SAFETY NOTICE

This manual has been prepared as a guide to correctly service and repair the 2015 Can-Am™ Outlander 6x6 ATVs as described in the model list in the *INTRODUCTION*.

This edition was primarily published to be used by mechanics and technicians who are already familiar with all service procedures relating to BRP products. Technicians should attend training courses given by BRPTI.

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

The contents of this manual depicts parts and procedures applicable to the particular product at the time of writing. Service and warranty bulletins may be published to update the content of this manual. Dealer modifications that were carried out after manufacturing of the product, whether or not authorized by BRP, are not included.

In addition, the sole purpose of the illustrations throughout the manual, is to assist identification of the general configuration of the parts. They are not to be interpreted as technical drawings or exact replicas of the parts.

The use of BRP parts is most strongly recommended when considering replacement of any component. Dealer and/or distributor assistance should be sought in case of doubt.

The engines and the corresponding components identified in this document should not be utilized on product(s) other than those mentioned in this document.

It is understood that certain modifications may render use of the ATV illegal under existing federal, provincial and state regulations.

This manual emphasizes particular information denoted by the following wording and symbols:

⚠ WARNING

Indicates a potential hazard that, if not avoided, could result in serious injury or death.

⚠ CAUTION Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE Indicates an instruction which, if not followed, could result in severe damage to vehicle components or other property.

NOTE: Indicates supplementary information required to fully complete an instruction.

Although the mere reading of such information does not eliminate the hazard, your understanding of the information will promote its correct use.

Always observe common shop safety practice.

Unless otherwise noted, the engine must be stopped and the key must be removed prior to perform any services.

Torque wrench tightening specifications must be strictly adhered to. Use the torque values and service products as in the exploded views or in the procedures when noted.

Locking devices when removed must be replaced (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.).

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

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

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

It is understood that this manual may be translated into another language. In the event of any discrepancy, the English version shall prevail.

BRP disclaims liability for all damages and/or injuries resulting from the improper use of the contents of this publication.

INTRODUCTION

This shop manual covers the following BRP made 2015 Can-Am Outlander 6x6.

MODEL	PACKAGE	ENGINE TYPE	MODEL NUMBER
Outlander 6x6 DPS	Flat Bed	660	4RFB
Outlander 6x6 XT	Side Wall	660	5NFB
	Flat Bed	660	5NFC
Outlander 6x6 XT	Side Wall	1010	5SFE, 5SFF, 5SFG, 5SFX
	Forestry	1010	5SFJ
	Winter	1010	5SFL
	Farmer	1010	5SFN
	Cargo	1010	5SFR
	Flat Bed	1010	1DFH, 1DFJ, 1DFK 5SFT, 5SFV, 5SFW

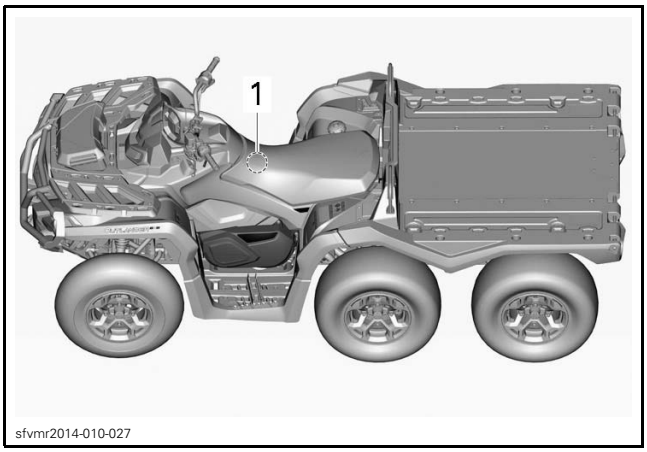
The information and component/system descriptions contained in this manual are correct at time of writing. BRP however, maintains a policy of continuous improvement of its products without imposing upon itself any obligation to install them on products previously manufactured.

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

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

VEHICLE INFORMATION

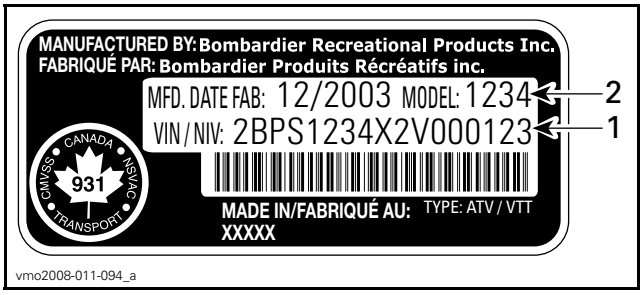
VEHICLE IDENTIFICATION NUMBER (VIN)



TYPICAL
1. VIN (Vehicle Identification Number) location

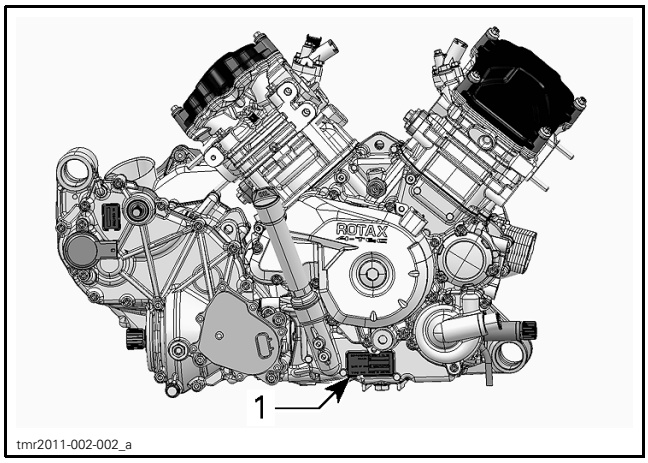
The VIN (Vehicle Identification Number) decal is located under the seat.

