	Major Engine overheat occurred	Poor cooling conditions. Engine may have been idling for too long. Low coolant level. Problem with cooling system.	Check coolant level. Check condition list to find out how it happened. Check cooling system.
P1231	ECM	Oil pump open circuit or shorted to ground	Damaged or disconnected oil pump, circuit wires or ECM output pins.	Check connetion on oil pump, check system circuit J1B-23. Check WHITE/RED wire on oil pump connector for 60 volts.
P1233	ECM	Oil pump feedback switch do not close	Damaged or disconnected oil pump feedback switch circuit wires or ECM input pin.	Check connetion on oil pump feedback switch, check system circuit J1A-32. Check black wire on oil pump feedback switch connector for resistivity to ground.

P1326	ECM	High engine detonation detected on MAG side	Poor fuel quality, low fuel pressure, wrong timing offset, damaged spark plug, engine temperature too high, worn piston/ring.	Measure fuel pressure, check timing offset, check spark plug, check coolant system, check for evidence of piston erosion.
P1327	ECM	High engine detonation detected on PTO side	Poor fuel quality, low fuel pressure, wrong timing offset, damaged spark plug, engine temperature too high, worn piston/ring.	Measure fuel pressure, check timing offset, check spark plug, check coolant system, check for evidence of piston erosion.
P1351	ECM	MAG ignition shorted to system voltage	Damaged circuit wires or connector, damaged ignition coil.	Check system circuit J1B-26, check WHITE/RED wire on ignition coil connector for 60 volts.
P1352	ECM	PTO ignition shorted to system voltage	Damaged circuit wires or connector, damaged ignition coil.	Check system circuit J1B-19, check WHITE/RED wire on injector connector for 60 volts.
P1426	ECM	High exhaust muffler temperature detected	Damaged sensor, low fuel pump pressure, air leak in exhaust system, poor fuel quality.	Check fuel pump pressure, check sensor and replace if necessary, check components in exhaust system.
P1427	ECM	Temperature module not detected	Temperature module is set to be active with B.U.D.S. but the module is not connected or it is damaged. Damaged wires.	Check if temperature module is connected. Check for damaged connector or damaged wires. Check if 12 volts system is ok. Check for 12 volts between pin 3 and 4 on connector TM. Check for continuity between TM connector pin 1 and BUDS connector pin 1. Check for continuity between TM connector pin 2 and BUDS connector pin 2.
P1428	ECM	Tuned pipe temperature sensor open circuit	Damaged sensor or damaged sensor wire.	Replace the temperature sensor with the kit available from BRP.
P1429	ECM	Tuned pipe temperature sensor functional problem	Intermittent contact with the temperature sensor. Damaged sensor or damaged sensor wire.	Replace the temperature sensor with the kit available from BRP.
P1430	ECM	Thermocouple module not correctly set	Thermocouple module is connected but it is not set to be active with B.U.D.S.	Go to the setting tab with B.U.D.S. and check "With Thermocouple Module" under Vehicule configuration.
P1471	ECM	E-RAVE® position sensor functional problem	Damaged circuit wires or connector, damaged E-RAVE position sensor.	Check E-RAVE position sensor connector for 5 volts between pin 1 and 3. Check system circuit J1A-18.
P1472	ECM	E-RAVE® position sensor voltage too low	Damaged circuit wires or connector, damaged E-RAVE position sensor.	Check E-RAVE position sensor connector for 5 volts between pin 1 and 3. Check system circuit J1A-18.

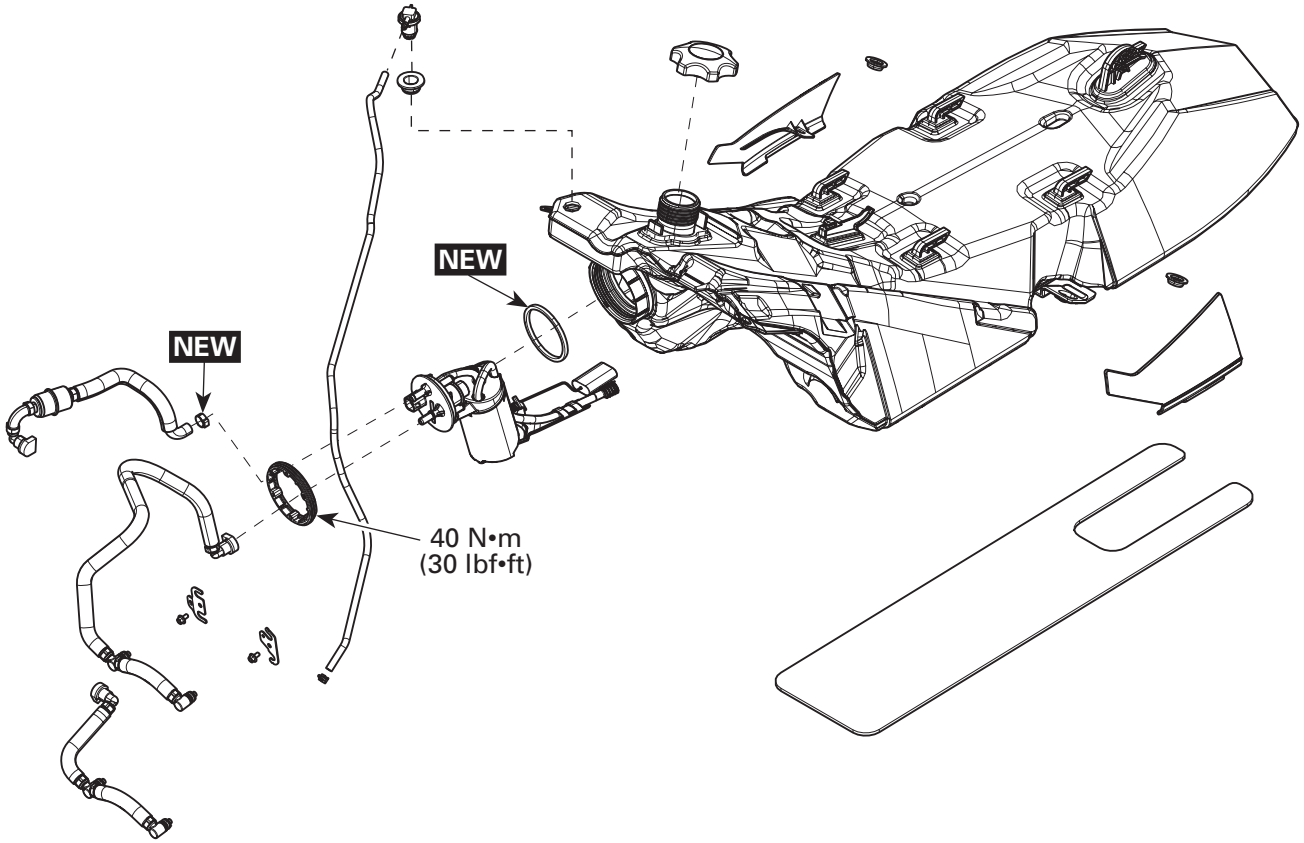
P1473	ECM	E-RAVE® position sensor voltage too high	Damaged circuit wires or connector, damaged E-RAVE position sensor.	Check E-RAVE position sensor connector for 5 volts between pin 1 and 3. Check system circuit J1A-18.
P1476	ECM	RAVE valve middle position not reached	Damaged bellows. Damaged or dicconnected hoses. Damaged E-RAVE solenoid valve. Adjustment of the link between the two E-RAVE valves. Carbon deposit around E-RAVE parts.	Check for damaged bellows. Check for damaged or disconnected vacuum hoses. Check for damaged or disconnected pressure hoses. Check if the E-RAVE valves move freely. Clean and make the necessary adjustment if necessary.
P1477	ECM	RAVE valve close position not reached	Damaged bellows. Damaged or dicconnected hoses. Damaged E-RAVE solenoid valve. Adjustment of the link between the two E-RAVE valves. Carbon deposit around E-RAVE parts.	Check for damaged bellows. Check for damaged or disconnected vacuum hoses. Check for damaged or disconnected pressure hoses. Check if the E-RAVE valves move freely. Clean and make the necessary adjustment if necessary.
P1478	ECM	RAVE valve open position not reached	Damaged bellows. Damaged or dicconnected hoses. Damaged E-RAVE solenoid valve. Adjustment of the link between the two E-RAVE valves. Carbon deposit around E-RAVE parts.	Check for damaged bellows. Check for damaged or disconnected vacuum hoses. Check for damaged or disconnected pressure hoses. Check if the E-RAVE valves move freely. Clean and make the necessary adjustment if necessary.
P1532	ECM	High ECM temperature detected	Poor fuel flow in ECM. Damaged ECM.	Check fuel system for clogged filter, damaged regulator or damaged fuel pump.
P1533	ECM	Major ECM overheat occurred	Low fuel pressure, low fuel circulation in ECM.	Check fuel pump pressure, check fuel line for pinched hose.
P1549	ECM	Major exhaust muffler overheat occurred	Damaged sensor, low fuel pump pressure, air leak in exhaust system, poor fuel quality.	Check fuel pump pressure, check sensor and replace if necessary, check components in exhaust system.
P1562	ECM	Low voltage on system voltage circuit	Damaged circuit wires, connector, injector, ignition coil, oil pump, capacitor or ECM.	Check for inverted wires on magneto connector, loose connection on capacitor. Check for defective component as describe in Possible Causes.
P1563	ECM	High voltage on system voltage circuit	Damaged circuit wires, connector or ECM.	Check for inverted wires on magneto connector, loose connection on capacitor.
P1621	ECM	Overload on 12 V primary circuit	Damaged circuit wires or connector.	Check RED/ORANGE circuit for damaged or shorted wires. Check tail light, headlamp or diagnostic connector.

P1622	ECM	Overload on 12 V secondary circuit	Damaged circuit wires or connector.	Check RED/YELLOW circuit for damaged or shorted wire. Check connections on visor outlet, check heated grips if equipped with standard gauge.
P1623	ECM	Overload on 12 V battery circuit	Damaged circuit wires, connector or battery.	Check RED/WHITE circuit for damaged or shorted wire. Check battery condition. A blown 30 amp fuse is a good indication of a problem with the wires or the battery.
P1656	ECM	D.E.S.S.® line shorted to ground	Damaged circuit wires or mixed up connections.	Check system circuits J1A-23 for continuity to terminal 1 of D.E.S.S. post connector, J1A-11 for continuity to terminal 3 of D.E.S.S. post connector and J1A-5 for continuity to terminal 2 of D.E.S.S. post connector. Check system circuit J1A-23 for continuity to circuit J1A-5 when D.E.S.S. key is installed on D.E.S.S. post. Check system circuit J1A-11 for continuity to the center contact of the D.E.S.S. post connector and circuit J1A-5 for continuity to the outer ring of the D.E.S.S. post. Check system circuits J1A-5, J1A-11 and J1A-23 for continuity to ground.
P1676	ECM	Battery relay open circuit or shorted to ground	Damaged or disconnected relay, circuit wires or terminals.	Check for disconnected relay, damaged circuit wires.
P1679	ECM	Accessory relay open circuit or shorted to ground	Damaged or disconnected relay, circuit wires or terminals.	Check for disconnected relay, damaged circuit wires.
P2299	ECM	Incompatibility between brake lever position and engine/vehicle speed	Brake lever was left in Park position. The pilot kept a constant pressure applied on the brake lever while running. Defective or stuck brake switch. Brake circuit is shorted to 12 volts.	Check if the brake switch operate properly. Check if brake switch is secured on the master cylinder. Check for 12 volts at ECM connector J1A_30 when brake is applied. Check for 0 volt at ECM connector J1A-30 when brake is not applied. Check for a faulty ground on the brake light.

FUEL TANK AND FUEL PUMP

SERVICE TOOLS

SERVICE PRODUCTS



NEW = Component must be replaced when removed.

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GENERAL

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

⚠ WARNING

Always disconnect battery prior to working on the fuel system.

⚠ 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.

⚠ WARNING

Proceed with care and use appropriate safety equipment when working on the fuel system. Wear safety glasses and work in a well ventilated area.

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.

SYSTEM DESCRIPTION

Electric Fuel Pump

An electric fuel pump is mounted in the upper RH front part of the fuel tank.

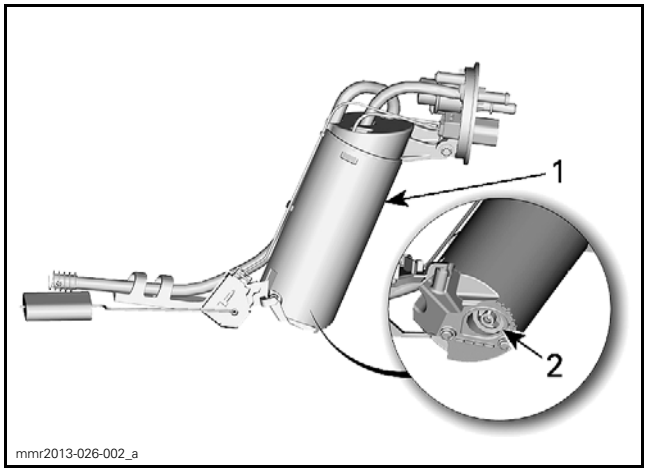
A 12 Vdc high pressure fuel pump with an integrated jet pump is used.

NOTE: Although the fuel pump is connected to the 55/60 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 START/RER button is depressed, the electric fuel pump turns on for a few seconds to pressurize the fuel system 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.

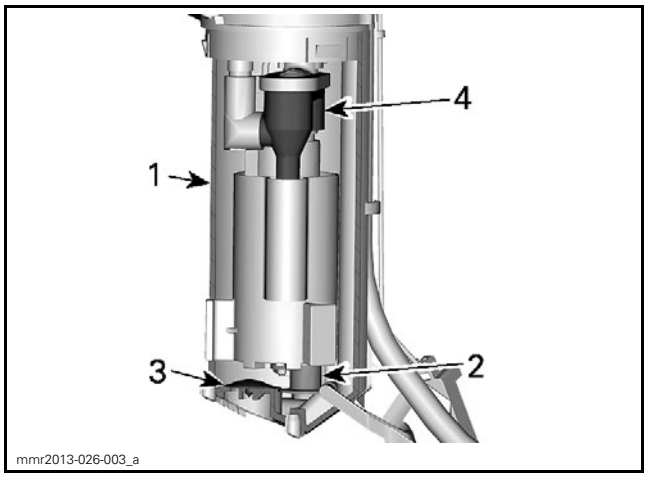
The fuel pump reservoir is actually the housing of the fuel pump module in which the fuel pump is located. A check valve at the bottom of the housing allows the fuel in the tank to enter the fuel pump reservoir.



TYPICAL
1. Fuel pump reservoir
2. Check valve

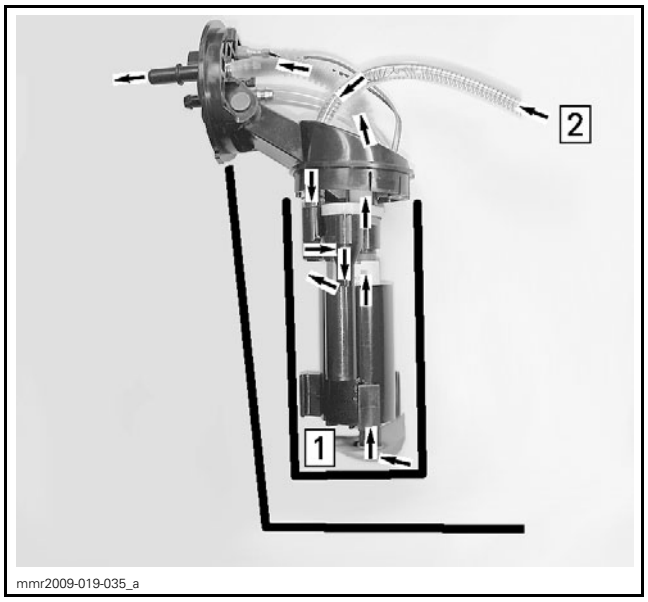
When the fuel pump runs, it draws the fuel from the fuel pump reservoir and feeds it to the injection system. This causes fuel in the tank to be drawn into the fuel pump reservoir through its bottom inlet check valve.

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)
4. Venturi

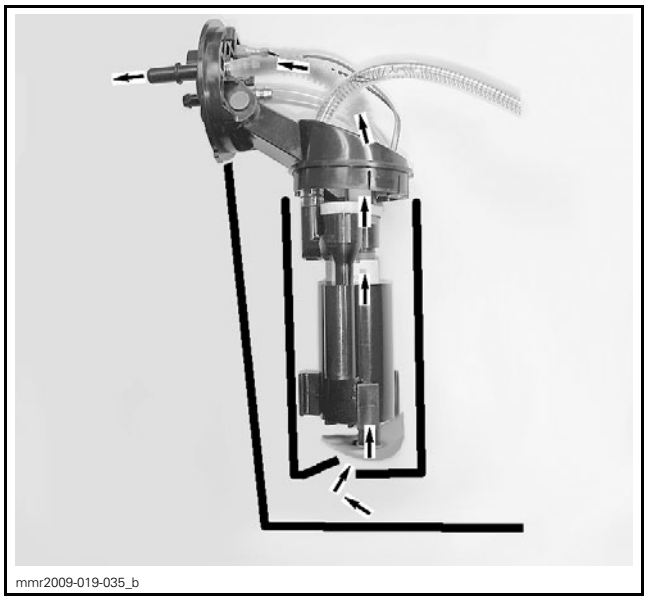
As the fuel accelerates through the venturi, it generates a low pressure area at a connection to the remote pickup, which draws fuel into the fuel pump reservoir from the remote pickup.



TYPICAL
Step 1: Bottom inlet draws fuel from fuel pump reservoir
Step 2: Low pressure from venturi draws fuel from rear pickup into fuel pump reservoir

When riding the vehicle on a level surface, fuel is drawn 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 check valve opens and fuel enters the fuel pump reservoir from the fuel tank 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 rear 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:

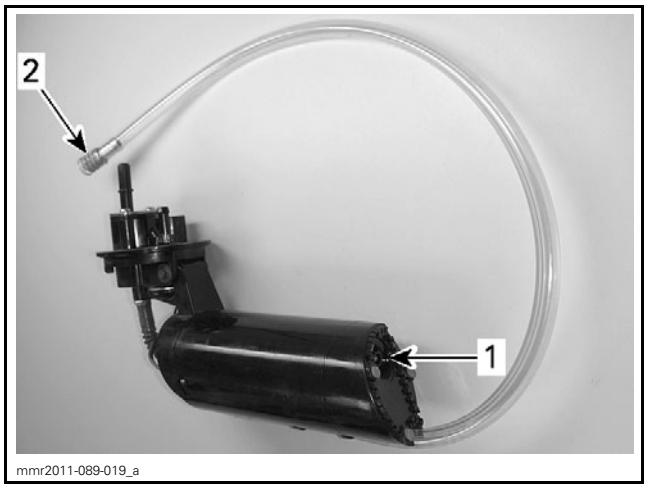
– Out of fuel pump
– Through the ECM
– To the injectors (around the voice coils)
– Through the pressure regulator
– Back to fuel tank.

NOTE: The hose loop between the MAG injector outlet and the ECM dampens the engine torque reaction movement.

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.

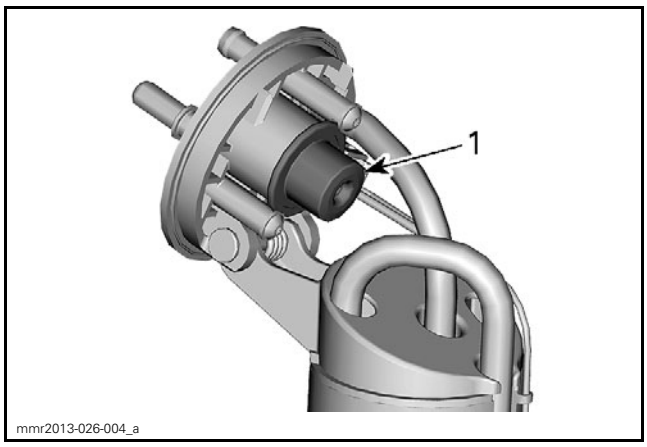
The remote pickup uses a replaceable steel mesh strainer to filter out relatively large dirt particles and prevent clogging of the jet pump. The fuel entering the fuel pump reservoir through the check valve will be filtered by the fuel pump prefilter.



1. *Fuel pump reservoir check valve*
2. *Remote pickup with steel mesh strainer*

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.



1. *Integrated fuel pressure regulator*

FUEL PRESSURE
Approximately 303 kPa (44 PSI) at 2000 RPM (will be lower at idle)

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.

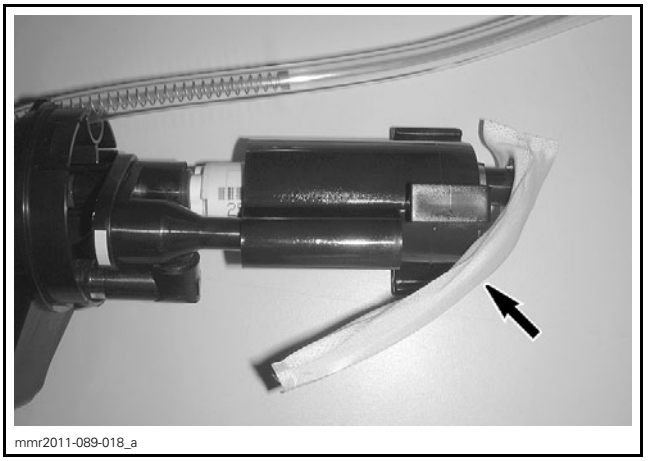
As fuel is consumed by the engine, a negative pressure would occur in the fuel tank. This could eventually prevent the fuel pump from drawing enough fuel. The **negative pressure relieve function** of the valve allows the higher outside air pressure in.

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).



FUEL PUMP PRE-FILTER (FUEL RESERVOIR REMOVED)

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 at front of the fuel tank, above the oil injection tank.

It is a replaceable metallic canister type filter used to deliver dirt-free fuel to the injectors.

Fuel Level Indication

A float type fuel level sensor varies its resistance with fuel level thus providing a signal to the multifunction gauge for fuel level indication.

INSPECTION

FUEL SYSTEM PRESSURIZATION AND LEAK TEST

Using B.U.D.S., active the fuel pump to apply a pressure in the fuel system. Check to detect any leak.

– Select **Activation** and **ECM** tabs.
– Click on the **Fuel Pump (CLick/Hold)** button in the **Activate** field.

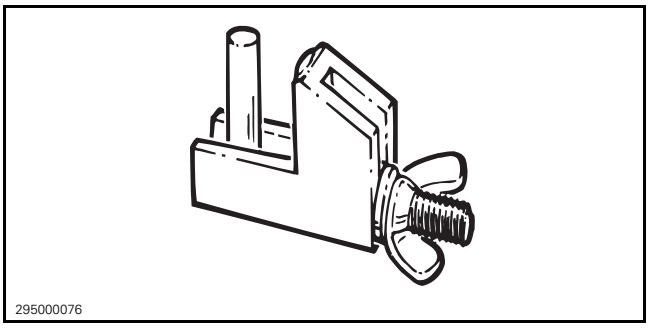
1. Press here to activate fuel pump

⚠ WARNING

After working on the fuel system, carry out a fuel system pressurization test to check for leaks. Failure to carry out a fuel system pressurization test could result in severe injury or a life threatening situation should a leak occur.

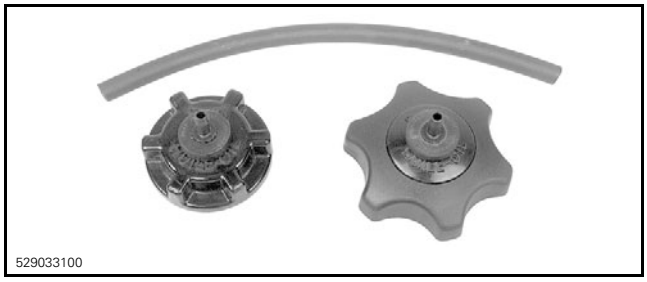
FUEL TANK LEAK TEST

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.

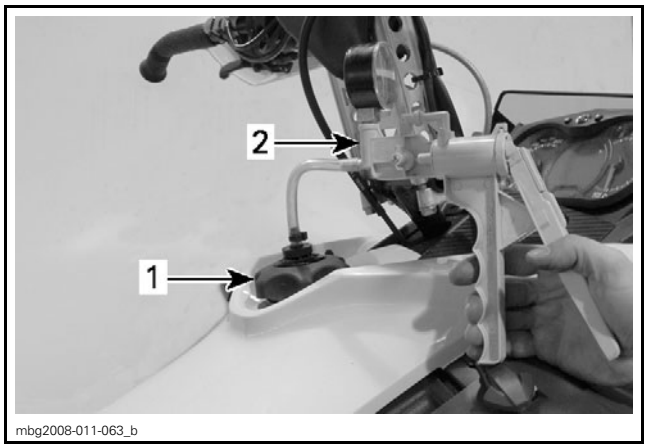


TYPICAL - HOSE PINCHER ON FUEL VENT TUBE

4. Install the appropriate test cap from the LEAK TEST KIT (P/N 529 033 100) on fuel tank inlet.



5. Install VACUUM/PRESSURE PUMP (P/N 529 021 800) on pressure test fuel cap.



TYPICAL
1. Pressure test fuel cap
2. Vacuum/pressure pump

6. Set pump selector to pressure.
7. Pressurize fuel tank as follows.

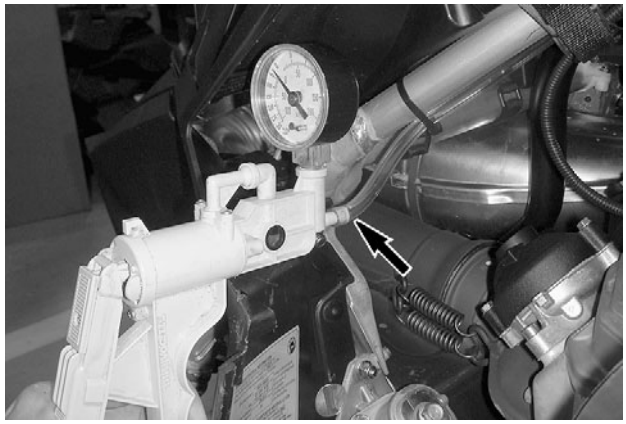
PRESSURE	TIME WITHOUT PRESSURE DROP
21 kPa (3 PSI)	3 minutes

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

To ease locating leak(s), spray soapy water on components; bubbles will indicate leak location(s).

Fuel Tank Vent Valve Test

1. While the fuel tank is still pressurized as in the previous test, carry out the following:
2. Place a finger over the vent hose outlet.
3. When removing hose pincher, alternately touch and release vent hose outlet. You should feel pressurized air flowing out indicating the pressure relief valve function is working.
4. Release any remaining pressure in the fuel tank by slowly unscrewing fuel tank cap.
5. Remove the pressure test fuel cap.
6. Remove the fuel tank vent tube from its fitting on the lower left front body panel.
7. Install the VACUUM/PRESSURE PUMP (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.



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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.

FUEL PUMP PRESSURE TEST

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.

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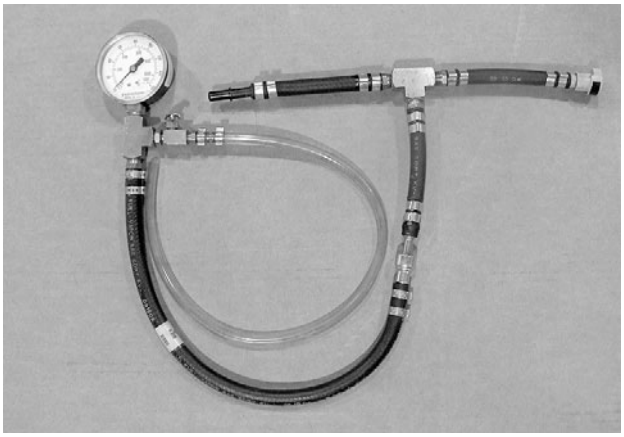
TYPICAL
1. Disconnect here

4. Install the FUEL HOSE ADAPTER (P/N 529 036 023) and the PRESSURE GAGE (P/N 529 035 709) between fuel pressure hose and ECM.



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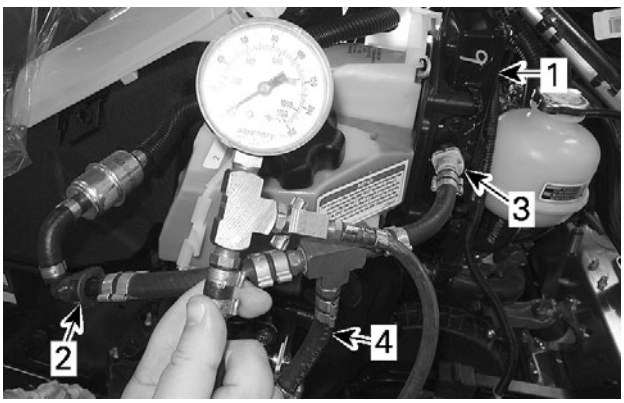
PRESSURE GAUGE WITH FUEL HOSE ADAPTER



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1. ECM
2. Fuel pressure hose fitting
3. Fuel hose adapter to ECM fitting
4. Fuel hose adapter to pressure gauge

⚠ 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.

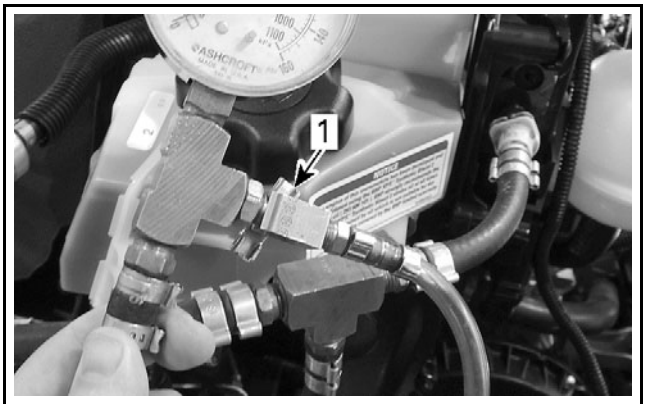
If pressure does not rise with the fuel return blocked, refer to *PRESSURE BELOW SPECIFICATIONS* in the following table.

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.



1. Pressure gauge bleed valve

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

Fuel Hose Replacement

When replacing fuel hoses, be sure to use hoses as available from BRP parts department. This will ensure continued proper and safe operation.

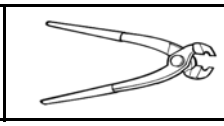
⚠ WARNING

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*.

Oetiker Clamp Replacement

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

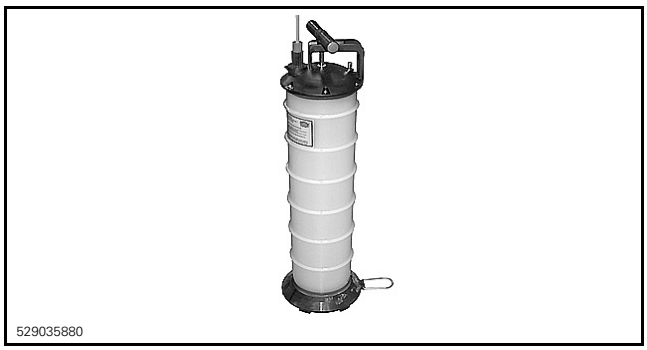
⚠ WARNING

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

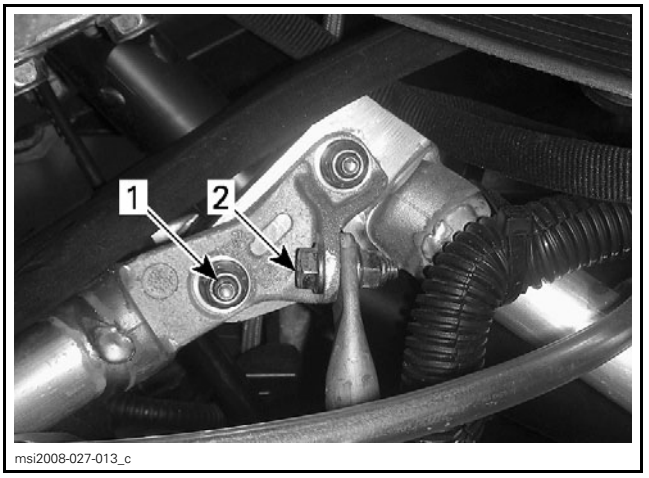
FUEL TANK

Fuel Tank Removal

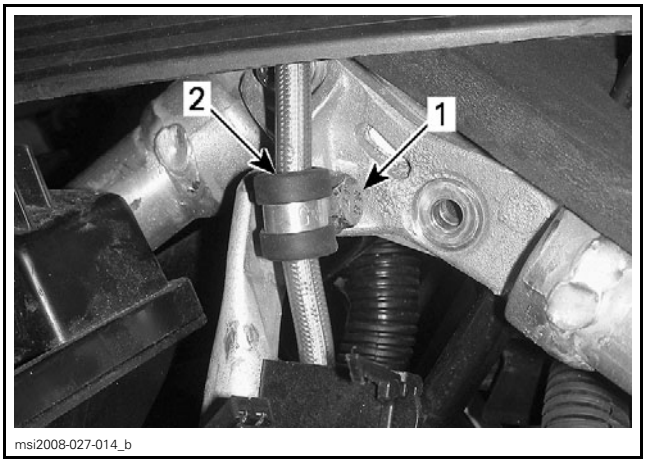
1. Remove the following items, refer to *BODY* section:
   - Seat
   - Upper body module
   - Console.
2. Drain fuel tank as much as possible using the SUCTION PUMP (P/N 529 035 880).



3. Remove the aft mounting bolt from the rear frame member forward mount, and the top mounting bolts from upper column support as indicated on the illustration. Discard the elastic nuts.

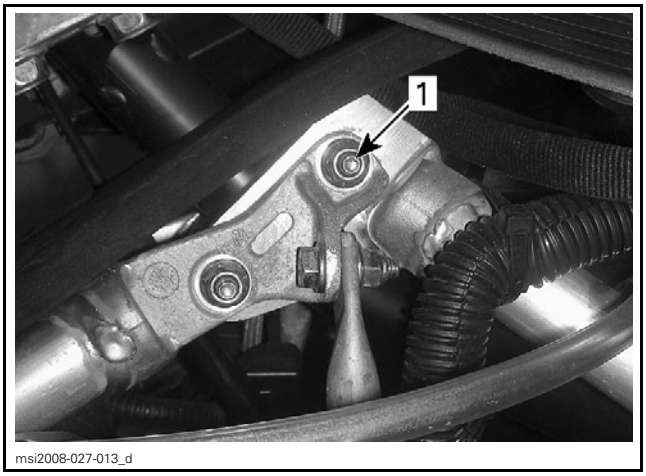


RIGHT SIDE SHOWN
1. *At mounting bolt on rear frame member forward mount*
2. *RH top mounting bolt on upper column support*



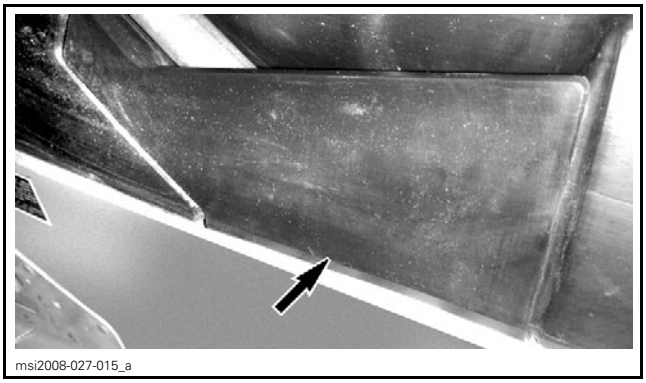
LEFT SIDE SHOWN
1. *Top mounting bolt on LH upper column support*
2. *Brake hose retaining clamp*

4. Release the torque applied to the mounting bolt on the front frame member, but do not remove bolt and elastic nut.

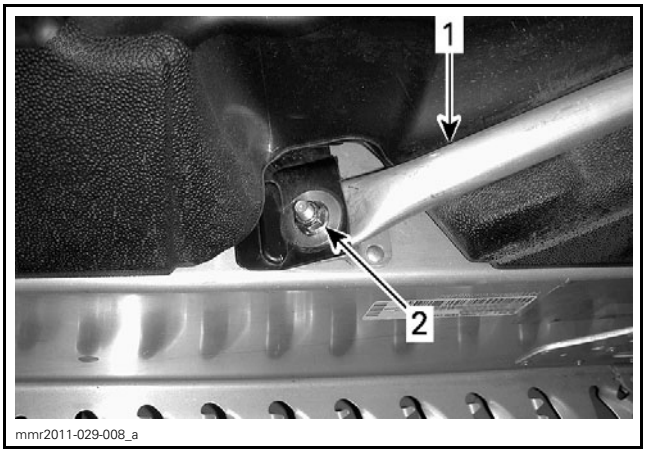


1. Mounting bolt, front frame member

5. Remove trim panels covering the aft end of the rear frame members by pulling upwards, then pulling out (one each side).

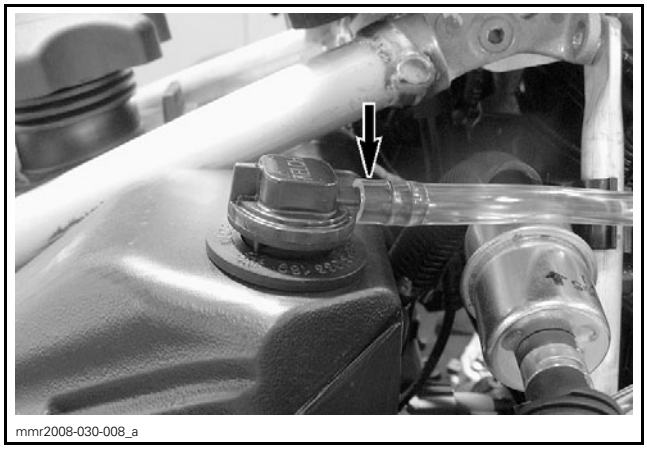


6. Remove elastic nut and shoulder bushing retaining the rear frame members (one each side) to the tunnel (discard nuts, keep shoulder bushings).



1. Frame member
2. Elastic nut

7. Disconnect the fuel tank vent tube at the check valve.



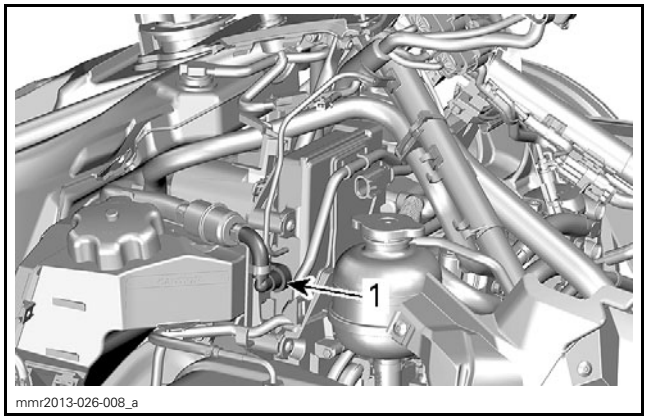
TYPICAL - DISCONNECT FUEL VENT TUBE

8. Disconnect the magneto connector.

⚠ WARNING

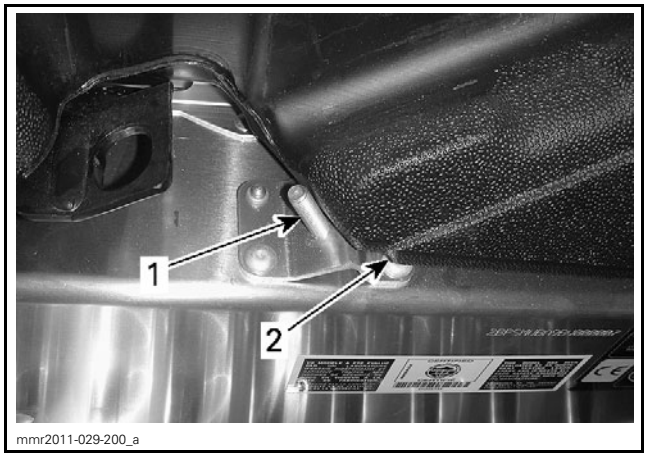
The magneto connector must be disconnected to prevent any spark in the engine compartment and to remove power from the fuel pump. Otherwise, if engine is cranked, fuel vapors may ignite in presence of a spark creating a fire hazard.

9. Install a rag around the ECM hose quick connect to catch fuel spillage.
10. Disconnect fuel pressure hose from ECM.



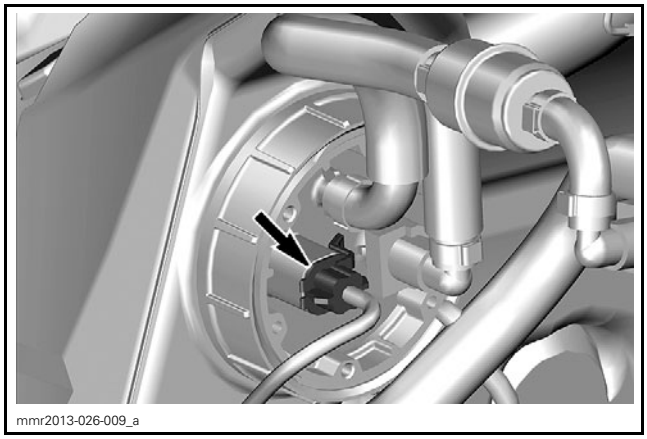
TYPICAL
1. Fuel pressure hose fitting at ECM

11. Move the fuel tank backwards until it contacts the studs.



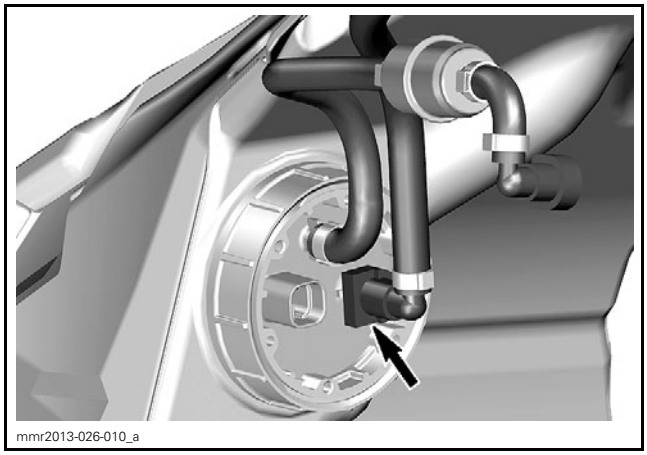
1. Stud
2. Fuel tank

12. Disconnect fuel pump electrical connector.



FUEL PUMP CONNECTOR TO DISCONNECT

13. Carefully disconnect fuel return hose from fuel pump.



FUEL RETURN HOSE TO DISCONNECT

NOTE: Place a container under the return hose end to recover the fuel remaining in the system.

14. Carefully and slowly lift the aft end of the fuel tank from the side frame mounting studs and remove it from vehicle.

Fuel Tank Installation

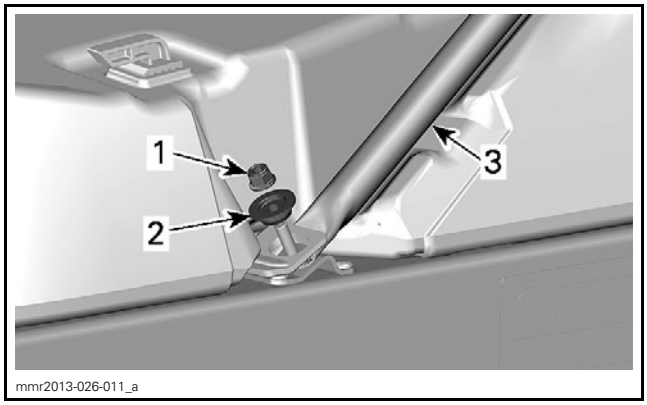
Installation is the reverse of the removal procedure however, pay attention to the following.

Connect return hose to fuel pump. Pull on hose to ensure it is properly locked and secure.

When installing vent hose, ensure it is not kinked or pinched.

Secure the rear frame member using new elastic nuts and previously removed shoulder bushings.

TIGHTENING TORQUE	
Rear frame member retaining nuts	31 N•m (23 lbf•ft)



1. New elastic nut
2. Previously removed shoulder bushing
3. Rear member frame

Secure all frame members at the top of pyramid using new elastic nuts.

TIGHTENING TORQUE	
Frame member upper bolts	14 N•m (124 lbf•**in**)

Validate fuel system tightness by performing a *FUEL SYSTEM PRESSURIZATION AND LEAK TEST*. Refer to *INSPECTION* at the beginning of this subsection.

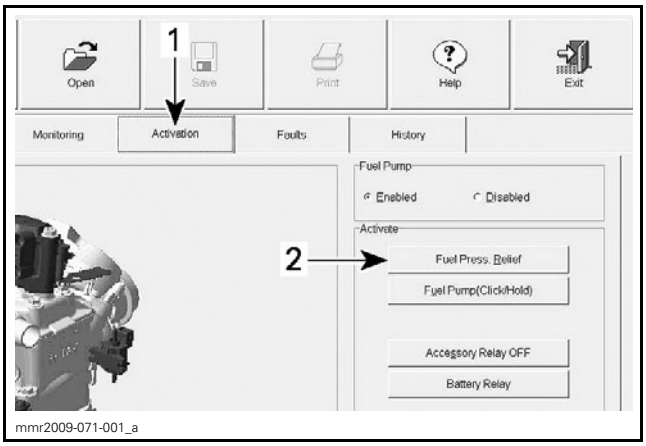
Reinstall all other removed parts and refill the fuel tank.

FUEL PUMP

Fuel Pressure Release

1. Connect vehicle to the latest applicable B.U.D.S. software, refer to the *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Select the **Activation** and **ECM** tabs.

3. Click on the **Fuel Press. Relief** button in the **Activate** field.

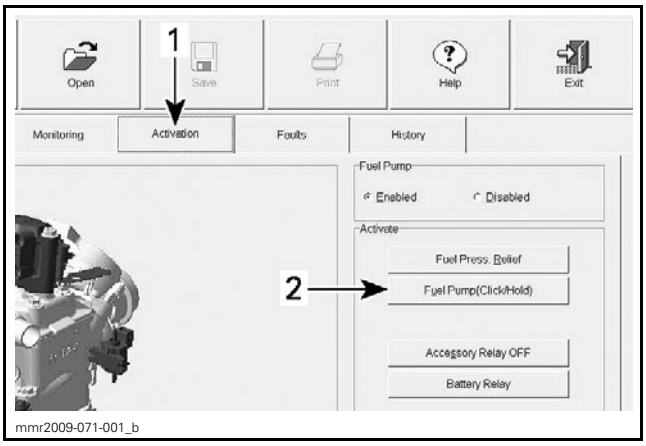


RELEASING FUEL SYSTEM PRESSURE IN B.U.D.S.
1. Activation tab
2. Fuel Press. Relief button on ECM page

Electric Fuel Pump Test 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 the latest B.U.D.S. software, refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Select the **Activation** and **ECM** tabs.
3. Click on the **Fuel Pump (Click/Hold)** button in the **Activate** field.



1. Activation tab
2. Fuel Pump (Click/Hold) button

4. Listen for fuel pump operation.

NOTE: The fuel pump should run as long as you hold the **Fuel Pump (Click/Hold)** button in B.U.D.S.

If you do not hear the pump come ON, select the **Faults** tab in B.U.D.S. 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.

Electric Fuel Pump Pressure Test

Refer to *INSPECTION* in this subsection.

Electric Fuel Pump Removal

1. Release the fuel pressure in the system. Refer to *ELECTRIC FUEL PUMP (E-TEC)* in this subsection.
2. Disconnect magneto connector.

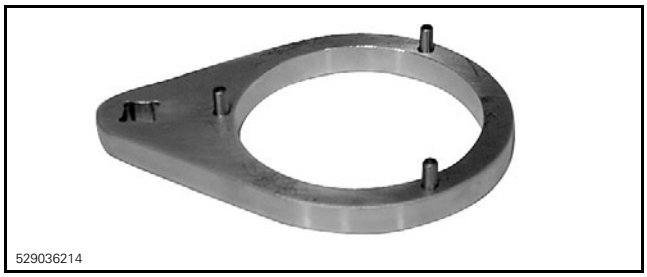
⚠ WARNING

The magneto connector must be disconnected to prevent any spark in the engine compartment and to remove power from the fuel pump. Otherwise, if engine is cranked, fuel vapors may ignite in presence of a spark creating a fire hazard.

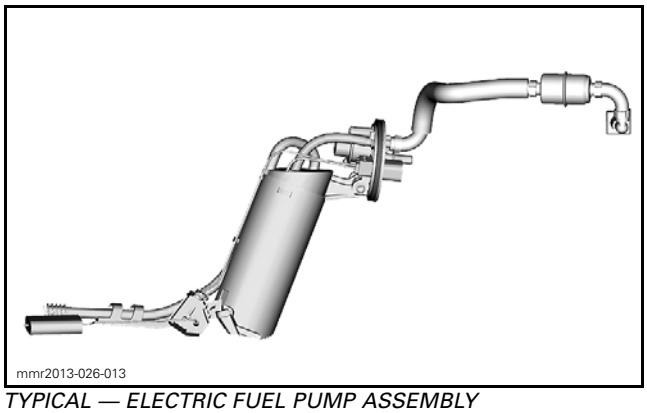
Follow procedures for removing fuel tank and move fuel tank back for access to fuel pump. Refer to *FUEL TANK REMOVAL* in this subsection.

3. Disconnect fuel pump as described in the *FUEL TANK REMOVAL* procedure in this section.
4. Remove fuel pump spanner nut.

REQUIRED TOOL
FUEL PUMP NUT TOOL (P/N 529 036 214)

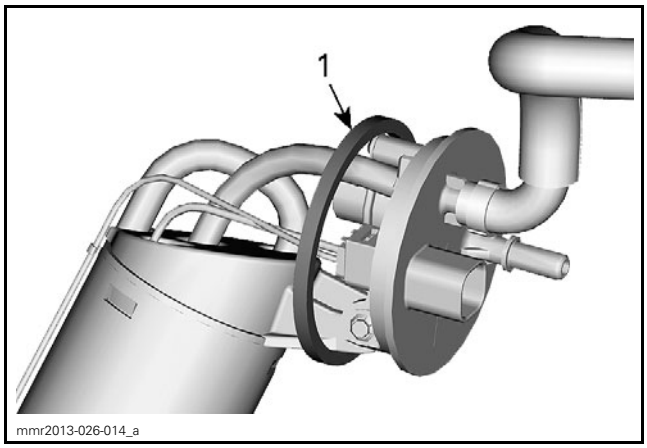


5. Remove fuel pump assembly from fuel tank.



TYPICAL — ELECTRIC FUEL PUMP ASSEMBLY

6. Remove and discard fuel pump gasket.



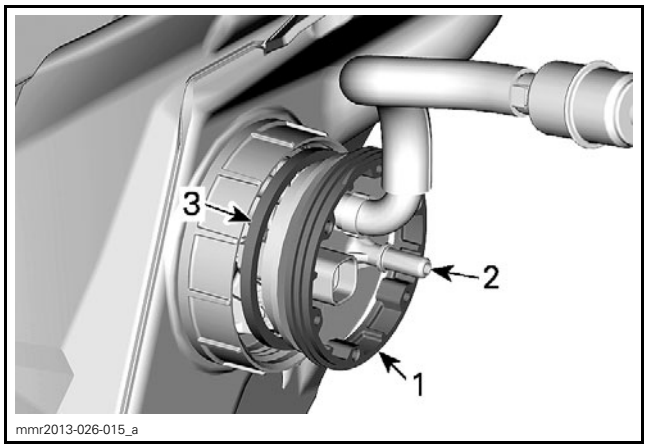
1. Fuel pump gasket

Electric Fuel Pump Installation

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

1. Make sure the rear pick-up is inserted all the way to the rear of fuel tank and does not interfere with the fuel level sensor float.
2. Install a NEW gasket on the fuel pump prior to installing the pump in the tank.

NOTE: The gasket must be installed on the fuel tank side so it is located between the pump and the fuel tank.



TYPICAL - FUEL PUMP INSTALLATION
1. Fuel pump spanner nut
2. Fuel pump face plate
3. Fuel pump gasket

3. Install a torque wrench perpendicularly (90°) to FUEL PUMP NUT TOOL (P/N 529 036 214).

TIGHTENING TORQUE	
Fuel pump spanner nut	40 N•m (30 lbf•ft)

4. To reconnect fuel pump and install fuel tank, refer to the *FUEL TANK INSTALLATION* procedure in this subsection.
5. Carry out a *FUEL TANK LEAK TEST* and a *FUEL SYSTEM PRESSURIZATION AND LEAK TEST* as detailed in this subsection.

⚠ WARNING

After working on the fuel system, carry out a fuel system pressurization test to check for leaks. Failure to carry out a fuel system leak test could result in severe injury or a life threatening situation should a leak occur.

FUEL PUMP INLET FILTER

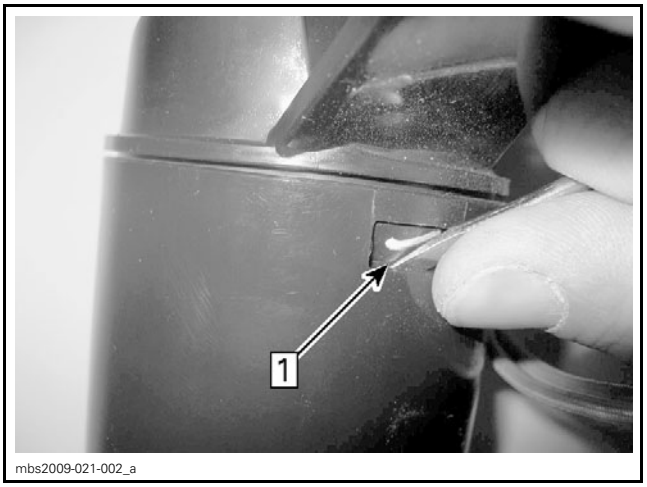
Fuel Pump Inlet Filter Replacement

1. Remove fuel pump assembly from fuel tank. Refer to procedure in this subsection.
2. Pull rear pickup hose to make room.

1. Rear pickup hose

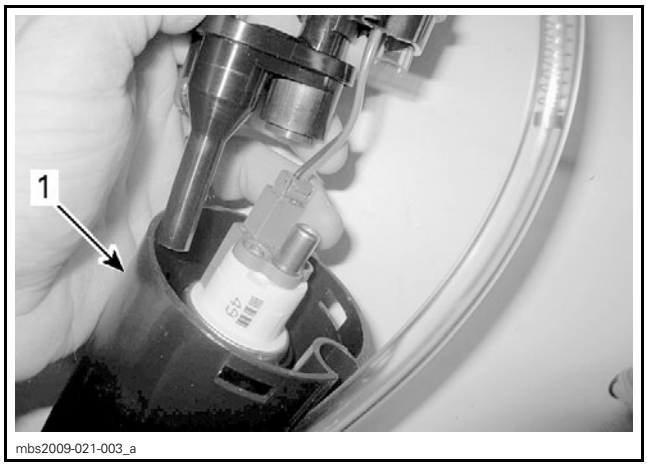
3. Unlock sump tank by carefully inserting a small screwdriver between the tab and the sump tank.

NOTICE Be careful not to damage tabs while pushing them.

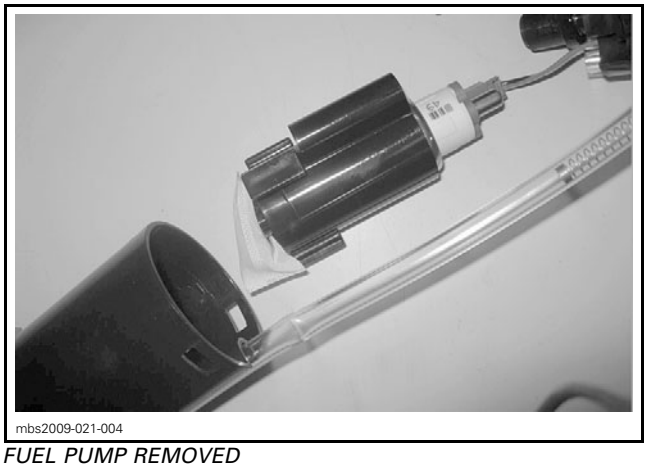


Step 1: Insert screwdriver between tab and sump tank

4. Completely remove sump tank from pump by pulling it carefully.

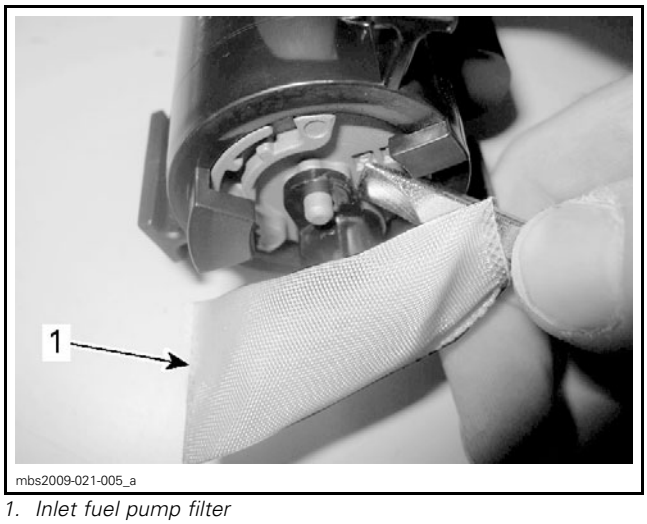


1. Sump tank



FUEL PUMP REMOVED

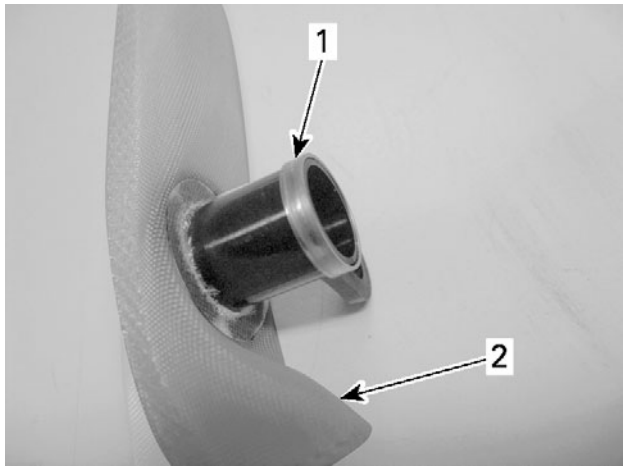
5. Remove inlet fuel pump filter using a small screwdriver.



1. Inlet fuel pump filter

6. Discard inlet fuel pump filter and steel ring.
7. Install NEW steel ring on NEW inlet filter.

NOTE: Steel ring can be installed on both sides. If steel ring is loose during installation, it will tighten when plastic will contact fuel, the plastic will swell.



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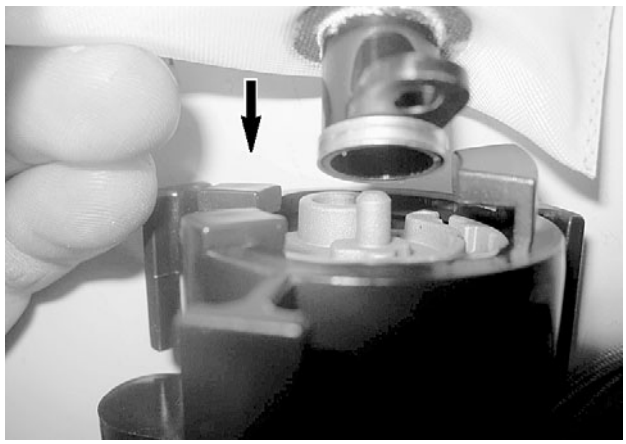
1. Steel ring
2. Inlet filter

8. Insert inlet filter into fuel pump by pressing it downward.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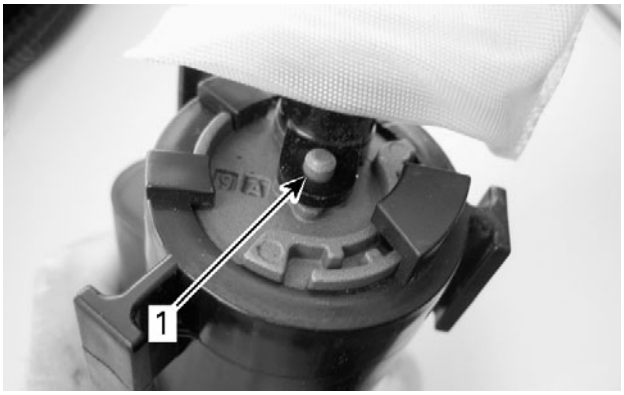
9. Ensure that the filter hole is properly positioned into the pin.



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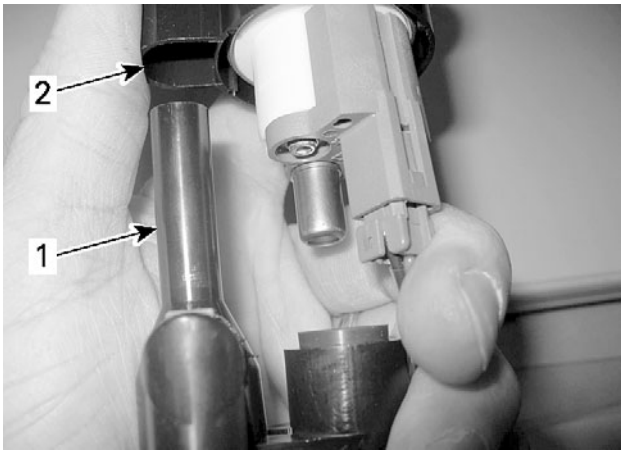
1. Pin

10. Align jet pump outlet into its opening.



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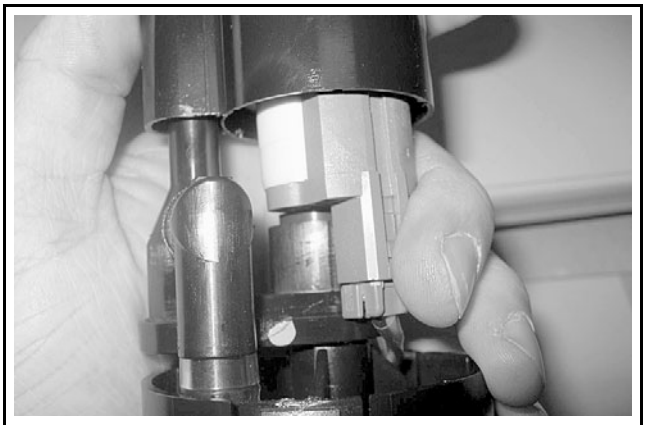
1. Jet pump outlet
2. Opening

11. Install motor into jet pump.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12. Install sump tank carefully and ensure that all parts are properly positioned.


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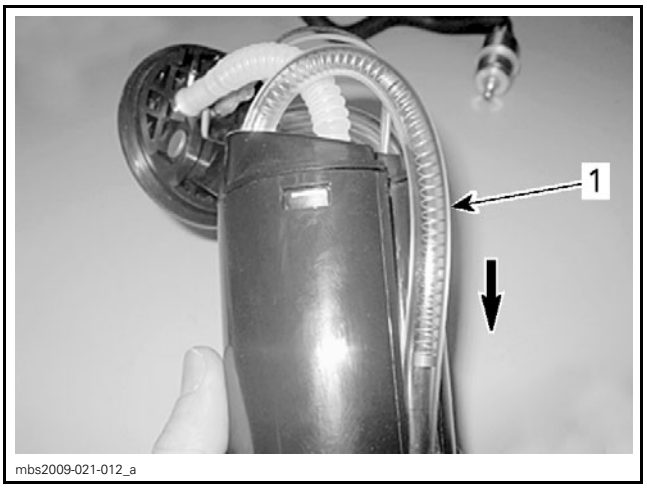
13. Ensure that sump tank tabs are properly locked.
14. Position rear pickup hose by pulling it downward.



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1. Rear pickup hose

15. Reinstall fuel pump from fuel tank. Refer to procedure in this subsection.

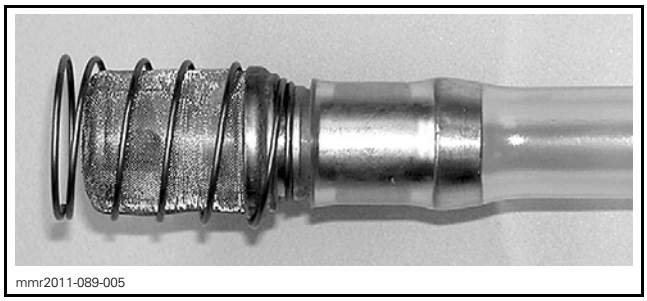
STEEL MESH FILTER

Steel Mesh Filter Location

The steel mesh fuel filter is located on the remote pickup of the fuel pump module.

Steel Mesh Filter Cleaning

1. Remove fuel pump from fuel tank, refer to *FUEL PUMP REMOVAL* in this subsection.
2. Clean steel mesh filter on fuel pump remote pickup using low pressure filtered air and XPS BRAKES AND PARTS CLEANER (USA) (P/N 219 701 705) or XPS BRAKES AND PARTS CLEANER (CAN) (P/N 219 701 776).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STEEL MESH FILTER, FUEL PUMP REMOTE PICK-UP

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

FUEL PRESSURE REGULATOR

Fuel Pressure Regulator Replacement

Remove fuel pump from fuel tank. Refer to *ELECTRIC FUEL PUMP REMOVAL* in this subsection.

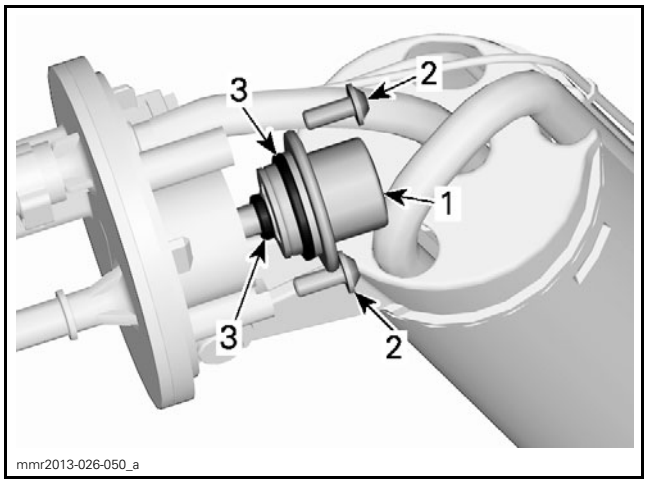
Remove screws securing fuel pressure regulator on fuel pump.

Discard fuel pressure regulator with its O-rings.

Install new O-rings on the new fuel pressure regulator.

Install the regulator on fuel pump and secure it using previously removed screws.

TIGHTENING TORQUE	
Fuel pressure regulator screws	Hand-tight



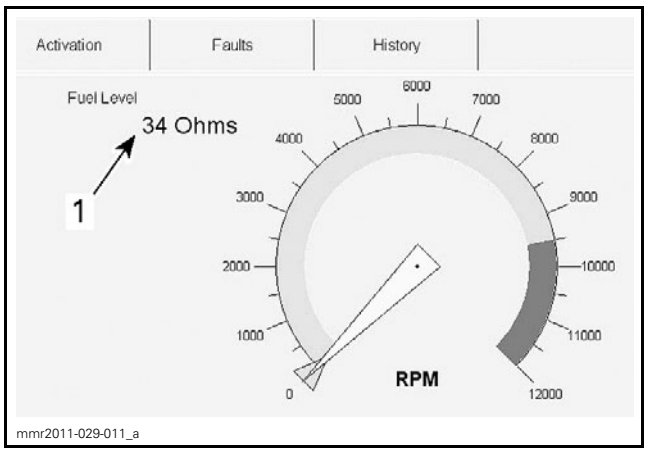
1. *Fuel pressure regulator*
2. *Retaining screws*
3. *New O-rings*

FUEL LEVEL SENSOR

NOTE: Verify the gauge functions related to the fuel level sensor before testing the sensor. Refer to *GAUGE* in *LIGHTS, GAUGE AND ACCESSORIES* subsection.

Fuel Level Sensor Test with B.U.D.S.

1. Connect vehicle to the latest applicable B.U.D.S. version.
2. Select the **Monitoring** and **Cluster** tabs.
3. Monitor the fuel level sensor resistance under **Fuel Level** and compare to the table below.



1. *Fuel level sensor resistance*

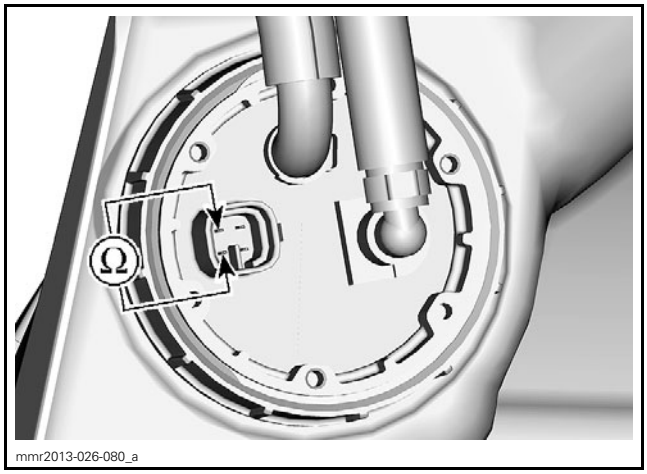
FUEL LEVEL SENSOR RESISTANCE TABLE	
Full level resistance value	7 Ω ± 3 Ω
Empty level resistance value	95 Ω ± 5 Ω

If resistance is within specifications, the fuel level sensor, wiring and fuse are ok.

If resistance is not within specifications, carry out the *FUEL LEVEL SENSOR RESISTANCE TEST*.

Fuel Level Sensor Resistance Test

1. Move fuel tank back to obtain access to the fuel pump connector. Refer to *FUEL TANK REMOVAL* in this subsection.
2. Disconnect fuel pump.
3. Connect the FLUKE 115 MULTIMETER (P/N 529 035 868) between the two pins in the sensor connector and set it to Ω.
4. Test resistance of sensor as follows.



NOTE: Lift the rear of fuel tank to change fuel level.

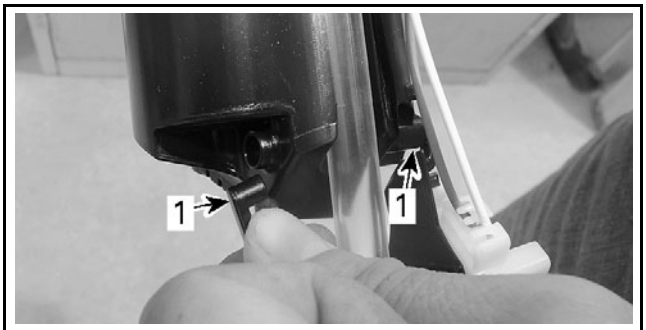
FUEL LEVEL SENSOR RESISTANCE TABLE	
Full level resistance value	7 Ω ± 3 Ω
Empty level resistance value	95 Ω ± 5 Ω

If resistance is within specifications, check the wiring between the fuel pump connector and gauge.

If resistance is not within specifications, replace fuel level sensor.

Fuel Level Sensor Replacement

Open both fuel level sensor support tabs.



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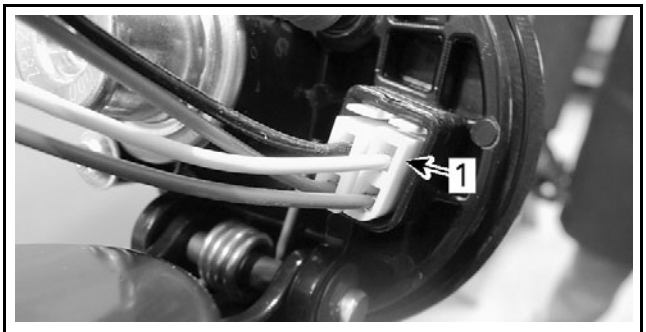
1. Tabs of fuel level sensor support

Disconnect the fuel level sensor connector from the pump module.



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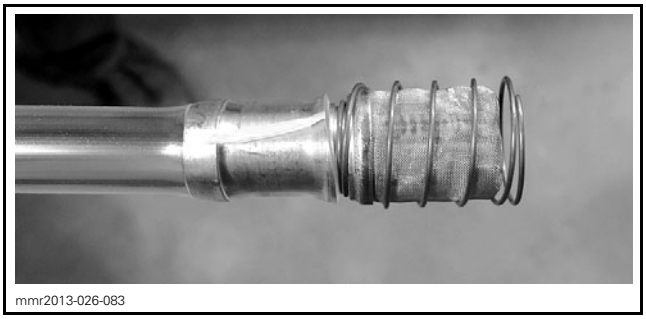
1. Fuel level sensor connector (Yellow connector)

Remove the steel mesh fuel filter from its hose.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Remove the fuel level sensor.

Reinstall the new one by reversing the procedure

E-TEC DIRECT FUEL INJECTION

SERVICE TOOLS

Description	Part Number	Page
EXTRACTOR ADAPTOR	529 036 136	17
FLUKE 115 MULTIMETER	529 035 868	13–14, 26, 38–39, 43, 45
INJECTOR RETAINER PLATE	529 036 137	11
OETIKER PLIERS	295 000 070	6
SMALL HOSE PINCHER	295 000 076	35

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
SNAP-ON HAMMER	CJ125-6	17
SNAP-ON SCREW	CJ93-1	17

SERVICE PRODUCTS

Description	Part Number	Page
DIELECTRIC GREASE	293 550 004	20
PULLEY FLANGE CLEANER	413 711 809	36

GENERAL

⚠ 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 *ELECTRIC FUEL PUMP (E-TEC)* 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.
- Crank engine to pressurize fuel system. Do not let engine run. If it starts, stop it right away.
- 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

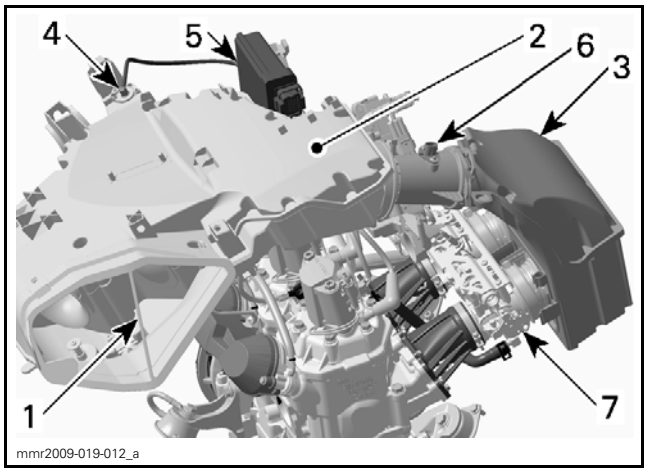
The ECM reads the input signals from different sensors which indicate engine operating conditions at micro-second intervals.

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



TYPICAL
1. *Mesh filter*
2. *Secondary air intake silencer*
3. *Primary air intake silencer*
4. *Air pressure fitting and hose*
5. *Air pressure sensor in ECM*
6. *Air temperature sensor*
7. *Throttle body*

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.

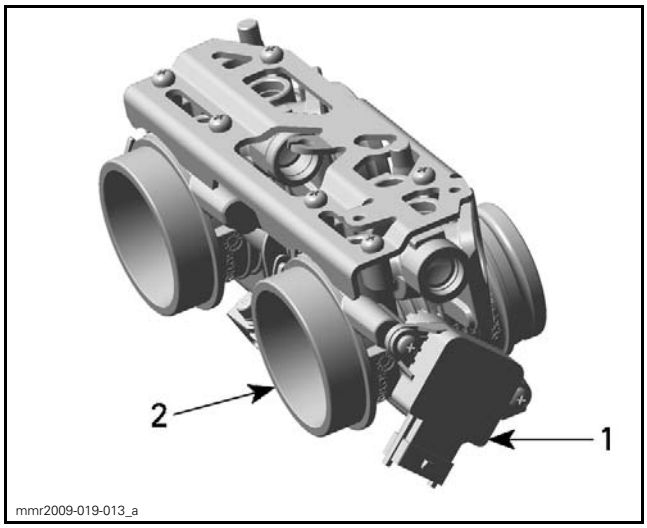
Air pressure is measured in the secondary air intake silencer through a tube connected to the ECM.

Air then flows through the primary air intake silencer.

Air temperature is measured at the entry point of the primary air intake silencer.

Air is then drawn in through a dual throttle body mounted on the engine intake side.

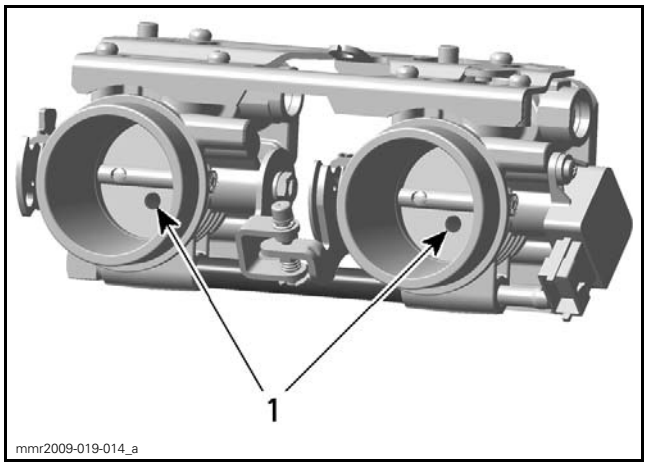
Throttle Body



1. *Throttle body*
2. *TPS (Throttle Position Sensor)*

A Dell'Orto dual throttle body assembly is directly mounted on the intake flange of each cylinder (46 mm for the 600 HO and 52 mm for the 800R).

The air flow is controlled by two throttle plates. Each throttle plate has a 6.8 mm (.268 in) idle port in it.

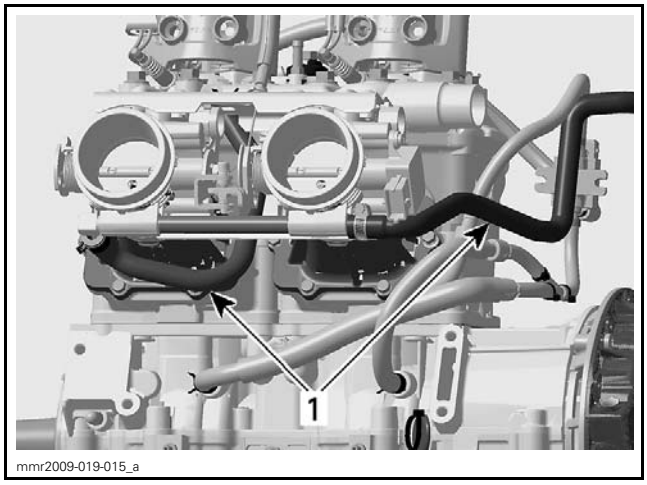


1. *Idle ports*

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.



1. Coolant-heated lines

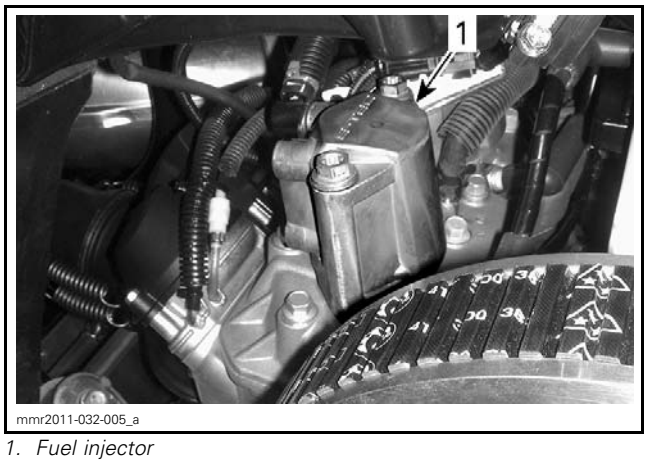
The air then continues through the reed valves into the cylinder base then into the crankcase.

Fuel Injector

The fuel injectors are powered from the 55/60 Vdc system.

One fuel injector per cylinder is used.

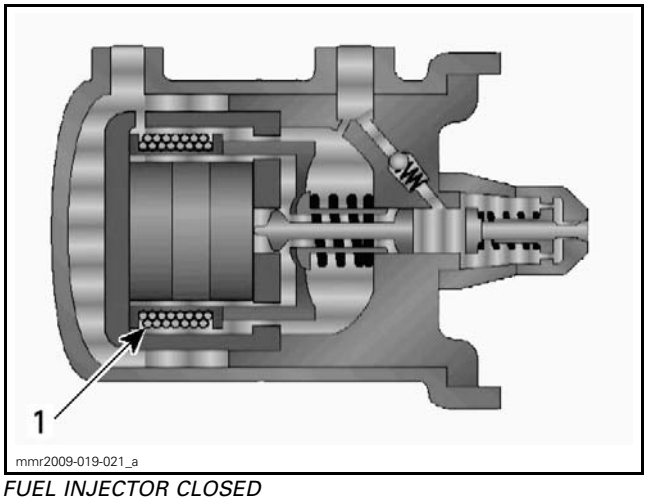
The E-TEC fuel injector is mounted directly on top of the cylinder head.



1. Fuel injector

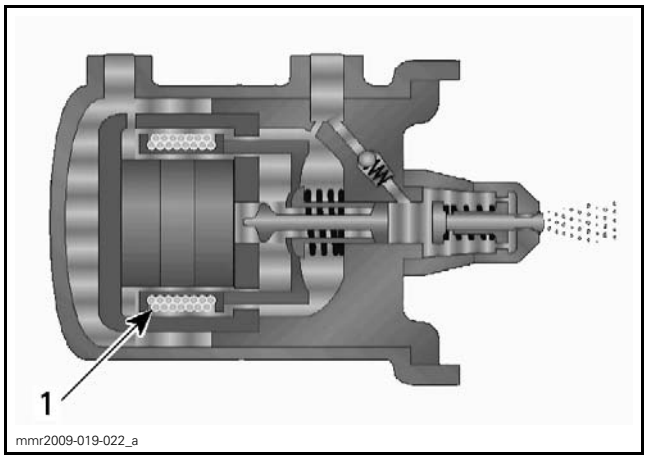
The fuel injector achieves a direct injection right into the combustion chamber. This keeps the piston cooler with less fuel.

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.

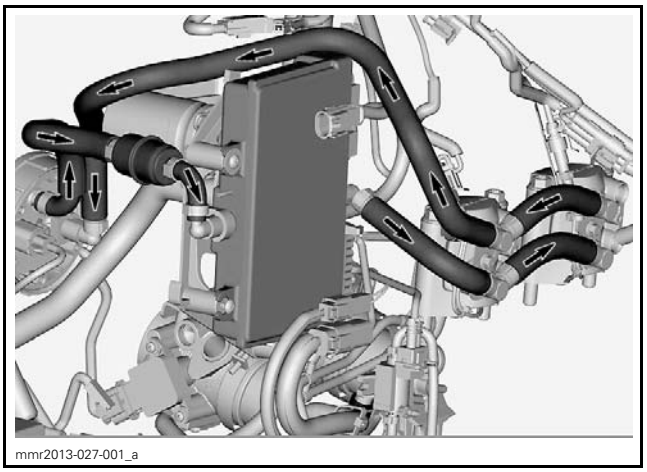
The stratified fuel charge provides a cleaner combustion, better idling and less smoke.

Fuel Injector Cooling

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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1. Fuel injectors
2. ECM

ADJUSTMENT

IDLE SPEED

Idle speed is controlled by the EMS (Engine Management System) 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)*.

CLOSED THROTTLE RESET (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.

The closed throttle reset must be carried out **only** if the:

– TPS is loosen, removed or replaced.
– TPS is out of tolerance or sets a fault code.
– Throttle body is replaced.
– ECM is replaced.

NOTE: **Do not** reset TPS needlessly. See *TPS CLOSED THROTTLE VERIFICATION*.

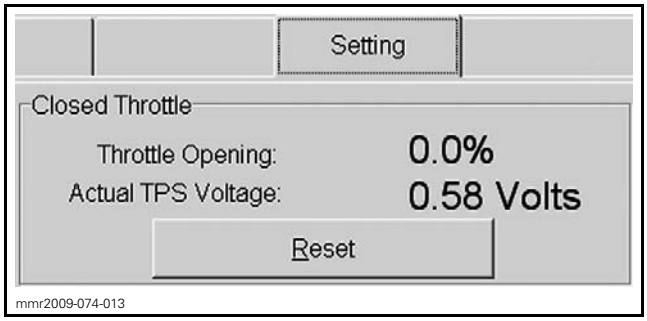
NOTICE **An improperly set TPS may lead to poor engine performance.**

TPS Closed Throttle Verification

1. Connect vehicle to the latest applicable B.U.D.S. version. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. In B.U.D.S., select the **Setting** and **ECM** tabs.
3. Activate and release throttle lever 2 - 3 times to settle throttle plates.
4. Look for the throttle opening indication in the **Close Throttle** area.

NOTE: The **Throttle Opening** indication must be within the following specification.

THROTTLE OPENING SPECIFICATION
(0 % ± 0.2)



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THROTTLE OPENING INDICATION

If the throttle opening is within the % specification, DO NOT carry out the **Closed Throttle Reset** unless the following parts were replaced:

– Engine control module (ECM)
– Throttle body
– Throttle position sensor (TPS).

If TPS is not within specification, carry out the **Closed Throttle** reset procedure that follows.

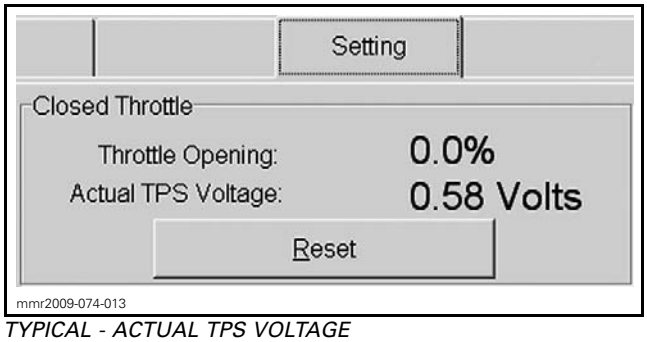
Closed Throttle Reset Procedure (TPS)

1. **Ensure** throttle cable is properly adjusted, refer to *THROTTLE CABLE ADJUSTMENT* in this subsection.
2. Activate throttle lever 2 - 3 times to settle throttle plate.

NOTICE **Proper throttle cable adjustment must be verified before proceeding with the Closed Throttle reset.**

3. In B.U.D.S.
   - 3.1 Select the **Setting** tab.
   - 3.2 Select the **ECM** tab.
4. In the **Closed Throttle** area, confirm the **Actual TPS Voltage** is within specification.

ACTUAL TPS VOLTAGE SPECIFICATION
0.3 to 0.7 Volts

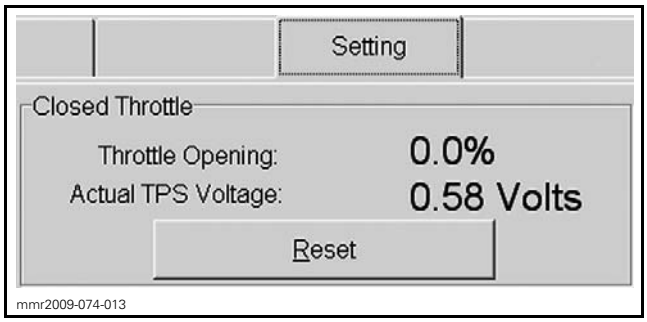


TYPICAL - ACTUAL TPS VOLTAGE

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*.

5. Press on the **Reset** button.
6. Confirm **Throttle Opening** value indicates 0.0%.

NOTE: A throttle opening of 0.0% after reset indicates the operation is successful.



TYPICAL - THROTTLE OPENING MUST BE 0.0%

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

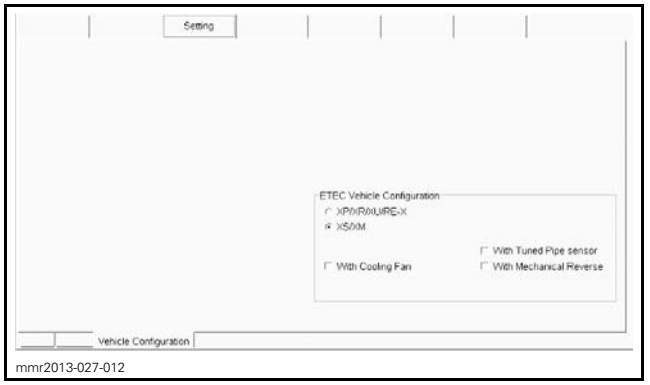
Engine problems are not necessarily related to the injection system.

It is important to ensure the mechanical integrity of the engine is present.

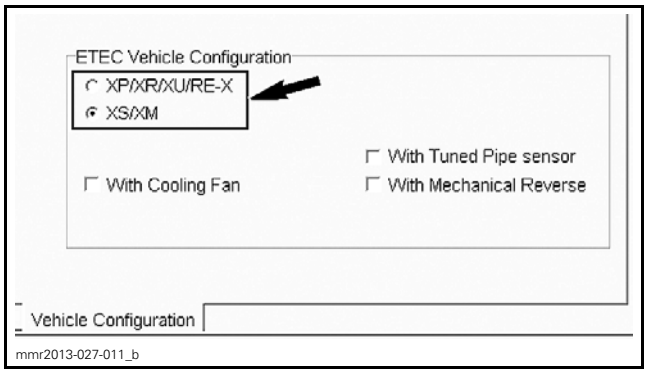
No Engine Acceleration, No Throttle Response

If this occurs, use B.U.D.S. and check the following.

1. Select the **Setting** tab then **Vehicle Configuration**.



2. In the **Vehicle Configuration** page:
   - 2.1 Ensure the proper vehicle platform is selected in the **ETEC Vehicle Configuration** area.



Spark Plugs

800R E-TEC Only

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 *IGNITION SYSTEM* 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:

– 55/60V 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 (55/60 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

Oetiker Clamp Removal and Installation

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

Always use a shop rag when disconnecting a fuel hose.

⚠ CAUTION **Fuel system is under high pressure.**

⚠ WARNING

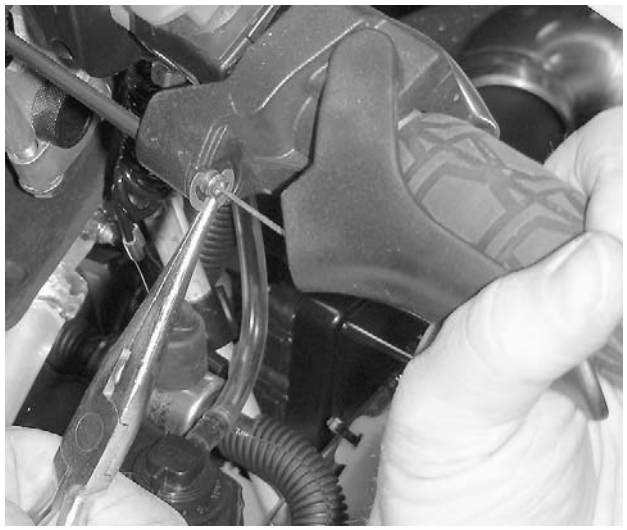
- Never use a hose pincher on high pressure hoses.
- Never change the routing of a fuel hose.
- Always reinstall the corrugated protective tubing on fuel hoses.
- Secure fuel hoses using the appropriate locking tie or fastener to prevent contact with sharp edges or hot, rotating and moving parts.
- After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

Throttle Cable Removal

1. Remove handlebar cover.
2. Depress and hold throttle lever.
3. Pull out circlip using long nose pliers. Keep circlip for re-use.



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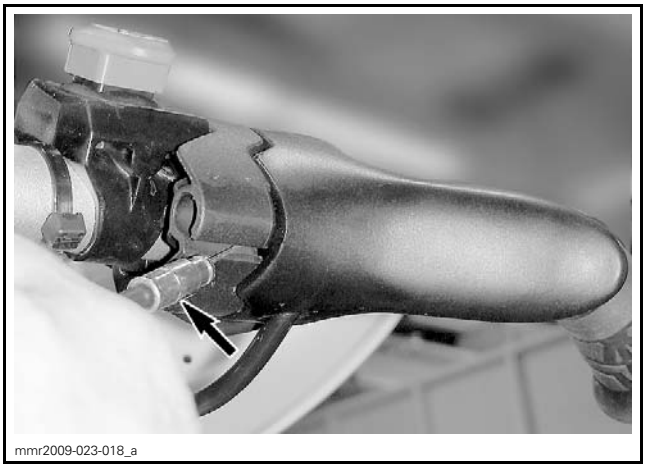
4. Pull throttle cable out of the throttle lever housing.



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5. Unhook cable end barrel from throttle lever and remove cable.

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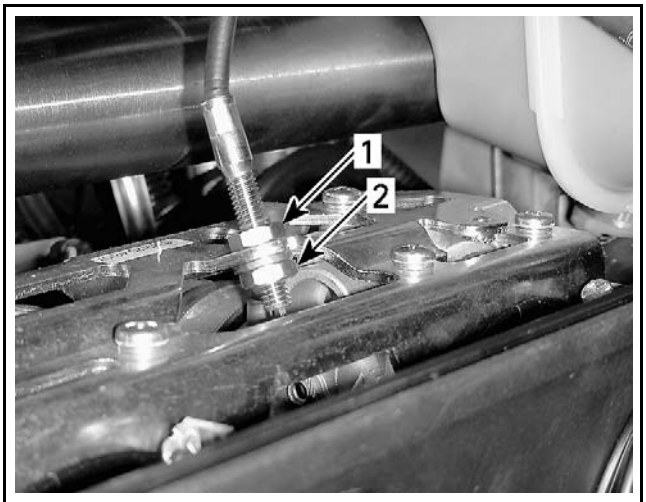
NOTE: Take note of cable routing before removal.

6. Remove drive belt guard. Refer to *DRIVE BELT* subsection.
7. Remove primary air intake silencer. Refer to *AIR INTAKE SYSTEM* subsection.
8. At throttle body, fully unscrew cable adjuster lock nut.



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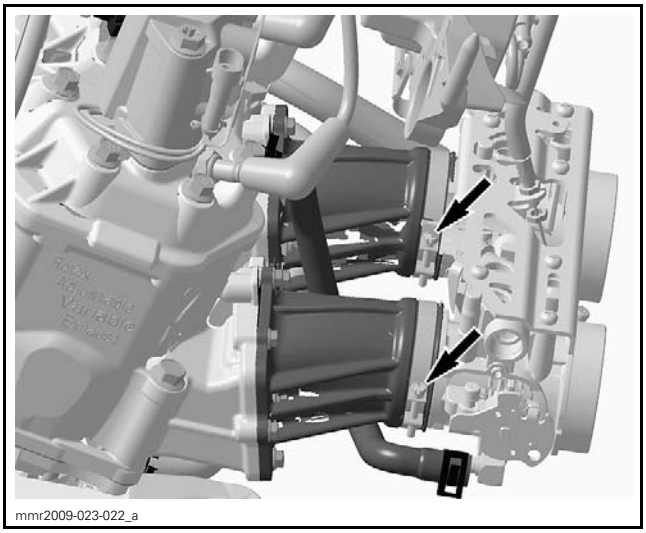
1. Adjustment nut
2. Lock nut

9. Loosen throttle body retaining clamps and remove throttle body from air intake adapters.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10. Pull out throttle body sufficiently to unhook throttle cable end.


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11. Remove throttle cable.

Throttle Cable Installation

Reverse removal procedure however, pay attention to the following.

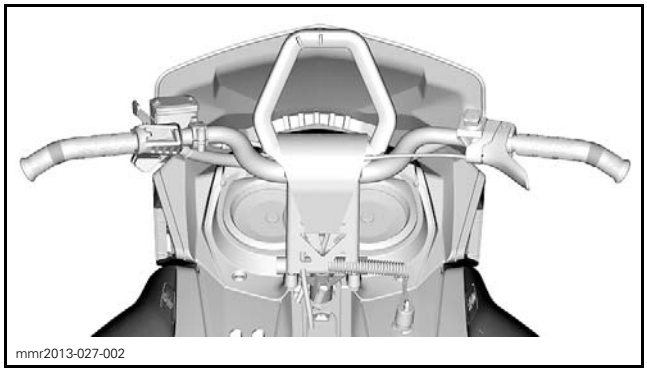
Route cable as noted prior to removal.

Ensure that cable ends are properly secured in their levers.

Proceed with throttle cable adjustment.

Throttle Cable Adjustment

1. Position handlebar straight and level.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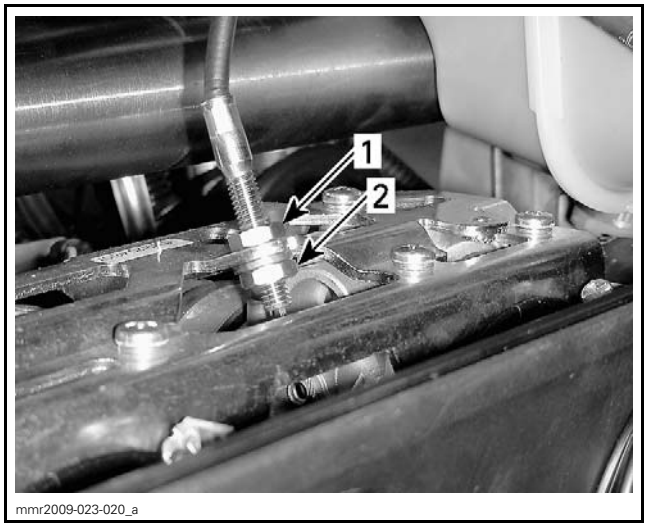
TYPICAL - HANDLEBAR IN STRAIGHT AHEAD POSITION

2. Turn throttle cable adjuster nut until the following is observed:
   – Throttle plate stopper is in contact with master zero position screw
   – Throttle cable is slightly loose (cable free play).



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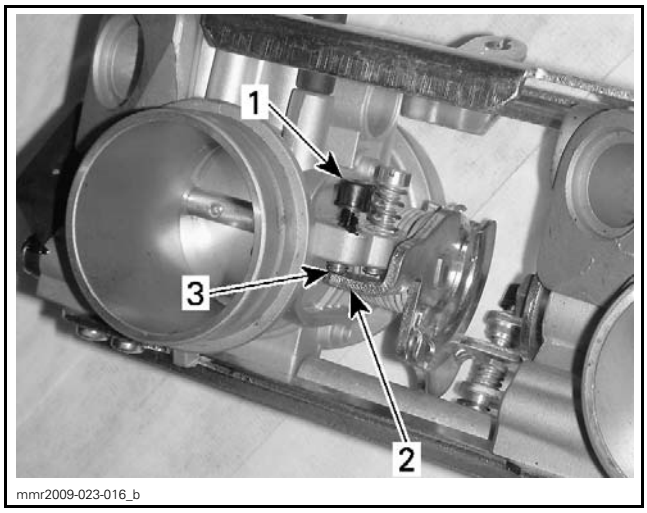
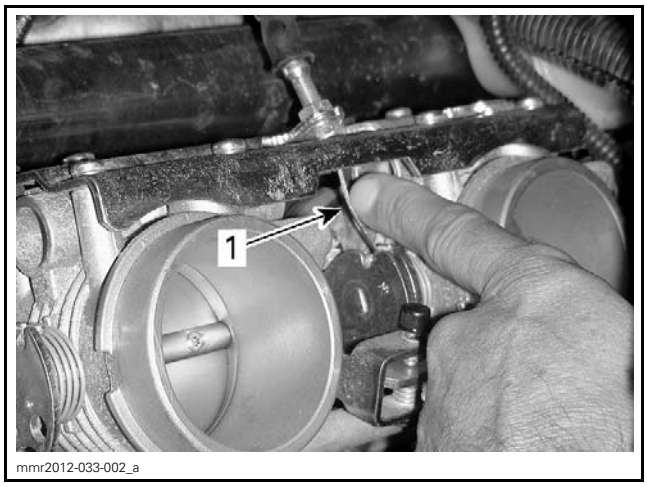
THROTTLE CABLE ADJUSTER
1. Adjuster nut (top)
2. Adjuster lock nut (Bottom)



THROTTLE BODY MASTER ZERO POSITION
1. *Master zero position screw (black)*
2. *Throttle plate stopper*
3. *Contact here*

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*

3. Activate and release throttle lever 2 - 3 times to settle throttle plate.
4. Confirm throttle plate stopper is STILL in contact with master zero position screw.
5. Readjust throttle cable if necessary.
6. Carry out the *THROTTLE CABLE OPERATING RANGE INSPECTION WITH B.U.D.S.*

Throttle Cable Operating Range Inspection with B.U.D.S.

1. In B.U.D.S.
   1.1 Select the **Monitoring** tab.
   1.2 Select the **ECM** tab.
2. Fully depress throttle lever and hold.
   2.1 Confirm throttle opening is within specification.

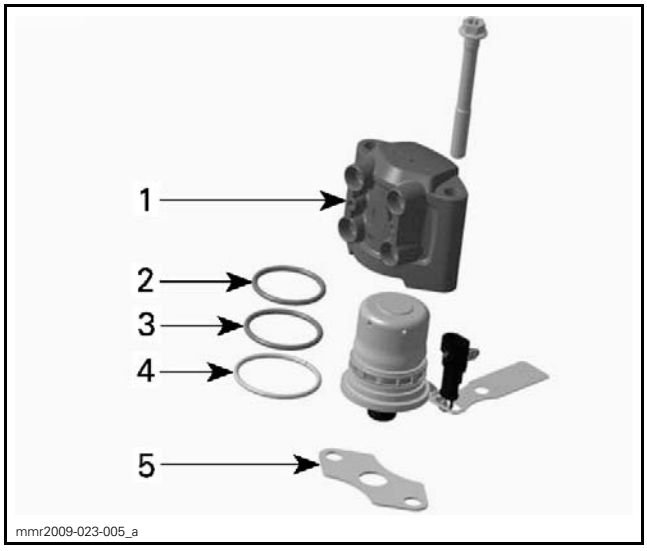
THROTTLE OPENING SPECIFICATION (WIDE OPEN THROTTLE)
95% to 100%

THROTTLE CABLE OPERATING RANGE

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

FUEL INJECTOR



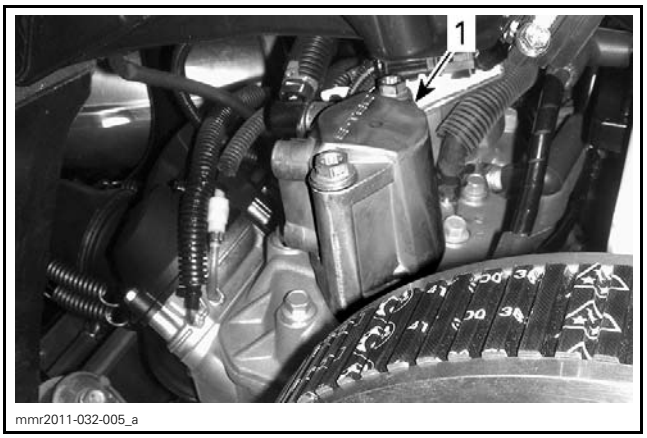
1. *Fuel injector housing*
2. *Top O-ring*
3. *Bottom O-ring*
4. *Crush ring*
5. *Thermal insulator*

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 B.U.D.S. so that the ECM properly controls the fuel injector.

Fuel Injector Visual Inspection

1. Open LH panel.
2. Remove drive belt guard. Refer to *DRIVE BELT* subsection.
3. Visually inspect the fuel injector area.



1. Fuel injector

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.

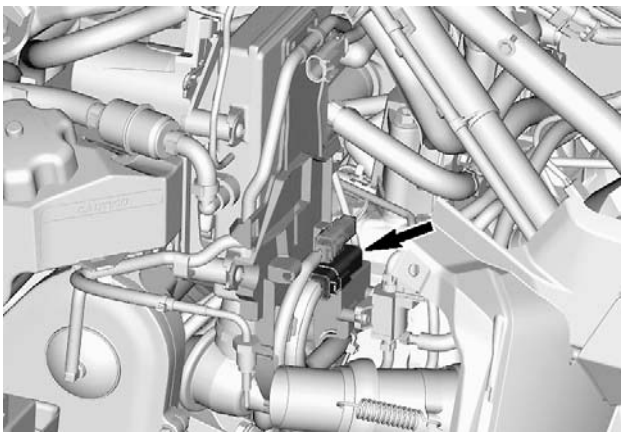
Fuel Injector Leak Test

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 (6-pin connector). Refer to *Stator Connector* in *CHARGING SYSTEM* 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. Release fuel pressure. Refer to *FUEL TANK AND FUEL PUMP*.

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.
5. Unlock ECM support to move ECM as necessary to lift fuel injectors.

NOTE: Fuel injector leak test can be done on one injector at a time or on both injectors simultaneously.

6. Unscrew both fuel injectors. Refer to *FUEL INJECTOR REMOVAL* in this subsection.
7. 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.

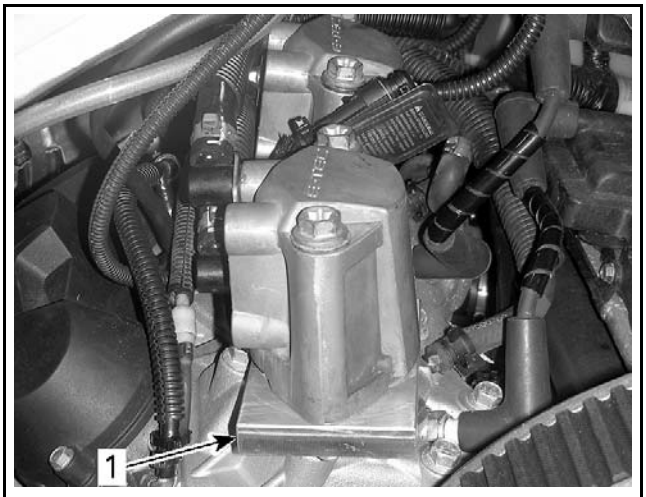

mmr2012-033-003

TYPICAL

NOTE: Do not install the thermal insulators against fuel injectors.

8. Secure each fuel injector to an INJECTOR RETAINER PLATE (P/N 529 036 137).


529036137



mmr2012-033-004_a

TYPICAL
1. Fuel injector retainer plate

NOTICE Ensure to position machined groove in the retainer plate on the fuel injector wiring side.

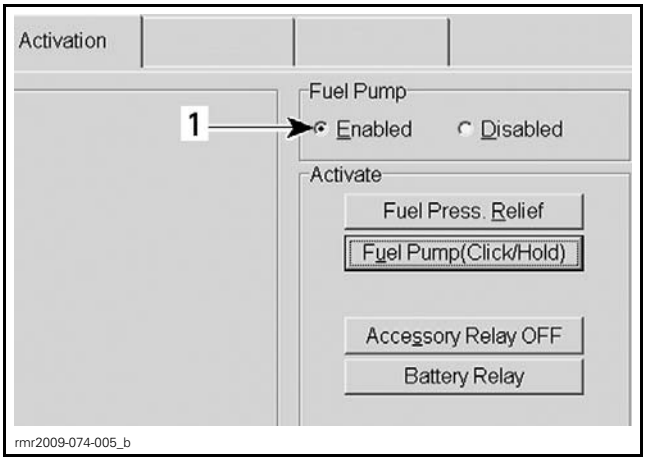
⚠ WARNING

Fuel injector must be secured during the leak test to avoid the fuel injector to be projected.

9. Place an appropriate container under the fuel injectors.
10. Ensure spark plug caps are installed on spark plugs.
11. Ensure there is enough fuel in fuel tank.
12. Connect vehicle to latest applicable B.U.D.S. version. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

Leak Test

1. In B.U.D.S., select the **Activation** tab.
2. Ensure fuel pump is enabled.

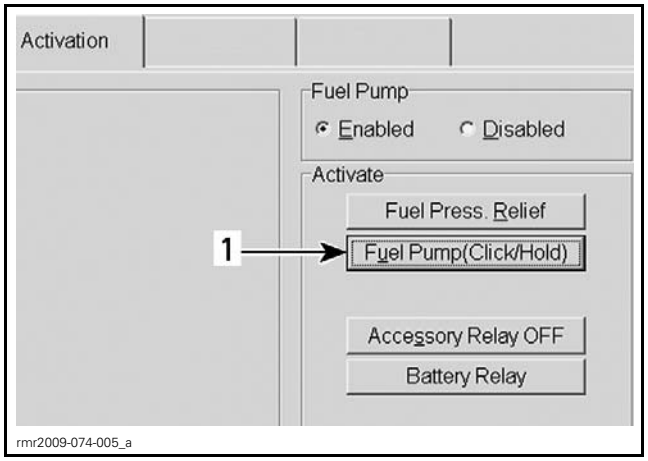


rmr2009-074-005_b

ACTIVATION TAB
1. Pump enabled

3. Click and hold the **Fuel Pump** button.

NOTE: Fuel pump will operate as long as button is held depressed in B.U.D.S.



ACTIVATION TAB
1. *Click and hold*

4. Check for fuel leakage from the fuel injector nozzle.
5. 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

6. If test is not within specification, replace the faulty fuel injector.
7. Properly reinstall fuel injectors. Refer to *FUEL INJECTOR INSTALLATION* in this subsection.
8. Reinstall remaining removed components.
9. Connect magneto connector.

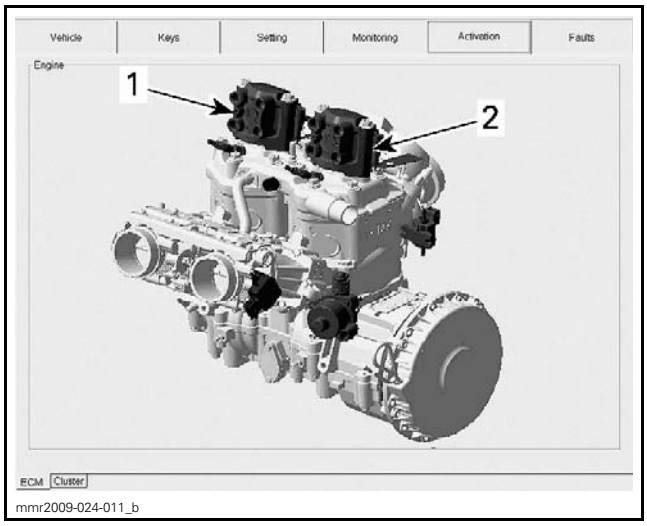
⚠ WARNING

Wipe up any spilled fuel.

Fuel Injector Functional Test

NOTE: This test is valid if one of the fuel injectors functions normally when activated.

1. Connect vehicle to latest applicable B.U.D.S. version. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Select the **ECM** and **Activation** tabs.
3. Activate the fuel injector by clicking on it in B.U.D.S.



ACTIVATION TAB
1. *Click on PTO fuel injector to activate*
2. *Click on MAG fuel injector to activate*

NOTE: The fuel injector action should be felt. If the fuel injector does not function, connect it to the opposite fuel injector connector, then test again.

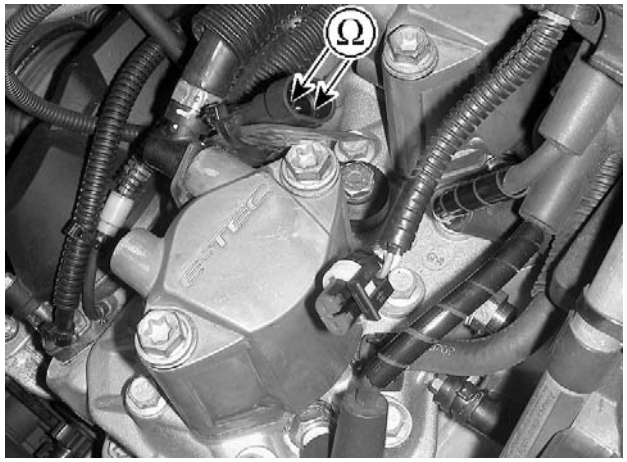
If the suspected fuel injector functions normally with the opposite fuel injector connector, carry out the *FUEL INJECTOR INPUT VOLTAGE TEST* in this subsection.

If the fuel injector still does not function, carry out the *FUEL INJECTOR RESISTANCE TEST*.

Fuel Injector Resistance Test

1. Remove upper body module. Refer to *BODY* subsection.
2. Disconnect the fuel injector connector.
3. Measure fuel injector resistance directly on its terminals.

FUEL INJECTOR		MEASUREMENT @ 22°C (72°F)
Pin 1	Pin 2	Below 2.7 Ω



TYPICAL

If measurement is out of specification, replace fuel injector.

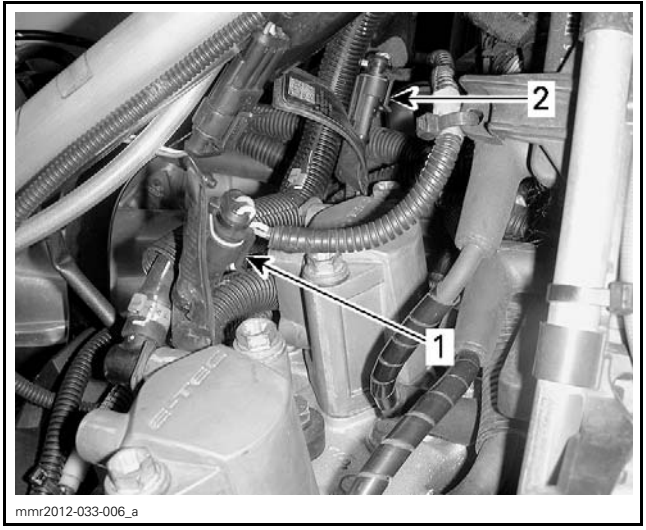
Fuel Injector Input Voltage Test

600 HO E-TEC Engine

1. Set emergency engine stop switch to RUN to enable ignition and injection.

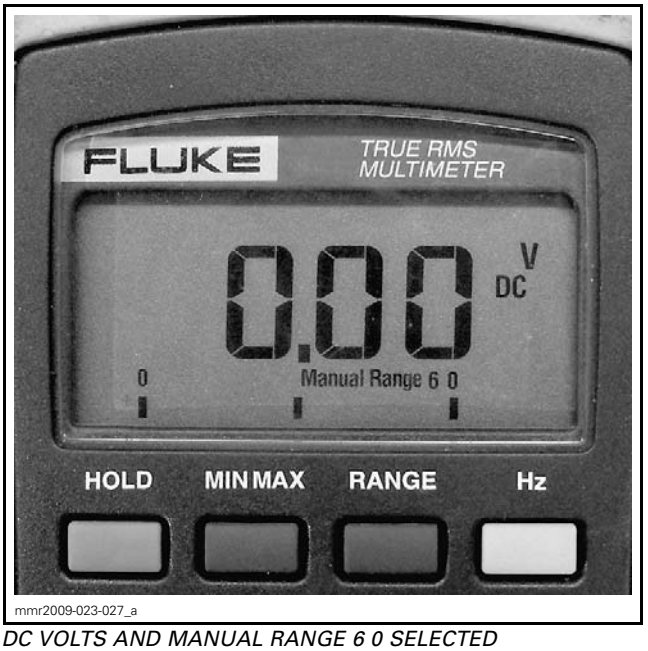
NOTE: Ensure magneto connector is properly connected.

2. Disconnect both electrical connectors from the fuel injectors.



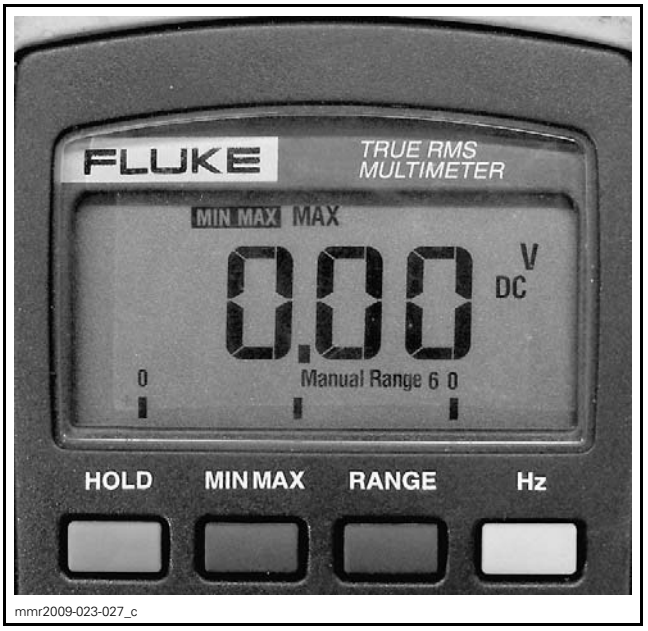
TYPICAL
1. PTO fuel Injector connector
2. MAG fuel injector connector

3. Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and set it to Vdc.
4. Repeatedly press the RANGE button until the display shows Manual Range 6 0.



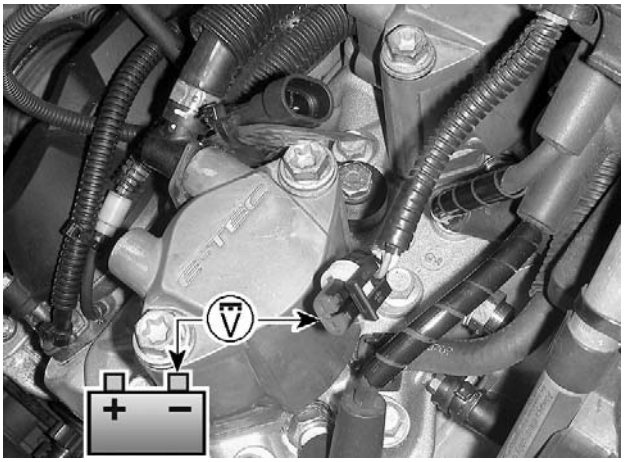
DC VOLTS AND MANUAL RANGE 6 0 SELECTED

5. Press the MIN MAX button so that the display shows MIN MAX.



MIN MAX SELECTED

6. Measure voltage while cranking engine.



TYPICAL

7. Read the MAX value.

FUEL INJECTOR CONNECTOR		MEASUREMENT
Pin 1	Battery ground	30 Vdc minimun

NOTE: Reset multimeter by pressing and holding MIN MAX button until meter beeps.

If voltage test is as per specification, carry out the *FUEL INJECTOR CONTROL CIRCUIT SIGNAL TEST*.

If voltage test is not as per specification, check wire continuity between ECM and fuel injector connector.

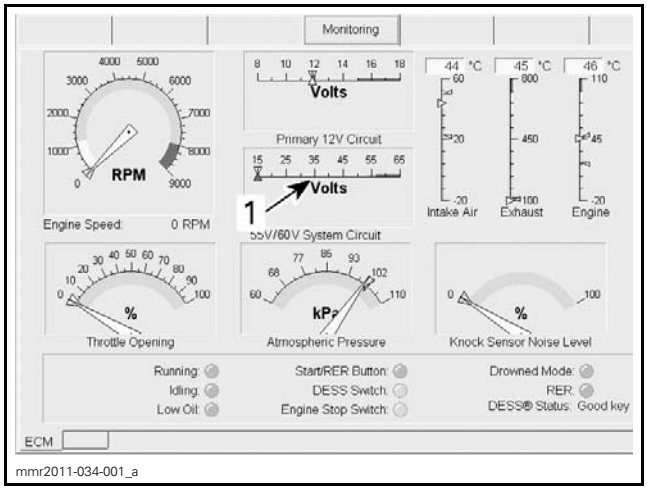
800R E-TEC Engine

NOTE: This test can also be used on the 600 HO E-TEC engine.

1. Connect vehicle to latest applicable B.U.D.S. version. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

In B.U.D.S., select Monitoring tab, thenECM tab.

2. Press and hold the START/RER button for a few seconds.
3. Read the voltage on the 55 V/60 V System Circuit meter in B.U.D.S. as the engine is being cranked.



1. 55 V/60 V System circuit

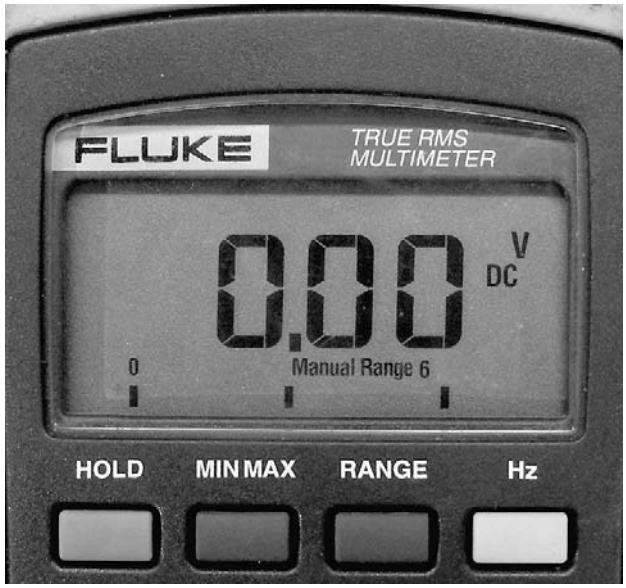
55 V/60 V SYSTEM CIRCUIT VALUE
30 Vdc minimun

If voltage test is as per specification, carry out the *FUEL INJECTOR CONTROL CIRCUIT SIGNAL TEST*.

If voltage test is not as per specification, check wire continuity between ECM and fuel injector connector.

Fuel Injector Control Circuit Signal Test

1. Connect vehicle to the latest applicable B.U.D.S. version. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and set it to Vdc (Hz).
3. Repeatedly press the RANGE button until the display shows Manual Range 6.



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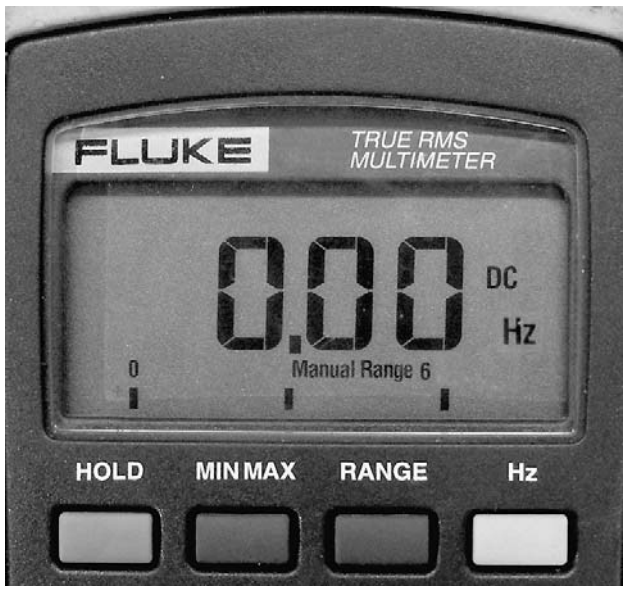
DC VOLTS AND MANUAL RANGE 6 SELECTED

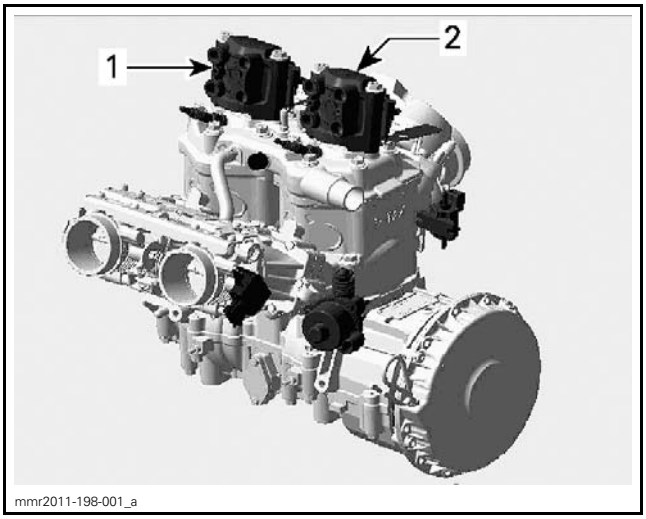
4. Press the **Hz** button so that the display shows Hz.



mmr2009-023-027_b

Hz SELECTED

5. In B.U.D.S., select the **Activation** and **ECM** tabs.
6. Activate fuel injector and read the frequency on the multimeter.

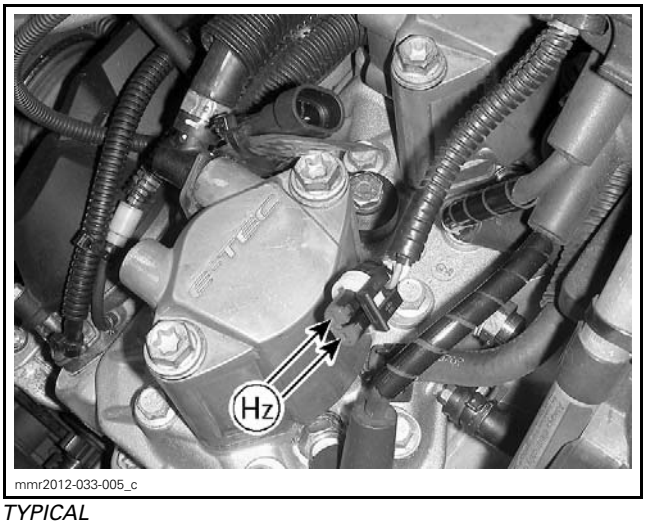


mmr2011-198-001_a

ECM, ACTIVATION PAGE
1. PTO injector activation
2. MAG injector activation

NOTE: The multimeter counts the pulses per minute (Hertz) of current the ECM sends to the fuel injector.

FUEL INJECTOR CONNECTOR		MEASUREMENT
Pin 1	Pin 2	Approximately 2 Hz



mmr2012-033-005_c

TYPICAL

If there is no reading, check continuity of wiring between ECM and fuel injector connector.

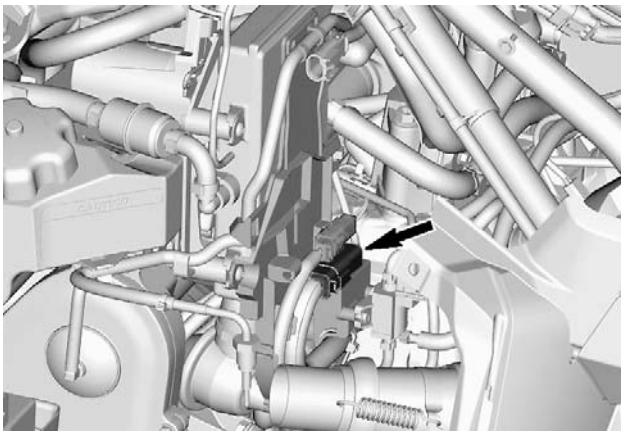
If reading is good, the control circuit is functional.

Fuel Injector Removal

IMPORTANT: NEW O-rings 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. Remove upper body module. Refer to *BODY* subsection.

2. Disconnect magneto connector (6-pin connector). Refer to *Stator Connector* in *CHARGING SYSTEM* subsection.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⚠ 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.

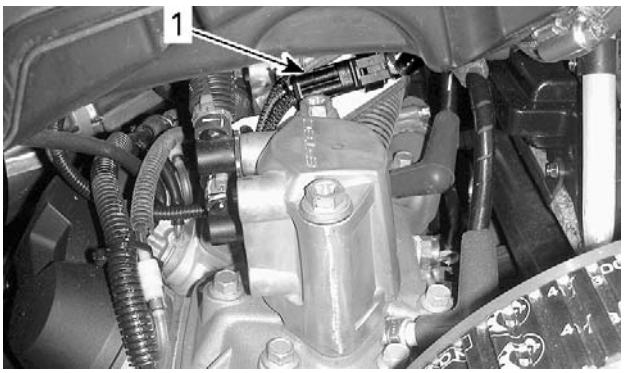
3. Clean fuel injector area.
4. Release the fuel pressure in the system. Refer to *FUEL TANK AND FUEL PUMP* subsection.

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.

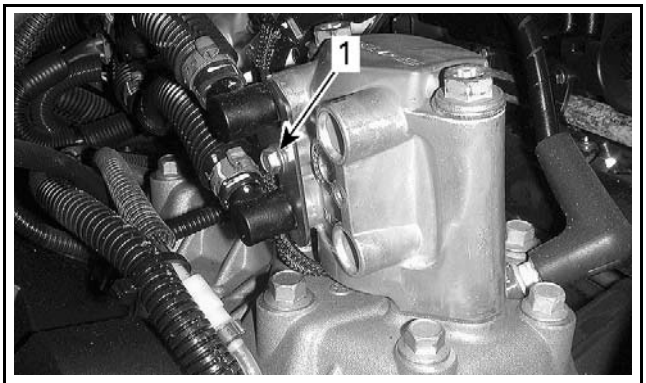
5. Disconnect fuel injector connector.



mmr2011-032-009_a

TYPICAL
1. Fuel injector connector

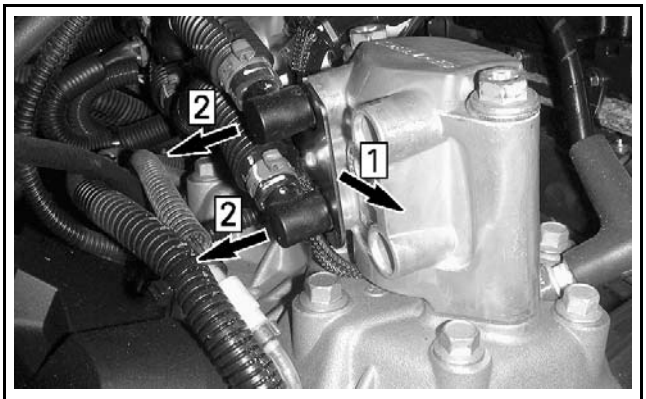
6. Install a rag under the hose ends to catch fuel spillage.
7. Remove fuel hose retainer screw.



mmr2011-032-007_a

1. Fuel hose retainer screw

8. Slide the fuel hose retainer out and disconnect fuel hoses from fuel injector.



mmr2011-032-006_a

Step 1: Remove fuel hose retainer
Step 2: Remove fuel hoses

⚠ WARNING

More fuel than usual will flow out of the fuel injectors. Work in a well ventilated area and wipe up spilled fuel.

9. Remove fuel injector screws.

10. Gently pull up on the fuel injector to remove it.

NOTE: If a fuel injector is to be reinstalled, mark it (MAG or PTO) to reinstall it in the same cylinder position.

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.

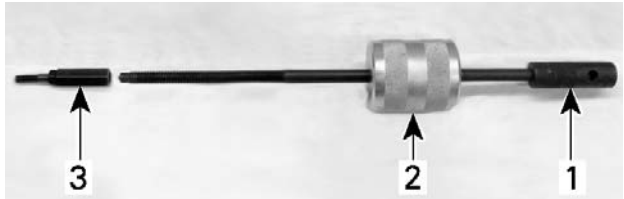
Fuel Injector Disassembly

To remove fuel injector from its housing, use a Snap-on slide hammer puller including:

– SNAP-ON SCREW (P/N CJ93-1)

– SNAP-ON HAMMER (P/N CJ125-6).

1. Install the EXTRACTOR ADAPTOR (P/N 529 036 136) on the Snap-on screw.



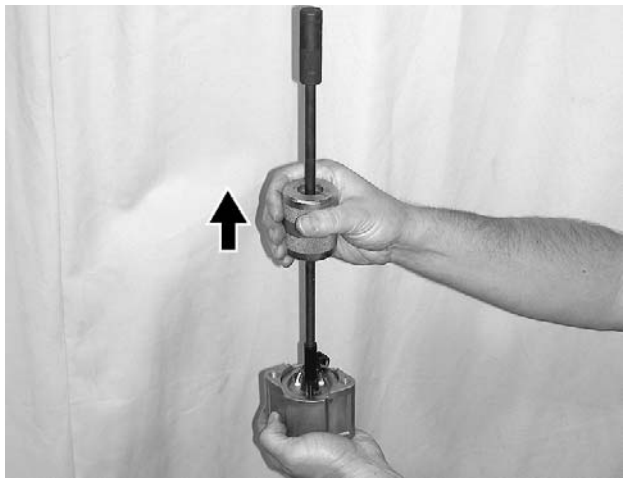
mmr2009-023-032

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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mmr2009-023-034

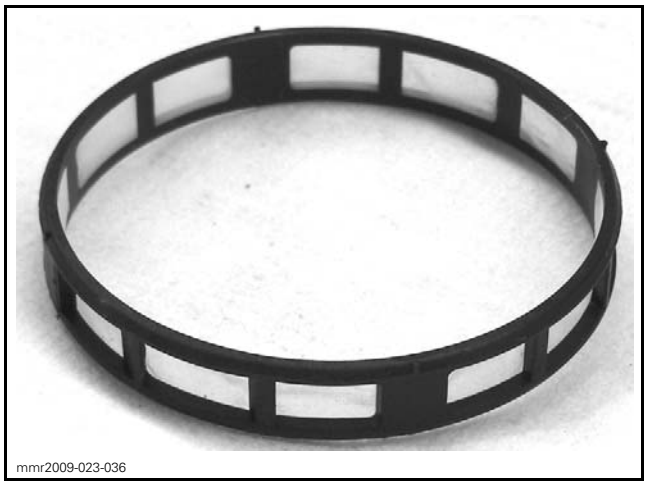
5. Remove the extractor adaptor from the fuel injector.

6. Remove O-rings, crush ring and filter from the fuel injector.

mmr2009-023-035_b

1. Crush ring
2. ORANGE O-ring
3. Filter
4. BLUE O-ring

7. Inspect and clean fuel injector filter.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Fuel Injector Assembly

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

IMPORTANT: Apply injection oil on O-rings.

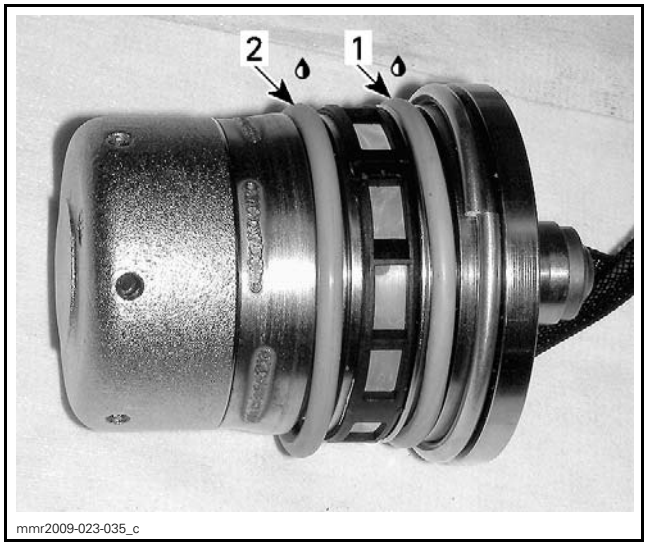
Install a new crush ring.

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.



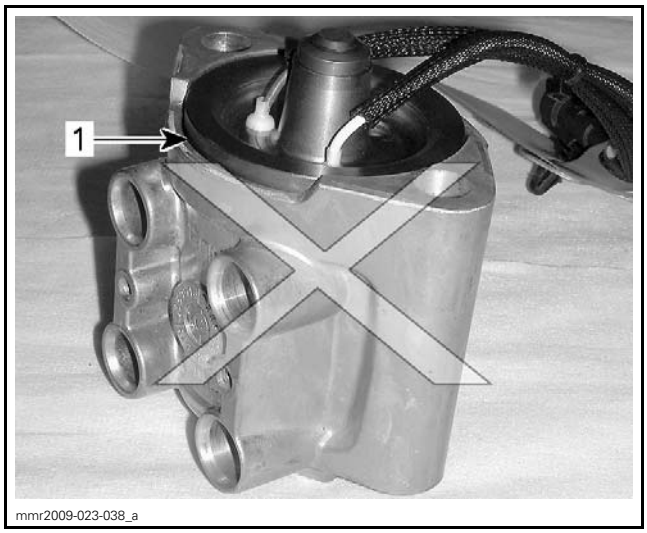
mmr2009-023-035_c

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.



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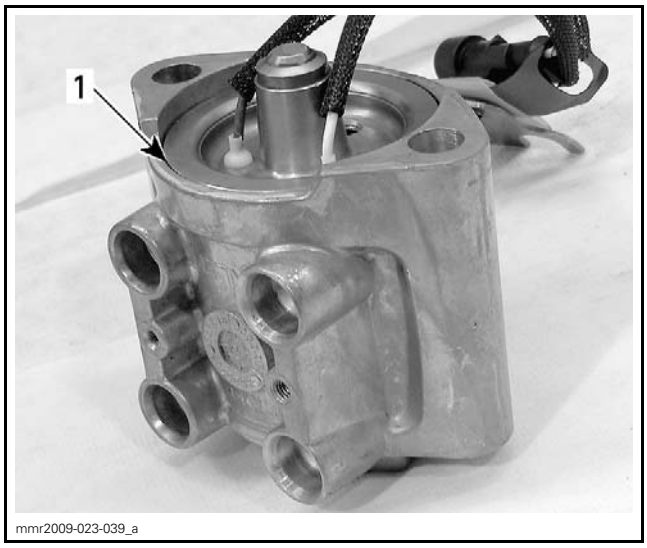
WRONG INSTALLATION
1. Fuel injector not fully inserted in its housing



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CORRECT INSTALLATION
1. Fuel injector fully inserted in its housing

Fuel Injector Installation

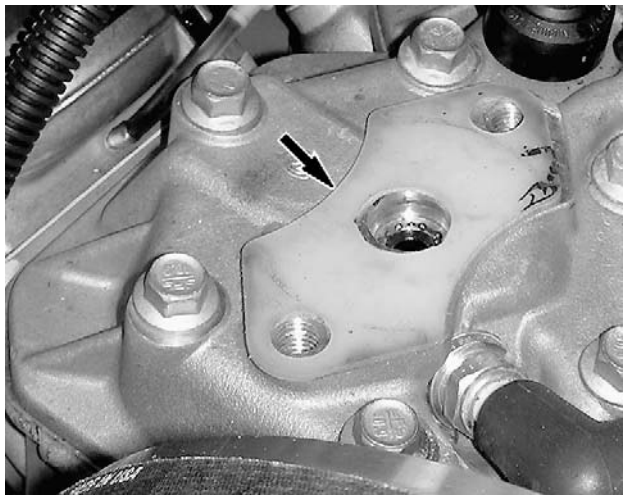
The following items and their mating surfaces must be cleaned and inspected prior to assembly:

– 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 B.U.D.S. Refer to *FUEL INJECTOR POSITION VALIDATION*.

1. Position the thermal insulator on cylinder head.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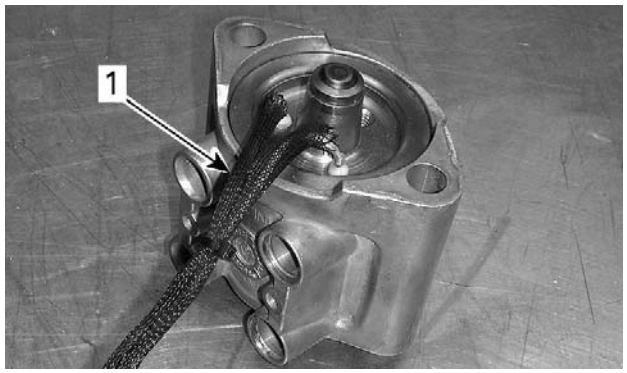
2. Route the fuel injector wires towards the fuel ports.



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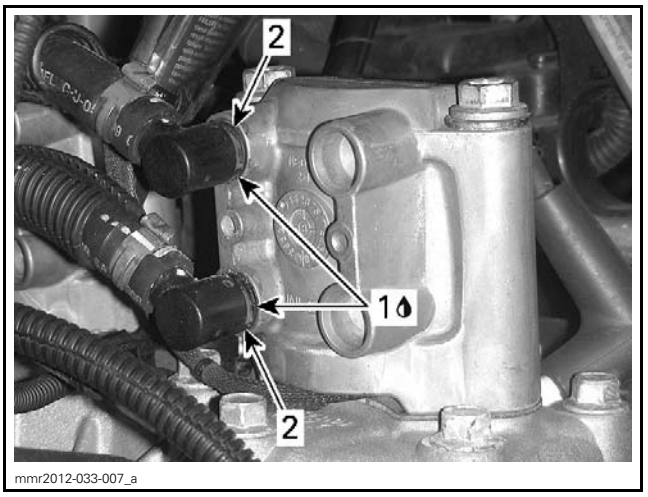
1. Fuel injector wires towards fuel ports

3. Place the fuel injector on the cylinder head, then thread in NEW screws with NEW washers.

NOTICE **Torque fuel injector retaining screws prior to installing fuel hoses.**

4. Tighten both injector retaining screws alternately in the following sequence:
   - 4.1 Hand tighten until the screw heads contact the fuel injector housing
   - 4.2 5 N•m (44 lbf•**in**)
   - 4.3 25 N•m (18 lbf•ft)
   - 4.4 60 N•m (44 lbf•ft).

5. Check condition of fuel hose O-rings and plastic flange on hose fittings.
6. Apply injection oil on O-rings.
7. Insert fuel hoses in fuel injector housing.

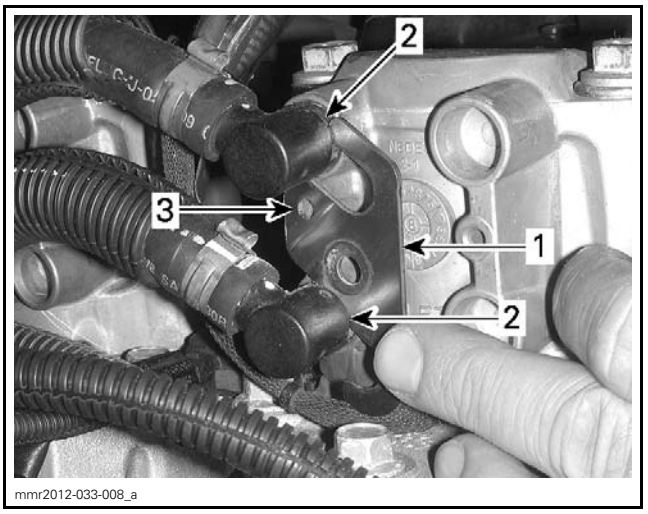


mmr2012-033-007_a

TYPICAL
1. Injection oil on O-rings
2. Hose fittings fully inserted here

NOTE: Both hose fittings must be fully seated in the fuel injector housing.

8. Insert the hose retainer so that it engages the groove in the fuel injector fittings.



mmr2012-033-008_a

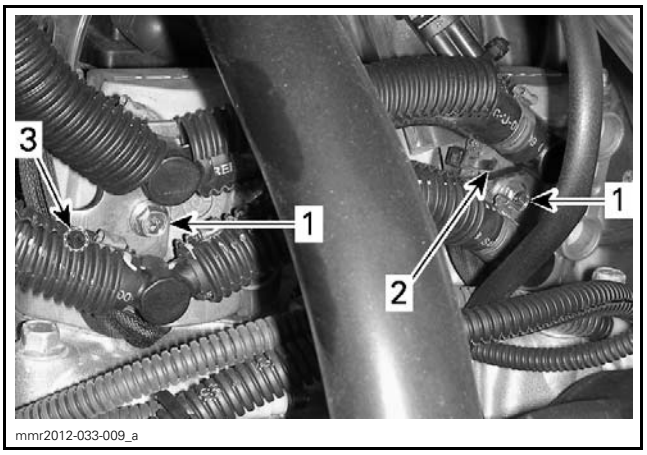
TYPICAL
1. Retainer
2. Retainer engagement in fuel injector fitting groove
3. Hole for securing injector wiring (up on PTO side)

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.

9. 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.

10. Torque fuel hose retainer screw to 5 N•m (44 lbf•**in**).



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1. NEW fuel hose retainer screw
2. PTO injector wiring secured with locking tie
3. MAG injector wiring secured with locking tie (not visible)

11. Secure fuel injector wiring using a new locking tie.
12. Apply some DIELECTRIC GREASE (P/N 293 550 004) in fuel injector connector.
13. Reconnect fuel injector connector.

NOTICE Never fasten the electrical connector to the fuel injector. The connector must be "free floating".

14. If installing a **NEW** fuel injector, use B.U.D.S. 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

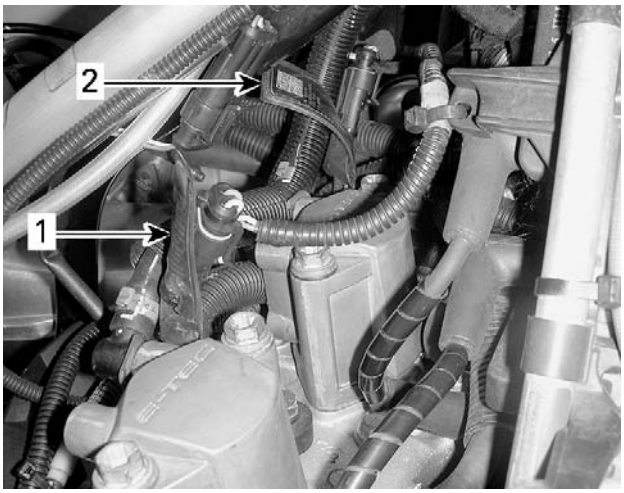
Perform a fuel pressure test and make sure there is no leak.

Fuel Injector Position Validation

When troubleshooting or reinstalling a fuel injector, the correct matching of the fuel injector and cylinder must be confirmed using B.U.D.S. 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.*

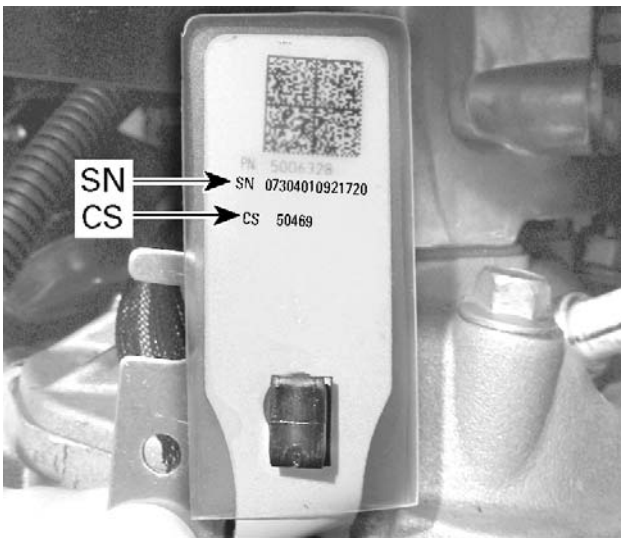
1. Look for the fuel injector identification tag.



mmr2012-033-006_b

TYPICAL
1. PTO fuel injector tag
2. MAG fuel injector tag

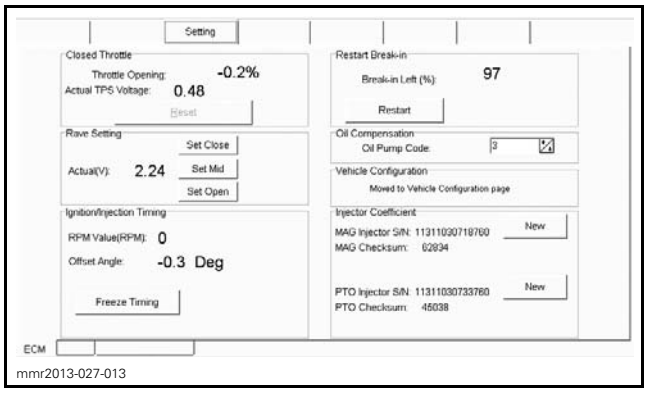
2. Note the fuel injector serial number (SN) on the tag of the fuel injector you wish to validate.



mmr2009-019-023_b

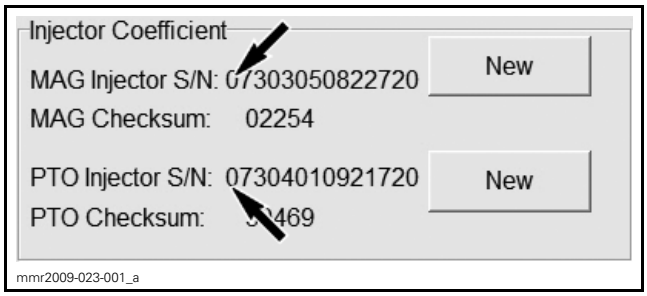
SN: Serial number
CS: Checksum number

3. In B.U.D.S., select **Setting** and **ECM** tabs.



mmr2013-027-013

4. In the **Injector Coefficient** box, look for the fuel injector serial numbers (S/N) that are registered in the ECM.



mmr2009-023-001_a

PTO AND MAG INJECTOR S/N

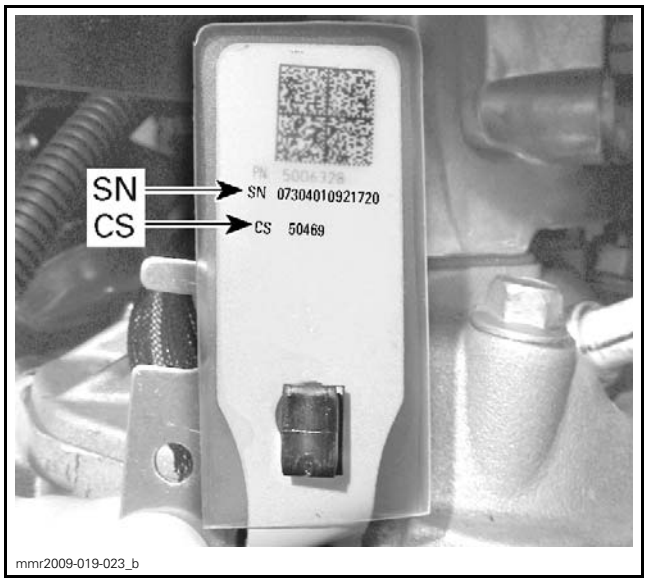
5. Compare the **MAG** or **PTO Injector S/N** that is configured in the ECM with the fuel injector SN installed on the engine.

NOTICE **The actual fuel injector number (SN) must match the number in B.U.D.S. (Injector S/N). If not, check if fuel injectors have been installed in the wrong position (or replaced).**

If numbers do not match, configure the fuel injector in B.U.D.S. Refer to *SETTING A FUEL INJECTOR TO A CYLINDER.*

Setting a Fuel Injector to a Cylinder

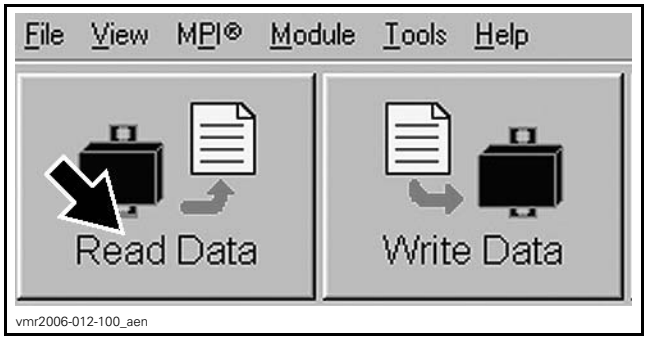
1. Note the serial number (SN) and the checksum number (CS) on the fuel injector tag.



mmr2009-019-023_b

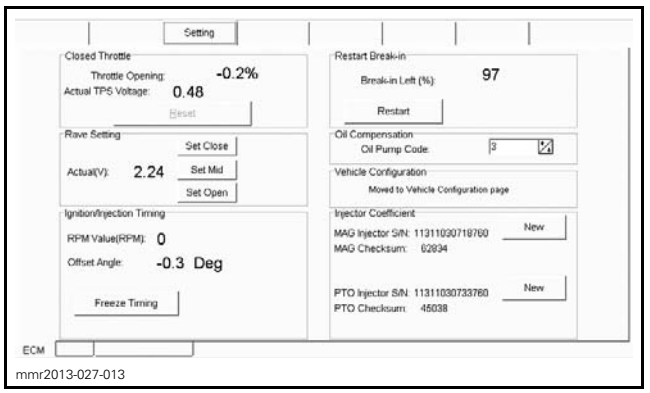
SN: Serial number
CS: Checksum number

2. Using BOSSWeb, download the matching calibration file.
3. Save the calibration file to your PC computer in the folder:
   C:\Program Files\BRP\BUDSCommon\InjectorCoefficients.
4. Start B.U.D.S. and click on the **Read Data** button.



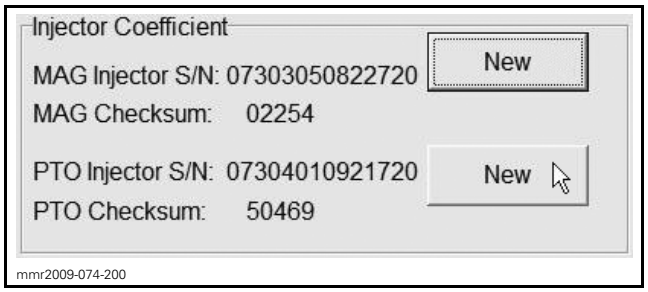
vmr2006-012-100_aen

5. Select **Setting** and **ECM** tabs.



mmr2013-027-013

6. In the **Injector Coefficient** box, click on the **New** button of the fuel injector you want to replace (MAG or PTO).

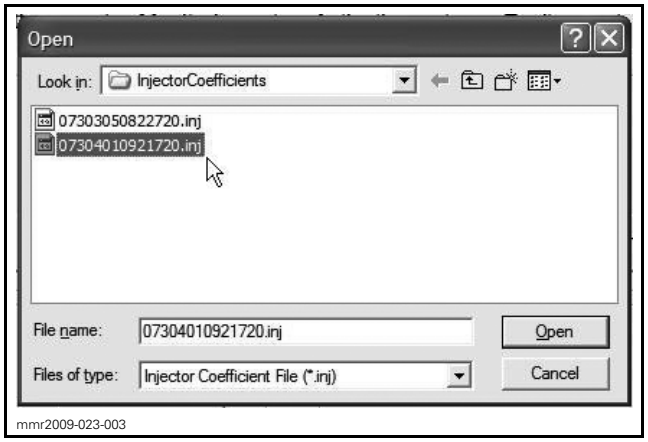


mmr2009-074-200

ECM TAB UNDER SETTING TAB

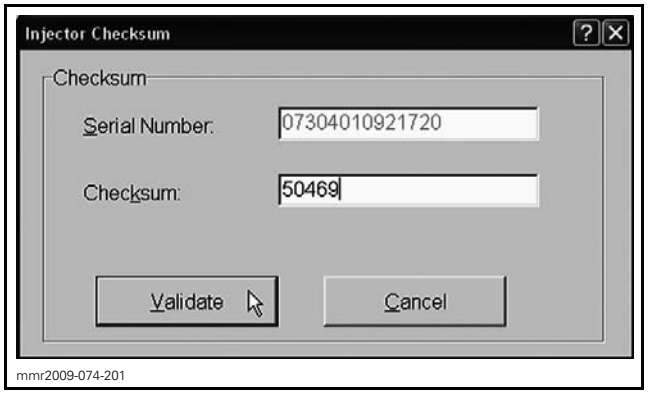
NOTE: Every time the **New** button is clicked, B.U.D.S. will automatically open the **Injector Coefficients** folder.

7. Select and open the fuel injector serial number file that matches the fuel injector installed on the engine.



mmr2009-023-003

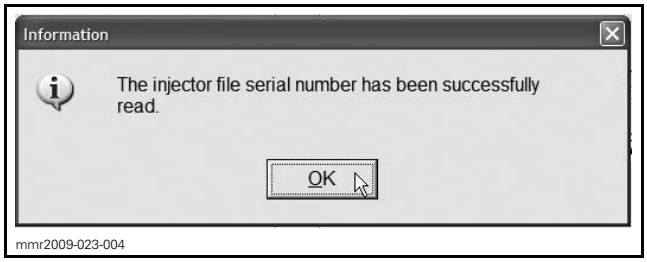
8. Enter the checksum number noted earlier and select **Validate**.



mmr2009-074-201

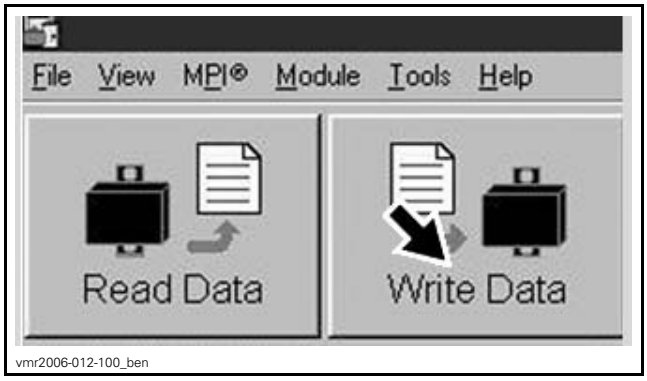
NOTE: The file will be quickly read and loaded in B.U.D.S.

9. Click the **OK** button when the confirmation box appears.



mmr2009-023-004

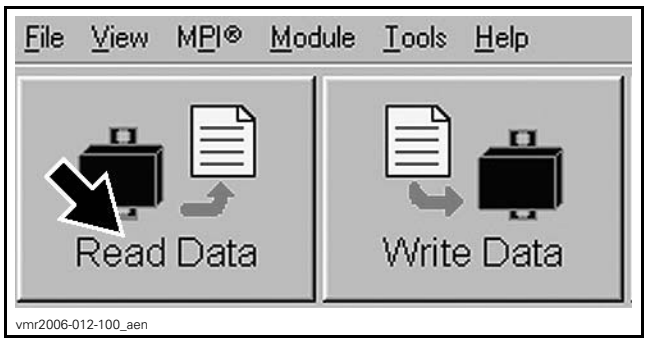
10. Click on the **Write Data** button to save the changes to the ECM.



vmr2006-012-100_ben

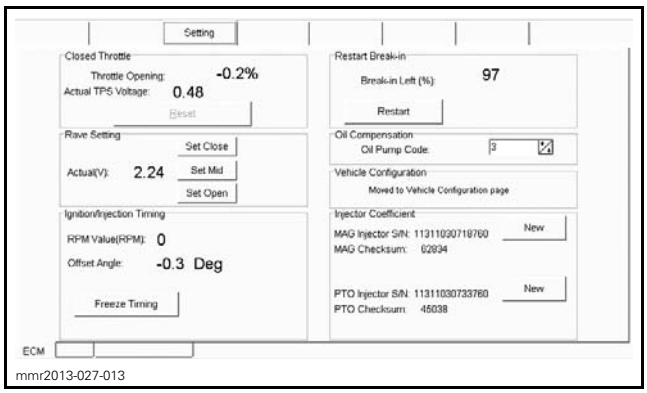
IMPORTANT: To ensure the proper file has been saved in the ECM, do the following:

11. Click on the **Read Data** button again in B.U.D.S.

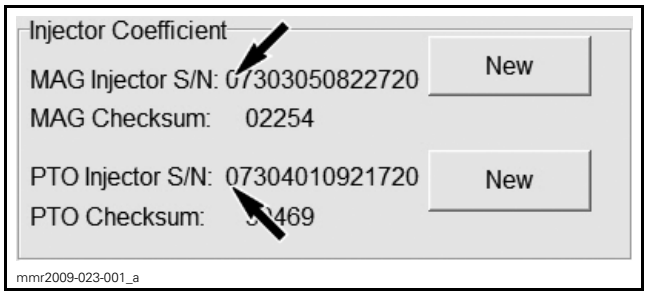


vmr2006-012-100_aen

12. Look in the **Injector Coefficient** area in the ECM **Setting** page.



mmr2013-027-013



mmr2009-023-001_a

13. Ensure the S/N in B.U.D.S. matches the SN of the fuel injector installed on the engine and the PTO/MAG numbers are not inverted.
14. If there is a mismatch, reload the proper configuration file. Write data and read it again to recheck.

NOTE

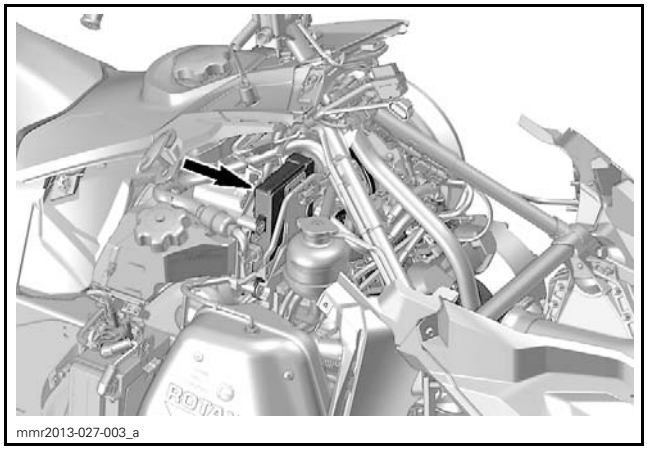
Every time an ECM is read or when an **.mpem** file is opened, the fuel injector calibration files (example: 07303050822720 and 07304010921720.inj) are automatically stored on your PC computer under a folder that will be common to all versions of B.U.D.S.:

C:\Program Files\BRP\BUDSCommon\ InjectorCoefficients.

If B.U.D.S. is uninstalled, the files won't be deleted.

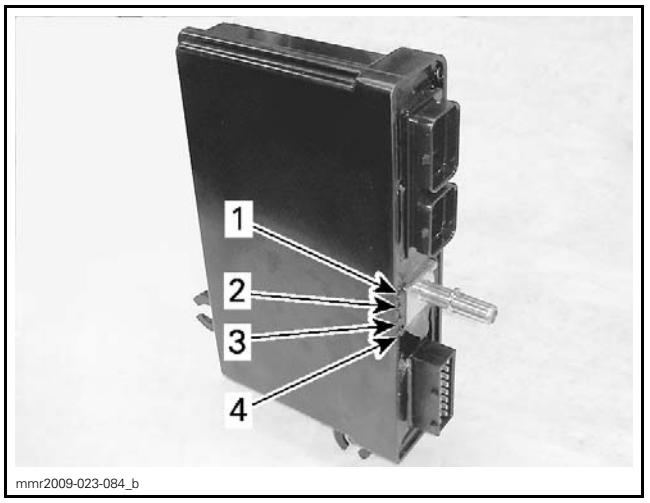
If you ever replace an ECM from which you were not able to read the data, you could load its latest **.mpem** file, look at the fuel injector serial numbers stored in the ECM and then read the matching calibration files from the common files without the need to download the file from BOSSWeb.

ECM (ENGINE CONTROL MODULE)


mmr2013-027-003_a

NOTE: Prior to replacing an ECM, carry out all testing procedures.

ECM Self Diagnostic LEDs



mmr2009-023-084_b

SELF DIAGNOSTIC LED
1. LED 1
2. LED 2
3. LED 3
4. LED 4

LED ON	ENGINE STARTING	ENGINE RUNNING
1	Charging OK	Charging fault
2	CPS signal OK	Fuel injection or ignition fault
3	Sensors OK	Sensor fault
4	Emergency and engine cut-off switch OK	No oil or engine overheat

ECM Pin Identification

CONNECTOR J1A (ALL E-TEC)	
FUNCTION	PIN
TPS in	1
Oil injection pump feedback switch + (**600 HO only**)	4
D.E.S.S. ground	5
CPS +	6
CPS	7
Emergency engine stop switch	9
TPS/RAVE position sensor +	10
D.E.S.S. signal	11
EGTS signal	12
CAN LO	13
CAN HI	14
ECM 12V power	15

CONNECTOR J1A (ALL E-TEC)	
FUNCTION	PIN
RAVE signal feedback	18
CTS signal	19
ATS signal	20
D.E.S.S. switch	23
TPS/RAVE position sensor ground	26
ATS/CTS ground EGTS ground (**600 HO only**)	27
START/RER switch signal	28
Oil level sensor +	29
Brake switch signal (**600 HO only**) Not used (**800R only**)	30
Not used (**600 HO only**) Oil injection pump feedback switch + (**800R only**)	32
Knock sensor +	33
Knock sensor ground	34

CONNECTOR J1B (600 HO E-TEC)	
FUNCTION	PIN
PTO fuel injector control	1
MAG fuel injector control	8
Starter solenoid control	9
ECM 12V power from diagnostic connector	10
Ground (fuel injectors)	14
PTO ignition coil control	19
Ground (fuel injectors)	20
Ground (fuel injectors)	21
E-RAVE solenoid control	22
Oil injection pump control	23
MAG ignition coil control	26

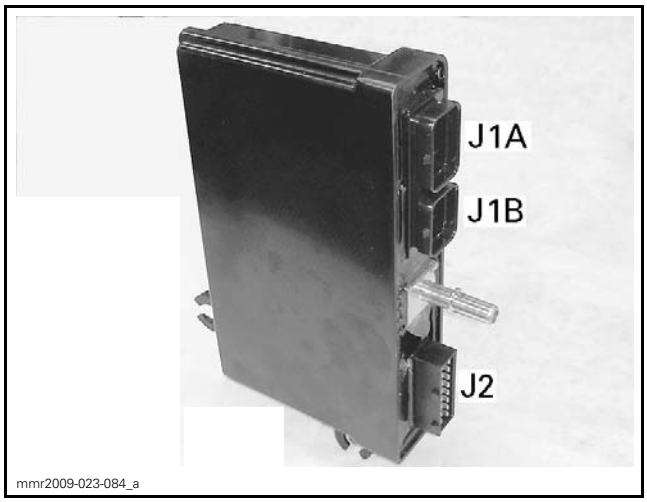
CONNECTOR J1B (800R E-TEC)	
FUNCTION	PIN
MAG fuel injector -	1
PTO fuel injector +	2
60V supply in	3
60V supply in	4

CONNECTOR J1B (800R E-TEC)	
FUNCTION	PIN
PTO fuel injector -	7
MAG fuel injector +	8
Starter solenoid control	9
ECM 12V power from diagnostic connector	10
Ground (fuel injectors)	14
PTO ignition coil control	19
Ground (fuel injectors)	20
Ground (fuel injectors)	21
E-RAVE solenoid control	22
Oil injection pump control	23
Brake switch signal	25
MAG ignition coil control	26

CONNECTOR J2 (ALL E-TEC)	
FUNCTION	PIN
Magneto winding	1
Magneto winding	2
Magneto winding	3
Fuel pump control	4
Ground	5
Secondary 12V supply (battery charging)	6
Ground	7
Ground	8
Magneto winding	9
Magneto winding	10
Magneto winding	11
Fuel pump flyback diode supply	12
55/60V power	13
Secondary 12V supply (battery charging)	14
Primary 12V supply	15
Primary 12V supply	16

ECM Connectors

ECM Connector Identification

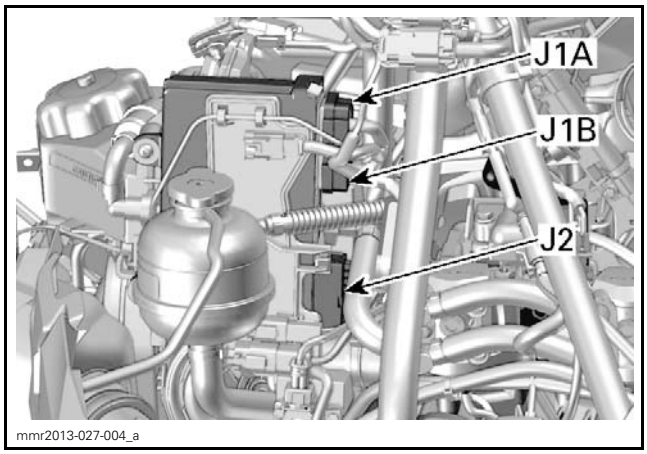


J1A: Signal pins
J1B: Signal pins
J2: Power terminals

ECM Connector Access

To access ECM connectors:

1. Remove upper body module. Refer to *BODY*.
2. Unlock ECM support to move ECM as necessary.

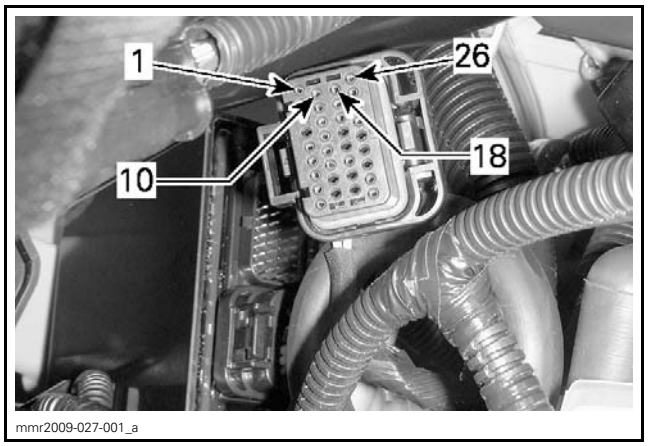


ECM CONNECTORS — PARTS REMOVED FOR CLARITY

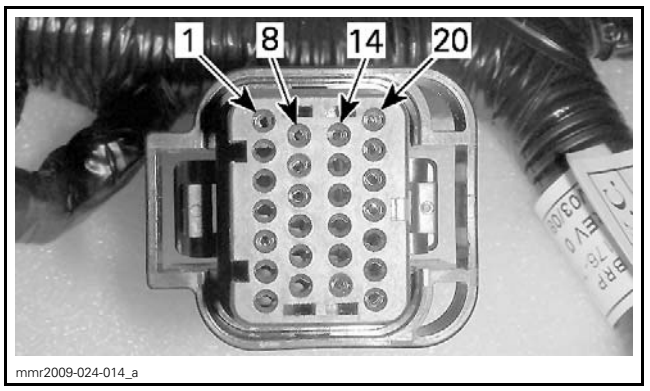
ECM Connector Removal

Refer to *CONNECTOR INFORMATION* subsection.

