INTRODUCTION

GENERAL INFORMATIONS

This shop manual covers the following BRP made 2015 Outlander L and Outlander L MAX Series vehicles.

MODEL YEAR	MODEL	ENGINE	MODEL NUMBER
2015	Outlander L (STD)	450 EFI	5AFA, 5AFB, 5AFC, 5AFD, 5AFE
	Outlander L (DPS)		2WFA, 2WFB, 2WFC, 2WFD
	Outlander L MAX		5CFA, 5CFB, 5CFC
	Outlander L MAX (DPS)		2XFA, 2XFB, 2XFC, 2XFD
	Outlander L (STD)	500 EFI	2TFA, 2TFB, 2TFC, 2TFD
	Outlander L (DPS)		2CFA, 2CFB, 2CFC, 2CFD, 2CFE, 2CFF
	Outlander L MAX		2EFA, 2EFB
	Outlander L MAX (DPS)		2FFA, 2FFB, 2FFC, 2FFD, 2FFE, 2FFF

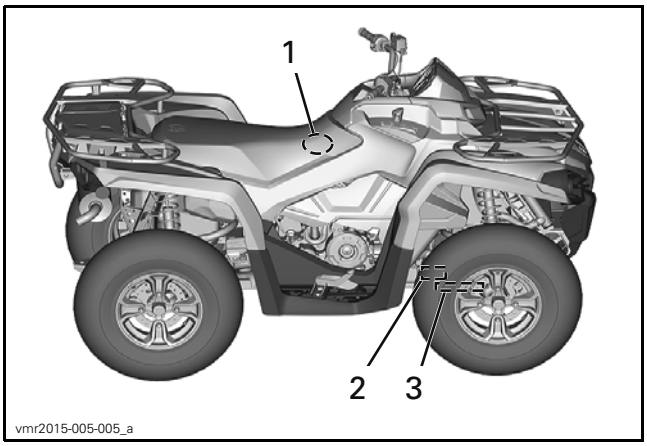
The information and component/system descriptions contained in this manual are correct at time of publication. BRP however, maintains a policy of continuous improvement of its products without imposing upon itself any obligation to install them on products previously manufactured.

Due to late changes, it may have 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.

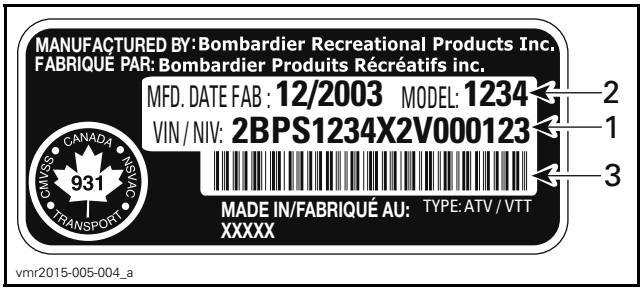
VEHICLE INFORMATION

VEHICLE IDENTIFICATION NUMBER (VIN) LOCATIONS



VIN LOCATIONS
1. *VIN decal under seat*
2. *VIN decal on lower frame member, RH side*
3. *VIN stamped on lower frame member, RH side*

VIN Decal Description

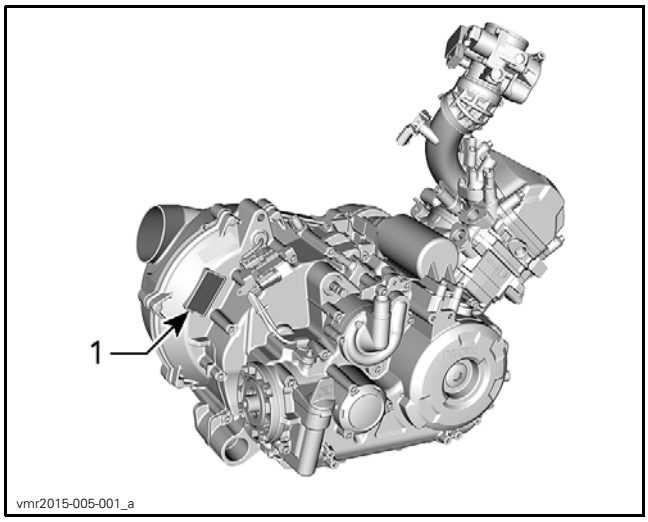


TYPICAL — VEHICLE SERIAL NUMBER DECAL UNDER SEAT
1. *VIN (Vehicle Identification Number)*
2. *Vehicle manufacturing date and model number*
3. *VIN bar code*

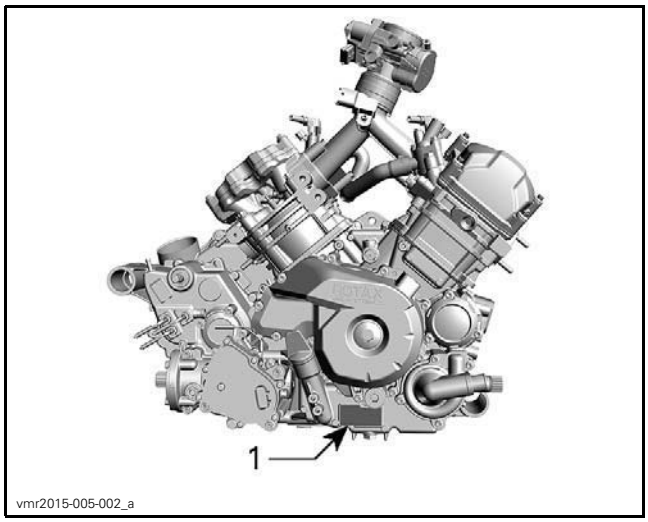


TYPICAL — VEHICLE SERIAL NUMBER DECAL ON RH SIDE OF FRAME
1. *VIN (Vehicle Identification Number)*
2. *Vehicle manufacturing date and model number*

ENGINE IDENTIFICATION NUMBER (EIN)



BACK OF 450 ENGINE
1. *EIN (Engine Identification Number)*



RH SIDE OF 500 ENGINE
1. *EIN (Engine Identification Number)*

ENGINE EMISSIONS INFORMATION

MANUFACTURER'S RESPONSIBILITY

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

DEALER RESPONSIBILITY

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

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

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

Exceptions include manufacturer's prescribed changes.

OWNER RESPONSIBILITY

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

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

EPA EMISSION REGULATIONS

Vehicles 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 vehicle 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 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

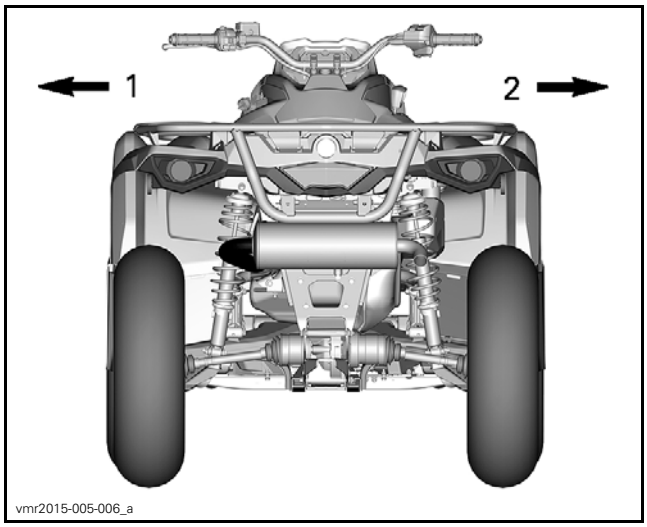
Many of the procedures in this manual are interrelated. Before undertaking any task, you should read and thoroughly understand the entire section or subsection in which the procedure is contained.

⚠ WARNING

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

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

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



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*.

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

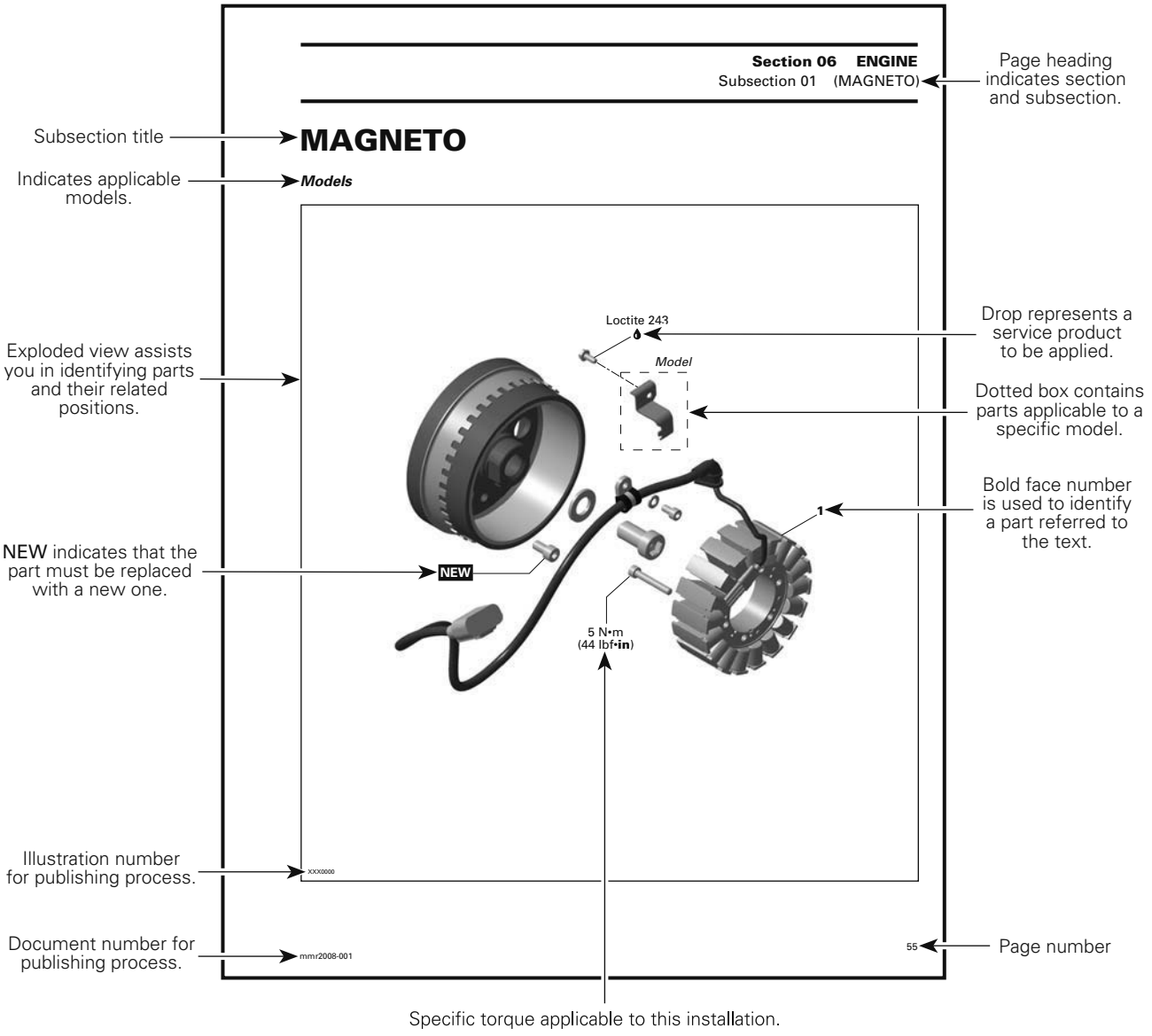
MANUAL LAYOUT

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

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

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

TYPICAL PAGE



Typical_iso_2008_en

TYPICAL PAGE

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

GENERAL

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

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

Reference to a specific section or subsection.

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

⚠ WARNING

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

PROCEDURES

Indicates component procedures apply to.

MAGNETO FLYWHEEL

Magneto Flywheel Cleaning

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

CAUTION: Clean magneto flywheel using only a clean cloth.

Indicates specific procedure to be carried out.

Magneto Flywheel Removal

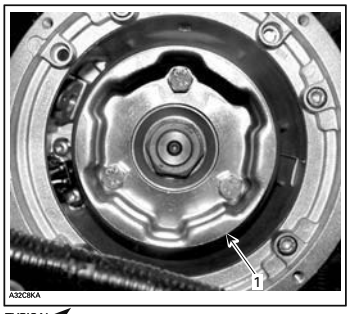
Remove muffler, refer to the *EXHAUST SYSTEM* section.

Remove acoustic panel.

Remove rewind starter.

Remove starting pulley **no. 2**.

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



TYPICAL
1. Starting pulley

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

Call-outs pertaining to above illustration.

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



TYPICAL

Illustration always follows text to which it applies.

Models

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

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

typical_txt_2008_en

TIGHTENING TORQUE

Tighten fasteners to the torque specified in the exploded view(s) and/or in the written procedure. When a torque is not specified, refer to the following table.

⚠ WARNING

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

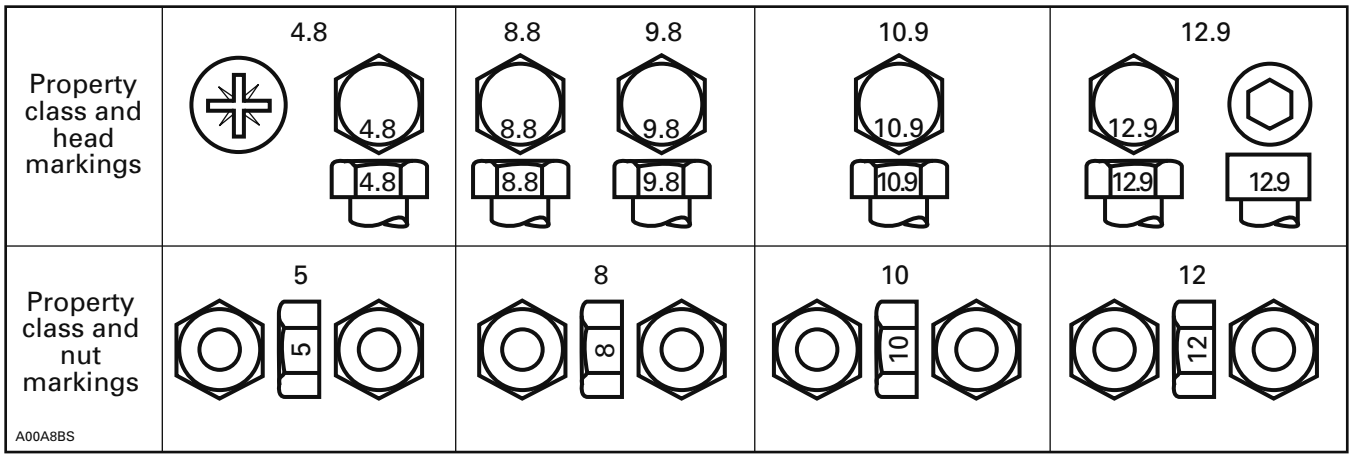
In order to avoid a poor assembly, tighten screws, bolts, or nuts in accordance with the following procedure:

1. Manually screw in 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: Whenever 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.

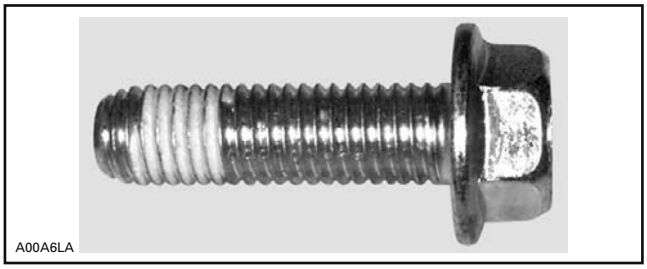


FASTENER SIZE	FASTENER GRADE/TORQUE			
	5.8 Grade	8.8 Grade	10.9 Grade	12.9 Grade
M4	1.5 – 2 N•m (13 – 18 lbf•**in**)	2.5 – 3 N•m (22 – 27 lbf•**in**)	3.5 – 4 N•m (31 – 35 lbf•ft)	4 – 5 N•m (35 – 44 lbf•ft)
M5	3 – 3.5 N•m (27 – 31 lbf•ft)	4.5 – 5.5 N•m (40 – 47 lbf•ft)	7 – 8.5 N•m (62 – 75 lbf•ft)	8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



TYPICAL — SELF-LOCKING FASTENER

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

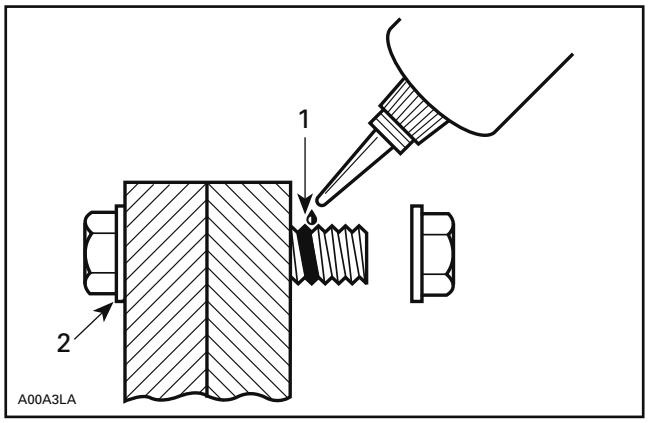
Use a metal brush or a tap to properly clean a threaded hole, then use a solvent. Allow the solvent time to act, approximately 30 minutes, then wipe off. Solvent utilization is to ensure proper adhesion of the product used for locking the fastener.

LOCTITE® THREADLOCKER APPLICATION PROCEDURE

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

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

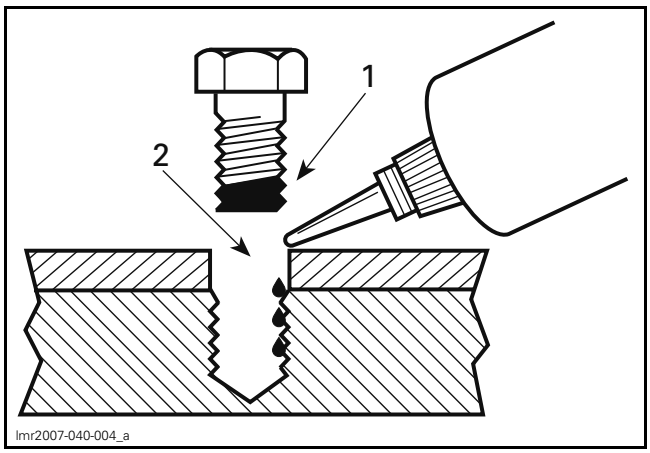
Threadlocker Application for Uncovered Holes (Bolts and Nuts)



1. Apply here
2. Do not apply

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

Threadlocker Application for Blind Holes

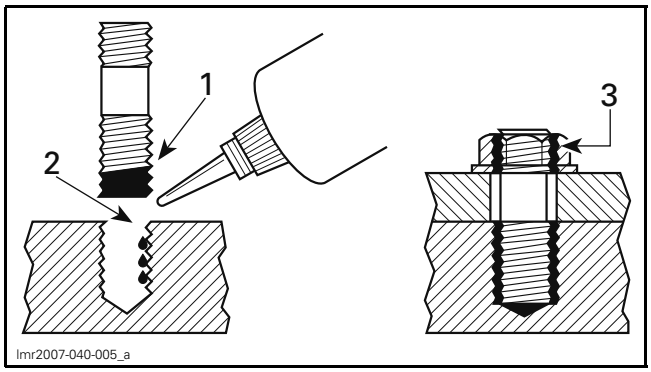


1. On fastener threads
2. On threads and at the bottom of hole

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

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

Threadlocker Application for Stud Installation in Blind Holes



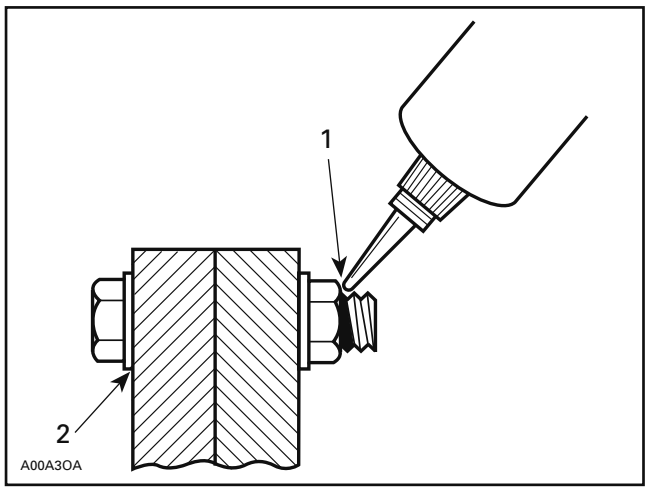
1. On stud threads
2. On threads and in the hole
3. On retaining nut threads

1. Clean threads (stud and hole) with solvent.
2. Apply LOCTITE 7649 (PRIMER) (P/N 293 800 041) on threads and allow to dry.
3. Apply 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

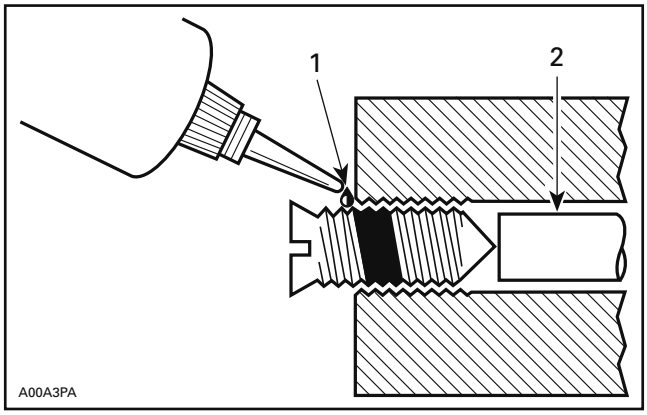


1. Apply here
2. Do not apply

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

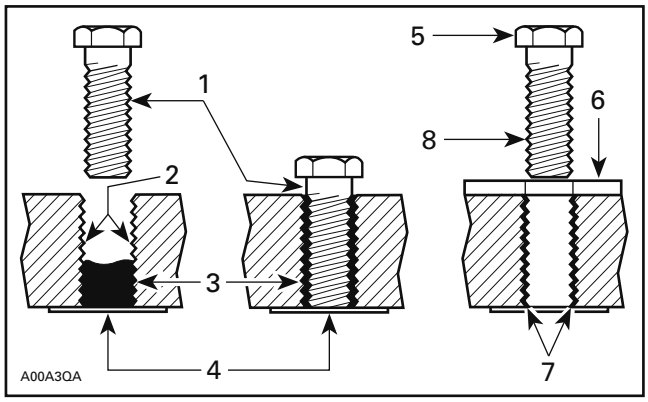


1. Apply here
2. Plunger

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. Tape
5. Cleaned bolt
6. Plate
7. New threads
8. Threadlocker

Standard Thread Repair

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

If a plate is used to align bolt:

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

NOTE: NOT intended for engine stud repairs.

Repair of Small Holes/Fine Threads

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

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

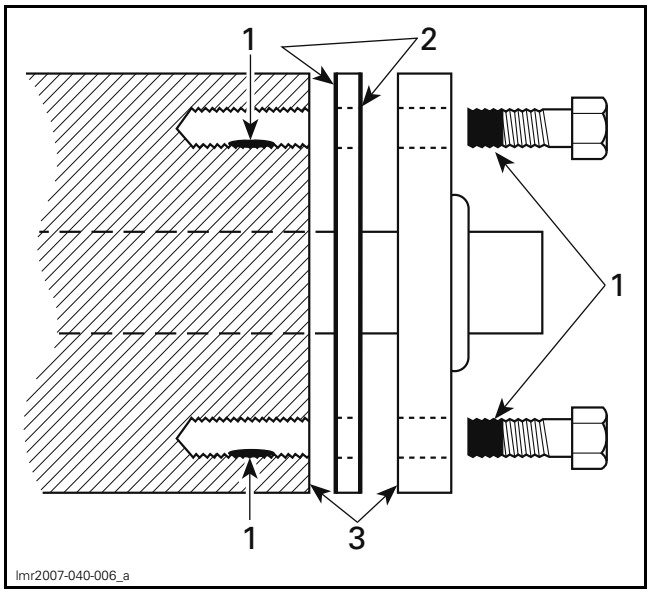
Permanent Stud Installation (Light Duty)

1. Use a stud of the desired thread length.

NOTE: DO NOT apply release agent on stud.

2. Follow Standard Thread Repair procedure.
3. Allow 30 minutes for Loctite FORM-A-THREAD to cure.
4. 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.

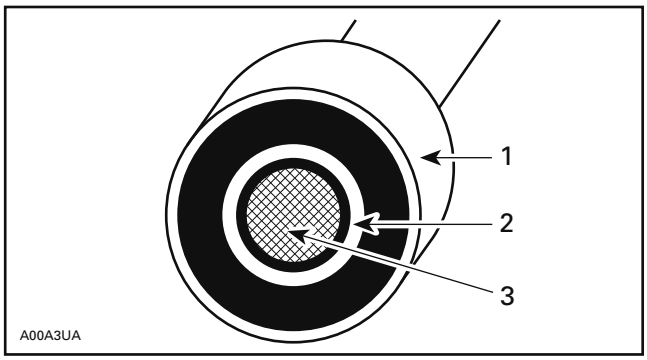
NOTE: If the cover is bolted to blind holes, apply proper strength Loctite in the hole and on threads. Tighten fastener.

NOTE: 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

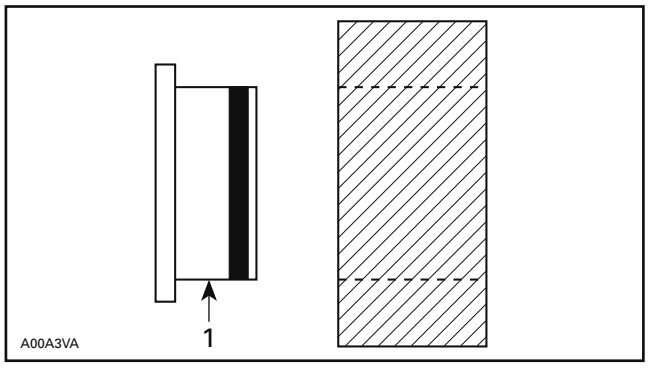
1. Clean shaft external contact surface.
2. Clean internal contact surface of part to be installed on shaft.
3. Apply a strip of proper strength Loctite on circumference of shaft contact surface at insertion or engagement point.

NOTE: Retaining compound is always forced out when applied on shaft. DO NOT use Loctite antiseize or any similar product. 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 in the prescribed order.

Threadlocker Application for Case-In Components (Metallic Gaskets)



1. Proper strength Loctite

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

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

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

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

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

SERVICE TOOLS INDEX

ADAPTER HOSE
(P/N 529 035 652)



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BACKLASH MEASUREMENT TOOL
(P/N 529 035 665)



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BACKLASH MEASUREMENT TOOL
(P/N 529 036 030)



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BALL JOINT REMOVAL TOOL
(P/N 529 036 310)



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BEARING INSTALLER (GEARBOX)
(P/N 529 035 763)



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BEARING INSTALLER (GEARBOX)
(P/N 529 035 762)



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BEARING INSTALLER (GEARBOX)
(P/N 529 035 763)



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BLIND HOLE BEARING PULLER SET
(P/N 529 036 117)



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BLIND HOLE PULLER KIT
(P/N 529 036 056)



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CAMSHAFT TIMING TOOL
(P/N 529 036 268)



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CLUTCH HOLDER
(P/N 529 036 238)



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CLUTCH PULLER
(P/N 529 035 746)



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COUNTERSHAFT OIL SEAL PUSHER
(P/N 529 036 222)



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SERVICE TOOLS INDEX

CRANKCASE SUPPORT (MAG SIDE)
(P/N 529 035 916)



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CRANKCASE SUPPORT MAG/PTO
(P/N 529 036 031)



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CRANKCASE SUPPORT PTO
(P/N 529 035 754)



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CRANKSHAFT LOCKING BOLT
(P/N 529 035 617)



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



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CRANKSHAFT PROTECTOR
(P/N 529 036 034)



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CRANKSHAFT TDC POSITION TOOL
(P/N 529 036 201)



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



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CV BOOT CLAMP PLIER
(P/N 529 036 120)



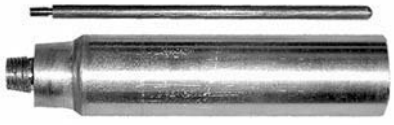
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CV JOINT EXTRACTOR
(P/N 529 036 005)



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DIAL INDICATOR ADAPTER
(P/N 529 036 159)



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DISCONNECT TOOL
(P/N 529 035 714)



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DRIVE PULLEY HOLDER (CVT)
(P/N 529 006 400)



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DRIVE SHAFT OIL SEAL INSTALLER
(P/N 529 036 028)



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DRIVE SHAFT OIL SEAL PROTECTOR
(P/N 529 036 029)



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DRIVEN CLUTCH HOLDER
(P/N 529 035 771)



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ECM ADAPTER TOOL (ONE CONNECTOR)
(P/N 529 036 085)



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SERVICE TOOLS INDEX

ECM ADAPTER TOOL
(P/N 529 036 166)



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



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



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ENGINE LEAK DOWN TEST KIT
(P/N 529 035 661)



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ENGINE LIFTING TOOL
(P/N 529 035 898)



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ENGINE LIFTING TOOL
(P/N 529 036 022)



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FLUKE 115 MULTIMETER
(P/N 529 035 868)



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FUEL HOSE ADAPTER
(P/N 529 036 023)



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FUEL PUMP NUT TOOL
(P/N 529 035 899)



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HANDLE
(P/N 420 877 650)



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MAGNETO PULLER
(P/N 529 035 748)



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MPI-2 DIAGNOSTIC CABLE
(P/N 710 000 851)



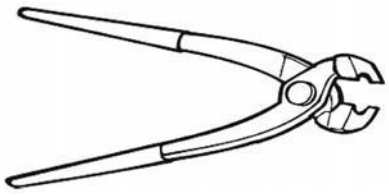
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MPI-2 INTERFACE CARD
(P/N 529 036 018)



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OETIKER PLIERS
(P/N 295 000 070)



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OIL SEAL INSTALLER (GEARBOX)
(P/N 529 035 758)



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SERVICE TOOLS INDEX

OIL SEAL INSTALLER
(P/N 529 036 069)



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OIL SEAL PUSHER
(P/N 529 035 757)



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OUTPUT SHAFT SEAL INSTALLER
(P/N 529 035 941)



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PISTON CIRCLIP INSTALLER
(P/N 529 036 083)



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PISTON RING COMPRESSOR
(P/N 529 035 977)

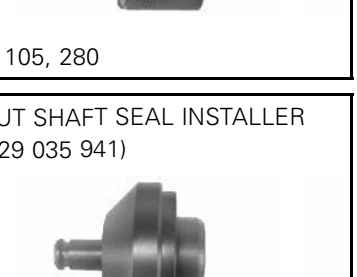


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PITMAN ARM JIG
(P/N 529 036 225)

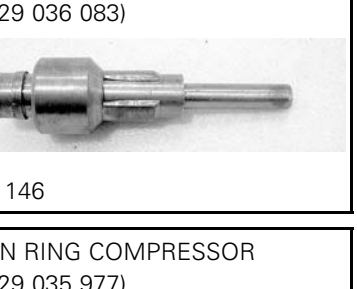
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PITMAN ARM PULLER
(P/N 529 036 227)



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PLAIN BEARING
REMOVER/INSTALLER
(P/N 529 035 917)



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PLAIN BEARING
REMOVER/INSTALLER
(P/N 529 036 032)



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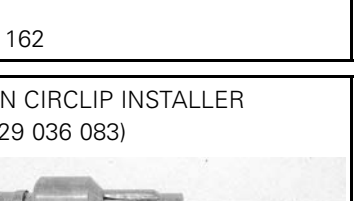
POSITIONING ADAPTOR
(P/N 529 036 230)

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PRESSURE GAUGE
(P/N 529 035 709)

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PTO COVER OIL SEAL INSTALLER
(P/N 529 036 033)



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PULLER/LOCKING TOOL
(P/N 529 036 098)



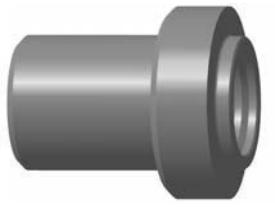
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ROTARY SEAL PUSHER PLATE
(P/N 529 036 130)

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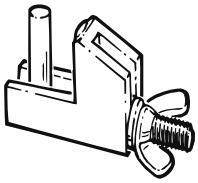
SERVICE TOOLS INDEX

SEAL PUSHER
(P/N 529 035 766)



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SMALL HOSE PINCHER
(P/N 295 000 076)



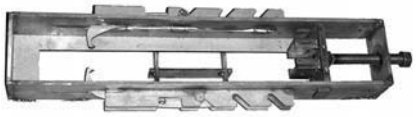
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SPANNER SOCKET
(P/N 529 035 649)



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SPRING COMPRESSOR
(P/N 529 036 184)



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STARTER DRIVE NEEDLE INSTALLER
(P/N 529 035 934)



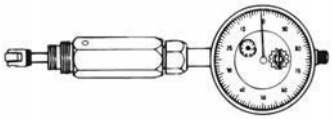
Page: 120

STEERING ALIGNMENT TOOL
(P/N 529 036 059)



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TDC DIAL INDICATOR
(P/N 414 104 700)



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TEST CAP
(P/N 529 035 991)



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



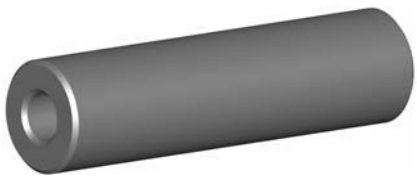
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VALVE GUIDE INSTALLER
(P/N 529 036 140)



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VALVE GUIDE INSTALLER
(P/N 529 036 269)



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VALVE GUIDE REMOVER (6 MM)
(P/N 529 036 074)



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VALVE GUIDE REMOVER 5 MM
(P/N 529 035 924)



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VALVE SPRING COMPRESSOR CUP
(P/N 529 035 764)



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VALVE SPRING COMPRESSOR CUP
(P/N 529 036 270)



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VALVE SPRING COMPRESSOR
(P/N 529 035 724)



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BREAK-IN INSPECTION

Procedures are detailed in *PERIODIC MAINTENANCE PROCEDURES* subsection.

BREAK-IN INSPECTION
Replace engine oil and filter
Check valve clearance and adjust as required
Inspect engine air filter
Inspect battery connections
Replace gearbox oil (500)
Clean vehicle speed sensor

PERIODIC MAINTENANCE SCHEDULE

Procedures are detailed in *PERIODIC MAINTENANCE PROCEDURES* subsection.

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

EVERY 1 500 KM (1,000 MI) OR 50 HOURS OF OPERATION IN TRAIL RIDING CONDITIONS (WHICHEVER COMES FIRST) EVERY 750 KM (500 MI) OR 25 HOURS OF OPERATION IN SEVERE RIDING CONDITIONS (DUSTY OR MUDDY) OR CARRYING HEAVY LOADS CONDITION (WHICHEVER COMES FIRST)
Inspect and clean engine air filter. Replace as needed
Check battery connections
Inspect front differential/rear final drive oil level
Lubricate front and rear propeller shaft joints (450)
Lubricate rear propeller shaft joints (500)
Inspect tie rod end and ball joints
Lubricate front suspension arms
Inspect and lubricate rear anti-sway bar bushings
Inspect the drive shaft boots and protectors
Inspect brake pads

EVERY 3 000 KM (2,000 MI) OR 100 HOURS OF OPERATION IN TRAIL RIDING CONDITIONS (WHICHEVER COMES FIRST) EVERY 1 500 KM (1,000 MI) OR 50 HOURS OF OPERATION IN SEVERE RIDING CONDITIONS (DUSTY OR MUDDY) OR CARRYING HEAVY LOADS CONDITION (WHICHEVER COMES FIRST)
Replace engine oil and filter
Inspect and adjust valve clearance
Inspect and clean muffler spark arrester
Inspect and clean throttle body
Inspect, clean and lubricate throttle cable
Replace fuel vent breather filter
Inspect CVT drive belt
Inspect, clean and lubricate CVT drive and driven pulleys (including one-way bearing)
Check gearbox oil level and condition (500)
Inspect wheel bearings (check for abnormal play)
Inspect steering system (check for abnormal play)
Inspect and clean brake system
Replace rear final drive oil
Check battery condition and connections

EVERY 6 000 KM (4,000 MI) OR 200 HOURS OF OPERATION IN TRAIL RIDING CONDITIONS (WHICHEVER COMES FIRST) EVERY 3 000 KM (2,000 MI) OR 100 HOURS OF OPERATION IN SEVERE RIDING CONDITIONS (DUSTY OR MUDDY) OR CARRYING HEAVY LOADS CONDITION (WHICHEVER COMES FIRST)
Check cooling system and perform a pressure test on pressure cap and cooling system
Check engine coolant strength
Check fuel system condition and perform a fuel system leak test
Inspect fuel pump prefilter and replace if soiled, clogged or damaged
Carry out a fuel pump pressure test
Replace spark plugs
Replace front differential oil
Replace gearbox oil (500)
Inspect gearbox and differential seals
Clean vehicle speed sensor
Replace the brake fluid
Clean and lubricate lower and upper steering column half bushings

EVERY 5 YEARS OR 12 000 KM (8,000 MI) IN TRAIL RIDING CONDITIONS (WHICHEVER COMES FIRST) EVERY 5 YEARS OR EVERY 6 000 KM (4,000 MI) IN SEVERE RIDING CONDITIONS (DUSTY OR MUDDY) OR CARRYING HEAVY LOADS CONDITION (WHICHEVER COMES FIRST)
Replace engine coolant.

PERIODIC MAINTENANCE PROCEDURES (450)

SERVICE TOOLS

Description	Part Number	Page
TEST CAP	529 035 991	18
VACUUM/PRESSURE PUMP	529 021 800	18, 29

SERVICE PRODUCTS

Description	Part Number	Page
AIR FILTER CLEANER	219 700 341	13
AIR FILTER OIL	219 700 340	13
BRAKE FLUID GTLMA DOT4	293 600 131	29
CABLE LUBRICANT	293 600 041	21
LONG LIFE ANTIFREEZE	219 702 685	17
SUSPENSION GREASE	293 550 033	26–27
XPS 4-STROKE SYNTH. BLEND OIL (SUMMER)	293 600 121	14
XPS 4-STROKE SYNTHETIC OIL (ALL CLIMATE)	293 600 112	14
XPS BRAKES AND PARTS CLEANER (USA)	219 701 705	23, 28
XPS BRAKES AND PARTS CLEANER	219 701 776	23, 28
XPS SYNTHETIC GEAR OIL (75W 140)	293 600 140	25
XPS SYNTHETIC GEAR OIL (75W 90)	293 600 043	24
XPS SYNTHETIC GREASE	293 550 010	28

GENERAL

This subsection provides:
– Fluid level verifications
– Maintenance procedures.

The following systems should be serviced according to the *PERIODIC MAINTENANCE SCHEDULE*.

PROCEDURES

ENGINE (AIR INTAKE SYSTEM)

Engine Air Filter Maintenance Guideline

As with any ATV, air filter maintenance is critical to ensure proper engine performance and life span.

Air filter maintenance should be adjusted according to riding conditions.

Air filter maintenance must be increased in frequency and oil must be added to the foam filter for the following dusty conditions:
– Riding on dry sand
– Riding on dry dirt covered surfaces
– Riding on dry gravel trails or similar conditions.

NOTE: Riding in a group in these conditions would increase even more the air filter maintenance.

Engine Air Filter Removal

NOTICE Never remove or modify any component in the air filter housing. Otherwise, engine performance degradation or damage can occur. The engine is calibrated to operate specifically with these components.

1. Remove seat.
2. Remove console. Refer to *BODY* subsection.
3. Rotate air filter cover counterclockwise to remove it.

NOTE: A socket wrench may be used to remove the filter cover.



1. Air filter cover

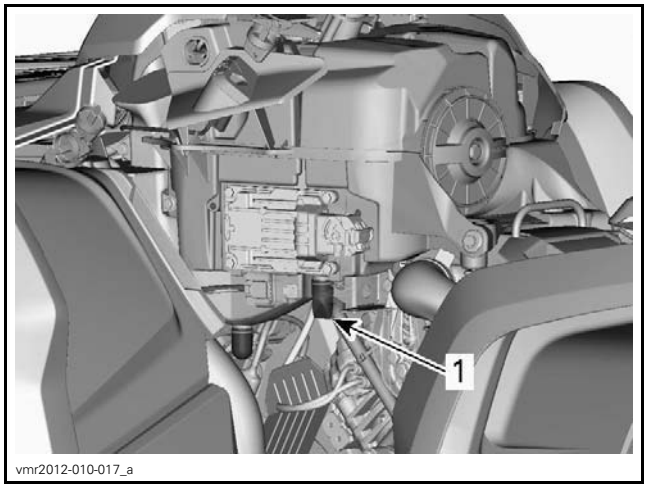
4. Remove air filter.



AIR FILTER REMOVAL

Engine Air Filter Housing Inspection and Draining

1. Remove LH side panel and extension. Refer to *BODY* subsection.
2. Drain air filter housing inlet drain tube.

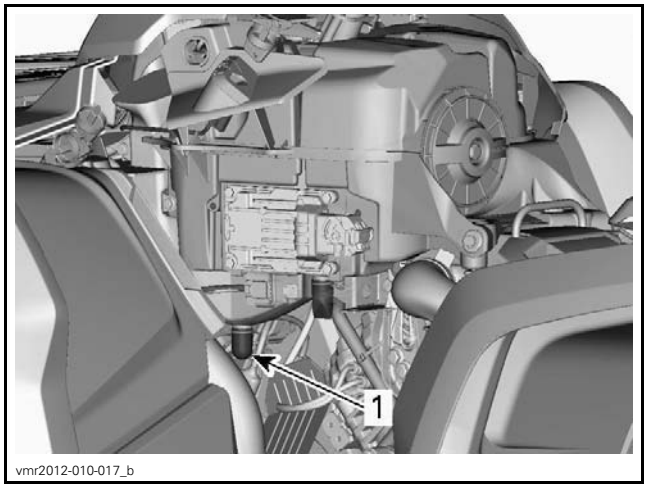


TYPICAL - SOME PARTS REMOVED FOR CLARITY
1. Air filter housing inlet drain tube

3. Check air filter dirty chamber for cleanliness.
   – If any debris or water are found, clean air filter chamber using a vacuum cleaner.

NOTICE Do not blow compressed air into air filter chamber.

4. Check air filter drain tube (clean chamber).
   – If any debris or water are found, refer to *SPECIAL PROCEDURES* subsection.
   – Investigate for contamination source.



TYPICAL - SOME PARTS REMOVED FOR CLARITY
1. Air filter drain tube

Paper Filter Cleaning

1. Ensure that the foam filter is removed from paper filter.
2. Tap out heavy dust from the paper filter.

This will allow dirt and dust to get out of the paper filter.

NOTE: Paper filter have a limited life span; replace filter if too dirty or clogged.

NOTICE It is not recommended to blow compressed air on the paper filter; this could damage the paper fibers and reduce its filtration ability when used in dusty environments.

NOTICE Do not wash the paper filter with any cleaning solution.

Foam Filter Cleaning

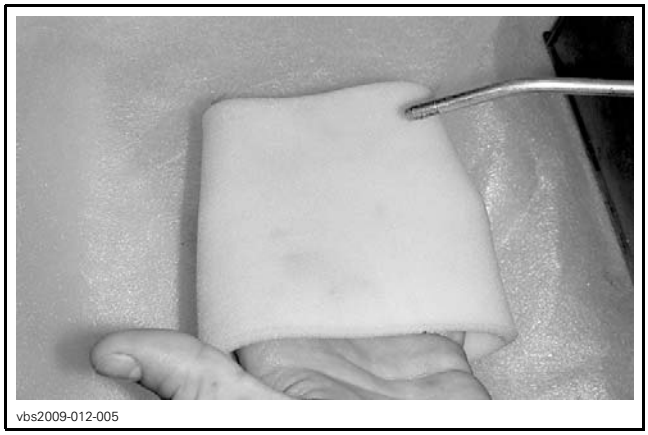
1. Spray the foam filter inside and out with air filter cleaner.

RECOMMENDED PRODUCT	
AIR FILTER CLEANER (P/N 219 700 341)	


vbs2009-012-015_a

TYPICAL - SPRAY THE FOAM FILTER

2. Let stand for 3 minutes.
3. As stated on air filter cleaner (UNI) container, rinse with plain water.
4. Dry the foam filter completely.


vbs2009-012-005

TYPICAL - DRY

NOTE: A second application may be necessary for heavily soiled elements.

Foam Filter Oiling

1. Carefully remove foam filter from air paper filter.
2. Spray recommended air filter oil on the foam filter.

RECOMMENDED PRODUCT	
AIR FILTER OIL (P/N 219 700 340)	


vbs2009-012-014

TYPICAL - OIL THE FOAM FILTER

3. Let stand for 3 to 5 minutes.
4. Remove any excess of oil that could transfer to the air paper filter by wrapping the foam filter into an absorbent cloth and squeezing gently. This will also ensure a full oil coverage on foam filter.

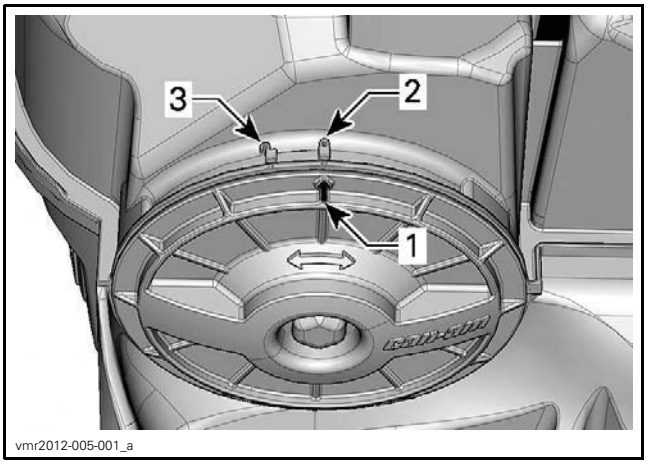
Engine Air Filter Installation

Reinstall oiled foam filter on paper air filter.

Slightly grease O-ring seal and plastic body of air filter. Refer to *AIR INTAKE SYSTEM* exploded view.

Install filter assembly in air filter housing.

Ensure air filter cover is properly locked onto the air filter housing. See indications on filter cover and housing.



1. *Cover position arrow*
2. *Locked*
3. *Unlocked*

ENGINE (EXHAUST SYSTEM)

Muffler Spark Arrester Cleaning

The muffler must be periodically purged of accumulated carbon.

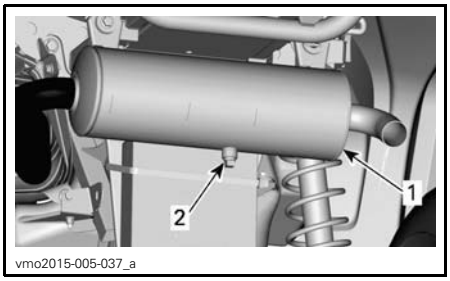
⚠ WARNING

Never run engine in an enclosed area. Never perform this operation immediately after the engine has been run because exhaust system is very hot. Make sure that there are no combustible materials in the area. Wear eye protection and gloves. Never stand behind the vehicle while purging exhaust system. Respect all applicable laws and regulations.

Select a well-ventilated area and make sure the muffler is cool.

Place transmission on PARK position.

Remove the clean out plug of the muffler.



TYPICAL
1. *Muffler*
2. *Clean out plug*

Block the end of the muffler with a shop rag and start engine.

Momentarily increase engine RPM several times to purge accumulated carbon out of the muffler.

Stop engine and allow muffler to cool.

Reinstall the clean out plug.

ENGINE (LUBRICATION SYSTEM)

Recommended Engine Oil

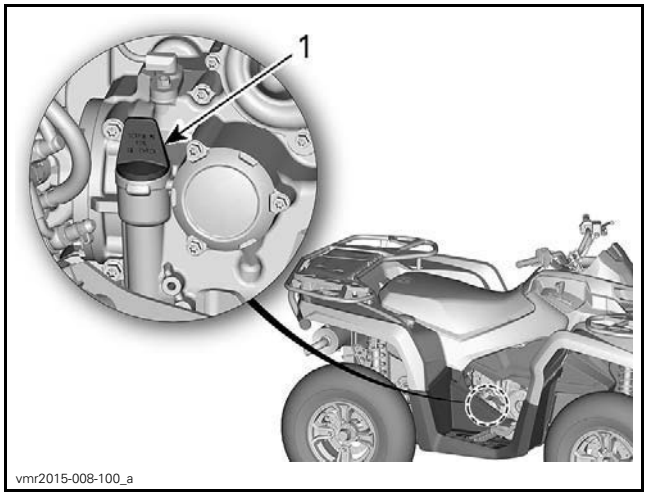
RECOMMENDED ENGINE OIL	
SEASON	TYPE
Summer	XPS 4-STROKE SYNTH. BLEND OIL (SUMMER) (P/N 293 600 121)
Winter	XPS 4-STROKE SYNTHETIC OIL (ALL CLIMATE) (P/N 293 600 112)

If recommended XPS oil is not available, use a 4-stroke SAE 5W 40 engine oil that meets or exceeds the requirements for API service classification SG, SH or SJ. Always check the API service label certification on the oil container, it must contain at least one of the above standards.

Engine Oil Level Verification

NOTICE **Operating the engine with an improper level may severely damage engine.**

NOTE: While checking the oil level, visually inspect engine area for leaks.

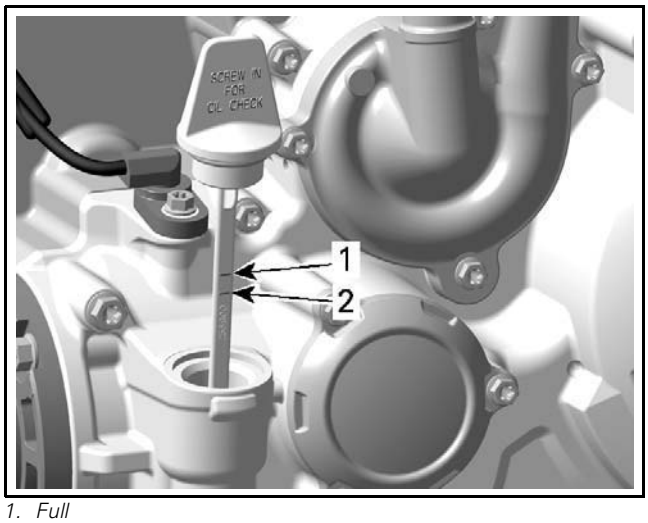


RH SIDE OF ENGINE
1. *Dipstick*

NOTE: Do not lose the O-ring placed on the dipstick.

With vehicle on a level surface and engine cold, not running, check the oil level as follows:

1. Unscrew dipstick then remove it and wipe clean.
2. Reinstall dipstick, screw in it completely.
3. Remove and check oil level. It should be near or equal to the upper mark.



1. Full
2. Add

To add oil, remove the dipstick. Place a funnel into the dipstick orifice.

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

Repeat the above procedures until oil level reaches the dipstick's upper mark.

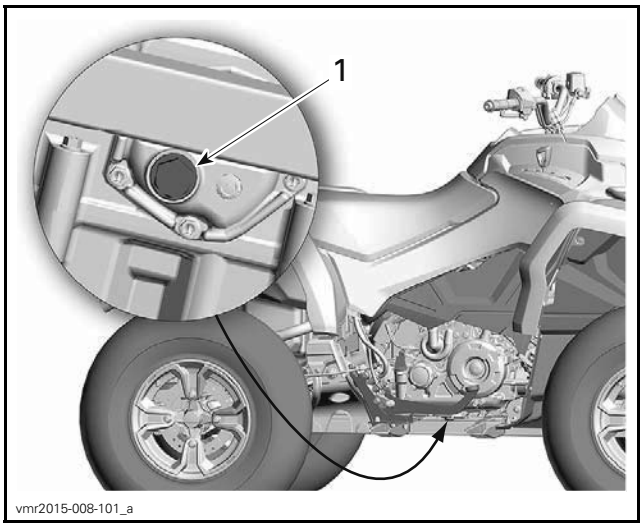
NOTE: Do not overfill. Wipe off any spillage.

Properly tighten dipstick.

Engine Oil Change

1. Start and warm-up engine.
2. Stop engine.
3. Ensure vehicle is on a level surface.
4. Remove dipstick.
5. Place a drain pan under the engine drain plug area.
6. Clean the drain plug area.
7. Unscrew drain plug and discard the gasket ring.

⚠ CAUTION The engine oil can be very hot.



1. Drain plug

NOTE: Allow oil to drain completely from the crankcase.

8. Clean the magnetic drain plug from metal shavings and residue. Presence of debris gives an indication of internal engine damage.
9. Install a NEW gasket ring on the drain plug.

NOTICE Never use the gasket ring a second time. Always replace by a new one.

10. Install and tighten drain plug to the recommended torque.

DRAIN PLUG	
Gasket ring	New
Tightening torque	30 N•m ± 2 N•m (22 lbf•ft ± 1 lbf•ft)

11. Replace oil filter. Refer to *ENGINE OIL FILTER REPLACEMENT* in this subsection.
12. Refill engine with recommended engine oil.

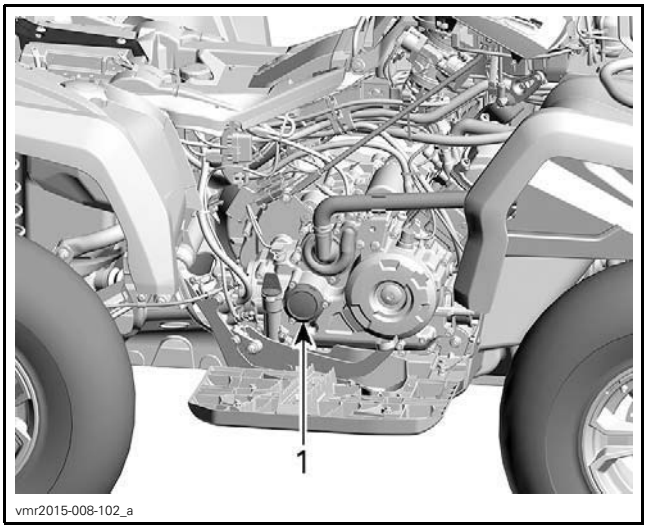
ENGINE OIL CAPACITY
3 L (3.2 qt (U.S. liq.))

13. After filling, check the oil level, refer to *ENGINE OIL LEVEL VERIFICATION* in this subsection.
14. Start engine and let it idle for a few minutes.
15. Ensure oil filter and drain plug areas are not leaking.
16. Stop engine.
17. Wait a while to allow oil to flow down to crankcase, then check oil level again.
18. Dispose oil and filter as per your local environmental regulations.

Engine Oil Filter Replacement

Engine Oil Filter Access

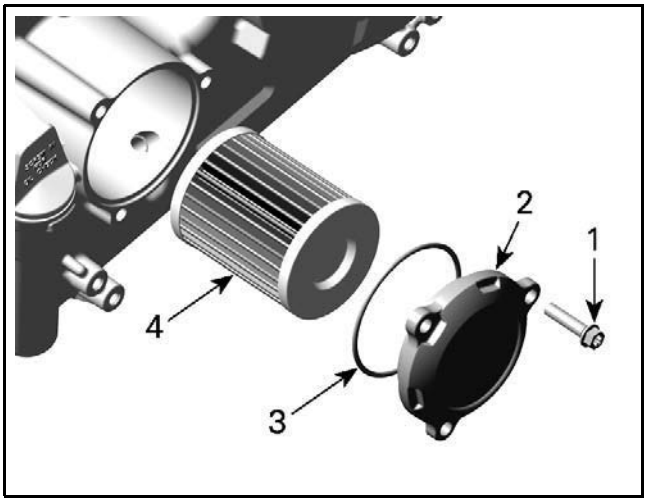
To reach oil filter, refer to *BODY* and remove the following parts:
– Seat
– Console
– RH side panel and extension(s)
– RH footrest panel.



1. Oil filter cover

Engine Oil Filter Removal

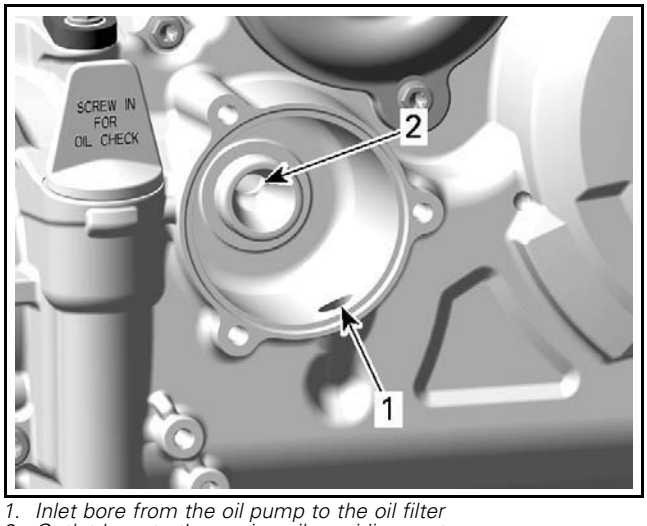
1. Clean oil filter area.
2. Remove oil filter cover screws.
3. Remove oil filter cover.
4. Remove oil filter.



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

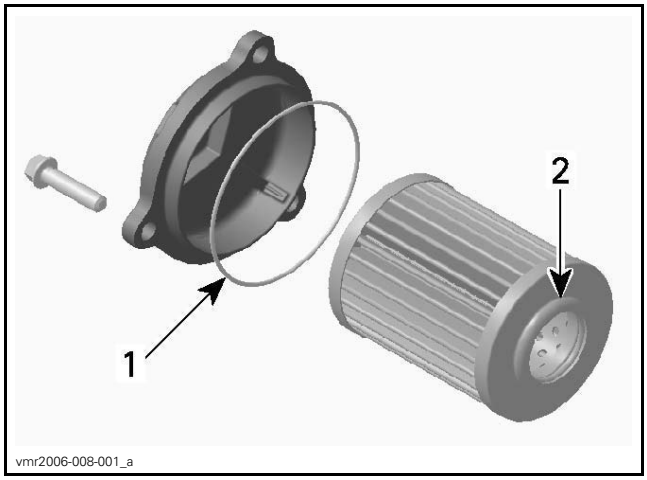
Engine Oil Filter Installation

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



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

2. Install a **NEW** O-ring on oil filter cover.
3. Install the filter into the cover.
4. Apply engine oil on O-ring and on end of filter.



1. Slightly oil
2. Slightly oil

5. Install the cover on the engine.
6. Tighten oil filter cover screws to recommended torque.

OIL FILTER COVER SCREWS	
Tightening torque	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

7. Reinstall remaining parts if applicable.

ENGINE (COOLING SYSTEM)

Recommended Engine Coolant

COOLANT	
BRP RECOMMENDED PRODUCT	BRP premixed coolant LONG LIFE ANTIFREEZE (P/N 219 702 685)
ALTERNATIVE, OR IF NOT AVAILABLE	Distilled water/antifreeze solution (50%/50%)

NOTICE Always use ethylene-glycol antifreeze containing corrosion inhibitors specifically formulated for internal combustion aluminum engines.

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

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 and does not have the same efficiency.

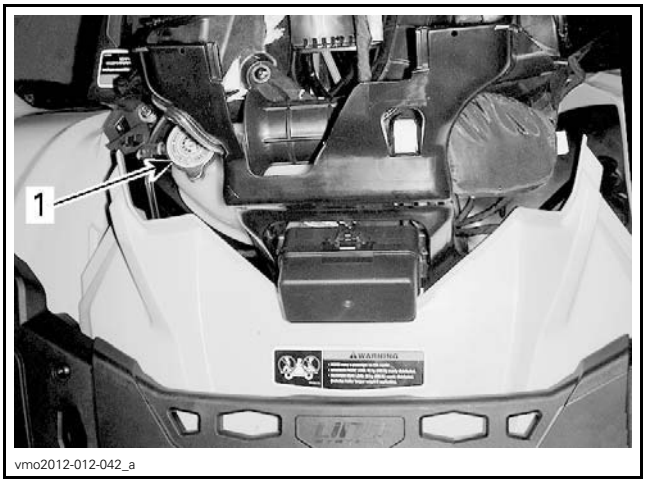
Engine Coolant Level Verification

⚠ WARNING

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

1. Place vehicle on a level surface.
2. Remove the gauge support. Refer to *BODY* subsection.

With the vehicle on a level surface, coolant level should be between the MIN. and MAX. marks of the reservoir.



TYPICAL
1. Engine coolant reservoir

NOTE: When checking level at temperature lower than 20°C (68°F), it may be slightly lower than MIN. mark.

3. Add coolant up to MAX. mark if required.

⚠ WARNING

Do not remove the coolant reservoir cap if engine is hot.

4. Use a funnel to avoid spillage. **Do not overfill.**
5. Properly reinstall and tighten reservoir cap.
6. Reinstall gauge support.

NOTICE **Do not store any objects under the gauge support.**

Engine Coolant Specific Gravity Check

1. Remove gauge support. Refer to *BODY* subsection.
2. Remove pressure cap.

⚠ WARNING

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

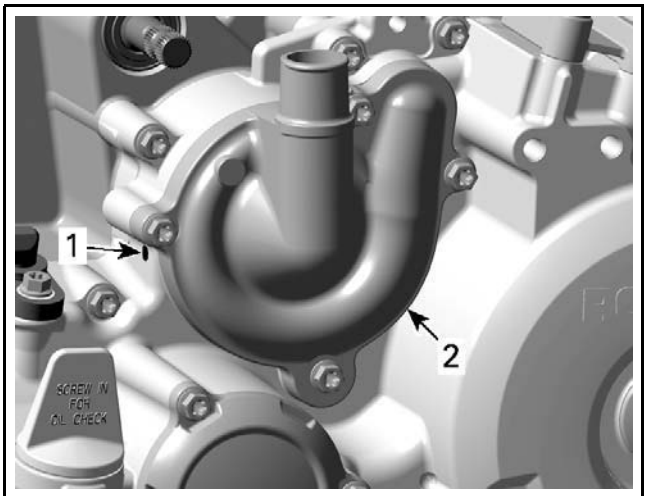
3. Using an antifreeze tester, test coolant strength.

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

Engine Cooling System Inspection

1. Check general condition of hoses and clamps for tightness.
2. Check the leak indicator hole for oil or coolant.

NOTE: Leaking coolant indicates a defective rotary seal. Leaking oil indicates a defective oil seal. If either seal is leaking, both seals must be replaced at the same time. Refer to *WATER PUMP SHAFT AND SEALS* in the *COOLING SYSTEM* subsection.



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1. Leak indicator hole
2. Water pump cover

3. Ensure vent hose on coolant expansion tank is not obstructed.

Engine Cooling System Pressure Cap Test

1. Remove gauge support. Refer to *BODY* subsection.
2. Remove pressure cap.

⚠ WARNING

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

3. Test the pressure cap using a cooling system tester.
4. Replace the cap if it does not hold the pressure, or if it opens at a relief pressure that is too low or too high.

PRESSURE CAP RELIEF PRESSURE
Approximately 110 kPa (16 PSI)

Engine Cooling System Leak Test

1. Remove gauge support. Refer to *BODY* subsection.
2. Remove pressure cap.

⚠ WARNING

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

3. Pressurize cooling system as follows.

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

COOLING SYSTEM LEAK TEST
110 kPa (16 PSI)

If there is no pressure drop after 10 minutes, there is no leak in the cooling system.

If the pressure drops, check all hoses, radiator, cylinders and engine base for coolant leaks or air bubbles.

Engine Coolant Replacement

Engine Cooling System Draining

⚠ CAUTION Engine coolant can be very hot. Coolant draining should be carried out on a cold engine.

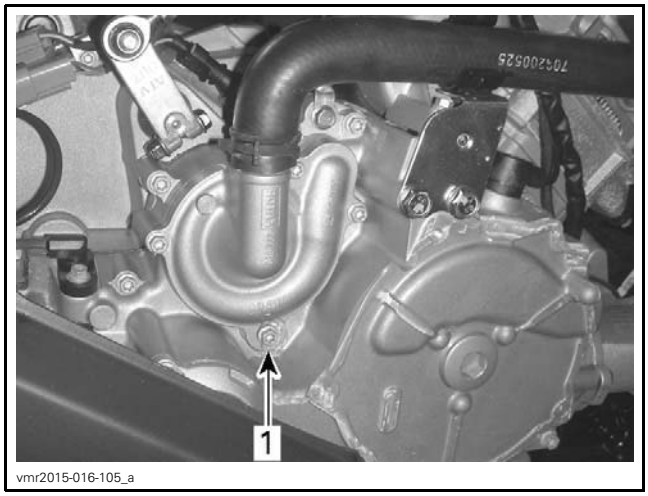
1. Remove gauge support. Refer to *BODY* subsection.
2. Remove cooling system pressure cap.



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TYPICAL
1. Cooling system pressure cap

3. Unscrew coolant drain plug.



TYPICAL - SOME PARTS REMOVED FOR CLARITY
1. Coolant drain plug

4. Drain cooling system into a suitable container.
5. Disconnect the lower radiator hose and drain the remaining coolant.

NOTE: Take note of the hose clamp position before it is loosened for hose removal.

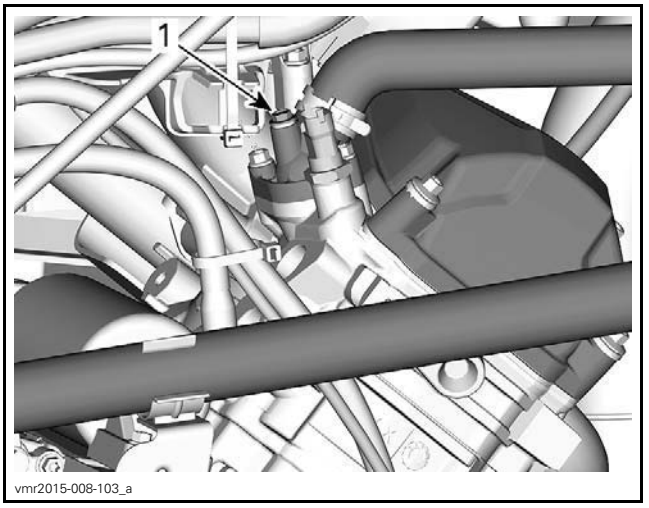
6. Reinstall coolant drain plug with a NEW gasket ring.
7. Tighten coolant drain plug to specification.

COOLANT DRAIN PLUG	
Gasket ring	NEW
Tightening torque	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

8. Fill cooling system with recommended coolant, refer to *COOLING SYSTEM FILLING AND BLEEDING* procedure.

Engine Cooling System Filling and Bleeding

1. Remove cooling system pressure cap.
2. Remove RH side panel. Refer to *BODY* subsection.
3. Unscrew bleed screw on thermostat housing cover.



1. Bleed screw

4. Fill cooling system until coolant comes out of bleed screw.
5. Squeeze the top of the coolant hose between the radiator and coolant pump several times to bleed all air from the highest point of the hose.
6. Install bleed screw using NEW gasket ring.
7. Tighten bleed screws to specification.

BLEED SCREW	
Gasket ring	NEW
Tightening torque	5.0 N•m ± 0.6 N•m (44 lbf•**in** ± 5 lbf•**in**)

8. Refill coolant tank up to MAX level mark.
9. Install cooling system pressure cap.
10. Run engine at idle with the pressure cap ON until the cooling fan cycles on for a second time.
11. Stop the engine and let it cool down.

⚠ WARNING

Do not remove the pressure cap if the engine is hot.

12. Check coolant level in the coolant tank. Refer to *ENGINE COOLANT LEVEL VERIFICATION* in this subsection.
13. Add coolant if required.

ENGINE (CYLINDER HEAD)

Engine Valve Clearance Inspection and Adjustment

NOTE: Check and adjust valve clearance only when engine is cold.

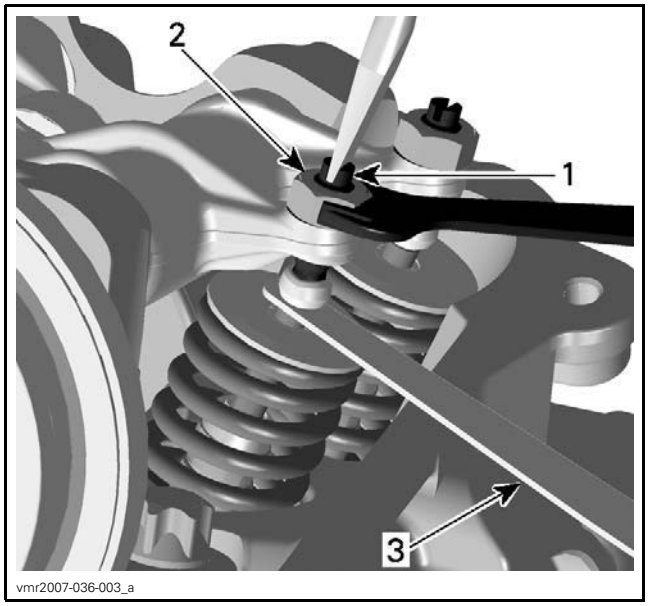
1. Remove valve cover, refer to *TOP END* subsection.
2. Before checking or adjusting the valve clearance, turn crankshaft clockwise to TDC ignition, refer to *CRANKSHAFT LOCKING PROCEDURE* in the *BOTTOM END* subsection.
3. Using a feeler gauge, check the valve clearance.

VALVE CLEARANCE	
EXHAUST	0.11 mm to 0.19 mm (.0043 in to .0075 in)
INTAKE	0.06 mm to 0.14 mm (.0024 in to .0055 in)

If the valve clearance is out of specification, adjust valves as follows.

NOTE: Use the center value of exhaust/intake specification to ensure a proper valve adjustment.

4. Hold the adjustment screw at the proper position and torque the locking nut.



1. Adjustment screw
2. Locking nut
3. Feeler gauge

5. Repeat the procedure for each valve.
6. Before installing valve covers, recheck valve clearance.

CONTINUOUSLY VARIABLE TRANSMISSION (CVT)

CVT Air Inlet/Outlet Cleaning

1. Remove CVT cover, refer to *CONTINUOUSLY VARIABLE TRANSMISSION (CVT)* subsection.
2. Inspect and clean the air inlet and outlet openings from inside the CVT cover.
3. Inspect and clean the air outlet duct connected to the exhaust system heat shield under the seat.

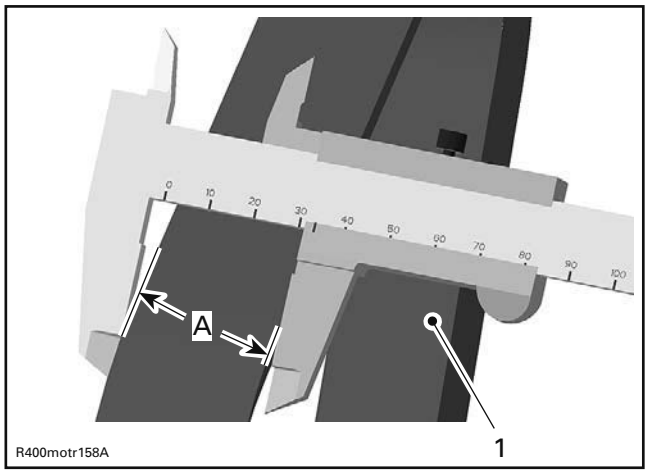
NOTE: If a lot of debris or grime are found in the CVT system, it may be necessary to remove the ducts and thoroughly clean them.

4. Reinstall CVT cover.

Drive Belt Inspection

1. Inspect belt for cracks, fraying or abnormal wear. Replace if necessary.
2. Check drive belt width at cord level. Replace if it is out of specification (see table below).

DRIVE BELT WIDTH	
SERVICE LIMIT	30 mm (1.181 in)



1. Drive belt
A. Belt width

Drive Pulley, Driven Pulley and One-Way Bearing Maintenance

Refer to *CONTINUOUSLY VARIABLE TRANSMISSION (CVT)* subsection.

FUEL SYSTEM

Throttle Body Inspection and Cleaning

1. Refer to *AIR INTAKE SYSTEM* subsection and remove the following.
   – Air filter housing.
2. Visually inspect throttle plate and throttle body venturi for cleanliness.
3. Clean inside throttle body if necessary. Refer to *ELECTRONIC FUEL INJECTION (EFI)*.

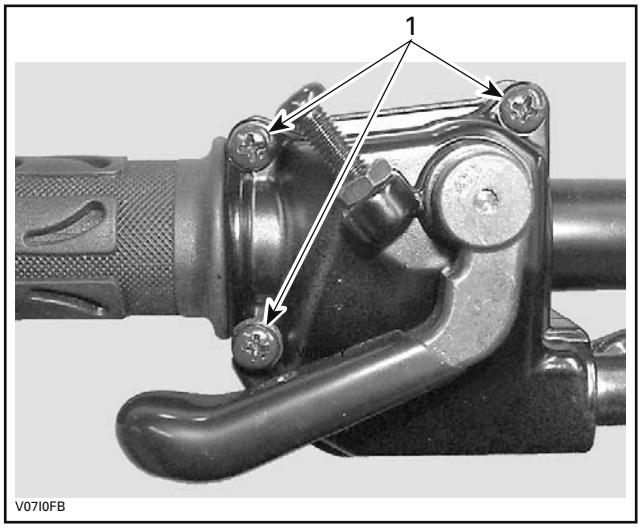
Throttle Cable Lubrication

The throttle cable must be lubricated with CABLE LUBRICANT (P/N 293 600 041) or an equivalent.

⚠ WARNING

Always use a silicone-based lubricant. Using another lubricant (like a water-based lubricant) could cause the throttle lever/cable to become sticky and stiff.

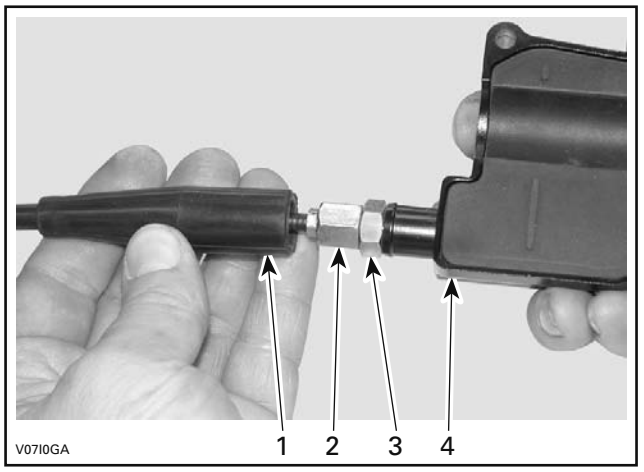
Open the throttle lever housing.



1. Remove these screws

Separate the housing.

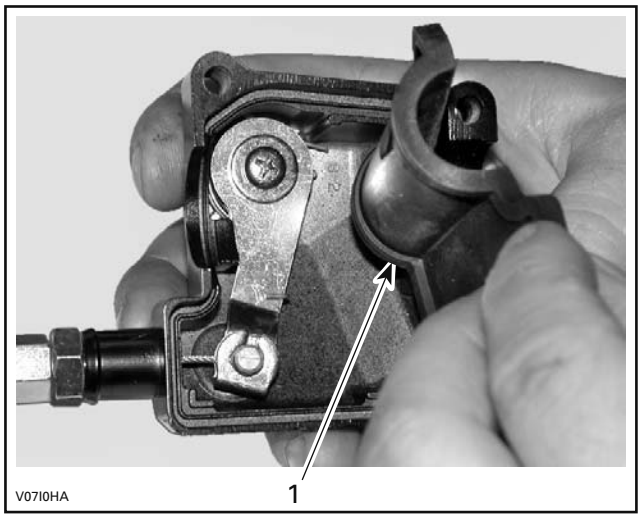
Slide rubber protector back to expose throttle cable adjuster.



1. Cable protector
2. Throttle cable adjuster
3. Lock nut
4. Throttle lever housing

Screw in the throttle cable adjuster.

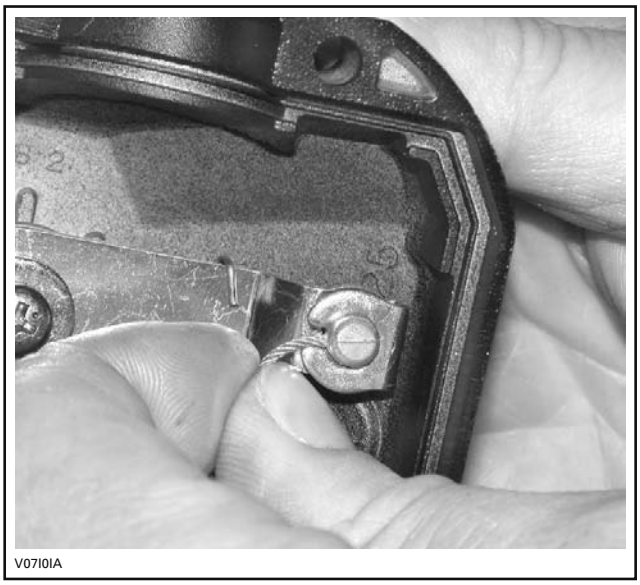
Remove inner housing protector.



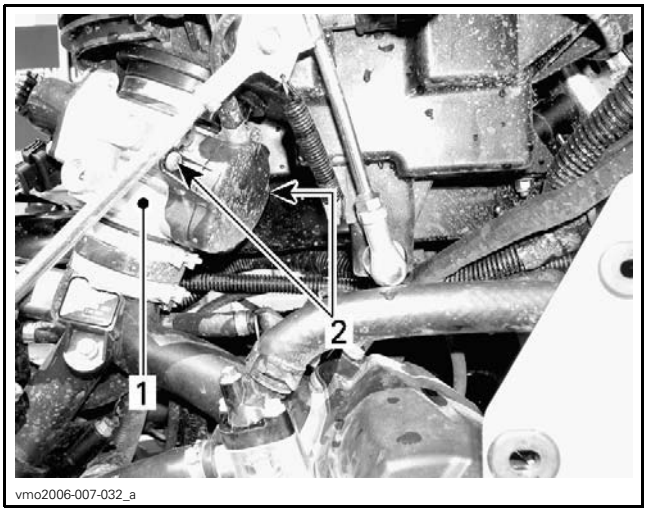
1. Inner housing protector

Remove the cable from the throttle lever housing.

NOTE: Slide cable in clip slot and remove the end of cable from clip.


V07I0IA

Remove the throttle body side cover.



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1. *Throttle body*
2. *Side cover screws*

Insert the needle of the lubricant can in the end of throttle cable adjuster.

⚠ CAUTION Always wear appropriate skin and eye protection. Chemicals can cause a skin rash and eye injury.


V07I0JA

TYPICAL

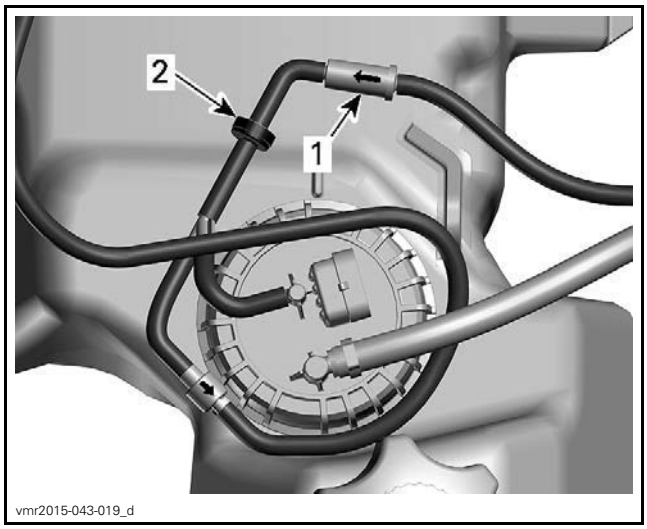
NOTE: Place a rag around the throttle cable adjuster to prevent the lubricant from splashing.

Add lubricant until it runs out at throttle body end of the throttle cable.

Reinstall and adjust the cable. Refer to *ELECTRONIC FUEL INJECTION* subsection.

Fuel Tank Vent Breather Filter Replacement

Ensure breather filter is installed with the flow arrow pointing towards the vent inlet check valve.



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1. *Vent breather filter*
2. *Vent inlet check valve*

Fuel System Inspection

1. Visually inspect fuel tank for cracks, wear marks, signs of leakage or any other damages.
2. Visually inspect fuel system hoses for proper rooting, cracking, wear marks, signs of leakage or any other damages.

3. Carry out a *FUEL TANK LEAK TEST*, refer to *FUEL TANK AND FUEL PUMP* subsection.

⚠ WARNING

All fuel system leaks must be repaired. Damaged, worn or leaking fuel system components should be replaced to ensure fuel system tightness.

Fuel Pump Pressure Test

Refer to *FUEL TANK AND FUEL PUMP* subsection for procedure.

Fuel Pump Prefilter Cleaning

1. Remove fuel pump from fuel tank, refer to *FUEL PUMP REMOVAL* in *FUEL TANK AND FUEL PUMP* subsection.
2. Clean the fuel pump prefilter (strainer) using XPS BRAKES AND PARTS CLEANER (P/N 219 701 776) or XPS BRAKES AND PARTS CLEANER (USA) (P/N 219 701 705) and low pressure air.
3. If the fuel pump prefilter is heavily soiled, clogged or damaged:
   - Replace it with a new one. Refer to *FUEL PUMP STRAINER REPLACEMENT* in the *FUEL TANK AND FUEL PUMP* subsection.
   - Inspect inside of fuel tank for contaminants.
   - Clean fuel tank as required.
   - Inspect fuel tank vent breather filter. Replace as necessary. Refer to *FUEL TANK VENT BREATHER FILTER REPLACEMENT* in this subsection.

ELECTRICAL SYSTEM

Battery Inspection

Visually inspect battery casing for cracks or other damage. If casing is damaged, replace battery and thoroughly clean battery rack with water and sodium bicarbonate (baking soda).

Inspect battery posts condition and battery retainer plate.

For battery testing, refer to *CHARGING SYSTEM* subsection.

Spark Plug Replacement

Spark Plug Access

Remove the LH inner fender panel. Refer to *BODY* subsection.

Spark Plug Removal

1. Remove spark plug cable from spark plug.
2. Clean the spark plug area using pressurized air.
3. Remove spark plug.

Spark Plug Installation

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

1. Using a wire feeler gauge, set electrode gap as specified in *TECHNICAL SPECIFICATIONS*.
2. Apply antiseize lubricant over the spark plug threads to prevent possible seizure.

NOTICE **Do not apply antiseize lubricant on the first 2 spark plug threads.**

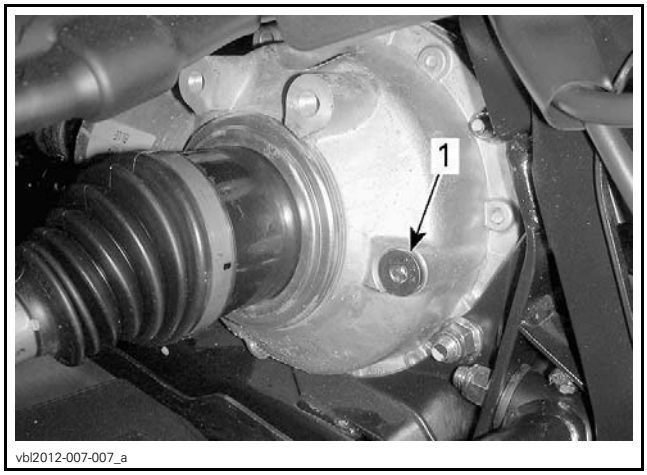
3. Hand screw spark plug into cylinder head, then tighten to specification using a torque wrench and an appropriate socket.

SPARK PLUG	
Tightening torque	11 N•m ± 1 N•m (97 lbf•**in** ± 9 lbf•**in**)

DRIVE SYSTEM

Front Differential Oil Level Verification

1. Clean filler plug prior to checking oil level.



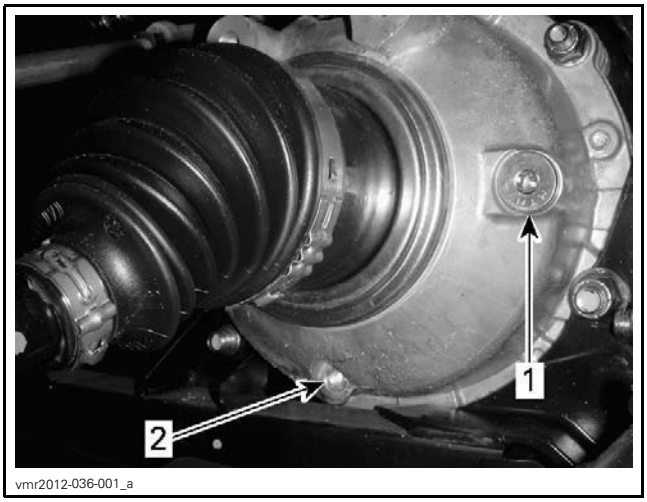
RH SIDE OF VEHICLE
1. Filler plug

2. With vehicle on a level surface, check oil level by removing filler plug. Oil level must reach the lower edge.
3. Reinstall filler plug with a NEW sealing ring.

FILLER PLUG	
Gasket	NEW
Tightening torque	22.5 N•m ± 2.5 N•m (17 lbf•ft ± 2 lbf•ft)

Front Differential Oil Replacement

1. Place vehicle on a level surface. Set transmission in park position.
2. Place a drain pan under the front differential.
3. Remove drain plug.
4. Remove filler plug.



RH SIDE OF VEHICLE
1. Filler plug
2. Drain plug

5. Lift LH side of vehicle to completely drain front differential.

NOTE: Allow enough time for oil to flow out.

6. Lower vehicle on the ground.
7. Install and tighten drain plug to specification.

DRAIN PLUG	
Tightening torque	7.5 N•m ± 0.5 N•m (66 lbf•**in** ± 4 lbf•**in**)

8. Refill front differential with recommended oil.

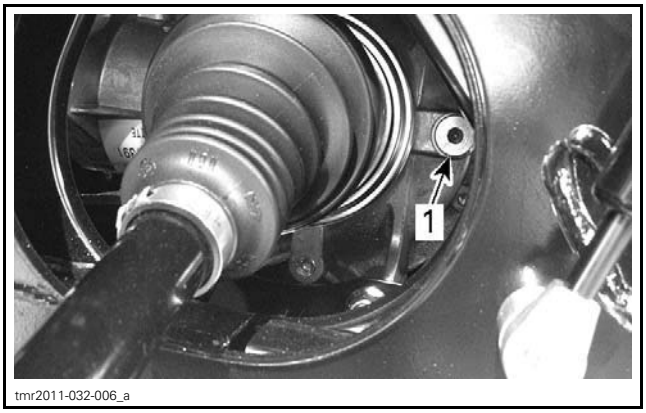
RECOMMENDED OIL	QUANTITY
XPS SYNTHETIC GEAR OIL (75W 90) (P/N 293 600 043) or a 75W 90 (API GL-5) gear oil	500 ml (17 U.S. oz)

9. Reinstall filler plug with a NEW sealing ring.
10. Tighten filler plug to specification.

FILLER PLUG	
Gasket	NEW
Tightening torque	22.5 N•m ± 2.5 N•m (17 lbf•ft ± 2 lbf•ft)

Rear Final Drive Oil Level Verification

1. Ensure vehicle is on a level surface.
2. Clean filler plug area.
3. Remove filler plug.



LH REAR SIDE OF VEHICLE
1. Filler plug

4. Verify the oil level by inserting a wire with a 90° bend through the oil filler hole.
5. Oil level must be within the following specification from the bottom of oil filler hole.

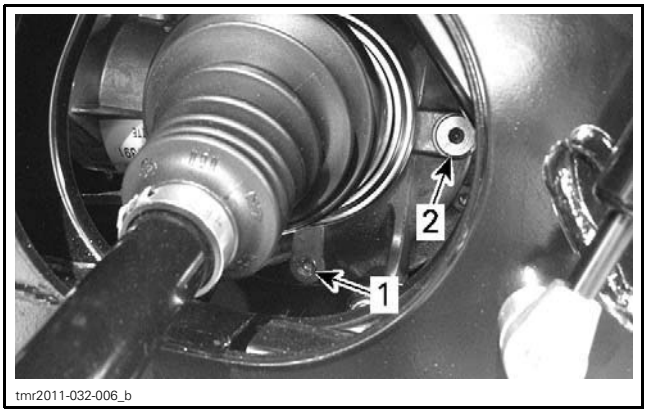
OIL LEVEL
20 mm ± 5 mm (9/16 in ± 3/16 in)

6. Reinstall filler plug with a NEW sealing ring.

FILLER PLUG	
Gasket	NEW
Tightening torque	22.5 N•m ± 2.5 N•m (17 lbf•ft ± 2 lbf•ft)

Rear Final Drive Oil Replacement

1. Ensure vehicle is on a level surface.
2. Clean filler and drain plug areas.
3. Place a drain pan under rear final drive.
4. Unscrew filler plug.
5. Remove drain plug.



LH REAR SIDE OF VEHICLE
1. *Drain plug*
2. *Filler plug*

6. Install drain plug.

DRAIN PLUG	
Tightening torque	7.5 N•m ± 0.5 N•m (66 lbf•**in** ± 4 lbf•**in**)

7. Refill the rear final drive.

RECOMMENDED OIL	QUANTITY
XPS SYNTHETIC GEAR OIL (75W 140) (P/N 293 600 140) or a 75W 140 (API GL-5) gear oil	300 ml (10 U.S. oz)

8. Reinstall filler plug with a NEW sealing ring.

FILLER PLUG	
Gasket	NEW
Tightening torque	22.5 N•m ± 2.5 N•m (17 lbf•ft ± 2 lbf•ft)

Drive Shaft Boot and Protector Inspection

1. Visually inspect each drive shaft boot for grease leak, cracks or opening.
2. Check if the drive shaft boot protectors are fixed firmly, not torn or otherwise damaged.
3. Replace if necessary.

Drive Shaft Joint Inspection

Turn and move drive shaft back and forth to detect excessive play.

Rear Propeller Shaft U-Joint Condition

Check yoke U-joints for wear, backlash or axial play. Replace if necessary.

Rear Propeller Shaft U-Joint Lubrication

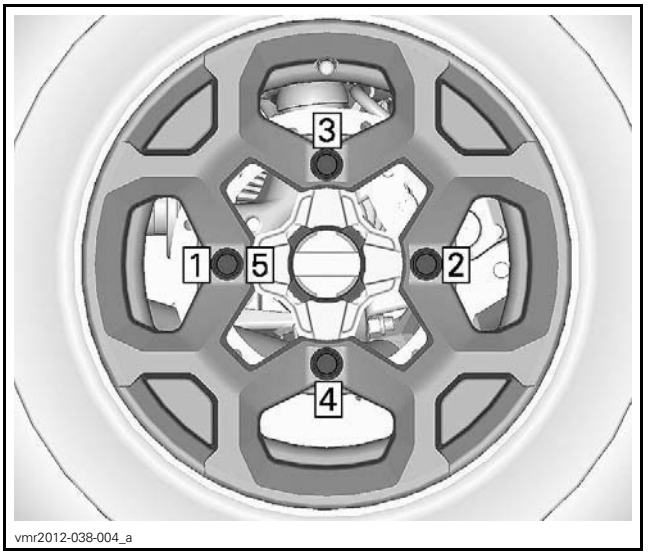
PROPELLER SHAFT U-JOINT LUBRICATION
Use Hi-temp bearing grease NLGI-2 or an equivalent

CHASSIS (WHEELS AND TIRES)

Wheel Lug Nut Torque Inspection

Tighten wheel lug nuts to the specified torque using the illustrated sequence.

WHEEL LUG NUTS	
Tightening torque	100 N•m ± 10 N•m (74 lbf•ft ± 7 lbf•ft)



TIGHTENING SEQUENCE

Wheel Bearing Inspection

1. Safely lift and support the front of vehicle.
2. Hold wheel by the top and the bottom and try to move it by pulling and push alternately with both hands. Check for any play.
3. If there is any looseness detected, replace the wheel bearing. refer to *STEERING SYSTEM* subsection.

NOTE: To properly locate play during this inspection, be sure to check other components for wear or looseness (ball joints, suspension pivots, etc). If necessary repair or replace all defective parts before checking the wheel bearing condition. Be careful not to misinterpret a loose ball joint as a loose wheel bearing.

CHASSIS (STEERING SYSTEM)

Steering System Inspection

Steering Column

Turn and move steering column back and forth to detect any abnormal play.

If abnormal play is detected, inspect upper and lower steering column half bushings. Replace halve bushings and O rings as necessary, refer to *STEERING SYSTEM* subsection.

If steering column feels stiff, refer to *STEERING COLUMN HALF BUSHING CLEANING AND LUBRICATION* in this subsection.

Tie-Rod End

Check tie-rod end ball joint for:
– Damage
– Pitting
– Abnormal play.

Replace if necessary.

Steering Column Half Bushing Cleaning and Lubrication

Clean, inspect and lubricate upper and lower steering column half bushings and O rings. Refer to *STEERING SYSTEM* subsection.

CHASSIS (SUSPENSION)

Shock Absorber Inspection

Check shock absorber for any leaks, replace if necessary.

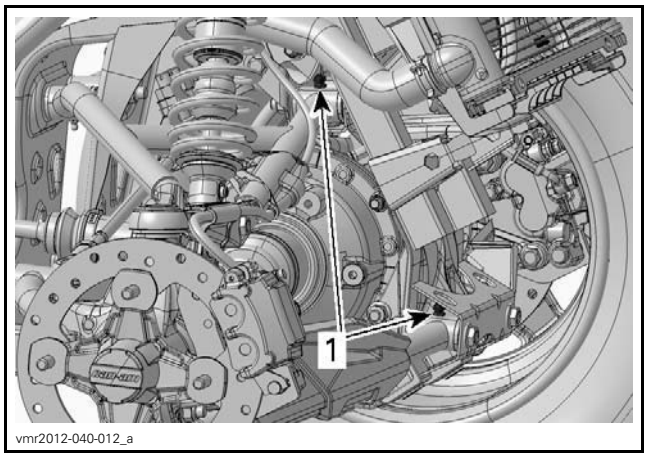
Check shock absorber for abnormal play:
– Front to back
– Up and down.

If any play is detected, replace shock absorber bushings. Refer to *REAR SUSPENSION* subsection.

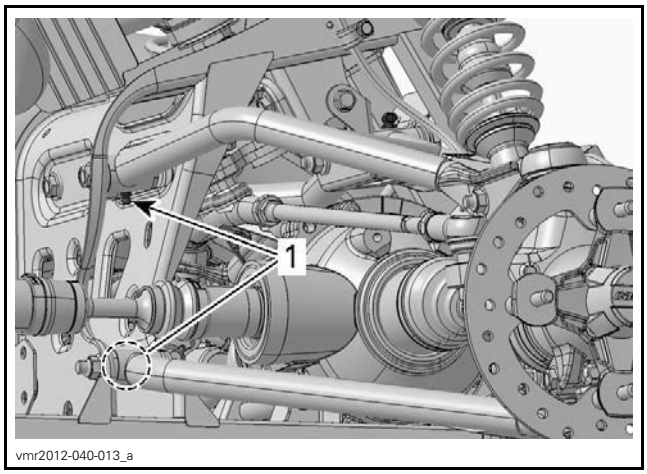
Front Suspension Arm Lubrication

Lubricate suspension arm at grease fittings.

SUSPENSION ARM LUBRICATION
SUSPENSION GREASE (P/N 293 550 033)



TYPICAL
1. Grease fittings



TYPICAL
1. Grease fittings

Front Suspension Arm Inspection

1. Check suspension arm for:
   – Cracks
   – Pitting
   – Bending
   – Distortion.
2. Check suspension arm for abnormal play:
   – Side to side
   – Up and down.
3. If any play is detected, inspect:
   – Wear plates
   – Bushings
   – Sleeves.
4. Check ball joint for:
   – Damage
   – Pitting
   – Play.

5. Check ball joint bellows for:
   – Damage
   – Cracks.

Rear Suspension Arm Inspection

1. Check suspension arm for:
   – Cracks
   – Pitting
   – Bending
   – Distortion.
2. Check suspension arm for abnormal play:
   – Side to side
   – Up and down.
3. If any play is detected, inspect:
   – Spacers
   – Bearings
   – Inner spacers.
4. Check ball joint for:
   – Damage
   – Pitting
   – Play.
5. Check ball joint bellows for:
   – Damage
   – Cracks.

Rear Anti-Sway Bar Bushing Inspection and Lubrication

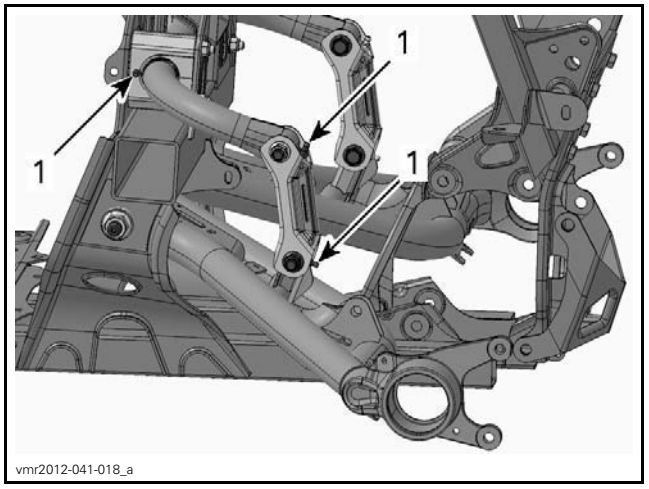
Rear Anti-Sway Bar Bushing Inspection

Inspect bushings for:
– Cracks
– Damage
– Abnormal wear.

Rear Anti-Sway Bar Bushing Lubrication

Lubricate bushings at grease fittings.

LUBRICATION	
Anti-sway bar bushing	SUSPENSION GREASE (P/N 293 550 033)



TYPICAL
1. Grease fittings

CHASSIS (BRAKES)

Brake System Inspection and Cleaning

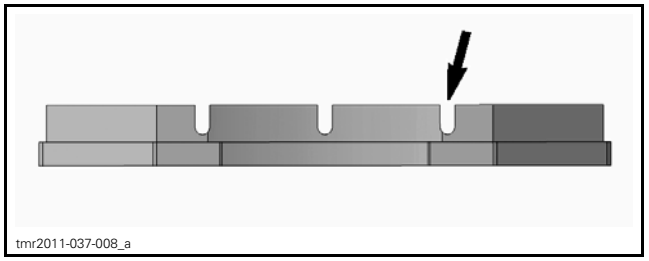
NOTICE Do not clean brake components in petroleum based solvent. Use brake system cleaner only. Soiled brake pads must be replaced with new ones.

Brake Pads

1. Measure brake pad lining thickness.

BRAKE PAD MINIMUM THICKNESS
1 mm (1/32 in)

NOTE: The brake pad grooves are wear indicators.



BRAKE PAD GROOVE

⚠ WARNING

Brake pads must always be replaced in pairs.

Brake Caliper

1. Remove caliper then check the following components:
   – Check brake pad pin
   – Check caliper boots for cracks
   – Check caliper movement on its support

– Check pistons movement
– Check pistons for scratches, rust or other damages.

2. Clean the following components using XPS BRAKES AND PARTS CLEANER (P/N 219 701 776) or XPS BRAKES AND PARTS CLEANER (USA) (P/N 219 701 705):
   – Brake pads
   – Caliper support and slider
   – Caliper pistons and pin.

NOTE: Do not remove pistons from caliper for cleaning them.

3. Lubricate caliper slider using an appropriate *BRAKE CALIPER SYNTHETIC GREASE*.

Brake Disc

1. Check brake disc as follows:
   – Check disc thickness
   – Check disc surfaces
   – Check disc warpage.

NOTE: Refer to *BRAKE DISC INSPECTION* in *BRAKES* subsection for details.

2. Clean brake disc using XPS BRAKES AND PARTS CLEANER (USA) (P/N 219 701 705).

Master Cylinder

1. Check master cylinder as follows:
   – Leaks or damages.
   – Brake fluid level.
   – Check cleanliness of master cylinder rod and boot.
   – Check master cylinder boot for cracks or damage. Replace as necessary.

Hand Lever

Check hand lever as follows:
– Lever pivot bolt cleanliness
– Lever pivot bolt movement.

Brake Pedal

1. Check brake pedal as follows:
   – Brake pedal pivot movement
   – Brake pedal pivot cleanliness.

2. If required, clean then lubricate brake pedal pivot using XPS SYNTHETIC GREASE (P/N 293 550 010).

Brake Hoses

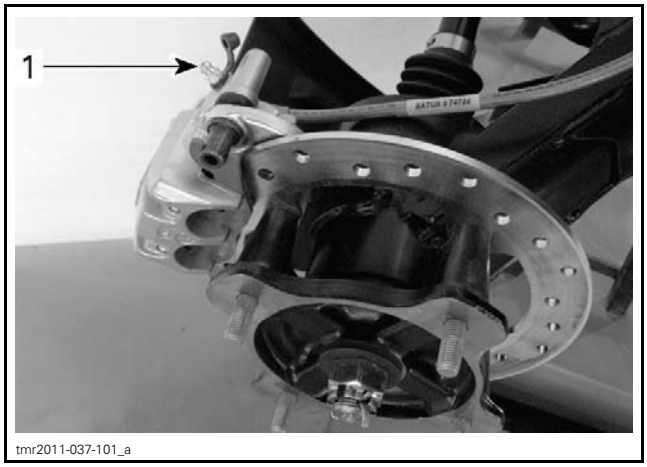
1. Check hoses for leaks, crushed, deformations, cracking or scrapes.

NOTE: Any deformation can restrict the proper flow of fluid and cause braking problems.

Brake Fluid Replacement

Brake Fluid Draining

1. Clean and remove reservoir cover with its diaphragm.
2. Connect a clear hose onto bleeder.



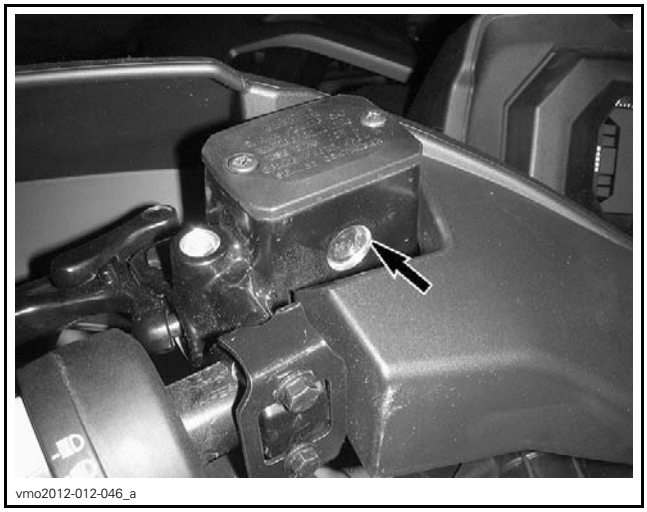
TYPICAL
1. Caliper bleeder

3. Loosen bleeder.
4. Pump brake lever(s) and/or brake pedal until no more fluid flows out.
5. Repeat draining procedure for the other bleeders.

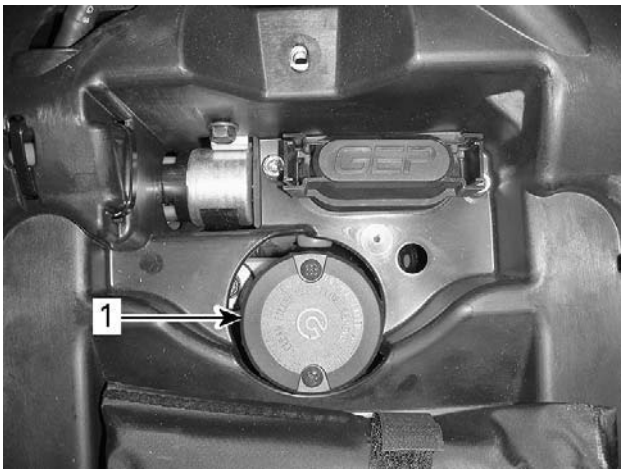
NOTE: To locate all bleeders according to vehicle configuration, refer to *EXPLODED VIEW* and *BRAKE CIRCUIT CONFIGURATIONS*. See *BRAKES* subsection.

Brake Fluid Filling

1. Add recommended brake fluid to MAX. mark. Do not overfill.



TYPICAL - BRAKE FLUID RESERVOIR



TYPICAL - UNDER THE SEAT
1. Brake fluid reservoir

NOTE: If applicable, ensure filler cap diaphragm is fully retracted before closing the cap.

RECOMMENDED BRAKE FLUID
DOT 4 BRAKE FLUID GTLMA DOT4 (P/N 293 600 131)

⚠ WARNING

- Use only DOT 4 brake fluid from a sealed container.
- Do not use brake fluid from an old or already opened container.

Brake Fluid Bleeding (Procedure Using a Vacuum Pump)

NOTE: Brake fluid reservoir must be kept full to prevent air from being pumped into the system.

1. Unscrew all bleeders until brake fluid comes out then close it.

NOTE: To locate all bleeders according to vehicle configuration, refer to *EXPLODED VIEW* and *BRAKE CIRCUIT CONFIGURATIONS*. See *BRAKES* subsection.

2. Install the Vacuum/pressure pump onto bleeder.

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

3. Place pump to vacuum position.
4. Pump vacuum pump a few times.
5. Loosen bleeder.
6. Continue to pump until no more air bubbles appear in clear hose.
7. Close then tighten bleeder.

BLEEDER	
Tightening torque	5.5 N•m ± 1.5 N•m (49 lbf•**in** ± 13 lbf•**in**)

8. Add recommended brake fluid to MAX. mark. Do not overfill.
9. Perform bleeding procedure for the other bleeders.
10. Check brakes operation:
    – If brakes feel spongy, bleed system again then carry out the *BRAKE SYSTEM PRESSURE VALIDATION* as detailed in *BRAKES* subsection.

Brake Fluid Bleeding (Manual Procedure)

NOTE: Brake fluid reservoir must be kept full to prevent air from being pumped into the system.

1. Connect a clear hose onto bleeder.
2. Pump up system pressure slowly using brake pedal and/or lever(s) until resistance is felt.
3. Depress and hold brake pedal and/or lever(s).
4. Open bleeder and then close it.
5. Release brake pedal and/or lever(s) slowly.

NOTE: Do not release brake pedal and/or lever(s) until bleeder has been closed.

6. Repeat procedure until fluid flows out without any air bubbles.
7. Tighten bleeder.

BLEEDER	
Tightening torque	5.5 N•m ± 1.5 N•m (49 lbf•**in** ± 13 lbf•**in**)

8. Perform bleeding procedure for the other bleeders.

NOTE: To locate all bleeders according to vehicle configuration, refer to *EXPLODED VIEW* and *BRAKE CIRCUIT CONFIGURATIONS*. See *BRAKES* subsection.

9. Check brakes operation:
    – If brakes feel spongy, bleed system again then carry out the *BRAKE SYSTEM PRESSURE VALIDATION* as detailed in *BRAKES* subsection.

CHASSIS (BODY)

Seat Latch Inspection and Operation

Ensure seat latch functions properly and that seat is properly secured when latched.

CHASSIS (FRAME)

Frame Inspection

Inspect frame for damages such as:
- Cracks
- Dents
- Twisting
- Deformation
- Corrosion
- Loose fasteners.

Pay particular attention to:
- Front and rear frame extensions (body modules)
- Underside of frame
- Suspension attachment points
- Engine attachment points.

Tow Hitch Inspection

1. Ensure tow hitch receptacle module is solidly mounted.
2. Inspect hitch for cracks and other damages.
3. Repair or replace if necessary.

STORAGE PROCEDURE

SERVICE PRODUCTS

Description	Part Number	Page
BRP HEAVY DUTY CLEANER	293 110 001	55
XPS ALL PURPOSE CLEANER	219 701 709	55
XPS ATV CLEANING KIT	219 701 713	55
XPS ATV FINISHING SPRAY	219 701 704	55
XPS ATV WASH	219 701 702	54
XPS FUEL STABILIZER	413 408 601	53
XPS LUBE	293 600 016	54–55
XPS STORAGE OIL (EXCEPT U.S. COUNTRY)	413 711 600	53
XPS STORAGE OIL (U.S. COUNTRY ONLY)	413 711 900	53

GENERAL

If the ATV is not used or is to be stored for more than 4 months, be sure to perform the storage procedures described below.

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

PROCEDURES

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

FUEL SYSTEM

Fuel System Protection

Pour fuel stabilizer in fuel tank and fill up fuel tank.

Start vehicle to allow for fuel stabilizer to spread through the fuel system.

Follow the manufacturer's instructions for proper use.

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

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

ENGINE

Engine Internal Lubrication

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

Proceed as follows:

1. Remove side body panels.
2. Remove spark plugs.
3. Spray storage oil into each cylinder (see following table).

NOTE: Use the storage oil as per country availability.

RECOMMENDED PRODUCTS
XPS STORAGE OIL (EXCEPT U.S. COUNTRY) (P/N 413 711 600)
XPS STORAGE OIL (U.S. COUNTRY ONLY) (P/N 413 711 900)

4. In drowned mode, press start button, 1 or 2 seconds maximum, to lubricate cylinders.
5. Reinstall spark plugs.

NOTE: Do not run engine during storage period.

Engine Air Intake System

Remove parts required for access to engine air inlet hose, refer to *AIR INTAKE SYSTEM* subsection.

Block engine air inlet hose using a rag to prevent intrusion of small animals.

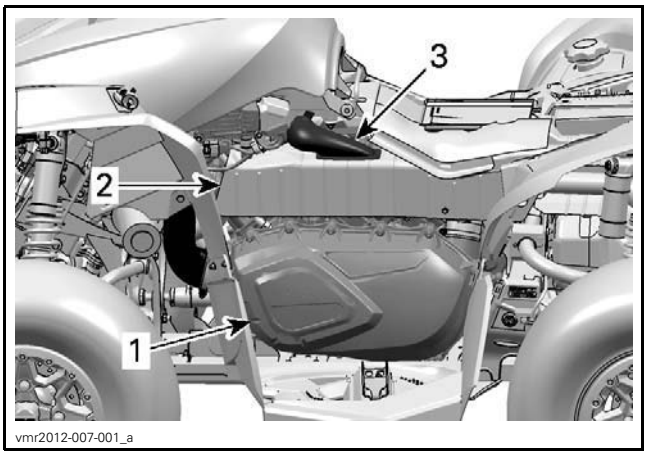
CVT Protection

1. Remove drive belt. Refer to *CONTINUOUSLY VARIABLE TRANSMISSION (CVT)*.
2. Inspect and clean pulleys.

3. Protect pulleys by spraying XPS LUBE (P/N 293 600 016) on pulley faces.

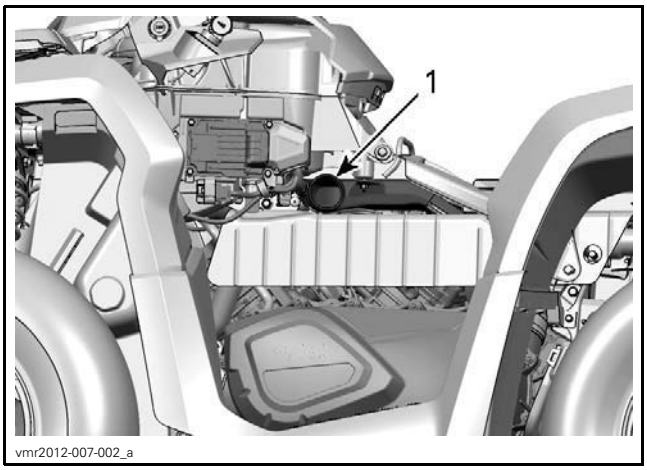
NOTE: Do not reinstall drive belt.

4. Close CVT cover.
5. Remove CVT outlet from exhaust system heat shield and from CVT outlet hose.



TYPICAL
1. *CVT cover*
2. *Exhaust system heat shield*
3. *CVT outlet*

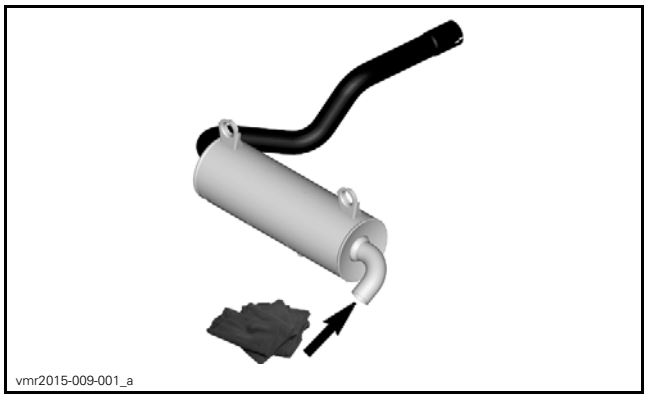
6. Block CVT outlet hose using a rag.



TYPICAL
1. *CVT outlet hose*

Exhaust System

Block muffler outlet using a rag to avoid intrusion of small animals.



ELECTRICAL SYSTEM

Battery

Remove battery from ATV.

Store and charge battery as per battery manufacturer's recommendations.

DRIVE SYSTEM

Lubricate rear propeller shaft U-joints.

CHASSIS

Lubrication

Lubricate front and rear suspension as applicable.

Tire Pressure

Inflate tires to recommended pressure.

Vehicle Cleaning

Wash and dry the vehicle.

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

Remove any dirt or rust.

To clean plastic parts, use only flannel cloths and XPS ATV WASH (P/N 219 701 702) or soapy water.

To clean vinyl parts, use only flannel cloths and a mild non abrasive multipurpose cleaner.

RECOMMENDED PRODUCT FOR PLASTIC PARTS
XPS ATV Wash (P/N 219 701 702)
Soapy water

NOTICE It is necessary to use flannel cloths on plastic parts to avoid damaging surfaces. Never clean plastic parts with strong detergent, degreasing agent, paint thinner, acetone, products containing chlorine, etc. To avoid damaging the glossy finish on Polypropylene body parts, never use:

– Petroleum based cleaning products
– XPS ATV FINISHING SPRAY (P/N 219 701 704)
– XPS ATV CLEANING KIT (P/N 219 701 713).

RECOMMENDED PRODUCT FOR VINYL PARTS
XPS ALL PURPOSE CLEANER (P/N 219 701 709)

To clean heavily soiled parts of the vehicle, including metallic parts use the following.

RECOMMENDED PRODUCT FOR HEAVILY SOILED PARTS
BRP HEAVY DUTY CLEANER (P/N 293 110 001)

Inspect the vehicle and repair any damage. Touch up all metal spots where paint has been scratched off.

Spray all metal parts with an appropriate lubricant for rust protection.

RECOMMENDED RUST PROTECTION
XPS LUBE (P/N 293 600 016)

Vehicle Protection

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

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

PRESEASON PREPARATION

Proper vehicle preparation is required after a storage period.

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

Remove rags that were installed for storage: engine air inlet hose, CVT outlet hose and muffler.

Clean drive and driven pulleys to remove storage protective lubricant, then reinstall drive belt. Refer to *CONTINUOUSLY VARIABLE TRANSMISSION (CVT)*.

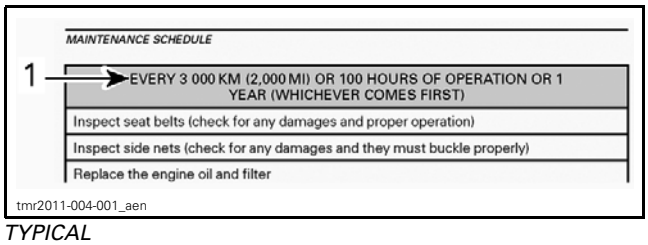
Remove parts required to allow inspection of entire engine air inlet system. Check for animal nests and other foreign material. Reinstall removed parts.

Drain fuel tank and fill with fresh fuel if a fuel stabilizer was not used for storage.

Reinstall battery. Refer to *CHARGING SYSTEM* subsection.

Inflate tires to the recommended pressure.

Using the *MAINTENANCE SCHEDULE*, perform the items titled EVERY 3 000 km (2,000 mi) OR 100 HOURS OF OPERATION OR 1 YEAR.



TYPICAL
1. Use this schedule

NOTE: If the EVERY 6 000 km (4,000 mi) OR 200 HOURS OF OPERATION OR 2 YEARS maintenance service is due, also perform the related items as per the *MAINTENANCE SCHEDULE*.

Test drive vehicle.

SPECIAL PROCEDURES

SERVICE PRODUCTS

Description	Part Number	Page
XPS LUBE	293 600 016	61

GENERAL

NOTE: Component failures resulting from these events are not warrantable.

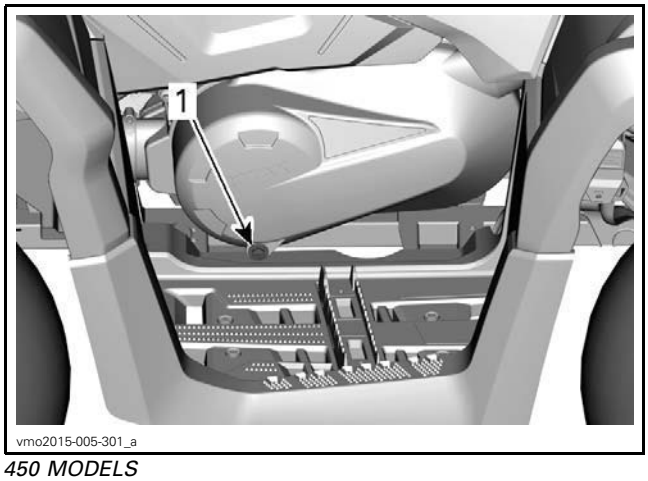
Refer to the appropriate subsections in this manual for details of the required tasks as outlined in these procedures.

WHAT TO DO IF WATER IS IN THE CVT

The CVT drain plug is located on the CVT cover. It is accessible from the rear LH fender.

450 Models

Remove the CVT drain plug to validate if water is present.

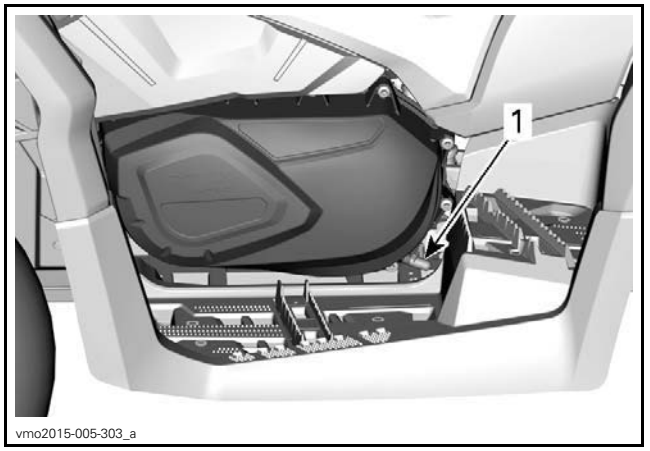


450 MODELS
1. CVT drain plug

500 Models

Inspect the CVT drain plug to validate if water is present.

If water is present, remove CVT drain plug to expel water.



500 MODELS
1. CVT drain plug

All Models

NOTICE If water is present in the CVT, it could result in belt slippage. The engine will accelerate but the vehicle will remain still.

450 Models

Reinstall slotted hexagonal 15 mm (19/32 in) drain plug.

500 Models

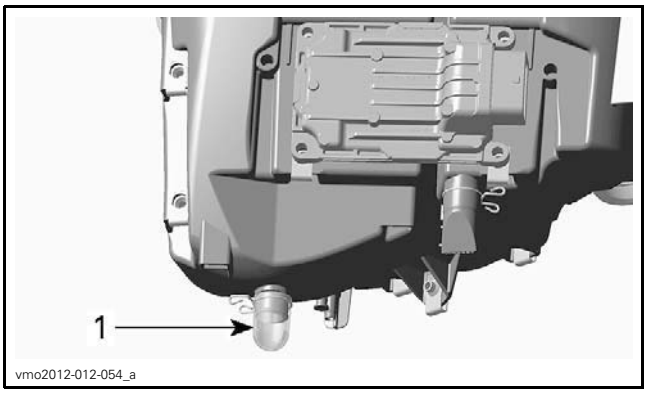
Reinstall the drain plug and secure it using the spring clamp.

NOTE: Make sure hose is properly inserted on CVT cover nipple.

NOTICE See an authorized Can-Am dealer to have the CVT inspected and cleaned.

WHAT TO DO IF WATER IS IN THE AIR FILTER HOUSING

Inspect the drain reservoir underneath the air filter housing to validate if water is present.



TYPICAL
1. Air filter housing drain reservoir

If water is present, press clamp and remove reservoir to drain water from air filter housing.

If one of the following conditions is met, refer to *WHAT TO DO IF VEHICLE IS IMMERSED IN WATER*:

– If more than 50 ml (2 U.S. oz) of water (approximately 5 drain reservoirs) is found in the air filter housing.
– If any deposits are present in the drain reservoir.

NOTICE **Failure to service vehicle properly may lead to component permanent damage.**

WHAT TO DO IF VEHICLE IS TURNED OVER

In the event the vehicle was rolled over tilted on it's side; put the vehicle back on its wheel, wait 3 to 5 minutes, then check the following:

– Inspect air filter housing for oil accumulation, if any oil is found, clean air filter and air filter housing.
– Check engine oil level and refill if necessary.
– Check engine coolant level and refill if necessary.
– Check gearbox oil level and refill if necessary.
– Check rear final drive oil level and refill if necessary.
– Inspect suspension components and steering system components.
– Inspect body and chassis for any damages.
– Start engine. If the oil pressure light stays on, stop engine immediately and investigate the problem.
– After restarting engine, check for indicator lights or messages displayed in the multifunction gauge. Correct as required.

⚠ WARNING

Do not use vehicle if any of the controls, steering, suspension or brakes are damaged or inoperative.

WHAT TO DO IF VEHICLE IS IMMERSED IN WATER

In the event the vehicle was immersed, proceed with the following.

NOTICE **A vehicle that was immersed may be damaged or prone to malfunctions (short and long term) if not serviced promptly and appropriately. Do not crank or start engine.**

Drain the entire air intake system. Inspect the throttle body. Remove parts as required.

Inspect and clean air box as needed. Remove parts as required.

Replace the air filter.

Drain, inspect and clean the CVT.

Inspect front differential and rear final drive vents. Clean or replace as necessary.

Drain muffler and exhaust pipes (removal required).

Remove fuse box covers. Check for presence of water. Dry as necessary.

Disconnect, clean and dry the following electrical connectors:
– ECM
– Multifunction gauge
– DPS (if equipped).

Replace the engine oil (without starting the engine).

Replace gearbox oil.

Inspect fuel tank for water intrusion. If in doubt, flush fuel tank and refill with new fuel.

Inspect fuel tank vent system for water intrusion. Clean as required. Replace breather filter. Carry out a fuel pump pressure test.

Inspect brake system for water intrusion. Replace brake fluid as required.

Inspect all lights for water intrusion. Dry as required.

Inspect multifunction switch for water intrusion. Dry as required.

Remove spark plug(s). Crank engine in drowned mode to expel any water.

⚠ CAUTION Keep away from spark plug hole(s) to avoid being splashed when cranking engine.

Add a small quantity of engine oil in cylinder(s) (approximately 2 teaspoonfuls).

Install spark plug(s) (replace if required).

⚠ WARNING

Before starting engine, use B.U.D.S. and check vehicle for fault codes.

Start the engine and allow it to run at idle speed until the engine reaches its operating temperature.

Stop the engine.

Change engine oil and filter.

NOTE: Change oil as many times as necessary, until there is no whitish appearance in engine oil.

Replace front differential oil.

Replace rear final drive oil.

Lubricate front and rear suspensions and propeller shaft joints.

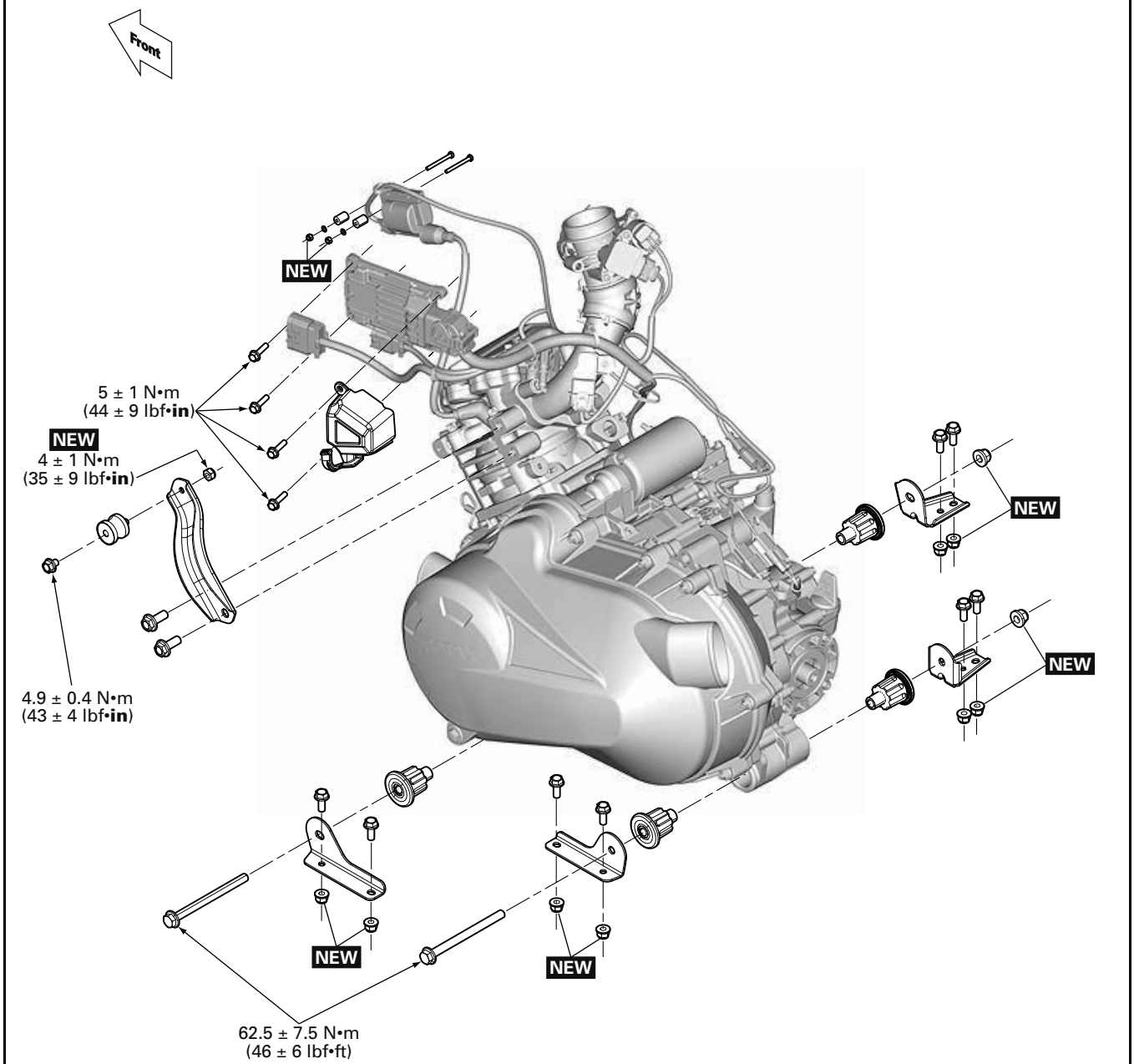
Spray all metal parts with XPS LUBE (P/N 293 600 016).

Test drive to confirm proper operation.

ENGINE REMOVAL AND INSTALLATION

SERVICE TOOLS

Description	Part Number	Page
ENGINE LIFTING TOOL	529 035 898	68



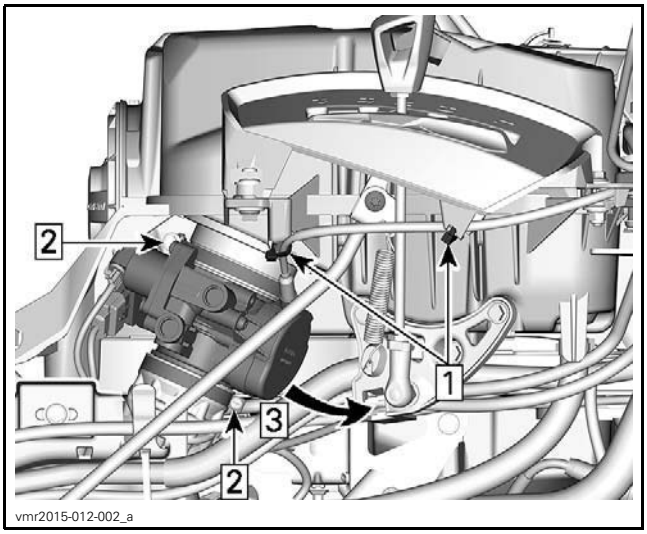
PROCEDURES

ENGINE REMOVAL

1. Place vehicle on a workstation equipped with an engine-lifting hoist.
2. Set transmission to park "P" and engage parking brake.
3. Carry out procedures in following table.

OPERATIONS	REFERENCES (SUBSECTION)
Disconnect and remove battery from vehicle	*CHARGING SYSTEM*
Release fuel pressure	*FUEL TANK AND FUEL PUMP*
Drain engine coolant	*PERIODIC MAINTENANCE PROCEDURES*
Remove LH and RH inner fender panels	*BODY*
Remove front body module	
Remove LH and RH footrest panels	
Remove LH footrest support	
Remove muffler	*EXHAUST SYSTEM*
Remove exhaust pipe	

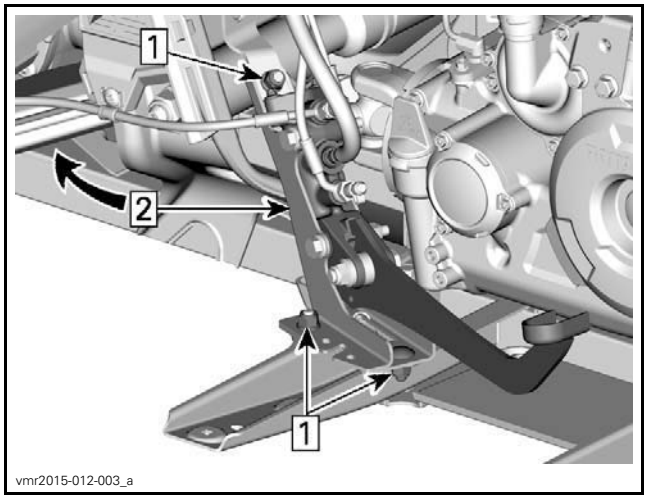
4. Secure throttle body towards front of vehicle to make room for engine removal.



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Step 1: Cut locking ties
Step 2: Loosen clamps
Step 3: Move throttle body

5. Carry out procedures in following illustrations.



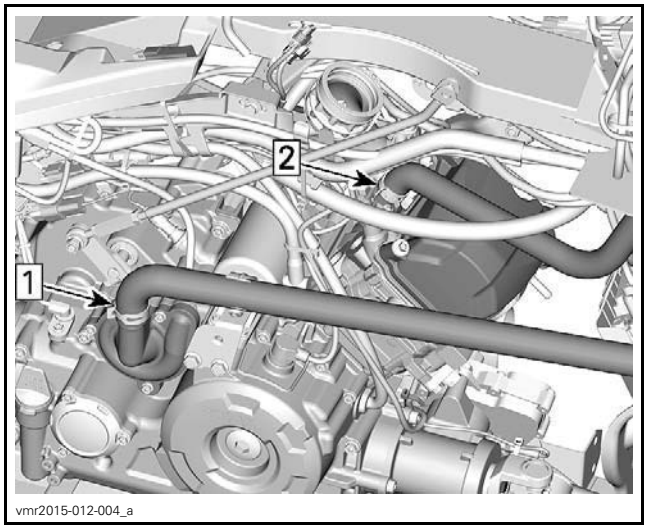
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MASTER BRAKE CYLINDER
Step 1: Remove these fasteners
Step 2: Move master cylinder assembly back



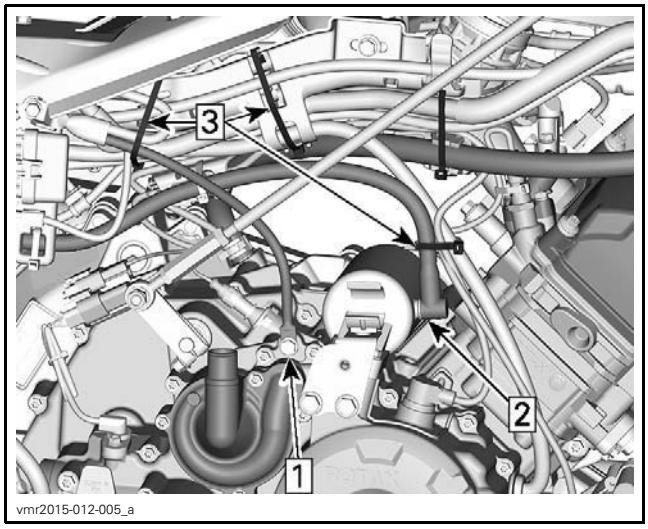
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1. Master cylinder assembly moved back

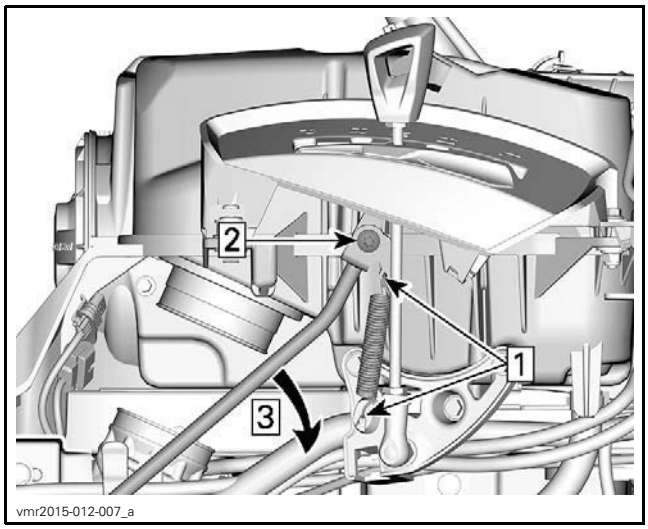


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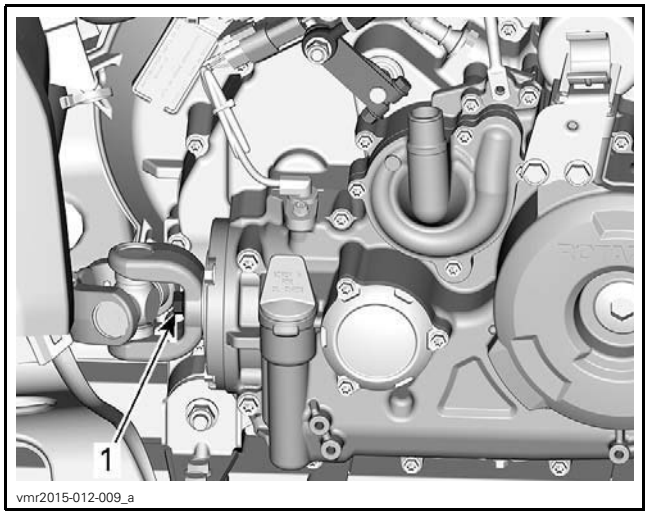
COOLING SYSTEM HOSE DISCONNECT
Step 1: Disconnect radiator hose at water pump
Step 2: Disconnect return hose at thermostat



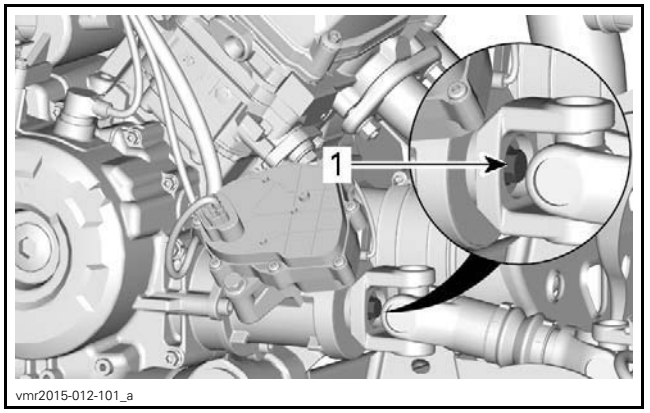
ENGINE GROUND AND STARTER CABLE DISCONNECT
Step 1: Disconnect engine ground wire
Step 2: Disconnect starter power wire
Step 3: Cut locking ties (3)



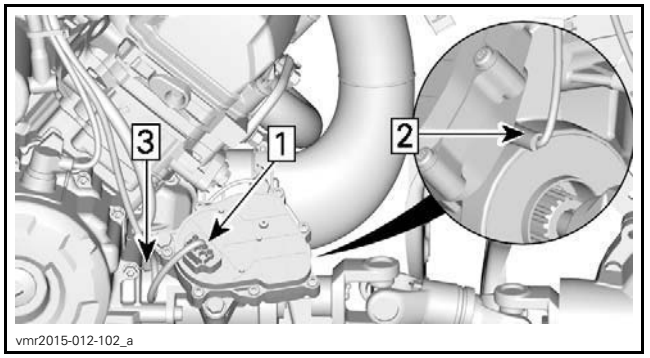
SHIFT ROD DISCONNECT
Step 1: Remove spring
Step 2: Remove fasteners and bushing
Step 3: Move shift rod



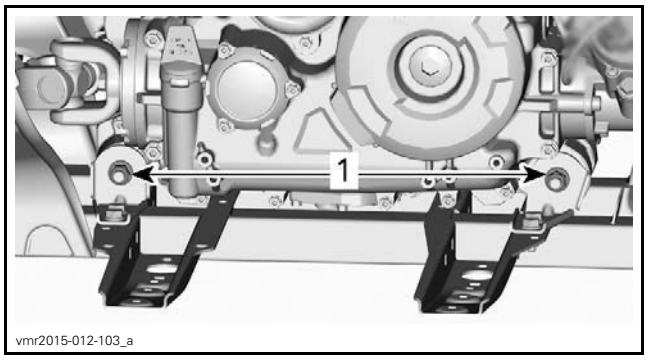
1. Remove rear propeller shaft bolt



1. Remove front propeller shaft bolt and washer

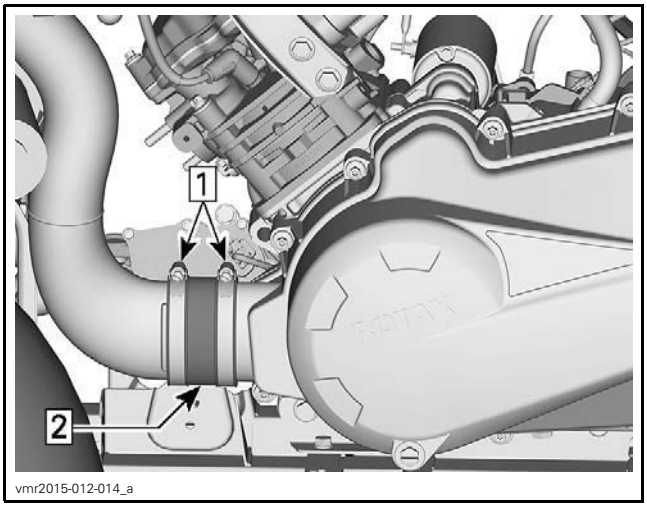


4 X 4 COUPLING UNIT DISCONNECT
1. Disconnect motor connector
2. Disconnect light switch connector
3. Remove locking tie



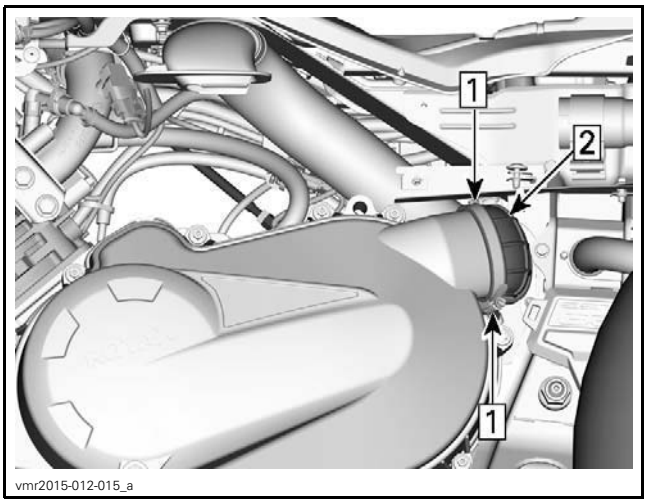
ENGINE MOUNT NUT REMOVAL, RH SIDE
1. Remove nuts

NOTE: Do not remove engine mount bolts at this time.



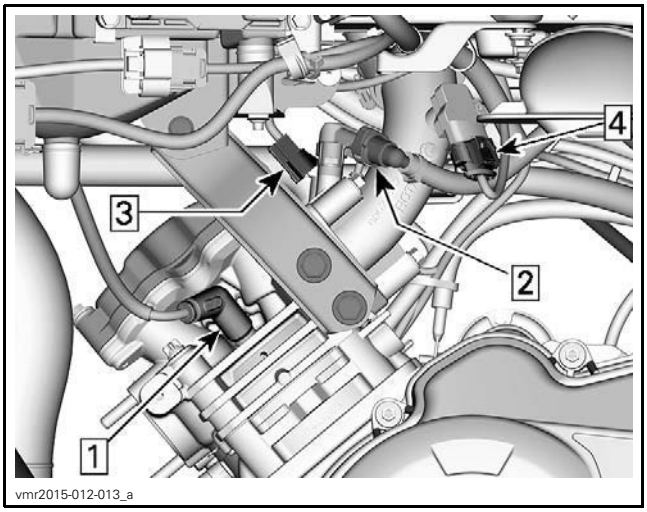
vmr2015-012-014_a

CVT AIR INLET DUCT DISCONNECT
1. *Loosen clamps*
2. *Remove CVT air inlet adapter*



vmr2015-012-015_a

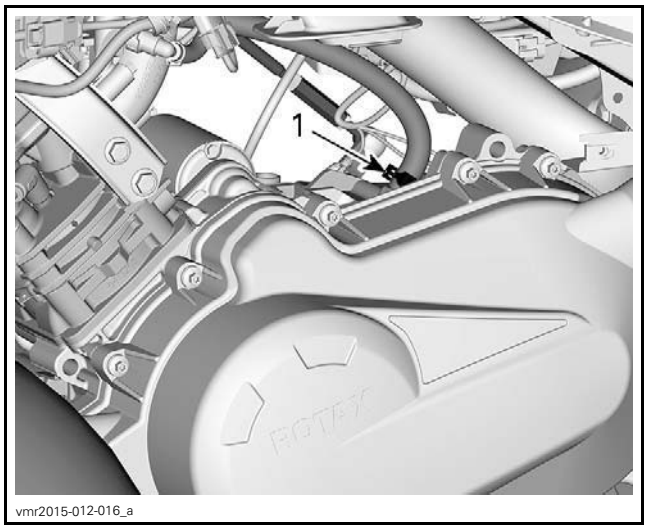
CVT AIR OUTLET DUCT DISCONNECT
Step 1: Loosen clamps
Step 2: Remove CVT air outlet adapter



vmr2015-012-013_a

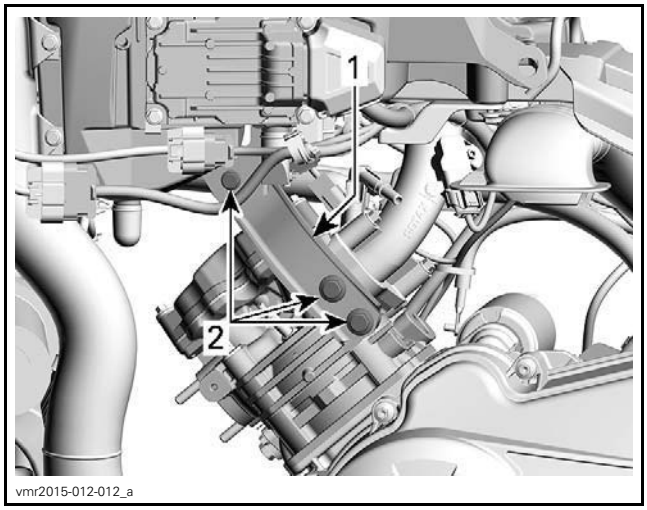
FUEL AND IGNITION DISCONNECT
Step 1: Disconnect spark plug wire
Step 2: Disconnect fuel injector hose
Step 3: Disconnect fuel injector connector
Step 4: Disconnect MAPTS sensor

NOTE: Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection for fuel injector disconnect.



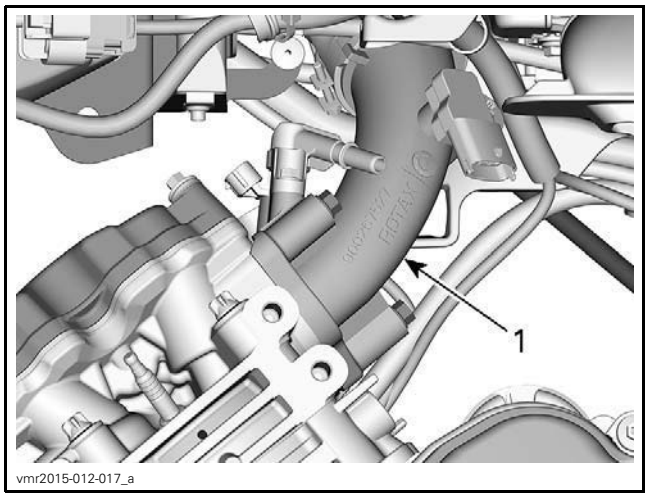
vmr2015-012-016_a

CRANKCASE VENT DISCONNECT
1. *Disconnect crankcase vent hose from engine*

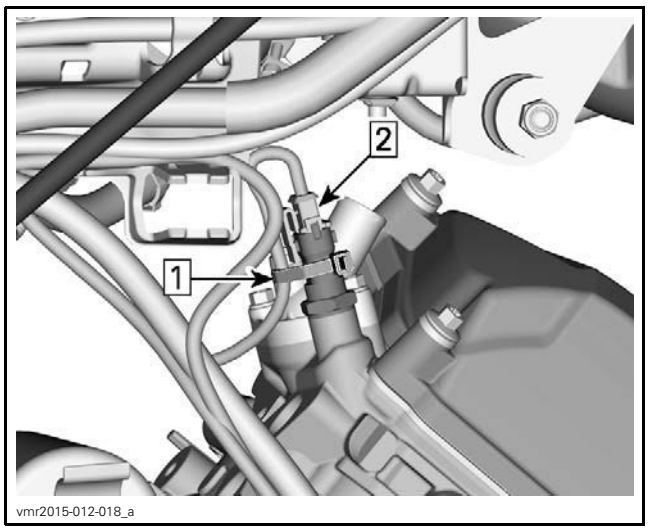


vmr2015-012-012_a

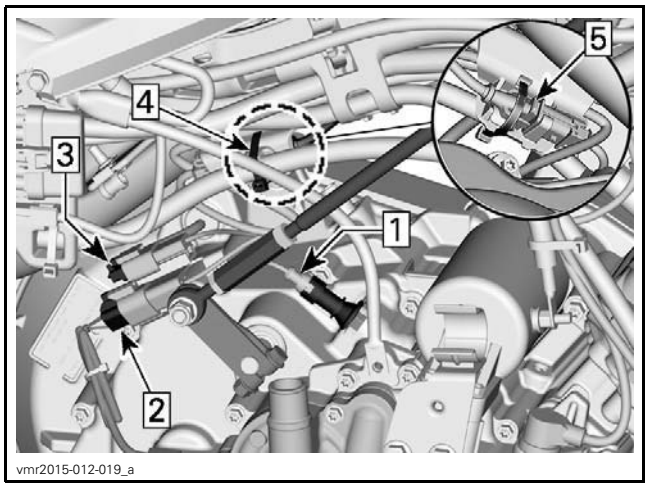
FRONT ENGINE MOUNT REMOVAL
1. *Upper engine mount*
2. *Remove these screws*



AIR INTAKE MANIFOLD REMOVAL
1. Remove air intake manifold

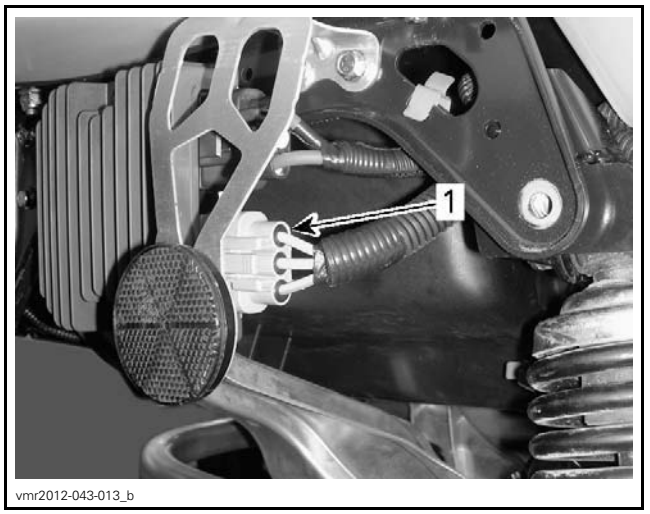


COOLANT TEMPERATURE SENSOR REMOVAL
Step 1: Cut this locking tie
Step 2: Disconnect coolant temp sensor



ELECTRICAL DISCONNECTS
Step 1: Disconnect OPS connector
Step 2: Disconnect VSS connector
Step 3: Disconnect Gear Switch connector
Step 4: Cut this locking tie
Step 5: Disconnect CPS connector (rear view)

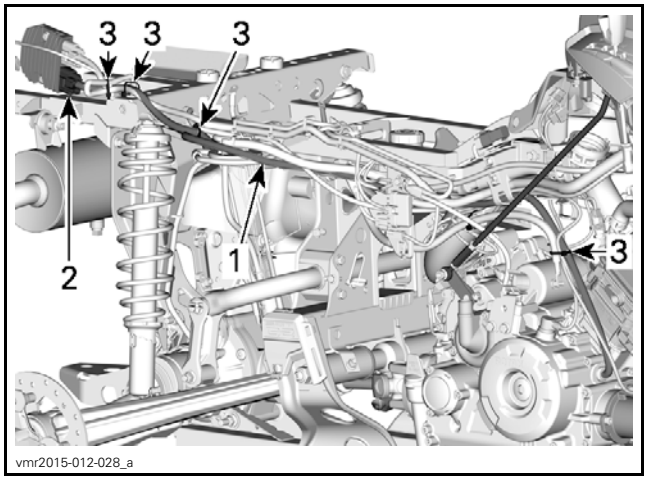
6. Remove the gear switch connector and VSS connectors from their support.
7. Disconnect magneto connector from voltage regulator rectifier.



TYPICAL
1. Magneto connector

8. Remove magneto harness from its location along vehicle and gather it in a bundle near engine.

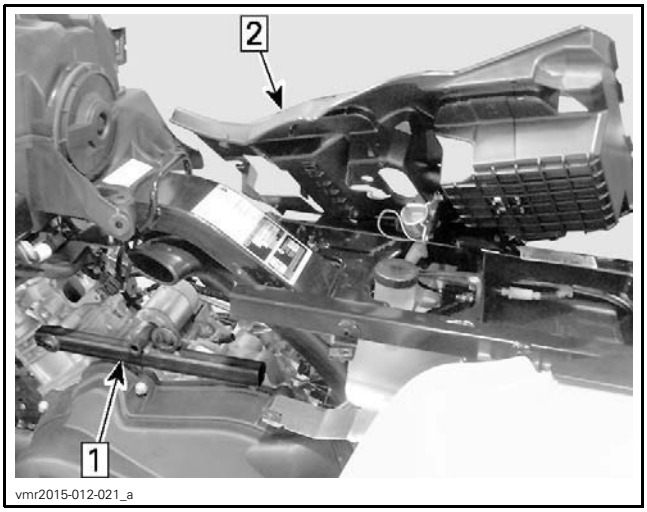
NOTE: It may be necessary to slightly lift the rear body module to ease magneto harness removal. Refer to *BODY* subsection.



MAGNETO HARNESS ROUTING (SOME PARTS REMOVED FOR CLARITY)
1. Magneto harness
2. Voltage regulator connector to disconnect (gray)
3. Locking ties to remove

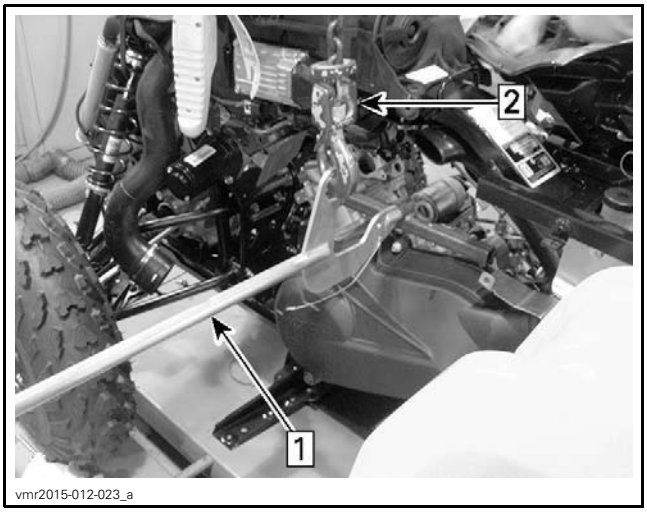
Engine Lifting

REQUIRED TOOL
ENGINE LIFTING TOOL (P/N 529 035 898)

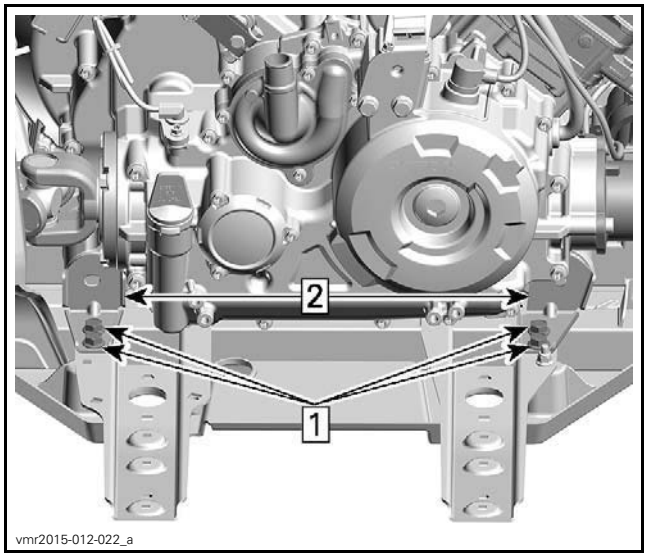


1. Install engine lifting tool
2. Move battery tray to make room

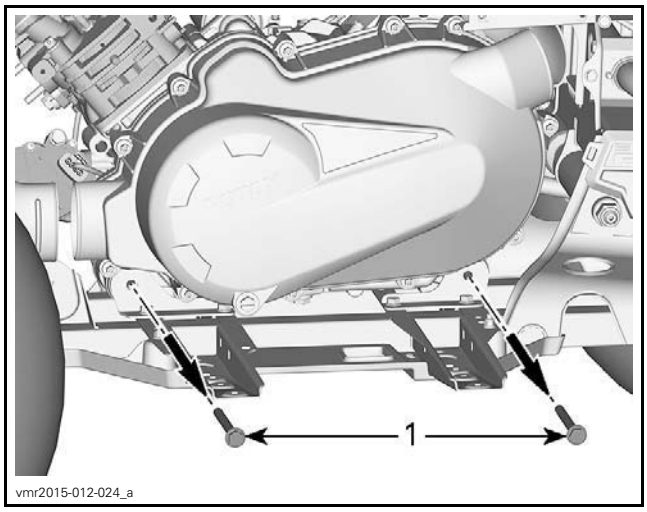
1. Install extension tool (P/N 529 035 619) onto engine lifting tool to ease engine manoeuvring.
2. Attach hoist to extension tool and slightly pick up some engine weight with the hoist.



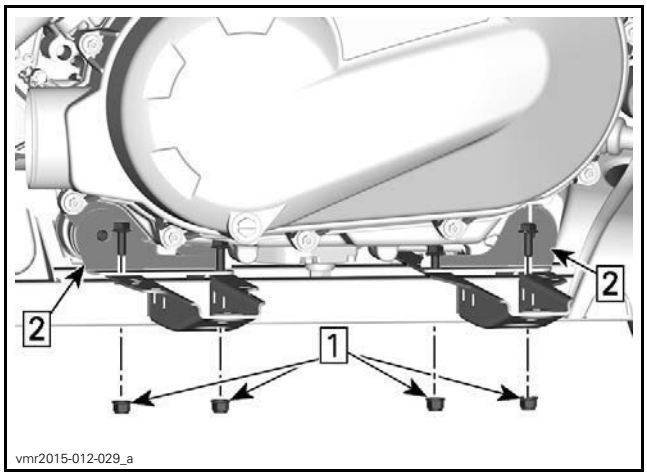
1. Install extension tool
2. Hoist attached to extension tool



RH SIDE, ENGINE MOUNTING PLATE REMOVAL
1. Remove these fasteners
2. Remove right side engine mounting plates

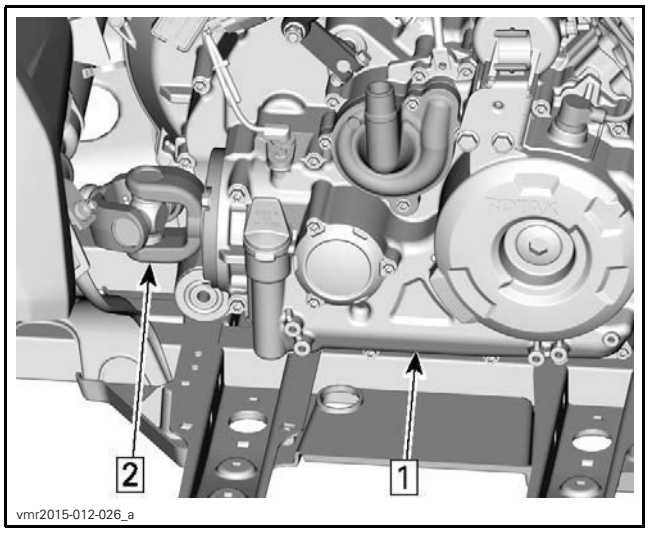


LH SIDE, ENGINE MOUNTING BOLT REMOVAL
1. Engine mounting bolts

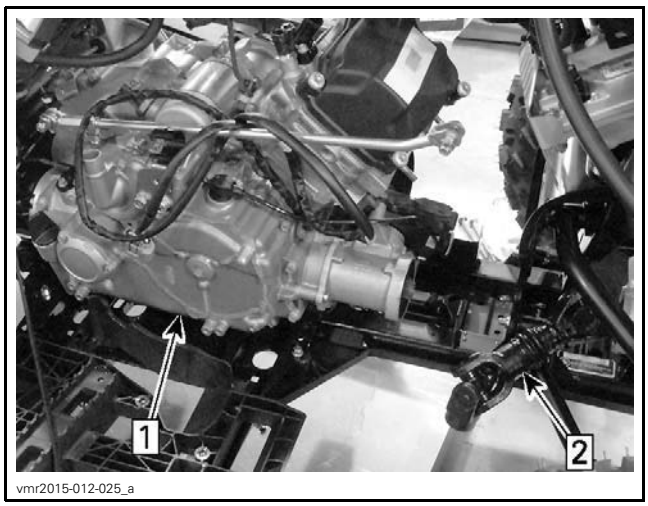


LH SIDE, ENGINE MOUNT BRACKET REMOVAL
Step 1: Remove engine mount bracket bolts
Step 2: Remove engine mounts

Remove the engine mount brackets on the right hand side.



REAR PROPELLER SHAFT DISCONNECT
1. *Slightly lift engine and move forward*
2. *Disconnect rear propeller shaft*



TYPICAL FRONT PROPELLER SHAFT DISCONNECT
1. *Move engine rearward*
2. *Disconnect front propeller shaft*



ENGINE INSTALLATION

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

When installing a part, refer to its applicable subsection for tightening torques and products required.

Inspect condition of engine mounts.

Install engine on vehicle.

Install all engine retaining bolts loosely.

Install front and rear propeller shafts. Tighten retaining screws to specification.

Tighten engine mounting bolts to specification.

TIGHTENING TORQUE	
Engine retaining bolts	62.5 N•m ± 7.5 N•m (46 lbf•ft ± 6 lbf•ft)

Reconnect all hoses, adapters and electrical connections.

If applicable, fill engine as per specification with engine oil. Refer to *LUBRICATION SYSTEM* subsection.

Fill and bleed cooling system. Refer to *PERIODIC MAINTENANCE PROCEDURE* subsection.

Check for any leaks.

Install all remaining removed parts.

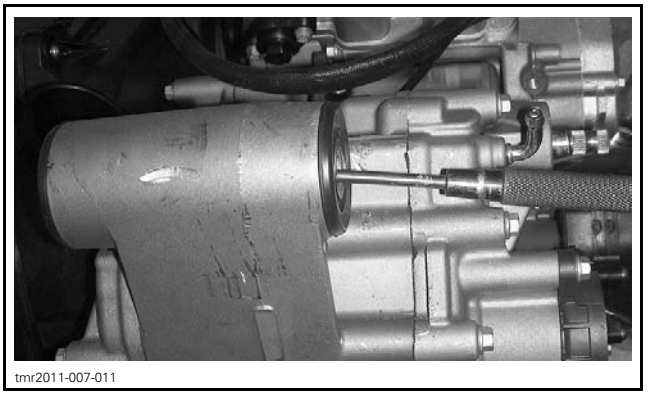
Test drive vehicle to confirm proper operation.

ENGINE MOUNTS REPLACEMENT

NOTE: Use the same procedure for the front and rear engine mounts.

Engine Mount Removal

Insert a punch into one engine mount bushing and push the opposite bushing out.



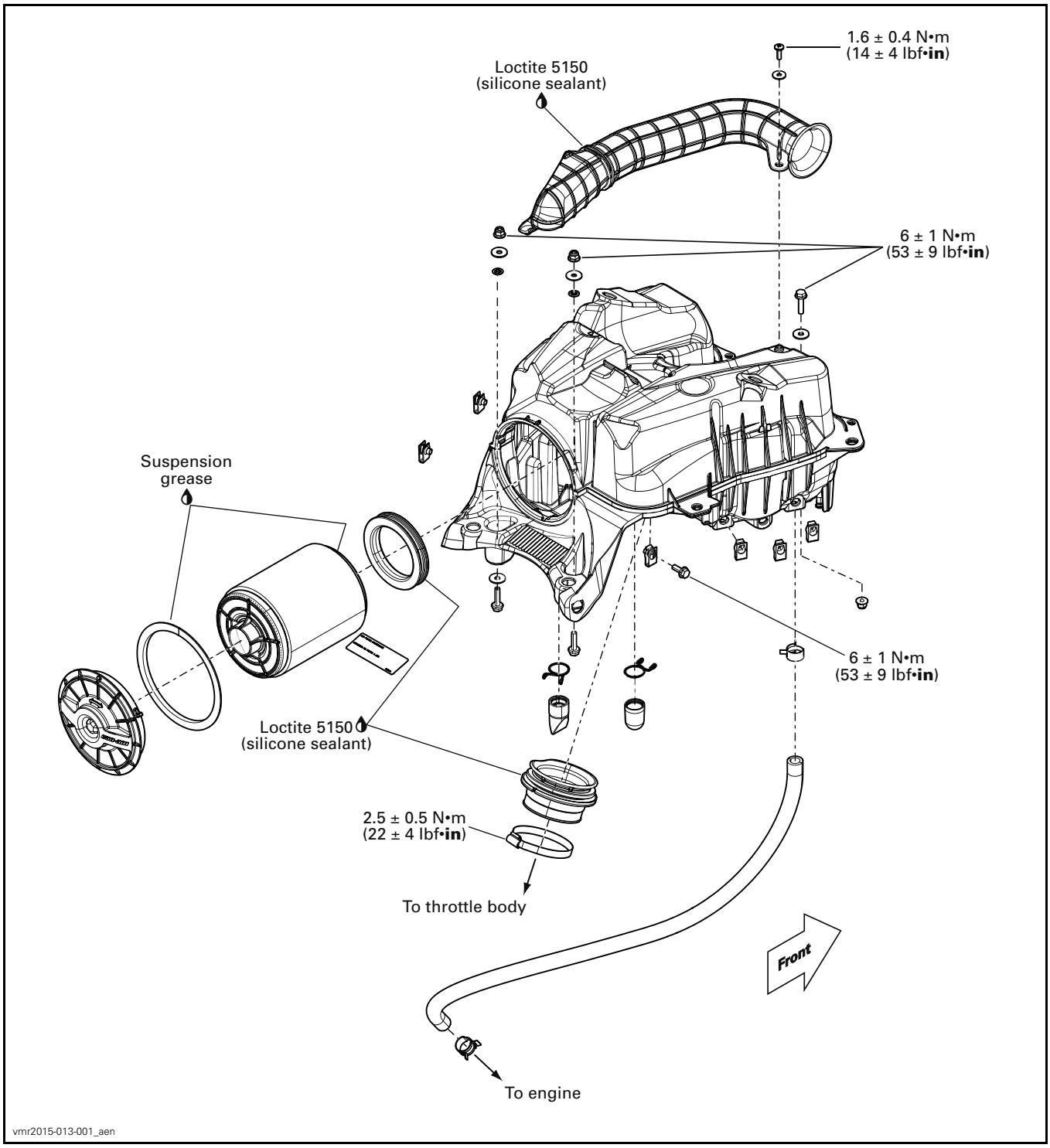
TYPICAL

Engine Mount Installation

Push in each mount bushing until it bottoms out.

AIR INTAKE SYSTEM

AIR FILTER HOUSING



GENERAL

NOTICE Never modify the air intake system. Otherwise, engine performance degradation or damage can occur. The engine is calibrated to operate specifically with these components.

PROCEDURES

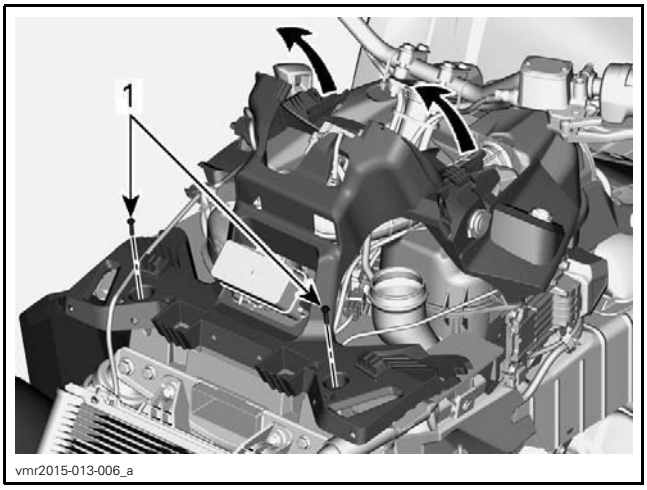
AIR FILTER

For air filter servicing, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

AIR FILTER HOUSING

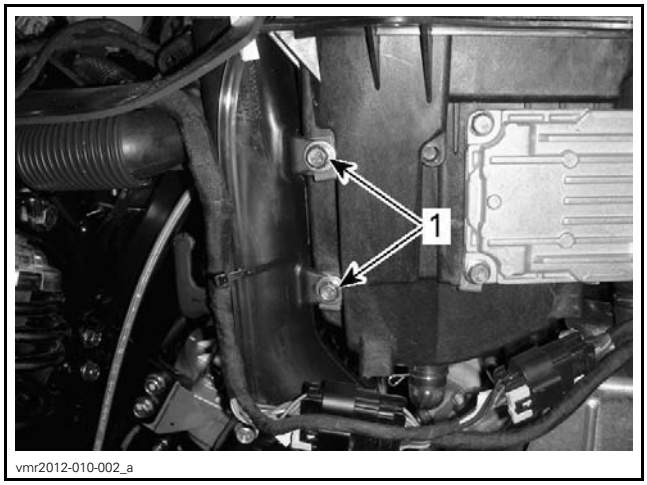
Air Filter Housing Removal

1. Remove front body module. Refer to *BODY* subsection.
2. Remove dashboard support retaining screws. Pull aft pins from grommets and move support toward front.



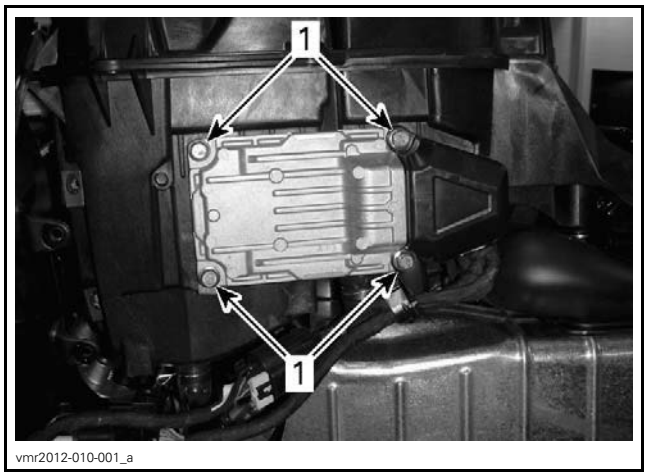
DASHBOARD SUPPORT REMOVAL
1. Screws to remove

3. On LH side, remove screws securing CVT air inlet to air filter housing.



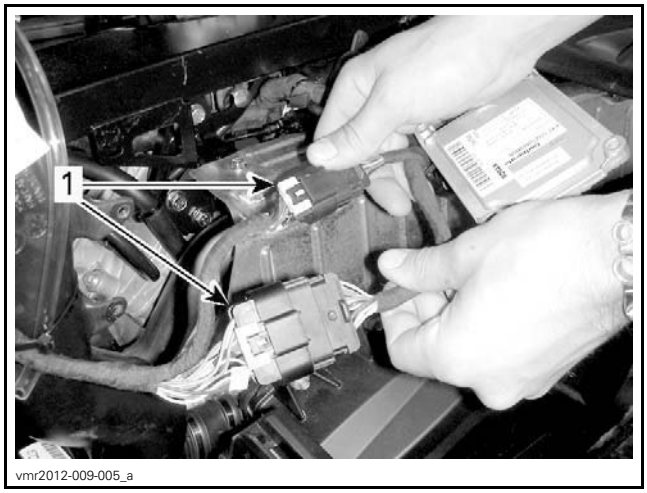
TYPICAL
1. CVT air inlet screws

4. Remove ECM retaining screws.



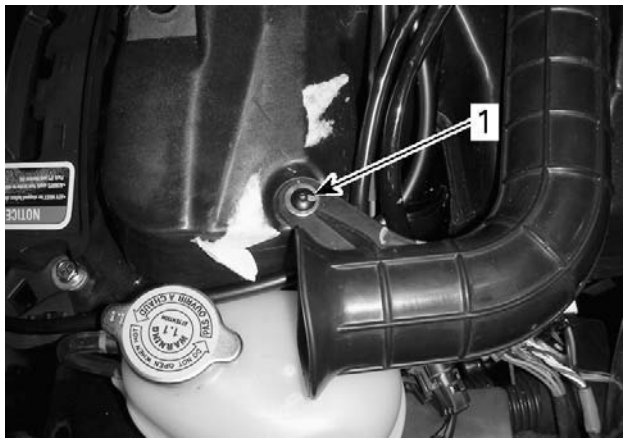
1. ECM retaining screws

5. Remove engine harness connectors (HIC) from air filter housing.
6. Move ECM aside.



TYPICAL
1. Engine harness connectors (HIC)

7. Remove air intake tube retaining screw.



vmr2012-010-003_a

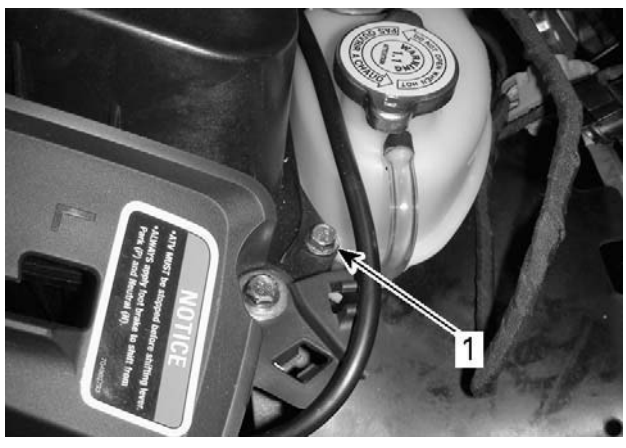
1. Air intake tube retaining screw

8. Move air intake tube forward for access to LH coolant tank screw.
9. Remove coolant tank retaining screws.



vmr2012-010-004_a

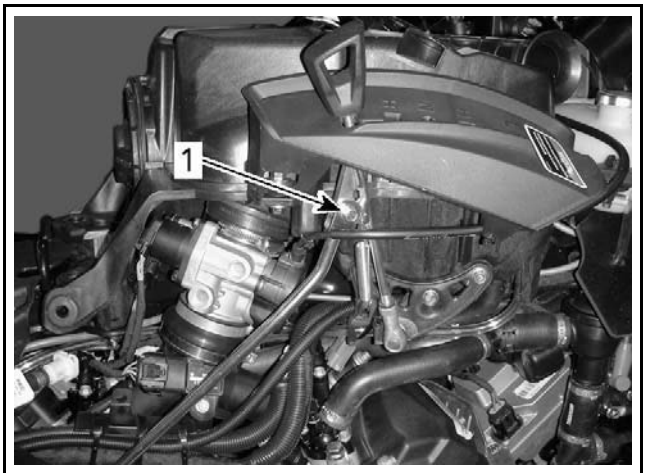
AIR INTAKE TUBE MOVED FOR ACCESS
1. LH coolant tank retaining screw



vmr2012-010-005_a

1. RH coolant tank retaining screw

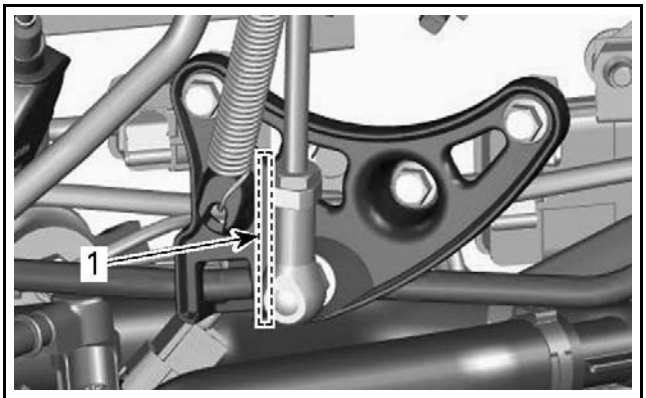
10. Remove link rod from shift lever.



vmr2012-010-006_a

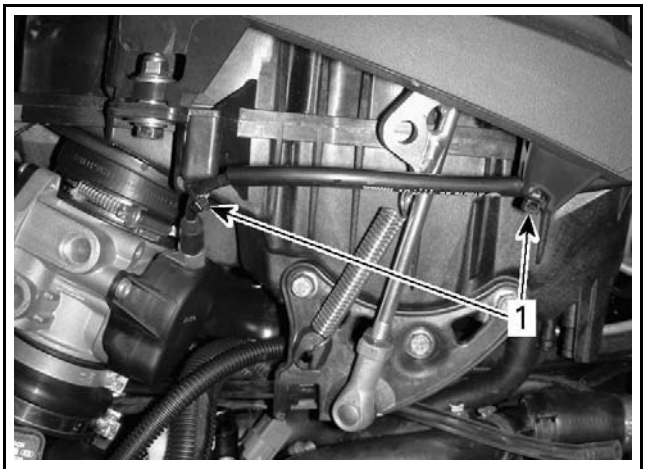
TYPICAL
1. Link rod retaining bolt

11. Carefully move link rod downward.
12. Remove the following locking ties.



vmr2013-010-001_a

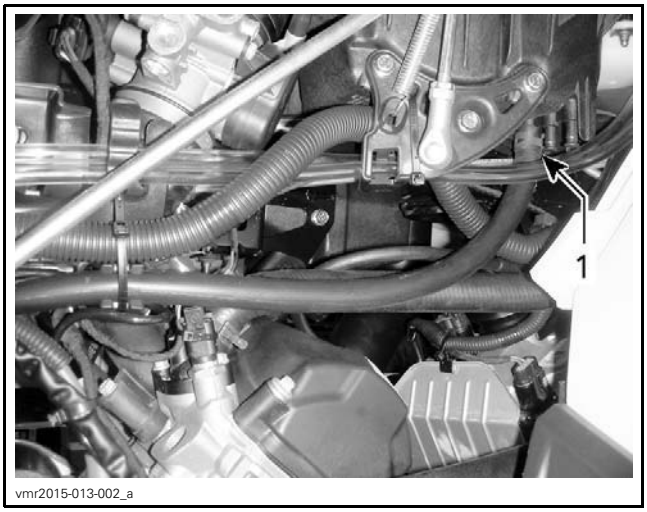
1. Locking tie to remove - location shown



vmr2012-010-009_a

1. Locking ties to remove

13. Remove crankcase vent hose from air filter housing.



vmr2015-013-002_a

1. Remove crankcase vent hose here

14. Remove fasteners retaining aft end of air filter housing.



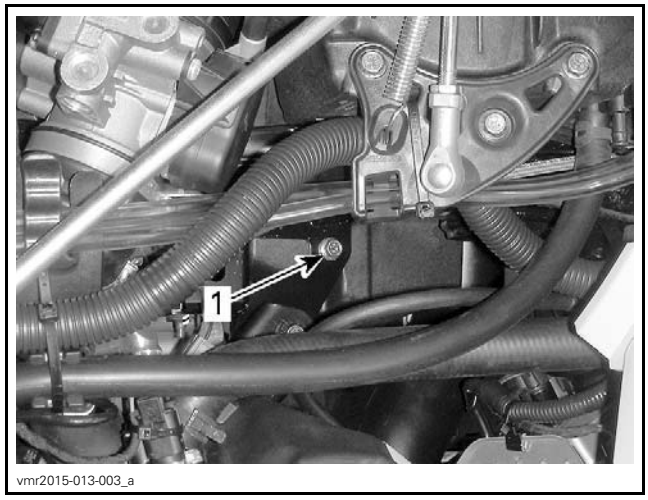
vmr2012-010-012_a

FASTENERS LOCATED NEAR FORWARD SEAT ANCHORAGE
1. Nuts (2)



vmr2012-010-013_a

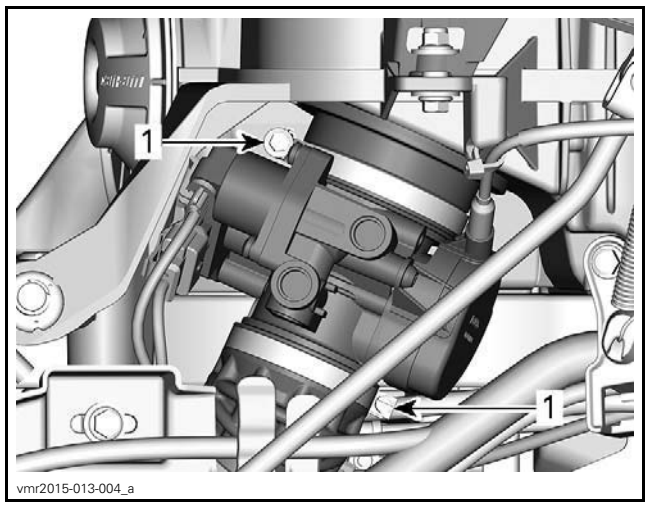
SCREW LOCATED UNDER COOLANT TANK
1. Screw



vmr2015-013-003_a

SCREW ACCESSED FROM UNDER SHIFT LEVER
1. Screw

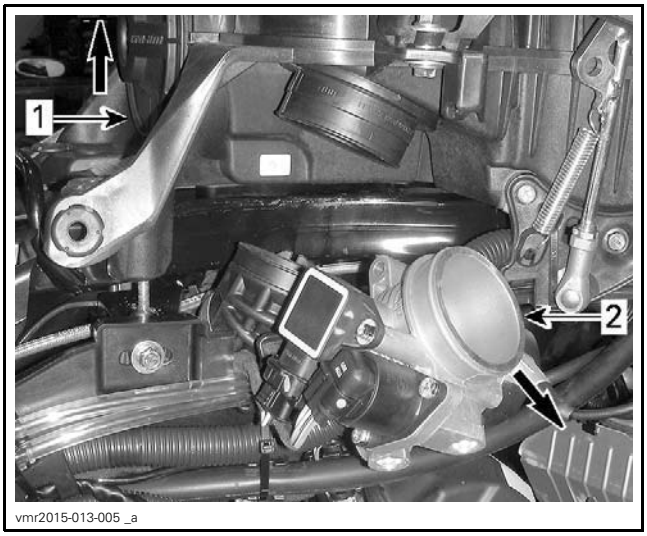
15. Detach throttle body from intake adapter and air filter housing.



vmr2015-013-004_a

1. Clamp screws to loosen

16. Slightly lift air filter housing upward.
17. Move throttle body aside to make room.



1. Air filter housing
2. Throttle body

18. Remove air filter housing by pulling it towards rear.



AIR FILTER HOUSING REMOVAL

19. Remove remaining components from air filter housing.

Air Filter Housing Inspection

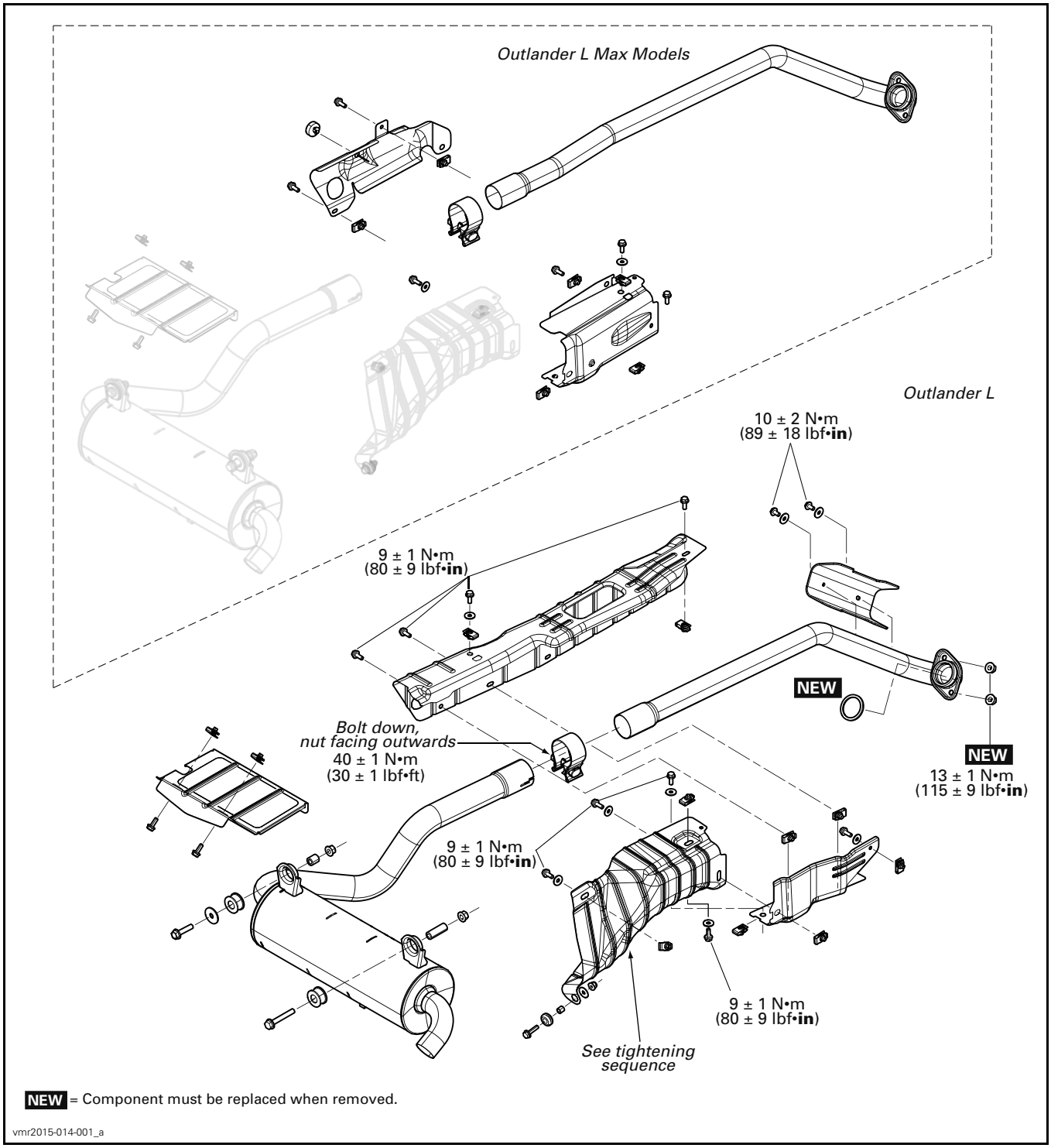
Check air filter housing for cracks or other damage. Replace if necessary.

Air Filter Housing Installation

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

Refer to applicable exploded views for tightening torque.

EXHAUST SYSTEM



GENERAL

⚠ WARNING

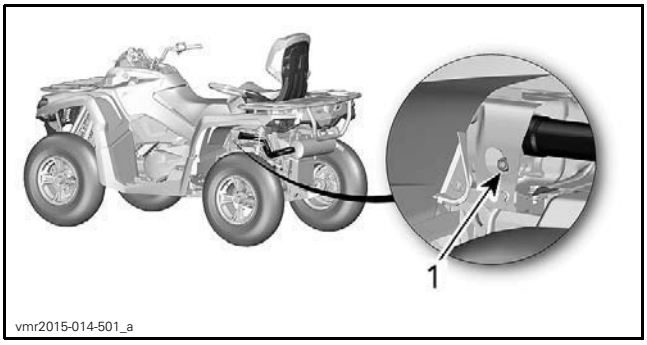
Never touch exhaust system components immediately after the engine has run.

PROCEDURES

MUFFLER

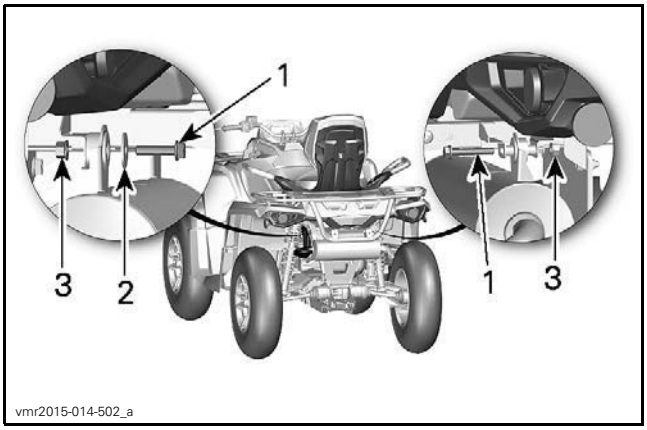
Muffler Removal

1. Loosen exhaust pipe clamp.



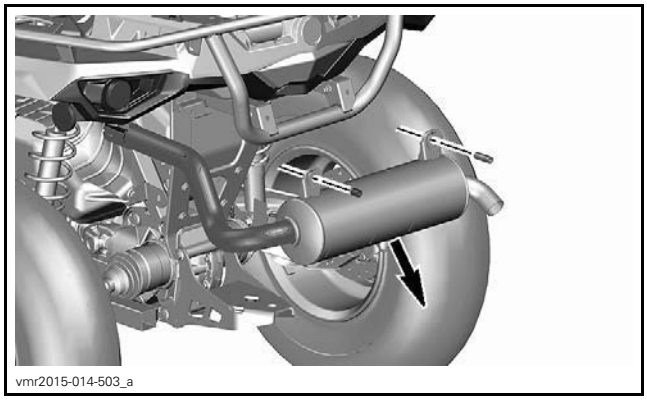
1. Clamp nut

2. Remove muffler retaining bolts.



1. Bolt
2. Washer
3. Nut

3. Remove the muffler.



Muffler Inspection

Check muffler and cover for cracks or other damages. Replace if necessary.

Check if the rubber supports are brittle, hard or otherwise damaged. Replace if needed.

Muffler Installation

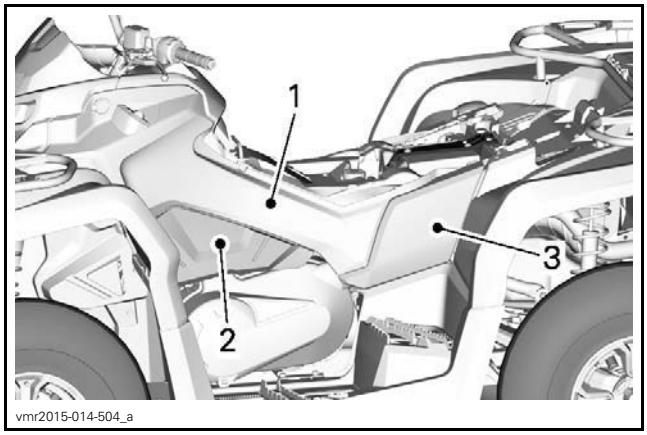
Reverse the removal procedure.

Refer to exploded view for torque specifications.

HEAT SHIELDS

Heat Shield Removal

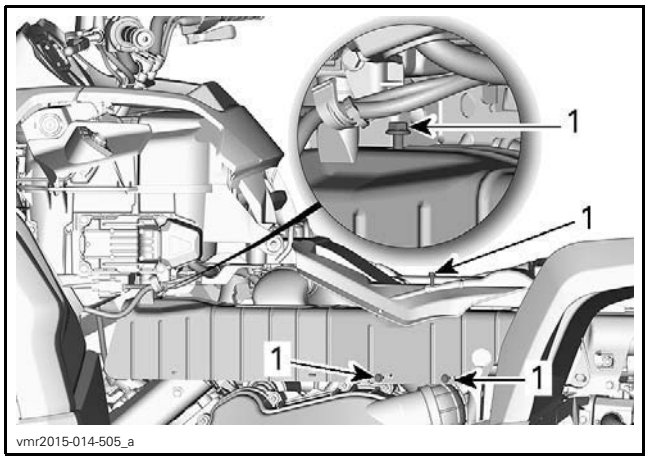
1. Refer to *BODY* and remove following LH body panels.



LH SIDE
1. Side panel
2. Side panel extension
3. Rear panel extension (Max models)

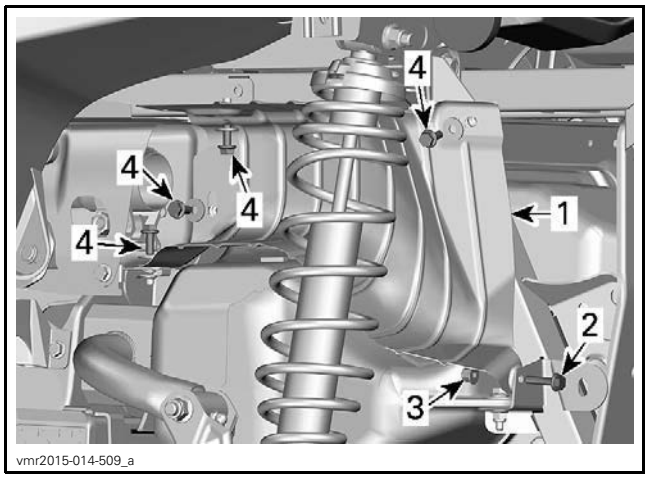
2. Remove outer heat shield retaining bolts.

NOTICE **Do not use impact tool to remove or install heat shield bolts.**

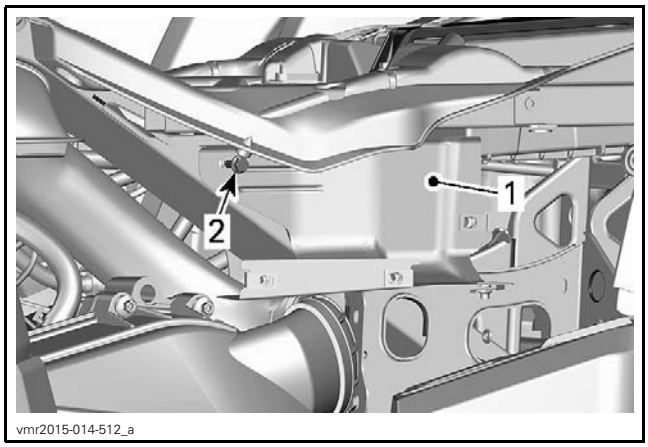


OUTER HEAT SHIELD - SHORT MODEL SHOWN
1. *Heat shield bolts*

3. Remove muffler for rear and inner heat shield removal.



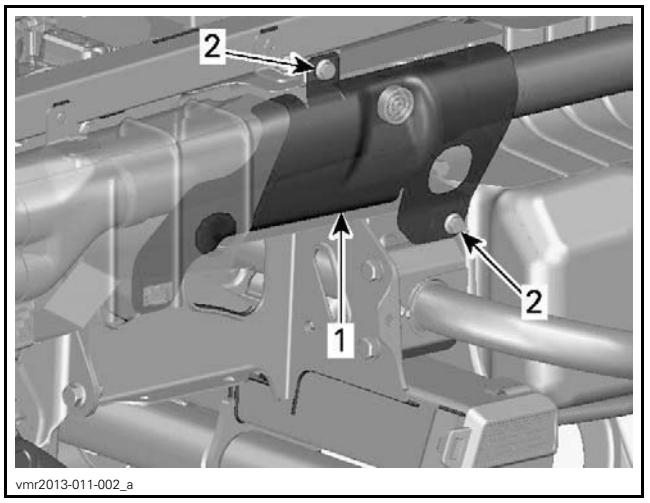
1. *Rear heat shield*
2. *M6 x 25 bolt*
3. *M6 elastic nut*
4. *M6 x 16 bolts with washers*



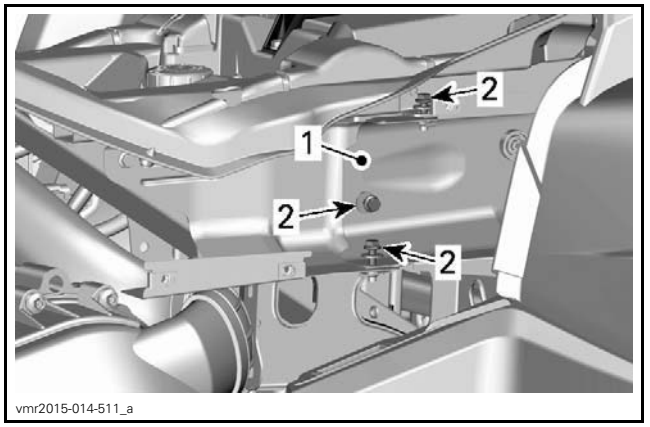
1. *Inner heat shield*
2. *M6 x 16 bolts*

Max Models

4. Remove heat shield extension retaining bolts.



1. *Outer heat shield extension*
2. *M6 x 16 bolts*

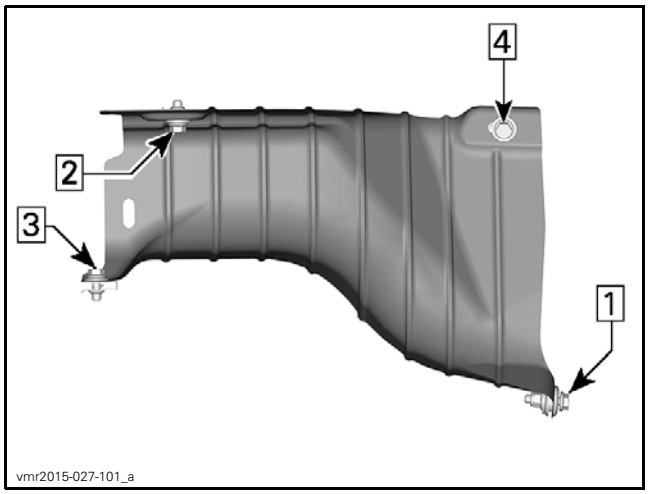


1. *Inner heat shield extension*
2. *M6 x 16 bolts*

Heat Shield Installation

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

Refer to exploded view for torque specifications, and following illustration for rear heat shield tightening sequence.

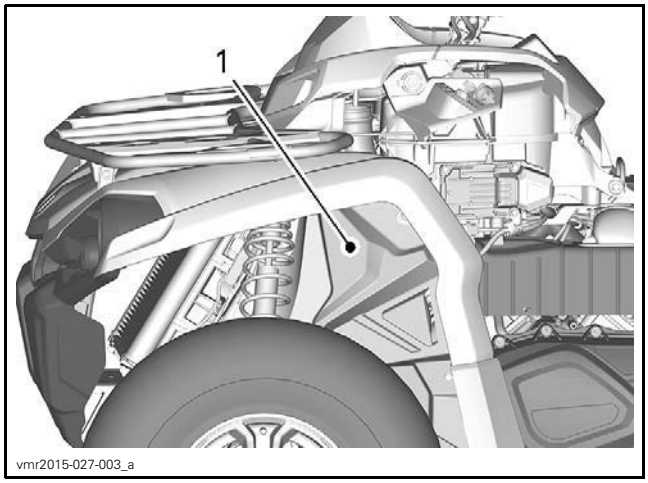


REAR HEAT SHIELD TIGHTENING SEQUENCE

HEAD PIPE

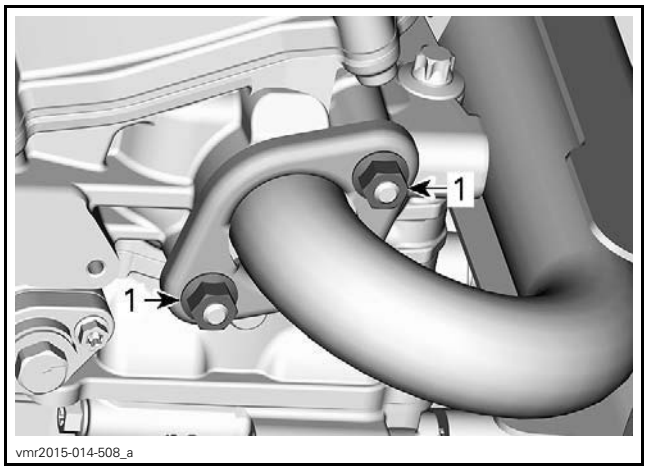
Head Pipe Removal

1. Remove *MUFFLER* See procedure in this subsection.
2. Refer to *BODY* and remove RH and LH inner fender panels.



LH ILLUSTRATED, RH SIMILAR
1. Remove inner fender panel (both sides)

3. From RH side of vehicle, remove head pipe retaining nuts.



1. Retaining nuts

4. Remove front head pipe from vehicle.

NOTE: The space to remove the front head pipe is limited. Remove it without force.

Head Pipe Inspection

Check head pipe for cracks, bending or other damages. Replace if needed.

Head Pipe Installation

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

Install NEW exhaust gasket and pipe exhaust retaining nuts.

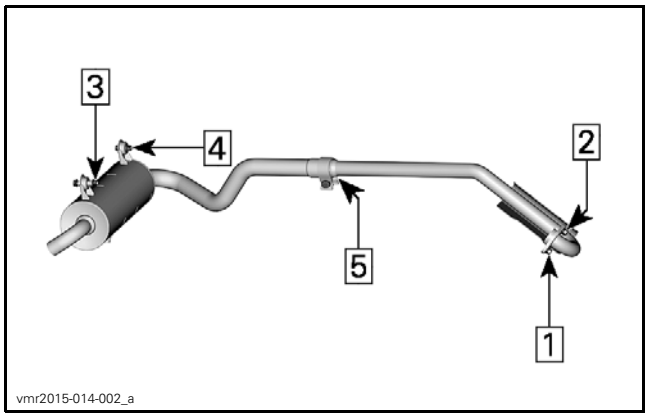
TIGHTENING TORQUE	
Head pipe nuts	13 N•m ± 1 N•m (115 lbf•**in** ± 9 lbf•**in**)

Exhaust System Tightening System Sequence

Install all nuts and bolts loosely.

Install springs.

Tighten all fasteners as per following tightening sequence. Refer to exploded view for torque specifications.



EXHAUST SYSTEM TIGHTENING SYSTEM SEQUENCE

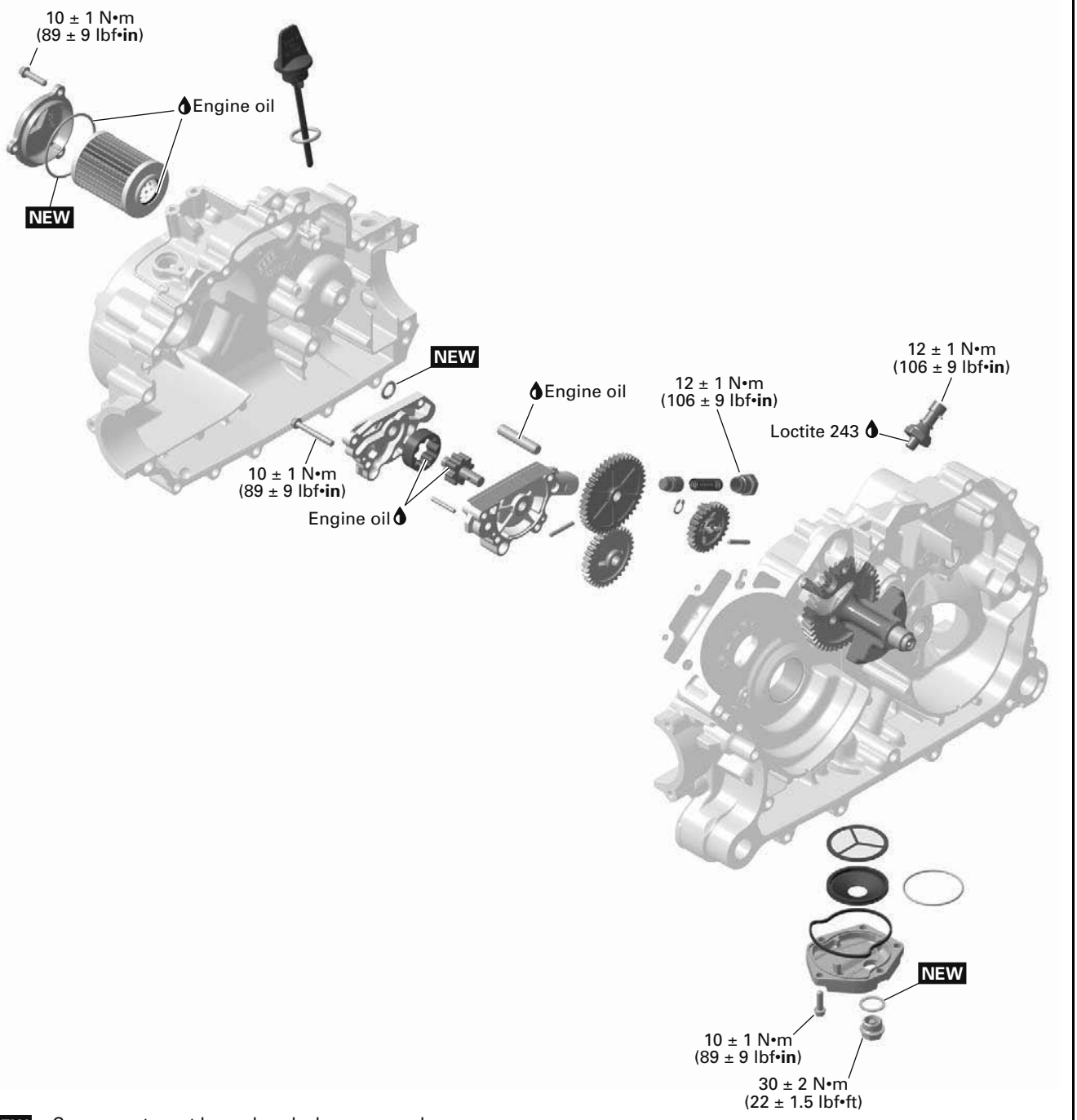
LUBRICATION SYSTEM

SERVICE TOOLS

Description	Part Number	Page
ADAPTER HOSE	529 035 652	85
DISCONNECT TOOL	529 035 714	85
PRESSURE GAUGE	529 035 709	85

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	87



NEW = Component must be replaced when removed.

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INSPECTION

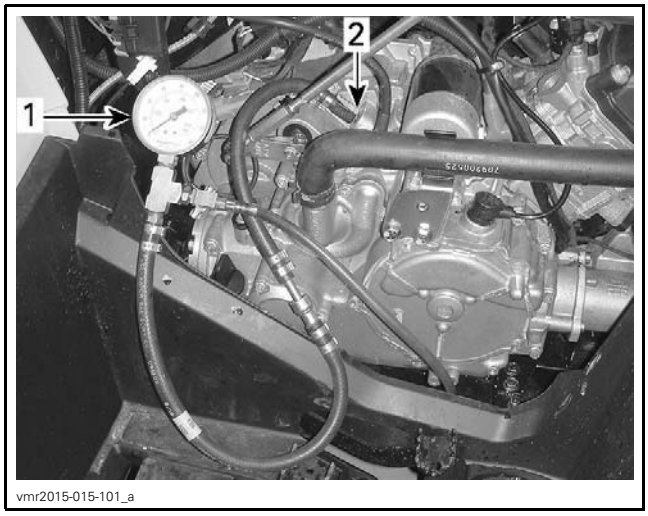
ENGINE OIL PRESSURE

NOTE: The engine oil pressure test should be done with a warm engine (100°C (212°F)) and the recommended oil.

Remove the oil pressure switch, refer to *OIL PRESSURE SWITCH* in this subsection.

Install the pressure test gauge with the proper adapter hose in the oil pressure switch bore.

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



1. *Pressure test gauge assembly*
2. *Hose adapter installed in oil pressure switch bore*

Start engine and measure oil pressure as per following table.

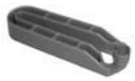
The engine oil pressure should be within the following values.

PRESSURE	1300 RPM	6000 RPM
Minimal	70 kPa (10 PSI)	350 kPa (51 PSI)
Nominal	300 kPa (44 PSI)	450 kPa (65 PSI)
Maximal	550 kPa (80 PSI)	700 kPa (102 PSI)

If the engine oil pressure is out of specifications, check the points described in *TROUBLESHOOTING* in this subsection.

Remove oil pressure gauge and adapter hose.

NOTE: To remove adapter hose from oil pressure gauge, use the disconnect tool.

REQUIRED TOOL	
DISCONNECT TOOL (P/N 529 035 714)	

Reinstall the oil pressure switch.

TROUBLESHOOTING

LOW OR NO OIL PRESSURE

1. Oil level is too low
   - *Refill engine with recommended engine oil. Refer to OIL LEVEL VERIFICATION in the PERIODIC MAINTENANCE PROCEDURES subsection.*
   - *Check for high oil consumption, refer to HIGH OIL CONSUMPTION in the TROUBLESHOOTING subsection.*
   - *Check for engine oil leaks. For leak indicator hole, refer to COOLING SYSTEM INSPECTION in the PERIODIC MAINTENANCE PROCEDURES subsection. Repair if necessary.*
2. Use of unsuitable engine oil type.
   - *Replace engine oil by the recommended engine oil.*
3. Clogged oil filter.
   - *Replace oil and oil filter at the same time.*
4. Defective oil pressure switch.
   - *Test oil pressure switch, see procedure in this subsection.*
5. Defective or worn oil pump.
   - *Check oil pump, see procedure in this subsection.*
6. Defective engine oil pressure regulator.
   - *Check engine oil pressure regulator, see procedure in this subsection.*
7. Worn plain bearings in crankcase.
   - *Check plain bearings clearance, refer to BOTTOM END subsection.*
8. Clogged engine oil strainer.
   - *Clean engine oil strainer, see procedure in this subsection.*

OIL CONTAMINATION

1. Defective water pump seal ring or rotary seal.
   - *Check for oil or coolant leak from indicator hole near water pump, refer to COOLING SYSTEM INSPECTION in the PERIODIC MAINTENANCE PROCEDURES subsection. Replace seals if necessary.*

2. Cylinder head or cylinder base gasket leak.
   - *Retighten cylinder head to specified torque, refer to TOP END subsection. Replace gasket if tightening does not solve the problem.*
3. Engine internal damage.
   - *Repair engine.*

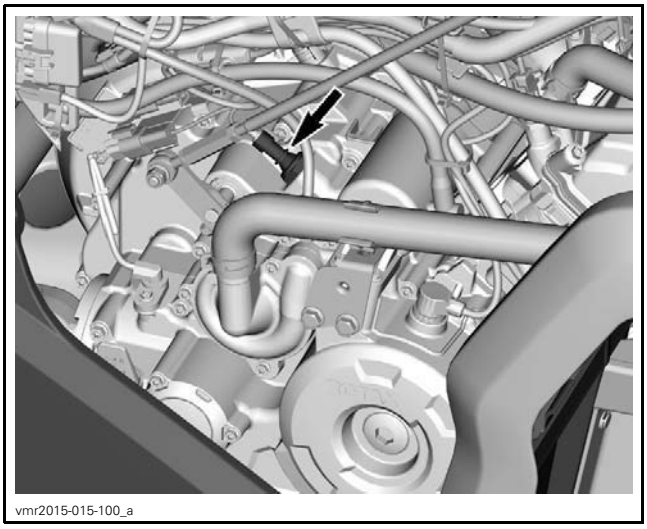
HIGH OIL CONSUMPTION

1. Leaking breather oil seal.
   - *Check if the oil seal of the breather (underneath PTO side ball bearing of balancer shaft) is brittle, hard or damaged. Refer to BOTTOM END subsection.*
2. Valve stem seals worn or damaged.
   - *Replace valve stem seals. Refer to TOP END subsection.*
3. Worn piston rings (blue exhaust smoke).
   - *Replace piston rings. Refer to TOP END subsection.*

PROCEDURES

OIL PRESSURE SWITCH (OPS)

Oil Pressure Switch Location


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OPS LOCATION - RIGHT SIDE OF ENGINE

Oil Pressure Switch Access

Refer to *BODY* subsection and remove the following components:

– Seat
– Console
– RH side panel and extension.

Oil Pressure Switch Activation

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

OIL PRESSURE SWITCH ACTIVATION RANGE
30 kPa ± 10 kPa (4.35 PSI ± 1.45 PSI)

To check the function of the oil pressure switch, an oil pressure test has to be performed. Refer to *ENGINE OIL PRESSURE* in this subsection.

If the engine oil pressure is good, perform the oil pressure switch resistance test.

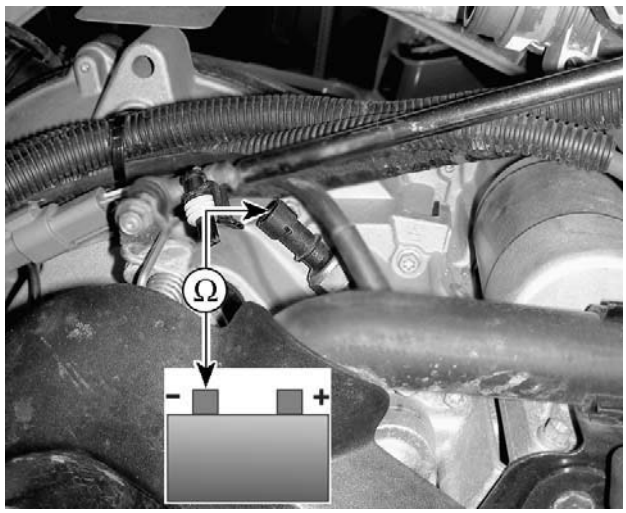
Oil Pressure Switch Resistance Test

Disconnect the connector from the oil pressure switch.

Using a multimeter set to Ω, check the OPS resistance as per following table.

OPS CONNECTOR		ENGINE NOT RUNNING	ENGINE NOT RUNNING
PIN		RESISTANCE (Ω)	
1	Engine ground	Close to 0 Ω (normally closed switch)	Close to 0 Ω (normal closed switch

OPS CONNECTOR		ENGINE NOT RUNNING	ENGINE RUNNING
PIN		RESISTANCE (Ω)	
1	Engine ground	Close to 0 Ω (normally closed switch)	Infinitely high when pressure reaches 30 kPa ± 10 kPa (4.35 PSI ± 1.45 PS)



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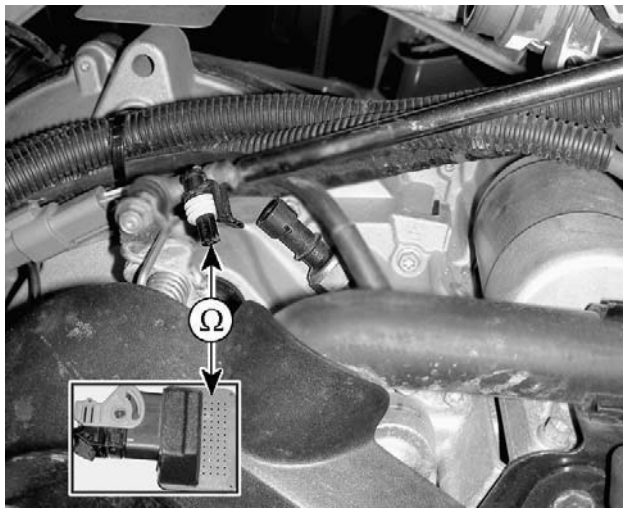
TYPICAL

If resistance values are incorrect, replace the oil pressure switch.

If the values are correct, check the continuity of the wiring harness.

Disconnect the ECM connector and check continuity of circuit between switch and ECM.

OPS CIRCUIT		**MEASUREMENT**
OPS PIN	ECM pin	Resistance (Ω) @ 20°C (68°F)
1	E2	Close to 0 Ω

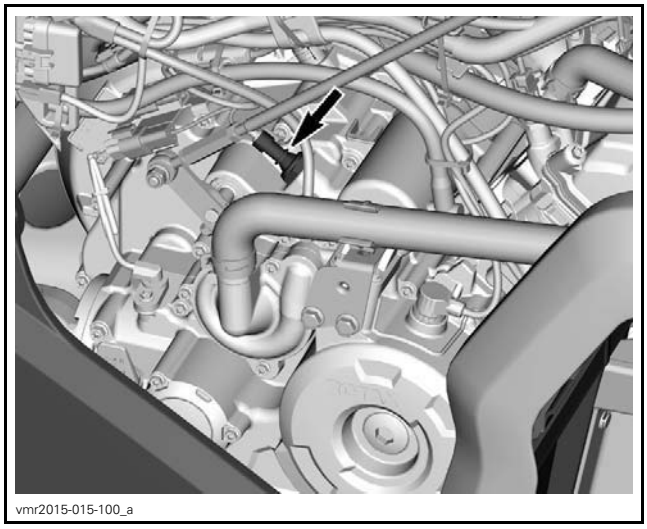


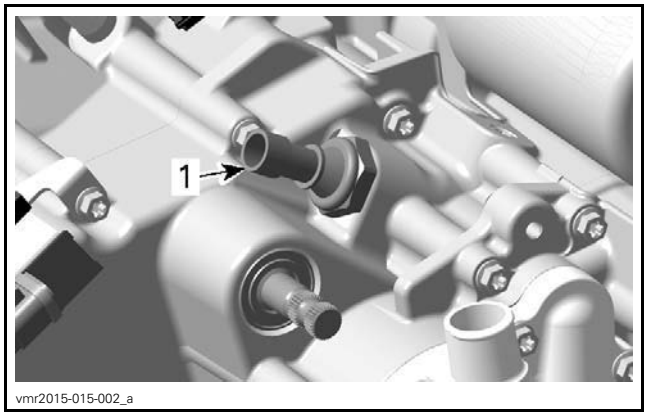
vmr2008-124-104_b

TYPICAL

Oil Pressure Switch Removal

Disconnect and unscrew oil pressure switch.


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vmr2015-015-002_a

1. Oil pressure switch

Oil Pressure Switch Installation

Tighten oil pressure switch to specification.

OIL PRESSURE SWITCH	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening torque	12 N•m ± 1 N•m (106 lbf•**in** ± 9 lbf•**in**)

Plug switch connector.

OIL STRAINER

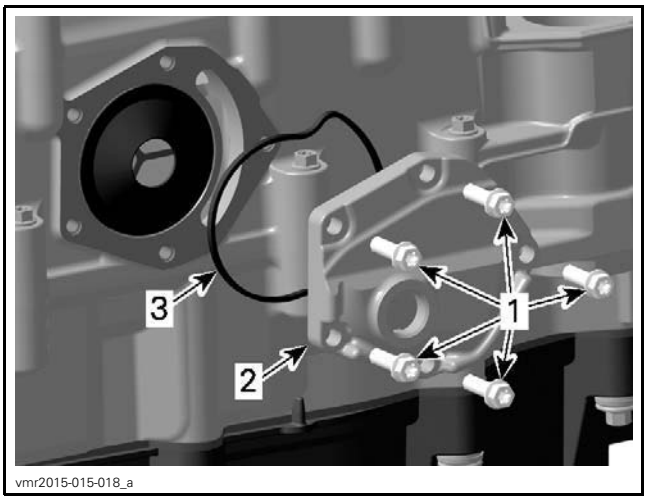
Oil Strainer Access

Engine must be lifted or removed to access the oil strainer. Refer to the *ENGINE REMOVAL AND INSTALLATION* subsection.

Oil Strainer Removal

Drain engine oil, refer to *ENGINE OIL CHANGE* in the *PERIODIC MAINTENANCE PROCEDURES* subsection.

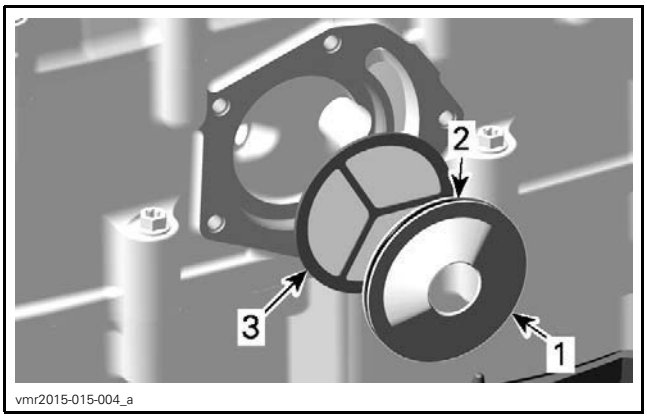
Remove:
– Retaining screws
– Oil strainer cover
– Gasket.



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1. Retaining screws
2. Oil strainer cover
3. Gasket

Remove:
– Oil collector with O-ring
– Oil strainer.



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1. Oil collector
2. O-ring
3. Oil strainer

Oil Strainer Cleaning and Inspection

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

⚠ WARNING

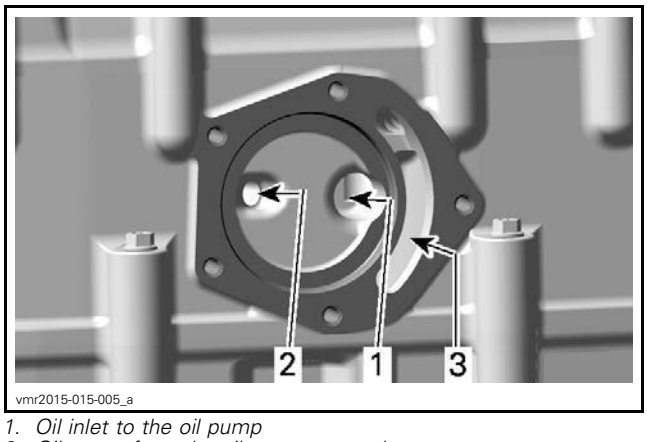
Always wear eye protector. Chemicals can cause a rash break out in and an injury to your eyes.

Check engine oil strainer for cracks or other damage. Replace if damaged.

Inspect O-ring on the oil collector and rubber ring on the oil strainer cover if brittle, cracked or hard. Replace the defective parts.

Clean both contact surfaces of oil strainer cover.

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



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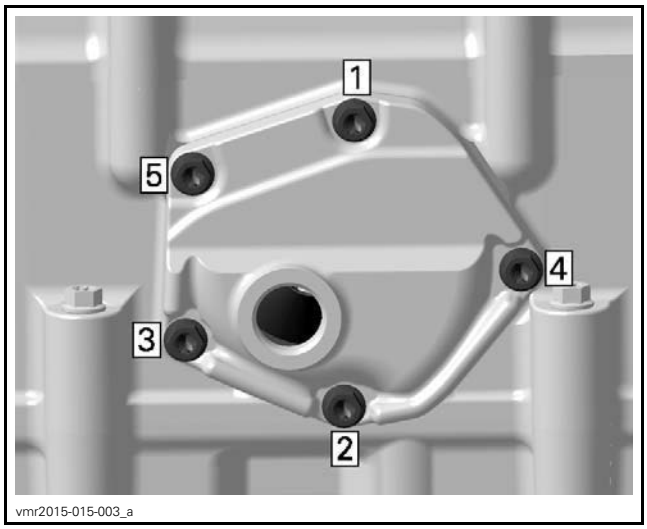
1. Oil inlet to the oil pump
2. Oil return from the oil pressure regulator system
3. Oil return from the engine oil circulation

Oil Strainer Installation

For installation, reverse the removal procedure.

Tighten oil strainer cover screws as per following sequence.

OIL STRAINER COVER SCREWS	
Tightening torque	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)



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TIGHTENING SEQUENCE

Tighten magnetic drain plug to specification.

MAGNETIC DRAIN PLUG	
Gasket ring	NEW
Tightening torque	30 N•m ± 2 N•m (22 lbf•ft ± 1 lbf•ft)

Reinstall engine in vehicle, refer to *ENGINES REMOVAL AND INSTALLATION* subsection.

Refill engine at the proper level with the recommended oil, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

Start engine and let idle for a few minutes.

Ensure oil filter and magnetic drain plug areas are not leaking.

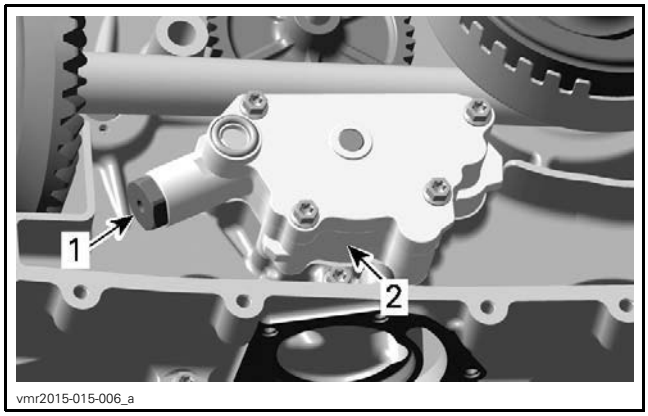
Stop engine.

Wait a while to allow oil to flow down to crankcase then check oil level. Refill as necessary.

ENGINE OIL PRESSURE REGULATOR

Oil Pressure Regulator Location

The oil pressure regulator is located in the oil pump housing (engine MAG side, behind magneto cover).



1. Oil pressure regulator plug
2. Oil pump housing

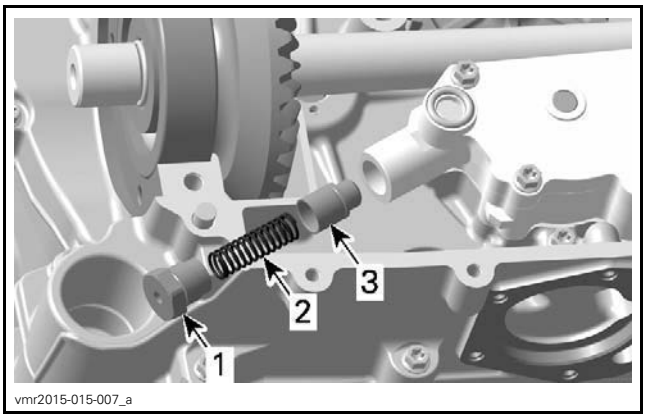
NOTE: The oil pressure regulator system works when the oil pressure exceeds 500 kPa (73 PSI).

Oil Pressure Regulator Removal

Remove:
- Engine from vehicle (refer to *ENGINE REMOVAL/INSTALLATION* subsection)
- Water pump cover (refer to *COOLING SYSTEM* subsection)
- Magneto cover (refer to *MAGNETO AND STARTER* subsection).

Remove:
- Oil pressure regulator plug
- Compression spring
- Valve piston.

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



1. Oil pressure regulator plug
2. Compression spring
3. Valve piston

Oil Pressure Regulator Inspection

Inspect valve piston for scoring or other damages.

Check compression spring for free length.

COMPRESSION SPRING FREE LENGTH	
NEW NOMINAL	64 mm (2.52 in)
SERVICE LIMIT	62 mm (2.441 in)

Replace both parts if important wear or damage are present.

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

Oil Pressure Regulator Installation

For installation, reverse the removal procedure.

Tighten oil pressure regulator plug screw to specification.

OIL PRESSURE REGULATOR PLUG SCREW	
Tightening torque	12 N•m ± 1 N•m (106 lbf•**in** ± 9 lbf•**in**)

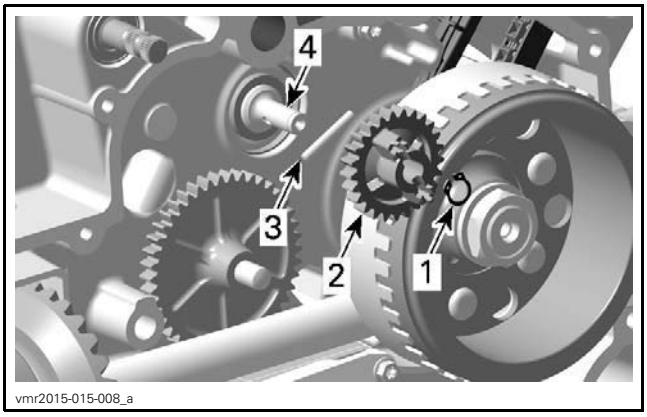
OIL PUMP

The oil pump is located on the engine MAG side (refer to *ENGINE OIL PRESSURE REGULATOR*).

Oil Pump Removal

Remove:
– Engine from vehicle (refer to *ENGINE REMOVAL AND INSTALLATION* subsection)
– Water pump cover (refer to *COOLING SYSTEM* subsection)
– Magneto cover (refer to *MAGNETO AND STARTER* subsection).

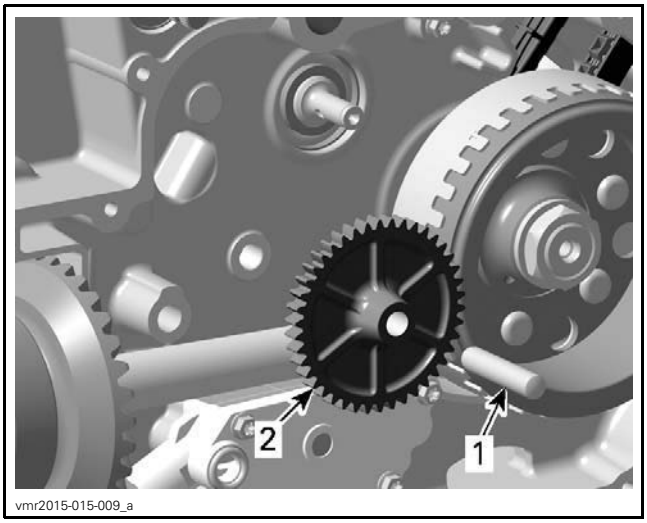
Remove only if necessary:
– Retaining ring (discard it)
– Drive gear
– Needle pin.



1. Retaining ring (discard)
2. Drive gear
3. Needle pin
4. Balancer shaft

NOTICE Never use the retaining ring a second time. Always replace by a NEW one.

Remove only if necessary:
– Pin
– Intermediate gear.

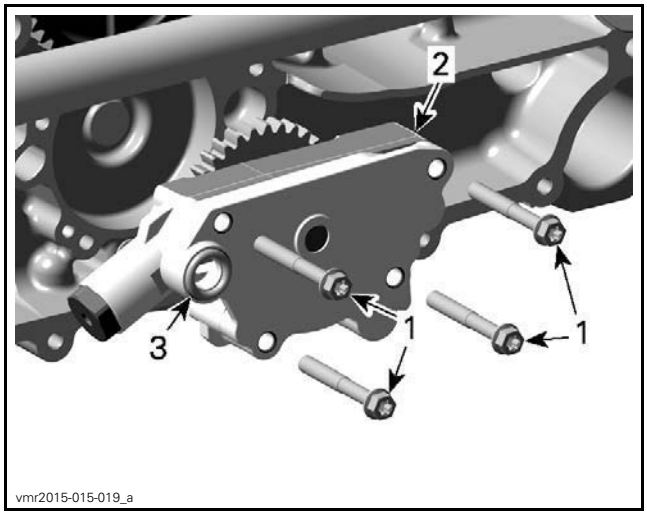


1. Pin
2. Intermediate gear

Remove:
– Oil pump cover screws
– Oil pump module with O-ring.

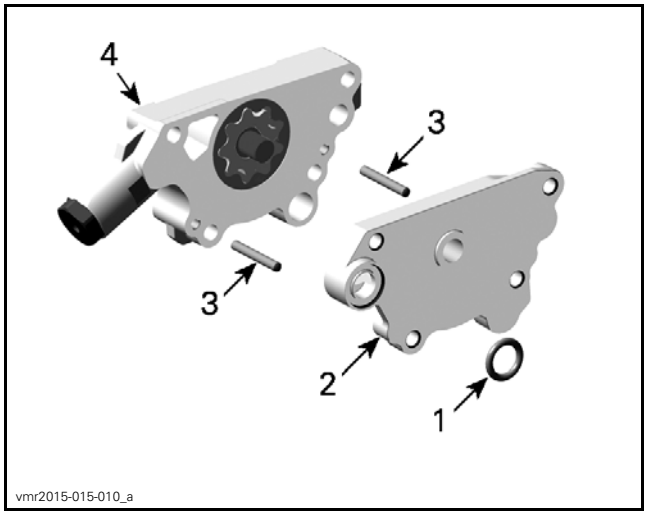
NOTICE Do not loose oil pump cover O-ring.

NOTICE Pay attention not to drop the dowel pins inside the engine.



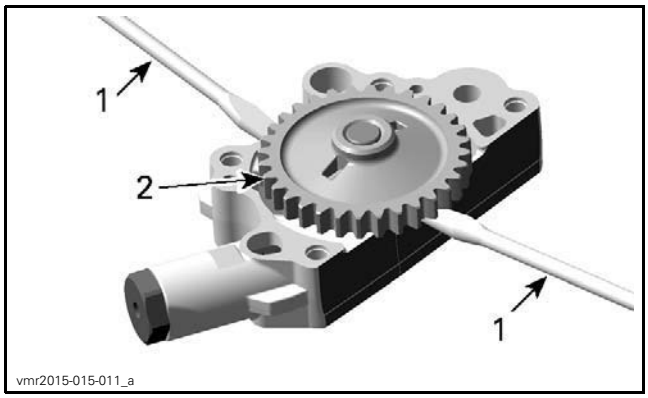
1. Oil pump cover screws
2. Oil pump module
3. O-ring, sealing to crankcase MAG side

Remove:
– O-ring
– Oil pump cover
– Dowel pins.



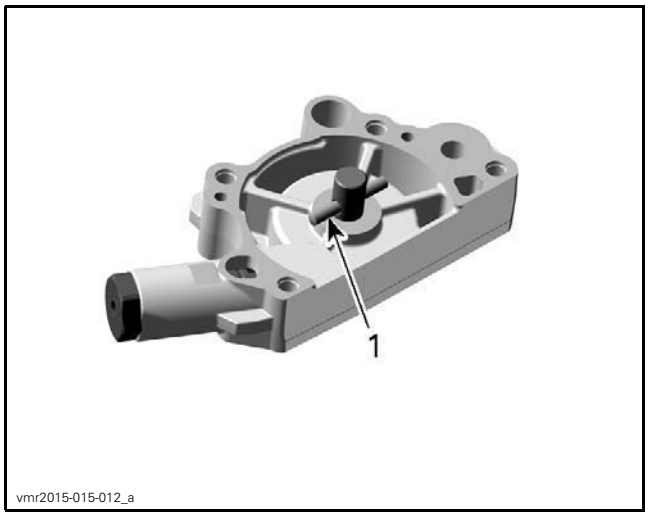
1. O-ring
2. Oil pump cover
3. Dowel pins
4. Oil pump housing

Use screwdrivers to remove oil pump gear.



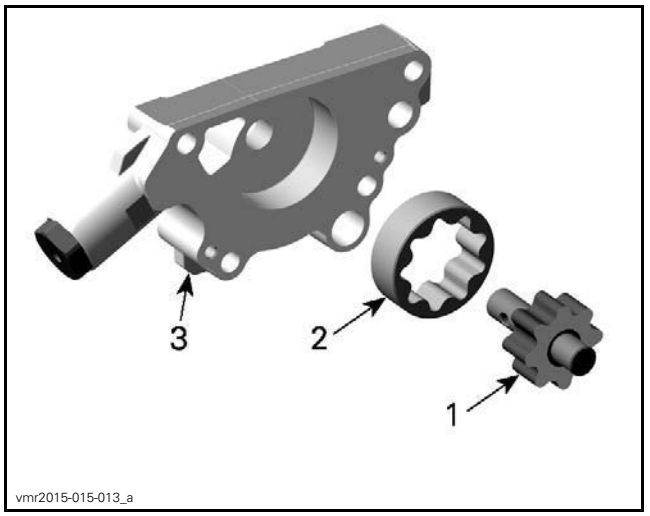
1. Flat screwdrivers
2. Oil pump gear

Remove:
– Needle pin



1. Needle pin

Remove:
– Oil pump shaft assembly
– Outer rotor.

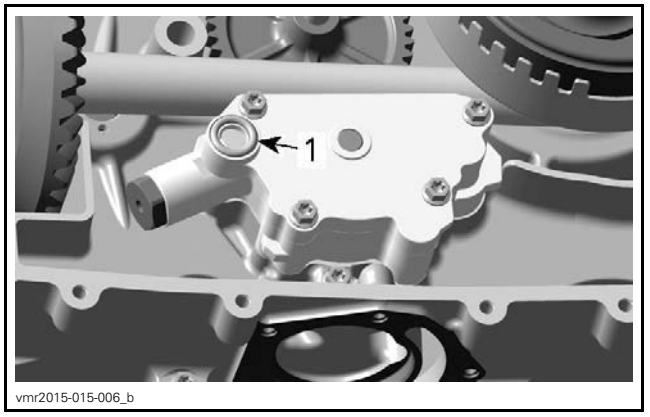


1. Oil pump shaft assembly
2. Outer rotor
3. Oil pump housing

Oil Pump Inspection

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

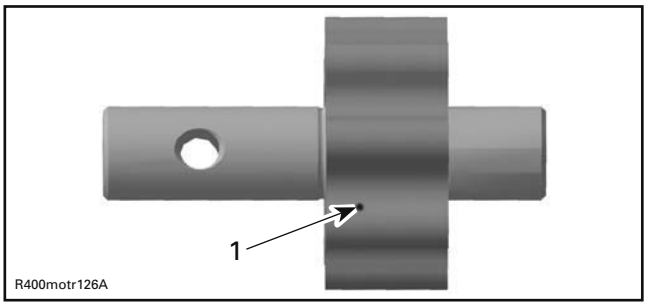
Replace O-ring if damaged, brittle or hard.



1. O-ring

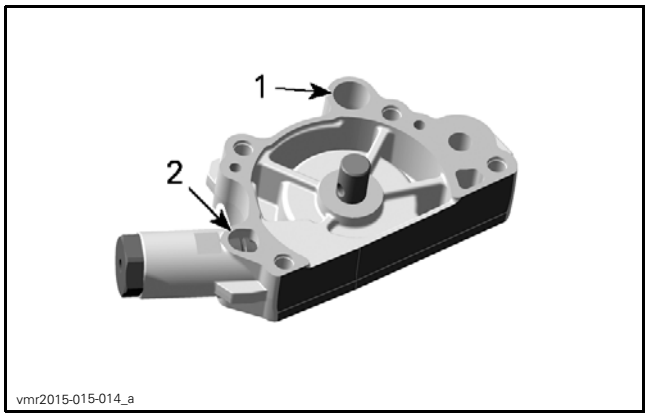
Check inner rotor for corroded pin holes or other damages. If so, replace oil pump shaft assembly.

Check the inside of oil pump housing and its cover for scoring or other damages. If so, change the complete oil pump assembly.

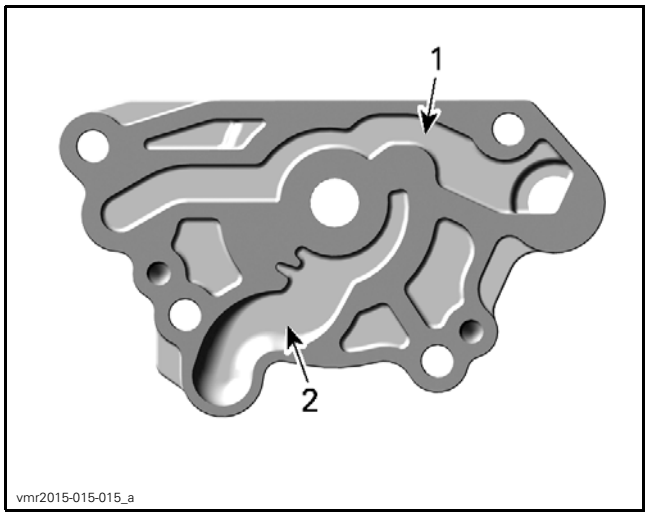


1. Pittings on the teeth

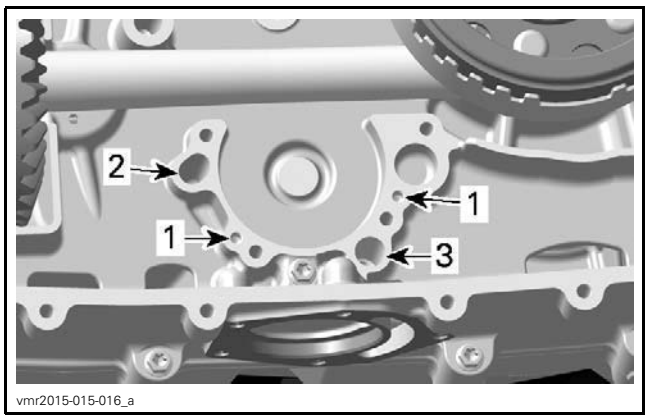
Clean oil passages and make sure they are not clogged.



OIL PUMP HOUSING
1. *Suction side of the oil pump*
2. *Outlet from the engine oil pressure regulator valve*

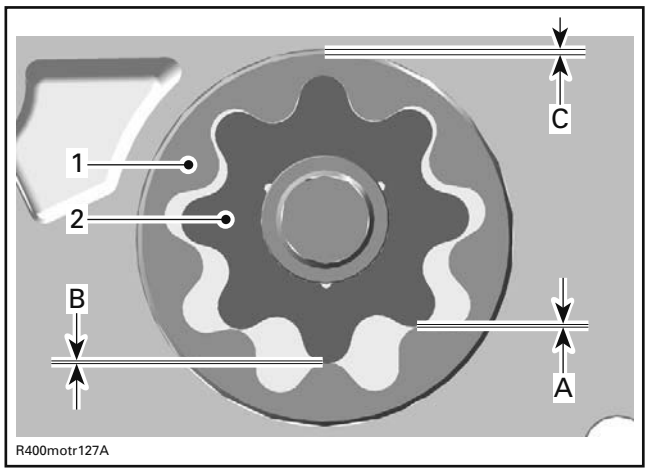


OIL PUMP COVER
1. *Oil from the pump to the oil filter in the magneto cover*
2. *Oil from the pump suction side to the oil pump*



CRANKCASE MAG SIDE
1. *Bores for dowel pins*
2. *Oil return from the oil pressure regulator system*
3. *Oil inlet to the oil pump (leads to strainer on engine bottom)*

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



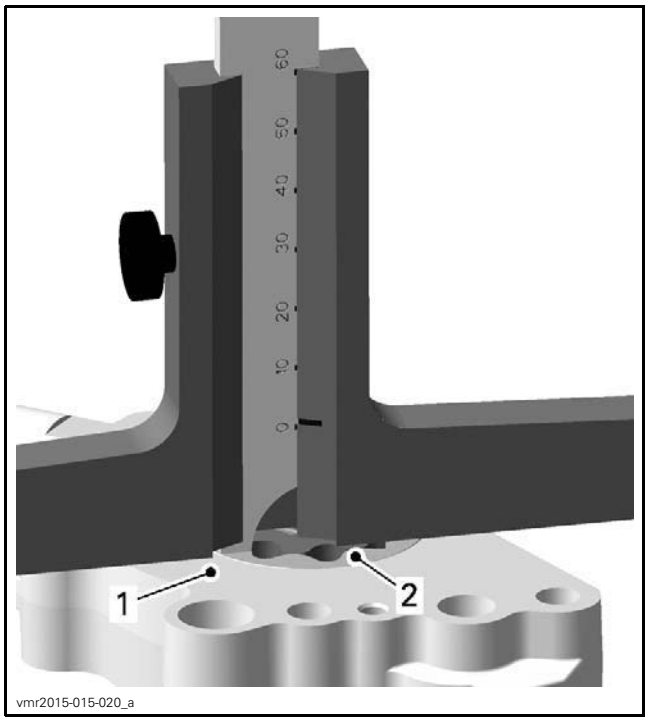
1. *Outer rotor*
2. *Inner rotor*

OUTER AND INNER ROTOR CLEARANCE	
SERVICE LIMIT	
A	0.25 mm (.0098 in)
B	
C	

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

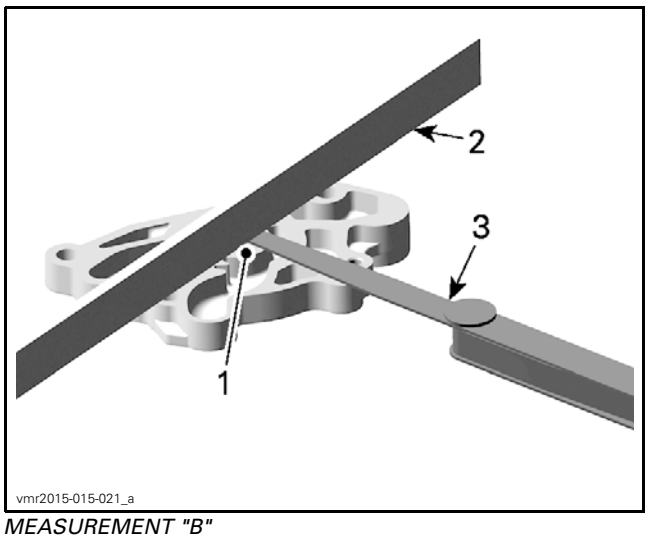
If clearance between outer rotor and its bore in oil pump exceeds the tolerance, replace the complete oil pump assembly.

Measure the axial clearance of the oil pump as shown.



MEASUREMENT "A"
1. *Oil pump housing surface*
2. *Oil pump rotor surface*

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



MEASUREMENT "B"
1. *Oil pump cover surface*
2. *Straight edge*
3. *Feeler gauge*

Add measurement A to measurement B to obtain axial clearance.

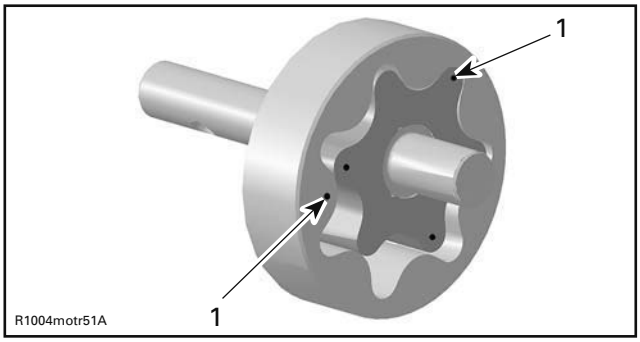
OIL PUMP AXIAL CLEARANCE	
SERVICE LIMIT	0.10 mm (.0039 in)

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

Oil Pump Installation

For installation, reverse the removal procedure.

When installing the oil pump rotors, make sure both markings are on the same side.

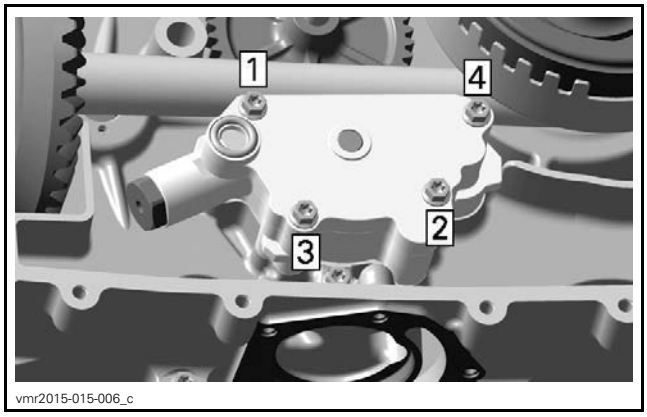


1. Markings on inner and outer rotor

NOTICE Never apply any sealing compound on split surfaces of oil pump.

Tightening oil pump cover screws as per following sequence.