VIN Decal Description



TYPICAL — VEHICLE IDENTIFICATION NUMBER LABEL
1. VIN (Vehicle Identification Number)
2. Manufacturing date and model number

ENGINE IDENTIFICATION NUMBER (EIN)



TYPICAL - RH SIDE OF ENGINE
1. Engine Identification Number (EIN)

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

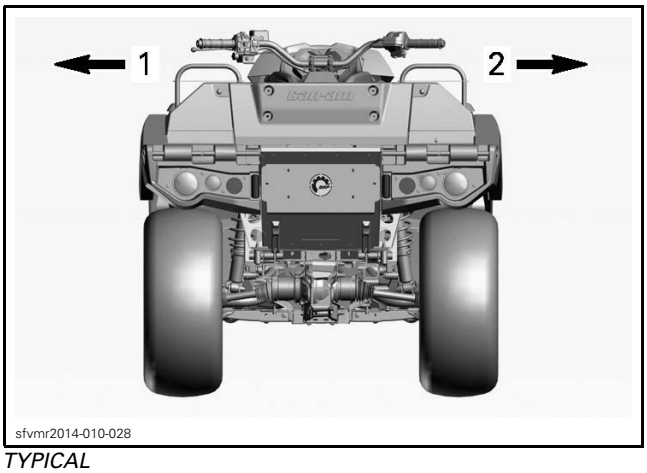
Many of the procedures in this manual are interrelated. Before undertaking any task, you should read and thoroughly understand the entire section or subsection in which the procedure is contained.

⚠ 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.**

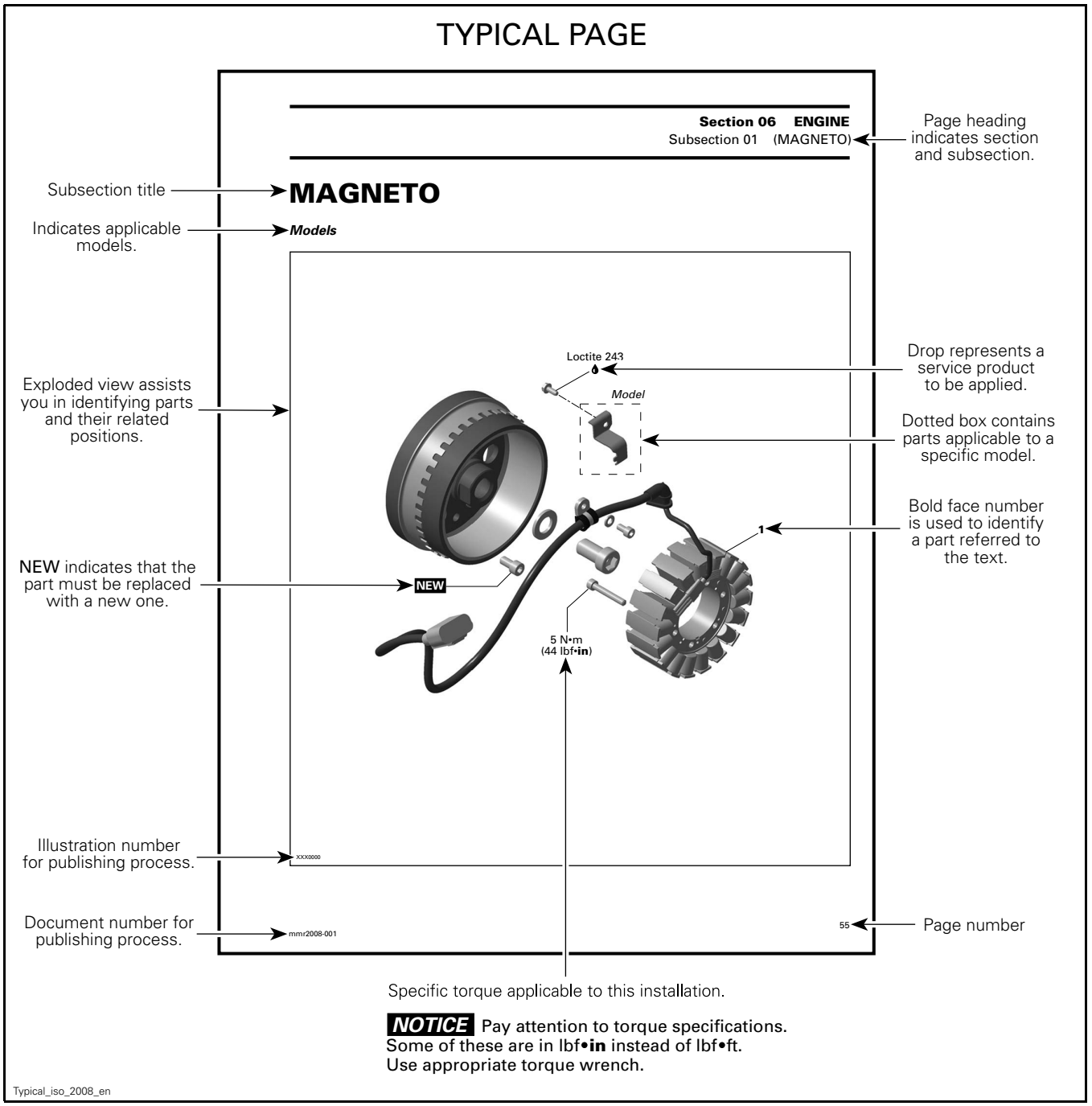
MANUAL LAYOUT

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 PAGE

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

Reference to a specific section or subsection.

Indicates component procedures apply to.

Indicates specific procedure to be carried out.

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

Call-outs pertaining to above illustration.

Illustration always follows text to which it applies.

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

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

Section 03 ENGINE
Subsection 09 (MAGNETO SYSTEM)

GENERAL

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

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

Clean threads before applying a threadlocker. Refer to 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

MAGNETO FLYWHEEL

Magneto Flywheel Cleaning

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

CAUTION: Clean magneto flywheel using only a clean cloth.