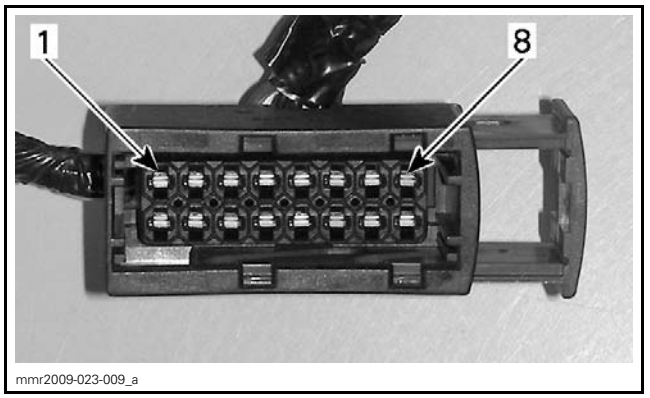
ECM Connector Pin-Outs



J1A PIN-OUT



J1B PIN-OUT



J2 PIN-OUT

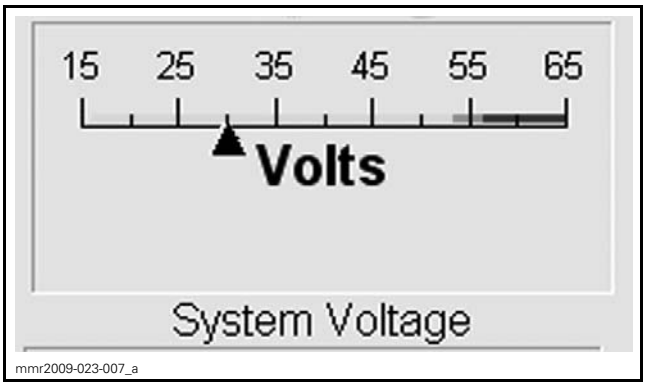
ECM Power Supply Troubleshooting

System Voltage Verification

Connect vehicle to latest applicable B.U.D.S. version. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

In B.U.D.S., select **Monitoring** tab, then**ECM** tab.

Crank engine while viewing **System Voltage**.



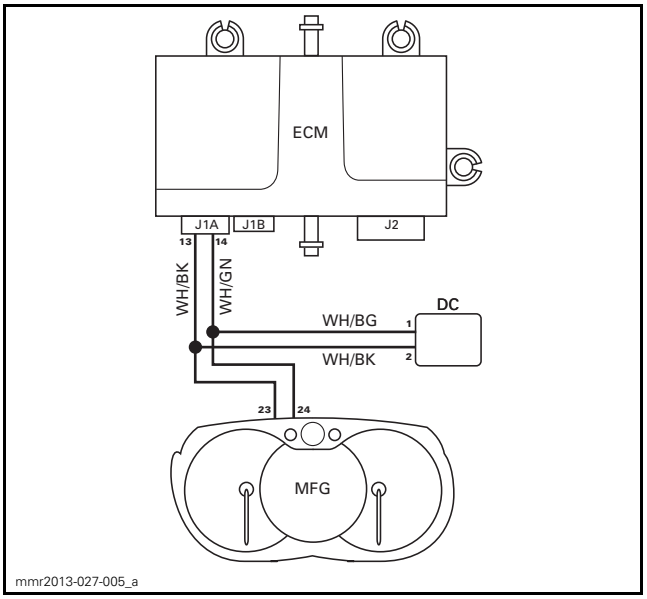
TEST CONDITION	VOLTAGE
Manual crank speed	30 Vdc min.

If voltage is as per specification, ECM is properly powered.

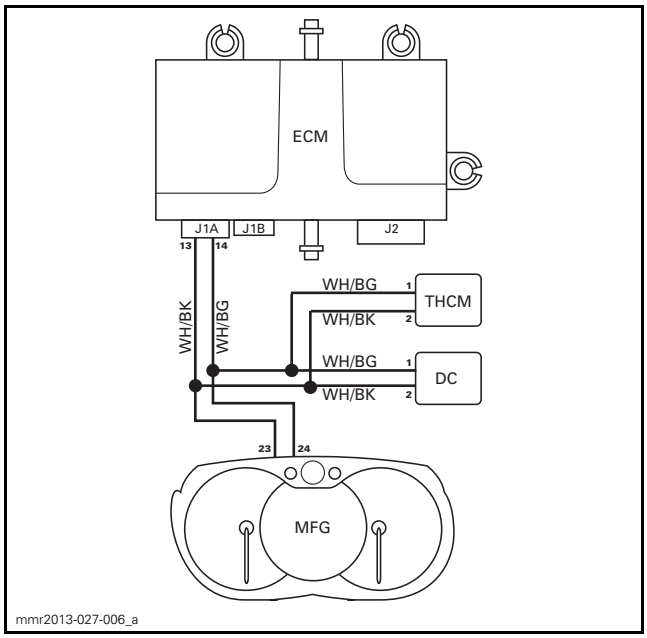
If voltage is out of specification, refer to *CHARGING SYSTEM*.

CAN Line Test

CAN lines link the ECM, multifunction gauge and vehicle diagnostic connector.



600 E-TEC
DC: Diagnostic connector
ECM: Electronic control module
MFG: Multifunction gauge



800R E-TEC
DC: Diagnostic connector
ECM: Electronic control module
MFG: Multifunction gauge
THCM: Thermocouple module

Test CAN wire continuity as follows.

1. Disconnect ECM connector J1A.
2. Disconnect multifunction gauge connector. Refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.
3. Using the FLUKE 115 MULTIMETER (P/N 529 035 868), read wire resistance as follows.

ECM ADAPTER	GAUGE CONNECTOR	MEASUREMENT
Pin 13	Pin 23	Close to 0 Ω
Pin 14	Pin 24	

If continuity is out of specification, repair or replace wiring harness between ECM and multifunction gauge.

If continuity is as per specification, carry out the following test.

4. Disconnect vehicle diagnostic connector from its protective cap.
5. Read wire resistance as follows.

DIAGNOSTIC CONNECTOR	GAUGE CONNECTOR	MEASUREMENT
Pin 2	Pin 23	Close to 0 Ω
Pin 1	Pin 24	

If continuity is out of specification, repair or replace wiring harness between diagnostic connector and multifunction gauge.

800R E-TEC Only

If continuity is as per specification, carry out the following test.

6. Disconnect THCM connector. Refer to *EXHAUST SYSTEM* subsection for THCM module access.
7. Read wire resistance as follows.

DIAGNOSTIC CONNECTOR	THERMOCOUPLE MODULE	MEASUREMENT
Pin 2	Pin 2	Close to 0 Ω
Pin 1	Pin 1	

All Models

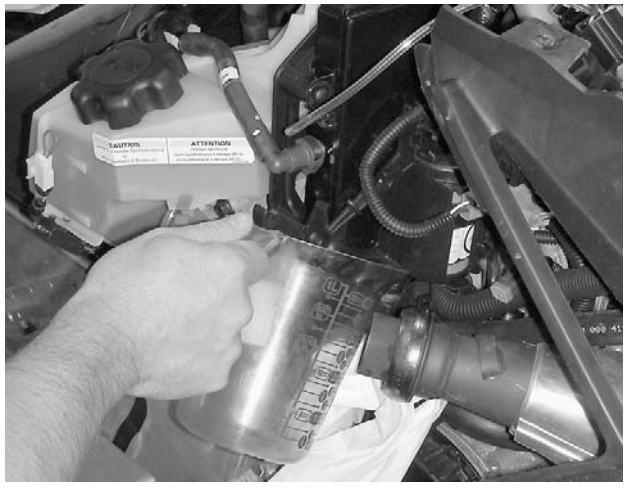
If continuity is as per specification, CAN lines are functional.

8. Reconnect connectors and reinstall removed parts.

ECM Removal

NOTE: If a new ECM is to be installed, read *ECM REPLACEMENT* in this subsection **before** removing the ECM.

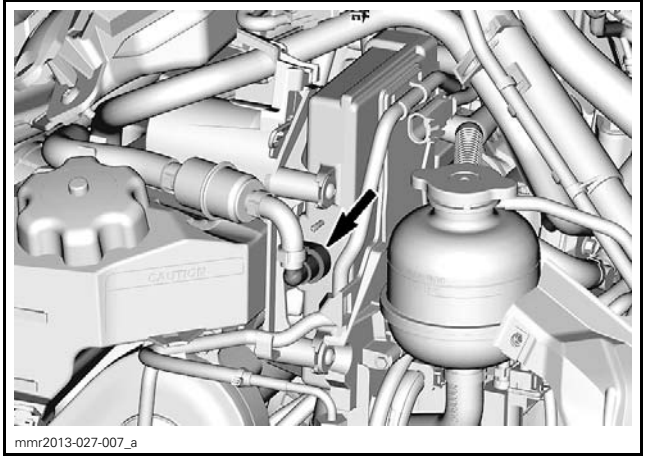
1. Remove tether cord cap (D.E.S.S. key) from engine cut-off switch.
2. Set emergency engine stop switch to STOP.
3. Remove upper body module. Refer to *BODY* subsection.
4. Install a rag under the ECM fuel hose quick connect to catch fuel spillage.
5. Place a container under the hose connector to recover fuel.



mmr2009-023-055

TYPICAL

6. Slowly disconnect fuel hose from ECM and drain fuel.



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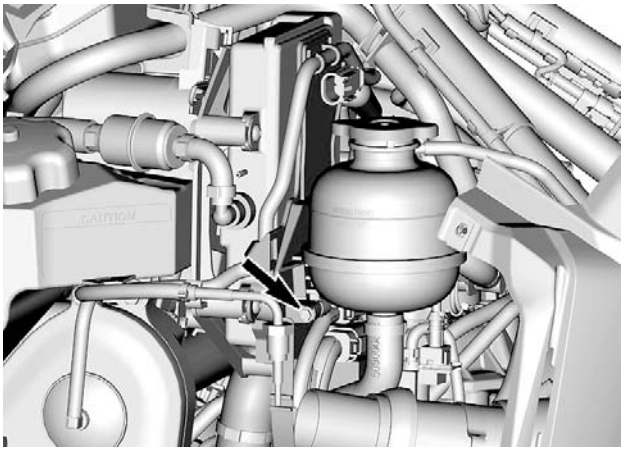
7. Detach coolant tank from its support.



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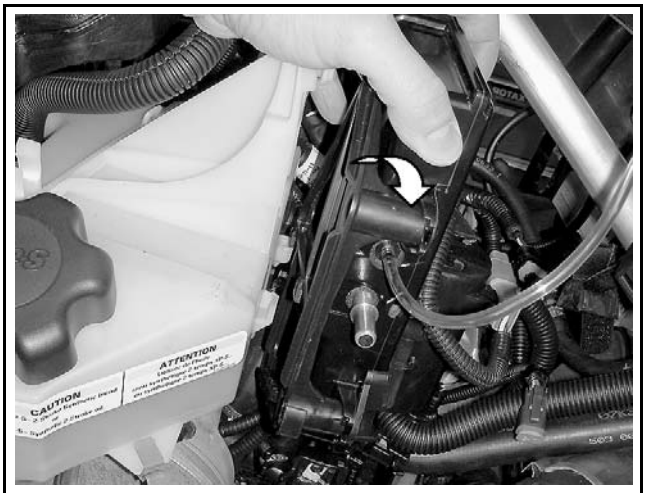
8. Unlock ECM support and slide toward right.


mmr2013-029-001_b

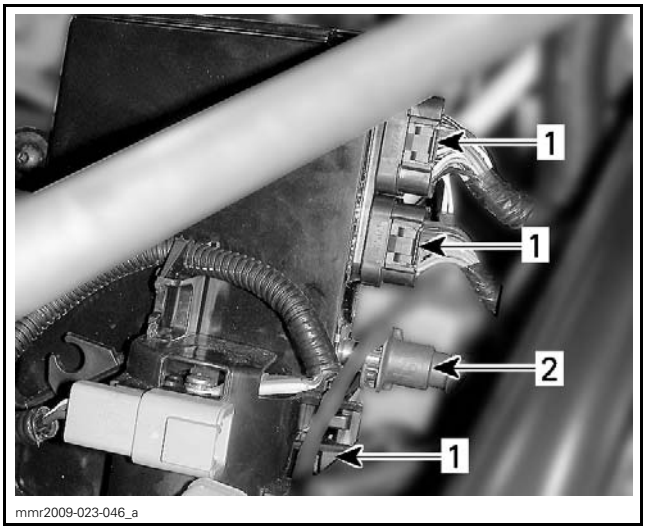
9. Slightly pull ECM out.
10. Tilt ECM in order to drain fuel remaining in ECM.



mmr2009-023-045_a

TYPICAL

11. Disconnect APS tube (air pressure sensor) from the ECM.
12. Disconnect ECM connectors.
13. Disconnect remaining fuel hose from ECM.



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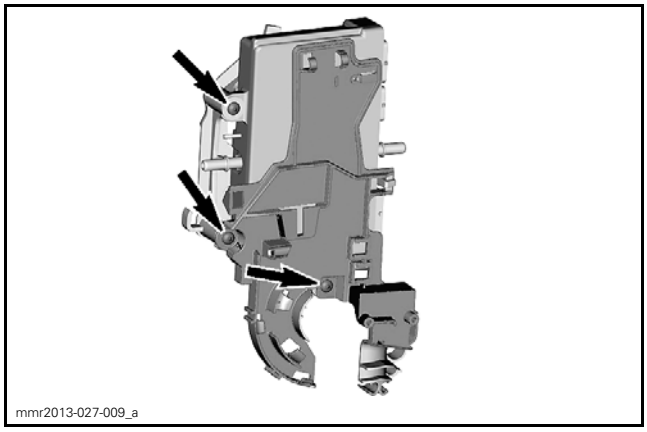
TYPICAL
1. ECM connectors
2. Fuel hose

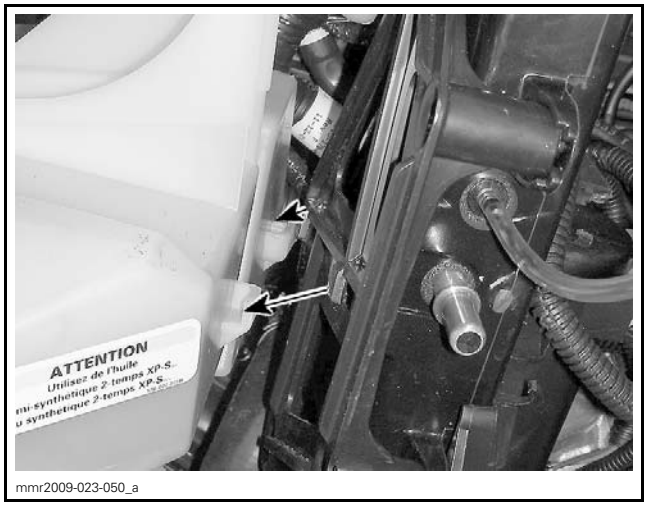
14. Remove ECM from its support.


mmr2013-027-009_a

ECM Installation

Reverse removal procedure however, pay attention to the following.

Ensure the ECM tabs are properly engaged on the oil injection reservoir.



mmr2009-023-050_a

⚠ 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 *ECM REPLACEMENT* in this subsection.

ECM Replacement

When installing a new ECM, data must be transferred manually and several resets are required to be carried out in B.U.D.S. Refer to *ECM MANUAL DATA ENTRY*

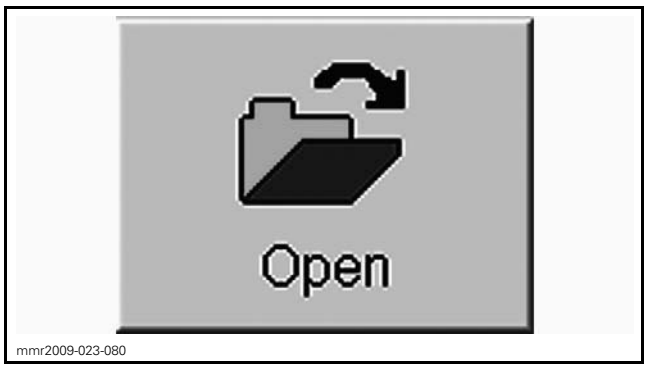
ECM Manual Data Entry

There are 2 possible methods to manually collect the required information. The 1st being the easiest.

– Use B.U.D.S. software and obtain the data from a saved .mpem file on your PC computer.
– Collect the information from the vehicle and obtain the fuel injector coefficient files from BOSSWeb.

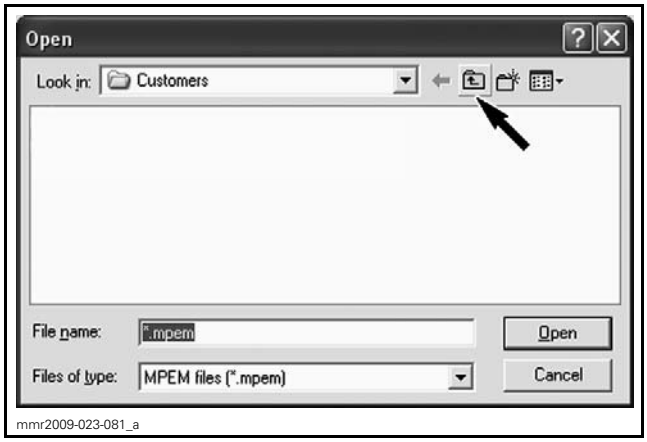
1st Collecting Method: Get the Data from a Saved **.mpem** File

1. Remove the faulty ECM, refer to *ECM REMOVAL* in this subsection.
2. Install and connect the new ECM, refer to *ECM INSTALLATION* in this subsection.
3. Connect vehicle to latest applicable B.U.D.S. version and log on. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
4. Click on the **Open** button.



mmr2009-023-080

5. Click once on the **Folder Up** button in the **Open** box.



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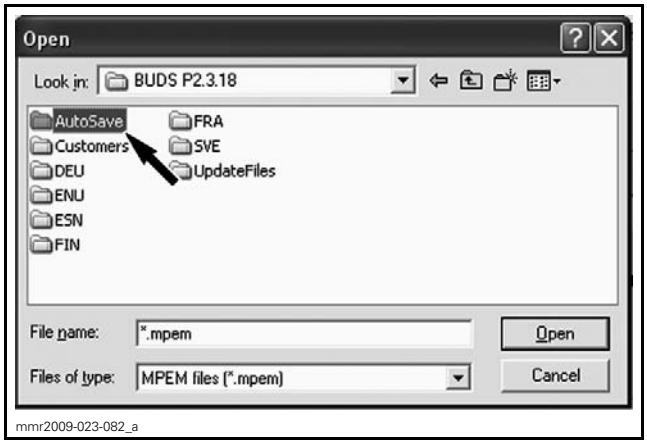
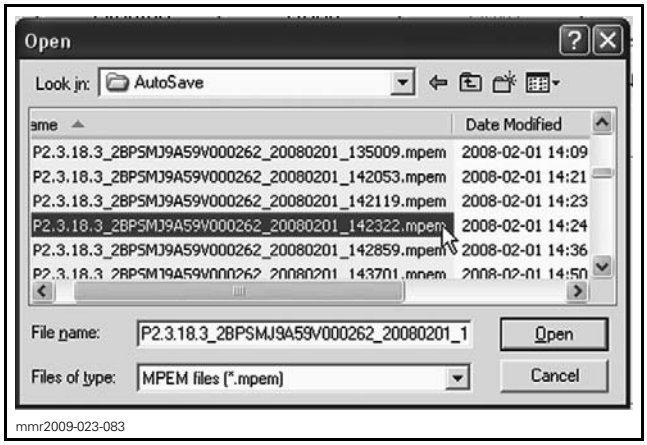
6. Double click on the **AutoSave** folder.



mmr2009-023-082_a

NOTE: You may have to go to another **AutoSave** folder from a previous version of B.U.D.S.

7. Choose the latest file saved for this specific vehicle.



mmr2009-023-083

IMPORTANT: Ensure to use the file that specifically matches the vehicle you are servicing.

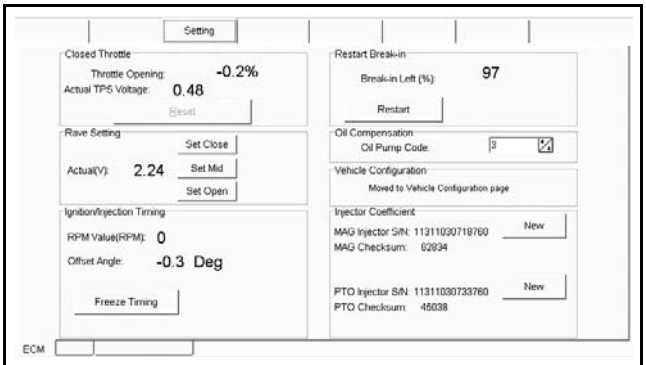
NOTE: The file name structure is as follows:
BUDS version_VIN_date read (yyyymmdd)_hour read (hhmmss).mpem
Example: P2.3.18.3_2BPSMJ9A59V000262_ 20080201_142322.mpem

8. In the **Vehicle** tab, record the following information;
   – Engine number (without the leading "M")
   – Customer name.

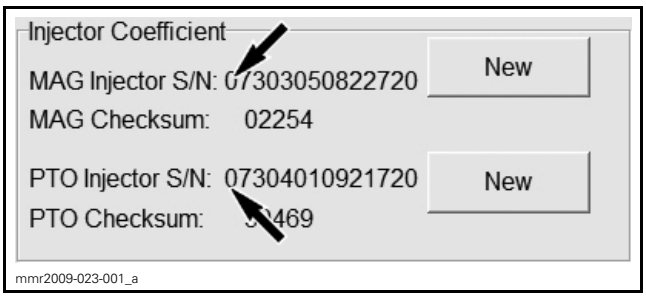
NOTE: It is not necessary to record the vehicle (VIN) and model numbers. They will be transferred later.

9. Select the **ECM** and **Setting** tabs and record the following information;
   – Ignition/Injection timing: Offset angle

– Oil compensation: Oil pump code
– Fuel injector coefficients: MAG/PTO injectors S/N and Checksums.

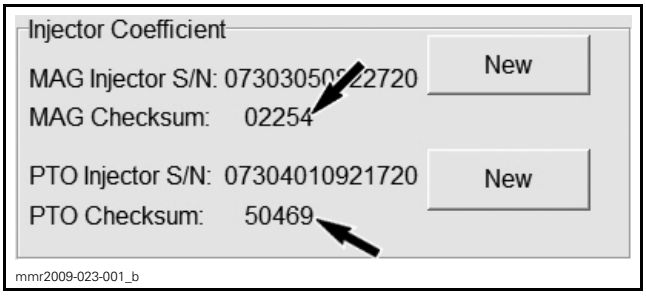


mmr2013-027-013



mmr2009-023-001_a

FUEL INJECTOR SERIAL NUMBER (S/N)



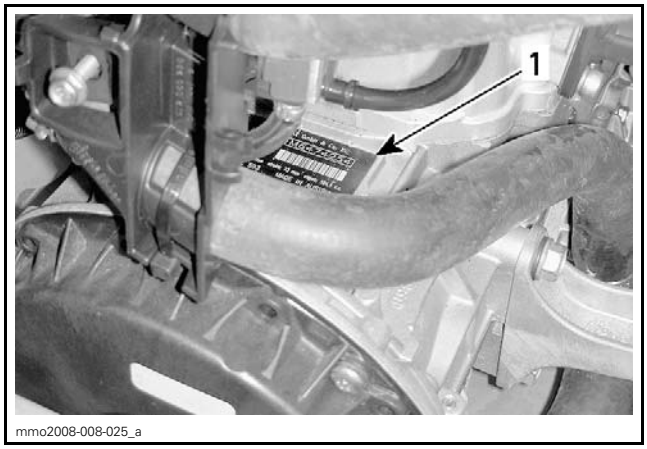
mmr2009-023-001_b

FUEL INJECTOR CHECKSUM (CS)

10. Enter data in ECM as detailed in *ENTERING THE COLLECTED INFORMATION INTO THE ECM*.

2nd Collecting Method: Collect the Information from the Vehicle

1. Record engine serial number.



mmo2008-008-025_a

RH SIDE OF ENGINE COMPARTMENT
1. Engine serial number

2. Record oil injection pump code.

mmr2009-023-093_a

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 BOSSWeb to get the matching calibration file.
Save the calibration file to your PC computer in the folder: C:\Program Files\BRP\BUDSCommon\InjectorCoefficients.

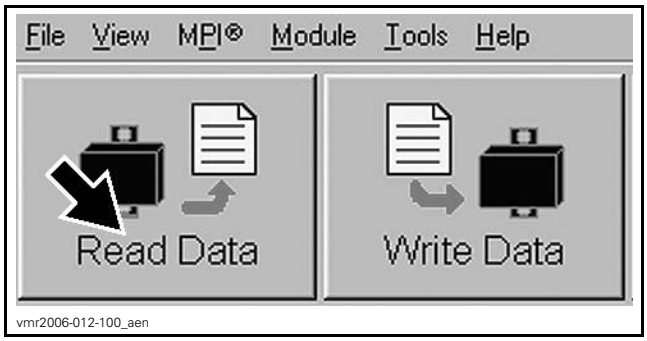
Enter data in ECM as detailed in *ENTERING THE COLLECTED INFORMATION INTO THE ECM*.

Entering the Collected Information Into the ECM

1. Ensure B.U.D.S. is properly connected to the vehicle and logged on.

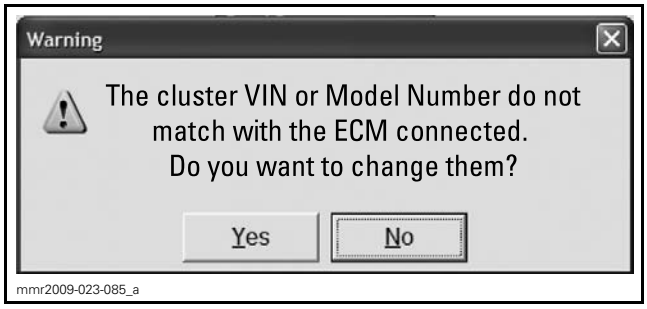
NOTE: The beeper will continuously sound a sequence of 11 beeps meaning that the D.E.S.S. key is not programmed. To stop the beeps, remove key.

2. In B.U.D.S., click the **Read Data** button to read the new "empty" ECM.



vmr2006-012-100_aen

Then, a message will appear saying that the cluster (multifunction gauge) does not recognize the ECM.

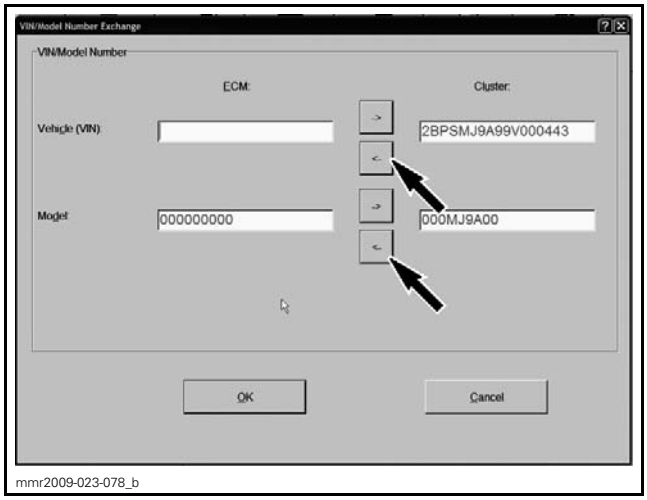


mmr2009-023-085_a

3. Click **Yes**.

NOTE: If the numbers are not matched, the gauge will stop operating within 10 seconds of engine operation. Only its D.E.S.S. LED will be turned ON.

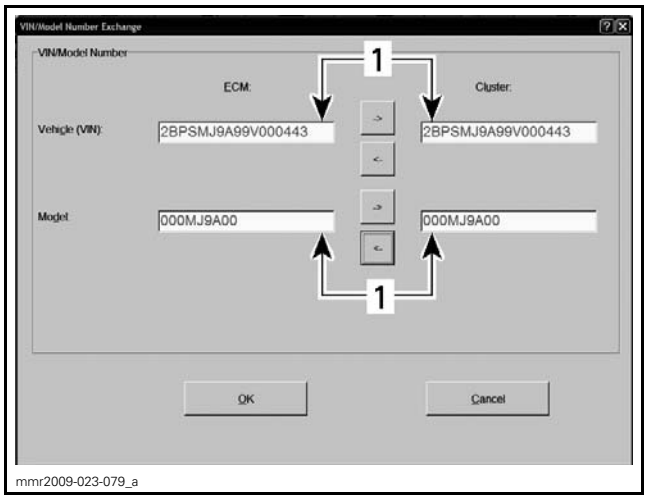
4. Click on the arrows to transfer the numbers from the **Cluster** column to the **ECM** column.



mmr2009-023-078_b

TYPICAL

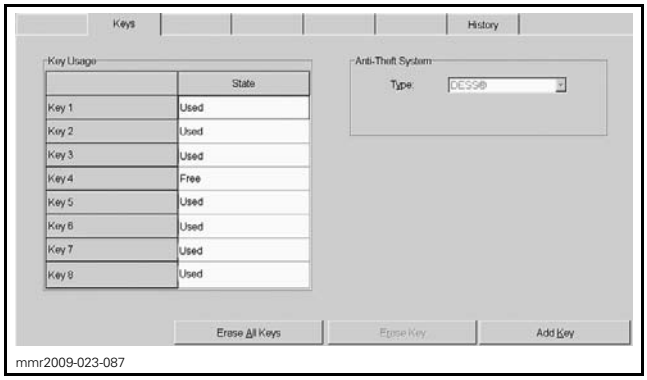
Ensure the **VIN** and **Model** numbers in the ECM and cluster are exactly matched.



mmr2009-023-079_a

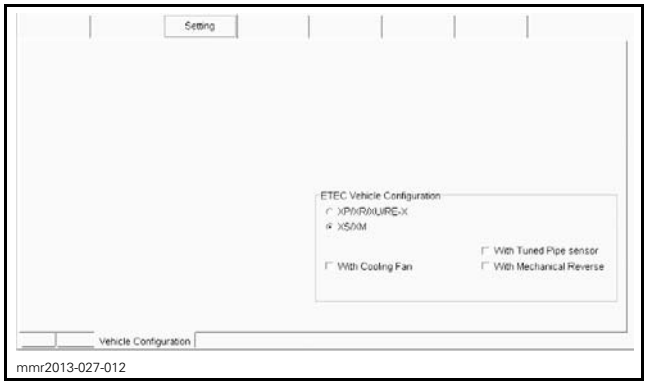
TYPICAL
1. Matching numbers

5. On the **Vehicle** page, enter the information you recorded previously:
   – Engine number (do not enter the leading "M")
   – Customer name.
6. In the **Keys** page, select **Erase All Keys**.



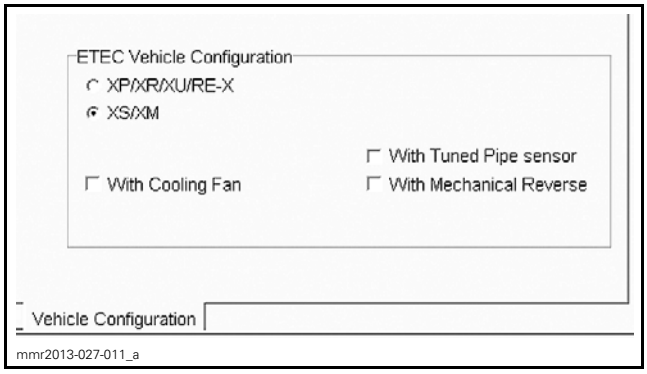
mmr2009-023-087

7. Program the desired key(s). Refer to *D.E.S.S. SYSTEM* subsection.
8. Select the **Setting** tab then **Vehicle Configuration**.



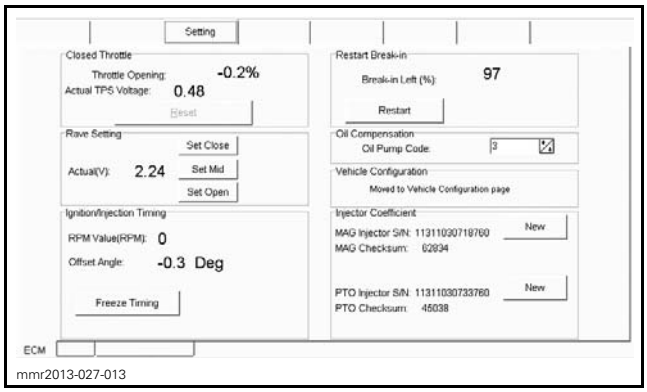
mmr2013-027-012

9. In the **Vehicle Configuration** page:
   9.1 Ensure the check boxes reflect the vehicle connected to B.U.D.S. in the **ETEC Vehicle Configuration** area. Otherwise, check the required boxes.



mmr2013-027-011_a

10. Select the **Setting** tab then **ECM**.

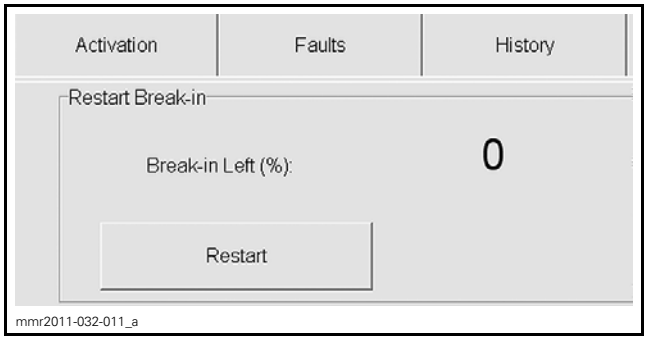


mmr2013-027-013

11. Reset the **Closed Throttle** setting as detailed in *CLOSED THROTTLE RESET (TPS)*.

NOTICE **The Closed Throttle Reset must be carried out as described in the specific procedure or engine damage may occur.**

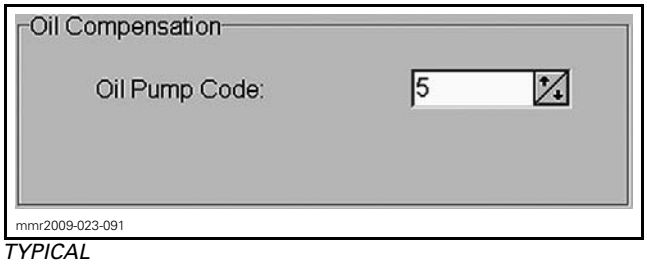
12. Carry the **3D Rave Valves Position Sensor Setting**. Refer to *RAVE (600 HO E-TEC AND 800R E-TEC)* subsection.
13. Set the **Ignition/Injection Timing**. Refer to *IGNITION SYSTEM* subsection.
14. **Restart Break-In**. Click **Restart** button if the actual engine hours are less than 5 hours.



mmr2011-032-011_a

TYPICAL

15. **Oil Compensation**. Enter the previously recorded **Oil Pump Code**.



mmr2009-023-091

TYPICAL

16. MAG and PTO fuel injector S/N.
   16.1 If the data was obtained from a saved .mpem file, refer to table A.
   16.2 If the fuel injector calibration file was obtained from BOSSWeb, refer to table B.

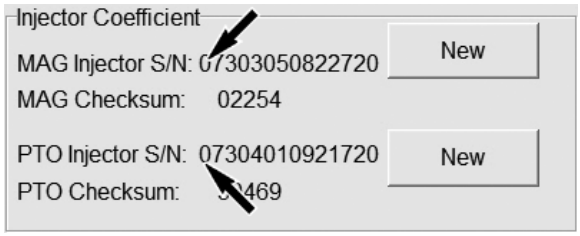
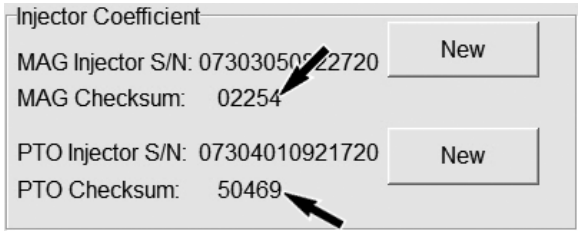
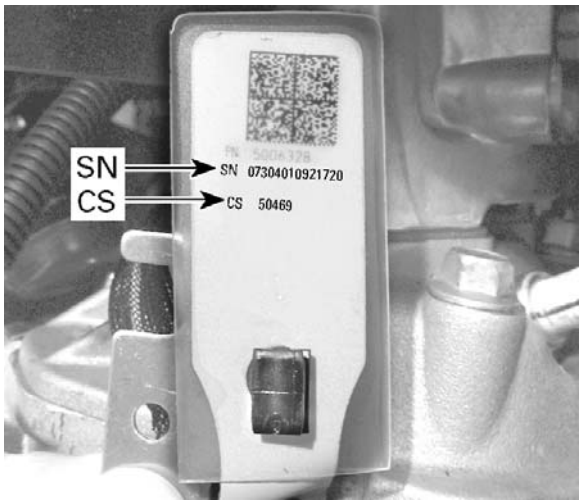
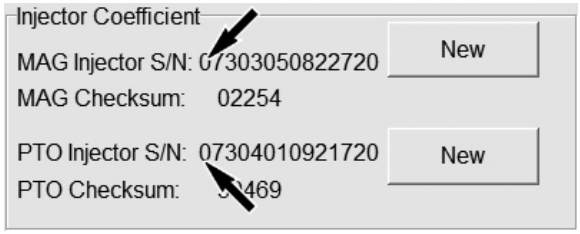
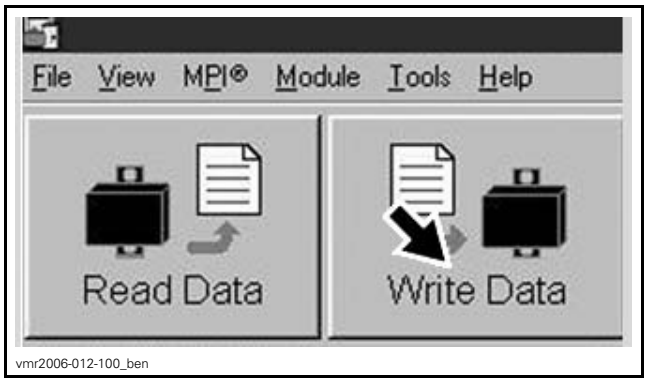
TABLE A (DATA FROM A SAVED .MPEM FILE)
Click on the **New** button and open the file that matches the previously recorded serial number.

Ensure the PTO and MAG side injector S/N correctly match those on the engine.
Once the file has been read, ensure the checksum number (CS) displayed in B.U.D.S. matches the CS previously recorded.

If the numbers do not match, the wrong file was read. Repeat the procedure to record the correct file.

TABLE B (CALIBRATION FILE FROM BOSSWEB)
Click on the **New** button and open the file that you previously saved on your PC computer in the folder: **C:\Program Files\BRP\BUDSCommon\InjectorCoefficient**
Ensure to correctly match the PTO and MAG side injector serial numbers.
Once the file has been read, ensure the fuel injector tag SN and CS matches those shown in B.U.D.S.
 SN: Serial Number CS: Checksum number

If the numbers do not match, the wrong file was read. Repeat the procedure to record the correct file.

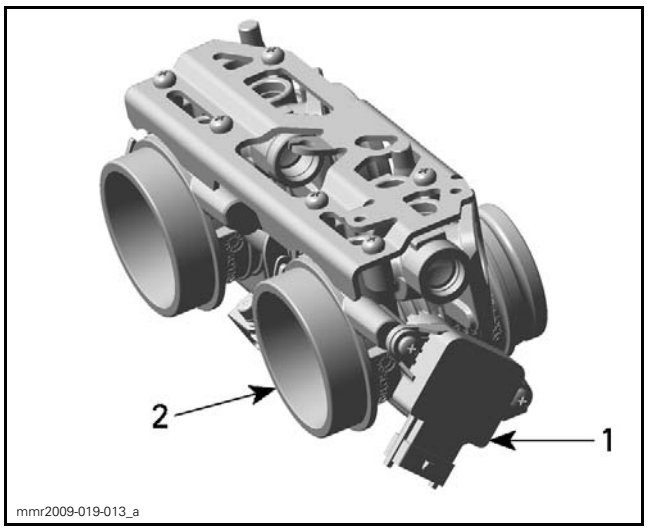
17. Click on the **Write Data** button to save the data to the ECM.



18. Lift rear of vehicle and safely support.

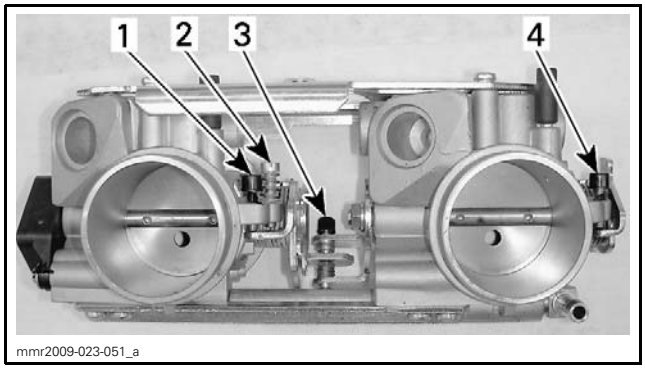
19. Start the engine and increase engine speed above 6000 RPM to be sure no fault codes appear.
20. Let engine idle to ensure idle is adequate.
21. If engine does not run as expected, ensure that the fuel injector calibration files are valid. Check with the tag of the fuel injectors installed on the engine.
22. Reinstall remaining removed parts.

THROTTLE BODY



1. Throttle body
2. TPS (Throttle position sensor)

Throttle Body Screw Identification



1. Master zero position screw (capped)
2. Idle screw (not used on E-TC engine)
3. Synchronizing screw (capped)
4. Slave zero position screw (capped)

NOTICE Do not tamper with any capped screw. Otherwise, throttle body may have to be replaced.

Throttle Body Inspection

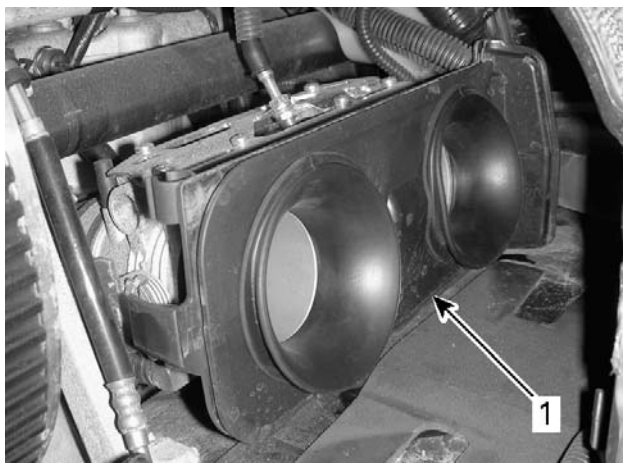
– Ensure throttle plates move freely and smoothly when depressing throttle lever.
– Ensure throttle body master zero position screw is **NOT** loose. If so, replace throttle body.
– Ensure that the master zero position screw stops the throttle plate, **not** the idle screw. There **must** be a gap under the idle screw.
– Ensure TPS is **NOT** loose.
– Check for corroded or damaged wiring or connectors.

Throttle Body Removal

⚠ WARNING

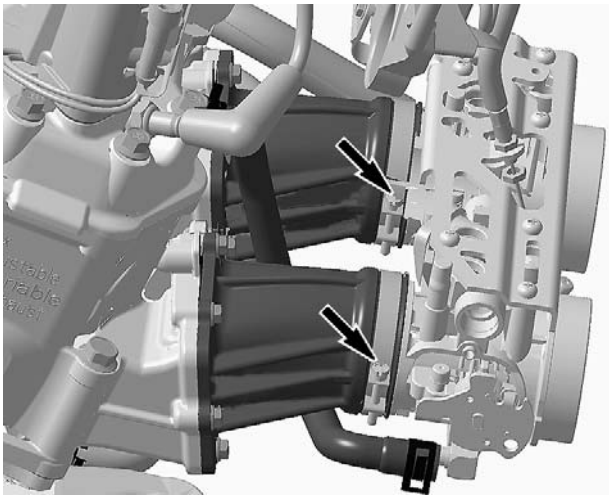
Always remove tether cord cap (D.E.S.S. key) and disconnect battery before removing the throttle body.

1. Remove drive belt guard. Refer to *DRIVE BELT* subsection.
2. Remove primary air intake silencer. Refer to *AIR INTAKE SYSTEM* subsection.
3. Remove adapter plate from throttle body.

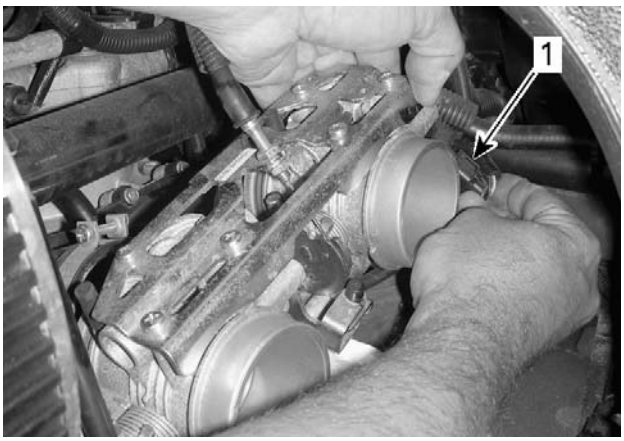


1. Adapter plate

4. Loosen clamps retaining throttle body.

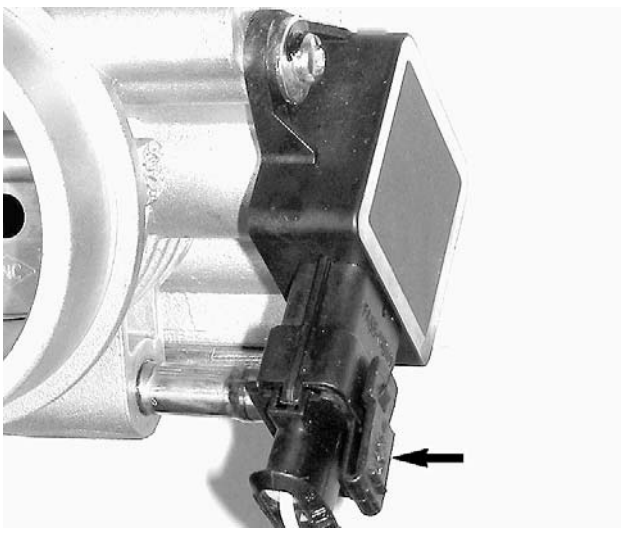

mmr2009-023-052_a

5. Pull out throttle body sufficiently to access coolant hoses and TPS connector.
6. Disconnect TPS connector.



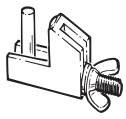
mbg2012-001-021_a

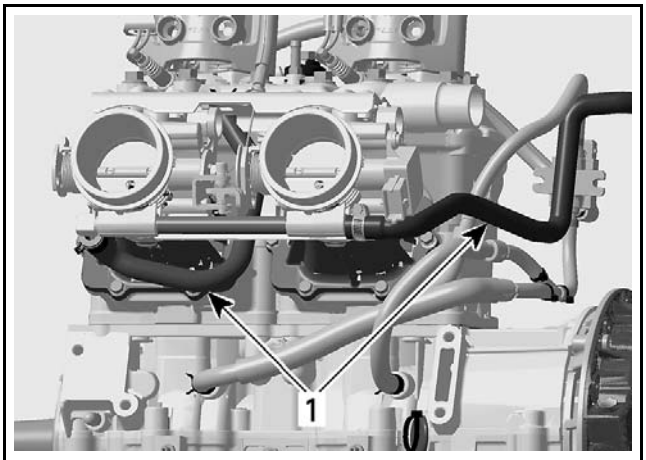
1. TPS connector


mmr2009-023-053_a

PUSH TAB TO UNLOCK

7. Install a small hose pincher on coolant hoses connected to throttle body.

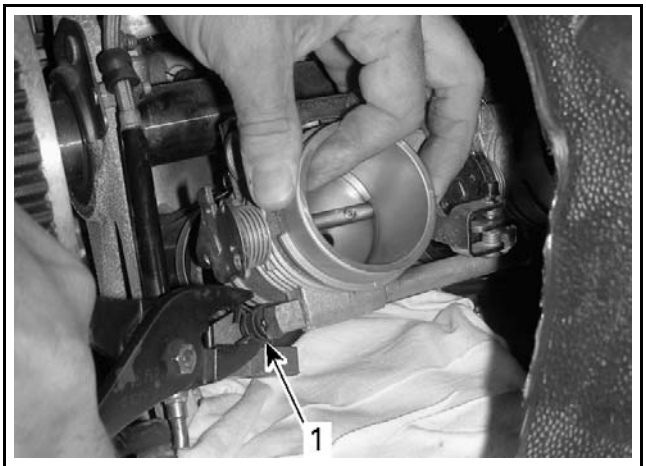
REQUIRED TOOL	
SMALL HOSE PINCHER (P/N 295 000 076)	



mmr2009-019-015_a

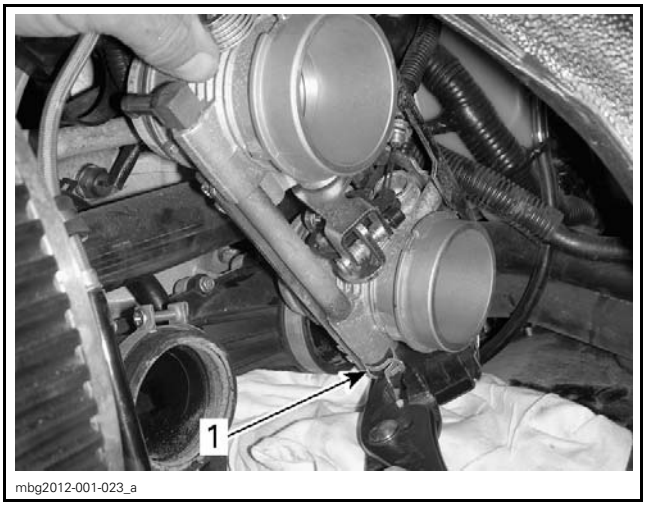
1. Install hose pinchers here

8. Remove coolant hoses from throttle body.



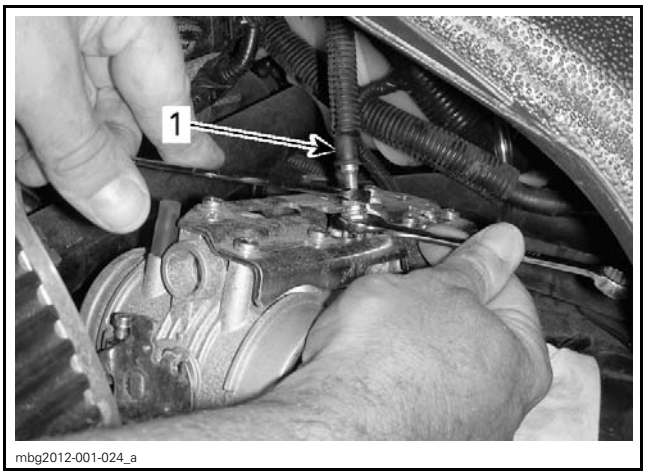
mbg2012-001-022_a

1. Coolant hose clamp to remove



1. Coolant hose clamp to remove

9. Disconnect throttle cable.



1. Throttle cable

10. Remove throttle body from vehicle.

Throttle Body Installation

1. If installing the removed throttle body, clean throttle plates and bores using PULLEY FLANGE CLEANER (P/N 413 711 809) before installation.
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. Tighten throttle body clamps to specification.

TIGHTENING TORQUE	
Throttle body clamps	1.4 N•m ± 0.2 N•m (12 lbf•**in** ± 2 lbf•**in**)

7. Install throttle cable loosely.
8. Carry out the *THROTTLE CABLE ADJUSTMENT* as detailed in this subsection.
9. If a new throttle body or TPS is installed, carry out the *CLOSED THROTTLE RESET (TPS)* as detailed in this subsection.
10. Refill engine coolant.

NOTE: If an important quantity of coolant was spilled, bleed cooling system. Refer to *COOLING SYSTEM* subsection.

11. Install adapter plate (primary air intake silencer) on throttle body.

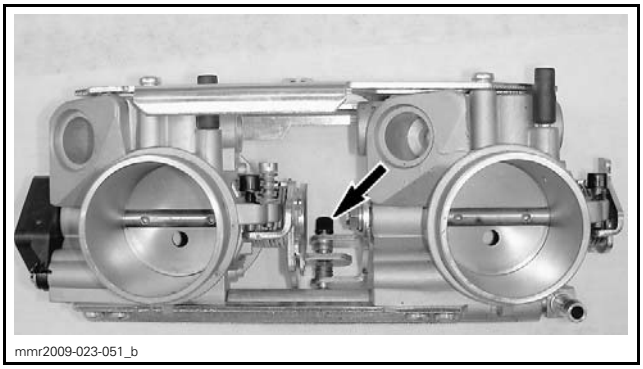
TIGHTENING TORQUE	
Adapter plate clamps	0.7 N•m ± 0.2 N•m (6 lbf•**in** ± 2 lbf•**in**)

12. Install primary air intake silencer, refer to *AIR INTAKE SYSTEM* subsection.
13. Install all remaining removed parts.

Throttle Body Synchronization

No synchronization is required as it has already been done at the factory.

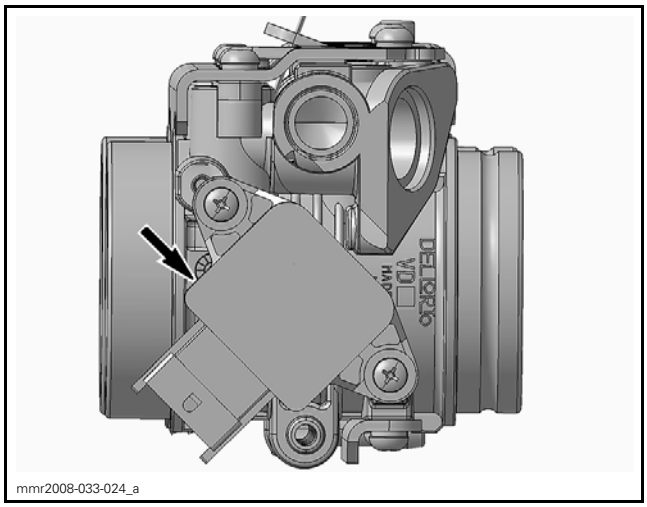
NOTICE **Do not alter synchronization screw setting. Otherwise throttle body must be replaced.**



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.



THROTTLE POSITION SENSOR (TPS)

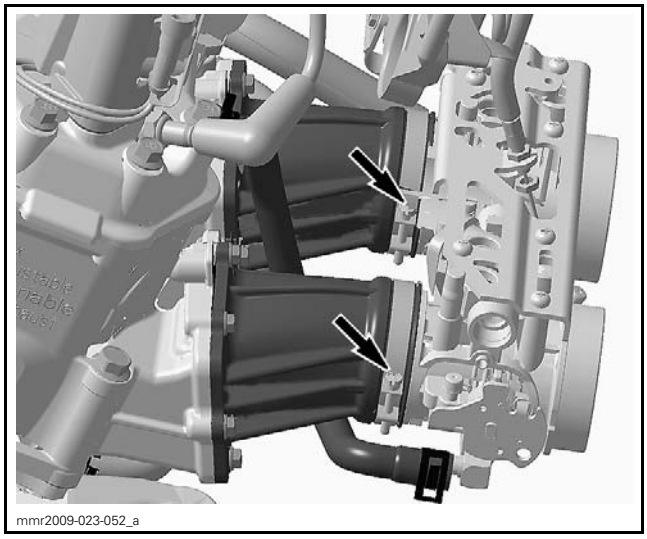
TPS Connector Access

1. Remove drive belt guard. Refer to *DRIVE BELT* subsection.
2. Remove primary air intake silencer. Refer to *AIR INTAKE SYSTEM* subsection.

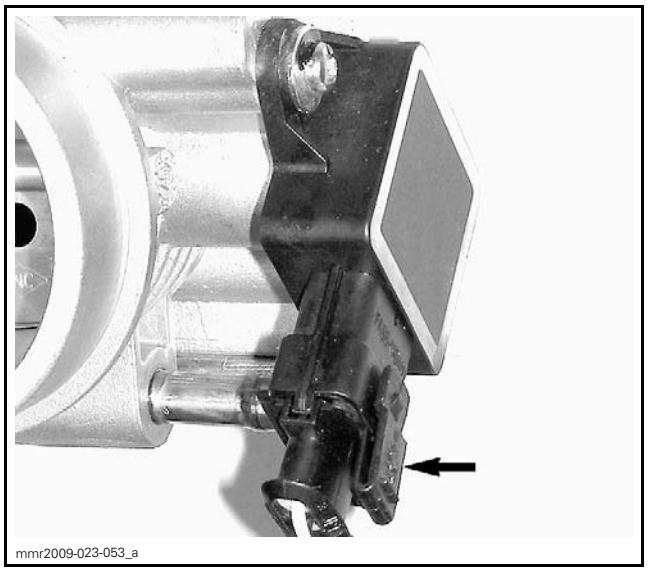
⚠ WARNING

Always remove tether cord cap (D.E.S.S. key) and disconnect battery before removing the throttle body.

3. Loosen clamps retaining throttle body.

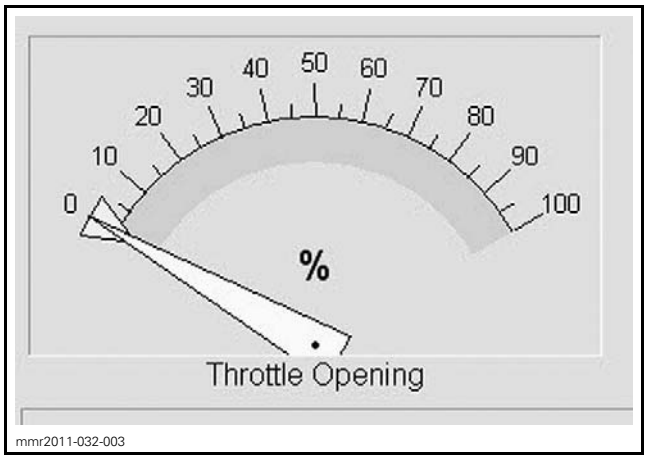


4. Pull out throttle body for access to TPS connector.
5. Disconnect TPS connector.



TPS Wear Test

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 B.U.D.S. software.
4. Select the **Monitoring** and **ECM** tabs. Monitor the TPS using the **Throttle Opening** indicator.



THROTTLE OPENING INDICATOR

5. Slowly and regularly depress the throttle. Observe the needle movement.

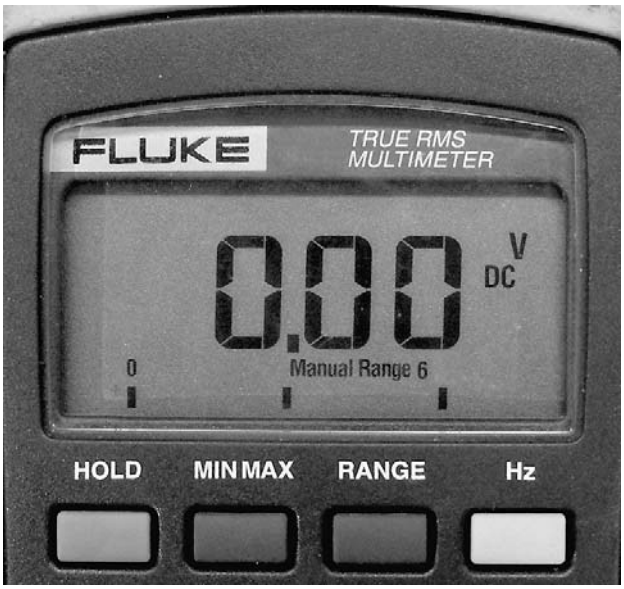
The needle must change gradually and regularly as the throttle is activated. If the needle "sticks", bounces, suddenly drops off or if any discrepancy between the throttle movement and the needle movement is noticed, it indicates a worn TPS that needs to be replaced.

TPS Reset (Closed Throttle)

Refer to *CLOSED THROTTLE RESET (TPS)* in the *ADJUSTMENT* topic of this subsection.

TPS Input Voltage Test

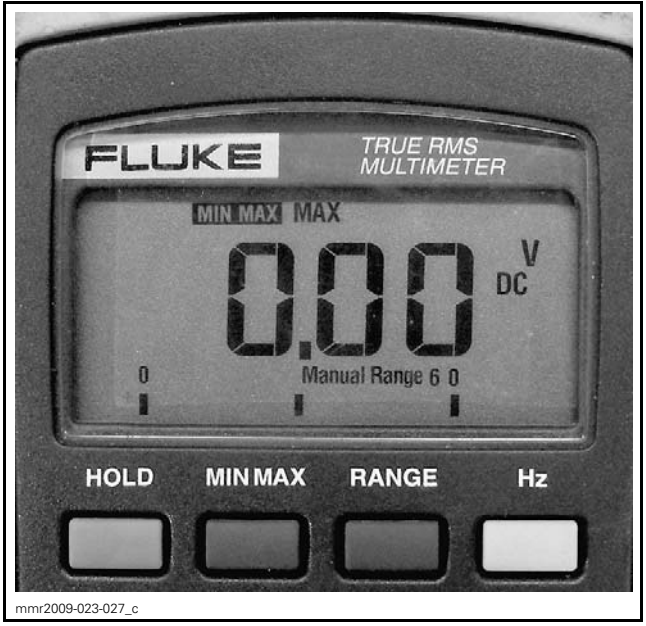
1. Remove parts required to access TPS connector, refer to *TPS CONNECTOR ACCESS* in this subsection.
2. Disconnect TPS connector.
3. Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and set it to Vdc.
4. Repeatedly press the **RANGE** button until the display shows Manual Range 6.



mmr2009-023-027_d

DC VOLTS, MANUAL RANGE 6 SELECTED

5. Press the **MIN MAX** button so that the display shows MIN MAX.

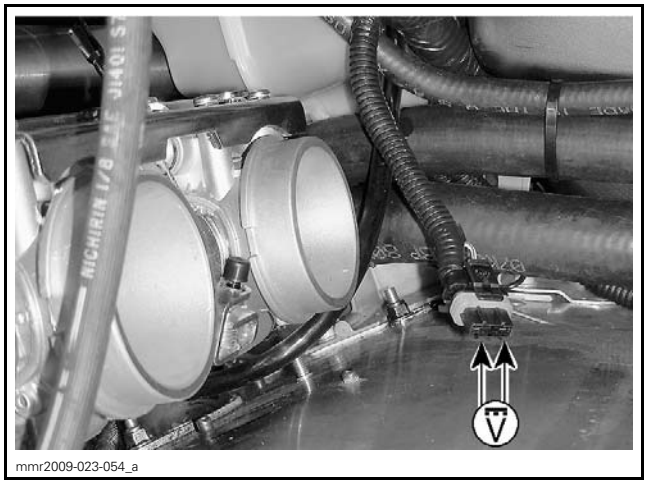


mmr2009-023-027_c

MIN MAX SELECTED

6. Crank engine.
7. Read voltage at TPS harness connector as follows.

TPS HARNESS CONNECTOR		VOLTAGE
Pin 1	Pin 2	5.0 Vdc



mmr2009-023-054_a

8. Read the MAX value.

NOTE: Reset multimeter by pressing and holding **MIN MAX** button until meter beeps.

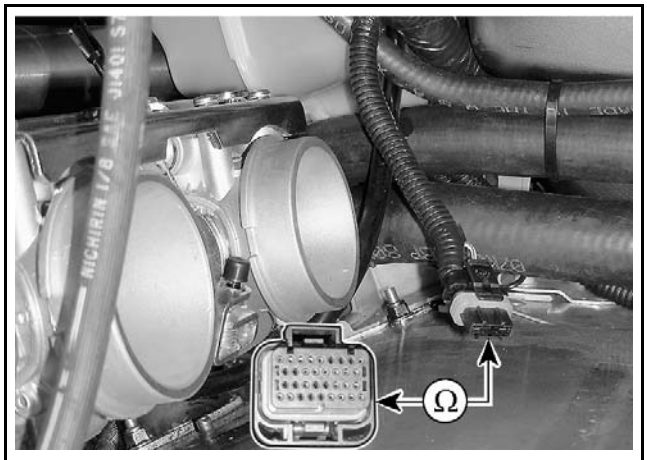
If voltage is good, carry out the *TPS SIGNAL WIRE TEST*.

TPS Signal Wire Test

Disconnect J1A connector from ECM, refer to *CONNECTOR INFORMATION* subsection.

Check the wiring continuity as follows.

TPS HARNESS CONNECTOR	ECM J1A CONNECTOR	RESISTANCE
Pin 3	Pin 1	Close to 0 Ω (continuity)



mmr2009-023-054_b

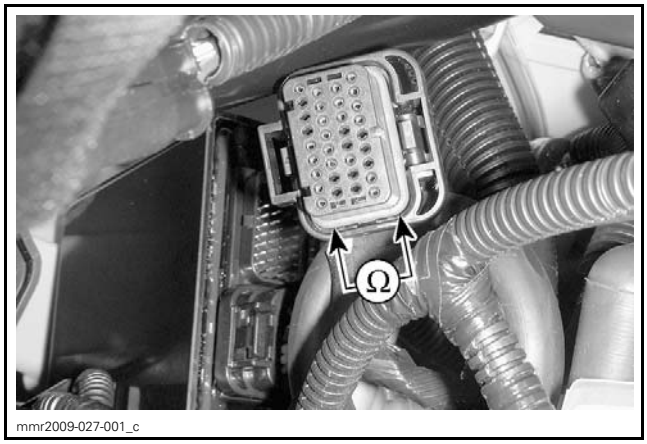
If tests are good, replace the TPS.

If tests are not good, continue to check the resistance of the remainder of the TPS circuit.

TPS Resistance Test

1. Reconnect the TPS.
2. Disconnect connector J1A from the ECM.
3. Using the FLUKE 115 MULTIMETER (P/N 529 035 868), check resistive value as per following table.

ECM CONNECTOR		THROTTLE IDLE POSITION	WIDE OPEN THROTTLE POSITION
PIN		RESISTANCE Ω	
J1A-1	J1A-26	1000	2500
J1A-26	J1A-10	1600 - 2400	1600 - 2400
J1A-1	J1A-10	2500	1000



mmr2009-027-001_c

NOTE: The resistive value should change smoothly and proportionally to the throttle movement. Otherwise, replace TPS.

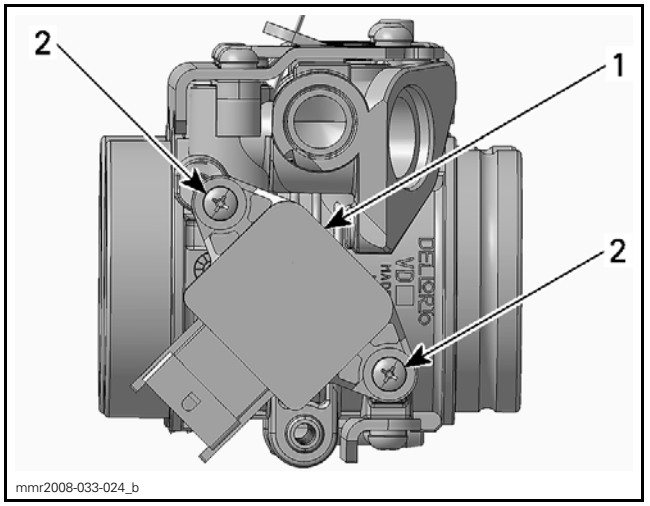
If resistive values are correct, try a new ECM. Refer to *ENGINE CONTROL MODULE (ECM)* elsewhere in this subsection.

If resistive values are incorrect:

– Repair/replace wiring/connectors.
– Replace TPS.

TPS Replacement

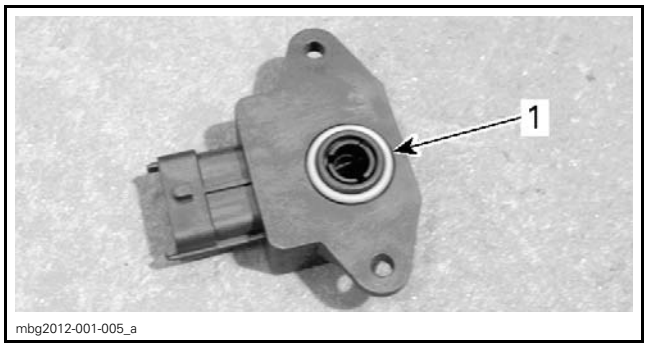
1. Remove the throttle body, refer to *THROTTLE BODY REMOVAL* in this subsection.
2. Remove TPS retaining screws.



mmr2008-033-024_b

1. Throttle position sensor (TPS)
2. Screws

3. Remove TPS.
4. Ensure O-ring is still positioned on TPS after removal.

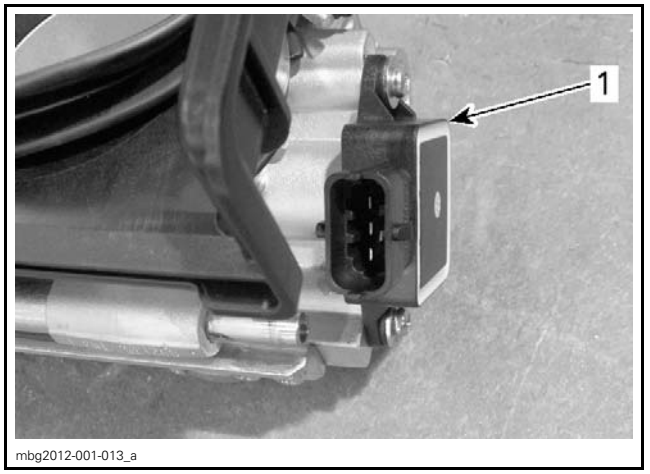


mbg2012-001-005_a

1. TPS O-ring

NOTE: If O-ring is missing, remove it from throttle body shaft.

5. Install new TPS.



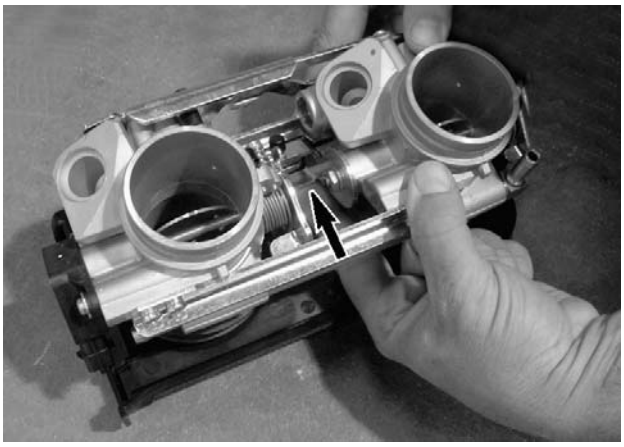
mbg2012-001-013_a

1. New TPS

6. Tighten TPS retaining screws to specification.

TIGHTENING TORQUE	
TPS retaining screws	2.0 N•m ± 0.4 N•m (18 lbf•**in** ± 4 lbf•**in**)

7. Open and quickly release throttle plates 6 times (throttle plates must snap shut).


mbg2012-001-014

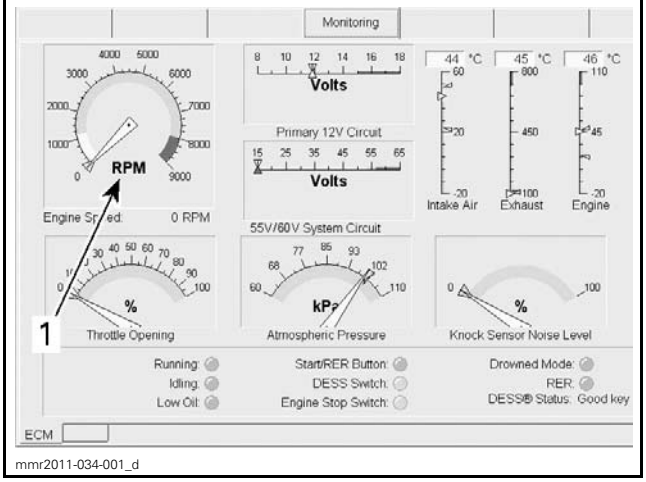
TYPICAL - PUSH TO OPEN THROTTLE PLATES

8. Reinstall remaining removed parts.
9. Reset TPS, refer to *CLOSED THROTTLE RESET (TPS)* in this subsection.

CPS (CRANKSHAFT POSITION SENSOR)

CPS Test with B.U.D.S.

1. Connect vehicle to the latest applicable B.U.D.S. version.
2. In B.U.D.S., select the **Monitoring** and **ECM** tabs.
3. Monitor the **Engine Speed** (RPM) indicator while cranking engine.



mmr2011-034-001_d

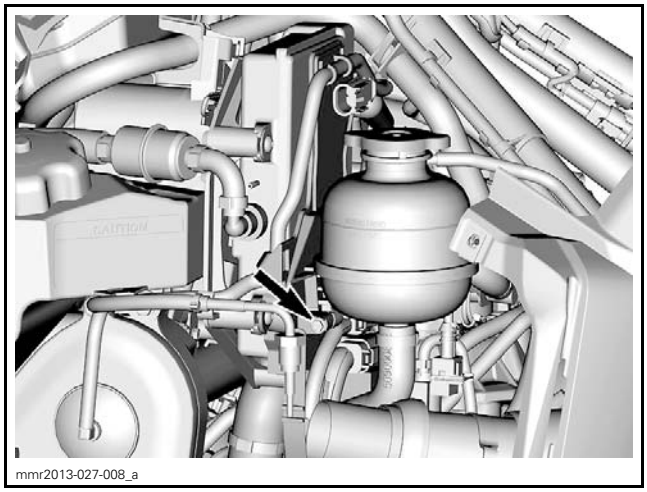
1. B.U.D.S. RPM indicator

The needle should move proportionally to the cranking RPM. If no needle movement is observed, carry out the *CPS OUTPUT VOLTAGE TEST*.

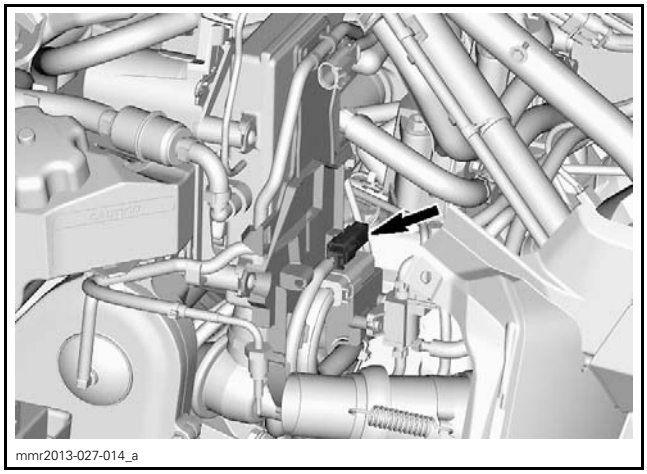
NOTE: A loose CPS or CPS connector can send an intermittent signal that can prevent the engine from starting.

CPS Output Voltage Test

1. Remove upper body module. Refer to *BODY* subsection.
2. Remove muffler. Refer to *EXHAUST SYSTEM* subsection.
3. Detach coolant tank from its support.

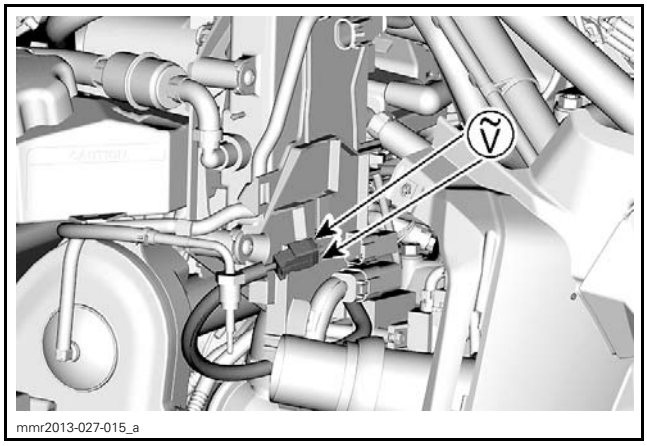

mmr2013-027-008_a

4. Disconnect CPS connector (2-pin connector).


mmr2013-027-014_a

5. Probe terminals coming from CPS while cranking engine.

CPS CONNECTOR		VOLTAGE
Pin 1	Pin 2	1 - 2 Vac min.



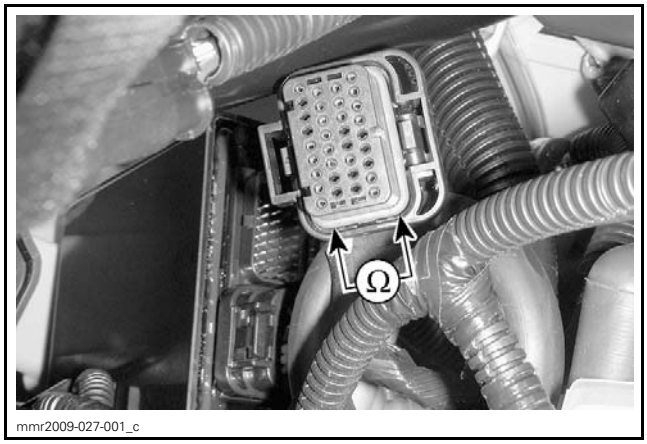
mmr2013-027-015_a

If voltage is out of specification, inspect wiring/connectors. Replace CPS if wiring is good.

CPS Resistance Test

1. Disconnect connector J1A from ECM.
2. Measure the resistance of the sensor through its wiring.

ECM J1A CONNECTOR		RESISTANCE @ 20°C (68°F)
Pin 6	Pin 7	190 - 290 Ω



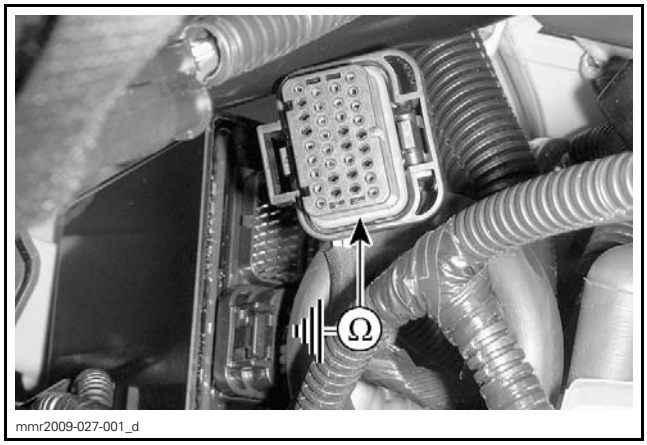
mmr2009-027-001_c

TYPICAL

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.

ECM J1A CONNECTOR		RESISTANCE @ 20°C (68°F)
Pin 6	Engine ground	Open circuit (OL)
Pin 7	Engine ground	



mmr2009-027-001_d

TYPICAL

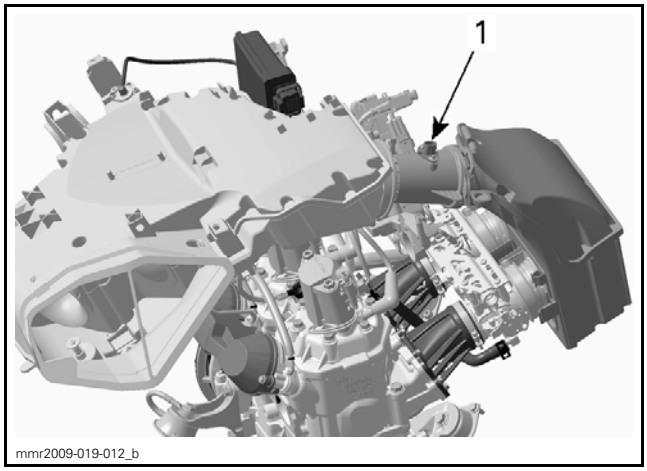
If the previous tests were good, replace CPS.

CPS Replacement

Refer to *MAGNETO SYSTEM* subsection.

ATS (AIR TEMPERATURE SENSOR)

ATS Location



mmr2009-019-012_b

TYPICAL - ATS SENSOR
1. Air temperature sensor (ATS)

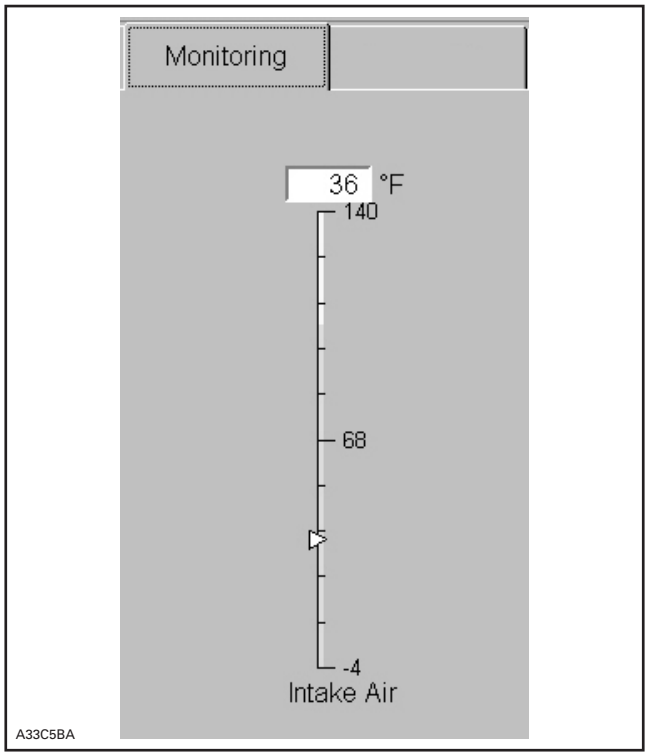
ATS Access

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

Remove primary air intake silencer. Refer to *AIR INTAKE SYSTEM* subsection.

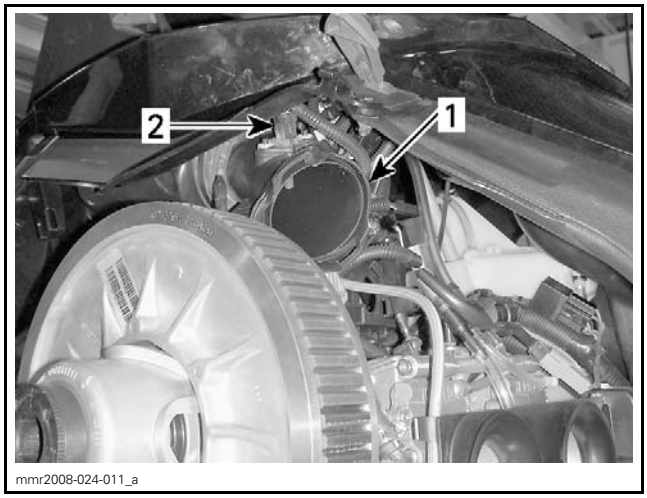
ATS Test with B.U.D.S.

1. Connect vehicle to latest applicable B.U.D.S. version.
2. Select the **Monitoring** and **ECM** tabs.
3. Monitor the **Intake Air** temperature indicator. It should indicate ambient temperature. Otherwise, perform the *ATS RESISTANCE TEST*.



ATS Connector Access

1. Remove drive belt guard. Refer to *DRIVE BELT* subsection.
2. Remove primary air intake silencer. Refer to *AIR INTAKE SYSTEM* subsection.
3. Rotate intake adapter to disconnect ATS sensor connector.

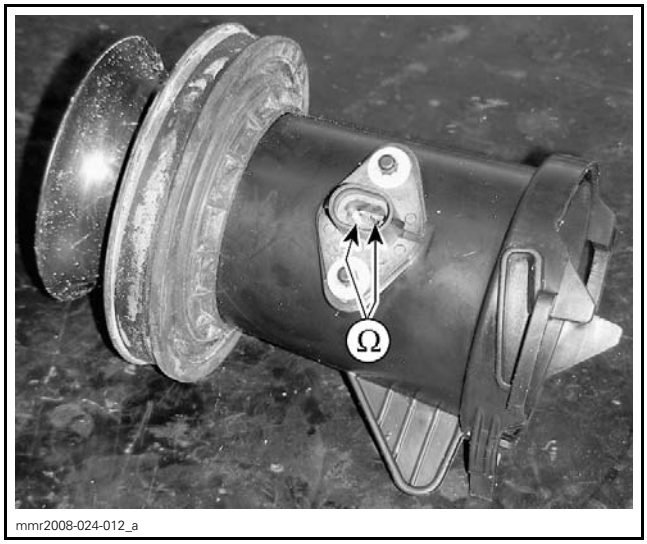


TYPICAL
1. Rotate intake adapter
2. Disconnect sensor connector

ATS Resistance Test

1. Remove parts required for access to ATS connector, refer to *ATS CONNECTOR ACCESS* in this subsection.
2. Measure sensor resistance.

ATS		MEASUREMENT
Pin 1	Pin 2	Refer to *SENSOR TEMPERATURE TABLE*



INTAKE ADAPTER REMOVED FOR CLARITY PURPOSE ONLY

SENSOR TEMPERATURE TABLE		
TEMPERATURE		**RESISTANCE (OHMS)**
°C	°F	ATS
- 40	- 40	43610
- 30	- 22	25090

SENSOR TEMPERATURE TABLE		
TEMPERATURE		RESISTANCE (OHMS)
°C	°F	ATS
- 20	- 4	14900
- 10	14	9102
0	32	5705
10	50	3680
20	68	2436
25	77	2000
30	86	1651
40	104	1144
50	122	808
60	140	580
70	158	424
80	176	316
90	194	238
100	212	182
110	230	141
120	248	111
130	266	88
140	284	70
150	302	57
160	320	47
170	338	39
180	356	32
190	374	27
200	392	23

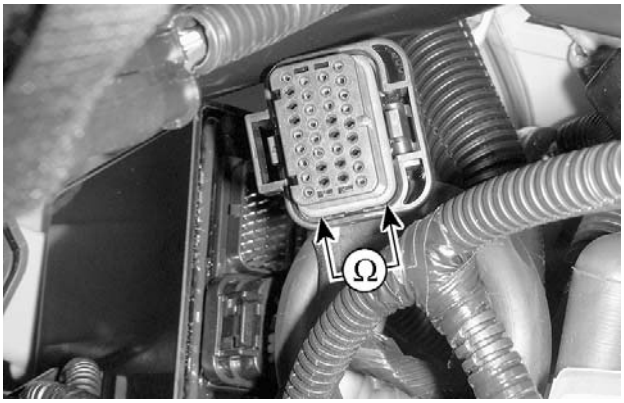
If resistance is out of specifications, replace sensor.

If resistance tests good, carry out the following steps.

3. Reconnect the ATS connector.
4. Disconnect the J1A connector from ECM.
5. Using the FLUKE 115 MULTIMETER (P/N 529 035 868), measure sensor circuit resistance value as follows.

IMPORTANT: Move wiring harness back and forth near the sensor connector while measuring the resistance. If the resistance value varies as the harness is moved, check sensor connections.

J1A CONNECTOR		MEASUREMENT
Pin J1A-20	Pin J1A-27	Refer to *SENSOR TEMPERATURE TABLE*



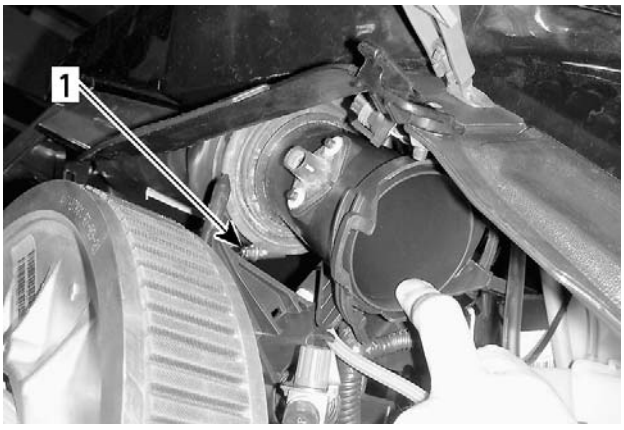
mmr2009-027-001_c

If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the ATS.

6. Reinstall removed parts. Ensure intake adapter boot is properly installed on the adapter. See below in *ATS REPLACEMENT.*

ATS Replacement

1. Remove parts required for access to ATS, refer to *ATS ACCESS* in this subsection.
2. Loosen clamp retaining adapter boot seal.



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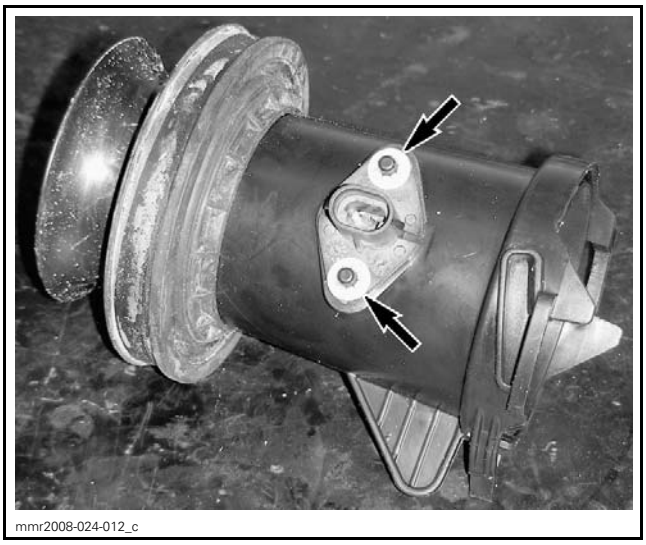
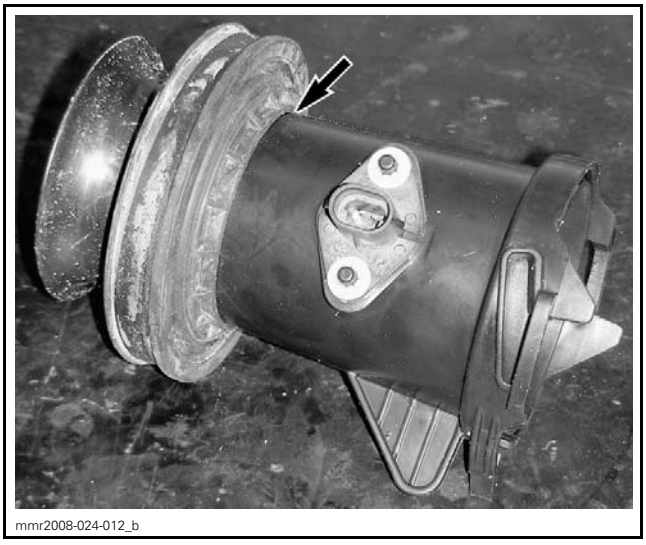
1. Boot clamp

3. Disconnect ATS connector.
4. Pull out intake adapter.
5. Remove sensor push nuts.


mmr2008-024-012_c

ATS SENSOR PUSH NUTS

6. Pull out sensor.
7. Using new push nuts, secure the new sensor to the adapter.
8. Reconnect ATS.
9. Ensure adapter boot is properly installed as shown.


mmr2008-024-012_b

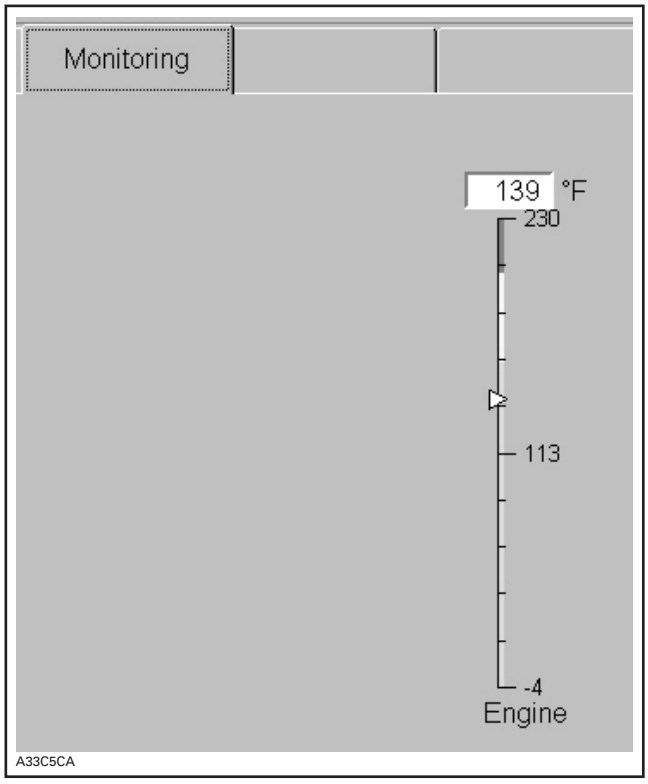
CORRECT BOOT INSTALLATION

10. Reinstall removed parts.

CTS (COOLANT TEMPERATURE SENSOR)

CTS Test with B.U.D.S.

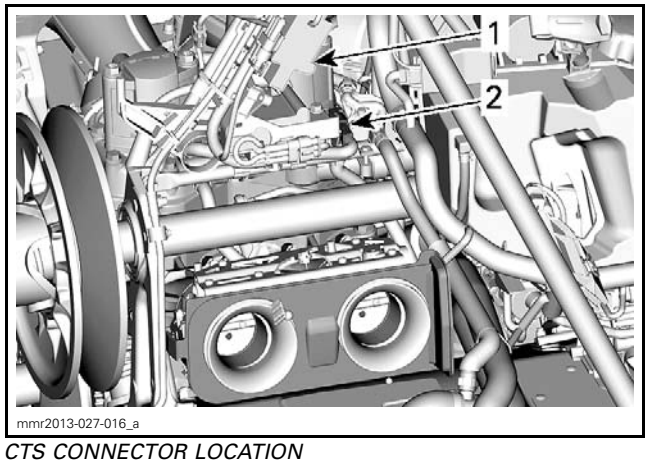
1. Connect vehicle to latest applicable B.U.D.S. version.
2. Select the **Monitoring** and **ECM** tabs.
3. Monitor the **Engine** temperature indicator. It should show the coolant temperature. Otherwise, perform the following *CTS RESISTANCE TEST*.



A33C5CA

CTS Connector Access

Remove primary air intake silencer. Refer to *AIR INTAKE SYSTEM* subsection.



mmr2013-027-016_a

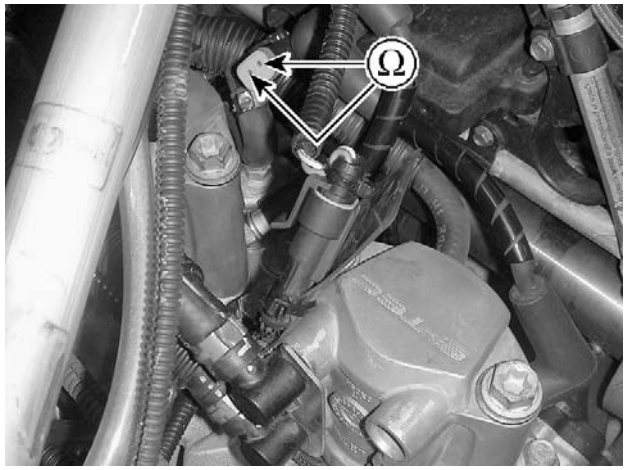
CTS CONNECTOR LOCATION
1. PTO ignition coil
2. CTS connector

CTS Resistance Test

1. Disconnect CTS sensor connector, refer to *CTS CONNECTOR ACCESS*.

2. Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and set it to Ω.
3. Measure resistance between sensor terminals.

CTS		MEASUREMENT
Pin 1	Pin 2	Refer to *CTS SENSOR TEMPERATURE TABLE (E-TEC)*
Pin 1 or 2	Engine ground	Open circuit (OL)



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CTS RESISTANCE CHECK

CTS SENSOR TEMPERATURE TABLE (E-TEC)		
TEMPERATURE		**RESISTANCE (OHMS)**
°C	°F	ATS
- 40	- 40	72412
- 30	- 22	38681
- 20	- 4	21529
- 10	14	12431
0	32	7418
10	50	4582
20	68	2919
30	86	1912
40	104	1284
50	122	883
60	140	622
70	158	448
80	176	328
90	194	245
100	212	186

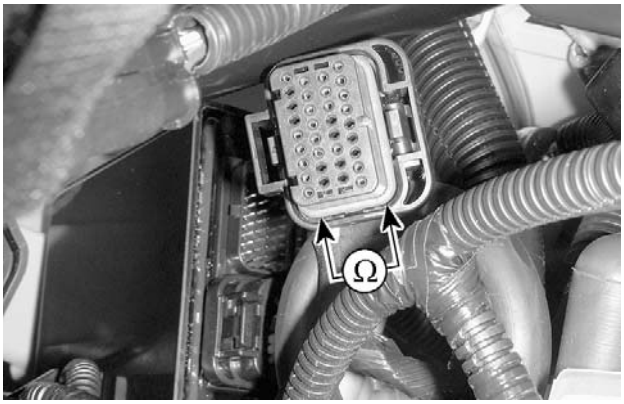
CTS SENSOR TEMPERATURE TABLE (E-TEC)		
TEMPERATURE		**RESISTANCE (OHMS)**
°C	°F	ATS
110	230	143
120	248	112
130	266	88
135	275	79
140	284	71
145	293	64
150	302	57

If resistance is out of specifications, replace CTS.

If resistance tests good, carry out the following steps.

4. Reconnect the CTS.
5. Disconnect the J1A connector from ECM.
6. Measure CTS circuit resistance as follows.

J1A CONNECTOR		MEASUREMENT
Pin 19	Pin 27	Refer to *CTS SENSOR TEMPERATURE TABLE (E-TEC)*



mmr2009-027-001_c

TYPICAL

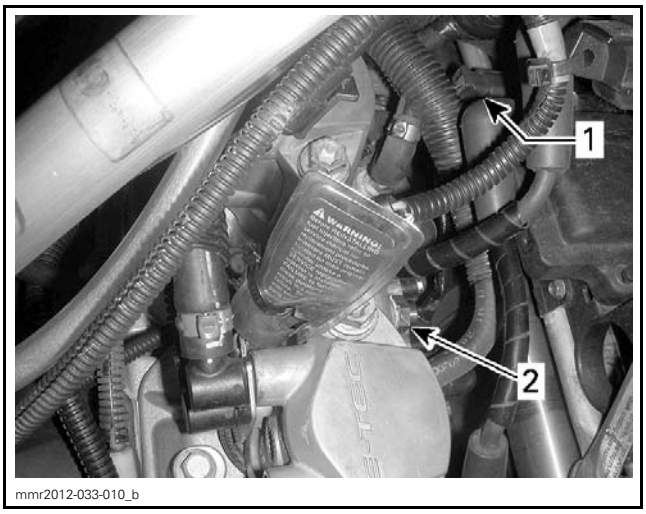
If resistance value is correct, sensor and wiring/connectors are good.

If resistance value is incorrect, repair/replace wiring/connectors between ECM and CTS.

CTS Replacement

1. Remove parts required to access CTS, refer to *CTS ACCESS* in this subsection.
2. Lift rear of vehicle to minimize coolant spillage.
3. Disconnect CTS connector.

4. Remove CTS.



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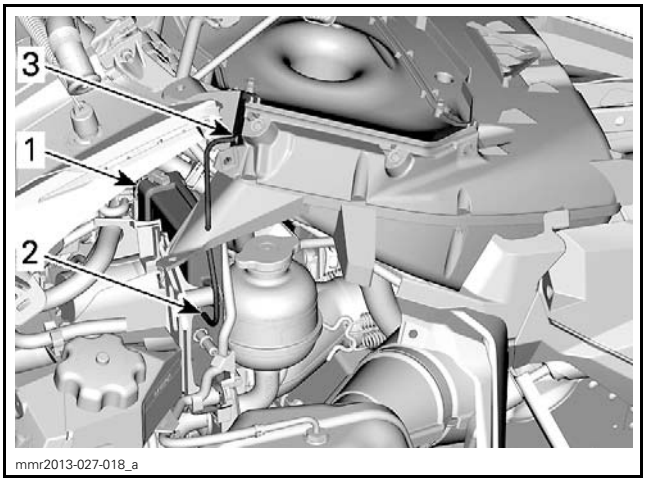
1. CTS connector
2. CTS

5. Install new CTS and torque to 12 N•m (106 lbf•**in**).
6. Reinstall removed parts.
7. Refill engine coolant. If an important quantity of coolant spilled from the engine, bleed cooling system. Refer to *COOLING SYSTEM* subsection.

APS (AIR PRESSURE SENSOR)

APS Location



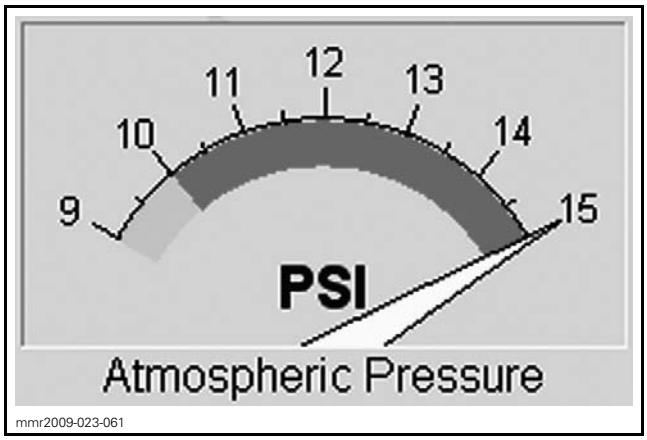
mmr2013-027-018_a

1. ECM
2. APS (inside ECM)
3. APS tube to secondary air intake silencer

APS Inspection

1. Open RH side panel. Refer to *BODY* subsection.
2. Ensure sensor hose is correctly connected on secondary air intake silencer and on ECM.
3. Check inside hose for cleanliness, water, or ice. Ensure it is not bent, kinked or burnt.
4. Connect to latest applicable B.U.D.S. version. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
5. Select the **Monitoring** and **ECM** tabs.
6. In B.U.D.S., monitor the **Atmospheric Pressure** indicator. The gauge should read the local atmospheric pressure of the day.

NOTE: At sea level, the atmospheric pressure gauge should read around 101.3 kPa (14.7 PSI) and less as altitude increases.



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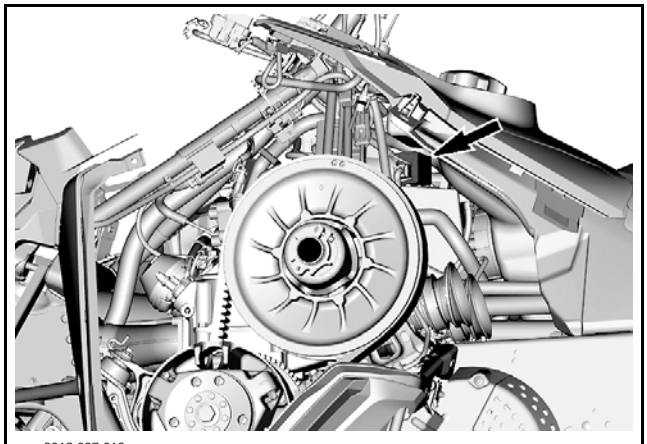
ATMOSPHERIC PRESSURE

Otherwise, replace ECM.

THCM (THERMOCOUPLE MODULE)

800R E-TEC



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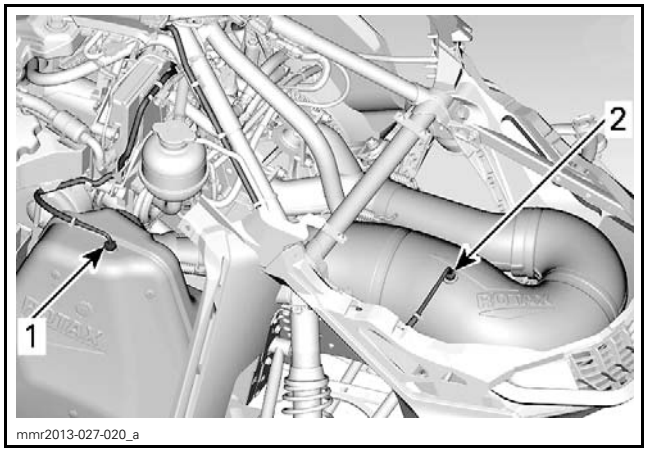
THCM MODULE



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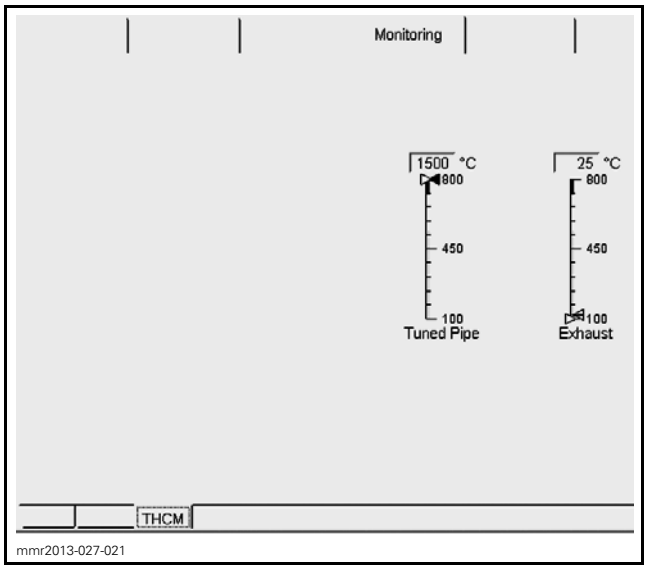
1. *Thermocouple on muffler*
2. *Thermocouple on tuned pipe (Summit X/SP and Renegade Backcountry X)*

THCM Test with B.U.D.S.

1. Connect vehicle to latest applicable B.U.D.S. version.
2. Select the **Monitoring** tab then **THCM**.
3. In B.U.D.S., monitor the **Exhaust** (Muffler) and **Tuned Pipe** temperature indicators (as applicable).



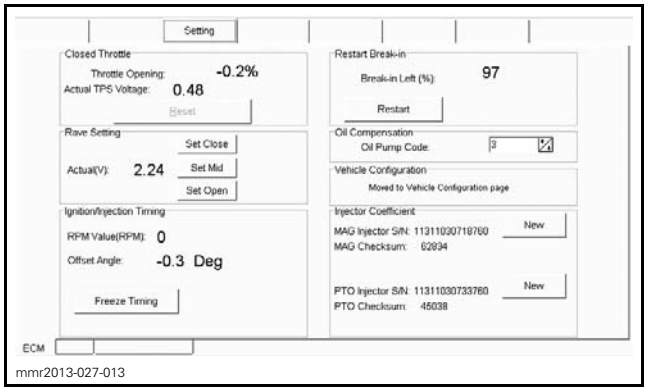
mmr2013-027-021

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.

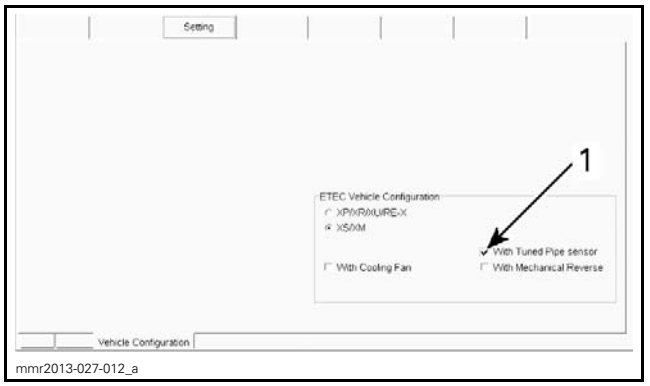
If sensor temperature is(are) not read, carry out the following steps.

4. In B.U.D.S., select the **Setting** and **ECM** tabs.



mmr2013-027-013

5. Ensure the **With Tuned Pipe Sensor** selection box is checked in the **Vehicle Configuration** area (on Summit X/SP and Renegade Backcountry X). Otherwise, the THCM will not be monitored by the ECM.



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ECM SETTING PAGE IN B.U.D.S.
1. **With Tuned Pipe Sensor** *selection box*

6. Check for an applicable fault code (P0428, P1427, P1428.

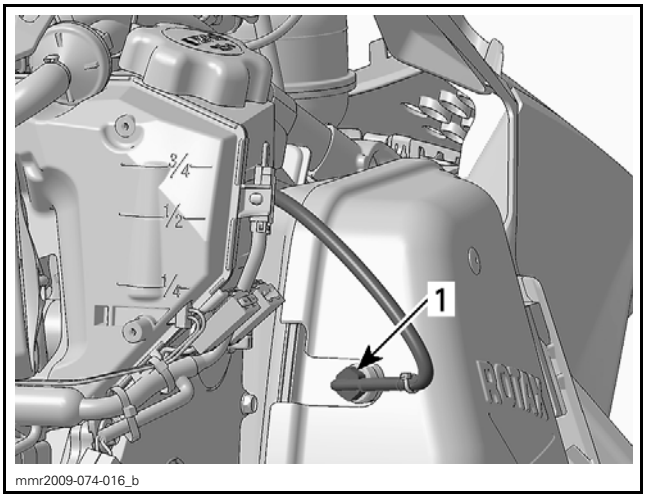
If configuration is Ok, carry out service action as suggested by fault code.

If the THCM or thermocouple requires replacement, refer to *EXHAUST SYSTEM* subsection.

EXHAUST GAS TEMPERATURE SENSOR (EGTS)

EGTS Location

600 HO E-TEC



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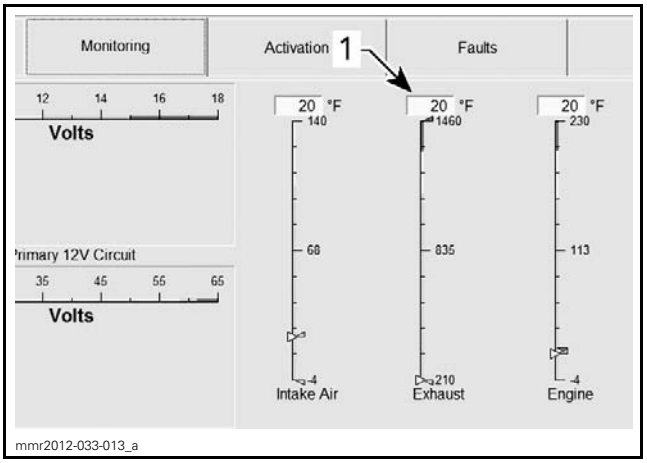
1. EGTS

EGTS Test with B.U.D.S.

In B.U.D.S., select the **Monitoring** and **ECM** tabs.

Monitor the **Exhaust** temperature indicator. It should show the exhaust temperature, otherwise carry out the *EGTS RESISTANCE TEST*.



mmr2012-033-013_a

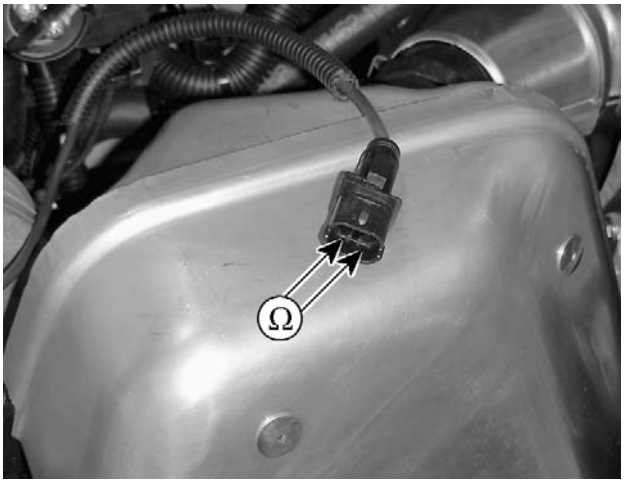
1. Muffler **Exhaust** *temperature indicator*

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 Resistance Test

1. Remove RH side panel. Refer to *BODY*.
2. Disconnect EGTS connector.
3. Measure sensor resistance as follows.

EGTS		MEASUREMENT
Pin 1	Pin 2	Refer to *EGTS SENSOR TEMPERATURE TABLE*



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TYPICAL

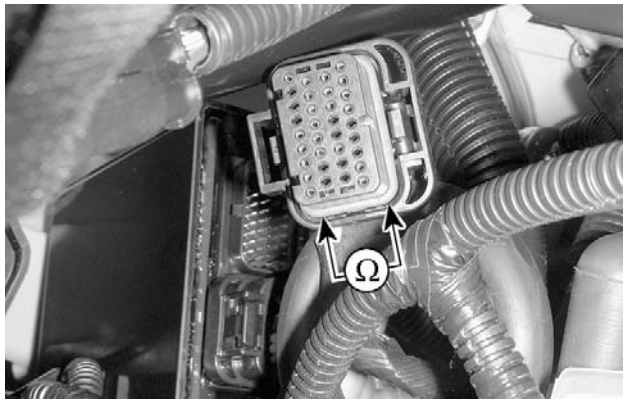
EGTS SENSOR TEMPERATURE TABLE		
TEMPERATURE		**RESISTANCE (OHMS)**
°C	°F	ATS
- 40	- 40	170
- 20	- 4	185
0	32	201
25	77	220
50	122	239
100	212	276
150	302	313
200	392	349
250	482	385
300	572	420
350	662	454
400	752	488
450	842	521
500	932	554
600	1112	618
700	1292	679
800	1472	738
900	1652	795
1000	1832	849

If resistance is out of specification, replace the sensor.

If resistance is as per specification, carry out the following steps.

4. Reconnect the EGTS.
5. Disconnect the J1A connector from ECM.
6. Measure resistance as follows.

J1A CONNECTOR		MEASUREMENT
Pin 12	Pin 27	Refer to *EGTS SENSOR TEMPERATURE TABLE*



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TYPICAL

If resistive value is correct, try a new ECM. Refer to *ENGINE CONTROL MODULE (ECM)* in this subsection.

If resistive value is incorrect, repair the connector or replace the wiring harness between ECM connector and the EGTS.

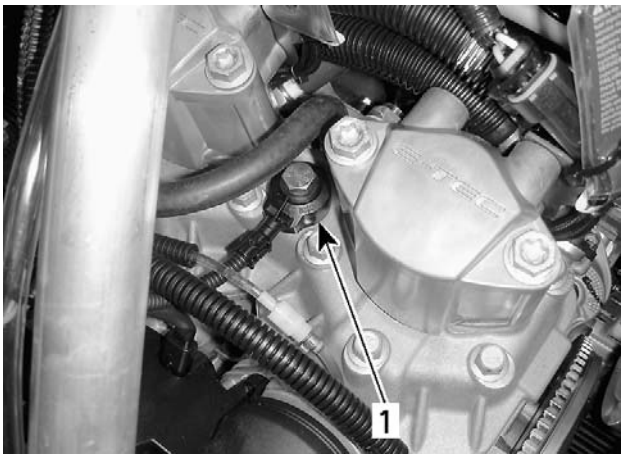
EGTS Replacement

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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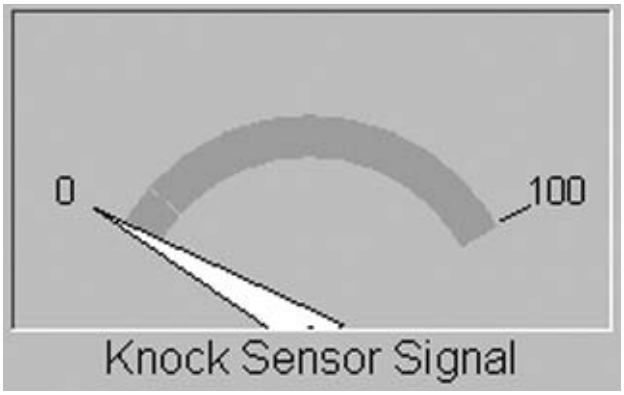
TYPICAL
1. Knock sensor

KS Test with B.U.D.S.

1. Lift rear of vehicle off the ground and support it with a wide-base mechanical stand.
2. Use the latest applicable B.U.D.S. version.
3. Monitor the knock sensor using the **Knock Sensor Signal** indication in the **ECM Monitoring** page of B.U.D.S.



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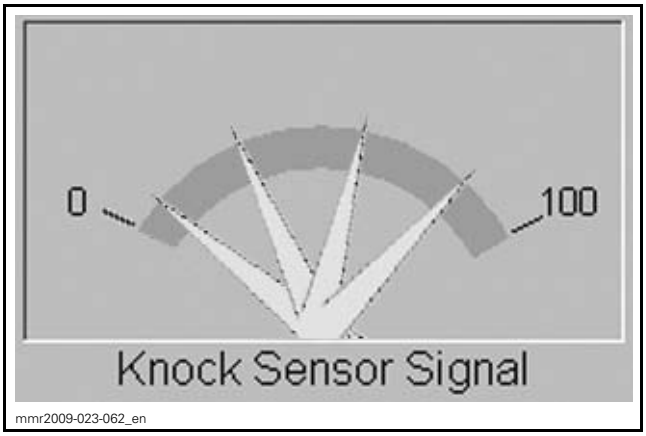
MONITORING TAB

4. Start the engine.
5. Bring engine speed above 5200 RPM and vary engine RPM above 5200 RPM.

The needle of the **Knock Sensor Signal** gauge should move between 0 and 100. The needle movement pattern is of no importance as long as it moves indicating the knock sensor senses the engine vibrations.



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If the needle moves as described, the knock sensor should be good.

If the needle sticks either at 0 or 100, there is a problem.

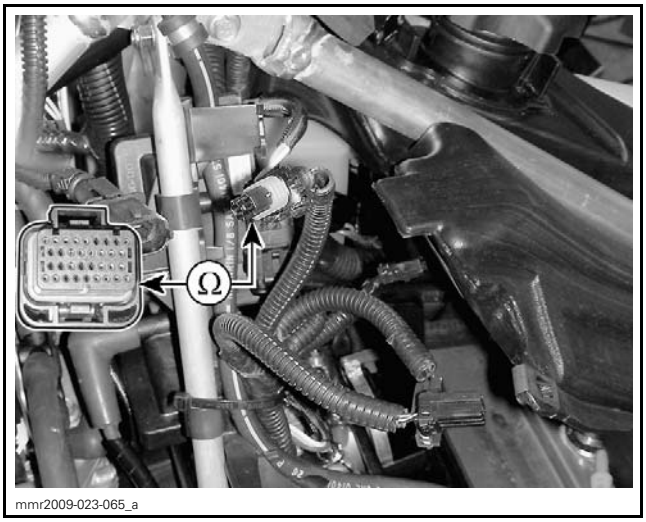
NOTE: Ensure ignition coil cables are not close to knock sensor harness. If so, this might generate a false fault code.

Carry out the *KS CIRCUIT CONTINUITY TEST*.

KS Circuit Continuity Test

1. Ensure sensor and cylinder head contact surfaces are clean and mounting bolt and washer are correct and properly torqued down.
2. Disconnect knock sensor connector (DT). Refer to *KNOCK SENSOR REPLACEMENT.*
3. Disconnect J1A connector from ECM.
4. Check wire continuity of circuit as per following table.

J1A CONNECTOR	KS CONNECTOR	MEASUREMENT
J1A-34	Pin 1	Close to 0 Ω (continuity)
J1A-33	Pin 2	



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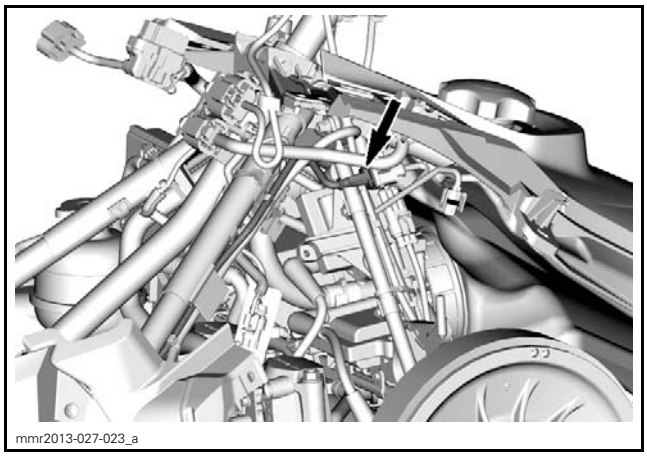
If test is not good, repair/replace wiring/connectors between ECM and knock sensor.

If test is good, try a new knock sensor.

KS Replacement

1. Unscrew and remove knock sensor from cylinder head.
2. Remove drive belt guard. Refer to *DRIVE BELT* subsection.
3. Remove primary air intake silencer. Refer to *AIR INTAKE SYSTEM* subsection.
4. Disconnect knock sensor connector located near ATS.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5. Clean contact surfaces on cylinder head, then install the new knock sensor.
6. Torque knock sensor screw to 29 N•m (21 lbf•ft).

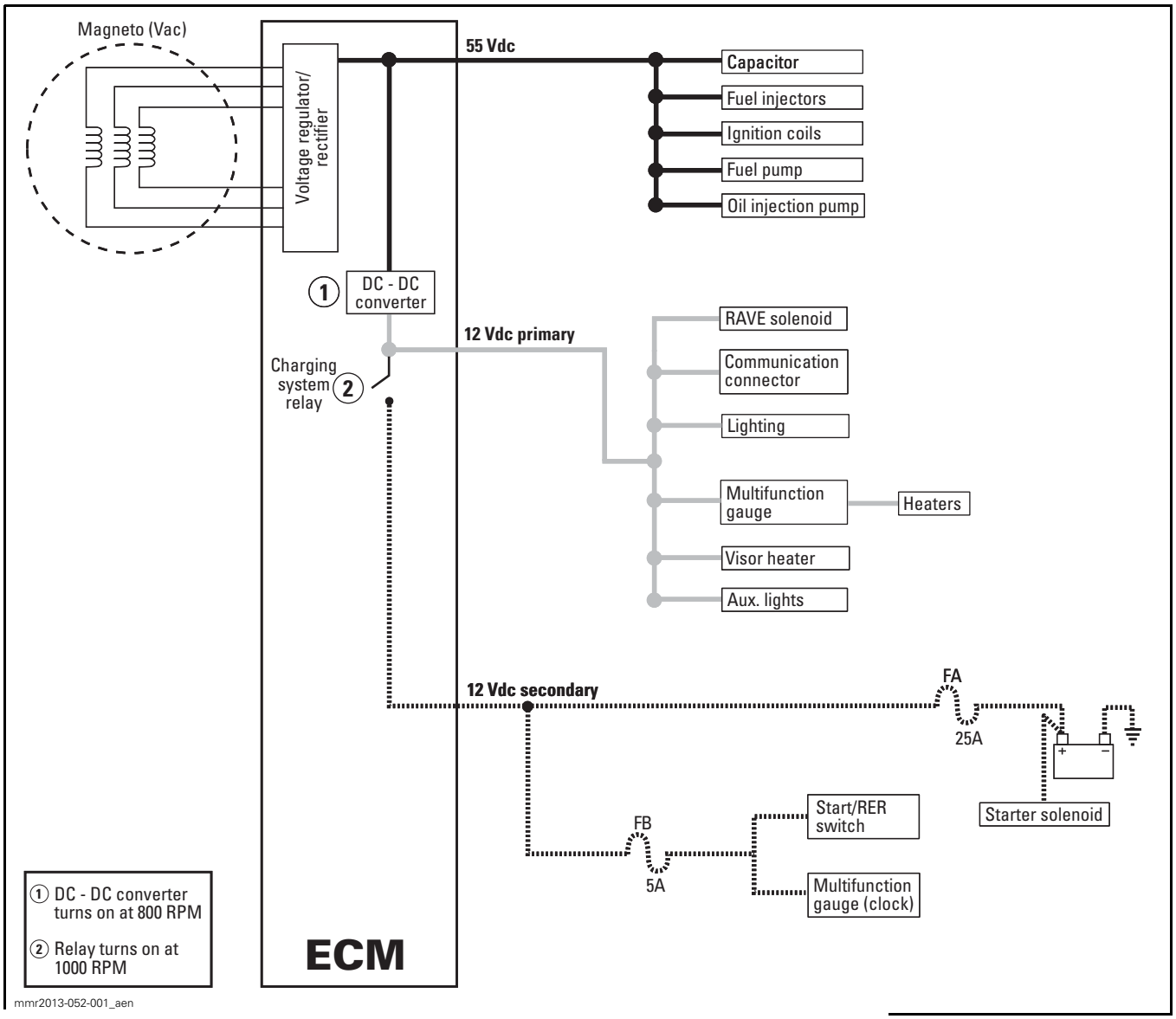
NOTICE **Improper torque may prevent sensor from functioning properly possibly leading to severe internal engine component damage.**

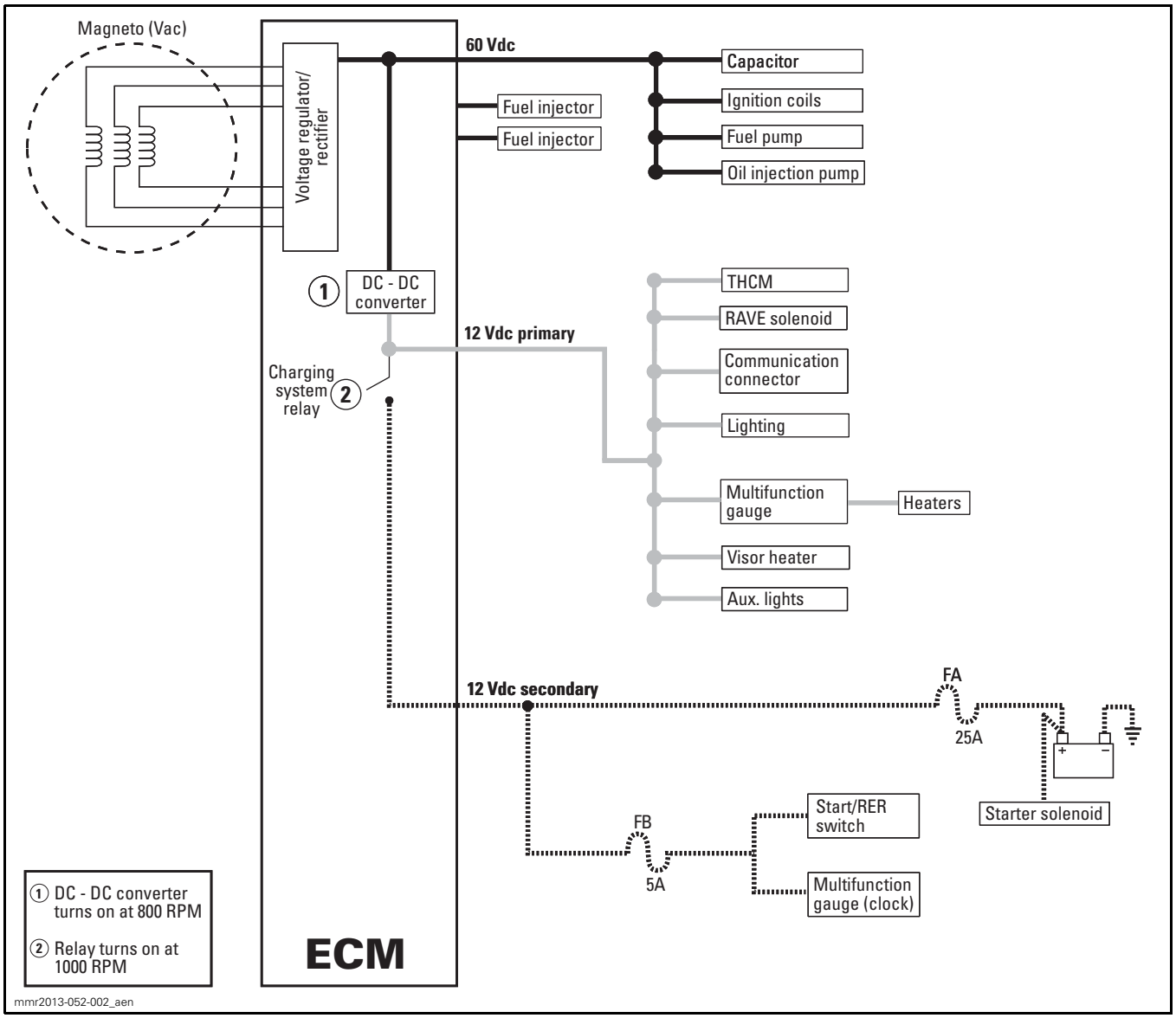
7. Reconnect connector.
8. Reinstall remaining parts.

POWER DISTRIBUTION

GENERAL

OVERVIEW





800R E-TEC SIMPLIFIED SCHEMATIC

THCM	Thermocouple module

The magneto stator is wired with 3 independent windings that works in phase. Each winding is separately wound, they are not connected, so 6 wires go to the ECM.

The vehicle requires the highest possible voltage at low RPM (to quickly supply the fuel pump, injectors and ignition coils) and the highest possible current at higher RPM (to properly supply the engine electrical loads that increase with RPM and all the other components like RAVE valves, gauge, lights and heaters). To achieve this, the stator windings are connected in series at low RPM to meet the voltage requirements and then connected in parallel at higher RPM to meet the current requirements. This series-parallel switch is done in the ECM.

The series to parallel switching occurs at approximately 1500 RPM.

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 as per the following chart.

MODEL	VOLTAGE
600 HO E-TEC	55 Vdc
800R E-TEC	60 Vdc

SYSTEM VOLTAGE (55/60 VDC)

Since the available power is low when cranking, the ECM first supplies 55/60 Vdc to the components that mandatory need voltage for the starting and the basic operation of the engine:

- ECM (internally powered to a lower voltage)
- Fuel pump
- Fuel injectors
- Ignition coils
- Electronic oil injection pump.

A large capacitor is used to stabilize the 55/60 Vdc system to provide a constant power to the injectors.

The capacitor is attached to the oil tank.

SYSTEM VOLTAGE (12 VDC)

A DC-DC converter, in the ECM, steps down the 55/60 DC voltage to 12 Vdc when the engine reaches 800 RPM.

The 12 Vdc voltage is then divided in a primary and a secondary system.

Below 2000 RPM, the total available current is limited to reduce the load on the system voltage. Above 2000 RPM, the 12 Vdc system have a maximum of 25 A available. In all running conditions, the system voltage must be kept at 55/60 Vdc.

Primary Voltage (12 Vdc)

Since the available power is not at its maximum at the early stage of engine starting, the ECM supplies 12 Vdc to the components that are critical for the engine and vehicle when engine reaches 800 RPM.

- THCM (thermocouple module) on some models
- RAVE solenoid
- Communication connector
- Lighting system
- Multifunction gauge
- Heaters
- Heated visor
- Auxiliary lights
- 12 V power outlet
- Other accessories

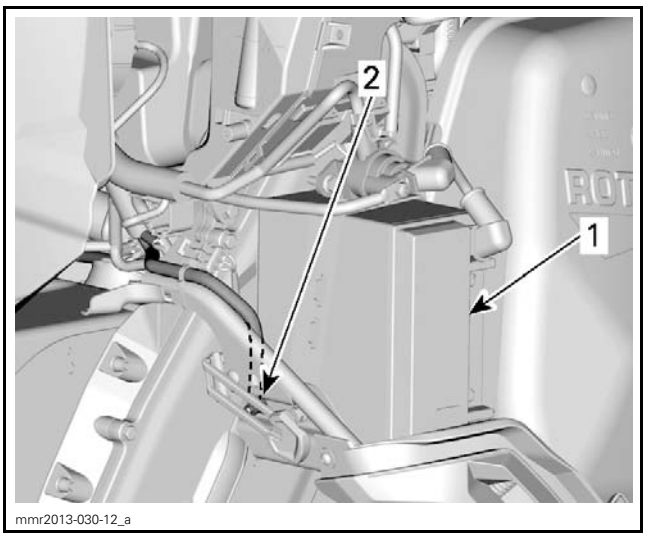
Secondary Voltage (12 Vdc)

On **electric start models**, when the engine speed reaches 1000 RPM, the charging system relay closes and battery charging can take place.

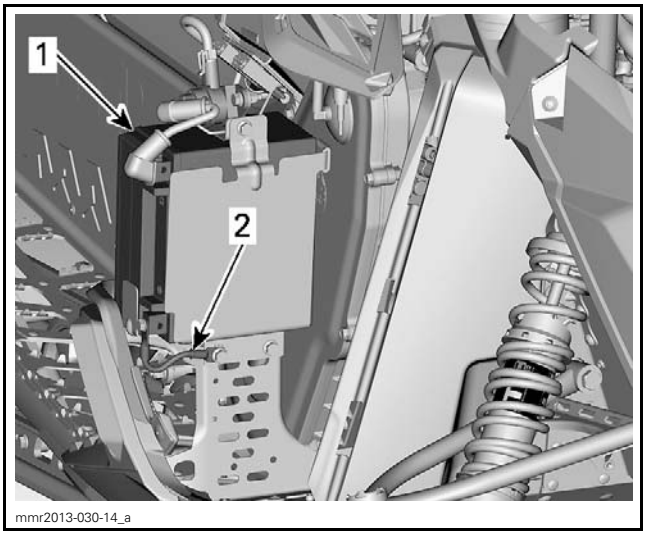
POWER DISTRIBUTION SUMMARY

ENGINE OPERATION	VOLTAGE DELIVERED	COMPONENT SUPPLIED
Any engine speed	55/60 Vdc	– ECM (internally powered) – Fuel pump – Fuel injectors – Ignition coils – Electronic oil injection pump
When engine reaches 800 RPM	12 Vdc	– THCM (thermocouple module) on some models – RAVE solenoid – Communication connector – Lighting system – Multifunction gauge – Heaters – Heated visor – Auxiliary lights – 12 V power outlet – Other accessories
When engine reaches 1000 RPM	12 Vdc	– Battery charging on electric start models

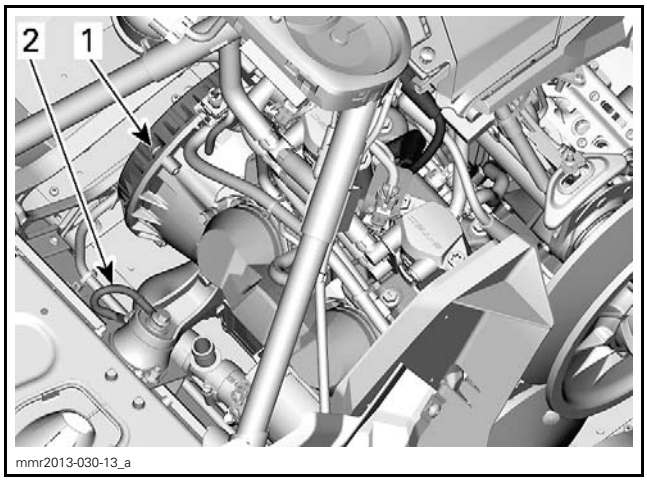
GROUNDS



RH SIDE, VIEWED FROM REAR
1. *Battery*
2. *Main harness ground*



RH SIDE, VIEWED FROM FRONT
1. *Battery*
2. *Battery ground*



LH SIDE, VIEWED FROM FRONT
1. *Rewind starter*
2. *Engine ground*

IGNITION SYSTEM

SERVICE TOOLS

Description	Part Number	Page
12 V BATTERY SUPPLY CABLE	529 035 997	16
DIAL INDICATOR ADAPTER	529 036 132	5
FLUKE 115 MULTIMETER	529 035 868	11, 13
IGNITION TIMING TOOL	529 036 129	4
POWER INTERFACE	515 177 223	10
TDC DIAL INDICATOR	295 000 143	5
TDC DIAL INDICATOR	414 104 700	5

GENERAL

⚠ WARNING

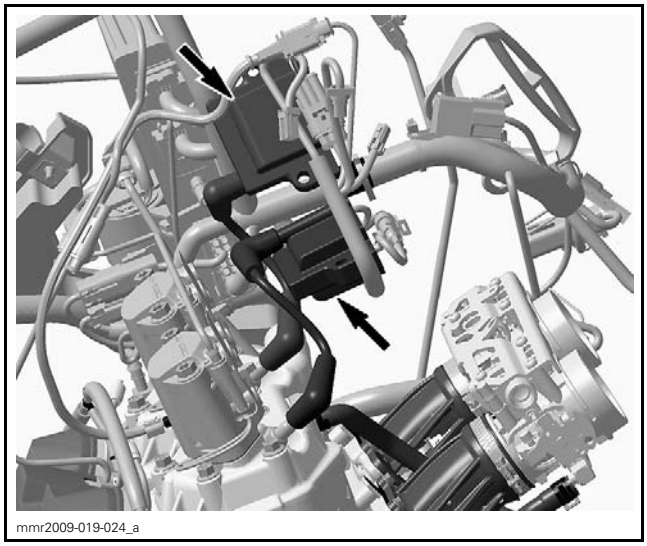
Always electrically disconnect both fuel injectors prior to testing for ignition spark. Otherwise, fuel vapors may ignite in presence of a spark creating a fire hazard.

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 similar to a CDI system but with a longer 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 voltage to a high level in their secondary winding to produce a spark at each spark plug independently.



TYPICAL — IGNITION COILS

The ignition coils receive power from the 55/60 Vdc system. Their operating voltage varies from 20 to 55/60 Vdc.

Ignition System Basic Operation

A 3-wire connector is connected to the primary winding of each coil.

The ignition coils are powered by the 55/60 Vdc system voltage through pin 3. Pin 1 is connected to a ground circuit.

Each ignition coil uses an active circuitry to energize the primary winding when it receive a pulse from the ECM via pin 2. The dwell time 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.

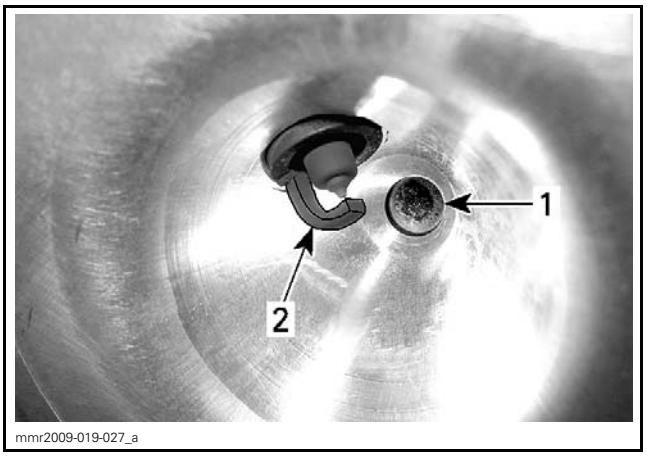
A resistive core spark plug cable is used to prevent the RFI (Radio Frequency Interference). There is no resistor in the spark plug cap.

Spark Plugs

800R E-TEC

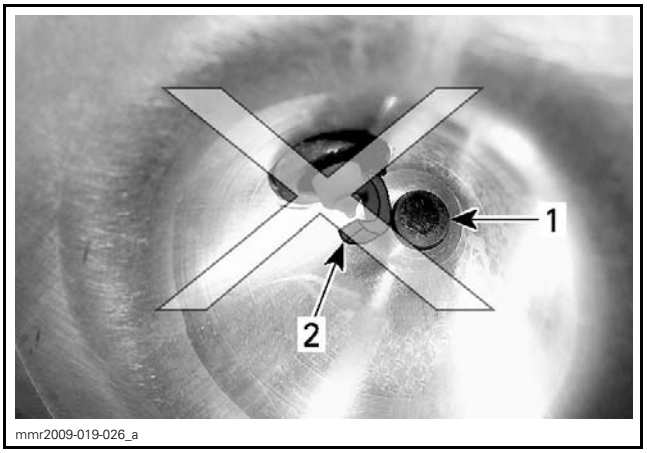
The OEM spark plug used is specially indexed for optimum engine operation and efficiency.

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.



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

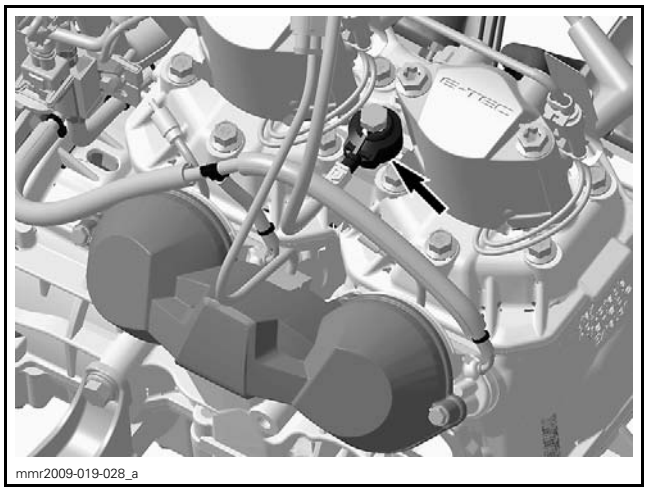
The crankshaft position sensor (CPS), the air pressure sensor (APS) and the throttle position sensor (TPS) are the primary sensors used to control the ignition timing.

The ECM is programmed with data (ignition mappings). Using engine operating parameters provided by the sensors, the ECM controls the ignition timing for optimum engine operation under all operating conditions.

Ignition timing can be adjusted using B.U.D.S.

Knock Detection

A knock sensor is mounted on top of the cylinder head. It detects specific vibration that would be typically generated by engine detonation.



TYPICAL

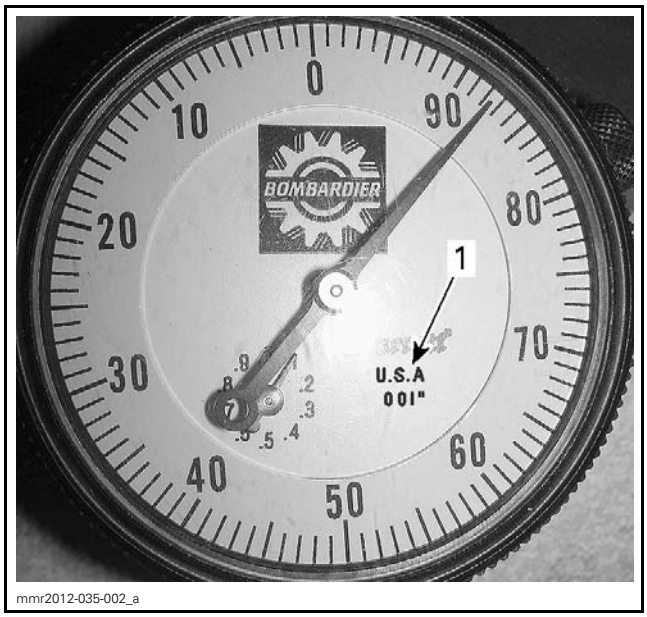
If detonation occurs, the ECMs retards the ignition and increases the fuel injected temporarily (it goes into a specific operating mode) until detonation stops.

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



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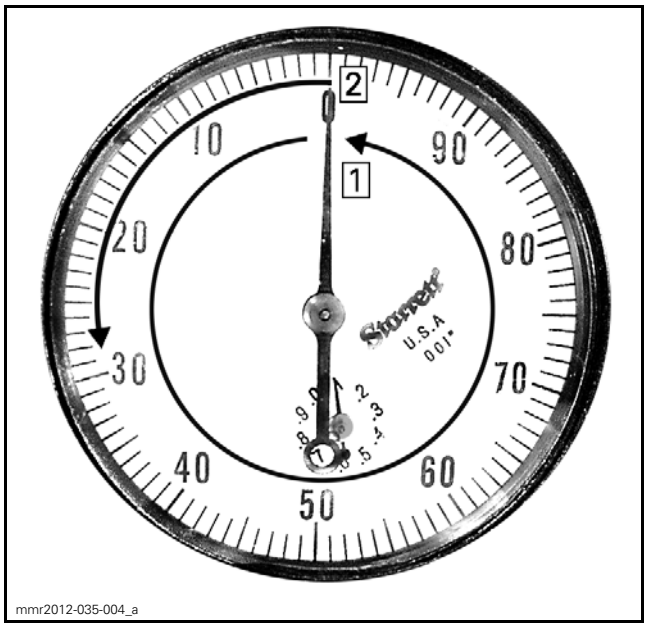
IMPERIAL GAUGE EXAMPLE
1. 001 inch means it is graduated each 1/1000 inch

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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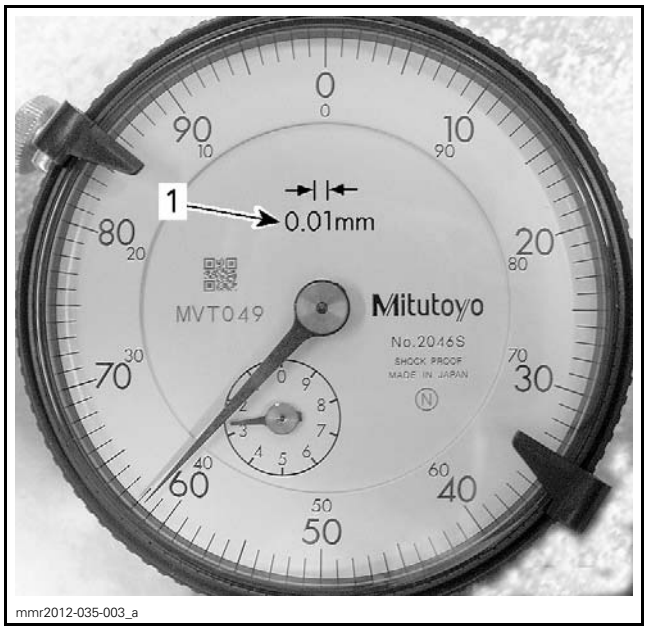
.128 INCH AS AN EXAMPLE
Step 1: 1 complete turn
Step 2: 28 lines

Metric Dial Gauge



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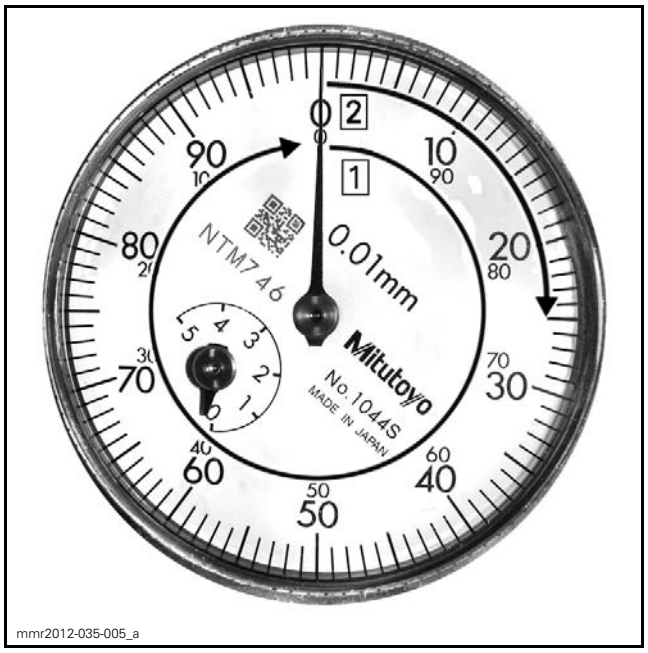
METRIC GAUGE EXAMPLE
1. 0.01mm means its graduated each 1/100 millimeter

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.



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

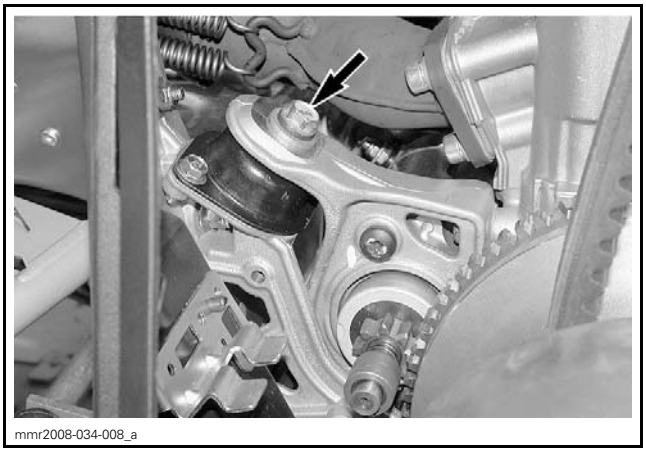
If the ignition timing is found incorrect, first check for proper crankshaft alignment. This might be an indication of a twisted crankshaft. Refer to *ENGINE MEASUREMENT* subsection.

Ignition Timing Tool Installation

⚠ WARNING

Ensure tether cord is removed from engine cut-off switch and emergency engine stop switch is in the STOP position.

1. Remove the LH front engine mounting screw.



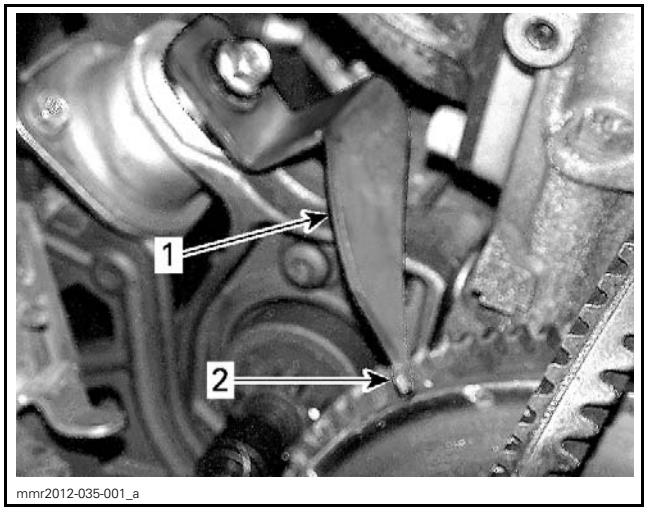
LH FRONT ENGINE MOUNT SCREW

NOTE: Note position of washers for installation.

2. Install the appropriate ignition timing tool on the LH front engine mount.

	REQUIRED TOOL
	IGNITION TIMING TOOL (P/N 529 036 129) 

TIGHTENING TORQUE	
Engine mount screw	25 N•m (18 lbf•ft)



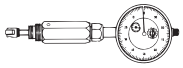
1. Ignition timing tool
2. Pointer

TDC Gauge Installation

⚠ WARNING

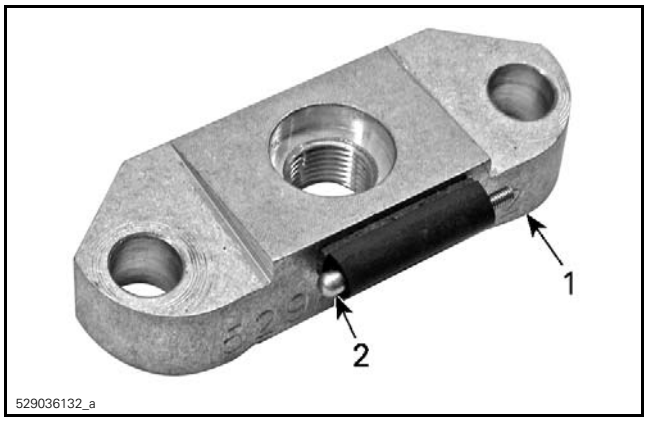
Ensure tether cord is removed from engine cut-off switch and emergency engine stop switch is in the STOP position.

Two TDC gauges can be used:

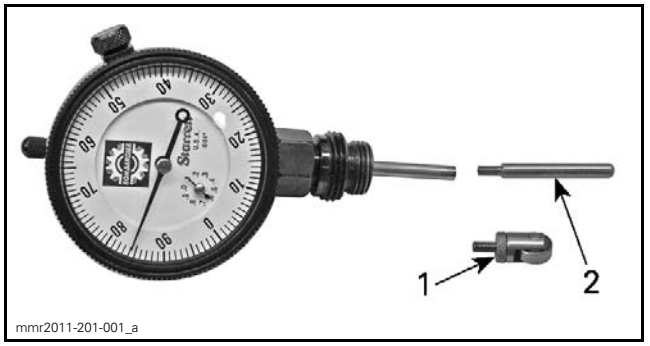
TDC GAUGES	
Preferred Gauge TDC DIAL INDICATOR (P/N 295 000 143) **(short reach)**	
TDC DIAL INDICATOR (P/N 414 104 700) **(long reach)**	

Short Reach Gauge Preparation (Preferred Gauge)

1. Remove the roller tip from the gauge.
2. Use the rounded tip from the DIAL INDICATOR ADAPTER (P/N 529 036 132).



1. Dial indicator adaptor
2. Rounded tip



1. Roller tip removed
2. Rounded tip to install

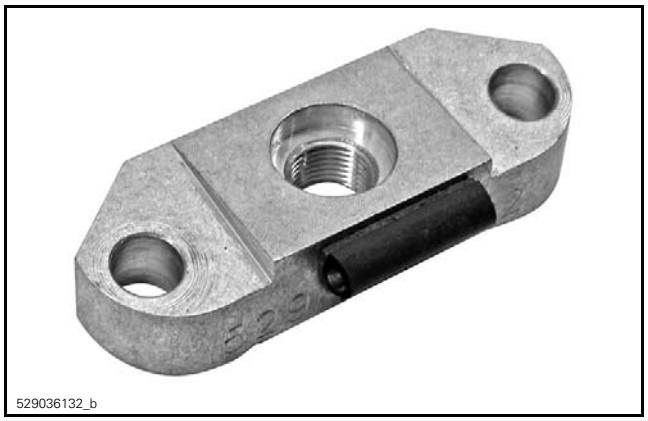
3. Install the rounded tip on the gauge.

Long Reach Gauge Preparation

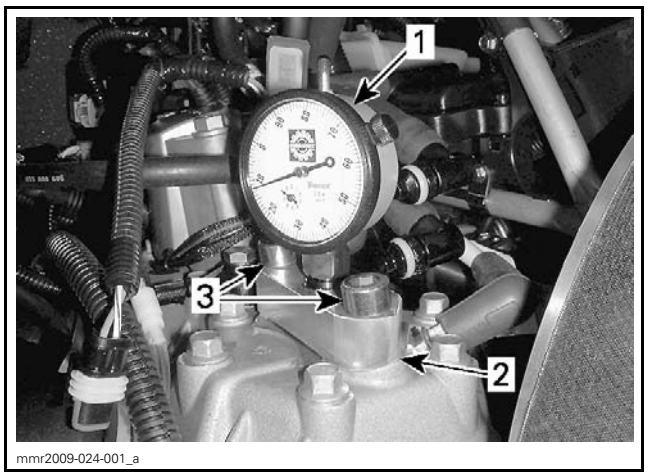
1. Loosen and lift the console, gauge support and secondary air intake silencer to provide clearance for the long reach gauge.
2. Replace the roller tip by the rounded tip as described in the *SHORT REACH GAUGE PREPARATION*.

Gauge Installation (both gauges)

1. Remove the PTO injector, refer to *E-TEC DIRECT FUEL INJECTION* subsection.
2. Install the DIAL INDICATOR ADAPTER (P/N 529 036 132) over the PTO injector hole.


529036132_b

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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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.

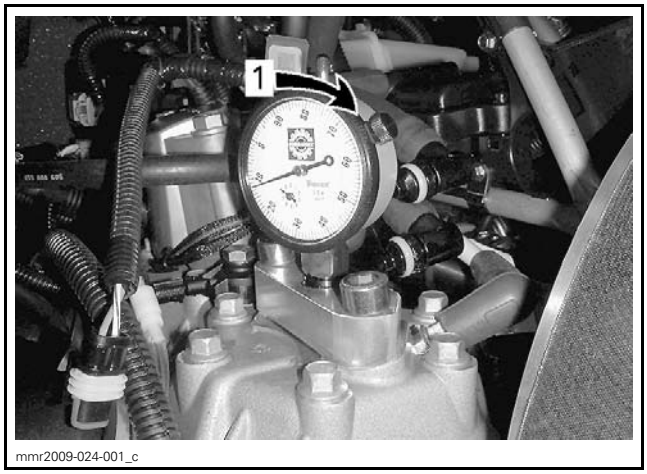
5. Again, slowly rotate the drive pulley back and forth across TDC and confirm the needle always stops exactly at "0" before changing direction. "0" now indicates exact TDC.
6. Lock the dial face with the dial lock screw.

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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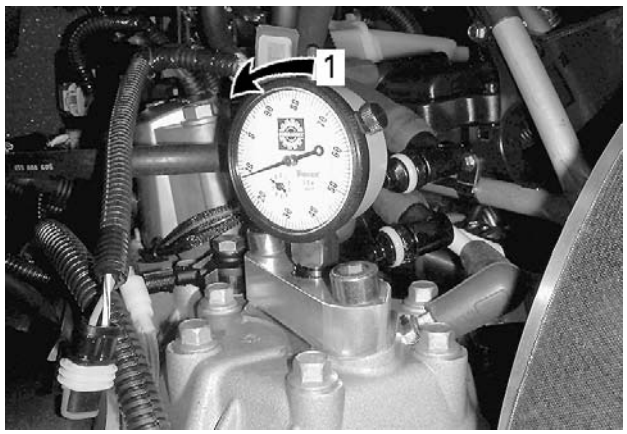
1. Pass the BTDC specification

2. Then carefully rotate engine forward until needle precisely points the measurement specified in the table.



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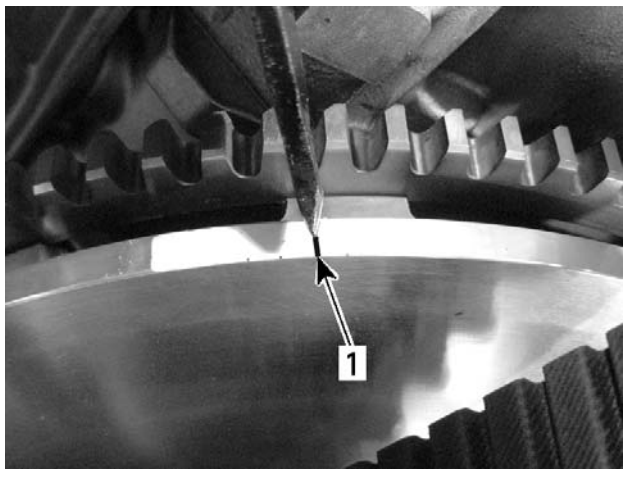
1. Bring dial needle to the BTDC specification

NOTE: Final setting must always be made in the normal engine rotation.

IGNITION TIMING BTDC		
ENGINE	BTDC SPECIFICATION	DEGREE SETTING BTDC
600 HO E-TEC	5.39 mm (.212 in)	28°
800R E-TEC	5.63 mm (.222 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.



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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.	

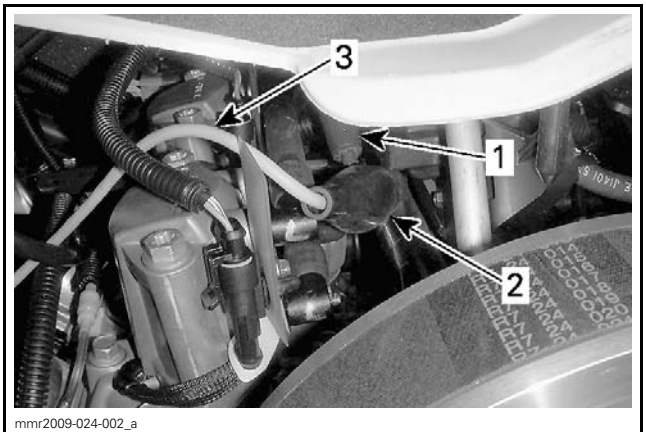
To check the ignition timing proceed as follows:

⚠ 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.



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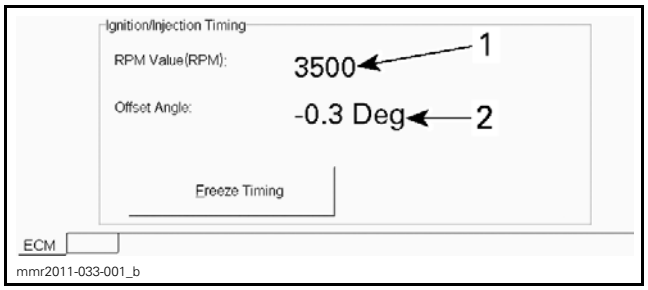
TYPICAL — TIMING LIGHT CONNECTION
1. PTO spark plug cable
2. Timing light connection to PTO plug cable
3. Timing light wire routing

2. Remove RH side panel, refer to *BODY* subsection.

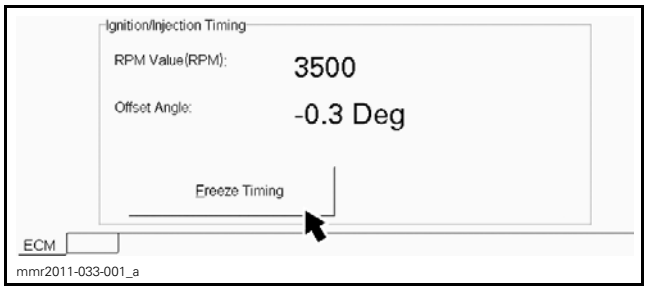
3. Connect the vehicle to the latest applicable B.U.D.S. version, refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
4. Start engine and let idle.
5. In B.U.D.S., select **Read Data**.
6. Select the **Setting** tab.
7. At the bottom of the setting page, select the **ECM** tab.
8. At the bottom left hand corner of the page, you will be able to read the **RPM Value** and the **Offset Angle** in the **Ignition/Injection Timing** area.



TYPICAL
1. *RPM Value*
2. *Timing Offset Angle*

9. In the **Ignition/Injection Timing** area, select **Freeze timing**.

NOTE: Timing will be frozen on the PTO cylinder only for RPM stability. RPM will be limited to 4000 RPM.



TYPICAL — SELECTING FREEZE TIMING

Note how the available buttons in the **Ignition/Injection Timing** area have changed.

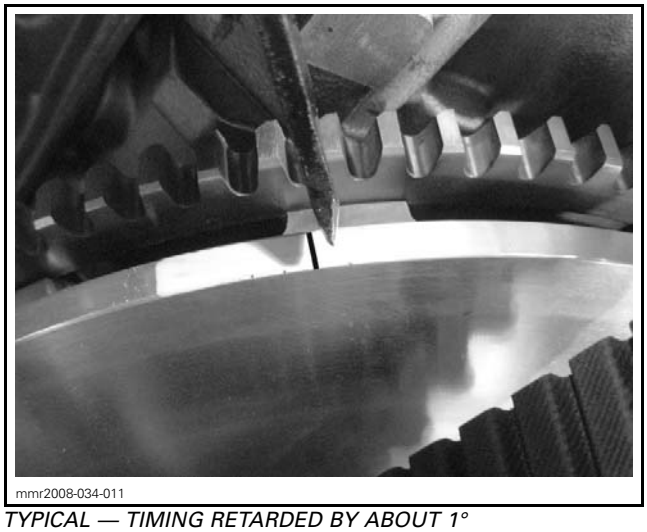
TYPICAL

10. Point the timing light on the timing mark and increase engine to **3500 RPM** for a brief instant.
11. The timing mark must be aligned with the pointer end within the specified tolerance.

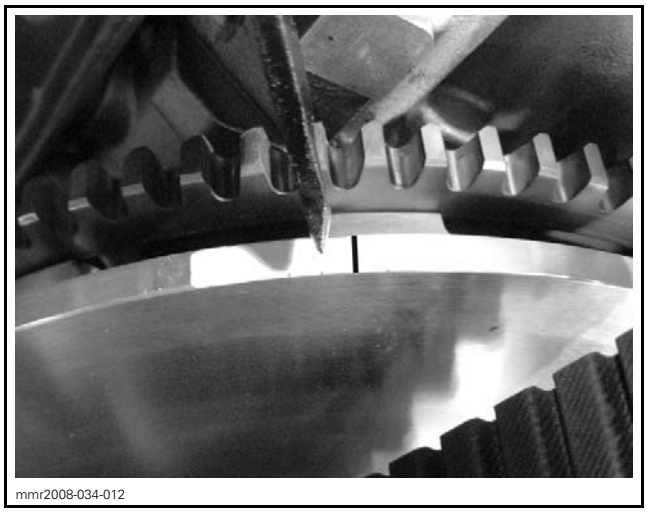
	TOLERANCE
	± 0.5°

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.



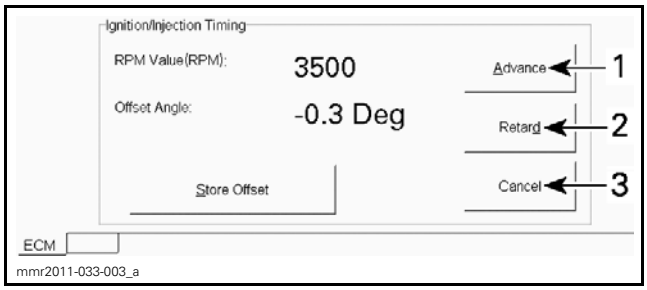
TYPICAL — TIMING RETARDED BY ABOUT 1°



TYPICAL — TIMING ADVANCED BY ABOUT 2°

Adjusting Timing

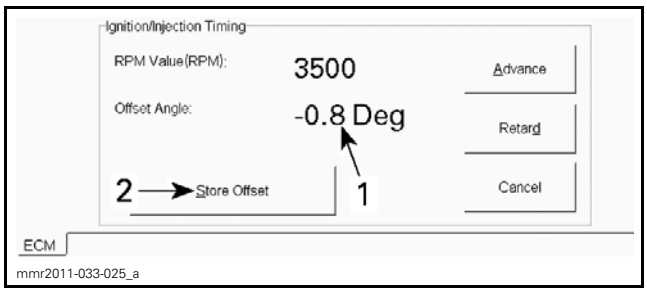
1. In the **Ignition/Injection Timing** area on the **Setting** page, select **Advance** or **Retard** to change the ignition timing, and **Cancel** to erase the last change.



TYPICAL
1. *Advance timing button*
2. *Retard timing button*
3. *Cancel timing change*

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°. Then click **Store Offset** button to store the ignition timing correction.