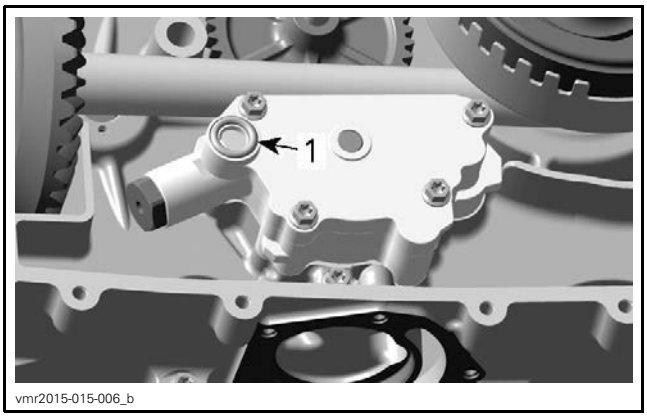
OIL PUMP COVER SCREWS	
Tightening torque	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)



TIGHTENING SEQUENCE

NOTE: After tightening the oil pump cover screws check for smooth operation of the oil pump assembly.

Install the O-ring on oil pump cover.



1. O-ring

After engine is completely reassembled, start engine and make sure oil pressure is within specifications (refer to *ENGINE OIL PRESSURE TEST* in this subsection).

COOLING SYSTEM

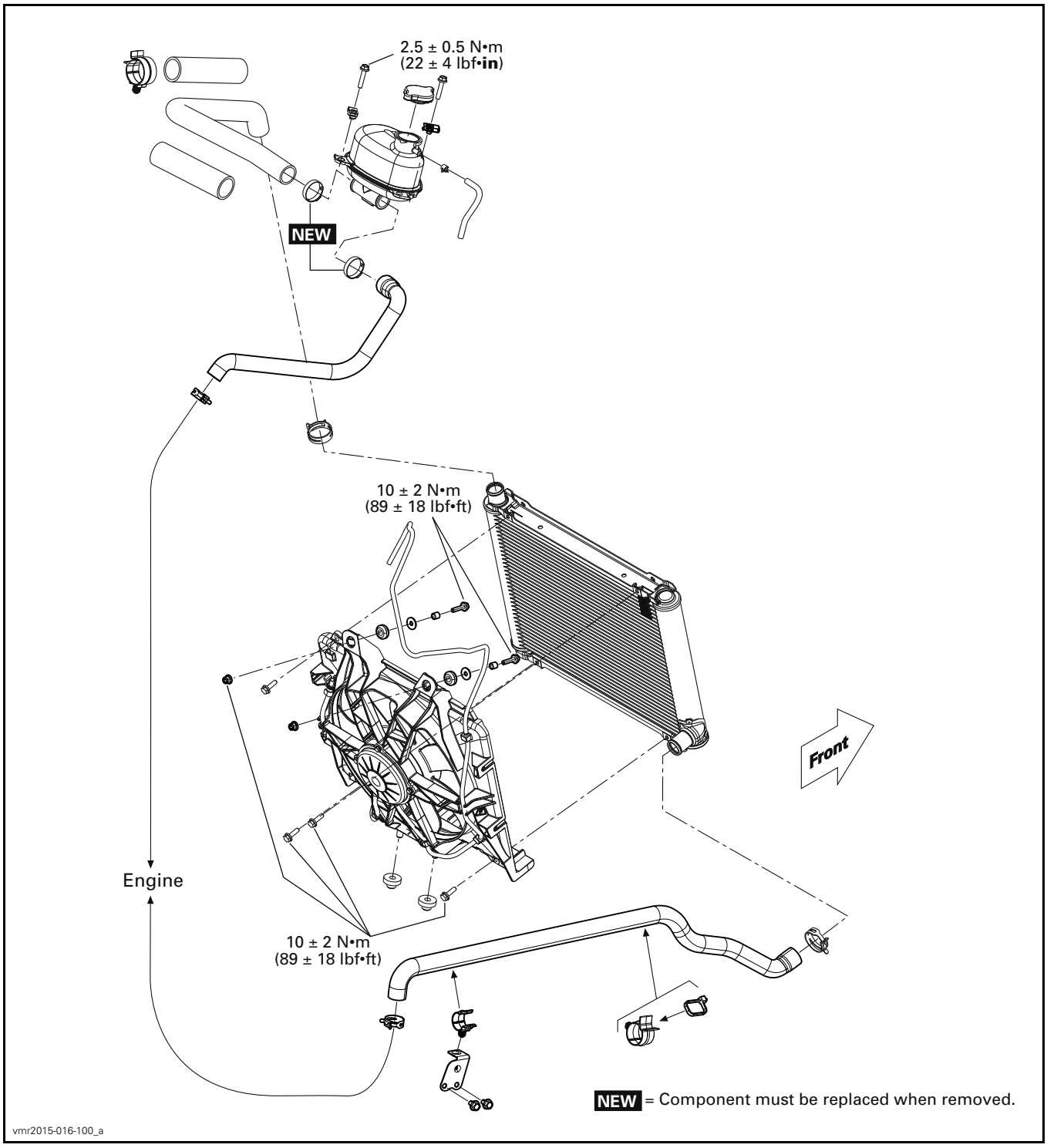
SERVICE TOOLS

Description	Part Number	Page
BLIND HOLE PULLER KIT	529 036 056	104
HANDLE	420 877 650	105
OIL SEAL PUSHER	529 035 757	105
SEAL PUSHER	529 035 766	105

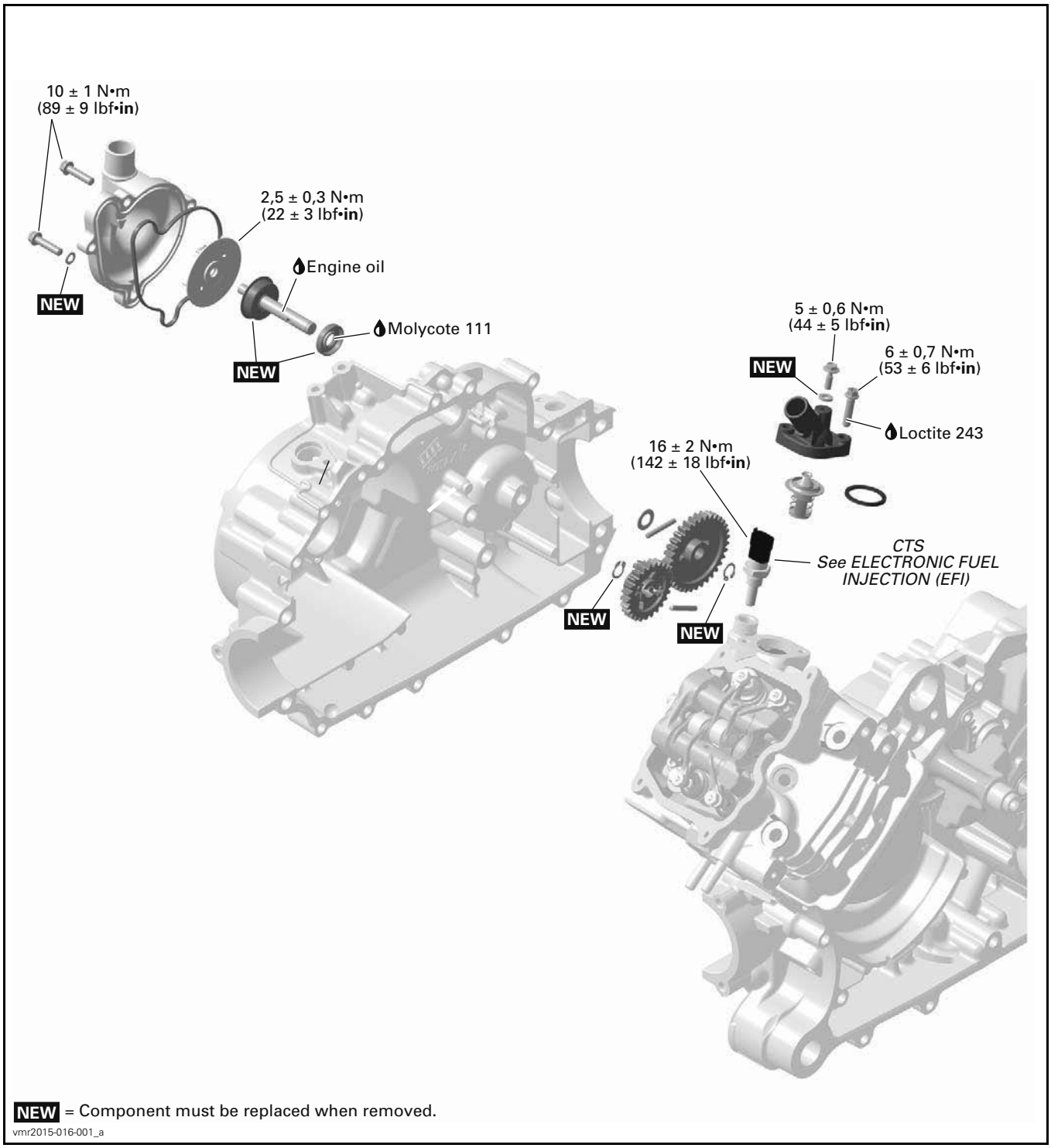
SERVICE PRODUCTS

Description	Part Number	Page
DOW CORNING 111	413 707 000	106
LOCTITE 243 (BLUE)	293 800 060	99

RADIATOR


2.5 ± 0.5 N•m
(22 ± 4 lbf•in)
NEW
10 ± 2 N•m
(89 ± 18 lbf•ft)
Front
Engine
10 ± 2 N•m
(89 ± 18 lbf•ft)
NEW = Component must be replaced when removed.
vmr2015-016-100_a

WATER PUMP AND THERMOSTAT



NEW = Component must be replaced when removed.

vmr2015-016-001_a

GENERAL

⚠ WARNING

Never start engine without coolant. Engine parts and ceramic seal on water pump shaft can be damaged.

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, self-locking fasteners, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

INSPECTION

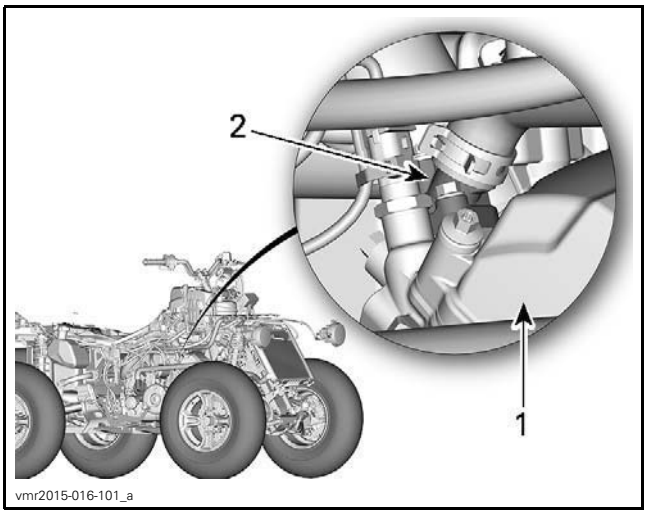
PROCEDURES

THERMOSTAT

The thermostat is a single action type, located on the RH rear side of the cylinder head.

Thermostat Access

Remove the RH side body panel.

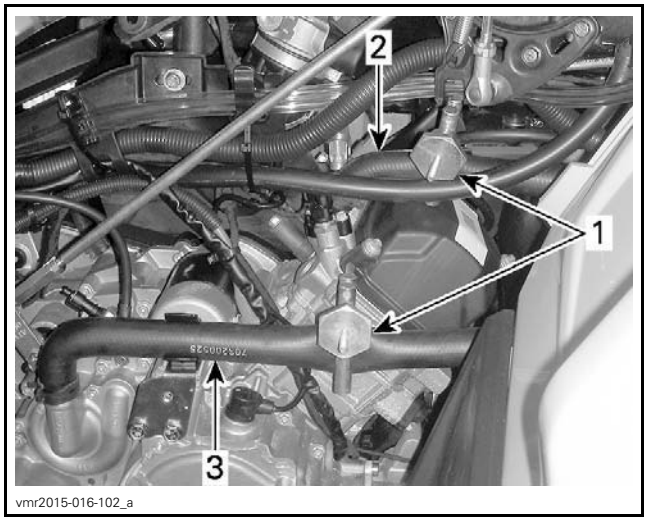


vmr2015-016-101_a

1. Valve cover
2. Thermostat housing

Thermostat Removal

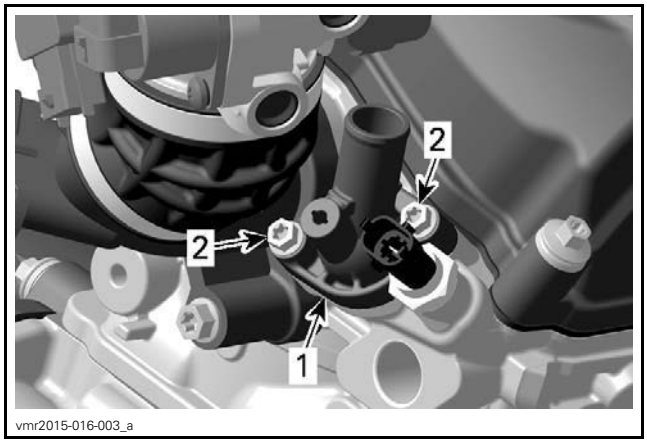
Install a hose pincher on both radiator hoses.



vmr2015-016-102_a

1. Hose pinchers
2. Coolant return hose from thermostat
3. Radiator coolant outlet hose

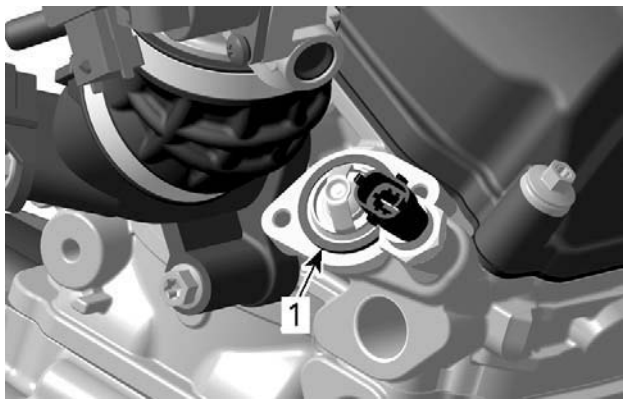
Remove thermostat housing screws and pull thermostat housing off cylinder head.



vmr2015-016-003_a

1. Thermostat housing
2. Screws

Remove thermostat with gasket.



1. Thermostat with gasket

Thermostat Test

To test thermostat, put it in water and heat the water.

THERMOSTAT OPENING TEMPERATURE	
STARTS TO OPEN	FULLY OPEN
65°C (149°F)	75°C (167°F)

Replace thermostat if it does not begin to open at specified temperature.

Check gasket to see if it is brittle, hard or damaged. If so, replace gasket.

Thermostat Installation

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

Tighten thermostat cover screws to specification.

THERMOSTAT COVER SCREWS	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening torque	6 N•m ± 0.7 N•m (53 lbf•**in** ± 6 lbf•**in**)

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

Check cooling system for leaks.

RADIATOR

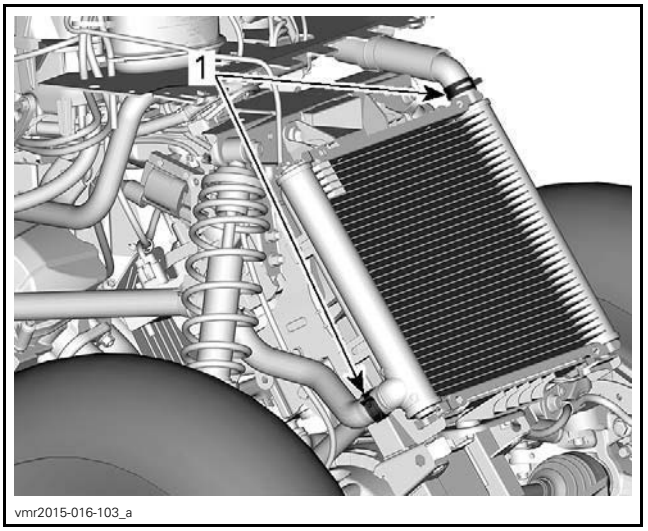
Radiator Inspection

Check radiating fins for clogging or damage.

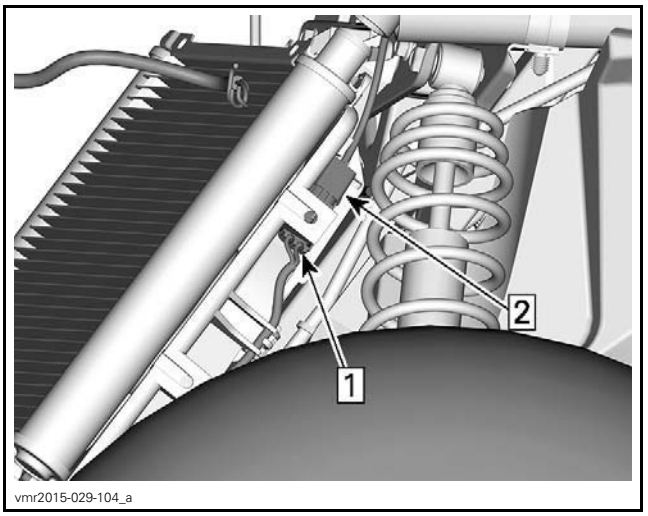
Remove insects, mud or other obstructions with compressed air or low pressure water.

Radiator Removal

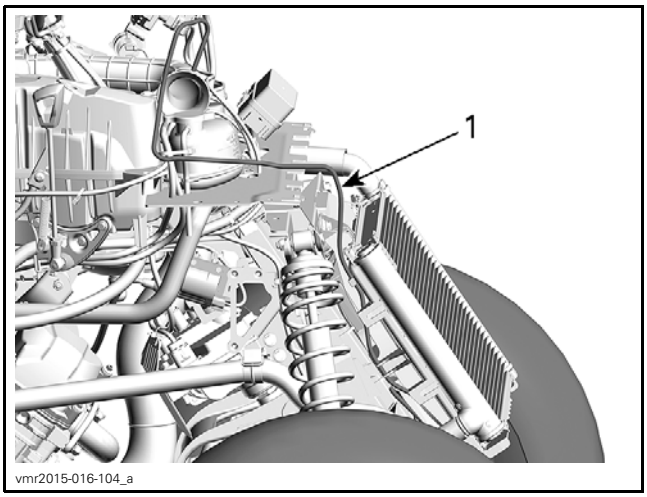
1. Drain engine coolant. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
2. Remove front body module. Refer to *BODY* subsection.
3. Disconnect radiator and fan assembly.



1. Radiator hoses

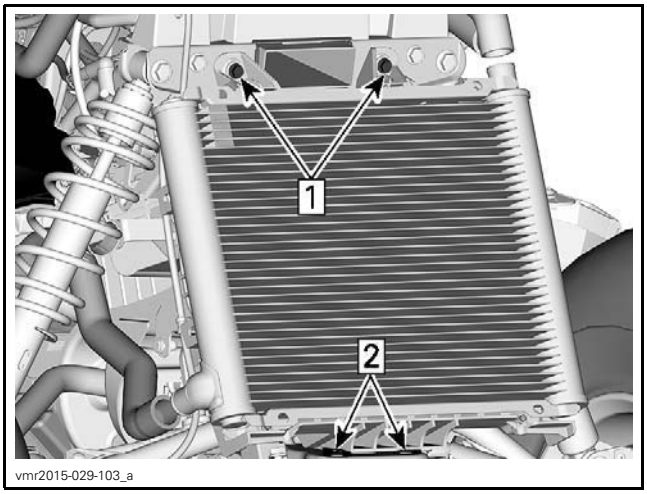


Step 1: Disconnect cooling fan connector
Step 2: Remove the harness connector from the fan shroud



TYPICAL
1. Remove fan motor vent hose

NOTE: Take note of the rooting of vent hose on vehicle to ease reinstallation.



Step 1: Remove upper retaining bolts
Step 2: Remove radiator from bushings

Radiator Installation

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

Ensure that rubber bushings are properly installed between frame and fan shroud.

Ensure that vent hose of the cooling fan motor is properly rooted as prior to removal.

NOTICE **If the vent hose of the cooling fan motor is not properly rooted, the fan motor may be damaged due to improper venting.**

Tighten radiator upper retaining bolts to specification.

RADIATOR UPPER RETAINING BOLTS	
Tightening torque	10 N•m ± 2 N•m (89 lbf•**in** ± 18 lbf•**in**)

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

Check cooling system for leaks.

RADIATOR COOLING FAN

Radiator Cooling Fan Operation

The ECM controls the radiator cooling fan via the input of the coolant temperature sensor (CTS) and the manifold air pressure and temperature sensor (MAPTS). Refer to the following tables.

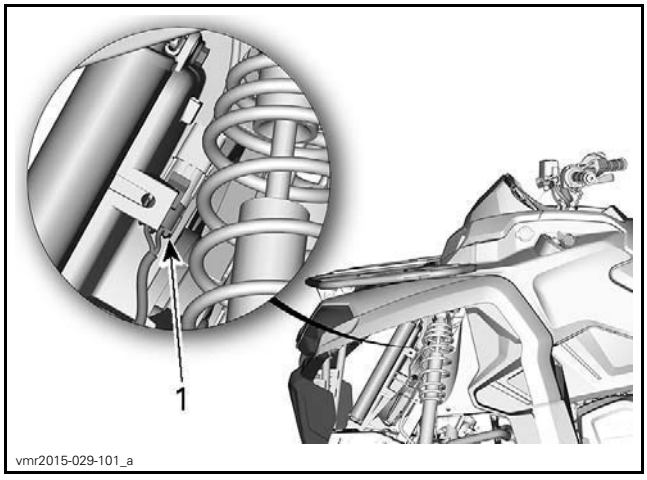
ENGINE TEMP.	COOLING FAN	CHECK ENGINE LIGHT	GAUGE MESSAGE
95°C (203°F)	Turns ON		
93°C (199°F)	Turn OFF		
115°C (239°F)	ON	Turns ON	Check engine Hi Temp
118°C (244°F)	ON	Flashes	Limp Home

Radiator Cooling Fan Fuse Location

The fuse (F9) is located in front fuse box under gauge support.

Radiator Cooling Fan Test

1. Disconnect radiator cooling fan connector.



1. Cooling fan connector

2. Connect cooling fan connector pin B to a suitable 20 A fuse jumper and then directly to the positive battery post.

3. Connect cooling fan connector pin A (BK wire) directly to the negative battery post.
4. Check if cooling fan works properly.
   – If cooling fan does not work, replace it.
   – If cooling fan works properly, refer to *RADIATOR COOLING FAN TROUBLESHOOTING CHART*.
5. Reconnect radiator cooling fan connector.

Radiator Cooling Fan Troubleshooting

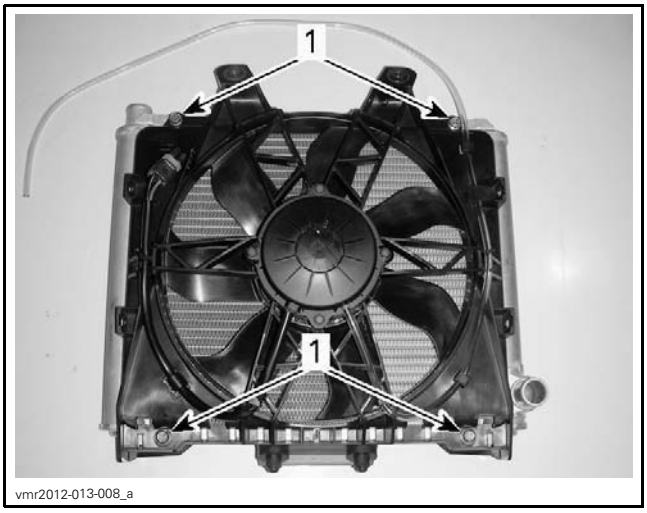
NOTE: The following troubleshooting chart assumes that the engine is operating in the fan activation temperature range. Refer to *RADIATOR COOLING FAN OPERATION*.

COOLING FAN TROUBLESHOOTING CHART		
Is fan working?	YES →	Everything is OK
NO ↓		
Check FAN fuse (F9) Is fuse burnt?	YES →	Replace fuse Is fan working?
NO ↓		
Bypass fan relay R1 (refer to *RELAY OPERATION TEST*)		
↓		
Fan turns?	YES →	Replace relay Is fan working?
NO ↓		
Apply 12 Vdc and a ground to fan connector (refer to *RADIATOR COOLING FAN TEST*)		
↓		
Fan turns?	NO →	Replace fan Is fan working?
YES ↓		
Check CTS (refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection)		
↓		
CTS works?	NO →	Replace CTS Is fan working?
YES ↓		
Check wiring harness and connectors (refer to *WIRING DIAGRAM*)		
↓		
Harness and connectors good?	NO →	Repair or replace defective part(s)
YES ↓		
Try a new ECM	→	Is fan working?

Radiator Cooling Fan Removal

1. Proceed with *RADIATOR REMOVAL*. See procedure in this subsection.

2. Remove radiator cooling fan retaining screws.



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1. Cooling fan retaining screws

3. Remove radiator cooling fan.

Radiator Cooling Fan Installation

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

Tighten cooling fan retaining screws to specification.

RADIATOR COOLING FAN SCREWS	
Tightening torque	10 N•m ± 2 N•m (89 lbf•**in** ± 18 lbf•**in**)

RADIATOR COOLING FAN RELAY (R1)

Relay Location (Radiator Cooling Fan)

The relay (R1) is located in front fuse box under gauge support.

Relay Operation Test (Radiator Cooling Fan)

1. Remove relay (R1).
2. Bypass relay using a jumper. Refer to *WIRING DIAGRAM* to locate proper terminals.
3. If the radiator cooling fan is activated, replace the relay.

Relay Continuity Test (Radiator Cooling Fan)

Refer to *POWER DISTRIBUTION AND GROUNDS* subsection.

COOLANT TEMPERATURE SENSOR (CTS)

The coolant temperature sensor is located next to the thermostat housing on the RH rear side of the cylinder head.

Refer to *ELECTRONIC FUEL INJECTION* subsection.

WATER PUMP HOUSING

NOTE: The water pump housing is located on the engine MAG side (RH).

Water Pump Housing Location

The water pump housing is located on the RH side of the engine.

Water Pump Housing Access

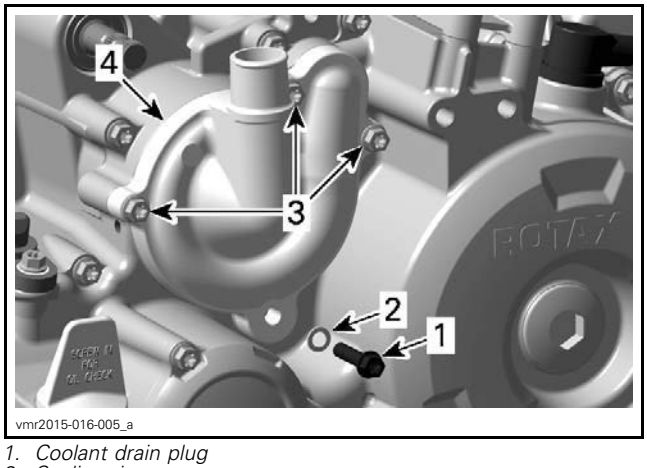
Remove RH side panel and extension, refer to *BODY* subsection.

Water Pump Housing Removal

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

Remove radiator outlet hose from water pump housing.

Remove screws retaining water pump housing.



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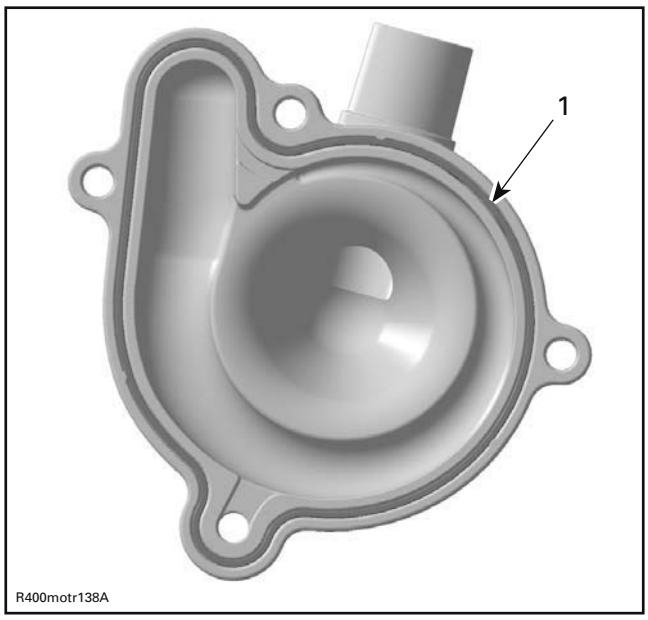
1. Coolant drain plug
2. Sealing ring
3. Screws
4. Water pump housing

Pull on water pump housing to remove it.

Water Pump Housing Inspection

Check if gasket is brittle, hard or damaged.

Replace as required.



WATER PUMP COVER
1. Gasket

Water Pump Housing Installation

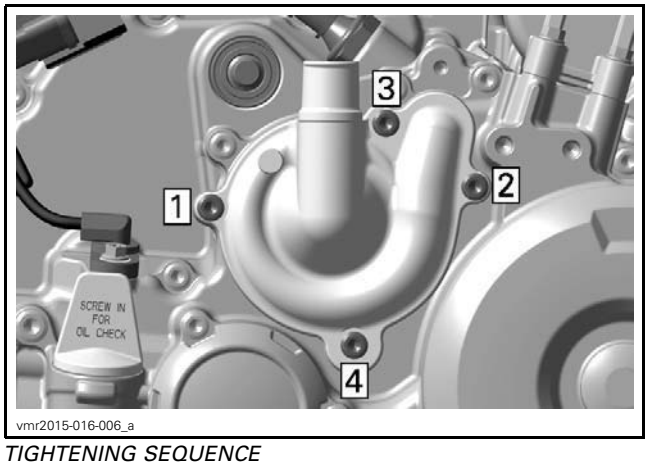
The installation is the opposite of the removal procedure.

NOTICE **To prevent leaking, make sure the gasket is properly inserted in the water pump housing groove when you reinstall the water pump cover.**

Install a NEW gasket ring on water pump housing screw.

Tightening sequence for screws on water pump cover is as per following illustration (criss-cross).

WATER PUMP HOUSING SCREWS	
Gasket ring	NEW
Tightening torque	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)



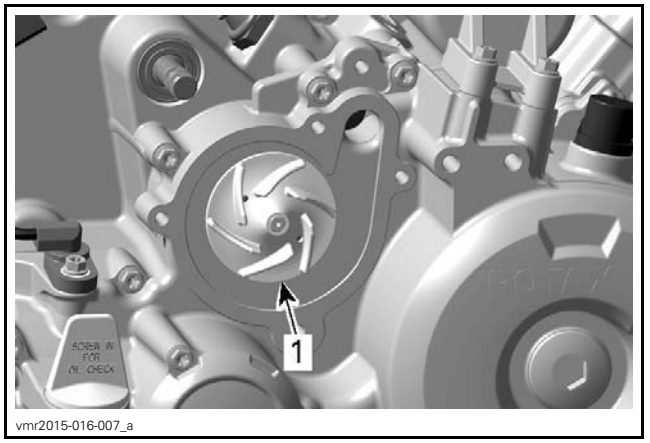
TIGHTENING SEQUENCE

WATER PUMP IMPELLER

Water Pump Impeller Removal

Remove water pump housing, see procedure in this subsection.

Unscrew impeller from water pump shaft.



1. Impeller

Water Pump Impeller Inspection

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

Water Pump Impeller Installation

The installation is the opposite of the removal procedure.

NOTE: Be careful not to damage the impeller blades during installation.

WATER PUMP SHAFT AND SEALS

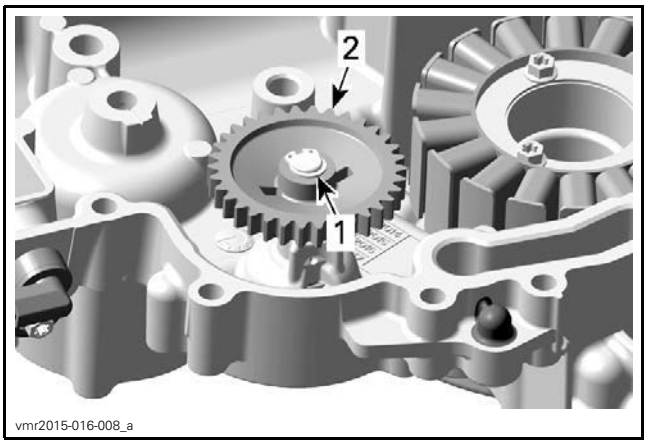
Water Pump Shaft and Seal Removal

Remove water pump housing, refer to *WATER PUMP HOUSING* in this subsection.

Remove impeller.

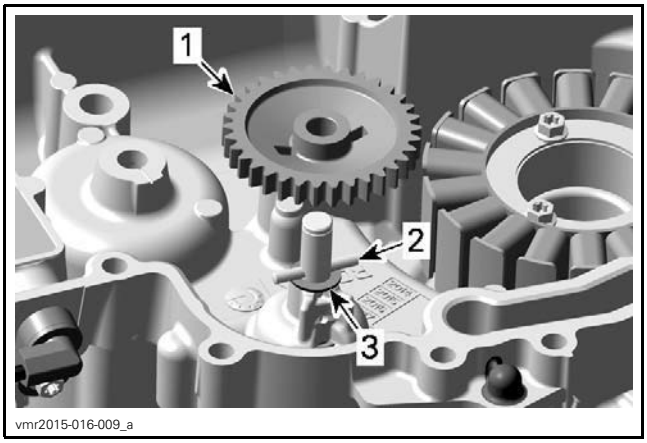
Remove magneto cover, refer to the *MAGNETO AND STARTER* subsection.

Remove circlip from the water pump gear using the appropriate pliers. Discard the circlip.



1. Circlip
2. Water pump gear

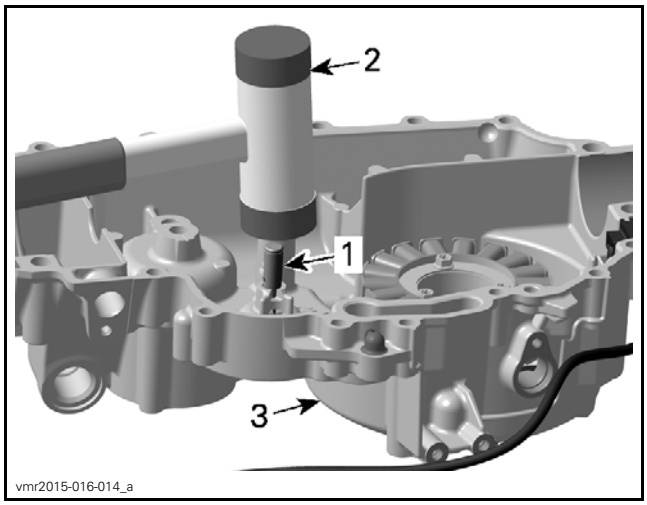
Remove:
– Water pump gear
– Needle pin
– Thrust washer.



1. Water pump gear
2. Needle pin
3. Thrust washer

Push the water pump shaft with inner portion of the rotary seal from inside of magneto cover.

REQUIRED TOOL
Soft hammer

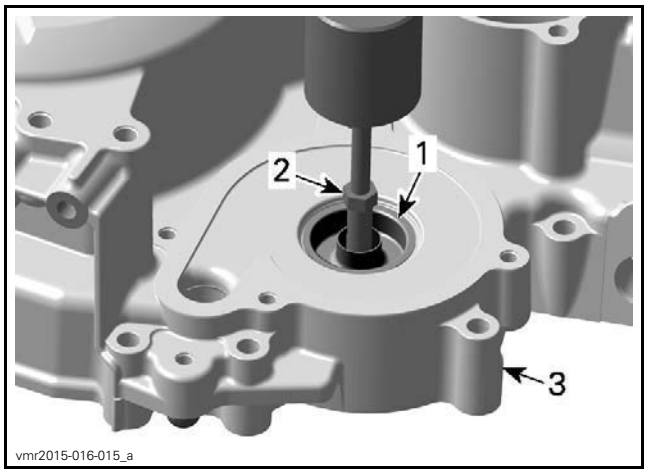


1. Water pump shaft
2. Soft hammer
3. Magneto cover

Install expander snugly against outer part of rotary seal.

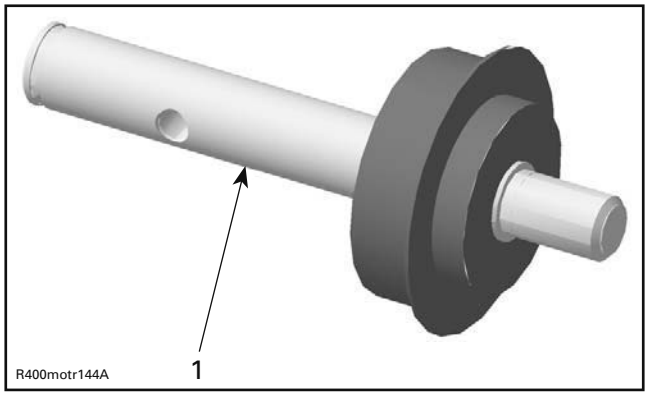
REQUIRED TOOL	
BLIND HOLE PULLER KIT (P/N 529 036 056)	

Pull outer part of rotary seal out.



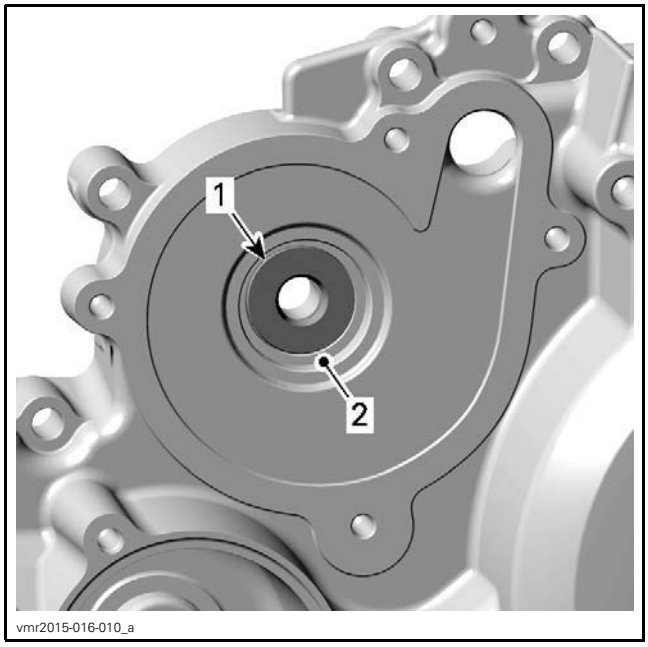
1. Outer part of rotary seal
2. Expander
3. Magneto cover

NOTICE Always replace rotary seal and water pump shaft together. Also install a NEW oil seal at the same time.



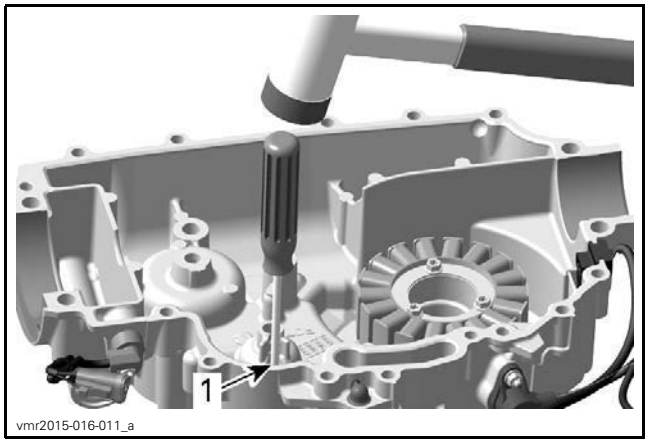
1. Water pump shaft with rotary seal

Remove oil seal from inside magneto cover using an appropriate pusher.



1. Oil seal behind the rotary seal
2. Rotary seal bore

NOTICE Be careful not to damage the surface of the rotary seal bore in magneto cover.



1. Special area for oil seal removal

Water Pump Shaft and Gear Inspection

Inspect water pump gear for:
- Wear
- Cracks
- Broken teeth
- Damage on snap mechanism to the needle pin.

Replace if damaged.

Inspect shaft and rotary seal for wear or damages.

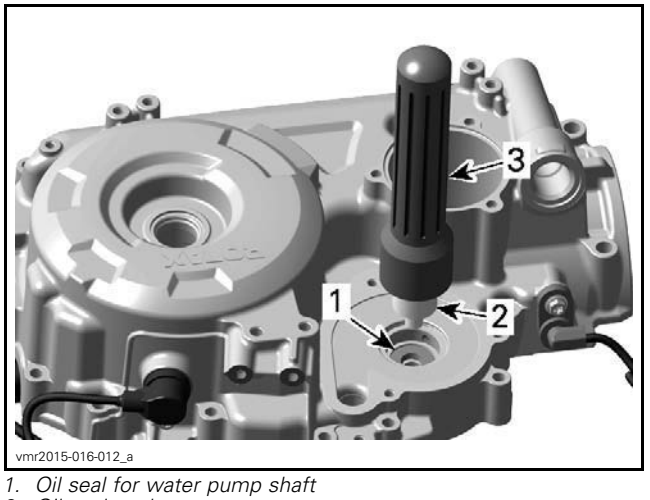
Water Pump Shaft and Seal Installation

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

NOTICE When replacing water pump shaft, always replace circlip, oil seal, water pump shaft and rotary seal with new parts.

Install the water pump shaft oil seal.

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



1. Oil seal for water pump shaft
2. Oil seal pusher
3. Handle

Install the water pump shaft assembly.

REQUIRED TOOL	
SEAL PUSHER (P/N 529 035 766)	

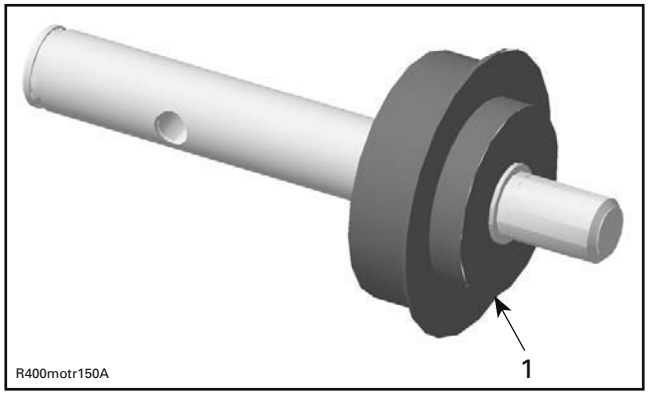
NOTE: Never use oil or grease in the press fit area of the oil seal and rotary seal bores.

Lubricate the sealing lip of the oil seal.

OIL SEAL SEALING LIP	
Service product	DOW CORNING 111 (P/N 413 707 000)

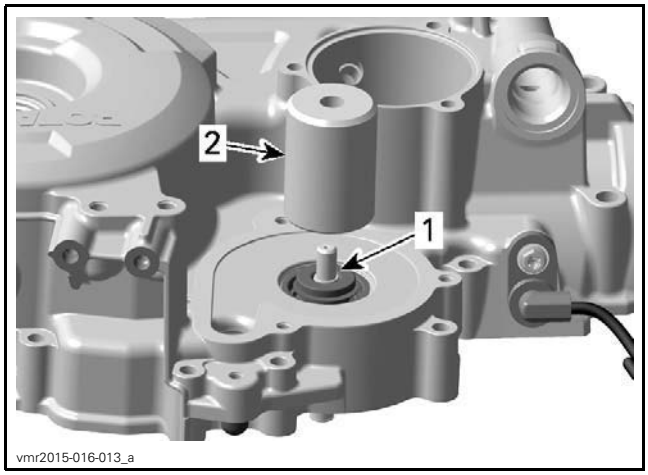
Apply a light coat of engine oil on the water pump shaft.

Press the water pump shaft assembly into the magneto cover using the outside area of the rotary seal.



1. Surface used to press water pump shaft assembly in place

NOTICE Never use a hammer for rotary seal installation. To avoid damaging the ceramic component, seal must be installed using a press.



1. Water pump shaft with rotary seal
2. Water pump ceramic seal installer

NOTE: After installation water pump shaft with rotary seal must rotate freely.

Install magneto cover, refer to *MAGNETO AND STARTER* subsection.

Install all other removed parts.

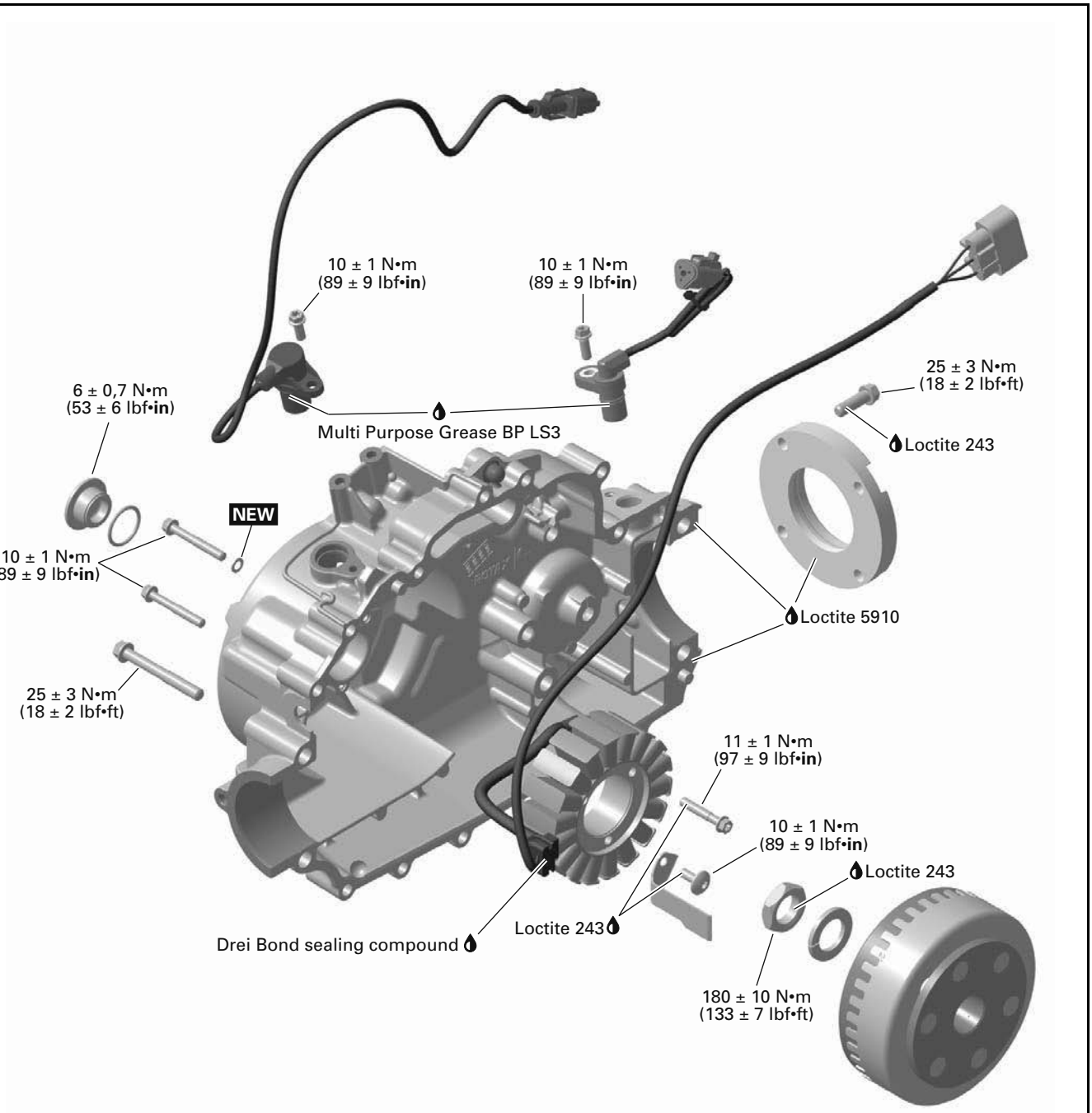
MAGNETO AND STARTER

SERVICE TOOLS

Description	Part Number	Page
BLIND HOLE BEARING PULLER SET	529 036 117	119
CRANKSHAFT PROTECTOR (MAG)	420 876 557	115
FLUKE 115 MULTIMETER	529 035 868	113
HANDLE	420 877 650	120
MAGNETO PULLER	529 035 748	115
STARTER DRIVE NEEDLE INSTALLER	529 035 934	120

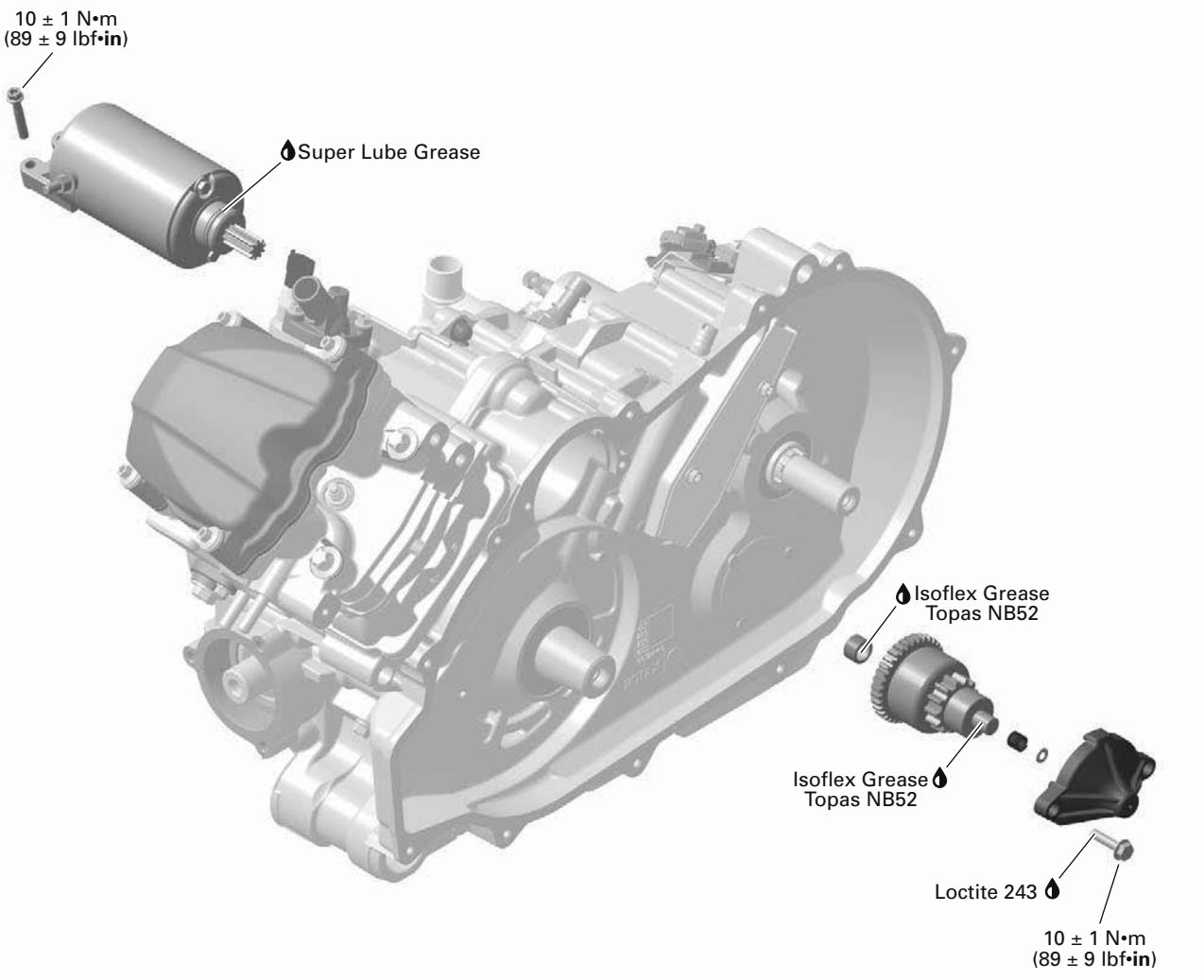
SERVICE PRODUCTS

Description	Part Number	Page
DIELECTRIC GREASE	293 550 004	118
ISOFLEX GREASE TOPAS NB 52	293 550 021	120
LOCTITE 243 (BLUE)	293 800 060	116
LOCTITE 5910	293 800 081	111
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	111
PULLEY FLANGE CLEANER	413 711 809	116
SUPER LUBE GREASE	293 550 030	118



NEW = Component must be replaced when removed.

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NEW = Component must be replaced when removed.

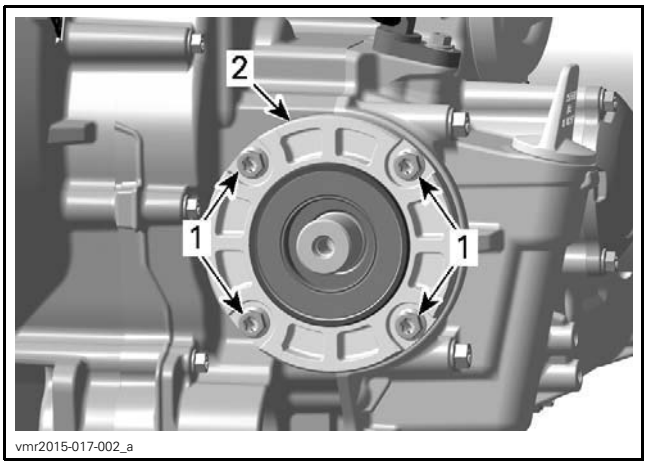
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PROCEDURES

MAGNETO COVER

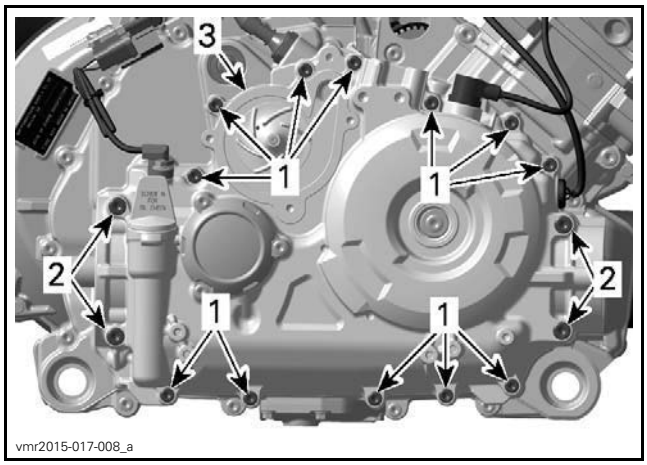
Magneto Cover Removal

1. Remove engine from vehicle.
2. Remove 4WD coupling unit.
3. Lock crankshaft at TDC (refer to *BOTTOM END* subsection.
4. Disconnect stator, CPS and vehicle speed sensor connectors.
5. Remove:
   – Water pump cover, refer to *COOLING SYSTEM* subsection
   – Starter, refer to procedure in this subsection.
6. Remove bearing cover screws.
7. Remove bearing cover.



1. Screws
2. Bearing cover

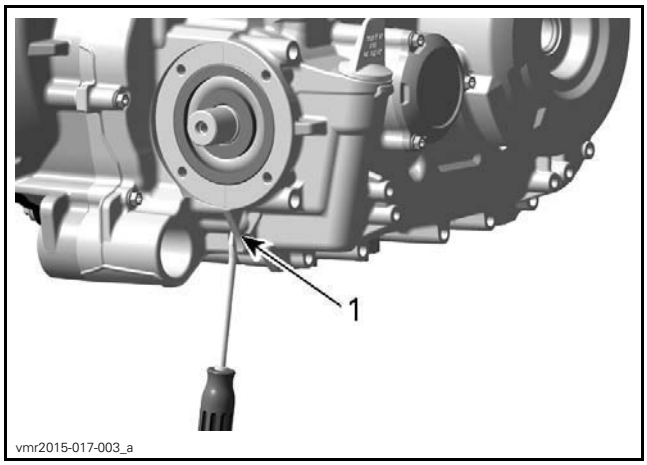
8. Remove magneto cover screws:
   8.1 Start removing M6 screws.
   8.2 Then remove the M8 screws.



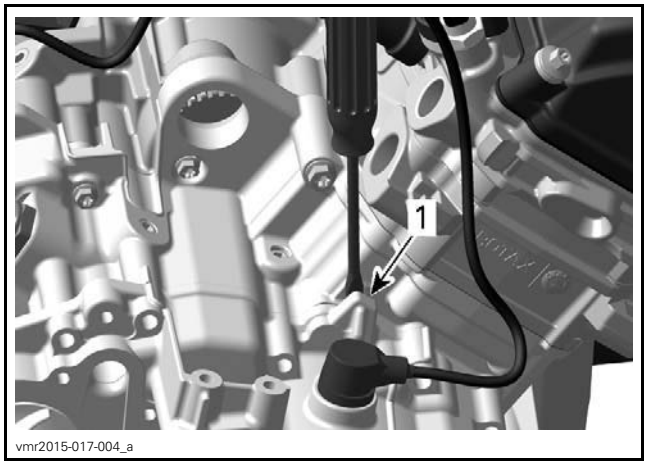
1. M6 screws
2. M8 screws
3. Magneto cover

9. Remove magneto cover.

NOTE: Lift the magneto cover from the provided area using two flat screwdrivers prying equally at the same time.

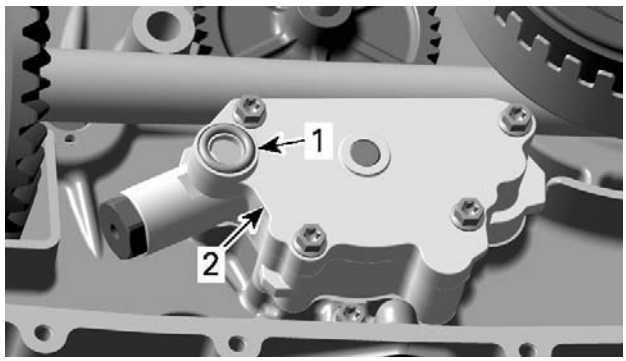


1. Special area for removal of magneto cover



1. Special area for removal of magneto cover

NOTE: Do not loose oil pump cover O-ring when removing the magneto cover.



vmr2015-017-022_a

1. *O-ring*
2. *Oil pump cover*

Magneto Cover Inspection and Cleaning

Check magneto cover and bearing cover for cracks or other damages. Replace if necessary.

Clean all metal component in a solvent.

Clean magneto cover, crankcase and bearing cover sealing surfaces using a combination of LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500) and a brass brush. First brush in one direction, then make the final brushing perpendicularly (90°) to the first pass.

NOTICE **Do not wipe with rags. Use a new clean hand towel only.**

⚠ WARNING

Wear safety glasses and work in a well ventilated area when working with strong chemical products. Also wear suitable non-absorbent gloves to protect your hands.

Magneto Cover Installation

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

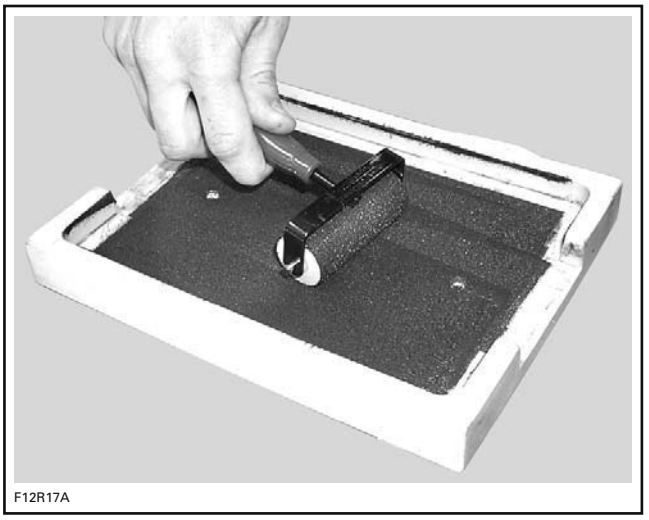
Put ball bearings of output shaft exactly in place, refer to *OUTPUT SHAFT* in the *GEARBOX AND 4X4 COUPLING UNIT* subsection.

Use LOCTITE 5910 (P/N 293 800 081) on mating surfaces.

IMPORTANT: When beginning the application of the sealant, the assembly and the first torquing should be done within 10 minutes. It is suggested to have all you need on hand to save time.

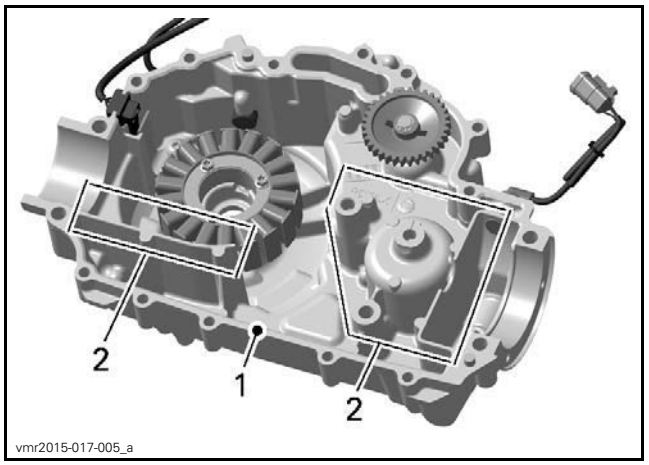
Use a plexyglass plate and apply some sealant on it. Use a soft rubber roller50 mm to 75 mm (2 in to 3 in), available in arts products suppliers for printing, and roll the sealant to get a thin uniform coat on the plate (spread as necessary). When ready, apply the sealant on magneto cover and bearing cover mating surfaces.

NOTE: It is recommended to apply this specific sealant as described here to get an uniform application without lumps. If you do not use the roller method, you may use your finger to uniformly distribute the sealant (using a finger will not affect the adhesion).


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Apply Loctite 5910 all around the magneto cover mating surface except the areas described below.

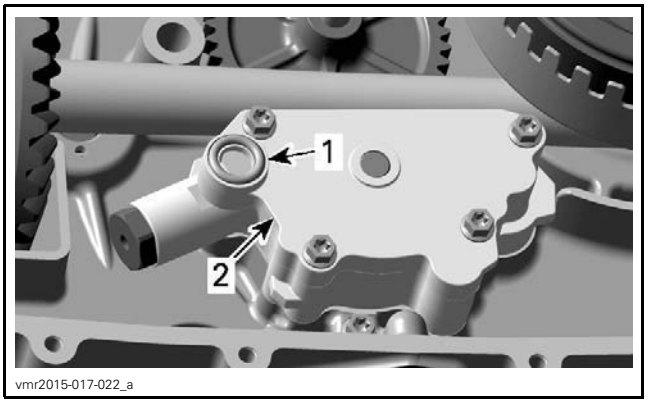
NOTE: Do not apply in excess as it will spread out inside cover.



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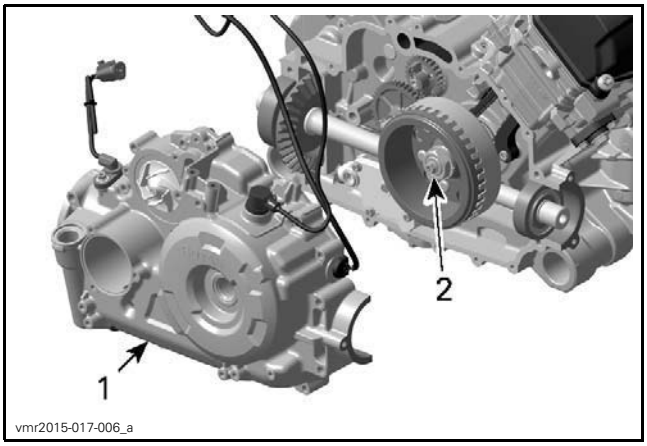
1. *Mating surface on the magneto cover*
2. *No need to apply Loctite 5910*

NOTE: Ensure that oil pump cover O-ring is in place before installing the magneto cover.



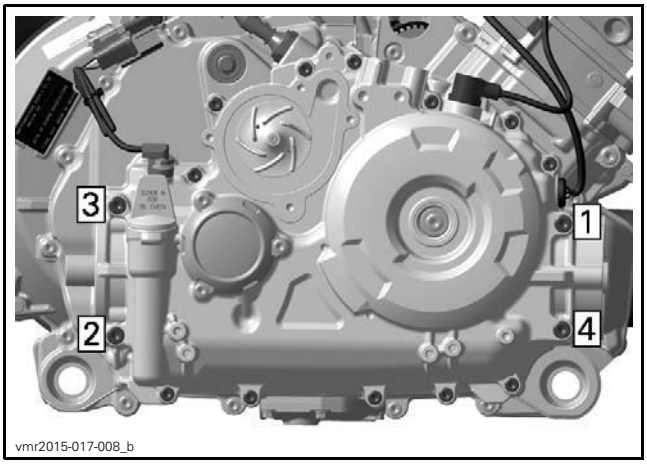
1. O-ring
2. Oil pump cover

Install the magneto cover.



1. Magneto cover
2. Crankshaft MAG side

Tighten the M8 magneto cover screws as per following sequence.

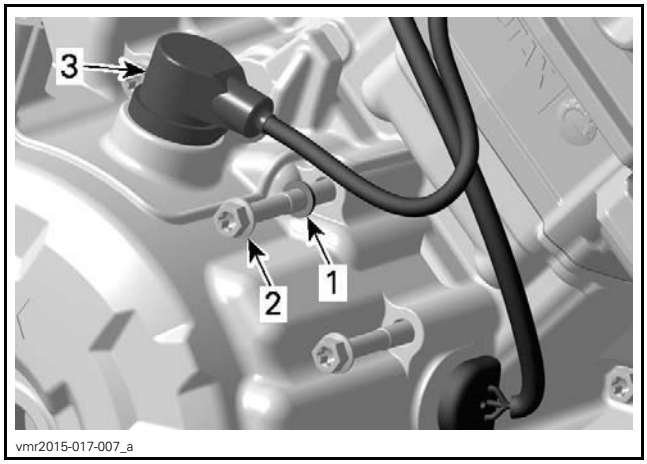


M8 SCREWS TIGHTENING SEQUENCE

M8 MAGNETO COVER SCREWS	
Tightening torque	25 N•m ± 3 N•m (18 lbf•ft ± 2 lbf•ft)

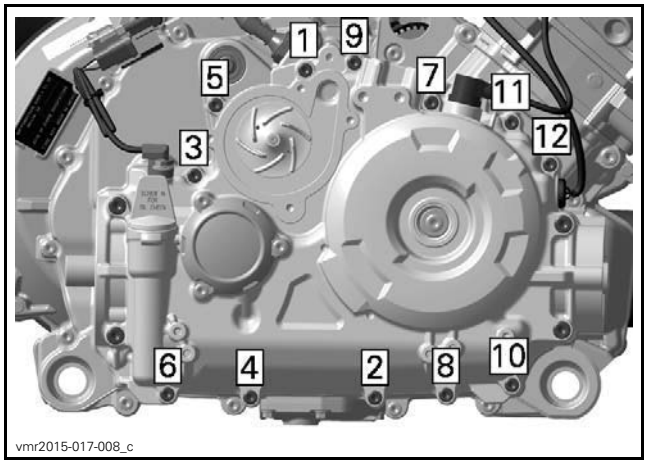
Install a **NEW** gasket ring on M6 magneto cover screw beside the CPS.

NOTICE Never use the gasket ring a second time. Always install a new one.



1. Gasket ring
2. Screw M6
3. CPS (Crankshaft Position Sensor)

Tighten the M6 magneto cover screws as per following sequence.



M6 SCREWS TIGHTENING SEQUENCE

M6 MAGNETO COVER SCREWS	
Gasket ring	NEW
Tightening torque	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

Install the bearing cover.

Tighten bearing cover screws in a criss-cross sequence to specification.

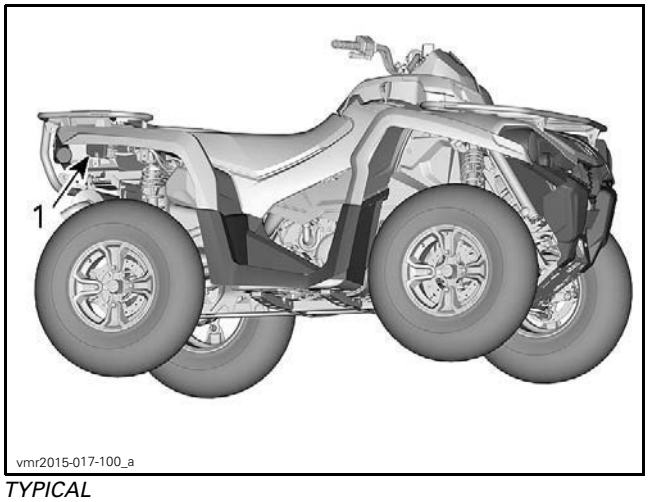
BEARING COVER SCREWS	
Tightening torque	25 N•m ± 3 N•m (18 lbf•ft ± 2 lbf•ft)

Let the sealant dry before starting engine. Refer to the manufacturer's label for the sealant curing time.

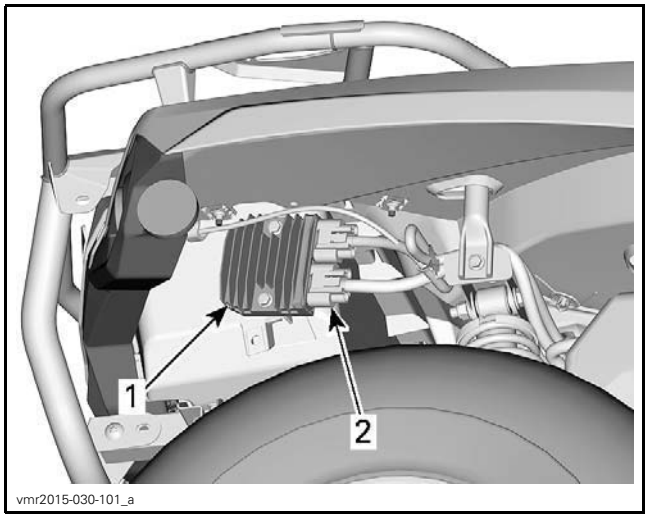
STATOR

Stator Connector Access

NOTE: The stator is directly connected to the voltage regulator/rectifier.



TYPICAL
1. Voltage regulator/rectifier location



1. Voltage regulator/rectifier
2. Three YELLOW wires

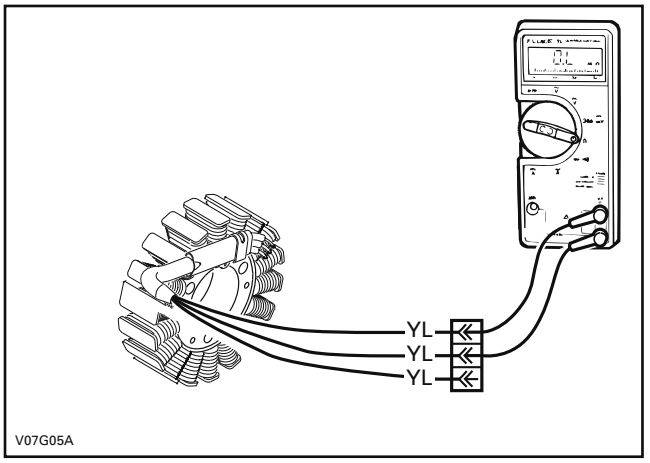
Stator Static Test: Continuity

1. Disconnect the stator connector on the voltage regulator/rectifier.

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

2. Set multimeter to Ω.
3. Connect multimeter between YELLOW wires.
4. Read resistance.

TERMINAL	RESISTANCE @ 20°C (68°F)
1 and 2	0.15 - 0.30 Ω
1 and 3	
2 and 3	



TYPICAL

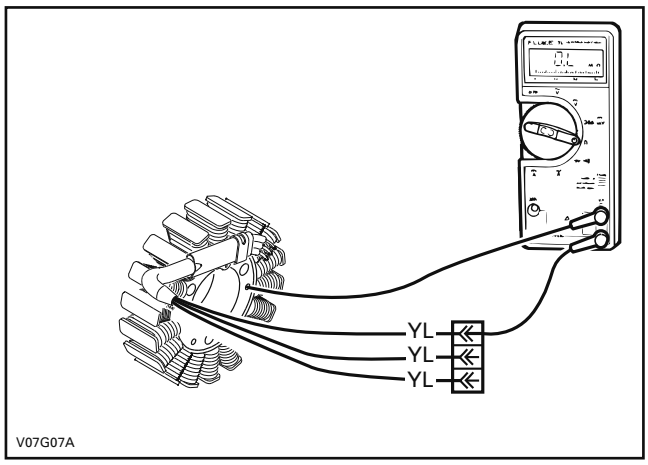
5. If any reading is out of specification, replace stator.
6. Re-plug connectors properly.

Stator Static Test: Insulation

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

1. Set multimeter to Ω.
2. Connect multimeter between any YELLOW wire (on stator connector) and engine ground.
3. Read resistance.

TEST PROBES	RESISTANCE @ 20°C (68°F)
Any YELLOW wire and engine ground	Infinite (open circuit)



TYPICAL

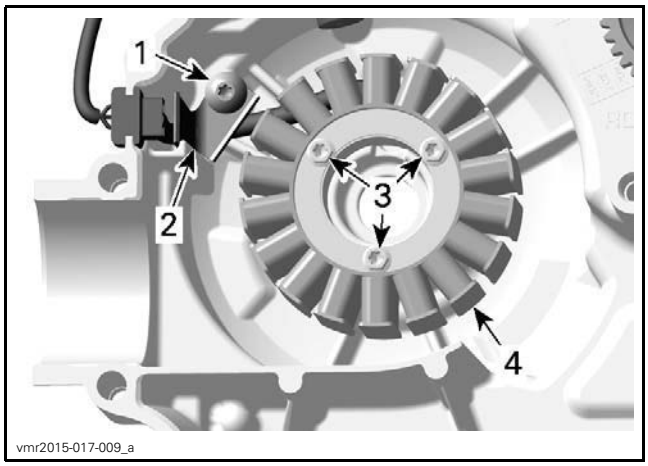
4. If there is a resistance or continuity, the stator coils and/or the wiring is shorted to ground and needs to be repaired or replaced.
5. Re-plug connectors properly.

Stator Dynamic Test: AC Voltage

Stator Removal

Remove magneto cover, refer to procedure in this subsection.

Remove:
- Holding strip screw
- Holding strip
- Stator screws
- Stator.



1. Holding strip screw
2. Holding strip
3. Stator screws
4. Stator

Stator Inspection

Check stator windings and insulation for cracks or other damages. If damaged replace it.

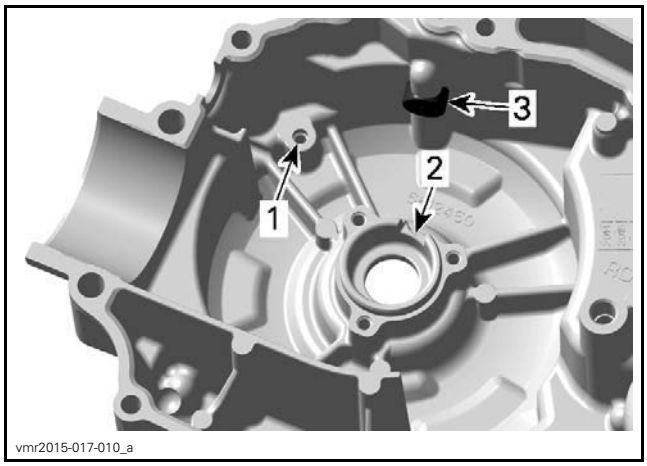
Check if stator wires are brittle, hard or otherwise damaged.

Stator Installation

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

NOTICE When installing the stator take care to route wires properly and install holding strip.

There is only one position for the stator (notch in the magneto cover).



1. Thread for holding strip
2. Notch for stator
3. Crank position sensor

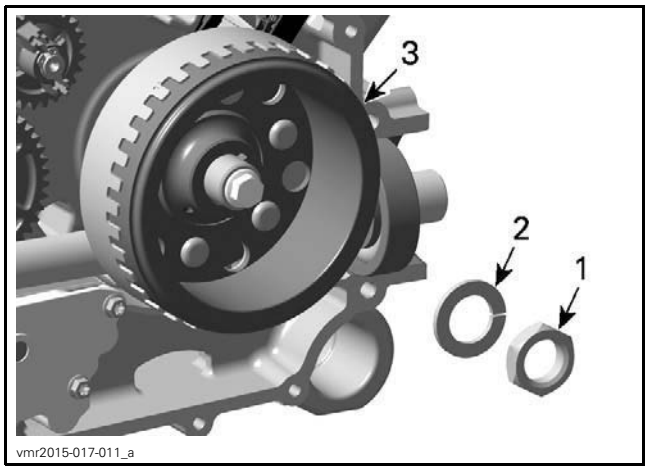
ROTOR

Rotor Removal

Remove magneto cover, refer to procedure in this subsection.

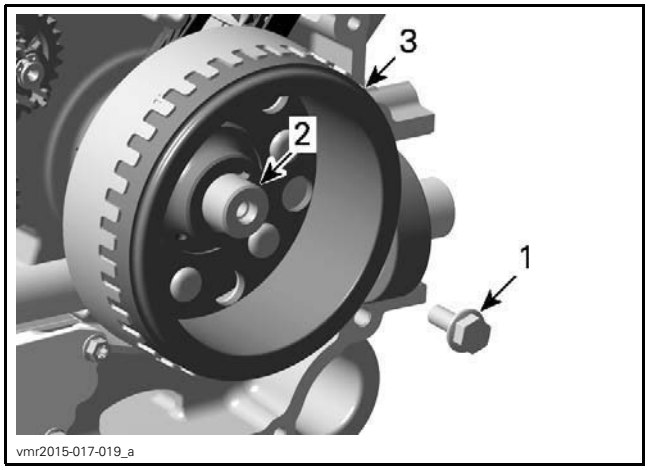
Lock crankshaft. Refer to *BOTTOM END* subsection.

Remove:
- Nut retaining rotor
- Lock washer.



1. Nut
2. Lock washer
3. Rotor

Remove crankshaft plug screw.

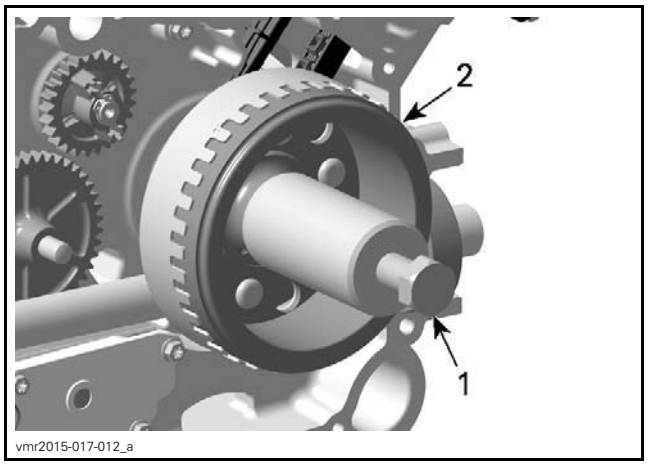


1. Crankshaft plug screw
2. Crankshaft MAG side
3. Rotor

Remove rotor.

REQUIRED TOOL	
CRANKSHAFT PROTECTOR (MAG) (P/N 420 876 557)	
MAGNETO PULLER (P/N 529 035 748)	

NOTE: Use grease to place protector on crankshaft end prior to screw on the magneto puller.



1. Rotor
2. Magneto puller

Screw magneto puller bolt to remove rotor.

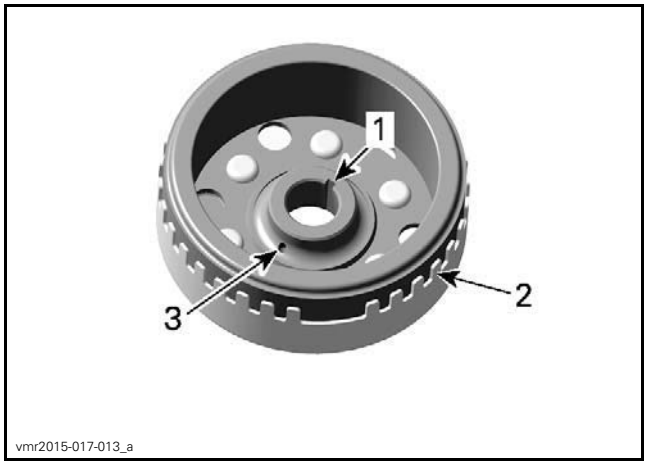
Rotor Inspection

Check inner side of rotor for scratches or other damage.

Blow pressurized air in the rotor oil bore and make sure it is not clogged.

Check keyway of the rotor for wear or damages.

Check if trigger wheel teeth are bent or otherwise damaged.



ROTOR
1. Keyway
2. Trigger wheel
3. Oil bore

Check woodruff key and keyway on the crankshaft for wear or damages.

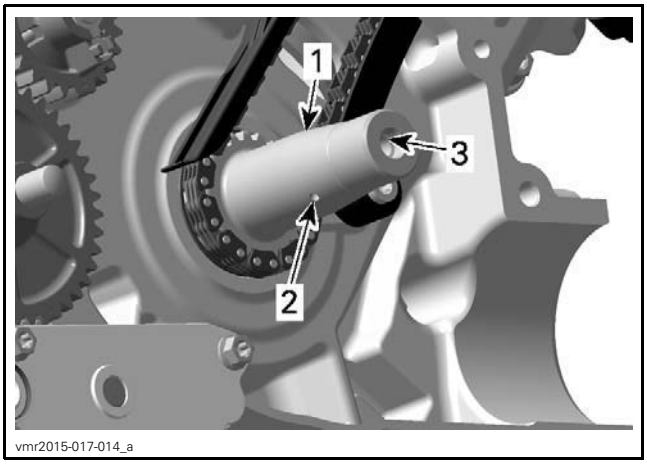
Replace parts as necessary.

Rotor Installation

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

Use PULLEY FLANGE CLEANER (P/N 413 711 809) to clean following parts:
- Crankshaft taper
- Oil passage in crankshaft taper
- Thread on crankshaft
- Oil bore in rotor
- Rotor taper.

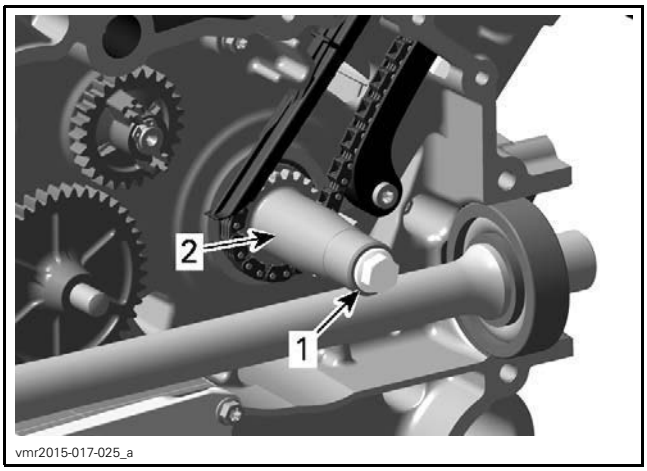
NOTICE Taper on crankshaft and rotor must be free of grease.



CRANKSHAFT MAG SIDE
1. *Keyway*
2. *Oil passage*
3. *Threads*

Install crankshaft plug screw.

CRANKSHAFT PLUG SCREW	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening torque	35 N•m ± 4 N•m (26 lbf•ft ± 3 lbf•ft)



1. *Crankshaft plug screw*
2. *Crankshaft MAG side*

Slide rotor onto crankshaft. The woodruff key and the keyway must be aligned.

Tighten rotor retaining nut to specification.

ROTOR RETAINING NUT	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening torque	180 N•m ± 10 N•m (133 lbf•ft ± 7 lbf•ft)

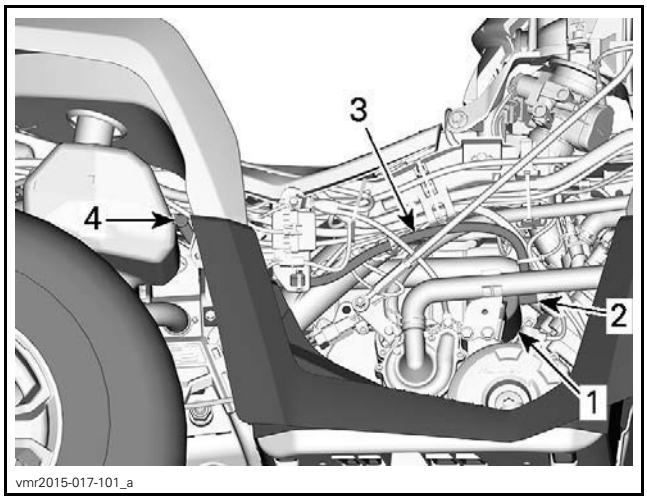
STARTER

Starter Access

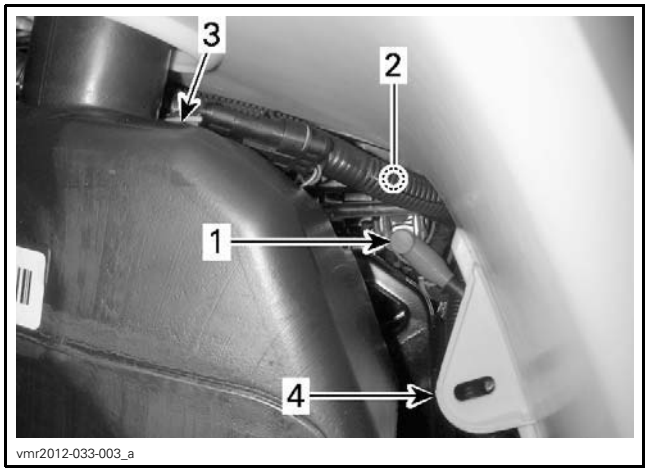
To access starter, refer to *BODY* subsection and remove the following:
- Seat
- Console
- RH side panel and extension panel
- RH footboard panel.

Starter Operational Test

1. Disconnect starter power cable from starter solenoid and pull cable out to RH side of vehicle.



1. *Starter*
2. *Starter power cable connection at starter*
3. *Starter power cable*
4. *Starter power cable connection at solenoid*



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1. Power cable from starter solenoid to starter
2. Power cable from battery to starter solenoid (not visible)
3. Fuel tank
4. RH rear fender

2. Using booster cables, carefully supply current from a 12 volt battery directly to the starter power cable.

NOTICE **First connect the red jumper cable from the booster battery to the starter cable. Momentarily connect the BLACK (-) cable from the booster battery to engine ground last.**

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

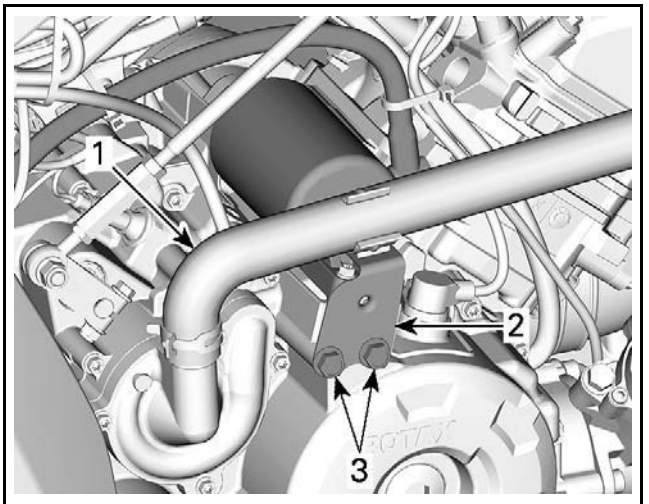
Starter Removal

1. Make sure the ignition switch is in the OFF position.
2. Disconnect the BLACK (-) battery cable from the battery.

⚠ WARNING

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

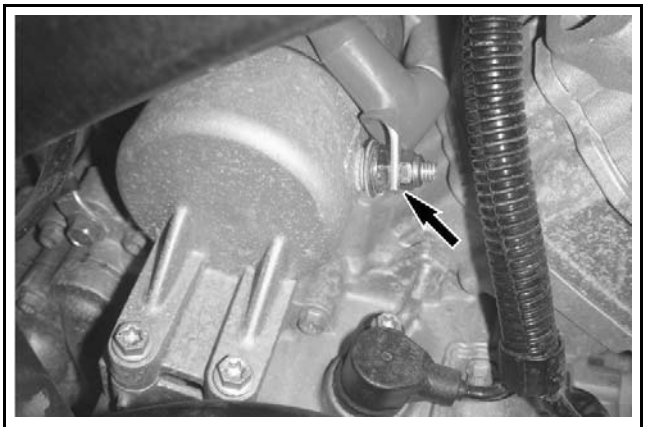
3. Remove body parts as listed in *STARTER ACCESS*.
4. Remove the radiator coolant hose support from engine.



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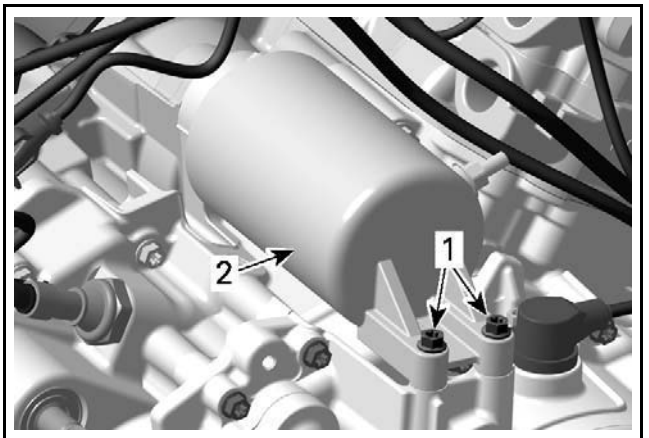
1. Radiator coolant hose
2. Hose support
3. Remove support screws

5. Disconnect the RED (+) power cable from starter.


vmr2008-139-009_d

TYPICAL

6. Clean starter and surrounding area.
7. Remove starter mounting screws.



vmr2015-017-015_a

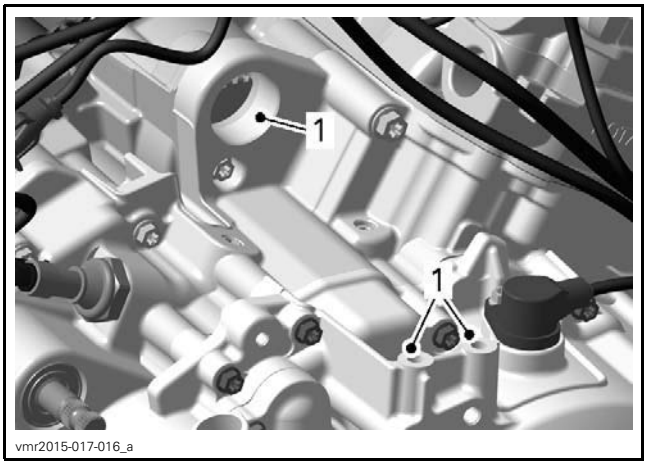
1. Starter mounting screws
2. Starter

8. Pull starter out from gear box.

Starter Installation

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

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

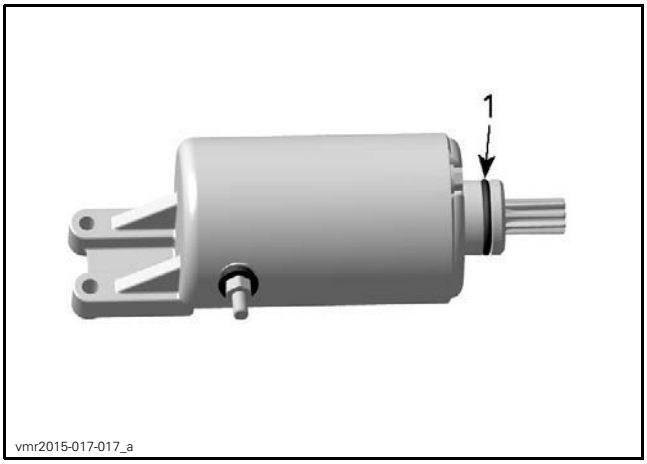


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1. Clean starter mating surfaces

STARTER O-RING	
Service product	SUPER LUBE GREASE (P/N 293 550 030)

Lubricate starter O-ring.



vmr2015-017-017_a

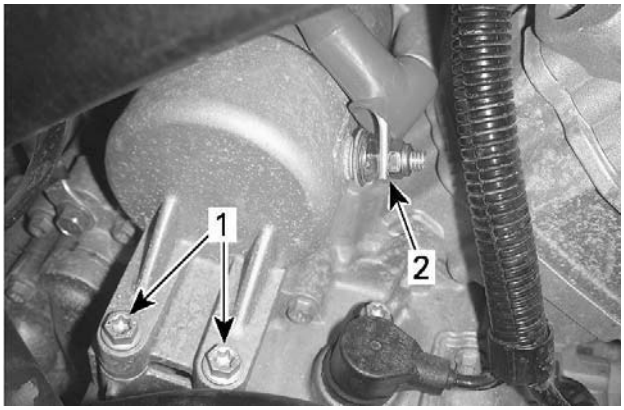
1. Lubricate starter O-ring

Install starter and tighten retaining screws to specification

STARTER MOUNTING SCREWS	
Tightening torques	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

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

STARTER TERMINAL AND RETAINING NUT	
Service product	DIELECTRIC GREASE (P/N 293 550 004)
Tightening torque	6 N•m ± 0.5 N•m (53 lbf•**in** ± 4 lbf•**in**)



vmr2008-139-009_e

1. Starter mounting screws
2. Starter terminal retaining nut

Connect the BLACK (-) battery cable last.

⚠ WARNING

Always connect the RED (+) starter cable first, then the BLACK (-) battery cable last. Whenever connecting the RED (+) cable to the starter motor, always make sure the BLACK (-) battery cable is disconnected to prevent electric shock.

Test starter operation.

STARTER DRIVE

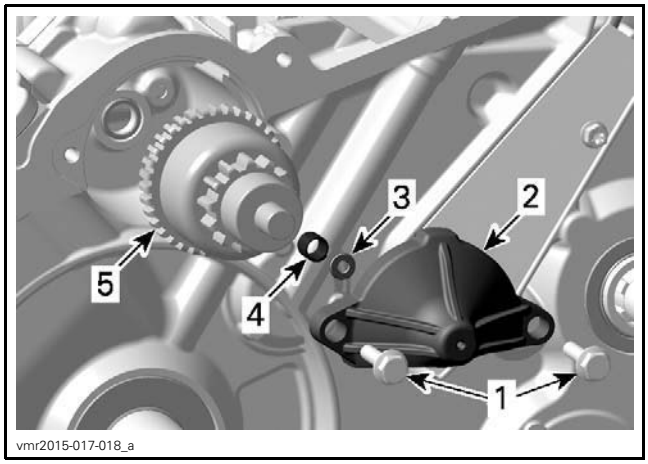
Starter Drive Removal

Remove drive pulley, refer to *CONTINUOUSLY VARIABLE TRANSMISSION* subsection.

Remove:
– Retaining screws
– Starter drive cover.

NOTE: Do not lose shim and/or spring during removal of starter drive cover.

Pull out starter drive.

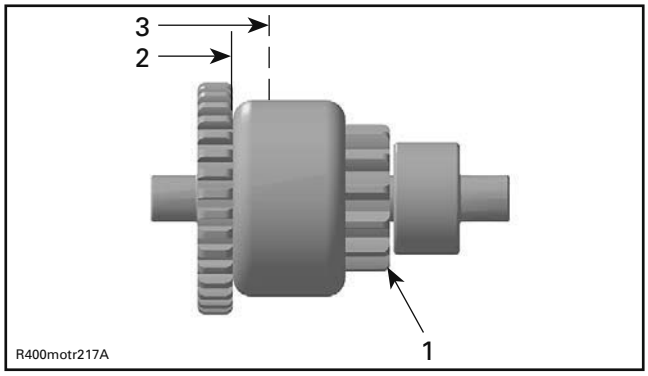


1. *Retaining screws*
2. *Starter drive cover*
3. *Shim*
4. *Spring*
5. *Starter drive*

Starter Drive Inspection

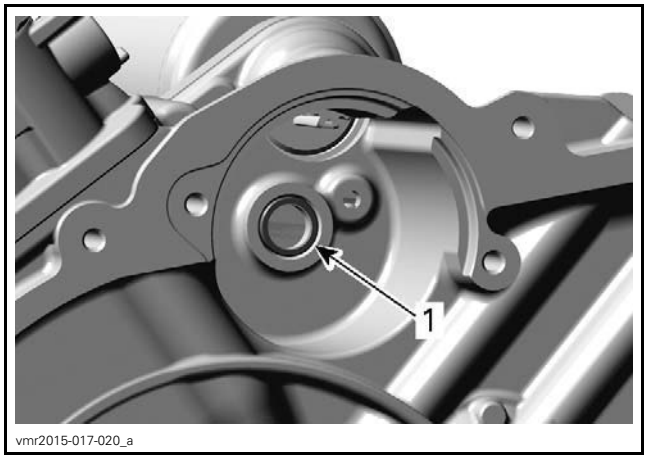
Check if starter drive pinion is free of movement.

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



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

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



1. *Starter drive needle bearing*

Check starter drive cover for cracks and clean it before reinstallation.

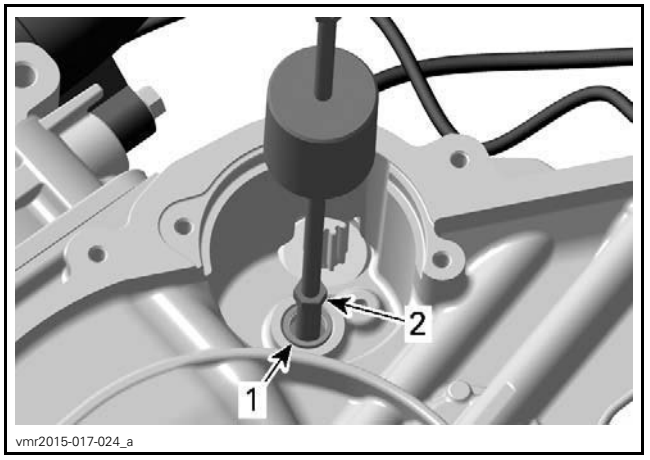
Check bore inside starter drive cover if damaged, worn or otherwise damaged. Replace as necessary.

Starter Drive Needle Bearing Replacement

Starter Drive Needle Bearing Removal

Remove needle bearing.

REQUIRED TOOL	
BLIND HOLE BEARING PULLER SET (P/N 529 036 117)	

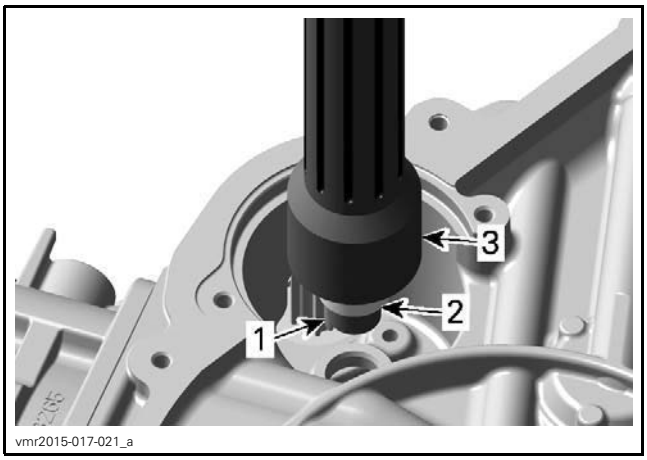


1. *Starter drive needle bearing*
2. *Blind hole bearing puller*

Starter Drive Needle Bearing Installation

Install needle bearing.

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



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

Starter Drive Installation

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

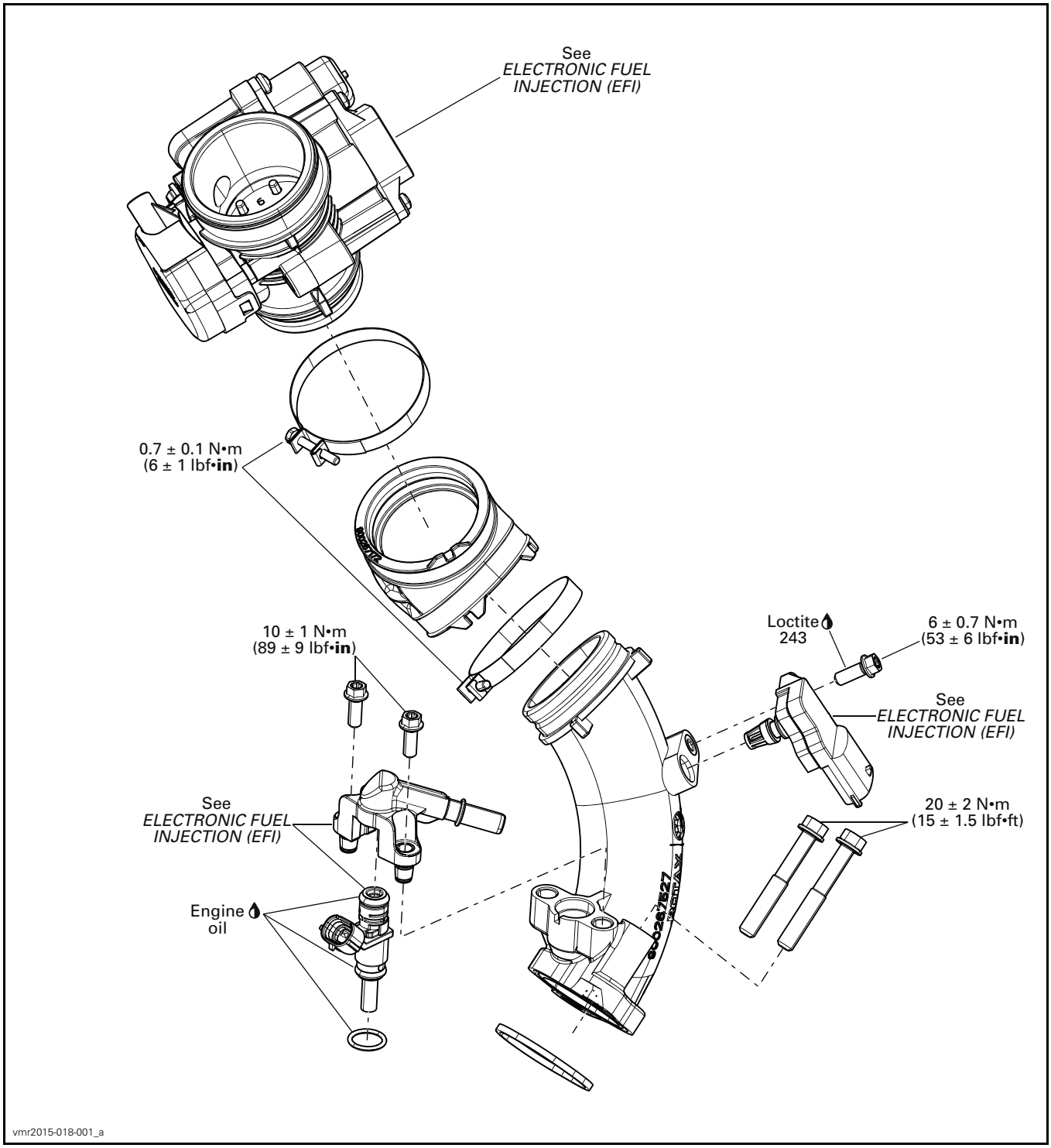
Apply multi-purpose grease inside starter drive pinion cover.

Clean out all residues of grease from:
– Needle bearing in the crankcase
– Starter drive journals
– Starter drive cover bore
– Spring.

Lubricate needle bearing and starter drive cover bore with specified service product.

NEEDLE BEARING AND STARTER DRIVE COVER BORE LUBRICATION	
Service product	ISOFLEX GREASE TOPAS NB 52 (P/N 293 550 021)

INTAKE MANIFOLD



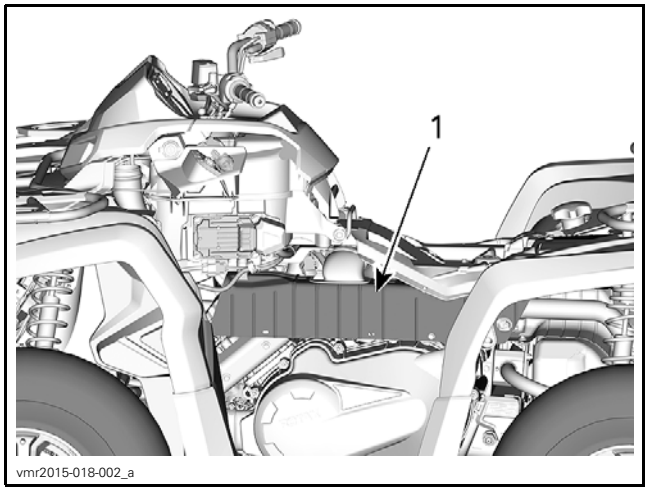
PROCEDURES

INTAKE MANIFOLD

Intake Manifold Access

Refer to *BODY* subsection and remove the following:
– Console
– LH side panel and extension
– RH side panel and extension.

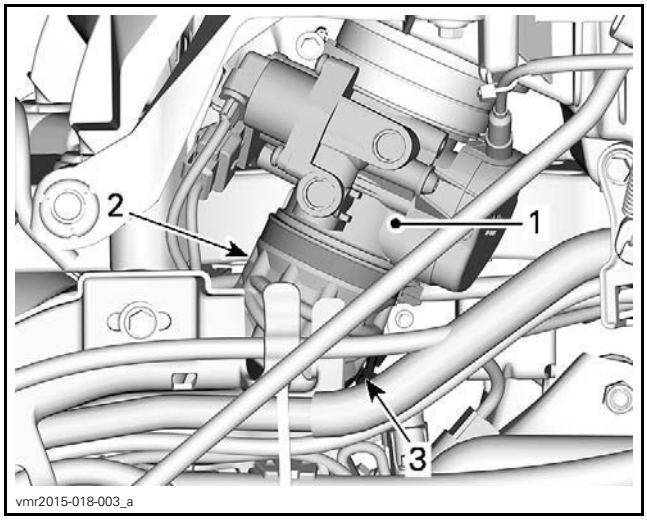
Refer to *EXHAUST SYSTEM* subsection and remove the outer exhaust system heat shield.



1. Remove this heat shield

Intake Manifold Removal

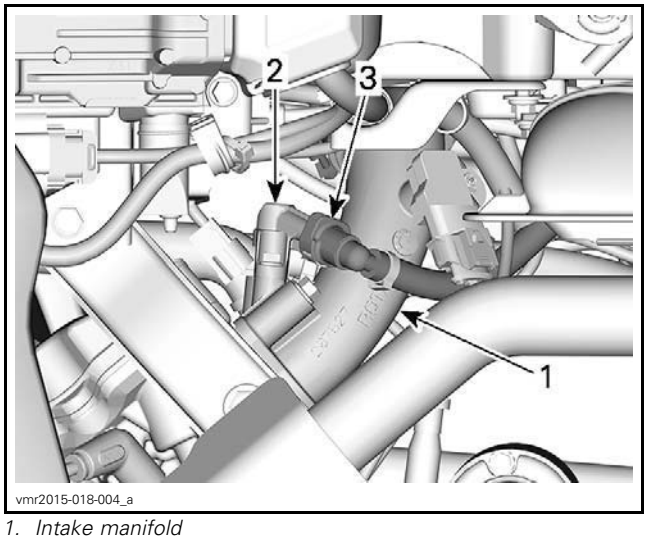
1. Release fuel pressure. Refer to *FUEL TANK AND FUEL PUMP* subsection.
2. From the right side of the vehicle, loosen the lower clamp that retains the intake adapter to the intake manifold.



1. Throttle body
2. Intake adapter
3. Loosen this clamp

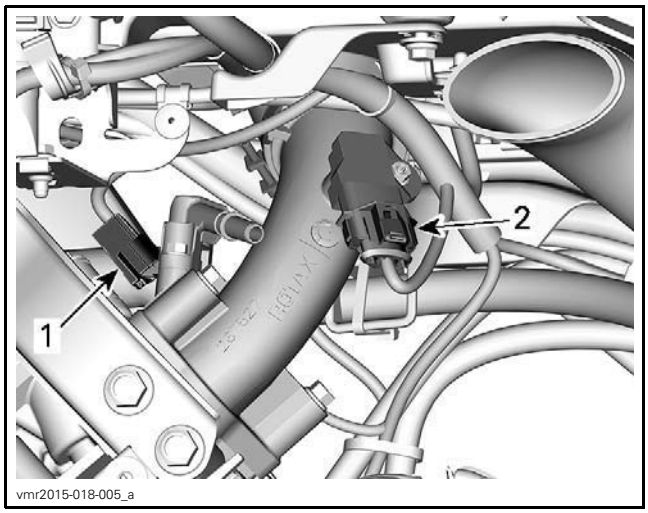
3. From left side, disconnect the fuel hose from fuel rail, refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.

⚠ CAUTION The fuel hose may still be under pressure.



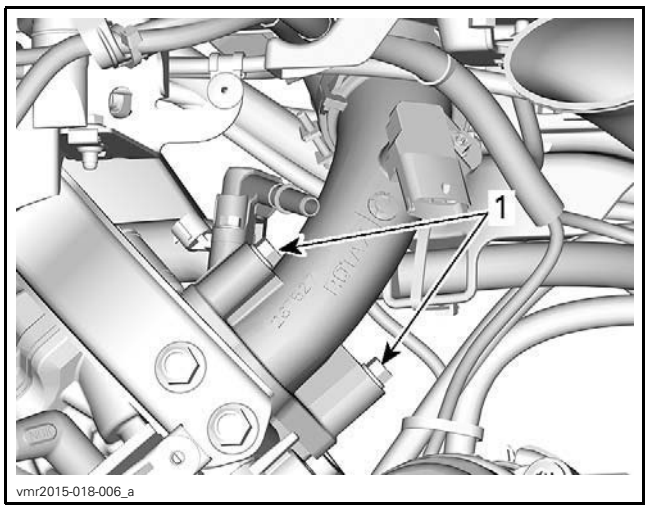
1. Intake manifold
2. Fuel rail
3. Fuel rail disconnect

4. Disconnect fuel injector electrical connector.
5. Disconnect MAPTS connector.



1. Fuel injector connector
2. MAPTS connector

6. Remove intake manifold from engine and intake adapter.



1. Remove 2 manifold retaining screws

Intake Manifold Inspection

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

Intake Manifold Installation

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

Tighten intake manifold retaining screws to specified torque.

INTAKE MANIFOLD RETAINING SCREWS	
Tightening torque	20 N•m ± 2 N•m (15 lbf•ft ± 1 lbf•ft)

TOP END

SERVICE TOOLS

Description	Part Number	Page
DIAL INDICATOR ADAPTER	529 036 159	129
ENGINE LEAK DOWN TEST KIT	529 035 661	129
PISTON CIRCLIP INSTALLER	529 036 083	146
TDC DIAL INDICATOR	414 104 700	129
VALVE GUIDE INSTALLER	529 036 269	141
VALVE GUIDE REMOVER (6 MM)	529 036 074	141
VALVE SPRING COMPRESSOR CUP	529 036 270	137
VALVE SPRING COMPRESSOR	529 035 724	137

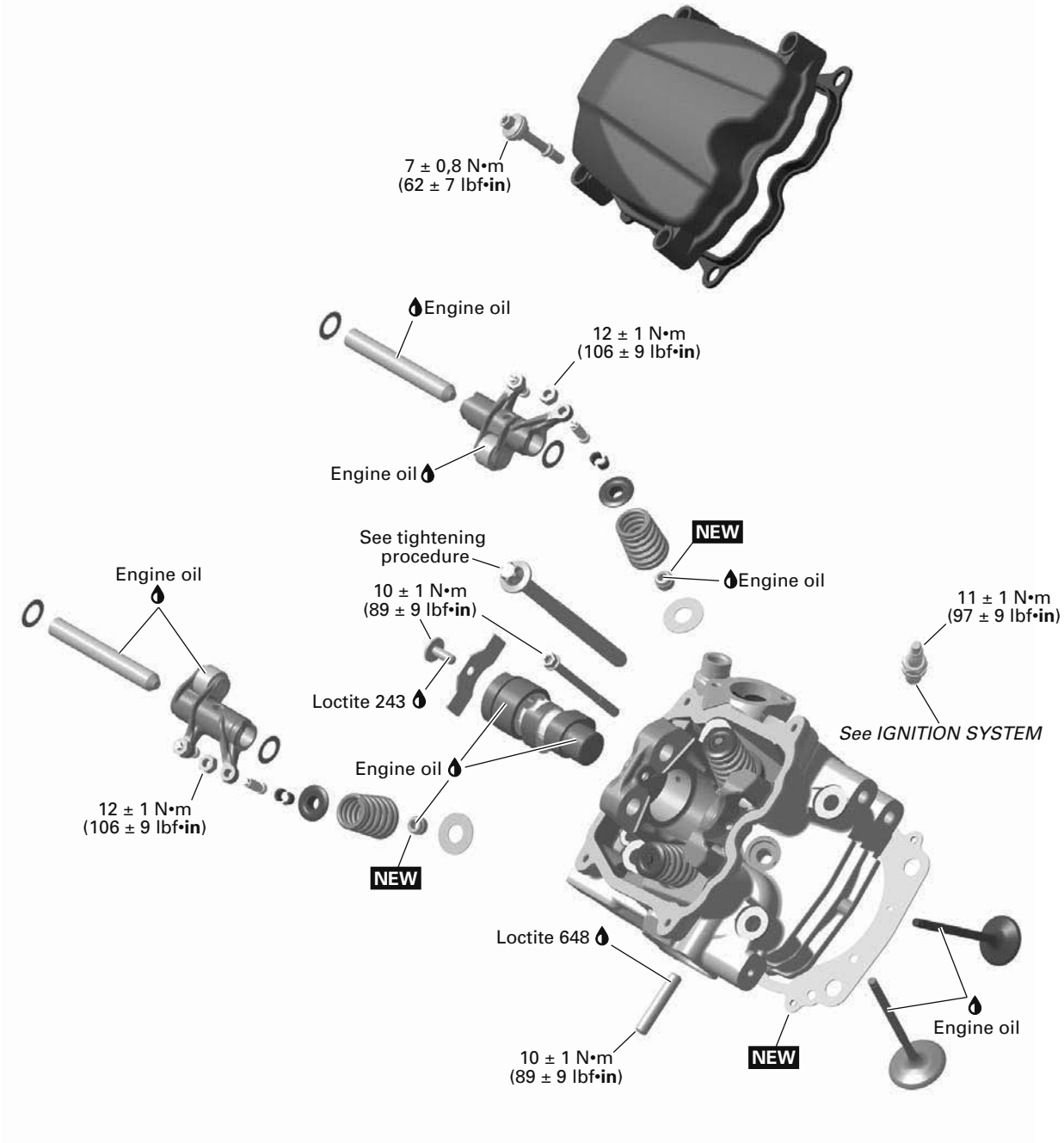
SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
SNAP-ON PLIERS	YA 8230	139

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 767 (ANTISEIZE LUBRICANT)	293 800 070	141

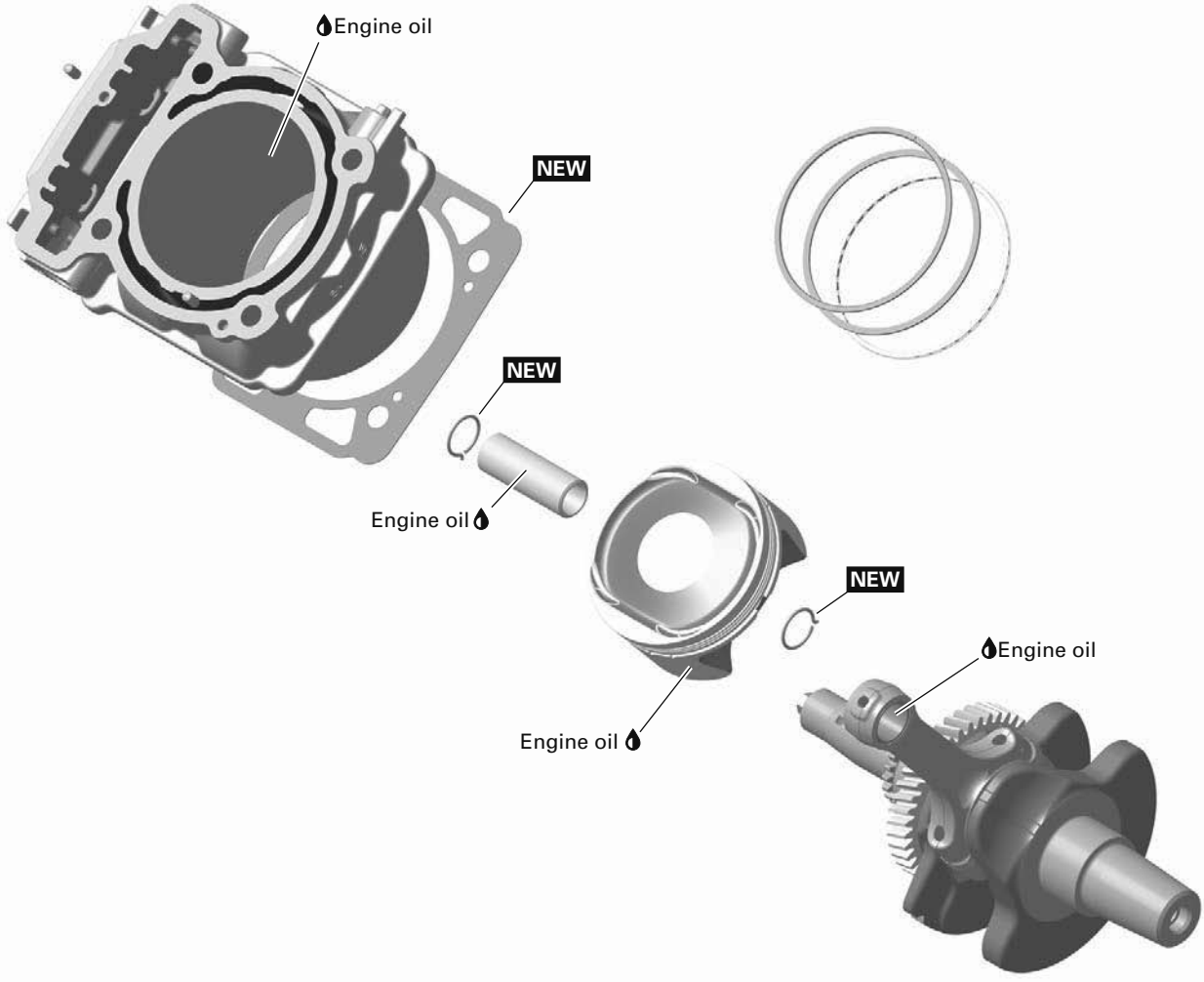
CYLINDER HEAD



NEW = Component must be replaced when removed.

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CYLINDER AND PISTON



NEW = Component must be replaced when removed.

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GENERAL

When diagnosing an engine problem, always perform a cylinder leak test.

NOTE: Even though the following procedures do not require the engine removal, many illustrations show the engine out of the vehicle for more clarity.

IMPORTANT: Note position of parts on disassembly. This may help to find the root cause of a problem. A component that is not replaced should be reinstalled in the same position as originally mounted.

INSPECTION

LEAK TEST

Before performing the cylinder leak test, verify the following:
– Clamp(s) tightness
– Radiator and hoses.

NOTE: For best accuracy, the leak test should be done with the engine at normal operating temperature.

⚠ WARNING

Prevent burning yourself on hot engine parts.

Preparation

Disconnect battery.

⚠ WARNING

Always respect this order for disassembly; disconnect BLACK (-) cable first.

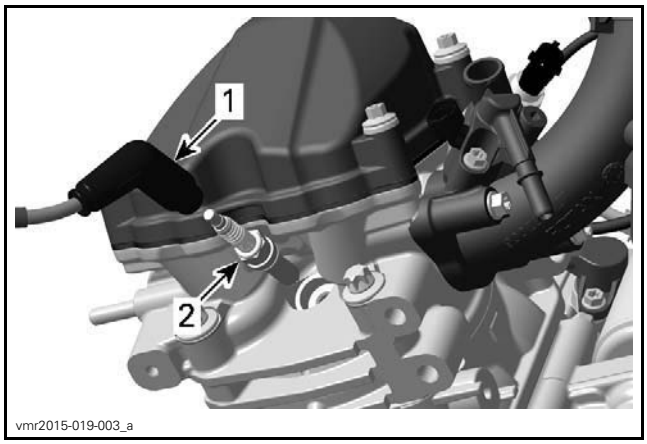
Remove radiator cap.

⚠ WARNING

To prevent burning yourself only remove the radiator cap by wearing the appropriate safety equipment.

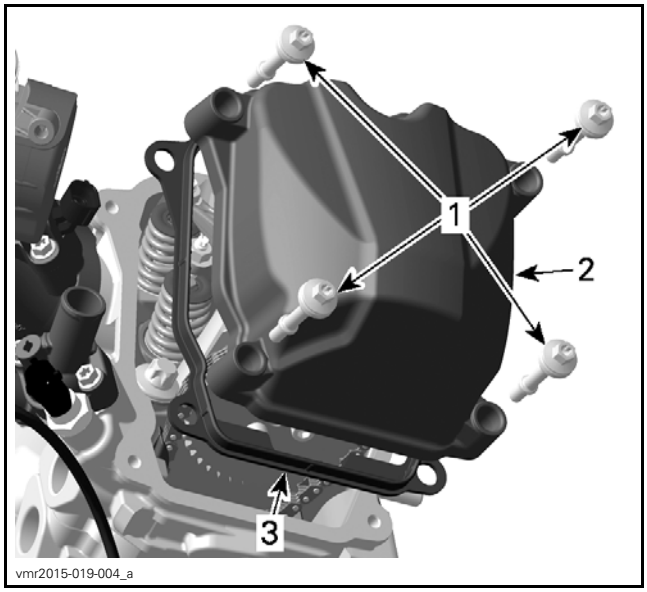
Unplug spark plug cable.

Clean spark plug area and remove spark plug from cylinder head.



1. Spark plug cable
2. Spark plug

Remove valve cover. Refer to procedure in this subsection.



1. Valve cover screws
2. Valve cover

Rotate crankshaft until piston is at TDC ignition.

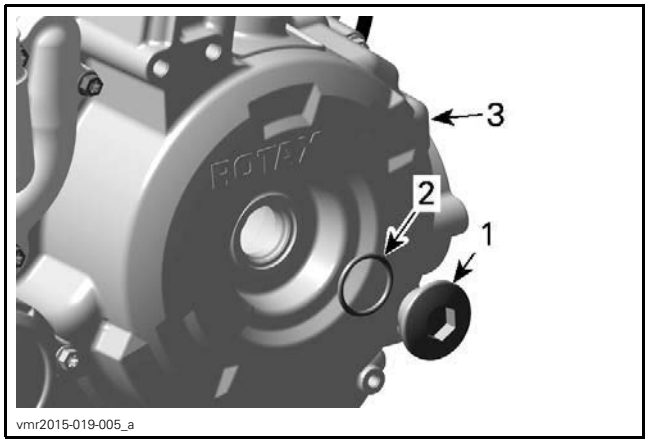
To turn crankshaft, there are two possible procedures.

First Procedure

Turn the drive pulley.

Second Procedure

1. Remove plug screw with O-ring from magneto cover.



1. *Plug screw*
2. *O-ring*
3. *Magneto cover*

2. Turn crankshaft.

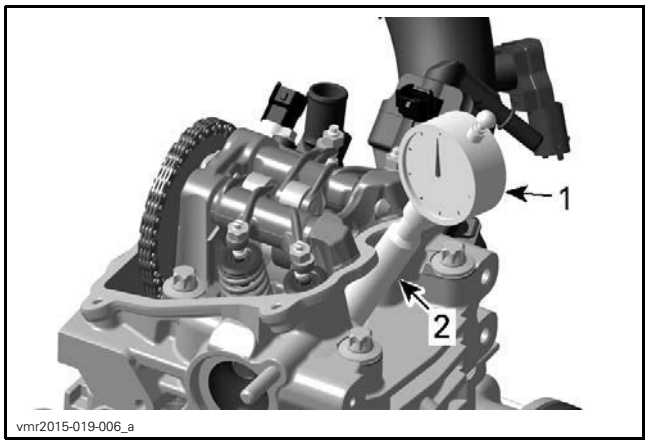
REQUIRED TOOL
13 mm socket

NOTICE Turn only clockwise to avoid loosening of the MAG side screw of the crankshaft.

Set the piston to precisely TDC ignition. For proper procedure refer to *CRANKSHAFT LOCKING PROCEDURE* in the *BOTTOM END* subsection.

NOTE: If engine is removed from vehicle a dial indicator can be used.

REQUIRED TOOL	
TDC DIAL INDICATOR (P/N 414 104 700)	
DIAL INDICATOR ADAPTER (P/N 529 036 159)	

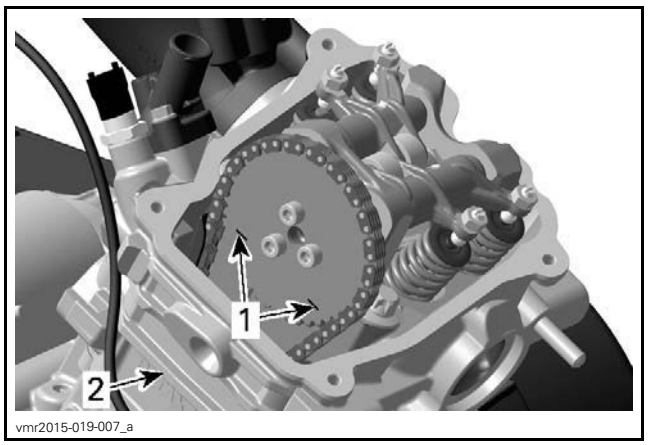


1. *TDC dial indicator*
2. *Dial indicator adapter*

NOTE: If a dial indicator is not available, use a screwdriver or another similarly suitable tool.

NOTICE Do not scratch or damage piston/cylinder surface.

NOTE: At TDC ignition the marks on the camshaft timing gear have to be parallel to cylinder head base as per following illustration.



1. *Marks on camshaft timing gear*
2. *Cylinder head base*

Leak Test

REQUIRED TOOL	
ENGINE LEAK DOWN TEST KIT (P/N 529 035 661)	

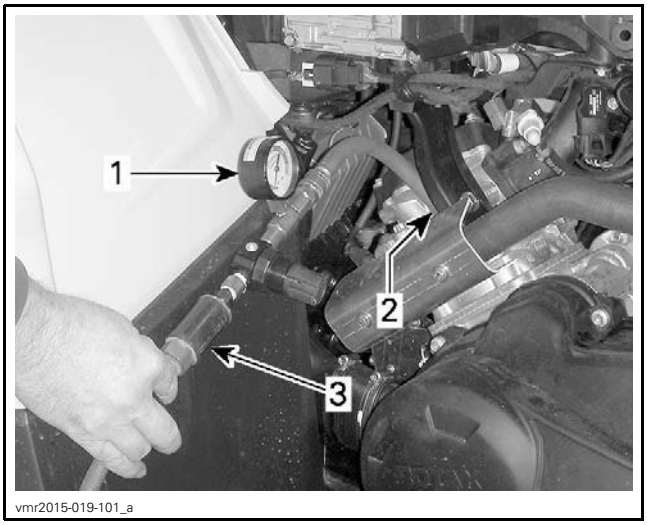
Connect leak tester to adequate air supply.

Set needle of measuring gauge to zero.

NOTE: All testers have specific instructions on gauge operation and required pressure.

Install gauge adapter into previously cleaned spark plug hole.

Supply combustion chamber with air pressure.



1. Leak tester
2. Leak tester installed in spark plug bore
3. Air supply hose

Note the amount or percentage of leakage (depending on tester).

LEAKAGE PERCENTAGE	ENGINE CONDITION
0% to 15%	Excellent condition
16% to 25%	Good condition
26% to 40%	Fair condition; reduced engine performance
41% and higher	Poor condition, diagnose and repair engine

NOTE: To make sure there is no false reading due to a valves not perfectly seated, tap each valve adjustment screw (on the rocker) using a soft hammer.

Diagnosis

Listen for air leaks.

– Air escaping in intake port/throttle body means leaking intake valve(s).
– Air escaping in exhaust port means leaking exhaust valve(s).
– Air bubbles in the coolant (radiator) means leaking cylinder head gasket.
– Air/coolant escaping from cylinder/head means damaged gasket(s) and/or loosened screws.
– Air escaping into crankcase area means excessively worn cylinder and/or broken piston rings.
– Air/oil escaping from crankcase means damaged gasket and/or loosened screws (refer to *BOTTOM END* subsection).

NOTE: For all the checkpoints mentioned above, see the appropriate engine section to diagnose and repair the engine.

Reassembly

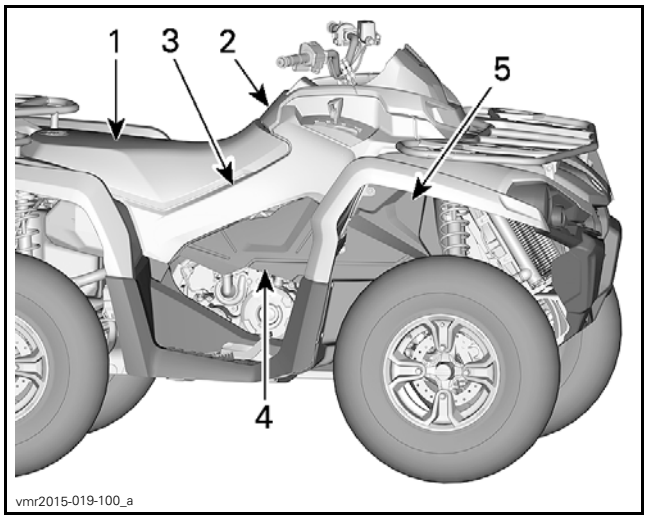
Reverse the preparation procedure. Ensure to respect torque values and use of appropriate products/lubricants. Refer to exploded views in other subsections of this manual as required.

PROCEDURES

VALVE COVER

Valve Cover Access

Refer to *BODY* subsection and remove the following.

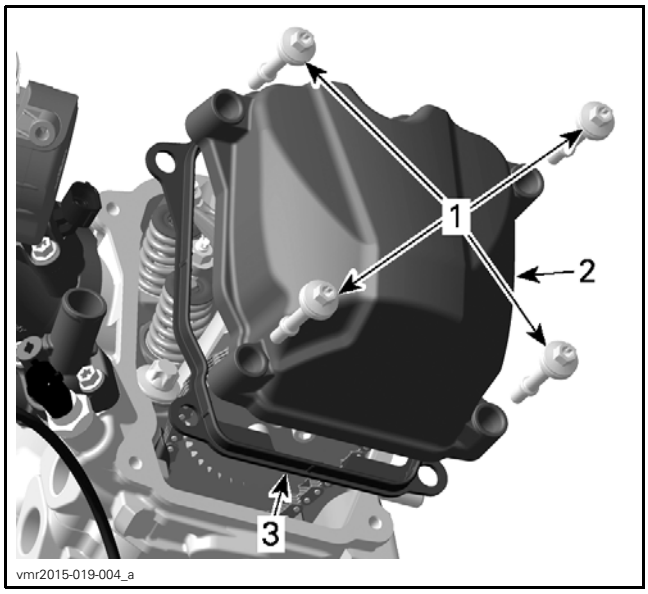


1. Seat
2. Console
3. RH side panel
4. RH side panel extension
5. RH inner fender panel

Valve Cover Removal

Remove:

– Valve cover screws
– Valve cover
– Gasket.



1. *Valve cover screws*
2. *Valve cover*
3. *Gasket*

Valve Cover Inspection

Check the gasket on the valve cover if it is brittle, cracked or hard. If so, replace the gasket.

Valve Cover Installation

The installation is the reverse of the removal procedure.

Tighten valve cover retaining screws to specified torque in a criss-cross sequence.

VALVE COVER RETAINING SCREWS	
Tightening torque	7 N•m ± 0.8 N•m (62 lbf•**in** ± 7 lbf•**in**)

ROCKER ARM

Rocker Arm Removal

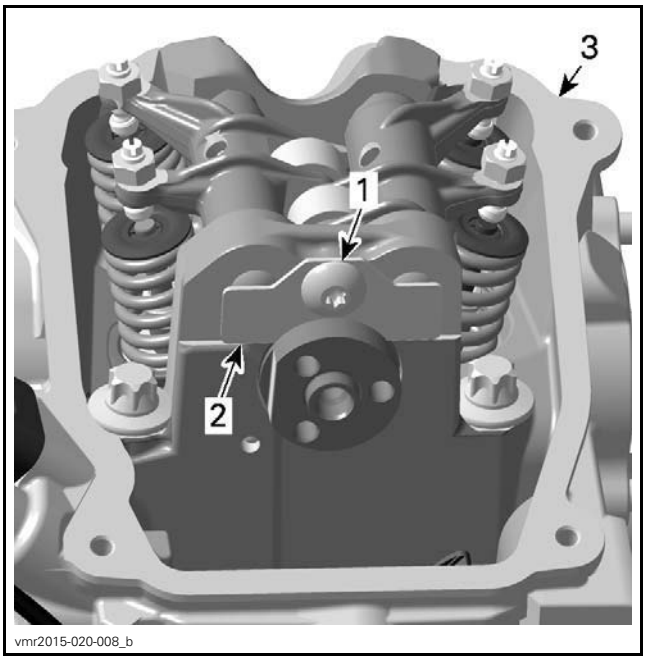
Remove valve cover.

Refer to *TIMING CHAIN* subsection and remove the following parts:

– Timing chain tensioner
– Camshaft timing gear.

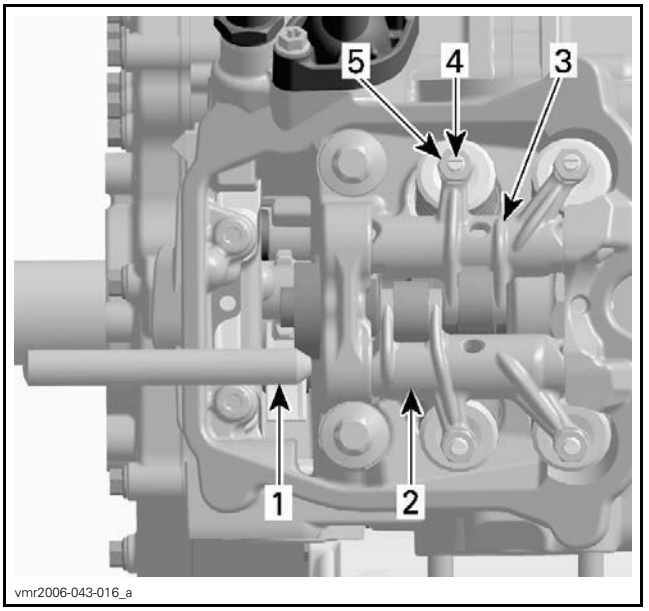
Remove:

– Pan head screw
– Camshaft retaining plate.



1. *Pan head screw*
2. *Camshaft retaining plate*
3. *Cylinder head*

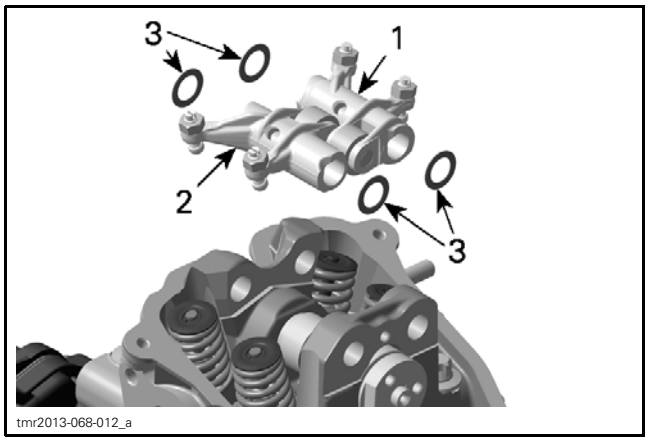
Remove rocker arm shafts.



1. *Rocker arm shaft*
2. *Rocker arm (exhaust side)*
3. *Rocker arm (intake side)*
4. *Adjustment screw*
5. *Lock nut*

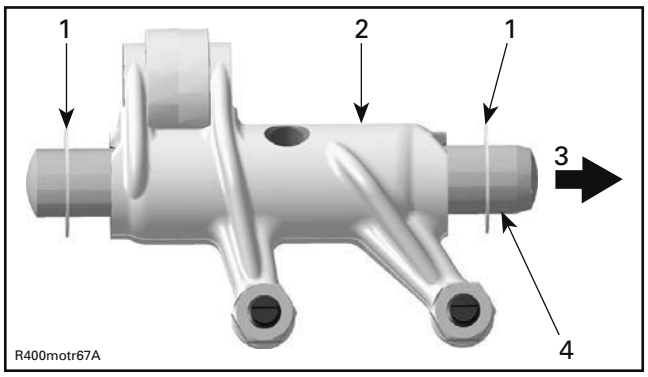
Remove:

– Rocker arm assembly (exhaust side and intake side) with adjustment screws and lock nuts
– Thrust washers.



1. Rocker arm (exhaust side)
2. Rocker arm (intake side)
3. Thrust washers

NOTICE **Pay attention not to lose thrust washers or drop them into the timing chain compartment.**

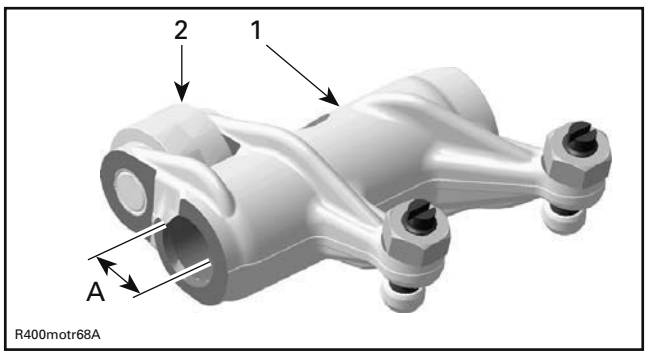


1. 2 thrust washers
2. Rocker arm (exhaust side)
3. Cylinder head (spark plug side)
4. Big taper to spark plug side

Rocker Arm Inspection

Inspect each rocker arm for cracks and scored friction surfaces. If so, replace rocker arm assembly.

Check the rocker arm rollers for free movement, wear and excessive radial play. Replace rocker arm assembly if necessary.



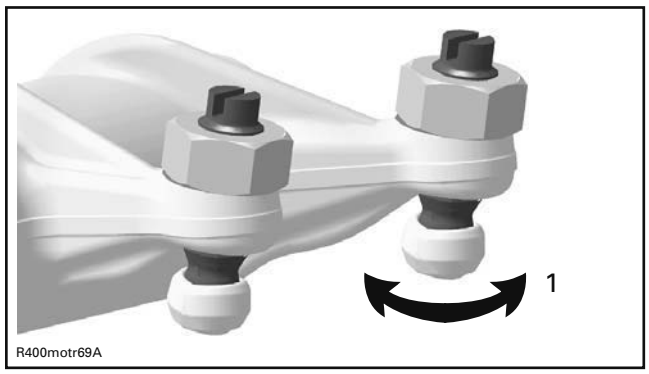
1. Rocker arm (exhaust side)
2. Roller

A. Bore for rocker arm shaft

Measure rocker arm bore diameter. If diameter is out of specification, change the rocker arm assembly.

ROCKER ARM BORE DIAMETER	
NEW	12.036 mm to 12.050 mm (.4739 in to .4744 in)
SERVICE LIMIT	12.060 mm (.4748 in)

Check adjustment screws for free movement, cracks and/or excessive play.

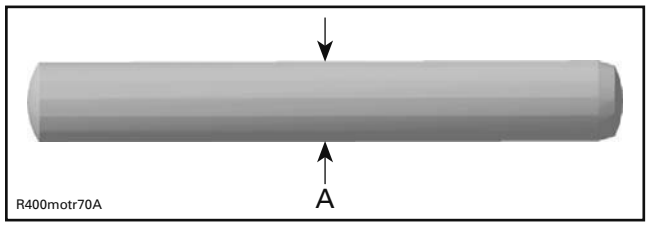


1. Free movement of adjustment screw top

Rocker Arm Shaft Inspection

Check for scored friction surfaces; if so, replace parts.

Measure rocker arm shaft diameter.



A. Measure rocker arm shaft diameter here

ROCKER ARM SHAFT DIAMETER	
NEW	12.00 mm to 12.018 mm (.4724 in to .4731 in)
SERVICE LIMIT	11.990 mm (.472 in)

Any area worn excessively will require parts replacement.

Rocker Arm Installation

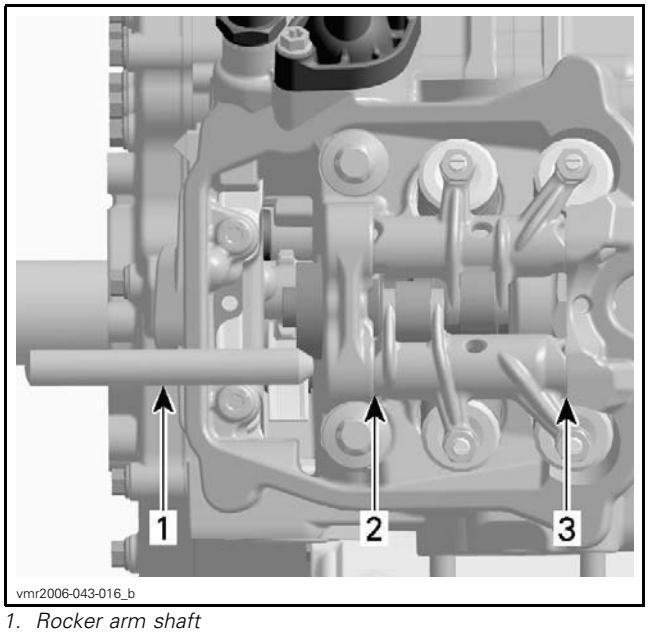
NOTE: Use the same procedure for exhaust and intake rocker arm.

Apply engine oil on rocker arm shaft.

Insert a rocker arm shaft with the chamfered edge first through rocker arm pin bore.

Install a thrust washer at timing chain side, then the proper rocker arm (exhaust side or intake side).

Push in rocker arm shaft until its chamfer reaches the end of rocker arm bore.



1. Rocker arm shaft
2. Thrust washer (timing chain side)
3. Thrust washer (spark plug side)

Place the other thrust washer and push rocker arm shaft to end position.

Install the camshaft retaining plate.

Tighten pan head screw to specification.

PAN HEAD SCREW	
Tightening torque	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

Adjust valve clearance, refer to *PERIODIC MAINTENANCE PROCEDURE*.

CAMSHAFT

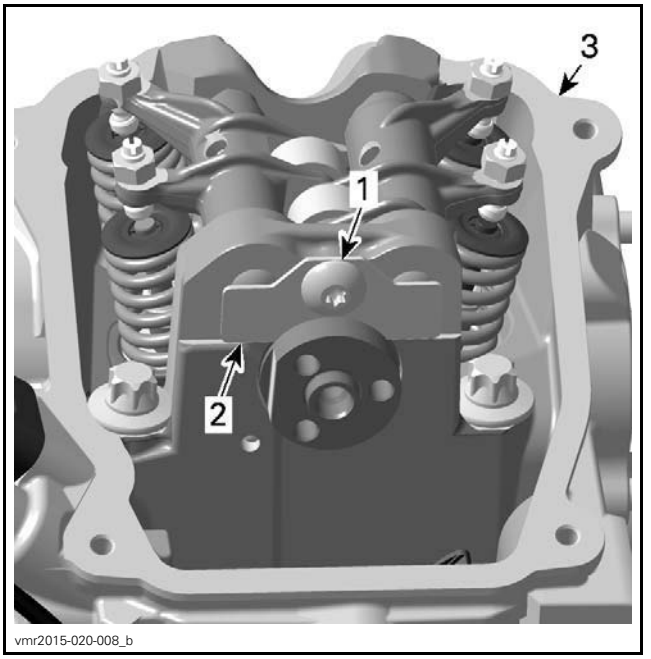
Camshaft Removal

Remove valve cover (see *VALVE COVER* in this subsection).

Refer to *TIMING CHAIN* subsection and remove the following parts:

– Timing chain tensioner
– Camshaft timing gear.

Remove the camshaft retaining plate.

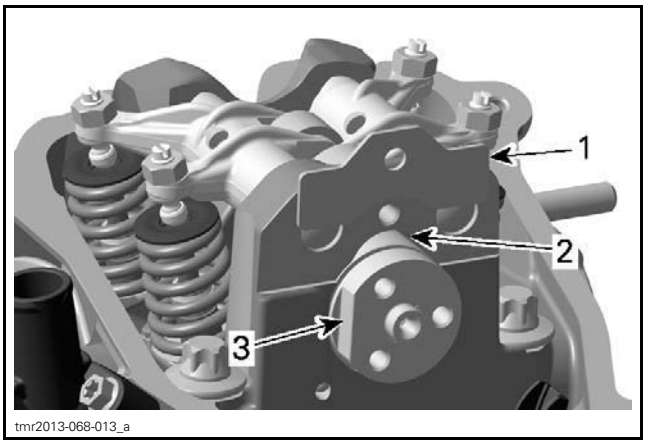


1. Camshaft retaining plate
2. Pan head screw
3. Cylinder head

Remove rocker arms (see *ROCKER ARM* in this subsection).

Remove the camshaft.

NOTE: For removal rotate camshaft so that intake/exhaust lobe shows to upper side of cylinder head.



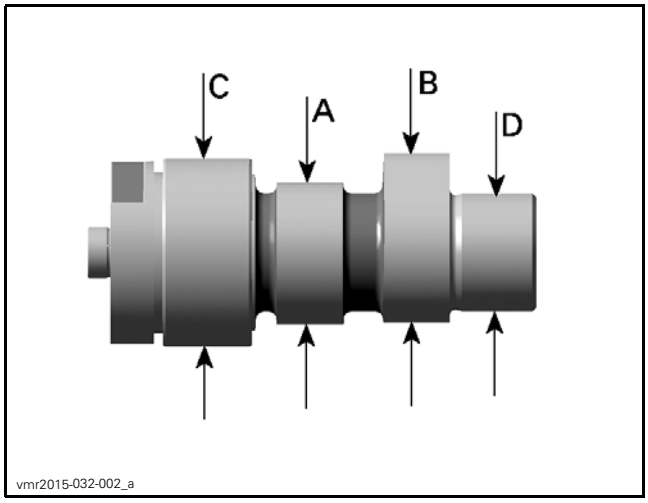
1. Camshaft retaining plate
2. Area for camshaft lobes
3. Camshaft

Camshaft Inspection

Check each lobe and bearing journal for:

– scoring
– scuffing
– cracks
– signs of wear.

Using a micrometer to measure:
– camshaft lobe height
– camshaft journal.



A. Camshaft lobe (exhaust valves)
B. Camshaft lobe (intake valves)
C. Camshaft journal (timing chain side)
D. Camshaft journal (spark plug side)

CAMSHAFT LOBE (EXHAUST)	
NEW	32.890 mm to 33.090 mm (1.295 in to 1.303 in)
SERVICE LIMIT	32.840 mm (1.293 in)

CAMSHAFT LOBE (INTAKE)	
NEW	32.950 mm to 33.150 mm (1.297 in to 1.305 in)
SERVICE LIMIT	32.900 mm (1.295 in)

CAMSHAFT JOURNAL (TIMING CHAIN SIDE)	
NEW	34.959 mm to 34.975 mm (1.3763 in to 1.377 in)
SERVICE LIMIT	34.950 mm (1.376 in)

CAMSHAFT JOURNAL (SPARK PLUG SIDE)	
NEW	21.959 mm to 21.980 mm (.8645 in to .8654 in)
SERVICE LIMIT	21.950 mm (.8642 in)

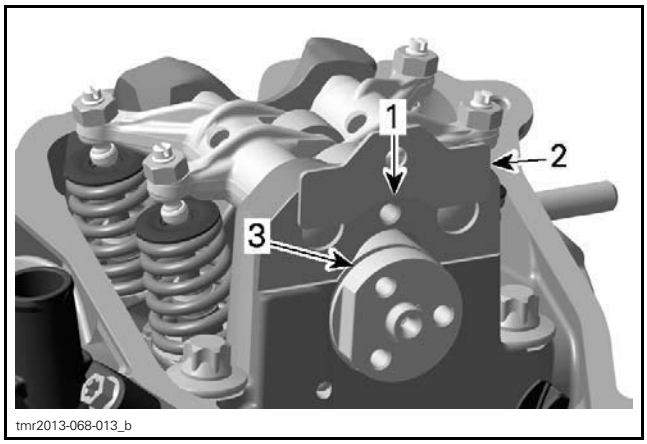
Measure camshaft bearing in cylinder head. Refer to *CYLINDER HEAD INSPECTION* in this subsection.

Camshaft Installation

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

NOTICE The camshafts are not identical in design. Do not invert the camshafts during assembly. Any mix-up of the components will lead to engine damage.

Place the camshaft retaining plate in the slot of the camshaft.



1. Direction of movement
2. Camshaft retaining plate
3. Slot retaining camshaft

Tighten pan head screw to specification.

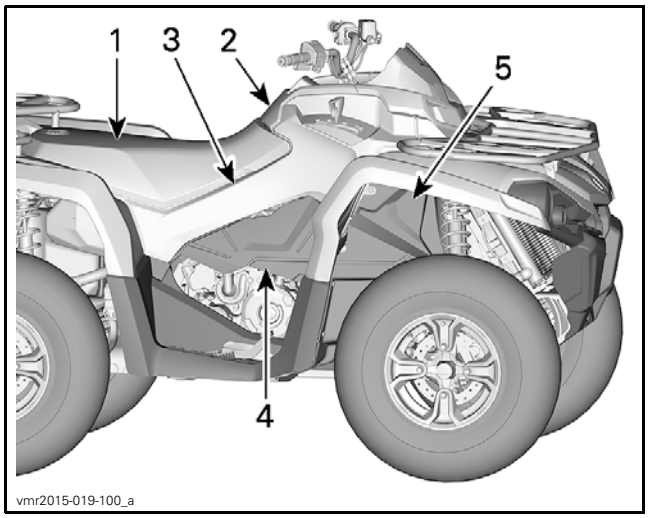
PAN HEAD SCREW	
Tightening torque	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

For other parts, refer to proper installation procedure.

CYLINDER HEAD

Cylinder Head Access

Refer to *BODY* subsection and remove the following.



1. *Seat*
2. *Console*
3. *RH side panel*
4. *RH side panel extension*
5. *RH inner fender panel*

Cylinder Head Removal

Drain engine coolant. Refer to *ENGINE COOLANT REPLACEMENT* in the *PERIODIC MAINTENANCE PROCEDURES* subsection.

Disconnect the coolant hose from the thermostat housing.

NOTE: Before removing cylinder head, blow out remaining coolant using air pressure. During cylinder head removal, the remaining coolant in cylinder head could overflow into the engine and the engine oil will be contaminated.

Refer to *EXHAUST SYSTEM* subsection and disconnect exhaust pipe from cylinder head.

Refer to *INTAKE MANIFOLD* and disconnect the intake manifold from the cylinder head.

Disconnect spark plug wire.

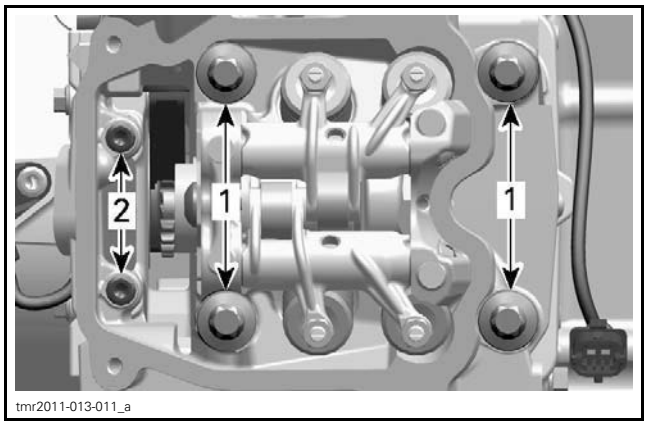
Disconnect CTS connector, located at the cylinder head.

Remove the valve cover and its gasket (see *VALVE COVER* in this subsection).

Refer to *TIMING CHAIN* subsection and remove the following parts:

– Timing chain tensioner
– Camshaft timing gear.

First remove the M6 cylinder head screws, then the M10 cylinder head screws.

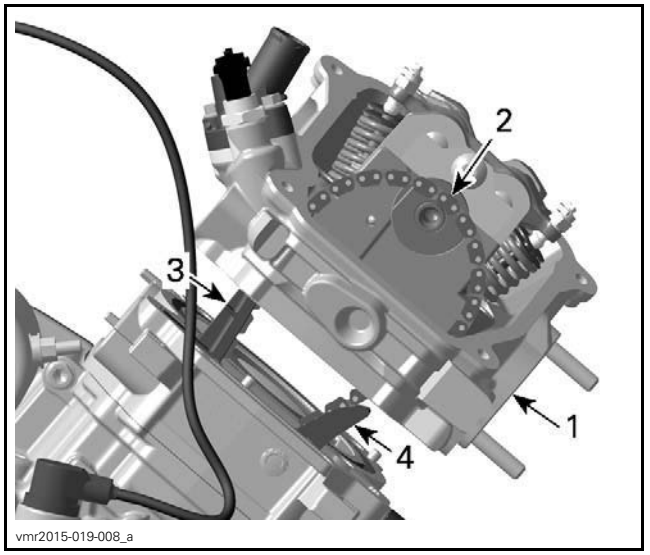


1. *Cylinder head screws M10*
2. *Cylinder head screws M6*

Pull up cylinder head.

Remove timing chain guide (fixed).

Remove and discard the cylinder head gasket.



1. *Cylinder head*
2. *Timing chain*
3. *Chain guide (fixed)*
4. *Cylinder head gasket*

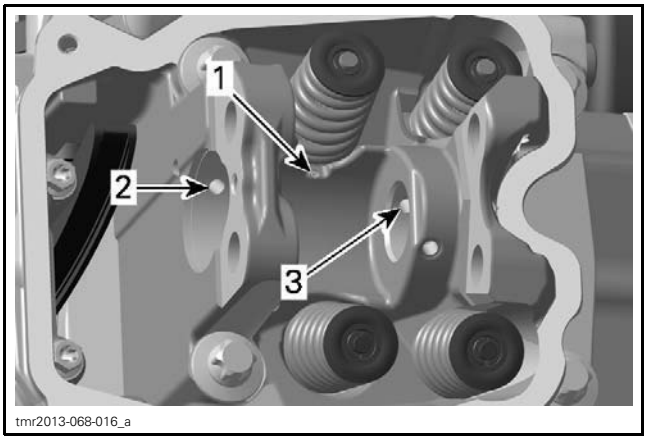
Cylinder Head Inspection

Inspect timing chain guide (fixed) for wear, cracks or other damages. Replace if necessary.

Check for cracks between valve seats, if so, replace cylinder head.

Check mating surface between cylinder and cylinder head for contamination. If so, clean both surfaces.

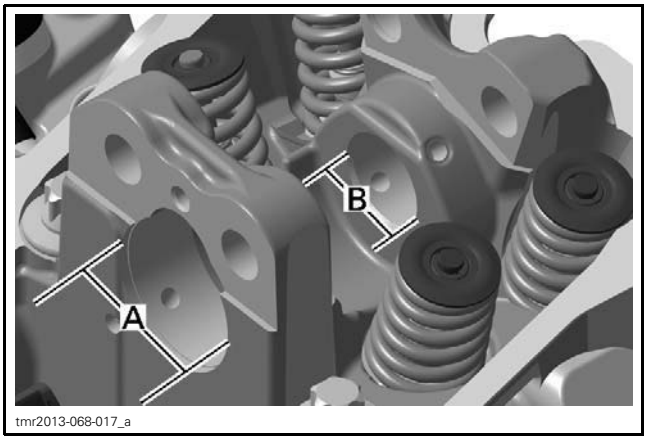
Clean oil support through the cylinder head from contamination.



1. Oil port to lubricate camshaft lobes intake/exhaust
2. Oil supply to camshaft bearing journal (timing chain side)
3. Oil supply to camshaft bearing journal (spark plug side)

Cylinder Head Camshaft Bearing Inspection

Measure camshaft bearing in cylinder head.



A. Camshaft bearing (timing chain side)
B. Camshaft bearing (spark plug side)

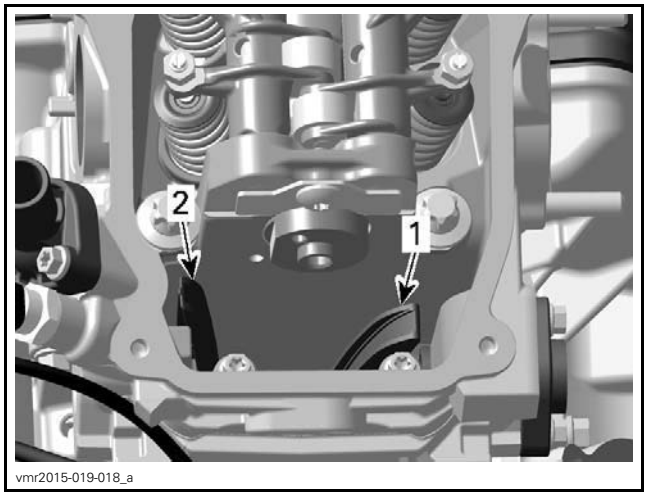
CAMSHAFT BEARING (TIMING CHAIN SIDE)	
NEW	35.000 mm to 35.025 mm (1.378 in to 1.3789 in)
SERVICE LIMIT	35.040 mm (1.3795 in)
CAMSHAFT BEARING (SPARK PLUG SIDE)	
NEW	22.000 mm to 22.021 mm (.8661 in to .867 in)
SERVICE LIMIT	22.040 mm (.8677 in)

Cylinder Head Installation

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

Ensure dowel pins are in place.

NOTICE **Timing chain guide (fixed) has to be fixed between cylinder and cylinder head.**

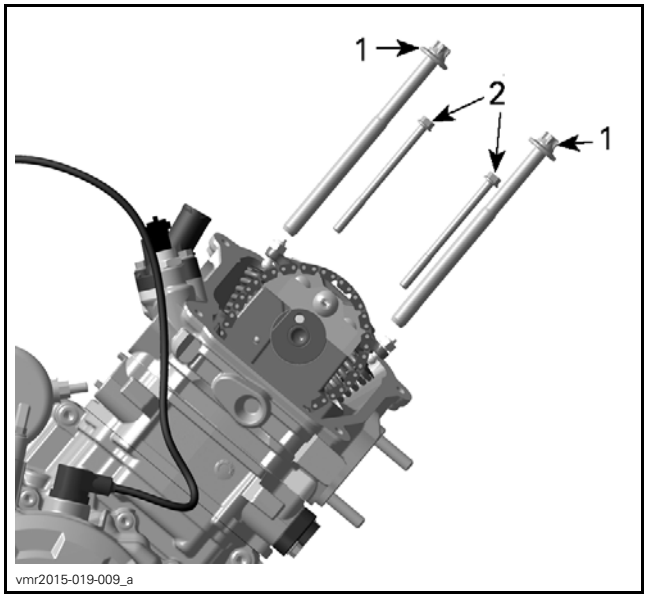


1. Timing chain guide (tensioner side) mounted in crankcase
2. Timing chain guide (fixed) between cylinder and cylinder head

Install a NEW cylinder head gasket.

Install cylinder head screws.

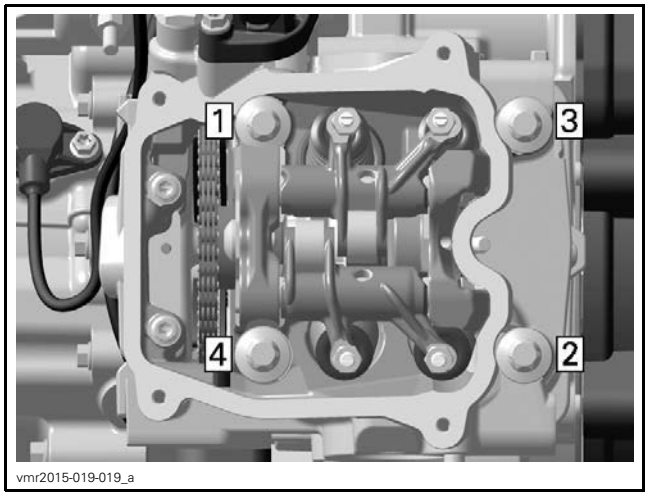
NOTICE **Check for proper lengths of the cylinder head screws.**



1. Location no. 1
2. Location no. 2

CYLINDER HEAD SCREW IDENTIFICATION	
Location no. 1	M10 x 140
Location no. 2	M6 x 85

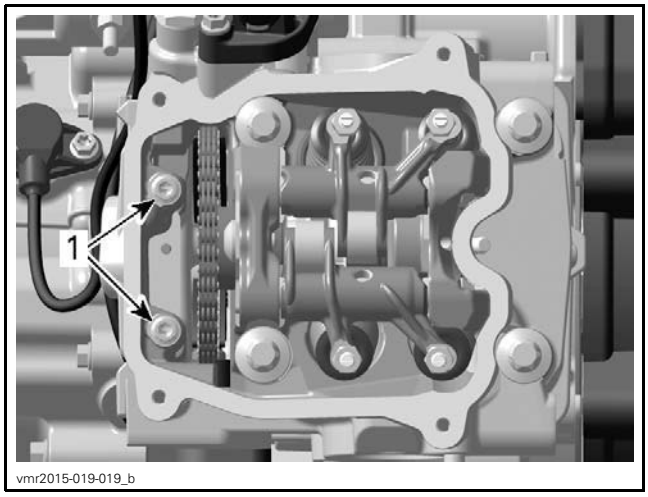
Tighten M10 cylinder head screws FIRST as per following specifications.



TIGHTENING SEQUENCE - M10 CYLINDER HEAD SCREWS

M10 CYLINDER HEAD SCREWS		
Tightening torque	step 1	20 N•m ± 1 N•m (15 lbf•ft ± 1 lbf•ft)
	step 2	180° ± 5°

Tighten M6 cylinder head screws as per following specification.



1. M6 Screws

M6 CYLINDER HEAD SCREWS	
Tightening torque	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

Check timing chain guide (tensioner side) for movement.

Refer to applicable subsection for installation details of remaining removed parts.

VALVE SPRINGS

Valve Spring Removal

Refer to following procedures in this subsection to remove:

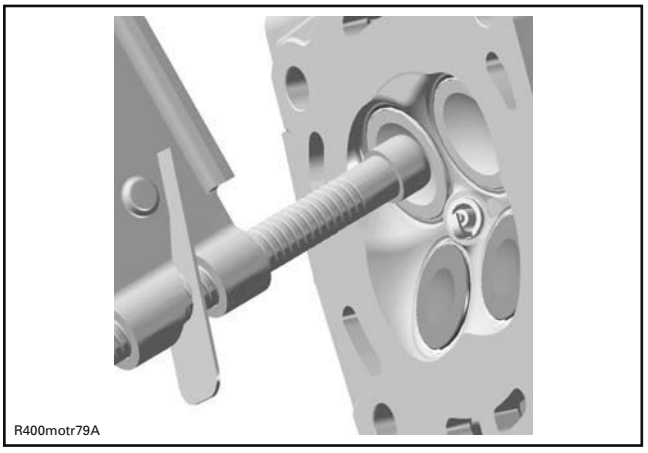
– *CAMSHAFT*
– *CYLINDER HEAD*.

Compress valve spring.

REQUIRED TOOL	
VALVE SPRING COMPRESSOR (P/N 529 035 724)	
VALVE SPRING COMPRESSOR CUP (P/N 529 036 270)	

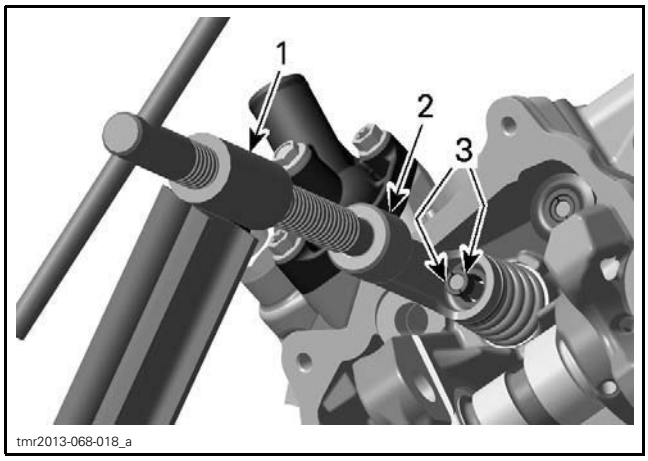
⚠ WARNING

Always wear safety glasses when disassembling valve springs. Be careful when unlocking valves. Components could fly away because of the strong spring preload.



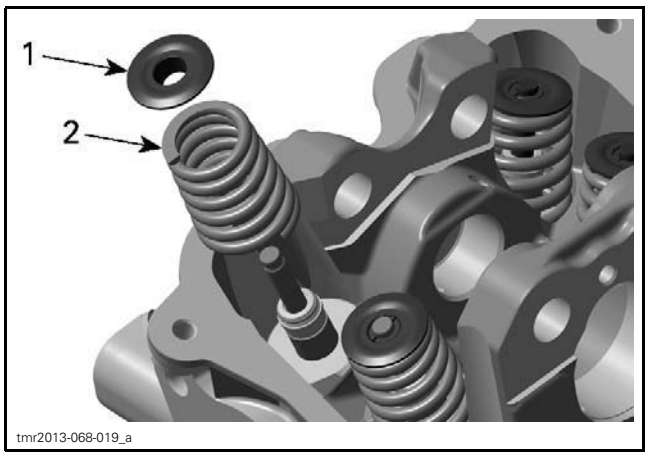
LOCATE VALVE SPRING COMPRESSOR IN CENTER OF THE VALVE

Remove valve cotters.



1. *Valve spring compressor*
2. *Valve spring compressor cup*
3. *Valve cotter*

Remove tools and withdraw valve spring retainer and valve spring.

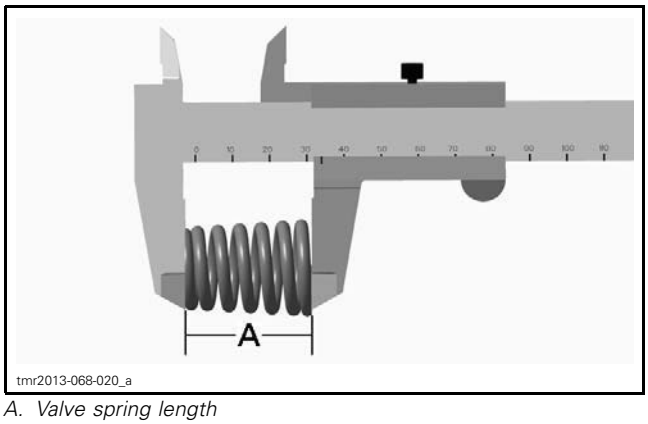


1. *Valve spring retainer*
2. *Valve spring*

Valve Spring Inspection

Check valve spring for visible damage. If so, replace valve spring.

Check valve spring for free length and straightness.



A. Valve spring length

VALVE SPRING FREE LENGTH	
NEW	40.41 mm (1.591 in)
SERVICE LIMIT	39.00 mm (1.535 in)

Replace valve springs if not within specifications.

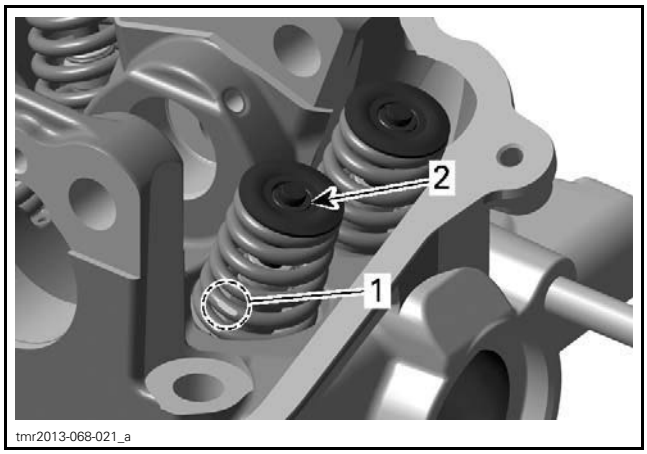
Valve Spring Installation

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

Colored area of the valve spring must be placed on bottom side.

To ease installation of cotters, apply oil or grease on them so that they remain in place while releasing the spring.

NOTE: Valve cotter must be properly engaged in valve stem grooves.



1. *Colored area position of the valve spring*
2. *Valve cotter*

After spring is installed, ensure it is properly locked by tapping on valve stem end with a soft hammer so that valve opens and closes a few times.

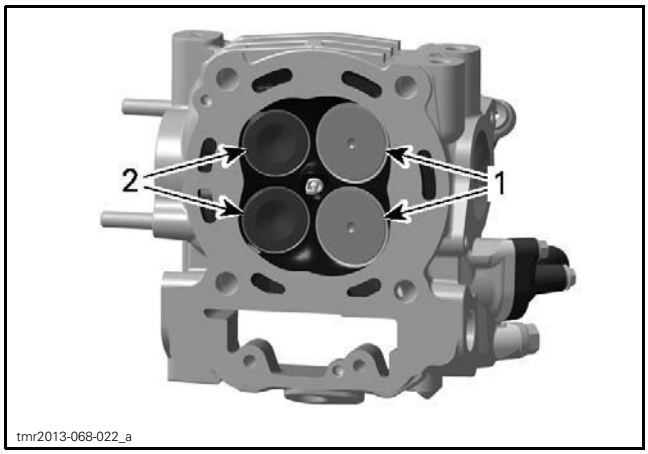
NOTICE An improperly locked valve spring will cause engine damage.

VALVES

Valve Removal

Remove valve spring, see *VALVE SPRING* in this subsection.

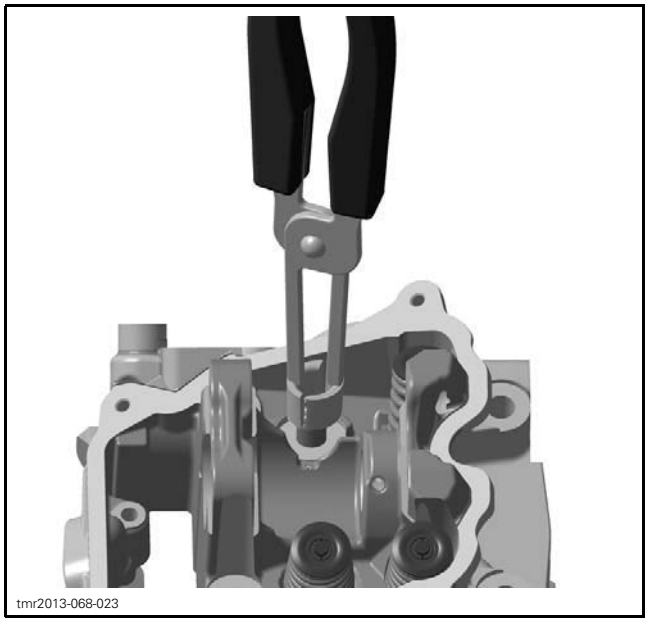
Push valve stem, then pull valves (intake and exhaust) out of valve guide.



1. Intake valves 36.5 mm (1.437 in)
2. Exhaust valves 31 mm (1.22 in)

Remove valve stem seal and discard it.

REQUIRED TOOL	
SNAP-ON PLIERS (P/N YA 8230)	



Valve Inspection

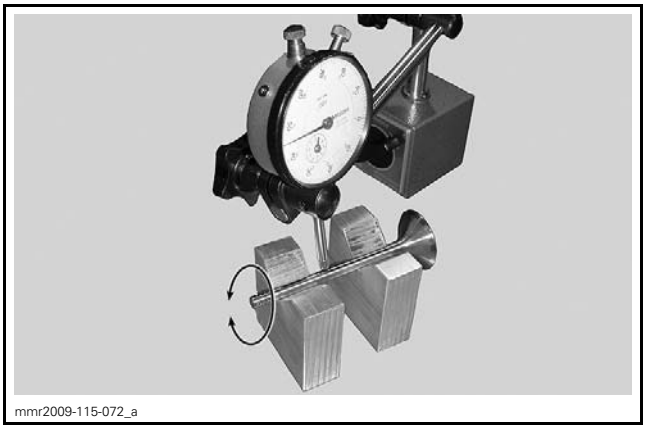
Whenever valves are removed always inspect valve guides. Refer to *VALVE GUIDES* in this subsection.

Valve Stem Seal

Always install **NEW** seals whenever valves are removed.

Valve

Inspect valve surface, check for abnormal stem wear and bending. If out of specification, replace by a new one.

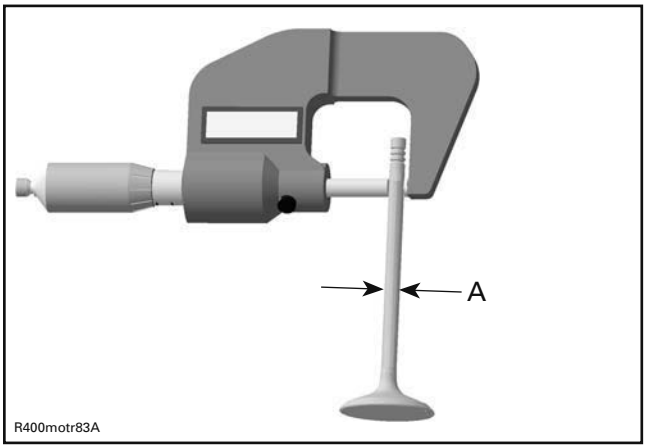


VALVE OUT OF ROUND (INTAKE AND EXHAUST VALVES)	
NEW	0.005 mm (.0002 in)
SERVICE LIMIT	0.060 mm (.0024 in)

Valve Stem

Measure valve stem in three places using a micrometer.

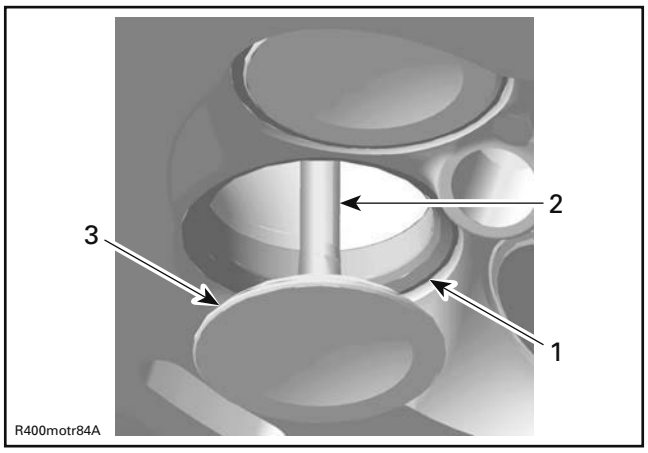
Replace valve if valve stem is out of specification or has other damages such as wear or friction surface.



A. Valve stem diameter

VALVE STEM DIAMETER	
EXHAUST VALVE	
NEW	5.461 mm to 5.476 mm (.215 in to .2156 in)
SERVICE LIMIT	5.440 mm (.2142 in)
INTAKE VALVE	
NEW	5.472 mm to 5.486 mm (.2154 in to .216 in)
SERVICE LIMIT	5.450 mm (.2146 in)

Valve Face and Seat



1. Valve seat
2. Exhaust valve contaminated area
3. Valve face (contact surface to valve seat)

Check valve face and seat for burning or pittings and replace valve or cylinder head if there are signs of damage.

Ensure to seat valves properly. Apply some lapping compound to valve face and work valve on its seat with a lapping tool (see *VALVE GUIDES* in this subsection).

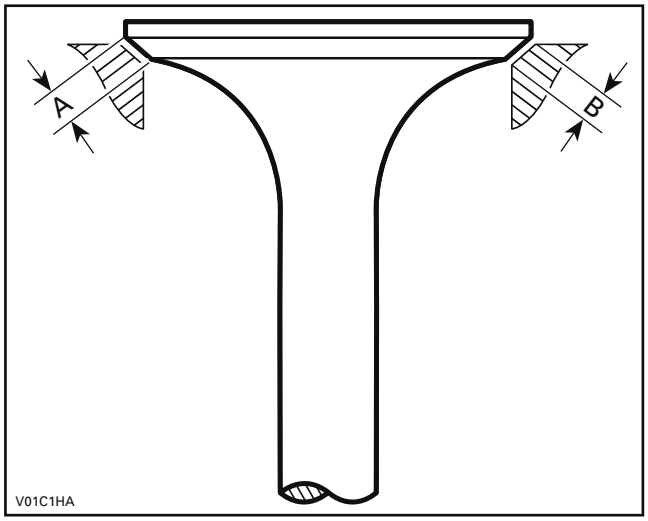
Measure valve face contact width.

NOTE: The location of contact area should be in center of valve seat.

Measure valve seat width using a caliper.

VALVE SEAT CONTACT WIDTH	
EXHAUST VALVE	
NEW	1.25 mm to 1.55 mm (.049 in to .061 in)
SERVICE LIMIT	2.00 mm (.079 in)
INTAKE VALVE	
NEW	1.05 mm to 1.35 mm (.041 in to .053 in)
SERVICE LIMIT	1.80 mm (.071 in)

If valve seat contact width is too wide or has dark spots, replace the cylinder head.



A. Valve face contact width
B. Valve seat contact width

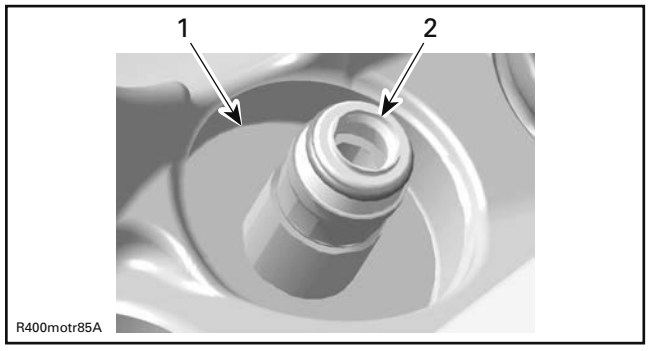
Valve Installation

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

Install a NEW valve stem seal. Make sure thrust washer is installed before installing seal.

Apply engine oil on valve stem and install it.

NOTICE Be careful when valve stem is passed through sealing lips of valve stem seal.



1. Thrust washer
2. Sealing lips of valve stem seal

For proper valve spring installation refer to *VALVE SPRINGS* in this subsection.

NOTICE An improperly locked valve spring will cause engine damage.

VALVE GUIDES

Valve Guide Inspection

Always replace valve stem seals whenever valve guides are removed.

Measure valve guide in three places using a small bore gauge.

NOTE: Clean valve guide to remove carbon deposits before measuring.

Replace valve guide if it is out of specification or has other damages such as wear or friction surface.

VALVE GUIDE DIAMETER (INTAKE AND EXHAUST VALVES)	
NEW	5.506 mm to 5.518 mm (.2168 in to .2172 in)
SERVICE LIMIT	5.568 mm (.2192 in)

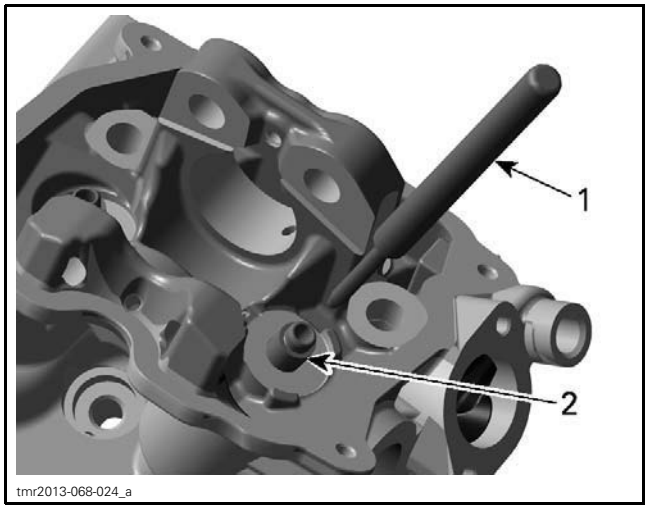
Valve Guide Removal

Refer to following procedures in this subsection to remove:
- Cylinder head
- Valve springs
- Valves
- Valve stem seals
- Thrust washers.

NOTE: Clean valve guide area from contamination before removal.

Drive the valve guide out of cylinder head.

REQUIRED TOOL	
Hammer	
VALVE GUIDE REMOVER (6 MM) (P/N 529 036 074)	



1. Valve guide remover
2. Valve guide

Valve Guide Installation

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

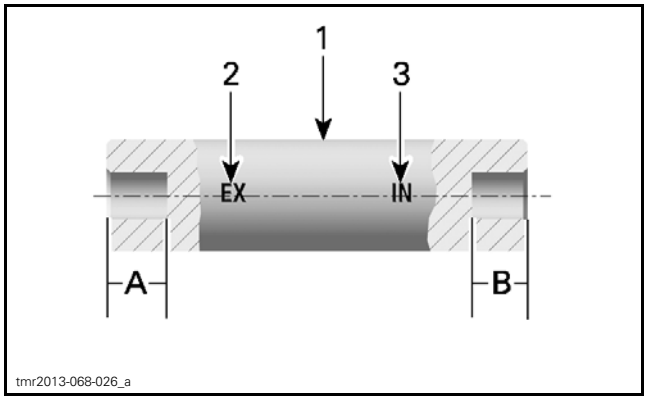
Clean the valve guide bore before reinstalling the valve guide into cylinder head.

NOTE: Apply LOCTITE 767 (ANTISEIZE LUBRICANT) (P/N 293 800 070) on valve guide prior to install it into the cylinder head.

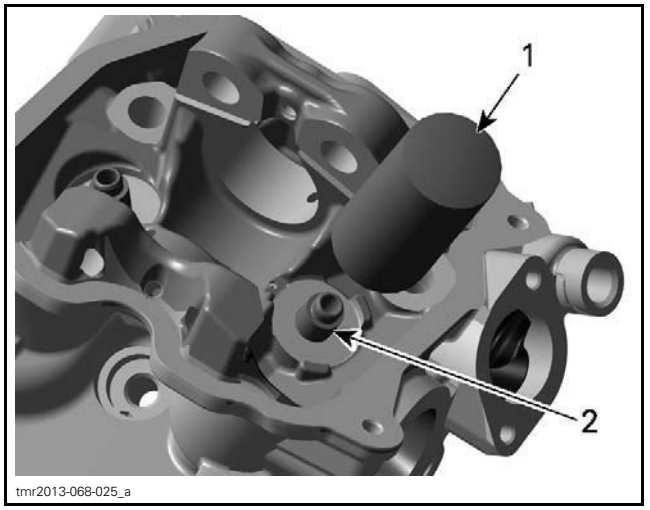
Install valve guide.

REQUIRED TOOL	
VALVE GUIDE INSTALLER (P/N 529 036 269)	

NOTICE Valve guide installer is used for intake and exhaust valve guides. Choose proper side for installation.

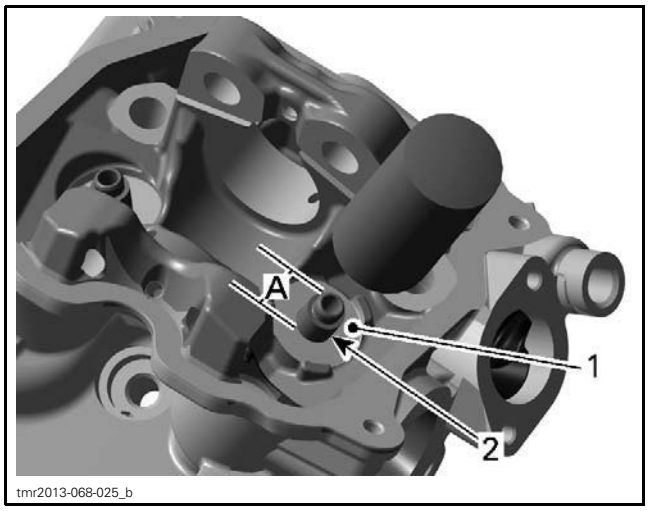


1. Valve guide installer
2. Mark "EX" - exhaust valve guide installer
3. Mark "IN" - intake valve guide installer
A. 14.5 mm (.571 in)
B. 13.3 mm (.524 in)



1. Valve guide installer
2. Valve guide

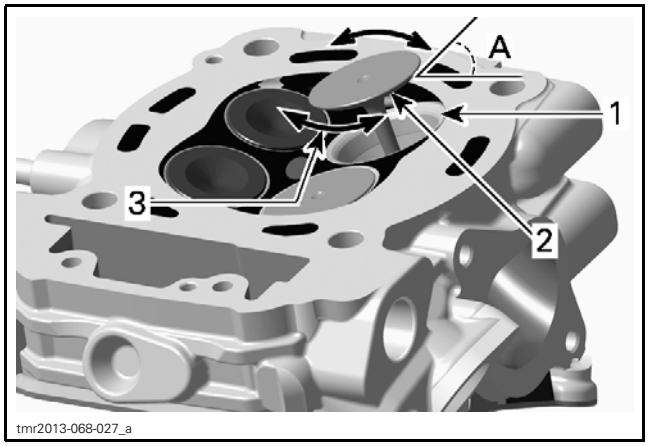
NOTICE Push valve guide in the cold cylinder head as per following illustration.



1. Thrust surface of cylinder head
2. Valve guide
A. Measurement from thrust surface to valve guide top

VALVE GUIDE (MEASUREMENT "A")	
INTAKE	13.1 mm to 13.5 mm (.5157 in to .5315 in)
EXHAUST	14.3 mm to 14.7 mm (.563 in to .579 in)

Apply some lapping compound to valve face and work valve on its seat with a lapping tool.



1. Valve seat
2. Valve face (contact surface to valve seat)
3. Turn valve while pushing against cylinder head
A. Valve seat angle 45°

NOTE: Ensure to seat valves properly. Apply marking paste to ease checking contact pattern.

Repeat procedure until valve seat/valve face fits together.

CYLINDER

Cylinder Removal

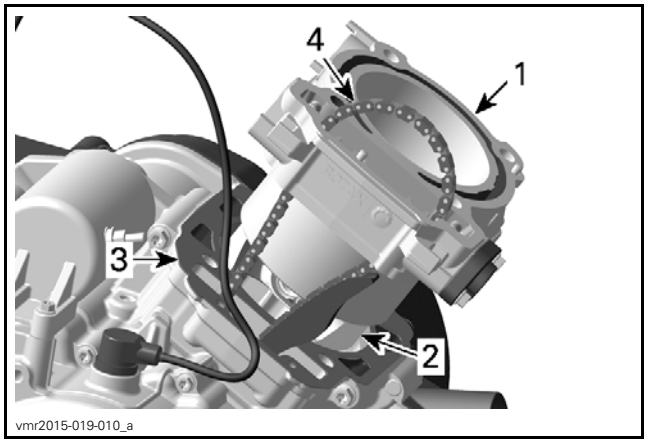
Refer to *TIMING CHAIN* subsection and remove the following parts:

– Timing chain tensioner
– Camshaft timing gear.

Remove the cylinder head (see *CYLINDER HEAD* in this subsection).

Pull cylinder.

Discard cylinder base gaskets.



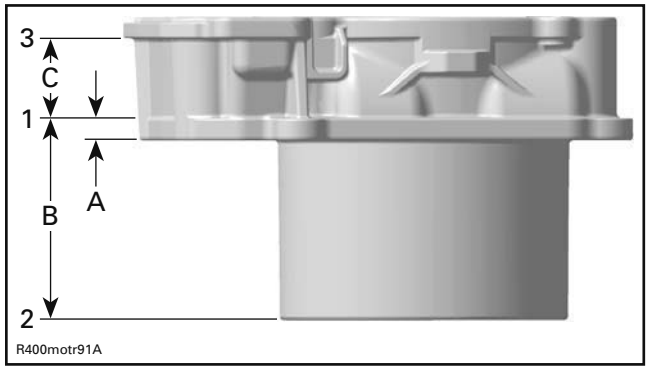
1. Cylinder
2. Piston assembly
3. Cylinder base gasket
4. Camshaft timing chain

Cylinder Inspection

Check cylinder for cracks, scoring and wear ridges on the top and bottom of the cylinder. If so, replace cylinder.

Cylinder Taper

Measure cylinder bore at 3 recommended positions.



A. First measurement (from cylinder bottom)
B. Second measurement
C. Third measurement

CYLINDER TAPER MEASUREMENTS	
MEASUREMENT	SPECIFICATION
A	5 mm (.197 in)
B	58 mm (2.283 in)
C	52 mm (2.047 in)

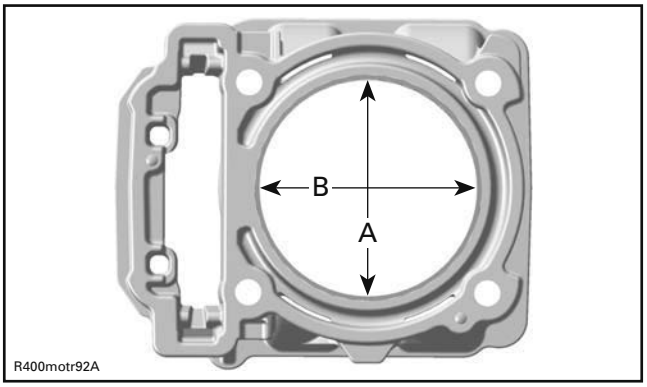
CYLINDER TAPER SPECIFICATION	
NEW (MAXIMUM)	0.038 mm (.0015 in)
SERVICE LIMIT	0.090 mm (.0035 in)

Distance between measurements should not exceed the service limit mentioned above. Otherwise, replace cylinder and piston rings.

Cylinder Out of Round

Measure cylinder diameter in piston axis direction from top of cylinder. Take another measurement 90° from first one and compare.

NOTE: Take the same measuring points like described in *CYLINDER TAPER* above.



A. Perpendicular to crankshaft axis
B. Parallel to crankshaft axis

CYLINDER OUT OF ROUND	
NEW (MAXIMUM)	0.015 mm (.0006 in)
SERVICE LIMIT	0.020 mm (.0008 in)

Cylinder Installation

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

NOTICE Always replace cylinder base gasket before installing the cylinder.

NOTE: Make sure piston rings are properly spaced, refer to *PISTON RINGS* in this subsection.

Apply engine oil:

– In the bottom area of the cylinder bore
– On the piston rings
– On the piston ring compressor.

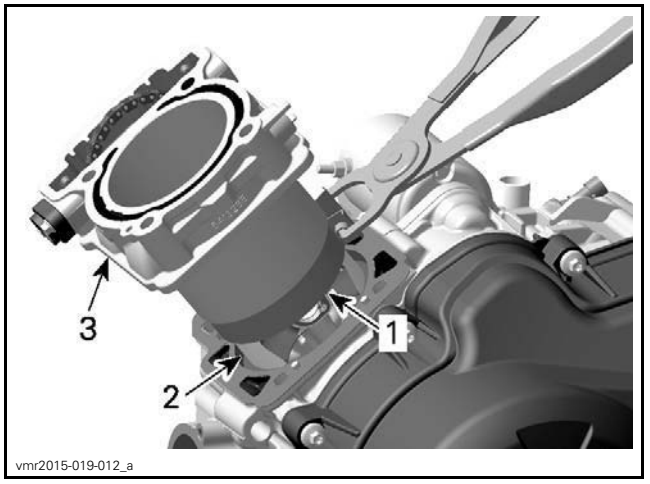
Compress piston rings.

Apply engine oil on the band of the tool.

REQUIRED TOOL
Piston ring compressor with band width of 15 mm to 20 mm (.59 in to .79 in)

NOTE: The cylinder can not be pushed fully over the piston unless the piston is located at TDC.

Put timing chain through the chain pit then put the cylinder in place.



1. Piston ring compressor
2. Piston
3. Cylinder

NOTICE Chain guide has to be fixed between cylinder and cylinder head.

Install cylinder head and the other parts in accordance with the proper installation procedures.

PISTON

Piston Removal

Refer to following procedures in this subsection to remove:

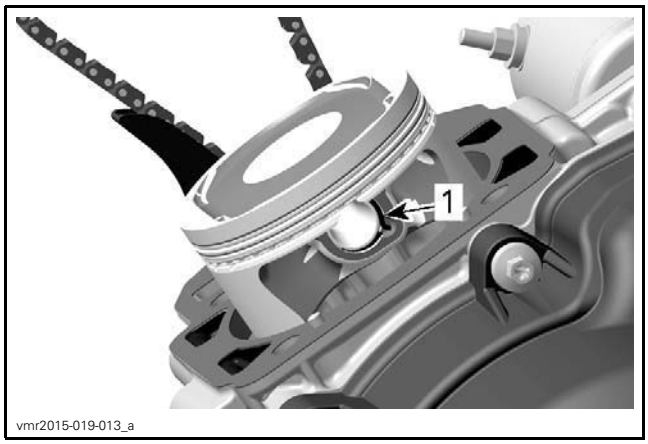
– Cylinder head
– Cylinder.

Place a rag under piston and in the area of timing chain compartment.

⚠ WARNING

Piston circlips are spring loaded.

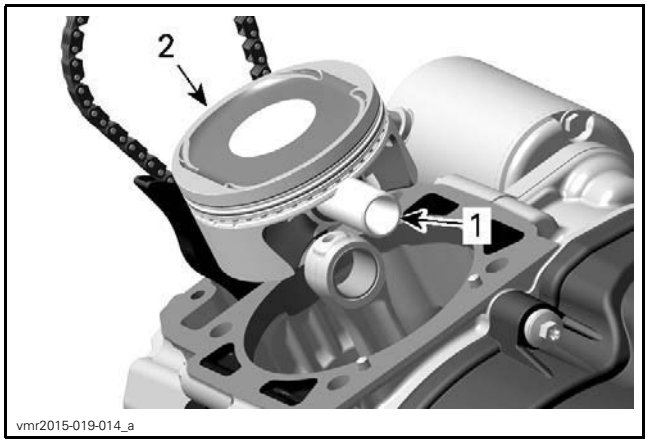
Remove one piston circlip and discard it.



1. Piston circlip

NOTE: The removal of both piston circlips is not necessary to remove piston pin.

Push piston pin out of piston.



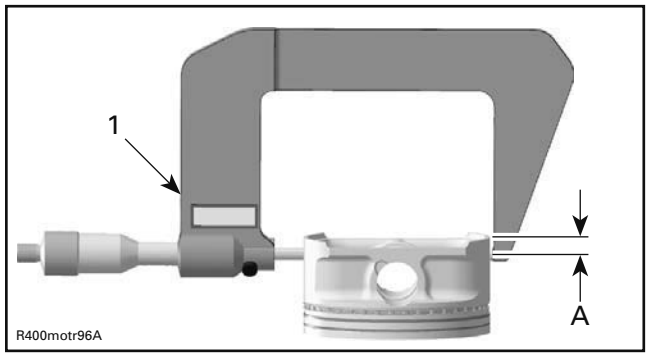
1. Piston pin
2. Piston

Detach piston from connecting rod.

Piston Inspection

Inspect piston for scoring, cracking or other damages. Replace piston and piston rings if necessary.

Using a micrometer, measure piston at 8 mm (.315 in) perpendicularly (90°) to piston pin.



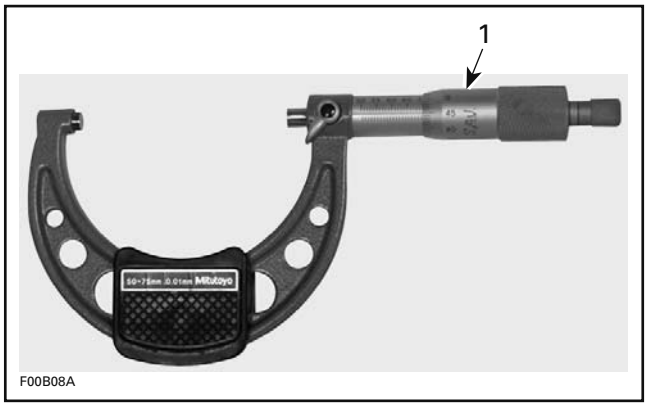
1. Measuring perpendicularly (90°) to piston pin
A. 8 mm (.315 in)

The measured dimension should be as described in the following tables. If not, replace piston.

PISTON MEASUREMENT	
NEW	93.950 mm to 93.966 mm (3.6988 in to 3.6994 in)
SERVICE LIMIT	93.940 mm (3.6984 in)

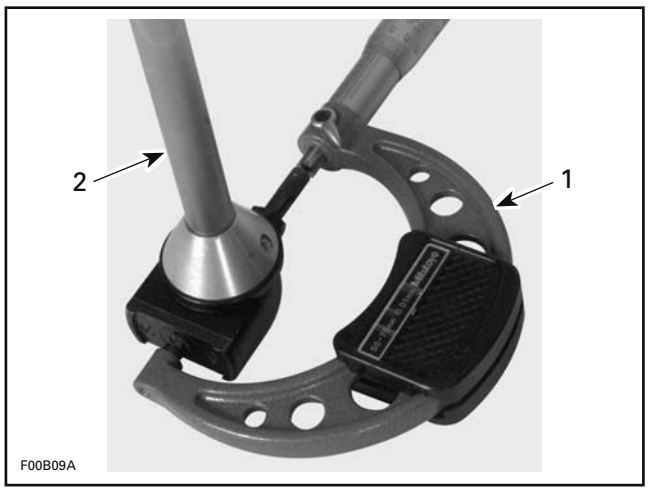
Piston/Cylinder Clearance

Adjust and lock a micrometer to the piston dimension.

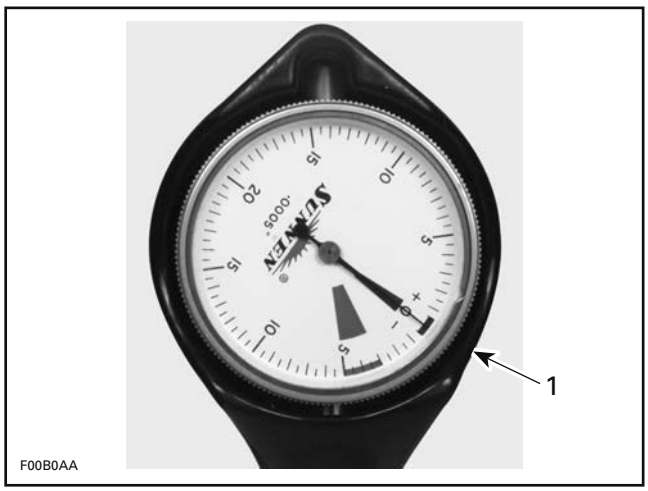


1. Micrometer set to the piston dimension

With the micrometer set to the dimension, adjust a cylinder bore gauge to the micrometer dimension and set the indicator to 0 (zero).



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



TYPICAL
1. Indicator set to 0 (zero)

Position the dial bore gauge 20 mm (.787 in) above cylinder base, measuring perpendicularly (90°) to piston pin axis.

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

PISTON/CYLINDER CLEARANCE	
NEW	0.027 mm to 0.057 mm (.0011 in to .0022 in)
SERVICE LIMIT	0.100 mm (.0039 in)

NOTE: Make sure used piston is not worn.

If clearance exceeds specified tolerance, replace piston by a new one and measure piston/cylinder clearance again.

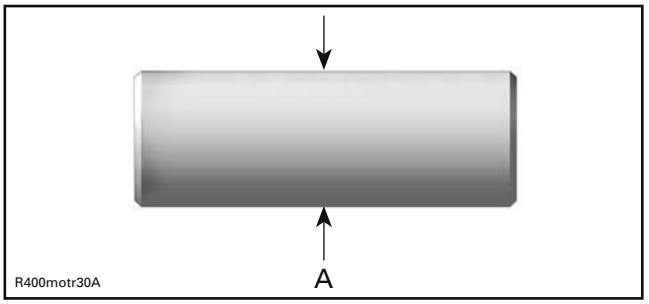
NOTE: Make sure the cylinder bore gauge indicator is set exactly at the same position as with the micrometer, otherwise the reading will be false.

Connecting Rod/Piston Pin Clearance

Using synthetic abrasive woven, clean piston pin from deposits.

Inspect piston pin for scoring, cracking or other damages.

Measure piston pin. See the following illustration for the proper measurement positions.

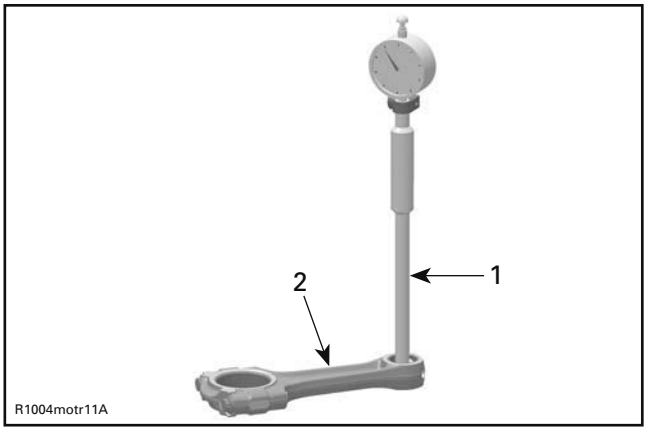


A. Piston pin diameter

PISTON PIN DIAMETER	
NEW	19.996 mm to 20.000 mm (.7872 in to .7874 in)
SERVICE LIMIT	19.980 mm (.7866 in)

Replace piston pin if diameter is out of specifications.

Measure inside diameter of connecting rod small end bushing.



1. Bore gauge
2. Connecting rod

CONNECTING ROD SMALL END DIAMETER	
NEW	20.010 mm to 20.020 mm (.7878 in to .7882 in)
SERVICE LIMIT	20.060 mm (.7898 in)

Replace connecting rod if diameter of connecting rod small end is out of specifications. Refer to *BOTTOM END* subsection for removal procedure.

Compare measurements to obtain the connecting rod/piston pin clearance.

CONNECTING ROD/ PISTON PIN CLEARANCE	
SERVICE LIMIT	0.080 mm (.0031 in)

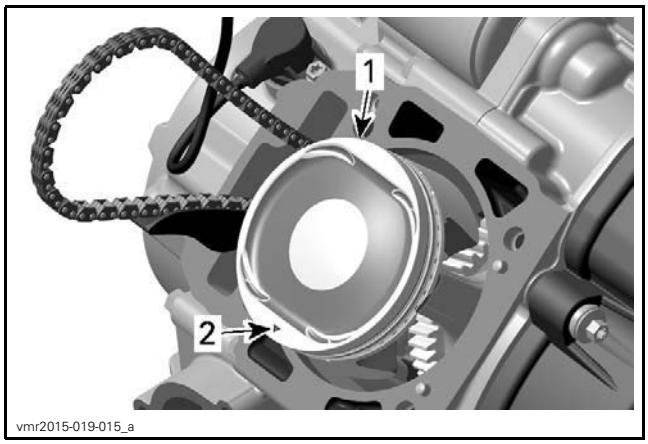
Piston Installation

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

Apply engine oil on the piston pin.

Insert piston pin into piston and connecting rod.

Install piston with the punched arrow on piston dome must point towards exhaust side of the engine.



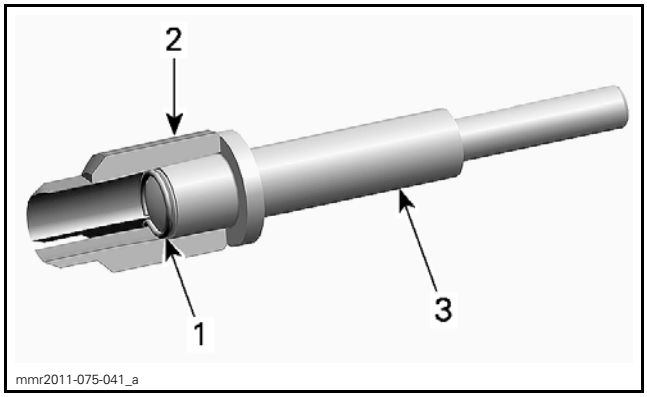
1. Piston
2. Mark on piston must show to exhaust side

Install NEW piston circlip as per following procedure:

REQUIRED TOOL	
PISTON CIRCLIP INSTALLER (P/N 529 036 083)	

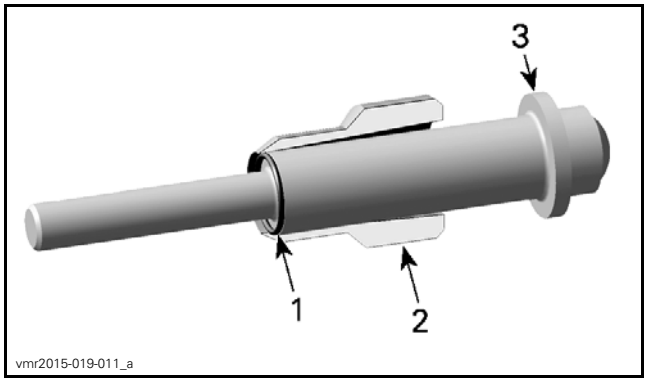
NOTICE Always replace disassembled piston circlip(s) by NEW ones. Place a rag on cylinder base to avoid dropping the circlip inside the engine.

1. Place circlip in sleeve and push piston circlip installer handle until circlip reaches the mid position in the sleeve.



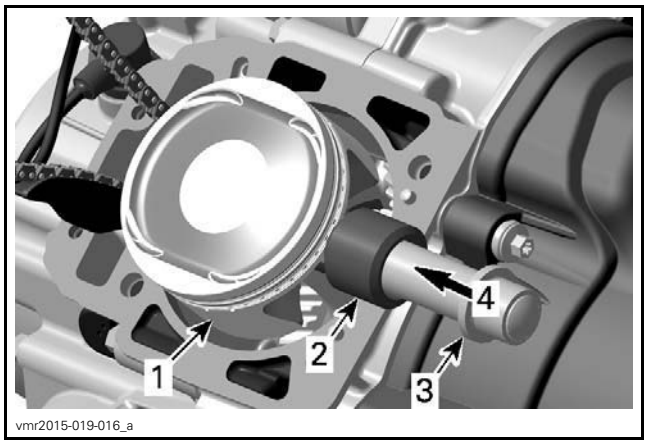
TYPICAL
1. Circlip
2. Sleeve
3. Installer handle

2. Push piston circlip installer handle until circlip reaches end position in the sleeve.



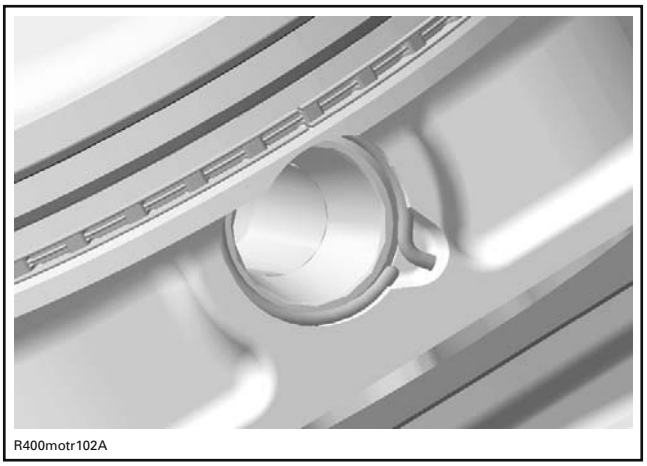
TYPICAL
1. Circlip
2. Sleeve
3. Installer handle

3. Align sleeve with piston pin axis and push installer handle until circlip engages in piston.



1. Hold piston while pushing circlip in place
2. Sleeve
3. Installer handle
4. Direction to push circlip

NOTE: Take care that the hook of the piston circlip is positioned properly.



CORRECT POSITION OF THE PISTON CIRCLIP

PISTON RINGS

Ring Removal

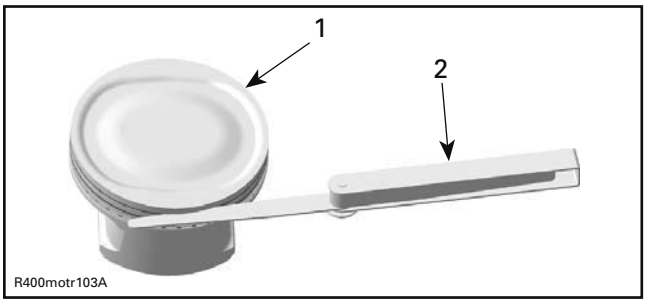
Remove the piston (see *PISTON* in this subsection).

Ring Inspection

Ring/Piston Groove Clearance

Using a feeler gauge measure each ring/piston groove clearance. If the clearance is too large, the piston and the piston rings should be replaced.

RING/PISTON GROOVE CLEARANCE	
UPPER COMPRESSION RING	
NEW	0.03 mm to 0.07 mm (.0012 in to .0028 in)
SERVICE LIMIT	0.150 mm (.0059 in)
LOWER COMPRESSION RING	
NEW	0.02 mm to 0.06 mm (.0008 in to .0024 in)
SERVICE LIMIT	0.150 mm (.0059 in)
OIL SCRAPER RING	
NEW	0.01 mm to 0.18 mm (.0004 in to .0071 in)
SERVICE LIMIT	0.250 mm (.0098 in)



1. Piston
2. Feeler gauge

Ring End Gap

RING END GAP	
UPPER COMPRESSION RING	
NEW	0.20 mm to 0.35 mm (.008 in to .014 in)
SERVICE LIMIT	0.60 mm (.024 in)
LOWER COMPRESSION RING	
NEW	0.35 mm to 0.55 mm (.014 in to .022 in)
SERVICE LIMIT	0.85 mm (.033 in)
OIL SCRAPER RING	
NEW	0.20 mm to 0.70 mm (.008 in to .028 in)
SERVICE LIMIT	1.00 mm (.039 in)

To measure the ring end gap place the ring in the cylinder in the area of 8 mm to 16 mm (5/16 in to 5/8 in) from top of cylinder.

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

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

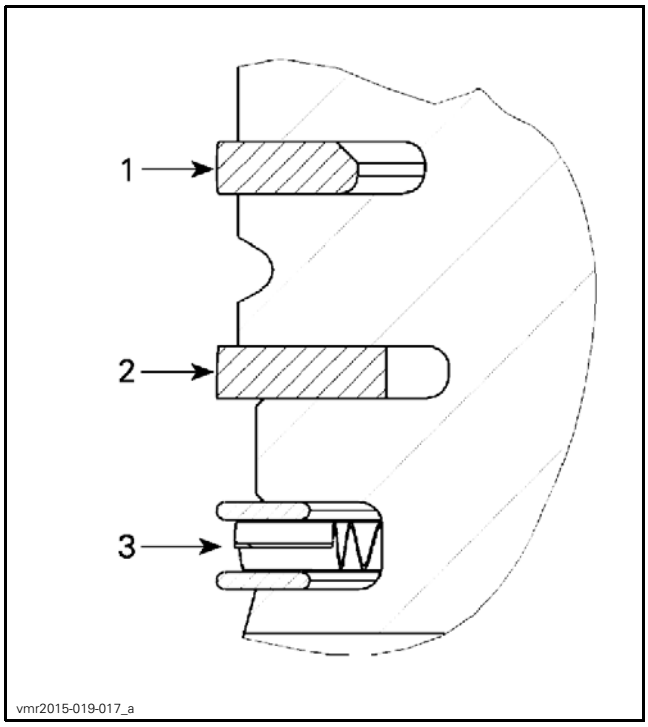
Ring Installation

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

NOTE: Use a ring expander to prevent breakage during installation. The oil ring must be installed by hand.

NOTE: First install spring and then rings of oil scraper ring.

Install the oil scraper ring first, then the lower compression ring with the word "N and TOP " facing up, then the upper compression ring with the word "N and TOP" facing up.

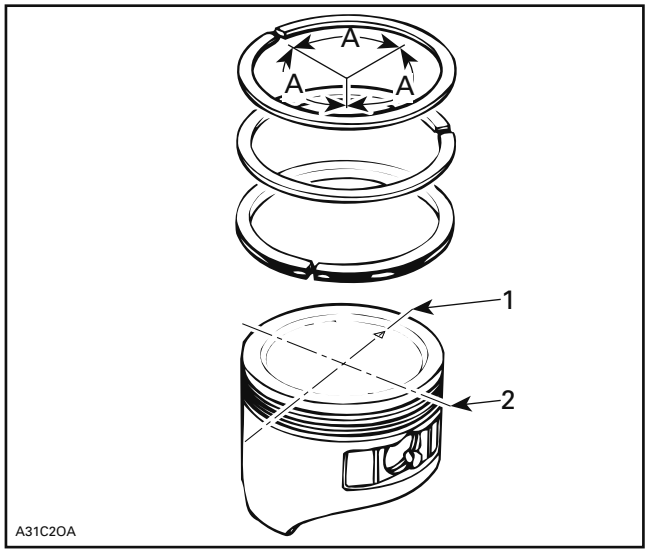


1. Upper compression ring
2. Lower compression ring
3. Oil scraper ring

NOTICE Ensure that top and second rings are not interchanged.

Check that rings rotate smoothly after installation.

Space the piston ring end gaps 120° apart and do not align the gaps with the piston pin bore or the thrust side axis.



1. DO NOT align ring gap with piston thrust side axis
2. DO NOT align ring gap with piston pin bore axis
A. 120°

TIMING CHAIN

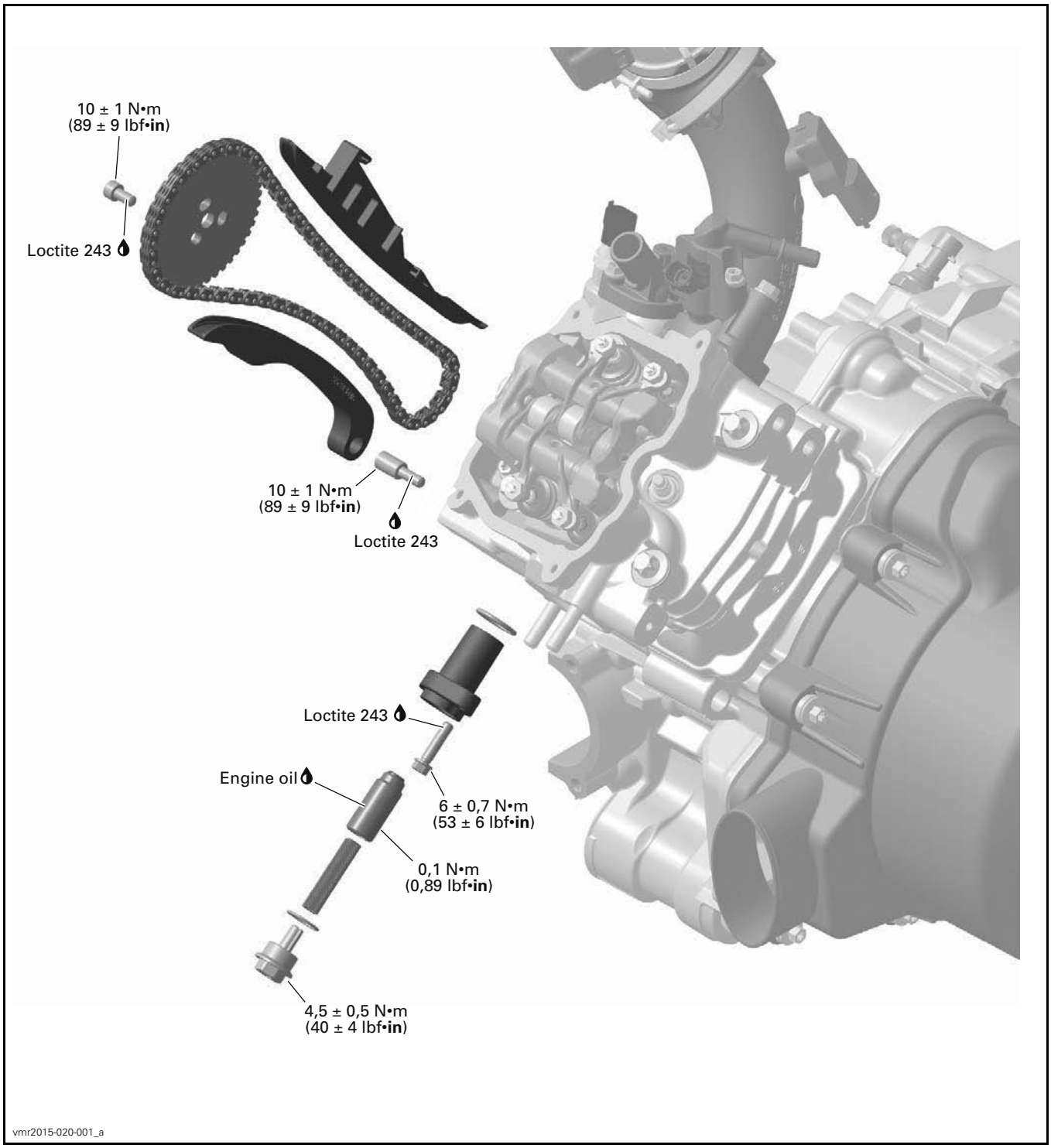
SERVICE TOOLS

Description	Part Number	Page
CAMSHAFT TIMING TOOL	529 036 268	154–155

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	155, 157

TIMING CHAIN



GENERAL

IMPORTANT: Note position of parts on disassembly. This may help to find the root cause of a problem. A component that is not replaced should be reinstalled in the same position as originally mounted.

TROUBLESHOOTING

UNUSUAL ENGINE NOISE OR VIBRATION

1. IMPROPER VALVE CLEARANCE ADJUSTMENT AND/OR WORN OUT ROCKER ARM(S)
   - *Readjust valve clearance and/or replace defective part(s), refer to TOP END subsection.*
2. DEFECTIVE CHAIN TENSIONER
   - *Replace chain tensioner.*
3. WORN OUT TIMING CHAIN GUIDE(S)
   - *Replace timing chain guide(s).*
4. STRETCHED TIMING CHAIN OR WORN OUT TIMING GEARS
   - *Replace timing chain and timing gears.*
5. LOOSE TIMING GEAR RETAINING SCREWS
   - *Retighten screws to recommended torque.*
6. INCORRECT CAMSHAFT TIMING
   - *Replace damaged components and readjust camshaft timing.*

ENGINE LACKS ACCELERATION OR POWER

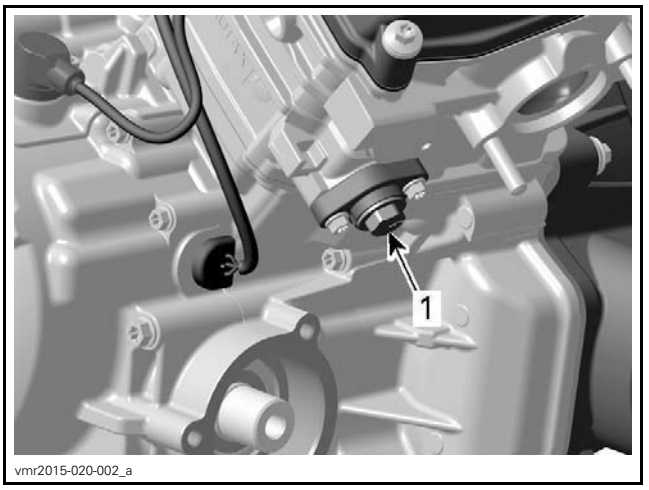
1. INCORRECT CAMSHAFT TIMING
   - *Replace damaged components and readjust camshaft timing.*

PROCEDURES

TIMING CHAIN TENSIONER

Timing Chain Tensioner Location

The timing chain tensioner is located in the cylinder.



1. Timing chain tensioner

Timing Chain Tensioner Access

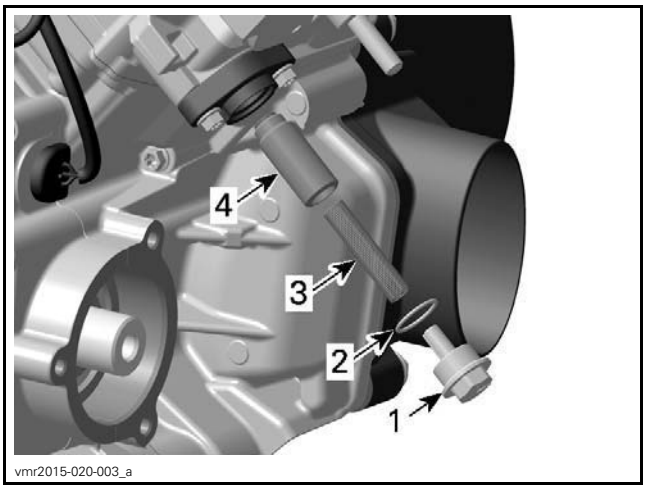
Refer to *BODY* subsection and remove the RH inner fender panel.

Timing Chain Tensioner Removal

1. Make sure the piston is set to TDC ignition. Refer to *CRANKSHAFT LOCKING PROCEDURE* in the *BOTTOM END* subsection.
2. Carefully unscrew chain tensioner plug and release spring tension.

⚠ CAUTION Tensioner is spring loaded.

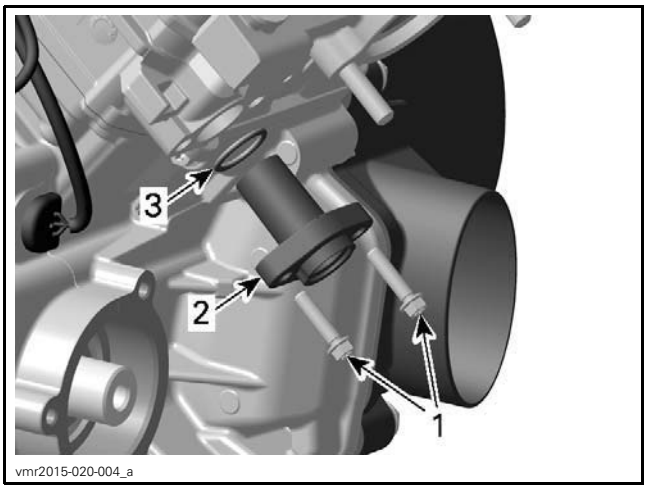
3. Remove:
   – O-ring
   – Spring
   – Chain tensioner plunger.



1. Chain tensioner plug
2. O-ring
3. Spring
4. Chain tensioner plunger

4. Remove:
   – Chain tensioner housing retaining screws

– Chain tensioner housing
– O-ring.



1. Screws
2. Chain tensioner housing
3. O-ring

Timing Chain Tensioner Inspection

Check the chain tensioner housing and plug for cracks or other damages. Replace if necessary.

Check chain tensioner plunger for free movement and/or scoring.

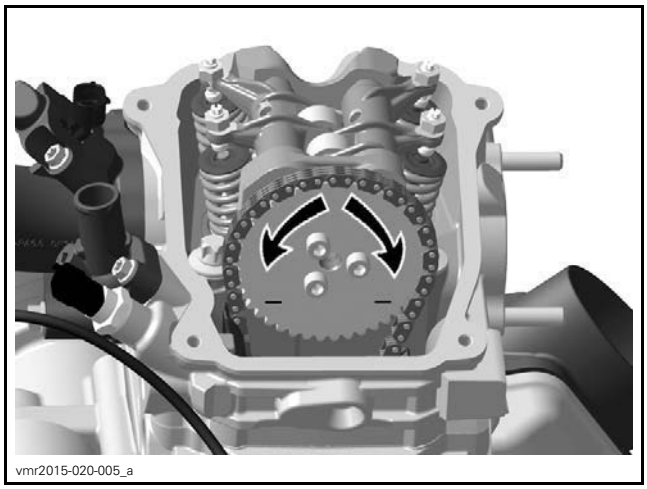
Check if O-rings are brittle, cracked or hard. Replace if necessary.

Check spring condition. Replace if bent, broken or worn.

Timing Chain Tensioner Installation

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

NOTE: Before installing the chain tensioner make sure, that the camshaft timing gear can be moved back and forth.



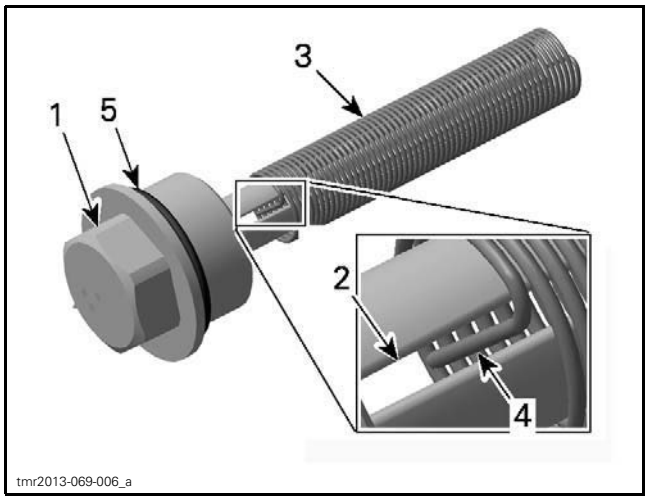
MOVE GEAR BACK AND FORTH

2. Apply engine oil on the plunger before installation.
3. Slightly turn the camshaft timing gear in order to get the timing chain play on the tensioner side.
4. Slightly screw the plunger in until the timing chain allows no more back and forth movement of the camshaft timing gear.
5. Screw the plunger in an additional 1/8 turn to reach the required specified torque.

TIMING CHAIN TENSIONER ADJUSTMENT (TORQUE)
0.1 N•m (.9 lbf•**in**)

NOTICE **Improper adjustment of the timing chain will lead to severe engine damage.**

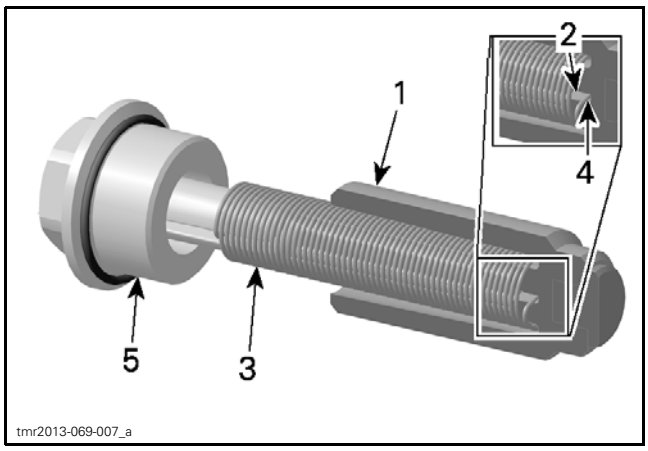
6. Place the O-ring on plug.
7. Fit the spring on one side into the slot of the plug.



1. Plug
2. Slot
3. Spring
4. Spring end
5. O-Ring

Fit the spring on the other side into the plunger.

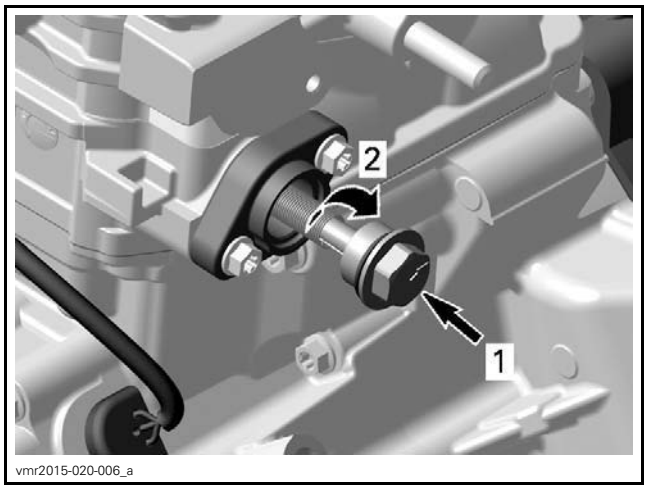
NOTE: Turn spring only clockwise in order to fit the spring end into the notch of the plunger to avoid loosening the plunger during spring installation. Do not preload the spring.



FOR CLARITY PARTS ARE REMOVED FROM CYLINDER
1. Plunger
2. Notch
3. Spring
4. Spring end
5. Plug with O-ring

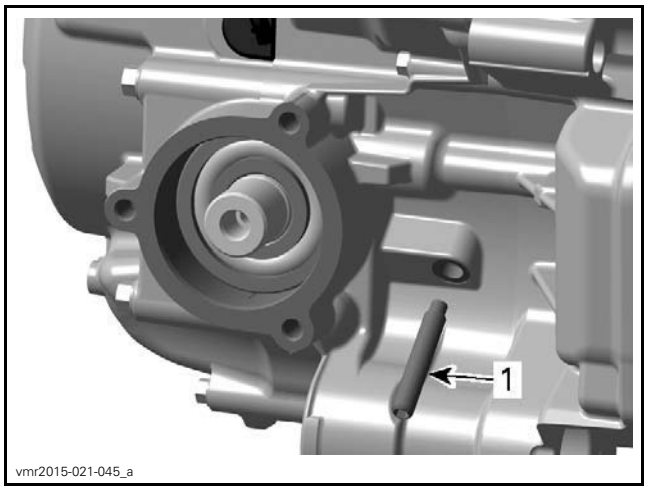
8. Then compress the spring and screw the plug in.

NOTE: To avoid overstressed timing chain, the plug must engage into threads within the first full turn.



Step 1: Compress spring
Step 2: Screw in plug

9. Remove the crankshaft locking bolt and install all other removed parts.



1. Crankshaft locking bolt

10. Finally, tighten the chain tensioner plug to specification.

CHAIN TENSIONER PLUG	
Tightening torque	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)

CAMSHAFT TIMING GEAR

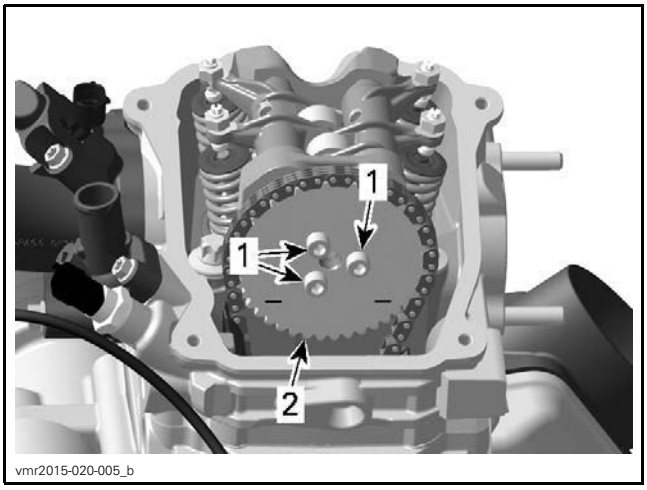
Camshaft Timing Gear Removal

Remove the valve cover, refer to *TOP END* subsection.

Turn crankshaft to TDC ignition and lock crankshaft, refer to *CRANKSHAFT LOCKING PROCEDURE* in the *BOTTOM END* subsection.

Unscrew timing chain tensioner. Refer to *TIMING CHAIN TENSIONER* in this subsection.

Remove:
– Camshaft timing gear retaining screws
– Camshaft timing gear.



1. Camshaft timing gear retaining screws
2. Camshaft timing gear

NOTE: Secure timing chain with a piece of wire.

Camshaft Timing Gear Inspection

Check camshaft timing gear for wear or deterioration.

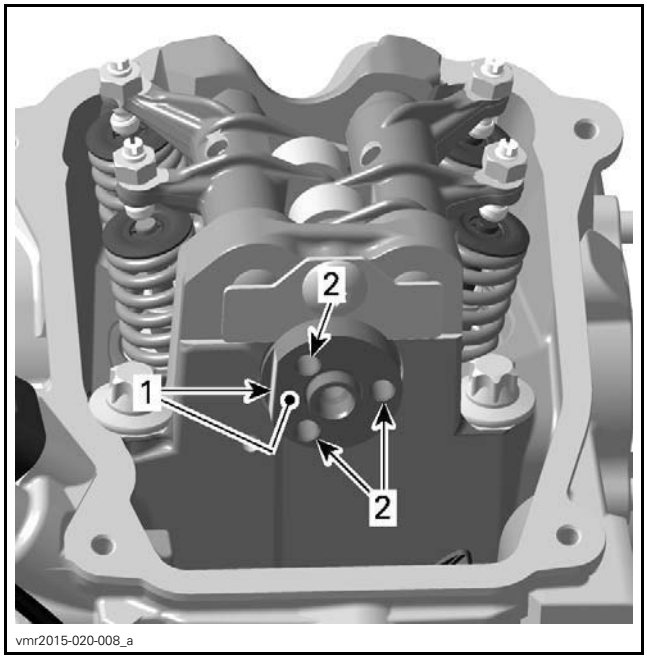
If gear is worn or damaged, replace it as a set with the timing chain.

For crankshaft gear, refer to *BOTTOM END* subsection, see *CRANKSHAFT*.

Camshaft Timing Gear Installation

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

1. Clean mating surface and threads of camshaft prior installing camshaft timing gear.

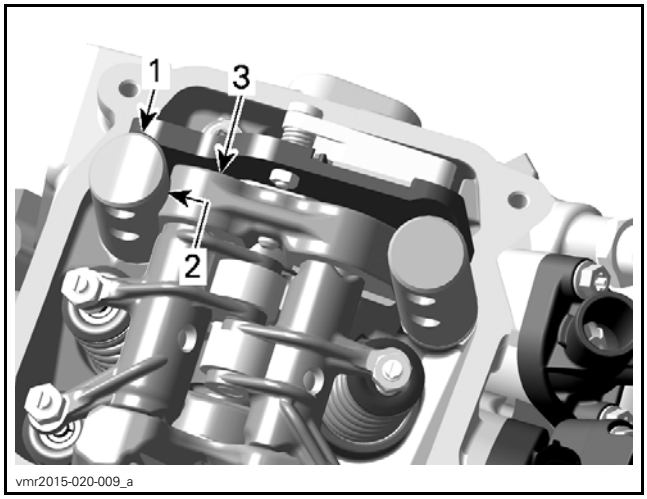


1. Mating surface on camshaft
2. Threads for camshaft screws

2. Crankshaft must be locked at TDC position before installing the timing chain, refer to *CRANKSHAFT LOCKING PROCEDURE* in the *BOTTOM END* subsection.
3. Install the camshaft timing tool on the cylinder head.

REQUIRED TOOL	
CAMSHAFT TIMING TOOL (P/N 529 036 268)	

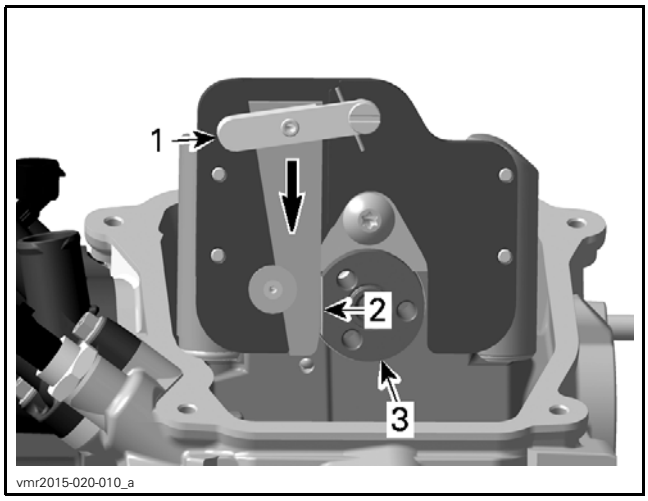
NOTE: Align tube of camshaft adjustment tool properly with machined radius on cylinder head.



CAMSHAFT TIMING TOOL INSTALLED
1. Tube (camshaft adjustment tool)
2. Machined radius (camshaft adjustment tool)
3. Cylinder head

4. Set camshaft to TDC ignition position by aligning the camshaft flange flat spot with the tool lever.

NOTE: In addition, to ensure proper camshaft timing, press camshaft adjustment tool lever downwards.

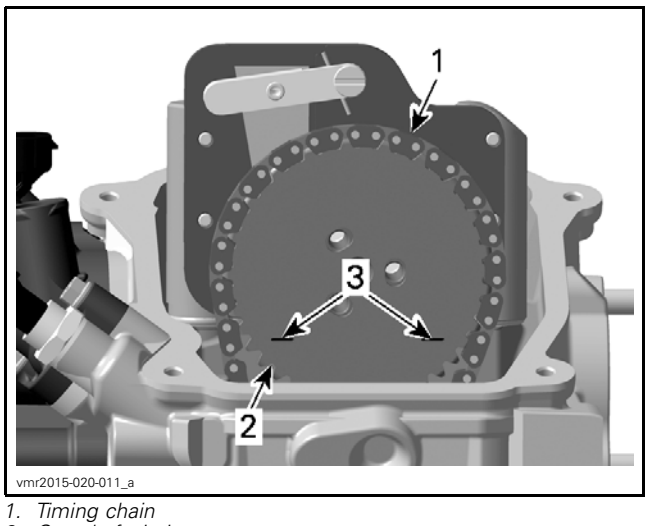


PRESS TOOL LEVER DOWN
1. *Lever*
2. *Flat spot*
3. *Camshaft*

NOTICE Crankshaft and camshaft must be locked at TDC ignition position to place camshaft timing gear and timing chain in the proper position.

5. Place camshaft timing gear along with the timing chain on the camshaft.

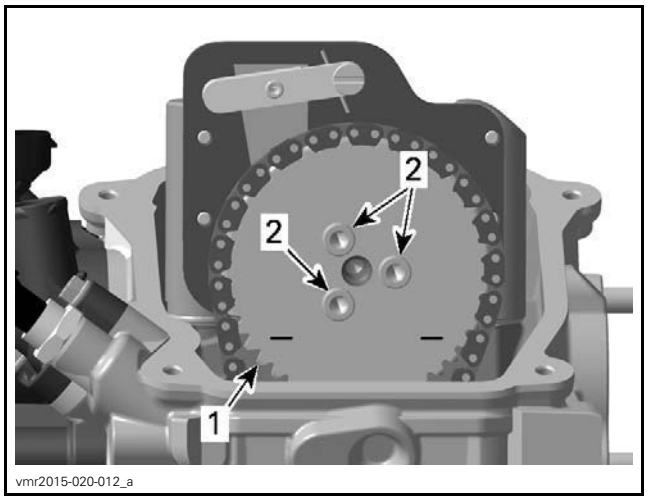
NOTE: The printed marks on the camshaft timing gear must be parallel to the cylinder head base.



1. *Timing chain*
2. *Camshaft timing gear*
3. *Printed marks on camshaft timing gear*

6. Install and adjust timing chain tensioner, refer to *TIMING CHAIN TENSIONER* in this subsection.

7. Install and tighten camshaft timing gear retaining screws to specified torque.



1. *Camshaft timing gear*
2. *Timing gear retaining screws*

CAMSHAFT TIMING GEAR RETAINING SCREWS	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening torque	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

8. Remove the CAMSHAFT TIMING TOOL (P/N 529 036 268).

TIMING CHAIN

Timing Chain Removal

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

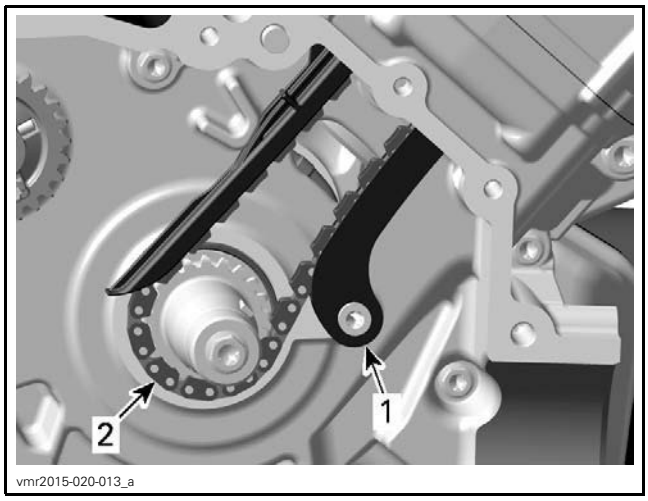
Refer to *MAGNETO AND STARTER SYSTEM* subsection and remove following parts:
– Magneto cover
– Rotor.

Refer to *TOP END* subsection and remove the valve cover.

Refer to *GEARBOX AND 4X4 COUPLING UNIT* subsection and remove the output shaft.

NOTE: Mark the operating direction of the timing chain and check for excessive radial play before removal. Refer to *TIMING CHAIN INSPECTION*.

Refer to following procedures in this subsection and remove following parts:
– Chain tensioner
– Camshaft timing gear.



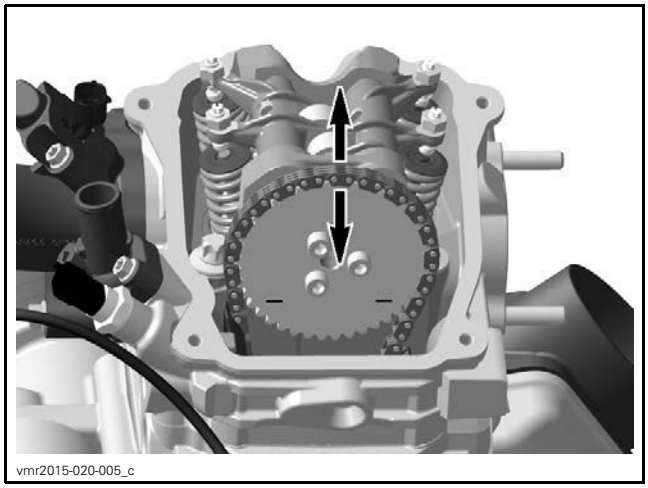
vmr2015-020-013_a

1. Timing chain guide (tensioner side)
2. Timing chain

Carefully pull the timing chain downwards and sideways, then out of the crankcase.

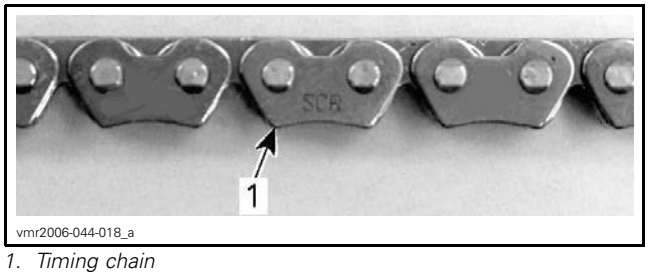
Timing Chain Inspection

Check timing chain on camshaft timing gear for excessive radial play.


vmr2015-020-005_c

CHECKING TIMING CHAIN RADIAL PLAY

Check chain condition for wear and teeth condition.



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1. Timing chain

If chain is excessively worn or damaged, replace it as a set (camshaft timing gear and timing chain).

Check timing chain guides for wear, cracks or deforming. Replace as required.

NOTE: Check also the timing chain guide (tensioner side).

Timing Chain Installation

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

Install timing chain with camshaft timing gear.

NOTE: Ensure to carry out proper valve timing, refer to *CAMSHAFT TIMING GEAR* in this subsection.

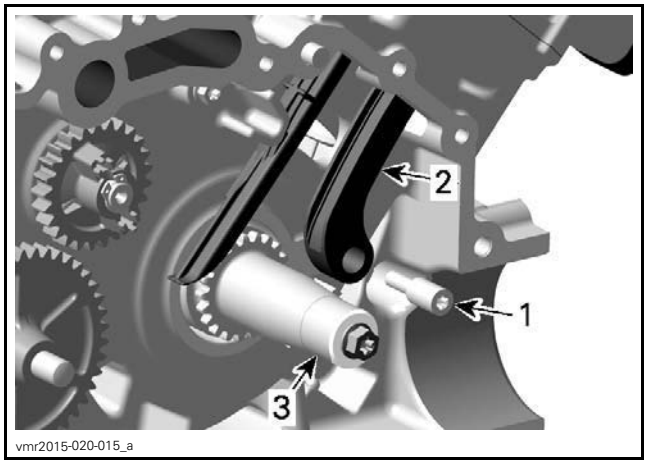
NOTICE **Improper valve timing will damage engine components.**

TIMING CHAIN GUIDE (TENSIONER SIDE)

Timing Chain Guide Removal (Tensioner Side)

Refer to procedures in this subsection and remove:
– Camshaft timing gear
– Timing chain.

Remove:
– Bearing screw
– Timing chain guide (tensioner side).



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1. Bearing screw
2. Timing chain guide (tensioner side)
3. Crankshaft MAG side

Timing Chain Guide Inspection (Tensioner Side)

Check timing chain guide for wear, cracks or deforming. Replace if necessary.

Timing Chain Guide Installation (Tensioner Side)

The installation is the reverse of the removal procedure.