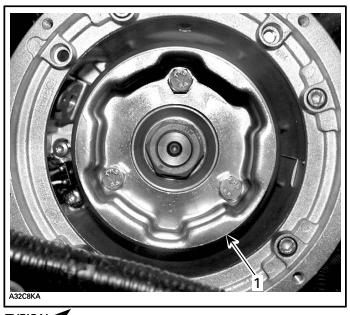
Magneto Flywheel Removal

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

Remove acoustic panel.

Remove rewind starter.

Remove starting pulley **no. 2**.



TYPICAL
1. Starting pulley

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



TYPICAL

Models

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

mmr2008-001

57

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.).

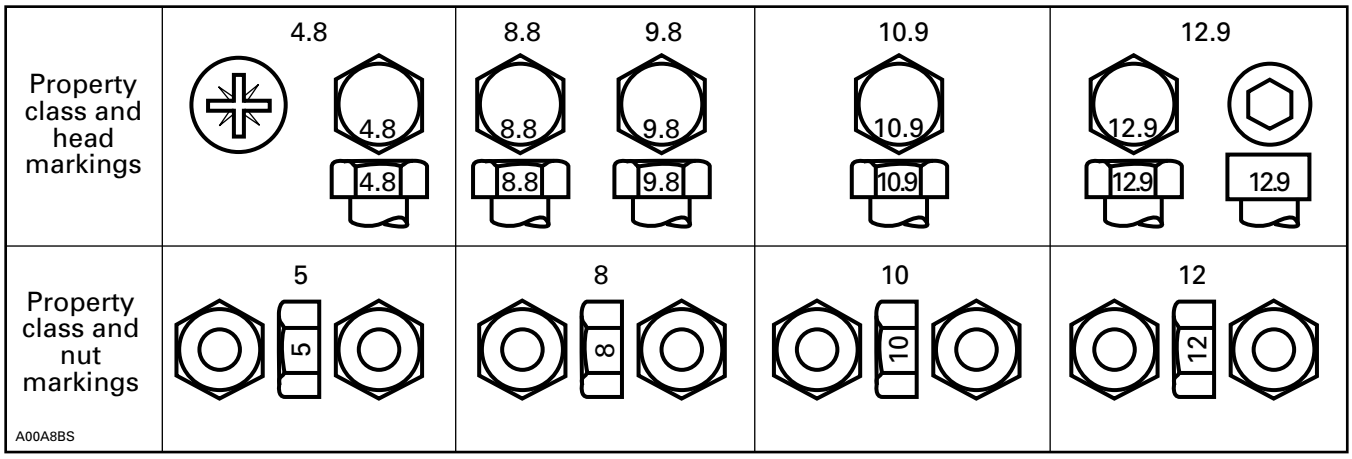
In order to avoid a poor assembly, tighten screws, bolts, or nuts in accordance with the following procedure:

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.

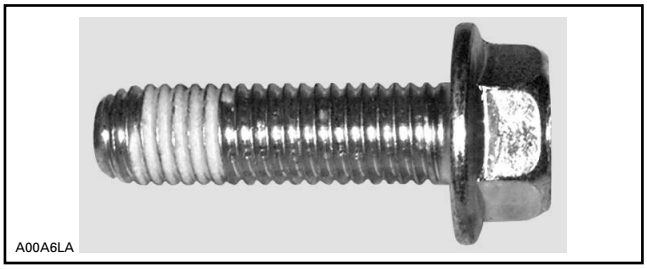


FASTENER SIZE	FASTENER GRADE/TORQUE			
	5.8 Grade	8.8 Grade	10.9 Grade	12.9 Grade
M4	1.5 – 2 N•m (13 – 18 lbf•**in**)	2.5 – 3 N•m (22 – 27 lbf•**in**)	3.5 – 4 N•m (31 – 35 lbf•ft)	4 – 5 N•m (35 – 44 lbf•ft)
M5	3 – 3.5 N•m (27 – 31 lbf•ft)	4.5 – 5.5 N•m (40 – 47 lbf•ft)	7 – 8.5 N•m (62 – 75 lbf•ft)	8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

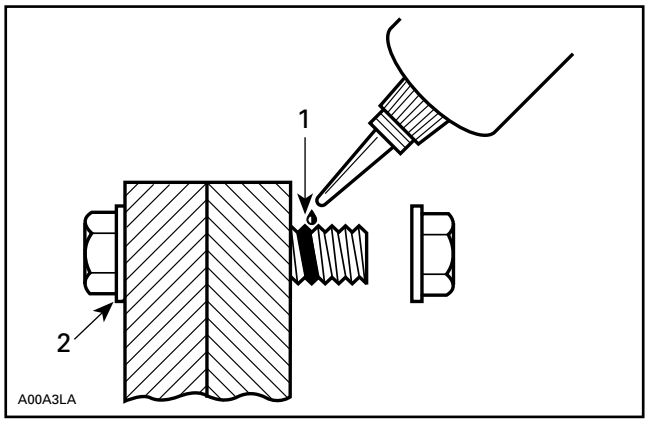
Use a metal brush or a tap to properly clean a threaded hole, then use a solvent. Allow the solvent time to act, approximately 30 minutes, then wipe off. Solvent utilization is to ensure proper adhesion of the product used for locking the fastener.

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.