TYPICAL
1. *Timing angle changed by 0.5 degrees*
2. *Store Offset button*

3. Shut down engine.
4. Restart engine and select **Read Data** in B.U.D.S.
5. Recheck timing to ensure ignition timing adjustment was properly stored in the ECM.
6. Increase engine RPM pass 4000 RPM to ascertain the **Freeze Timing** function is no longer active.

NOTE: The **Freeze Timing** function automatically disengages when the **Store Offset** is selected or when engine is stopped.

7. Remove all tools.

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).

800R E-TEC

If engine idles roughly or shows signs of increased emissions, the spark plugs may be incorrectly indexed. Refer to *PERIODIC MAINTENANCE PROCEDURE* subsection.

PROCEDURES

SPARK PLUGS

Spark Plug Application

A platinum NGK spark plug is used, one per cylinder.

MODEL	NGK SPARK PLUG NUMBER
600 HO E-TEC	PZFR6F
800R E-TEC	PFR7AB

TYPICAL

Spark Testing

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. Bring the new spark plug into contact with the engine.
3. Pull rewind starter or press START/RER button as applicable.
4. If no spark is produced, refer to *IGNITION SYSTEM TESTING SEQUENCE* in this subsection.
5. 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.

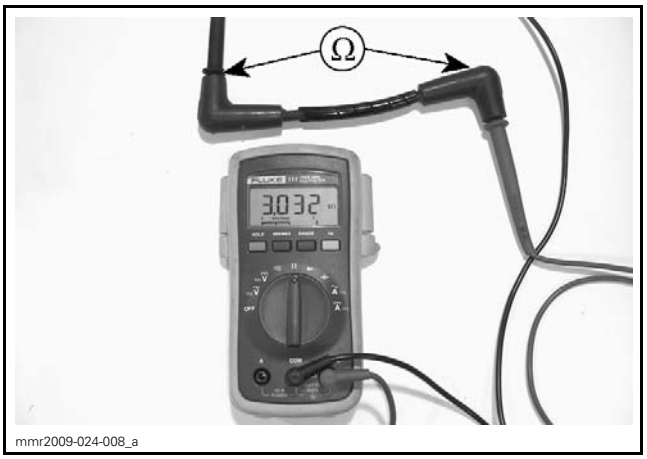
SPARK PLUG CABLES

Spark Plug Cable Resistance Test

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. Set multimeter to Ω.
3. Insert a probe in each cable end and measure the resistance.

SPARK PLUG CABLE RESISTANCE
1283 – 4083 Ω



SPARK PLUG CABLE RESISTANCE TEST

If resistance is not as specified, replace spark plug cable.

NOTICE Do not interchange spark plug cables. The lower LH coil must be matched to the PTO spark plug.

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.

The ground signal is applied to ECM connector J1A pin 9, through the emergency engine stop switch (STOP position).

Refer to applicable *WIRING DIAGRAM* for details.

Emergency Engine Stop Switch Troubleshooting

Engine Will Not Start, No Spark

If the engine will not start and you do not have ignition spark at the plugs, the emergency engine stop switch or its wiring to the ECM may be shorted to ground.

Provide power to the electrical system using the POWER INTERFACE (P/N 515 177 223) and connect as described in *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

1. Using B.U.D.S., select the **Monitoring** tab.
2. On the lower LH side of the page, choose the **ECM** tab.
3. In B.U.D.S., look for the "engine stop switch" indicator light at the bottom of the page.
4. Toggle the emergency engine stop switch STOP and RUN positions.

1. Engine stop light indication

EMERGENCY ENGINE STOP SWITCH NORMAL RESULT	
STOP position (down)	B.U.D.S. indicator light ON
RUN position (UP)	B.U.D.S. indicator light OFF

If results are not as specified, carry out an *EMERGENCY ENGINE STOP SWITCH CONTINUITY TEST*, and a *EMERGENCY ENGINE STOP SWITCH WIRING TEST* as per applicable procedures in this subsection.

NOTE: If emergency engine stop switch or wiring is open, the engine will not shut off.

Emergency Engine Stop Switch Continuity Test

To test the emergency engine stop switch, carry out the following steps.

1. Disconnect the 6-pin (RH) under the steering cover.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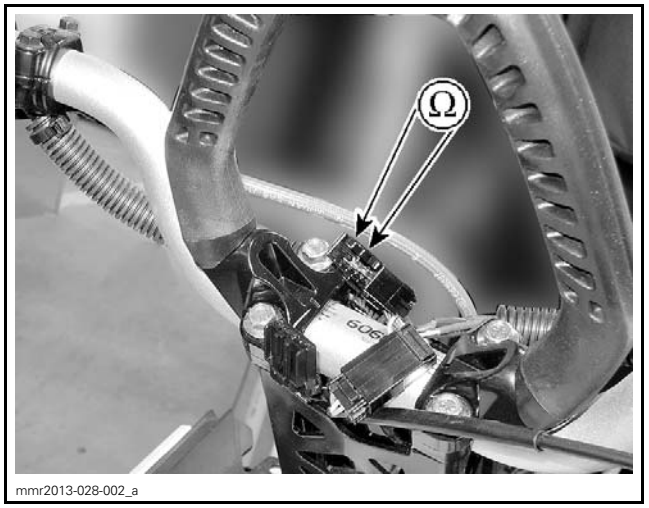
6-PINCONNECTOR (RH)

2. Set the FLUKE 115 MULTIMETER (P/N 529 035 868) multimeter to Ω.
3. Measure the resistance through the switch and its wiring as follows.

EMERGENCY ENGINE STOP SWITCH CONTINUITY TEST			
SWITCH POSITION	TEST PROBES		RESISTANCE
RUN	Pin 5	Pin 6	Infinite (OL)
STOP			0 to 0.5 Ω



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If readings are not as specified in table, replace switch or repair wiring/connector.

If readings are as specified, refer to *EMERGENCY ENGINE STOP SWITCH WIRING TEST*.

Emergency Engine Stop Switch Wiring Test

Emergency Engine Stop Switch Input Wiring Test

1. Remove the steering cover and disconnect the 6-pin connector (RH).


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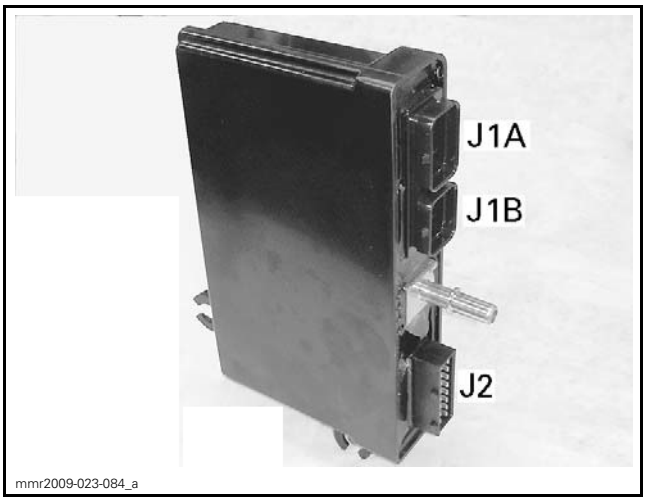
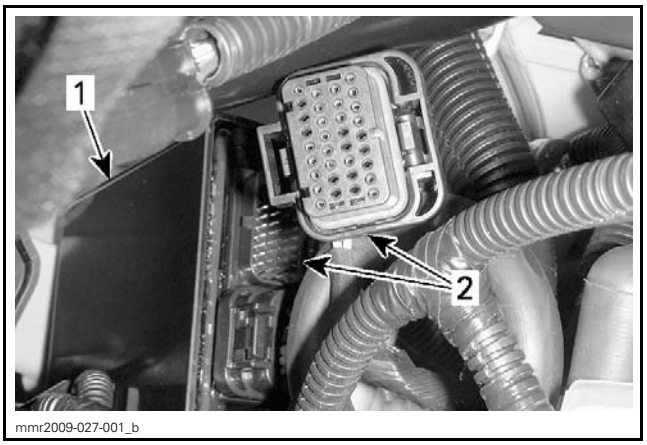
6-PINCONNECTOR (RH)

2. Remove upper body module. Refer to *BODY* subsection.
3. Disconnect J1A from the ECM (**top connector**).



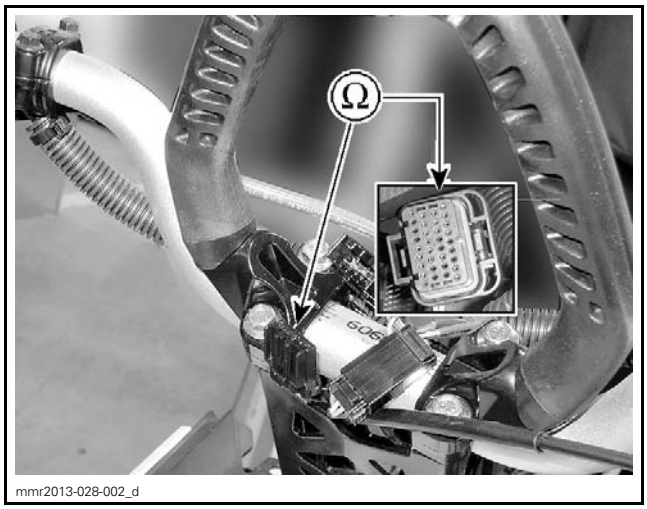


SEEN FROM RH SIDE
1. *ECM*
2. *J1A disconnected*

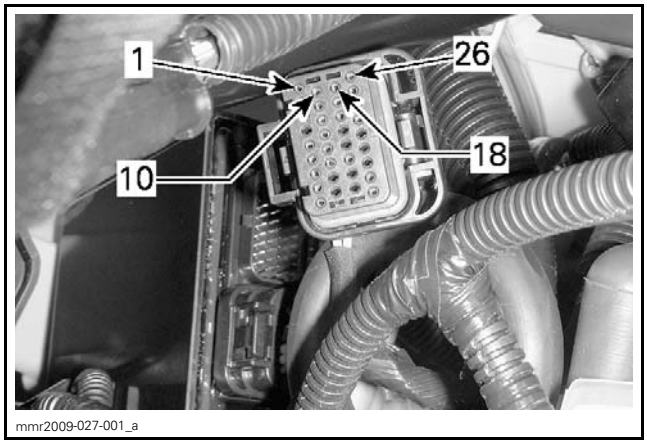
4. Test the emergency engine stop switch circuit as per following tables.

Refer to the applicable *WIRING DIAGRAM* for circuit details.

EMERGENCY ENGINE STOP SWITCH WIRING CONTINUITY TEST		
PROBE (VEHICLE HARNESS SIDE)		RESISTANCE
RH pin 6	ECM J1A pin 9	Close to 0 Ω (continuity)



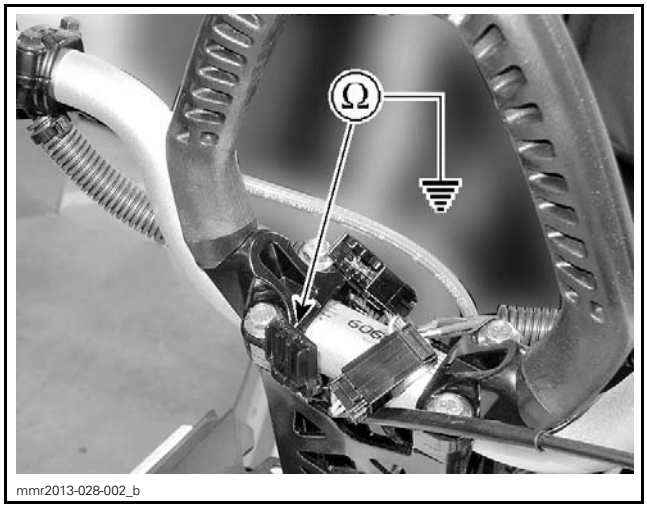
MEASURING TO ECM CONNECTOR J1A



J1A PIN-OUT

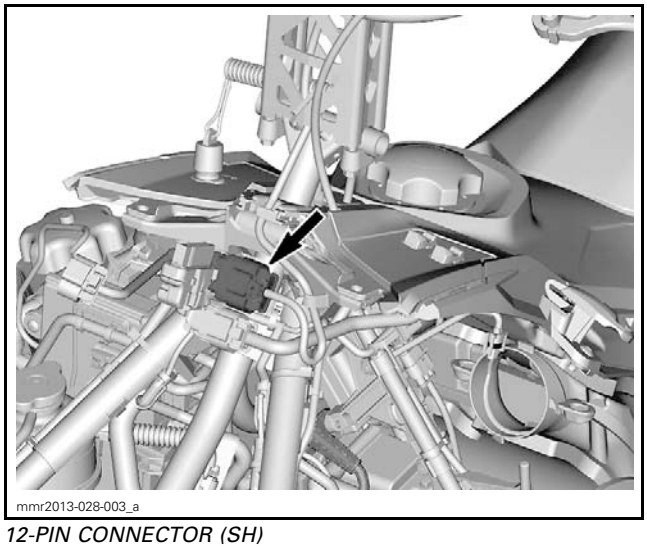
5. If circuit continuity is not good, check vehicle and steering harnesses for an open wire. Refer to *WIRING DIAGRAMS* subsection.
6. If circuit continuity is good, check if wiring is shorted to ground as per table.

EMERGENCY ENGINE STOP SWITCH WIRING GROUND TEST		
PROBE (VEHICLE HARNESS SIDE)		RESISTANCE
RH pin 6	Chassis ground	Infinite (OL)



MEASURING TO CHASSIS GROUND

7. If an open circuit is found, then the wiring harnesses are functional.
8. If a short circuit (low resistance to ground) is found, disconnect the 12-pin connector (SH) at steering column and check vehicle and steering harnesses individually to find the faulty harness. Repair or replace the faulty wiring or connection.



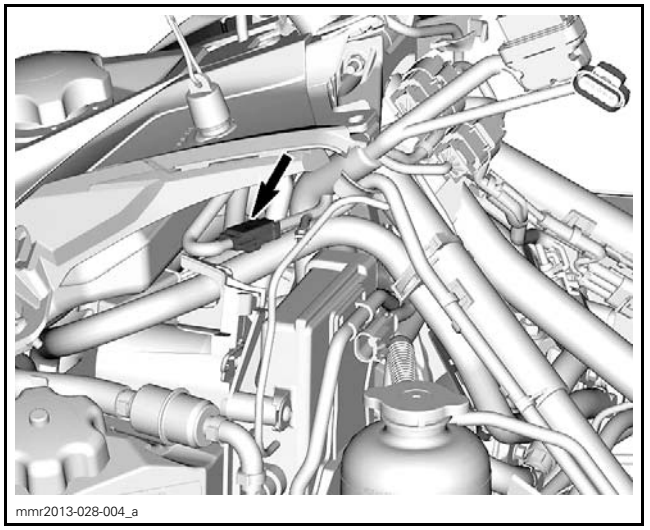
12-PIN CONNECTOR (SH)

ENGINE CUT-OFF SWITCH

Engine Cut-off Switch Continuity Test

Remove upper body module. Refer to *BODY* subsection.

Disconnect engine cut-off switch connector (DS).



ENGINE CUT-OFF SWITCH CONNECTOR (DS)

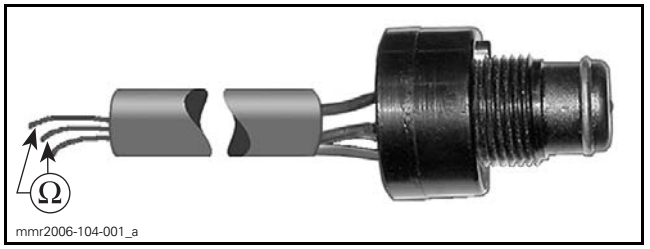
The following continuity tests can be performed using the FLUKE 115 MULTIMETER (P/N 529 035 868).

Tether Cord Cap Removed from Switch

Set multimeter to Ω.

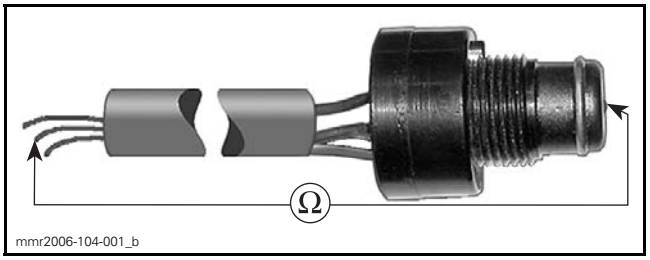
Connect test probes to engine cut-off switch and its connector as per tables and measure resistance.

ENGINE CUT-OFF SWITCH		RESISTANCE Ω @ 20°C (68°F)
WIRE		
BK/GN	BK/WH	Open circuit



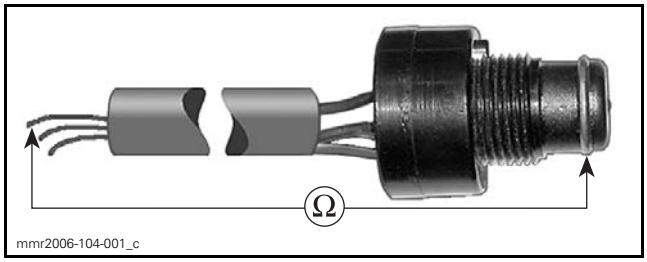
TYPICAL

ENGINE CUT-OFF SWITCH		RESISTANCE Ω @ 20°C (68°F)
WIRE		
WH/GY	Switch terminal	Close to 0 Ω



TYPICAL

ENGINE CUT-OFF SWITCH		RESISTANCE Ω @ 20°C (68°F)
WIRE		
BK/GN	Switch ring	Close to 0 Ω

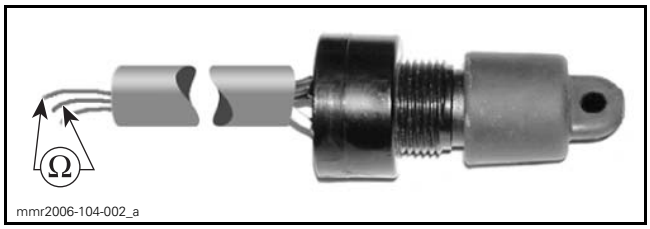


TYPICAL

Tether Cord Cap on Switch

Connect test probes to engine cut-off switch connector as per table and measure resistance.

ENGINE CUT-OFF SWITCH		RESISTANCE Ω @ 20°C (68°F)
WIRE		
BK/GN	BK/WH	Close to 0 Ω



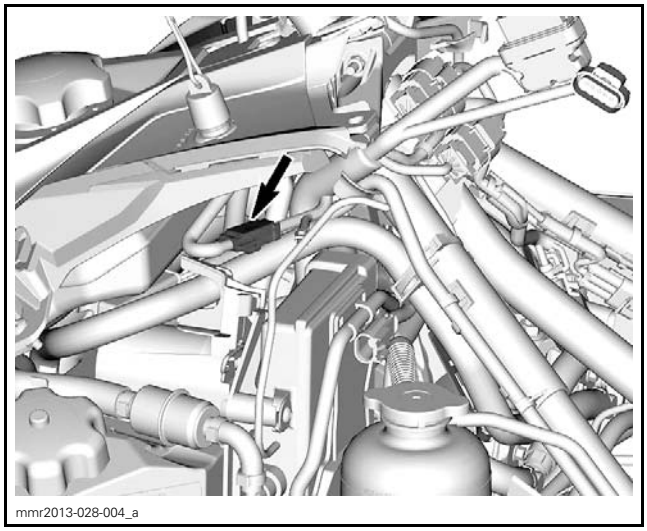
TYPICAL

If the latest test failed, try a known good cut-off switch cap. It the resistance test is now good, replace cap.

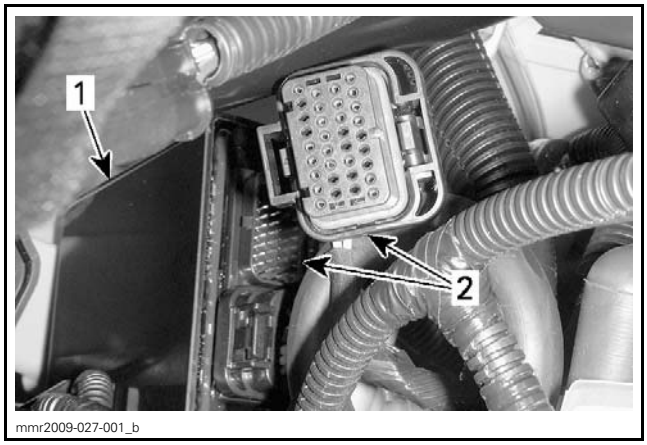
If any resistance test failed from the other tests, replace engine cut-off switch.

Engine Cut-off Switch Vehicle Harness Continuity Test

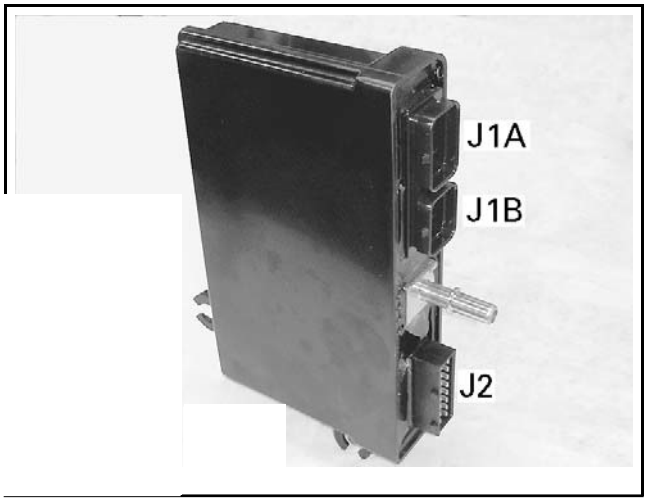
Disconnect engine cut-off switch connector.



Disconnect the J1A connector from ECM (**top connector**).

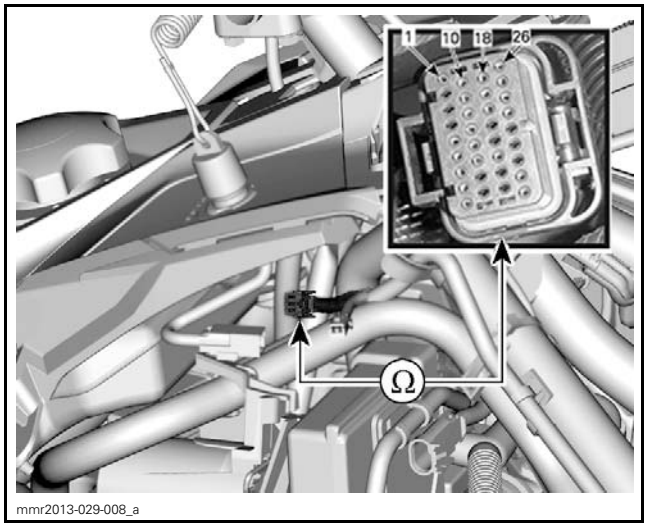


1. ECM
2. J1A disconnected



Set multimeter to Ω and check wire continuity between engine cut-off switch connector and ECM as follows.

ENGINE CUT-OFF SWITCH CONNECTOR	ECM J1A CONNECTOR	RESISTANCE Ω @ 20°C (68°F)
WIRE	PIN	
WH/GY	11	Close to 0 Ω
BK/WH	23	
BK/GN	5	



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– If any continuity test failed, repair or replace wiring connectors/terminals.
– If problem persists and all tests have been performed, try a new ECM. Refer to *ECM REPLACEMENT.*

Reinstall removed parts.

IGNITION COILS

Ignition Coil Testing Sequence

NOTE: A resistance test of the ignition coil primary and secondary windings cannot be carried out due to internal circuits.

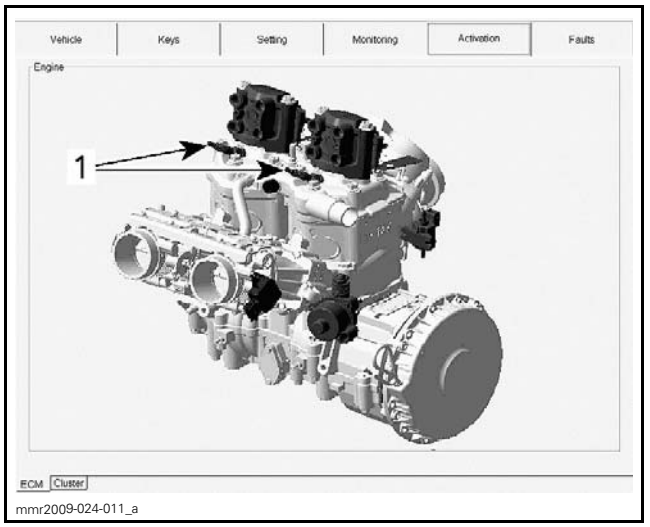
Before replacing an ignition coil, carry out the following in this order:
– Ignition coil test with B.U.D.S.
– Ignition coil input voltage test
– Ignition control signal test with B.U.D.S.
– Ignition coil control circuit test
– Ignition coil ground circuit test
– Spark plug cable test
– Spark plug replacement.

Ignition Coil Test with B.U.D.S.

NOTE: The battery must be fully charged. The test with B.U.D.S. will fail if the battery voltage is less than 11 Vdc.

NOTE: The ECM energizes and sends a trigger signal to each ignition coil individually. It can detect if each ignition coil is connected, display a trouble code in the multifunction display, and a CHECK ENGINE upon engine starting.

1. Connect the vehicle to the latest applicable B.U.D.S. version, refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Select **Read Data**.
3. Select the **Activation** tab.
4. At the bottom LH corner of the activation page, select the **ECM** tab.
5. Energize each ignition coil separately.



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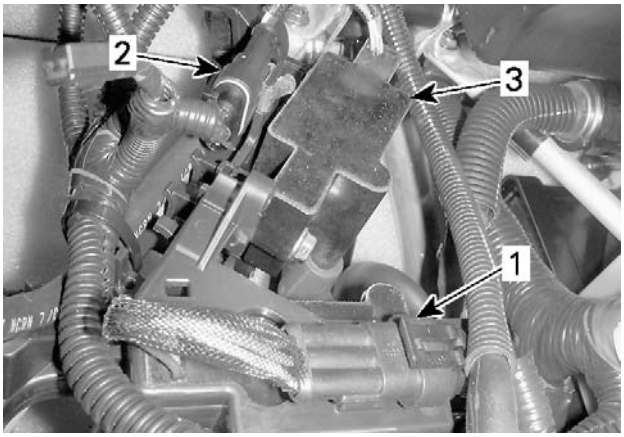
1. Activate here

You should hear the spark occurring. If in doubt, use an inductive spark tester.

If there is no spark, carry out an *IGNITION COIL INPUT VOLTAGE TEST*.

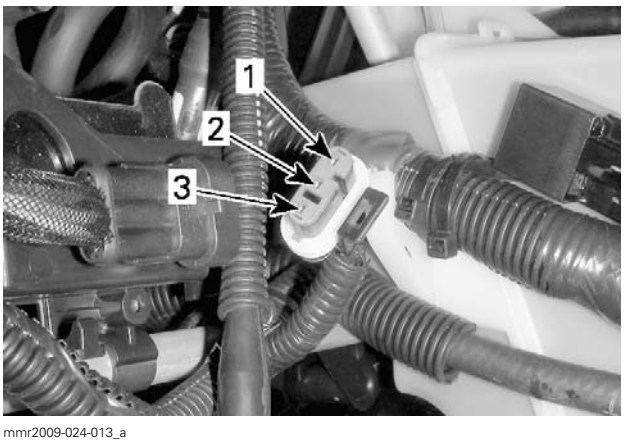
Ignition Coil Input Voltage Test

1. Remove the upper body module. Refer to *BODY* subsection.
2. Disconnect the connector from each ignition coil.



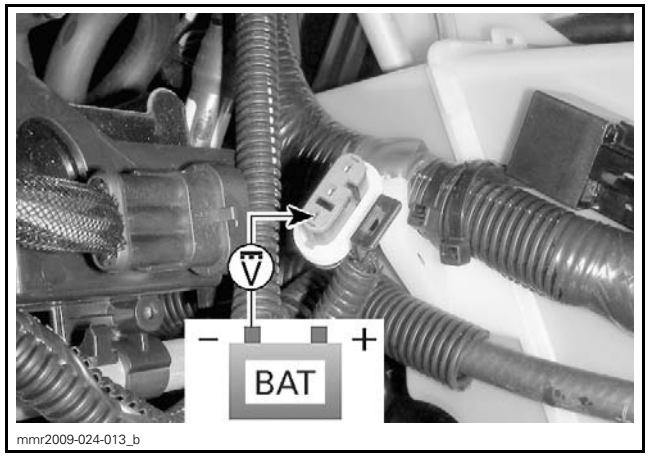
IGNITION COIL CONNECTORS, REAR VIEW
1. *PTO coil connector*
2. *MAG coil connector*
3. *MAG ignition coil*

3. Install the following tools to supply 12 Vdc to the primary 12 Vdc circuits and to the 55/60 Vdc circuits for this test. Refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection for proper connections.
   – (P/N 515 177 223)
   – 12 V BATTERY SUPPLY CABLE (P/N 529 035 997)
   – 12 volts battery.
4. Set multimeter to Vdc and measure supply battery voltage.
5. Check ignition coil input voltage as follows.



IGNITION COIL CONNECTOR PIN-OUT

IGNITION COIL TERMINAL		VOLTAGE (VDC)
3	Battery ground	Battery voltage minus 0.7 Vdc



INPUT VOLTAGE TEST (PRIMARY COIL WINDING)

If voltage is NOT as specified, carry out the following. Refer to applicable *WIRING DIAGRAM* for details.
– Test for supply battery voltage at pins 15 and 16 of ECM J2 connector.
– Check continuity of wire between terminal 3 of ignition coil and pin 13 of the ECM J2 connector.
– Test continuity of all ECM ground circuits, refer to *E-TEC DIRECT INJECTION* subsection.
– Repair or replace wiring as required.

If battery voltage is read at coil input, carry out the following. Refer to applicable *WIRING DIAGRAM* for details.
– Ignition control signal test with B.U.D.S.
– Spark plug cable resistance test
– Continuity test of ignition coil control circuit
– Continuity test of coil ground circuit, pin 1 to chassis ground
– Replace coil
– Replace ECM.

Ignition Coil Control Signal Test with B.U.D.S.

1. Disconnect the affected ignition coil connector.
2. Set multimeter to Vdc, then select the frequency function (Hz), and manually set the scale to 6 Hz.

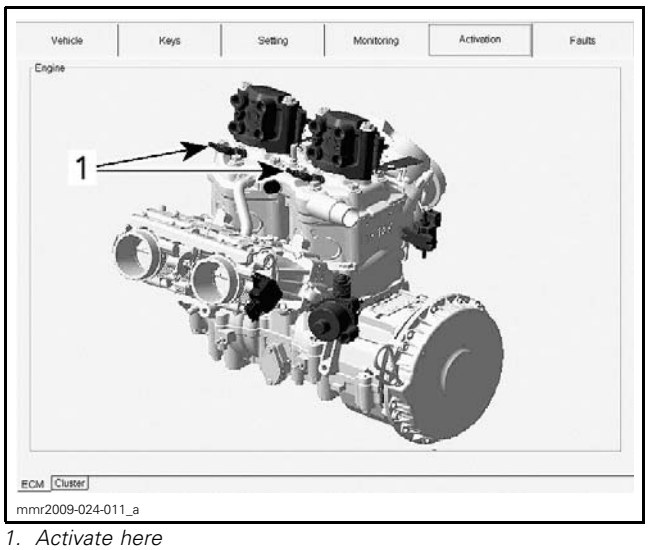
NOTE: If the meter is left in automatic range mode, you will not obtain a reading as the ignition control signal is too fast and for too short a period of time for the meter to adjust and take the reading.

3. Select the MAX. function on the multimeter to record the maximum reading detected.

4. Install an alligator clip adapter to the BLACK (–) probe, and a thin rigid back probe to the RED multimeter probe.

IGNITION SIGNAL TEST AT COIL CONNECTOR

5. Insert the RED probe in pin 2 (OG wire) of the coil connector, and clip the BLACK probe to engine ground.
6. In B.U.D.S., energize the affected ignition coil separately.



1. Activate here

METER SELECTION	TEST PROBES		READING
Vdc Hz manual range	Coil connector	Engine	Approximately 2 Hz
	Pin 2 (OG)	Ground	

Frequency of ignition signal should consistently be approximately 2 Hz.

If signal is not present, refer to *IGNITION COIL CONTROL CIRCUIT*.

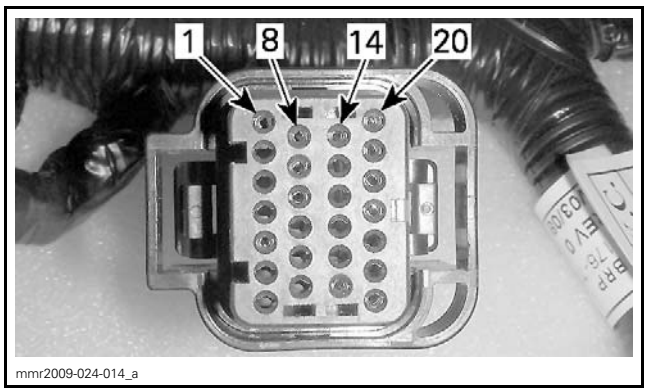
If the ignition coil control signal test was good, test the following before installing a new coil.

– Ignition coil ground circuit test
– Spark plug cable resistance test
– Spark plugs.

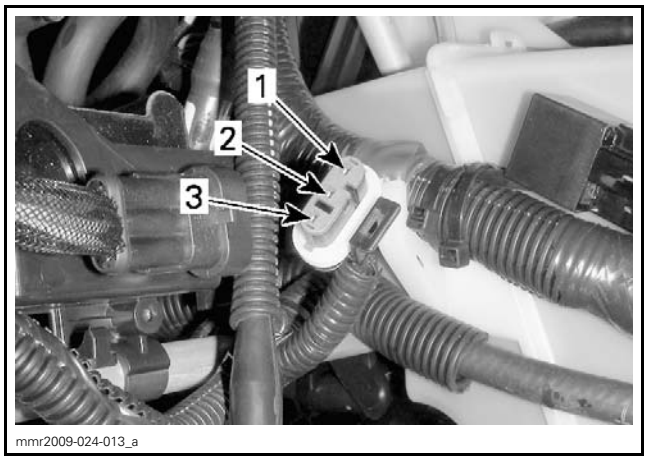
Ignition Coil Control Circuit Test

1. Disconnect connector J1B from ECM.
2. Test for continuity of the circuit between ECM connector and ignition coil connector as follows.

CONNECTOR PIN			
CYLINDER	ECM J1B	IGNITION COIL	RESISTANCE
PTO	19	2	Close to 0 Ω (continuity)
MAG	26	2	



J1B PIN-OUT



IGNITION COIL CONNECTOR PIN-OUT

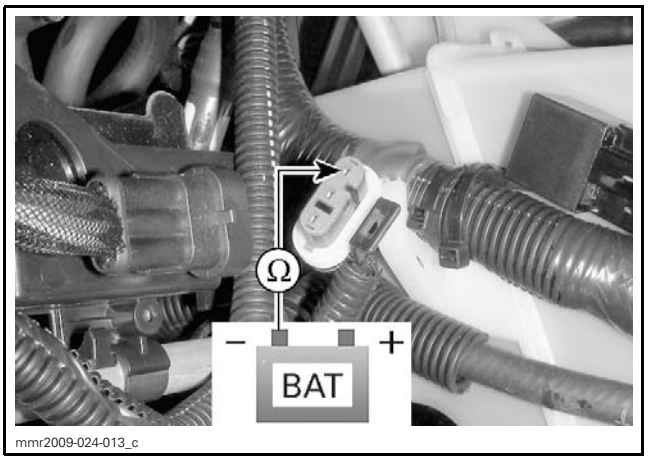
If wiring harness is defective, repair the connector or replace the wiring harness between ECM connector and the ignition coil.

If wiring harness tested good, refer to *IGNITION COIL GROUND CIRCUIT TEST*.

Ignition Coil Ground Circuit Test

1. Disconnect the input connector from both coils.
2. Test for continuity of the coil ground circuit as follows.

CYLINDER	IGNITION COIL CONNECTOR		RESISTANCE
PTO	Pin 1	Chassis ground	Close to 0 Ω (continuity)
MAG			



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IGNITION COIL GROUND CIRCUIT TEST (PIN 1)

If wiring harness is defective, repair or replace the wiring and connectors.

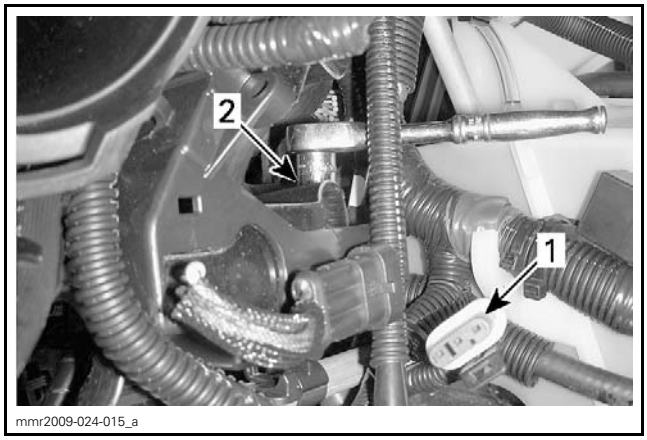
If the ground circuit tested good, replace the ignition coil.

Ignition Coil Removal

1. Remove the upper body module. Refer to *BODY* subection.
2. Note position of spark plug cables and remove them from the spark plugs.

PTO Coil Removal

1. Disconnect the ignition coil connector.
2. Remove the coil retaining screw.



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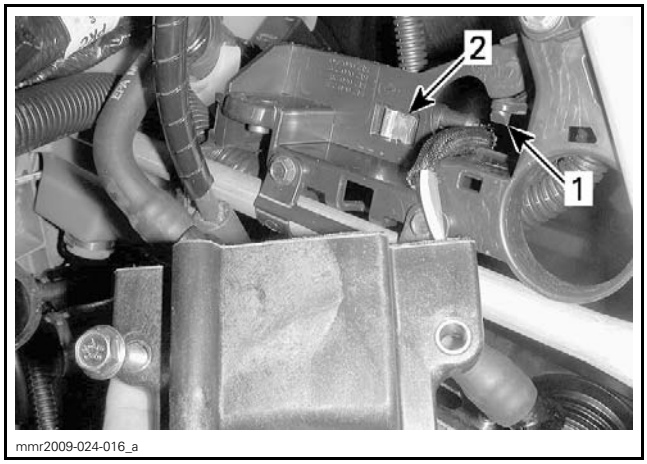
PTO IGNITION COIL (REAR VIEW)
1. Disconnect coil connector
2. Remove coil retaining screw

NOTE: PTO coil connector is mounted to the support with a retaining clip. Coil must be off support to access clip for removal.

3. Using a screwdriver, lift the retaining tab out of the second coil mounting hole to release coil from support. Do not pull coil away from support.
4. Using a small screwdriver, remove spring clip retaining coil connector to support and pull connector through support opening.



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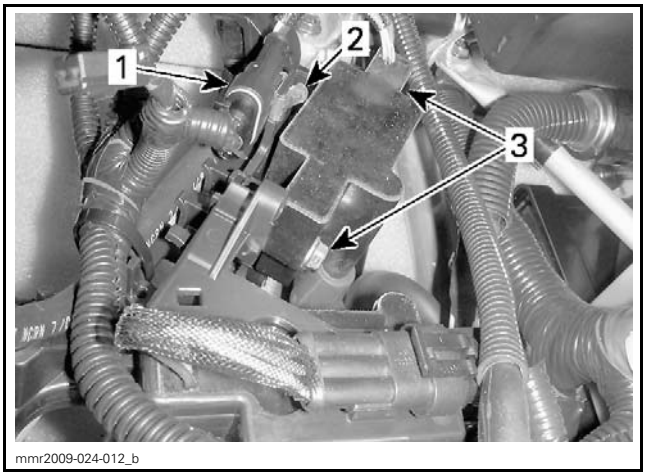
1. Lift to release coil from support
2. Remove connector retaining clip from support

MAG Coil Removal

1. Disconnect the ignition coil connector.
2. Using a small screwdriver, remove connector retaining clip from support.
3. Remove the two coil retaining screws.

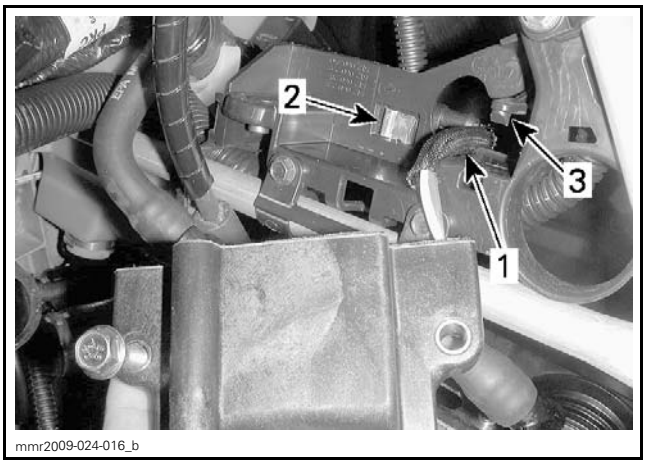


1. Disconnect coil connector
2. Remove connector retaining clip
3. Remove two mounting screws

Ignition Coil Installation

Reverse the removal procedures but pay attention to the following:

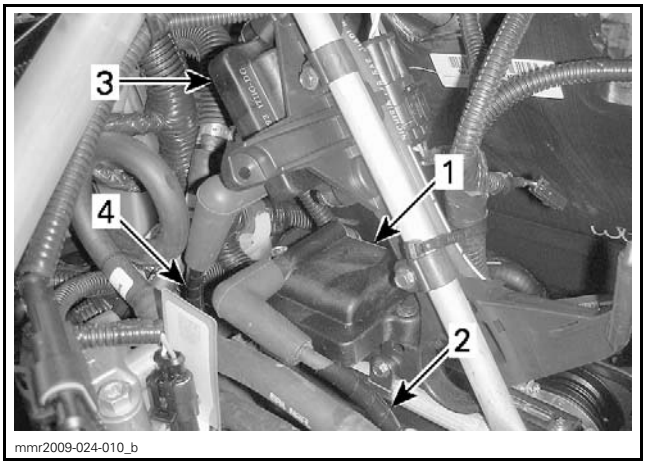
1. On the PTO coil, insert the coil connector through the coil support and install its retaining clip on the support before installing the coil.
2. Insert the PTO coil under the coil support retaining tab and slide it onto the support until the tab drops into the coil mounting hole.



1. Insert coil connector through support
2. Install connector retaining clip
3. Lift tab and insert coil

3. Install the retaining screw(s) and torque to 10 N•m (89 lbf•**in**) (both coils).
4. Reconnect the primary winding connectors and the spark plug cables.

NOTE: Pay attention to the position of the spark plug cables when connecting them. Lower coil connects to the PTO spark plug. Apply dielectric grease, refer to *SPARK PLUG CABLE*.



1. PTO ignition coil
2. Cable To PTO spark plug
3. MAG ignition coil
4. To MAG spark plug

⚠ WARNING

Always reconnect ignition coil cables to the same spark plugs they were disconnected from. Otherwise, severe backfire may occur with possible damage to exhaust system components.

CHARGING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
12 V BATTERY SUPPLY CABLE	529 035 997	3–4
FLUKE 115 MULTIMETER	529 035 868	6–7
POWER INTERFACE	515 177 223	3–4

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
NAPA ULTRA PRO BATTERY LOAD TESTER	95260	11

SERVICE PRODUCTS

Description	Part Number	Page
DIELECTRIC GREASE	293 550 004	12–13

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 on the E-TEC 600 HO E-TEC and 800R engines. 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

Magneto

A magneto provides the primary source of electrical energy. It transforms a magnetic field into an alternating current (AC).

The magneto is comprised of a 3 winding, single phase wound stator that has a capacity of 1200 watts.

AC current is rectified and regulated by a voltage regulator/rectifier circuit, and a DC to DC converter, both integrated within the ECM.

The charging system provides 3 outputs to the vehicle electrical system, one 55/60 Vdc and two 12 Vdc outputs.

Battery

A battery is installed on **electric start models** as a secondary power source. It is primarily used for energizing the starter and it provides power to instantly power the ECM when the START/RER button is pressed.

On **vehicles equipped with a high end multifunction gauge**, it also provides power to maintain the clock function within the gauge.

NOTE: Never use a battery charger to temporarily substitute the battery as it may cause the ECM (engine control module) to function erratically or not at all.

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

Weak or Discharged Battery

Electric Start Models

If the battery is weak or discharged, check the following items:

– Battery charging fuse (FA)
– Charging system voltage, see *PRIMARY 12 VDC CIRCUIT TEST WITH B.U.D.S.* in this subsection

– Battery
– Wiring and connections.

Low or No System Voltage (Engine May Not Start)

The vehicle cannot start without having a minimum voltage to the 55/60 V power circuit. If the engine does not start, see *VOLTAGE REGULATOR/RECTIFIER* in this subsection and carry out the *55/60 VDC VOLTAGE OUTPUT TEST WITH B.U.D.S.*

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 55/60 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.

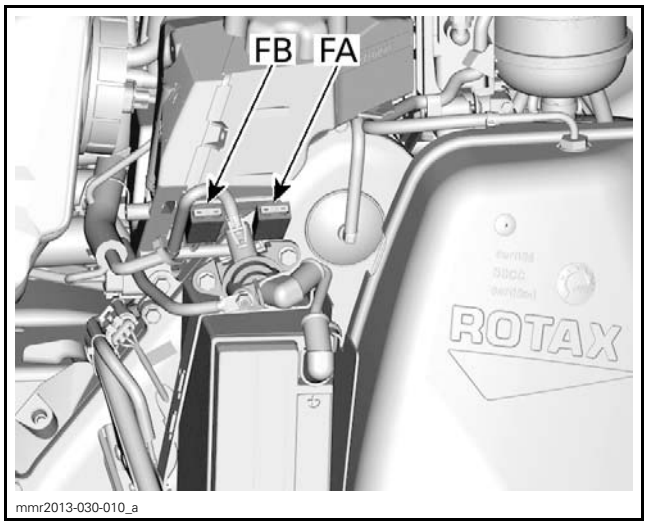
NOTE: When the 55/60 Vdc test good after a component is disconnected, replace that component and repeat the test.

PROCEDURES

BATTERY CHARGING FUSE

Fuse Location

Fuses are located behind the RH side panel above battery.



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1. FA: Battery charging fuse
2. FB: START/RER fuse

Fuse Information

The voltage regulator could be the culprit of a blown battery charging fuse (FA).

To check for this, carry out the *PRIMARY 12 VDC CIRCUIT TEST WITH B.U.D.S.* in this subsection. Also check for an applicable fault code, refer to *DIAGNOSTIC AND FAULT CODES*.

BATTERY CHARGING RELAY

The battery charging relay is located within the ECM. It completes the charging circuit between the voltage regulator output (within the ECM) and the battery. It then outputs the secondary 12 Vdc voltage.Refer to *POWER DISTRIBUTION* for more details.

The ECM turns on the relay so that battery charging occurs at approximately 1000 RPM. When engine is stopped, the ECM opens the charging circuit to isolate the battery from the ECM.

The relay operation will be tested through the *SECONDARY 12 VDC CIRCUIT TEST*.

VOLTAGE REGULATOR/ RECTIFIER

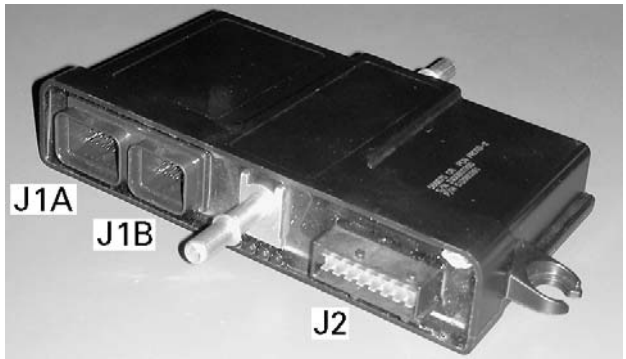
Description

The voltage regulator/rectifier is integrated within the ECM. It receives three single phase alternating current (AC) inputs from the magneto which it rectifies and regulates to 55/60 Vdc.

On a single pull start with the engine between 250 and 500 RPM, the magneto, combined with an ingenious series/parallel switching capability of the voltage regulator/rectifier, is capable of producing 55/60 Vdc.

55/60 Vdc Output Path

ECM CONNECTOR	TO
J2 pins 12 and 13	55/60 Vdc to: - Capacitor - Fuel Injectors (**600 HO E-TEC**) - Ignition coils - Fuel pump - Oil injection pump
J1B pins 2 and 8	Fuel injectors (**800R E-TEC**)



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Continuity Test (Voltage Regulator/Rectifier)

Due to internal circuitry, there is no static test available to check continuity.

55/60 Vdc Voltage Output Test 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.

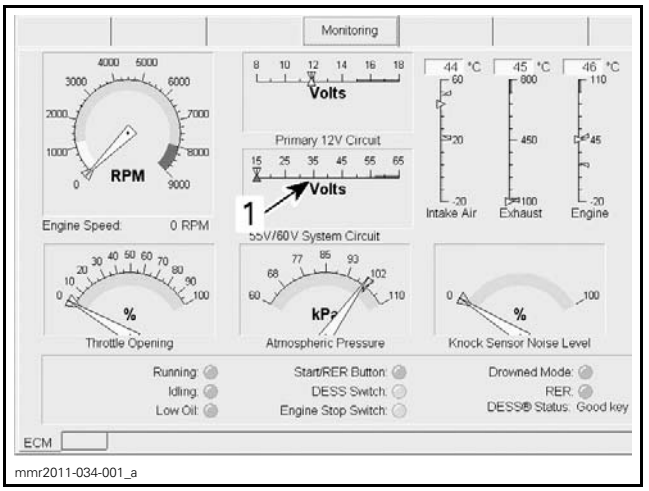
2. Remove RH side panel, refer to *BODY* subsection.
3. Use the applicable B.U.D.S. version available from BOSSWeb. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

Procedure When Engine Cannot be Started

Manual Start Models

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. In B.U.D.S., select **Read Data**.
3. Select the **Monitoring** tab.
4. At the bottom of the monitoring page, select the **ECM** tab.
5. Crank the engine 4 - 5 times using the rewind starter.
6. Read the voltage on the **55 V/60 V System Circuit** meter in B.U.D.S. as the engine is turning over.

55/60 VDC VOLTAGE OUTPUT TEST		
	TEST ENGINE SPEED	VOLTAGE
	Pull start (engine not running)	At least 30 Vdc



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1. 55 V/60 V System circuit

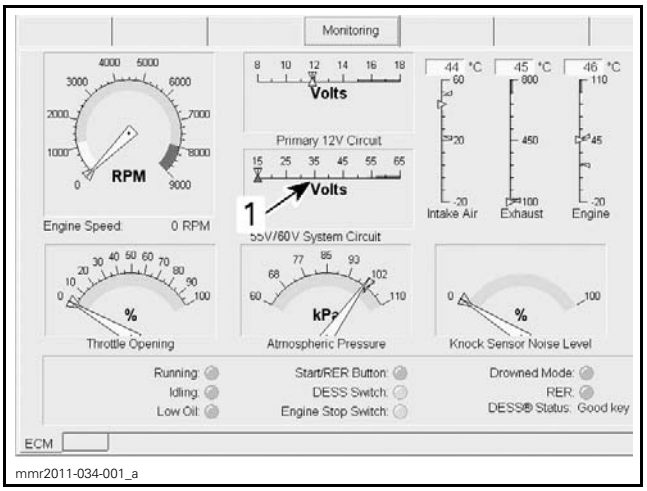
If you cannot obtain the specified voltage, refer to *TROUBLESHOOTING* in this subsection and carry out the required tests.

Also carry out the *VOLTAGE REGULATOR/RECTIFIER GROUND CIRCUIT TEST* in this subsection.

Electric Start Models

1. Connect the following tools to the vehicle before connecting it to the applicable B.U.D.S. software version. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
   - POWER INTERFACE (P/N 515 177 223)
   - 12 V BATTERY SUPPLY CABLE (P/N 529 035 997)
   - 12 volts battery.
2. In B.U.D.S., select **Read Data**.
3. Select the **Monitoring** tab.
4. At the bottom of the monitoring page, select the **ECM** tab.
5. Crank the engine over by pressing and holding the START/RER button for a few seconds.
6. Read the voltage on the **55 V/60 V System Circuit** meter in B.U.D.S. as the engine is being cranked.

NOTICE **Do not hold the START/RER button more than 10 seconds. A rest period should be observed between the cranking cycles to let the starter cool down. Holding the START/RER button for extended periods could overheat and permanently damage the starter.**



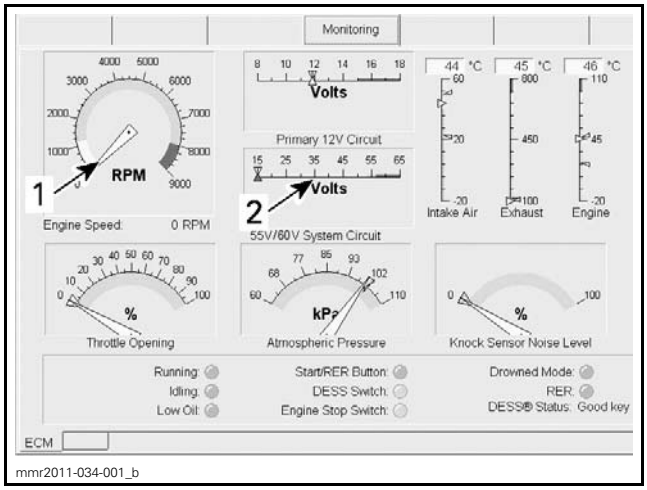
1. 55 V/60 V System circuit

7. Refer to the *55/60 VDC VOLTAGE OUTPUT TEST* table in the previous *MANUAL START MODELS* for specifications.

Procedure With Engine Running (All Models)

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. In B.U.D.S., select **Read Data**.
4. Select the **Monitoring** tab.
5. At the bottom of the **Monitoring** page, select the **ECM** tab.
6. Read the voltage on the **55 V/60 V System Circuit** meter in B.U.D.S.

55/60 VDC VOLTAGE OUTPUT TEST (ENGINE RUNNING)		
MODEL	TEST ENGINE SPEED	VOLTAGE
600 HO E-TEC	Any RPM from idle and above	55 Vdc ± 2
800R E-TEC		60 Vdc ± 2



1. RPM indication
2. 55 V/60 V System circuit indication

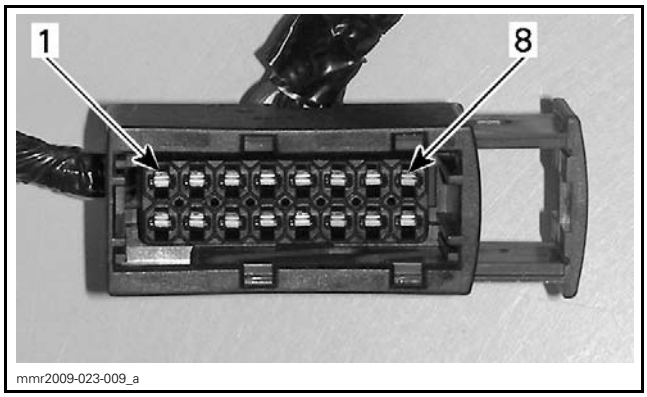
If voltage is below or above specification, refer to *TROUBLESHOOTING* in this subsection and carry out the required tests.

Also carry out the *VOLTAGE REGULATOR/RECTIFIER GROUND CIRCUIT TEST*.

Ground Circuit Test (Voltage Regulator/Rectifier)

1. Disconnect the ECM J2 connector.
2. Test ground circuit continuity as follows.

VOLTAGE REGULATOR/RECTIFIER GROUND CIRCUIT TEST	
ECM J2 CONNECTOR	Chassis ground
Pin 5	
Pin 7	
Pin 8	



ECM J2 PIN-OUT

DC-DC CONVERTER

Description

The DC-DC converter is integrated within the ECM. It receives 55/60 Vdc from the voltage regulator/rectifier which, it steps down to 12 Vdc. This 12 Vdc power is then split into two separate circuits, a primary and a secondary 12 Vdc output.

Primary 12 Vdc Output

From approximately 800 RPM and 50/55 V from the voltage regulator, the primary 12 Vdc output provides power to the following:

- Multifunction gauge and heaters
- 3D RAVE valve solenoid
- THCM (Thermocouple module on **800R E-TEC**)
- Lighting system.
- Visor heater
- Auxiliary lights
- Communication connector

NOTE: If the 12 Vdc outputs failed, the engine wouldl still run on the 55/60 Vdc supply voltage.

Secondary 12 Vdc Output

The secondary 12 Vdc output provides power to the following components when the engine reaches approximately 1000 RPM.

- Clock in multifunction gauge (**high end multifunction gauge**)
- Start/RER switch
- Battery

NOTE: If the 12 Vdc outputs failed, the engine would still run on the 55/60 Vdc supply voltage.

12 Vdc Output Voltage Tests (DC-DC Converter)

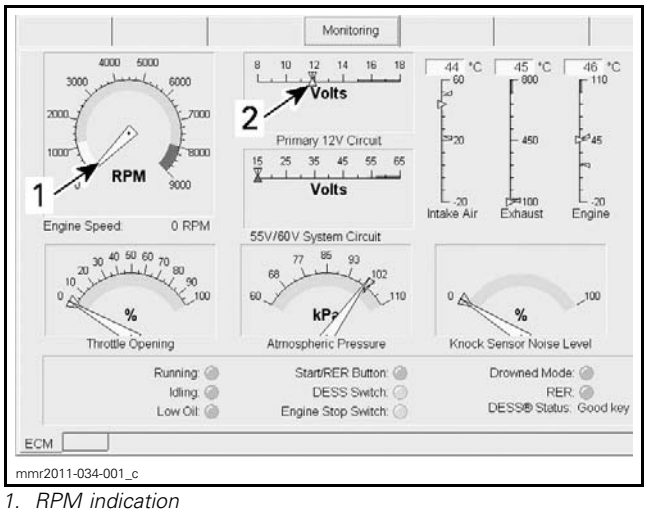
12 VDC OUTPUT VOLTAGE	
OUTPUT	ECM CONNECTOR AND PIN
Primary 12 Vdc	J2 pins 15 and 16
Secondary 12 Vdc	J2 pins 6 and 14

Since ECM connector J2 is not easily accessible. To carry out 12 Vdc output tests, carry out the following procedures.

Primary 12 Vdc Circuit Test with B.U.D.S.

1. Remove RH side panel, refer to *BODY* subsection.
2. Use the applicable B.U.D.S. software version available from BOSSWeb. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
3. Start engine.
4. In B.U.D.S., select **Read Data**.
5. Select the **Monitoring** tab.
6. At the bottom of the **Monitoring** page, select the **ECM** tab.
7. 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	14.75 ± 0.5 Vdc



1. RPM indication
2. Primary 12 V circuit indication (battery)

If voltage is above specification, replace ECM.

If voltage is below specification, check the *PRIMARY 12 VDC CIRCUIT TEST WITH B.U.D.S.*.

Also carry out the *VOLTAGE REGULATOR/RECTIFIER GROUND CIRCUIT TEST* in this subsection.

Install all removed parts and connectors.

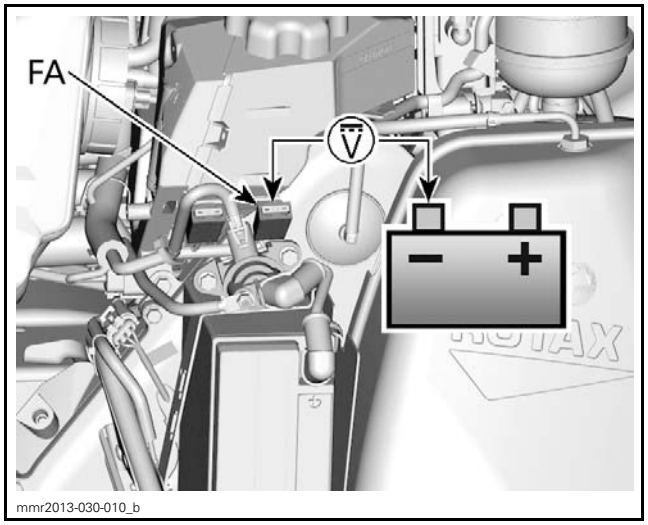
Secondary 12 Vdc Circuit Test

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. To measure the voltage, probe the battery charging fuse holder (FA) as follows.

FA FUSE HOLDER	
RED TEST PROBE	BLACK TEST PROBE
Terminal A (RD/WH wire)	Chassis ground



FA: BATTERY CHARGING FUSE HOLDER

SECONDARY 12 VDC CIRCUIT TEST	
TEST ENGINE SPEED	VOLTAGE
Any RPM from idle and above	14.75 ± 0.5 Vdc

If voltage cannot be measured, test continuity of wire from FA fuse holder to pins 6 and 14 of ECM J2 connector.

If the wire continuity is good and other voltages from ECM tested good, ECM may not output secondary 12 Vdc.

Carry out the *VOLTAGE REGULATOR/RECTIFIER GROUND CIRCUIT TEST*. 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 55/60 Vdc for their operation, are particularly sensitive to voltage variations. A capacitor is connected to the 55/60 Vdc electrical system to stabilize the system voltage.

The capacitor is located on the RH side of the vehicle, just on top of oil injection reservoir.

CAPACITOR LOCATION

Quick Troubleshooting

A faulty capacitor will lead to the following symptoms:

– Unstable, low, or no system voltage (55/60 V).
– Engine will not start
– Engine hard to start
– Poor idling
– Engine misfiring.

NOTE: A defective capacitor is likely to give off a burn 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 10 seconds after engine has been stopped, or after engine was last cranked before carrying out any maintenance procedure on the capacitor or 55/60 volt electrical system.

Capacitor Charge Hold Test

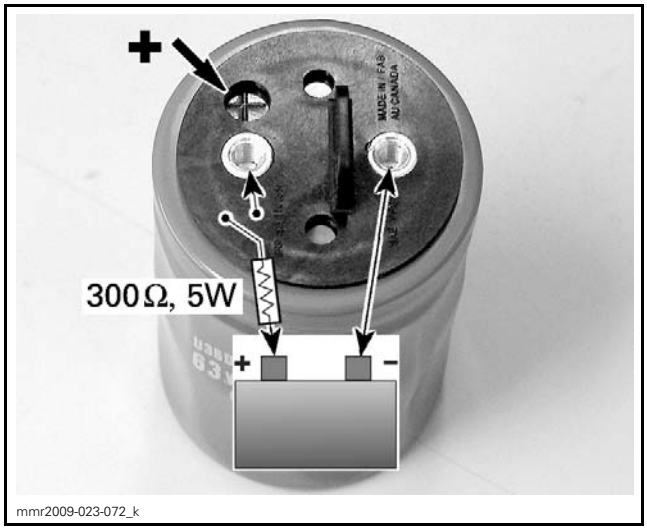
Procedure Setup

1. Remove capacitor from vehicle. Refer to *CAPACITOR REMOVAL* 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.



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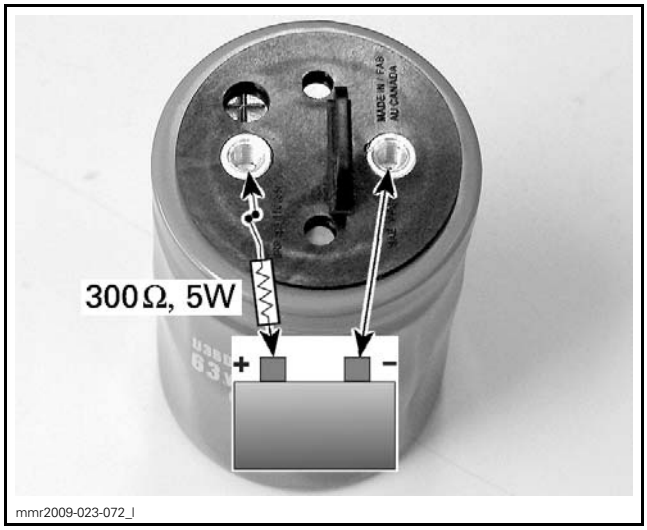
SWITCH AT OFF

Test Procedure

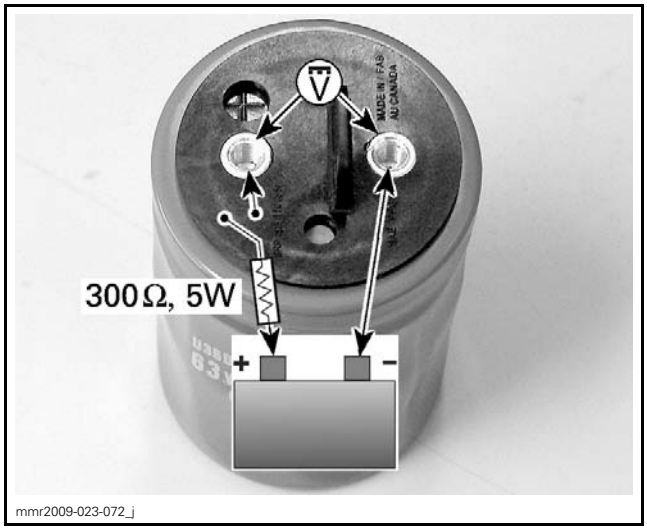
1. Turn switch to ON and read capacitor voltage. Wait until voltage reaches 12 V.



mmr2009-023-072_l

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.



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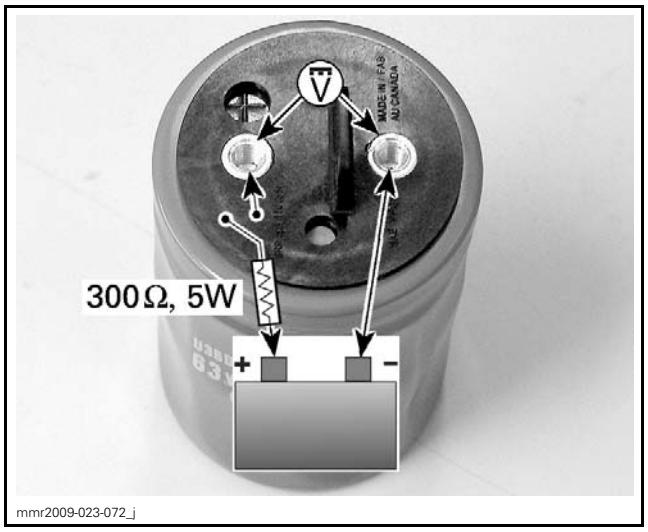
SWITCH AT OFF

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 *CAPACITOR INSTALLATION* in this subsection.

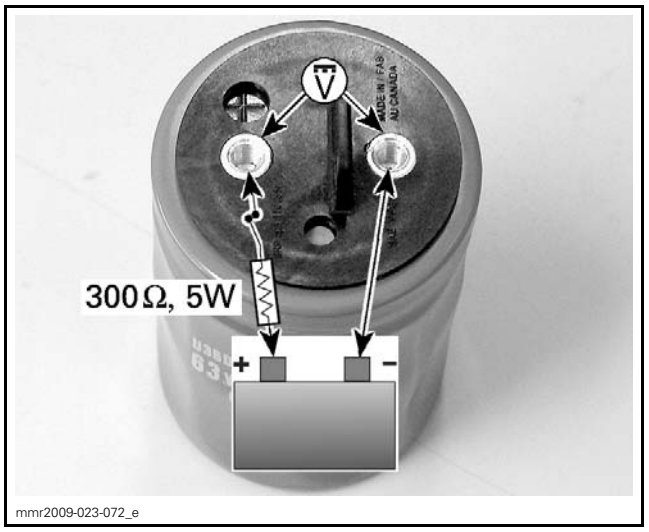
Capacitor Residual Voltage Test

Procedure Setup

Follow the same steps as described in Procedure Setup of *CAPACITOR CHARGE HOLD TEST* above.

Test Procedure

1. Turn switch to ON and read capacitor voltage. Wait until voltage reaches 12 V to ensure the capacitor is fully charged.

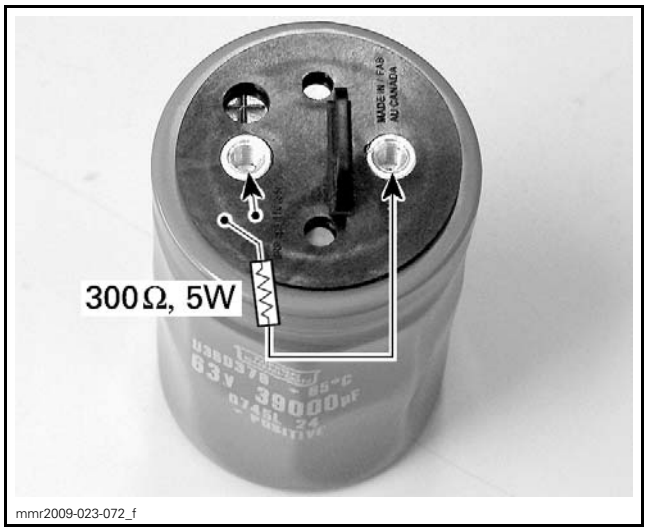


2. Turn test switch to OFF.

NOTE: Carry out the following steps **within one minute** to ensure the capacitor does not begin to discharge before the test.

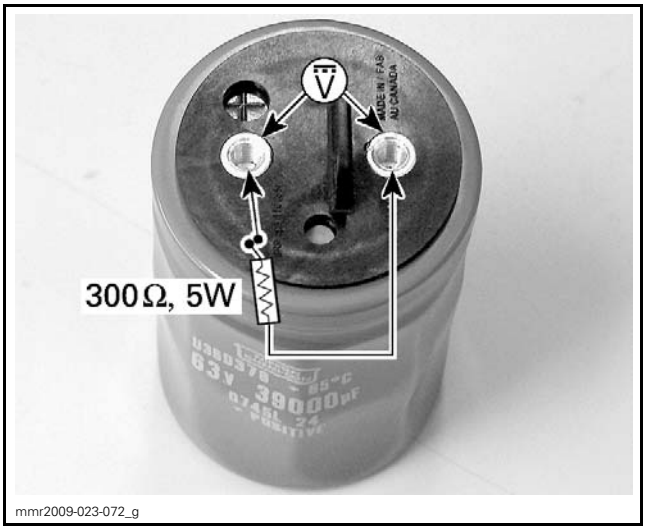
3. Remove battery from circuit and connect the resistor and switch across capacitor terminals.

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.



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SWITCH AT ON

CAPACITOR RESIDUAL VOLTAGE
Must be above 2.6 Vdc

If voltage is out of specification, replace capacitor.

Capacitor Removal

1. Disconnect magneto connector.

⚠ 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.

2. Ensure capacitor remained connected for at least 10 seconds after engine shut down, or after engine was last cranked. This ensures capacitor is fully discharged.
3. Remove upper body module. Refer to *BODY* subsection.
4. Release fuel hose from oil injection tank clip.
5. Unlock ECM support and slide toward right.


mmr2013-029-001_b

6. Move ECM support away from capacitor as much as possible.
7. Carefully remove terminal screws from capacitor.


mmr2013-029-002_a

8. Pull out capacitor toward rear.

⚠ WARNING

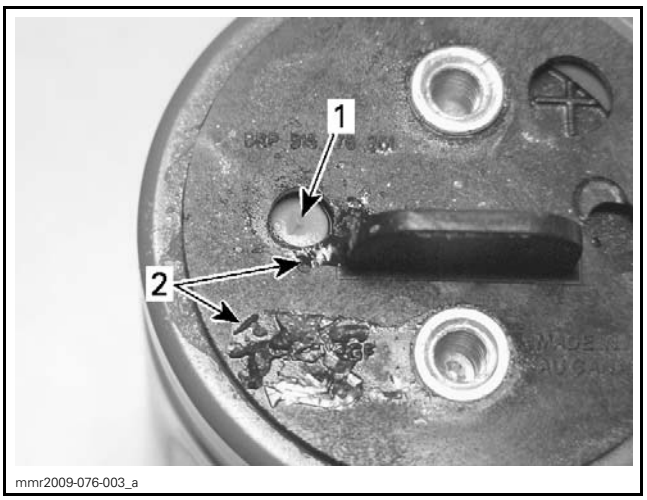
Do not remove plastic protector from top of capacitor unless the capacitor is to be replaced. The cover prevents the two capacitor contacts from being easily shorted together which may cause a spark, possibly resulting in a fire.

9. Check inspection hole on top of capacitor.

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.



1. *Perforated shield*
2. *Capacitor fluid leakage*

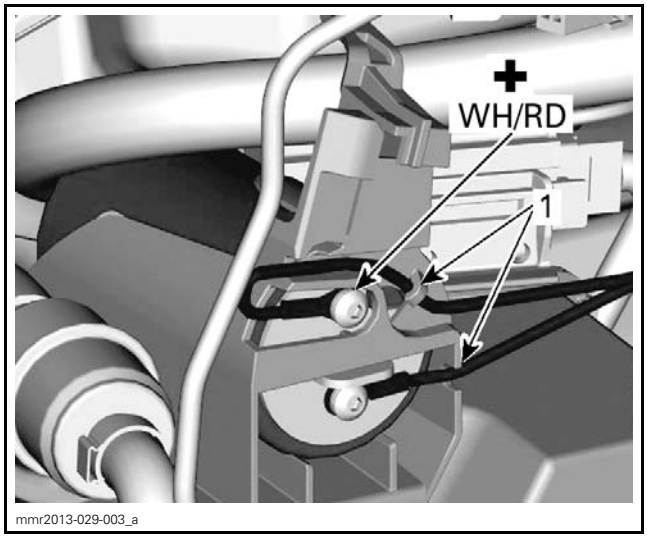
Capacitor Installation

1. If capacitor was replaced, install a plastic protector cap on new capacitor.

NOTE: When reinstalling plastic protector, ensure the **+** sign on top of capacitor is visible through the hole in protector. 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.**



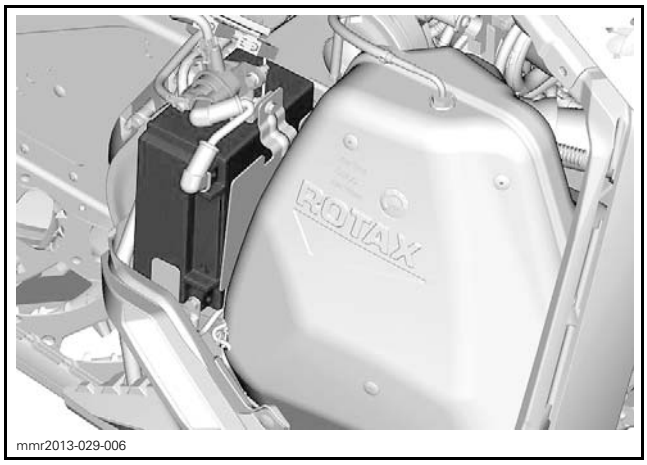
1. *Wires secured in clips*

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.

BATTERY

Electric start models are equipped with a sealed valve regulated lead acid (VRLA) battery. It is a non-spillable, maintenance-reduced type (no electrolyte level to be checked and readjusted). No ventilation tube is attached to the battery.



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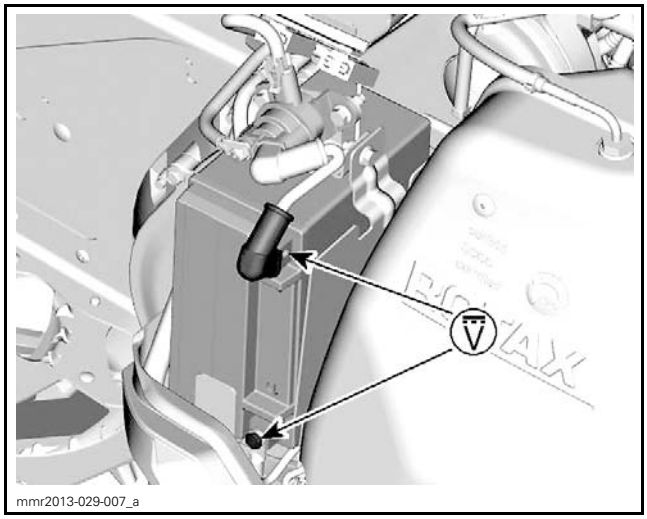
Battery Testing

Battery Voltmeter Test (No Load Applied)

NOTE: An unloaded voltmeter test is carried out on a battery without discharging current. It is the simplest and most commonly used. However, be aware that a voltage test can indicate that the battery is in good condition even though the battery does not have enough power to crank the engine. A voltage reading provides an instant indication of the state of charge of the battery, not of its current storage capacity. A battery load test gives a more accurate indication of the battery condition.

If the battery has just received a charge, allow it to rest for 1 - 2 hours before taking a voltage reading.

Set multimeter to Vdc and connect to battery terminals. Always respect polarity.



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Batteries with a voltage above 12.8 V do not need to be charged.

Batteries with a voltage of 12.8 V and below need to be charged. Refer to *BATTERY CHARGING* in this subsection.

Battery Testing (Load Applied)

This is the best test used to determine the battery condition.

Using a load testing device such as the NAPA ULTRA PRO BATTERY LOAD TESTER (P/N 95260), test the storage capacity of the battery. It has a 500 A carbon pile adjustable load.

The battery should be fully charged before testing.

If battery has just been recharged, allow battery to rest for at least one hour.

Follow battery load tester instructions.

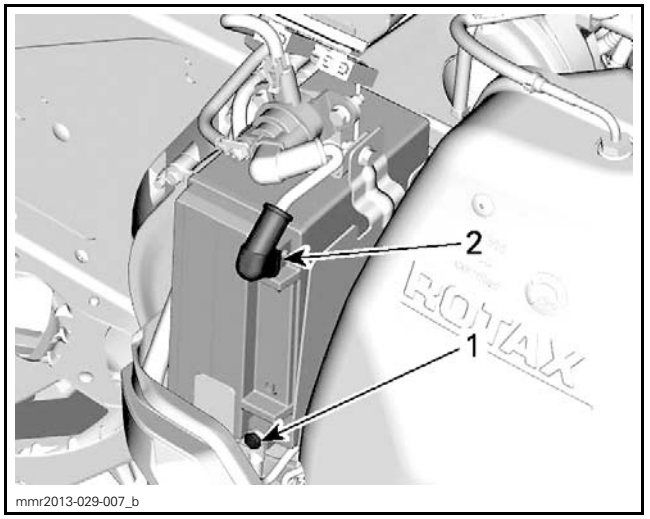
If battery voltage has dropped below 10 Vdc (or voltage indicated on battery temperature compensation chart), battery storage capacity has decreased appreciably and should be replaced.

Battery Removal

⚠ WARNING

The BLACK (–) battery cable must always be disconnected first and reconnected last. Never charge or boost a battery while installed on vehicle.

1. Open RH side panel.
2. Disconnect BLACK (–) cable terminal from the negative battery post.
3. Slide the RED rubber protector off the (+) cable terminal and disconnect it from the battery post.



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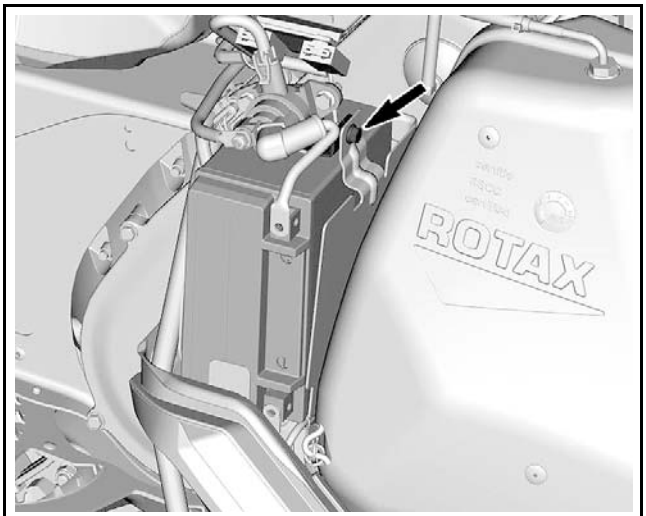
1. *Negative post*
2. *RED rubber protector on positive post*

4. Remove the battery retaining plate bolts.



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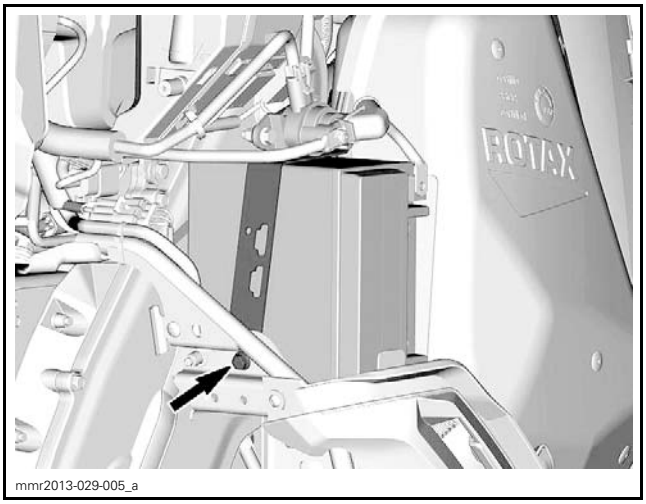

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5. Remove battery.

NOTICE **Should any electrolyte spillage occur, immediately wash off with a solution of baking soda and water to prevent damage to vehicle components.**

Battery Cleaning

Clean the battery, battery casing, cables and battery posts using a solution of baking soda and water.

Remove corrosion from battery cable terminals and battery posts using a firm wire brush. Battery top should be cleaned with a soft brush and any grease-cutting soap or baking soda solution.

Battery Inspection

Visually inspect battery casing for cracks, leaks or other possible damage.

Discoloration, warping or raised top, indicates that the battery has overheated or been overcharged.

If the casing is damaged, replace battery and thoroughly clean battery tray and surrounding area with a water and baking soda solution.

⚠ WARNING

Should the battery casing be damaged, wear a suitable pair of non-absorbent gloves when removing the battery by hand.

Inspect the battery posts for security of mounting.

Battery Storage

NOTICE **A discharged battery will freeze and may damage its casing. A damaged casing will allow electrolyte spillage that may damage surrounding parts.**

1. Disconnect and remove battery from the vehicle.
2. Clean battery terminals and cable connections using a wire brush. Apply a light coat of DIELECTRIC GREASE (P/N 293 550 004) or petroleum jelly on terminals.
3. Clean battery casing using a solution of baking soda and water. Rinse battery with clear water and dry thoroughly using a clean cloth.

NOTE: The battery must always be stored in fully a charged state.

4. Charge the battery every month if stored at a temperature **below** 15°C (59°F).
5. Charge the battery every two week if stored at a temperature **above** 15°C (59°F).

NEW Battery Activation

Refer to the instructions provided with the battery.

Battery Charging

⚠ WARNING

Always wear safety glasses and charge the battery in a ventilated area. Never charge or boost a battery while installed on a vehicle. Do not open the sealed caps during charging. Do not place battery near an open flame.

NOTICE **If the battery becomes hot to the touch, stop charging and allow it to cool before continuing.**

NOTE: Sealed VRLA batteries have an internal safety valve. If battery pressure increases due to overcharging, the valve opens to release excess pressure, preventing battery damage.

Carry out a battery *UNLOADED VOLTMETER TEST* as described in this subsection, then proceed as described here.

An automatic charger is the fastest and most convenient way for error-proof charging.

When using a constant current charger, charge battery according to the chart below.

Battery Voltage Below 12.8 V and Above 11.5 V

STANDARD CHARGING (RECOMMENDED)		
BATTERY TYPE	TIME	CHARGE
YTX20HL-PW	4 - 9 hours	2 A

QUICK CHARGING		
BATTERY TYPE	TIME	CHARGE
YTX20HL-PW	50 minutes	10 A

Battery Voltage Below 11.5 V

A battery with a voltage below 11.5 V requires a special procedure to recharge. In charging an over discharged battery, its internal resistance may be too high to charge at a normal charging rate.

Set charger to the 10 A charging rate and monitor charging current for approximately 30 minutes. If there is no change in charging current or battery becomes abnormally hot, the battery is most likely at the end of its service life and should be replaced.

Battery Installation

Reinstall battery and secure properly.

Connect **RED (+) cable FIRST** to positive battery terminal.

Connect **BLACK (–) cable LAST**.

⚠ WARNING

Battery BLACK (–) cable must always be disconnected first and reconnected last.

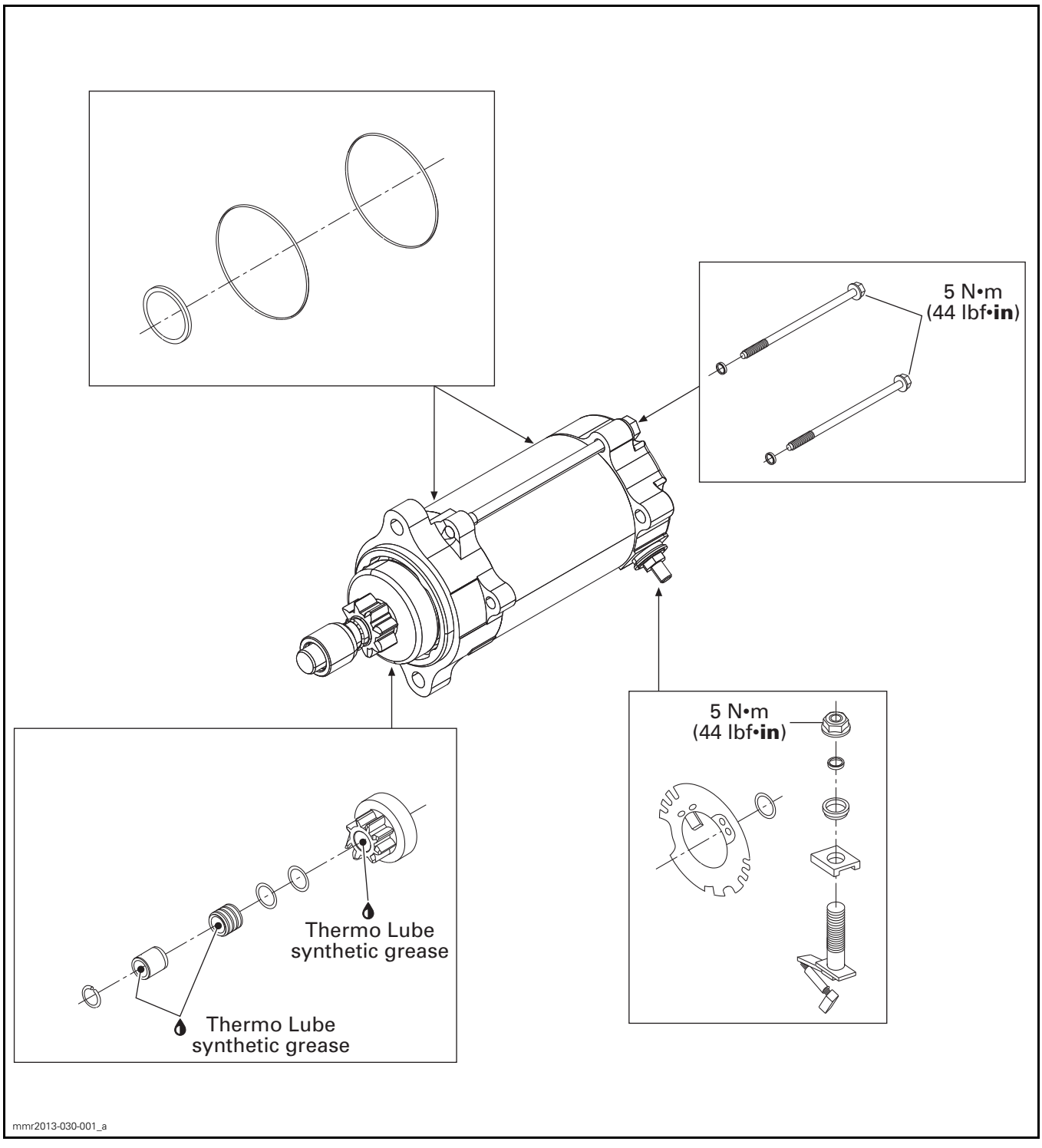
Cover the RED (+) cable terminal with the protective rubber boot.

Apply DIELECTRIC GREASE (P/N 293 550 004) on battery posts and connectors.

STARTING SYSTEM

SERVICE PRODUCTS

Description	Part Number	Page
SUSPENSION GREASE	293 550 033	8, 10



GENERAL

STARTING SYSTEM BASICS

Conditions for Engine Cranking

– Emergency engine stop switch set to RUN
– Tether cord cap installed
– START/RER button depressed.

Starting System Operation

1. The START/RER switch:
   1.1 Supplies starter solenoid
   1.2 Sends a 12-volt signal to the ECM
2. ECM grounds starter solenoid pin 2.
3. Starter solenoid contacts close and supply the starter motor with battery power.

In case of starter malfunction, first ensure the problem is not related to an engine mechanical component.

TROUBLESHOOTING

TROUBLESHOOTING TIPS

It is good practice to check for fault codes using B.U.D.S. as a first troubleshooting step. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

Refer to *POWER DISTRIBUTION AND GROUNDS* for relay information.

Always refer to the *WIRING DIAGRAM* when troubleshooting an electrical circuit.

NOTICE **Never force a multimeter probe into an electrical terminal.**

PROCEDURES

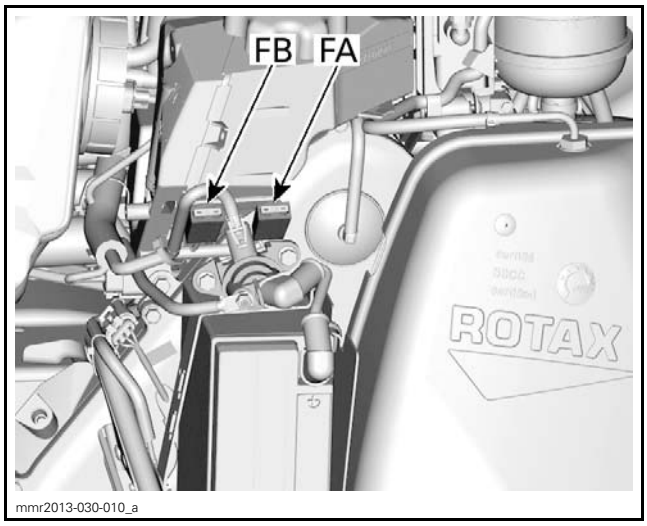
FUSES

Fuse Inspection

Fuses are located behind the RH side panel above battery.

Check Start/RER (FB) fuse condition and replace as necessary.

NOTE: When a burnt fuse is found, always identify the cause before replacing it.



1. FA: Battery charging fuse
2. FB: START/RER fuse

ELECTRIC STARTER

Starter Operation Test

1. Apply parking brake.
2. Disconnect injector connectors to prevent engine from starting.
3. Crank engine.
4. The starter should rotate powerfully and regularly.
5. If it does not, try the following:
   5.1 Set emergency engine stop switch to STOP.
   5.2 Remove tether cord cap from the engine cut-off switch.
   5.3 Manually rotate the engine using the drive pulley.
   5.4 If the engine cannot be rotated, check engine.

⚠ WARNING

When manually rotating engine, the emergency engine stop switch MUST BE set to STOP and tether cord cap MUST NOT be installed or severe injury may occur.

   5.5 If the engine can be rotated, carry out a *STARTER INPUT VOLTAGE TEST*.

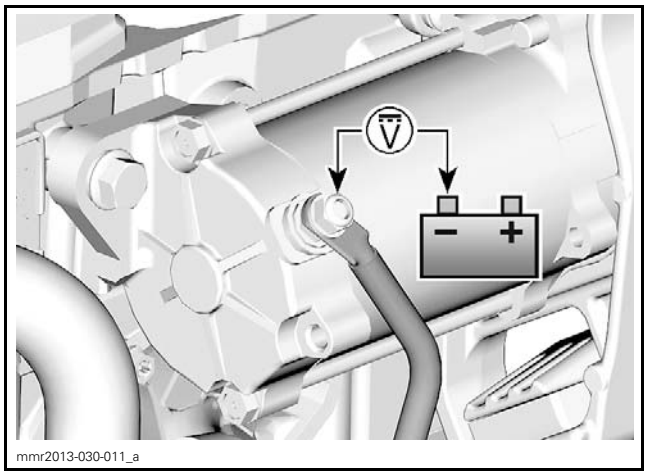
Starter Input Voltage Test

1. Set multimeter to Vdc.
2. Disconnect injector connectors to prevent engine from starting.

3. Measure voltage as per table while cranking engine.

NOTE: Battery voltage will drop and fluctuate with starter cranking load.

STARTER INPUT VOLTAGE TEST		
TEST PROBES		RESULT (WHILE PRESSING START/RER BUTTON)
Starter terminal	Battery negative post	Battery voltage



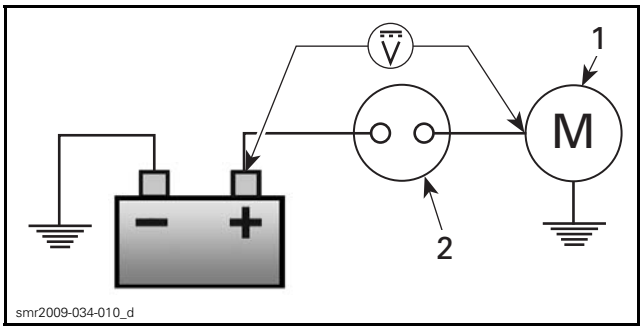
TEST RESULTS	
READING	WHAT TO DO
No voltage	Check Start/RER switch using B.U.D.S.
Voltage is low	Carry out a *STARTER CABLE VOLTAGE DROP TEST*.
Voltage is good	Carry out a *GROUND CIRCUIT VOLTAGE DROP TEST*.

Starter Cable Voltage Drop Test

This test confirms if there is parasitic resistance in the cable, solenoid or connections.

1. Set multimeter to Vdc.
2. Connect multimeter probes to the starter terminal and battery positive post.
3. Disconnect injector connectors to prevent engine from starting.
4. Measure voltage drop as follows while cranking engine.

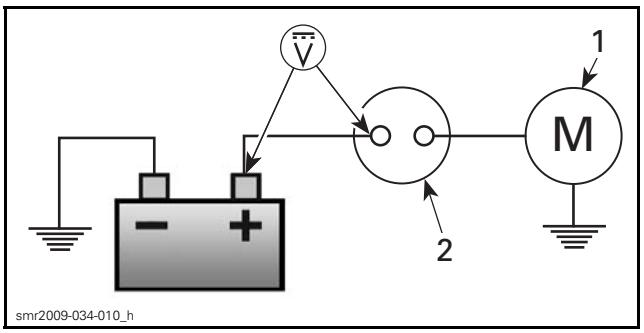
STARTER CABLE VOLTAGE DROP TEST		
PROBES		RESULT (WHILE STARTING)
Battery positive post	Starter terminal	1 Vdc maximum



1. *Starter*
2. *Solenoid*

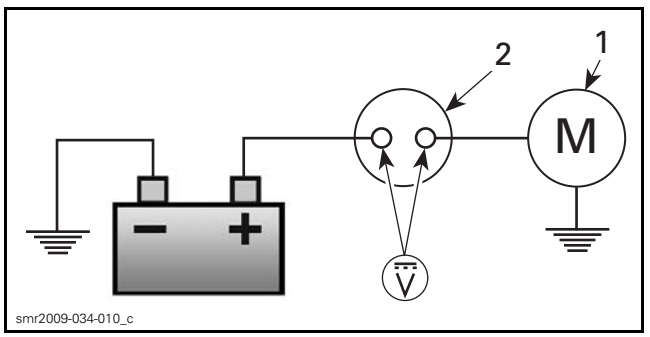
5. If voltage exceeds the specification, test voltage drop between the following points using the same method to determine what part of the circuit is at fault:

5.1 Battery positive post and starter solenoid post (cable from battery).

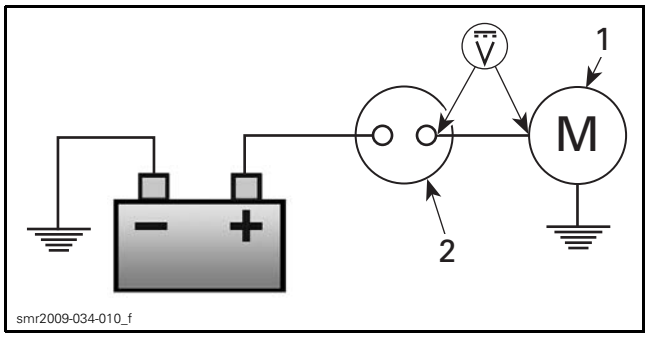


1. *Starter*
2. *Solenoid*

5.2 Both starter solenoid posts.



5.3 Starter solenoid post (to starter) and starter terminal.



1. Starter
2. Solenoid

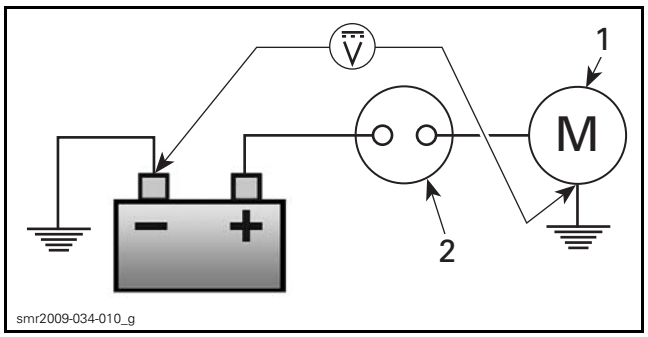
5.4 Replace cable(s) or solenoid if necessary.

Starter Ground Circuit Voltage Drop Test

This test confirms if there is parasitic resistance in the ground cables or connections.

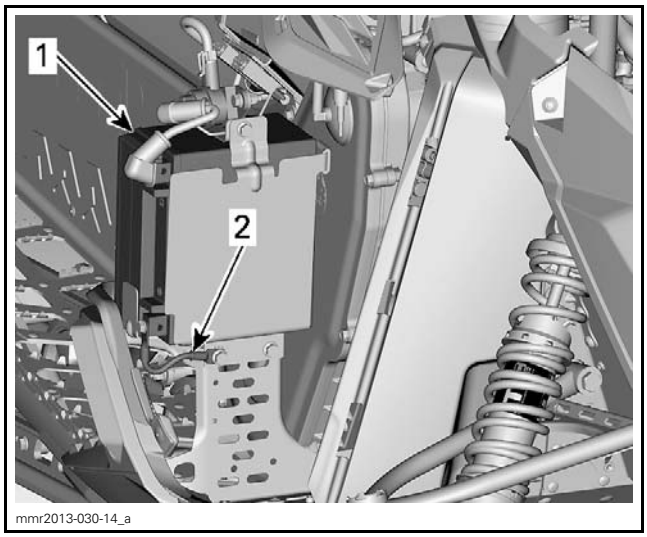
1. Set multimeter to Vdc.
2. Connect multimeter probes to the starter housing and battery negative post.
3. Disconnect injector connectors to prevent engine from starting.
4. Measure voltage drop as follows while cranking engine.

STARTER GROUND CIRCUIT VOLTAGE DROP TEST		
PROBES		RESULT (WHILE STARTING)
Starter housing	Battery negative post	0.8 Vdc maximum

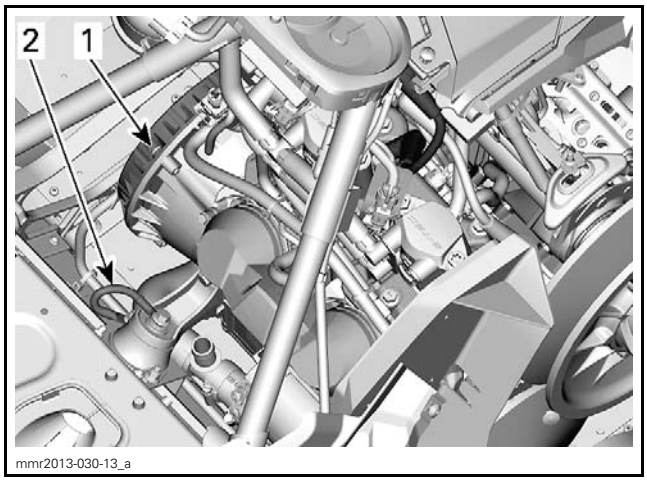


1. Starter
2. Solenoid

If voltage exceeds the specification, check ground cables and connections:
– from battery to chassis
– from engine support to chassis



RH SIDE, VIEWED FROM FRONT
1. Battery
2. Battery ground



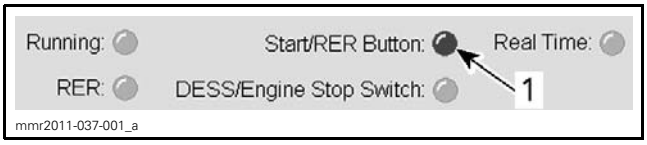
LH SIDE, VIEWED FROM FRONT
1. Rewind starter
2. Engine ground

If voltage is as per specification, test starter.

START/RER SWITCH

Start/RER Switch Test with B.U.D.S.

1. Connect the vehicle diagnostic connector to a computer with the appropriate version of the B.U.D.S. software. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Select the **Read Data** button.
3. Select the **Monitoring** and **ECM** tabs.
4. Set emergency engine stop switch to RUN and install tether cord cap on engine cut-off switch.
5. Press the start/RER button and look at the **Start/RER Button** indicator.



1. Should turn ON

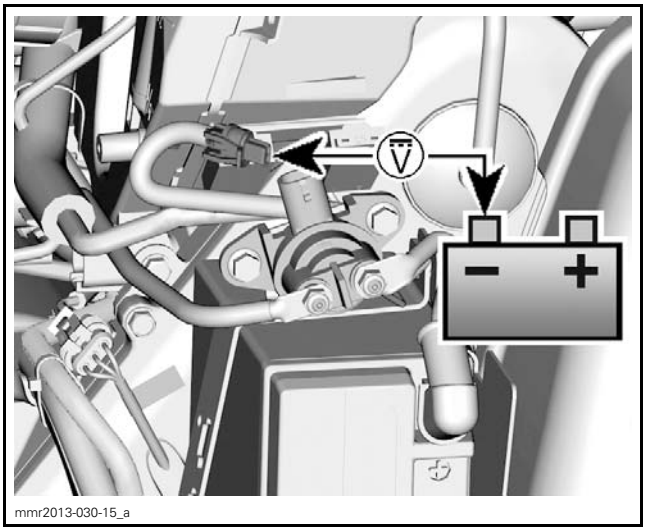
TEST RESULTS	
START/RER BUTTON INDICATOR IN B.U.D.S.	WHAT TO DO
Comes ON while start/RER button is pressed in	The starting system input side is functioning normally (start button, ECM, wiring and connections). Make sure engine stop switch tests good (see *IGNITION SYSTEM* subsection), then proceed with *STARTER SOLENOID TESTS*.
Does not come ON while start/RER button is pressed in	Check for an open circuit or defective start/RER switch. Refer to *WIRING DIAGRAM*.

STARTER SOLENOID

Starter Solenoid Input Voltage Test

1. Disconnect connector from solenoid and test voltage as follows.
2. Set emergency engine stop switch to RUN and install tether cord cap on engine cut-off switch.
3. Read voltage while start/RER button is pressed in.

STARTER SOLENOID INPUT VOLTAGE TEST		
TEST PROBES		RESULT (WHILE PRESSING START/RER BUTTON)
Terminal "A" (RD/GN)	Battery negative post	Battery voltage



If there is no voltage, check for an open circuit.

If voltage is as specified, carry out a *STARTER SOLENOID CONTROL CIRCUIT TEST*.

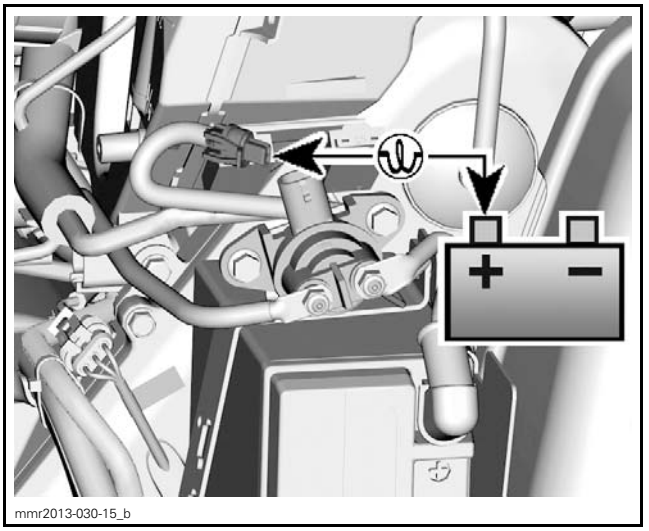
Starter Solenoid Control Circuit Test

1. Disconnect connector from solenoid.
2. Use a 12 Vdc test light and probe as per table.

IMPORTANT: Using a voltmeter could lead to false results.

3. Observe test light while start button is pressed in.

STARTER SOLENOID CONTROL CIRCUIT TEST		
TEST PROBES		RESULT (WHILE PRESSING START/RER BUTTON)
Terminal "B" (OG/BK)	Battery positive terminal	Test light should be bright



If test light does not turn on or is dimmed while cranking, check for an open circuit.

If test light is bright, the solenoid gets a proper ground signal. Carry out a *STARTER SOLENOID STATIC TEST: CONTINUITY*.

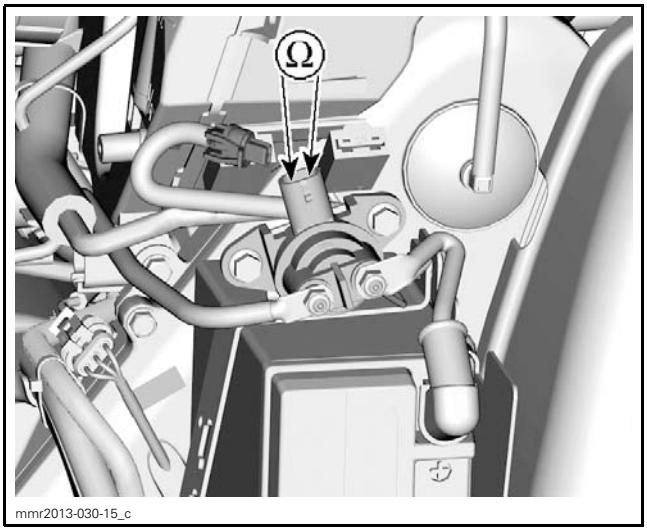
Starter Solenoid Static Test: Continuity

Disconnect battery.

Disconnect connector from solenoid.

With a multimeter, measure the primary winding resistance as follows.

SOLENOID WINDING CONTINUITY TEST		
SOLENOID TERMINALS		**MEASUREMENT**
		RESISTANCE @ 20°C (68°F)
A	B	Approximately 5 Ω



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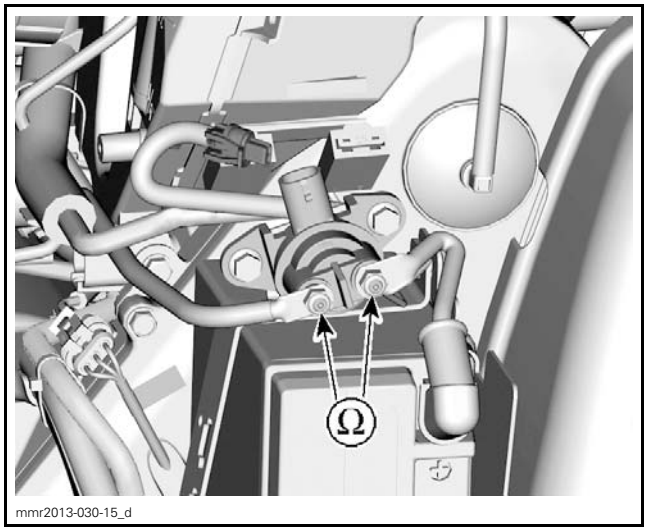
Test for a stuck solenoid plunger as follows.

SOLENOID CONTACTS CONTINUITY TEST		
SOLENOID CONNECTOR		MEASUREMENT
Battery terminal	Starter terminal	Open circuit



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If any measurement is out of specification, replace solenoid.

Reconnect battery and starter solenoid terminals.

Starter Solenoid Removal

Disconnect the battery.

Remove the electrical connections from the starter solenoid.

Remove the two mounting screws.

Starter Solenoid Installation

Install the new solenoid in the reverse order of the removal procedure.

Carry out an engine start to validate that the new solenoid functions.

STARTER

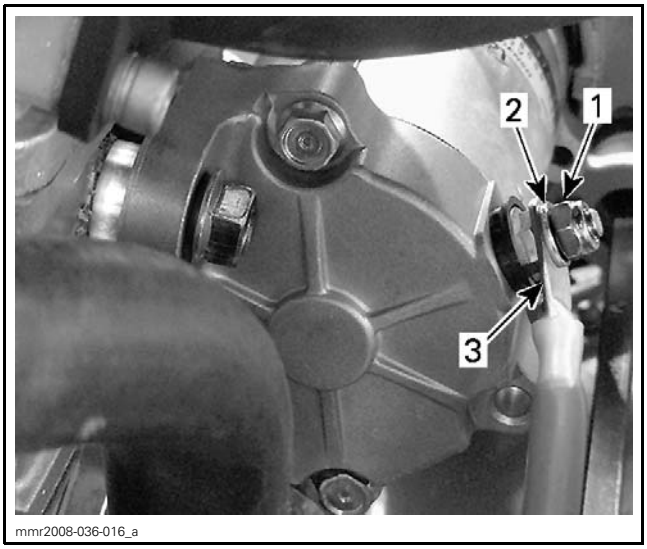
Starter Removal

1. Remove tuned pipe. Refer to *EXHAUST SYSTEM* subsection.
2. Disconnect BLACK (-) cable from battery.
3. Disconnect RED (+) cable from battery.

⚠ WARNING

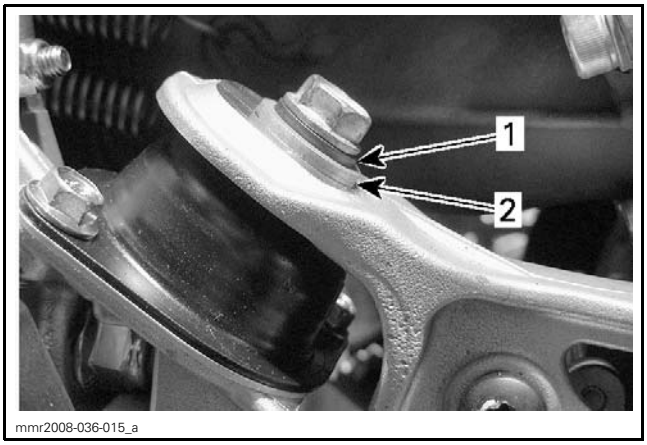
Always disconnect BLACK (-) cable first and reconnect last.

4. Remove drive belt and drive pulley. Refer to *ENGINE DRIVE SYSTEM* subsection.
5. Disconnect RED power cable from starter.



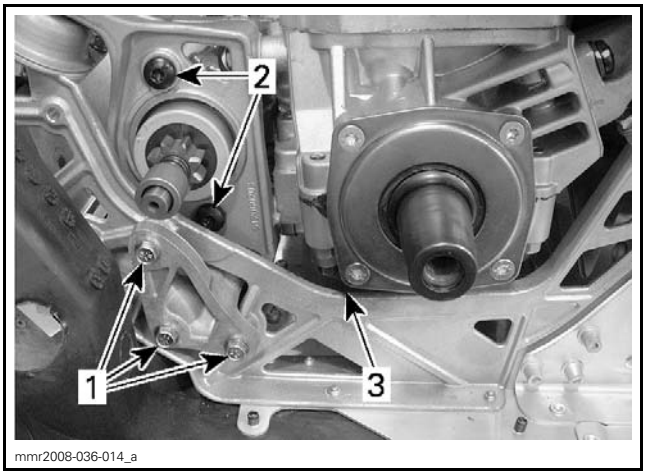
TYPICAL - STARTER POWER CABLE
1. *Elastic nut*
2. *Washer*
3. *Power cable*

6. Remove the LH front and rear engine mounting hex screws (PTO side). Discard the screws.



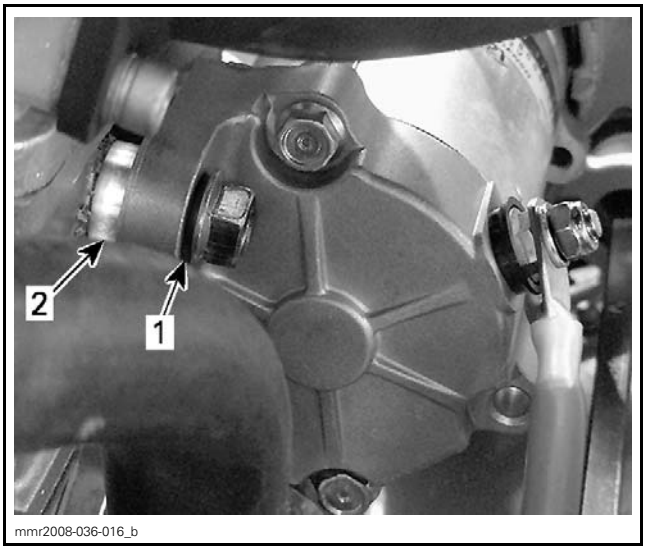
LH FRONT ENGINE MOUNT
1. *Conical washer*
2. *Flat washer*

7. Remove and discard the three bolts retaining the engine torque stopper support.



1. *Screws, torque stopper support*
2. *Starter screws*
3. *Pry bar position*

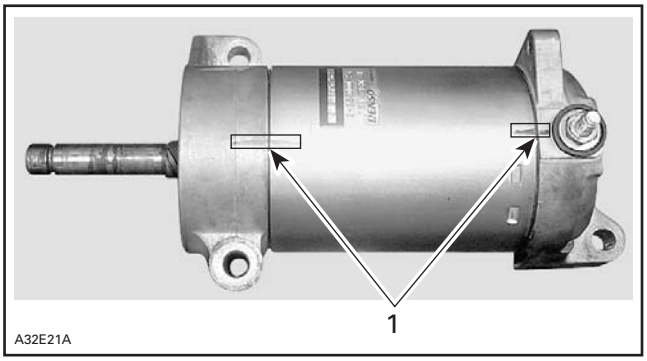
8. Insert a pry bar over the LH frame member and gently raise the engine just enough to access the lower mounting torx screw on the starter.
9. Remove and discard the lower mounting screw from the starter.
10. Remove the pry bar.
11. Remove and discard the upper mounting screw from the starter.
12. Remove and discard the RH starter mounting screw from the front of the engine.



STARTER MOUNTING SCREW, RH
1. *Washer under screw head*
2. *Washer spacer between starter and engine*

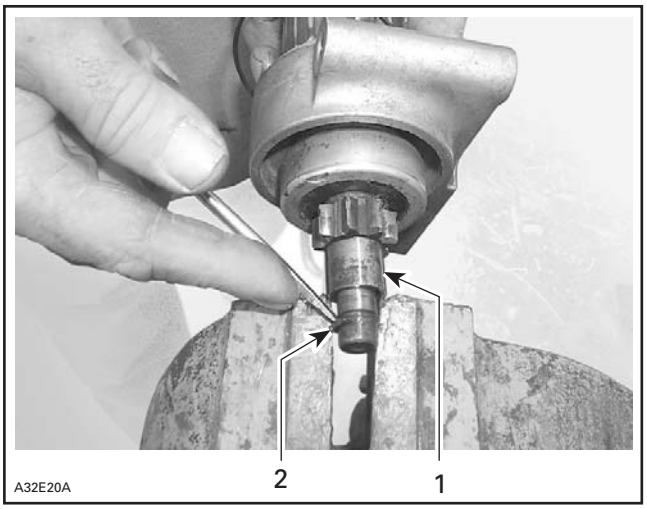
Starter Disassembly

1. Refer to the exploded view in the beginning of this subsection.
2. Before disassembling, trace index marks on the starter housing and covers for parts alignment at reassembly.



TYPICAL
1. Alignment index marks for reassembly

3. Remove starter through bolts.
4. Separate end cap from starter housing.
5. Withdraw armature from starter housing.
6. If necessary, remove brush holder from end cap.
7. Check for radial play between the armature shaft and end cap bearing. Replace the starter if radial play is detected.
8. If parts are in good condition, coat them with SUSPENSION GREASE (P/N 293 550 033) before reinstallation.
9. Push back the collar near the starter gear/clutch assembly using a screwdriver.
10. Remove snap ring, collar, and spring.



1. Collar
2. Snap ring

11. Turn starter clutch clockwise to remove it from the armature assembly.
12. Pull yoke from armature.

Starter Cleaning

NOTICE **Yoke, drive unit (clutch assembly) and end cap must not be immersed in cleaning solvent.**

1. Clean brushes and holders with a clean cloth impregnated with solvent. Brushes must be dried thoroughly with a clean cloth.
2. Blow brush holders clean using compressed air.

⚠ WARNING

Always wear safety glasses when using compressed air.

3. Remove dirt, oil or grease from commutator using a clean cloth soaked in suitable solvent. Dry well using a clean and dry cloth.
4. Clean engine ring gear teeth and drive unit (clutch).

NOTE: Bushings or bearings must not be cleaned with grease dissolving agents.

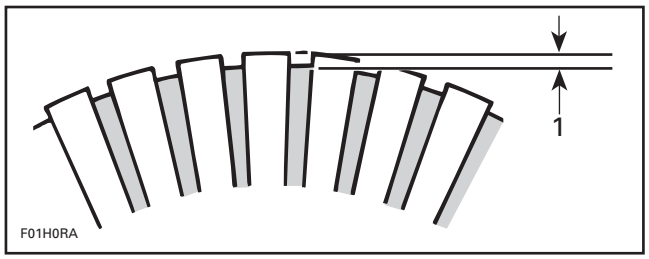
5. Immerse all metal components in cleaning solution. Dry using a clean and dry cloth.

Starter Inspection

Armature

NOTE: An ohmmeter may be used for the following test procedures, except when testing for shorted windings in the armature.

1. Check the commutator for roughness, burnt or scored surface. If necessary, turn the commutator on a lathe, enough to remove grime only.
2. Check the commutator for mica depth. If the depth is less than 0.20 mm (.008 in), undercut the mica. Be sure that no burrs are left and no copper dust remains between the segments after the undercutting operation is completed.



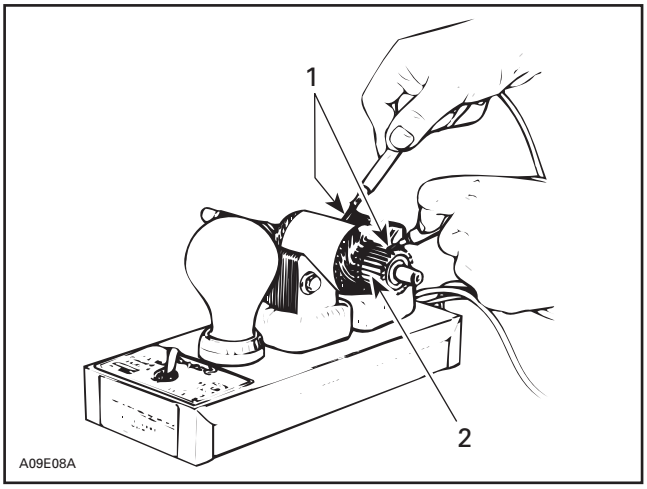
1. Commutator undercut 0.20 mm (.008 in)

3. Check the commutator out-of-round condition with V Blocks and an indicator. If the commutator out-of-round is more than 0.40 mm (.016 in), the commutator should be turned on a lathe.

4. Check commutator outer diameter for signs of excessive wear. Replace starter as necessary.

Test for Grounded Armature Winding

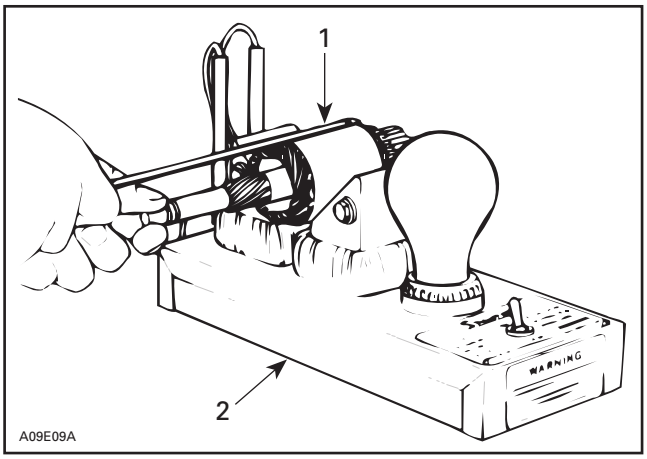
Use growler test probes. Check between armature core and the commutator bars. If growler lamp turns on, bars are grounded. If so, replace starter.



1. Test probes
2. Commutator bars

Test Armature for Shorted Winding

When the armature is rotated in the growler with a steel strip (hacksaw blade) held above it, the strip will vibrate over that area of the armature which has a short circuit. Replace starter if a shorted winding is found.



1. Steel strip (hack-saw blade)
2. Growler

Test the Armature for Open Circuit

1. Use growler test probes.
2. Place one test probe on a commutator bar and the other test probe on the neighboring bar.
3. Repeat this operation for all bars, moving one test probe at a time.

If the growler lamp does not turn on, the armature circuit between these 2 bars is opened. If an open circuit is found, replace the starter.

NOTE: Open circuits most often occur at the commutator riser where windings are soldered. Burnt commutator bars are usually an indication of an open-circuit in an armature winding.

Brush Holder

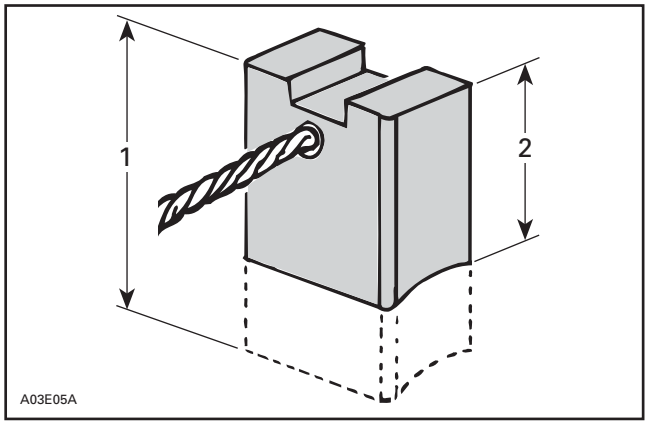
1. Check the brush holder for insulation using growler test probes.
2. Place one test probe on the insulated brush holder and the other test probe on the brush holder plate.

If the growler lamp turns on, the brush holder has to be repaired or replaced.

Brush Length

Measure brush length as illustrated. If less than the specified value, replace them.

MODEL	LENGTH	
	NEW	WEAR LIMIT
All	10 mm (.4 in)	6 mm (.24 in)

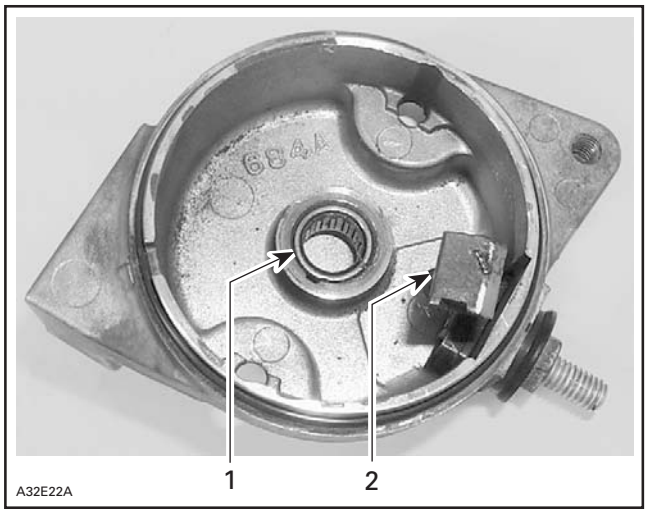


TYPICAL
1. NEW
2. Wear limit

End Cap

Check the mica insulation of the positive brush.

Check the roller bearing (or bushing) condition. Replace starter, if necessary.



1. Roller bearing
2. Positive brush

Overrunning Clutch

The pinion of the overrunning clutch should turn smoothly in a clockwise direction, and should not slip in a counterclockwise direction. If defective, replace clutch assembly.

Check the pinion teeth for wear and damage. If defective, replace.

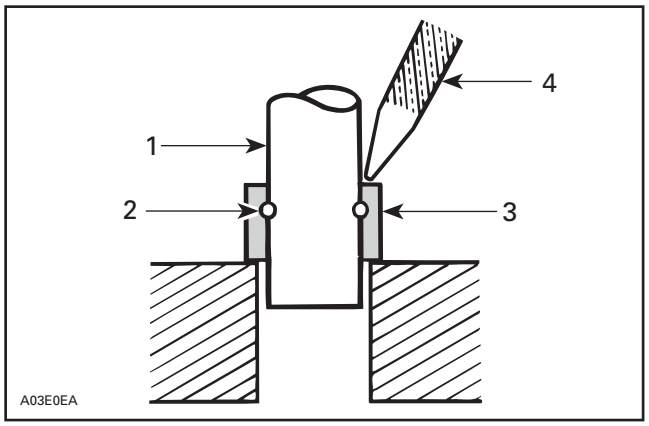
Starter Assembly

Reverse the order of disassembly to reassemble starter. However, pay attention to the following operations.

Prior to assembling, coat sliding surfaces on armature shaft splines, overrunning clutch and bushing with SUSPENSION GREASE (P/N 293 550 033).

After placing collar on armature shaft, install a new snap ring on the armature shaft and ensure that it is properly secured.

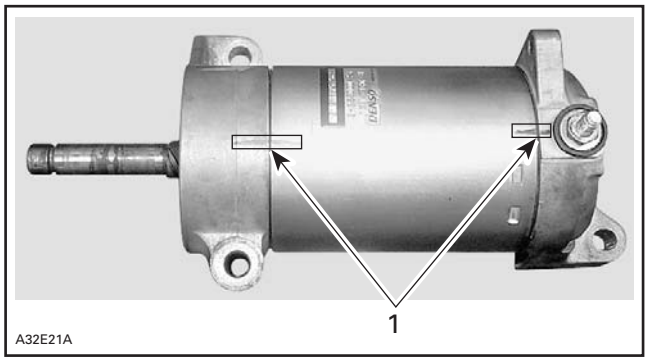
Slide collar over snap ring and secure in place by punching it at two or three places.



1. Armature shaft
2. Snap ring
3. Collar
4. Punch

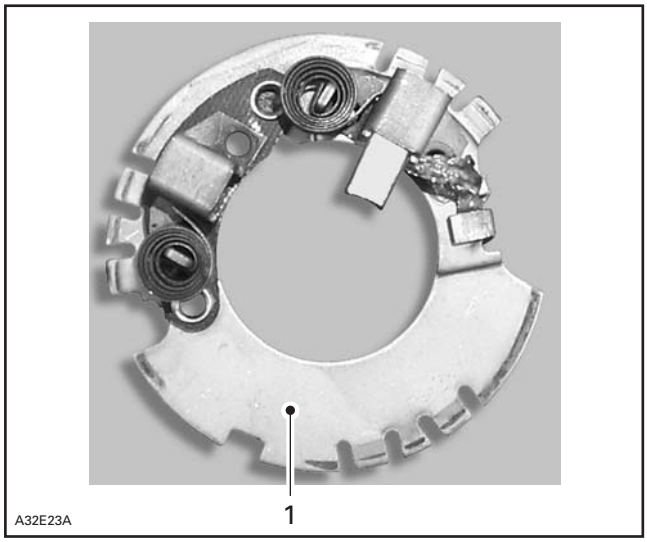
Starter Housing, Yoke and End Cap

1. Align previously traced index marks on housing, yoke and end cap.



TYPICAL
1. Aligned index marks

2. Open brushes and slide over commutator.
3. Align end cap locating notch with yoke locating protrusion and properly sit brush holder into cap.



1. Brush holder

NOTE: To ease end cap installation, retain brush holder with a small screwdriver while installing armature assembly.

NOTICE **Place two end caps on a flat surface before tightening the through bolts. Ensure end cap fits perfectly on yoke.**

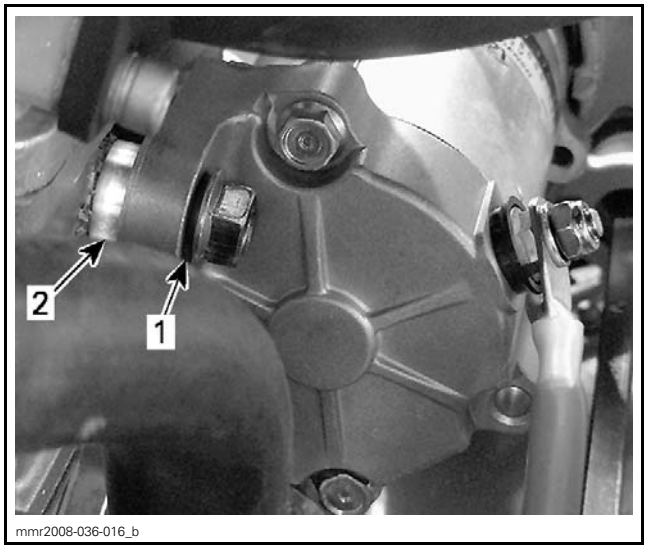
4. Torque starter through bolts as per exploded view.

Starter Installation

Install removed parts in the reverse order of removal, however, pay attention to the following.

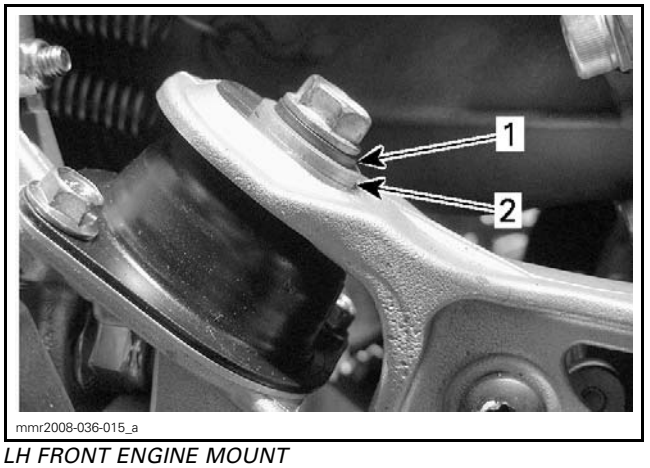
1. Ensure starter and engine mating surfaces are free of grime. Serious trouble may arise if starter is not properly aligned.
2. Replace all scotch grip screws.
3. For ease of installation, install the three new starter mounting screws loosely before torquing.
4. Install the washer and spacer as shown.

NOTICE **Be sure to install the washer and spacer as shown when installing the mounting screw on the RH side of the starter.**



STARTER MOUNTING SCREW, RH
1. Washer under screw head
2. Washer spacer between starter and engine

5. Torque the two starter mounting Torx screws first, then the hex screw to 28 N•m (21 lbf•ft).
6. Install the torque stopper support and two new engine mounting bolts, refer to *ENGINE REMOVAL AND INSTALLATION* subsection. Install washers under front mount bolt head as shown.



LH FRONT ENGINE MOUNT
1. Conical washer
2. Flat washer

7. Connect the RED wire to the large terminal on the starter.
8. Install the drive pulley and drive belt, refer to *DRIVE SYSTEM AND BRAKE* subsection.
9. Install the muffler and tune pipe, refer to *EXHAUST SYSTEM* subsection.
10. Reconnect the positive (+) RED battery cable, then the negative (-) BLACK cable.

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

GENERAL

SYSTEM DESCRIPTION

The following components are specially designed for this system: ECM, D.E.S.S. key (inside tether cord cap) and engine cut-off switch.

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 ROM chip.

– The magnet closes the reed switch inside the engine cut-off switch. It is the equivalent of a rotary mechanical ignition switch.
– The ROM chip contains a unique digital code. It is the equivalent of the tooth-pattern cut on a conventional ignition key.

The D.E.S.S. system is quite flexible. Up to 8 D.E.S.S. keys may be programmed in the ECM memory using the B.U.D.S. software. 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 (1)		
2 shorts beeps	SKI-DOO	Welcome message, good key	Working D.E.S.S. key.
Shorts beeps repeating slowly	CHECK KEY	Unable to read key (bad connection)	– Make sure the key contacts are free of dirt, snow or ice. – Reinstall key and restart engine. – Vehicle can not be driven.
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.
(1) Only available on premium gauge.			

PROCEDURES

D.E.S.S. KEY

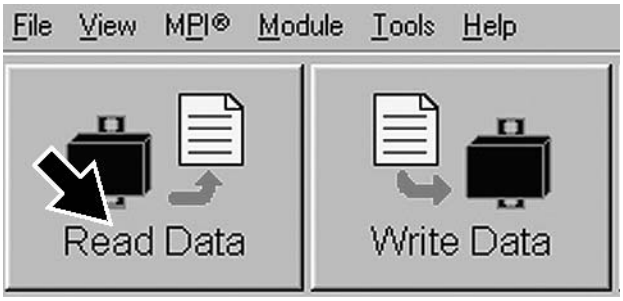
D.E.S.S. Key Programming

Use the latest B.U.D.S. software available from BOSSWeb.

1. Carry out the proper connections to use B.U.D.S. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

IMPORTANT: Ensure all connections have been made **before starting B.U.D.S.** to allow proper operation.

2. Start B.U.D.S. and logon.
3. In B.U.D.S., click on the **Read Data** button to read the ECM.



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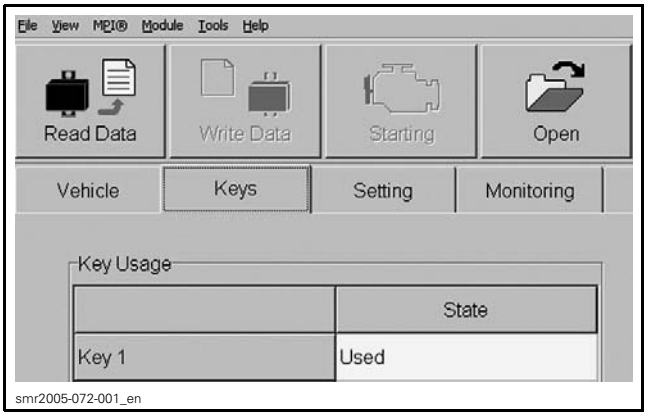
4. Install the new key to be programmed on the engine cut-off switch.
5. In B.U.D.S., click on the **Keys** tab.



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6. Click on the **Add Key** button at the bottom of the screen.

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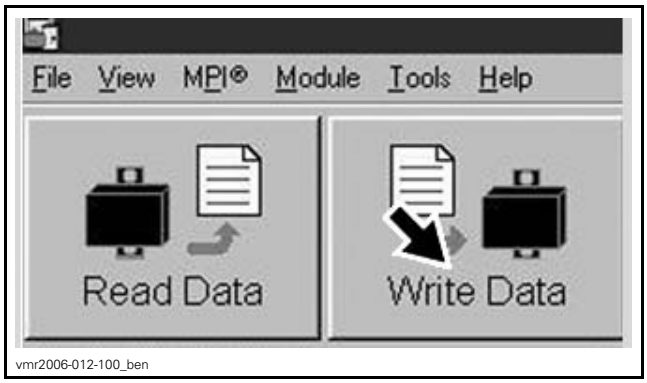
1. Click on this button

The D.E.S.S. key is now saved in the computer.

NOTE: To program other key(s), install a new key on the engine cut-off switch and click on the **Add Key** button again.

7. Save the new key(s) in the ECM by clicking the **Write Data** button.



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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 *LIGHTS, GAUGE AND ACCESSORIES* subsection.

ROTAX ELECTRONIC REVERSE (RER)

SERVICE TOOLS

SERVICE TOOLS – OTHER SUPPLIER

GENERAL

The main components of the RER system are:
- RER switch
- ECM
- Crankshaft position sensor.

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 disable and nothing takes place when the RER button is pressed.
- RPM to be between 1000 and 4300 RPM
- Throttle lever to be release (TPS opening below 2%)
- Vehicle speed below 25 km/h (16 MPH).

On electric start models, the switch is called the START/RER switch as it serves both purposes. If it is pressed when the **engine is stopped**, it signals the ECM to start the engine. If it is pressed when the **engine is running**, the same signal is interpreted by the ECM as the reverse signal.

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

Manual Start Models

Check the following:
- 5 A RER fuse condition
- *RER SWITCH SIGNAL TEST WITH B.U.D.S.*

Electric Start Models

Check the following:
- *RER SWITCH SIGNAL TEST WITH B.U.D.S.*

Engine Stops after Pressing RER Button

This confirms that RER control circuits function normally. Check the following:
- CPS
- 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.

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 *RER SWITCH CONTINUITY TEST* in this subsection
   – Loose (intermittent) electrical connections
   – Drive belt adjustment, refer to *DRIVE SYSTEM AND BRAKE* subsection
   – ECM.

PROCEDURES

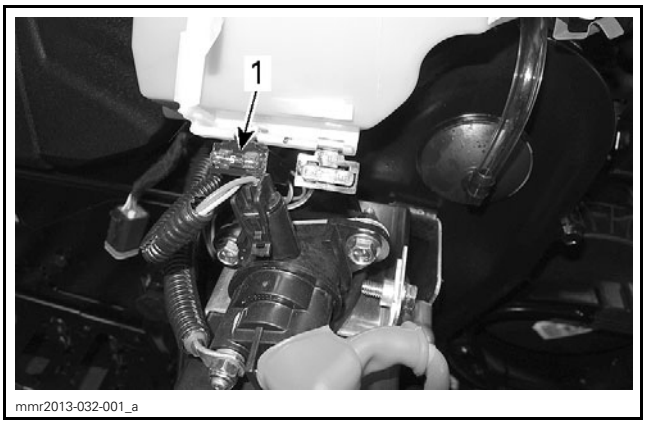
RER FUSE

The RER circuit is protected by a 5 A fuse attached to the oil injection tank.

RER Fuse Location

The RER fuse is attached to the bottom of the oil injection tank.

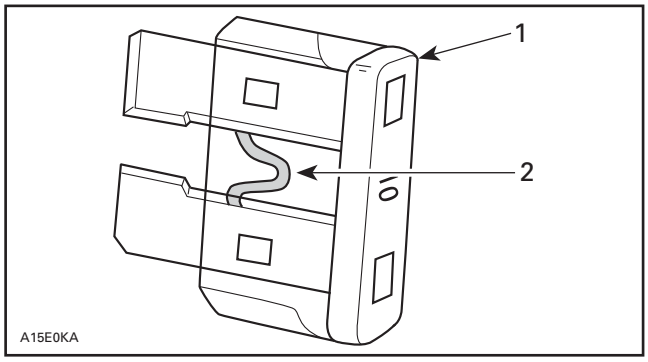
To access fuse, open RH side panel.



1. RER fuse

RER Fuse Inspection

Check if filament is melted. Replace as necessary.



1. Fuse
2. Check if melted

NOTICE **Do not use a higher rated fuse as this can cause severe damage to electric components and/or a fire. If fuse has burnt out, the cause of the malfunction should be determined and corrected before restarting.**

RER SWITCH

RER Switch Signal Test with B.U.D.S.

1. Connect vehicle to the latest applicable B.U.D.S. software version available from BOSSWeb. 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)	
MPI-2 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: On **manual start models**, a 12 volt battery is required to activated the electrical system.

2. In B.U.D.S., select the **Read Data** button.
3. Select the **Monitoring** tab.
4. At the bottom LH corner of the **Monitoring** page, select the **ECM** tab.
5. Set emergency engine STOP switch to STOP.

6. Press vehicle START/RER button and look for the **START/RER Button** light to come ON in the bottom field of the **ECM Monitoring** page.

1. Should turn ON (green)

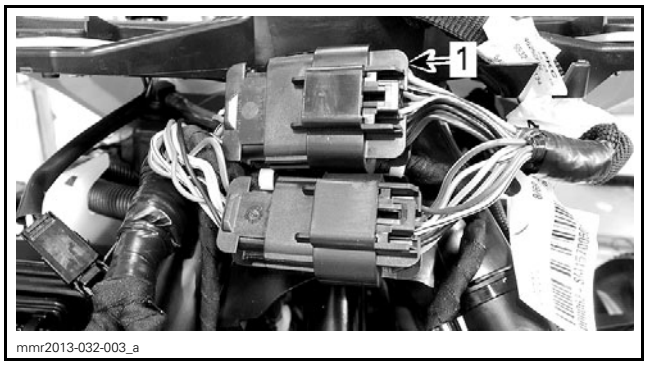
If the light comes ON, it indicates the START/RER switch, ECM and wiring are functioning properly. Test CPS. Refer to *E-TEC DIRECT FUEL INJECTION* subsection.

If the light does not come on, carry out the START/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 (green).

RER Switch Continuity Test

1. Remove the upper body module, refer to *BODY* subsection.
2. Disconnect the START/RER switch 12-pin (SH) connector.



1. 12-pin (SH) connector

3. Using the FLUKE 115 MULTIMETER (P/N 529 035 868) set to Ω, measure continuity of RER switch as per following table.

SWITCH POSITION	FEMALE SH CONNECTOR		RESISTANCE
Release	Pin C (RD/GN)	Pin H (RD/VT)	High value or infinite (OL)
Press and held			Continuity (0.4 Ω max.)

If continuity test fails, replace switch.

If continuity tests were good, measure voltage as per *RER SWITCH INPUT VOLTAGE TEST*.

RER Switch Input Voltage Test

1. Set multimeter to Vdc.
2. Measure voltage of battery used to power the vehicle.
3. Measure for RER switch input voltage on the vehicle harness side as follows.

12-PIN (SH) CONNECTOR		VOLTAGE
Pin H (RD/VT)	Chassis ground	Battery voltage

If battery voltage is measured, reconnect SH connector and carry out an *RER SWITCH OUTPUT VOLTAGE TEST* in this subsection.

If battery voltage is not measured, test continuity of the RD/VT power wire between the fuse contact B and pin H of the 12-pin (SH) connector.

RER Switch Output Voltage Test

Connect the 12-pin (SH) connector.

Measure RER switch output voltage by back-probing the female SH connector as follows.

SWITCH POSITION	SH CONNECTOR		VOLTAGE
Released	Pin C (RD/GN)	Chassis ground	Close to 0 Vdc
Pressed and held			Approximately 12 Vdc

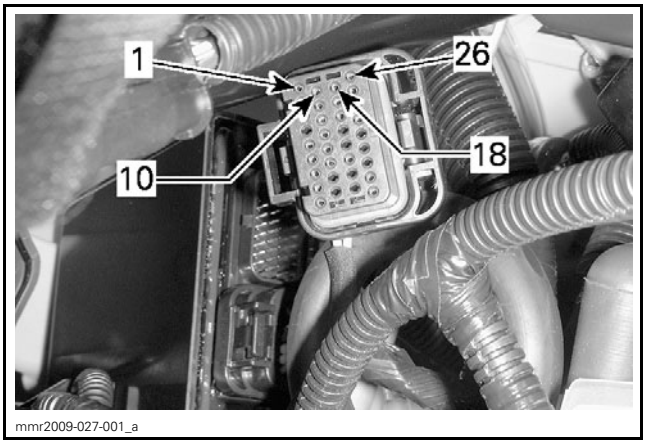
If RER switch output voltage test failed, replace switch.

If RER switch output voltage test is good, carry out the *RER SWITCH CONTINUITY TEST TO ECM*.

RER Switch Continuity Test to ECM

1. Disconnect the 12-pin (SH) connector and ECM J1A connector.
2. Disconnect the 2-pin (SD) connector from starter solenoid.
3. Test wire continuity between the 12-pin (SH) connector and the ECM connector as follows.

SB CONNECTOR	ECM J1A CONNECTOR	RESISTANCE
Pin C (RD/GN)	Pin 28 (RD/GN)	Continuity (0.2 Ω max.)
Pin C (RD/GN)	Chassis ground	Infinite (OL)



PIN-OUT — ECM CONNECTOR J1A

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 *LIGHTS, GAUGE AND ACCESSORIES* subsection for the testing procedure.

LIGHTS, GAUGE AND ACCESSORIES

SERVICE TOOLS

Description	Part Number	Page
12 V BATTERY SUPPLY CABLE	529 035 997	5
FLUKE 115 MULTIMETER	529 035 868	8, 14, 21, 24
POWER INTERFACE	515 177 223	5

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
MULTILOCK - TERMINAL EXTRACTION TOOL	755430-2	25

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 5900	293 800 066	19

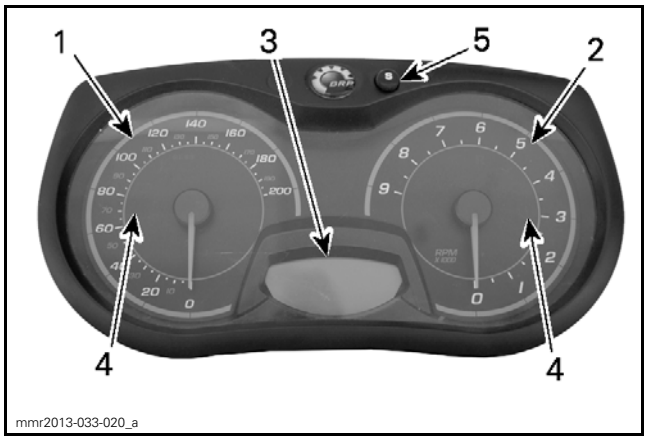
GENERAL

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

⚠ CAUTION The battery charging fuse should always be removed before carrying out any maintenance on the vehicle to prevent any unexpected electrical activation. Removal of this fuse isolates the battery from the vehicle electrical system, except for the starter relay input terminal.

⚠ 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.).



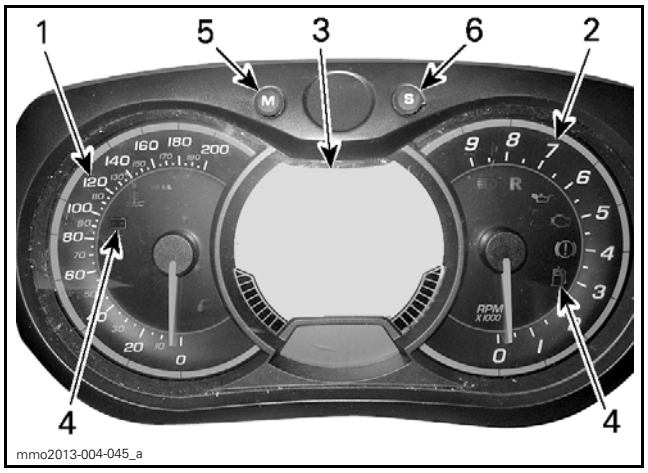
ANALOG/DIGITAL GAUGE (STANDARD)
1. *Speedometer*
2. *Tachometer (RPM)*
3. *Gauge Digital Display*
4. *Gauge Pilot Lamps*
5. *Gauge SET "S" button*

SYSTEM DESCRIPTION (GAUGE)

Two different type gauges which provide all indications in a single unit are used. An **analog/digital gauge (standard gauge)** and a **multifunction analog/digital gauge (premium gauge)**.

The premium gauge provides more functions and display features.

Both units can be set to indicate in metric or imperial units.



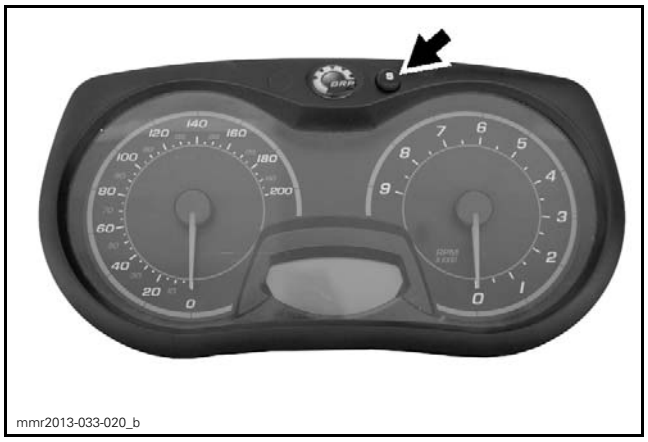
MULTIFUNCTION ANALOG/DIGITAL GAUGE (PREMIUM)
1. *Speedometer*
2. *Tachometer (RPM)*
3. *Gauge Multifunction Digital Display*
4. *Gauge Pilot Lamps*
5. *Gauge MODE "M" button*
6. *Gauge SET "S" button*

The premium gauge is also used to control 9 heating intensity settings for the heated hand grips and the heated throttle lever.

Mode and Set Buttons

Analog/Digital Gauge

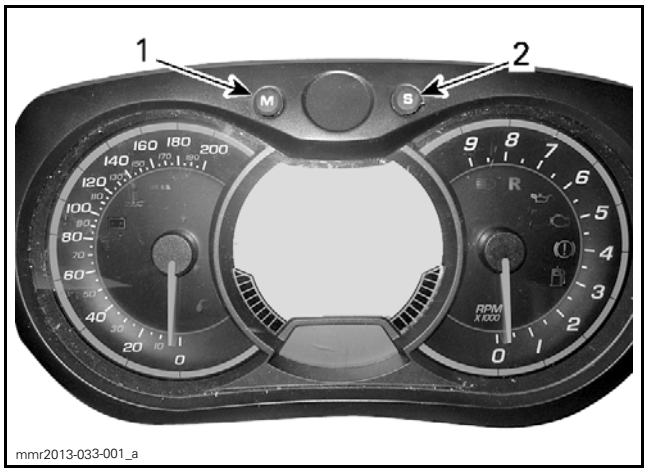
The standard gauge is equipped with a SET button only at the top of the indicator.



SET "S" BUTTON

Multifunction Analog/Digital Gauge (Premium)

The premium gauge is equipped with MODE and SET buttons at the top of the indicator.



PREMIUM GAUGE
1. *MODE button*
2. *SET button*

These buttons allow you to toggle through the different functions and settings of the indicator.

Except Summit Models, all vehicles that are factory equipped with the premium gauge also come with a remote M/S button on the LH multifunction switch. It can be used instead of the buttons on the gauge simply by pressing the "M" for MODE and "S" for SET.

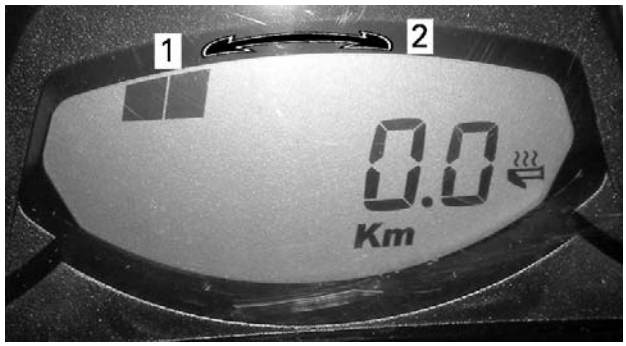
SYSTEM DESCRIPTION (HEATED THROTTLE LEVER)

The type of system used is usually determined by the gauge package installed at the factory, standard gauge or premium gauge.

The throttle lever heat is controlled through the gauge.

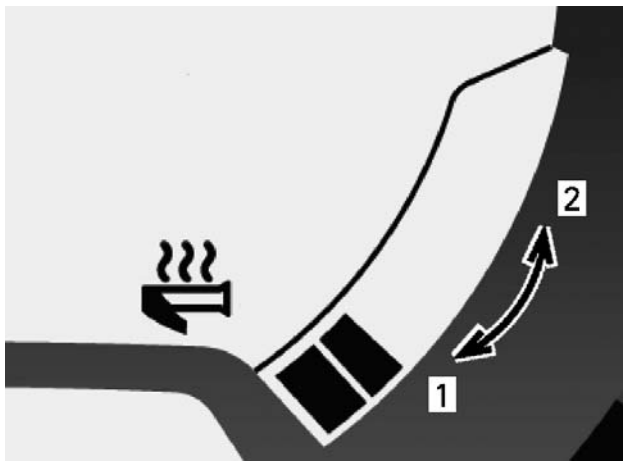
A three position switch on the LH multifunction switch allows selection of 9 heat levels, which are displayed in the indicator.

NOTE: The heating intensity is displayed via the digital display with the activation of the throttle lever switch. When released, display will return to fuel tank level.



mmo2013-004-040_a

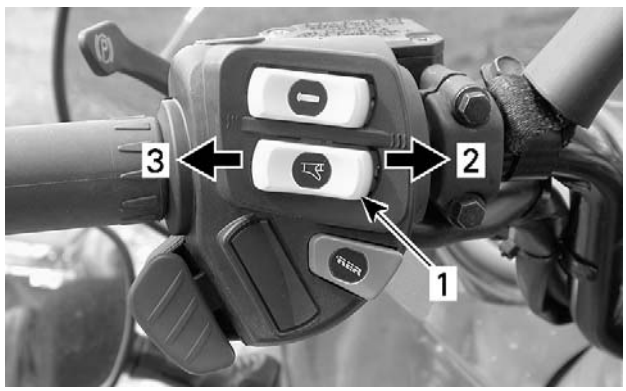
VARIABLE HEATING INTENSITY DISPLAY - STANDARD GAUGE
1. *Less heat*
2. *More heat*



mmo2007-009-044_b

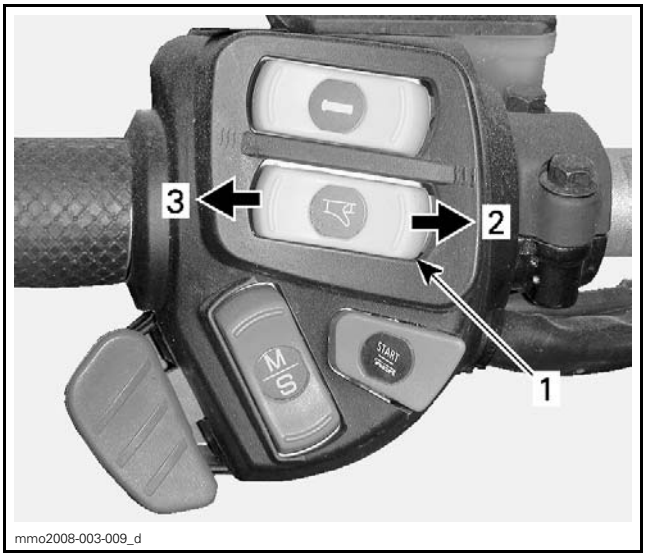
THROTTLE LEVER HEAT INDICATOR - PREMIUM GAUGE
1. *Decrease heat*
2. *Increase heat*

The switch selection sends a signal to the premium gauge to increase or decrease heat.



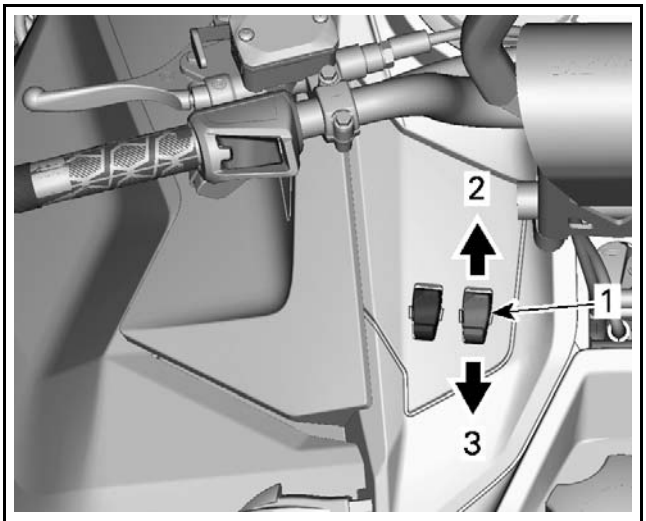
mmo2007-003-003_g

VARIABLE HEATING INTENSITY - STANDARD GAUGE
1. *Heated throttle lever switch*
2. *Increase heat*
3. *Decrease heat*



mmo2008-003-009_d

VARIABLE HEATING INTENSITY - PREMIUM GAUGE (EXCEPT SUMMIT)
1. *Throttle lever heat switch*
2. *Increase heat*
3. *Decrease heat*



mmo2013-004-014_b

VARIABLE HEATING INTENSITY - PREMIUM GAUGE (SUMMIT ONLY)
1. *Heated throttle lever switch*
2. *Increase heat*
3. *Decrease heat*

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.

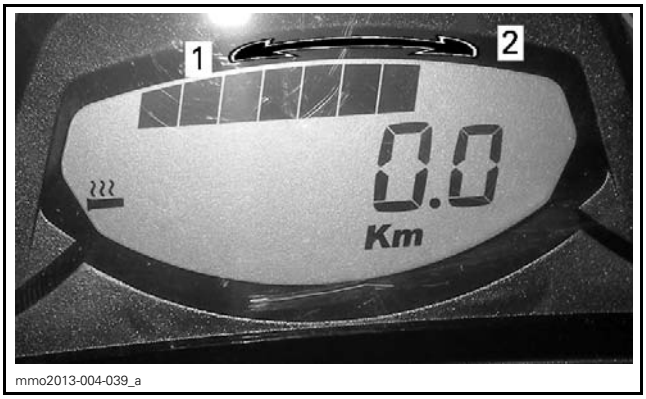
SYSTEM DESCRIPTION (HEATED HANDLEBAR GRIPS)

The type of system used is usually determined by the gauge package installed at the factory, standard gauge or premium gauge.

The grip heat is controlled through the gauge.

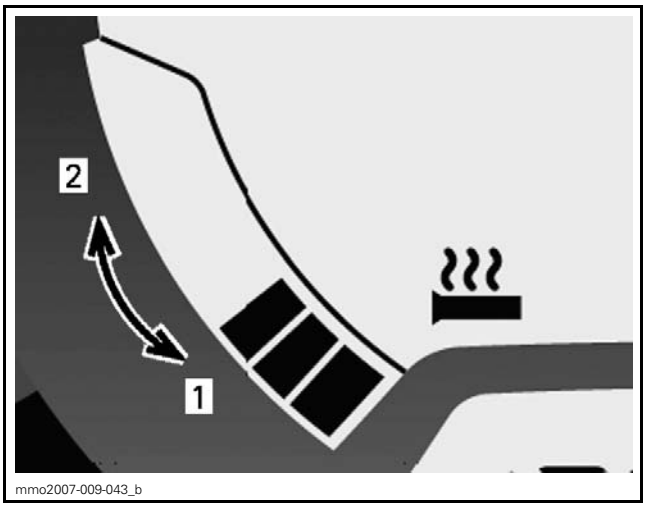
A three position switch on the LH multifunction switch allows selection of 9 heat levels, which are displayed in the indicator.

NOTE: The heating intensity is displayed via the digital display with the activation of the heated grips switch. When released, display will return to fuel tank level.



mmo2013-004-039_a

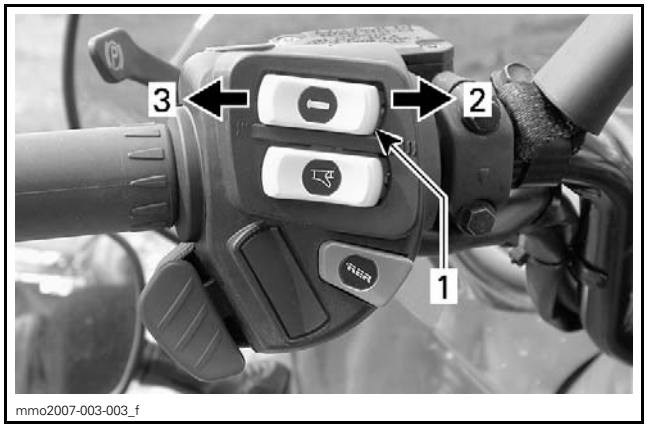
HEATING INTENSITY DISPLAY - STANDARD GAUGE
1. *Less heat*
2. *More heat*



mmo2007-009-043_b

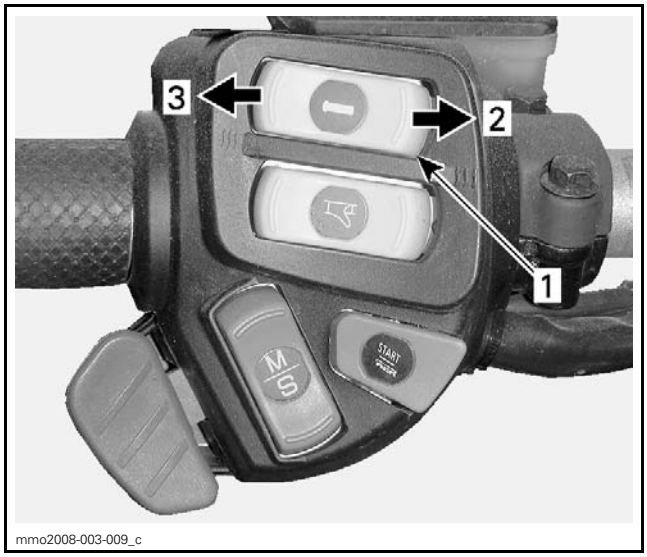
HEATING INTENSITY DISPLAY - PREMIUM GAUGE
1. *Decrease heat*
2. *Increase heat*

The switch selection sends a signal to the premium gauge to increase or decrease heat.



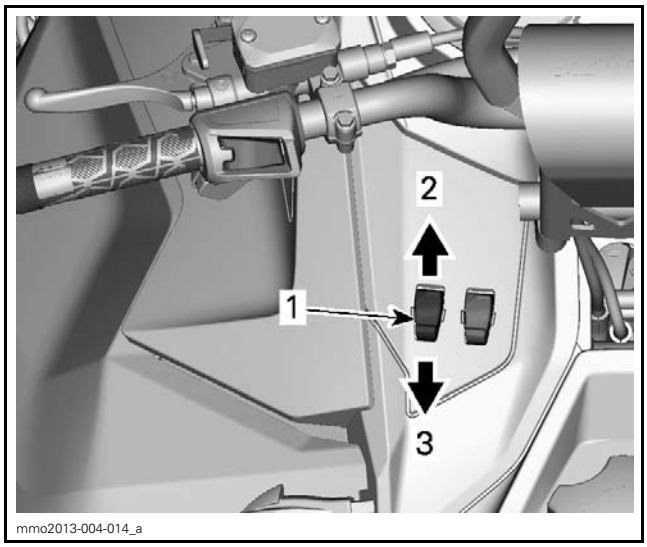
mmo2007-003-003_f

VARIABLE HEATING INTENSITY - STANDARD GAUGE
1. *Heated grip switch*
2. *Increase heat*
3. *Decrease heat*



mmo2008-003-009_c

VARIABLE HEATING INTENSITY - PREMIUM GAUGE (EXCEPT SUMMIT)
1. *Grip heat control switch*
2. *Increase heat*
3. *Decrease heat*



VARIABLE HEATING INTENSITY - PREMIUM GAUGE (SUMMIT ONLY)
1. *Heated grip switch*
2. *Increase heat*
3. *Decrease heat*

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.

TROUBLESHOOTING

LIGHTING AND ACCESSORIES 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.

There are no relays or fuses outside the ECM to test or replace for the light circuits. Refer to *CHARGING SYSTEM* for more information on testing the primary 12 Vdc circuits.

If a light does not come ON, carry out the following:
- Obtain access to the bulb and make sure it is not burnt.
- Test for input voltage to the bulb.
- Test for continuity of the ground circuit.
- Test the applicable control switch (brake switch, headlight switch).

Refer to *WIRING DIAGRAM* for circuit details.

To provide power to specific circuits, refer to the following chart to meet the required conditions.

SYSTEM	MODEL	CONDITIONS REQUIRED
		– POWER INTERFACE (P/N 515 177 223) – 12 V BATTERY SUPPLY CABLE (P/N 529 035 997) (for **manual start**) – 12-volt battery (for **manual start**)
– Lights – Gauge – Heaters	All	
– Heaters	All	– Start engine and rev above 800 RPM for at least 2 seconds – OR Use B.U.D.S. and activate the Accessory Relay

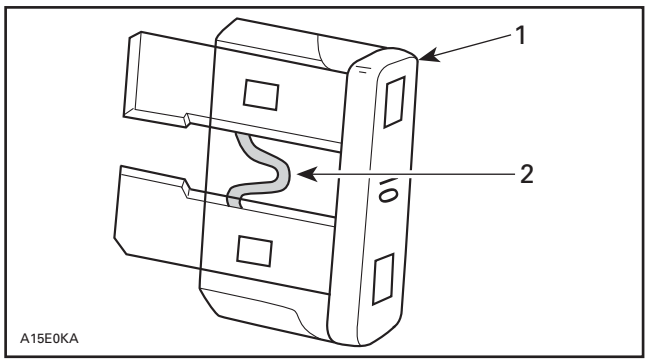
To use B.U.D.S., refer to the *COMMUNICATION TOOLS AND B.U.D.S.* subsection for proper connections.

PROCEDURES

FUSES

Fuse Inspection

Check if filament is melted. Replace as necessary.



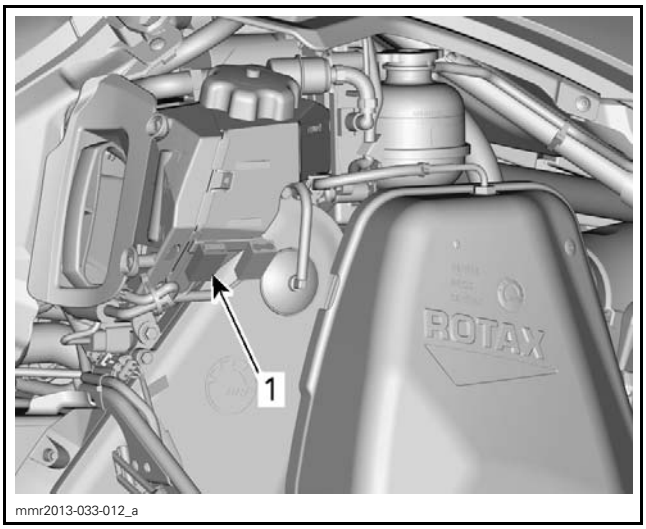
1. *Fuse*
2. *Check if melted*

NOTICE **Do not use a higher rated fuse as this can cause severe damage to electric components and/or a fire. If fuse has burnt out, the cause of the malfunction should be determined and corrected before restarting.**

Fuse Location

All fuses are located near the battery. The following illustrations depict the locations of the various fuses as in an **electric start model**. The fuse(s) applicable to the **manual start models** will be in the same locations.