TIMING CHAIN GUIDE BEARING SCREW	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening torque	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

BOTTOM END

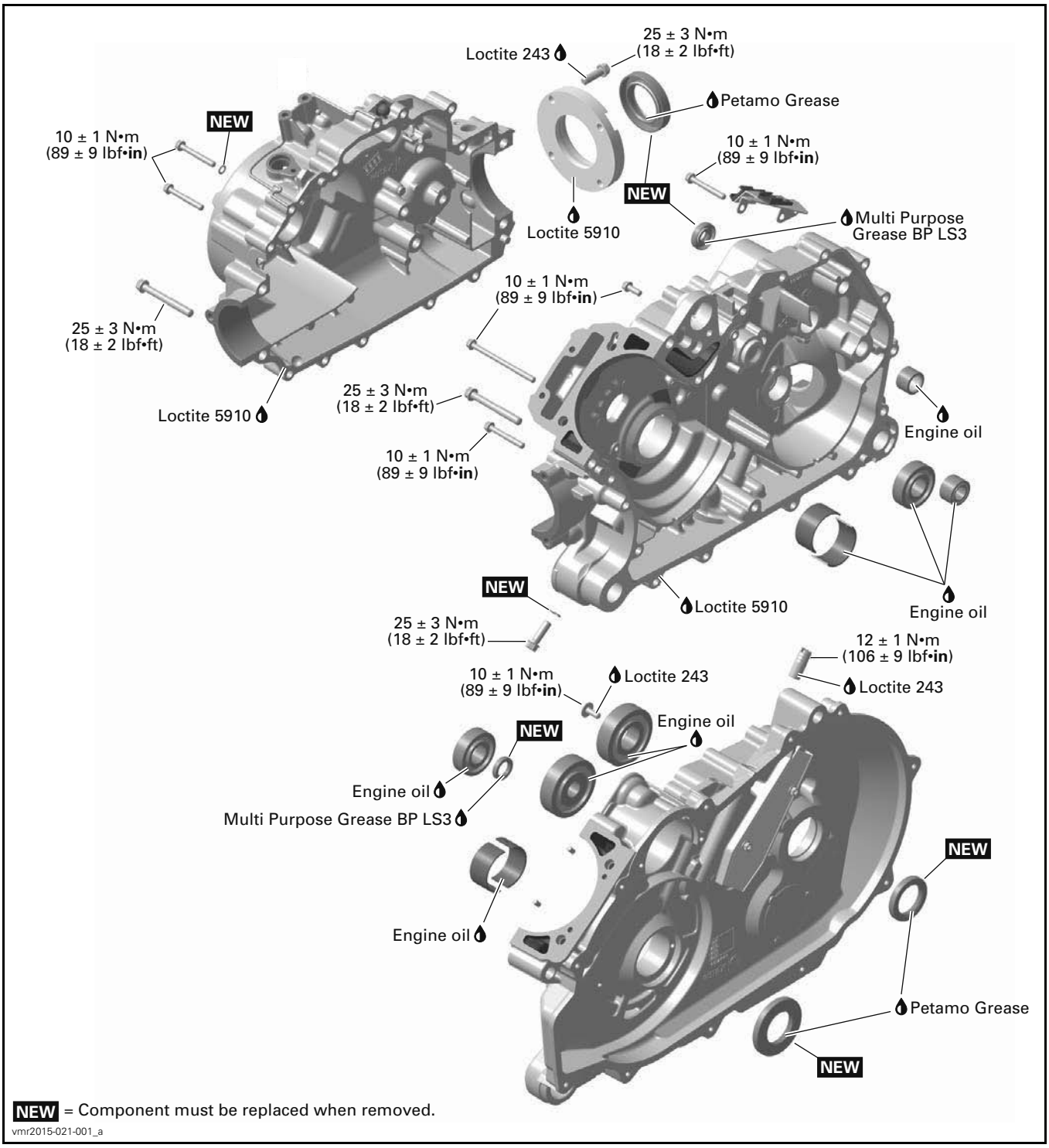
SERVICE TOOLS

Description	Part Number	Page
BEARING INSTALLER (GEARBOX)	529 035 762	172
BEARING INSTALLER (GEARBOX)	529 035 763	171
BLIND HOLE BEARING PULLER SET	529 036 117	172
CRANKCASE SUPPORT (MAG SIDE)	529 035 916	169–170
CRANKCASE SUPPORT PTO	529 035 754	169–170
CRANKSHAFT LOCKING BOLT	529 035 617	176, 180
DIAL INDICATOR ADAPTER	529 036 159	175
HANDLE	420 877 650	162, 169, 171–172
OIL SEAL INSTALLER	529 036 069	169
OUTPUT SHAFT SEAL INSTALLER	529 035 941	162
PLAIN BEARING REMOVER/INSTALLER	529 035 917	169–170
TDC DIAL INDICATOR	414 104 700	175

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 5910	293 800 081	173
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	167

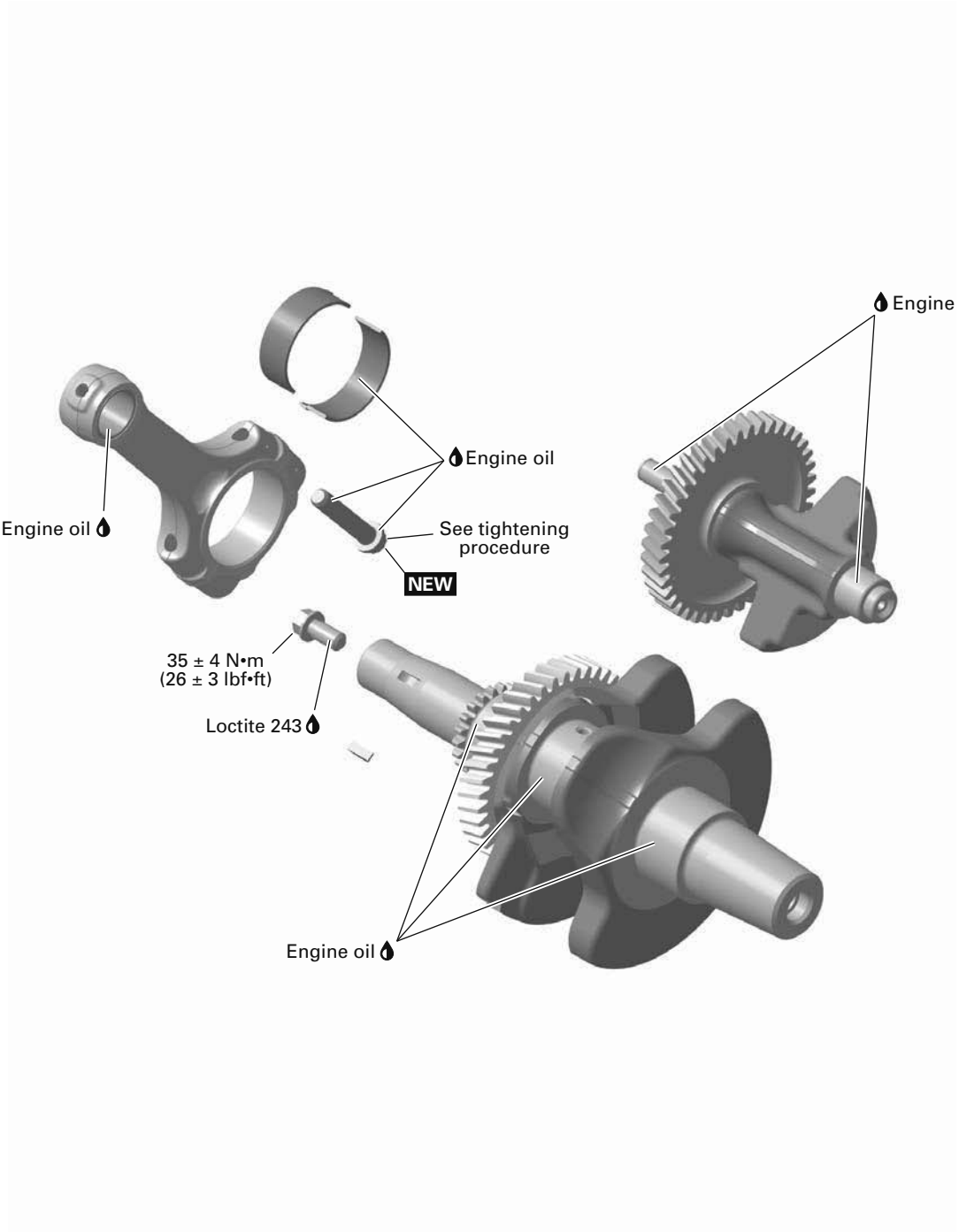
CRANKCASE



NEW = Component must be replaced when removed.

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CRANKSHAFT/BALANCER SHAFT



NEW = Component must be replaced when removed.

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GENERAL

This section includes the procedures pertaining to the crankcase, crankshaft and balancer shaft. For the gearbox, follow the procedure for the *CRANKCASE* then refer to *GEARBOX AND 4X4 COUPLING UNIT* subsection.

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

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

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices when removed (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PROCEDURES

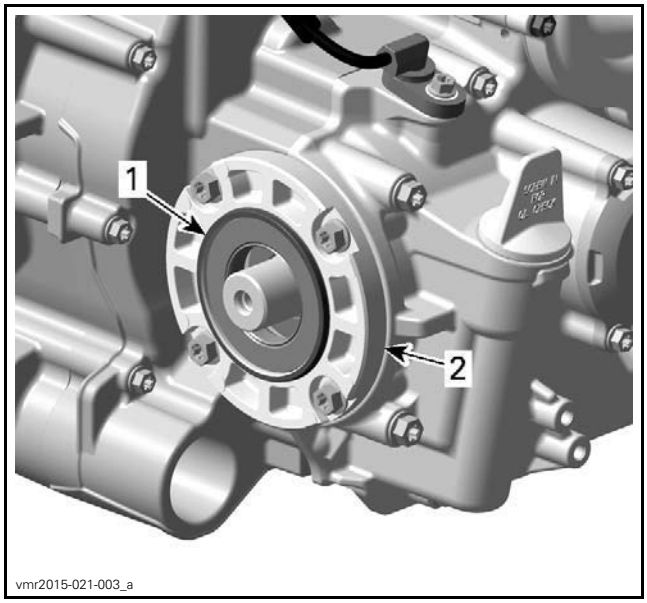
IMPORTANT: Note position of parts on disassembly. This may help to find the root cause of a problem. A component that is not replaced should be reinstalled in the same position as originally mounted.

OUTPUT SHAFT OIL SEAL

Output Shaft Oil Seal Removal

Replace oil seal if brittle, hard or otherwise damaged.

NOTE: The output shaft oil seal can be removed and installed without removing the engine from vehicle.



1. Output shaft oil seal
2. Bearing flange

Drain engine oil, refer to *ENGINE OIL CHANGE* in the *PERIODIC MAINTENANCE PROCEDURES* subsection.

Disconnect the rear propeller shaft from output shaft, refer to *REAR DRIVE* subsection.

Using a small screwdriver, remove the output shaft oil seal from bearing flange.

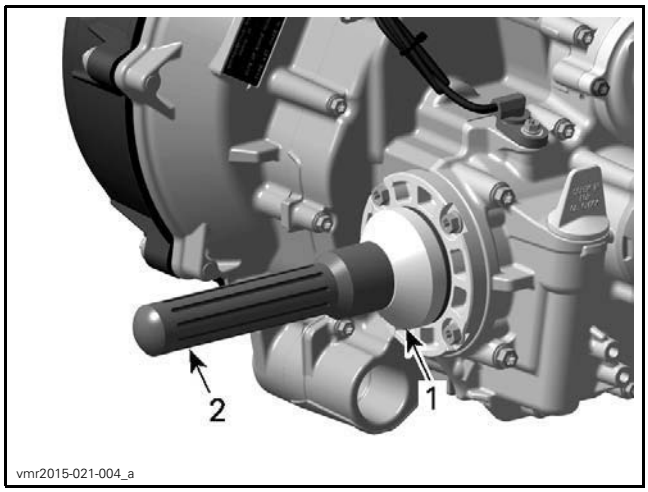
NOTICE **Avoid scratching the bearing flange or output shaft during oil seal removal.**

Check oil seal seating surface for grooves. Replace bearing flange if necessary.

Check bearing behind oil seal for contamination and/or metal shavings. Replace if necessary.

Output Shaft Oil Seal Installation

REQUIRED TOOL	
OUTPUT SHAFT SEAL INSTALLER (P/N 529 035 941)	
HANDLE (P/N 420 877 650)	



1. Outputshaftseal installer
2. Handle

Install all remaining removed parts. Refer to applicable subsections.

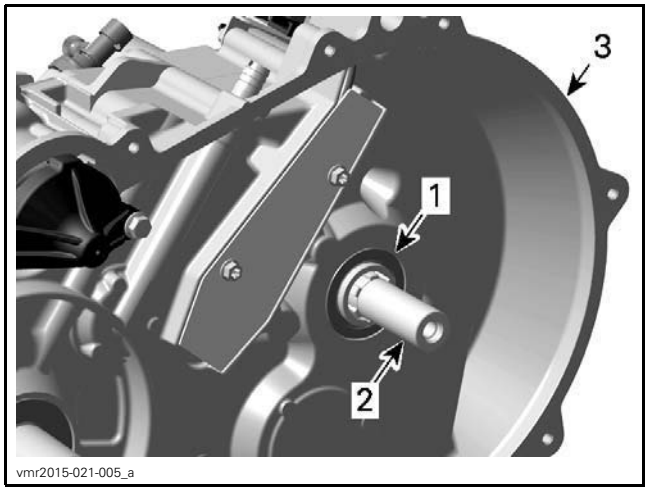
COUNTER SHAFT OIL SEAL

Counter Shaft Oil Seal Removal

Replace oil seal if brittle, hard or otherwise damaged.

NOTE: The counter shaft oil seal can be removed without removing the engine from vehicle.

Remove the driven pulley. Refer to *CONTINUOUSLY VARIABLE TRANSMISSION* subsection.



1. Counter shaft oil seal
2. Counter shaft
3. Crankcase, PTO side

Using a small screwdriver, remove the counter shaft oil seal.

NOTICE **Avoid scratching the crankcase or counter shaft during oil seal removal.**

Counter Shaft Oil Seal Installation

Using a suitable tube with the proper diameter to install the oil seal.

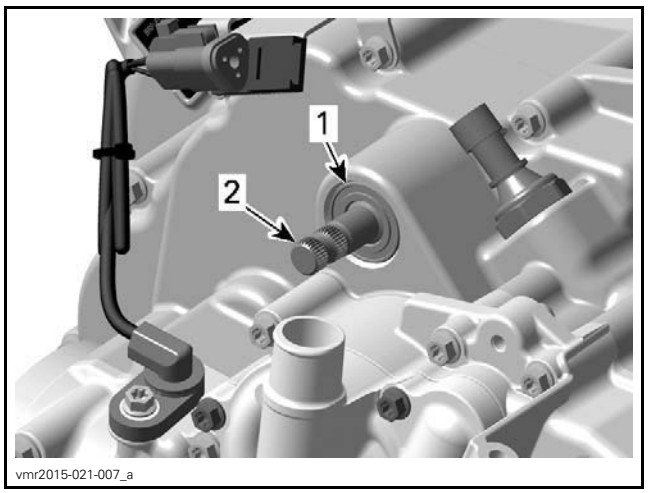
Install all removed parts.

SHIFT SHAFT OIL SEAL

Shift Shaft Oil Seal Removal

Replace oil seal if brittle, hard or otherwise damaged.

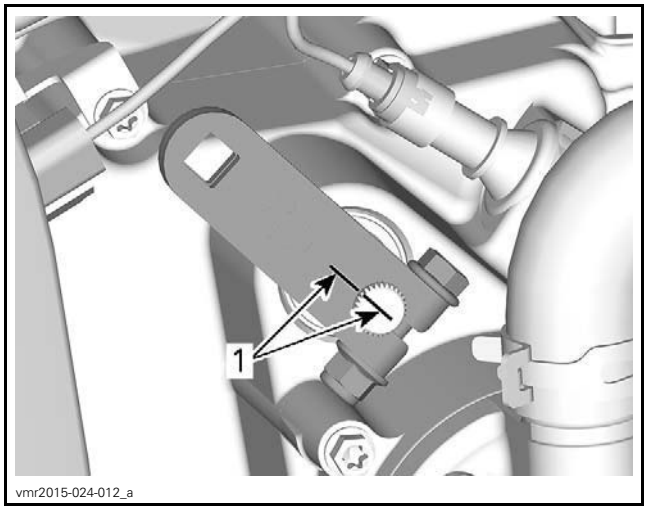
NOTE: The shift shaft oil seal can be removed without removing the engine from vehicle.



1. Shift shaft oil seal
2. Shift shaft

Scribe a mark on the end of shift shaft and on shifting plate.

Unscrew shifting plate bolt then remove shifting plate.



1. Index mark

Using a small screwdriver, remove the shift shaft oil seal.

NOTICE Avoid scratching the crankcase or shift shaft during oil seal removal.

Shift Shaft Oil Seal Installation

Using a suitable tube, with the proper diameter, install the seal.

Align the previously scribed marks and install the shift plate.

Tighten shift plate screw to specification.

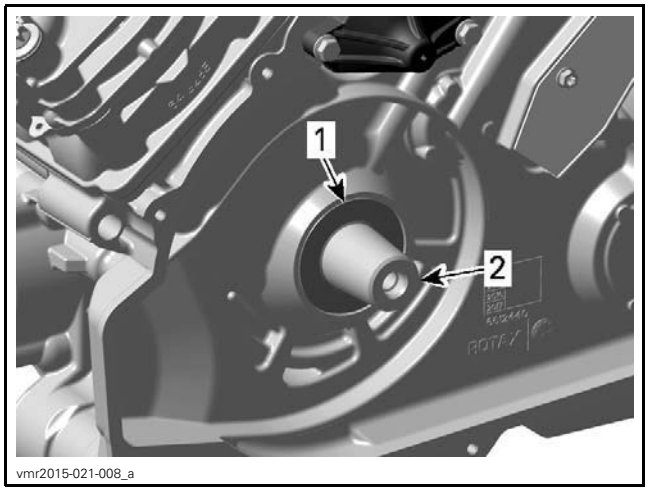
SHIFT PLATE	
Tightening torque	9 N•m ± 1 N•m (80 lbf•**in** ± 9 lbf•**in**)

CRANKSHAFT OIL SEAL

Crankshaft Oil Seal Removal

Replace oil seal if brittle, hard or otherwise damaged.

NOTE: The crankshaft oil seal can be removed without removing the engine from vehicle.



1. Crankshaft oil seal
2. Crankshaft, PTO side

Remove the drive pulley. Refer to *CONTINUOUSLY VARIABLE TRANSMISSION* subsection.

Using a small screwdriver, remove the crankshaft oil seal.

NOTICE Avoid scratching the crankcase or crankshaft during oil seal removal.

Crankshaft Oil Seal Installation

Using a suitable tube with the proper diameter to install the seal.

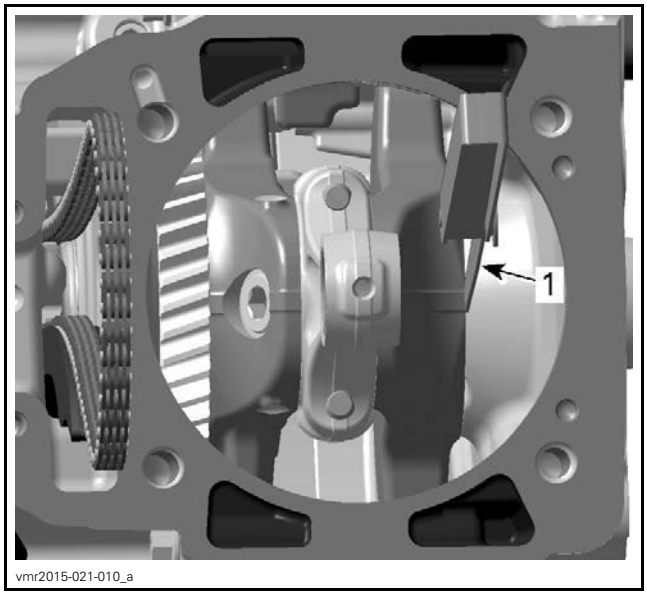
CRANKCASE

Crankcase Disassembly

NOTE: Oil pump removal from crankcase MAG side is not necessary, but recommended to see condition of oil pump, refer to *LUBRICATION SYSTEM* subsection.

Remove:
- Engine from vehicle, refer to *ENGINE REMOVAL AND INSTALLATION* subsection
- Magneto cover and rotor, refer to *MAGNETO AND STARTER* subsection
- Output shaft, refer to *GEARBOX AND 4X4 UNIT* subsection
- Cylinder head and cylinder, refer to *TOP END* subsection
- Drive and driven pulley, refer to *CONTINUOUSLY VARIABLE TRANSMISSION* subsection
- Oil pressure switch, refer to *LUBRICATION SYSTEM* subsection.

Measure axial clearance between the crankshaft and crankcase PTO with a feeler gauge.



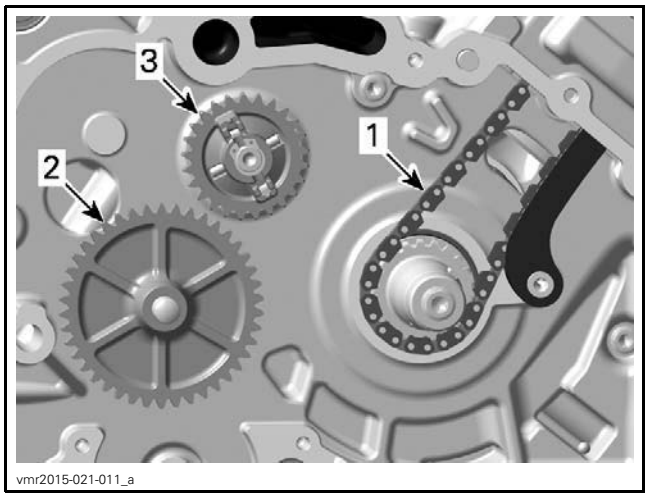
1. Feeler gauge

CRANKSHAFT AXIAL CLEARANCE	
NEW	0.1 mm to 0.4 mm (.004 in to .016 in)
SERVICE LIMIT	0.5 mm (.02 in)

If measurement is out of specification, inspect butting faces of crankshaft and crankcase (MAG/PTO side) for excessive wear.

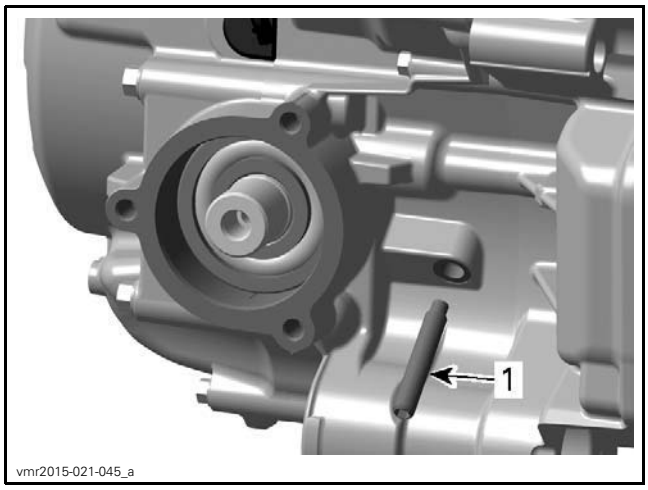
Remove:
- Timing chain

– Intermediate gear of oil pump
– Drive gear of water pump.



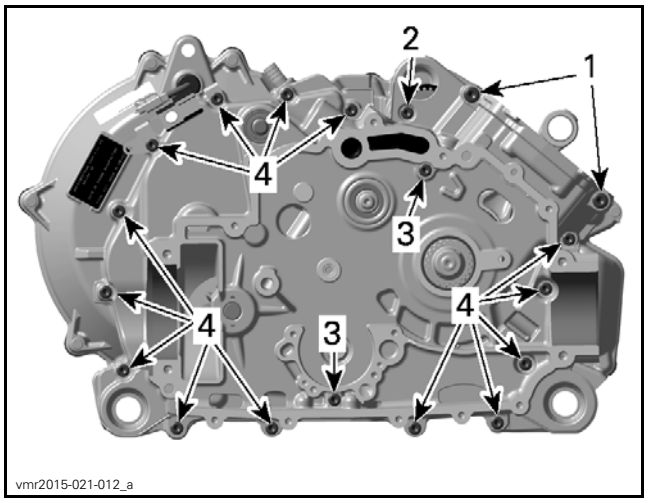
1. Timing chain
2. Intermediate gear, oil pump
3. Drive gear, water pump

Remove crankshaft locking bolt.



1. Crankshaft locking bolt

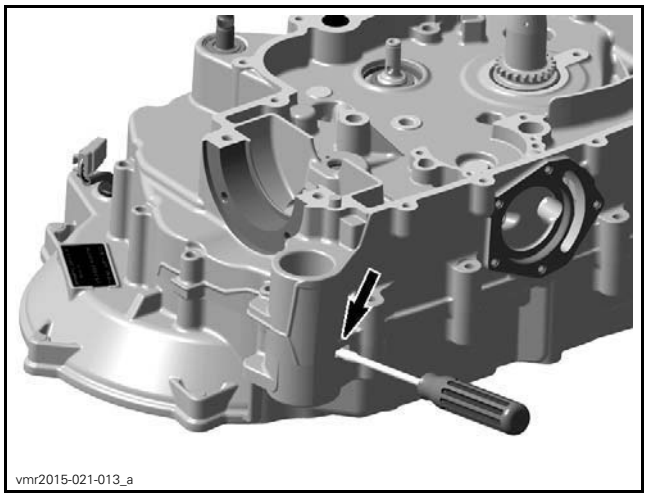
Remove crankcase retaining screws:
1. Start removing the M6 screws
2. Then remove the M8 screws.



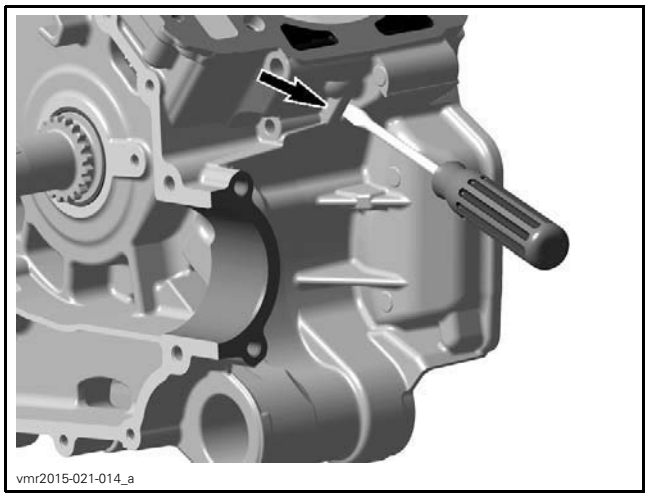
1. 2x screws M8 x 85
2. 1x screw M6 x 16
3. 2x screws M6 x 85
4. 14x screws M6 x 45

Place the crankcase on a wood stand, MAG side upwards.

Split crankcase with 2 screwdrivers.



POSITION FOR BIG FLAT SCREWDRIVER

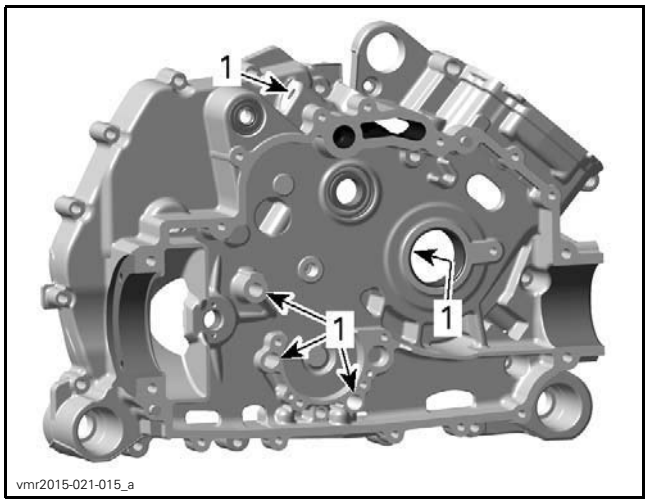


POSITION FOR BIG FLAT SCREWDRIVER

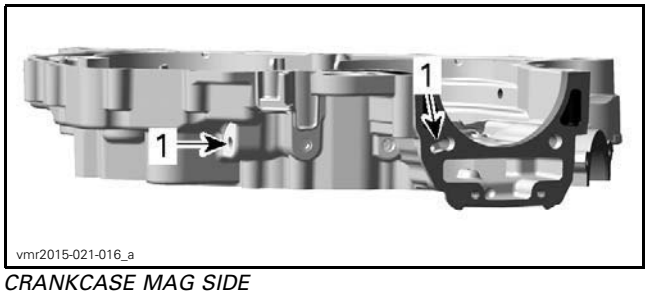
Crankcase Cleaning

Clean all metal components in a solvent.

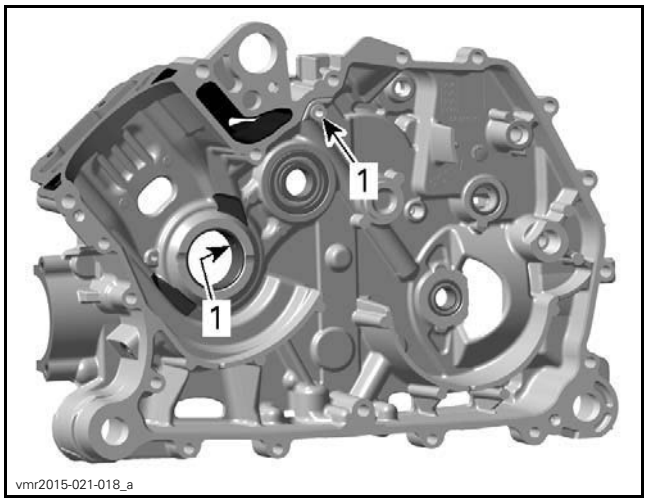
Clean oil passages and make sure they are not clogged.



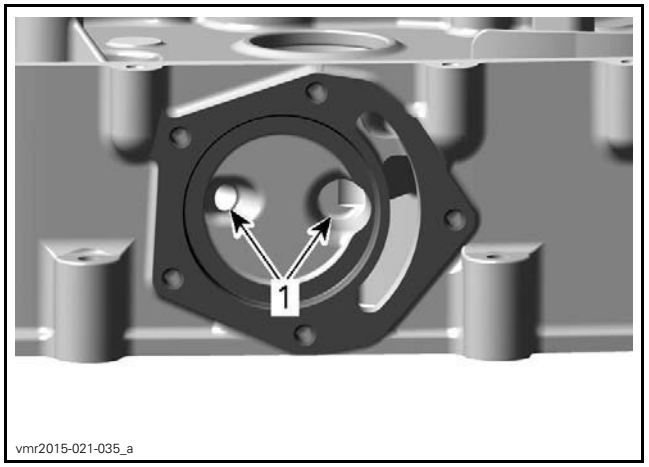
CRANKCASE MAG SIDE
1. Oil orifices



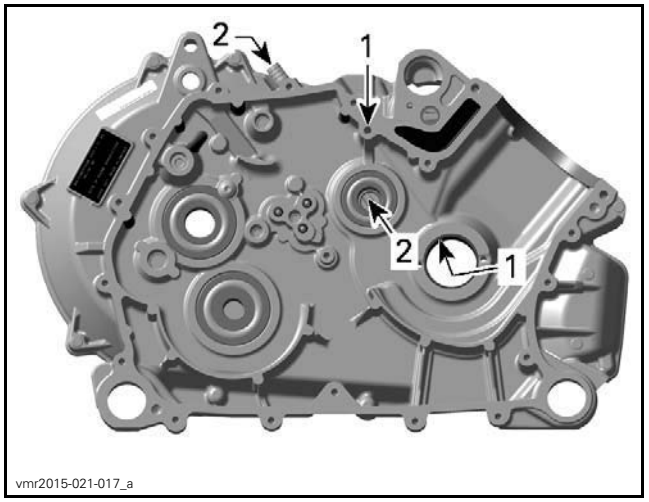
CRANKCASE MAG SIDE
1. Oil orifices



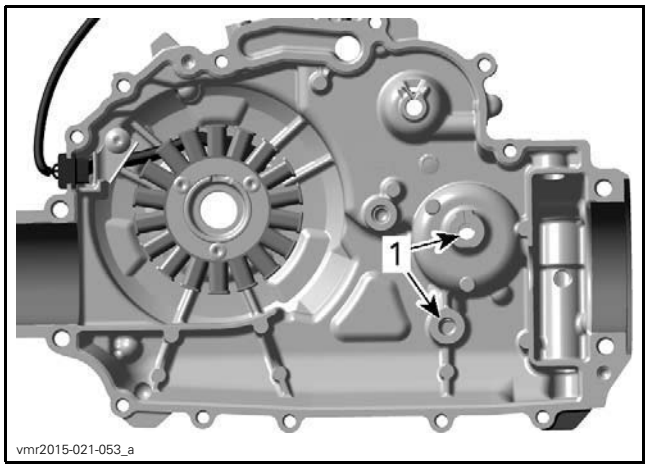
CRANKCASE MAG SIDE
1. Oil orifices



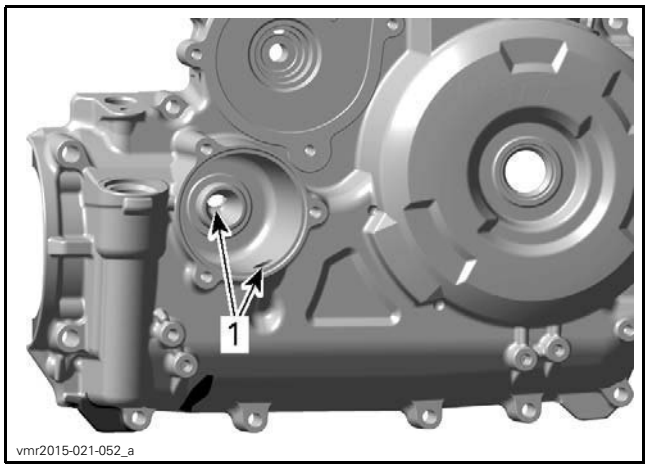
CRANKCASE MAG SIDE
1. Oil orifices



CRANKCASE PTO SIDE
1. Oil orifices
2. Engine blow by bore



MAGNETO COVER
1. Oil orifices



MAGNETO COVER
1. Oil orifices

Clean crankcase mating surfaces using a combination of LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500) and a brass brush. First brush in one direction then make the final brushing perpendicularly (90°) to the first pass.

NOTICE **Do not wipe with rags. Use a new clean hand towel only.**

Crankcase Inspection

NOTE: To check some parts, it is recommended to remove all components from crankcase.

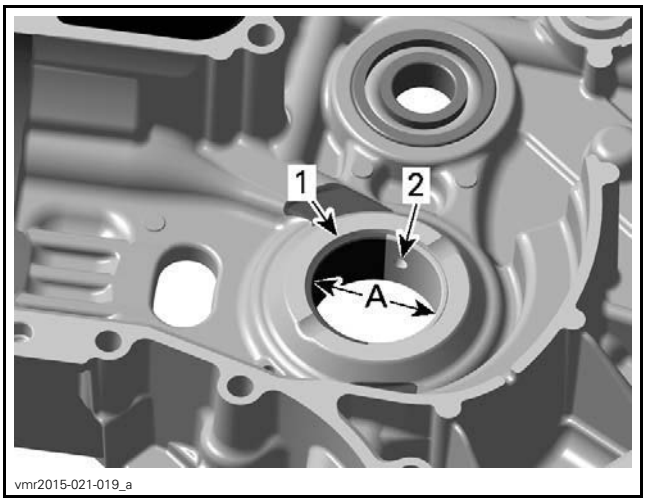
Crankshaft Plain Bearing

Check MAG and PTO plain bearings for scoring or other damages.

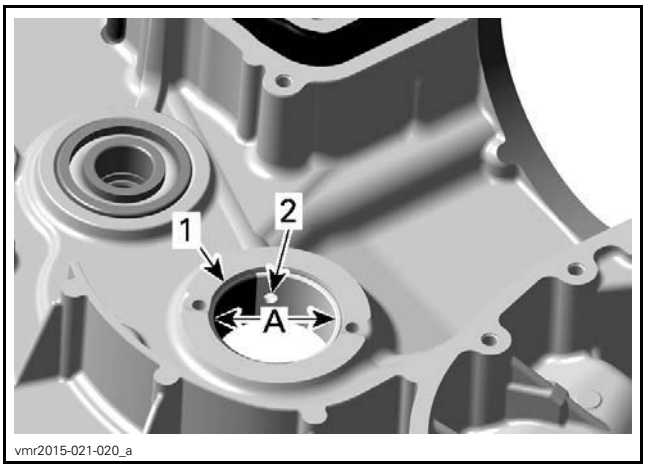
Measure plain bearing inside diameter.

Compare measurements to MAG/PTO main journal diameters of crankshaft, refer to *CRANKSHAFT* in this subsection.

Replace if the measurement is out of specification.



MAG PLAIN BEARING
1. Plain bearing
2. Oil bore
A. Plain bearing inside diameter

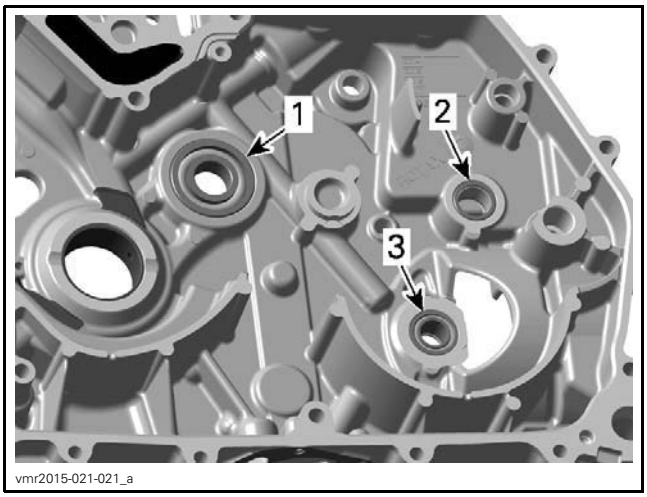


PTO PLAIN BEARING
1. Plain bearing
2. Oil bore
A. Plain bearing inside diameter

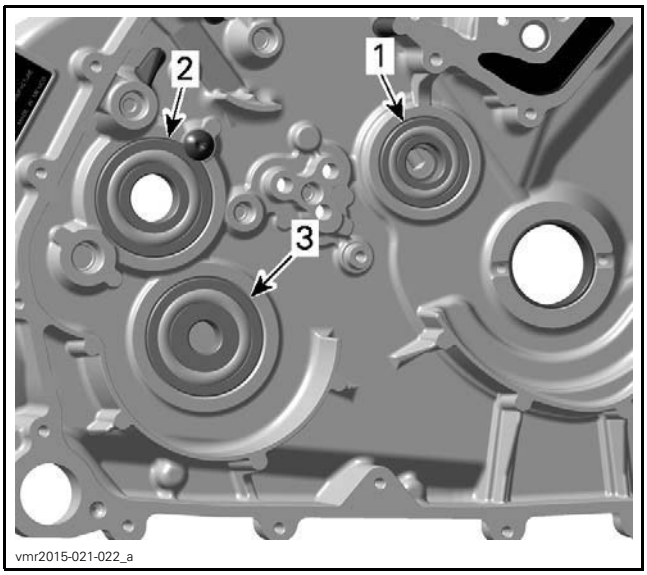
PLAIN BEARING INSIDE DIAMETER (MAG/PTO)	
SERVICE LIMIT	42.100 mm (1.6575 in)

Ball and Needle Bearings

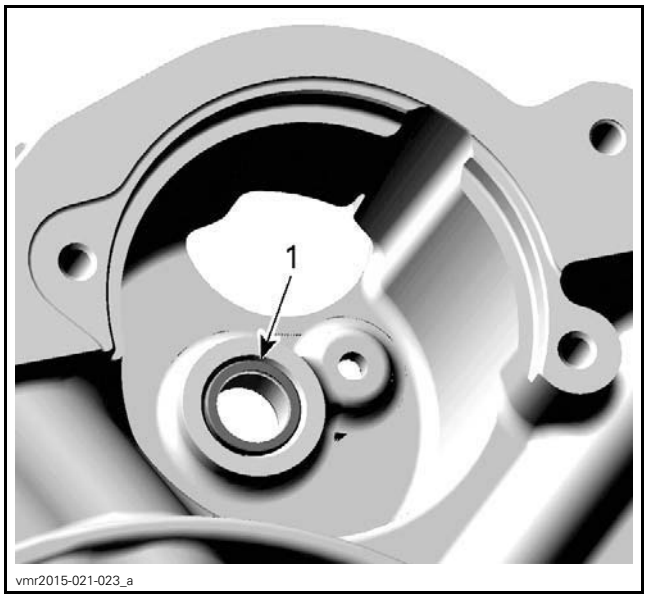
Check ball bearings and needle bearings for excessive play and smooth operation. Replace if necessary.



CRANKCASE MAG
1. *Balancer shaft ball bearing*
2. *Counter shaft needle bearing*
3. *Bevel gear needle bearing*



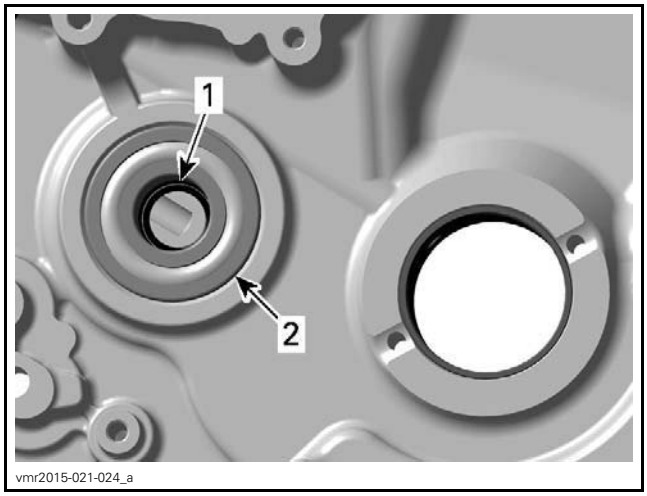
CRANKCASE PTO
1. *Balancer shaft ball bearing*
2. *Counter shaft ball bearing*
3. *Bevel gear ball bearing*



CRANKCASE PTO
1. *Starter drive needle bearing*

Balancer Shaft Oil Seal

Replace oil seal if brittle, hard or otherwise damaged.



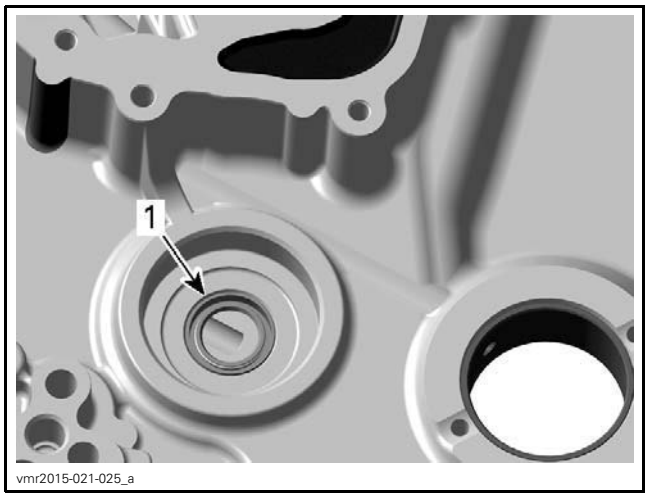
CRANKCASE PTO
1. *Balancer shaft oil seal*
2. *Balancer shaft ball bearing*

Balancer Shaft Oil Seal Replacement Procedure

Balancer Shaft Oil Seal Removal

Remove balancer shaft ball bearing, refer to *BEARING REPLACEMENT PROCEDURE* in this subsection.

The oil seal is removed easily with a flat screwdriver.



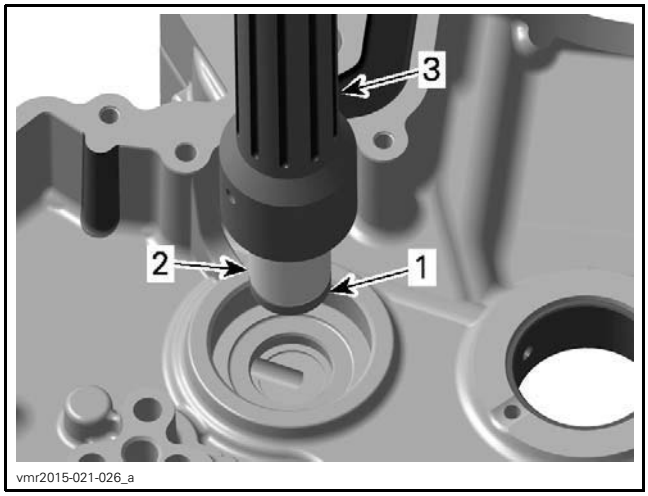
CRANKCASE PTO
1. Balancer shaft oil seal

NOTICE Avoid scoring bearing seat or oil seal bore in crankcase.

Balancer Shaft Oil Seal Installation

NOTICE Oil seal must be installed with sealing lip towards balancer shaft.

REQUIRED TOOL	
OIL SEAL INSTALLER (P/N 529 036 069)	
HANDLE (P/N 420 877 650)	



CRANKCASE, PTO SIDE
1. Balancer shaft oil seal
2. Oil seal installer
3. Handle

Bearing Replacement Procedure

NOTICE Clean oil, outside and inside, from crankcase.

NOTICE Always support crankcase properly when ball bearings, needle bearings or plain bearings are removed or installed; otherwise, crankcase could be damaged.

Unless otherwise instructed, never use hammer to install ball bearings, needle bearings or plain bearings. Use press machine only.

NOTICE Ball bearings have to be installed with closed bearing cage to the engine outside.

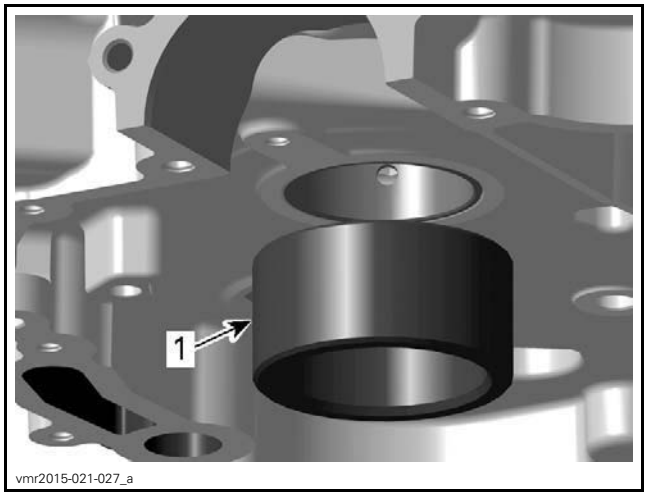
Crankshaft Plain Bearing Removal

NOTE: Always use a press for removal or installation of plain bearing halves.

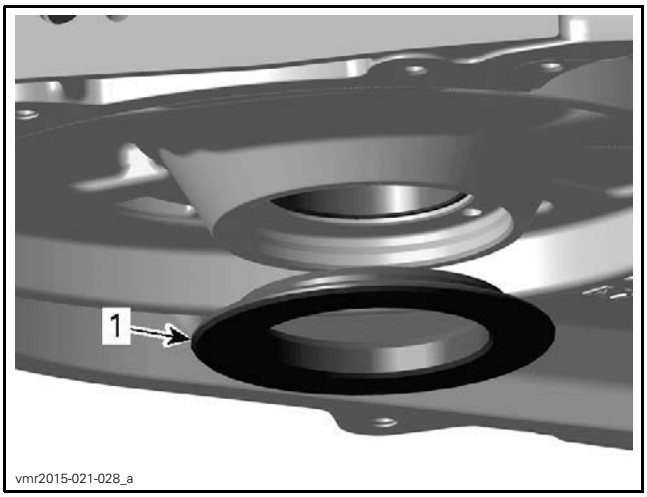
Carefully press the plain bearings out from the crankcase half from inside towards the outside.

NOTE: Use proper crankcase support when removing plain bearings.

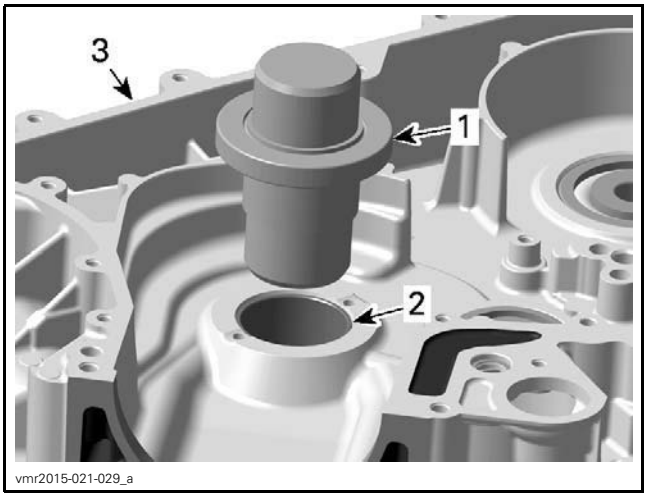
REQUIRED TOOL	
PLAIN BEARING REMOVER/INSTALLER (P/N 529 035 917)	
CRANKCASE SUPPORT (MAG SIDE) (P/N 529 035 916)	
CRANKCASE SUPPORT PTO (P/N 529 035 754)	



CRANKCASE MAG SIDE
1. Crankcase support MAG



CRANKCASE PTO SIDE
1. Crankcase support PTO



PRESS PLAIN BEARINGS OUTSIDE
1. Plain bearing remover/installer
2. Plain bearing
3. Crankcase (PTO side shown)

Crankshaft Plain Bearing Installation

NOTICE **Unless otherwise instructed, never use hammer to install plain bearings. Use press only.**

NOTE: Use proper crankcase support when installing plain bearings. Damage to crankcase may occur if this procedure is not performed correctly.

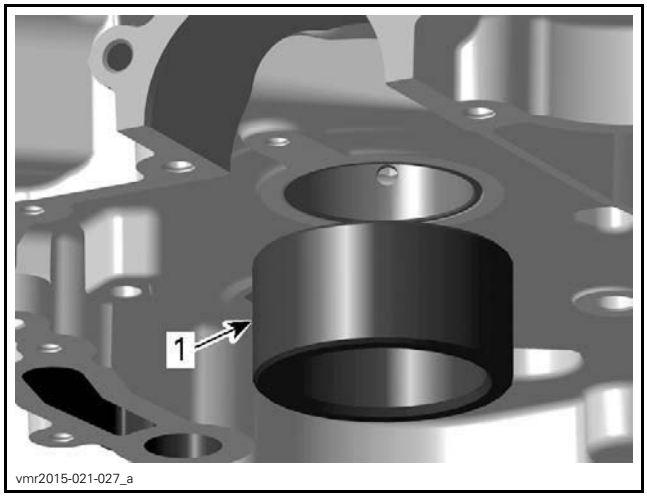
Carefully press in the plain bearings in the same direction as during disassembly, from the crankcase inside towards the outside.

Install plain bearings in a cold crankcase.

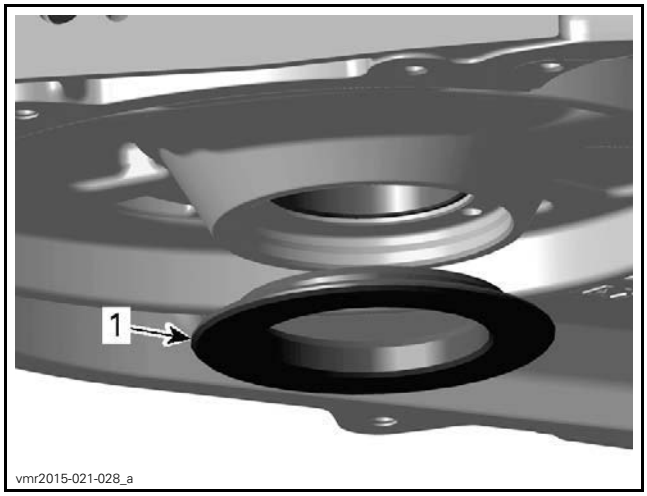
NOTE: Do not lubricate plain bearings and/or crankcase for installation.

REQUIRED TOOL	
PLAIN BEARING REMOVER/INSTALLER (P/N 529 035 917)	
CRANKCASE SUPPORT (MAG SIDE) (P/N 529 035 916)	
CRANKCASE SUPPORT PTO (P/N 529 035 754)	

Use an O-ring (Ø 42 mm (1.65 in) x 1 mm to 1.5 mm (.04 in to .06 in) thickness) to hold plain bearings in place during installation. The O-ring will disappear in the groove of the plain bearing remover/installer.



CRANKCASE MAG SIDE
1. Crankcase support MAG

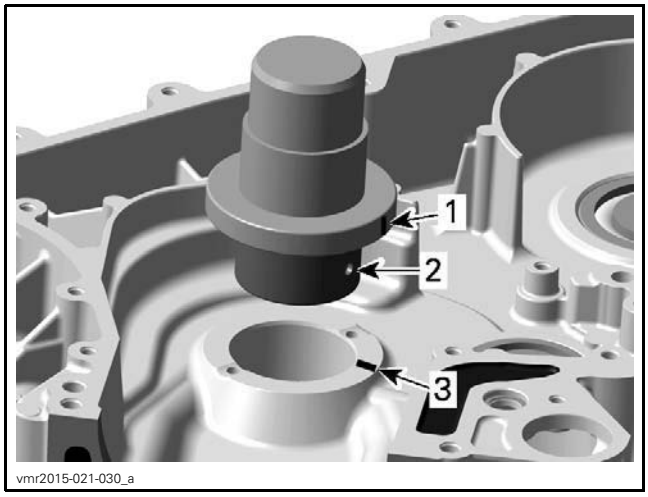


CRANKCASE PTO SIDE
1. Crankcase support PTO

Mark position of plain bearing oil bore on plain bearing remover/installer.

Mark position of oil bore on crankcase half.

Align mark on plain bearing remover/installer with mark on crankcase half.

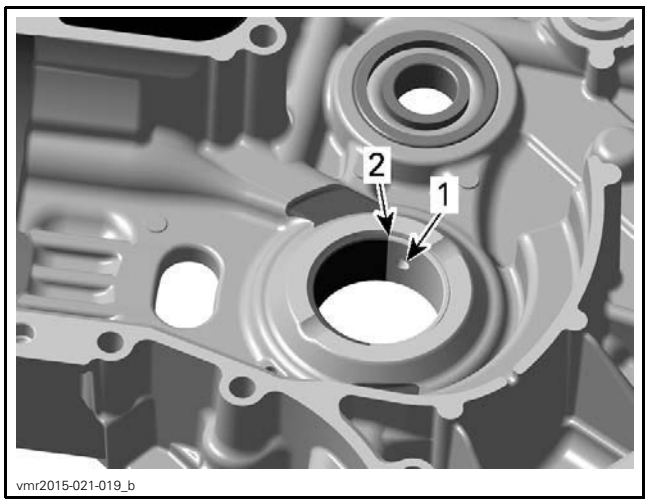


PRESS PLAIN BEARINGS INSIDE
1. *Oil bore position marked on plain bearing remover/installer*
2. *Plain bearing oil bore*
3. *Oil bore position marked on crankcase*

NOTICE Misalignment of the plain bearing and crankcase oil bores will prevent proper oil supply to plain bearings.

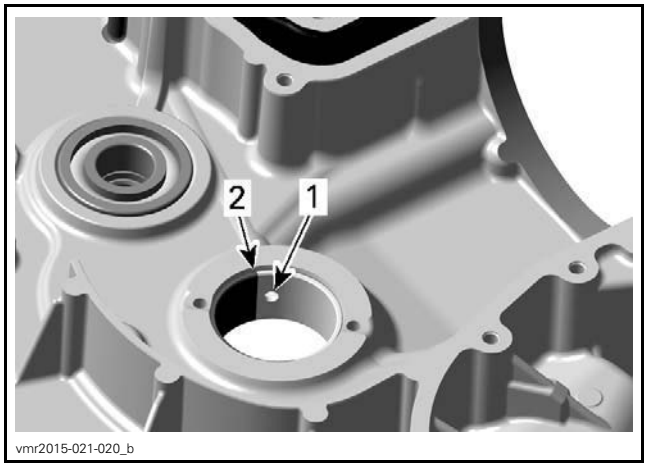
Carefully press in the plain bearings from inside the crankcase towards the outside.

NOTICE The partition of the plain bearings in crankcase half MAG side must be positioned near to oil bore in counterclockwise direction.



CRANKCASE MAG
1. *Oil bore*
2. *Partition*

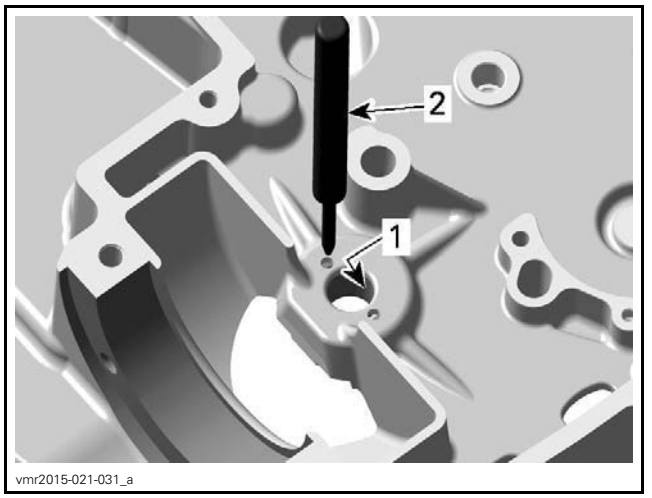
NOTICE The partition of the plain bearings in crankcase half PTO side must be positioned near to oil bore in counterclockwise direction.



CRANKCASE PTO
1. *Oil bore*
2. *Partition*

Bevel Gear Needle Bearing Removal

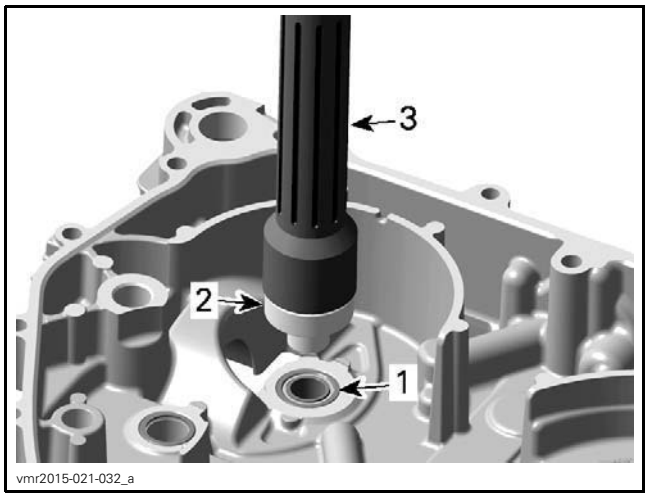
Remove bevel gear needle bearing using a punch.



1. *Bevel gear needle bearing*
2. *Punch*

Bevel Gear Needle Bearing Installation

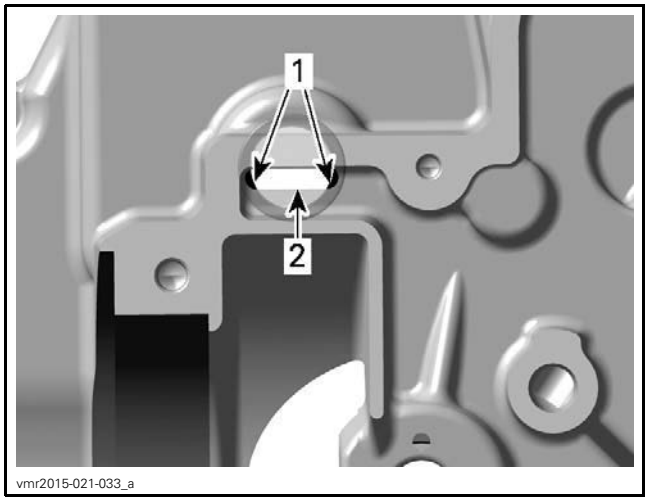
REQUIRED TOOL	
BEARING INSTALLER (GEARBOX) (P/N 529 035 763)	
HANDLE (P/N 420 877 650)	



1. Bevel gear needle bearing
2. Needle bearing installer
3. Handle

Counter Shaft Needle Bearing Removal

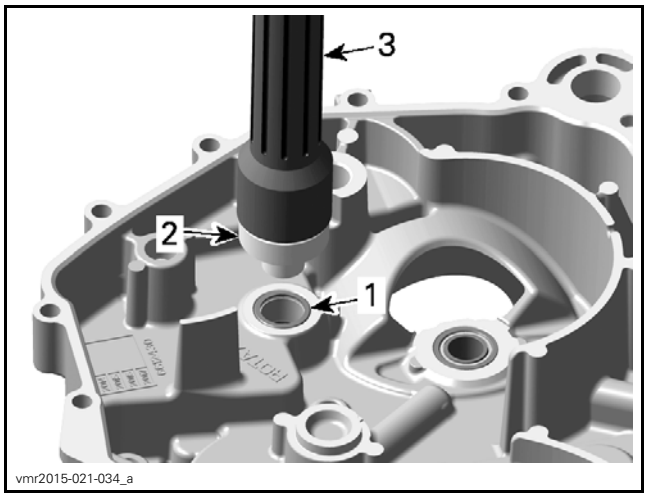
Remove counter shaft needle bearing, using a punch.



1. Counter shaft needle bearing
2. Hole in crankcase MAG side

Counter Shaft Needle Bearing Installation

REQUIRED TOOL	
BEARING INSTALLER (GEARBOX) (P/N 529 035 762)	
HANDLE (P/N 420 877 650)	



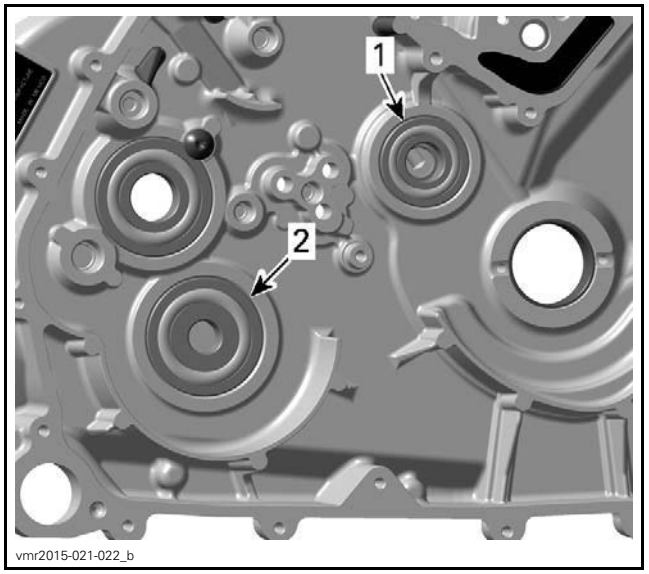
1. Counter shaft needle bearing
2. Needle bearing installer
3. Handle

Starter Drive Needle Bearing Replacement

For starter drive needle bearing replacement refer to *MAGNETO AND STARTER* subsection.

Balancer Shaft (PTO side) and Bevel Gear Ball Bearing Removal

To remove ball bearings use a blind hole bearing puller.



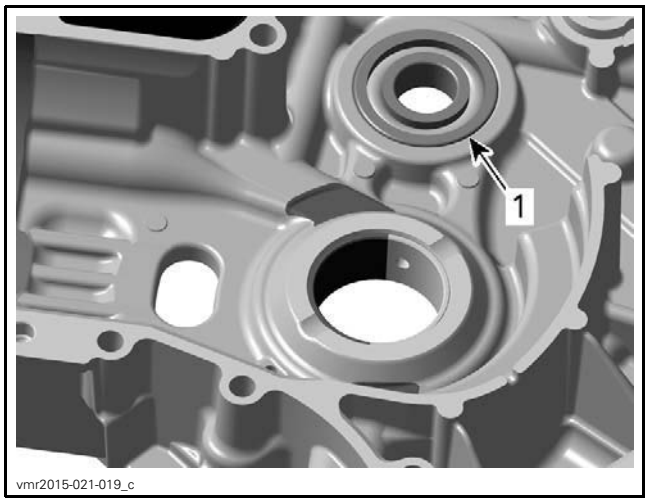
CRANKCASE PTO
1. Balancer shaft ball bearing
2. Bevel gear ball bearing

REQUIRED TOOL	
BLIND HOLE BEARING PULLER SET (P/N 529 036 117)	

Balancer Shaft (PTO side) and Bevel Gear Ball Bearing Installation

Use a suitable installer for installing ball bearings.

Balancer Shaft (MAG side) Ball Bearing Removal



CRANKCASE MAG
1. Balancer shaft ball bearing

Removed ball bearing with a suitable pusher from outside in.

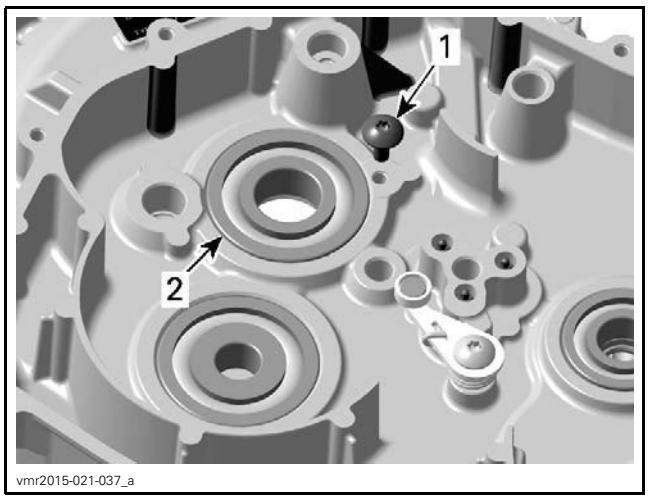
Balancer Shaft (MAG side) Ball Bearing Installation

Use a suitable installer.

Counter Shaft (PTO side) Ball Bearing Removal

Remove screw.

Push ball bearing from outside in with a punch.



1. Screw
2. Counter shaft ball bearing

Counter Shaft (PTO side) Ball Bearing Installation

Use a suitable installer.

NOTE: Install ball bearing with closed bearing cage towards outside of engine.

Crankcase Assembly

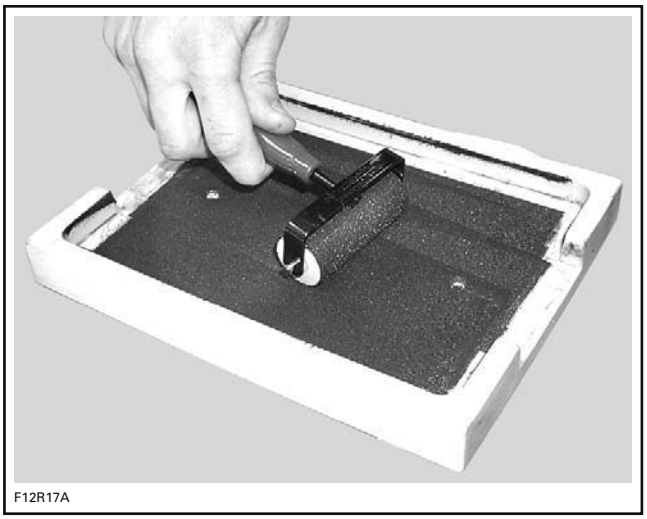
The assembly is the reverse of the disassembly procedure. However, pay attention to the following.

Use LOCTITE 5910 (P/N 293 800 081) on mating surfaces.

IMPORTANT: When beginning the application of the crankcase sealant, the assembly and the first torquing should be done within 10 minutes. It is suggested to have all you need on hand to save time.

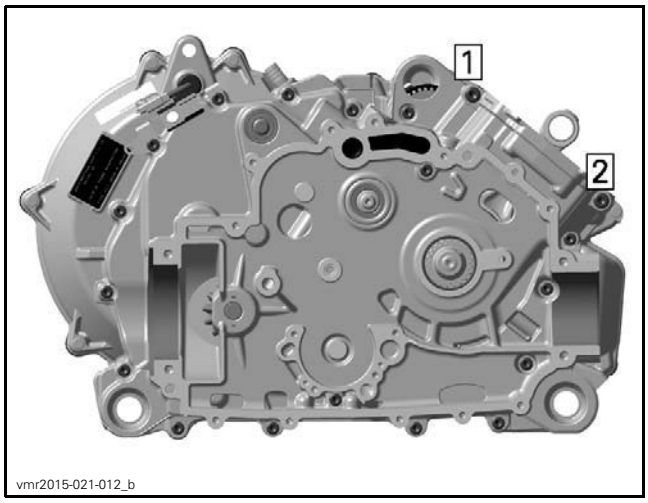
Use a polycarbonate plate and apply some sealant on it. Use a soft rubber roller 50 mm to 75 mm (2 in to 3 in) available in arts products suppliers for printing and roll the sealant to get a thin uniform coat on the plate (spread as necessary). When ready, apply the sealant on crankcase mating surfaces.

NOTE: It is recommended to apply this specific sealant as described here to get a uniform application without lumps. If you do not use the roller method, you may use your finger to uniformly distribute the sealant (using a finger will not affect the adhesion). Do not apply in excess as it will spread out inside crankcase.



First tighten crankcase M8 retaining screws as per following sequence:

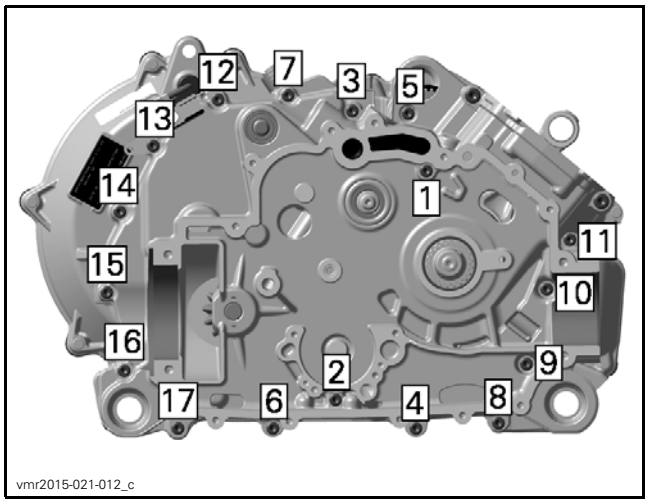
CRANKCASE M8 RETAINING SCREWS	
Tightening torque	25 N•m ± 3 N•m (18 lbf•ft ± 2 lbf•ft)



M8 SCREWS TIGHTENING SEQUENCE

Then tighten crankcase M6 retaining screws as per following sequence.

CRANKCASE M6 RETAINING SCREWS	
Tightening torque	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)



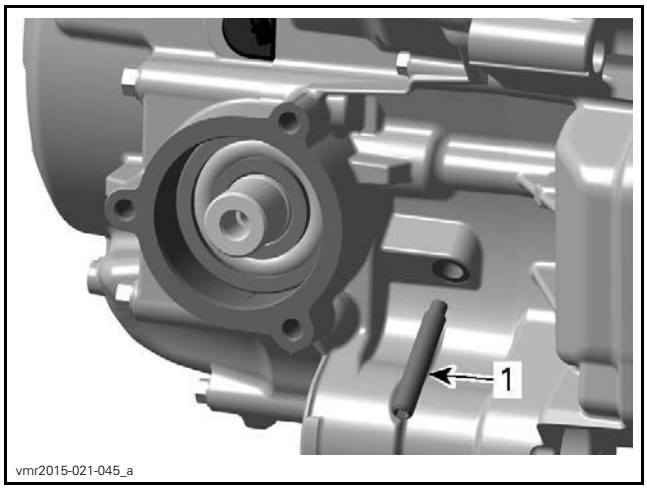
M6 SCREWS TIGHTENING SEQUENCE

BALANCER SHAFT

Balancer Shaft Removal

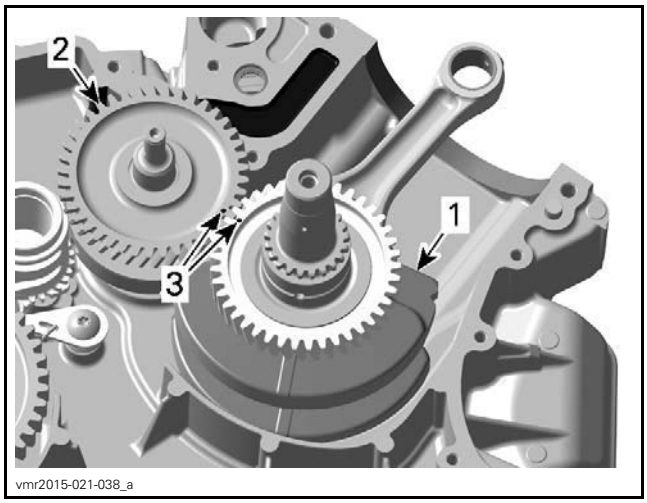
Split crankcase, refer to *CRANKCASE* in this subsection.

Remove the crankshaft locking bolt.



1. Crankshaft locking bolt

Align the dot of crankshaft gear with the balancer shaft gear dot then remove balancer shaft.



1. Crankshaft
2. Balancer shaft
3. Dots on crankshaft gear and balancer shaft gear

Balancer Shaft Inspection

Check balancer shaft and replace if damaged.

Check ball bearings on MAG and PTO side for excessive play and smooth operation. Replace if necessary.

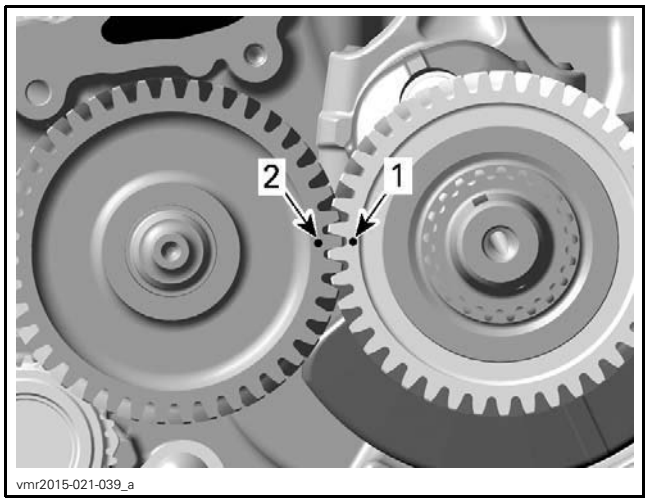
Inspect the balancer shaft gear for chipped, worn or broken teeth. Replace balancer shaft if necessary.

NOTE: If any imperfection is detected, check also the crankshaft gear, refer to *CRANKSHAFT* in this subsection.

Balancer Shaft Installation

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

Align the dot on crankshaft gear with the balancer shaft gear dot.



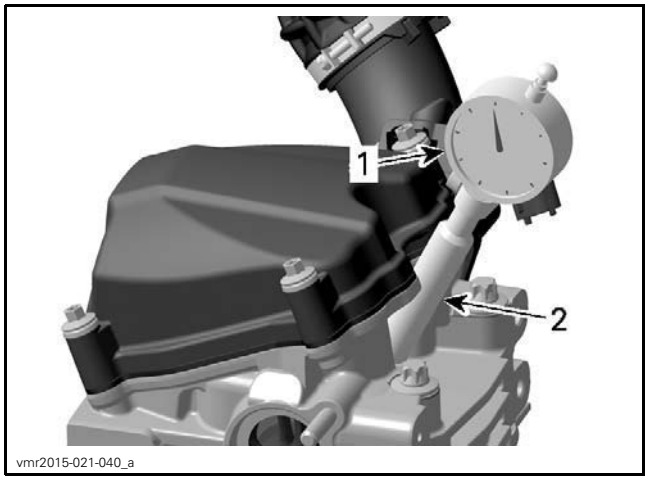
1. Mark on crankshaft gear
2. Mark on balancer shaft gear

CRANKSHAFT

Crankshaft Locking Procedure

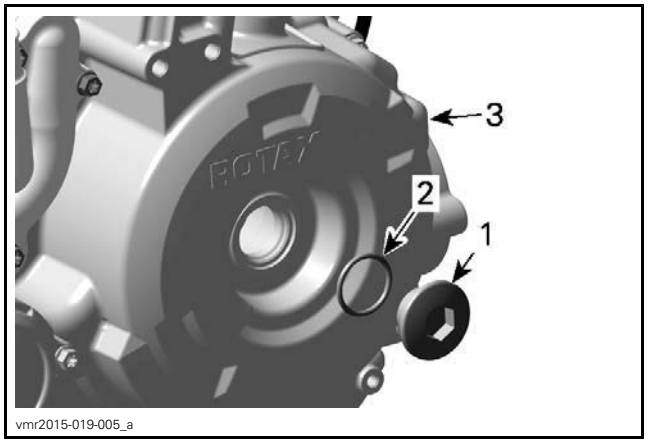
Disconnect spark plug cable and remove the spark plug.

REQUIRED TOOL	
TDC DIAL INDICATOR (P/N 414 104 700)	
DIAL INDICATOR ADAPTER (P/N 529 036 159)	



1. Dial gauge
2. Dial indicator adapter

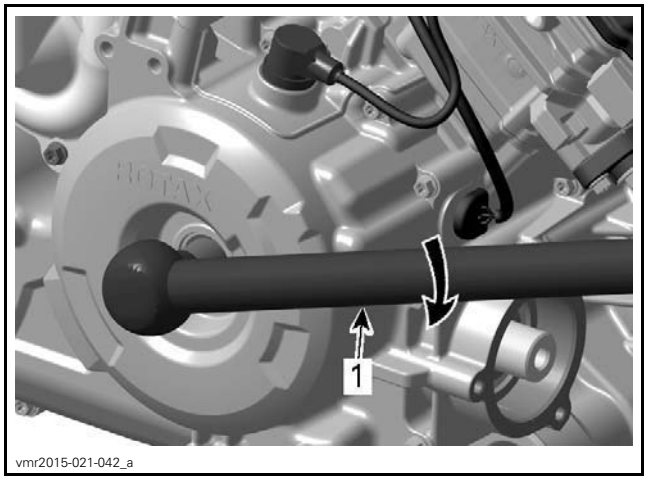
Remove the plug screw and O-ring from magneto cover.



1. Plug screw
2. O-ring
3. Magneto cover

Set piston to TDC ignition by turning the crankshaft.

REQUIRED TOOL
13 mm socket



1. Wrench with 13 mm socket

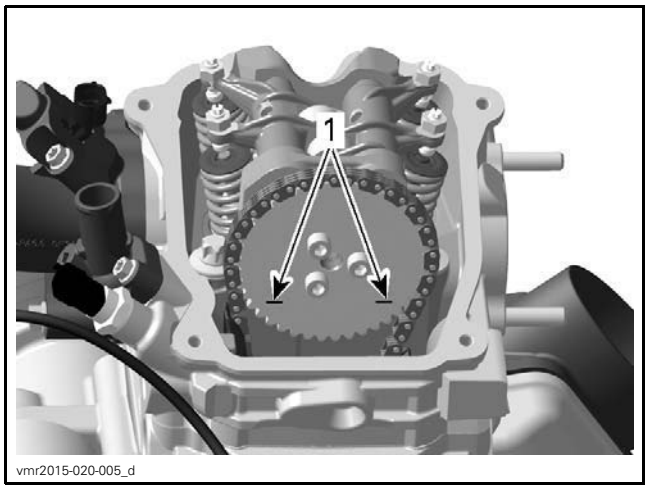
TDC ignition

NOTICE **Never use the mark on the magneto to find the TDC. Only use the crankshaft locking tool to locate the TDC.**

Remove valve cover and verify if the printed marks on the camshaft timing gear are parallel with the cylinder head edge. If so, the engine is at TDC ignition position.

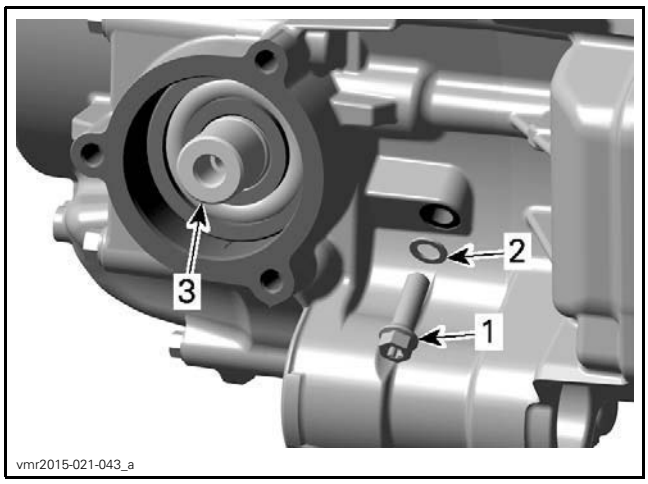
NOTE: If printed marks on camshaft timing gear are not as specified, turn crankshaft 360°.

NOTE: In this position the piston is set to TDC ignition.



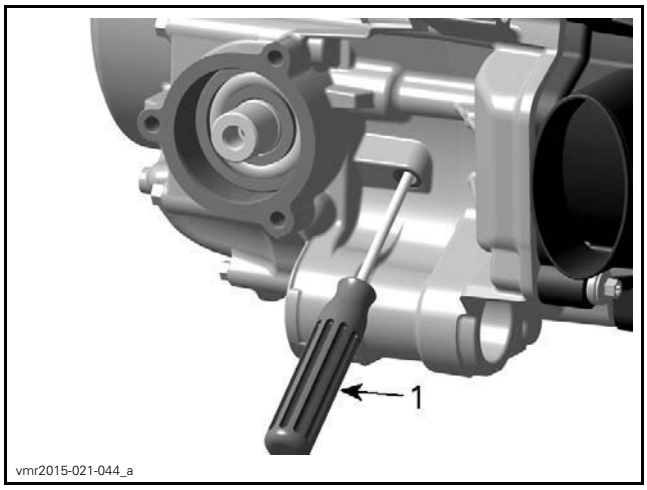
TYPICAL - PISTON AT TDC IGNITION
1. *Printed marks on camshaft timing gear*
2. *Cylinder head base*

Remove:
– Screw
– Sealing ring.



1. *Screw*
2. *Sealing ring*
3. *Output shaft on front side of vehicle*

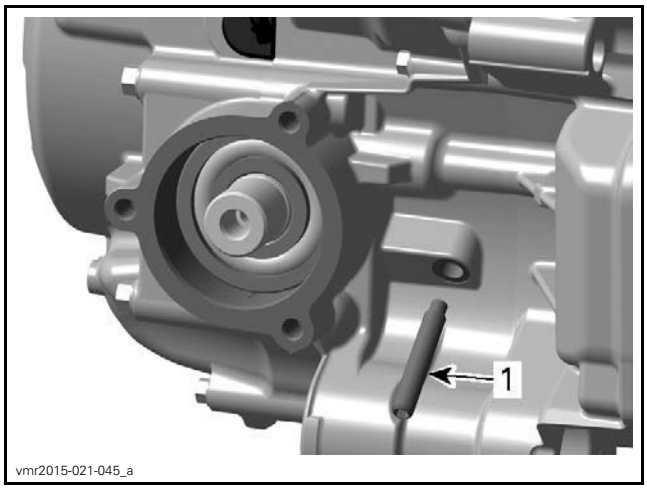
Use a screwdriver to check if groove in crankshaft is aligned with the hole.



1. *Screwdriver*

Lock crankshaft.

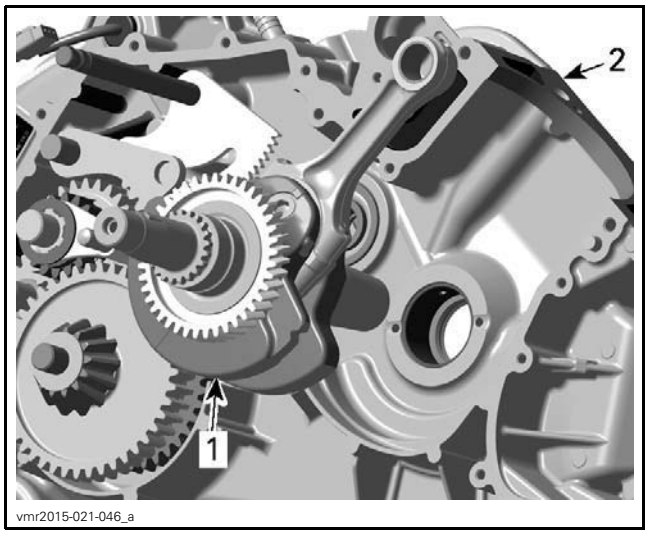
REQUIRED TOOL	
CRANKSHAFT LOCKING BOLT (P/N 529 035 617)	



1. *Crankshaft locking bolt*

Crankshaft Removal

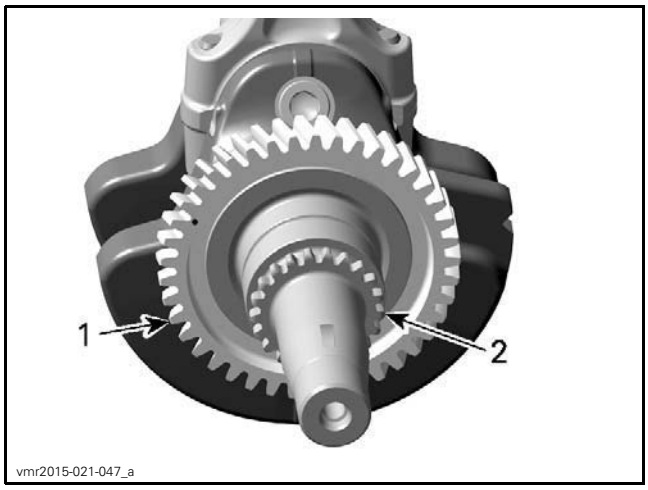
Remove:
– Balancer shaft, see *BALANCER SHAFT* in this subsection
– Crankshaft.



1. *Crankshaft*
2. *Crankcase PTO*

Crankshaft Inspection and Disassembly

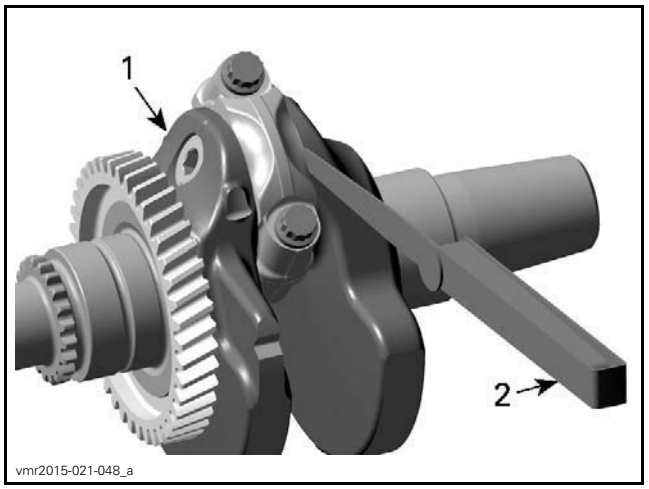
Replace crankshaft if the gears are worn or otherwise damaged.



1. *Balancer gear*
2. *Crankshaft timing gear*

Connecting Rod Big End Axial Play

Using a feeler gauge, measure distance between butting face of connecting rod and crankshaft counterweight. If the distance exceeds specified tolerance, replace the crankshaft.



1. *Crankshaft*
2. *Feeler gauge*

CONNECTING ROD BIG END AXIAL PLAY	
NEW	0.100 mm to 0.452 mm (.004 in to .018 in)
SERVICE LIMIT	0.500 mm (.02 in)

Connecting Rod/Piston Pin Clearance

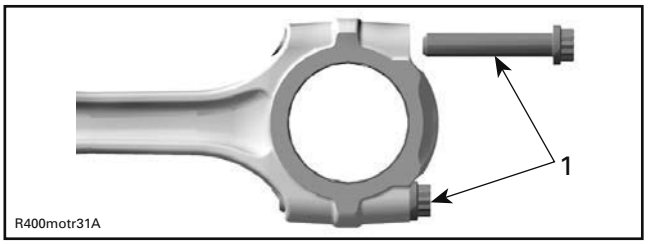
Refer to *TOP END* subsection.

Connecting Rod Big End Radial Play

NOTE: Prior to remove connecting rod from the crankshaft, mark big end halves together to ensure a correct reinstallation (cracked surface fits in only one position).

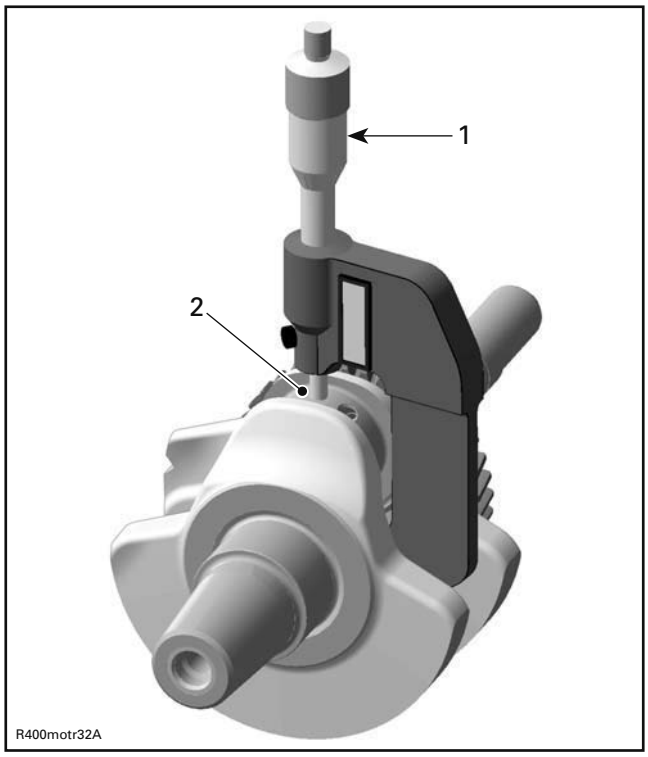
Remove connecting rod from crankshaft.

NOTICE **Connecting rod screws are not reusable. Always discard screws and replace by NEW ones. It is recommended to install new plain bearings when reinstalling connecting rods.**



1. *Connecting rod screw*

Measure crankpin. Compare to inside diameter of connecting rod big end.



1. Micrometer
2. Crankpin area for plain bearings

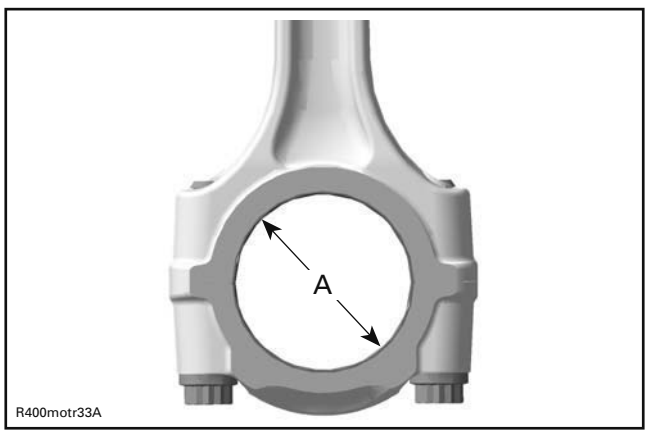
CRANK PIN DIAMETER	
NEW	40.001 mm to 40.025 mm (1.5748 in to 1.5758 in)
SERVICE LIMIT	39.980 mm (1.574 in)

If the crank pin diameter is out of specification, replace crankshaft.

To measure the connecting rod big end diameter, use the OLD screws.

Install the OLD plain bearings as they were mounted initially.

Carry out the tightening procedure described in *CRANKSHAFT ASSEMBLY* in this subsection.



A. Connecting rod big end plain bearing

If the crank pin diameter is out of specification, replace crankshaft.

CONNECTING ROD BIG END DIAMETER	
SERVICE LIMIT	40.100 mm (1.579 in)

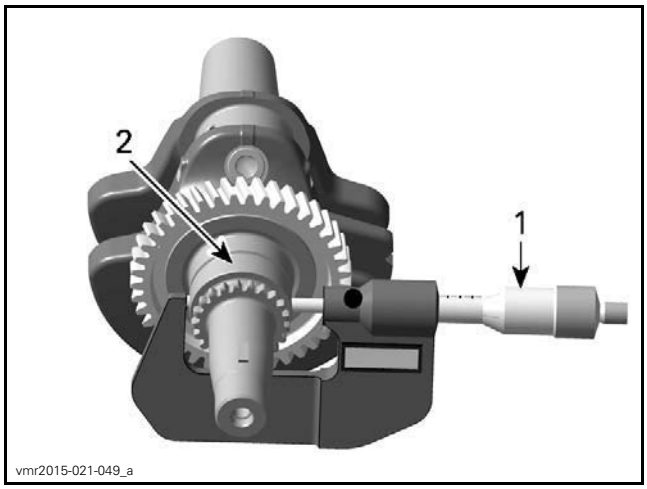
If connecting rod big end diameter is out of specification, replace plain bearings and recheck.

CONNECTING ROD BIG END RADIAL PLAY	
SERVICE LIMIT	0.09 mm (.0035 in)

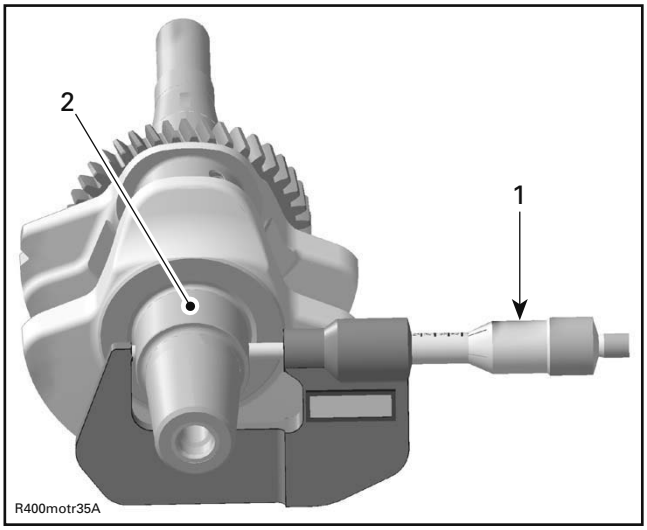
If connecting rod big end radial clearance is out of specification, replace plain bearings and recheck.

Crankshaft Radial Play MAG/PTO Side

Measure crankshaft MAG/PTO side. Compare to inside diameter of MAG/PTO plain bearings, refer to *CRANKCASE* in this subsection.



1. Micrometer
2. Crankshaft, MAG side main bearing journal



1. Micrometer
2. Crankshaft area for PTO plain bearing

CRANKSHAFT MAG/PTO DIAMETER	
NEW	42.016 mm to 42.040 mm (1.6542 in to 1.6551 in)
SERVICE LIMIT	42.000 mm (1.6535 in)

CRANKSHAFT MAG RADIAL PLAY	
SERVICE LIMIT	0.07 mm (.0028 in)

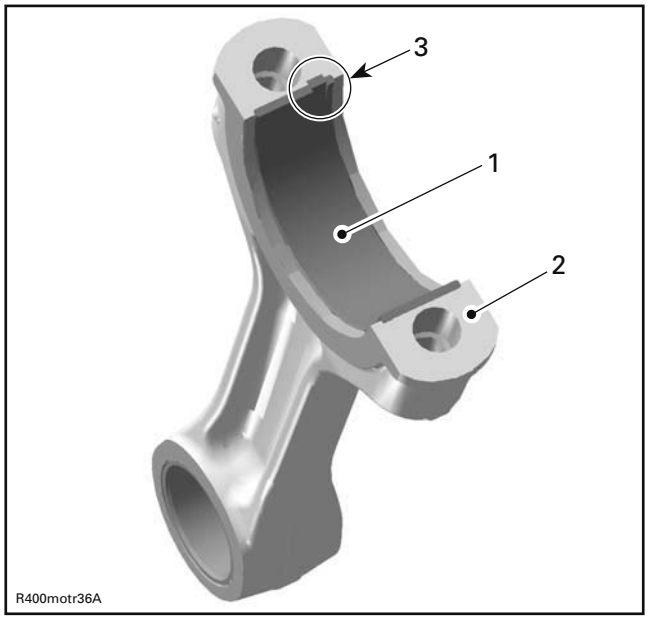
Crankshaft Assembly

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

Clean the split surface on both sides (cracked area) carefully with compressed air.

Use NEW bearings, when connecting rod big end diameter is out of specification.

Put plain bearings correctly in place.



1. *Half plain bearing of connecting rod big end*
2. *Split surface of the connecting rod*
3. *Nose of bearing in line with connecting rod groove*

Oil the plain bearing surface of the connecting rod and crank pin before installation.

NOTICE Lower cap and rod must match together since there is a cracked surface.

Oil NEW connecting rod screws.

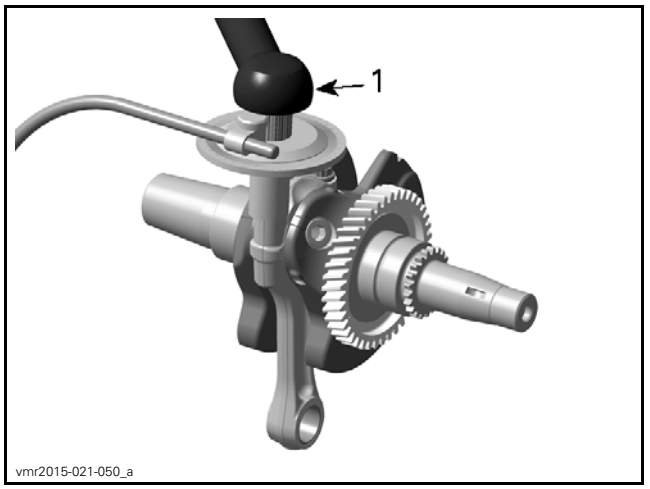
NOTICE Always use NEW connecting rod screws for the final assembly. They are not reusable.

Thread screws in connecting rod, then tighten as per following procedure.

NOTICE Strictly adhere following instructions:

- Do not apply any thread locker.
- The running direction of the big end bearings and of the piston pins must not change.
- Always perform each step on both connecting rod screws before going to the next step.
- Failure to strictly follow procedure may cause connecting rod screws to loosen and lead to severe engine damage.

REQUIRED TOOL
Torque wrench
Angle torque wrench



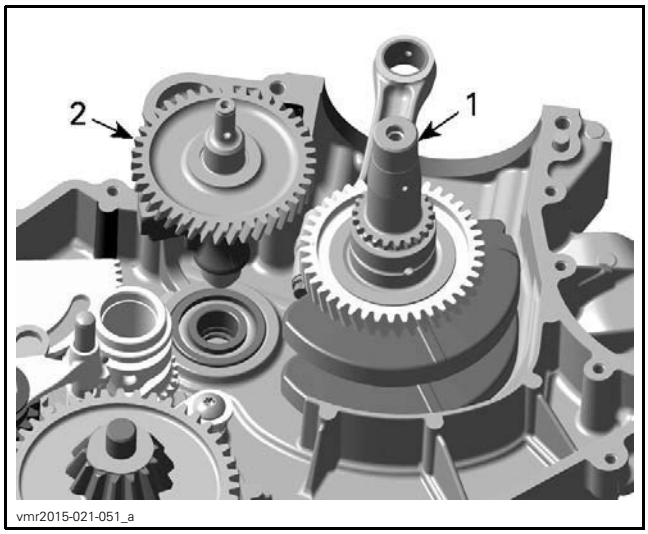
1. *Angle torque wrench*

CONNECTING RODS SCREWS TIGHTENING SEQUENCE	
Step 1	Tighten to 1/2 of specified torque
Step 2	Tighten to 20 N•m ± 2 N•m (15 lbf•ft ± 1 lbf•ft)
Step 3	Torque by an additional 60 ± 5° turn using an angle torque wrench

Crankshaft Installation

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

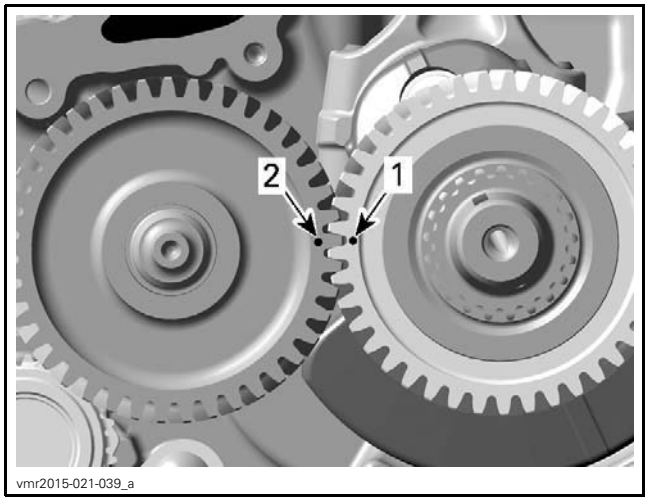
Install crankshaft first then balancer shaft.



vmr2015-021-051_a

1. *Crankshaft*
2. *Balancer shaft*

Align the marks of crankshaft and balancer shaft.



vmr2015-021-039_a

1. *Mark on crankshaft gear*
2. *Mark on balancer shaft gear*

After reinstalling of crankcase MAG, measure axial clearance of crankshaft with a feeler gauge between PTO crankcase and crankshaft thrust surface.

Install the CRANKSHAFT LOCKING BOLT (P/N 529 035 617) to keep the crankshaft in TDC position before installing the camshaft timing chain (refer to *CRANKSHAFT LOCKING PROCEDURE* in this subsection).

NOTICE **Make sure the woodruff key on crankshaft MAG is present and correctly in place.**

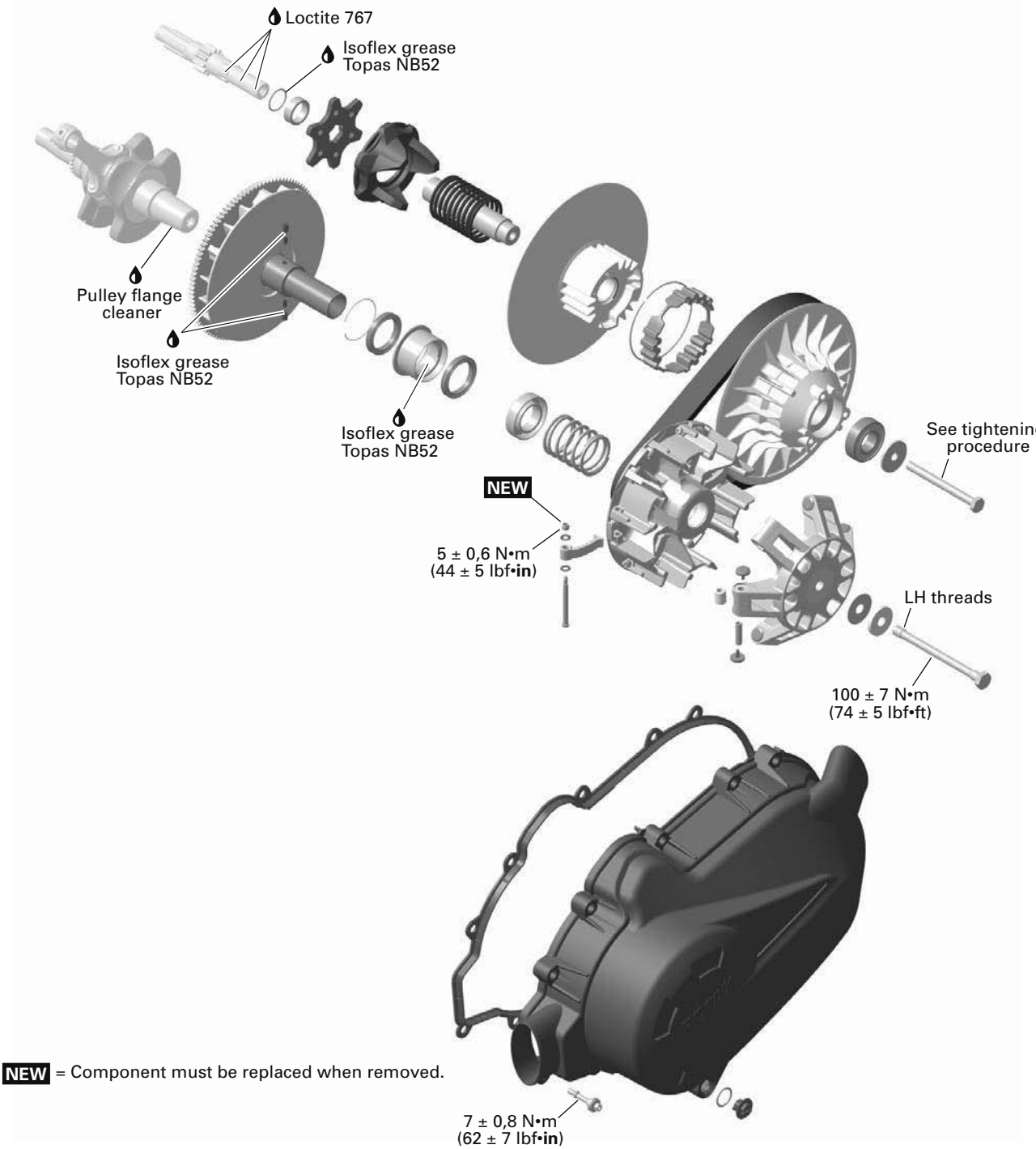
CONTINUOUSLY VARIABLE TRANSMISSION (CVT)

SERVICE TOOLS

Description	Part Number	Page
CLUTCH PULLER	529 035 746	187
DRIVE PULLEY HOLDER (CVT)	529 006 400	186
DRIVEN CLUTCH HOLDER	529 035 771	196
PULLER/LOCKING TOOL	529 036 098	185, 202

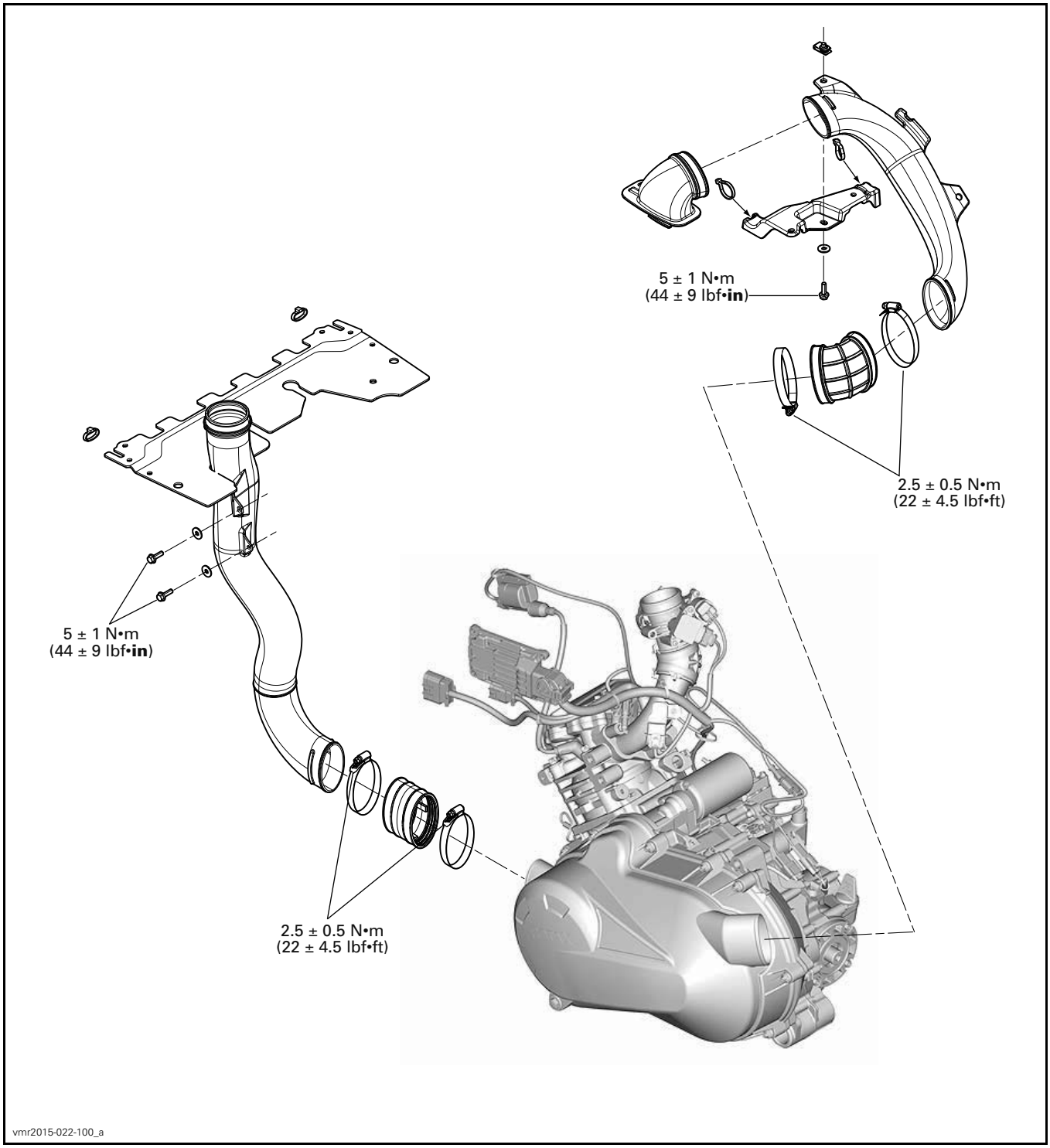
SERVICE PRODUCTS

Description	Part Number	Page
ISOFLEX GREASE TOPAS NB 52	293 550 021	194
PULLEY FLANGE CLEANER	413 711 809	189, 197, 201



NEW = Component must be replaced when removed.

vmr2015-022-001_a


5 ± 1 N•m
(44 ± 9 lbf•**in**)
2.5 ± 0.5 N•m
(22 ± 4.5 lbf•ft)
5 ± 1 N•m
(44 ± 9 lbf•**in**)
2.5 ± 0.5 N•m
(22 ± 4.5 lbf•ft)
vmr2015-022-100_a

GENERAL

NOTE: For a better understanding, the following illustrations are taken with engine out of vehicle. To perform the following instructions, it is not necessary to remove engine from vehicle.

This CVT is lubrication free. Never lubricate any components except drive pulley one-way clutch.

⚠ WARNING

Never touch CVT while engine is running. Never drive vehicle when CVT cover is removed.

⚠ WARNING

Any drive pulley repairs must be performed by an authorized Can-Am dealer. Subcomponent installation and assembly tolerances require strict adherence to procedures detailed.

NOTICE Never use any type of impact wrench at drive pulley removal and installation.

⚠ WARNING

The clutch assembly is a precisely balanced unit. Never replace parts with used parts from another clutch assembly.

NOTICE These pulleys have metric threads. Do not use imperial thread puller. Always tighten puller by hand to ensure that the drive pulley has the same type of threads (metric vs imperial) before tightening completely.

PROCEDURES

CVT COVER

CVT Cover Access

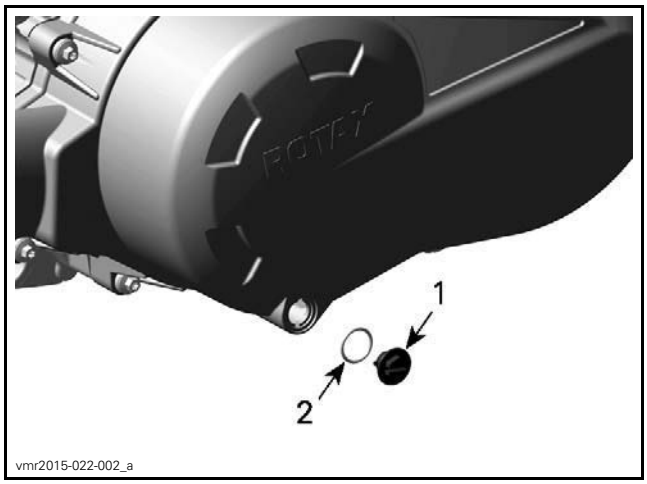
Refer to *BODY* subsection and remove the following:

– LH side and extension panels
– LH footboard panel.

CVT Cover Draining

Turn bayonet cap 90° counterclockwise to open it.

Remove bayonet cap with O-ring.



1. Bayonet cap
2. O-ring

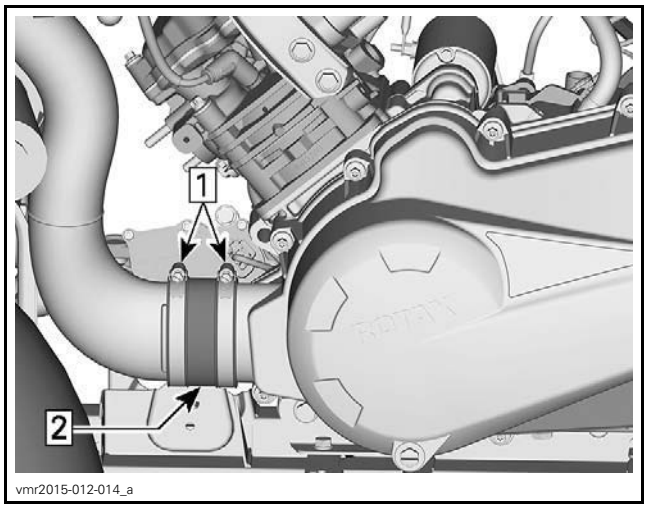
Let water drain from CVT cover.

NOTICE If an appreciable amount of water or any debris entered the CVT cover, CVT must be cleaned and inspected.

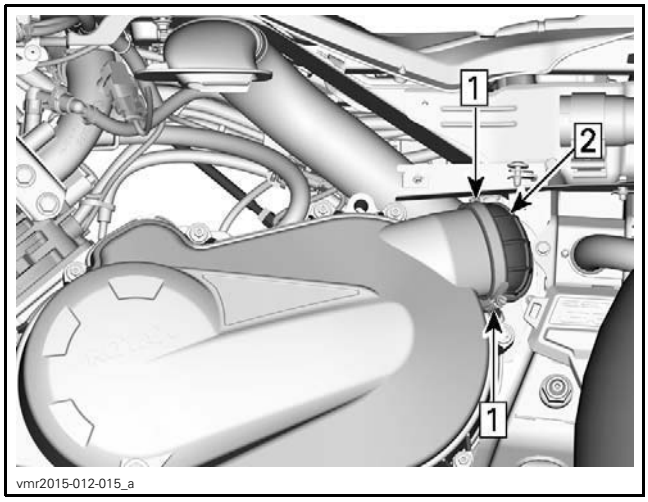
Reinstall bayonet cap with O-ring.

CVT Cover Removal

Disconnect CVT cooling air ducts.

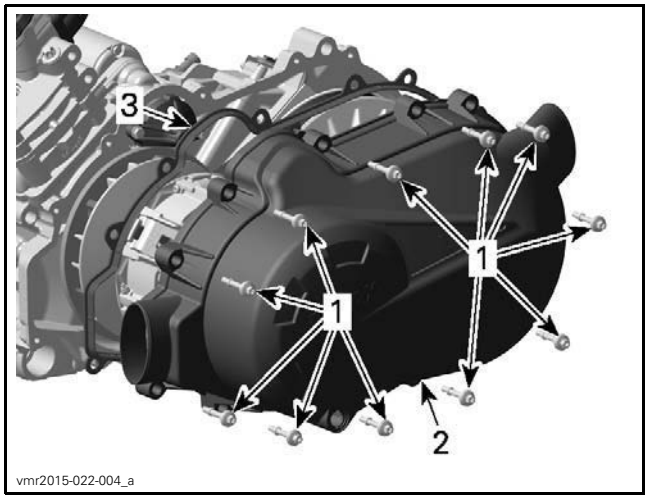


CVT AIR INLET DUCT DISCONNECT
1. Loosen clamps
2. Remove CVT air inlet adapter



CVT AIR OUTLET DUCT DISCONNECT
Step 1: Loosen clamps
Step 2: Remove CVT air outlet adapter

Remove:
– Retaining screws
– CVT cover
– Gasket.



1. *Retaining screws*
2. *CVT cover*
3. *Gasket*

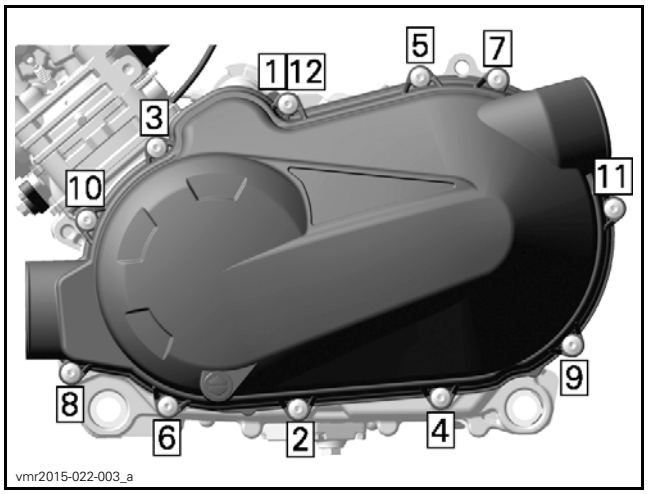
NOTE: To support the cover remove the center top screw last.

CVT Cover Installation

Install the center top screw of cover in first.

Install the other screws then torque them in a crisscross sequence.

Tighten the CVT cover screws as per following sequence.



CVT COVER TIGHTENING SEQUENCE

CVT COVER RETAINING SCREWS	
Tightening torque	7 N•m ± 0.8 N•m (62 lbf•**in** ± 7 lbf•**in**)

DRIVE BELT

Drive Belt Removal

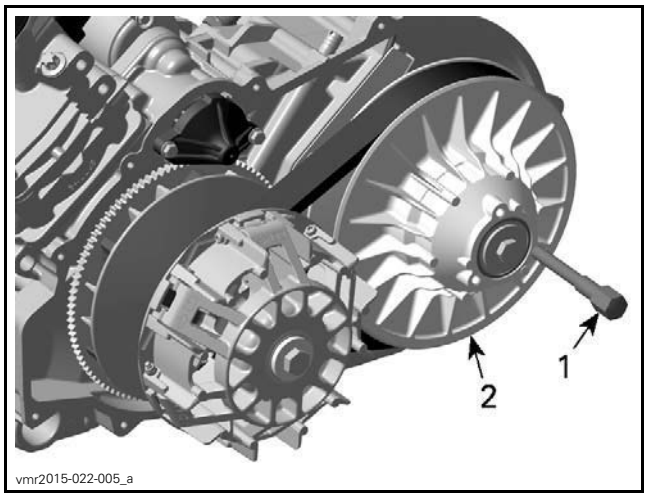
NOTICE **In case of a drive belt failure, the CVT cover, air inlet and air outlet must be cleaned and inspected for obstruction.**

Remove CVT cover, refer to procedure in this subsection.

Open driven pulley.

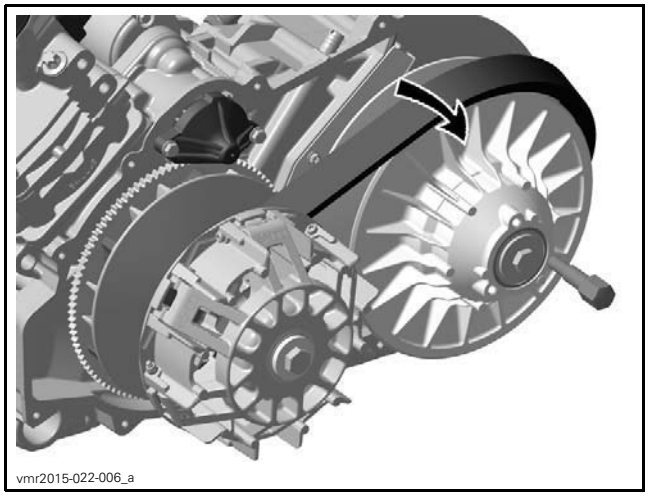
REQUIRED TOOL	
PULLER/LOCKING TOOL (P/N 529 036 098)	

Screw tool in the threaded hole of driven pulley and tighten to open the pulley.



1. *Puller/locking tool*
2. *Fixed sheave of driven pulley*

Slide belt over the top edge of fixed sheave.


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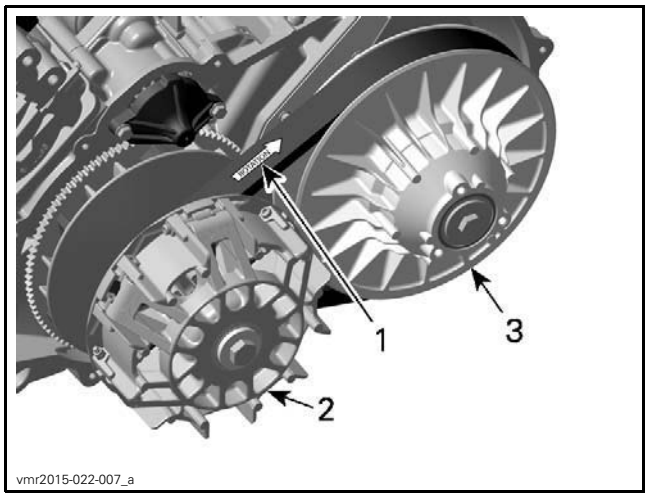
Drive Belt Inspection

For drive belt inspection refer to *DRIVE BELT INSPECTION* in the *PERIODIC MAINTENANCE PROCEDURES* subsection.

Drive Belt Installation

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

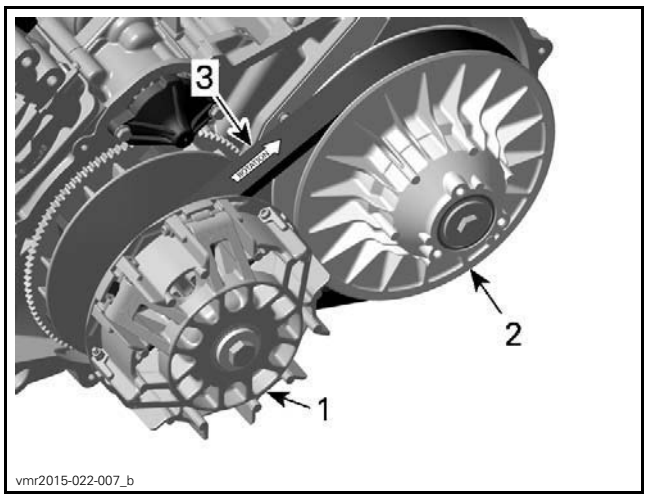
The maximum drive belt life span is obtained when the drive belt has the proper rotation direction. Install it so that the arrow printed on belt is pointing towards the back of the vehicle.



vmr2015-022-007_a

1. Arrow towards the back of the vehicle
2. Drive pulley (front)
3. Driven pulley (rear)

DRIVE PULLEY



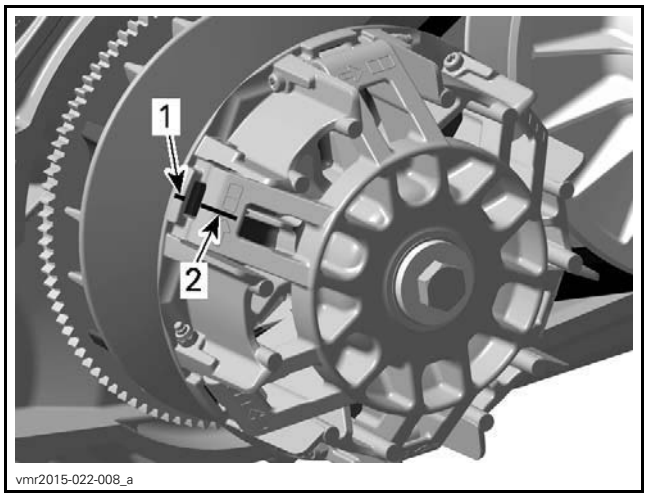
vmr2015-022-007_b

1. Drive pulley
2. Driven pulley
3. Belt

Drive Pulley Removal

Remove drive belt, refer to procedure in this subsection.

Prior to removing the drive pulley, mark sliding sheave and governor cup together to ensure correct reinstallation. There are 4 levers mounted out of 6 possible positions.

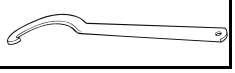


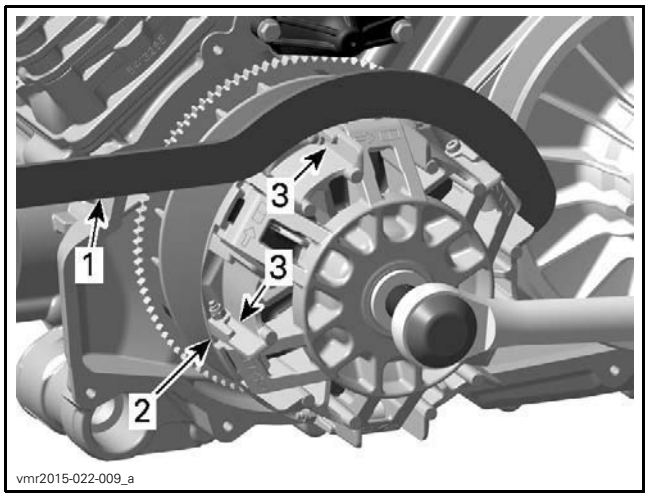
vmr2015-022-008_a

1. Mark on drive pulley sliding sheave
2. Mark on governor cup

To block drive pulley, two methods can be used:

– Lock crankshaft. Refer to *CRANKSHAFT LOCKING PROCEDURE* in the *BOTTOM END* subsection.
– Block drive pulley.

REQUIRED TOOL	
DRIVE PULLEY HOLDER (CVT) (P/N 529 006 400)	



1. Drive pulley holder
2. Drive pulley sliding sheave
3. Area to place holding tool hook

Loosen drive pulley screw clockwise.

NOTICE Drive pulley screw has LH threads.

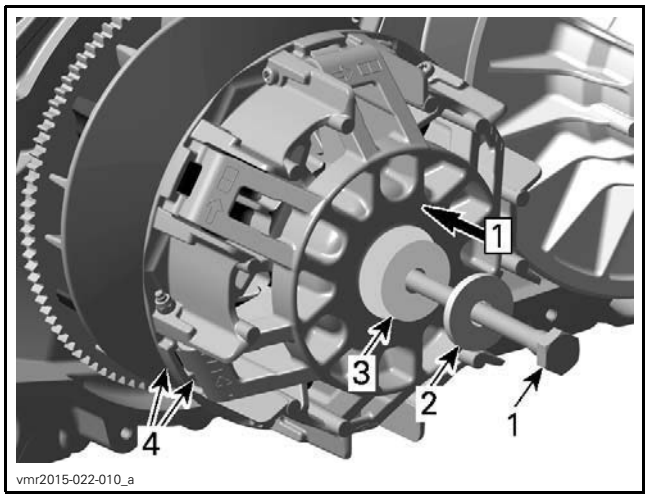
NOTE: Do not unscrew the drive pulley screw completely. If governor cup is stuck, hit it using a soft hammer.

Remove service tool.

Apply axial pressure with your hand on the sliding sheave and governor cup.

Remove:
– Screw
– Spring washer
– Thrust washer.

⚠ CAUTION Sliding sheave of drive pulley is spring loaded.



Step 1: Push

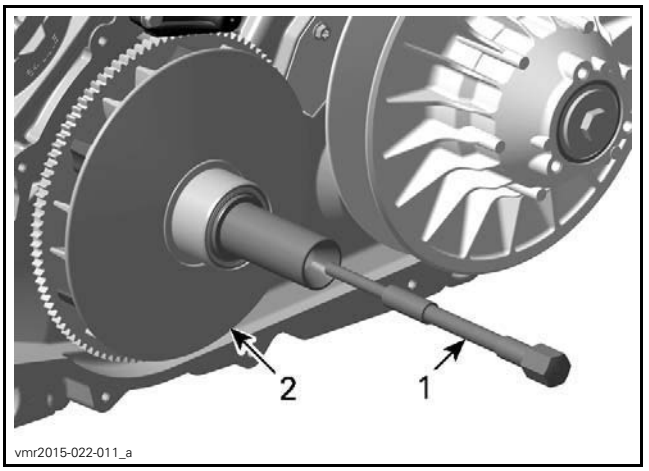
1. Drive pulley screw
2. Spring washer
3. Thrust washer
4. Sliding sheave with governor cup

Slowly release spring pressure and remove sliding sheave.

Slowly release sliding sheave.

Remove fixed sheave.

REQUIRED TOOL	
CLUTCH PULLER (P/N 529 035 746)	

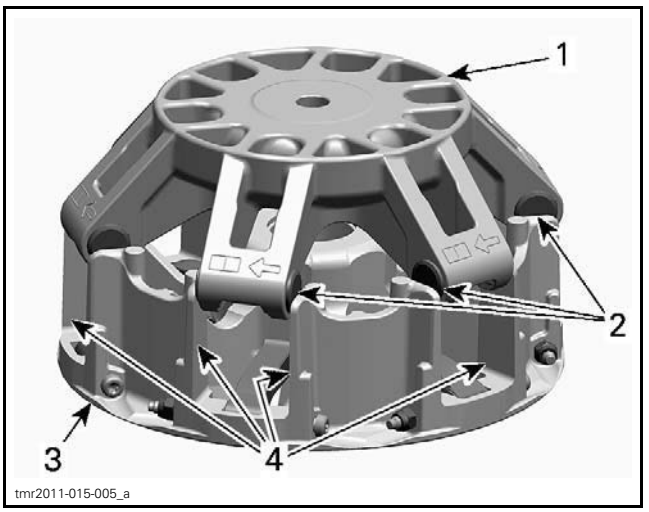


1. Drive pulley puller
2. Fixed sheave

Drive Pulley Disassembly

Governor Cup

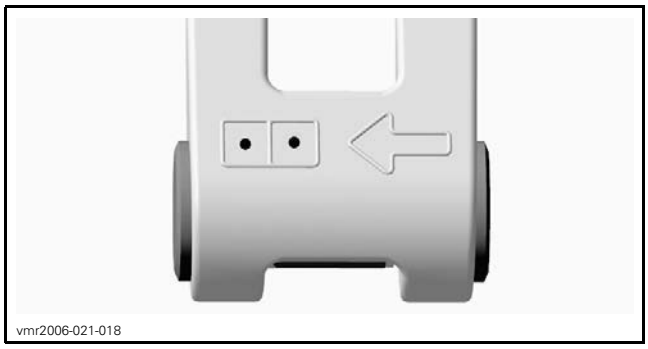
Carefully lift governor cup until slider shoes come at their highest position into guides.



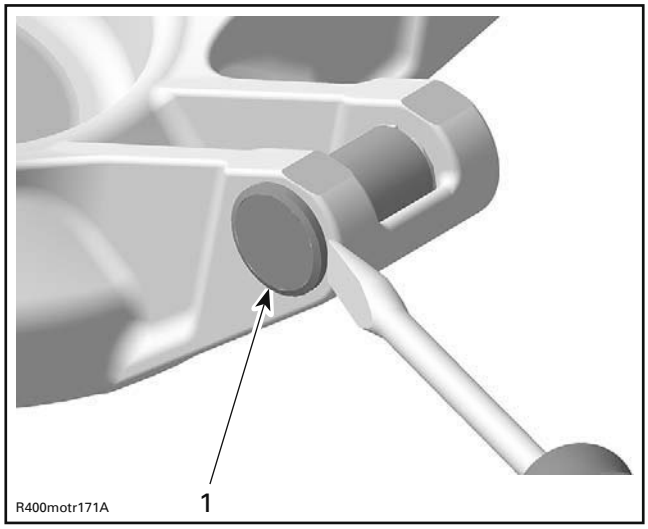
1. Governor cup
2. Slider shoes
3. Sliding sheave
4. Guides

NOTE: The following procedure is not necessary except if roller must be removed. Refer to *DRIVE PULLEY INSPECTION* before proceeding.

NOTE: Whenever removing a governor cup that has the 2 boxes marked (punch marks), replace it with a new one.



Remove slider shoess



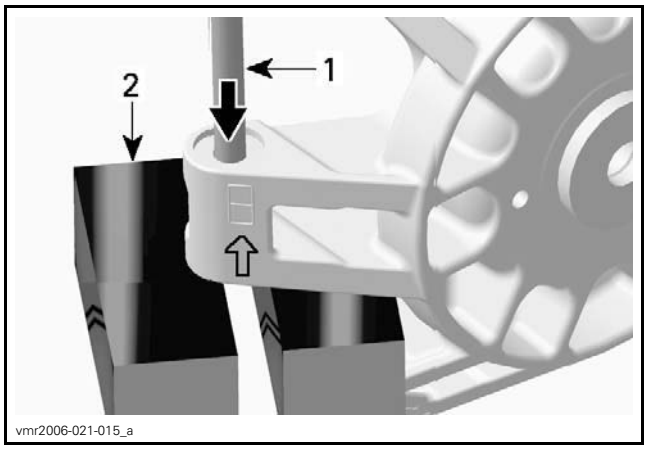
1. Slider shoe

Put governor cup on a vise. Use protection plates on the vise jaws to avoid marks and/or damages to the governor cup.

Push out roller sleeve with an appropriate punch in the direction illustrated (against insertion arrow marked on governor cup arm).

NOTE: Use a punch with a smaller diameter than the roller sleeve.

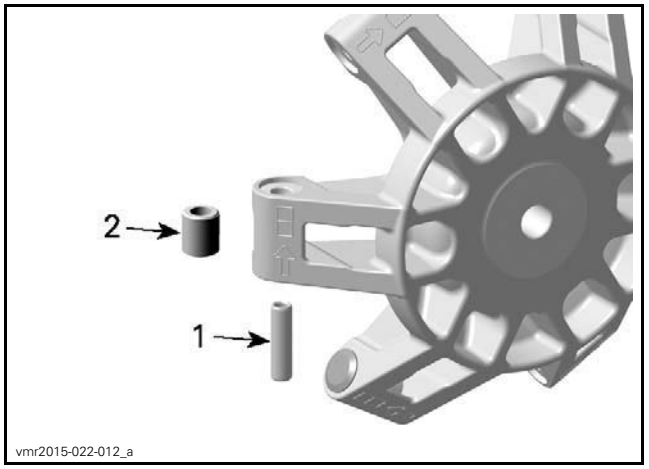
NOTICE Do not clamp the governor cup in the vise to push out bearing sleeve. Governor cup will be damaged.



PUSHING OUT ROLLER SLEEVE
1. Punch
2. Vise

NOTICE Always replace all rollers at the same time. Partially worn rollers may cause damage to the CVT system.

Remove roller sleeve and roller.



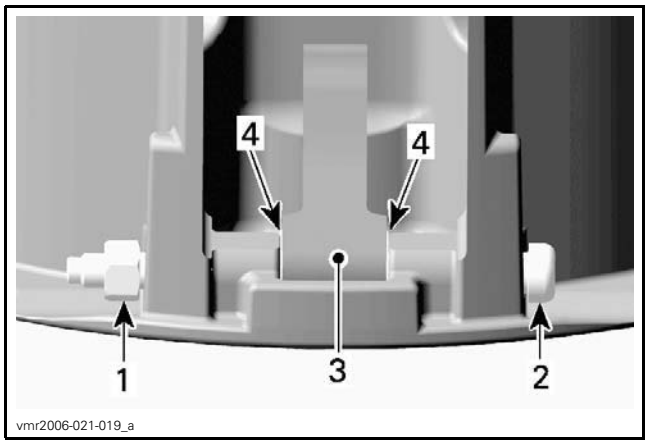
1. Roller sleeve
2. Roller

Sliding Sheave

NOTE: This drive pulley is equipped with 4 levers.

Unscrew lock nut and remove centrifugal lever pivot bolt.

Remove centrifugal lever and both thrust washers.



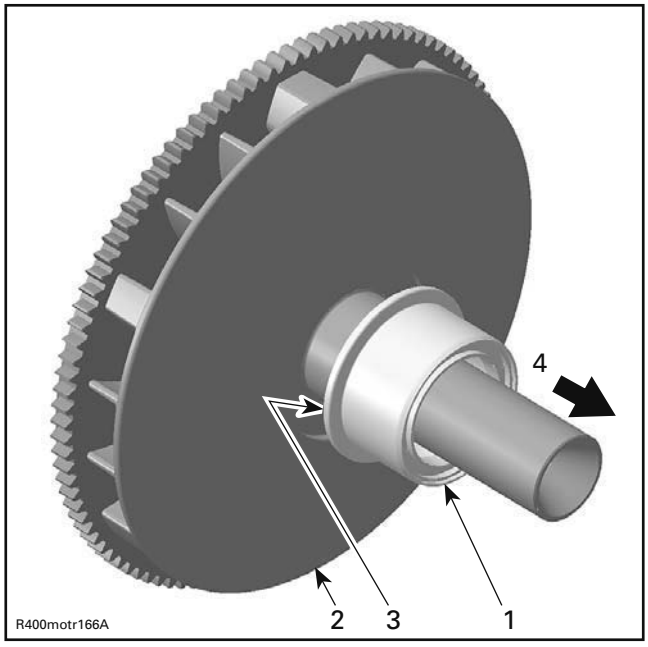
1. *Lock nut*
2. *Centrifugal lever pivot bolt*
3. *Centrifugal lever*
4. *Thrust washers*

Fixed Sheave

⚠ WARNING

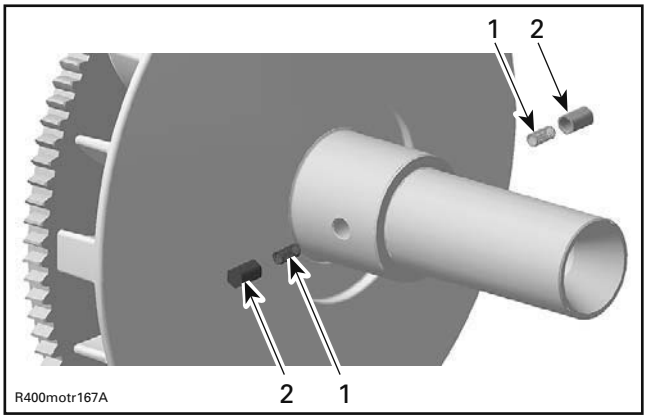
Always wear safety glasses to remove spring sleeves.

Pull and rotate one-way clutch slowly until the half of spring sleeves are visible.



1. *One-way clutch*
2. *Fixed sheave*
3. *Spring sleeve area*
4. *Direction of removal*

Hold both spring sleeves with fingers and carefully remove them when the one-way clutch is disengaged.



1. *Spring*
2. *Spring sleeves*

Drive Pulley Cleaning

Clean pulley faces and shaft with fine steel wool and dry cloth.

Using a paper towel with the recommended cleaning solvent, clean:
- Crankshaft tapered end
- Crankshaft threads
- Taper inside of the fixed sheave of the drive pulley
- Drive pulley screw threads.

REQUIRED SERVICE PRODUCT
PULLEY FLANGE CLEANER (P/N 413 711 809)

NOTICE **To avoid damage, make sure cleaner does not contact the crankshaft seal.**

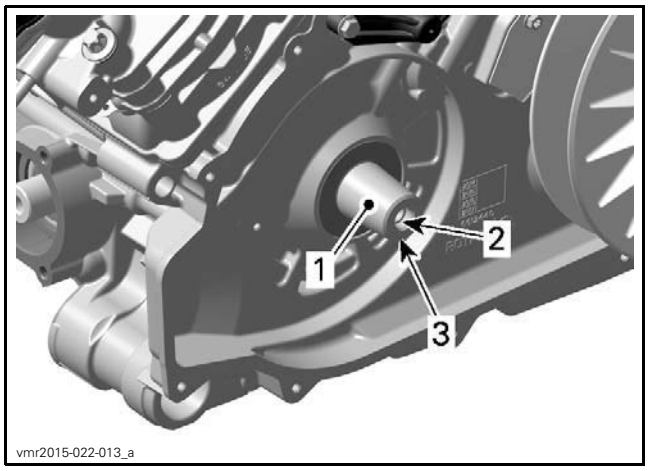
Remove all hardened oil deposits that have baked on crankshaft and pulley tapered surfaces with coarse or medium steel wool and/or sand paper no. 600.

NOTICE **Do not use any other type of abrasive.**

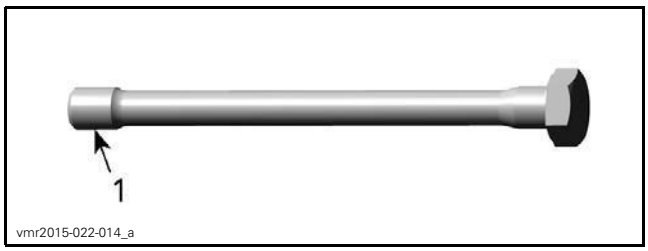
Reclean mounting surfaces with paper towel and cleaning solvent.

Wipe off the mounting surfaces with a clean, dry paper towel.

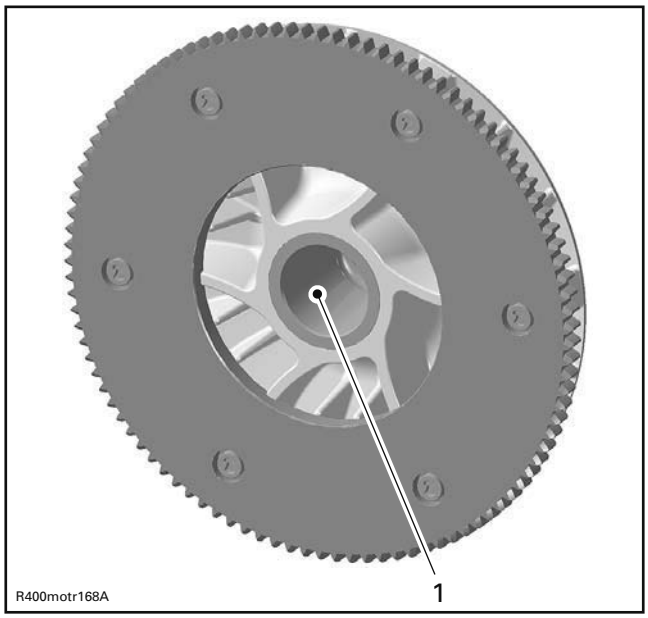
NOTICE **Mounting surfaces must be free of any oil, cleaner or towel residue.**



1. *Taper*
2. *Threads*
3. *Crankshaft*

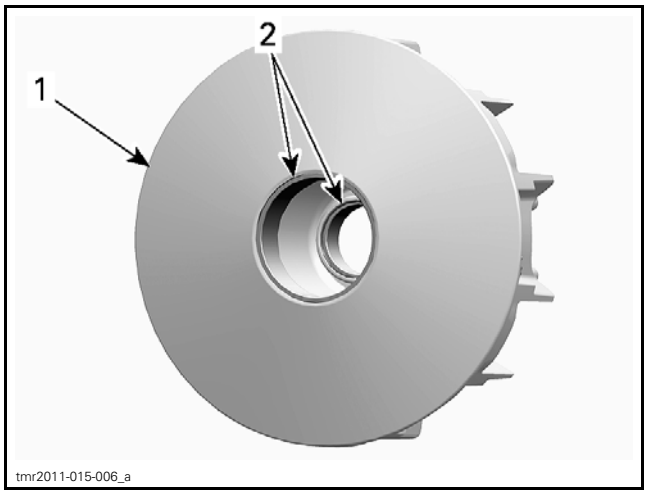


1. *Drive pulley screw threads*



1. *Taper of fixed sheave*

Only use petrol base cleaner when cleaning bushings.



1. *Sliding sheave*
2. *Bushings*

NOTICE Do not use acetone to clean bushing.

Drive Pulley Inspection

Governor Cup

Check governor cup for cracks or other visible damages. Replace if necessary.

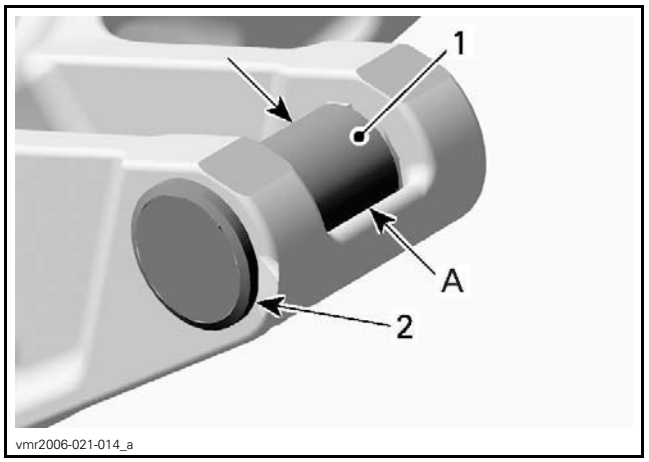
Roller and Slider Shoe

Check each roller for roundness of external diameter.

NOTE: Whenever replacing rollers and slider shoes, always replace all rollers and slider shoes as a set.

Check slider shoes for visible wear and replace if damaged.

Measure the roller diameter. If one roller is out of specification, replace all rollers.



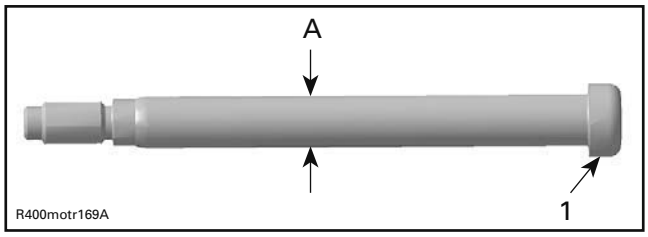
1. *Roller*
2. *Slider shoe*

A. Roller outer diameter

ROLLER OUTER DIAMETER	
NEW	13.80 mm to 14.00 mm (.543 in to .551 in)
SERVICE LIMIT	13.20 mm (.52 in)
ROLLER INNER DIAMETER	
NEW	8.025 mm to 8.175 mm (.316 in to .322 in)
SERVICE LIMIT	9.00 mm (.354 in)

Centrifugal Lever Pivot Bolt

Measure diameter of centrifugal lever pivot bolt, replace if it is out of specification.

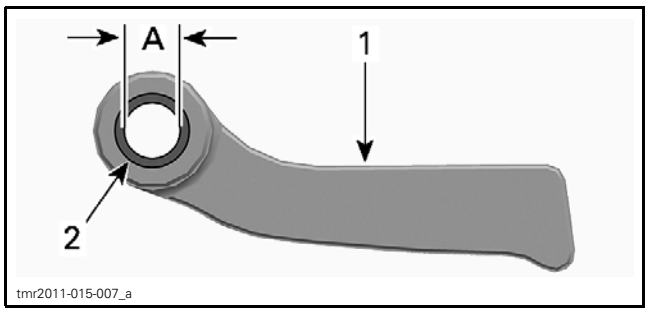


1. Centrifugal lever pivot bolt
A. Measure diameter here

CENTRIFUGAL LEVER PIVOT BOLT DIAMETER	
SERVICE LIMIT	6.000 mm (.236 in)

Centrifugal Lever

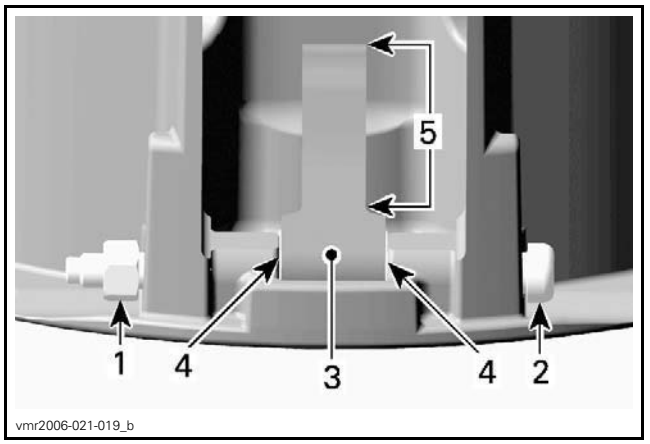
Check bushing diameter in the centrifugal lever for wear. If a centrifugal lever must be replaced, replace all levers at the same time.



1. Centrifugal lever
2. Bushing
A. Bushing inner diameter

CENTRIFUGAL LEVER BORE DIAMETER	
SERVICE LIMIT	6.200 mm (.244 in)

Inspect and replace as necessary the following items if their contact surfaces are heavy worn:
– Centrifugal lever
– Thrust washers
– Centrifugal lever pivot bolts
– Lock nuts.



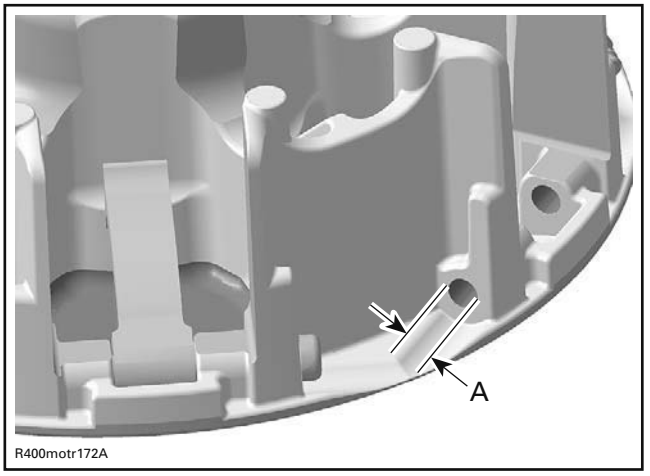
1. Lock nut
2. Centrifugal lever pivot bolt
3. Centrifugal lever
4. Thrust washers
5. Contact surface to the roller

NOTICE Whenever replacing centrifugal levers, always replace all levers at the same time. Otherwise, the drive pulley will be unbalanced (because of lever differences).

Sliding Sheave

Check sliding sheave for cracks and sliding contact surface for excessive wear. Replace sliding sheave if necessary.

Measure centrifugal lever pivot bolt bores. Replace sliding sheave if bores are out of specification or damaged.



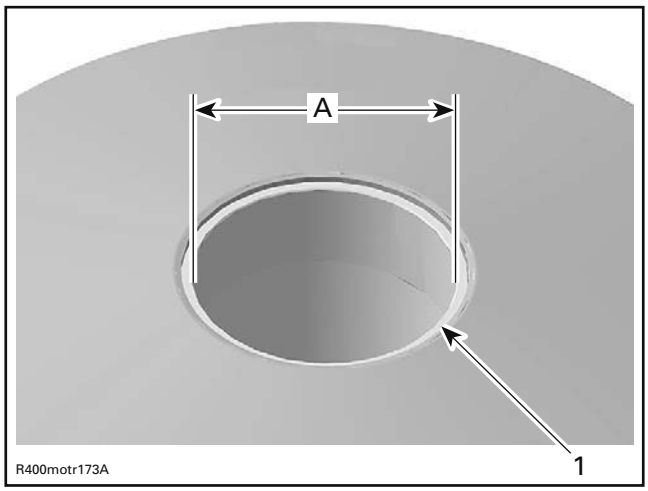
A. Centrifugal lever pivot bolt bore diameter

CENTRIFUGAL LEVER PIVOT BOLT BORE DIAMETER	
NEW	6.113 mm to 6.171 mm (.241 in to .243 in)
SERVICE LIMIT	6.300 mm (.248 in)

Measure bushing diameters of sliding sheave.

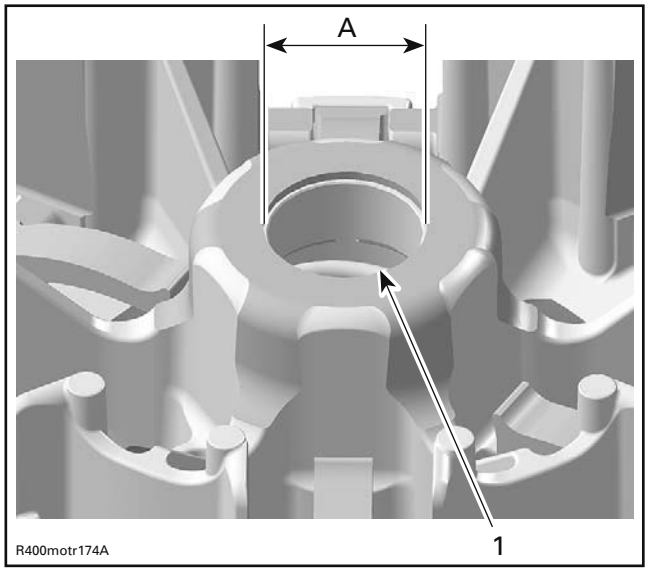
REQUIRED TOOL
Dial bore gauge

MEASURING POINT
At least 5 mm (1/4 in) from bushing edge



1. Bushing on fixed sheave side
A. Bore diameter of bushing

SLIDING SHEAVE LARGE BUSHING	
NEW	55.000 mm to 55.040 mm (2.165 in to 2.167 in)
SERVICE LIMIT	55.200 mm (2.173 in)



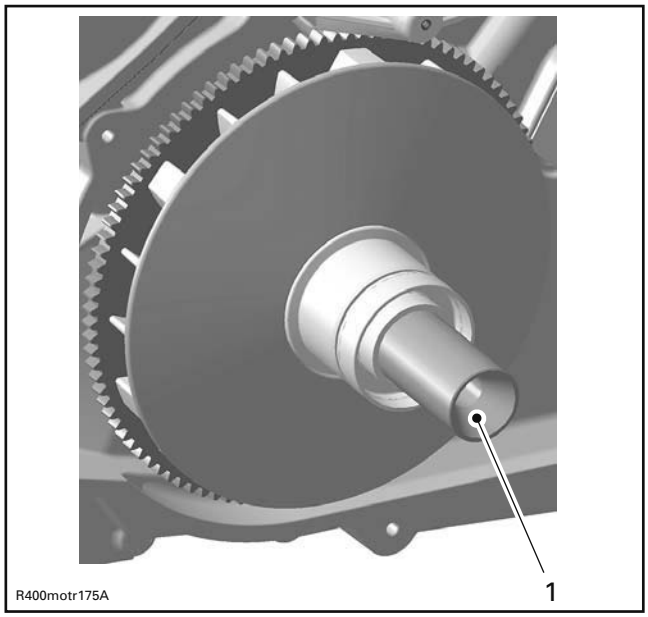
1. Bushing on governor cup side
A. Bore diameter of bushing

SLIDING SHEAVE SMALL BUSHING	
NEW	30.000 mm to 30.040 mm (1.181 in to 1.183 in)
SERVICE LIMIT	30.200 mm (1.189 in)

Replace sliding sheave if one of the bushings is out of specification. Visually inspect coatings.

Fixed Sheave

Check fixed sheave contact surface to the governor cup for scoring and other damages. If so, replace fixed sheave.



1. Visually check here

Check for any marks on fixed sheave plate. Replace if necessary.

Check ring gear teeth for excessive wear or other damage. Replace fixed sheave if necessary.

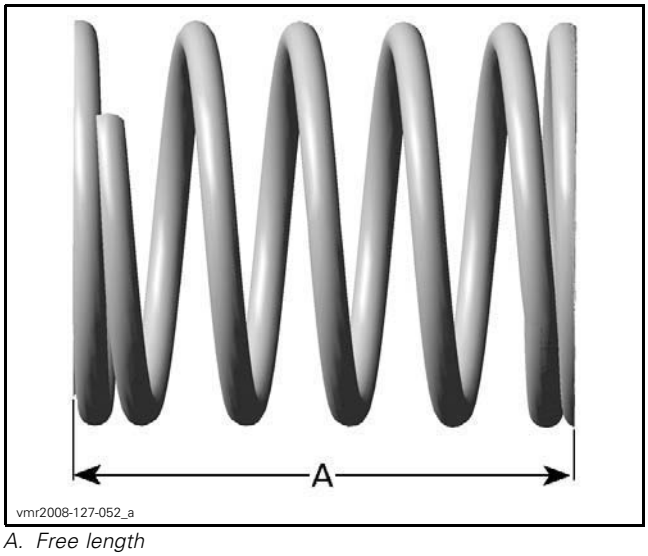
⚠ WARNING

Fixed sheave and ring gear are balanced together. Always replace both parts together otherwise severe injury and/or damages may occur.

Spring

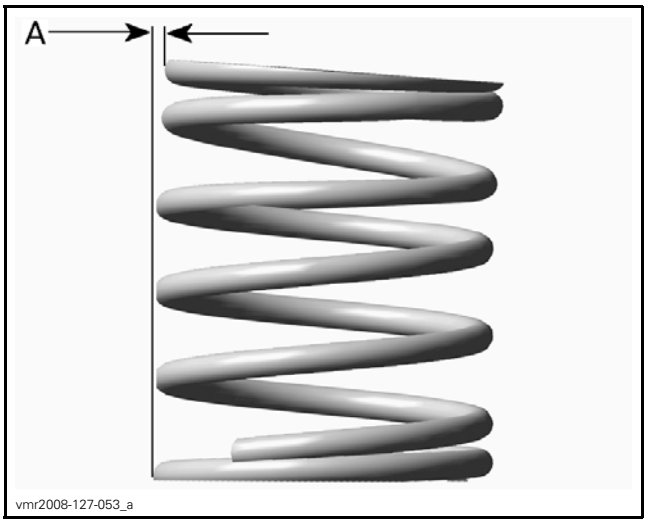
Measure spring free length and squareness. If spring is out of specification, replace by a new one.

SPRING FREE LENGTH	
SERVICE LIMIT	75 mm (2.953 in)



A. Free length

CLUTCH SPRING SQUARENESS	
SERVICE LIMIT	4 mm (.157 in)

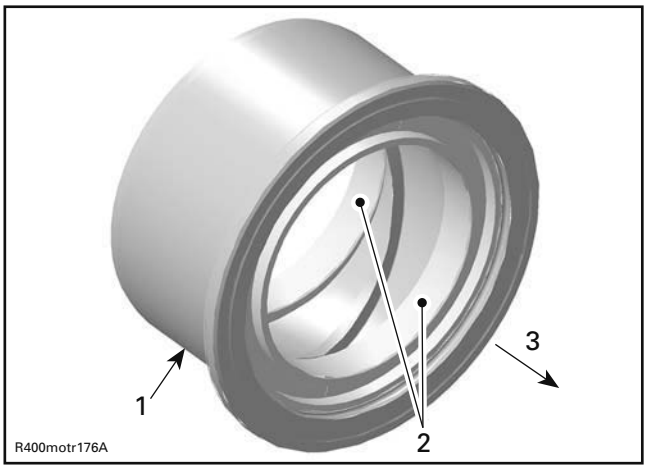


A. Squareness

One-Way Clutch

Check bearings for excessive play and smooth operation. Replace one-way clutch if necessary.

NOTICE Be careful not to damage the inside of one-way clutch during bearing removal.



1. One-way clutch
2. Bearings
3. Drive pulley sliding sheave side

Measure length of spring sleeve and check if edges on top of the spring sleeve are excessively worn. If out of specifications, replace both spring sleeves and springs at the same time.

SPRING SLEEVE LENGTH	
NEW	9.2 mm to 9.4 mm (.362 in to .37 in)
SERVICE LIMIT	9.0 mm (.354 in)

Drive Pulley Assembly

For assembly, reverse the disassembly procedure. Pay attention to following details.

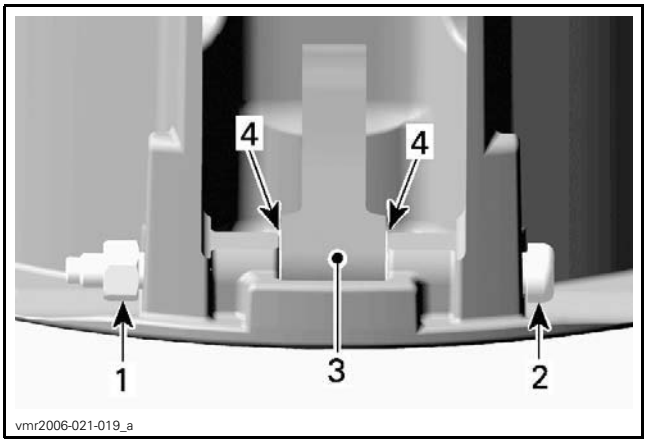
One-Way Clutch

Lubricate spring sleeves, springs and between one-way clutch bearings using recommended product.

REQUIRED SERVICE PRODUCTT
ISOFLEX GREASE TOPAS NB 52 (P/N 293 550 021)

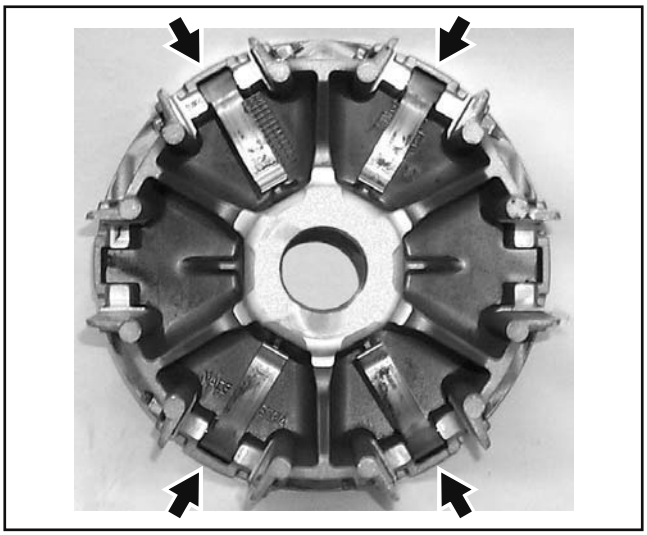
Sliding Sheave

Install centrifugal lever and both thrust washers.



vmr2006-021-019_a

1. *Lock nut*
2. *Centrifugal lever pivot bolt*
3. *Centrifugal lever*
4. *Thrust washers*



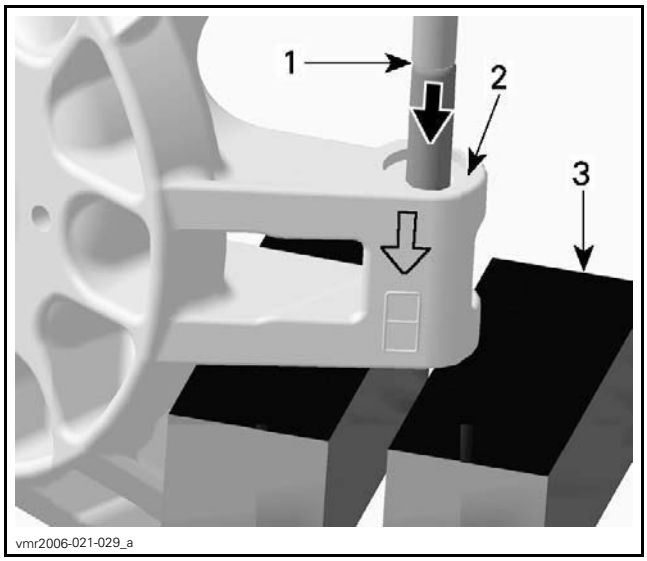
NOTICE Centrifugal lever must move easily after installation.

Governor Cup

Rebuild governor cup with NEW roller sleeves, thrust washers, rollers and slider shoes.

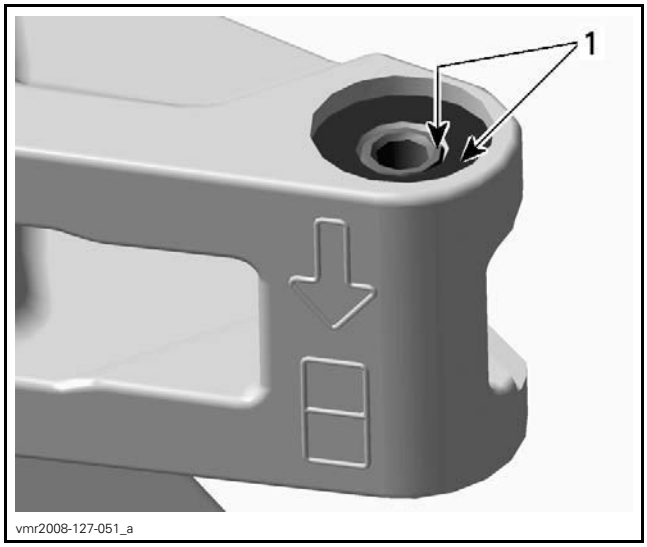
Push in roller sleeve with an appropriate punch in the direction of the protruding arrow. Push until roller sleeve aligns with the contact surface of the slider shoe.

NOTICE Final position of roller sleeve has to be flush with the contact surface of the slider shoes (no protrusion).



vmr2006-021-029_a

1. *Top edge of roller sleeve*
2. *Mating surface of slider shoes*
3. *Vise*

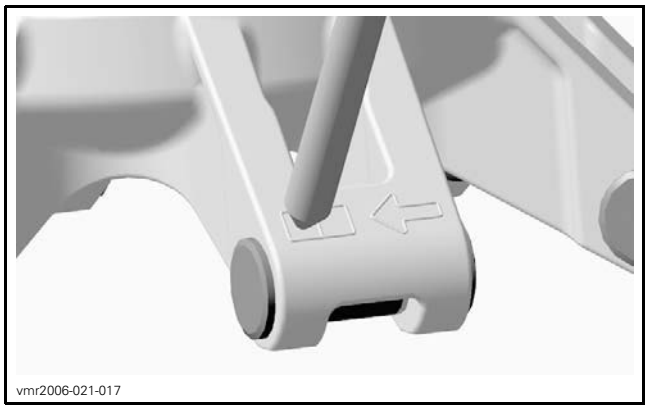


vmr2008-127-051_a

1. *Flush surfaces*

Whenever replacing roller sleeves, punch a mark in an empty telltale box. If each box is already marked, replace governor cup with a new one.

NOTICE Do not tap too hard. Severe damage to the governor cup may appear.

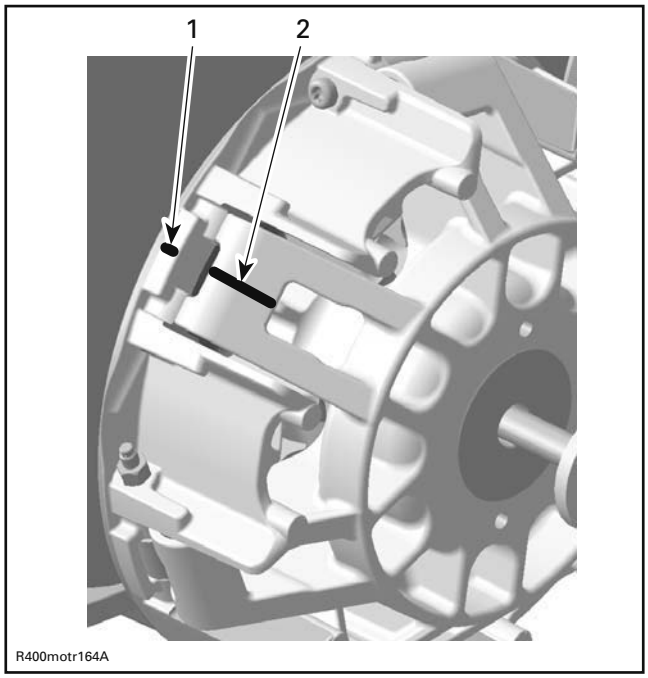

vmr2006-021-017

NOTICE Rollers must move easily after installation.

Carefully press slider shoes in the governor cup arm so they **bottom out evenly** in the machined portion of the governor cup arm.

NOTICE Slider shoes must be pressed in evenly to ensure they are centered in the arm and slide properly in the guides.

Align governor cup with sliding sheave using the marks traced at disassembly.



R400motr164A

1. Mark on drive pulley sliding sheave
2. Mark on governor cup

Drive Pulley Installation

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

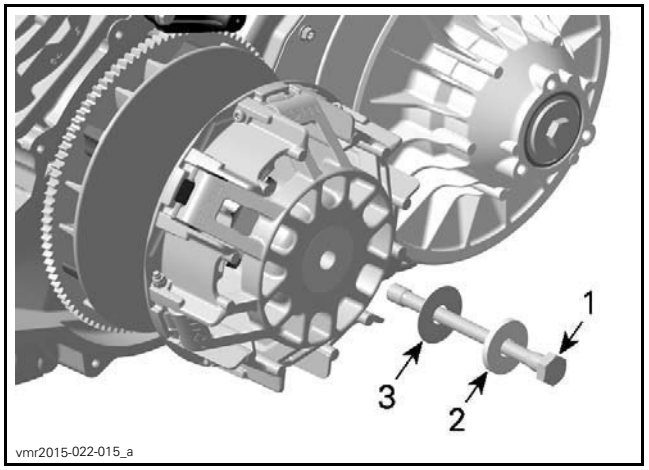
NOTICE Do not apply antiseize or any lubricant on crankshaft and drive pulley tapers.

NOTICE Never use any type of impact wrench at drive pulley removal and installation.

Clean mounting surfaces as described in *DRIVE PULLEY CLEANING* in this subsection.

Install drive pulley on crankshaft extension.

Install:
– Thrust washer
– Spring washer with its concave side towards drive pulley
– Drive pulley screw.



vmr2015-022-015_a

1. Drive pulley screw
2. Spring washer
3. Thrust washer

⚠ WARNING

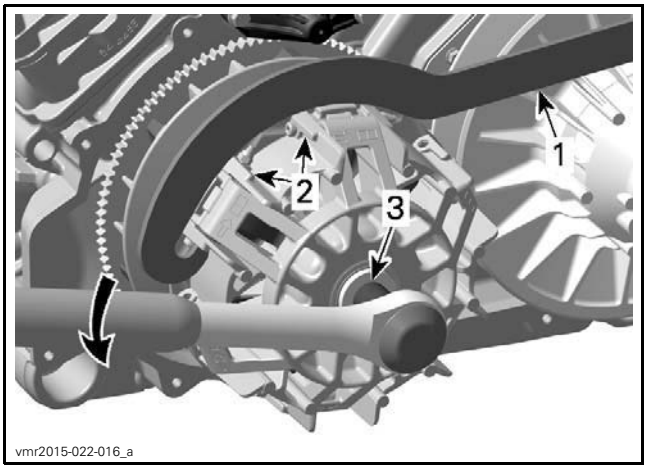
Never substitute spring washer and/or screw with aftermarket parts. Always use BRP genuine parts.

Lock the drive pulley as per removal procedure.

Tighten drive pulley screw counterclockwise to specification.

DRIVE PULLEY SCREW	
Tightening torque	100 N•m ± 7 N•m (74 lbf•ft ± 5 lbf•ft)

NOTE: Drive pulley screw has LH threads.



1. Drive pulley holder
2. Drive pulley removal/installation area
3. Drive pulley screw

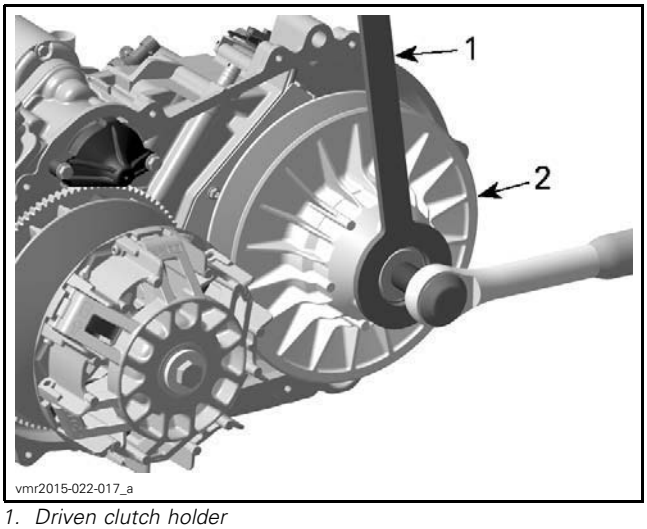
DRIVEN PULLEY

Driven Pulley Removal

Remove drive belt, refer to *DRIVE BELT* in this subsection.

Block driven pulley fixed sheave.

REQUIRED TOOL	
DRIVEN CLUTCH HOLDER (P/N 529 035 771)	



1. Driven clutch holder
2. Driven pulley fixed sheave

Unscrew the driven pulley screw.

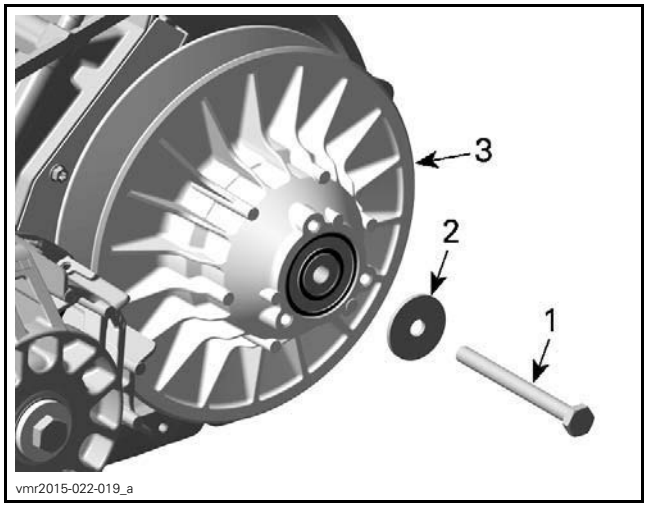
NOTE: Do not remove screw completely.

Apply axial pressure with your hand on driven pulley and maintain during screw removal.

Remove:
– Driven pulley screw
– Washer.

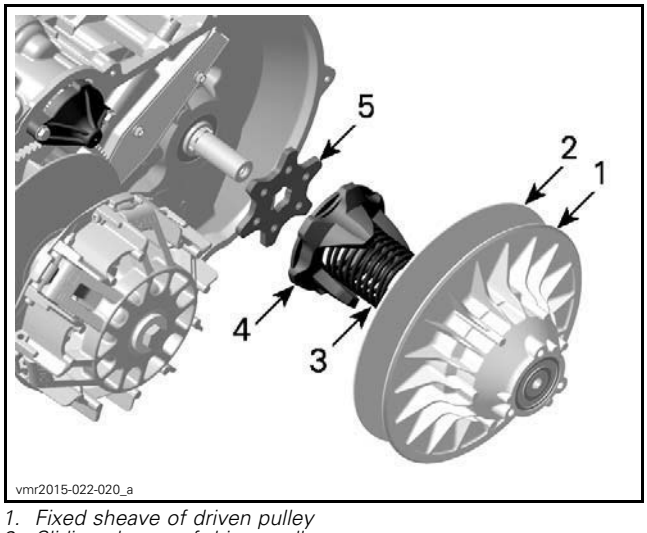
⚠ WARNING

Driven pulley is spring loaded. Hold driven clutch pulley tight and slowly remove the driven pulley screw to release spring tension.



1. Driven pulley screw
2. Washer
3. Driven pulley fixed sheave

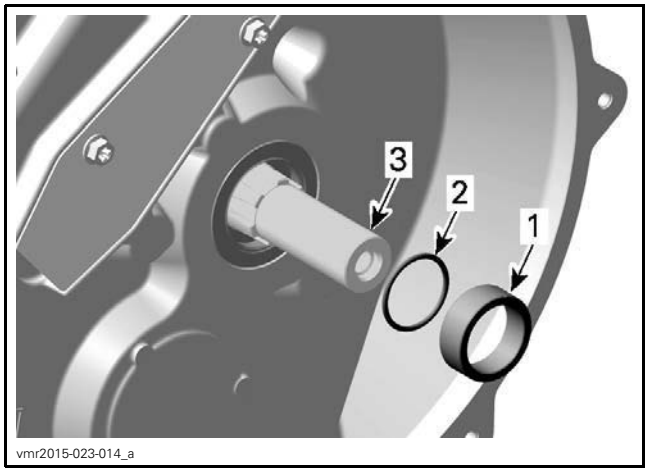
Remove:
– Driven pulley
– Spring
– Cam
– Plate.



1. Fixed sheave of driven pulley
2. Sliding sheave of driven pulley
3. Spring
4. Cam
5. Plate

Remove distance sleeve including O-ring from counter shaft on engine PTO side.

Replace O-ring if brittle, hard or damaged.

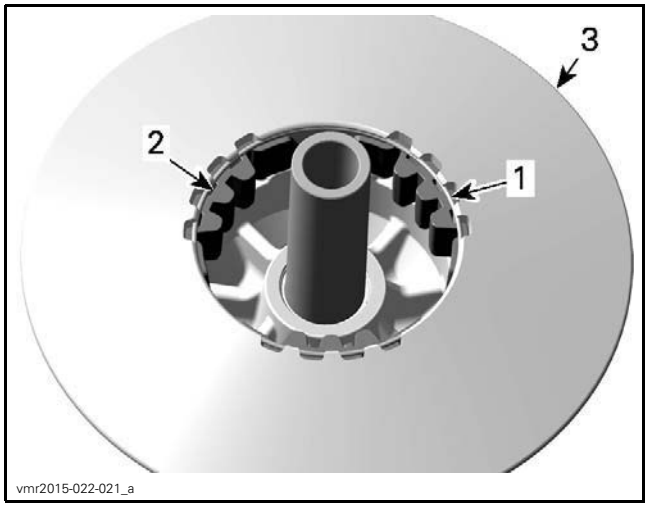


1. Distance sleeve
2. O-ring
3. Counter shaft

Driven Pulley Disassembly

Fixed Sheave

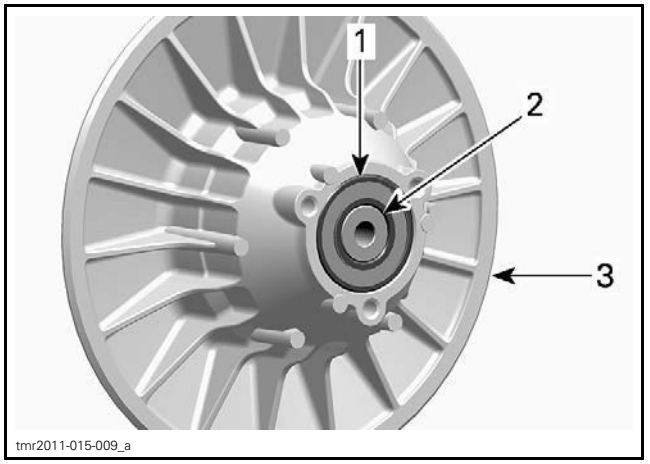
Remove retaining ring and lift torque gear.



1. Retaining ring
2. Torque gear
3. Fixed sheave of driven pulley

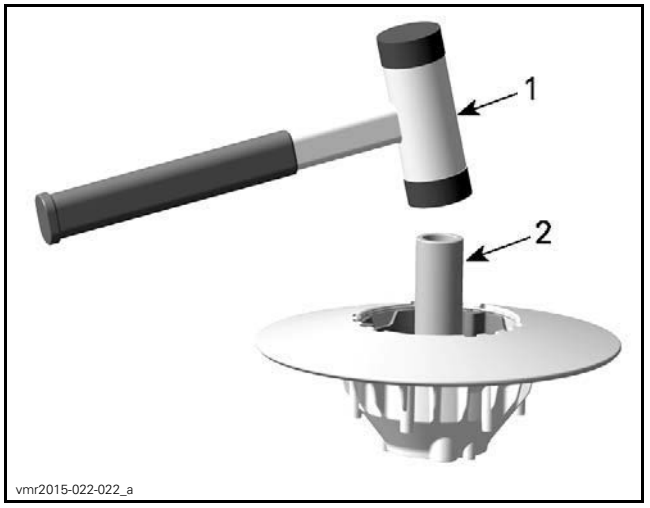
NOTE: The following procedure is not necessary except if ball bearing or shaft must be removed. Refer to *INSPECTION* before proceeding.

Heat ball bearing area up to 100°C (212°F) before removing ball bearing.



1. Ball bearing
2. Shaft
3. Fixed sheave of driven pulley

Use a soft hammer to push shaft with bearing out of fixed sheave.



1. Soft hammer
2. Shaft

Remove shaft from ball bearing.

Driven Pulley Cleaning

To remove a dust deposit from cam or shaft, use a dry cloth.

Clean pulley faces and shaft with fine steel wool and dry cloth.

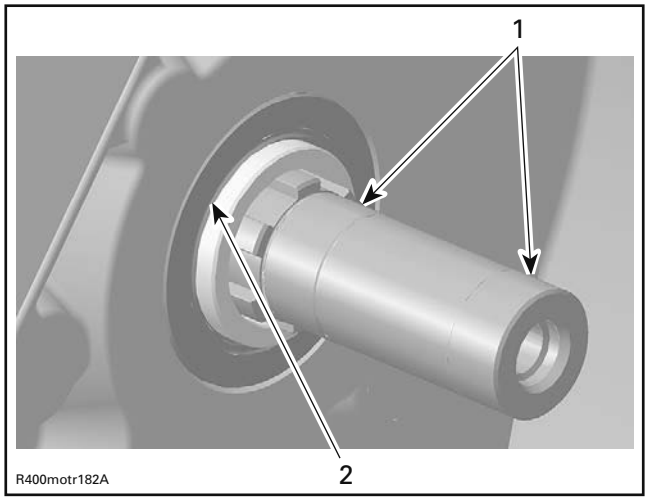
Clean driven pulley using the recommended product

RECOMMENDED PRODUCT
PULLEY FLANGE CLEANER (P/N 413 711 809)

Clean the CVT crankcase area from contamination.

Using a paper towel with cleaning solvent to clean counter shaft end and the inside of the shaft.

NOTICE To avoid damage, make sure cleaner does not contact the counter oil shaft seal.



1. Counter shaft supports
2. Sealing lip of counter shaft oil seal

Driven Pulley Inspection

Sliding Sheave

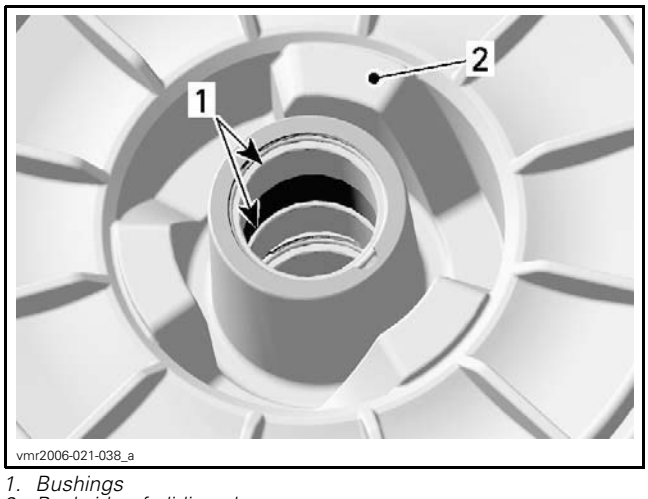
Check sliding sheave for cracks and sliding contact surface for excessive wear. Replace sliding sheave if necessary.

Check bushings for cracks, scratch and for free movement when assembled to sliding sheave.

Using a dial bore gauge, measure bushing diameters. Measuring point must be at least 5 mm (1/4 in) from bushing edges.

Measure bushing inner diameter.

NOTE: Bushings cannot be replaced. Replace sliding sheave if bushings are out of specification. Visually inspect coatings.



1. Bushings
2. Backside of sliding sheave

REQUIRED TOOL
Dial bore gauge

MEASURING POINT
At least 5 mm (1/4 in) from bushing edge

BUSHINGS INNER DIAMETER	
NEW	30.060 mm to 30.100 mm (1.183 in to 1.185 in)
SERVICE LIMIT	30.200 mm (1.189 in)

Fixed Sheave

Check fixed sheave for cracks and excessive wear. Replace fixed sheave if necessary.

Check ball bearing for free play and smooth operation. Replace if necessary.

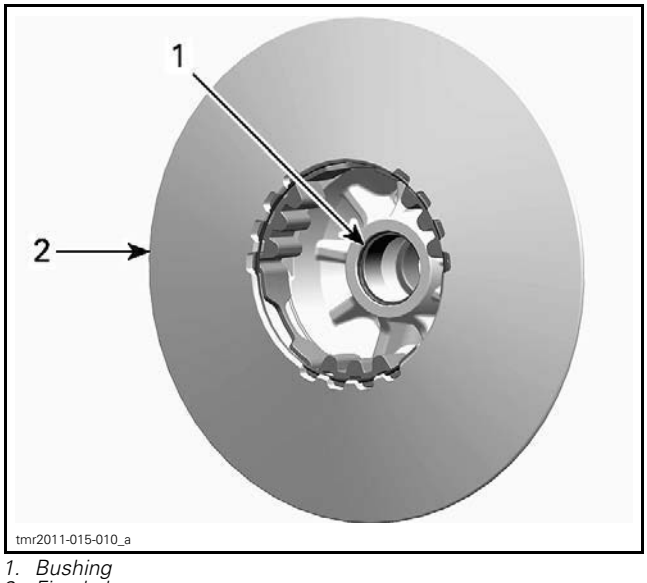
Check shaft for heavy wear or visible damage. Replace if necessary.

If the shaft is removed, measure bushing inner diameter

NOTE: This bushing cannot be replaced. Replace fixed sheave if bushing is out of specification. Visually inspect coatings.

REQUIRED TOOL
Dial bore gauge

MEASURING POINT
At least 5 mm (1/4 in) from bushing edge

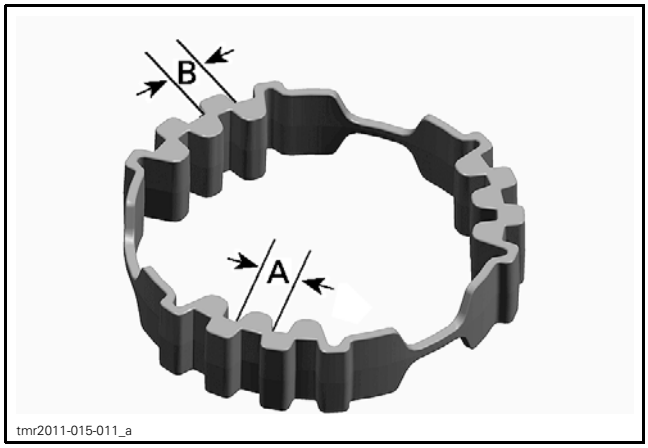


1. Bushing
2. Fixed sheave

BUSHING INNER DIAMETER	
NEW	30.060 mm to 30.100 mm (1.183 in to 1.185 in)
SERVICE LIMIT	30.200 mm (1.189 in)

Check torque gear for visible damage and cracks.

Measure for wear limit using a caliper.

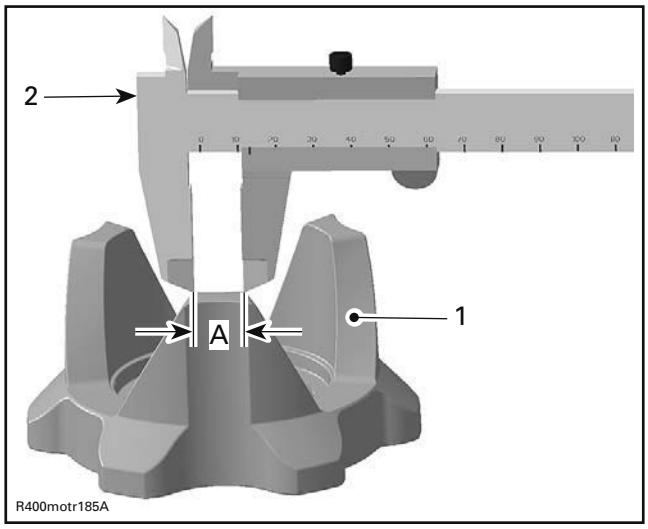


A. Measurement inside
B. Measurement outside

WEAR ON TEETH (BOTH SIDES)	
SERVICE LIMIT	7.500 mm (.295 in)

Cam

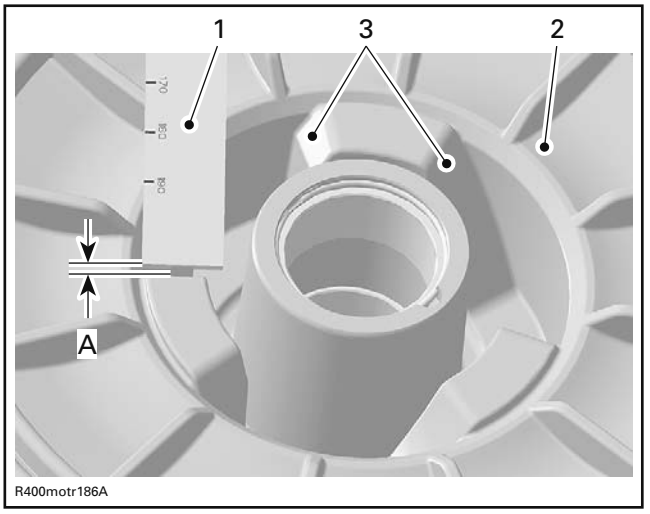
Check cam for visible damage and measure for wear using a caliper.



1. Contact surfaces for power train
2. Caliper

A. Width to be measured due to wear on contact surface

WIDTH ON TOP SURFACE	
SERVICE LIMIT	6.000 mm (.236 in)



1. Caliper
2. Sliding sheave
3. Contact surface

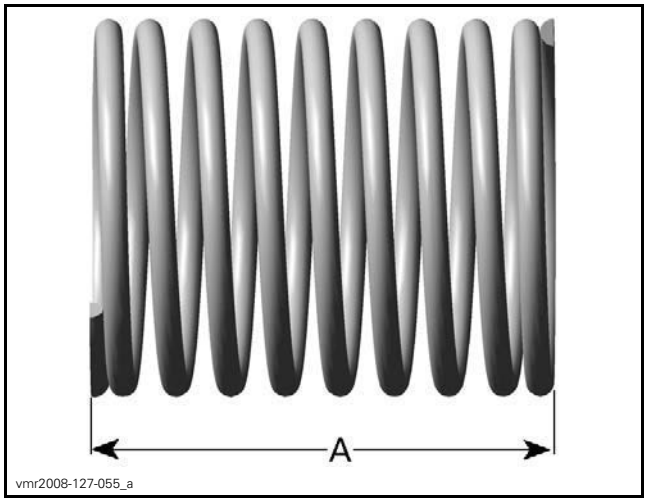
A. Wear to be measured

WEAR ON CONTACT SURFACE	
SERVICE LIMIT	1.000 mm (.039 in)

Spring

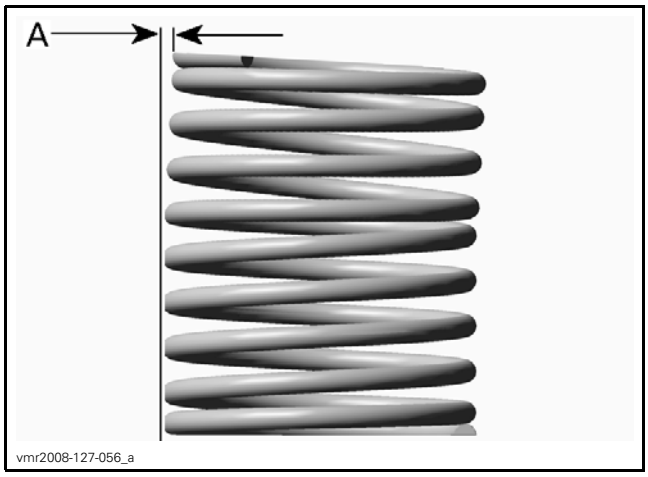
Measure spring free length and squareness. If spring is out of specification, replace by a new one.

SPRING FREE LENGTH	
SERVICE LIMIT	164 mm (6.457 in)



A. Free length

CLUTCH SPRING SQUARENESS	
SERVICE LIMIT	3.8 mm (.15 in)



A. Squareness

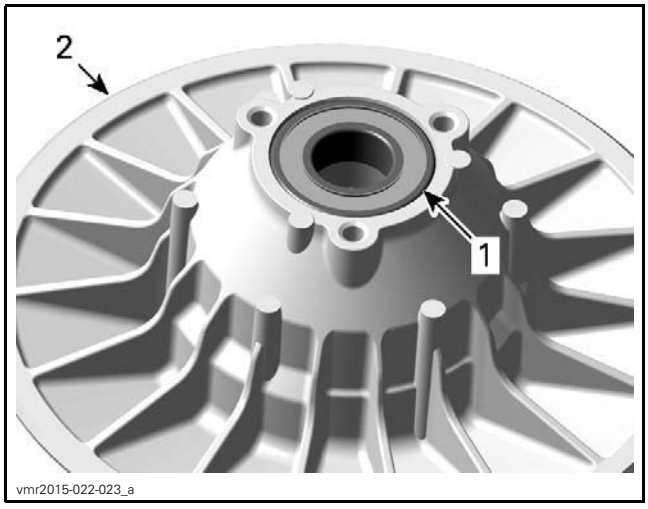
Driven Pulley Assembly

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

Heat ball bearing area up to 100°C (212°F) before ball bearing installation.

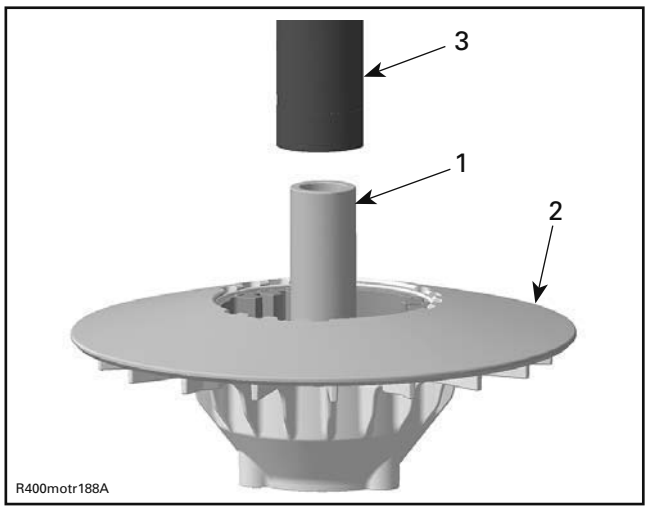
NOTE: Place new ball bearing in a freezer for 10 minutes before installation.

Install ball bearing with the writing on top and push only on the outer ring.



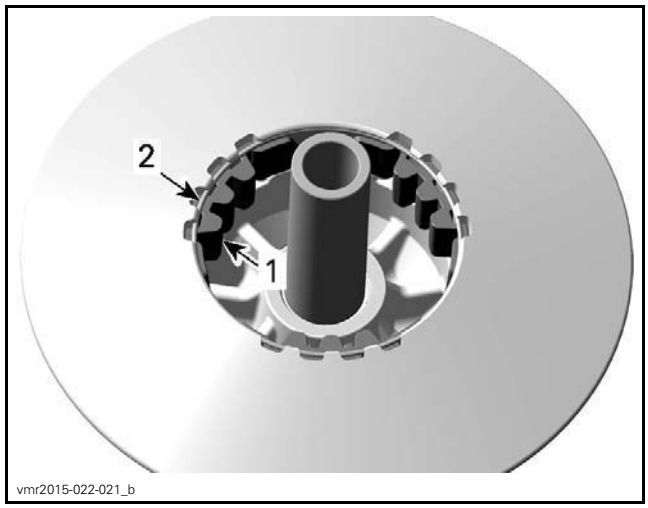
1. Ball bearing

NOTICE Do not use a hammer, use a press only.



1. Shaft
2. Fixed sheave
3. Press machine

Install torque gear then secure it with retaining ring.



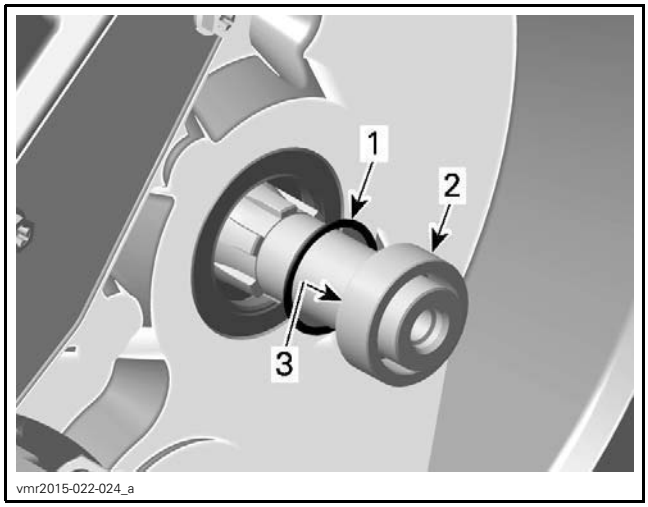
1. Torque gear
2. Retaining ring

Driven Pulley Installation

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

Place O-ring on counter shaft splines and move it with spacer in end position.

NOTICE Chamfer on inside diameter of the spacer must face engine side.



1. O-ring
2. Distance sleeve
3. Chamfered area of distance sleeve

Clean:

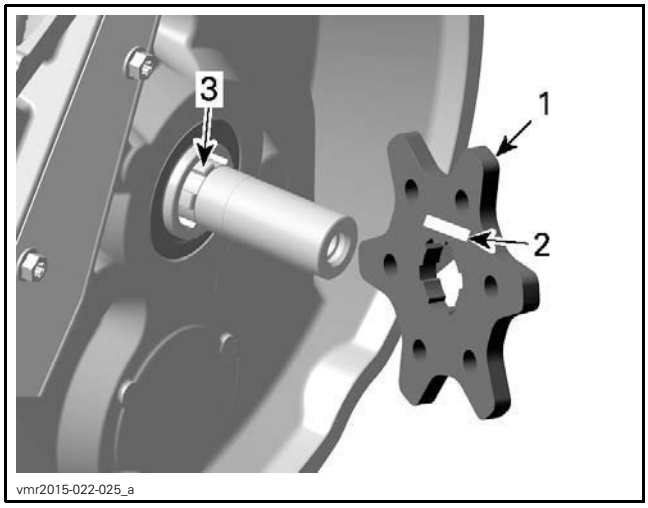
– Threads of gearbox counter shaft
– Driven pulley screw threads.

REQUIRED SERVICE PRODUCT
PULLEY FLANGE CLEANER (P/N 413 711 809)

NOTICE **Threads of gearbox counter shaft and driven pulley screw must be free of oil and grease. Lubricants in threads will create too high preload to tightened driven pulley screw.**

Install cam retainer on counter shaft spline the right way then install cam.

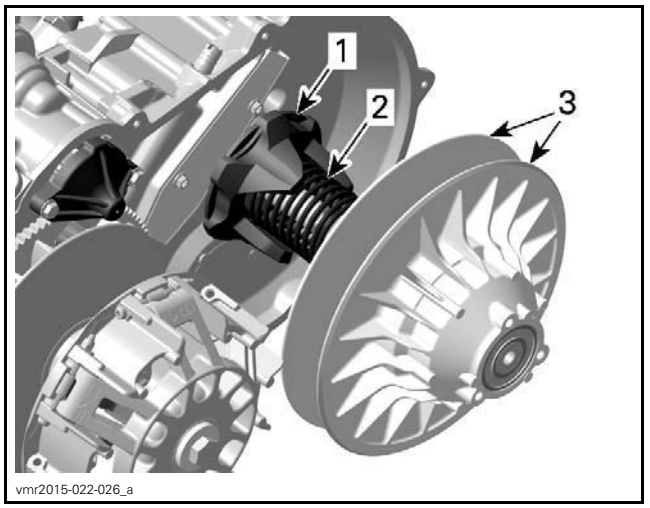
NOTE: Place cam retainer with printed mark "ENGINE SIDE" towards the engine.



1. Cam retainer
2. Printed mark "ENGINE SIDE"
3. Counter shaft spline

Insert sliding sheave into fixed sheave.

Place spring behind sliding sheave then align driven pulley with cam.



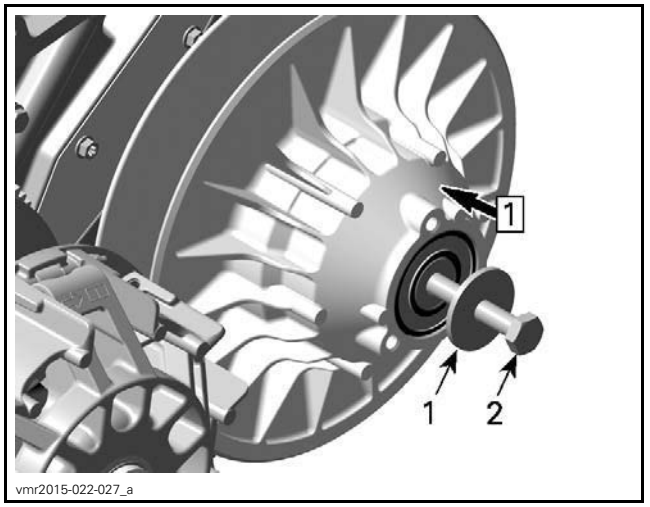
1. Cam
2. Spring
3. Driven pulley

With your hand, push the driven pulley onto the shaft to compress the spring.

NOTICE **A cam not correctly engaged will cause damage to the driven pulley and cam.**

Install the driven pulley screw and its washer.

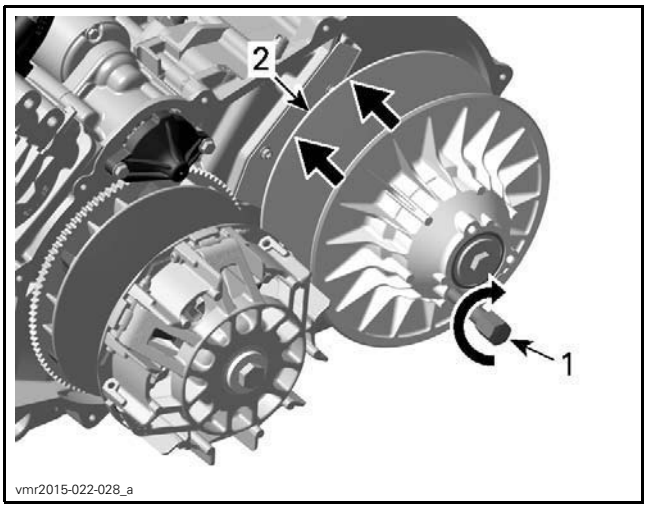
NOTE: Tighten the screw with your hand sufficiently for the cam to remain engaged.



Step 1: Push
1. Washer
2. Driven pulley screw

Install drive belt. Refer to *DRIVE BELT* in this subsection.

REQUIRED TOOL	
PULLER/LOCKING TOOL (P/N 529 036 098)	



1. Puller/locking tool
2. Sliding sheave

NOTE: If driven pulley sheaves cannot be opened when the service tool is screwed in, the cam is not correctly engaged in the sliding sheave.

Torque driven pulley screw to specification.

DRIVEN PULLEY SCREW TIGHTENING PROCEDURE	
Step 1	20 N•m ± 1 N•m (15 lbf•ft ± 1 lbf•ft)
Step 2	180° ± 5°

Check driven pulley end play.

SPECIFICATION	
Driven pulley end play	0 mm (0 in)

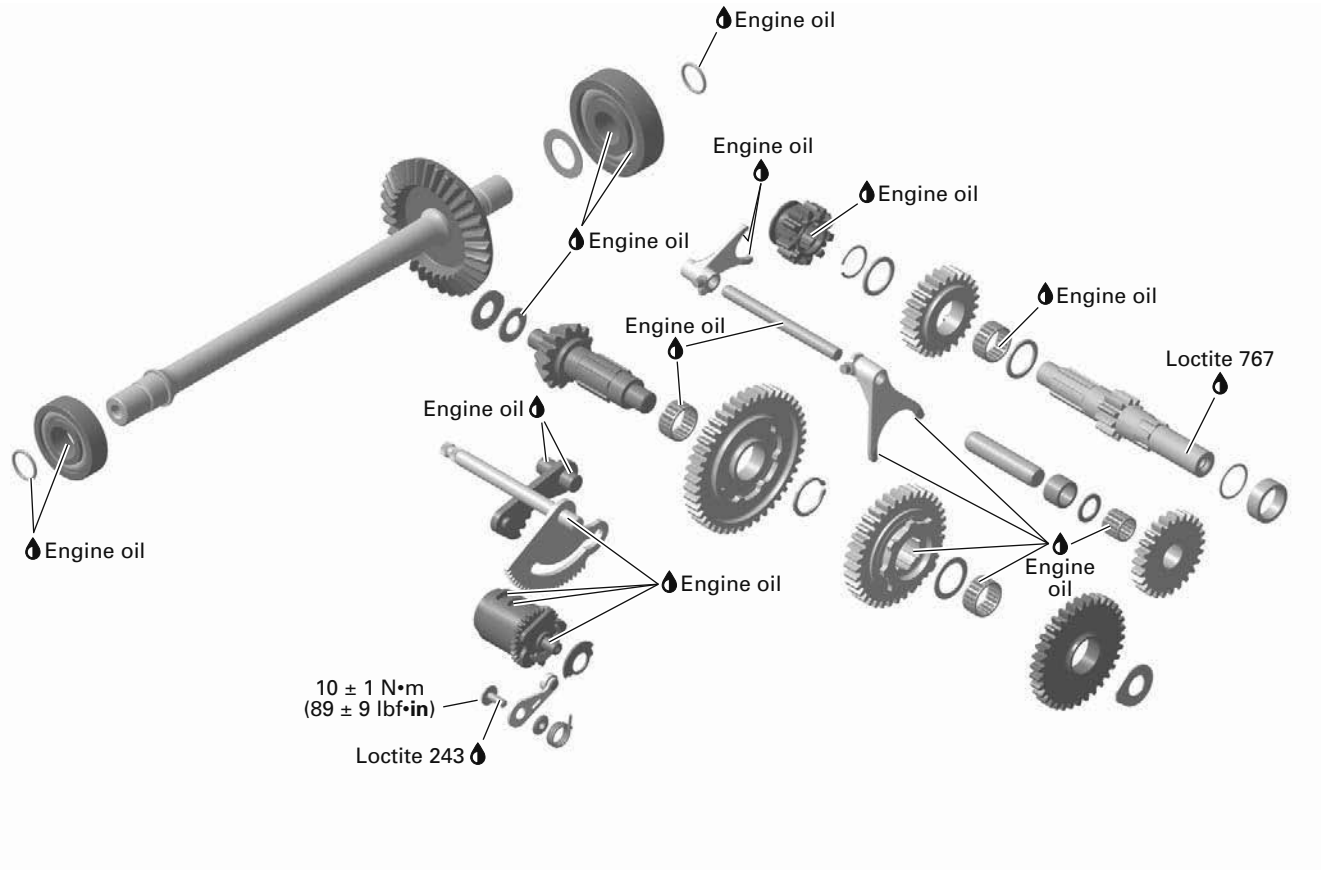
GEARBOX AND 4X4 COUPLING UNIT

SERVICE TOOLS

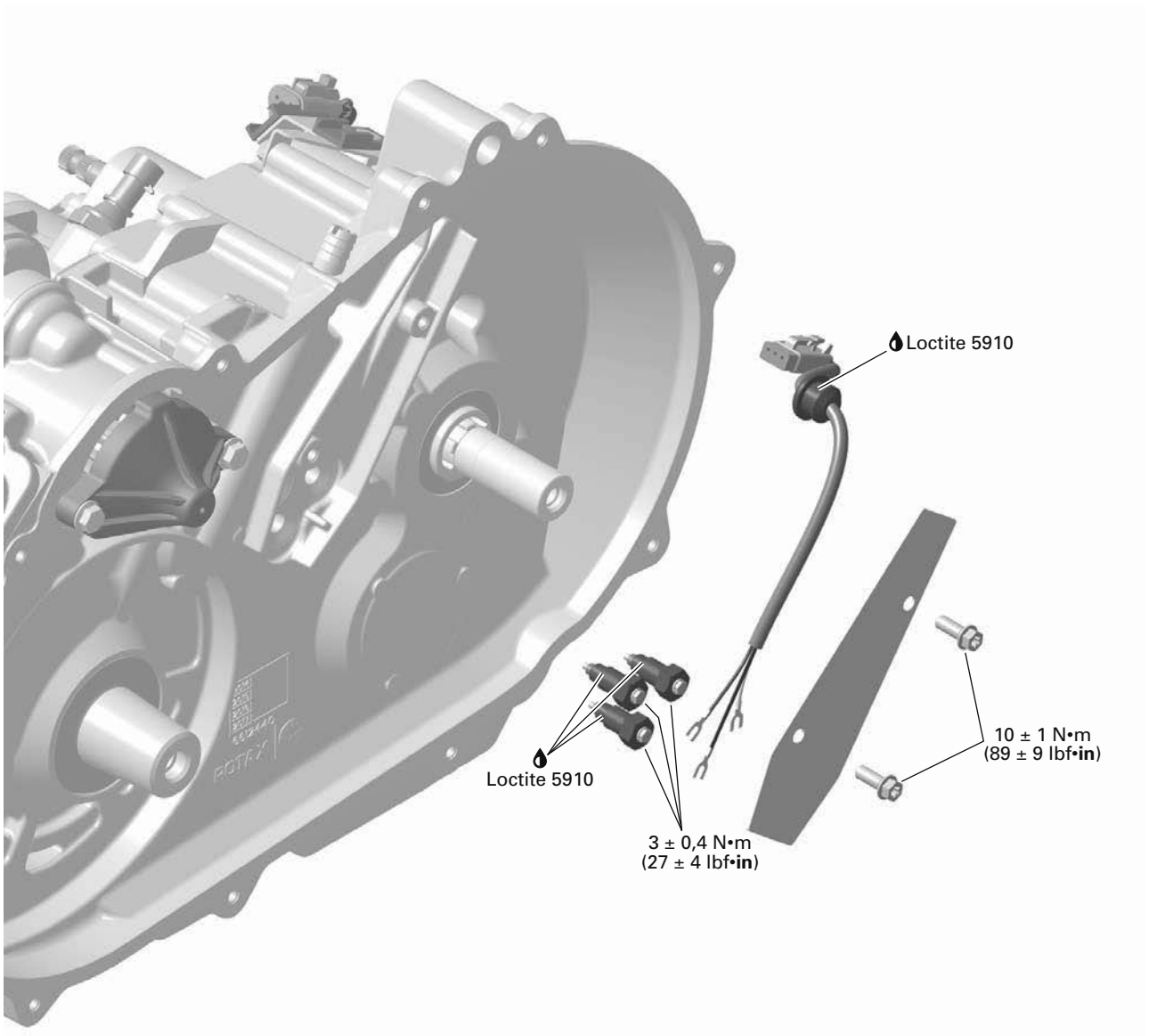
Description	Part Number	Page
BLIND HOLE BEARING PULLER SET	529 036 117	227
FLUKE 115 MULTIMETER	529 035 868	221

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	224, 229–230
LOCTITE 5910	293 800 081	222
XPS SYNTHETIC GREASE	293 550 010	230

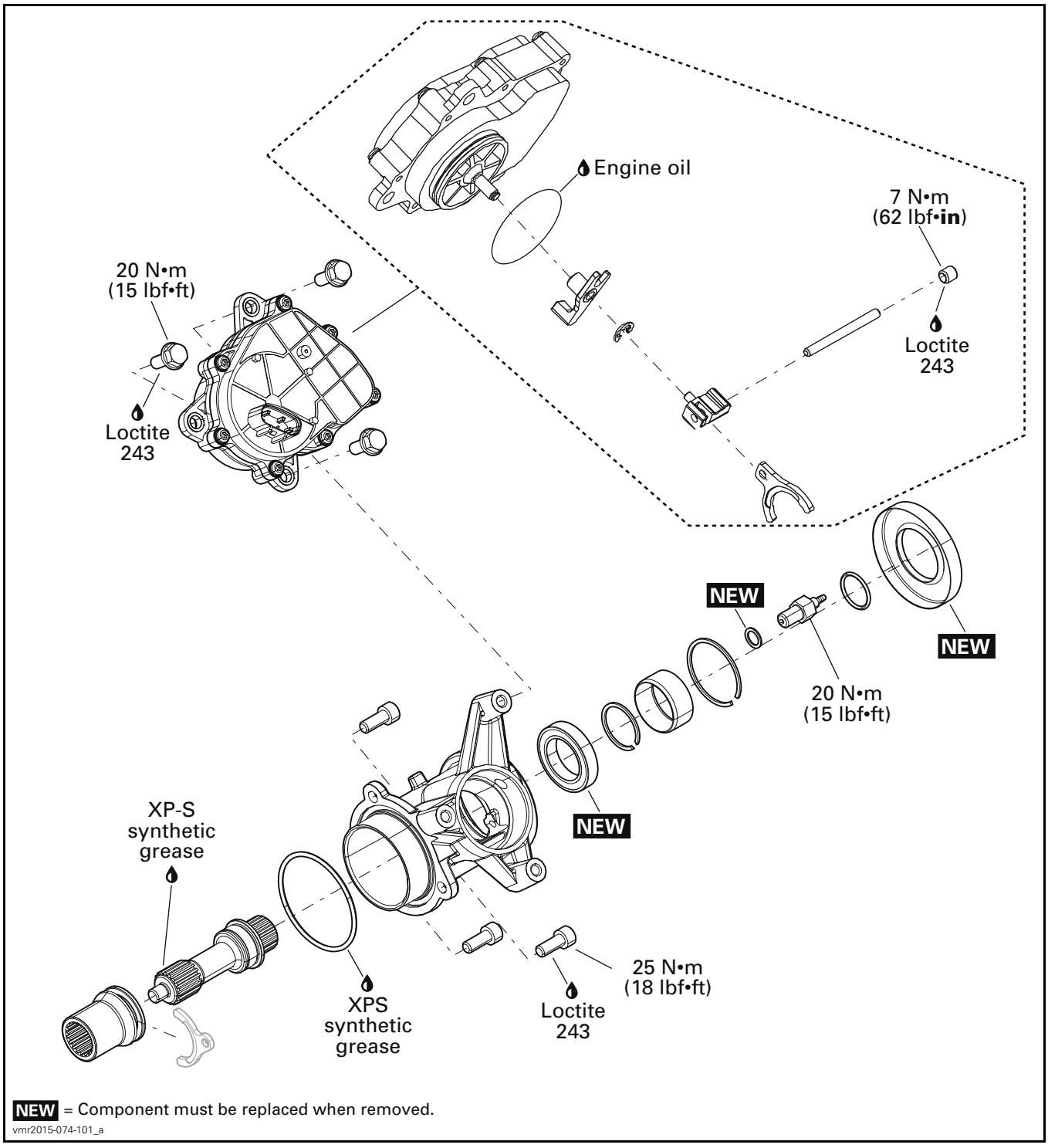


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4X4 COUPLING UNIT



NEW = Component must be replaced when removed.

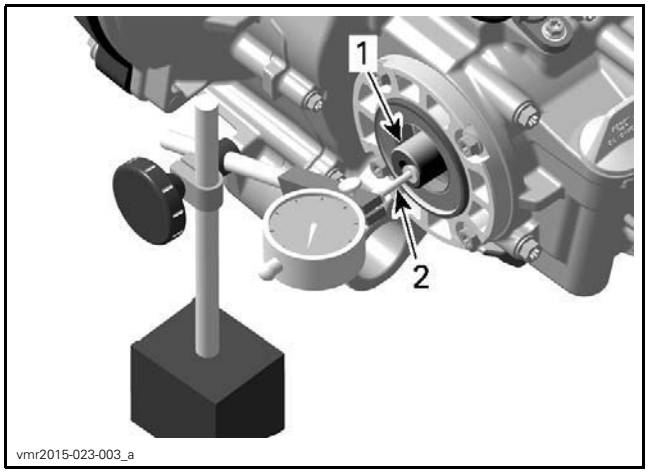
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PROCEDURES

OUTPUT SHAFT

Output Shaft Removal

1. Remove engine from the vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
2. Measure output shaft axial clearance prior to remove it.



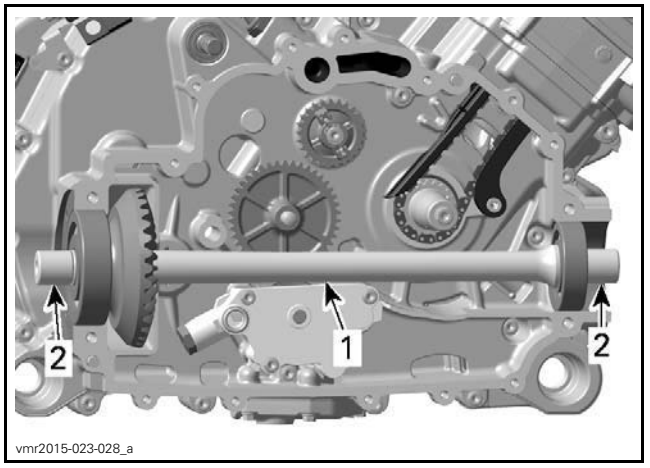
1. Output shaft
2. Dial indicator

OUTPUT SHAFT AXIAL CLEARANCE	
NEW	0.09 mm to 0.18 mm (.004 in to .007 in)
SERVICE LIMIT	0.30 mm (.012 in)

If the output shaft axial clearance is out of specification, crankcase must be split and the bevel gear must be adjusted. See *GEARBOX ADJUSTMENT* in this subsection.

NOTICE If the output shaft must be replaced, always replace the bevel gear shaft at the same time.

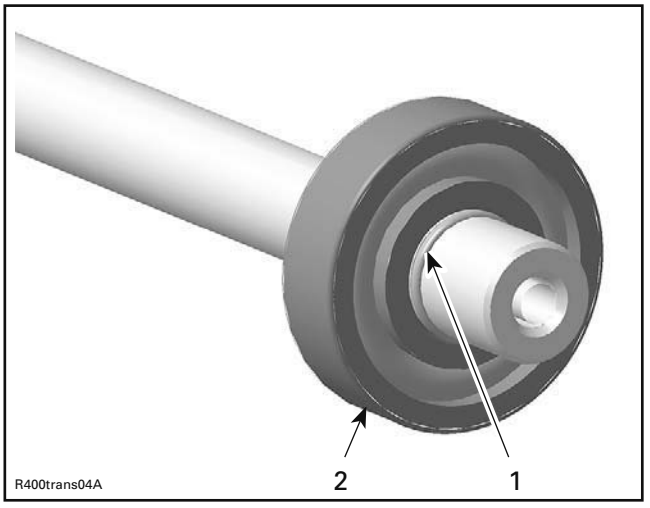
3. Refer to *MAGNETO AND STARTER* subsection to remove:
   - Output shaft bearing cover
   - Magneto cover
   - Rotor.
4. Use a soft hammer to remove output shaft with its bearings from housing.



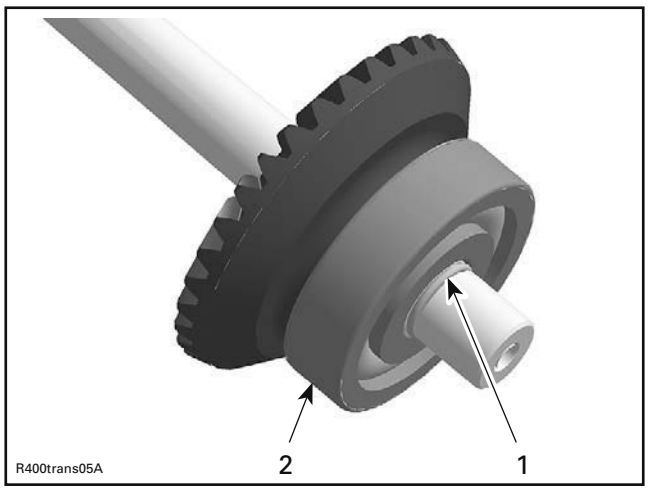
1. Output shaft
2. Ball bearings

5. Remove both O-rings and both bearings from output shaft.

NOTE: Both bearings on output shaft have a transition fit.

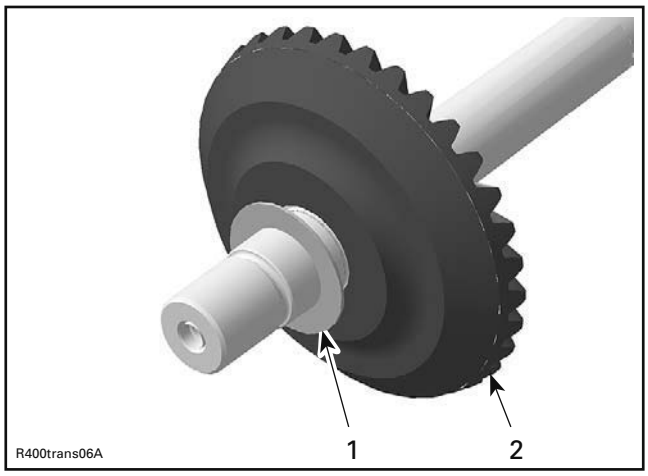


1. O-ring
2. Bearing on front side



1. O-ring
2. Bearing on rear side

6. Withdraw adjustment shim.



1. Adjustment shim
2. Output shaft bevel gear

Output Shaft Inspection

Check output shaft for bending, cracks and other visible damages.

NOTICE Always replace output shaft and bevel gear shaft at the same time.

Check output shaft bevel gear for wear and teeth damages.

Check if output shaft bearings turn freely and smoothly. Replace if necessary.

Replace output shaft oil seal if brittle, hard or damaged. Refer to *BOTTOM END* subsection for replacement procedure.

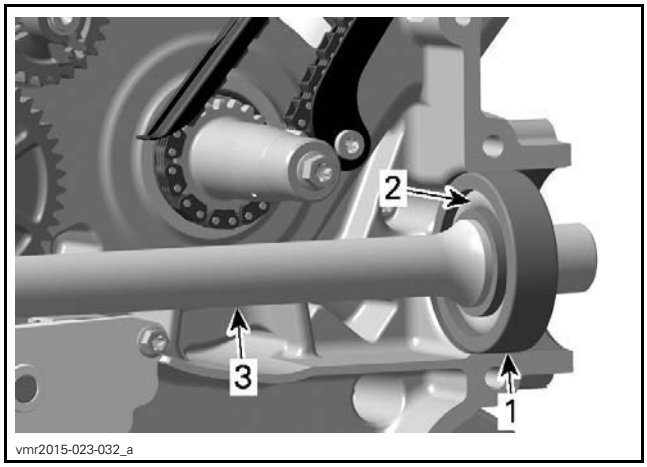
Replace O-rings of output shaft if brittle, hard or damaged.

Clean crankcase and magneto cover mating surface and especially the bearing areas from metal particles or other contamination.

Output Shaft Installation

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

Install front ball bearing with open side of plastic-cage facing to the inside of the engine.



1. Ball bearing (front side)
2. Open side of plastic cage
3. Output shaft

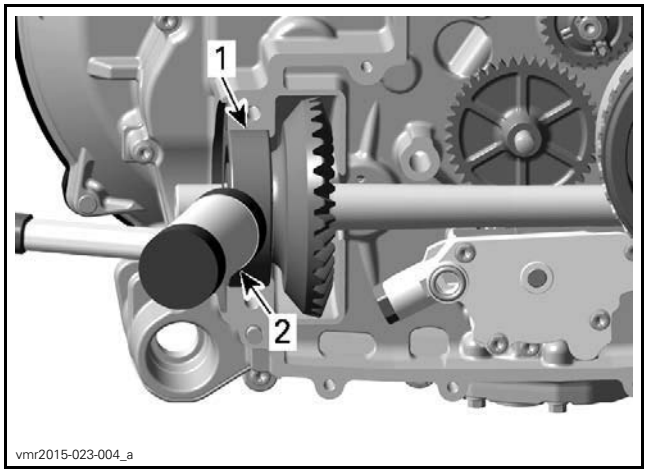
Adjust axial play as per following procedure:

Install output shaft in crankcase.

NOTICE Do not install thrust washer on output shaft ring gear side yet.

Put bearings exactly in place against crankcase.

REQUIRED TOOL
Soft hammer

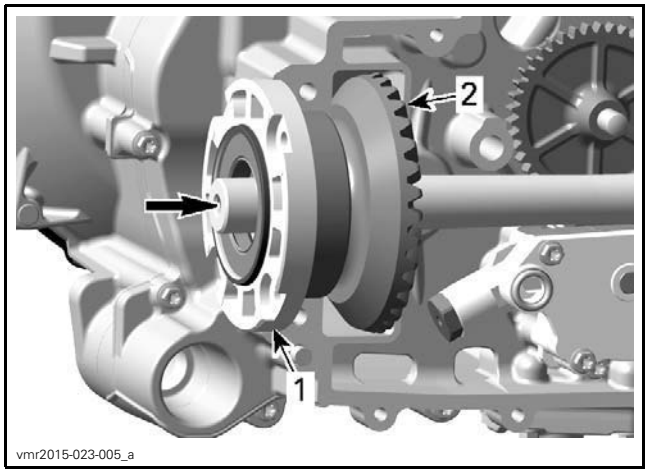


1. Output shaft ball bearing
2. Soft hammer

Install output shaft bearing cover.

NOTE: Do not apply sealant on bearing cover yet.

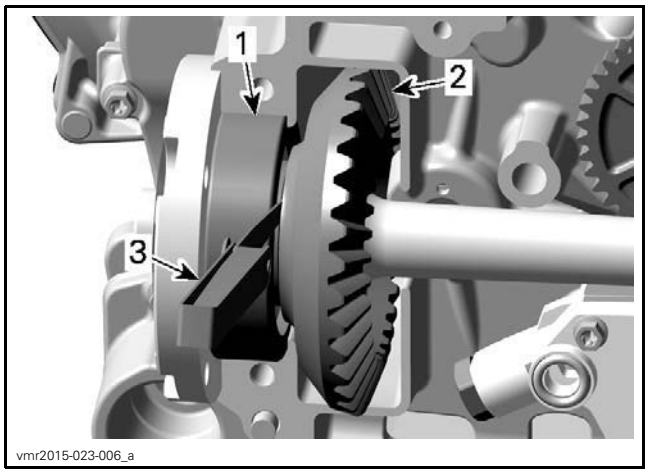
Push output shaft as per following illustration.



WAY TO PUSH THE BEVEL GEARS TOGETHER
1. *Bearing cover*
2. *Output shaft bevel gear*

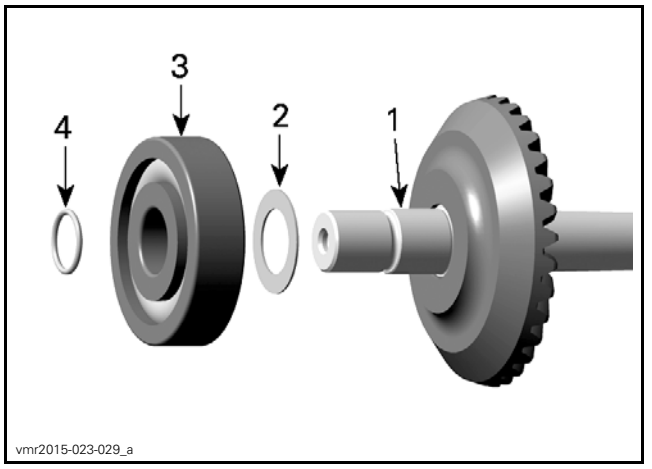
Measure axial gap between bearing and output shaft bevel gear.

REQUIRED TOOL
Feeler gauge



1. *Output shaft ball bearing*
2. *Output shaft bevel gear*
3. *Feeler gauge*

Remove output shaft again and rebuild it with proper adjustment shim.



1. *Output shaft*
2. *Adjustment shim*
3. *Ball bearing*
4. *O-ring*

Use the measured thickness to choose the required adjustment shim as per the following table.

MEASURED THICKNESS	ADJUSTMENT SHIM THICKNESS
0.79 mm to 0.88 mm (.0311 in to .0346 in)	0.70 mm (.0276 in)
0.89 mm to 0.98 mm (.035 in to .0386 in)	0.80 mm (.0315 in)
0.99 mm to 1.08 mm (.039 in to .0425 in)	0.90 mm (.0354 in)
1.08 mm to 1.18 mm (.0425 in to .0465 in)	1.00 mm (.0394 in)
1.19 mm to 1.28 mm (.0469 in to .0504 in)	1.10 mm (.0433 in)
1.29 mm to 1.38 mm (.0508 in to .0543 in)	1.20 mm (.0472 in)
1.39 mm to 1.48 mm (.0547 in to .0583 in)	1.30 mm (.0512 in)
1.49 mm to 1.58 mm (.0587 in to .0622 in)	1.40 mm (.0551 in)

NOTE: Output shaft axial clearance of 0.09 mm to 0.18 mm (.004 in to .007 in) is included in the above table.

Install output shaft.

Install magneto cover and bearing cover. Refer to *MAGNETO AND STARTER* subsection in this manual for procedure.

GEARBOX

Gearbox Disassembly

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

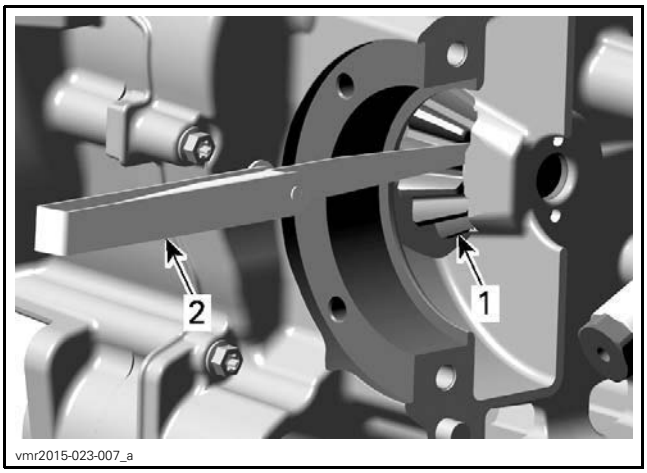
NOTE: During gearbox disassembly, inspect the condition of each part closely.

2. Remove magneto cover and rotor, refer to *MAGNETO AND STARTER* subsection.
3. Remove output shaft.
4. Measure the axial clearance of bevel gear.

NOTE: Bevel gear axial clearance should be measured before crankcase separation.

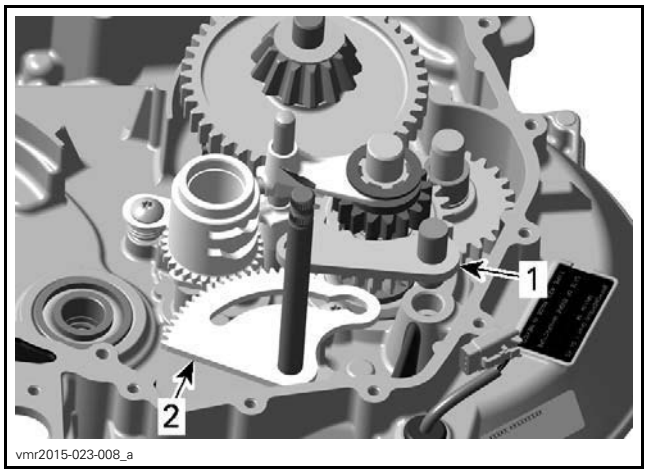
REQUIRED TOOL
Feeler gauge

BEVEL GEAR AXIAL CLEARANCE	
NEW	0.02 mm to 0.11 mm (.0008 in to .0043 in)
SERVICE LIMIT	0.15 mm (.006 in)



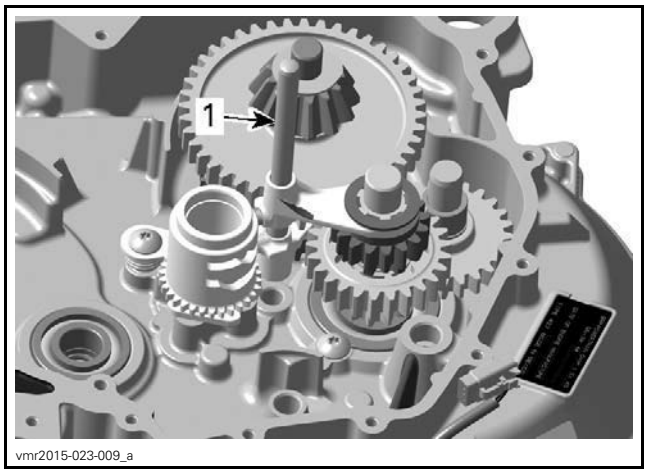
MEASURE AXIAL CLEARANCE
1. Bevel gear
2. Feeler gauge

5. Separate crankcase, refer to *BOTTOM END* subsection.
6. Remove balancer shaft, refer to *BOTTOM END* subsection.
7. Remove:
   – Parking lever
   – Shift shaft.



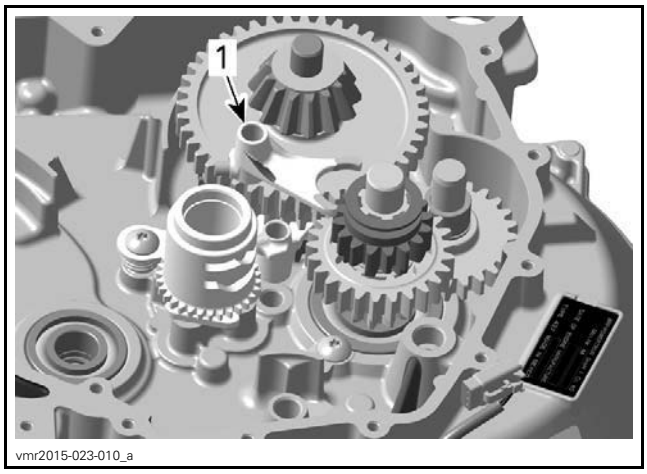
1. Parking lever
2. Shift shaft

8. Remove shift fork shaft.



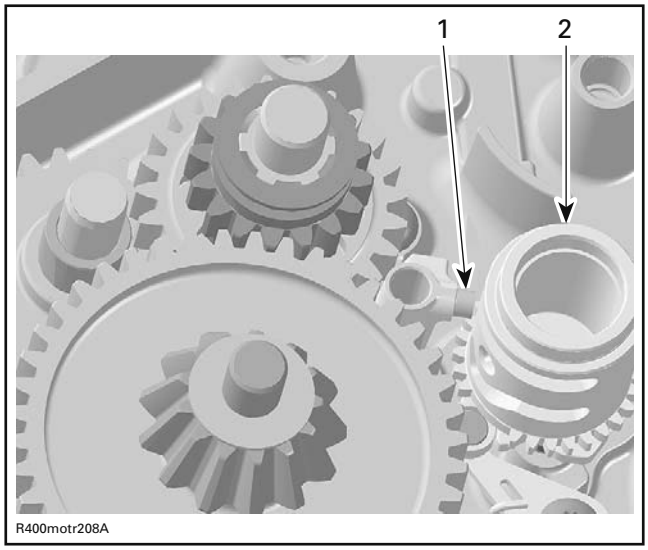
1. Shift fork shaft

9. Remove shift fork.



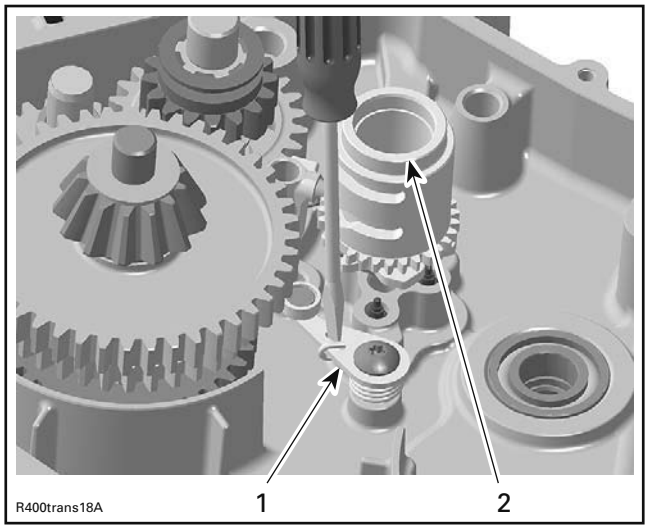
1. Shift fork (engaged in counter shaft gear)

10. Disengage shift fork from shift drum.



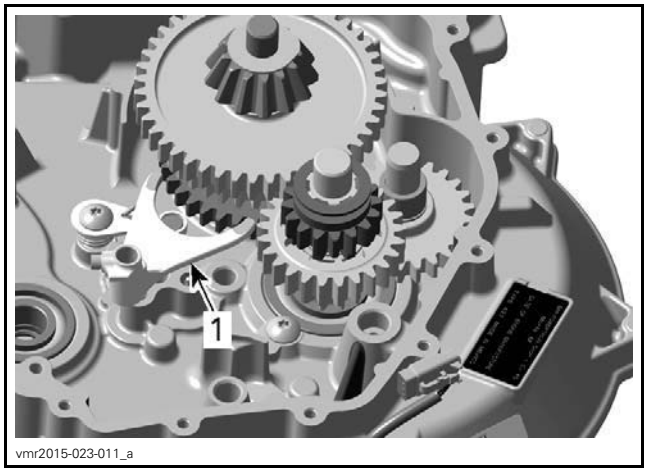
1. Shift fork engagement pin
2. Shift drum

11. Insert a flat screwdriver in the slot of index lever. Turn screwdriver counterclockwise and remove shift drum.



1. Index lever
2. Shift drum

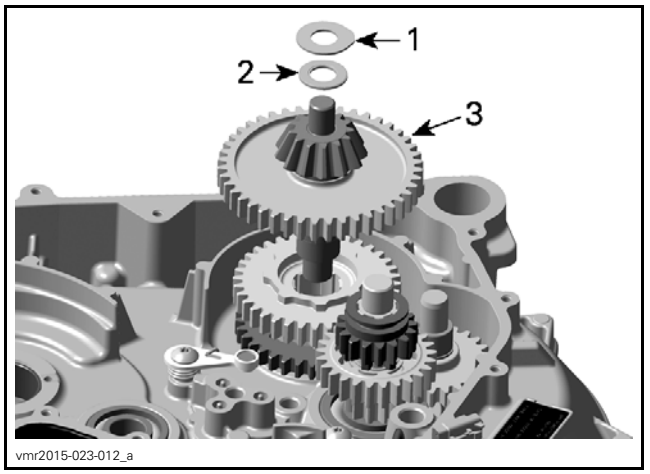
12. Remove shift fork.



1. Shift fork

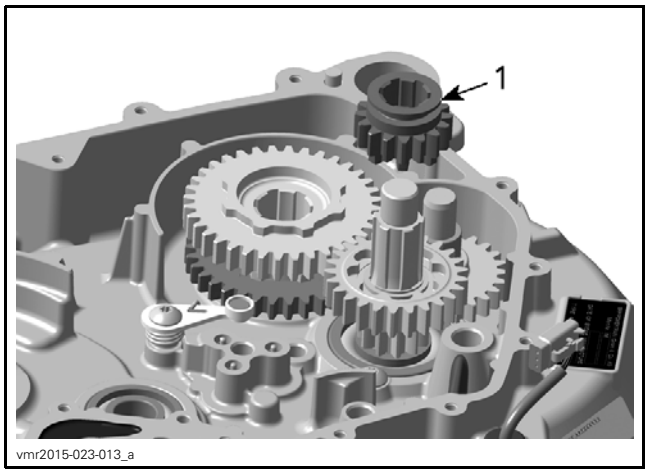
13. Remove:
- Thrust washer
- Axial needle bearing
- Bevel gear shaft with low range gear assembly.

.



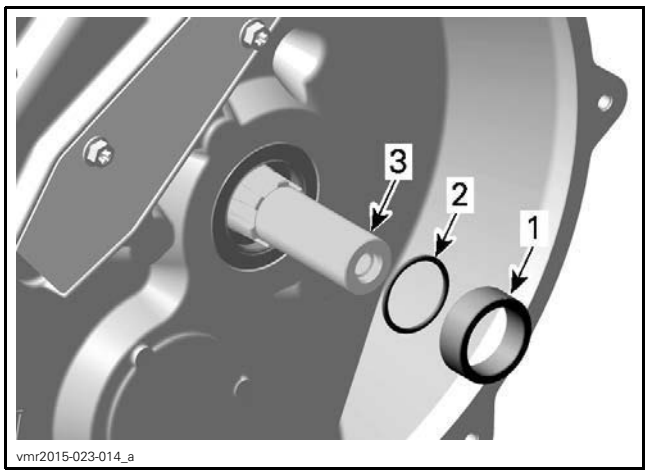
1. Thrust washer
2. Axial needle bearing
3. Bevel gear shaft with low range gear assembly

14. Remove main gear from counter shaft.



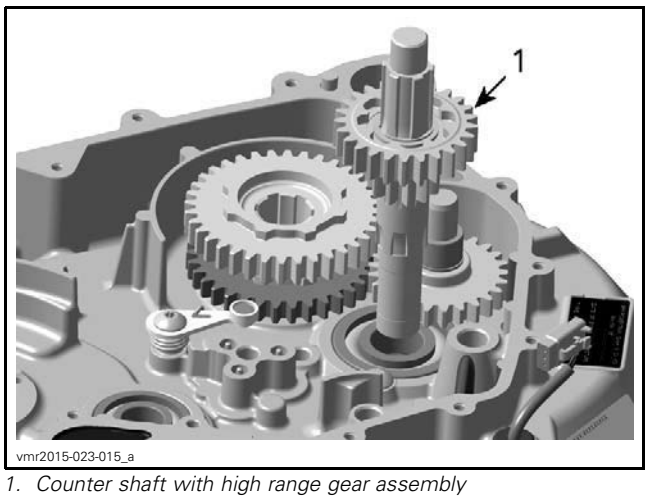
1. Main gear

15. Remove distance sleeve including O-ring from counter shaft on engine PTO side.



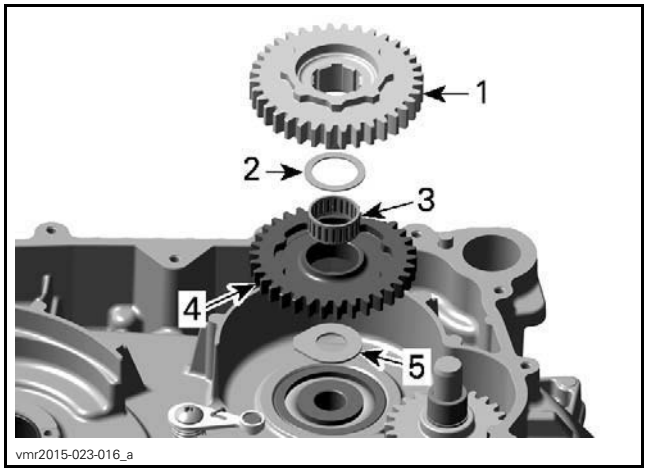
1. Distance sleeve
2. O-ring
3. Counter shaft

16. Remove counter shaft with high range gear assembly.



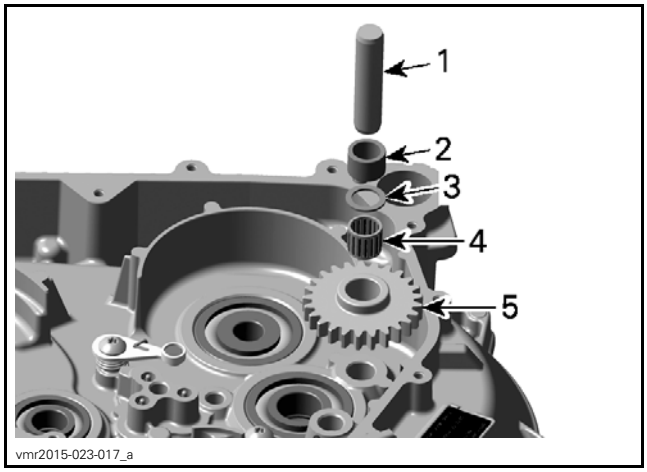
1. Counter shaft with high range gear assembly

17. Remove:
- Sliding gear
- Needle bearing
- Thrust washer
- Reverse gear
- Thrust washer.



1. Sliding gear
2. Needle bearing
3. Thrust washer
4. Reverse gear
5. Thrust washer

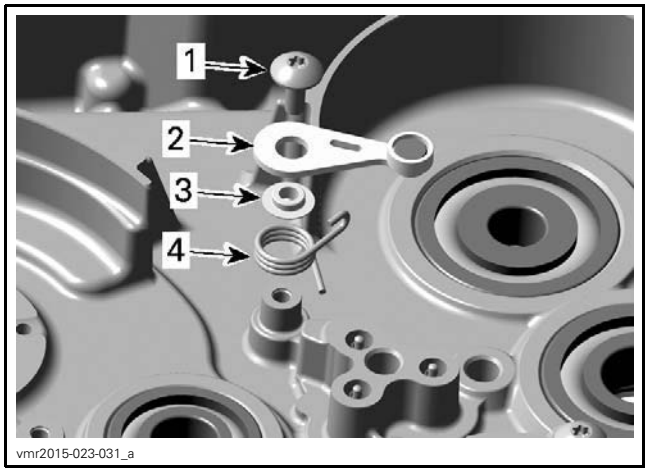
18. Remove:
- Intermediate gear shaft
- Distance sleeve
- Thrust washer
- Needle bearing
- Intermediate gear.



1. Intermediate gear shaft
2. Distance sleeve
3. Thrust washer
4. Needle bearing
5. Intermediate gear

Remove index lever only if necessary.

NOTE: Check index lever for visible damage and if it moves freely. Replace if necessary.



1. *Screw*
2. *Index lever*
3. *Step ring*
4. *Index spring*

Gearbox Inspection

Always verify for the following when inspecting gearbox components:

– Gear teeth damage
– Worn or scored bearing surfaces
– Bent, worn or scored shift fork
– Worn shift fork engagement pins
– Bent, worn or scored shift fork shaft
– Rounded engagement dogs and slots of gears
– Worn grooves on shift drum
– Worn gear engagement groove
– Worn splines on shafts and gears.

Bearings

Check all ball bearings and needle bearings turn freely and smoothly. If rough or any excessive play is detected, replace bearing.