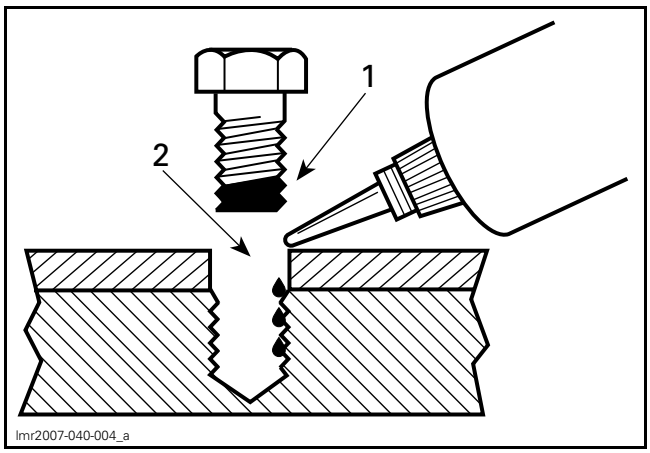
Threadlocker Application for Uncovered Holes (Bolts and Nuts)



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

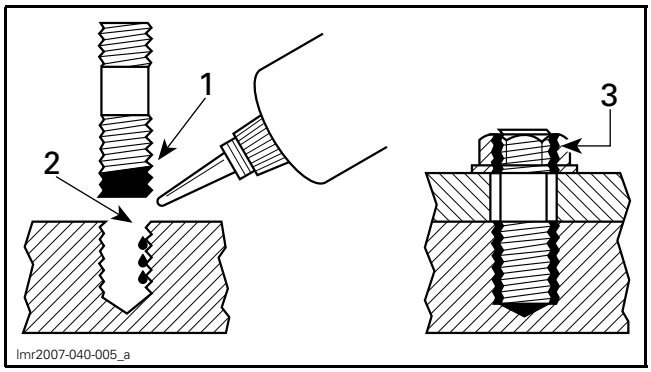


1. On fastener threads
2. On threads and at the bottom of hole

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



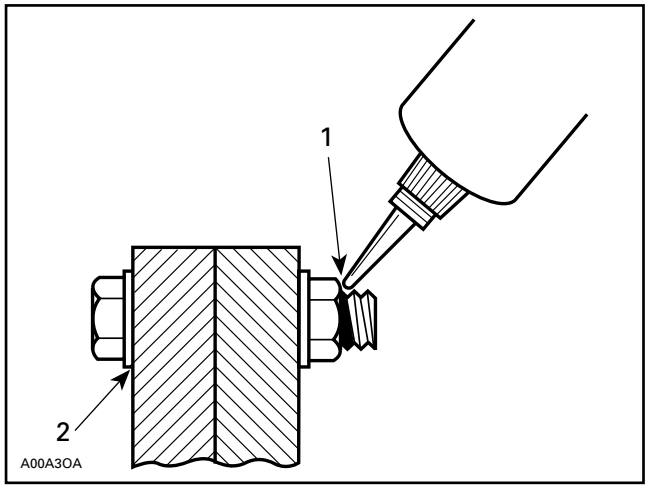
1. On stud threads
2. On threads and in the hole
3. On retaining nut threads

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

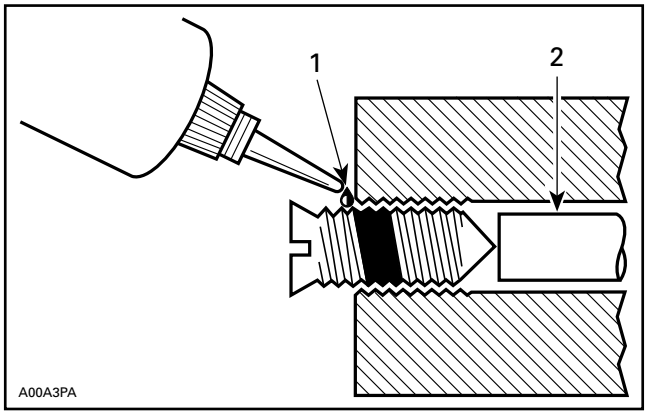


1. Apply here
2. Do not apply

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

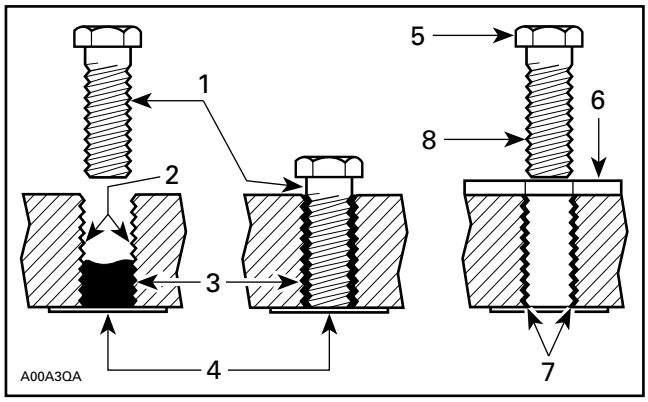


1. Apply here
2. Plunger

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.

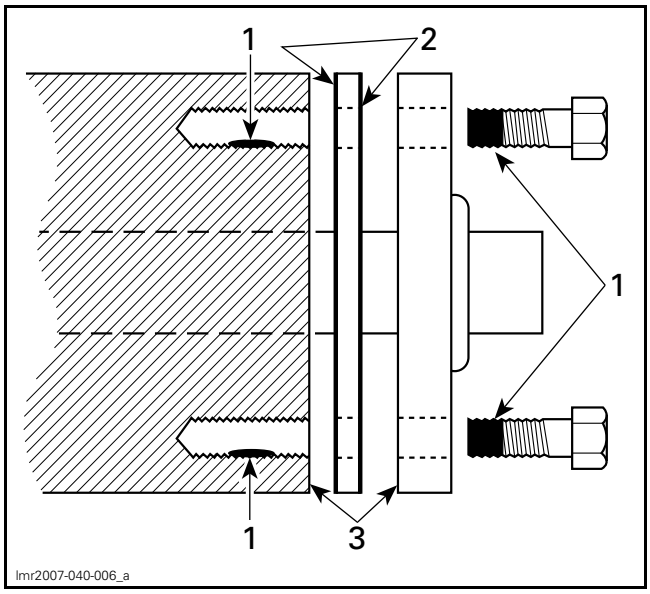
Permanent Stud Installation (Light Duty)

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.