Manual Start



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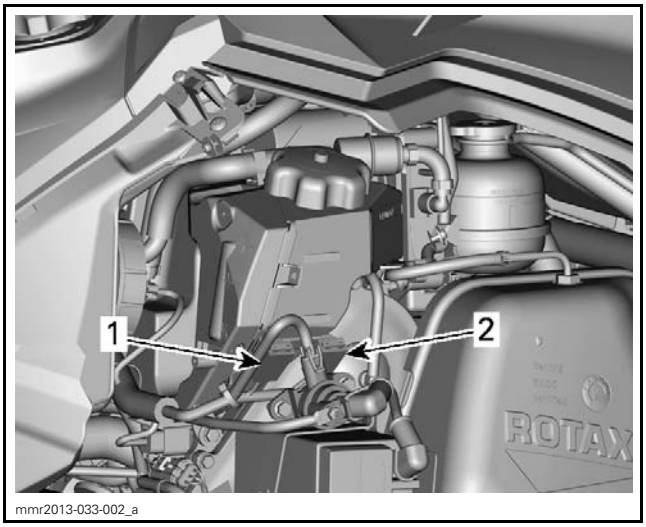
TYPICAL - RH SIDE OF ENGINE COMPARTMENT
1. 5 A start/RER fuse

Electric Start



mmr2013-033-002_a

TYPICAL - RH SIDE OF ENGINE COMPARTMENT
1. 5 A charging system fuse
2. 25 A start/RER fuse

Fuse Description

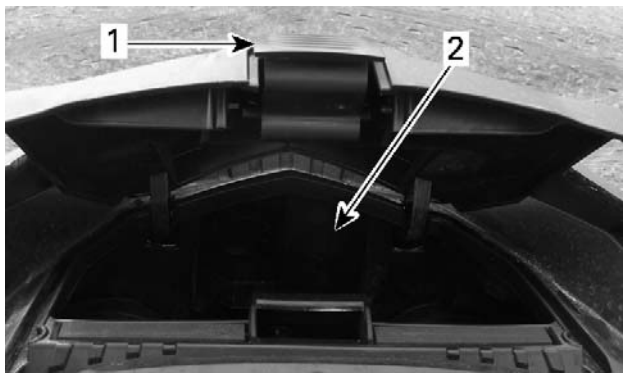
MODEL	FUSE	DESCRIPTION	LOCATION
Electric start	25 A	Battery charging (FA)	Attached to oil tank
All	5 A	ECM START/RER (FB)	Attached to oil tank

HEADLIGHTS

Headlight Bulb Removal

If a headlight bulb is burnt, proceed as follows.

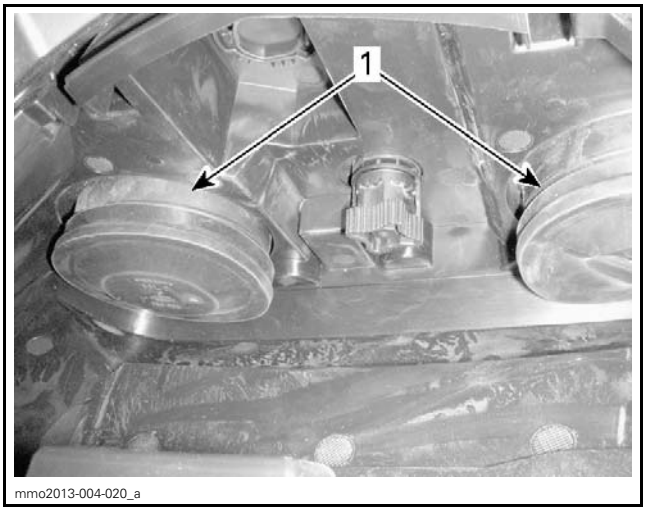
1. Open the front storage compartment by pulling the tab.



mmo2013-004-017_a

1. Tab
2. Storage compartment

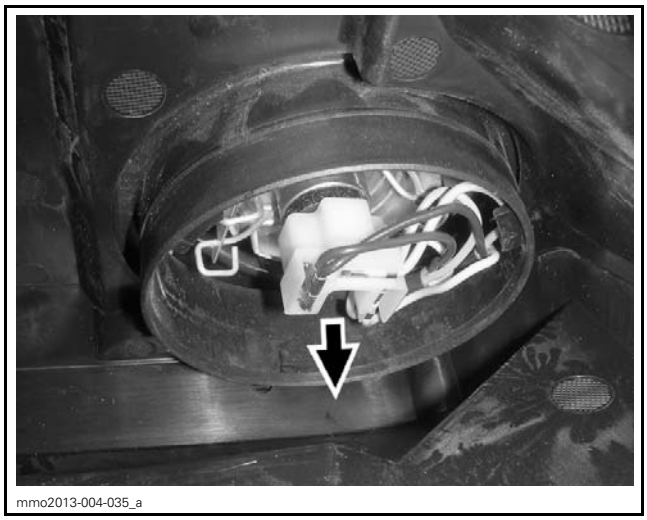
2. Remove the applicable rubber boot.



mmo2013-004-020_a

1. Rubber boots

3. Disconnect electrical connector.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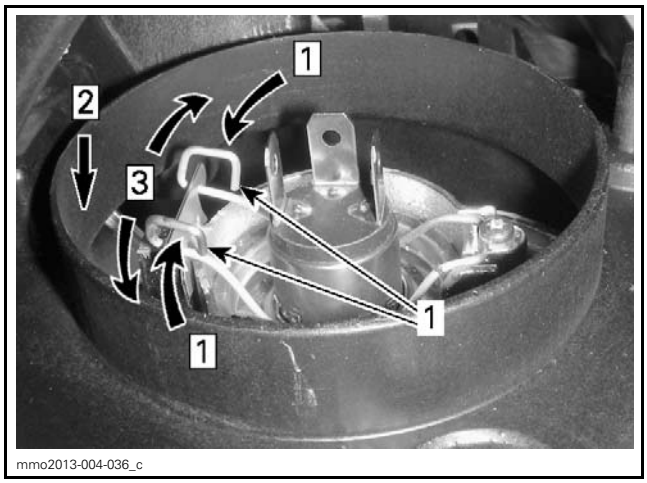
ELECTRICAL CONNECTOR

4. Press and pull both sides of the retaining clip at the same time to release it from bulb support.



mmo2013-004-036_c

Step 1: Push both sides
Step 2: Push down to release
Step 3: Release both sides

1. Retaining clip

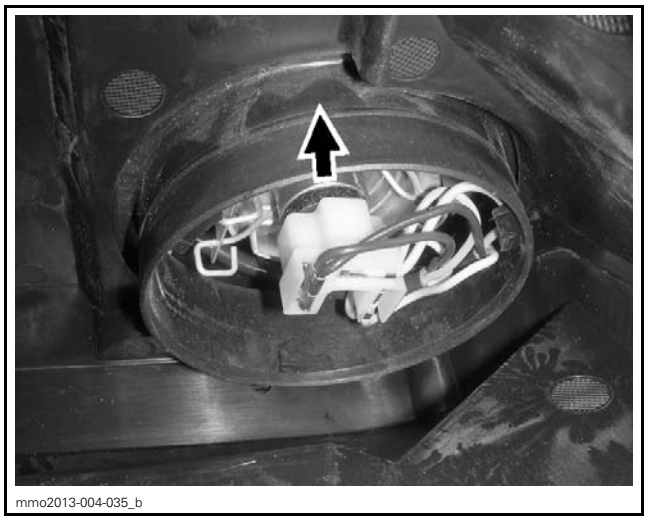
Headlight Bulb Installation

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.**

1. Insert bulb in headlight.

NOTE: Widest alignment tab on bulb should be at top of headlight.

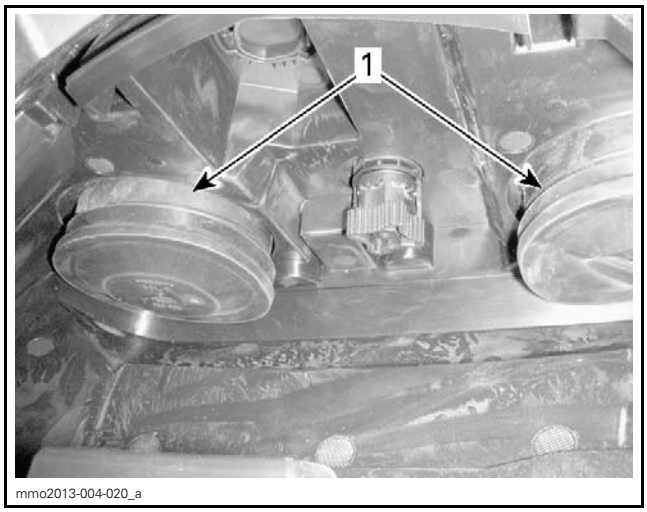
2. Insert top of bulb holder (spring clip) as you squeeze the two sides inwards. Release bulb holder so that it locks in the grooves on either side of headlight.
3. Connect electrical connector.


mmo2013-004-035_b

ELECTRICAL CONNECTOR

4. Install rubber boot cover. Ensure cover is properly inserted in groove provided in the headlight, and around the base of the bulb.

NOTE: Make sure to properly reinstall both rubber boots to ensure that no humidity gets inside the headlamp. Humidity can create fog inside the headlamp.



mmo2013-004-020_a

1. Rubber boots

5. Always test light operation after bulb replacement.

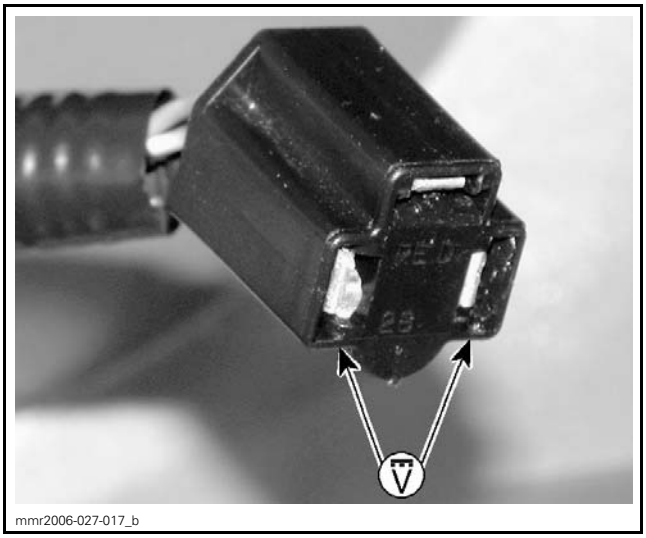
Headlight Input Voltage Test

If a headlight does not function, proceed as follows.

1. Remove multifunction gauge, see procedure in this subsection.
2. Disconnect headlight connector(s).

3. Provide electrical power to the headlights for testing. Refer to *LIGHTING AND ACCESSORIES SYSTEM TESTING* in the *TROUBLESHOOTING* topic at the beginning of this subsection for proper procedure.
4. 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	



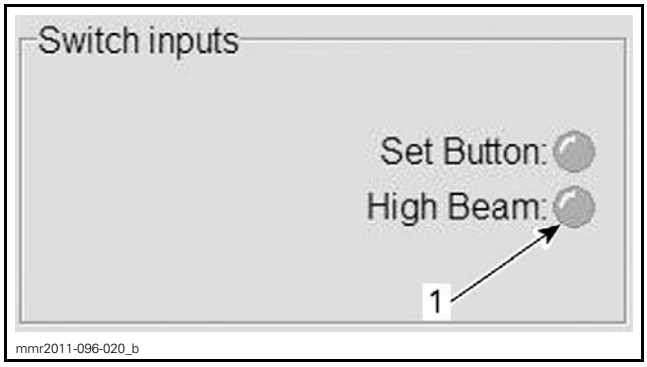
TYPICAL

If voltage is inadequate, carry out the following to find the source of the problem:

– Test headlights dimmer switch. Refer to *HEADLIGHT DIMMER SWITCH CONTINUITY TESTING* in this subsection.
– Test wiring harness and connectors.
– Test primary 12 Vdc system. Refer to *CHARGING SYSTEM*.

Headlight Dimmer Switch Test with B.U.D.S.

1. Using the B.U.D.S. software, select the **Monitoring** tab.
2. On the bottom of the page, choose the **Cluster** tab.
3. Set vehicle dimmer switch to High Beam and look for applicable indicator light in the **Switch inputs** field to turn green.

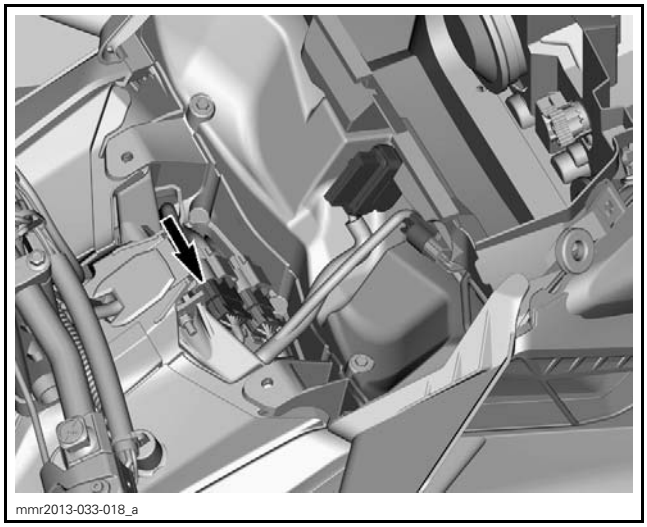


TYPICAL
1. Indicator light

If the indicator light come ON in B.U.D.S., the dimmer switch is functioning correctly.

Headlight Dimmer Switch Continuity Test

1. Remove the gauge.
2. Disconnect the SH-2 connector (12 positions).



TYPICAL - SH CONNECTOR

3. Using the FLUKE 115 MULTIMETER (P/N 529 035 868), select the Ω position.
4. Test switch circuits on SH-2 connector (12 positions) on harness side as per table.

HEADLIGHT DIMMER SWITCH CONTINUITY TEST			
SWITCH POSITION	SH-2		RESISTANCE
HIGH	M	G	Close to 0 Ω
	F	G	Infinite (OL)
LOW	F	G	Infinite (OL)
	M	G	Close to 0 Ω

If tests were good, switch is functioning properly.

If any test failed, check wiring and connections going to switch.

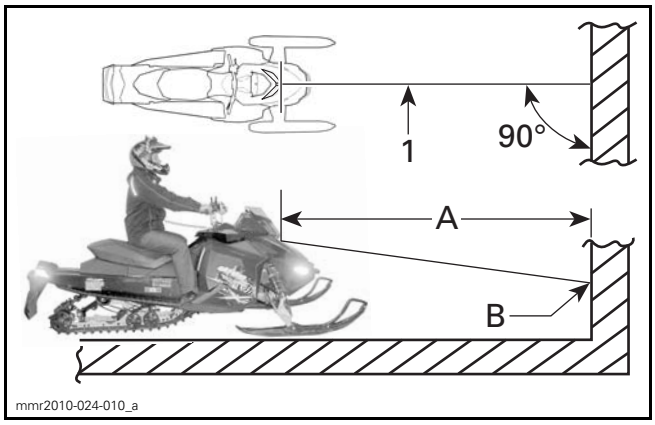
If test of wiring and connections was good, replace switch.

NOTE: When testing headlight dimmer switch from SH-2 connector, if an open circuit is found through the switch, remove the screws retaining the multifunction switch, disconnect the LA and LB connectors and test for continuity of switch and wiring separately.

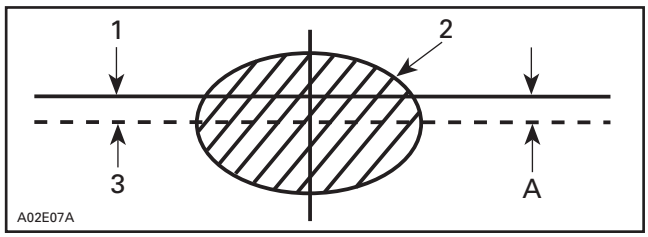
Headlight Beam Aiming

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)

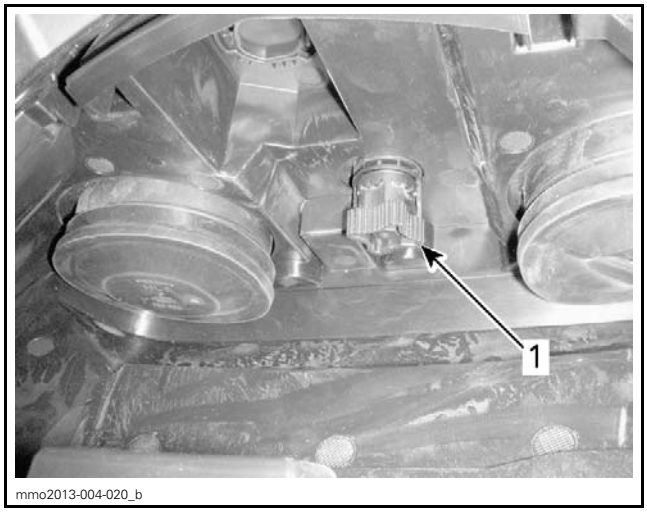
Beam Aiming Adjustment

Open the front storage compartment.

Turn knob clockwise to lower the beam height.

Turn knob counterclockwise to raise the beam height.

NOTE: Avoid reaching extreme adjustments as the headlight assembly might move out of position.

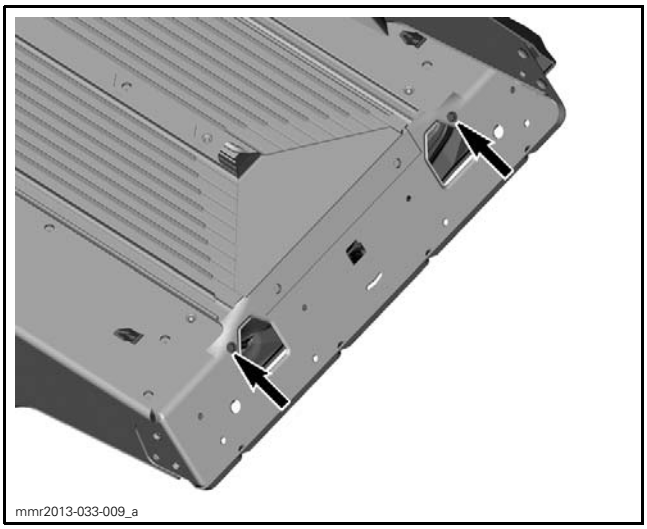


TYPICAL
1. Knob

TAILLIGHT

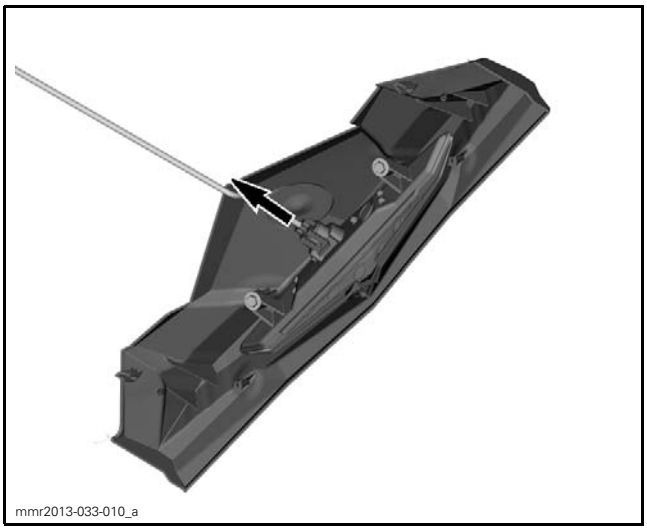
Taillight Replacement

Remove both retaining bolts securing rear taillight to frame.



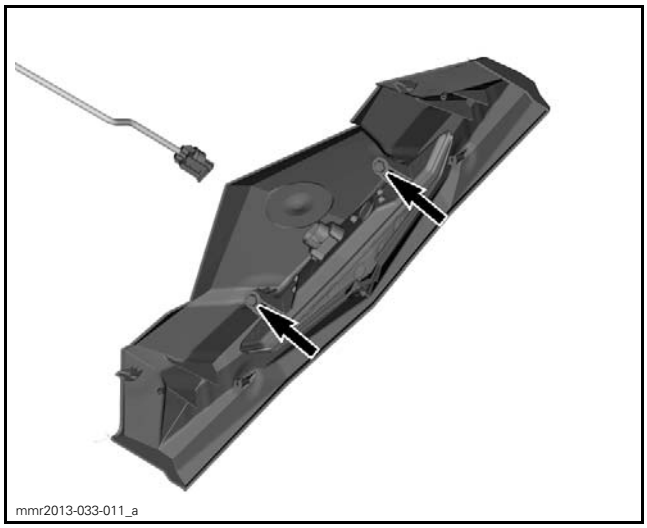
RETAINING BOLTS LOCATION - VIEWED FROM UNDER

Pull rear taillight support out of location and disconnect taillight connector.



TAILLIGHT CONNECTOR DISCONNECTION

Remove both retaining screws securing taillight to taillight support.



RETAINING BOLTS SECURING TAILLIGHT TO TAILLIGHT SUPPORT

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

Gauge Self Test Function

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.

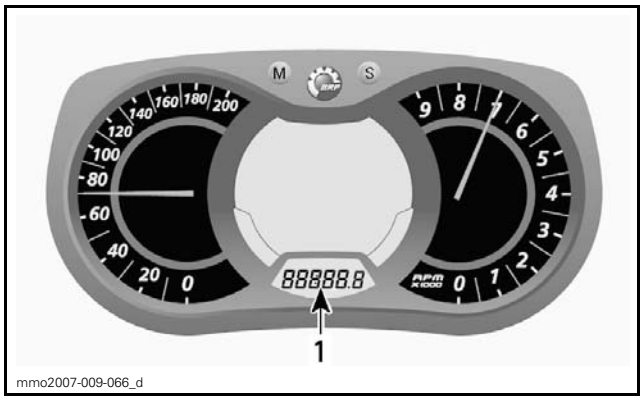
If the self test does not take place, proceed with the *GAUGE POWER INPUT TEST*.

Gauge Setup

Clock Activation (Premium Gauge)

The gauge has an internal clock that can display the time of day in the lower digital display (when selected).

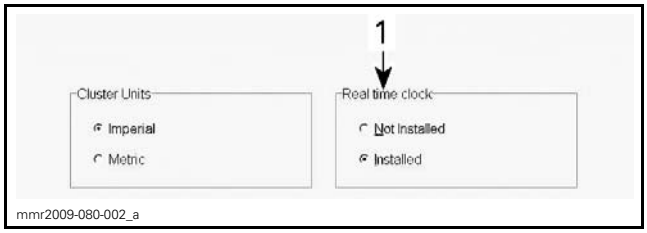
This clock requires power from the vehicle battery to maintain the proper time of day.



mmo2007-009-066_d

1. Clock displayed

1. Provide electrical power to the gauge, refer to *LIGHTING AND ACCESSORIES SYSTEM TESTING* in the *TROUBLESHOOTING* topic at the beginning of this subsection.
2. In B.U.D.S., select the **Setting** tab.
3. At the bottom of the page, select the **Cluster** tab.
4. Select the **Installed** in the **Real time clock** field if the vehicle is equipped with a battery. Choose **Not installed** if the vehicle does not have a battery.



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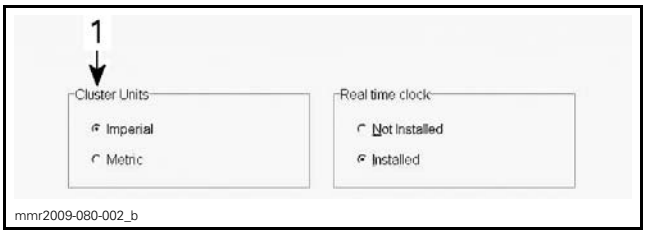
1. Real time clock selection field

Changing Gauge Units of Measurement

The gauges are factory preset to indicate in metric units and can be changed using the B.U.D.S. software.

To change the gauge units of measurement in B.U.D.S.:

1. Provide electrical power to the gauge, refer to *LIGHTING AND ACCESSORIES SYSTEM TESTING* in the *TROUBLESHOOTING* topic at the beginning of this subsection for proper procedure.
2. In B.U.D.S., select the **Setting** tab.
3. At the bottom of the page, select the **Cluster** tab.
4. Select **Imperial** or **Metric** in the **Cluster Units** field.



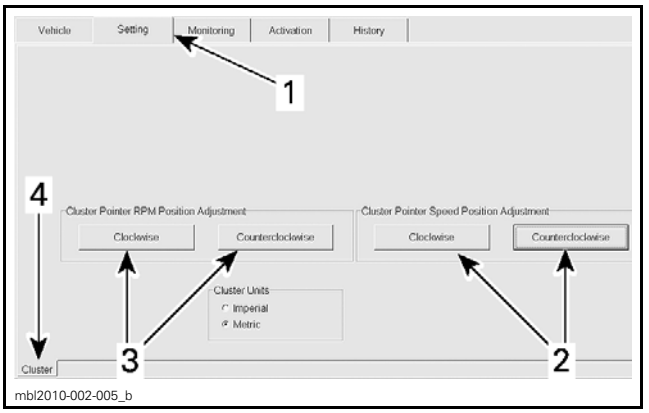
mmr2009-080-002_b

1. Cluster Units field

NOTE: Speedometer, odometer and trip meter will have their units (kilometer or miles) changed simultaneously.

Speedometer and Tachometer Pointer Adjustment

1. Make connections to use B.U.D.S. Refer to *COMMUNICATION TOOLS AND B.U.D.S.*
2. In B.U.D.S., select the **Setting** tab.
3. At the bottom of the page, select the **Cluster** tab.
4. Ensure to be facing gauge to prevent parallax error.
5. Click on **Clockwise** or **Counterclockwise** button to align gauge pointer with the zero (0).



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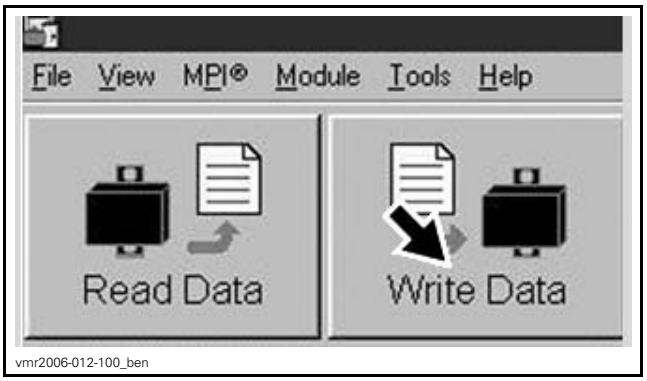
TYPICAL
1. Setting tab
2. Speedometer pointer buttons
3. Tachometer pointer buttons
4. Cluster tab

NOTE: Because of the fine tuning of the pointer, the button must be pressed several times before perceiving pointer movement.

6. Click on **Write Data** to save the new setting in the gauge.



WRITE DATA

Displaying "P" Codes (Premium Gauge Only)

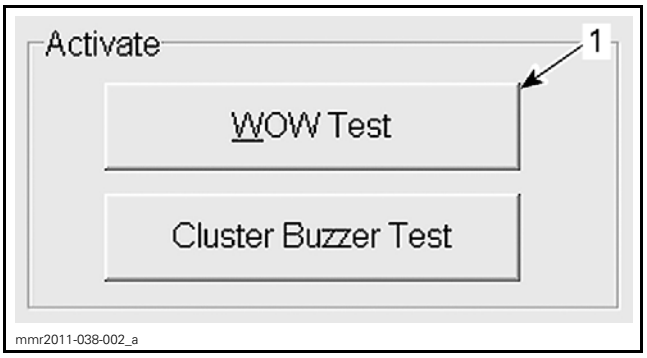
1. To activate **P CODE** mode, push and hold the "M" button for 2 seconds.
2. As you hold the "**M**" button, quickly turn ON and OFF the high beams a few times. The gauge will enter **P CODE** mode.
3. While in **P CODE** mode, use the "**M**" or "**S**" button to scroll over available failure codes.
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.

Gauge Test With B.U.D.S.

The *GAUGE SELF TEST* can be duplicated using B.U.D.S.

1. Connect vehicle to B.U.D.S. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. In B.U.D.S.,choose the **Activation** tab.
3. At the bottom of the page, select the **Cluster** tab.
4. Select **WOW Test** in the **Activate** field.



1. *Select this button*

Gauge Power Input Test (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 battery ground as per following table.

MODEL	GAUGE CONNECTOR	VOLTAGE
E-TEC	Pin 8 (RD/OG)	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.

NOTE: The gauge receives its main power input directly from the primary 12 Vdc bus. There are no fuses or relays to test, only wiring and connectors.

Gauge Ground Circuit Continuity Test

1. Set multimeter to Ω selection.
2. Measure for continuity of gauge ground wire as per following table.

GAUGE CONNECTOR	RESISTANCE
Pin 11 (BK)	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.

Clock 12 Vdc Input Test (Premium Gauge)

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.

NOTE: The clock receives 12 Vdc from the battery through the 5 A START/RER fuse (FB) in order to maintain correct time when the engine is not running.

1. Remove multifunction gauge.
2. Disconnect the gauge connector.
3. Set multimeter to Vdc.
4. Measure voltage as per following table.

MODELS	GAUGE CONNECTOR	VOLTAGE
All	Pin 9 (RD/VT)	Battery voltage

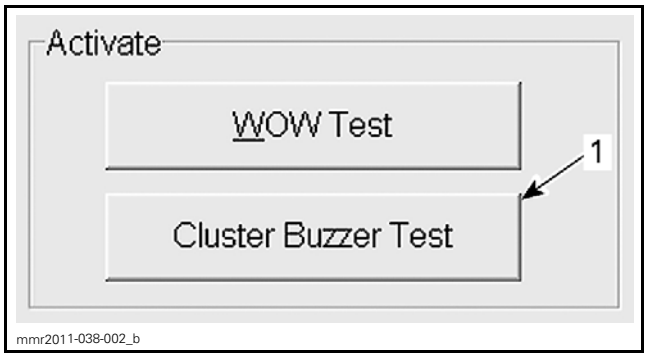
NOTE: If the START/RER fuse was open, the electrical start and RER functions would not be operational.

5. If there is no voltage read, test input wire continuity. Refer to *WIRING DIAGRAM* for circuit details.

Gauge Beeper Test

To test beeper, perform the following test with B.U.D.S.

1. Connect vehicle to B.U.D.S. Refer to *COMMUNICATION TOOLS AND B.U.D.S.*
2. In B.U.D.S., choose the **Activation** tab.
3. At the bottom of the page, select the **Cluster** tab.
4. Select **Cluster Buzzer Test** in the **Activate** field.



1. Select this button

You should hear a few beeps.

– If you do not hear the beeper, replace gauge.

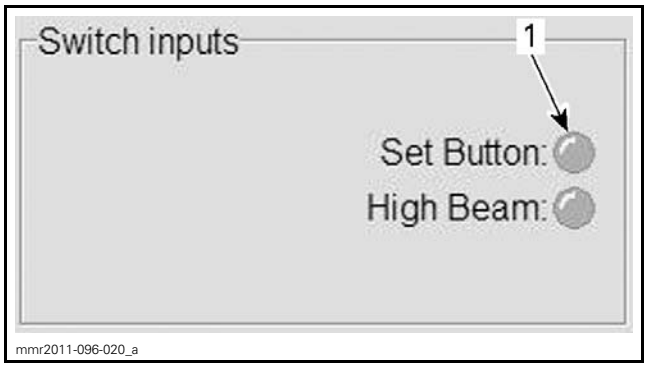
Gauge Button Test with B.U.D.S.

Using the B.U.D.S. software, select the **Monitoring** tab.

On the bottom of the page, choose the **Cluster** tab.

Standard Gauge

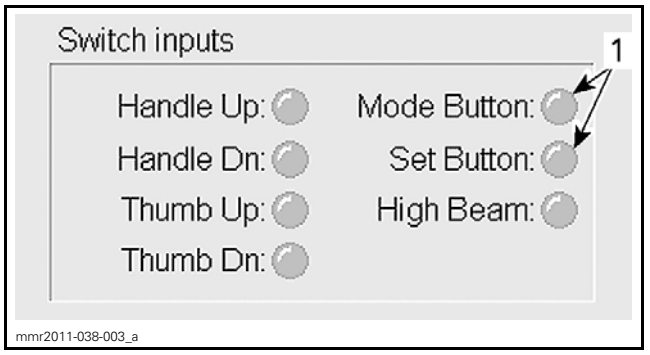
Press on the gauge "**S**" button and look for applicable indicator light in the **Switch inputs** field to turn green.



1. Indicator light

Premium Gauge

Alternately press on the gauge "**M**" and "**S**" buttons and look for applicable indicator light in the **Switch inputs** field to turn green.



1. Indicator lights

All Gauges

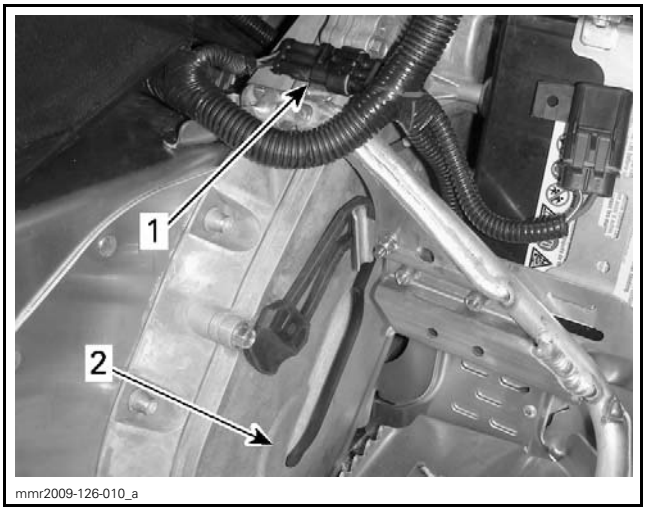
If the indicator light(s) come ON in B.U.D.S., the gauge button(s) is(are) functioning correctly.

If the indicator light(s) do not come ON, check button(s). If they are in good condition, replace gauge.

Gauge Speedometer Function Test

First ensure the gauge pointer is not stuck. Refer to *GAUGE TEST WITH B.U.D.S.* in this subsection.

1. Unplug speed sensor connector.



TYPICAL
1. *Speed sensor connector*
2. *Speed sensor (inside cover)*

2. Provide electrical power to the gauge for testing. Refer to *LIGHTING AND ACCESSORIES SYSTEM TESTING* in the *TROUBLESHOOTING* topic at the beginning of this subsection.
3. Use the FLUKE 115 MULTIMETER (P/N 529 035 868).
4. Set multimeter to Vdc.
5. Probe connector on vehicle harness side as per table.

GAUGE VOLTAGE TEST		
SPEED SENSOR CONNECTOR (MAIN HARNESS SIDE)		VOLTAGE
RD/BK	BK/RD	Close to battery voltage
GN/WH	BK/RD	Close to battery voltage

If test succeeded, gauge is good, proceed with *SPEED SENSOR SIGNAL TEST*.

If test failed, check wiring harness going to gauge. If wiring harness is good, replace gauge.

Gauge Fuel Level Function Test

1. Unplug fuel pump connector.
2. Provide electrical power to the gauge for testing. Refer to *LIGHTING AND ACCESSORIES SYSTEM TESTING* in the *TROUBLESHOOTING* topic at the beginning of this subsection.
3. Use the FLUKE 115 MULTIMETER (P/N 529 035 868).
4. Set multimeter to Vdc.
5. Probe connector on vehicle harness side as per table.

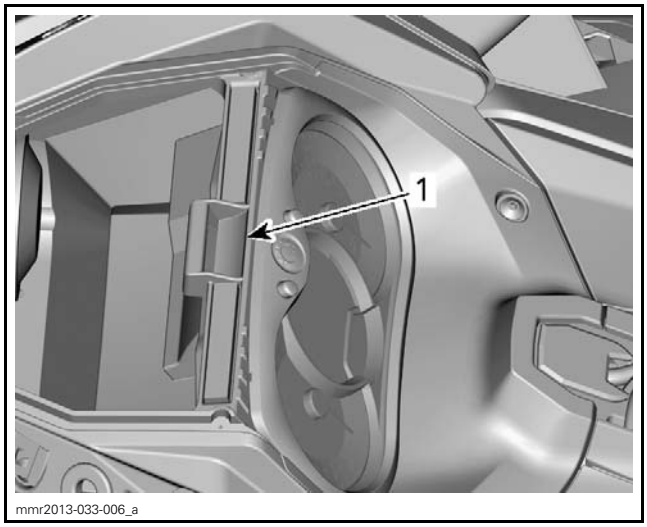
GAUGE VOLTAGE TEST		
FUEL LEVEL SENSOR CONNECTOR (MAIN HARNESS SIDE)		VOLTAGE
BU	BK/RD	Approximately 5 V

If test succeeded, gauge is good, proceed with *FUEL LEVEL SENSOR TEST* in *FUEL TANK AND FUEL PUMP* subsection.

If test failed, check wiring harness going to gauge. If wiring harness is good, replace gauge.

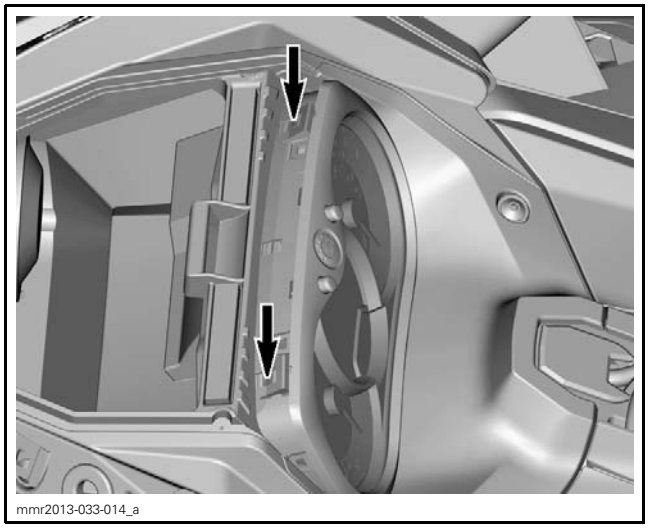
Gauge Removal

1. Open storage compartment.



1. Storage compartment

2. Insert a small screwdriver in one of the rectangular slots at top of gauge.
3. As you gently press down on the screwdriver to release multifunction gauge locking tab, pull out and hold gauge in position.
4. Insert screwdriver in second hole and press to release other tab.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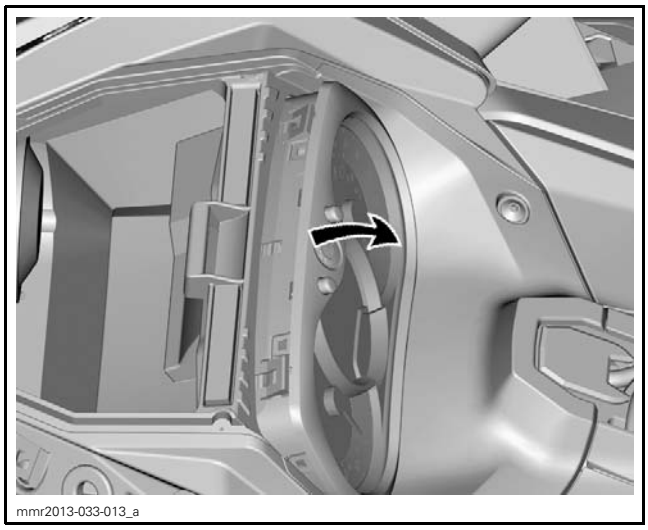
RETAINING TABS TO PRESS ON

5. Gently pull multifunction gauge from gauge support.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TYPICAL

6. Press on connector locking tab and pull connector off gauge.
7. Store gauge in a secure area to prevent it from being damaged.

Gauge Installation

1. Carefully align and install gauge connector, pressing it in until connector lock engages.
2. Insert bottom of gauge in gauge holder.
3. Press top of gauge in holder until you feel locking tabs engage in holder.
4. Start vehicle engine and test gauge functions.

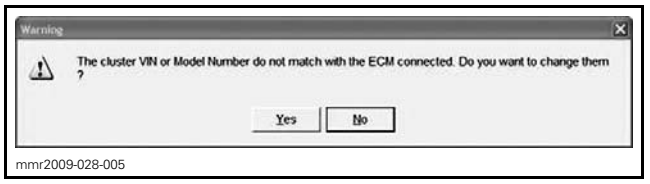
NOTE: If a new gauge is installed, refer to *GAUGE TO ECM MATCHING*.

Gauge to ECM Matching

NOTE: If the gauge is replaced, the VIN (Vehicle Identification Number) and the vehicle model number must be entered in the gauge memory so they match those stored in the ECM.

If the numbers stored in the gauge do not match those stored in the ECM, the engine will start but the new gauge will stop operating within 10 seconds after the engine is started. The indicator needles will function normally but the LCD display will remain blank and the D.E.S.S. LED will be turned ON. This is a gauge antitheft feature.

1. To write the VIN number and model number into the gauge, connect to the applicable B.U.D.S. version for the **600 HO E-TEC and 800R E-TEC** from BOSSWeb. Refer to the *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Follow the instructions in the referenced subsection and in the software.
3. Once connected and activated, select the **Read Data** button. You will see a message similar to the following illustration.



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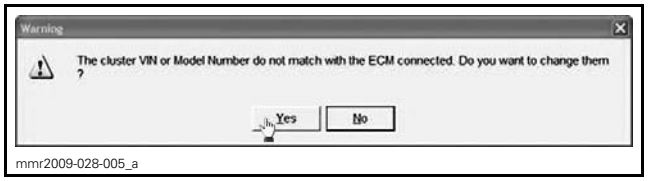
4. Select **Yes** in the displayed window.



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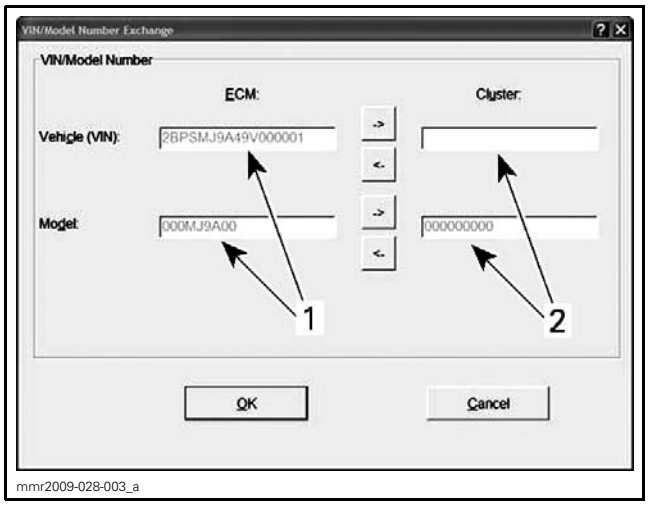
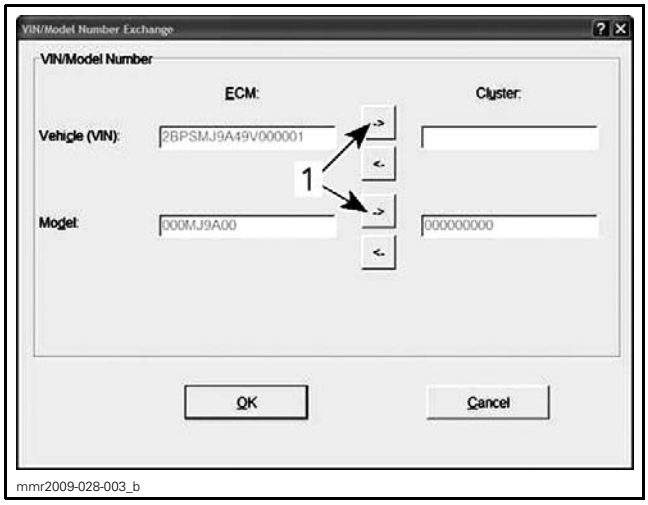
The following window illustrates that the VIN number or model number in the ECM and cluster are not the same.



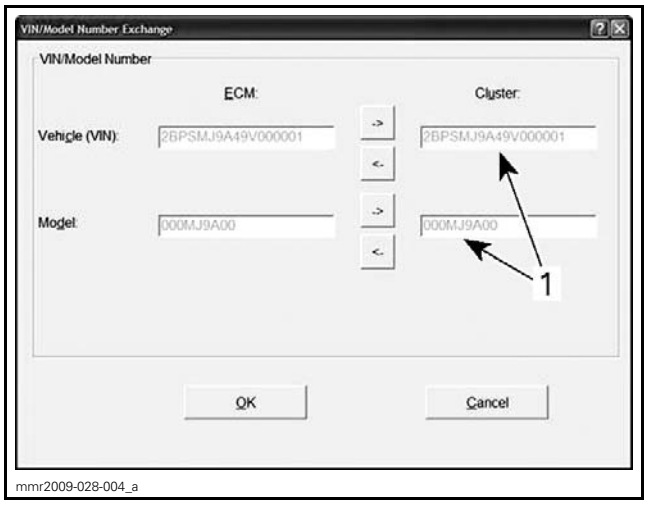
1. *Numbers stored in ECM*
2. *No numbers stored in new cluster*

5. Select each of the arrows indicated in the following illustration to copy the VIN and model numbers from the ECM to the cluster.



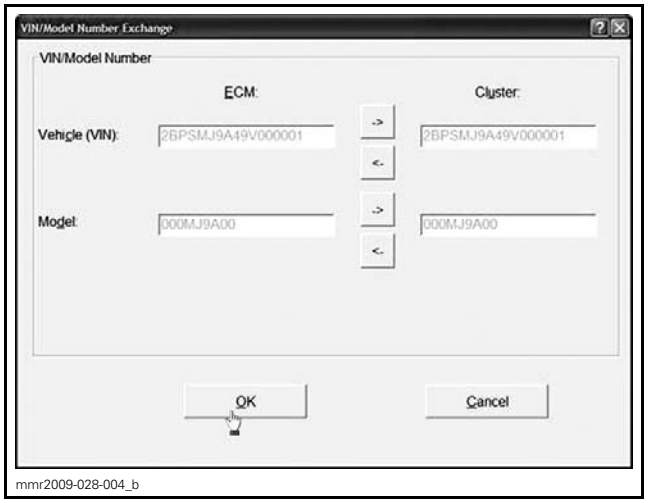
1. *Select each arrow button indicated*

Note how the numbers in the **Cluster** field now match those in the **ECM** field.



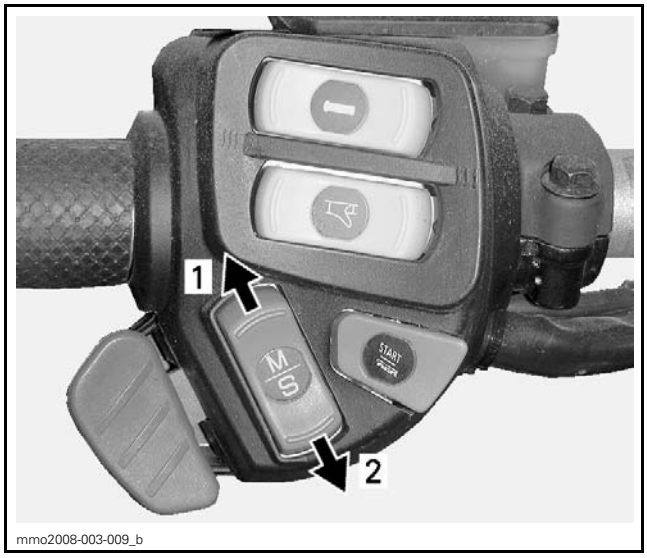
1. *Numbers in Cluster field now match those in the ECM field*

6. Select **OK** to continue.



7. Once the gauge has been matched to the ECM, you will need to set the units of measurement (imperial or metric). See procedures in this subsection.
8. Ensure the gauge functions properly and that all settings and indications are within parameters.
9. Be sure to set the clock function according to gauge and vehicle type, refer to *CLOCK ACTIVATION (PREMIUM GAUGE)* in this subsection.
10. Shut down vehicle and disconnect the communication tools.

REMOTE MODE AND SET BUTTONS (PREMIUM GAUGE EXCEPT SUMMIT)

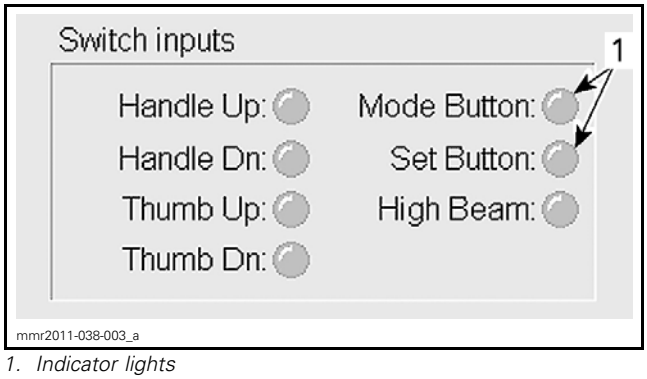


REMOTE M/S BUTTON
1. *MODE selection "M"*
2. *SET selection "S"*

Remote M/S Button Test with B.U.D.S.

1. Connect vehicle to the latest applicable B.U.D.S. version. Refer to the *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Using the B.U.D.S. software, select the **Monitoring** tab.
3. On the bottom of the page, choose the **Cluster** tab.
4. Alternately press on the remote "**M**" and "**S**" buttons and look for the applicable indicator light in the **Switch inputs** field to turn GREEN.

NOTE: Indicator lights should not be GREEN when no button is pressed.



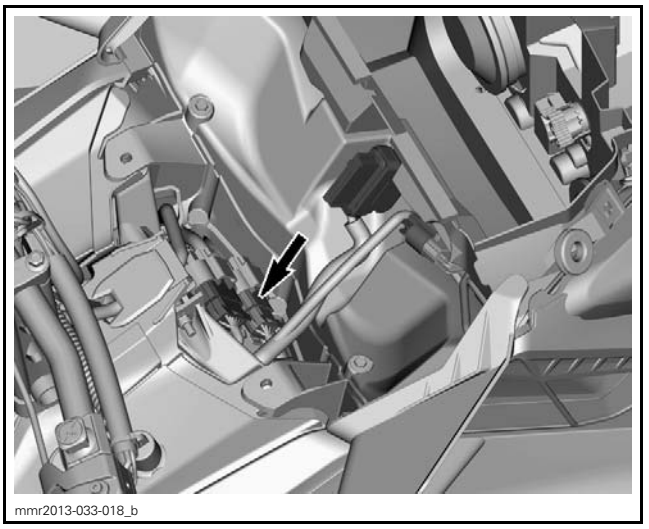
1. *Indicator lights*

If the indicator lights come ON in B.U.D.S., the remote **M/S** button is functioning correctly and the gauge receives the signals from the switches.

If the indicator lights do not come ON, verify the switch is not damaged internally, then carry out the *REMOTE M/S BUTTON CONTINUITY TEST* procedure in this subsection.

Remote M/S Button Continuity Test

1. If using the remote **M/S** button does not affect the indication, try using the buttons on the gauge. If they function, the remote **M/S** button circuit may be open.
2. Remove the gauge.
3. Disconnect the WMS connector (8 pin).



TYPICAL - WMS CONNECTOR (8 PIN)

4. Using a multimeter set to Ω, carry out the following continuity test.

REMOTE M/S BUTTON TEST (EXCEPT SUMMIT)			
SWITCH SELECTION	WMS CONNECTOR (8 PIN) WIRE		RESISTANCE
Centered	Pin B (YE/BN)	Pin A (BK)	Infinite Ω
	Pin G (YE/GN)		
M	Pin B (YE/BN)	Pin A (BK)	Close to 0 Ω
S	Pin G (YE/GN)		

If you do not obtain the values as specified, repair or replace switch, wiring and connections.

SPEED SENSOR

Speed Sensor Location

The speed sensor is mounted in the chaincase cover.

Speed Sensor Signal Test

First proceed with the *GAUGE SPEEDOMETER FUNCTION TEST* in this subsection.

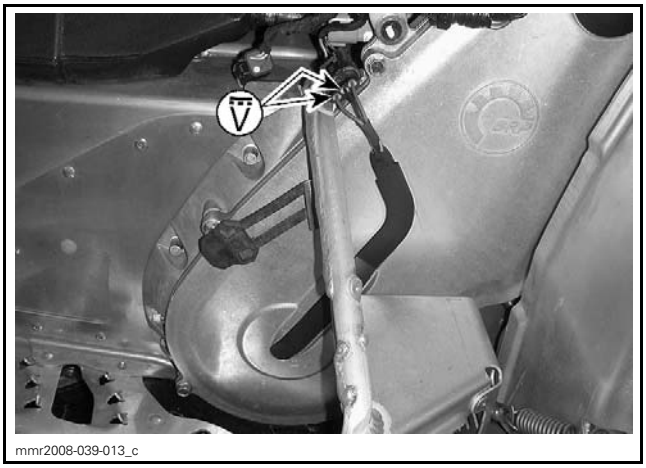
1. Lift and support rear of vehicle.

⚠ CAUTION **Use proper lifting techniques, notably using your leg force. Do not attempt to lift the vehicle if it is above your limits.**

2. Ensure speed sensor connector is properly connected.
3. Provide electrical power to the gauge for testing. Refer to *LIGHTING AND ACCESSORIES SYSTEM TESTING* in the *TROUBLESHOOTING* topic at the beginning of this subsection for proper procedure.
4. Rotate driven pulley so that tracks rotates slowly.
5. Back-probe connector with Fluke TP88 rigid back probe pins or equivalent, between wires as per table.

NOTICE **Be careful not to damage connector seals when back probing.**

SPEED SENSOR SIGNAL TEST			
ROTATE DRIVEN PULLEY	SPEED SENSOR CONNECTOR (SENSOR SIDE)		VOLTAGE
	GN	BK	Alternate 12 Vdc and 0 Vdc



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TYPICAL — SENSOR SIGNAL VOLTAGE TEST

The signal voltage should alternate between approximately 12 Vdc and 0 Vdc.

If test failed, replace the speed sensor.

Speed Sensor Replacement

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.

Speed Sensor Removal

1. Remove chaincase cover, refer to *CHAINCASE* subsection.
2. Using a heat gun, heat the speed sensor at plastic sheath end.

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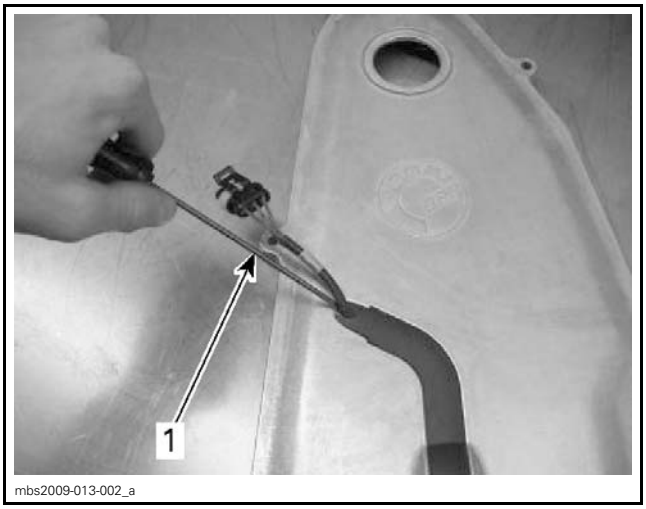
1. Plastic sheath end

NOTE: Plastic sheath color will slightly change, which tells it is adequately heated.

3. Use a flat screwdriver to pry out the end of the plastic sheath from chaincase cover.



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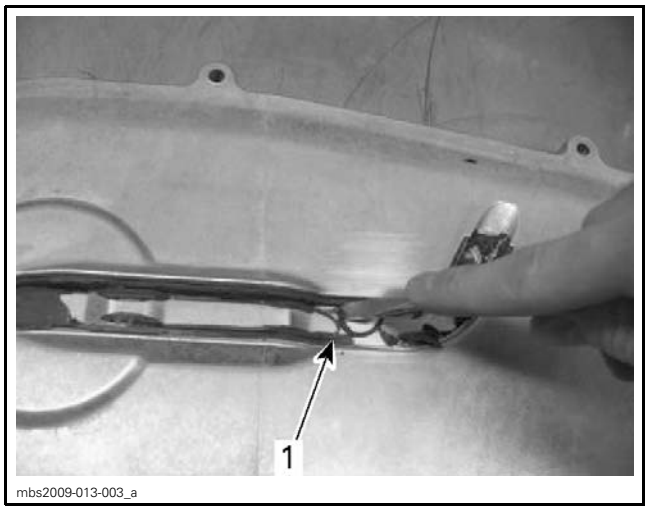
1. Prying out plastic sheath

NOTICE **Use care when prying out the plastic sheath not to damage the chaincase cover.**

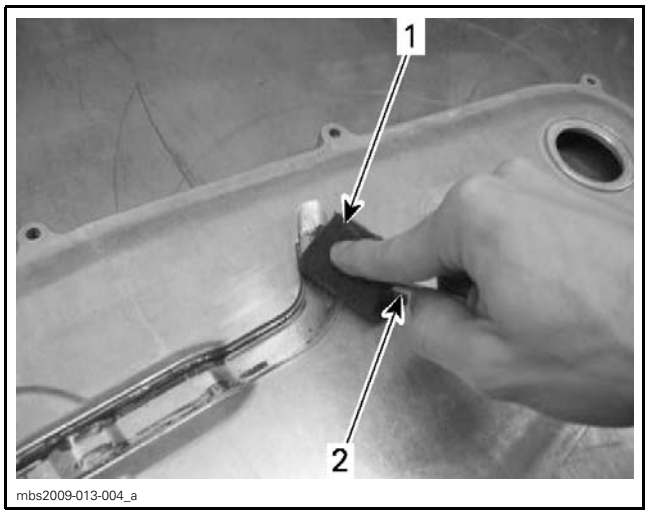
4. Heat the next section of the plastic sheath.
5. Pry out the heated section using the flat screwdriver.
6. Repeat steps 4 and 5 until the plastic sheath is completely removed.
7. Use the flat screwdriver to remove the remaining sealant from the chaincase cover.



1. Remaining sealant

NOTICE Do not apply excessive pressure when removing the remaining sealant not to damage the chaincase cover.

8. Rub the sealant using a scouring pad.



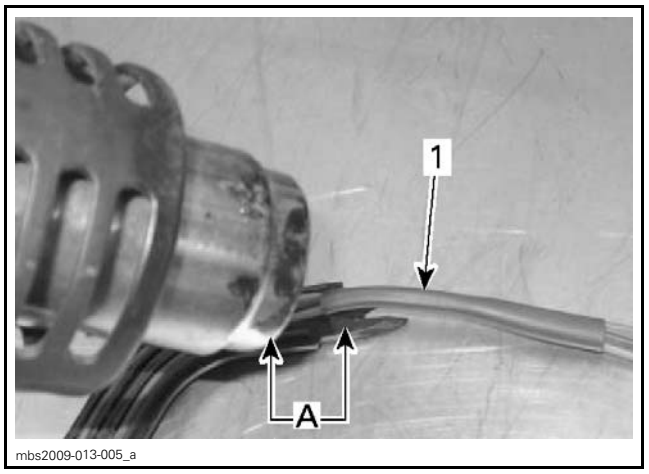
1. Scouring pad
2. Flat screwdriver

Speed Sensor Installation

1. Thoroughly clean the surface where the speed sensor is to be stuck.

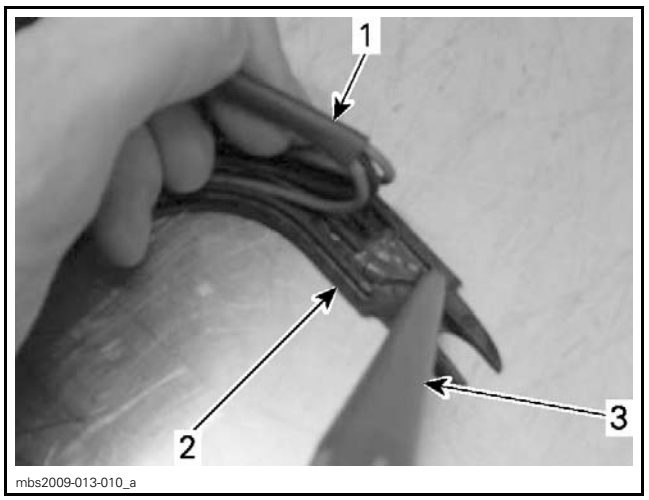
NOTE: Make sure surface is clean and free of grease.

2. Slide the shrink tubing into sensor plastic housing. The end of tubing must be inside sensor plastic housing about 15 mm (19/32 in).



1. Shrink tubing
A. 15 mm (19/32 in)

3. Apply LOCTITE 5900 (P/N 293 800 066) under the sensor wires, between the end of the guide grooves and the plastic sheath extremity.

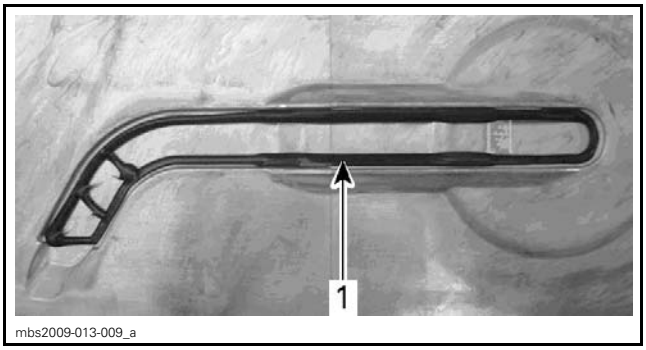


1. Sensor wires
2. Plastic sheath extremity
3. Loctite 5900 (P/N 293 800 066) bottle tip

NOTE: The assembly must be watertight.

4. Apply LOCTITE 5900 (P/N 293 800 066) all around the plastic sheath location on the chaincase cover.

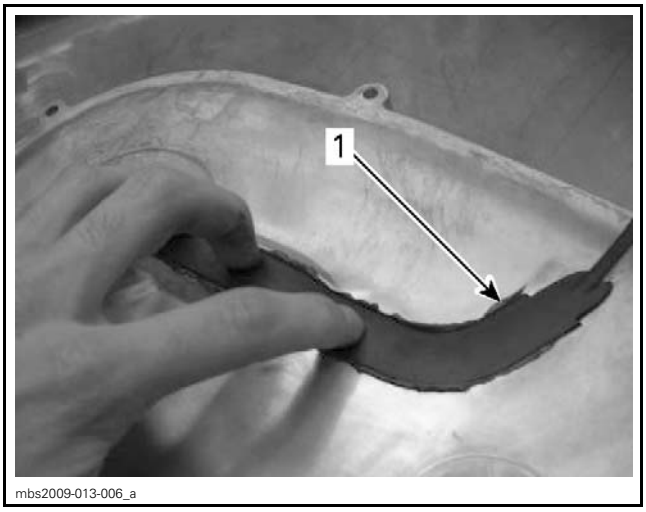
Follow the pattern shown on the next picture.



1. Loctite 5900 (P/N 293 800 066)

NOTE: Make sure the plastic sheath circumference is well covered.

5. Place the plastic sheath in position and firmly push in order to evacuate all the surplus sealant. Keep pressure for at least 1 minute.

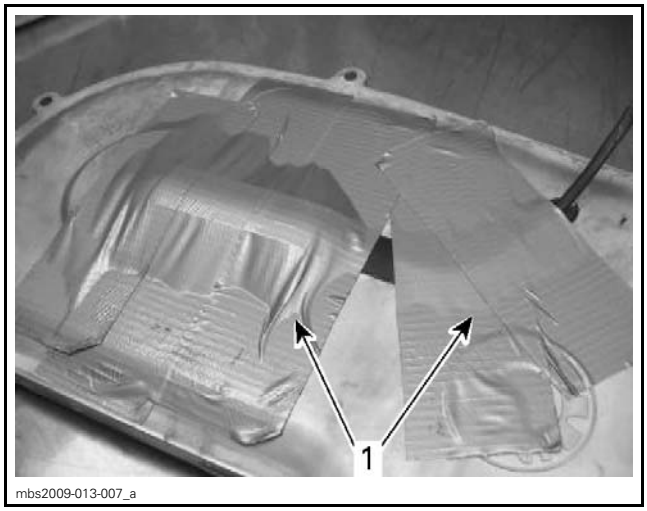


1. Surplus sealant

6. Wipe off all the sealant surplus around the plastic sheath.
7. Once cleaned up, inspect all the circumference for sealant lacks.

NOTE: Sealant must be visible all around.

8. Place some adhesive tape on the sensor to maintain a pressure on the sensor for at least 24 hours.



1. Adhesive tape

NOTE: Wait for at least 1 hour before exposing vehicle to cold temperature.

9. Reinstall chaincase cover, refer to *CHAINCASE* subsection.

FUEL LEVEL SENSOR

First proceed with the *GAUGE FUEL LEVEL FUNCTION TEST* in this subsection.

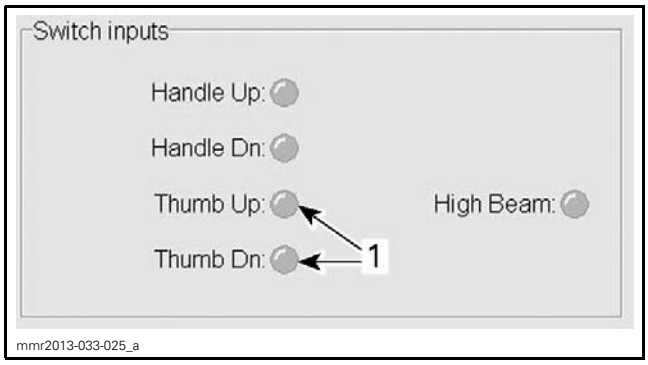
Refer to *FUEL TANK AND FUEL PUMP* for *FUEL SENSOR RESISTANCE TEST*.

HEATED THROTTLE LEVER

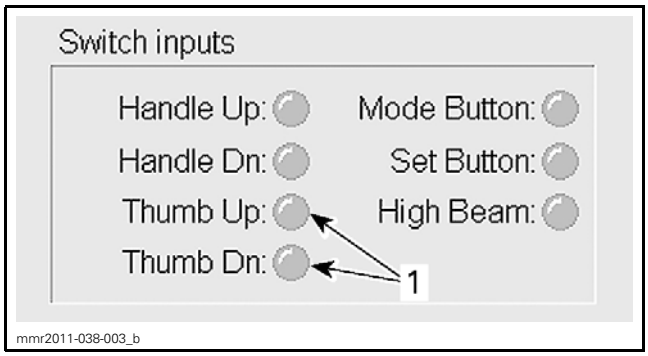
Throttle Lever Heat Switch Test with B.U.D.S.

1. Provide electrical power to the gauge for testing. Refer to *LIGHTING AND ACCESSORIES SYSTEM TESTING* in the *TROUBLESHOOTING* topic at the beginning of this subsection for proper procedure.
2. Using the B.U.D.S. software, select the **Monitoring** tab.
3. On the lower LH side of the page, choose the **Cluster** tab.
4. Press on the vehicle thumb lever heat switch to alternately increase or decrease heat.
5. In B.U.D.S., look for the applicable indicator light in the **Switch inputs** field to turn GREEN (Thumb Up or Thumb Dn).

NOTE: Indicator lights should not be GREEN when no button is pressed.



STANDARD GAUGE
1. Throttle lever heat selection



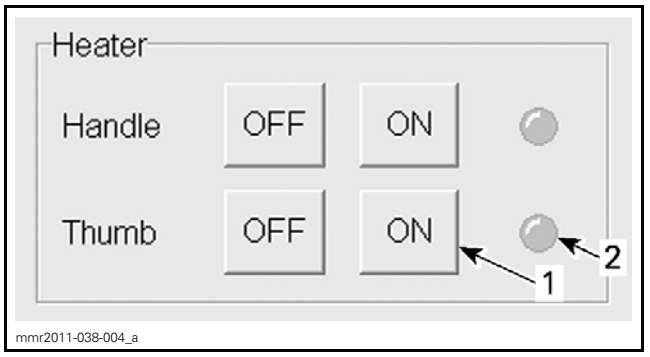
PREMIUM GAUGE
1. Throttle lever heat selection

If test is good, proceed with *GAUGE HEATER OUTPUT TEST WITH B.U.D.S.* in this subsection.

If test failed, proceed with *THROTTLE LEVER HEAT SWITCH TEST* in this subsection.

Gauge Heater Power Output Test with B.U.D.S.

1. Provide electrical power to the gauge for testing. Refer to *LIGHTING AND ACCESSORIES SYSTEM TESTING* in the *TROUBLESHOOTING* topic at the beginning of this subsection for proper procedure.
2. Using the B.U.D.S. software, select the **Activation** tab.
3. On the lower LH side of the page, choose the **Cluster** tab.
4. In B.U.D.S., select the **ON** button next to **Thumb**
5. Look for the indicator light next to the **ON** button to turn GREEN and touch throttle lever to confirm it heats up.



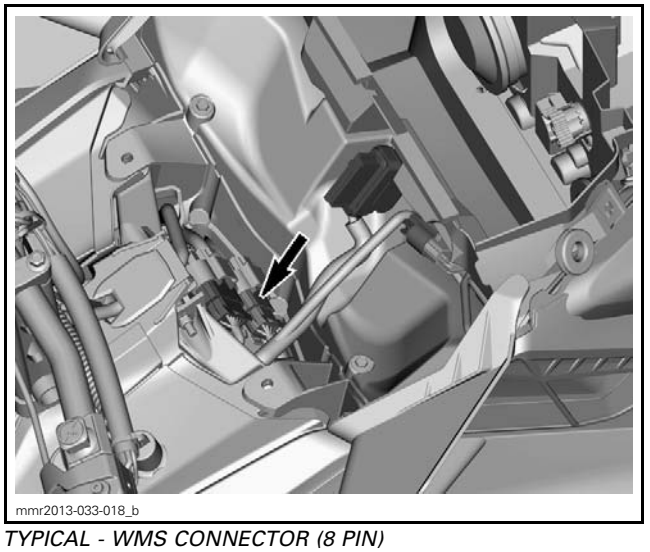
1. Throttle lever heat selection
2. Indicator light should turn GREEN

6. If test is good, the gauge output to throttle lever heater is good. Proceed with *THROTTLE LEVER HEATING ELEMENT TEST* in this subsection.
7. If the test failed, replace the gauge.

NOTE: When finished testing, ensure to select the **OFF** button next to **Thumb** in B.U.D.S.

Throttle Lever Heat Switch Test

1. Remove the gauge.
2. Disconnect the WMS connector (8 pin).



TYPICAL - WMS CONNECTOR (8 PIN)

3. Using the FLUKE 115 MULTIMETER (P/N 529 035 868), select the Ω position.
4. Test throttle lever heat switch and circuits as per table.

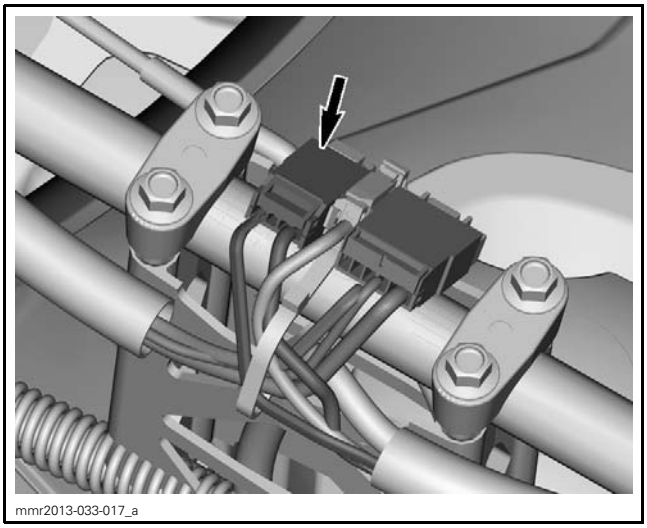
THROTTLE LEVER HEAT SWITCH TEST			
SWITCH SELECTION	WMS PIN		RESISTANCE
UP	D	A	Close to 0 Ω
	C	A	Infinite (OL)
DOWN	D	A	Infinite (OL)
	C	A	Close to 0 Ω

If continuity test is as per specification, proceed with *THROTTLE LEVER HEATING ELEMENT TEST* in this subsection.

If continuity test is out of specification, check switch circuit as per wiring diagram. If good, replace switch.

Throttle Lever Heating Element Test

1. Disconnect the RH steering connector (4 pin) located under the steering cover.



TYPICAL — RH STEERING CONNECTOR (4 PIN)

2. Carry out a resistance check of the heating elements as follows.

THROTTLE LEVER HEATING ELEMENT TEST STANDARD GAUGE			
SWITCH SELECTION	HEATER WIRE		RESISTANCE @ 20°C (68°F)
DOWN	BN/YE	BK	5.7 to 18.5 Ω
UP	BN		1.7 to 4.2 Ω

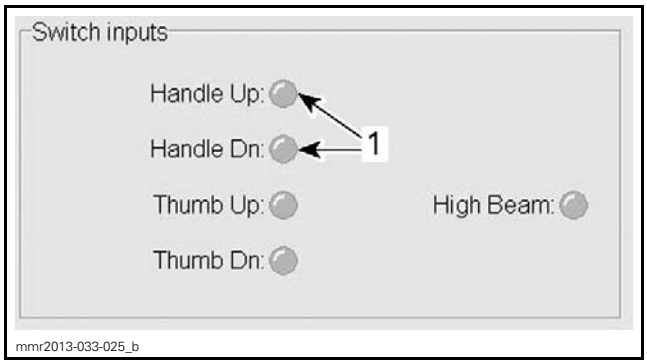
3. If readings are out of specifications, replace throttle lever.
4. If heating element readings are within specifications, check wiring and connections.
5. Reconnect connectors.

HEATED HANDLEBAR GRIPS

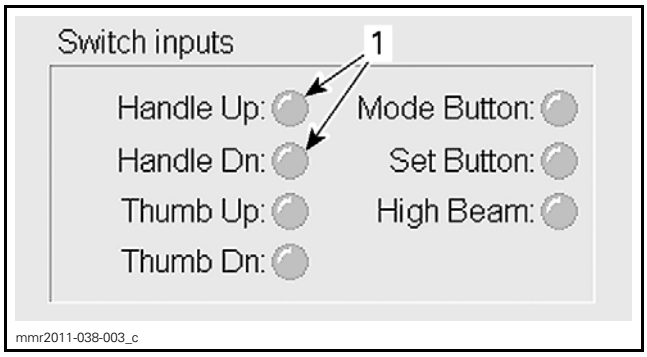
Handlebar Heated Grip Switch Test with B.U.D.S.

1. Provide electrical power to the gauge for testing. Refer to *LIGHTING AND ACCESSORIES SYSTEM TESTING* in the *TROUBLESHOOTING* topic at the beginning of this subsection for proper procedure.
2. Using the B.U.D.S. software, select the **Monitoring** tab.
3. On the lower LH side of the page, choose the **Cluster** tab.
4. Press on the vehicle handle grip heat switch to alternately increase or decrease heat.
5. In B.U.D.S., look for the applicable indicator light in the **Switch inputs** field to turn GREEN (Handle Up or Handle Dn).

NOTE: Indicator lights should not be GREEN when no button is pressed.



STANDARD GAUGE
1. Handle grip heat selection



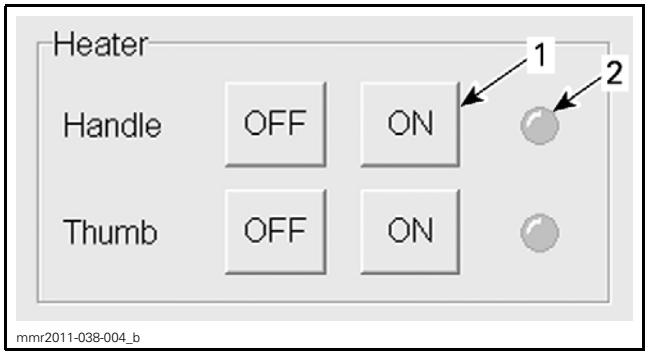
PREMIUM GAUGE
1. Handle grip heat selection

If test is good, proceed with *GAUGE HEATER OUTPUT TEST WITH B.U.D.S.* in this subsection.

If test failed, proceed with *HANDLEBAR GRIP HEAT SWITCH TEST* in this subsection.

Gauge Heater Power Output Test with B.U.D.S.

1. Provide electrical power to the gauge for testing. Refer to *LIGHTING AND ACCESSORIES SYSTEM TESTING* in the *TROUBLESHOOTING* topic at the beginning of this subsection for proper procedure.
2. Using the B.U.D.S. software, select the **Activation** tab.
3. On the lower LH side of the page, choose the **Cluster** tab.
4. In B.U.D.S., select the **ON** button next to **Handle**
5. Look for the indicator light next to the **ON** button to turn GREEN.



1. *Hand grip heat selection*
2. *Indicator light should turn GREEN*

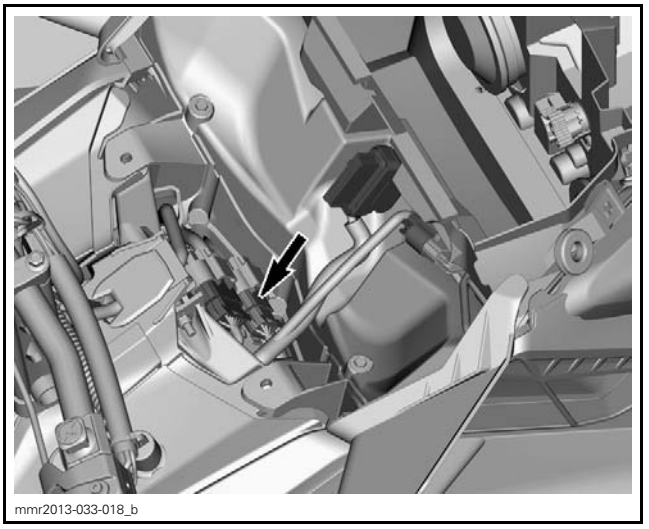
6. If test is good, the gauge heater to handlebar grip heater is good. Proceed with *HANDLEBAR GRIP HEATING ELEMENT TEST* in this subsection.
7. If the test failed, replace the gauge.

NOTE: When finished testing, ensure to select the **OFF** button next to **Handle** in B.U.D.S.

Handlebar Heated Grip Switch Test

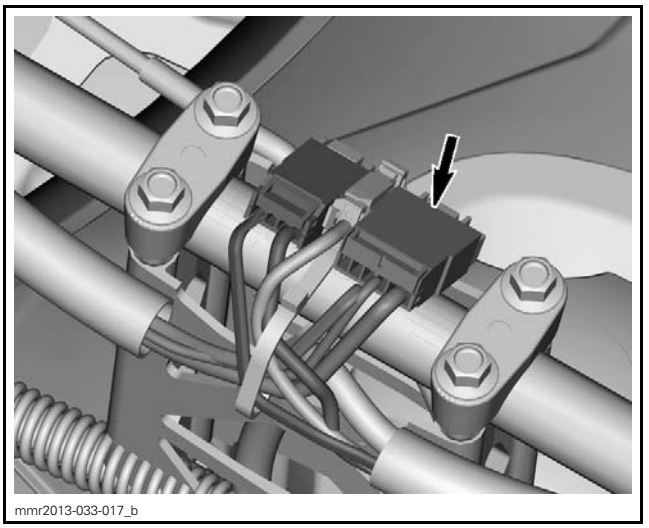
Remove the gauge.

Disconnect the WMS connector (8 pin).

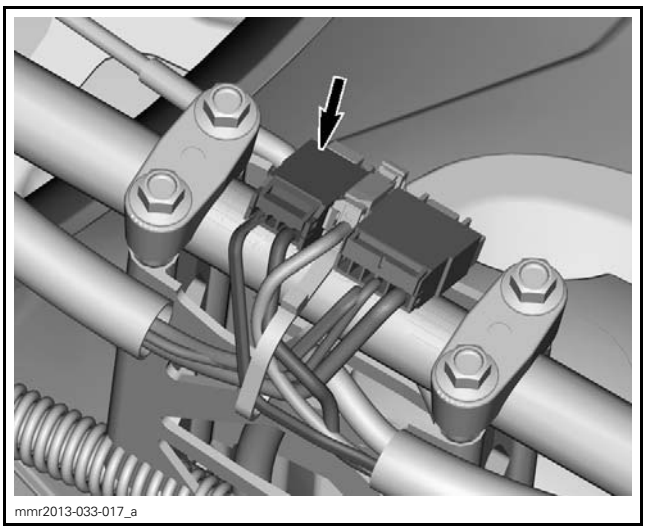


TYPICAL - WMS CONNECTOR (8 PIN)

Disconnect both LH (6 pin) and RH (4 pin) connectors under the steering cover.



TYPICAL LH STEERING CONNECTOR (6 PIN)



TYPICAL — RH STEERING CONNECTOR (4 PIN)

To test the RH heater circuit, probe the RH steering connector (4 pin).

To test the LH heater circuit, probe the LH steering connector (6 pin).

Using the FLUKE 115 MULTIMETER (P/N 529 035 868), select the Ω position.

Test handlebar grips switch and circuits as per table.

HANDLEBAR HEATED GRIP SWITCH TEST RH HEATER			
SWITCH SELECTION	WMS PIN	RH PIN	RESISTANCE
UP	F	1	Close to 0 Ω
		4	Infinite (OL)
DOWN	E	4	Infinite (OL)
		1	Close to 0 Ω

HANDLEBAR HEATED GRIP SWITCH TEST LH HEATER			
SWITCH SELECTION	CONNECTORS		RESISTANCE
	WMS PIN	LH PIN	
UP	F	2	Close to 0 Ω
		1	Infinite (OL)
DOWN	E	1	Infinite (OL)
		2	Close to 0 Ω

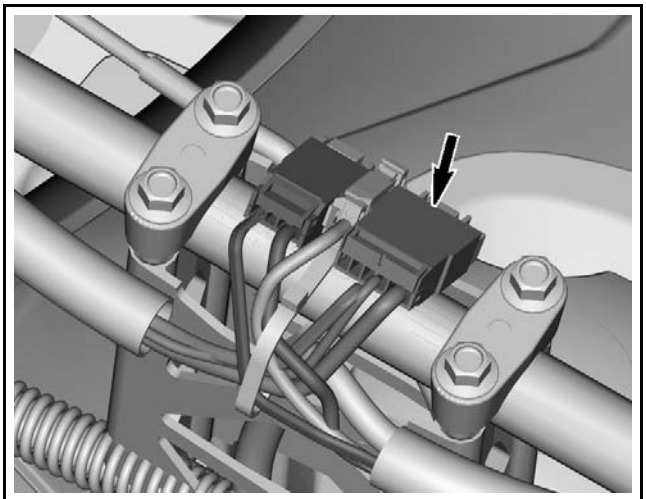
If continuity test is as per specification, proceed with *HANDLEBAR GRIP HEATING ELEMENT TEST* in this subsection.

If continuity test is out of specification, check switch circuit. If good, replace switch.

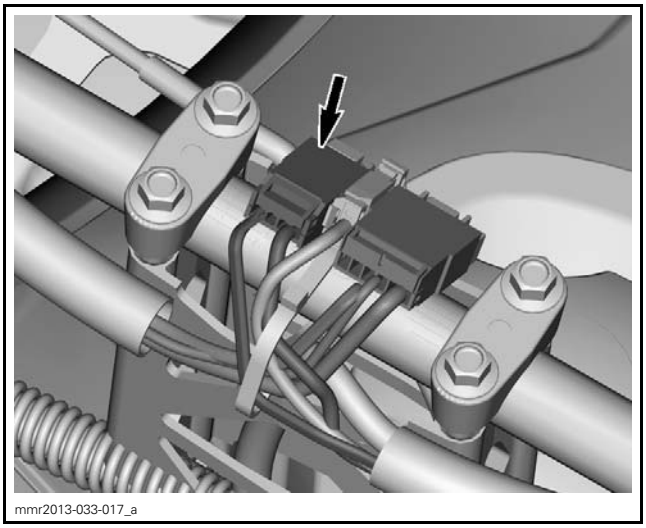
Handlebar Grip Heating Element Test

If you cannot feel the temperature increase of a hand grip heating element, carry out the following steps.

1. Disconnect the two steering connectors located under the steering cover.


mmr2013-033-017_b

TYPICAL LH STEERING CONNECTOR (6 PIN)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TYPICAL — RH STEERING CONNECTOR (4 PIN)

2. Test heating elements on either side as per following specifications.

HANDLEBAR GRIP HEATING ELEMENT TEST 32 W ADHESIVE FILM HEATERS FOR ALUMINUM HANDLEBAR		
HEATER WIRE		RESISTANCE @ 20°C (68°F)
OG	BK	5.3 to 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.

Heater Element Removal

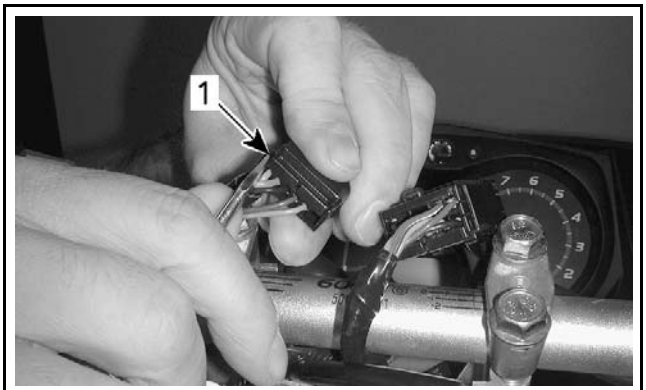
NOTICE Heater wire routing may vary significantly due to different type handlebars and vehicles. Its highly important to take note of exact positioning of grip heaters, locking ties, and wire routing before removing them from the handlebars. Failure to properly route wires may lead to equipment damage or failure.

1. Remove the following items as applicable, refer to *STEERING SYSTEM* subsection for details.
   - Steering cover
   - Rubber hand grip
   - Multifunction switch cover.
2. Disconnect the LH (6 pin) or RH (4 pin) steering connectors under the steering cover (as applicable).


mbg2008-009-005

TYPICAL — STEERING CONNECTORS

3. Open the cover on the back of the connector housing using a small screwdriver or a suitable tool.



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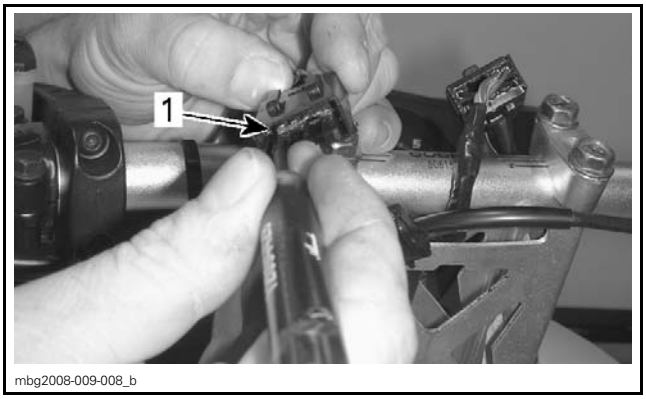
TYPICAL
1. Connector housing cover locks (one each side)

4. Using an appropriate tool such as the MULTILOCK - TERMINAL EXTRACTION TOOL (P/N 755430-2), unlock the heater wire terminals and push them out of the connector housing.



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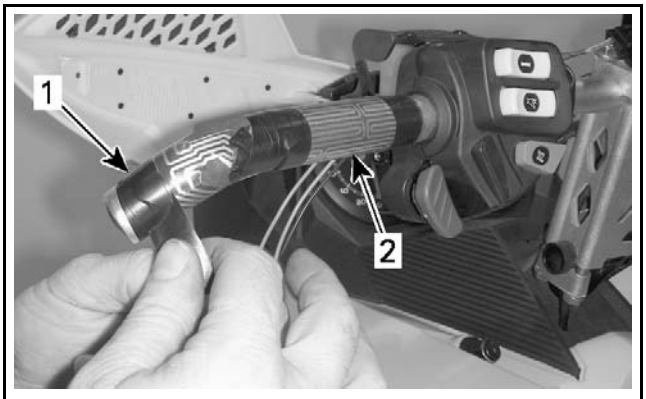
TYPICAL — UNLOCKING CONNECTOR PIN (FRONT SIDE)
1. Pin removal tool inserted above pin

NOTE: Terminals are unlocked and pushed out from the front (pin side) of the connector housing.

NOTICE Be sure to take note of exact positioning of grip heaters, locking ties, and wire routing before removing them from the handlebars.

5. Cut locking ties securing heater wires to handlebars.
6. Pull wires from harness protective sheath, multifunction switch housing or throttle lever housing.
7. Cut and remove black electrical tape from heater element and remove heater from cork insulator.



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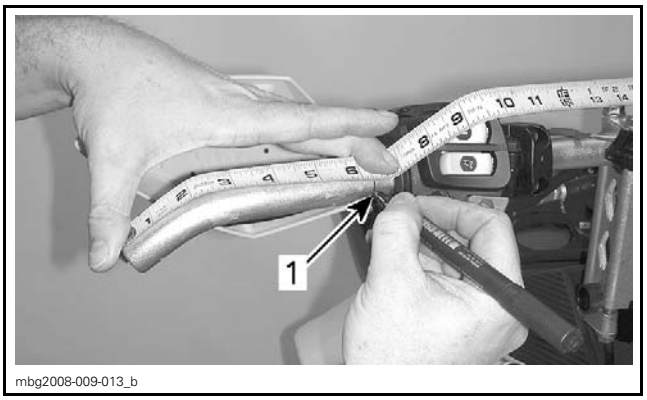
TYPICAL — LH HEATER
1. Electrical tape (4 places)
2. Heater element

8. If damaged, remove cork insulator from handlebar and clean all adhesive residue from the handlebar.

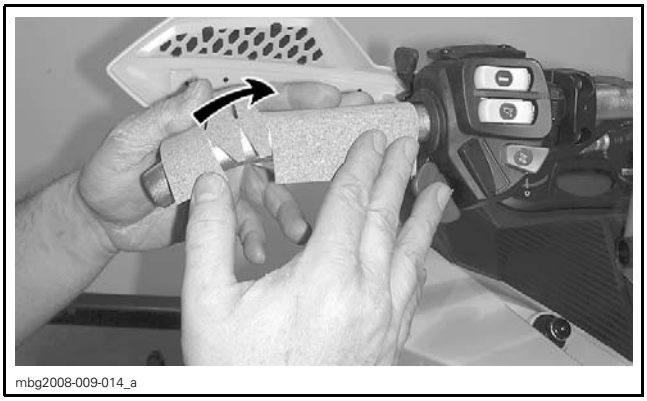
Heater Element Installation

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.



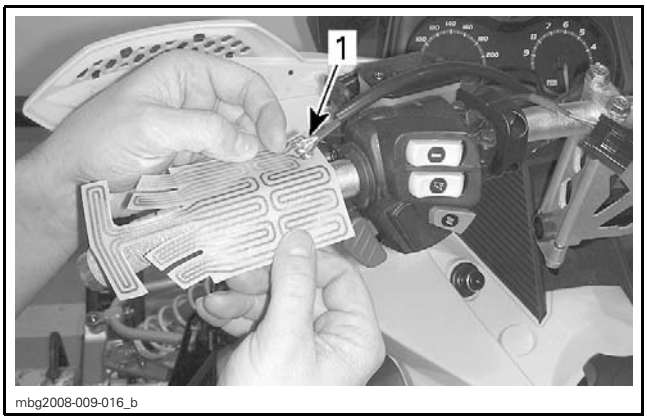
TYPICAL — MEASURING FOR HEATER POSITION
1. Trace reference line

2. Align the edge of the cork insulator with the reference line centered with the handlebar folding axis as illustrated.



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.

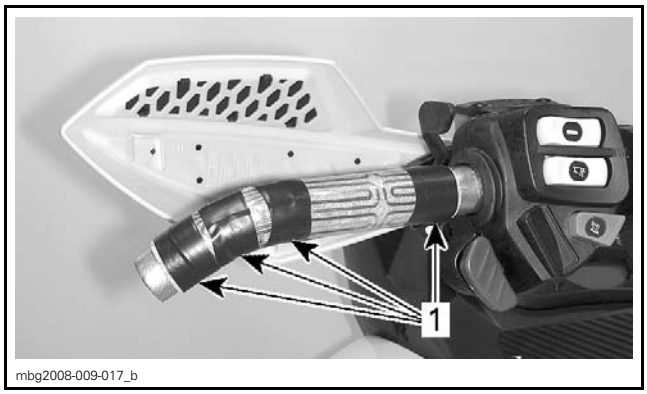


TYPICAL — HEATER ALIGNMENT
1. Heater wire position (LH front, RH rear)

5. Apply firm pressure to heater to assure proper adherence to cork insulator.

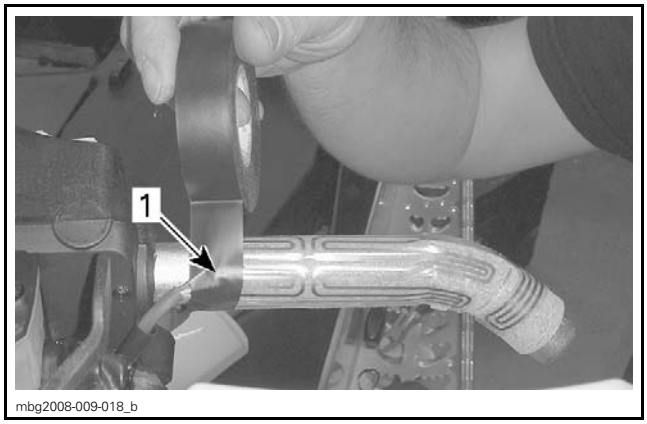
NOTE: The same heater element is used for both the LH and RH sides. Therefore, the electrical wiring will be in front of the handlebar on the LH side, and behind the handlebar (towards driver) on the RH side.

6. Apply two turns of black electrical tape at each of the four locations illustrated so that it covers the edges of the heater element and prevents snagging and damage to the element during rubber grip installation.



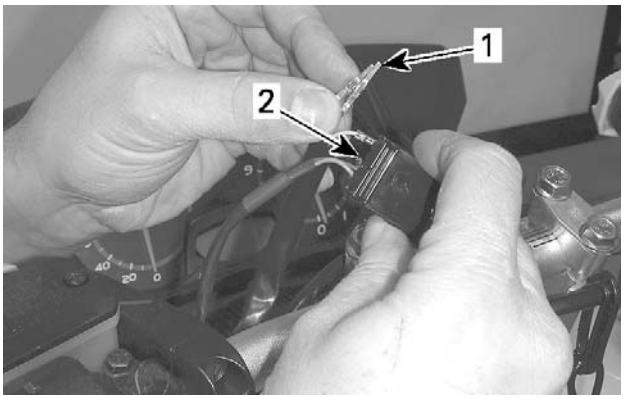
TYPICAL
1. Electrical tape application (4x)

NOTE: It is highly important to apply tape so that it fully secures the electrical wire connections. This will ease installation of the rubber hand grip and prevent undue stress to the connections.



TYPICAL — IMPORTANT
1. Tape application over wire connections

7. Install rubber hand grip, refer to *STEERING SYSTEM* subsection for detail.
8. Route wiring as noted during the removal procedure.
9. Insert wire connectors in steering connector housing, refer to *WIRING DIAGRAM* for wire color and pin number locations.



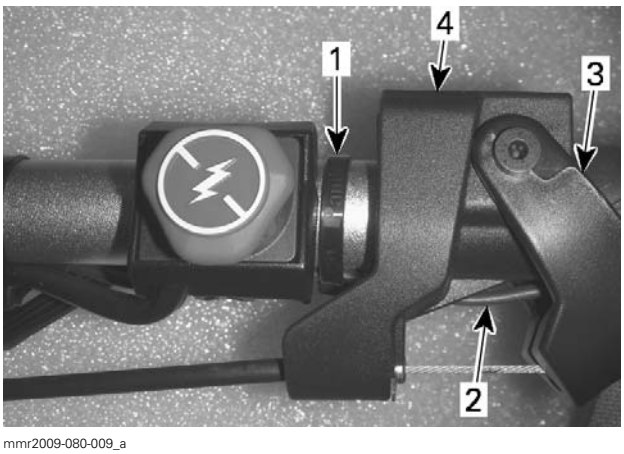
TYPICAL
1. *Heater wire terminals*
2. *Insertion through back of connector*

NOTE: On **vehicles equipped with premium gauges**, only two of the heater wires are used. The ORANGE/VIOLET wire terminal will need to be cut off near the connector, insulated (using heat shrink, a terminal end or electrical tape), then stored inside the wire harness protective sheath.

10. Install locking ties to secure the heater wire tightly against the handlebar.

⚠ 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 immediately after the lever housing.



TYPICAL
1. *Locking tie*
2. *Heater wire straight through throttle lever housing*
3. *Throttle lever*
4. *Lever housing*

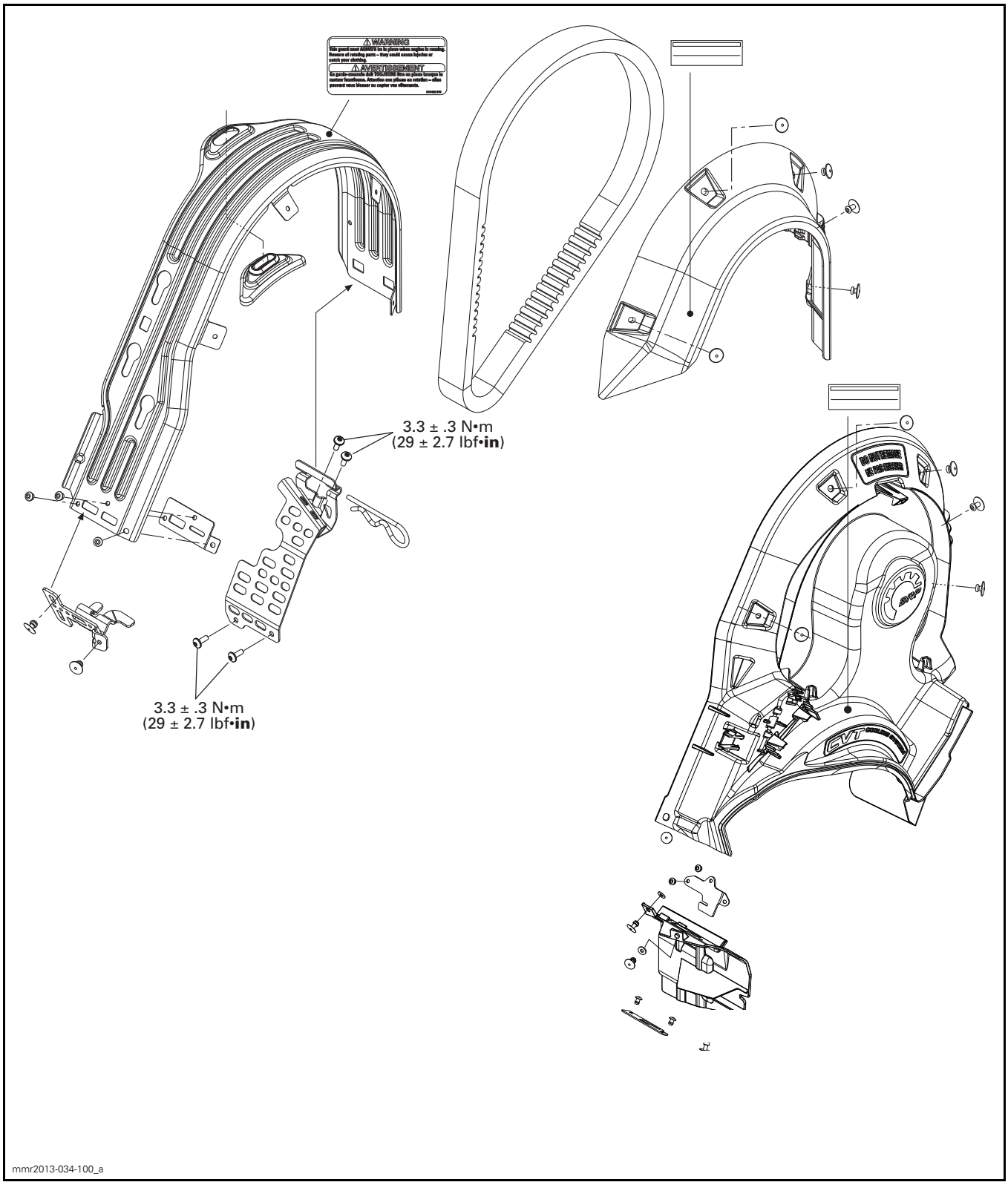
NOTICE **Ensure LH heater wires are properly routed through multifunction switch housing to prevent them from being pinched when installing housing cover. Pinched or damaged wires may result in a short circuit.**

11. Provide electrical power to the heaters for testing. Refer to *LIGHTING AND ACCESSORIES SYSTEM TESTING* in the *TROUBLESHOOTING* topic at the beginning of this subsection for proper procedure.
12. Using the hand grip heat switch, turn on the hand grip heaters and ensure they are functioning correctly.

DRIVE BELT

SERVICE TOOLS

Description	Part Number	Page
TENSIOMETER	414 348 200	7


3.3 ± .3 N•m
(29 ± 2.7 lbf•in)
3.3 ± .3 N•m
(29 ± 2.7 lbf•in)
mmr2013-034-100_a

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 DRIVE BELT HEIGHT ADJUSTMENT procedure in this subsection.*

ENGINE STALLS WHEN ENGAGING RER

1. Improper drive belt height (too high)
   - *Refer to DRIVE BELT HEIGHT ADJUSTMENT procedure in this subsection.*

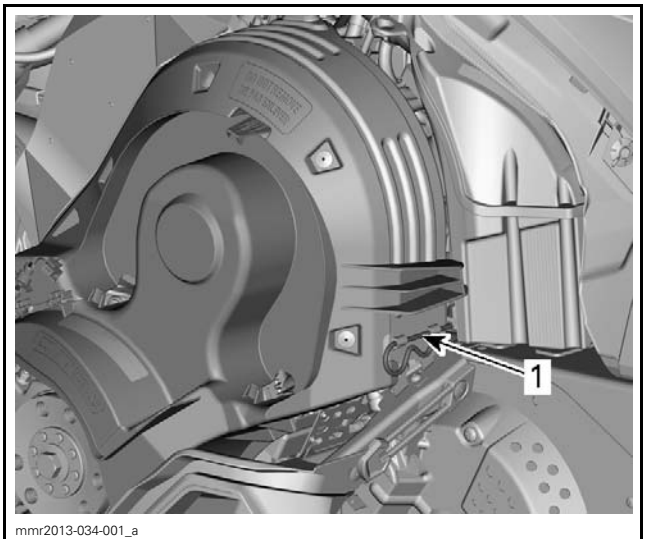
PROCEDURES

DRIVE BELT GUARD

NOTE: Belt guard is purposely made slightly oversize to maintain tension on its pins and retainers preventing undue noise and vibration.

Drive Belt Guard Removal

1. Remove LH side panel.
2. Remove retaining pin.

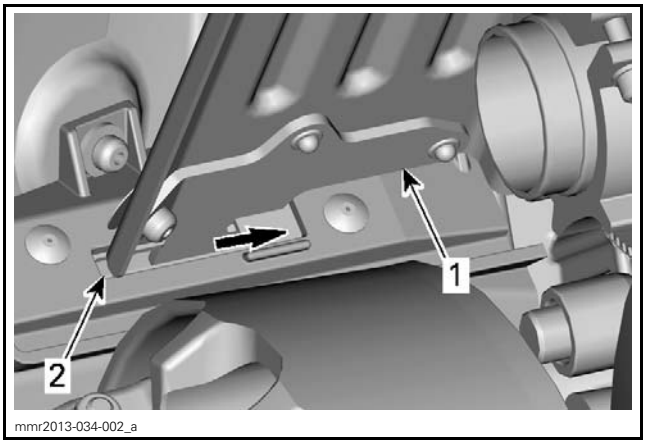


TYPICAL
1. Retaining pin

3. Lift rear portion of guard then release from front tabs.

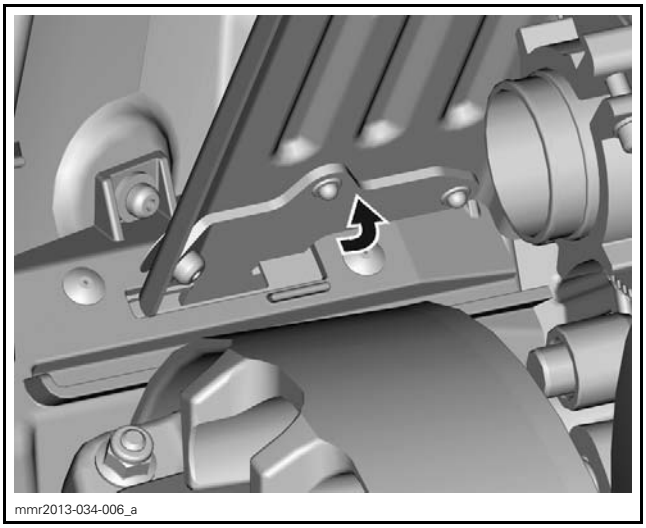
Drive Belt Guard Installation

1. Insert belt guard tab in front support slot.

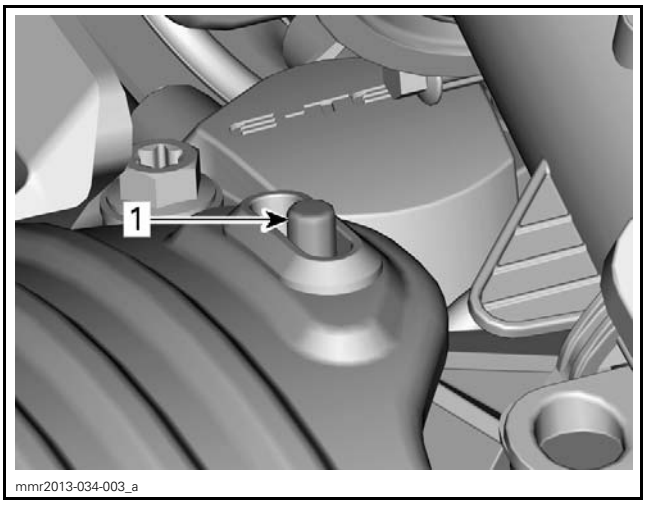


1. Belt guard tab
2. Front support slot

2. Push drive belt guard toward engine then toward front of vehicle.

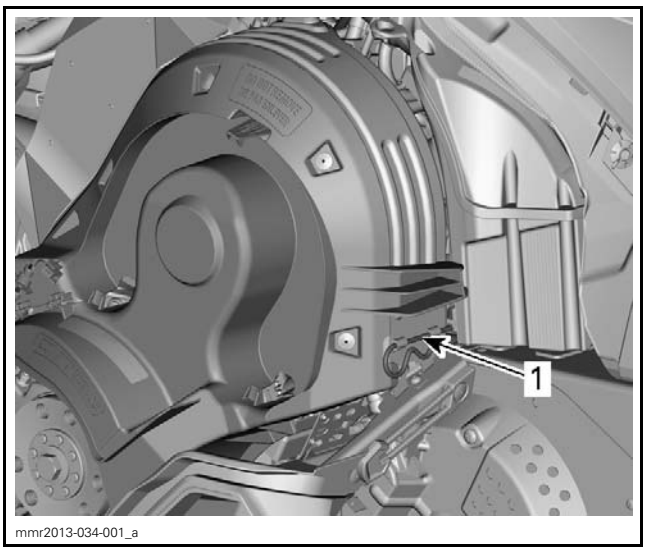


3. Position the grommet over the retaining rod. It may be necessary to slightly lift the console to make room.



1. Retaining rod

4. Position rear portion of the drive belt guard over the retainer and secure it using the retaining pin.

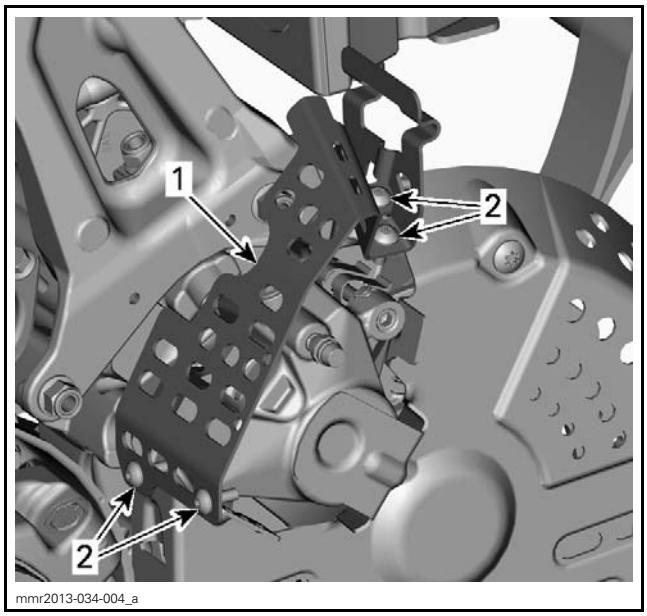


1. Retaining pin

DRIVE BELT GUARD SUPPORT

Drive Belt Guard Support Removal

1. Remove the drive belt guard.
2. Remove screws securing the support to vehicle.



TYPICAL
1. Drive belt guard support
2. Screws

Drive Belt Guard Support Installation

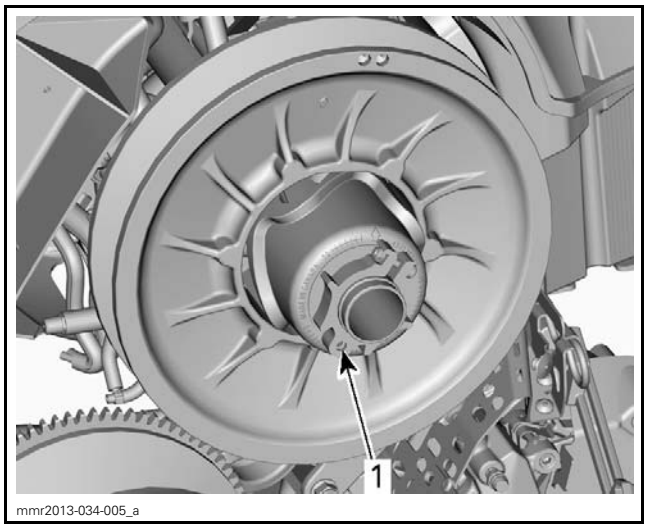
The installation is the reverse of the removal procedure. However pay attention to the following.

Tighten screws to 3.5 N•m (31 lbf•**in**).

DRIVE BELT

Drive Belt Removal

1. Remove tether cord cap from engine cut-off switch.
2. Remove LH side panel.
3. Remove drive belt guard, refer to *DRIVE BELT GUARD REMOVAL*.
4. Insert the driven pulley expander provided in the tool kit in the threaded hole on the adjuster hub as illustrated.



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.

Drive Belt Inspection

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.

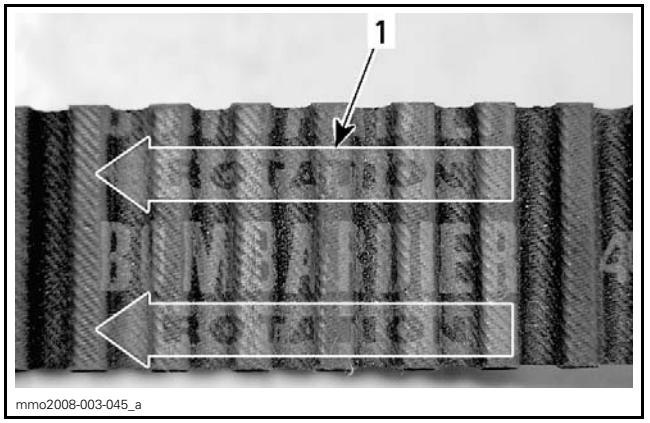
ENGINE	DRIVE BELT	
	NEW	WEAR LIMIT
600 HO E-TEC	38.5 mm (1.516 in)	36.1 mm (1.421 in)
800R E-TEC	38.3 mm (1.508 in)	35.9 mm (1.413 in)

Drive Belt Installation

1. If necessary, open the driven pulley, refer to *DRIVE BELT REMOVAL*.
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.

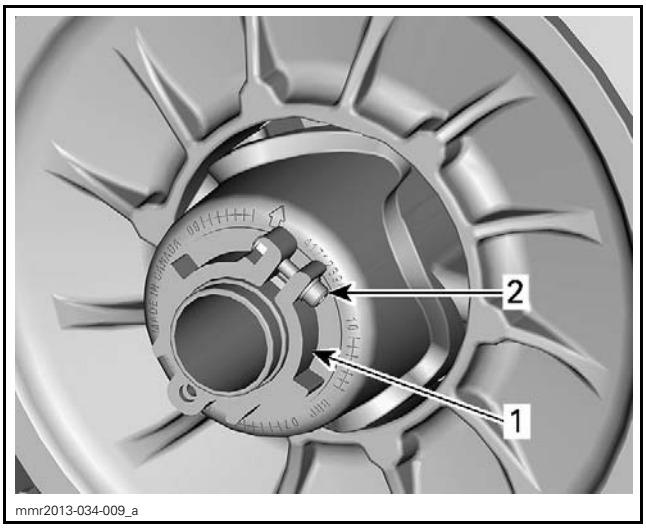


TYPICAL
1. To be pointed in the direction of rotation

3. Unscrew and remove the driven pulley expander from the driven pulley.
4. Rotate the driven pulley several times to properly set the belt between the sheaves.
5. Adjust drive belt height. Refer to *DRIVE BELT HEIGHT ADJUSTMENT* procedure.
6. Install drive belt guard, refer to *DRIVE BELT GUARD INSTALLATION*.
7. Install LH side panel.

Drive Belt Height Adjustment

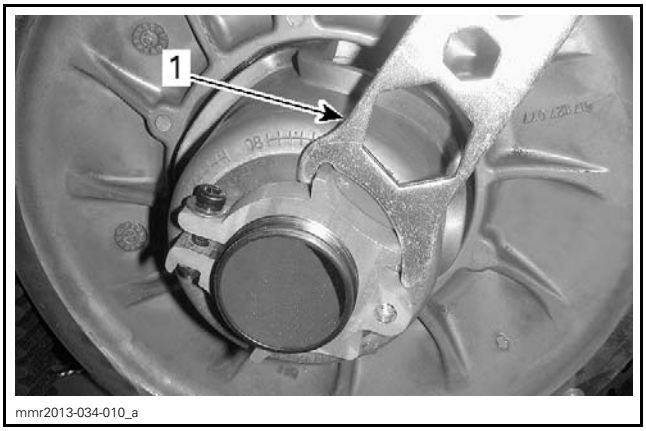
1. Remove tether cord cap from engine cutout switch.
2. Remove LH side panel.
3. Remove drive belt guard, refer to *DRIVE BELT GUARD REMOVAL*.
4. Loosen the clamping screw.



mmr2013-034-009_a

TYPICAL
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.

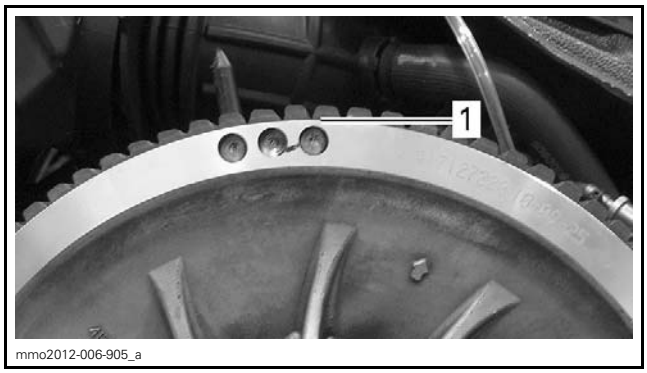


mmr2013-034-010_a

TYPICAL
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.



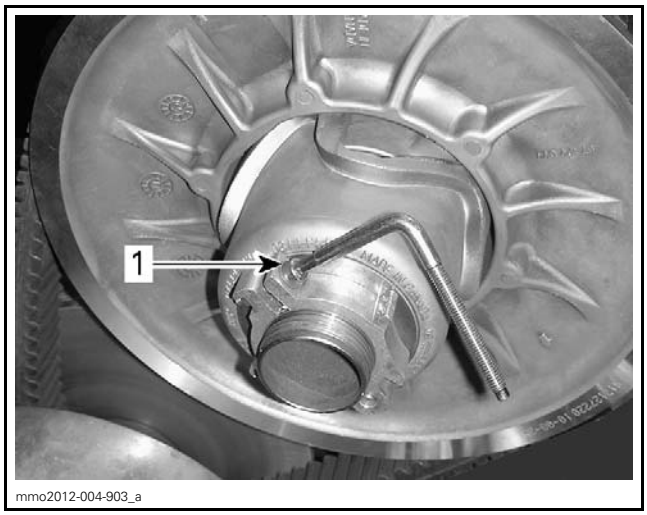
mmo2012-006-905_a

TYPICAL - 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.

TORQUE	
Adjustment ring clamping screw	5.5 N•m ± 0.5 N•m (49 lbf•**in** ± 4 lbf•**in**)



mmo2012-004-903_a

TYPICAL
1. *Clamping screw*

7. Install belt guard, refer to *DRIVE BELT GUARD INSTALLATION*.
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.

Drive Belt Deflection Verification

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.

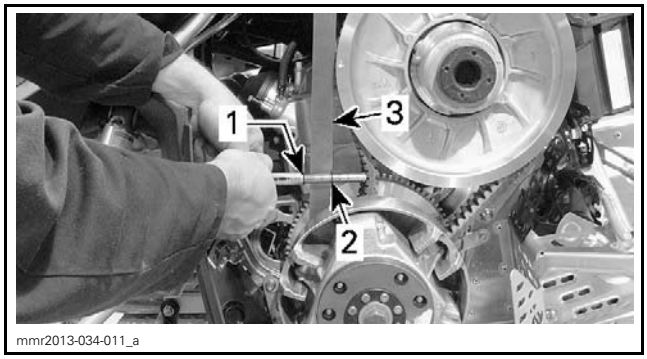
DRIVE BELT DEFLECTION	
DRIVE BELT DEFLECTION SETTING	32 mm ± 5 mm (1.26 in ± .2 in)

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 drive belt is within specification, drive belt is properly adjusted.
9. If drive belt is out of specification, try the following:
   – Lower drive belt height from initial setting.
   – Try another drive belt.
10. If proper load still cannot be obtained, check the following:
    – Inspect engine supports.
    – Inspect countershaft and bearing.
    – Inspect chassis for damages.

DRIVE PULLEY

SERVICE TOOLS

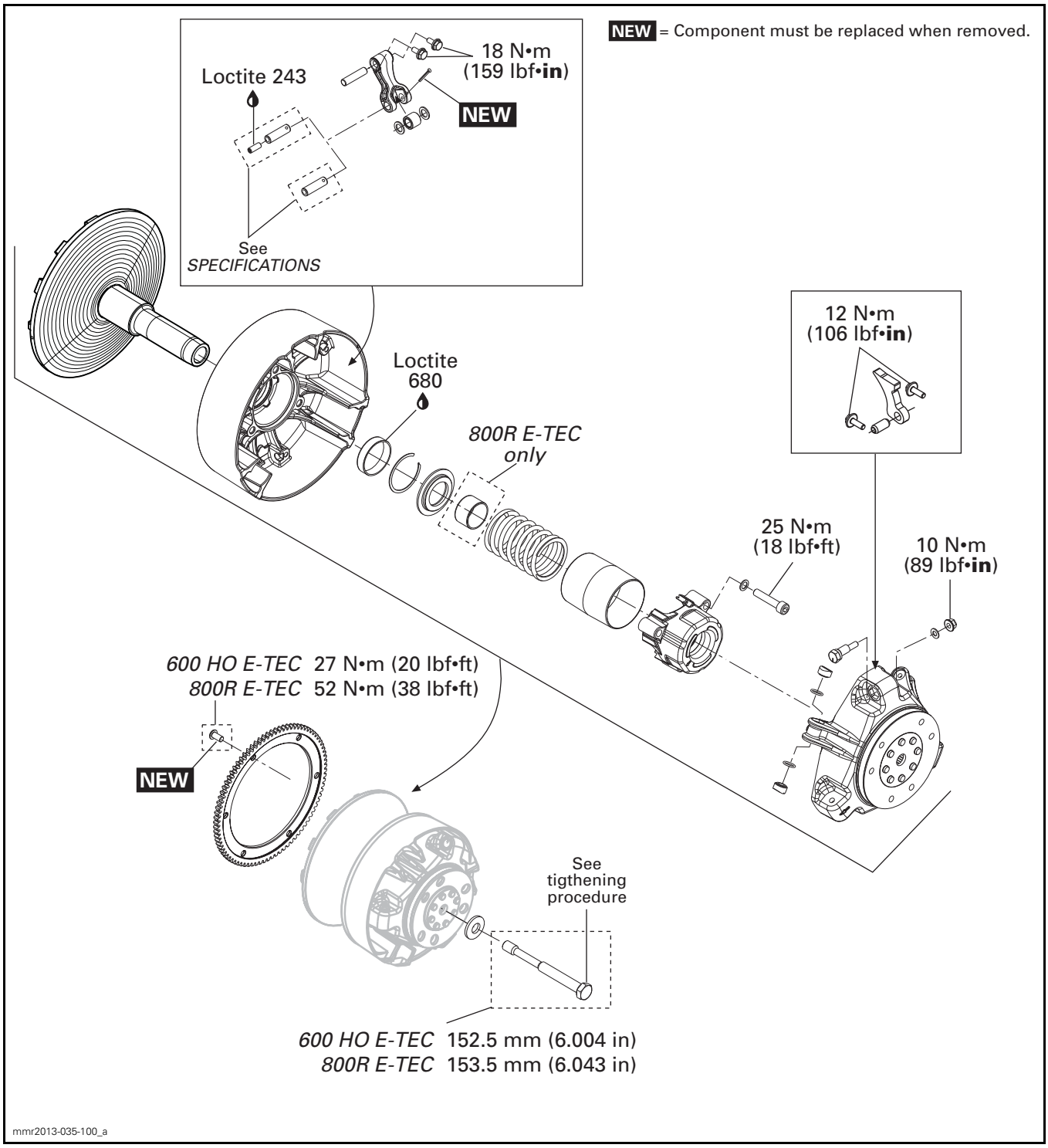
Description	Part Number	Page
BUSHING PULLER/INSTALLER	529 031 200	8
BUSHING REMOVER/INSTALLER	529 035 931	8, 10
DRIVE PULLEY HOLDER	529 035 674	3–4, 15
DRIVE PULLEY PULLER	529 000 064	4
PULLEY SPRING COMPRESSOR TOOL	529 036 012	5, 8, 10, 12
SLIDER SHOE FORK	529 005 500	5, 11

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
TEMPILSTIK INDICATOR STICK	TS212F	6

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	13
LOCTITE 680	293 800 118	10
PULLEY FLANGE CLEANER	413 711 809	8–9


NEW = Component must be replaced when removed.
Loctite 243
18 N•m
(159 lbf•in)
NEW
See
SPECIFICATIONS
12 N•m
(106 lbf•in)
Loctite
680
800R E-TEC
only
25 N•m
(18 lbf•ft)
10 N•m
(89 lbf•in)
600 HO E-TEC 27 N•m (20 lbf•ft)
800R E-TEC 52 N•m (38 lbf•ft)
NEW
See
tigthening
procedure
600 HO E-TEC 152.5 mm (6.004 in)
800R E-TEC 153.5 mm (6.043 in)
mmr2013-035-100_a

GENERAL

TRA™ drive pulley stands for **Total Range Adjustable** drive pulley.

These are lubrication free drive pulleys. Do not lubricate any component.

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 (return spring, ramp) 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 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

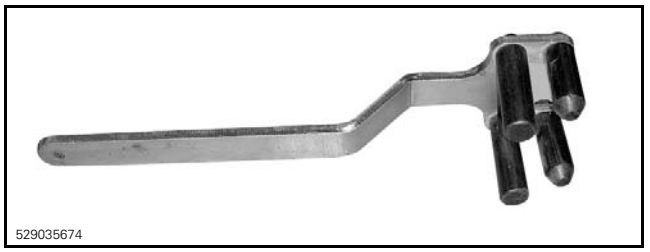
Torque wrench tightening specifications must be strictly adhered to.
Locking devices must be replaced with new ones when removed (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.).

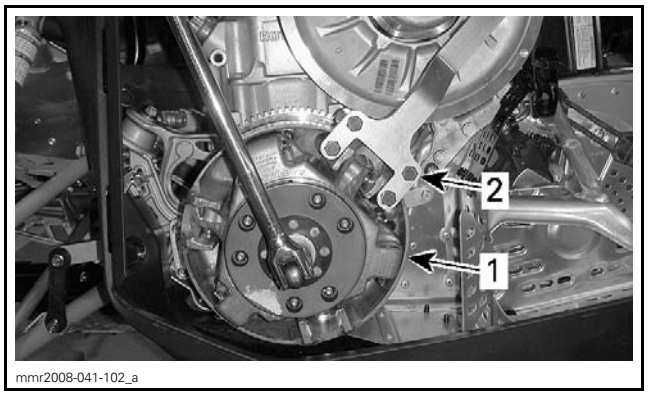
PROCEDURES

DRIVE PULLEY

Drive Pulley Removal

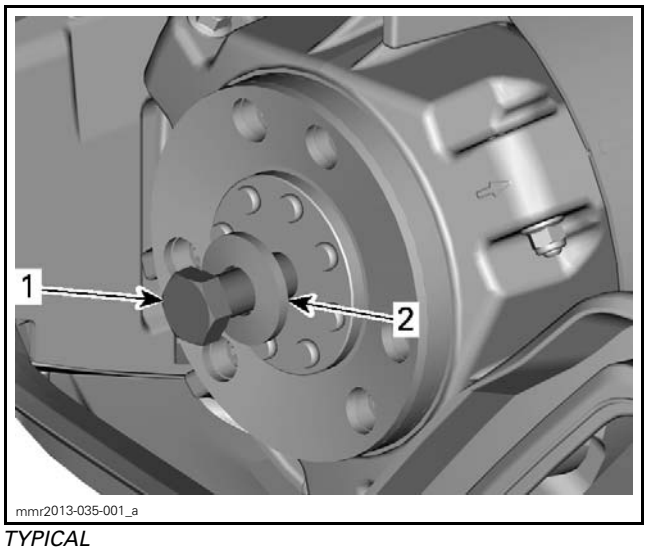
1. Remove drive belt. Refer to *DRIVE BELT* subsection.
2. Secure drive pulley with the DRIVE PULLEY HOLDER (P/N 529 035 674). Install it over a sliding sheave tower.





TYPICAL
1. *Drive pulley*
2. *Drive pulley holder*

3. Remove the drive pulley bolt and its conical spring washer.

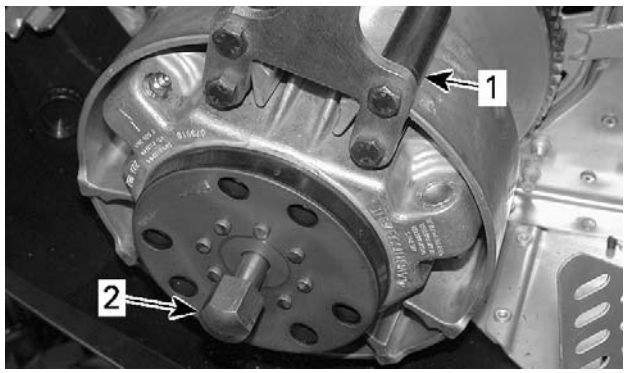


TYPICAL
1. *Drive pulley bolt*
2. *Conical spring washer*

4. To remove drive pulley from engine, use the following tools

TOOL	MODEL
DRIVE PULLEY HOLDER (P/N 529 035 674) 	All
DRIVE PULLEY PULLER (P/N 529 000 064) 	All

5. To remove the drive pulley, hold drive pulley and tighten the puller.



mmr2008-041-104_a

TYPICAL
1. *Drive pulley holder*
2. *Drive pulley puller*

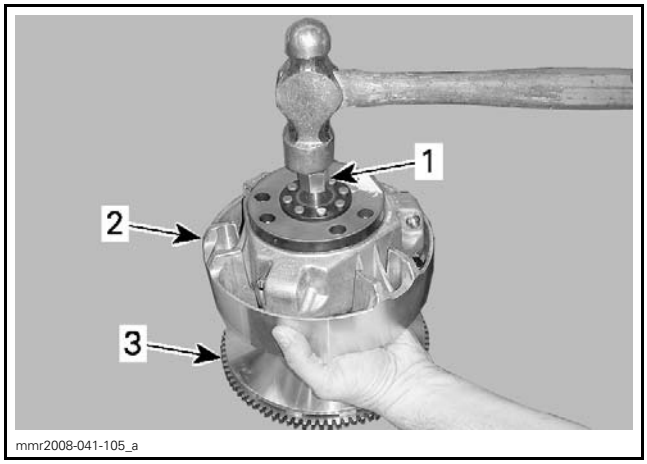
NOTICE These pulleys have metric threads. Do not use a puller with ANS (American National Standard) or IS (International Standard) type threads. Always tighten puller by hand to ensure that the drive pulley has the same type of threads (metric vs ANS or IS) prior to fully tightening.

Drive Pulley Disassembly

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 governor cup.



mmr2008-041-105_a

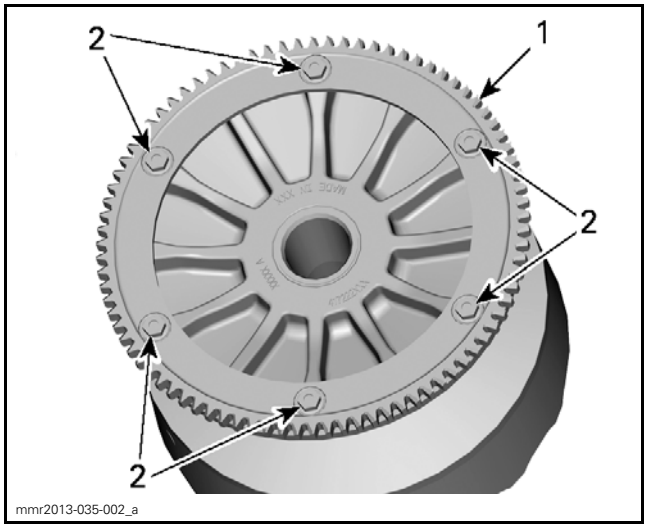
TYPICAL
1. *Puller screwed 13 mm (1/2 in) in fixed sheave*
2. *Sliding sheave*
3. *Fixed sheave*

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 governor cup.

Ring Gear Removal

To remove the ring gear, use a heat gun to break the threadlocker on ring gear screws. Discard the ring gear screws.



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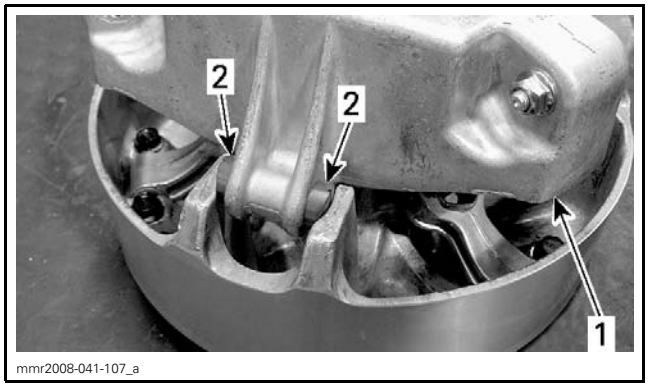
1. *Ring gear*
2. *Ring gear screws*

NOTICE If a tool other than a heat gun is used, do not exceed 150°C (302°F).

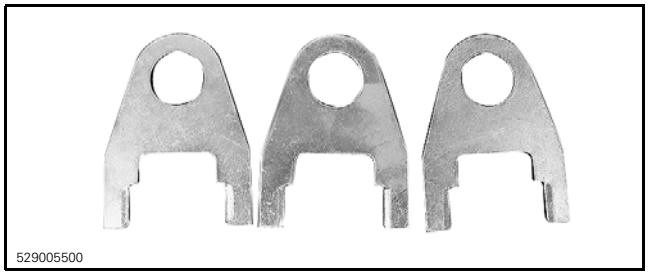
Slider Shoes and Governor Cup Removal

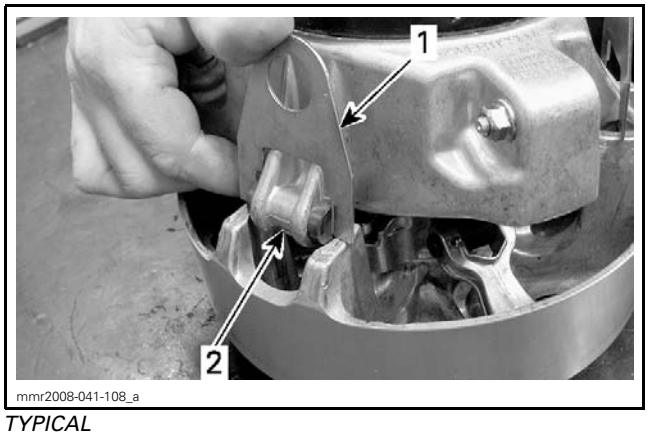
1. Carefully lift governor cup until slider shoes are at their highest position in the guides.



TYPICAL
1. *Governor cup*
2. *Slider shoes*

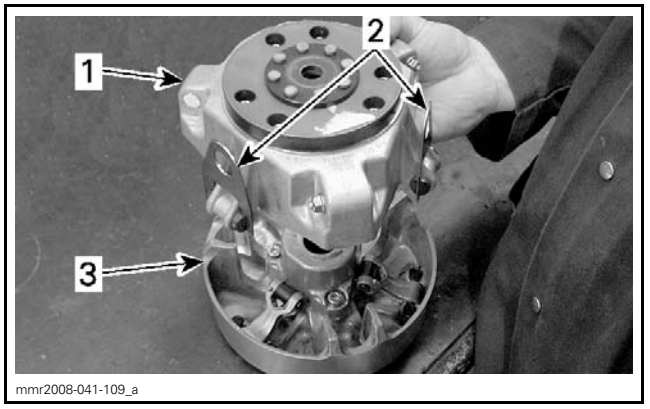
2. Hold a slider shoe set then carefully lift its housing and install a SLIDER SHOE FORK (P/N 529 005 500). Proceed the same way for other housings lifting one at a time.





TYPICAL
1. *Governor cup*
2. *Slider shoe forks*

3. When all slider shoes are held with the forks, remove the governor cup.



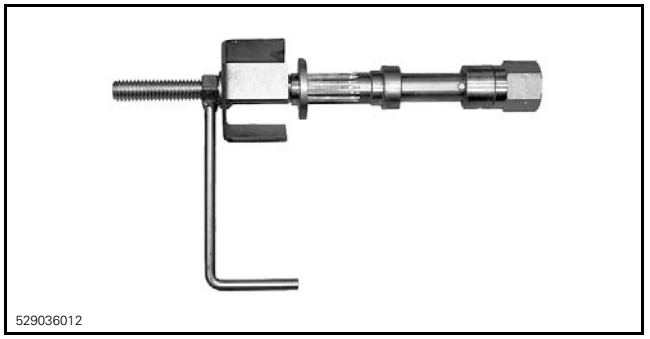
TYPICAL
1. *Governor cup*
2. *Slider shoe forks*
3. *Sliding sheave*

Spring Cover Removal

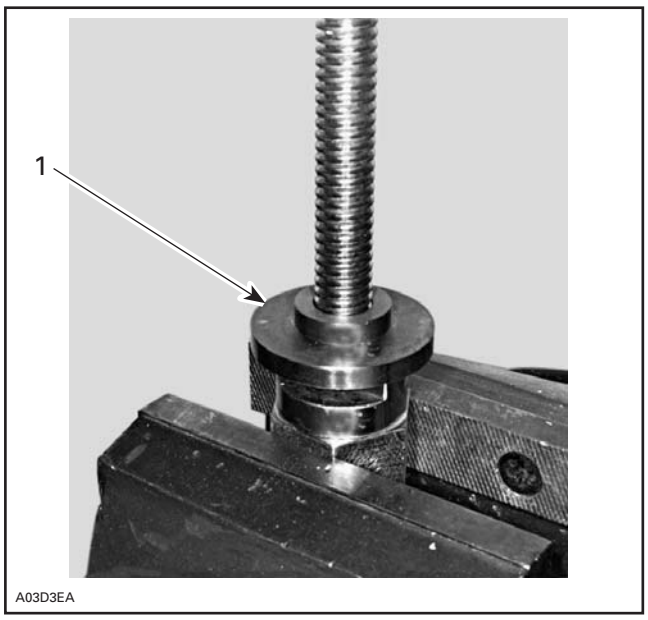
1. To remove the spring cover, always use the PULLEY SPRING COMPRESSOR TOOL (P/N 529 036 012).

⚠ WARNING

Clutch spring cover is under high clutch spring preload. Never attempt to remove spring cover without the recommended tools.



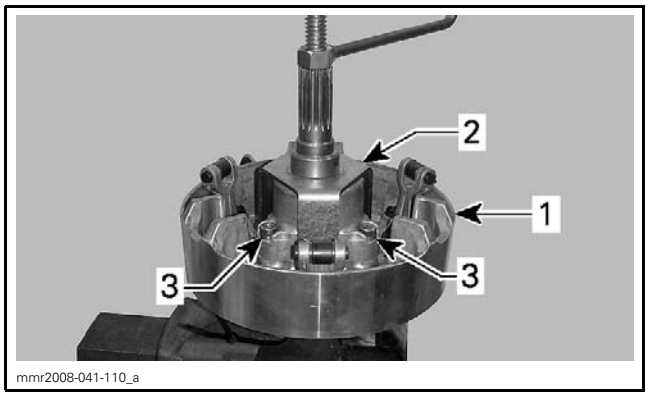
2. Install support guide of spring compressor in a vice.



1. Support guide

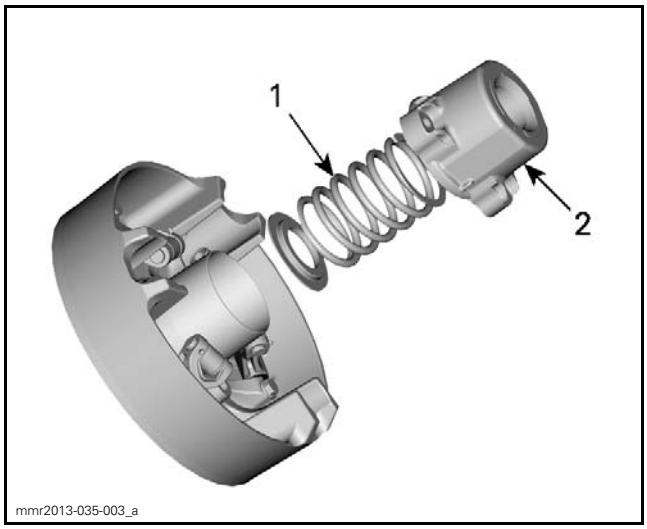
NOTE: The support guide will prevent bushing damage.

3. Install sliding sheave then the support cup over spring cover.
4. Remove 3 Allen screws and washers retaining spring cover, then unscrew compressor tool.



TYPICAL
1. Sliding sheave
2. Support cup
3. Spring cover screws

5. Remove spring cover, spring and spring seat.



TYPICAL
1. Spring
2. Spring cover

Hollow Threaded Pin Set Screw Removal

1. Position a propane torch ± 25.4 mm (1 in) from the end of the pin (on the opposite side of the cotter pin).
2. Heat during 10 to 15 seconds or until the end of the pin reaches 100°C (212°F) and stop heating.

NOTE: Probe the end of the pin with a temperature indicator stick such as the TEMPILSTIK INDICATOR STICK (P/N TS212F), which will liquefy when pin reaches the correct temperature.

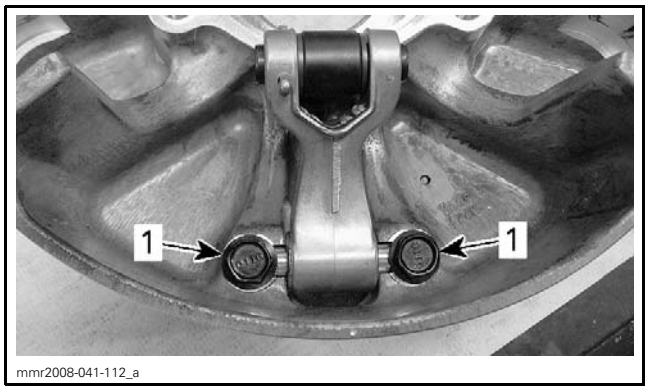
NOTICE **Make sure not to exceed 100°C (212°F). Exceeding this temperature will cause severe pulley damage.**

3. Wait approximately 30 seconds and remove the set screw.

NOTE: If the set screw cannot be removed, heat the pin end again during 5 seconds and try again to remove set screw. Make sure not to exceed 100°C (212°F).

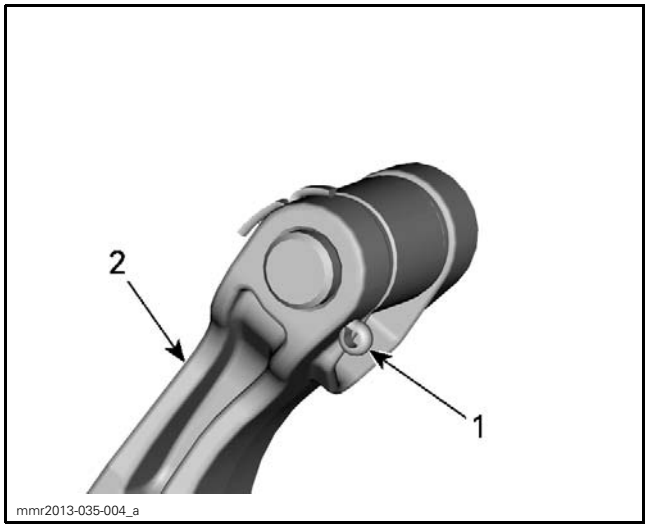
Lever, Roller and Pin Removal

1. Remove lever retaining screws.



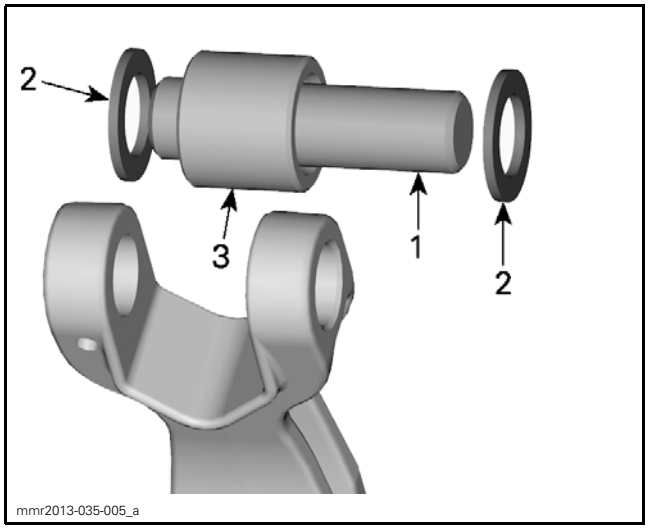
1. Lever retaining screws

2. Pull lever to remove it from sliding sheave.
3. Remove and discard the cotter pin.



1. Cotter pin
2. Lever

4. Remove pin, thrust washers and roller.

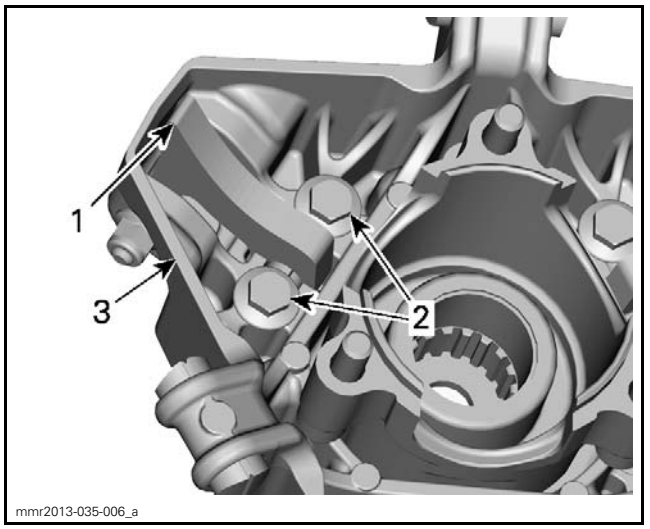


1. Pin
2. Thrust washers
3. Roller

Ramp Removal

Turn the governor cup up side down.

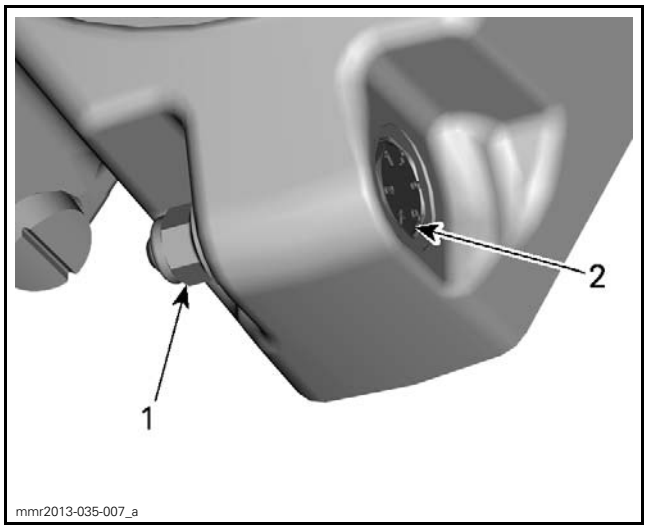
Remove screws retaining ramp to governor cup.



1. Ramp
2. Ramp screws
3. Governor cup

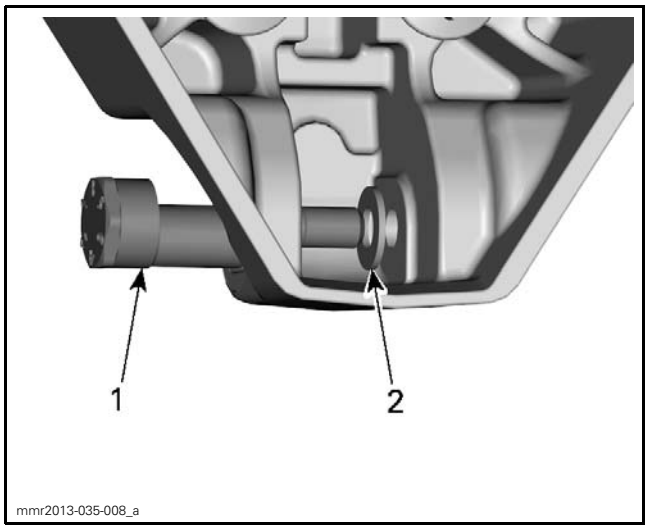
Calibration Screw Removal

Unscrew the nut securing the calibration screw.



1. Retaining nut
2. Calibration screw

Remove calibration screw and its washer.



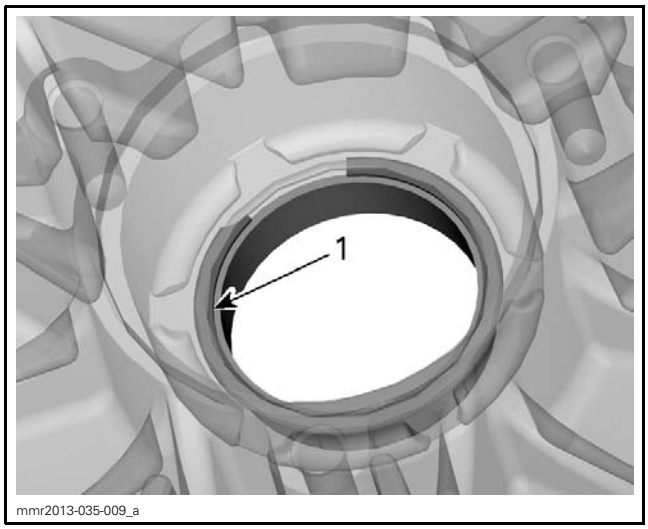
1. Calibration screw
2. Washer

Sliding Sheave Bushing Removal

NOTE: 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.

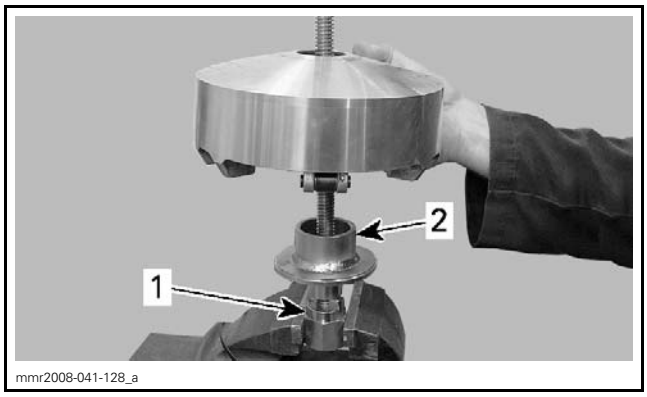
If bushing is out of specifications, remove it as follows:

1. Remove circlip from sliding sheave.



1. Circlip

2. Secure the PULLEY SPRING COMPRESSOR TOOL (P/N 529 036 012) in a vice.
3. Mount the BUSHING PULLER/INSTALLER (P/N 529 031 200) and the sliding sheave assembly on it.



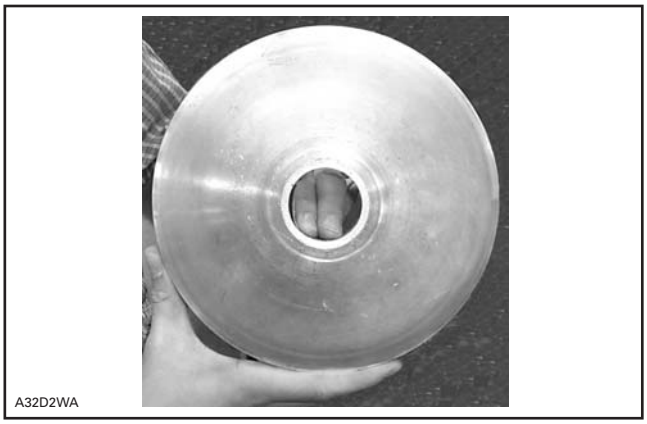
TYPICAL
1. Spring compressor
2. Bushing remover/installer

4. Use the BUSHING REMOVER/INSTALLER (P/N 529 035 931) to press out old bushing.

NOTE: Make sure to use the tool as marked; to remove the bushing press using the side marked "OUT", as shown below in the picture.

TYPICAL

5. Use a soft sand paper to clean sliding sheave bushing mounting surface.



6. Clean sliding sheave bushing mounting surface with PULLEY FLANGE CLEANER (P/N 413 711 809).
7. Clean the circlip groove.

Drive Pulley Cleaning

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.

Drive Pulley Inspection

NOTE: During inspection, replace any component if found defective or out of specifications.

Fixed Sheave and Governor Cup Inspection

Inspect fixed sheave for marks or scratches.

600 HO E-TEC

Inspect fixed sheave and governor cup splines.

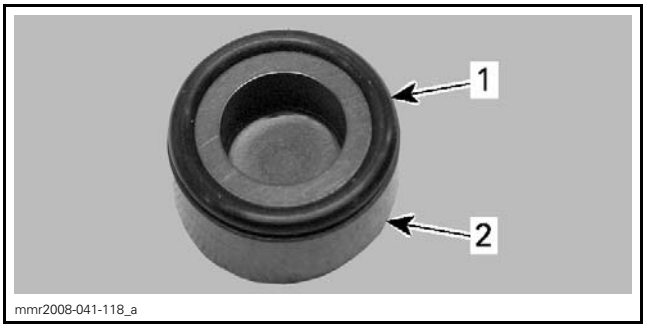
Check free-play between governor cup and fixed sheave.

NOTE: Maximum free play is measured at calibration screw radius.

MAXIMUM FREE PLAY	
Between fixed sheave and governor cup splines	0.5 mm (.02 in)

Slider Shoe Inspection

Check if slider shoe O-rings are cracked, cut or crushed.

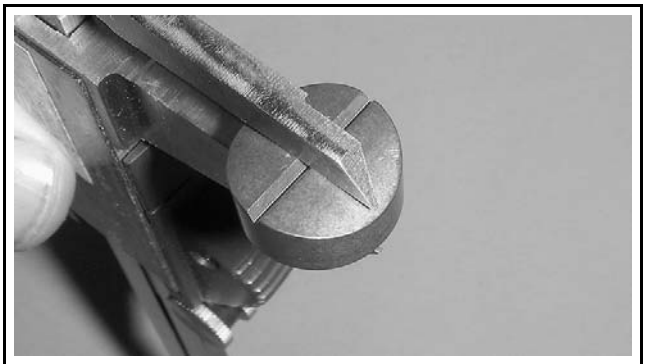


mmr2008-041-118_a

1. O-ring
2. Slider shoe

Measure the thickness of slider shoes. Take measurement at the center of slider shoe, perpendicularly with the groove.

SLIDER SHOE THICKNESS	
MODELS	SERVICE LIMIT
600 HO E-TEC	7.45 mm (19/64 in)
800R E-TEC	7.95 mm (5/16 in)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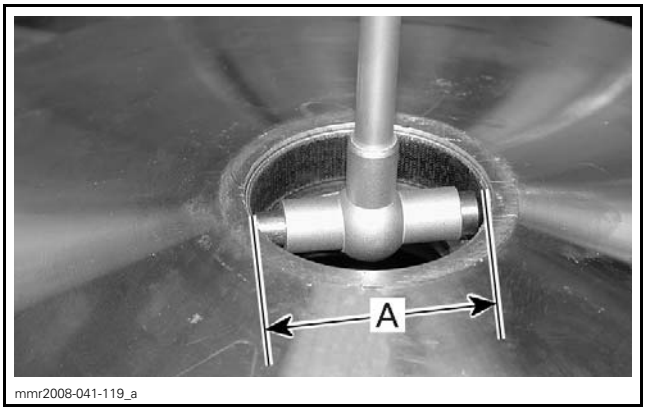
Sliding Sheave Inspection

Inspect pulley sheave for marks or scratches.

Visually inspect coating of bushings.

Using a bore gauge, measure the inner diameter of sliding sheave bushing.



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A. Inner diameter of sliding sheave bushing

MEASURING POINT
At least 5 mm (1/4 in) from bushing edge

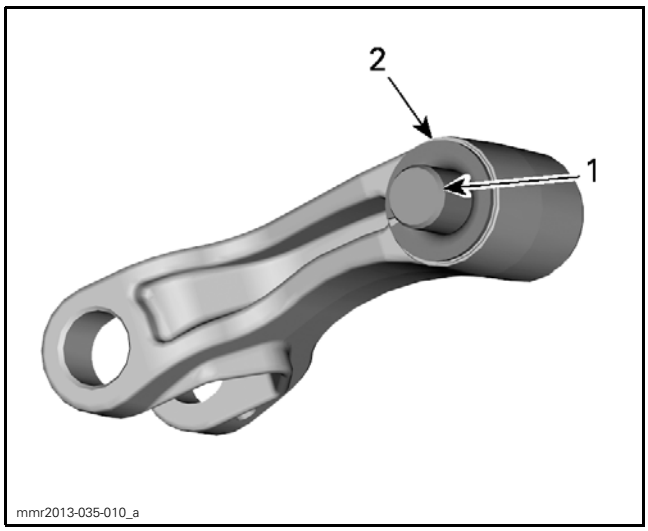
SLIDING SHEAVE BUSHING	SERVICE LIMIT
Inner diameter	40.3 mm (1.587 in)

Lever, Roller and Pin Inspection

Check levers for cracks, distortion or other damages.

Check lever pivot for wear.

Check lever flanged bushing for wear.



1. Lever pivot
2. Lever flanged bushing

Check rollers for roundness of external diameter.

Check thrust washers for thickness wear.

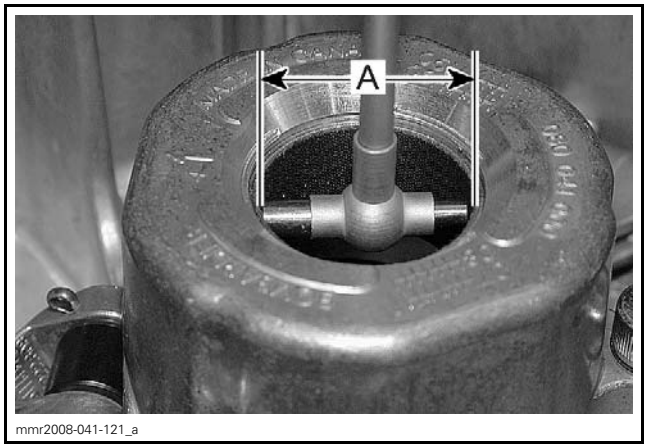
Check roller pins for wear.

Spring Cover Inspection

Check spring cover for cracks or wear.

Visually inspect the coating of spring cover bushing for wear.

Using a bore gauge, measure the inner diameter of spring cover bushing.



A. Inner diameter of spring cover bushing

MEASURING POINT
At least 5 mm (1/4 in) from bushing edge

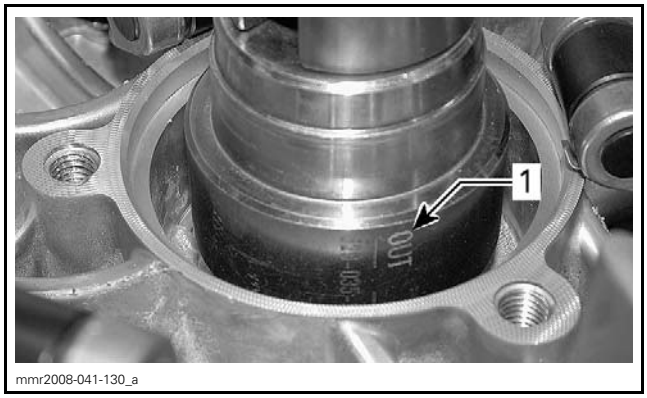
SPRING COVER BUSHING	SERVICE LIMIT
Inner diameter	30.4 mm (1.197 in)

Replace the spring cover if the inner diameter of bushing is out of specification.

Drive Pulley Assembly

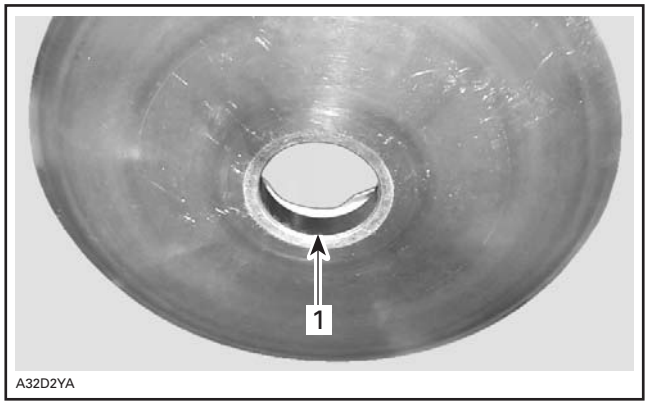
Sliding Sheave Bushing Installation

1. Secure the PULLEY SPRING COMPRESSOR TOOL (P/N 529 036 012) in a vice and mount the sliding sheave.
2. Apply LOCTITE 680 (P/N 293 800 118) on the outside of **NEW** bushing face.
3. Insert the bushing from inner side of sliding sheave.
4. Mount the BUSHING REMOVER/INSTALLER (P/N 529 035 931) with side marked "IN" to press in a new bushing.



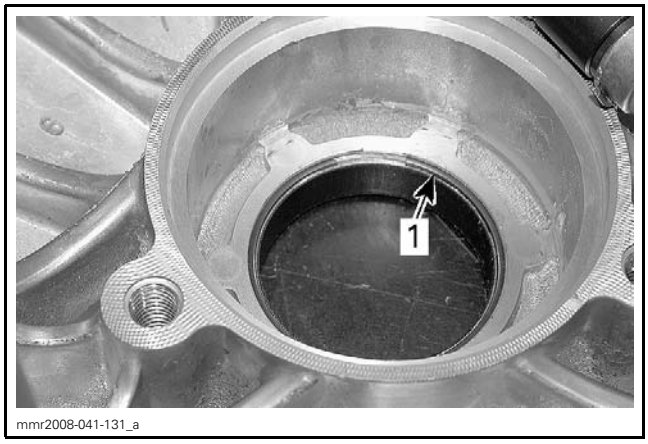
1. Mark "OUT" toward outside

NOTE: Make sure that the bushing is well seated on the sliding sheave.



1. Bushing

5. Install the circlip.



1. Circlip

NOTICE Make sure that the circlip is properly position in its groove.

Ring Gear Installation

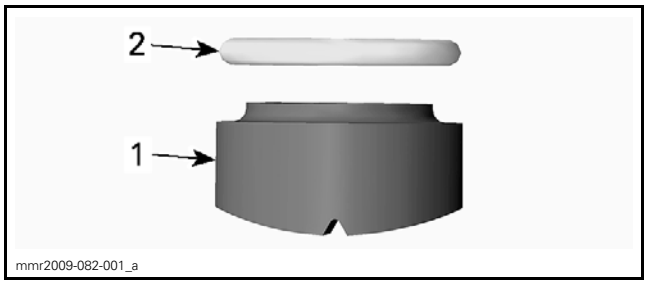
Clean ring gear and the inner threads of fixed sheave.

Install NEW ring gear screws and torque them in accordance with the following chart.

RING GEAR SCREW TORQUE	
600HO E-TEC	27 N•m (20 lbf•ft)
800R E-TEC	52 N•m (38 lbf•ft)

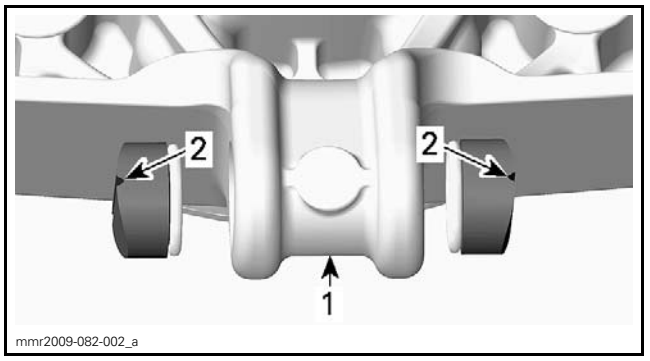
Sliding Sheave, Slider Shoes and Governor Cup Installation

1. Install an O-ring on each slider shoes.



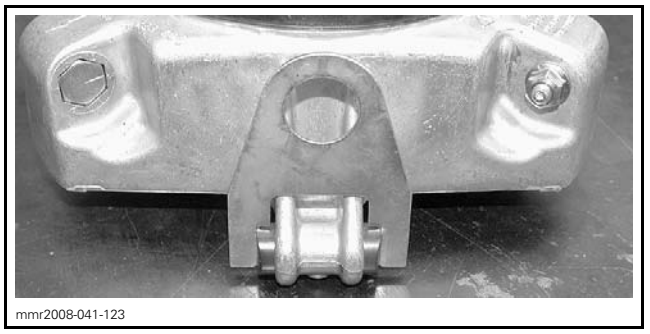
1. Slider shoe
2. O-ring

2. Insert slider shoes into governor cup so that groove in each slider shoe is vertical to properly slide in guides.



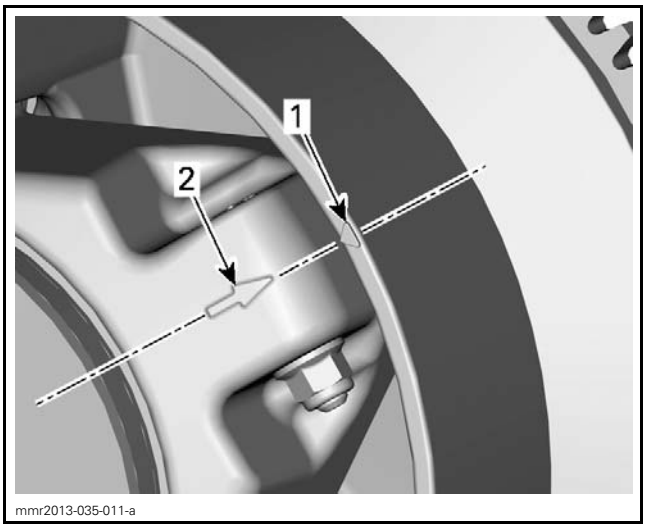
1. Governor cup
2. Slider shoe grooves

3. Install a SLIDER SHOE FORK (P/N 529 005 500) into slider shoe grooves to maintain them for governor cup installation. Proceed on 3 set of slider shoes.

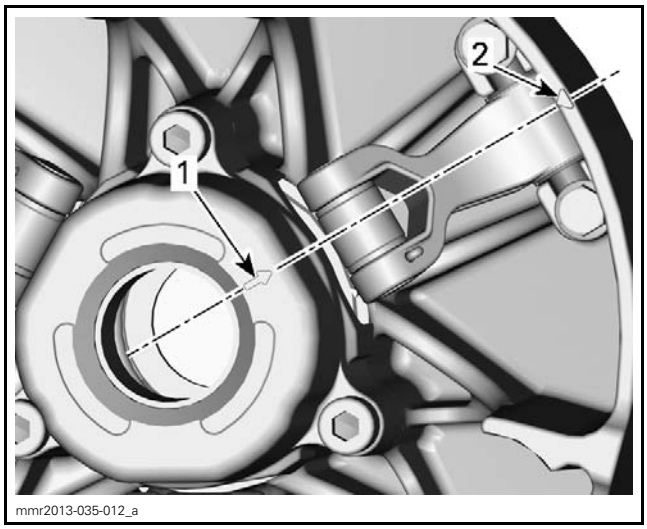


4. Index governor cup with sliding sheave by aligning index marks.

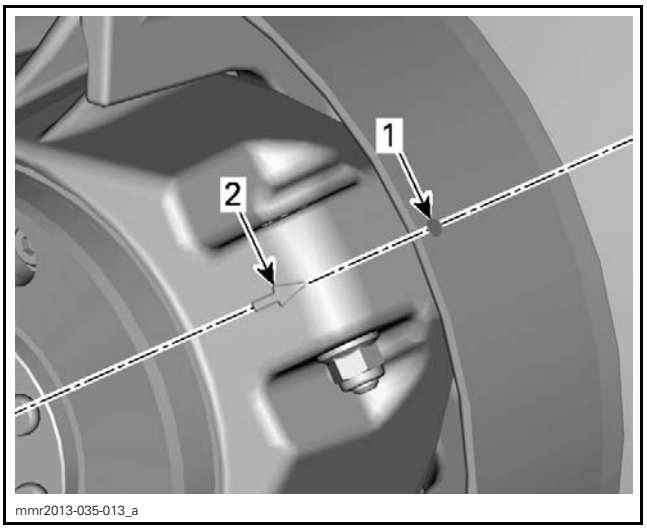
NOTE: Disregard any paint markings.