Gears

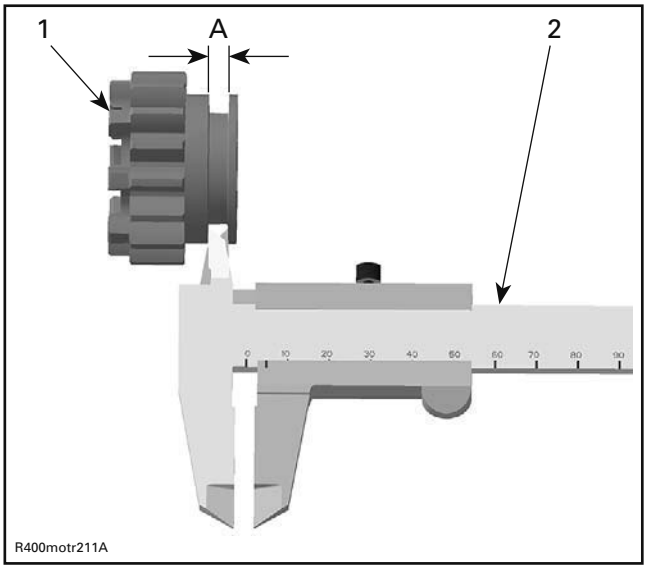
Check tooth flanks of gears.

Replace gears only together with the corresponding meshing gears.

NOTE: Always replace circlips and use special pliers to install them.

Measure the engagement groove width of sliding gears.

ENGAGEMENT GROOVE WIDTH	
NEW	5.00 mm to 5.10 mm (.197 in to .201 in)
SERVICE LIMIT	5.20 mm (.205 in)

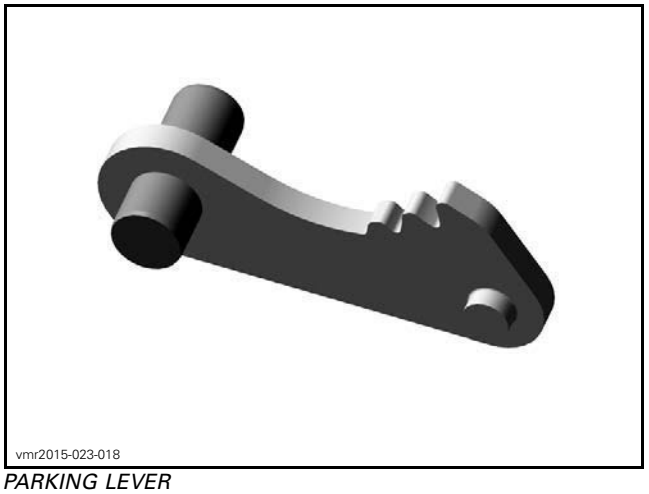


TYPICAL
1. *Main gear*
2. *Caliper*

A. Engagement groove width

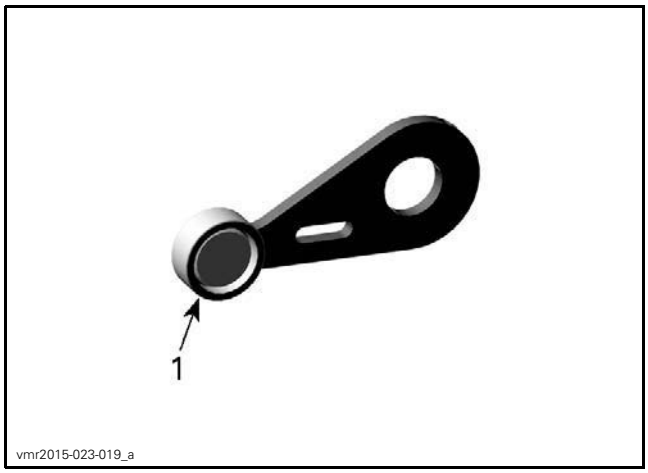
Levers

Parking lever for cracks or other damages.



PARKING LEVER

Roller of index lever must have free movement.



INDEX LEVER
1. Roller

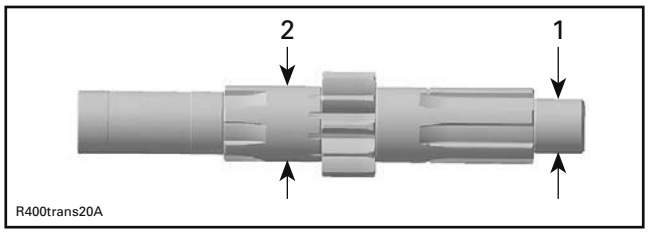
Shafts

Check taper grooves and annular grooves of shafts. Annular grooves must have sharp edges.

Check shift shaft for worn splines and gears.

Check counter shaft for wear.

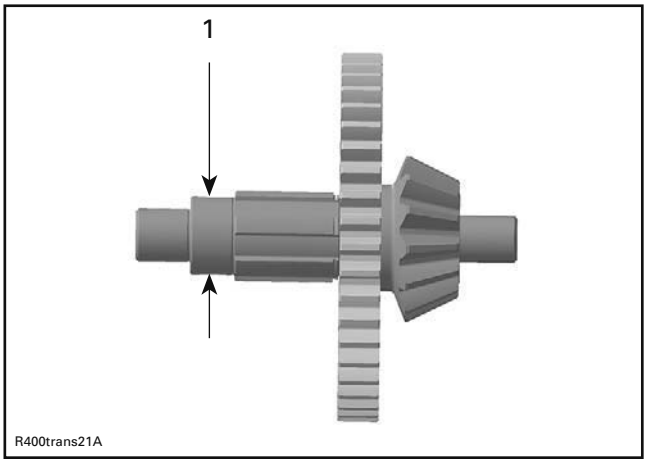
COUNTER SHAFT SERVICE LIMIT	
MAG side	17.990 mm (.708 in)
PTO side	24.950 mm (.982 in)



1. Mag side
2. PTO side

Check bevel gear shaft.

BEVEL GEAR SHAFT SERVICE LIMIT	
PTO side	24.990 mm (.984 in)



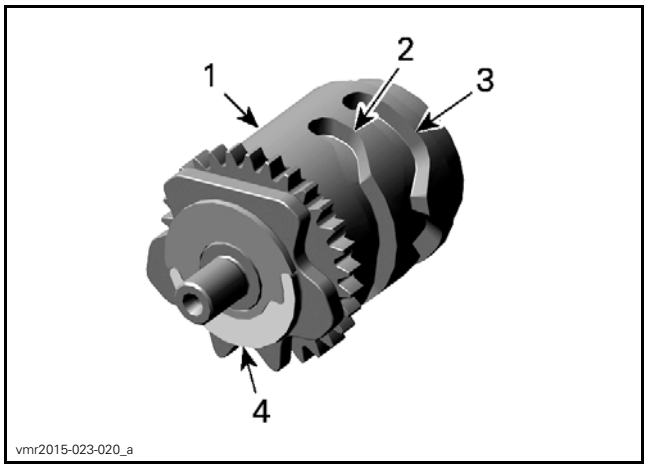
1. PTO side

Shift Drum

Check tracks of shift drum for scoring or heavy wear like rounded engagement slots.

Check index washer on shift drum for scoring or visible damages.

Replace isolating washer if there are signs of wear or visible damages.



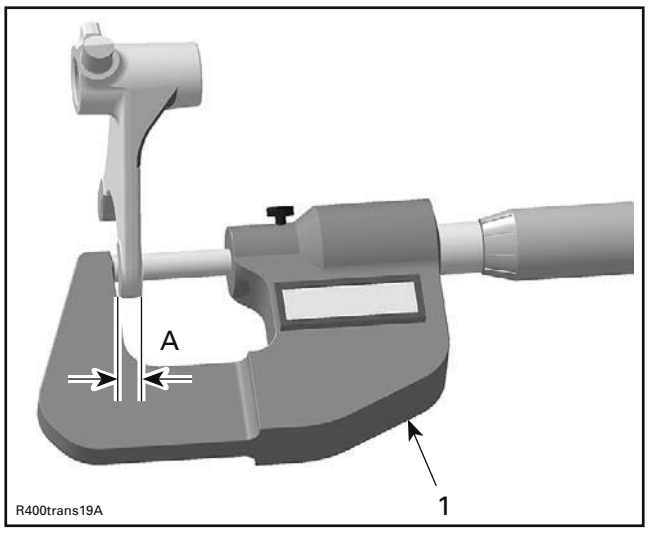
1. Shift drum
2. Track for the low/reverse gear shift fork
3. Track for the high gear shift fork
4. Isolating washer

Shift Forks

Check both shift forks for visible damage, wear or bent shift fork claws.

Measure the shift fork claw thickness.

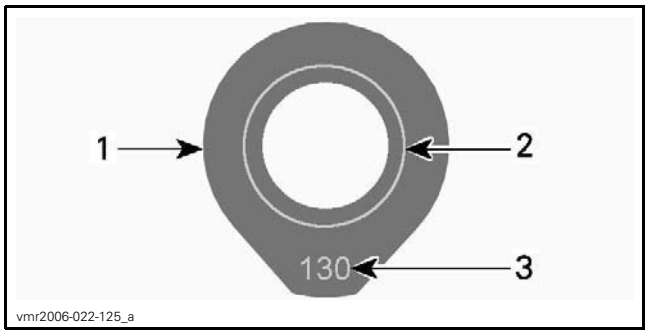
SHIFT FORK CLAW THICKNESS	
NEW	4.800 mm to 4.860 mm (.189 in to .191 in)
SERVICE LIMIT	4.750 mm (.187 in)



1. Micrometer
A. Shift fork claw thickness

Thrust Washers

Check thrust washers for wear. Always replace thrust washer by a new one with the same thickness, when reassembling the gearbox with existing output shaft and bevel gear.



1. Thrust washer for adjusting the bevel gear axial clearance on PTO side
2. Area where wear signs appear
3. Adjustment thickness of the washer

Gearbox Adjustment

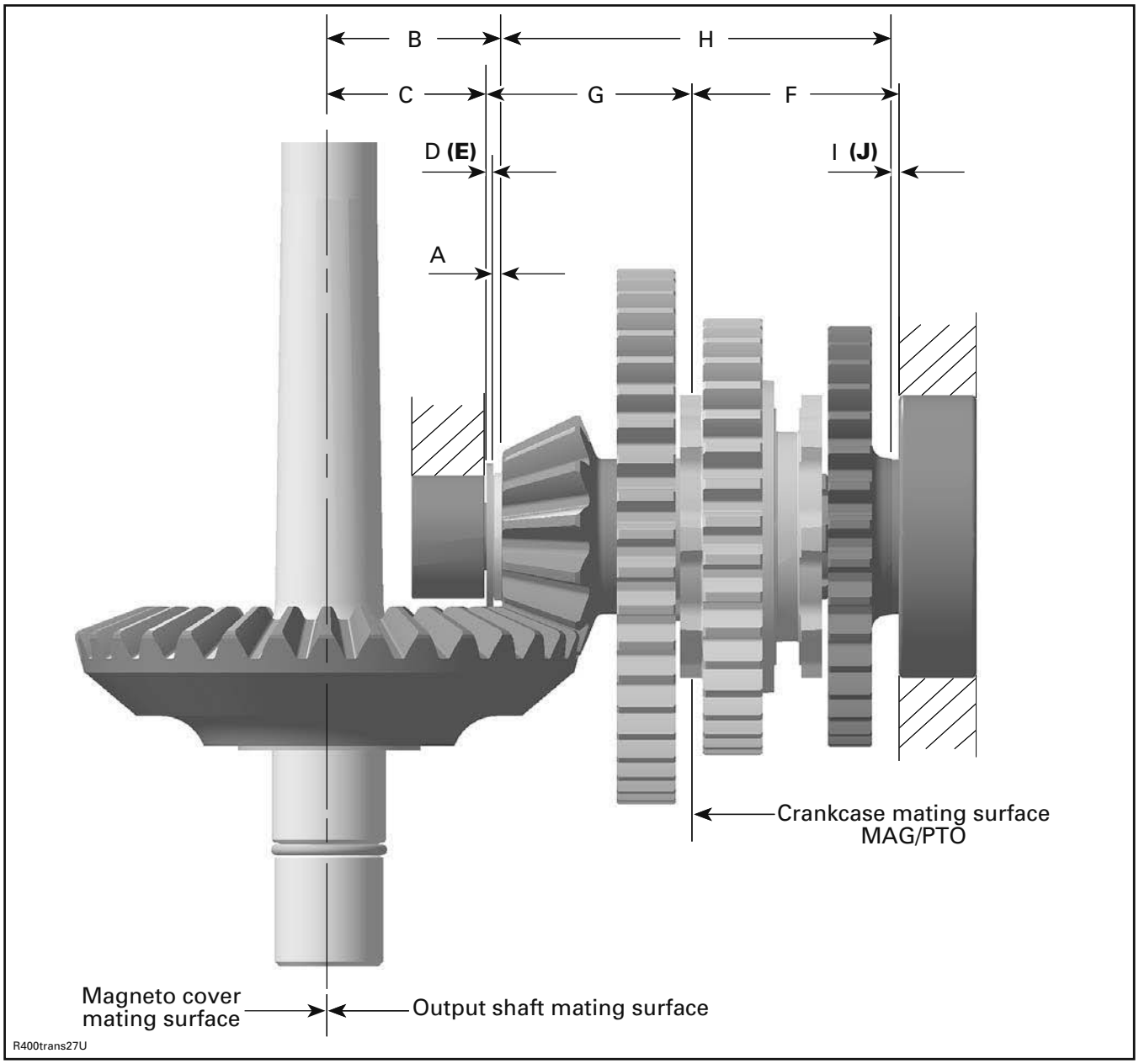
NOTE: Only necessary if the bevel gear backlash and the axial clearance is out of specification or if parts are changed (output shaft, bevel gear or crankcase).

The bevel gear adjustment includes:
– Bevel gear backlash on MAG side crankcase
– Bevel gear axial clearance on PTO side crankcase.

The bevel gear backlash is adjusted by finding the proper thrust washer thickness E as per following illustration.

The bevel gear axial clearance is adjusted by finding the proper thrust washer thickness J as per following illustration.

NOTE: Clean mating surface of crankcase before taking measurements. Refer to *BOTTOM END* subsection.



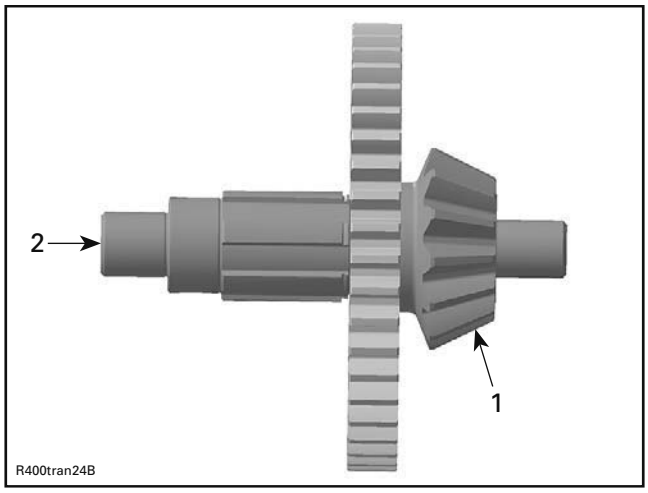
Bevel Gear Backlash Procedure (MAG Side Crankcase)

Use the following course of calculation to determine the theoretical thrust washer thickness D:

D = B - C - A

B = Distance between the thrust surface of bevel gear and the theoretical center of its taper. This is defined by manufacturer and written on the bevel gear shaft.

NOTE: Bevel gear reference number is a value between - 10 and + 10.



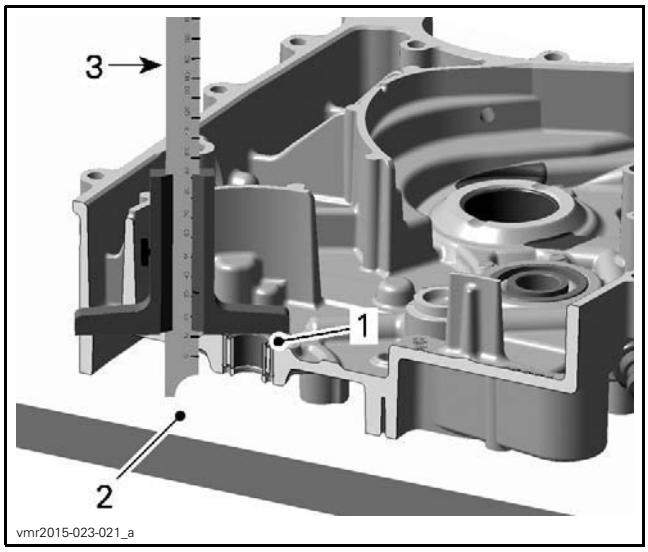
1. Bevel gear
2. Bevel gear reference number location

Use following course of calculation to find out value B.

$$B = \left(\frac{\text{bevel gear reference number}}{100}\right) + 37.8$$

C = Distance between the washer thrust surface in the MAG side and the mating surface of crankcase magneto cover.

NOTE: For a better understanding following illustration is made as a cutaway.



MEASUREMENT C
1. Washer thrust surface
2. Mating surface of crankcase to the magneto cover
3. Depth gauge

A = 2 mm (.0787 in) nominal thickness of axial needle bearing.

When all the measurements are taken, calculate the theoretical thickness D of thrust washer using the formula (D = B - C - A).

Take the obtained theoretical thrust washer thickness D and choose the proper thrust washer number E according to the following table.

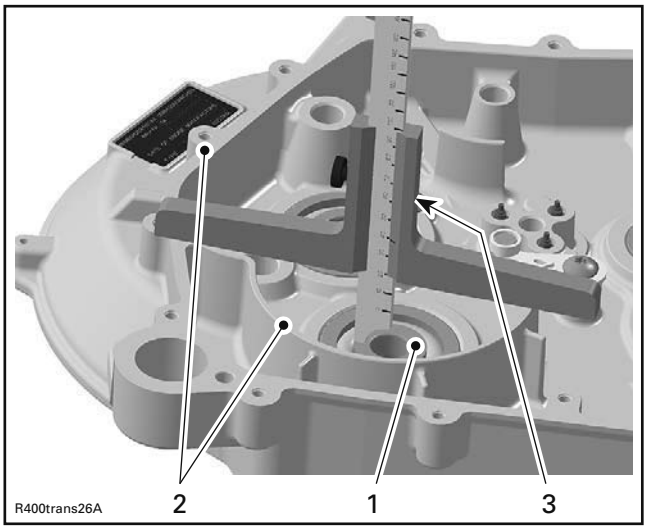
THEORETICAL THRUST WASHER THICKNESS D	THRUST WASHER NUMBER E
1.20 mm to 1.29 mm (.0472 in to .0508 in)	120
1.30 mm to 1.39 mm (.0512 in to .0547 in)	130
1.40 mm to 1.49 mm (.0551 in to .0587 in)	140
1.50 mm to 1.59 mm (.0591 in to .0626 in)	150
1.60 mm to 1.69 mm (.063 in to .0665 in)	160
1.70 mm to 1.79 mm (.0669 in to .0705 in)	170
1.80 mm to 1.89 mm (.0709 in to .0744 in)	180

Bevel Gear Axial Clearance Procedure (PTO Side Crankcase)

Use the following course of calculation to determine the theoretical thrust washer thickness I:

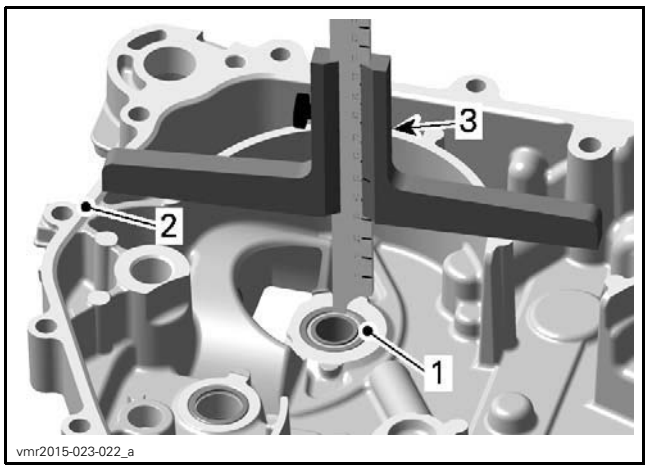
I = F + G - H - A - E

F = Distance between mating surface (crankcase PTO) to ball bearing inner race.



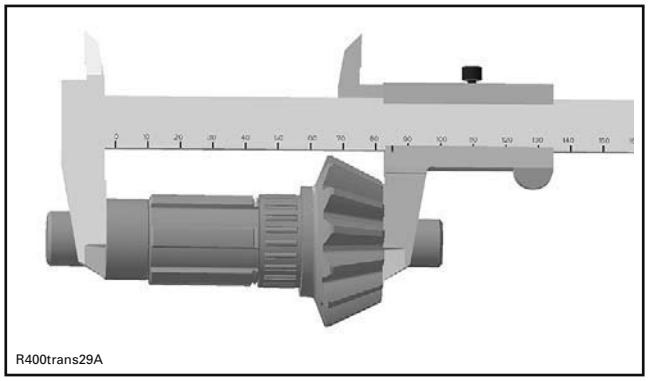
1. Ball bearing inner race
2. Mating surface of crankcase PTO
3. Depth gauge

G = Distance between mating surface of crankcase MAG and outer race of needle bearing.



1. Needle bearing inner race
2. Mating surface of crankcase MAG
3. Depth gauge

H = Distance between thrust surfaces of bevel gear shaft.



A = 2.00 mm (.0787 in) nominal thickness of needle bearing..

E = The thrust washer number nominal value as found in the *BEVEL GEAR BACKLASH PROCEDURE*. For example, thrust washer number 170 represents a value of 1.70 mm (.0669 in).

When all the measurements are taken, calculate the theoretical thrust washer thickness I using the formula (I = F + G - H - A - E).

Take the obtained theoretical thrust washer thickness I and choose the proper thrust washer number J according to the following table.

THEORETICAL THRUST WASHER THICKNESS I	THRUST WASHER NUMBER J
1.22 mm to 1.31 mm (.048 in to .0516 in)	120
1.32 mm to 1.41 mm (.052 in to .0555 in)	130
1.42 mm to 1.51 mm (.0559 in to .0594 in)	140
1.52 mm to 1.61 mm (.0598 in to .0634 in)	150
1.62 mm to 1.71 mm (.0638 in to .0673 in)	160
1.72 mm to 1.81 mm (.0677 in to .0713 in)	170
1.82 mm to 1.91 mm (.0717 in to .0752 in)	180

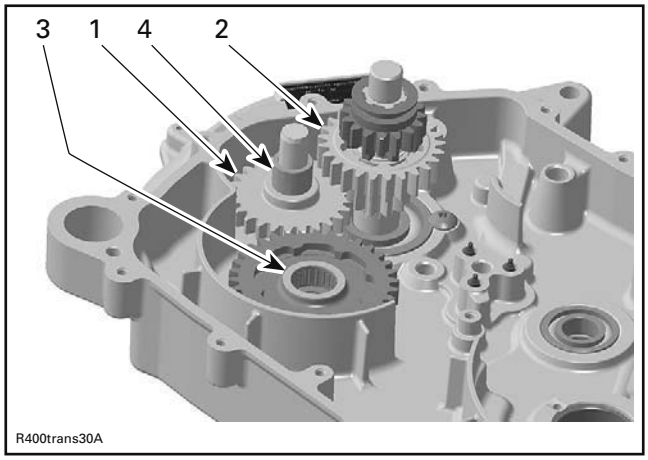
NOTE: Bevel gear axial clearance of 0.02 mm to 0.11 mm (.0008 in to .0043 in) is included in the above table.

Gearbox Assembly

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

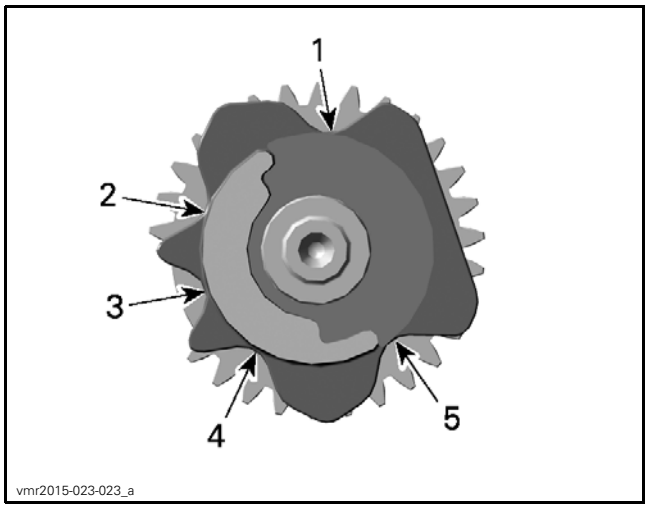
1. Install:
   - Intermediate gear shaft , needle bearing, intermediate gear, thrust washer and distance sleeve
   - Thrust washer, needle bearing, reverse gear, thrust washer and sliding gear
   - Counter shaft with high range gear assembly.
2. Main gear.
3. Bevel gear shaft with low range gear assembly.

NOTE: If a new bevel gear is used, it is necessary to perform the bevel gear adjustments, refer to *GEARBOX ADJUSTMENT* in this subsection. If the existing bevel gear is used, it is mandatory to use new thrust washers with the same thickness and also a new axial needle bearing.



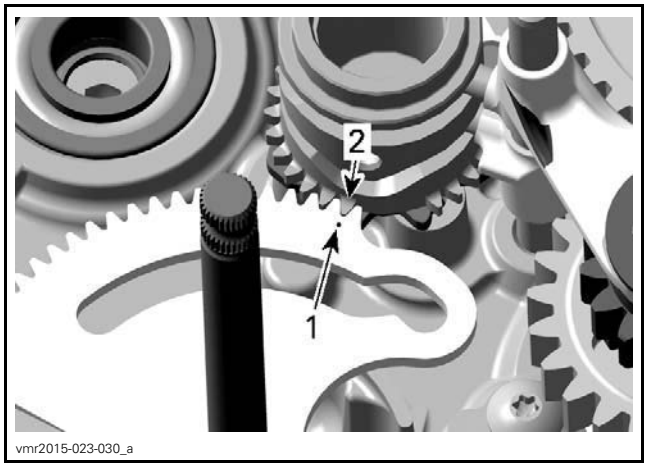
1. *Intermediate gear*
2. *Counter shaft*
3. *Thrust washer after sliding gear on bevel gear*
4. *Thrust washer between distance sleeve and reverse gear*

4. Install shift forks.
5. Put shift forks in place and afterward insert pin with the chamfer on top for a better installation of crankcase MAG side.
6. Insert a flat screwdriver in the slot of index lever. Turn screwdriver counterclockwise and install shift drum on park position as per the following illustration.



1. *Parking stop location*
2. *Reverse stop location*
3. *Neutral stop location*
4. *High gear stop location*
5. *Low gear stop location*

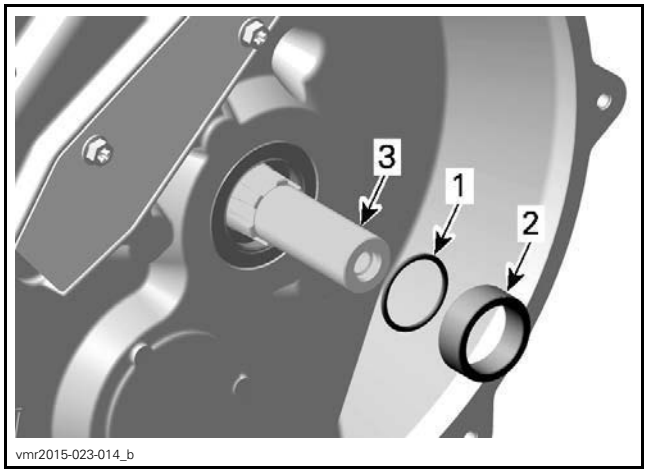
7. Insert shift shaft with mark in line to first tooth on shift drum.



1. *Mark on shift shaft*
2. *First tooth on shift drum*

8. Install parking lever.
9. Run all gears as a final function check.
10. Install balancer shaft then close crankcase housings. Refer to *BOTTOM END* subsection.
11. Install O-ring including distance sleeve on counter shaft end PTO side.

NOTICE **Place O-ring including distance sleeve right away. Chamfered bore of distance sleeve has to face the engine.**



1. *O-ring*
2. *Distance sleeve*
3. *Main shaft end PTO side*

12. Install output shaft and measure axial clearance, refer to *OUTPUT SHAFT* in this subsection.
13. Install all other removed parts.

GEARBOX POSITION INDICATOR SWITCHES

NOTE: First ensure shifter link rod is properly adjusted, Refer to *SHIFTER* subsection.

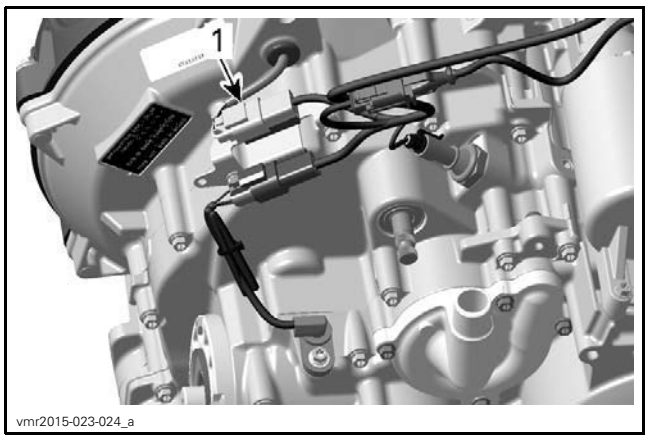
The multifunction gauge uses one switch state (open or closed) for each P, N and R switch to determine the gearbox position.

Gearbox Position Indicator Switch Access

The switches are located in the crankcase, behind the CVT cover.

However, a common connector for the gearbox position indicator switches is easily accessible on the RH side of the engine.

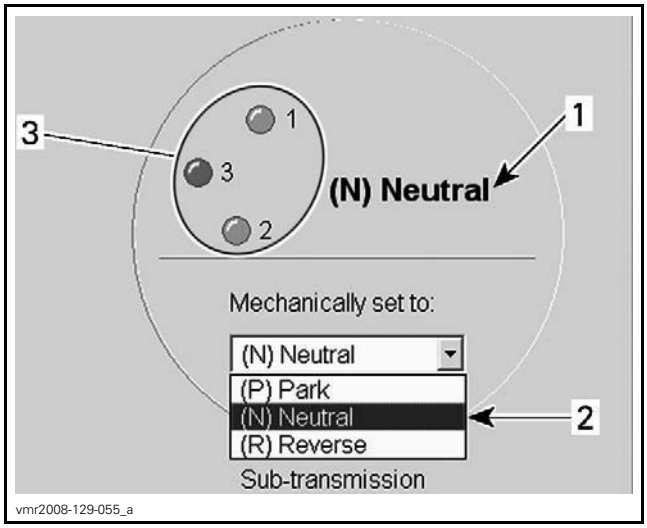
Refer to *BODY* subsection and remove the following:
– Seat
– Console
– RH side panel and extension(s).



1. Gearbox position indicator switch connector

Gearbox Position Indicator Switch Test with B.U.D.S.

1. Connect B.U.D.S. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Select the **Monitoring** tab and go to page 2 then use the Sub-transmission area.
3. Set the vehicle shifter lever to the position to test.
4. In B.U.D.S., select the position matching the shifter selection.
5. Look at the "LED" area in B.U.D.S.



1. Selected shifter position of vehicle
2. Choose position that matches the vehicle shifter selection
3. Test result (see table below): GREEN is good, RED is bad

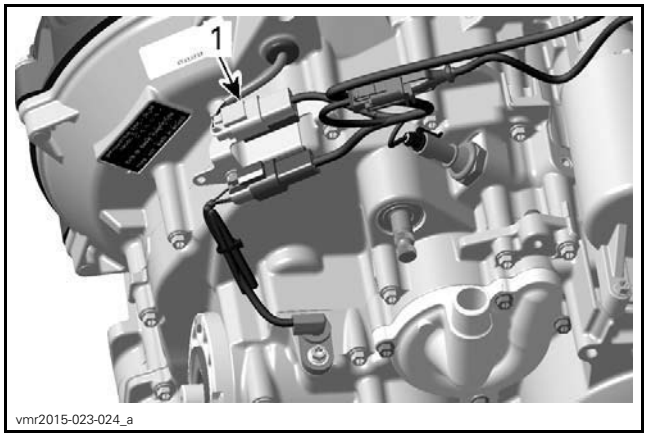
LED AREA IN B.U.D.S.	
Number shown in B.U.D.S.	Matching switch
1	Park
2	Reverse
3	Neutral

A GREEN LED should appear at the proper shifter position. If so, the switch is working.

A RED LED means the switch or wiring/connector is faulty. Carry out the resistance test.

Gearbox Position Indicator Switch Continuity Test

1. Remove parts required for access, refer to *GEARBOX POSITION INDICATOR SWITCH ACCESS* in this subsection.
2. Disconnect gearbox position indicator switch connector.



1. Gearbox position indicator switch connector

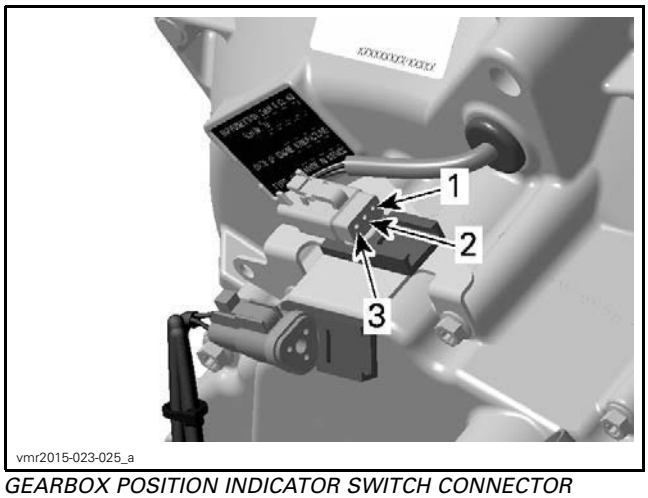
REQUIRED TOOL	
FLUKE 115 MULTIMETER (P/N 529 035 868)	

3. Using a multimeter, measure resistance of the position switch while selecting the gearbox to each position. Compare results with following table.

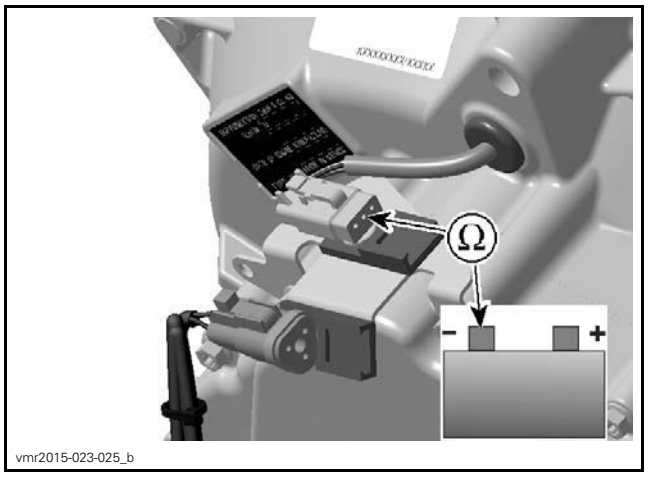
SHIFTER POSITION	CORRESPONDING SWITCH		
	YELLOW/ GREEN	BLUE	BROWN
	Position 3	Position 1	Position 2
L		X	X
H			X
N	X		X
R	X		
P	X	X	

An "X" indicates switch is making ground contact, thus there should be continuity (R is close to 0 Ohms).

A blank space indicates switch is not making contact, there should be no continuity (R = infinite).



GEARBOX POSITION INDICATOR SWITCH CONNECTOR
1. *Blue wire*
2. *Brown wire*
3. *Yellow/green wire*



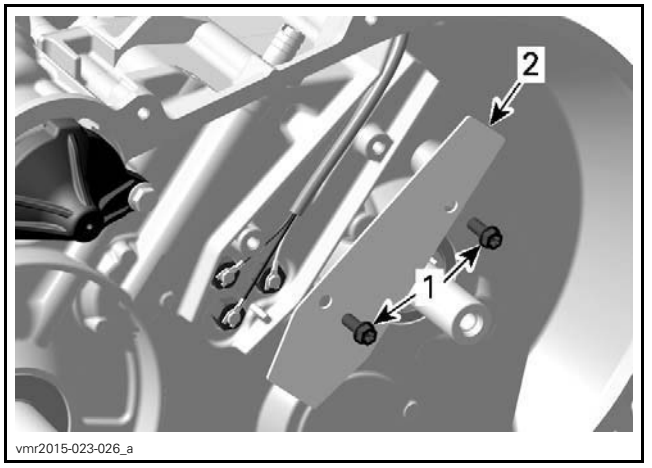
If the indicator switch is good, check the vehicle harness and/or indicator lights.

Gearbox Position Indicator Switch Removal

NOTE: Engine removal is not necessary.

Refer to *CONTINUOUSLY VARIABLE TRANSMISSION (CVT)* subsection and remove:
- CVT cover
- Driven pulley.

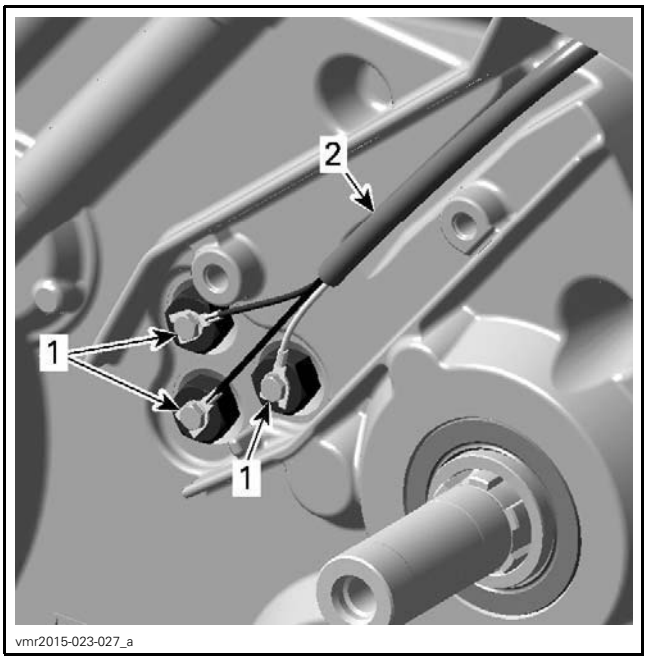
Remove:
- Retaining screws
- Switch protection plate.



1. *Retaining screws*
2. *Switch protection plate*

NOTE: Clean area from dirt and belt dust before removing gearbox position indicator switch(es). Take note of corresponding switch position and wire color.

Remove screw retaining terminals of intermediate wiring harness to gearbox position indicator switch.



vmr2015-023-027_a

1. Retaining screws
2. Intermediate wiring harness

Unscrew gearbox position indicator switch.

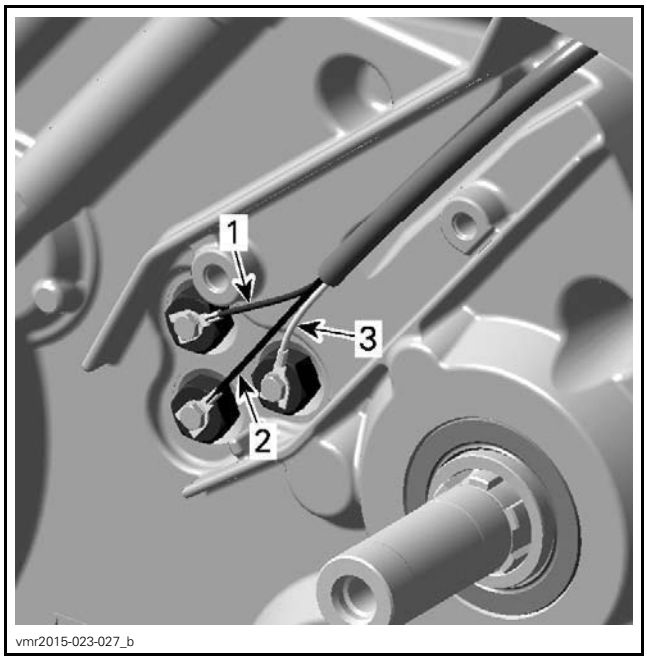
Gearbox Position Indicator Switch Installation

1. Reverse the removal procedure. However, pay attention to the following.
2. Take care to avoid damaging threads in switch bores during installation.

GEARBOX POSITION INDICATOR SWITCH	
Service product	LOCTITE 5910 (P/N 293 800 081)
Tightening torque	3 N•m ± 0.4 N•m (27 lbf•**in** ± 4 lbf•**in**)

NOTICE **Do not apply thread locker on switch plunger as it will lead to switch malfunction.**

3. If all terminals were removed, put them back in the proper location as noted prior to removal.



vmr2015-023-027_b

1. Gearbox position switch position 1 — BLUE wire
2. Gearbox position switch position 2 — BROWN wire
3. Gearbox position switch position 3 — GREEN/YELLOW wire

4. Install protection plate and tighten screws to specification.

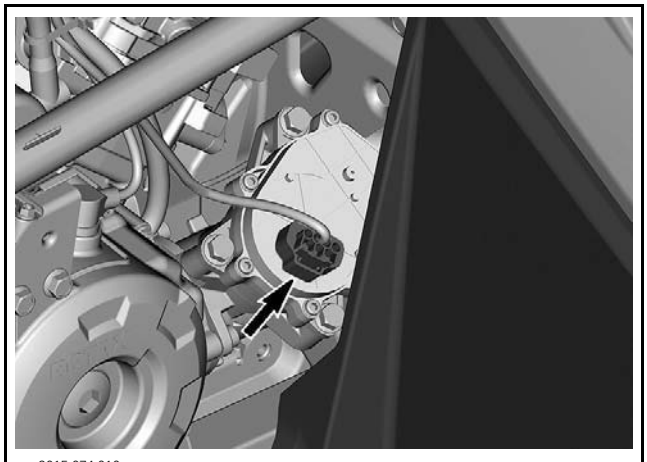
PROTECTION PLATE RETAINING SCREWS	
Tightening torque	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

4WD SELECTOR

4WD Selector Test

Remove RH side panel. Refer to *BODY* section.

Unplug connector from coupling unit.


vmr2015-074-010_a

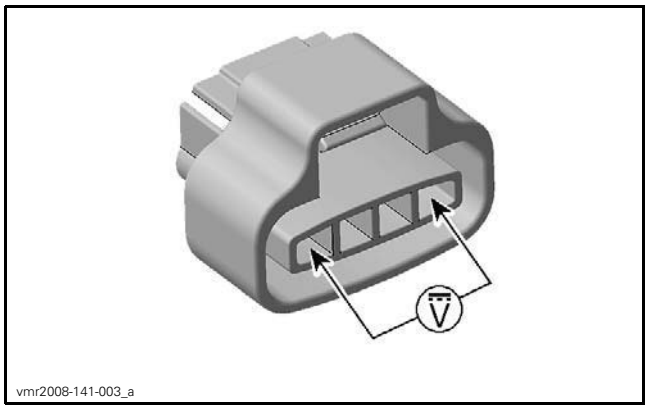
Using a multimeter, check if the 4WD selector at handlebar works properly.

Turn ignition key ON.

Select 2WD position.

Install the RED probe to the WHITE wire connector and the BLACK probe to the WHITE/BLACK wire connector.

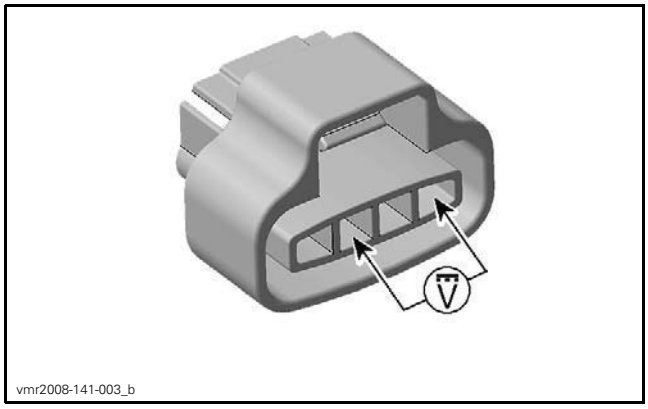
The obtained value should be 12 Vdc.



Select 4WD position.

Install the RED probe to the WHITE/BLUE wire connector and the BLACK probe to the WHITE wire connector.

The obtained value should be 12 Vdc.



If voltage is not as specified, check wires and connectors. If good, replace the 4WD selector at handlebar.

4WD Selector Replacement

To replace the 4WD selector, refer to *THROTTLE LEVER* in *STEERING SYSTEM* section.

4WD ACTUATOR

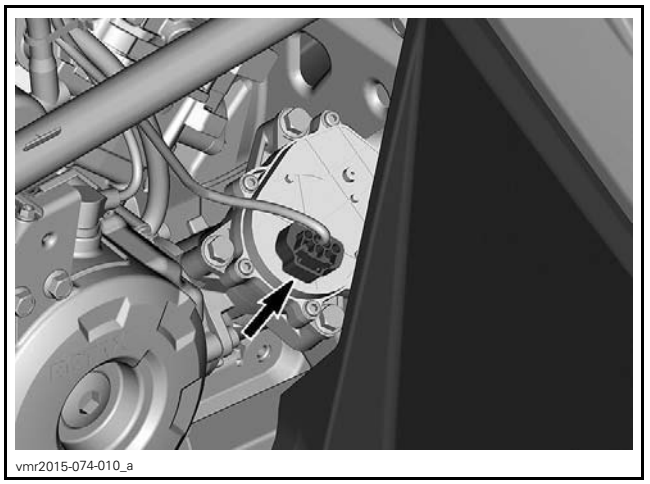
4WD Actuator Removal

Lift and support front end of the vehicle.

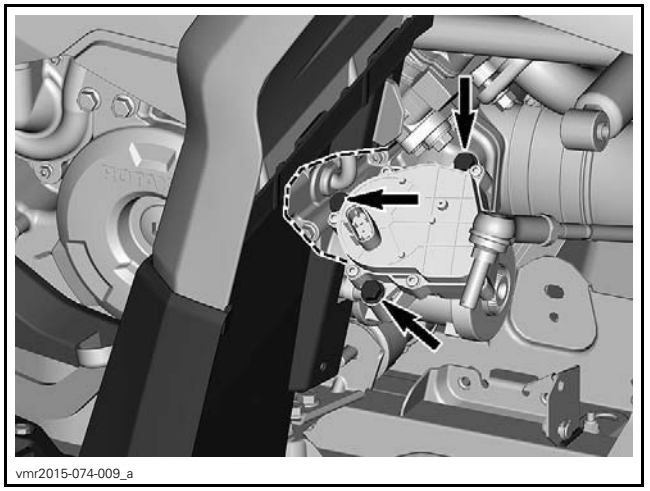
Remove the RH wheel. Refer to *WHEELS AND TIRES* subsection.

Refer to *BODY* subsection to remove;
- RH inner fender panel
- RH side panel

Unplug actuator connector.



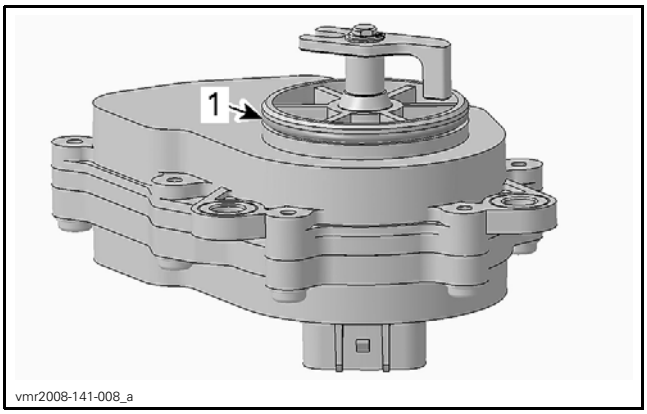
Remove actuator screws.



Pull the actuator out of the housing.

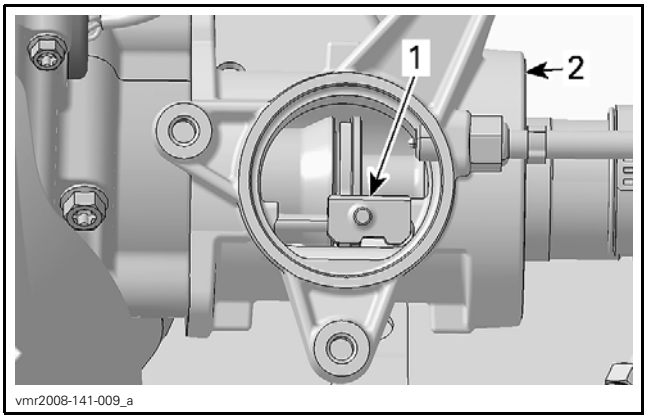
4WD Actuator Installation

Apply a small amount of engine oil on actuator O-ring.



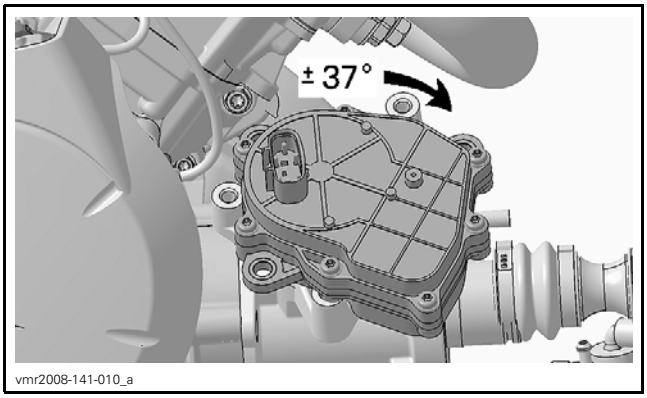
1. Actuator O-ring

Verify if sliding sleeve is in 2WD position. The sliding sleeve should be pointed toward the front of vehicle.



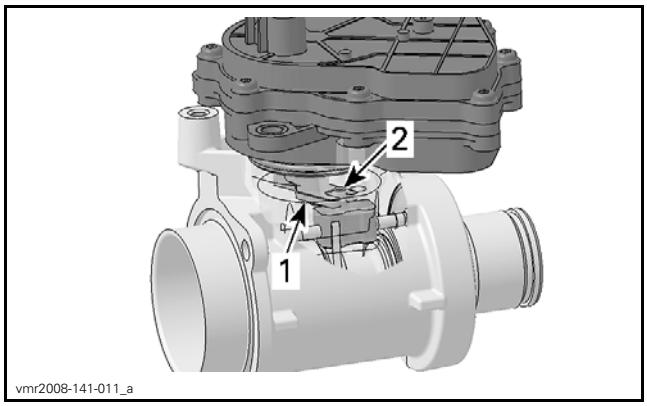
1. Sliding sleeve
2. Coupling unit housing

Turn the actuator 37 degrees clockwise from the mounting position.



FROM RH SIDE — ACTUATOR POSITIONS AT 37 DEGREES

Align the actuator fork with the dog on sliding sleeve then push the actuator in the housing.



1. Actuator fork
2. Sliding sleeve dog

Rotate the actuator counterclockwise until it orients itself to mounting position.

⚠ CAUTION Do not cut or break the actuator O-ring.

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

Tighten actuator screws to specification.

TIGHTENING TORQUE	
Actuator screw	20 N•m ± 2 N•m (15 lbf•ft ± 1 lbf•ft) + LOCTITE 243 (BLUE) (P/N 293 800 060)

Connect actuator.

Lift the front of vehicle until front wheels turn freely.

Try to turn the front propeller shaft. The shaft should turn easily.

Place ignition switch to ON position and select the 4WD position.

The front propeller shaft should not turn (the PARK position must be selected).

If the front propeller shaft turns, the actuator is not installed correctly. Remove actuator and reinstall it.

Install all other removed parts.

4WD SWITCH

4WD Switch Removal

Lift and support front end of the vehicle

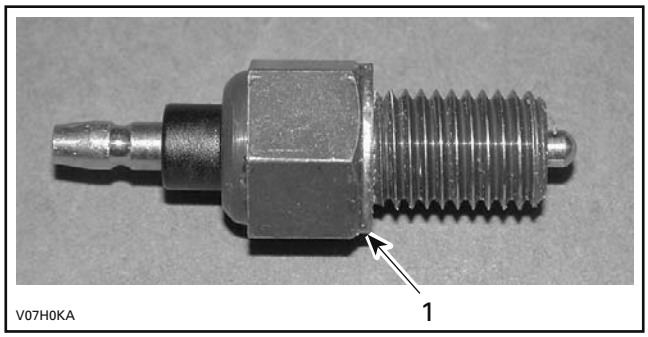
Remove the RH wheel. Refer to *WHEELS AND TIRES* subsection.

Remove RH inner fender panel.

Unplug the 4WD switch connector.

Unscrew the switch from coupling unit housing.

Discard the sealing washer.

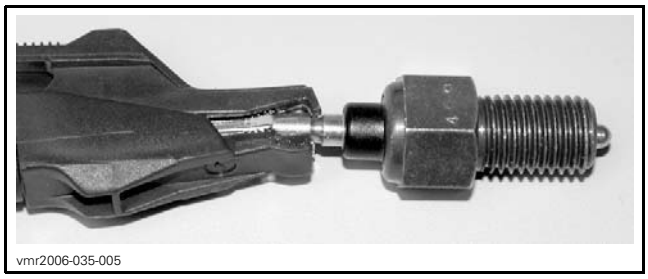


1. Sealing washer

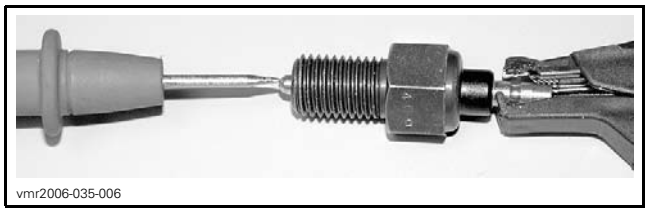
4WD Switch Test

Using a multimeter, do the following to check the switch.

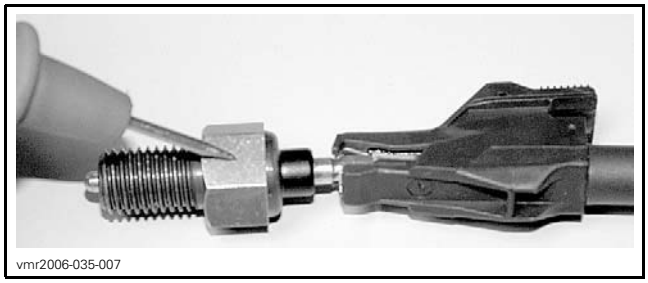
Using an alligator clip, place the BLACK probe on the external pin.



Touch the contact pin with the RED probe. The multimeter should indicate ± 1 Ω.



Apply the RED probe on switch body. The measure should be OL.



If switch is out of specifications, replace it.

4WD Switch Installation

The installation is the reverse of the removal procedure.

Use a **new** sealing washer when installing the switch.

COUPLING UNIT

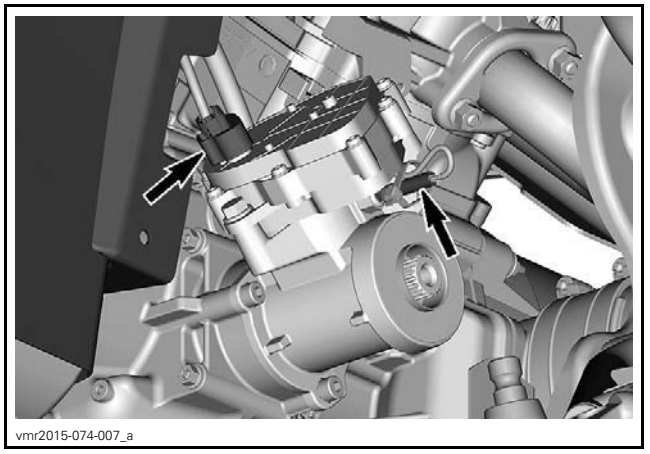
Coupling Unit Removal

Lift and support front end of the vehicle.

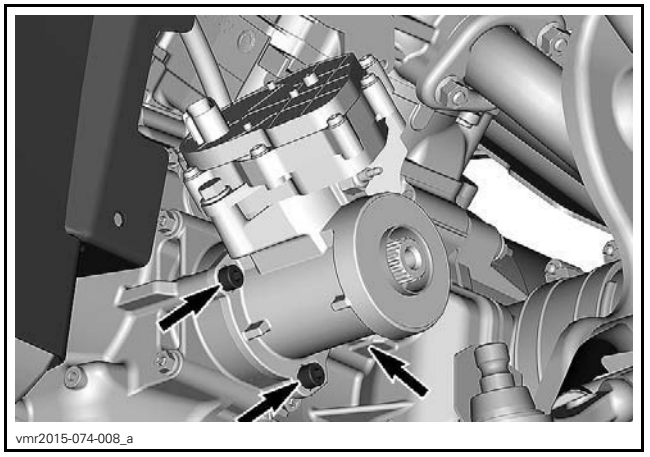
Remove RH inner fender panel. Refer to *BODY* subsection.

Remove front propeller shaft. Refer to *FRONT PROPELLER SHAFT REMOVAL* in this subsection.

Unplug coupling unit connector and 4WD switch connector.



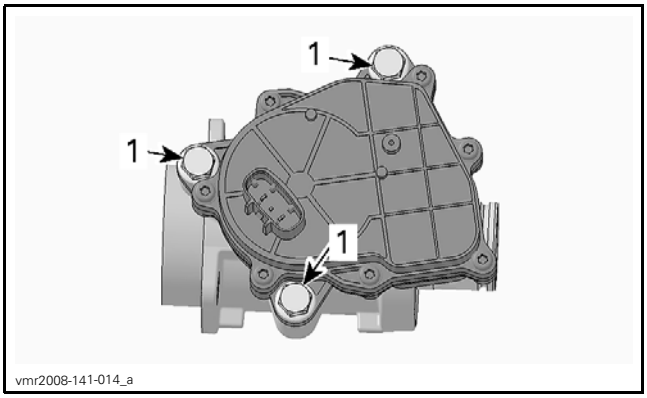
Remove screws (3) retaining the coupling unit housing to the engine.



Pull out the coupling unit from the engine.

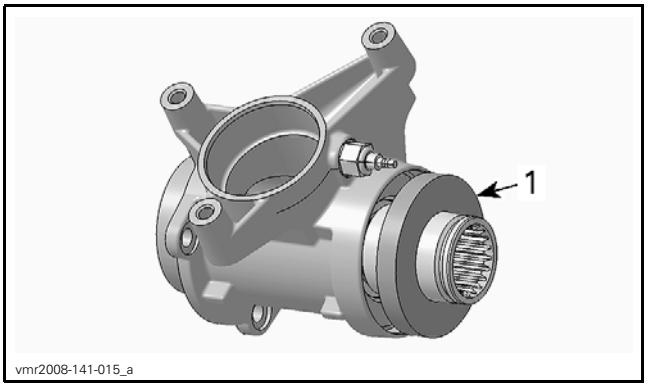
Coupling Unit Disassembly

Remove the actuator from the coupling unit by removing the three retaining screws.



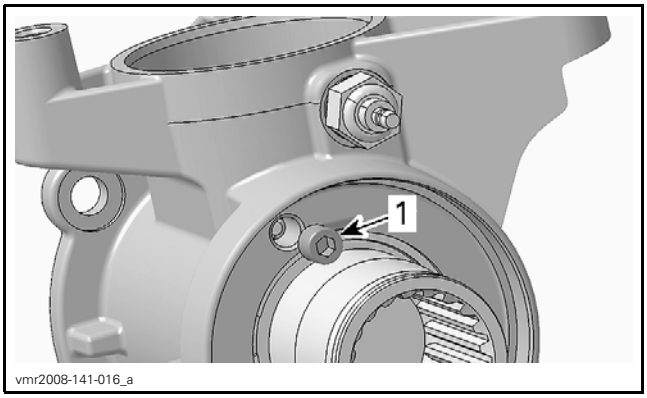
1. Actuator screws

Remove the oil seal.



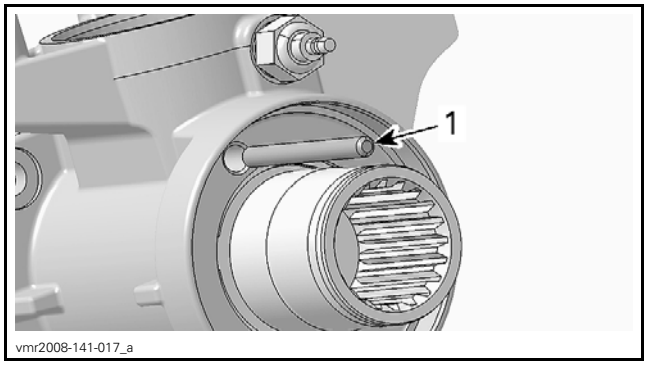
1. Oil seal

Remove the Allen set screw.



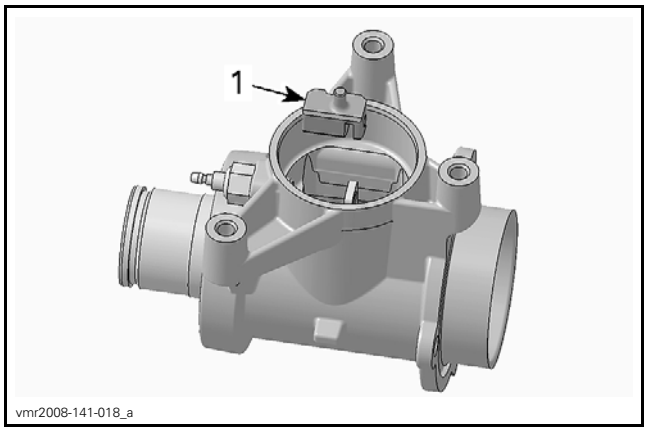
1. Allen set screw

Pull out the sliding sleeve pin.



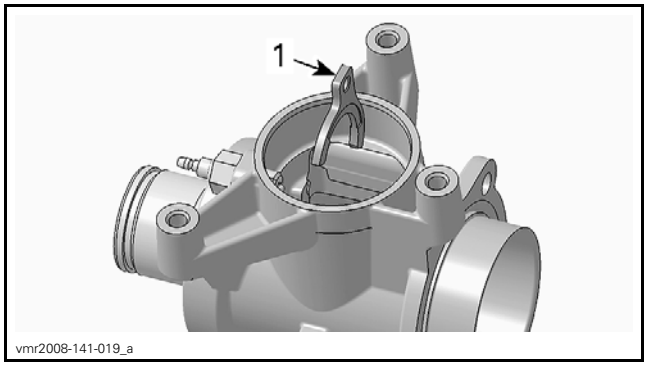
1. Sliding sleeve pin

Remove sliding sleeve.



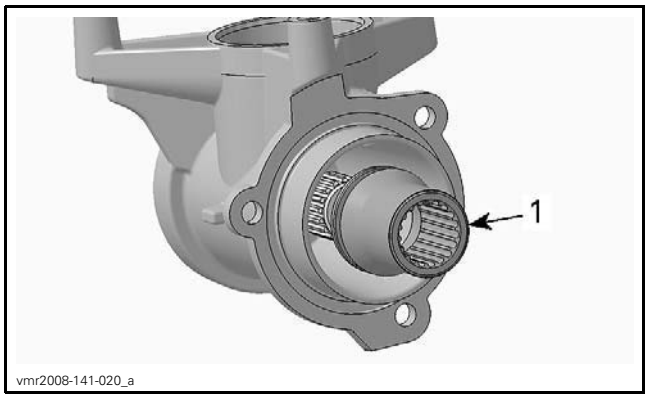
1. Sliding sleeve

Remove the shifter fork.



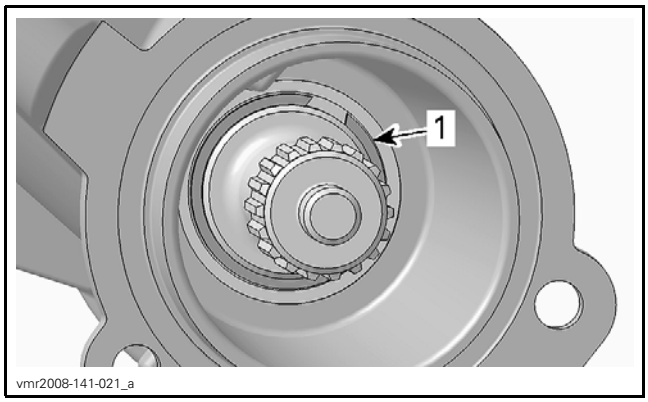
1. Shifter fork

Pull out the coupling sleeve.



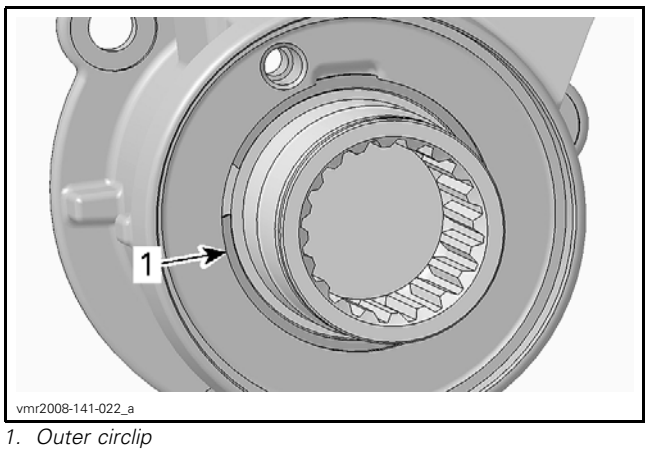
1. Coupling sleeve

Remove the inner circlip.



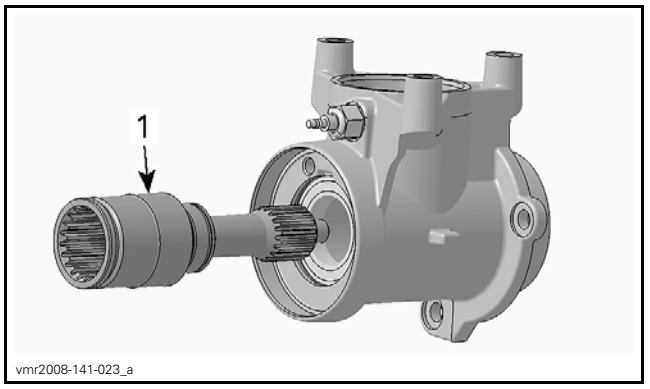
1. Inner circlilp

Turn the coupling unit housing and remove the outer circlip.



1. Outer circlip

Remove coupling unit shaft.



1. Coupling unit shaft

Using the BLIND HOLE BEARING PULLER SET (P/N 529 036 117), remove the ball bearing.



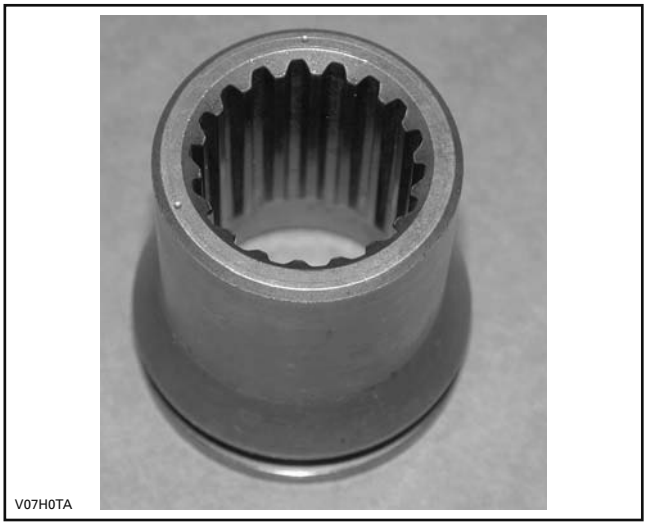
NOTE: Remove the ball bearing only if it does not turn freely and smoothly.

Coupling Unit Inspection

Check disconnect unit housing and actuator for cracks or other damages. Replace defective part(s) if necessary.

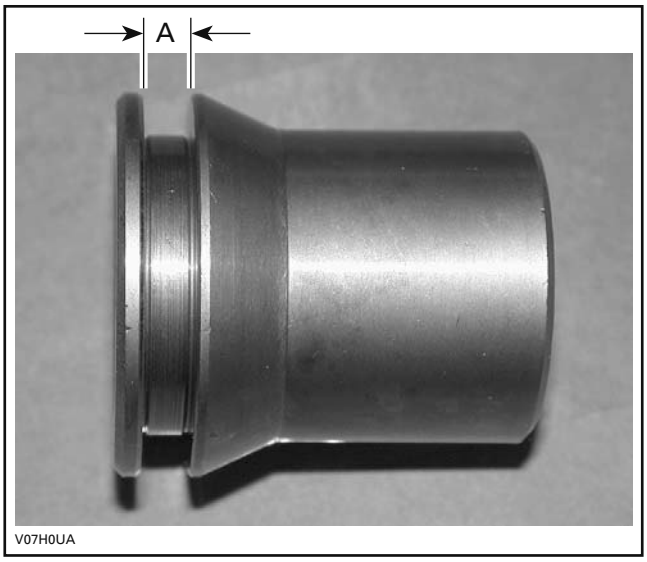
Check if the actuator O-ring and the coupling unit housing O-ring are brittle, hard or damaged.

Check splines of coupling sleeve for wear or other damages. Replace if splines are damaged.



Measure the coupling sleeve groove. If the width of groove is out of specification replace the coupling sleeve.

COUPLING SLEEVE GROOVE WIDTH	
Service limit	5.00 mm (.197 in)



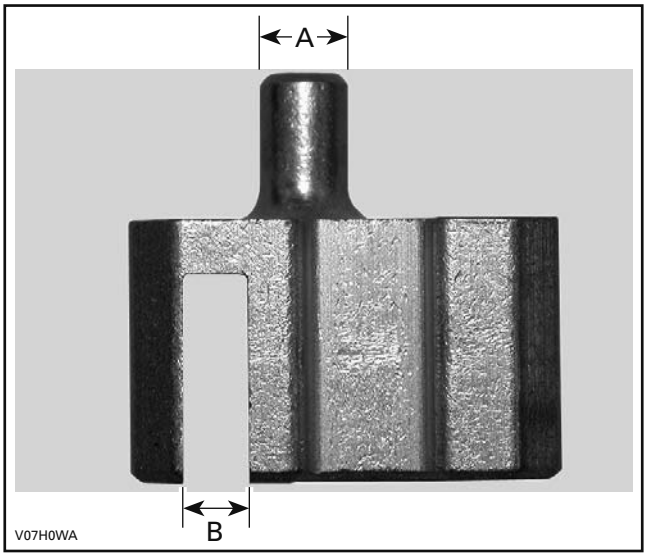
A. Groove width

Check sliding sleeve dog for bend and measure it.

SLIDING SLEEVE DOG THICKNESS	
Service limit	4.80 mm (.189 in)

Measure the sliding sleeve groove.

SLIDING SLEEVE GROOVE WIDTH	
Service limit	3.60 mm (.142 in)

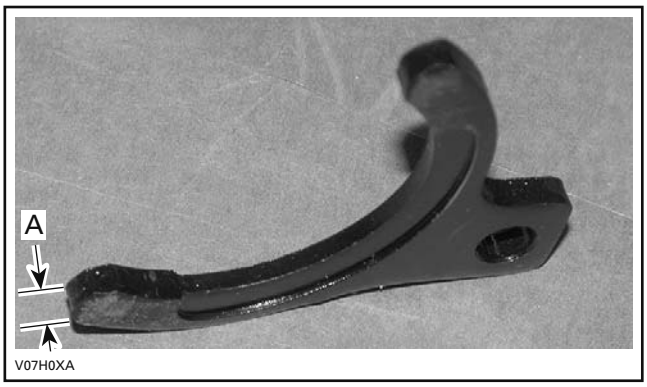


A. Sliding sleeve dog thickness
B. Sliding sleeve groove width

Check shifter fork for visible damage, wear or bent claws.

Measure the shifter fork claw thicknesses.

SHIFTER FORK CLAWS THICKNESS	
Service limit	2.93 mm (.115 in)

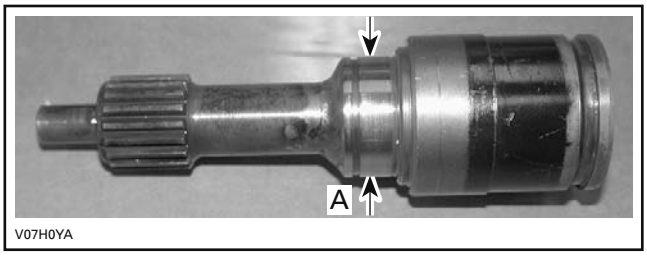


A. Shifter fork claw thickness

Check inner and outer shaft splines for wear or other damages. Replace shaft if necessary.

Measure the coupling unit shaft for wear limit.

COUPLING UNIT SHAFT	
Service limit	29.995 mm (1.181 in)



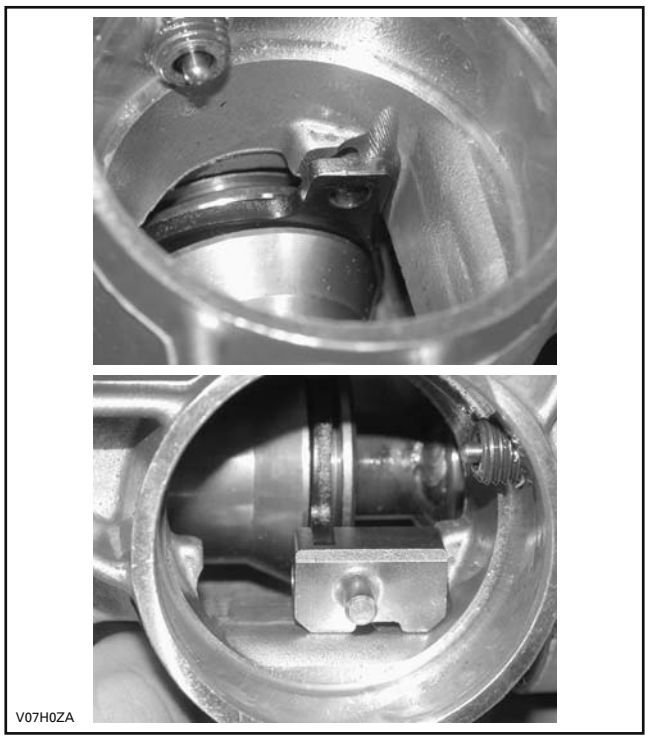
A. Shaft diameter in the area of bearing

Coupling Unit Assembly

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

Apply engine oil on moving parts.

Install the shifter fork and coupling sleeve as per the following illustrations.



Insert pin and install Allen set screw.

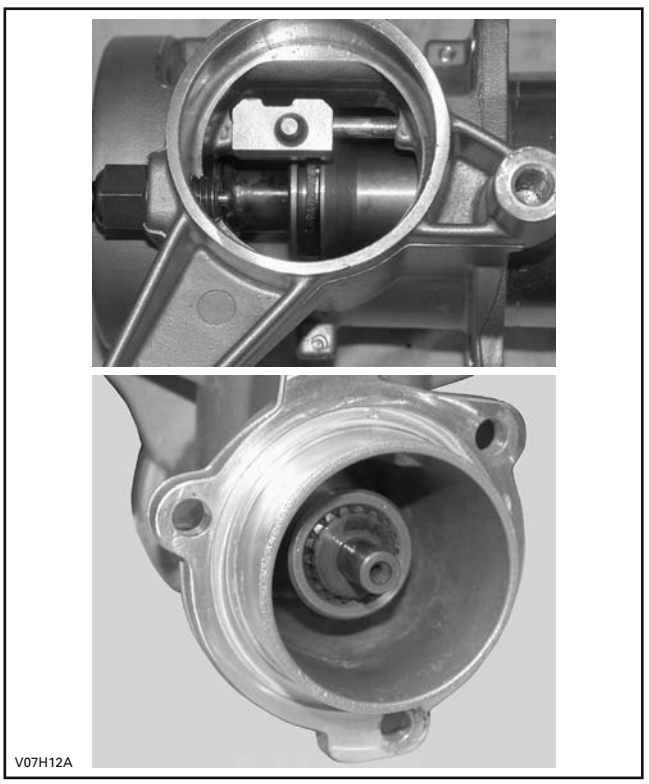
Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on threads of Allen set screw.

Install and tighten the Allen set screw to specification.

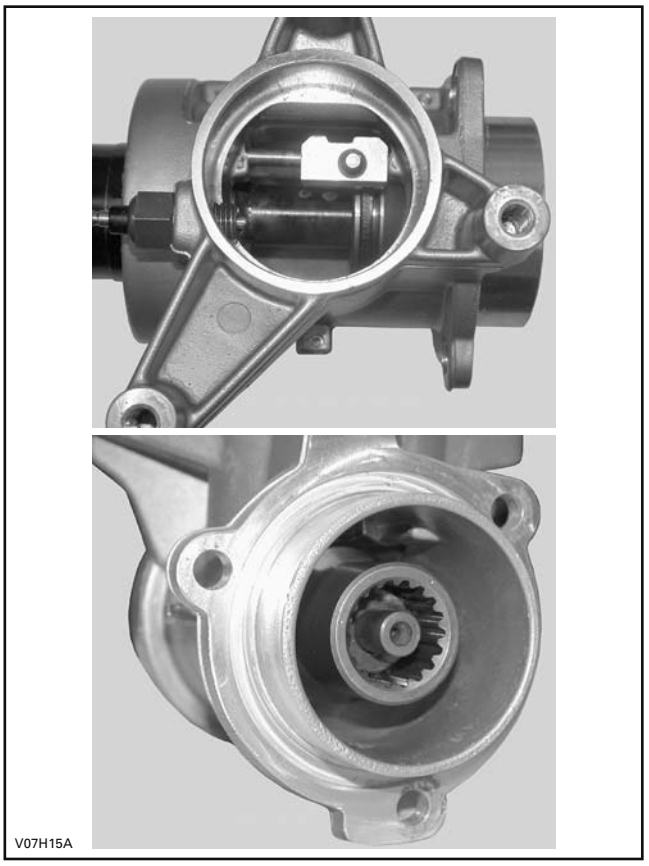
TIGHTENING TORQUE	
Actuator screw	7 N•m ± 1 N•m (62 lbf•**in** ± 9 lbf•**in**) **+** LOCTITE 243 (BLUE) (P/N 293 800 060)

Check if the shifter plate and the coupling sleeve are installed properly.

When the sliding sleeve is positioned on left side, the coupling sleeve is equal with the end of the shaft splines.



Move the sliding sleeve on right side and check if the coupling sleeve is flush with the end of shaft.



Install the actuator onto the coupling unit. Refer to *ACTUATOR INSTALLATION* in this section.

Coupling Unit Installation

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

Apply XPS SYNTHETIC GREASE (P/N 293 550 010) on coupling unit housing O-ring.

Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on threads of coupling unit screws and tighten to specification.

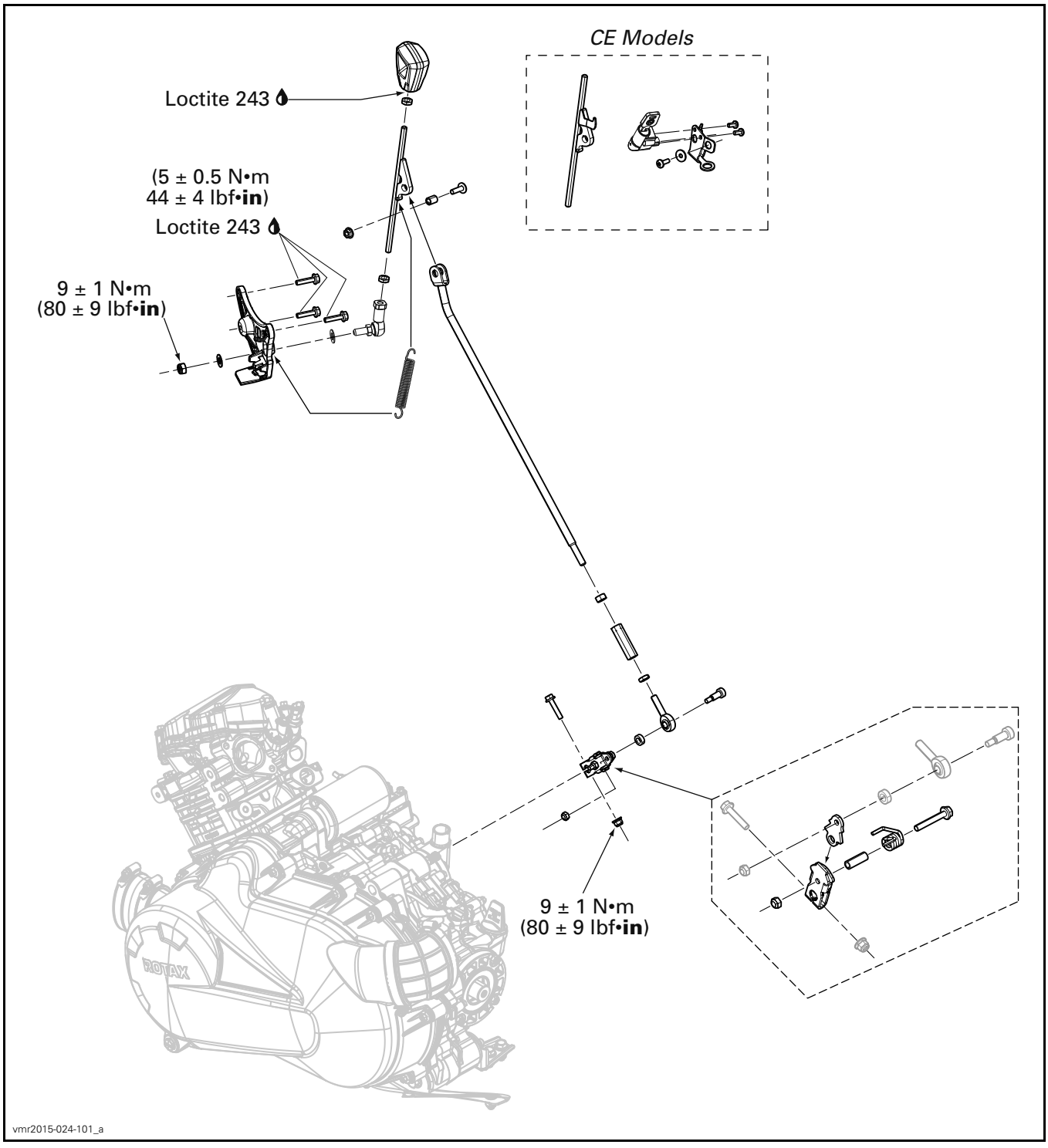
TIGHTENING TORQUE	
Coupling unit screw	25 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft) + LOCTITE 243 (BLUE) (P/N 293 800 060)

Install all other removed parts and check if the actuator is operational. See the procedure in *ACTUATOR INSTALLATION* in this subsection.

SHIFTER

SERVICE PRODUCTS

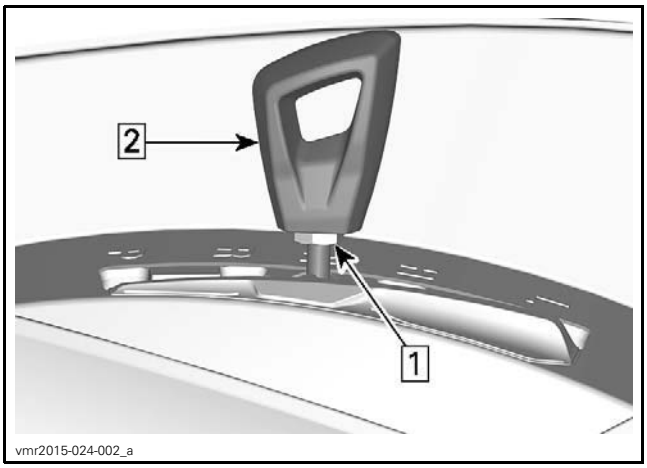
Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	232



PROCEDURES

HANDLE

Handle Removal



Step 1: Loosen lock nut
Step 2: Unscrew shift lever handle

Handle Installation

Reverse the removal procedure.

SERVICE PRODUCT	WHERE USED
LOCTITE 243 (BLUE) (P/N 293 800 060)	Shift lever threads

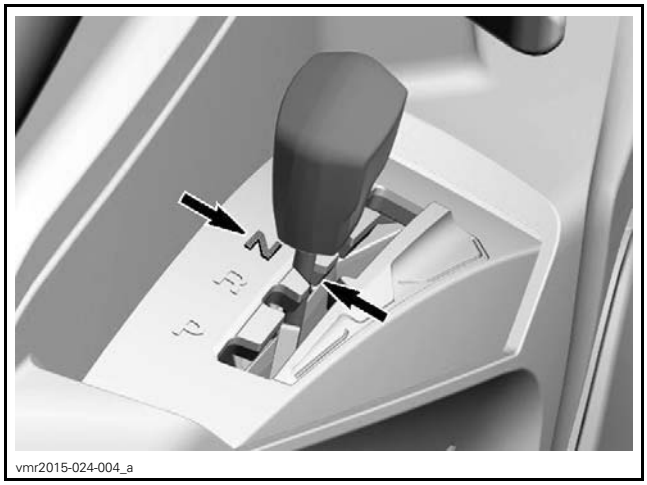
SHIFT LEVER

Shift Lever Access

1. Refer to *BODY* subsection and remove the following components:
   - Seat
   - Console
   - RH side panel and extension panel.

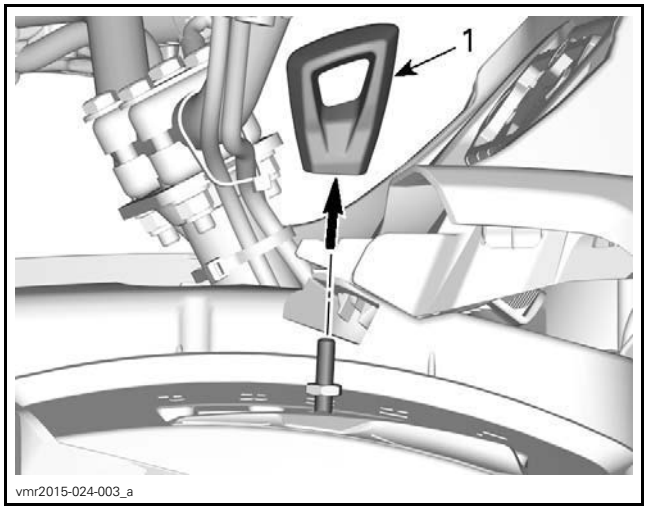
Shift Lever Removal

1. Remove body parts as required. Refer to *SHIFT LEVER ACCESS* in this subsection.
2. Secure vehicle using wheel blocks.

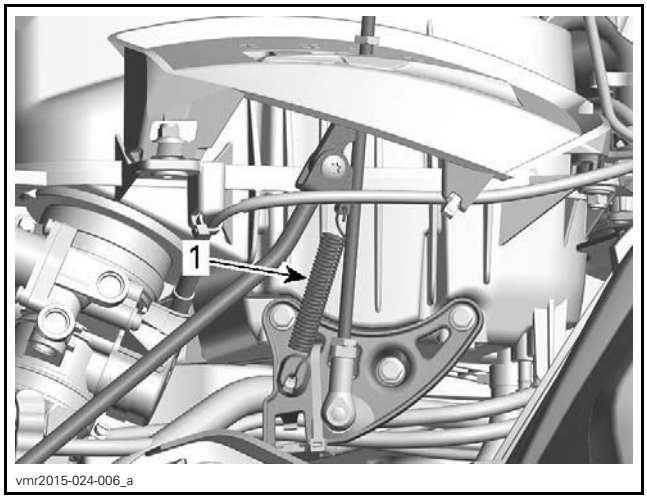


SHIFT LEVER POSITION

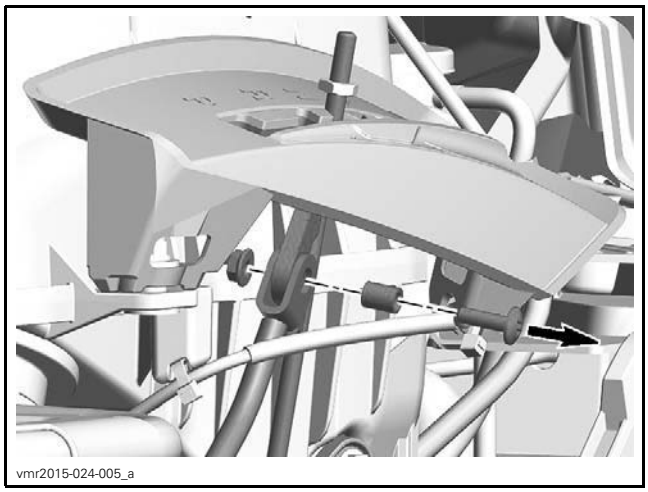
3. Remove parts as indicated in following illustrations.

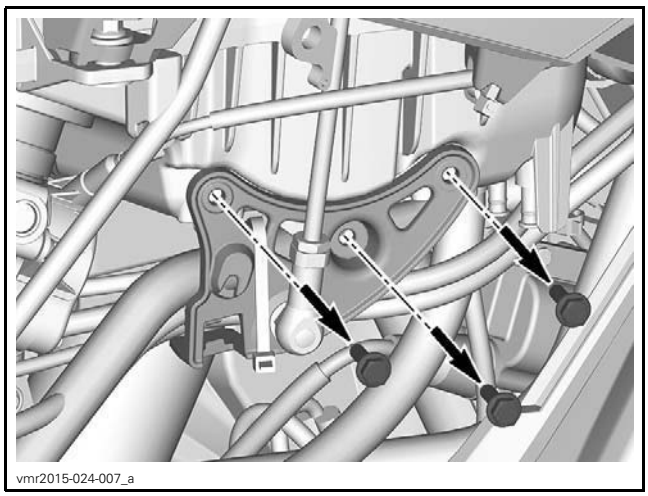


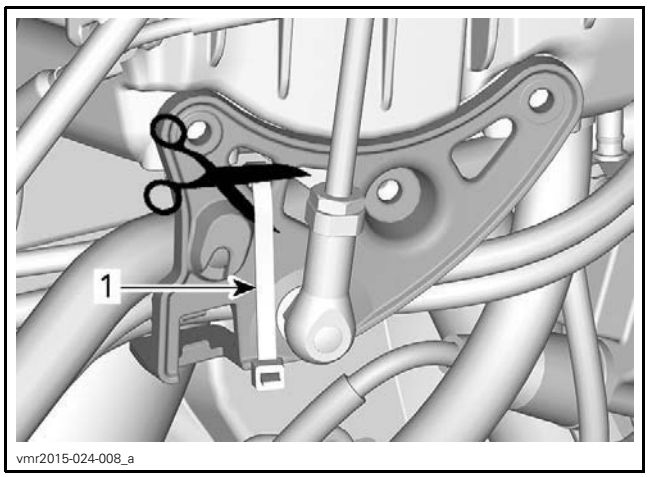
1. Shift lever handle



1. Remove spring


vmr2015-024-005_a


vmr2015-024-007_a



vmr2015-024-008_a

1. Locking tie to cut

4. Remove shift lever with shift lever support.

Shift Lever Inspection

Check shift lever for bending or cracks.

Check spring and bushing condition.

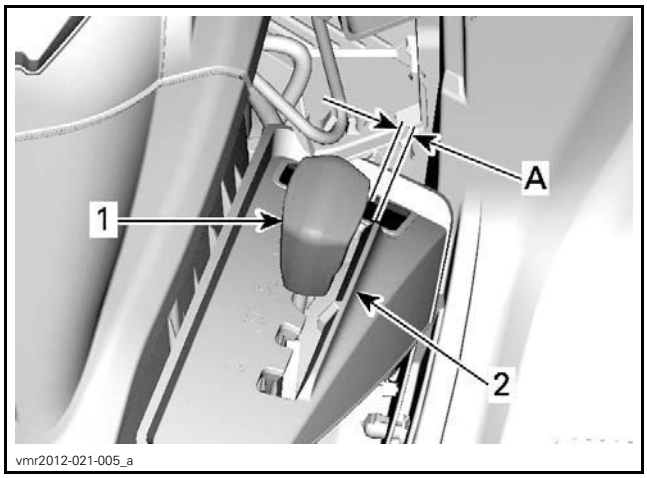
Check ball joint condition.

Replace all damaged parts.

Shift Lever Installation

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

Adjust shift lever handle as per following illustration.

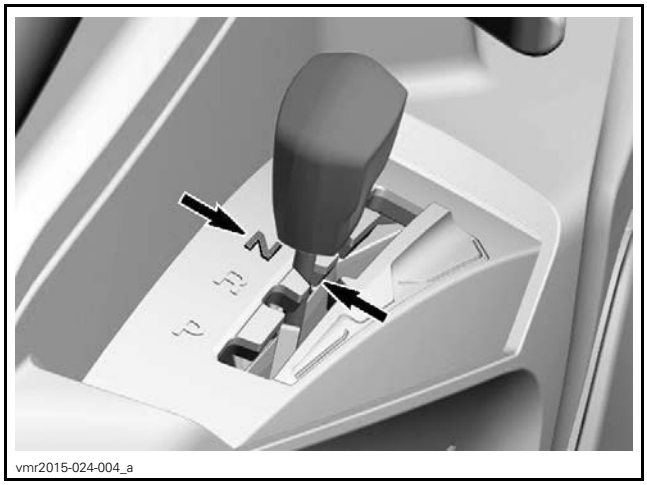


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SHIFT LEVER HANDLE ALIGNMENT
1. Handle
2. Ridge
A. Handle parallel with ridge

Check if shift lever works properly in all positions. Ensure throttle cable does not interfere with shift lever in all positions.

NOTE: Shift lever must be perfectly centered with the neutral position indicator when transmission is engaged in neutral.



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SHIFT LEVER ALIGNMENT WITH NEUTRAL POSITION INDICATOR

NOTE: If adjustment is required, refer to *SHIFT ROD ADJUSTMENT* in this subsection.

SHIFT ROD

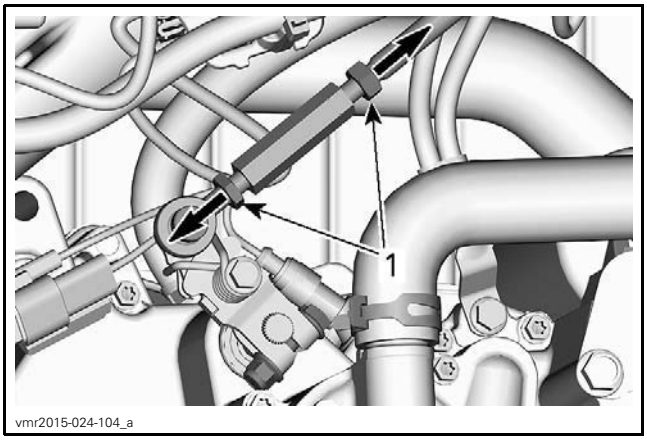
Shift Rod Adjustment

1. Place shift lever in NEUTRAL position.

NOTICE **Move vehicle back and forth to ensure gearbox is set in neutral position.**

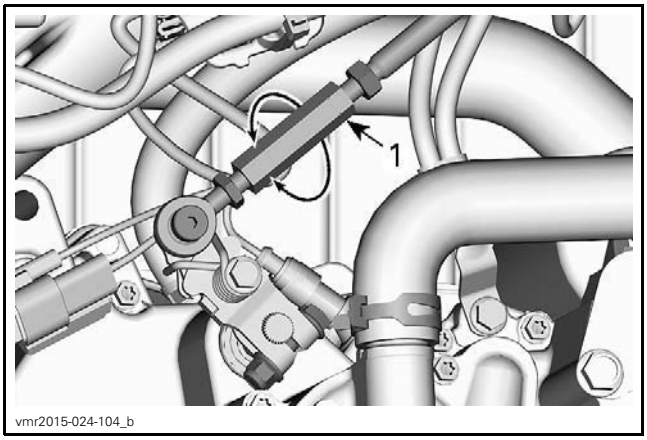
2. Secure vehicle using wheel blocks.
3. Remove body parts as required. Refer to *SHIFT LEVER ACCESS* in this subsection.
4. Loosen shift rod adjuster lock nuts.

NOTE: Be aware that one of the adjuster lock nuts has LH threads, while the other has RH threads.

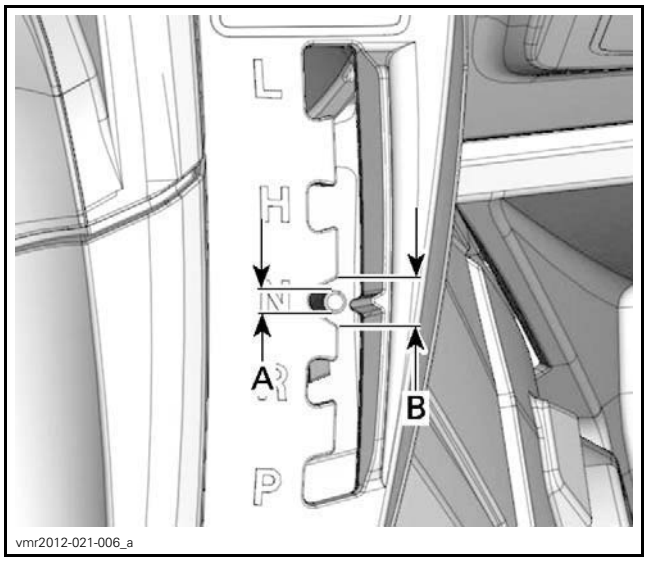


1. Adjuster lock nuts

5. Turn rod adjuster to center shift lever in neutral notch.

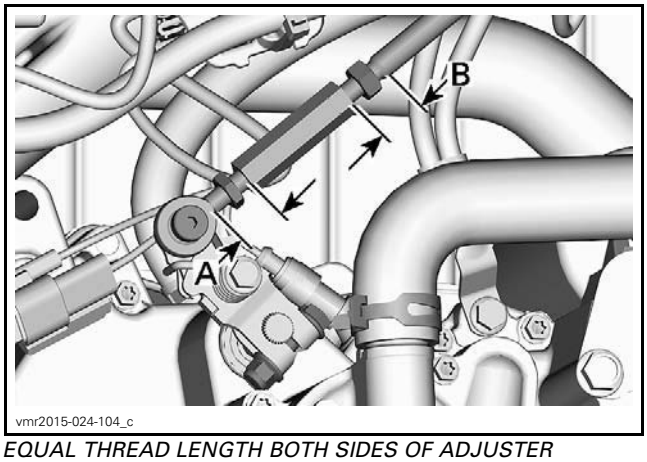


1. Shift rod adjuster



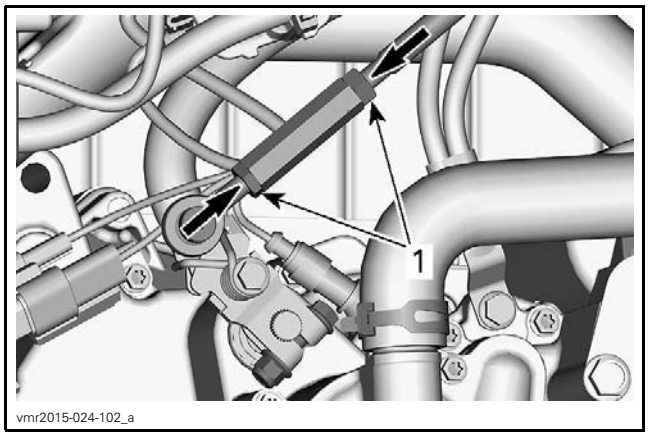
SHIFT LEVER CENTERED WITHIN NEUTRAL NOTCH
A. Shift lever
B. Neutral notch

NOTE: Ensure there is the same thread length each side of rod adjuster.



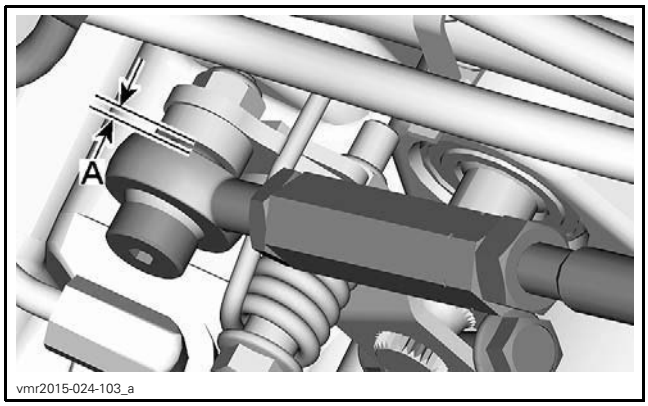
EQUAL THREAD LENGTH BOTH SIDES OF ADJUSTER
A. Thread length ball joint end
B. Thread length shift rod end

6. Move shift lever to R position then to H position.
7. Place shift lever in NEUTRAL position.
8. Check if shift lever is properly centered in neutral notch. Readjust as required.
9. Test the shifter to confirm that the system works properly in all positions.
10. Hold adjuster steady and tighten lock nuts.



1. Adjuster lock nuts tightened

NOTE: Ensure shift rod ball joint is parallel with shift plate. It may be necessary to realign shift rod ball joint to ensure freedom of movement.



A. Parallel within +/- 5°

⚠ WARNING

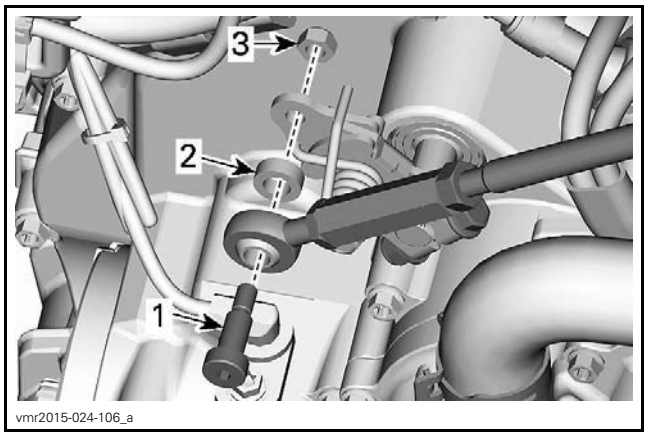
After adjustment, make sure the PARK position is also properly set.

SHIFT PLATE

Shift Plate Removal

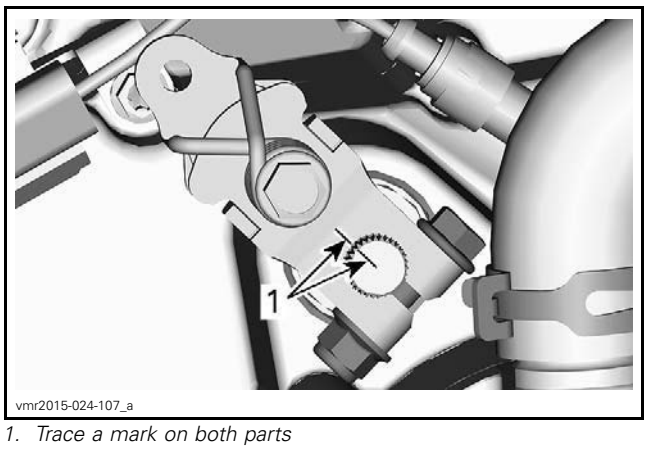
NOTE: Do not remove shift plate needlessly.

1. Refer to *BODY* subsection and remove the following components:
   - Seat
   - Console
   - RH side panel
   - RH engine cover
2. Remove shift rod from shift plate.



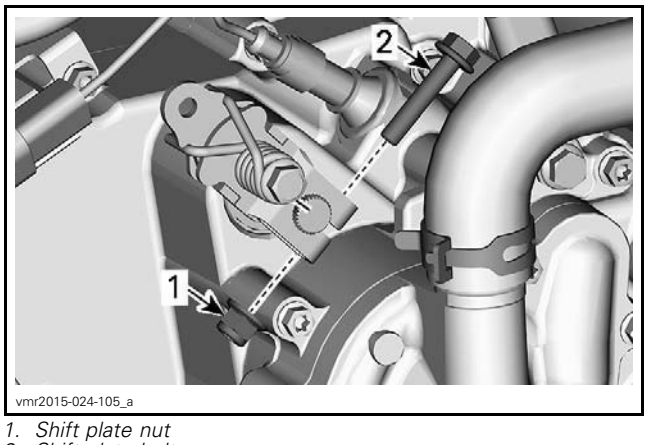
1. Remove nut and bolt

3. Trace an index mark on shift plate and shift shaft.



1. Trace a mark on both parts

4. Remove shift plate nut and bolt.



1. Shift plate nut
2. Shift plate bolt

5. Remove shift plate.

Shift Plate Inspection

Check shift plate for:
- Cracks
- Bending
- Spline condition.

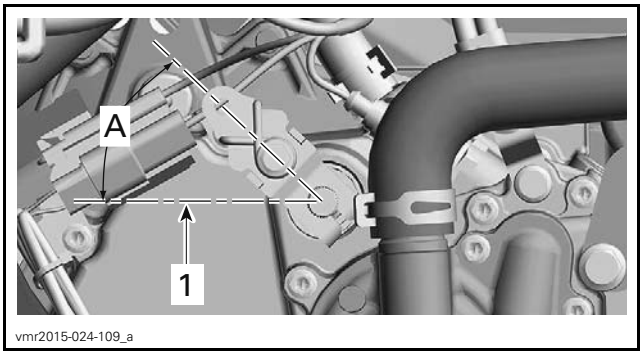
Shift Plate Installation

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

Ensure gearbox is in NEUTRAL position before shift plate installation.

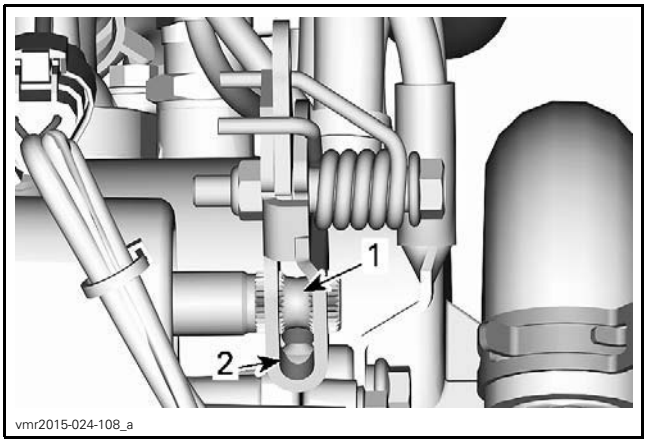
Align shift plate using marks previously traced.

If there are no index marks, adjust shift plate as per following illustration.



1. Horizontal plane line (ref. lower frame member)
A. 43.7°

Center the shift plate opening with the groove of the shift shaft.



1. Shift plate opening
2. Shift shaft groove

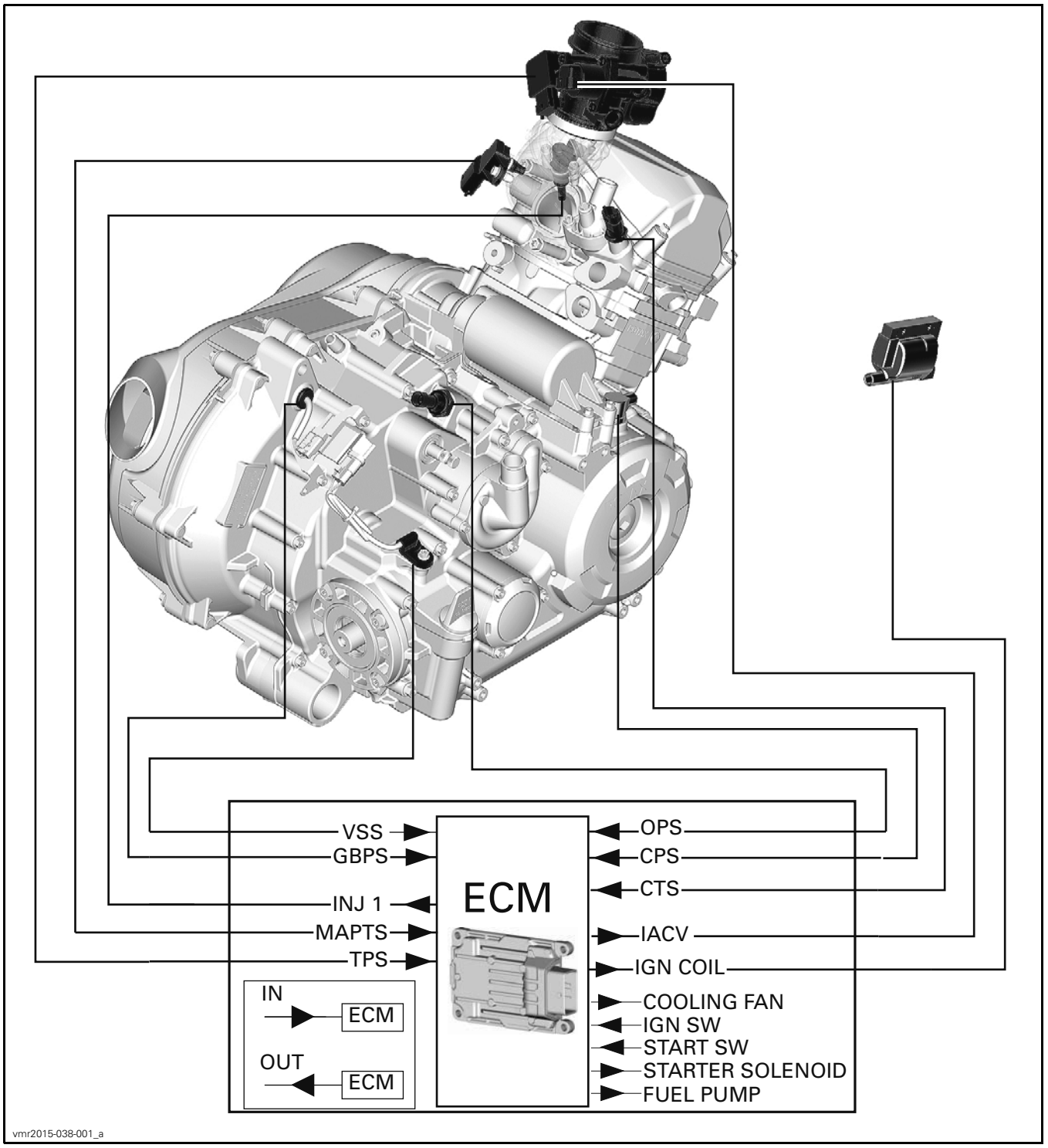
Adjust shift rod, refer to *SHIFT ROD ADJUSTMENT* in this subsection.

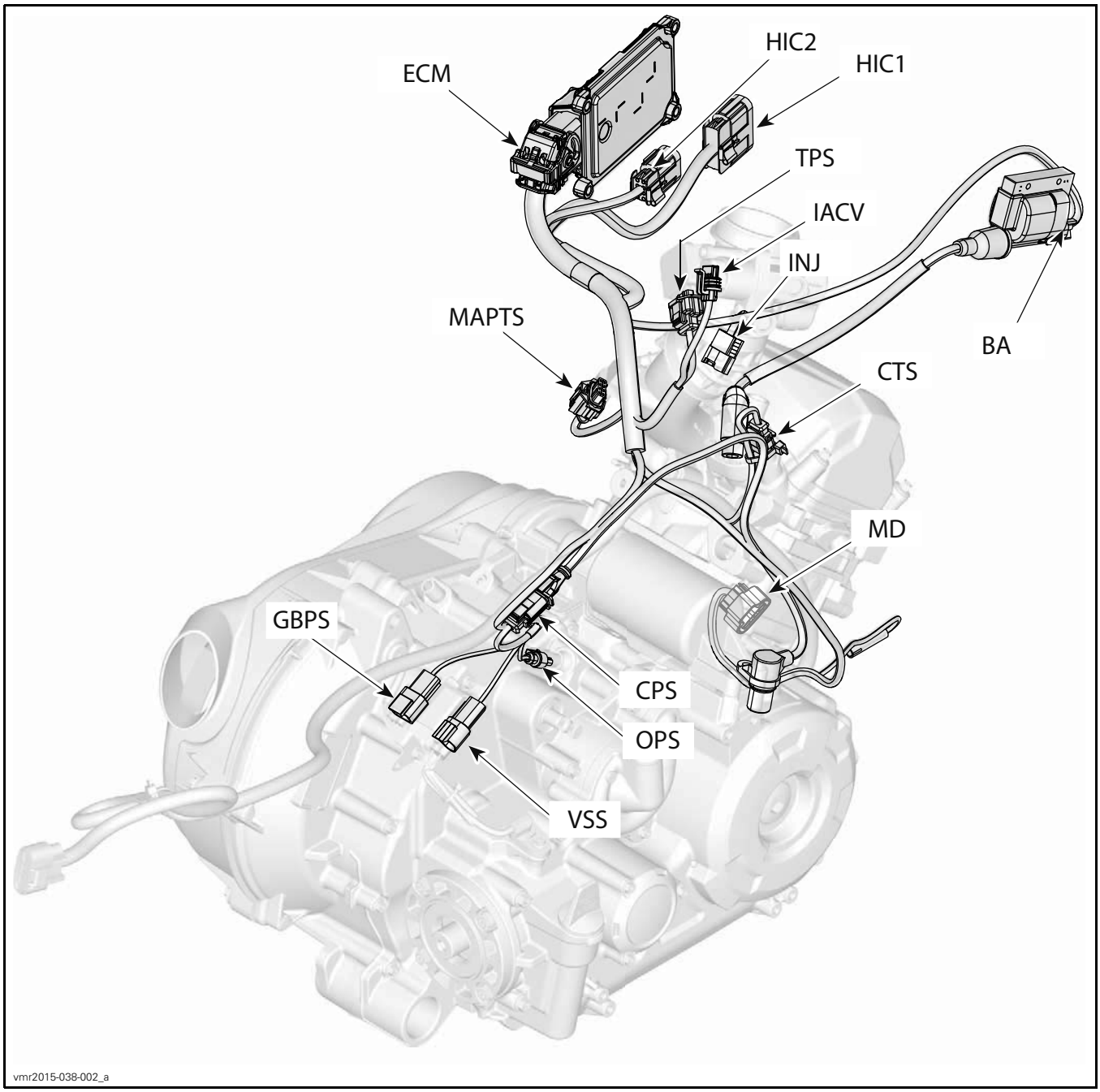
Tighten shift plate nut to specification.

SHIFT PLATE NUT TORQUE
9 N•m ± 1 N•m (80 lbf•**in** ± 9 lbf•**in**)

ENGINE MANAGEMENT SYSTEM (450)

GENERAL





ABBREVIATION	DEFINITION
BA	Ignition coil
CPS	Crankshaft position sensor
CTS	Coolant temperature sensor
ECM	Electronic control module
GBPS	Gear box position sensor
HIC1‡	Harness interconnect 1
HIC2‡	Harness interconnect 2
IACV	Idle air control valve
INJ1	Injector 1 (front)

ABBREVIATION	DEFINITION
MAPTS	Manifold absolute pressure and temperature sensor
MD	4WD Actuator
OPS	Oil pressure switch
SD	4WD Signal
TPS	Throttle position sensor
VSS	Vehicle speed sensor
‡Refer to applicable *WIRING HARNESS AND CONNECTORS* subsection for the vehicle harness.	

SYSTEM DESCRIPTION

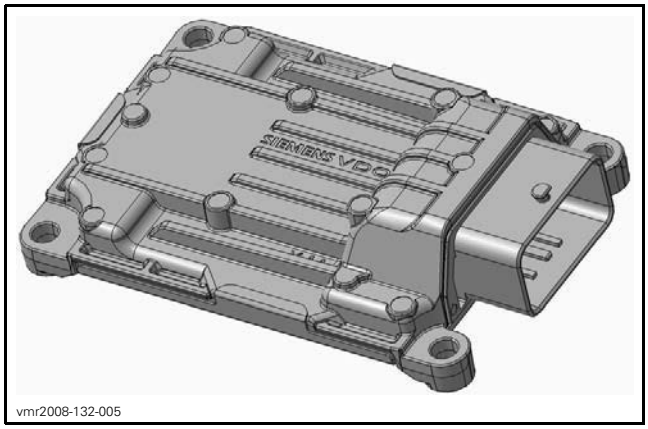
The HIC# connectors connect the vehicle harness to the powertrain harness.

The MD connector connects to the 4 wheel drive actuator.

There are 4 main systems that are controlled by the engine management system (EMS):

1. Electronic fuel injection (EFI)
2. Ignition system
3. Starting system
4. Cooling system.

ENGINE CONTROL MODULE (ECM)



ECM

The ECM controls the electrical system and the engine management functions, by processing the information given by various sensors.

The ECM is located on the left hand side of the air filter housing.

Engine RPM Limiter

The ECM will limit the maximum engine speed when vehicle shifter is in:

– Forward position (Hi and LO individually)
– Neutral position
– Park position
– Reverse position.

The ECM uses the CPS and the GBPS for this function.

An override switch, on the handlebar, allows the engine speed to run higher than the RPM limiter when more power is needed in reverse operation. Refer to *LIGHTS, GAUGE AND ACCESSORIES*.

Vehicle Speed Limiter

The ECM will limit the maximum vehicle speed both in 2WD and in 4WD. For this purpose, the ECM uses the VSS and the GBPS .

Drowned Mode (Flooded Engine)

If engine is fuel-flooded and does not start, this special mode can be activated to prevent fuel injection and ignition while cranking. Proceed as follows to activate it.

With ignition key in ignition switch at ON position while engine is stopped, press and HOLD throttle lever at WOT position.

Press the start button. The mode is now on.

Releasing throttle lever will bring back the normal mode.

Monitoring System

The ECM monitors the electronic components of the fuel injection system and also parts of the electrical system.

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

Limp Home Mode

The ECM may automatically set default parameters to the engine management to ensure the adequate operation of the engine if a component of the fuel injection system is not operating properly. The engine will operate with reduced performance to protect the engine. In more severe cases, the engine RPM will be limited, also to protect the engine.

These performance-reduced modes allow the rider to go back home which would not be otherwise possible without this advanced system. Refer to the *MONITORING SYSTEM/FAULT CODES*.

Diagnostic Mode

The ECM features a self-diagnostic mode when ignition key is turned on. However, some components need the engine to be running so that they can be monitored. Some problems will turn on a warning lamp or will set the engine in limp home mode. Refer to *DIAGNOSTIC AND FAULT CODES* section for more information.

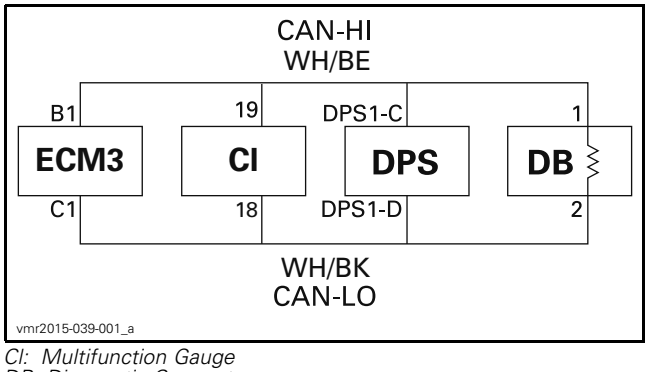
CONTROLLER AREA NETWORK (CAN)

GENERAL

SYSTEM DESCRIPTION

The Controller Area Network (CAN) protocol is an ISO standard for serial data communication. The CAN bus links the ECM, multifunction gauge and DPS module together so that they can communicate to each other and interact as required. The components (modules) are connected together by 2 wires and are in constant communication at a rate of about every 20 milliseconds. CAN lines consist of a pair of wires (WH/BE and WH/BK).

If a component or system malfunction is detected, a module (ECM, multifunction gauge or DPS) may generate a fault code, which it transmits through the CAN bus as a signal. The fault signal may be used for various functions such as triggering the display of an error message in the multifunction gauge cluster, turning on a fault indicator light, limiting or inhibiting vehicle or engine operation, or viewed using the B.U.D.S. software for troubleshooting.



CI: Multifunction Gauge
DB: Diagnostic Connector
ECM3: Engine Control Module
DPS: Dynamic Power Steering
WH/BE: (wire color code)
WH/BK: (wire color code)

COMMUNICATION TOOLS AND B.U.D.S.

SERVICE TOOLS

Description	Part Number	Page
MPI-2 DIAGNOSTIC CABLE	710 000 851	431
MPI-2 INTERFACE CARD	529 036 018	431

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
MALE-FEMALE EXTENSION SERIAL CABLE	DB9	431

GENERAL

Refer to *PROCEDURES* for instructions on the communication tools.

If communication problems occur, refer to *TROUBLESHOOTING* in this subsection.

TROUBLESHOOTING

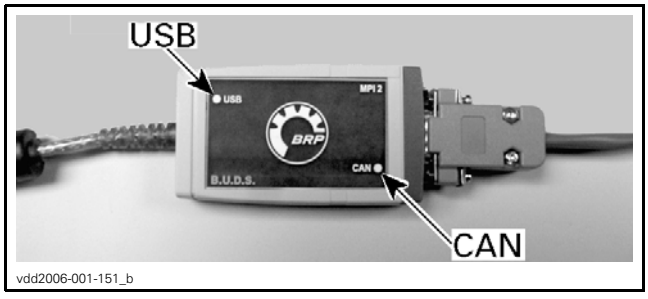
DIAGNOSTIC TIPS

IMPORTANT: Make sure all connections are made and vehicle is powered up **before starting B.U.D.S.** to allow proper communication between the vehicle and B.U.D.S.

MPI-2 Connection Troubleshooting

MPI-2 Status Lights

The MPI-2 includes 2 status lights that indicate the connection condition: 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.

USB LIGHT	
STATUS	WHAT TO DO
Light is OFF	Check USB connection between MPI-2 and PC computer. Check USB operation on PC computer (hardware or Windows drivers)
Light is GREEN	Connections are GOOD. Communication can take place on USB side

Prerequisite for CAN Communication:
- MPI-2 connected to diagnostic connector on vehicle.
- ECM turned on (electrical system powered up without engine started).
- Ignition key installed and turned to ON.
- B.U.D.S. started and logged on.

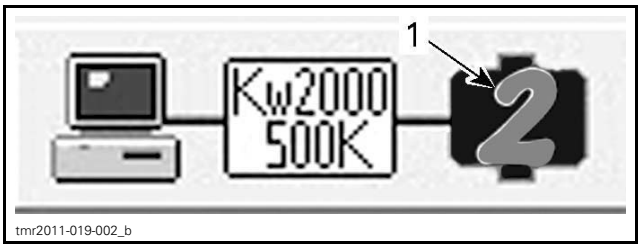
CAN LIGHT	
STATUS	WHAT TO DO
Light is OFF	Check connection between MPI-2 and diagnostic connector on vehicle
Light is RED	Check CAN wires/connectors on vehicle
Light is GREEN	Connections are GOOD. Communication can take place on CAN side

Communication Problems when Using B.U.D.S.

Missing Module

Ensure the appropriate number of modules is shown at the bottom RH side of B.U.D.S. screen.

MODEL	NUMBER OF MODULES
Models without DPS	2 (ECM and multifunction gauge)
Models with DPS	3 (ECM, DPS and multifunction gauge)

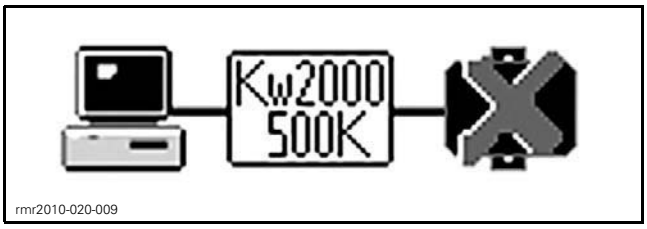


TYPICAL
1. Number of modules

If one or more "ECU" is not communicating with the MPI, refer to *DIAGNOSTIC SYSTEM AND FAULT CODES*.

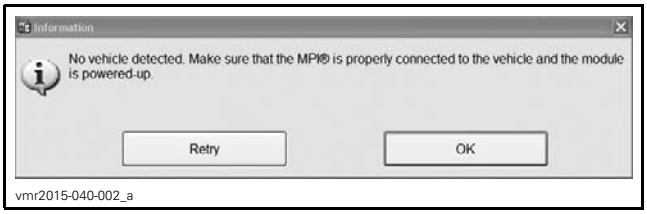
No Vehicle is Detected

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.



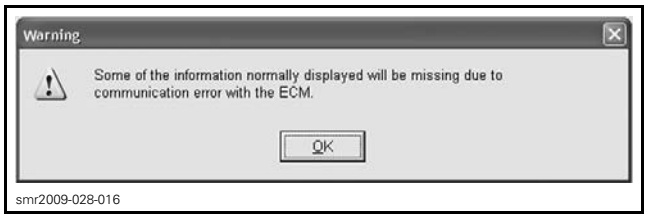
Check the following:
- Connections between the PC computer and the vehicle.
- The multifunction gauge is powered up.

If B.U.D.S. does not automatically exit the following message box, click the **Retry** button. This will manually establish the communication with the vehicle.



Message Box: "Some of the Information Normally Displayed..."

If the following message box is displayed in B.U.D.S.:



1. Click on the **OK** button in the box.
2. Click on the **Read Data** button in B.U.D.S.

PROCEDURES

MULTI-PURPOSE INTERFACE-2 (MPI-2)

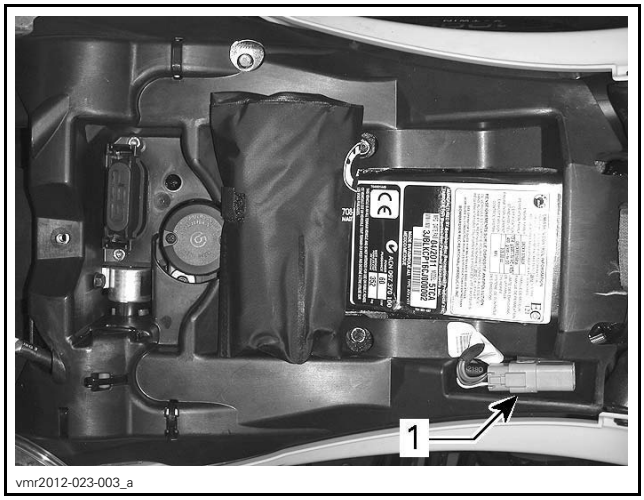
The MPI-2 (Multi-Purpose Interface-2) in conjunction with the MPI-2 diagnostic cable is used with B.U.D.S. to communicate with the ECM (engine control module) and other modules.

MPI-2 Power

The MPI-2 interface card uses the power from the PC computer's USB port.

Diagnostic Connector Location

The 6-pin diagnostic connector is located under the seat, stored in it's protective cap.



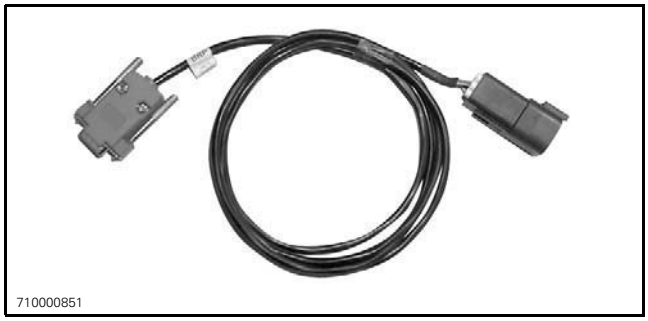
1. Diagnostic connector

Connecting the PC to the Vehicle

⚠ WARNING

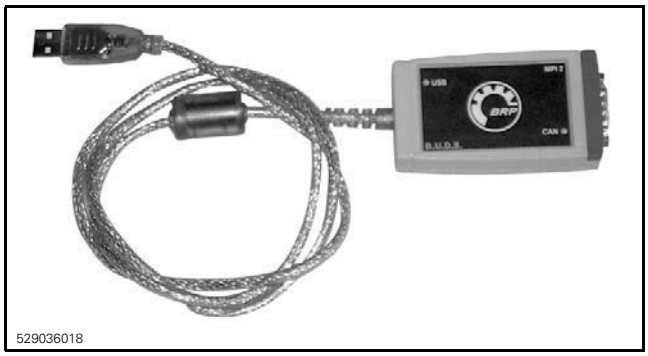
If the computer you are using is connected to the 110 Vac power outlet, there is a potential risk of electrocution when working in contact with water. Be careful not to touch water while working with the VCK.

1. Locate the 6-pin diagnostic connector, refer to *DIAGNOSTIC CONNECTOR LOCATION* in this subsection.
2. Disconnect the 6-pin diagnostic connector from it's holder (protective cap).
3. Connect one end of the MPI-2 DIAGNOSTIC CABLE (P/N 710 000 851) to the vehicle connector.

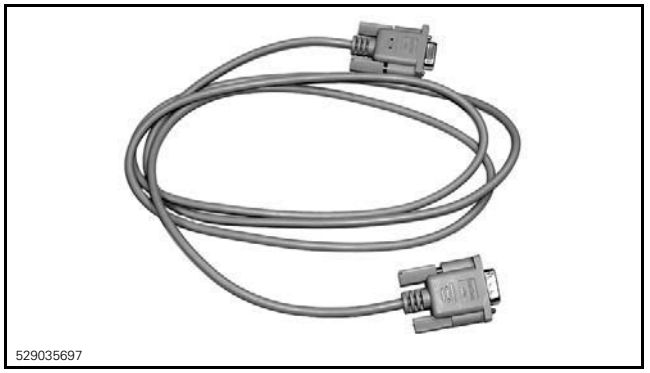


DIAGNOSTIC CABLE CONNECTED TO VEHICLE

4. Connect the other end of diagnostic cable to the MPI-2 INTERFACE CARD (P/N 529 036 018).

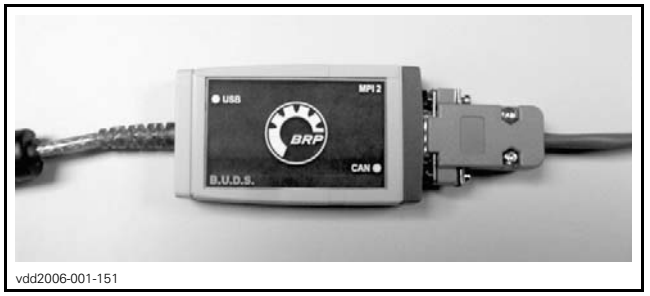


NOTE: An optional MALE-FEMALE EXTENSION SERIAL CABLE (P/N DB9) available at electronic retail outlets can be used between diagnostic cable and MPI-2 interface. Do not exceed 7.6 m (25 ft).

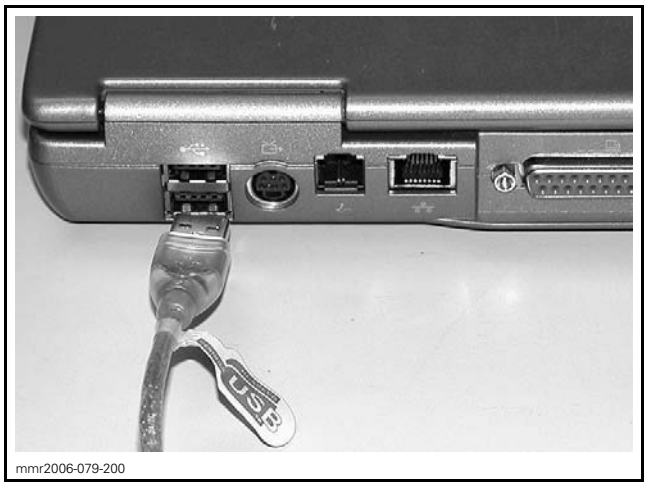


OPTIONAL MALE-FEMALE EXTENSION SERIAL CABLE

5. Connect the MPI-2 INTERFACE CARD (P/N 529 036 018) to the USB port of a PC (personal computer).



DIAGNOSTIC CABLE CONNECTED TO MPI-2 INTERFACE CARD



MPI-2 INTERFACE CARD CONNECTED TO USB PORT

6. Use B.U.D.S. as described further in *B.U.D.S.*

B.U.D.S.

B.U.D.S. (Bombardier Utility and Diagnostic Software) is designed to allow programming key(s) to the vehicle, allow electrical and electronic component monitoring, activation of certain components for diagnostic purposes, and to carry out setting changes.

For more information pertaining to the use of the B.U.D.S., use its **Help** menu which contains detailed information on its functions.

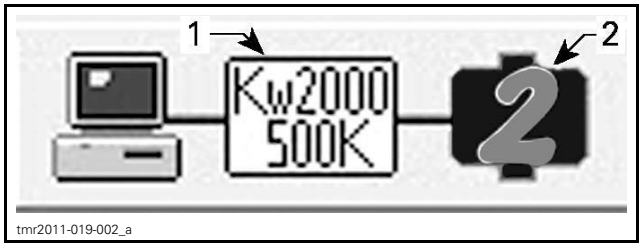
Always use the latest applicable B.U.D.S. version available on BOSSWeb.

How to Establish Communication Using B.U.D.S. Software

IMPORTANT: Ensure all connections have been made **before starting B.U.D.S.** to allow proper operation. Refer to *MPI-2* in this subsection.

1. Turn ignition switch to ON using any of the keys provided with the vehicle. Do not start the engine.
2. Set the emergency engine stop switch to RUN.
3. Start B.U.D.S. and logon.
4. Ensure the status bar shows the Kw2000 (500K) protocol and the appropriate number of modules to its right according to the vehicle model.

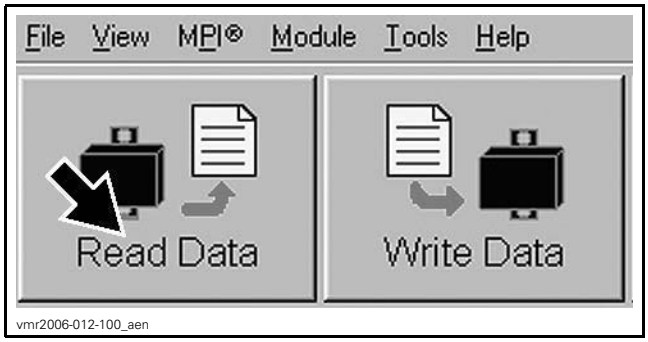
VEHICLE MODEL	PROTOCOL	NUMBER OF MODULES
Models without DPS	Kw2000 (500K)	2
Models with DPS		3



tmr2011-019-002_a

TYPICAL - SUCCESSFUL CONNECTION
1. Connection protocol
2. Number of modules read

5. Read ECUs by clicking the **Read Data** button.



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B.U.D.S. is now ready to use.

When clicking on the **Read Data** button, B.U.D.S. will read the modules through CAN bus.

Electronic Modules (ECU) Updates

NOTICE **Failure to strictly follow a procedure to update 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.



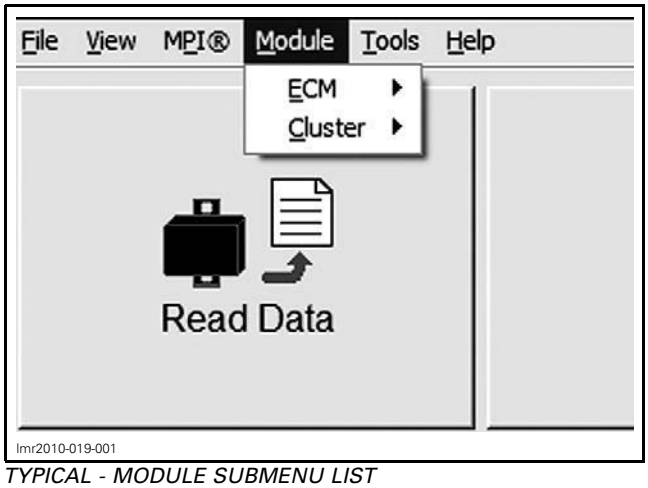
smr2010-030-002_a

TYPICAL

If the icon is visible, it indicates that a file is available in B.U.D.S. to update at least one of the electronic modules:

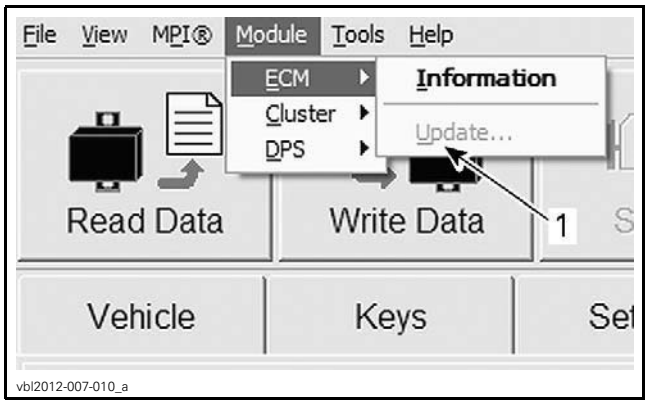
NOTE: If an update file is available on BOSSWeb but the B.U.D.S. software being used is not up to date, the update icon will not appear. Refer to the *SERVICE BULLETINS* to see if there is an update available.

Use the **Module** submenu and check all modules one at a time to see which module(s) can be updated.



TYPICAL - MODULE SUBMENU LIST

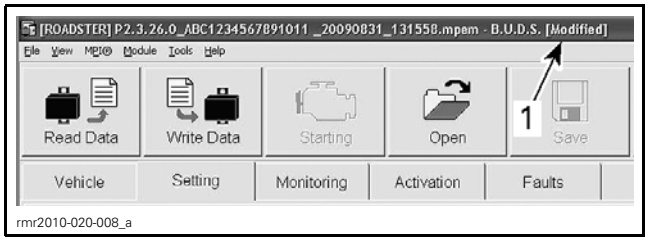
1. If the **Update** option is **greyed out**, no update file is available for this module.
2. If the **Update** option is **black**, an update file is available for this module.



1. Greyed out: No update to perform
Black: Update file available

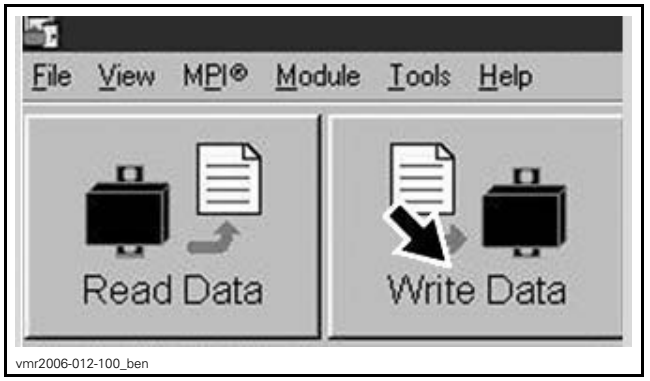
Writing Changes (Saving) in a Module

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.

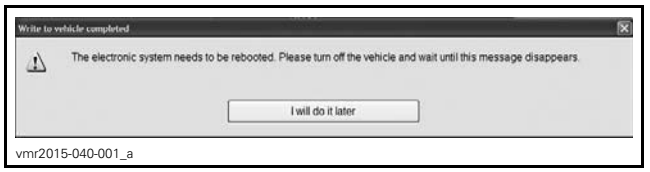


TYPICAL
1. Indicate setting or data modified; Write Data to save

Click the **Write Data** button.

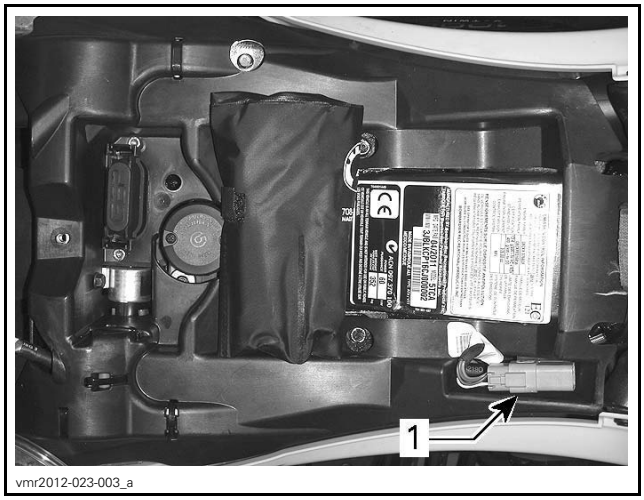


After clicking on **Write Data**, the following message may appear.



In such a case, turn ignition switch OFF, then wait for the message to disappear before disconnecting the MPI.

Disconnect MPI and store the vehicle diagnostic connector in its protective cap.



1. Diagnostic connector in its storage cap

NOTICE Failure to secure the diagnostic connector in its protective cap may result in corrosion or other damage to the terminals.

DIAGNOSTIC AND FAULT CODES

GENERAL

MONITORING SYSTEM

The Engine Management System (EMS) features a monitoring system that self-diagnoses various electrical and electronic components. This mode becomes active when the ignition key is turned ON.

NOTE: Some components require the engine to be running to be monitored (fuel injectors for example).

The monitoring system continuously validates that the components (control modules, sensors and actuators) are not faulty or defective. When a malfunction is detected, the related electronic module(s):

- Sets an active fault code.
- Adapts the proper protection strategy according to the failure.
- Sends out signals to the multifunction gauge to inform the rider of a particular condition.

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

If a minor fault occurs, the engine and vehicle will continue to operate without noticeable loss of performance.

If a more important fault occurs, engine RPM may be limited. The engine/vehicle will continue to operate with reduced performance.

If a major component of the EMS fails, engine RPM will be limited as well as vehicle speed.

These strategies are used to protect engine/electrical system from damage and to maintain safe operation of the vehicle. In extreme cases, the engine may also be completely shut down.

Pilot Lamps for Problematic Conditions

When a problem is detected, a pilot lamp will turn on or blink in the multifunction gauge. If the fault that caused the pilot lamp to come on is momentary, the pilot lamp may turn off automatically, or may need to be reset by powering down the vehicle and then restarting it.

A message may also be displayed to provide additional information related to the fault that turned on the pilot lamp. Refer to the following chart.

NOTE: In some cases, the CHECK ENGINE message can be displayed along with other messages.

PILOT LAMP	MULTI-FUNCTION GAUGE MESSAGE	CAUSE
	LO BATT VOLT	Low system voltage
	HIGH BATT VOLT	High system voltage
	LOW OIL PRESSURE STOP ENGINE	Low engine oil pressure
	LIMP HOME MODE	An important engine management component is not working properly. Vehicle performance is purposely limited
	CHECK ENGINE	An engine management component is not functioning properly
	MAINTENANCE REQUIRED	Periodic maintenance required
	ECM NOT RECOGNIZED	Communication error between gauge and ECM
	CHECK DPS	DPS malfunction (DPS model only)
	TRANSMISSION SIGNAL FAULT	Gauge receives an invalid gear position data
	BRAKE	Displayed when brake is applied for more than 15 seconds (while riding)
	HI TEMP	High engine temperature

Limp Home Mode

When a major component of the EMS is not operating properly, limp home mode will be set.

Engine RPM will be limited and/or engine behavior and control may be modified depending on the cause of the failure.

This mode allows the rider to return home, which would otherwise not be possible without this advanced system.

LIMP HOME will be displayed in the multifunction gauge and the CHECK ENGINE light symbol will be on in the gauge.

FAULT CODES

Fault Code Categories

A fault code consists of an alphanumeric designator followed by a hexadecimal number of 3 digits. The alphanumeric designator defines the category of the fault code while the hexadecimal number refers to a unique fault.

FAULT CODE CATEGORIES		
ALPHANUMERIC DESIGNATOR	MODULE/ SYSTEM	EXAMPLE OF FAULT CODE
From P0 to P3	Power train, TCM and DPS	P0116
From U0 to U3	Communication between module and sensors	U0073

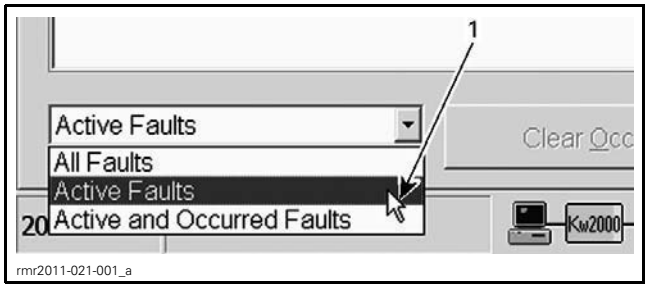
RELATED MODULE AND FAULTS	
MODULE	FAULT CODE CATEGORY
ECM	P and U
DPS	P and U
Cluster	P and U

Fault Code States

Fault codes have 3 possible states:
- Active
- Occurred
- Inactive.

Click the **Fault** tab then click on the drop-down list on the LH lower corner.

Choose the fault code state you want to display.



TYPICAL
1. Drop down list

Active Fault Codes

An active fault code is an indication of a fault that is **currently triggered**.

The active fault may or may not compromise normal operation of the system(s). Service action should be taken to correct the problem that caused the fault code.

Once the fault condition(s) of the active fault is no longer present, its state will change to "occurred".

Occurred Fault Codes

An occurred fault code indicates a fault that was active, but **no longer** is.

The occurred fault does not presently affect system or component operation but is retained as a history of the faults that were detected.

The fault may have been generated due to a system or component that was momentarily operating outside normal parameters. Repeated occurred faults of this type should be considered when troubleshooting a problem, and may require that maintenance action be taken.

An occurred fault may also be generated when disconnecting and reconnecting a component, replacing a burnt fuse, when the software update of an electronic module has been carried out, or may be due to a momentary high or low voltage.

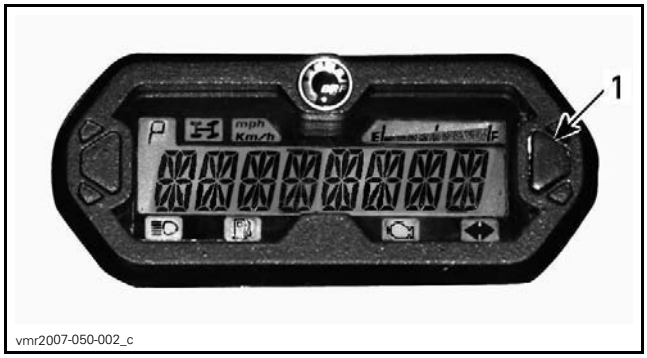
Inactive Fault Codes

An inactive fault code represents a fault code that is neither active, nor occurred. It is simply part of a list of all possible faults that can be monitored by the ECM and multifunction gauge, which may become active or occurred if the monitoring system detects an applicable fault. These codes can be viewed in B.U.D.S.

How to Display Fault Codes in the Multifunction Gauge

NOTE: A fault code must be in an "Active" state to be displayed in the multifunction gauge. B.U.D.S. must be used to read all fault codes states.

1. Use the selector button or mode button and scroll to Engine Hour (EH) on the gauge.



RENEGADE
1. Selector button

2. Press and HOLD mode button while QUICKLY toggling HI - LO beam.

NOTE: A minimum of 3 HI - LO toggles must be completed within 2 seconds.



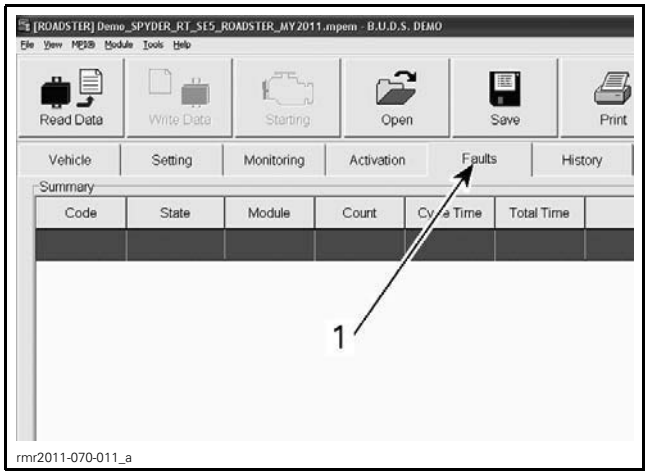
vdd2008-001-097_a

TYPICAL
Step 1: Press and hold
Step 2: Quickly toggle HI - LO beam

How to Read Fault Codes Using B.U.D.S.

NOTE: All fault code (regardless of their state) can be read with B.U.D.S.

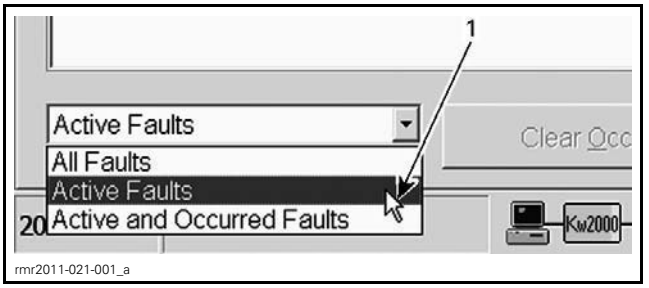
1. Connect vehicle to the latest applicable B.U.D.S. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Click on the **Read Data** button.
3. Click on the **Faults** tab.



rmr2011-070-011_a

1. Fault tab

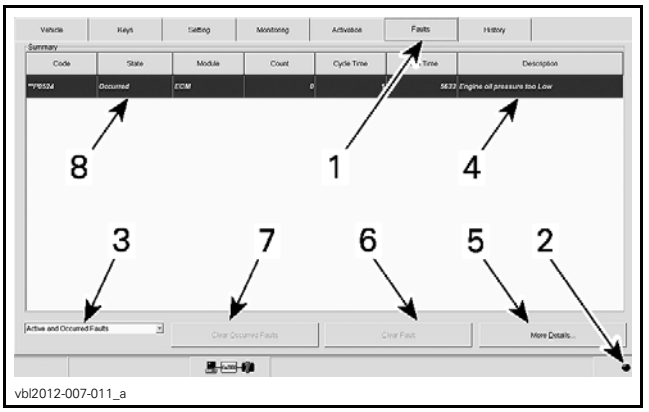
4. Click on the drop-down list on the LH lower corner.
5. Choose the fault state to display.



rmr2011-021-001_a

1. Drop down list

FAULT STATE	INFORMATION
All faults	Display all possible faults regardless of state
Active faults	Display only faults matching this state Empty area if there is no active fault
Active and occurred faults	Display only faults that have either state Empty area if there is neither active nor occurred fault



vbl2012-007-011_a

FAULT PAGE
*1. **Fault** tab*
2. Fault indicator light
3. Fault code state drop box
4. Fault description
5. More Details button
6. Clear Fault button
7. Clear Occurred Faults button
8. Selected fault

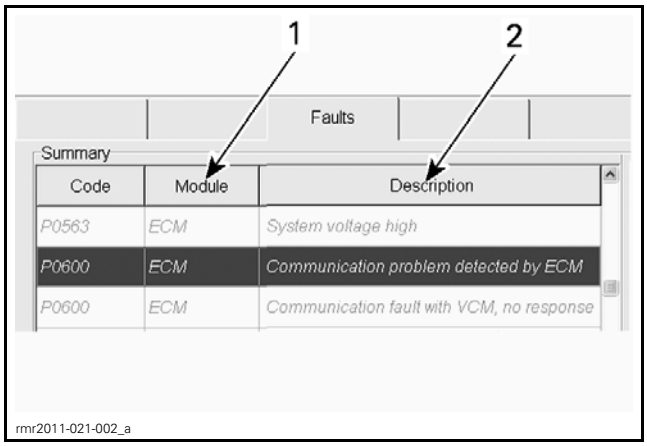
FAULT PAGE DESCRIPTION	
ITEM	INFORMATION
Fault tab	Click tab to display the fault page
Fault indicator light	When flashing, it indicates there is active fault(s)
Fault code state drop box	Click drop box to select the type of faults to display
Fault nomenclature	Display specific information and statistics related to the fault (see fault nomenclature table)

FAULT PAGE DESCRIPTION	
ITEM	INFORMATION
More Details button	To display possible causes and service actions related to the selected fault
Clear Fault button	To clear occurred faults one at a time
Clear Occurred Faults button	To clear all occurred faults in related ECU(s)
Selected fault	When a fault is selected, additional information pertaining to that fault will be displayed when clicking the "More details" button. To select a fault, click on the fault with the mouse or use the cursor up or down to scroll to the desired fault

FAULT NOMENCLATURE	
COLUMN	INFORMATION
Code	Fault code number. When 2 stars (**) precedes the code, detailed conditions when the fault occurred, can be displayed by clicking the "More details" button
State	Display the fault state (active, occurred, inactive)
Module	Displays the module that reports the fault code. This is the module that detects or has received a message of an anomaly and reports it. List of modules: - Cluster (multifunction gauge) - DPS (dynamic power steering) - ECM (engine control module)
Count	Number of times this fault occurred within the driving cycle. Value: From 0 to 255
Cycle time	Not to be used. Value: From 0 to 255 minutes
Total time	Not to be used. Value: From 0 to 64 255 minutes
Description	Provides a short description of the fault

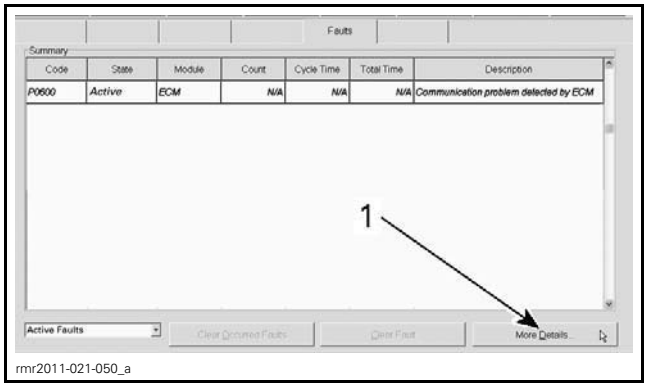
When reading a fault code in B.U.D.S., pay particular attention to which module reports a fault. It is indicated in the **Module** column.

The **Description** column gives a short description of the fault.

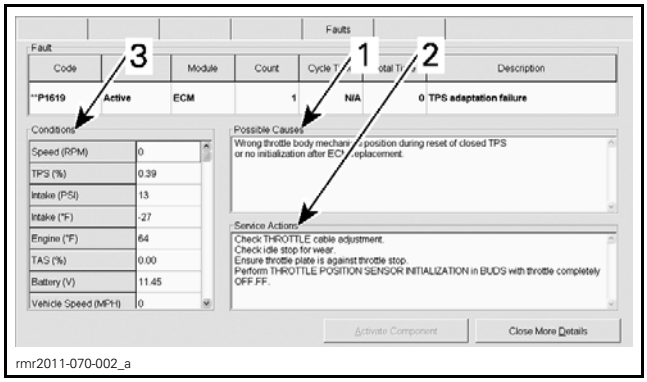


SOME COLUMNS REMOVED FOR CLARITY PURPOSE
1. *Module that reports a fault*
2. *Fault description*

Click on the **More Details** button, on the RH lower corner, to display the "Possible Causes" and the "Service Actions" to step further in the diagnosis.



1. *Click here*



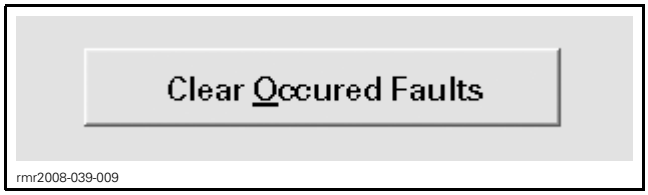
MORE DETAILS PAGE
1. *Possible causes related to the selected fault*
2. *Service actions*
3. *Operating conditions when fault occurred*

MORE DETAILS PAGE DESCRIPTION	
ITEM	INFORMATION
Possible causes	List the possible causes that triggered the fault
Service actions	List the possible actions to perform to solve the fault
Conditions when fault occurred	List the operating conditions of the engine and/or vehicle when the fault was triggered

How to Clear Fault Codes Using B.U.D.S.

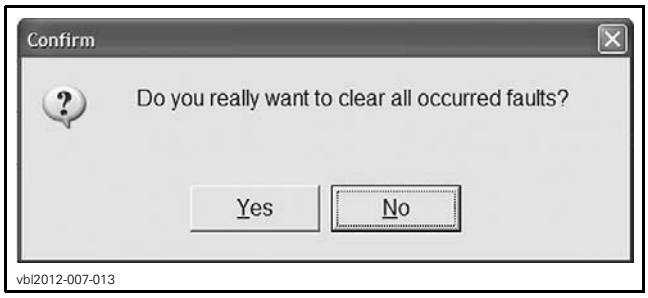
1. Connect vehicle to the latest applicable B.U.D.S. software. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Click on the **Read Data** button.
3. Click on the **Faults** tab.

The fault(s) (occurred state only) can be cleared by pressing the **Clear Occurred Faults**or **Clear Fault** buttons in B.U.D.S.



FAULTS PAGE TAB, CLEAR OCCURRED FAULTS

4. Click YES on the following message box.



The following message will appear.



5. Turn ignition OFF and wait until the message disappears.

This will reset the appropriate counter(s) and will also record that the problem has been fixed in the related ECU memory.

NOTE: An active fault code cannot be cleared. In other words, the problem relevant to the fault code must be repaired before the fault can be cleared.

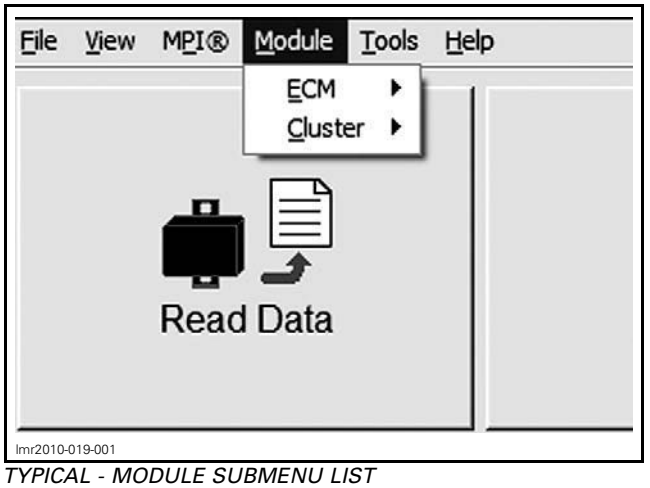
FAULT CODE DIAGNOSTIC

Missing Module

If a module is missing, several fault codes will appear.

To quickly find which module is missing, perform the following:

1. Connect vehicle to the latest applicable B.U.D.S. software. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Click on the **Read Data** button.
3. Click **Module** in the menu bar.
4. Look at the list of modules.
5. If a module is not visible, then it is not communicating through the CAN bus (controller area network).



TYPICAL - MODULE SUBMENU LIST

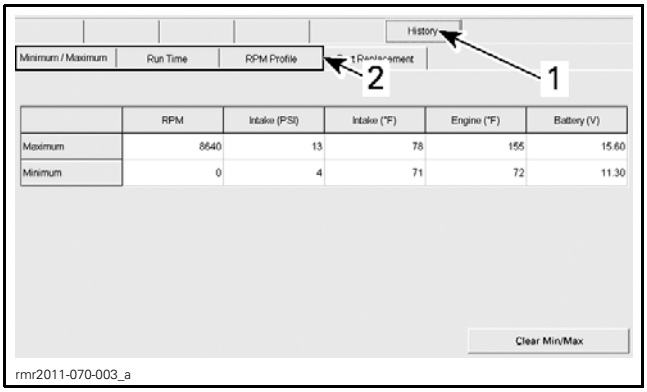
6. Refer to the following table to find the appropriate subsection in this manual to diagnose the missing module.

MISSING MODULE	SECTION TO REFER TO
ECM	*ELECTRONIC FUEL INJECTION (EFI)*
Cluster	*LIGHTS, GAUGE AND ACCESSORIES*
DPS	*DYNAMIC POWER STEERING (DPS)*

Diagnostic Tips

To see the last minute of operating conditions, click on the **History** tab in B.U.D.S.

NOTE: The page displays data whatever there is fault code(s) or not.



1. History tab
2. Additional history pages

HISTORY PAGE DESCRIPTION	
ITEM	INFORMATION
Minimum/ Maximum	Display the minimum and maximum values encountered. Click "Clear Min/Max" to reset the values
Run time	Display the time proportion in what mode the engine was running in
RPM profile	Display the RPM range proportion in which the engine was running in

When a minor fault occurs:
– Turn ignition key OFF.
– Wait 30 seconds.
– Turn ignition key ON.

This should change the fault state from "Active" to "Occurred".

The vehicle should then operate normally.

If a sensor-related fault persists, you may try disconnecting/reconnecting the sensor.

Read the following for a general approach to troubleshoot fault codes (active or occurred).

GENERAL GUIDELINES TO SOLVE FAULT CODES	
CONDITION	ACTION
Troubleshooting vehicle	Use B.U.D.S. to: Read fault codes. Display "Active" faults to see components currently not operating normally. Display "Occurred" faults to troubleshoot intermittent problems. Monitor system(s), sensor(s), switches and actual conditions. Activate component(s) for troubleshooting. Set components (resets etc). Know the last minute of operating conditions by using the "History" page. Know the operating conditions, if available, when a fault code occurred by using the "More details" button in the fault page.
New fault(s) appear after a vehicle maintenance or repair	Check sensor connections or mixed up connections. **Before** vehicle maintenance: Read the electronic modules with B.U.D.S. **After** vehicle maintenance: Read the electronic modules with B.U.D.S. Compare the fault code(s) before and after the maintenance using the printed copy and the current B.U.D.S. reading. Investigate only the newly fault codes. Clear all occurred faults in B.U.D.S.
Communication faults displayed as "Occurred" after module flashing	Normal behavior when flashing a module. Clear all occurred faults and check again.
Sensor "Active" fault	Read the fault description in B.U.D.S. Click on the "More Details" button. Look at the "Conditions" when available. Read the "Possible Causes". Apply the "Service Actions".

GENERAL GUIDELINES TO SOLVE FAULT CODES	
CONDITION	ACTION
Low system voltage on one module. Power problem on sensor(s)	Check related fuse(s) and relay. Check related power and ground wires. Check for common power supply to several sensors/modules (refer to *POWER DISTRIBUTION AND GROUNDS)*. **NOTE:** Some sensors are supplied by the battery while others are supplied by a module.
Low system voltage on several modules (several communication faults will also appear)	Check battery condition and connections. Check related fuse(s) and relay. Check voltage regulator/rectifier.
High system voltage on several modules	A battery charger has likely been used to substitute the vehicle battery. Clear all occurred faults and check again. Check voltage regulator/rectifier.
When all modules report that a module is missing	Check the module that is reported as missing. Check related fuse(s) and relay. Check related power and ground wires.
When several modules are in fault	Search for a common problem such as a faulty sensor.
CAN bus OFF	When several modules and sensors report that a module is missing. The missing module may report CAN bus off. Check related CAN wires (continuity, short to ground, short between CAN low and high). Check module pins and wiring terminals. Then, the other modules should stop reporting that module is missing.
Occurred fault(s)	May have been generated due to a system or component that was momentarily operating outside normal parameters.
	May be generated when disconnecting and reconnecting a component, replacing a burnt fuse, or may be due to a momentary high or low voltage.
	Before being "Occurred", a fault has always been "Active" for a certain time, indicating that an unexpected condition or problem has been present during the driving cycle. A frequent momentarily fault or an intermittent fault may never be seen as "Active" in B.U.D.S. while there is still a pending problem. This type of malfunctions can be discovered by looking at the "Occurred" faults and then by evaluating the fault count. As long as a fault is present, it is displayed as "Active".
Fault count (0 - 255)	**Low value:** Suggests handling problems (connections, terminal contact/shape etc.). **High value:** Suggests a frequent and unsolved problem. The problem should be investigated.
Fault conditions (more details button)	Look for abnormal, excessive values.
Hard to find problems	When the basic troubleshooting has been done and the fault code(s) persists, often the problem is related to the wiring harness, connections or electromechanical components. Short to ground, to battery or between wires. Wire splices, chafing, terminal problems (pulled out, bent, out of shape, corroded etc.). Bad contacts in switch or relay.

ECUs share information and their systems may interact with each other. Certain faults may cause more than one ECU to set a fault code or indication (pilot lamp or message) as the failure of some components may affect the operation of several systems.

FAULT CODE TABLE

ACRONYMS USED IN THE FAULT CODE TABLE	
USED IN FAULT CODE TABLE	MEANING
ECM	Engine Control Module
DPS	Dynamic Power Steering
CAN	Controller Area Network
TPS	Throttle Position Sensor
GBPS	Gearbox Position Sensor

HOW TO FIND FAULT CODE DESCRIPTIONS

For the latest fault code table, use the **Info Center** submenu in BOSSWeb and enter the following search criteria:

– Enclose the search within quotes " "
– Enter: "ATV DTC (All engines) 2015".

DIAGNOSTIC AND FAULT CODES

GENERAL

FAULT CODE TABLE

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
C2109	SCM-XMR	Release valve activation delay exceeded	Pressure did not drop to desired set point after predefined delay Release valve tube momentary blocked Blown valve fuse Damaged circuit wires or connectors Faulty valve block Faulty SCM	1- Go to Activations - SCM and start Rear Test routine. If the test passed, the system is working properly. Check the harness and connection to see a potential source of intermittent dysfunction, if nothing is found clear the occurred fault and no more actions have to be done. Mud, dust or water in the release tube may explain the fault code. If the Test status shows a Fail_release, proceed to next action step. 2-Verify the release tube (orange) for obstruction. If nothing is found go to next action step. 3- Unplug the valves block connector and measure that 12V is present between pin D of the connector on the SCM side and the battery negative post. If not, verify the valve fuse and relay (refer to schematics for more information). Verify the harness and the connection between the valve and the SCM. If everything is fine, go to next action step. 4- Verify the release valve activation by disconnecting the valve block electrical connector and applying 12V across pin D and H on valve connector. If the release valve is operating, change the SCM, otherwise change the valve block.

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
C2111	SCM-XMR	Auxiliary line pressure sensor value out of range	Too many values of the external sensor out of range (negative pressure) Sensor disconnect Damaged circuit wires or connectors Faulty auxiliary line sensor Faulty SCM	1- Go to Activations - SCM and start Rear Test routine. Verify that the Shock Absorber Pressure and the Auxiliary Line Pressure correlates in BUDS. If the test is done with no fault, the system is working properly. Check the harness and connection to see a potential source of intermittent dysfunction, if nothing is found clear the occurred fault and no more actions have to be done. If the Test Status shows a Fail_Comparison_Sensor_Test, verify for leak. If no leak found, verify the wiring and connector of the external sensor and the SCM. In the next action step, verify which of Shock absorber or Auxiliary Line Pressure sensors is defective. 2-Make sure to have no pressure in the system by activating the relief valve in Activation -SCM. Connect the supplied air hose into the compressor fitting and plug it to a known pressure supply in the range of 30 to 120 psi (as car tire) and compare it to the Shock absorber pressure and Auxiliary line pressure, it should be similar. If the Shock absorber pressure is off, change the SCM module. Go to next action step to perform Auxiliary Line Pressure sensor test. 3-Back probe the signal coming from the sensor between the pin 3 of the SCM electrical connector and the negative battery post (this action must be done with special probe to not damage the connector seal). The value must be between 0.9 and 8.3 Volts for a pressure range of 0 - 100 psi. If not go to next action step. If the value is in the range, the Auxiliary Line Pressure sensor is fine, change the SCM. 5- Unplug the Auxiliary Line Pressure sensor and make sure to have 12V between pin 3 and 1 on the connector coming from SCM. If 12V is present change the sensor, if not change the SCM.

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
C21E0	SCM-XMR	System rear suspension pumping delay exceeded	Pressure did not reach to desired set point after predefined delay Leak in the system Jammed compressor intake tube Damaged circuit wires or connectors Blown compressor fuse Corroded or disconnected compressor GND Faulty relay Faulty compressor Jammed check valve Faulty SCM	1- Check for leaks. If no leak found go to next action step. 2- Go to Activations - SCM and start Rear Test routine. If the test is done with no fault, the system is working properly. Check the harness and connector to see a potential source of intermittent dysfunction, if nothing is found clear the occurred fault and no more actions have to be done. If the compressor is not starting check the compressor GND, harness and connection then continue to the next action step. If the compressor is running and the Test Status show a Fail_Pumping_Rear go to action step 6. 3-Test the compressor with an external power supply (as a 12V battery). If the compressor is functional go to next action step. 4-Unplug the relay and make sure to have 12V between battery negative post and relay pin 30. If not, check the compressor fuse and harness. If 12V is present, test the relay. If the relay is functional plug it back and go to next action step. 5- Disconnect the SCM, take a jumper wire and connect pin 8 to the battery negative post. If then the compressor starts, change the SCM. 6- Verify that the compressor intake tube (transparent) is not blocked or kinked. Unplug the SCM air tube (yellow) and start the compressor. If air blow out of the tube change the SCM. If not go to next action step. 7- During the Rear Test routine verify the pressure sensors value. If the Shock Absorber Pressure and Auxiliary Line Pressure is not going up verify the first check valve at the exit of the compressor. If only the Shock Absorber Pressure is not going up verify the second check valve after green tube.
C21E1	SCM-XMR	System rear suspension high leakage detected	Leak in the system	1- Verify suspension system for air leaks.

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
C21E2	SCM-XMR	System rear suspension valve failure	Too many occurrence of pressure pumping and release in short delay Rear valve tube blocked Blown valve fuse Faulty valve block Damaged circuit wires or connectors Faulty SCM	1- Disconnect the air line to the rear shocks. Go to Activations - SCM and start Rear Test routine. If the air blows out the system is working properly. Check the harness and connection to see a potential source of intermittent dysfunction, if nothing is found clear the occurred fault and no more actions have to be done. If the air do not blow out continue to next action step. 2- Verify the air tube (black) from the valve to the rear suspension. If nothing found go to next action step. 3- Unplug the valve block electrical connector and verify that 12V is present between pin A and battery negative post. If not verify valve fuse, relay and harness (refer to schematics for more information). If 12V is read go to next action step. 4- Verify the rear valve activation by disconnecting the valve block electrical connector and applying 12V across pin A and E while compressor running (Go to Activations - SCM and start Rear Test routine). If the rear valve is opening and filling the shocks change the SCM. If the rear valve is not opening, change the block valve.

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
C21F0	SCM-XMR	System front suspension pumping delay exceeded	Pressure did not reach to desired set point after predefined delay Leak in the system Jammed compressor intake tube Damaged circuit wires or connectors Blown compressor fuse Corroded or disconnected compressor GND Faulty relay Faulty compressor Jammed check valve Faulty SCM	1- Check for leaks. If no leak found go to next action step. 2- Go to Activations - SCM and start Rear Front routine. If the test is done with no fault, the system is working properly. Check the harness and connector to see a potential source of intermittent dysfunction, if nothing is found clear the occurred fault and no more actions have to be done. If the compressor is not starting check the compressor GND, harness and connection then continue to the next action step. If the compressor is running and the Test Status show a Fail_Pumping_Rear go to action step 6. 3-Test the compressor with an external power supply (as a 12V battery). If the compressor is functional go to next action step. 4-Unplug the relay and make sure to have 12V between battery negative post and relay pin 30. If not, check the compressor fuse and harness. If 12V is present, test the relay. If the relay is functional plug it back and go to next action step. 5- Disconnect the SCM, take a jumper wire and connect pin 8 to the battery negative post. If then the compressor starts, change the SCM. 6- Verify that the compressor intake tube (transparent) is not blocked or kinked. Unplug the SCM air tube (yellow) and start the compressor. If air blow out of the tube change the SCM. If not go to next action step. 7- During the Front Test routine verify the pressure sensors value. If the Shock Absorber Pressure and Auxiliary Line Pressure is not going up verify the first check valve at the exit of the compressor. If only the Shock Absorber Pressure is not going up verify the second check valve after green tube.
C21F1	SCM-XMR	System front suspension high leakage detected	Leak in the system	1- Verify suspension system for air leaks.

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
C21F2	SCM-XMR	System front suspension valve failure	Too many occurrence of pressure pumping and release in short delay Front valve tube blocked Blown valve fuse Faulty valve block Damaged circuit wires or connectors Faulty SCM	1- Disconnect the air line from the front shocks. Go to Activations - SCM and start Front Test routine. If the air blows out of both shocks the system is working properly. Check the harness and connection to see a potential source of intermittent dysfunction, if nothing is found clear the occurred fault and no more actions have to be done. If the air does not blow out even from one shock continue to next action step. 2- Verify the air tubes (blue) from the valves to both front shocks. If clear go to next action step. 3- Unplug the valve block electrical connector and verify that 12V is present between pin B and battery negative post (right) / between pin C and battery negative post (left). If not verify valve fuse, relay and harness (refer to schematics for more information). If both 12V are read go to next action step. 4- Verify the front valves activation by disconnecting the valve block electrical connector and applying 12V across pin B and F (right) or C and G (wrong in wire diagram) (left) while compressor running (Go to Activations - SCM and start Front Test routine.). If the front valves are opening and filling the shocks change the SCM. If either of the front valves are not opening, change the block valve.
P0008	ECM	Lost of Synchronisation	Engine Synchronisation Check Failed	Check for Crankshaft Position Sensor fault Check for dirty Crankshaft Position Sensor. Check compression on engine

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0107	ECM	Manifold Air Pressure Sensor voltage too Low	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM pins, ECM voltage supply Low	Make sure sensor connector is fully inserted. Measure voltage between harness connector pins 1 and 3 . (Expected value: 4.8 to 5.1 volts) Measure resistance from connector: ECM-F3 to MAPTS-2 (Expected value: < 2 ohms) Measure resistance from connector: ECM-A1 to MAPTS-3 (Expected value: < 2 ohms) Measure resistance from connector: ECM-G2 to MAPTS-1 (Expected value: < 2 ohms) Measure resistance from connector: ECM-F2 to MAPTS-4 (Expected value: < 2 ohms)
P0108	ECM	Manifold Air Pressure Sensor voltage too High	Damaged sensor, wires shorted to battery +, ECM voltage supply too High.	Make sure sensor connector is fully inserted. Measure voltage between harness connector pins 1 and 3 . (Expected value: 4.8 to 5.1 volts) Measure resistance from connector: ECM-F3 to MAPTS-2 (Expected value: < 2 ohms) Measure resistance from connector: ECM-A1 to MAPTS-3 (Expected value: < 2 ohms) Measure resistance from connector: ECM-G2 to MAPTS-1 (Expected value: < 2 ohms) Measure resistance from connector: ECM-F2 to MAPTS-4 (Expected value: < 2 ohms)
P0112	ECM	Intake Air Temperature Sensor 1 circuit Low	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM pins, ECM voltage supply Low	Make sure sensor connector is fully inserted. Measure voltage between harness connector pins 1 and 3 . (Expected value: 4.8 to 5.1 volts) Measure resistance from connector: ECM-F3 to MAPTS-2 (Expected value: < 2 ohms) Measure resistance from connector: ECM-A1 to MAPTS-3 (Expected value: < 2 ohms) Measure resistance from connector: ECM-G2 to MAPTS-1 (Expected value: < 2 ohms) Measure resistance from connector: ECM-F2 to MAPTS-4 (Expected value: < 2 ohms)

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0113	ECM	Intake Air Temperature Sensor 1 circuit High	Damaged sensor, wires shorted to battery +, ECM voltage supply too High.	Make sure sensor connector is fully inserted. Measure voltage between harness connector pins 1 and 3 . (Expected value: 4.8 to 5.1 volts) Measure resistance from connector: ECM-F3 to MAPTS-2 (Expected value: < 2 ohms) Measure resistance from connector: ECM-A1 to MAPTS-3 (Expected value: < 2 ohms) Measure resistance from connector: ECM-G2 to MAPTS-1 (Expected value: < 2 ohms) Measure resistance from connector: ECM-F2 to MAPTS-4 (Expected value: < 2 ohms)
P0114	ECM	Intake Air Temperature Sensor Intermittent	Damaged sensor, damaged circuit wires, damaged connector or damaged ECM pins, ECM voltage supply	Make sure sensor connector is fully inserted. Measure voltage between harness connector pins 1 and 3 . (Expected value: 4.8 to 5.1 volts) Measure resistance from connector: ECM-F3 to MAPTS-2 (Expected value: < 2 ohms) Measure resistance from connector: ECM-A1 to MAPTS-3 (Expected value: < 2 ohms) Measure resistance from connector: ECM-G2 to MAPTS-1 (Expected value: < 2 ohms) Measure resistance from connector: ECM-F2 to MAPTS-4 (Expected value: < 2 ohms)
P0116	ECM	Engine Coolant Temperature Sensor 1 circuit range/performance	Damaged sensor, wires shorted to battery +, ECM voltage supply.	Disconnect the sensor. Measure resistance from connector: ECM-F4 to CTS-1 (Expected value: < 2 ohms) Measure resistance from connector: ECM-C3 to CTS-2 (Expected value: < 2 ohms) Measure CTS resistance value (Expected value: 2280 to 2736 ohms at 19 to 21°C (66 to 70°F))
P0117	ECM	Engine Coolant Temperature Sensor 1 circuit Low	Engine temperature sensor or circuit wires shorted to ground.	Disconnect the sensor. Measure resistance from connector: ECM-F4 to CTS-1 (Expected value: < 2 ohms) Measure resistance from connector: ECM-C3 to CTS-2 (Expected value: < 2 ohms) Measure CTS resistance value (Expected value: 2280 to 2736 ohms at 19 to 21°C (66 to 70°F))

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0118	ECM	Engine Coolant Temperature Sensor 1 circuit High	Disconnected sensor, or sensor resistance too High.	Disconnect the sensor. Measure resistance from connector: ECM-F4 to CTS-1 (Expected value: < 2 ohms) Measure resistance from connector: ECM-C3 to CTS-2 (Expected value: < 2 ohms) Measure CTS resistance value (Expected value: 2280 to 2736 ohms at 19 to 21°C (66 to 70°F))
P011A	ECM	Engine Coolant Temperature Correlation Check failed	Correlation Check failed	Check for coolant fluid leak and coolant fluid level Check radiator condition Check for other fault, Check thermostat
P0122	ECM	Throttle Position Sensor (TPS) Short circuit to GND	Damaged circuit wires, damaged sensor or damaged ECM pins.	Make sure sensor connector is fully inserted. Measure resistance from connector: ECM-A1 to TPS-1 (Expected value: < 2 ohms) Measure resistance from connector: ECM-G3 to TPS-3 (Expected value: < 2 ohms) Measure resistance from connector: ECM-G2 to TPS-2 (Expected value: < 2 ohms)
P0123	ECM	Throttle Position Sensor (TPS) shorted to battery +	Damaged circuit wires, damaged sensor or damaged ECM pins.	Make sure sensor connector is fully inserted. Measure resistance from connector: ECM-A1 to TPS-1 (Expected value: < 2 ohms) Measure resistance from connector: ECM-G3 to TPS-3 (Expected value: < 2 ohms) Measure resistance from connector: ECM-G2 to TPS-2 (Expected value: < 2 ohms)
P0217	ECM	Engine Coolant over temperature condition	Coolant fluid temperature too high	Check for coolant fluid leak and coolant fluid level Check radiator condition Check for other fault, Check thermostat
P0219	ECM	Engine Overspeed Condition detected	Engine speed too high	

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0231	ECM	Fuel Pump circuit shorted to ground, or open circuit	Blown fuse, damaged or disconnected fuel pump relay, damaged circuit wires, damaged connectors or damaged ECM output pins.	Check fuse Measure voltage between harness connector PF1-12B and ground (Expected value: 11 to 13 volts) Measure voltage between harness connector PF1-11B and ground (Expected value: 11 to 13 volts) Measure resistance from harness connector: ECM-J1 to PF1-12A (Expected value: < 2 ohms) Measure resistance from harness connector: PF1-11A to FP-3 (Expected value: < 2 ohms) Measure resistance from harness connector: FP-4 to ground (Expected value: < 2 ohms)
P0232	ECM	Fuel Pump circuit shorted to battery +	Blown fuse, damaged or disconnected fuel pump relay, damaged circuit wires, damaged connectors or damaged ECM output pins.	Check fuse Measure voltage between harness connector PF1-12B and ground (Expected value: 11 to 13 volts) Measure voltage between harness connector PF1-11B and ground (Expected value: 11 to 13 volts) Measure resistance from harness connector: ECM-J1 to PF1-12A (Expected value: < 2 ohms) Measure resistance from harness connector: PF1-11A to FP-3 (Expected value: < 2 ohms) Measure resistance from harness connector: FP-4 to ground (Expected value: < 2 ohms)
P0261	ECM	Cylinder 1 injector open circuit or shorted to ground	Blown fuse, damaged or disconnected injector, damaged or disconnected circuit wires, damaged ECM output pins.	Disconnect injector 1 Measure resistance between injector pin 1 and 2 (Expected value = 14 to15 ohms). Measure resistance from harness connector: INJ1-1 to INJ1-2 (Expected value: > OPEN) Measure voltage between harness connector INJ1-2 and ground. (Expected value: 11 to 13 volts) Measure resistance from harness connector: ECM-K4 to INJ1-1 (Expected value: < 2 ohms)

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0262	ECM	Cylinder 1 injector shorted to battery +	Damaged injector, damaged circuit wires, damaged connector or damaged ECM output pins.	Disconnect injector 1 Measure resistance between injector pin 1 and 2 (Expected value = 14 to15 ohms). Measure resistance from harness connector: INJ1-1 to INJ1-2 (Expected value: > OPEN) Measure voltage between harness connector INJ1-2 and ground. (Expected value: 11 to 13 volts) Measure resistance from harness connector: ECM-K4 to INJ1-1 (Expected value: < 2 ohms)
P0264	ECM	Cylinder 2 injector open circuit or shorted to ground	Blown fuse, damaged or disconnected injector, damaged or disconnected circuit wires, damaged ECM output pins.	Disconnect injector 2 Measure resistance between injector pin 1 and 2 (Expected value = 14 to15 ohms). Measure resistance from harness connector: INJ2-1 to INJ2-2 (Expected value: > OPEN) Measure voltage between harness connector INJ2-2 and ground. (Expected value: 11 to 13 volts) Measure resistance from harness connector: ECM-L4 to INJ2-1 (Expected value: < 2 ohms)
P0265	ECM	Cylinder 2 injector shorted to battery +	Damaged injector, damaged circuit wires, damaged connector or damaged ECM output pins.	Disconnect injector 2 Measure resistance between injector pin 1 and 2 (Expected value = 14 to15 ohms). Measure resistance from harness connector: INJ2-1 to INJ2-2 (Expected value: > OPEN) Measure voltage between harness connector INJ2-2 and ground. (Expected value: 11 to 13 volts) Measure resistance from harness connector: ECM-L4 to INJ2-1 (Expected value: < 2 ohms)
P0338	ECM	Crankshaft Position Sensor Spike detected	Damaged CPS, damaged circuit wires, damaged connector or damaged ECM output pins. Wrong mounting position of sensor	Make sure sensor connector is fully inserted. Measure resistance from connector: ECM-E1 to CPS-1 (Expected value: < 2 ohms) Measure resistance from connector: ECM-D1 to CPS-2 (Expected value: < 2 ohms)
P0339	ECM	Crankshaft Position Sensor Intermittent	incorect nomber of tooth detecded Damaged CPS, damaged circuit wires, damaged connector or damaged ECM output pins. Wrong mounting position of sensor	Make sure sensor connector is fully inserted. Measure resistance from connector: ECM-E1 to CPS-1 (Expected value: < 2 ohms) Measure resistance from connector: ECM-D1 to CPS-2 (Expected value: < 2 ohms)

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0480	ECM	Radiator cooling fan relay	Blown fuse, damaged or disconnected relay, damaged circuit wires or connectors, damaged ECM output pins, damaged Relay.	Check fuse Disconnect relay. Measure resistance between terminals 85 and 86 on relay. (Expected value: 70 to 90 Ohms) Measure resistance between harness connector PF-1E and ground. (Expected value > OPEN). Measure resistance from harness connector: ECM-B3 to PF1-1E (Expected value: < 2 ohms)
P0500	DPS	Invalid or missing vehicle speed	No vehicle speed available & Vehicle is in (H or L Gear) with Engine RPM over 4000RPM. Damaged Vehicle Speed sensor circuit, Damaged sensor, Wrong mounting position of speed sensor.	Check if vehicle speed is available in Monitoring page in BUDS. Measure voltage between harness connector CV-A (red) and CV-C (ground black). (Expected value: 11 to 13 volts) Measure resistance from connector: CI-9 to CV-B (pink) (Expected value: < 5 ohms) on ATV
P0508	ECM	Idle Air Control System Circuit Low	Damaged IDLE, damaged circuit wires, damaged connector or damaged ECM output pins.	Make sure IDLE connector is fully inserted. Measure resistance from connector: ECM-D4 to IDLE-D (Expected value: < 2 ohms) Measure resistance from connector: ECM-D3 to IDLE-A (Expected value: < 2 ohms) Measure resistance from connector: ECM-E4 to IDLE-B (Expected value: < 2 ohms) Measure resistance from connector: ECM-C4 to IDLE-C (Expected value: < 2 ohms)
P0509	ECM	Idle Air Control System Circuit High	Damaged IDLE, damaged circuit wires, damaged connector or damaged ECM output pins.	Make sure IDLE connector is fully inserted. Measure resistance from connector: ECM-D4 to IDLE-D (Expected value: < 2 ohms) Measure resistance from connector: ECM-D3 to IDLE-A (Expected value: < 2 ohms) Measure resistance from connector: ECM-E4 to IDLE-B (Expected value: < 2 ohms) Measure resistance from connector: ECM-C4 to IDLE-C (Expected value: < 2 ohms)
P0513	ECM	Invalid Access Key Detected	A non stored access key was detected when key switch was turned to ON.	Use a stored access key to turn key switch. If no stored access keys are available program one and try again

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0523	ECM	Engine oil pressure sensor sticking	Damaged switch, damaged circuit wires, damaged connector, damaged ECM pins.	Measure resistance between harness connector OPS and ground When engine stopped. (Expected value < 2 ohms) Measure resistance between harness connector OPS and ground When engine running. (Expected value = open) Measure resistance from harness connector: OPS to ECM-E2 (Expected value: < 2 ohms)
P0524	ECM	Engine oil pressure too Low	Damaged switch, damaged circuit wires, damaged connector, damaged ECM pins.	Measure resistance between harness connector OPS and ground When engine stopped. (Expected value < 2 ohms) Measure resistance between harness connector OPS and ground When engine running. (Expected value = open) Measure resistance from harness connector: OPS to ECM-E2 (Expected value: < 2 ohms)
P0551	DPS	TORQUE_ SENSOR_ OPEN	Damaged DPS	External troubleshooting is not possible Replace the DPS.
P0552	DPS	TORQUE_ SENSOR_ SHORT_GND	Damaged DPS	External troubleshooting is not possible Replace the DPS.
P0553	DPS	TORQUE_ SENSOR_ SHORT_5V	Damaged DPS	External troubleshooting is not possible Replace the DPS.
P0562	DPS	System voltage low	Blown fuse, battery low (damaged magneto/regulator), damaged circuit wires or connection, intense winch usage	Check the two DPS fuses Validate that all the DPS connectors are secured Measure voltage between harness connector DPS2-A&B and ground. (Expected value = 11 to 13 volts) Measure battery voltage with engine stopped. (Expected value: 11 to 13 volts) Check ground and positive connections on battery.
P0562	ECM	System voltage low	Blown fuse FC, battery failure, voltage regulator failure, damaged circuit wires or connection, damaged magneto generator. An external battery charger may have been used. Intense winch usage	Measure battery voltage with engine stopped. (Expected value: 11 to 13 volts) Measure battery voltage with engine running. (Expected value: 13 to 14.7 volts) Check connections on voltage regulator. Check ground and positive connections on battery. Check ground on vehicle frame

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0563	DPS	system voltage high	Rectifier failure, damaged circuit wires or connection.	Measure battery voltage with engine stopped. (Expected value: 11 to 13 volts) Measure battery voltage with engine Running at 3500RPM. (Expected value: 13 to 14.7 volts) Check connections on voltage regulator. Check ground and positive connections on battery.
P0563	ECM	System voltage high	Damaged regulator. An external battery charger may have been used.	Measure battery voltage with engine stopped. (Expected value: 11 to 13 volts) Measure battery voltage with engine running. (Expected value: 13 to 14.7 volts) Check connections on voltage regulator. Check ground and positive connections on battery. Check ground on vehicle frame
P0601	DPS	CALIBRATION FAULT	DPS not calibrated or damage DPS	Try updating the DPS
P0601	SCM-XMR	Bad checksum of Calibration memory section	Lost of power on reflash	If an update file is available reflash the SCM, if not clear the fault, if it returns, replace the SCM.
P0615	ECM	Starter Relay circuit open	Damaged relay, Danaged start switch, damaged circuit wires, damaged connector, damaged ECM pins.	Check start button, Check Run/Stop button, check if free weeling diode is in the good way. Disconnect starter solenoid relay Measure resistance from harness connector: ECM-L3 to SS2 (Expected value: < 2 ohms) Measure resistance from harness connector: MG2-6 to SS1 (Expected value: < 2 ohms) Measure resistance between terminals SS1 and SS2. (Expected value: 3 to 6 ohms)
P0616	ECM	Starter Relay circuit shorted to ground	Damaged relay, Danaged start switch, damaged circuit wires, damaged connector, damaged ECM pins.	Check start button, Check Run/Stop button, check if free weeling diode is in the good way. Disconnect starter solenoid relay Measure resistance from harness connector: ECM-L3 to SS2 (Expected value: < 2 ohms) Measure resistance from harness connector: MG2-6 to SS1 (Expected value: < 2 ohms) Measure resistance between terminals SS1 and SS2. (Expected value: 3 to 6 ohms)

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0617	ECM	Starter Relay circuit shorted to battery +	Damaged relay, Danaged start switch, damaged circuit wires, damaged connector, damaged ECM pins.	Check start button, Check Run/Stop button, check if free weeling diode is in the good way. Disconnect starter solenoid relay Measure resistance from harness connector: ECM-L3 to SS2 (Expected value: < 2 ohms) Measure resistance from harness connector: MG2-6 to SS1 (Expected value: < 2 ohms) Measure resistance between terminals SS1 and SS2. (Expected value: 3 to 6 ohms)
P0636	DPS	MOTOR LOW CURRENT FAULT	Internal error or damaged DPS	External troubleshooting is not possible Replace the DPS.
P0637	DPS	MOTOR HIGH CURRENT FAULT	Internal error or damaged DPS	External troubleshooting is not possible Replace the DPS.
P0642	ECM	Sensor Reference Voltage Low	Damaged sensor connected to ECM voltage supply, Damaged ECM voltage supply output.	Measure voltage between harness connector ECM-A1 and ground. (Expected value: 4.8 to 5.1 volts) Check sensor connected to ECM voltage supply output
P0643	ECM	Sensor Reference Voltage High	Damaged sensor connected to ECM voltage supply, Damaged ECM voltage supply output.	Measure voltage between harness connector ECM-A1 and ground. (Expected value: 4.8 to 5.1 volts) Check sensor connected to ECM voltage supply output
P0658	DPS	PHASE A_LOW	DPS motor supply Damaged DPS	External troubleshooting is not possible Replace the DPS.
P0659	DPS	PHASE A_HIGH	DPS motor supply Damaged DPS	External troubleshooting is not possible Replace the DPS.
P0666	DPS	HIGH TEMPERATURE	High temperature of the DPS. Extreme usage of the unit.	Let the unit cool down.

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0685	ECM	Accessory relay circuit	diagnosis related to Accessories or Light relay, Blown fuse, damaged or disconnected relay, damaged circuit wires, damaged connectors or damaged ECM output pins	Check fuse Disconnect Accessory relay and Lights relay & turn key switch (on w/lights) Measure voltage between harness connector PF1-10E and ground. (Expected value: 11 to 13 volts) Measure voltage between harness connector PF1-6D and ground. (Expected value: 11 to 13 volts) Measure resistance from harness connector: ECM-K2 to PF1-12D (Expected value: < 2 ohms) Measure resistance from harness connector: ECM-K2 to PF1-7C (Expected value: < 2 ohms) Measure resistance between terminals 85 and 86 on the 2 relays. (Expected value: 70 to 90 ohms)
P0686	ECM	Accessory relay circuit shorted to ground or open circuit	diagnosis related to Accessories or Light relay, Blown fuse, damaged or disconnected relay, damaged circuit wires, damaged connectors or damaged ECM output pins	Check fuse Disconnect Accessory relay and Lights relay & turn key switch (on w/lights) Measure voltage between harness connector PF1-10E and ground. (Expected value: 11 to 13 volts) Measure voltage between harness connector PF1-6D and ground. (Expected value: 11 to 13 volts) Measure resistance from harness connector: ECM-K2 to PF1-12D (Expected value: < 2 ohms) Measure resistance from harness connector: ECM-K2 to PF1-7C (Expected value: < 2 ohms) Measure resistance between terminals 85 and 86 on the 2 relays. (Expected value: 70 to 90 ohms)
P0687	ECM	Accessory relay circuit shorted to battery +	diagnosis related to Accessories or Light relay, Damaged relay, damaged circuit wires, damaged connector or damaged ECM output pins.	Check fuse Disconnect Accessory relay and Lights relay & turn key switch (on w/lights) Measure voltage between harness connector PF1-10E and ground. (Expected value: 11 to 13 volts) Measure voltage between harness connector PF1-6D and ground. (Expected value: 11 to 13 volts) Measure resistance from harness connector: ECM-K2 to PF1-12D (Expected value: < 2 ohms) Measure resistance from harness connector: ECM-K2 to PF1-7C (Expected value: < 2 ohms) Measure resistance between terminals 85 and 86 on the 2 relays. (Expected value: 70 to 90 ohms)

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0691	ECM	Radiator fan circuit shorted to ground or open circuit	Blown fuse, damaged or disconnected fan relay, damaged circuit wires, damaged connectors or damaged ECM output pins.	Check fuse Disconnect radiator fan relay Measure voltage between harness connector PF1-3D and ground. (Expected value: 11 to 13 volts) Measure resistance from harness connector: ECM-B3 to PF1-1E (Expected value: < 2 ohms) Measure resistance between terminals 85 and 86 on relay. (Expected value: 70 to 90 ohms)
P0692	ECM	Radiator fan circuit shorted to battery +	Damaged fan relay, damaged circuit wires, damaged connector or damaged ECM output pins.	Check fuse Disconnect radiator fan relay Measure voltage between harness connector PF1-3D and ground. (Expected value: 11 to 13 volts) Measure resistance from harness connector: ECM-B3 to PF1-1E (Expected value: < 2 ohms) Measure resistance between terminals 85 and 86 on relay. (Expected value: 70 to 90 ohms)
P0705	ECM	Subtransmission Internal switch Combinations error	Wrong Switch Combinations Damaged Switch, damaged circuit wires, damaged connectors or damaged ECM pins.	Check for disconnected transmission connector. Check for misplaced terminal on gearbox Measure resistance form each switch to ground in all position (PR & N) (Expected value if switch activated: < 2 ohms) Measure resistance from harness connector: ECM-J3 to PRN-1 (Expected value: < 2 ohms) Measure resistance from harness connector: ECM-H2 to PRN-2 (Expected value: < 2 ohms) Measure resistance from harness connector: ECM-H4 to PRN-3 (Expected value: < 2 ohms)
P0706	ECM	GBPS invalide gear position	GBPS position not plausible	Verify that gear position information change when you change the position of gear on vehicle. Disconnect GBPS Measure voltage between harness connector GBPS-1 and GBPS-3. (Expected value: 4.8 to 5.1 volts) Measure resistance from connector: ECM-D2 to GBPS-2 (Expected value: < 2 ohms) Measure resistance from connector: ECM-C3 to GBPS-3 (Expected value: < 2 ohms) Replace GBPS sensor

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P0707	ECM	Gear position sensor shorted to ground, or open circuit		Verify that gear position information change when you change the position of gear on vehicle. Disconnect GBPS Measure voltage between harness connector GBPS-1 and GBPS-3. (Expected value: 4.8 to 5.1 volts) Measure resistance from connector: ECM-D2 to GBPS-2 (Expected value: < 2 ohms) Measure resistance from connector: ECM-C3 to GBPS-3 (Expected value: < 2 ohms) Replace GBPS sensor
P0708	ECM	Gear position sensor circuit shorted to battery +		Verify that gear position information change when you change the position of gear on vehicle. Disconnect GBPS Measure voltage between harness connector GBPS-1 and GBPS-3. (Expected value: 4.8 to 5.1 volts) Measure resistance from connector: ECM-D2 to GBPS-2 (Expected value: < 2 ohms) Measure resistance from connector: ECM-C3 to GBPS-3 (Expected value: < 2 ohms) Replace GBPS sensor
P1562	ECM	System voltage low (from Key switch)	Blown fuse FC, battery failure, voltage regulator failure, damaged circuit wires or connection, damaged magneto generator. An external battery charger may have been used.	Measure battery voltage with engine stopped. (Expected value: 11 to 13 volts) Measure battery voltage with engine running. (Expected value: 13 to 14.7 volts) Check connections on voltage regulator. Check ground and positive connections on battery. Check ground on vehicle frame
P1563	ECM	System voltage high (from Key switch)	Damaged regulator. An external battery charger may have been used.	Measure battery voltage with engine stopped. (Expected value: 11 to 13 volts) Measure battery voltage with engine running. (Expected value: 13 to 14.7 volts) Check connections on voltage regulator. Check ground and positive connections on battery. Check ground on vehicle frame
P1619	ECM	TPS adaptation failure	Wrong throttle body mechanical position during reset of closed TPS or no initialization after ECM replacement.	Replace gauge if necessary.

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P1F01	DPS	Power output overload	Motor short circuit or power output failed	Reset fault, If fault re-occur, replace DPS unit
P1F02	DPS	Power output overload (18V).	High voltage at the unit input.	Measure battery voltage with engine stopped. (Expected value: 11 to 13 volts) Measure battery voltage with engine running. (Expected value: 13 to 14.7 volts) test charging system as per shop manual
P1F03	DPS	Electronic Circuit Overheat	Hi temperature detected by on board temperature sensor.	Fault may become Active in extreme use situations. Reset fault and let DPS cool down. If fault re-occur in normal riding conditions, replace DPS unit
P1F05	DPS	Motor current sensor range/performance	Motor input vs output Current correlation check failed	External troubleshooting is not possible Replace the DPS.
P2300	ECM	Cyllinder 1 Ignition output shorted to ground	Damaged ignition coil, damaged circuit wires, damaged connector or damaged ECM output pins.	Open the ECM Activation page in BUDS Perform an ignition coil activation and check if ignition coil is reacting as expected Measure resistance from harness connector: ECM-M2 to BA-3 (Expected value: < 2 ohms) Measure voltage between harness connector BA-2 and ground. (Expected value: 11 to 13 volts) Refer to the service manual for detailed ignition coil testing procedure.
P2301	ECM	Cyllinder 1 Ignition output short to V +	Damaged ignition coil, damaged circuit wires, damaged connector or damaged ECM output pins.	Open the ECM Activation page in BUDS Perform an ignition coil activation and check if ignition coil is reacting as expected Measure resistance from harness connector: ECM-M2 to BA-3 (Expected value: < 2 ohms) Measure voltage between harness connector BA-2 and ground. (Expected value: 11 to 13 volts) Refer to the service manual for detailed ignition coil testing procedure.

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P2303	ECM	Cyllinder 2 Ignition output shorted to ground	Damaged ignition coil, damaged circuit wires, damaged connector or damaged ECM output pins.	Open the ECM Activation page in BUDS Perform an ignition coil activation and check if ignition coil is reacting as expected Measure resistance from harness connector: ECM-M1 to BA-1 (Expected value: < 2 ohms) Measure voltage between harness connector BA-2 and ground. (Expected value: 11 to 13 volts) Refer to the service manual for detailed ignition coil testing procedure.
P2304	ECM	Cyllinder 2 Ignition output short to V +	Damaged ignition coil, damaged circuit wires, damaged connector or damaged ECM output pins.	Open the ECM Activation page in BUDS Perform an ignition coil activation and check if ignition coil is reacting as expected Measure resistance from harness connector: ECM-M1 to BA-1 (Expected value: < 2 ohms) Measure voltage between harness connector BA-2 and ground. (Expected value: 11 to 13 volts) Refer to the service manual for detailed ignition coil testing procedure.
P2670	DPS	PHASE B_LOW	DPS motor supply Damaged DPS	External troubleshooting is not possible Replace the DPS.
P2671	DPS	PHASE B_HIGH	DPS motor supply Damaged DPS	External troubleshooting is not possible Replace the DPS.
P280A	ECM	Gear position sensor adaptation not plausible	GBPS learning position failure Wrong transmission mechanical position during GBPS reset, No initialization after ECM replacement.	Using BUDS performe a GBPS initialization.

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P3000	SCM-LTD	Auxiliary line pressure sensor value out of range	Too many values of the external sensor out of range (negative pressure) Sensor disconnect Damaged circuit wires or connectors Faulty auxiliary line sensor Faulty SCM	1- Go to Activations - SCM and start Test routine. Verify that the Shock Absorber Pressure and the Auxiliary Line Pressure correlates in BUDS. If the test is done with no fault, the system is working properly. Check the harness and connection to see a potential source of intermittent dysfunction, if nothing is found clear the occurred fault and no more actions have to be done. If the Test Status shows a Fail_Comparison_Sensor_Test, verify for leak. If no leak found, verify the wiring and connector of the external sensor and the SCM. In the next action step, verify which of Shock absorber or Auxiliary Line Pressure sensors is defective. 2-Make sure to have no pressure in the system by activating the relief valve in Activation -SCM. Connect the supplied air hose into the compressor fitting and plug it to a known pressure supply in the range of 30 to 120 psi (as car tire) and compare it to the Shock absorber pressure and Auxiliary line pressure, it should be similar. If the Shock absorber pressure is off, change the SCM module. Go to next action step to perform Auxiliary Line Pressure sensor test. 4-Back probe the signal coming from the sensor between the pin 3 of the SCM electrical connector and the negative battery post (this action must be done with special probe to not damage the connector seal). The value must be between 0.9 and 8.3 Volts for a pressure range of 0 - 100 psi. If not go to next action step. If the value is in the range, change the SCM. 5- Unplug the Auxiliary Line Pressure sensor and make sure to have 12V between pin 3 and 1 on the connector coming from SCM. If 12V is present change the sensor, if not change the SCM.

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P3001	SCM-LTD	System suspension pumping delay exceeded	Pressure did not reach to desired set point after predefined delay Leak in the system Jammed compressor intake tube Damaged circuit wires or connectors Blown compressor fuse Corroded or disconnected compressor GND Faulty relay Faulty compressor Jammed check valve Faulty SCM	1- Check for leaks. If no leak found go to next action step. 2- Go to Activations - SCM and start Test routine. If the test is done with no fault, the system is working properly. Check the harness and connector to see a potential source of intermittent dysfunction, if nothing is found clear the occurred fault and no more actions have to be done. If the compressor is not starting check the compressor GND, harness and connection then continue to the next action step. If the compressor is running and the Test Status show a Fail_Pumping go to action step 6. 3-Test the compressor with an external power supply (as a 12V battery). If the compressor is functional go to next action step. 4-Unplug the relay and make sure to have 12V between battery negative post and relay pin 30. If not, check the compressor fuse and harness. If 12V is present, test the relay. If the relay is functional plug it back and go to next action step. 5- Disconnect the SCM, take a jumper wire and connect pin 8 to the battery negative post. If then the compressor starts, change the SCM. 6- Verify that the compressor intake tube (transparent) is not blocked or kinked. Unplug the SCM air tube (yellow) and start the compressor. If air blow out of the tube change the SCM. If not go to next action step. 7- During the Test routine verify the pressure sensors value. If the Shock Absorber Pressure and Auxiliary Line Pressure is not going up verify the first check valve at the exit of the compressor. If only the Shock Absorber Pressure is not going up verify the second check valve after green tube.

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
P3002	SCM-LTD	Release valve activation delay exceeded	Pressure did not drop to desired set point after predefined delay Release valve momentary blocked Blown valve fuse Damaged circuit wires or connectors Faulty valve block Faulty SCM	1- Go to Activations - SCM and start Test routine. If the test passed, the system is working properly. Check the harness and connection to see a potential source of intermittent dysfunction, if nothing is found clear the occurred fault and no more actions have to be done. Mud, dust or water in the release valve may explain the fault code. If the Test status shows a Fail_release, proceed to next action step. 2-Verify the release valve for obstruction. If nothing is found go to next action step. 3- Unplug the valve connector and verify that 12V is present between pin 1 of the connector on the SCM side and the battery negative post. If not, verify the valve fuse and relay (refer to schematics for more information). Verify the harness and the connection between the valve and the SCM. If everything is fine, go to next action step. 4- Verify the release valve activation by disconnecting the valve block electrical connector and applying 12V across pin 1 and 2 on valve connector. If the release valve is operating, change the SCM, otherwise change the valve block.
P3003	SCM-LTD	System high leakage detected	Leak in the system	1- Verify suspension system for air leaks
P3004	SCM-LTD	Bad checksum of Calibration memory section	Lost of power on reflash	If an update file is available reflash the SCM, if not clear the fault, if it returns, replace the SCM.
P3005	SCM-LTD	Communication network disconnected	Lost of CAN communication	1- Verify if all the module are present in BUDS (under Module Menu), if they are the vehicle is working properly. 2- Check continuity between the cluster, ECM and SCM CAN network.
U0073	DPS	CAN bus off, no messages	Damaged circuit wires or damaged DPS pins.	Disconnect MPI2 from DB connector. Measure resistance between DB-1 and DB-2 (Expected value = 50 to 70 ohms). Measure resistance between DB-1 and DPS1-C (Expected value < 5 ohms). Measure resistance between DB-2 and DPS1-D (Expected value < 5 ohms).

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
U0073	ECM	CAN bus off, no messages	Damaged circuit wires or damaged CLUSTER pins.	Disconnect MPI2 from DB connector. Measure resistance between DB-1 and DB-2 (Expected value = 50 to 70 ohms). Measure resistance between DB-1 and ECM-B1 (Expected value < 2 ohms). Measure resistance between DB-2 and ECM-C1 (Expected value < 2 ohms).
U0100	DPS	Lost communication with ECM (lost of CAN ID's)	Damaged CAN Bus wires to ECM, damaged DPS/ECM pins.	Disconnect MPI2 from DB connector. Measure resistance between DB-1 and DB-2 (Expected value = 50 to 70 ohms). Measure resistance between DB-1 and ECM B1 (Expected value < 5 ohms). Measure resistance between DB-2 and ECM C1 (Expected value < 5 ohms).
U0155	DPS	Lost communication with CLUSTER	Damage CAN Bus wires to cluster Damaged circuit wires or damaged Cluster module pins.	Measure voltage between harness connector CL-17 and ground. (Expected value = 11 to 13 volts) Disconnect MPI2 from DB connector. Measure resistance between DB-1 and DB-2 (Expected value = 50 to 70 ohms). Measure resistance between DB-1 and CL-4 (Expected value < 5 ohms). Measure resistance between DB-2 and CL-19 (Expected value < 5 ohms).
U0155	ECM	Lost communication with CLUSTER	Missing CLUSTER CAN ID Module internal error Damaged circuit wires or damaged module pins.	Measure voltage between harness connector CL-17 and ground. (Expected value = 11 to 13 volts) Disconnect MPI2 from DB connector. Measure resistance between DB-1 and DB-2 (Expected value = 50 to 70 ohms). Measure resistance between DB-1 and ECM-B1 (Expected value < 2 ohms). Measure resistance between DB-2 and ECM-C1 (Expected value < 2 ohms). Measure resistance between DB-1 and CL-19 (Expected value < 2 ohms). Measure resistance between DB-2 and CL-18 (Expected value < 2 ohms).

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
U0155	ECM	Lost communication with CLUSTER (lost of CAN ID's)	Missing CAN ID Module internal error Damaged circuit wires or damaged module pins.	Check for Cluster fault or ECM fault Measure voltage between harness connector CL-17 and ground. (Expected value = 11 to 13 volts) Disconnect MPI2 from DB connector. Measure resistance between DB-1 and DB-2 (Expected value = 50 to 70 ohms). Measure resistance between DB-1 and ECMB-C1 (Expected value < 2 ohms). Measure resistance between DB-2 and ECMB-C2 (Expected value < 2 ohms). Measure resistance between DB-1 and CL-19 (Expected value < 2 ohms). Measure resistance between DB-2 and CL-18 (Expected value < 2 ohms).
U0155	SCM-XMR	Communication network disconnected	Lost of CAN communication	1- Verify if all the module are present in BUDS (under Module Menu), if they are the vehicle is working properly. 2- Check continuity between the cluster, ECM and SCM CAN network.
U0167	ECM	Lost communication with Vehicle Immobilizer Control Module	The Vehicle Immobilizer is reporting an electrical fault on the communication line.	Check for dirty or oxidized Key contact. Clean key contact if needed. Check for broke key contact Ensure sensor connector is fully inserted. Measure resistance between ECMB-A1 and CC-C (Expected value < 2 ohms). Measure resistance between ECMB-C2 and CC-E (Expected value < 2 ohms).
U0167	ECM	Lost communication with Vehicle Immobilizer Control Module	The Vehicle Immobilizer is reporting an electrical fault on the communication line.	Check for dirty or oxidized Key contact. Clean key contact if needed. Check for broke key contact Ensure sensor connector is fully inserted. Measure resistance between ECMB-A1 and CC-C (Expected value < 2 ohms). Measure resistance between ECMB-C2 and CC-E (Expected value < 2 ohms).
U0300	ECM	Invalid Security Exchange received	Incorrect ECM or CLUSTER, Incorrect software version.	Install the proper ECM or CLUSTER on vehicle. Update security coding using BUDS
U0400	DPS	Variant Coding failure Software incompatibility	Faulty variant coding Faulty programming	Check in the BUDS Tab "vehicle configuration" if the DPS option is checked. Reflash the DPS with the latest software

PCODE	MODULE	DESCRIPTION	CAUSE	ACTION
U0400	SCM-XMR	Variant coding failure	Faulty variant coding Faulty programming	1- Verify in Setting - Vehicle Configuration page is correctly set up. 2- If Update File is available reflash the SCM. If not, clear the fault, if it returns replace the SCM.
U0400	SCM-LTD	Variant coding failure	Faulty variant coding Faulty programming	1- Verify in Setting - Vehicle Configuration page is correctly set up. 2- If Update File is available reflash the SCM. If not, clear the fault, if it returns replace the SCM.
U0426	ECM	Invalid Data Received From Vehicle Immobilizer Control Module	The Vehicle Immobilizer could not read the number of the access key.	Check for dirty or oxidized Key contact. Clean key contact if needed. Check for broke key contact Ensure sensor connector is fully inserted. Measure resistance between ECMB-A1 and CC-C (Expected value < 2 ohms). Measure resistance between ECMB-C2 and CC-E (Expected value < 2 ohms).
U3001	DPS	Module improper shutdown	Lost of power on DPS that can be caused by damaged circuit wires or damaged DPS pins.	Check the two DPS fuses Ensure DPS connector is fully inserted. Check for Damaged tail light, DPS, Cluster circuit wires Check for damaged DPS pins.

ELECTRONIC FUEL INJECTION (450)

SERVICE TOOLS

Description	Part Number	Page
ECM ADAPTER TOOL	529 036 166	446–447, 451, 457, 459, 461–463
FLUKE 115 MULTIMETER	529 035 868	447, 451, 457, 461–463
OETIKER PLIERS	295 000 070	453

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	458, 462
XPS SYNTHETIC GREASE	293 550 010	460

GENERAL

⚠ WARNING

Fuel is flammable and explosive under certain conditions. Ensure work area is well ventilated. Do not smoke or allow open flames or sparks in the vicinity.

⚠ WARNING

Fuel lines remain under pressure at all times. Always proceed with care and use appropriate safety equipment when working on pressurized fuel system. Wear safety glasses. Wipe off any fuel spillage. Do not allow fuel to spill on hot engine parts and/or on electrical connectors.

⚠ WARNING

Replace any damaged, leaking or deteriorated fuel lines or connections. Always, pressurize the fuel system if any fuel related component was disconnected or removed. Proceed with care when removing/installing high pressure test equipment.

SYSTEM DESCRIPTION

Refer to the applicable *ENGINE MANAGEMENT SYSTEM* subsection for a general layout of the various EFI system components.

The electronic fuel injection system (EFI) is comprised of various sensors used for detecting ongoing operating conditions of the engine and vehicle, and includes all the components that perform the required adjustments to the engine.

Electrical System

ECM (Electronic Control Module)

The ECM controls the electrical system and the engine management functions, by processing the information given by various sensors.

EFI Sensors

The ECM reads the inputs from the sensors which it compares to predetermined parameters stored in the ECM, makes computations, and activates the outputs accordingly (injectors, ignition coils etc.).

Signals from sensors are used by the ECM to determine the injection and ignition parameters (referenced to fuel maps) as required to maintain the optimum air-fuel ratio.

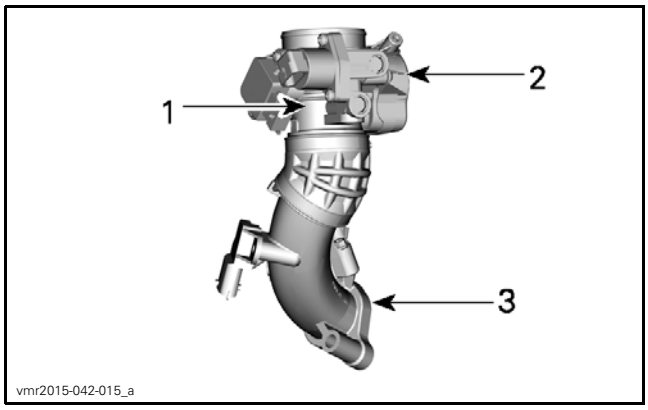
Air Intake System

Refer to the *AIR INTAKE SYSTEM* subsection for additional information.

Throttle Body

The throttle body is mounted on the intake manifold.

Air for combustion, drawn in by the engine, flows through the air intake system, then through the throttle body where it is regulated by a throttle plate.



1. Throttle body
2. Idle air control valve (IACV)
3. Intake manifold

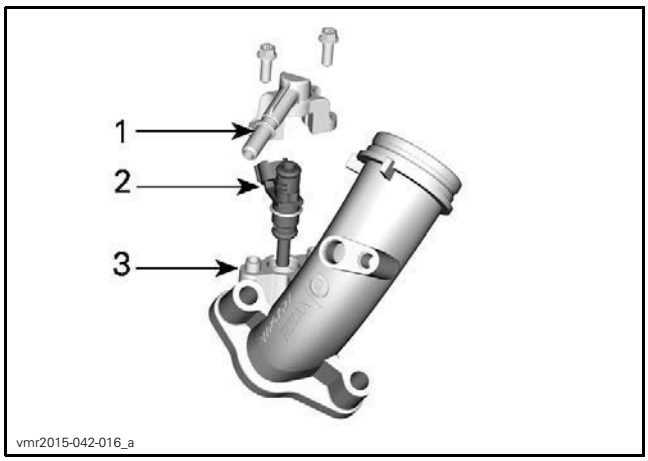
Fitted on the throttle body, a throttle plate regulates the amount of air that enters the engine.

A TPS is incorporated on the throttle body. It provides a signal to the ECM of the actual throttle plate position.

An idle air control valve (IACV) is also incorporated on the throttle body, It allows the ECM to control the idle speed while the throttle plate is closed.

Fuel System

Refer to the *FUEL TANK AND FUEL PUMP* subsection for additional information.



1. Fuel rail
2. Fuel Injector
3. Intake manifold

Fuel Rail

The fuel rail is mounted on the intake manifold. The fuel rail secures the injector to the manifold and provides the injector with fuel from the fuel pump.

The fuel pressure applied to the fuel rail is regulated by the fuel pressure regulator located in the fuel pump module.

Fuel Injector

The fuel injector is used to inject fuel into the intake port of the cylinder head.

Fuel Pump

An electric fuel pump with an integrated pressure regulator and fuel system filters is used. For more details on the fuel pump unit, refer to *FUEL TANK AND FUEL PUMP* subsection.

ADJUSTMENT

IDLE SPEED

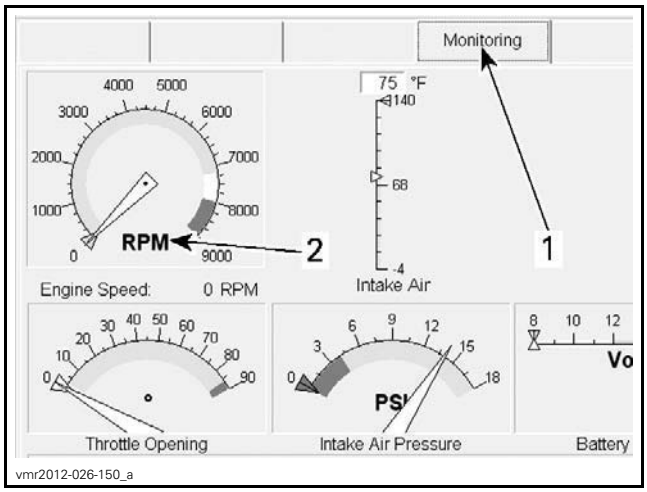
Idle speed is not adjustable. The ECM controls the IACV.

NOTICE Never attempt to adjust the sealed idle stop screw. It is calibrated at the factory. If the screw adjustment is changed, the throttle body must be replaced.

The vehicle multifunction gauge can provide an accurate digital readout of the engine's idle speed.

The engine RPM may also be verified using the applicable B.U.D.S. software version, refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

In B.U.D.S., click the following:
– **Read Data** button
– **Monitoring** tab
– **ECM** tab.



VERIFYING ENGINE RPM USING B.U.D.S.
1. **Monitoring** *tab*
2. Engine RPM indication

NOTE: The multifunction gauge and B.U.D.S. use the same signal to provide the engine RPM indication.

CLOSED THROTTLE AND IDLE ACTUATOR RESET

NOTE: This operation performs a reset of the values in the ECM.

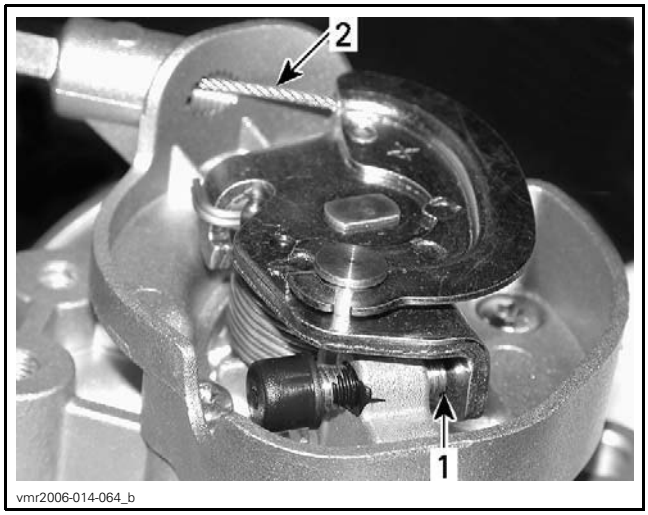
This reset is very important. The setting of the TPS will determine the basic parameters for all fuel mapping and several ECM calculations and the setting of the idle air control valve will determine the basic parameters for the idle speed control of the engine.

Closed throttle and idle actuator reset must be done if:

– TPS is loosened, removed or replaced
– Throttle body is replaced
– Idle air control valve is replaced
– ECM is replaced.

NOTICE **An improperly set TPS or IACV may lead to poor engine performance and emission compliance could possibly be affected. In addition, improper IACV reset may lead to poor engine starting, improper idle (too low or too high) and engine stop on deceleration.**

Remove throttle body cap and ensure the throttle cam of throttle body rests against set screw without any tension in the cable.



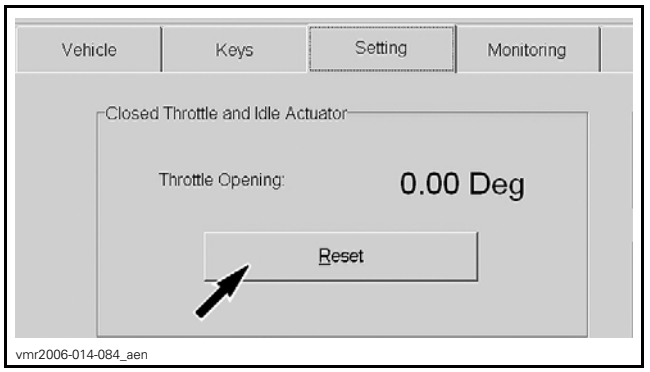
1. Contact here
2. Free-play here

Open throttle approximately one quarter then quickly release. Repeat 2 - 3 times to settle throttle plate. If stopper does not rest against its stop lever, perform throttle cable adjustment. Refer to *THROTTLE CABLE* in this subsection.

To reset IACV and TPS, perform the following:

1. Connect the 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., click the following:
   – **Read Data** button
   – **Setting** tab
   – **ECM** tab

Click on the Reset button in the **Closed Throttle and Idle Actuator** area.



NOTE: If operation is wrong, an error message will be displayed.

NOTE: If TPS is not within the allowed range while resetting the Closed Throttle and Idle Actuator, the ECM will generate a fault code and will not accept the setting. Repeat the reset procedure.

Start engine and make sure it operates normally through its full engine RPM range. If fault codes appear, refer to *DIAGNOSTIC SYSTEM AND FAULT CODES* subsection for more information.

TROUBLESHOOTING

DIAGNOSTIC TIPS

Engine problems are not necessarily related to the fuel injection system.

It is important to ensure that the engine and propulsion system, fuel delivery and electrical systems are functioning normally.

For diagnostics purposes, use B.U.D.S. software. See *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

After a problem has been solved, be sure to clear the fault(s) in the ECM using the B.U.D.S. software.

⚠ WARNING

Electrical actuators and electronic modules may be powered up as soon as the ignition switch is set to ON and emergency engine stop switch is set to RUN. Always disconnect the battery prior to disconnecting any electrical or electronic parts.

Never use a battery charger to temporarily substitute the battery as it may cause the ECM to function erratically, or not at all.

Check related-circuit fuse solidity and condition with an ohmmeter. A visual inspection could lead to a false diagnosis.

Electrical Related Problems

It is important to check the following in the electrical system:
– Battery voltage
– Fuses
– Ground connections
– Wiring and connectors.

Ensure that all electronic components are genuine OEM. Any modification to the wiring harness may lead to poor system operation or generate fault codes.

Electrical Connections

Pay particular attention to ensure that terminals and pins are not out of their connectors, corroded, or out of shape.

When probing terminals, pay attention not to deform the terminals as this could cause a loose or intermittent connection that would be difficult to troubleshoot.

PROCEDURES

ENGINE CONTROL MODULE (ECM)

NOTE: As a first troubleshooting step, always check for applicable fault codes using B.U.D.S. software.

Quick Test to Validate ECM Operation

Turn ignition key to ON.

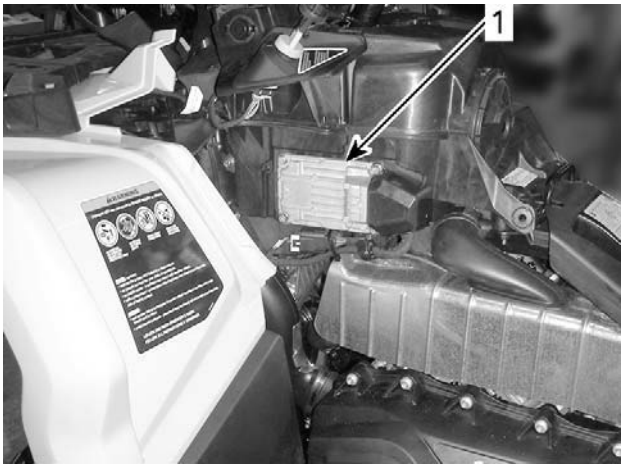
Set emergency engine stop switch to RUN.

NOTE: This wakes up the ECM, which then turns on the following. If the following do not turn on, check ECM fuses (PF1 (F5 and F8)).

QUICK INDICATION THAT ECM IS FUNCTIONING (assuming the observed component is in good working order)
Multifunction gauge turns ON.
Fuel pump turns on for approx. 5 seconds.
Rear lights turn on.
Headlamps turn on (ignition key on with lights position).

ECM Access

Refer to *BODY* and remove the LH panel.



LH PANEL REMOVED
1. ECM location

ECM Connector

There is one connector connected to the ECM. It links:
– Engine harness
– Vehicle system control harness.

NOTE: For connector information, cleaning and probing, refer to *WIRING HARNESS AND CONNECTORS* subsection.

ECM Adapter Tool

To probe ECM connector terminals, use the ECM ADAPTER TOOL (P/N 529 036 166).


529036166

NOTE: This tool will prevent deforming or enlarging terminals which would lead to bad ECM terminal contact creating intermittent or permanent problems.

ECM Power Supply Test

1. Disconnect ECM connector.
2. Install ECM connector on the ECM ADAPTER TOOL (P/N 529 036 166).
3. Install a jumper wire between K1 and M4 on the ECM adapter tool.
4. Turn the ignition switch to ON.
5. Set emergency engine stop switch to RUN.
6. Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and select Vdc.
7. Check for voltage as follows.

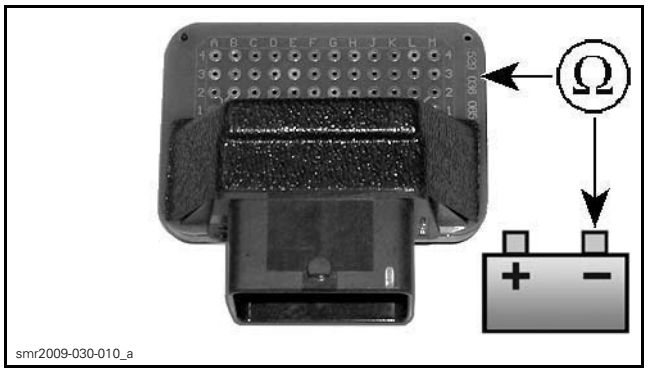
ECM ADAPTER	BATTERY	VOLTAGE
L1	Negative post	Battery voltage

If voltage is not measured, check the following:
– ECM fuse
– Main relay
– Wiring and connections, refer to the *WIRING DIAGRAM*.

Continuity Test of ECM Ground Circuits

1. Disconnect ECM connector.
2. Install the ECM ADAPTER TOOL (P/N 529 036 166) on ECM connector.
3. Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and select Ω.
4. Probe adapter terminals as per following table.

ECM ADAPTER	BATTERY POST	RESISTANCE
Pins M3 and M4	Ground	Close to 0 Ω (continuity)



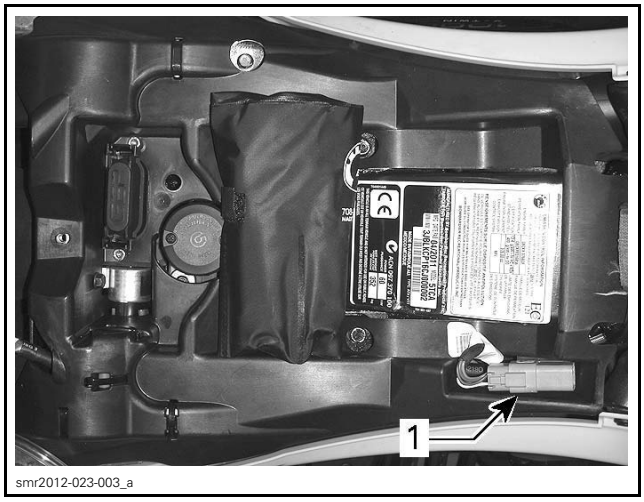
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If any measurement is out of specification, refer to *POWER DISTRIBUTION* and check all grounds.

CAN Resistor Test

Remove the DPS1 connector (4-pin connector) from DPS module (if so equipped). Refer to *STEERING SYSTEM* subsection.

1. Remove seat to access the diagnostic link connector (DB).
2. Remove diagnostic link connector from its holder.



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TYPICAL
1. Diagnostic link connector (DB)

3. Set a FLUKE 115 MULTIMETER (P/N 529 035 868) to Ω setting.


529035868

4. Measure the resistance of the CAN resistors as per following table.

CAN RESISTOR TEST	
DIAGNOSTIC LINK CONNECTOR	RESISTANCE
Pins 1 and 2	Approximately 60 Ω

TEST RESULT	
READING	RESULT
Approximately 60 Ω	ECM and CLUSTER CAN wires and resistors good
Approximately 120 Ω	ECM CAN resistor open, or CLUSTER CAN resistor open, or CAN wire to CLUSTER or ECM open
Infinite (open circuit)	CAN wire to DB connector open circuit

If 120 ohms is read, isolate the CLUSTER from CAN by disconnecting it and measuring again at the diagnostic link connector.

If 120 ohms is still read, the ECM CAN resistor and wires are good. Check for continuity of the CLUSTER CAN wires, refer to *WIRING DIAGRAM*.

If an open circuit is read, the ECM CAN resistor (or wire) is open. Check for continuity of the ECM CAN wires, refer to *WIRING DIAGRAM* to determine if the wires or the resistor is at fault.

If the CAN resistor of a module is at fault, replace that module.

If a module cannot communicate and the CAN resistor and wires test good, try a new module.

5. Reconnect DPS1 to DPS module,

ECM Removal

NOTE: If a new ECM is to be installed, first read the procedures in *ECM REPLACEMENT* in this subsection.

1. Disconnect battery cables.

NOTICE **Always disconnect the BLACK negative (–) battery cable first, then disconnect RED positive (+) cable.**

2. Disconnect ECM connector.
3. Unscrew all retaining screws and pull out ECM.

ECM Installation

Reverse removal procedure however, pay attention to the following.

1. Reconnect ECM connector.
2. Reconnect battery cables.

⚠ WARNING

Always reconnect the RED positive (+) battery cable first, then reconnect BLACK negative (–) cable.

3. If a new ECM is installed, refer to *ECM REPLACEMENT* in this subsection.

ECM Replacement

Prior to replacing an ECM, ensure that all the recommendations in the general introduction of this section have been followed.

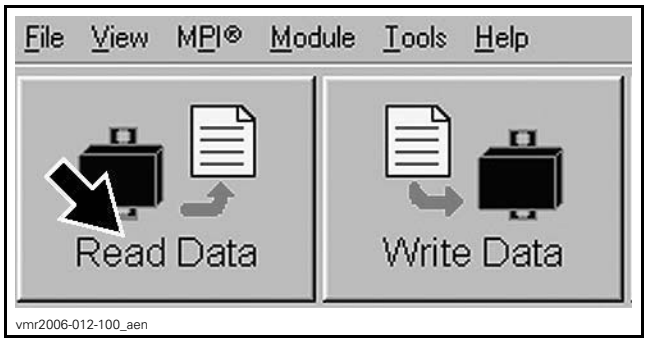
NOTE: Proceed with the *CLOSED THROTTLE AND IDLE ACTUATOR RESET* as it may resolve the problem.

If the ECM is replaced, data must be entered into the new ECM.

ECM Data Transfer

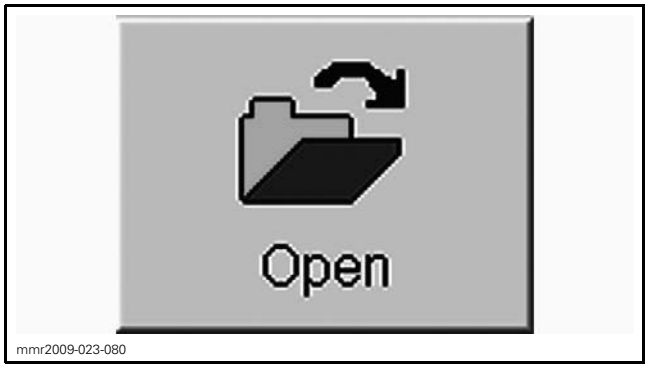
To transfer the original ECM recorded information to the new ECM, use the B.U.D.S. software and proceed as follows.

1. Connect the original ECM to vehicle.
2. In B.U.D.S., click the Read Data button to load the information from the original ECM.



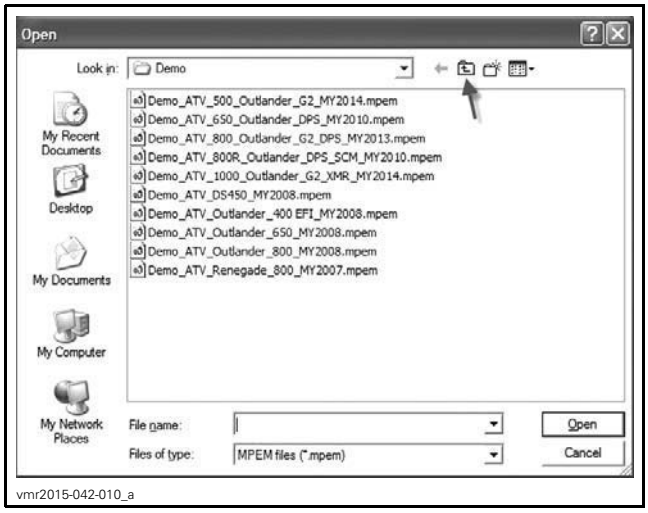
NOTE: Keep B.U.D.S. running while replacing ECMs. The data will remain stored in the PC computer as long as B.U.DS. is running.

3. Get the Data from the saved .mpem file.
   3.1 Click on the Open button.



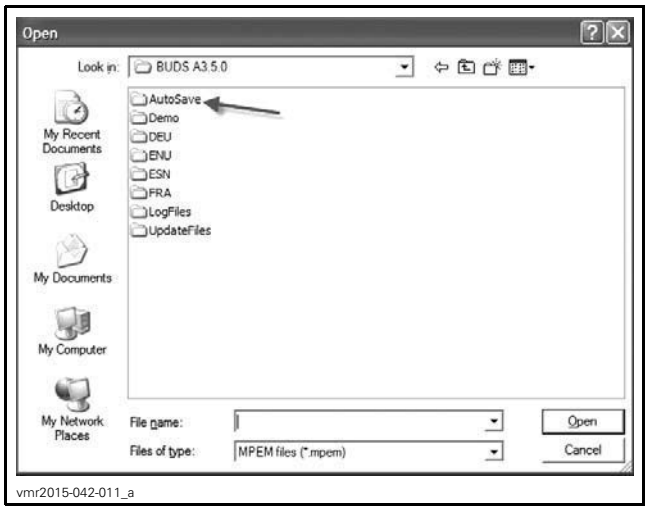
mmr2009-023-080

3.2 Click once on the Folder Up button in the open box.



vmr2015-042-010_a

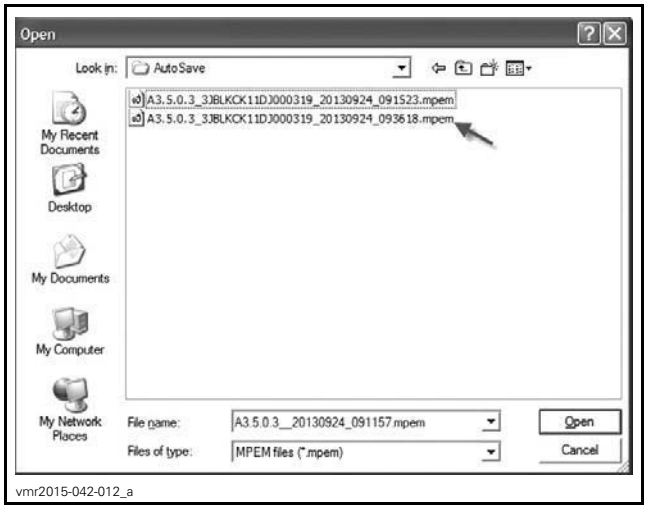
3.3 Double click on the AutoSave folder.



vmr2015-042-011_a

NOTE: You may have to go to another AutoSave folder from a previous version of B.U.D.S.

3.4 Choose the latest file saved for this specific vehicle.

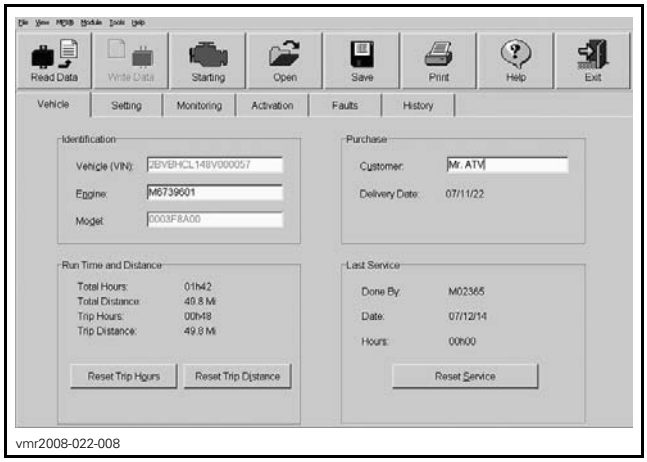


vmr2015-042-012_a

IMPORTANT: Ensure to use the file that specifically matches the vehicle you are servicing.

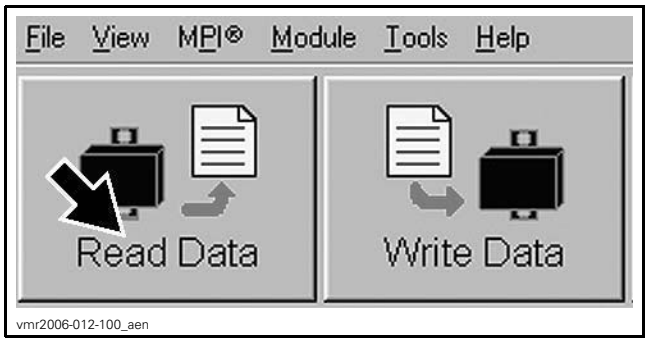
NOTE: The file name structure is as follows:
BUDS version_VIN_date read (yyyymmdd)_hour read (hhmmss).mpem
Example: **A3.5.0.3_3JBLKCK11DJ000319_20130924_093618.mpem** B.U.D.S. version = A3.5.0.3 VIN = 3JBLKCK11DJ000319 Date file was read = 2013-09-24 Hour file was read = 09h 36m 18s

4. Go to the Vehicle tab and record the following information.
   - Vehicle (V.I.N.) number
   - Engine number (without the leading "M")
   - Model number
   - Customer.

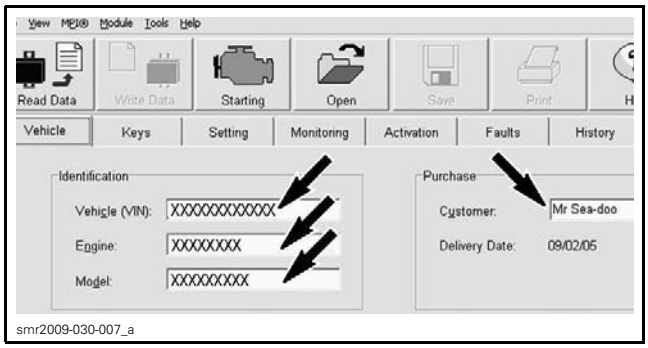


vmr2008-022-008

5. Remove the original ECM.
6. Install the new ECM.
7. In B.U.D.S., click the **Read Data** button to read the new ECM.

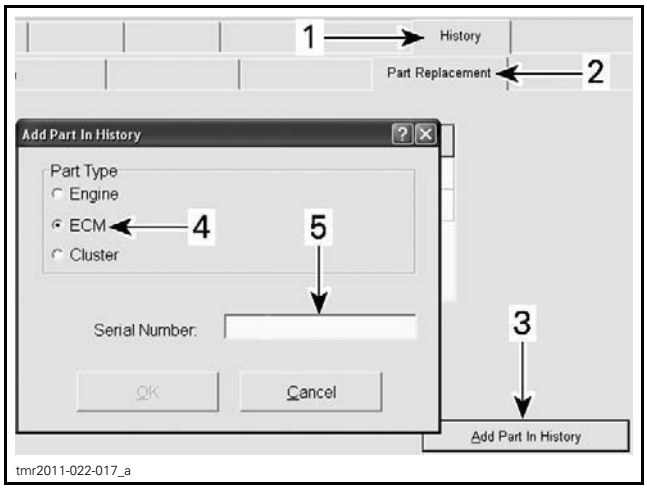


8. Select the **Vehicle** tab and enter the information you recorded previously.
   - Vehicle serial number
   - Engine number (do not enter the "M" at the beginning of the engine number)
   - Enter model number.
   - Customer name.



VEHICLE TAB

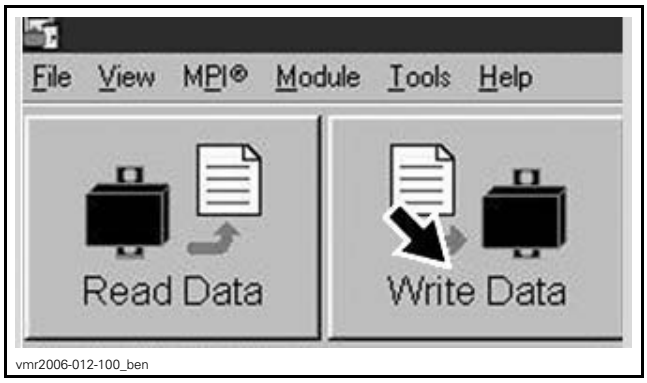
9. Click on the following tabs:
   - **History**
   - **Part Replacement**
   - **Add Part in History**.
10. Enter the **old** ECM serial number in the Add Part In History window.



ADDING PART IN HISTORY
1. **History** *tab*
2. **Part Replacement** *tab*
3. **Add part in history** *button*
4. **ECM** *selection*
5. *Add ECM serial number here*

NOTE: The ECM serial number can be found on the ECM sticker that also identifies the part number.

11. Click on the **OK** button.
12. Click on the **Write Data** button.



13. Perform the **Closed Throttle and Idle Actuator Reset** under the Settings/ECM tab.
14. Program the vehicle ignition keys into the new ECM

FUEL INJECTOR

Refer to the *ENGINE MANAGEMENT SYSTEM* subsection for component and connector locations.

Fuel Injector Leak Test

Carry out the *FUEL PUMP PRESSURE TEST* as detailed in the *FUEL TANK AND FUEL PUMP* subsection.

Fuel Injector Input Voltage Test

Disconnect the fuel injector electrical connector.

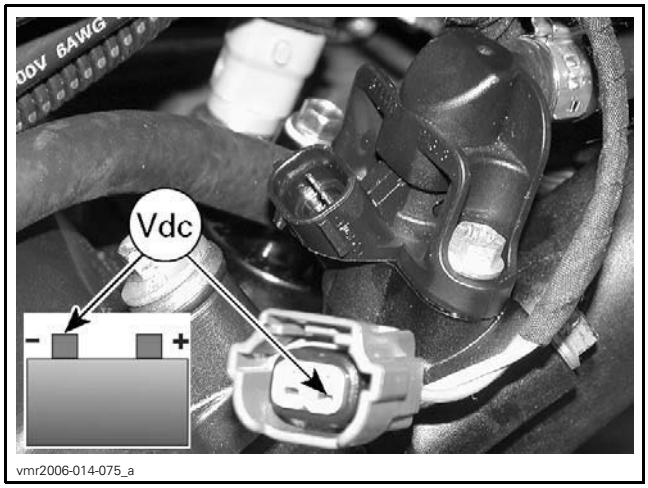
Turn on ignition switch.

Set emergency engine stop switch to RUN.

NOTE: Ensure to read voltage before ECM automatically turns off.

Use a multimeter and set it to Vdc. Read voltage.

INJECTOR CONNECTOR		MEASUREMENT
WIRE		
INJ-2	BAT2 (-)	Battery voltage



TYPICAL

If supply voltage is not good, check fuse and if good, perform an *INJECTOR POWER CIRCUIT RESISTANCE TEST*.

If supply voltage is good, perform a *FUEL INJECTOR RESISTANCE TEST*.

Injector Power Circuit Resistance Test

Check continuity between main relay and injector as follows:

– Remove main relay.
– Disconnect the fuel injector connector.
– Use a multimeter and set it to Ω.
– Read resistance.

INJECTOR CIRCUIT		MEASUREMENT
WIRE		
INJ-2	PF1-B2	Close to 0 Ω

If continuity is not good, repair or replace wiring going to injector.

If continuity is good, perform the *FUEL INJECTOR RESISTANCE TEST*.

Fuel Injector Resistance Test

Disconnect ECM connector.

Install the ECM connector on the ECM ADAPTER TOOL (P/N 529 036 166).

Connect the fuel injector connector.

Using a FLUKE 115 MULTIMETER (P/N 529 035 868), check resistance value between terminals as follows.

FUEL INJECTOR RESISTANCE TEST AT ECM ADAPTER		
FUSE BOX TERMINAL	ECM ADAPTER	RESISTANCE @ 20°C (68°F)
PF1-B2	L4	11.4 - 12.6 Ω

If resistance value obtained is incorrect, perform an *INJECTOR GROUND CIRCUIT RESISTANCE TEST*.

Injector Ground Circuit Resistance Test

Disconnect the fuel injector connector.

Disconnect ECM connector.

Install ECM connector on the ECM ADAPTER TOOL (P/N 529 036 166).

Using a FLUKE 115 MULTIMETER (P/N 529 035 868), check resistance value between terminals as follows.