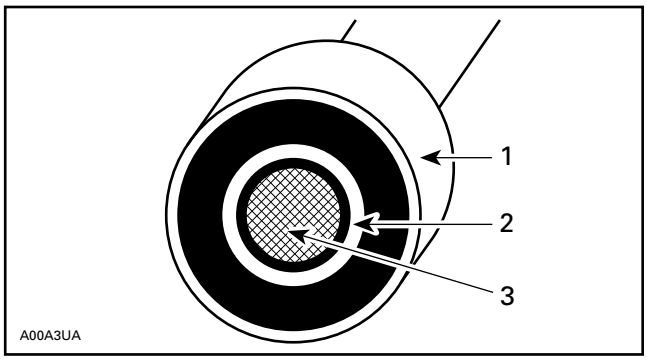
NOTE: If the cover is bolted to blind holes, apply proper strength Loctite in the hole and on threads. Tighten fastener.

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

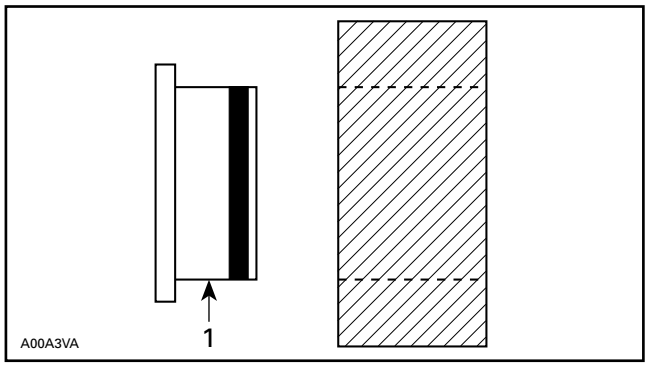
1. Clean shaft external contact surface.
2. Clean internal contact surface of part to be installed on shaft.
3. Apply a strip of proper strength Loctite on circumference of shaft contact surface at insertion or engagement point.

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)



Page: 90

BACKLASH MEASUREMENT TOOL
(P/N 529 035 665)



Page: 469, 486, 491

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



Page: 543

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



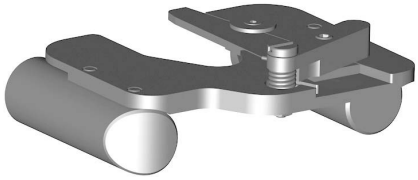
Page: 332

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



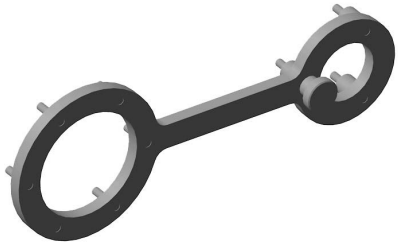
Page: 112, 132

CAMSHAFT TIMING TOOL
(P/N 529 036 268)



Page: 205, 217

CLUTCH HOLDER
(P/N 529 036 238)



Page: 278, 285, 291, 298, 305, 311–312

CLUTCH PULLER
(P/N 529 035 746)



Page: 278, 298

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



Page: 325

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



Page: 239, 263

CRANKSHAFT LOCKING BOLT
(P/N 529 035 617)



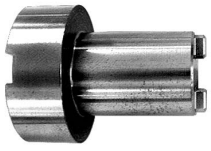
Page: 144, 172, 196, 242, 266

CRANKSHAFT PROTECTOR
(P/N 529 036 034)



Page: 144

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



Page: 205, 209, 217, 221

SERVICE TOOLS INDEX

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



Page: 426

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



Page: 467, 482

CV JOINT EXTRACTOR
(P/N 529 036 005)



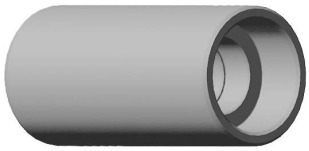
Page: 467, 483

DISCONNECT TOOL
(P/N 529 035 714)



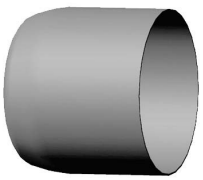
Page: 90

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



Page: 231–232, 255–256

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



Page: 230, 254

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



Page: 443

ECM ADAPTER TOOL
(P/N 529 036 166)



Page: 321, 371, 423, 430, 433–434, 560

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



Page: 424

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



Page: 424

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



Page: 158, 182

ENGINE LIFTING TOOL
(P/N 529 036 022)



Page: 73

FLUKE 115 MULTIMETER
(P/N 529 035 868)



Page: 104, 124, 141, 318, 322, 371, 399, 433, 445, 455, 520

FUEL HOSE ADAPTER
(P/N 529 036 023)



Page: 393

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



Page: 401

HANDLE
(P/N 420 877 650)



Page: 113, 133, 325

MAGNETO PULLER
(P/N 529 035 748)



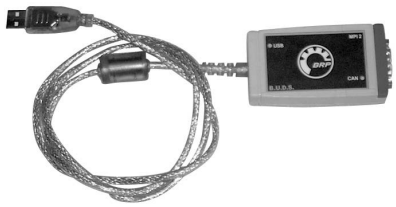
Page: 144

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



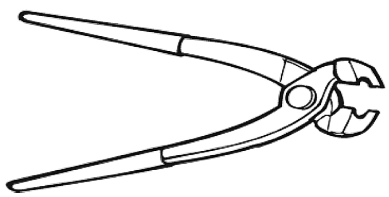
Page: 355

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



Page: 355

OETIKER PLIERS
(P/N 295 000 070)



Page: 377, 396, 573

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



Page: 325

OIL SEAL INSTALLER
(P/N 529 036 204)



Page: 326

OIL SEAL PUSHER
(P/N 529 035 757)