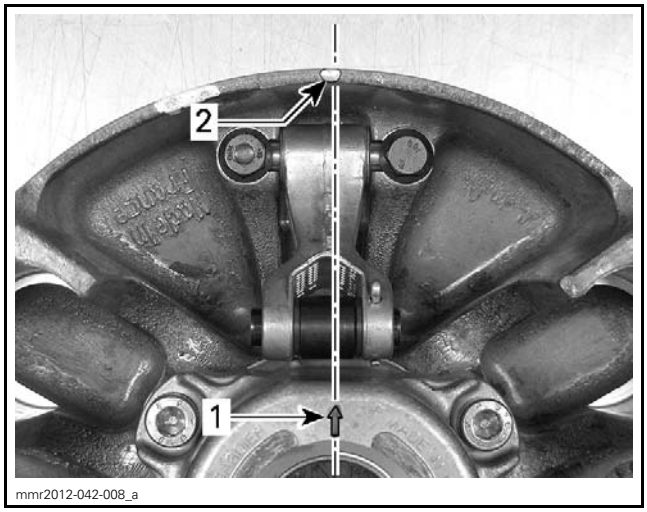
600 HO E-TEC - SLIDING SHEAVE/GOVERNOR CUP ALIGNMENT
1. *Sliding sheave index mark (EMBOSSMENT)*
2. *Governor cup index mark (ARROW)*



600 HO E-TEC - SPRING COVER ALIGNMENT
1. *Spring cover index mark (ARROW)*
2. *Sliding sheave index mark (EMBOSSMENT)*



800R E-TEC - SLIDING SHEAVE/GOVERNOR CUP ALIGNMENT
1. *Sliding sheave index mark (4 mm (5/32 in) CIRCLE)*
2. *Governor cup index mark (ARROW)*



800R E-TEC - SPRING COVER ALIGNMENT
1. *Spring cover index mark (ARROW)*
2. *Sliding sheave index mark (NOTCH)*

All Engines

5. Carefully slide governor cup into sliding sheave.
6. Remove forks and fully insert governor cup.

Spring Cover Installation

1. Install spring cover using the following tool.

REQUIRED TOOL	
PULLEY SPRING COMPRESSOR TOOL (P/N 529 036 012)	

2. Index spring cover with sliding sheave by aligning index marks.

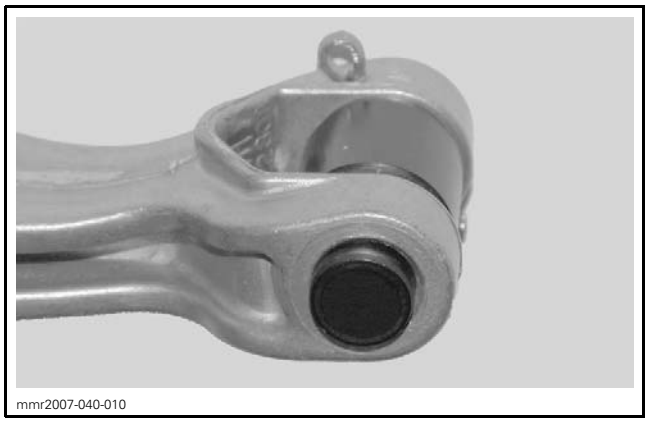
NOTE: Disregard any paint markings.

3. Tighten spring cover screws to specification.

TIGHTENING TORQUE	
Spring cover screws	25 N•m (18 lbf•ft)

Lever, Roller and Pin Installation

Always use the same type of pin as originally installed when servicing. Refer to *TECHNICAL SPECIFICATIONS*.



SOLID PIN

HOLLOW PIN

NOTE: Different types have different weights for calibration purpose. Refer to *HIGH ALTITUDE BULLETIN*.

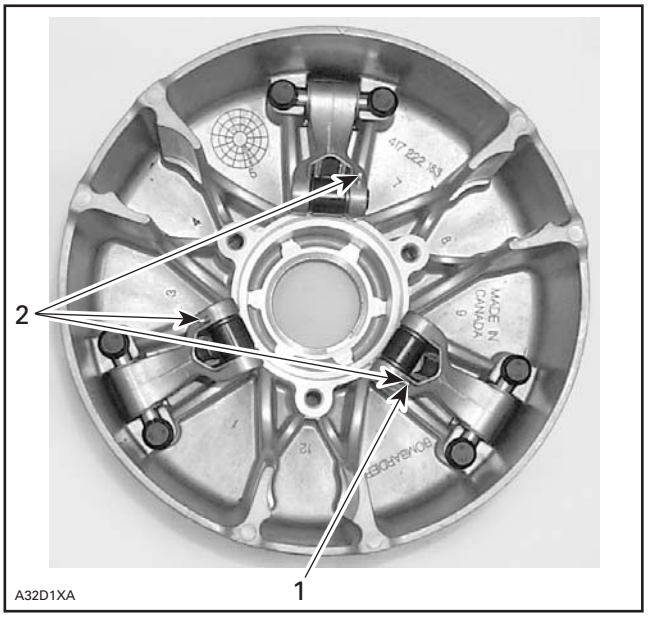
While installing lever make sure that the curved sides of the levers are outwards as shown.

Always install lever assemblies so cotter pin heads are oriented on top when lever is set at the bottom of sliding sheave.

Bend cotter pin ends gently to sit perfectly against lever.

⚠ WARNING

Whenever replacing centrifugal levers, always replace all 3 at the same time. Otherwise, drive pulley unbalance will occur because of levers difference.



TYPICAL
1. *Cotter pin head on top*
2. *All on the same side*

Tighten lever screws to specification.

TIGHTENING TORQUE	
Lever screws	25 N•m (18 lbf•ft)

NOTICE **Levers and rollers must move easily after installation.**

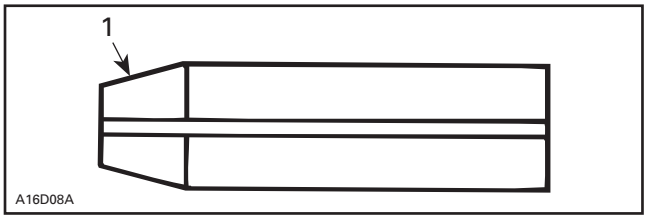
Hollow Threaded Pin Set Screw Installation

Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on set screw.

Tighten the set screw completely inside the hollow threaded pin.

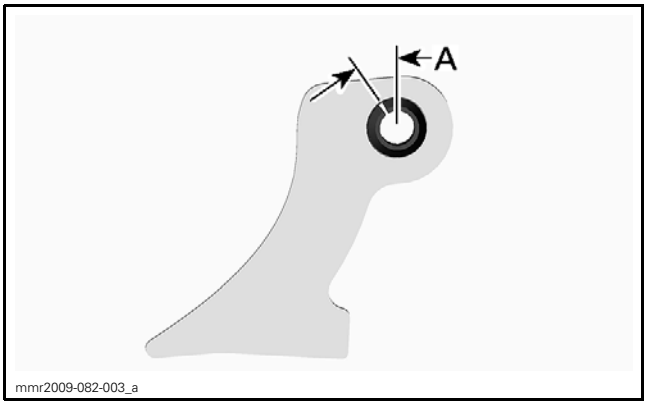
Ramp Installation

Insert dowel tube from chamfered side.



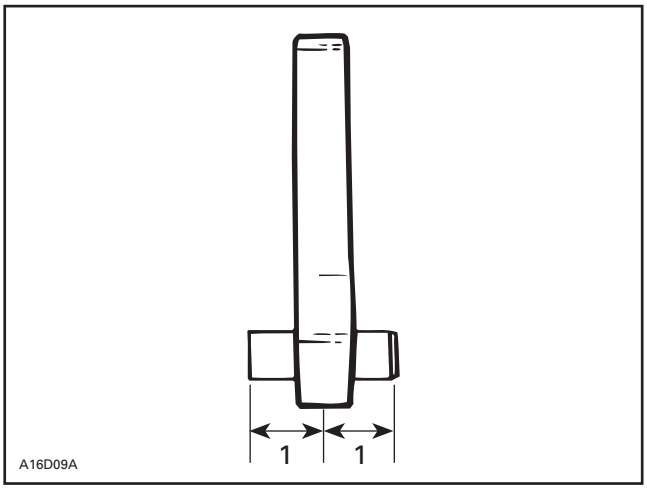
1. *Chamfered side*

Position dowel tube split at the angle "A".



MODEL	ANGLE "A"
All	45 ± 3°

Make sure ramp is centered on dowel tube.



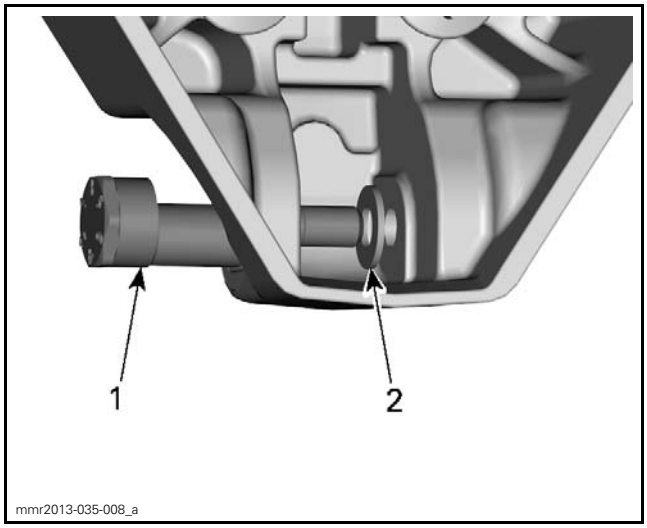
1. Equal distance

Tighten ramp screws to specification12 N•m (106 lbf•**in**).

TIGHTENING TORQUE	
Ramp screws	12 N•m (106 lbf•**in**)

Calibration Screw Installation

When installing calibration screw, make sure to install washer as shown.



1. Washer
2. Calibration screw

NOTE: Refer to *DRIVE PULLEY ADJUSTMENT*, further in this section, to install the calibration screws in original setting.

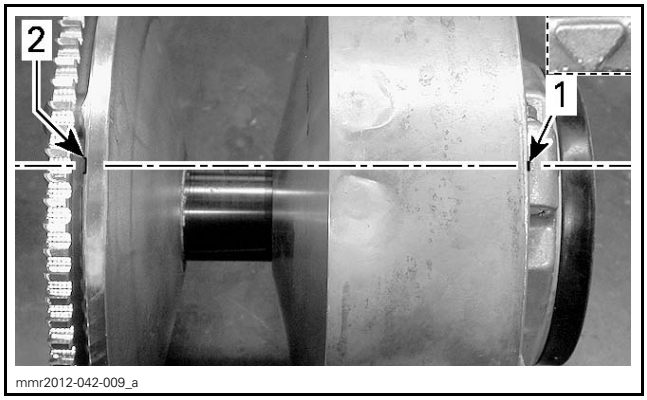
Tighten lock nut to specification.

TIGHTENING TORQUE	
Calibration screw lock nut	10 N•m (89 lbf•**in**)

Sliding Sheave and Fixed Sheave Assembly

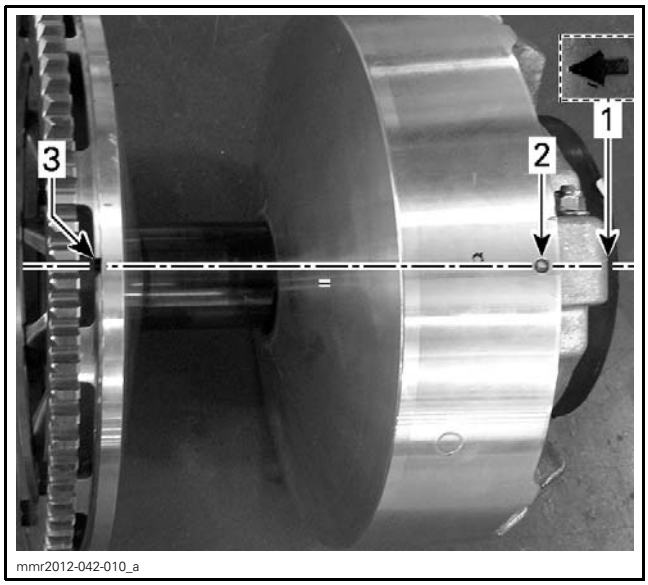
Index sliding sheave with fixed sheave by aligning index marks.

NOTE: Disregard any paint markings.



600 HO E-TEC - SLIDING SHEAVE/FIXED SHEAVE ALIGNMENT
1. Sliding sheave index (EMBOSSMENT)
2. Fixed sheave index (NOTCH)

Push sliding sheave until governor cup splines are engaged on fixed sheave splines.



800R E-TEC - SLIDING SHEAVE/FIXED SHEAVE ALIGNMENT
1. *Governor cup index (ARROW)*
2. *Sliding sheave index (4 mm (5/32 in)) CIRCLE*
3. *Fixed sheave index (NOTCH)*

Drive Pulley Installation

Clean mounting surfaces as described in *DRIVE PULLEY CLEANING* above.

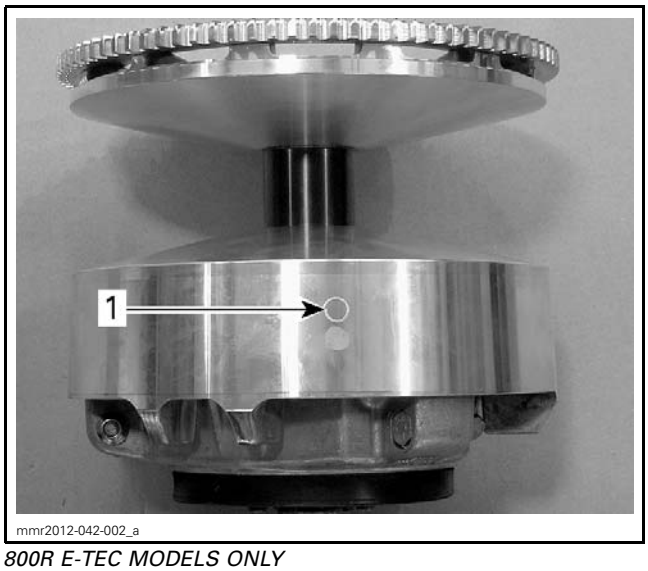
NOTICE **Do not apply antiseize or any lubricant on crankshaft and drive pulley tapers.**

Install drive pulley on crankshaft.

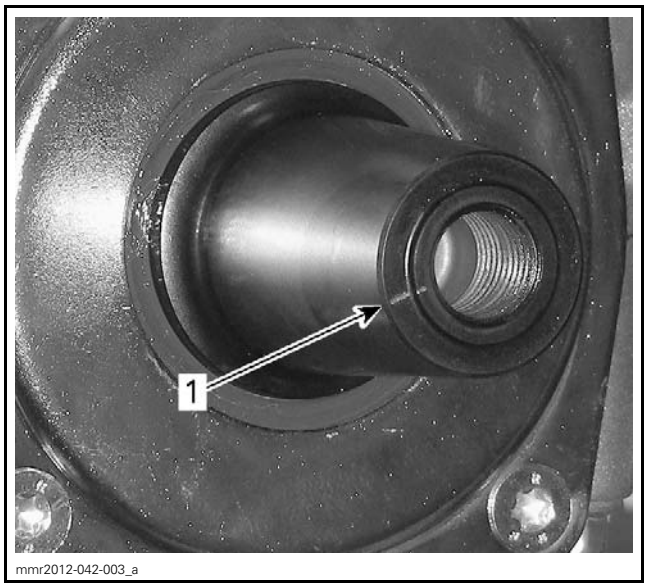
800R E-TEC Engine

Install drive pulley on crankshaft by aligning index marks.

NOTE: Disregard any paint markings.



800R E-TEC MODELS ONLY
1. *Drive pulley index mark (9 mm (11/32 in) CIRCLE)*



800R E-TEC MODELS ONLY
1. *Crankshaft index mark*

All Models

Install a NEW conical spring washer with its concave side towards drive pulley then install drive pulley bolt.

Install the drive pulley bolt. Refer to the following table to use the proper bolt length.

ENGINE	DRIVE PULLEY BOLT LENGTH
600 HO E-TEC	152.5 mm (6.004 in)
800R E-TEC	153.5 mm (6.043 in)

NOTICE **Always use BRP genuine parts for conical spring washer and bolt.**

Use the DRIVE PULLEY HOLDER (P/N 529 035 674) to retain drive pulley. See removal procedure.

Torque drive pulley bolt.

DRIVE PULLEY FIRST TORQUE	
All engines	120 N•m (89 lbf•ft)

Before starting engine, perform drive pulley adjustment, see further in this section.

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.

Re-torque drive pulley bolt.

DRIVE PULLEY FINAL TORQUE	
All engines	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 properly torqued.

Drive Pulley 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.

Calibration screws should be adjusted so that actual maximum engine RPM in vehicle matches the maximum horsepower RPM given in *TECHNICAL SPECIFICATIONS*.

NOTE: The adjustment has an effect on high RPM only.

To adjust, modify ramp end position by turning calibration screws.

Governor cup has a notch while calibration screw head has 6 positions numbered 1 to 6.

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GOVERNOR CUP
1. Notch

mmr2011-040-002_b

CALIBRATION SCREW HEAD
1. Position 1

See the following table for original setting.

CALIBRATION SCREW		
ENGINE	MODEL	POSITION
600 HO E-TEC	All models	3
800R E-TEC	MX Z	3
	RENEGADE	
	Summit (EUR models)	2
	Summit (except EUR)	1

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.

Example:

Calibration screw is set at position 3 and is changed to position 5. So maximum engine RPM is increased by about 400 RPM.

To Adjust:

Just loosen locking nut enough to pull calibration screw **partially** out. Do not completely remove the locking nut.

NOTICE **Do not completely remove calibration screw otherwise its inside washer will fall off.**

mmr2011-040-004_a

1. Loosen just enough to permit rotating of calibration screw

Adjust to desired position.

NOTICE **Always adjust all 3 calibration screws and make sure they are all set at the same number.**

Torque locking nuts to 10 N•m (89 lbf•**in**).

DRIVEN PULLEY AND COUNTERSHAFT

SERVICE TOOLS

Description	Part Number	Page
COUNTERSHAFT BEARING INSTALLER	529 036 066	11
COUNTERSHAFT BEARING REMOVER	529 036 065	10
COUNTERSHAFT SUPPORT	529 036 067	11
DRIVEN PULLEY SPRING COMPRESSOR	529 036 182	5
UPPER GEAR RETAINING TOOL	529 036 110	3

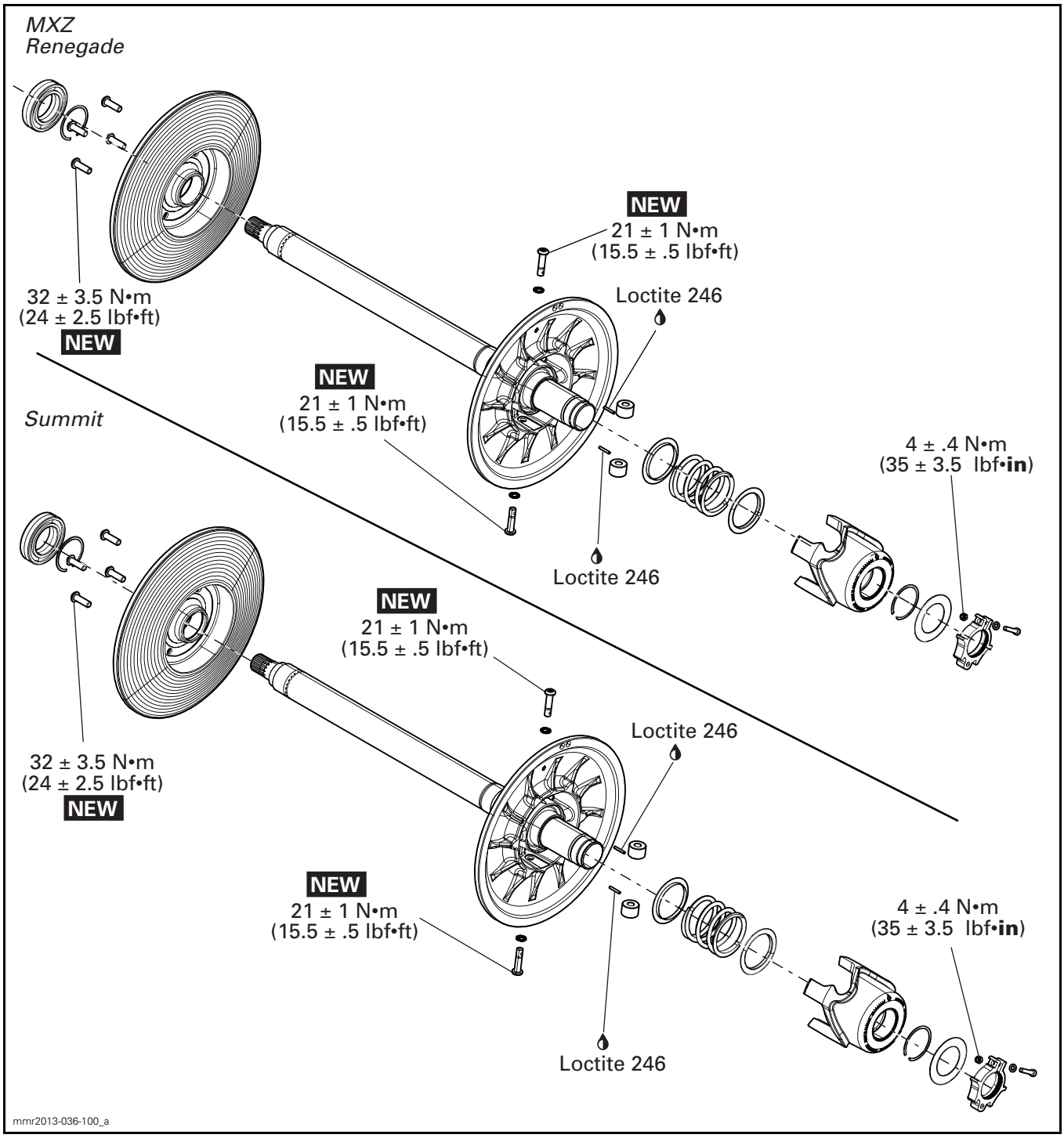
SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
SUSPENSION ADJUSTMENT TOOL	-	4

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	8
LOCTITE 609	413 703 100	11
LOCTITE 767 (ANTISEIZE LUBRICANT)	293 800 070	10
PULLEY FLANGE CLEANER	413 711 809	8, 11

DRIVEN PULLEY



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.

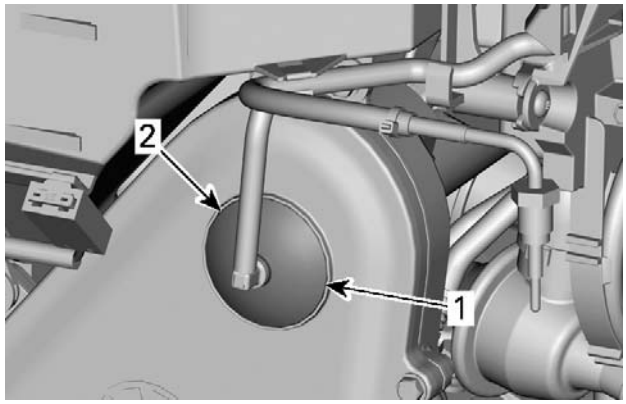
PROCEDURES

DRIVEN PULLEY

Driven Pulley Removal

NOTE: The driven pulley is removed with the countershaft.

1. Open right side panel.
2. Remove the muffler. Refer to *EXHAUST SYSTEM* section.
3. On **models with electric starters**, remove battery and battery support. Refer to *CHARGING SYSTEM* subsection.
4. Remove the filling plug on the top of chaincase.



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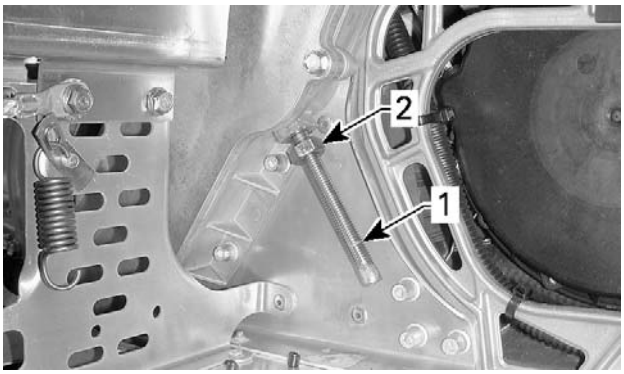
1. Filling plug
2. Chaincase

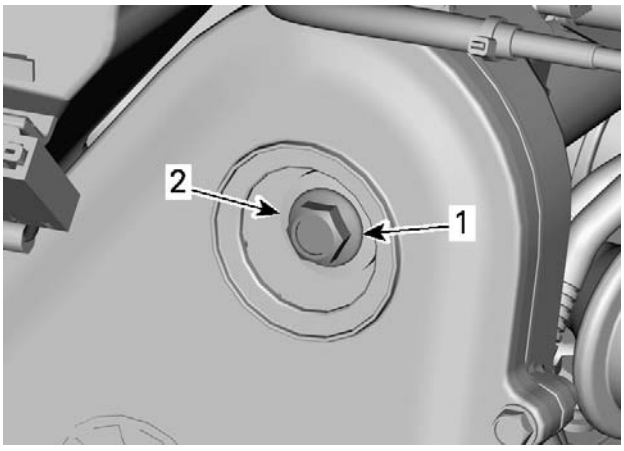
5. Release drive chain tension by unscrewing tensioner adjustment screw.



mmr2008-042-102_a

1. Tensioner adjustment screw
2. Lock nut

6. Remove the upper gear screw and the conical spring washer.



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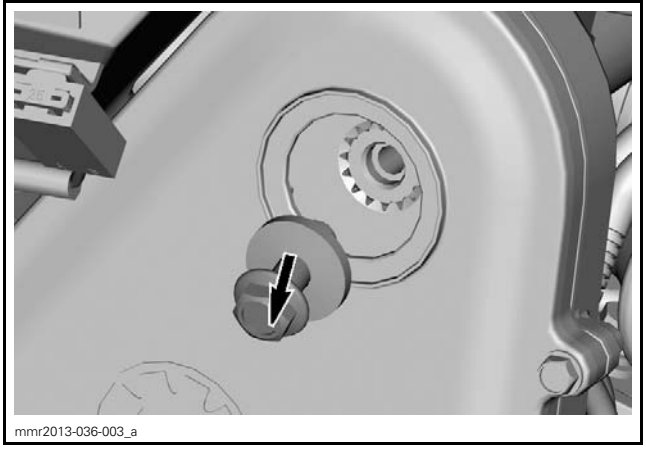
1. Upper gear screw
2. Conical spring washer

NOTE: Slightly tilt the bolt to avoid dropping washer inside chaincase.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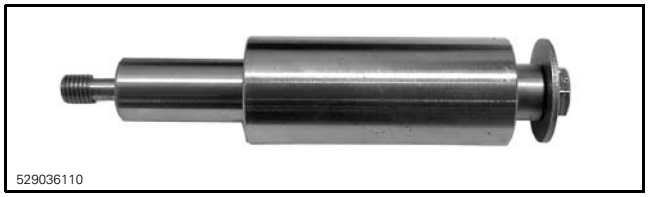
BOLT TILTED

7. Install the UPPER GEAR RETAINING TOOL (P/N 529 036 110) on countershaft end.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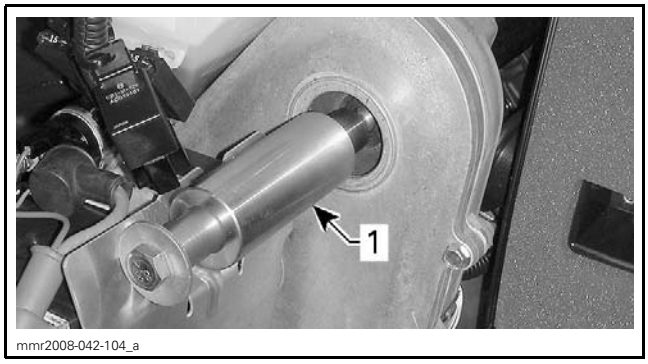

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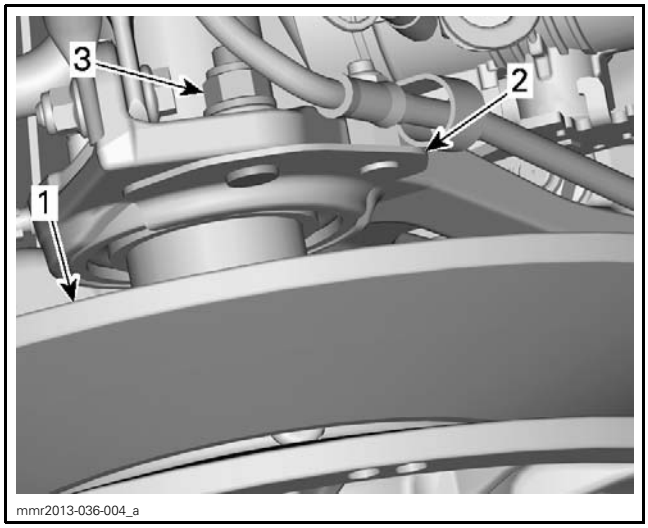
TYPICAL
1. Upper gear retaining tool

8. Remove left side panel.
9. Remove the drive belt. Refer to *DRIVE BELT* section.
10. Behind driven pulley, remove nut securing the countershaft bearing flange.



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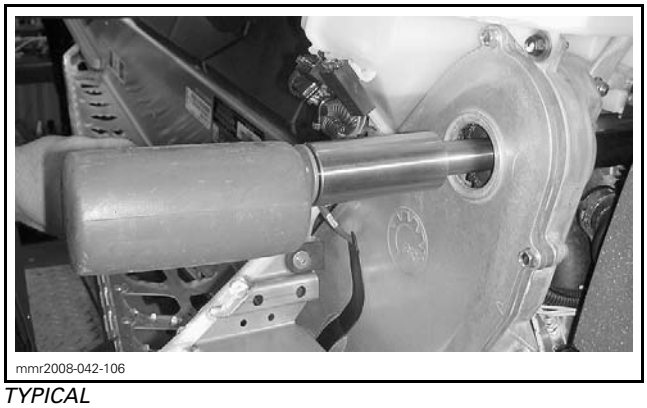
1. Driven pulley
2. Countershaft bearing flange
3. Nut

11. Pull out bearing flange.
12. 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

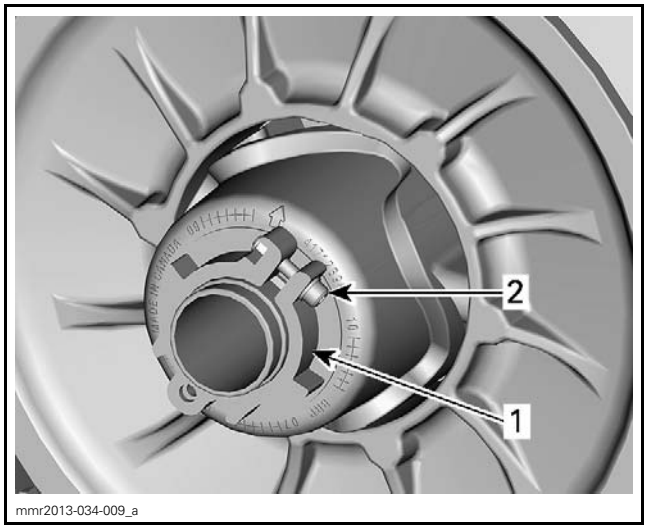
13. Unscrew countershaft from the upper gear retaining tool. **Do not** remove tool.

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

Cam and Spring Removal

1. Loosen the clamping screw.



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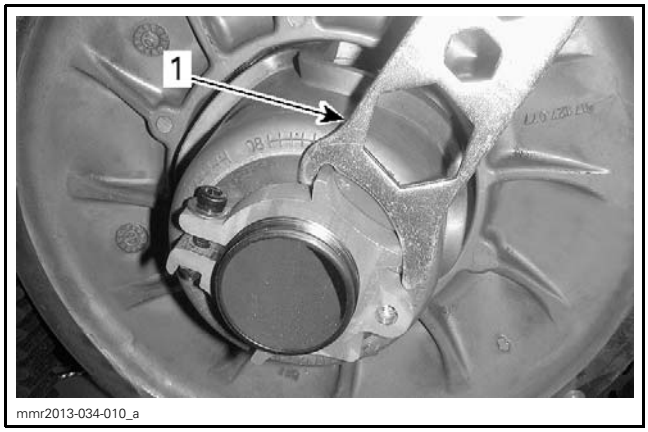
TYPICAL
1. Adjuster hub
2. Clamping screw

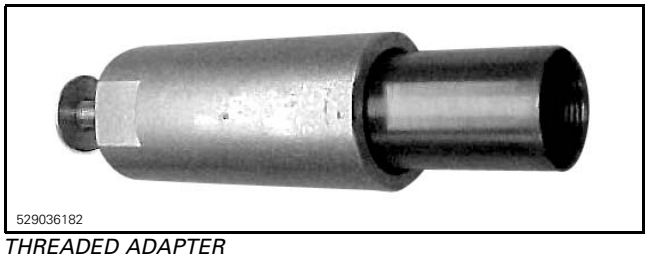
2. Unscrew the adjuster hub **clockwise** using the SUSPENSION ADJUSTMENT TOOL (P/N -) provided in the vehicle tool kit.

NOTE: The adjuster hub has LH treads.

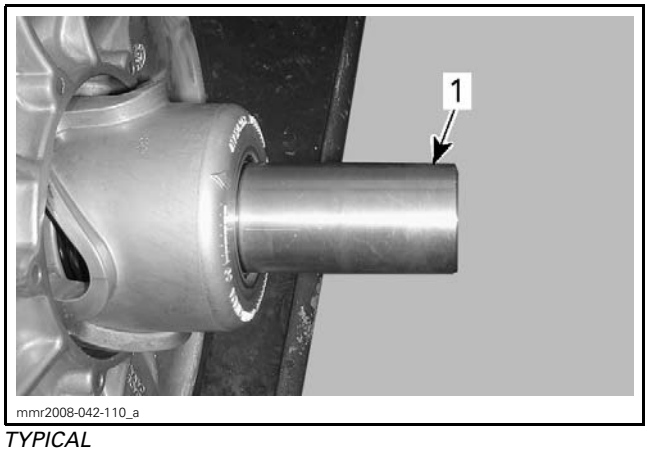


TYPICAL
1. *Suspension adjustment tool shown*

3. Install the threaded adapter of the DRIVEN PULLEY SPRING COMPRESSOR (P/N 529 036 182) at the end of driven pulley.

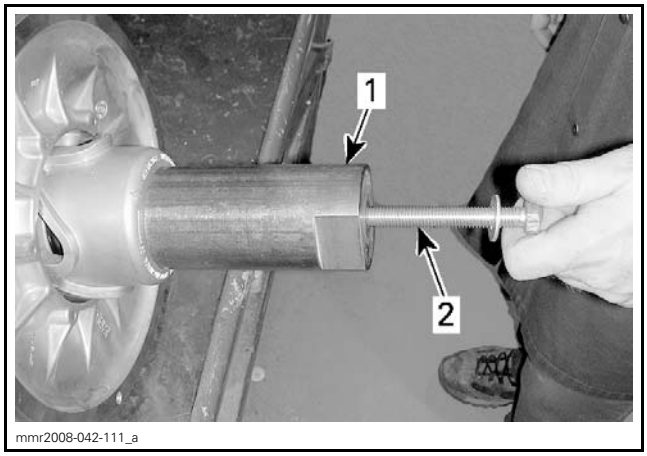


THREADED ADAPTER



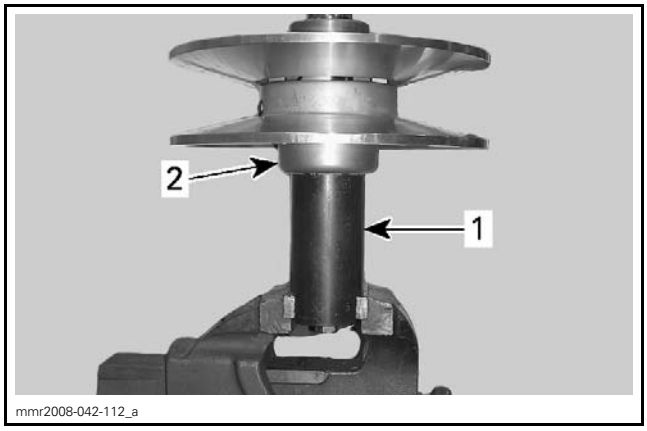
TYPICAL
1. *Threaded adapter*

4. Install the external sleeve over the threaded adapter and secure sleeve with the tool screw.



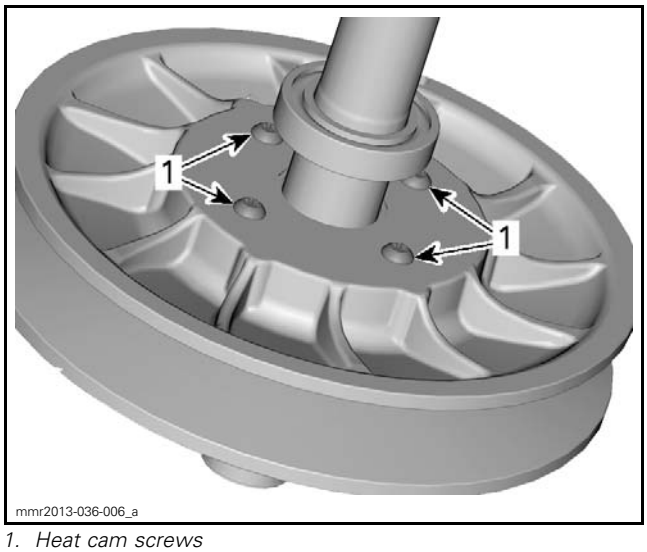
TYPICAL
1. *External sleeve*
2. *Driven pulley spring compressor screw*

5. Tighten the tool screw to compress the cam.
6. Install the tool in a vice.



TYPICAL
1. *Driven pulley spring compressor*
2. *Driven pulley*

7. Using a heat gun, heat cam screws to break the thread locker.

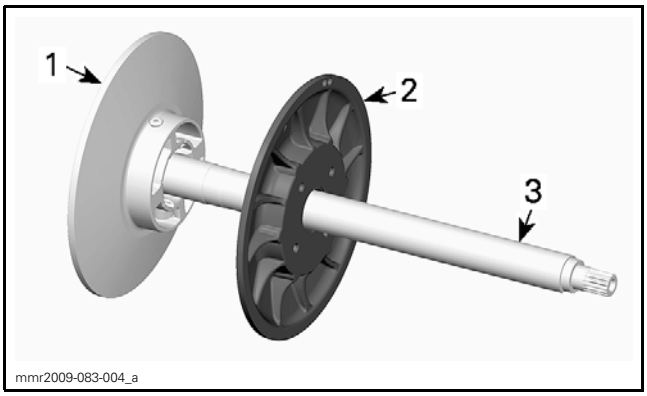


1. *Heat cam screws*

8. Remove and discard cam screws.
9. Unscrew the tool screw completely.
10. Remove cam, spring stoppers and spring.

Sliding Sheave Removal

1. Remove the cam and spring. Refer to *CAM AND SPRING REMOVAL*.
2. Remove the *COUNTERSHAFT BEARING*, see procedure in this section.
3. Remove sliding sheave.



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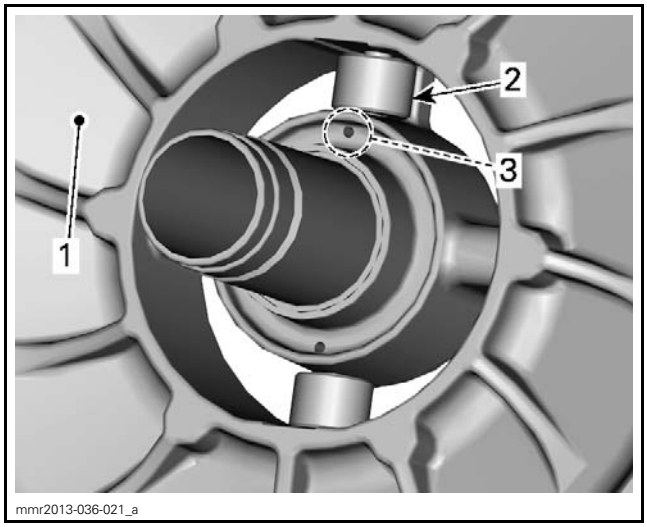
1. Fixed sheave
2. Sliding sheave
3. Countershaft

Fixed Sheave Removal

The fixed sheave and countershaft are sold as an assembly. They are not available separately.

Driven Pulley Roller Removal

1. Move sliding and fixed sheaves apart.
2. Remove spring pin used to lock pivot screw.
   - 2.1 Use tap wrench to start removing spring pin.
   - 2.2 Once spring pin is accessible to pliers, pull pin out using pliers.

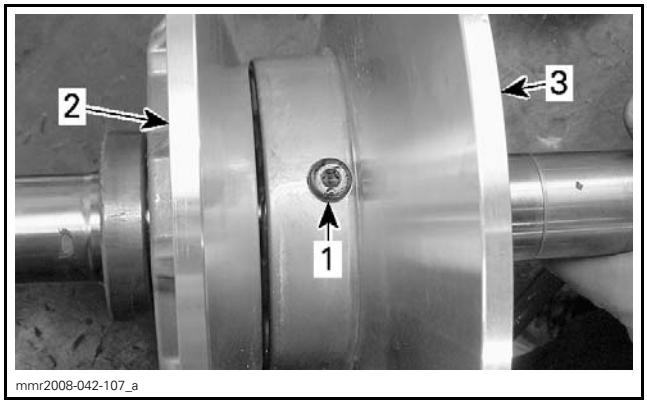


mmr2013-036-021_a

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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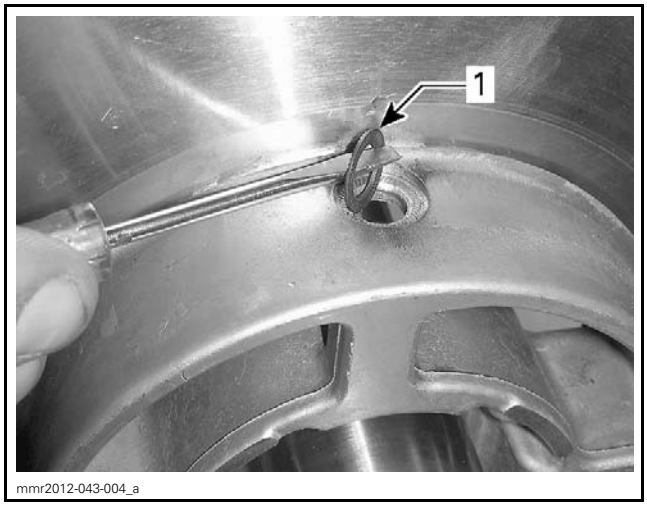
1. Pivot screw
2. Sliding sheave
3. Fixed sheave


mmr2012-043-003

PIVOT SCREW REMOVAL



mmr2012-043-004_a

1. Ribbed lock washer

5. Remove roller.
6. Proceed with removal of other roller.

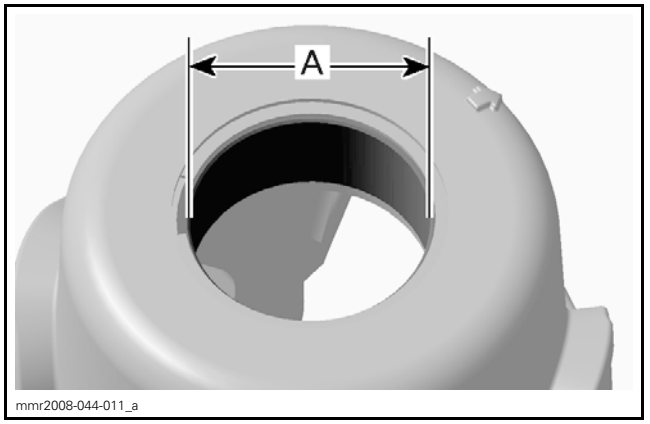
IMPORTANT: For proper fit, each pivot screw must be reinstalled where originally mounted in the fixed sheave.

NOTE: If pivot screw must be replaced, replace fixed sheave assembly.

Driven Pulley Inspection

Cam and Spring Inspection

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.



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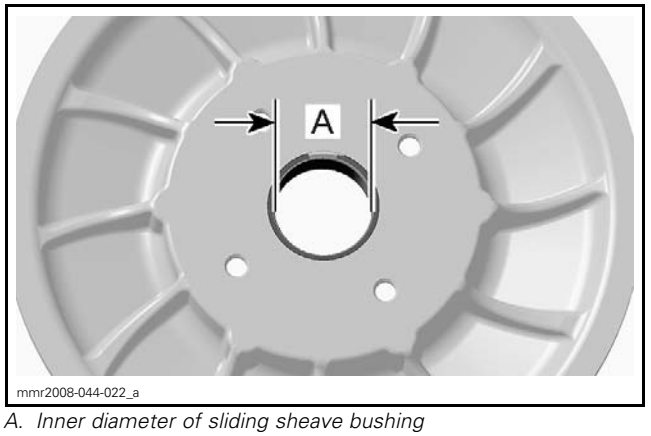
A. Inner diameter of cam bushing

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.

Sliding Sheave Inspection

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.



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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.

Fixed Sheave Inspection

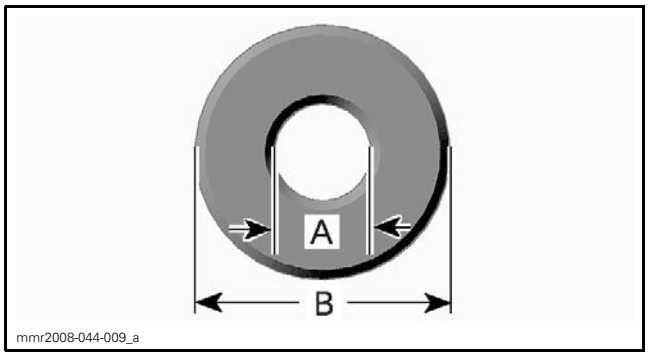
Replace fixed sheave and countershaft if one of the following problem is detected:

– Marks or scratches on pulley sheave

– Bent, twisted or otherwise damaged countershaft
– Defective splines and threads at the end of countershaft.

Driven Pulley Roller Inspection

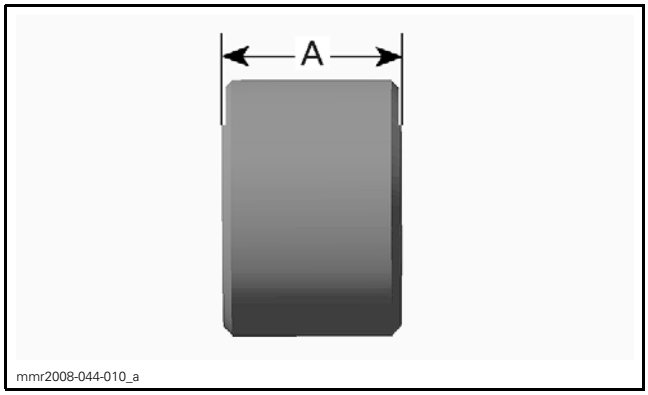
1. Check the rollers for flat spots, cracks or other visible damages. Replace if necessary (as a set).
2. Measure inner and outer diameter of rollers.



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.

Driven Pulley Cleaning

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

Cam and Spring Cleaning

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

Driven Pulley Roller Installation

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.

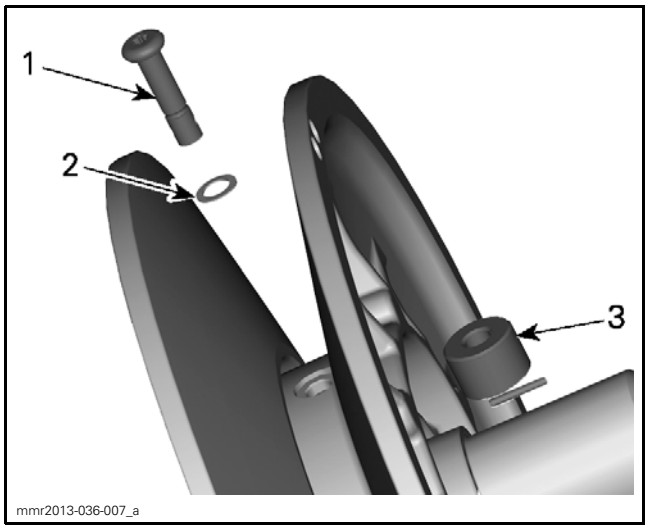
NOTE: Pivot screw and ribbed lock washer must be reused if in good condition. If damaged, replace fixed sheave assembly.

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

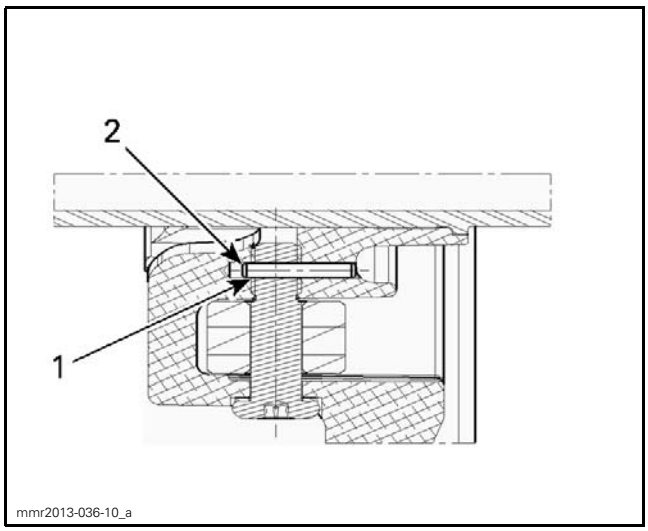
IMPORTANT: For proper fit, each pivot screw must be reinstalled where originally mounted in the fixed sheave.

4. Torque pivot screw as specified.

TIGHTENING TORQUE	
Pivot screws	21 N•m ± 1 N•m (15 lbf•ft ± 1 lbf•ft)

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.**

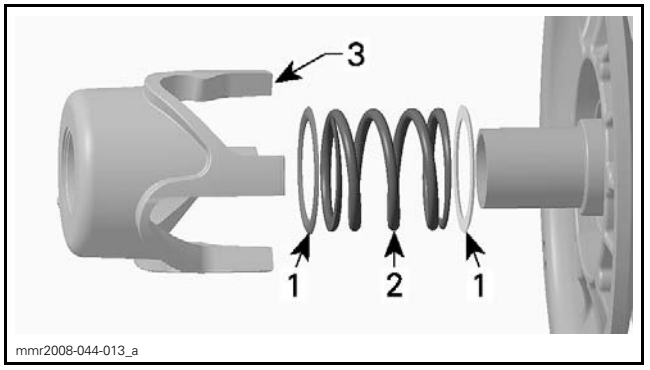


1. Hole in pivot screw
2. Spring pin

5. Install spring pin and tighten as specified.

Cam and Spring Installation

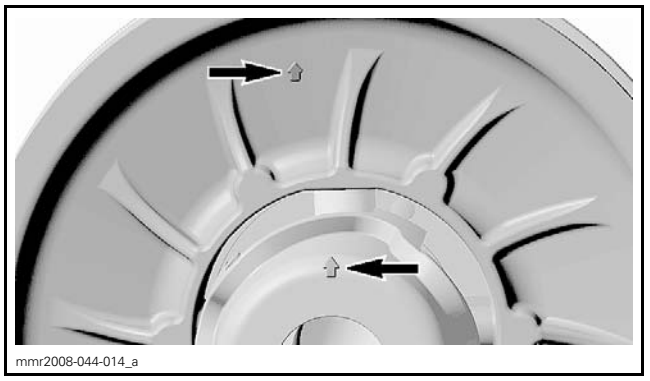
1. Install a spring stopper, the spring, the other spring stopper and the cam.



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.

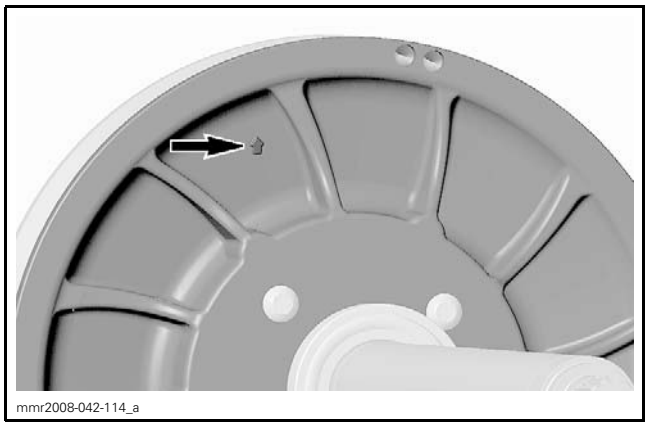
TIGHTENING TORQUE	
Cam screws	32 N•m (24 lbf•ft)

6. Remove the tool.

Sliding Sheave Installation

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.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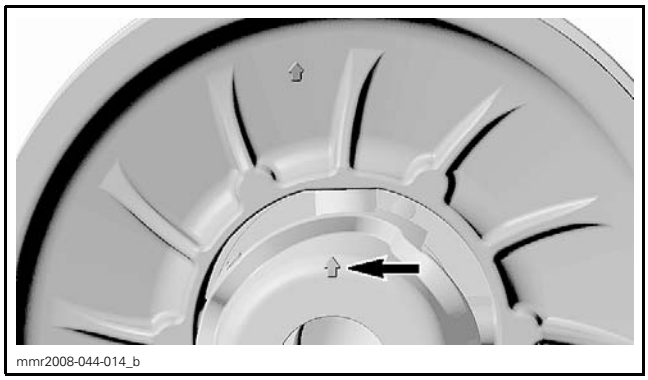
SLIDING SHEAVE ARROW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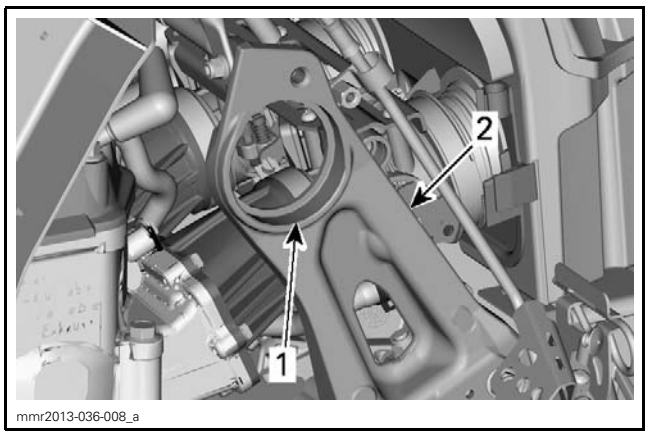
CAM ARROW

Driven Pulley Installation

1. Using sand paper (600-grit or 1000-grit) or steel wool, remove any rust on bearing shoulder of countershaft bearing support.



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1. *Bearing shoulder*
2. *Countershaft bearing support*

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, install countershaft in upper gear. 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	16 N•m (142 lbf•**in**)

12. Install the adjuster hub onto the countershaft end and temporarily tighten.
13. Install and adjust drive belt. Refer to *DRIVE BELT* section.
14. Install all other removed parts.

COUNTERSHAFT

The countershaft and the fixed sheave are sold as an assembly. They are not available separately.

Countershaft Removal and Installation

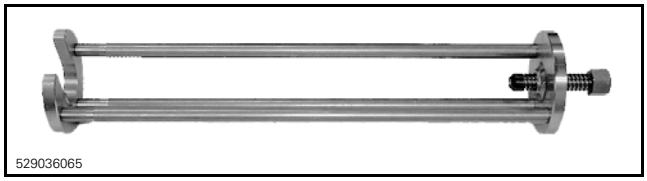
Refer to *DRIVEN PULLEY* in this section for the procedures.

COUNTERSHAFT BEARING

Countershaft Bearing Removal

Remove *DRIVEN PULLEY*, see procedure in this section.

Install the COUNTERSHAFT BEARING REMOVER (P/N 529 036 065) on countershaft.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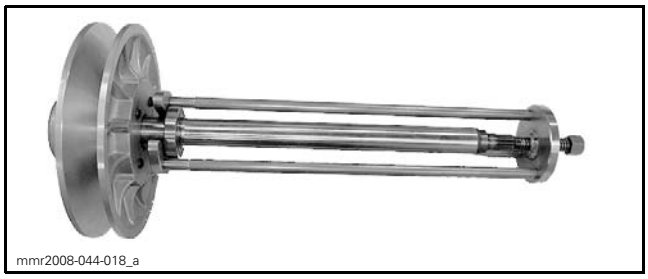
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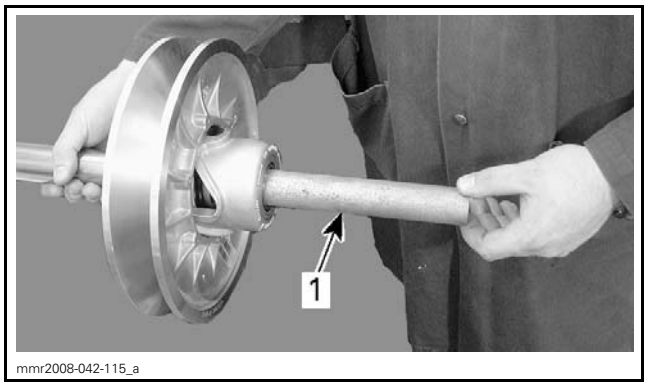
Tighten the screw at the end of tool to extract the bearing. Discard bearing.

Countershaft Bearing Installation

1. Remove the adjuster hub from the cam.
2. Insert the COUNTERSHAFT SUPPORT (P/N 529 036 067) in the countershaft.



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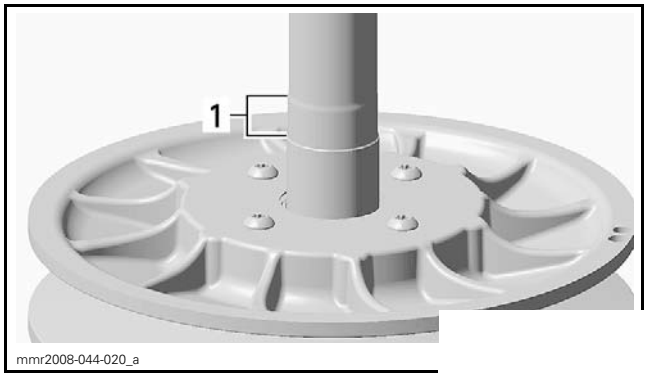
1. Countershaft support

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 609 (P/N 413 703 100) on countershaft bearing surface.



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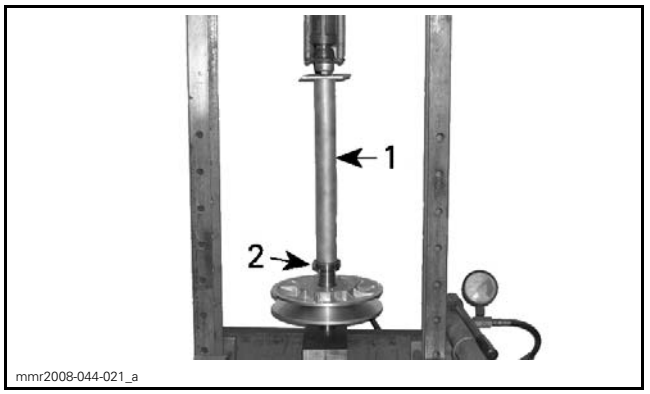
1. Apply Loctite 609 in this region

6. Using a press and the COUNTERSHAFT BEARING INSTALLER (P/N 529 036 066), install the NEW bearing on countershaft.



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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.**

7. Clean the surplus Loctite with a rag to avoid having Loctite on sliding sheave bushing.

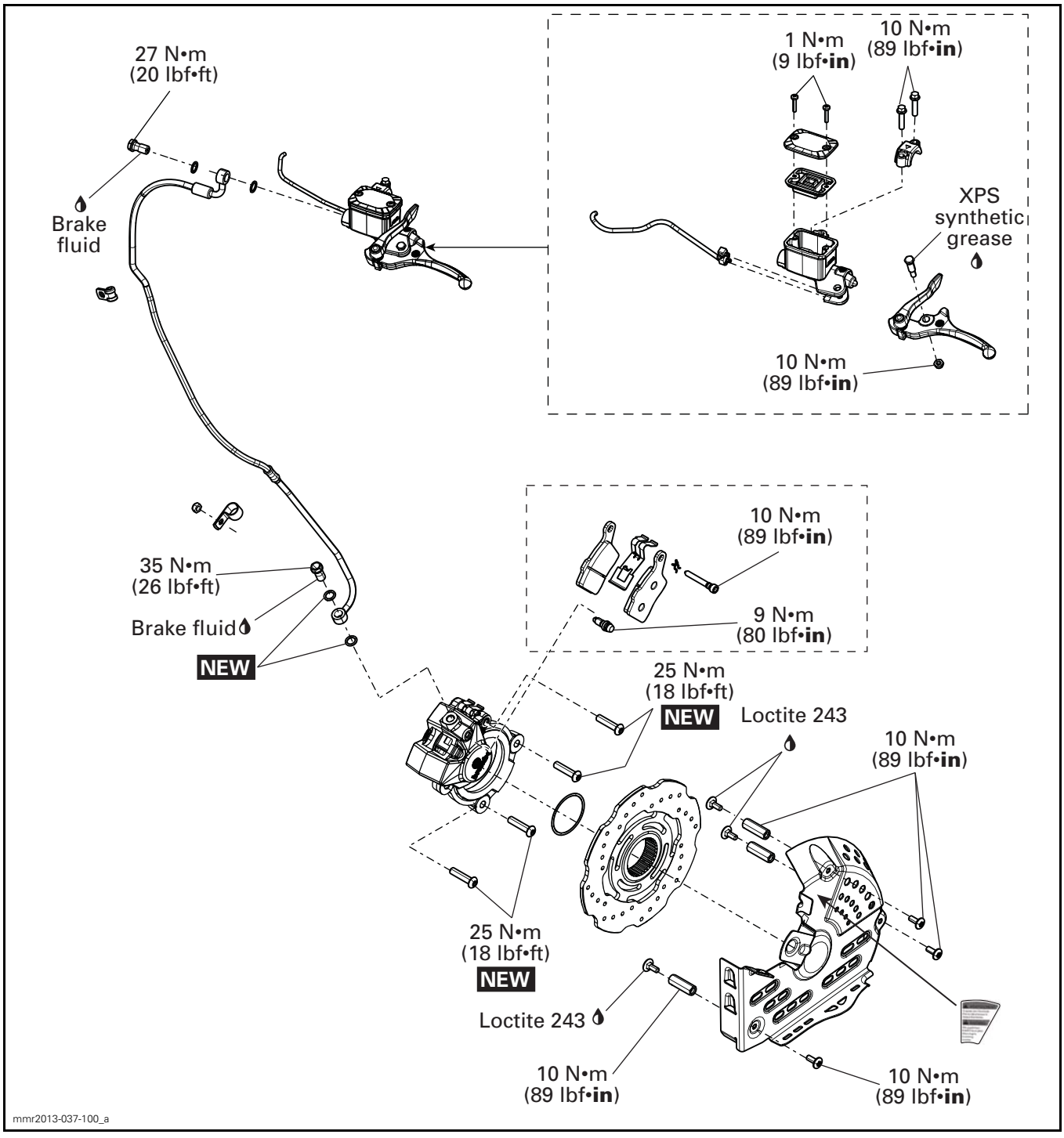
COUNTERSHAFT BEARING SUPPORT

For countershaft bearing support removal and installation, refer to *COUNTERSHAFT BEARING SUPPORT* in *FRAME*.

BRAKE

SERVICE TOOLS

SERVICE PRODUCTS


27 N•m
(20 lbf•ft)
Brake
fluid
1 N•m
(9 lbf•in)
10 N•m
(89 lbf•in)
XPS
synthetic
grease
10 N•m
(89 lbf•in)
10 N•m
(89 lbf•in)
9 N•m
(80 lbf•in)
35 N•m
(26 lbf•ft)
Brake fluid
NEW
25 N•m
(18 lbf•ft)
NEW
Loctite 243
10 N•m
(89 lbf•in)
25 N•m
(18 lbf•ft)
NEW
Loctite 243
10 N•m
(89 lbf•in)
10 N•m
(89 lbf•in)
mmr2013-037-100_a

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

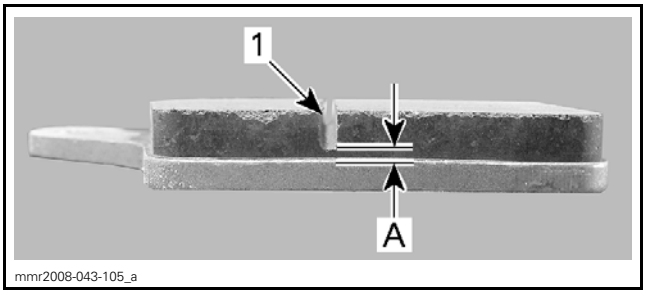
BRAKE PADS

Brake Pad Inspection

1. Measure brake pad lining thickness.

SERVICE LIMIT	
Brake pad thickness	1 mm (1/32 in)

NOTICE Brake pads must always be replaced in pairs.



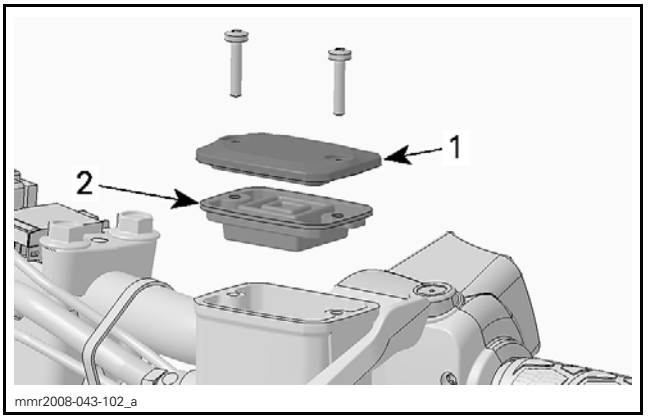
1. Groove on pad lining
A. Brake pad minimum thickness 1 mm (1/32 in)

2. Also inspect the brake disc, refer to *BRAKE DISC INSPECTION* in this subsection.

Brake Pad Replacement

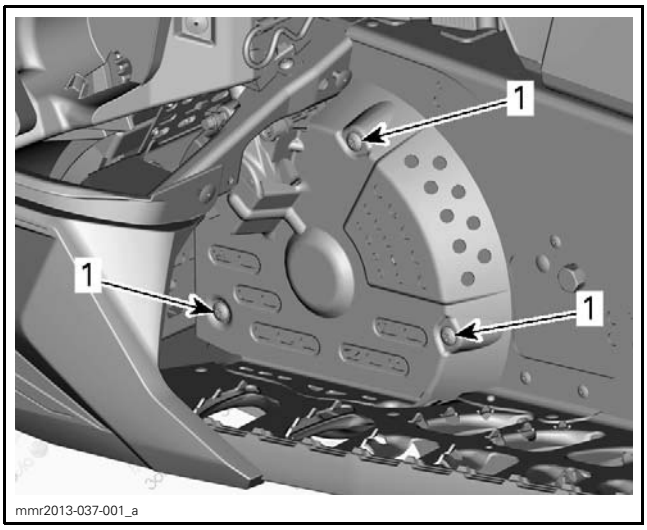
Brake Pad Removal

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.



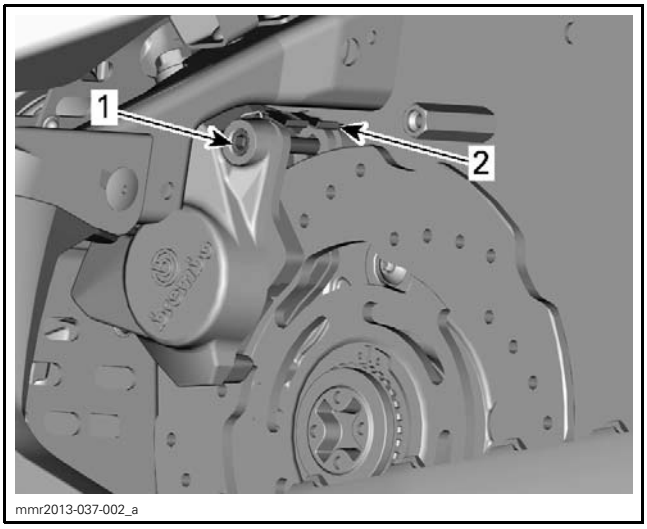
1. Reservoir cover
2. Diaphragm

4. Remove the disc brake protective cover.



1. Retaining screws

5. Remove the clip securing brake pad pin.
6. Unscrew and remove the brake pad pin.

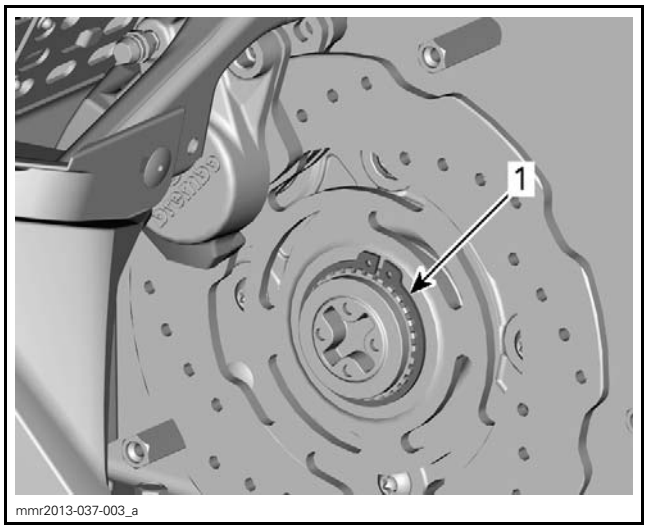


1. Clip
2. Brake pad pin

7. Using a flat screwdriver, depress caliper pistons into their bores.

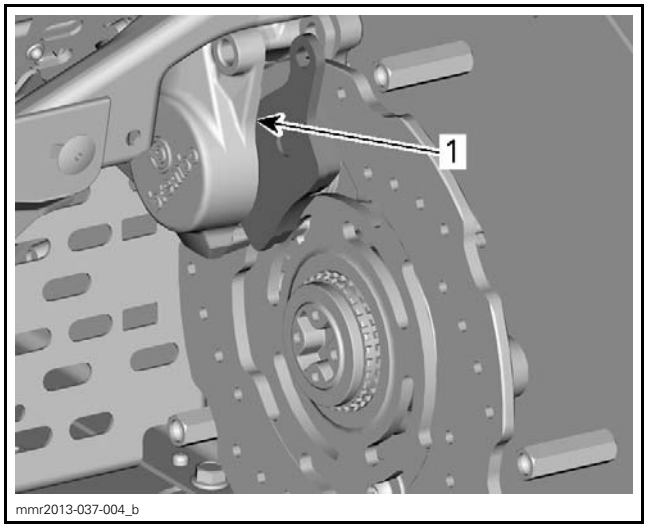
NOTICE Pay attention to avoid scratching brake disc.

8. Remove the circlip securing brake disc to drive axle.



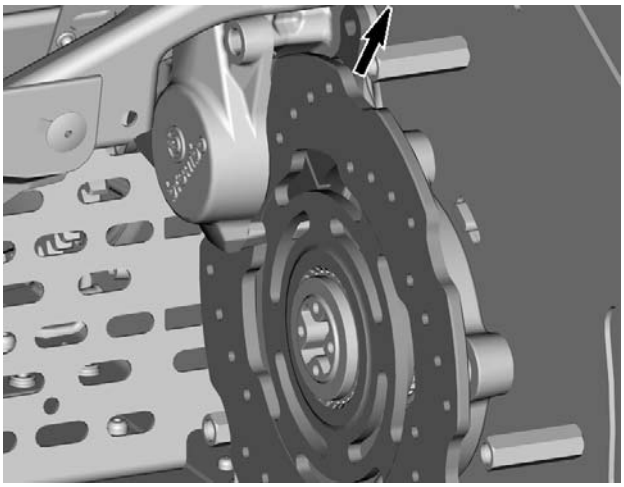
1. Brake disc circlip

9. Remove brake pads.
   9.1 Remove the external pad first.



1. External pad

   9.2 Pull the brake disc outward and remove the internal pad.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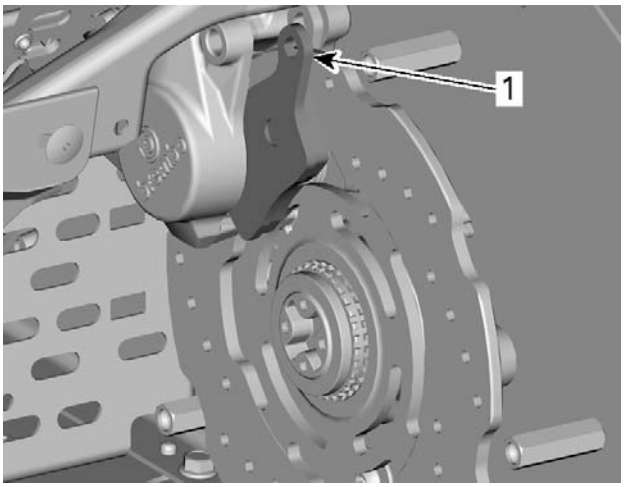
Brake Pad Installation

1. Install **NEW** brake pads with tabs facing upward.



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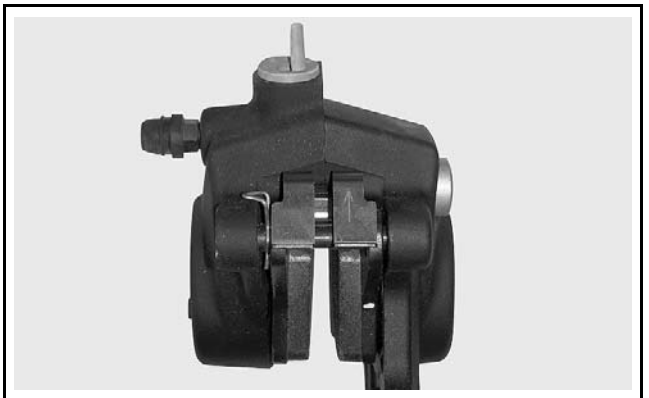
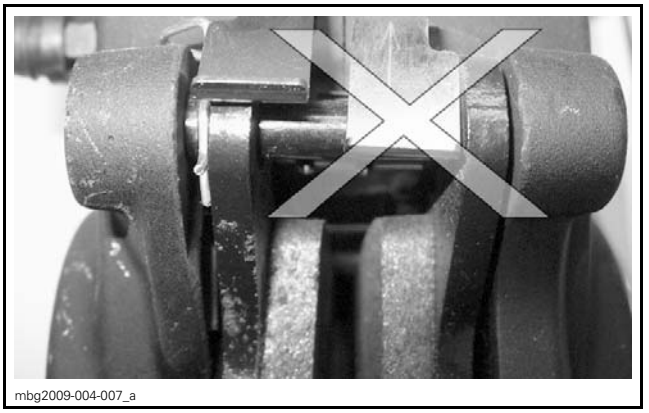
1. Brake pad tab

2. Install brake pad pin.
3. Torque brake pad pin to 10 N•m (89 lbf•**in**).
4. Install spring clip on brake pad pin. If the clip seems loose, replace it with a new one.

NOTE: Make sure spring ends on brake pads pins are correctly installed as per following pictures.


mdd2009-001-236

CORRECT


mbg2009-004-007_a

INCORRECT (ON RIGHT SIDE)

5. Operate the brake lever several times to bring the brake pads into contact with the disc brake.
6. Check brake fluid level in master cylinder and refill if necessary.
7. Install the diaphragm and the reservoir cover.
8. Install the disc brake protective cover.
9. Ride the vehicle a few minutes to make sure the repair is successful.

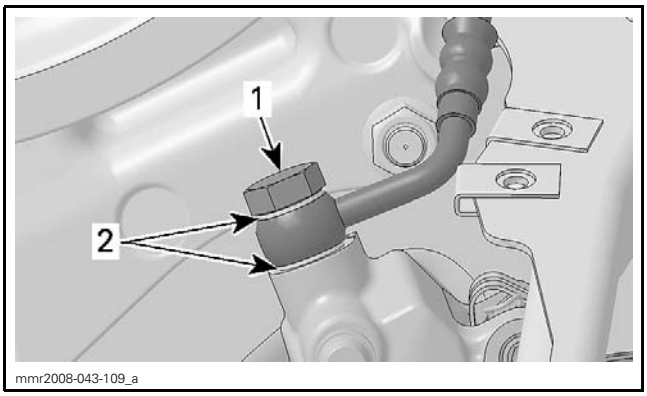
CALIPER

Caliper Removal

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.

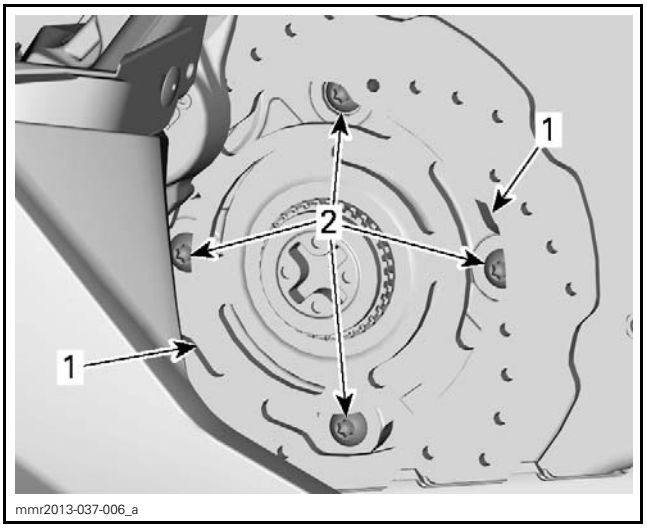
NOTE: If the caliper is not replaced, omit steps 5 and 6 concerning the brake system draining and brake hose removal.

5. Drain the brake system, refer to *BRAKE FLUID* in *MAINTENANCE* subsection.
6. Remove the Banjo fitting and discard the sealing washers.



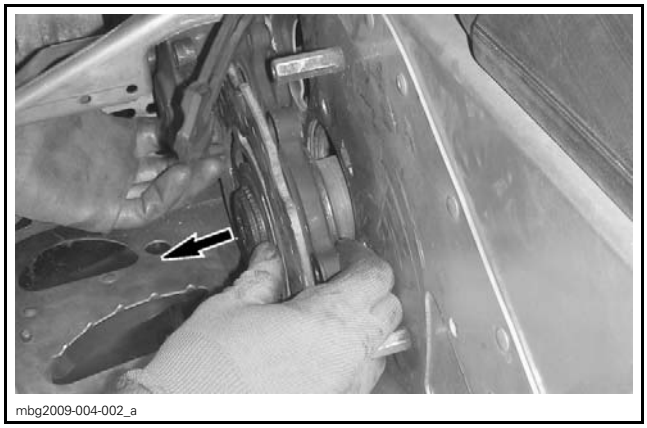
1. Banjo fitting
2. Sealing washers

7. Remove the *BRAKE PADS*, see procedure in this subsection.
8. Lift the rear of vehicle and release track tension completely.
9. Turn driven pulley to align brake disc slots with caliper bracket screws.
10. Remove caliper screws (4) behind brake disc.



1. Brake disc slots
2. Caliper screws behind brake disc

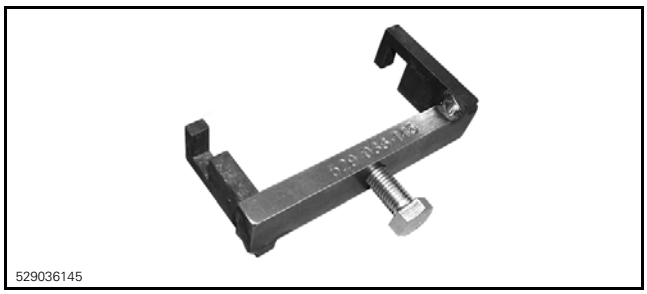
11. Pull the bearing housing assembly (brake disc, caliper and bearing) from LH side.



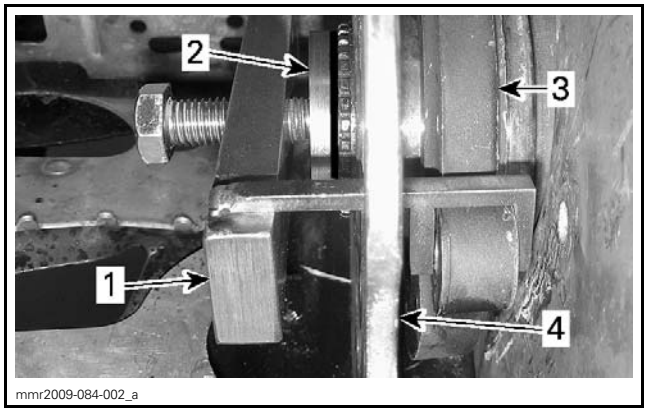
TYPICAL - PULL

12. Install the CALIPER PULLER (P/N 529 036 145) on the brake caliper through brake disc slots.

NOTE: Make sure puller tabs are correctly engaged on caliper.



13. Install the PROTECTIVE CAP (P/N 529 036 150) between caliper puller bolt and plastic cap in drive axle end.



TYPICAL
1. Caliper puller
2. Protective cap
3. Caliper bracket
4. Brake disc

14. 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.

15. When brake disc is out of splines, remove it.
16. Remove caliper.

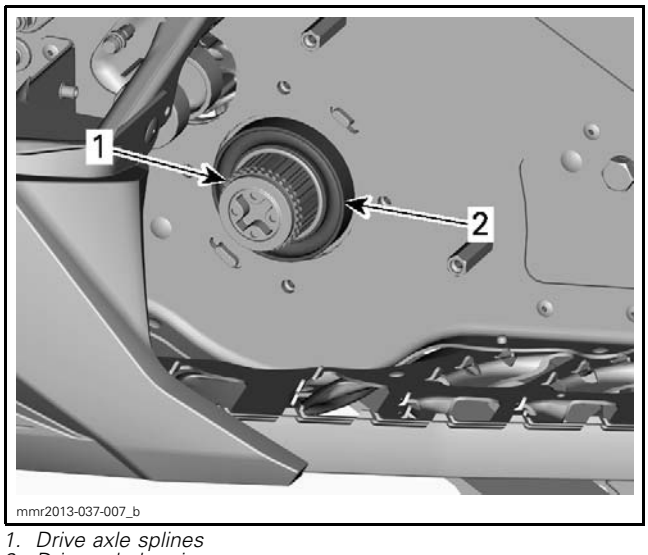
NOTICE **Do not let caliper hang by the hose and do not stretch or twist the hose.**

Caliper Inspection

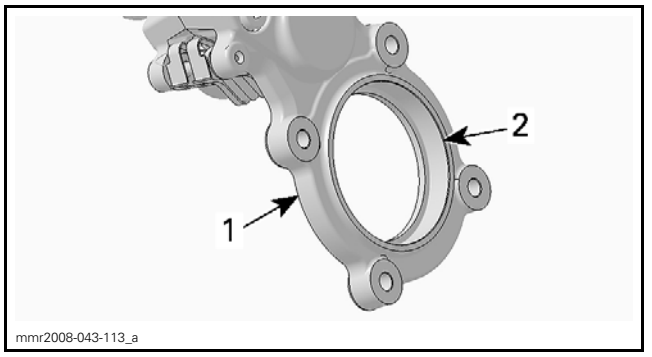
1. Check caliper pistons for:
   – Proper operation
   – Rust
   – Scratches
   – Leaks.
2. Check caliper bracket for:
   – Cracks
   – Rust on bearing shoulder (clean with a steel wood).
3. Replace caliper if required.

Caliper Installation

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.

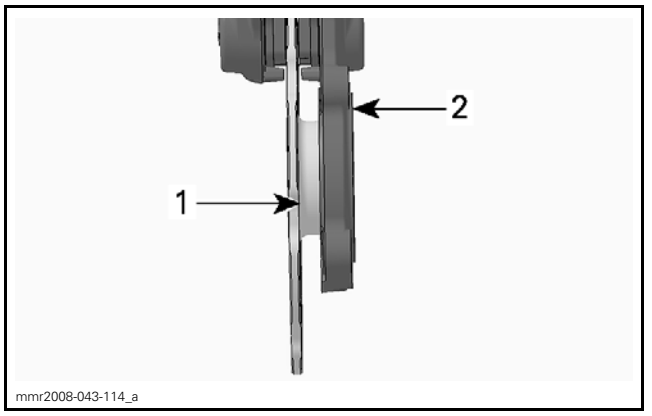


1. Drive axle splines
2. Drive axle bearing



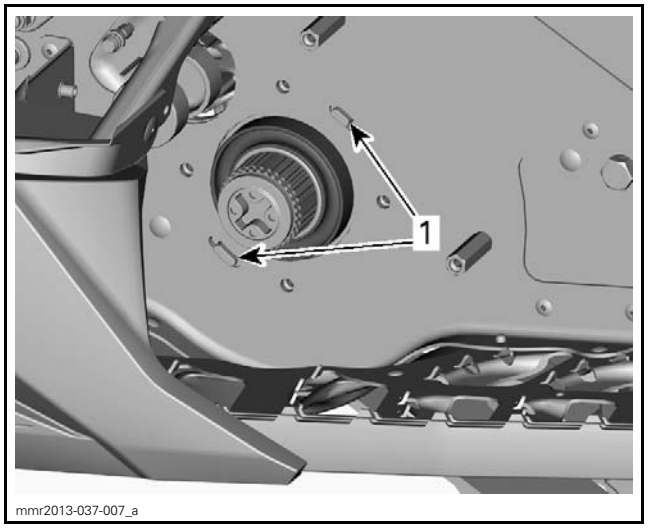
TYPICAL
1. Caliper bracket
2. Bearing shoulder

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

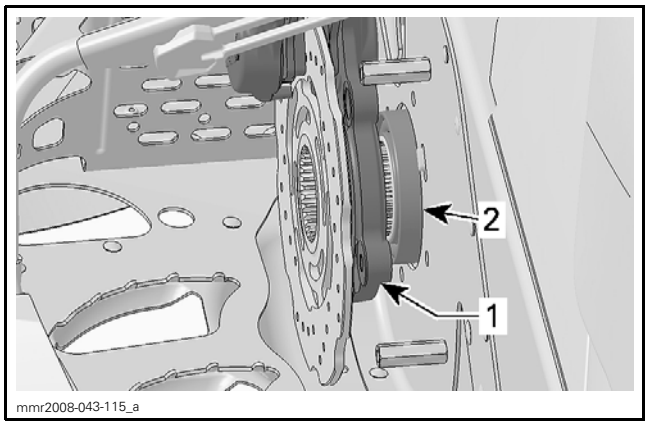
5. Ensure bearing flange is properly locked in the frame. Tabs must be properly inserted in frame slots.



VIEW FROM OUTSIDE FRAME
1. Bearing flange locking tabs

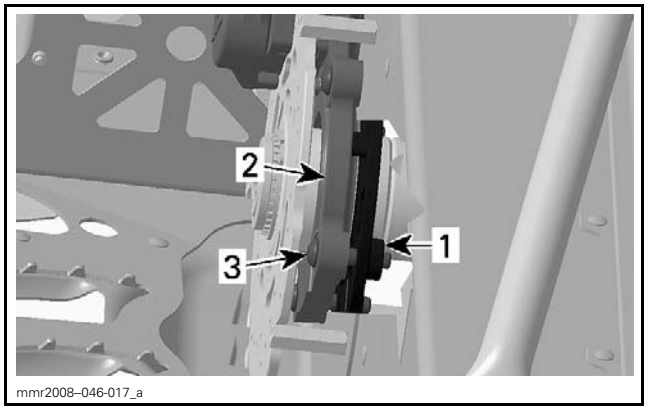
6. Align brake disc splines with drive axle splines and push brake disc onto drive axle.

7. Push the caliper bracket over the drive axle bearing.



TYPICAL
1. *Caliper bracket*
2. *Drive axle bearing*

8. Align caliper bracket holes with bearing flange holes and install caliper screws.



TYPICAL
1. *Bearing flange (inside frame)*
2. *Caliper bracket*
3. *Caliper screws*

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 *BRAKE PADS*, see procedure in this subsection.
11. Install brake disc circlip.
12. Torque brake caliper screws to 25 N•m (18 lbf•ft).
13. Apply brake fluid on Banjo fitting threads.
14. Install the Banjo fitting with two NEW sealing washers.
15. Torque Banjo fitting to 35 N•m (26 lbf•ft).
16. Fill and bleed the brake system. Refer to *BRAKE FLUID* in *MAINTENANCE* subsection.
17. Install all other removed parts.
18. Check the operation of the brake carefully before riding the snowmobile.

BRAKE DISC

Brake Disc Inspection (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)

Brake Disc Inspection (Removed)

1. Check brake disc splines and drive axle splines for wear or other damages. Replace defective parts.

Brake Disc Removal and Installation

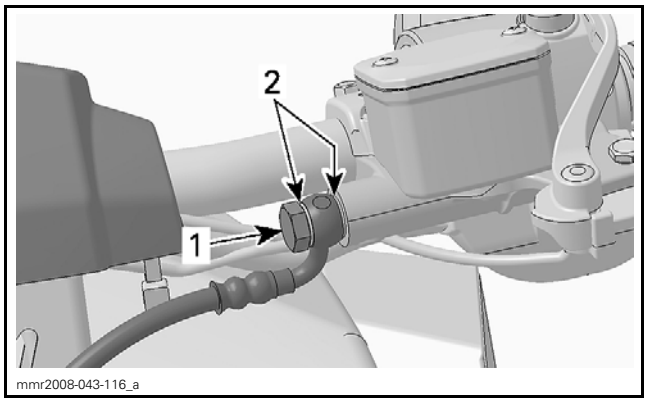
Follow procedures for caliper removal and installation.

MASTER CYLINDER

Master Cylinder Removal

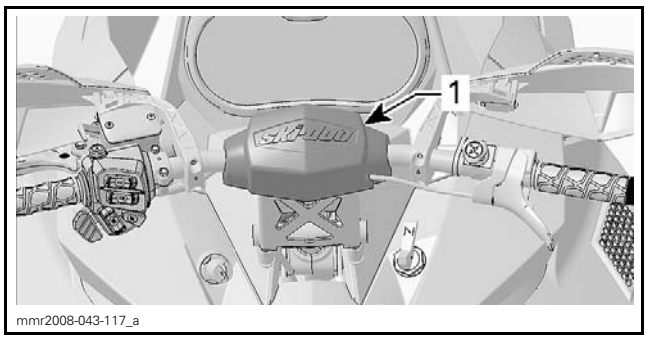
NOTE: If the master cylinder is not replaced, omit the steps concerning brake system draining and brake hose removal.

1. Drain brake system, refer to *BRAKE FLUID* in *PERIODIC MAINTENANCE PROCEDURES* subsection.
2. Remove the Banjo fitting and discard the sealing washers.



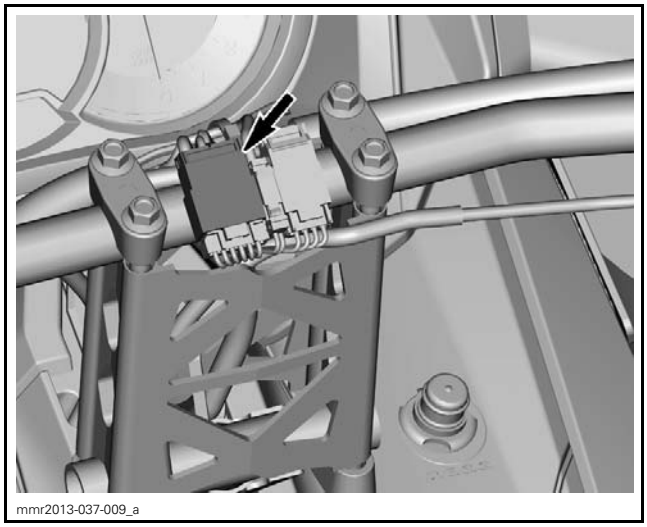
1. Banjo fitting
2. Sealing washers

3. Remove steering pad.



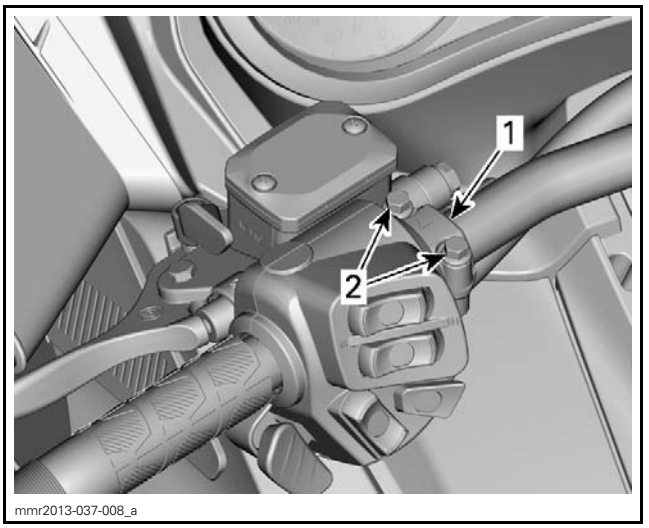
TYPICAL
1. Steering pad

4. Disconnect the LH steering connector.



TYPICAL

5. Cut locking tie securing brake light switch wiring to handlebar.
6. Remove screws and clamp securing master cylinder to handlebar.



1. Master cylinder clamp
2. Master cylinder clamp screws

7. Remove master cylinder.

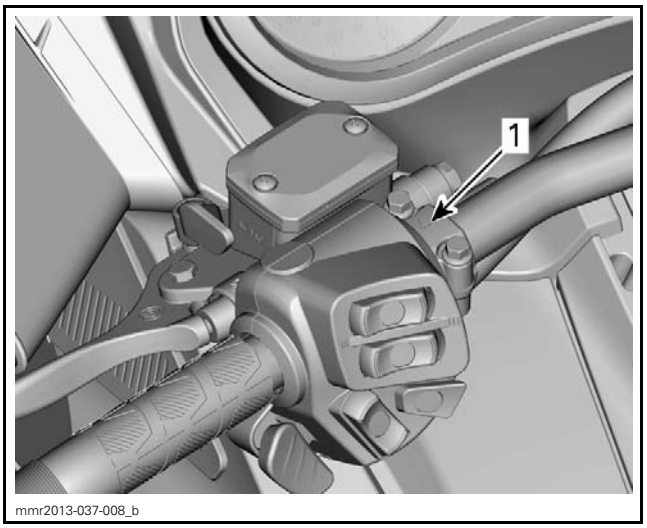
NOTICE **Do not let master cylinder hang by the hose and do not stretch or twist the hose.**

Master Cylinder Inspection

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.

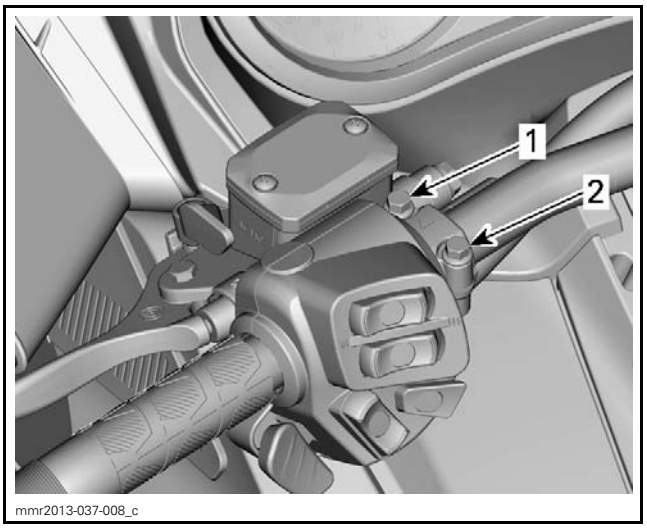
Master Cylinder Installation

1. Place the master cylinder on the handlebar.
2. Install master cylinder retaining clamp with its arrow pointing toward the front of vehicle.



1. Arrow on clamp

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. Torque master cylinder clamp screws to 10 N•m (89 lbf•**in**) in the sequence shown in the next illustration.



TYPICAL
Step 1: Torque this screw first
Step 2: Torque this screw last

6. Install the Banjo fitting with two **NEW** sealing washers.
7. Torque Banjo fitting to specification.

TIGHTENING TORQUE	
27 N•m (20 lbf•ft)	

8. Fill and bleed the brake system. Refer to *BRAKE FLUID* in *PERIODIC MAINTENANCE PROCEDURES* subsection.
9. Connect brake light switch connector.
10. Install steering cover.

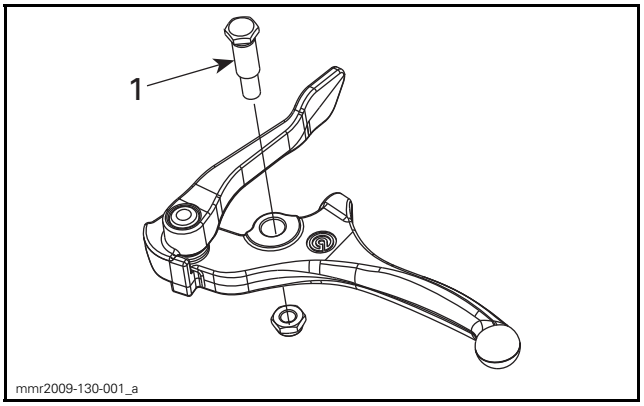
BRAKE LEVER

Brake Lever Lubrication

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.

Brake Lever Replacement

Lubricate brake lever pivot using XPS SYNTHETIC GREASE (P/N 293 550 010).



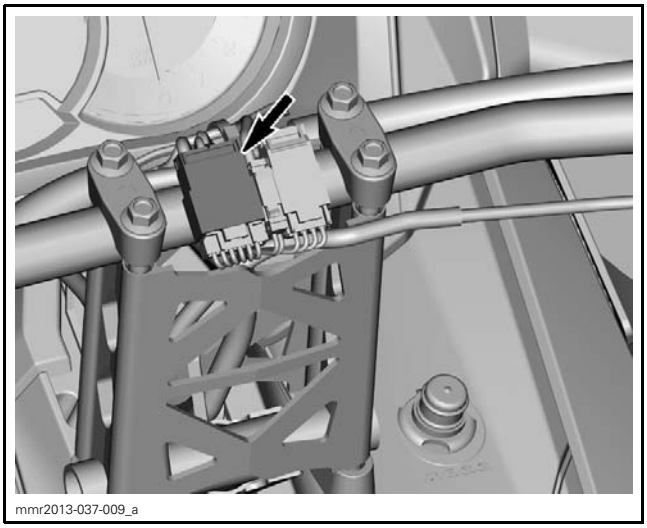
TYPICAL
1. Lubricate brake lever pivot

Torque pivot nut of brake lever to 6 N•m (53 lbf•**in**).

BRAKE LIGHT SWITCH

Brake Light Switch Resistance Test

1. Remove steering cover and disconnect the LH steering connector.



TYPICAL

2. Validate switch operation with an ohmmeter as follows.

STANDARD STEERING HARNESS AND RACING TYPE SWITCH		
SWITCH	WIRE	RESISTANCE
Released	Pin 4 and pin 5	Infinite (OL)
Squeezed and held		Close to 0 Ω

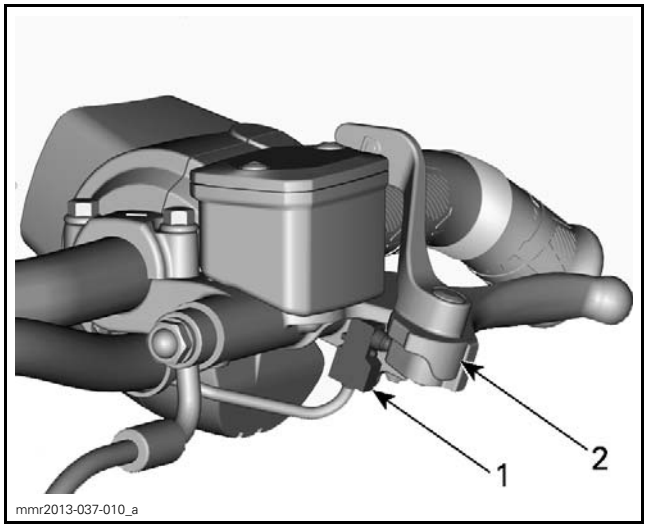
PREMIUM STEERING HARNESS		
SWITCH	WIRE	RESISTANCE
Released	Pin 3 and pin 4	Infinite (OL)
Squeezed and held		Close to 0 Ω

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).

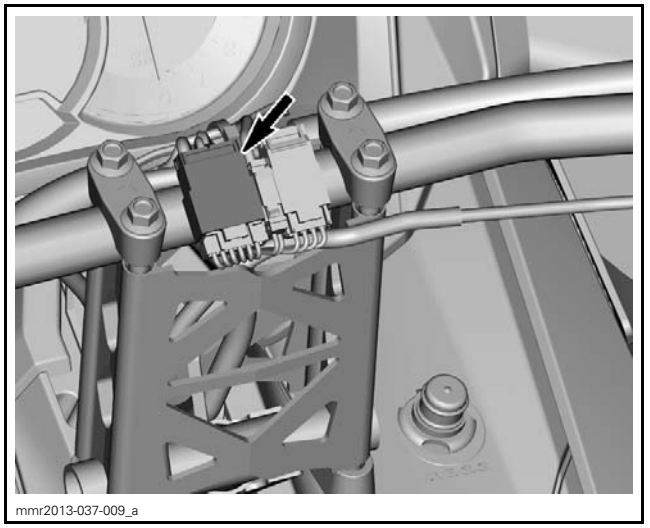
Brake Light Switch Removal

1. Slip a small screwdriver between brake light switch and brake lever and separate them.



1. Brake light switch
2. Brake lever

2. Remove the steering cover and unplug the LH connector.



3. Cut all locking ties securing switch wires.
4. Remove switch wires from connector.

NOTE: Check wires location for reinstallation.

Brake Light Switch Installation

1. Plug switch wires into connector as per following tables.

STANDARD STEERING HARNESS AND RACING TYPE SWITCH	
WIRE	CONNECTOR
GRAY	Pin 4
BROWN	Pin 5

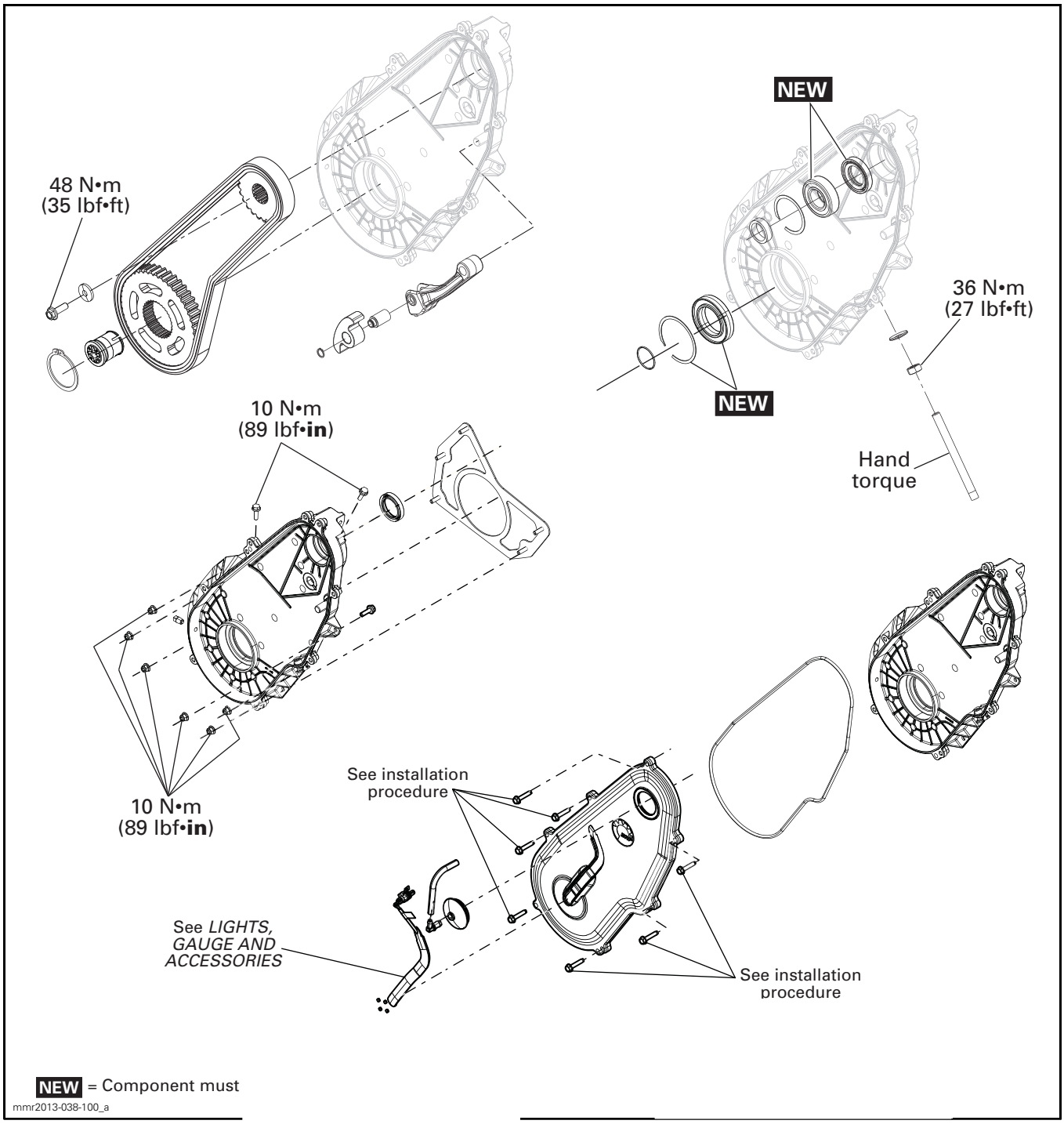
PREMIUM STEERING HARNESS	
WIRE	CONNECTOR
GRAY	Pin 4
BROWN	Pin 3

2. Squeeze brake lever.
3. Insert the both tabs of switch into brake lever body.
4. Plug the connector.
5. Check if switch is working properly.
6. Install new locking ties and the steering cover.

CHAINCASE

SERVICE TOOLS

SERVICE TOOLS – OTHER SUPPLIER


48 N•m
(35 lbf•ft)
NEW
36 N•m
(27 lbf•ft)
NEW
Hand
torque
10 N•m
(89 lbf•in)
10 N•m
(89 lbf•in)
See installation
procedure
See *LIGHTS, GAUGE AND ACCESSORIES*
See installation
procedure
NEW = Component must
mmr2013-038-100_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.**

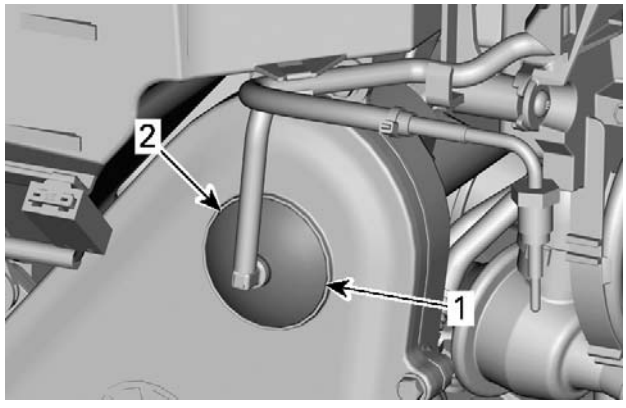
PROCEDURES

CHAINCASE

Chaincase Disassembly

Chaincase Cover Removal

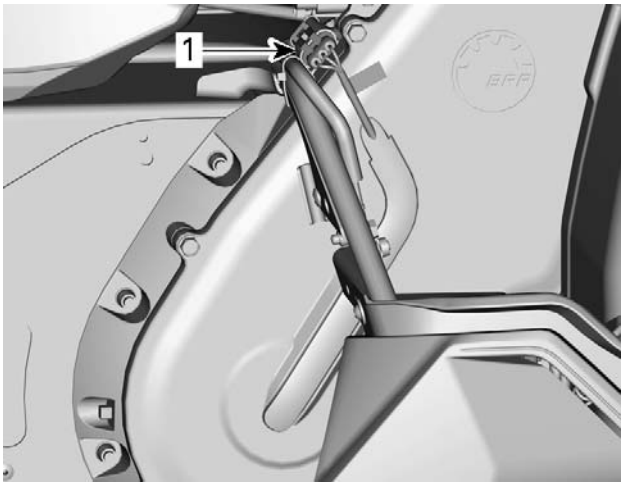
1. Apply parking brake.
2. Proceed with *MUFFLER REMOVAL*. Refer to *EXHAUST SYSTEM* subsection.
3. On electric start models, remove battery and battery rack. Refer to *CHARGING SYSTEM* subsection.
4. Remove filler plug on top of chaincase cover.



mmr2013-036-001_a

TYPICAL
1. *Filler plug*
2. *Chaincase cover*

5. Disconnect speed sensor connector.



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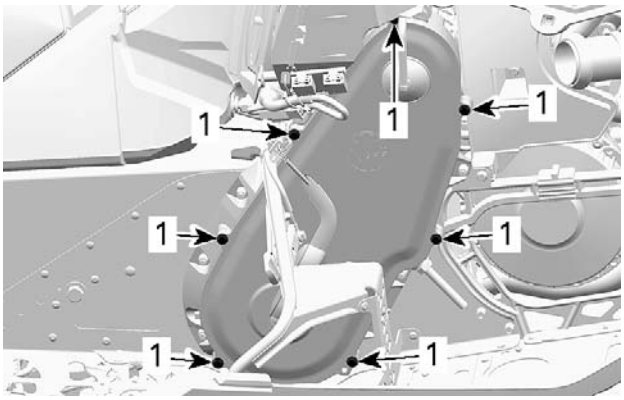
TYPICAL
1. *Speed sensor connector*

6. Place a container under vehicle in line with chaincase to catch chaincase oil.
7. Unscrew and remove chaincase cover screws.



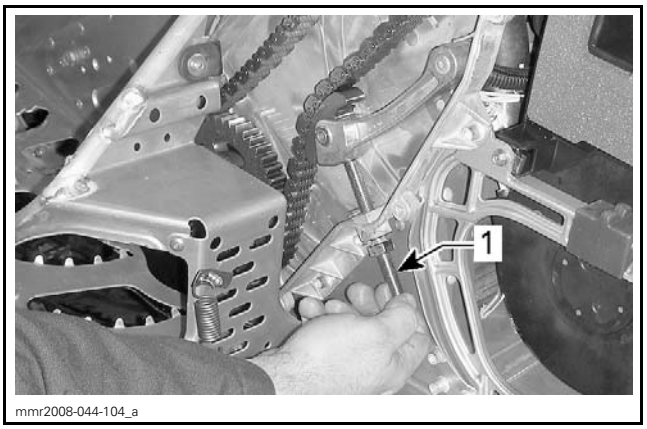
mmr2009-085-003_a

TYPICAL
1. *Chaincase cover screws*

8. Pull on bottom of chaincase cover to drain oil.
9. Wait a moment then remove the cover completely.

Chain Tensioner Removal

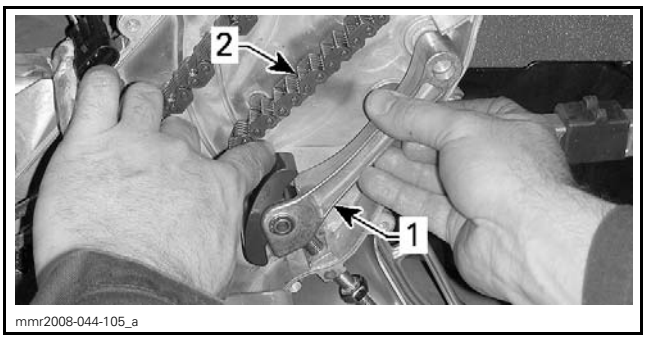
1. Release tension from drive chain by unscrewing the tensioner adjustment screw.



mmr2008-044-104_a

1. Tensioner adjustment screw

2. Remove tensioner arm.

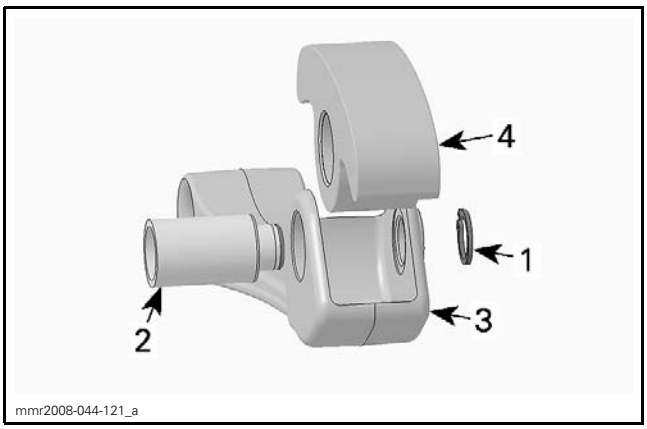


mmr2008-044-105_a

TYPICAL
1. Tensioner arm
2. Drive chain

NOTE: The following steps are required only if the tensioner or the slider is defective.

3. Remove the shaft ring securing the tensioner shaft to tensioner arm.
4. Remove the tensioner shaft to remove the slider.



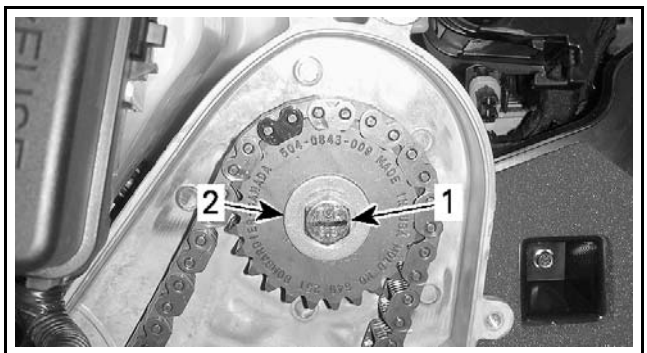
mmr2008-044-121_a

TYPICAL
1. Shaft ring
2. Tensioner shaft
3. Tensioner arm
4. Slider

Drive Chain and Sprocket Removal

NOTE: Prior to removing the drive chain, check the drive chain deflection.

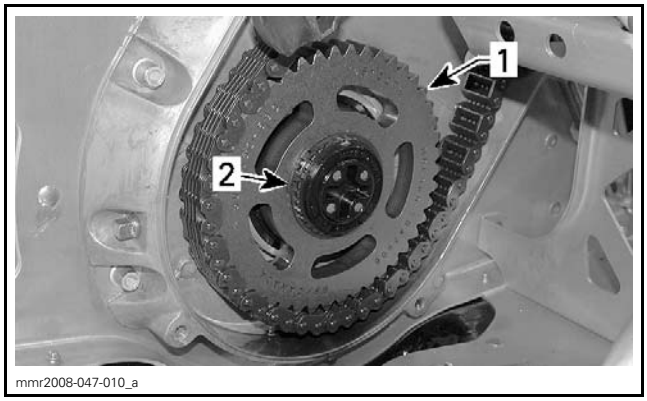
1. Remove the upper sprocket screw and its conical spring washer.



mmr2008-044-103_a

TYPICAL
1. Upper socket
2. Conical spring washer

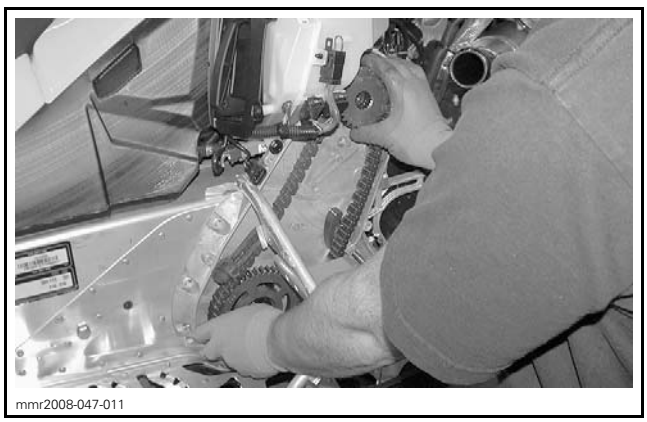
2. Remove the lower sprocket circlip.



mmr2008-047-010_a

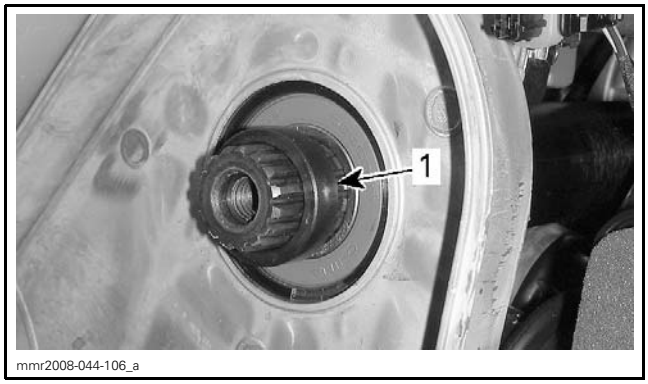
TYPICAL
1. Lower sprocket
2. Circlip

3. Remove the upper sprocket, lower sprocket and drive chain simultaneously.


mmr2008-047-011

TYPICAL

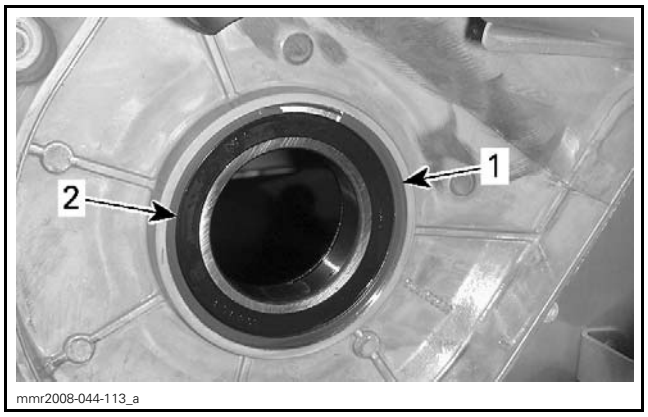
4. Remove the countershaft spacer.



1. Countershaft spacer

Chaincase Bearing Removal

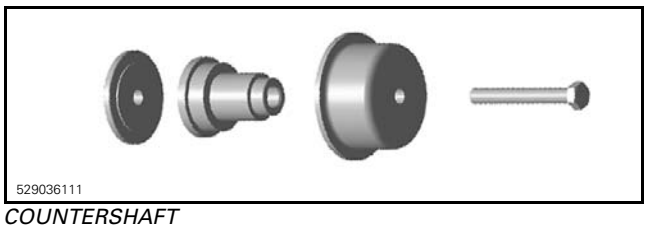
1. Remove countershaft or drive axle, depending which bearing is replaced. Refer to the appropriate subsection, *DRIVEN PULLEY AND COUNTERSHAFT* or *DRIVE AXLE*.
2. Remove snap ring securing bearing into chaincase.



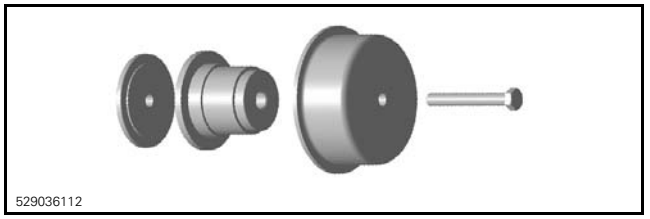
DRIVE AXLE BEARING SHOWN
1. Snap ring
2. Bearing

3. Install the appropriate bearing extractor:

BEARING	TOOL
Countershaft	BEARING PULLER/PUSHER (P/N 529 036 111)
Drive axle	BEARING PULLER/PUSHER (P/N 529 036 112)

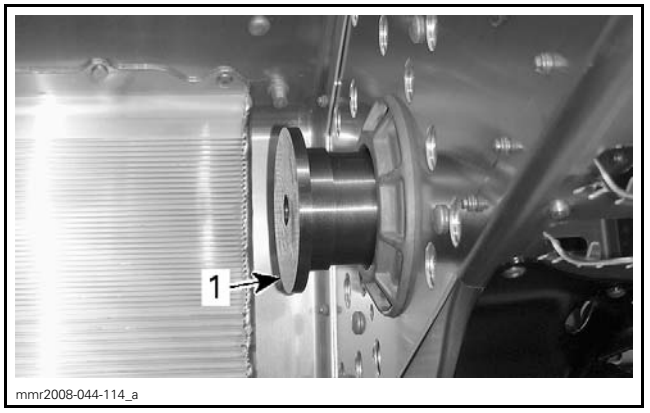


COUNTERSHAFT



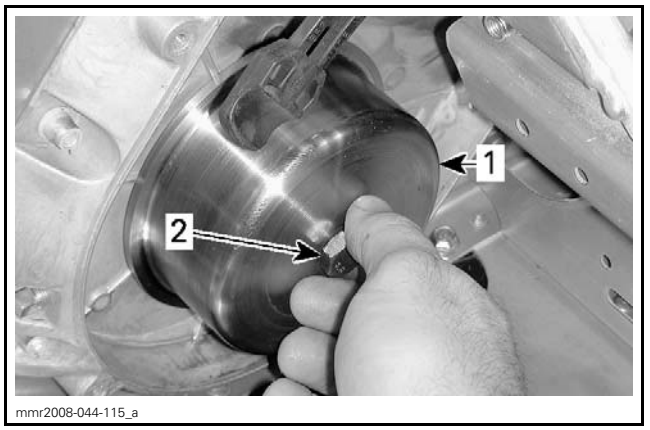
DRIVE AXLE

4. Install the extractor/installer tool behind the bearing.



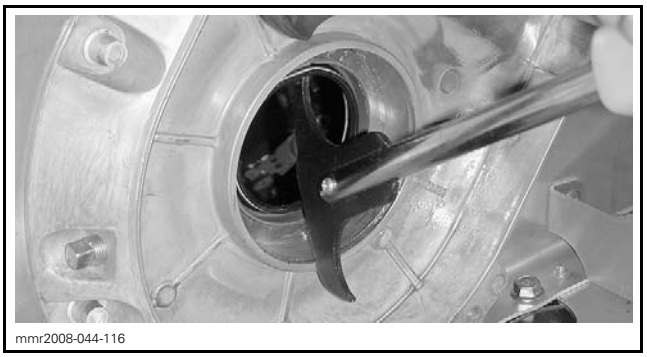
1. Extractor/installer tool

5. Install the extractor cup over bearing.
6. Tighten the extractor/installer tool screw to remove the bearing.



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.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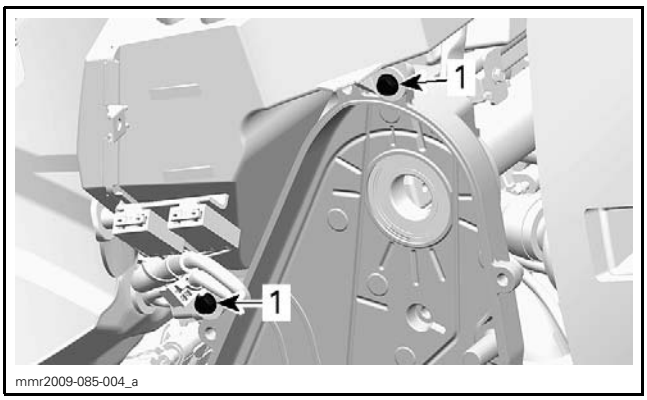
Chaincase Housing Removal

1. Proceed with *DRIVE AXLE REMOVAL*. Refer to *DRIVE AXLE* subsection.
2. Proceed with *COUNTERSHAFT REMOVAL*. Refer to *DRIVEN PULLEY AND COUNTERSHAFT* subsection.
3. Remove bolts securing the injection oil reservoir.



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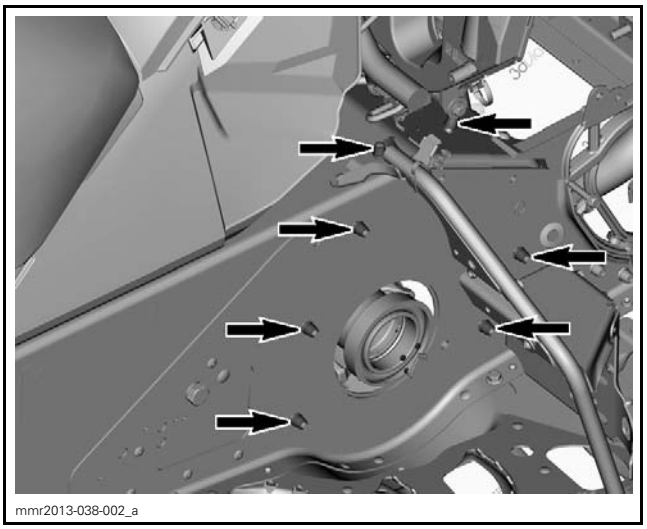
1. Reservoir retaining bolts

4. Remove the following Huck rivets. Refer to *FRAME* subsection for proper removal procedure.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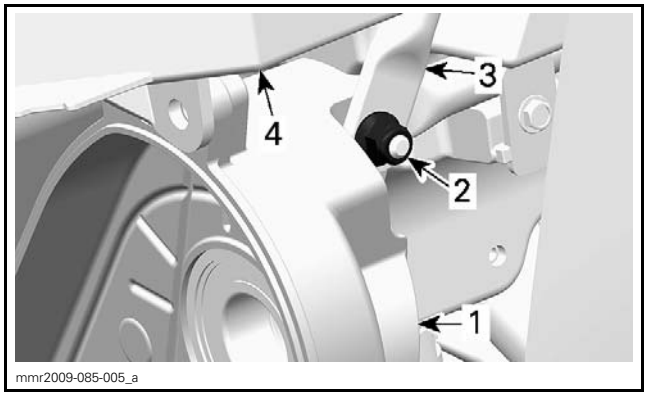
TYPICAL - SOME PARTS REMOVED FOR CLARITY

5. Unscrew bolt behind the top of chaincase.



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1. Chaincase
2. Retaining bolt
3. RH side frame member
4. Injection oil reservoir

6. Using 2 large pry bars inserted between chaincase and frame, pry chaincase out of vehicle.

Chaincase Inspection

Chaincase Cover Inspection

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.

Chain Tensioner Inspection

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.

Check rubber washer condition, replace as required.

Drive Chain and Sprockets Inspection

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.

Chaincase Bearing Inspection

Check for worn or defective bearings.

Chaincase Assembly

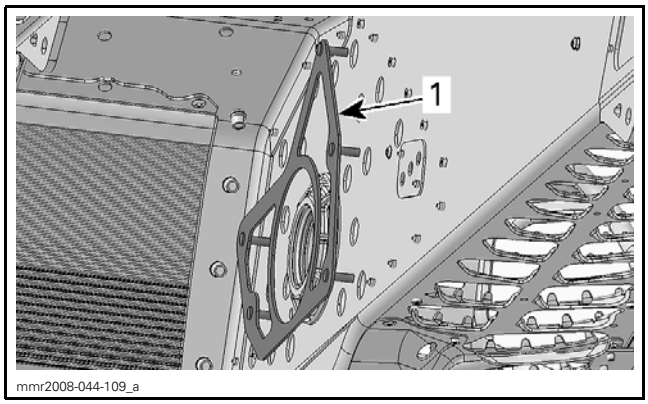
Chaincase Housing Installation

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	(P/N 518 325 816)
2	M6 x 20 hexagonal flanged bolt	(P/N 207 662 034)
8	M6 elastic flanged nut	(P/N 233 261 434)

Install the mounting plate on frame.

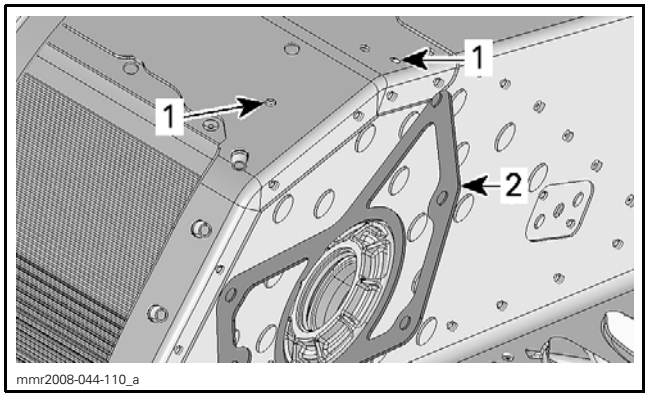


TYPICAL - UNDERNEATH FRAME
1. Mounting plate

Install 5 elastic flanged nuts to secure chaincase on mounting plate.

Bolts and nuts holding the chaincase must be installed loosely FIRST.

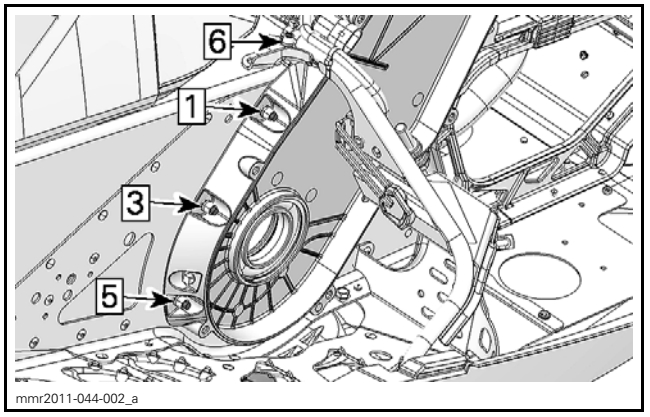
Install 2 flanged bolts and 2 elastic flanged nuts to secure chaincase on frame.



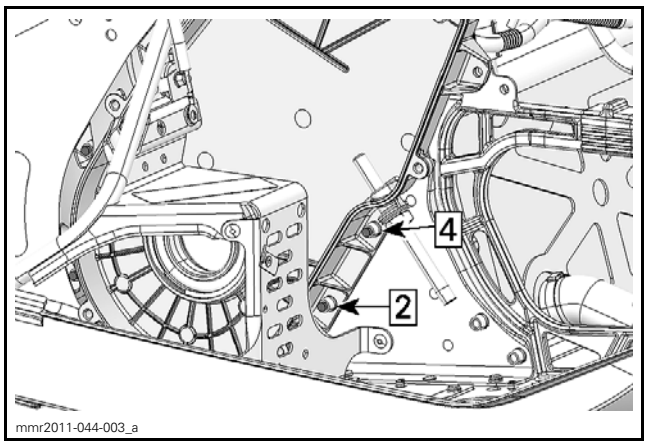
TYPICAL
1. Install bolt here (2x)
2. Mounting plate

Install bolt behind the top of chaincase.

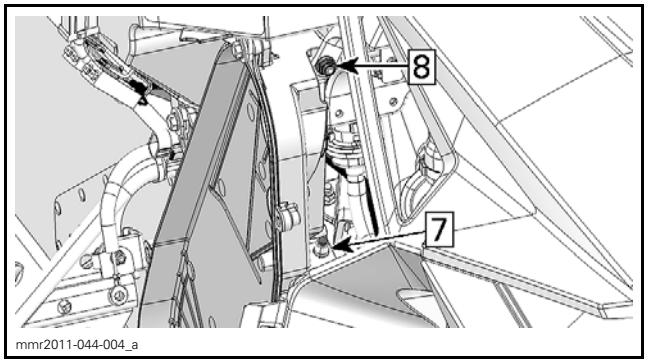
Using the following sequence, tighten all nuts to 10 N•m (89 lbf•**in**).



TYPICAL



TYPICAL



TYPICAL

Install all removed parts.

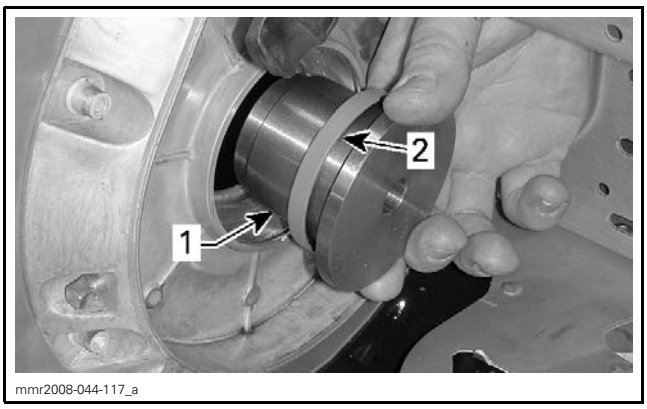
Proceed with *DRIVE CHAIN ADJUSTMENT*, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

Refill chaincase with recommended oil, refer to *CHAINCASE OIL REPLACEMENT* in *PERIODIC MAINTENANCE PROCEDURES* subsection.

Chaincase Bearing Installation

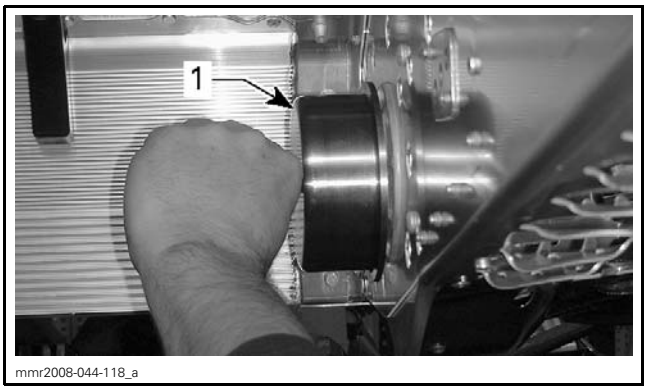
The installation is the reverse of the removal procedure. However, pay attention to the following.

Install the **NEW** oil seal on the extractor/installer tool. Position the lips toward bearing.



1. Extractor/installer tool
2. Oil seal lips on this side

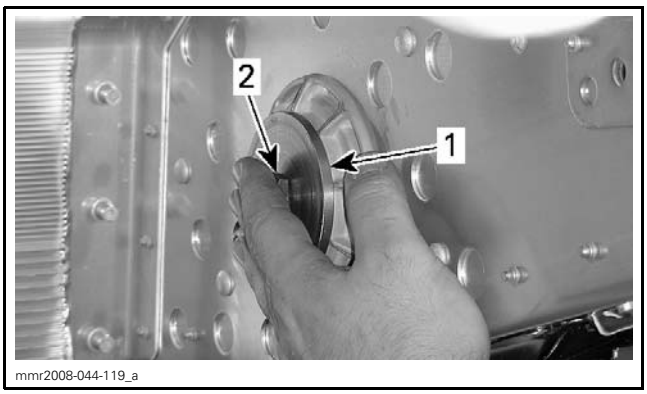
Install the extractor cup inside frame.



1. Extractor cup

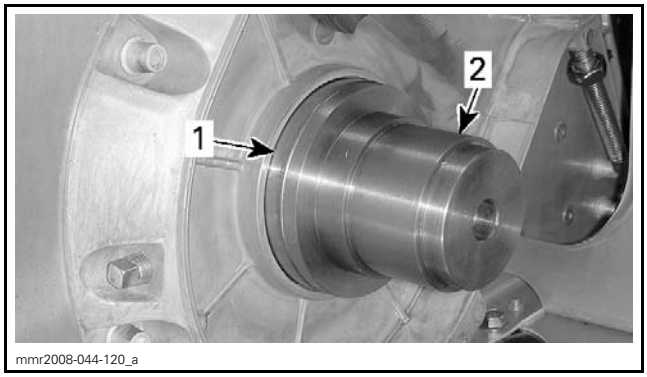
Tighten the extractor/installer tool screw to install the oil seal.

Install the large washer and the extractor/installer tool screw inside frame.



1. Large washer
2. Extractor/installer tool screw

In chaincase, install **NEW** bearing and the extractor/installer tool.



1. Bearing
2. Extractor/installer tool

Tighten the extractor/installer tool screw to install the bearing.

Drive Chain and Sprocket Installation

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 socket with its concave side toward sprocket.

Torque upper sprocket screw to 48 N•m (35 lbf•ft).

Chain Tensioner Installation

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.

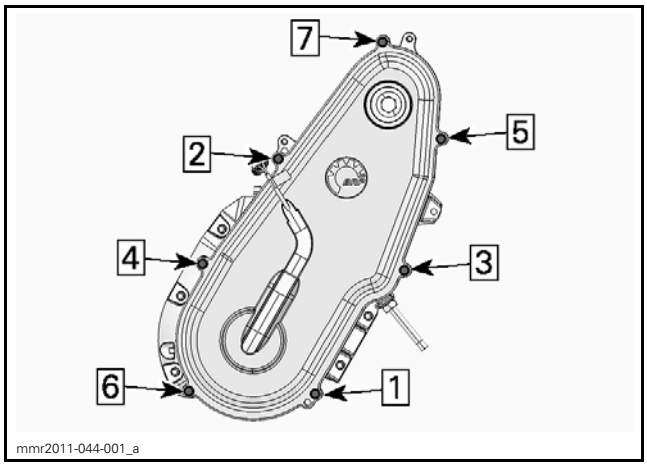
Proceed with *DRIVE CHAIN ADJUSTMENT*, see procedure in *PERIODIC MAINTENANCE PROCEDURES* subsection.

Chaincase Cover Installation

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

Ensure cover O-ring is positioned correctly in its groove.

Tighten chaincase cover screws in accordance with the following sequence.



CHAINCASE COVER SCREWS TORQUE	
SAME CHAINCASE	10 N•m (89 lbf•**in**)
NEW CHAINCASE	15 N•m (133 lbf•**in**)

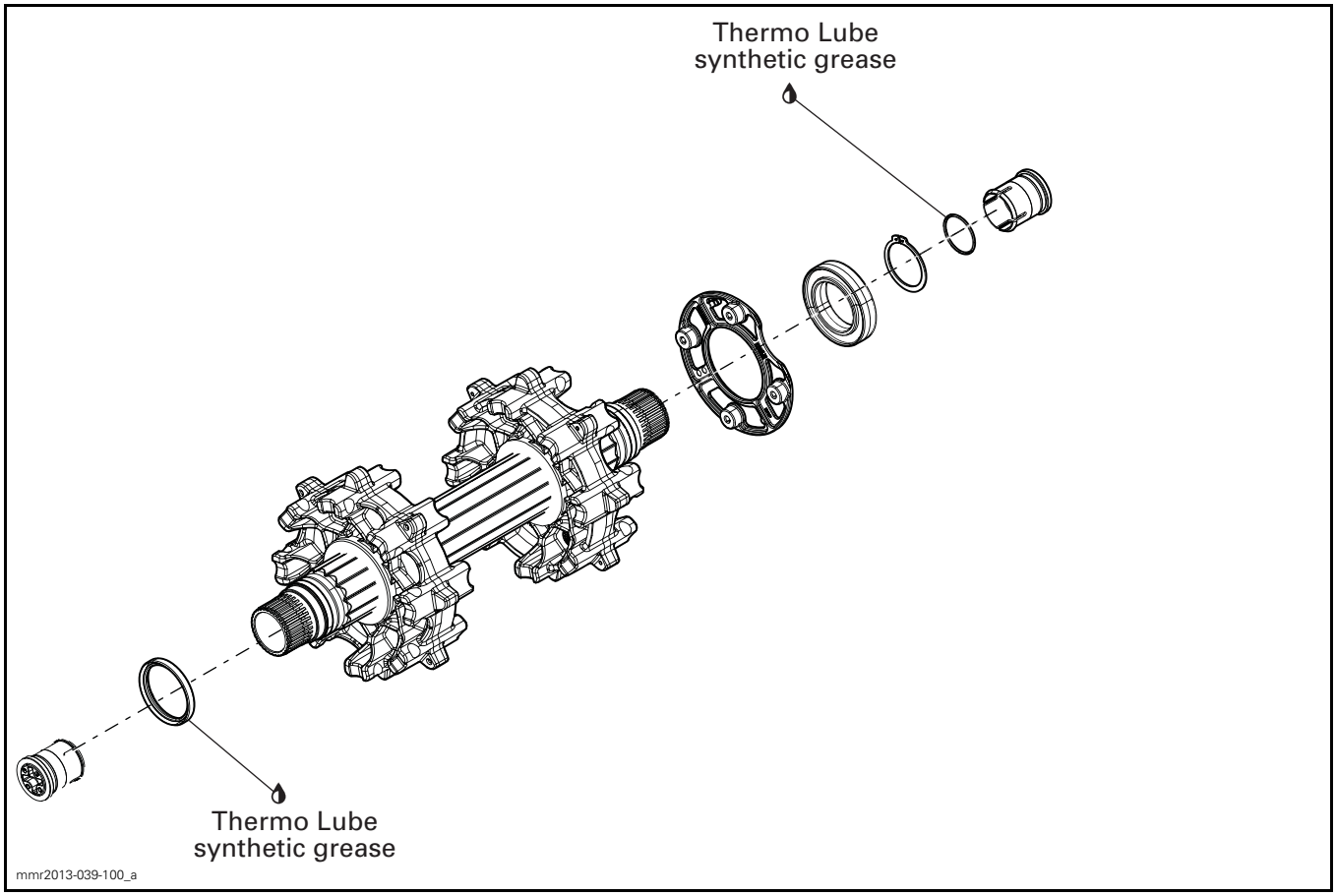
Refill chaincase with recommended oil, refer to *CHAINCASE OIL REPLACEMENT* in *PERIODIC MAINTENANCE PROCEDURES* subsection.

Reinstall all other removed parts.

DRIVE AXLE

SERVICE TOOLS – OTHER SUPPLIER

SERVICE PRODUCTS



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

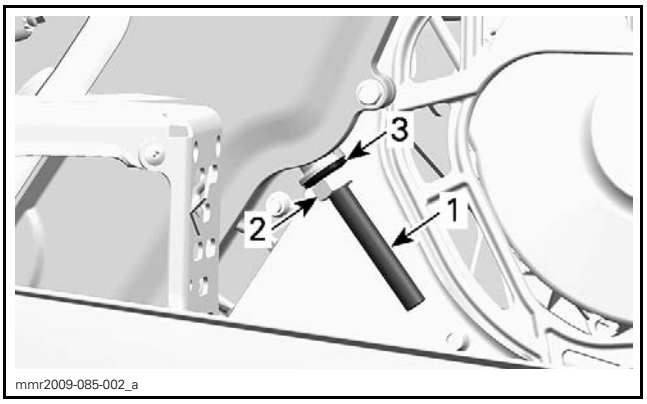
Torque wrench tightening specifications must be strictly adhered to.
Locking devices must be replaced with new ones when removed (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.).

PROCEDURES

DRIVE AXLE

Drive Axle Removal

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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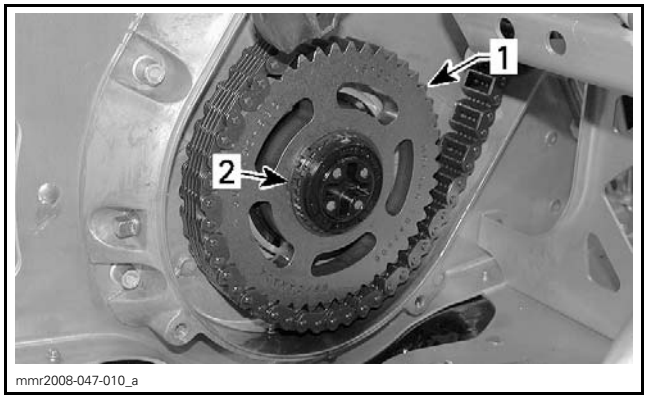
1. Tensioner adjustment screw
2. Lock nut
3. Washer with rubber surface

4. Remove the lower sprocket circlip.



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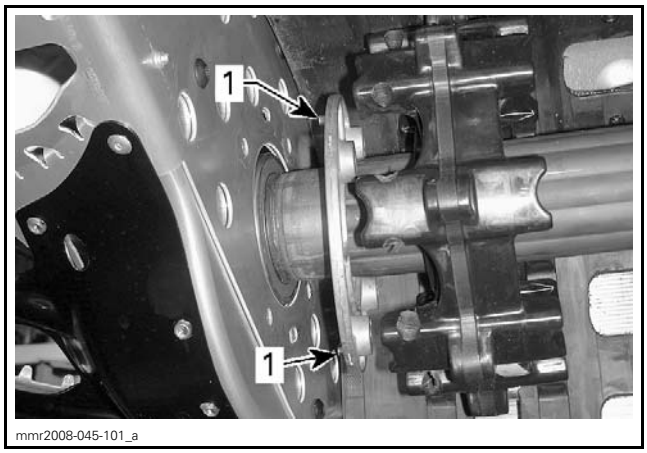
1. Lower sprocket
2. Circlip

5. Remove lower gear and drive chain.
6. Remove the caliper. Refer to *BRAKE* subsection.
7. From underneath of vehicle, turn the LH bearing flange counterclockwise to unlock it from frame.



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TYPICAL
1. Bearing flange locking tabs

8. Release drive axle sprockets from track and at the same time, push the drive axle toward the LEFT side.
9. Move the drive axle towards the right side to remove it from vehicle.

Drive Axle Inspection

Check if bearing turns smoothly and freely. Replace bearing if necessary.

Check if bearing seals are damaged. Replace bearing seals if necessary.

Check if the bearing flange is cracked, bent or otherwise damaged. Replace if required.

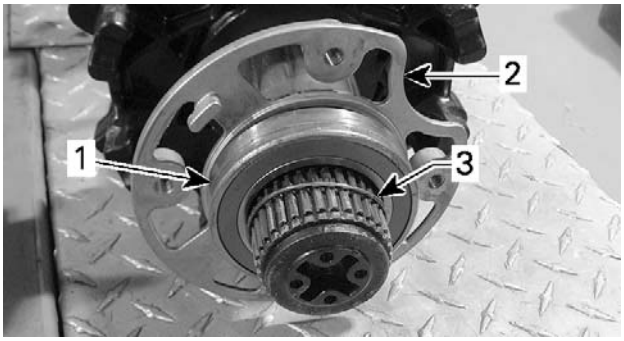
Replace drive axle if one of the following situations is detected:

– Cracked, worn or damaged drive axle
– Worn or damaged drive axle splines

– Worn or damaged sprockets
– Worn bearing journal.

Drive Axle Bearing Removal

1. Remove O-ring.



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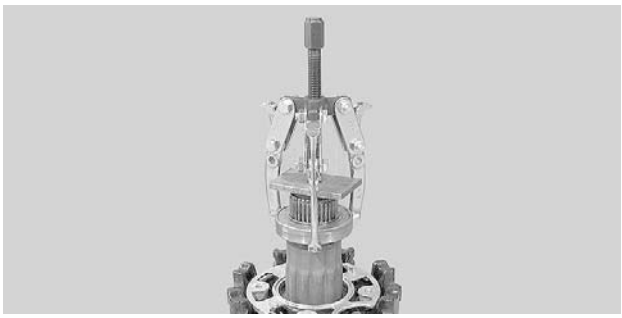
1. Drive axle bearing
2. Bearing flange
3. O-ring

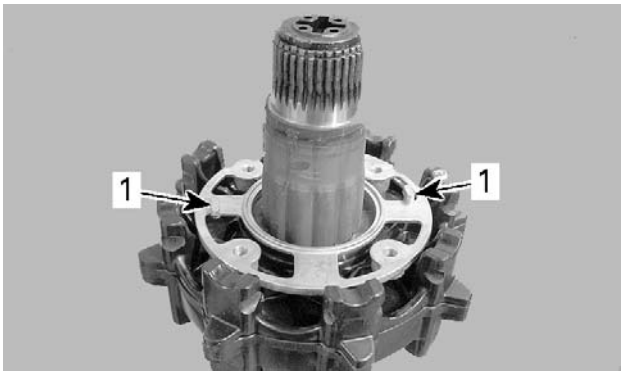
2. Using a 3-jaw puller such as the SNAP-ON 3-JAW PULLER (P/N CG273), remove the drive axle bearing.


mmr2008-045-104

3. Remove the bearing flange.

Drive Axle Bearing Installation

1. Install bearing flange on drive axle.



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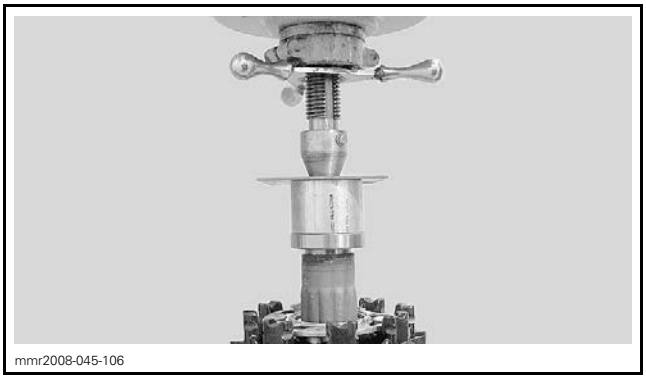
1. Locking tabs outwards

2. Using a press and a suitable pipe, push the bearing onto drive axel.

NOTICE **Always push the bearing by inner race.**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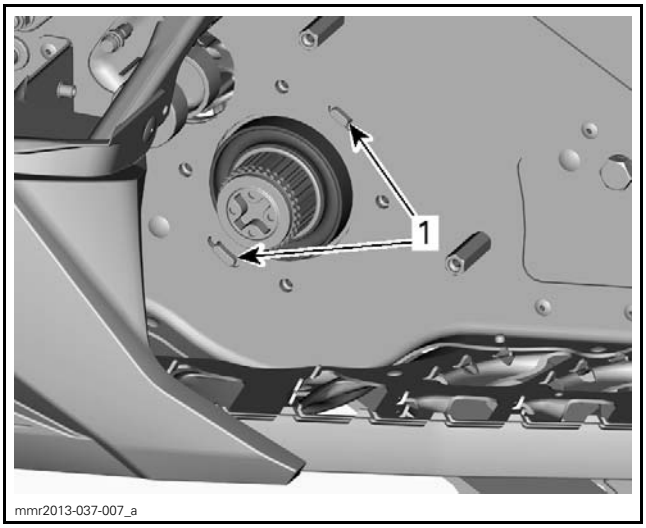
Drive Axle Installation

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

1. 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
1. Bearing flange locking tabs

2. Install the caliper and the disc brake. Refer to *BRAKE* subsection for the specific procedure.
3. Install all other removed parts. Refer to appropriate subsections.

MAGNETIC CAPS

Magnetic Cap Removal

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. Using two screwdrivers or pliers, pry or pull the magnetic cap out of drive axle end.
4. Discard the magnetic cap.

Magnetic Cap Installation

1. Apply SUSPENSION GREASE (P/N 293 550 033) on O-ring.
2. Insert NEW magnetic cap in drive axle.
3. Install all other removed parts.

TRACK

SERVICE TOOLS

Description	Part Number	Page
TRACK CLEAT INSTALLER	529 036 044	1

PROCEDURES

TRACK

Track Inspection

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
- Broken studs
- Bent studs
- Studs that are torn off the track
- 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.

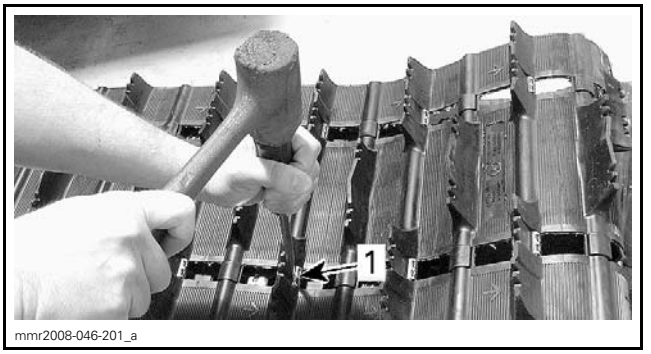
Track Cleat Replacement

Raise rear of vehicle off the ground.

Lift snow guard.

Rotate track to expose a cleat to be replaced.

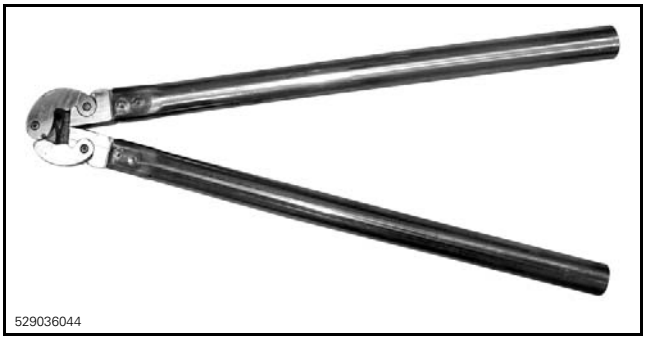
Remove cleat from track using plastic hammer and a big screwdriver.



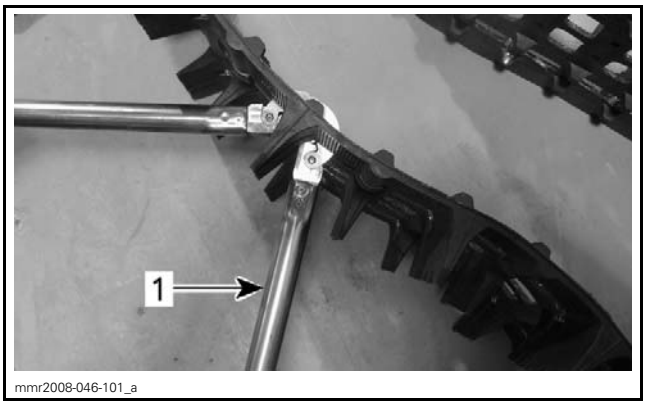
TYPICAL
1. Cleat

Place new cleat in position on the track.

Secure cleat using the 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.

Track Removal

Remove rear suspension from vehicle. Refer to *REAR SUSPENSION*.

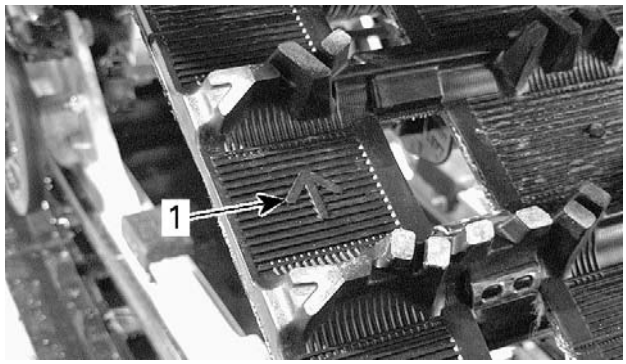
Remove drive axle, refer to *DRIVE AXLE* subsection.

Remove track.

Track Installation

Reverse the removal procedure.

NOTE: When installing the track, respect rotation direction indicated by an arrow on track thread.



1. Arrow pointing forwards

Track Adjustment and Alignment

Refer to *PERIODIC MAINTENANCE PROCEDURE* subsection to adjust and align the track.

TRACTION ENHANCING PRODUCTS (STUDS)

Important Safety Rules

All REV-XS tracks use special single ply of fabric track to reduce weight and rolling resistance. The conventional track design is a 2 layers of fabric and one layer of high strength tensile cord. These new tracks design is a single layer of fabric and one layer of tensile cord. This results in a thinner track and if studded, absolutely requires the use of the 286 Phantom series designed studs.

⚠ WARNING

REV-XS require special studs. Use only the 286 Phantom series studs and support plates on these tracks. The use of other kinds of studs on these tracks may cause risks of injuries.

⚠ WARNING

Installing an incorrect number of studs or an improper installation could reduce the track life and possibly resulting in serious injury or death.

⚠ WARNING

- **Never stud a track that has not been approved for studs. Installing studs on an unapproved track could increase the risk of the track tearing or severing, possibly resulting in serious injury or death. Approved tracks can be identified by a stud symbol molded into the track surface.**
- **Studs should only be installed in the locations indicated by molded bulges in the track surface.**
- **Never stud a track with a profile of 35 mm (1.378 in) or more.**
- **The maximum allowable stud penetration range is 6.4 mm to 9.5 mm (1/4 in to 3/8 in).**
- **The number of studs installed must match the number of molded bulges in the track.**
- **Strictly adhere to the specified tightening torque.**

⚠ WARNING

To prevent serious injury to individuals near the snowmobile:

- **NEVER stand behind or near a moving track.**
- **ALWAYS use a wide-base snowmobile stand with a rear deflector panel.**
- **When the track is raised off the ground, only run it at lowest possible speed.**

Centrifugal force could cause debris, damaged or loose studs, pieces of torn track, or an entire severed track to be violently thrown backwards out of the tunnel with tremendous force, possibly resulting in the loss of a leg or other serious injury.

Effects of Having a Studded track on the Life of the Snowmobile

The use of traction enhancing products can increase the load and the stress on certain snowmobile components, as well as the vibration level. This can cause premature wear on parts such as belts, brake lining, bearings, chain, and chaincase sprockets, and on approved studded tracks, shorten track life. For this reason, it is even more

important to follow the detailed maintenance program given in the *PERIODIC MAINTENANCE SCHEDULE*.

Studs on the track can also cause serious damage to the snowmobile if it is **not equipped** with the tunnel protectors designed for the particular model. Damage to the electrical wiring or perforation of the heat exchangers are potential hazards, that could cause the engine to overheat and be severely damaged.

⚠ WARNING

If tunnel protectors are excessively worn or not installed, the gas tank could be punctured, causing a fire.

Studs and Track Inspection

A visual inspection of the track should be performed before each use. Refer to *TRACK INSPECTION*.

Replace broken or damaged studs immediately. If the track shows signs of deterioration, it must be replaced immediately. In doubt, replace the track.

⚠ WARNING

Riding with a damaged track or studs could lead to loss of control, resulting in a risk of serious injury or death.

Stud Installation Tables

Use the following table for appropriate size and quantity of studs.

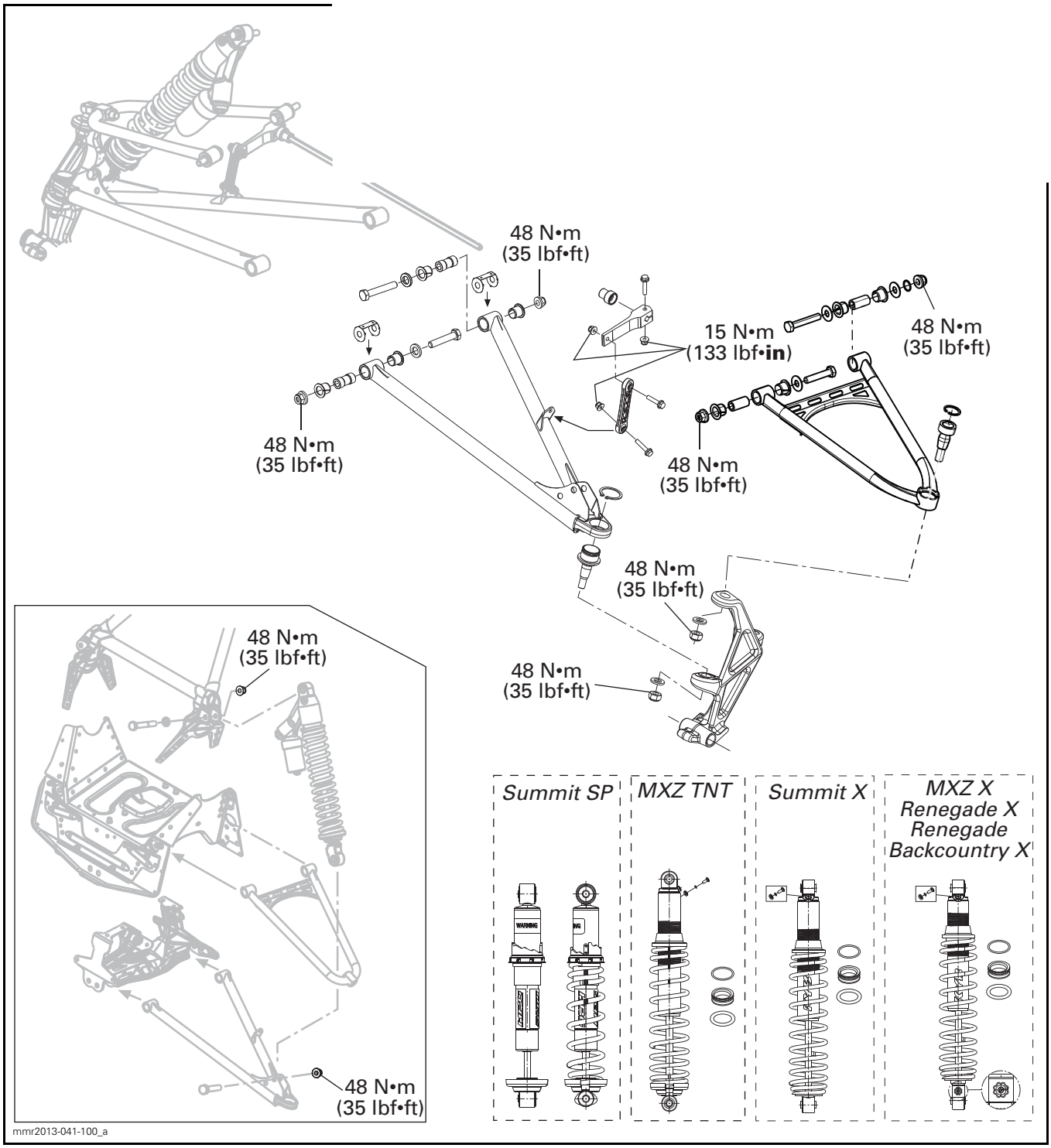
APPROVED STUDS ACCORDING TO TRACK LUG HEIGHT

LUG HEIGHT	STUD SIZE	QTY OF STUDS FOR A 120″ TRACK	QTY OF STUDS FOR A 137″ TRACK
25.4 mm (1 in)	1.075 in	84	96
31.75 mm (1-1/4 in)	1.325 in	84	96

Ensure installed track is compatible with stud kit. Refer to proper studs application publication on *BOSSWEB*.

FRONT SUSPENSION

SERVICE TOOLS


48 N•m
(35 lbf•ft)
15 N•m
(133 lbf•in)
48 N•m
(35 lbf•ft)
48 N•m
(35 lbf•ft)
48 N•m
(35 lbf•ft)
48 N•m
(35 lbf•ft)
48 N•m
(35 lbf•ft)
48 N•m
(35 lbf•ft)
Summit SP
MXZ TNT
Summit X
MXZ X
Renegade X
Renegade
Backcountry X
mmr2013-041-100_a

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

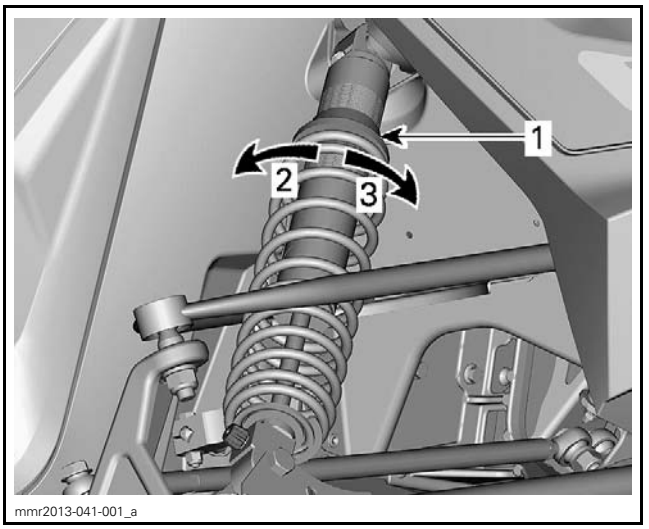
⚠ WARNING

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

Ring Type Adjustment

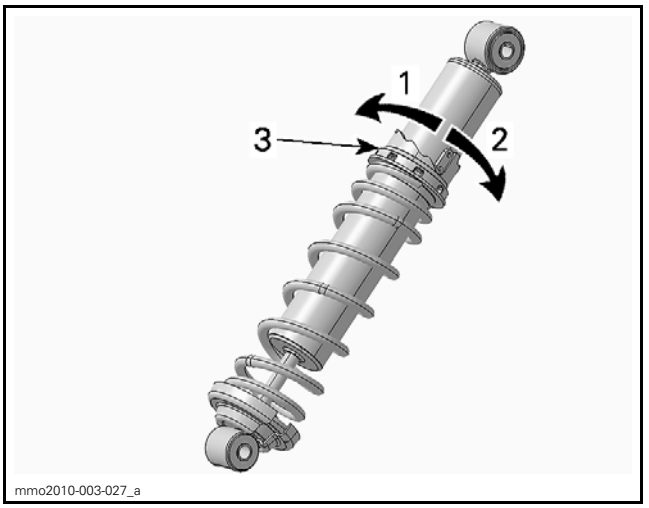
Grab and turn the spring to increase or decrease spring preload.



TYPICAL - RING TYPE
1. *Spring preload adjustment ring*
2. *Increase preload*
3. *Decrease preload*

Cam Type Adjustment

Using the suspension adjustment tool (included in the vehicle tool kit), turn the cam to increase or decrease spring preload.



HPG SHOCK ABSORBER
1. *Decrease preload*
2. *Increase preload*
3. *Spring preload adjustment cam*

SHOCK ABSORBER

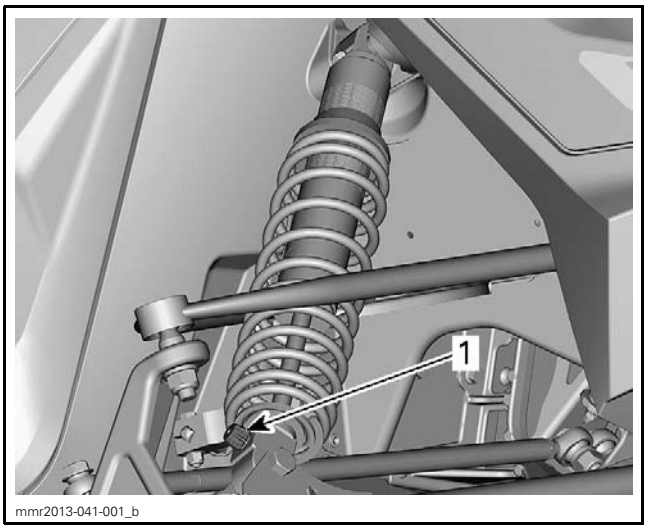
Shock Absorber Rebound Damping

HPG Plus R only

Rebound damping controls how the shock absorber restrains the extension stroke.

ACTION	RESULT
Increasing rebound damping force	Firmer rebound damping (slower extension) More efficient on large bumps
Decreasing rebound damping force	Softer rebound damping (faster extension) More efficient on small repetitive bumps

NOTE: In repetitive short small bumps (ripple), it is recommended to use a lower rebound damping setting.



1. Rebound adjuster knob

PROCEDURES

SHOCK ABSORBER

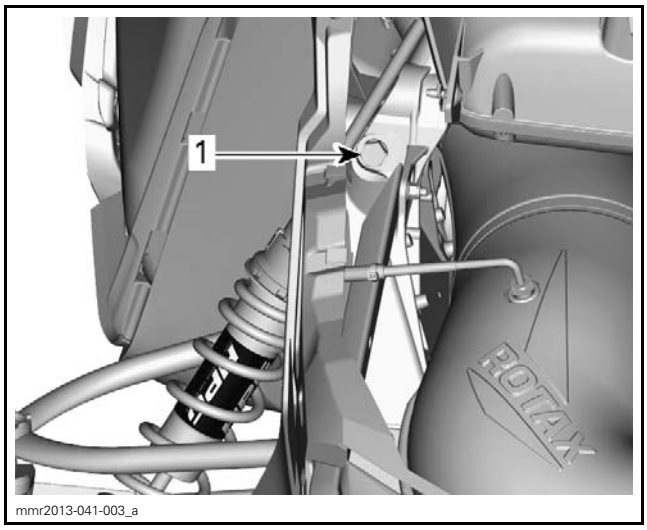
Shock Absorber Removal

Refer to *BODY* section to remove the following:
- Upper body module
- Side panel(s)
- Bottom pan cover.

To remove the RH shock absorber, remove the muffler. Refer to *EXHAUST SYSTEM* section.

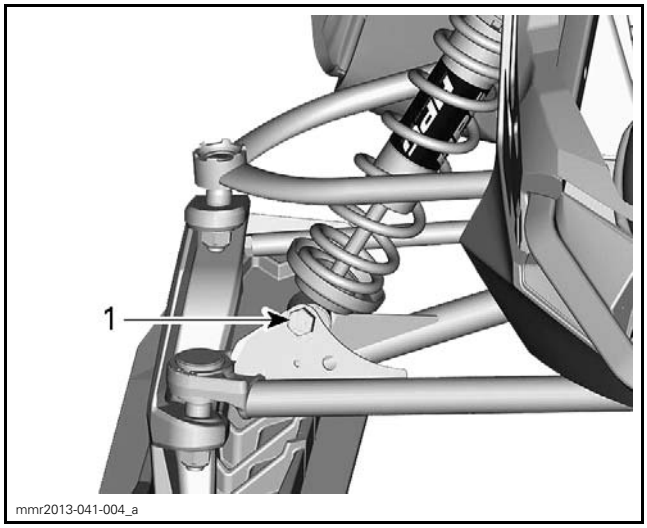
Lift the front of vehicle until skis are off the ground.