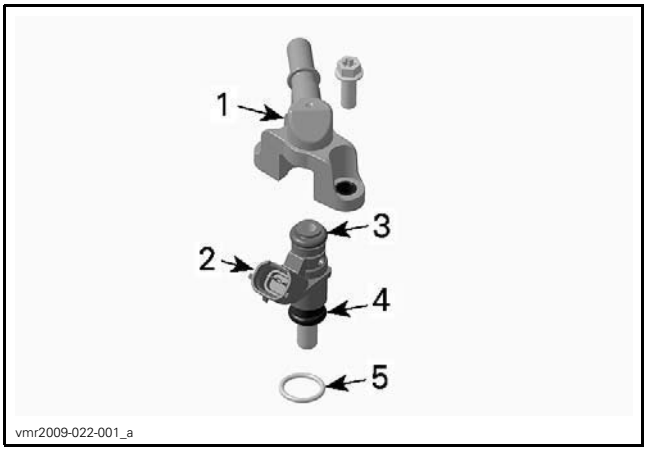
INJECTOR GROUND CIRCUIT		MEASUREMENT
WIRE	ECM ADAPTER	
INJ-1	L4	Close to 0 Ω

If continuity is not good, repair or replace wiring going to injector.

If continuity is good, replace the injector.

Fuel Injector Removal

To remove the injector, first remove the fuel rail. Refer to *FUEL RAIL*.



TYPICAL - FUEL RAIL ASSEMBLY
1. *Fuel rail*
2. *Fuel injector*
3. *Injector top O-ring*
4. *Injector bottom O-ring*
5. *Manifold O-ring*

Then, pull fuel injector out of the fuel rail.

Fuel Injector Installation

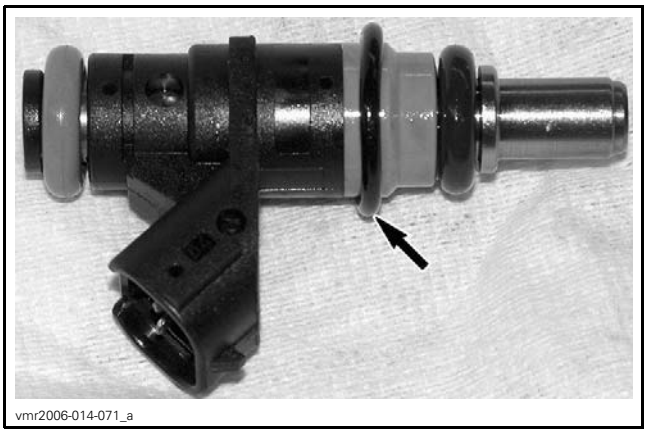
For the installation, reverse the removal procedure. Pay attention to the following details.

Apply a thin film of engine oil to O-rings to ease insertion in rail.

Install fuel injector with your hand. Do not use any tool.

FUEL INJECTOR INSTALLATION		
O-RINGS	New	Lubricate with engine oil

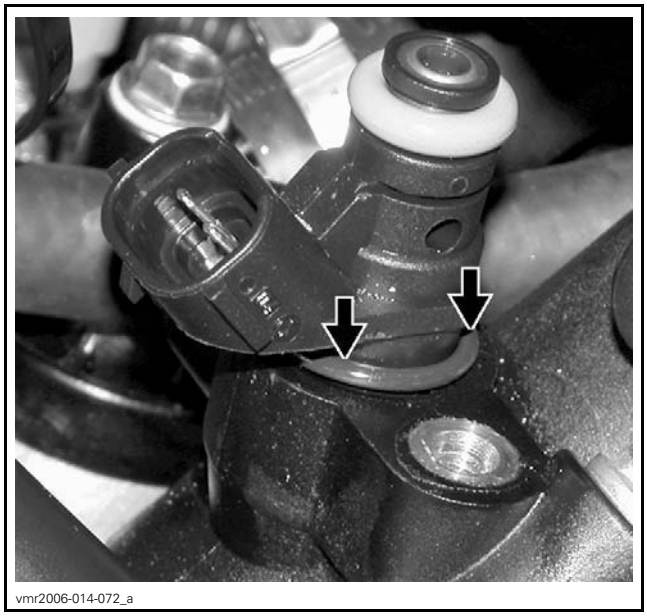
Position the manifold O-ring on injector as in following illustration.



TYPICAL - MANIFOLD O-RING POSITION

Carefully insert injector in manifold paying attention to the manifold O-ring.

NOTICE Gently push O-ring in evenly all around while inserting injector. O-ring must be completely inserted and not visible, before completing the insertion of the injector.



Firmly push injector until it bottoms out.

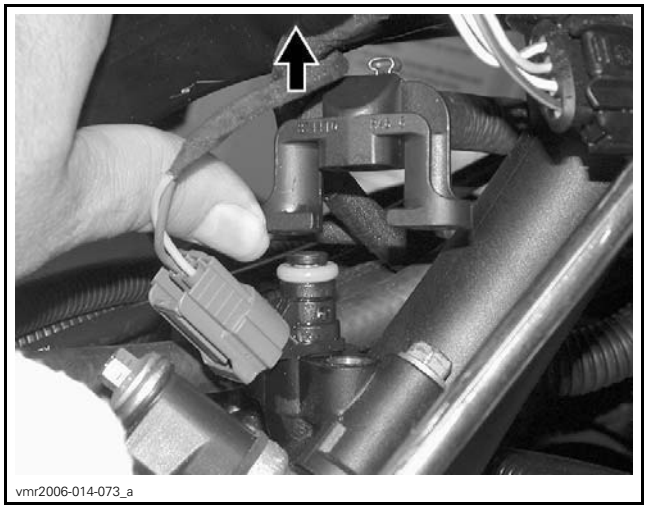
Reinstall fuel rail.

FUEL RAIL

Fuel Rail Replacement

Fuel Rail Removal

1. Unscrew rail retaining screws.
2. Gently pull rail off by hand.



TYPICAL

To disconnect fuel rail from hose, cut clamp on fuel hose using OETIKER PLIERS (P/N 295 000 070). Refer to *FUEL TANK AND FUEL PUMP* for clamp removal/installation procedures.

NOTE: If fuel rail is removed for access to fuel injector, it is not necessary to cut hose clamp. Only to replace fuel rail.

Fuel Rail Installation

For installation, reverse the removal process however, pay attention to the following.

Install new clamps using pliers as per removal (if fuel rail was replaced).

Install fuel rail and evenly tighten screws a little at a time each side.

FUEL RAIL INSTALLATION	
INJECTOR O-RINGS	RETAINING SCREW TORQUE
NEW (Lubricate with engine oil)	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

NOTE: Activate fuel pump a few times to built fuel pressure.

⚠ WARNING

Perform a fuel pressure test and ensure that there is no leak. Refer to *FUEL TANK AND FUEL PUMP*.

THROTTLE CABLE

Throttle Cable Removal

Remove steering cover.

Remove LH side panel.

Disconnect throttle cable from throttle body. Refer to procedure in this subsection.

Disconnect throttle cable from throttle lever.

Remove throttle cable.

Throttle Cable Installation

Reverse removal procedure.

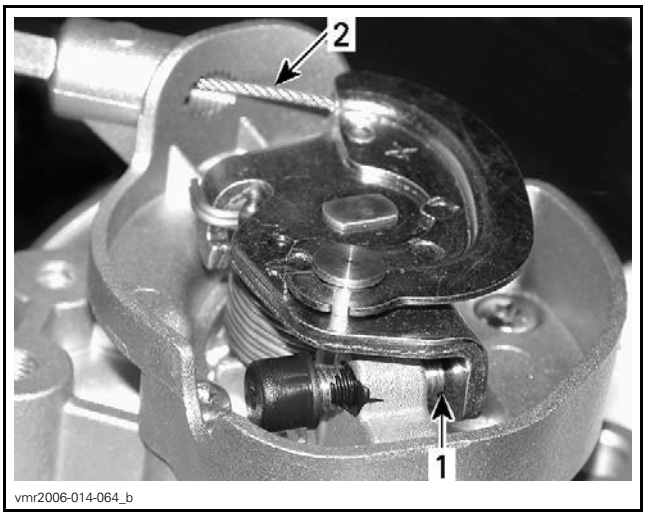
Proceed with *THROTTLE CABLE ADJUSTMENT* in this subsection.

Throttle Cable Adjustment

Mechanically adjust the throttle cable as follows.

Handlebar and throttle cable must be at their normal position. Throttle cable routing must have been performed before adjusting cable.

Activate throttle lever a few times. Make sure throttle cam of throttle body rests against set screw without any tension in the cable.



vmr2006-014-064_b

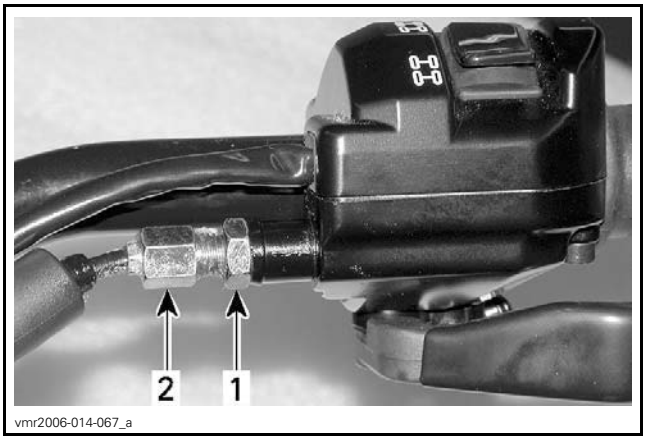
1. Contact here
2. Free-play here

⚠ CAUTION If there is no free-play at idle position, it may cause poor idling and startability problems. Improper cable adjustment will cause strain on cable and/or damage cable bracket or throttle lever at handlebar.

⚠ WARNING

Make sure idle speed stopper contacts throttle cam when throttle lever is fully released at handlebar.

If adjustment is needed, proceed with adjuster at handlebar. Adjust to have 2 mm (.078 in) free-play at the end of throttle lever. When done, slide back cable protector over adjuster.



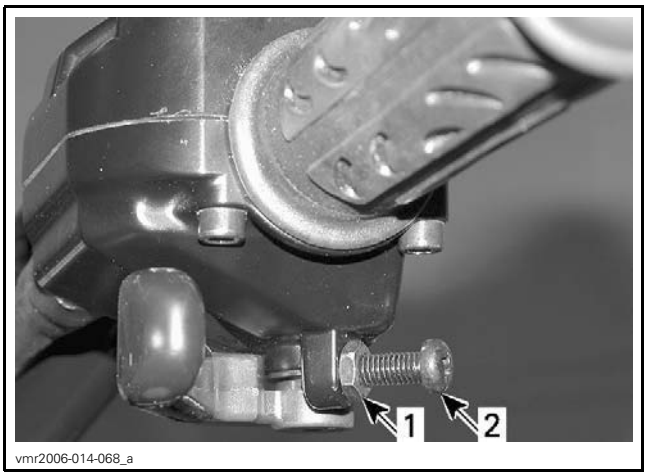
vmr2006-014-067_a

TYPICAL
1. Adjuster lock nut
2. Adjuster

Turn handlebar side to side and ensure there is still free-play in each position.

To ensure there is no strain in the cable at wide open position:

– Fully depress throttle lever and hold.
– Loosen adjuster lock nut/adjuster until it just releases lever.
– Turn adjuster clockwise until it touches lever again.
– From there, tighten adjuster 1/2 turn (to remove strain in cable).
– Tighten lock nut.
– Release throttle lever.



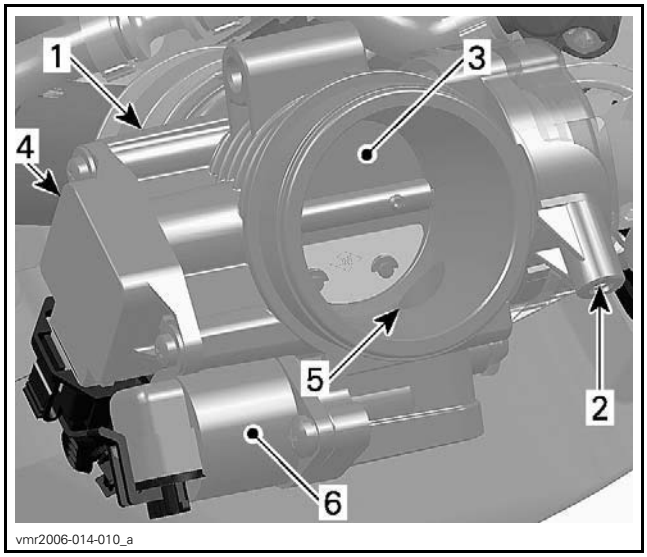
vmr2006-014-068_a

1. Adjuster lock nut
2. Adjuster

Reinstall throttle cable cover.

THROTTLE BODY

Throttle Body Description



vmr2006-014-010_a

1. Throttle body
2. Throttle cable attachment
3. Throttle plate
4. TPS
5. Idle air bypass channel
6. Idle air control valve

Throttle Body Access

Remove the RH side panel. Refer to *BODY* subsection.

Throttle Body Inspection

Check that the throttle plate moves freely and smoothly when depressing throttle lever.

– Check if throttle body idle set screw is loose or worn.
– NOTE: Throttle body must be replaced if idle set screw is loose or worn.
– Check if TPS is loose.
– Check if idle air control valve is loose.
– Check for corroded or damaged connectors.

Throttle Body Cleaning

1. Check throttle body cleanliness using a flashlight. Fully open throttle plate and verify:
   – Throttle body bore
   – Throttle plate edge.

Look for:

– Dirt
– Oily surfaces
– Carbon and salt deposits on throttle plate and the surrounding bore.

2. Clean as necessary.

3. Use a throttle body cleaner such as GUNK INTAKE MEDIC or an equivalent.

NOTICE **Only use an appropriate throttle body cleaner that will not damage O-rings and EFI sensors.**

⚠ CAUTION **Use the product in a well ventilated area. Refer to product manufacturer's warnings.**

4. To avoid getting dirt into engine, spray cleaner on a clean rag then rub rag against throttle plate and bore. A toothbrush may also be used.
5. Gently open throttle plate and hold fully open to reach all surfaces.
6. To remove residual dirt, spray cleaner on throttle plate and on bore.
7. Reinstall removed parts.

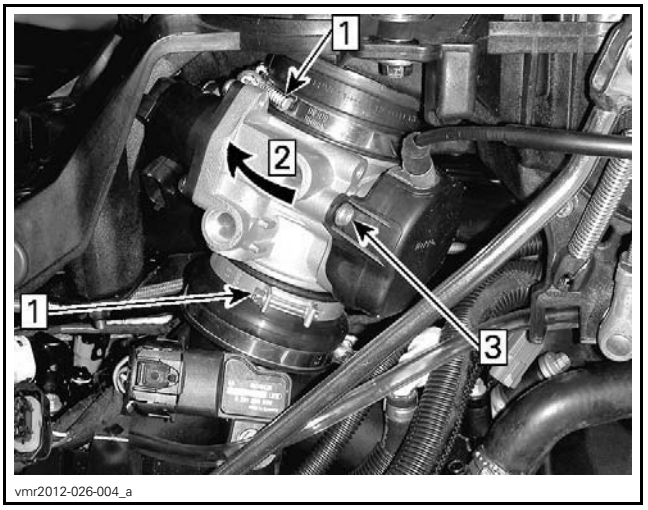
Throttle Body Removal

1. Remove the RH side panel. Refer to *BODY* subsection.
2. Remove the air intake silencer retaining screws.



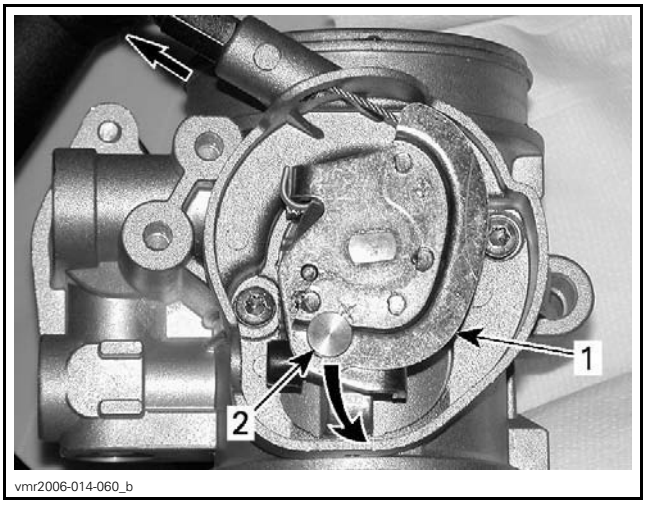
1. Remove these screws

3. Lift rear of air intake silencer as much as possible and block in this position.
4. Unplug connectors from TPS and IACV.
5. Loosen both throttle body clamps.
6. Rotate throttle body to gain access to throttle cable.
7. Remove throttle cable cover.



Step 1: Loosen
Step 2: Rotate
Step 3: Remove

8. Rotate throttle lever and pull out cable barrel.



1. Throttle lever
2. Cable barrel

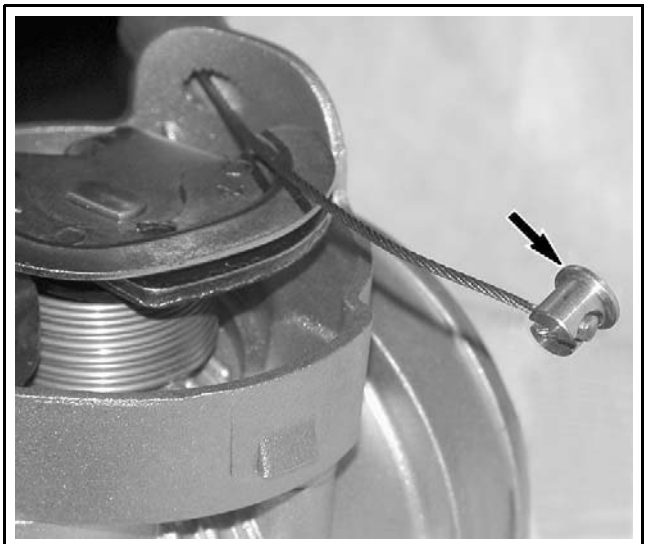
9. Remove barrel from cable.
10. Pull out throttle cable.
11. Pull out throttle body.

Throttle Body Installation

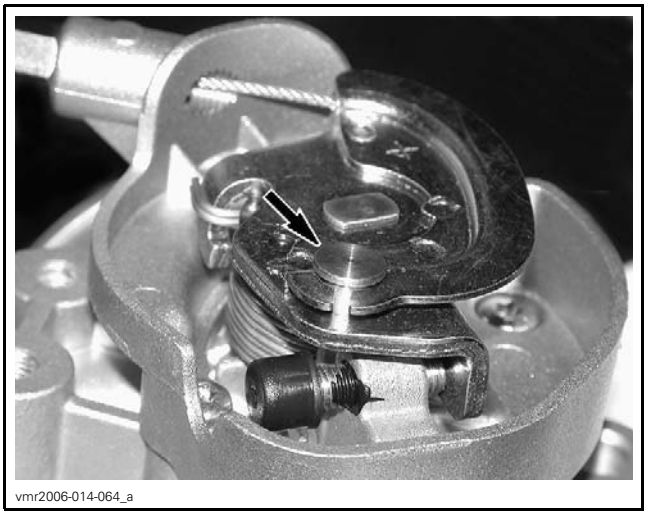
Installation of the throttle body is the reverse of the removal procedure. However, pay attention to the following.

Temporarily install throttle body into position.

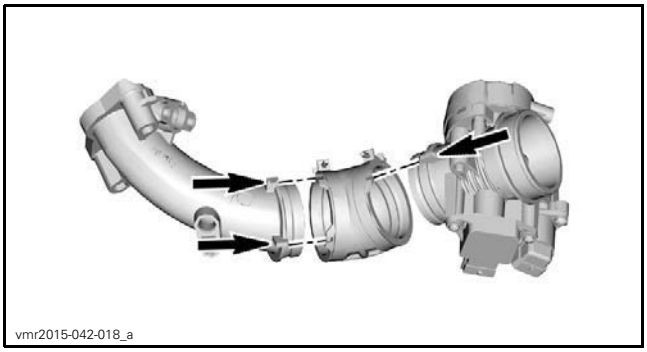
Properly install cable barrel to throttle cable end.

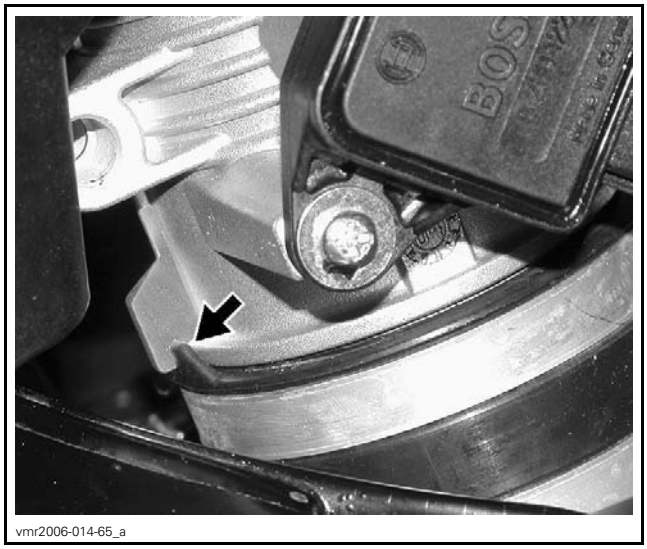

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Hook cable to throttle lever.


vmr2006-014-064_a

Rotate throttle body into position and ensure to index throttle body tab with boot notch.


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vmr2006-014-65_a

Tighten clamps.

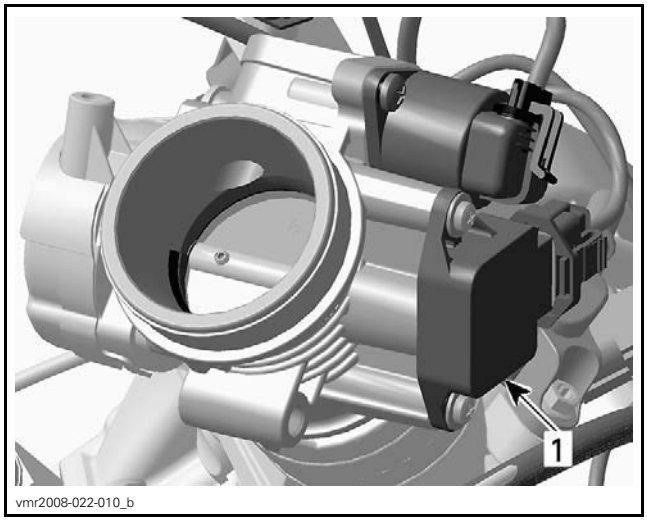
– Check throttle cable adjustment. Refer to *THROTTLE CABLE* in this subsection.
– If throttle body was replaced, perform the **Closed Throttle And Idle Actuator Reset** procedure. Refer to *CLOSED THROTTLE AND IDLE ACTUATOR RESET* in this subsection.

THROTTLE POSITION SENSOR (TPS)

Refer to the *ENGINE MANAGEMENT SYSTEM* subsection for component and connector locations.

General

The throttle position sensor (TPS) is a potentiometer that sends a signal to the ECM which is proportional to the throttle plate angle.



vmr2008-022-010_b

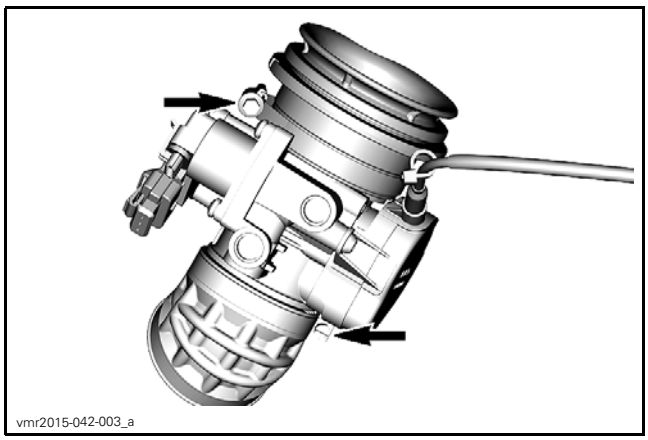
1. Throttle position sensor (TPS)

The ECM may generate several fault codes pertaining to the TPS. Refer to *DIGANOSTIC AND FAULT CODES* subsection for more information.

TPS Access

Remove the LH side panel. Refer to *BODY* subsection.

Loosen both throttle body clamps.


vmr2015-042-003_a

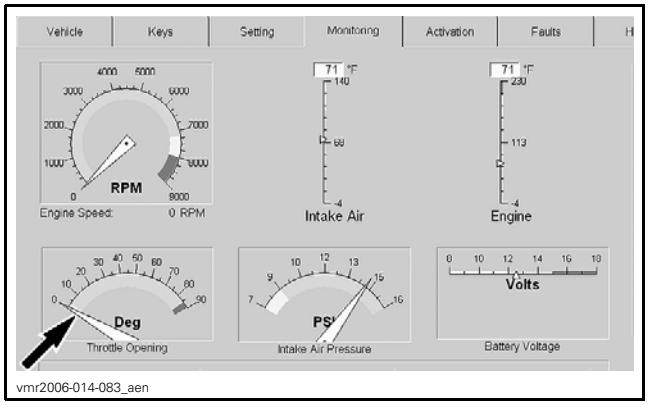
Rotate throttle body to gain access to TPS.

TPS Wear Test

IMPORTANT: Prior to testing the TPS, ensure that mechanical components of throttle body are checked.

While engine is not running, activate throttle and pay attention for smooth operation without physical stops of the cable.

Using the B.U.D.S. software, use the Throttle Opening display under Monitoring.



vmr2006-014-083_aen

TYPICAL

Slowly and regularly depress the throttle. Observe the needle movement. It must change gradually and regularly as you move the throttle. If the needle "sticks", bounces, suddenly drops or if any discrepancy between the throttle movement and the needle movement is noticed, it indicates that the TPS needs to be replaced or the computer used may be too slow to transfer data fast enough for real time display.

TPS Resistance Test

Ensure correct throttle cable adjustment. Refer to *THROTTLE CABLE ADJUSTMENT* in this subsection.

Ensure TPS is connected to wiring harness.

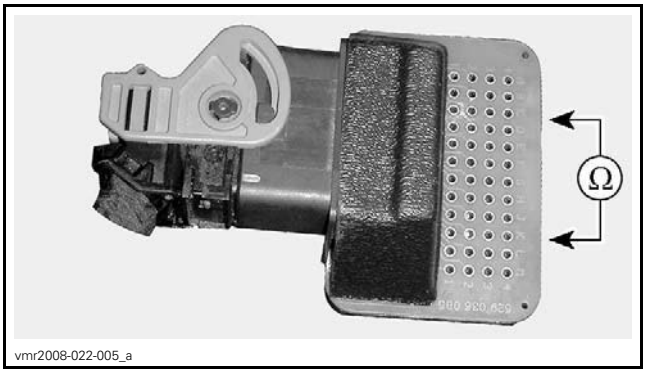
Disconnect the ECM connector.

Using the following tools, check resistance values.

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

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

ECM ADAPTER		THROTTLE IDLE POSITION	WIDE OPEN THROTTLE POSITION
PIN		RESISTANCE (Ω) @ 20°C (68°F)	
G3	G2	900-1600	2600-3100
G2	A1	1800-2200	1800-2200
G3	A1	2200-3100	800-1200



vmr2008-022-005_a

NOTE: The resistance value should change smoothly and proportionally to throttle movement. Otherwise, replace TPS.

If resistance values are correct, perform the *TPS INPUT VOLTAGE TEST* below.

If resistance values are incorrect, check wiring harness. If wiring is faulty, repair/replace. If wiring is good, replace TPS.

Reconnect ECM connector.

TPS Input Voltage Test

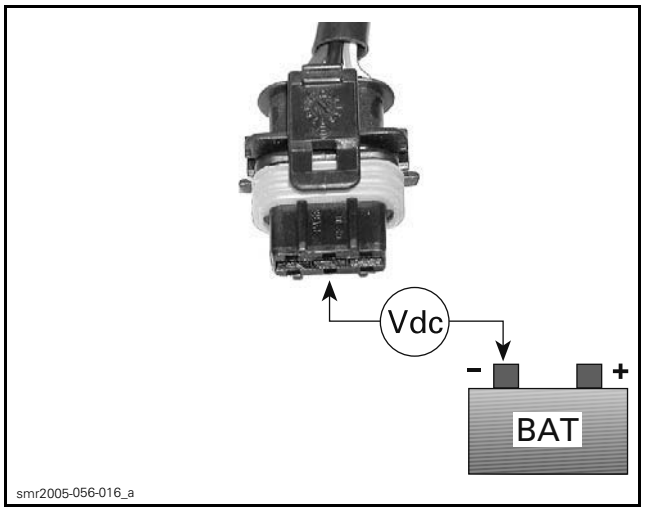
Disconnect connector from TPS.

Turn ignition key ON.

Set emergency engine stop switch to RUN.

Check the voltage readings from harness connector as follows.

CONNECTION	VOLTAGE
Pin 1 with battery ground	5.0 V
Pin 2 with battery ground	0 V



If voltage test is not good, check/repair wiring harness. If wiring tests good, refer to *ECM REPLACEMENT*.

If voltage test is good, everything is in order (assuming resistance test was performed).

TPS Replacement

Refer to *TPS ACCESS* in this subsection to gain access to TPS.

Unplug connector from TPS.

Loosen TPS retaining screws.

Remove TPS.

Install the new TPS.

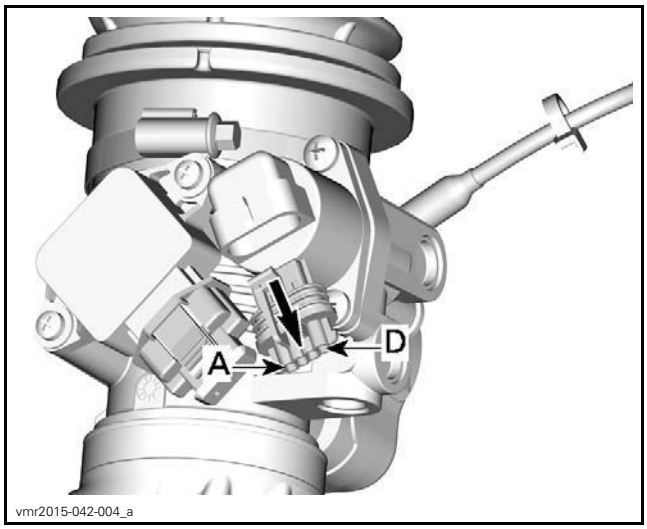
Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on the TPS retaining screws, then torque to 3 N•m (27 lbf•**in**).

Perform the **Closed Throttle And Idle Actuator Reset** procedure. Refer to *CLOSED THROTTLE AND IDLE ACTUATOR RESET* in this subsection.

IDLE AIR CONTROL VALVE (IACV)

Refer to the *ENGINE MANAGEMENT SYSTEM* subsection for component and connector locations.

An idle air control valve with good resistance measurement can still be faulty. It is also possible that a mechanical failure occurs which is not detectable without measuring the air flow. Replacing the IACV may be necessary as a test.



IACV Access

Refer to *TPS ACCESS* in this subsection to gain access to IACV.

IACV Resistance Test

Disconnect IACV from the wiring harness.

Using a multimeter, check the resistance in both windings.

Check the resistance between pins as shown.

IDLE AIR CONTROL VALVE		**MEASUREMENT**
PIN		RESISTANCE (Ω) @ 20°C (68°F)
A	D	50 ± 5
B	C	

If the resistance of any winding is not good, replace the idle air control valve.

If resistance test of valve windings is good, check continuity of circuits C4, D3, D4, E4 at the ECM. If not good, check/repair wiring/connectors.

IACV Visual Inspection

NOTE: Make sure the ignition key is turned off during the following procedure.

Remove Idle air control valve from throttle body.

Check the piston and bypass channel for dirt/deposits which can cause a sticking piston.

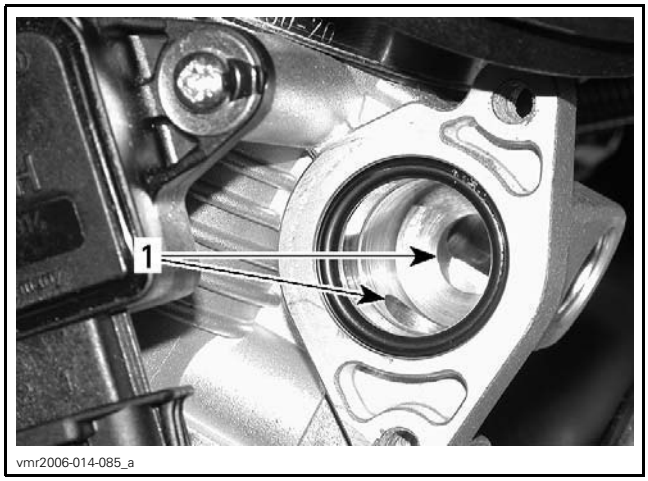
NOTICE Always keep the ignition key turned OFF, while the idle air control valve is removed.

NOTICE Do not try to operate the piston of the idle air control valve when it is dismounted. Also do not move the piston by hand. The drive screw is very sensitive and may be destroyed.

Using a part cleaner, clean idle bypass in throttle body from contamination then use an compressed air to dry it.

⚠ WARNING

Always wear eye protector. Chemicals can cause a rash break out and injure your eyes.



1. Clean bore from contamination

Clean all remaining parts and install the idle air control valve on the throttle body.

Proceed with the **Closed Throttle and Idle Actuator Reset**. See procedure in *CLOSED THROTTLE AN D IDLE ACTUATOR RESET* in this subsection.

CRANKSHAFT POSITION SENSOR (CPS)

Refer to applicable *ENGINE MANAGEMENT SYSTEM* subsection for component and connector locations.

NOTE: Take into account that a CPS fault can be triggered by bent or missing encoder wheel teeth. First check fault codes using B.U.D.S., then check the encoder wheel teeth condition if necessary. Refer to *MAGNETO AND STARTER* subsections.

CPS Access

Remove the RH side panel. Refer to *BODY* subsection.

CPS Resistance Test

Disconnect the ECM connector.

Install ECM connector on ECM ADAPTER TOOL (P/N 529 036 166).



Using a multimeter, measure resistance as per table.

ECM ADAPTER		MEASUREMENT
PIN		RESISTANCE Ω @ 20°C (68°F)
D1	E1	700 - 900 Ω

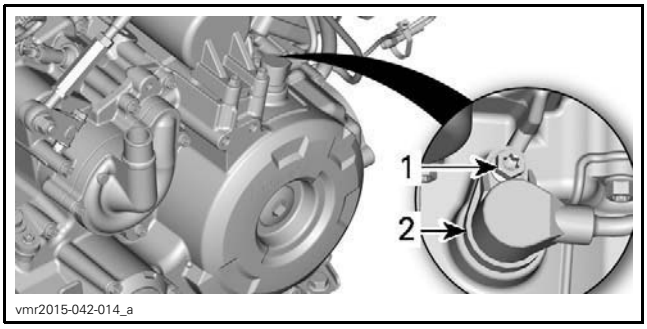
If resistance value is incorrect, check or repair the connectors and the wiring harness between ECM connector and the CPS. If resistance value is still incorrect, replace CPS.

CPS Replacement

Refer to *CPS ACCESS* in this subsection to reach CPS.

Disconnect CPS connector and cut harness locking tie (if applicable).

Remove CPS retaining screw and pull up on CPS to remove it.



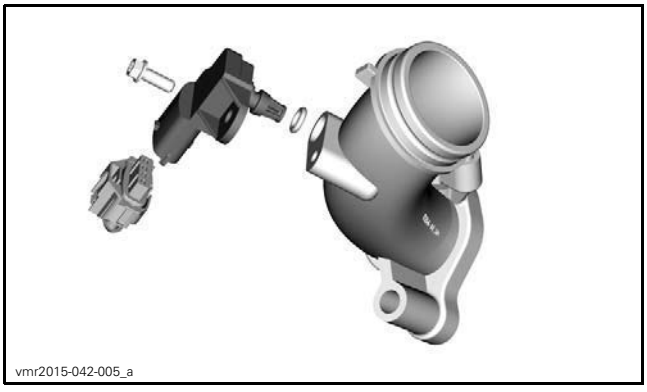
1. Retaining screw
2. CPS

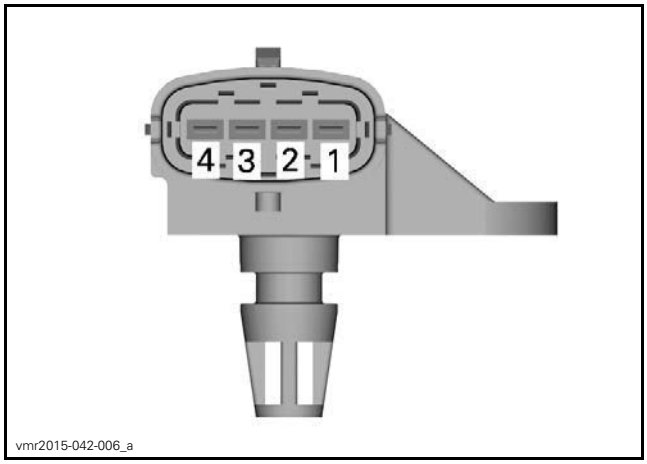
Install new CPS and secure harness with a new locking tie (as applicable).

CPS INSTALLATION	
O-RING	PRODUCT
	XPS SYNTHETIC GREASE (P/N 293 550 010)
SCREW	TIGHTENING TORQUE
	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

MANIFOLD ABSOLUTE PRESSURE AND TEMPERATURE SENSOR (MAPTS)

Refer to applicable *ENGINE MANAGEMENT SYSTEM* subsection for component and connector locations.





NOTE: This sensor is a multifunction device.

MAPTS Access

Remove the RH side panel. Refer to *BODY* subsection.

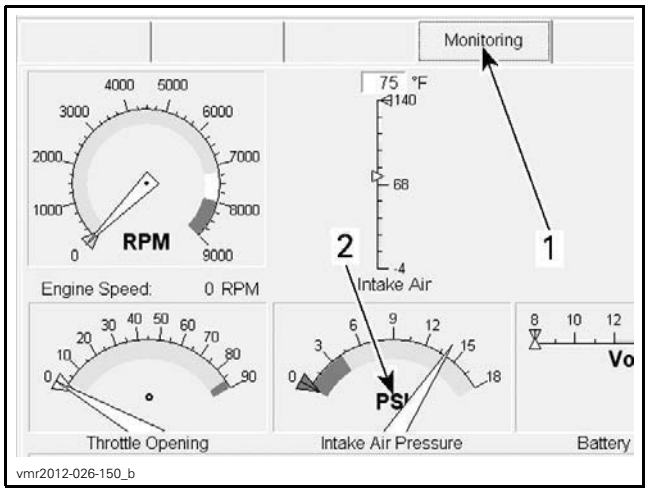
MAPTS Pressure Function

Before the engine is started, when power is applied to the system, the sensor measures the ambient air atmospheric pressure. The ambient pressure is, at that moment, stored in the ECM. Thereafter, once the engine is started, it measures the air pressure in the intake manifold at operating RPMs.

The sensor must be correctly installed on intake manifold. Otherwise, the MAPTS could generate a fault code for an unexpected sensor range at idle when it reads the atmospheric pressure. If this is the case, remove sensor and check for oil or dirt on its end and if problem persists, check throttle plate condition/position and the wiring harness. Perform the following tests.

MAPTS Pressure Function Quick Test

1. Connect vehicle to the latest applicable B.U.D.S. software version.
2. In B.U.D.S., click the following:
   - Read Data
   - Monitoring tab
   - ECM tab.



TYPICAL
1. *Monitoring tab*
2. *MAPTS pressure reading*

3. Look for and take note of the MAPTS pressure reading while the engine is stopped.
4. Perform the same test with a new MAPTS and compare both readings.

Values have to be within ± 3.4 kPa (.5 PSI).

MAPTS PRESSURE FUNCTION QUICK TEST			
RESULT	SERVICE ACTION		
NO READING	Circuit continuity test of MAPTS pressure function	MAPTS input voltage test	Repair or replace wiring
VALUE IS OUT OF RANGE	Replace MAPTS		

MAPTS Input Voltage Test

Check the voltage output from ECM to the pressure sensor.

1. Turn ignition key ON.
2. Set emergency engine stop switch to RUN.
3. Remove electrical connector from MAPTS.
4. Using a FLUKE 115 MULTIMETER (P/N 529 035 868), measure for input voltage as per following table.

MAPTS CONNECTOR		MEASUREMENT
PIN		VOLTAGE
1 (-)	3 (+)	5 Vdc

If voltage test is good, replace the MAPTS.

If voltage test is not good, carry out the *MAPTS CIRCUIT CONTINUITY TEST (PRESSURE FUNCTION)*.

MAPTS Circuit Continuity Test (Pressure Function)

1. Disconnect the ECM connector.
2. Install ECM connector on ECM ADAPTER TOOL (P/N 529 036 166).
3. Using a multimeter, check continuity of the following circuits.

MAPTS CIRCUIT CONTINUITY TEST (PRESSURE FUNCTION)		
ECM ADAPTER	MAPTS CONNECTOR	RESISTANCE VALUE
A1	Pin 3	Close to 0 Ω
F2	Pin 4	
G2	Pin 1	

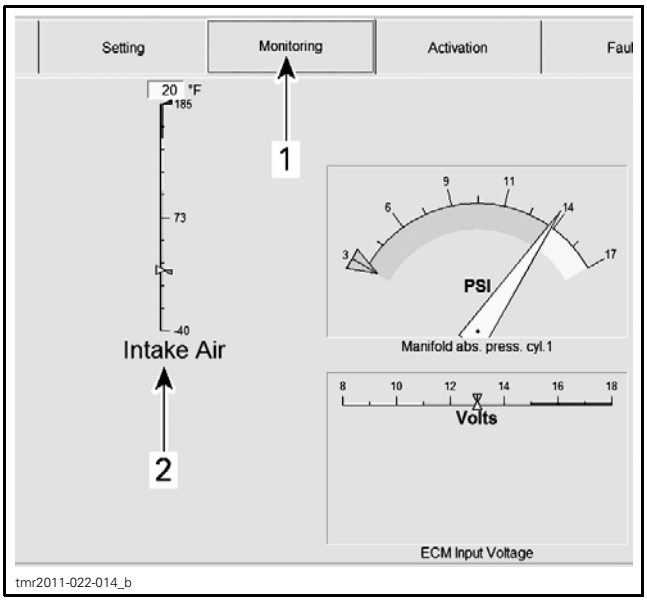
If resistance is not within specification, repair or replace the wiring harness between ECM connector and the MAPTS.

MAPTS Temperature Function

The sensor monitors the temperature in the intake manifold.

MAPTS Quick Test (Temperature Function)

1. Connect vehicle to the applicable B.U.D.S. software version.
2. In B.U.D.S., click the following:
   - Read Data
   - Monitoring tab
   - ECM tab.
3. Look for the Intake Air temperature reading while the engine is stopped.



TYPICAL
1. *Monitoring tab*
2. *MAPTS temperature reading*

4. Perform the same test with a new MAPTS and compare both readings.

If the engine MAPTS temperature reading is significantly different than the new MAPTS, replace it.

NOTE: Both sensors must feel the same ambient air temperature.

If there is no reading, carry out a *MAPTS RESISTANCE TEST (TEMPERATURE FUNCTION)*.

MAPTS Resistance Test (Temperature Function)

Disconnect the connector from the MAPTS.

Using the FLUKE 115 MULTIMETER (P/N 529 035 868), check the resistance of the sensor itself as shown.

MAPTS		MEASUREMENT
PIN		RESISTANCE Ω @ 20°C (68°F)
1	2	2280 - 2740

If resistance is not within specification, replace the MAPTS.

If resistance tests good, **reconnect** the MAPTS and disconnect the ECM connector.

Install ECM-A connector on ECM ADAPTER TOOL (P/N 529 036 166).



Using a multimeter, recheck resistance value as per following table.

ECM ADAPTER		MEASUREMENT
PIN		RESISTANCE Ω @ 20°C (68°F)
F3	G2	2280 - 2740

MAPTS TEMPERATURE SENSOR TEST RESULTS			
RESULT	SERVICE ACTION		
NO READING	Circuit Continuity Test of MAPTS Temperature Function	MAPTS Input Voltage Test	Repair or replace wiring
INCORRECT RESISTANCE VALUE	Replace MAPTS		

MAPTS Circuit Continuity Test (Temperature Function)

MAPTS CIRCUIT CONTINUITY TEST (TEMPERATURE FUNCTION)		
ECM ADAPTER	MAPTS CONNECTOR	RESISTANCE VALUE
G2	Pin 1	Close to 0 Ω
F3	Pin 2	

MAPTS Replacement

Remove the RH side panel. Refer to *BODY* subsection.

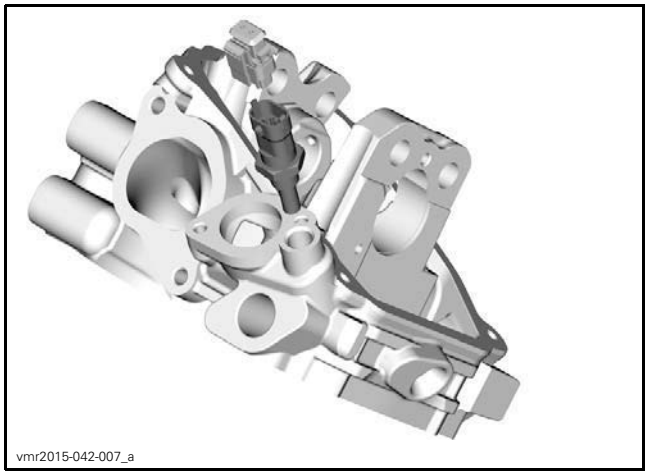
Disconnect MAPTS connector and remove the MAPTS.

Install new MAPTS as per following table.

TIGHTENING TORQUE	PRODUCT
6 N•m ± 0.7 N•m (53 lbf•**in** ± 6 lbf•**in**)	LOCTITE 243 (BLUE) (P/N 293 800 060)

CTS (COOLANT TEMPERATURE SENSOR)

Refer to appropriate *ENGINE MANAGEMENT SYSTEM* subsection for component and connector locations.



CTS Access

Remove the RH side panel. Refer to *BODY* subsection.

CTS Resistance Test

1. Disconnect the ECM connector.
2. Using the following tools, check resistance values.

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



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

3. Install ECM connector on the following tool.

ECM ADAPTER		MEASUREMENT
PIN		RESISTANCE (Ω) @ 20°C (68°F)
C3	F4	2280 - 2736

If resistance value is incorrect, check wiring continuity between ECM connector and the CTS. Refer to *CTS CIRCUIT CONTINUITY TEST* in this subsection.

CTS Circuit Continuity Test

1. Disconnect connector from CTS and check the circuit continuity.

CTS CIRCUIT CONTINUITY TEST		
ECM ADAPTER	CTS CONNECTOR	RESISTANCE VALUE
Pin F4	Pin 1	Close to 0 Ω
Pin C3	Pin 2	

If resistance value is incorrect, repair or replace wiring or connectors/terminals.

If resistance test is good, replace the CTS.

CTS Replacement

1. Refer to *CTS ACCESS* in this subsection to reach CTS.
2. Disconnect CTS connector and remove CTS.
3. Install the new CTS and torque as specified.

CTS TORQUE
16 N•m ± 2 N•m (142 lbf•**in** ± 18 lbf•**in**)

4. Reinstall remaining removed parts.
5. Refill and bleed the cooling system. Refer to *COOLING SYSTEM* subsection.

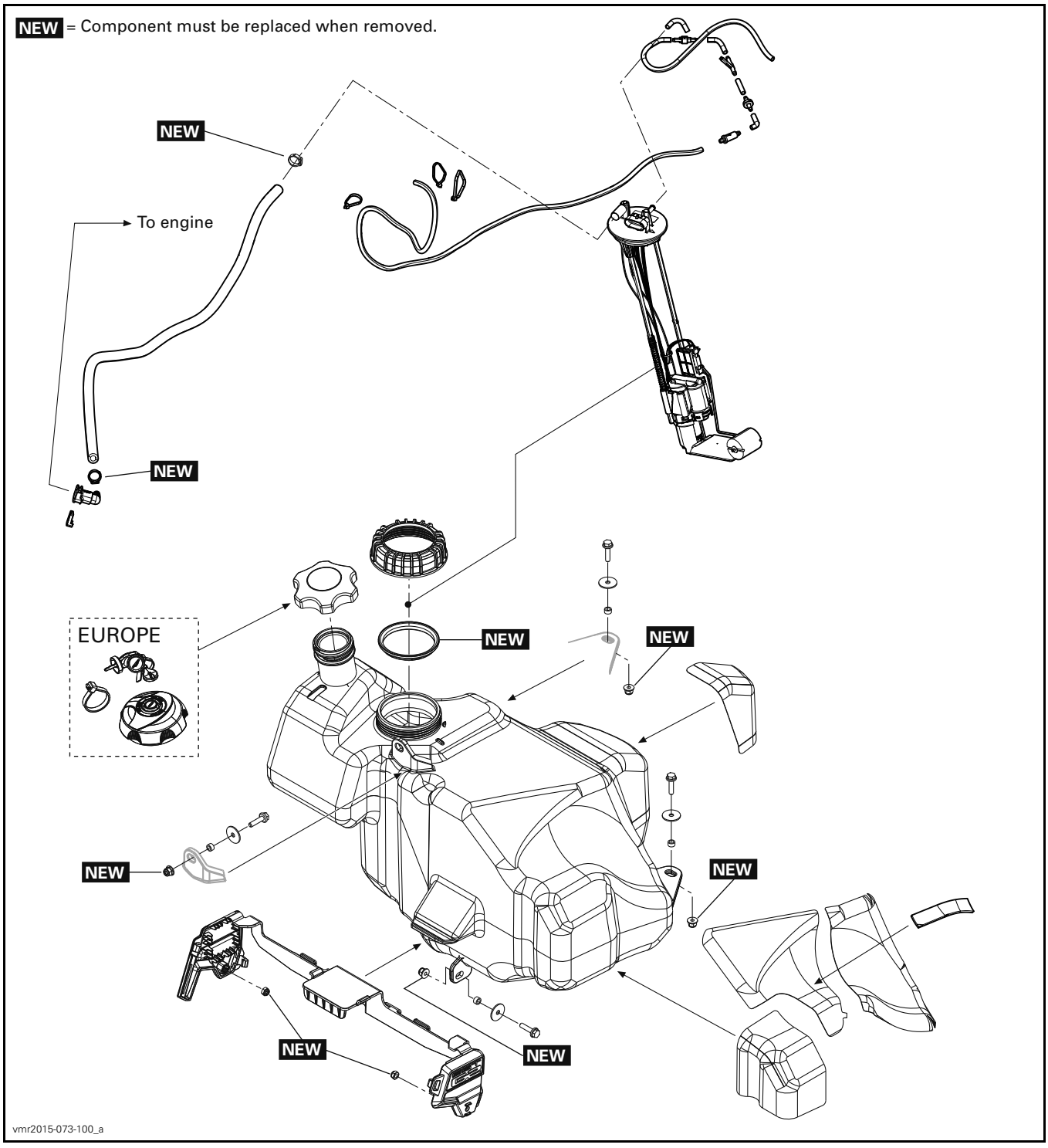
FUEL TANK AND FUEL PUMP (450)

SERVICE TOOLS

Description	Part Number	Page
FLUKE 115 MULTIMETER	529 035 868	499
FUEL HOSE ADAPTER	529 036 023	493
FUEL PUMP NUT TOOL	529 035 899	501
OETIKER PLIERS	295 000 070	496
PRESSURE GAUGE	529 035 709	493
SMALL HOSE PINCHER	295 000 076	504
VACUUM/PRESSURE PUMP	529 021 800	492

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
FLUKE RIGID BACK PROBE	TP88	499


NEW = Component must be replaced when removed.
NEW
To engine
NEW
EUROPE
NEW
NEW
NEW
NEW
NEW
NEW
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GENERAL

⚠ WARNING

Fuel is flammable and explosive under certain conditions. Ensure work area is well ventilated. Do not smoke or allow open flames or sparks in the vicinity.

⚠ WARNING

Always disconnect battery prior to working on the fuel system.

⚠ WARNING

Always proceed with care and use appropriate safety equipment when working on pressurized fuel system. Wear safety glasses.

⚠ WARNING

Do not allow fuel to spill on hot engine parts and/or on electrical connectors.

When the repair is completed, ensure that all hoses are connected and secured. Perform the *FUEL PRESSURE TEST* and the *FUEL TANK LEAK TEST* as explained in this subsection.

Fuel lines remain under pressure at all times. Proceed with care when removing/installing high pressure test equipment.

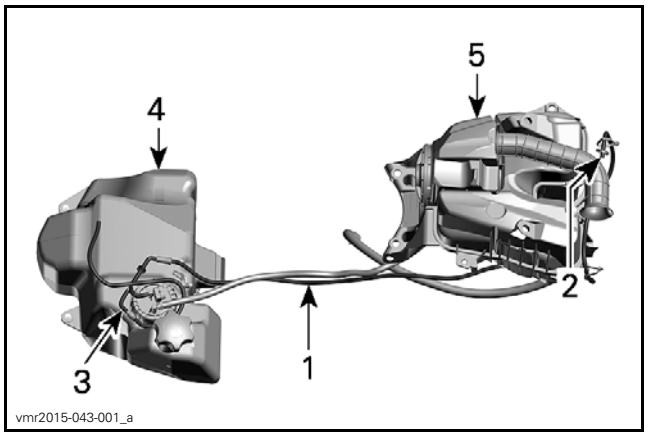
Use the B.U.D.S. software or disconnect the fuel pump electrical connector to disable fuel pump and crank engine to release fuel pressure prior to disconnecting any fuel hose.

Cover the fuel hose connections with an absorbent shop rag and carefully disconnect them to minimize spilling.

SYSTEM DESCRIPTION

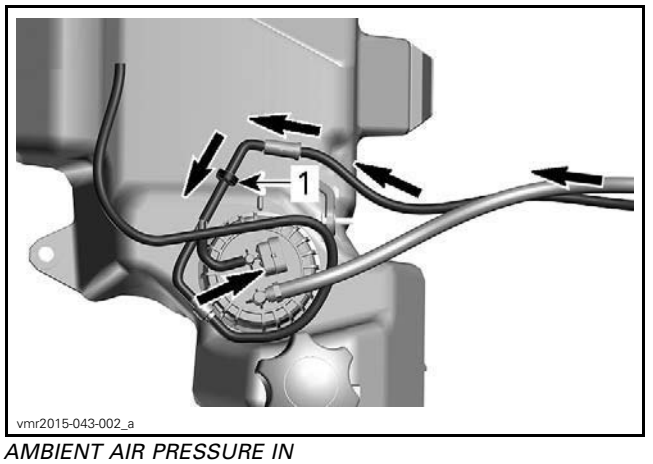
Fuel Tank Vent System

The fuel tank is equipped with a vent system that provides over pressure relief and negative pressure relief of the fuel tank.



FUEL TANK VENT SYSTEM
1. *Vent hose*
2. *Vent system hose inlet*
3. *Vent system connected to fuel pump*
4. *Fuel tank*
5. *Engine air intake system*

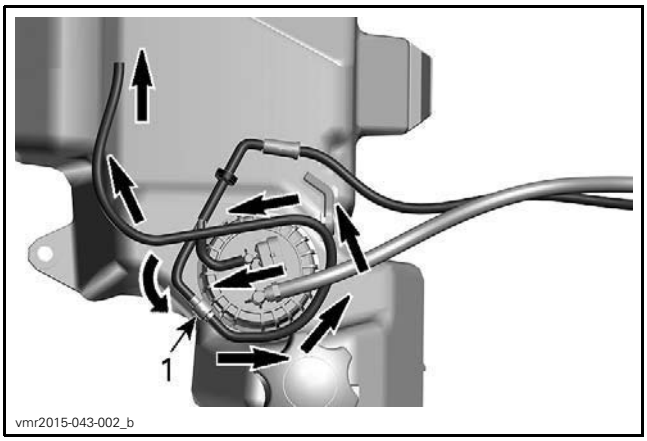
Air can enter the fuel tank at all times through the vent system INLET check valve. This prevents negative pressure within the fuel tank which could cause fuel starvation.



AMBIENT AIR PRESSURE IN
1. *Vent inlet check valve*

The vent inlet check valve also prevents fuel from flowing out through the inlet of the vent system.

If the pressure in the fuel tank builds up and exceeds 2.5 kPa - 7.6 kPa (.36 PSI - 1.1 PSI), the pressure relief valve opens and lets the excess pressure evacuate through the vent system outlet hose.

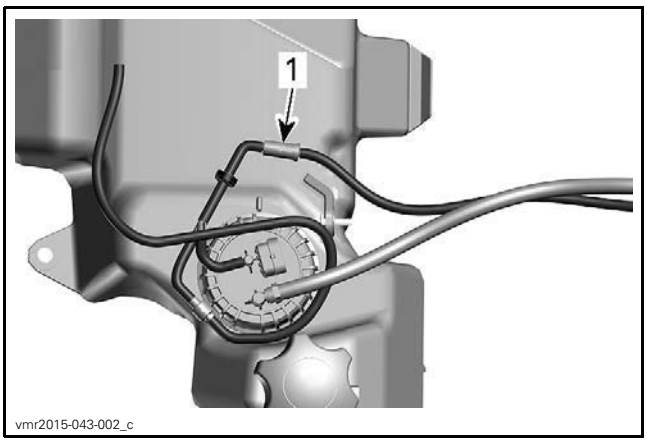


OVER PRESSURE RELIEF
1. Outlet pressure relief valve

Fuel Tank Vent Breather Filter

The vent system is equipped with an in-line breather filter that prevents entry of particles such as dust or small insects. It is located next to the fuel pump, on the inlet hose, before the air inlet check valve.

To access the fuel tank vent breather filter, remove the rear body module.



1. Fuel tank vent breather filter

Fuel Pump Module

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

– Electric fuel pump
– Fuel pump prefilter (replaceable)
– Fuel pressure regulator
– Fuel level sender.

Fuel Filters

The system comprises a replaceable prefilter element attached to the bottom of the fuel pump.

Fuel Pump Pressure Regulator

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

INSPECTION

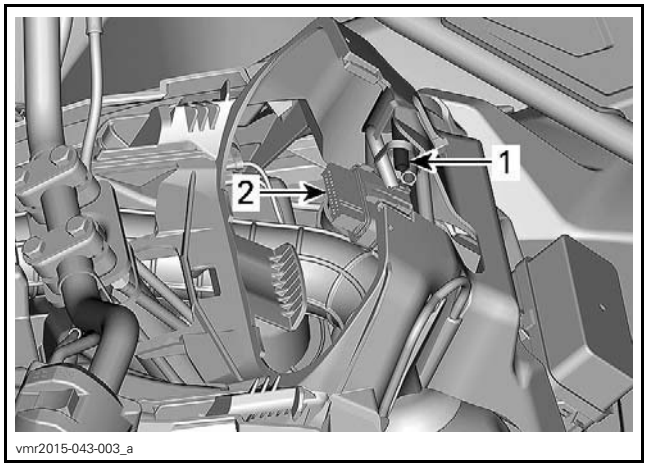
FUEL TANK LEAK TEST

⚠ WARNING

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

1. Refill fuel tank and ensure fuel tank cap is in good condition and properly installed.
2. Remove the gauge support for access to the fuel vent inlet hose.
3. Using the VACUUM/PRESSURE PUMP (P/N 529 021 800), pressurize the fuel tank through the vent hose.

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



1. Fuel tank vent inlet hose
2. Gauge connector

PRESSURE	TIME WITHOUT PRESSURE DROP
14 kPa (2 PSI)	3 minutes

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

To locate a leak, check for a fuel smell or leaking fuel.

To ease locating leak(s), spray soapy water on all hose connections and components; bubbles will indicate the leak location(s).

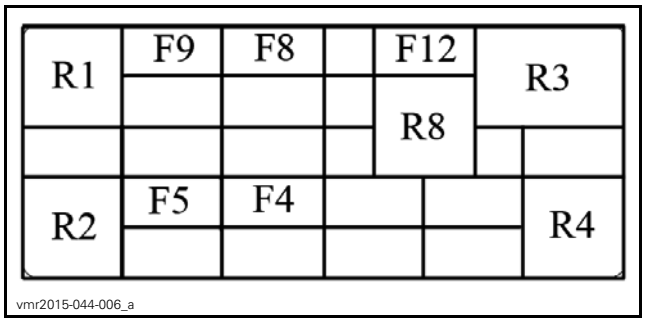
NOTE: For access to the fuel tank vent system, refer to *FUEL PUMP ACCESS* in this subsection.

FUEL SYSTEM PRESSURE TEST

The pressure test will show the available pressure in the system. It validates the pressure regulator and the fuel pump, and allows for checking the fuel system for leaks (high pressure side).

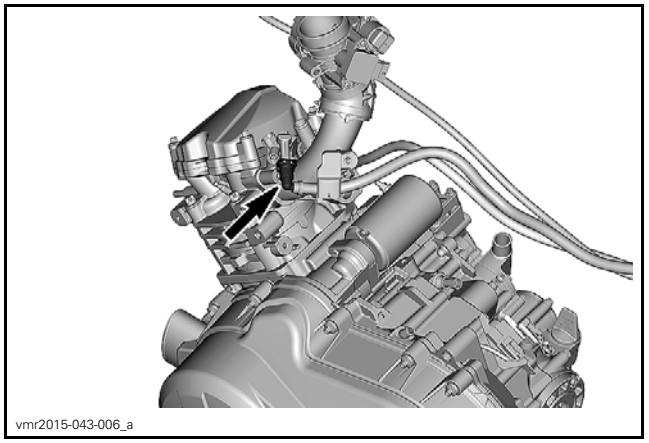
NOTE: Refer to the *FUEL SYSTEM DIAGNOSTIC FLOW CHART* in this subsection to help diagnose a fuel system related problem.

1. Ensure the fuel level in the tank is sufficient.
2. Ensure the battery voltage is over 12 volts.
3. Remove seat.
4. Remove LH side body panel, refer to *BODY* subsection.
5. Remove heat shield, refer to *EXHAUST* subsection.
6. Remove the fuel pump relay fuse (F5) in the front fuse box.



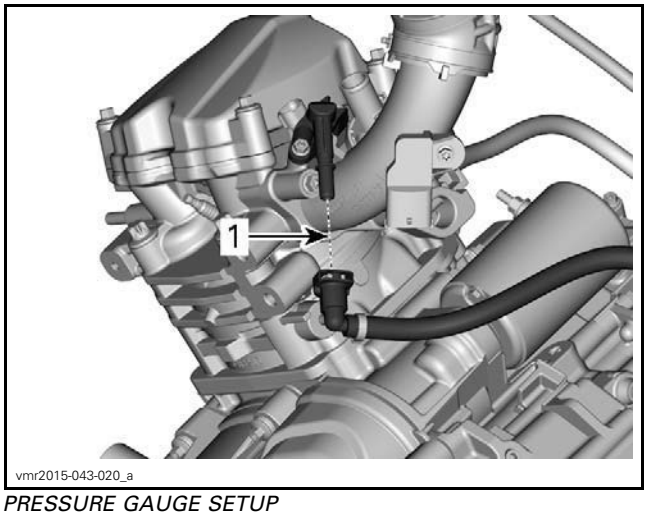
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7. Release fuel pressure by running engine until it runs out of gas.
8. Carefully disconnect the fuel hose fitting from the injector fuel rail by pressing on the release tab of the quick disconnect fitting.


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9. Install the fuel pressure gauge and fuel hose adapter between the disconnected injector hose and fuel rail (in-line installation).

REQUIRED TOOLS	
PRESSURE GAUGE (P/N 529 035 709)	
FUEL HOSE ADAPTER (P/N 529 036 023)	



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PRESSURE GAUGE SETUP
1. Fuel hose adapter location

10. Reinstall the fuel pump relay fuse (F5) in the forward fuse box.
11. Turn ignition key ON and observe fuel pressure.

FUEL PRESSURE	350 kPa ± 10 kPa (51 PSI ± 1 PSI)

NOTE: Valid at 12v ± 0.1v.

12. Start engine and observe fuel pressure.
13. Stop engine.

14. Remove test equipment and reconnect fuel hose to injector fuel rail by proceeding in the same manner as for its installation.

Test Conclusion

The fuel pressure should be within specification in static or dynamic tests.

Rapid Pressure Drop

If there is a rapid pressure drop after the engine is stopped, check for leakage at:

– The fuel hose
– The fuel rail.

NOTE: The fuel pump check valve integral to the fuel pump module may also be at fault.

If no leak is detected, replace fuel pump.

Slow Pressure Drop

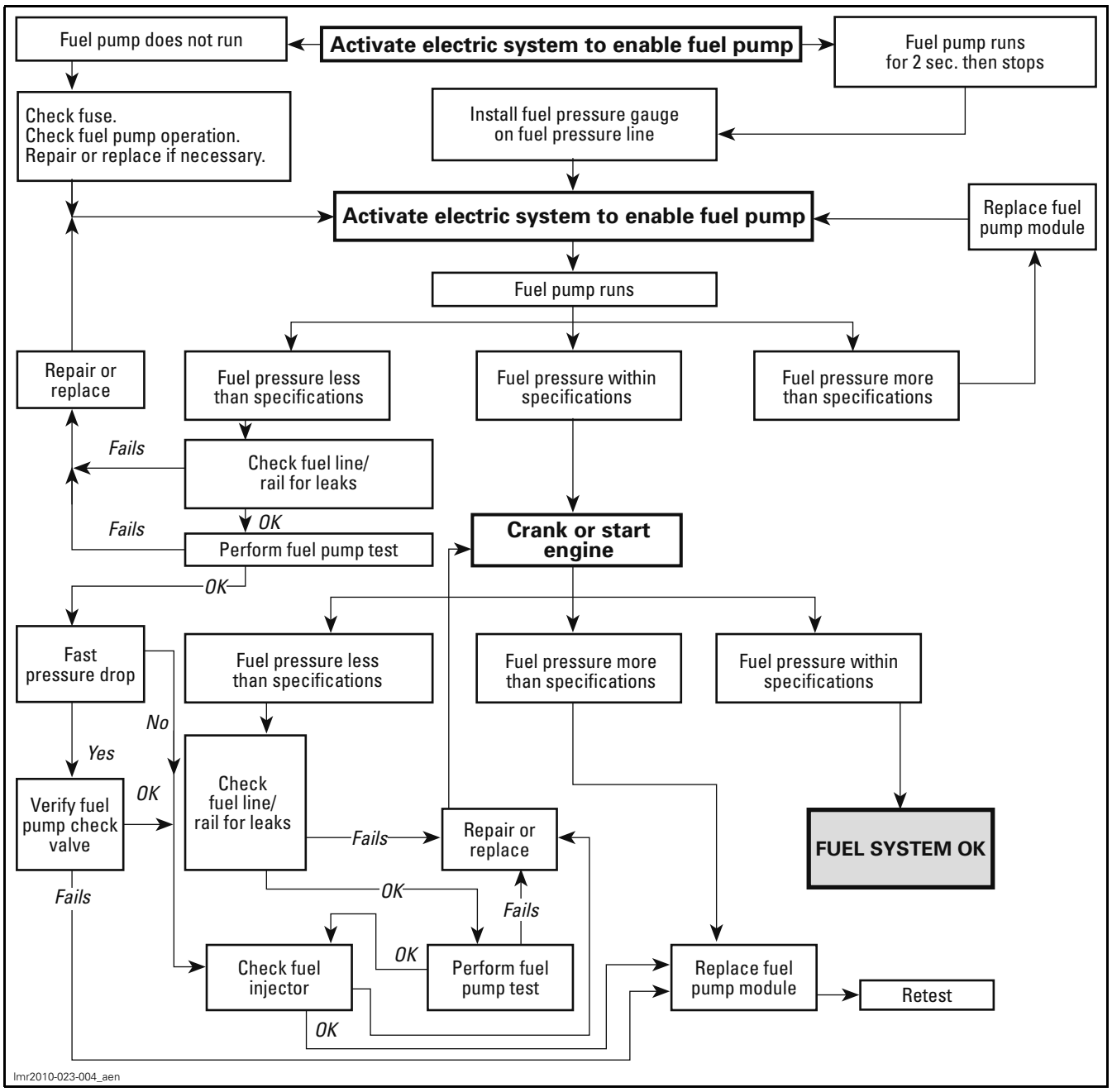
If there is a slow pressure drop after the engine is stopped, check for a fuel injector leak. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.

NOTE: The fuel pressure regulator or fuel pump check valve integral to the fuel pump module may also be at fault.

If no leak is detected, replace fuel pump.

TROUBLESHOOTING

FUEL SYSTEM DIAGNOSTIC FLOW CHART



PROCEDURES

FUEL HOSE AND OETIKER CLAMPS

Fuel Hose Replacement

When replacing fuel hoses, be sure to use hoses and clamps as available from BRP parts department. This will ensure continued proper and safe operation.

⚠ WARNING

Use of fuel lines other than those recommended by BRP may compromise fuel system integrity.

⚠ WARNING

Whenever removing a hose in the fuel system, always use new Oetiker clamps at assembly. Then validate fuel system tightness by performing a fuel pressure test.

Oetiker Clamp Replacement

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

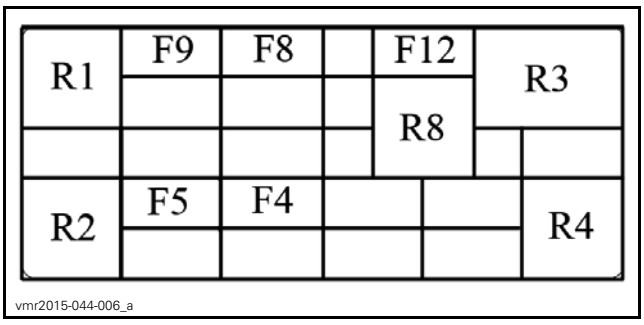
FUEL TANK

Fuel Tank Draining

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

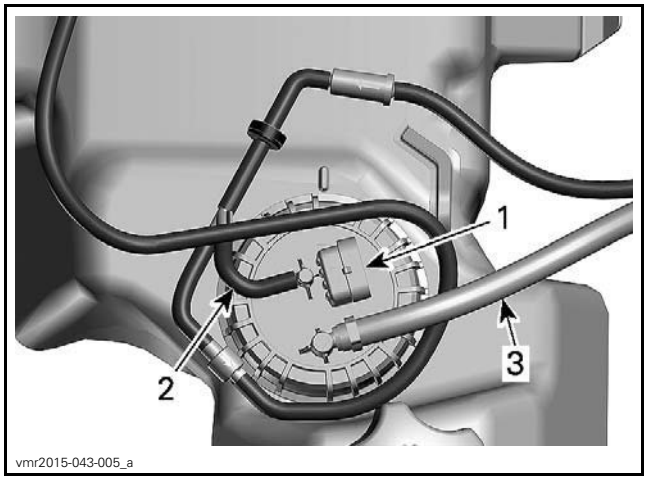
Fuel Tank Removal

1. Drain fuel tank. Refer to *FUEL TANK DRAINING* in this subsection.
2. Remove the fuel pump relay fuse (F5) in the front fuse box.



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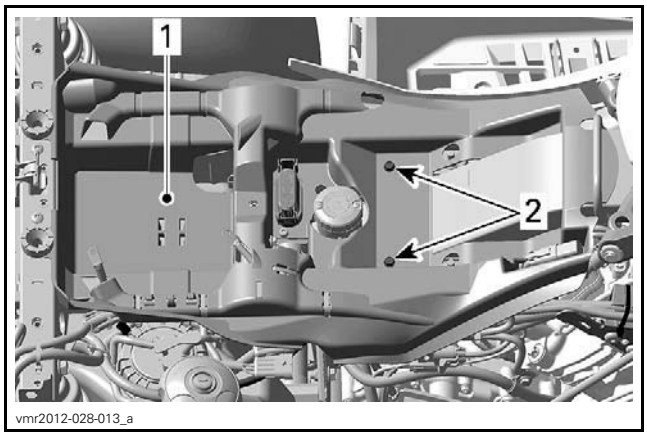
3. Release fuel pressure by running engine until it runs out of gas.
4. Disconnect and remove the battery, refer to *CHARGING SYSTEM* subsection.
5. Remove the rear body module, refer to *BODY* subsection.
6. Refer to *EXHAUST SYSTEM* and remove the following:
   – Muffler assembly
   – Muffler/exhaust pipe heat shield.
7. Reinstall fuel tank cap to prevent foreign objects from entering the fuel tank.
8. Disconnect the following from the fuel pump module:
   – Fuel pump electric connector
   – Fuel system vent hose
   – Fuel pump pressure hose.



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1. Fuel pump connector
2. Vent hose
3. High pressure fuel hose

9. Disconnect the positive (+) battery cable from the starter solenoid.
10. Remove the 2 screws that secure the front of the battery support.

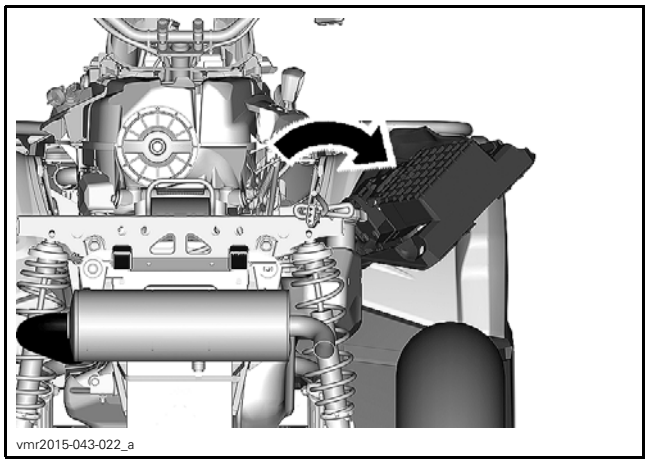


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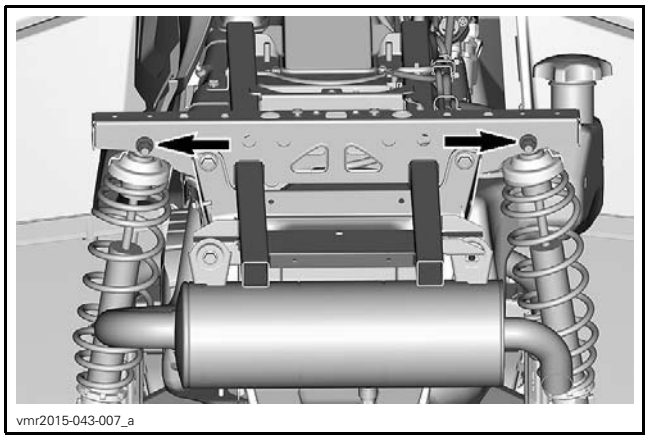
1. Battery support
2. Support retaining screws

NOTE: It is not necessary to remove the wiring harness or other components from the battery support.

11. Flip the battery support over towards the RH side of the vehicle for access to the rear frame extension.


vmr2015-043-022_a

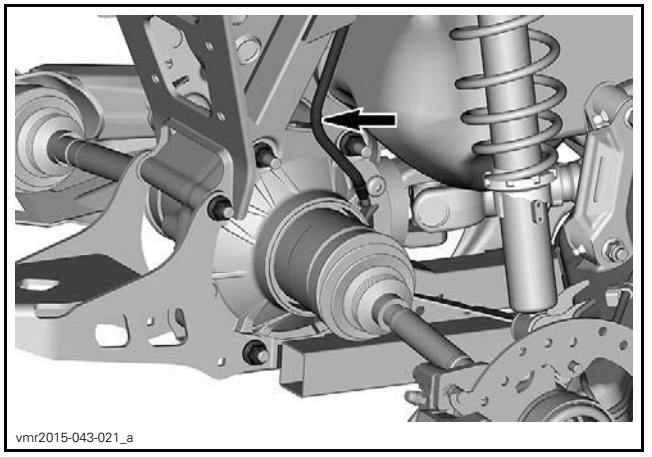
12. Remove the upper mounting bolt from both rear shock absorbers.


vmr2015-043-007_a

13. Block the front wheels with wooden blocks.
14. Lift back end of vehicle and properly support under the lower rear portion of the frame, near the final drive.

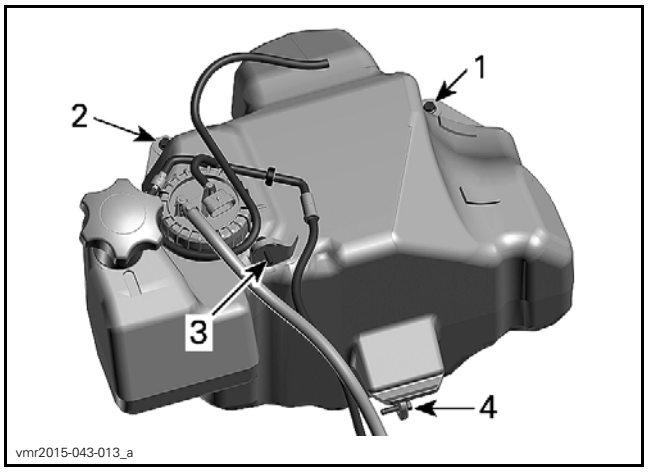
⚠ CAUTION Before working on vehicle, ensure the vehicle is securely supported.

15. Remove vent tube from final drive.


vmr2015-043-021_a

16. Remove fuel tank retaining screws (4).

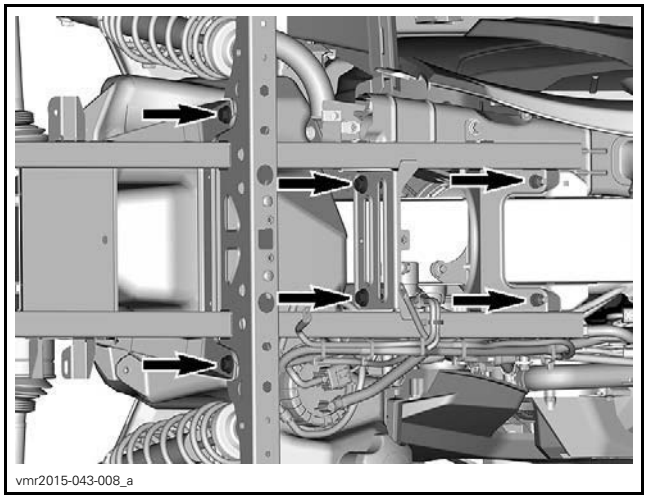
NOTE: Note position of washers and bushings on each screw.



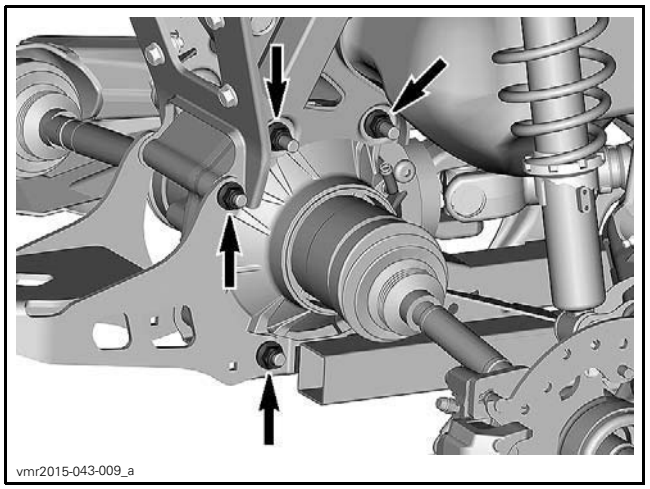
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FUEL TANK MOUNTING SCREWS (4)
1. *LH rear*
2. *RH rear*
3. *Forward top*
4. *Forward bottom*

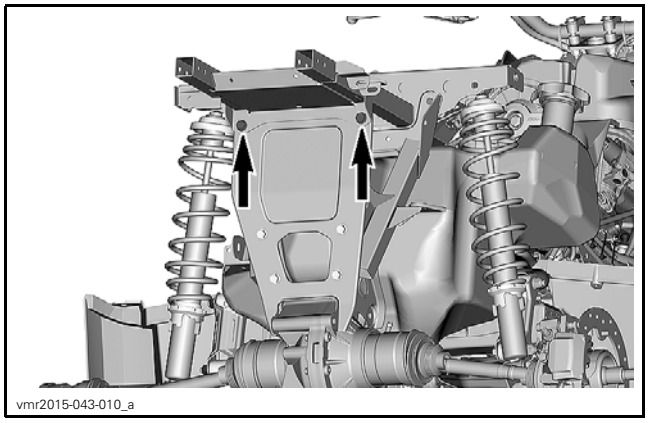
17. Loosen the front 2 nuts and remove the 4 screws retaining the rear frame extension.

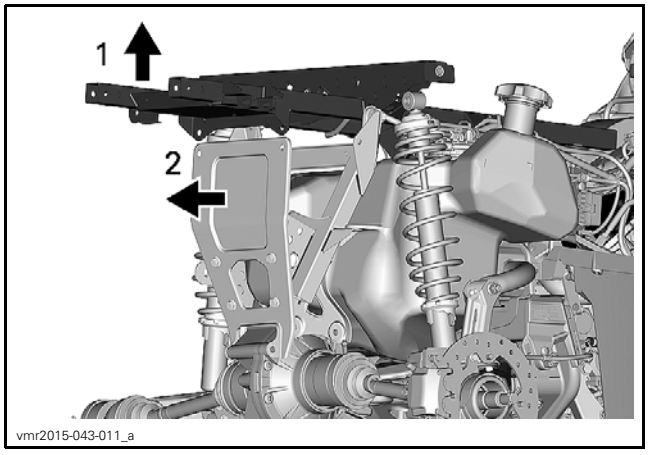

vmr2015-043-008_a

18. Remove nuts and screws securing trailer hitch and rear frame support to rear final drive.


vmr2015-043-009_a

19. Remove 2 nuts and screws securing rear frame support to rear frame section.

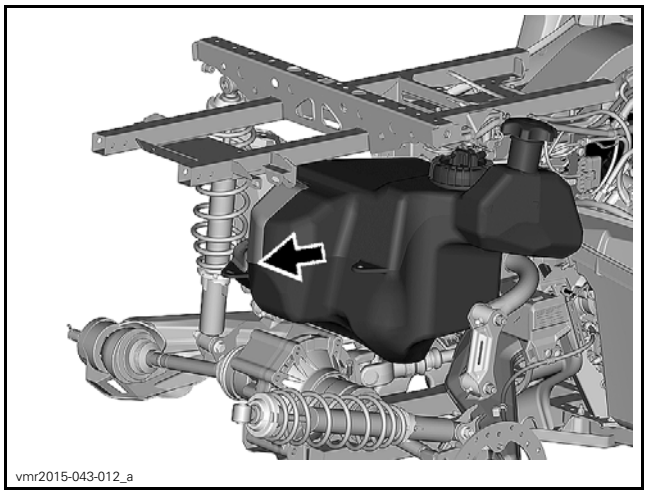

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vmr2015-043-011_a

20. Lift up on rear frame extension and pull fuel tank out of vehicle.

NOTE: When lifting up on the rear frame extension, the chock absorbers will fall backwards.


vmr2015-043-012_a

Fuel Tank Inspection

Inspect fuel tank for any damages or cracks which may result in fuel leaks.

Inspect fuel tank and fuel tank protector on frame for damages.

Inspect protector for damages.

If cracks, gouges or other damages which may lead to a fuel leak, or damages to attachment points that could prevent the tank from being secure are found, replace fuel tank.

Fuel Tank Installation

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

Install a bushing on each fuel tank mounting screw. The bushing inserts within the fuel tank screw hole cavity.

Be sure to install the washers between the fuel tank and the fastener as noted at removal.

Install **all** fuel tank fasteners loosely.

NOTICE **The fuel tank fasteners must not be tightened to specified torque until complete assembly in vehicle.**

Install all frame component fasteners loosely, then apply torque as specified in the *FRAME* subsection.

Apply specified torque to fuel tank retaining screws.

TIGHTENING TORQUE	
Fuel tank retaining screws	6.5 N•m ± 0.5 N•m (58 lbf•**in** ± 4 lbf•**in**)

Be sure to properly connect and route:
– Fuel tank vent tube

– Fuel pump pressure hose
– Electrical connectors.

Refuel tank and ensure there are no leaks by performing a *FUEL TANK LEAK TEST* and a *FUEL PUMP PRESSURE TEST* as described in this subsection.

FUEL PUMP

Fuel Pressure Release

Remove fuel pump relay fuse (F5), refer to *POWER DISTRIBUTION* subsection.

Start and run engine until it runs out of fuel.

Fuel Pump Pressure Test

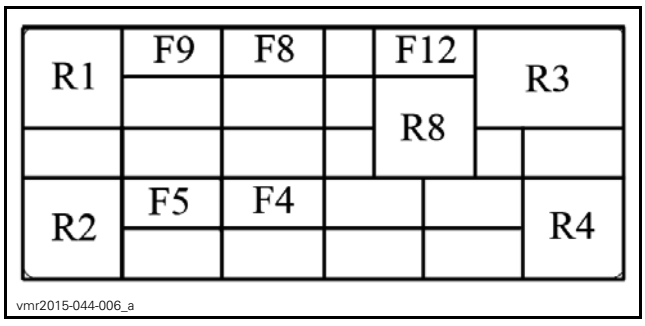
Refer to *INSPECTION* in this subsection.

Fuel Pump Quick Test

1. Turn ignition key to ON.
2. Listen for fuel pump operation.

NOTE: Fuel pump should come ON for a few seconds, then stop.

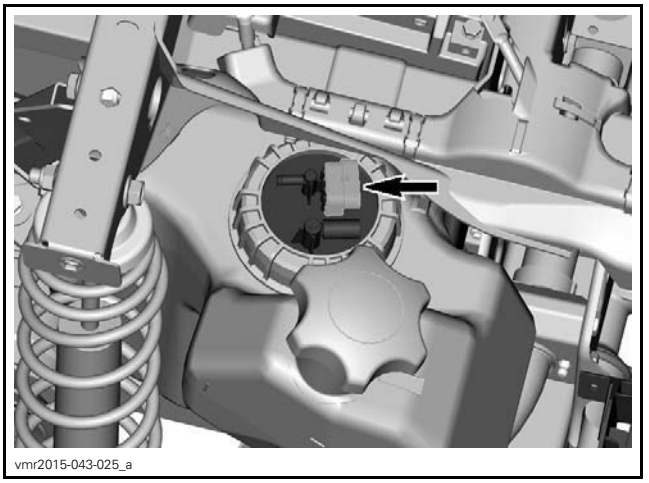
If fuel pump does not come ON, carry out the following:
– Check fuel pump relay fuse (F5).
– Check in B.U.D.S. for applicable fault codes. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
– Carry out a fuel pump input voltage test.



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Fuel Pump Connector Access

Remove rear body module. Refer to *BODY* subsection.


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Fuel Pump Input Voltage Test

1. Disconnect the fuel pump connector.
2. Turn ignition key ON.
3. Read voltage as follows.

REQUIRED TOOLS	
FLUKE 115 MULTIMETER (P/N 529 035 868)	
FLUKE RIGID BACK PROBE (P/N TP88)	

FUEL PUMP INPUT VOLTAGE TEST		
TEST PROBES		VOLTAGE READING
Fuel pump connector Pin 3	Fuel pump connector Pin 4	Battery voltage

If battery voltage is read, carry out a fuel pump resistance test.

If battery voltage is not read, test fuel pump power input as follows.

FUEL PUMP POWER WIRE TEST		
TEST PROBES		VOLTAGE READING
Fuel pump connector Pin 3	Battery ground	Battery voltage

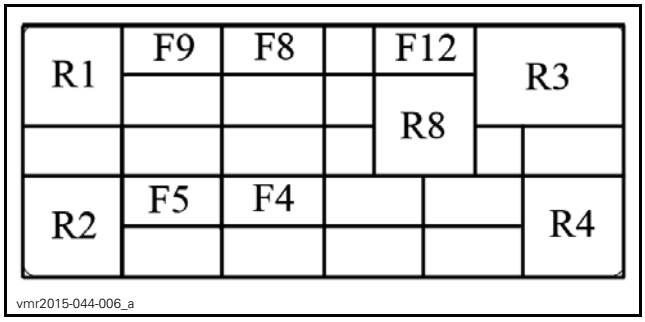
If battery voltage is now read, check fuel pump ground circuit between fuel pump connector FP-4 and battery ground.

If battery voltage is still not read, check fuel pump:
– Fuse (F5)
– Fuel pump relay (R4)

– Fuel pump relay input voltage (control and power circuits)
– Fuel pump relay control circuit continuity to ECM-J1
– Fuel pump power circuit
– Wiring and connectors.

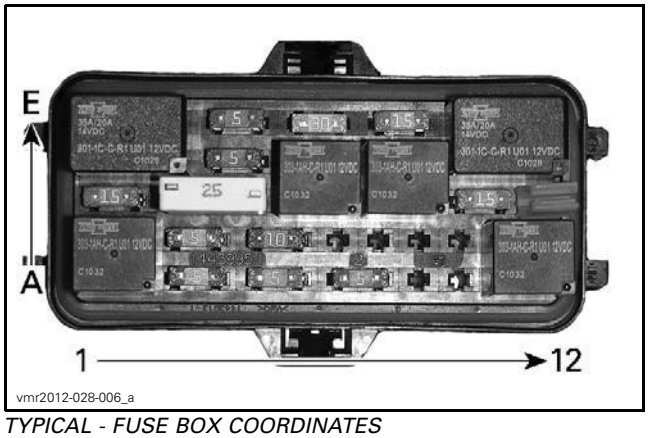
Fuel Pump Resistance Test

1. Ensure fuel pump connector is properly connected.
2. Remove fuel pump relay (R4).



3. Using a multimeter, measure fuel pump resistance as follows.

FUEL PUMP RESISTANCE TEST (AT FUSE BOX)		
TEST PROBES		RESISTANCE Ω @ 20°C (68°F)
Fuse box contact A11	Battery ground	Approximately 2 Ω



TYPICAL - FUSE BOX COORDINATES

If resistance test failed, disconnect fuel pump connector and measure resistance at fuel pump connector.

FUEL PUMP RESISTANCE TEST (AT FUEL PUMP CONNECTOR)	
Pins 3 and 4	Approximately 2 Ω

If test failed at pump connector, replace fuel pump.

If test succeeded at pump connector, check wiring and connectors from:
– Fuse box to fuel pump
– Fuel pump to battery ground.

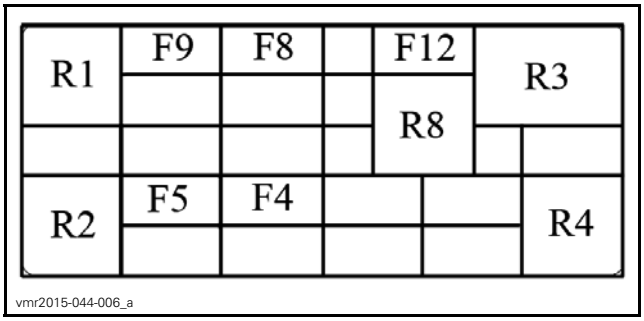
Repair or replace as necessary.

Fuel Pump Access

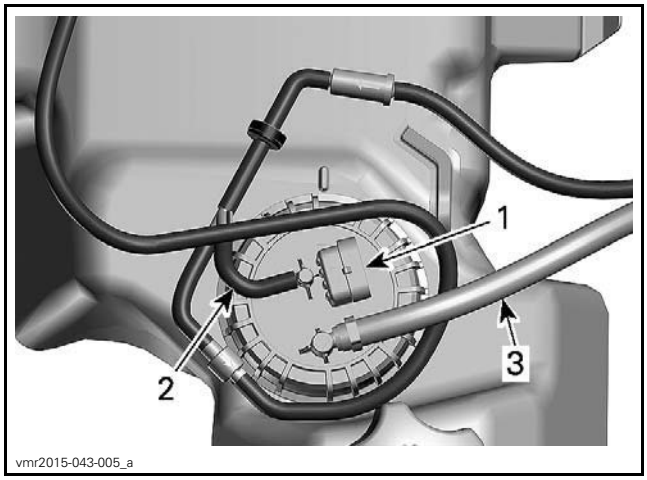
Remove rear body module, refer to *BODY* subsection.

Fuel Pump Removal

1. Remove the fuel pump relay fuse (F5) to disable fuel pump:



2. Release fuel pressure by running engine until it runs out of gas.
3. Disconnect the following from the fuel pump:
   – Fuel pump electric connector
   – Fuel system vent hose
   – Fuel pump pressure hose.



1. Fuel pump connector
2. Vent hose
3. High pressure fuel hose

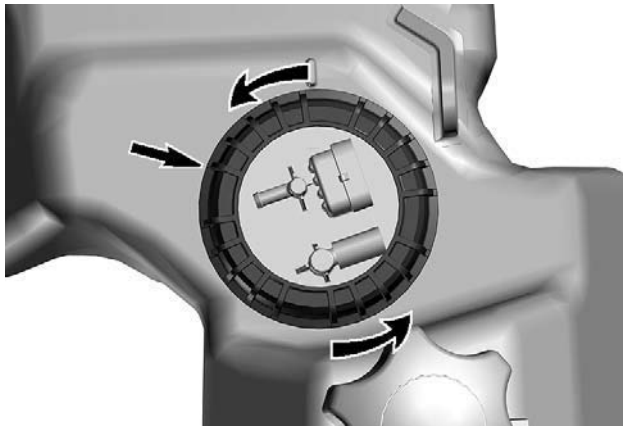
4. Remove fuel pump retaining nut.

⚠ WARNING

Fuel vapors are flammable and explosive under certain conditions. Use only non-sparking tools.

⚠ CAUTION Replace fuel pump gasket whenever fuel pump retaining nut is loosened.

REQUIRED TOOL	
FUEL PUMP NUT TOOL (P/N 529 035 899)	


vmr2015-043-014_a

5. Carefully pull out and rotate fuel pump as required.

NOTICE Pay attention not to damage fuel sender and fuel pump prefilter.

6. Discard gasket ring.
7. Wipe off any fuel spillage.

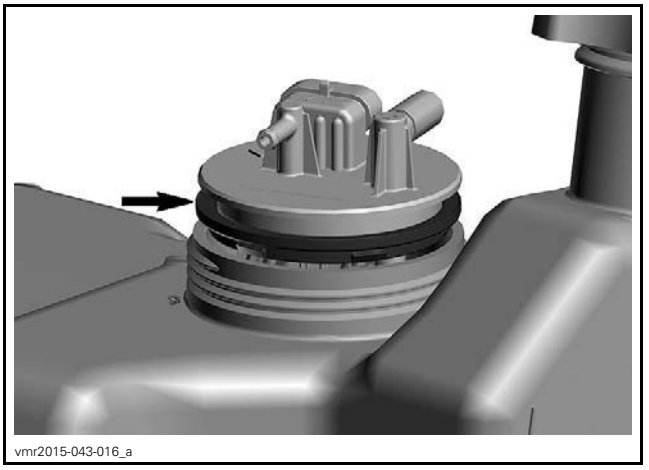
Fuel Pump Installation

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

Rotate fuel pump during insertion as per removal procedure.

⚠ CAUTION Pay attention not to damage fuel sender and fuel pump prefilter.

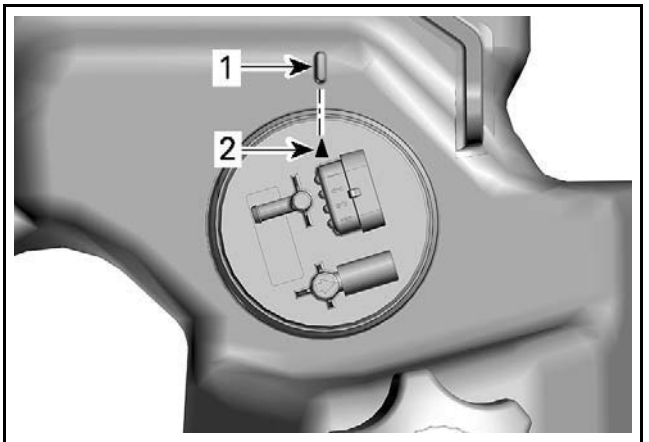
1. Install a NEW gasket ring.
2. Place gasket so that it is properly located between fuel pump and fuel pump mounting neck on fuel tank.


vmr2015-043-016_a

⚠ WARNING

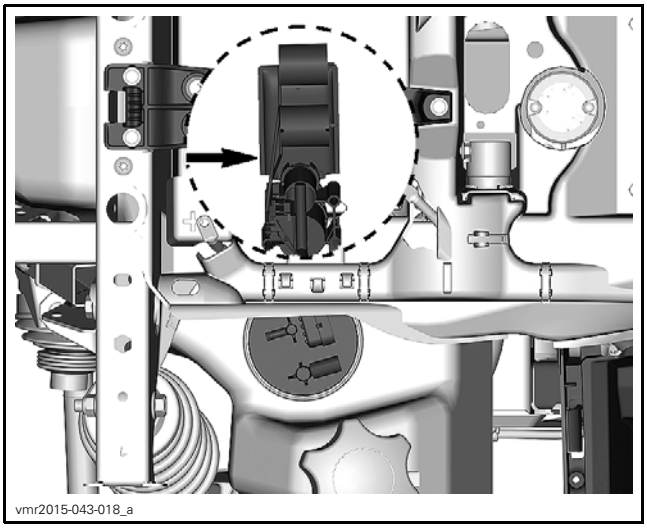
Ensure gasket ring makes good contact all around fuel pump and fuel pump mounting neck on fuel tank.

3. Ensure proper fuel pump orientation as in following illustration.



vmr2015-043-017_a

1. Fuel tank pump index
2. Fuel pump index


vmr2015-043-018_a

ALIGNEMENT OF FUEL PUMP IN TANK

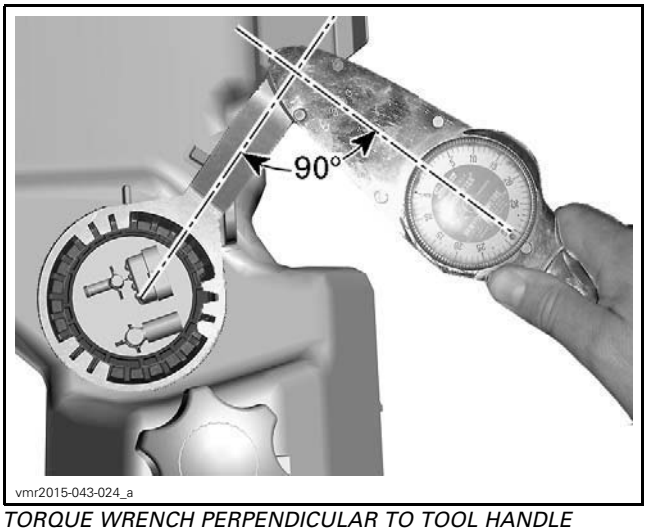
4. Insert fuel pump retaining nut over the fuel pressure hose and electrical wiring connector.
5. While firmly holding pump against tank, engage fuel pump retaining nut on fuel tank flange.

NOTE: If necessary, move the pump in order to ensure the flange is sitting completely flat on the tank.

6. Tighten fuel pump retaining nut to specification.

TIGHTENING TORQUE	
Fuel pump retaining nut	29 N•m ± 1 N•m (21 lbf•ft ± 1 lbf•ft)

NOTE: To apply the proper torque to the fuel pump retaining nut, install the fuel pump nut tool on a torque wrench with it's handle perpendicularly (90°) to the torque wrench.



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TORQUE WRENCH PERPENDICULAR TO TOOL HANDLE

Ensure pump is properly aligned with index marks after nut it tightened to specification.

⚠ WARNING

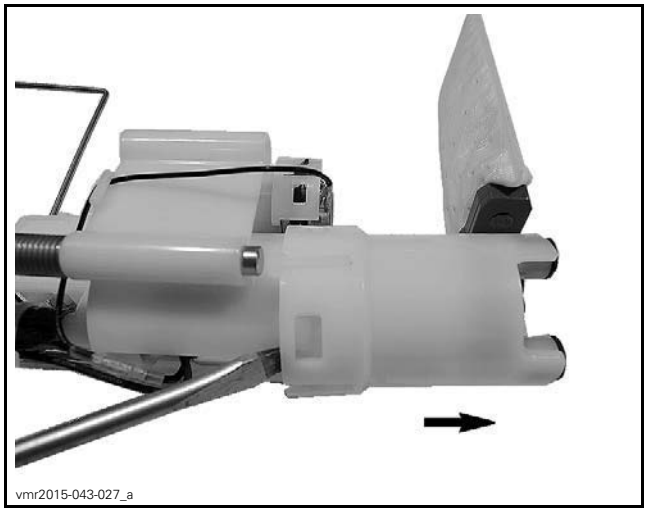
Fuel vapors are flammable and explosive under certain conditions. Use only non-sparking tools. Ensure pump locking ring is fully engaged.

7. Install fuel pressure hose on fuel pump using a NEW Oetiker clamp.
8. Install fuel vent tube on fuel pump.
9. Install electrical connector on fuel pump.
10. Install fuel pump relay fuse.
11. Refuel tank and ensure there are no leaks by performing a *FUEL TANK LEAK TEST* and a *FUEL PUMP PRESSURE TEST* as described in this subsection.
12. Check fuel level sender operation.

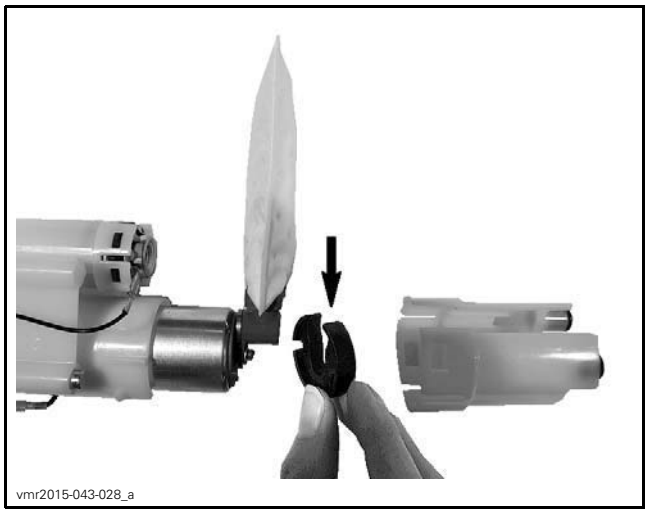
FUEL PUMP PREFILTER (STRAINER)

Fuel Pump Prefilter Replacement

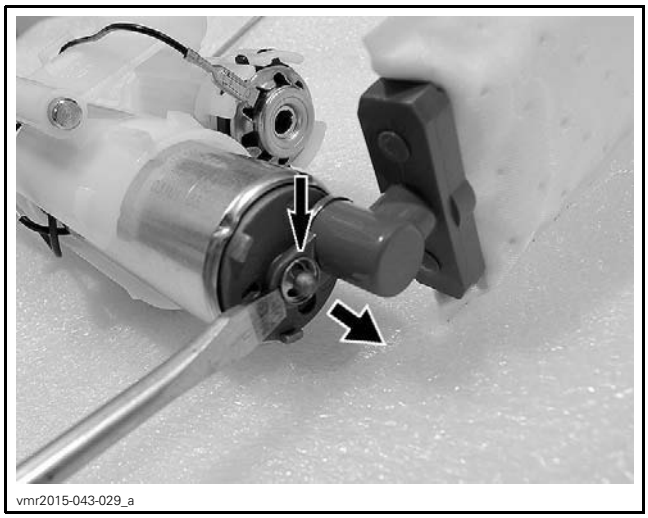
1. Remove *FUEL PUMP*, see *FUEL PUMP REMOVAL* in this subsection.
2. Unlock 3 tabs on strainer plastic ring.


vmr2015-043-027_a

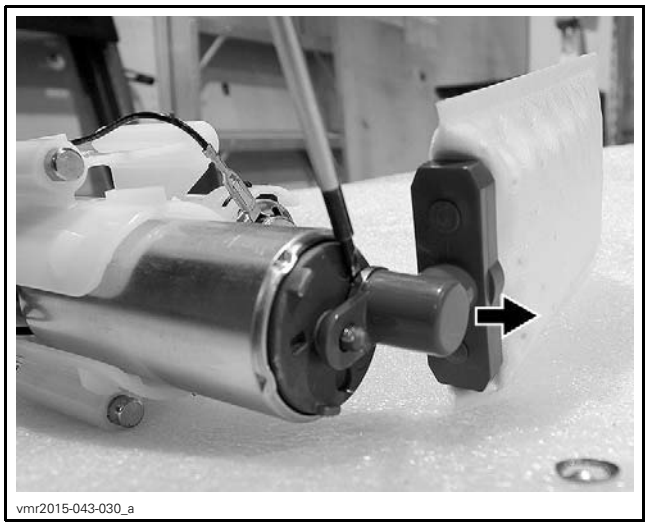
3. Remove rubber pad.


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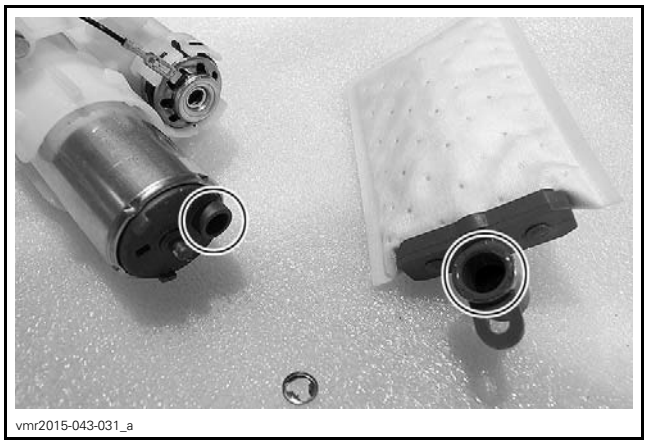
4. Remove push nut securing strainer to fuel pump. Be careful not to break the assembly locator pin.


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5. Pull strainer off fuel pump.


vmr2015-043-030_a

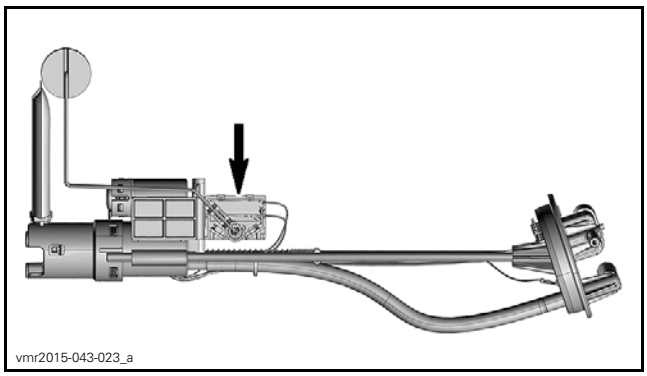
6. Lubricate assembly area of new strainer and fuel pump with O-ring lubricant or clean oil


vmr2015-043-031_a

7. Insert the new strainer on fuel pump making sure to press it in tightly against the fuel pump surface.
8. Using a small nut socket, press in a NEW push nut to secure strainer.
9. Reinstall remaining removed parts.

FUEL LEVEL SENDER

The fuel level sender is a float actuated variable resistance type that is part of the fuel pump.

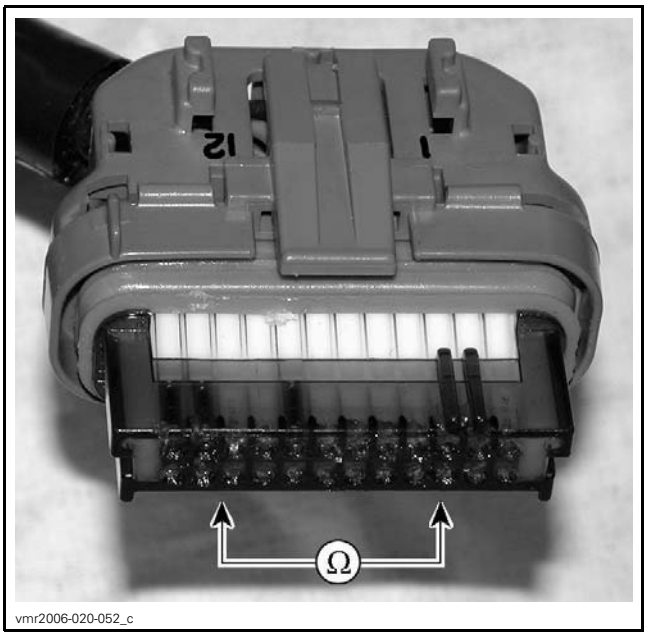

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FUEL LEVEL SENDER

Fuel Level Sender Resistance Test (Fuel Pump Module Installed)

1. Disconnect multifunction gauge, refer to the *LIGHTS/GAUGE/ACCESSORIES* subsection.
2. Using a multimeter, measure the resistance of the fuel level sender as follows.

FUEL LEVEL SENDER RESISTANCE TEST		
FUEL LEVEL	GAUGE CONNECTOR	RESISTANCE Ω @ 20°C (68°F)
Full	Pins 4 and 21	5 Ω ± 1
Empty		100 Ω ± 5



vmr2006-020-052_c

If readings are out of specification, refer to *FUEL LEVEL SENDER RESISTANCE TEST (AT FUEL PUMP CONNECTOR)*.

If readings are as specified, refer to *FUEL LEVEL SENDER INPUT VOLTAGE TEST*.

Fuel Level Sender Resistance Test (at Fuel Pump Connector)

FUEL LEVEL SENDER RESISTANCE TEST		
FUEL LEVEL	FUEL PUMP CONNECTOR	RESISTANCE Ω @ 20°C (68°F)
Full	Pins 1 and 2	5 Ω ± 1
Empty		100 Ω ± 5

If resistance test at fuel pump connector is failed, replace fuel pump module.

Fuel Level Sender Input Voltage Test

1. Set ignition switch to ON.
2. Disconnect fuel pump connector, refer to *FUEL PUMP CONNECTOR ACCESS* in this subsection.
3. Using a multimeter, measure input voltage as follows.

FUEL LEVEL SENDER INPUT VOLTAGE TEST		
FUEL PUMP CONNECTOR	BATTERY	VOLTAGE
Pin 2	Negative terminal	5V

TEST RESULT	SERVICE ACTION
5V is not read	Test wiring continuity between fuel level sender and multifunction gauge
Wiring continuity is good	Replace multifunction gauge
Wiring continuity is not obtained	Repair or replace wiring

Fuel Level Sender Replacement

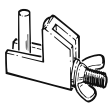
Replace fuel pump. Refer to *FUEL PUMP* in this subsection.

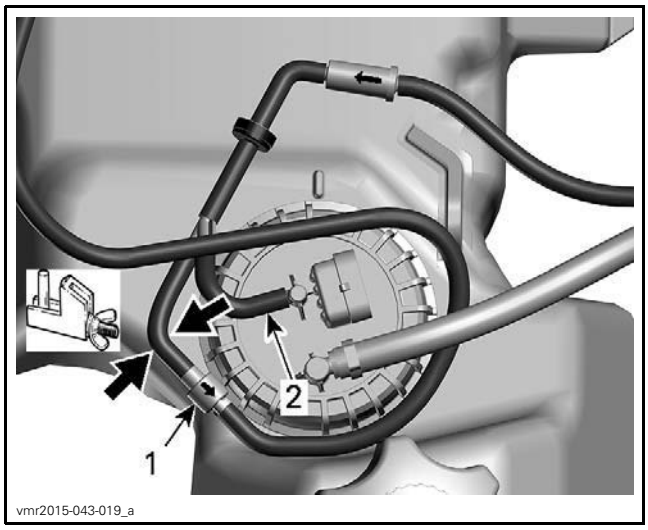
FUEL TANK VENT VALVES

Fuel Tank Vent Valve Test

Inlet Check Valve Test

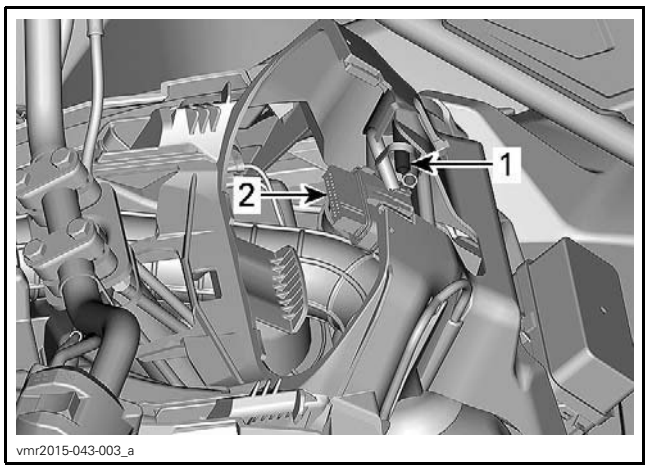
1. Remove rear body module, refer to *BODY* subsection.
2. Remove multifunction gauge for access to the vent system inlet hose, refer to the *LIGHTS/GAUGE/ACCESSORIES* subsection.
3. Install a small hose pincher between the vent pressure relief valve and the fuel pump vent inlet.

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



1. Pressure relief valve
2. Fuel pump vent inlet

4. Connect the vacuum/pressure pump to the fuel tank vent hose inlet.



1. Fuel tank vent hose inlet
2. Gauge connector

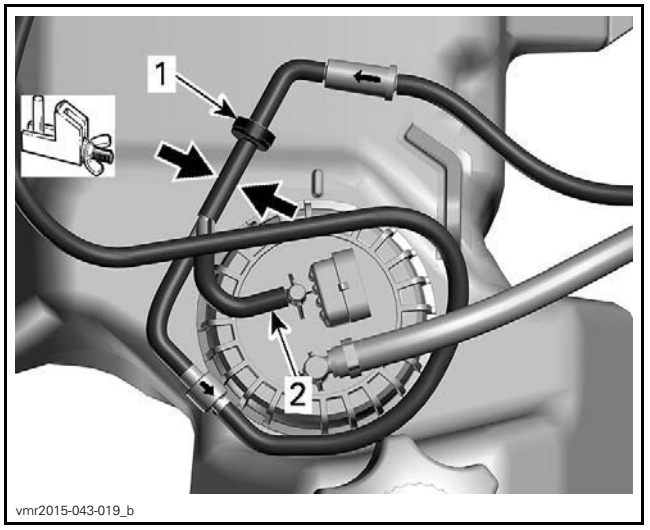
5. Remove fuel tank cap.
6. Set vacuum/pressure pump to **PRESSURE** and activate pump. The gauge on the pump **should not change in reading**.
7. Set vacuum/pressure pump to **VACUUM** and activate pump. The **gauge should increase in reading**.

If the test failed, carry out the following:

– Ensure breather filter is properly installed, refer to *PERIODIC MAINTENANCE PROCEDURES*.
– Ensure inlet check valve is properly installed, refer to *FUEL TANK VENT VALVE INSTALLATION* in this subsection.
– Test inlet check valve separately. If good, replace the breather filter, refer to *PERIODIC MAINTENANCE PROCEDURES*.

Pressure Relief Valve Test

1. Install the small hose pincher between the inlet check valve and the fuel pump vent inlet fitting.

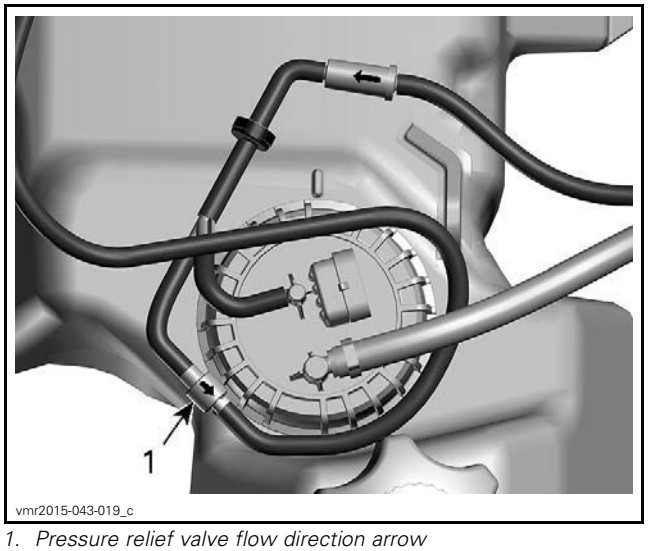


1. Inlet check valve
2. Fuel pump vent inlet fitting

2. Set vacuum/pressure pump to **PRESSURE** and activate pump. The **gauge should increase in reading**.
3. Set vacuum/pressure pump to **VACUUM** and activate pump. The gauge on the pump **should not change in reading**.

If the test failed, carry out the following:

– Ensure pressure relief valve is properly installed, refer to *PRESSURE RELIEF VALVE INSTALLATION* in this subsection.
– Replace pressure relief valve if it fails the test.

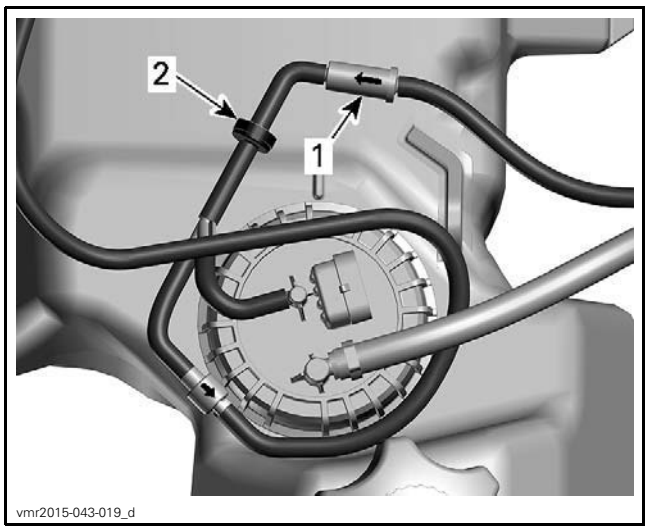


1. Pressure relief valve flow direction arrow

Fuel Tank Vent Valve Installation

Inlet Check Valve Installation

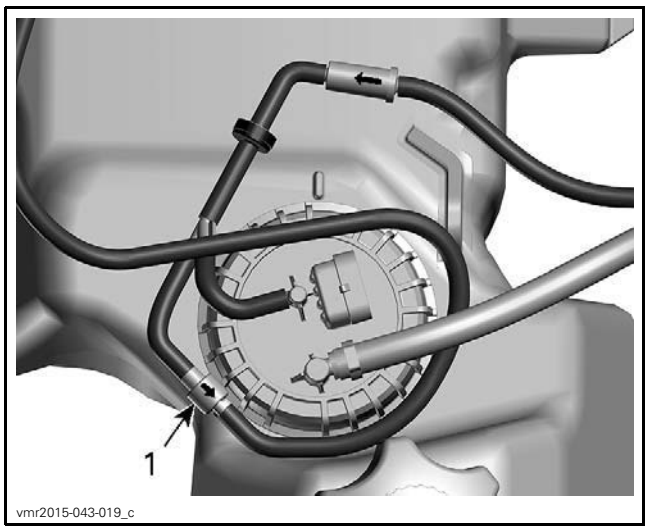
Ensure white portion of inlet check valve is towards the vent breather filter.



1. Vent breather filter
2. White portion of inlet check valve

Pressure Relief Valve Installation

Ensure pressure relief valve flow arrow is pointing away from fuel pump vent fitting.



1. Pressure relief valve flow direction arrow

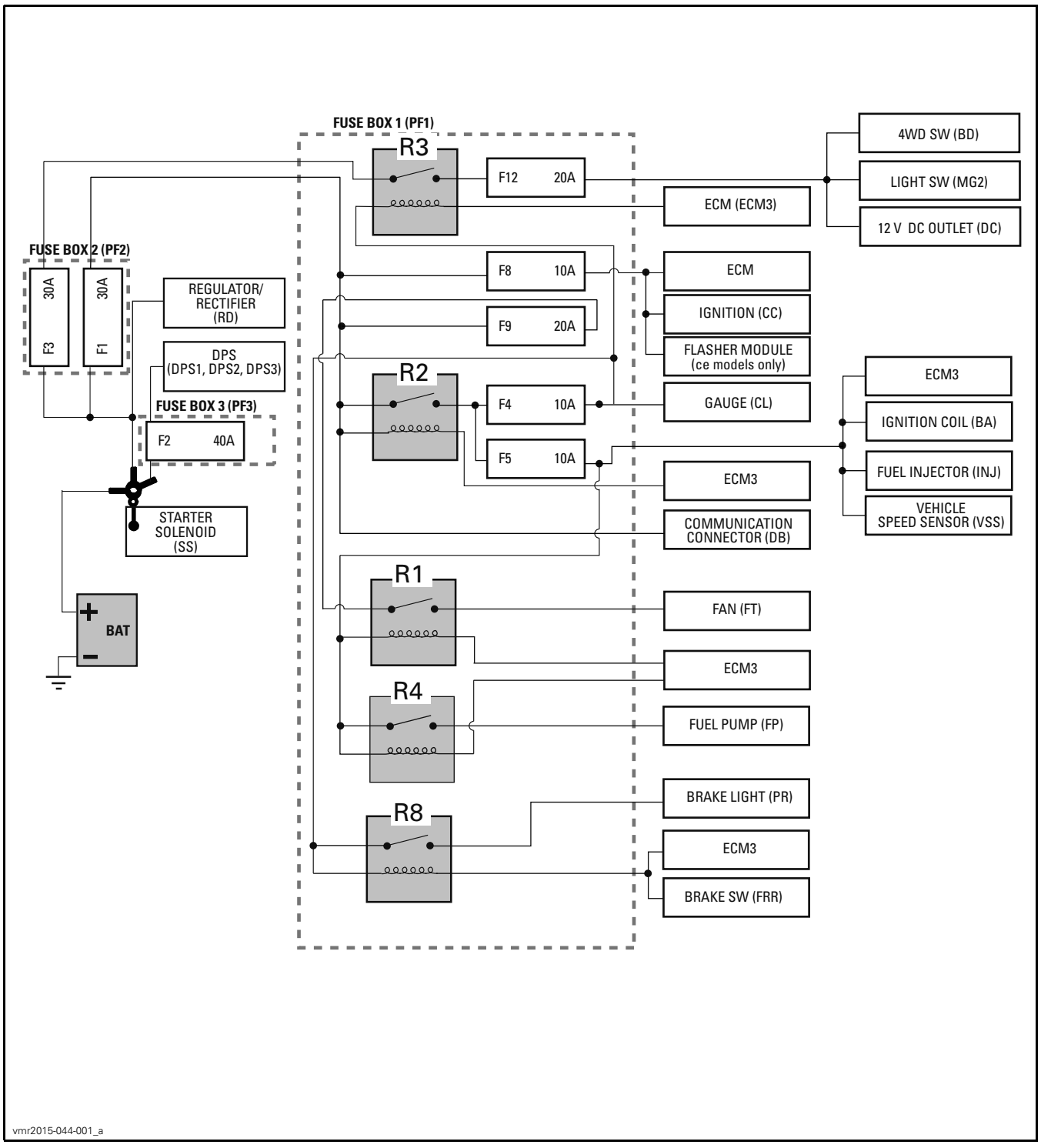
POWER DISTRIBUTION AND GROUNDS

SERVICE TOOLS

Description	Part Number	Page
FLUKE 115 MULTIMETER	529 035 868	527

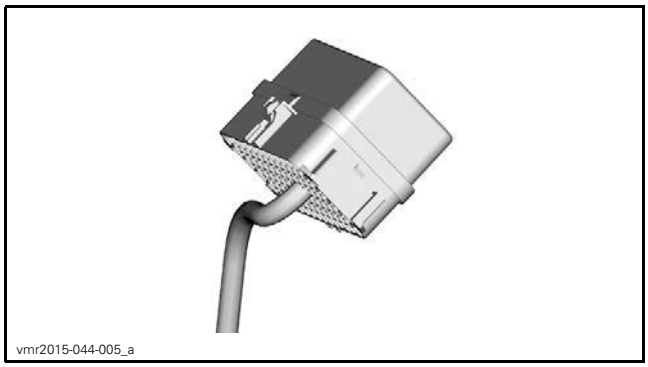
GENERAL

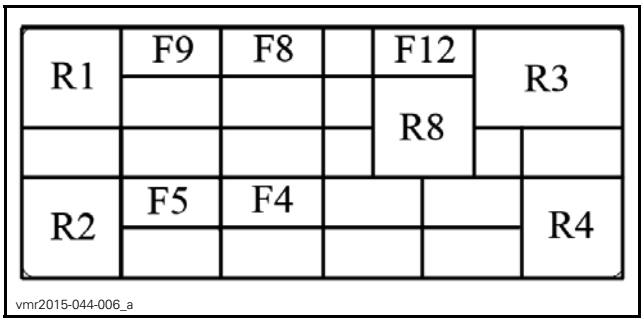
POWER DISTRIBUTION DIAGRAM



Refer to *WIRING HARNESS AND CONNECTORS* for wiring harness layout and component locations.

FUSE BOX 1


vmr2015-044-005_a



vmr2015-044-006_a

FUSE IDENTIFICATION			RATING
Fuse	4	Speedo / Relay	10 A
	5	Injector(s) / Ignition / Fuel Pump	10 A
	8	Key Switch / Starter Solenoid	10 A
	9	Cooling Fan	20 A
	12	DC Out. / Lights / Acc.	20 A

RELAY IDENTIFICATION		RELAY STATE (ON)	RELAY STATE (OFF)
R1	Cooling fan	See *COOLING SYSTEM*	
R2	Main	When ignition key is turned ON **AND** Run/Stop switch is set to RUN	Approximately 30 seconds after ignition key is turned OFF **OR** Approximately 30 minutes if ignition key is left ON
R3	Accessories	Same as main relay	When ignition key is turned OFF **OR** Approximately 30 minutes if ignition key is left ON **OR** When engine speed is less than 1000 RPM for at least 50 minutes
R4	Fuel pump	See *FUEL TANK AND FUEL PUMP*	
R8	Brake lights	See *BRAKES*	

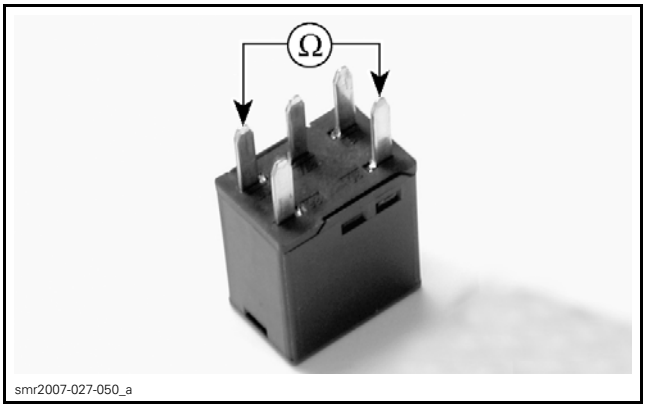
RELAY CONTINUITY TEST

1. Remove relay.
2. Set multimeter to Ω.

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

3. Probe relay as follows.

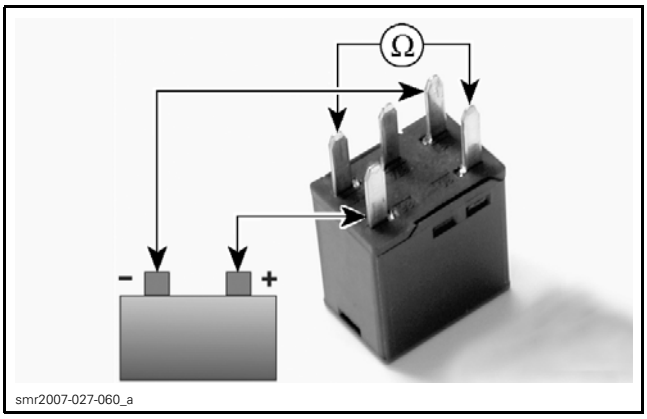
TERMINAL		RESISTANCE
30	87	Open circuit (OL)



smr2007-027-050_a

4. Connect battery as shown and probe relay again as follows.

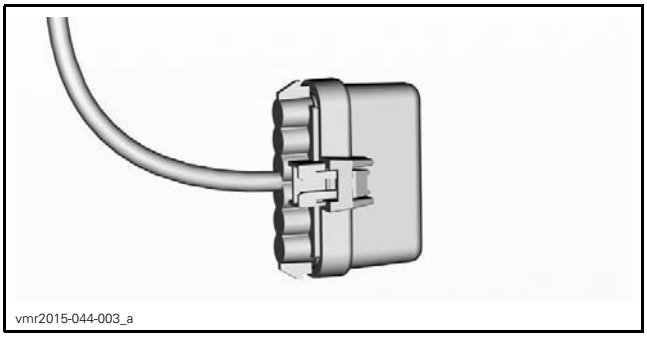
TERMINAL		RESISTANCE
30	87	0.5 Ω max. (continuity)



smr2007-027-060_a

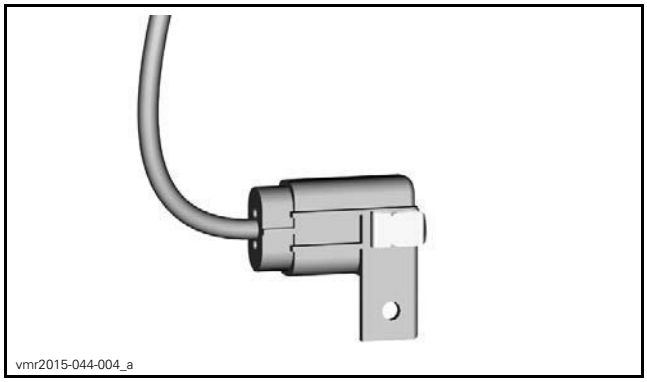
If relay failed any test, replace it.

FUSE BOX 2 (PF2)


vmr2015-044-003_a

FUSE IDENTIFICATION			
Fuse	1	Main	30 A
	-	Spare	30 A
	3	Fan / Accessories	30 A

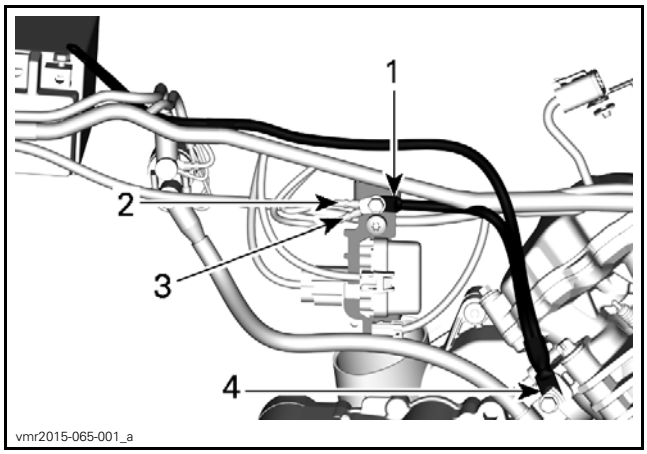
FUSE BOX 3 (PF3)


vmr2015-044-004_a

FUSE IDENTIFICATION			
Fuse	2	DPS	40 A

GROUNDS

All grounds are grouped at the same location on RH side of frame.



vmr2015-065-001_a

RH SIDE
1. *Battery ground*
2. *Harness ground (BN1)*
3. *BN2*
4. *Engine ground*

WIRING HARNESS AND CONNECTORS

SERVICE TOOLS

Description	Part Number	Page
CRIMPING TOOL (HEAVY GAUGE WIRE)	529 035 730	541
ECM ADAPTER TOOL	529 036 166	539
ECM TERMINAL REMOVER 2.25	529 036 175	539
ECM TERMINAL REMOVER 3.36	529 036 174	539

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
GM TERMINAL EXTRACTOR	12094430	540
SNAP-ON TERMINAL REMOVER TOOL	TT600-4	536

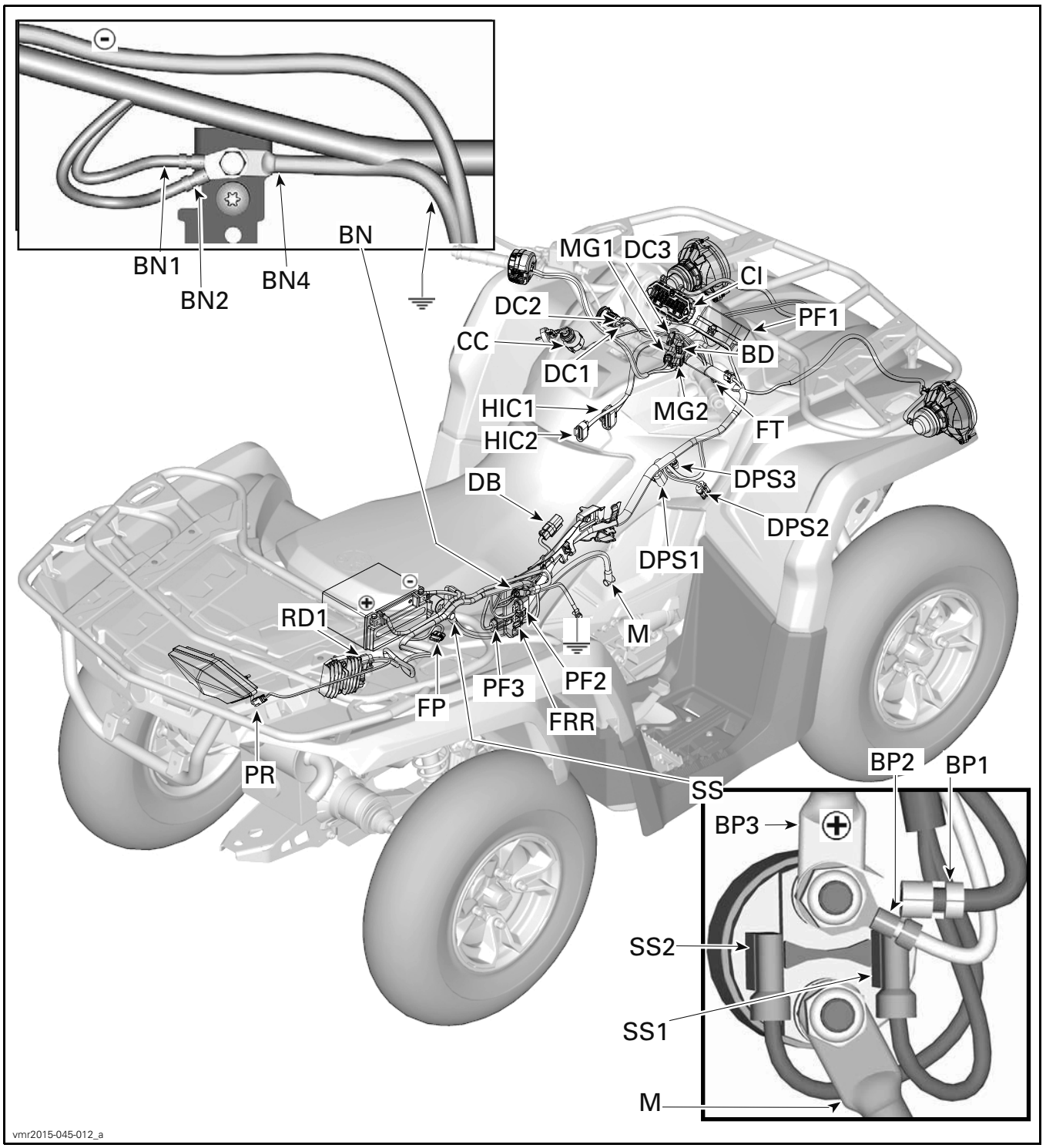
GENERAL

The illustrations in this subsection are typical. Several variants of the connector types, such as different number of pin cavities, are used on the vehicle.

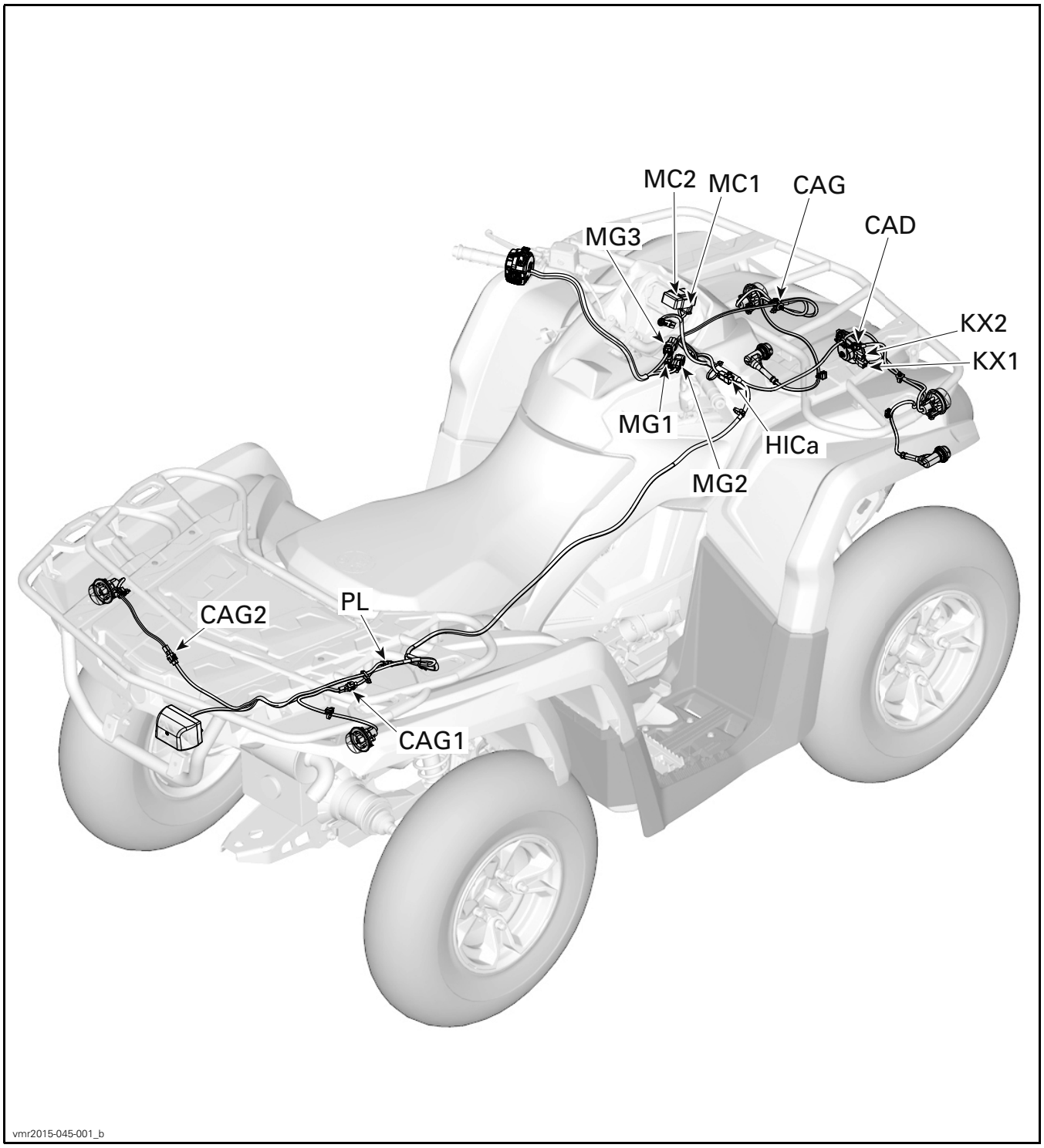
CONNECTOR ABBREVIATION DESCRIPTION

ABBREVIATION	DESCRIPTION
BD	RH multifunction switch
BN1	Ground terminal
BN2	Ground terminal
BN4	Ground terminal
BP1	Positive terminal
BP2	Positive terminal (DPS model only)
BP3	Positive terminal
RFF	RH front turn light
LFF	LH front turn light
RRF	RH rear turn light
LRF	LH rear turn light
CC	Ignition switch
CL	Cluster
CAD	Rear RH turn light
CAG	Rear LH turn light
DB	Diagnostic connector
DC1	Accessory outlet
DC2	Accessory outlet
DC3	Accessory outlet
DPS1	Dynamic power steering
DPS2	Dynamic power steering
DPS3	Dynamic power steering
FP	Fuel pump
FRR	Rear brake light switch
FT	Cooling fan
HIC1‡	Harness interconnect 1
HIC2‡	Harness interconnect 2
HICa	Harness interconnect
KX1	Horn
KX2	Horn
M	Starter positive terminal
MC1	Turn light relay
MC2	Turn light relay
MD	4WD actuator
MG1	LH multifunction switch
MG2	LH multifunction switch
MG3	LH multifunction switch
PF1	Front Fuse box
PF2	Rear fuse holder (main and accessories)
PF3	Rear fuse holder (DPS)
PG	LH headlight
PD	RH headlight
LL	License plate light
RPL	RH marker light
LPL	LH marker light
PR	Park/Brake light
RD	Voltage regulator/rectifier
SS1	Starter solenoid
SS2	Starter solenoid
‡ Refer to applicable *EMS* subsection for powertrain harness.	

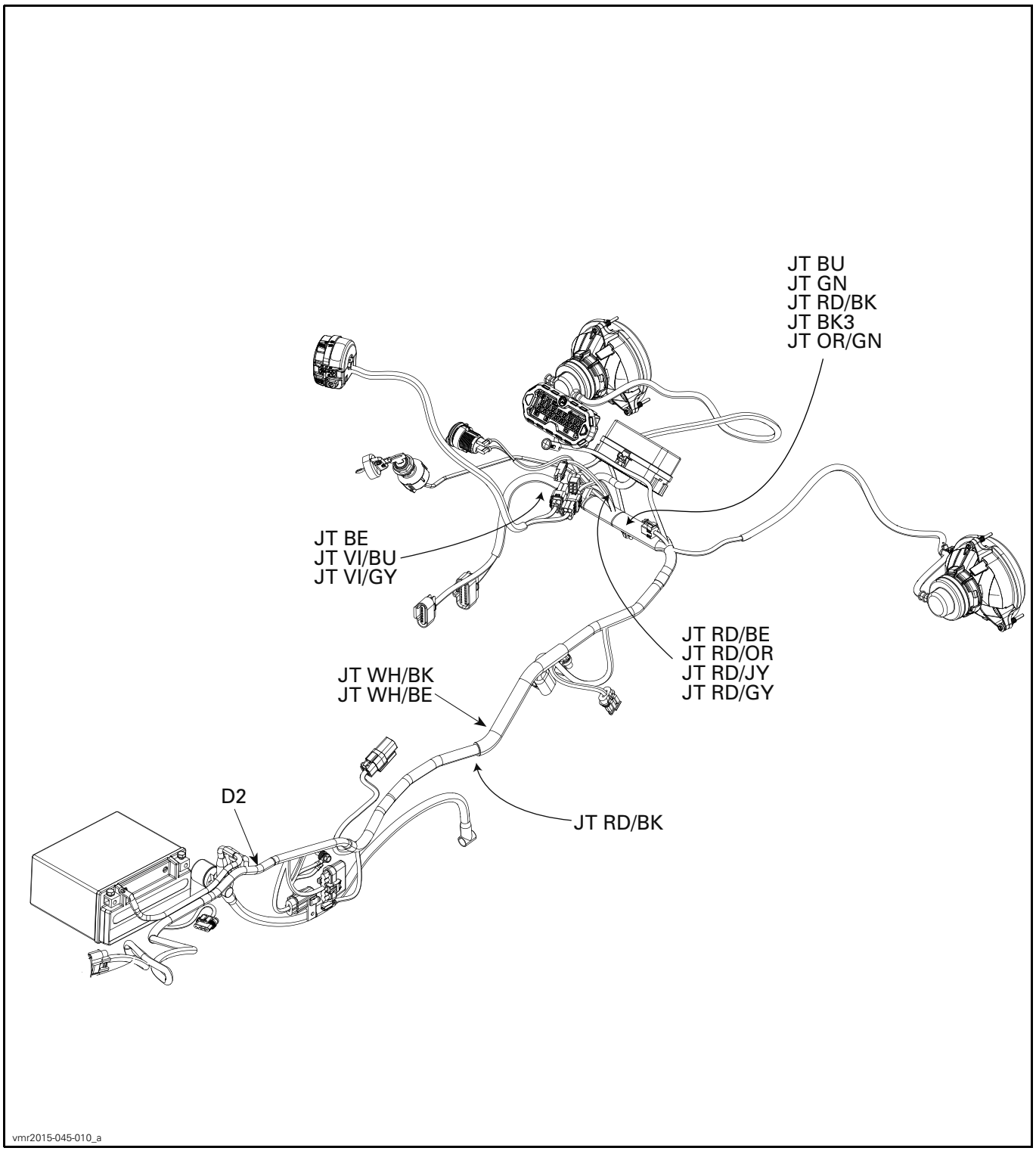
WIRING HARNESS ARRANGEMENT



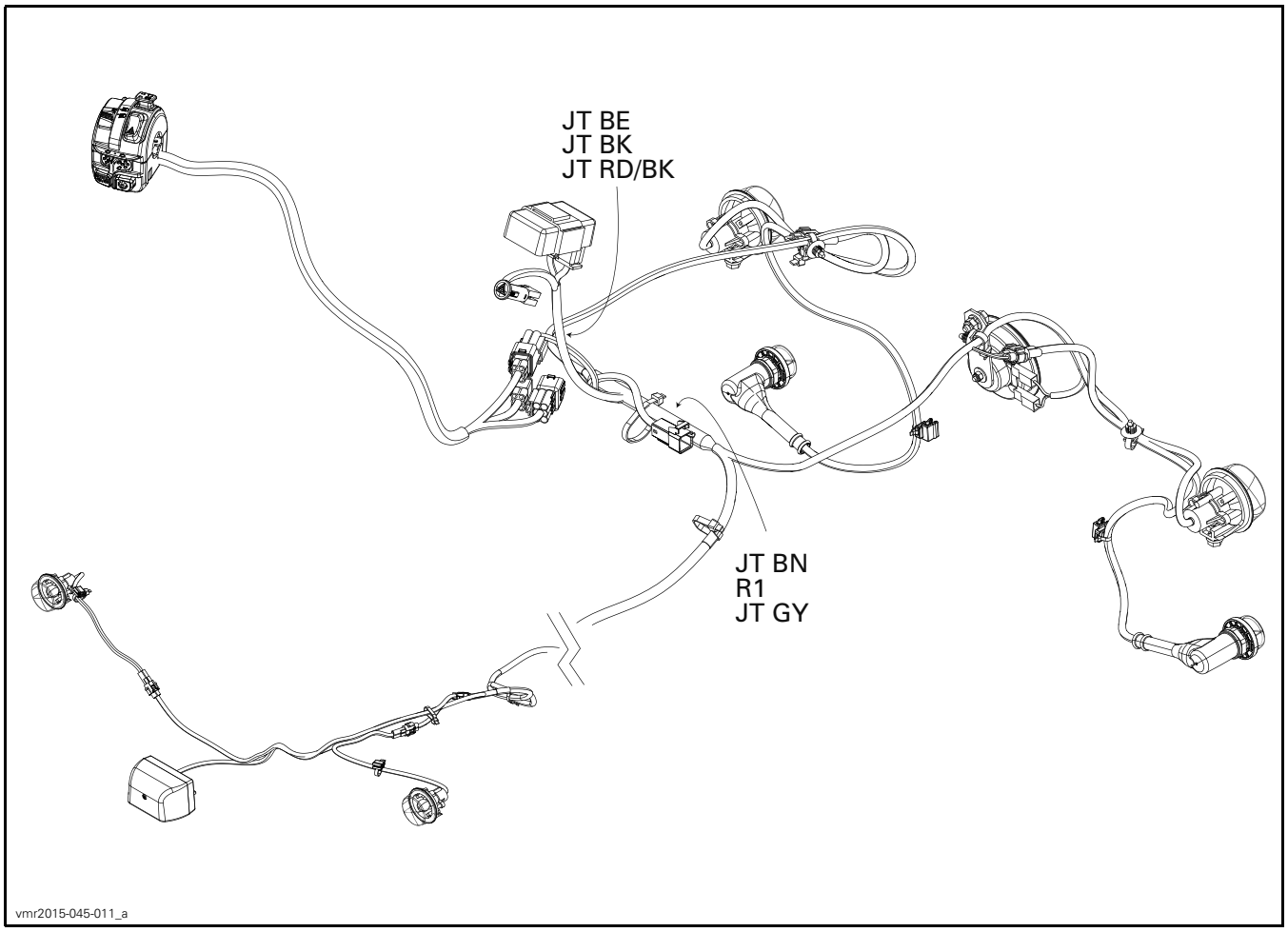
CE models


MC2
MC1
CAG
CAD
MG3
KX2
KX1
MG1
HICa
MG2
CAG2
PL
CAG1
vmr2015-045-001_b

DIODE AND JOINT TERMINAL LOCATIONS



CE models



PROCEDURES

DEUTSCH CONNECTORS

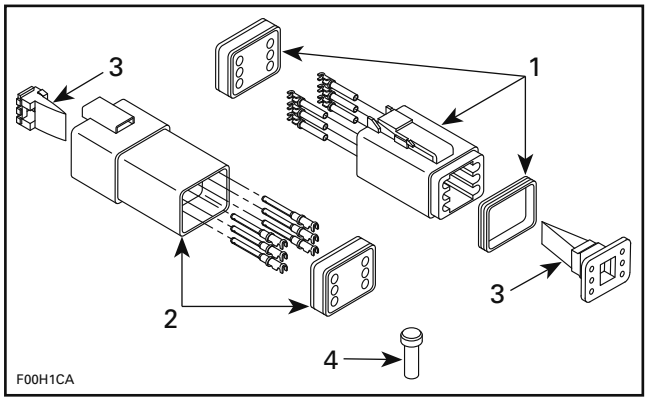
Deutsch Connector Application

A variety of Deutsch connectors are used on various systems:

– Diagnostic connector
– Vehicle speed sensor (VSS) connector.

The following procedures may be used on each as they are similar in construction.

Deutsch Connector Disassembly and Reassembly



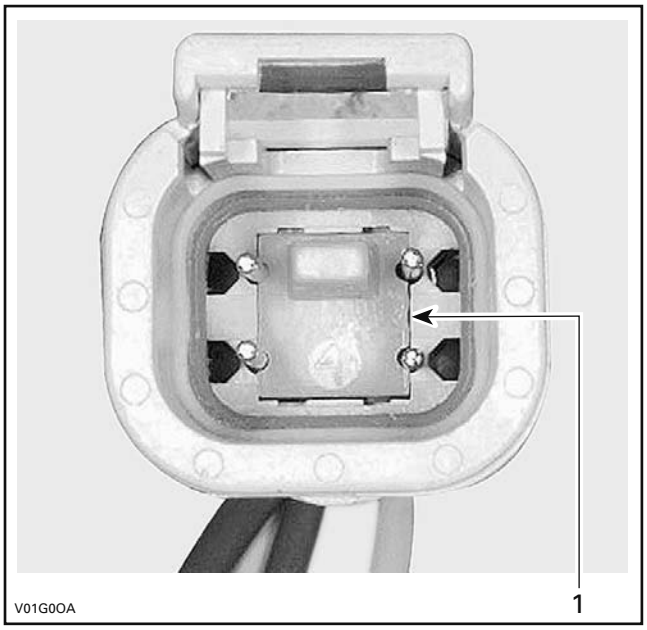
TYPICAL —DEUTSCH CONNECTOR
1. *Male connector*
2. *Female connector*
3. *Secondary lock*
4. *Sealing cap*

NOTICE Do not apply dielectric grease on terminal inside connector.

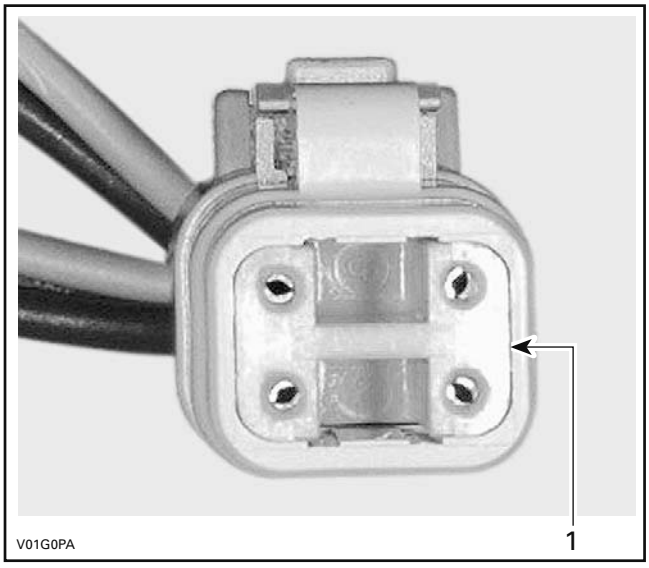
Terminal Removal

To remove terminals from connector, proceed as follows:

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



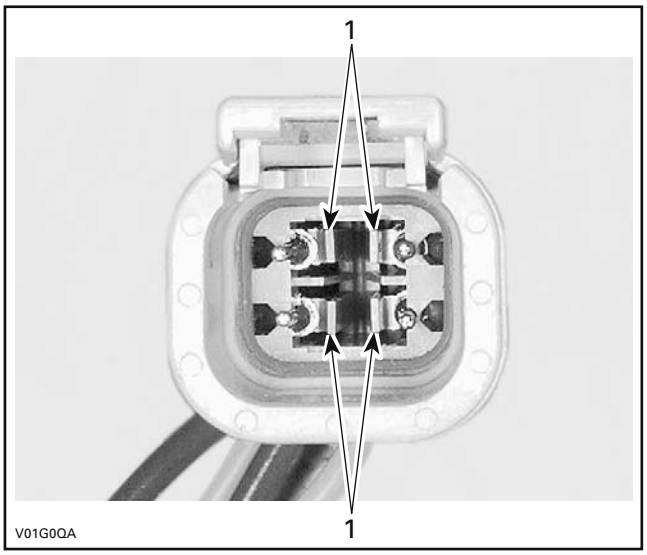
TYPICAL — FEMALE CONNECTOR
1. *Female lock*



TYPICAL — MALE CONNECTOR
1. *Male lock*

NOTE: Before pin extraction, push wire forward to relieve pressure on retaining tab.

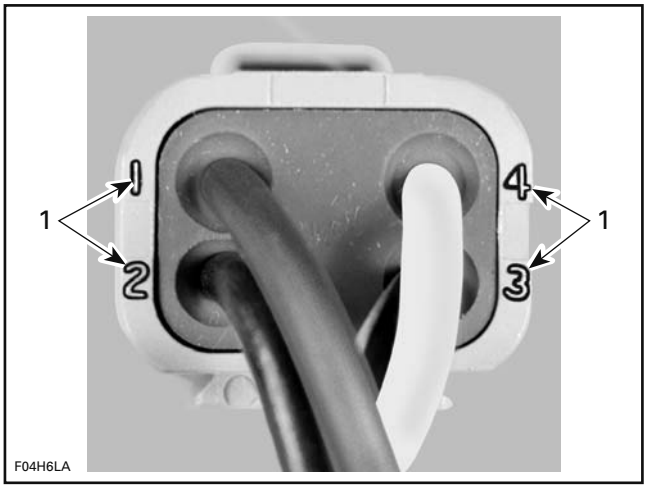
2. Insert a 4.8 mm (.189 in) wide screwdriver blade inside the front of the terminal cavity.
3. Pry the retaining tab away from the terminal while gently pulling the wire and terminal out of the back of the connector.



TYPICAL — FEMALE CONNECTOR
1. Retaining tabs

Terminal Insertion

1. For insertion of a terminal, ensure the secondary plastic lock is removed.
2. Insert terminal through the back of the connector in the appropriate position, and push it in as far as it will go. You should feel or hear the terminal lock engage.
3. Pull back on the terminal wire to be sure the retaining tabs are holding the terminal.
4. After all required terminals have been inserted, the lock must be installed.



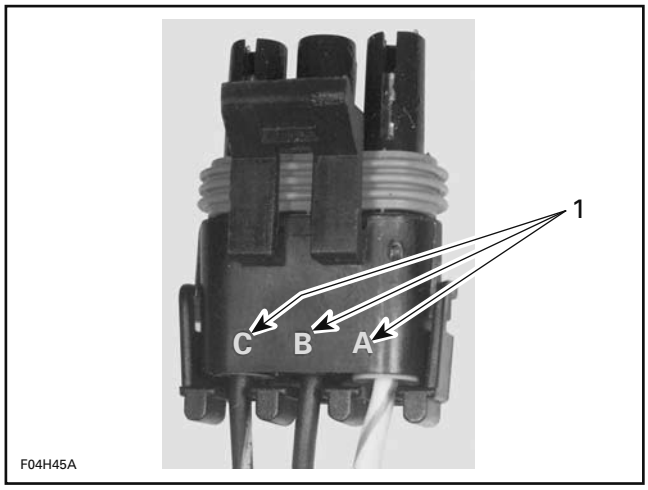
TYPICAL — CONNECTOR PIN-OUT
1. Terminal position identification numbers

PACKARD CONNECTORS

Packard Connector Application

Packard connectors are used to connect:
– Electrical harnesses
– Gauges.

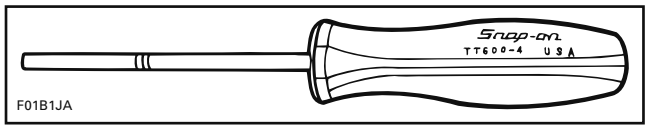
3-Pin Packard Connector



VIEW OF A 3-PIN PACKARD CONNECTOR
1. Identification letters

NOTE: This type of connector also comes in other pin configurations.

To remove a terminal from a 3-pin Packard connector, use the SNAP-ON TERMINAL REMOVER TOOL (P/N TT600-4).

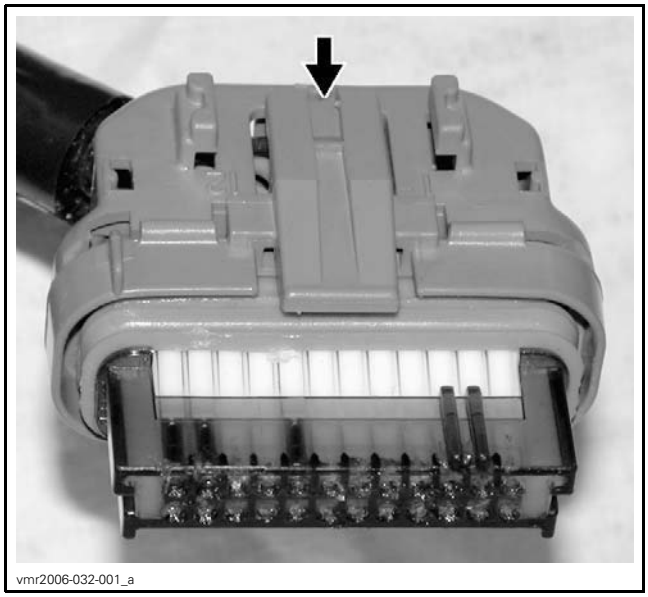


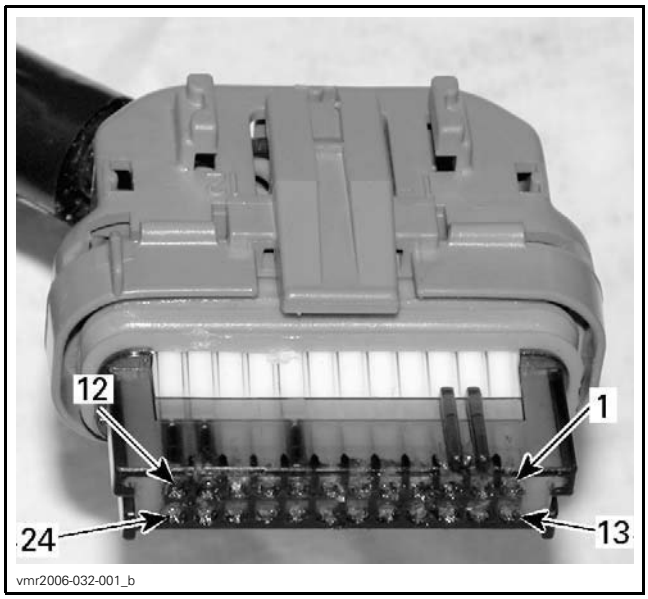
⚠ WARNING

Ensure all terminals are properly crimped on wires and connectors are properly fastened.

PACKARD CONNECTOR (MULTIFUNCTION GAUGE)

Firmly push down tab and hold to unlock connector while pulling it out.

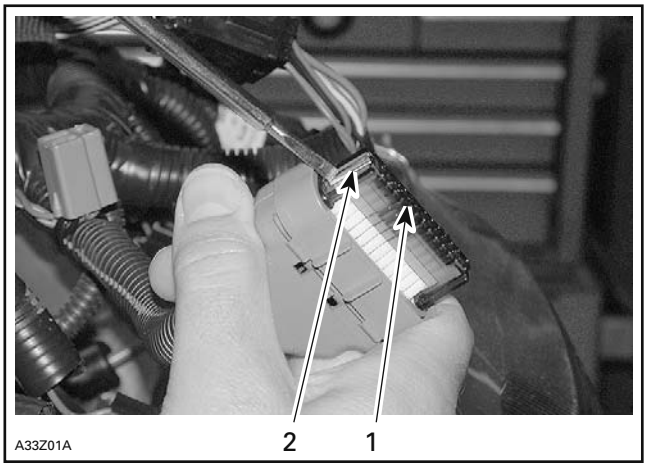

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vmr2006-032-001_b

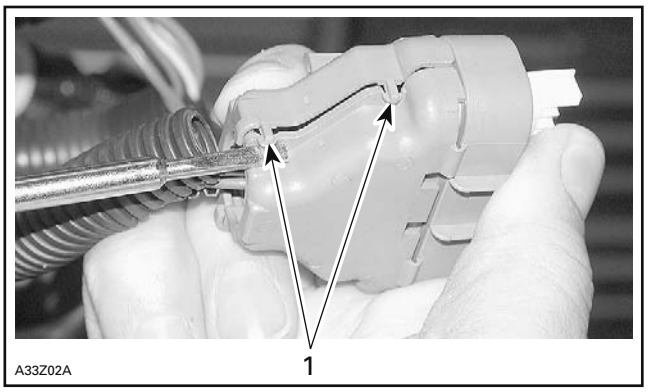
CONNECTOR PINOUT

Push on both tabs to remove retainer.



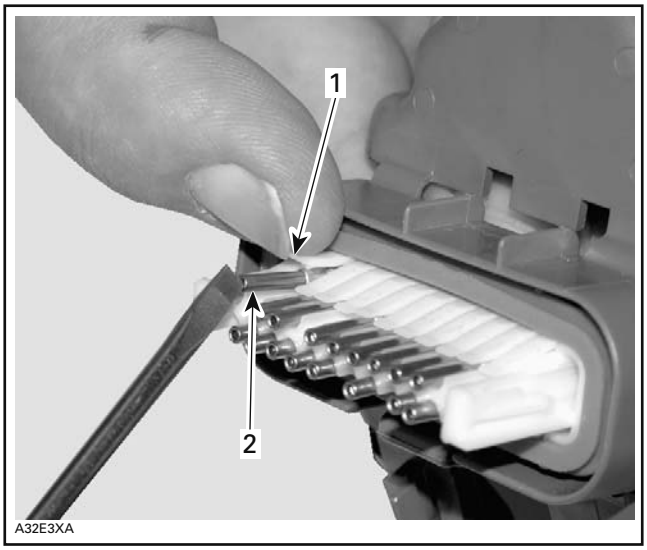
TYPICAL
1. Retainer
2. Tab (one on each side)

Open housing by lifting 4 tabs.



TYPICAL
1. Tabs (2 on each side)

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.



TYPICAL
1. *Lift and hold plastic lock*
2. *Lift to unlock and push out*

MOLEX CONNECTOR

Molex Connector Application

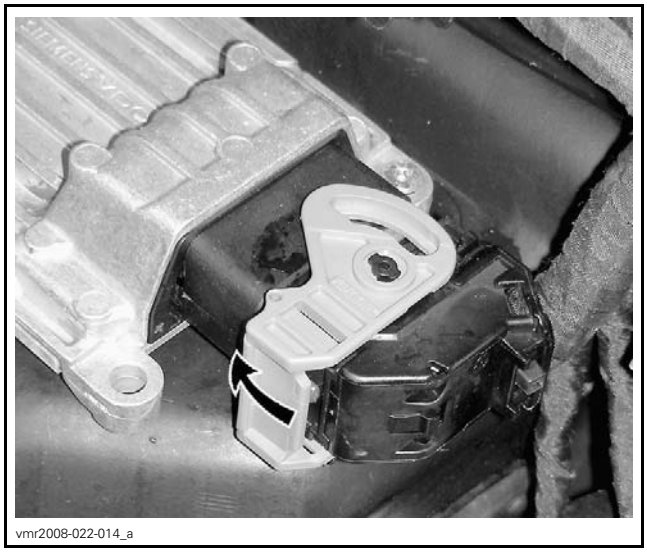
Molex connectors are used on the following system:
– ECM

Molex Connector Removal

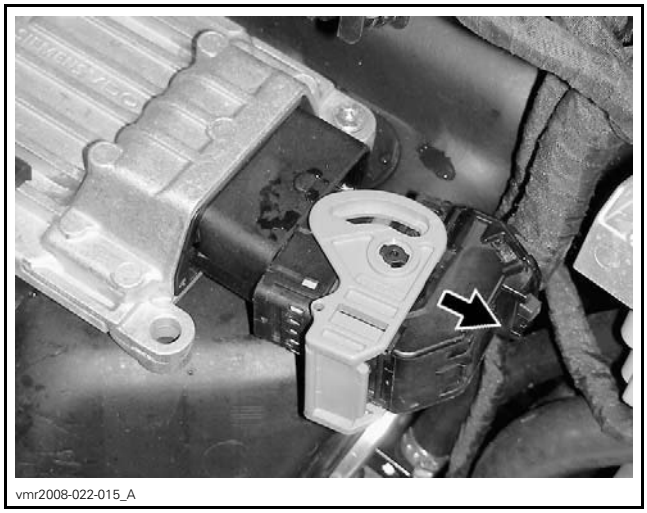
Push and hold the locking tab.



Rotate connector lock until it stops.

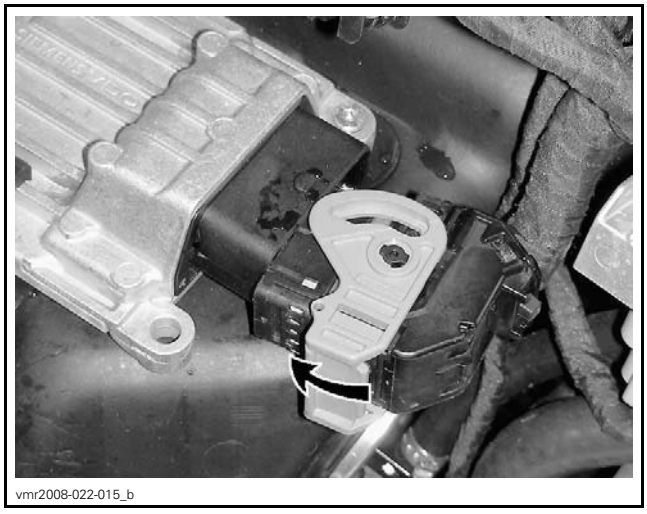


Pull out connector.



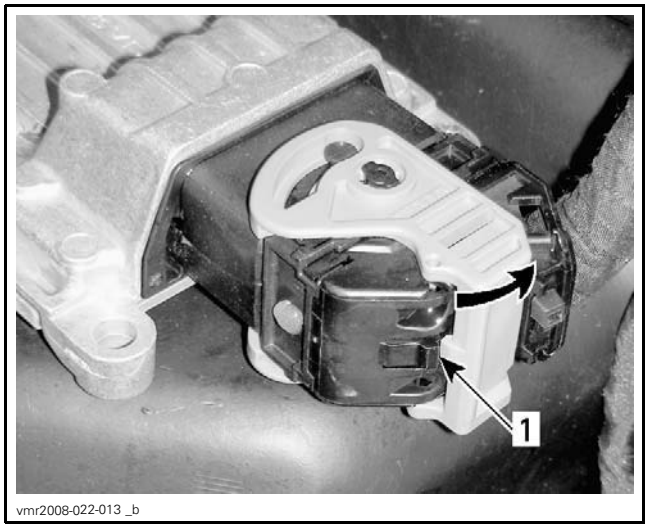
Molex Connector Installation

Fully open connector lock.



Install connector to ECM.

Rotate connector lock until it snaps locked.



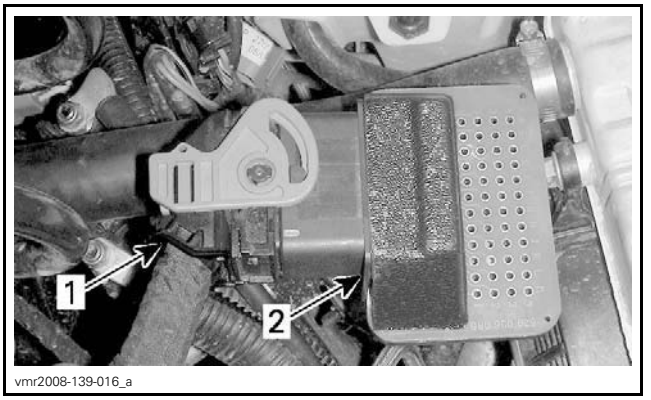
1. Locked here

Molex Connector Probing

The most recommended and safest method to probe ECM connector terminals is to use the ECM ADAPTER TOOL (P/N 529 036 166). This tool will prevent deforming or enlarging terminals which would lead to bad ECM terminal contact creating intermittent or permanent problems.



Disconnect the ECM connector and reconnect on the tool connector. Probe required terminals directly in the tool holes.



1. ECM connector (harness side)
2. ECM adapter

NOTICE **Never probe directly on ECM harness connector. This could change the shape or enlarge the terminals and create intermittent or permanent contact problems.**

Molex Connector Inspection

Before replacing an ECM, always check electrical connections.

1. Ensure connector locking mechanism is functioning properly.
2. Ensure all wire terminals (pins) are properly locked in the connector.
3. Ensure they are very tight, make good contact with the pins in the ECM.
4. Ensure the pins in the harness connector and the ECM connector are clean, shiny and corrosion-free.
5. Check wiring harness for signs of scoring.

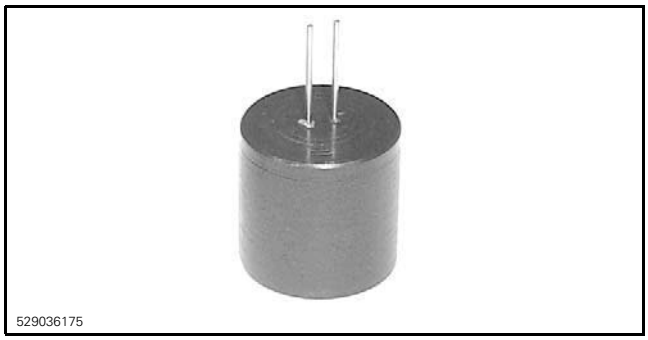
NOTE: A "defective ECM module" could possibly be repaired simply by disconnecting and reconnecting it.

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

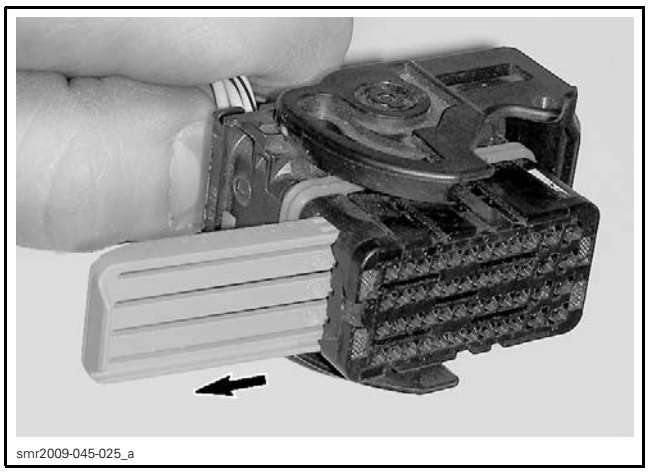
Molex Connector Terminal Removal (Harness Connector)

To remove a signal terminal from the ECM harness connector, use the ECM TERMINAL REMOVER 2.25 (P/N 529 036 175).

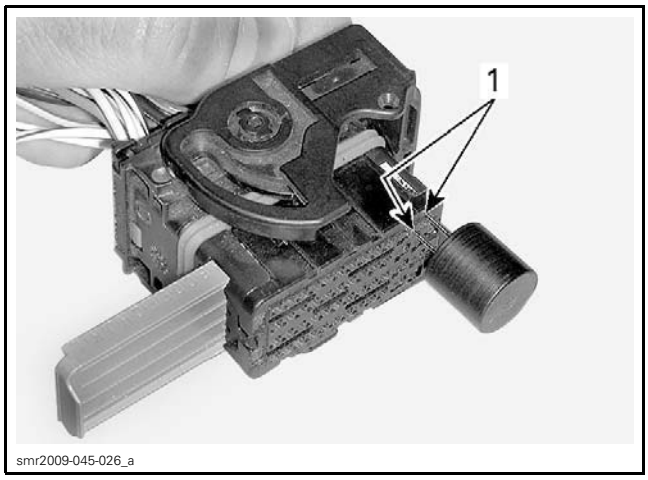
To remove a power terminal, use the ECM TERMINAL REMOVER 3.36 (P/N 529 036 174).


529036175

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


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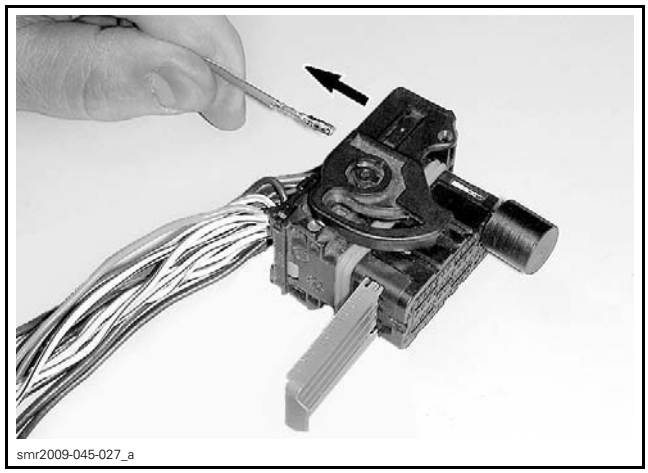
3. Insert tool to unlock terminal.



smr2009-045-026_a

1. Unlock here

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


smr2009-045-027_a

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

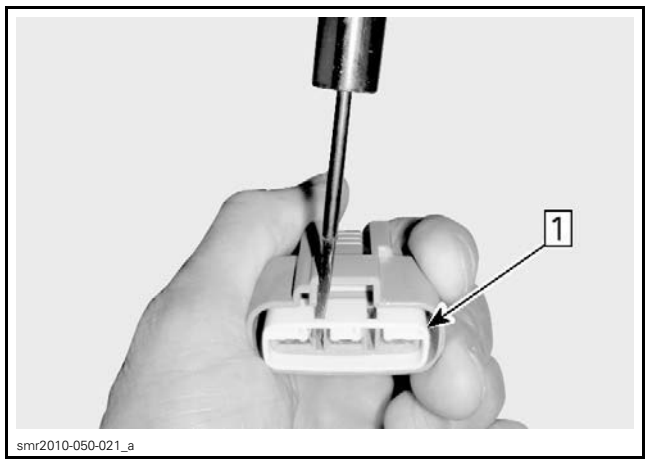
FURUKAWA CONNECTOR

Furukawa Connector Application

Voltage regulator/rectifier.

Terminal Removal

1. Remove the secondary lock (plastic insert).



smr2010-050-021_a

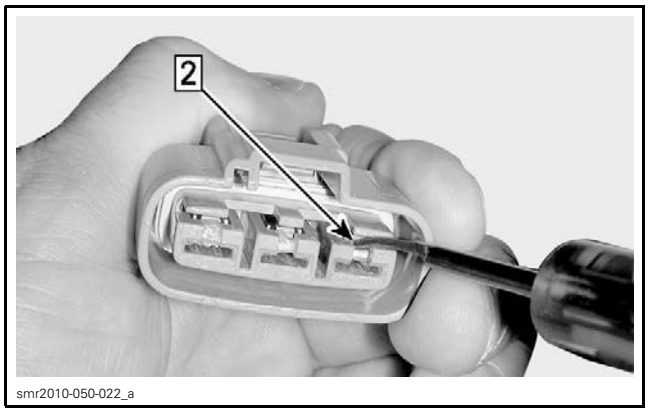
Step 1: Remove the secondary lock

2. Carefully insert the GM TERMINAL EXTRACTOR (P/N 12094430) between the lock and the pin to release the pin.



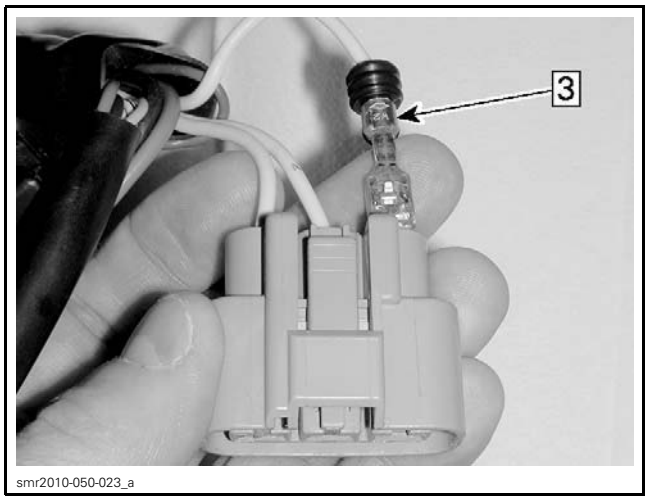
smr2010-052-003

GM TERMINAL EXTRACTOR (P/N 12094430)



Step 2: Insert GM terminal extractor tool (P/N 12094430)

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



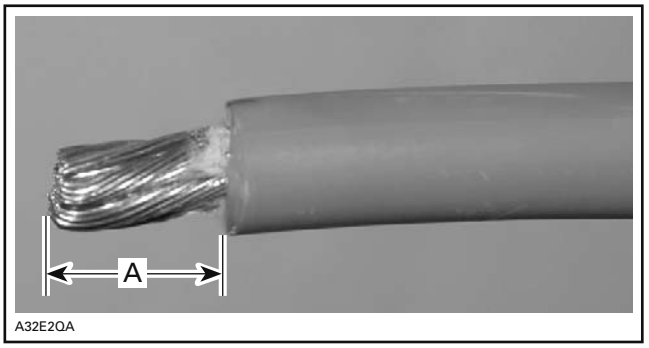
Step 3: Pull wire to extract pin

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

BATTERY AND STARTER CABLE TERMINALS

Cable Crimping

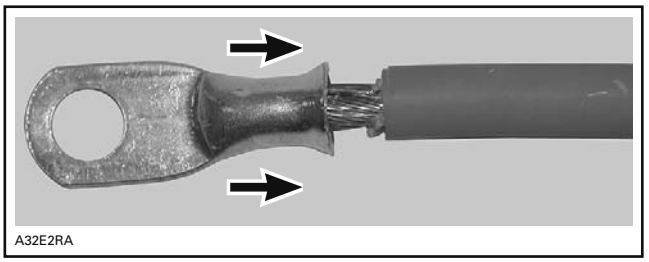
Carefully strip the wire approximately to 10 mm (3/8 in) in length, using a wire stripping tool or sharp blade/knife.



A. 10 mm (3/8 in)

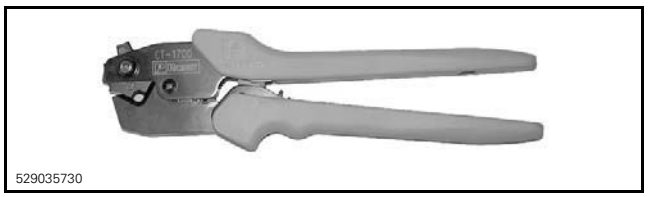
NOTE: Make sure not to cut wire strands while stripping the wire.

Install the appropriate terminal on the wire according to the requirement. Refer to appropriate *PARTS CATALOG*.

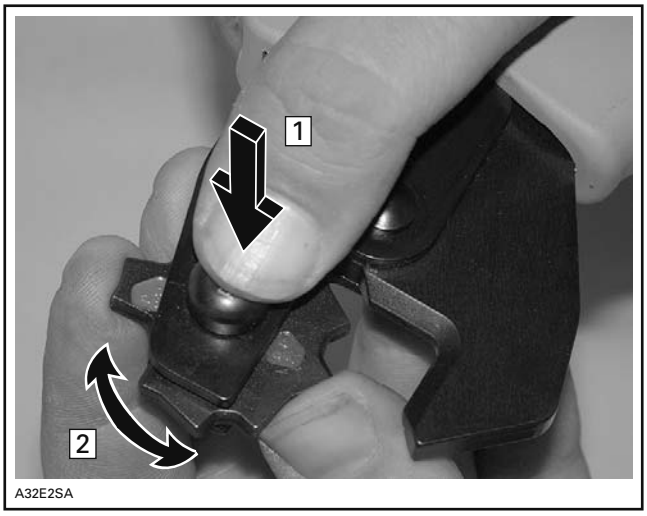


INSTALLATION OF TERMINAL

Follow the instructions provided with the CRIMPING TOOL (HEAVY GAUGE WIRE) (P/N 529 035 730) to select the proper position of the tool.



NOTE: Different wires require different crimping pliers settings.

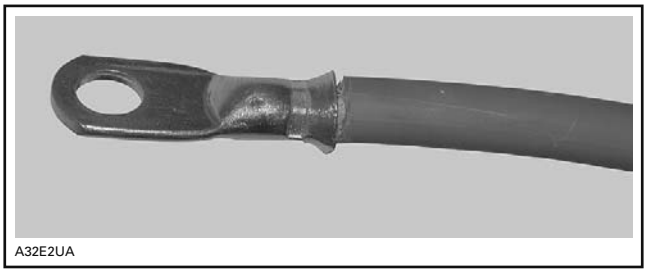


POSITIONING THE CRIMPING PLIERS
Step 1: Press
Step 2: Rotate

After positioning the crimping pliers, crimp the terminal already installed on wire.



CRIMPING OF WIRE



PROPERLY CRIMPED WIRE

To verify, if the wire is properly crimped, apply some pulling force on wire and the terminal at the same time from both directions.

NOTICE Never weld the wire to the terminal. Welding can change the property of the wire and it can become brittle and break.

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

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

IGNITION SYSTEM (450)

SERVICE TOOLS

Description	Part Number	Page
ECM ADAPTER TOOL (ONE CONNECTOR)	529 036 085	548
FLUKE 115 MULTIMETER	529 035 868	544–548

GENERAL

IGNITION SYSTEM OPERATION

The battery supplies 12 Vdc from fuse F5, to the primary side of the ignition coil. The ECM completes the circuit by switching it to ground at the right moment.

As the engine rotates, a signal from the crankshaft position sensor (CPS) relative to the position of the piston in the cylinder, is produced and sent to the ECM. The ECM uses this signal as well as engine RPM to establish the exact moment at which the ignition spark is required. It then provides the ground to the primary winding of the ignition coil.

With the ground provided by the ECM, current flows through the primary coil winding which induces a higher current potential in the secondary winding. This high current potential jumps across the spark plug gap and ignites the fuel/air mixture within the cylinder.

Ignition Timing

Ignition timing is not adjustable.

TROUBLESHOOTING

IGNITION SYSTEM TESTING

NOTE: It is 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.

The ECM controls the ignition system and can detect an open or short circuit in the ignition coil primary winding. However, it does not monitor the secondary winding.

Ignition Testing Sequence

Set engine stop switch to RUN.

Turn the ignition switch to the ON position.

No Multifunction Gauge and Taillight

If the multifunction gauge and taillight do not function, the ECM may not be powered. Check the following:

1. Fuses. Refer to *WIRING DIAGRAM*.
2. Battery (refer to *CHARGING SYSTEM*).

If the items in the previous list tested good, the problem may also be related to one of the following:

– Main relay
– Ignition switch
– Engine STOP switch
– ECM.

For the main relay circuit and ECM testing, refer to the *ELECTRONIC FUEL INJECTION (EFI)* subsection.

Multifunction Gauge and Taillight Turn ON

If the multifunction gauge and taillight turn ON, the ignition switch and engine shut off switch are functioning normally.

Test the following items in the indicated order:

1. Spark plug
2. Battery (refer to *CHARGING SYSTEM* subsection)
3. Ignition coil
4. CPS (refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection)
5. ECM (refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection).

Intermittent Ignition Problems

In dealing with intermittent problems there is no easy diagnosis. Problems that occur only during normal engine operation may be related to vibrations, or the engine operating temperature, and have to be tested under similar conditions.

Some intermittent problems may be attributable to loose, dirty or corroded connections, or water infiltration, and may be resolved by cleaning the contacts and applying a dielectric grease for pro-

tection. Always check for these problems before replacing expensive components and apply the protective grease as specified in the procedures.

Multiple Problems

There is always the possibility of more than one component being at fault. If, after a component has been replaced, the problem still persists, carefully repeat the testing procedure to find the other faulty part.

PROCEDURES

SAFETY PRECAUTIONS

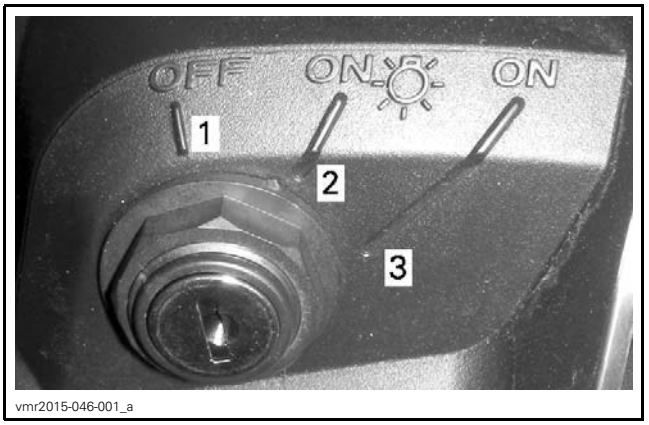
⚠ WARNING

To prevent powerful electric shock while cranking engine, do not touch any of the ignition components (ignition coil, spark plug wire, etc.) nor tester leads. Also make sure that tester leads do not touch any metallic object.

IGNITION SWITCH

Ignition Switch Operation

The ignition switch is a three position switch, OFF, ON with headlights, ON without headlights.



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1. OFF
2. ON with headlights
3. ON without headlights

The primary function of the ignition switch is to provide a signal to the ECM of the intent to start (wake up signal) and run the engine.

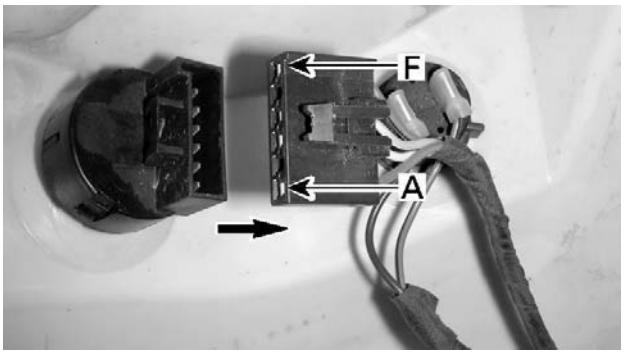
The ignition switch receives 12 Vdc directly from the ECM fuse (F8). When the ignition switch is set to ON (with or without headlights), it sends a power signal to the ECM through the engine stop switch (RUN position). This wakes up the ECM which then waits for the START switch signal to engage the starter, and control ignition timing for proper engine operation.

If the engine is running and the ignition switch is turned to the OFF position, ignition will cease immediately, the engine will shut down, but the ECM will maintain power on the vehicle for 30 seconds.

Ignition Switch Input Voltage Test

Remove console, refer to the *BODY* subsection.

Disconnect the ignition switch connector.

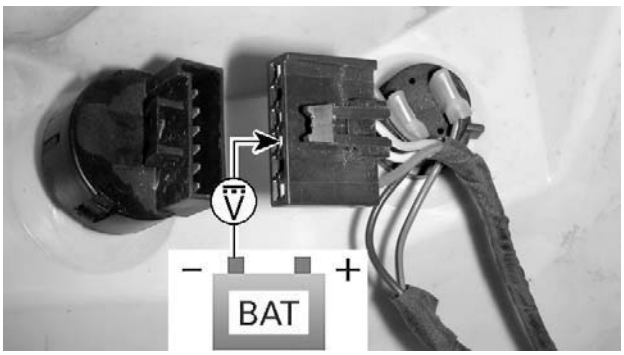


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Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to Vdc.

Measure the ignition switch input voltage as follows.

IGNITION SWITCH INPUT VOLTAGE TEST		
Ignition switch connector (CC)		Voltage
Pin "C" (BE wire)	Battery ground	Battery voltage



vmr2008-137-001_b

IGNITION SWITCH INPUT VOLTAGE TEST

If you do not obtain battery voltage, test:

1. Fuses
2. Wiring harness.

If ignition switch input voltage is good, test the:

1. Ignition switch continuity

2. Engine stop switch
3. Wiring and connectors.

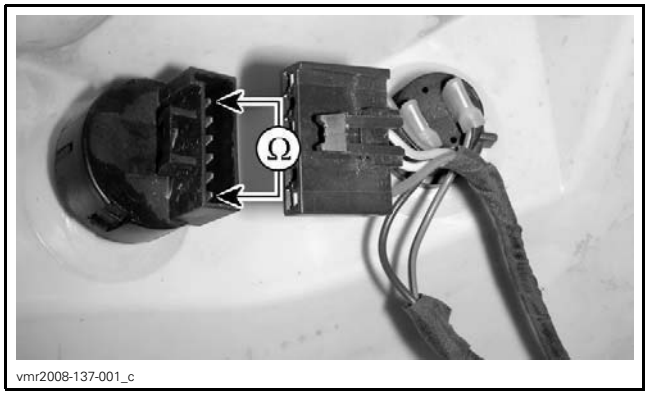
Ignition Switch Continuity Test

Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to Ω.

Measure the resistance through the ignition switch between the following pins.

NOTE: Connector pins "B" and "E" are not used.

IGNITION SWITCH CONTINUITY TEST		
Ignition switch POSITION	Ignition switch pins	RESISTANCE
OFF	Pins "A" to "F"	Infinite (OL)
	Pins "C" to "D"	
ON (w/lights)	Pins "A" to "F"	0.2 ± 0.2 Ω max.
	Pins "C" to "D"	
ON (w/o lights)	Pins "A" to "F"	Infinite (OL)
	Pins "C" to "D"	0.2 ± 0.2 Ω max.



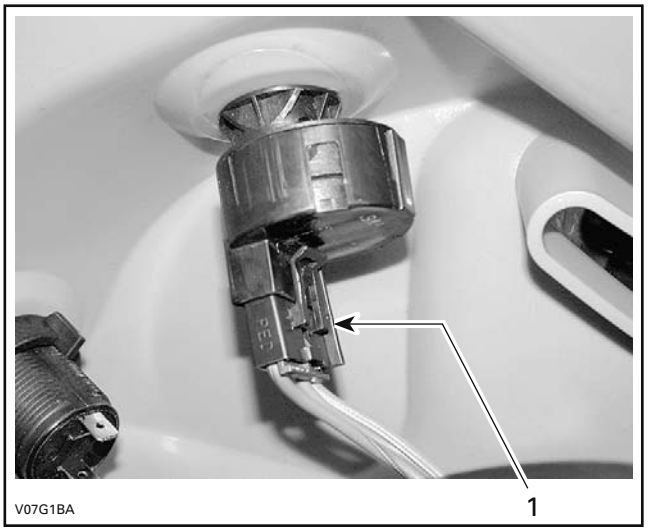
IGNITION SWITCH CONTINUITY TEST

Replace switch if defective.

Ignition Switch Removal

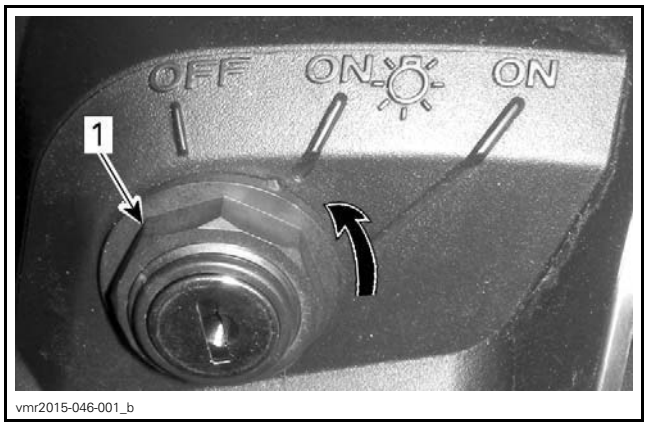
Remove the console, refer to the *BODY* subsection.

Disconnect the ignition switch connector.



TYPICAL
1. Disconnect ignition switch connector

While holding switch with one hand, unscrew the ignition switch retaining nut with the other.



1. Remove retaining nut

Ignition Switch Installation

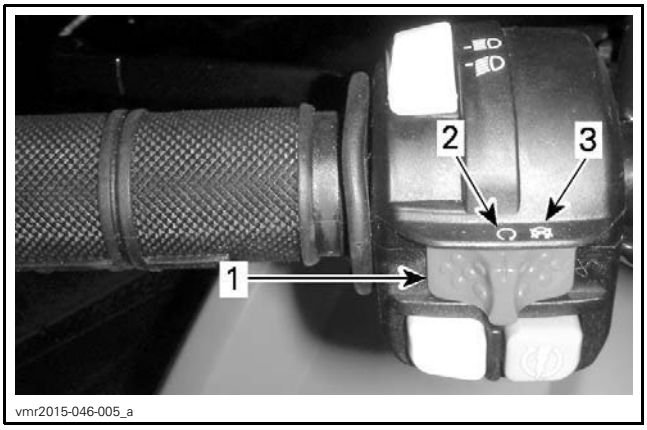
For installation of the ignition switch, reverse the removal procedure.

TIGHTENING TORQUE	
Ignition switch retaining nut	4 N•m (35 lbf•**in**)

ENGINE STOP SWITCH

Engine Stop Switch Operation

The engine stop switch functions as an engine shutoff switch for a normal shutdown or for an emergency situation. It can be quickly activated without letting go of the handlebars.



vmr2015-046-005_a

1. Engine stop switch button
2. RUN position
3. STOP position

When the engine stop switch is set to RUN, it completes a circuit between the ignition switch and the ECM. This circuit provides the 12 Vdc power used to initialize the ECM.

If the engine is running and the engine stop switch is set to OFF, the ignition will cease immediately, the engine will shut down, but the ECM will maintain power on the vehicle for 30 seconds.

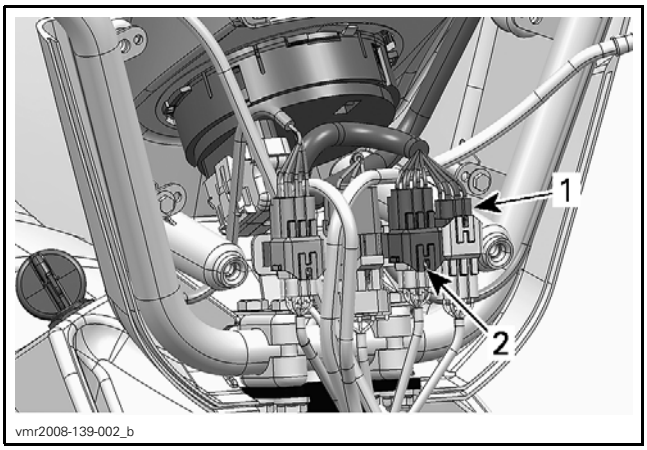
When the switch is set to STOP, it opens the 12 Vdc circuit to pin "A4" of the ECM and applies a ground to pin "K3".

If the engine stop switch is left in the STOP position when the ignition switch is turned to ON, the ECM will not be initialized, the multifunction gauge and tail light will not turn ON.

Engine Stop Switch Continuity Test

Remove the front steering cover, refer to the *BODY* subsection.

Disconnect the multifunction switch connectors, MG1 and MG2.



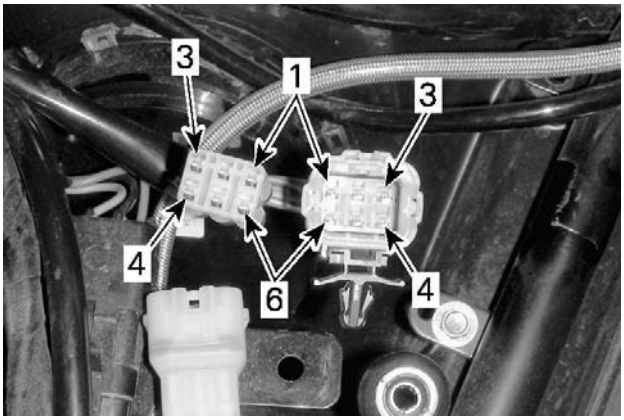
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MULTIFUNCTION SWITCH CONNECTORS
1. Disconnect MG1
2. Disconnect MG2

Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to Ω.

Measure the resistance through the stop switch (steering harness side) as per following table.

ENGINE STOP SWITCH CONTINUITY TEST			
POSITION	Connector		RESISTANCE
Switch to STOP	MG2 pin 3 (BK)	MG1 pin 3 (BK/WH)	1 Ω max.
	MG1 pin 1 (BR)	MG1 pin 2 (YL)	Infinite (OL)
Switch to RUN	MG2 pin 3 (BK)	MG1 pin 3 (BK/WH)	Infinite (OL)
	MG1 pin 1 (BR)	MG1 pin 2 (YL)	1 Ω max.



vmr2008-137-003_a

MG1 AND MG2 PIN OUT

Replace multifunction switch assembly if engine stop switch continuity test results are not as per specification.

IGNITION COIL

The ignition coil is mounted under the top RH side of the frame, along the steering column, in front of the engine.


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IGNITION COIL LOCATION

When troubleshooting an ignition coil problem, first carry out a spark occurrence test, refer to *SPARK PLUG* in this subsection.

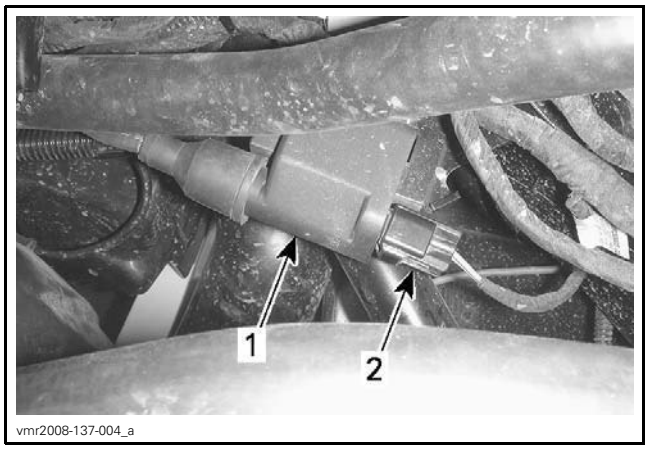
If there is no spark, carry out the Ignition Coil Input Voltage test and Ignition Coil Ground Circuit Continuity Test.

Ignition Coil Input Voltage Test

Ensure ignition coil is properly powered as follows.

Remove RH inner fender. Refer to the *BODY* subsection.

Disconnect the ignition coil input connector.



vmr2008-137-004_a

1. *Ignition coil*
2. *Coil input connector*

Using a small screwdriver, remove the plastic connector pin lock for easy access to pins.



vmr2008-137-005_a

1. *Remove plastic pin lock*

Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to Vdc.

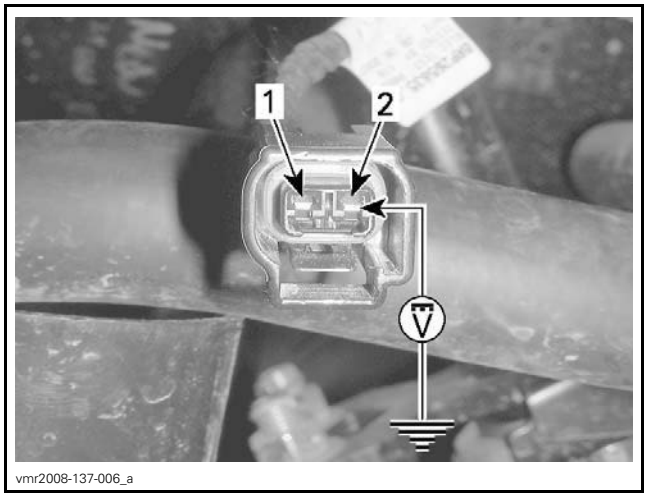
Measure battery voltage between the battery terminal on the starter solenoid and battery ground.

Set engine stop switch to RUN.

Turn ignition switch to ON.

Measure coil input voltage as follows.

IGNITION COIL INPUT VOLTAGE TEST	
IGNITION COIL CONNECTOR	VOLTAGE
Pin 2 with chassis ground	Battery voltage



vmr2008-137-006_a

IGNITION COIL INPUT VOLTAGE TEST
1. *Pin 1 (VIOLET/BLUE)*
2. *Pin 2 (BROWN/ORANGE)*

If you did not read battery voltage, check:
- Fuses and relay. Refer to *WIRING DIAGRAM*.
- Continuity of the ignition coil input circuit.

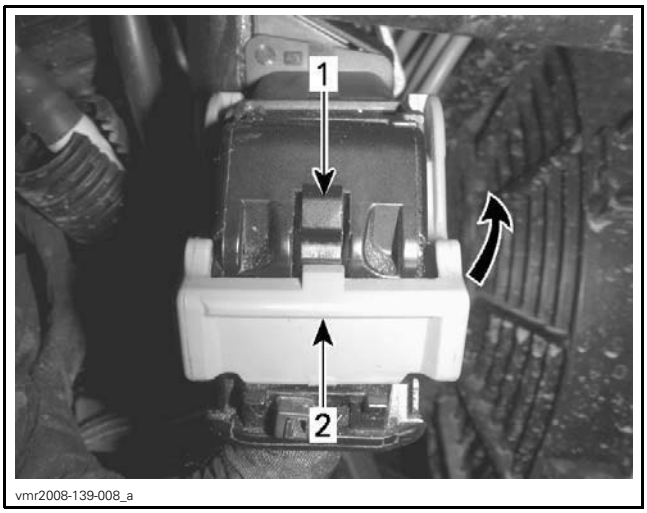
If battery voltage was read, proceed with the Ignition Coil Ground Circuit Continuity Test.

If the measure is out of specification, verify the coil ground wire and connection.

Ignition Coil Ground Circuit Continuity Test

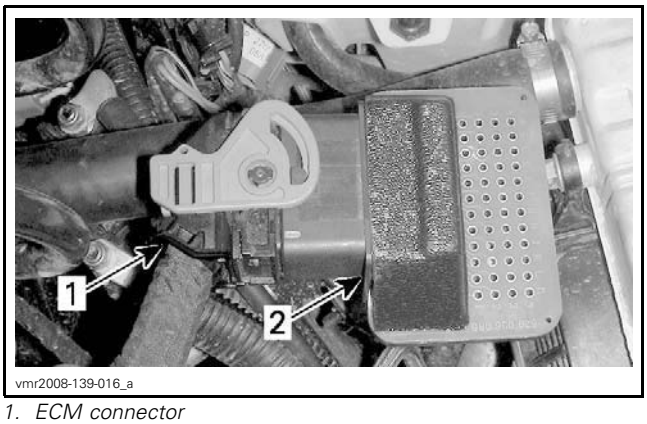
Disconnect ignition coil input connector.

Disconnect ECM connector.



1. Press to release connector lock
2. Push to rotate connector lock upwards

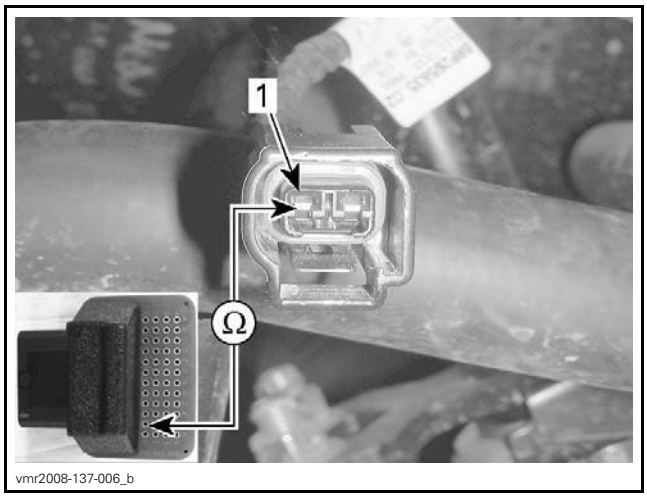
Install the ECM connector onto the ECM ADAPTER TOOL (ONE CONNECTOR) (P/N 529 036 085).



1. ECM connector
2. Adapter tool

Measure for continuity through the coil ground wire to the ECM as follows.

IGNITION COIL GROUND CIRCUIT CONTINUITY TEST		
TEST PROBES		RESISTANCE
Coil input connector pin 1	ECM pin M1	Close to 0 Ω



COIL GROUND CIRCUIT CONTINUITY TEST
1. Pin 1 (BROWN/ORANGE)

Ignition Coil Resistance Tests

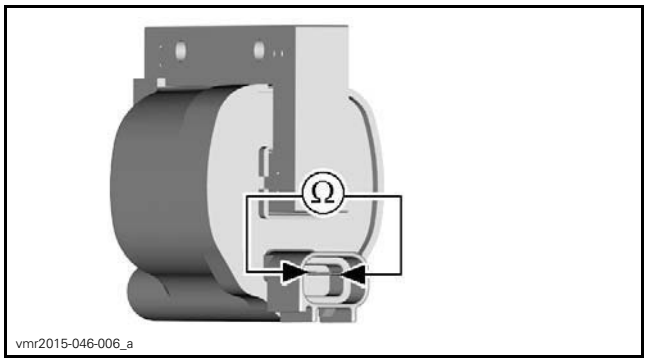
NOTE: An ignition coil with good resistance measurements can still be faulty. Voltage leak can occur at high voltage levels which is not detectable with an ohmmeter. Replacing the ignition coil may be necessary as a test.

Primary Winding Resistance Test

Disconnect the ignition coil input connector.

Set the FLUKE 115 MULTIMETER (P/N 529 035 868) to Ω and test the coil resistance as follows.

IGNITION COIL PRIMARY WINDING RESISTANCE TEST		
ignition coil input connector		resistance @ 25°C (77°F)
Pin 1	Pin 2	0.47 ± 0.05 Ω



COIL PRIMARY WINDING RESISTANCE TEST

If the primary coil resistance is not within specification, replace the ignition coil.

Secondary Winding Resistance Test

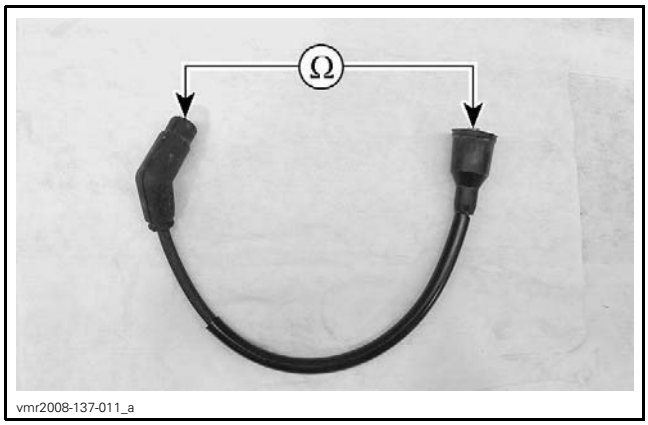
A resistance test of the ignition coil secondary winding is not possible due to internal circuitry.

Spark Plug Cable Resistance Test

Disconnect the spark plug cable from the spark plug and the ignition coil.

Measure resistance through the cable.

SPARK PLUG CABLE		RESISTANCE @ 20°C (68°F)
Coil side	Spark plug side	5 KΩ ± 1 KΩ



SPARK PLUG CABLE RESISTANCE TEST

If resistance value obtained is not close to value specified, or cable shows signs of deterioration, replace spark plug cable.

SPARK PLUG

For spark plug replacement procedure refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

Testing for Spark Occurrence

⚠ WARNING

Never check for ignition spark from an open coil and/or spark plug as spark may cause potential fuel vapors to ignite.

Use an approved inductive type spark tester to test for ignition. Follow spark tester manufacturer procedures.

Remove the LH side panel for access to the spark plug and spark plug cable.

Turn ignition switch to ON.

Set engine stop switch to RUN.

Press and hold the start button.

If nothing happens when the start button is pressed, refer to the *STARTING SYSTEM* subsection.

If the starter rotates the engine and there is no spark indicated by the tester, follow the ignition system troubleshooting sequence as indicated.

If the inductive spark tester indicates ignition to the spark plug, install a new spark plug.

If a known good spark plug does not solve the problem, continue testing the other system components. The ignition spark may not be correct due to other system components being out of tolerance.

NOTE: Keep in mind that even if there is a spark during this static test, the voltage requirement to produce a spark in the combustion chamber is higher when the engine is running. The ignition coil may not be functioning properly. Replacing the ignition coil may be necessary as a test.

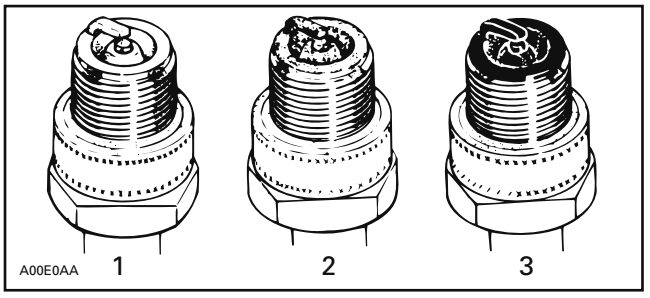
Troubleshooting a Fouled Spark Plug

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

Other possible causes are: a clogged air filter, incorrect or bad fuel, defective ignition system, incorrect spark plug gap, lubricating oil entering the combustion chamber, or use of a spark plug with a temperature rating too cold for the engine requirement.

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

Spark Plug Analysis



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

The plug face reveals the condition of the engine, operating condition, method of driving and fuel mixture. For this reason it is advisable to inspect

the spark plug at prescribed intervals, examining the plug face (i.e. the part of the plug projecting into the combustion chamber).

CHARGING SYSTEM

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
EXTECH INDUCTIVE AMMETER	380941	558
NAPA ULTRA PRO BATTERY LOAD TESTER	95260	558–560

GENERAL

SYSTEM DESCRIPTION

The purpose of the charging system is to keep the battery at a full state of charge.

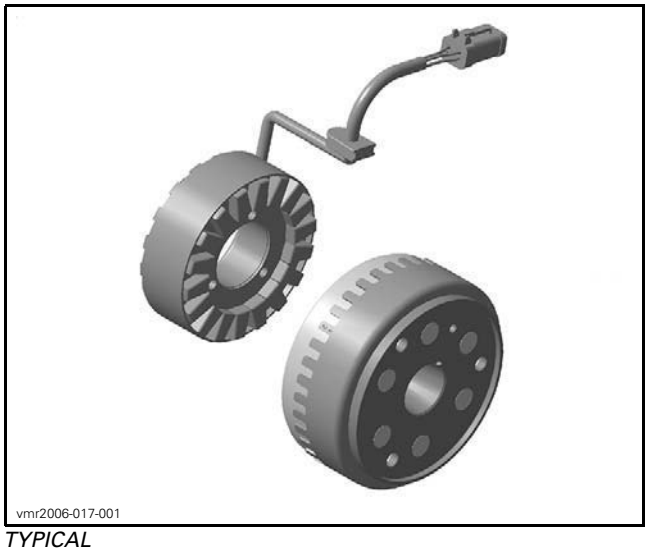
NOTE: For an overview of the vehicle electrical system, refer to *ENGINE MANAGEMENT SYSTEM* section.

Magneto

The magneto is the primary source of electrical energy. It transforms a magnetic field into electric current (AC).

The alternating current is regulated and transformed into direct current (DC) by the voltage regulator, and normally powers all of the vehicle's systems and accessories.

The magneto has a 3 phase delta wound stator.



TYPICAL

Voltage Regulator

The regulator receives AC current from the magneto and transforms it into direct current (DC).

The voltage regulator output voltage is distributed as follows:

– Fuse 1 30A
– Fuse 3 30A
– Battery.

The voltage regulator limits voltage to prevent any damage to electrical components.

COMPONENT	VOLTAGE Vdc
Voltage Regulator	Minimum 12.5
	Maximum 15



TYPICAL

Battery

The battery supplies DC power to every electrical and electronic system in the vehicle as well as all accessories. At low engine RPM operation and high current load conditions, it supplements the magneto's output as required, and helps to maintain a steady system voltage.

TROUBLESHOOTING

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

BATTERY REGULARLY DISCHARGED OR WEAK

1. Loose or corroded battery cable connections.
   - *Tighten or repair battery cable connections.*
2. Worn or defective battery.
   - *Charge and test battery.*
3. Defective magneto stator.
   - *Test stator, refer to MAGNETO AND STARTER SYSTEM subsection.*
4. Defective regulator/rectifier.
   - *Test system voltage.*
5. Damaged magneto rotor or Woodruff key.
   - *Replace magneto rotor or Woodruff key, refer to MAGNETO AND STARTER SYSTEM subsection.*

PROCEDURES

Ensure battery is fully charged.

Refer to *WIRING HARNESS AND CONNECTORS* subsection for harness layout and connector locations on vehicle.

Refer to appropriate *WIRING DIAGRAM* for additional information.

The magneto is covered in *MAGNETO AND STARTER* subsection.

⚠ WARNING

Ensure vehicle is in PARK when performing charging system tests.

BATTERY LOAD TEST

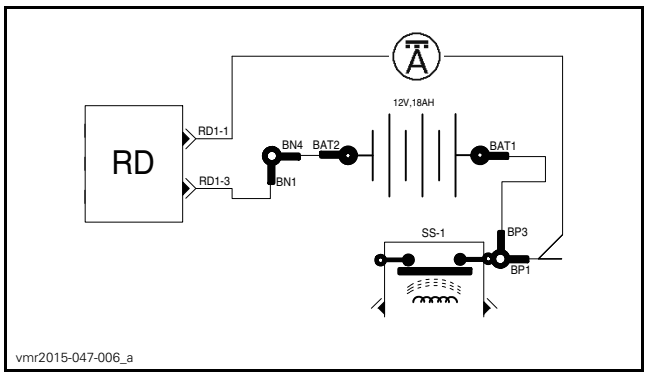
1. Remove seat.
2. Connect a battery load tester such as the NAPA ULTRA PRO BATTERY LOAD TESTER (P/N 95260).
3. Ensure proper test conditions.

TEST CONDITIONS	
Initial battery voltage‡	Above 12.5 Vdc
Engine	OFF
Load	3 times the amp-hour (AH) rating
Time	15 seconds
‡ Required for accurate testing	

SPECIFICATION	
Battery	Above 9.6 Vdc

If battery voltage drops below specification during test, replace battery and perform a *CHARGING SYSTEM LOAD TEST*.

CHARGING SYSTEM LOAD TEST

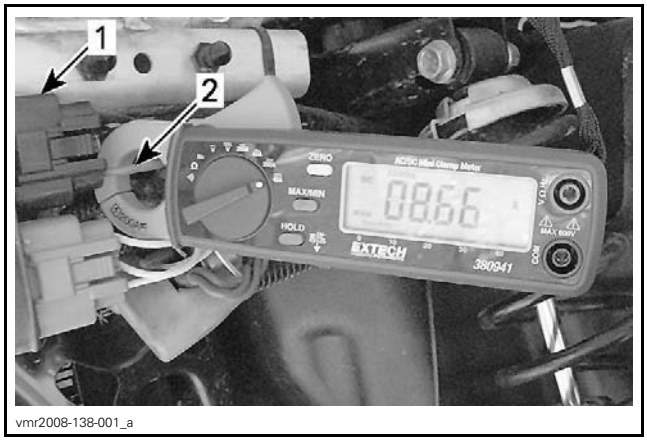


1. Remove seat.
2. Connect a battery load tester such as the NAPA ULTRA PRO BATTERY LOAD TESTER (P/N 95260).
3. Start vehicle and read voltage on tester.

SPECIFICATION	
Voltage	12.5 - 15 Vdc

If voltage is **above** specification, replace regulator and continue *CHARGING SYSTEM LOAD TEST*.

4. Connect an ammeter such as EXTECH INDUCTIVE AMMETER (P/N 380941) around RD1-1 wire.



DC CURRENT TEST WITH INDUCTIVE AMMETER
1. Output connector of voltage regulator
2. Ammeter clamped over RED wire

5. Ensure proper test conditions.

TEST CONDITIONS	
Battery voltage at idle‡	Above 12.6 Vdc
Engine	Increase to 4000 RPM

TEST CONDITIONS	
Load	As required to decrease battery voltage to 12 Vdc
Time	15 seconds
‡ Required for accurate testing	

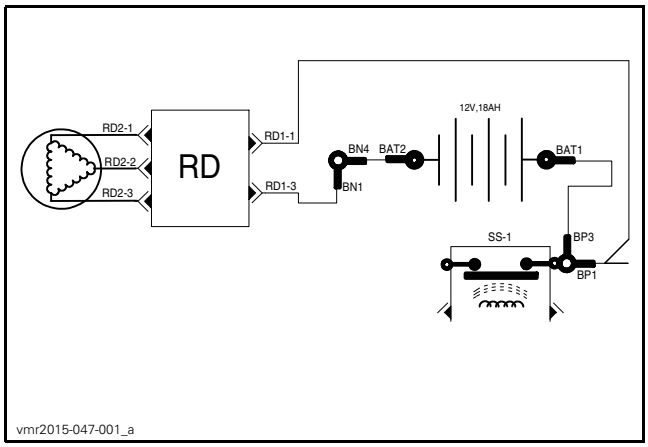
6. Read amperage on ammeter.

MODEL	SPECIFICATION
Base models (no-DPS, not CE)	35 ± 5 Amps
DPS models	41 ± 5 Amps
All CE models	41 ± 5 Amps

If amperage or voltage is not within specification, verify magneto and wires. Refer to *MAGNETO AND STARTER* subsection. Replace:

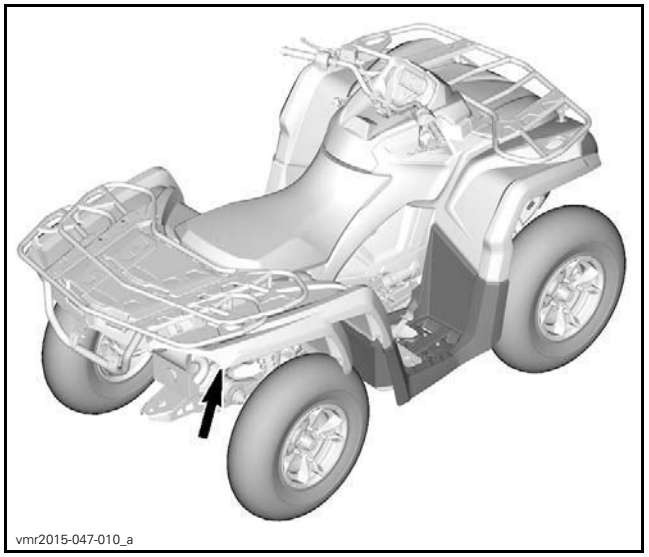
– Voltage regulator if magneto test is within specifications.
– Magneto if magneto test is not within specifications.

VOLTAGE REGULATOR (RD)



Voltage Regulator Access

The voltage regulator/rectifier is accessible on the RH rear side of the vehicle.



Voltage Regulator Continuity Test

Due to internal circuitry, there is no static test available.

Voltage Regulator Power Test

1. Check voltage at RD1-1.

TEST CONDITIONS	
RD1-1	Hot at all times

BACKPROBE	PROBE	SPECIFICATION
RD1-1	BAT2 (-)	Battery voltage

2. Connect a battery load tester such as the NAPA ULTRA PRO BATTERY LOAD TESTER (P/N 95260).
3. Start vehicle.
4. Ensure proper test conditions.

TEST CONDITIONS	
Battery voltage at idle‡	Above 12.6 Vdc
Engine	Increase to 4000 RPM
Load	As required to decrease battery voltage to 12 Vdc
Time	15 seconds
‡ Required for accurate testing	

5. Measure voltage drop.

BACKPROBE	PROBE	SPECIFICATION
RD1-1	BAT1 (+)	Under 0.2 Vdc

If voltage drop is above specification, locate and repair damaged connector/wire.

Voltage Regulator Ground Test

1. Check ground at RD1-3.

TEST CONDITIONS	
RD1-3	Permanent ground

BACKPROBE	PROBE	SPECIFICATION
RD1-3	BAT1 (+)	Battery voltage

2. Connect a battery load tester such as the NAPA ULTRA PRO BATTERY LOAD TESTER (P/N 95260).
3. Start vehicle.
4. Ensure proper test conditions.

TEST CONDITIONS	
Battery voltage at idle‡	Above 12.6 Vdc
Engine	Increase to 4000 RPM
Load	As required to decrease battery voltage to 12 Vdc
Time	15 seconds
‡ Required for accurate testing	

5. Measure voltage drop.

BACKPROBE	PROBE	SPECIFICATION
RD1-3	BAT2 (-)	Under 0.4 Vdc

If voltage drop is above specification, locate and repair damaged connector/wire.

BATTERY

Battery Information

These vehicles are equipped with a VRLA battery (Valve Regulated Lead Acid). It is a maintenance-free type battery.

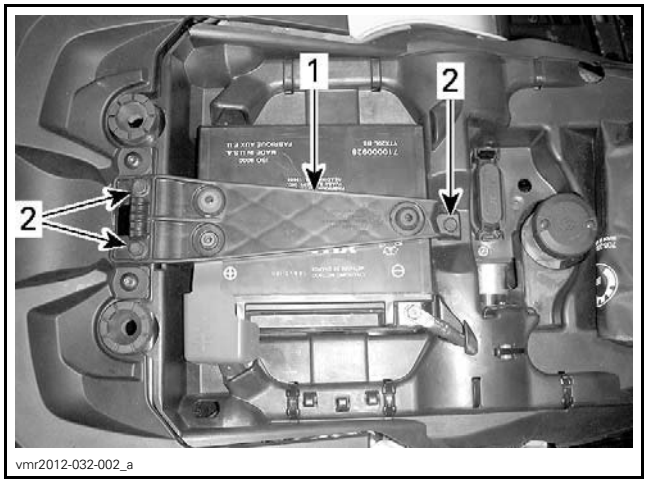
Refer to battery manufacturer's instructions for proper filling, activation and routine charging procedures.

Battery Removal

1. Remove seat.
2. Disconnect BLACK (-) cable first, then the RED (+) cable.

NOTICE **Always respect this order for removal; disconnect BLACK (-) cable first.**

3. Remove battery retaining plate.



TYPICAL
1. Battery retaining plate
2. Retaining plate screws (3)

4. Remove battery.

Battery Cleaning

Clean the battery support, cables and battery posts using a solution of baking soda and water.

Remove corrosion (if so) from battery cable terminals and battery posts using a firm wire brush. Rinse with clear water and dry well.

Battery Inspection

Visually inspect battery casing for cracks or any other damages. If casing is damaged, replace battery and thoroughly clean battery support with a water and baking soda solution.

Inspect condition of battery posts, battery support, holding strap and strap attachment points and wire terminal lugs.

Battery Storage

It is not necessary to remove the battery during vehicle storage but it is recommended for long term storage.

If the battery is left in the vehicle during storage or used infrequently, disconnect the BLACK (-) negative battery cable to eliminate battery current drain from the electrical equipment.

Recharge the battery once a month with an approved battery charger as per manufacturer's recommendations.

Clean battery, battery support and connections as required, refer to *BATTERY CLEANING* in this section.

For other recommendations during storage, refer to battery manufacturers instructions.

⚠ WARNING

Ensure battery is stored in a safe place, out of reach for children.

New Battery Activation

Refer to the instructions provided with the battery.

Battery Charging

⚠ WARNING

Always wear safety glasses and charge in a well ventilated area. Never charge or boost a battery while it is installed on vehicle. Do not open the sealed cap during charging. Do not place battery near open flame.

NOTICE If battery becomes hot, 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.

An automatic charger is a fast and convenient way for error-proof charging.

Always follow the battery manufacturer's charging instructions.

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
YTX20L-BS	4 - 9 HOURS	2 A

QUICK CHARGING		
BATTERY TYPE	TIME	CHARGE
YTX20L-BS	50 MINUTES	10 A

Battery Installation

NOTICE Always connect RED (+) cable first then BLACK (-) cable.

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

TIGHTENING TORQUE	
Battery retaining plate screws	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)

STARTING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
ECM ADAPTER TOOL (ONE CONNECTOR)	529 036 085	565
FLUKE 115 MULTIMETER	529 035 868	567

GENERAL

STARTING SYSTEM OPERATION

When the START button is pressed, 12 Vdc is applied through the start switch (MG1) to the starter solenoid coil. If the engine cranking conditions are met, the ECM completes the starter solenoid control circuit by providing a ground. The starter solenoid then closes its contacts and battery power is applied to the starter for cranking the engine.

Engine Cranking Conditions

The following conditions must be met to allow engine cranking.

– Ignition switch turned ON
– Engine stop switch to RUN
– Transmission in Park, Neutral or a brake pedal/lever is applied
– Start button is pressed and held.

TROUBLESHOOTING

Check for fault codes. Refer to: *DIAGNOSTIC AND FAULT CODES* subsection.

ENGINE WILL NOT TURN

If the starter cranks over the engine with the brakes applied, check the shifter adjustment and the gearbox position sensor and wiring. Refer to the *SHIFTER* and *GEARBOX AND 4X4 COUPLING UNIT* sections.

If the "Engine cranking conditions" are met and the starter will not crank the engine, check the following:

1. Battery and connections (refer to *CHARGING SYSTEM*)
2. Starter solenoid
3. Start button switch
4. Starter (refer to *MAGNETO AND STARTER* subsection)
5. Wiring and connections.

ENGINE TURNS

Starting system is OK.

1. Verify ignition system. Refer to *IGNITION SYSTEM* subsection.
2. Verify EFI systems. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.
3. Verify mechanical condition of engine. Refer to *ENGINE, CVT AND GEARBOX* section.

PROCEDURES

Ensure battery is fully charged.

Refer to applicable *WIRING HARNESS AND CONNECTORS* for harness layout and connector locations on vehicle.

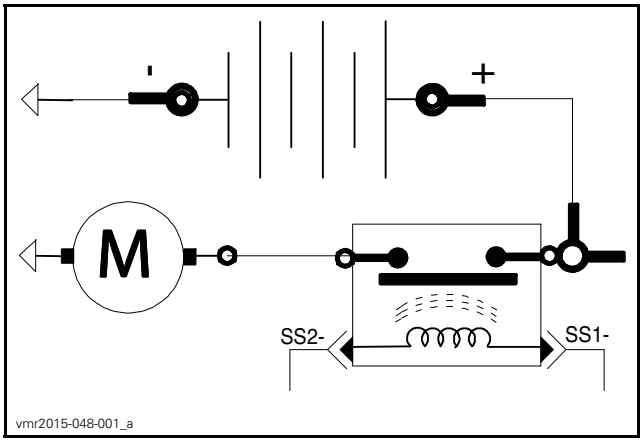
Refer to applicable *WIRING DIAGRAM* for additional information.

⚠ WARNING

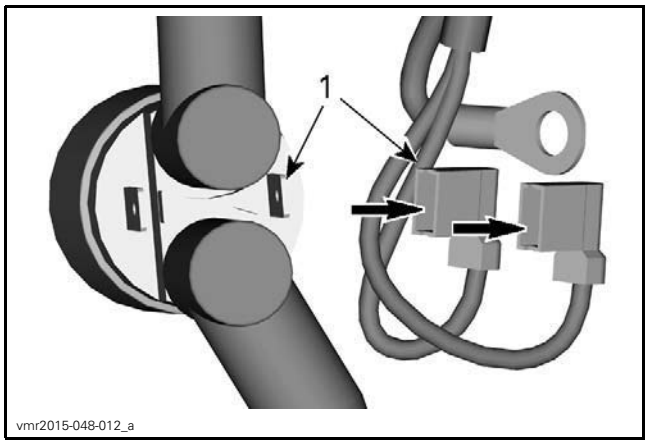
Ensure vehicle is in PARK when performing starting system tests.

STARTING SYSTEM TESTS

Starter Solenoid

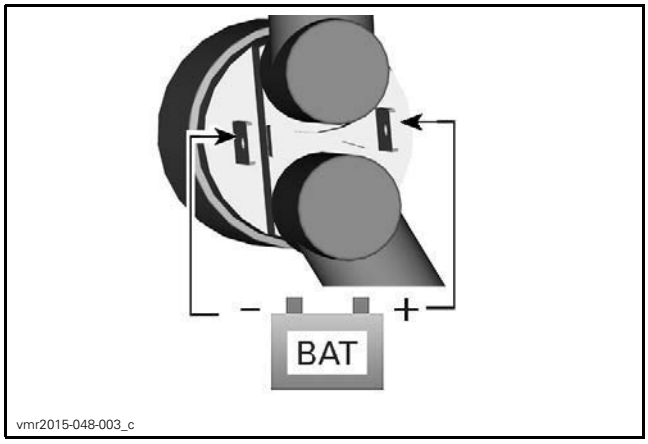


1. Disconnect SS1 and SS2



1. SS1

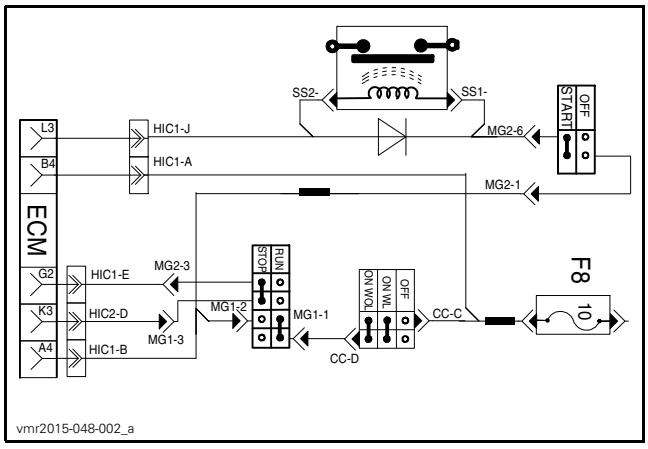
2. Activate the starter solenoid.
   2.1 Apply 12Vdc to SS1
   2.2 Ground SS2



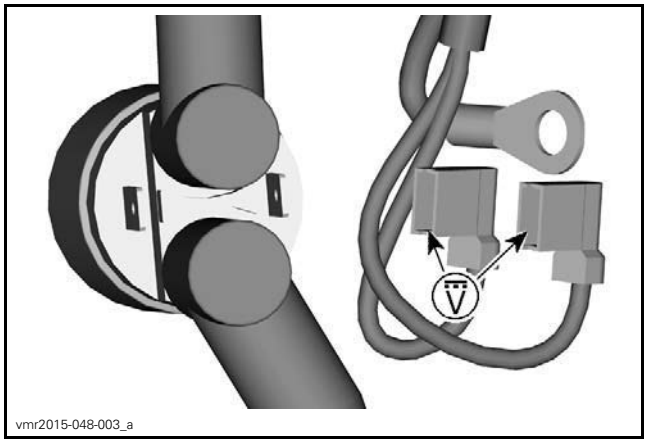
SS1 IS ON THE RIGHT

3. If starter turns, verify *STARTER SOLENOID CONTROL CIRCUIT*.
4. If starter does not turn, verify *STARTER SOLENOID CONTINUITY*.

Starter Solenoid Control Circuit



TEST CONDITION	
Engine stop switch	RUN
Ignition switch	ON
Start button	Pressed



SS1 IS ON THE RIGHT

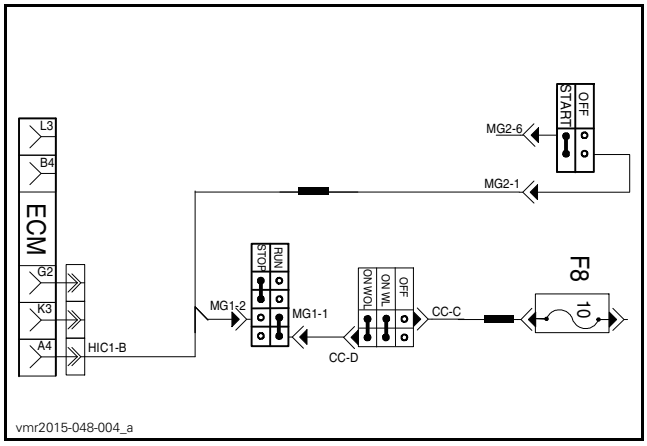
PROBE	PROBE	SPECIFICATION
SS1	SS2	Battery voltage
SS1	BAT -	Battery voltage
BAT +	SS2	Battery voltage

If voltage is as per specification replace starter solenoid.

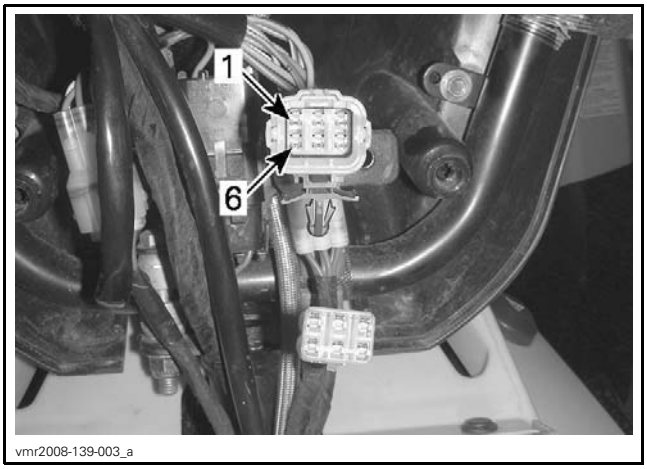
If voltage is not as per specification, verify *STARTER SOLENOID CONTROL POWER CIRCUIT* or *STARTER SOLENOID CONTROL GROUND CIRCUIT* as applicable.

Starter Solenoid Control Power Circuit

NOTE: This procedure also tests the start button.



1. Disconnect MG2 connector.



MG2 STEERING HARNESS CONNECTOR PIN-OUT

TEST CONDITION	
Engine stop switch	RUN
Ignition switch	ON

PROBE	PROBE	SPECIFICATION
MG2-1	BAT -	Battery voltage.

2. If voltage is not as per specification:
   1. Check fuse(s)
   2. Test engine stop switch. Refer to *IGNITION SYSTEM* subsection
   3. Test ignition switch Refer to*IGNITION SYSTEM* subsection.
3. Test start button.

TEST CONDITION	
Start button	Pressed

PROBE	PROBE	SPECIFICATION
MG2-1	MG2-6	Close to 0Ω

If start button does not test as specified, replace the multifunction switch assembly.

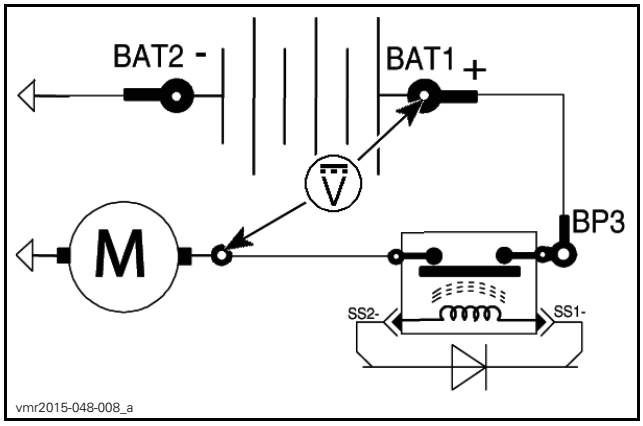
If start switch tests as specified, repair wire to starter solenoid SS1 terminal.

Starter Power Circuit Voltage Drop

NOTE: Engine must be in starting condition for this test. Do not perform on a «No Start» vehicle.

TEST CONDITION	
Fuse F5	Removed‡
Engine stop switch	RUN
Ignition switch	ON
Start button	Pressed
Engine	Cranking
‡ Will prevent engine from starting	

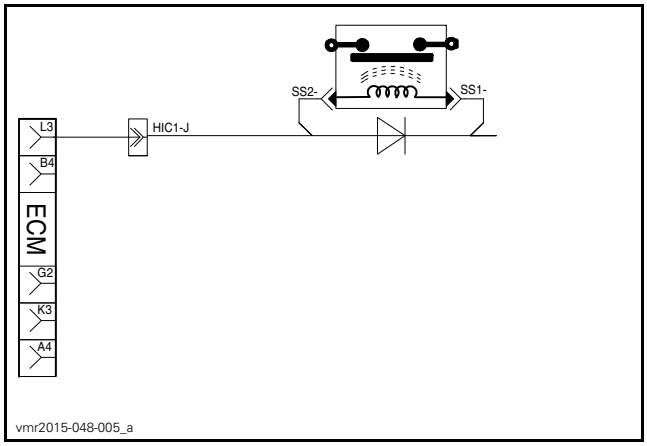
1. Measure voltage drop.



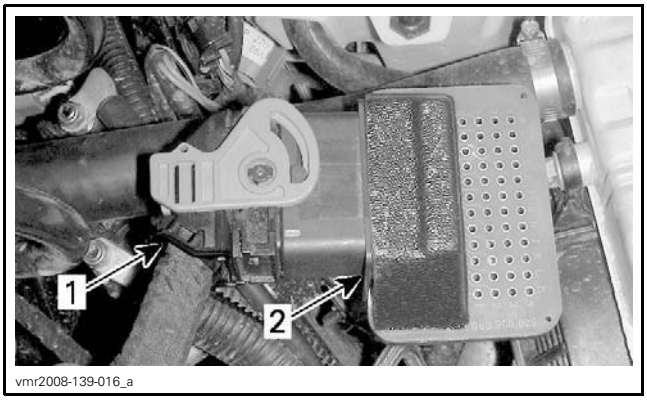
PROBE	PROBE	SPECIFICATION
BAT1	Starter B+ terminal	Below 0.4 Vdc

If voltage drop is above specification, repair or replace sources of high resistance in circuit.

Starter Solenoid Control Ground Circuit



1. Disconnect SS2.
2. Install the ECM connector onto the ECM ADAPTER TOOL (ONE CONNECTOR) (P/N 529 036 085)



1. ECM connector
2. ECM adapter tool

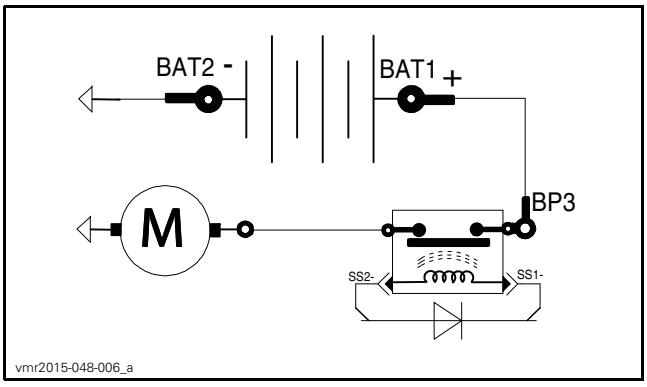
PROBE	PROBE	SPECIFICATION
SS2	ECM-L3	Close to 0Ω

If resistance is not as specified, repair or replace wiring/connections.

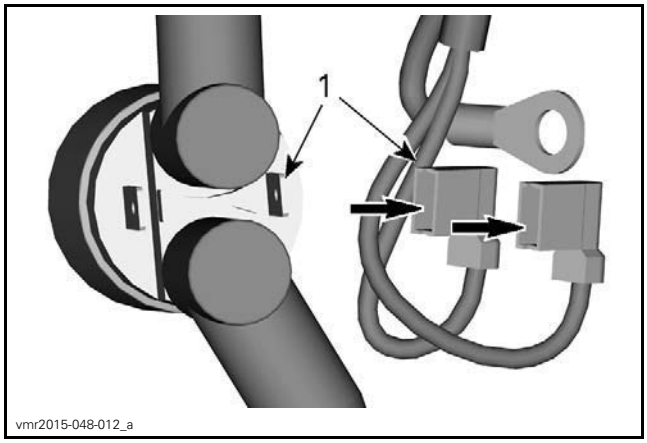
If solenoid power control circuit and ground control circuit both test good, test ECM ground circuits. Refer to *ELECTRONIC FUEL INJECTION (EFI)* section.

NOTE: Supply a ground with a jumper wire if you suspect that the ECM is not supplying a ground to the solenoid.

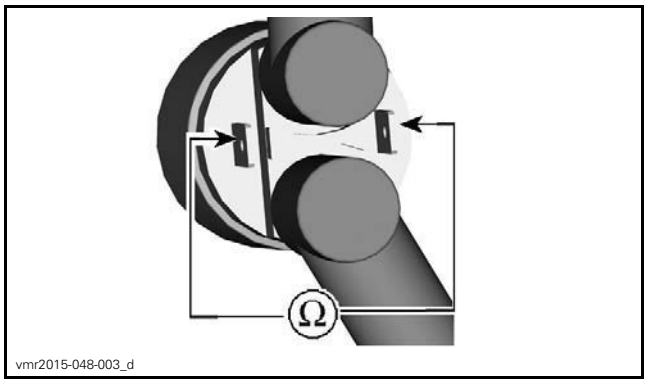
Starter Solenoid Continuity



1. Disconnect the black (-) negative battery cable.
2. Disconnect SS1 and SS2



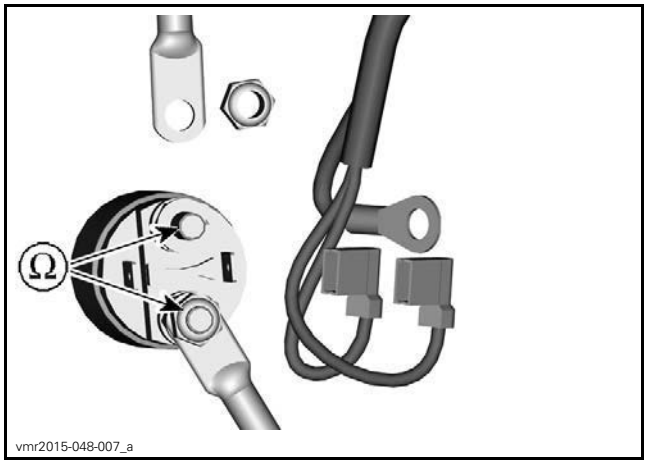
1. SS1



PROBE	PROBE	SPECIFICATION @ 20°C (68°F)
SS1	SS2	Close to 6Ω

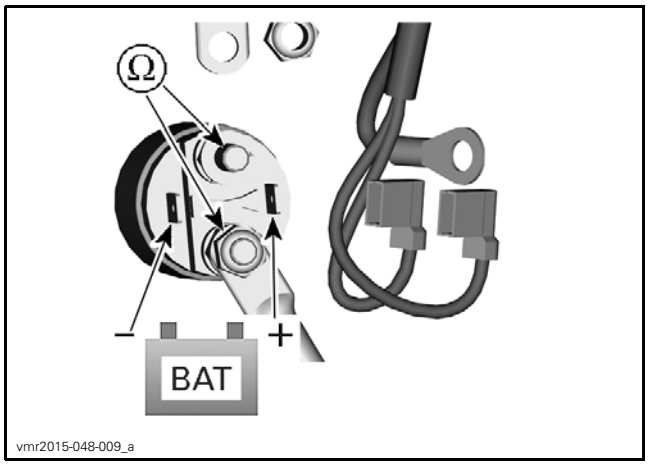
If resistance is not as per specification, replace the solenoid.

3. Disconnect BP3.



PROBE	PROBE	SPECIFICATION
BP3	Terminal to starter motor	O.L.

4. Jump starter solenoid.



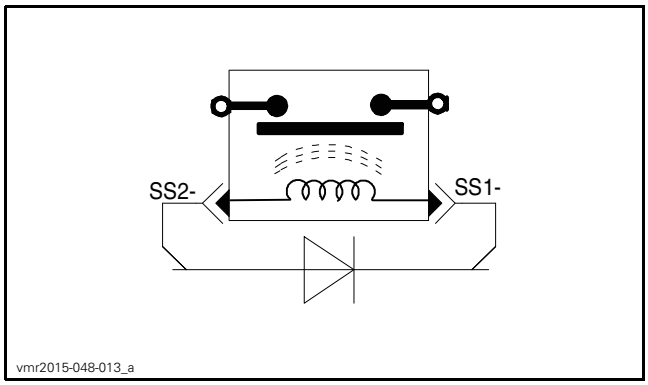
SS1 IS ON THE RIGHT

PROBE	PROBE	SPECIFICATION
BP3	Terminal to starter motor	Close to 0Ω

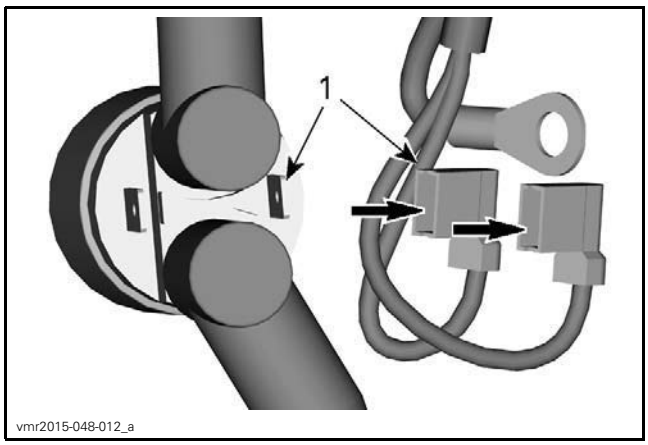
If resistance is not as per specification, replace the solenoid.