Page: 113, 133

PISTON CIRCLIP INSTALLER
(P/N 529 035 921)



Page: 175

PISTON CIRCLIP INSTALLER
(P/N 529 036 153)



Page: 199

PISTON RING COMPRESSOR
(P/N 529 035 919)



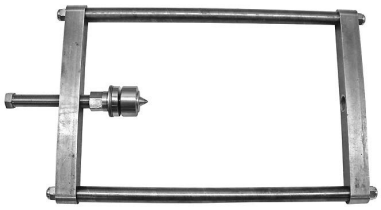
Page: 195

PISTON RING COMPRESSOR
(P/N 529 035 977)



Page: 171

PITMAN ARM JIG
(P/N 529 036 225)



Page: 532, 534

PITMAN ARM PULLER
(P/N 529 036 227)



Page: 533

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



Page: 239, 263

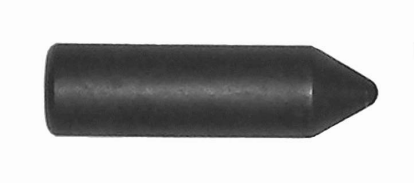
SERVICE TOOLS INDEX

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



Page: 234, 258

POSITIONING ADAPTOR
(P/N 529 036 230)



Page: 532

PRESSURE GAUGE
(P/N 529 035 709)



Page: 90, 393

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



Page: 233, 257

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



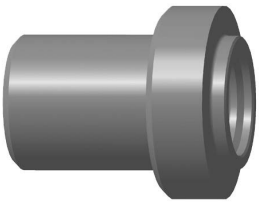
Page: 277, 291, 297, 312

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



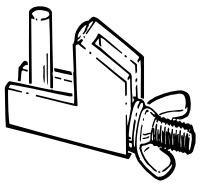
Page: 111, 131

SEAL PUSHER
(P/N 529 035 766)



Page: 111, 114, 131, 134

SMALL HOSE PINCHER
(P/N 295 000 076)



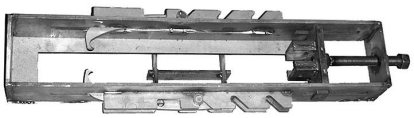
Page: 404

SPANNER SOCKET
(P/N 529 035 649)



Page: 471, 488, 494

SPRING COMPRESSOR
(P/N 529 036 184)



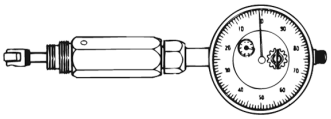
Page: 548

STEERING ALIGNMENT TOOL
(P/N 529 036 059)



Page: 501

TDC DIAL INDICATOR
(P/N 414 104 700)



Page: 158, 182

TEST CAP
(P/N 529 035 991)



Page: 21, 45

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



Page: 21, 34, 45, 58, 392, 405

VALVE GUIDE INSTALLER
(P/N 529 036 140)



Page: 170, 194

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



Page: 170, 194

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



Page: 166, 190

VALVE SPRING COMPRESSOR
(P/N 529 035 724)



Page: 166, 190

BREAK-IN INSPECTION

This vehicle should be serviced by an authorized Can-Am dealer after the first 10 hours or 300 km (200 mi) of operation, whichever comes first. The break-in inspection is very important and must not be neglected.

The following message will appear in the cluster as a reminder of when the break-in inspection is due: MAINTENANCE SOON. The message can be cancelled by alternately pressing the override button and the brake pedal 3 times, or by using B.U.D.S. software.

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
Clean vehicle speed sensor

PERIODIC MAINTENANCE SCHEDULE

GENERAL

Maintenance is very important for keeping the vehicle in a safe operating condition. Proper maintenance is the owner's responsibility. This vehicle should be serviced as per the maintenance schedule.

⚠ WARNING

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

MAINTENANCE SOON MESSAGE

The following message will appear in the cluster after the first 10 hours of operation and then at every 50 hours that follow as a reminder of when an inspection is due: MAINTENANCE SOON. The message can be cancelled by alternately pressing the override button and the brake pedal 3 times, or by using B.U.D.S. software.

SEVERE DUSTY CONDITIONS

Engine Air Filter Maintenance Guideline

Air filter maintenance should be adjusted according to riding conditions.

Air filter maintenance must be increased in frequency in the following dusty conditions:

– Riding on dry sand
– Riding on dry dirt covered surfaces
– Riding on dry gravel roads or similar conditions.

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

MAINTENANCE SCHEDULE

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
Inspect and clean CVT air filter and replace as needed
Check battery connections
Inspect front differential / middle and rear final drive oil level
Lubricate front, middle and rear propeller shaft joints
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
Inspect wheel bearings (check for abnormal play)
Inspect steering system (check for abnormal play)
Inspect and clean brake system
Replace rear and center 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
Clean the fuel pump pre-filter
Carry out a fuel pump pressure test
Replace spark plugs
Replace front differential oil
Replace gearbox oil
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 (1000)

SERVICE TOOLS

Description	Part Number	Page
TEST CAP	529 035 991	45
VACUUM/PRESSURE PUMP	529 021 800	45, 58

SERVICE PRODUCTS

Description	Part Number	Page
AIR FILTER CLEANER	219 700 341	39
AIR FILTER OIL	219 700 340	39
BRAKE FLUID GTLMA DOT4	293 600 131	58
CABLE LUBRICANT	293 600 041	49
LOCTITE 243 (BLUE)	293 800 060	46
LONG LIFE ANTIFREEZE(F)	619 590 204	43
LONG LIFE ANTIFREEZE	219 702 685	43
SUSPENSION GREASE	293 550 033	55–56
XPS 4-STROKE SYNTH. BLEND OIL (SUMMER)	293 600 121	41
XPS 4-STROKE SYNTHETIC OIL (ALL CLIMATE)	293 600 112	41
XPS BRAKES AND PARTS CLEANER (USA)	219 701 705	51, 57
XPS BRAKES AND PARTS CLEANER	219 701 776	51, 57
XPS SYNTHETIC GEAR OIL (75W 140)	293 600 140	47, 54
XPS SYNTHETIC GEAR OIL (75W 90)	293 600 043	52
XPS SYNTHETIC GREASE	293 550 010	57