Remove the shock absorber upper bolt.



1. LH shock absorber upper bolt

Remove the shock absorber lower bolt.



1. Lower bolt

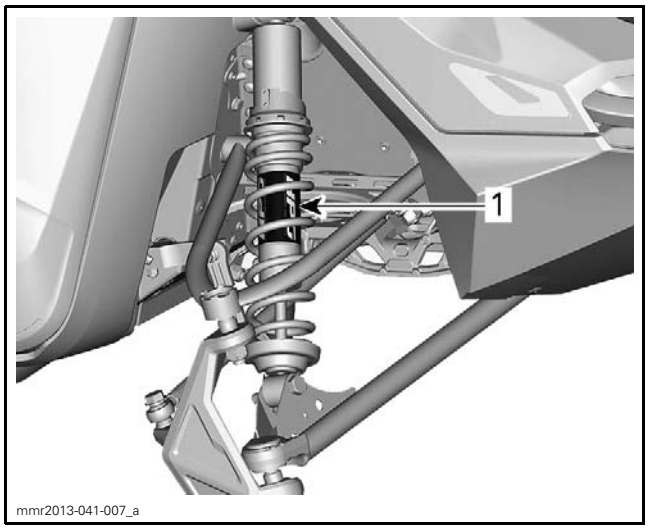
Remove the shock absorber.

Shock Absorber Inspection

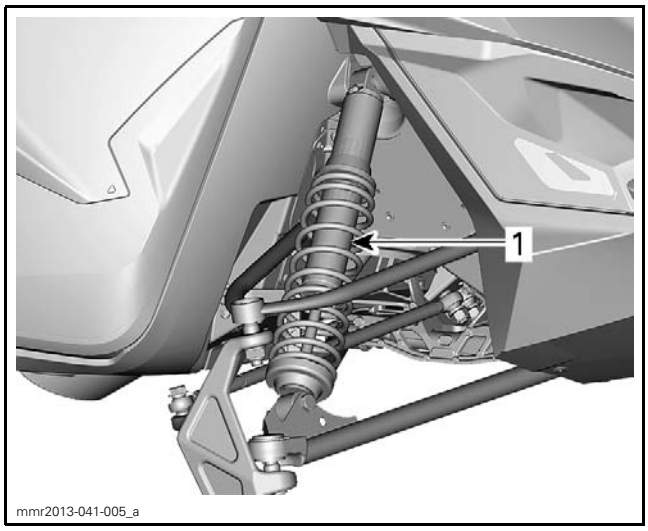
Refer to *REAR SUSPENSION (RMOTION)* subsection.

Shock Absorber Installation

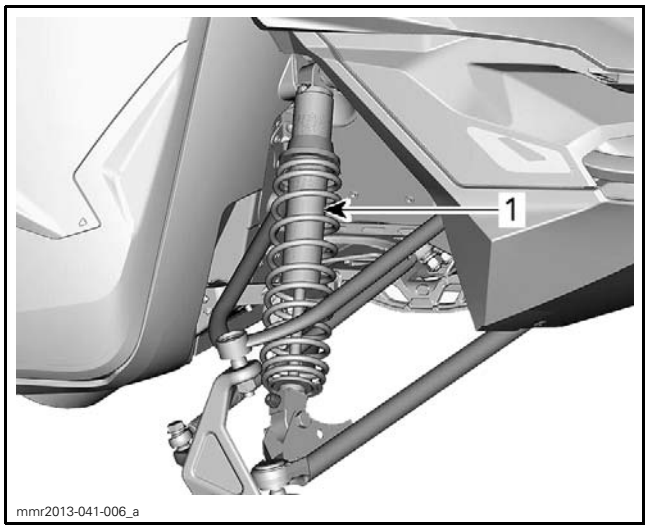
For installation, reverse the removal procedure, however, pay attention to the layout.



HPG
1. Body up, decal gap toward the inside



HPG PLUS
1. Body up

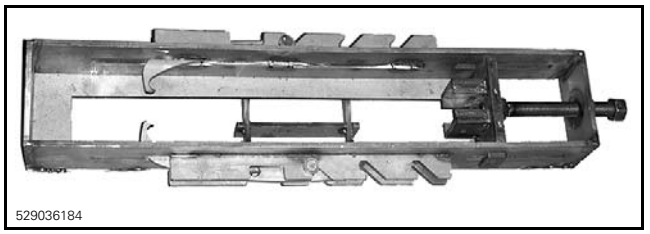


HPG PLUS R
1. Body up

SPRING

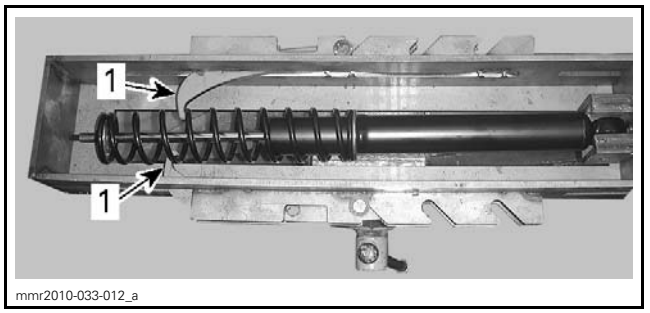
Spring Removal

1. Secure the SPRING COMPRESSOR (P/N 529 036 184) in a vise.



SPRING COMPRESSOR

2. Position the shock absorber in the tool and install the spring compressor hooks.



TYPICAL
1. Spring compressor hooks

3. Tighten the spring compressor tool screw until the spring is sufficiently compressed to remove spring stopper.
4. Release the spring compressor tool screw.
5. Remove spring from shock absorber.

Spring Inspection

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.

Spring Installation

For installation, reverse the removal procedure.

UPPER SUSPENSION ARM

Upper Suspension Arm Inspection

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.

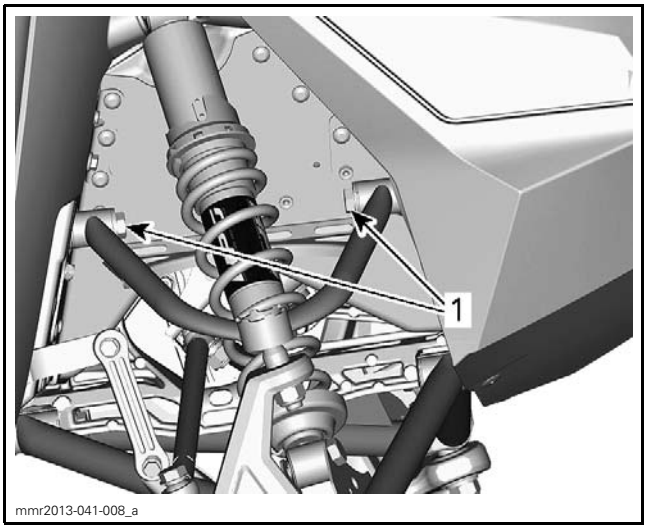
4. Lower vehicle to the ground.
5. Move suspension up and down.
6. There should be no noticeable looseness. Replace bushings and/or sleeves if necessary.

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.

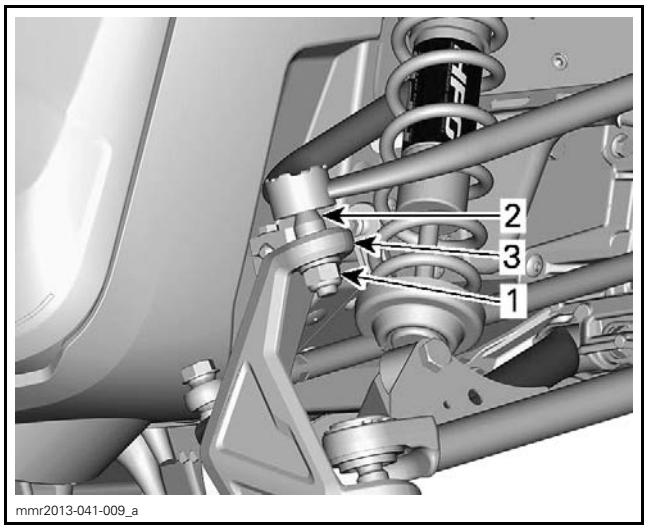
Upper Suspension Arm Removal

1. Lift the front of vehicle until skis are off the ground.
2. Remove muffler and tuned pipe. Refer to *EXHAUST SYSTEM* section.
3. Remove shock absorber upper bolt. See procedure in *SHOCK ABSORBER REMOVAL* in this section.
4. Remove the upper suspension arm bolts.



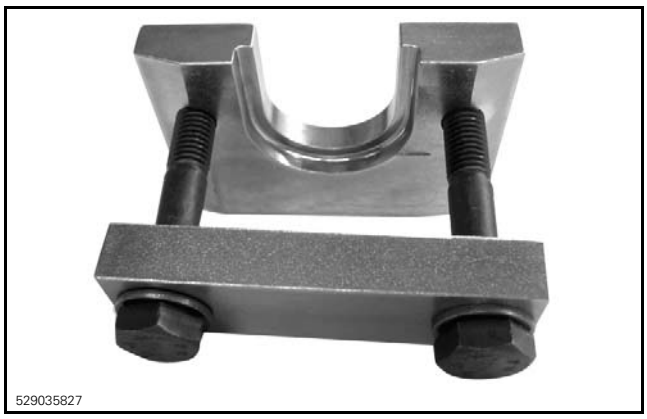
1. Upper suspension arm bolts

5. Detach ball joint from ski leg as follows.
   5.1 Remove nut securing ball joint to ski leg.



PRESS-FITTED BALL JOINT LAYOUT
1. Ball joint nut
2. Ball joint
3. Ski leg

   5.2 Install the BALL JOINT EXTRACTOR (P/N 529 035 827) and detach ball joint from ski leg.



6. Remove upper suspension arm.

Upper Suspension Arm Installation

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

Ensure suspension arm ball joint socket is parallel to ski leg tab.

NOTE: Interchanging right and left ball joint sockets would result in them not being parallel.

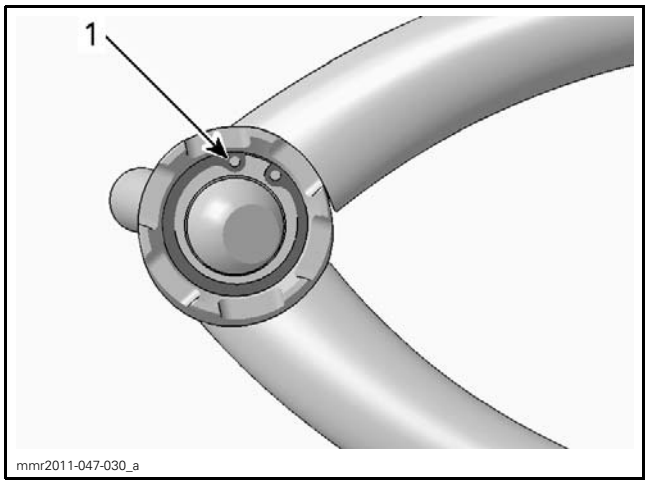
UPPER BALL JOINT

Upper Ball Joint Inspection

Check both upper ball joints for damage, pitting, looseness and roughness. If so, replace with a new one.

Upper Ball Joint Removal

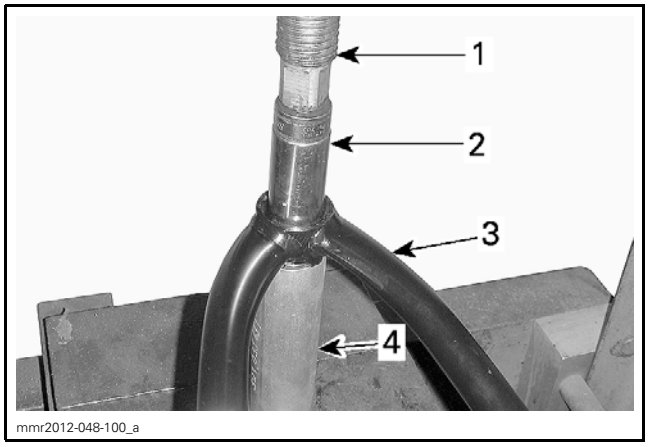
1. Remove the *UPPER SUSPENSION ARM*, see procedure in this subsection.
2. Remove circlip securing ball joint to suspension arm.



1. Circlip

3. Press ball joint out of the suspension arm.

REQUIRED TOOLS
Shop press
SUSPENSION ARM SUPPORT (P/N 529 035 637) 
Suitable socket



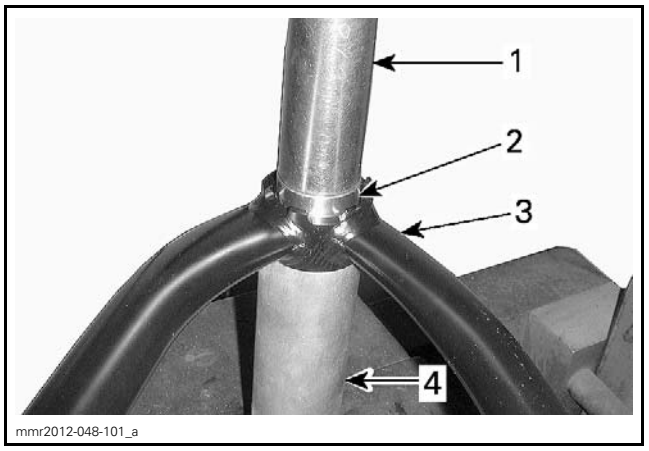
TYPICAL
1. Press rod
2. Socket
3. Suspension arm
4. Suspension arm support (P/N 529 035 637)

Upper Ball Joint Installation

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

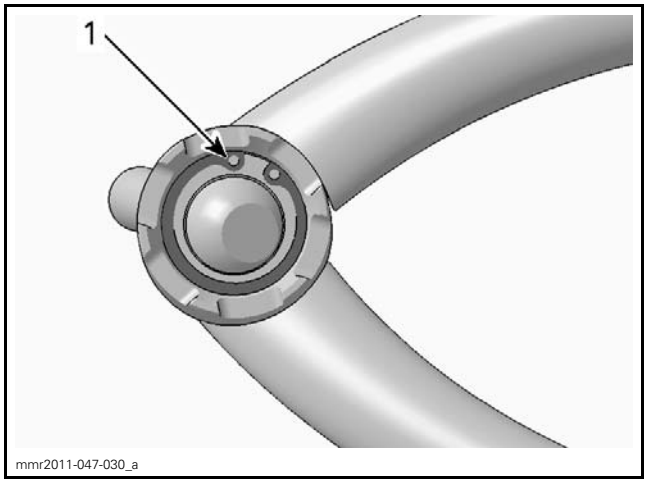
1. Press ball joint into the suspension arm.

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.



1. Circlip

LOWER SUSPENSION ARM

Lower Suspension Arm Inspection

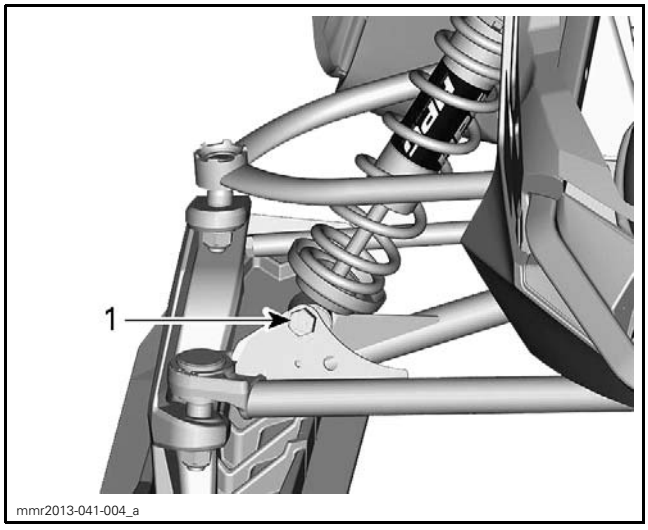
1. Check suspension arm for distortion or damage. Replace if necessary.
2. Lift the front of vehicle until skis are off the ground.
3. Detach shock absorber and stabilizer bar link from lower suspension arm.
4. Move suspension arm from side to side.
5. Lower vehicle to the ground.
6. Move suspension 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.

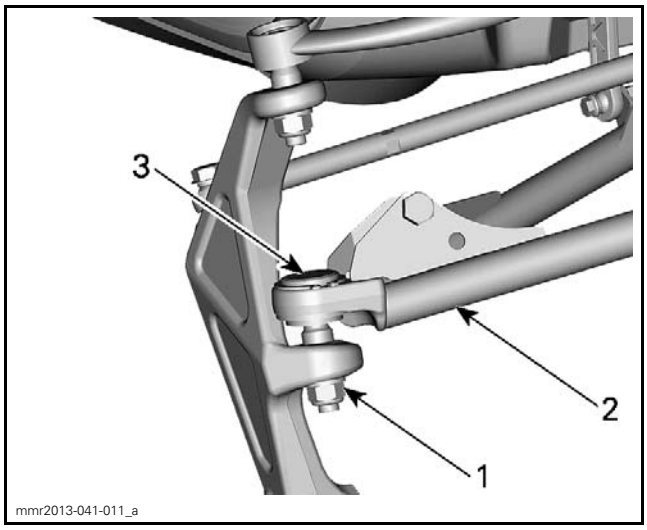
Lower Suspension Arm Removal

1. Lift the front of vehicle until skis are off the ground.
2. Remove shock absorber lower bolt.



1. Lower bolt

3. Detach stabilizer bar link from lower suspension arm. Refer to *STABILIZER BAR* further in this section.
4. Remove lower ball joint nuts.

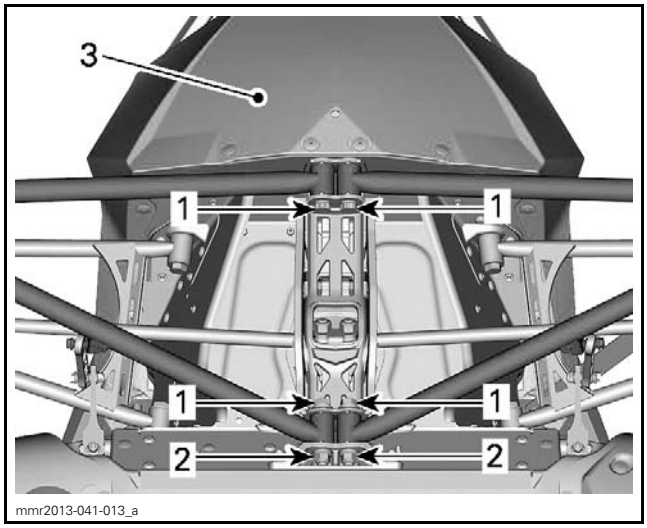


1. Ball joint nut
2. Lower suspension arm
3. Lower ball joint

5. Using a suitable ball joint remover, detach lower ball joint from ski leg.

NOTE: If no tool is available, turn ball joint nut until it is flush with the end of ball joint then, tap on nut with a hammer to release ball joint.

6. Remove suspension arm screws.



UNDERNEATH FRONT OF VEHICLE
1. Suspension arm screws
2. Rear nuts
3. Bottom pan

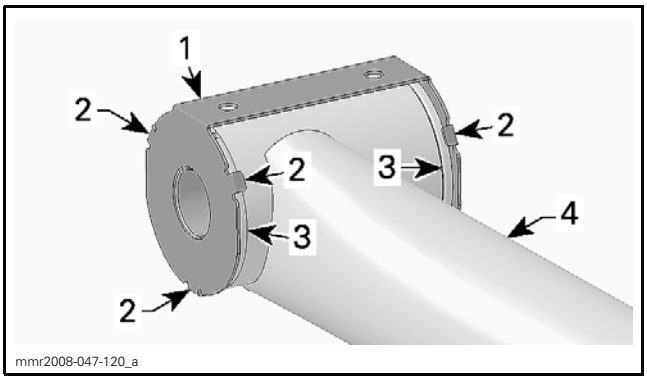
NOTE: To hold rear nuts, grind a 15 mm opened wrench as shown.

7. Remove lower suspension arm from vehicle.

Lower Suspension Arm Installation

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

1. Install a wear plate over bushings.
2. Position the wear plate on top.
3. Fold all tabs against bushings.



1. Wear plate
2. Wear plate tabs
3. Bushings
4. Lower suspension arm

Install all other removed parts.

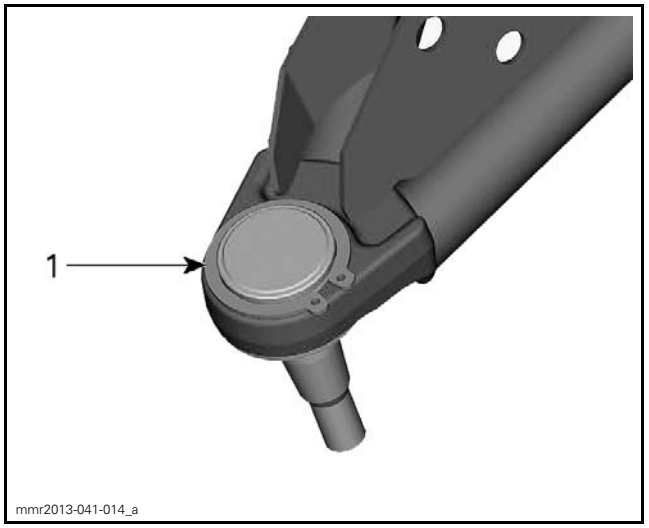
LOWER BALL JOINT

Lower Ball Joint Inspection

Inspect ball joint end for damage. Ensure it's moving freely without play. Replace ball joints as required.

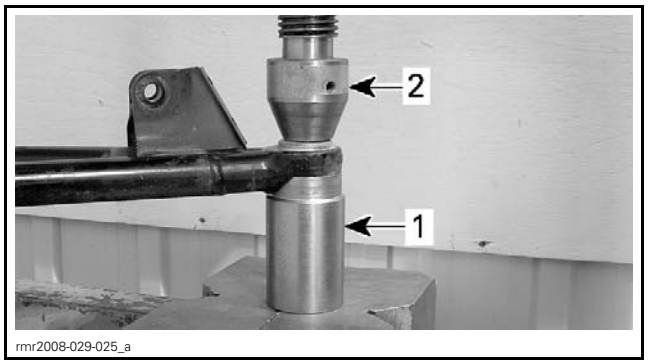
Lower Ball Joint Removal

1. Remove the *LOWER SUSPENSION ARM*, see procedure in this section.
2. Remove circlip securing ball joint to suspension arm.



1. Circlip

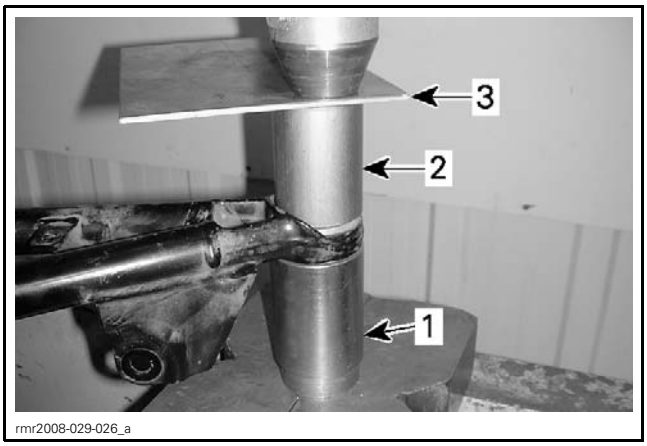
3. Using a press and the BALL JOINT REMOVER SUPPORT (P/N 529 036 121), press ball joint out of the lower suspension arm.



TYPICAL
1. Ball joint remover
2. Press

Lower Ball Joint Installation

1. Using a press, the BALL JOINT REMOVER SUPPORT (P/N 529 036 121) and the BALL JOINT INSTALLER (P/N 529 035 975), press ball joint into the suspension arm end.



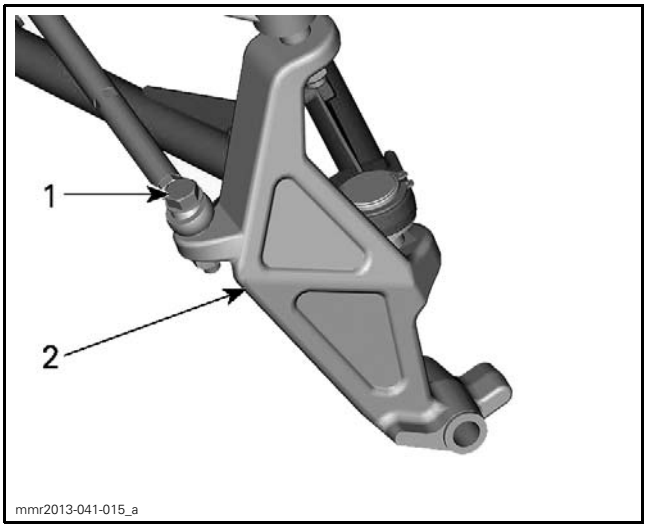
TYPICAL
1. *Ball joint remover support*
2. *Ball joint installer*
3. *Steel plate*

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 section.

SKI LEG

Ski Leg Removal

1. Remove ski from ski leg.
2. Detach tie-rod end from ski leg.



1. *Tie-rod end bolt*
2. *Ski leg*

3. Remove upper and lower ball joints from ski leg. Refer to *UPPER BALL JOINT* and *LOWER BALL JOINT* in this section.

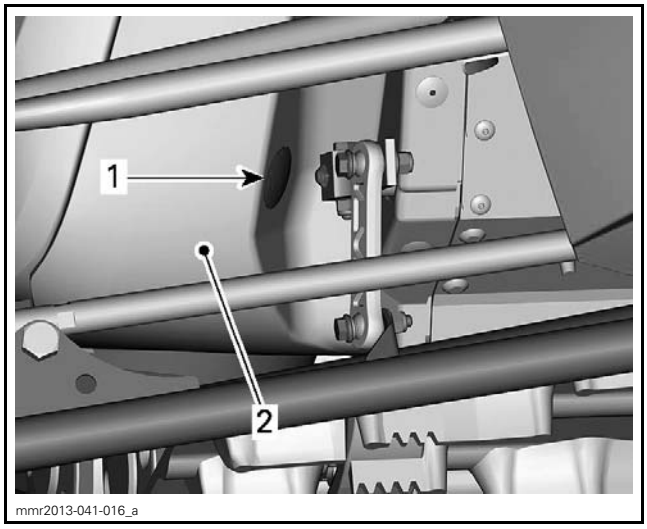
Ski Leg Installation

The installation is the reverse of the removal procedure.

STABILIZER BAR

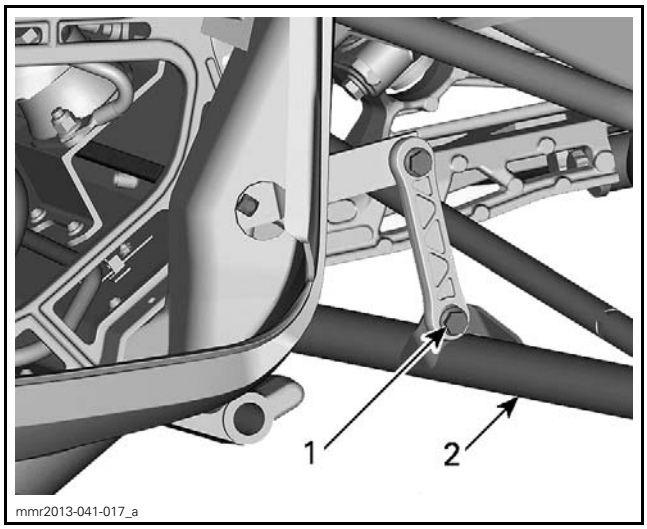
Stabilizer Bar Removal

1. Remove the RH side panel. Refer to *BODY* section.
2. Remove the muffler. Refer to *EXHAUST SYSTEM* section.
3. Remove the cap at the bottom of the RH side bottom pan.



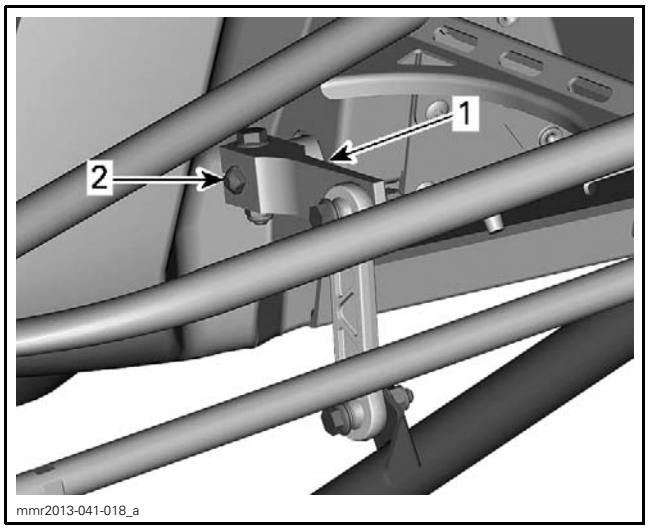
1. *Stabilizer bar cap*
2. *RH side bottom pan*

4. Remove bolts securing stabilizer links to lower suspension arms.



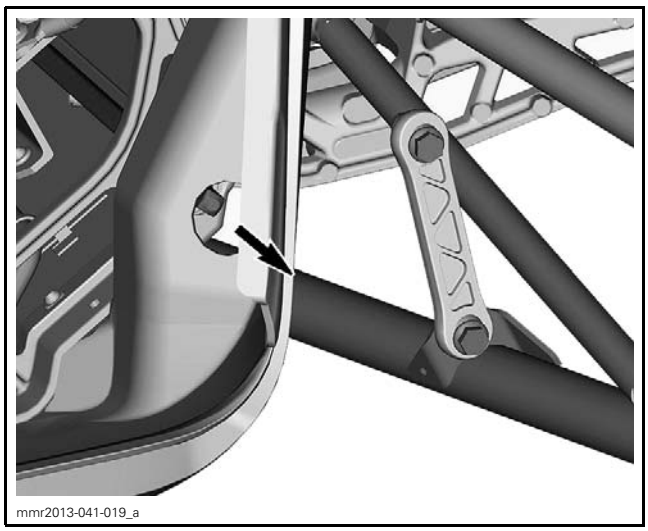
RH SIDE SHOWN
1. *Stabilizer link bolt*
2. *Lower suspension arm*

5. Remove stabilizer lever bolts.
6. Remove stabilizer levers from stabilizer bar.



RH SIDE SHOWN
1. *Stabilizer lever*
2. *Stabilizer bar*

7. Slide stabilizer bar out of vehicle.



RH SIDE REMOVAL

Stabilizer Bar Installation

The installation is the reverse of the removal procedure.

REAR SUSPENSION (rMOTION)

SERVICE TOOLS

Description	Part Number	Page
RMOTION SUSPENSION TOOL	529 036 234	10, 23
SHOCK ABSORBER SUPPORTS	529 036 186	21

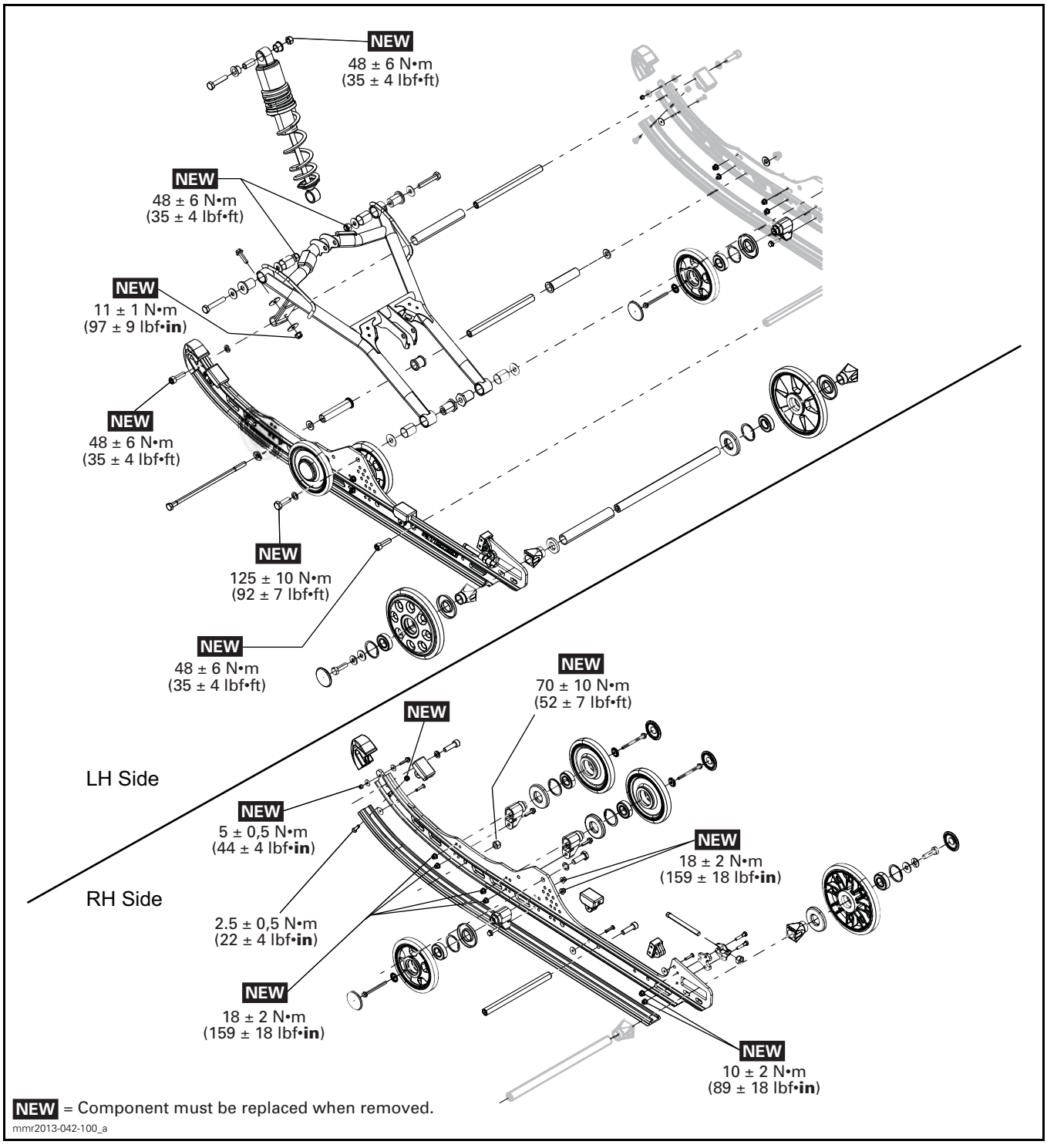
SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
BENCH SCALE SUCH AS SALTER BRECKNELL	PS 400	21

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	13

RAILS AND FRONT ARM



NEW = Component must be replaced when removed.

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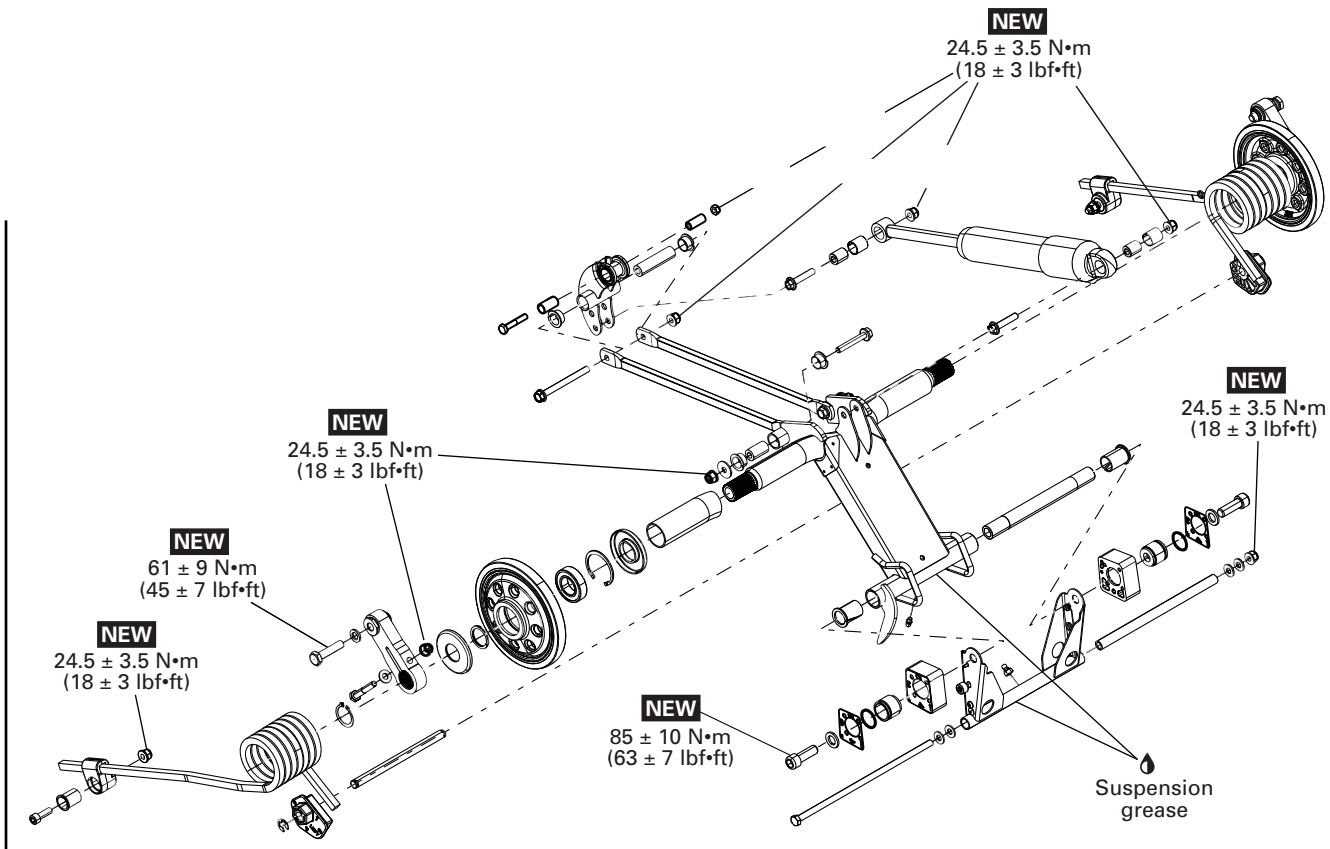
REAR ARM (MODELS WITHOUT ADJUSTABLE REAR SHOCK)



NEW = Component must be replaced when removed.

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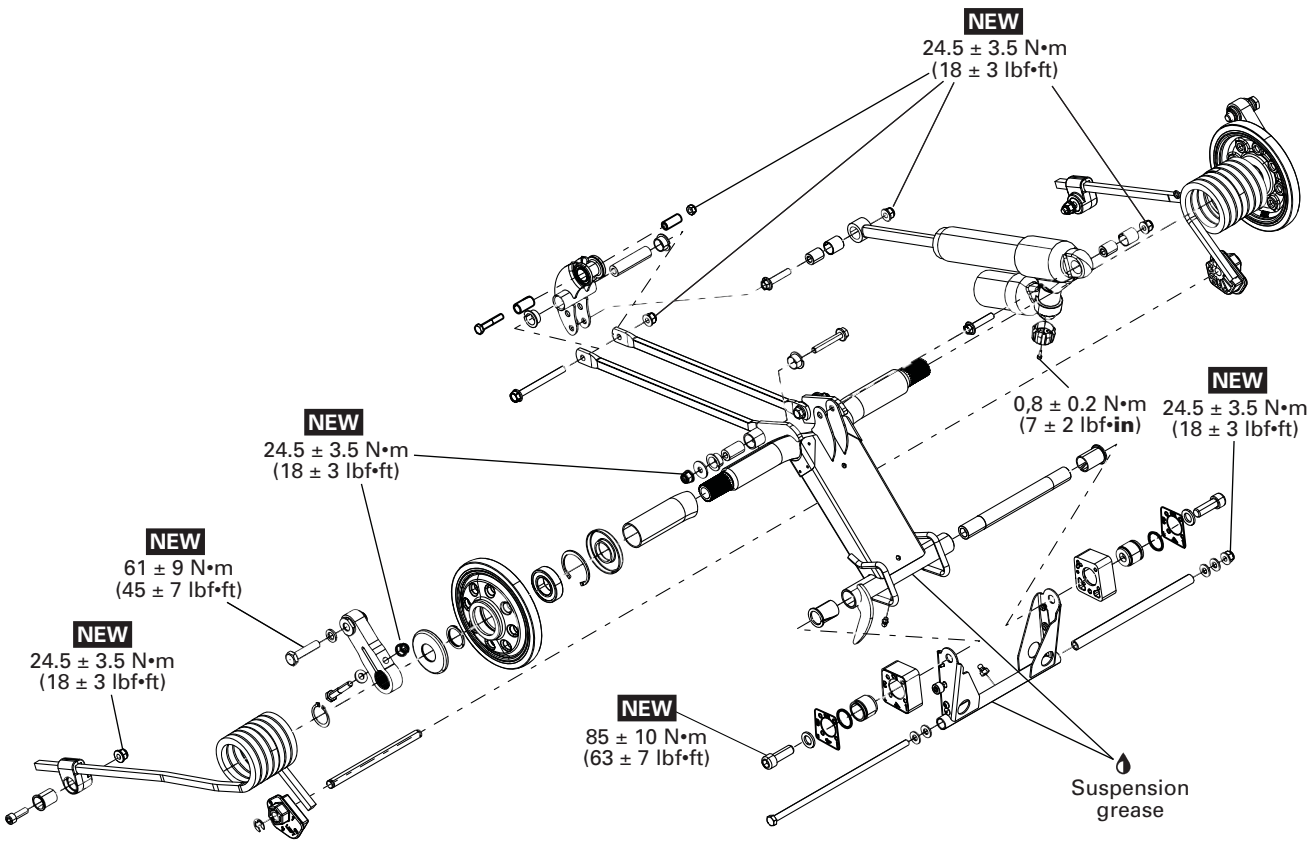
REAR ARM (MODELS WITHOUT QUICK ADJUST SYSTEM)



NEW = Component must be replaced when removed.

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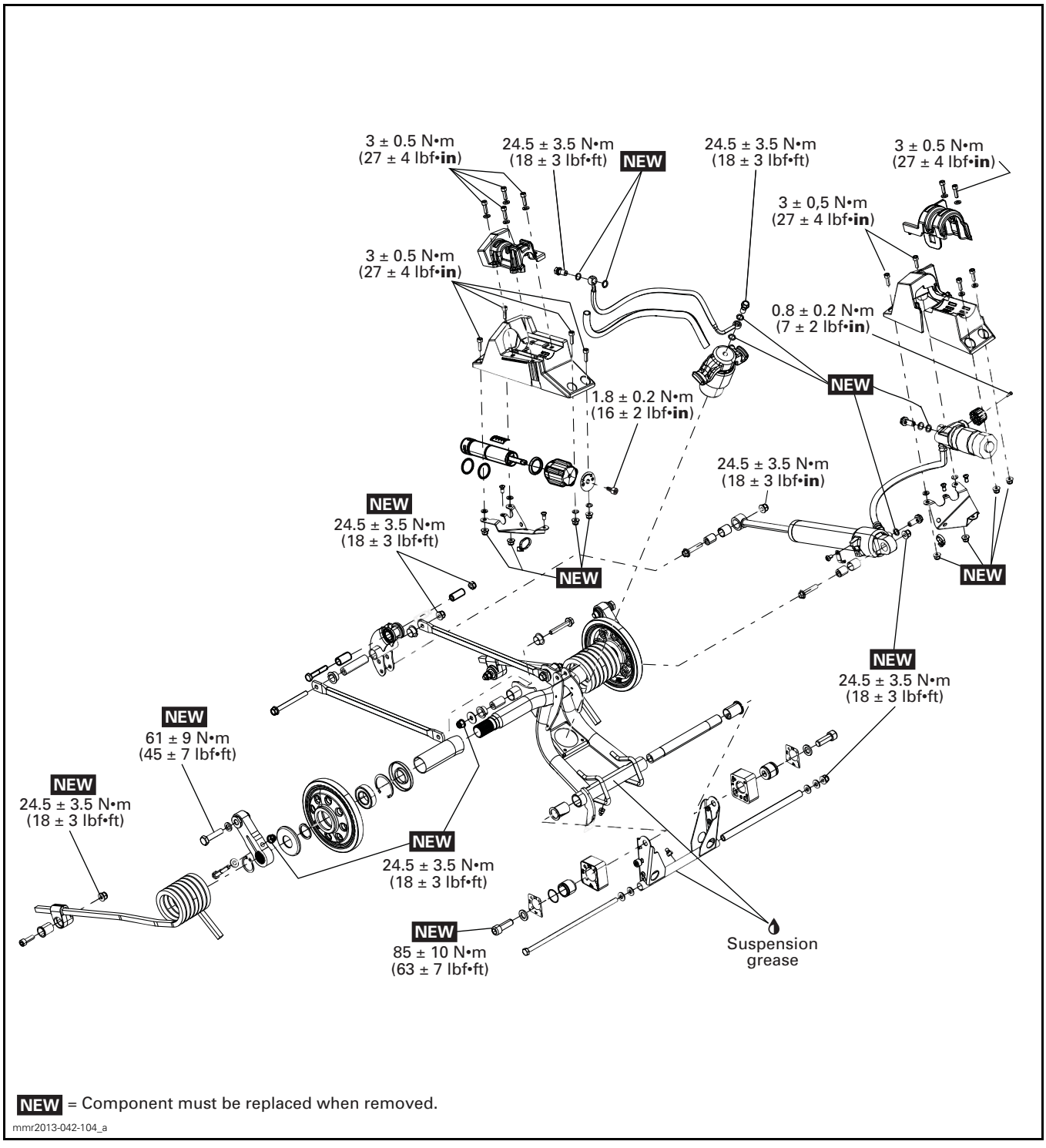
REAR ARM (MODELS WITH QUICK ADJUST SYSTEM)



NEW = Component must be replaced when removed.

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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.

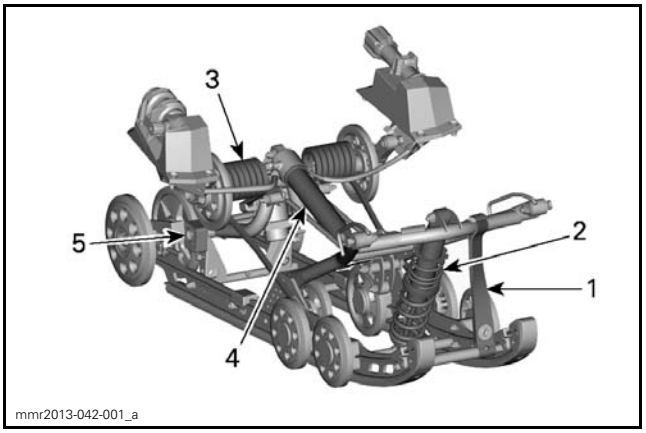
⚠ WARNING

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.**

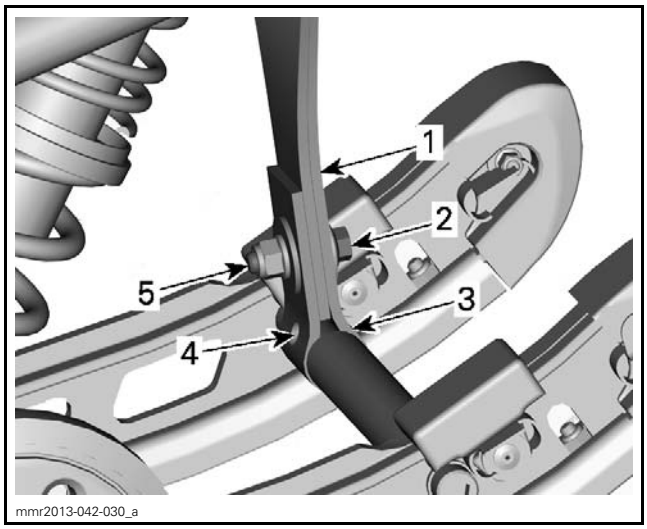
Stopper Strap

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



TYPICAL
1. *Position 1*
2. *Position 2*
3. *Position 3*
4. *Position 4*
5. *Position 5 (factory setting)*

NOTE: Decreasing the stopper strap length may reduce comfort. If too much weight transfer is felt, try to correct it by adjusting the coupling blocks first. Always install stopper strap bolt as close as possible to the lower shaft.

When operating the snowmobile in deep snow, it may be necessary to vary stopper strap length and/or riding position, to change the angle at which the track rides on the snow. Operator's familiarity with the various adjustments as well as snow conditions will dictate the most efficient combination.

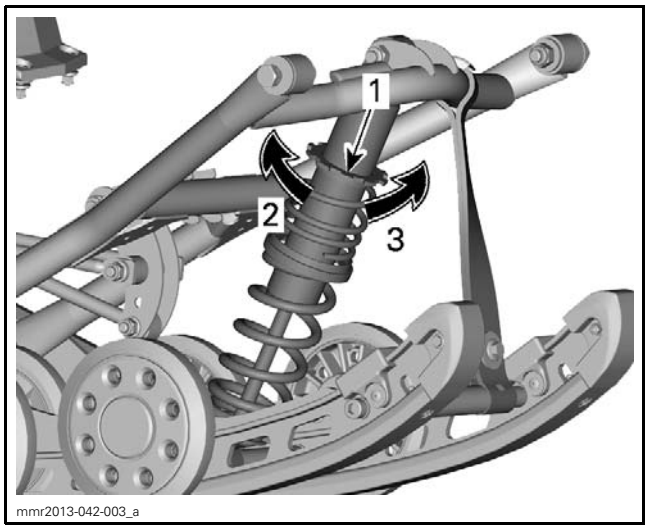
Generally, a longer stopper strap setting gives better performance in deep snow on a flat landscape.

Center Spring

Center spring preload has an effect on steering effort, handling and bump absorption.

Also, since center spring preload adjustment puts more or less pressure on the front of the track, it has an effect on the performance in deep snow.

ACTION	RESULT
Increasing preload	Lighter steering
	More bump absorption capability
	Better deep snow starts
	Better deep snow performance and handling
Decreasing preload	Heavier steering
	Less bump absorption capability
	Better trail handling



TYPICAL- RING TYPE SHOWN
1. *Spring preload adjustment ring*
2. *Increase preload*
3. *Decrease preload*

Rear Spring

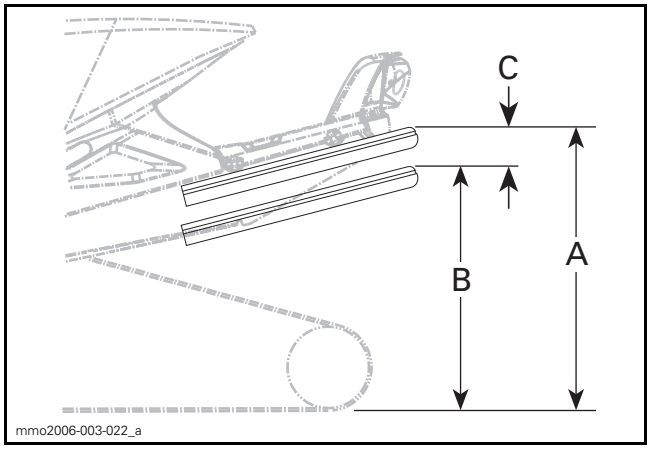
Rear spring preload has an effect on comfort, ride height and load compensation.

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

NOTE: 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 (Except MXZ TNT)

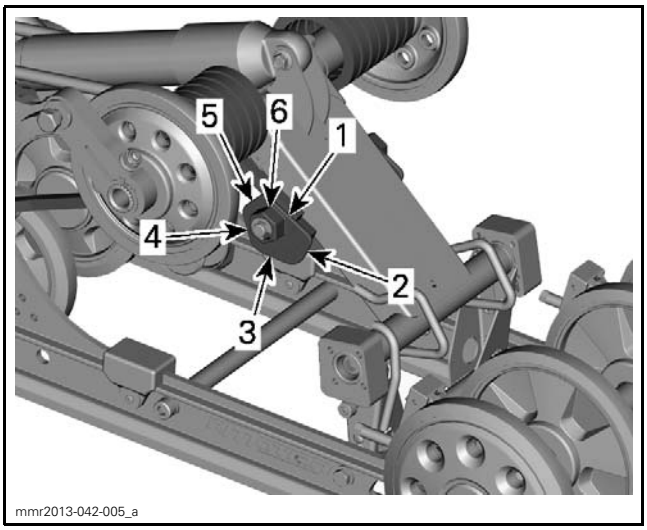
To increase spring preload using tool, always turn the left side adjustment cam in a clockwise direction, and the right side cam in a counterclockwise direction.

⚠ CAUTION Never set preload cams directly from position 5 to 1 or directly from position 1 to 5.

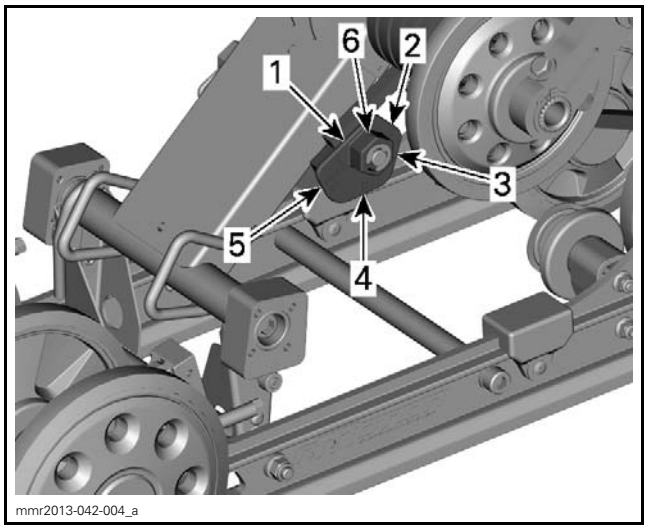
⚠ WARNING

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.



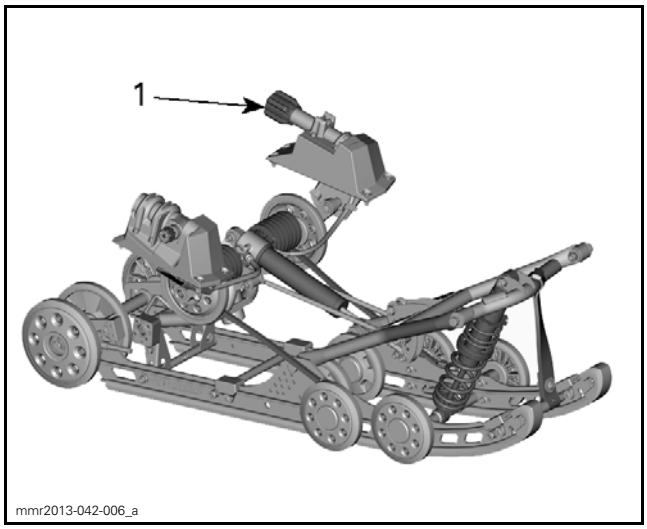
rMOTION WITHOUT QUICK ADJUST SYSTEM — LH SIDE
1. *Position 1*
2. *Position 2*
3. *Position 3*
4. *Position 4*
5. *Position 5*
6. *Adjustment nut*



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.

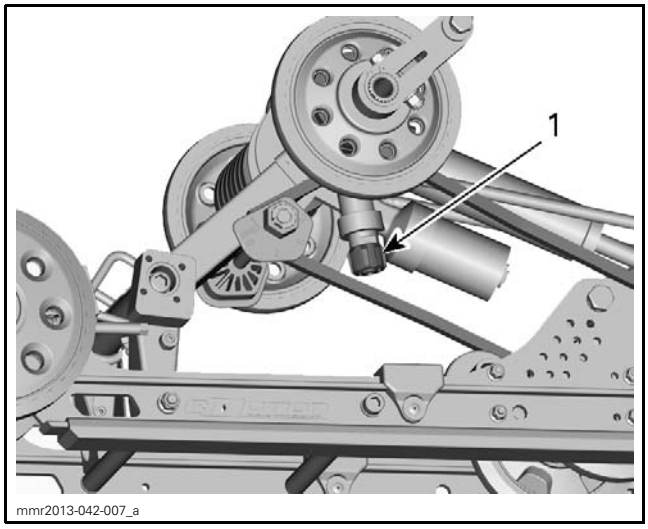
Low speed compression damping controls how the shock absorber reacts to a low suspension velocity (slow compression strokes, in most cases when riding at lower speeds).

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

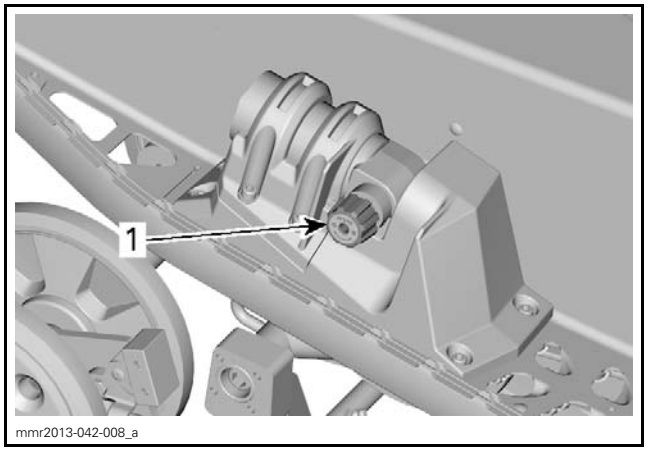
To adjust, turn the adjuster button located on the oil reservoir on shock clockwise to increase compression damping force and counterclockwise to decrease compression damping force.



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.

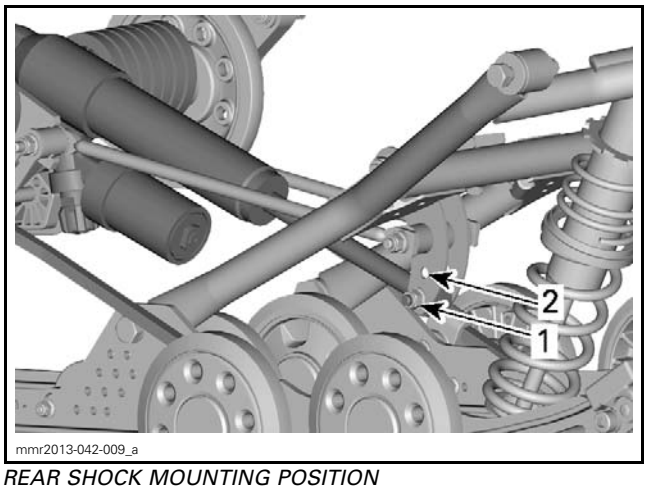


TYPICAL — rMOTION WITH QUICK ADJUST SYSTEM
1. Knob to adjust low/high speed compression damping

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

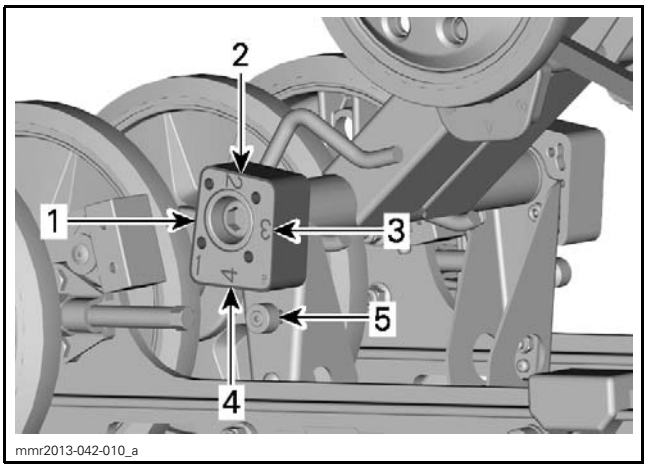
Coupling blocks adjustment has an effect on vehicle handling during acceleration only.

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.



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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*.

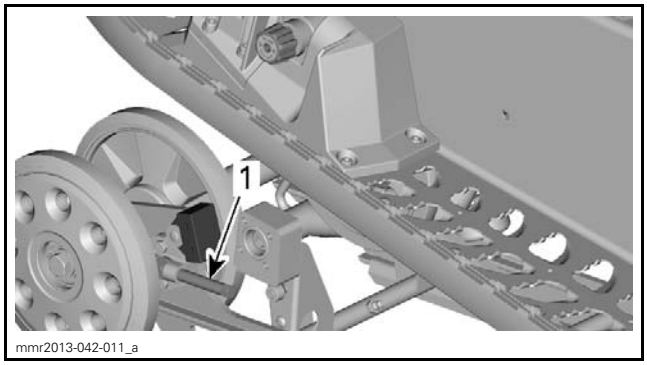
PROCEDURES

NOTE: Parts can be replaced without suspension removal, unless otherwise noted.

SUSPENSION ASSEMBLY

Suspension Assembly Removal

1. Lift rear of vehicle and support it off the ground.
2. Completely loosen track tension by unscrewing both adjustment screws.



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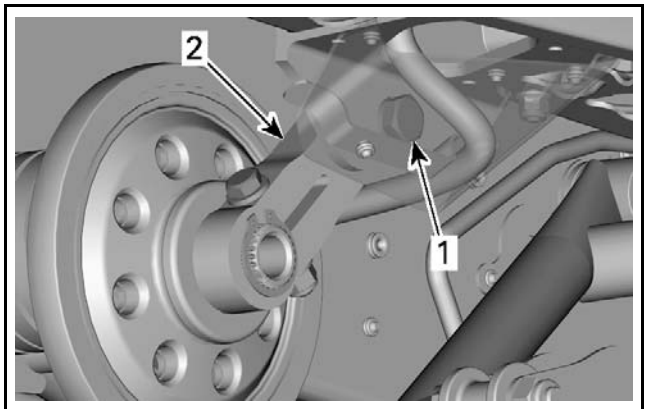
1. *Adjustment screw*

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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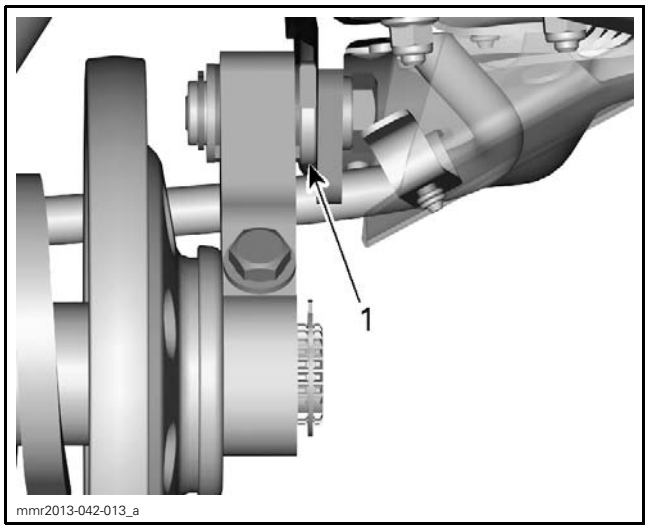
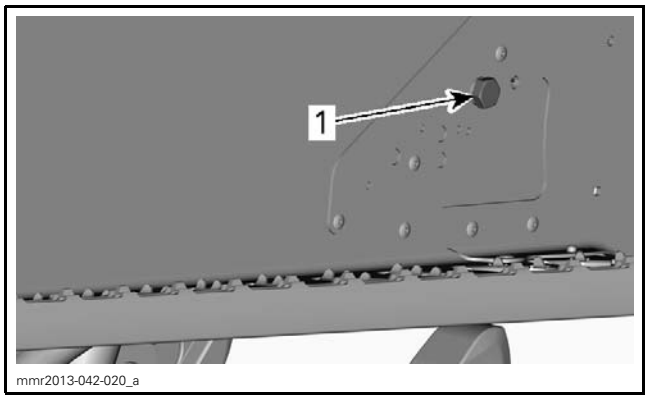
1. *Retaining screw*
2. *Connecting rod*

REQUIRED TOOL	
RMOTION SUSPENSION TOOL (P/N 529 036 234)	



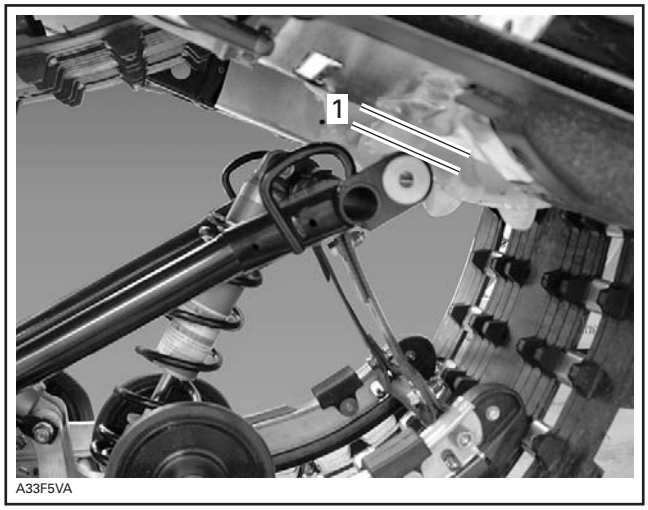
1. rMotion suspension tool to be installed here

6. Remove front arm retaining bolts.



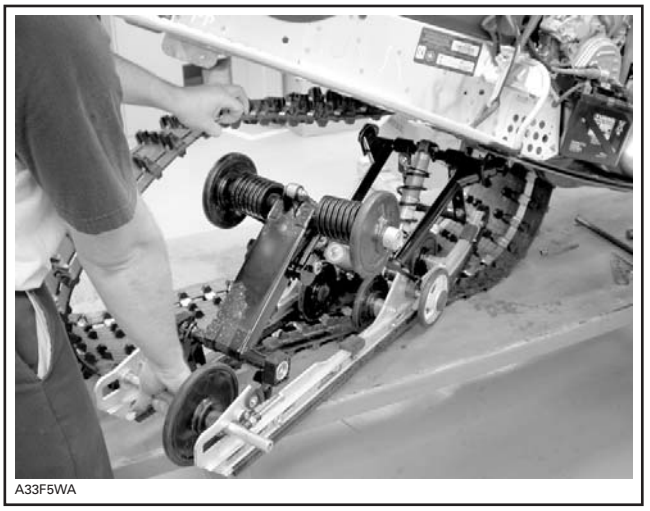
TYPICAL
1. Front arm bolt
2. Chaincase

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

Suspension Assembly Installation

Installation is the reverse of removal procedure. Pay attention to the following.

Install suspension into track with front portion first.

Tighten screws to specified torque.

UPPER SUSPENSION ARM FASTENERS TIGHTENING TORQUE	
Front arm bolts **(NEW)**	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)
Rear arm connecting rod screws**(NEW)**	61 N•m ± 9 N•m (45 lbf•ft ± 7 lbf•ft)

Adjust track tension, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

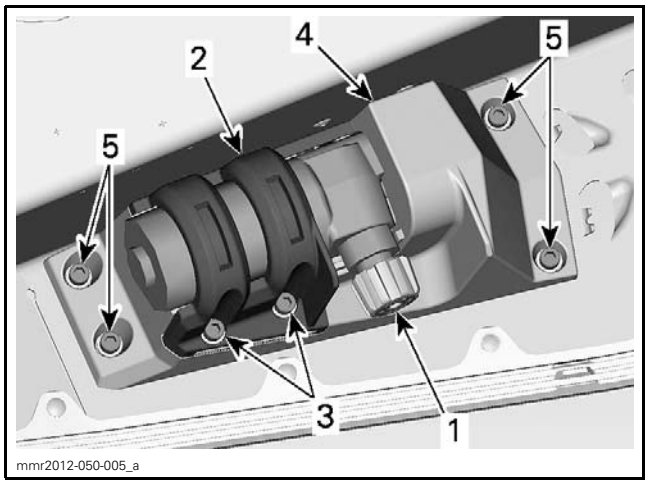
rMotion with Quick Adjust System

Install quick adjuster control modules, refer to:
– *SHOCK DAMPING QUICK ADJUSTER SYSTEM*
– *SPRING PRELOAD QUICK ADJUSTER SYSTEM*.

SHOCK DAMPING QUICK ADJUSTER SYSTEM

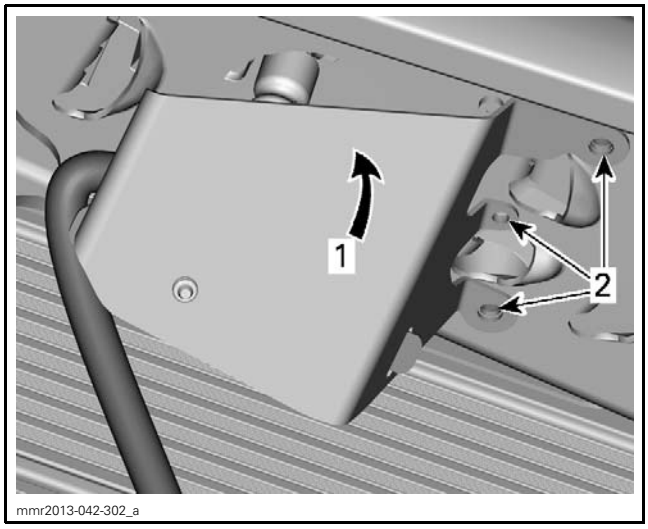
Shock Damping Quick Adjuster Control Module Removal

1. Remove the following parts:
   – Knob
   – Retaining clamp
   – Support.



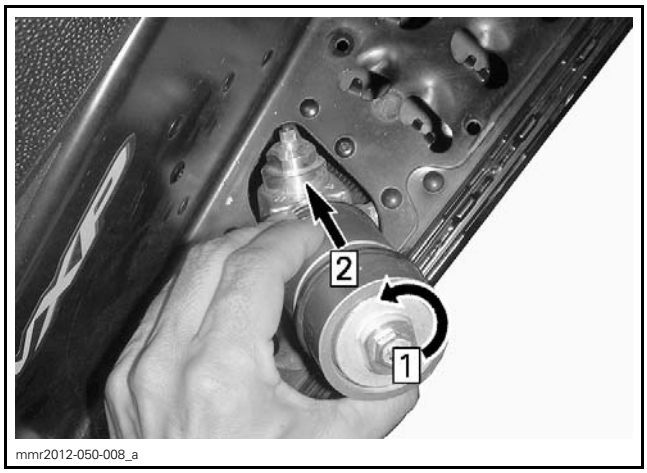
CONTROL MODULE
1. *Knob screw*
2. *Clamp*
3. *Clamp screws*
4. *Support*
5. *Support screws*

2. Remove front fasteners from hose guard.
3. Remove hose from its retainer tab and rotate hose guard outwards around rear rivet.



1. *Pivot outwards*
2. *Front fasteners*

4. Remove shock remote reservoir as follows:
   – Rotate
   – Pass through tunnel opening.



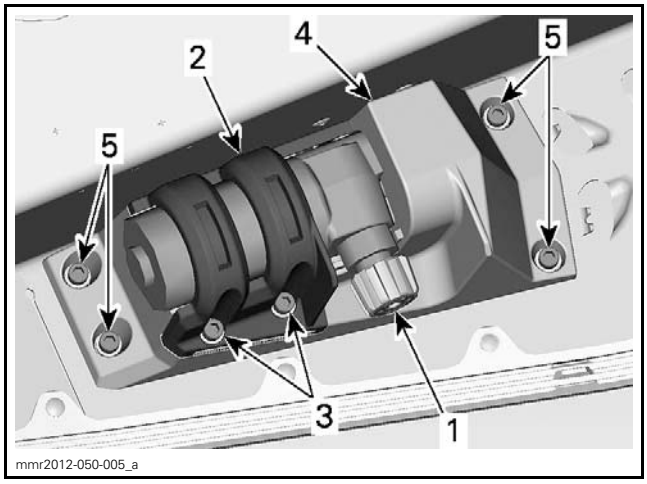
Step 1: Rotate
Step 2: Pass through tunnel opening

Shock Damping Quick Adjuster Control Module Installation

1. Align the hose guard front holes with the support front holes.

NOTE: No rivet needed at front of hose guard.

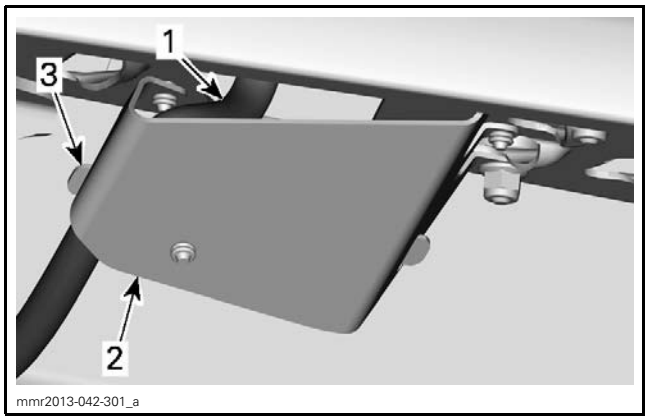
2. Install parts as follows:



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.



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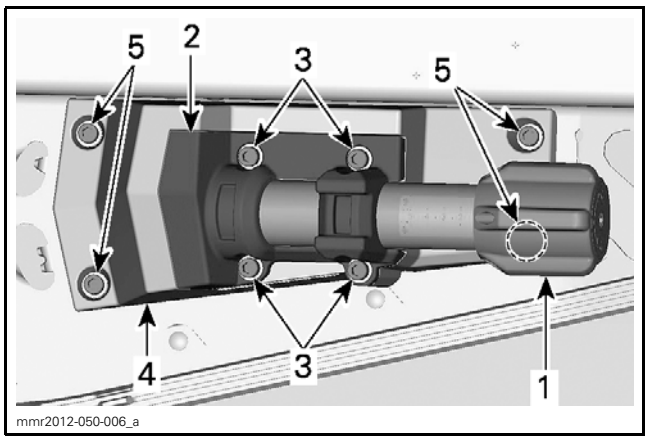
1. Hose
2. Hose guard
3. Hose guard bracket

SPRING PRELOAD QUICK ADJUSTER SYSTEM

Spring Preload Quick Adjuster Control Module Removal

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.



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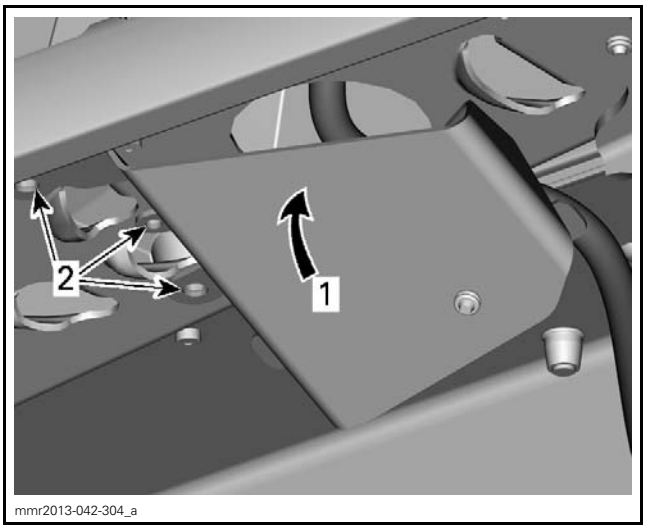
SPRING PRELOAD QUICK ADJUSTER CONTROL MODULE
1. Knob
2. Clamp
3. Clamp screws
4. Support
5. Support screws

2. Remove front fasteners from hose guard.
3. Remove hose from its retainer tab and rotate hose guard outwards around rear rivet.



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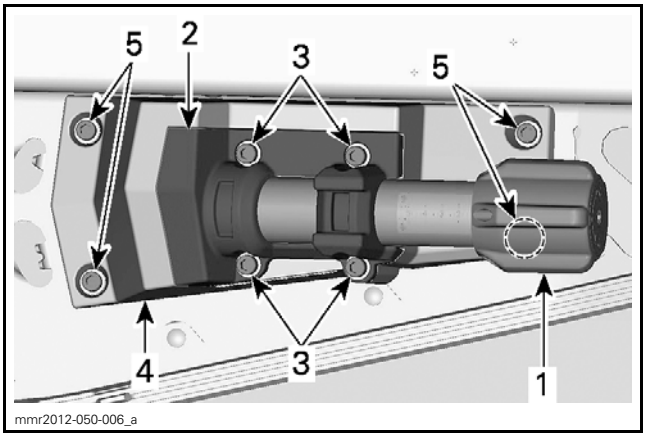
1. Pivot outwards
2. Front fasteners

4. Pass control cylinder through the opening in the tunnel.

Spring Preload Quick Adjuster Control Module Installation

1. Align the hose guard front holes with the support front holes.
2. Install parts as follows:



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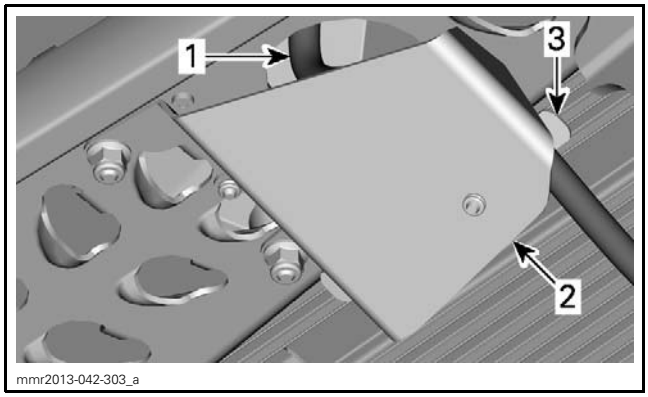
SPRING PRELOAD QUICK ADJUSTER CONTROL MODULE
1. Knob
2. Clamp
3. Clamp screws
4. Support
5. Support screws

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.



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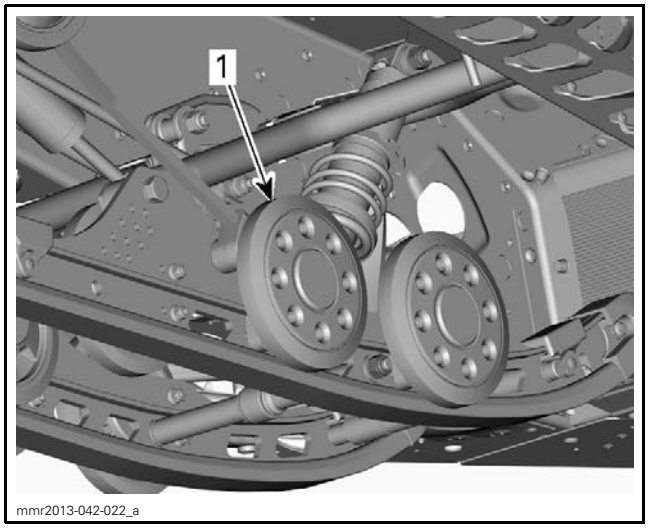
1. Hose
2. Hose guard
3. Hose guard bracket

Spring Preload Quick Adjuster System Removal

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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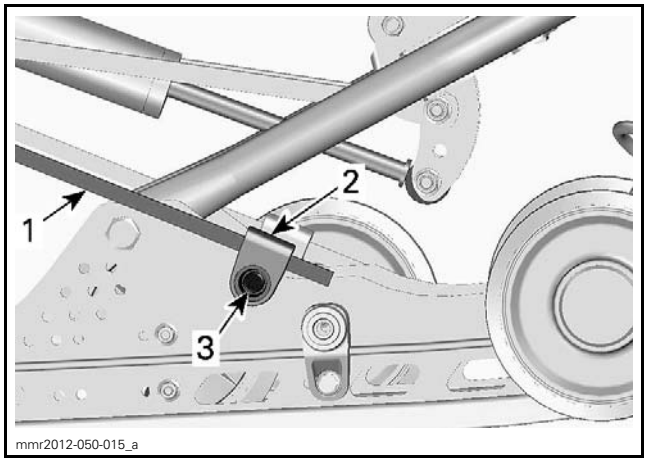
1. Idler wheel to be removed (on each side)

4. Firmly hold the spring supports and remove spring support bolts.

⚠ CAUTION Spring support are spring loaded.



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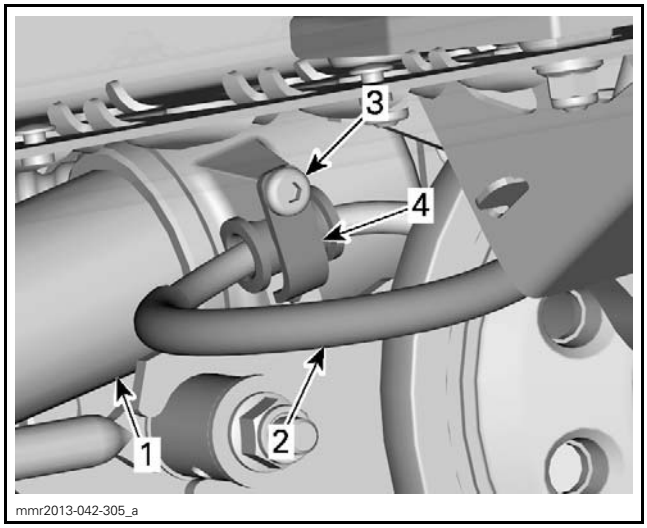
1. Spring
2. Spring support
3. Spring support bolt

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.



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1. Shock
2. Hose
3. Retaining screw
4. Hose retainer

8. Remove actuator from rear arm.
9. Remove spring adjuster assembly.

Spring Preload Quick Adjuster System Disassembly

NOTE: System bleeding is required whenever the hose is disconnected.

NOTICE Thoroughly clean parts before disassembly. Work on a clean surface.

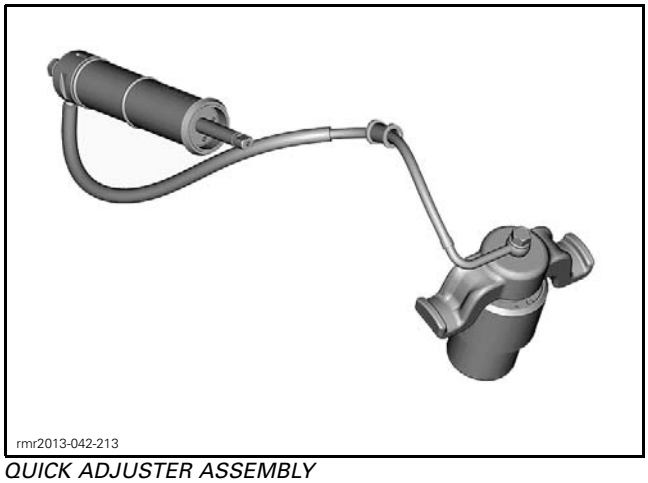
1. Set controller to the minimum preload.
2. Remove the banjo bolt(s) retaining the hose.
3. Drain fluid.

Spring Preload Quick Adjuster System Seals Replacement

NOTE: System bleeding is required whenever the hose is disconnected.

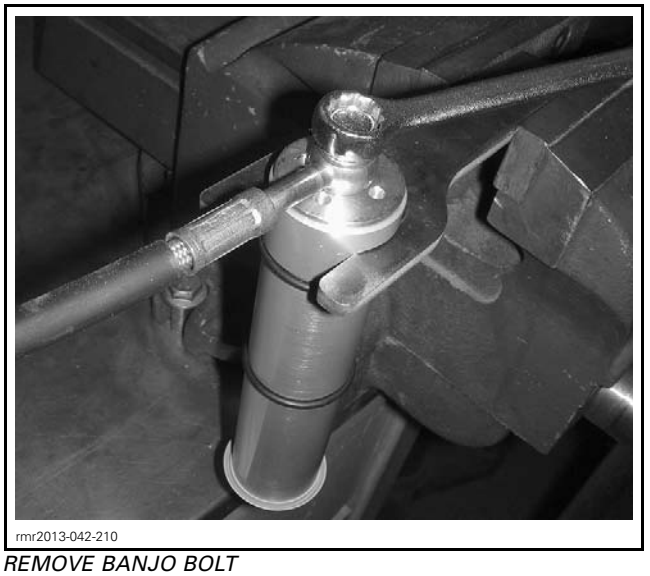
NOTICE Thoroughly clean parts before disassembly. Work on a clean surface.

1. Remove quick adjuster assembly from vehicle. Refer to *SPRING PRELOAD QUICK ADJUSTER CONTROL MODULE REMOVAL*.



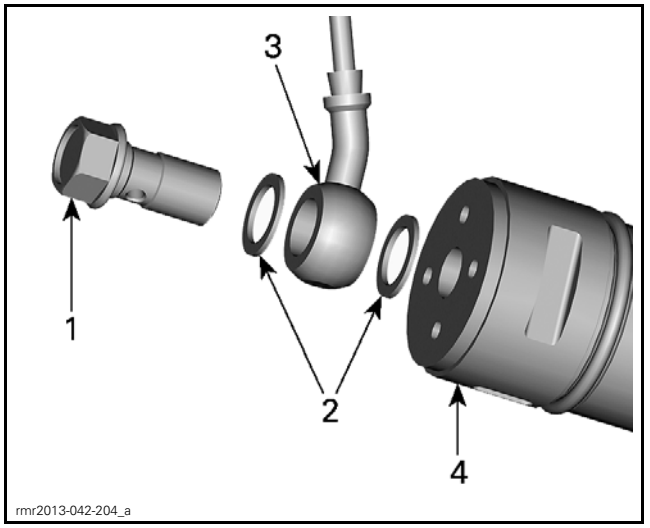
QUICK ADJUSTER ASSEMBLY

2. Use retainer tool *529 036 254* to hold cylinder while removing banjo bolt.



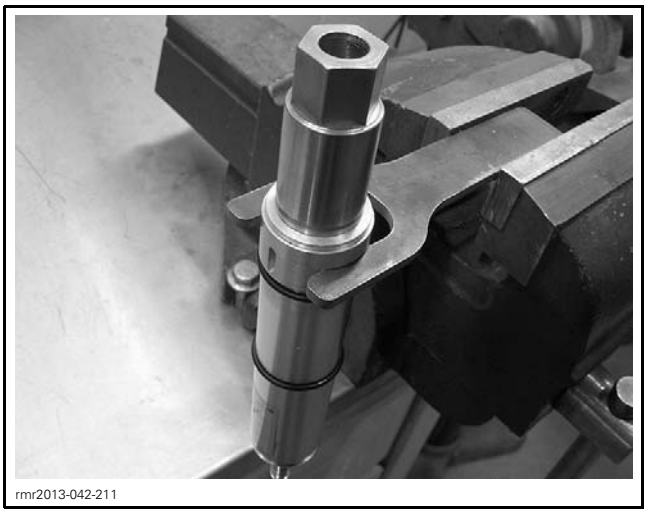
REMOVE BANJO BOLT

3. Remove banjo bolt, washers and hose from cylinder.



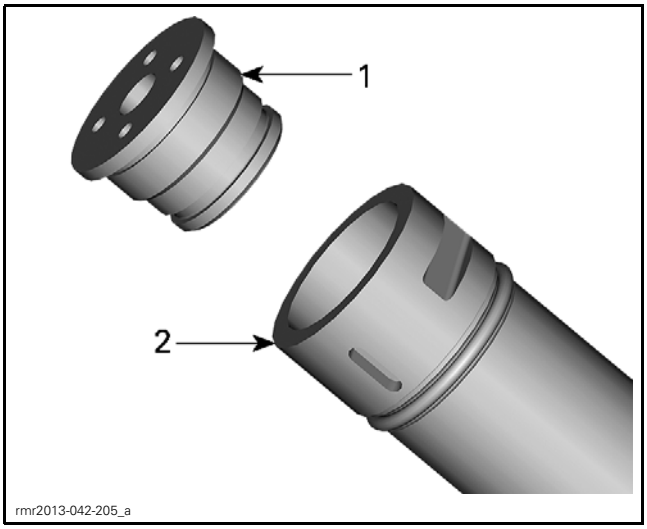
1. *Banjo bolt*
2. *Washer*
3. *Hose fitting*
4. *Cylinder body*

4. Hold cylinder body with tool *529 036 254* and unscrew end cap using tool *529 036 255*.



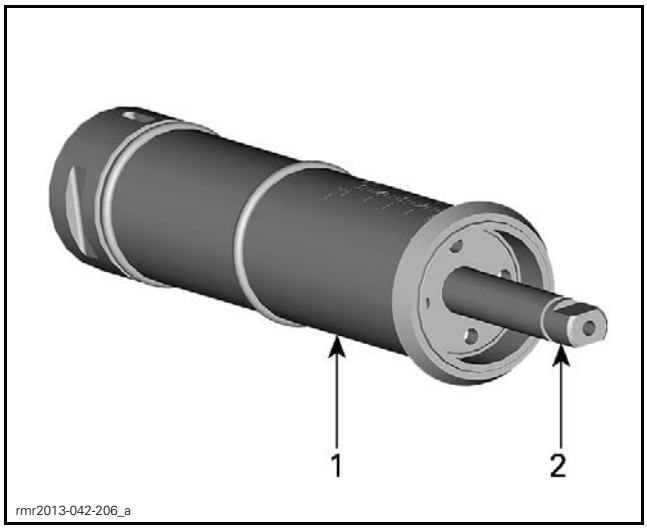
REMOVE END CAP

5. Remove end cap.



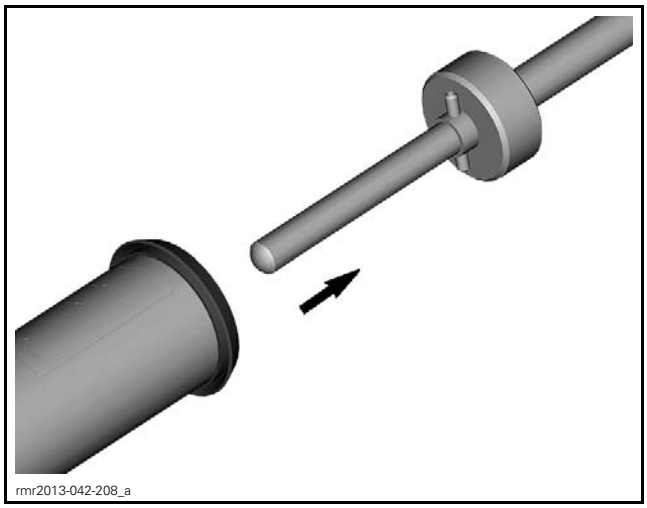
1. *End cap*
2. *Cylinder body*

6. At other end of cylinder, unscrew piston rod using tools (P/N 529 036 254) and (P/N 529 036 255).



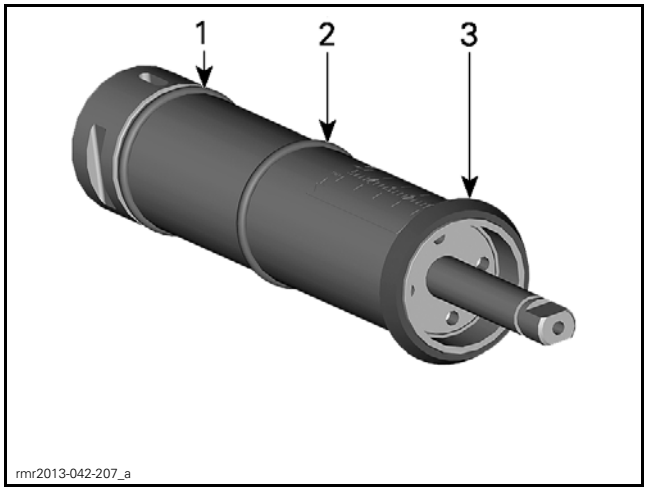
1. *Cylinder body*
2. *Piston rod*

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.

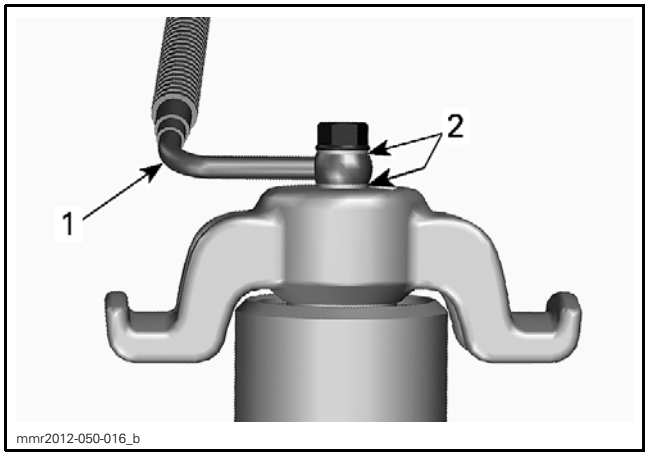
Spring Preload Quick Adjuster System Bleeding and Reassembly

NOTE: Actuator, control module and hose have to be separated from each other before carrying out bleeding procedure.

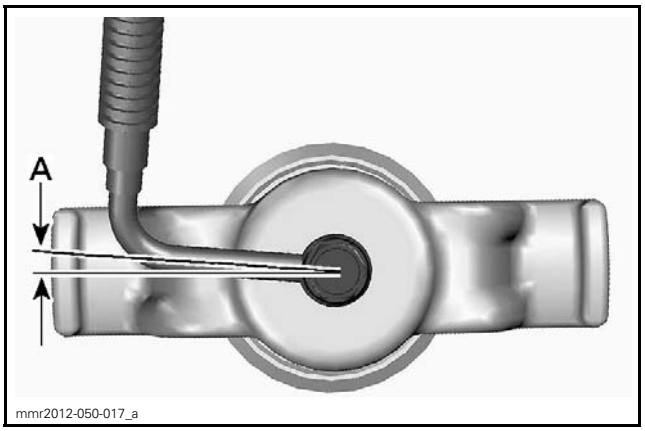
1. Fully extend the actuator by hand.
2. Add fluid in the actuator, see table.

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



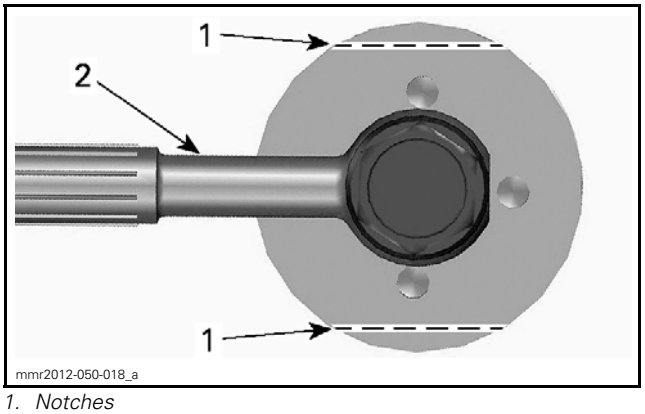
A. 5°

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).

Spring Preload Quick Adjuster System Installation

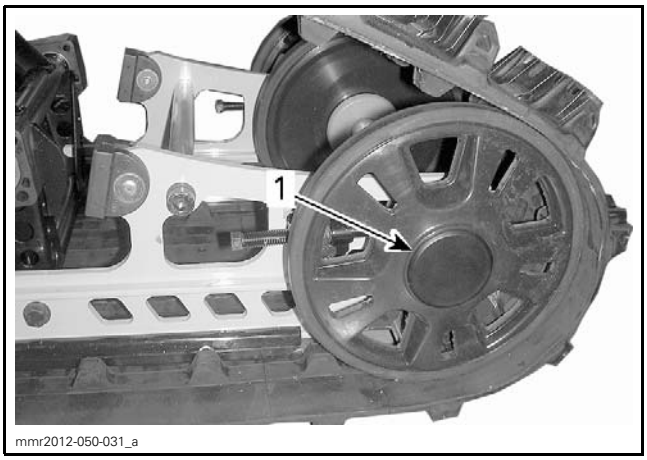
Installation is the reverse of removal procedure, however, pay attention to the following:

Set the preload to the minimum using the control cylinder adjustment rod first.

REAR AXLE

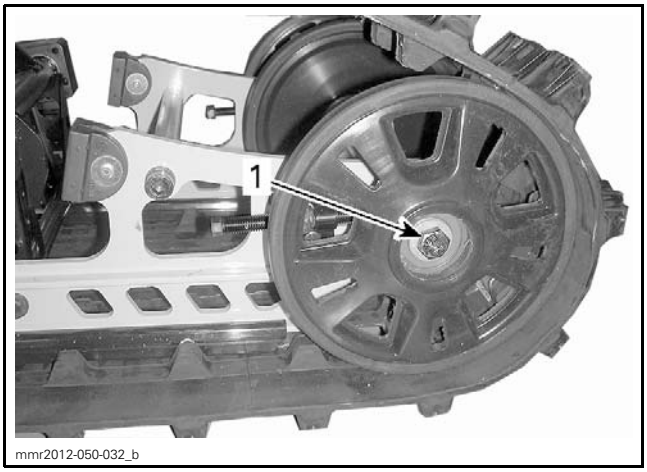
Rear Axle Removal

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



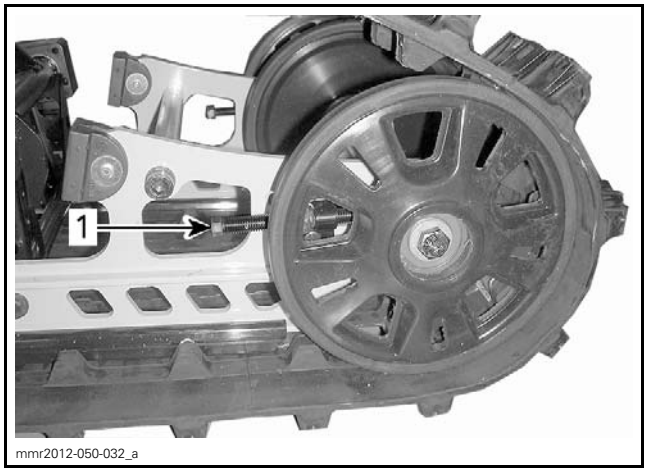
1. RH rear idler wheel cap

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



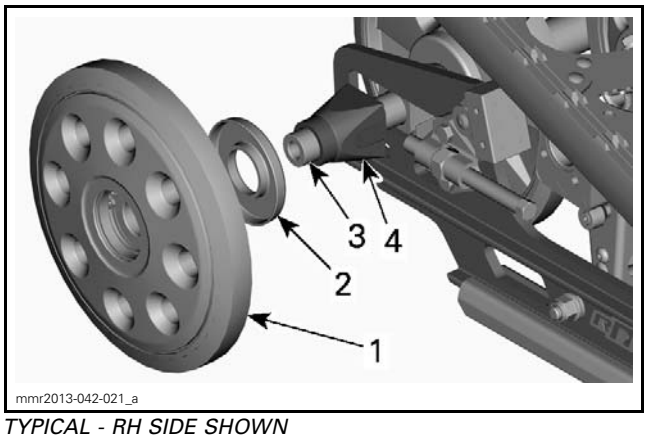
1. RH rear axle screw

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.



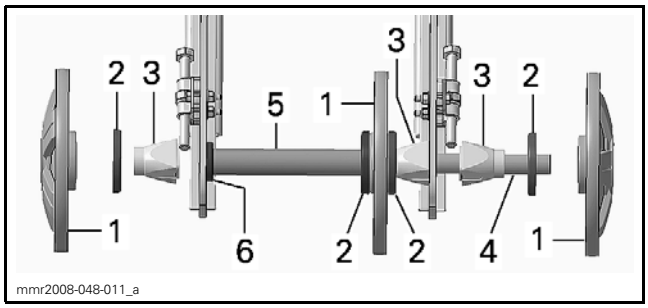
TYPICAL - RH SIDE SHOWN
1. Rear idler wheel
2. Seal
3. Rear axle
4. Wheel spacer

7. Pull out the rear axle.

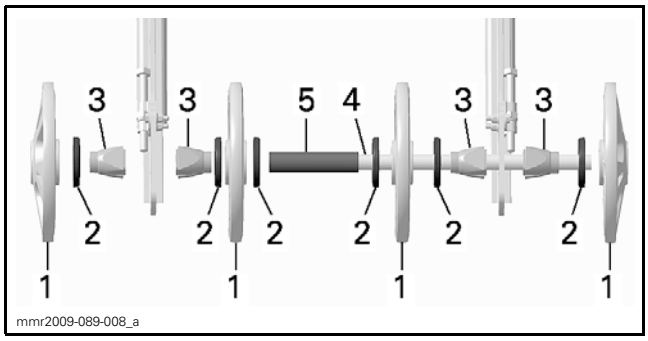
Rear Axle Installation

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

Make sure to position all parts correctly.

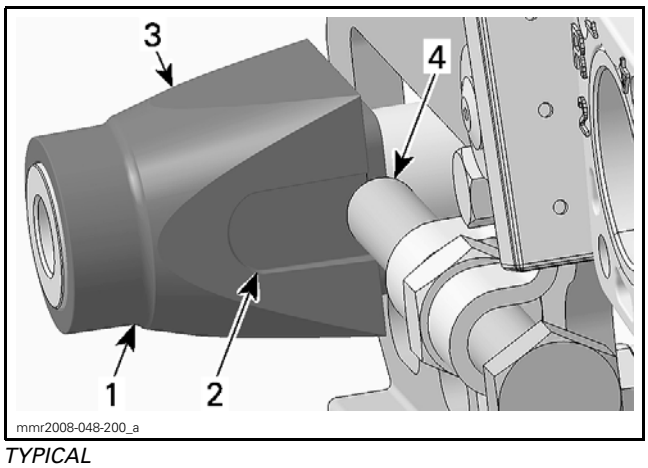


TYPICAL - 3 IDLER WHEELS LAYOUT
1. *Idler wheels*
2. *Seals*
3. *Wheel spacers*
4. *Rear axle*
5. *Rear axle spacer*
6. *Washer*



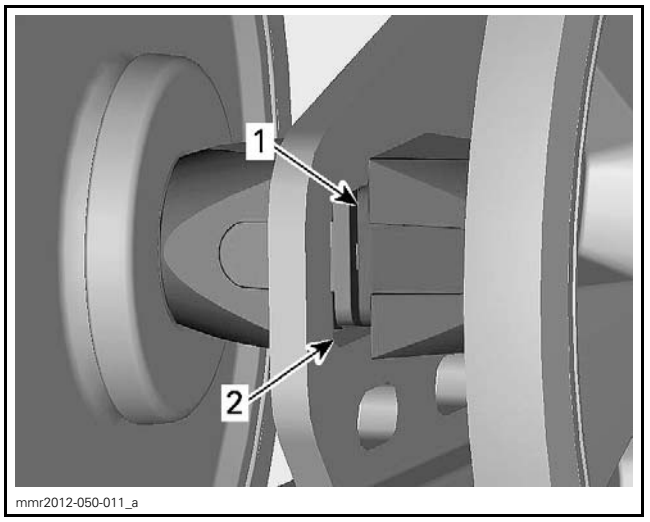
TYPICAL - 4 IDLER WHEELS LAYOUT
1. *Idler wheels*
2. *Seals*
3. *Wheel spacers*
4. *Rear axle*
5. *Rear axle spacer*

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

Rear Shock Absorber Removal

1. Lift rear of vehicle and support it off the ground.

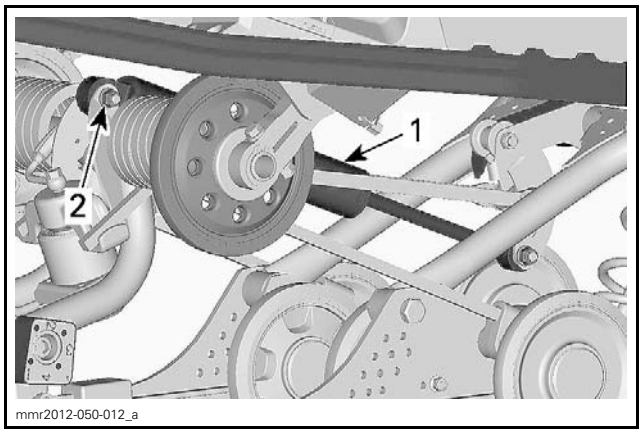
rMotion with Quick Adjust System

2. Carry out *SHOCK DAMPING QUICK ADJUSTER CONTROL MODULE REMOVAL*, see procedure in this subsection.

All Models

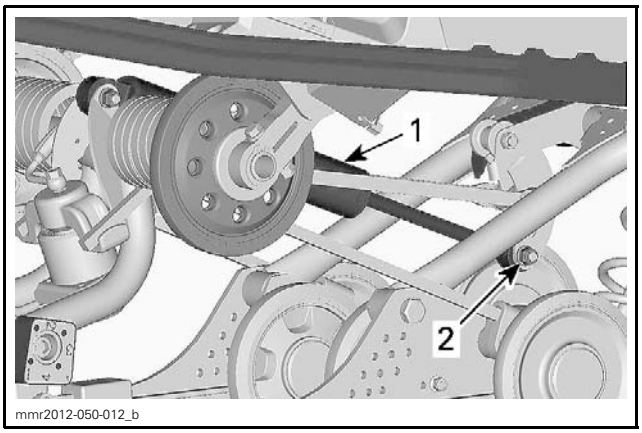
3. Remove the upper bolt.

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.

Rear Shock Absorber Installation

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.

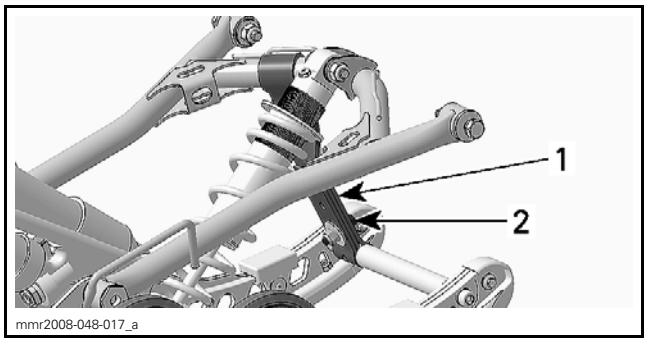
TIGHTENING TORQUE	
Shock absorber retaining bolts	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

rMotion with Quick Adjust System

Carry out *SHOCK DAMPING QUICK ADJUSTER CONTROL MODULE INSTALLATION*.

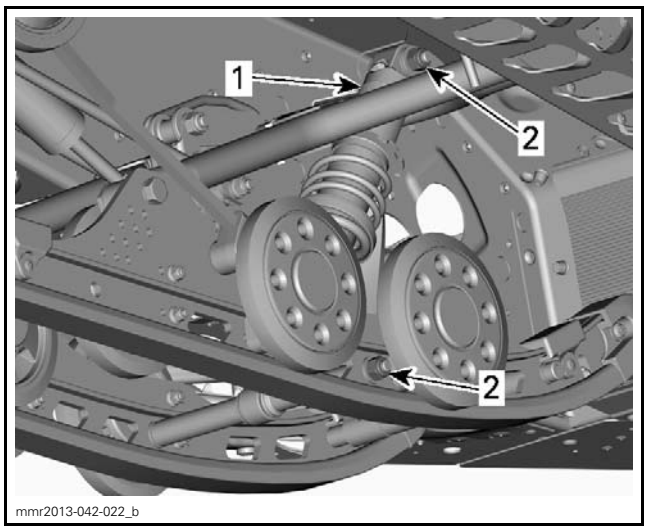
Center Shock Absorber Removal

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.

Shock Absorber Inspection

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.

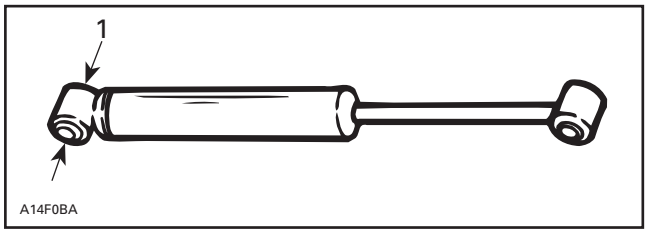
MC Hydraulic Shock

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.

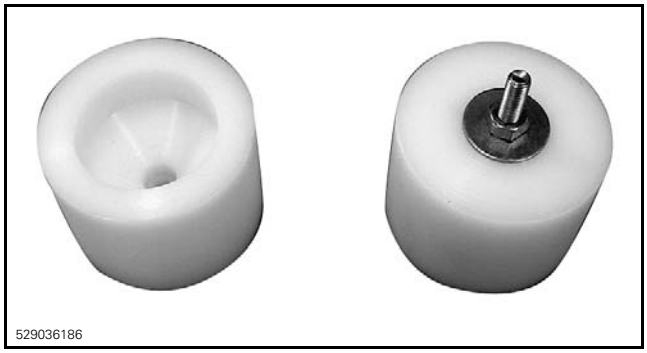
HPG SHOCK EXCEPT VARIABLE RATE
– The shock should extend unassisted. – The rod must come out at a steady speed.

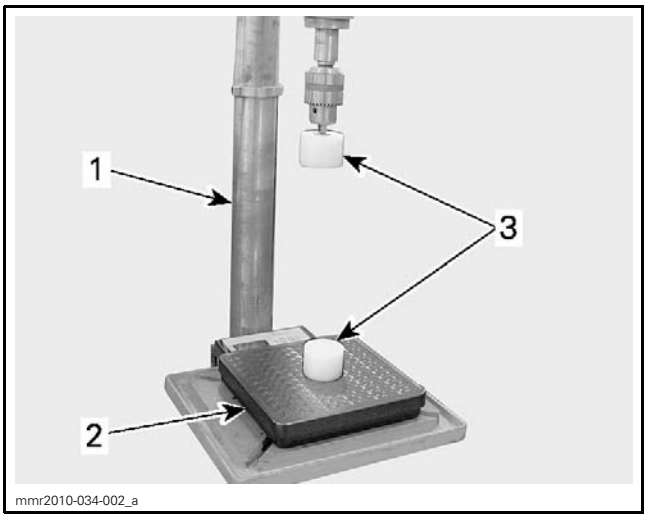
HPG VARIABLE RATE SHOCK
– The shock should extend unassisted. – Rod must come out slowly first, than faster and finally slow again for the last 25 mm (1 in).

4. Proceed with *SHOCK ABSORBER COMPRESSION TEST*. See procedure in this subsection.
5. If any faults are present, replace shock.

Shock Absorber Compression Test

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.





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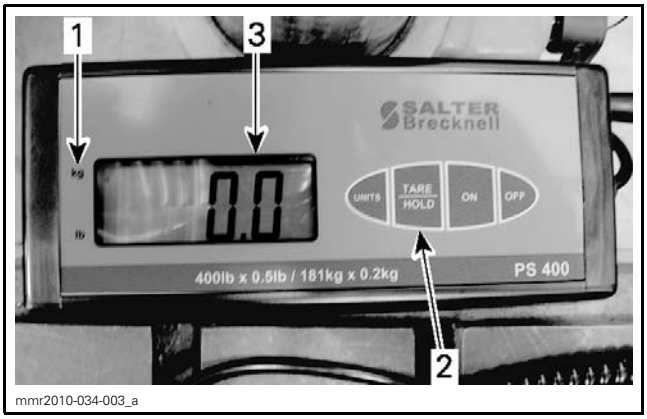
1. *Drill press*
2. *Bench scale*
3. *Shock absorber supports*

5. Set bench scale units to **kg** (or lb).
6. Press **TARE** to reset digits (must indicate (0) zero).



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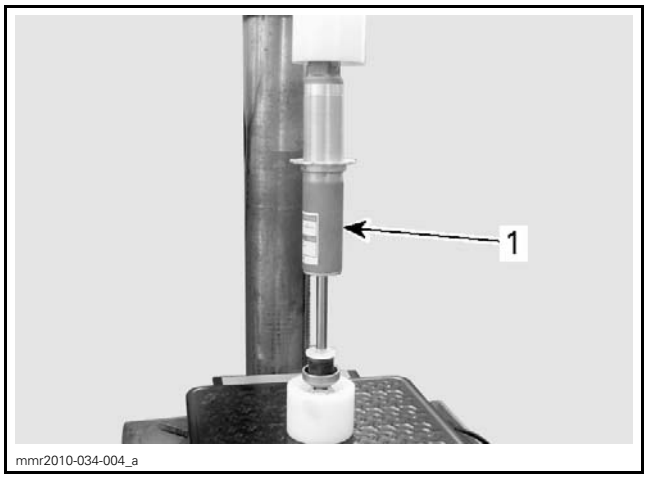
1. *Units indicator lamp*
2. *TARE button*
3. *Digits*

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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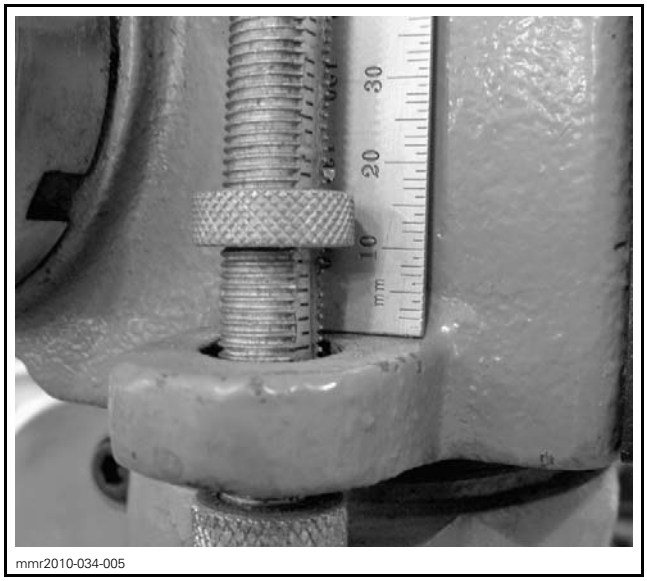
1. *Shock body upwards*

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.

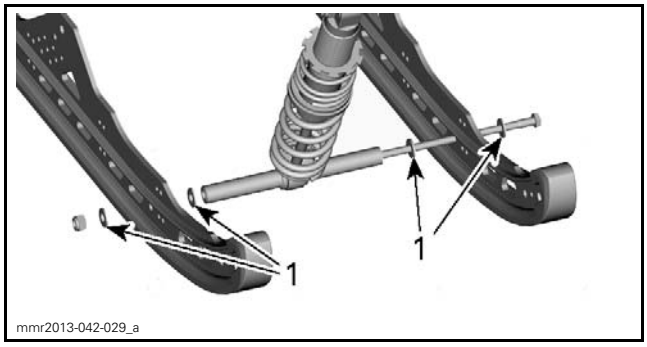
MODEL	ROD DIAMETER	SERVICE RANGE
All HPG VR/Plus/Plus R	12.5 mm (1/2 in)	24 kgf ± 4 kgf (53 lbf ± 9 lbf)
All HPG KYB PRO	16 mm (5/8 in)	39 kgf ± 5 kgf (86 lbf ± 11 lbf)

Center Shock Absorber Installation

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

TIGHTENING TORQUE	
Upper bolt	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)
Lower bolt	70 N•m ± 10 N•m (52 lbf•ft ± 7 lbf•ft)



BOTTOM OF SHOCK ABSORBER
1. Washers location

REAR SPRINGS

Rear Spring Removal

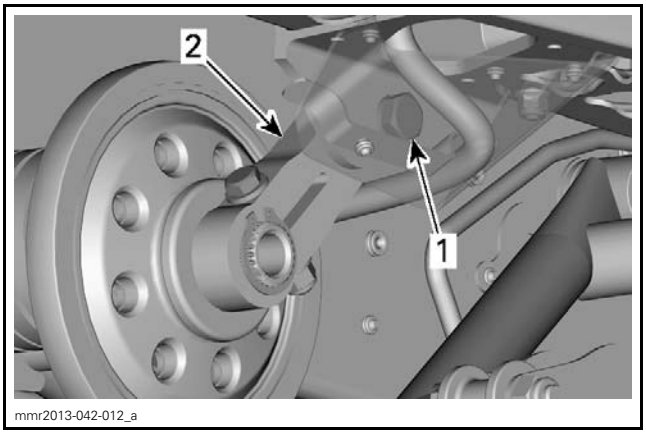
1. Support the rear of vehicle just enough to remove load on the rear suspension.
2. Set rear spring preload to the minimum.

rMotion with Quick Adjust System

3. Remove quick adjuster control modules, refer to:
   - *SHOCK DAMPING QUICK ADJUSTER SYSTEM*
   - *SPRING PRELOAD QUICK ADJUSTER SYSTEM*.

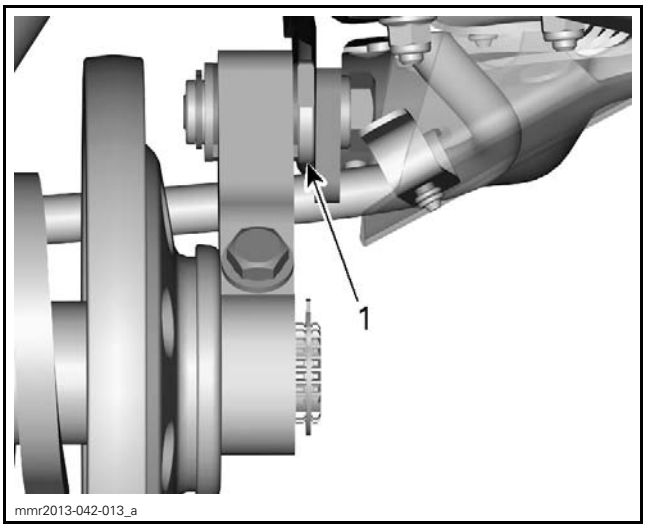
All Models

4. Remove rear arm connecting rod retaining screws.



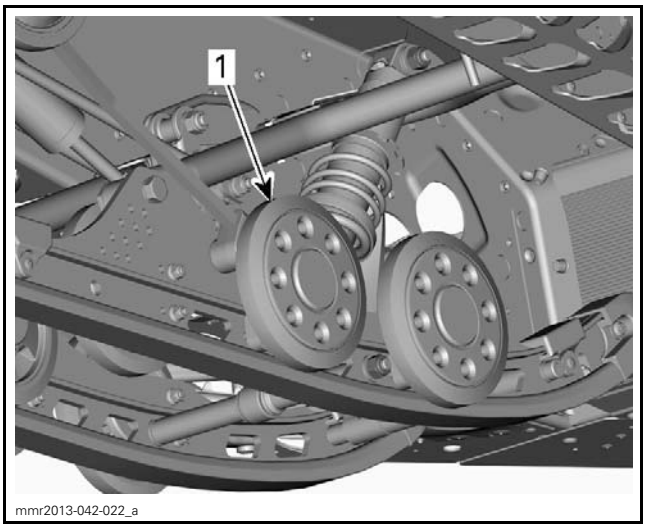
1. Connecting rod retaining screw
2. Connecting rod

REQUIRED TOOL	
RMOTION SUSPENSION TOOL (P/N 529 036 234)	



1. rMotion suspension tool to be installed here

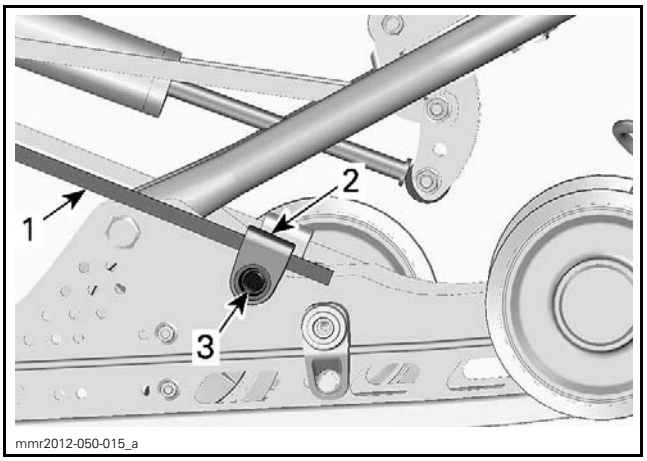
5. Remove idler wheels to have access to spring support screws.



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

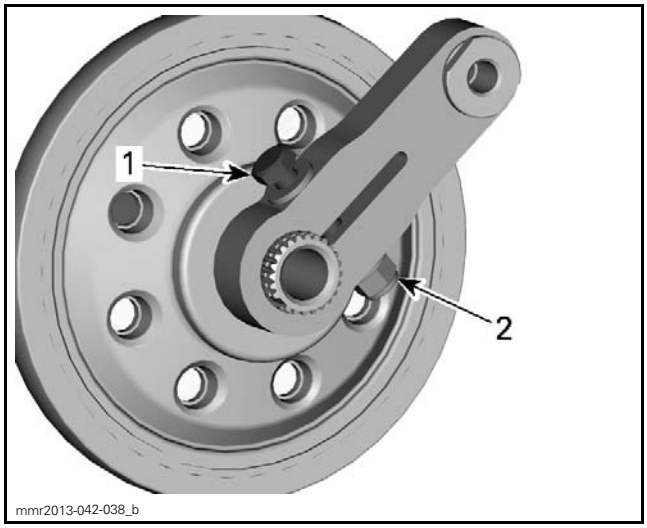
7. Move spring supports with spring ends over the idler wheel supports and let them sits on the track.

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.



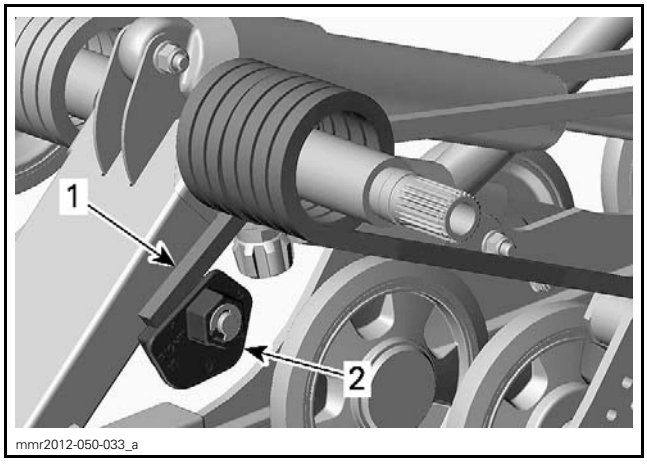
1. Retaining screw
2. Bolt

10. Remove upper idler wheels and hardware.
11. Remove rear spring from suspension.

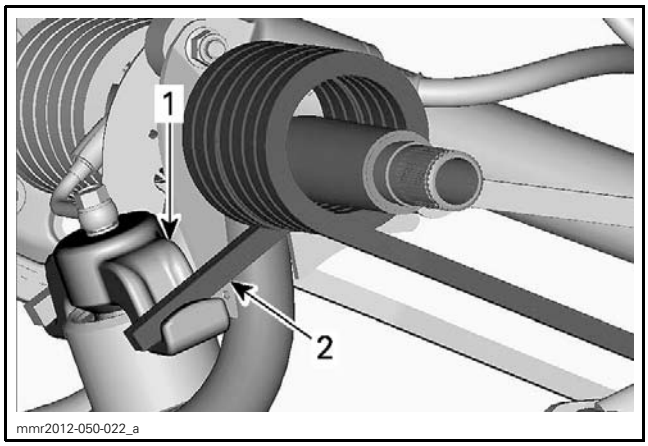
Rear Spring Installation

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.

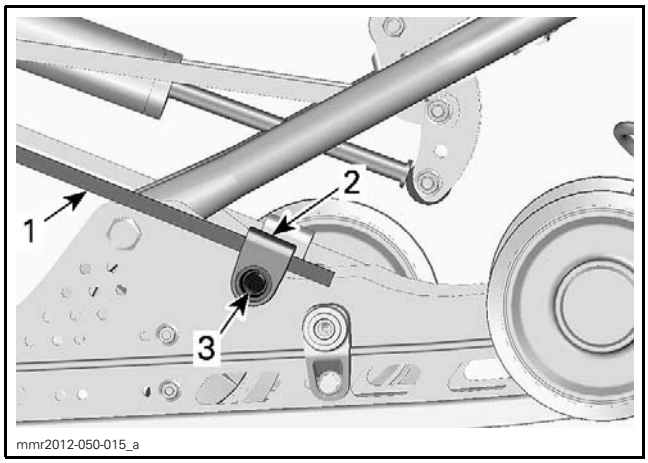


MODELS WITHOUT QUICK-ADJUST
1. Rear spring
2. Cams



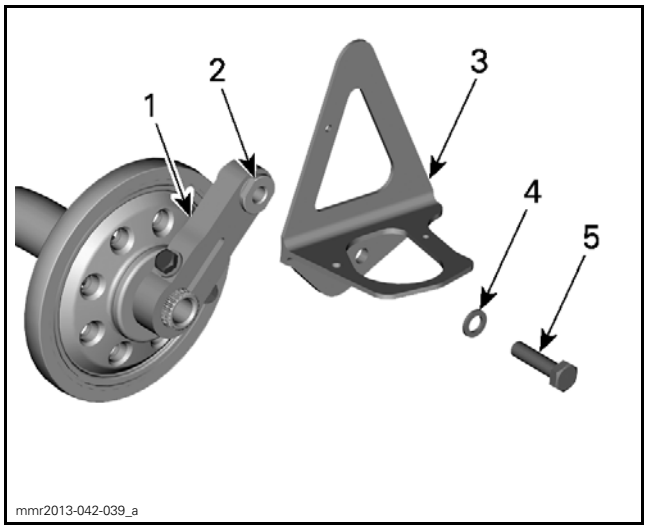
QUICK-ADJUST MODELS
1. *Actuator spring support*
2. *Rear spring*

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*

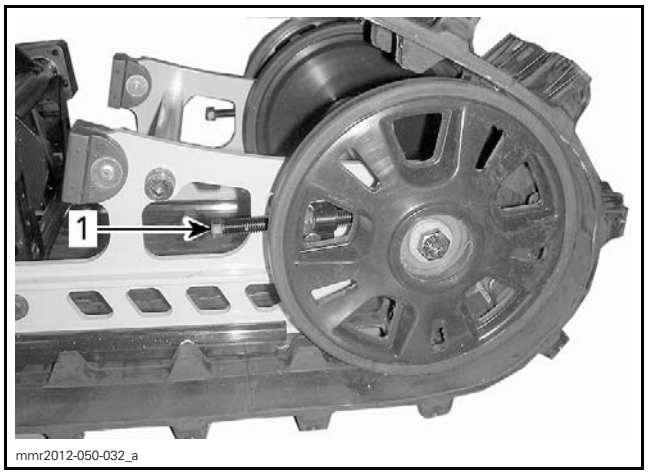
rMotion with Quick Adjust System

Install quick adjuster control modules, refer to:
– *SHOCK DAMPING QUICK ADJUSTER SYSTEM*
– *SPRING PRELOAD QUICK ADJUSTER SYSTEM*.

SLIDER SHOES

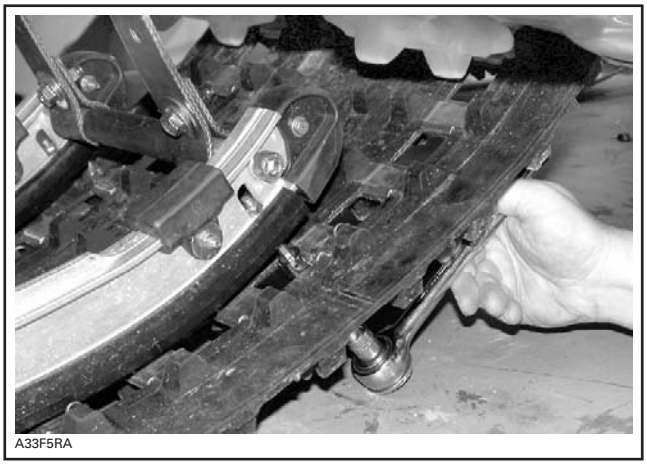
Slider Shoe Removal

1. Lift rear of vehicle and support it off the ground.
2. Completely loosen track tension by unscrewing both adjustment screws.



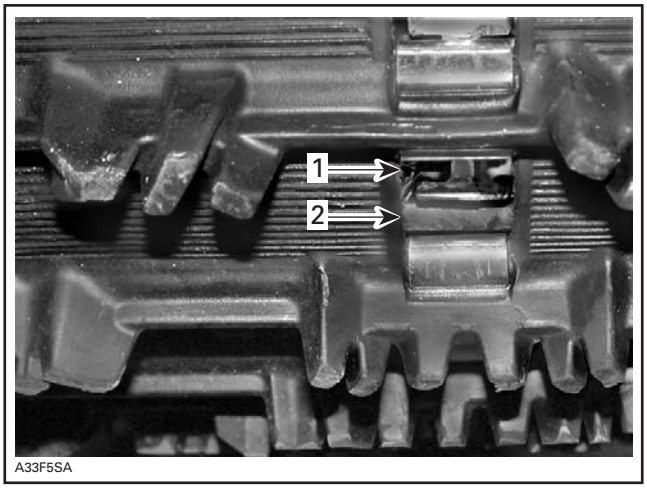
1. *RH adjustment screw*

3. Remove nut and screw of each runner.


A33F5RA

TYPICAL - REMOVE NUT AND SCREW OF EACH RUNNER

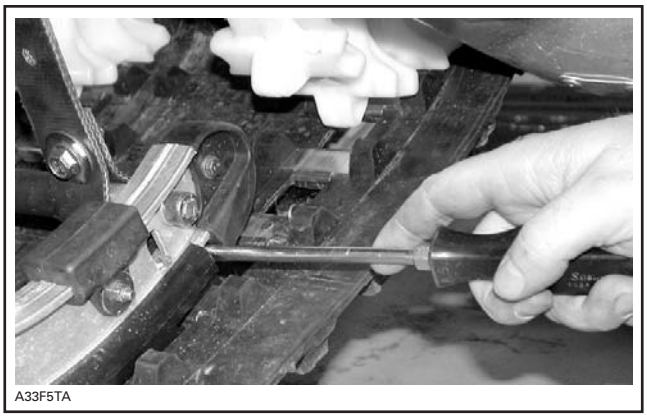
4. At the rear of vehicle, align a track window with slider shoe.



A33F5SA

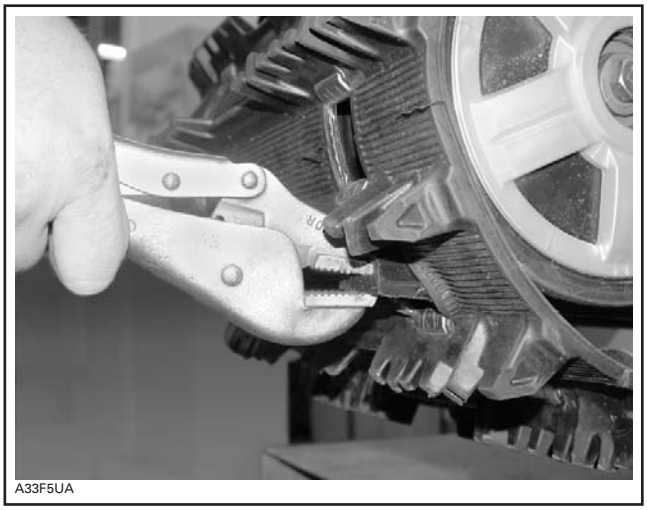
TYPICAL
1. Track window
2. Slider shoe

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

Slider Shoe Installation

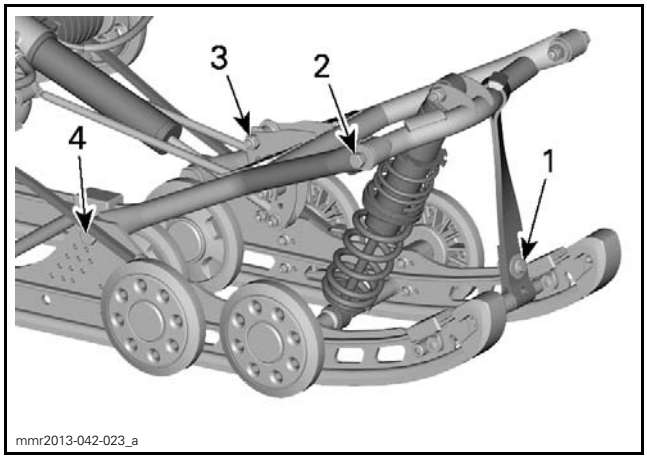
Installation is reverse of removal procedure. However, pay attention to the following.

Make sure to insert slider shoe end with hole first.

FRONT ARM

Front Arm Removal

1. Proceed with *SUSPENSION ASSEMBLY REMOVAL*. See 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.



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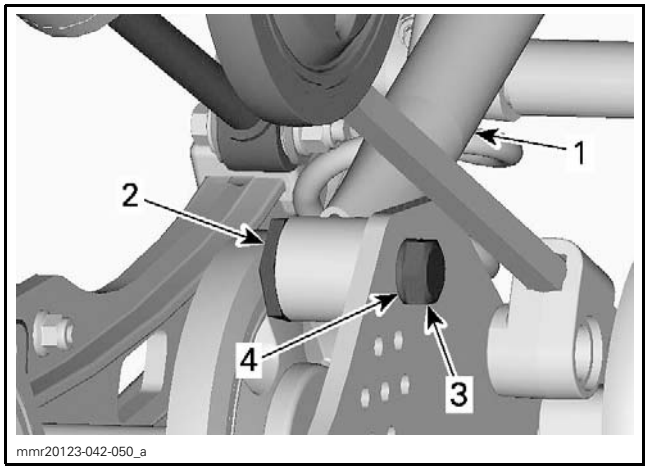
TYPICAL
1. Stopper strap bolt
2. Center shock to front arm bolt
3. Front arm to rocker bolt
4. Front arm to rail screw

4. Remove front arm from suspension assembly.

Front Arm Installation

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.**

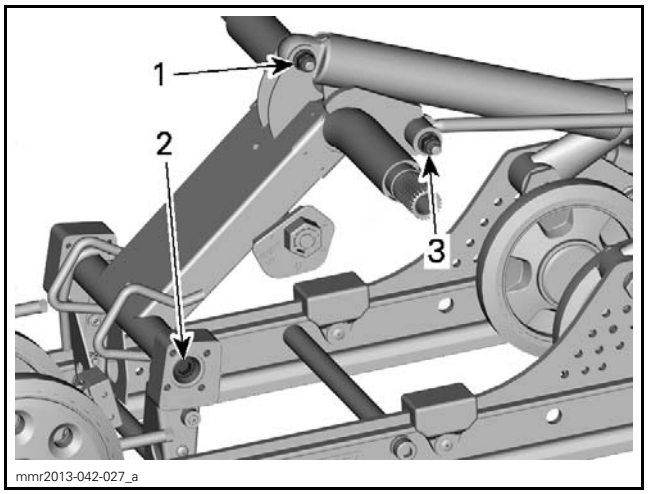
REAR ARM

Rear Arm Removal

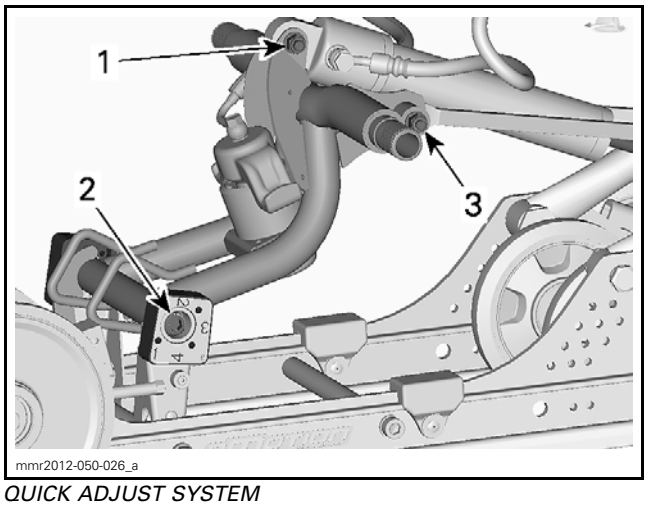
1. Remove rear springs, refer to *REAR SPRING REMOVAL* in this subsection.

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.

Rear Arm Installation

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

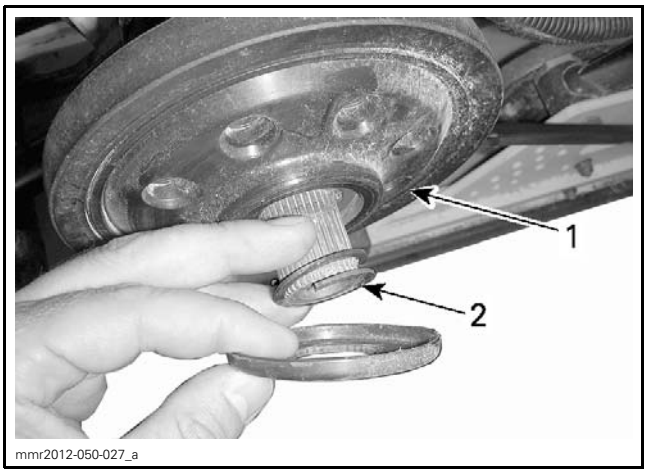
rMotion without Quick Adjust System

Place rear arm grease fitting towards the front of the vehicle.

All Models

Install coupling block with NEW socket screws.

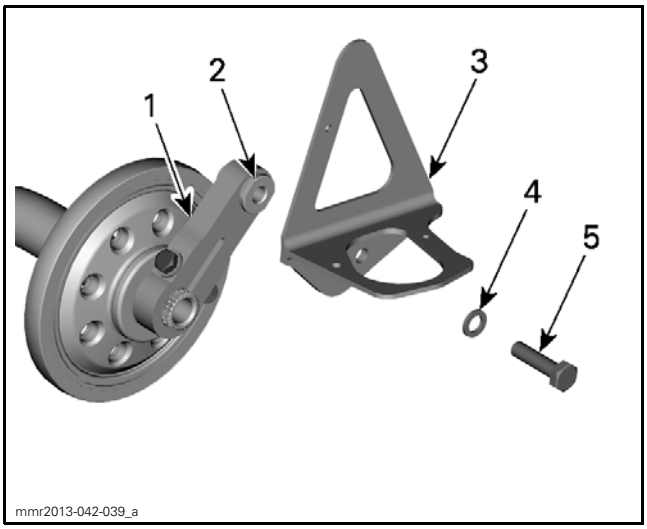
Install upper idler wheels as shown.



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

Install **NEW** connecting rod retaining screws.

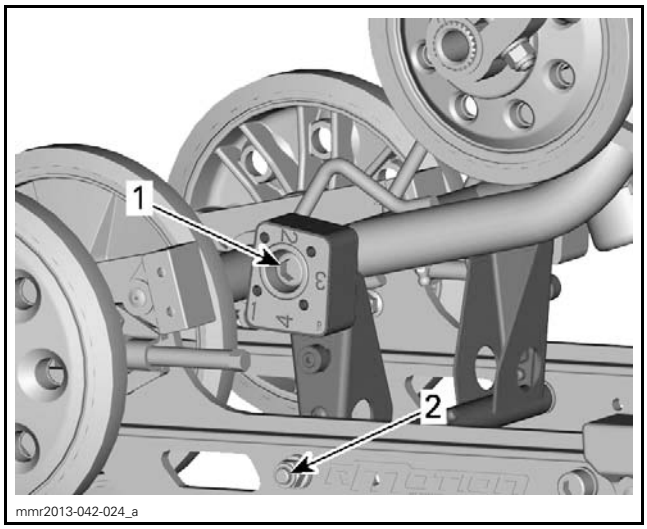
TIGHTENING TORQUE	
Connecting rod retaining screw	61 N•m ± 9 N•m (45 lbf•ft ± 7 lbf•ft)
Connecting rod center retaining screw	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

Lubricate rear arm pivot. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

PIVOT ARM

Pivot Arm Removal

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.

Pivot Arm Installation

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

Install **NEW** coupling block screws.

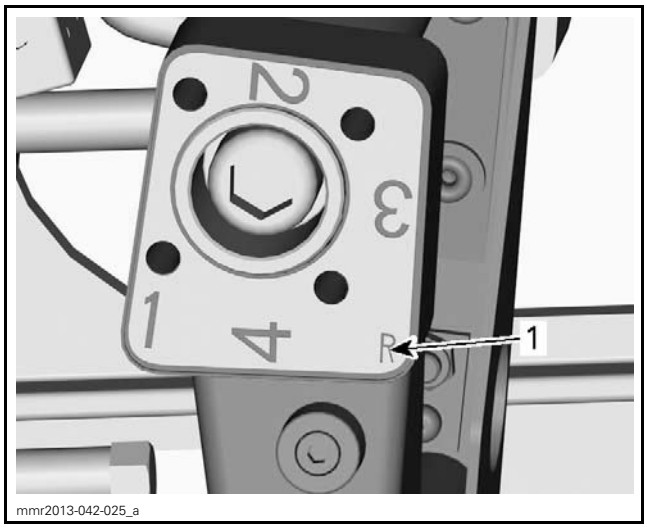
Install pivot arm with the grease fitting towards front of the vehicle.

Lubricate pivot arm. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

COUPLING BLOCKS

Coupling Blocks Removal and Installation

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.



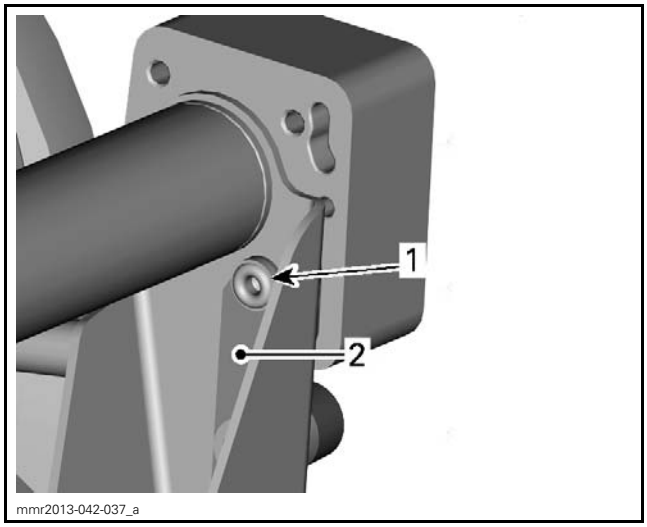
1. Side identification

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

Idler Wheels Removal and Installation

Refer to the exploded views at the beginning of this subsection for parts layout and fasteners tightening torque.

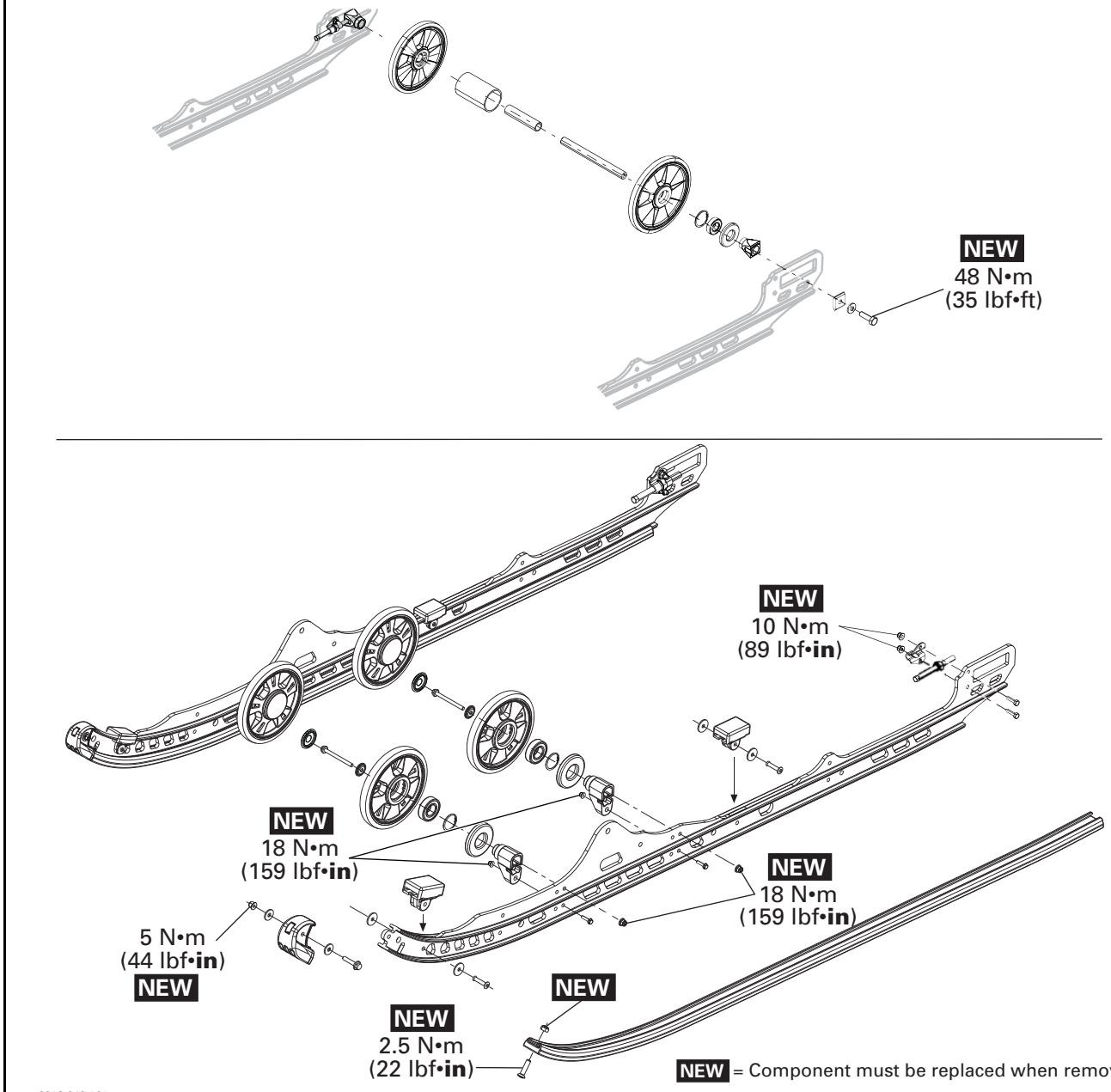
STOPPER STRAP

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)

RAILS AND IDLER WHEELS



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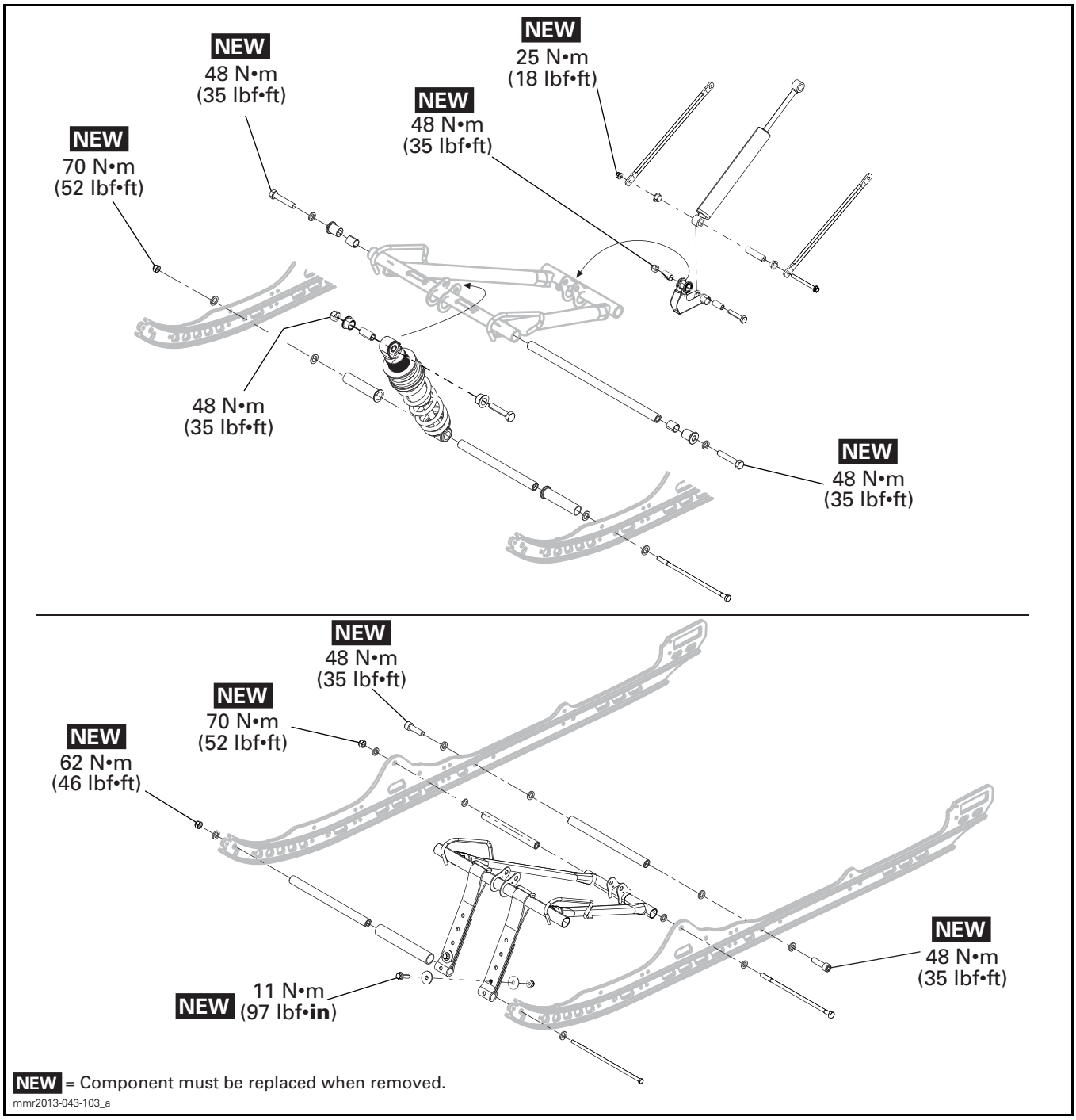
FRONT ARM


NEW
48 N•m
(35 lbf•ft)
NEW
25 N•m
(18 lbf•ft)
NEW
48 N•m
(35 lbf•ft)
NEW
70 N•m
(52 lbf•ft)
48 N•m
(35 lbf•ft)
NEW
48 N•m
(35 lbf•ft)
NEW
48 N•m
(35 lbf•ft)
NEW
70 N•m
(52 lbf•ft)
NEW
62 N•m
(46 lbf•ft)
NEW
48 N•m
(35 lbf•ft)
NEW
11 N•m
(97 lbf•in)
NEW = Component must be replaced when removed.
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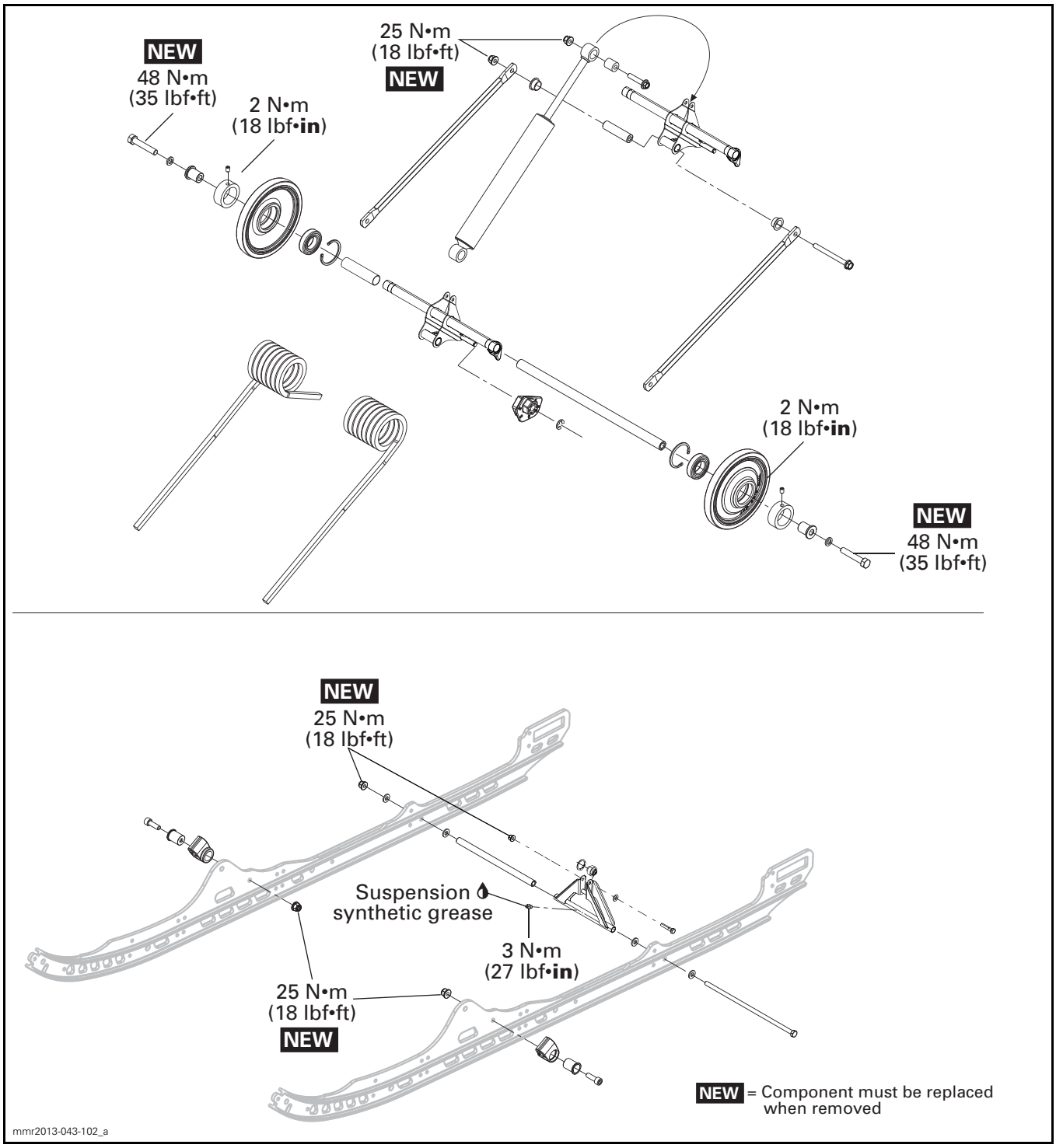
REAR ARM


NEW
48 N•m
(35 lbf•ft)
2 N•m
(18 lbf•in)
25 N•m
(18 lbf•ft)
NEW
2 N•m
(18 lbf•in)
NEW
48 N•m
(35 lbf•ft)
NEW
25 N•m
(18 lbf•ft)
Suspension
synthetic grease
3 N•m
(27 lbf•in)
25 N•m
(18 lbf•ft)
NEW
NEW = Component must be replaced when removed
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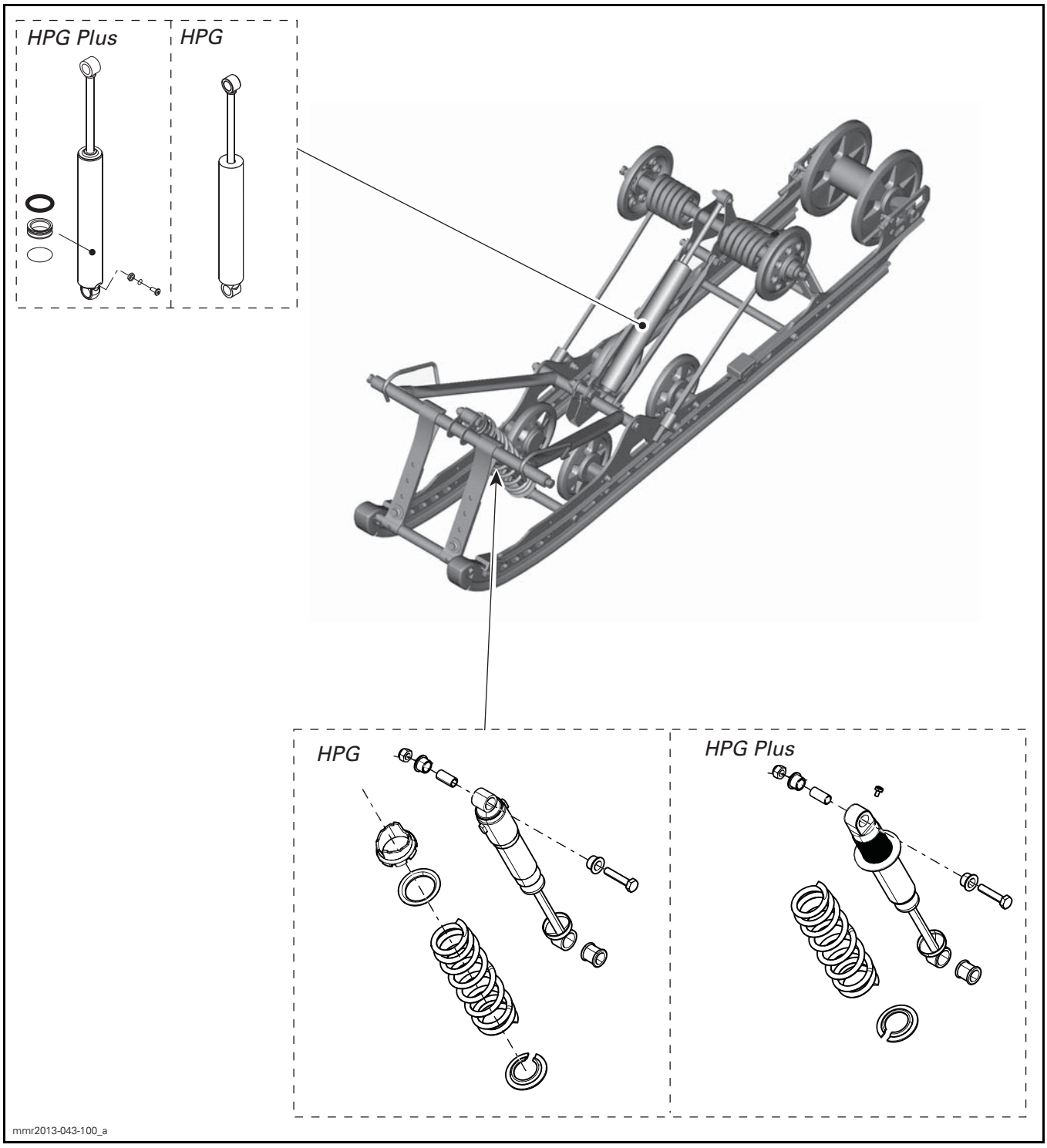
SHOCK ABSORBERS



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.

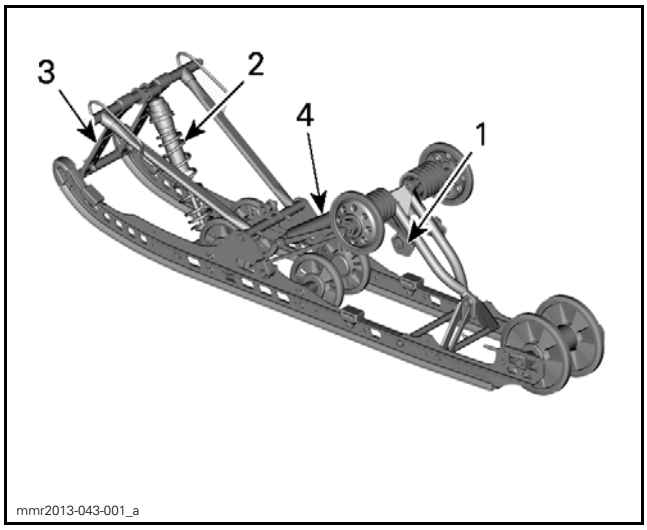
Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* at the beginning of this manual for complete procedure.

⚠ 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



TYPICAL - ADJUSTABLE COMPONENTS
1. *Rear springs*
2. *Center spring*
3. *Stopper strap*
4. *Rear shock absorber*

NOTICE **Whenever adjusting rear suspension, check track tension and adjust if necessary.**

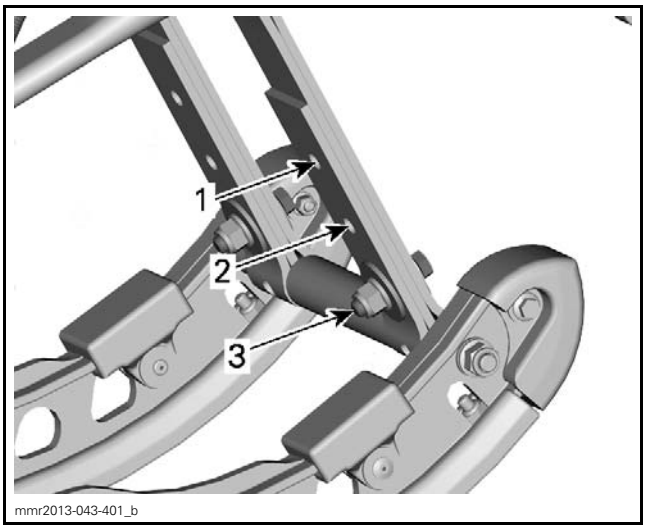
Stopper Strap

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



TYPICAL
1. *Position 1 (longest)*
2. *Position 2*
3. *Position 3 (factory setting)*
4. *Position 4 (not shown)*
5. *Position 5 (not shown - shortest)*

NOTE: Position 4 and 5 hidden on this illustration. Always install stopper strat 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 in deep snow on a flat landscape and a shorter setting will improve handling in steep hill climbing conditions.

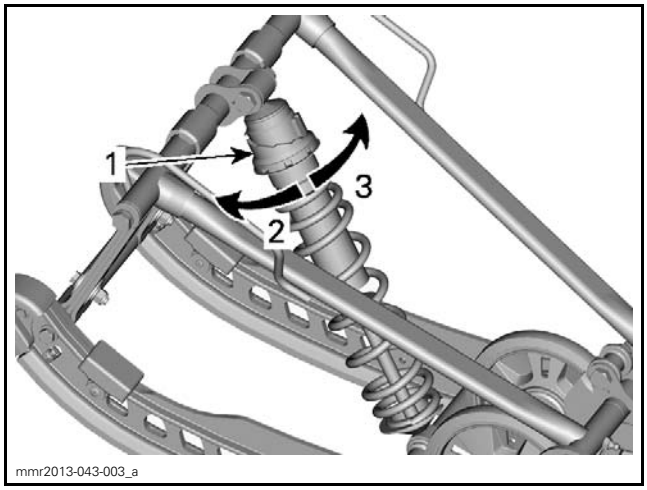
STOPPER STRAP SETTING	
POSITION	USE
1	Not used
2	Boon docking: – Better boon docking manoeuvrability – Better bump absorption – Better deep snow starts (forward and reverse)
3	Factory setting: Best overall setting (General use)
4	Hill climb: – Better track attack angle for hill climbing
5	Steep hill 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



CAM TYPE SHOWN - HPG™ SHOCK ABSORBER
1. *Spring preload adjustment cam*
2. *Decrease preload*
3. *Increase preload*

NOTE: Use the suspension adjustment tool provided in the tool kit.

Rear Springs

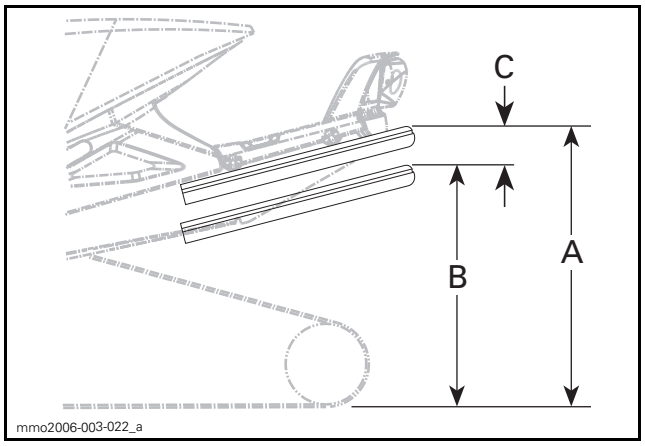
Rear spring preload has an effect on comfort, ride height and load compensation.

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.



TYPICAL — 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

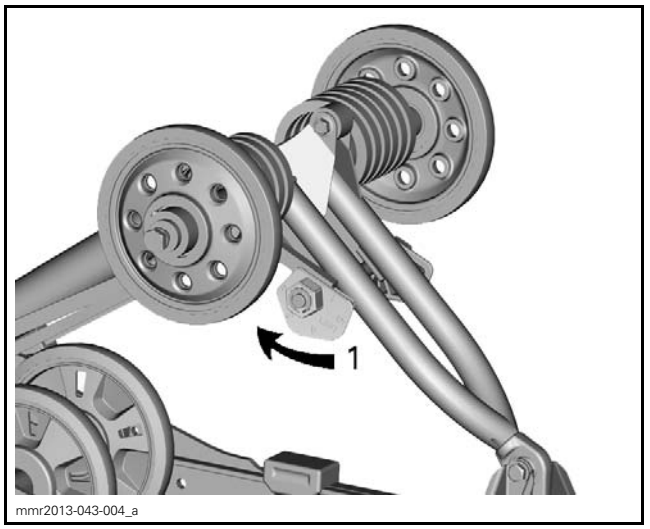
146/154/163" MODELS	
"C"	WHAT TO DO
65 mm to 100 mm (2.5 in to 4 in)	No adjustment required
More than 100 mm (4 in)	Adjusted too soft. Increase preload
Less than 65 mm (2.5 in)	Adjusted too firm. Decrease preload

NOTE: If the specification is unattainable with the original springs, refer to the applicable *SPRING CHART* bulletin for other available springs.

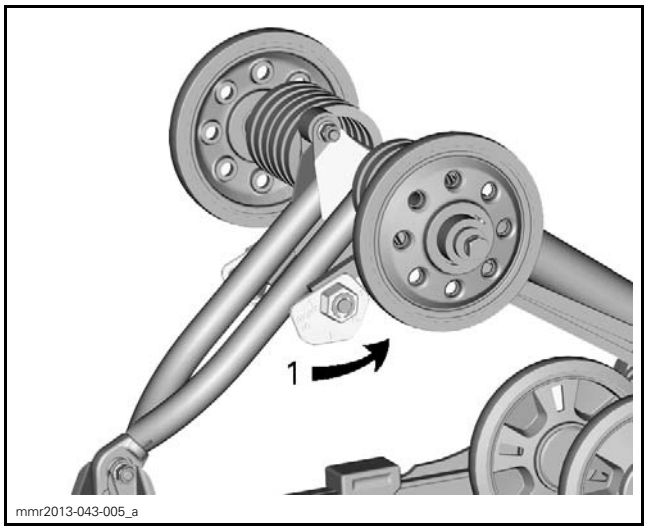
NOTICE **To increase spring preload, always turn the left side adjustment cam in a clockwise direction, and the right side cam in a counter-clockwise direction.**

⚠ CAUTION **Never set preload cams directly from position 5 to 1 or directly from position 1 to 5.**

The adjustment cams have 5 different settings, 1 being the softest.



TYPICAL —LH SIDE
1. Adjust spring preload



TYPICAL —RH SIDE
1. Adjust spring preload

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

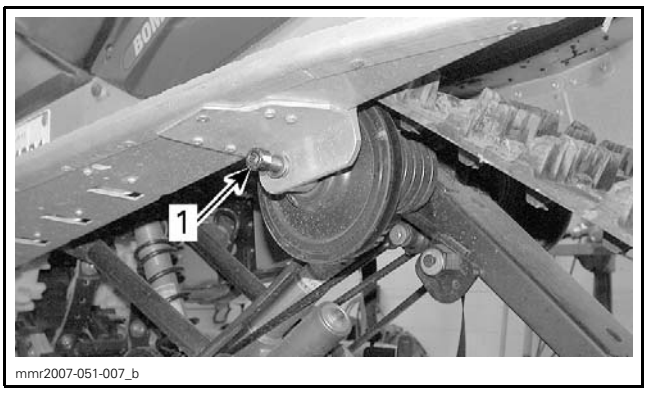
NOTE: Many parts can be changed with rear suspension in place. When specified, refer to *SUSPENSION ASSEMBLY* to remove rear suspension from vehicle.