5. If starter power and ground circuits are good, refer to *MAGNETO AND STARTER* subsection for starter diagnosis and replacement.

Solenoid Diode Test

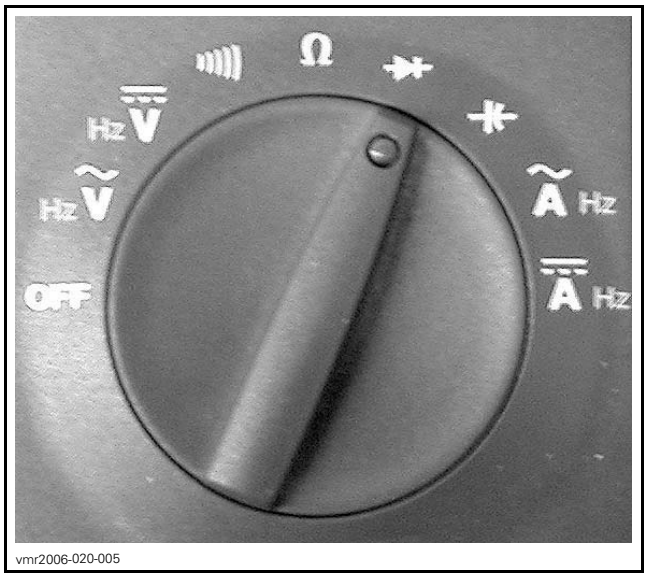


Disconnect SS1 and SS2 from starter solenoid.

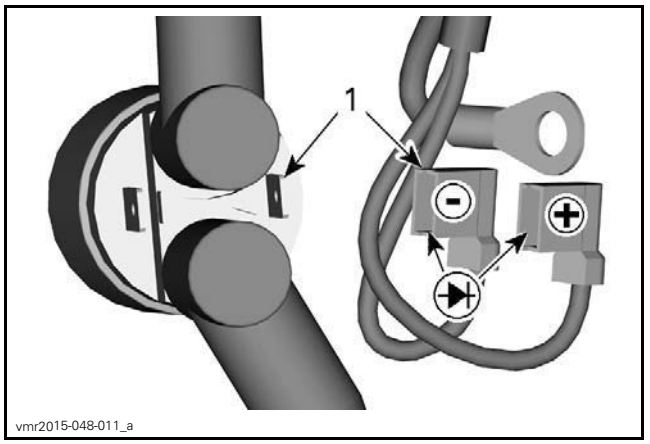


1. SS1

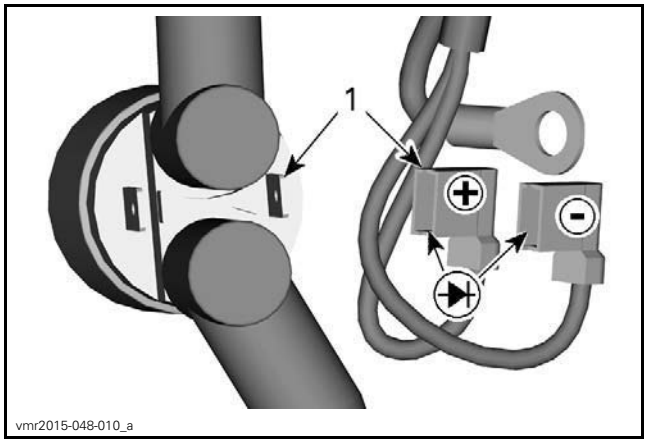
Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and set it to the diode symbol as shown.



Probe wires while paying attention to the diode polarity.



FORWARD POLARITY, MUST BE AROUND 0.5 V



REVERSE POLARITY, MUST BE OPEN CIRCUIT
1. SS1

If test failed, replace diode. Refer to *WIRING HARNESS AND CONNECTORS* for diode location.

NOTE: The diode is integrated in the harness near the starter solenoid.

LIGHTS, GAUGE AND ACCESSORIES

SERVICE TOOLS

Description	Part Number	Page
FLUKE 115 MULTIMETER	529 035 868	576, 578

SERVICE PRODUCTS

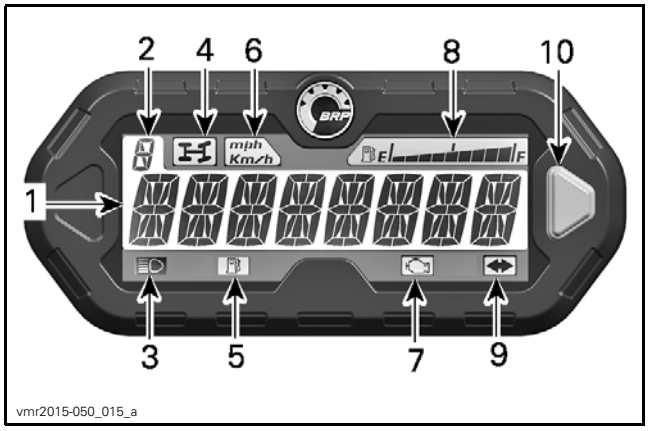
Description	Part Number	Page
DIELECTRIC GREASE	293 550 004	572

GENERAL

NOTICE It is recommended to always disconnect the battery when replacing any electric or electronic parts. Always disconnect battery exactly in the specified order, BLACK (-) cable first.

MULTIFUNCTION GAUGE

Multifunction Gauge Description



1. Main screen
2. Transmission position display
3. High beam indicator lamp
4. 4WD indicator lamp
5. Low fuel level indicator lamp
6. MPH, Km/h indicator lamp
7. Check engine indicator lamp
8. Fuel level display
9. Signal lights/hazard lights indicator lamp (CE models)
10. Selector button

1) Main Screen

The main screen is used to display numerous functions of the multifunction gauge.

Refer to *MULTIFUNCTION GAUGE MODES* for the available display modes.

2) Transmission Position Display

This display will show transmission position.

DISPLAY	FUNCTION
P	Park
R	Reverse
N	Neutral
H	High range
L	Low range

3) High Beam Indicator Lamp

When this indicator is ON, it indicates that **high beam** is selected on the headlights switch and that the ignition key is in the "ON with lights" position.

4) 4WD Indicator Lamp

When this indicator is ON, it indicates the **4WD** system is activated.

5) Low Fuel Level Indicator Lamp

When this indicator is ON, it indicates that there is approximately 5 L (1.3 U.S. gal.) of fuel left in fuel tank.

6) KM/H or MPH Indicator Lamp

mph
Km/h

The applicable lamp turns on to indicate the active speedometer unit of display.

7) Check Engine Indicator Lamp

When this indicator is ON, it indicates an engine fault code, look for a message in the main screen display.

When this indicator blinks, it indicates that **LIMP HOME** mode is activated.

8) Fuel Level Display

Bar gauge continuously indicates the level of fuel in the fuel tank while riding.

9) Turn signal/Hazard lights Indicator Lamp



When this indicator is ON, it indicates:
– A turn signal is activated, or
– The hazard lights are activated.

10) Selector Button

The selector button is used to navigate or change settings in the multifunction gauge.

Multifunction Display Modes

Speed Mode

In this mode, the display shows the speed of the vehicle either in km/h or in MPH.



vdd2008-001-084

RPM Mode

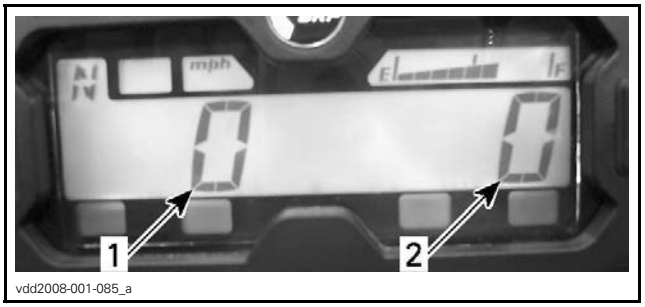
In this mode, the display shows the engine RPM.



vdd2008-001-089

Combined Mode

In this mode, the display shows the speed of the vehicle and the engine RPM.



vdd2008-001-085_a

1. Vehicle speed
2. Engine RPM

Odometer (OD)

Odometer records the total distance travelled either in miles or kilometers.



vsi2009-018-030

Clock

Shows current time.



vmo2011-008-001

Refer to *GAUGE SETUP* to set current time.

Trip Meter (TP)

The trip meter records the travelled distance since it has been reset. Distance travelled is displayed either in kilometers or miles.



vsi2009-018-031

Press and HOLD the selector button for 2 seconds to reset the trip meter.

Trip Hour Meter (TH)

The trip hour meter records vehicle running time when the electrical system is activated. It can be used to establish traveling time between 2 places.



vsi2009-018-032

Press and HOLD the selector button for 2 seconds to reset the hour meter.

Engine Hour Meter (EH)

The engine hour meter records engine running time.



vsi2009-018-033

Message Display Mode

If an abnormal engine condition occurs, a message may scroll across the main screen in conjunction with a pilot lamp.

Refer to *DIAGNOSTIC SYSTEM AND FAULT CODES* subsection.

Navigating the LCD Gauge

⚠ WARNING

Never adjust or set functions on the multi-function gauge while riding the vehicle.

Default Display Mode

After vehicle startup, the default display mode is either:

– Vehicle speed
– Engine revolutions per minute (RPM)
– Both parameters simultaneously (combined mode).

To change from one display to the other, proceed as follows.

1. Turn ignition key to ON to power-up the system.
2. Wait until the "greeting message" has been displayed.
3. Press and release selector button once to display OD (odometer).
4. Press the selector button again, this time for 2 seconds.

This will change the Mode to either Speed, RPM or Combined.



vdd2008-001-083

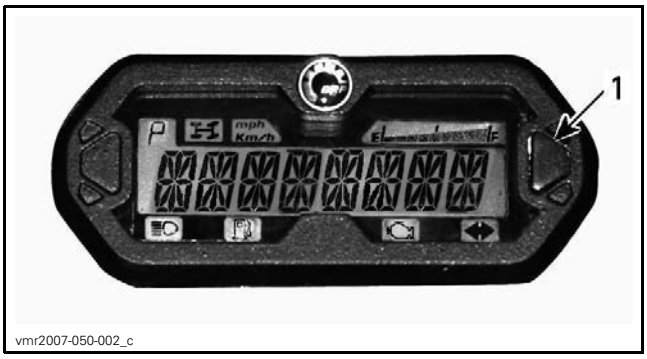
5. To select another mode, repeat steps 3 and 4 until the desired mode is displayed.

Temporary Display Mode

In the temporary display mode, the following functions are available:

– Odometer
– Clock
– Trip meter (resettable)
– Trip Hour meter (resettable)
– Engine hour meter.

Press and release selector button to change the default display mode to the temporary mode.



1. Selector button

The gauge will display the selected mode for 10 seconds then will return to the normal display mode.

While in a resettable mode, push and HOLD selector button for 2 seconds to reset it.

TROUBLESHOOTING

DIAGNOSTIC TIPS

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

IMPORTANT: When troubleshooting an electrical system fault, check battery condition, cables and connections first.

Circuit Testing

Check the related-circuit fuse condition with a fuse tester or test lamp (a visual inspection could lead to a wrong conclusion).

NOTE: If the ignition switch is left ON for more than 50 minutes, the accessory relay will shut down.

Electrical Connection Inspection

When replacing an electric or electronic component, always check electrical connections. Make sure they are tight, make good contact, and are corrosion-free. Dirty, loose or corroded contacts are poor conductors and are often the source of a system or component malfunction.

Pay particular attention to ensure that pins are not bent or pushed out of their connectors.

Ensure all wire terminals are properly crimped on wires, and connector housings are properly fastened.

Check for signs of moisture, corrosion or dullness. Clean pins properly and coat them with DIELECTRIC GREASE (P/N 293 550 004) or other appropriate lubricant when reassembling them, except if otherwise specified such as for the ECM connector.

Pay attention to ground wires.

For wiring harness connector locations, refer to *WIRING HARNESS AND CONNECTORS* subsection.

DIAGNOSTIC GUIDELINES (GAUGE)

MULTIFUNCTION GAUGE WILL NOT COME ON

1. **Multifunction gauge not powered up.**
   - *Check fuse (F4), refer to POWER DISTRIBUTION subsection.*
   - *Test multifunction gauge 12 Vdc input and ground circuits as per MULTIFUNCTION GAUGE WIRE IDENTIFICATION in this subsection. Refer to WIRING DIAGRAM.*
2. **Defective Multifunction Gauge.**
   - *Replace multifunction gauge.*

RELAYS/SPEEDO FUSE (F4) BURNS OUT REPEATEDLY

1. **Taillight/Brake light system short circuit.**
   - *Check taillight/brake light bulbs and circuit*

MULTIFUNCTION GAUGE COMMUNICATION ERROR

1. **Multifunction gauge CAN circuit open.**
   - *Ensure multifunction gauge is properly connected and powered up.*
   - *Check for applicable fault code using B.U.D.S., refer to MONITORING SYSTEM AND FAULT CODES subsection.*
   - *Carry out a MULTIFUNCTION GAUGE CAN RESISTOR TEST in this subsection.*
   - *Carry out a continuity test of the multifunction gauge CAN wires, refer to WIRING DIAGRAM.*

NO FUEL QUANTITY INDICATION

1. **Defective fuel level sender or wiring.**
   - *Refer to FUEL TANK AND FUEL PUMP subsection.*
2. **Defective Multifunction Gauge.**
   - *Replace multifunction gauge, refer to MULTIFUNCTION GAUGE in this subsection.*

DIAGNOSTIC GUIDELINES (LIGHTS)

BRAKE LIGHTS WILL NOT COME ON WHEN BRAKES APPLIED

1. Defective brake relay.
   - *Test brake relay (R8), refer to POWER DISTRIBUTION subsection.*
2. Defective brake light switch(es).
   - *Refer to BRAKE LIGHT SWITCHES in the BRAKE subsection.*
3. Defective wiring/connectors.
   - *Test wiring continuity, refer to applicable WIRING DIAGRAM.*

TURN SIGNAL LIGHTS WILL NOT COME ON WHEN SELECTED (CE MODELS)

1. Accessories fuse (F12) open circuit (turn signals inoperative only).
   - *Test fuse, refer to POWER DISTRIBUTION subsection.*
2. Clock/Hazard fuse (F8) open circuit (turn signals and hazard lights inoperative).
   - *Test fuse, refer to POWER DISTRIBUTION subsection.*
3. Defective Flasher Module.
   - *Replace flasher module, refer to FLASHER MODULE in this subsection.*
4. Defective wiring/connectors.
   - *Test wiring continuity, refer to applicable WIRING DIAGRAM.*

HAZARD LIGHTS WILL NOT COME ON WHEN SELECTED (CE MODELS ONLY)

1. Clock/Hazard fuse (F8) open circuit.
   - *Check fuse, refer to POWER DISTRIBUTION subsection.*
2. Hazard lights 12 Vdc input circuit open.
   - *Check wiring and connectors as per TURN SIGNAL/HAZARD LIGHTS WIRE IDENTIFICATION in this subsection. Refer to WIRING DIAGRAM.*
3. Hazard lights selector switch defective.
   - *Test switch as per TURN SIGNAL/HAZARD LIGHTS WIRE IDENTIFICATION in this subsection. Refer to WIRING DIAGRAM.*
4. Defective wiring/connector between hazard lights selector switch and flasher module.
   - *Refer to WIRING DIAGRAM.*
5. Flasher module ground circuit open.
   - *Test wiring and connectors, refer to WIRING DIAGRAM.*
6. Defective flasher module.
   - *Replace flasher module, refer to FLASHER MODULE in this subsection.*

HAZARD LIGHTS COME ON WITHOUT BEING SELECTED (CE MODELS ONLY)

1. Hazard lights switch or wiring short circuit.
   - *Check for water in LH multifunction switch.*
   - *Test hazard light switch and wiring, refer to WIRING DIAGRAM.*
2. Resistor R1 in flasher module input circuit is open.
   - *Test resistor R1, refer to WIRING DIAGRAM.*

TURN SIGNAL/HAZARD LIGHTS INDICATOR IN MULTIFUNCTION GAUGE WILL NOT COME ON WITH TURN SIGNAL OR HAZARD LIGHTS SELECTED ON, IGNITION SWITCH ON (CE MODELS ONLY)

1. Signal wire from flasher module to multifunction gauge open circuit.
   - *Test circuit continuity from flasher module (3–MC2–4) to multifunction gauge (1–C1–8).*
2. Defective flasher module.
   - *Replace flasher module, refer to FLASHER MODULE in this subsection.*
3. Defective multifunction gauge.
   - *Replace multifunction gauge.*

HAZARD LIGHTS INDICATOR NOT WORKING WITH IGNITION SWITCH OFF (CE MODELS ONLY)

1. Defective hazard LED
   - *Test LED. Observe polarity.*

POSITION LIGHTS WILL NOT COME ON (CE MODELS ONLY)

1. Defective light bulbs
   - *Test/replace light bulbs.*
2. Accessories fuse F12 open circuit.
   - *Test fuse, refer to POWER DISTRIBUTION subsection.*
3. Power or ground circuit wiring.
   - *Check wiring continuity, refer to WIRING DIAGRAM.*

HORN WILL NOT FUNCTION (CE MODELS ONLY)

1. Burnt Clock/Hazard fuse (F4)
   - *Check fuse*
2. Defective horn.
   - *Test horn by applying 12 Vdc and ground jumper to horn.*
3. Defective horn switch.
   - *Test horn switch as per HORN WIRE IDENTIFICATION in this subsection. Refer to WIRING DIAGRAM.*
4. Defective wiring.
   - *Check wiring continuity as per HORN WIRE IDENTIFICATION in this subsection. Refer to WIRING DIAGRAM.*

PROCEDURES

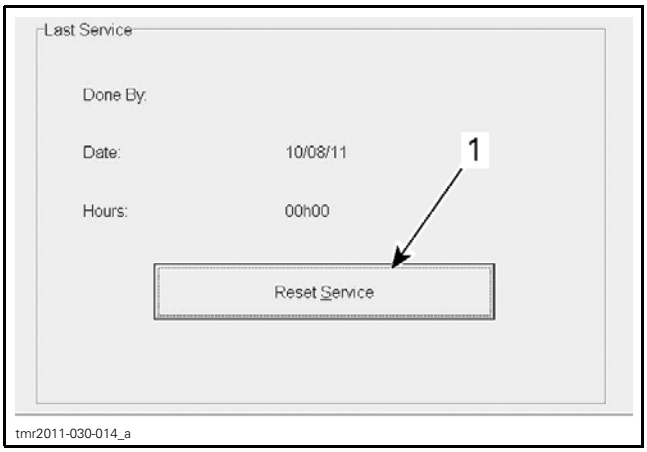
MULTIFUNCTION GAUGE

Maintenance Required Message Reset

Connect to the latest applicable B.U.D.S. software version. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

Select **Vehicle** tab.

Click on the **Reset Service** button.



TYPICAL
1. Reset Service button

Multifunction Gauge Wire Identification

FUNCTION	PIN	COLOR
12 volt input from fuse F4	17	OR/GN
12 volt input from fuse F8 (Clock)	16	BE
Ground	20	BK
CAN LO	18	WH/BK
CAN HI	19	WH/BE
Fuel level gauge supply	4	BR/PK
Fuel level gauge ground	21	VI/PK
2WD/4WD switch signal (-)	7	BK/BE
HI beam signal (+)	5	BU
Vehicle speed sensor signal (VSS)	9	PK

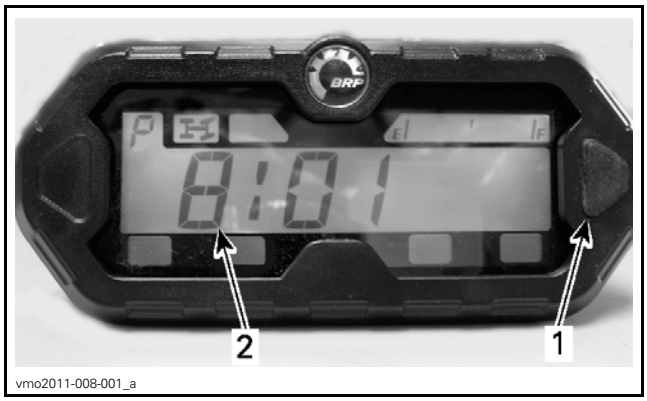
Multifunction Gauge Circuit Protection

CONDITION	CIRCUIT PROTECTION
Supplied at all times	Fuse 8
Supplied with main relay activated	Fuse 4

Clock Setting Using Gauge Selector Button

To set current time, proceed as follows:

1. Select the clock display.



1. Selector button
2. Time

2. Press and HOLD selector button.

NOTE: The display will flash.

3. Choose the 12-hour (12H) or 24-hour (24H) format by pressing button.

4. If the 12-hour format was selected, choose Am (A) or Pm (P) by pressing button.
5. Choose hour first digit by pressing button.
6. Choose hour second digit by pressing button.
7. Choose minutes first digit by pressing button.
8. Choose minutes second digit by pressing button.

NOTE: The gauge will display the current time for 10 seconds then will return to the normal display mode.

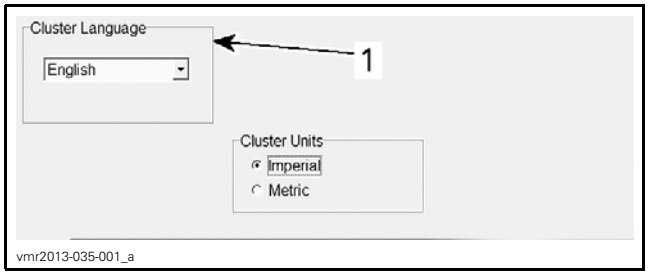
Multifunction Gauge Set-Up Using B.U.D.S.

Connect to the applicable B.U.D.S. software. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

Language Selection

In B.U.D.S., select the:
– **Setting** page tab
– **Cluster** page tab.

Scroll and select the desired display language in the **Cluster Language** box.

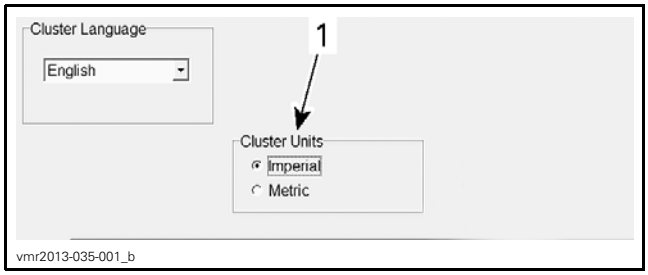


TYPICAL
1. Cluster Language box

Units of Display Selection

In B.U.D.S., select the:
– **Setting** page tab
– **Cluster** page tab.

Select **Imperial** or **Metric** in the **Cluster Units** box.



TYPICAL
1. Cluster Units box

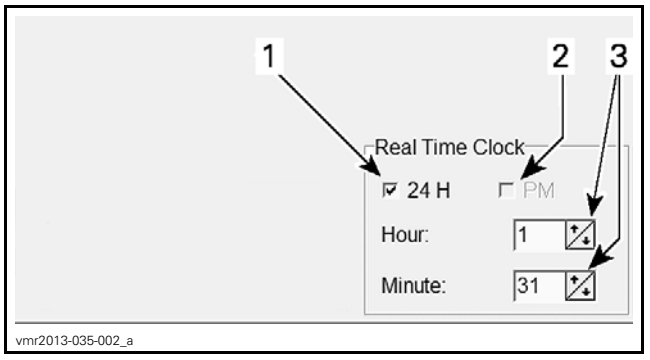
Clock Setting

In B.U.D.S., select the:
– **Setting** page tab
– **Cluster** page tab.

To set clock to the 24-hour format, check the **24 H** box. To set it to the 12-hour format, leave the box empty.

If 12-hour format was selected, check the **PM** box if required.

Set hour and minutes using the up or down arrows.



TYPICAL
1. 24 H box
2. PM box
3. Arrows

Multifunction Gauge Test Using B.U.D.S.

Connect to the latest applicable B.U.D.S. software version. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

Wow Test

This function is used to check if the indicator lights, display and analog indicators (if applicable) are functional.

NOTE: This function does not test the signals or external circuits.

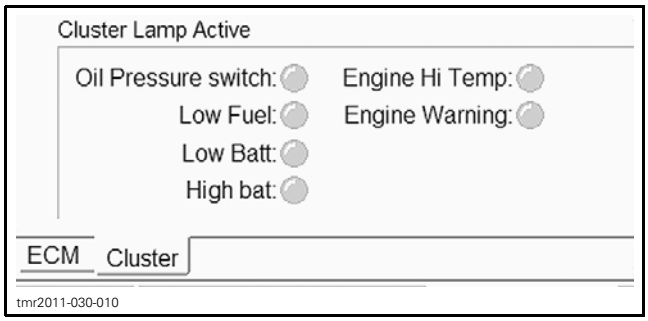
In B.U.D.S., select the:
– **Activation** page
– **Cluster** tab.

Click on the **WOW Test** button.

Indicator Lights Monitoring

In B.U.D.S., select the:
– **Monitoring** page
– **Cluster** tab.

Use the **Cluster Lamp Active** box to monitor different indicator lights outputs.



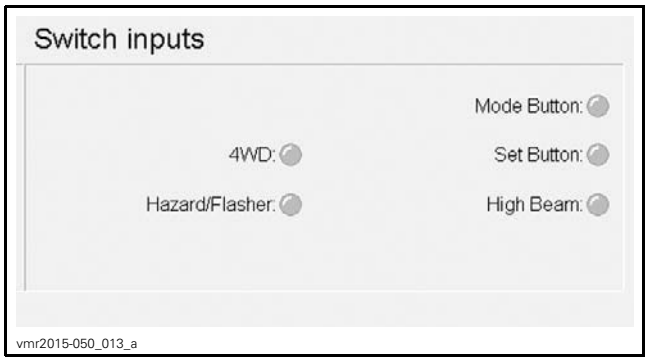
TYPICAL - CLUSTER LAMP ACTIVE BOX

This function confirms that the signals are broadcasting and the indicator lights should be ON in the multifunction gauge.

Switch Input Monitoring

In B.U.D.S., select the:
– **Monitoring** page
– **Cluster** tab.

Use the **Switch Inputs** box to monitor different switch inputs as you activates the switches.



TYPICAL - SWITCH INPUTS BOX

This function confirms that the ECM receives the inputs.

Vehicle Parameters Monitoring

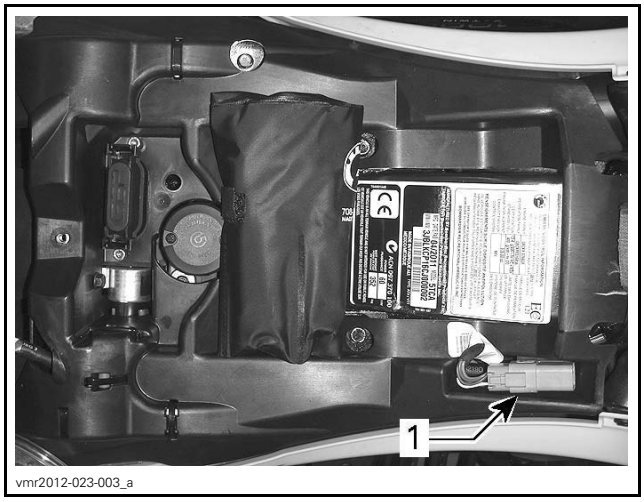
In B.U.D.S., select the:
– **Monitoring** page
– **Cluster** tab.

In the upper area of the B.U.D.S. cluster page, the following indications are displayed.
– Engine speed (RPM)
– Vehicle speed
– Fuel level
– Gear position.

These indications confirm that the applicable signals are transmitted and the information should be displayed in the multifunction gauge.

Multifunction Gauge CAN Resistor Test

1. Disconnect DPS1 connector (control) from the DPS module, refer to *STEERING SYSTEM* subsection.
2. Remove seat to access diagnostic link connector (DB).
3. Remove diagnostic link connector from its holder.



1. Diagnostic link connector (DB)

4. Measure the resistance of the CAN resistors as follows.

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

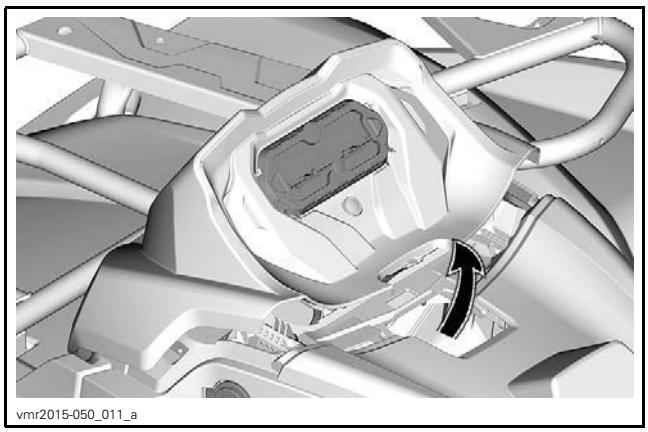
CAN RESISTOR TEST	
DIAGNOSTIC LINK CONNECTOR	RESISTANCE
Pins 1 and 2	Approximately 60 Ω

NOTE: This tests both the ECM and the Cluster CAN resistors and wires.

TEST RESULT	
READING	POSSIBLE CAUSE
Approximately 60 Ω	ECM and CLUSTER CAN wires and resistors good
Approximately 120 Ω	CAN wire to CLUSTER open CAN wire to ECM open CLUSTER CAN resistor open ECM CAN resistor open
Infinite (open circuit)	CAN wire to DB connector open circuit

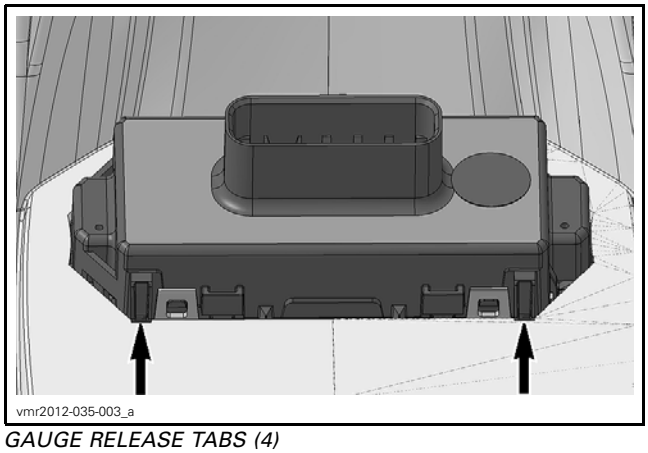
Gauge Support Removal

The gauge is clipped in place. Gently pull upwards and disconnect electrical connectors.


vmr2015-050_011_a

Multifunction Gauge Removal

1. Pull gauge support from vehicle.
2. From the back of the gauge support, release the gauge retaining tabs and remove the gauge from its support.


vmr2012-035-003_a

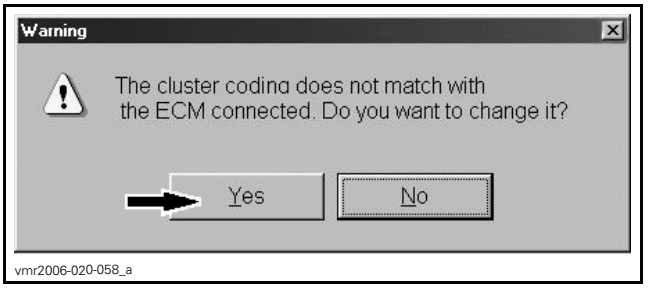
GAUGE RELEASE TABS (4)

Multifunction Gauge Installation

For the installation, reverse the removal procedure.

New Multifunction Gauge Registration (coding)

Whenever the multifunction gauge is replaced, B.U.D.S. must be used to register it in the ECM. Simply click **Yes** when the following message appears.



vmr2006-020-058_a

IMPORTANT: If a multifunction gauge from another vehicle model is installed and is not registered in the ECM through B.U.D.S., **engine starting will not be allowed until the gauge is registered with the proper coding**.

12 VOLT POWER OUTLET

12 Volt Power Outlet Removal and Installation

Refer to *BODY* subsection and remove the RH inner fender panel.

Unplug the connectors of the power outlet.

Unscrew the retaining nut.

Reverse procedure for installation.

12 Volt Power Outlet Wire Identification

FUNCTION	PIN	COLOR
12 volt input from fuse F12	2	RD/BK
Ground	1	BK

12 Volt Power Outlet Circuit Protection

CONDITION	CIRCUIT PROTECTION
Supplied when R2 and R3 are activated	Fuse 12 of fuse block 1 (from accessories relay R3)

HEADLIGHTS

Headlight Wire Identification

ACCESSORY RELAY (R3)		
FUNCTION	PIN	COLOR
12 volt input from fuse F3	E12	RD/GN
12 volt input from F4 (relay winding input)	E10	OR/GN
12 volt output to ignition switch (F12)	D10	RD/YE before F12 and RD/BK after F12
Relay winding ground (from ECM K2)	D12	OR/BK

HEADLIGHT LOW/HIGH BEAM SWITCH		
FUNCTION	PIN	COLOR
12 volt input from ignition switch	MG2-4	RD/BU
12 volt output to high beam headlights	MG2-5	BU
12 volt output to low beam headlights	MG2-2	GN

Headlights Circuit Protection

CONDITION	CIRCUIT PROTECTION
Supplied when R2 and R3 are activated	Fuse 12 of fuse block 1 (from fuse 3 of fuse block 2)

Headlight Test

1. Disconnect LOW beam and HIGH beam headlight connectors. Refer to *BULB REPLACEMENT*.
2. Set ignition switch to ON (with lights).
3. Measure the voltage on headlight connector as follows.

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

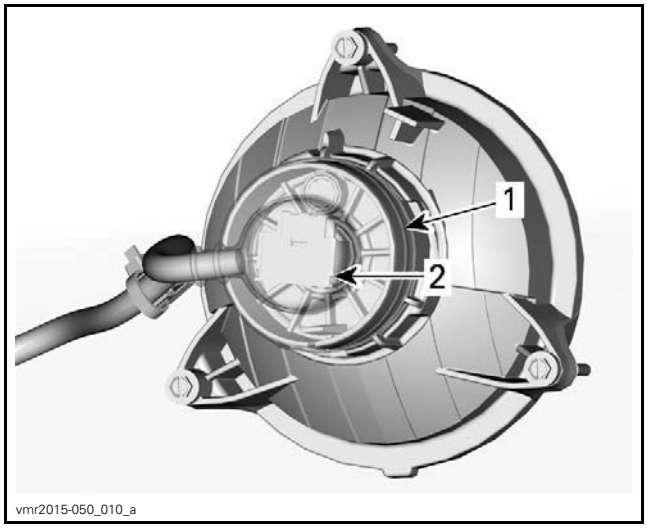
4. Measure the voltage on headlight connector as follows.

SWITCH POSITION	WIRE COLOR		VOLTAGE
LO beam	GREEN (Low beam connector)	BLACK	Battery voltage
HI beam			No voltage
Lo beam	BLUE (Hi beam connector)		
HI beam			Battery voltage

Headlight Bulb Replacement

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. Remove cover.
2. Unplug connector.
3. Remove bulb.



1. Cover
2. Connector

4. Properly reinstall removed parts in the reverse order of their removal.
5. Validate headlight operation.

Headlamp Beam Aiming

NOTE: Load vehicle as per normal use.

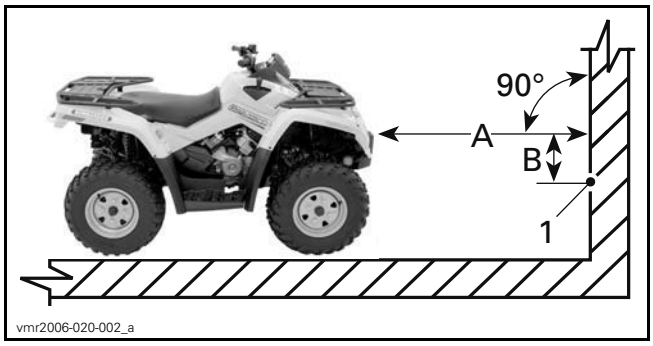
1. Position vehicle on a level surface 5 m (16 ft) in front of a test surface (wall or screen) as in first illustration.
2. Measure the distance from the center of each headlight to the ground (high beam and low beam).

3. Trace a line on the test surface parallel to the ground at each measured height (one for high beam and one for low beam).

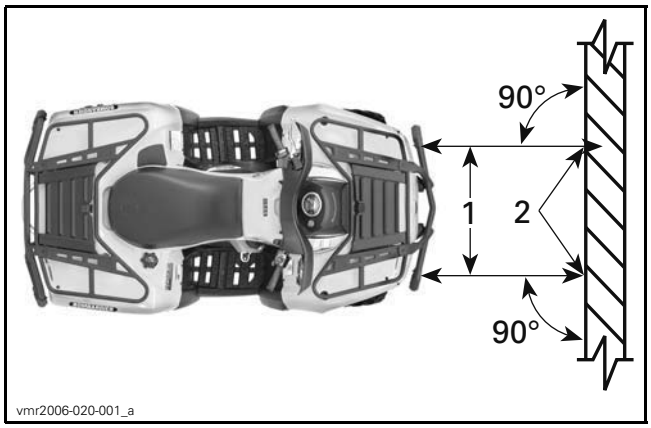
Low beam aiming is correct when the crest of the low beam is **below** the applicable horizontal center line traced on the test surface as per specification.

High beam aiming is correct when the center of the high beam (focus point) is **below** the applicable horizontal center line traced on the test surface as per specification.

SPECIFICATION	
Low beam crest (top of low beam)	25 mm to 125 mm (1 in to 5 in) **below** applicable line
High beam center (focus point)	



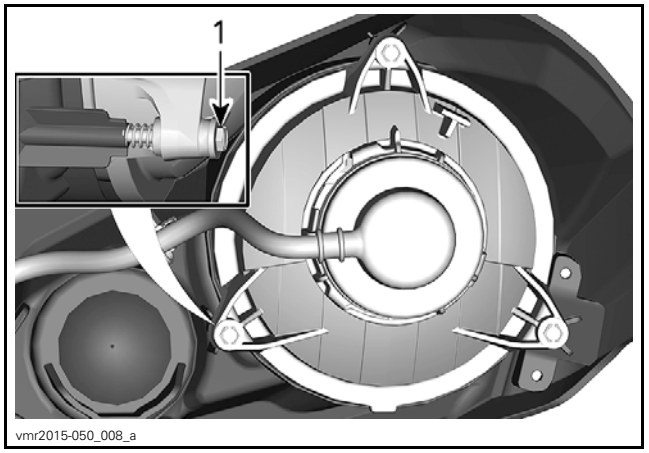
TYPICAL
1. Light beam center
A. 5 m (17 ft)
B. Beam aiming specification



TYPICAL
1. Headlight center lines
2. Light beam center

Beam Aiming Adjustment

Turn adjustment knobs to adjust beam height and side orientation to specification.



LOW BEAM
1. Adjustment knobs

TAILLIGHTS/BRAKE LIGHTS

Brake Light Switch

For brake light switch location and testing, refer to *BRAKES* subsection.

Brake Light Wire Identification

BRAKE LIGHT RELAY (R8)		
FUNCTION	PIN	COLOR
12 volt input from fuse F4 (brake light power)	C8	OR/GN
12 volt input from F4 (relay winding input)	D8	OR/GN
12 volt output to brake light	D9	WH/OR
Relay winding ground (from brake light switch(es))	C9	RD/OR

Brake Light Circuit Protection

CONDITION	CIRCUIT PROTECTION
Supplied when: Main relay R2 activated Brake relay R8 activated	Fuse 4 of fuse block 1 (from main relay R2)

Taillight Wire Identification

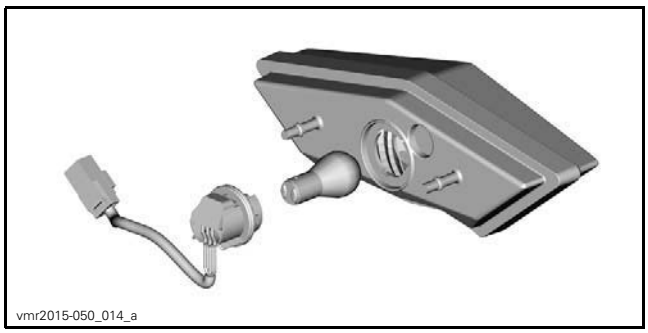
FUNCTION	PIN	COLOR
Supplied when main relay R2 activated	2	OR/GN
Ground from BN1	3	BLACK

Taillight Circuit Protection

CONDITION	CIRCUIT PROTECTION
Supplied when main relay R2 activated	Fuse 4 of fuse block 1 (from main relay R2)

Taillight/Brake Light Bulb Replacement

1. Unplug connector from bulb.
2. Rotate light bulb counterclockwise to remove it from taillight.



3. Remove bulb socket from taillight.

Installation is the reverse of the removal procedure.

TURN SIGNALS/HAZARD (CE MODELS ONLY)

Turn Signal/Hazard Lights Wire Identification

FLASHER MODULE		
FUNCTION	PIN	COLOR
12 volt input from fuse F8	MC2-1	BE
12 volt input from R3	MC1-5	RD/BK
RH turn 12 volt input from turn signal switch	MC1-1	BE/BR
LH turn 12 volt input from turn signal switch	MC1-2	BE/GY
Output to RH turn signal lights	MC2-2	BR
Output to LH turn signal lights	MC2-3	GY

FLASHER MODULE		
FUNCTION	PIN	COLOR
Output to multifunction gauge (turn signal indicator)	MC2-4	OR
Ground	MC1-4	BK
Hazard 12 volt input from hazard switch	MC1-6	BE/RD

TURN SIGNAL SWITCH (IN MULTIFUNCTION SWITCH)		
FUNCTION	PIN	COLOR
12 volt input from fuse F8	MG3-3	BE
RH turn 12 volt output to flasher module	MG3-1	BE/BR
LH turn 12 volt output to flasher module	MG3-2	BE/GY

HAZARD SWITCH		
FUNCTION	PIN	COLOR
12 volt input from fuse F8	MG3-3	BE
12 volt output to flasher module	MG3-5	BE/RD
12 volt output to hazard pilot lamp		

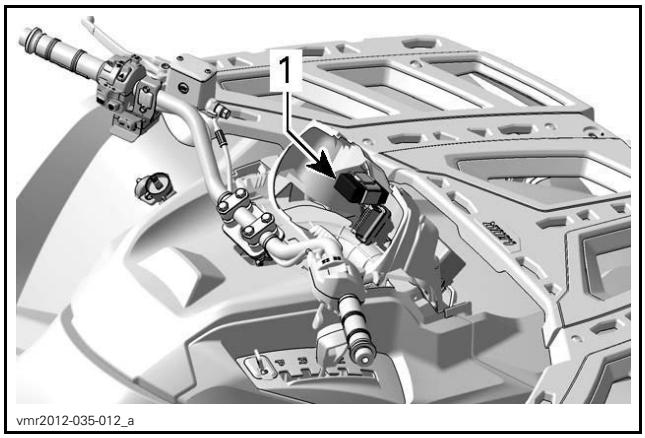
Turn Signal/Hazard Circuit Protection

TURN SIGNAL CIRCUIT	
CONDITION	CIRCUIT PROTECTION
Supplied when R2 and R3 are activated	Fuse 12 of fuse block 1 (from accessory relay R3)
Battery power (continuous)	Fuse 8 of fuse block 1

HAZARD CIRCUIT	
CONDITION	CIRCUIT PROTECTION
Battery power (continuous)	Fuse 8 of fuse block 1

Flasher Module Access

Remove multifunction gauge.



1. Flasher module location

HORN (CE MODELS ONLY)

Horn Wire Identification

HORN SWITCH (IN MULTIFUNCTION SWITCH)		
FUNCTION	PIN	COLOR
12 volt input from fuse F8	MG3-3	BE
12 volt output to horn	MG3-4	BE/BK

HORN		
FUNCTION	PIN	COLOR
12 volt input from horn switch	2	BE/BK
Ground	1	BLACK

Horn Circuit Protection

CONDITION	CIRCUIT PROTECTION
Battery power (continuous)	Fuse 8 of fuse block 1

FRONT DRIVE (450)

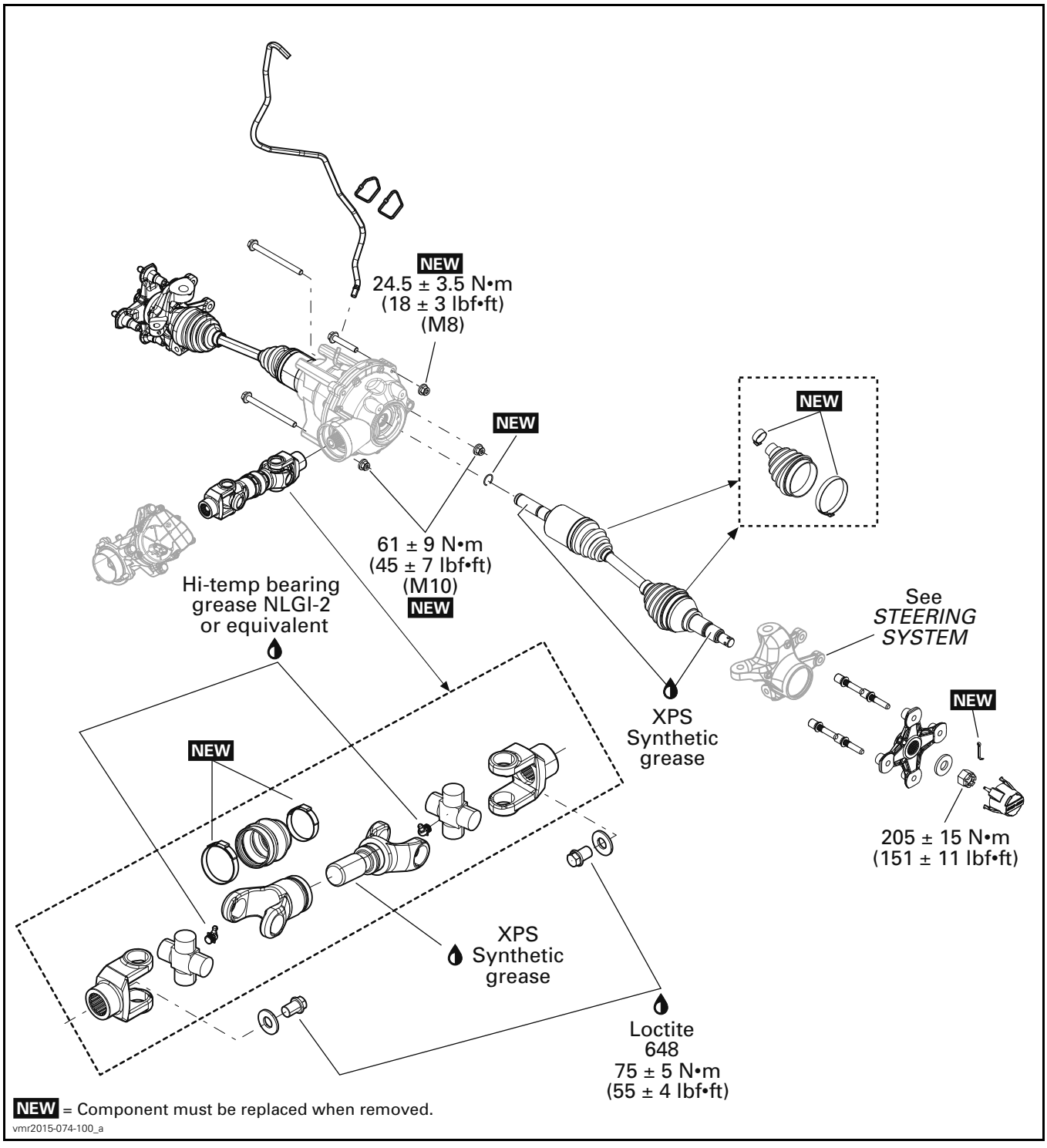
SERVICE TOOLS

Description	Part Number	Page
BACKLASH MEASUREMENT TOOL	529 035 665	589
CV BOOT CLAMP PLIER	529 036 120	587
CV JOINT EXTRACTOR	529 036 005	587
SPANNER SOCKET	529 035 649	591

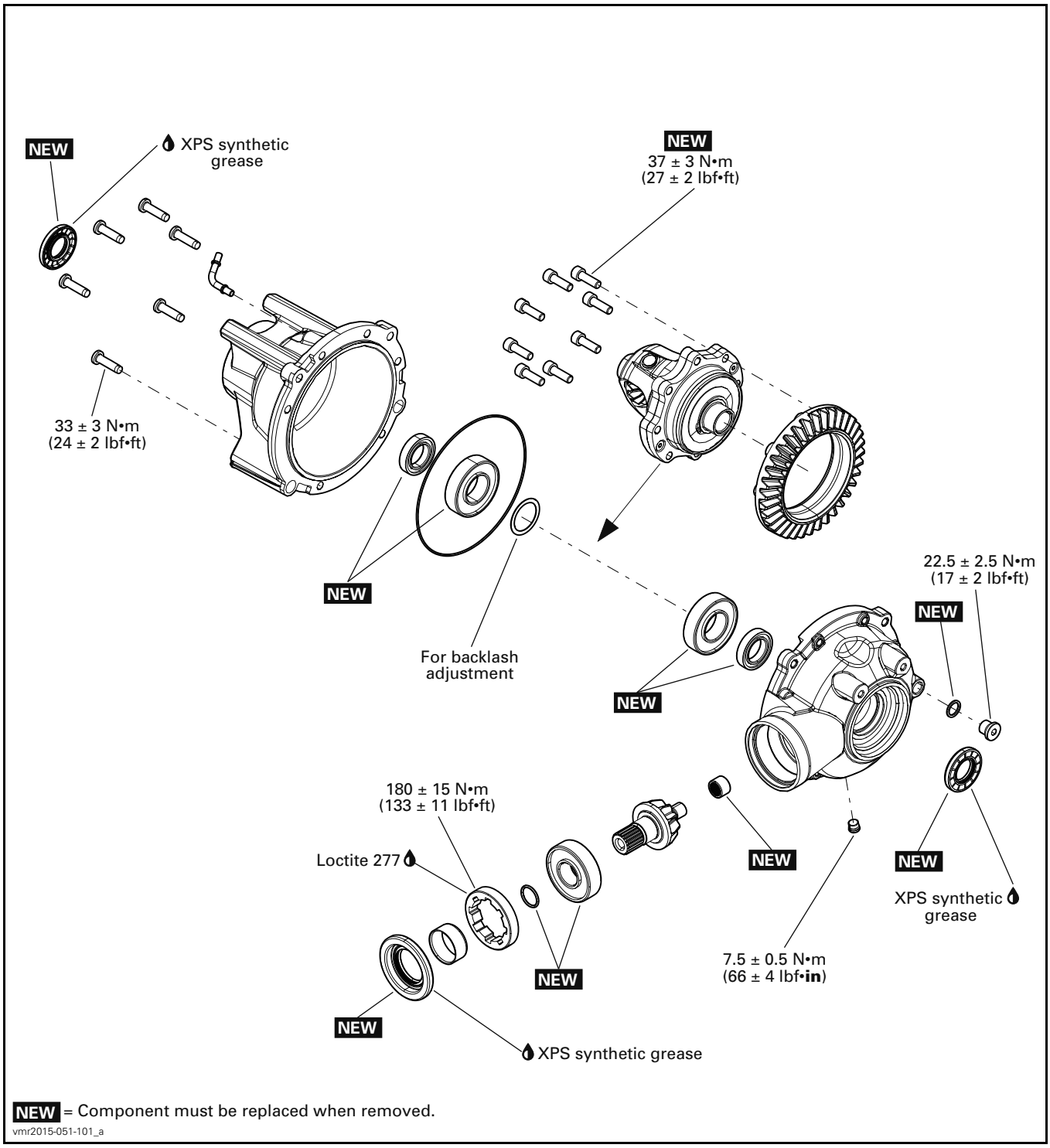
SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 277	293 800 073	593
LOCTITE 648 (GREEN)	413 711 400	594
XPS SYNTHETIC GREASE	293 550 010	587, 593–594

FRONT DRIVE SHAFTS AND FRONT PROPELLER SHAFT



FRONT DIFFERENTIAL



NEW = Component must be replaced when removed.

vmr2015-051-101_a

GENERAL

The procedure explained below is the same for the RH and LH sides unless otherwise instructed.

SYSTEM DESCRIPTION

The Visco-Lok® system constantly monitors front wheel speed and, if it detects one wheel spinning faster than its mate, it progressively sends more power to the wheel with the better traction.

The Visco-Lok system is comprised of two principal components, a shear pump and the controlled multi-plate clutch.

A unique feature of the shear pump is that it is self-contained and independent. It does not require an external source of hydraulic fluid. The self-contained viscous shear pump generates a pressure proportional to wheel speed differential - meaning the difference in rotational speed between the two wheels. This pressure engages the friction clutch via a piston to transmit the torque.

In the event of a failure, the Visco-Lok carrier/ring gear and pinion gear will have to be replaced.

NOTE: The Visco-Lok shear pump is not serviceable. If the pump is disassembled, the viscous fluid contained inside will be lost and it cannot be replaced.

PROCEDURES

WHEEL HUB

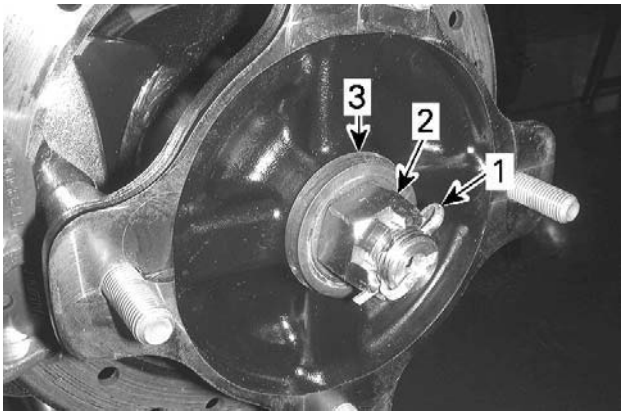
Wheel Hub Removal

Lift and support vehicle.

Select the 4WD position and place the transmission lever on "P".

Remove caliper from knuckle. Refer to *BRAKES* subsection.

Remove the following parts:
- Wheel cap
- Cotter pin
- Castellated nut
- Belleville washer.



tmr2011-032-003_a

TYPICAL
1. *Cotter pin*
2. *Castellated nut*
3. *Belleville washer*

Remove wheel hub.

Wheel Hub Inspection

Check wheel hub for cracks or other damages.

Check inner splines for wear or other damages.

If any damage is detected on wheel hub, replace it with a new one.

Wheel Hub Installation

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

Install Belleville washer with its convex side outwards.

Tighten castellated nut to specification.

TIGHTENING TORQUE	
Castellated nut	205 N•m ± 15 N•m (151 lbf•ft ± 11 lbf•ft)

NOTE: Tighten further castellated nut if required to align grooves with drive shaft hole.

Install a NEW cotter pin.


tmr2011-032-005

FRONT DRIVE SHAFT

Front Drive Shaft Removal

Lift and support vehicle.

Remove inner fender panel(s). Refer to *BODY* subsection.

Remove the *KNUCKLE*. Refer to *STEERING SYSTEM* subsection.

Remove shock absorber lower bolt.

Lift and attach the following parts to make room.

– Shock absorber
– Upper suspension arm.

Strongly pull drive shaft out of differential.


vmr2012-036-002_a

PULL DRIVE SHAFT

Discard the stop ring at the end of the shaft.

Front Drive Shaft Inspection

Inspect the condition of boots. If there is any damage or evidence of leaking lubricant, replace them. Refer to *DRIVE SHAFT BOOT* in this subsection.

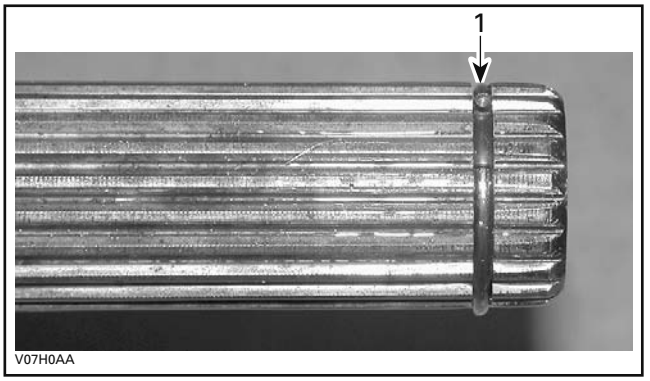
Check splines for excessive wear. Replace if necessary.

NOTE: If the splines on plunging joint are worn, a check of differential inner splines should be done.

Front Drive Shaft Installation

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

Install a NEW stop ring.



TYPICAL
1. Stop ring

Apply XPS SYNTHETIC GREASE (P/N 293 550 010) on the splines.

Ensure that wear ring is close to the differential.

DRIVE SHAFT BOOT

Drive Shaft Boot Removal

Remove *FRONT DRIVE SHAFT*. See procedure in this subsection.

Remove drive shaft boot clamps.

REQUIRED TOOL
CV BOOT CLAMP PLIER (P/N 529 036 120)


529036120

Dislodge the large end of the boot.

Separate the joint from the shaft. Two procedures can be done.

Without the Special Tool

Clamp joint housing in a vise.

Align shaft with joint.

Pull hard on shaft to remove from joint.

Remove boot from drive shaft.

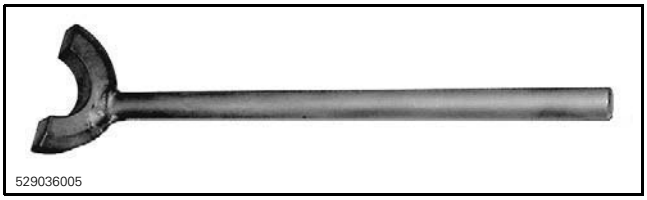
Remove and discard the circlip. A new one is included in the boot kit.

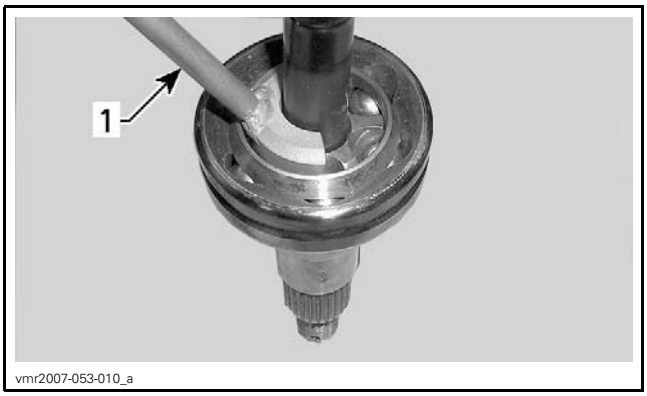
With the Special Tool

Place drive shaft in vice with the joint downward.

Install the tool on bearing.

REQUIRED TOOL
CV JOINT EXTRACTOR (P/N 529 036 005)


529036005



vmr2007-053-010_a

TYPICAL — CV JOINT SHOWN
1. Joint extractor tool

With an hammer, hit on the tool to separate joint from shaft.

When joint and shaft are separated, remove boot from drive shaft.

Remove and discard the circlip. A new one is included in the boot kit.

Drive Shaft Boot Installation

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

Install the NEW circlip.

Pack bearing area with grease (included with the new boot kit).

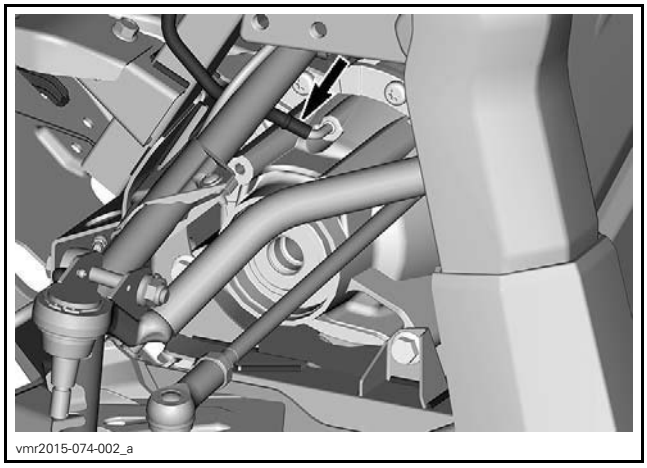
NOTE: Do not use or add other grease.

Install NEW drive shaft boot clamps.

FRONT DIFFERENTIAL

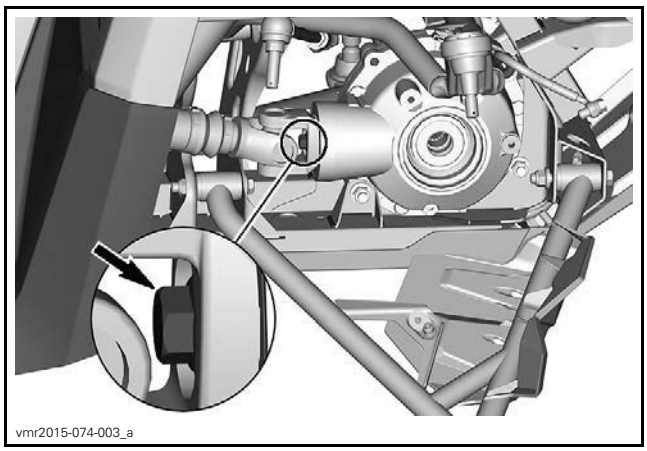
Front Differential Removal

1. Drain front differential. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
2. Remove both front drive shafts. Refer to *FRONT DRIVE SHAFT* in this subsection.
3. Detach vent hose from front differential.


vmr2015-074-002_a

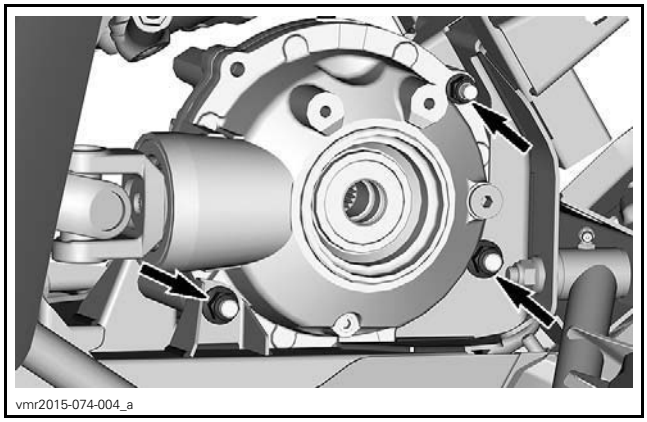
FROM LH SIDE

4. Remove screw securing the propeller shaft to the front differential.

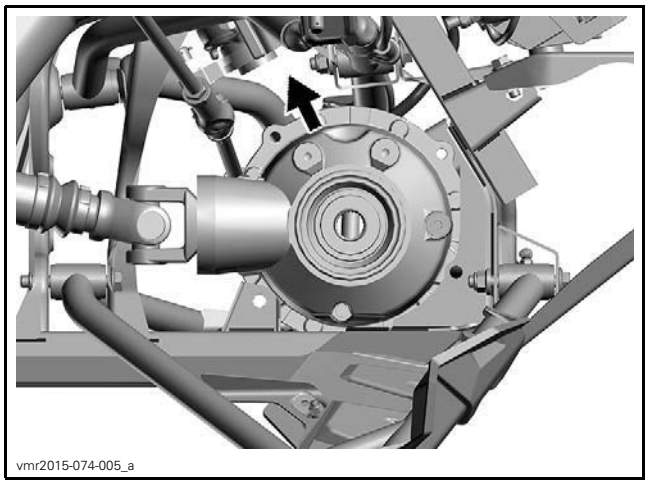

vmr2015-074-003_a

NOTE: Heat screw to break the threadlocker bond prior to removal.

5. Remove screws securing front differential to frame.


vmr2015-074-004_a

6. Move differential upward and rearward, and pull it out of the frame from the RH side.


vmr2015-074-005_a

NOTICE Be careful not to knock or to bend vent hose fitting while removing front differential.

Front Differential Inspection (Assembled)

Manually turn the pinion gear; it should turn smoothly. Repair if necessary.

Check if oil seals are brittle, hard or damaged. Replace if necessary.

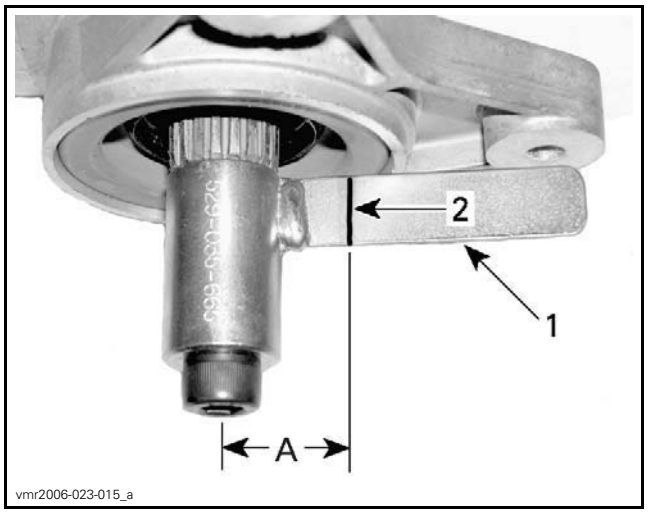
Backlash Inspection

When measuring backlash, the differential cover should be upside down to pull the ring gear out of mesh.

Using a dial indicator and the BACKLASH MEASUREMENT TOOL (P/N 529 035 665), measure the backlash.

Place the backlash measurement tool at the end of pinion gear.

From center of tool bolt, measure 25.4 mm (1 in) and scribe a mark on the tab.

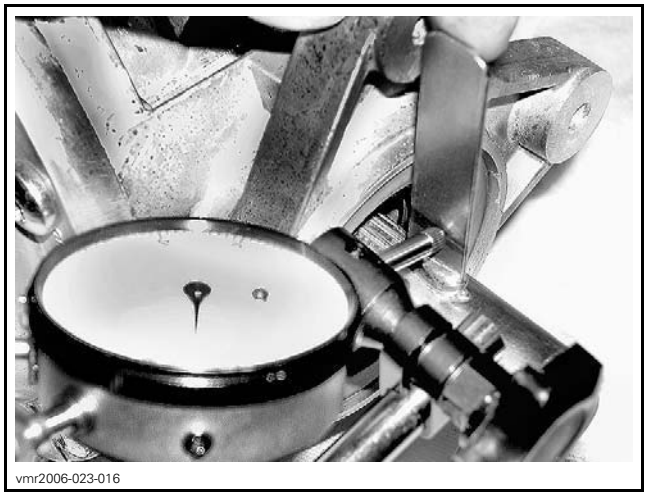


vmr2006-023-015_a

1. Tab of backlash measurement tool
2. Mark on tab
A. 25.4 mm (1 in)

Position the dial indicator tip against the tab at a 90° angle and right on the previously scribed mark.

Gently, move the tool tab back and forth. Note the backlash result.


vmr2006-023-016

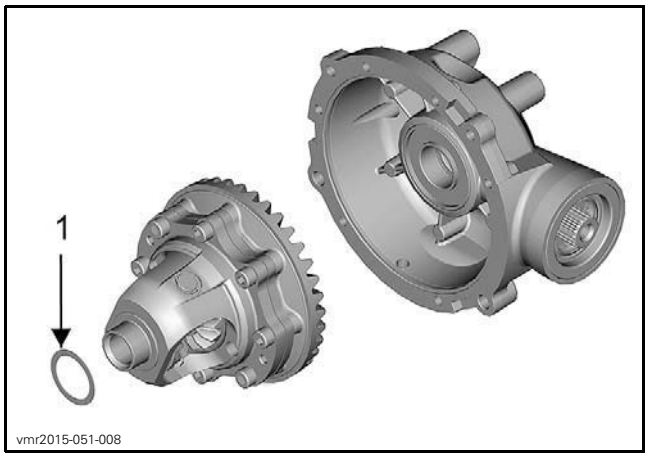
Rotate pinion gear 1/2 turn and recheck backlash. Note the result.

Rotate pinion gear 1 turn and recheck backlash.

BACKLASH SPECIFICATION
0.1 mm (.004 in) to 0.25 mm (.01 in)

If backlash is out of specification, split final drive housing and adjust shim thickness as per following guideline.

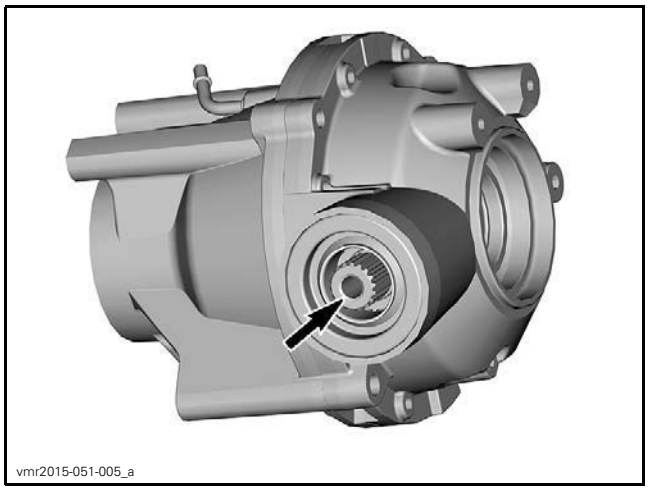
BACKLASH ADJUSTMENT GUIDELINE	
BACKLASH MEASUREMENT	WHAT TO DO
Below 0.1 mm (.004 in)	Remove shim(s) and recheck backlash
Above 0.25 mm (.01 in)	Add shim(s) and recheck backlash



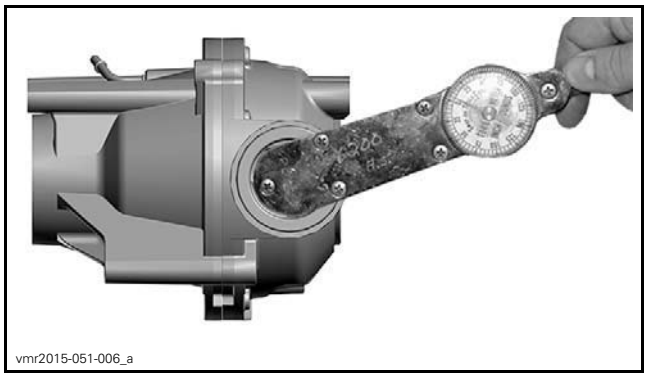
1. Backlash shim

Preload Inspection

Screw the propeller shaft screw in pinion gear.



Using a needle torque wrench, measure the preload.



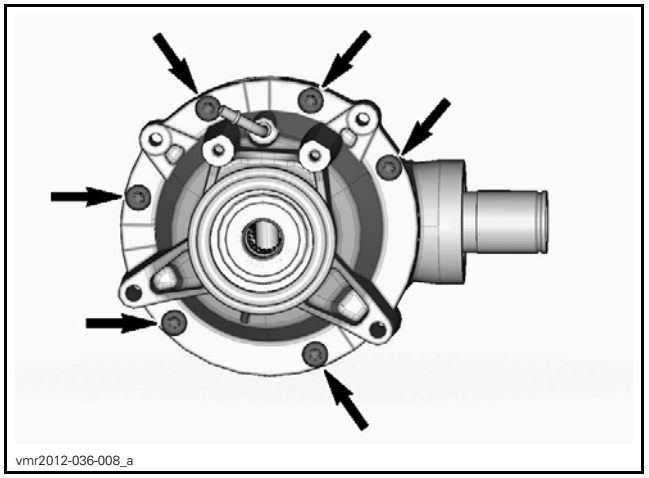
PRELOAD SPECIFICATION
Maximum 0.50 N•m (4 lbf•**in**)

If preload is out of specification, split front differential housing and check all bearings conditions.

Front Differential Disassembly

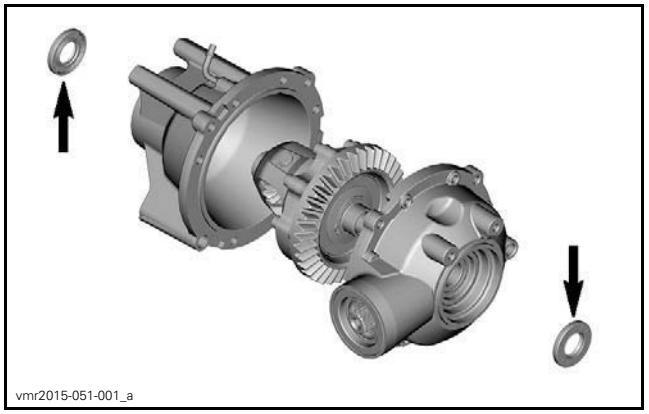
Differential Housing

Remove front differential housing screws.



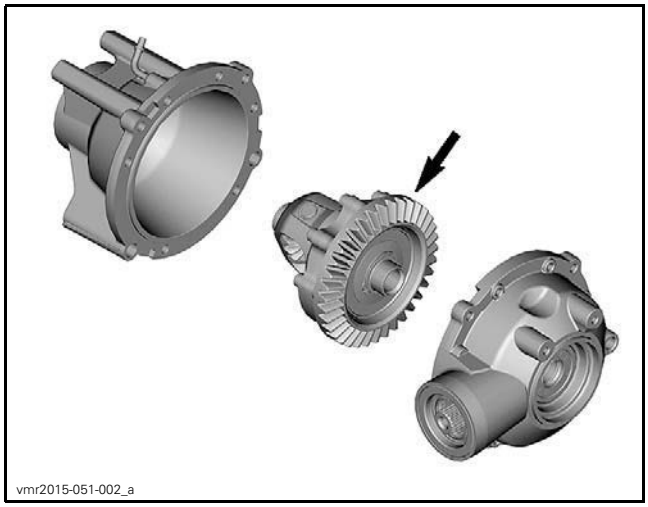
Separate half housings.

Remove oil seals.

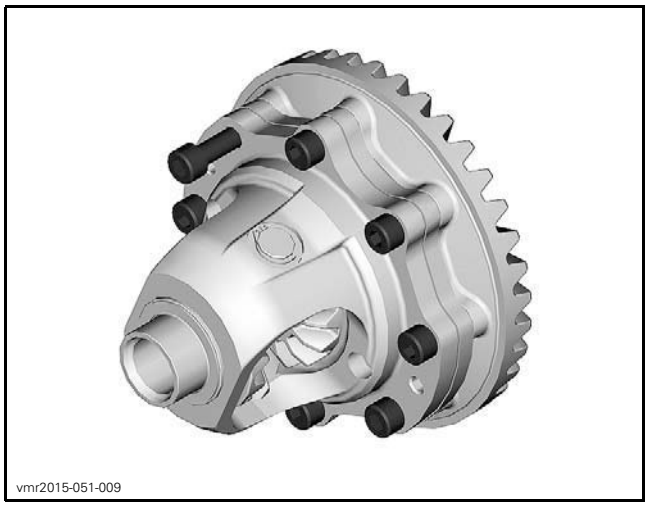


Visco-Lok Carrier/Ring Gear

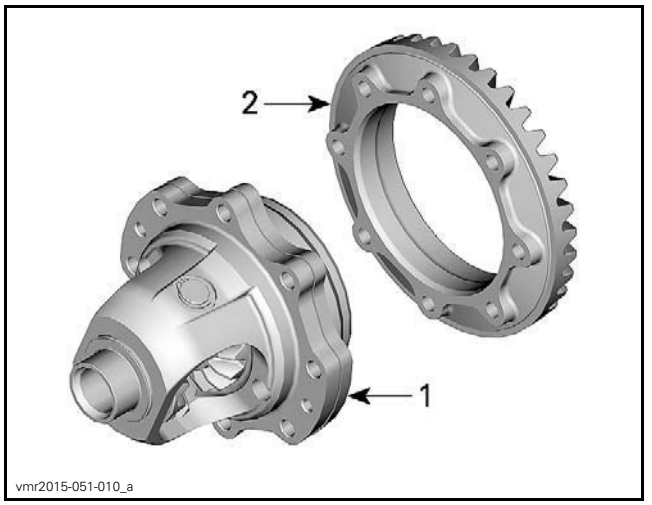
Remove Visco-Lok carrier/ring gear out of half housing.


vmr2015-051-002_a

Remove screws securing ring gear to Visco-Lok unit.


vmr2015-051-009

Separate ring gear from Visco-Lok unit.

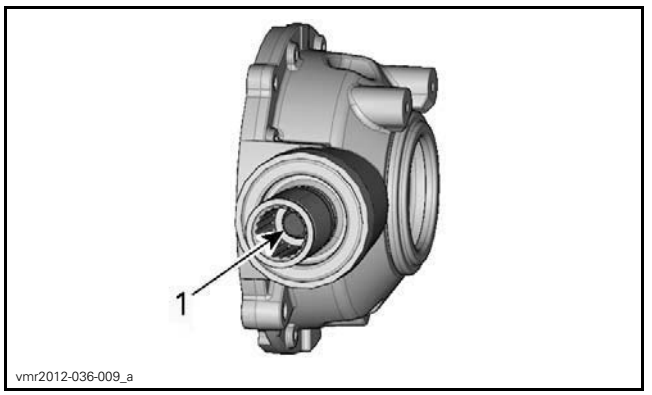


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1. Visco-Lok unit
2. Ring gear

Pinion Gear

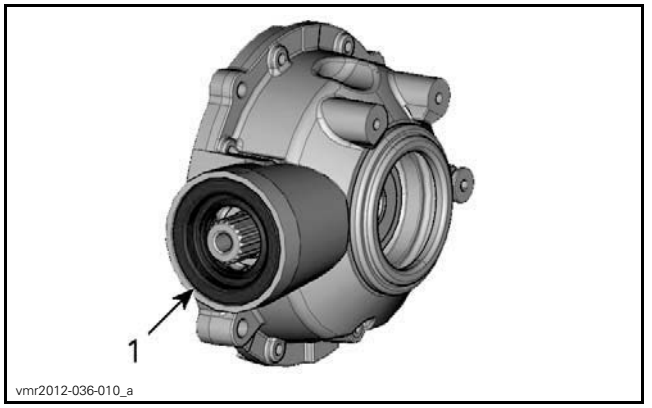
Remove screw retaining front propeller shaft adapter.



vmr2012-036-009_a

1. Retaining screw

Remove and discard oil seal.



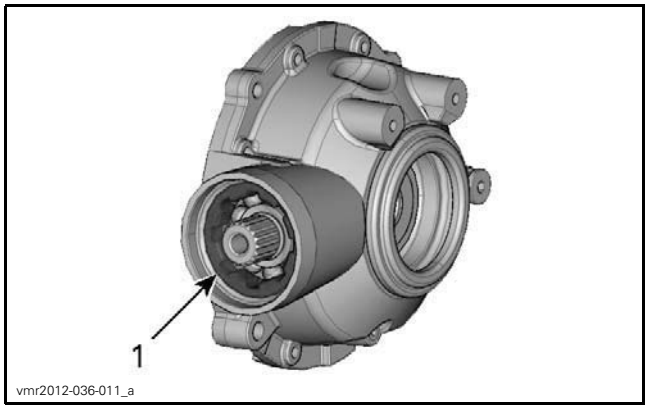
vmr2012-036-010_a

1. Oil seal

Unscrew the pinion nut.

REQUIRED TOOL
SPANNER SOCKET (P/N 529 035 649)

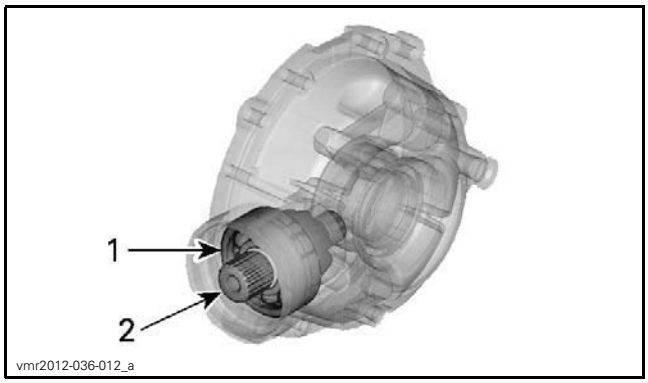




1. Pinion nut

Remove bearing and pinion gear together.

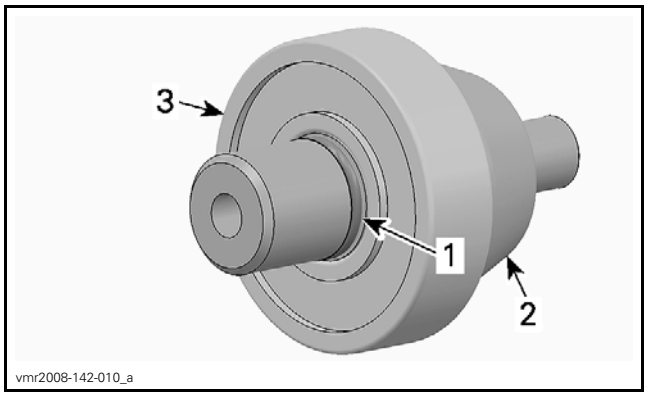
RECOMMENDED TOOLS	QTY
Pipe: 78 mm (3-1/16 in) diameter x 127 mm (5 in) in length	1
Threaded rod: M10 x 1.25, 178 mm (7 in) length	1
M10 x 1.25 nut	3
Flat bar	1



1. Bearing
2. Pinion gear

Remove and discard O-ring.

Remove bearing from pinion gear.



1. O-ring
2. Pinion gear
3. Bearing

Remove and discard the needle bearing.

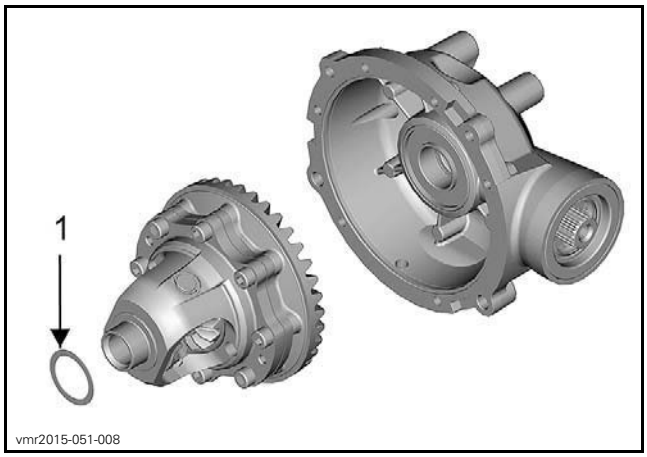
Front Differential Assembly

Adjustment is required when any of the following part is changed.

– Pinion gear
– Ring gear
– Viscolok unit
– Housing.

As a preliminary setup, install shim according to the following table.

RECOMMENDED SHIM THICKNESS	
BACKLASH	0.5 mm (.02 in) (as a preliminary adjustment)



1. Backlash shim

Prior to finalizing assembly, proceed in this order:

– Temporarily assemble final drive using recommended torques.
– Do not apply thread locker product.
– Do not install a new pinion nut.
– Check backlash.
– Check preload.

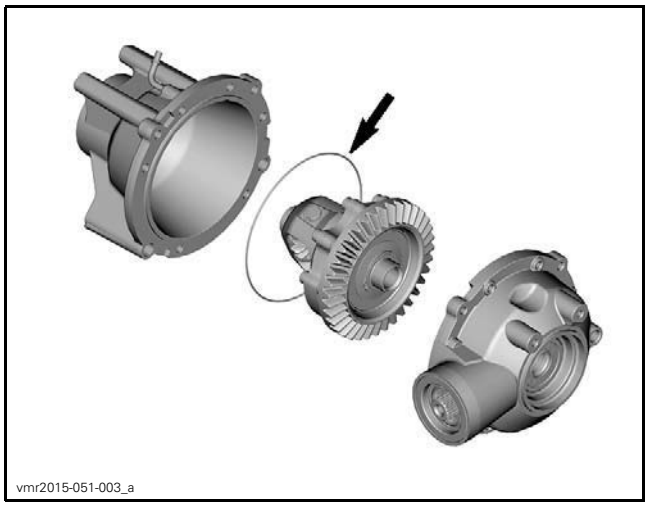
Visco-Lok Carrier/Ring Gear

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

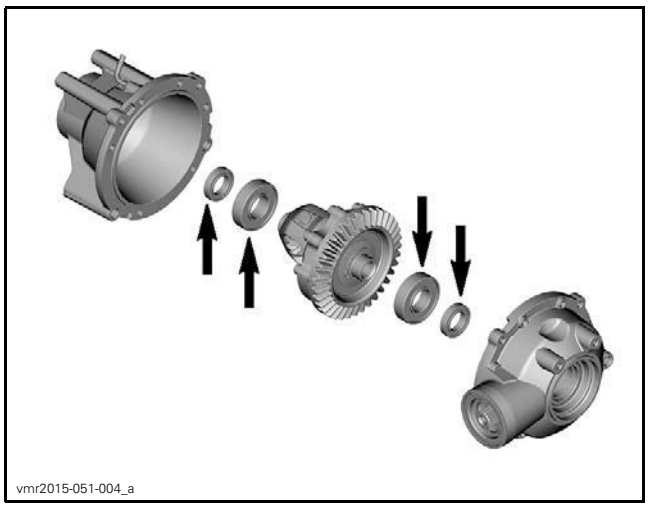
Tighten Visco-Lok / ring gear screws to specification.

TIGHTENING TORQUE	
Visco-Lok / ring gear screws	37 N•m ± 3 N•m (27 lbf•ft ± 2 lbf•ft)

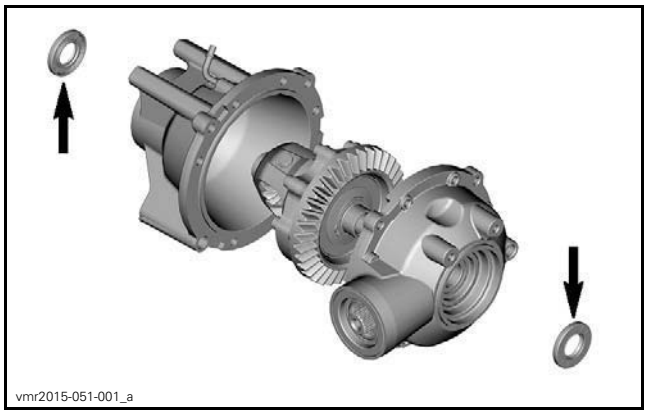
Check condition of seal. Replace if damaged.


vmr2015-051-003_a

Check bearings. Replace with **NEW** bearings if necessary.


vmr2015-051-004_a

Apply XPS SYNTHETIC GREASE (P/N 293 550 010) on **NEW** oil seals and install.


vmr2015-051-001_a

Tighten differential housing screws to specification.

TIGHTENING TORQUE	
Differential housing screws	23.5 N•m ± 3.5 N•m (17 lbf•ft ± 3 lbf•ft)

Pinion Gear

Install a **NEW** ball bearing.

Install a **NEW** O-ring.

Install a **NEW** needle bearing.

Apply LOCTITE 277 (P/N 293 800 073) to pinion nut.

Install and tighten the pinion nut to specification.

TIGHTENING TORQUE	
Pinion nut	180 N•m ± 15 N•m (133 lbf•ft ± 11 lbf•ft) + LOCTITE 277 (P/N 293 800 073)

Apply XPS SYNTHETIC GREASE (P/N 293 550 010) on **NEW** oil seal and install.

Tighten front propeller shaft adapter retaining screw to specification.

TIGHTENING TORQUE	
Front propeller shaft adapter retaining screw	75 N•m ± 5 N•m (55 lbf•ft ± 4 lbf•ft)

Front Differential Installation

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

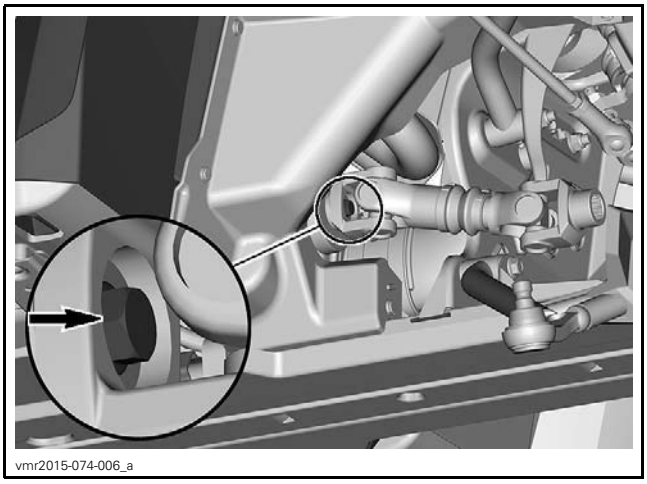
TIGHTENING TORQUE	
M8 nut securing front differential to frame	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)
M10 nuts securing front differential to frame	61 N•m ± 9 N•m (45 lbf•ft ± 7 lbf•ft)

Refill front differential with recommended oil. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

FRONT PROPELLER SHAFT

Front Propeller Shaft Removal

1. Lift and support vehicle.
2. Remove front wheel. Refer to *WHEELS AND TIRES* subsection.
3. Remove inner fender panel(s). Refer to *BODY* subsection.
4. Remove front differential.Refer to *FRONT DIFFERENTIAL REMOVAL* in this subsection.
5. Remove screw securing front propeller shaft to coupling unit.


vmr2015-074-006_a

NOTE: Heat screw to break the threadlocker bond prior to removal.

6. Remove front propeller shaft by pulling it forward.

Front Propeller Shaft Inspection

Inspect if propeller shaft is not bent or twisted.

Check propeller shaft splines for wear or damage.

Check if propeller shaft bellows is pierced or brittle.

Front Propeller Shaft Installation

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

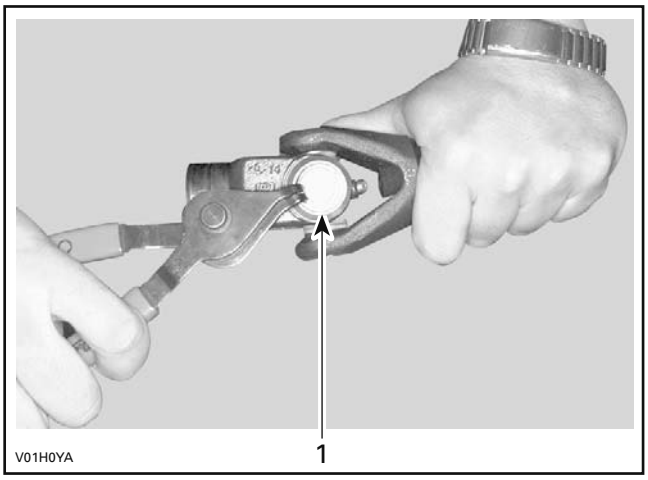
Apply XPS SYNTHETIC GREASE (P/N 293 550 010) on splines.

TIGHTENING TORQUE	
Propeller shaft screws	75 N•m ± 5 N•m (55 lbf•ft ± 4 lbf•ft) + LOCTITE 648 (GREEN) (P/N 413 711 400)

PROPELLER SHAFT U-JOINTS

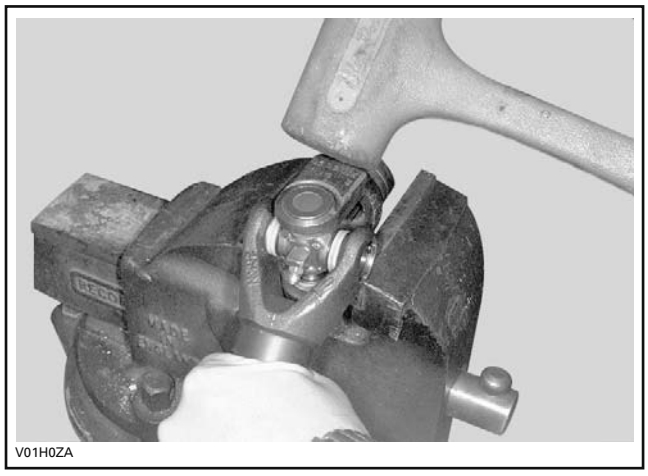
Propeller Shaft U-Joint Removal

Remove internal snap ring from bearing caps.



1. Snap ring

Support inner yoke in vice and drive other yoke down with a soft hammer.



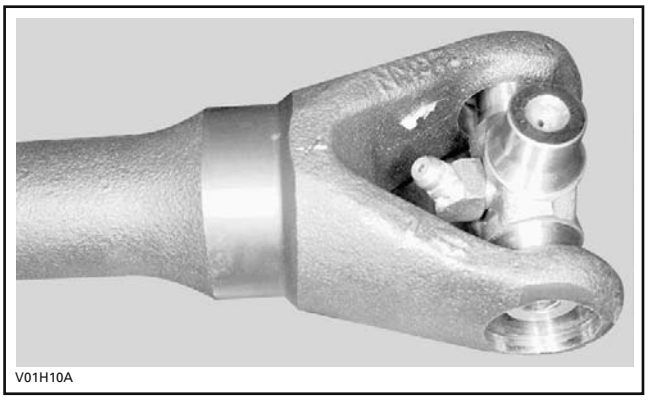
Support U-joint in vice and drive inner yoke down to remove remaining bearing caps.

Remove U-joint cross.

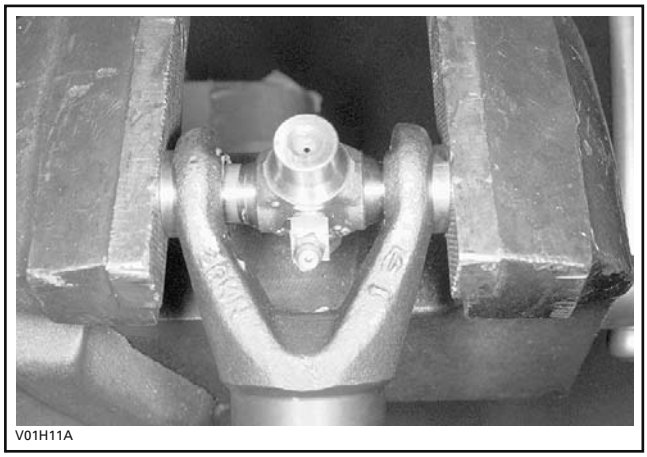
Propeller Shaft U-Joint Installation

Install new U-joint in inner yoke.

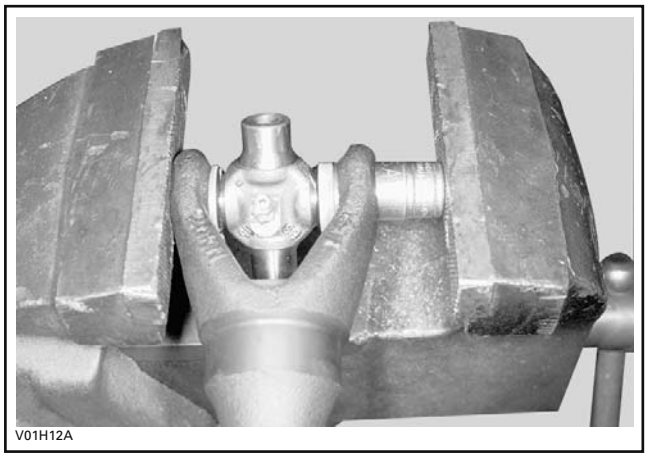
NOTE: Position propeller shaft U-joint as shown for proper grease fitting location.


V01H10A

Install bearing caps. Use a vise to push bearing caps.


V01H11A

Using a suitable pusher, fully seat bearing cap on one side.


V01H12A

Install snap ring.

Complete installation for the other bearing caps.

Grease U-joint. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

REAR DRIVE

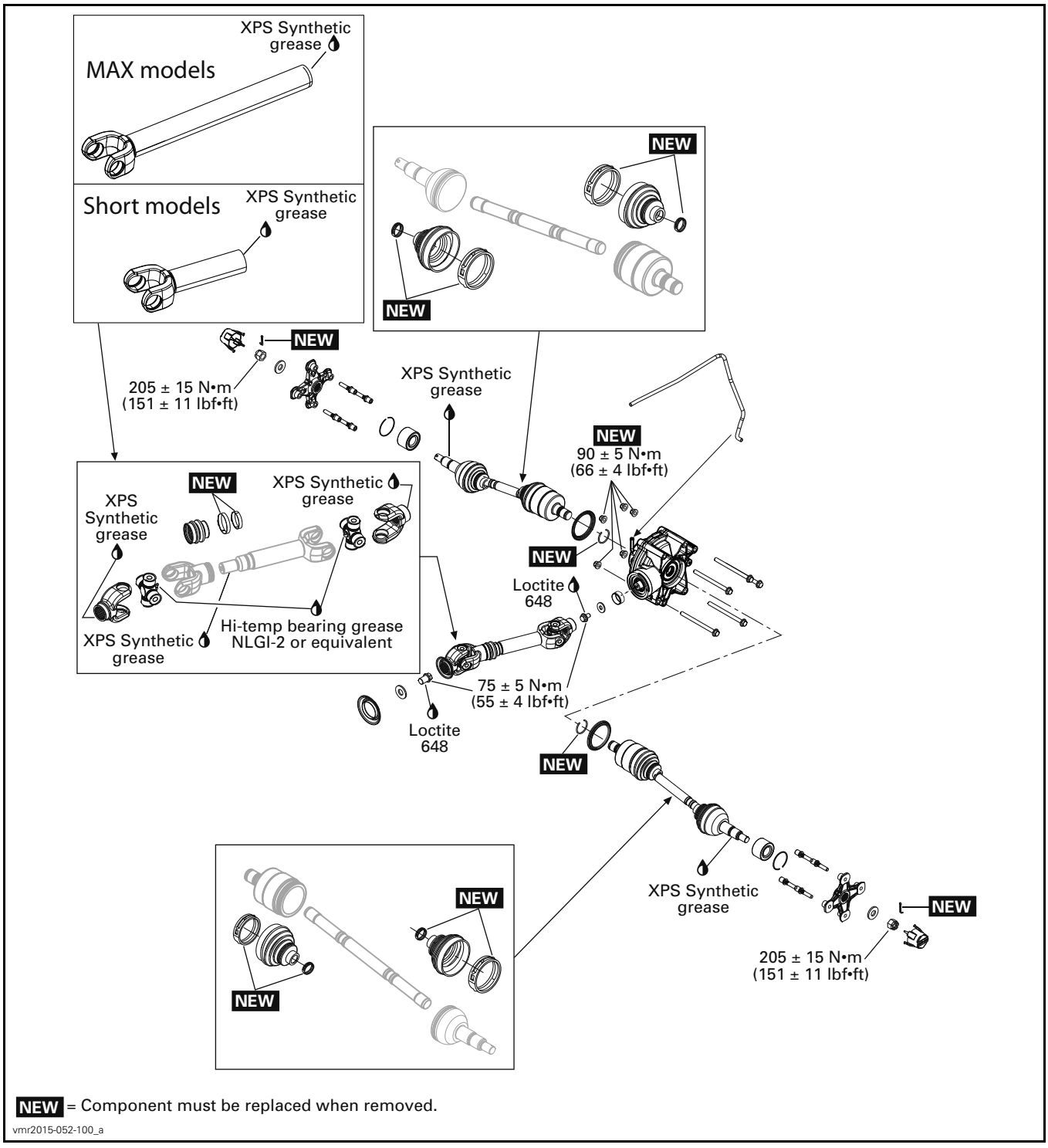
SERVICE TOOLS

Description	Part Number	Page
BACKLASH MEASUREMENT TOOL	529 035 665	620
CV BOOT CLAMP PLIER	529 036 120	616
CV JOINT EXTRACTOR	529 036 005	617
SPANNER SOCKET	529 035 649	623

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 277	293 800 073	625
LOCTITE 648 (GREEN)	413 711 400	619
XPS SYNTHETIC GREASE	293 550 010	615, 618

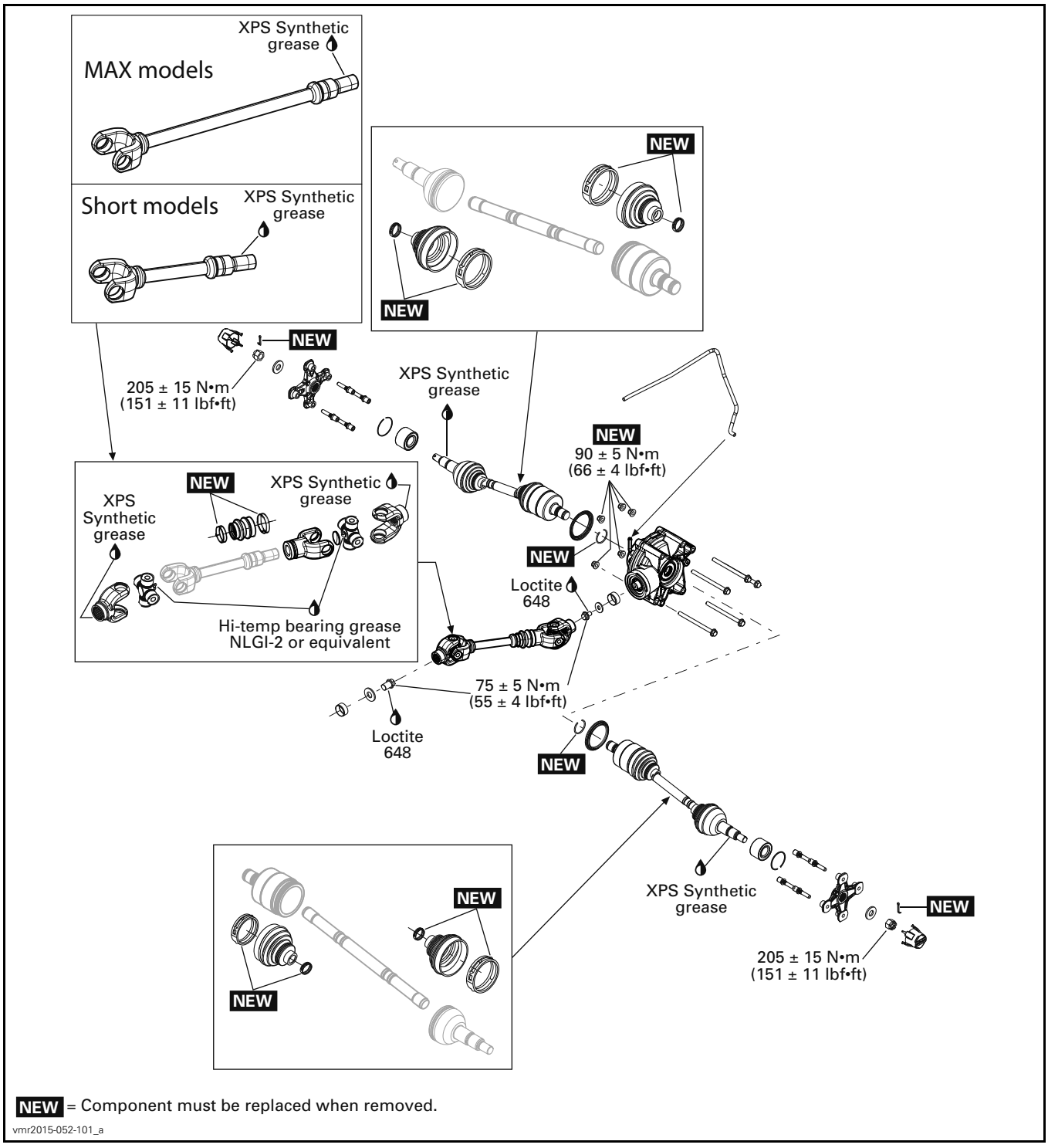
MODELS WITH 500 ENGINE

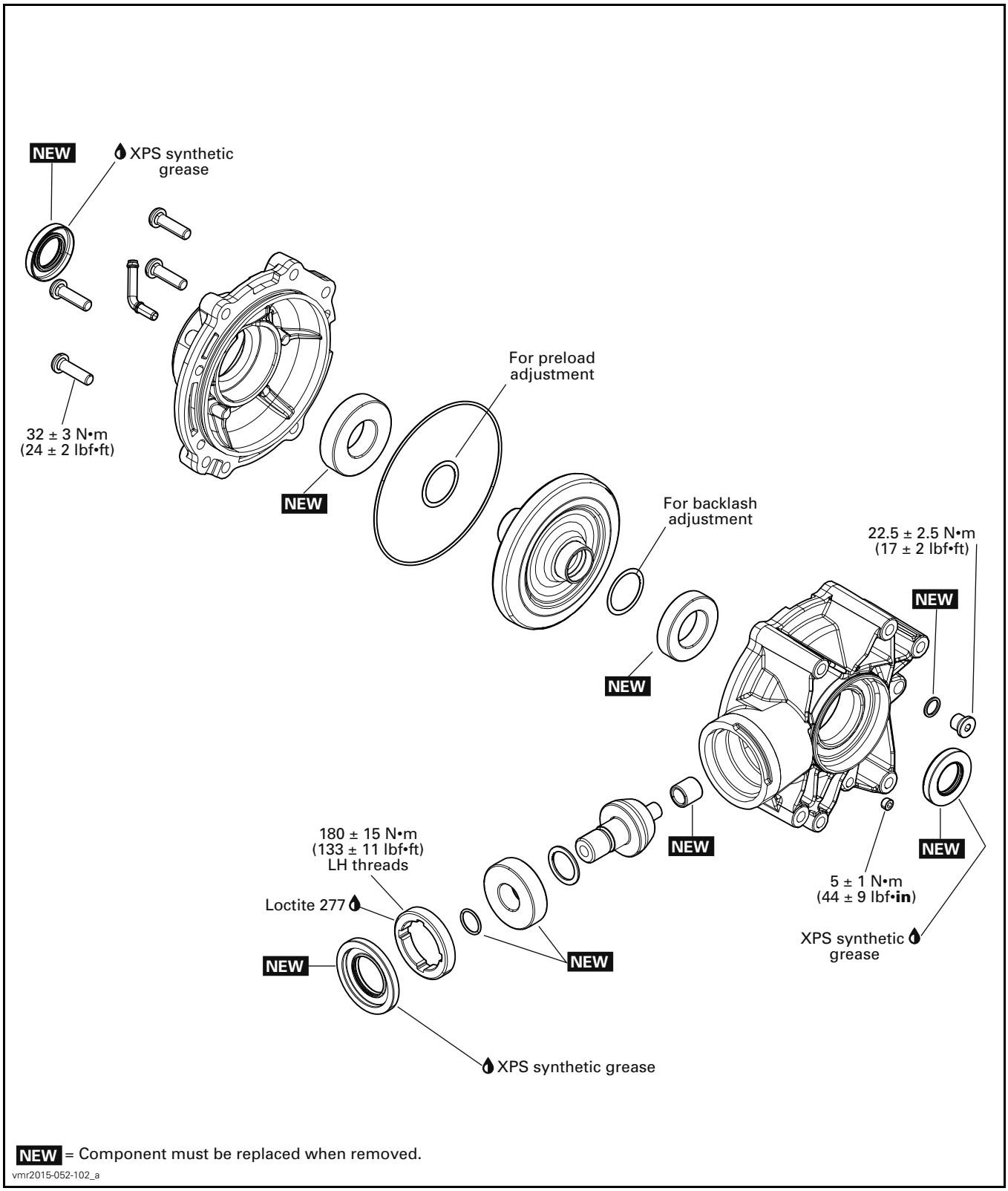


NEW = Component must be replaced when removed.

vmr2015-052-100_a

MODELS WITH 450 ENGINE





NEW = Component must be replaced when removed.

vmr2015-052-102_a

PROCEDURES

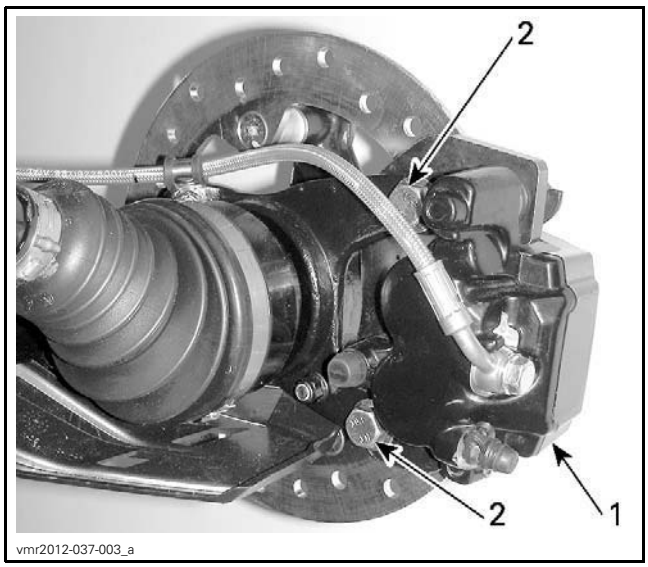
WHEEL HUB

Wheel Hub Removal

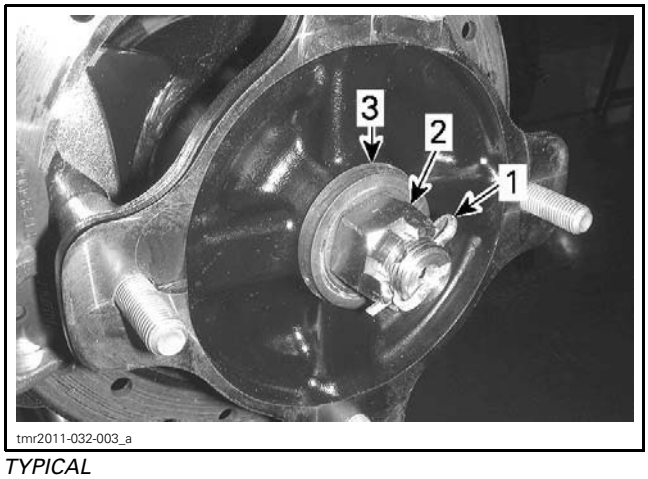
Lift and support vehicle.

Remove the wheel.

Remove the following parts:
- Caliper mounting bolts (if applicable), refer to *BRAKES* subsection
- Hub cap
- Cotter pin
- Wheel hub nut
- Belleville washer.



1. Caliper
2. Remove bolts



TYPICAL
1. Cotter pin
2. Wheel hub nut
3. Belleville washer

Remove wheel hub.

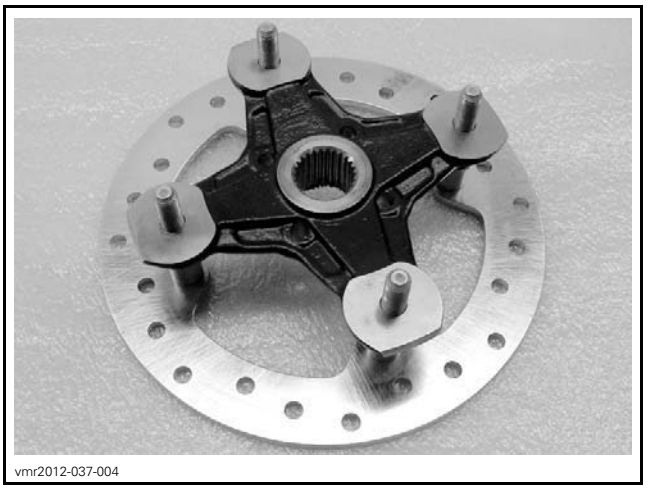
Wheel Hub Inspection

Remove disk from RH wheel hub as necessary.

Check wheel hub for cracks or other damages.

Check inner splines for wear or other damages.

If any damage is detected on wheel hub, replace it with a new one.

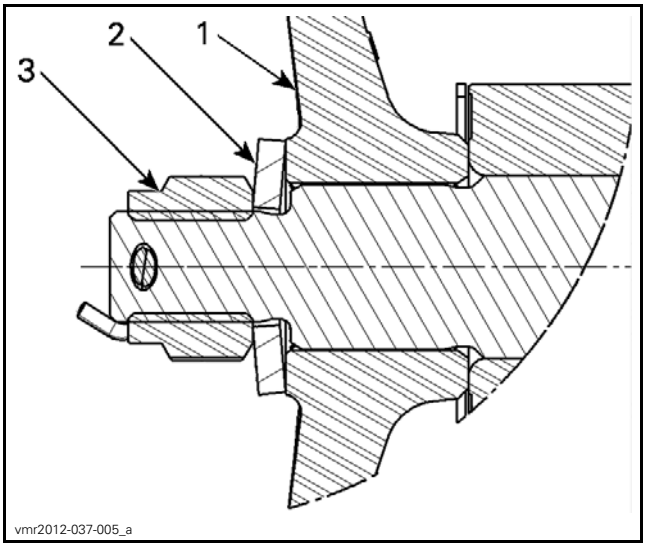


Wheel Hub Installation

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

Apply XPS SYNTHETIC GREASE (P/N 293 550 010) on drive shaft splines.

Install Belleville washer with its convex side outward.

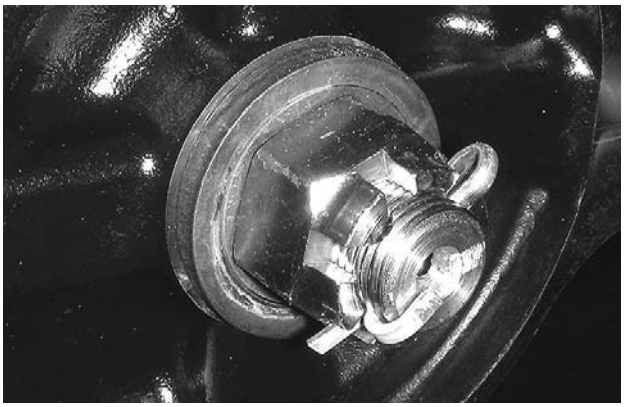


1. Wheel hub
2. Washer — Convex side here
3. Nut

TIGHTENING TORQUE	
Wheel hub nut	205 N•m ± 15 N•m (151 lbf•ft ± 11 lbf•ft)

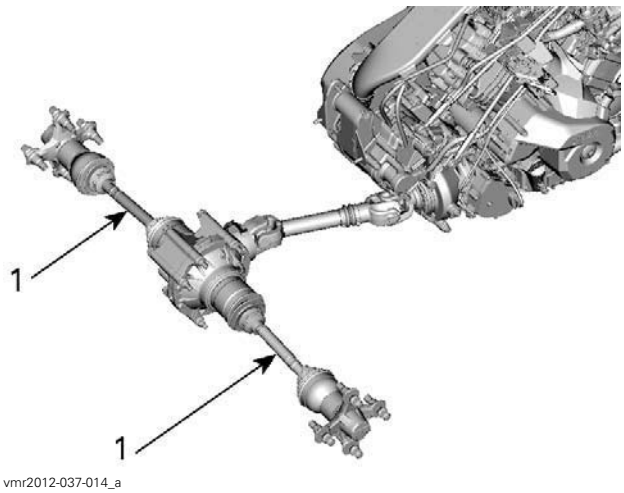
NOTE: If required, tighten castellated nut further to align grooves with drive shaft hole.

Install a NEW cotter pin.


tmr2011-032-005

DRIVE SHAFT

Drive Shaft Removal



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TYPICAL
1. Drive shafts

Lift and support vehicle.

Remove the wheel hub. See procedure in this subsection.

Remove trailing arm. Refer to *REAR SUSPENSION*.

Strongly pull drive shaft out of final drive.

Drive Shaft Inspection

Inspect the condition of boots. If there is any damage or evidence of leaking lubricant, replace them. Refer to *DRIVE SHAFT BOOT*.

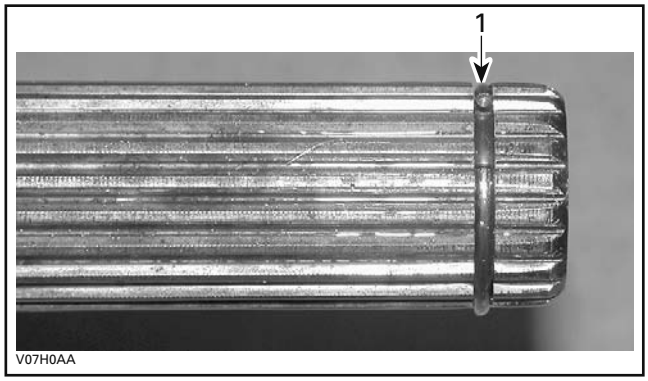
Check shaft splines. Replace drive shaft if necessary.

Check dust shield on drive shaft end. Replace if necessary.

Drive Shaft Installation

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

Install a NEW stop ring.



V07H0AA

TYPICAL
1. NEW stop ring

After drive shaft insertion in rear final drive, validate if properly locked.

DRIVE SHAFT BOOT

Drive Shaft Boot Removal

Remove the drive shaft from vehicle. See procedure in this subsection.

Remove drive shaft boot clamps using the following tool:

TOOL	
CV BOOT CLAMP PLIER (P/N 529 036 120)	

Dislodge the large boot end.

Separate the joint from the shaft. Two procedures can be done.

Without the Special Tool

Clamp joint housing in a vise.

Align shaft with joint.

Pull hard on shaft to remove from joint.

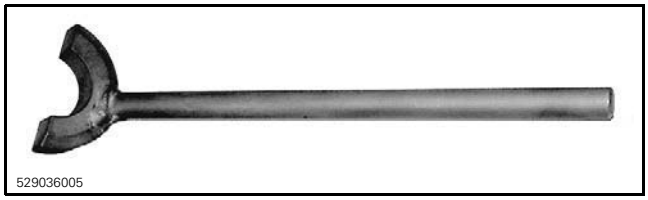
Remove boot from drive shaft.

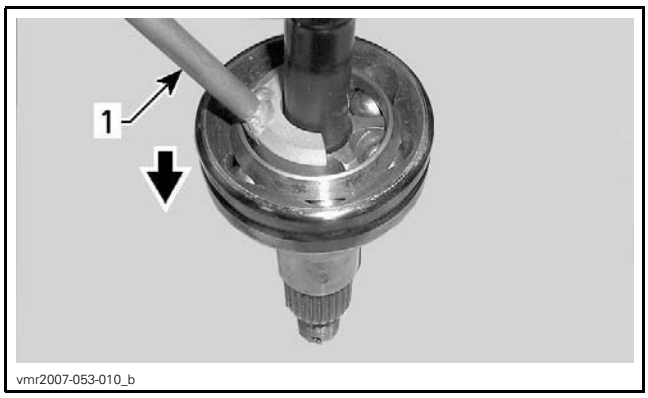
Remove and discard the circlip. A new one is included in the boot kit.

With the Special Tool

Place drive shaft in vice with the joint downward.

Install the CV JOINT EXTRACTOR (P/N 529 036 005) on bearing.





TYPICAL — CV JOINT SHOWN
1. Joint extractor tool

With an hammer, hit on the tool to separate joint from shaft.

When joint and shaft are separated, remove boot from drive shaft.

Remove and discard the circlip. A new one is included in the boot kit.

Remove drive shaft boot.

Drive Shaft Boot Installation

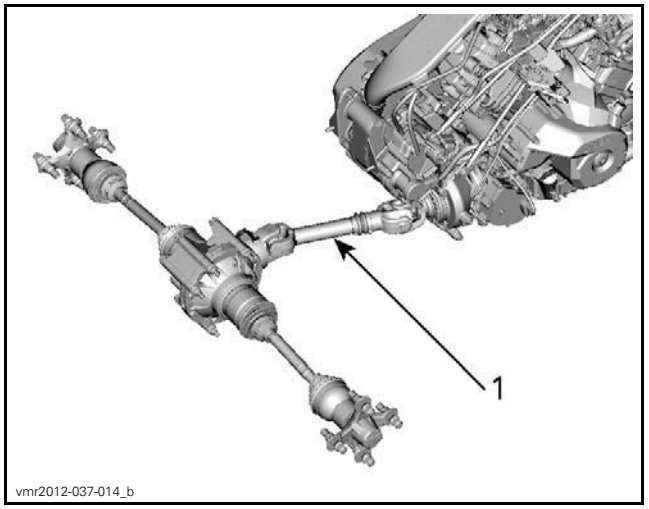
The installation is the reverse of the removal procedure. However, pay attention to the following:

Pack bearing area with grease (included with the new boot kit).

NOTE: Do not use any other grease.

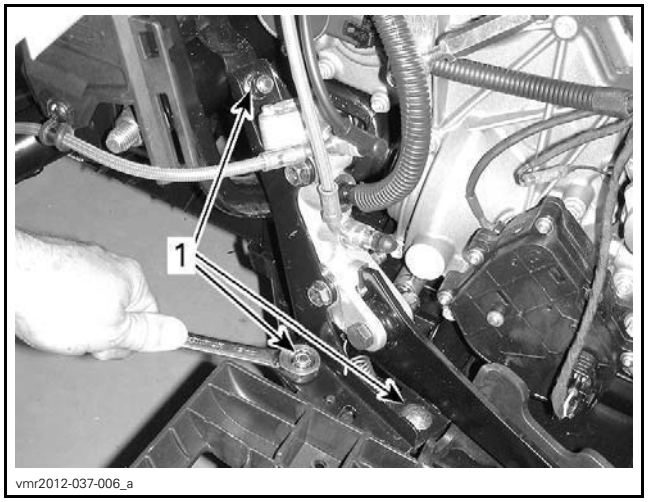
PROPELLER SHAFT

Propeller Shaft Removal

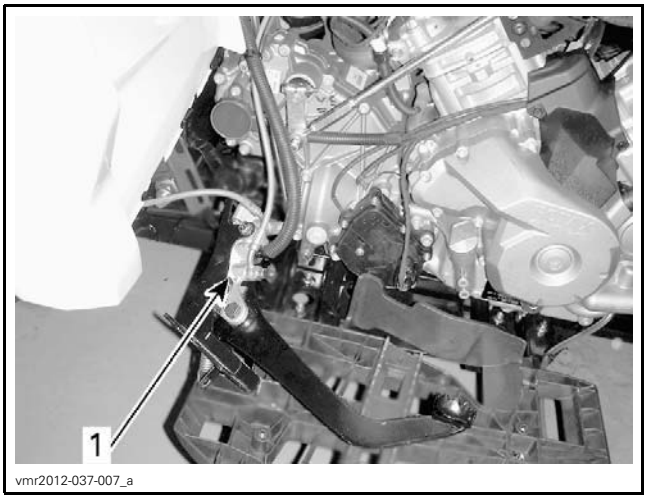


TYPICAL
1. Propeller shaft

1. Lift and support rear end of vehicle.
2. Remove wheels. Refer to *WHEELS AND TIRES* subsection.
3. Drain oil from rear final drive. Refer to *PERIODIC MAINTENANCE PROCEDURES*.
4. Detach brake master cylinder from frame. Refer to *BRAKES* subsection.



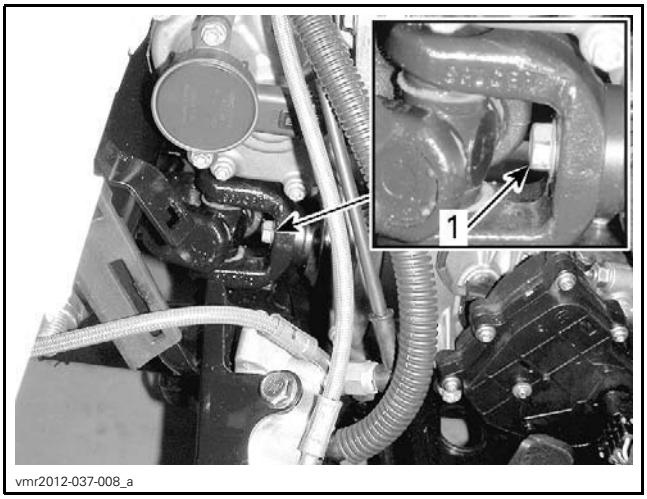
1. Remove retaining screws



1. Master cylinder moved apart

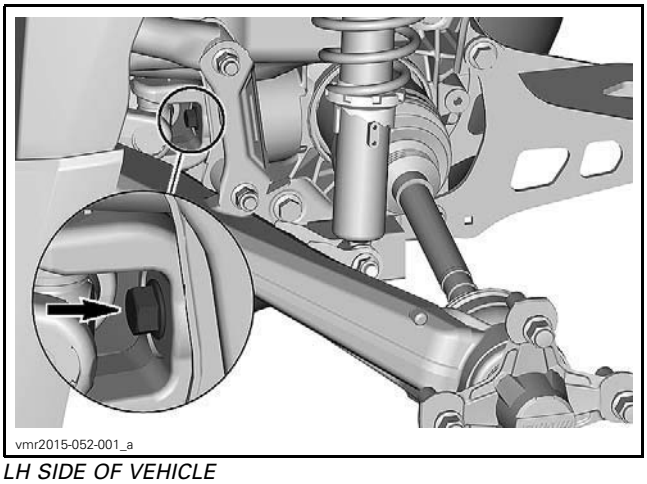
5. From RH side of vehicle, remove propeller shaft screw from gearbox output shaft.

NOTE: Heat screw to break the threadlocker bond prior to removal.



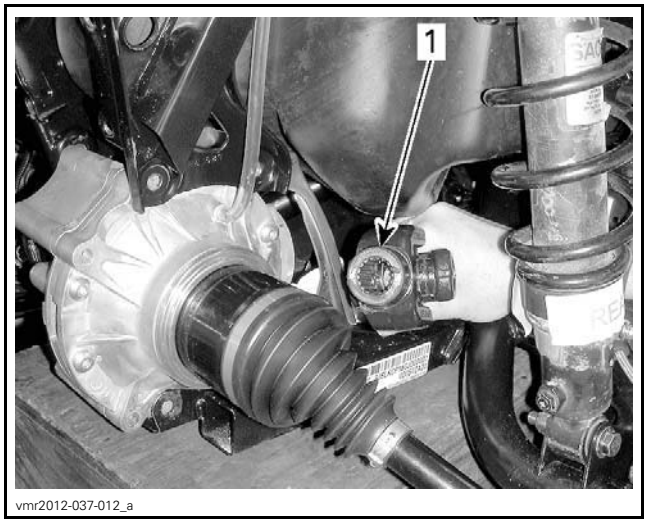
TYPICAL — RH SIDE OF VEHICLE
1. Remove screw

6. From LH side of vehicle, remove propeller shaft screw from rear final drive yoke.



LH SIDE OF VEHICLE

7. Remove rear final drive retaining bolts. Refer to *REAR FINAL DRIVE* in this subsection.
8. Remove bolts from rear retaining plate. Refer to *REAR FINAL DRIVE* in this subsection.
9. Move the rear final drive rearward to allow dislodging the propeller shaft.
10. Dislodge the propeller shaft from the gearbox.
11. Remove the propeller shaft.



1. Pull out propeller shaft

Propeller Shaft Inspection

Inspect if propeller shaft is not bent or twisted.

Check propeller shaft splines for wear or damage.

Check if propeller shaft bellow is cracked, pierced or brittle.

Propeller Shaft Installation

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

Apply XPS SYNTHETIC GREASE (P/N 293 550 010) to splines.

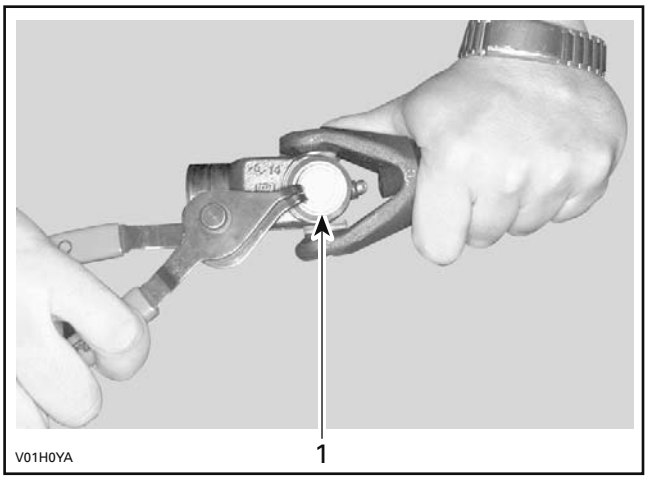
PARTS	TORQUE
Propeller shaft screw (rear final drive side)	75 N•m ± 5 N•m (55 lbf•ft ± 4 lbf•ft) + LOCTITE 648 (GREEN) (P/N 413 711 400)
Propeller shaft screw (gearbox side)	75 N•m ± 5 N•m (55 lbf•ft ± 4 lbf•ft) + LOCTITE 648 (GREEN) (P/N 413 711 400)

Refill rear final drive. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

PROPELLER SHAFT U-JOINTS

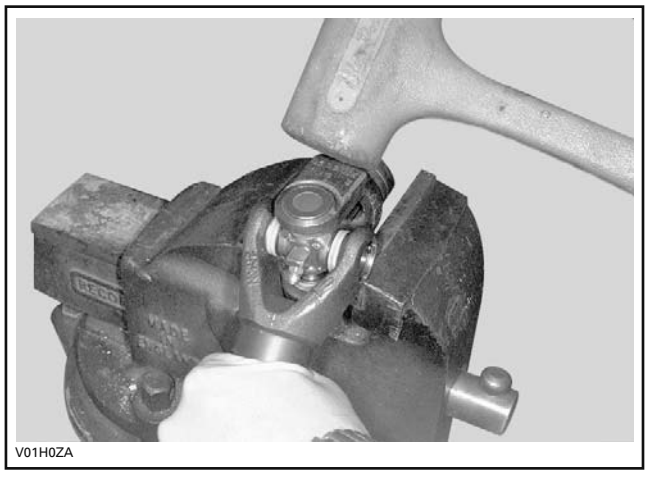
Propeller Shaft U-Joint Removal

Remove internal snap ring from bearing caps.



1. Snap ring

Support inner yoke in vice and drive other yoke down with a soft hammer.



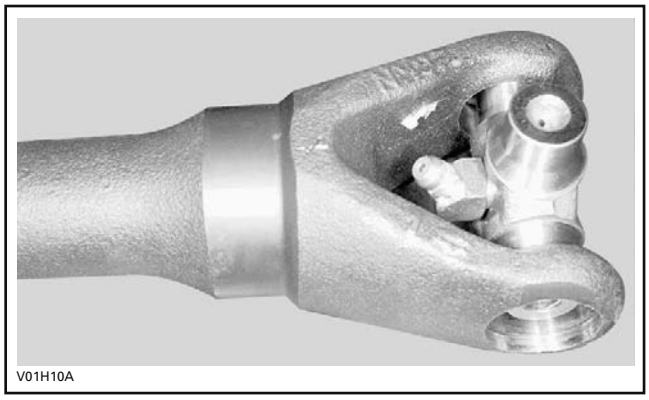
Support U-joint in vice and drive inner yoke down to remove remaining bearing caps.

Remove U-joint cross.

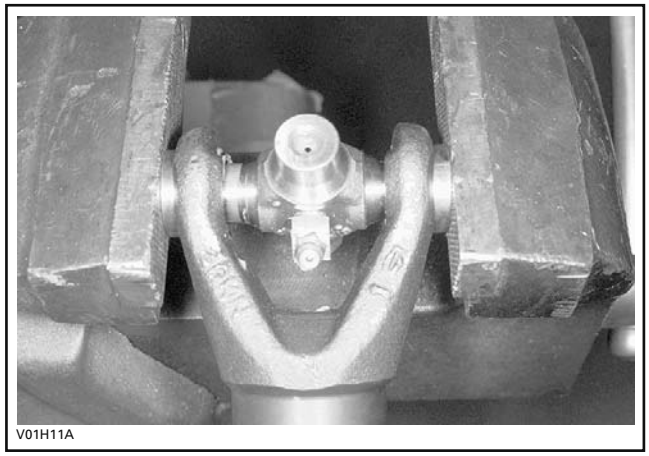
Propeller Shaft U-Joint Installation

Install a NEW U-joint in inner yoke.

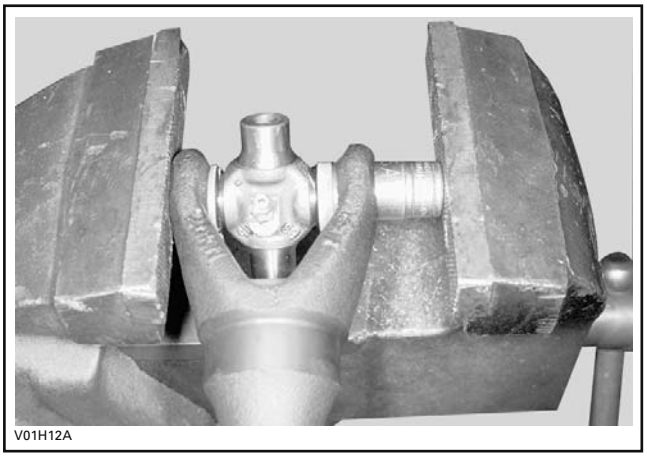
NOTE: Position propeller shaft U-joint as shown for proper grease fitting location.



Install bearing caps. Use a vise to push bearing caps.



Using a suitable pusher, fully seat bearing cap on one side.


V01H12A

Install snap ring.

Complete installation for the other bearing caps.

Grease U-joint. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

REAR FINAL DRIVE

Rear Final Drive Removal

Drain oil. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

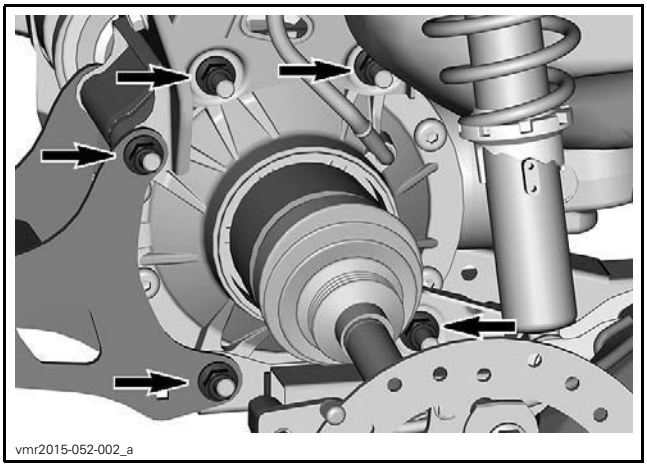
Lift and support vehicle.

Support rear bottom end of frame.

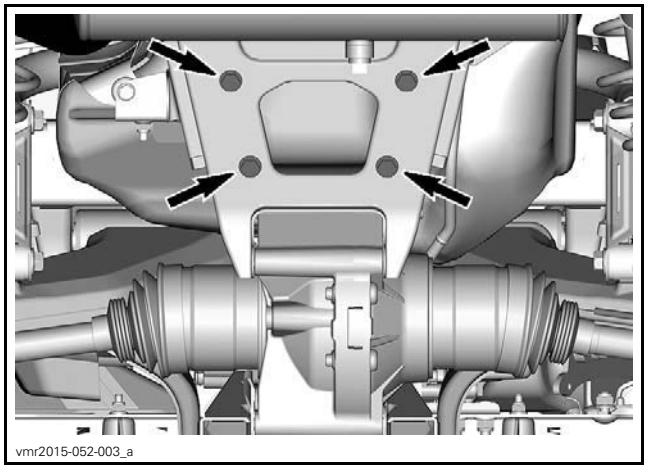
Remove drive shafts. See procedure in this subsection.

Remove rear propeller shaft screw from the rear final drive yoke. Refer to *PROPELLER SHAFT* in this subsection.

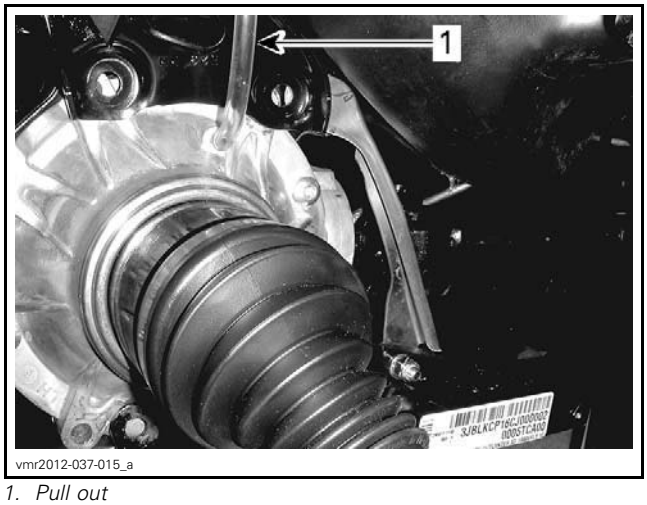
Remove rear final drive screws (5x).


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Remove bolts from rear retaining plate.


vmr2015-052-003_a

Unplug the vent hose from final drive.



vmr2012-037-015_a

1. Pull out

Remove the final drive.

Rear Final Drive Inspection (Assembled)

Manually turn rear final drive gear; it should turn smoothly. Repair if necessary.

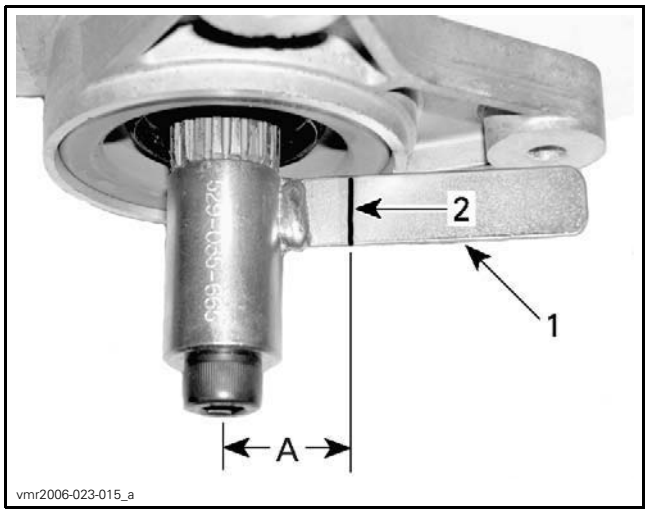
Check if oil seals are brittle, hard or damaged. Replace if necessary.

Backlash Inspection

Using a dial indicator and the BACKLASH MEASUREMENT TOOL (P/N 529 035 665), measure the backlash.

Place the backlash measurement tool at the end of pinion gear.

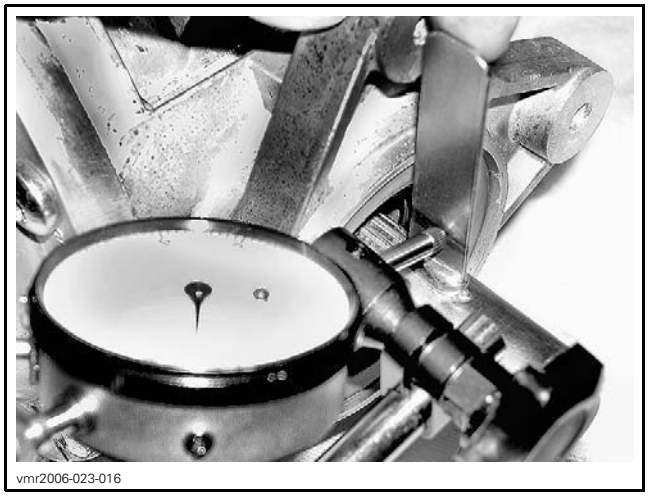
From center of tool bolt, measure 25.4 mm (1 in) and scribe a mark on the tab.



1. Tab of backlash measurement tool
2. Mark on tab
A. 25.4 mm (1 in)

Position the dial indicator tip against the tab at a 90° angle and right on the previously scribed mark.

Gently, move the tool tab back and forth. Note the backlash result.



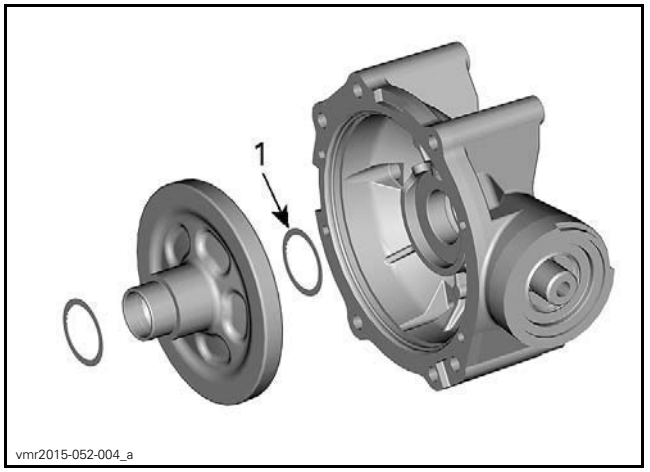
Rotate pinion gear 1/2 turn and recheck backlash. Note the result.

Rotate pinion gear 1 turn and recheck backlash.

BACKLASH SPECIFICATION
0.1 mm (.004 in) to 0.35 mm (.014 in)

If backlash is out of specification, split final drive housing and adjust shim thickness as per following guideline.

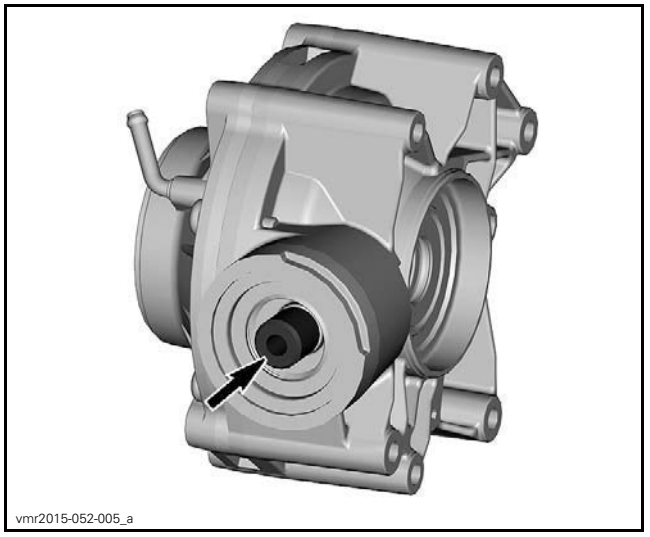
BACKLASH ADJUSTMENT GUIDELINE	
BACKLASH MEASUREMENT	WHAT TO DO
Below 0.1 mm (.004 in)	Add shim(s) and recheck backlash
Above 0.35 mm (.014 in)	Remove shim(s) and recheck backlash



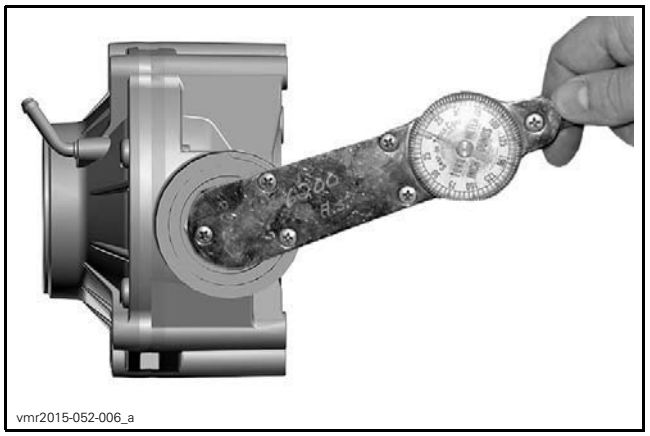
1. Backlash shim

Preload Inspection

Screw the propeller shaft screw in pinion gear.



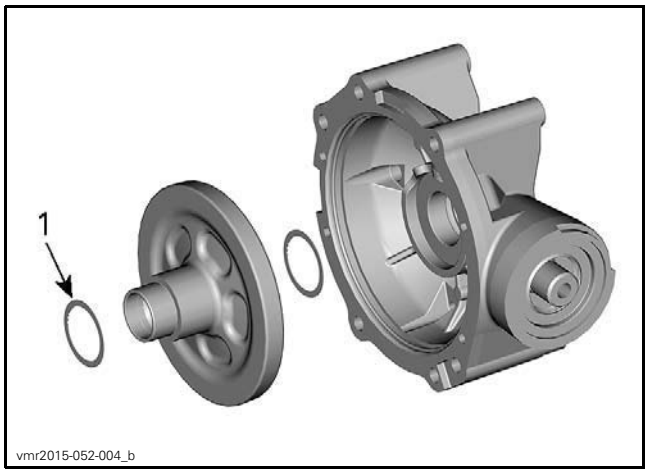
Using a needle torque wrench, measure the preload.


vmr2015-052-006_a

PRELOAD SPECIFICATION
0.06 N•m (.5 lbf•**in**) to 0.50 N•m (4 lbf•**in**)

If preload is out of specification, split final drive housing and adjust shim thickness as per following guideline.

PRELOAD GUIDELINE	
PRELOAD MEASUREMENT	WHAT TO DO
Below 0.06 N•m (.5 lbf•**in**)	Add shim(s) and recheck preload
Above 0.50 N•m (4 lbf•**in**)	Remove shim(s) and recheck preload



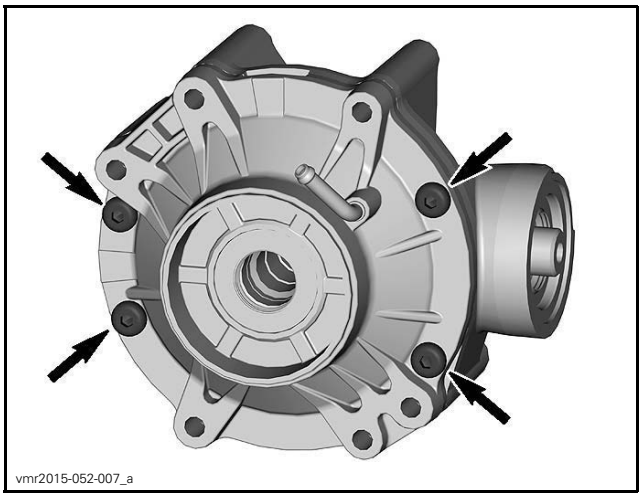
vmr2015-052-004_b

1. Preload shim

Rear Final Drive Disassembly

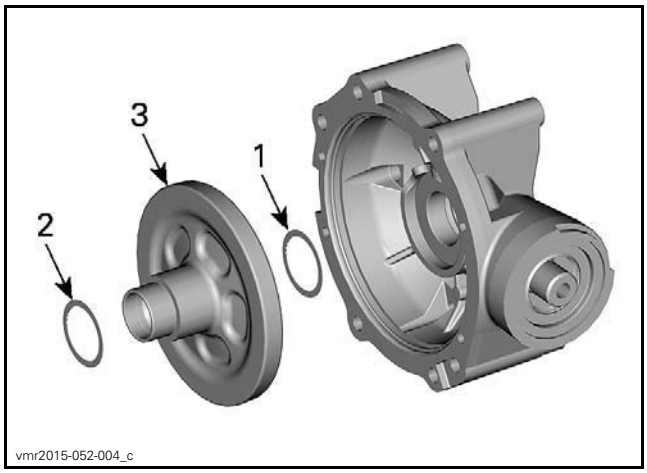
Ring Gear

Remove the final drive housing screws.


vmr2015-052-007_a

Split final drive housings.

NOTE: Be careful to keep track of shims on ring gear.



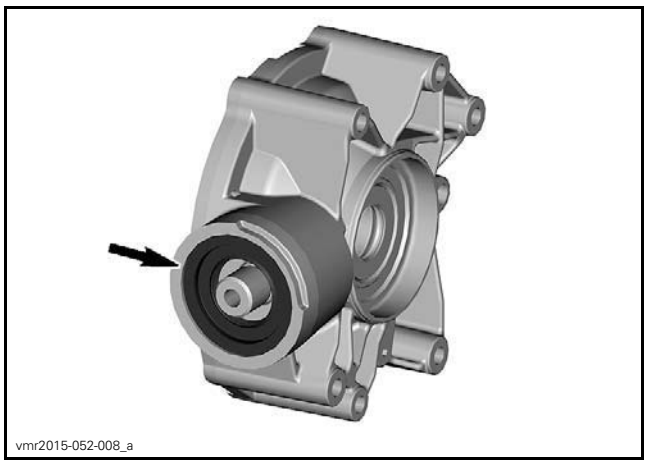
vmr2015-052-004_c

1. Backlash shim
2. Preload shim
3. Ring gear

Extract ring gear out of half housing.

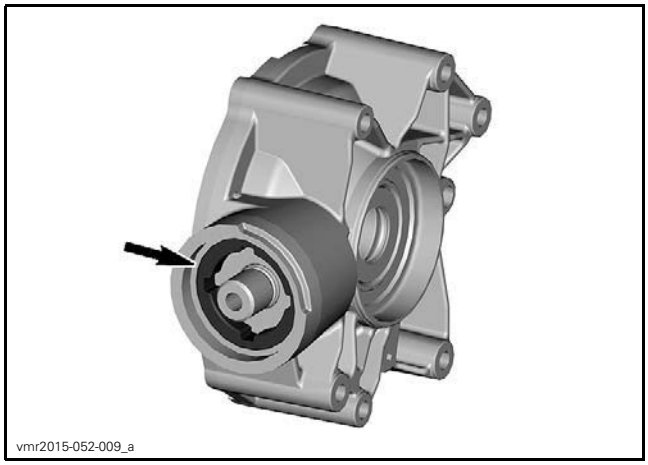
Pinion Gear

Remove and discard oil seal.


vmr2015-052-008_a

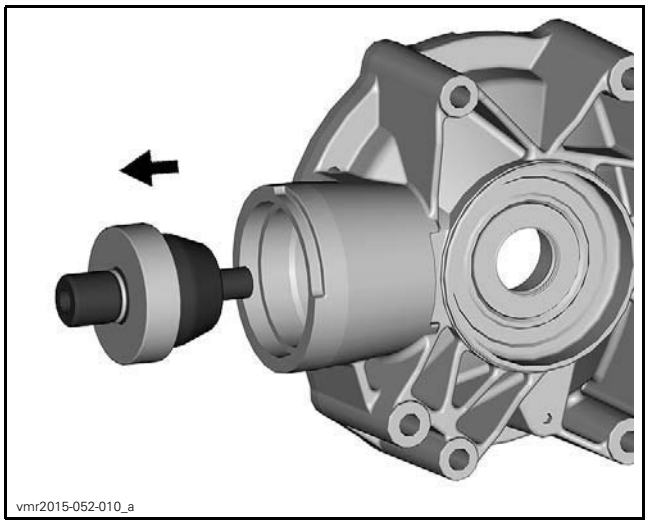
Unscrew the pinion nut. Use the SPANNER SOCKET (P/N 529 035 649).

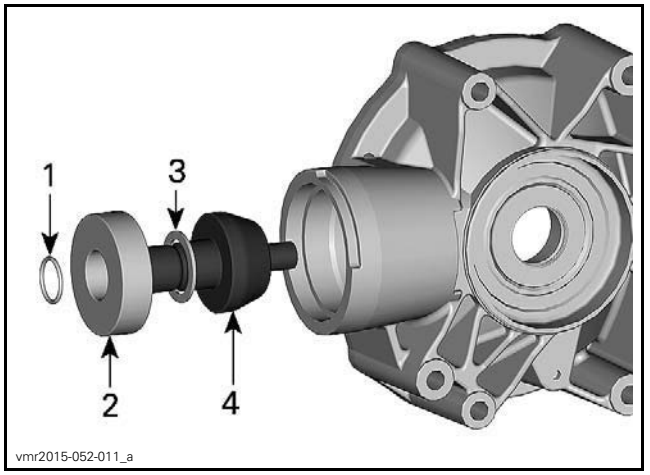




NOTE: The pinion nut is left hand threaded. Unscrew by turning clockwise.

Remove the bearing along with the pinion gear. Be careful to keep track of shims. Discard bearing.



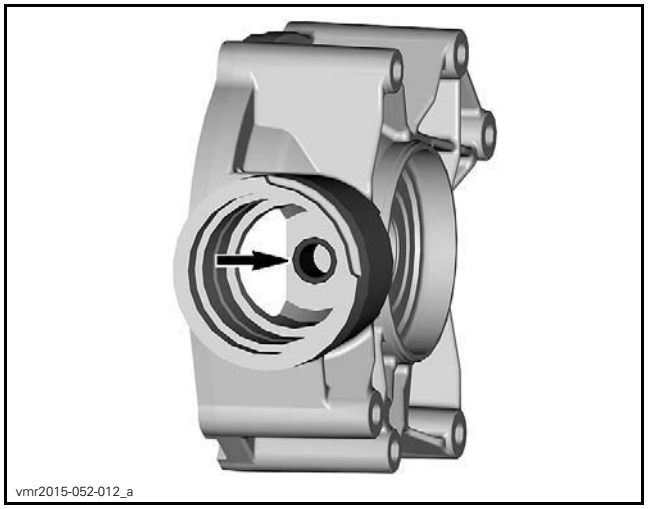


1. O-ring
2. Ball bearing
3. Pinion gear shim
4. Pinion gear

The pinion gear and bearing can be easily removed using the following suggested tool:

PART	QTY
Pipe: 83 mm (3-1/4 in) diameter x 127 mm (5 in)	1
Threaded rod: M10 x 1.25 x 178 mm (7 in)	1
M10 x 1.25 nut	3
Flat bar	1

Remove and discard the needle bearing.



Rear Final Drive Assembly

Adjustment is required when any of the following part is changed.

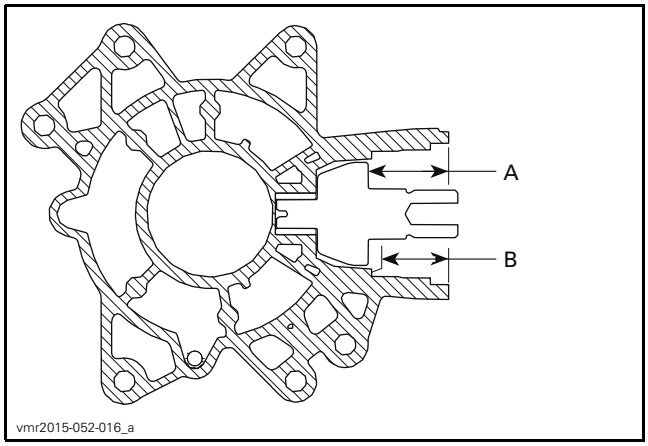
– Pinion gear
– Ring gear
– Housing.

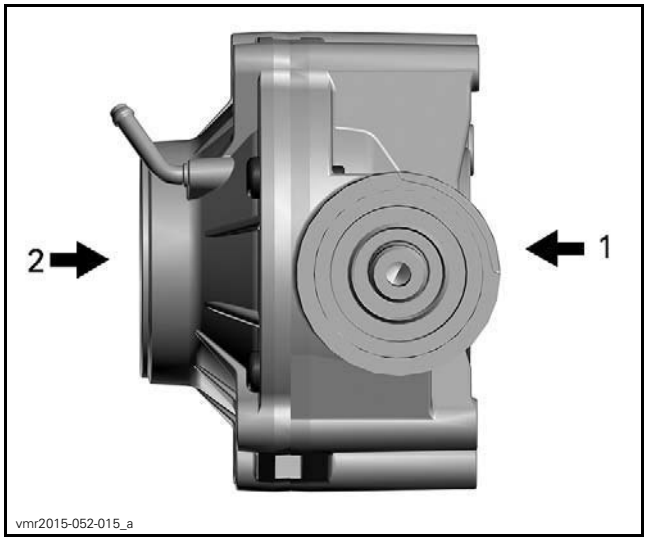
As a preliminary setup, install shims according to the following table.

RECOMMENDED SHIM THICKNESS	
PINION GEAR	See procedure for pinion gear shim thickness
BACKLASH	0.5 mm (.02 in) (as a preliminary adjustment)
PRELOAD	

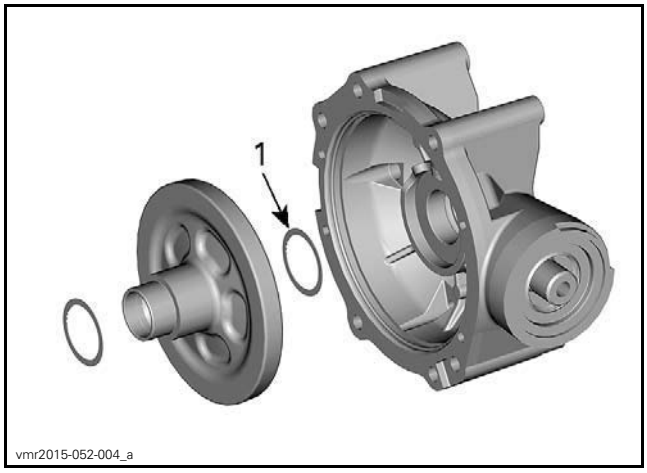
Procedure for pinion gear shim thickness:

1. Remove the old pinion gear and install the new one without the ball bearing. The new pinion will be located at the "zero" location.
2. Measure the distance "A" between outside surface of the gear case and the shim surface of pinion.
3. Measure the distance "B" between outside surface of the gear case and the bearing shoulder of the gear case.
4. The shim thicknesss will be "A-B-0.53 mm (.021 in)".
5. Select the good combination of shim to match the thickness calculated on step 4.

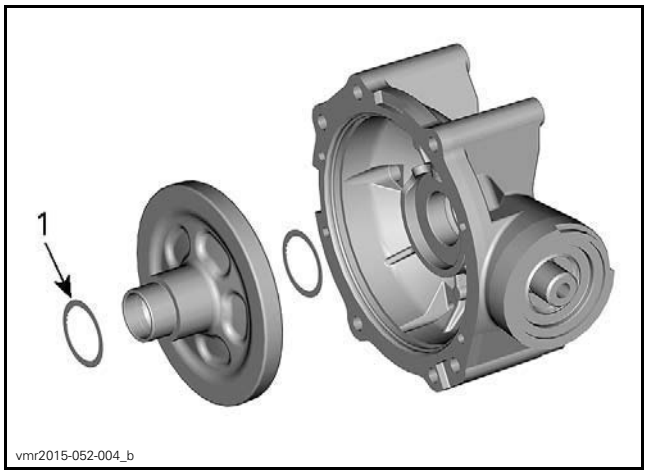




1. Backlash side
2. Preload side



1. Backlash shim



1. Preload shim

Prior to finalizing assembly, proceed in this order:

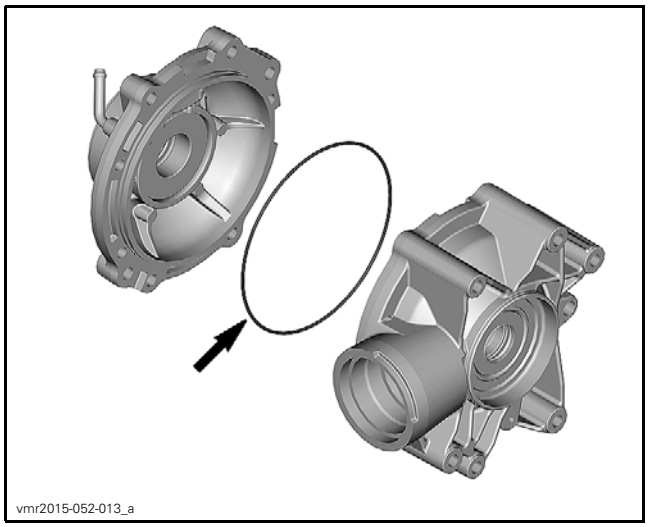
– Temporarily assemble final drive using recommended torques.
– Do not apply thread locker product.
– Do not install a new pinion nut.

– Check backlash.
– Check preload.

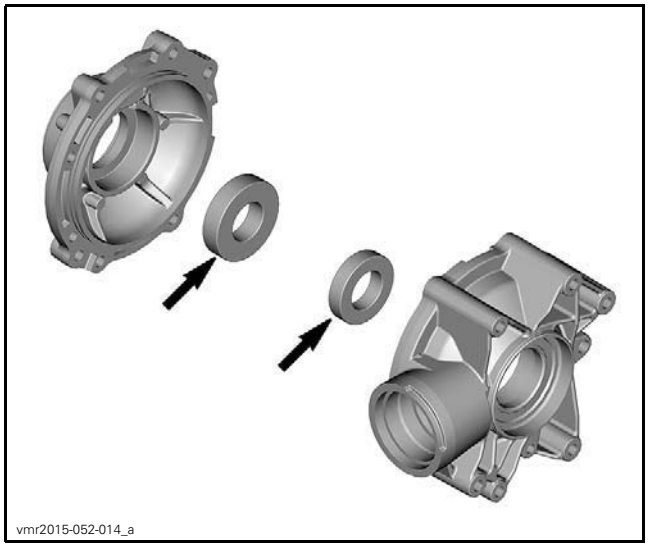
Ring Gear

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

Check condition of seal. Replace if damaged.


vmr2015-052-013_a

Install **NEW** bearings.


vmr2015-052-014_a

Tighten final drive housing screws as per specification.

TIGHTENING TORQUE	
Final drive housing screws	32 N•m ± 3 N•m (24 lbf•ft ± 2 lbf•ft)

Pinion Gear

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

Install a **NEW** needle bearing.

Install the shim(s) then a **NEW** ball bearing.

install a **NEW** O-ring.

Apply LOCTITE 277 (P/N 293 800 073) to pinion nut.

Install and tighten the pinion nut as per specification.

TIGHTENING TORQUE	
Pinion nut (LH THREADS)	180 N•m ± 15 N•m (133 lbf•ft ± 11 lbf•ft) + LOCTITE 277 (P/N 293 800 073)

Lubricate and install a **NEW** oil seal.

Rear Final Drive Installation

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

Install the lowest rear final drive retaining screws first.

Install all screws and nuts prior to tighten.

Tighten nuts to specification.

TIGHTENING TORQUE	
Final drive retaining nuts	90 N•m ± 5 N•m (66 lbf•ft ± 4 lbf•ft)

Refill the final drive with recommended oil. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

WHEELS AND TIRES

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 767 (ANTISEIZE LUBRICANT)	293 800 070	627

PROCEDURES

TIRES

⚠ WARNING

Do not rotate tires. The front and rear tires have a different size. Respect direction of rotation when applicable.

Tire Pressure

⚠ WARNING

Tire pressure greatly affects vehicle handling and stability. Insufficient pressure may cause tire to deflate and rotate on wheel. Excessive pressure may burst the tire. Always follow recommended pressure.

Check pressure when tires are **cold** before using the vehicle. Tire pressure changes with temperature and altitude. Recheck pressure if one of these conditions has changed.

TIRE PRESSURE	FRONT	REAR
MIN.	41.4 kPa (6 PSI)	41.4 kPa (6 PSI)
MAX. Use when total load is greater than 131.5 kg (290 lb)	48.3 kPa (7 PSI)	68.9 kPa (10 PSI)

Tire Inspection

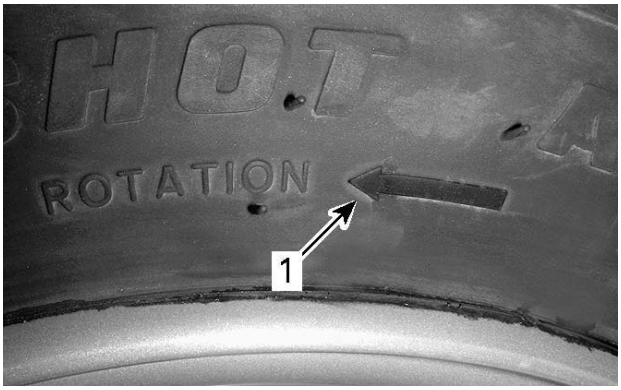
Check tire for presence of slits, bulges, wear or other damage. Replace if necessary.

Tire Replacement

Use an automotive tire changer to replace tires.

⚠ WARNING

- Replace tires only with the same type and size as original tires.
- For unidirectional tread pattern, ensure that the tires are installed in the correct direction of rotation.



TYPICAL
1. Direction of rotation

WHEELS

Wheel Removal

Loosen nuts just enough to be able to unscrew them once the vehicle will be off the ground.

Lift and support the vehicle.

Remove nuts, then remove wheel.

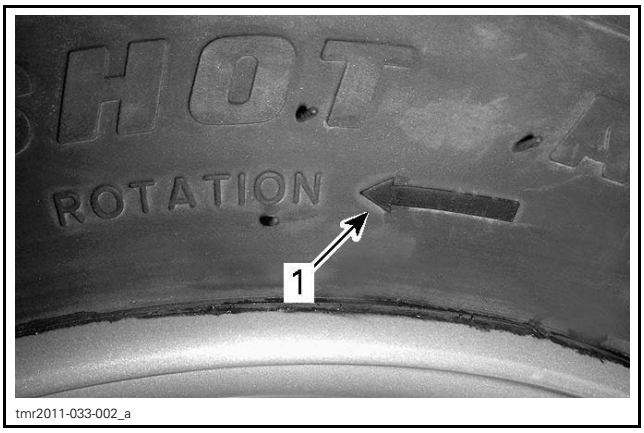
Wheel Inspection

Inspect wheel for wear or damage especially at the mounting holes.

Wheel Installation

At installation, it is recommended to apply LOCTITE 767 (ANTISEIZE LUBRICANT) (P/N 293 800 070) on threads.

Check if tires are unidirectional.



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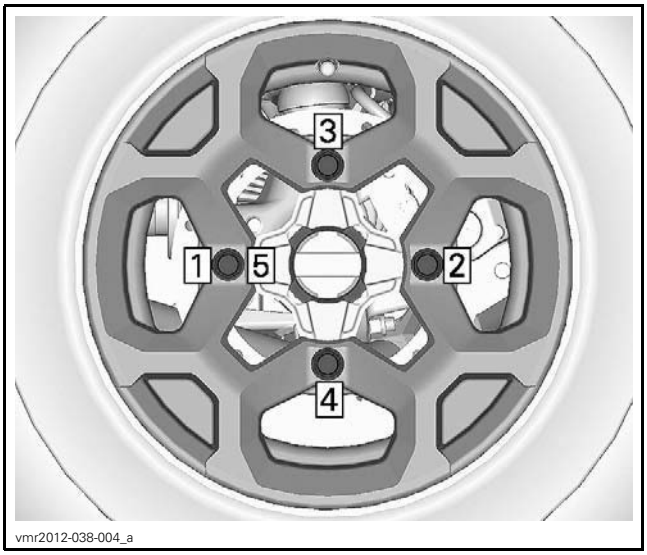
TYPICAL
1. Direction of rotation

Install wheel with the tire in the right direction of rotation.

Install lug nuts with the taper towards the wheel.

Tighten wheel lug nuts to the specified torque using the illustrated sequence.

WHEEL LUG NUTS	
TORQUE	100 N•m ± 10 N•m (74 lbf•ft ± 7 lbf•ft)



vmr2012-038-004_a

TYPICAL - TIGHTENING SEQUENCE

NOTICE Always use the recommended wheel nuts for the type of wheel. Using a different nut could cause damages to the rim or studs.

STEERING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
STEERING ALIGNMENT TOOL	529 036 059	632

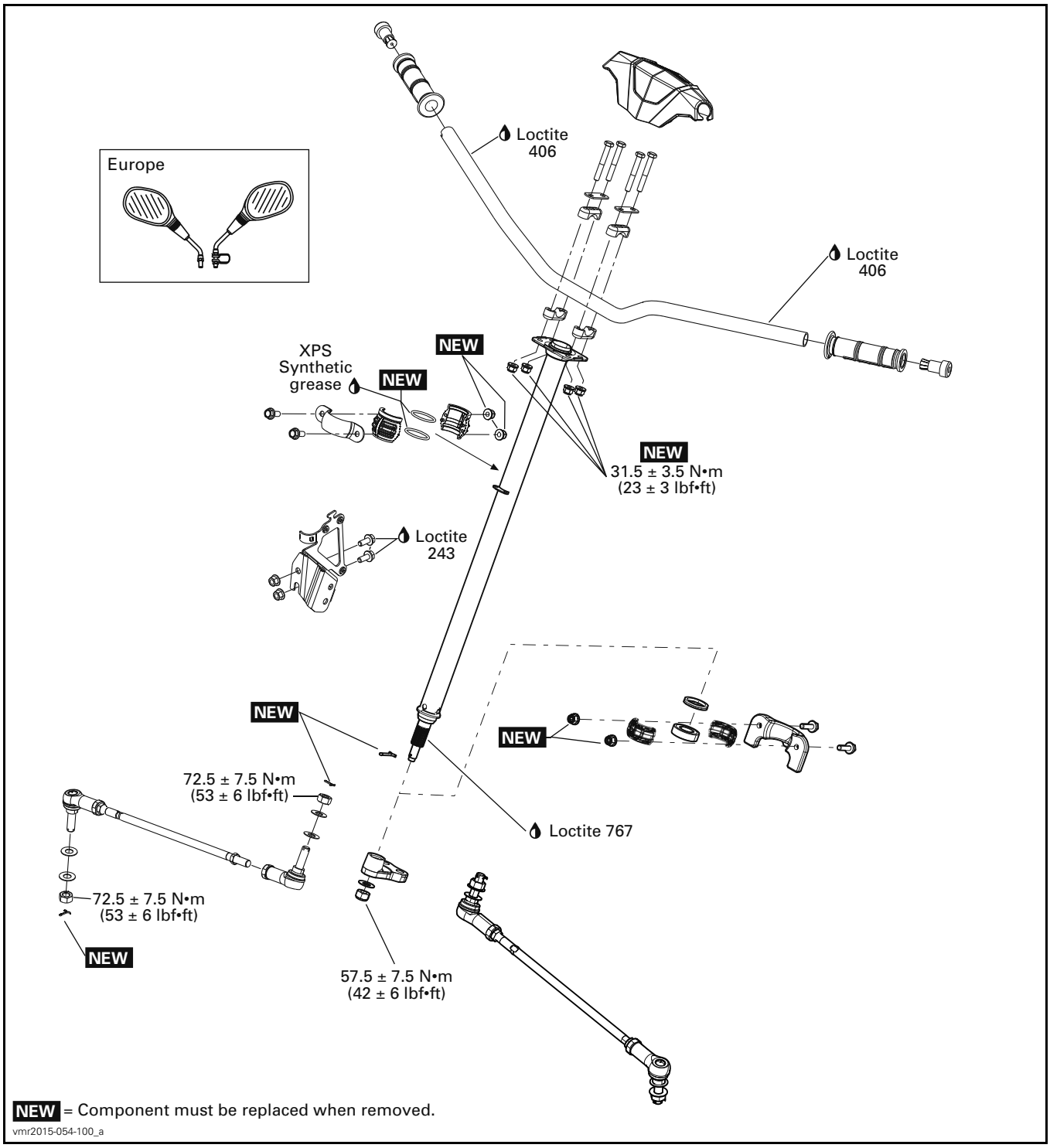
SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
SMOOTHFLOW™ TAPERED TIP	16 ga #511 rtt-b	633

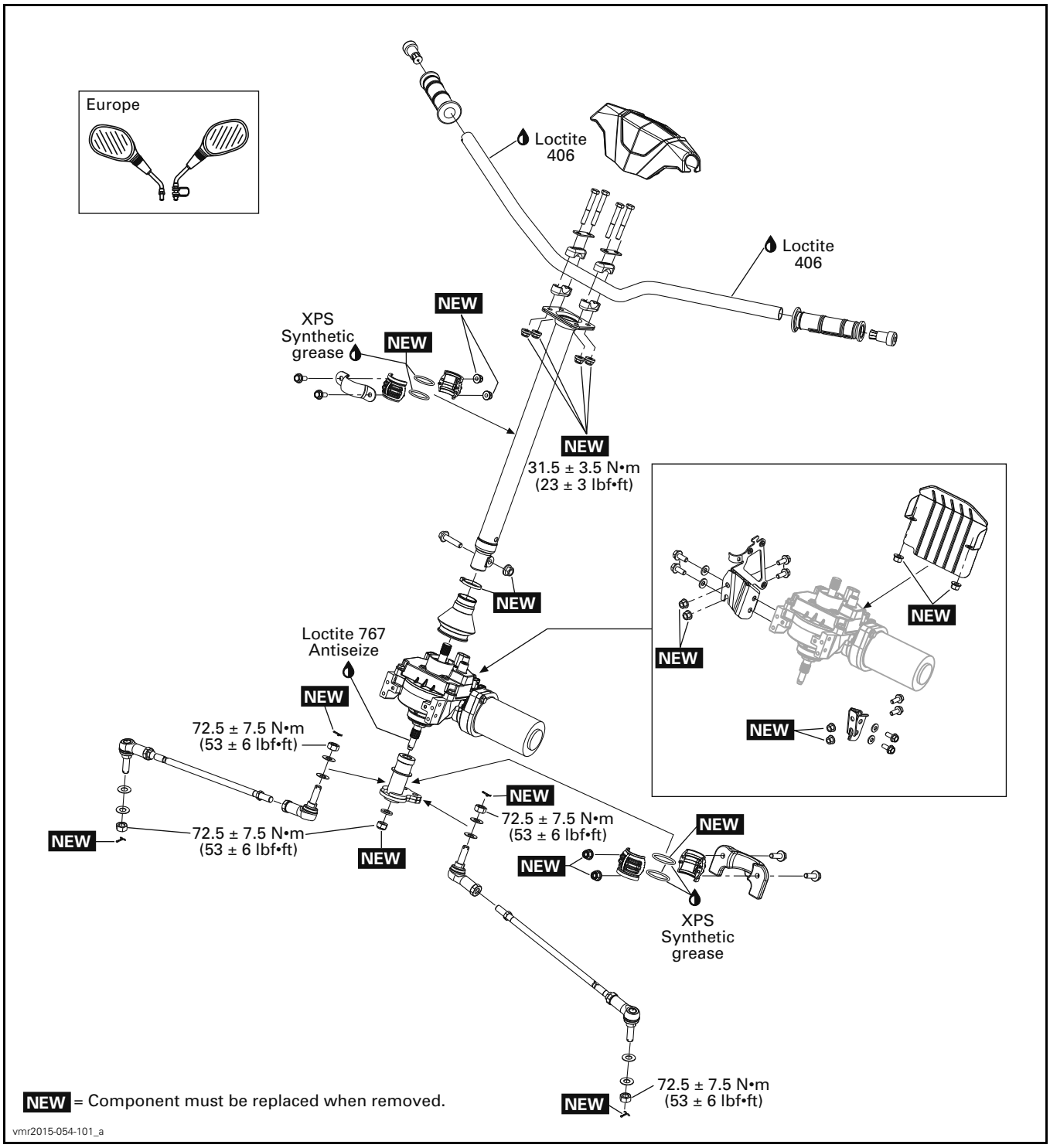
SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 406 (GLUE)	293 800 100	633
LOCTITE 767 (ANTISEIZE LUBRICANT)	293 800 070	639, 642
PULLEY FLANGE CLEANER	413 711 809	633
XPS SYNTHETIC GREASE	293 550 010	639

Without DPS


Europe
Loctite 406
Loctite 406
XPS Synthetic grease
NEW
NEW
NEW
31.5 ± 3.5 N•m (23 ± 3 lbf•ft)
Loctite 243
NEW
NEW
72.5 ± 7.5 N•m (53 ± 6 lbf•ft)
Loctite 767
72.5 ± 7.5 N•m (53 ± 6 lbf•ft)
NEW
57.5 ± 7.5 N•m (42 ± 6 lbf•ft)
NEW = Component must be replaced when removed.
vmr2015-054-100_a

With DPS


Europe
Loctite 406
Loctite 406
XPS Synthetic grease
NEW
NEW
NEW
31.5 ± 3.5 N•m (23 ± 3 lbf•ft)
NEW
NEW
NEW
NEW
Loctite 767 Antiseize
NEW
72.5 ± 7.5 N•m (53 ± 6 lbf•ft)
NEW
72.5 ± 7.5 N•m (53 ± 6 lbf•ft)
NEW
NEW
72.5 ± 7.5 N•m (53 ± 6 lbf•ft)
NEW
NEW
XPS Synthetic grease
NEW
72.5 ± 7.5 N•m (53 ± 6 lbf•ft)
NEW = Component must be replaced when removed.
vmr2015-054-101_a

GENERAL

The procedures described below are the same for the RH and LH sides, unless otherwise instructed.

ADJUSTMENT

STEERING ALIGNMENT

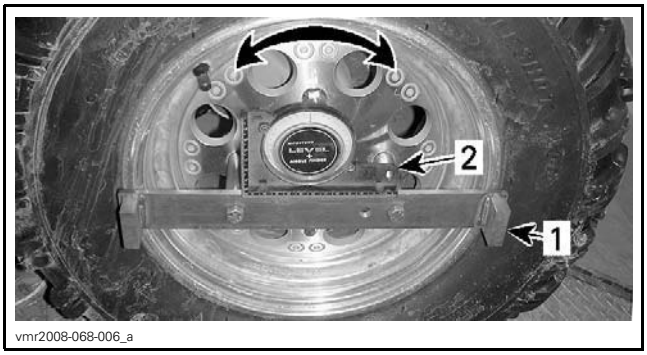
1. Place vehicle on a level surface.
2. Check pressure in each tire. Adjust to recommended pressure.
3. Lift and secure vehicle off the ground so that the suspension is fully extended.
4. Position and secure handlebar in the straight ahead position.
5. Remove two wheel nuts on the LH rear wheel and install the steering alignment tool.

REQUIRED TOOL	
STEERING ALIGNMENT TOOL (P/N 529 036 059)	

6. Place a rope around all four tires using an elastic, link both ends together.

NOTE: The rope must be placed at the center of the wheels.

7. Rotate the rear wheel to position the alignment tool level with the rope. Ensure rope passes over the spacer blocks on the alignment tool.

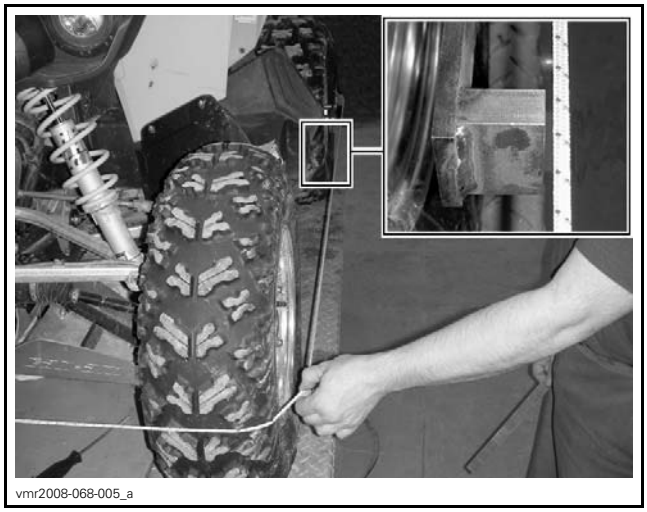


vmr2008-068-006_a

TYPICAL

1. *Steering adjustment tool*
2. *Angle gauge or level*

8. At the LH front of wheel, near the front of the rim, pull on the rope so that it does not touch the first spacer block on the alignment tool.


vmr2008-068-005_a

TYPICAL

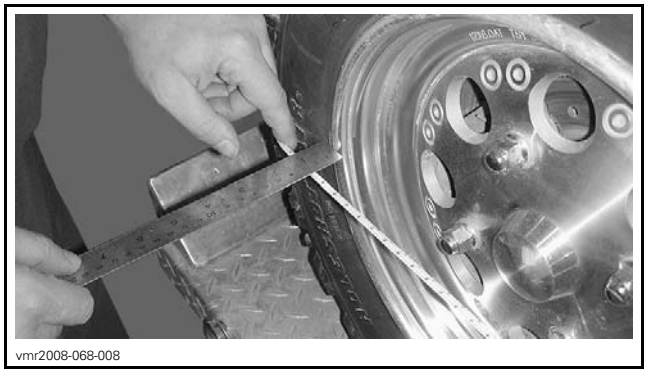
9. Slowly move rope back until it just makes contact with both spacers.

NOTE: Ensure rope remains in this position as you carry out the following steps.


vmr2008-068-007

TYPICAL

10. Measure the distance between the rope and the rim, at the front and at the rear of the wheel rim.


vmr2008-068-008

TYPICAL — FRONT OF WHEEL


vmr2008-068-009

TYPICAL — REAR OF WHEEL

11. Calculate the difference between the front and rear measurements and compare with following specification.

SPECIFICATION
0 mm to 3 mm (0 in to .118 in) **toe-in**

12. If the wheel toe measurement is out of specification, carry out the following:

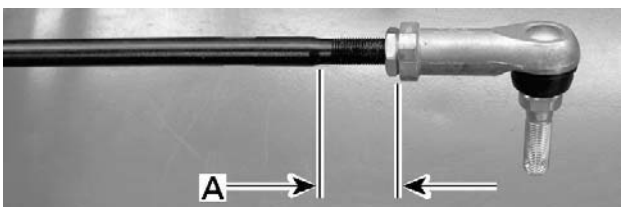
    12.1 Loosen tie-rod end lock nuts.

    12.2 Adjust tie-rod length.

    NOTE: For a toe-in adjustment, the distance must be longer at the front of the wheel. Lengthen tie-rod to increase toe-in, and vise-versa.

⚠ WARNING

The maximum unengaged tie-rod length must not exceed 32 mm (1-1/4 in) Tie rod unengaged length must be the same at both ends of the tie-rod.



tmr2011-034-107_a

A. Maximum unengaged length

    12.3 Tighten tie-rod end lock nuts to specification.

TIGHTENING TORQUE	
Tie-rod end locking nut	34 N•m ± 2 N•m (25 lbf•ft ± 1 lbf•ft)

13. Repeat procedure for other front wheel.

PROCEDURES

HANDLEBAR GRIP

Handlebar Grip Removal

1. Loosen the screw at the end of handlebar grip.
2. Remove the handlebar grip cap.
3. Cut and remove the handlebar grip.

Handlebar Grip Installation

1. Remove all rubber residues of the old grip before installing the new.
2. Clean the handlebar with PULLEY FLANGE CLEANER (P/N 413 711 809) or alcohol to remove any greasy matter on it.
3. Install handlebar grip by blowing compressed air between handle grip and handlebar.
4. Install a SMOOTHFLOW™ TAPERED TIP (P/N 16 GA #511 RTT-B) from EFD Inc on a bottle of LOCTITE 406 (GLUE) (P/N 293 800 100).
5. Lift a part of the grip using a small screwdriver and inject glue (about 4 spots per side).

NOTE: The glue dries quickly. Do not apply it before installing grip.

6. Apply pressure on the grip for approximately 30 seconds to set the glue.
7. Install the handlebar grip cap and torque screw 0.4 N•m (3.5 lbf•**in**).

HANDLEBAR COVER

Handlebar Cover Removal

Pull on plastic handlebar cover to remove it from the handlebar.

Handlebar Cover Inspection

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

Handlebar Cover Installation

The installation is the reverse of the removal procedure.

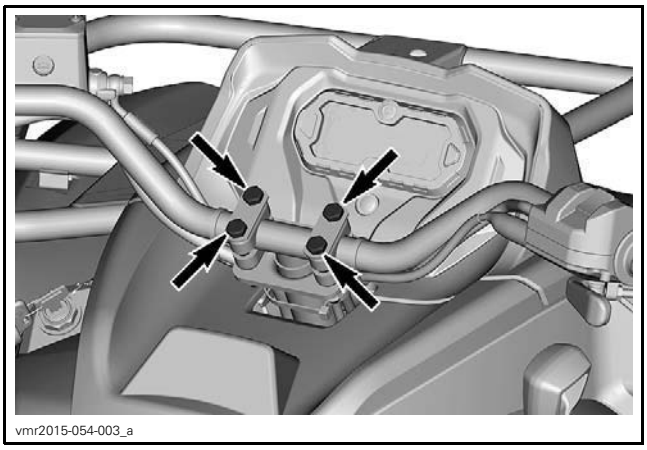
HANDLEBAR

Handlebar Removal

1. Remove handlebar cover.

NOTE: Remove handlebar grips, throttle handle, brake handle and multifunction switch only if the handlebar is defective and requires replacement.

2. Remove handlebar mounting screws.


vmr2015-054-003_a

Handlebar Inspection

Inspect the handlebar for damage, cracks or bending. Replace if any of these problems is detected.

Handlebar Installation

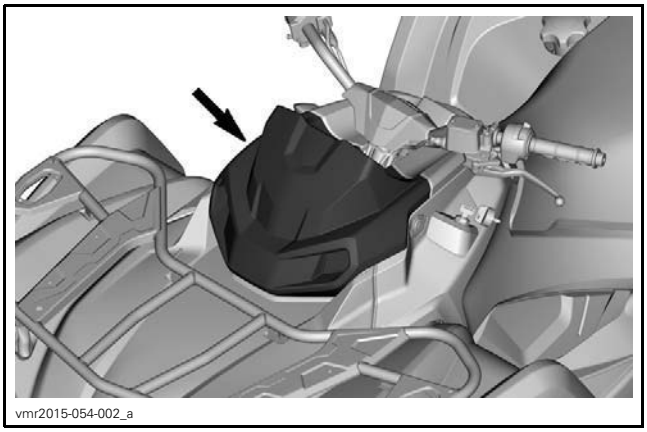
The installation is the reverse of the removal procedure.

NOTE: Ensure handlebar "U" clamps are tightened equally (equal distance on each side of clamps).

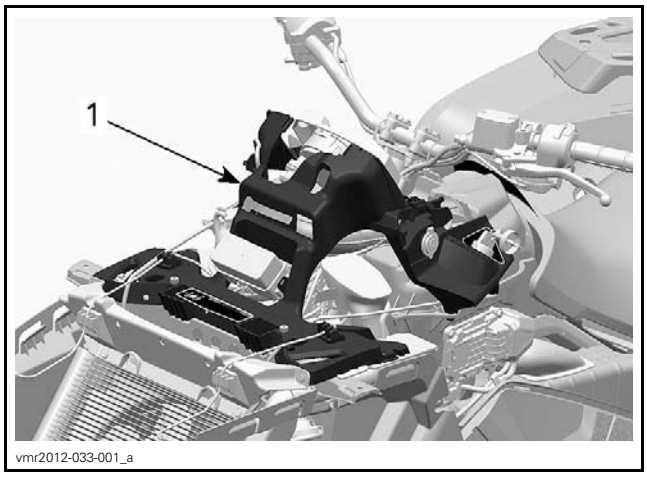
STEERING CONNECTORS

Steering Connector Access

1. Remove gauge support, refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.


vmr2015-054-002_a

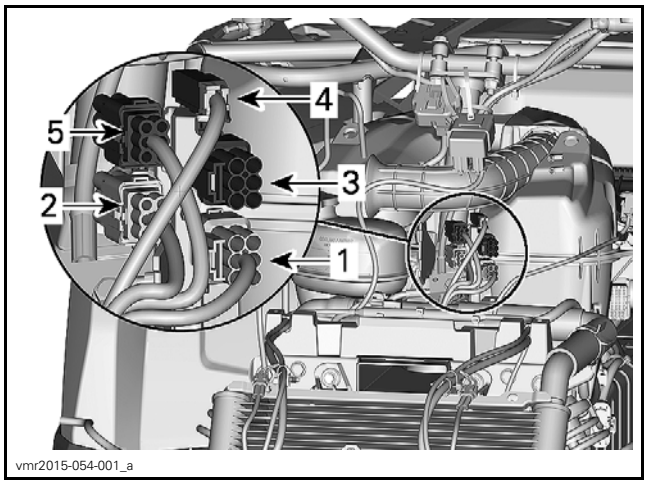
2. Remove front body module, refer to body subsection.
3. Remove dash board support.



vmr2012-033-001_a

1. Dash board support

Steering Connector Identification



vmr2015-054-001_a

STEERING CONNECTOR IDENTIFICATION
1. MG1 (LH multifunction switch)
2. MG2 (LH multifunction switch)
3. MG3 (LH multifunction switch)
4. DC3 (DC power connector)
5. HIC1 (Engine interconnect)

MULTIFUNCTION SWITCH

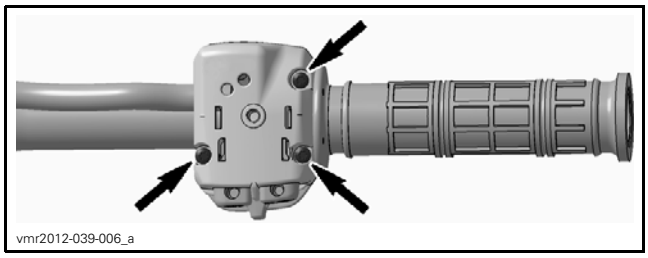
Multifunction Switch Removal (From Vehicle)

Remove gauge support. Refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.

Carry out steps in *MULTIFUNCTION SWITCH REMOVAL (AT HANDLEBAR)*.

Multifunction Switch Removal (At Handlebar)

1. Remove multifunction switch screws.



TYPICAL - MULTIFUNCTION SWITCH

2. Separate multifunction switch from handlebar.
3. Disconnect multifunction switch steering connectors, refer to *STEERING CONNECTOR IDENTIFICATION* in this subsection:
   – MG1
   – MG2
   – MG3.
4. Take note of the positions of the locking ties securing the steering harness, then cut them and remove the multifunction switch steering harness from the vehicle.

Multifunction Switch Installation

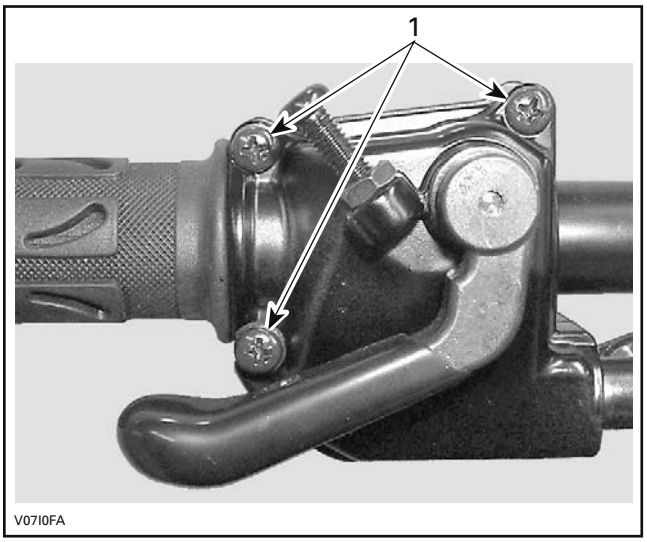
For installation, reverse the removal procedure.

NOTICE **Be sure to route and secure the multifunction switch steering harness as noted prior to removal.**

THROTTLE LEVER

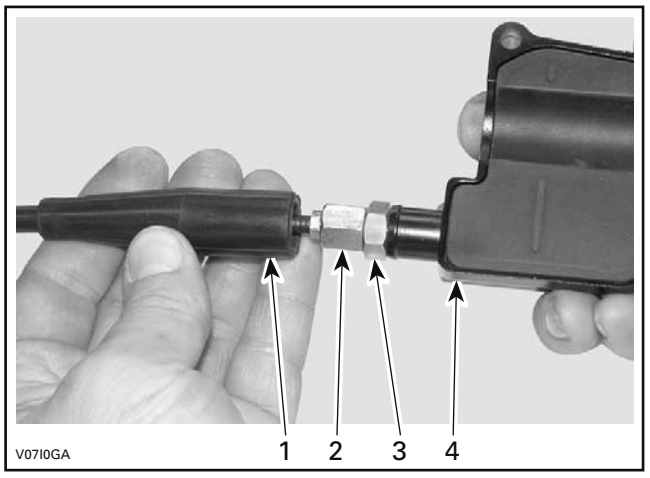
Throttle Lever Removal

1. Disconnect the HIC1 connector (2/4WD switch), refer to *STEERING CONNECTORS* in this subsection.
2. Remove throttle lever housing retaining screws.



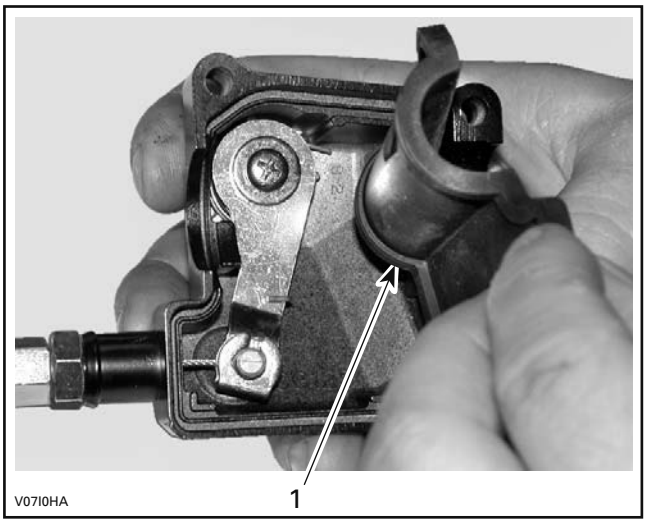
TYPICAL - THROTTLE LEVER HOUSING
1. Remove retaining screws

3. Separate throttle lever housing from handlebar.
4. Slide rubber protector back to expose throttle cable adjuster.



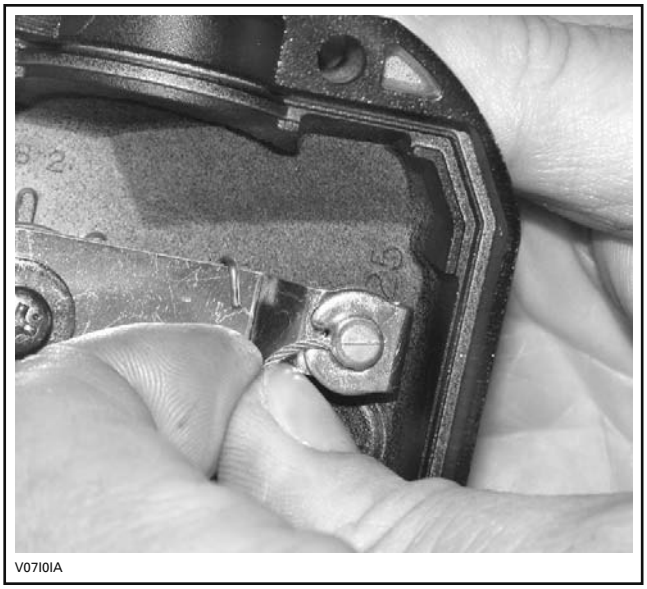
1. Cable protector
2. Throttle cable adjuster
3. Lock nut
4. Throttle lever housing

5. Loosen lock nut and screw in the throttle cable adjuster.
6. Remove inner housing protector.



1. Inner housing protector

7. Slide cable in clip slot and remove the end of the cable from clip.



8. Remove throttle cable from housing.

Throttle Lever Installation

The installation is the reverse of the removal procedure.

Adjust throttle cable. Refer to *THROTTLE CABLE ADJUSTMENT*.

BRAKE LEVER

Brake Lever Removal (From Vehicle)

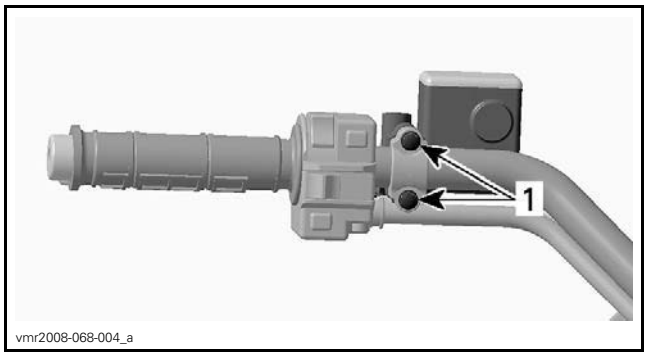
1. Carry out steps in *BRAKE LEVER REMOVAL (FROM HANDLEBAR)*.

NOTICE Avoid spilling brake fluid on plastic, rubber or painted parts.

2. Disconnect brake hose, refer to *BRAKES* subsection.

Brake Lever Removal (At Handlebar)

1. Remove brake lever retaining screws.



TYPICAL
1. Remove these retaining screws

2. Separate brake lever from handlebar.

Brake Lever Installation

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

Tighten brake lever mounting screw to specification.

TIGHTENING TORQUE	
Brake lever mounting screw	9 N•m ± 1 N•m (80 lbf•**in** ± 9 lbf•**in**)

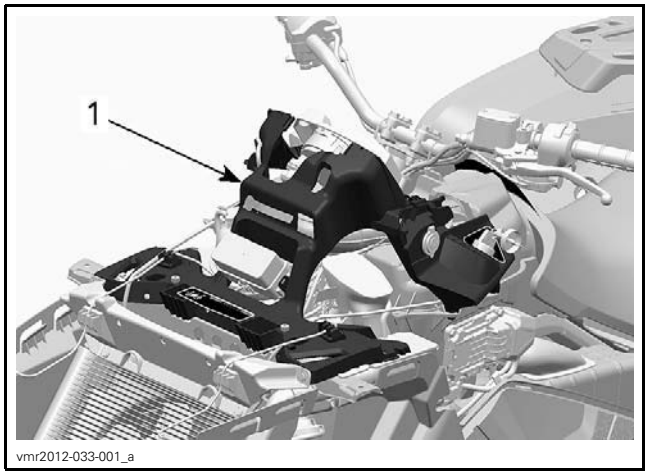
⚠ WARNING

If brake hose was disconnected, bleed brake system. Refer to *BRAKES* subsection.

STEERING COLUMN

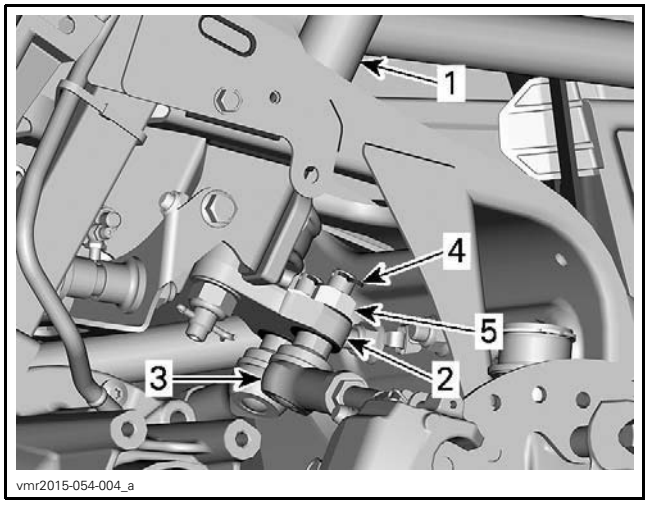
Steering Column Removal (Without a DPS)

1. Remove gauge support, refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.
2. Refer to *BODY* subsection to remove the following:
   – Front body module
   – Inner fender panels
3. Remove dash board support.



1. Dash board support

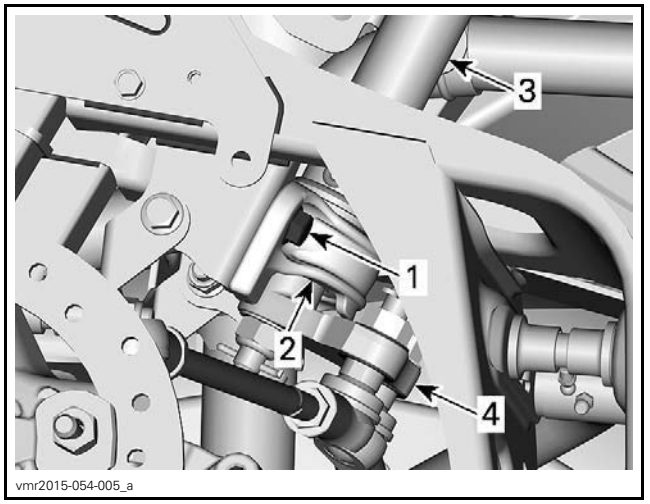
4. Remove the air intake silencer. Refer to *AIR INTAKE SYSTEM* subsection.
5. Remove handlebar, refer to *HANDLEBAR REMOVAL* in this subsection. Also remove locking ties and separate wiring harnesses and hoses from the steering column.
6. Disconnect the tie-rods from the pitman arm at the bottom of the steering column. Refer to *TIE-ROD* in this subsection.



1. Steering column
2. Pitman arm
3. Tie-rod end
4. Cotter pin
5. Tie-rod retaining nut

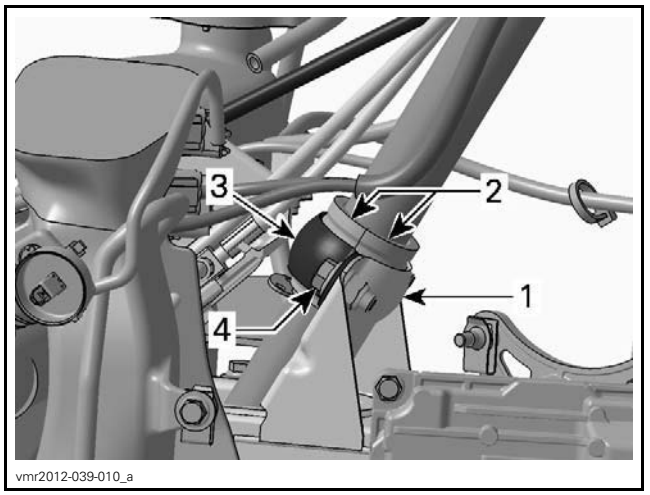
NOTE: When removing tie-rods from pitman arm, take note of positions of flat washers for installation.

7. Remove lower half bushing retaining screws and pull retainer off of half bushings.



1. Lower retainer mounting screws (2)
2. Lower half bushing retainer
3. Steering column
4. Pitman arm

8. Remove upper half bushing retaining screws and pull retainer off of half bushings.

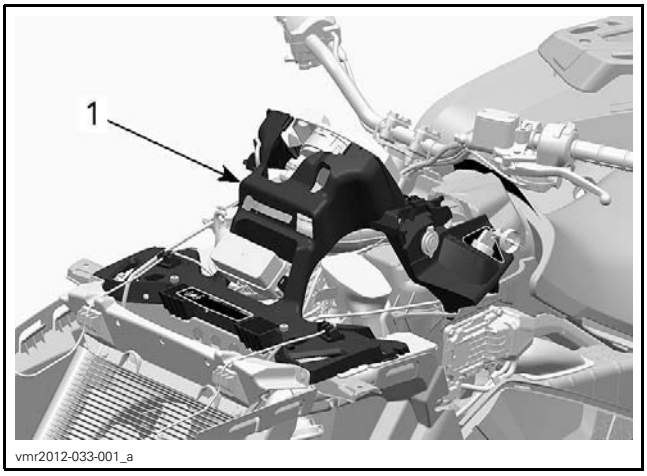


1. Upper steering column support
2. Half bushings
3. Half bushing retainer
4. Retainer mounting screws (2)

9. Pull steering column from vehicle.

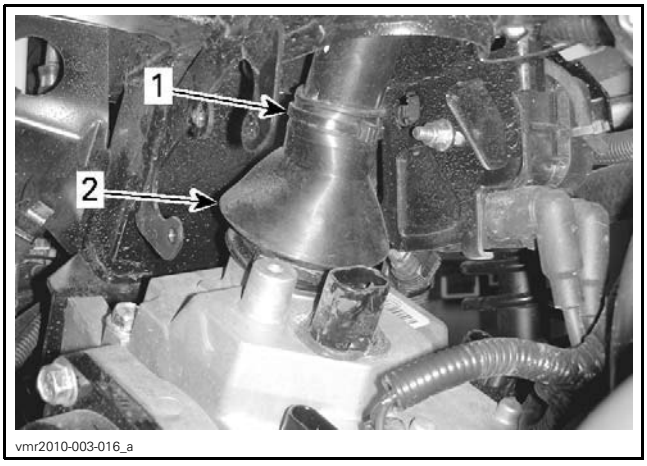
Steering Column Removal (With a DPS)

1. Remove gauge support, refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.
2. Refer to *BODY* subsection and remove the following:
   – Front body module
   – Inner fender panels
3. Remove dash board support.



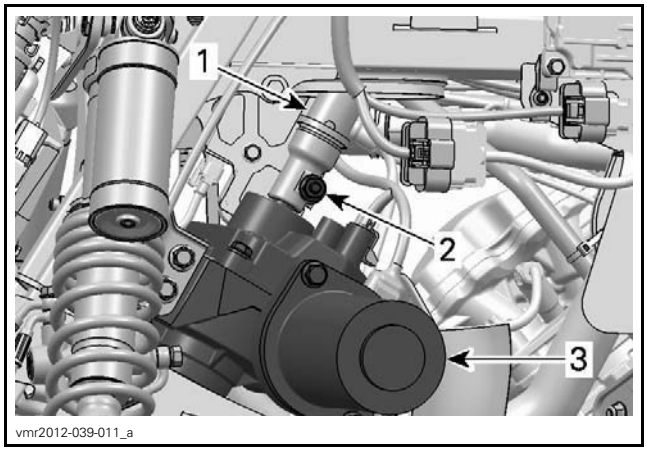
1. Dash board support

4. Remove the air intake silencer. Refer to *AIR INTAKE SYSTEM* subsection.
5. Remove handlebar, refer to *HANDLEBAR REMOVAL* in this subsection. Also remove locking ties and separate wiring harnesses and hoses from the steering column.
6. Cut the locking tie securing the bellows at the bottom of steering column near the DPS unit, and pull the bellows upwards sufficiently to access the steering column pinch screw.



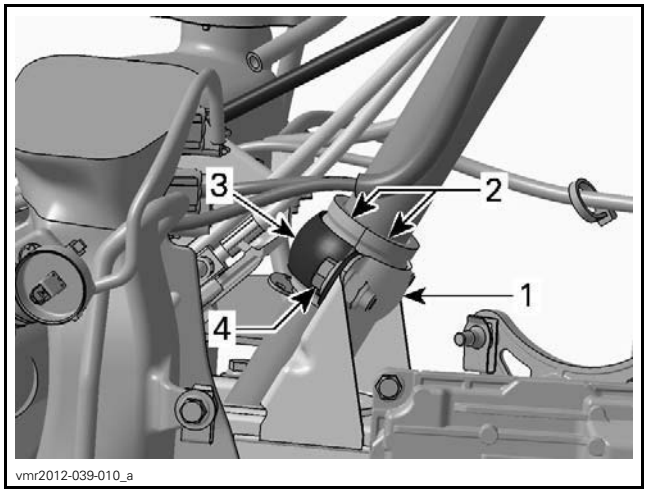
TYPICAL
1. Cut this locking tie
2. Steering column bellows

7. Remove steering column lower pinch screw and nut. Discard the nut.



SOME PARTS REMOVED FOR CLARITY
1. Steering column
2. Steering column lower pinch screw and nut
3. DPS unit

8. Remove upper half bushing retaining screws and pull retainer off of half bushings.



1. Upper steering column support
2. Half bushings
3. Half bushing retainer
4. Retainer mounting screws (2)

9. Pull steering column from vehicle.

Steering Column Inspection

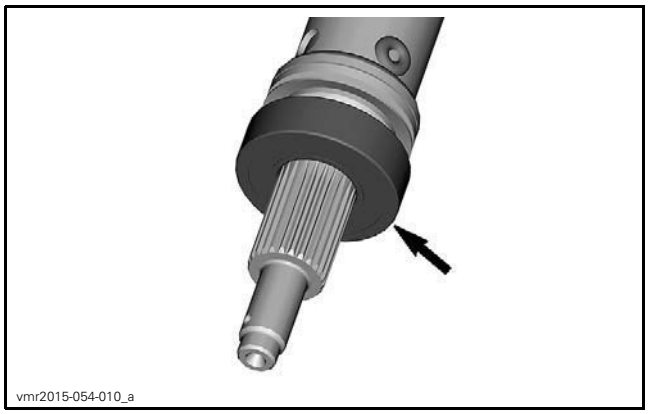
1. Inspect steering column for wear, cracks or bending. Replace if any of these problems is detected.
2. Check steering column O-rings and seal for brittleness, hardness, wear or other damage. Replace if necessary.
3. Clean and check steering column half bushings. If they show signs of wear or cracking, replace them.

Models Without a DPS

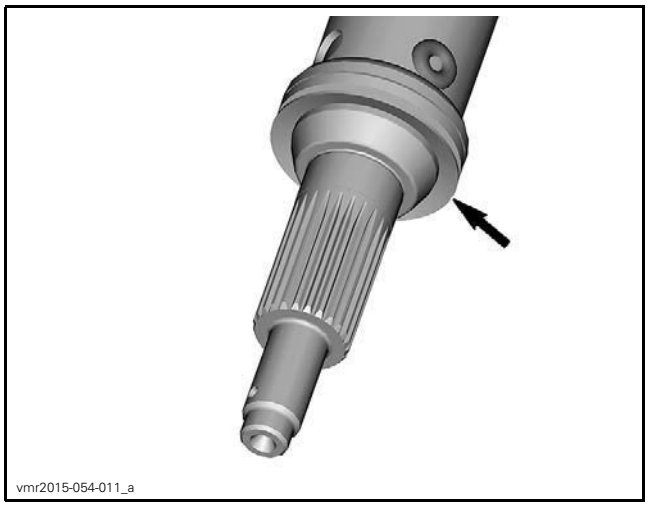
4. Check if steering column lower ball bearing turns freely and smoothly. Replace if necessary.

Steering Column Lower Ball Bearing and Seal Replacement (Without a DPS)

1. Remove the pitman arm. Refer to *PITMAN ARM* in this subsection.
2. Remove ball bearing.


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3. Remove seal.


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4. Install a **NEW** seal.
5. Install a **NEW** ball bearing.

Steering Column Installation

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

PRODUCT	
O-rings, half bushings and DPS input shaft splines	XPS SYNTHETIC GREASE (P/N 293 550 010)
DPS output shaft splines	LOCTITE 767 (ANTISEIZE LUBRICANT) (P/N 293 800 070)

Install **NEW** cotter pins (as applicable per model). Both ends of cotter pins must be folded.

Install **NEW** elastic nuts where used.

Torque all fasteners as specified in the applicable exploded view.

Carry out a *STEERING ALIGNMENT* procedure as detailed in this subsection.

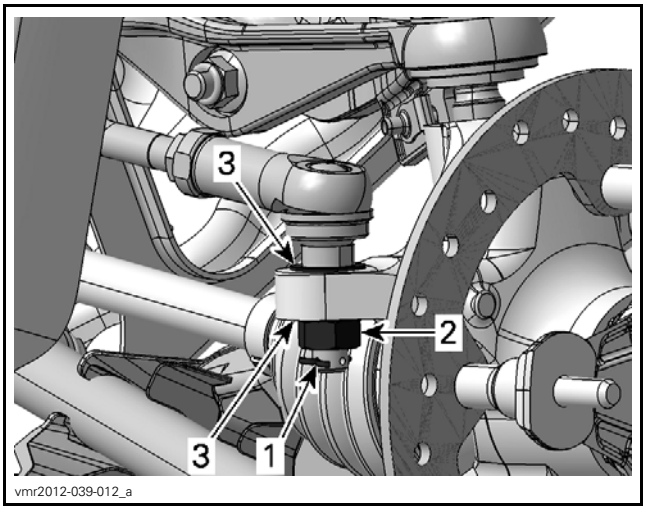
Carry out a *TORQUE OFFSET RESET* procedure as detailed in this subsection.

TIE-ROD

NOTE: Use the same procedure for RH and LH side.

Tie-Rod Removal

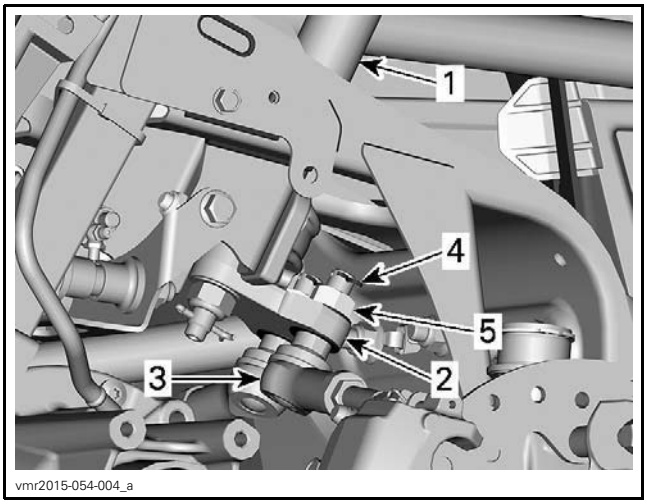
1. Place vehicle on jack stands and remove the applicable wheel.
2. Remove tie-rod end from steering knuckle by removing:
   - Cotter pin (discard)
   - Retaining nut
   - Hardened washers.



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TIE ROD AT STEERING KNUCKLE
1. *Cotter pin*
2. *Retaining nut*
3. *Hardened washers*

3. If completely removing tie-rod from vehicle, repeat previous step at pitman arm.



TIE ROD AT PITMAN ARM
1. *Steering column*
2. *Pitman arm*
3. *Tie-rod end*
4. *Cotter pin*
5. *Tie-rod end retaining nut*

Tie-Rod Inspection

Inspect tie-rod for straightness, cracks and other damages. Replace as required.

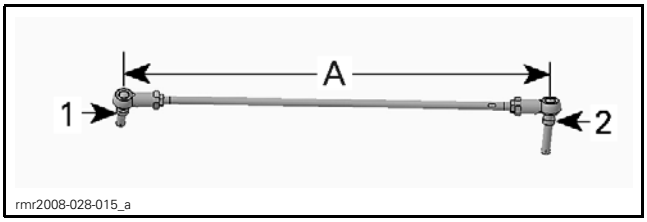
Inspect tie-rod ends for wear or excessive play. If excessive, replace the tie-rod end.

Tie-Rod Installation

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

When installing a new tie-rod or tie-rod end, adjust tie-rod to nominal length.

TIE-ROD NOMINAL LENGTH	
Dimension "A" - center to center	416.4 mm (16-3/8 in)



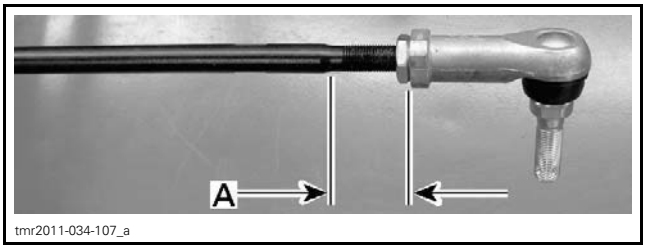
NOMINAL LENGTH
1. *Pitman arm side*
2. *Knuckle side*

A. 416.4 mm (16-3/8 in)

TIE-ROD MAXIMUM UNENGAGED LENGTH	
Dimension "A" - Shoulder to tie rod end face	32 mm (1-1/4 in)

⚠ WARNING

Maximum tie-rod unengaged length must not exceed specification. Both tie-rod ends must be engaged equally.



MAXIMUM TIE-ROD UNENGAGED LENGTH
A. 32 mm (1-1/4 in)

Install NEW cotter pins. Both ends of cotter pins must be folded.

Check the steering alignment, refer to *STEERING ALIGNMENT* in this subsection.

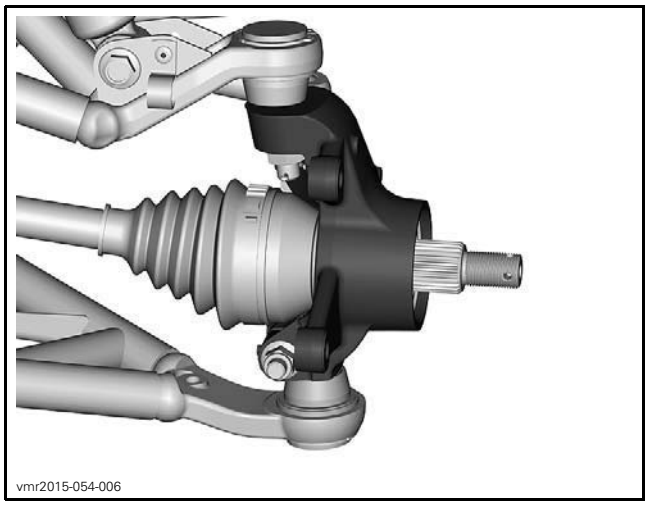
Apply specified torques.

TIGHTENING TORQUE	
Tie-rod lock nut	34 N•m ± 2 N•m (25 lbf•ft ± 1 lbf•ft)
Tie rod end retaining nut	72 N•m ± 7 N•m (53 lbf•ft ± 5 lbf•ft)

KNUCKLE

Knuckle Removal

1. Safely lift and support the front of vehicle.
2. Remove front wheel.
3. Detach tie-rod end from knuckle, refer to *TIE-ROD END* in this subsection.
4. Remove brake caliper, refer to *BRAKES* subsection.
5. Remove wheel hub, refer to *FRONT DRIVE* subsection.


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6. Detach upper suspension arm from knuckle, refer to *FRONT SUSPENSION*.
7. Detach lower suspension arm from knuckle, refer to *FRONT SUSPENSION*.
8. Remove knuckle from vehicle.

Knuckle Inspection

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

Check if wheel bearing turns freely and smoothly. See *WHEEL BEARING* in this subsection.

Knuckle Installation

The installation is the reverse of the removal procedure.

Refer to applicable subsection.

WHEEL BEARINGS

Wheel Bearing Inspection (Maintenance)

Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

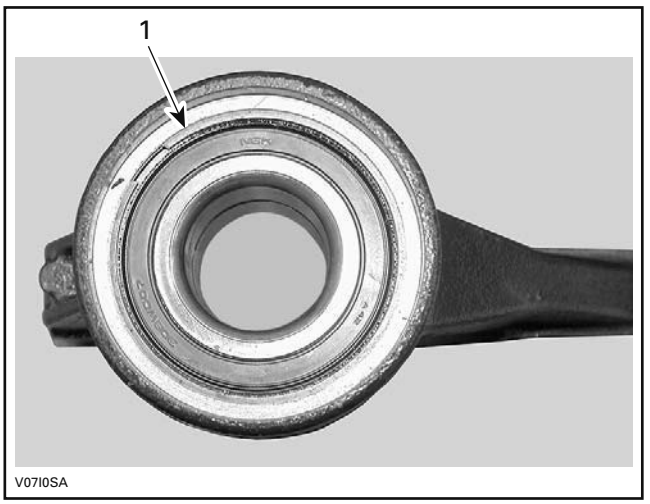
Wheel Bearing Inspection (During Component Removal)

Whenever the drive axle or knuckle is removed, check if wheel bearing turns freely and smoothly.

Replace if necessary.

Wheel Bearing Removal

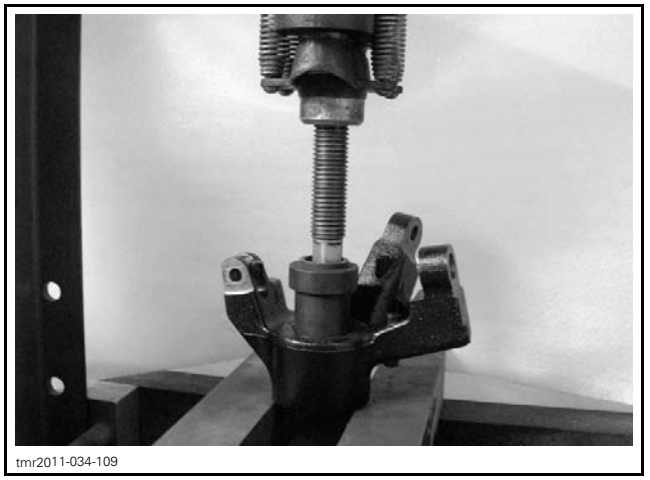
1. Remove knuckle from vehicle, refer to *KNUCKLE REMOVAL* in this subsection.
2. Remove the circlip.



V07I0SA

TYPICAL
1. Circlip

3. Install knuckle on a press.
4. Remove bearing from knuckle using an appropriate bearing remover.


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TYPICAL

NOTE: It may be necessary to heat the knuckle to remove bearing.

⚠ WARNING

Clean all grease from outside and inside of knuckle before heating it.

Wheel Bearing Installation

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

To ease wheel bearing installation:

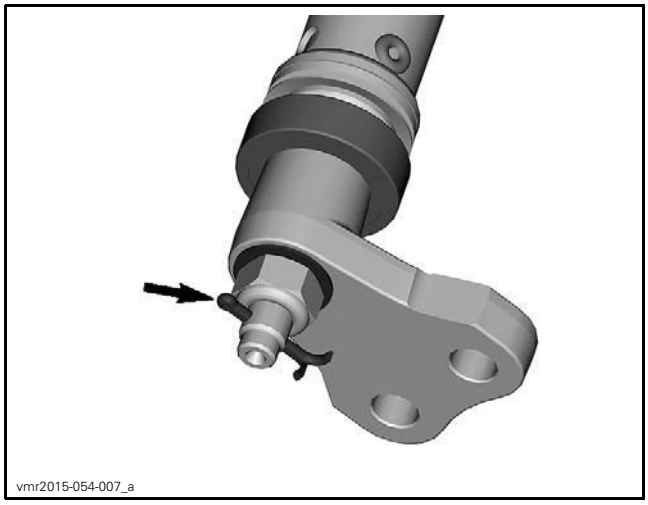
– Place bearing in a freezer for 10 minutes.
– Place knuckle in oven to 100°C (212°F) for 30 minutes maximum.

When knuckle is cooled down, install **NEW** circlip.

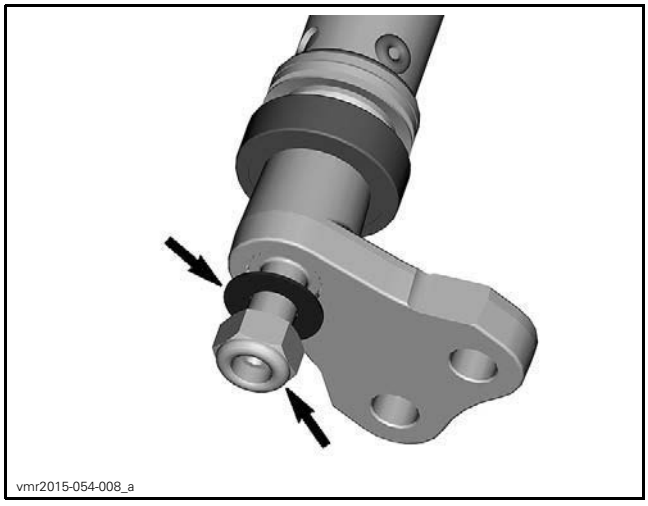
PITMAN ARM (WITHOUT A DPS)

Pitman Arm Removal

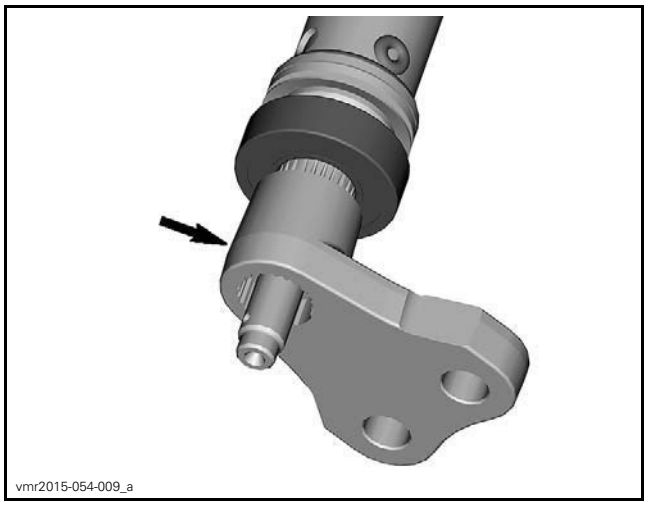
1. Remove tie rod ends from pitman arm. Refer to *TIE ROD* in this subsection.
2. Remove and discard cotter pin.


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3. Remove pitman arm retaining nut and washer.


vmr2015-054-008_a

4. Remove pitman arm.


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Pitman Arm Inspection

Inspect pitman arm for cracks or other damages. Replace if necessary.

Check pitman arm splines for excessive wear. Replace if necessary.

Pitman Arm Installation

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

PRODUCT	
Steering column splines	LOCTITE 767 (ANTISEIZE LUBRICANT) (P/N 293 800 070)

Tighten the pitman arm retaining nut to specification.

TIGHTENING TORQUE	
Pitman arm retaining nut	57.5 N•m ± 7.5 N•m (42 lbf•ft ± 6 lbf•ft)

Install a NEW cotter pin. Both ends of cotter pins must be folded.

PITMAN ARM (WITH A DPS)

Refer to *DYNAMIC POWER STEERING (DPS)* subsection.

DYNAMIC POWER STEERING (DPS)

SERVICE TOOLS

Description	Part Number	Page
FLUKE 115 MULTIMETER	529 035 868	652
PITMAN ARM JIG	529 036 225	663, 665
PITMAN ARM PULLER	529 036 227	664
POSITIONING ADAPTOR	529 036 230	664

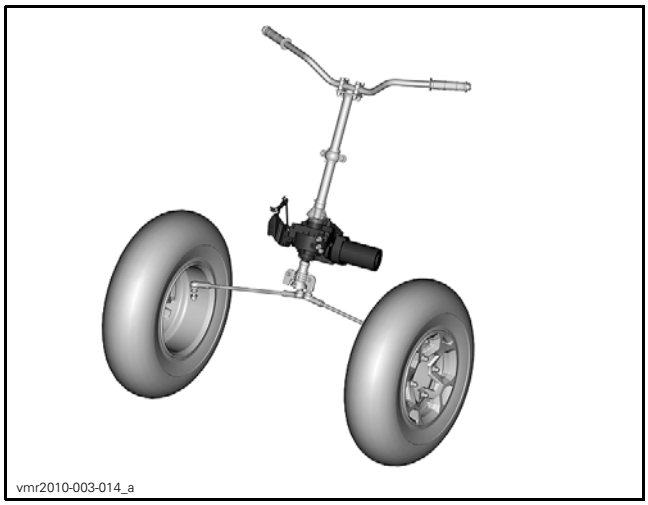
SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 767 (ANTISEIZE LUBRICANT)	293 800 070	665
XPS SYNTHETIC GREASE	293 550 010	659

GENERAL

SYSTEM DESCRIPTION (FEATURES)

The Dynamic Power Steering (DPS) provides a computer controlled, variable power assist, achieved by an electric motor to optimize the amount of steering input required by the rider.



1. Dynamic power steering unit (DPS)

The DPS system uses the following parameters to determine how much steering assist it provides:

– Engine RPM
– Battery/electrical system voltage
– Vehicle speed
– DPS shaft torque sensor input.

The amount of steering assist provided is dependent on the handlebar effort (steering torque), electrical power available, and vehicle speed.

The greater the handlebar effort (torque), the greater the assist will be.

The slower the vehicle speed, the greater the assist will be.

If the electrical system is activated but the engine is **not** running, there is **no** power assist provided.

When the handlebar is in the straight ahead position, there is no steering assist.

Steering torque may also come from the wheels due to rough terrain. Steering kickback is reduced while providing feedback to the driver.

The greater the power steering assist, the greater the load on the electrical system.

When the electrical system is under high load (battery not at full charge, operating the vehicle for prolonged periods of time at slow speed and low RPM which, requires higher power steering assist), the battery power reserve will gradually decrease. This further increases the load on the charging system and the electrical system voltage will drop. As system voltage drops, so does power steering assist.

NOTE: It is important to maintain the battery at a full state of charge to ensure proper DPS operation. The magneto output is 650 watts to minimize battery drain and system voltage drop.

DPS Assist Mode

The DPS system provides three rider selectable modes of operation.

DPS MAX provides maximum steering assist for technical low speed riding in rough or muddy terrain, or for touring.

DPS MED provides normal (medium) steering assist for general all purpose riding.

DPS MIN provides less steering assist for increased feedback and aggressive trail riding.

A fourth mode of operation is available as an accessory to adjust the steering assist level for operation with an approved BRP track kit.

Derating Explanation

Derating is an internal protection system integrated in the DPS electronic module.

This system protects the electronic components when DPS works too hard and the internal temperature reaches a critical level.

It also protects electronics when current ripples in the system are too high. These current ripples can be caused by:

- Loose battery connections
- Low battery voltage
- Bad grounds
- Defective stator or bad stator output wires connection
- Failed regulator
- High electrical loads.

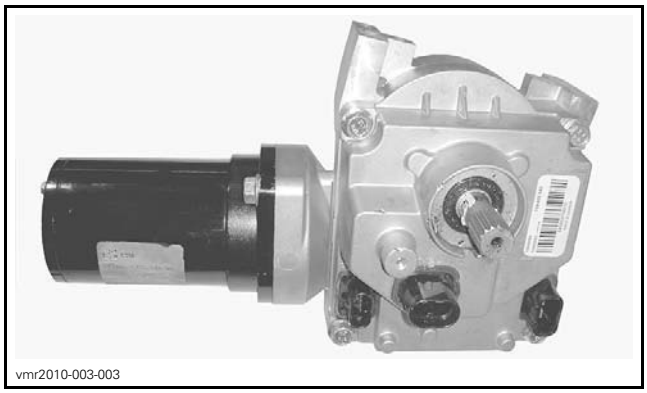
The internal protection system decreases the assistance level available to protect its electronic board. The normal assistance level will return when riding conditions are back to normal and the internal temperature decrease and/or when the ripples in the electric circuit decreases.

NOTE: This reaction is a normal protective behavior of the unit and it does not necessarily raise a fault in the cluster.

DPS SYSTEM DESCRIPTION (COMPONENTS)

DPS Unit

The DPS unit is a self contained unit that includes the steering gear, the DPS module, the DPS motor, and the torque sensor.



TYPICAL - DPS UNIT

The DPS module provides DC power to the motor. The amount and duration of that DC power is determined by the inputs to the DPS module. The direction in which the motor turns is changed by reversing the polarity of the circuit current.

The DPS motor does not "spin", but rather turns in very small increments based on the amount, duration, and direction of DC power delivered by the DPS module.

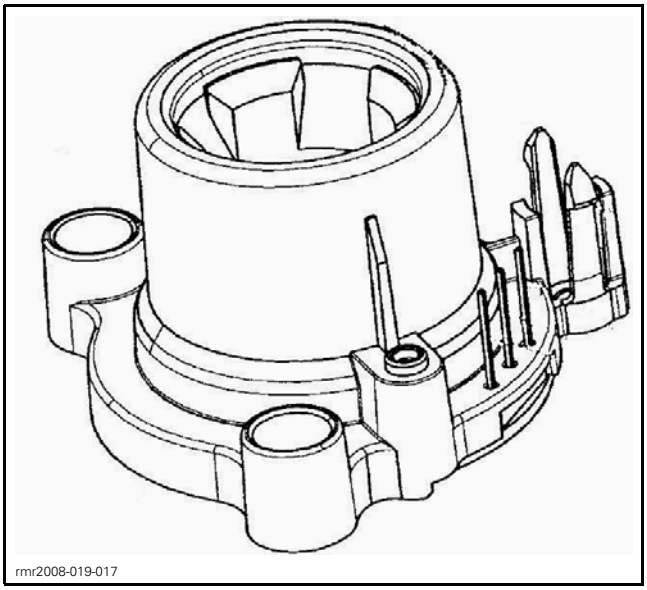
DPS Unit Protection

To protect the DPS electronic components, the steering assist behavior will change as follows.

CONDITION	DPS BEHAVIOR
When motor internal temperature reaches a certain temperature (DPS continuously estimates it)	Steering assist will gradually decrease
DPS **internal board temperature** is above 85°C (185°F)	
DPS **internal board temperature** is above 100°C (212°F)	Steering assist is stopped

When the DPS unit temperature is back within normal operating range, normal steering assist will resume.

Steering Torque Sensor


rmr2008-019-017

The steering column is connected to the shaft on the DPS unit. A small area of the DPS shaft is magnetized. Inside the DPS unit, a torque sensor surrounds the magnetized area of the DPS shaft.

When the handlebar is turned, torque is applied to the shaft which tends to twist the shaft slightly, deforming the magnetic field in the shaft. The sensor detects the torque by measuring the deviation of the magnetic field.

The torque sensor is very sensitive and can detect very small changes in the magnetic field. The harder the handlebar is turned, the greater the magnetic deviation, the greater the power steering assist.

ADJUSTMENT

TORQUE OFFSET RESET

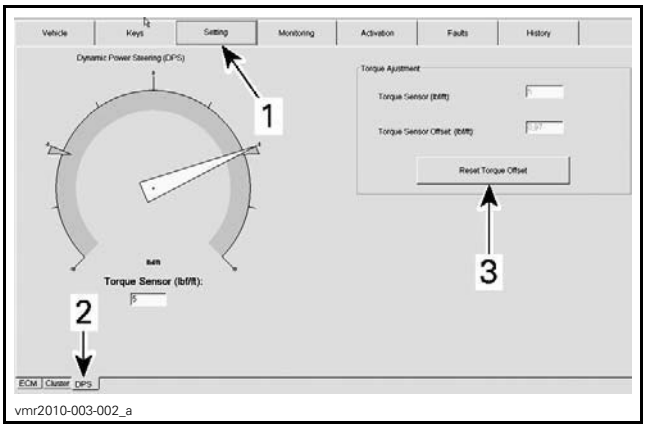
When replacing the following parts or adjusting steering alignment, the sensor torque offset must be reset to zero) for proper system operation.

PART ADJUSTED OR REPLACED	WHAT TO DO
– DPS unit – Steering column half bushings – Steering column – Tie rod – Tie rod end – Knuckle – Wheel bearing – Ball joint – Front suspension arm (lower/upper) – Pitman arm – Steering alignment	Reset Torque Offset in **Setting, DPS**

1. Ensure proper *STEERING ALIGNMENT*, see procedure in this subsection.
2. Connect vehicle to the latest applicable B.U.D.S. software version.
3. In B.U.D.S., select **Read Data**.
4. Choose the **Setting** page tab.
5. At the bottom LH corner of the **Setting** page, choose the **DPS** tab.

NOTICE **Ensure handlebar is free and centered within ±10 degrees of center position. There MUST NOT be any effort applied to the steering column.**

6. Press **Reset Torque Offset** button.

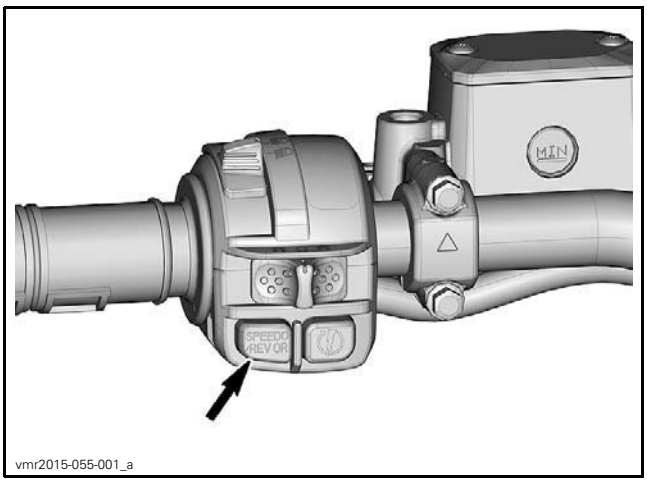


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DPS TORQUE OFFSET RESET
1. *Setting page tab*
2. *DPS tab*
3. *Reset Torque Offset button*

DPS ASSIST MODE

1. **To view** the active DPS ASSIST mode, momentarily press and release the OVERRIDE/DPS button on the LH multifunction switch assembly.



vmr2015-055-001_a

The active DPS mode will be displayed in the lower portion of multifunction gauge.



1. DPS mode display

2. **To change** DPS ASSIST mode, press and hold the OVERRIDE/DPS button for approximately 2 seconds to go to the next setting.

The DPS system will toggle to the following available mode. The newly activated DPS mode will be briefly displayed in the multifunction gauge.

3. Repeat previous step to toggle through the available mode.

NOTE: The DPS mode of operation cannot be changed if the vehicle is in reverse. The DPS/Override switch must be released between each DPS mode selection.

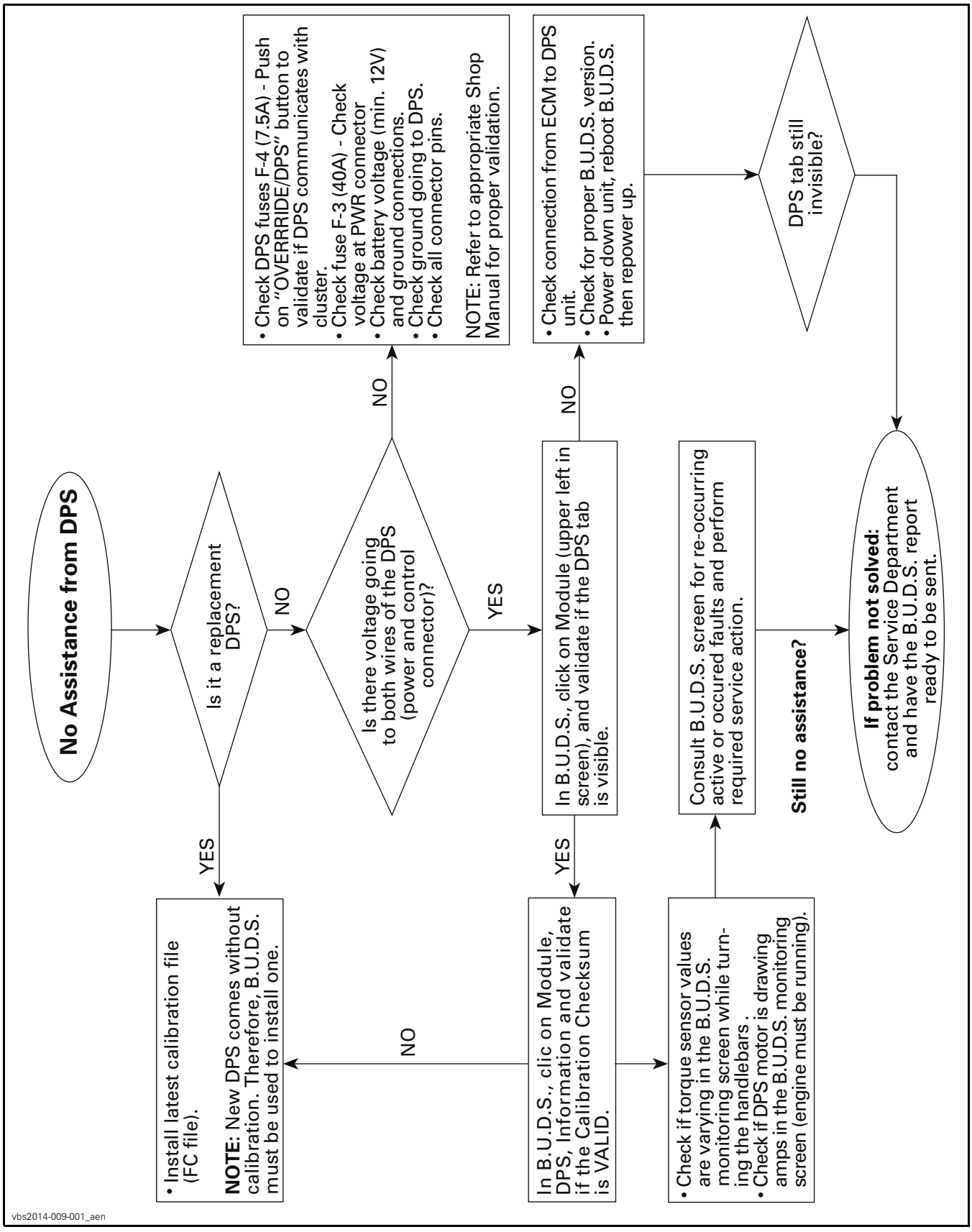
TROUBLESHOOTING

TROUBLESHOOTING FLOW CHARTS

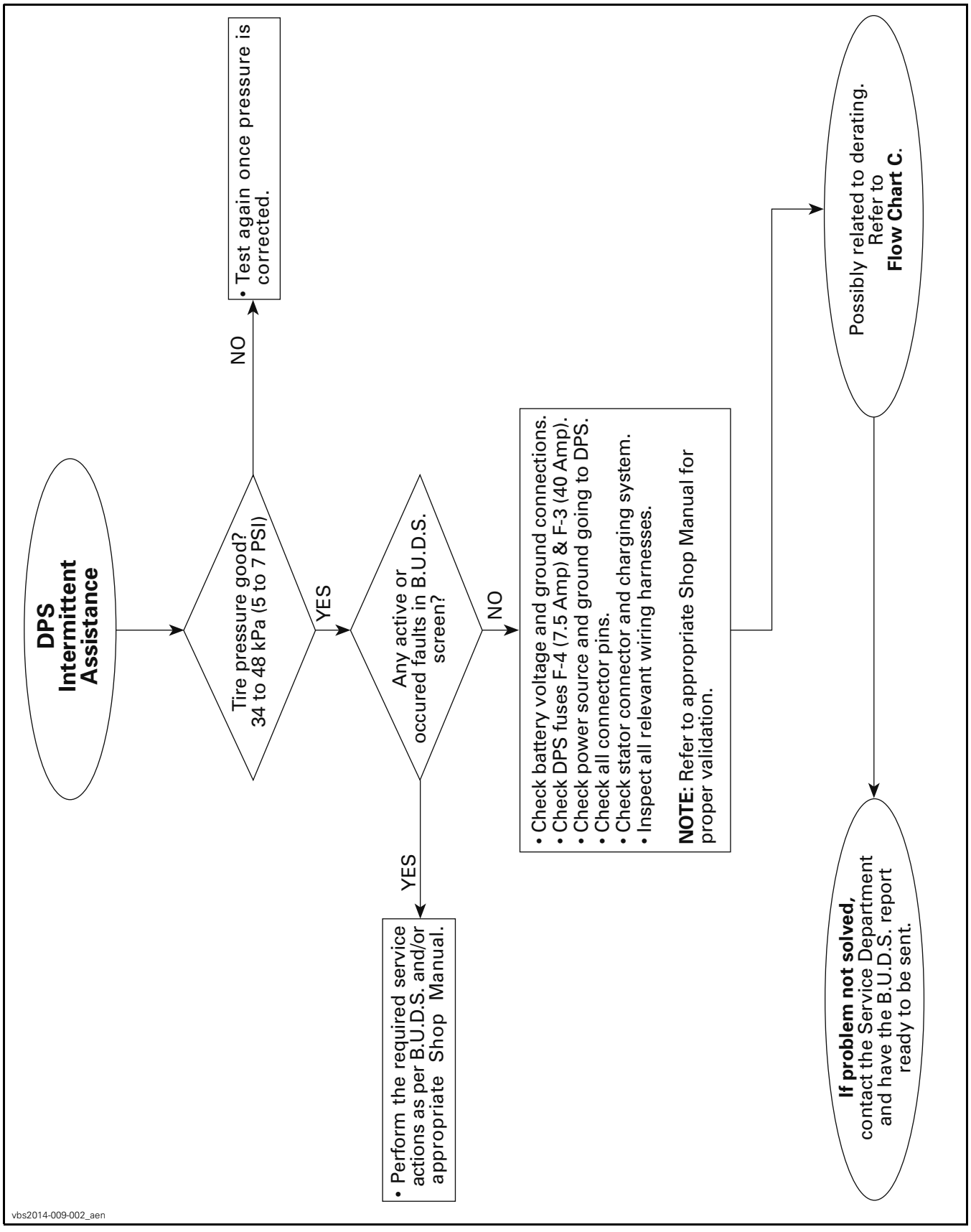
Use the troubleshooting flow charts to diagnose a problem. If a problem cannot be solved, contact a service representative for support before replacing a DPS.

Here is the list of provided flow charts:
- Flow chart A: No Assistance From DPS
- Flow chart B: DPS Intermittent Assistance
- Flow chart C: Derating or Limited Assistance
- Flow chart D: Free Play Felt in Steering System
- Flow chart E: Steering Turn Easier on One Side than the Other.