GENERAL

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

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

PROCEDURES

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

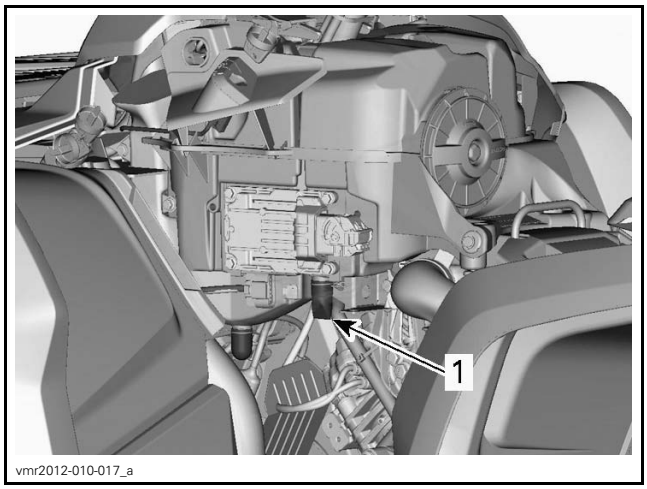
4. Remove air filter.



AIR FILTER REMOVAL

Engine Air Filter Housing Inspection and Draining

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

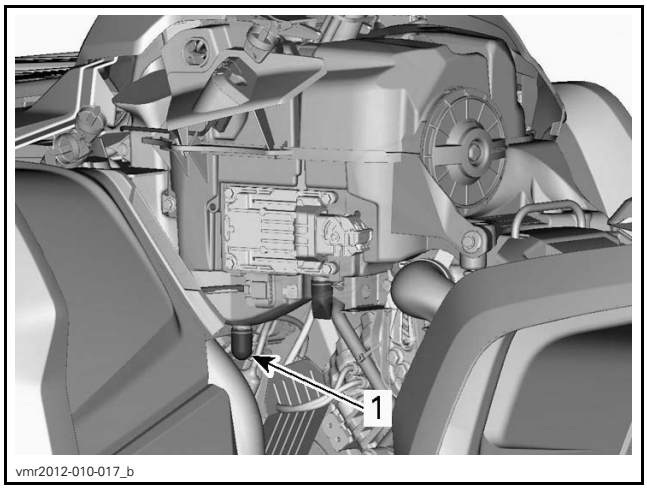


TYPICAL - SOME PARTS REMOVED FOR CLARITY
1. Air filter housing inlet drain tube

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

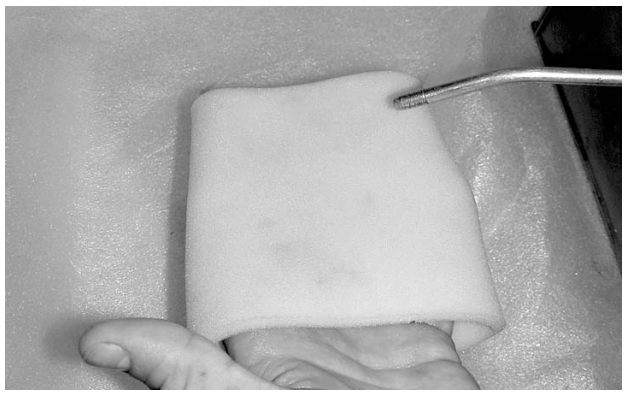
1. Spray the foam filter inside and out with air filter cleaner.

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



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.



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)	



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.

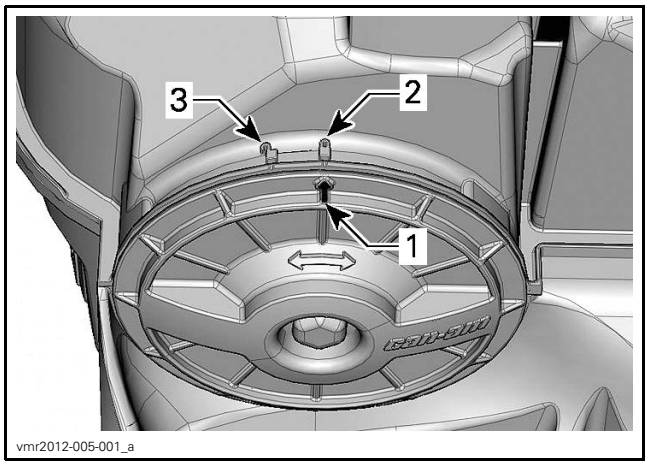
Engine Air Filter Installation

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 air 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.



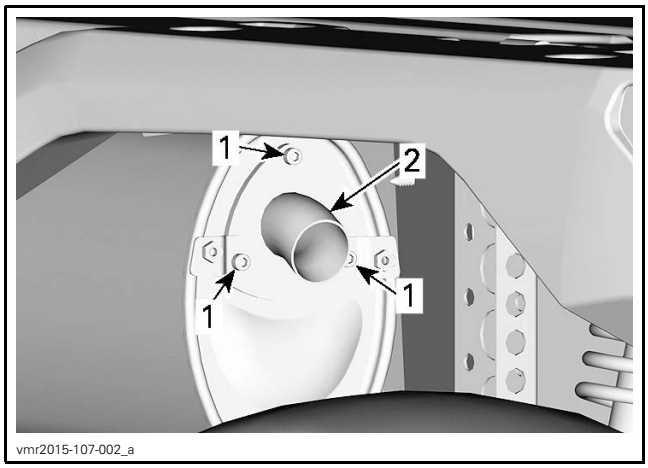
1. Cover position arrow
2. Locked
3. Unlocked