SUSPENSION ASSEMBLY

Suspension Assembly Removal

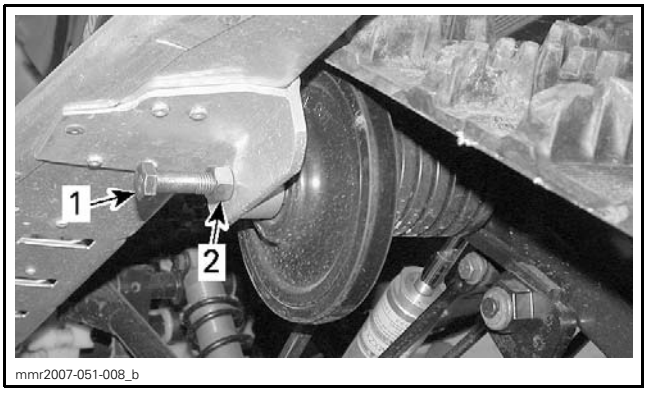
1. Lift rear of vehicle and support it off the ground.

2. Completely loosen track tension.
3. Remove and discard rear arm bolts from chassis. Use the following procedure to remove bolts easily.
   3.1 Unscrew one of the socket screws securing the rear arm to frame.



TYPICAL
1. Socket bolt

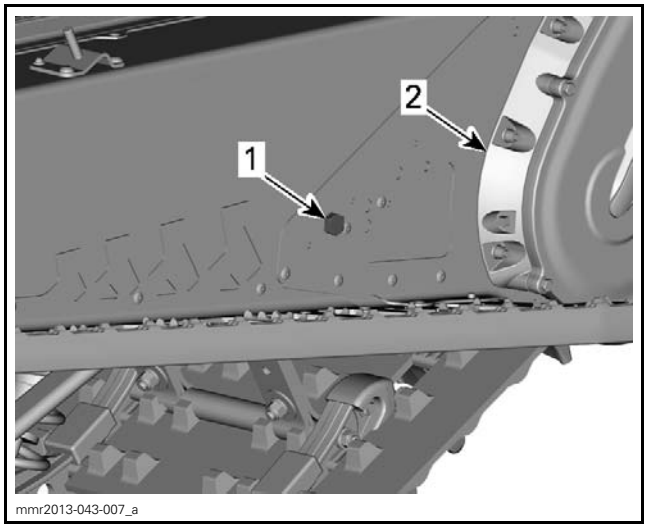
   3.2 Replace this socket screw with an hexagonal bolt (longer than socket screw) and a nut.
   3.3 Screw in the hexagonal bolt by approximately 7 turns.
   3.4 Hold the hexagonal bolt and tighten locking nut.



TYPICAL
1. Hexagonal bolt
2. Locking nut

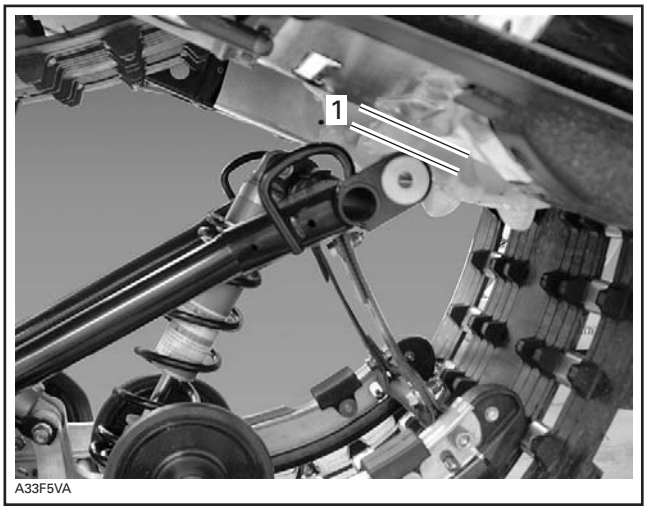
   3.5 Unscrew the socket screw on the other side then unlock nut and remove the hexagonal bolt.
4. Remove bolts retaining front arm to tunnel.

NOTE: Discard the front arm bolts.

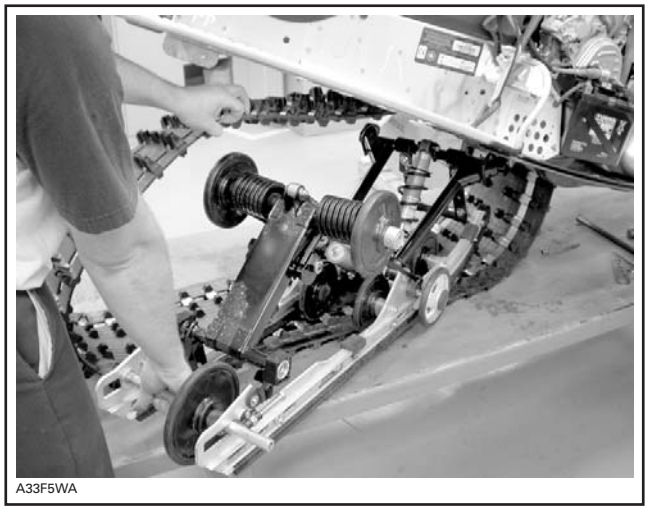


TYPICAL
1. Front arm bolt
2. Chaincase

5. Lift rear of vehicle until front arm as enough clearance to pass underneath tunnel.



TYPICAL
1. Enough clearance



TYPICAL — REMOVE SUSPENSION

Suspension Assembly Installation

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 arm nuts.

Install **NEW** rear arm screws.

Tighten screws to specified torque.

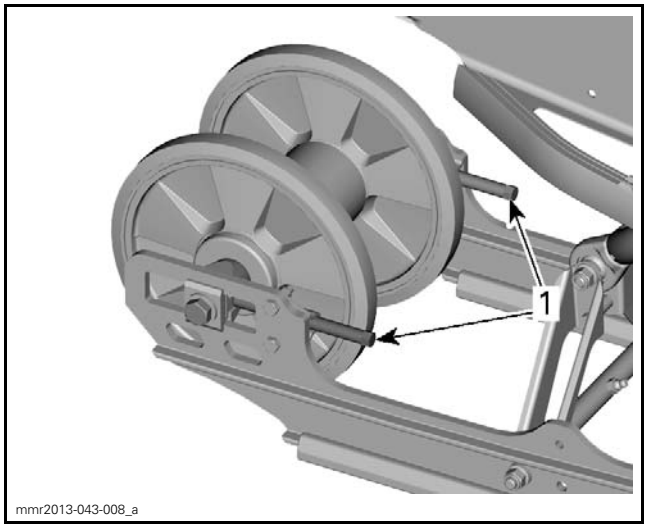
UPPER SUSPENSION ARM FASTENERS TIGHTENING TORQUE	
Front arm nuts	48 N•m (35 lbf•ft)
Rear arm screws	48 N•m (35 lbf•ft)

Adjust track tension, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

REAR AXLE

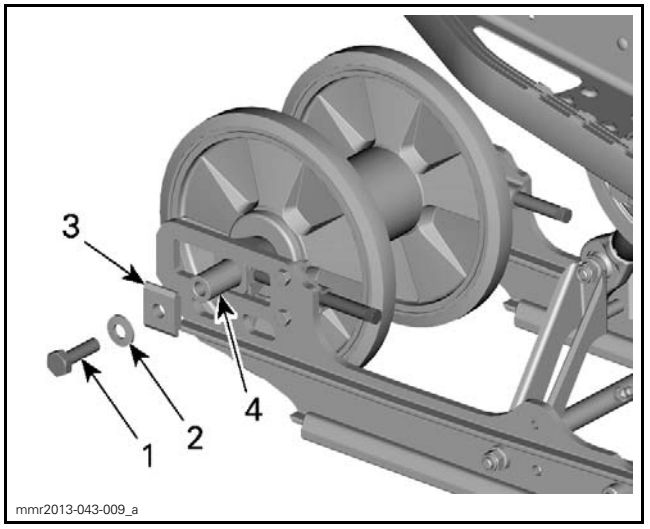
Rear Axle Removal

1. Lift rear of vehicle and support it off the ground.
2. Loosen rear axle screws (one each side).
3. Completely loosen track tension by unscrewing both adjustment screws.



1. Adjustment screws

4. Remove both rear axle screws.
5. Remove rear idler wheels, seals and wheel spacers.



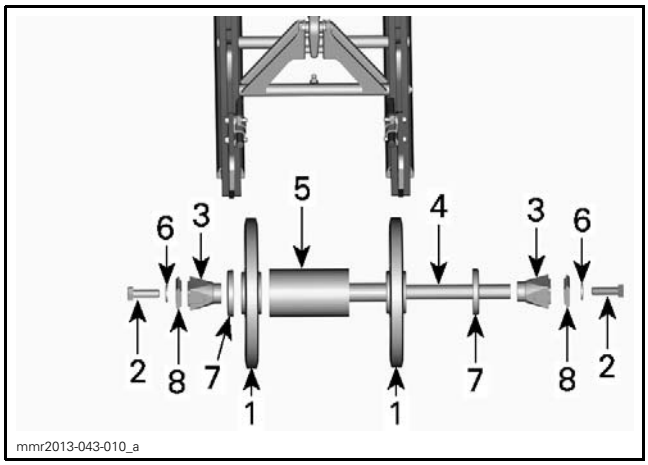
RH SIDE SHOWN
1. Retaining screw
2. Washer
3. Slider
4. Rear axle

6. Pull out the rear axle.
7. Remove spacer, washers and inner idler wheel(s).

Rear Axle Installation

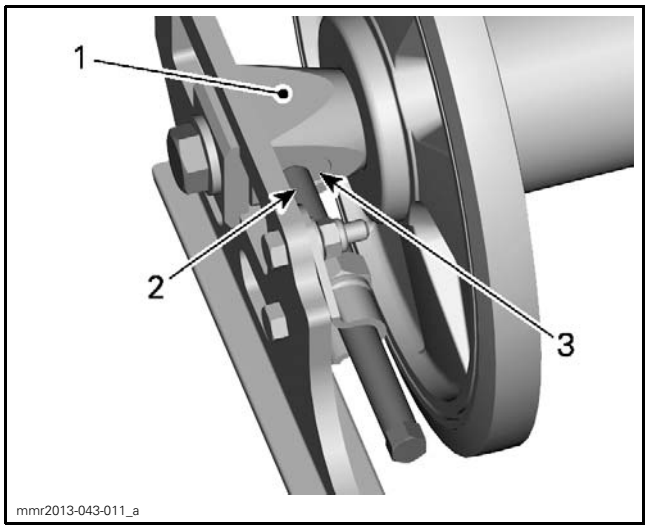
Installation is the reverse of removal procedure. However, pay attention to the following.

1. Make sure to position all parts correctly.



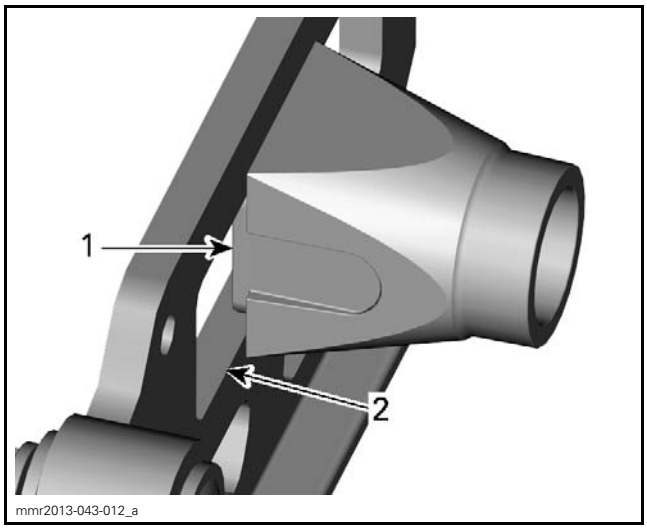
2 IDLER WHEELS LAYOUT
1. *Idler wheels*
2. *Retaining screws*
3. *Slider*
4. *Rear axle*
5. *Rear axle spacer*
6. *Washers*
7. *Seals*
8. *Slider*

2. Position wheel spacers with a flat side up and a groove in front of tensioner screw.



1. *Flat side of wheel spacer*
2. *Tensioner screw*
3. *Tensioner screw*

NOTE: When tightening rear axle, make sure each wheel spacer protuberance is engaged into runner slot.



1. *Wheel spacer protuberance*
2. *Runner slot*

3. Adjust track tension. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

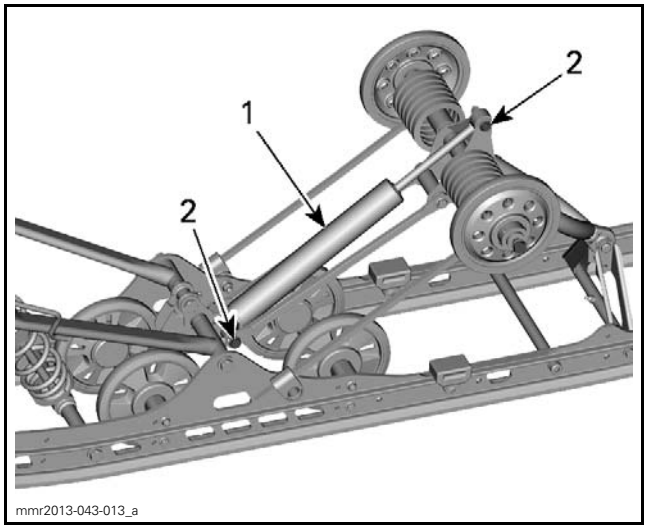
SHOCK ABSORBERS

Rear Shock Absorber Removal

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.

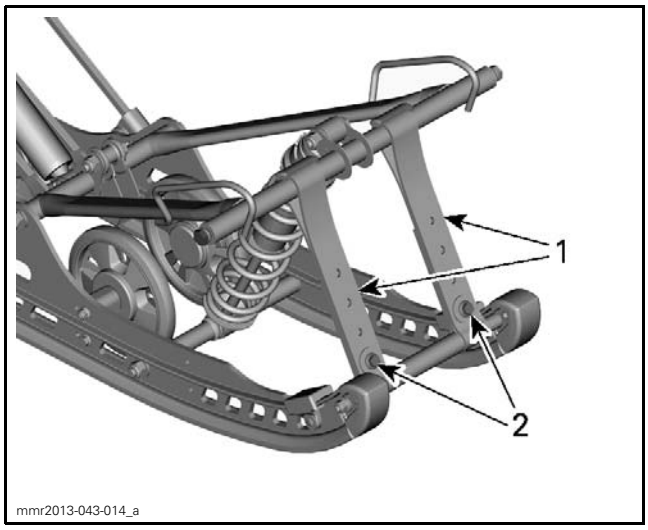
2. Remove bolts and nuts from shock.



1. *Rear shock absorber*
2. *Remove bolts and nuts*

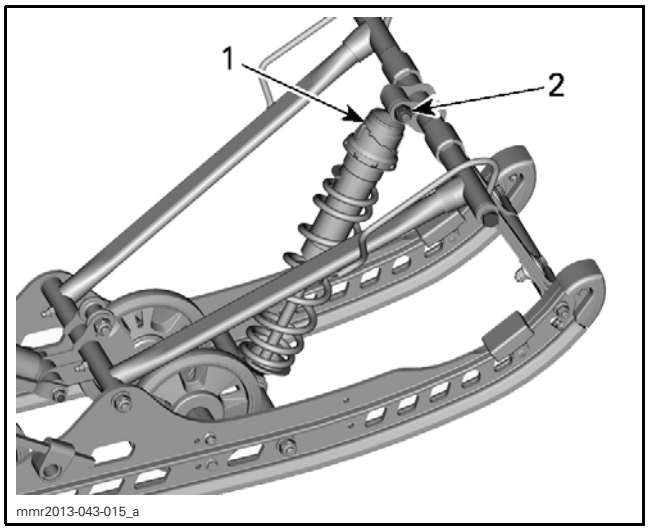
Center Shock Absorber Removal

1. Lift the rear of vehicle and support it off the ground.
2. Unfasten stopper strap(s).



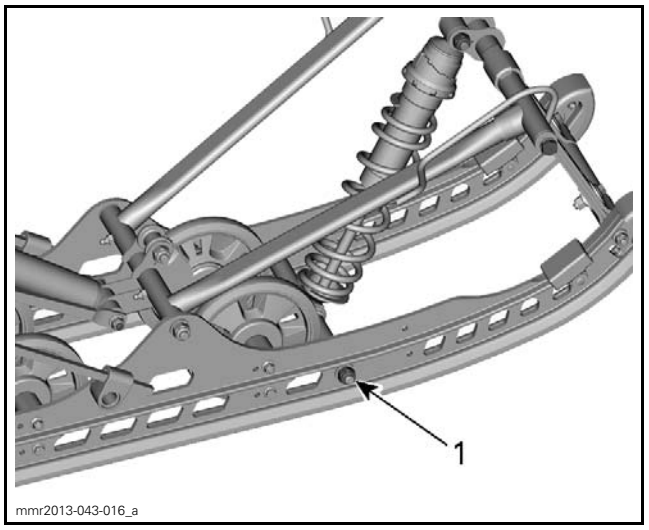
1. Stopper strap
2. Stopper strap bolt

3. Remove upper shock absorber bolt.



1. Front shock absorber
2. Remove bolt and nut

4. Remove and discard socket screws (one each side) securing shock shaft.



1. RH socket screw

5. Remove shock absorber from vehicle.
6. Remove bushings and shock shaft from shock absorber.

Shock Absorber Inspection

Refer to *REAR SUSPENSION (rMOTION)* subsection for complete procedures.

Shock Absorber Rebuilding

Refer to *REAR SUSPENSION (rMOTION)* subsection for complete procedures.

Rear Shock Absorber Installation

Installation is the reverse of removal procedure. Pay attention to the following.

To ease shock installation, secure upper side of shock first.

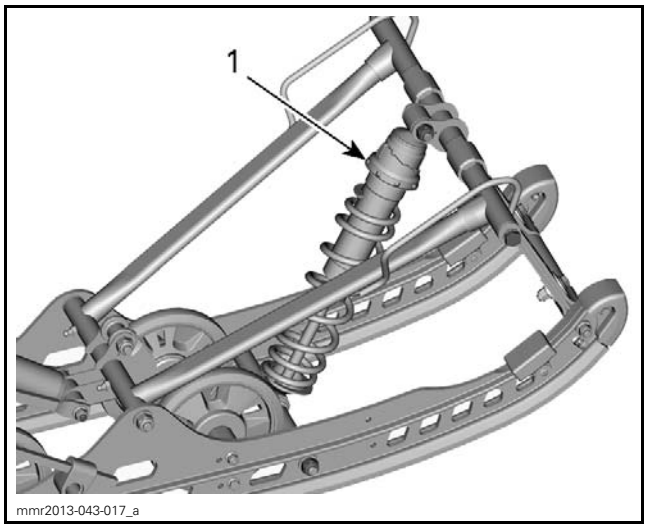
Install **NEW** shock absorber retaining nuts and tighten to specified torque.

REAR SHOCK ABSORBER FASTENERS TIGHTENING TORQUE	
Upper nut	25 N•m (18 lbf•ft)
Lower nut	25 N•m (18 lbf•ft)

Center Shock Absorber Installation

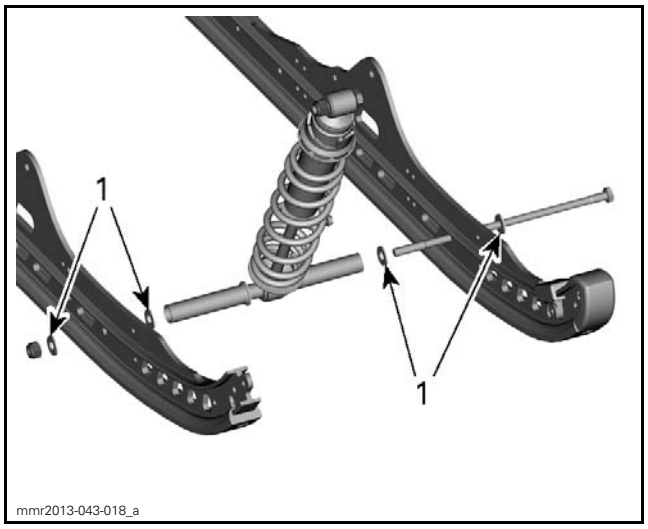
Installation is the reverse of removal procedure. Pay attention to the following.

1. Position the adjustment ring or cam upwards and the valve (if so equipped) towards the tunnel.



TYPICAL
1. Cam

2. Using NEW socket screws, install shock shaft to runners.
3. Position washers in proper position.



BOTTOM OF SHOCK ABSORBER
1. Washers location

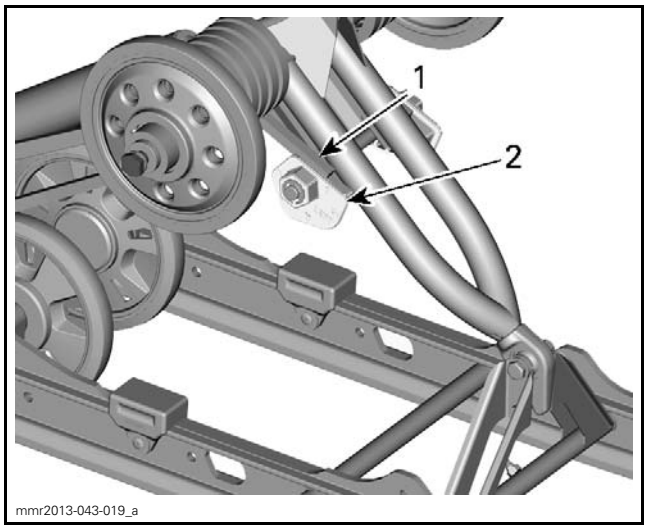
Tighten screws to the specified torque.

CENTER SHOCK ABSORBER LOWER FASTENERS TIGHTENING TORQUE
70 N•m (52 lbf•ft)

REAR SPRINGS

Rear Spring Removal

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.

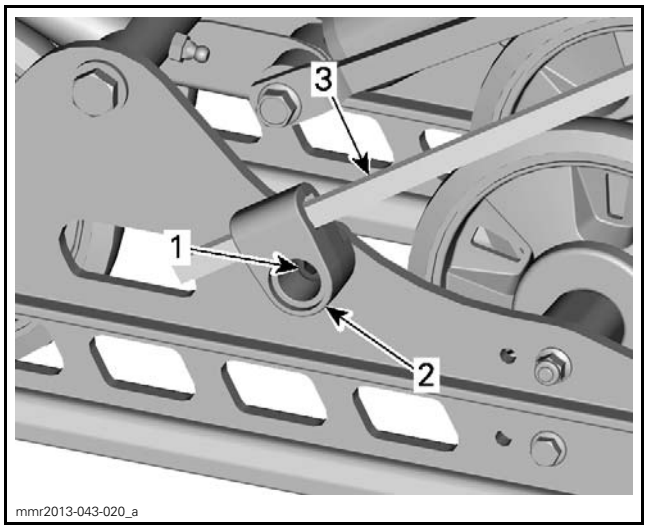


LH SIDE SHOWN
1. Rear spring
2. Cam

4. Firmly hold the spring support and unscrew its retaining bolt (one each side).

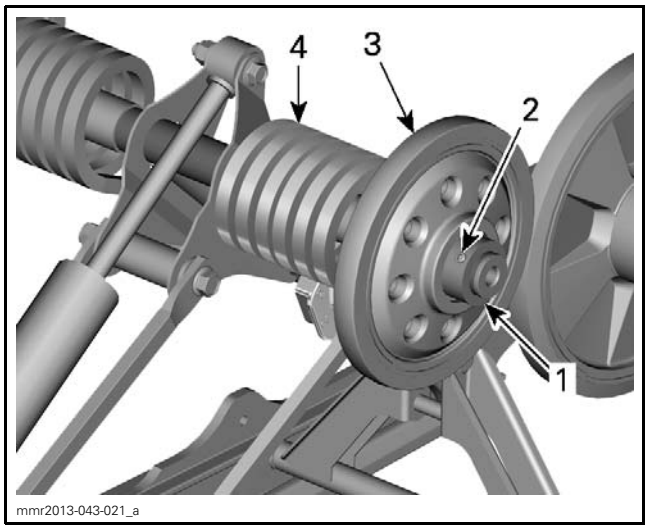
⚠ WARNING

Supports are spring loaded.



1. Spring support bolt
2. Spring support
3. Spring

5. Remove screws and washers from rear arm top axle.
6. Loosen set screw from locking rings.
7. Remove locking rings.
8. Remove upper idler wheels.
9. Remove springs.

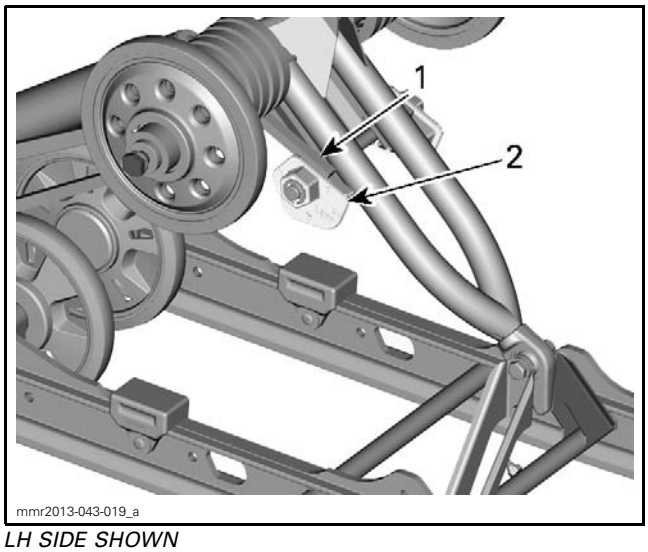


LH SIDE SHOWN
1. *Locking ring*
2. *Set screw*
3. *Upper idler wheel*
4. *Rear spring*

Rear Spring Installation

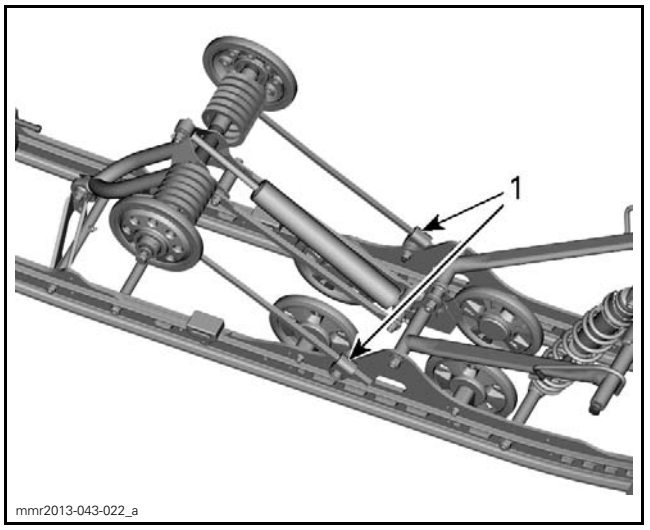
Installation is the reverse of removal procedure. Pay attention to the following.

1. Respect THIS SIDE OUT inscription on top idler wheels.
2. Make sure that spring end is in cam adjuster.



LH SIDE SHOWN
1. *Spring end*
2. *Cam*

3. Install spring supports upwards.

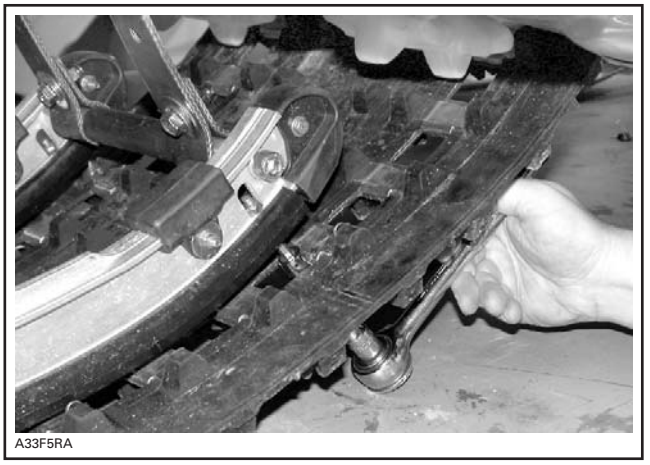


TYPICAL
1. *Spring supports upwards*

SLIDER SHOES

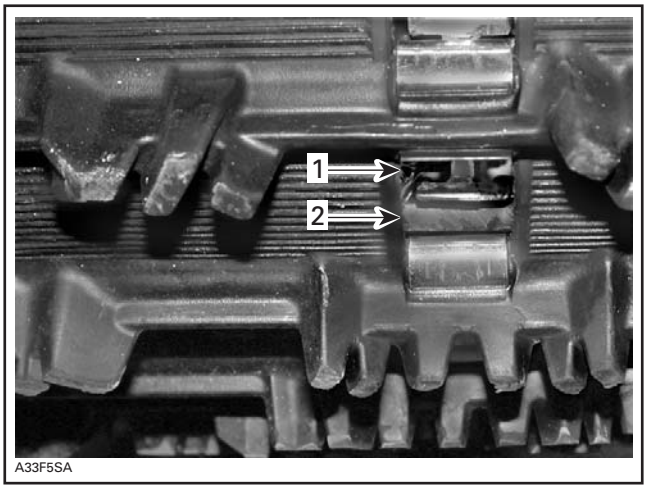
Slider Shoe Removal

1. Lift rear of vehicle and support it off the ground.
2. Completely loosen track tension.
3. Remove nut and screw of each runner.



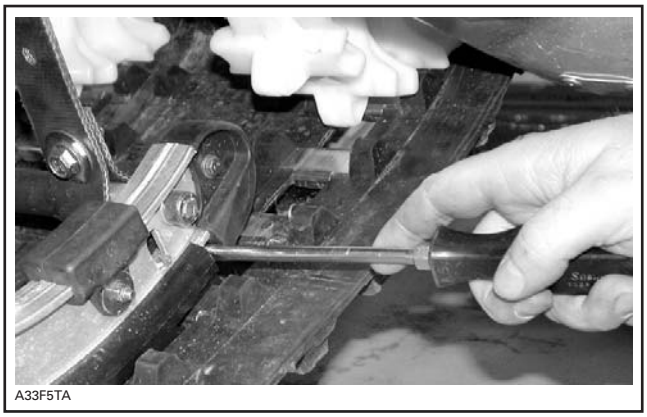
TYPICAL - REMOVE NUT AND SCREW OF EACH RUNNER

4. At the rear of vehicle, align a track window with slider shoe.



TYPICAL
1. Track window
2. Slider shoe

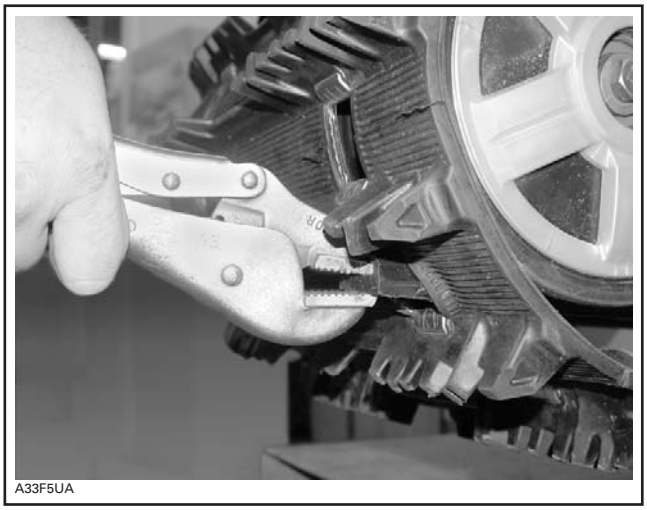
5. Using a pry bar or a screwdriver, push slider shoe rearward until it comes in contact with track.



PUSH ON SLIDER SHOE

6. Using locking pliers, pull slider shoe through track window to remove.

NOTE: If necessary, lubricate track window to facilitate slider shoe removal.



PULL ON SLIDER SHOE TO REMOVE

Slider Shoe Installation

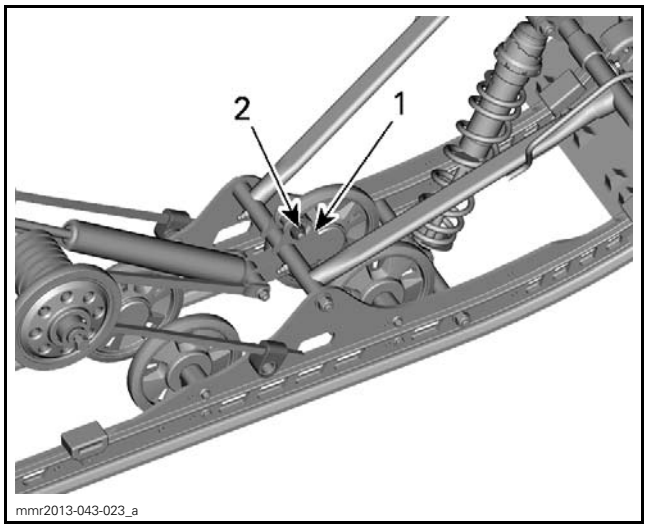
Installation is the reverse of removal procedure. Pay attention to the following detail.

Make sure to insert slider shoe end with hole first.

FRONT ARM

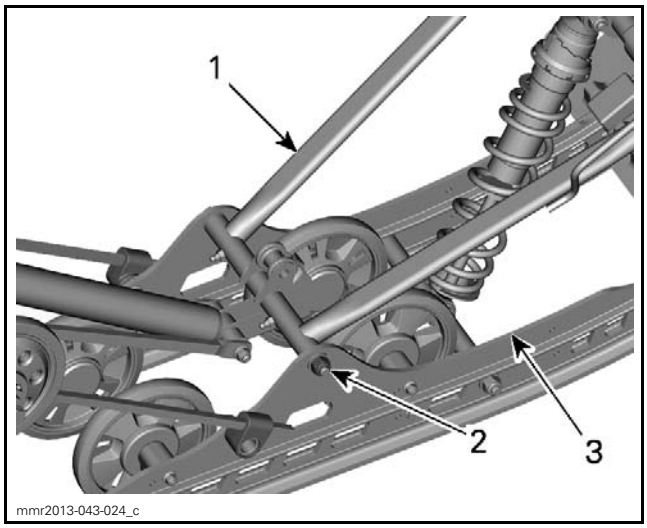
Front Arm Removal

1. Proceed with *SUSPENSION ASSEMBLY REMOVAL*, see procedure in this subsection.
2. Remove the bolt securing rocker to front arm.



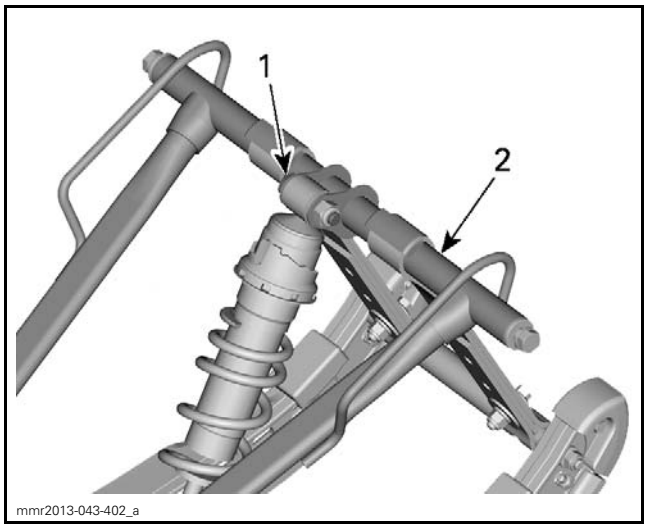
TYPICAL
1. Rocker
2. Retaining screw

3. Remove the front arm lower bolt, nut and washers. Discard retaining nut.



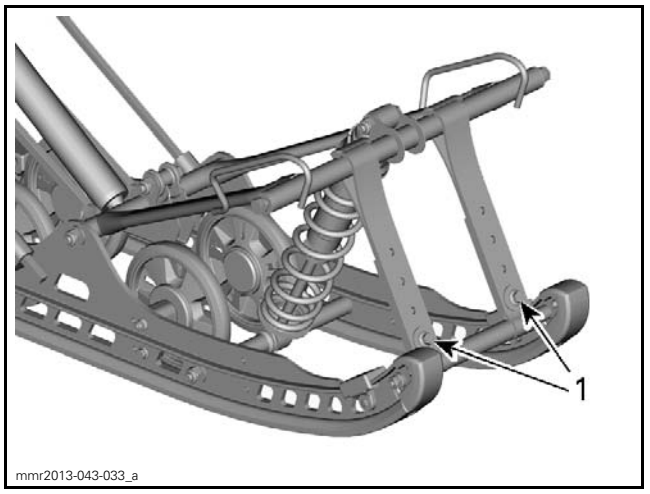
TYPICAL
1. *Front arm*
2. *Lower bolt*
3. *RH runner*

4. Remove the shock absorber upper bolt.



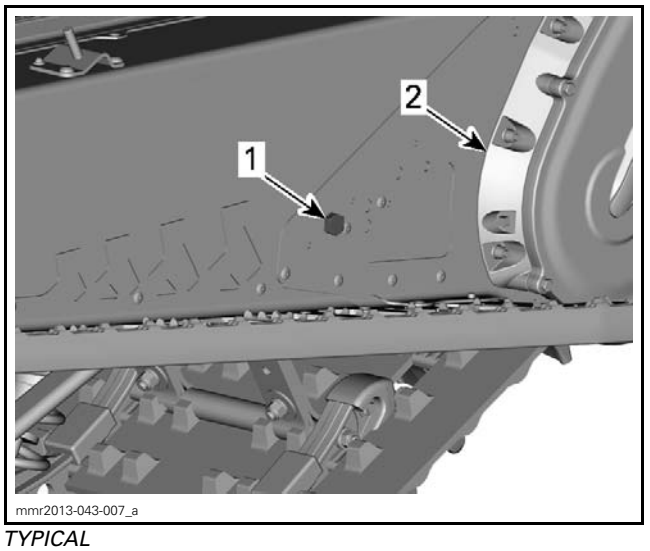
TYPICAL
1. *Shock absorber upper bolt*
2. *Front arm*

5. Unfasten stopper straps.



1. *Stopper strap bolts*

6. Remove and discard front arm upper bolts.



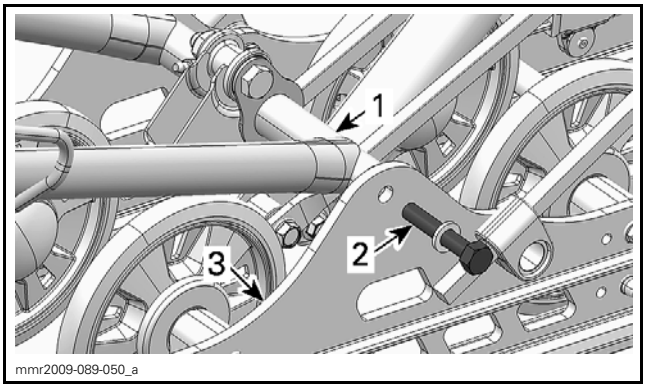
TYPICAL
1. *Front arm bolt*
2. *Chaincase*

7. Remove front arm.

Front Arm Installation

Installation is the reverse of removal procedure. Pay attention to the following.

1. Install **NEW** front arm lower nuts.
2. Install **NEW** front arm upper bolts.



mmr2009-089-050_a

1. Front arm
2. Front arm lower bolt (LH side)
3. Runner

3. Tighten screws to the specified torque.

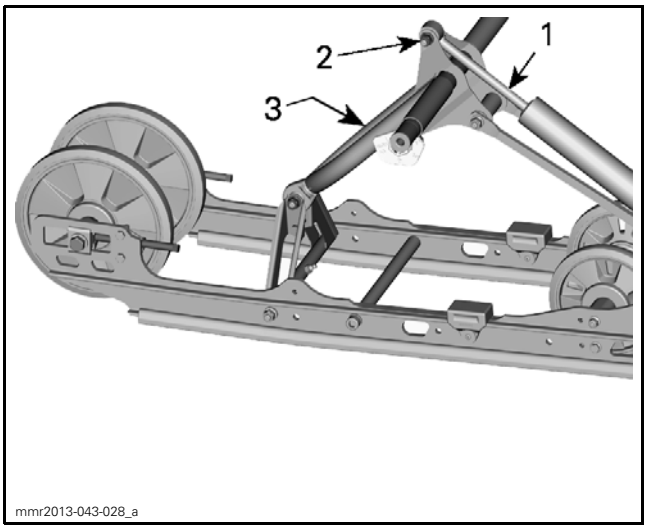
FRONT ARM LOWER FASTENERS TIGHTENING TORQUE
70 N•m (52 lbf•ft)

FRONT ARM UPPER FASTENERS TIGHTENING TORQUE
48 N•m (35 lbf•ft)

REAR ARM

Rear Arm Removal

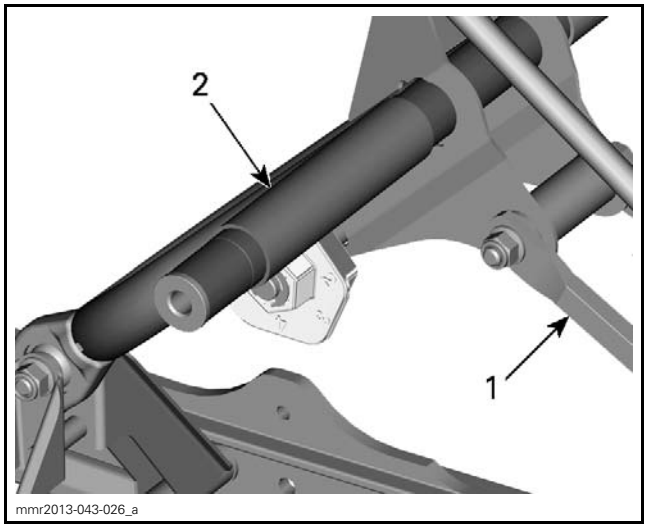
1. Lift rear of vehicle and support it off the ground.
2. Completely loosen track tension.
3. Proceed with *REAR SPRING REMOVAL*, see procedure in this section.
4. Remove the rear shock absorber upper bolt and discard nut.



mmr2013-043-028_a

1. Rear shock absorber
2. Shock absorber bolt
3. Rear arm

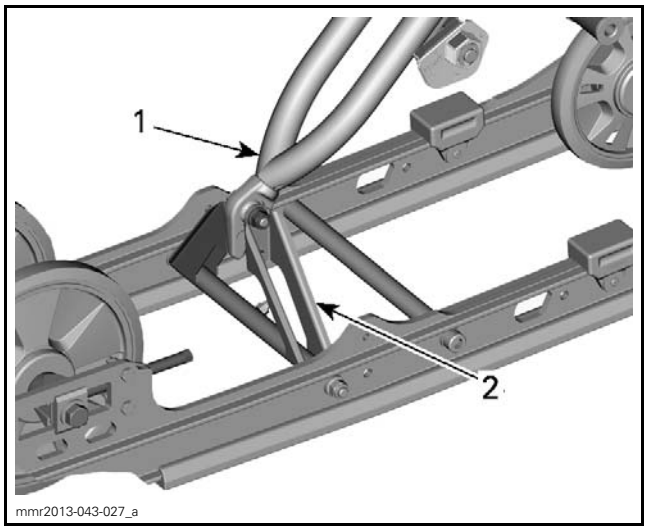
5. Remove throttle rods from rear arm.



mmr2013-043-026_a

1. Throttle rods (1 not illustrated)
2. Rear arm

6. Remove bolt, nut and washer holding rear arm to pivot arm. Discard nut.



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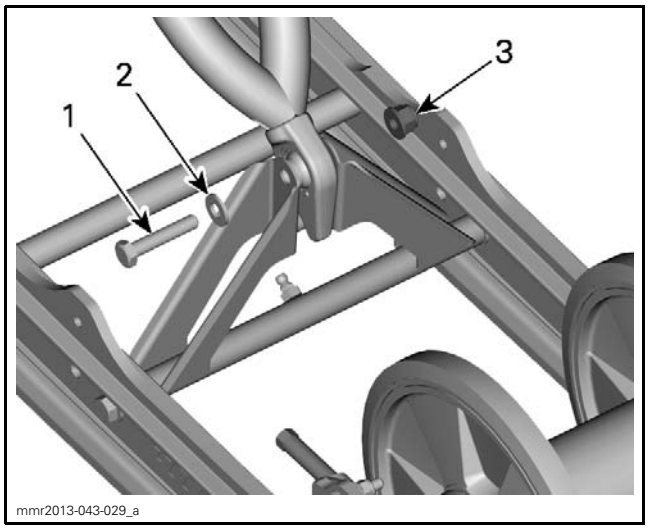
1. Rear arm
2. Pivot arm



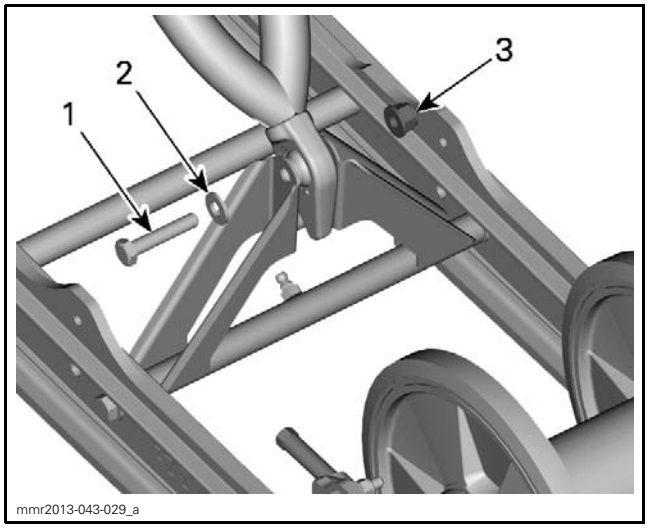
1. Retaining bolt
2. Washer
3. Retaining nut

Rear Arm Installation

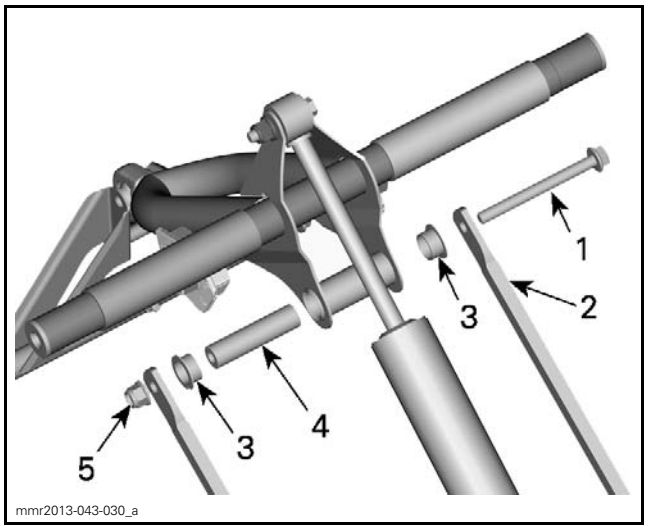
Installation is the reverse of removal procedure. Pay attention to the following.

1. Pivot arm grease fitting must be towards the front of the vehicle.
2. At installation, rear arm stroke limiter must be at rear.
3. Install **NEW** nuts and tighten to the specified torque.

Assemble rear arm fasteners as per following illustrations.



1. Retaining bolt
2. Washer
3. Retaining nut



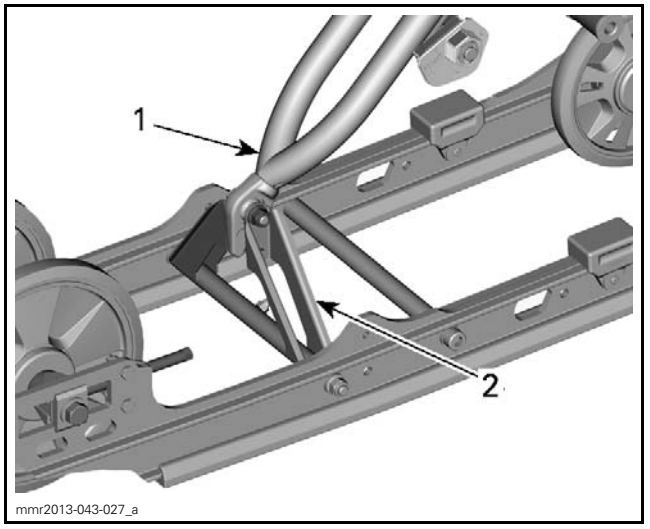
SOME PARTS REMOVED FOR CLARITY PURPOSES
1. Throttle rod upper bolt
2. Throttle rods
3. Bushings
4. Axle
5. Throttle rod upper nut

REAR ARM FASTENERS TIGHTENING TORQUE	
Rear shock absorber upper nut	25 N•m (18 lbf•ft)
Throttle rods upper nut	25 N•m (18 lbf•ft)
Pivot to rear arm nut	25 N•m (18 lbf•ft)

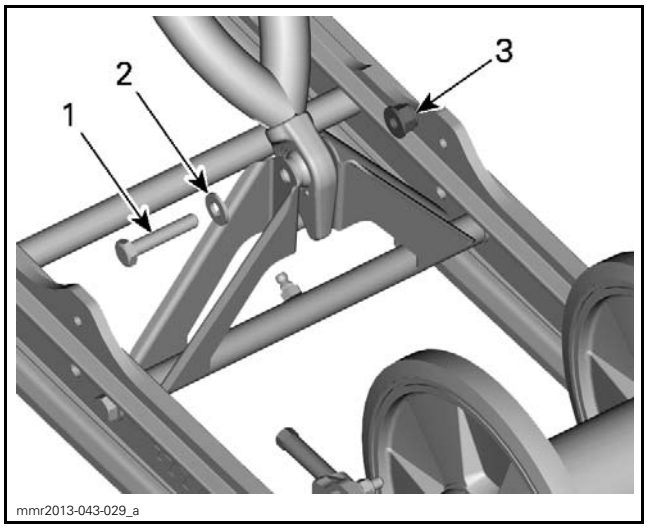
PIVOT ARM

Pivot Arm Removal

1. Lift rear of vehicle and support it off the ground.
2. Completely loosen track tension by unscrewing both adjustment screws.
3. Remove bolt and washers retaining rear arm to pivot arm. Discard nut.

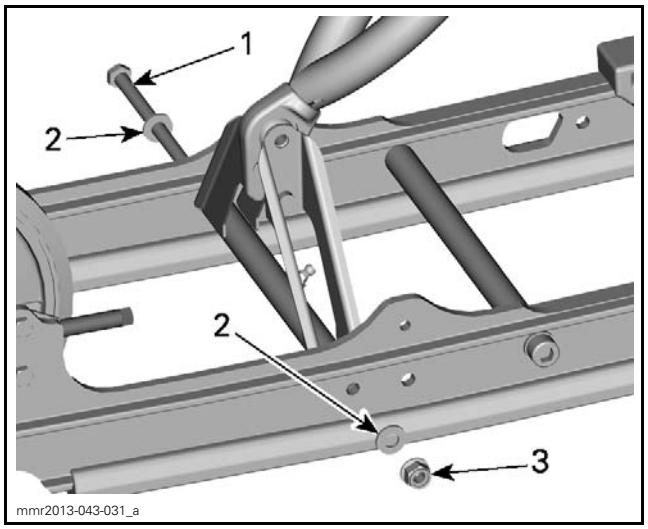


1. Rear arm
2. Pivot arm



1. Retaining bolt
2. Washer
3. Retaining nut

4. Remove bolt, nut and 4 washers retaining pivot arm to runners.



1. Retaining bolt
2. Outer washers
3. Retaining nut

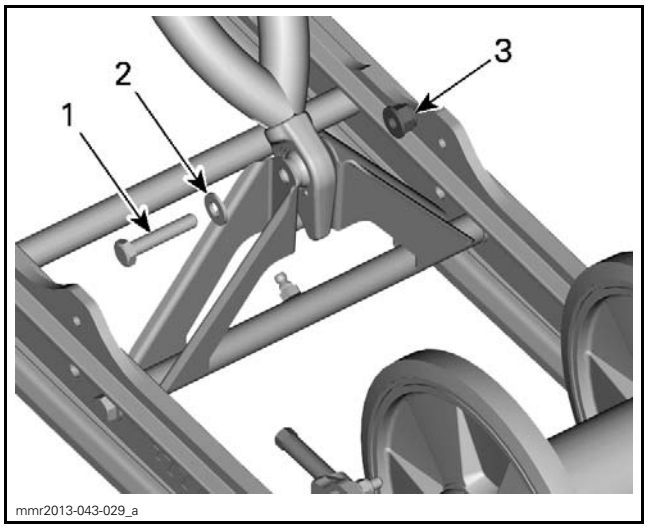
NOTE: Make sure inner washers are properly removed from assembly to avoid losing them

5. Carefully remove pivot arm from rear arm.

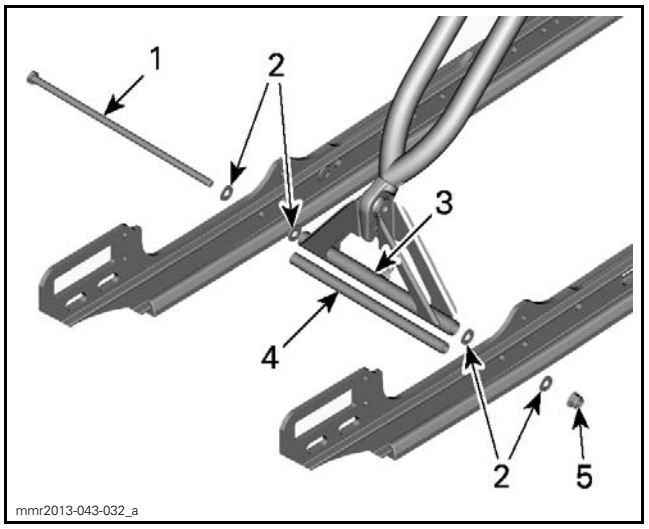
Pivot Arm Installation

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

Assemble pivot arm fastener as per following illustrations.



1. Retaining bolt
2. Washer
3. Retaining nut



PARTS REMOVED FOR CLARITY PURPOSE
1. Pivot arm lower nut
2. Washers
3. Pivot arm
4. Axle
5. Pivot arm lower screw

Torque pivot arm lower nut to 25 N•m (18 lbf•ft).

Lubricate pivot arm. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

IDLER WHEELS AND SUPPORTS

Refer to the exploded views at the beginning of this subsection for parts layout and fasteners tightening torque.

STOPPER STRAP

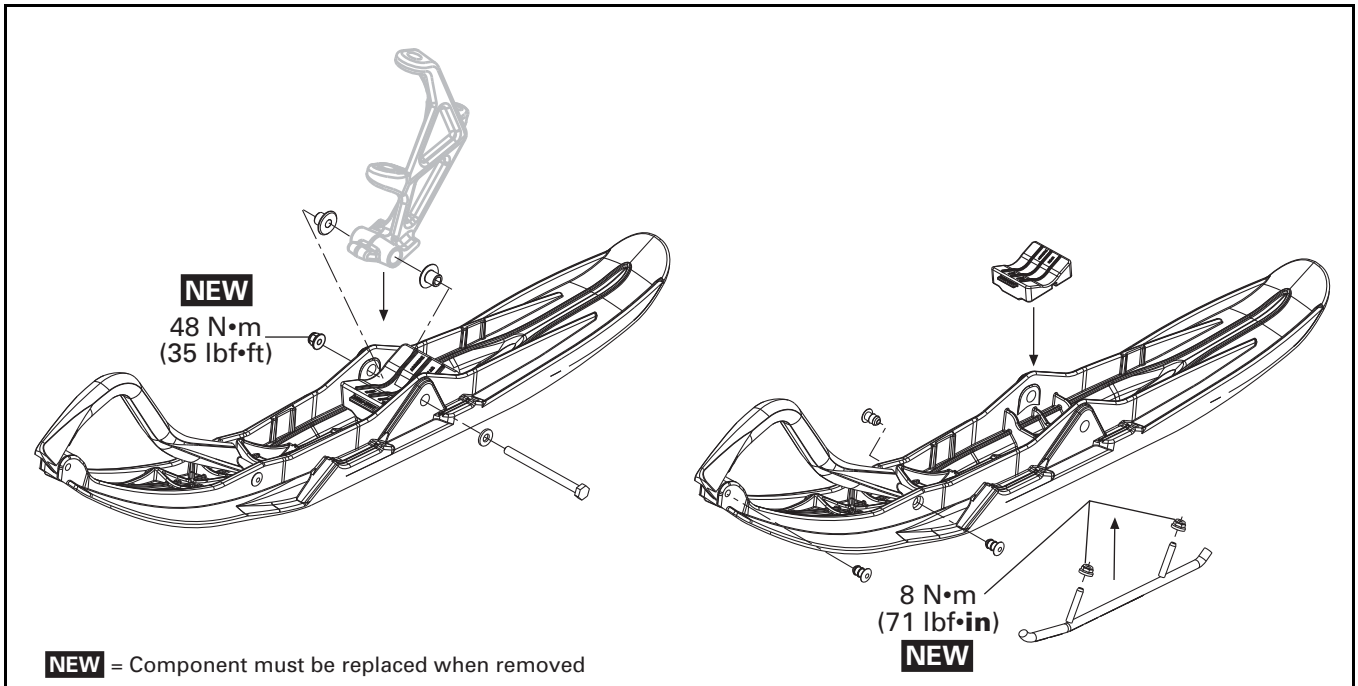
Refer to the exploded views at the beginning of this subsection for parts layout and fasteners tightening torque.

STEERING SYSTEM

SERVICE TOOLS – OTHER SUPPLIER

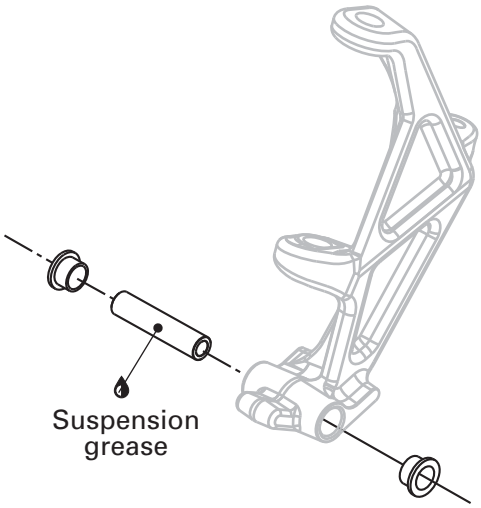
SERVICE PRODUCTS

SKIS

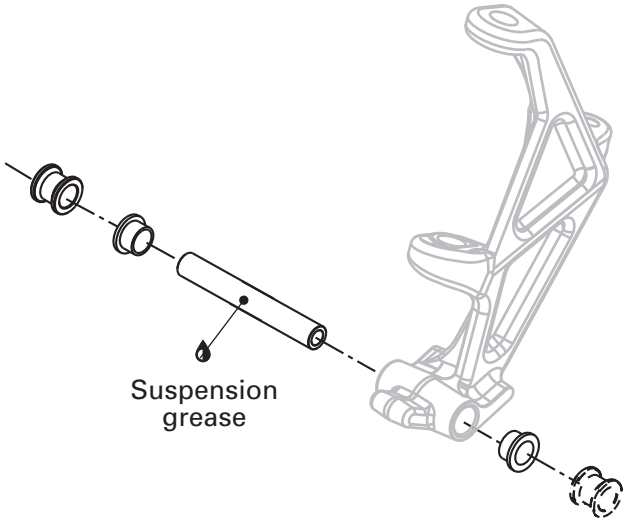


NEW = Component must be replaced when removed

Models without adjustable stance



Models with adjustable stance



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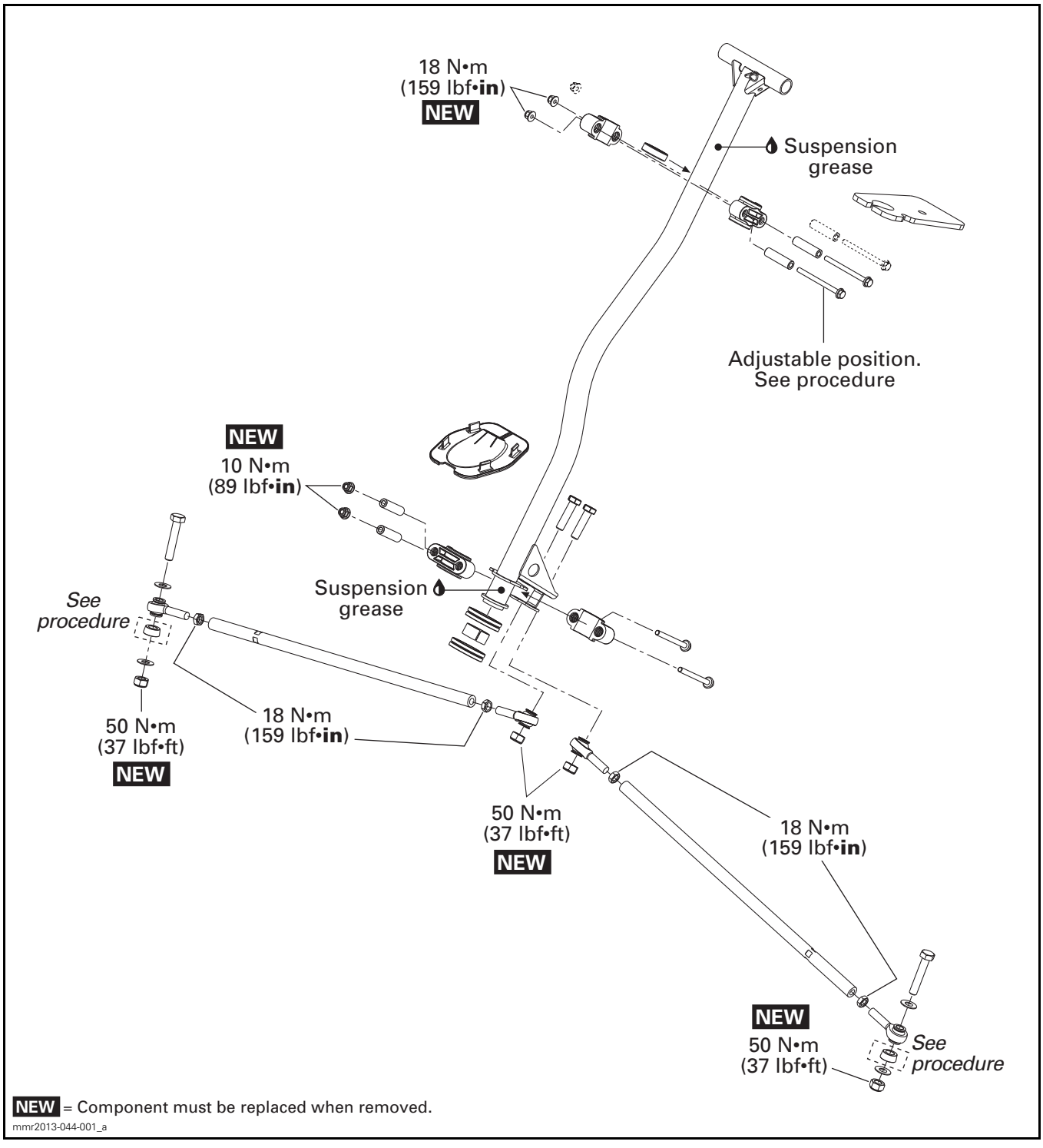
STEERING COLUMN AND TIE-RODS



NEW = Component must be replaced when removed.

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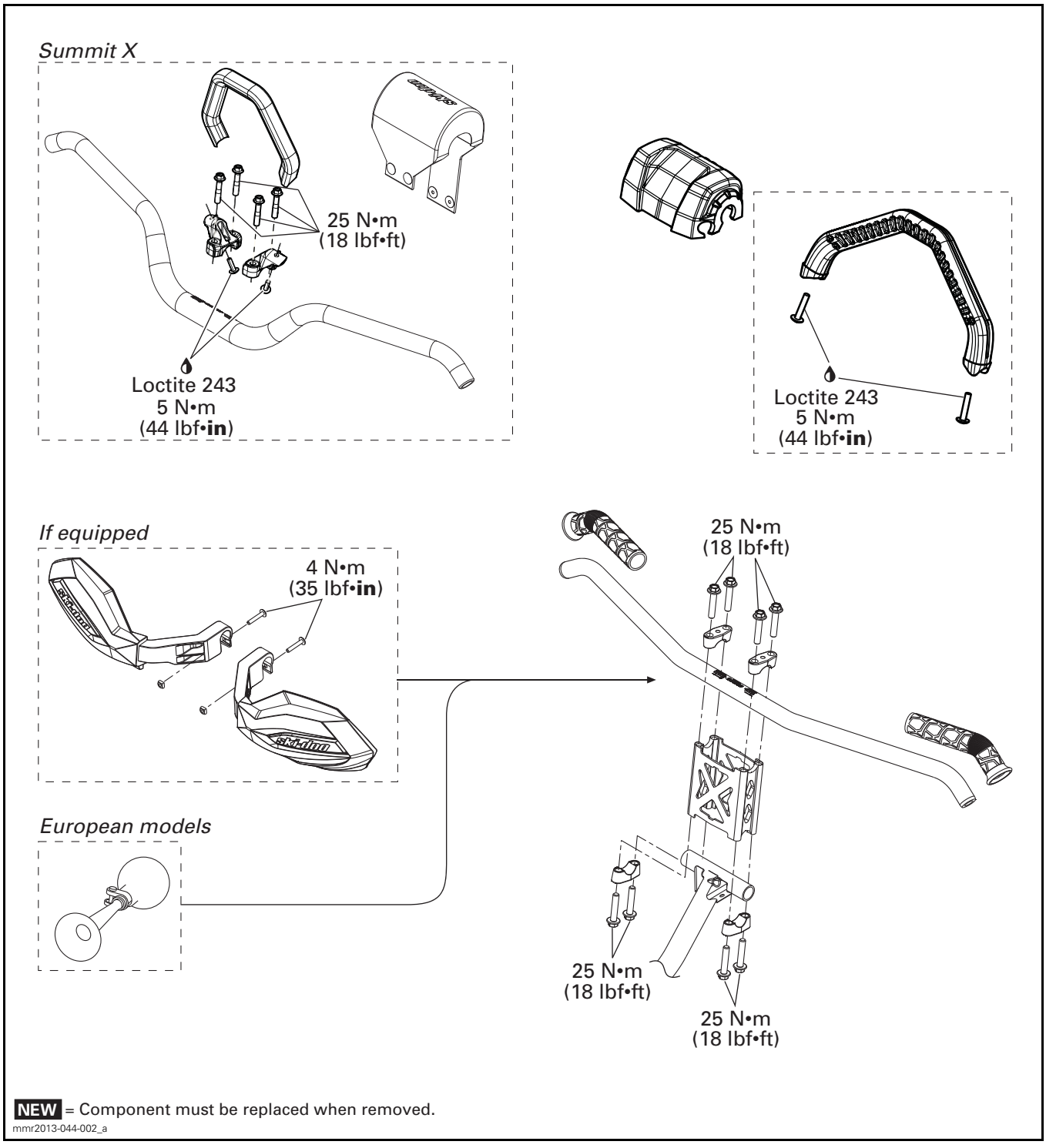
HANDLEBAR



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 *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.

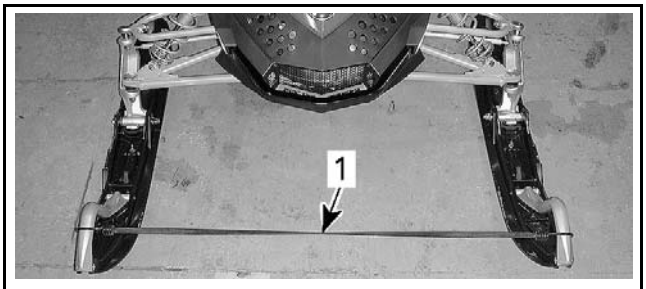
NOTICE **Hoses, cables and locking ties removed during a procedure must be reinstalled at the same location.**

ADJUSTMENT

STEERING ALIGNMENT

Ski alignment is performed by adjusting the length of left and right tie-rods.

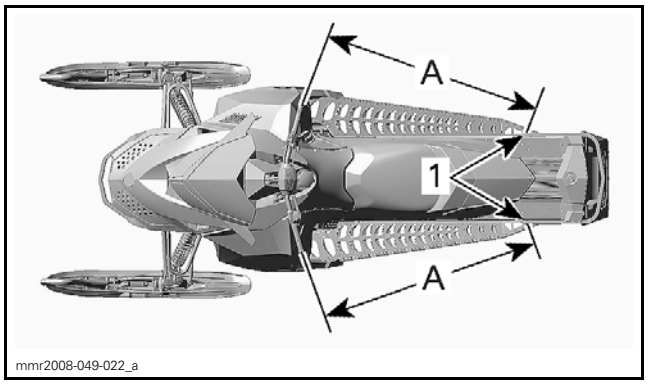
1. Leave the vehicle on the ground on its own weight.
2. Attach ski handles together with a bungee cord.



TYPICAL
1. Bungee cord

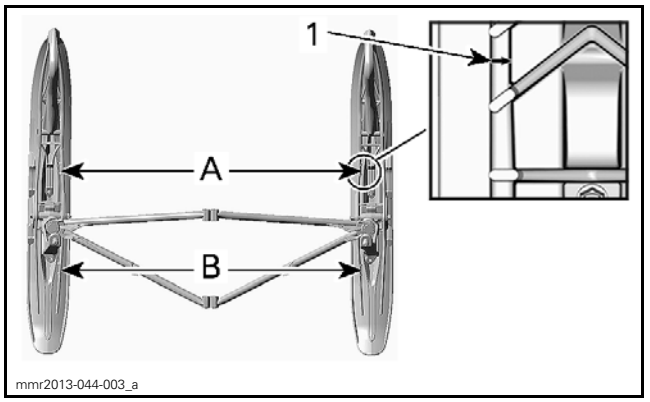
3. Position handlebar so that it is straight ahead position by measuring from the extremities of the grips to the rear most edge of the tunnel, as shown.

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



TYPICAL
1. Same reference point
A. Equal distance on each side

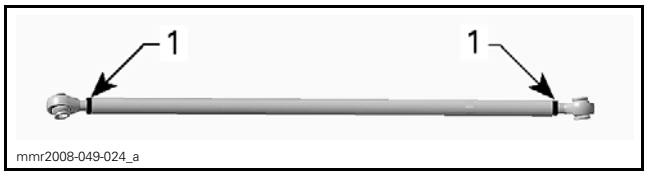
4. Ensure track is properly aligned.
5. Verify if skis are in straight-ahead position by placing a straight edge against track and measuring distance between front and rear ski bridges and straight edge.
6. With skis in straight ahead position, adjust the toe-out.
7. Measure the distance between front and rear ski bridges in line with arrows on skis.
8. Use the following illustration and this equation to determine the steering adjustment.



TYPICAL
1. Arrow on ski
A – B = 5 mm (.197 in)

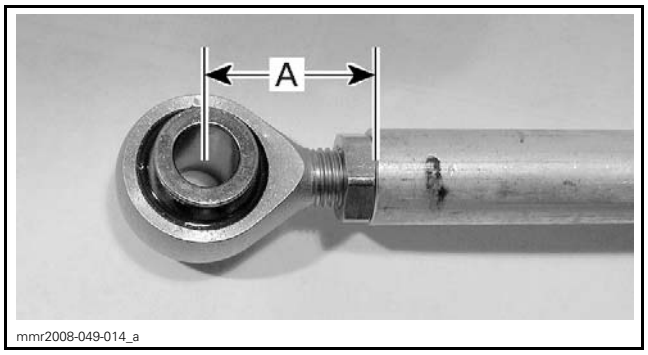
STEERING ALIGNMENT	
Toe-out	5 mm (.197 in)

9. If adjustment is needed, loosen tie-rod jam nuts then turn tie-rods to change their length.
10. Tighten jam nuts and torque them to 18 N•m (159 lbf•**in**).



1. Jam nut

NOTE: The maximum tie-rod end length not engaged in the tie rod must not exceed 34 mm (1.339 in).



A. 34 mm (1.339 in) maximum

PROCEDURES

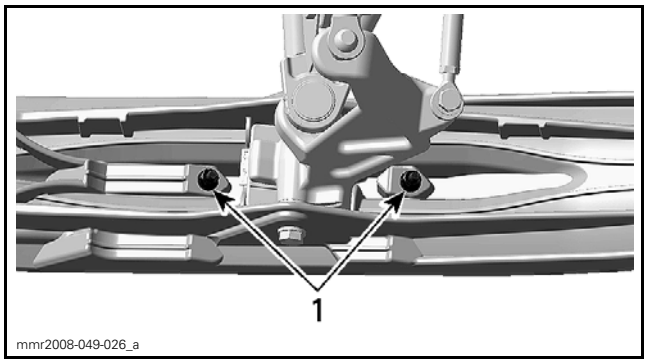
SKI RUNNER

Ski Runner Inspection

Refer to *PERIODIC MAINTENANCE PROCEDURES*.

Ski Runner Removal

1. Lift the front of vehicle and support it off the ground.
2. Unscrew the ski runner nuts then remove ski runners.



1. Ski runner nuts

Ski Runner Installation

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

Torque ski runner nuts to 8 N•m (71 lbf•**in**).

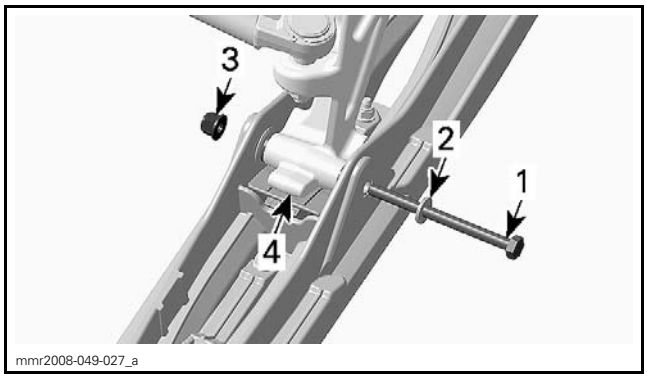
SKIS

Ski Inspection

Refer to *PERIODIC MAINTENANCE PROCEDURES*.

Ski Removal

1. Lift front of vehicle and support it off ground.
2. Unscrew nut then pull ski bolt out.



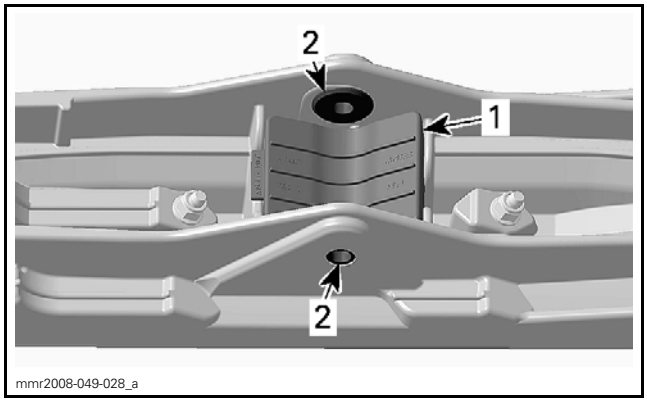
TYPICAL
1. Ski bolt
2. Washer
3. Nut
4. Ski leg

3. Remove ski from vehicle.

Ski Installation

Models Without Adjustable Stance

1. Make sure bushings are installed in ski holes.
2. Install the ski stopper. Position indicator in front and make sure the bump in the ski is in the groove of the ski stopper.

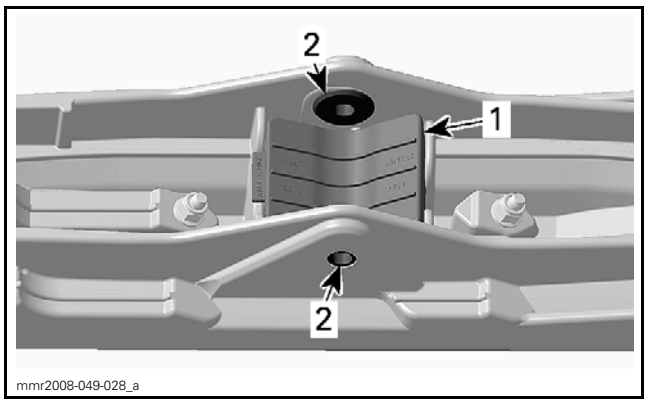


TYPICAL
1. Ski stopper
2. Bushings

3. Install ski bolt and torque it to 48 N•m (35 lbf•ft).

Models with Adjustable Stance

1. Make sure bushings are installed in ski holes.
2. Install the ski stopper. Position indicator in front and make sure the bump in the ski is in the groove of the ski stopper.

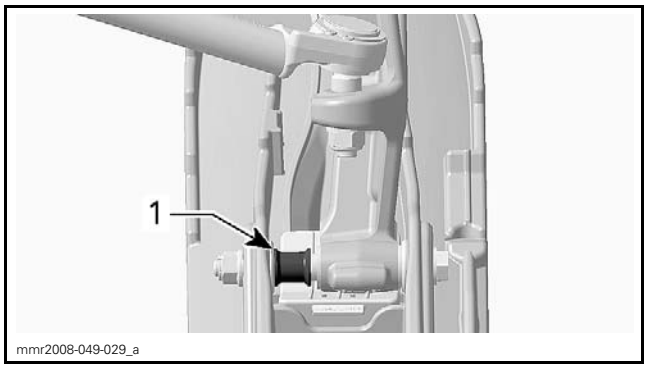


TYPICAL
1. *Ski stopper*
2. *Bushings*

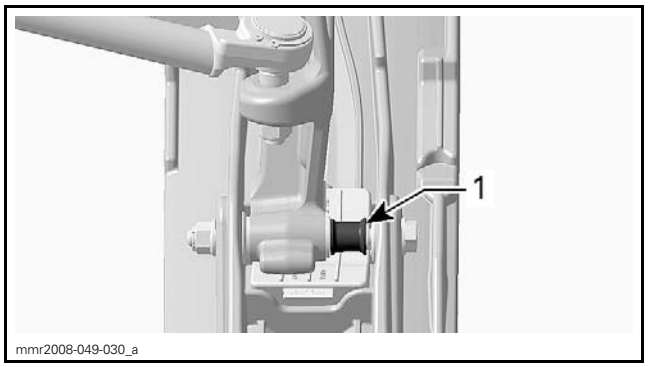
3. Determine the desired ski stance (2 positions).
4. Install the spacer inside for the narrower stance and outside for the wider stance.

⚠ WARNING

Proceed to the same setting for both skis.



NARROWER STANCE — LEFT SKI SHOWN
1. *Spacer here for the narrower stance*



WIDER STANCE — LEFT SKI SHOWN
1. *Spacer here for the wider stance*

5. Install ski bolt and torque it to 48 N•m (35 lbf•ft).

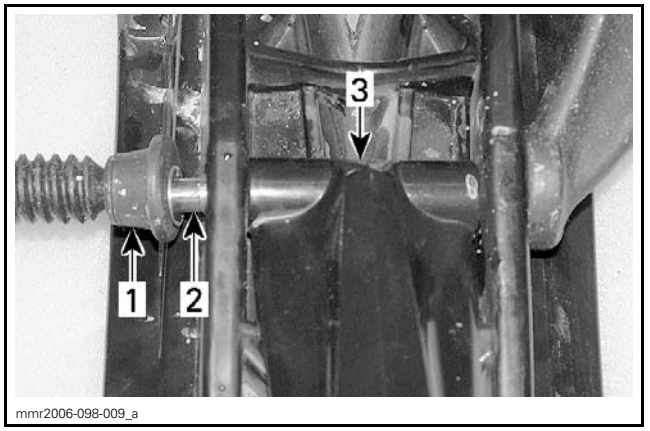
SKI HANDLES

Ski Handle Removal

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.

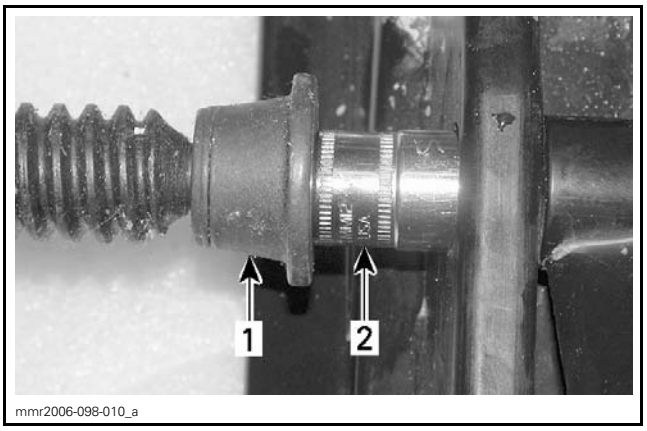
Ski Handle Installation

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.



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1. C-clamp
2. 10 mm socket

SKI LEG

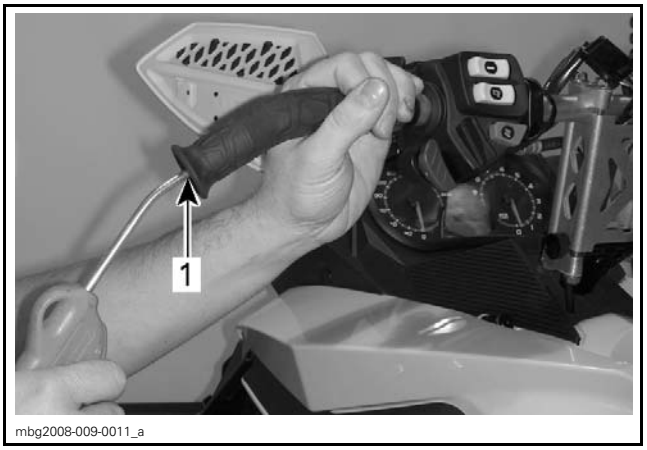
To replace a ski leg, refer to *FRONT SUSPENSION* subsection.

HANDLEBAR GRIP

NOTE: To verify or replace heating elements, refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.

Handlebar Grip Removal

Remove grips by pulling while using compressed air, which will inflate or loosen the fit between the grip and handlebar.



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TYPICAL
1. Blow air in the grip hole

Handlebar Grip Installation

Insert the handlebar grip on handlebar while blowing compressed air to inflate or loosen the fit between grip and handlebar.


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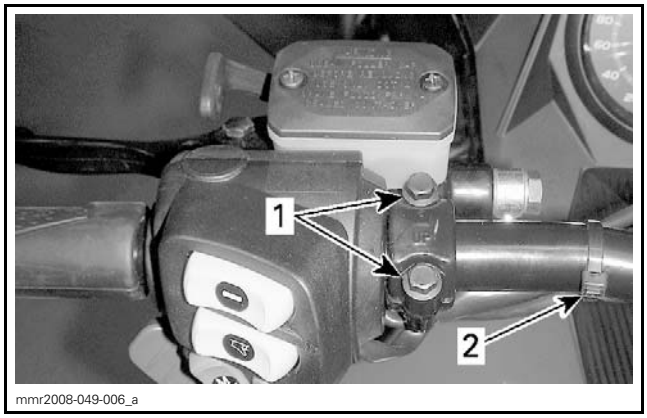
TYPICAL

MULTIFUNCTION SWITCH

Multifunction Switch Removal

1. Cut locking tie securing multifunction switch harness.
2. Unscrew master cylinder from handlebar.



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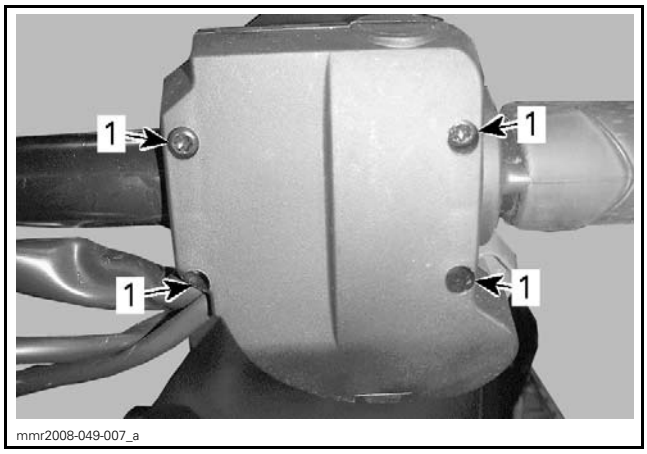
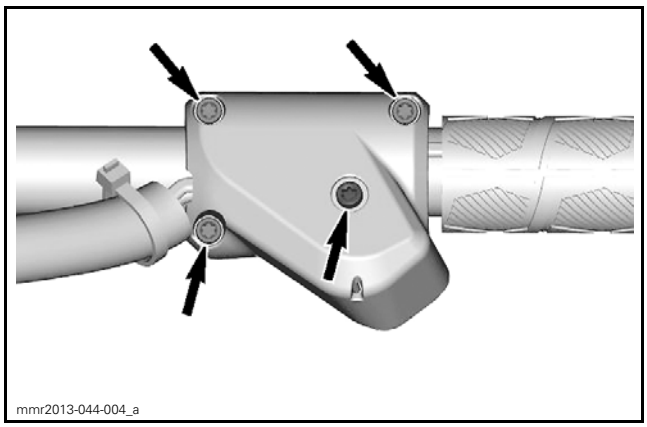
TYPICAL
1. Master cylinder screws
2. Cut this locking tie

3. Slide master cylinder toward the steering column.
4. Remove multifunction switch screws.



XS SERIES
1. Multifunction switch screws



XM SERIES

5. Disconnect both multifunction switch connectors.
6. Remove multifunction switch from vehicle.

Multifunction Switch Installation

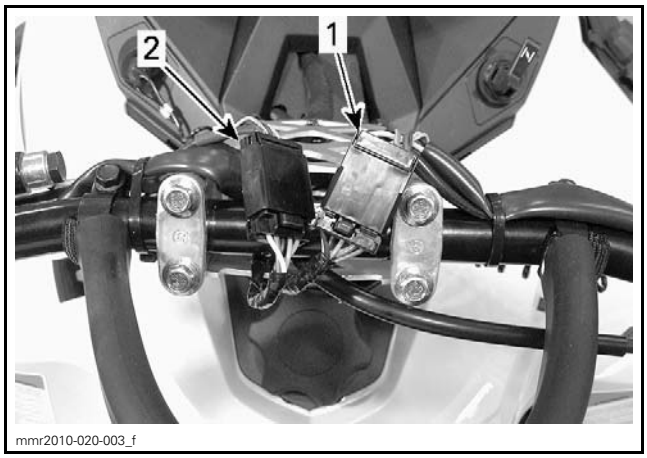
The installation is the reverse of the removal procedure. However, pay attention to the following.

Turn handlebar completely from side to side making sure it does not exert unwanted tension on handlebar wires.

THROTTLE LEVER HOUSING

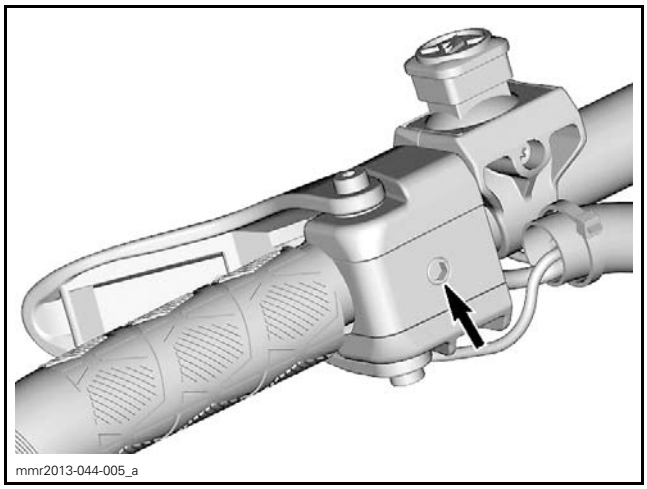
Throttle Lever Housing Removal

1. Proceed with RH *HANDLEBAR GRIP REMOVAL*, see procedure in this subsection.
2. Proceed with RH *HEATER ELEMENT REMOVAL*, see procedure in *LIGHTS, GAUGE AND ACCESSORIES* subsection.
3. Disconnect throttle cable from throttle lever.
4. Disconnect GD steering connector.



1. GD connector
2. GG connector

5. Cut locking ties securing throttle lever housing harness.
6. Remove throttle lever housing retaining screw.



7. Slide throttle lever housing outwards to remove it from handlebar.
8. Remove circlip from throttle lever pin.
9. Remove throttle lever pin then throttle lever.

Throttle Lever Housing Installation

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

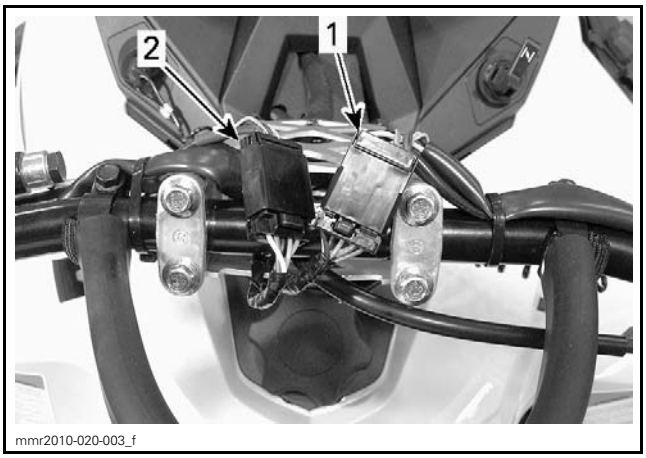
Turn handlebar completely from side to side making sure it does not exert unwanted tension on handlebar wires.

Install **NEW** circlip on throttle lever pin.

THROTTLE LEVER

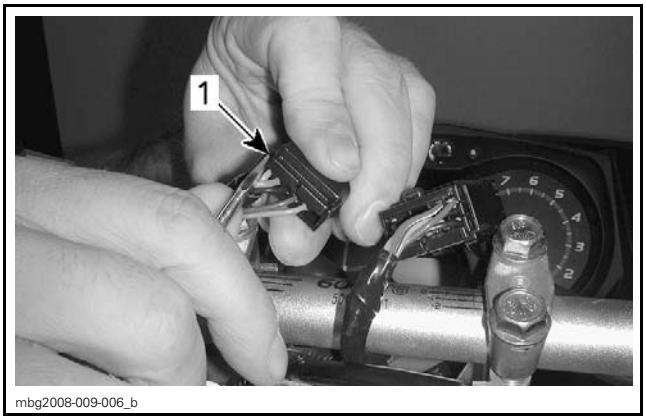
Throttle Lever Removal

1. Remove steering cover from handlebar.
2. Disconnect GD steering connector.



TYPICAL
1. GD connector
2. GG connector

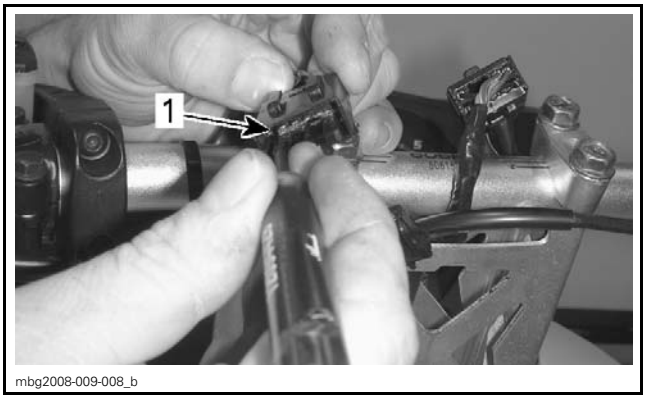
3. Open cover on the back of connector housing.



TYPICAL
1. Connector housing cover locks (one each side)

4. Unlock the heater wire terminals and pull them out of the connector housing.

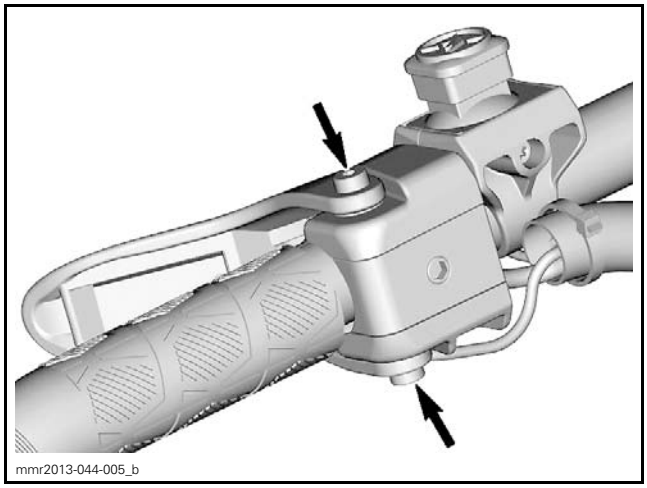
REQUIRED TOOL
MULTILOCK - TERMINAL EXTRACTION TOOL (P/N 755430-2)



TYPICAL - UNLOCKING CONNECTOR PIN (FRONT SIDE)
1. Pin removal tool inserted above pin

NOTICE Take note of exact positioning of throttle lever heater before removing it from the connector.

5. Cut locking ties securing heater wires to handlebars.
6. Disconnect throttle cable from throttle lever.
7. Remove throttle lever retaining screws.



8. Remove throttle lever and heater wires.

Throttle Lever Installation

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

Tighten throttle lever retaining screws to specification.

TIGHTENING TORQUE	
Throttle lever retaining screws	1.5 N•m (13 lbf•**in**)

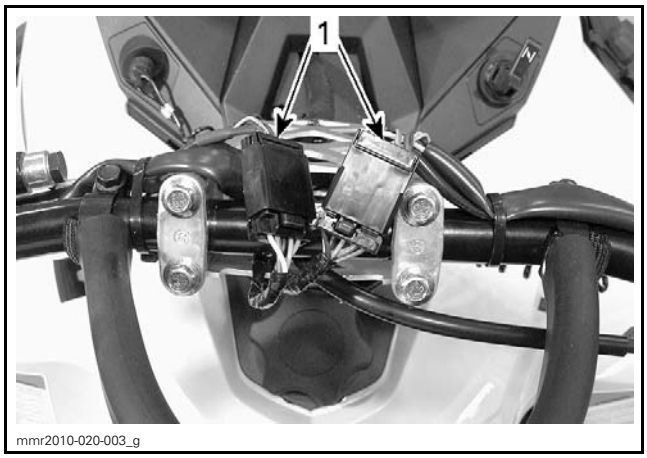
Turn handlebar completely from side to side making sure it does not exert unwanted tension on handlebar wires.

HANDLEBAR

Handlebar Removal

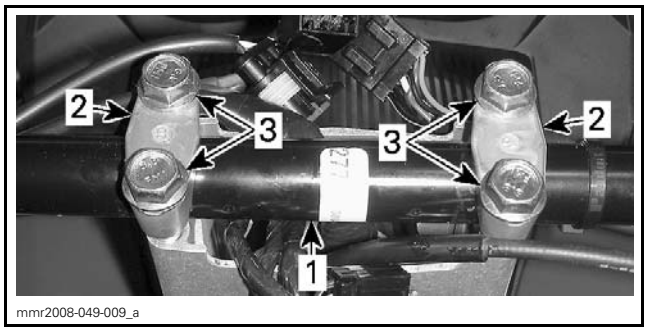
NOTE: If the handlebar must be changed, remove all components (handlebar grip, throttle lever housing, etc.) before removing it from vehicle.

1. Remove steering cover.
2. Unplug all connectors.



TYPICAL

3. Remove handlebar retaining clamp screws.



1. Handlebar
2. Retaining clamps
3. Screws

4. Remove handlebar from handlebar extension.

Handlebar Inspection

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.

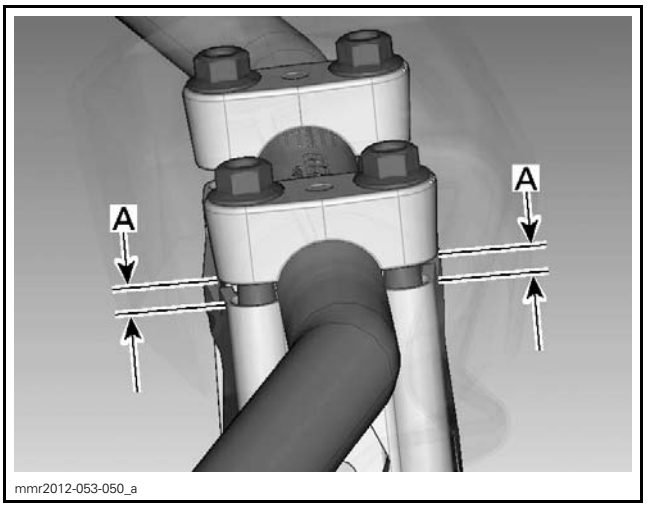
3. Check handlebar clamps for cracks or distortion, replace if necessary.

Handlebar Installation

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

Tighten handlebar clamps screws to 25 N•m (18 lbf•ft).

Ensure handlebar clamps are parallel with handlebar extension.



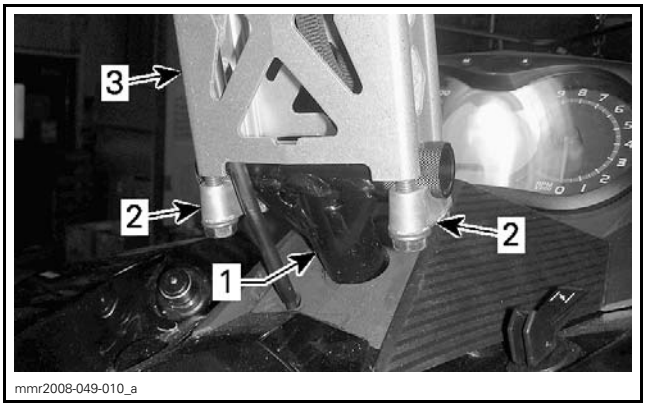
TYPICAL
A. Must be equal

Turn handlebar completely from side to side making sure it does not exert unwanted tension on handlebar wires.

HANDLEBAR EXTENSION

Handlebar Extension Removal

1. Proceed with *HANDLEBAR REMOVAL*, see procedure in this subsection.
2. Remove screws retaining the extension to steering column.



TYPICAL
1. Steering column
2. Handlebar extension clamps
3. Handlebar extension

3. Remove handlebar extension from vehicle.

Handlebar Extension Inspection

1. Check handlebar extension for:
   – Cracks
   – Bending
   – Other damages.
2. Replace if any of these problems is detected.

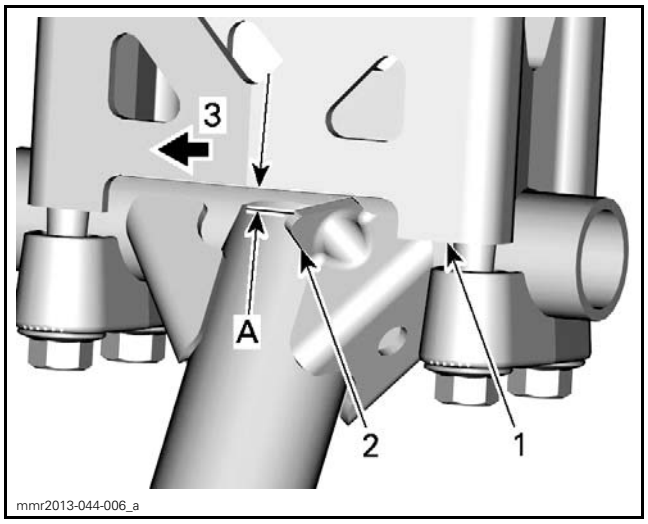
⚠ WARNING

Do not try to repair a defective handlebar extension.

Handlebar Extension Installation

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

When installing handlebar extension, ensure to leave a gap between handlebar extension and stop block on steering column.



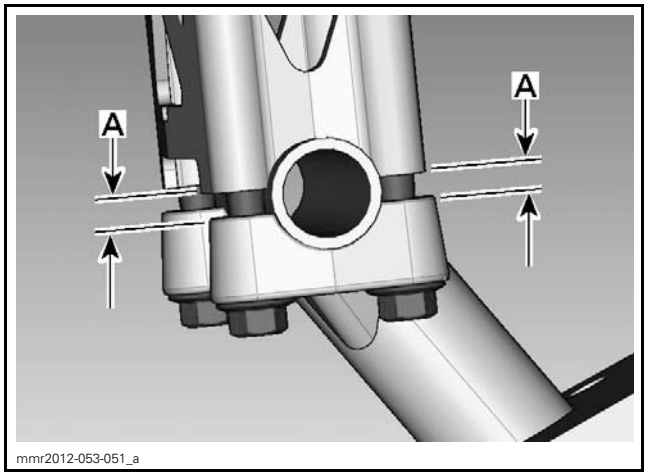
mmr2013-044-006_a

1. Bottom of handlebar extension
2. Steering column stop block
3. Front of vehicle

A. 1 mm (.039 in) minimum

Torque handlebar extension retaining screws to 25 N•m (18 lbf•ft).

Ensure extension clamps are parallel with handlebar extension.



mmr2012-053-051_a

TYPICAL
A. Must be equal

⚠ 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.

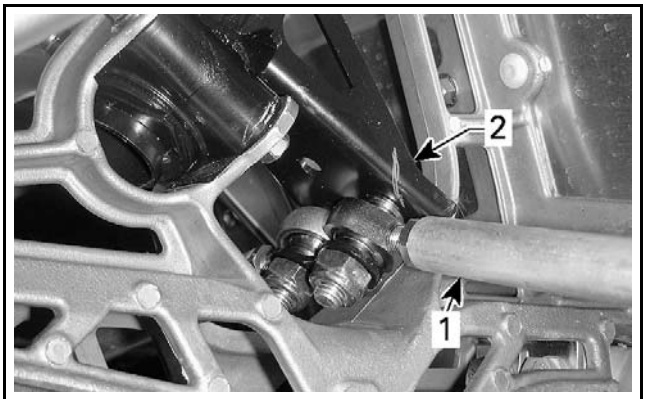
Tie-Rod Inspection

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.

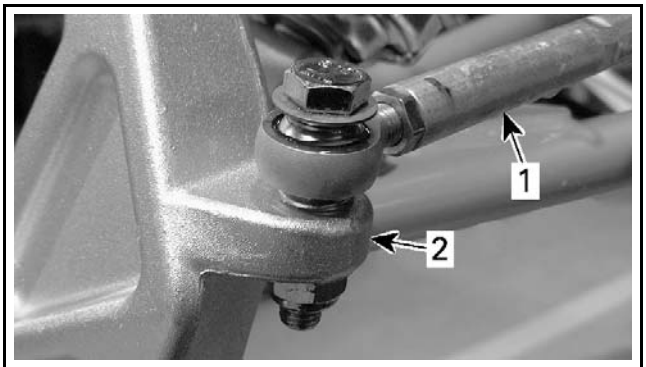
Tie-Rod Removal

1. Remove the tie-rod ends from the steering column and ski leg.



mmr2008-049-012_a

1. Tie-rod
2. Steering column



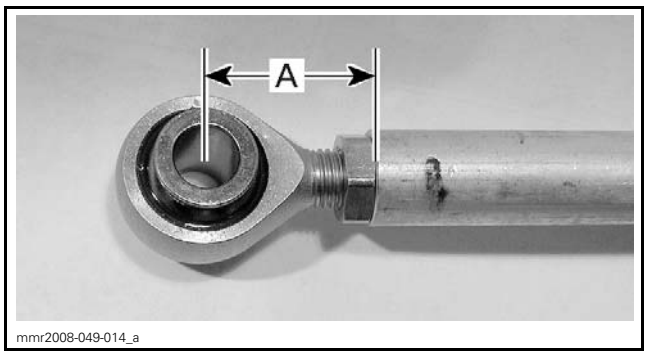
mmr2008-049-013_a

1. Tie-rod
2. Ski leg

2. Remove tie-rod from vehicle.

Tie-Rod Installation

1. The installation is the reverse of the removal procedure. However, pay attention to the following.
2. Adjust the length of all tie-rod end to 30 mm (1.181 in) without tightening the jam nuts.

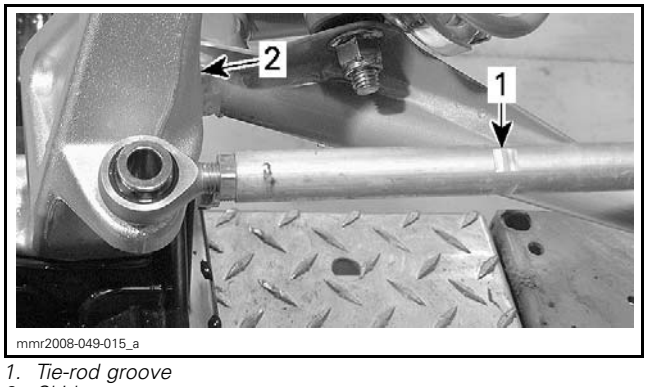


A. 30 mm (1.181 in)

⚠ WARNING

The maximum tie-rod end length not engaged in the tie rod must not exceed 34 mm (1.339 in).

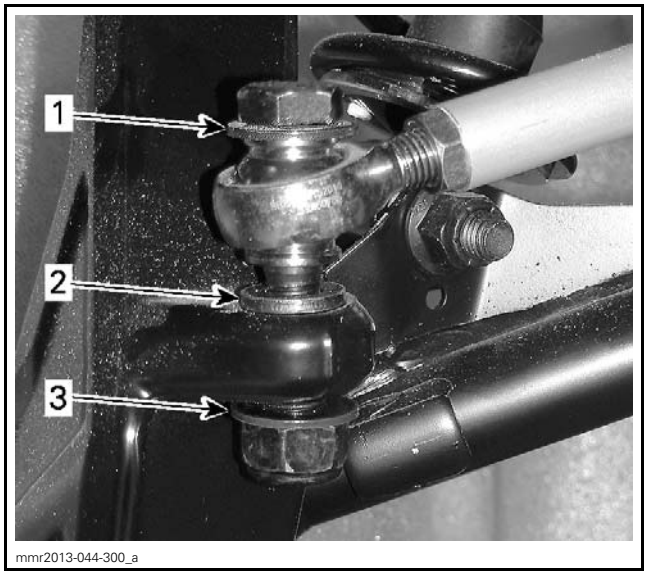
3. Install tie-rod with the groove on ski leg side.



1. Tie-rod groove
2. Ski leg

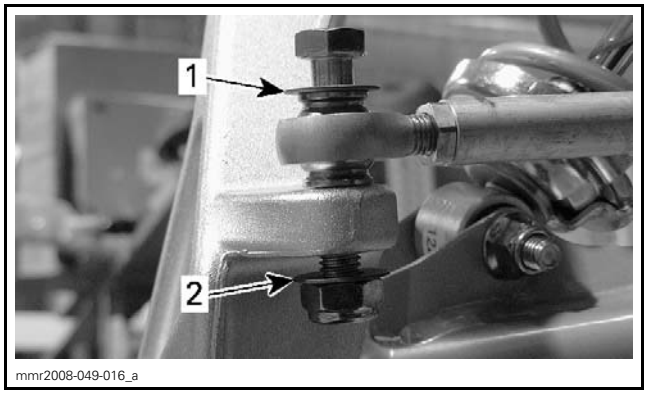
4. On ski leg side, install hardened washers as shown.

NOTE: When steering column is installed at the **front** position, **install** spacers against the ski legs as shown. Refer to *STEERING COLUMN* in this subsection.



WHEN STEERING COLUMN IS INSTALLED AT THE **FRONT** *POSITION*
1. Hardened washer
2. Spacer (2.6 mm (3/32 in) thick)
3. Hardened washer

NOTE: When steering column is installed at the **rear** position, **remove** spacers against the ski legs as shown. Refer to *STEERING COLUMN* in this subsection.



WHEN STEERING COLUMN IS INSTALLED AT THE **REAR** *POSITION*
1. Hardened washer
2. Hardened washer

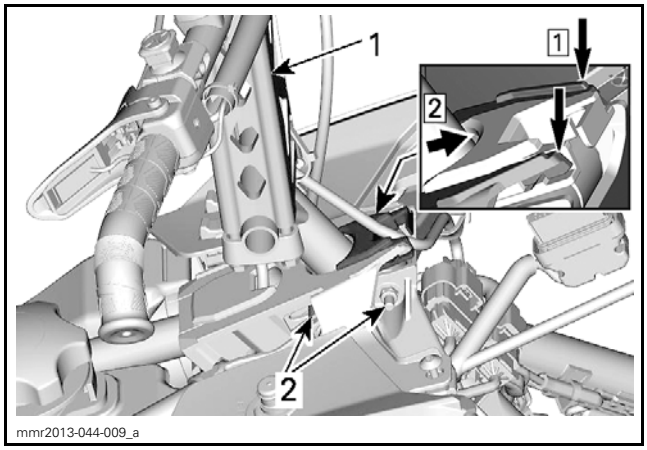
5. Install nuts retaining tie-rod ends. Torque them to 48 N•m (35 lbf•ft).
6. Perform the steering alignment, refer to *STEERING ALIGNMENT* in this section.

STEERING COLUMN

Steering Column Removal

1. Remove bottom pan cover. Refer to *BODY* subsection.
2. Remove *HANDLEBAR EXTENSION* from steering column. See procedure in this section.

3. Remove screws securing steering column upper support.
4. Remove the console front cap.

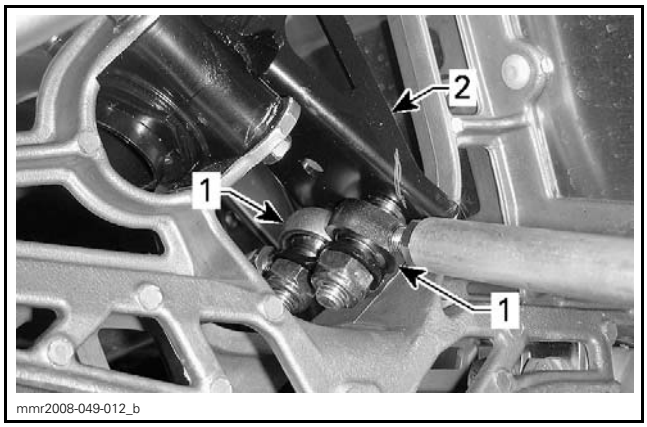


mmr2013-044-009_a

RH SIDE SHOWN
1. *Handlebar extension*
2. *Screws of steering column upper support*

Step 1: Push console support down and hold
Step 2: Pull out console front cap

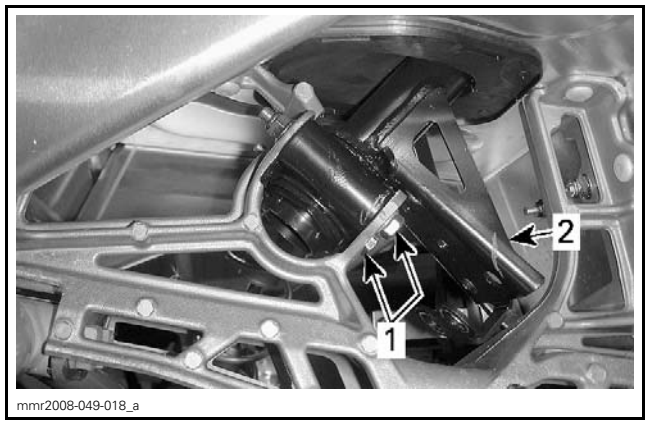
5. From outside engine compartment, remove the tie-rod ends from the steering column.



mmr2008-049-012_b

RH SIDE SHOWN
1. *Tie-rod ends*
2. *Steering column*

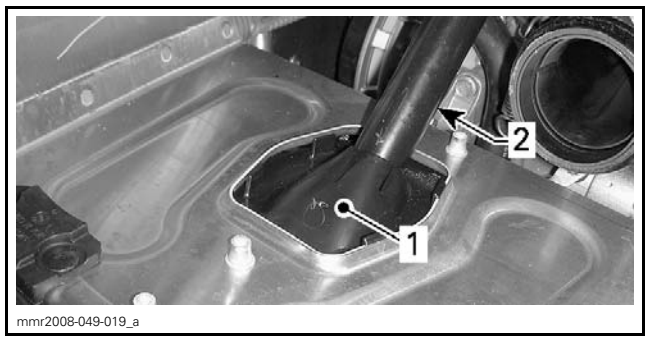
6. Remove screws securing the steering column lower support.



mmr2008-049-018_a

RH SIDE SHOWN
1. *Steering column support screws*
2. *Steering column*

7. From inside engine compartment, remove the steering column plate.



mmr2008-049-019_a

LH SIDE SHOWN
1. *Steering column plate*
2. *Steering column*

8. Pull steering column from top.

Steering Column Inspection

Check if steering column is:
- Cracked
- Bent
- Twisted
- Otherwise damaged.

Replace steering column if necessary.

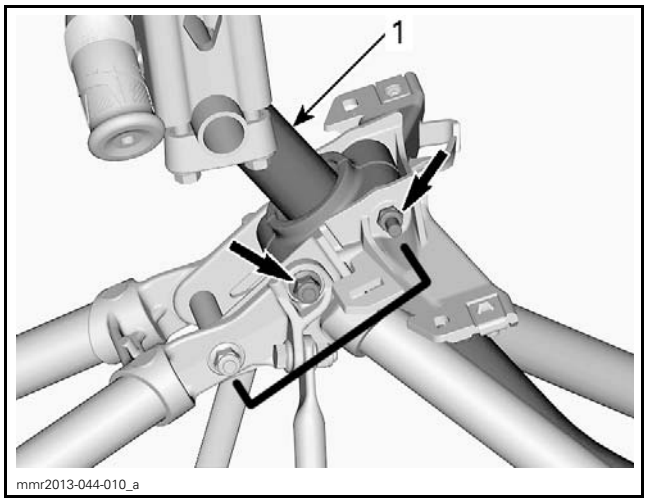
⚠ WARNING

Do not try to repair a defective steering column.

Steering Column Position Adjustment

The steering column may be installed in one of two positions as desired.

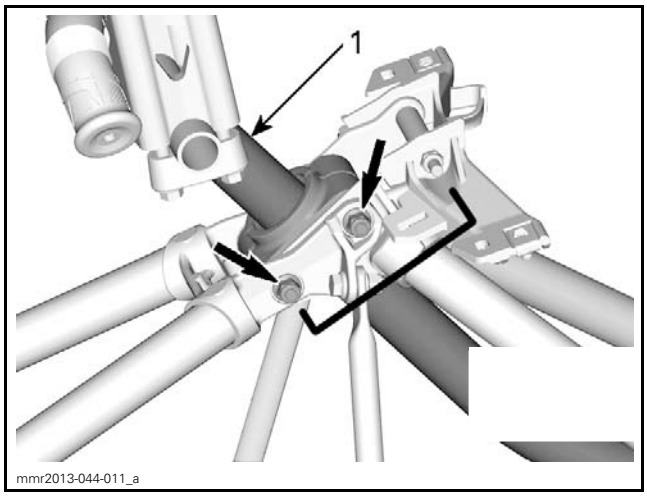
Installation at the Front Position



FRONT POSITION — PARTS REMOVED FOR CLARITY

– Install the console rear cap at the front of steering column.
– **Install** spacers against ski legs. Refer to *TIE-ROD INSTALLATION* in this subsection.

Installation at the Rear Position



REAR POSITION — PARTS REMOVED FOR CLARITY

– Install the console rear cap at the rear of steering column
– **Remove** the spacers against ski legs. Refer to *TIE-ROD INSTALLATION* in this subsection.

Steering Column Installation

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 the specified torque.

NUTS TIGHTENING TORQUE	
Upper steering column support	18 N•m (159 lbf•**in**)
Lower steering column support	10 N•m (89 lbf•**in**)

BODY

SERVICE TOOLS

Description	Part Number	Page
CONSOLE NUT WRENCH	529 036 183	11
SUPERTANIUM DRILL BIT 3/16"	529 031 800	12–15

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
ARROW TACKER	T-50	16

SERVICE PRODUCTS

Description	Part Number	Page
DIELECTRIC GREASE	293 550 004	4

GENERAL

CLEANING

Seat Cleaning

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.

Plastic Cleaning

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

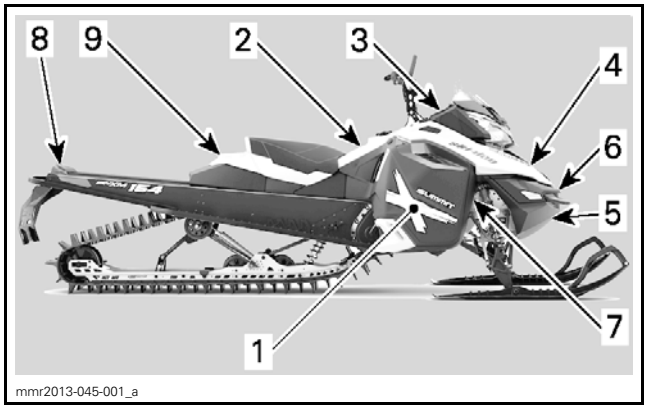
MATERIAL TYPE	COMPATIBLE CLEANING PRODUCT
Polypropylene	XPS ATV Wash (P/N 219 701 702)
	Soapy water

vbs2012-006-001

SAFE FOR POLYPROPYLENE

BODY PARTS REPAIR

The very first step before repairing plastic materials is to find out exactly which type of material is involved.



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TYPICAL — SUMMIT X SHOWN

PLASTIC PARTS		
PARTS		MATERIAL
1	Side panel	XS models: Polypropylene for bottom section and surlyn for top sectio XM models: Polypropylene
2	Console	Surlyn
3	Gauge support	Polypropylene with glass fiber
4	Hood	Center section: Polyprolylene Side section: Surlyn
5	Front bottom pan and side bottom pan	Polypropylene
6	Bottom pan cover	Polypropylene
7	Side bottom pan	Polypropylene
8	Tail light support	Polypropylene
9	Seat storage compartment	Polypropylene

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

Decal Replacement

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.

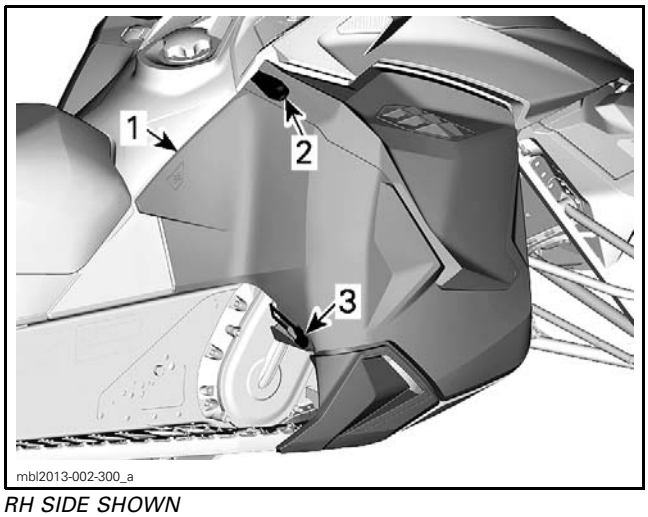
NOTICE Do not remove the pre-mask yet.

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

Side Panel Removal

1. Unhook both rubber latches.
2. Firmly pull the upper latch **upwards**.



RH SIDE SHOWN
1. *Side panel*
2. *Upper latch*
3. *Lower latch*

3. Open side panel.
4. Lift up the side panel and move the lower hinge out of its slot.
5. Free the upper hinge from its slot by lowering the side panel.

NOTICE Make sure to place panels in a safe place to avoid scratching.

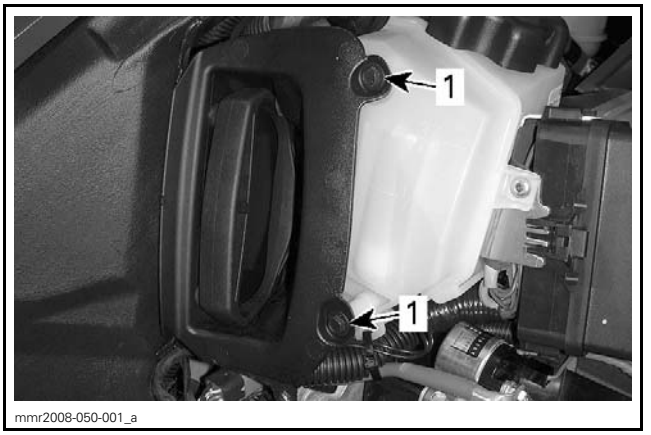
Side Panel Installation

The installation is the reverse of the removal procedure.

REWIND STARTER HANDLE HOUSING

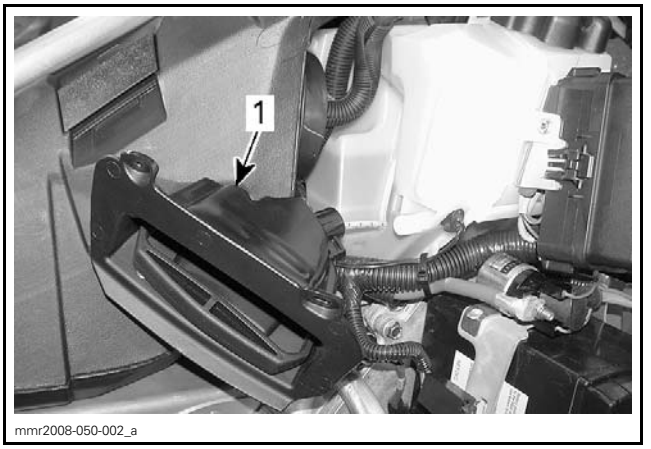
Rewind Starter Handle Housing Removal

1. Open RH side panel.
2. Remove screws retaining housing to oil reservoir.



RH SIDE SHOWN
1. *Screws*

3. Pull on housing to release it from oil reservoir.



1. *Housing*

4. Remove rewind starter handle. Refer to *REWIND STARTER* subsection.

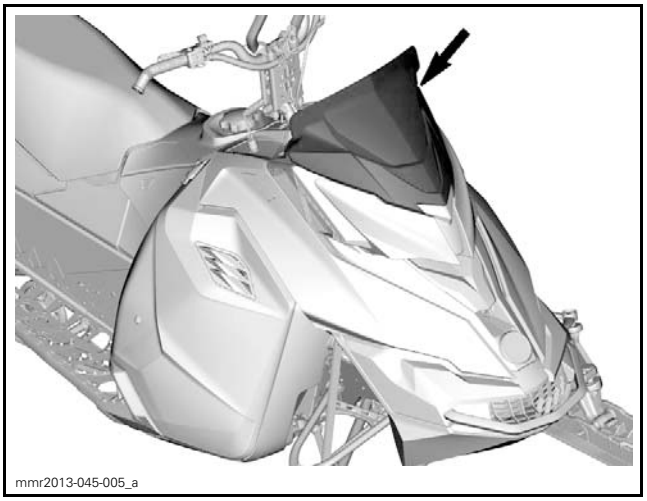
Rewind Starter Handle Housing Installation

Installation is the reverse of removal procedure. Pay attention to the following.

Push vigorously handle housing toward oil reservoir. Ensure it is properly set in place before installing hardware.

PART	TORQUE
Rewind starter handle housing screw	1 N•m (9 lbf•**in**)

WINDSHIELD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Windshield Removal

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.

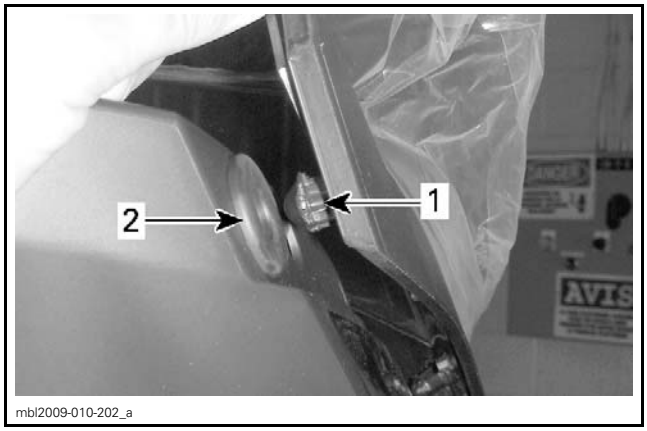
Windshield Installation

The installation is the reverse of removal procedure.

Lubricate the grommets using DIELECTRIC GREASE (P/N 293 550 004).

Secure windshield by inserting the windshield pins into the grommets.

NOTE: Make sure not to push grommets through gauge support holes.



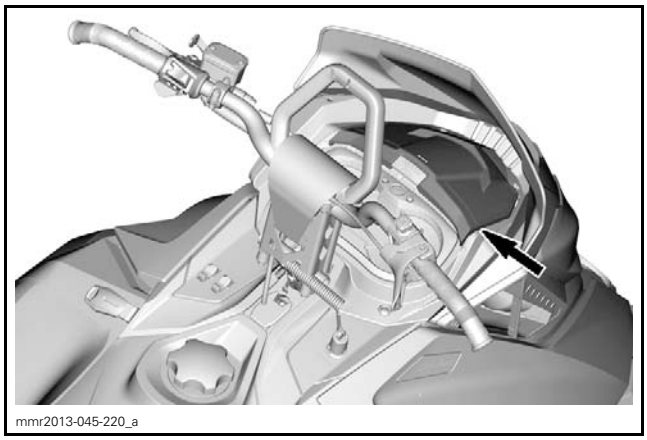
mbl2009-010-202_a

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.

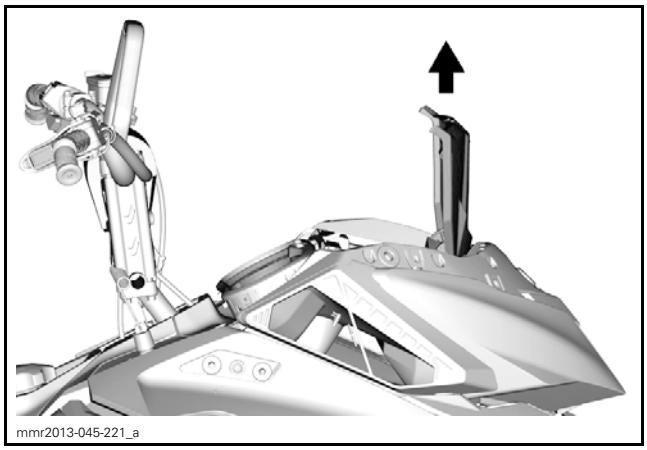
STORAGE COMPARTMENT COVER


mmr2013-045-220_a

Storage Compartment Cover Removal

NOTICE **First remove windshield. Otherwise, the storage cover could be damaged during removal.**

1. Remove windshield.
2. Fully open storage cover until it is vertical.
3. Pull out storage cover.

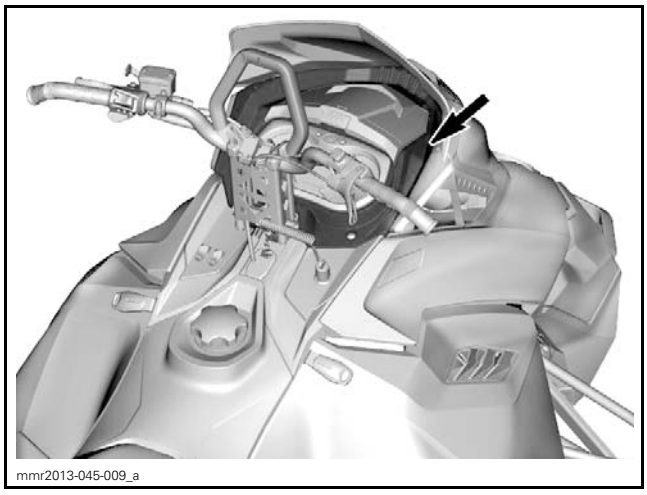

mmr2013-045-221_a

Storage Compartment Cover Installation

NOTICE Ensure windshield is NOT installed. Otherwise, the storage cover could be damaged during installation.

1. Position storage cover vertically.
2. Insert cover onto pivot pins.
3. Close and latch cover.
4. Install windshield.

GAUGE SUPPORT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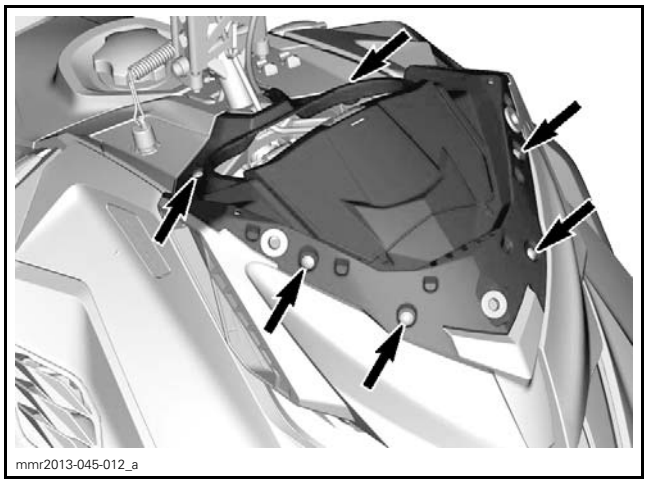
Gauge Support Removal

1. Remove *WINDSHIELD*. See procedure in this subsection.
2. Remove the multifunction gauge. Refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.
3. Remove the gauge support screws.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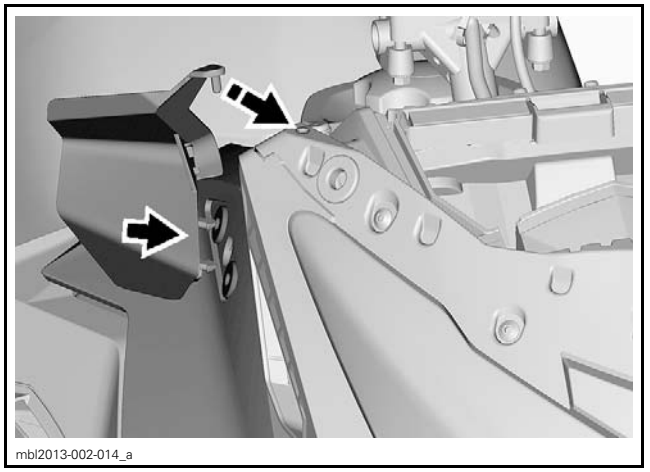
4. Pull out gauge support.

Gauge Support Installation

The installation is the reverse of removal procedure.

PART	TORQUE
Gauge support screws	2.3 N•m (20 lbf•**in**)

WIND DEFLECTORS (IF EQUIPPED)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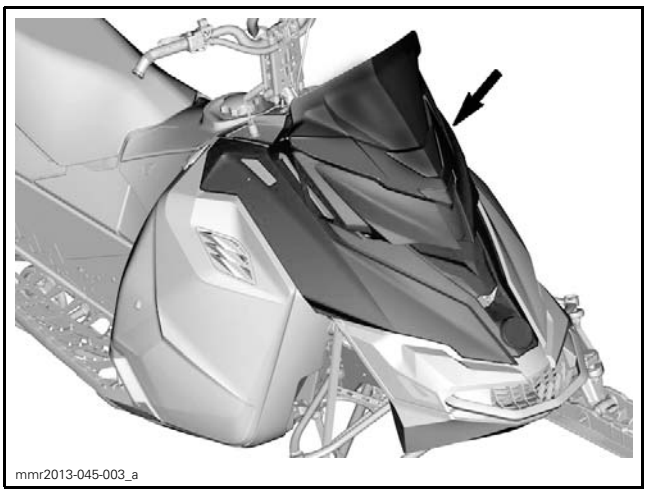
UPPER BODY MODULE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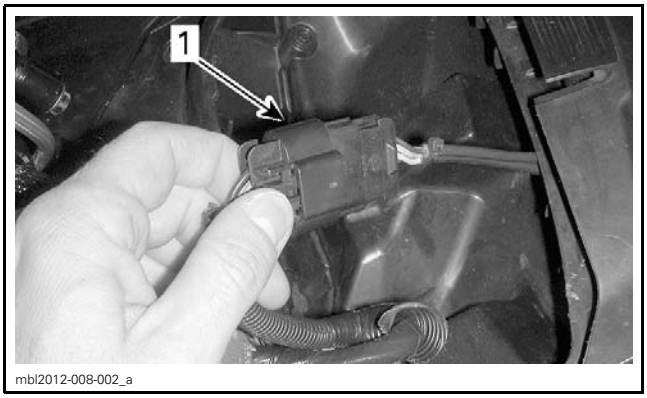
Upper Body Module Removal

NOTE: Upper body module can be removed with the windshield and gauge support installed as described in this procedure.

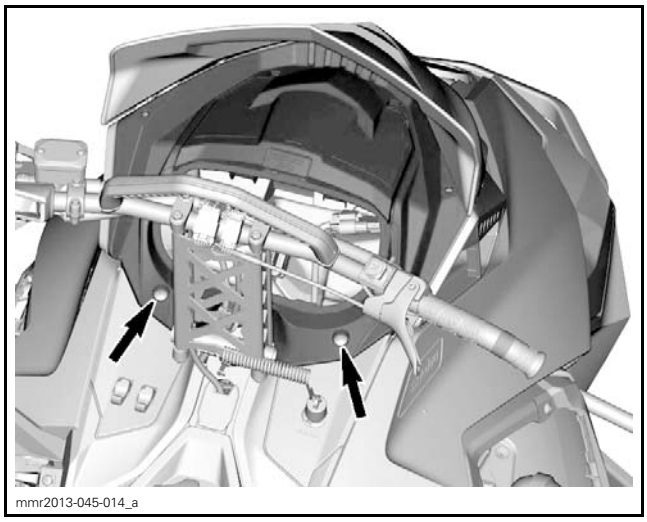
1. Remove the multifunction gauge. Refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.
2. Disconnect the headlight connector.



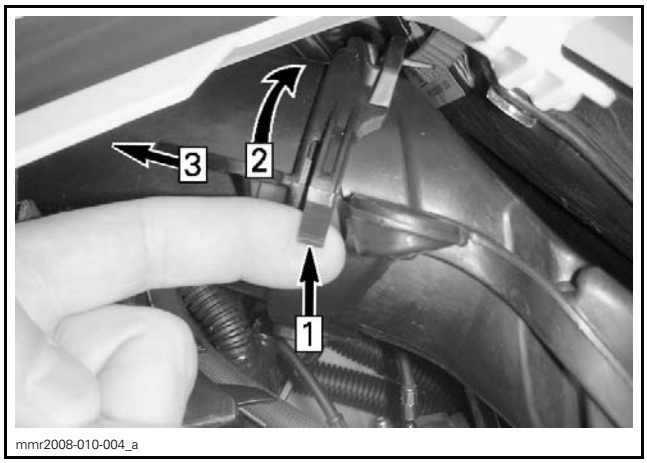
mbl2012-008-002_a

1. Headlights connector

3. Remove *SIDE PANELS*. See procedure in this subsection.
4. Remove gauge support rear screws.


mmr2013-045-014_a

5. Remove the drive belt guard.
6. Disconnect the air intake connector tube.



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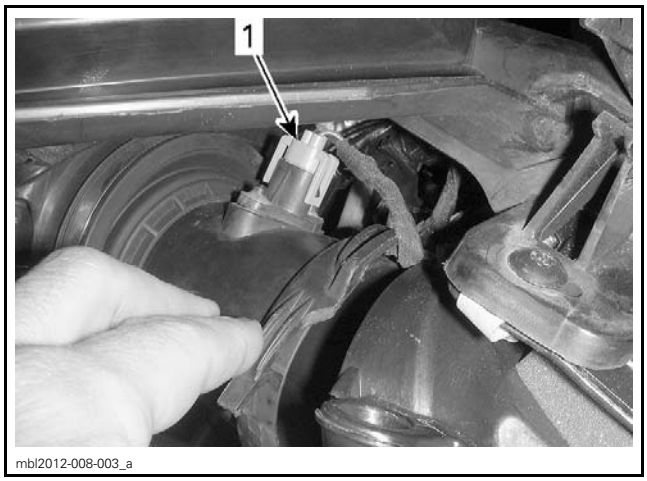
LH SIDE SHOWN
Step 1: Lift tab
Step 2: Twist tube
Step 3: Pull forward

7. Disconnect air temperature sensor (ATS) on top of connector tube.



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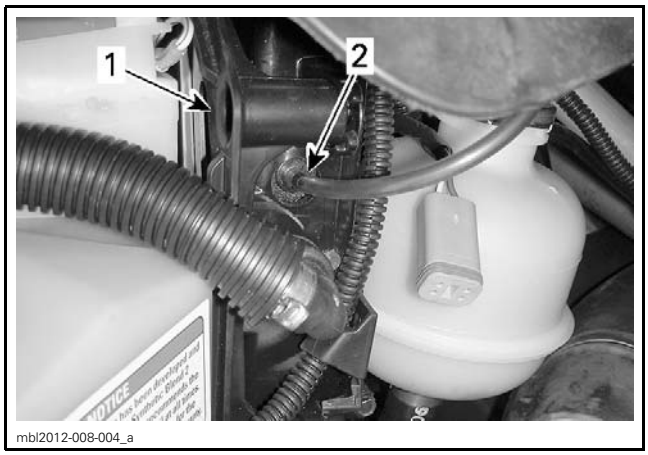
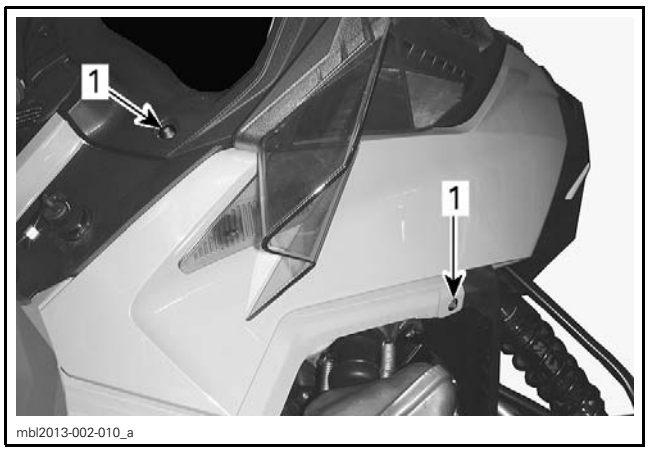
LH SIDE SHOWN
1. ATS connector

8. Disconnect the APS hose at the ECM.



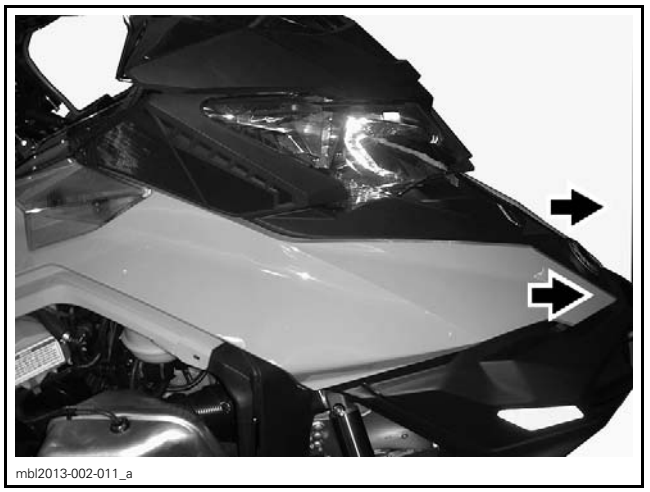
RH SIDE SHOWN
1. *ECM*
2. *APS hose*

9. Remove the upper body module retaining screws.



RH SIDE SHOWN
1. *Retaining screws*

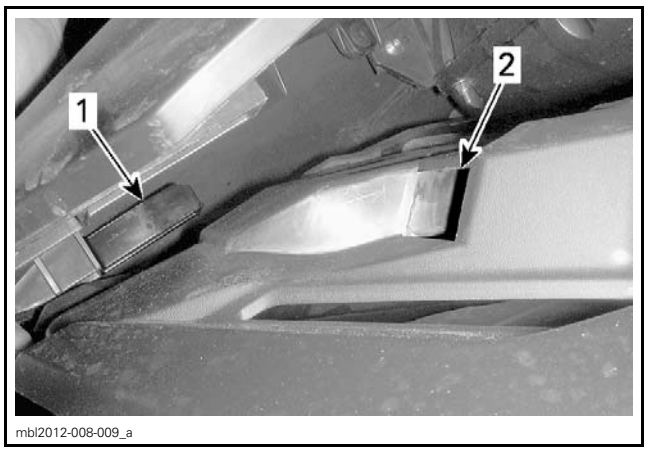
10. Remove the upper body module.
    - 10.1 Grab the upper body module in the gauge support section.
    - 10.2 Lift the module by approximately 15°.
    - 10.3 Pull the module forward.



SLIDE TOWARDS FRONT

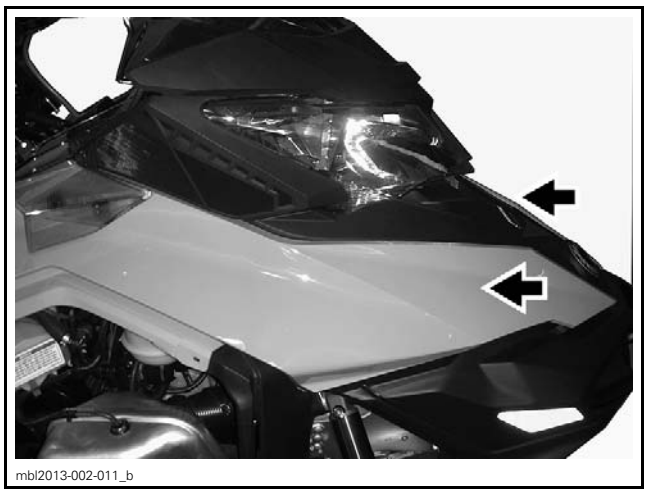
Upper Body Module Installation

1. Insert the upper body module tabs into the bottom pan cover openings.

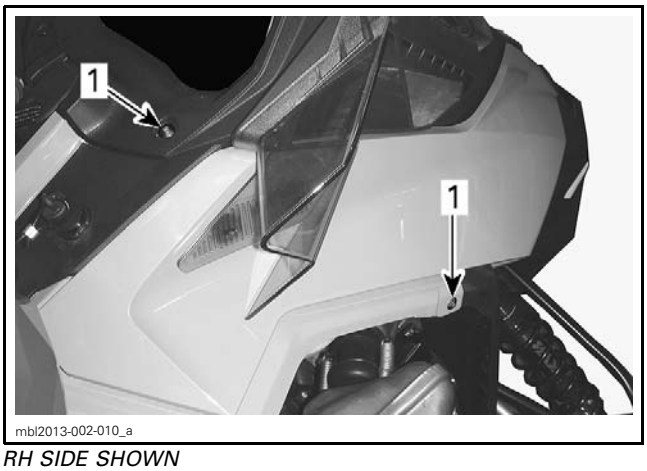


LH SIDE SHOWN

2. Slide the module towards rear with an angle of approximately 15°. When the pins are fully inserted in the slots, lower the module to reach the console screws.



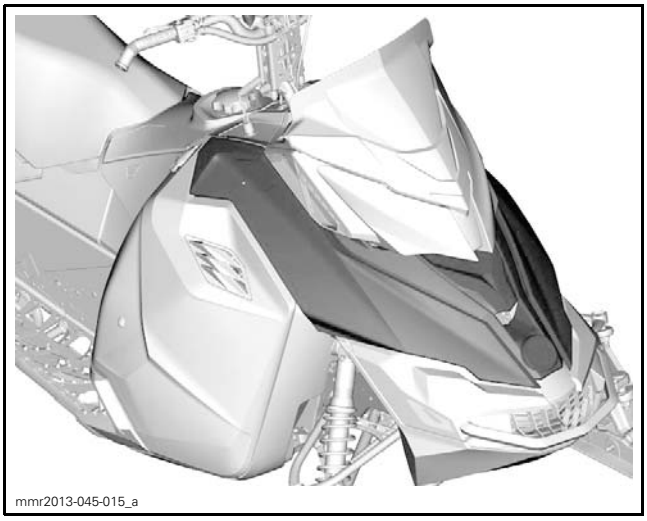
3. On both sides, install the upper body module retaining screws.



RH SIDE SHOWN
1. Retaining screws

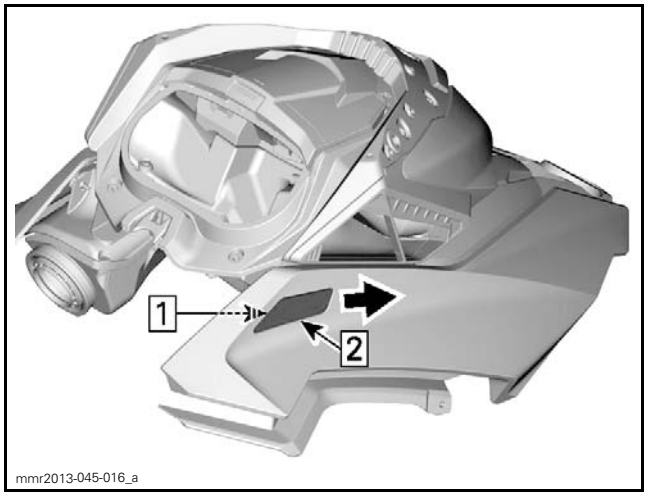
4. Connect:
   – APS hose on the ECM
   – Headlights connector
   – Gauge connector
   – Air temperature sensor (ATS)
   – Air intake connector tube.
5. Install:
   – Gauge support rear screws
   – Gauge
   – Drive belt guard.
6. Install side panels

HOOD



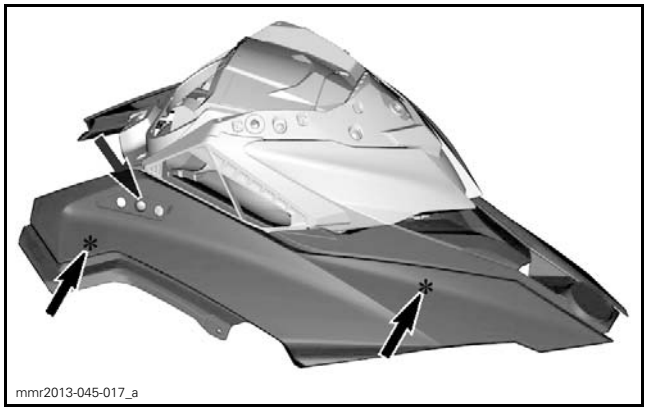
Hood Removal

1. See procedures in this subsection and remove:
– Windshield
– Upper body module
2. Remove hood access plate.



Step 1: Unlock from the back
Step 2: Slide plate forward

3. Remove hood screws.



4. Pull out hood.

NOTE: You may need to twist the hood before pulling it out.

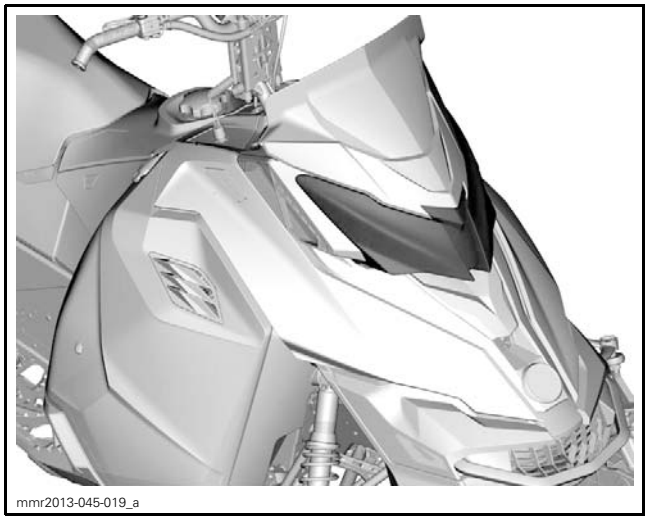
TOWARDS FRONT

Hood Installation

The installation is the reverse of removal procedure.

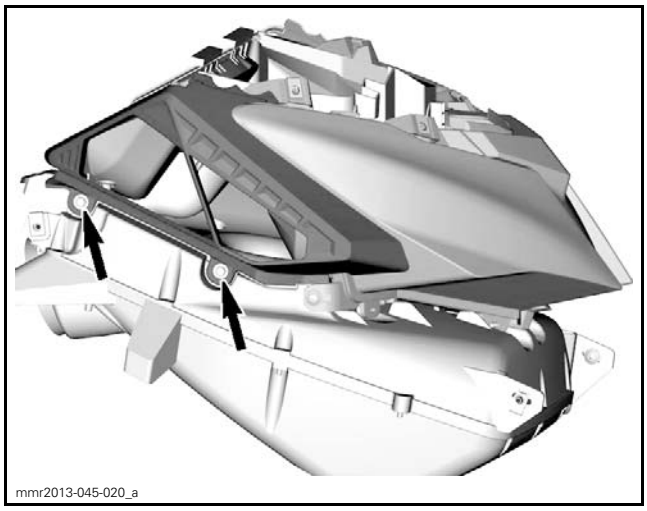
PART	TORQUE
Hood screws	1.7 N•m (15 lbf•**in**)

HEADLIGHT MODULE



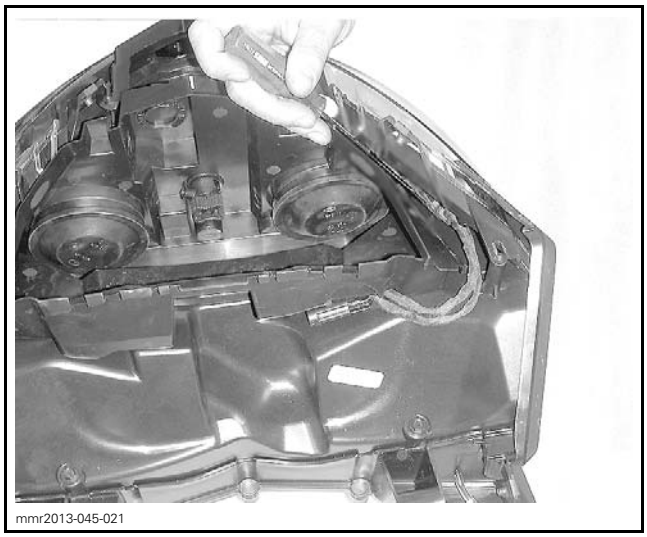
Headlight Module Removal

1. See procedures in this subsection and remove:
– Hood
– Gauge support
2. Remove retaining screws from mesh filter housing.

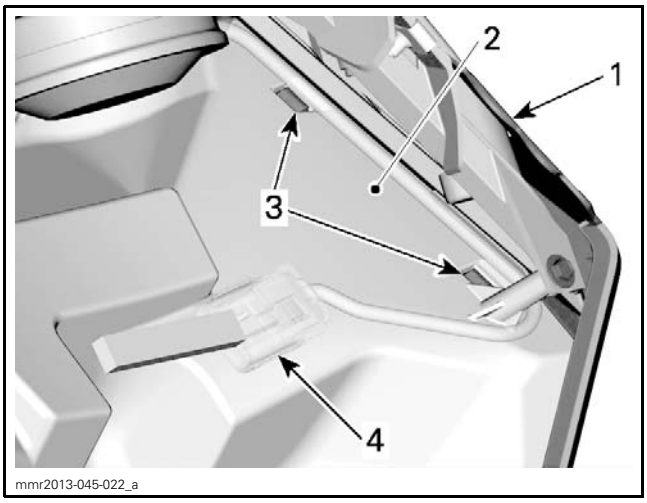


RH SIDE SHOWN

3. From top of upper body module, carefully release mesh filter housing tabs.
4. Detach connector from air intake silencer.



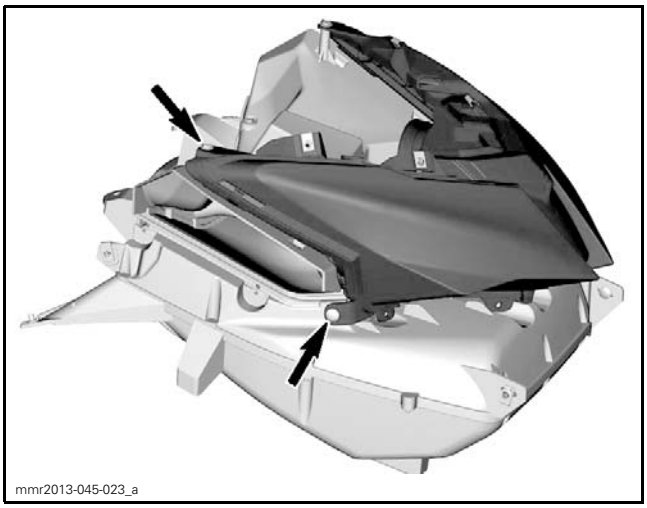
TOP OF UPPER BODY MODULE — RH SIDE TABS SHOWN



mmr2013-045-022_a

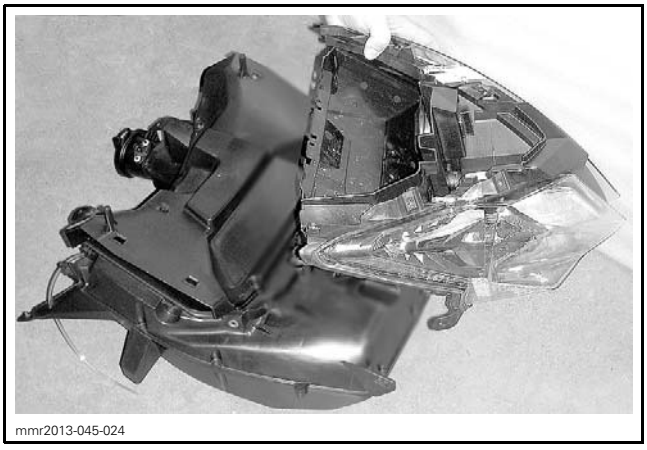
RH SIDE TABS SHOWN — RELEASE AND PUSH OUT BOTH TABS
1. *Headlight housing*
2. *Air intake silencer*
3. *Mesh filter housing tabs*
4. *Connector*

5. Remove headlight housing screws.


mmr2013-045-023_a

RH SIDE SHOWN

6. Pull out headlight housing.

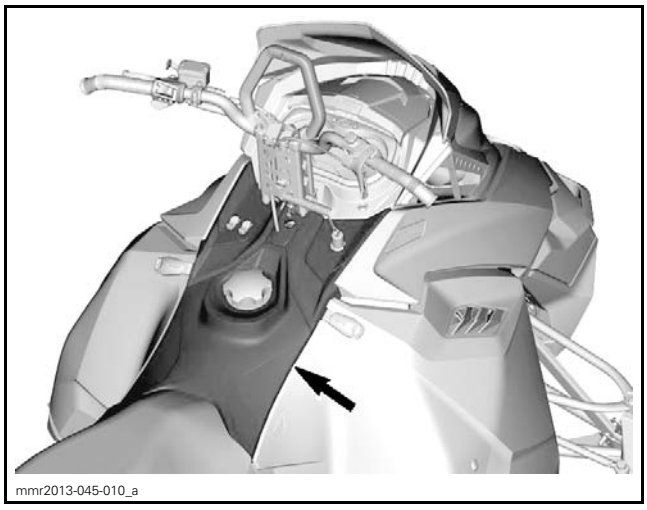

mmr2013-045-024

Headlight Module Installation

The installation is the reverse of removal procedure.

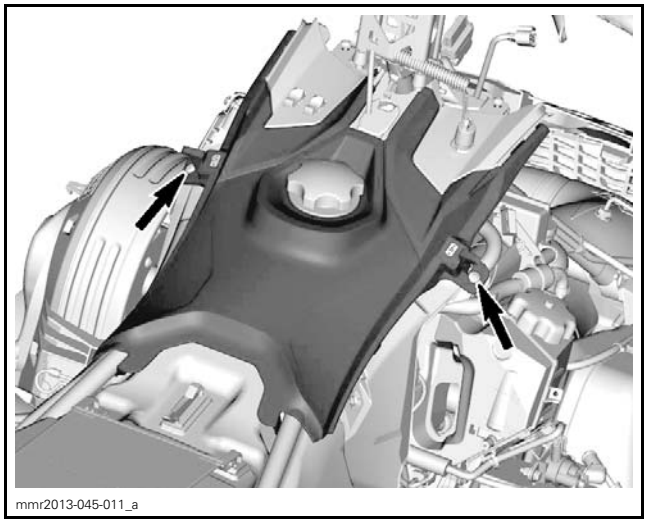
PART	TORQUE
Mesh filter housing screws	1.7 N•m (15 lbf•**in**)
Headlight housing screws	1.9 N•m (17 lbf•**in**)

CONSOLE


mmr2013-045-010_a

Console Removal

1. Remove *UPPER BODY MODULE*. See procedure in this subsection.
2. Remove seat.
3. Remove console screws.


mmr2013-045-011_a

4. Remove fuel tank cap.

5. Using the CONSOLE NUT WRENCH (P/N 529 036 183), unscrew the fuel tank nut.

529036183


mmr2011-110-001

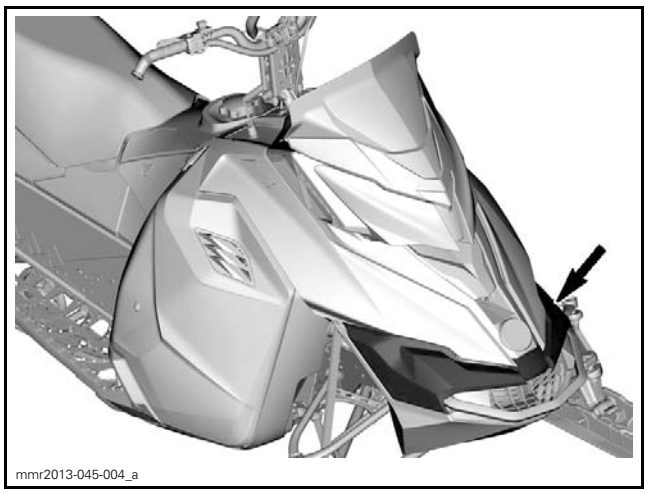
6. Lift up the console and unplug all connectors.
7. Install fuel tank cap.

Console Installation

The installation is the reverse of removal procedure.

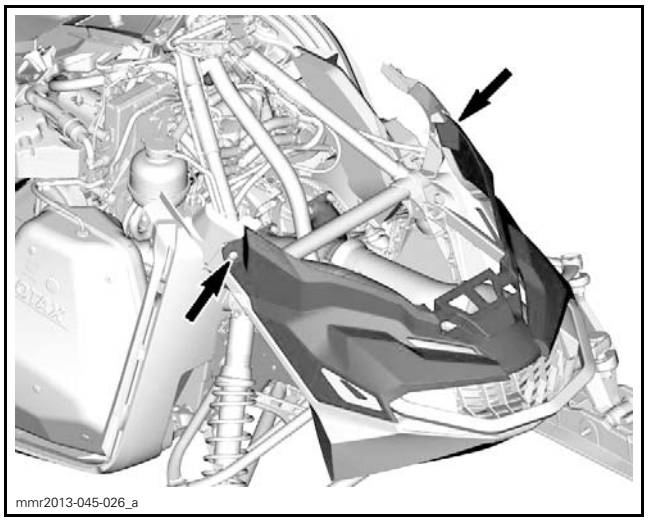
PART	TORQUE
Console screws	1.9 N•m (17 lbf•**in**)

BOTTOM PAN COVER

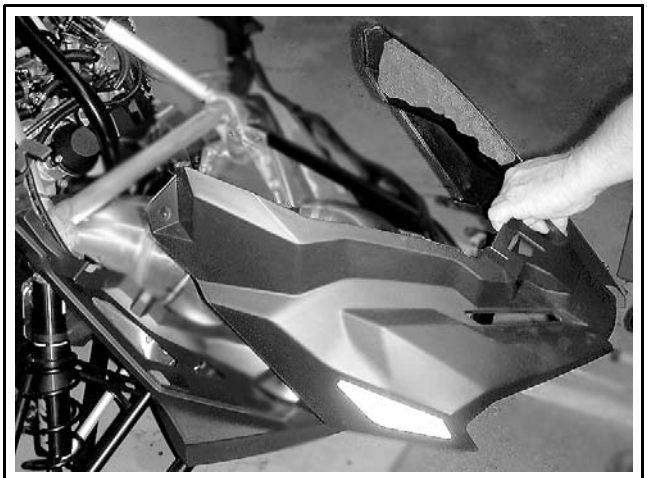

mmr2013-045-004_a

Bottom Pan Cover Removal

1. Remove *HOOD*.See procedure in this subsection.
2. Remove bottom pan cover screws.


mmr2013-045-026_a

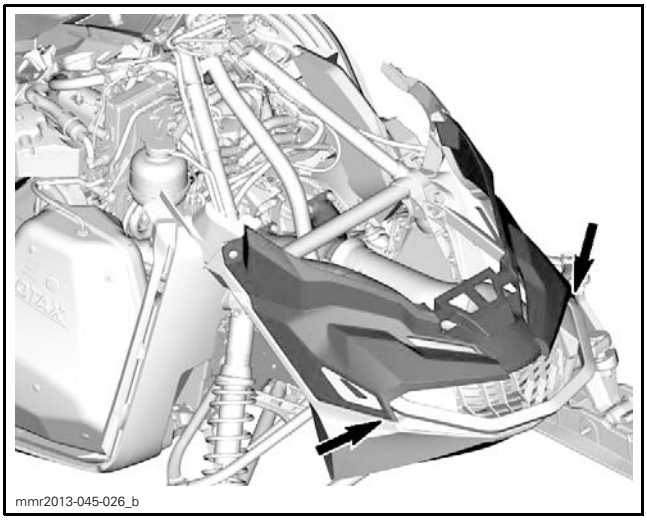
3. Pull out bottom pan cover toward front.


mmr2013-045-027_a

Bottom Pan Cover Installation

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

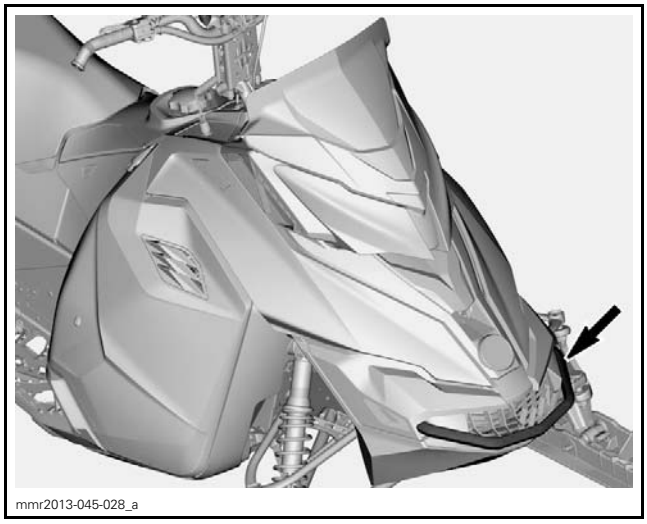
Ensure to slide front sides of bottom pan cover into bottom pan.


mmr2013-045-026_b

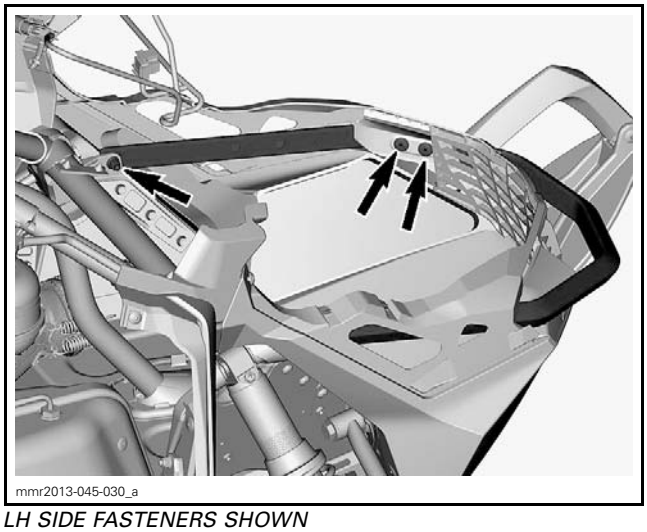
PART	TORQUE
Bottom pan cover screws	1.9 N•m (17 lbf•**in**)

FRONT BUMPER

Front Bumper Removal


mmr2013-045-028_a

1. Remove *BOTTOM PAN COVER*. See procedure in this subsection.
2. Remove tuned pipe. Refer to *EXHAUST SYSTEM* subsection.
3. Using a SUPERTANIUM DRILL BIT 3/16" (P/N 529 031 800), drill out rivets from front bumper.
4. Remove front bumper bolts.


mmr2013-045-030_a

LH SIDE FASTENERS SHOWN

5. Pull out bumper toward front.

Front Bumper Installation

Install bumper on vehicle.

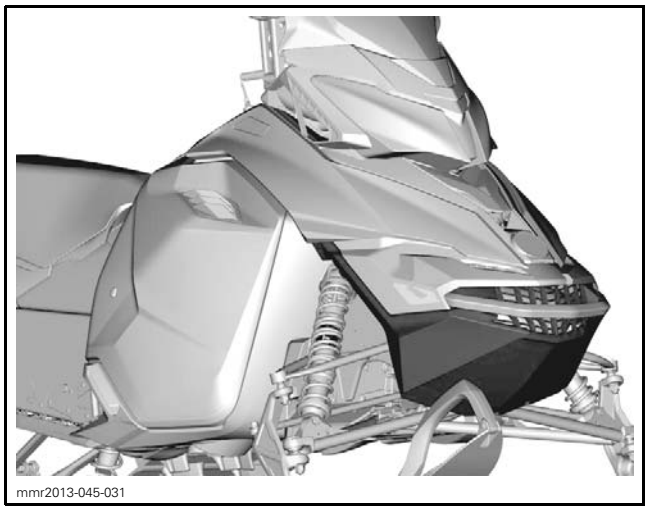
Install new rivets.

Install front bumper bolts and nuts.

PART	TORQUE
Front bumper screws	10 N•m (89 lbf•**in**)

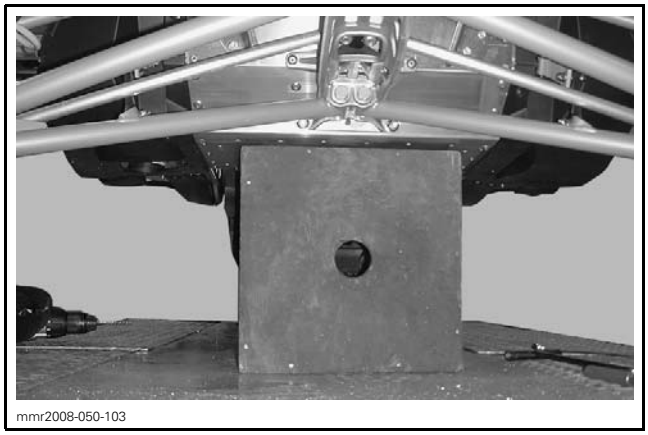
Install remaining components.

FRONT BOTTOM PAN


mmr2013-045-031

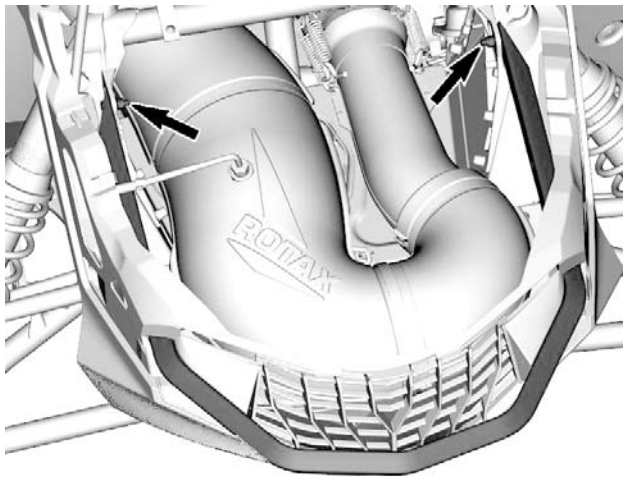
Front Bottom Pan Removal

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.