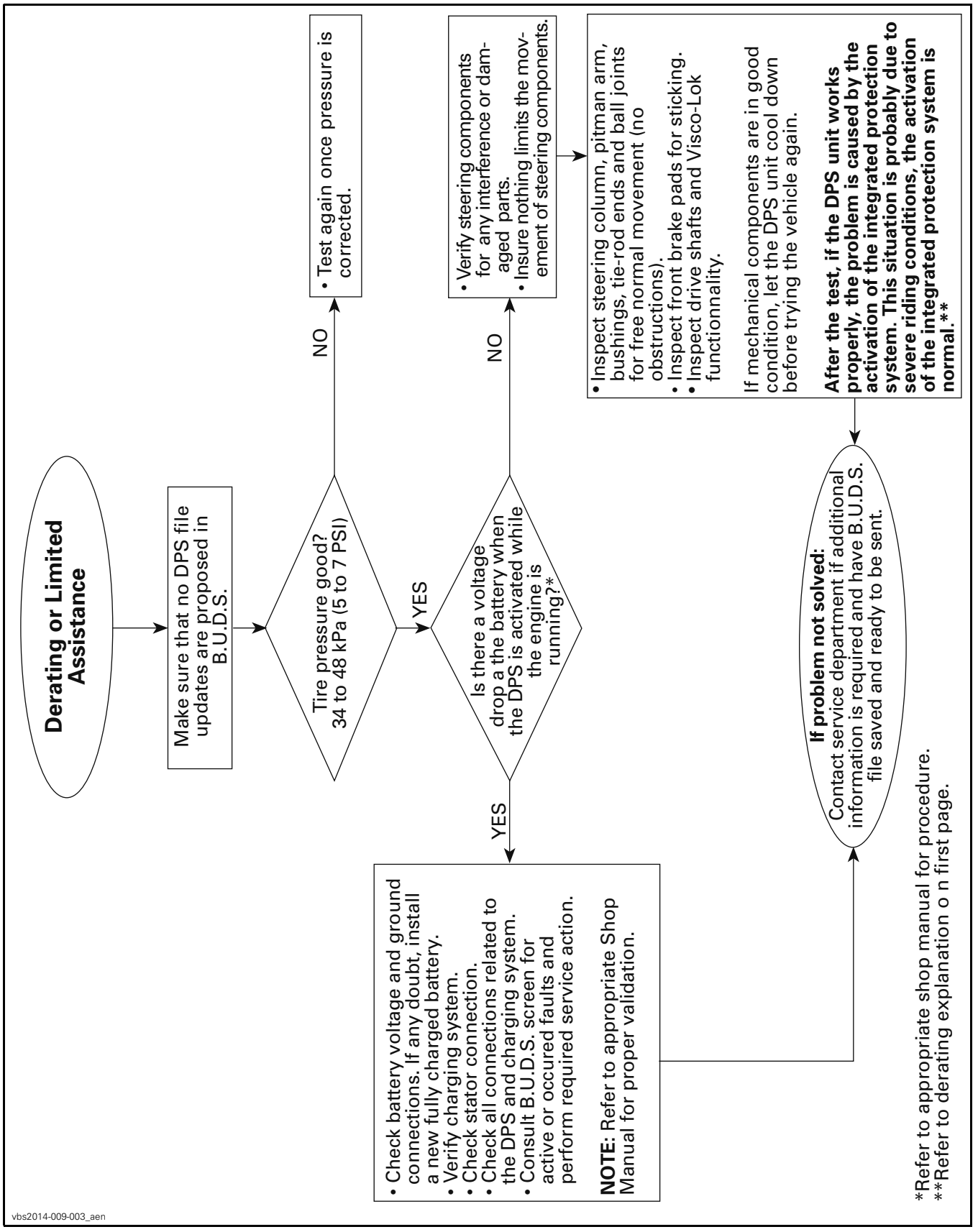
Flow Chart A


No Assistance from DPS
Is it a replacement DPS?
YES
NO
• Install latest calibration file (FC file).
NOTE: New DPS comes without calibration. Therefore, B.U.D.S. must be used to install one.
Is there voltage going to both wires of the DPS (power and control connector)?
NO
• Check DPS fuses F-4 (7.5A) - Push on "OVERRRIDE/DPS" button to validate if DPS communicates with cluster.
• Check fuse F-3 (40A) - Check voltage at PWR connector
• Check battery voltage (min. 12V) and ground connections.
• Check ground going to DPS.
• Check all connector pins.
NOTE: Refer to appropriate Shop Manual for proper validation.
YES
In B.U.D.S., click on Module (upper left in screen), and validate if the DPS tab is visible.
NO
• Check connection from ECM to DPS unit.
• Check for proper B.U.D.S. version.
• Power down unit, reboot B.U.D.S. then repower up.
DPS tab still invisible?
YES
In B.U.D.S., clic on Module, DPS, Information and validate if the Calibration Checksum is VALID.
NO
• Check if torque sensor values are varying in the B.U.D.S. monitoring screen while turning the handlebars .
• Check if DPS motor is drawing amps in the B.U.D.S. monitoring screen (engine must be running).
Consult B.U.D.S. screen for re-occurring active or occured faults and perform required service action.
Still no assistance?
If problem not solved: contact the Service Department and have the B.U.D.S. report ready to be sent.
vbs2014-009-001_aen

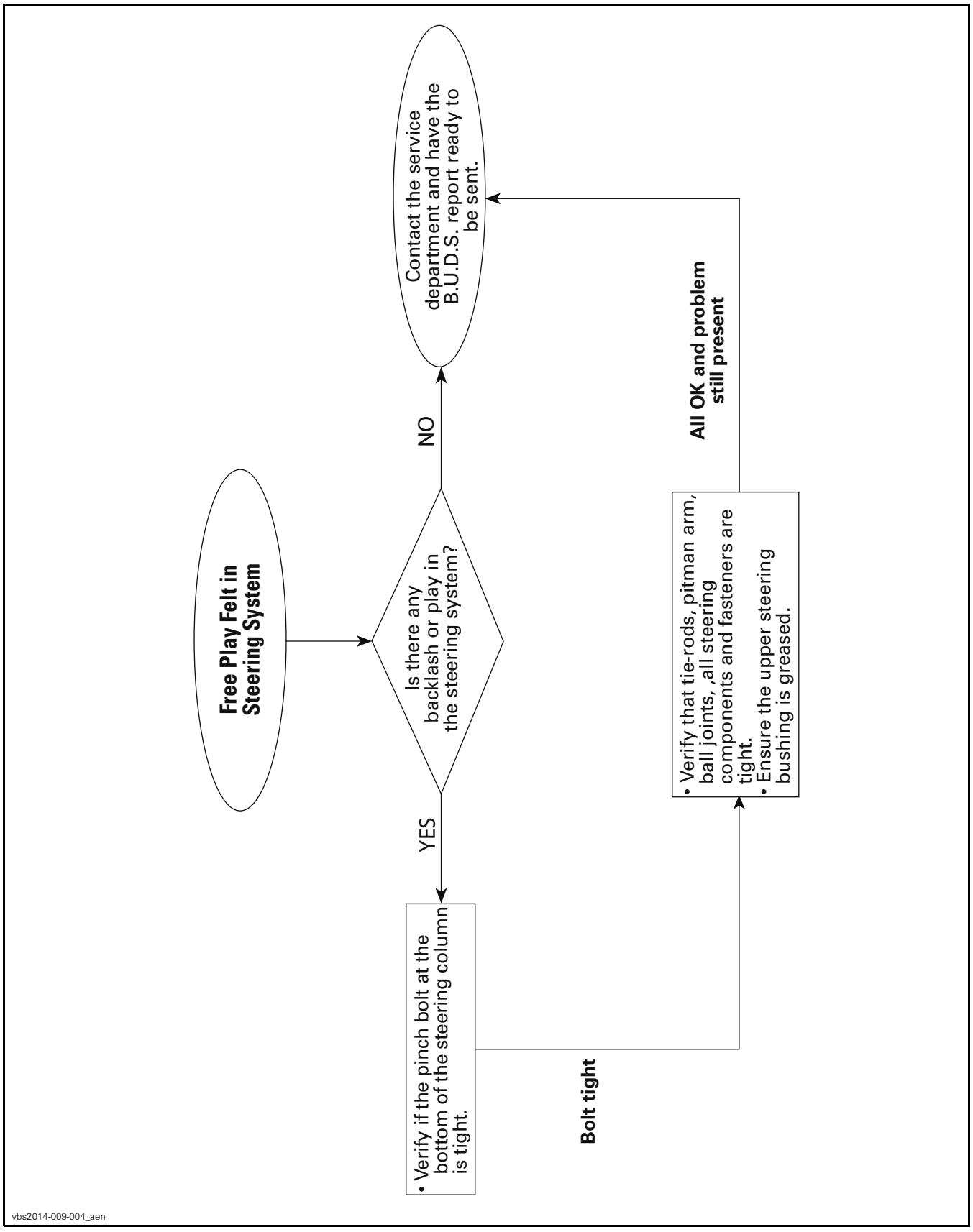
Flow Chart B


DPS Intermittent Assistance
Tire pressure good? 34 to 48 kPa (5 to 7 PSI)
NO
• Test again once pressure is corrected.
YES
Any active or occured faults in B.U.D.S. screen?
YES
• Perform the required service actions as per B.U.D.S. and/or appropriate Shop Manual.
NO
• Check battery voltage and ground connections.
• Check DPS fuses F-4 (7.5 Amp) & F-3 (40 Amp).
• Check power source and ground going to DPS.
• Check all connector pins.
• Check stator connector and charging system.
• Inspect all relevant wiring harnesses.
NOTE: Refer to appropriate Shop Manual for proper validation.
Possibly related to derating. Refer to **Flow Chart C**.
If problem not solved, contact the Service Department and have the B.U.D.S. report ready to be sent.
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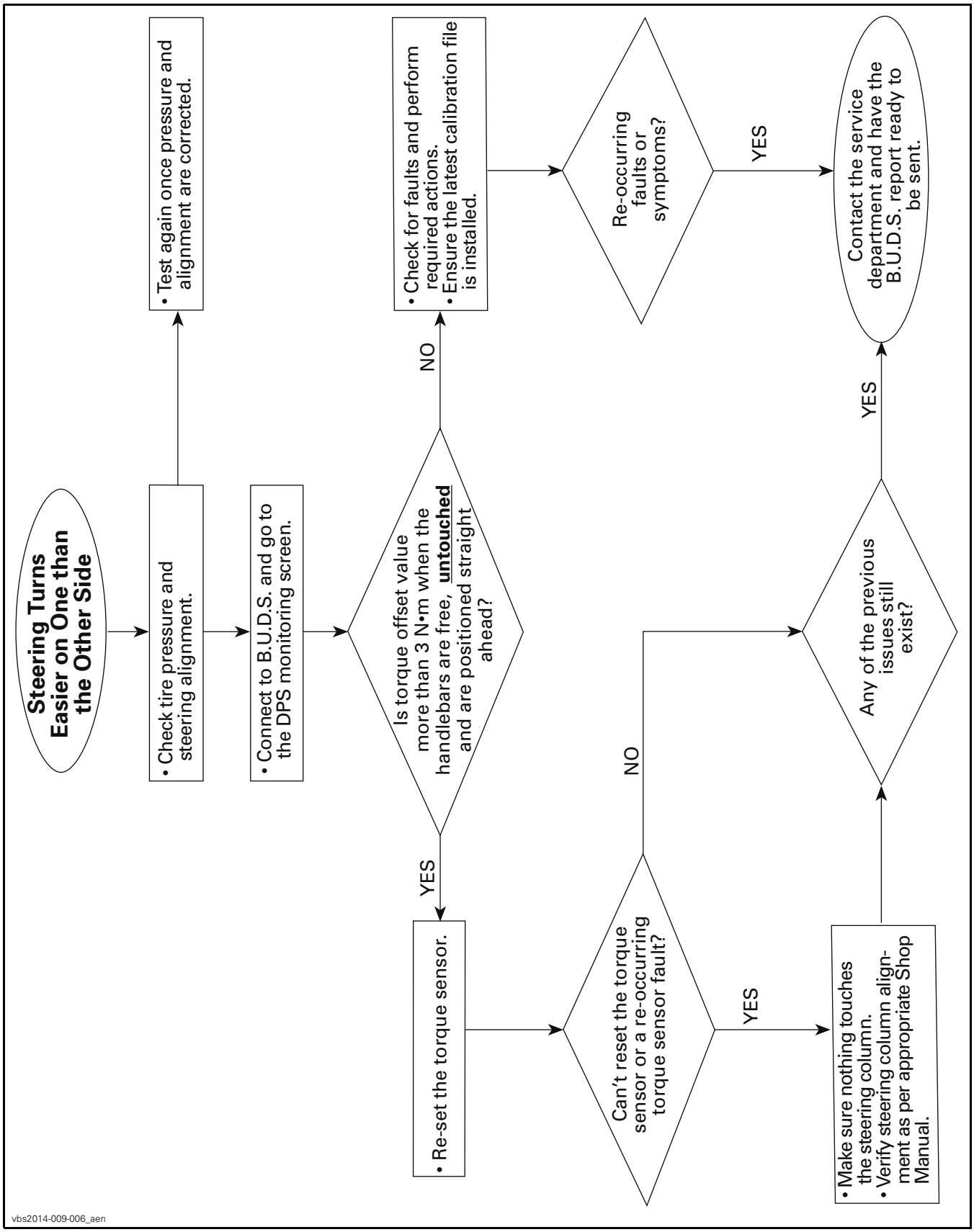
Flow Chart C


Derating or Limited Assistance
Make sure that no DPS file updates are proposed in B.U.D.S.
Tire pressure good? 34 to 48 kPa (5 to 7 PSI)
NO
• Test again once pressure is corrected.
YES
Is there a voltage drop a the battery when the DPS is activated while the engine is running?*
NO
• Verify steering components for any interference or damaged parts.
• Insure nothing limits the movement of steering components.
• Inspect steering column, pitman arm, bushings, tie-rod ends and ball joints for free normal movement (no obstructions).
• Inspect front brake pads for sticking.
• Inspect drive shafts and Visco-Lok functionnality.
If mechanical components are in good condition, let the DPS unit cool down before trying the vehicle again.
After the test, if the DPS unit works properly, the problem is caused by the activation of the integrated protection system. This situation is probably due to severe riding conditions, the activation of the integrated protection system is normal.**
YES
• Check battery voltage and ground connections. If any doubt, install a new fully charged battery.
• Verify charging system.
• Check stator connection.
• Check all connections related to the DPS and charging system.
• Consult B.U.D.S. screen for active or occured faults and perform required service action.
NOTE: Refer to appropriate Shop Manual for proper validation.
If problem not solved:
Contact service department if additional information is required and have B.U.D.S. file saved and ready to be sent.
*Refer to appropriate shop manual for procedure.
**Refer to derating explanation o n first page.
vbs2014-009-003_aen

Flow Chart D


Free Play Felt in Steering System
Is there any backlash or play in the steering system?
NO
YES
Contact the service department and have the B.U.D.S. report ready to be sent.
All OK and problem still present
• Verify that tie-rods, pitman arm, ball joints, ,all steering components and fasteners are tight.
• Ensure the upper steering bushing is greased.
Bolt tight
• Verify if the pinch bolt at the bottom of the steering column is tight.
vbs2014-009-004_aen

Flow Chart E

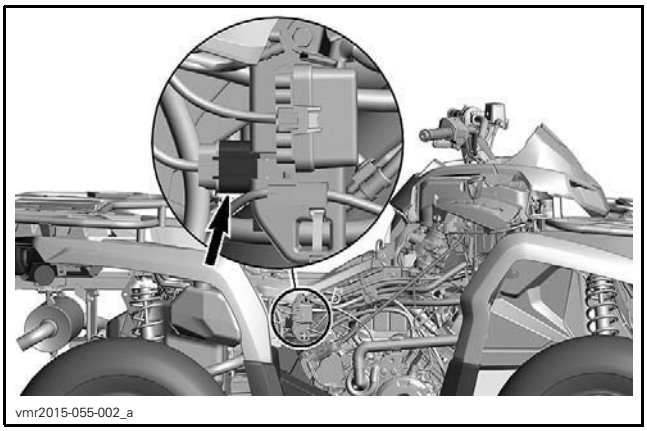

Steering Turns Easier on One than the Other Side
• Check tire pressure and steering alignment.
• Test again once pressure and alignment are corrected.
• Connect to B.U.D.S. and go to the DPS monitoring screen.
Is torque offset value more than 3 N•m when the handlebars are free, untouched and are positioned straight ahead?
NO
• Check for faults and perform required actions.
• Ensure the latest calibration file is installed.
Re-occurring faults or symptoms?
YES
Contact the service department and have the B.U.D.S. report ready to be sent.
YES
• Re-set the torque sensor.
Can't reset the torque sensor or a re-occurring torque sensor fault?
NO
YES
• Make sure nothing touches the steering column.
• Verify steering column alignment as per appropriate Shop Manual.
Any of the previous issues still exist?
vbs2014-009-006_aen

PROCEDURES

DPS UNIT

DPS Unit Fuse Test

A 40 A DPS fuse located in a fuse holder, on the RH side of the frame, under the battery support, provides power for the DPS motor.


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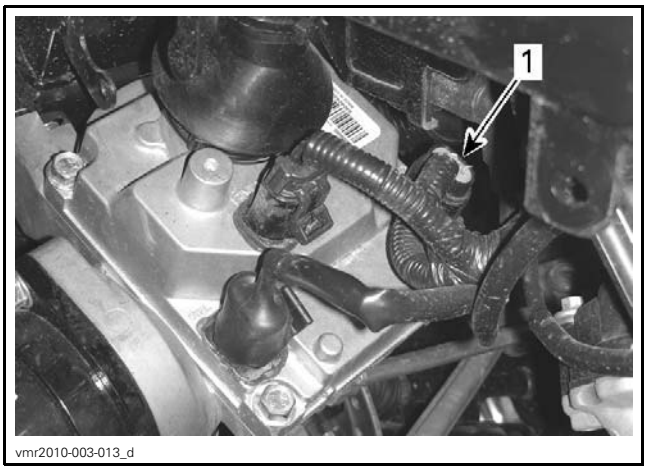
1. Test DPS fuse (PF3-F2) using a multimeter.

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

2. Replace fuse as required.

DPS Unit Input Voltage Test (Power Side)

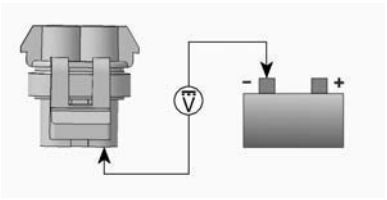
1. Disconnect the DPS PWR (power) connector.



vmr2010-003-013_d

TYPICAL
1. DPS PWR connector (motor power)

2. Test for 12 Vdc DPS motor power at DPS2-A and DPS2-B as per following table.

MULTIMETER PROBE POSITIONS		VOLTAGE
DPS2 power connector pin A	Battery ground	Battery voltage
DPS2 power connector pin B		
 rmr2008-028-091_a		

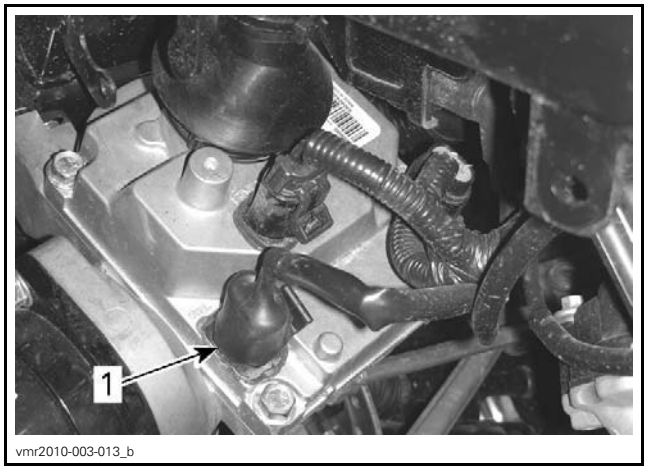
If NO voltage is measured, test the 40 A DPS fuse in the rear fuse holder (PF3-F2). If good, check wires and connector pins. Replace or repair defective parts and reset fault codes.

If battery voltage is measured, carry out the following *DPS UNIT INPUT VOLTAGE TEST (CONTROL SIDE)*.

NOTE: This test may also be carried out by connecting a 12 Vdc test light between each DPS PWR connector pins (A and B), and the battery (-) negative terminal. The test light must come on bright.

DPS Unit Input Voltage Test (Control Side)

1. Disconnect DPS CTRL (control) connector.

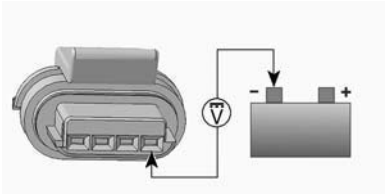


vmr2010-003-013_b

TYPICAL
1. DPS CTRL (control) connector

2. Set the ignition switch to ON.
3. Set the engine RUN/STOP switch to RUN.

4. Test for 12 Vdc power to the DPS module at DPS1-A as per following table.

MULTIMETER PROBE POSITIONS	VOLTAGE
DPS control connector (pin A) and battery ground	Battery voltage
 rmr2008-028-093_a	

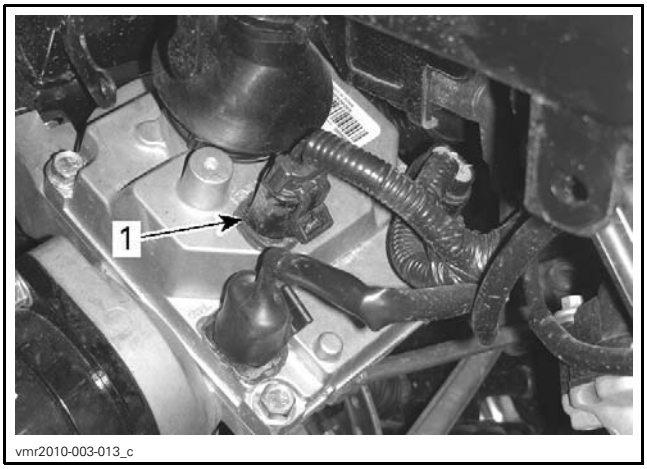
If NO voltage is measured, check wires and connector pins from DPS unit to the Relays/Speedo fuse in front fuse box (PF1-F4). Replace or repair defective parts and reset fault codes.

If battery voltage is measured, carry out the following *DPS UNIT GROUND CIRCUIT TEST*.

NOTE: This test may also be carried out by connecting a 12 Vdc test light between the DPS control connector (pin A), and the battery (-) negative terminal. The test light must come on bright.

DPS Unit Ground Circuit Test

1. Disconnect the DPS ground connector (GDN).



vmr2010-003-013_c

TYPICAL
1. DPS ground connector (GDN)

2. Test for continuity between DPS3-A and DPS3-B to battery ground.

MULTIMETER PROBE POSITIONS		READING
DPS GDN connector pin A	Battery ground	Continuity (close to 0 Ω)
DPS GDN connector pin B		

If there is NO continuity or a high resistance is measured, check wires and connector pins from DPS unit to chassis ground post. Replace or repair defective parts and reset fault codes.

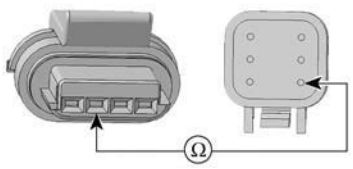
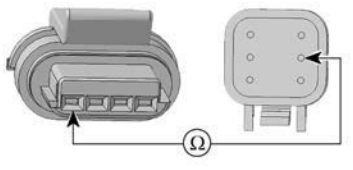
If there is good continuity, carry out the following *DPS UNIT COMMUNICATION LINK (CAN) CONTINUITY TEST*.

NOTE: This test may also be carried out by connecting a 12 Vdc test light between each GDN connector pin and the battery (+) positive terminal. The test light must come on bright.

DPS Unit Communication Link (CAN) Continuity Test

NOTE: DPS unit must receive an RPM signal to provide power steering assist.

1. Disconnect the DPS control connector and the diagnostic connector.
2. Test continuity of CAN Bus Wires at DPS1-C and DPS1-D.

MULTIMETER PROBE POSITIONS	RESISTANCE @ 20°C (68°F)
DPS control connector (pin C) and diagnostic connector (pin 1)	Below 1 Ω
 rmr2008-028-094_a	
DPS control connector (pin D) and diagnostic connector (pin 2)	
 rmr2008-028-094_b	

If resistance measured is out of specification, check wires and connector pins. Carry out repairs as required and reset fault codes using B.U.D.S software.

If resistance measured is good, replace the DPS unit and reset fault codes using B.U.D.S software.

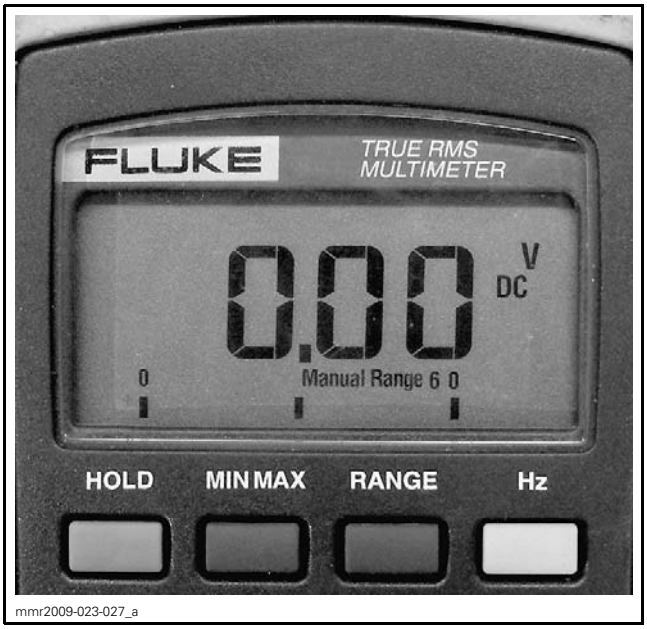
DPS System Load Test

If the charging system cannot sustain normal voltage when the DPS is operating, DPS ASSIST may be greatly reduced or nonexistent. Carry out the following steps.

1. Measure the battery voltage.

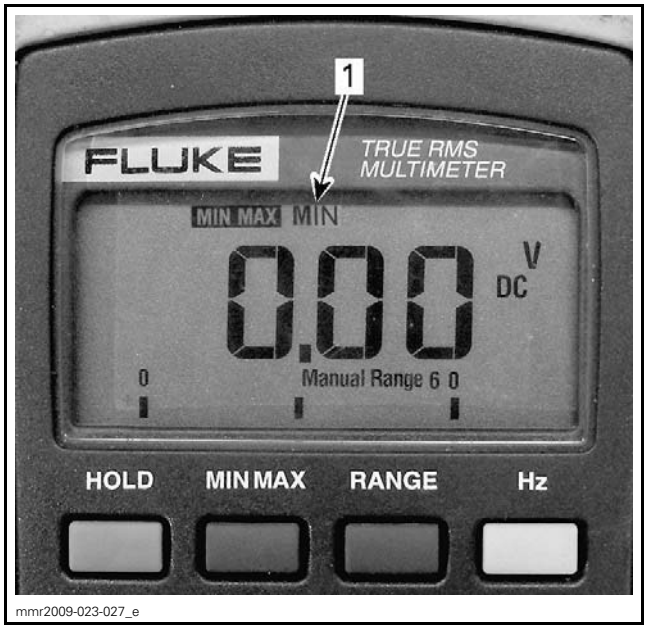
NOTE: If battery voltage is low, recharge battery.

2. Ensure the vehicle transmission is set to PARK.
3. Start the engine.
4. Note the voltage on the multimeter with the engine running (charging system voltage).
5. Press the RANGE button repeatedly to select Manual Range 6 0.



VDC SELECTED TO MANUAL RANGE 6 0

6. Press the MIN MAX button on the multimeter to engage the MIN function.



1. MIN function selected

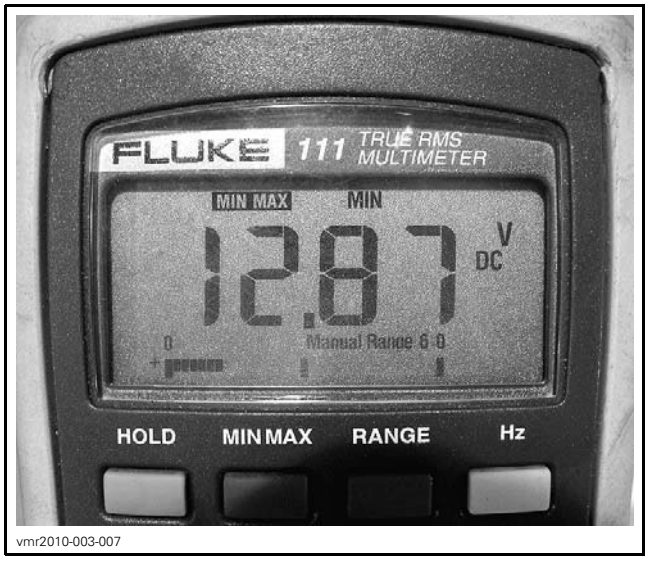
7. Turn the handlebar momentarily against the steering frame stops to each side.

NOTE: Do not hold steering against frame stops for an extended period of time.

8. Read the MIN charging system voltage recorded while the handlebar was turned against each stop.

DPS SYSTEM LOAD TEST			
PROBE POSITIONS		STEERING POSITION	VOLTAGE READING
Battery (-) terminal	DPS fuse holder pin B	LH stop	At least 12 Vdc
		RH stop	

NOTE: Turning the handlebar momentarily against the frame stops generates maximum DPS load (maximum current draw on electrical system). Electrical system must sustain at least 12 Vdc for proper DPS operation.



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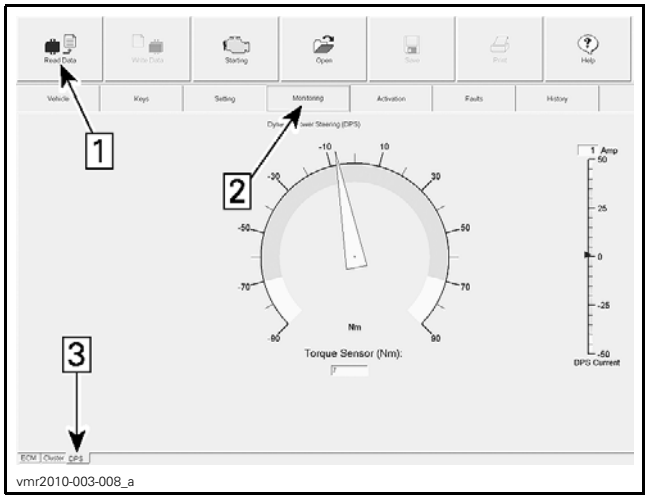
If the electrical system cannot sustain at least 12 Vdc, check the following:

– Battery
– Battery connections
– DPS unit power and ground connections
– Charging system
– Frame and engine ground studs.

If the previously listed items, carry out the following *DPS UNIT CURRENT TEST*.

DPS Unit Current Test

1. Connect vehicle to the latest applicable B.U.D.S. software version.
2. Click on the **Read Data** button.
3. Choose the **Monitoring** page tab.
4. At the bottom of the **Monitoring** page, choose the **DPS** tab.



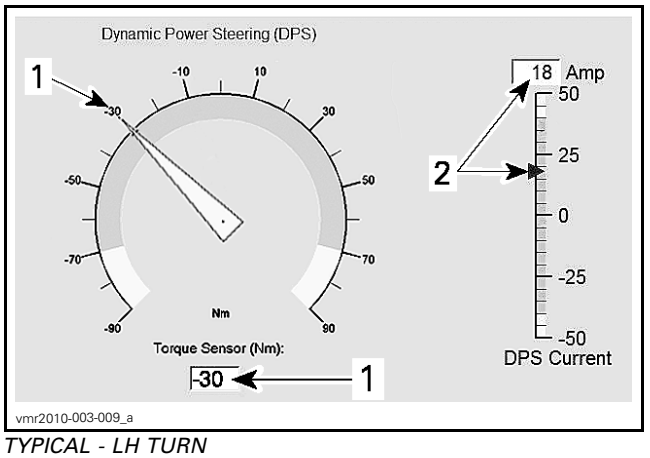
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Step 1: Press Data button
Step 2: Select Monitoring page tab
Step 3: Select DPS tab

5. With the vehicle engine running in PARK, turn the handlebar side to side, momentarily against each stop and observe the indications on the B.U.D.S. DPS **Monitoring** page.

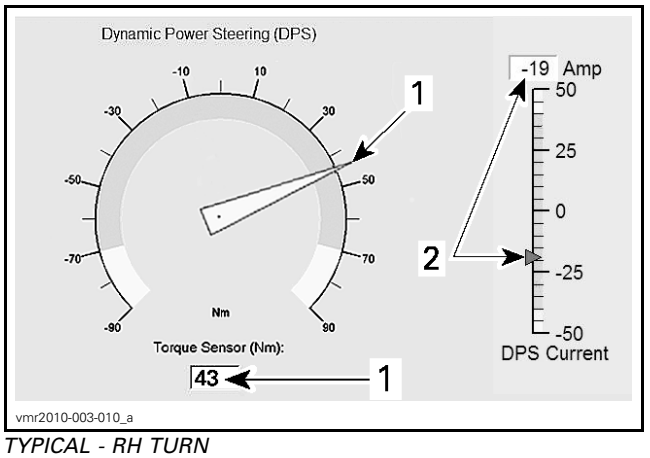
The DPS **Torque Sensor Nm** increase with torque applied to handlebar.

The **DPS Current** ammeter should increase proportionately to the torque applied, and decrease with the torque as steering assist is provided.



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TYPICAL - LH TURN
1. Torque sensor indication (negative)
2. DPS current indication (positive)



vmr2010-003-010_a

TYPICAL - RH TURN
1. Torque sensor indication (positive)
2. DPS current indication (negative)

NOTE: Increase and decrease in torque and current readings is very brief as steering assist is quickly provided. Current draw should remain within green scale but may momentarily peak to 60 amps, then drop off close to 0 amps as torque applied is nulled out by steering assist. A residual torque of 2 N•m (18 lbf•**in**) with a corresponding current draw is acceptable.

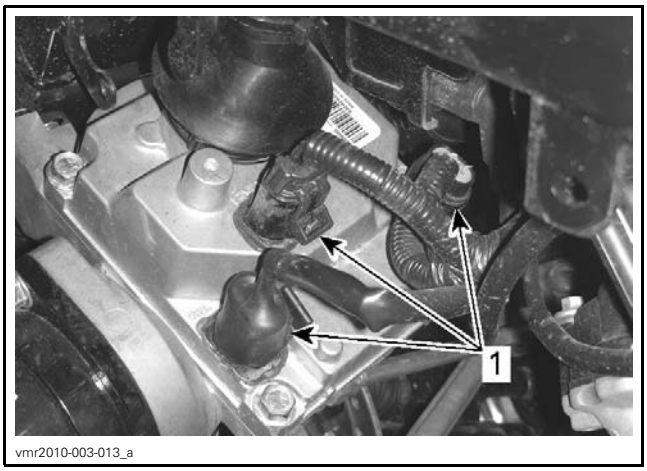
If current draw tends to remain high, carry out the following:

– Steering alignment check.

– Steering column shim adjustment at half bushings as described in the *DPS UNIT INSTALLATION* procedure detailed in this section.
– *TORQUE OFFSET RESET* procedure detailed in this section.
– Replace DPS unit.

DPS Unit Removal

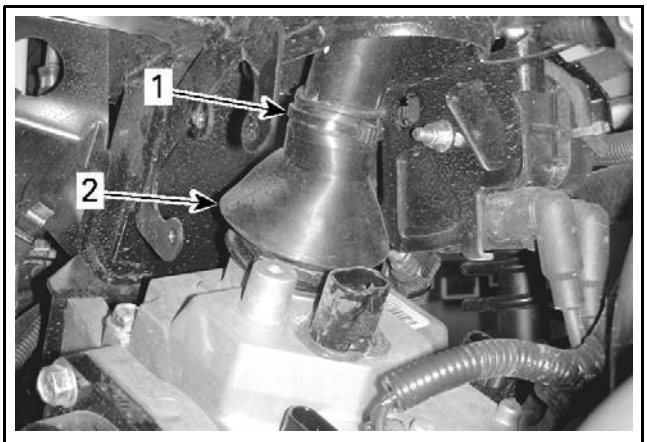
1. Remove the front body module, refer to *BODY* subsection.
2. Remove both inner fender panels
3. Remove the CVT air inlet duct assembly, refer to *AIR INTAKE SYSTEM* subsection.
4. Disconnect the 3 electrical connectors from the DPS unit.



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TYPICAL
1. DPS connectors (3x)

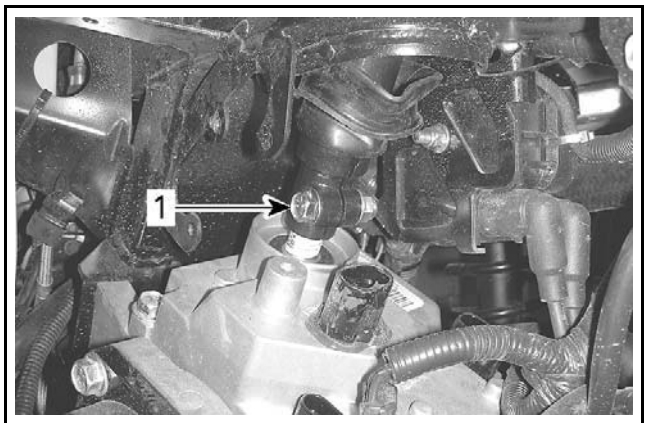
5. Cut the locking tie securing the bellows at the bottom of steering column near the DPS unit, and pull the bellows upwards sufficiently to access the steering column pinch bolt.



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TYPICAL
1. Cut this locking tie
2. Steering column bellows

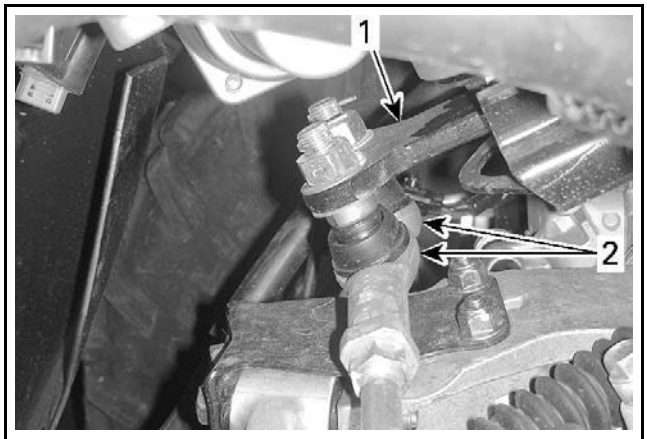
6. Remove the steering column pinch bolt and retaining nut. Discard the retaining nut.



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TYPICAL
1. Steering column pinch bolt

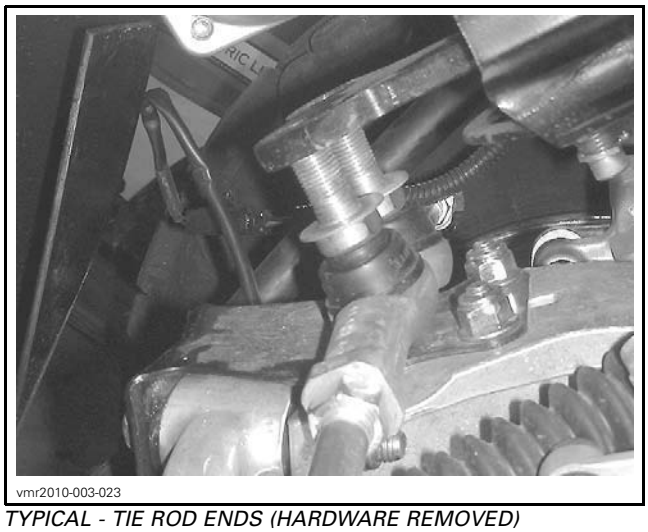
7. Remove the hardware that secures both tie-rod ends to the pitman arm (steering lever). Discard cotter pins.



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TYPICAL
1. Pitman arm
2. Tie rod ends

8. Turn the steering to each side and disengage each tie-rod end from the pitman arm.

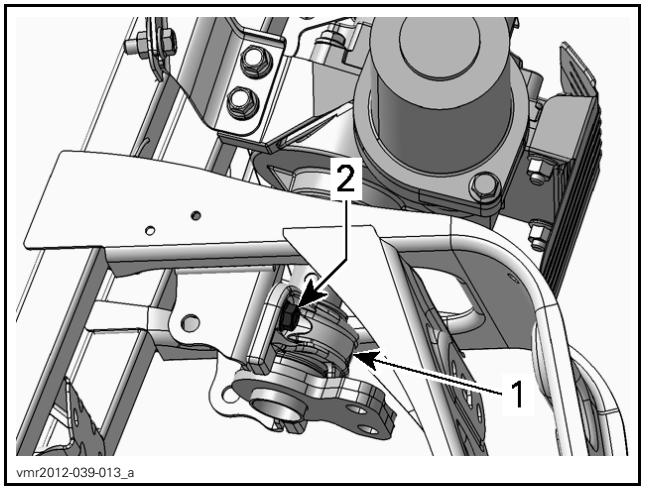

vmr2010-003-023

TYPICAL - TIE ROD ENDS (HARDWARE REMOVED)

9. Pull up on the steering column to partly disengage it from the DPS unit.

NOTE: A mechanical stop on the steering column will prevent you from fully disengaging the steering column.

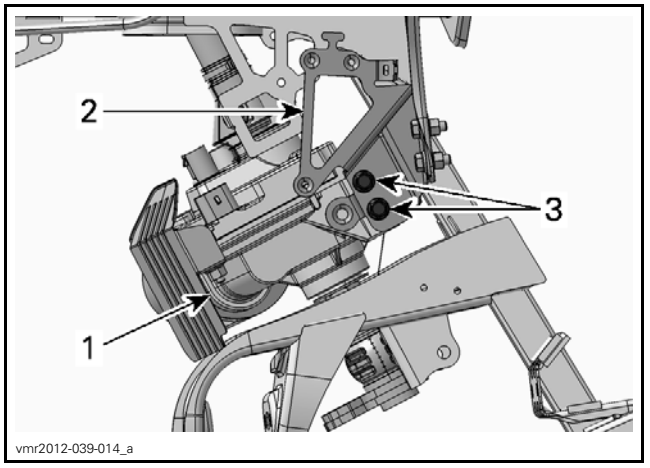
10. Remove the lower half bushing retainer that secures the steering shaft to the frame.



vmr2012-039-013_a

1. Lower half bushing retainer
2. Bolts to remove (2)

11. Remove the 2 hexagonal flanged screws securing the DPS unit to the RH support bracket.



vmr2012-039-014_a

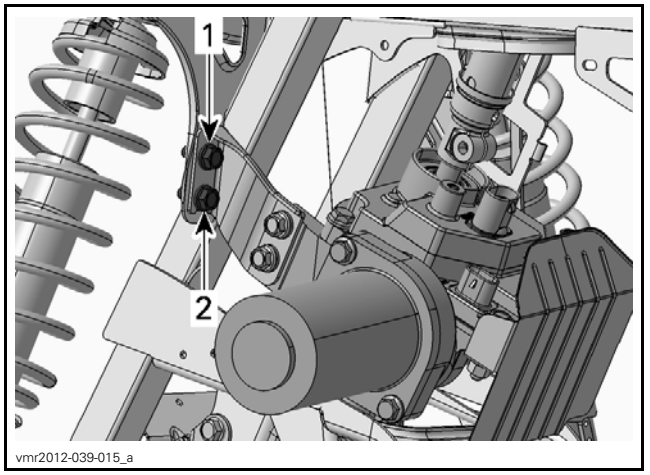
DPS REMOVAL - RH SIDE
1. DPS
2. RH DPS support bracket
3. Remove these screws (2)

NOTE: Discard the conical spring washers on the DPS retaining screws.

12. On the LH side of the DPS unit, remove the DPS support bracket from the frame in the following manner:

    12.1 Remove the top retaining screw.

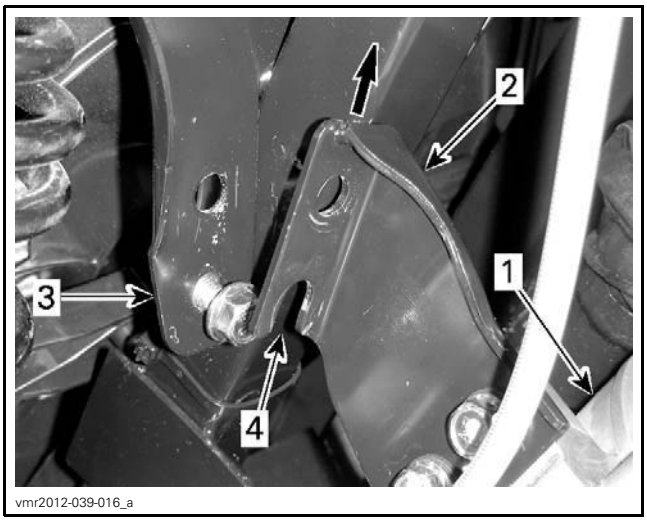
    12.2 Loosen the lower retaining screw sufficiently for the bracket to become loose on the frame.



vmr2012-039-015_a

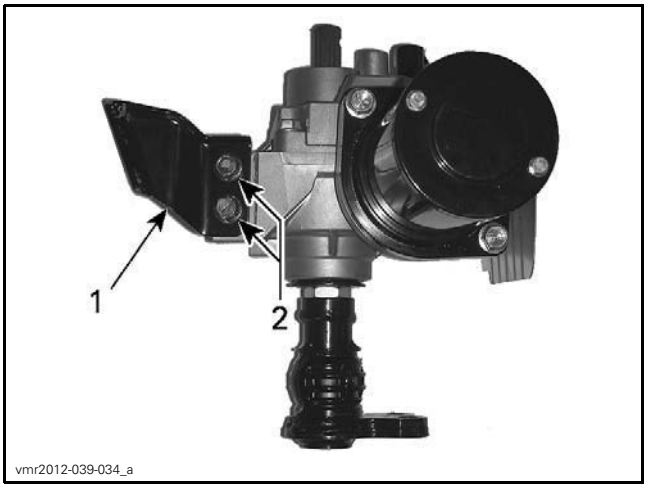
DPS REMOVAL - LEFT SIDE
Step 1: Remove DPS retaining screws (2 each side)
Step 2: Discard conical washers under screw head

13. Pull up on DPS unit to remove the DPS unit and support bracket from the frame.



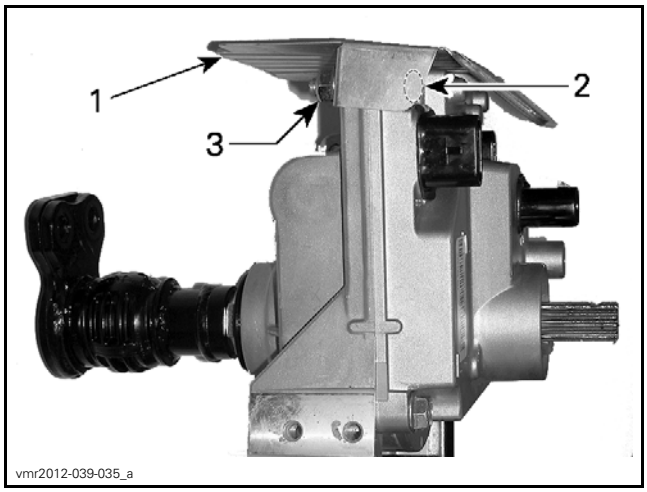
TYPICAL - LH DPS SUPPORT BRACKET
1. *DPS unit*
2. *DPS support bracket*
3. *Vehicle frame*
4. *Slotted hole in DPS support bracket*

14. If replacing DPS unit, remove the following from the DPS unit:
    - LH DPS support bracket
    - DPS heat shield.



1. *LH DPS support bracket*
2. *Retaining screws*

NOTE: When removing the DPS heat shield, hold the DPS housing screws steady using a wrench to as you remove the 2 heat shield retaining nuts.

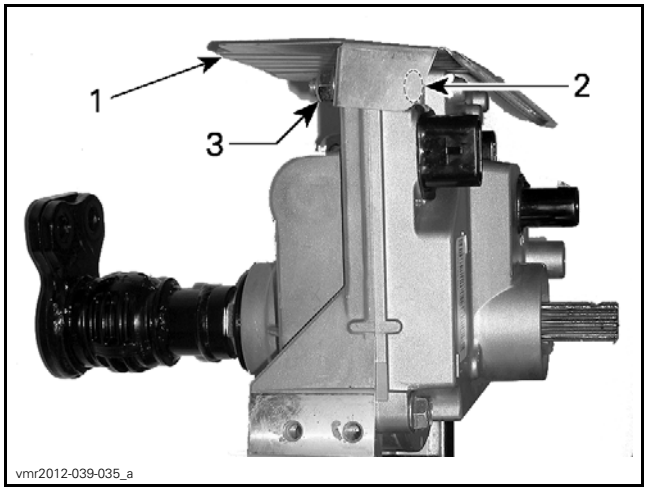


1. *DPS heat shield*
2. *Retaining screws to hold steady (2 not visible)*
3. *Retaining nuts to remove*

DPS Unit Installation

IMPORTANT: The following hardware **must all be replaced with new ones**:
- Hexagonal forming screws with threadlocker
- Conical spring washers
- Elastic nuts.

1. If the DPS unit is being replaced, install heat shield from old DPS unit onto new DPS unit.



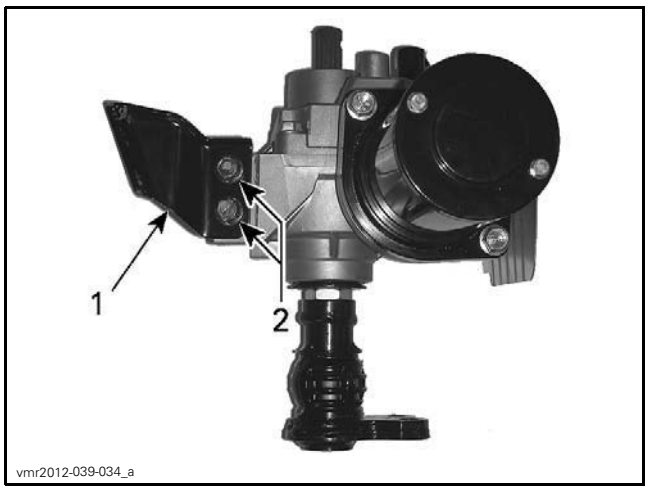
1. *DPS heat shield*
2. *Retaining screws to hold steady (2 not visible)*
3. *Retaining nuts to remove (2)*

NOTE: **Important:** Hold DPS housing screws steady using a wrench as you apply specified torque to heat shield retaining nuts.

TIGHTENING TORQUE	
Retaining nuts, DPS heat shield	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

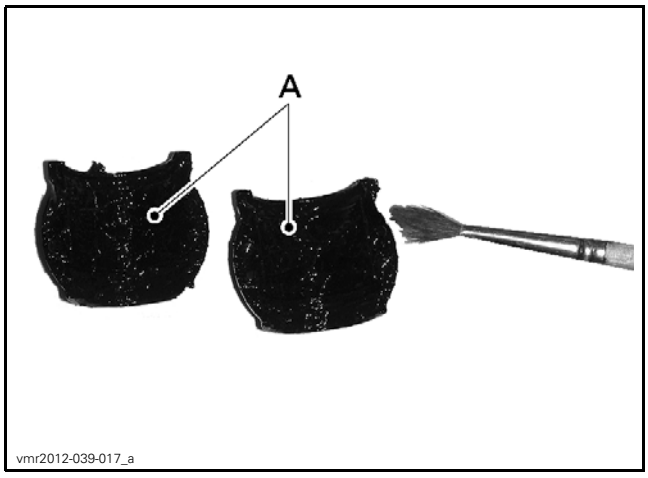
2. Install LH DPS support bracket loosely using NEW fasteners.

NOTE: Important: Install the retaining screws to the DPS support bracket loosely at this time. This is required to ensure proper DPS alignment at a later step when all steering and DPS fasteners are tightened to specified torque.

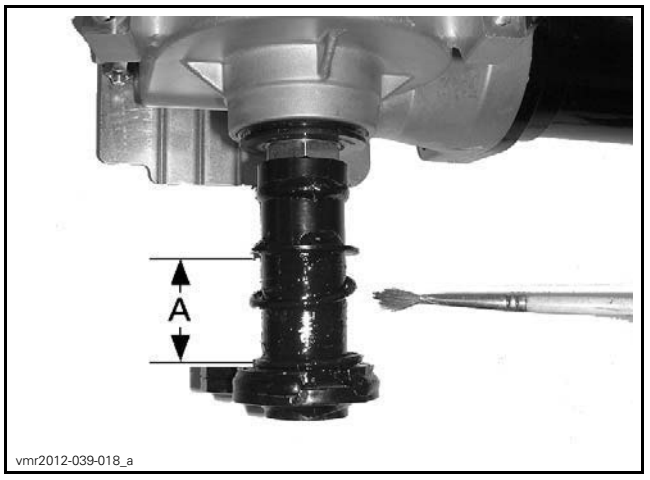


1. LH DPS support bracket
2. Retaining screws

3. Ensure "O" rings on steering shaft are in good condition.
4. Apply XPS SYNTHETIC GREASE (P/N 293 550 010) to:
   – The inside of both steering shaft half bushings
   – The steering shaft and "O" rings.

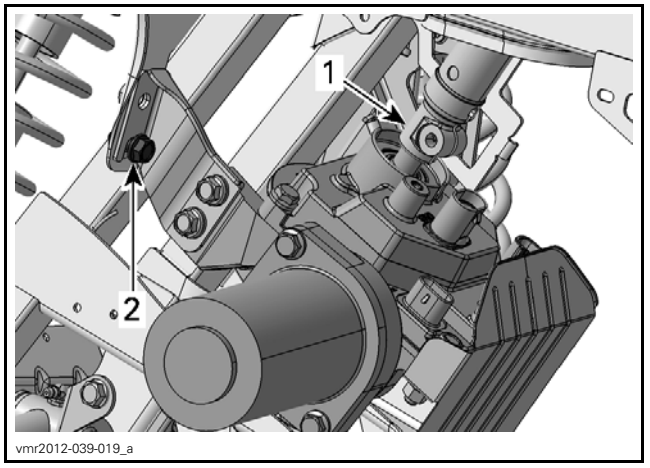


A. XPS synthetic grease (P/N 293 550 010) here



A. XPS synthetic grease (P/N 293 550 010) here

5. Insert the steering column onto the DPS input shaft
6. Position the LH DPS support bracket onto the hexagonal forming screw that was left on the frame DPS mount.



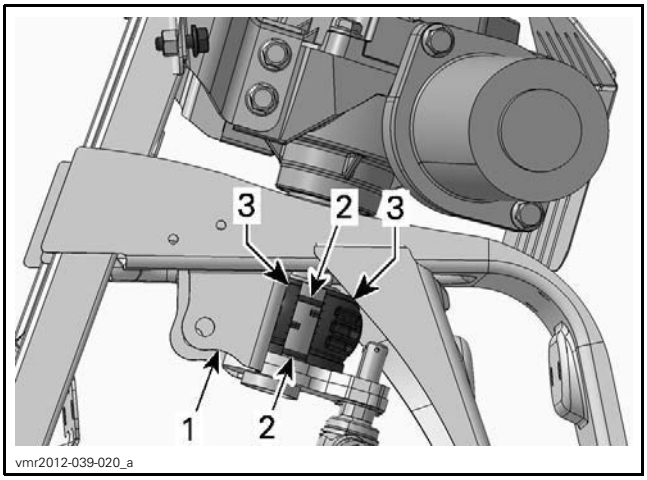
1. Steering column onto the DPS input shaft here
2. LH DPS support bracket onto the hexagonal forming screw here

NOTE: The DPS shaft splines have a key which **must be aligned** with the keyway in the steering column.


vmr2010-003-031

TYPICAL - STEERING COLUMN INDEXED TO DPS SHAFT SPLINES

7. Ensure the following are properly positioned on the lower steering shaft and lower steering shaft mount.
   – O-rings
   – Steering shaft half bushings.



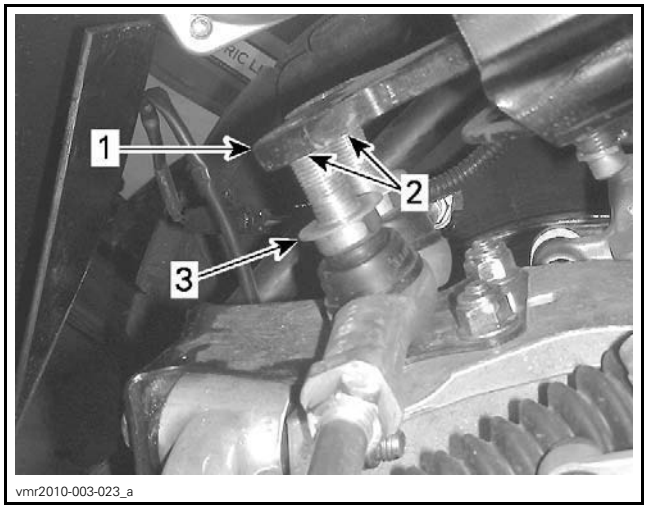
vmr2012-039-020_a

1. *Lower steering shaft mount*
2. *O-rings*
3. *Steering shaft half bushings*

8. Install the 3 remaining hexagonal forming screws that secure the DPS unit **loosely** using NEW fasteners.

NOTE: **Ensure** the support bracket retaining screws have a NEW conical spring washer between the screw head and the DPS frame support.

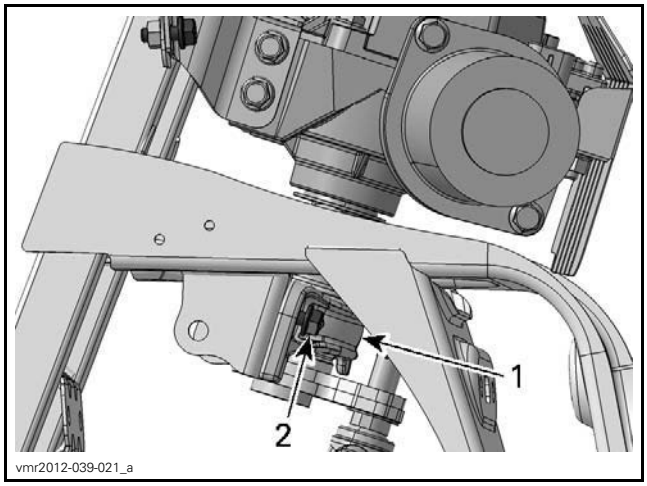
Ensure both tie rod ends have a hardened steel washer on them, then insert the tie-rod ends onto the pitman arm.



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TYPICAL
1. *Pitman arm*
2. *Tie rod ends inserted in pitman arm*
3. *Hardened steel washer on tie rod end*

9. Install the lower half bushing retainer **loosely** using NEW fasteners.

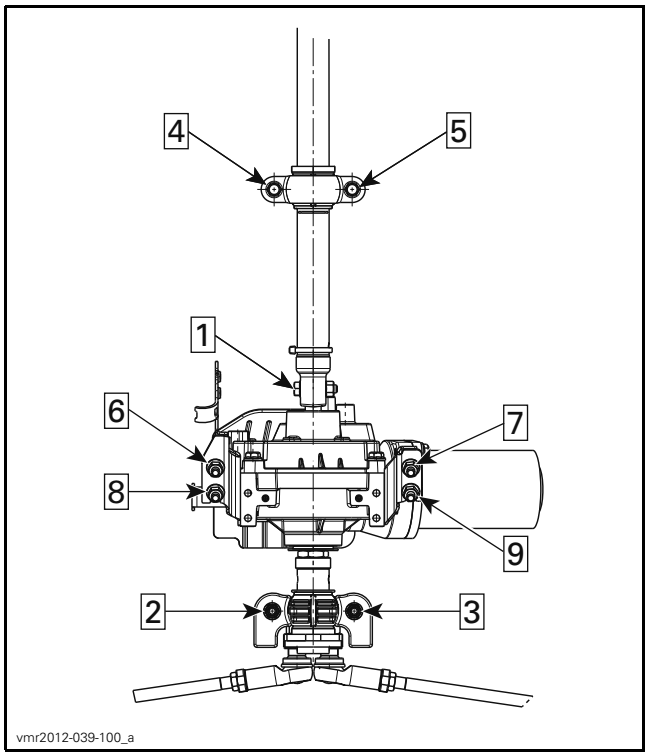


vmr2012-039-021_a

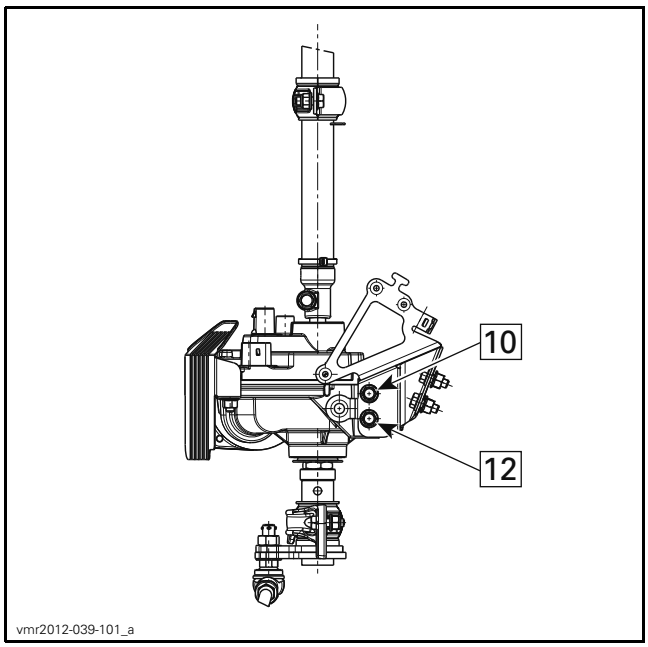
1. *Lower half bushing retainer*
2. *Hexagonal forming screws installed loosely*

10. Install steering column pinch bolt and a NEW elastic nut **loosely**.
11. Tighten the steering and DPS fasteners to specified torque using the torque sequence specified in the following 3 illustrations.

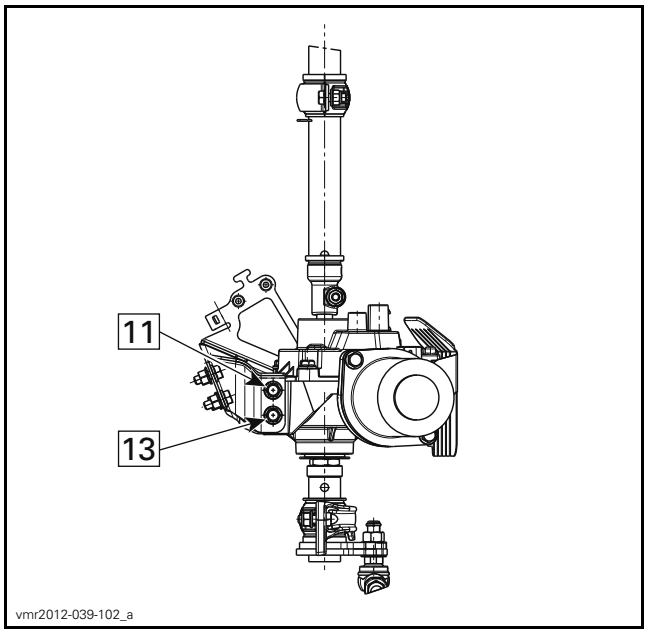
TIGHTENING TORQUE	
DPS retaining screws	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)
DPS bracket retaining screws	
Steering column retainer	
Steering column pinch bolt	



DPS AND STEERING TORQUE SEQUENCE (1 OF 3)



DPS AND STEERING TORQUE SEQUENCE (2 OF 3)

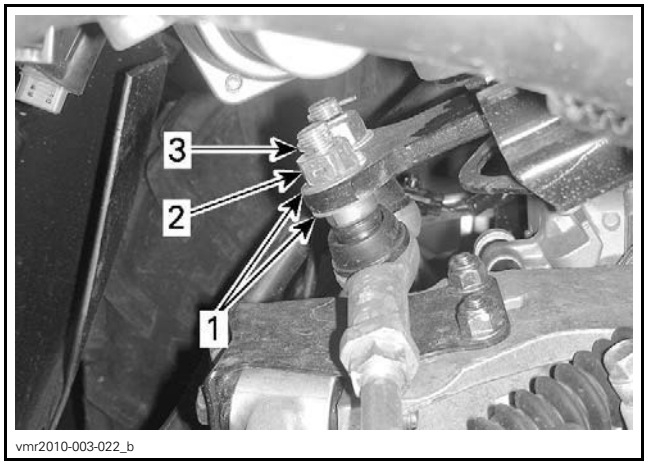


DPS AND STEERING TORQUE SEQUENCE (3 OF 3)

12. Install the second hardened steel washer and nut on each tie-rod end. Tighten retaining nuts as specified.

TIGHTENING TORQUE	
Tie-rod end to pitman arm	72.5 N•m ± 7.5 N•m (53 lbf•ft ± 6 lbf•ft)

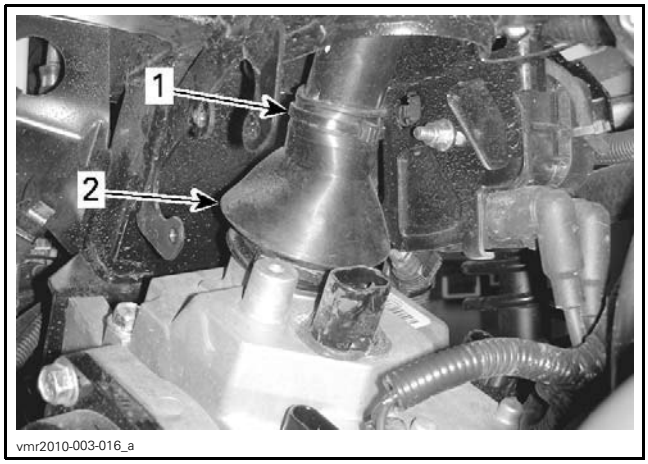
13. Install NEW cotter pins on the tie-rod ends.



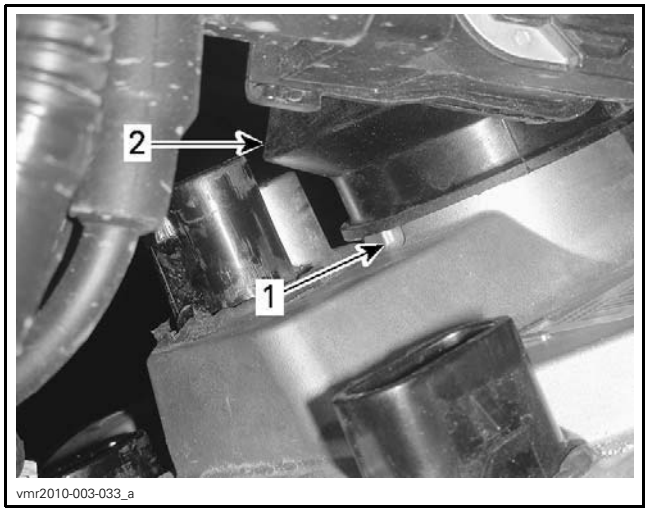
TYPICAL
1. *Hardened steel washers (one each side of pitman arm)*
2. *Tie rod end retaining nut (torque applied)*
3. *NEW cotter pin installed*

14. Pull bellows down over steering column pinch bolt and edge of DPS unit housing extension. Secure bellows using the appropriate locking tie.

NOTE: Ensure the locking tie is on the tube part of the steering column, **not** on the forged end. Bellows should cover end of ring flange on DPS unit but **not** cover the drainage hole at the bottom of the ring flange. **Do not** install a locking tie on the DPS end of the bellows. Lower portion of bellows **MUST** remain floating over the DPS housing.



TYPICAL
1. *Locking tie location*
2. *Steering column bellows*



TYPICAL
1. *Drainage hole in DPS ring flange*
2. *Steering column bellows*

15. Turn handlebar fully to each side and check for proper contact between pitman arm and pitman arm frame stops (both sides).



TYPICAL - LH ILLUSTRATED
1. *Pitman arm*
2. *Contact point with frame stop*

NOTE: Contact between pitman arm and pitman arm stops must be checked with vehicle weight on wheels.

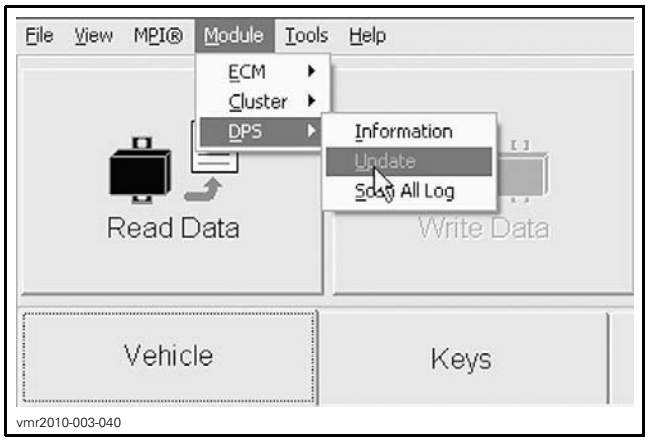
16. Reconnect DPS electrical connectors.
17. Perform a *STEERING ALIGNMENT* as described in the applicable Shop Manual subsection.
18. If installing a replacement DPS unit, refer to *DPS REPLACEMENT* in this subsection.
19. Perform the torque offset reset. Refer to *TORQUE OFFSET RESET* in this subsection.
20. Install all other removed parts in the reverse order of removal.
21. Carry out a test ride of the ATV to ensure proper operation of the DPS unit.

DPS Unit Replacement

New DPS units **do not** come with the required software programmed into the unit. A DPS unit fault will be generated when the vehicle is powered up. The check engine light will come on and a DPS FAULT message will appear in the multifunction gauge.

When DPS unit installation is complete, carry out the following steps.

1. Connect the ATV to the latest applicable B.U.D.S. software version.
2. Select the **Read Data** button.
3. In the **Module** menu, choose the **DPS** submenu and install the latest DPS software **Update** file as applicable to the type ATV (Outlander or Renegade).



DPS SOFTWARE UPDATE

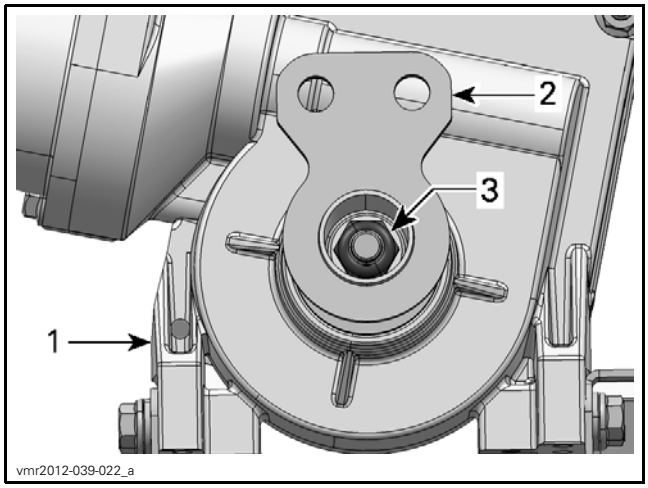
4. Once the correct DPS software file is installed, go to the **Faults** page and clear the fault codes.
5. Carry out the *TORQUE OFFSET RESET* procedure as described in this subsection.
6. Test drive the ATV to ensure proper DPS operation.

PITMAN ARM

NOTE: On models without a DPS, the pitman arm is replaced with the steering column. Refer to STEERING COLUMN in this subsection.

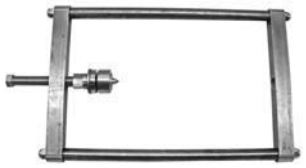
Pitman Arm Removal

1. Remove DPS unit from vehicle, refer to *DPS REMOVAL* in this subsection.
2. Remove Pitman arm retaining nut and washer.

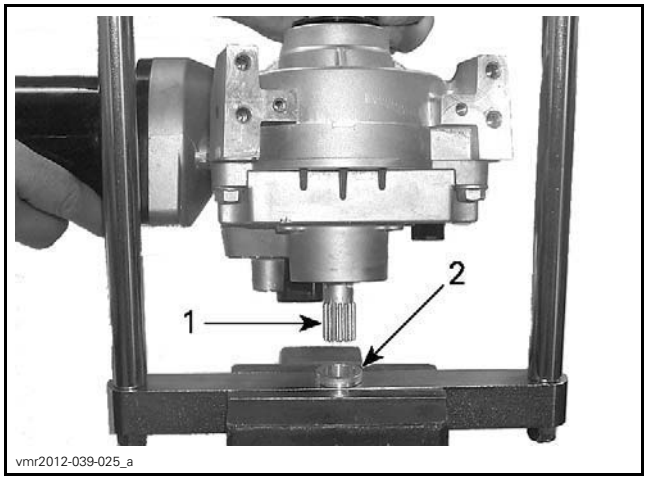


1. *DPS*
2. *Pitman arm*
3. *Pitman arm nut and washer*

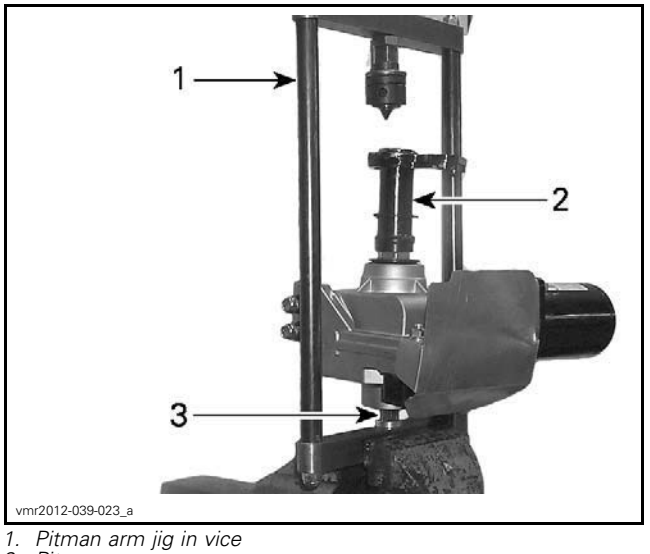
3. Install the pitman arm jig in a vise with the positioning screw upward.

REQUIRED TOOLS	
PITMAN ARM JIG (P/N 529 036 225)	

4. Insert the DPS input shaft in the Pitman arm jig receptacle with the Pitman arm facing up.



1. *DPS input shaft*
2. *Shaft receptacle in Pitman arm jig*

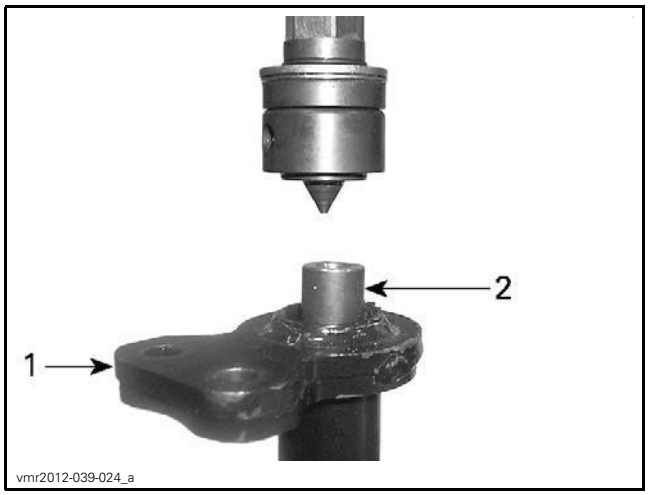


1. *Pitman arm jig in vice*
2. *Pitman arm up*
3. *DPS input shaft inserted in jig*

5. Insert the positioning adapter in the Pitman arm so its point rests in the DPS output shaft.

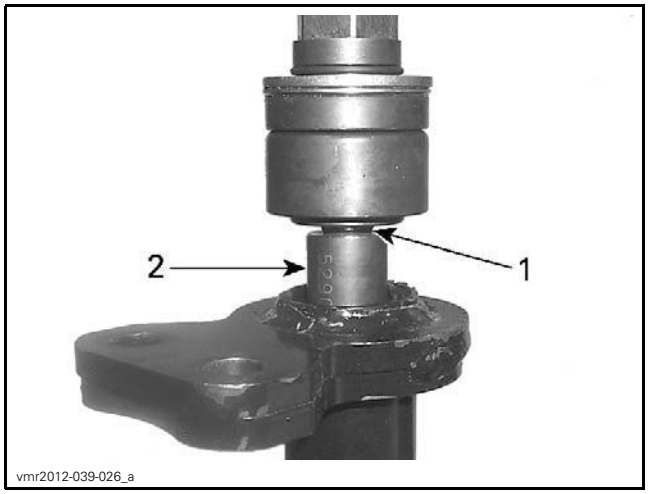
NOTE: A countersunk hole is machined in tip of the DPS output shaft to accept and center the positioning adapter point.

REQUIRED TOOL	
POSITIONING ADAPTOR (P/N 529 036 230)	



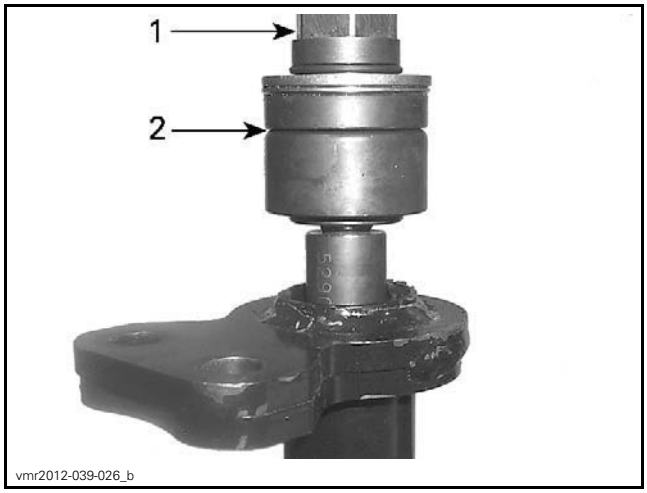
1. Pitman arm
2. Positioning adapter

6. Turn the jig positioning screw until the screw tip rests snugly in the positioning adapter.



1. Jig screw tip
2. Positioning adapter

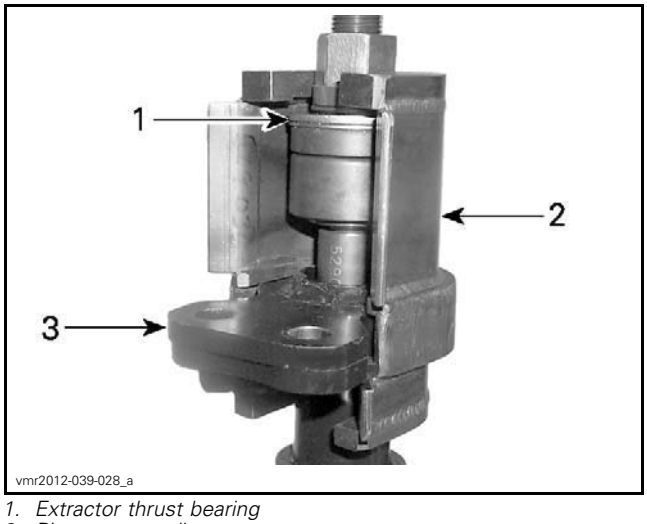
7. Turn the extractor nut down until their is no space between the extractor and the positioning tip.



1. Extractor nut
2. No space here

8. Install the universal Pitman arm puller over the Pitman arm and the extractor thrust bearing.

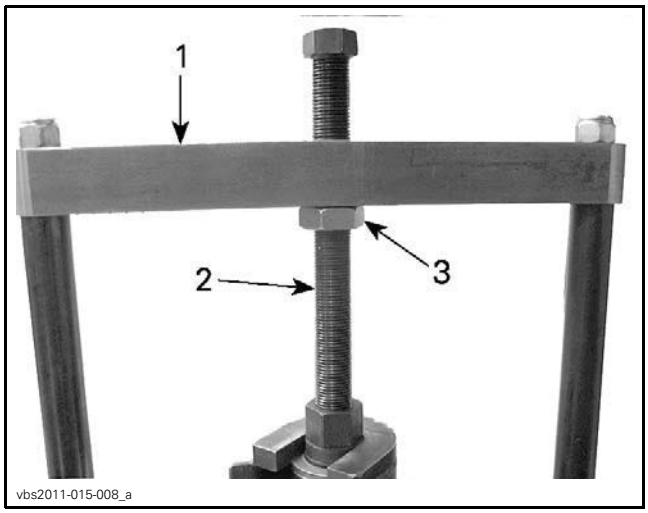
REQUIRED TOOL	
PITMAN ARM PULLER (P/N 529 036 227)	



1. Extractor thrust bearing
2. Pitman arm puller
3. Pitman arm

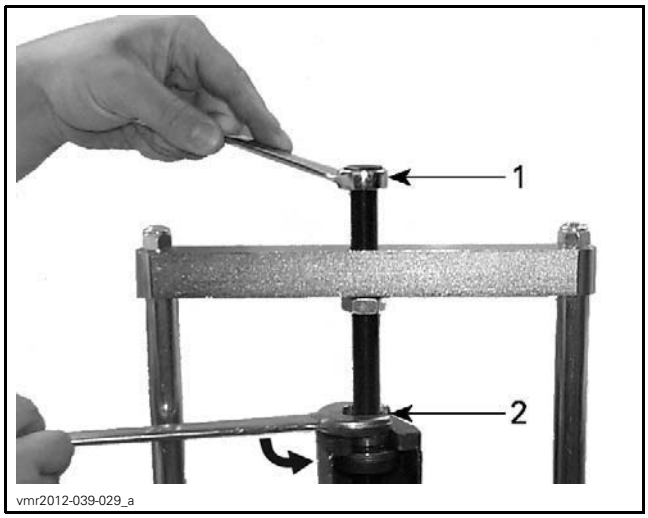
9. Lock the positioning screw by screwing the lock nut tightly against jig upper bar.

NOTE: Be sure to hold the position screw steady to prevent its tip from backing off the positioning adapter.



1. Jig upper bar
2. Positioning screw
3. Lock nut

10. As you hold the positioning screw steady, turn the extractor nut up to pull the Pitman arm off the DPS output shaft.

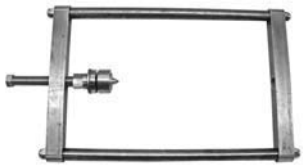


1. Positioning screw (held steady)
2. Extractor nut (turned up)

11. Remove Pitman arm puller.
12. Unscrew positioning screw.
13. Remove Pitman arm from the DPS shaft.

Pitman Arm Installation

1. Install Pitman arm jig in a vise with positioning screw upward.

REQUIRED TOOL	
PITMAN ARM JIG (P/N 529 036 225)	

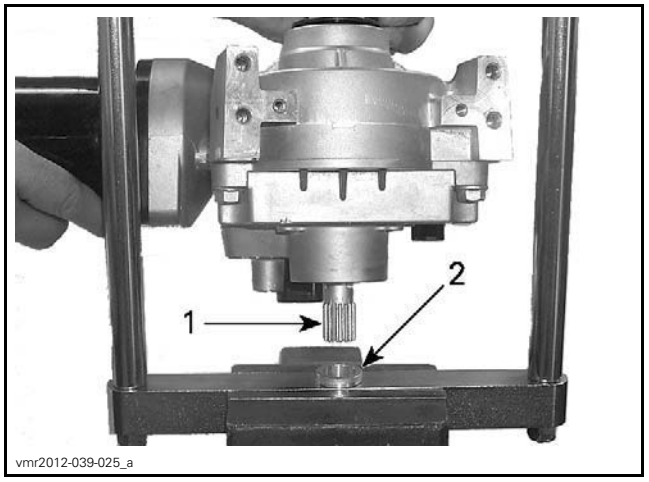
2. Apply antizeize lubricant on DPS output shaft splines; completely cover all the splines with a light coat.

PRODUCT	
DPS output shaft splines	LOCTITE 767 (ANTISEIZE LUBRICANT) (P/N 293 800 070)

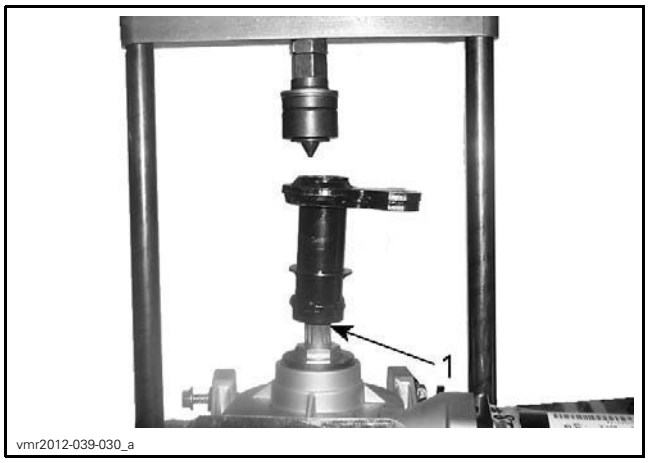
3. Place Pitman arm on DPS shaft as per following illustration.

NOTE: Be sure to correctly align the Pitman arm shaft key with the keyway (ground off splines) on the DPS output shaft.

4. Insert the DPS input shaft in the Pitman arm jig receptacle with the Pitman arm facing up.



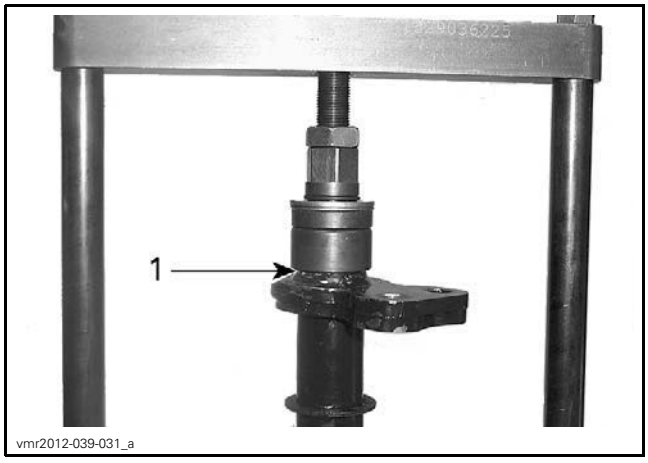
1. DPS input shaft
2. Shaft receptacle in Pitman arm jig



1. Spline keyway alignment here

5. Turn the jig positioning screw until the alignment point makes proper contact with the Pitman arm.

NOTE: Ensure positioning screw is centered in Pitman arm tube.

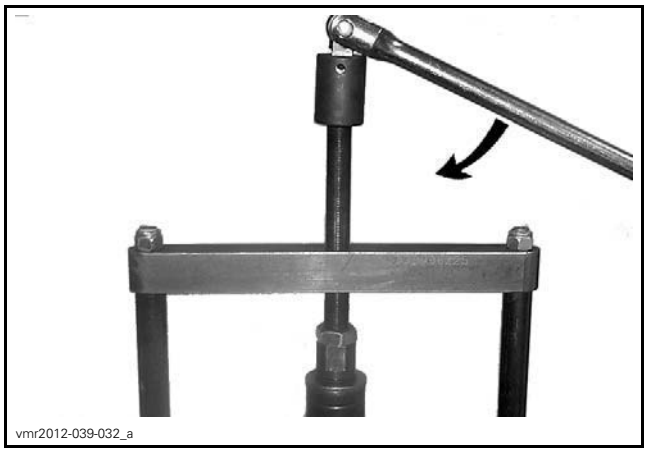


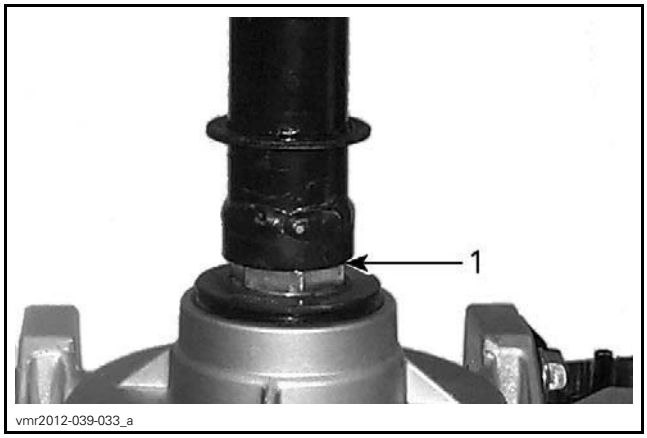
1. Ensure proper contact here

6. Turn the positioning screw to push the Pitman arm on the DPS output shaft until it bottoms out on the DPS output shaft nut.

NOTE: Ensure specified torque is applied.

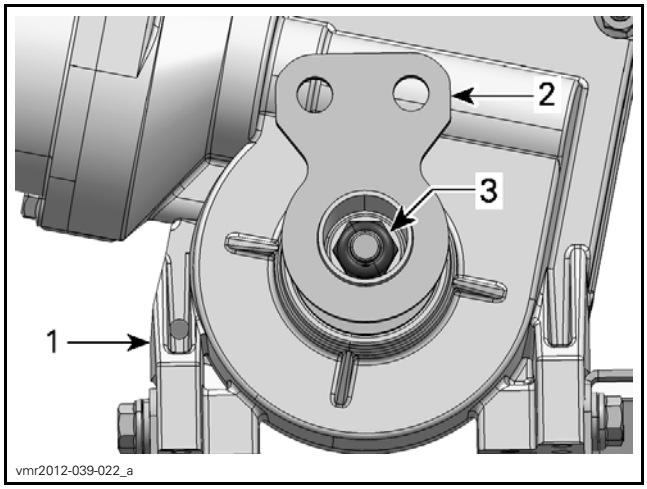
TIGHTENING TORQUE	
Positioning screw torque	50 N•m (37 lbf•ft)





1. Ensure proper contact here

7. Unscrew positioning screw and remove pusher adapter and pull out DPS unit.
8. Install Pitman arm retaining washer and nut. Tighten nut as specified.



1. DPS
2. Pitman arm
3. Pitman arm nut and washer

TIGHTENING TORQUE	
Pitman arm retaining nut	72.5 N•m ± 7.5 N•m (53 lbf•ft ± 6 lbf•ft)

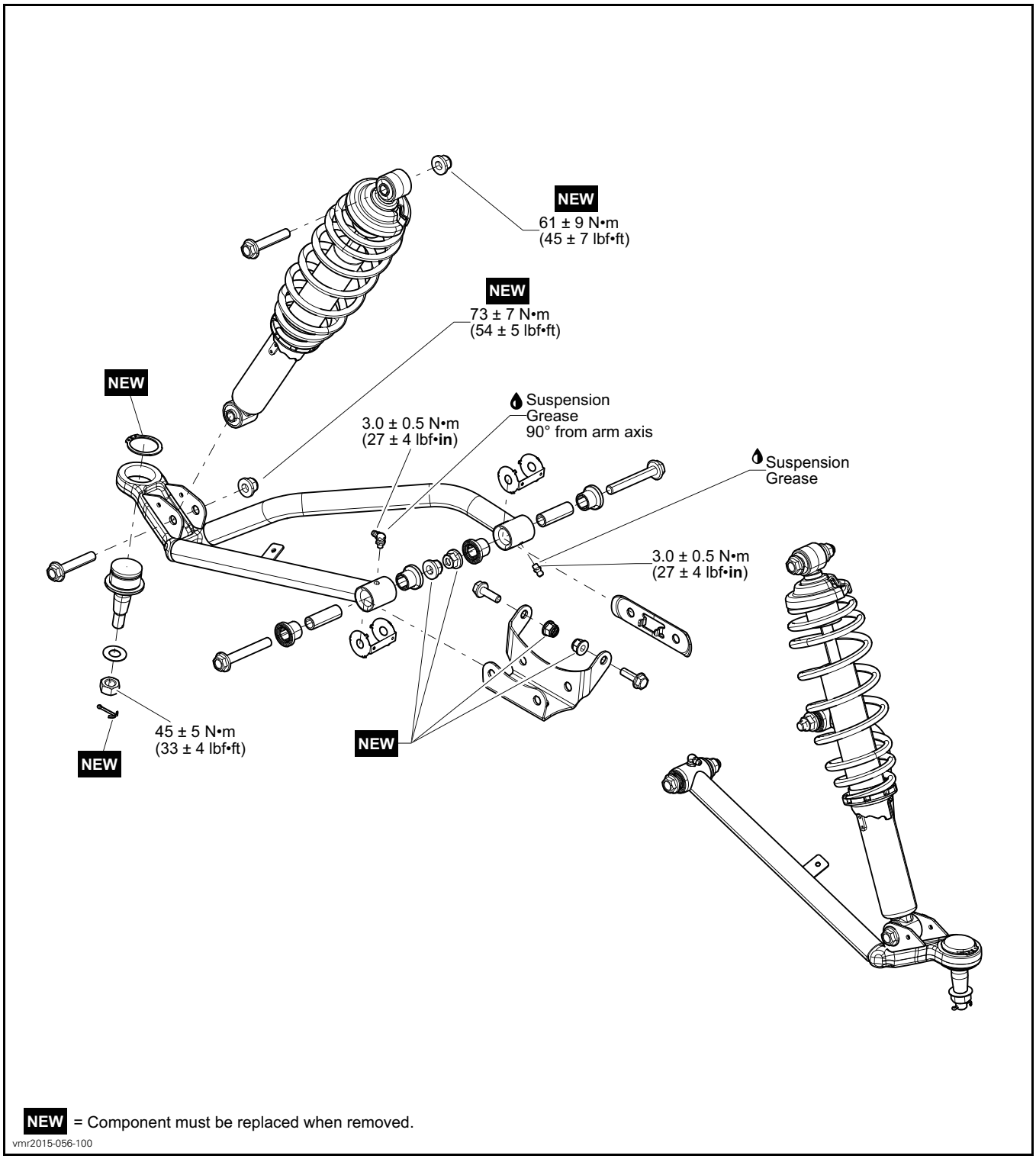
9. Carry out a steering alignment as described in this subsection.

FRONT SUSPENSION

SERVICE TOOLS

Description	Part Number	Page
BALL JOINT REMOVAL TOOL	529 036 310	675

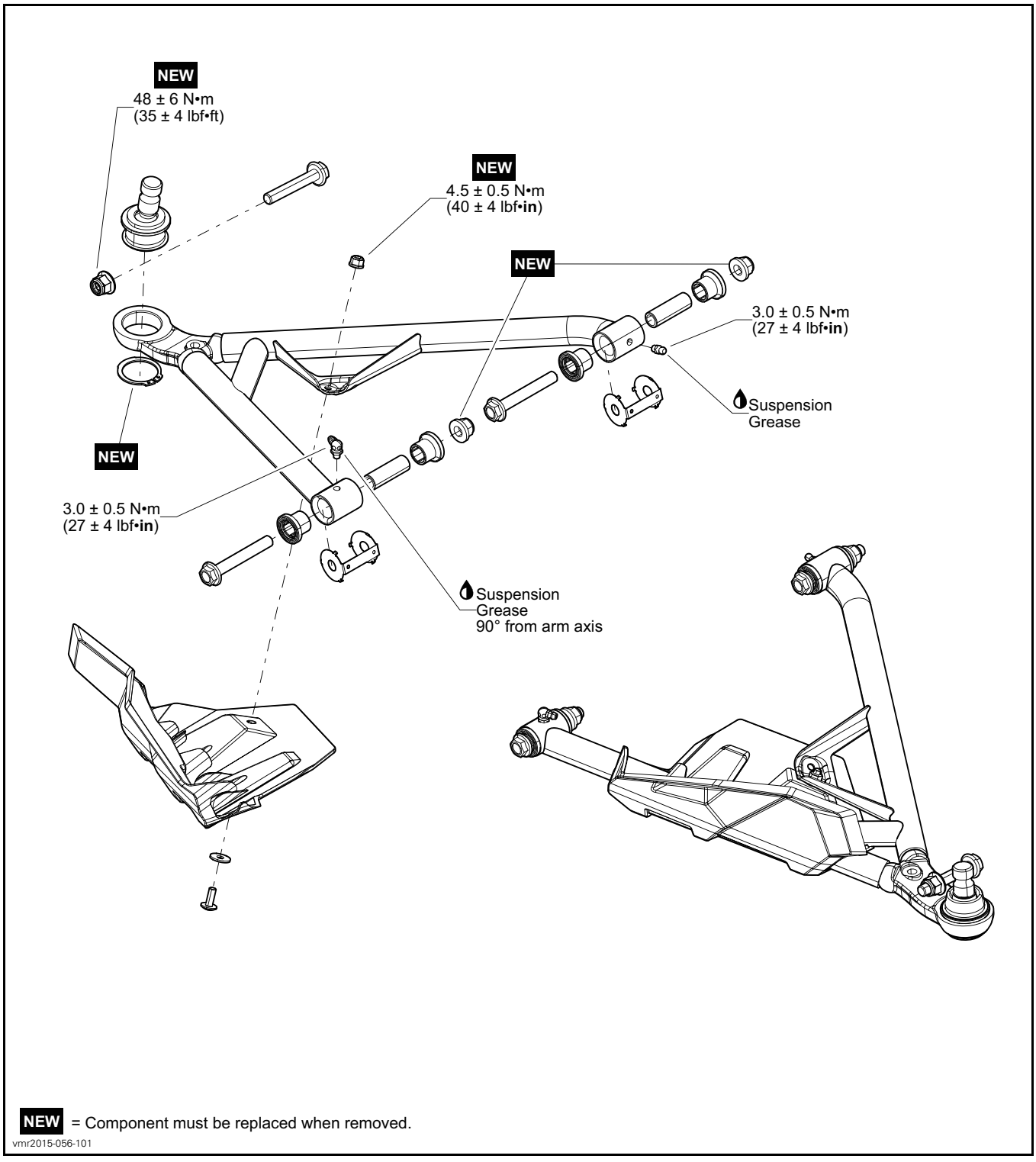
UPPER SUSPENSION ARMS AND COMPONENTS



NEW = Component must be replaced when removed.

vmr2015-056-100

LOWER SUSPENSION ARMS AND COMPONENTS



GENERAL

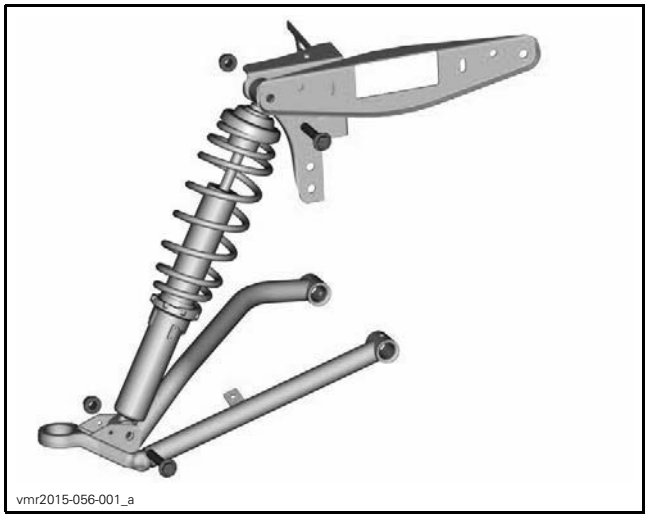
The procedure explained below is the same for the RH and LH sides unless otherwise noted.

PROCEDURES

SHOCK ABSORBER

Shock Absorber Removal

1. Safely lift and support the vehicle of the ground.
2. Remove screws and nuts retaining shock absorber.

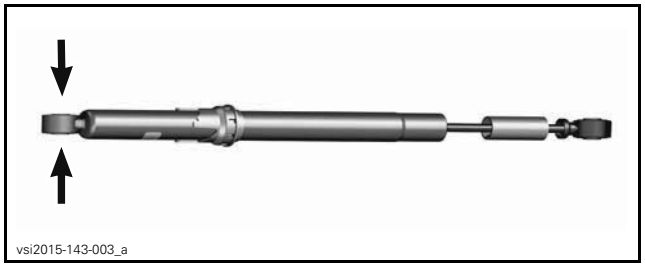

vmr2015-056-001_a

3. Remove shock absorber.

Shock Absorber Inspection

Remove spring from shock absorber. Refer to *SPRINGS* in this subsection.

Secure the end of shock body in a vise with its rod upward.


vsi2015-143-003_a

TYPICAL

NOTICE Do not clamp directly on shock body.

Extend and compress the piston several times over its entire stroke. Check that it moves smoothly and with uniform resistance with its rod upward.

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 stroke.

Replace if any faults are present.

Shock Absorber Installation

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

Install shock absorber screws from front towards rear of vehicle.

Tighten shock absorber nuts to specification.

TIGHTENING TORQUE	
Upper shock absorber nut	61 N•m ± 9 N•m (45 lbf•ft ± 7 lbf•ft)
Lower shock absorber nut	73 N•m ± 7 N•m (54 lbf•ft ± 5 lbf•ft)

SHOCK ABSORBER BUSHINGS

Refer to *SHOCK ABSORBER BUSHINGS* in *REAR SUSPENSION* subsection for complete procedures.

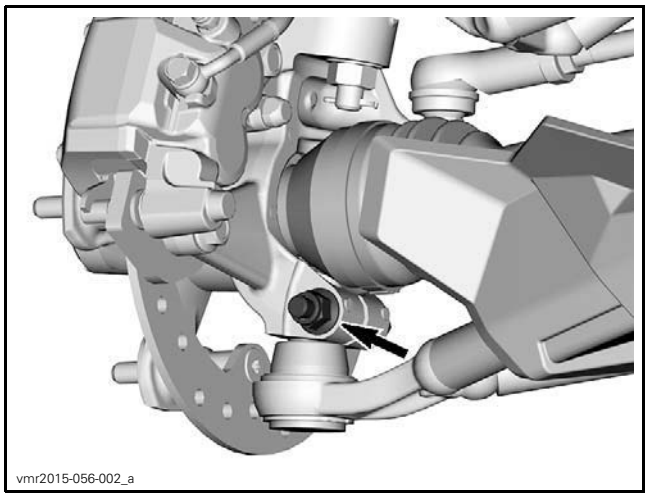
SPRINGS

Refer to *SPRINGS* in *REAR SUSPENSION* subsection for complete procedures.

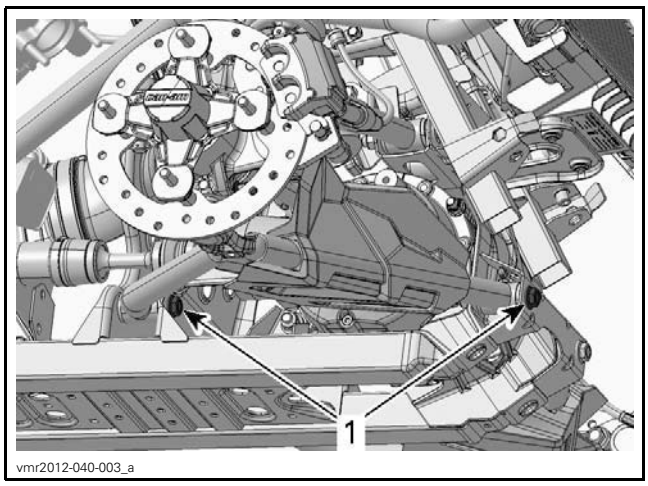
LOWER SUSPENSION ARM

Lower Suspension Arm Removal

1. Safely lift and support the vehicle off the ground.
2. Remove wheel, refer to *WHEELS AND TIRES* subsection.
3. Remove screw and nut securing lower ball joint to knuckle.


vmr2015-056-002_a

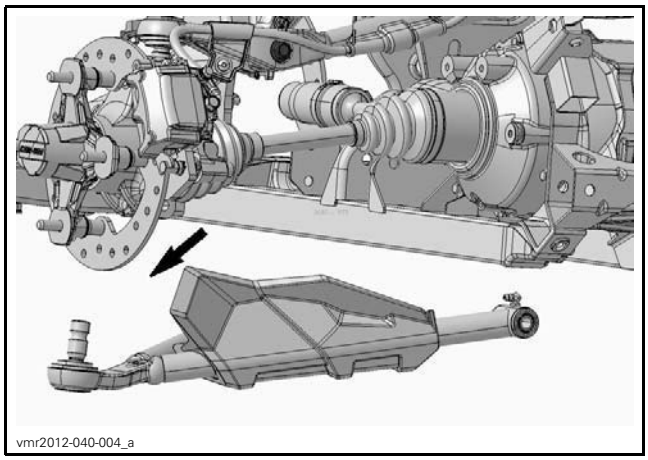
4. Remove screws and nuts securing suspension arm to frame.



vmr2012-040-003_a

1. Suspension arm screws

5. Remove suspension arm.


vmr2012-040-004_a

MOVE OUTWARDS

Lower Suspension Arm Installation

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

Lubricate suspension arm. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

Tighten ball joint nut to specification.

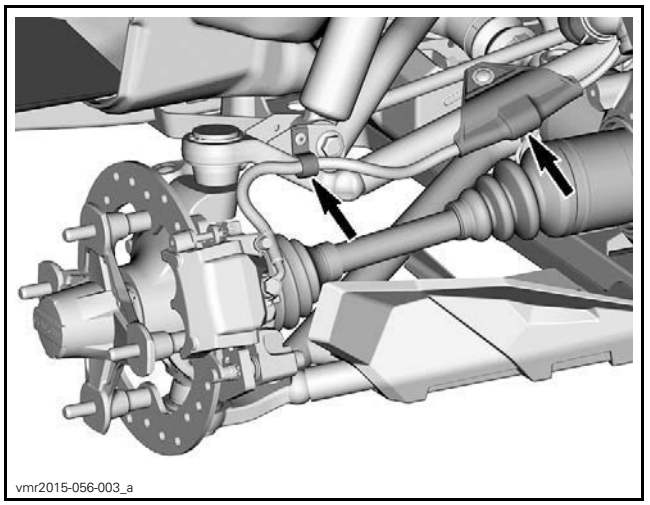
TIGHTENING TORQUE	
Nut securing ball joint to knuckle	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)

Perform steering alignment procedure. Refer to *STEERING ALIGNMENT* subsection.

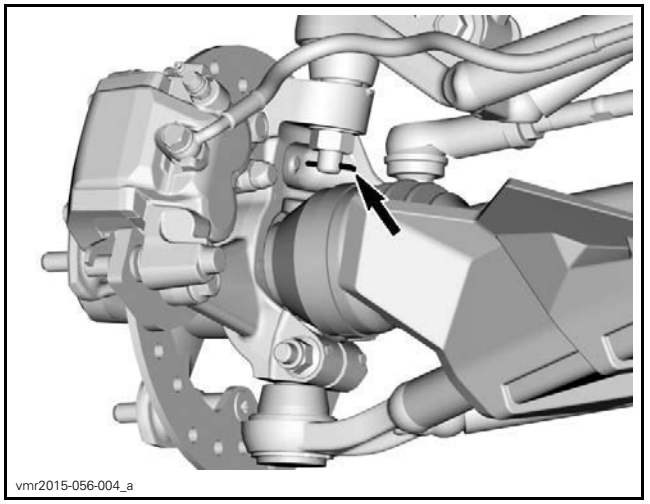
UPPER SUSPENSION ARM

Upper Suspension Arm Removal

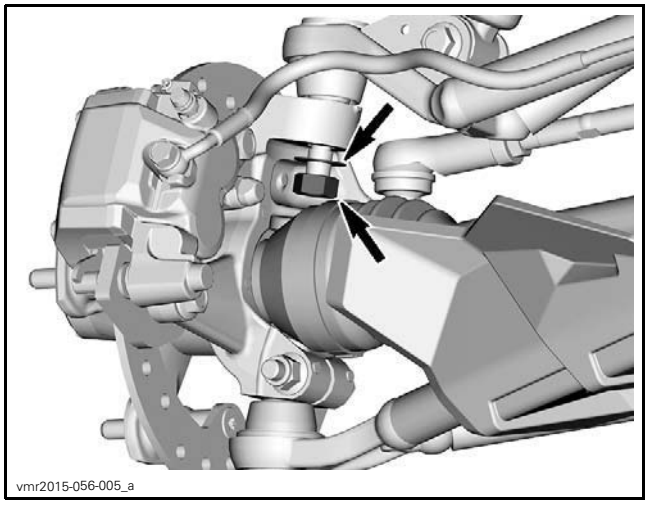
1. Safely lift and support the vehicle off the ground.
2. Remove wheel, refer to *WHEELS AND TIRES* subsection.
3. Remove fasteners retaining brake hose to vehicle.


vmr2015-056-003_a

4. Remove and discard cotter pin retaining ball joint.


vmr2015-056-004_a

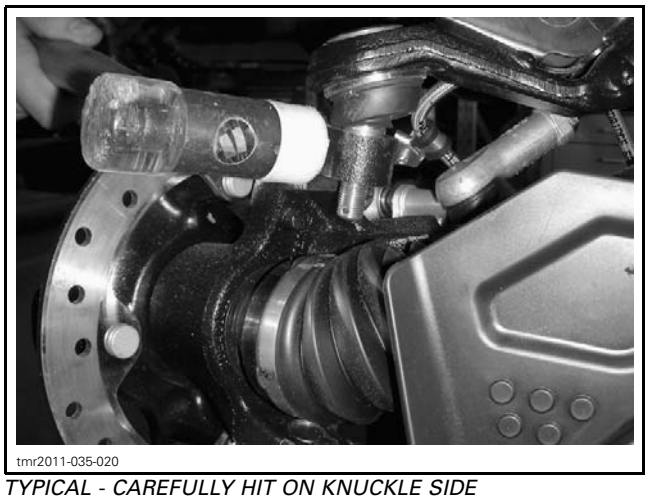
5. Remove ball joint nut and washer.


vmr2015-056-005_a

6. Carefully move brake hose aside.
7. Using a plastic hammer, carefully hit on the knuckle side to separate ball joint from knuckle.

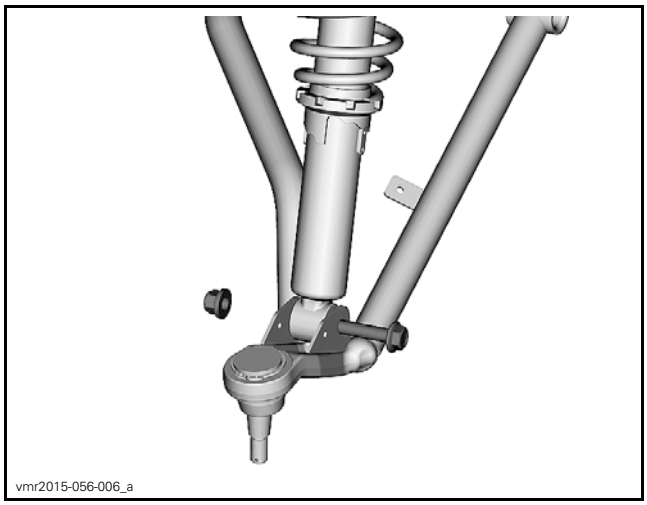
NOTE: A ball joint remover can be used if the ball joint is jammed into knuckle.

NOTICE Never hit on suspension arm to avoid damaging it permanently.

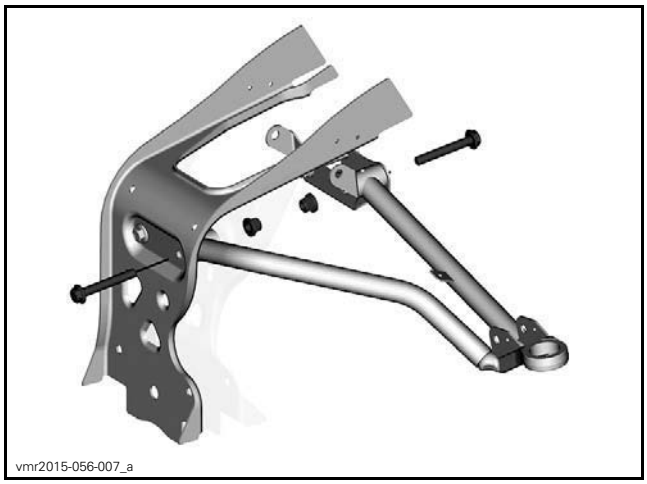

tmr2011-035-020

TYPICAL - CAREFULLY HIT ON KNUCKLE SIDE

8. Remove screw and nut securing suspension arm to shock absorber.


vmr2015-056-006_a

9. Remove screws and nuts securing suspension arm to frame.


vmr2015-056-007_a

10. Remove suspension arm.

Upper Suspension Arm Installation

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

Lubricate suspension arm. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

Install a NEW cotter pin to secure ball joint nut. Both end of cotter pin must be folded.

Tighten shock absorber nut to specification.

TIGHTENING TORQUE	
Lower shock absorber nut	73 N•m ± 7 N•m (54 lbf•ft ± 5 lbf•ft)

Tighten ball joint nut to specification.

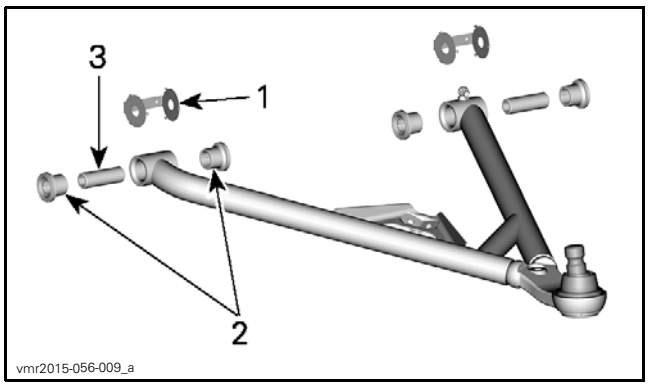
TIGHTENING TORQUE	
Ball joint nut	45 N•m ± 5 N•m (33 lbf•ft ± 4 lbf•ft)

Perform steering alignment procedure. Refer to *STEERING ALIGNMENT* subsection.

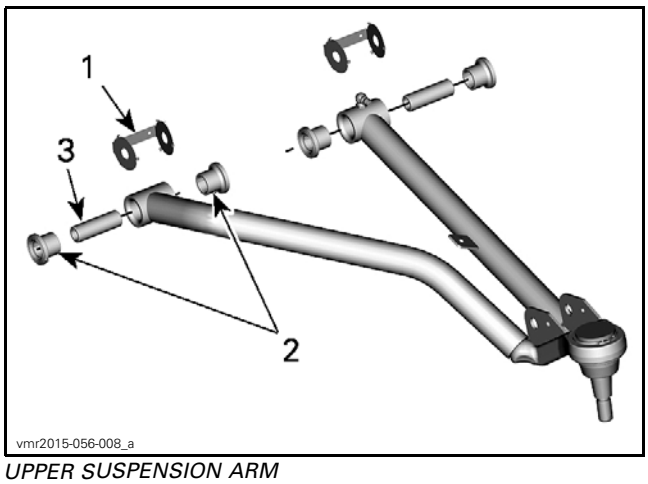
SUSPENSION ARM BUSHINGS

Suspension Arm Bushings Removal

1. Remove wear plates, bushings and sleeves from suspension arm.



LOWER SUSPENSION ARM
1. *Wear plates*
2. *Bushings*
3. *Sleeves*



UPPER SUSPENSION ARM
1. *Wear plates*
2. *Bushings*
3. *Sleeves*

Suspension Arm Bushings Installation

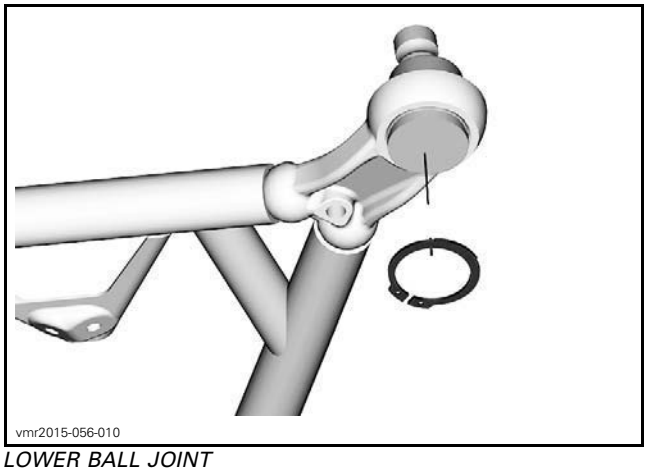
The installation is the reverse of the removal procedure. However, pay attention to the following.

Lubricate suspension arm. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

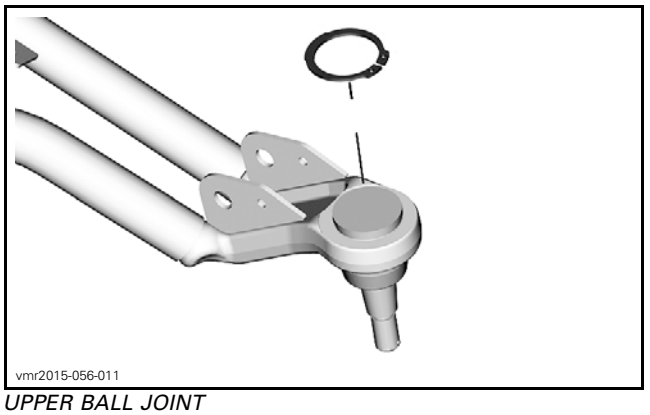
BALL JOINTS

Ball Joint Removal

1. Remove suspension arm from vehicle. Refer to *SUSPENSION ARM REMOVAL* in this subsection.
2. Remove circlip from ball joint.



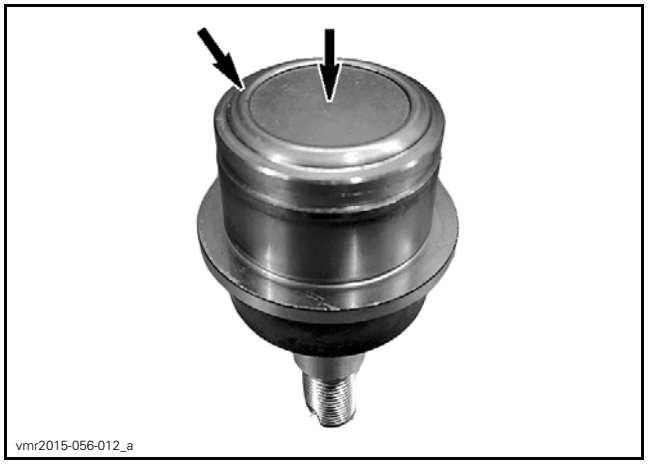
LOWER BALL JOINT



UPPER BALL JOINT

3. Install suspension arm on a press.

NOTICE **Pressing on the center or on the lip of the ball joint will damage it.**

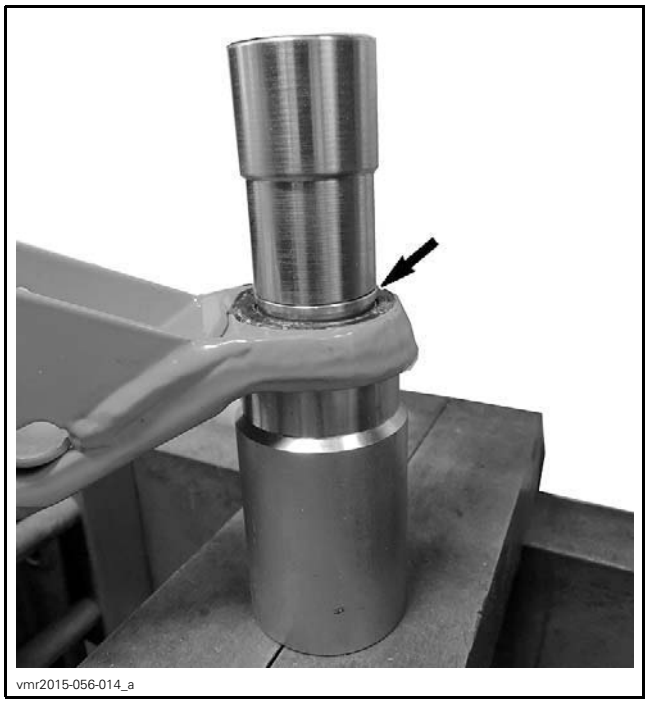


DO NOT PRESS THERE

NOTE: The BALL JOINT REMOVAL TOOL (P/N 529 036 310) is design to apply force only on the outside edge of the ball joint.


529036310


vmr2015-056-013


vmr2015-056-014_a

CONTACT BETWEEN TOOL AND BALL JOINT ON THE OUTSIDE EDGE ONLY

4. Remove ball joint from suspension arm.

NOTICE Make sure that suspension arm is properly supported on the press during ball joint removal.

Ball Joint Installation

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

Install a NEW circlip to secure ball joint.

REAR SUSPENSION

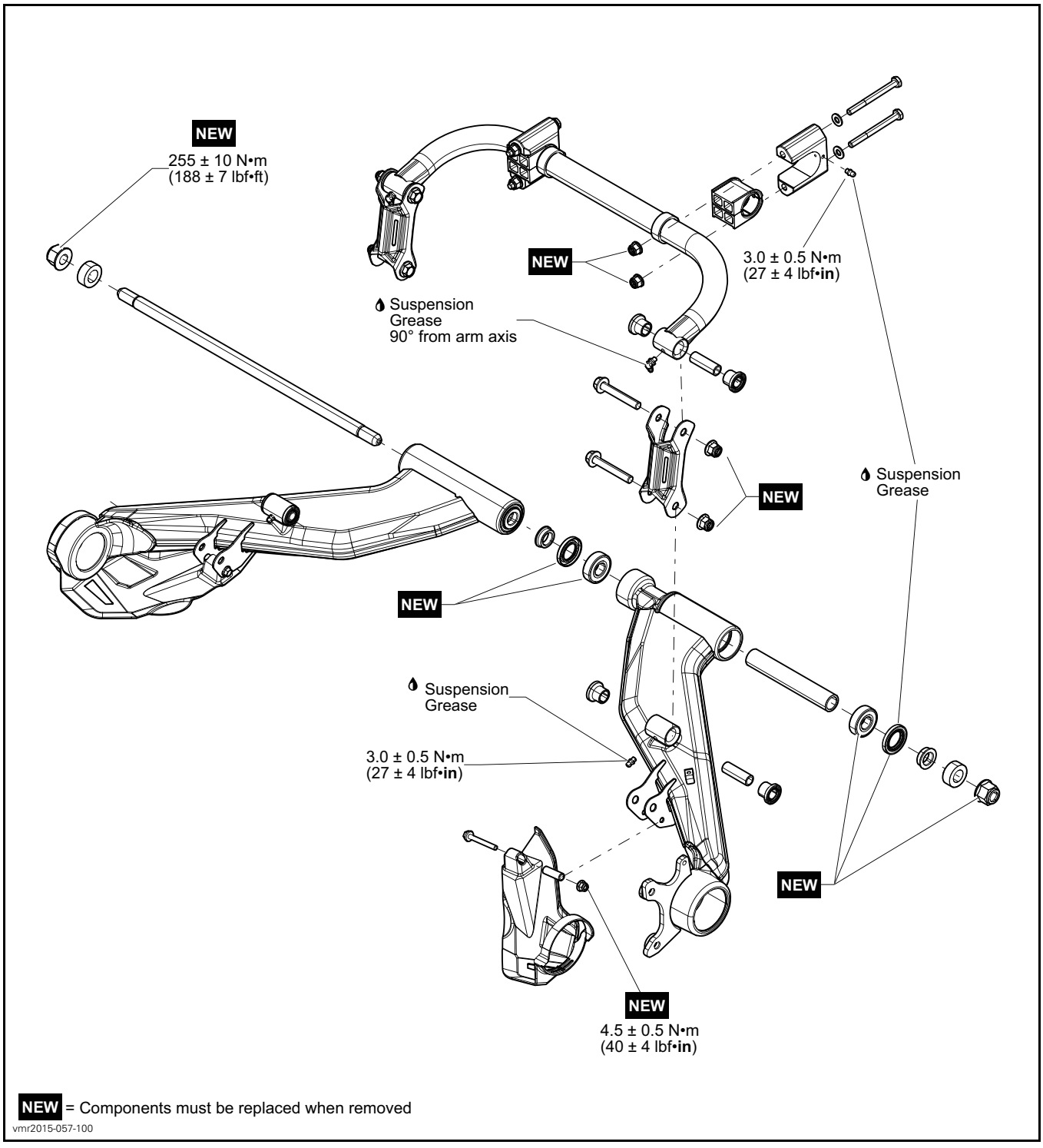
SERVICE TOOLS

Description	Part Number	Page
SPRING COMPRESSOR	529 036 184	681

SERVICE PRODUCTS

Description	Part Number	Page
SUSPENSION GREASE	293 550 033	684

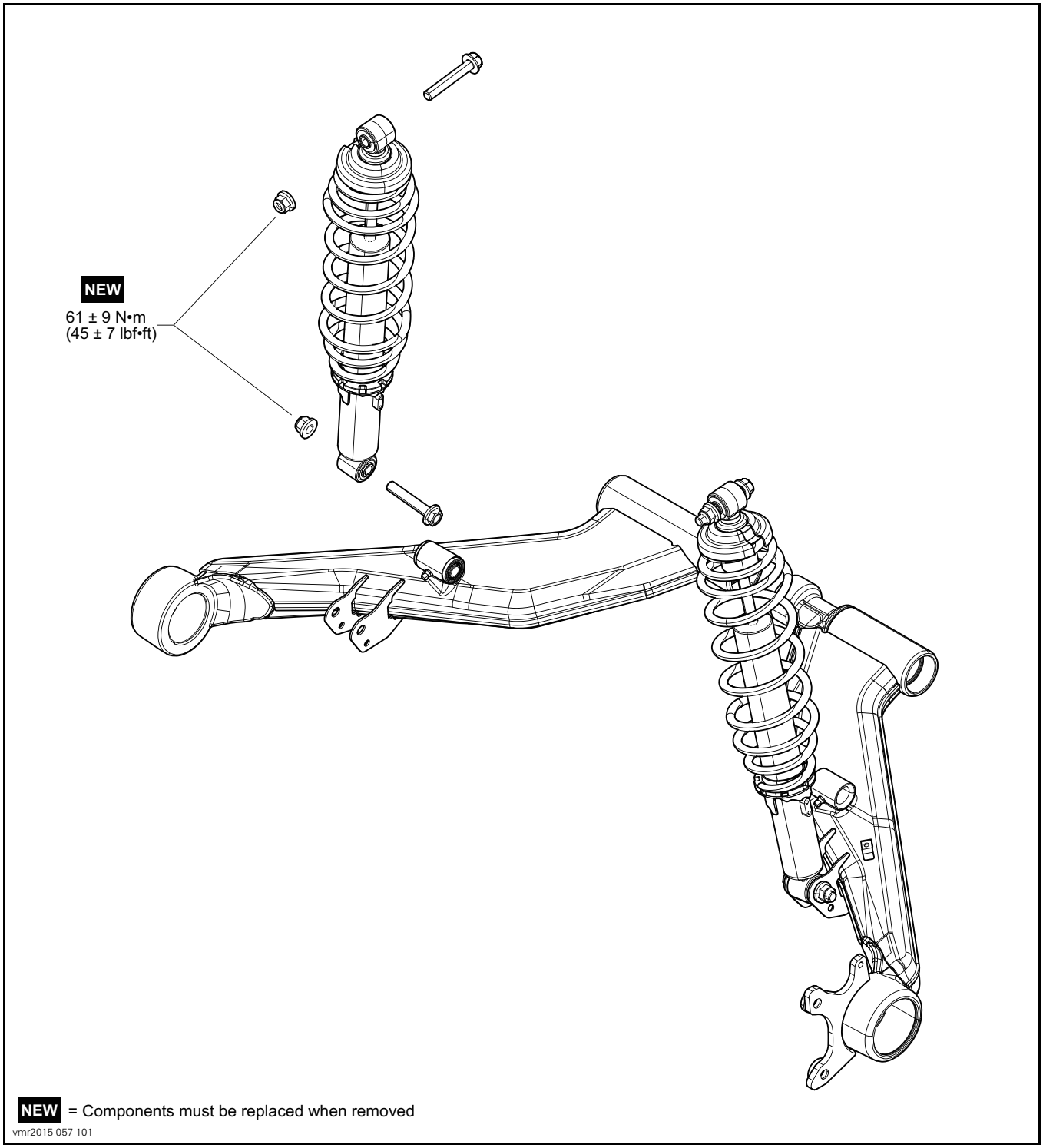
TRAILING ARMS AND SWAY BAR



NEW = Components must be replaced when removed

vmr2015-057-100

SHOCK ABSORBERS



GENERAL

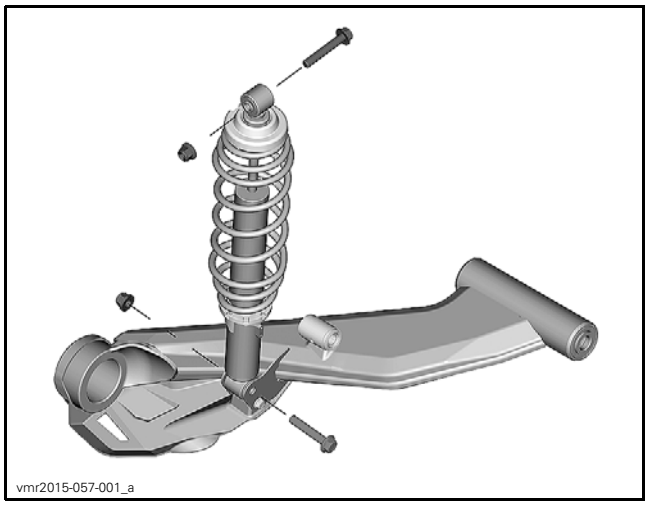
The procedure described below is the same for the RH and LH sides, unless otherwise instructed.

PROCEDURES

SHOCK ABSORBERS

Shock Absorber Removal

1. Safely lift and support the vehicle off the ground.
2. Remove screws and nuts retaining shock absorber.

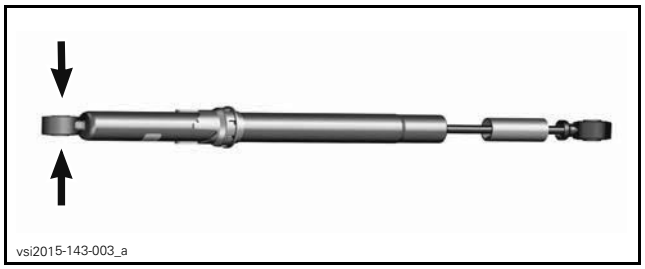

vmr2015-057-001_a

3. Remove shock absorber.

Shock Absorber Inspection

Remove spring from shock absorber. Refer to *SPRINGS* in this subsection.

Secure the end of shock body in a vise with its rod upward.


vsi2015-143-003_a

TYPICAL

NOTICE Do not clamp directly on shock body.

Extend and compress the piston several times over its entire stroke. Check that it moves smoothly and with uniform resistance with its rod upward.

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 stroke.

Replace if any faults are present.

Shock Absorber Installation

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

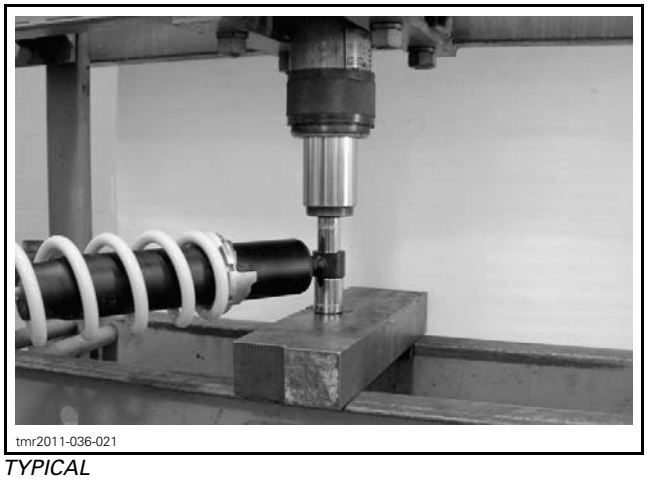
Tighten shock absorber nuts to specification.

TIGHTENING TORQUE	
Shock absorber nut	61 N•m ± 9 N•m (45 lbf•ft ± 7 lbf•ft)

SHOCK ABSORBER BUSHINGS

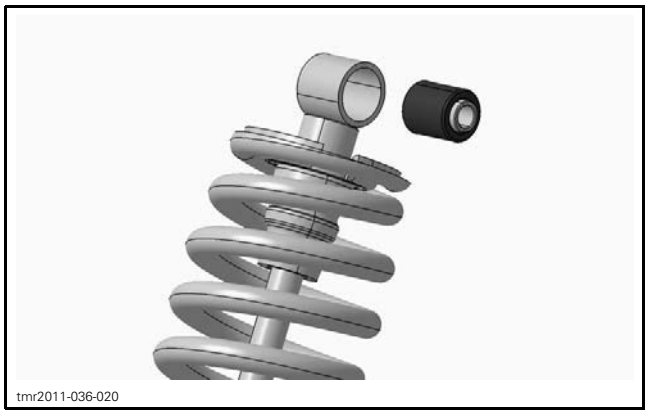
Shock Absorber Bushing Replacement

1. Remove shock absorber from vehicle. Refer to *SHOCK ABSORBERS* in this subsection.
2. Install shock absorber on a press.
3. Use an appropriate socket to push bushing.


tmr2011-036-021

TYPICAL

4. Remove bushing from shock absorber.



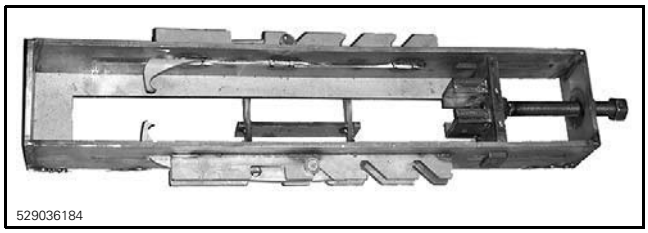
TYPICAL

5. Install a NEW bushing as the reverse of removal.
6. Install shock absorber on vehicle.

SPRINGS

Spring Removal

1. Remove shock absorber from vehicle. Refer to *SHOCK ABSORBERS* in this subsection.
2. Place the SPRING COMPRESSOR (P/N 529 036 184) in a vise.



3. Position the shock absorber in the tool.
4. Install the spring compressor pins.
5. Tighten spring remover screw until the spring is sufficiently compressed to remove spring cap.
6. Remove spring cap from shock absorber.
7. Release spring remover screw.
8. Remove spring from shock absorber.

Spring Inspection

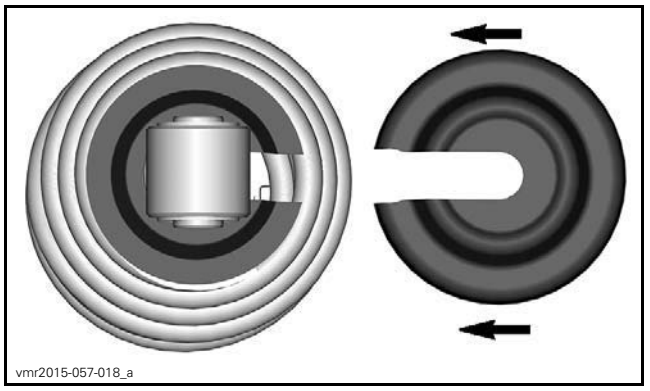
Inspect the spring for damage.

Replace if necessary.

Spring Installation

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

On applicable models, install spring cap opening at 180° from spring stopper opening.

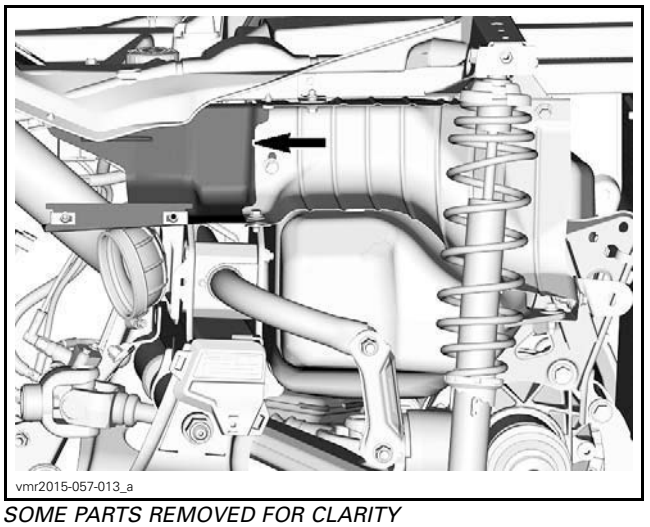


CAP OPENING AT 180°

SWAY BAR

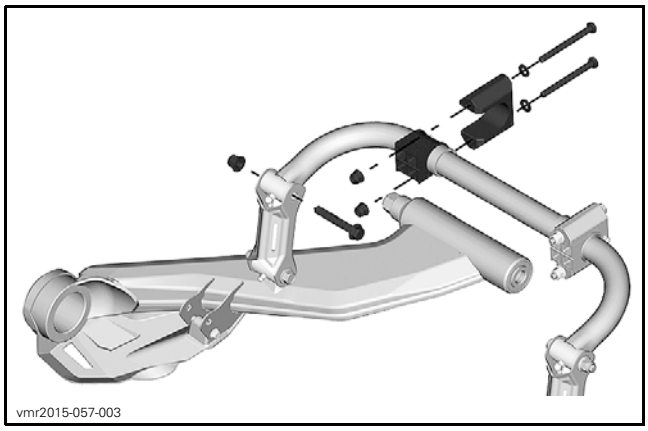
Sway Bar Removal

1. Safely lift and support the vehicle off the ground.
2. Remove rear wheels, refer to *WHEELS AND TIRES* subsection.
3. Refer to *EXHAUST SYSTEM* and remove:
   - Muffler
   - Exhaust pipe.
4. Remove the following inner heat shield.



SOME PARTS REMOVED FOR CLARITY

5. Remove fasteners and sway bar bushing holders.


vmr2015-057-003

6. Remove sway bar.

Sway Bar Inspection

Check sway bar for cracks, bending or other damages.

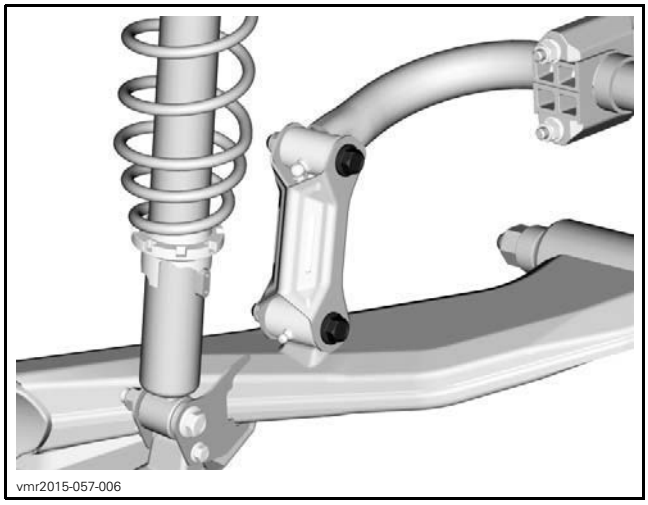
Replace if necessary.

Sway Bar Installation

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

Install all retaining screws of sway bar loosely first.

Position link arm screws with their heads towards inside.


vmr2015-057-006

Tighten sway bar retaining screws to specification.

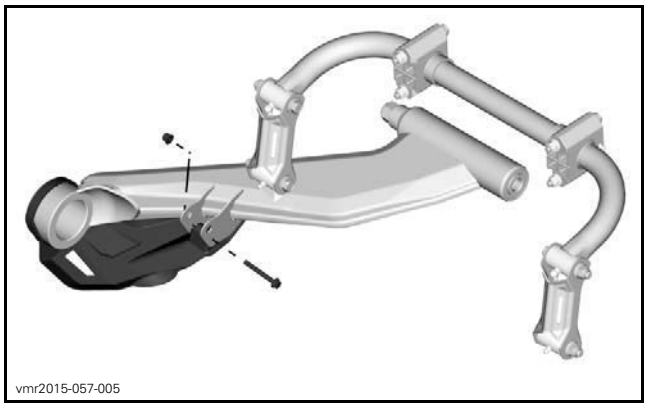
TIGHTENING TORQUE	
Screws securing sway bar to frame	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)
Screws securing sway bar to link arm	61 N•m ± 9 N•m (45 lbf•ft ± 7 lbf•ft)

Lubricate sway bar. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

TRAILING ARM

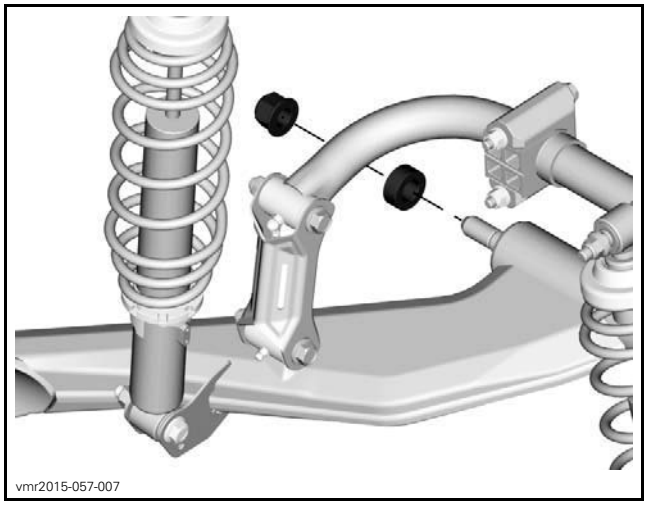
Trailing Arm Removal

1. Safely lift and support the vehicle off the ground.
2. Remove wheel hub, refer to *REAR DRIVE* subsection.
3. Remove protective plate from trailing arm.

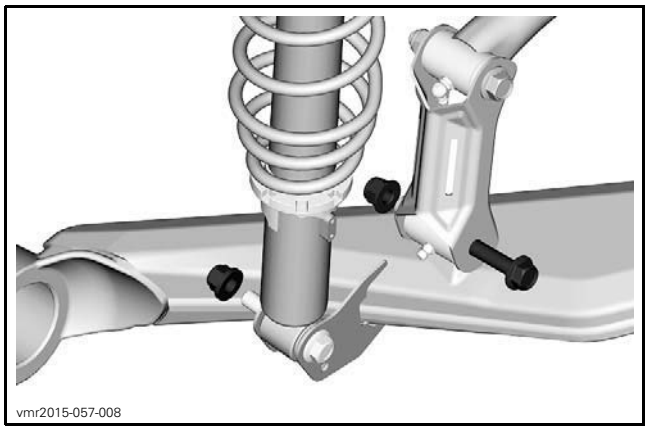

vmr2015-057-005

NOTE: If applicable, remove fasteners retaining brake hose to vehicle.

4. Remove nut and washer securing trailing arm pivot shaft.

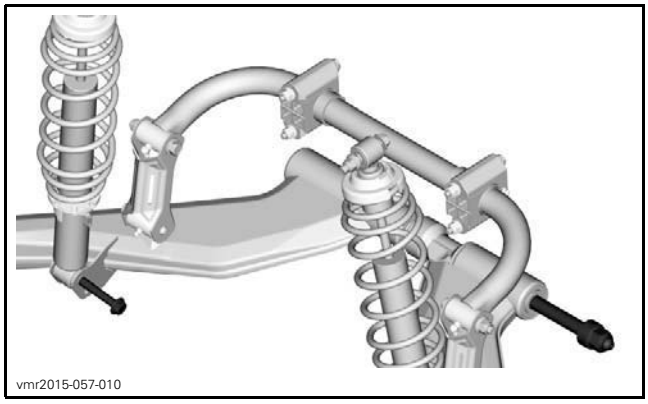

vmr2015-057-007

5. Detach trailing arm from link arm and remove lower nut retaining shock absorber.


vmr2015-057-008

6. Firmly hold trailing arm then remove:
   – Shock absorber lower screw
   – Trailing arm pivot shaft (pull from opposite side).

NOTE: If only one trailing arm is removed, pull pivot shaft just enough to clear trailing arm.

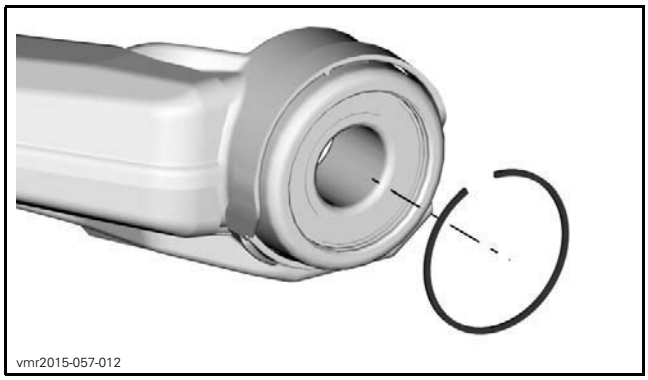

vmr2015-057-010

7. Remove trailing arm from vehicle.

Trailing Arm Disassembly

Drive Shaft Bearing Removal

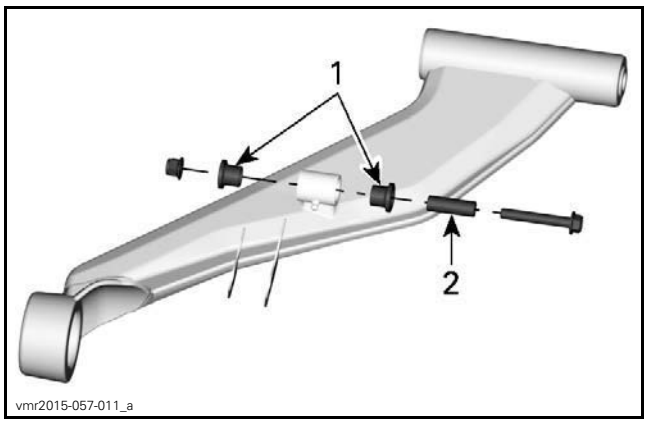
1. Remove circlip securing bearing into trailing arm.


vmr2015-057-012

2. Install trailing arm on a press.
3. Use an appropriate bearing remover.
4. Remove drive shaft bearing from trailing arm.

Link Arm Inner Bushing Removal

Remove both bushings and sleeve from trailing arm.

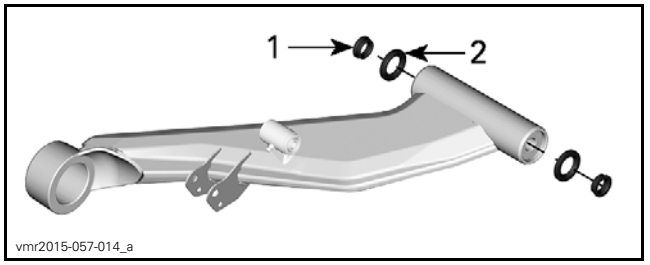


vmr2015-057-011_a

1. Bushings
2. Sleeve

Trailing Arm Pivot Bearing Removal

1. Remove both spacers and seals from trailing arm pivot.



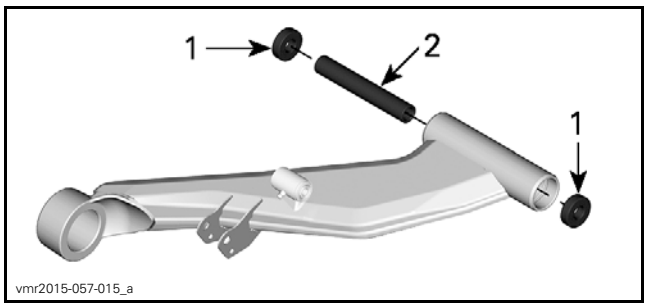
vmr2015-057-014_a

1. Spacer
2. Seal

2. Remove bearing with an appropriate bearing remover.

NOTE: Remove one bearing at a time.

3. Remove inner spacer from trailing arm.



vmr2015-057-015_a

1. Pivot bearings
2. Inner spacer

Trailing Arm Inspection

Check trailing arms for:
– Cracks
– Bending.

Check seals condition.

Check inner race of each pivot bearing with your finger. Bearings should turn smoothly and quietly.

Replace all damaged parts.

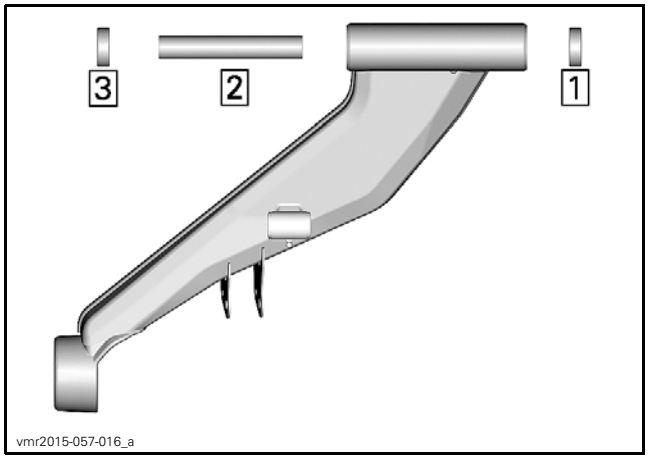
Trailing Arm Assembly and Installation

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

Install the following NEW parts:
– Trailing arm pivot nuts
– Pivot bearings
– Pivot seals
– Circlip.

Use an appropriate shaft to center trailing arm inner spacer during pivot bearings installation.

Install pivot bearings and inner spacer as per the following sequence.

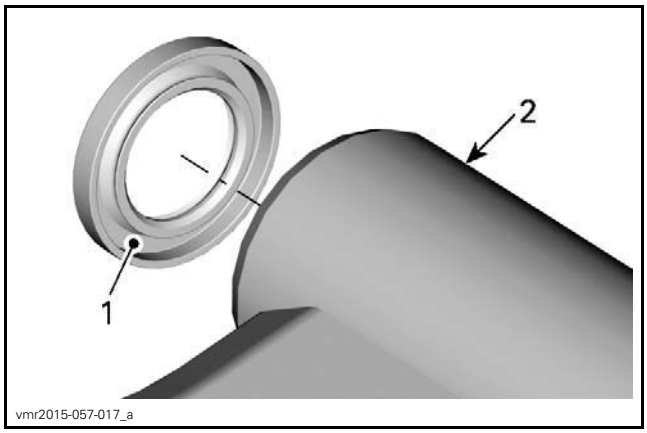


TYPICAL - LH TRAILING ARM
Step 1: Insert bearing on RH side
Step 2: Center inner spacer with RH side bearing using a shaft
Step 3: Insert bearing on LH side

Lubricate trailing arm pivot seals.

LUBRICATION	
Pivot seals	SUSPENSION GREASE (P/N 293 550 033)

Install trailing arm pivot seal with its cavity facing inwards.



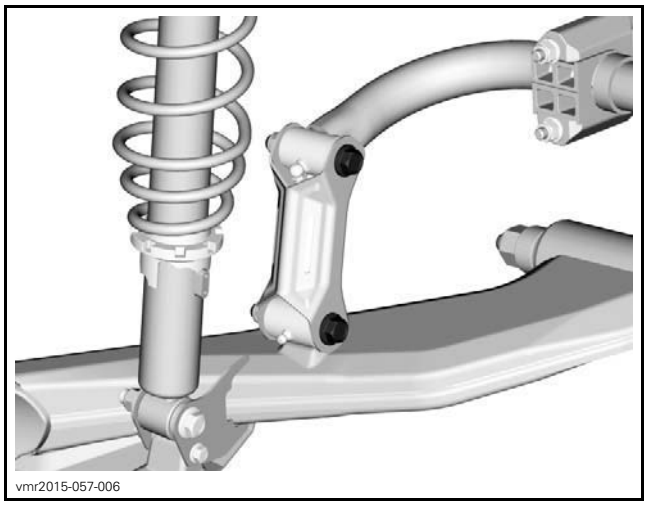
1. Seal cavity
2. Trailing arm

Center trailing arm pivot shaft.

Tighten trailing arm pivot nuts as per the following sequence.

TIGHTENING SEQUENCE		
Trailing arm pivot nuts	RH side nut	Tighten nut until it reaches end of threads
	LH side nut	255 N•m ± 10 N•m (188 lbf•ft ± 7 lbf•ft)

Position link arm bolts with their heads towards inside.



Tighten trailing arm fasteners to specification.

TIGHTENING TORQUE	
Bolts securing trailing arm to link arm	61 N•m ± 9 N•m (45 lbf•ft ± 7 lbf•ft)
Shock absorber nuts	61 N•m ± 9 N•m (45 lbf•ft ± 7 lbf•ft)
Protective plate retaining nuts	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)

BRAKES

SERVICE TOOLS

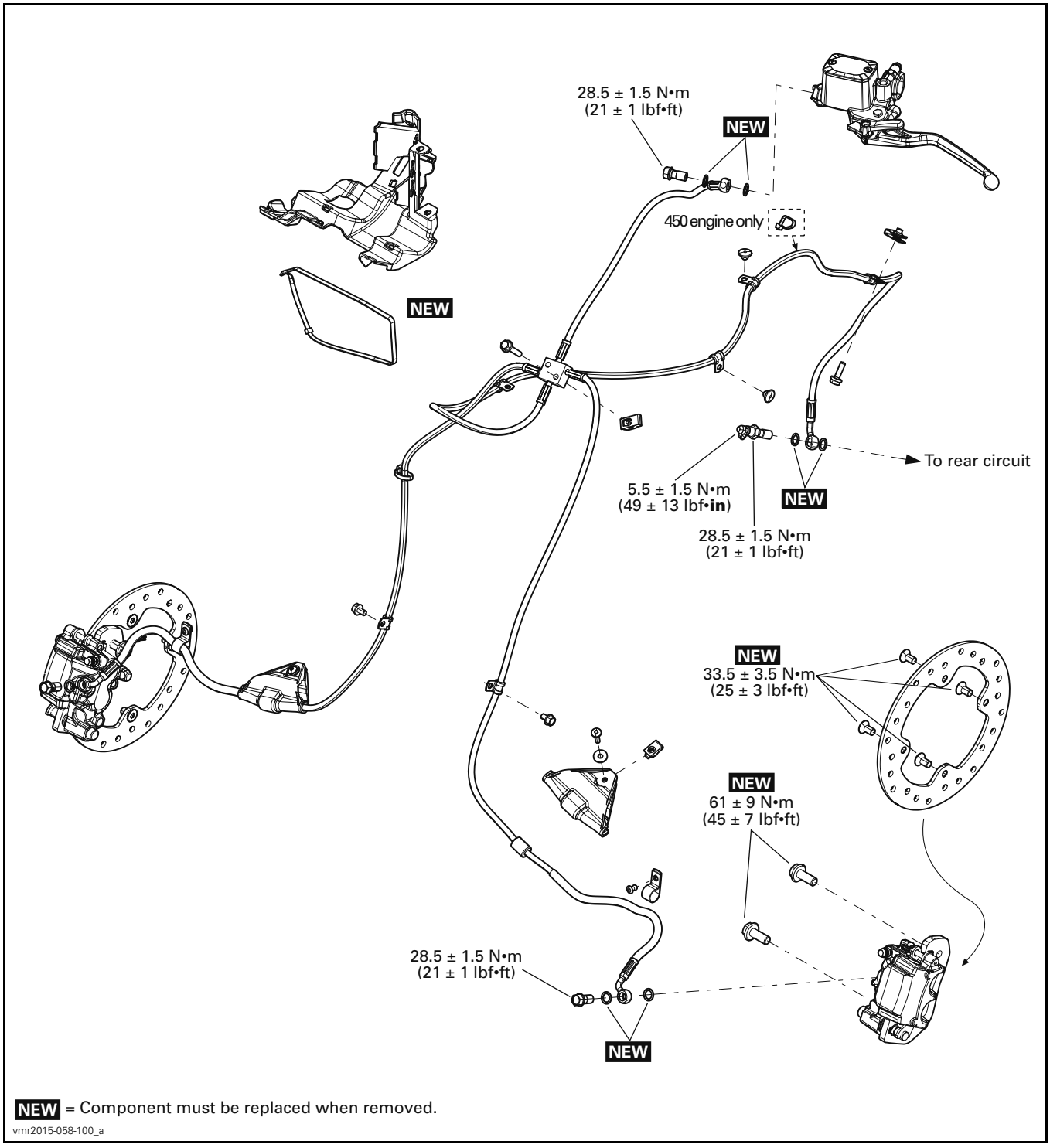
Description	Part Number	Page
ECM ADAPTER TOOL	529 036 166	692

SERVICE PRODUCTS

Description	Part Number	Page
XPS BRAKES AND PARTS CLEANER (USA)	219 701 705	695
XPS BRAKES AND PARTS CLEANER	219 701 776	695
XPS SYNTHETIC GREASE	293 550 010	693

OUTLANDER L (FRONT CIRCUIT)

All Except CE Models

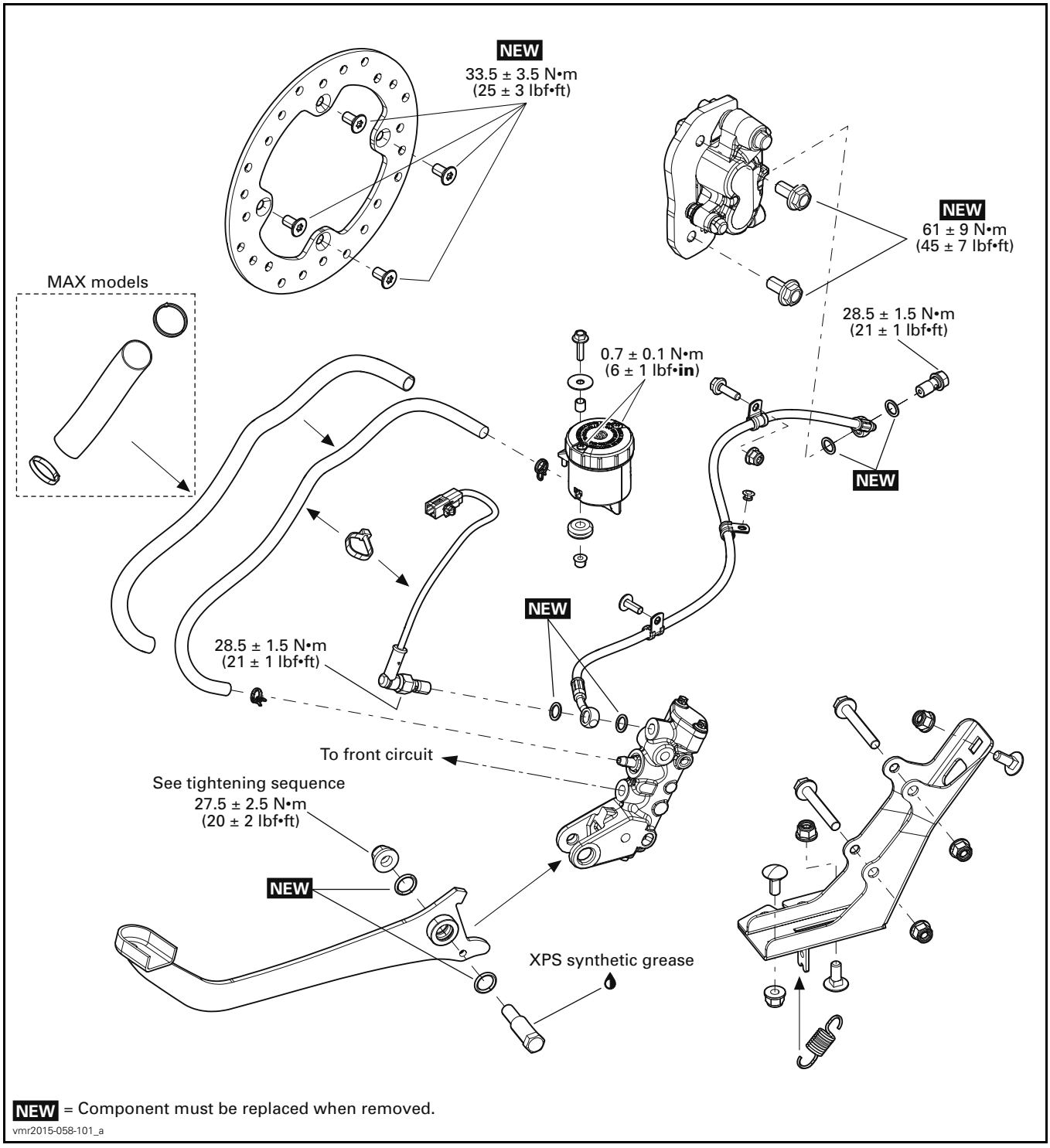


NEW = Component must be replaced when removed.

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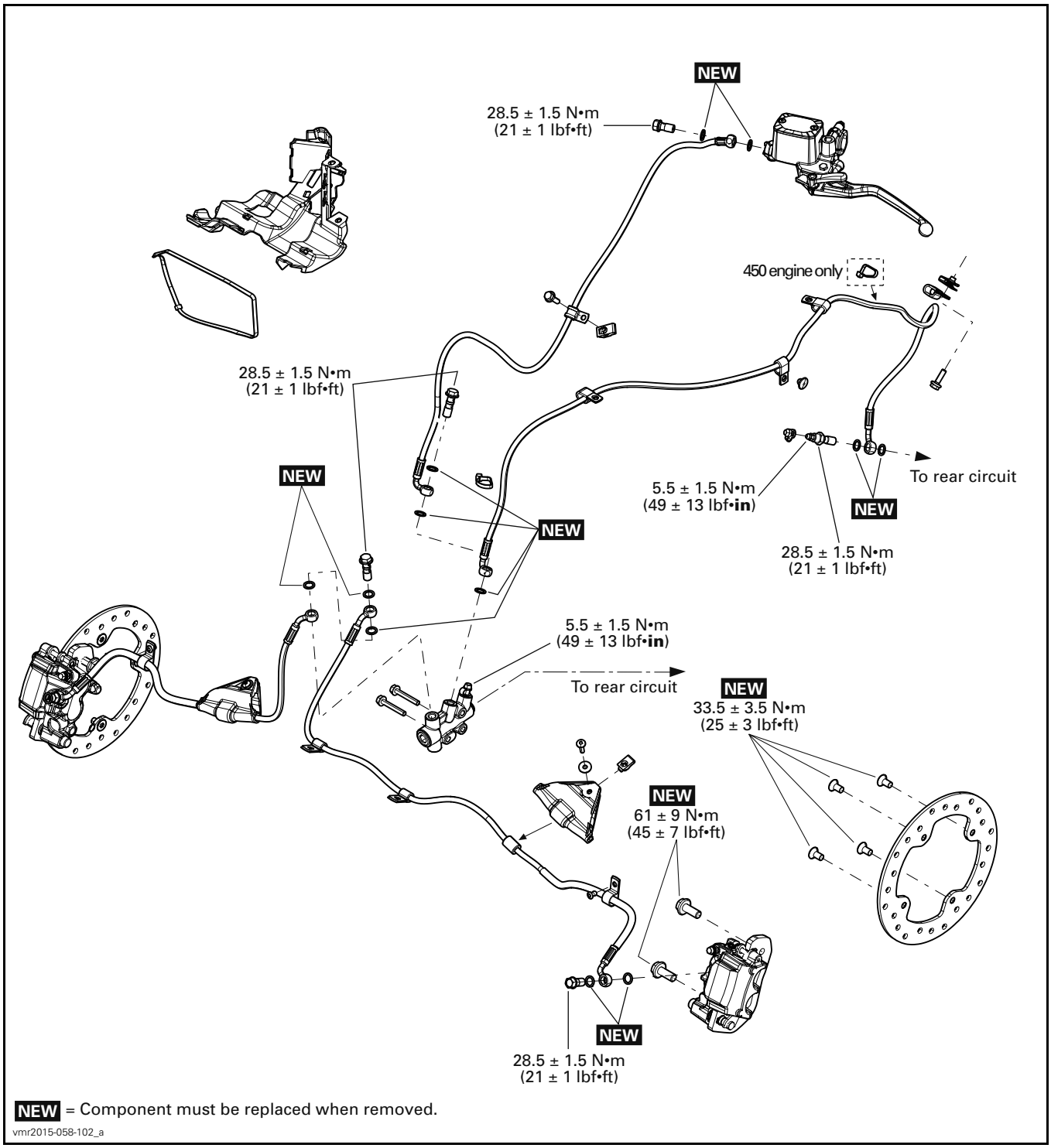
OUTLANDER L (REAR CIRCUIT)

All Except CE Models



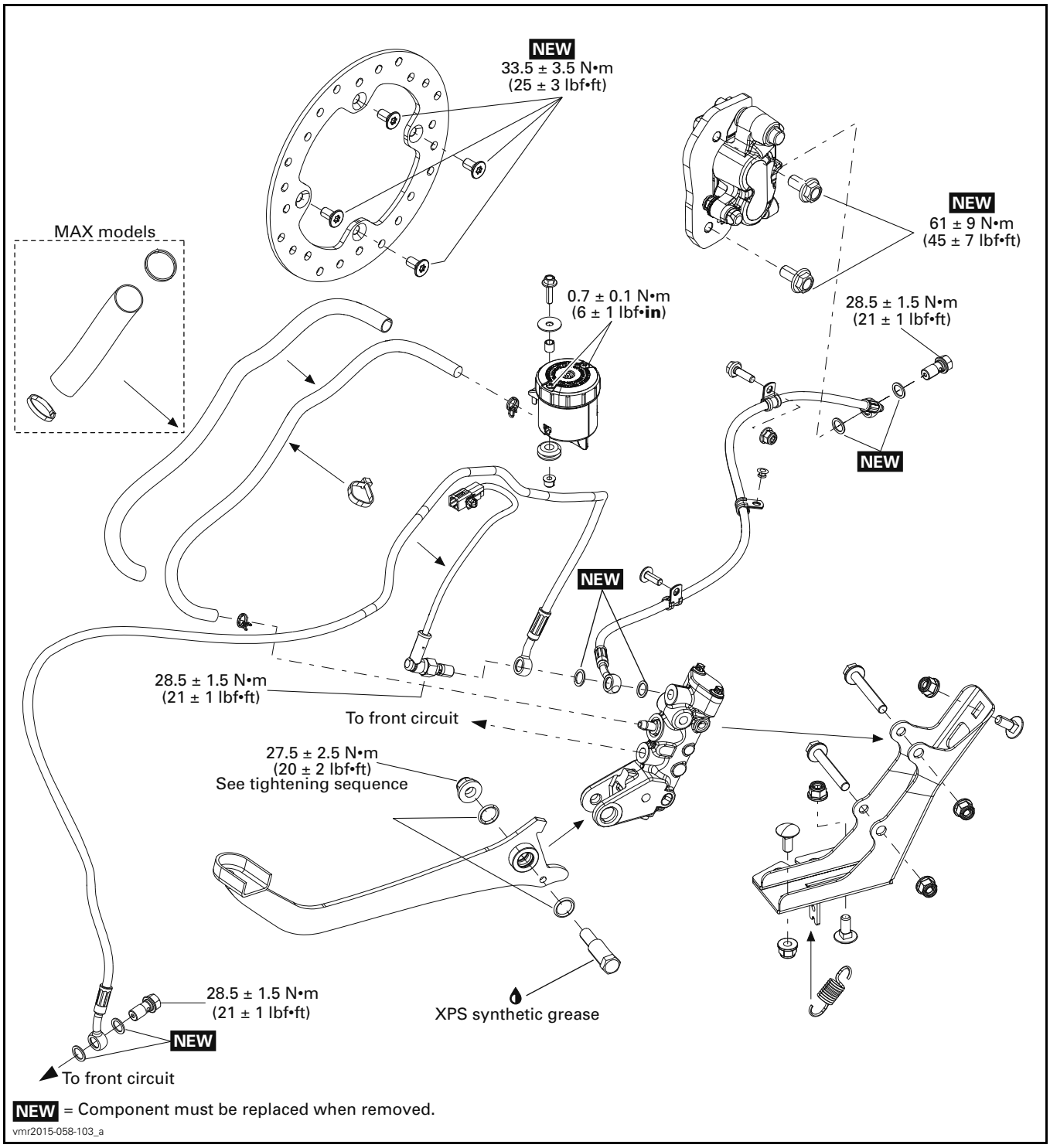
OUTLANDER L (FRONT CIRCUIT)

CE Models



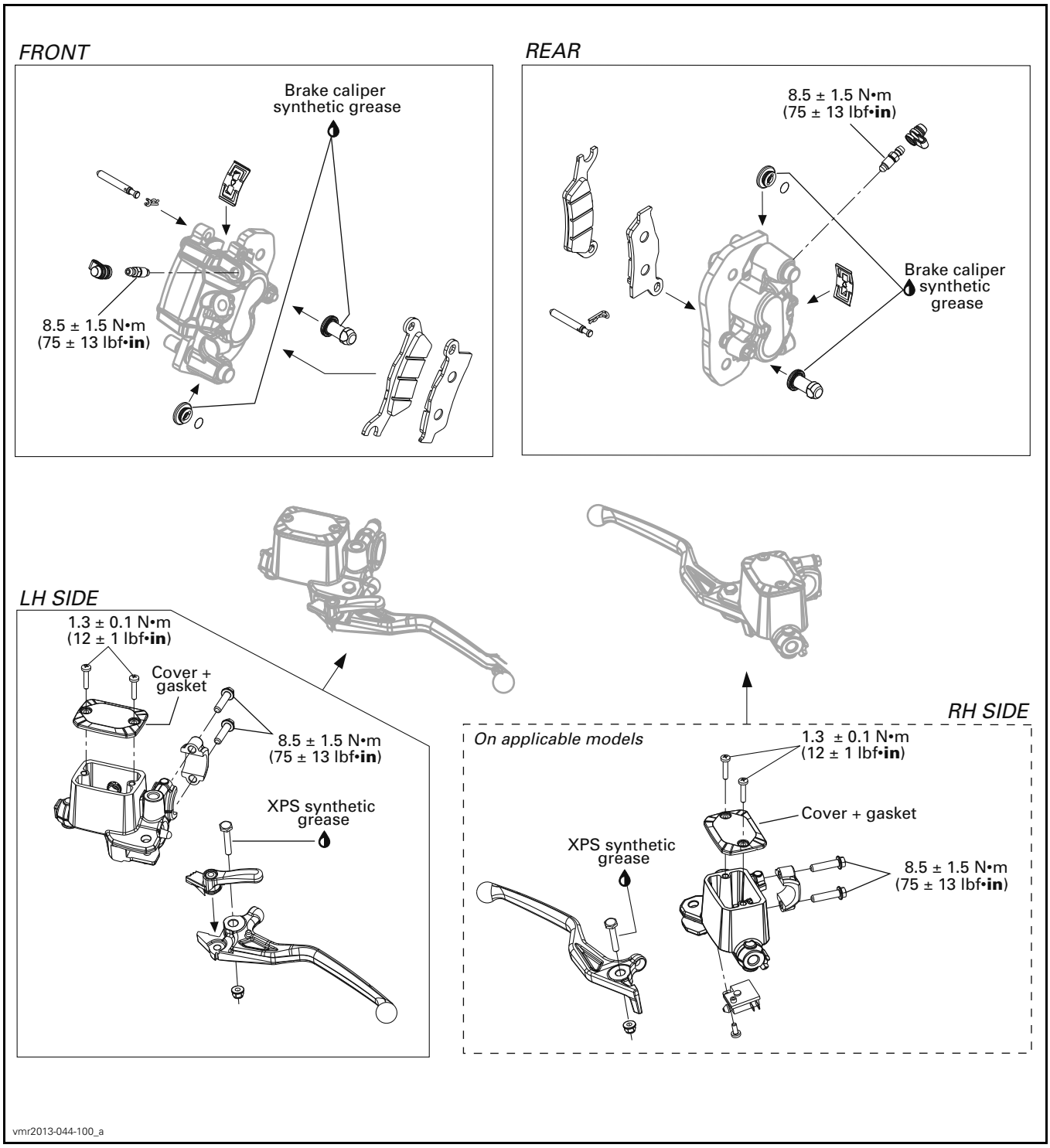
OUTLANDER L (REAR CIRCUIT)

CE Models



CALIPERS AND BRAKE LEVERS

All Models



GENERAL

⚠ WARNING

Always check brake system operation after removing or servicing a brake component.

NOTICE Avoid spilling brake fluid on plastic, rubber or painted parts. Protect these parts with a rag when servicing brake system.

NOTE: Sealing washers must be discarded and replaced with new ones every time a Banjo bolt is unscrewed.

NOTE: Always clean the area around a brake component before servicing.

SYSTEM DESCRIPTION

A disc brake system with twin-piston sliding calipers is used.

Disc Brake Configurations

OUTLANDER L		
MODELS	NUMBER OF DISC BRAKES	
	FRONT	REAR
All models	2	1

Brake Controls and Circuit Configurations

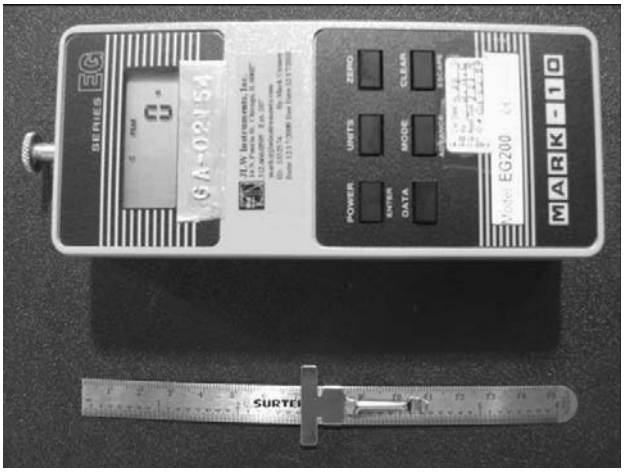
OUTLANDER L		
MODELS	LH BRAKE LEVER	BRAKE PEDAL
All except CE models	Controls front and rear brakes	Controls rear brakes
CE models	Controls front and rear brakes	Controls front and rear brakes

INSPECTION

BRAKE SYSTEM PRESSURE VALIDATION

Required Tools

Use an appropriate compression force gauge such as *MARK-10 EG-200* and a ruler.



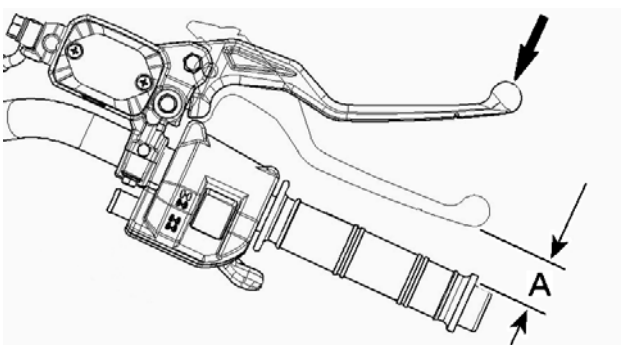
tmr2011-037-110

TYPICAL

Brake Lever Verification

NOTE: Do not pump up the brakes repeatedly before doing the validation.

1. Position force gauge perpendicularly on brake lever edge.
2. Position a ruler perpendicularly to handlebar grip.
3. Push brake lever at distance A from handlebar grip using force gauge.



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A. Distance from handlebar (refer to table)

4. Read load recorded by the force gauge.
5. Load reading must be as per the following table.

BRAKE LEVER VERIFICATION		
LEVER	DISTANCE **A**	MINIMUM LOAD
LH side lever	25 mm (1 in)	150 N (34 lbf)
RH side lever (if applicable)	25 mm (1 in)	130 N (29 lbf)

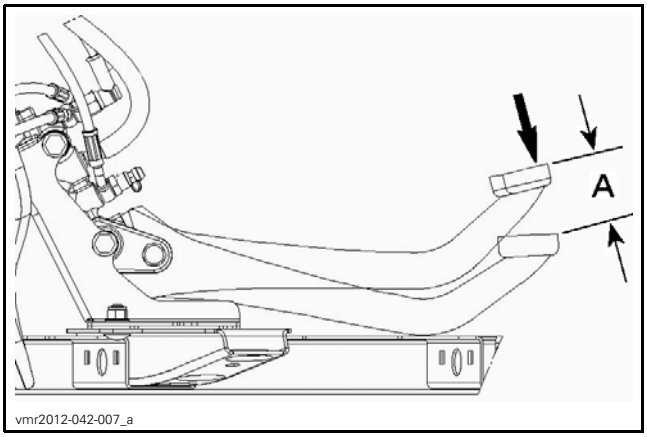
6. If load reading is not in accordance with the specification:
   6.1 Perform a brake system inspection and cleaning.
   6.2 Bleed brake system.

   NOTE: Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

Brake Pedal Verification

NOTE: Do not pump up the brakes repeatedly before doing the validation.

1. Position force gauge perpendicularly on brake pedal edge.
2. Position a ruler perpendicularly to brake pedal.
3. Push brake pedal from distance A using force gauge.



A. Distance to push (refer to table)

4. Read load recorded by the force gauge.
5. Load reading must be as per the following table.

BRAKE PEDAL VERIFICATION		
MODELS	DISTANCE **A**	MINIMUM LOAD
All Outlander L except CE	35 mm (1-3/8 in)	180 N (40 lbf)
Outlander L CE	55 mm (2-5/32 in)	180 N (40 lbf)

6. If load reading is not in accordance with the specification:
   6.1 Perform a brake system inspection and cleaning.
   6.2 Bleed brake system.

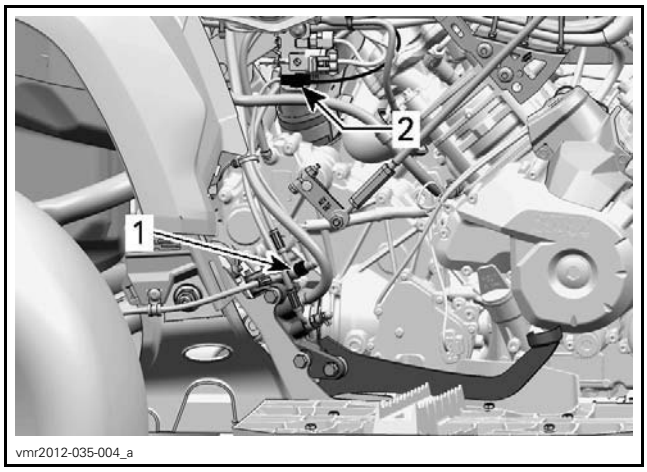
   NOTE: Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

PROCEDURES

BRAKE LIGHT SWITCHES

Brake Light Switch Location

The brake light switch is located on the brake pedal master cylinder.



BRAKE PEDAL MASTER CYLINDER
1. Brake light switch
2. Brake light switch connector

Brake Light Switch Resistance Test

1. Disconnect brake light switch connector.
2. Check switch operation as follows.

BRAKE LIGHT SWITCH POSITION	PIN		RESISTANCE
Firmly pushed	1	2	Close to 0 Ω
Released			Infinite (OL)

If switch is defective, replace with a new one.

If the switch tests good, verify wire continuity between harness connector and ECM connector. Refer to *BRAKE SYSTEMS WIRING DIAGRAM*.

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



Brake Light Switch Replacement

1. Disconnect brake light switch connector.
2. Drain brake line.
3. Remove brake light switch.

NOTE: Use shop rags to catch any spilled brake fluid.

4. Install NEW sealing washers.
5. Install brake light switch.

TIGHTENING TORQUE	
Brake light switch	28.5 N•m ± 1.5 N•m (21 lbf•ft ± 1 lbf•ft)

6. Connect brake light switch connector.
7. Refill and bleed brake system, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

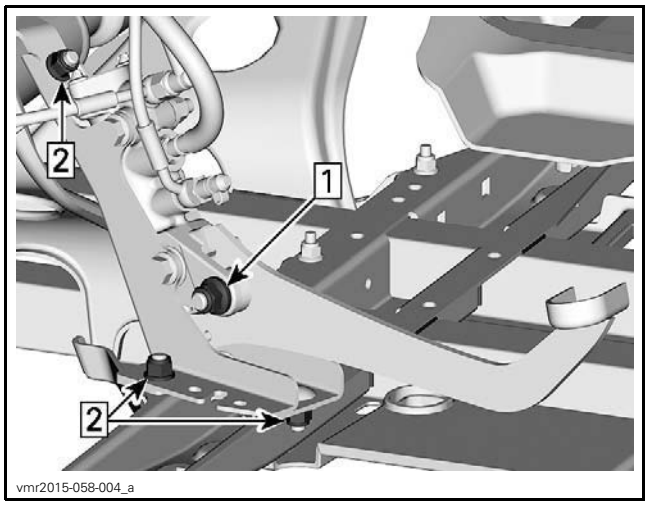
BRAKE PEDAL

Brake Pedal Removal

1. Drain brake system, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
2. Remove RH footrest panel. Refer to *BODY* subsection.

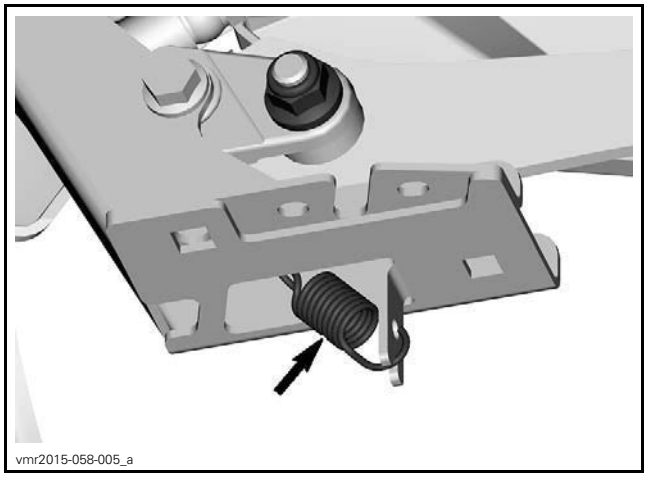
NOTE: Loosen brake pedal bolt before removing support from frame.

3. Remove master cylinder support from frame.

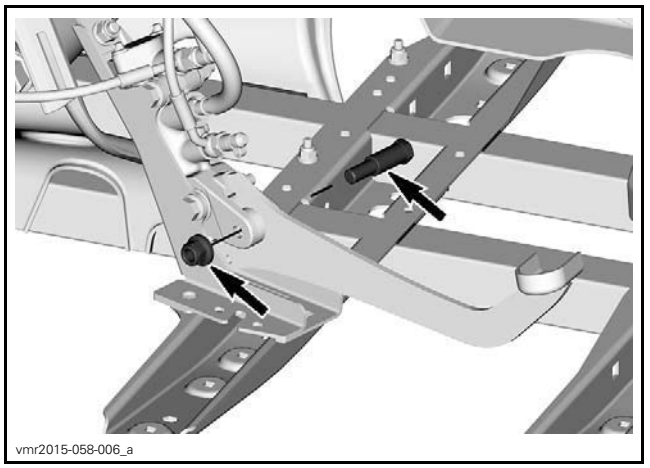


Step 1: Loosen brake pedal pivot
Step 2: Remove nuts

4. Remove brake pedal spring.



5. Remove brake pedal.



Brake Pedal Installation

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

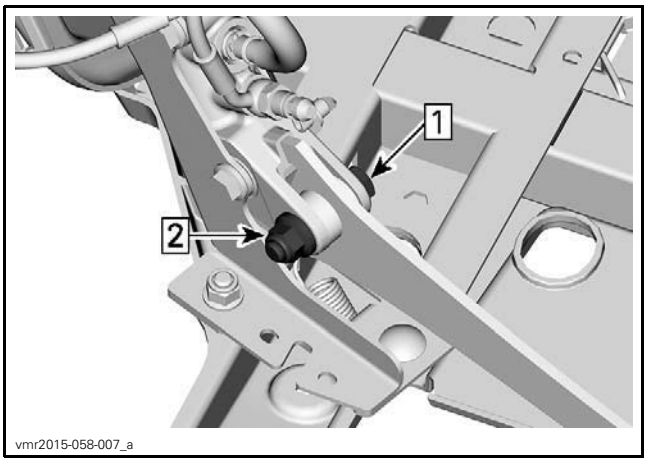
Install NEW brake pedal O-ring.

Lubricate brake pedal pivot.

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

Tighten brake pedal nut as per the following sequence.

TIGHTENING SEQUENCE		
STEP 1	Brake pedal bolt (pivot)	10 N•m ± 2 N•m (89 lbf•**in** ± 18 lbf•**in**)
STEP 2	Brake pedal nut	27.5 N•m ± 2.5 N•m (20 lbf•ft ± 2 lbf•ft)

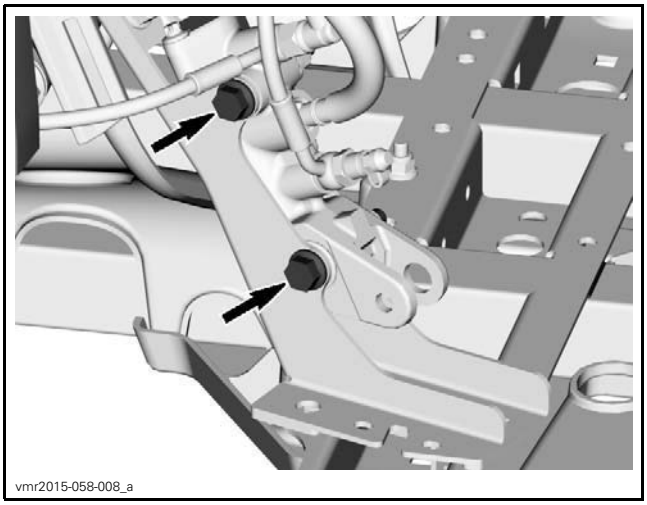


TIGHTENING SEQUENCE
Step 1: Tighten bolt
Step 2: Hold bolt then tighten nut

MASTER CYLINDER

Master Cylinder Removal

1. Remove *BRAKE PEDAL*. See procedure in this subsection.
2. Remove master cylinder from support.



3. Remove hoses and bleeder from master cylinder.

Master Cylinder Inspection

Check boot for crack.

Check rod for wear and scratch.

Check master cylinder housing for leak or damage.

Master Cylinder Installation

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

Tighten brake hoses and bleeder to specification.

TIGHTENING TORQUE	
Brake hose screw (banjo fitting)	28.5 N•m ± 1.5 N•m (21 lbf•ft ± 1 lbf•ft)
Bleeder	8.5 N•m ± 1.5 N•m (75 lbf•**in** ± 13 lbf•**in**)

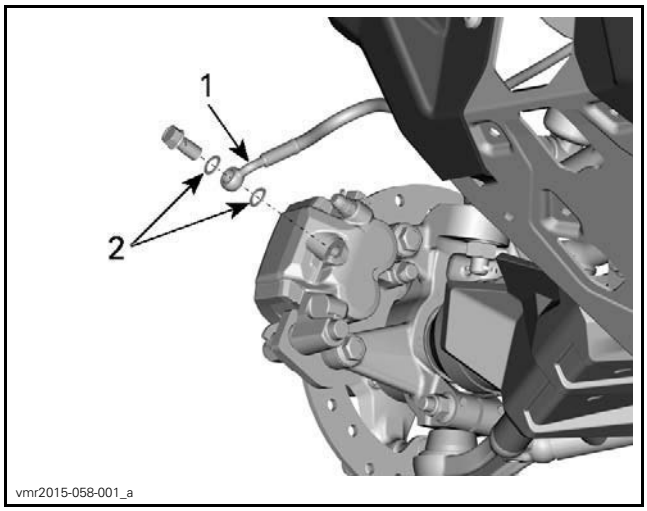
Install **NEW** sealing washers.

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

CALIPER

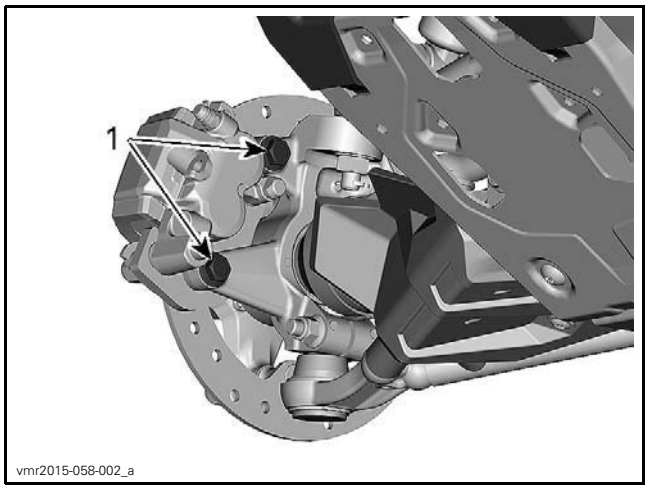
Caliper Removal

1. Safely lift and support the vehicle.
2. Remove wheel, refer to *WHEELS AND TIRES* subsection.
3. If caliper is removed from vehicle for replacement:
   3.1 Drain brake system, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
   3.2 Unscrew brake hose from caliper.



1. Brake hose
2. Sealing washers

4. Remove fasteners retaining brake hose.
5. Remove screws securing caliper support.



1. Caliper screws

6. Place caliper assembly onto a support.

NOTICE Do not let caliper hangs by the hose and do not stretch or twist hose.

Caliper Installation

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

If caliper was removed for replacement:

– Refill and bleed brake system, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
– Install NEW sealing washers.

Install NEW caliper retaining screws.

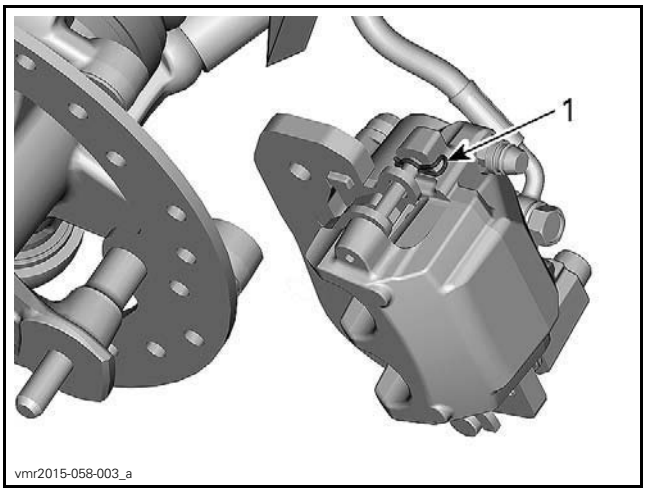
Tighten caliper retaining screws to specification.

TIGHTENING TORQUE	
Caliper retaining screws	61 N•m ± 9 N•m (45 lbf•ft ± 7 lbf•ft)

BRAKE PADS

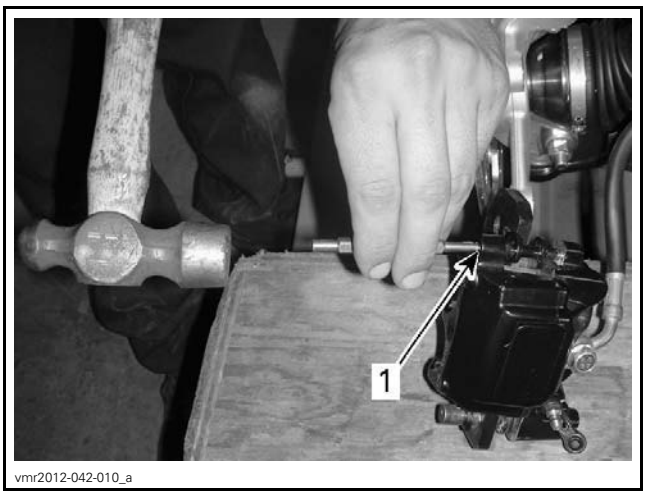
Brake Pads Replacement

1. Remove caliper, refer to *CALIPER REMOVAL* in this subsection.
2. Remove pin retainer securing brake pad pin.



1. Pin retainer

3. Remove brake pad pin from caliper.

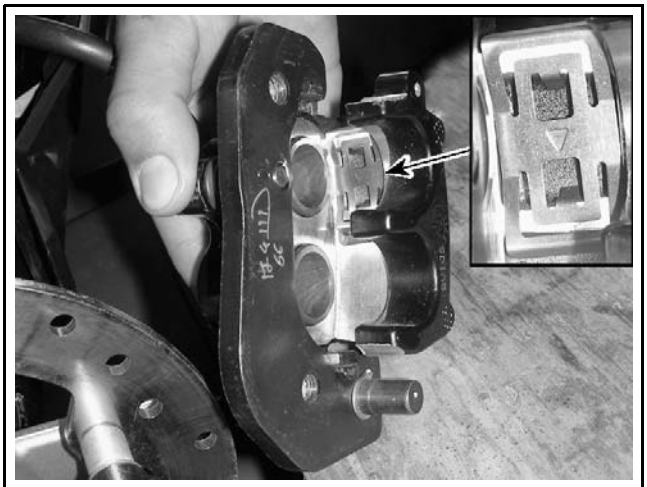


1. Brake pad pin

4. Carefully remove brake pads.
5. Clean pistons end using XPS BRAKES AND PARTS CLEANER (P/N 219 701 776) or XPS BRAKES AND PARTS CLEANER (USA) (P/N 219 701 705).
6. Push caliper pistons inward.

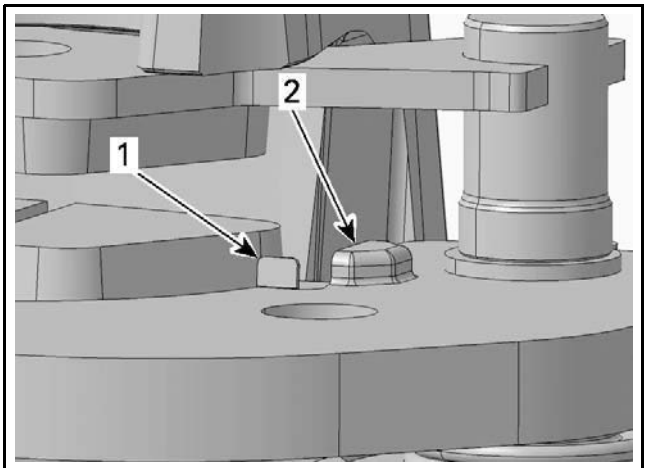
NOTE: To avoid damaging pistons, use an old pad to push it into the caliper using a C-clamp.

7. Ensure brake pad spring is properly positioned onto caliper and not damaged.


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BRAKE PAD SPRING

8. Ensure pad stopper is properly aligned with caliper support protrusion.

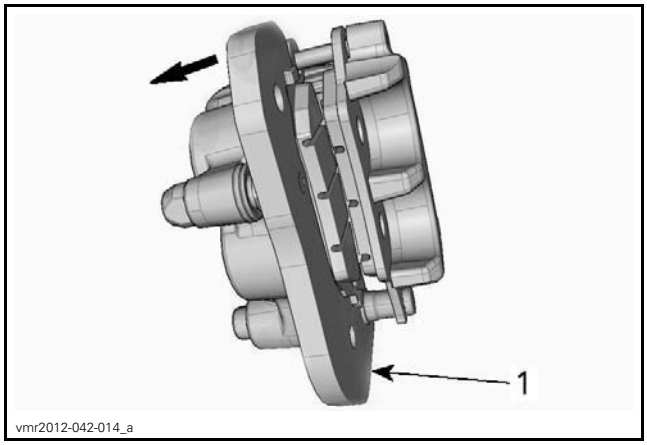


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1. Pad stopper
2. Caliper support protrusion

NOTICE Prior to installing brake pads, pad stopper must be properly positioned and not damaged.

9. Install NEW brake pads.
10. Clean and install brake pad pin on caliper.
11. Install pin retainer to secure brake pad pin.
12. Slide caliper support completely into caliper.



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1. Caliper support

13. Install caliper, refer to *CALIPER INSTALLATION* in this subsection.

BRAKE DISC

Brake Disc Inspection

1. Check disc surfaces for scratches or grooves on both sides.
2. Measure thickness of the disc.

DISC MINIMUM THICKNESS	
FRONT	4.0 mm (.157 in)
REAR	4.0 mm (.157 in)

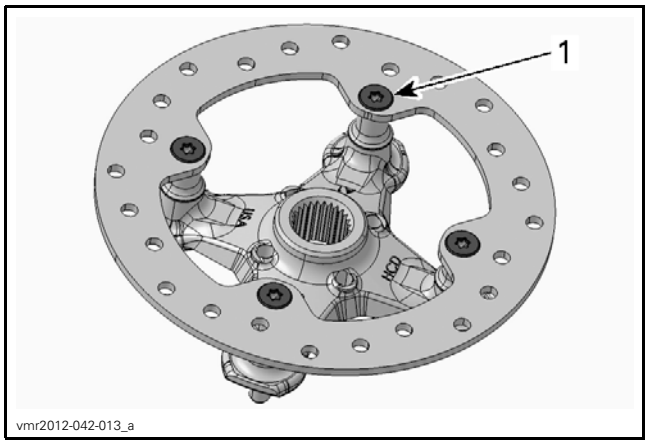
NOTICE Brake discs must never be machined.

3. Check warpage of the disc.

MAXIMUM DISC WARPAGE	
FRONT	0.2 mm (.01 in)
REAR	

Brake Disc Replacement

1. Remove caliper, refer to *CALIPER REMOVAL* in this subsection.
2. Remove wheel hub, refer to *FRONT DRIVE* or *REAR DRIVE* subsection.
3. Remove screws securing brake disc to wheel hub.



1. Brake disc screw

4. Replace brake disc.
5. Install **NEW** brake disc screws.
6. Tighten brake disc screws to specification.

TIGHTENING TORQUE	
Brake disc screws	33.5 N•m ± 3.5 N•m (25 lbf•ft ± 3 lbf•ft)

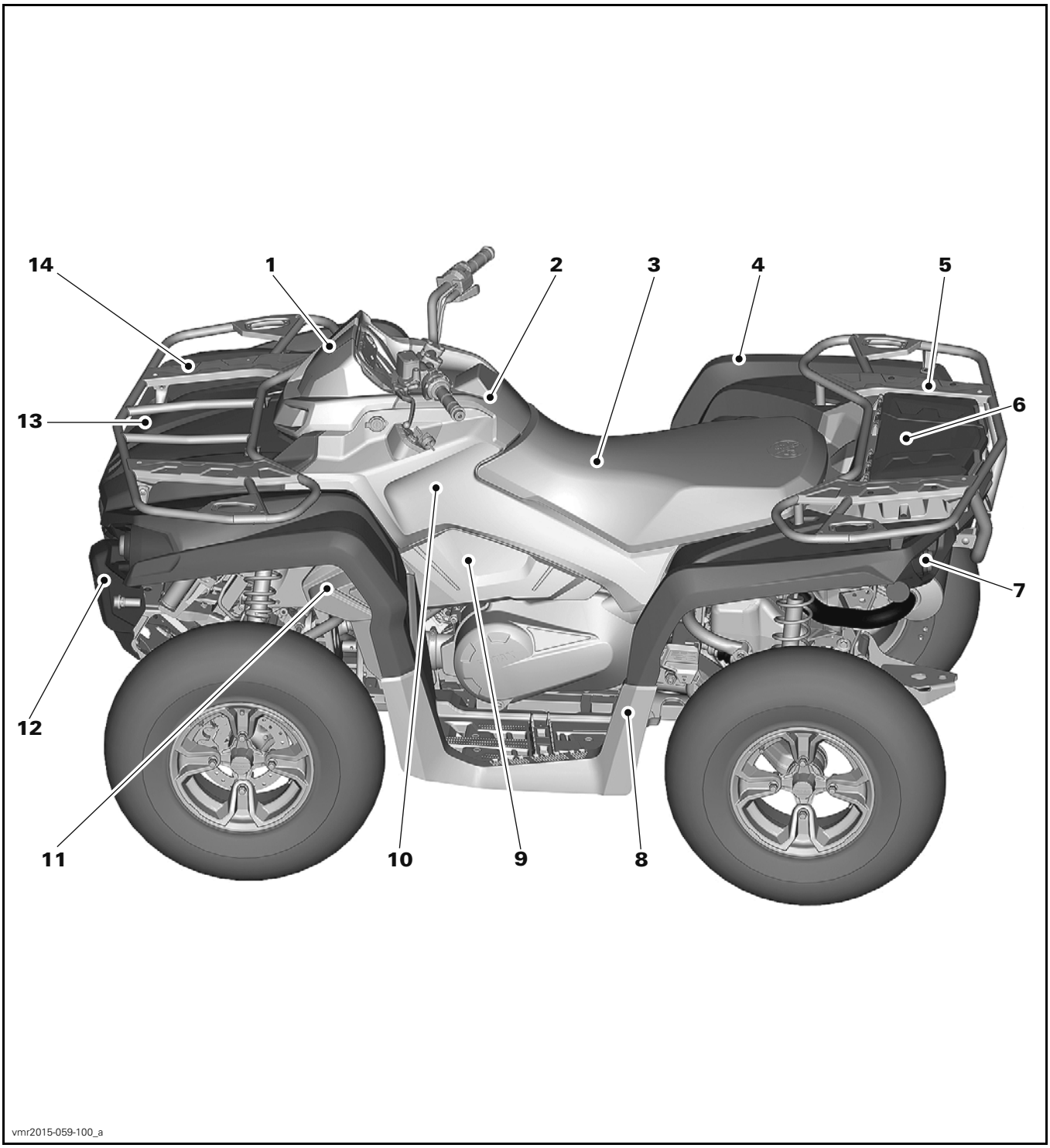
7. Install wheel hub then caliper.
8. Install **NEW** cotter pin to secure wheel hub nut.

BODY (450)

SERVICE TOOLS

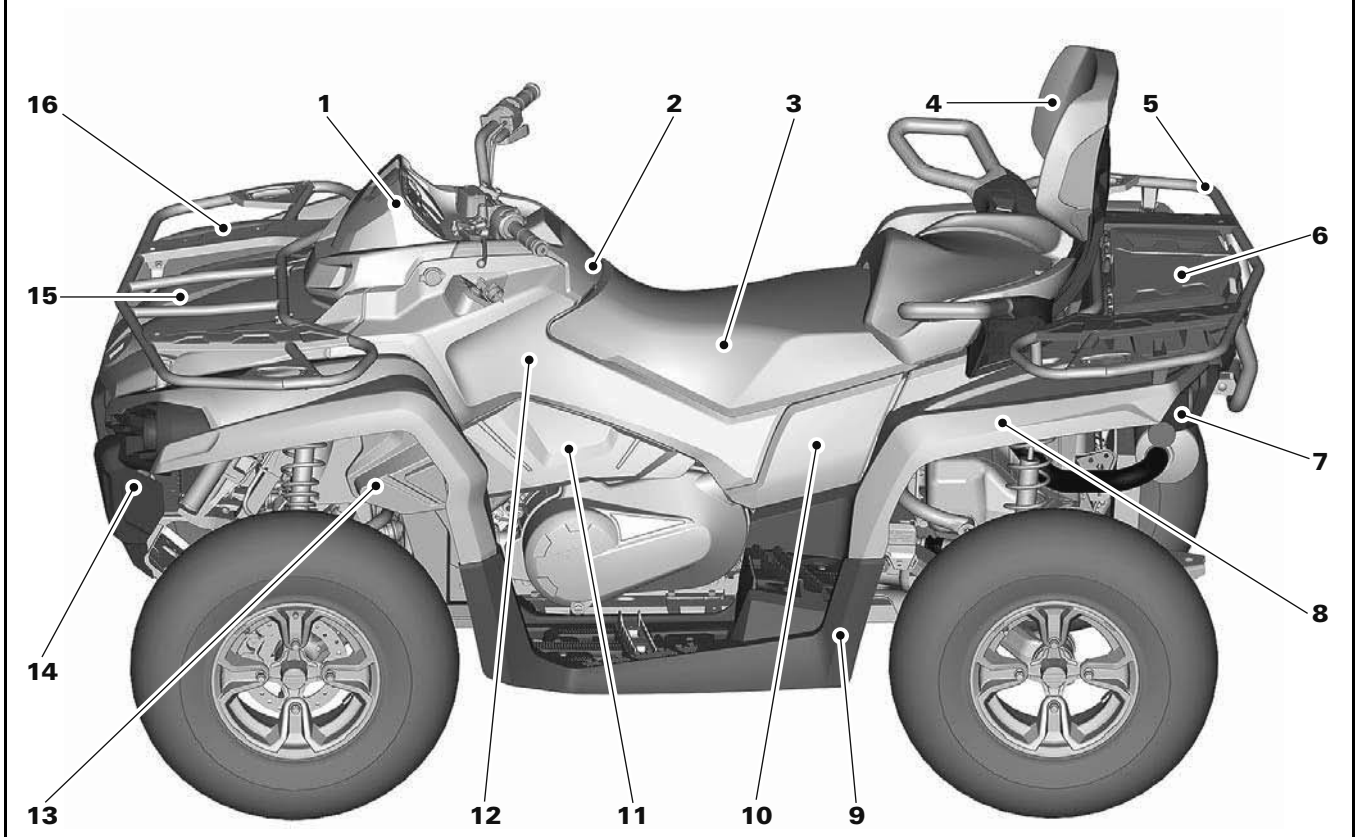
Description	Part Number	Page
OETIKER PLIERS	295 000 070	709

BODY PARTS NOMENCLATURE (SHORT MODEL)



1. *Gauge support*
2. *Console*
3. *Seat*
4. *Rear fender*
5. *Rear rack*
6. *Rear storage compartment*
7. *Rear fascia*
8. *Footrest panel*
9. *Side panel extension*
10. *Side panel*
11. *Inner fender panel*
12. *Front fascia*
13. *Front fender*
14. *Front rack*

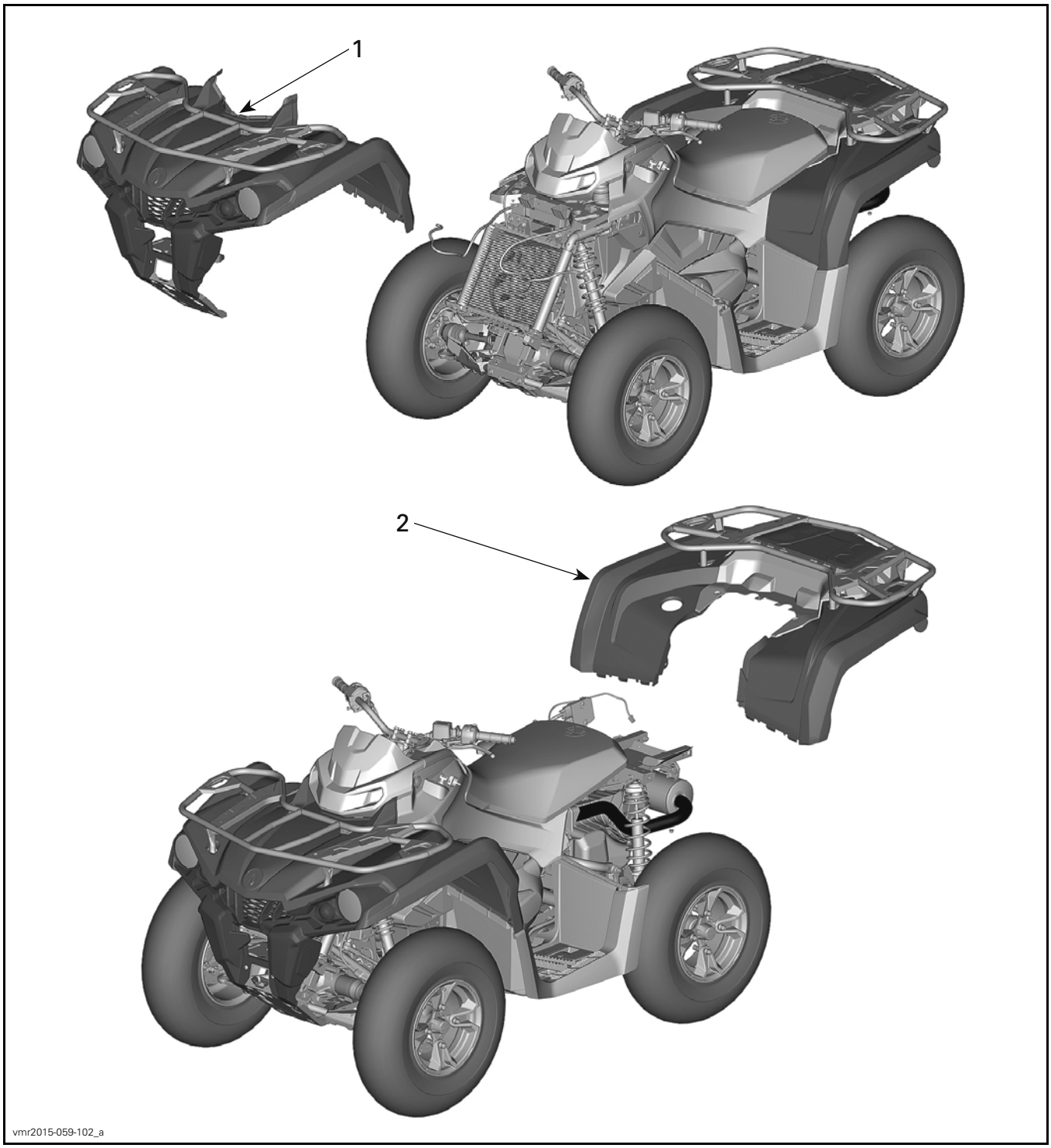
BODY PARTS NOMENCLATURE (MAX MODEL)



vmr2015-059-101_a

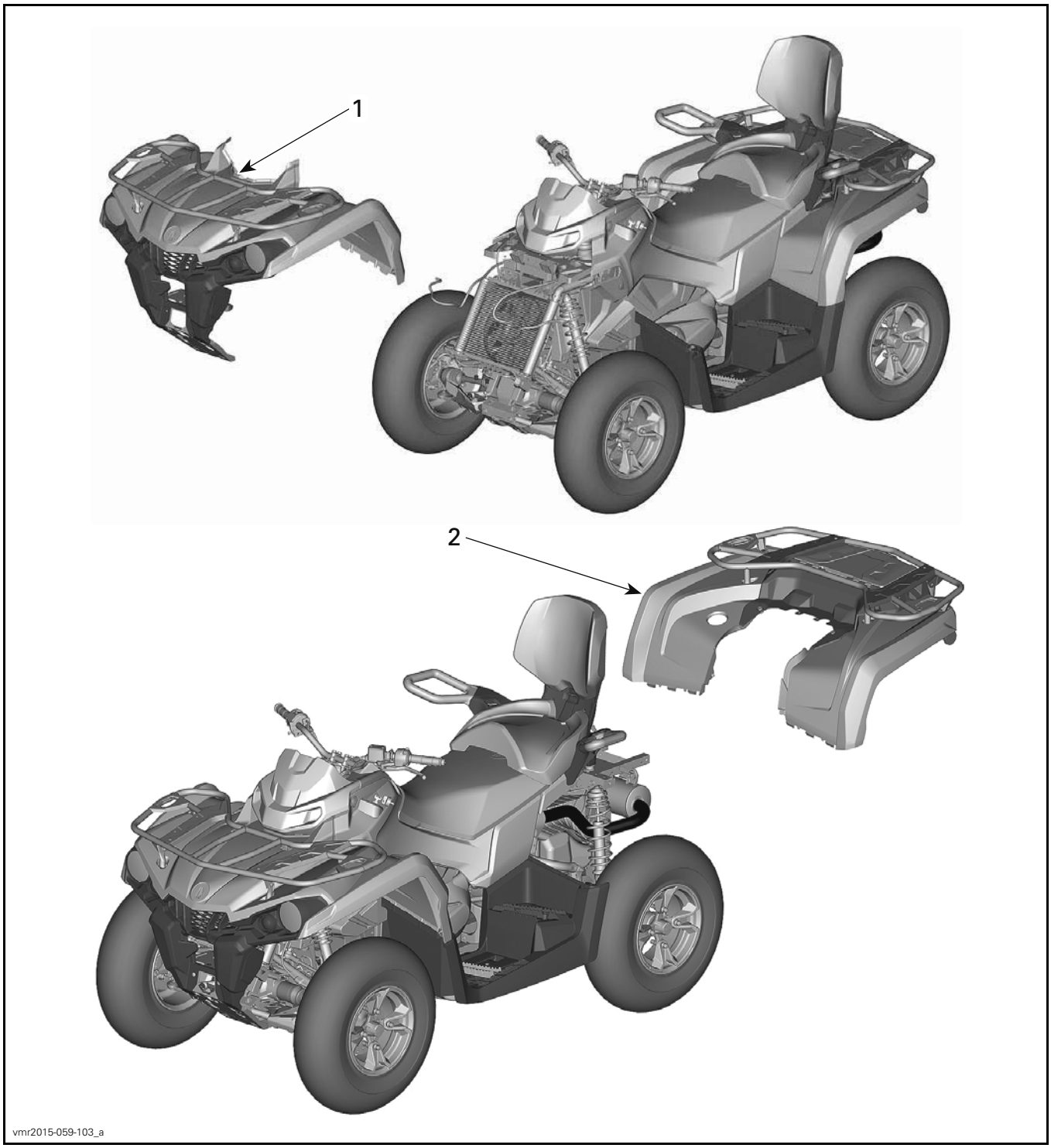
1. *Gauge support*
2. *Console*
3. *Seat*
4. *Passenger seat*
5. *Rear rack*
6. *Rear storage compartment*
7. *Rear fascia*
8. *Rear Fender*
9. *Footrest panel*
10. *Rear side panel extension*
11. *Side panel extension*
12. *Side panel*
13. *Inner fender panels*
14. *Front fascia*
15. *Front fender*
16. *Front rack*

FRONT AND REAR BODY MODULES (SHORT MODEL)



1. *Front body module*
2. *Rear body module*

FRONT AND REAR BODY MODULES (MAX MODEL)



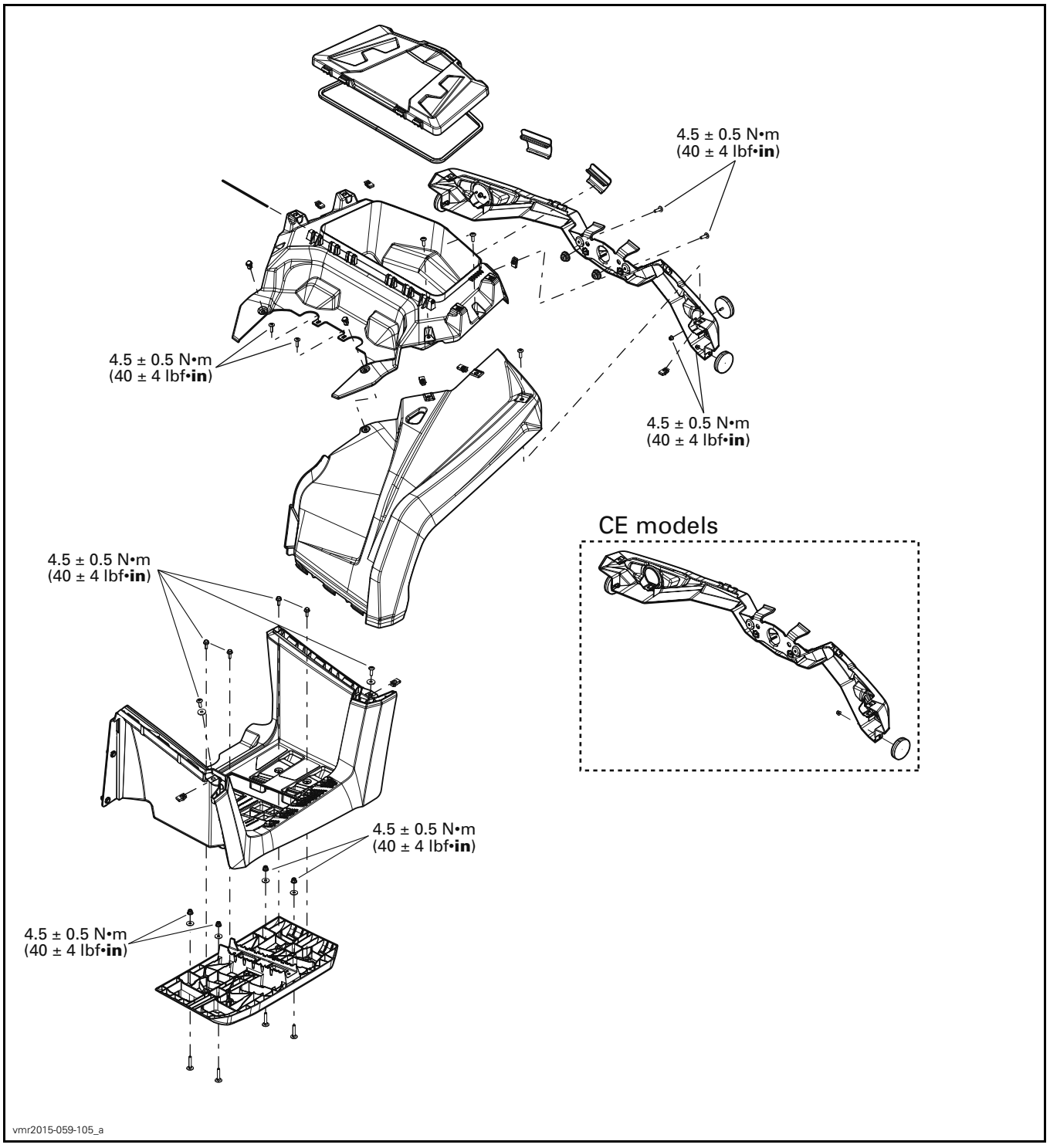
1. *Front body module*
2. *Rear body module*

BODY PARTS (SHORT MODEL)

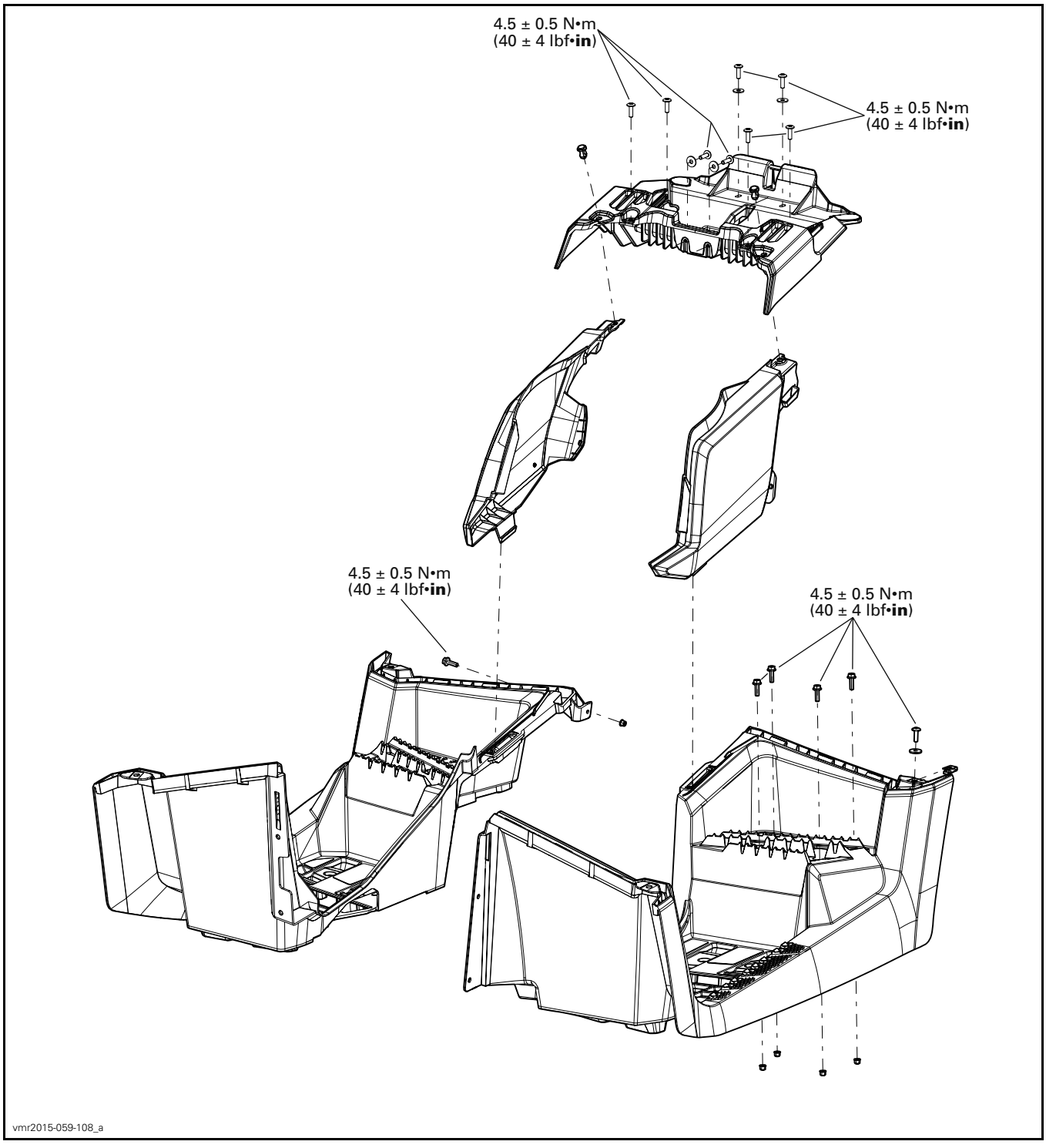
Please note that unless indicated, the procedure is the same for both sides.



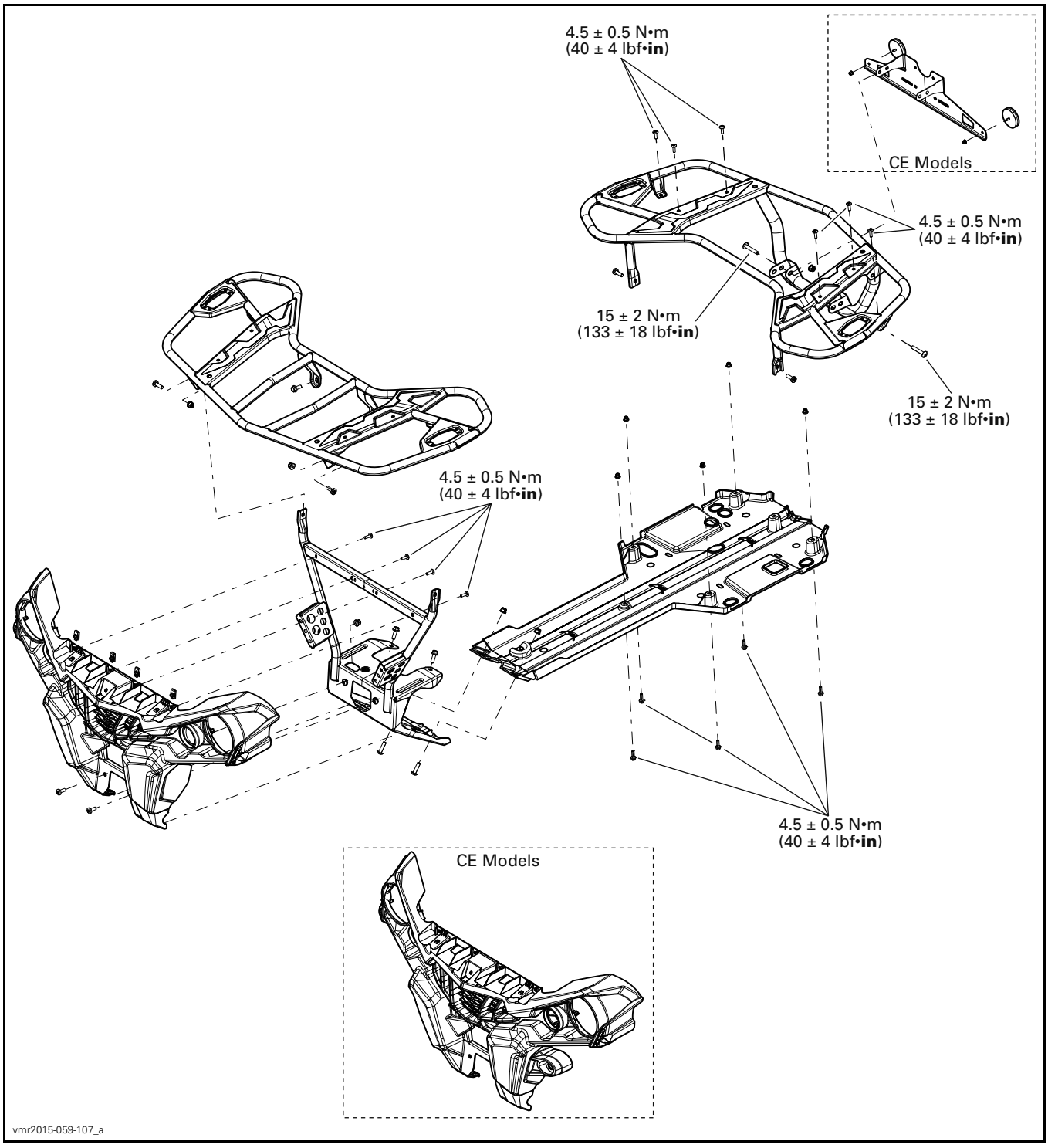
BODY PARTS (SHORT MODEL)



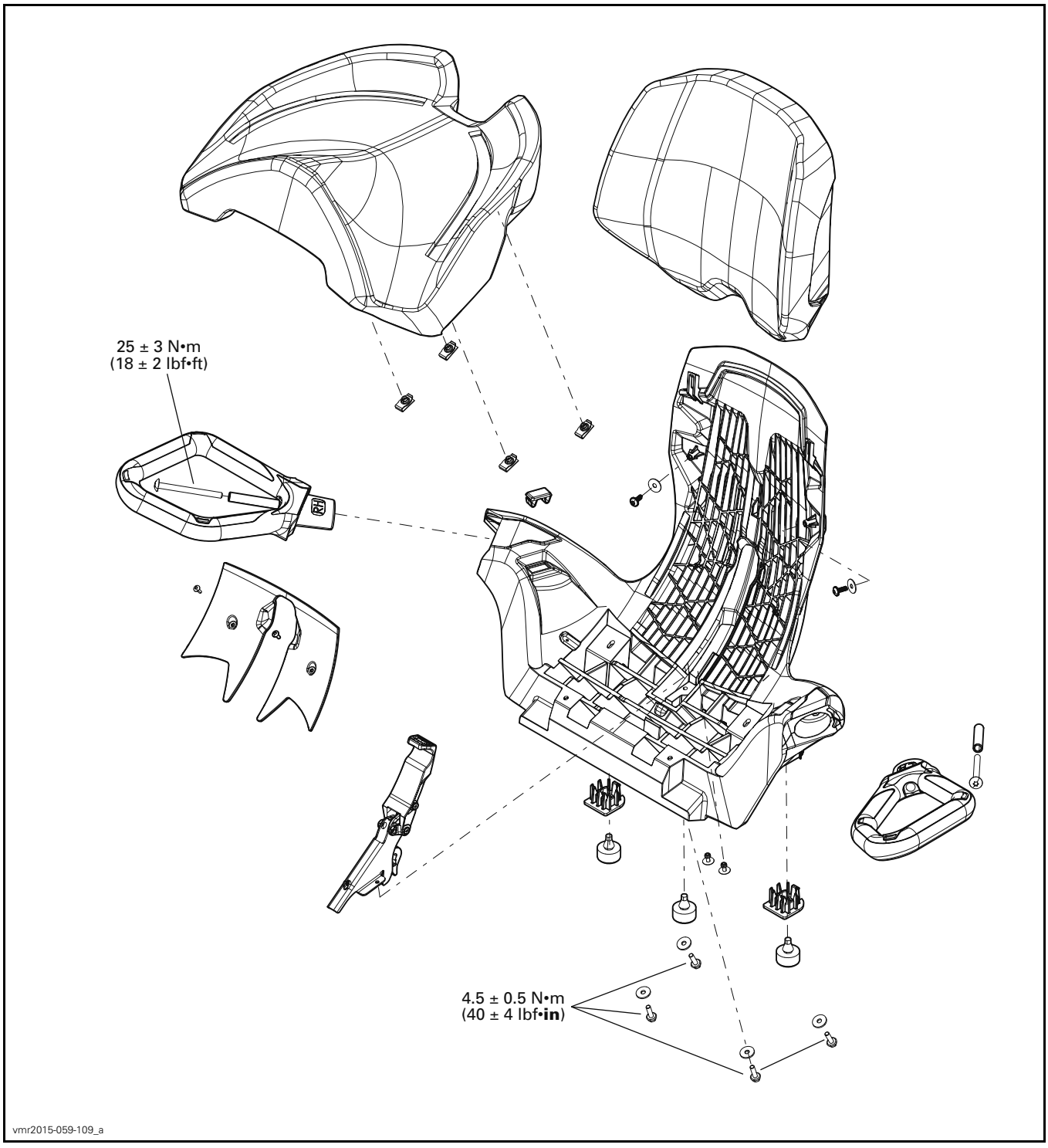
BODY PARTS (MAX MODEL)



RACKS AND BODY PARTS



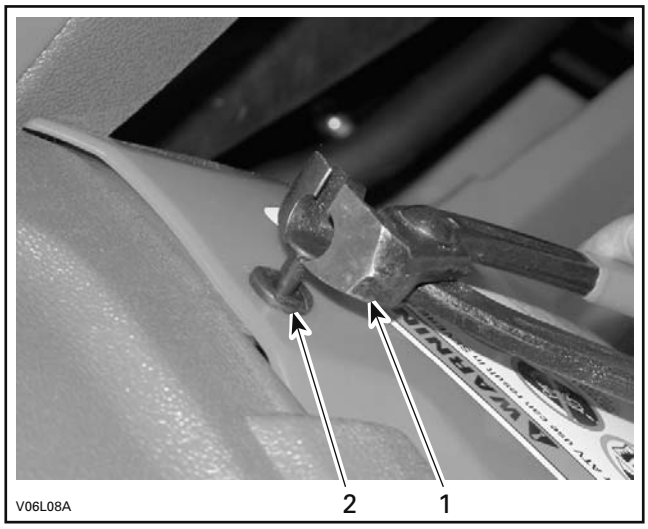
PASSENGER SEAT



PROCEDURES

PLASTIC RIVET

Plastic rivets are used in the riveting of the various body parts. Plastic rivets can be reused many times. Use the OETIKER PLIERS (P/N 295 000 070) to remove them.



TYPICAL
1. Pliers
2. Plastic rivet

DECALS

Decal Removal

Using a heat gun warm up one end of decal for a few seconds until decal can roll off when rubbing with your finger.

Pull decal slowly and when necessary apply more heat to ease removal on the area that has to be peeled off.

If decal tears while pulling off, it has to be heated for a few seconds longer. If decal tends to stretch while pulling off, stop heating and wait a few seconds to let it cool, then peel it off.

Decal Installation

Using isopropyl alcohol, clean the surface and dry thoroughly.

Apply liquid soap to new decal and carefully position it. Using a sponge or a squeegee, remove the air bubbles and surplus water working from the center toward the edges. Allow to air dry.

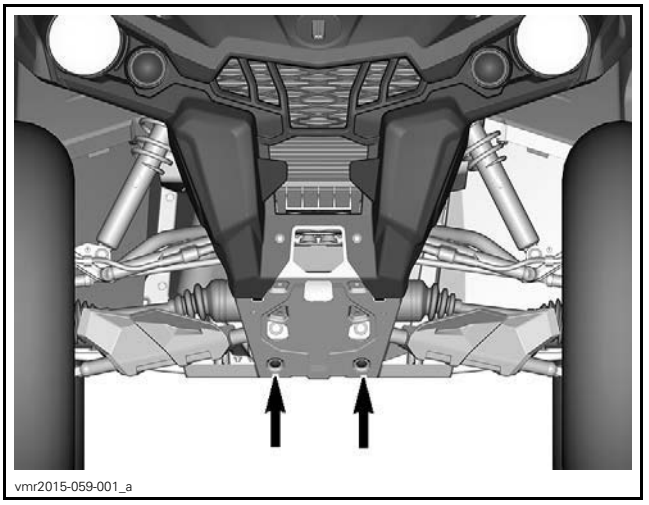
NOTICE **Do not apply isopropyl alcohol or solvent directly on decals. Use these products in a well ventilated area.**

FRONT BODY MODULE

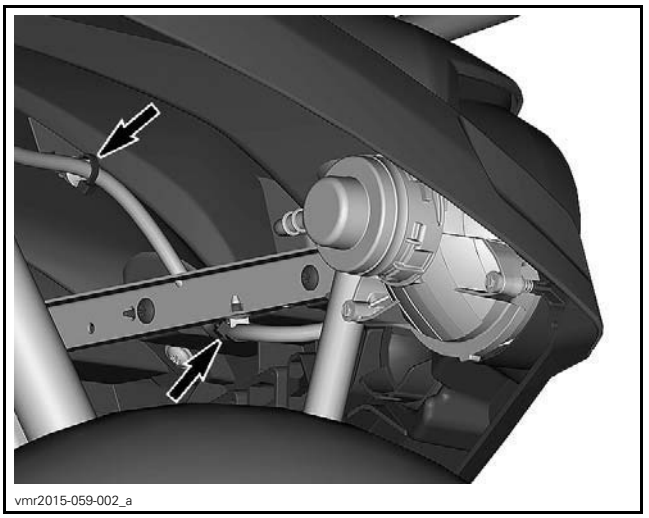
Front Body Module Removal

NOTE: Unless indicated, RH side shown on illustrations.

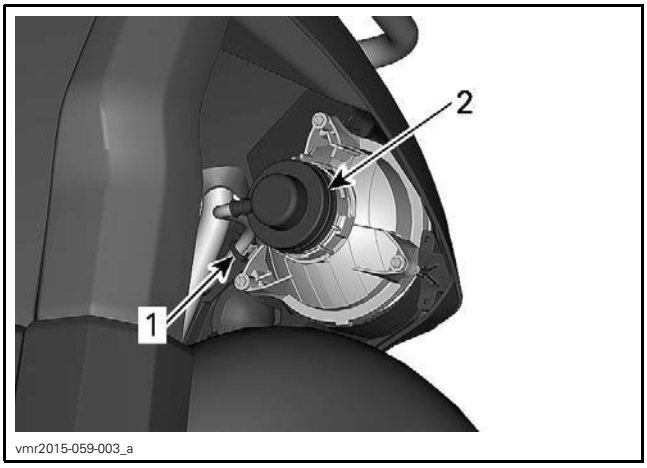
1. Disconnect battery negative (-) cable.
2. Remove the following panels, see procedure in this subsection:
   – *SIDE PANELS*
   – *INNER FENDER PANELS*.
3. Remove front skid plate retaining screws.



4. Remove locking ties securing headlights harness to subframe.



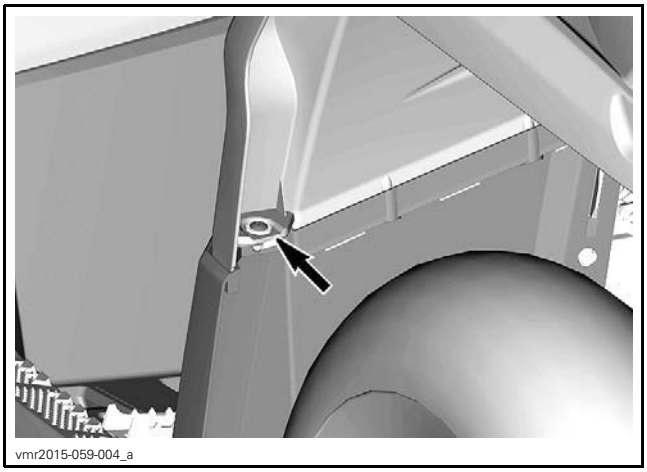
5. Disconnect headlights connectors.



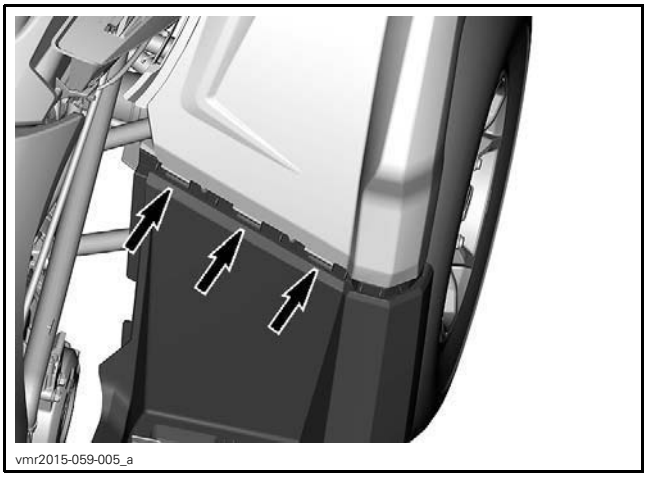
vmr2015-059-003_a

1. Locking tie
2. Headlight connectors

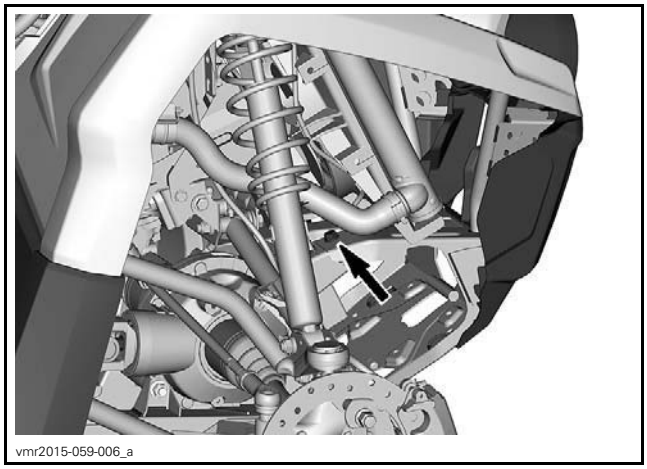
6. Remove screw securing front fender to footrest panel (on both sides).

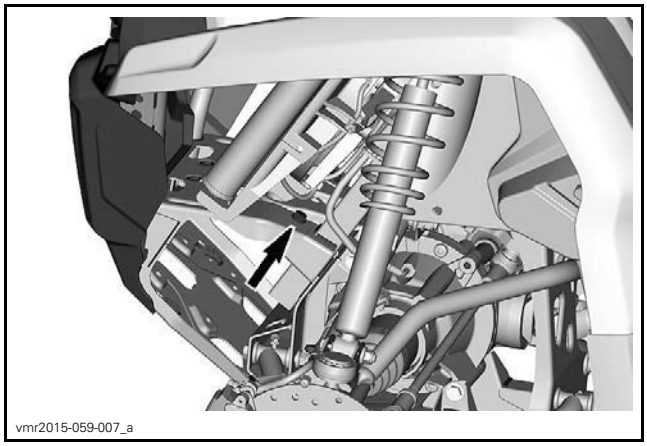

vmr2015-059-004_a

7. Detach front fender from footrest panel by releasing retaining tabs (on both sides).


vmr2015-059-005_a

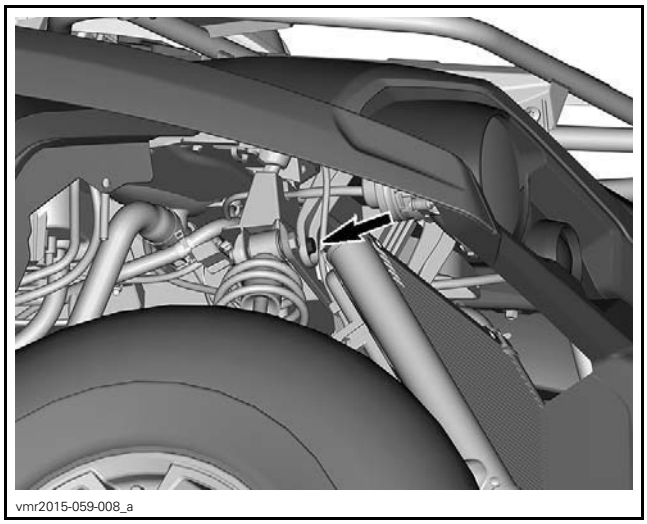
8. Remove screws securing front body module to frame.


vmr2015-059-006_a


vmr2015-059-007_a

LH SIDE

9. Remove screws securing front rack to frame.


vmr2015-059-008_a

10. With the assistance of a person, pull front body module forward.
11. Install front body module on a stable and clean support.

Front Body Module Installation

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

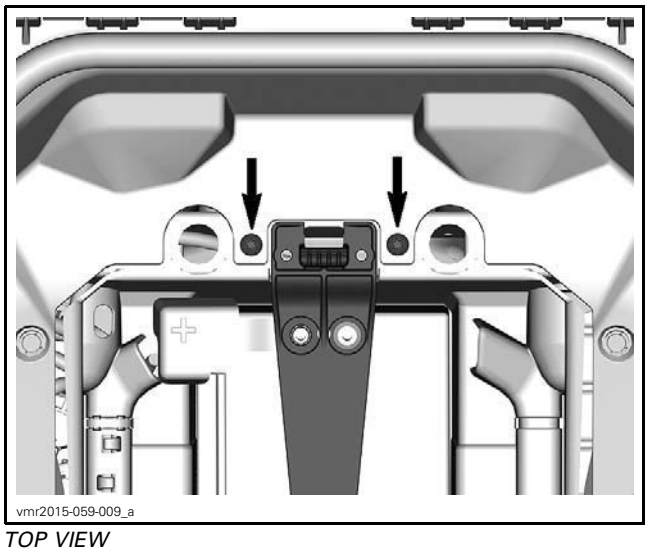
Tighten front fender screws to specification.

TIGHTENING TORQUE	
Screws securing footrest panels to front fender	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)

REAR BODY MODULE

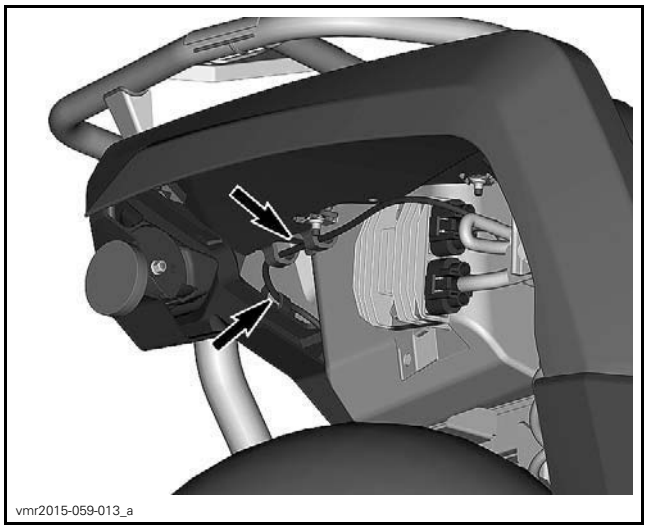
Rear Body Module Removal

1. Remove seat.
2. Remove the following panels, see procedure in this subsection:
   – *PASSENGER SEAT HOLDER **(MAX MODELS)***
   – *SIDE PANELS*.
3. On **Short Models**, remove rear storage compartment retaining screws.

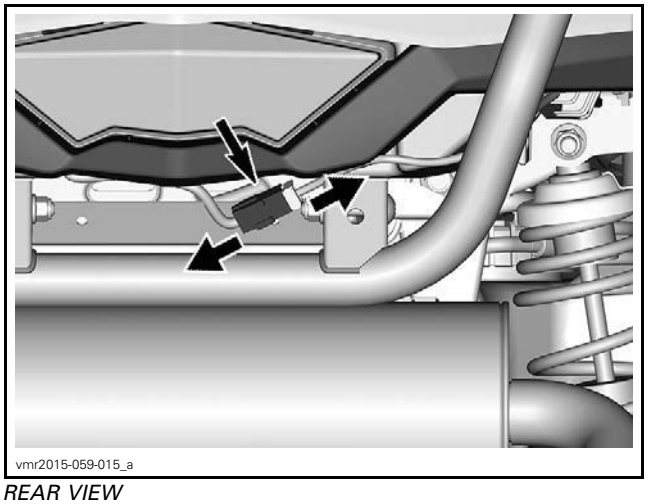


TOP VIEW

4. Release taillight harness from the rear fender tabs.

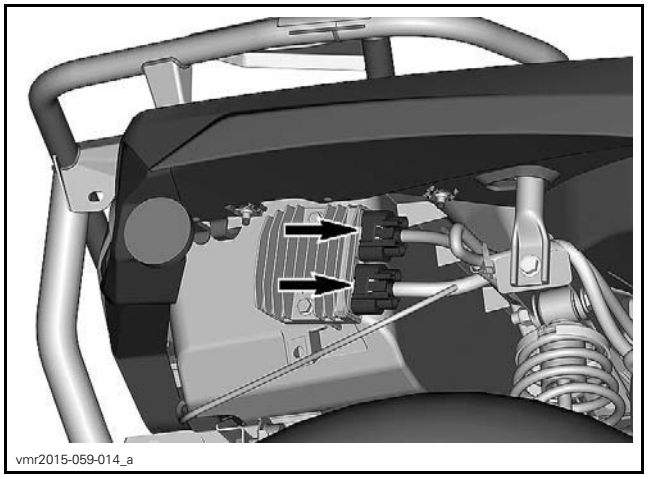


5. Disconnect taillight connector.

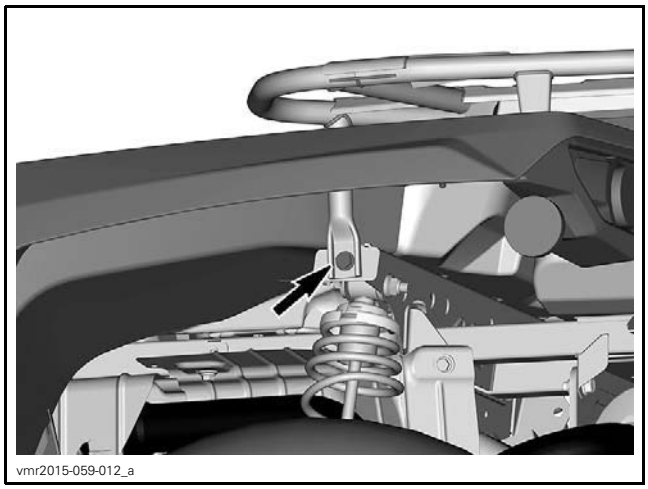


REAR VIEW

6. Disconnect connectors from voltage regulator rectifier.

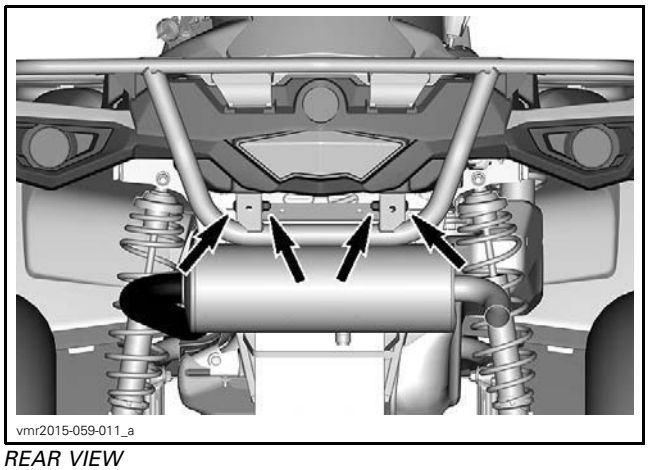


7. Remove rear rack upper retaining screws.


vmr2015-059-012_a

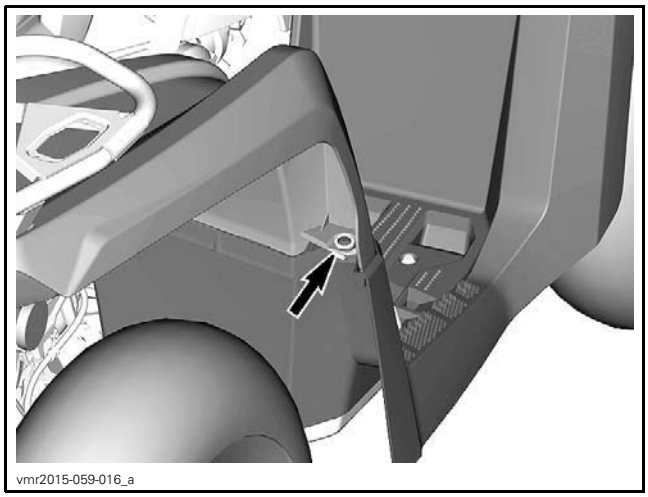
LH SIDE SHOWN

8. Remove rear rack lower retaining screws and nuts.


vmr2015-059-011_a

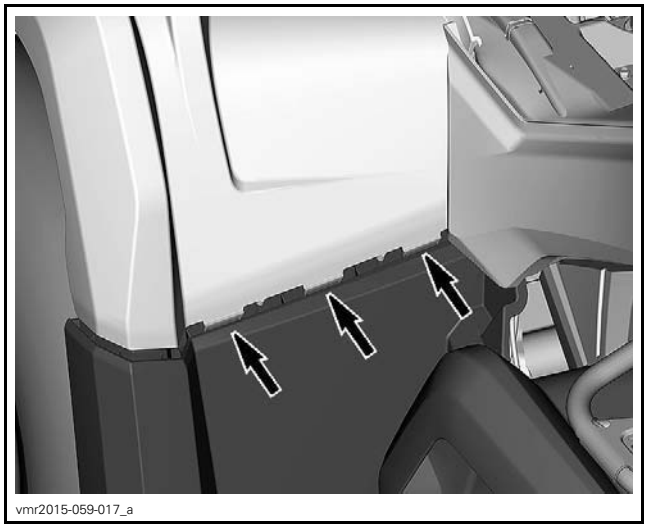
REAR VIEW

9. Remove screw securing rear fender to footrest panel (on both sides).


vmr2015-059-016_a

SHORT MODEL SHOWN

10. Detach rear fender from footrest panel by releasing retaining tabs (on both sides).


vmr2015-059-017_a

SHORT MODEL SHOWN

11. Remove fuel tank cap.
12. Place a **clean** rag into fuel tank filler tube.
13. With the assistance of a person, pull rear body module rearward.
14. Install rear body module on a stable and clean support.
15. Remove rag and reinstall fuel tank cap.

⚠ WARNING

Fuel vapors are flammable and explosive under certain conditions. Unless otherwise noted, the fuel tank cap must always be installed on vehicle.

Rear Body Module Installation

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

Tighten rear body module retaining screws to specification.

TIGHTENING TORQUE	
Rear rack **lower** screws	15 N•m ± 2 N•m (133 lbf•**in** ± 18 lbf•**in**)

Tighten rear fender screws to specification.

TIGHTENING TORQUE	
Screws securing footrest panels to rear fenders	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)

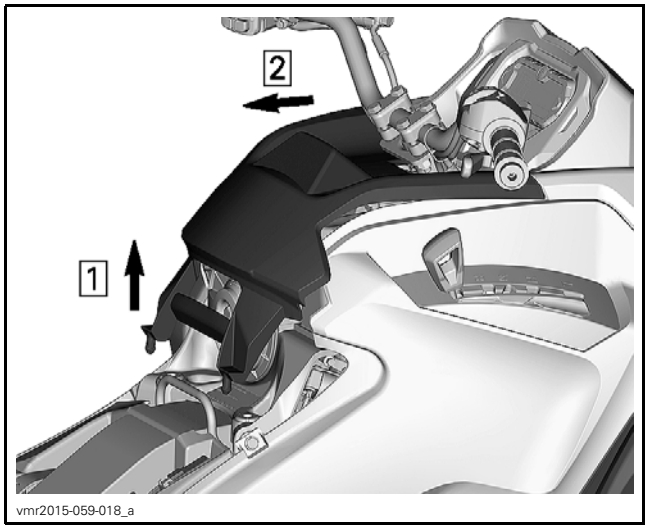
Tighten rear storage compartment to specification.

TIGHTENING TORQUE	
Rear storage compartment screws	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)

CONSOLE

Console Removal

1. Remove seat.
2. Lift rear portion of console upwards.
3. Pull console rearwards.

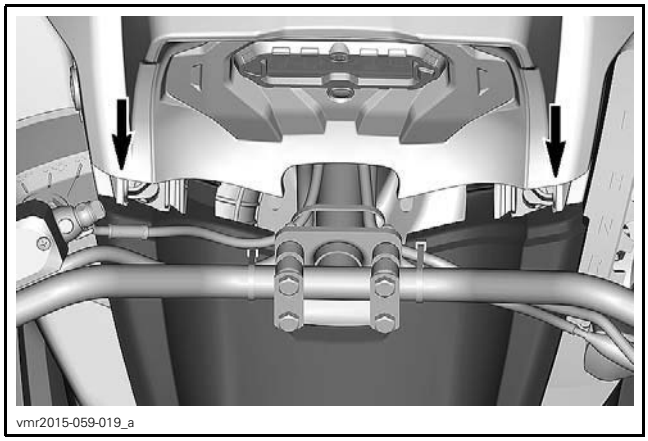


vmr2015-059-018_a

Console Installation

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

Align console front tabs with slots, then push console forward.


vmr2015-059-019_a

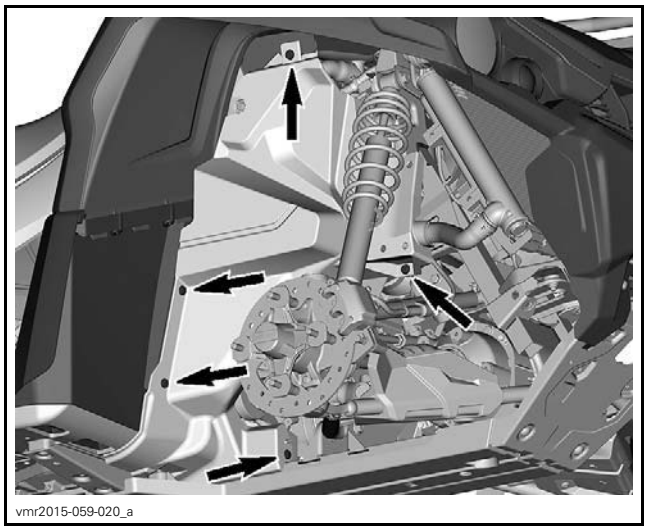
GAUGE SUPPORT

Refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.

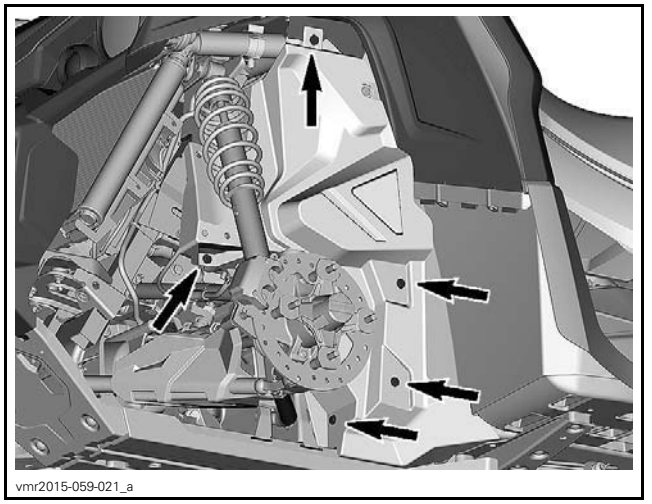
INNER FENDER PANELS

Inner Fender Removal and Installation

Remove plastic rivets from inner fender panels.


vmr2015-059-020_a

WHEEL REMOVED FOR CLARITY


vmr2015-059-021_a

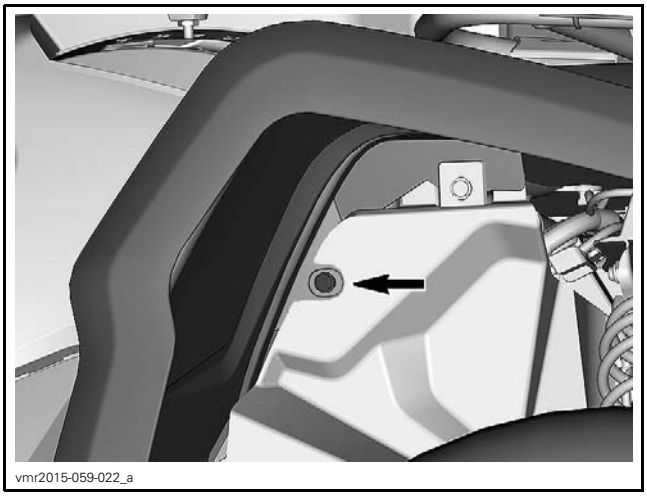
LH SIDE SHOWN, WHEEL REMOVED FOR CLARITY

The installation is the reverse of the removal procedure.

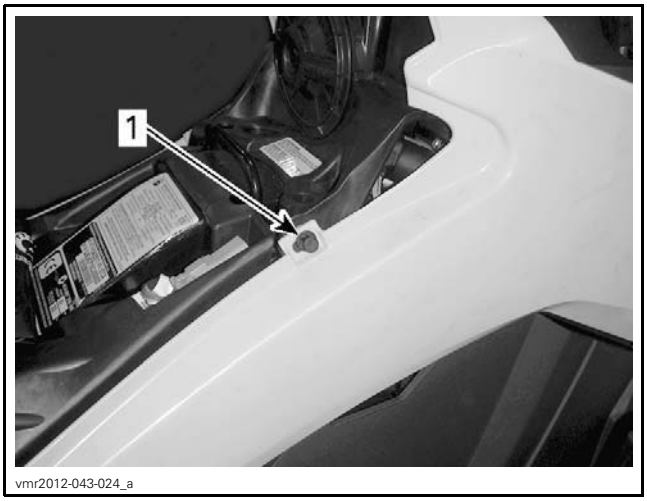
SIDE PANELS

Side Panel Removal

1. Remove following panels, see procedures in this subsection:
   – *CONSOLE*
   – *PASSENGER SEAT HOLDER* (MAX models).
2. Remove *GAUGE SUPPORT*. Refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.
3. Remove plastic rivet securing side panel to inner fender panel.


vmr2015-059-022_a

4. Remove plastic rivet securing side panel to air filter housing.

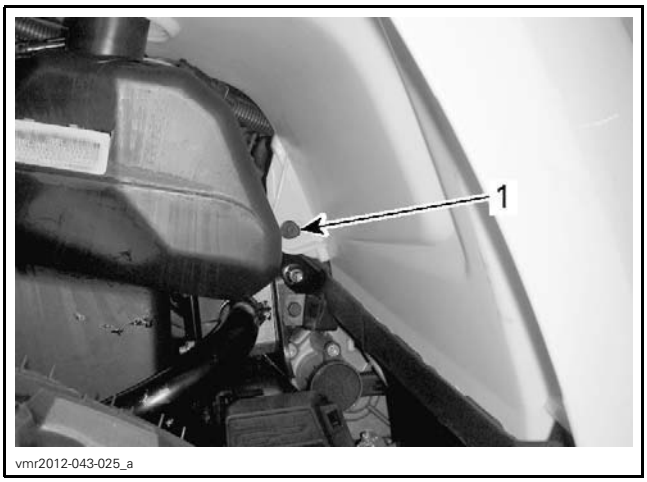


vmr2012-043-024_a

1. Plastic rivet securing side panel

Short Models

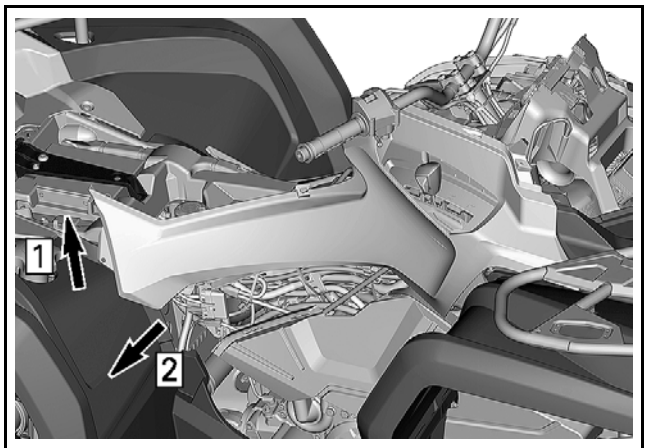
5. Remove plastic rivet securing side panel to rear fender.



vmr2012-043-025_a

1. Plastic rivet securing side panel

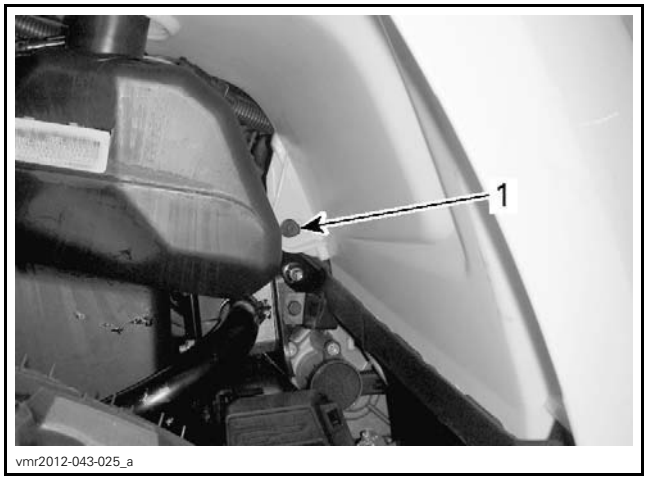
6. Lift rear portion of side panel assembly then pull it towards outside.



vmr2015-059-023_a

MAX Models

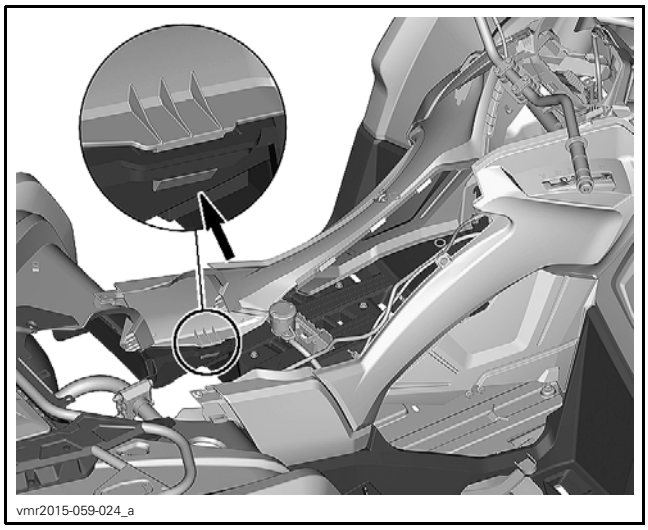
7. Remove plastic rivet securing rear side panel extension to rear fender.



vmr2012-043-025_a

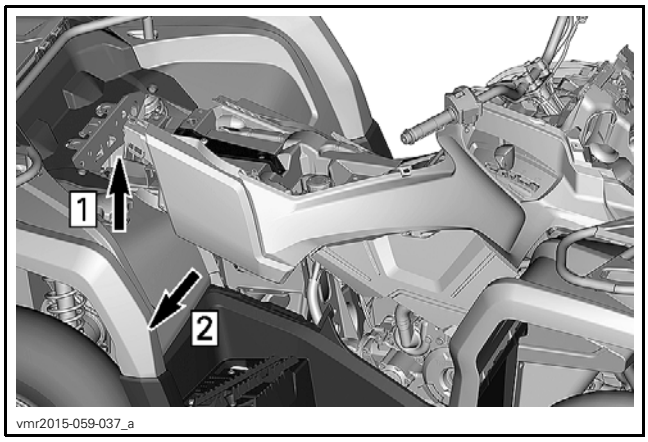
1. Plastic rivet securing side panel

8. Remove passenger seat holder. See procedure in this subsection.
9. Detach rear side panel extension from footrest panel by releasing retaining tab.



FRAME AND ENGINE REMOVED FOR CLARITY

10. Lift rear portion of side panel assembly then pull it towards outside.



Side Panel Installation

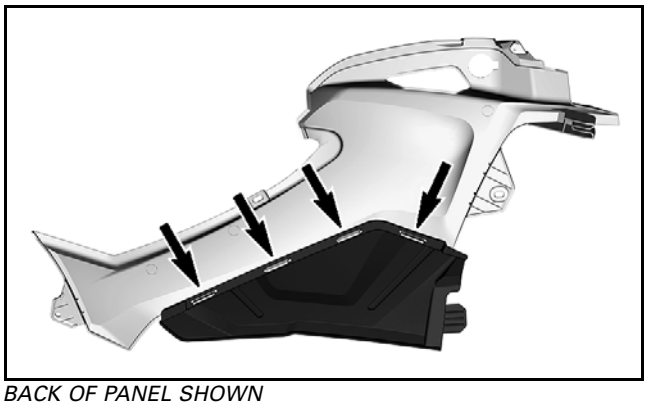
The installation is the reverse of the removal procedure. However, pay attention to the following.

Align side panel front tab with slot, then push side panel forward.

PANEL EXTENSIONS

Panel Extension Removal

1. Remove seat.
2. Remove *GAUGE SUPPORT*. Refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.
3. Remove following panels, see procedures in this subsection:
   - *CONSOLE*
   - *PASSENGER SEAT HOLDER* (MAX models)
   - *SIDE PANEL*.
4. Undo tabs securing panel extension to side panel.



BACK OF PANEL SHOWN

5. Remove panel extension.

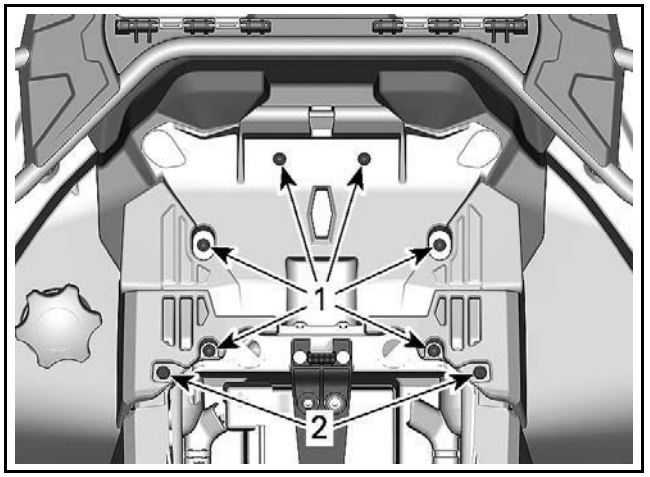
Panel Extension Installation

Installation is the reverse of removal.

PASSENGER SEAT HOLDER (MAX MODELS)

Passenger Seat Holder Removal

1. Remove driver and passenger seats.
2. Remove retaining screws securing passenger seat holder and rear storage compartment to frame.
3. Remove plastic rivets securing passenger seat holder to rear side panel extensions.



1. *Screws*
2. *Plastic rivets*

Passenger Seat Holder Installation

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

Tighten passenger seat holder retaining screws to specification.

TIGHTENING TORQUE	
Passenger seat holder retaining screws	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)

REAR SIDE PANEL EXTENSIONS (MAX MODEL)

Rear Side Panel Extension Removal

1. Remove driver and passenger seats.
2. Remove the following panels, see procedures in this subsection:
   – *PASSENGER SEAT HOLDER*
   – *SIDE PANEL*.
3. Unclip retaining tab securing rear side panel extension to side panel.

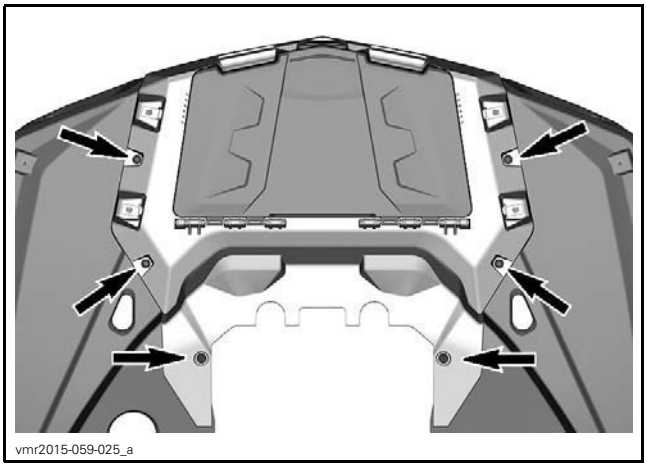
Rear Side Panel Extension Installation

Installation is the reverse of removal.

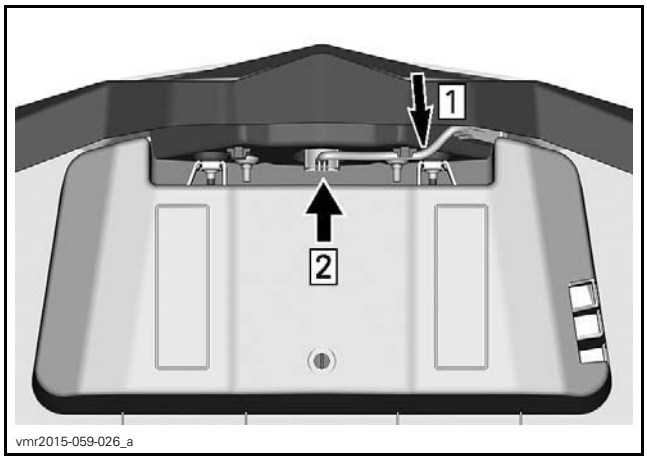
REAR STORAGE COMPARTMENT

Rear Storage Compartment Removal

1. Remove seat.
2. Remove rear body module. Refer to *REAR BODY MODULE*.
3. Remove rear rack. Refer to *REAR RACK REMOVAL*.
4. Remove retaining screws and plastic rivets securing rear storage compartment to rear fenders.

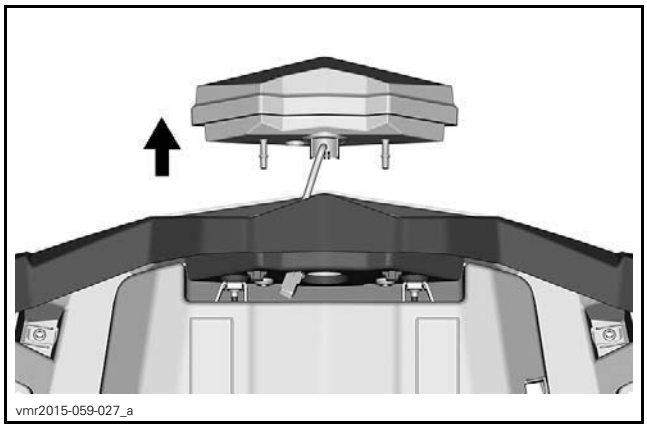

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5. Remove taillight from rear fascia.

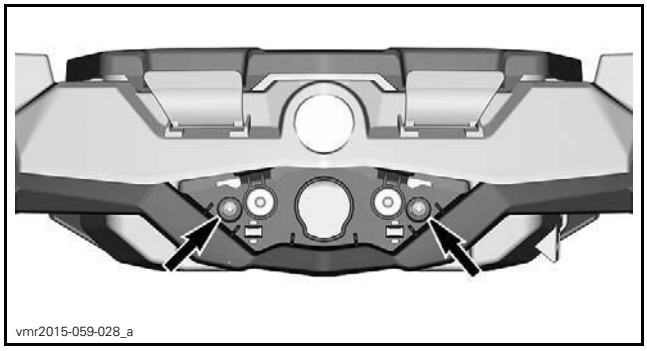


vmr2015-059-026_a

BOTTOM UP VIEW OF THE STORAGE COMPARTMENT
Step 1: Gently pull on taillight harness from rear fascia clip
Step 2: Push on the taillight from behind the fascia towards the rear


vmr2015-059-027_a

6. Remove retaining screws securing rear fascia to rear storage compartment.


vmr2015-059-028_a

Rear Storage Compartment Installation

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

Tighten rear storage compartment retaining screws to specification.

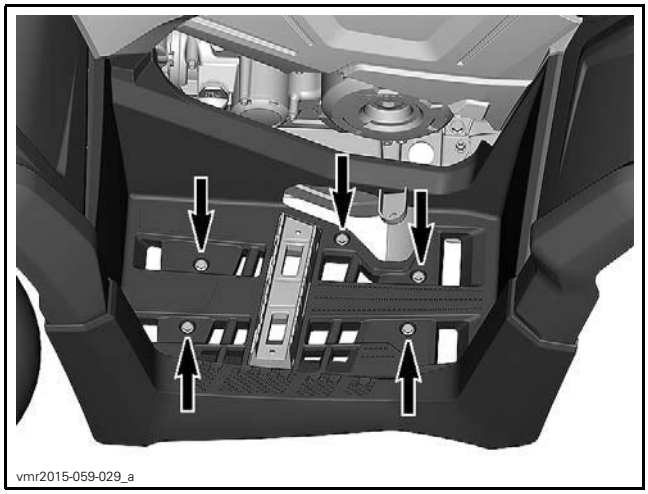
TIGHTENING TORQUE	
Rear storage compartment retaining screws	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)

FOOTREST PANELS

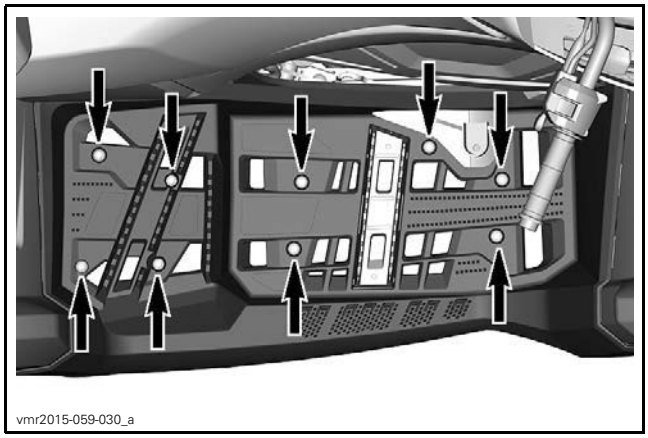
Footrest Panel Removal

Short Models

1. Remove footrest panel retaining screws.

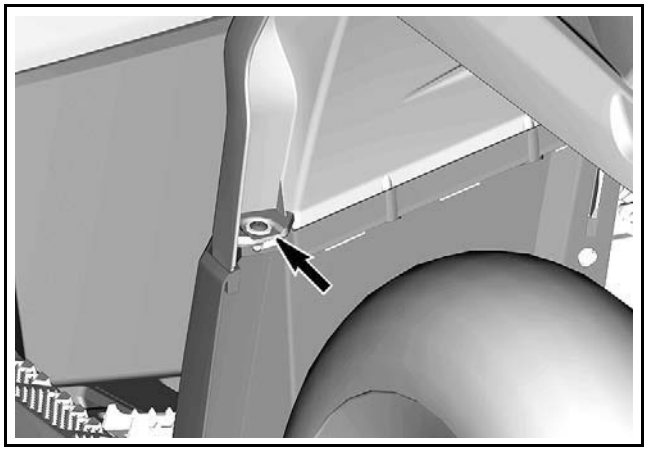


SHORT MODELS

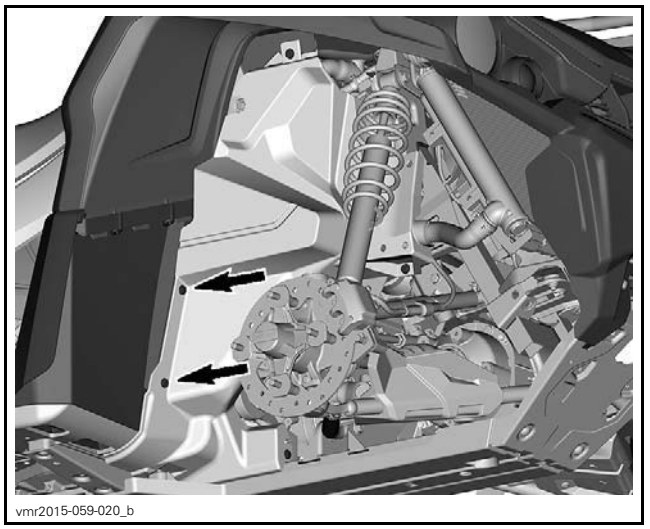


MAX MODELS

2. Remove screw securing front fender to footrest panel.

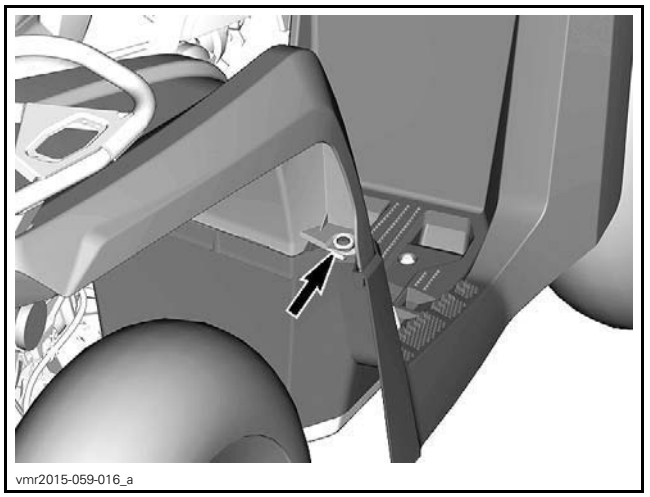


3. Remove both plastic rivet securing inner fender panel to footrest panel.



WHEEL REMOVED FOR CLARITY

4. Remove screw securing rear fender to footrest panel.



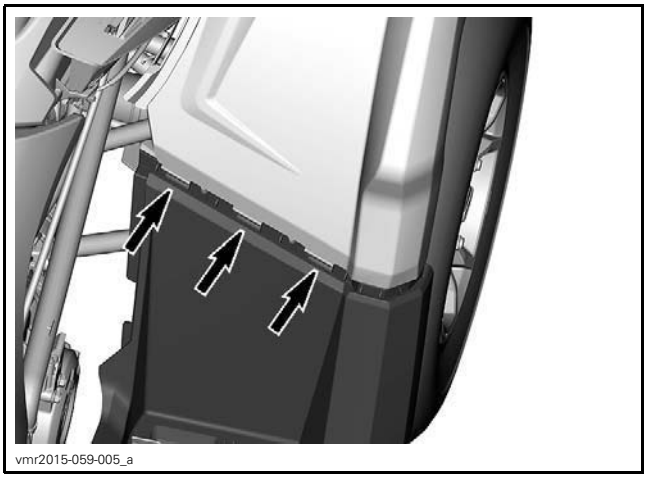
SHORT MODEL SHOWN

5. Remove screw securing footrest panel to frame.

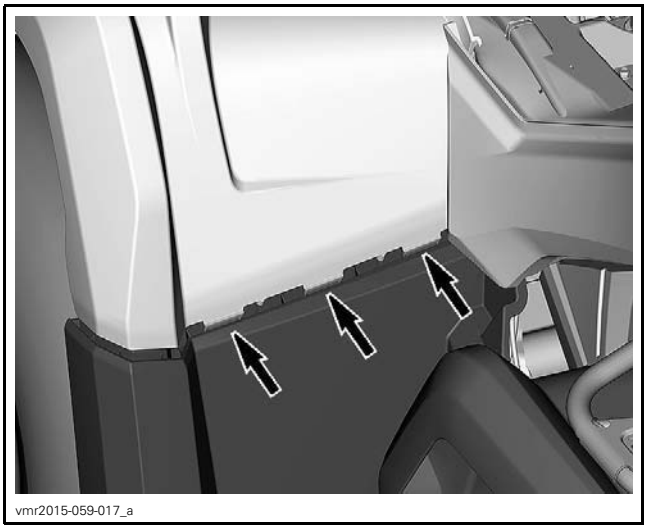


1. Screw securing footrest panel

6. Detach front fender from footrest panel by releasing retaining tabs.



7. Detach rear fender from footrest panel by releasing retaining tabs.



SHORT MODEL SHOWN

8. Remove footrest panel from vehicle.

Footrest Panel Installation

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

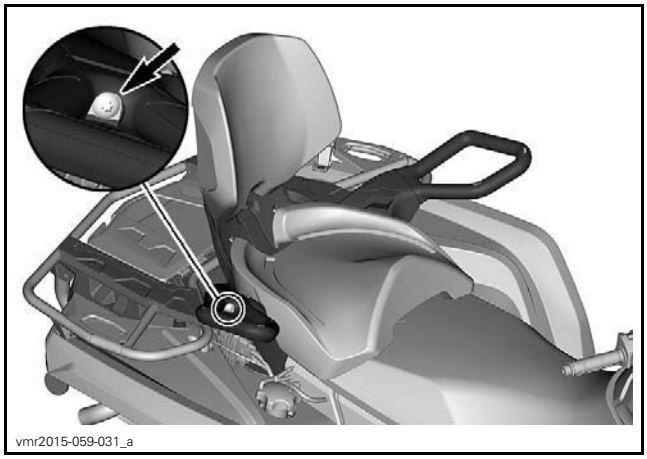
Tighten footrest panel screws to specification.

TIGHTENING TORQUE	
Footrest panel retaining screws	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)

PASSENGER GRIPS

Passenger Grips Removal

1. Remove retaining screw securing passenger grips and remove passenger grips.



Passenger Grips Installation

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

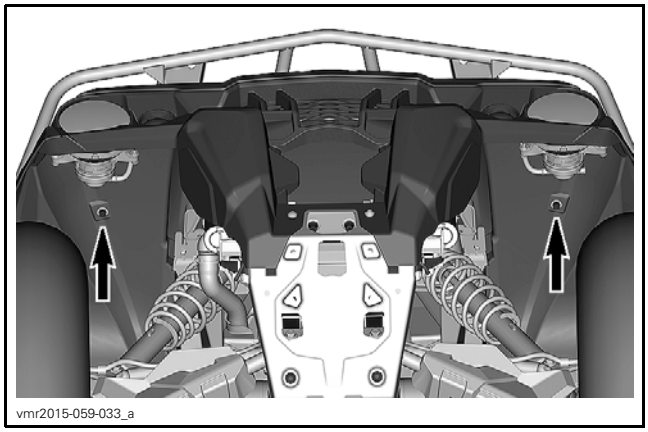
Tighten passenger grips retaining screw to specification.

TIGHTENING TORQUE	
Passenger grips retaining screw	25 N•m ± 3 N•m (18 lbf•ft ± 2 lbf•ft)

RACK (FRONT AND REAR)

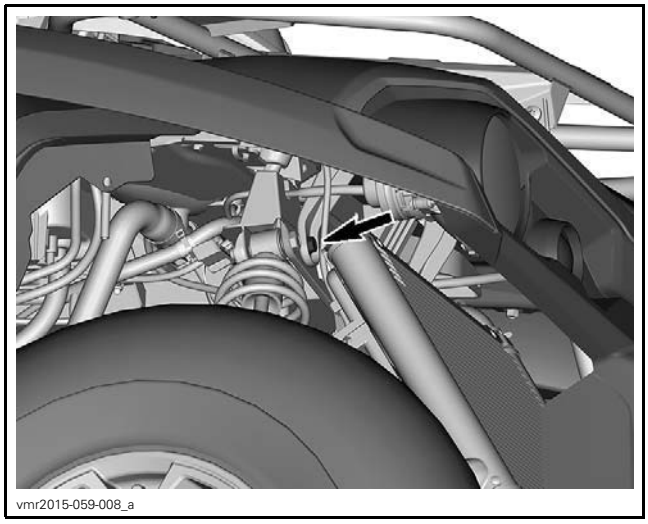
Front Rack Removal

1. Remove screws securing front fenders to rack.

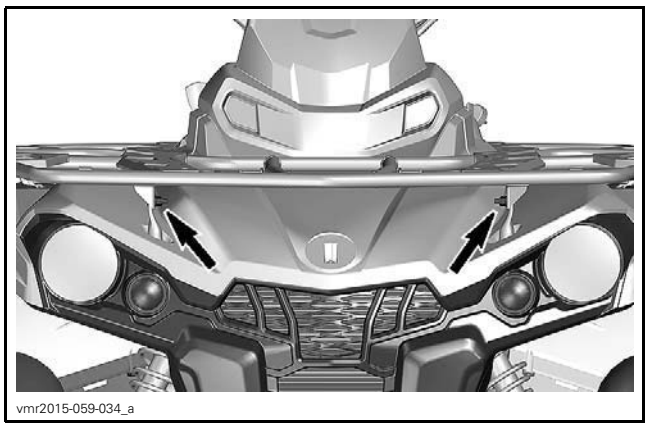

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BOTTOM UP VIEW

2. Remove screws securing rack to frame.


vmr2015-059-008_a

3. Remove screws securing rack to subframe.


vmr2015-059-034_a

4. Remove rack from vehicle.

Front Rack Installation

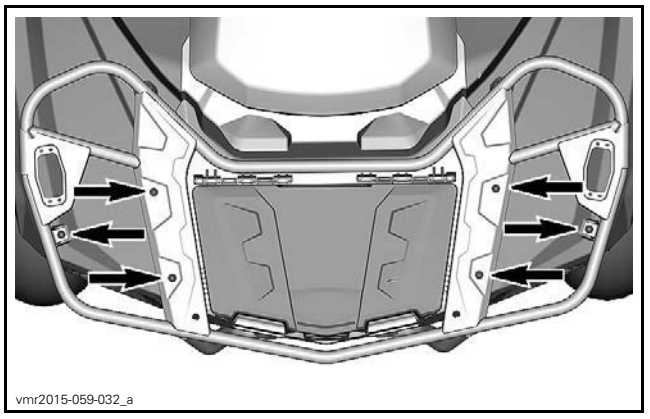
The installation is the reverse of the removal procedure. However, pay attention to the following.

Tighten front rack retaining screws to specification.

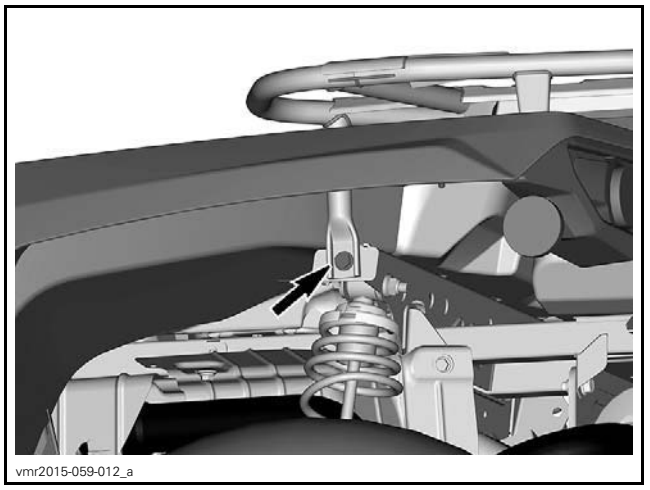
TIGHTENING TORQUE	
Screws securing fender to front rack	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)

Rear Rack Removal

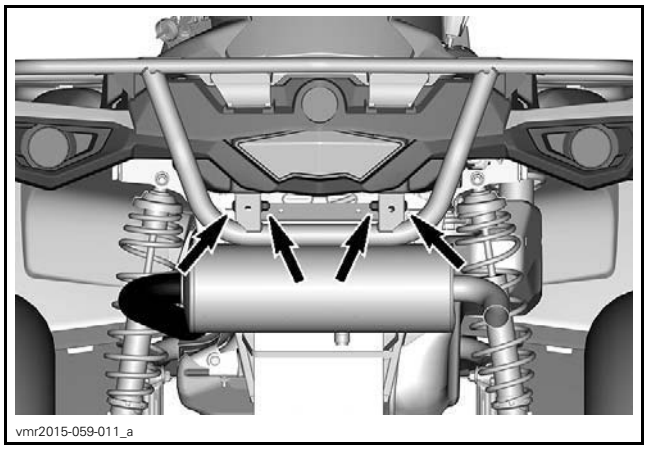
1. Remove screws securing rear fenders and storage compartment to rack.


vmr2015-059-032_a

2. Remove upper screws securing rack to frame.


vmr2015-059-012_a

3. Remove lower screws securing rack to frame.


vmr2015-059-011_a

4. Remove rack from vehicle.

Rear Rack Installation

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

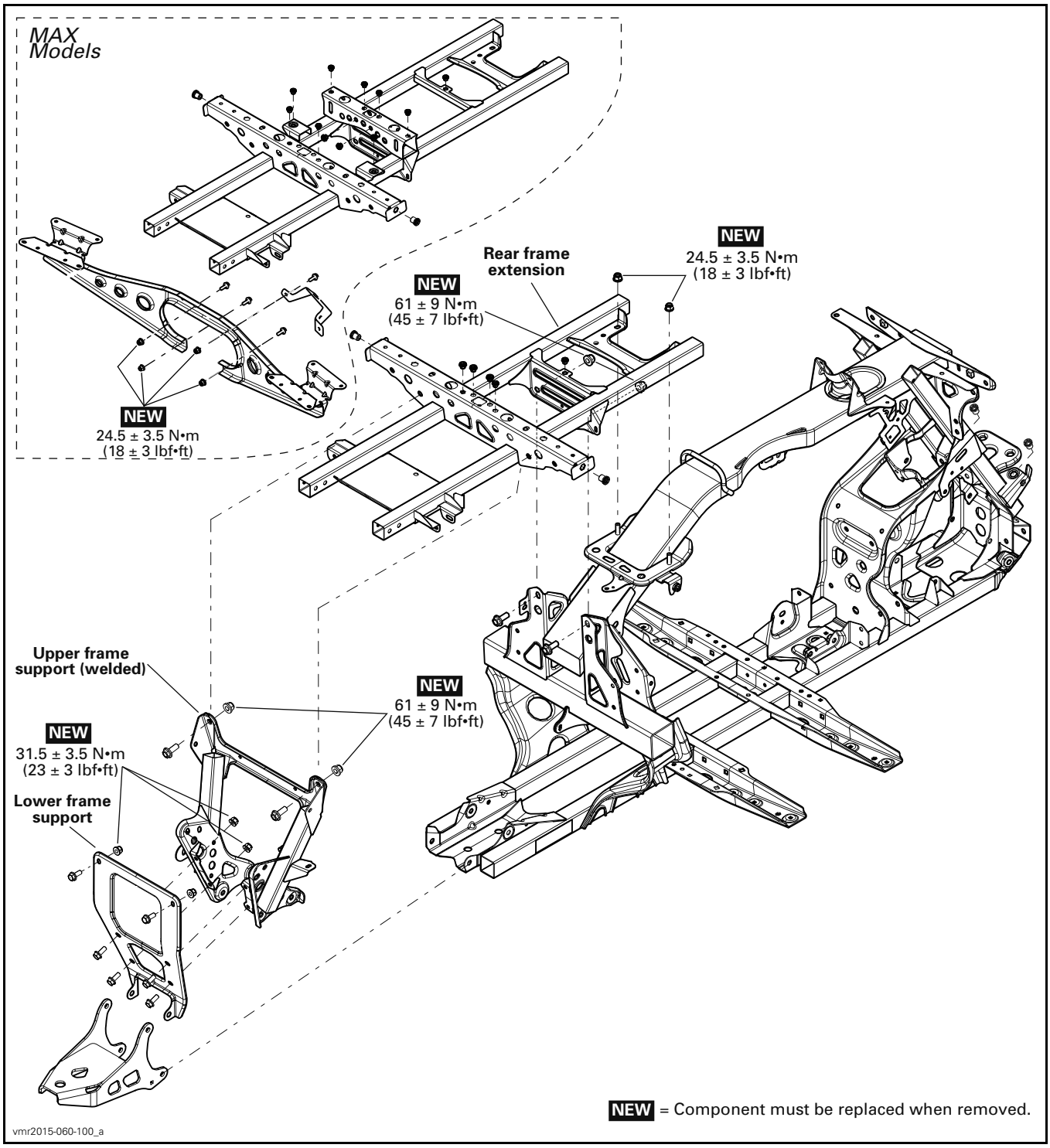
Tighten rear rack retaining screws to specification.

TIGHTENING TORQUE	
Screws securing rear fenders and storage compartment to rack	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)
Lower screws securing rear rack to frame	15 N•m ± 2 N•m (133 lbf•**in** ± 18 lbf•**in**)

FRAME

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
BLIND THREADED INSERT INSTALLER	model 9600	744



PROCEDURES

FRAME

Frame Inspection

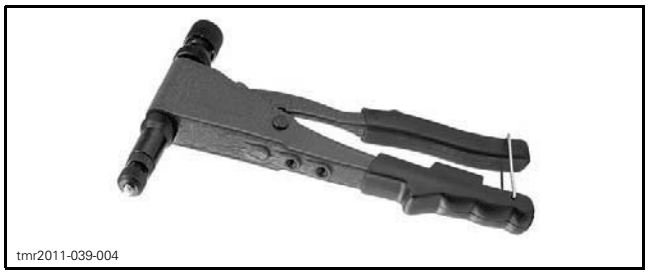
Check frame for bending, cracks, weld damages or any other damage. Replace frame as necessary.

Frame Welding

No welding should be done on frame except if mentioned or required on an approved BRP Bulletin.

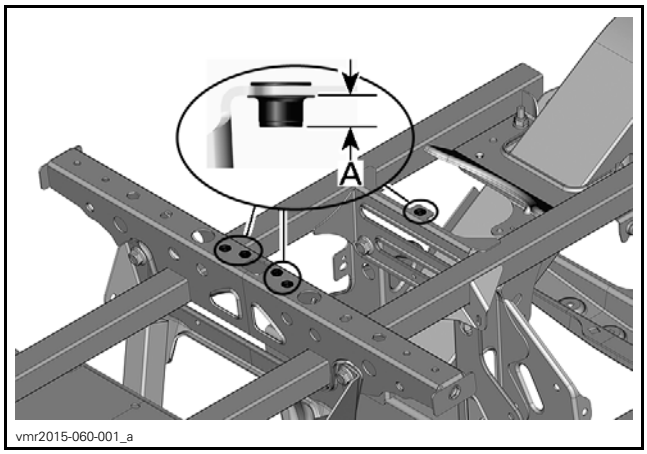
Frame Insert Replacement

To install a new blind threaded insert, use the following tool: BLIND THREADED INSERT INSTALLER (P/N MODEL 9600) from Textron. See their web site at: **www.textronfasteningsystems.com**.


tmr2011-039-004

After insert installation, ensure insert can hold the torque applied to the screw it retains and measure the compressed length of the frame insert. Otherwise, install a new insert.

INSERT	COMPRESSED LENGTH
Insert for M6 bolt	9 mm ± 0.5 mm (.354 in ± .02 in)
Insert for M8 bolt	11.5 mm ± 0.5 mm (.453 in ± .02 in)



vmr2015-060-001_a

INSERT FOR M6 BOLT SHOWN
A. 9 mm ± 0.5 mm (.354 in ± .02 in)

Frame Replacement

Blind threaded inserts are not installed on replacement frames. Make sure to order enough inserts when replacing frame. Refer to *ELECTRONIC PARTS CATALOG*.

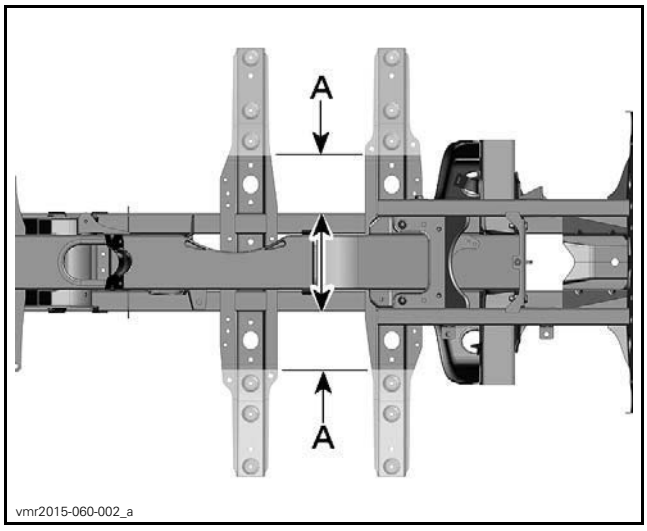
Footrest Bracket Replacement

A footrest bracket replacement kit (P/N 703 500 852) is available trough regular channel.

Order a replacement kit for each bracket to be replaced.

Replacing footrest bracket request to cut the original welded one. Cut the damaged bracket at 111 mm (4-3/8 in) from the square tube.

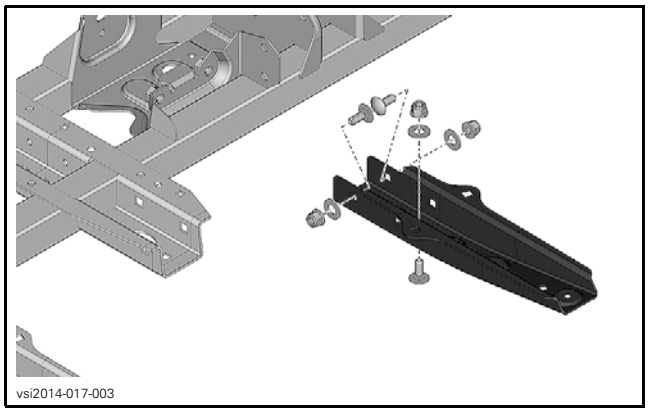
NOTICE **Do not cut shorter than dimension specified.**



vmr2015-060-002_a

A. 111 mm (4-3/8 in)

Install the new footrest bracket and tighten nuts to specification.


vsi2014-017-003

REPLACEMENT KIT

TIGHTENING TORQUE	
Footrest bracket nuts	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)

OUTLANDER L 450

ENGINE			
Engine type			ROTAX 450, 4-stroke, Single Over Head Camshaft (SOHC), liquid cooled
Number of cylinder			1
Number of valves			4 valves (mechanical adjustment)
Bore			94 mm (3.7 in)
Stroke			61.5 mm (2.42 in)
Displacement			426.8 cm^3 (26.04 in^3)
Compression ratio			10.3:1
Maximum HP RPM			7500
Intake valve opening			5° BTDC
Intake valve closing			45° ABDC
Exhaust valve opening			55° BBDC
Exhaust valve closing			5° ATDC
Valve clearance	Intake		0.06 mm to 0.14 mm (.0024 in to .0055 in)
	Exhaust		0.11 mm to 0.19 mm (.0043 in to .0075 in)
Valve stem diameter	Intake	New	5.472 mm to 5.486 mm (.2154 in to .216 in)
		Service limit	5.450 mm (.2146 in)
	Exhaust	New	5.461 mm to 5.476 mm (.215 in to .2156 in)
		Service limit	5.440 mm (.2142 in)
Valve out of round	Intake and Exhaust	New	0.005 mm (.0002 in)
		Service limit	0.060 mm (.0024 in)
Valve guide diameter	Intake and Exhaust	New	5.506 mm to 5.518 mm (.2168 in to .2172 in)
		Service limit	5.568 mm (.2192 in)
Valve spring free length		New	40.41 mm (1.591 in)
		Service limit	39.00 mm (1.535 in)
Valve seat contact width	Intake	New	1.05 mm to 1.35 mm (.041 in to .053 in)
		Service limit	1.80 mm (.071 in)
	Exhaust	New	1.25 mm to 1.55 mm (.049 in to .061 in)
		Service limit	2.00 mm (.079 in)
Piston measurement		New	93.950 mm to 93.966 mm (3.6988 in to 3.6994 in)
		Service limit	93.940 mm (3.6984 in)
Piston/cylinder clearance		New	0.027 mm to 0.057 mm (.0011 in to .0022 in)
		Service limit	0.100 mm (.0039 in)
Piston ring type		1st	Upper compression ring, rectangular
		2nd	Lower compression ring, taper-face
		3rd	Oil scraper ring, standard

ENGINE			
Piston ring end gap	Upper compression ring	New	0.20 mm to 0.35 mm (.008 in to .014 in)
	Lower compression ring		0.35 mm to 0.55 mm (.014 in to .022 in)
	Oil scraper ring		0.20 mm to 0.70 mm (.008 in to .028 in)
	Upper compression ring	Service limit	0.60 mm (.024 in)
	Lower compression ring		0.85 mm (.033 in)
	Oil scraper ring		1.00 mm (.039 in)
Ring/piston groove clearance	Upper compression ring	New	0.03 mm to 0.07 mm (.0012 in to .0028 in)
	Lower compression ring		0.02 mm to 0.06 mm (.0008 in to .0024 in)
	Oil scraper ring		0.01 mm to 0.18 mm (.0004 in to .0071 in)
	Upper compression ring	Service limit	0.150 mm (.0059 in)
	Lower compression ring		0.150 mm (.0059 in)
	Oil scraper ring		0.250 mm (.0098 in)
Rocker arm bore diameter		New	12.036 mm to 12.050 mm (.4739 in to .4744 in)
		Service limit	12.060 mm (.4748 in)
Rocker arm shaft diameter		New	12.00 mm to 12.018 mm (.4724 in to .4731 in)
		Service limit	11.990 mm (.472 in)
Cylinder bore		Nominal new	93.993 mm to 94.007 mm (3.7005 in to 3.7011 in)
Cylinder taper		Maximum new	0.038 mm (.0015 in)
		Service limit	0.090 mm (.0035 in)
Cylinder out of round		Maximum new	0.015 mm (.0006 in)
		Service limit	0.020 mm (.0008 in)
Camshaft main bearing journal	Spark plug side	New	21.959 mm to 21.980 mm (.8645 in to .8654 in)
		Service limit	21.950 mm (.8642 in)
	Timing chain side	New	34.959 mm to 34.975 mm (1.3763 in to 1.377 in)
		Service limit	34.950 mm (1.376 in)
Camshaft main bearing journal bore	Spark plug side	New	22.000 mm to 22.021 mm (.8661 in to .867 in)
		Service limit	22.040 mm (.8677 in)
	Timing chain side	New	35.000 mm to 35.025 mm (1.378 in to 1.3789 in)
		Service limit	35.040 mm (1.3795 in)
Camshaft lobe	Intake	New	32.890 mm to 33.090 mm (1.295 in to 1.303 in)
		Service limit	32.840 mm (1.293 in)
	Exhaust	New	32.950 mm to 33.150 mm (1.297 in to 1.305 in)
		Service limit	32.900 mm (1.295 in)
Crankshaft axial clearance		New	0.1 mm to 0.4 mm (.004 in to .016 in)
		Service limit	0.5 mm (.02 in)
Crankshaft deflection	MAG/PTO side	New	0.05 mm (.002 in)
Crankshaft pin diameter		New	40.001 mm to 40.025 mm (1.5748 in to 1.5758 in)
		Service limit	39.980 mm (1.574 in)

ENGINE			
Crankshaft main journal diameter	MAG/PTO side	New	42.016 mm to 42.040 mm (1.6542 in to 1.6551 in)
		Service limit	42.000 mm (1.6535 in)
Crankcase plain bearing diameter	MAG/PTO side	Service limit	42.100 mm (1.6575 in)
Crankshaft radial play	MAG/PTO side	Service limit	0.07 mm (.0028 in)
Connecting rod big end diameter			
		Service limit	40.100 mm (1.579 in)
Connecting rod big end radial play		Service limit	0.09 mm (.0035 in)
Connecting rod big end axial play		New	0.100 mm to 0.452 mm (.004 in to .018 in)
		Service limit	0.500 mm (.02 in)
Connecting rod small end diameter		New	20.010 mm to 20.020 mm (.7878 in to .7882 in)
		Service limit	20.060 mm (.7898 in)
Piston pin diameter		New	19.996 mm to 20.000 mm (.7872 in to .7874 in)
		Service limit	19.980 mm (.7866 in)
Connecting rod/piston pin clearance		Service limit	0.080 mm (.0031 in)

LUBRICATION SYSTEM			
Lubrication	Type		Wet sump with replaceable oil filter
	Oil filter		Replaceable cartridge .
	Engine oil pressure	Minimum	350 kPa (51 PSI) at 6000 RPM
	Engine oil	Capacity (oil change with filter)	3 L (3.2 qt (U.S. liq.)) (engine/transmission)
		Recommended	For the summer season use XPS 4-stroke synth. blend oil (summer) (P/N 293 600 121). For the summer season use XPS 4-stroke synthetic oil (All climate) (P/N 293 600 112). If not available, use a 4-stroke SAE 5W 40 engine oil that meets the requirements for API service classification SG, SH or SJ
Oil pressure regulator compression spring free length		New nominal	64 mm (2.52 in)
		Service limit	62 mm (2.441 in)
Oil pump inner and outer rotor clearance		Service limit	0.25 mm (.0098 in)
Oil pump axial clearance		Service limit	0.10 mm (.0039 in)

COOLING SYSTEM			
Coolant	Type		Ethyl glycol/destilled water mix (50%/50%). Use Long life antifreeze (P/N 219 702 685) or coolant specifically designed for aluminum engines
	Capacity		2.9 L (3.1 qt (U.S. liq.))
Thermostat		Starts to open	65°C (149°F)
		Fully open	75°C (167°F)
Radiator cap opening pressure			110 kPa (16 PSI)

TRANSMISSION		
Type		CVT (Continuously Variable Transmission)
Engagement RPM		2000 ± 100 RPM
Drive belt width	Service limit	30.00 mm (1.181 in)
Governor cup roller outer diameter	New	13.80 mm to 14.00 mm (.543 in to .551 in)
	Service limit	13.20 mm (.52 in)
Governor cup roller inner diameter	New	8.025 mm to 8.175 mm (.316 in to .322 in)
	Service limit	9.00 mm (.354 in)
Centrifugal lever pivot bolt diameter	New	6.078 mm to 6.100 mm (.239 in to .24 in)
	Service limit	6.000 mm (.236 in)
Centrifugal lever bore diameter		6.035 mm to 6.078 mm (.238 in to .239 in)
	Service limit	6.200 mm (.244 in)
Centrifugal lever pivot bolt bore diameter	New	6.113 mm to 6.171 mm (.241 in to .243 in)
	Service limit	6.300 mm (.248 in)
Drive pulley sliding sheave large bushing	New	55.000 mm to 55.040 mm (2.165 in to 2.167 in)
	Service limit	55.200 mm (2.173 in)
Drive pulley sliding sheave small bushing	New	30.000 mm to 30.040 mm (1.181 in to 1.183 in)
	Service limit	30.200 mm (1.189 in)
Drive pulley spring free length	Service limit	75 mm (2.953 in)
Drive pulley spring squareness	Service limit	4 mm (.157 in)
Spring sleeve length	New	9.2 mm to 9.4 mm (.362 in to .37 in)
	Service limit	9.0 mm (.354 in)
Driven pulley sliding sheave bushing	New	30.060 mm to 30.100 mm (1.183 in to 1.185 in)
	Service limit	30.200 mm (1.189 in)
Driven pulley fixed sheave bushing	New	30.060 mm to 30.100 mm (1.183 in to 1.185 in)
	Service limit	30.200 mm (1.189 in)
Torque gear on driven pulley	Service limit	7.500 mm (.295 in)
Cam width on top surface	Service limit	6.000 mm (.236 in)
Driven pulley sliding sheave wear on contact surface	Service limit	2.000 mm (.079 in)
Driven pulley spring free length	Service limit	164 mm (6.457 in)
Driven pulley spring squareness	Service limit	3.8 mm (.15 in)

GEARBOX		
Type		Dual range (HI-LO) with park, neutral and reverse
Output shaft axial clearance	New	0.09 mm to 0.18 mm (.004 in to .007 in)
	Service limit	0.30 mm (.012 in)
Bevel gear axial clearance	New	0.02 mm to 0.11 mm (.0008 in to .0043 in)
	Service limit	0.15 mm (.006 in)

GEARBOX			
Gear groove width		New	5.00 mm to 5.10 mm (.197 in to .201 in)
		Service limit	5.20 mm (.205 in)
Counter shaft	MAG side	Service limit	17.990 mm (.708 in)
	PTO side		24.950 mm (.982 in)
Bevel gear shaft	PTO side	Service limit	24.990 mm (.984 in)
Shift fork claw thickness		New	4.800 mm to 4.860 mm (.189 in to .191 in)
		Service limit	4.750 mm (.187 in)
Overall gear ratio		High	3,545
		Low	6,769
		Reverse	7,608

ELECTRICAL SYSTEM		
Magneto generator output	Without DPS	400 W @ 6000 RPM
	With DPS	500 W @ 6000 RPM
	CE version	500 W @ 6000 RPM
Stator resistance (20°C (68°F))		0.15 to 0.30 Ω
Ignition system type		IDI (Inductive Discharge Ignition)
Ignition timing		Not adjustable
Spark plug	Quantity	1
	Make and type	NGK LMAR8D-J
	Gap	0.7 mm to 0.9 mm (.028 in to .035 in)
Engine RPM limiter setting	Forward	8000 rpm
	Reverse	15 km/h (9 MPH) without Override)
Battery	Type	Maintenance free
	Voltage	12 Vdc
	Nominal rating	18 A•h
	Power starter output	0.7 KW
Headlights	High	HS1 35 W
	Low	HS1 35 W
Taillights		P21/5W
Turn signal lights (CE version)		R10W
Position light (CE version)		W5W
Licence plate light (CE version)		R10W

ELECTRICAL SYSTEM			
Fuses (PF1)	- Speedo - Relay	F4	10 A
	- Ignition coil - Fuel injector - Fuel pump	F5	10 A
	- Key switch - Starter solenoid	F8	10 A
	- Cooling fan	F9	20 A
	-DC out / lights / Acc.	F12	20 A
Relays (PF1)	Cooling fan	R1	20 A
	Main	R2	20 A
	Accessories	R3	20 A
	Fuel pump	R4	30 A
	Brake lights	R8	30 A
Fuses (PF2)	- Main	F1	30 A
	- Spare	F2	30 A
	- ACC	F3	30 A
Fuse (PF3)	- DPS	N/A	40 A

FUEL SYSTEM			
Fuel delivery		Type	Electronic Fuel Injection (EFI), 46 mm throttle body, 1 injector per cylinder
Fuel pump		Type	Electrical (in fuel tank)
		Operating pressure	350 kPa ± 10 kPa (51 PSI ± 1 PSI)
Idle speed			1250 rpm ± 50 (not adjustable)
Fuel	Type		Regular unleaded gasoline
	Minimum octane rating	Inside North America	87 (R+M)/2 or higher
		Outside North America	92 RON or higher
Fuel tank capacity			20.5 L (5.4 U.S. gal.)
Fuel remaining when low fuel light turns ON			± 5 L (1.3 U.S. gal.)

DRIVE SYSTEM			
Drive system type			Selectable 2WD/4WD
Front differential oil/ rear final drive oil	Capacity	Front	500 ml (17 U.S. oz)
		Rear	250 ml (8.5 U.S. oz)
	Type	Front	XPS synthetic gear oil (75W 90) (P/N 93 600 043) OR synthetic oil 75W 90 API GL5)
		Rear	XPS synthetic gear oil (75W 140) (P/N 293 600 140) or a 75W140 API GL-5 synthetic gear oil
Front drive		Base	Straight gear Visco-Lok
		All models except Base	Straight gear Visco-lok QE
Front drive ratio			3.6:1
Rear drive			Bevel Straight gear / final drive
Rear drive ratio			3.6:1
CV joint grease			Castrol CV joint grease (P/N 293 550 062)
Propeller shaft grease			Propeller shaft grease (P/N 293 550 063)

STEERING		
Turning radius	1-UP	205.7 cm (81 in)
	2-UP	233.7 cm (92 in)
Total toe (vehicle on ground)		2.5 mm ± 12.7 mm (.1 in ± .5 in)
Camber angle (vehicle on ground)		0°

FRONT SUSPENSION		
Suspension type		Double A-arm with dive-control geometry
Suspension travel		226 mm (8.9 in)
Shock absorber	Quantity	2
	Type	Oil
Spring free length		325.6 mm (12.82 in)
Preload adjustment type		5 position cam

REAR SUSPENSION		
Suspension type		Trailing arm Independant (TTI) with external sway bar
Suspension travel		224 mm (8.82 in)
Shock absorber	Qty	2
	Type	Oil

REAR SUSPENSION		
Spring free length	1 UP	315.6 mm (12.43 in)
	2 UP	325.6 mm (12.82 in)
Preload adjustment type		5 position cam

BRAKES		
Front brakes	Type	Dual 214 mm cross drilled disc brakes with hydraulic twin-piston calipers
Rear brake	Type	Single 214 mm cross drilled disc brake with hydraulic twin-piston caliper
Brake fluid	Capacity	260 ml (8.8 U.S. oz)
	Type	DOT 4
Caliper		Floating twin pistons (2 x 26 mm)
Brake pad material		Organic
Minimum brake pad thickness		1 mm (.039 in)
Minimum brake disc thickness		4.0 mm (.157 in)
Maximum brake disc warpage		0.2 mm (.008 in)

TIRES				
Pressure	Front	1-UP	UP TO 164 kg (360 lb)	41.4 kPa (6 PSI)
			FROM 164 kg (360 lb) TO 235 kg (517 lb)	48.2 kPa (7 PSI)
		2-UP	UP TO 132 kg (290 lb)	41.4 kPa (6 PSI)
			FROM 132 kg (290 lb) TO 272 kg (600 lb)	48.2 kPa (7 PSI)
	Rear	1-UP	UP TO 164 kg (360 lb)	41.4 kPa (6 PSI)
			FROM 164 kg (360 lb) TO 235 kg (517 lb)	68.9 kPa (10 PSI)
		2-UP	UP TO 132 kg (290 lb)	41.4 kPa (6 PSI)
			FROM 132 kg (290 lb) TO 272 kg (600 lb)	68.9 kPa (10 PSI)

TIRES		
Minimum tire thread depth		3 mm (.118 in)
Tire size	Front	635 x 203 x 305 mm (25 x 8 x 12 (in))
	Rear	635 x 279 x 305 mm (25 x 10 x 12 (in))

WHEELS		
Type	Base	Steel
	DPS	Cast Aluminum
Rim size	Front	305 x 152 mm (12 x 6 (in))
	Rear	305 x 191 mm (12 x 7.5 (in))
Wheel nut torque		100 N•m (74 lbf•ft)

DIMENSIONS		
Overall length	1-UP	211 cm (83 in)
	2-UP	231 cm (91 in)
Overall width		117 cm (46 in)
Overall height	1-UP	124 cm (49 in)
	2-UP	133 cm (52.5 in)
Wheelbase	1-UP	129.5 cm (51 in)
	2-UP	149.9 cm (59 in)
Wheel track	Front	97.4 cm (38 in)
	Rear	92.3 cm (36 in)
Ground clearance		26.7 cm (10.5 in)

LOADING CAPACITY AND WEIGHT		
Dry weight	1-UP	308 kg (678 lb)
	2-UP	324 kg (715 lb)
Front rack capacity		54 kg (120 lb)
Rear rack capacity		109 kg (240 lb)
Rear storage compartment loading capacity		10 kg (22 lb)
Total vehicle load allowed (including driver, all other loads and added accessories)	1-UP	235 kg (517 lb)
	2-UP	272 kg (600 lb)
Towing capacity		590 kg (1,300 lb)
Tongue capacity		23 kg (50 lb)

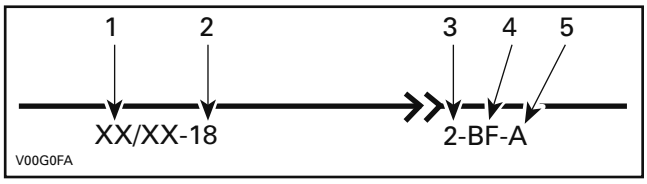
WIRING DIAGRAM INFORMATION

GENERAL

WIRING DIAGRAM INFORMATION

NOTE: The wiring diagrams are in the manual back cover pocket.

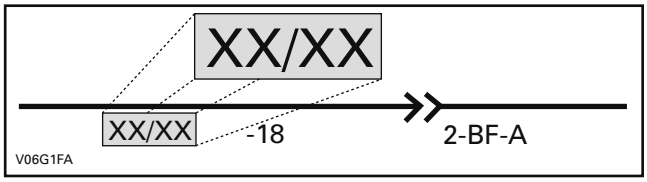
The wiring diagrams use the following codes.



1. *Wire colors*
2. *Wire gauge*
3. *Connector location area (some vehicles)*
4. *Connector identification*
5. *Terminal location in connector*

Wire Colors

It identifies the color of a wire. When a 2-color scheme is used, the first color is the main color while the second color is the tracer color.

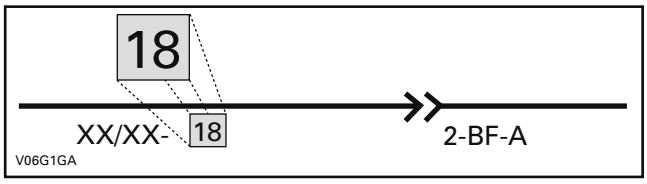


THE SHADED PART INDICATES THE WIRE COLOR

Example: YL/BK is a YELLOW wire with a BLACK stripe.

Wire Gauge

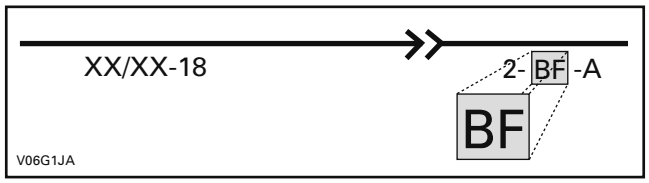
The number after wire color indicates the gauge of a wire.



THE SHADED PART INDICATES THE WIRE GAUGE

Connector Identification

Indicates the connector individually. If there are many connectors in the same area, this helps to identify which wire is in which connector.

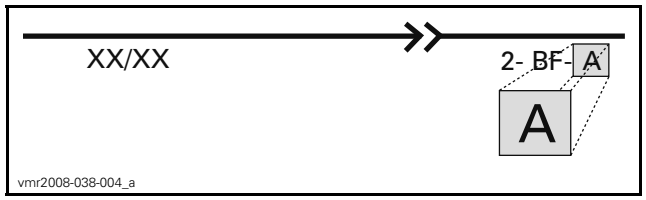


THE SHADED PART INDICATES A CONNECTOR IDENTIFICATION

Terminal Location in Connector

This is the terminal position in the connector. The number or letter given refers to the physical identification stamped on the connector.

NOTE: If no letter or number is indicated on the connector, they are indicated where there is a specific test using this connector.



THE SHADED PART INDICATES THE TERMINAL LOCATION IN CONNECTOR

OUTLANDER L 2015
GENERAL SYSTEM

"CE" HARNESS ONLY

FROM ACC RELAY (HOT AT KEY ON) — RD/BK (-C-6) — E
FROM F8 (HOT ALL TIME) — BE (-B-2) — D
TO CLUSTER FLASHER SIGNAL — OR (-A-5) — B
FROM VEHICLE GROUND — BK (-G-4) — A
HICA

WINCH OPTION

(-C-6) RD/BK
SWW — SWW-A
SWW-C — SWW-B
(-C-1) RD — LT-BU
GN/BU — SW1-1 — SW2-1
D6 D5 S-1
IN RD OUT
WINCH RELAY
BK BU YL
BK WM — WM-1
WINCH M

"DPS" MODEL ONLY

FROM STARTER SELENOID
BP2 — DPS — F2 40 — PF5-B — PF5-A
(-C-4) WH/BK — (-C-4) WH/BE — (-A-6) OR/GN
DPS1 D C A
RD/PK-14 — DPS2 A
RD/PK-16 — jt rd/pk — B 16
RD/PK-16
DPS3 (-G-1) BK A
(-G-1) BK B
DPS
DPS UNIT

4WD ACTUATOR SPECIFICITY

MONO CYLINDER
INJ-1 — IGNITION COIL — BA-1
FUEL INJ — INJ-1 — INJ-2 — BA-1 — M1 — L4
SPK-1
ECM

MONO CYLINDER ENGINE
HIC2-G HIC1-M HIC2-H
MD1-1 MD1-4 MD1-2
MD M 4WD ACTUATOR

TWIN CYLINDER ENGINE
HIC2-G HIC1-M HIC2-H
MD1-1 MD1-4 MD1-2
MD M 4WD ACTUATOR

PF_ACC PF_MAIN — RD/GN-16 — JT RD/GY — RD/GY-14
F3 30 PF2-F — F1 30 PF2-A — RD-14
MG1 OFF START — MG2-6 YL/RD 18 — MG2-1
BP6 — BP3 — SS-1 — SS-2 — D2
BE 22 — VI/BE 22 — OR/BR 18
IGNIT KEY OFF ON WL ON WOL — CC-C — CC-D — OR/VI 22
RUN/STOP SW RUN STOP — MG1-1 — MG1-2 — MG1-3 — VI/BE 22
BAT1 — BATTERY — 12V,18AH — BAT2
(-B-10)
STARTER M
RD1-1 — RD1-3
RD RECTIFIER/ REGULATOR
RD2-1 YL — RD2-2 YL — RD2-3 YL
MAGNETO
BN4 — BN2 — BN1 — BODY GND
(-E-9) — (-E-9) — BK 16 — BK 16
BK 18
BK 22

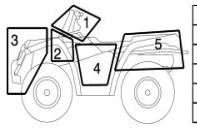
F8 10 KEY SW — PF1-E6 — RD/GY 16 — (-A-8)
FUEL PMP RELAY — FAN RELAY
F9 20 — PF1-E4 — PK 22
PF1-E5 — BE 22 — BR/RD 16
R-4 — R-1 — 86 30 85 87 — PF1-A12 VI/BU — PF1-A11 VI/BU — PF1-D1 VI/BU
PF1-B12 — PF1-B11 — BK/RD
PF1-E2 — PF1-E1 — BR/WH
JT VI/BU
FP — FUEL PMP — FP-3 — FP-4
FT — FAN — FT-A
BK/BU 22 — OR/WH 22
ECM
ECM3
DPS MODEL ONLY — (-C-6) VI/GY 22 — JT VI/GY — HIC1-K VI/GY 22
OVERRIDE SW OFF OVR — MG1-5 — MG-3
OIL SW — OPS — OPS-1 — LT-BU
BK 16 — BK 22

R-2 — 86 30 85 87 — PF1-B1 — PF1-A1
F4 10 — PF1-B6 — RD/GY 16
F5 10 — PF1-A2 — PF1-B3 — OR/BU 22
PF1-B4 — VI/BU
HIC2-B — HIC2-C
(D-10) WH/BE — (D-9) WH/BK
DB 5 4 1 WH/BE 20 2 WH/BK 20 3 — JT WH/BE — JT WH/BK — WH/BE 22 — WH/BK 22
BA — IGNITION COIL — BA-2 — BA-1 — BA-3
INJ1 — INJ2 — FUEL INJ — INJ1-1 — INJ2-1
SPK-1 — SPK-2
CAN HI — CAN LOW
N-1 — S-1 — H-1
L1 — K4 — L4 — K1 — M1 — M2 — B1 — C1
PK 22
BK 22 — BK 16 — JT BK3 — (-B-8) — BK 14

CI — P — FUEL — ENGINE — 4WD — SEAM
CI-19 — CI-18 — CI-20 — CI-12 — CI-17 — CI-16 — CI-9 — CI-8 — CI-4 — CI-7 — CI-5 — CI-6
OR/GN 22 — (-A-8) — (-D-10)
FUEL LVL — FUEL LEVEL — SD-1
(-F-5) — (-F-2) — F-12 — 20 — PF1-E8 — RD/YE 16 — PF1-E3
OR/BK 22 — RD/BK 16
4WD SIGNAL — SW 4WD — (-A-8) — (-A-10)
4WD SW — 2WD 4WD — BD-2 — BD-1 — BD-3 — BD-4 — BD-5
LIGHT SW — OFF ON WL ON WOL — CC-F — CC-A — RD/BK 22 — RD/BK-18 — RD/BU 18
MD — 4WD ACTUATOR — MD1-1 — MD1-4 — MD1-2
DC — DC OUTLET — DC3-2 — DC3-1 — DC1- — MG2-4 — BK 18
MG2 — H/L LOW HI — (-C-) — GN 18 — BU 18 — JT BU — GN 20 — PG-2 — PG-1 — PG-3
LT-2 — LT-1 — L H — PG4 BK 20
R-3 — R-8 — 86 30 85 87 87A — PF1-D12 — PF1-D10 — PF1-C9 — PF1-D9
PF1-E12 — PF1-E8 — PF1-C8 — OR/GN
JT RD/OR — RD/OR 22 — RD/OR22 — PR-2 — PR-1 — PR — P B — PR-3 — BK 22
BRK_RELAY — BRK SW — P — BRK — FRR-2 — FRR-1
ECM3 — K2 — J4 — HIC1-C — HIC1-L — HIC2-L — HIC2-H
IDLE-1 — IACV IDLE AIR CONTROL VALVE — A A2 — B B1 B2 — C D A1
CPS-2 — CPS — CPS-1 — BU/YL — BK — WH — 2 — E1
ECM3 — E3 HWA/G — E4 IDLE-A — E5 IDLE-B — C3 IDLE-C — D4 IAV/G — D1 IDLE-D — E2 HWA/L
PR — P B — PR-3 — BK 22

VSS-1 — VSS — HALL — RD WH BK — VSS-A — VSS-B — VSS-C
CTS-1 — CTS — C3 GN/BN — F4 BE/OG — CTS-1
GBPS-1 — GBPS — J3 BU — H4 GN/GR — GBPS-2 — GBPS-1 — GBPS-2
TPS-1 — TPS THROTTLE POSITION SENSOR — G3 WH/BN — A1 BU/BK — TPS-2 — TPS-1
MAPTS-1 — MAPTS — F3 WH/GY — G2 BU/RD — MAPTS-2 — MAPTS-1 — MAPTS-3
F2 TN/GY — MAPTS-4

OUTLANDER L 2015 - CE SYSTEM



ZONE #	ZONE DESCRIPTION
1	STEERING AREA
2	MODULE AREA
3	FRONT OF VEHICLE
4	ENGINE AREA
5	REAR OF VEHICLE

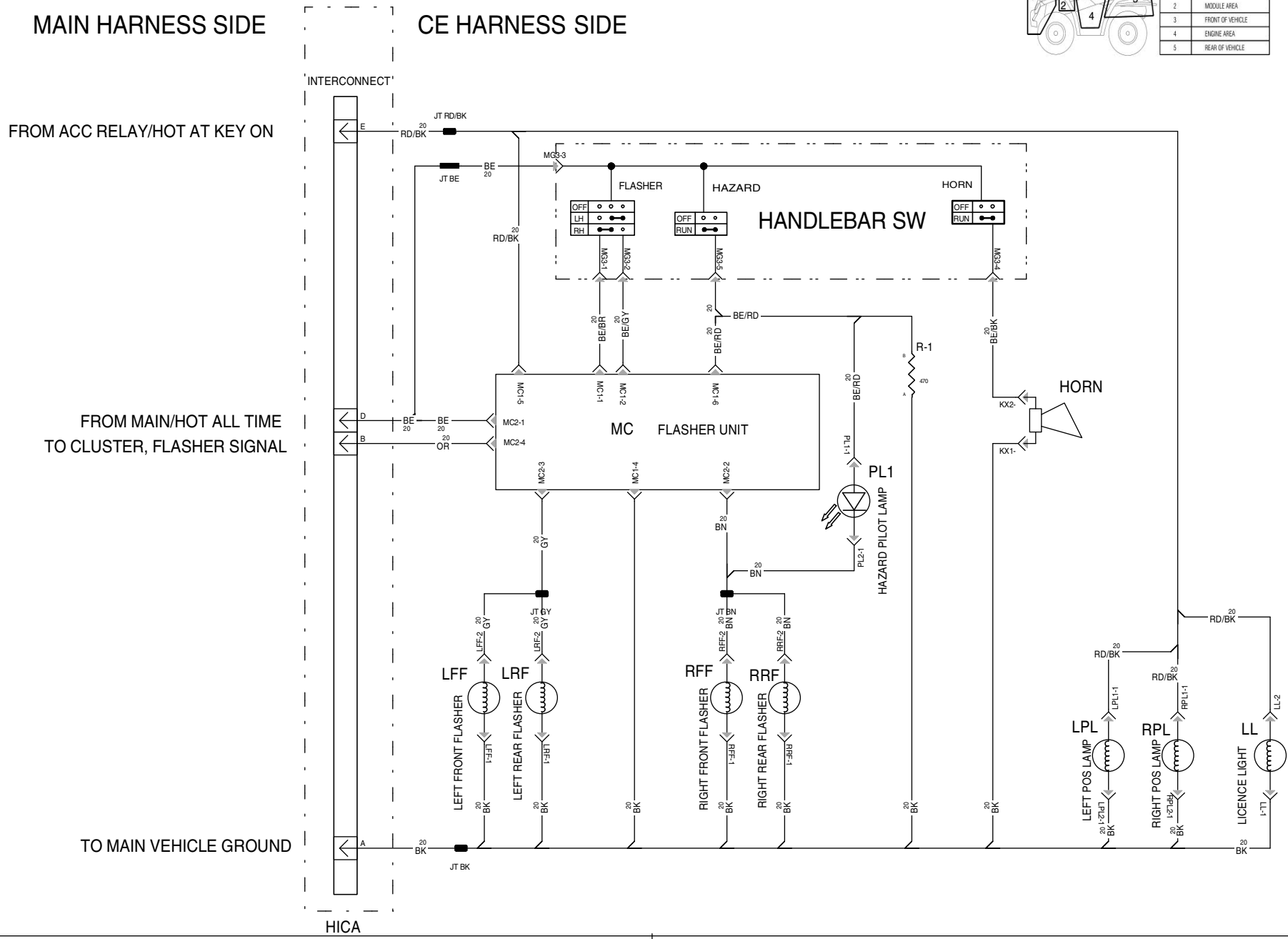
MAIN HARNESS SIDE

CE HARNESS SIDE

FROM ACC RELAY/HOT AT KEY ON

FROM MAIN/HOT ALL TIME
TO CLUSTER, FLASHER SIGNAL

TO MAIN VEHICLE GROUND



ENGINE SYSTEM
SYSTÈME MOTEUR

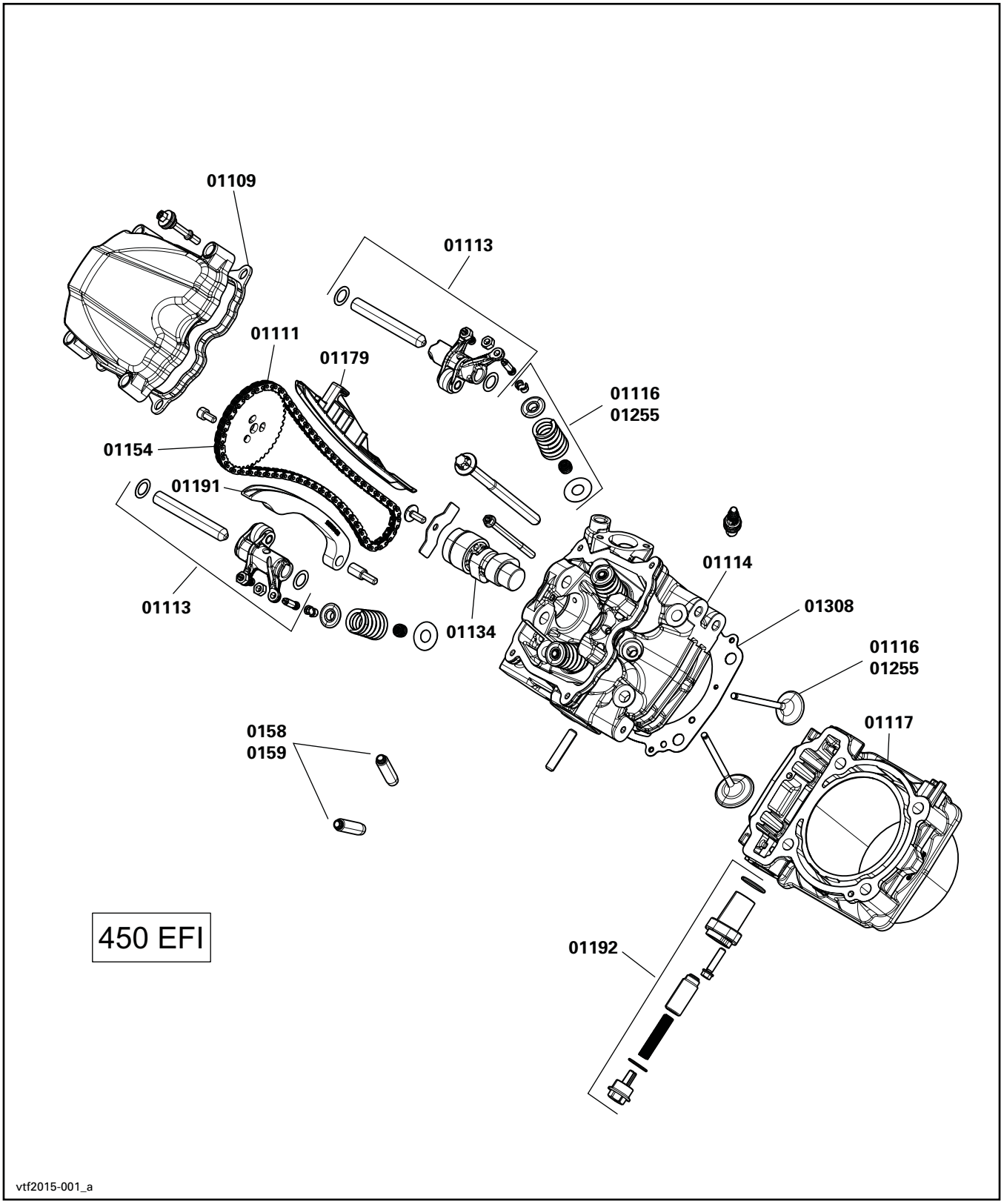
SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTKANDER MAX 500
			1	2	3	4
01	**00**	**NO LABOR INVOLVED** **AUCUNE MAIN D'OEUVRE**	**0**	**0**	**0**	**0**
01 *	01	REMOVE AND REPLACE ENGINE (ASS'Y) REMPLACEMENT DU MOTEUR (COMPLET)	4.5	4.5	4.7	4.7
01	03	OIL PRESSURE SWITCH INTERRUPTEUR DE PRESSION D'HUILE	0.3	0.3	0.3	0.3
01	04	HEAT SHIELD AND/OR RUBBER MOUNT DÉFLECTEUR DE CHALEUR ET/OU BUTÉE DE CAOUTCHOUC	0.4	0.4	0.4	0.4
01	08	FAN AND/OR FAN SUPPORT VENTILATEUR ET/OU SUPPORT DE VENTILATEUR	1.3	1.3	1.3	1.3
01	17	CYLINDERS AND/OR GASKETS (ALL) CYLINDRES E/O JOINTS (TOUS)	4.5	4.5	4.5	4.5
01	18	SENDER TEMPERATURE (ENGINE) CAPTEUR DE TEMPÉRATURE (MOTEUR)	0.9	0.9	0.9	0.9
01	19	THERMOSTAT THERMOSTAT	0.5	0.5	0.5	0.5
01	37	RADIATOR INLET HOSE BOYAU D'ENTRÉ DU RADIATEUR	0.5	0.5	0.5	0.5
01	38	WATER PUMP SHAFT (ALL PARTS) ARBRE DE POMPE À L'EAU (TOUTES LES PIÈCES)	5.3	5.3	5.5	5.5
01	45	ENGINE RUBBER MOUNT TAMPONS D'ANCRAGE DU MOTEUR	3.8	3.8	4.0	4.0
01	46	RADIATOR AND/OR GROMMMET RADIATEUR ET/OU PASSE-FILS	1.6	1.6	1.6	1.6
01	50	CRANKSHAFT AND/OR BEARINGS (FRONT/REAR) VILEBREQUIN ET/OU ROULEMENTS (AVANT/ARRIÈRE)			7.0	7.0
01	56	CRANKCASE COVER GASKET JOINT DE COUVERCLE DE CARTER			1.3	1.3
01	57	PTO CRANKCASE COVER COUVERCLE DE CARTER PDM			1.3	1.3
01	58	INTAKE OR EXHAUST VALVE GUIDE (1) GUIDE DE SOUPAPE D'ADMISSION OU D'ÉCHAPPEMENT (1)	2.3	2.3	2.8	2.8
01	59	INTAKE OR EXHAUST VALVE GUIDES (2) GUIDES DE SOUPAPE D'ADMISSION OU D'ÉCHAPPEMENT (2)	2.4	2.4	2.9	2.9
01	70	MUFFLER AND/OR EXHAUST GASKET AND/OR CLAMP SILENCIEUX D'ÉCHAPPEMENT ET/OU JOINT D'ÉCHAPPEMENT ET/OU BRIDE DE SERRAGE	0.3	0.3	0.3	0.3
01	73	EXHAUST MANIFOLD (REAR) CONNECTEUR D'ÉCHAPPEMENT (ARRIÈRE)			0.5	0.5
01	77	ANTI-VIBRATION RUBBER MOUNT (1 OR 2) (TOP) TAMPON D'ANCRAGE ANTI-VIBRATION (1 OU 2) (HAUT)	1.0	1.0	1.0	1.0

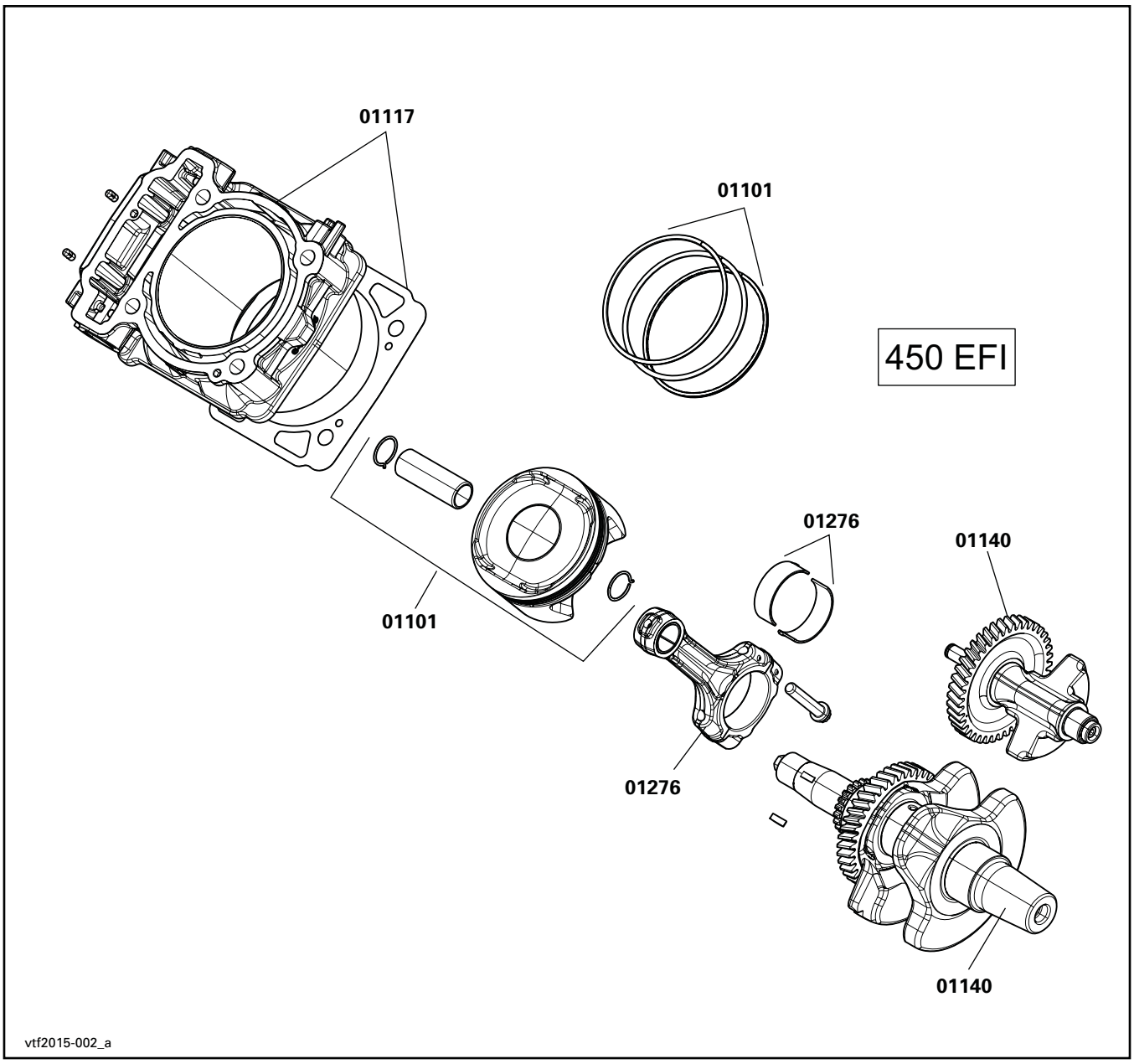
SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTKANDER MAX 500
			1	2	3	4
01	79	COOLANT HOSE (ENGINE TO TANK) BOYAU DU SYSTÈME DE REFROIDISSEMENT (RÉSERVOIR AU MOTEUR)	0.4	0.4	0.4	0.4
01	83	EXHAUST MANIFOLD (FRONT) CONNECTEUR D'ÉCHAPPEMENT (AVANT)	0.5	0.5	0.5	0.5
01	84	TUNE PIPE HEAT SHIELD (1) DÉFLECTEUR DE CHALEUR TUYAU D'ÉCHAPPEMENT (1)	0.3	0.3	0.3	0.3
01	85	TUNE PIPE HEAT SHIELD (2) DÉFLECTEUR DE CHALEUR TUYAU D'ÉCHAPPEMENT (2)	0.4	0.4	0.4	0.4
01	86	TUNE PIPE HEAT SHIELD (3) DÉFLECTEUR DE CHALEUR TUYAU D'ÉCHAPPEMENT (3)	0.4	0.4	0.4	0.4
01	88	RUBBER MOUNT (MUFFLER) TAMPON D'ANCRAGE (SILENCIEUX)	0.3	0.3	0.3	0.3
01	90	ENGINE OIL FILTER FILTRE À HUILE DU MOTEUR	0.3	0.3	0.3	0.3
01	96	OIL SIEVE AND/OR O-RING AND/OR COLLECTOR AND/OR RUBBER RING AND/OR COVER CRIBLE D'HUILE ET/OU JOINT TORIQUE ET/OU COLLECTEUR ET/OU ANNEAU DE CAOUTCHOUC ET/OU COUVERCLE	2.0	2.0	6.7	6.7
01	98	COOLING RESERVOIR RÉSERVOIR D'ANTIGEL	1.0	1.0	1.0	1.0
01	100	RADIATOR OUTLET HOSE BOYAU DE SORTIE DU RADIATEUR	0.4	0.4	0.4	0.4
01	101	PISTON, PIN, CIRCLIP, RINGS (1) PISTON, GOUPILLE, CIRCLIP, SEGMENTS (1)	3.0	3.0	3.0	3.0
01	102	PISTONS, PINS, CIRCLIPS, RINGS (2) PISTONS, GOUPILLES, CIRCLIPS, SEGMENTS (2)			4.7	4.7
01	109	VALVE COVER AND/OR GASKET COUVERCLE DE SOUPAPE ET/OU JOINT D'ÉTANCHÉITÉ	0.5	0.5	0.5	0.5
01	111	TIMING GEAR PIGNON DE DISTRIBUTION	1.2	1.2	1.2	1.2
01	113	ROCKER ARM AND/OR PUSH ROD AND/OR ROCKER ARM SHAFT CULBUTEUR ET/OU TIGE POUSSOIR ET/OU ARBRE DE CULBUTEUR	1.3	1.3	1.3	1.3
01	114	CYLINDER HEAD CULASSE	3.5	3.5	3.5	3.5
01	116	EXHAUST AND/OR INLET VALVE AND/OR SPRING AND/OR SEAL VALVE ADMISSION ET/OU ÉCHAPPEMENT ET/OU RESSORT ET/OU ANNEAU D'ÉTANCHÉITÉ	2.7	2.7	2.7	2.7
01	117	CYLINDER AND/OR GASKET CYLINDRE ET/OU JOINT D'ÉTANCHÉITÉ	2.8	2.8	2.8	2.8
01	119	WATER PUMP HOUSING AND/OR IMPELLER CARTER DE LA POMPE À EAU ET/OU ROUE À AILETTES	0.4	0.4	0.4	0.4
01	122	SHIFT SHAFT ASS'Y ARBRE D'EMBRAYAGE COMPLET	5.3	5.3		

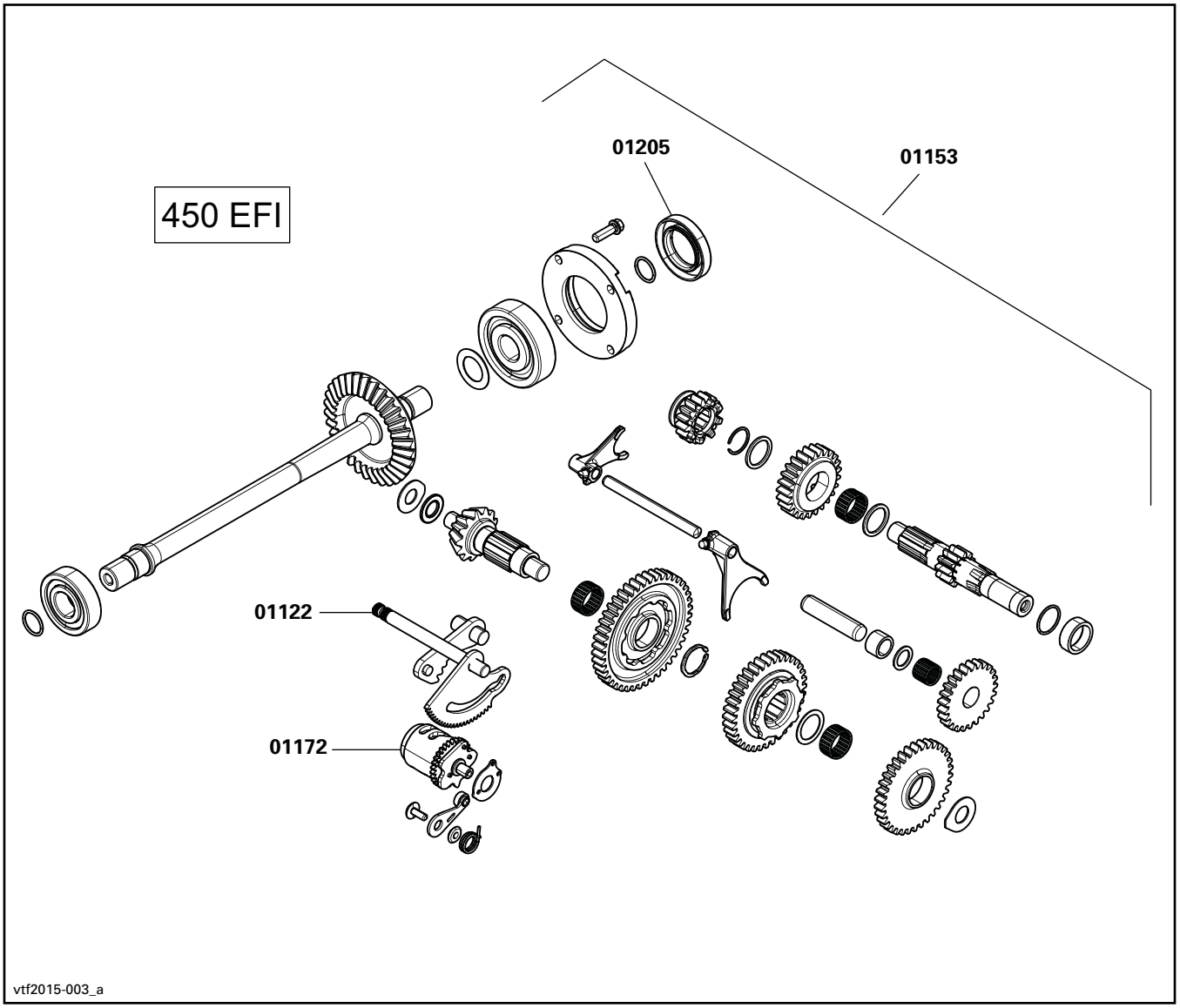
SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTKANDER MAX 500
			1	2	3	4
01	132	OIL PUMP GEAR ENGRENAGE DE LA POMPE À HUILE	5.2	5.2	1.5	1.5
01	134	CAMSHAFT ARBRE À CAME	2.3	2.3	2.3	2.3
01	137	OIL PUMP COVER AND/OR SHAFT AND/OR ROTOR COUVERCLE DE LA POMPE À HUILE ET/OU ARBRE ET/OU ROTOR	5.2	5.2	1.5	1.5
01	138	CRANKCASE RESEAL OR GASKET RECELLEMENT DU CARTER ET/OU JOINT D'ÉTANCHÉITÉ	6.1	6.1	6.9	6.9
01	139	CRANKCASE REPLACEMENT REMPLACEMENT DU CARTER	6.6	6.6	7.2	7.2
01	140	CRANKSHAFT A/O BALANCE SHAFT VILEBREQUIN E/O ARBRE D'EQUILIBRAGE	6.1	6.1		
01	152	DRIVE SHAFT AND/OR BEARINGS AND/OR SEALS ARBRE D'ENTRAÎNEMENT ET/OU ROULEMENT À BILLES ET/OU ANNEAUX D'ÉTANCHÉITÉ	6.3	6.3	6.9	6.9
01	153	GEARS BOX ASS'Y / MAIN SHAFT BOITE D'ENGRENAGE COMPLET / ARBRE PRINCIPAL	6.3	6.3		
01	154	TIMING CHAIN CHAÎNE D'ENGRENAGE	4.3	4.3	3.1	3.1
01	155	OUTPUT SHAFT ARBRE DE SORTIE	6.3	6.3		
01	172	SHIFT DRUM TAMBOUR D'EMBRAYAGE	6.4	6.4		
01	179	CHAIN GUIDE GUIDE DE CHAÎNE	1.0	1.0	1.0	1.0
01	191	CHAIN TENSION GUIDE GUIDE DE TENSION DE CHAÎNE	3.1	3.1	3.1	3.1
01	192	CHAIN TENSIONER (ASS'Y) TENDEUR DE CHAÎNE (COMPLET)	0.3	0.3	0.3	0.3
01	196	HEAT SHIELD (RH OR LH) DÉFLECTEUR DE CHALEUR (DR OU GA)		0.5		0.5
01	200	WATER PUMP GEAR ENGRENAGE DE LA POMPE À EAU	5.1	5.1	1.6	1.6
01	205	REAR OUTPUT SHAFT SEAL ANNEAU D'ÉTANCHÉITÉ DE L'ARBRE DE SORTIE ARRIÈRE	3.0	3.0	5.2	5.2
01	209	OUTPUT CRANKSHAFT SEAL ANNEAU D'ÉTANCHÉITÉ SORTIE VILBREQUIN	0.8	0.8		
01	210	MAIN SHAFT SEAL JOIN D'ÉTENCHÉITÉ DE L'ARBRE PRINCIPAL	0.8	0.8		
01	215	OIL DIPSTICK JAUGE À HUILE	0.3	0.3	0.3	0.3
01	216	PRESSURE CAP BOUCHON À PRESSION	0.3	0.3	0.3	0.3

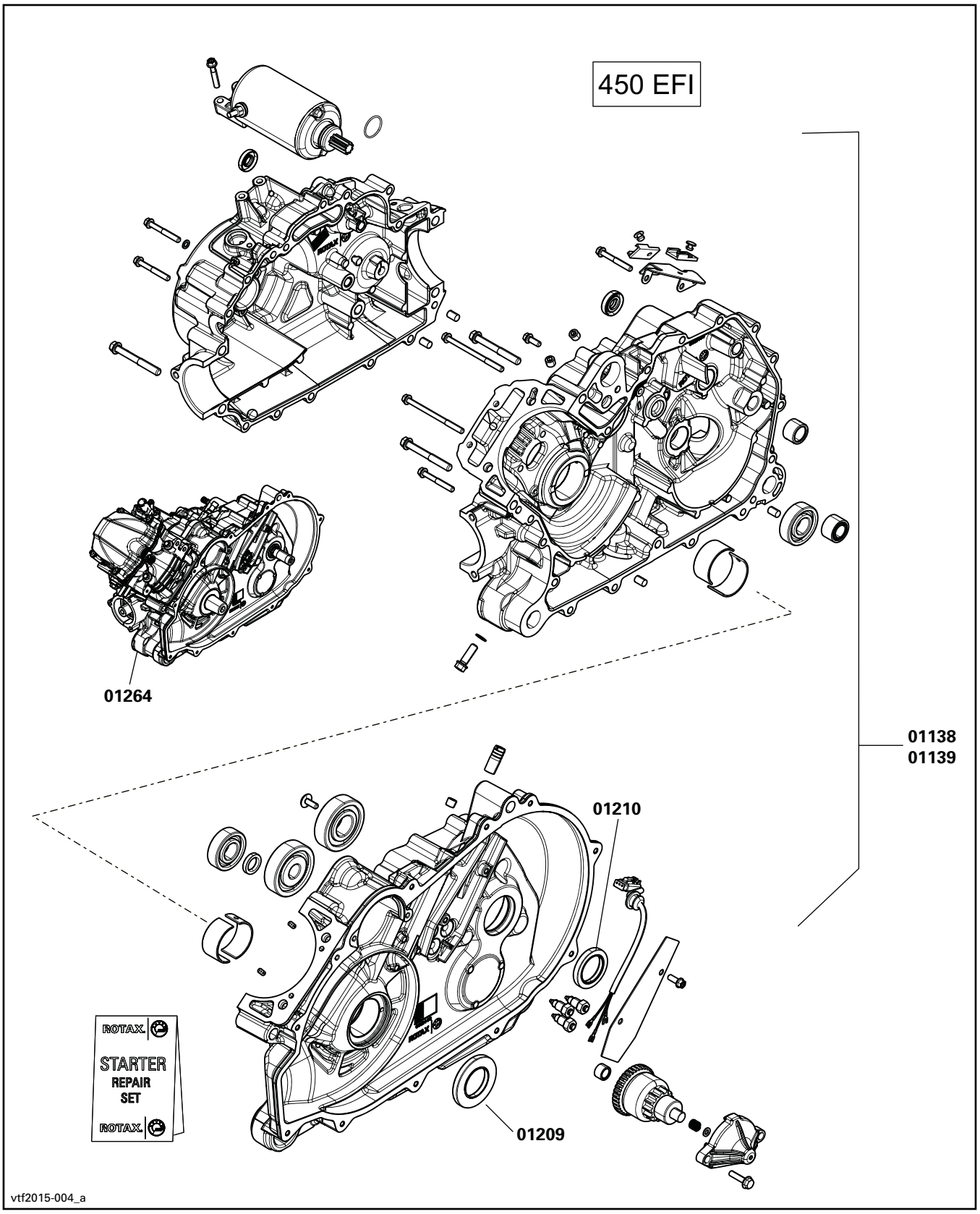
SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTKANDER MAX 500
			1	2	3	4
01	217	ENGINE BRACKET AND/OR RUBBER MOUNT ATTACHE MOTEUR ET/OU TAMPON D'ANCRAGE	0.3	0.3	0.3	0.3
01	220	MAIN DRIVE GEAR AND/OR PIN ROUAGE D'ENTRAÎNEMENT PRINCIPALE ET/OU GOUPILLE	5.2	5.2	1.6	1.6
01	221	INTERMEDIATE GEAR AND/OR PIN AND/OR THRUST WASHER ROUAGE INTERMEDIAIRE ET/OU GOUPILLE ET/OU RONDELLE D'APPUI	5.2	5.2	1.6	1.6
01	223	FRONT OUTPUT SHAFT SEAL ANNEAU ÉTANCHÉITÉ ARBRE SORTIE AVANT			2.7	2.7
01	245	OUTPUT CRANKSHAFT SEAL (PTO SIDE) ANNEAU ÉTANCHÉITÉ SORTIE VILBREQUIN (CÔTÉ PDM)	1.0	1.0	1.0	1.0
01	246	WATER PUMP GEAR AND/OR SEAL ARBRE POMPE À EAU ET/OU JOINT ÉTANCHÉITÉ	5.5	5.5	5.5	5.5
01	247	REED VALVE AND/OR STOPPER SOUPAPE À CLAPET ET/OU BUTOIR			1.6	1.6
01	248	BREATHER GEAR AND/OR V-RING RENIFLARD ET/OU ANNEAU ÉTANCHÉITÉ EN «V»			1.6	1.6
01	249	CAMSHAFT POSITION SENSOR CAPTEUR DE POSITION DE L'ARBRE À CAME			0.3	0.3
01	250	CRANKSHAFT POSITION SENSOR (CPS) CAPTEUR DE POSITION DU VILEBREQUIN (CPV)	0.3	0.3	0.3	0.3
01	255	EXHAUST AND/OR INLET VALVES AND/OR SPRINGS AND/OR SEALS (4) ÉCHAPPEMENT ET/OU VALVES ADMISSION ET/OU RESSORTS ET/OU ANNEAUX D'ÉTANCHÉITÉ (4)	3.3	3.3	3.3	3.3
01	256	EXHAUST AND/OR INLET VALVES AND/OR SPRINGS AND/OR SEALS (8) ÉCHAPPEMENT ET/OU VALVES ADMISSION ET/OU RESSORTS ET/OU ANNEAUX D'ÉTANCHÉITÉ (8)			6.4	6.4
01	261	TIMING CHAIN (MAG SIDE) CHAÎNE D'ENGRENAGE (CÔTÉ MAG)	2.8	2.8	2.8	2.8
01	264	LONG BLOCK ENSEMBLE CARTER - CYLINDRE - CULASSE	6.0	6.0	6.7	6.7
01	276	CONNECTING ROD ASS'Y (1) BIELLE COMPLET (1)	6.2	6.2		
01	301	WATER PUMP DYNAMIC SEAL AND/OR OIL SEAL ANNEAU D'ÉTANCHÉITÉ DYNAMIQUE DE LA POMPE À EAU	2.1	2.1	2.1	2.1
01	303	TIMING CHAINS (ALL) CHAÎNES D'ENGRENAGE (TOUTES)			5.3	5.3
01	304	CHAINS TENSION GUIDE (ALL) GUIDE DE TENSION DE CHAÎNES (TOUS)			5.3	5.3
01	305	CHAINS GUIDE (ALL) GUIDE DE CHAÎNES (TOUS)			1.8	1.8
01	307	VALVE COVERS AND/OR GASKETS (2) COUVERCLES SOUPAPE ET/OU JOINTS D'ÉTANCHÉITÉ (2)			0.6	0.6

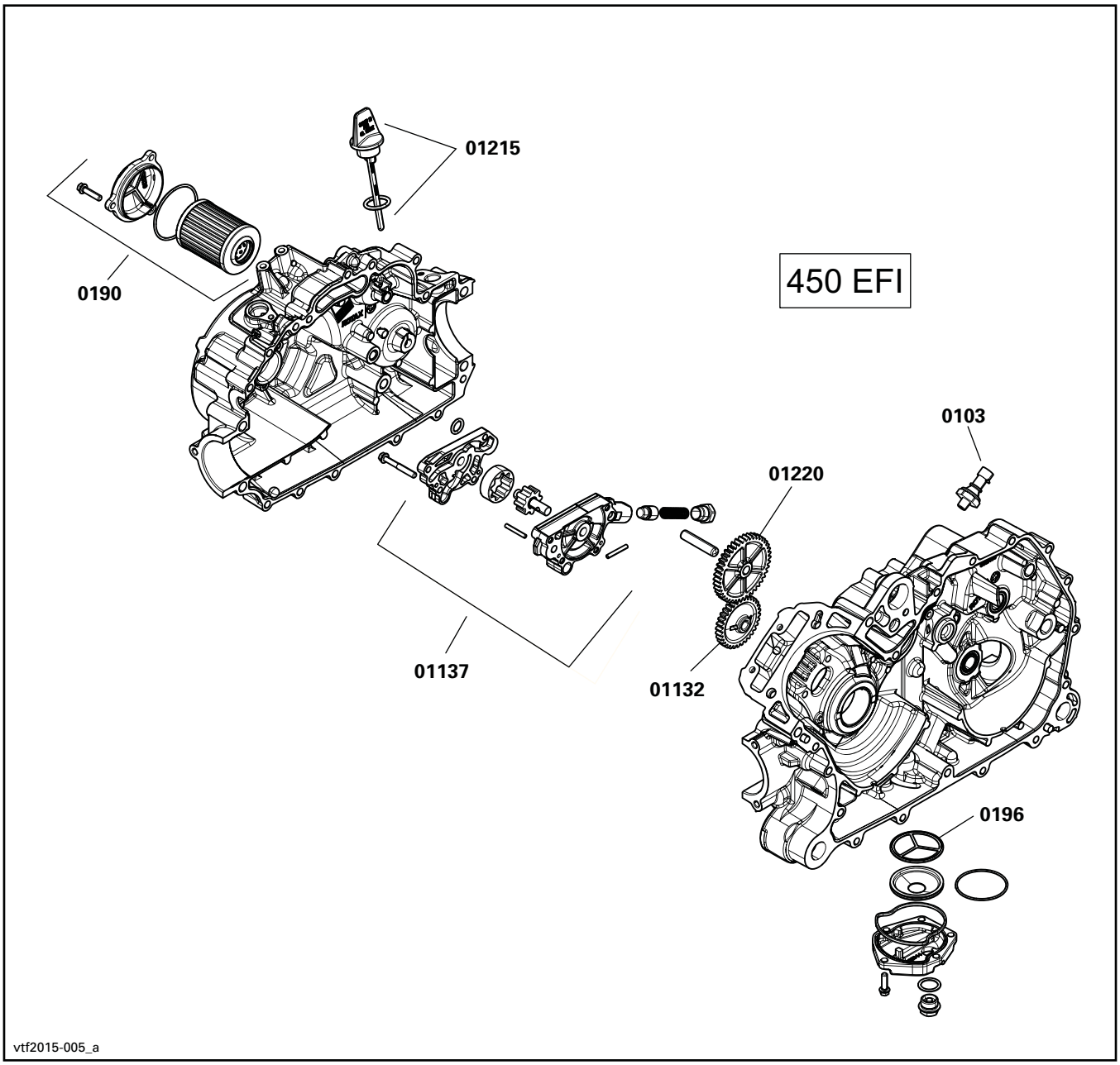
SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTKANDER MAX 500
			1	2	3	4
01	308	CYLINDER HEAD GASKET (1) JOINT D'ÉTANCHÉITÉ DE LA CULASSE (1)	1.4	1.4	1.4	1.4
01	309	CYLINDER HEAD GASKETS (2) JOINTS D'ÉTANCHÉITÉ DE LA CULASSE (2)			2.3	2.3
01	329	INJECTOR (1) INJECTEUR(1)	1.8	1.8	1.8	1.8
01	330	INJECTOR (2) INJECTEUR(2)			1.9	1.9
01	336	COOLANT HOSE (ENGINE INLET) BOYAU DE REFROIDISSEMENT (ENTRÉE DU MOTEUR)	0.4	0.4	0.4	0.4
01	340	PLUG SCREW BOUCHON FILETÉ			0.5	0.5

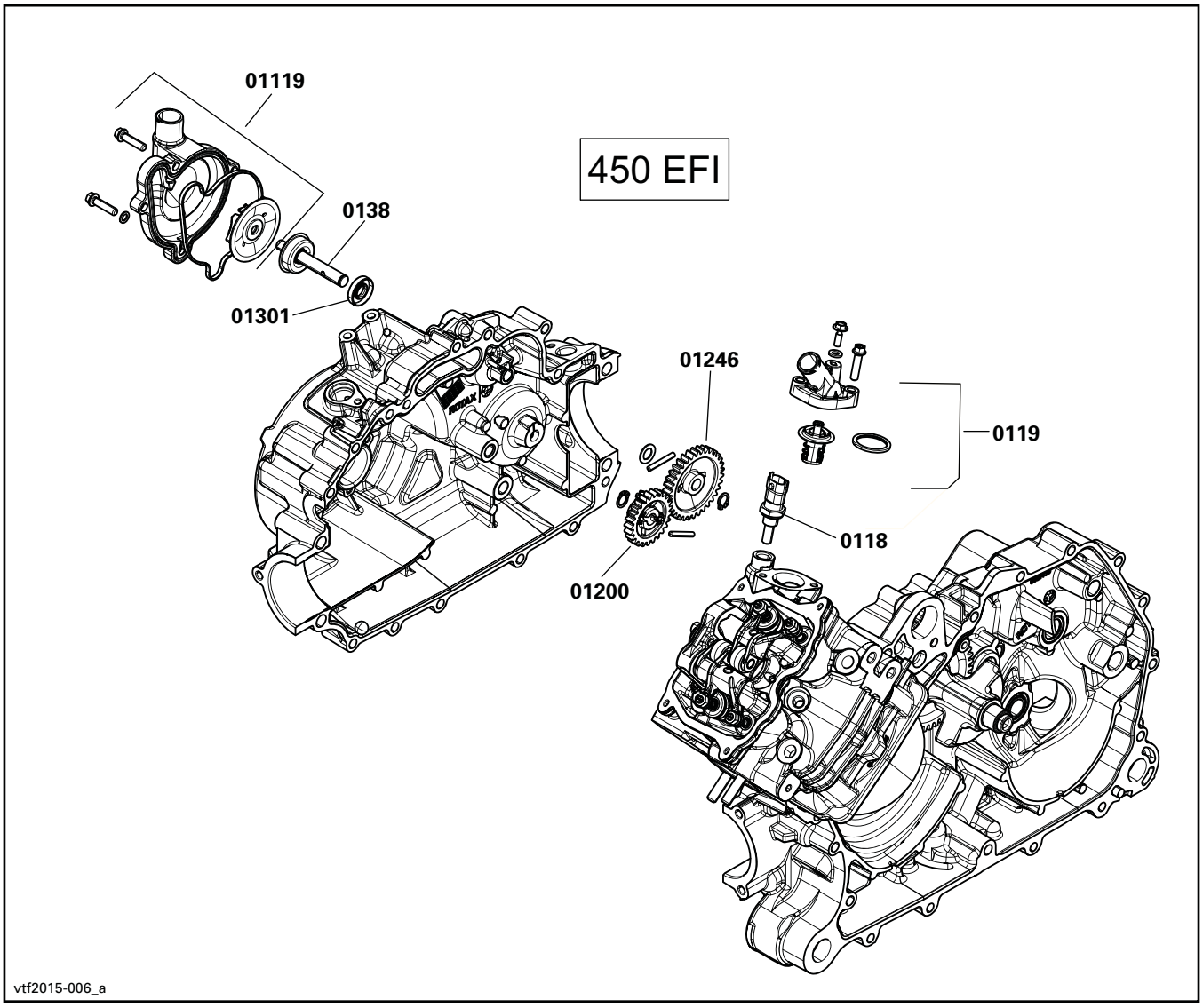

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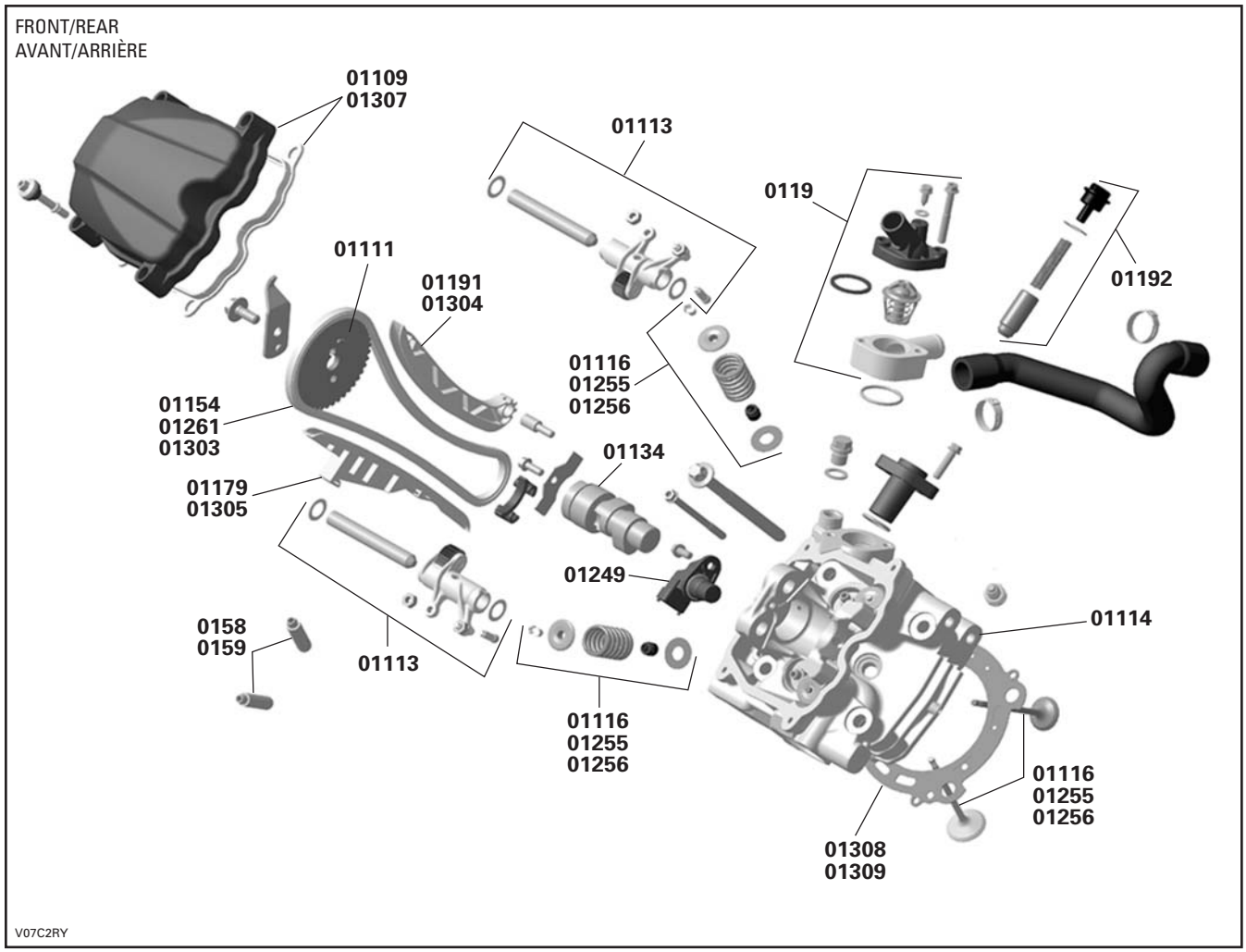

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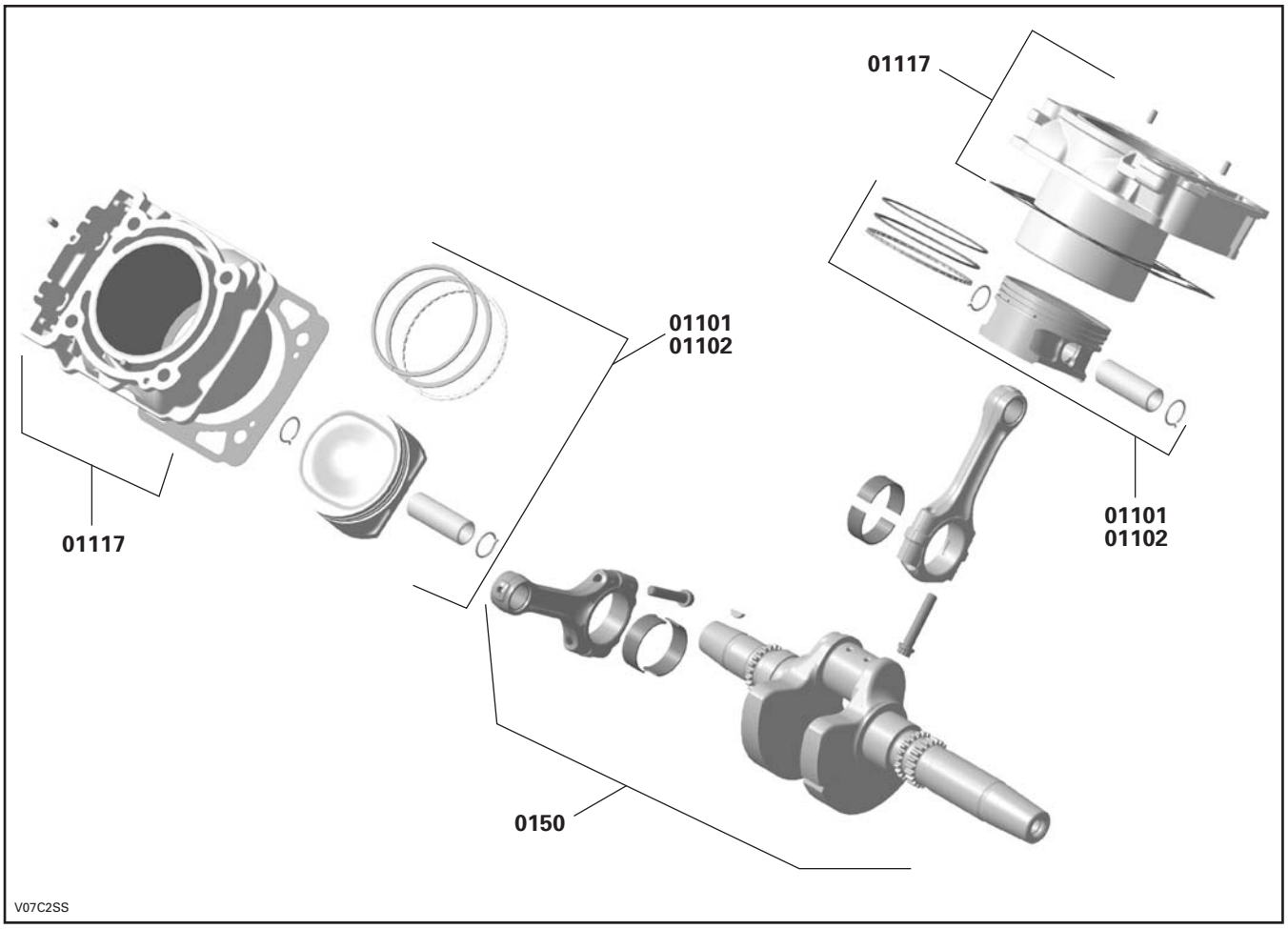

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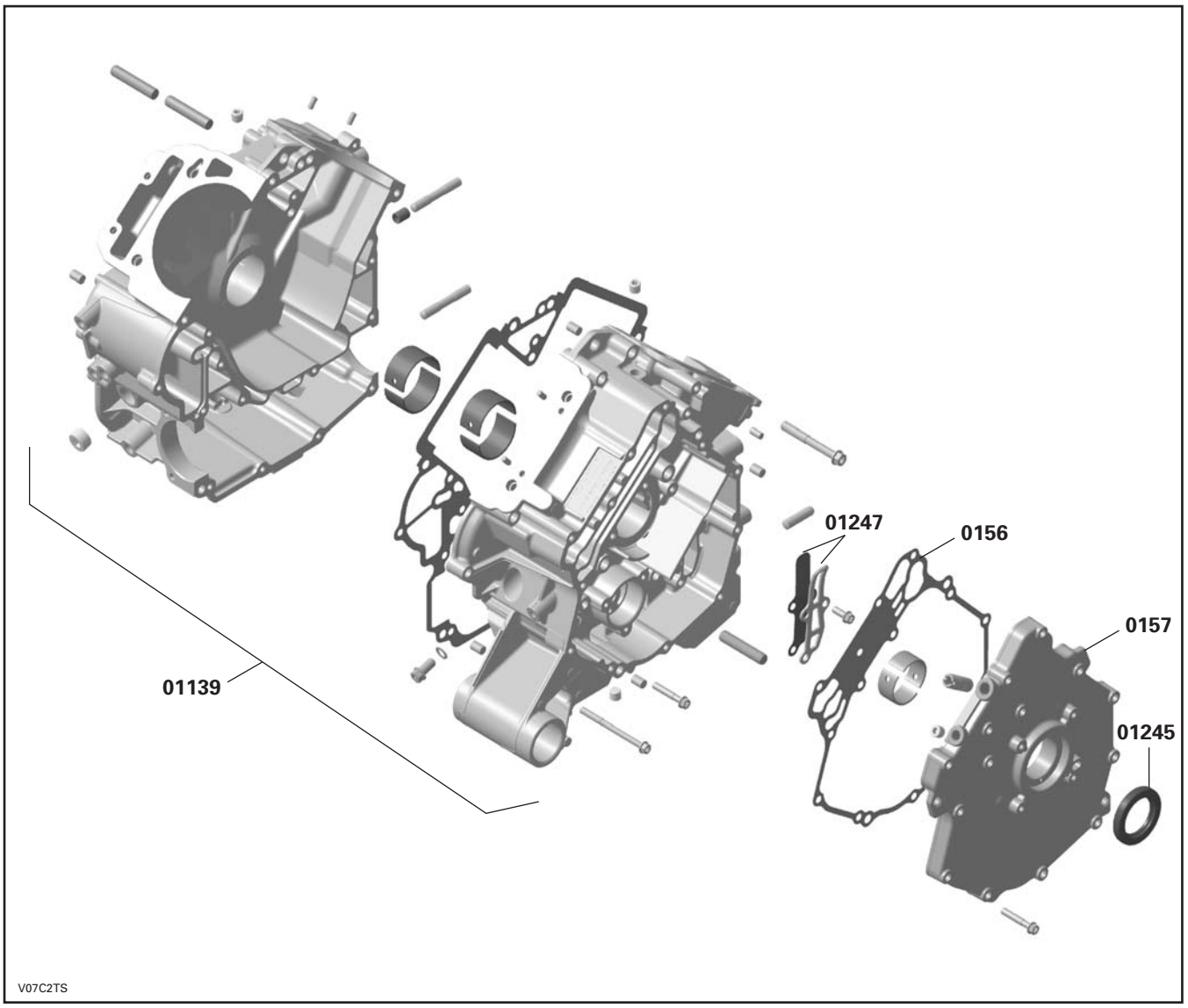

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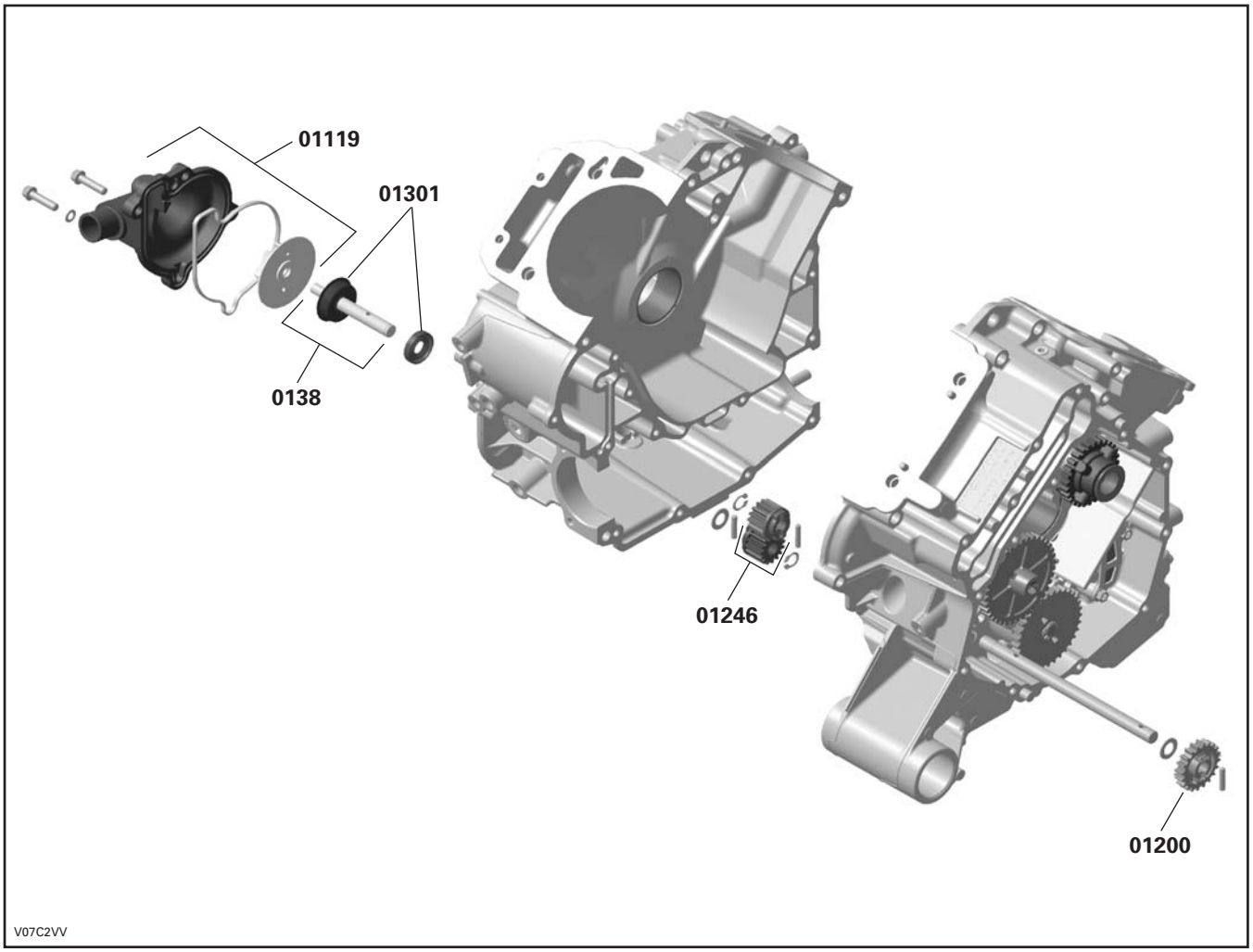

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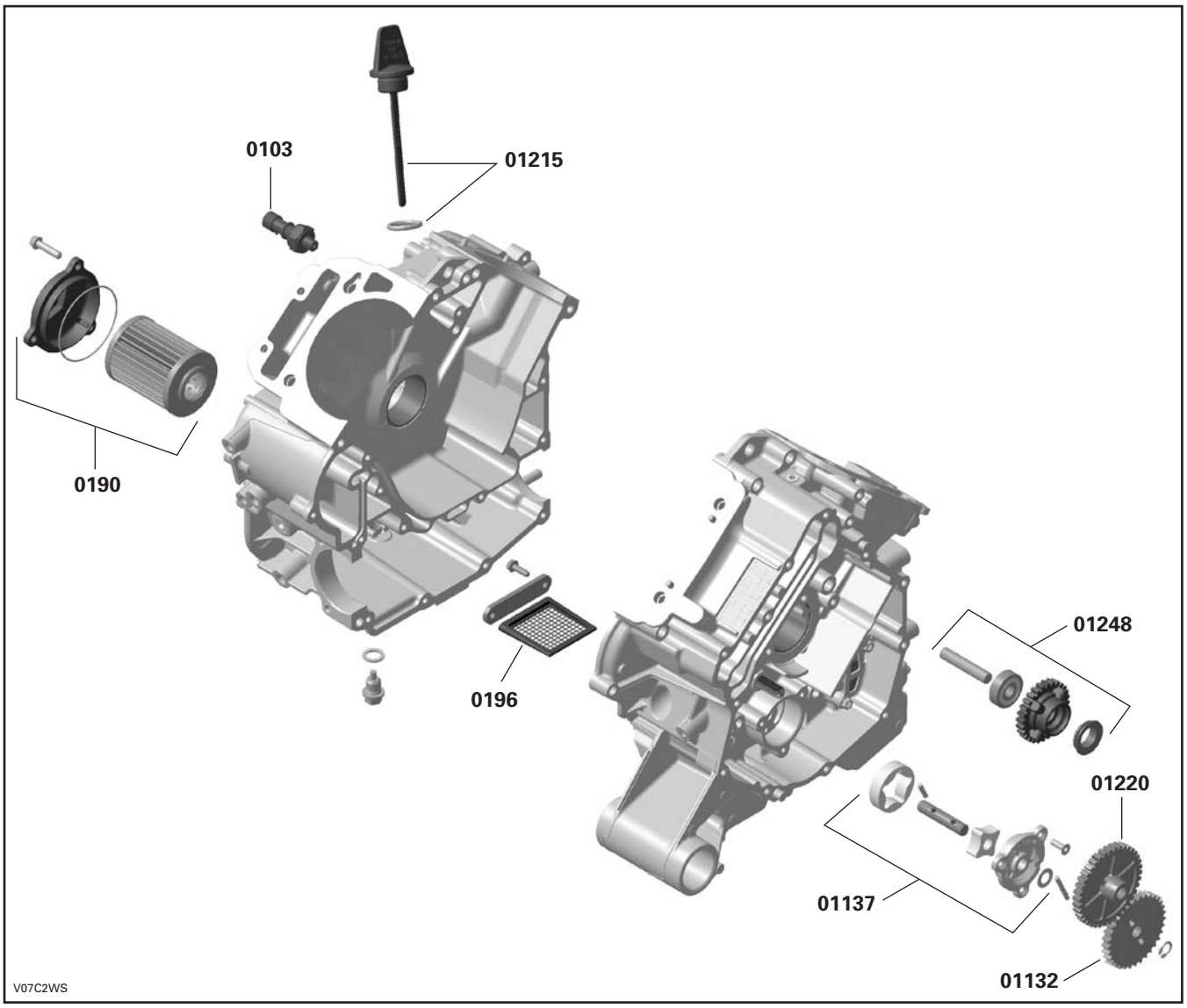

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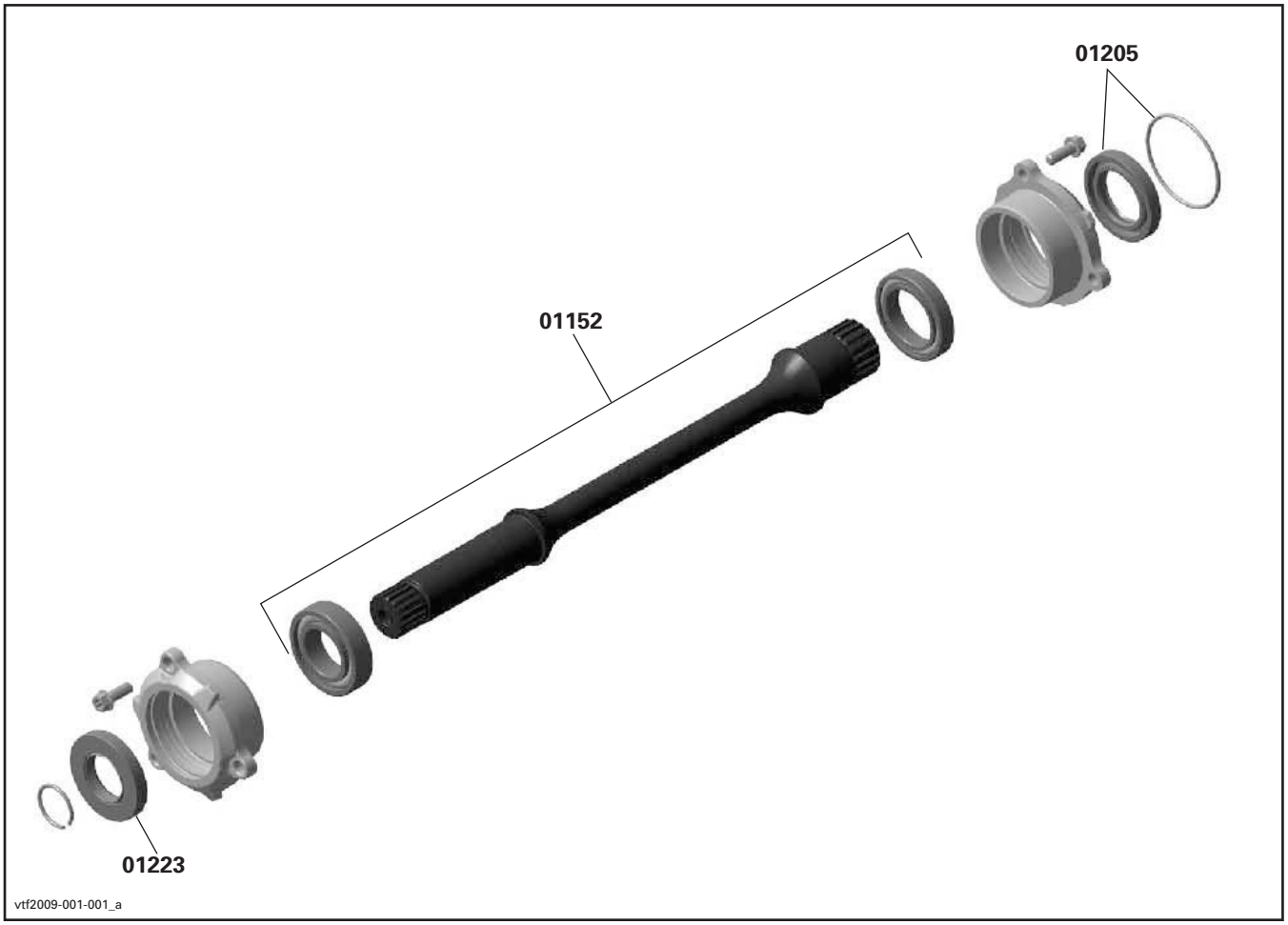

FRONT/REAR
AVANT/ARRIÈRE
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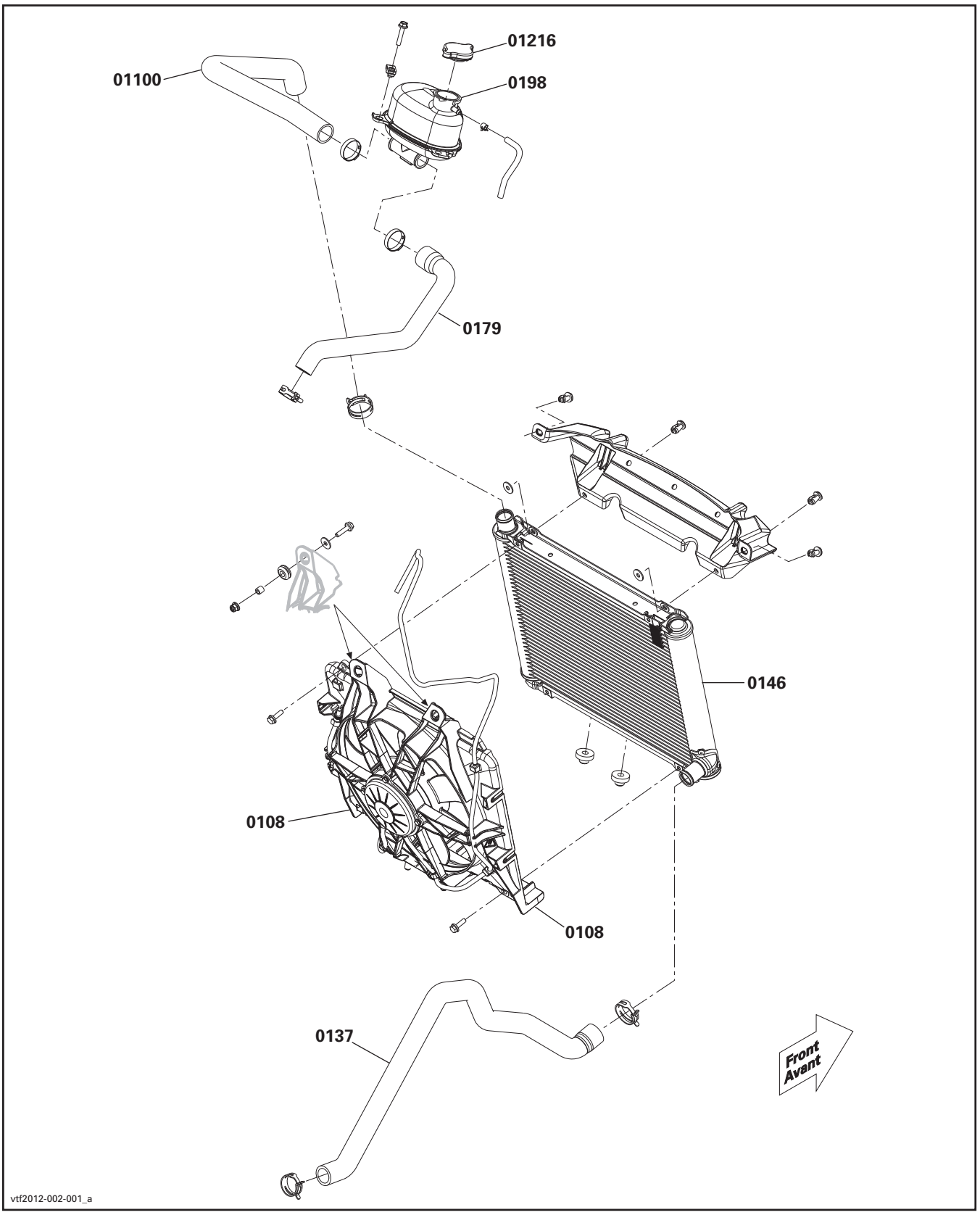

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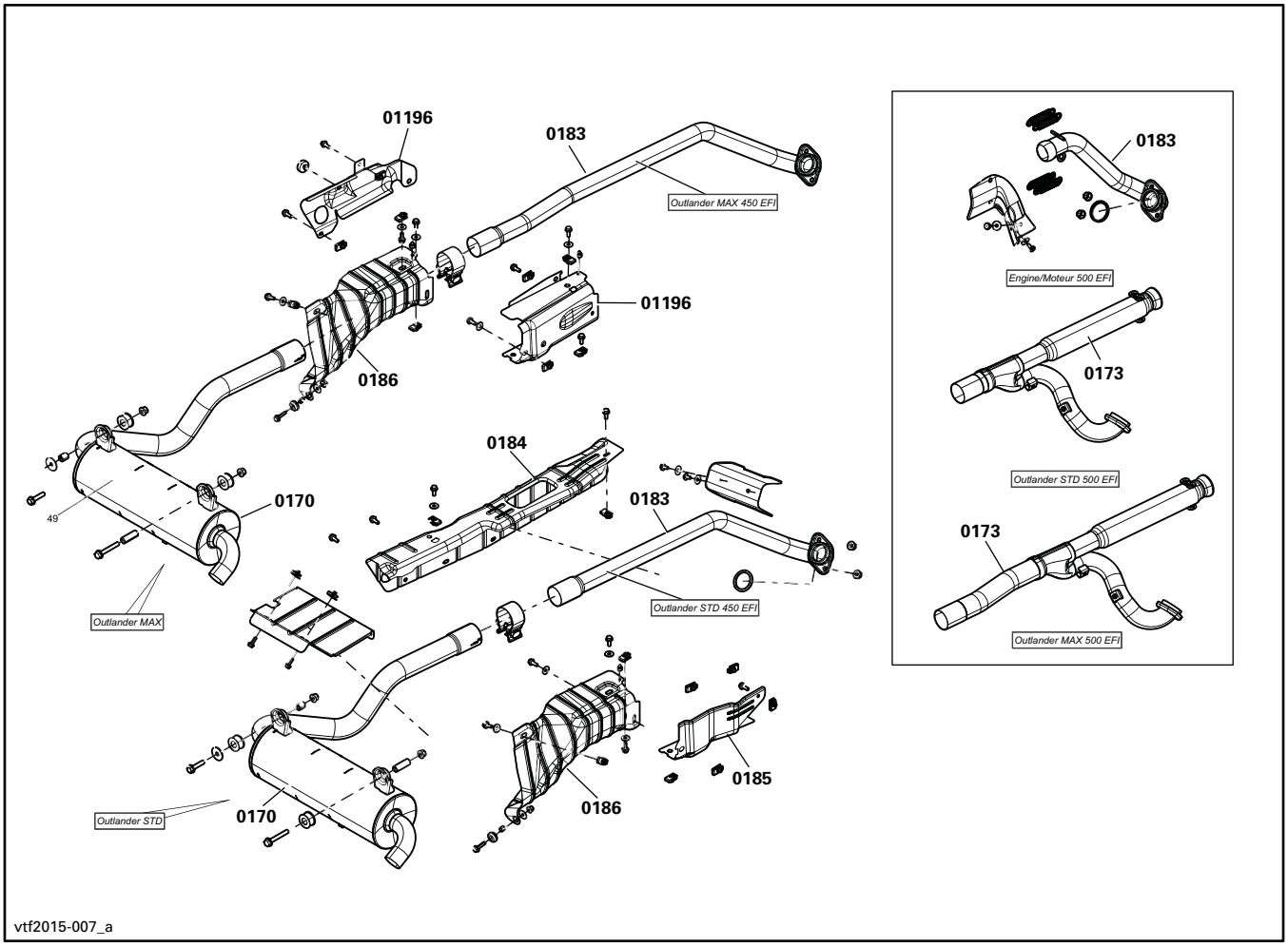

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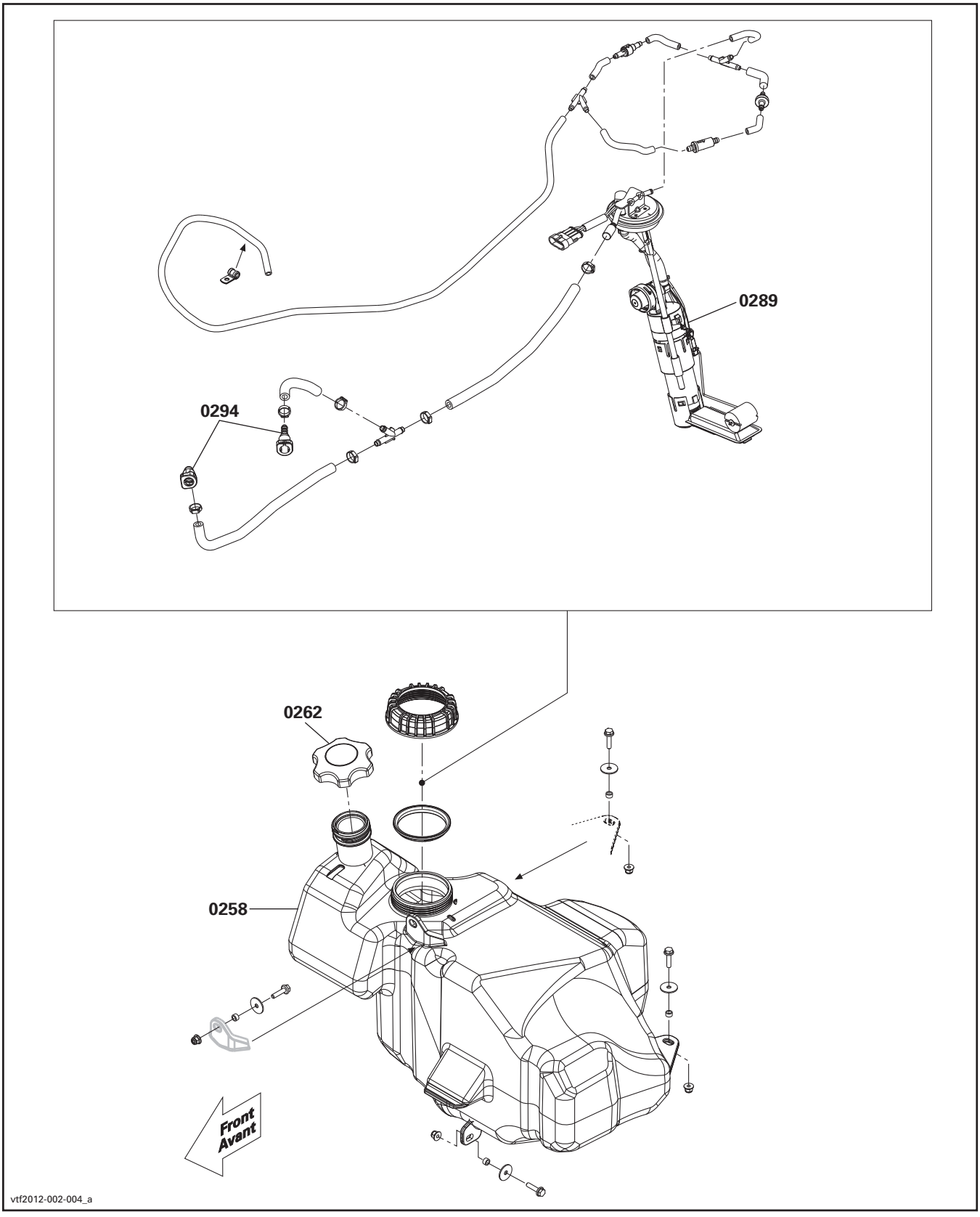

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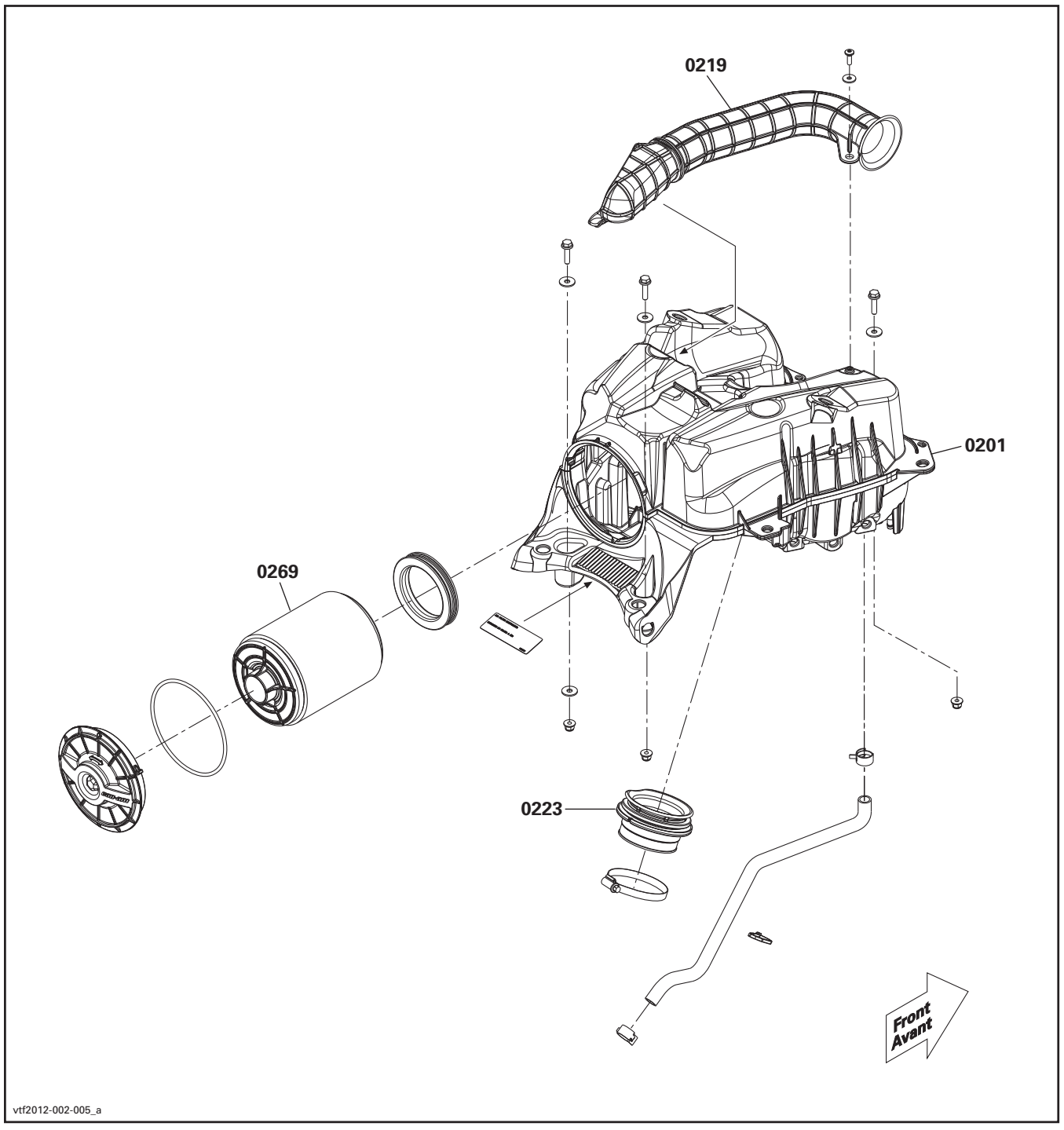

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Outlander MAX 450 EFI
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Outlander STD 450 EFI
Outlander MAX
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Outlander STD
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Engine/Moteur 500 EFI
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Outlander STD 500 EFI
0173
Outlander MAX 500 EFI
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SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTLANDER MAX 500
			1	2	3	4
02	**00**	**NO LABOR INVOLVED** **AUCUNE MAIN D'OEUVRE**	**0**	**0**	**0**	**0**
02	01	AIR INTAKE SILENCER (ASS'Y) SILENCIEUX D'ADMISSION D'AIR (COMPLET)	1.8	1.8	1.8	1.8
02	06	THROTTLE CABLE CÂBLE D'ACCÉLÉRATEUR	0.6	0.6	0.6	0.6
02	16	INTAKE ADAPTOR ADAPTATEUR D'ADMISSION	1.0	1.0	1.0	1.0
02	19	AIR INTAKE TUBE TUYAU D'ADMISSION D'AIR	1.0	1.0	1.0	1.0
02	23	REAR AIR INTAKE TUBE AND/OR SLEEVE TUYAU D'ADMISSION D'AIR ARRIÈRE ET/OU DOUILLE	1.8	1.8	1.8	1.8
02	46	AIR TEMPERATURE SENSOR CAPTEUR DE TEMPÉRATURE D'AIR	0.3	0.3	0.3	0.3
02	57	FUEL FILTER FILTRE À ESSENCE	1.0	1.0	1.0	1.0
02	58	FUEL TANK RÉSERVOIR D'ESSENCE	1.6	1.6	1.6	1.6
02	59	INTAKE COVER AND/OR SEAL COUVERCLE D'ADMISSION ET/OU JOINT D'ÉTANCHÉITÉ	0.3	0.3	0.3	0.3
02	60	FUEL CAP BOUCHON DU RÉSERVOIR À ESSENCE	0.3	0.3	0.3	0.3
02	69	AIR FILTER FILTRE À AIR	0.3	0.3	0.3	0.3
02	72	INTAKE MANIFOLD CONNECTEUR D'ADMISSION	1.9	1.9	1.9	1.9
02	79	FUEL RAIL (1 OR 2) RAMPE D'ESSENCE (1 OU 2)	1.9	1.9	1.9	1.9
02	81	THROTTLE BODY (ASS'Y) CARTER ACCÉLÉRATEUR (COMPLET)	1.7	1.7	1.7	1.7
02	82	THROTTLE SENSOR CAPTEUR POSITION D'ACCÉLÉRATEUR	1.5	1.5	1.5	1.5
02	84	IDLE BY-PASS VALVE VALVE DU RALENTI	1.5	1.5	1.5	1.5
02	89	FUEL PUMP MODULE MODULE POMPE À ESSENCE	1.0	1.0	1.0	1.0
02	94	FEMALE QUICK FITTING CONNECTEUR RAPIDE FEMELLE	0.4	0.4	0.4	0.4
02	99	FUEL INJECTION HOSE (ASS'Y) BOYAU À INJECTION D'ESSENCE (COMPLET)	0.4	0.4	0.4	0.4

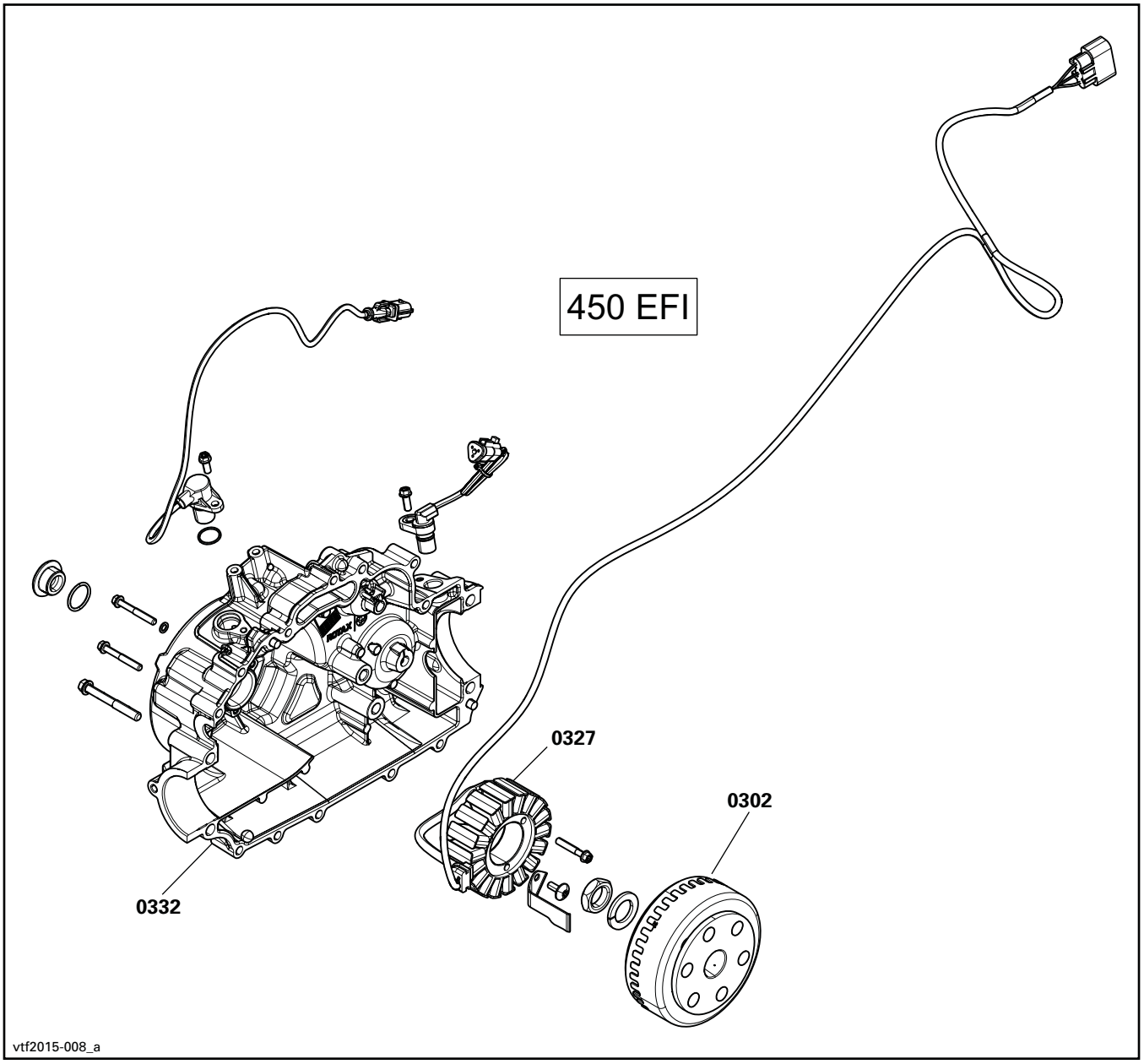
CARBURETOR AND FUEL SYSTEM
CARBURATEUR ET SYSTÈME D'ALIMENTATION D'ESSENCE

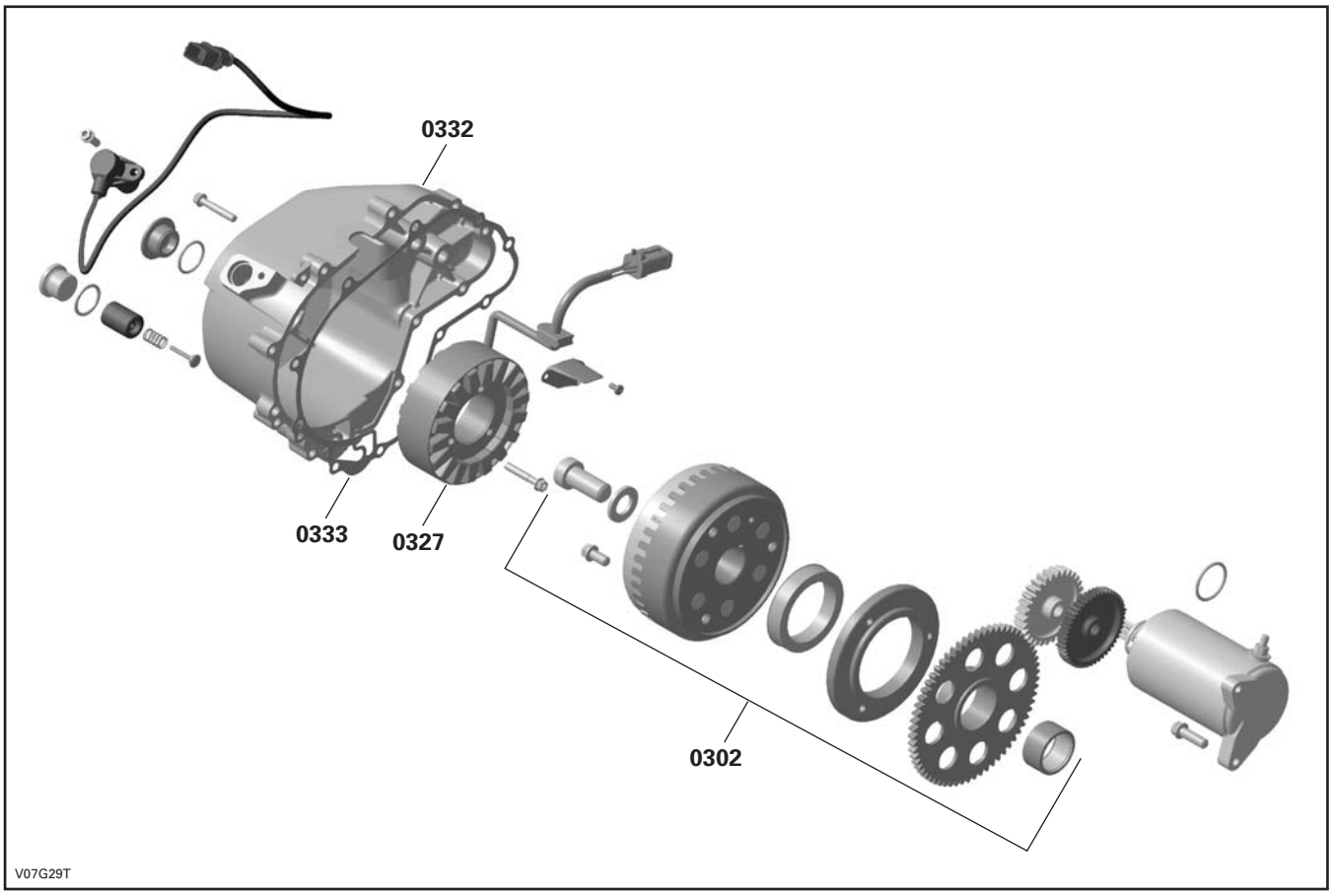



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IGNITION SYSTEM
SYSTÈME D'ALLUMAGE

SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTLANDER MAX 500
			1	2	3	4
03	**00**	**NO LABOR INVOLVED AUCUNE MAIN D'OEUVRE**	**0**	**0**	**0**	**0**
03	02	MAGNETO (ASS'Y) MAGNÉTO (COMPLET)	3.9	3.9	2.3	2.3
03	08	IGNITION COIL (EACH) BOBINE D'ALLUMAGE (CHAQUE)	0.5	0.5	0.5	0.5
03	10	IGNITION CABLE CÂBLE D'ALLUMAGE	0.5	0.5	0.5	0.5
03	27	STATOR (ASS'Y) STATOR (COMPLET)	3.7	3.7	2.0	2.0
03	32	MAGNETO COVER COUVERCLE DE MAGNÉTO	3.7	3.7	2.1	2.1
03	33	MAGNETO COVER GASKET JOINT D'ÉTANCHÉITÉ COUVERCLE DE MAGNÉTO			2.0	2.0


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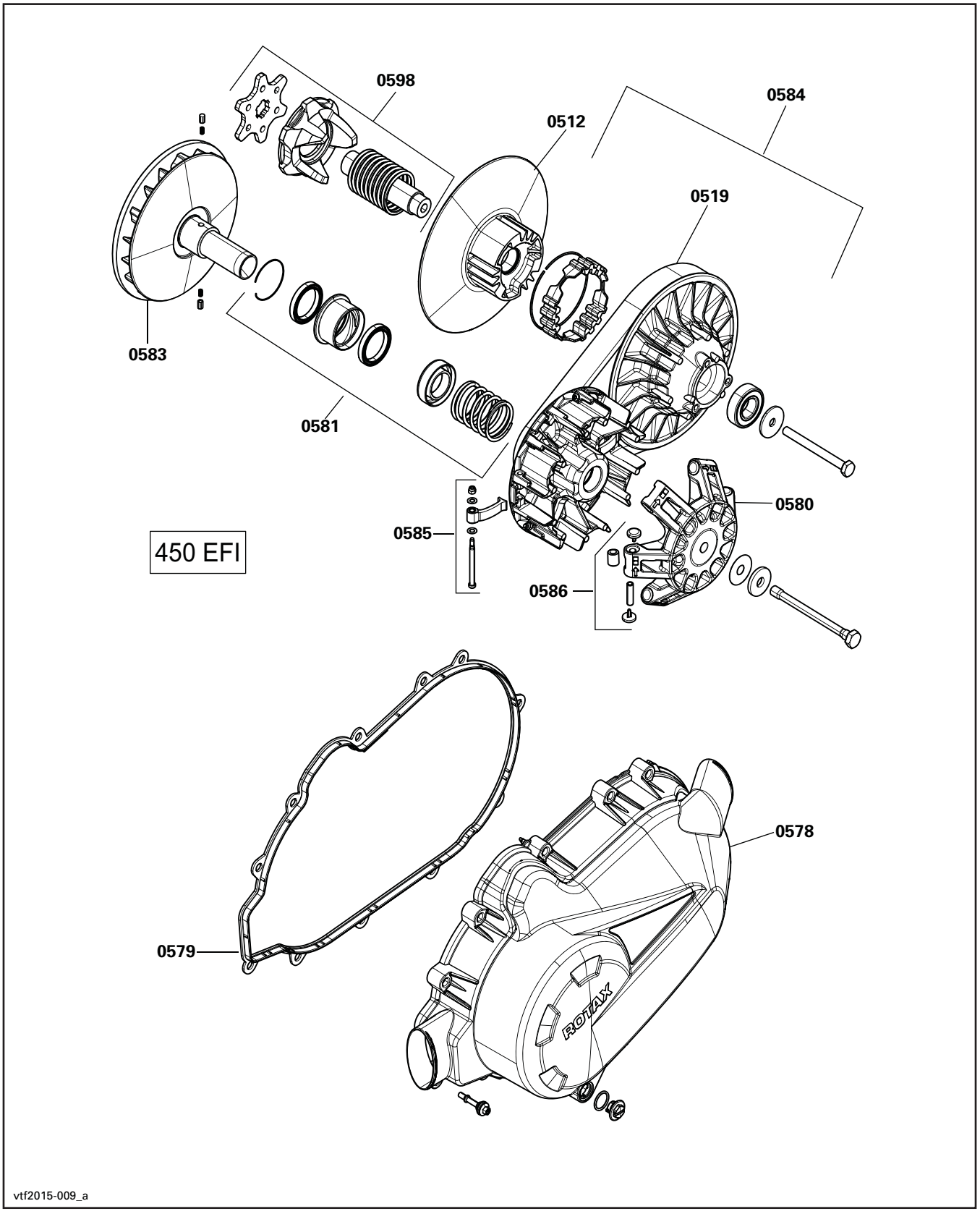
SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTLANDER MAX 500
			1	2	3	4
04	**00**	**NO LABOUR INVOLVED AUCUNE MAIN-D'OEUVRE**	**0**	**0**	**0**	**0**
04	02	ELECTRIC STARTER (ASS'Y) DÉMARREUR (COMPLET)	0.3	0.3	1.6	1.6
04	03	STARTER RELAY SOLÉNOÏDE DE DÉMARRAGE	0.3	0.3	0.3	0.3
04	19	STARTER DRIVE LANCEUR DÉMARREUR	1.0	1.0	1.9	1.9

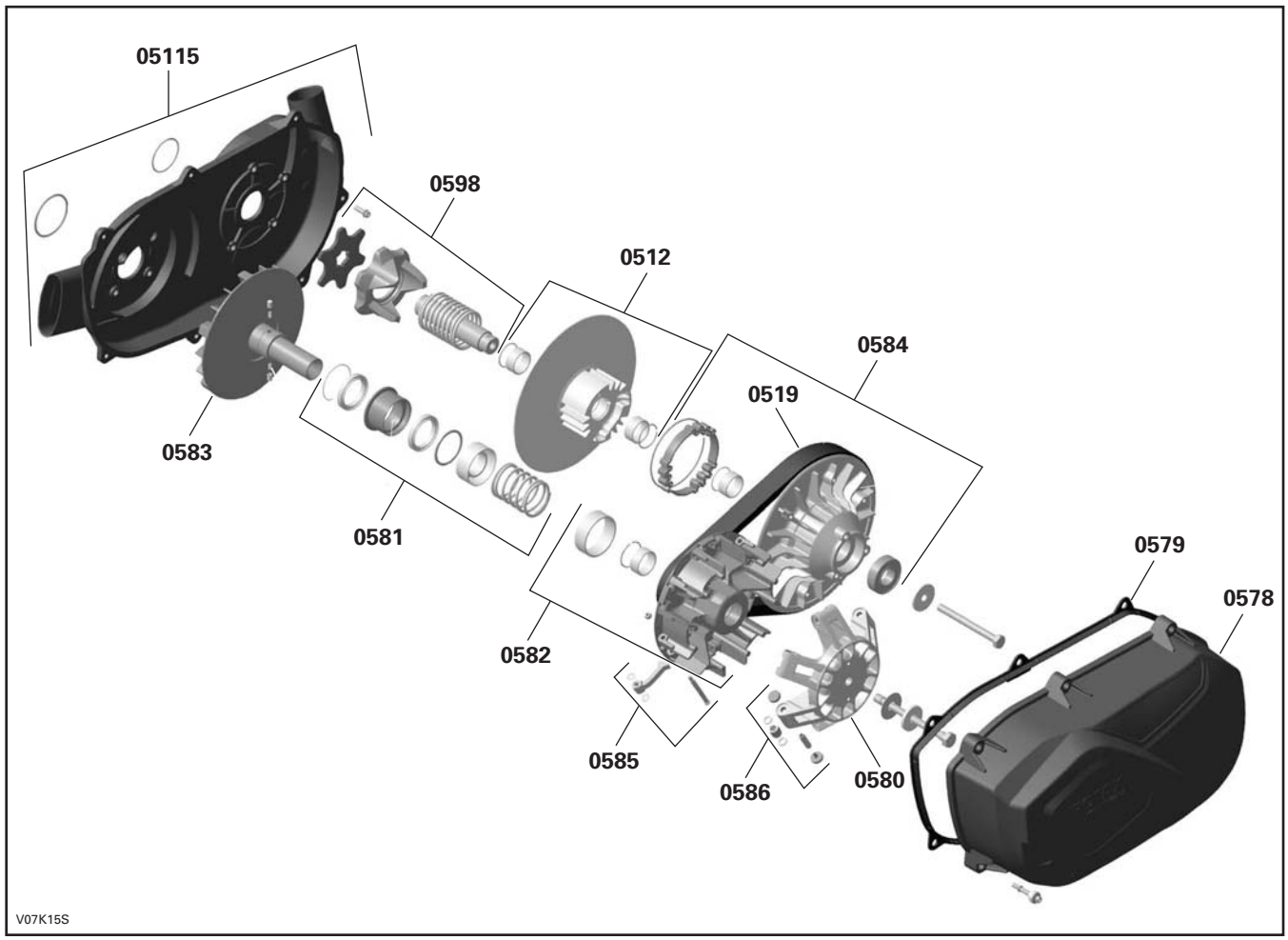
TRANSMISSION AND LINKAGE SYSTEM
SYSTÈME DE TRANSMISSION ET DE TRINGLERIE

SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTLANDER MAX 500
			1	2	3	4
05	**00**	**NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE IMPLIQUÉE**	**0**	**0**	**0**	**0**
05	12	DRIVEN PULLEY SLIDING HALF DEMI-POULIE MENÉE COULISSANTE	0.5	0.6	0.5	0.6
05	19	BELT COURROIE	0.4	0.5	0.4	0.5
05	55	LEVER BUTTON BOUTON DE LEVIER	0.3	0.3	0.3	0.3
05	56	LEVER (ASS'Y) AND/OR LEVER SPRING LEVIER (COMPLET) ET/OU RESSORT DE LEVIER	0.3	0.3	0.3	0.3
05	59	SPEED SENSOR CAPTEUR DE VITESSE	0.6	0.6	0.6	0.6
05	77	LEVER LEVIER	0.7	0.7	0.7	0.7
05	78	CVT COVER COUVERCLE CVC	0.3	0.4	0.3	0.4
05	79	GASKET JOINT D'ÉTANCHÉITÉ	0.3	0.4	0.3	0.4
05	80	GOVERNOR CUP COUPOLE RÉGULATEUR	0.6	0.7	0.6	0.7
05	81	ONE WAY CLUTCH, FLANGE, RING, SPRING EMBRAYAGE À ROUE LIBRE, FLASQUE, ANNEAU, RESSORT	0.6	0.7	0.6	0.7
05	82	DRIVE PULLEY (ASS'Y) POULIE MOTRICE (COMPLET)	0.7	0.8	0.7	0.8
05	83	DRIVE PULLEY FIXED HALF POULIE MOTRICE FIXE	0.7	0.8	0.7	0.8
05	84	DRIVEN PULLEY OUTER CAM AND/OR SPRING CAME DE POULIE MENÉE EXTERNE ET/OU RESSORT	0.5	0.6	0.5	0.6
05	85	CENTRIFUGAL LEVER LEVIER CENTRIFUGE	0.8	0.9	0.8	0.9
05	86	SLIDER SHOES GLISSIÈRES	0.7	0.8	0.7	0.8
05	87	LEVER SPRING LEVIER À RESSORT	0.3	0.3	0.3	0.3
05	89	REMOVE AND REPLACE TRANSMISSION (ASS'Y) REMPLACEMENT DE LA TRANSMISSION (COMPLET)			5.1	5.1
05	91	MAIN SHAFT (ASS'Y) ARBRE DE RENVOI (COMPLET)			6.7	6.7
05	95	AIR INTAKE (CVT) ENTRÉE D'AIR (CVT)	0.3	0.3	0.3	0.3
05	96	AIR OUTLET (CVT) SORTIE D'AIR (CVT)	0.3	0.3	0.3	0.3

SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTLANDER MAX 500
			1	2	3	4
05	97	FLEXIBLE ADAPTOR ADAPTATEUR FLEXIBLE	0.3	0.3	0.3	0.3
05	98	CAM, PLATE, DRIVEN SHAFT, SPRING CAME, PLAQUE, ARBRE POULIE MENÉE, RESSORT	0.5	0.6	0.5	0.6
05	99	OUTPUT SHAFT ARBRE DE SORTIE			5.9	5.9
05	100	REAR OUTPUT SHAFT SEALS ANNEAUX ÉTANCHÉITÉ DE L'ARBRE DE SORTIE ARRIÈRE			2.2	2.2
05	101	GEARS KIT/MAIN SHAFT ENSEMBLE D'ENGRENAGES/ARBRE PRINCIPAL			6.0	6.0
05	102	SHIFT SHAFT (ASS'Y) ARBRE D'EMBRAYAGE (COMPLET)			6.0	6.0
05	103	SHIFT DRUM TAMBOUR D'EMBRAYAGE			6.0	6.0
05	104	INDEX LEVER (ASS'Y) LEVIER D'INDEXATION (COMPLET)			6.0	6.0
05	105	MAIN SHAFT SEAL JOINT D'ÉTANCHÉITÉ DE L'ARBRE PRINCIPAL			0.9	0.9
05	106	LH HOUSING GEAR AND/OR BEARINGS AND/OR GEAR LOGEMENT DE TRANSMISSION GAUCHE ET/OU ROULEMENT À BILLE ET/OU ENGRENAGE			6.0	6.0
05	107	SPACER AND/OR O-RING ENTRETOISE ET/OU JOINT TORIQUE			0.9	0.9
05	108	ACTUATOR AND/OR FORK AND/OR SEAL ACTUATEUR ET/OU FOURCHETTE ET/OU JOINT D'ÉTANCHÉITÉ	0.5	0.5	0.5	0.5
05	109	FORK AND/OR PIN FOURCHETTE ET/OU GOUPILLE	0.7	0.7	0.7	0.7
05	110	CENTER HOUSING GEAR AND/OR BEARING LOGEMENT DE TRANSMISSION CENTRE ET/OU ROULEMENT			6.0	6.0
05	111	RH HOUSING GEAR AND/OR BEARING LOGEMENT DE TRANSMISSION DROIT ET/OU ROULEMENT			5.9	5.9
05	113	SHIFTING SWITCH INTERRUPTEUR D'EMBRAYAGE	0.3	0.3	0.3	0.3
05	114	SHIFT SHAFT SEAL JOINT D'ÉTANCHÉITÉ D'ARBRE D'EMBRAYAGE			0.7	0.7
05	115	CVT AIR GUIDE AND/OR O-RINGS GUIDE D'AÉRATION ET/OU JOINT D'ÉTANCHÉITÉ			0.8	0.8
05	120	GEARBOX POSITION SENSOR CAPTEUR DE POSITION D'ENGRENAGE	0.4	0.4	0.4	0.4
05	166	SHIFT ARM BASE BASE DU BRAS D'EMBRAYAGE	0.5	0.5	0.5	0.5

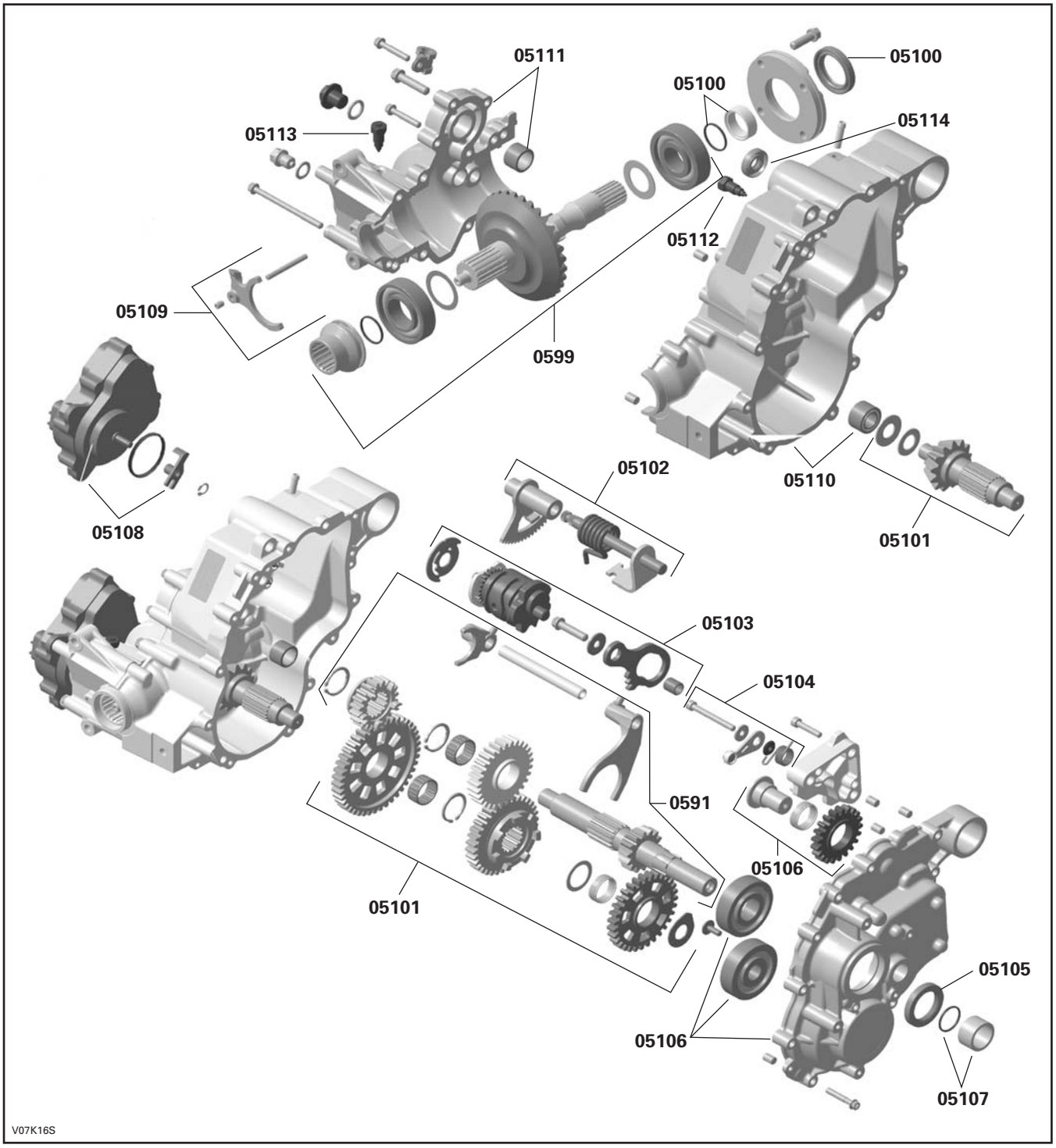
TRANSMISSION AND LINKAGE SYSTEM
SYSTÈME DE TRANSMISSION ET DE TRINGLERIE




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TRANSMISSION AND LINKAGE SYSTEM
SYSTÈME DE TRANSMISSION ET DE TRINGLERIE

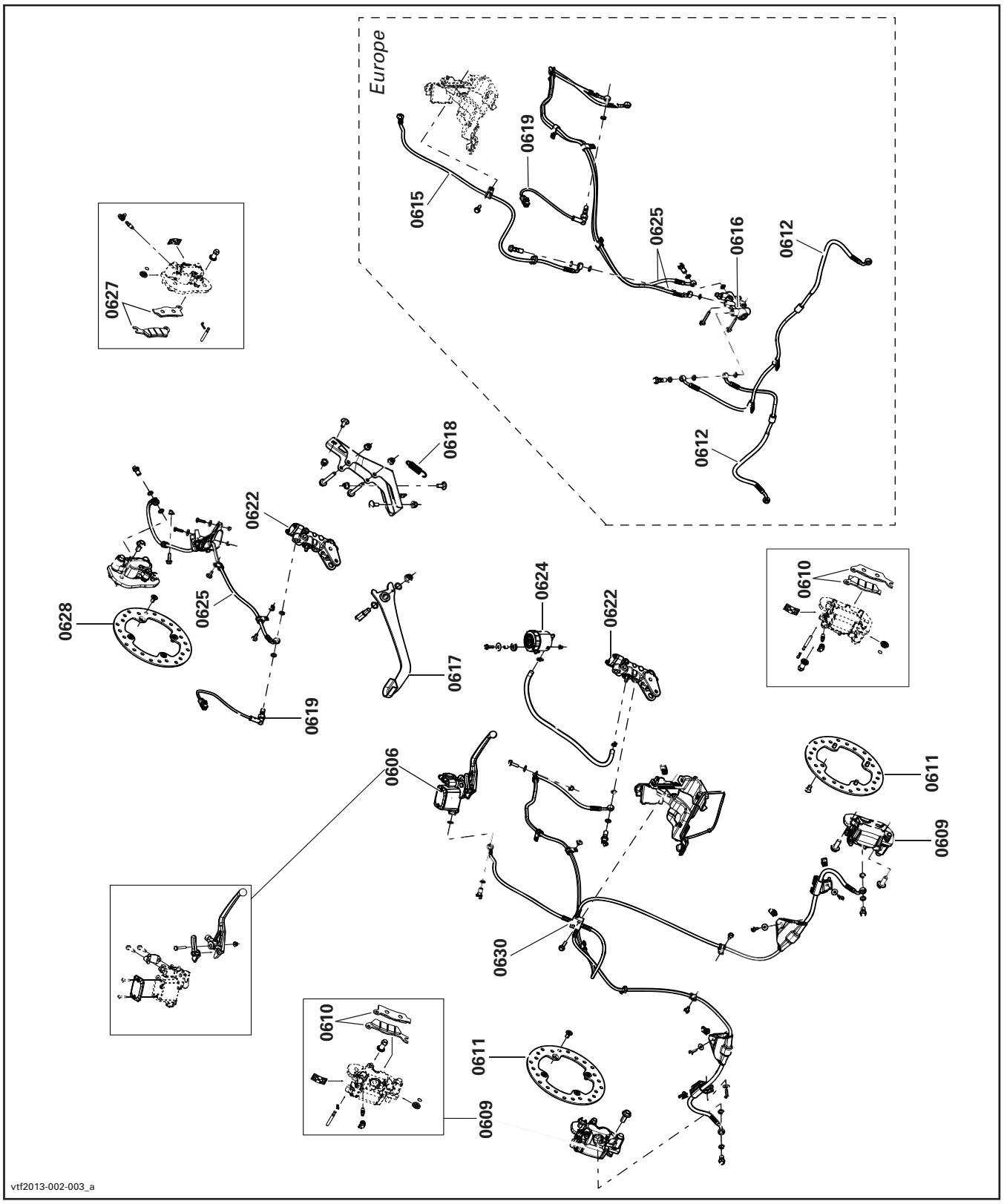
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SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTLANDER MAX 500
			1	2	3	4
06	**00**	**NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE**	**0**	**0**	**0**	**0**
06	06	MASTER CYLINDRE MAÎTRE-CYLINDRE	0.3	0.3	0.3	0.3
06	09	FRONT CALIPER (RH OR LH) ÉTRIER AVANT (DROIT OU GAUCHE)	0.4	0.4	0.4	0.4
06	10	FRONT BRAKE PAD (RH OR LH) PLAQUETTE DE FREIN AVANT (DROIT OU GAUCHE)	0.3	0.3	0.3	0.3
06	11	FRONT BRAKE DISC (RH OR LH) DISQUE DE FREIN AVANT (DROIT OU GAUCHE)	0.5	0.5	0.5	0.5
06	12	FRONT FLEXIBLE BRAKE HOSE BOYAU FLEXIBLE DE FREIN AVANT	0.6	0.6	0.6	0.6
06	15	FRONT BRAKE HANDLE HOSE BOYAU DE FREIN DE LA MANETTE AVANT	0.6	0.6	0.6	0.6
06	16	FRONT MASTER CYLINDER MAÎTRE-CYLINDRE AVANT	0.8	0.8	0.8	0.8
06	17	REAR BRAKE PEDAL PÉDALE DE FREIN ARRIÈRE	0.4	0.4	0.4	0.4
06	18	REAR BRAKE PEDAL SPRING RESSORT DE LA PÉDALE DE FREIN ARRIÈRE	0.3	0.3	0.3	0.3
06	19	BRAKE SWITCH INTERRUPTEUR DE FREIN	0.5	0.6	0.5	0.6
06	22	REAR MASTER CYLINDER MAÎTRE-CYLINDRE ARRIÈRE	0.7	0.7	0.7	0.7
06	23	REAR OIL HOUSING HOSE BOYAU CARTER D'HUILE ARRIÈRE	0.6	0.6	0.6	0.6
06	24	REAR OIL HOUSING CARTER D'HUILE ARRIÈRE	0.3	0.3	0.3	0.3
06	25	REAR BRAKE HOSE BOYAU DE FREIN ARRIÈRE	0.6	0.6	0.6	0.6
06	26	REAR CALIPER ÉTRIER ARRIÈRE	0.4	0.4	0.4	0.4
06	27	REAR BRAKE PAD PLAQUETTE DE FREIN ARRIÈRE	0.3	0.3	0.3	0.3
06	28	REAR BRAKE DISC AND/OR HUB DISQUE DE FREIN ARRIÈRE ET/OU MOYEU	0.5	0.5	0.5	0.5
06	30	BRAKE LINE BOYAU DE FREIN	3.5	3.5	3.8	3.5

BRAKE SYSTEM
SYSTÈME DE FREIN

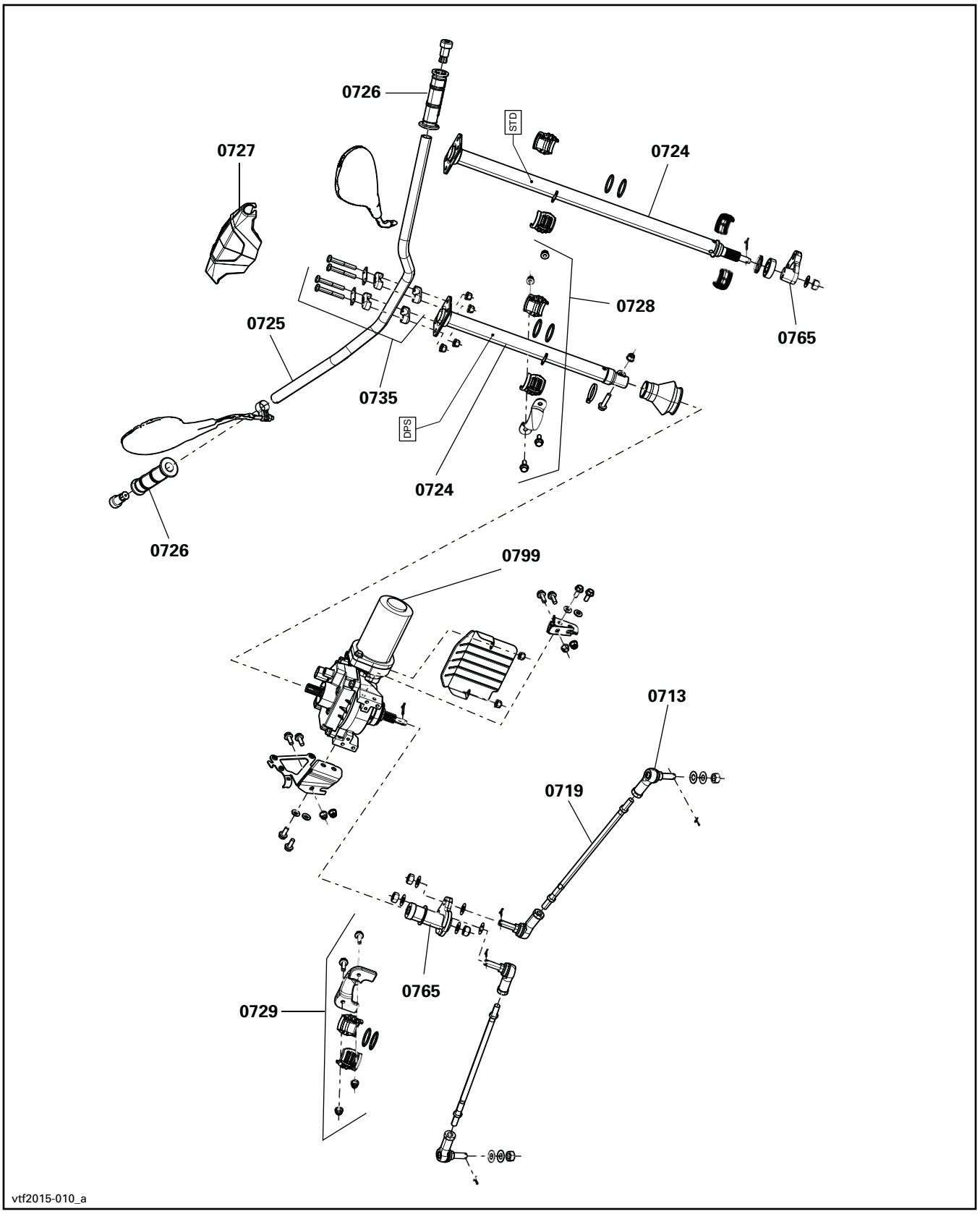
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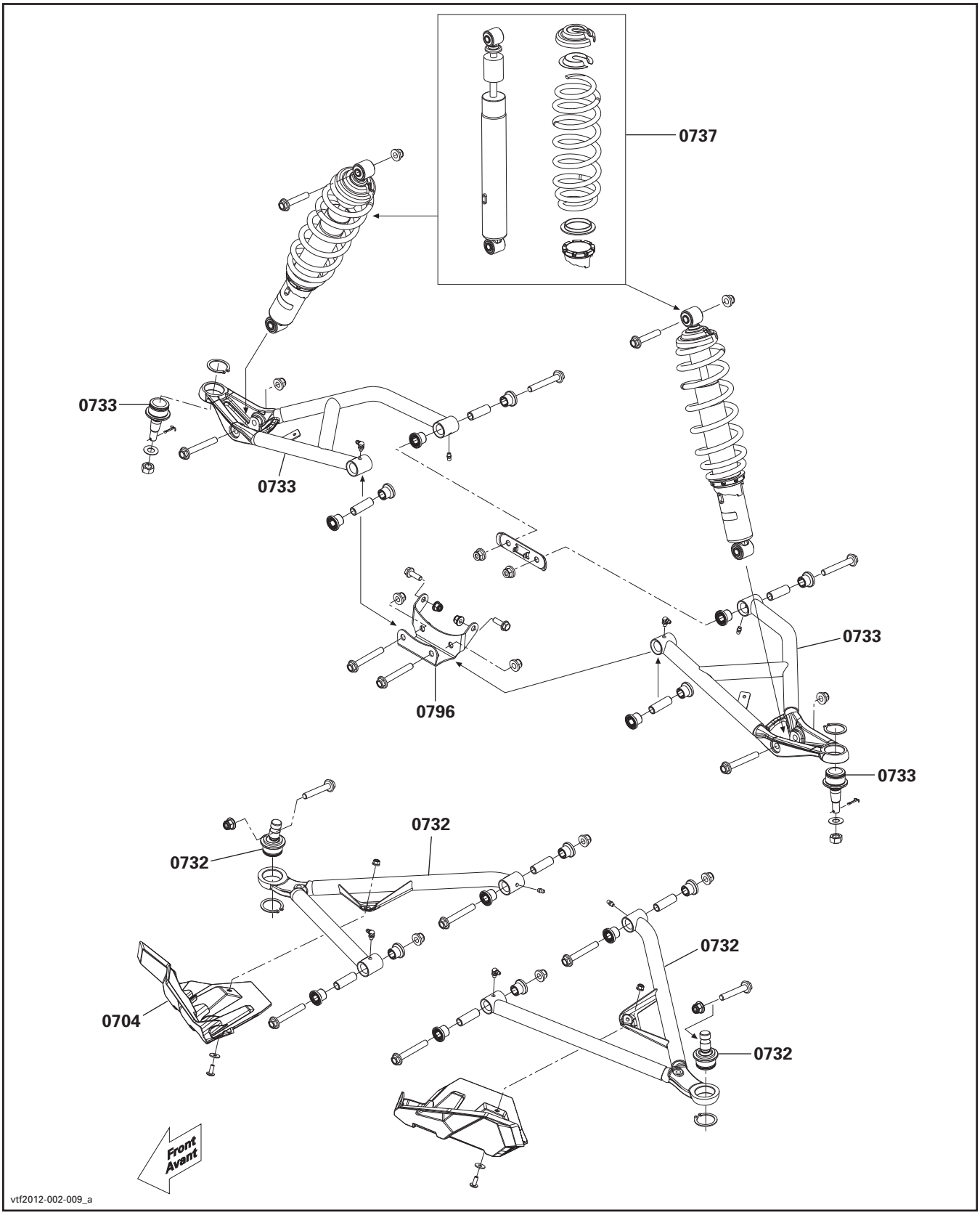
SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTLANDER MAX 500
			1	2	3	4
07	**00**	**NO LABOR INVOLVED AUCUNE MAIN-D'OEUVRE**	**0**	**0**	**0**	**0**
07	04	ARM PROTECTOR (RH OR LH) PROTECTEUR DE BRAS (DROIT OU GAUCHE)	0.3	0.3	0.3	0.3
07	05	STEERING CLAMP AND/OR STEERING COVER SUPPORT BRIDE DE DIRECTION ET/OU SUPPORT DU COUVRE-GUIDON	0.4	0.4	0.4	0.4
07	12	INTERNAL BALL JOINT (RH OR LH) JOINT À ROTULE INTERNE (DROIT AU GAUCHE)	0.9	0.9	0.9	0.9
07	13	EXTERNAL BALL JOINT (RH OR LH) JOINT À ROTULE EXTERNE (DROIT OU GAUCHE)	0.8	0.8	0.8	0.8
07	19	TIE ROD (RH OR LH) BARRE D'ACCOUPLEMENT (DROIT OU GAUCHE)	0.9	0.9	0.9	0.9
07	24	MAIN TUBE TUBE PRINCIPAL	2.6	2.6	2.6	2.6
07	25	HANDLEBAR GUIDON	1.1	1.1	1.1	1.1
07	26	HANDLEBAR GRIP KIT (RH AND/OR LH) ENSEMBLE DE GAINE DE GUIDON (DROIT ET/OU GAUCHE)	0.3	0.3	0.3	0.3
07	27	STEERING COVER COUVRE-GUIDON	0.3	0.3	0.3	0.3
07	28	HALF HOUSING AND HOUSING BUSHING DEMI-LOGEMENT ET DOUILLE DE LOGEMENT	2.1	2.1	2.1	2.1
07	29	LOWER STEERING MAIN TUBE BUSHING DOUILLE INFÉRIEURE DE LA COLONNE DE DIRECTION	1.0	1.0	1.0	1.0
07	32	LOWER ARM AND/OR BALL JOINT (RH OR LH) BRAS INFÉRIEUR ET/OU JOINT À ROTULE (DROIT OU GAUCHE)	0.7	0.7	0.7	0.7
07	33	UPPER ARM (RH OR LH) BRAS DE SUSPENSION SUPÉRIEUR (DROIT OU GAUCHE)	0.8	0.8	0.8	0.8
07	35	HANDLE STEERING SUPPORT (ALL) SUPPORT DE GUIDON (TOUS)	0.3	0.3	0.3	0.3
07	37	FRONT SHOCK AND/OR SPRING AND/OR STOPPER AND/OR PROTECTOR AND/OR SEAT (RH OR LH) AMORTISSEUR AVANT ET/OU RESSORT ET/OU BUTÉE ET/OU SIÈGE ET/OU PROTECTEUR (DROIT OU GAUCHE)	0.7	0.7	0.7	0.7
07	40	FRONT DIFFERENTIEL (ASS'Y) DIFFÉRENTIEL AVANT (COMPLET)	2.4	2.4	2.4	2.4
07	42	FRONT PROPELLER SHAFT (ASS'Y) ARBRE DE PROPULSION AVANT (COMPLET)	1.3	1.3	1.3	1.3
07	45	CV JOINT (RH OR LH) JOINT HOMOCINÉTIQUE (DROIT OU GAUCHE)	0.8	0.8	0.8	0.8
07	46	FRONT WHEEL HUB (SEAL AND/OR BEARING) (RH OR LH) MOYEU DE ROUE AVANT (JOINT ET/OU ROULEMENT) (DROIT OU GAUCHE)	0.5	0.5	0.5	0.5
07	47	KNUCKLE (RH OR LH) PORTE-FUSÉE (DROIT OU GAUCHE)	0.8	0.8	0.8	0.8

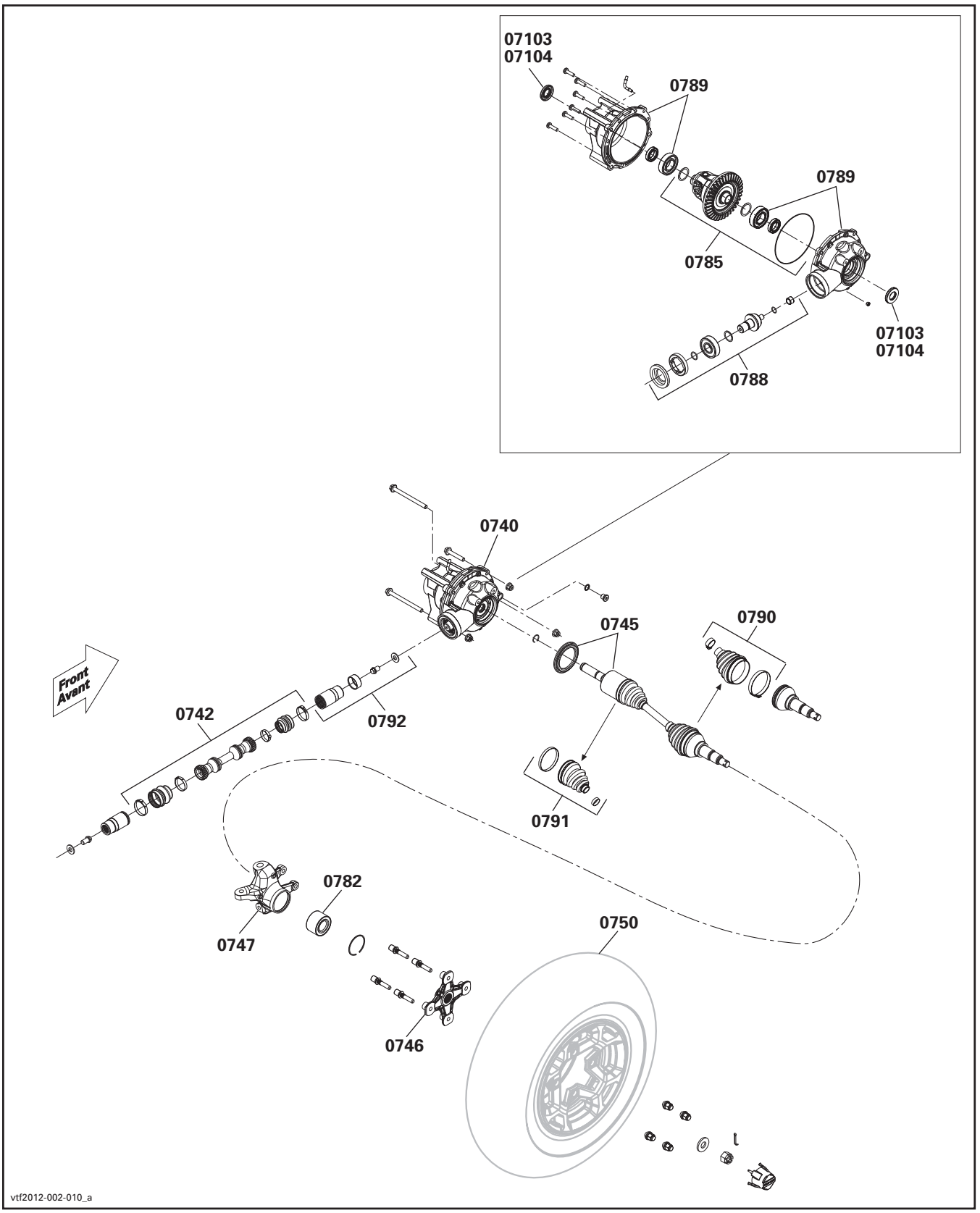
STEERING - FRONT DRIVE SYSTEM AND SUSPENSION
DIRECTION - SYSTÈME D'ENTRAÎNEMENT AVANT ET SUSPENSION

SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTLANDER MAX 500
			1	2	3	4
07	50	FRONT RIM AND/OR TIRE JANTE AVANT ET/OU PNEU	0.4	0.4	0.4	0.4
07	56	THROTTLE HANDLE MANETTE D'ACCÉLÉRATEUR	0.3	0.3	0.3	0.3
07	65	PITMAN ARM LEVIER DE DIRECTION	2.6	2.6	2.6	2.6
07	72	INTERNAL BUSHING AND/OR CUSHION (LOWER AND/OR UPPER ARM) (RH OR LH) DOUILLE INTERNE ET/OU COUSSIN (BRAS INFÉRIEUR ET/OU SUPÉRIEUR) (DROIT OU GAUCHE)	0.4	0.4	0.4	0.4
07	73	BALL JOINTS REPLACEMENT (2) REMPLACEMENT DES JOINTS A ROTULE (2)	1.0	1.0	1.0	1.0
07	80	FRONT RIM JANTE AVANT	0.4	0.4	0.4	0.4
07	82	RADIAL BALL BEARINGS ROULEMENTS À BILLE RADIALES	0.8	0.8	0.8	0.8
07	85	RING GEAR AND/OR CARRIER AND/OR SHIM COURONNE DE LANCEMENT ET/OU SUPPORT ET/OU CALE	3.0	3.0	3.0	3.0
07	88	RING GEAR DRIVE GEAR AND/OR BEARING AND/OR SHIM PIGNON DE COMMANDE DE LA COURONNE ET/OU ROULEMENT À BILLE ET/OU CALE	2.7	2.7	2.7	2.7
07	89	COVER AND/OR PINION COVER AND/OR SEAL AND/OR BEARING COUVERCLE ET/OU COUVERCLE DE PIGNON ET/OU JOINT D'ÉTANCHÉITÉ ET/OU ROULEMENT À BILLE	3.0	3.0	3.0	3.0
07	90	BOOT WHEEL KIT AND/OR CV JOINT (RH OR LH) ENSEMBLE DE SOUFFLET DE ROUE ET/OU JOINT CV (DROIT OU GAUCHE)	0.8	0.8	0.8	0.8
07	91	BOOT DIFFERENTIAL KIT AND/OR PLUNGING JOINT (RH OR LH) ENSEMBLE DE SOUFFLET DE DIFFÉRENCIEL ET/OU JOINT PLONGEANT (DROIT OU GAUCHE)	0.8	0.8	0.8	0.8
07	92	SLEEVE AND/OR WEARRING MANCHON ET/OU BAGUE D'USURE	1.3	1.3	1.3	1.3
07	94	UNIT PACK KIT ENSEMBLE JOINT CARDAN	2.3	2.3	2.3	2.3
07	96	UPPER ARM BRACKET ATTACHE BRAS SUPÉRIEUR	2.2	2.2	2.2	2.2
07	99	POWER STEERING SERVODIRECTION	2.6	2.6	2.6	2.6
07	101	DEFLECTOR (LH OR RH) DÉFLECTEUR (GA OU DR)	0.3	0.3	0.3	0.3
07	103	DIFFERENTIAL SEAL (1) JOINT D'ÉTANCHÉITÉ DU DIFFÉRENTIEL (1)	0.8	0.8	0.8	0.8
07	104	DIFFERENTIAL SEALS (2) JOINTS D'ÉTANCHÉITÉ DU DIFFÉRENTIEL (2)	1.5	1.5	1.5	1.5


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STEERING - FRONT DRIVE SYSTEM AND SUSPENSION
DIRECTION - SYSTÈME D'ENTRAÎNEMENT AVANT ET SUSPENSION



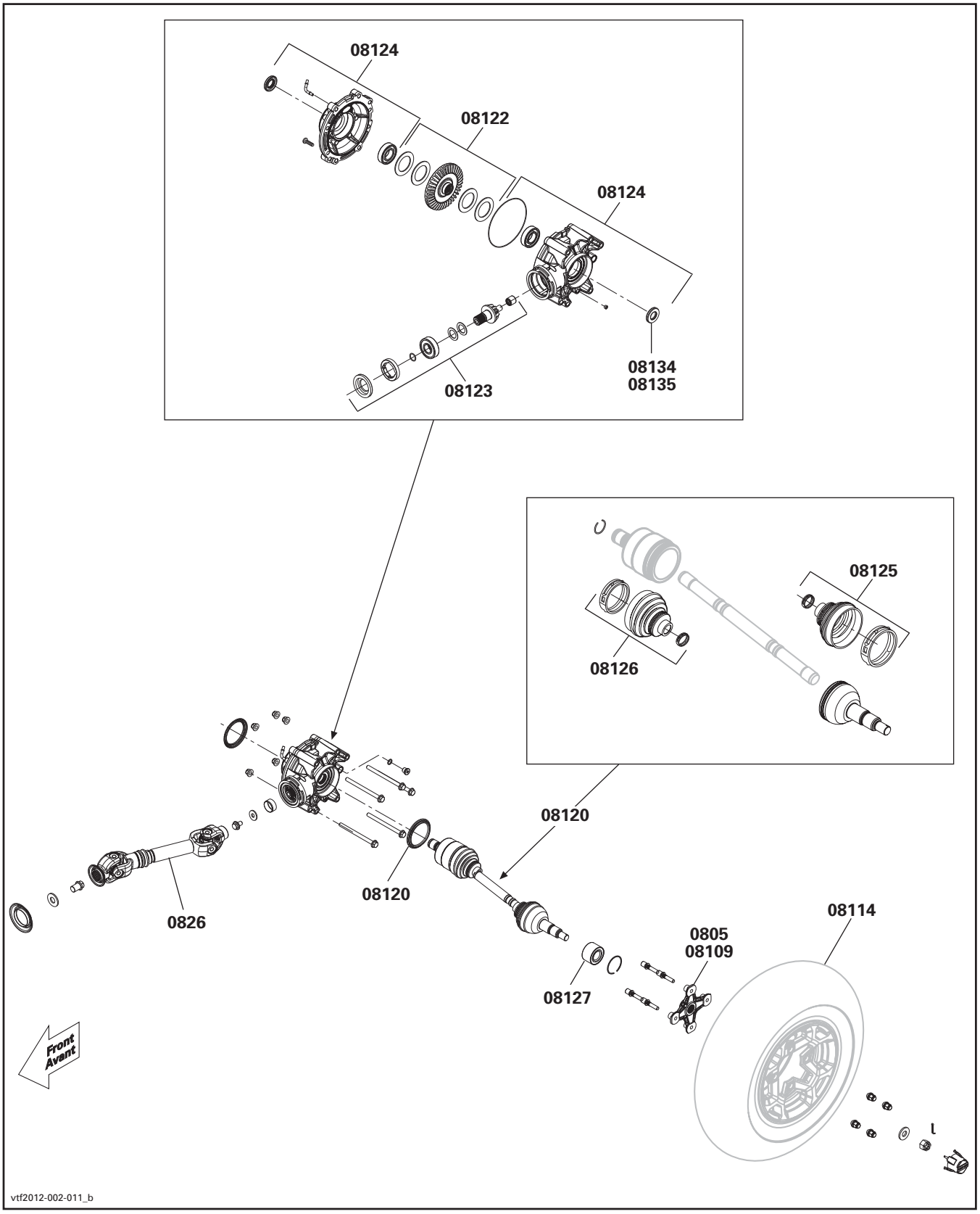

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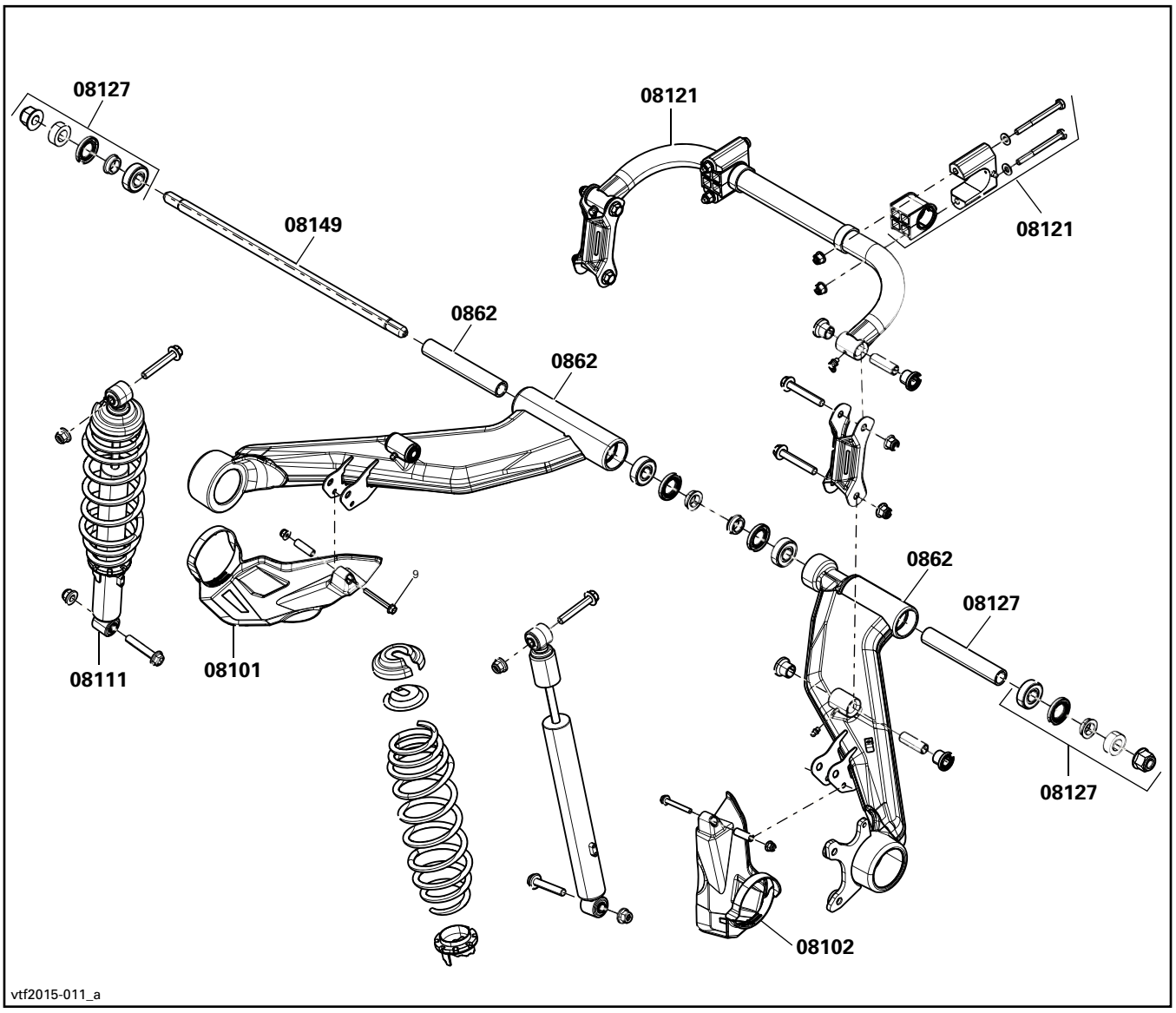
REAR DRIVE SYSTEM AND SUSPENSION
SYSTÈME D'ENTRAÎNEMENT ARRIÈRE ET SUSPENSION

SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTLANDER MAX 500
			1	2	3	4
08	**00**	**NO LABOR INVOLVED AUCUNE MAIN D'OEUVRE**	**0**	**0**	**0**	**0**
08	05	REAR WHEEL HUB (RH) MOYEU DE ROUE ARRIÈRE (DROIT)	0.5	0.5	0.5	0.5
08	07	REAR DIFFERENTIAL (ASS'Y) DIFFÉRENTIEL ARRIÈRE (COMPLET)	1.8	1.8	1.8	1.8
08	26	REAR PROPELLER SHAFT (ASS'Y) ARBRE DE PROPULSION ARRIÈRE (COMPLET)	1.5	1.5	1.5	1.5
08	62	SWING ARM BRAS OSCILLANT	1.2	1.2	1.2	1.2
08	101	LH PROTECTOR PROTECTEUR GAUCHE	0.3	0.3	0.3	0.3
08	102	RH PROTECTOR PROTECTEUR DROIT	0.3	0.3	0.3	0.3
08	109	REAR WHEEL HUB (LH) MOYEU DE ROUE ARRIÈRE (GAUCHE)	0.3	0.3	0.3	0.5
08	111	REAR SHOCK (RH OR LH) AMORTISSEUR ARRIÈRE (DROIT OU GAUCHE)	0.4	0.4	0.4	0.4
08	114	REAR RIM AND/OR TIRE JANTE ARRIÈRE ET/OU PNEU	0.4	0.4	0.4	0.4
08	120	CV JOINT (RH OR LH) JOINT HOMOCINÉTIQUE (DROIT OU GAUCHE)	0.8	0.8	0.8	0.8
08	121	STABILIZER BAR BARRE STABILISATRICE	2.3	2.3	2.3	2.3
08	122	RING GEAR AND/OR SHIM COURONNE DE LANCEMENT ET/OU CALE	3.1	3.1	3.1	3.1
08	123	RING GEAR DRIVE GEAR AND/OR BEARING AND/OR SHIM PIGNON DE COMMANDE DE LA COURONNE ET/OU ROULEMENT À BILLE ET/OU CALE	3.1	3.1	3.1	3.1
08	124	COVER AND/OR PINION COVER AND/OR SEAL AND/OR BEARING COUVERCLE ET/OU COUVERCLE DE PIGNON ET/OU JOINT D'ÉTANCHÉITÉ ET/OU ROULEMENT À BILLE	3.3	3.3	3.3	3.3
08	125	BOOT WHEEL KIT AND/OR CV JOINT (RH OR LH) ENSEMBLE DE SOUFFLET DE ROUE ET/OU JOINT CV (DROIT OU GAUCHE)	0.9	0.9	0.9	0.9
08	126	BOOT DIFFERENTIAL KIT AND/OR PLUNGING JOINT (RH OR LH) ENSEMBLE DE SOUFFLET DE DIFFÉRENTIEL ET/OU JOINT PLONGENT (DROIT OU GAUCHE)	0.9	0.9	0.9	0.9
08	127	RADIAL BALL BEARINGS ROULEMENTS À BILLE RADIALES	1.0	1.0	1.0	1.0
08	128	UNIT PACK KIT ENSEMBLE DE JOINT CARDAN	1.2	1.2	1.2	1.2
08	129	UNIT PACK KIT (2) ENSEMBLE DE JOINT CARDAN (2)	1.5	1.5	1.5	1.5

SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTLANDER MAX 500
			1	2	3	4
08	134	DIFFERENTIAL SEAL (1) JOINT D'ÉTANCHÉITÉ DU DIFFÉRENTIEL (1)	0.9	0.9	0.9	0.9
08	148	DIFFERENTIAL OIL SEAL ANNEAU D'ÉTANCHÉITÉ DU DIFFÉRENTIEL	1.0	1.0	1.0	1.0
08	135	DIFFERENTIAL SEALS (2) JOINTS D'ÉTANCHÉITÉ DU DIFFÉRENTIEL (2)	1.8	1.8	1.8	1.8
08	149	AXIAL PIVOT AXE DE PIVOT	0.5	0.5	0.5	0.5

REAR DRIVE SYSTEM AND SUSPENSION
SYSTÈME D'ENTRAÎNEMENT ARRIÈRE ET SUSPENSION



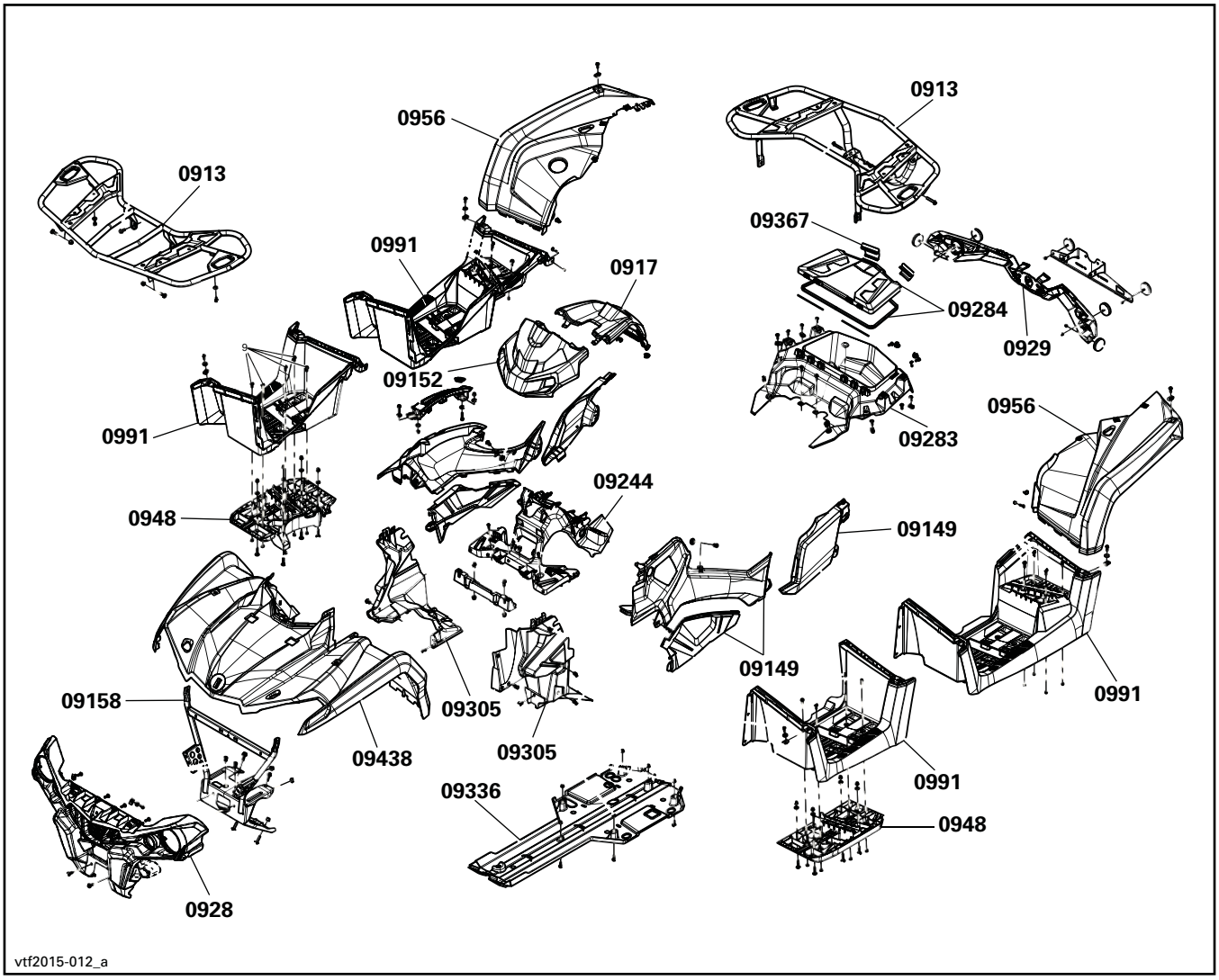

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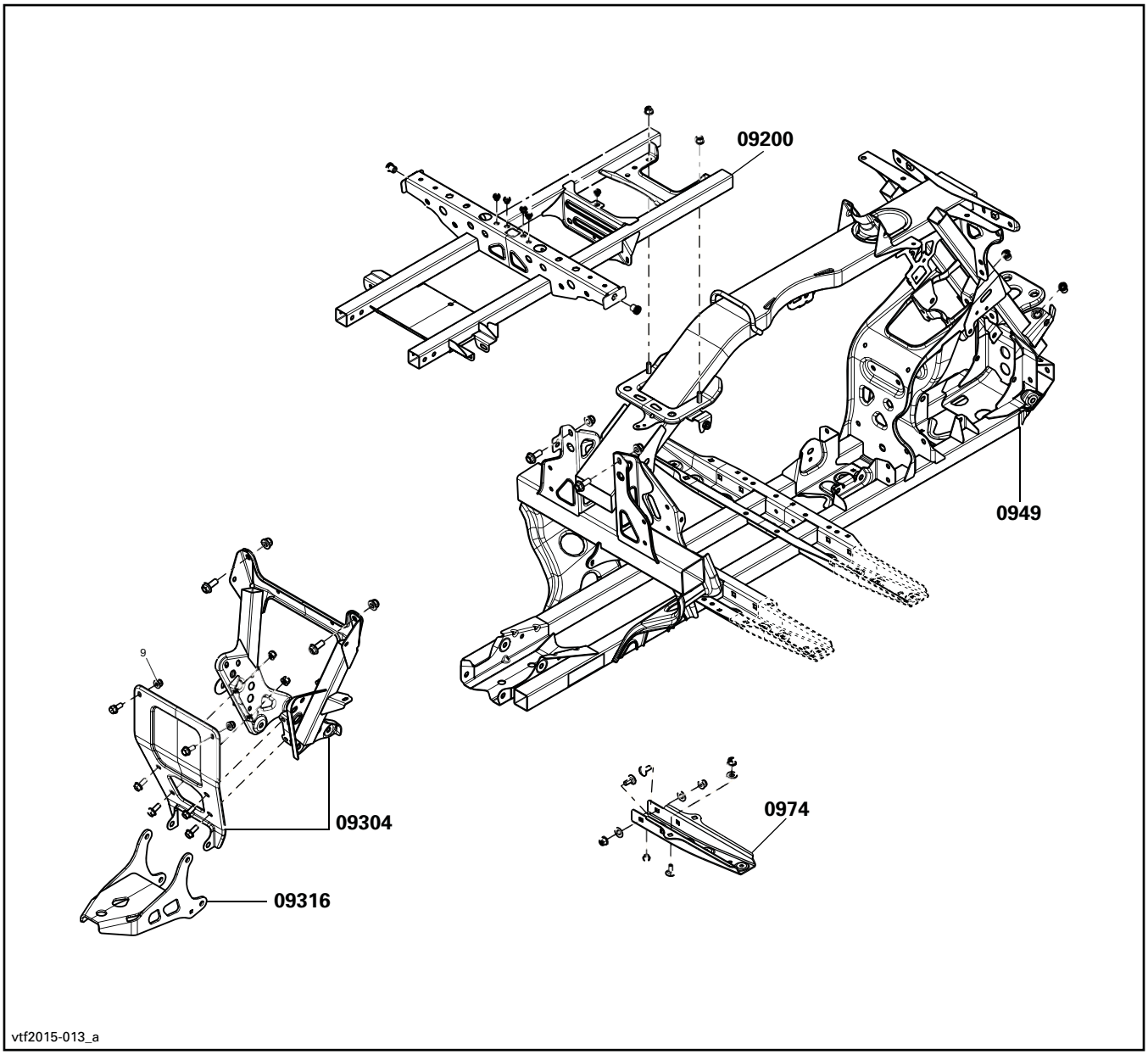
BODY AND ACCESSORIES
CARROSSERIE ET ACCESSOIRES

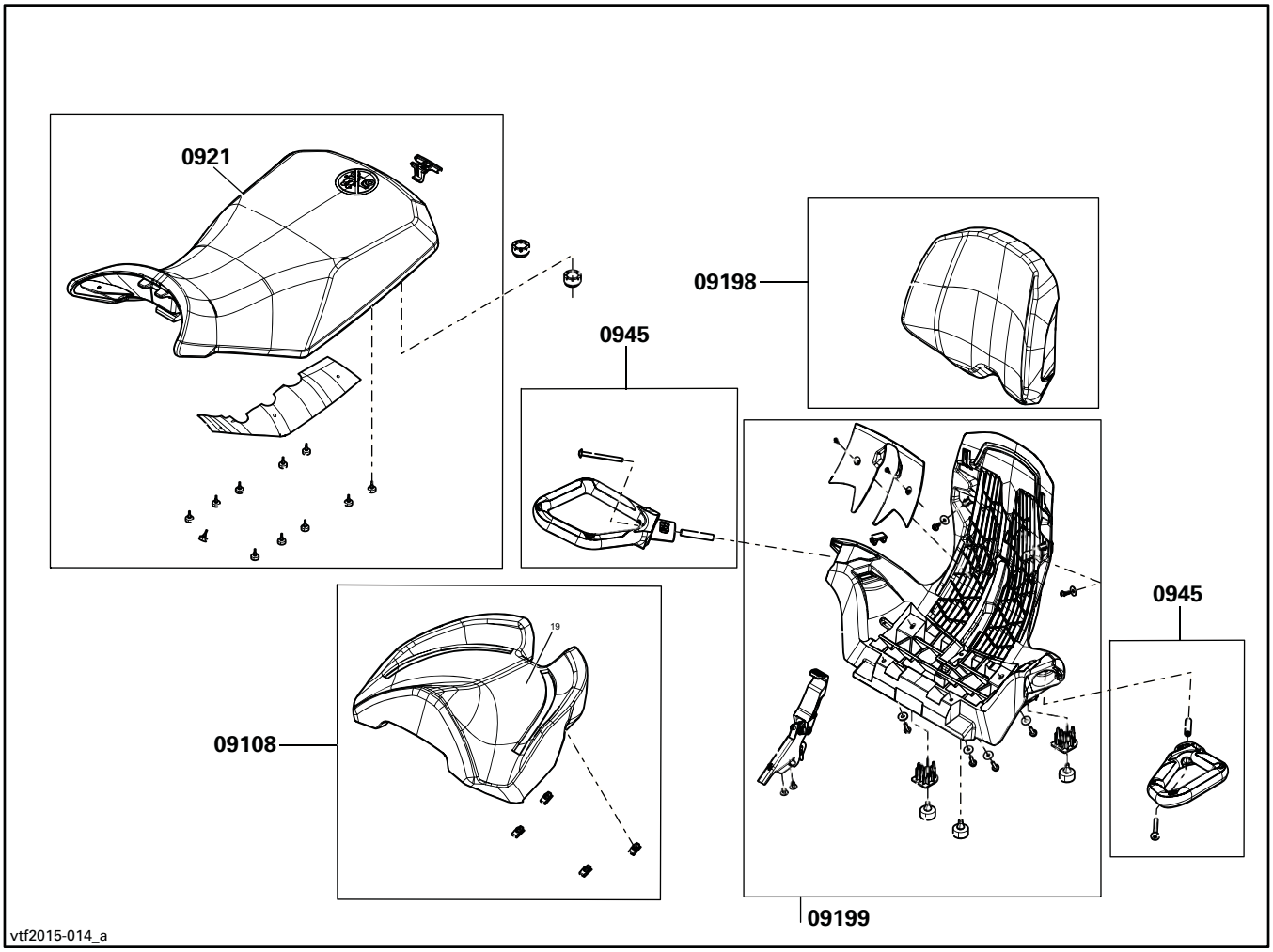
SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTLANDER MAX 500
			1	2	3	4
09	**00**	**NO LABOR INVOLVED AUCUNE MAIN D'OEUVRE IMPLIQUÉE**	**0**	**0**	**0**	**0**
09	13	LUGGAGE RACK KIT (FRONT OR REAR) ENSEMBLE DE PORTE-BAGAGES (AVANT OU ARRIÈRE)	0.5	0.5	0.5	0.5
09	17	CONSOLE CONSOLE	0.3	0.3	0.3	0.3
09	21	SEAT SIÈGE	0.3	0.3	0.3	0.3
09	28	FRONT FASCIA FASCIA AVANT	0.9	0.9	0.9	0.9
09	29	REAR FASCIA FASCIA ARRIÈRE	0.3	0.3	0.3	0.3
09	45	REAR HANDLE (RH OR LH) POIGNÉE ARRIÈRE (GAUCHE OU DROITE)		0.3		0.3
09	48	FOOTREST (RH OR LH) MARCHEPIED (DROIT OU GAUCHE)	0.4	0.5	0.4	0.5
09 *	49	FRAME CHÂSSIS	12.5	13.0	13.0	13.5
09	56	REAR FENDER AILE ARRIÈRE	0.9	0.9	0.9	0.9
09	74	FOOTREST SUPPORT (RH OR LH) SUPPORT DE REPOSE PIED (DROIT OU GAUCHE)	0.4	0.5	0.4	0.5
09	91	FOOTWELL (RH OR LH) REPOSE-PIED (DROIT OU GAUCHE)	0.3	0.4	0.3	0.4
09	95	EACH DECAL (1) CHAQUE AUTOCOLLANT (1)	0.3	0.3	0.3	0.3
09	108	REAR SEAT ASS'Y SIÈGE ARRIÈRE ASS.		0.4		0.4
09	149	ENGINE SIDE PANELS (2) PANNEAUX MOTEUR (2)	0.3	0.3	0.3	0.3
09	157	UPPER CONSOLE CONSOLE SUPÉRIEURE	0.3	0.3	0.3	0.3
09	158	FRONT FENDER SUPPORT SUPPORT D'AILE AVANT	1.3	1.3	1.3	1.3
09	198	BACKREST PARTS PIÈCES DU DOSSIER		0.4		0.4
09	199	REAR SEAT BASE A/O ALL PARTS BASE SIÈGE ARRIÈRE ET/OU TOUTES LES PIÈCES		1.0		1.0
09	200	REAR FENDER SUPPORT SUPPORT D'AILE ARRIÈRE	1.9	1.9	1.9	1.9
09	244	CONSOLE SUPPORT SUPPORT DE CONSOLE	0.5	0.5	0.5	0.5

SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTLANDER MAX 500
			1	2	3	4
09	283	REAR BOX COFFRE ARRIÈRE	1.1	1.1	1.1	1.1
09	284	BOX DOOR PORTE DE COFFRE	0.3	0.3	0.3	0.3
09	304	REAR SUPPORT SUPPORT ARRIÈRE	1.9	1.9	1.9	1.9
09	305	INNER FENDER (RH OR LH) FAUSSE AILE (DROIT OU GAUCHE)	0.3	0.3	0.3	0.3
09	316	HITCH ATTACHE	0.3	0.3	0.3	0.3
09	336	CENTRAL SKID PLAT PLAQUE DE PROTECTION CENTRALE	0.4	0.4	0.4	0.4
09	367	LOCK VERROU	0.3	0.3	0.3	0.3
09	438	FRONT FENDER AILE AVANT	1.0	1.0	1.0	1.0

BODY AND ACCESSORIES
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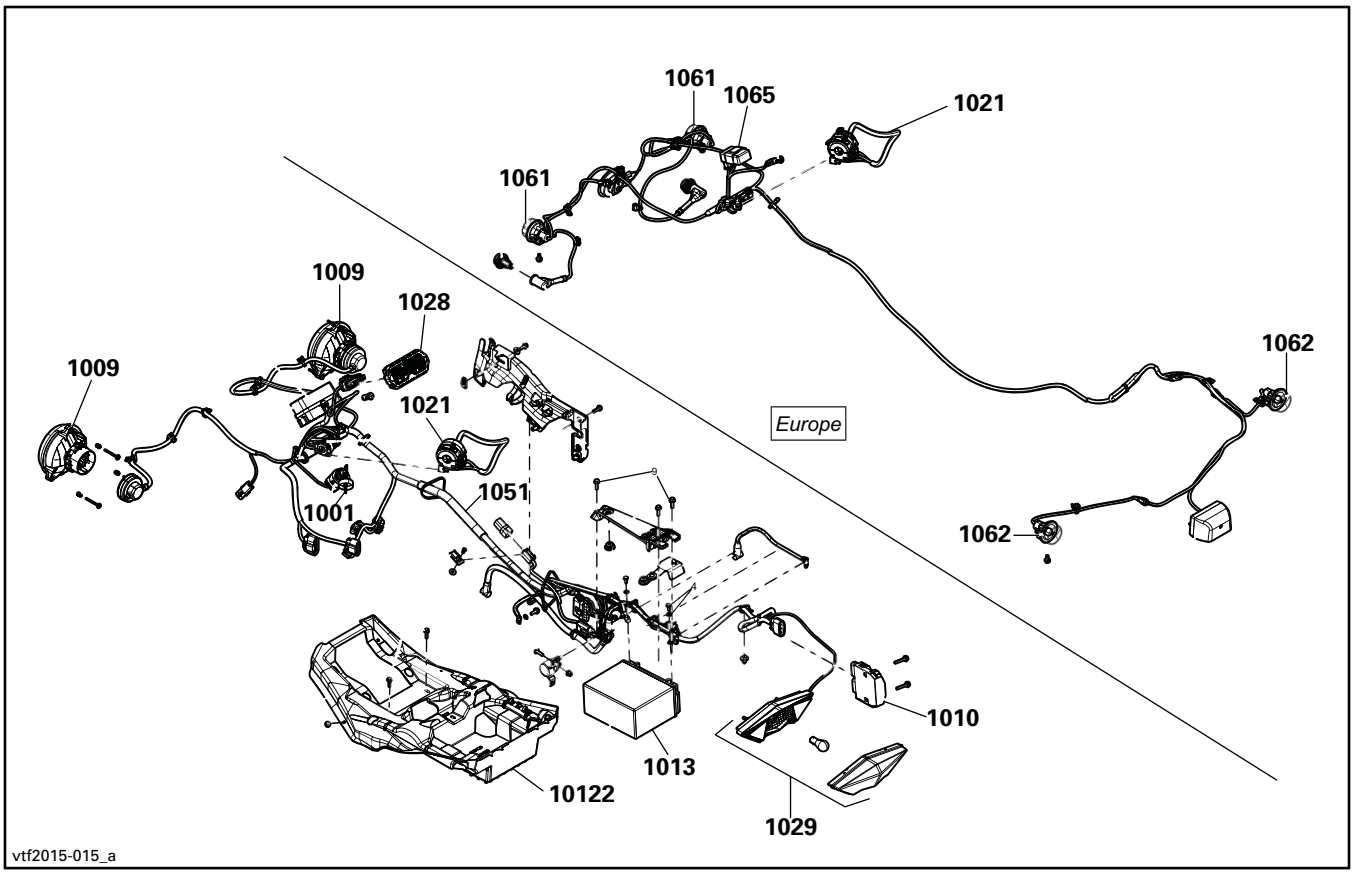



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SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTLANDER MAX 500
			1	2	3	4
10	**00**	**NO LABOR INVOLVED** **AUCUNE MAIN-D'OEUVRE**	**0**	**0**	**0**	**0**
10	01	IGNITION SWITCH INTERRUPTEUR D'ALLUMAGE	0.3	0.3	0.3	0.3
10	09	HEADLAMP AND/OR HEADLAMP SUPPORT (ASS'Y) (RH OR LH) PHARE AVANT ET/OU SUPPORT (COMPLET) (DROIT OU GAUCHE)	0.3	0.3	0.3	0.3
10	10	VOLTAGE REGULATOR RÉGULATEUR DE TENSION	0.3	0.3	0.3	0.3
10	13	BATTERY BATTERIE	0.3	0.3	0.3	0.3
10	21	MULTIFUNCTION SWITCH INTERRUPTEUR MULTIFONCTION	0.8	0.8	0.8	0.8
10	28	SPEEDOMETER/TACHOMETER INDICATEUR DE VITESSE/COMPTE-TOURS	0.3	0.3	0.3	0.3
10	29	TAIL LAMP HOUSING (ASS'Y) BOÎTIER DE FEU ARRIÈRE (COMPLET)	0.3	0.3	0.3	0.3
10	31	DC OUTLET PLUG PRISE D'ACCESSOIRE DC	0.3	0.3	0.3	0.3
10	34	ELECTRONIC MODULE MODULE ÉLECTRONIQUE	0.4	0.4	0.4	0.4
10	41	ENGINE HARNESS CÂBLAGE DU MOTEUR	1.4	1.4	1.4	1.4
10	51	MAIN WIRE HARNESS CÂBLAGE PRINCIPAL	2.5	2.7	2.5	2.7
10	52	STARTING RELAY RELAIS DE DÉMARRAGE	0.3	0.3	0.3	0.3
10	61	FRONT FLASHERS 1 OR 2 (**CE** ONLY) CLIGNOTANTS AVANT 1 OU 2 (**CE** SEULEMENT)	0.3	0.3	0.3	0.3
10	62	REAR FLASHERS 1 OR 2 (**CE** ONLY) CLIGNOTANTS ARRIÈRE 1 OU 2 (**CE** SEULEMENT)	0.3	0.3	0.3	0.3
10	65	12 VOLT RELAY (CE ONLY) RELAIS 12 VOLT (CE SEULEMENT)	0.3	0.3	0.3	0.3
10	66	HORN AVERTISSEUR	0.3	0.3	0.3	0.3
10	67	RELAY RELAIS	0.3	0.3	0.3	0.3
10	68	ANY BULBS TOUTES LES AMPOULES	0.6	0.6	0.6	0.6
10	71	LICENSE LIGHT (ASS'Y) (**CE** ONLY) LUMIÈRE D'IMMATRICULATION (COMPLET) (**CE** SEULEMENT)	0.3	0.3	0.3	0.3
10	101	MULTIFONCTION SWITCH (RH) INTERRUPTEUR MULTIFONCTION (DR)	0.3	0.3	0.3	0.3

SYSTEM SYSTÈME	CODE	DESCRIPTION	OUTLANDER 450	OUTLANDER MAX 450	OUTLANDER 500	OUTLANDER MAX 500
			1	2	3	4
10	122	BATTERY SUPPORT SUPPORT DE BATTERIE	0.5	0.5	0.5	0.5


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TABLE	DESCRIPTION	MODEL/ MODÈLE	ENGINE TYPE/ TYPE DE MOTEUR	COOLING SYSTEM/ SYSTEME DE REFROIDISSEMENT
1	OUTLANDER 450	5AFA/5AFB 5AEC/5AFD 5AFE	450 CVT	Liquid cooled/ Refroidi par liquide
	OUTLANDER DPS 450	2WFA/2WFB 2WFC/2WFD		
2	OUTLANDER MAX 450	5CFA/5CFB 5CFC	450 CVT	Liquid cooled/ Refroidi par liquide
	OUTLANDER MAX DPS 450	2XFA/2XFB 2XFC/2XFD		
3	OUTLANDER 500	2TFA/2TFB 2TFC/2TFD	500 CVT	Liquid cooled/ Refroidi par liquide
	OUTLANDER DPS 500	2CFA/2CFB 2CFC/2CFD 2CFE/2CFF		
4	OUTLANDER MAX 500	2EFA/2EFB	500 CVT	Liquid cooled/ Refroidi par liquide
	OUTLANDER MAX DPS 500	2FFA/2FFB 2FFC/2FFD 2FFE/2FFF		