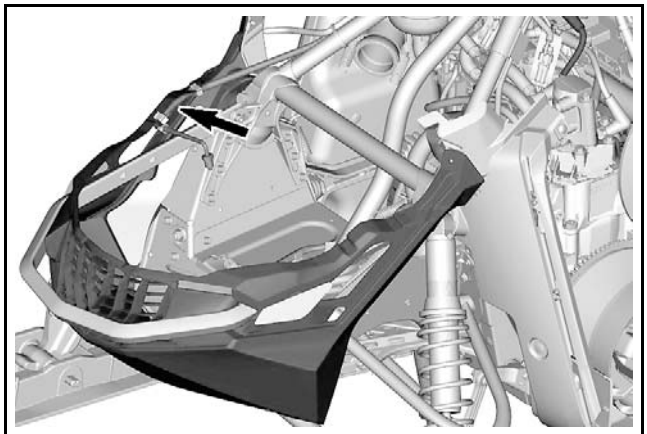

mmr2008-050-103

3. Remove *FRONT BUMPER*. See procedure in this subsection.

NOTE
Front bumper may remain attached to the front bottom pan. In this case, detach bumper from front member.



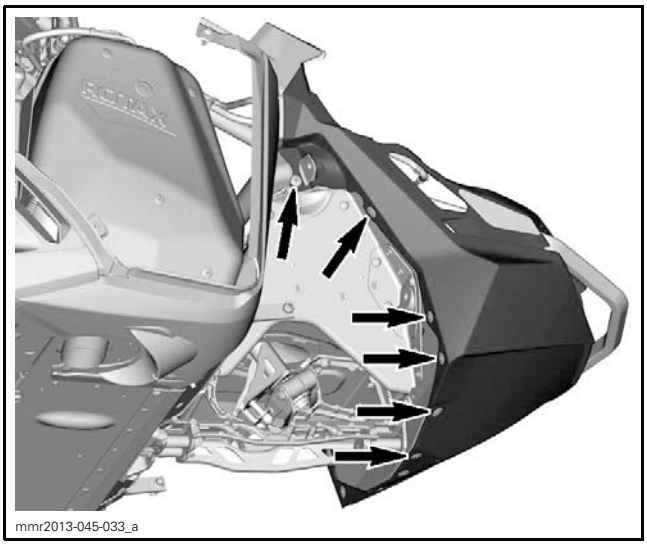
4. Remove tuned pipe. Refer to *EXHAUST SYSTEM* subsection.
5. On 800R models, detach TCM module harness from bottom pan.


mmr2013-045-034_a

VIEW FROM LH SIDE — HARNESS ON RH SIDE

6. Remove front shock absorbers. Refer to *FRONT SUSPENSION* subsection.
7. Using an angle drill and a SUPERTANIUM DRILL BIT 3/16" (P/N 529 031 800), drill out all rivets retaining bottom pan.

NOTE: Refer to *FRAME* for proper procedure when drilling rivets retaining plastic parts.



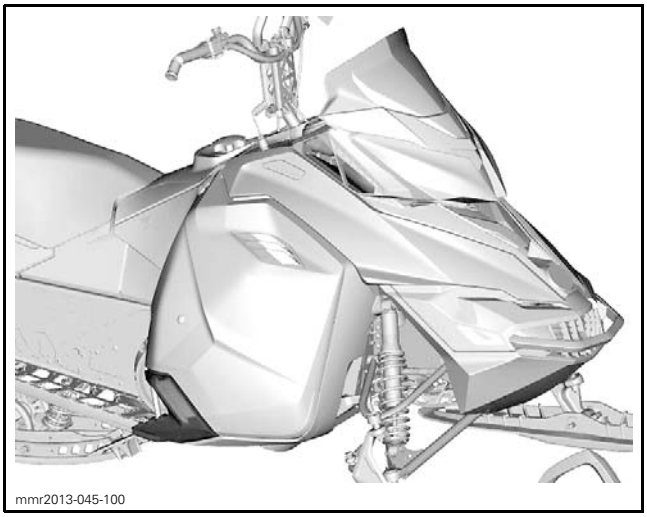
RH SIDE SHOWN — SOME PARTS REMOVED FOR CLARITY PURPOSE

8. Remove bottom pan.

Front Bottom Pan Installation

The installation is the reverse of removal procedure.

SIDE BOTTOM PAN CAP

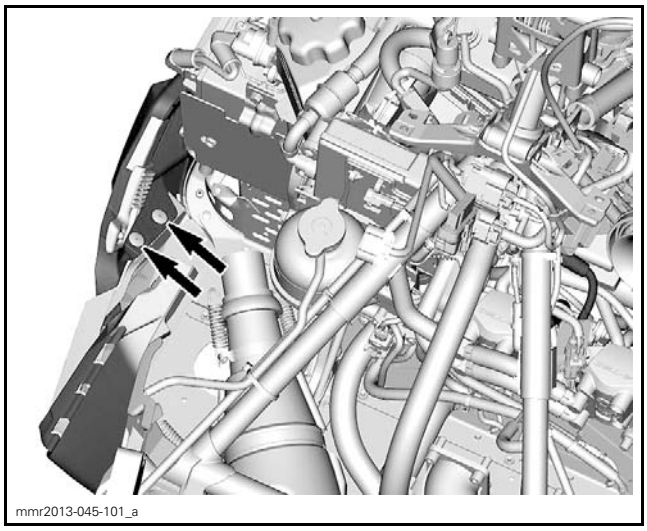


Side Bottom Pan Cap Removal

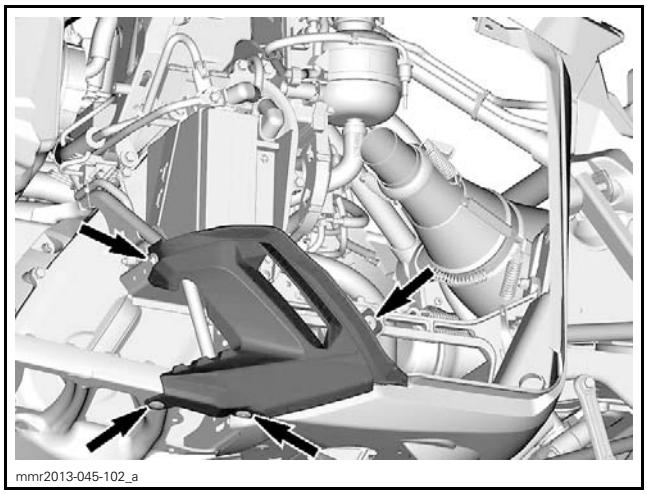
1. Remove LH and RH panels. Refer to procedure in this subsection.
2. Remove drive belt guard. Refer to *DRIVE BELT* subsection.
3. Remove muffler. Refer to *EXHAUST SYSTEM* subsection.
4. Using an angle drill and a SUPERTANIUM DRILL BIT 3/16" (P/N 529 031 800), drill out all rivets retaining side bottom pan cap.

NOTE: Refer to *FRAME* for proper procedure when drilling rivets retaining plastic parts.

5. Remove screw retaining the rear of side bottom pan.



RH SIDE SEEN FROM FRONT LH SIDE



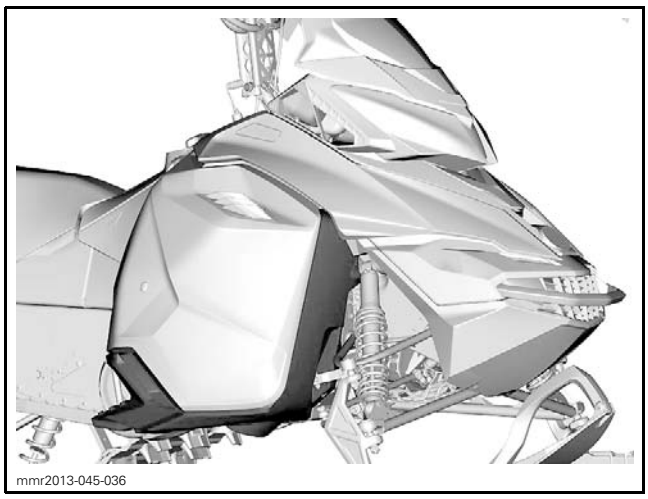
RH SIDE

Side Bottom Pan Cap Installation

The installation is the reverse of removal procedure.

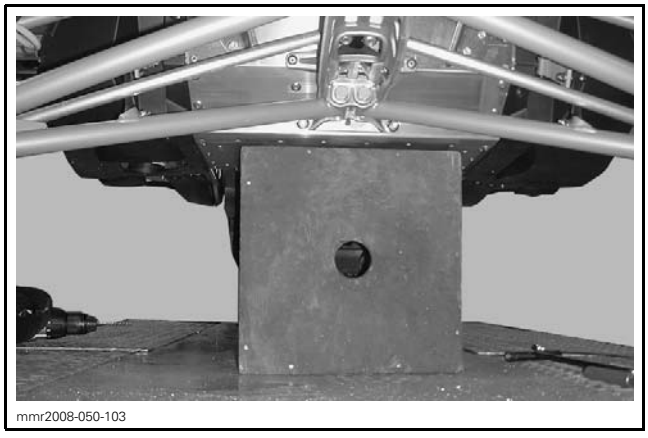
PART	TORQUE
Side bottom pan cap screws	1.9 N•m (17 lbf•**in**)

SIDE BOTTOM PAN

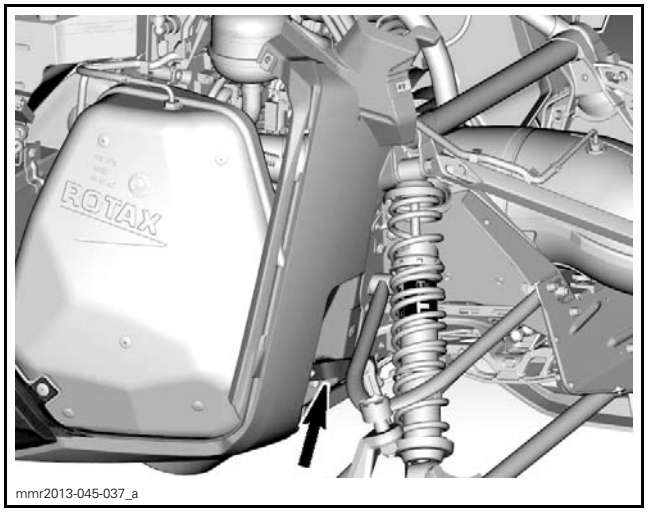

mmr2013-045-036

Side Bottom Pan Removal

1. Remove LH and RH panels. Refer to procedure in this subsection.
2. Remove drive belt guard. Refer to *DRIVE BELT* subsection.
3. Lift front of vehicle until skis are off the ground.
4. Place the front portion of frame on a wooden box to support it securely.


mmr2008-050-103

5. Remove *BOTTOM PAN COVER*. See procedure in this subsection.
6. Disconnect vent tube from side bottom pan.
7. Remove stabilizer bar lever. Refer to *FRONT SUSPENSION* subsection.



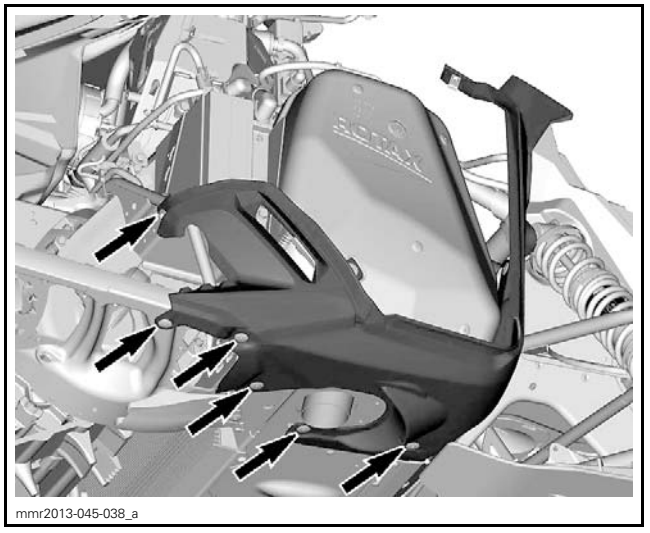
mmr2013-045-037_a

RH SIDE SHOWN

8. Using an angle drill and a SUPERTANIUM DRILL BIT 3/16" (P/N 529 031 800), drill out all rivets retaining side bottom pan.

NOTE: Refer to *FRAME* for proper procedure when drilling rivets retaining plastic parts.

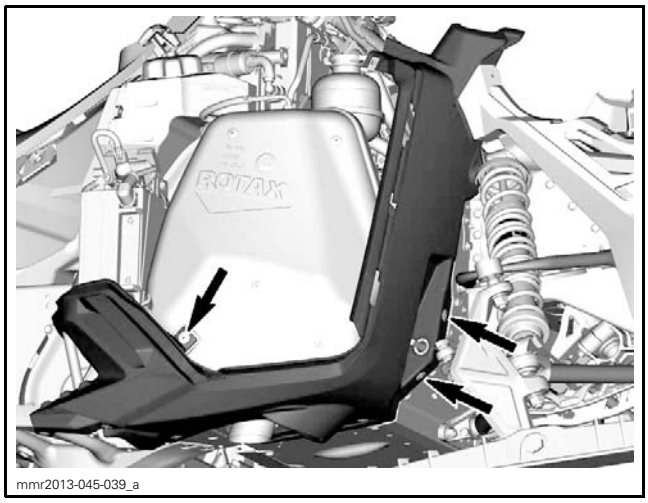
9. Remove screws retaining the rear of side bottom pan.



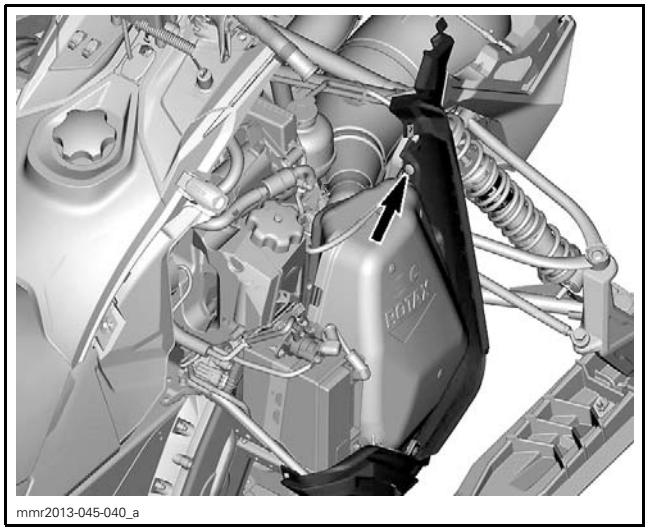
mmr2013-045-038_a

RH SIDE SHOWN

NOTICE **Be careful not to drill through muffler.**



RH SIDE SHOWN



RH SIDE SHOWN

10. Remove bottom pan.

Side Bottom Pan Installation

The installation is the reverse of removal procedure.

PART	TORQUE
Side bottom pan screws	1.9 N•m (17 lbf•**in**)

SEAT COVER

Seat Cover Replacement

Remove seat.

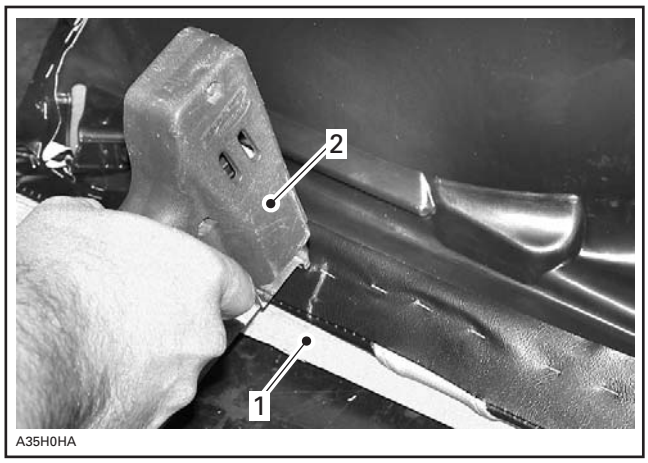
Remove the old seat cover. Check the foam and replace it if necessary.

Install staples with an electric tacker such as Arrow tacker ETN-50 or with a manual tacker such as ARROW TACKER (P/N T-50).

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.



TYPICAL
1. *Piece of wood*
2. *Tacker*

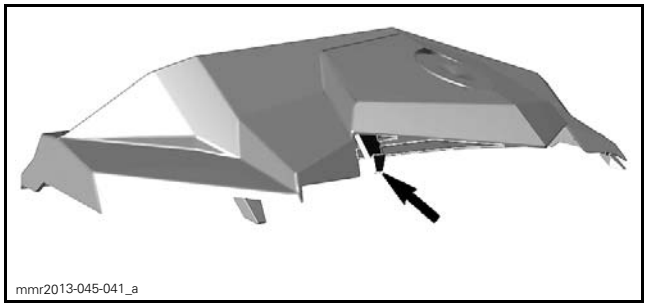
After seat cover installation, cut all around the excess of material.

REAR BUMPER

PART	TORQUE
Rear bumper screws	16 N•m (142 lbf•**in**)

TAIL LIGHT HOUSING

Release the locking tab from underneath tunnel.



Pull housing toward rear.

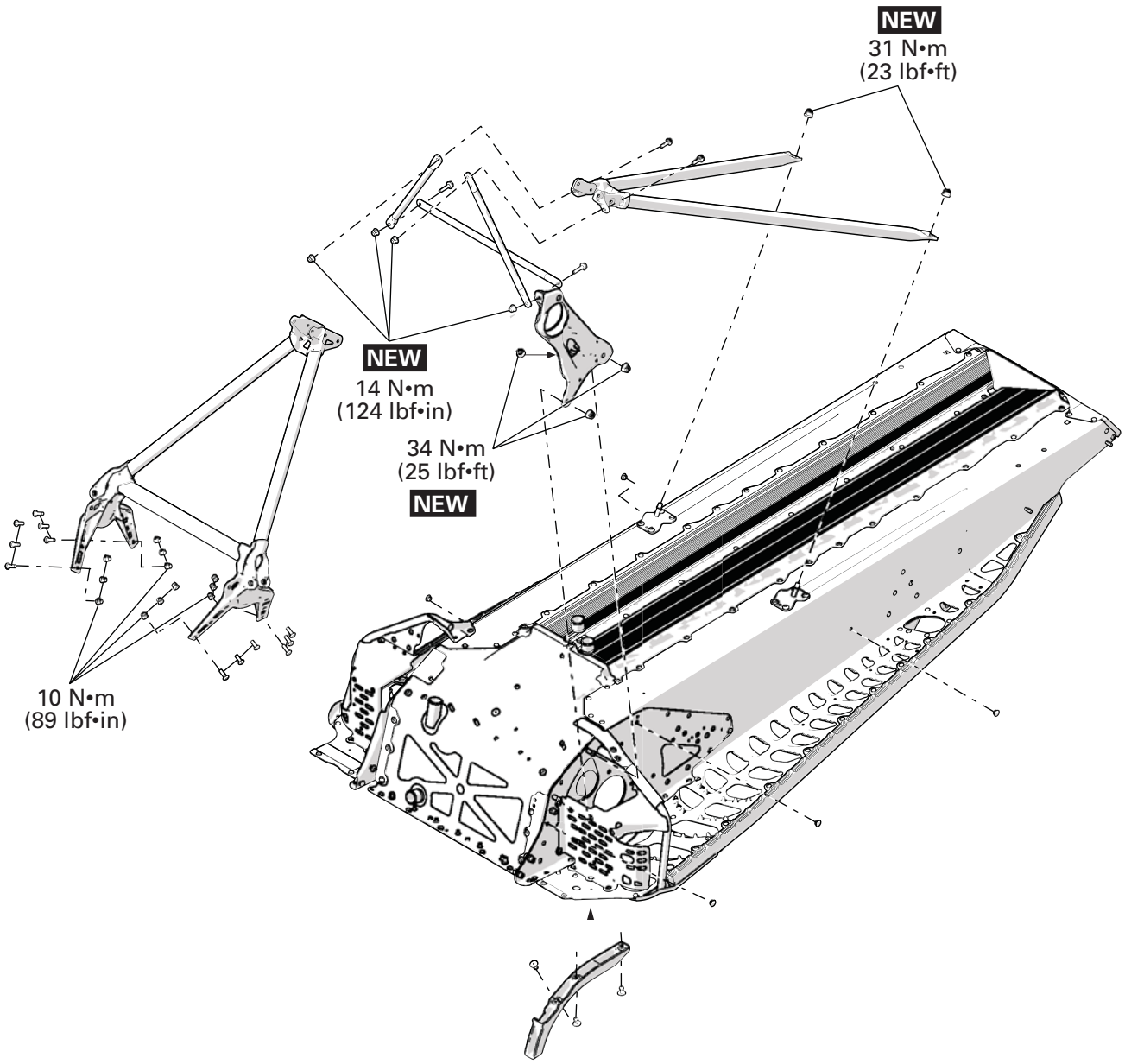
FRAME

SERVICE TOOLS

Description	Part Number	Page
SUPERTANIUM DRILL BIT 3/16"	529 031 800	6

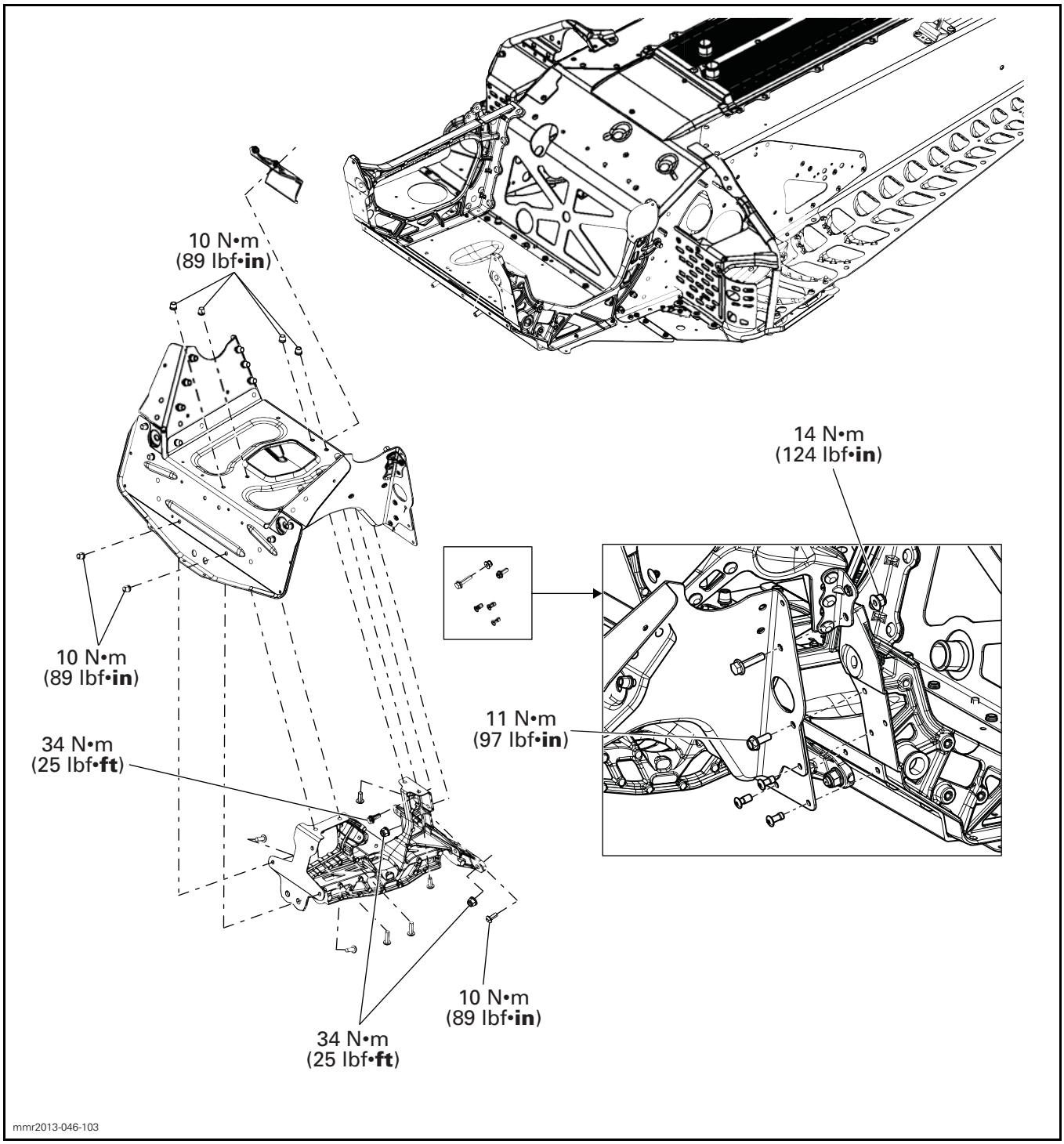
SERVICE PRODUCTS

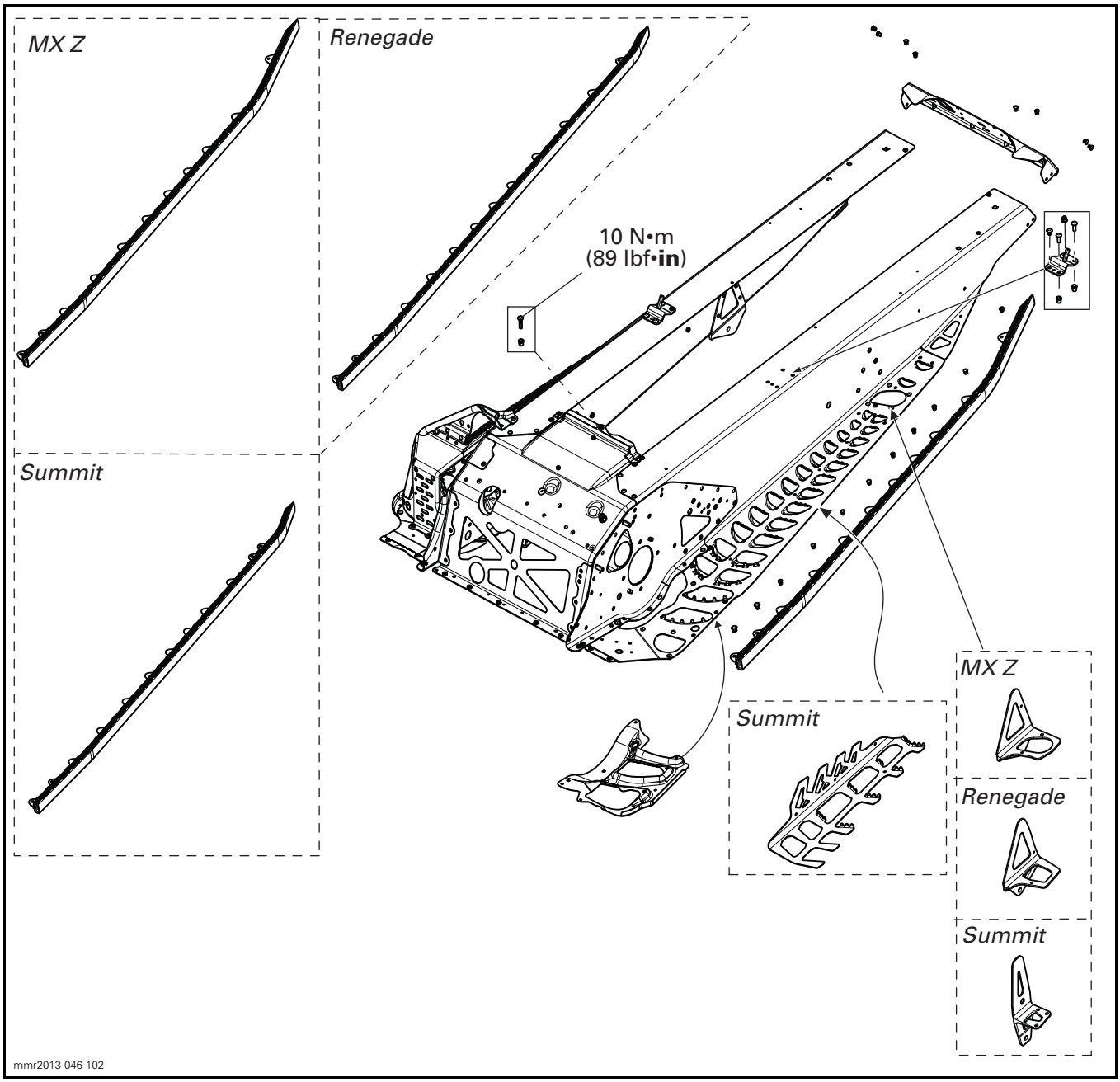
Description	Part Number	Page
LOCTITE 380 (BLACK MAX)	413 408 300	14
XPS SYNTHETIC CHAINCASE OIL	413 803 300	6

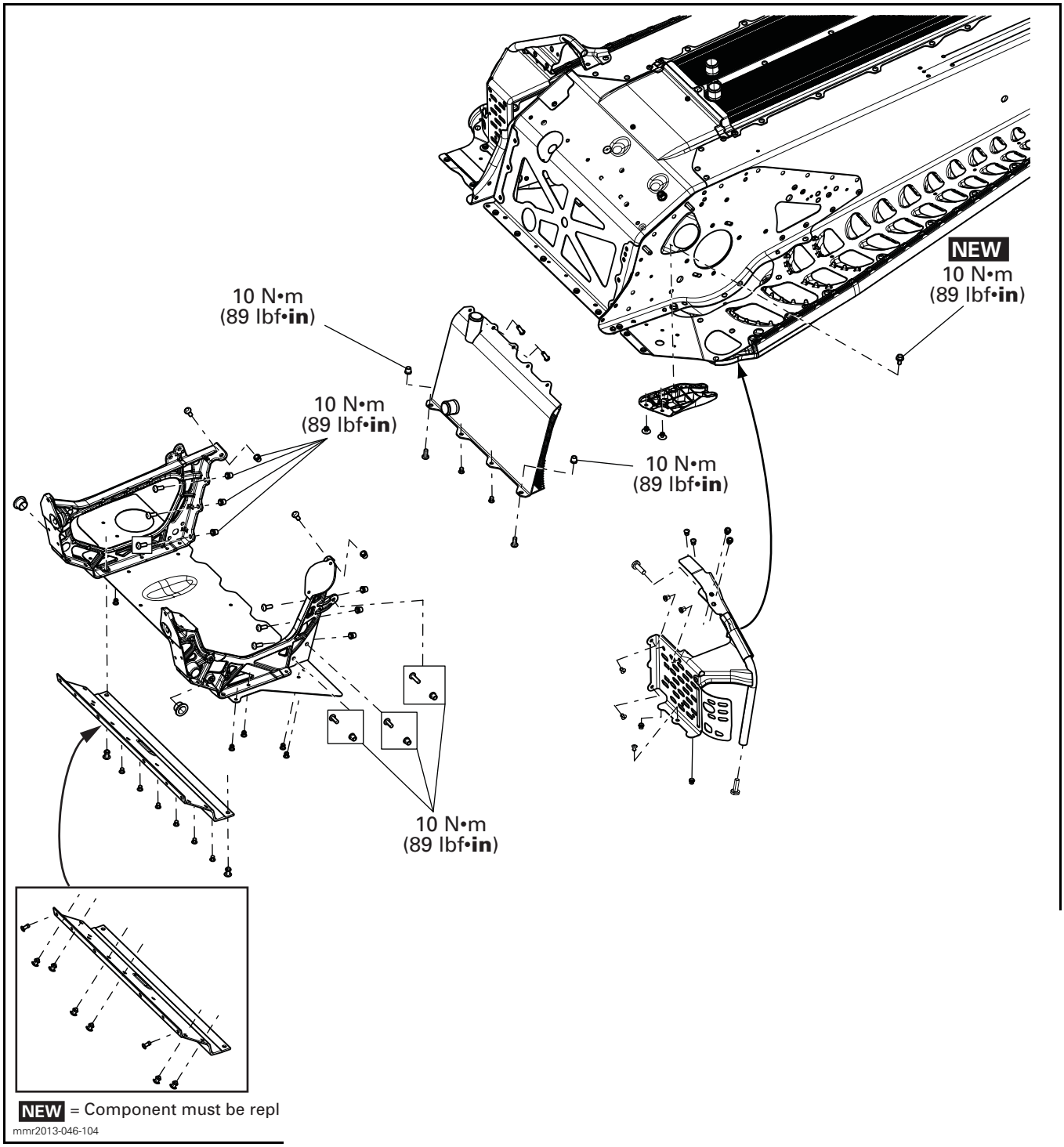


NEW = Component must be replaced when removed.

mmr2013-046-100


10 N•m
(89 lbf•**in**)
14 N•m
(124 lbf•**in**)
10 N•m
(89 lbf•**in**)
11 N•m
(97 lbf•**in**)
34 N•m
(25 lbf•**ft**)
10 N•m
(89 lbf•**in**)
34 N•m
(25 lbf•**ft**)
mmr2013-046-103


MX Z
Renegade
Summit
10 N•m
(89 lbf•in)
MX Z
Summit
Renegade
Summit
mmr2013-046-102


NEW
10 N•m
(89 lbf•in)
10 N•m
(89 lbf•in)
10 N•m
(89 lbf•in)
10 N•m
(89 lbf•in)
10 N•m
(89 lbf•in)
NEW = Component must be repl
mmr2013-046-104

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

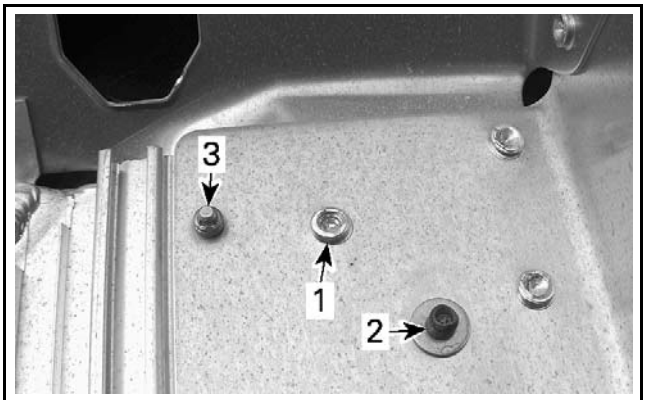
For proper drilling instructions and to prevent premature wear, follow the procedures as detailed.

NOTICE **When removing rivets, do not enlarge or deform the rivet holes in the frame.**

Self-Percing Rivet Removal

Recommended Method

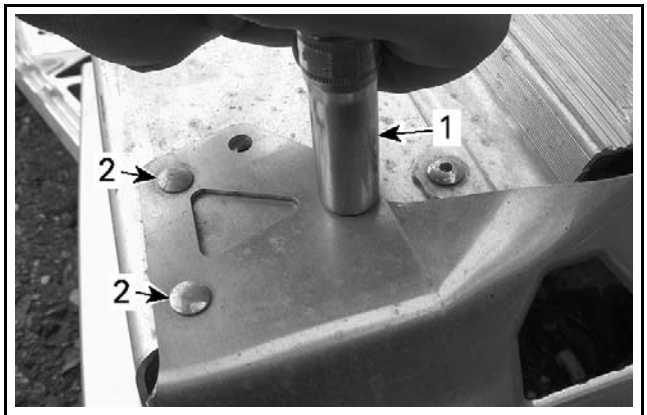
1. Using a grinding disk, grind the rivet end.



mmr2009-092-001_a

TYPICAL
1. Grind this side of self-drilling rivet
2. Pop rivet
3. STAVEX rivet

2. Support the frame around the rivet head with a socket on the opposite side to avoid warpage.



mmr2009-092-002_a

TYPICAL
1. 11 mm socket over a rivet head
2. Rivet heads

3. Drive out remaining rivet using a punch.

Alternative Method

1. Use a SUPERTANIUM DRILL BIT 3/16" (P/N 529 031 800) and a variable speed drill.
2. Partially drill **rivet end** — not the rivet head.

NOTICE **High speed drilling will cause excessive heat which may destroy the cutting edge of the bit; therefore, avoid using pneumatic drills.**

NOTE: To increase bit life, use XPS SYNTHETIC CHAINCASE OIL (P/N 413 803 300) as a cutting oil.

3. Cut rivet using a chisel.
4. Remove riveted part.
5. Drive out remaining rivet head using a punch.

Pop Rivet Removal

1. Use a SUPERTANIUM DRILL BIT 3/16" (P/N 529 031 800), and a variable speed drill.
2. Drill **rivet head** sufficiently to cut through rivet head.

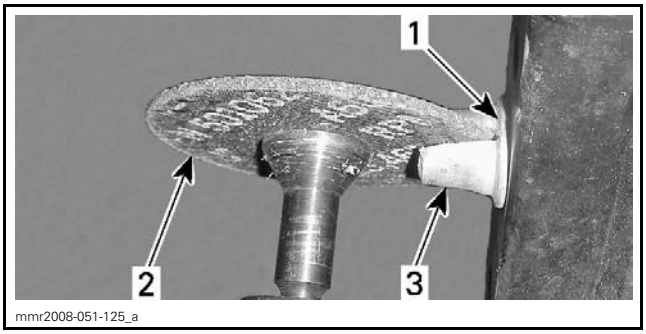
NOTICE **Drill only sufficiently to cut rivet head. Do not drill into frame material, or part secured using the rivet. When rivet is used to secure a plastic part, use pliers to avoid rotation of rivet with drill bit and heating or melting of the plastic part.**

3. Using a small punch, drive out the remaining rivet end.

HUCK Rivet Removal

Recommended Method

1. Using a cut-off tool, cut the rivet retainer without touching the retainer's shoulder.



1. Rivet retainer's shoulder
2. Cutter wheel
3. Rivet retainer

NOTE: Apply a thin layer of grease on cutter wheel to increase its durability.

2. Break the rivet retainer's shoulder using a chisel.
3. Use a small punch to drive out the rivet stem.

Alternative Method

1. Measure outside diameter of rivet stem and select appropriate drill bit.
2. Drill the **rivet stem — not the rivet head** using a variable speed drill until rivet retainer is freed.

NOTE: When possible, use an angle grinder to grind rivet head or use an air hammer to cut the rivet retainer.

FRAME

Frame Cleaning

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.**

Frame Welding

No welding is permitted unless it is specified on a BRP bulletin.

Frame Repair

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. Refer to *MINOR REPAIRS* and *MAJOR REPAIRS* for paint information.
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.

Minor Repairs

BRP COLOR		PAINT STICK P/N
White	B-229	549 011 400
Black	B-160	549 011 404

Major Repairs

BLACK B-160 FORMULA (430g TOTAL)	
PRODUCT	QTY
UR50	41.35 g (1.46 oz)
BC200	388.65 g (13.71 oz)

WHITE B-229 FORMULA (430g TOTAL)	
PRODUCT	QTY
UR50	43 g (1.52 oz)
BC190	387 g (13.65 oz)

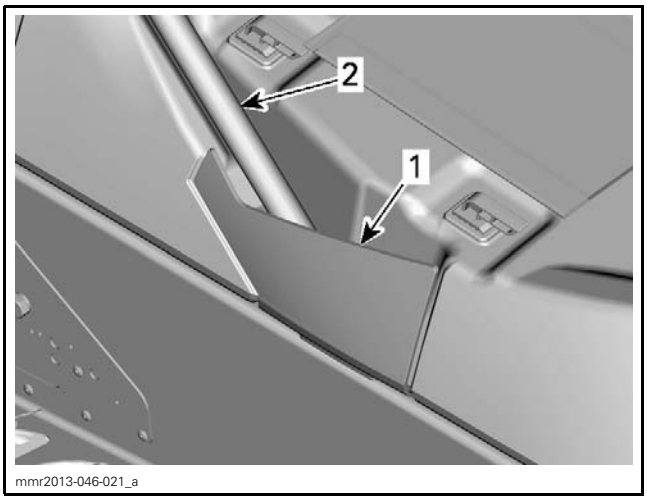
REAR BUMPER

Refer to *BODY* subsection for rear bumper removal and installation procedure.

REAR FRAME MEMBER

Rear Frame Member Removal

1. Refer to *BODY* subsection to remove the following:
   – Seat
   – Gauge and gauge support
   – Console.
2. Remove trim panel at the bottom of rear frame member (one each side).



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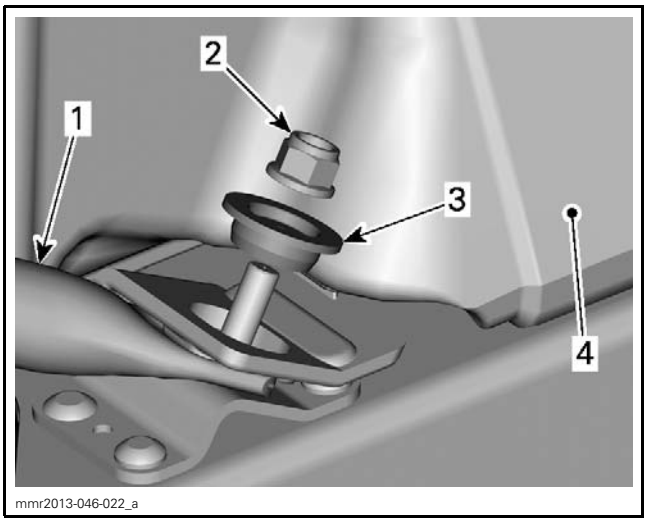
1. Trim panel
2. Rear frame member

3. Remove nut and shouldered washer securing rear frame member (one each side).



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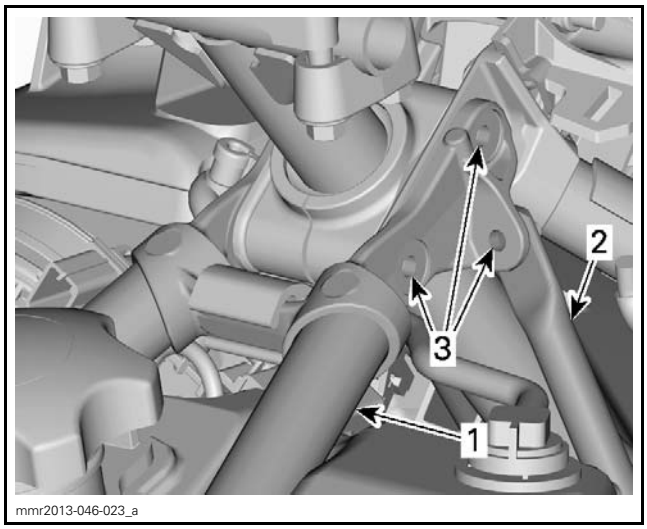
1. Rear frame member
2. Nut to remove
3. Shouldered washer
4. Fuel tank

4. Remove screws securing the rear frame member to steering column support and side frame members.



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1. Rear frame member
2. LH side frame member
3. Bolts to remove

5. Remove rear frame member.

Rear Frame Member Installation

The installation is the reverse of the removal procedure.

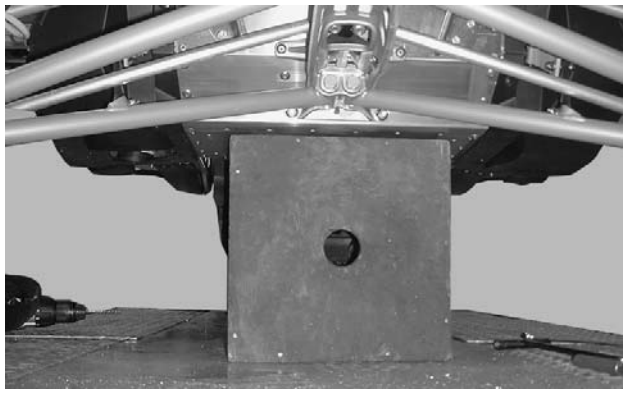
NOTE: Install all bolts and nuts before tightening them.

TIGHTENING TORQUE	
Rear bolts	18 N•m (159 lbf•**in**)
Side bolts	14 N•m (124 lbf•**in**)

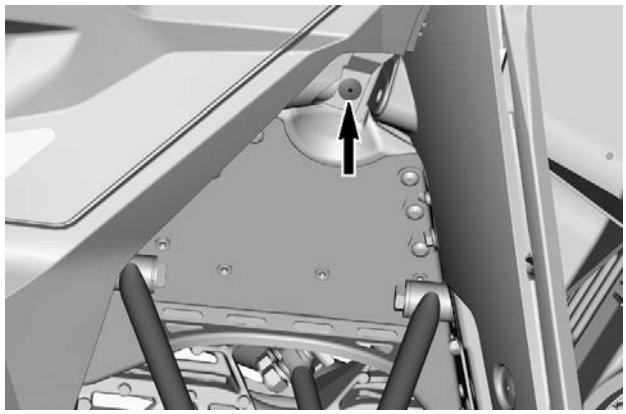
FRONT FRAME MEMBER

Front Frame Member Removal

1. Refer to *BODY* subsection to remove the following:
   – Hood
   – Console
   – Gauge and gauge support.
2. Remove the secondary air intake silencer. Refer to *AIR INTAKE SYSTEM* subsection.
3. Remove the tuned pipe. Refer to *EXHAUST SYSTEM* subsection.
4. Lift front of vehicle until skis are off the ground.
5. Place the front portion of frame on a wooden box to support it securely.


mmr2008-050-103

6. Remove front shock absorbers.
7. Drill the rivet retaining the front bottom pan to front frame member (one each side).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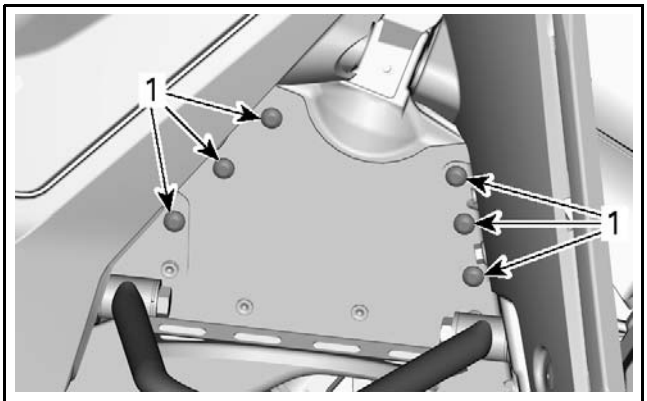
8. Remove HUCK rivets (six each side), see removal procedure at the beginning of this section.



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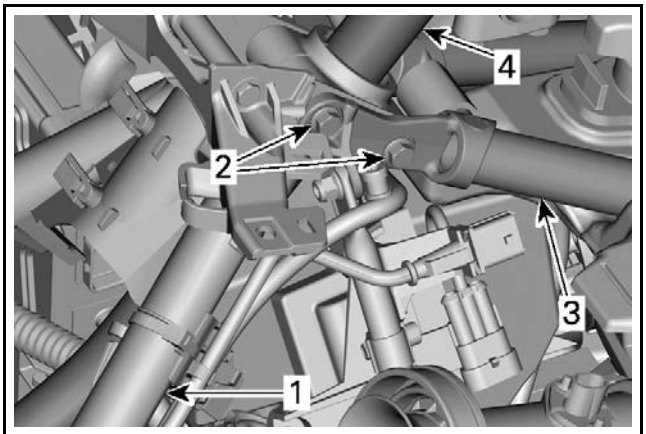
1. HUCK rivets

9. Remove bolts securing front frame member, rear frame member and steering column support.



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1. Front frame member
2. Bolts to remove
3. Rear frame member
4. Steering column

10. Remove the front frame member.

Front Frame Member Installation

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

1. Replace the HUCK rivets with the following parts.

NEW FASTENERS	
Hexagonal flanged bolt M6 x 20	(P/N 207 662 044)
Hexagonal flanged elastic stop nut M6	(P/N 233 261 414)

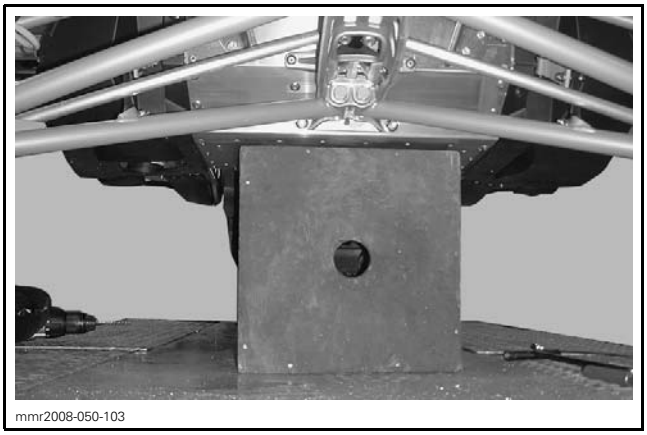
NOTE: Unless stated otherwise, install bolt heads toward outside of the vehicle.

2. Torque new fasteners to 10 N•m (89 lbf•**in**).

FRONT SUSPENSION MODULE

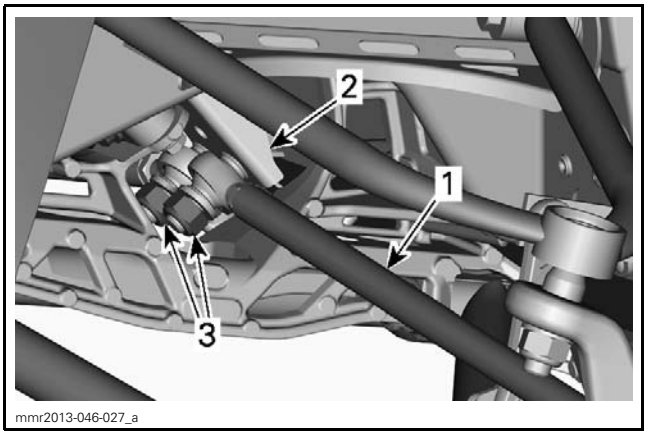
Front Suspension Module Removal

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

TYPICAL

3. Remove the muffler and the tuned pipe. Refer to *EXHAUST SYSTEM* subsection.
4. Remove the RH front suspension assembly in the following manner:
   4.1 Detach both tie-rod ends from steering column.



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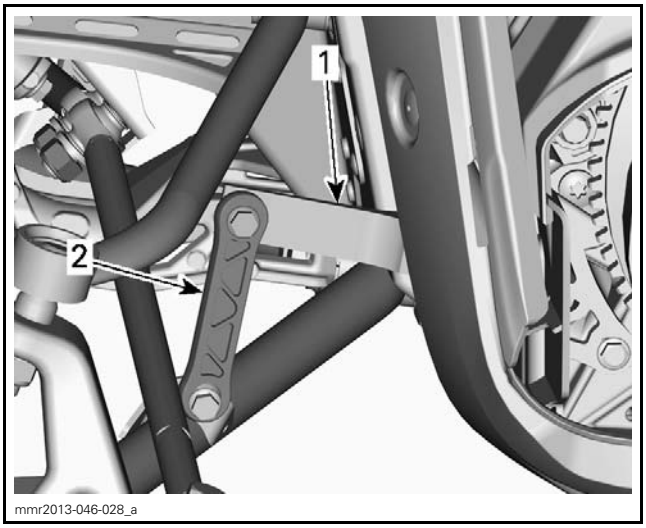
1. *Tie-rod*
2. *Steering column*
3. *Tie-rod end nut*

   4.2 Remove upper mounting bolt from both front shock absorbers.
   4.3 Remove bolt that secures stabilizer link to stabilizer lever (1 each side).



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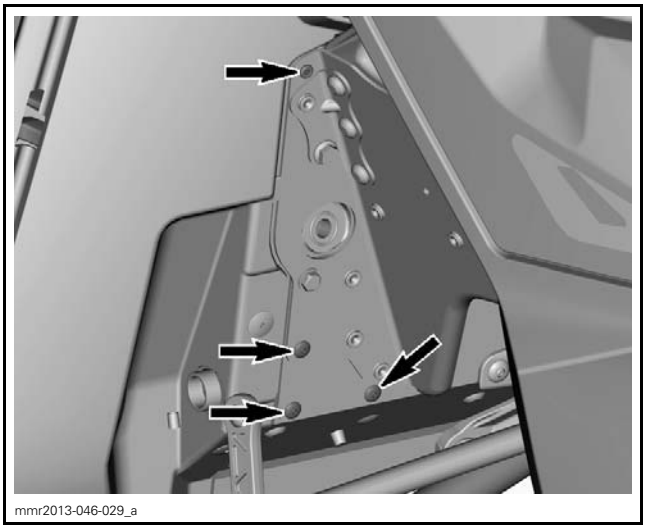
1. *Stabilizer lever*
2. *Stabilizer link*

   4.4 Remove upper and lower suspension arms bolts (both sides). Refer to *FRONT SUSPENSION* subsection.
   4.5 Pull suspension arms from front suspension module to remove front suspension assembly from vehicle.
5. Remove the stabilizer bar, refer to *FRONT SUSPENSION* subsection.
6. Remove the front bottom pan. Refer to *BODY* subsection.

NOTE: Keep the front bumper installed on front bottom pan.

7. Remove the following pop rivets, refer to *POP RIVET REMOVAL* at the beginning of this subsection.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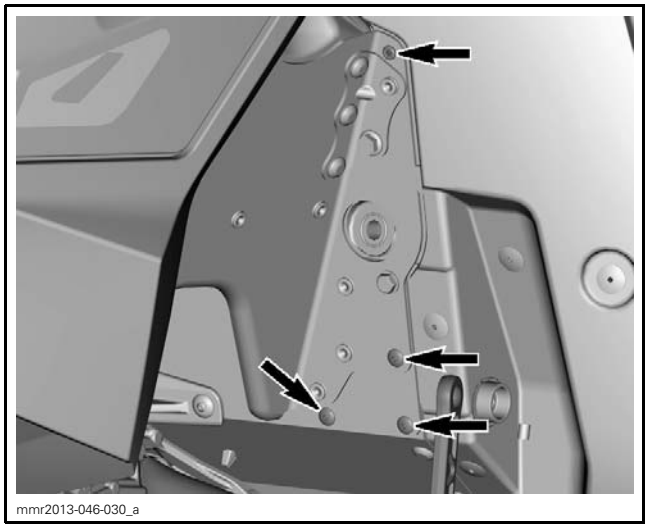
RH SIDE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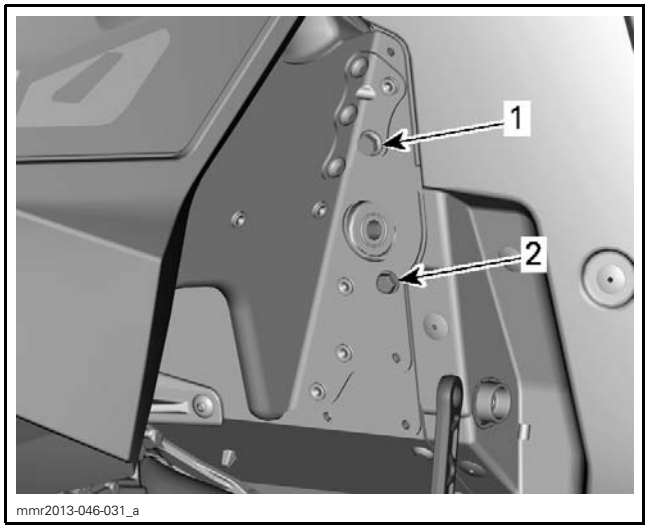
LH SIDE

8. Remove screws securing front suspension module to frame (2 each side).



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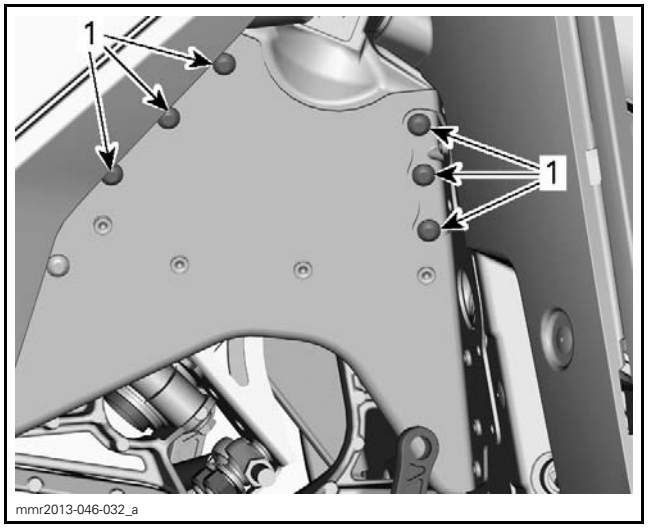
LH SIDE SHOWN
1. *Hexagonal flanged bolt*
2. *Torx screw*

9. Remove HUCK rivets (six each side), see removal procedure at the beginning of this subsection.



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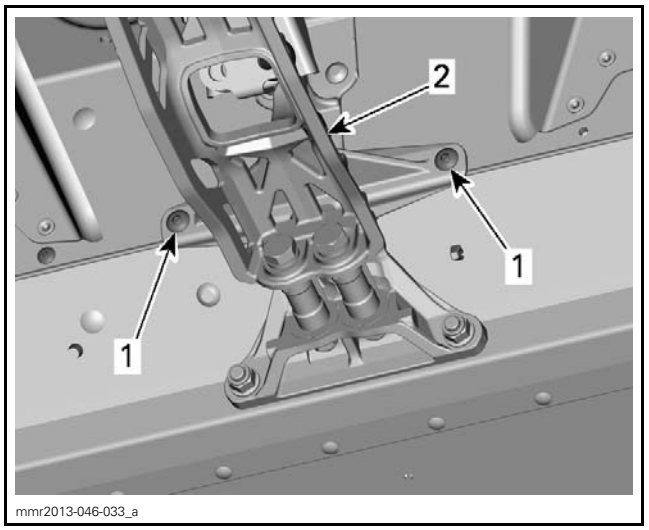
LH SIDE SHOWN
1. *HUCK rivets*

10. Grind rivets securing the lower suspension arm support to engine module.



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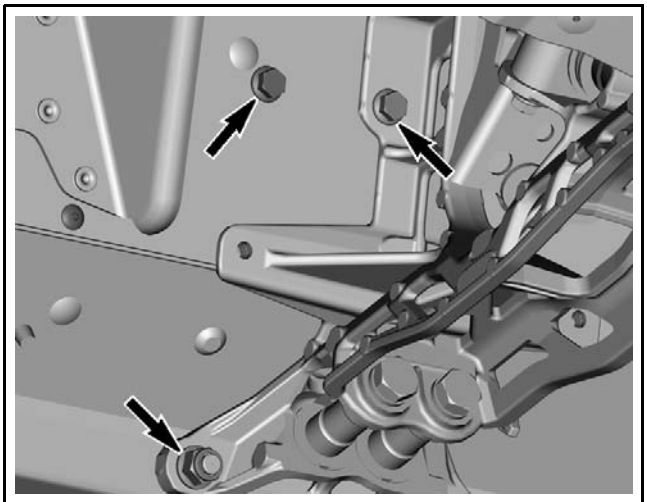
1. *Rivets*
2. *Lower suspension arm support*

11. Remove the following bolts and nuts.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12. Remove the front suspension module.

Front Suspension Module Installation

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

1. Replace the HUCK rivets with the following parts.

NEW FASTENERS	
Hexagonal flanged bolt M6 x 20	(P/N 207 662 044)
Hexagonal flanged elastic stop nut M6	(P/N 233 261 414)

NOTE: Unless otherwise stated, install bolt heads toward outside of the vehicle.

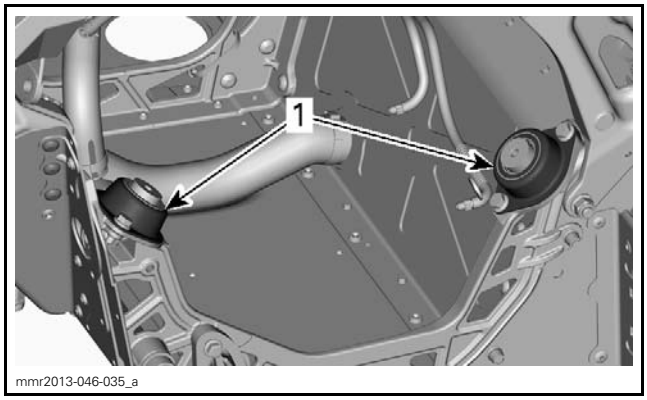
2. Torque new fasteners to 10 N•m (89 lbf•**in**).
3. Reinstall all removed parts by using the appropriate installation procedure.

TIGHTENING TORQUE	
Lower suspension arm nuts	34 N•m (25 lbf•ft)

ENGINE MODULE

Engine Module Removal

1. Remove engine from vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
2. Remove track, refer to *TRACK* subsection.
3. Remove the *FRONT SUSPENSION MODULE*, see procedure in this subsection.
4. Remove side bottom parts. Refer to *BODY*.
5. On LH side, remove front and rear engine rubber mounts.



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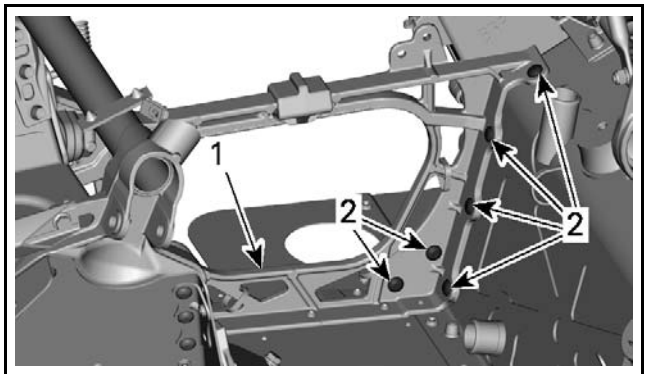
1. Engine rubber mounts

6. Remove HUCK rivets, see removal procedure at the beginning of this subsection.



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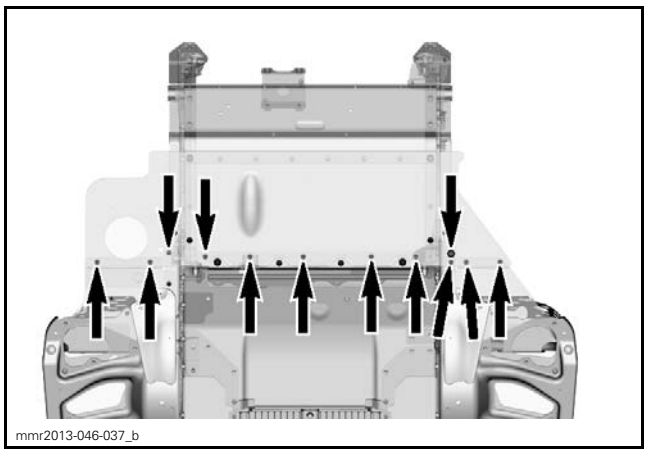
RH SIDE SHOWN
1. RH engine module
2. HUCK rivets

7. Drill or grind rivets securing engine module to frame.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8. Remove the engine module.

Engine Module Installation

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

1. Replace the HUCK rivets with the following parts.

NEW FASTENERS	
Hexagonal flanged bolt M6 x 20	(P/N 207 662 044)
Hexagonal flanged elastic stop nut M6	(P/N 233 261 414)

NOTE: Install bolt heads toward outside of the vehicle, except the one securing chaincase.

2. Torque new fasteners to 10 N•m (89 lbf•**in**).
3. Reinstall all removed parts by using the appropriate installation procedure.

HEAT EXCHANGERS

Heat Exchanger Cleaning and Inspection

Remove all debris between heat exchanger fins.

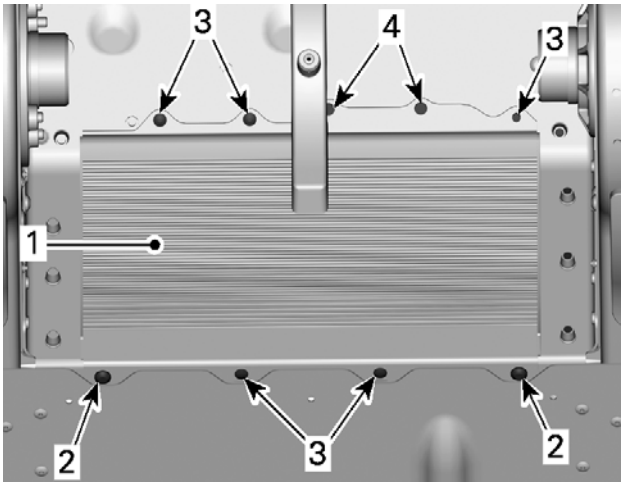
Check if heat exchanger fins are damaged. Replace heat exchanger if necessary.

NOTE: A heat exchanger with many broken fins does not work properly.

Front Heat Exchanger Removal

1. Drain cooling system. Refer to *COOLING SYSTEM DRAINING* in *PERIODIC MAINTENANCE PROCEDURES* subsection.
2. Remove LH and RH body panels. Refer to *BODY* subsection.
3. Remove drive belt guard. Refer to *DRIVE BELT* subsection.
4. Remove primary air intake silencer. Refer to *AIR INTAKE SYSTEM* subsection.
5. Remove throttle body . Refer to *E-TEC-DIRECT FUEL INJECTION* subsection.

NOTE: To remove the front heat exchanger rivets, refer to *RIVETS* in this subsection for procedure according to rivet type.



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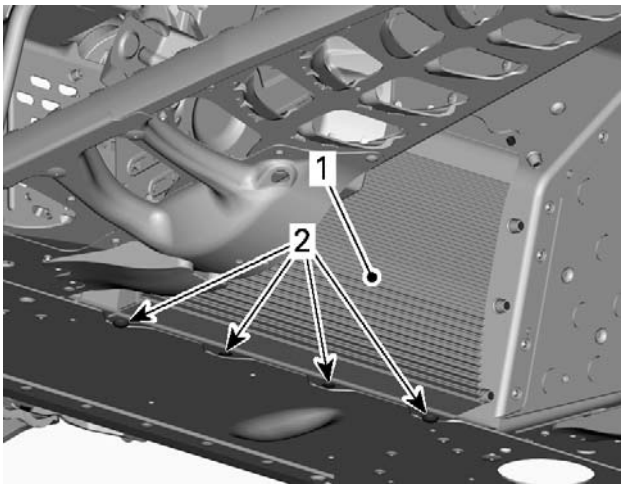
TYPICAL FRONT HEAT EXCHANGER FASTENERS - VIEW IN TUNNEL LOOKING FORWARD
1. *Front heat exchanger*
2. *HUCK rivets*
3. *AVEX rivets*
4. *Studs (RH aft engine mount)*

6. From underneath the frame, remove rivets securing bottom of front heat exchanger.



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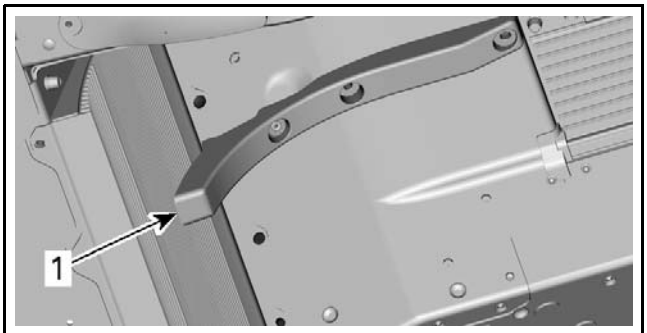
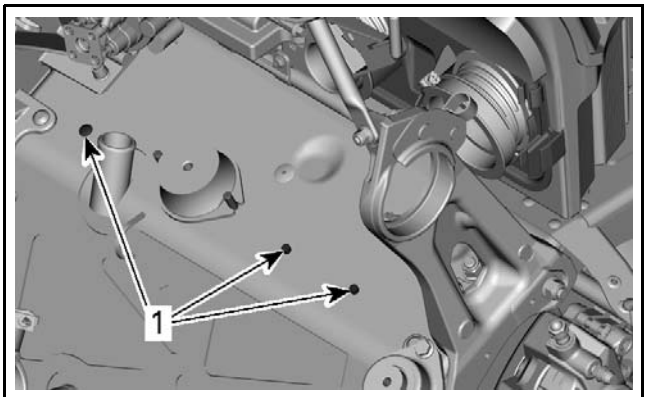
TYPICAL
1. *Front heat exchanger*
2. *Rivets to remove*

7. From engine compartment, remove rivets (3x) retaining heat exchanger protector.



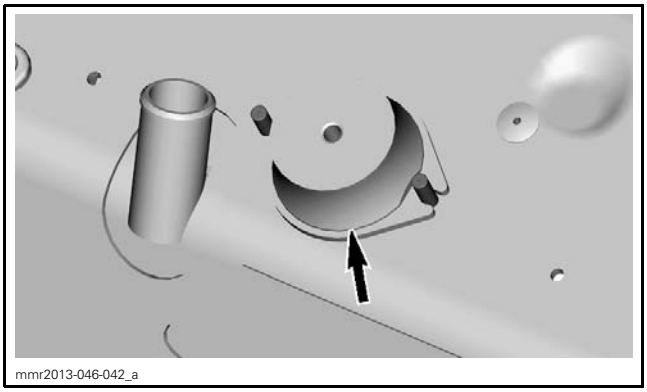
TYPICAL
1. Heat exchanger protector (in front of track)

8. Remove upper rivets retaining front heat exchanger to frame.



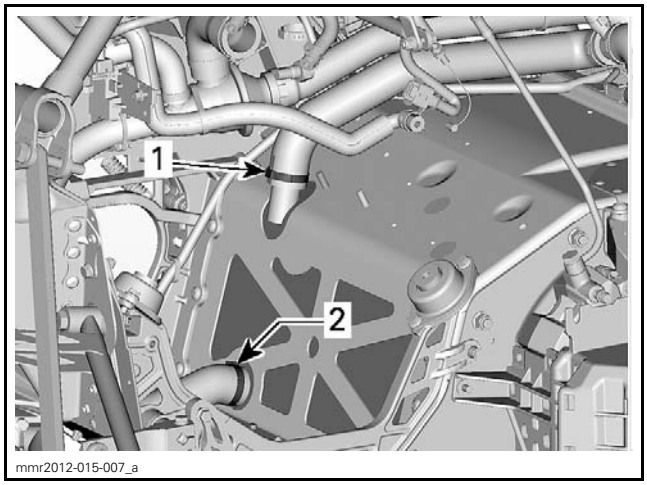
TYPICAL - SOME PARTS REMOVED FOR CLARITY
1. Upper rivets of front heat exchanger

9. Remove nuts retaining RH rear engine mount.



TYPICAL - ENGINE MOUNT SHOWN WITHOUT COUNTERSHAFT FOR CLARITY

10. Remove Oetiker clamp securing upper coolant hose.



TYPICAL
1. Upper coolant hose
2. Lower coolant hose

11. Disconnect upper coolant hose from heat exchanger.
12. Carefully pull out on bottom of heat exchanger to expose Oetiker clamp on lower coolant hose.
13. Remove Oetiker clamp securing lower coolant hose.
14. Disconnect lower coolant hose from heat exchanger.
15. Remove heat exchanger.

Front Heat Exchanger Installation

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

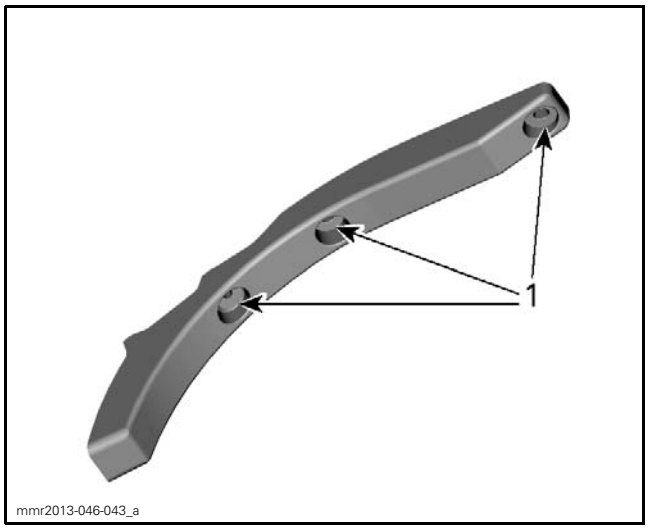
Install heat exchanger protector as follows to avoid removing track:

Lift and secure rear of vehicle.

Use 3 washers (P/N 517 124 300).

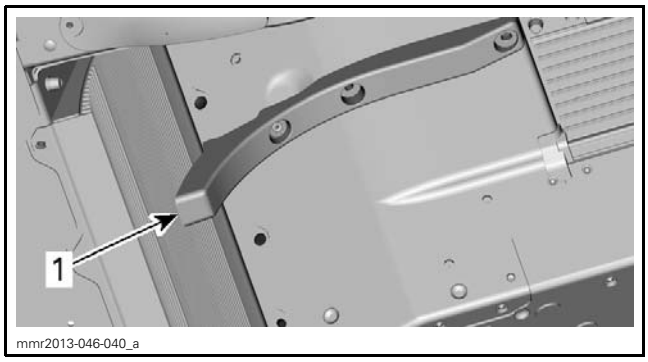
Glue washers in protector bores using LOCTITE 380 (BLACK MAX) (P/N 413 408 300).

NOTE: Only apply a slight quantity of glue between washers and protector.



1. Glue washers here

From underneath frame, position protector.



1. Heat exchanger protector (in front of track)

Apply pressure on protector to ensure that it makes contact with frame.

From engine compartment, secure protector with rivets.

NOTE: Ensure to insert rivet ends in washers.

Replace the HUCK rivets with the following parts.

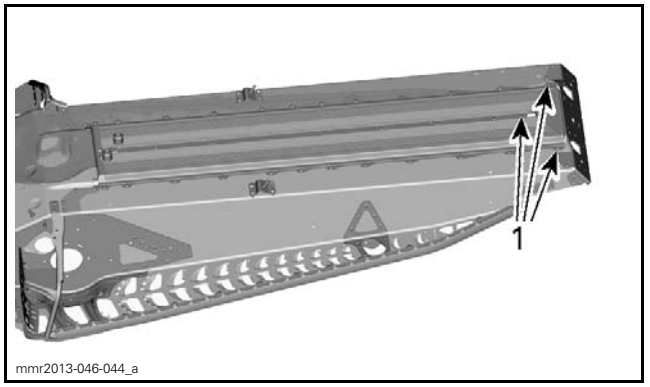
NEW FASTENERS	
Hexagonal flanged bolt M6 x 20	(P/N 207 662 044)
Hexagonal flanged elastic stop nut M6	(P/N 233 261 414)
TORQUE	
10 N•m (89 lbf•**in**)	

NOTE: Install bolt head towards outside of vehicle.

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

Rear Heat Exchanger Removal

1. Drain cooling system, Refer to *COOLING SYSTEM DRAINING* in *PERIODIC MAINTENANCE PROCEDURES* subsection.
2. Remove rear suspension. Refer to the *REAR SUSPENSION* subsection.
3. Remove fuel tank. Refer to *FUEL TANK AND FUEL PUMP* subsection.
4. Remove luggage rack if necessary.
5. Remove snow guard.
6. Remove all rivet rows retaining rear heat exchanger to frame.



1. Remove all rivet rows

NOTE: When pushing the rivets out, support the frame around the rivet with a socket on the opposite side to avoid frame warping.

7. Unplug coolant hoses from rear heat exchanger then remove it from vehicle.

Rear Heat Exchanger Installation

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

NOTE: If traction enhancing products (studs) are used on vehicle, install the appropriate heat exchanger protector. Refer to *TRACK* subsection to choose the proper protectors kit.

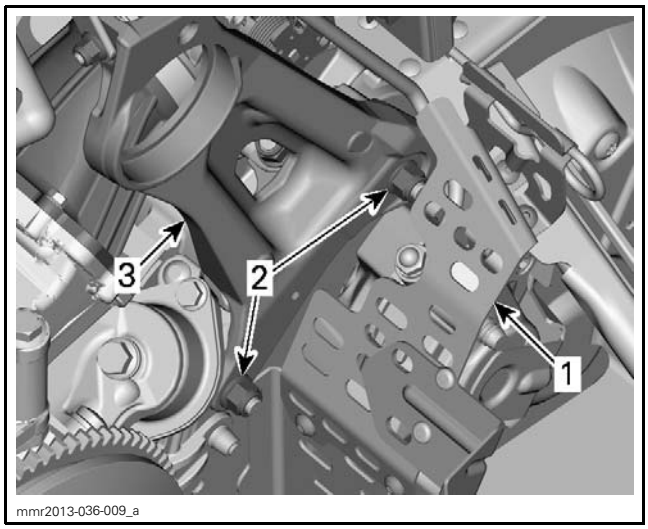
Properly refill cooling system. Refer to *COOLING SYSTEM REFILL AND BLEEDING* in *PERIODIC MAINTENANCE PROCEDURES* subsection.

COUNTERSHAFT BEARING SUPPORT

Countershaft Bearing Support Removal

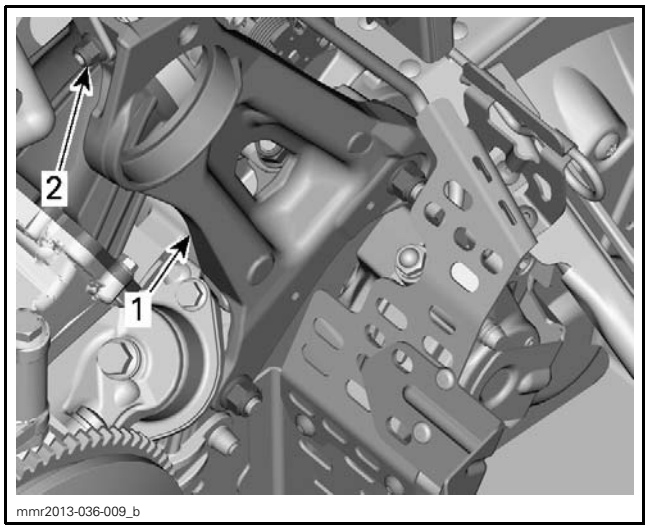
1. Remove *DRIVEN PULLEY*, see procedure in this section.
2. Remove drive belt guard bracket.

3. Remove nuts securing the bottom of countershaft bearing support.



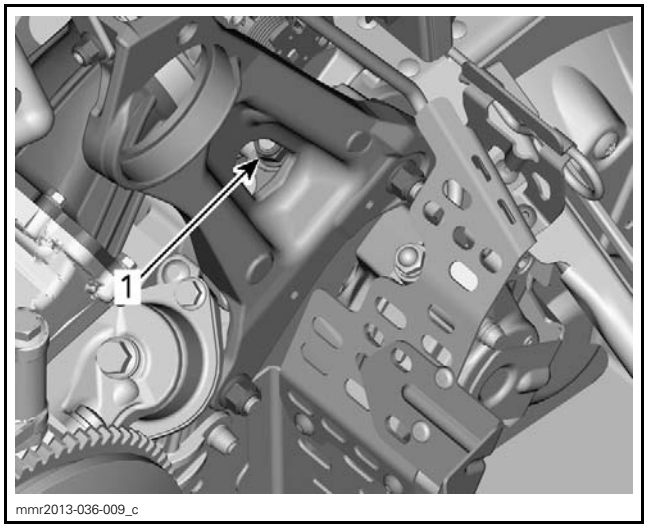
TYPICAL
1. *Drive belt guard bracket*
2. *Nuts to remove*
3. *Countershaft bearing support*

4. Remove bolt retaining top of countershaft bearing support.



1. *Countershaft bearing support*
2. *Upper bolt*

5. Remove primary air intake silencer.
6. Loosen lower nut located behind support.



1. *Loosen this nut*

7. Remove the countershaft bearing support.

Countershaft Bearing Support Installation

1. Position the countershaft bearing support in vehicle.
2. Install all bolts and nuts loosely.
3. Torque all fasteners in the order specified.

TIGHTENING TORQUE	
1) Lower bearing support (2 outer nuts)	34 N•m (25 lbf•ft)
2) Lower bearing support (inner nut)	
3) Upper bearing support nut and bolt	14 N•m (124 lbf•**in**)

4. Install drive belt guard bracket.

TIGHTENING TORQUE	
Drive belt guard bracket	3.3 N•m (29 lbf•**in**)

5. Install the driven pulley with the countershaft then all other removed parts.

600 HO E-TEC MODELS

ENGINE			
Engine type			Rotax 593 E-TEC
Number of cylinder			2
Bore			72 mm (2.835 in)
Stroke			73 mm (2.874 in)
Displacement			594.4 cm^3 (36.27 in^3)
Compression ratio			12.25 ± 0.50
Combustion chamber volume			2642 cc + 1.23/-1.12
Maximum power engine speed			8100 ± 100 RPM
3D RAVE spring	Compression spring	Color	Red
		Wire diameter	0.8 mm (.031 in)
		Minimum free length	45 mm (1.772 in)
	Valve springs	Color	Red
		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 0.55 mm (.016 in to .022 in)
		Wear limit	1 mm (.039 in)
Ring/piston groove clearance		New	0.05 mm to 0.1 mm (.002 in to .0039 in)
		Wear limit	0.2 mm (.0079 in)
Piston/cylinder wall clearance		New	0.130 mm ± 0.022 mm (.0051 in ± .0009 in)
		Wear limit	0.2 mm (.0079 in)
Piston projection			0.9 mm - 1.1 mm (.035 in - .043 in)
Piston skirt wear		Wear limit	0.15 mm (.006 in)
Cylinder head warpage		Wear limit	0.5 mm (.0197 in)
Cylinder taper		New (max.)	0.05 mm (.002 in)
		Wear limit	0.1 mm (.0039 in)
Cylinder out of round		New (max.)	0.012 mm (.0005 in)
		Wear limit	0.08 mm (.0031 in)
Crankshaft end play		New	MIN.: 0.10 mm (.0039 in) MAX.: 0.30 mm (.0118 in)
Crankshaft deflection		Max.	MAG: 0.06 mm (.0024 in) CENTER: 0.08 mm (.0031 in) PTO: 0.06 mm (.0024 in)
Connecting rod big end axial play		New	0.28 mm to 0.68 mm (.011 in to .0268 in)
		Wear limit	1.2 mm (.0472 in)

COOLING SYSTEM			
Coolant	Type		Ethyl glycol and distilled water (50%/50%). Use BRP premix coolant (P/N 219 700 362) or coolant specifically formulated for aluminum engines
	Quantity	MX Z X	5.42 L (183.3 U.S. oz)
		Renegade X Renegade Backcountry X	5.77 L (195.1 U.S. oz)
Thermostat opening temperature			37°C (99°F)
Cap opening pressure			110 kPa (16 PSI)
LUBRICATION SYSTEM			
Oil injection pump type			Electronic oil injection pump
Injection oil	Type		XPS synthetic blend 2-stroke oil (P/N 293 600 100)
	Quantity		3.7 L (125.1 U.S. oz)
FUEL SYSTEM			
Fuel delivery			E-TEC direct injection
Throttle body			Dell'Orto 46 mm
Fuel pump			In-tank electrical fuel pump
Idle speed (not adjustable)			1200 ± 200 RPM
Fuel	Type		Premium unleaded gasoline (fuel which may contain up to 10% MAX ethanol)
	Octane rating	Inside North America	91 (R+M)/2)
		Outside North America	95 (RON)
Fuel tank capacity			40 L (10.6 U.S. gal.)
ELECTRICAL SYSTEM			
Lighting system output			1340 W @ 6000 RPM
Ignition type			Inductive
Spark plug	Make and type		NGK PZFR6F
	Gap		Not adjustable 0.75 mm ± 0.05 mm (.03 in ± .002 in)
Ignition timing BTDC @ 3500 RPM			28°
			5.39 mm (.212 in)
Crankshaft position sensor (CPS)			190 to 290 Ω
Stator			0.63 ± 0.03 Ω
Battery			12 V, 18 A•h

ELECTRICAL SYSTEM (cont'd)			
Headlamp			2 x 60/55 W (H4)
Taillight and stoplight			2.6 W / 139mW LED
Fuses	RER		5 A
	Fuel level sensor		0.25 A
	Main		25 A
DRIVE SYSTEM			
Chaincase oil	Type		XPS synthetic chaincase oil (P/N 413 803 300)
	Quantity		350 ml (12 U.S. oz)
Chain drive ratio		MX Z X	25/45
		Renegade X	23/45
		Renegade Backcountry X	21/49
Chain	Pitch		9.530 mm (.375 in)
	Type/links qty/ plate qty	Renegade Backcountry X	Silent 106/13
		MX Z X Renegade X	Silent 104/13
Drive pulley type			TRA III
Drive pulley calibration	Clutch engagement		3400 ± 100 RPM
	Spring color		Blue/Green
	Spring length	Blue/Green	105.7 mm (4.161 in)
	Pin		Solid
	Ramp		412
	Screw position		3
Driven pulley type	Type		QRS
	Spring color		Green
	Spring preload		0
	Cam angle		48°
Pulley distance	Z		Not adjustable 20.9 mm (.823 in)
Pulley distance	X		Not adjustable 36.40 mm ± 1.80 mm (1.433 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		38.5 mm (1.516 in)
	Wear limit		36.1 mm (1.421 in)

DRIVE SYSTEM (cont'd)			
Track	Width	Renegade Backcountry X	406.4 mm (16 in)
		MX Z X Renegade X	381 mm (15 in)
	Length	MX Z X	3 051 mm (120 in)
		Renegade X Renegade Backcountry X	3 486 mm (137 in)
	Profile height	MX Z X Renegade X	31.8 mm (1-1/4 in)
		Renegade Backcountry X	44.5 mm (1-3/4 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			REV-XP
Suspension maximum travel		MX Z X Renegade X	229 mm (9 in)
		Renegade Backcountry X	210 mm (8.3 in)
Shock absorber type			HPG Plus R
Stabilizer bar type			Link
REAR			
Suspension type			rMotion
Suspension maximum travel		Renegade X Renegade Backcountry X	406 mm (16 in)
		MX Z X	394 mm (15.5 in)
Shock absorber type	Center		HPG Plus
Shock absorber type	Rear		KYB PRO 36 EA
Stroke limiter standard position		Renegade X Renegade Backcountry X	3
		MX Z X	2
STEERING SYSTEM			
Ski type		MX Z X Renegade X	Pilot 5.7
		Renegade Backcountry X	Pilot DS
Toe-out			5 mm (.197 in)
Camber			0°

WEIGHT AND DIMENSIONS		
Mass (dry)	MX Z X	210 kg (462 lb)
	Renegade X	215 kg (474 lb)
	Renegade Backcountry X	217 kg (478 lb)
Length	MX Z X	290.5 cm (114.4 in)
	Renegade X Renegade Backountry X (CA/US)	311 cm (122.4 in)
	Renegade Backcountry X (EUR)	317.7 cm (125.1 in)
Width	Renegade Backcountry X	120.4 cm (47.4 in)
	MX Z X Renegade X	121.7 cm (47.9 in)
Height	MX Z X Renegade X	121 cm (47.6 in)
	Renegade Backcountry X	124.5 cm (49 in)
Ski stance (carbide to carbide)	Renegade Backcountry X	101.9 cm (40.1 in)
	MX Z X Renegade X	107.7 cm (42.4 in)
MATERIAL		
Frame		Aluminum
Side bottom pan, front hull cover, gauge support, gauge support cover, side panel XM, bottom side panel XS, center hood, and front console		Polypropylene
Lateral hood, rear console, and XS top side panel		Polypropylene and/or Surlyn

800R E-TEC MODELS

ENGINE			
Engine type			Rotax 797 E-TEC
Number of cylinder			2
Bore			82 mm (3.228 in)
Stroke			75.7 mm (2.98 in)
Displacement			799.5 cm^3 (48.79 in^3)
Compression ratio			12.30 ± 0.3
Combustion chamber volume			35.39 cc ± 0.93
Maximum power engine speed			7900 ± 100 RPM
3D RAVE spring	Compression spring	Color	Red
		Wire diameter	0.8 mm (.031 in)
		Minimum free length	45 mm (1.772 in)
	Valve springs	Color	Red
		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)
		Wear limit	1 mm (.039 in)
Ring/piston groove clearance		New	0.06 mm to 0.1 mm (.0024 in to .0039 in)
		Wear limit	0.2 mm (.0079 in)
Piston/cylinder wall clearance		New	0.148 mm ± 0.013 mm (.0058 in ± .0005 in)
		Wear limit	0.2 mm (.0079 in)
Piston projection			1.82 mm - 1.92 mm (.072 in - .076 in)
ENGINE (cont'd)			
Piston skirt wear		Wear limit	0.15 mm (.006 in)
Cylinder head warpage		Wear limit	0.5 mm (.0197 in)
Cylinder taper		New (max.)	0.05 mm (.002 in)
		Wear limit	0.1 mm (.0039 in)
Cylinder out of round		New (max.)	0.010 mm (.0004 in)
		Wear limit	0.08 mm (.0031 in)
Crankshaft end play		New	MIN.: 0.10 mm (.0039 in) MAX.: 0.30 mm (.0118 in)
Crankshaft deflection		Max.	MAG: 0.05 mm (.002 in) CENTER: 0.04 mm (.0016 in) PTO: 0.06 mm (.0024 in)
Connecting rod big end axial play		New	0.23 mm to 0.617 mm (.0091 in to .0243 in)
		Wear limit	1.2 mm (.0472 in)

COOLING SYSTEM			
Coolant	Type		Ethyl glycol and distilled water (50%/50%). Use BRP premix coolant (P/N 219 700 362) or coolant specifically formulated for aluminum engines
	Quantity	MX Z TNT MX Z X	6.12 L (206.9 U.S. oz)
		Renegade X Renegade Backcountry X	6.47 L (218.8 U.S. oz)
		Summit SP 146"	5.74 L (194.1 U.S. oz)
		Summit X 146"	5.77 L (195.1 U.S. oz)
		Summit SP 154" Summit X 154"	6 L (202.9 U.S. oz)
		Summit SP 163" Summit X 163"	6.06 L (204.9 U.S. oz)
Thermostat opening temperature			37°C (99°F)
Radiator cap opening pressure			90 kPa (13 PSI)
LUBRICATION SYSTEM			
Oil injection pump type			Electronic oil injection pump
Injection oil	Type		XPS synthetic 2-stroke oil (P/N 293 600 132)
	Quantity		3.7 L (125.1 U.S. oz)
FUEL SYSTEM			
Fuel delivery			E-TEC direct injection
Throttle body			Dell'Orto 52 mm
Fuel pump			In-tank electrical fuel pump
Idle speed (not adjustable)			1200 ± 200 RPM
Fuel	Type		Premium unleaded gasoline (fuel which may contain up to 10% MAX ethanol
	Octane rating	Inside North America	91 (R+M)/2)
		Outside North America	95 (RON)
Fuel tank capacity			40 L (10.6 U.S. gal.)

ELECTRICAL SYSTEM			
Lighting system output			1340 W @ 6000 RPM
Ignition type			Inductive
Spark plug	Make and type		NGK PFR7AB (engine and spark plug threads are indexed)
	Gap		Not adjustable 0.75 mm ± 0.05 mm (.03 in ± .002 in)
Ignition timing BTDC @ 3500 RPM			28°
			5.63 mm (.222 in)
Crankshaft position sensor (CPS)			190 to 290 Ω
Stator			0.63 ± 0.03 Ω
Battery			12 V, 18 A•h
Headlamp			2 x 60/55 W (H4)
Taillight and stoplight			2.6 W / 139mW LED
Fuses	RER		5 A
	Fuel level sensor		0.25 A
	Main		25 A
DRIVE SYSTEM			
Chaincase oil	Type		XPS synthetic chaincase oil (P/N 413 803 300)
	Quantity		350 ml (12 U.S. oz)
Chain drive ratio		MX Z TNT MX Z X (CA/US)	27/45
		MX Z X (EUR) Renegade X	25/45
		Renegade Backcountry X	23/45
		Summit SP 154" Summit X 154" (CA/US)	19/49
		Summit SP 146" Summit X 146" Summit X 154" (EUR)	21/49
		Summit SP 163" Summit X 163"	19/51

DRIVE SYSTEM (cont'd)			
Chain	Pitch		9.530 mm (.375 in)
	Type		Silent
	Links qty/ plate qty	MX Z TNT MX Z X (CA/US) Summit SP 146" Summit SP 163" Summit X 146" Summit X 154" (EUR) Summit X 163"	106/13
		MX Z X (EUR) Renegade X Renegade Backcountry X Summit SP 154" Summit X 154" (CA/US)	104/13
Drive pulley type			TRA VII
Drive pulley calibration	Clutch engagement		3800 ± 100 RPM
	Spring color	Summit X 146" (EUR) Summit X 154" (EUR) Summit X 163" (EUR)	Yellow/Green
		MX Z TNT MX Z X Renegade X	Blue/Green
		Renegade Backcountry X	Purple/Blue
		Summit SP Summit X 146" (CA/US) Summit X 154" (CA/US) Summit X 163" (CA/US)	Purple/Pink
	Spring length	Yellow/Green	94.61 mm (3.725 in)
		Blue/Green	105.7 mm (4.161 in)
		Purple/Blue	114.6 mm (4.512 in)
		Purple/Pink	101.8 mm (4.008 in)
	Pin	Summit SP Summit X (CA/US)	Hollow threaded
		MX Z TNT MX Z X Renegade X Renegade Backcountry X Summit X (EUR)	Solid long
	Ramp	Renegade Backcountry X Summit X (EUR)	413
		Summit SP Summit X (CA/US)	441
		MX Z TNT MX Z X Renegade X	414

DRIVE SYSTEM (cont'd)			
Drive pulley calibration	Screw position	Summit SP Summit X (CA/US)	1
		Summit X (EUR)	2
		MX Z TNT MX Z X Renegade X Renegade Backcountry X	3
Driven pulley type	Type		QRS
	Spring color	Summit	Blue
		MX Z TNT MX Z X Renegade X Renegade Backcountry X	Green
	Spring preload		0
	Cam angle	MX Z TNT MX Z X	47°/44°
		Renegade X Renegade Backcountry X	44°/42°
		Summit	40°
Pulley distance	Z		Not adjustable 20.9 mm (.823 in)
	X	Summit	Not adjustable 39.4 mm ± 1.8 mm (1.551 in ± .071 in)
		All others	Not adjustable 36.4 mm ± 1.8 mm (1.433 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 SYSTEM (cont'd)			
Track	Width	MX Z TNT MX Z X	381 mm (15 in)
		Renegade X Renegade Backcountry X Summit	406.4 mm (16 in)
	Length	Renegade X Renegade Backcountry X	3 486 mm (137 in)
		MX Z TNT MX Z X	3 051 mm (120 in)
		Summit 146"	3.7 m (146 in)
		Summit 154"	3.9 m (154 in)
		Summit 163"	4.14 m (163 in)
	Profile height	MX Z Renegade X	31.8 mm (1-1/4 in)
		Renegade Backcountry X	44.5 mm (1-3/4 in)
		Summit	63.5 mm (2.5 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		REV-XP
	MX Z Renegade X Summit	229 mm (9 in)
	Renegade Backcountry X	210 mm (8.3 in)
Shock absorber type	Summit SP	HPG
	MX Z TNT Summit X	HPG Plus
	MX Z X Renegade	HPG Plus R
Stabilizer bar type		Link
REAR		
Suspension type	MX Z Renegade	rMotion
	Summit	tMotion
Suspension maximum travel	Summit 146"	356 mm (14 in)
	MX Z TNT Summit 154"	381 mm (15 in)
	MX Z X	394 mm (15.5 in)
	Renegade Summit 163"	406 mm (16 in)

SUSPENSION (cont'd)			
Shock absorber type	Center	Summit SP	HPG
		MX Z Renegade Summit X	HPG Plus
	Rear	Summit SP	HPG
		MX Z TNT Summit X	HPG Plus
		MX Z X Renegade	KYB PRO 36 EA
Stroke limiter standard position		MX Z X	2
		MX Z TNT Renegade Summit X (CA/US) Summit XP	3
		Summit X (EUR)	4
STEERING SYSTEM			
Ski type		MX Z Renegade X	Pilot 5.7
		Renegade Backcountry X	Pilot DS
		Summit	Pilot DS 2
Toe-out			5 mm (.197 in)
Camber			0°

WEIGHT AND DIMENSIONS		
Mass (dry)	MX Z TNT	212 kg (468 lb)
	MX Z X	215 kg (474 lb)
	Renegade X	219 kg (483 lb)
	Renegade Backcountry X (CA/US)	222 kg (489 lb)
	Renegade Backcountry X (EUR)	231 kg (509 lb)
	Summit SP 163"	213 kg (469 lb)
	Summit X 146"	206 kg (454 lb)
	Summit X 154" Summit XP 146"	209 kg (461 lb)
	Summit X 163" Summit XP 154"	215 kg (472 lb)
Length	MX Z	290.5 cm (114.4 in)
	Summit 146"	322.6 cm (127 in)
	Summit 154"	333.5 cm (131.3 in)
	Renegade X Renegade Backcountry X (CA/US)	311 cm (122.4 in)
	Renegade Backcountry X (EUR)	317 cm (125 in)
	Summit 163"	344.5 cm (135.6 in)
Width	Renegade Backcountry X	120.4 cm (47.4 in)
	Summit	112.6 cm (44.3 in)
	MX Z Renegade X	121.7 cm (47.9 in)
Height	MX Z Renegade X	121 cm (47.6 in)
	Renegade Backcountry X	124.5 cm (49 in)
	Summit	134.6 cm (53 in)
Ski stance (carbide to carbide)	Renegade Backcountry X	101.9 cm (40.1 in)
	Summit	90.7 cm - 95 cm (35.7 in - 37.4 in)
	MX Z Renegade X	107.7 cm (42.4 in)
MATERIAL		
Frame		Aluminum
Side bottom pan, front hull cover, gauge support, gauge support cover, side panel XM, bottom side panel XS, center hood, and front console		Polypropylene
Lateral hood, rear console, and XS top side panel		Polypropylene and/or Surlyn

WIRING DIAGRAM INFORMATION

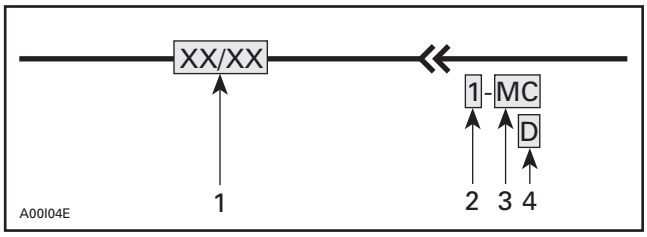
GENERAL

WIRING DIAGRAM LOCATION

Wiring diagrams are found in the *WIRING DIAGRAM BOOKLET*.

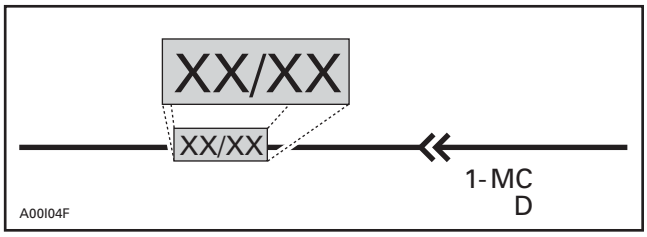
WIRING DIAGRAM CODES

The wiring diagrams use the following codes.



1. *Wire colors*
2. *Connector location*
3. *Connector code*
4. *Terminal position in connector*

Wire Colors



The first color of a wire is the main color, second color is the stripe.

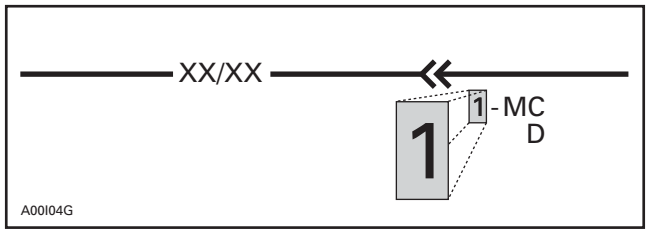
Example: YE/BK is a YELLOW wire with a BLACK stripe.

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

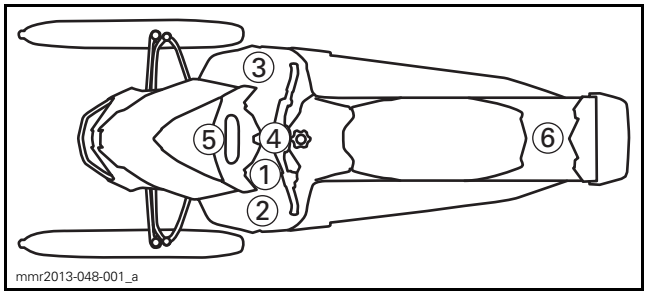
LT prefix means a "light" color. E.g: LT GN = Light green

Connector Location

The first digit of the connector identification number presents the location of the connector on the vehicle. It may also describe the part removal that is required to reach the connector.



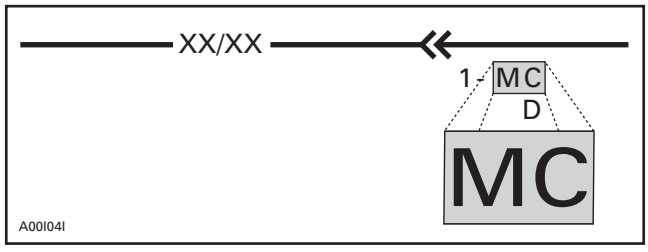
The location of the connectors are indicated on the wiring diagram with a vehicle schematic as illustrated below.



VEHICLE SCHEMATIC FOR CONNECTOR LOCATION (SEE WIRING DIAGRAM)

Connector Code

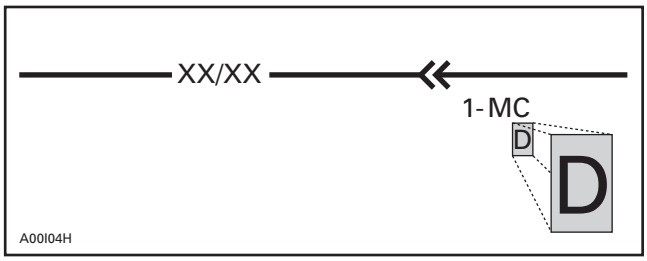
The letters (up to 8 letters) in the second part of a connector identification number represents the connector reference to a system or component. If there are many connectors in the same area, this helps to identify which wire is in which connector.



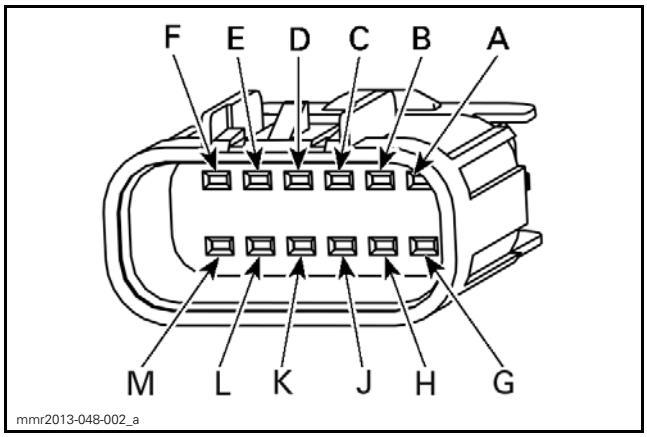
Terminal Position in Connector

The third portion of the connector identification number represents the location of the terminal in the connector. This could be identified by either a number or by a letter depending on the type of connector used.

NOTE: The terminal position identifier may also be the right most portion of the description.



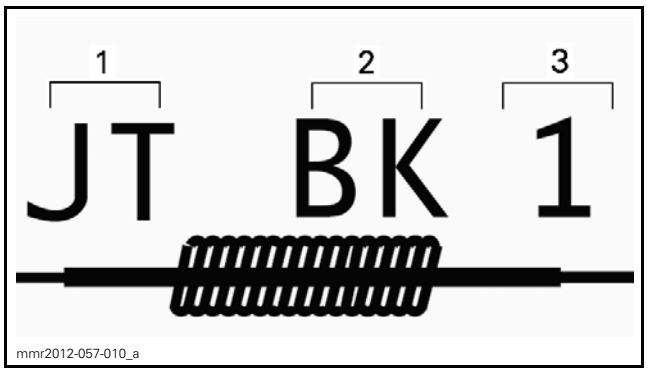
NOTE: On the 12-pin steering harness connector (SH), the letter "i" is skipped in the terminal lettering. See illustration.



NOTICE THE MISSING "I" LETTER

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*

CONNECTOR INFORMATION

SERVICE TOOLS

SERVICE TOOLS – OTHER SUPPLIER

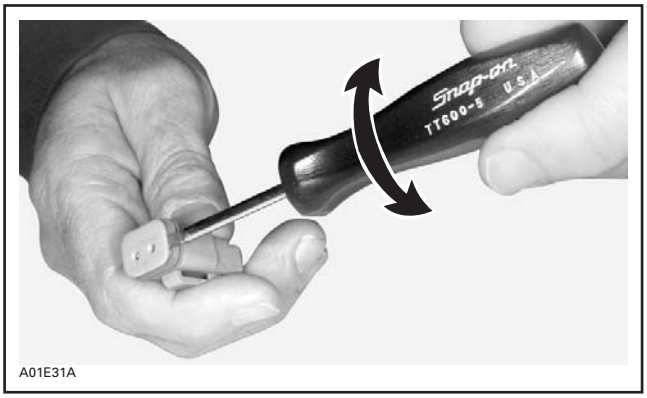
GENERAL

DEUTSCH CONNECTOR

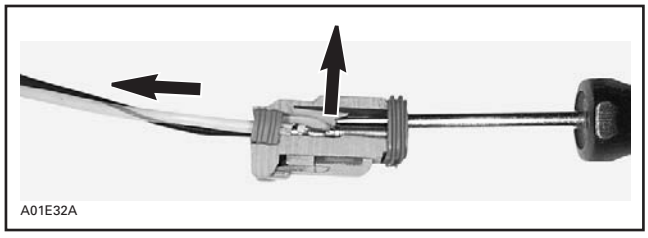
Connector Disassembly

Male Housing

Insert SNAP-ON SCREWDRIVER (P/N TT600-5) under lock and twist to lift it.



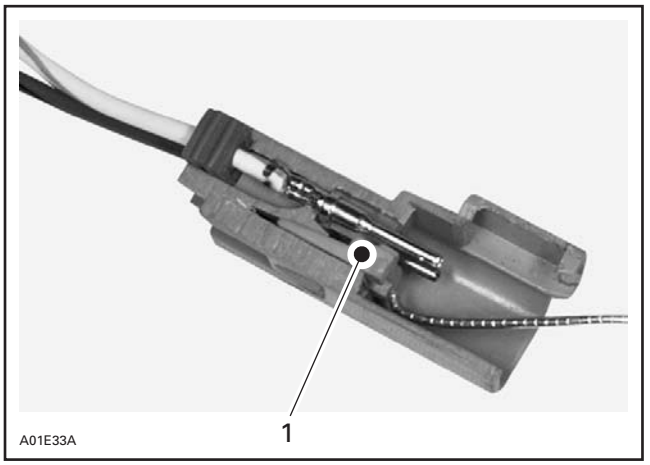
Pry tab to free connector then pull wire out of housing.



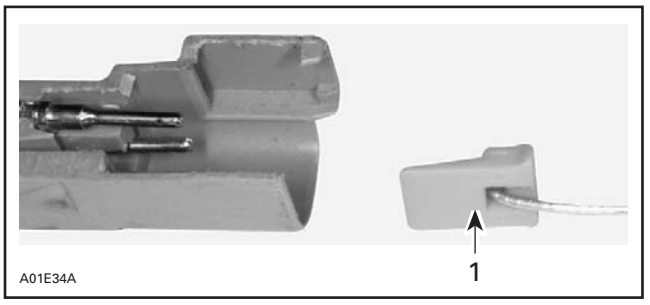
FEMALE CONNECTOR HOUSING — CUT-AWAY

Female Housing

Using a small hook, pull out the lock.

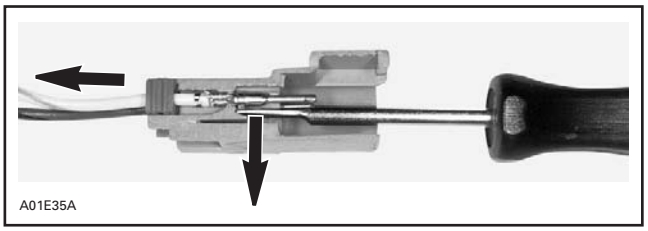


1. Lock



1. Lock

Pry tab to free connector then pull wire out of housing.



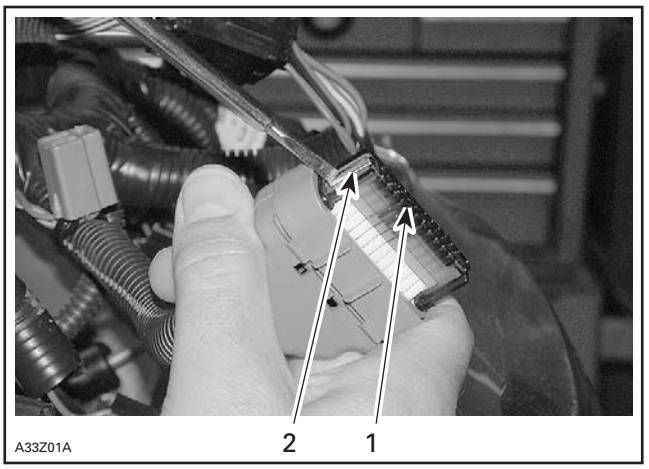
FEMALE HOUSING — CUT-AWAY

PACKARD CONNECTOR

Connector Disassembly

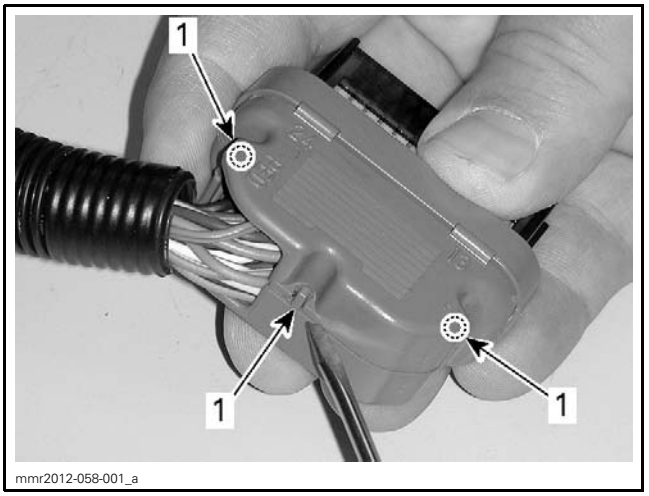
Multifunction Gauge

Push on both tabs to remove retainer.



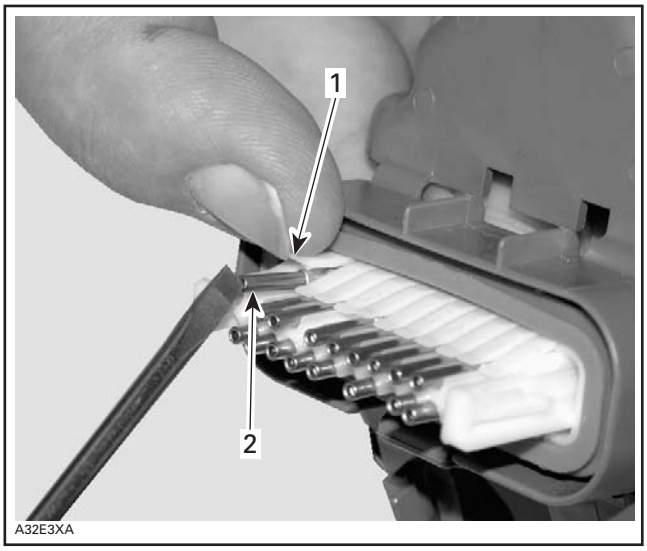
TYPICAL
1. *Retainer*
2. *Tab (one on each side)*

Open connector housing by lifting 3 retaining tabs.



TYPICAL
1. *Tabs (2 are hidden from view)*

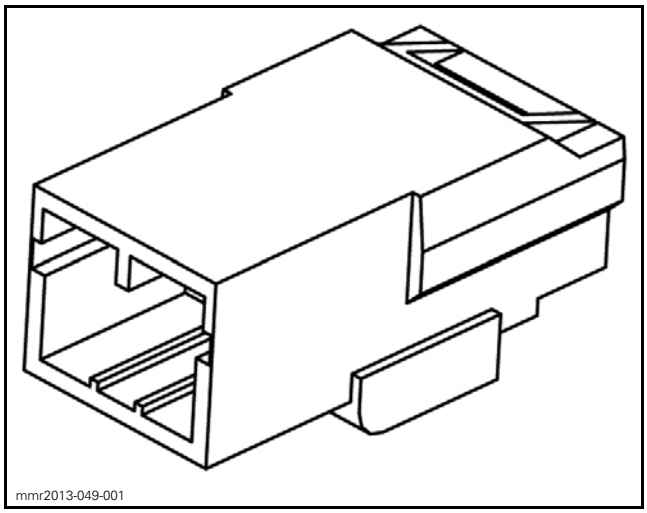
Lift the top plastic lock of the female terminal to be removed and hold in position. Lift the female terminal to unlock from the housing and push out of housing.



1. *Lift and hold plastic lock*
2. *Lift to unlock and push out*

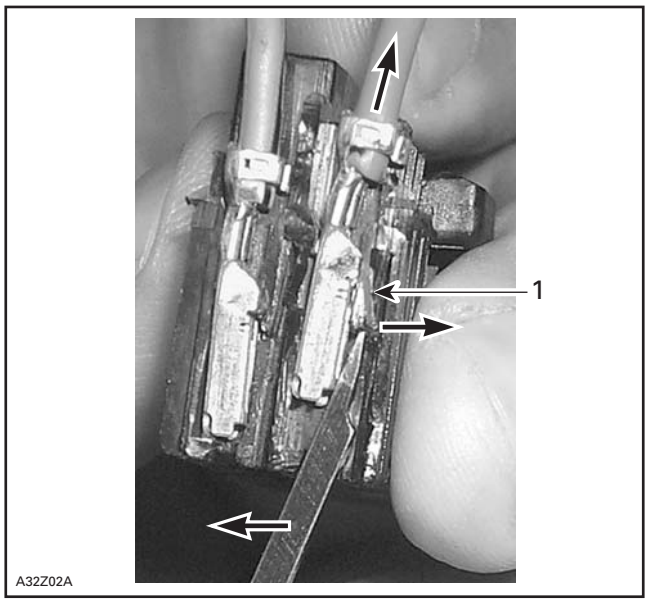
AMP MULTILOCK CONNECTOR (e.g: DESS (DS))

Connector Disassembly



Male Housing

Insert AMP EXTRACTION TERMINAL TOOL (P/N 755430-2) under lock and twist to lift it.

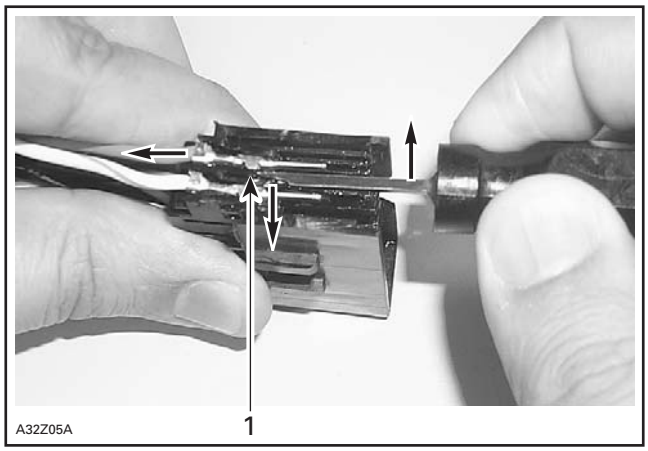


TYPICAL MALE HOUSING — CUT-AWAY
1. Lock

Female terminals can be removed from housing with sharp head pin.

Female Housing

Insert AMP EXTRACTION TERMINAL TOOL (P/N 755430-2) under lock and twist to lift it.



TYPICAL FEMALE HOUSING — CUT-AWAY
1. Lock

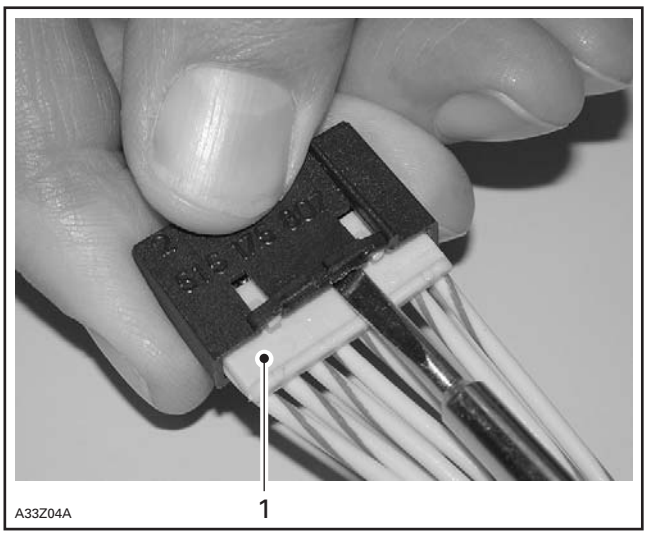
Terminal Crimping

Refer to *TERMINAL CRIMPING (AMP 8-CIRCUIT AND MULTILOCK)* further in this subsection.

AMP CONNECTOR (8-CIRCUIT)

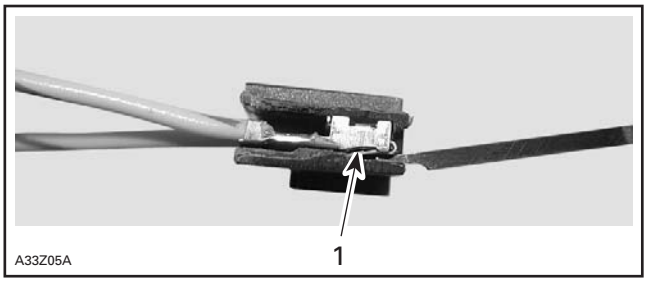
Connector Disassembly

Pry housing to release lock.



1. Lock

Insert AMP EXTRACTION TERMINAL TOOL (P/N 755430-2) under tab and pry it to free connector. Pull on the female terminal wire to remove female terminal from housing.



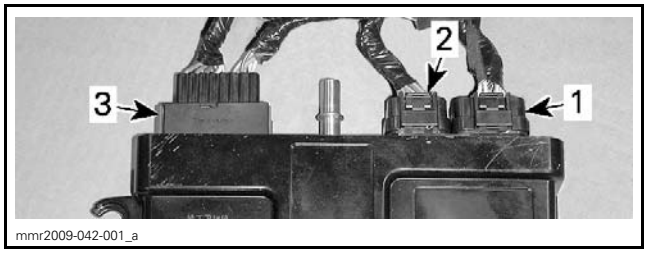
AMP 8-CIRCUIT CONNECTOR — CUT-AWAY
1. Tab

Terminal Crimping

Refer to *TERMINAL CRIMPING* further in this subsection.

AMP CONNECTOR (ALL E-TEC ECM)

Connector Identification

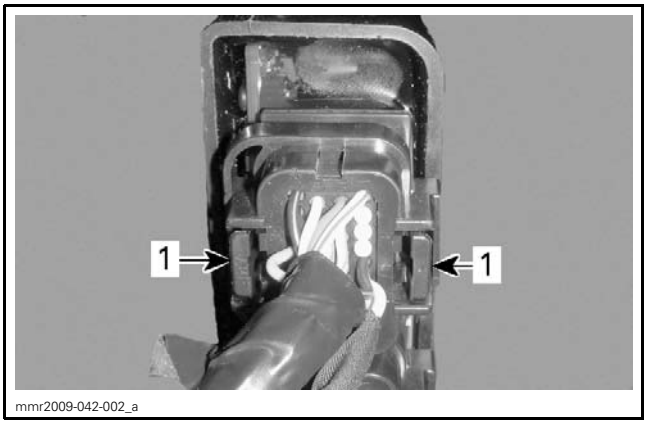


1. J1A connector
2. J1B connector
3. J2 connector

Connector Removal

J1A and J1B Connectors

Depress both latches and pull connector housing.



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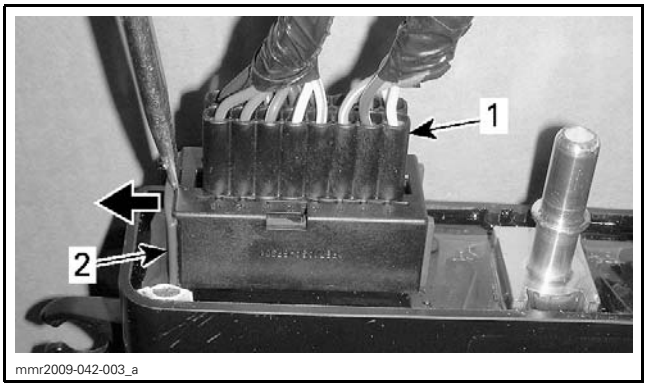
1. Latches

J2 Connector

Using a small screwdriver, open the connector lock.



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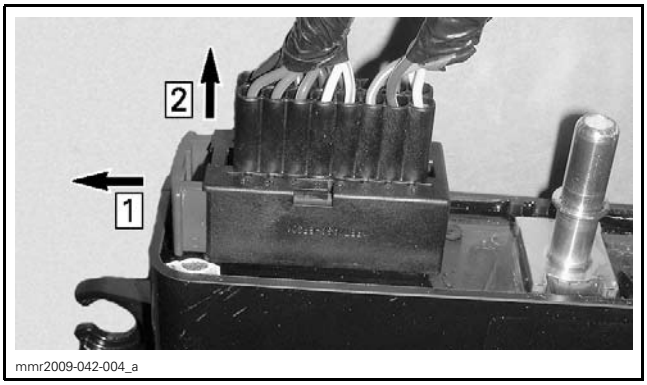
1. Connector
2. Connector lock

Pull the lock approximately 20 mm (3/4 in)to remove the connector.



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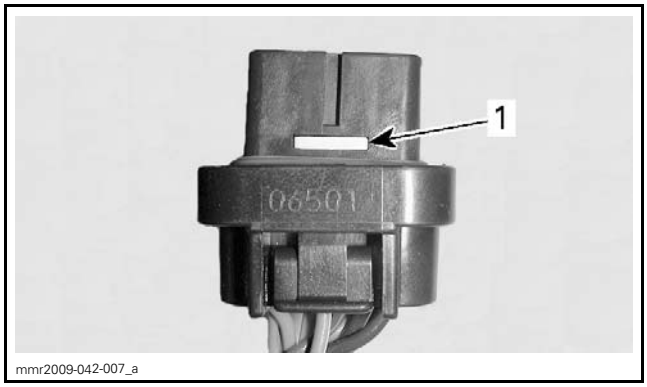
Step 1: Pull lock
Step 2: Lift the connector

Connector Disassembly

J1A and J1B Connectors

Push the lock mechanism to open it.



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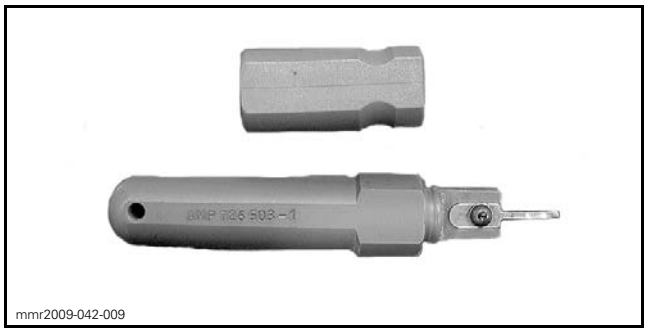
1. Lock mechanism

Pull on wire to extract terminal from connector housing.

J2 Connector

Using the AMP EXTRACTION TERMINAL TOOL (P/N 726503-1), release both locking tabs of connector. Pull terminal from housing.



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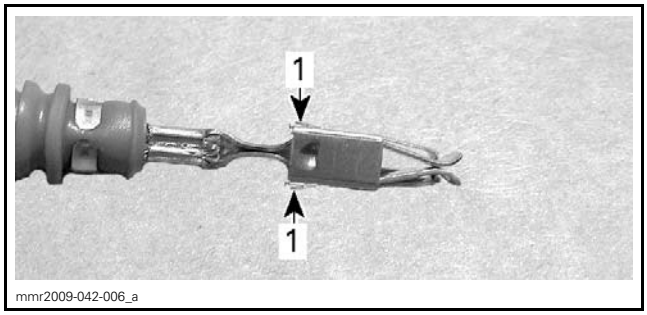
AMP EXTRACTION TERMINAL TOOL



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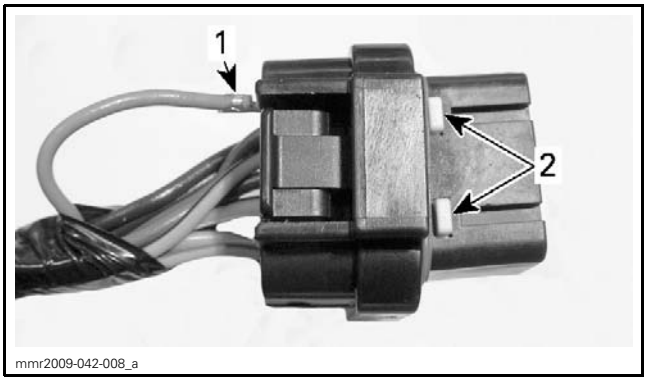
1. Locking tabs

Connector Assembly

J1A and J1B Connectors

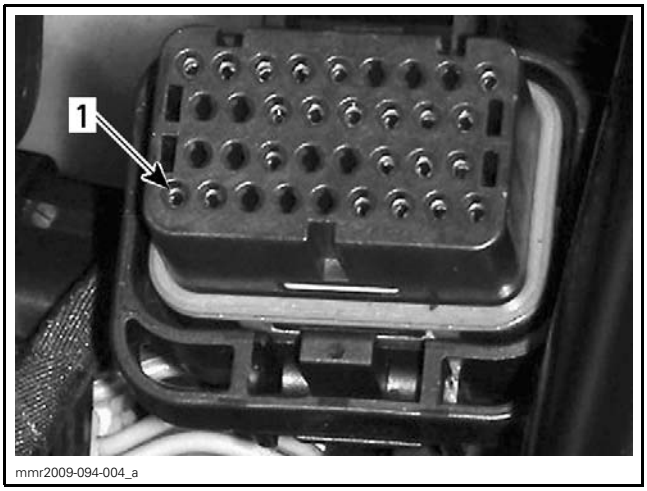
Push terminal through seal until it is seated in connector housing.

Close the lock mechanism.



1. Insert terminal into housing
2. Push here to close the lock mechanism

NOTE: If the locking mechanism does engage, it is likely due to an improperly inserted terminal. Look at the end of connector to see if a terminal is partially out. If, so push the corresponding wire fully into connector then lock mechanism.



1. Terminal fully inserted in connector

J2 Connector

Align terminal with connector housing and push terminal with seal into connector housing until seated.

Terminal Crimping

Refer to *TERMINAL CRIMPING (AMP 8-CIRCUIT AND MULTILOCK)* further in this subsection for procedure.

DELPHI CONNECTOR (GT 150) (e.g: HEADLAMP (HL), STEERING HARNESS (SH, WMS))

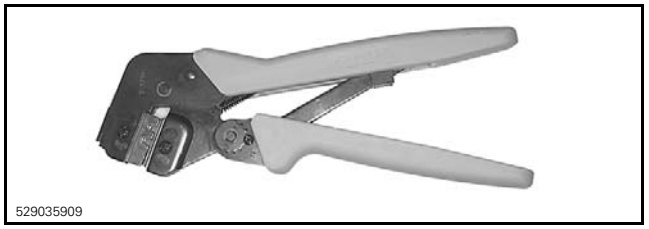
TERMINAL EXTRACTION TOOL
DELPHI METRI-PACK REMOVAL TOOL (GREEN) (P/N 12094429)

JAE CONNECTOR (MX44) (e.g: THCM)

TERMINAL EXTRACTION TOOL
JAE EXTRACTION TOOL (P/N ET-MX44-1)

TERMINAL CRIMPING (AMP 8-CIRCUIT AND MULTILOCK)

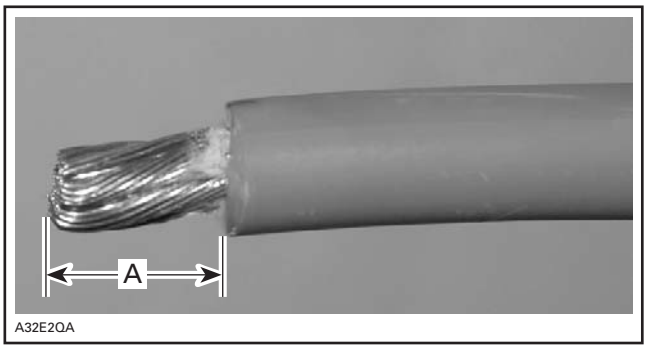
To crimp a new connector terminal, use the CRIMPING TOOL (KOSTAL) (P/N 529 035 909) and the KOSTAL DIE (P/N 529 035 906).



CRIMPING TOOL

To properly crimp the terminal on the wire, strictly follow this procedure.

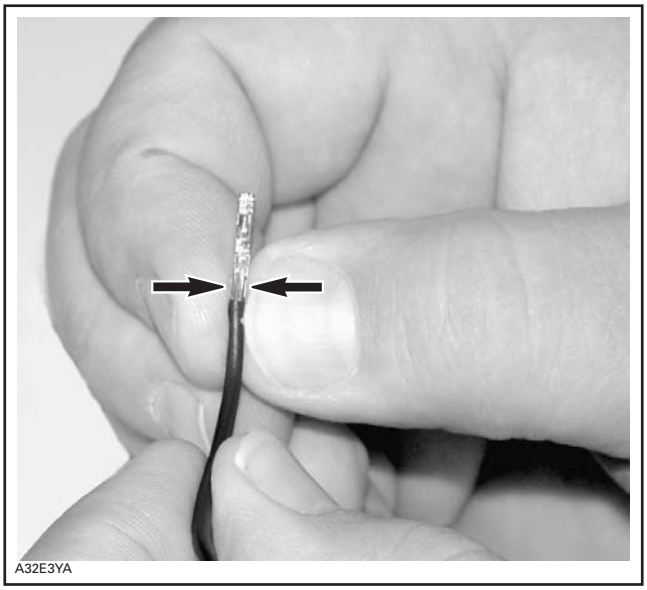
Strip the wire to a maximum of 3 mm (1/8 in).



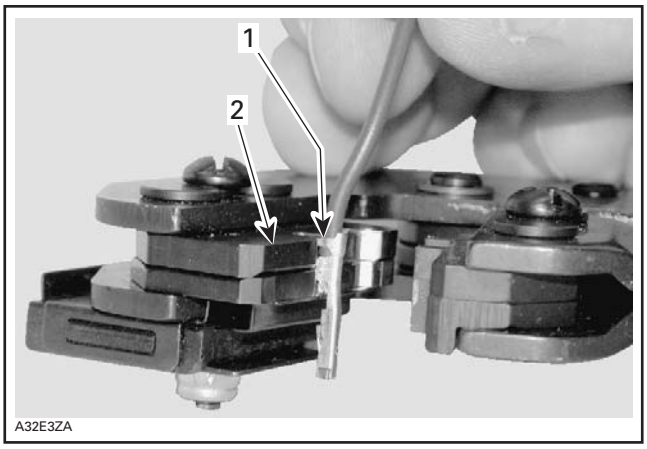
TYPICAL
A. 3 mm (1/8 in) maximum

Position wire in terminal.

Squeeze the terminal tabs with your fingers to temporarily retain terminal in place.


A32E3YA

Insert terminal with wire in crimping pliers and position it so the top of tthe erminal tabs are flush with the pliers edge, or a little bit lower as shown.



A32E3ZA

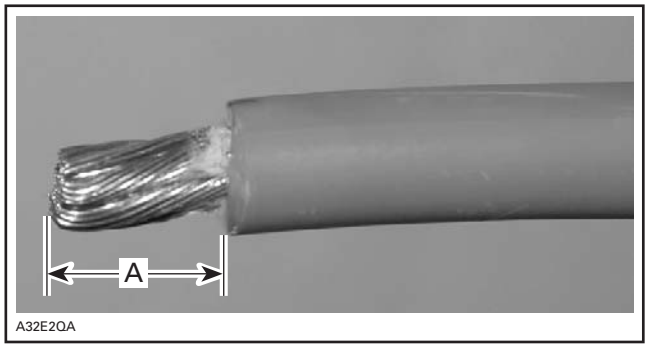
1. Top of terminal tabs
2. Align tabs with pliers edge

Crimp terminal. Ensure all wire strands are in the terminal. If not, the loose strands may cause strange problems in the electrical system.

BATTERY CABLE TERMINAL

Terminal Installation

Carefully strip the wire approximately to 10 mm (1/2 in) in length using a wire stripping tool or sharp blade/knife.

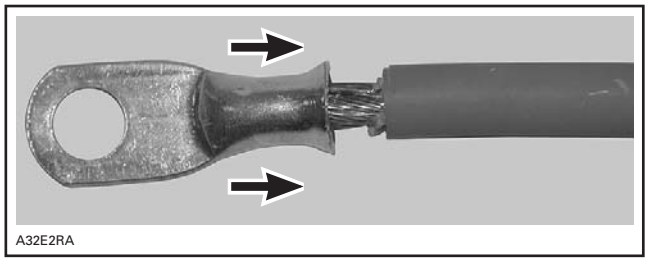


A32E2QA

A. 10 mm (1/2 in)

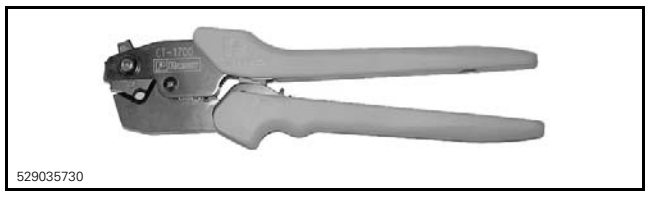
NOTE: Make sure not to cut wire strands while stripping the wire.

Install the appropriate terminal on the wire according to the requirement. Refer to appropriate *PARTS CATALOG*.

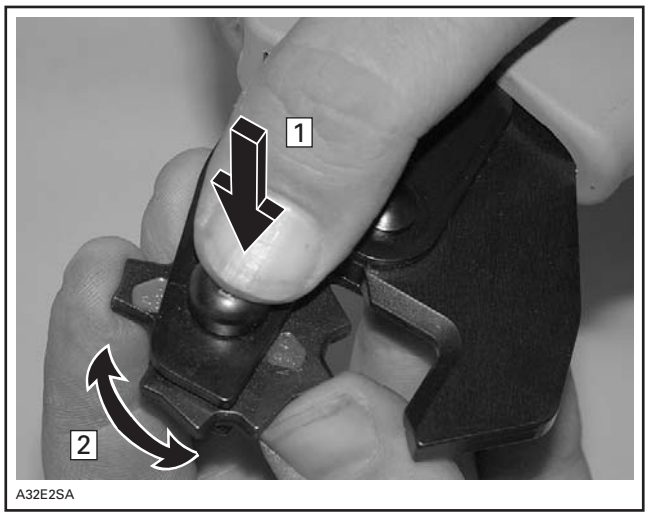

A32E2RA

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.


529035730

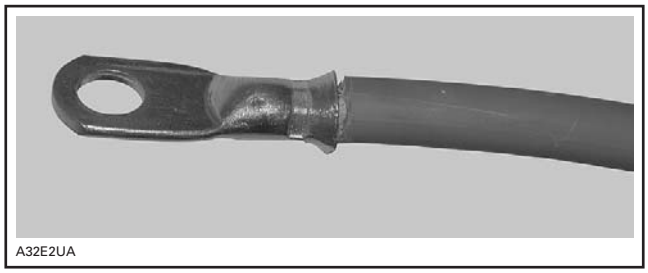
NOTE: Different wires require different crimp plier settings. Make sure to follow the instructions supplied with the tool.



POSITIONING THE CRIMP PLIERS
Step 1: Press
Step 2: Rotate

After positioning the crimp pliers, crimp the terminal already installed on wire.

CRIMPING OF WIRE



PROPERLY CRIMPED WIRE

To verify if the wire is properly crimped, simultaneously pull on the wire and on the terminal in opposite directions using moderate force.

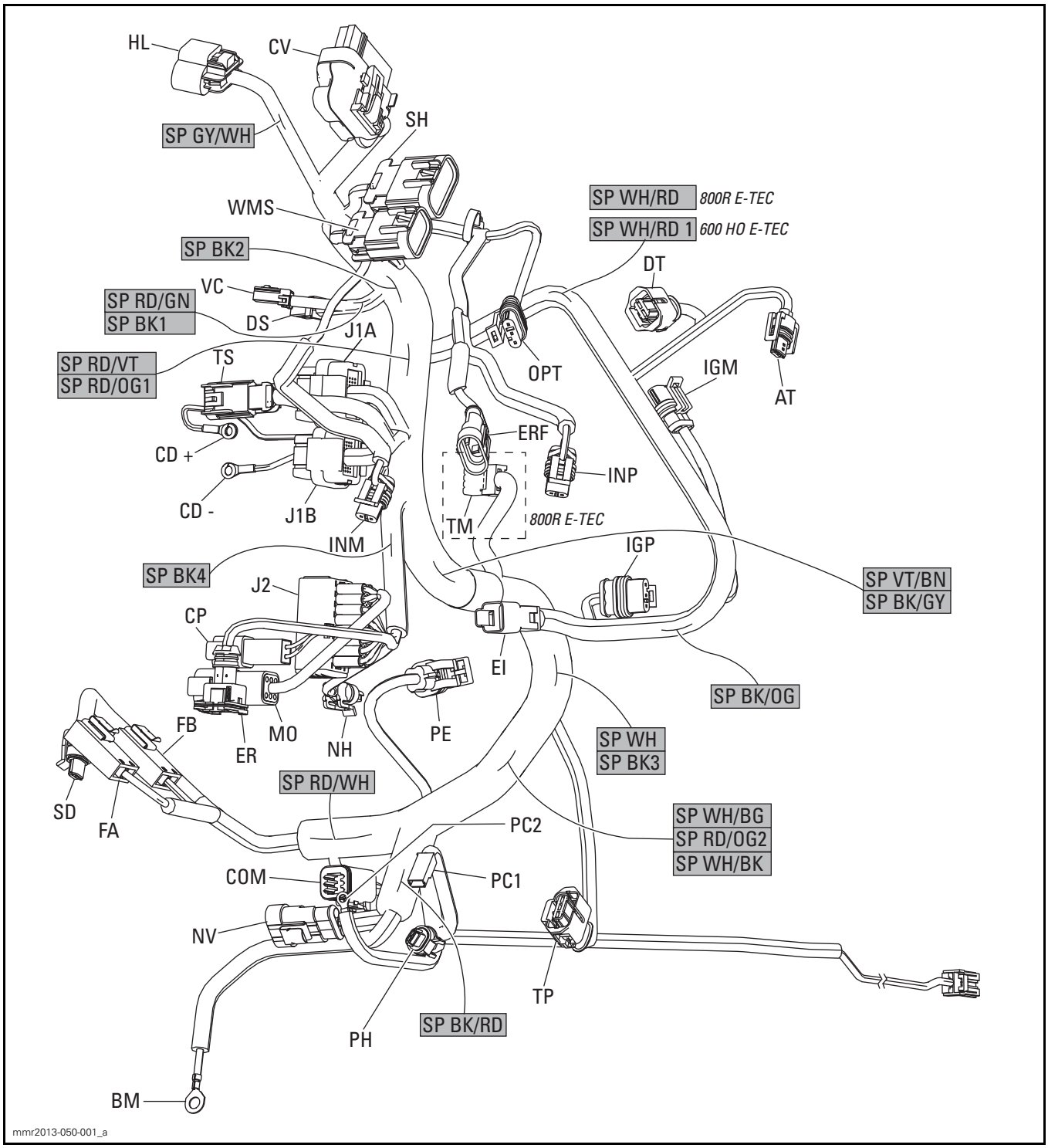
NOTICE Never solder the wire to the terminal. Soldering can change the property of the wire and it can become brittle and break.

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.

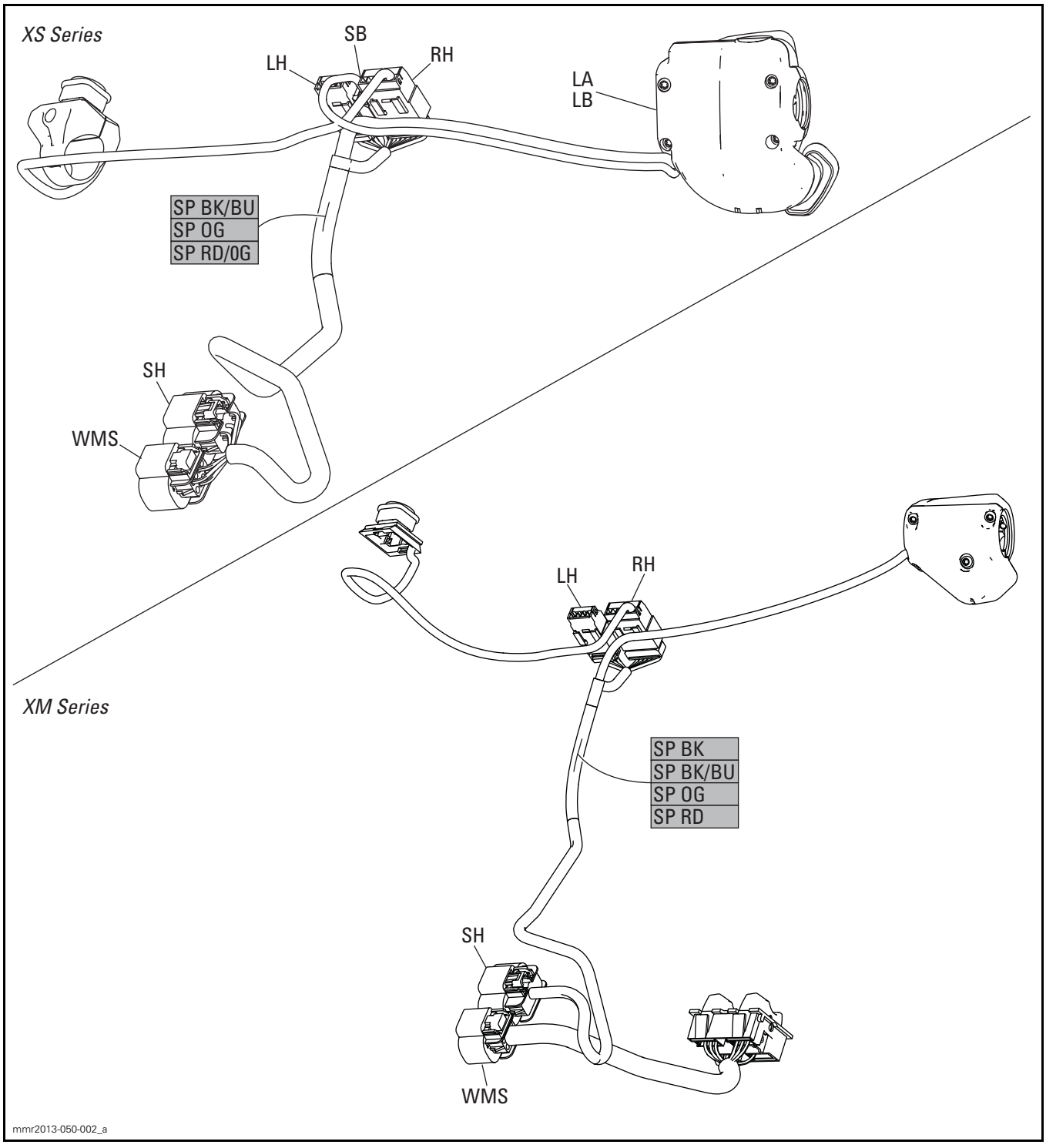
NOTICE Make sure that the protective heat shrink rubber tube has been properly installed and no part of wire is exposed.

SPLICE INFORMATION

MAIN HARNESS



STEERING HARNESS



PROCEDURES

This section gives the procedures and the location diagrams in order to quickly repair electrical harness splices and should be used in conjunction with the *WIRING DIAGRAM INFORMATION* subsection.

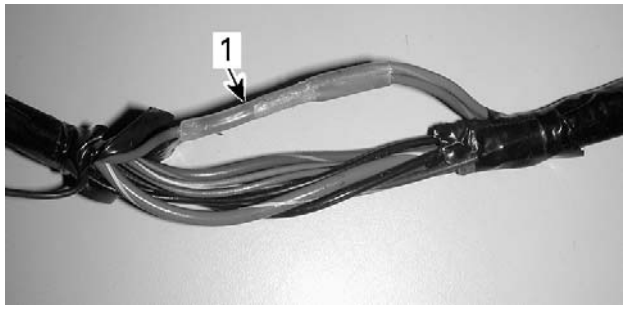
1. Make sure to perform the usual tests described in *ELECTRICAL SYSTEM* sections before investigating the harness splices.
2. If an electrical issue can not be found with the usual tests, locate the main harness splice that is involved in the faulty circuit and repair it as per the *SPLICES REPAIR PROCEDURE*.
3. To repair a splice, we recommend the use of a tin solder meeting the followings requirements or an equivalent.

TIN SOLDER REQUIREMENTS
SN 60
PB 40
DIA 0.062
FLUX RA 2%

SPLICES REPAIR PROCEDURE

CASE 1: Wire Detached from Splice

1. Locate splice. Refer to splices location diagrams.
2. Remove wires from protector tube.
3. Locate the shrink tube protecting the defective splice.



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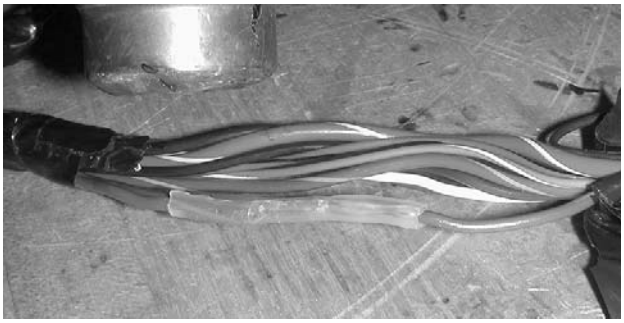
1. Shrink tube

4. Remove the shrink tube.
   4.1 Using a blade, cut the shrink tube.

mmr2010-043-002

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

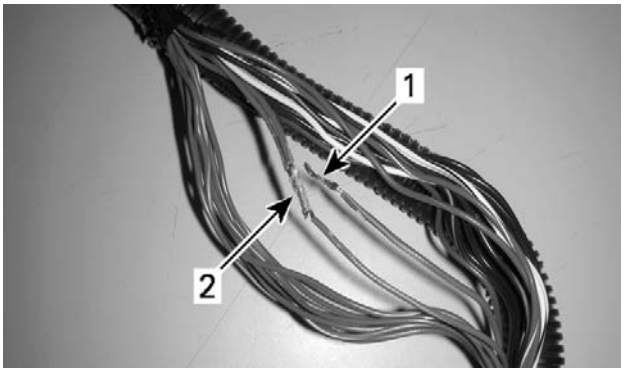
   4.2 Slightly heat the shrink tube using a heat gun.



mmr2010-043-003

   4.3 Remove the shrink tube with long nose pliers.

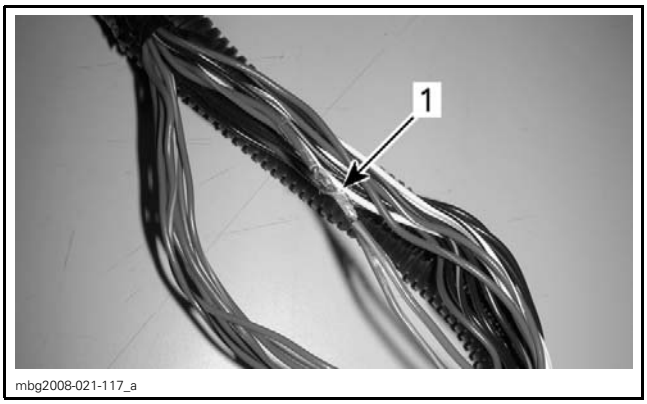
5. Locate detached wire from splice.



mbg2008-021-116_a

1. Detached wire
2. Splice

6. Twist detached wire around splice.



1. Twisted wire

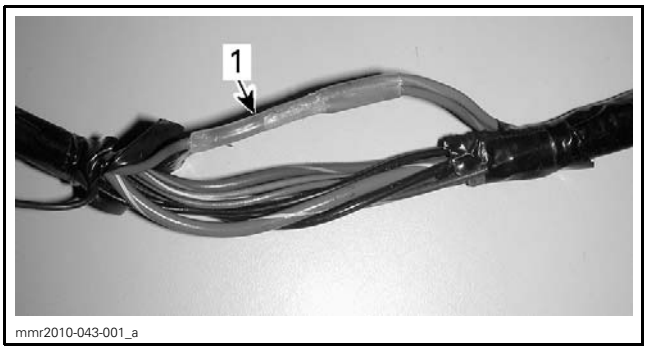
7. Perform a tin solder on twisted wire.
8. Apply electrical tape to cover splice.

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

9. Reinstall wires into protector tube.

CASE 2: Wire Broken from Splice

1. Locate splice. Refer to splices location diagrams.
2. Remove wires from protector tube.
3. Locate the shrink tube protecting the defective splice.

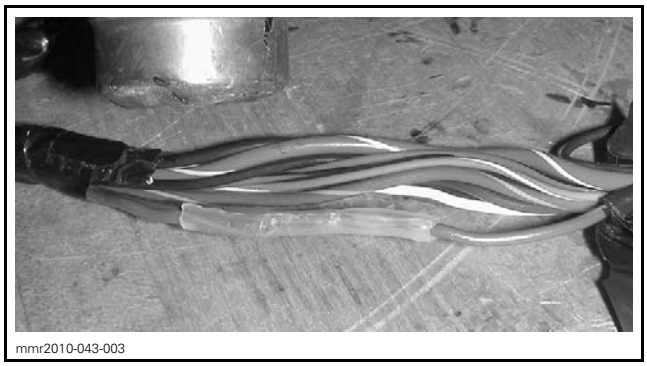


1. Shrink tube

4. Remove the shrink tube.
   4.1 Using a blade, cut the shrink tube.

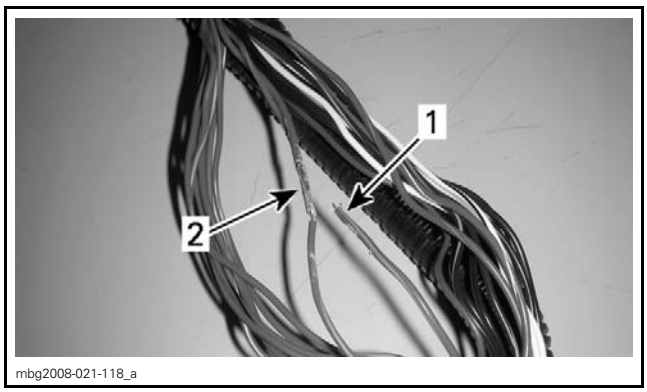
NOTICE Be careful with the blade to avoid cutting wires insulation.

   4.2 Slightly heat the shrink tube using a heat gun.



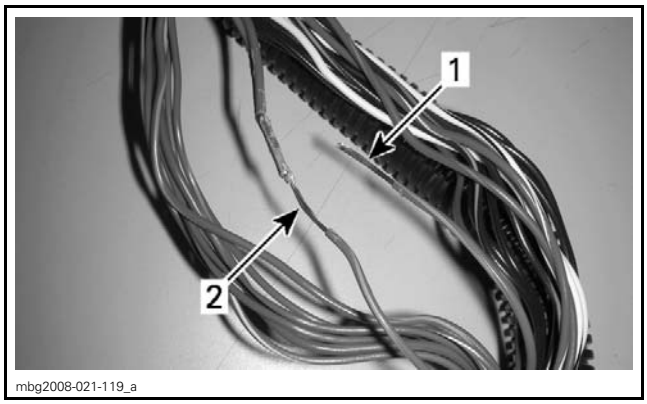
   4.3 Remove the shrink tube with long nose pliers.

5. Locate broken wire from splice.



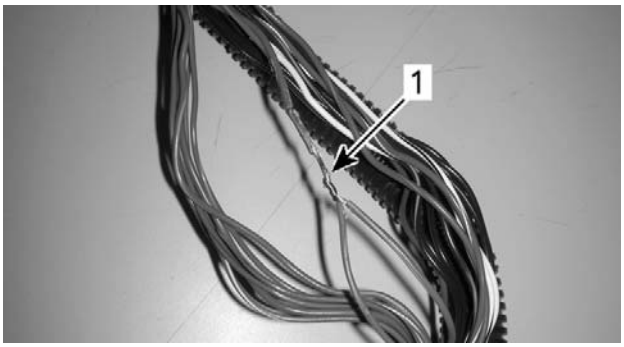
1. Broken wire
2. Splice

6. Strip wire insulation at the end of broken wire.
7. Strip wire insulation below the splice.



1. Broken wire stripped
2. Splice wire stripped

8. Twist wire around stripped wire.



1. Twisted wire

9. Perform a tin solder on twisted wire.

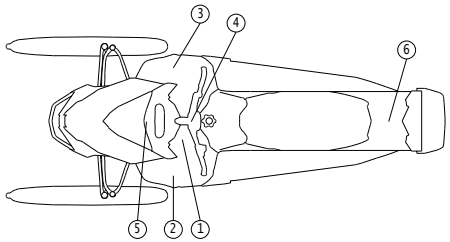
10. Apply electrical tape to cover splice.

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

11. Reinstall wires into protector tube.

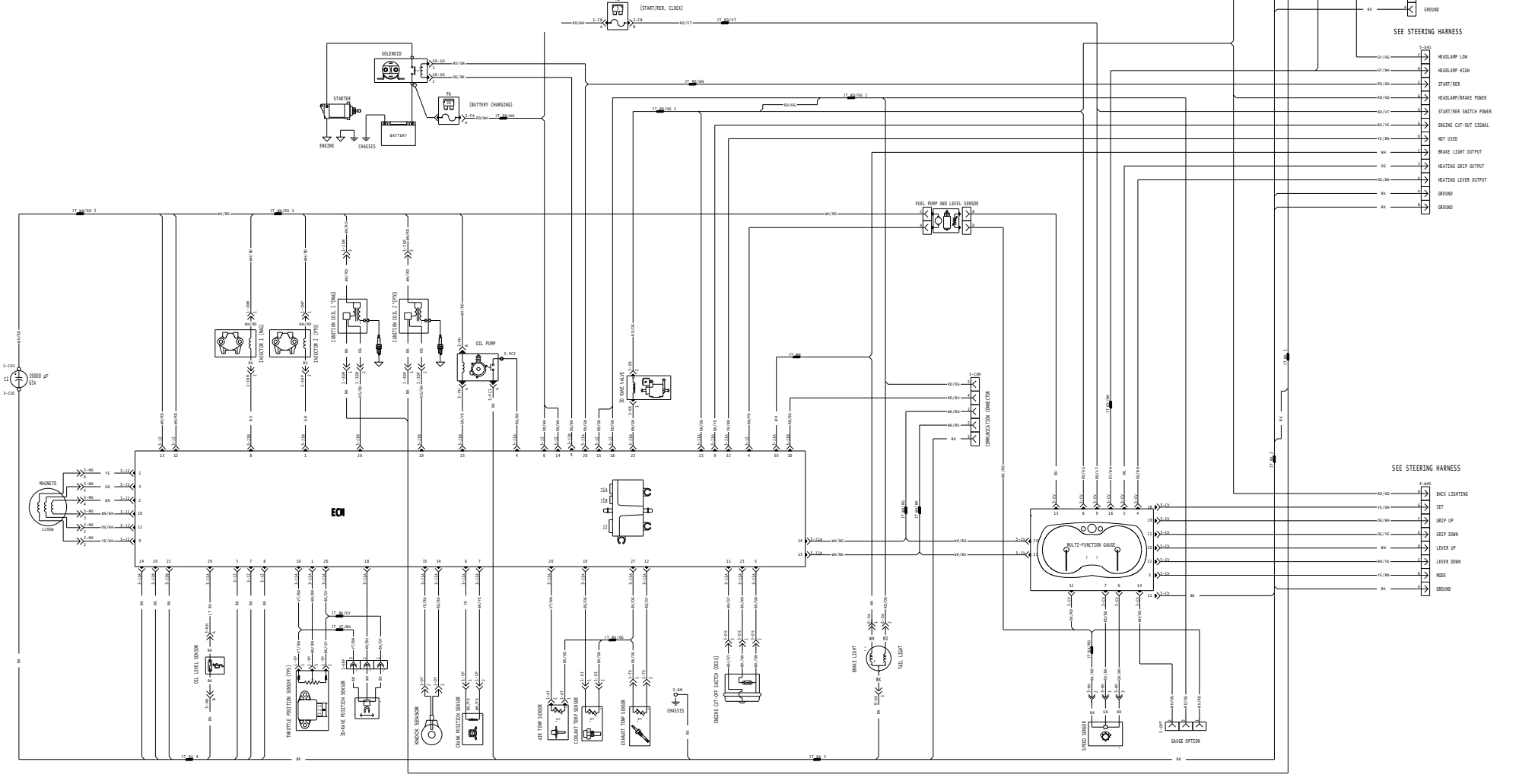
NOTE: Always perform a solder on a bigger wire (lower gage).

2013 REV-XS 600 HO E-TEC
2013 REV-XM 600 HO E-TEC



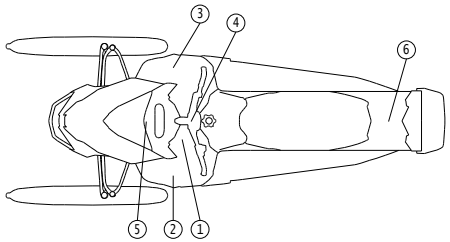
CONNECTOR LOCATION	
1	ENGINE RELATED CONNECTOR
2	LH SIDE PANEL
3	RH SIDE PANEL
4	HANDLEBAR AREA
5	BEHIND MULTI-FUNCTION GAUGE
6	REAR PART OF FRAME

COLOR CODE	
BG	BEIGE
BK	BLACK
BN	BROWN
BU	BLUE
GN	GREEN
GY	GRAY
OG	ORANGE
PK	PINK
RD	RED
VT	VIOLET
YE	YELLOW
LT	LIGHT COLOR
JT	JUNCTION



MY: 2013	600 E-TEC SPARK	REVISION a
ING: BP	TECH: JL	DATE: 2012-12-03

2013 REV-XS 800R E-TEC
2013 REV-XM 800R E-TEC



CONNECTOR LOCATION	
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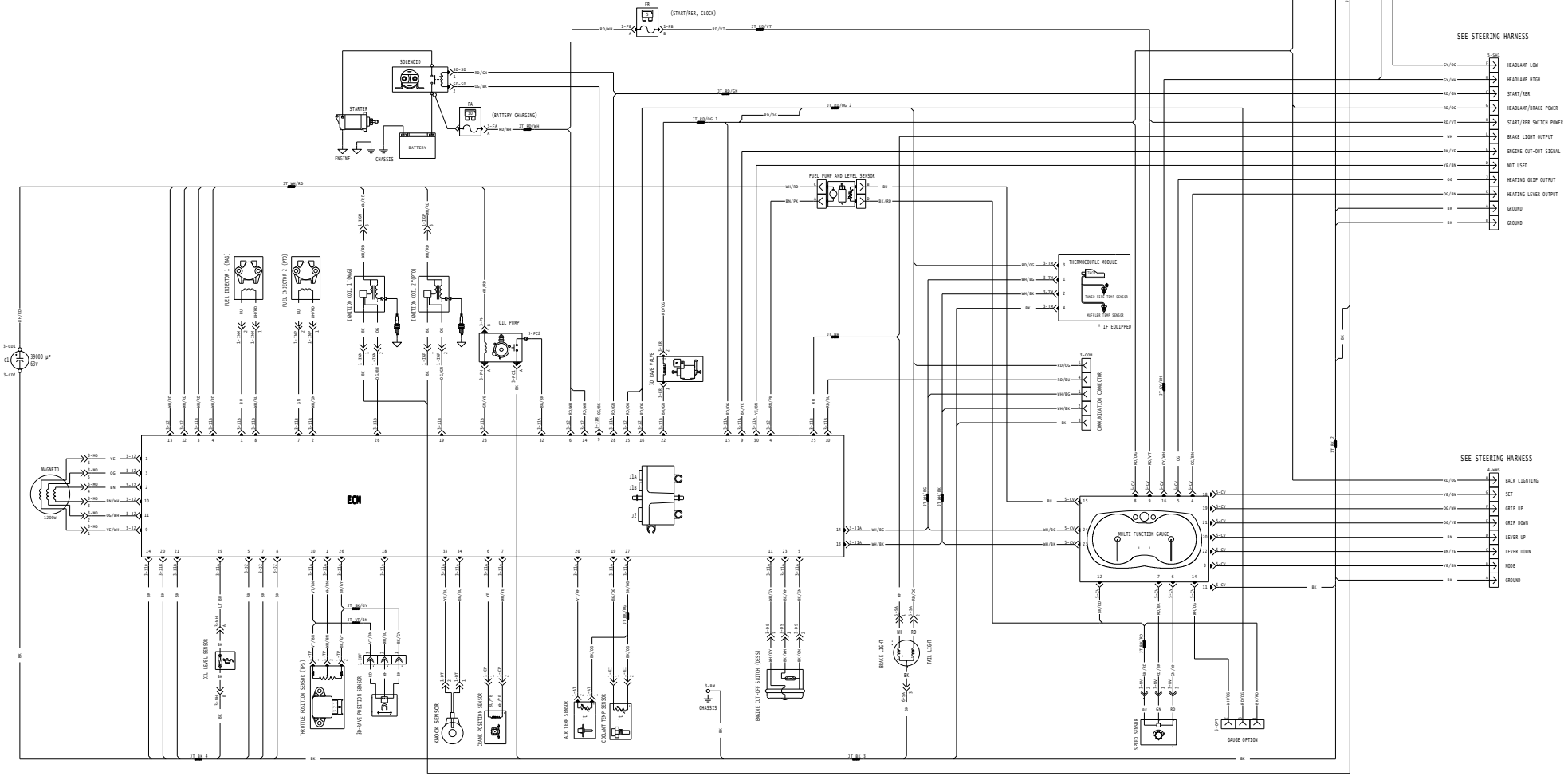
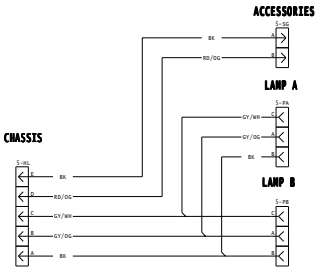


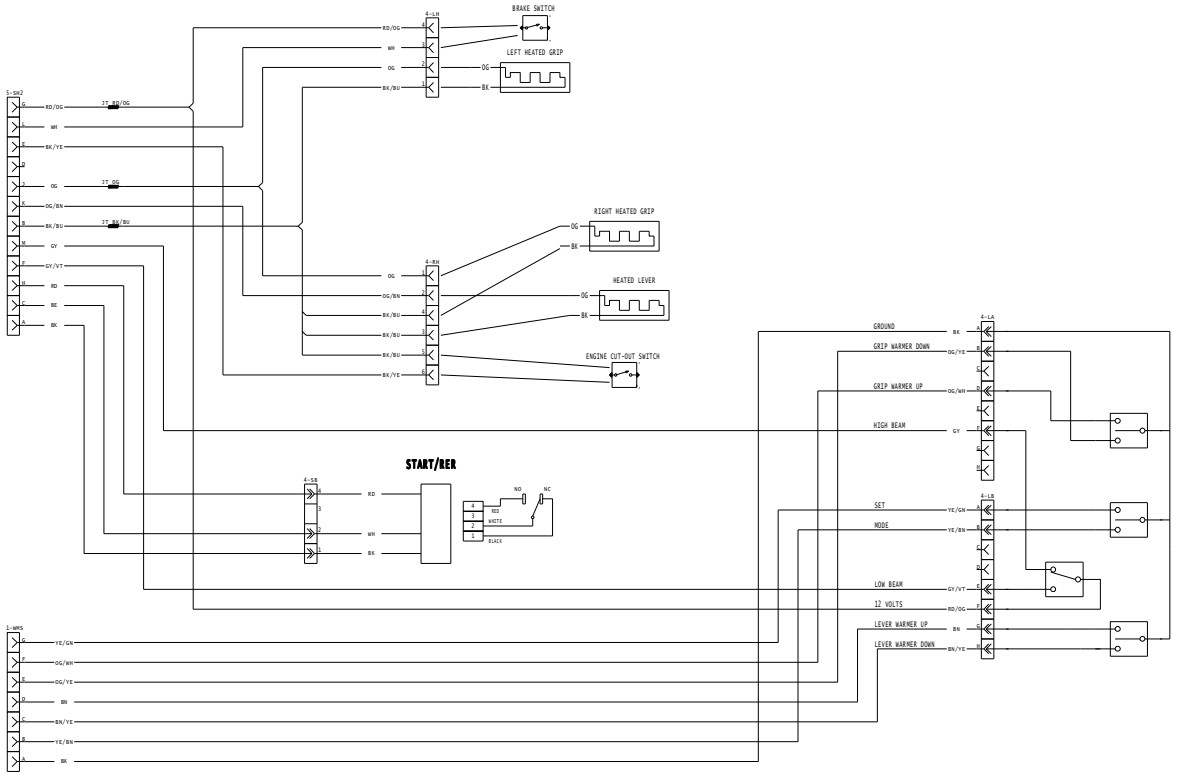
MY: 2013	800R E-TEC SPARK	REVISION a
ING: BP	TECH: JL	DATE: 2012-12-03

2013 REV-XM STEERING HARNESS
2013 REV-XS AND REV-XM HEADLAMP HARNESS
2013 REV-XS STEERING HARNESS

HEADLAMP HARNESS

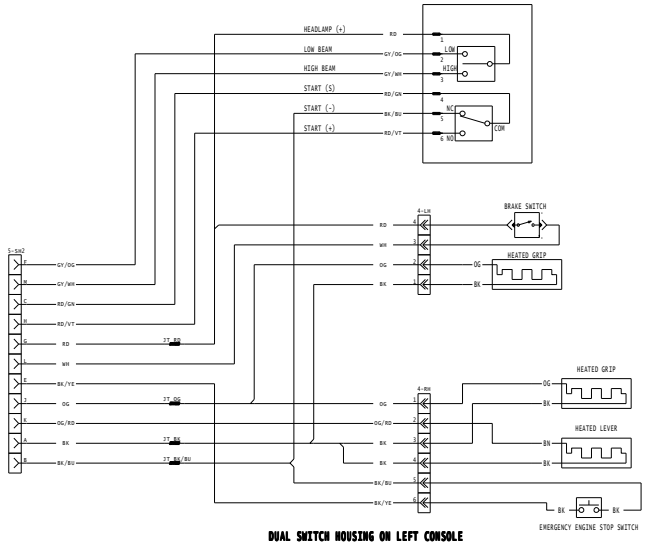


REV-XS SETTERING HARNESS

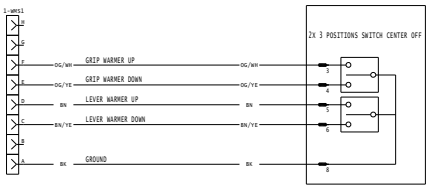


REV-XM SETTERING AND CONSOLE HARNESSES

LEFT HANDLEBAR SWITCH HOUSING



DUAL SWITCH HOUSING ON LEFT CONSOLE



MY: 2013	TITRE		REVISION 0
ING: BP	TECH: JL	DATE: 2012-12-04	