EXHAUST SYSTEM

Muffler Spark Arrester Cleaning and Inspection

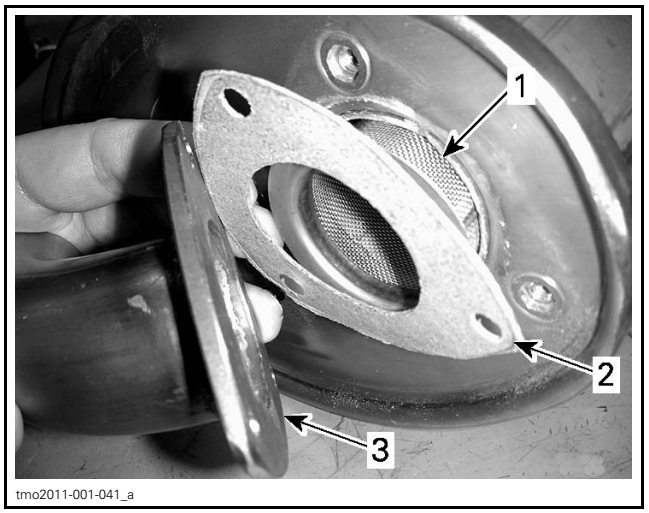
⚠ CAUTION Never perform this operation immediately after the engine has been running as exhaust system is very hot.

1. Remove and discard the tail pipe retaining screws.



1. Screws
2. Tail pipe

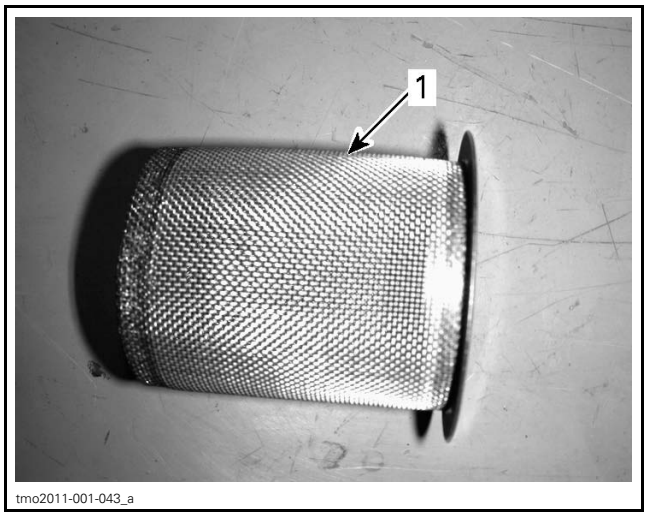
2. Remove exhaust tail pipe, gasket (discard) and spark arrester.



1. Spark arrester
2. Gasket
3. Exhaust tail pipe

3. Remove carbon deposits from the spark arrester using a brush.

NOTICE **Use a soft brush and be careful to avoid damaging spark arrester mesh.**



1. Clean spark arrester

4. Inspect mesh of spark arrester for any damage. Replace as required.
5. Inspect spark arrester chamber in muffler. Clean as required.

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

Install new gasket and new retaining screws.

TAIL PIPE RETAINING SCREWS	
Tightening torque	11 N•m ± 1 N•m (97 lbf•**in** ± 9 lbf•**in**)

LUBRICATION SYSTEM

Recommended Engine Oil

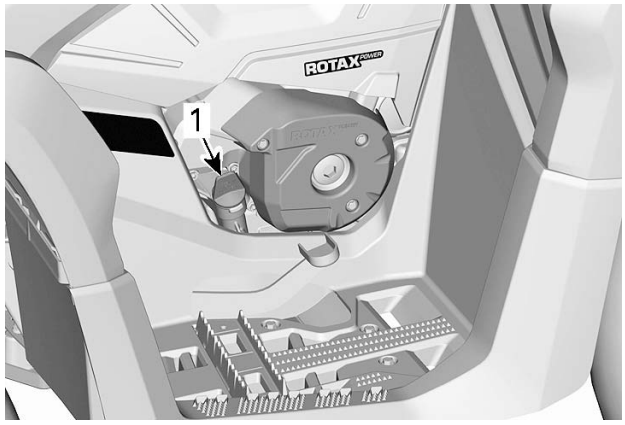
RECOMMENDED ENGINE OIL	
SEASON	TYPE
Summer	XPS 4-STROKE SYNTH. BLEND OIL (SUMMER) (P/N 293 600 121)
Winter	XPS 4-STROKE SYNTHETIC OIL (ALL CLIMATE) (P/N 293 600 112)

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.

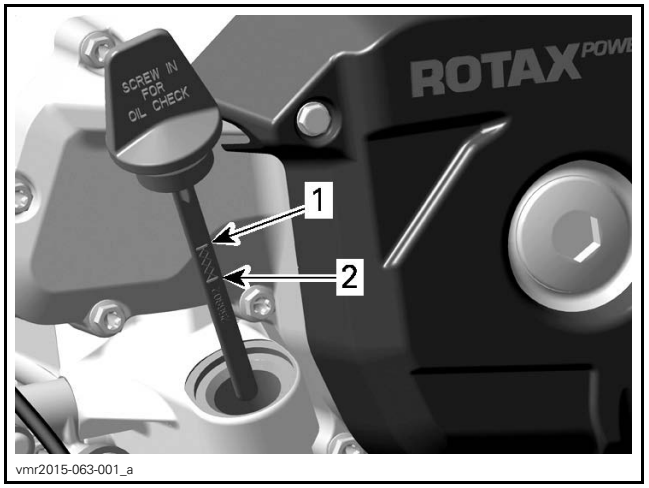
NOTE: While checking the oil level, visually inspect engine area for leaks.



RH SIDE OF ENGINE
1. Dipstick

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.

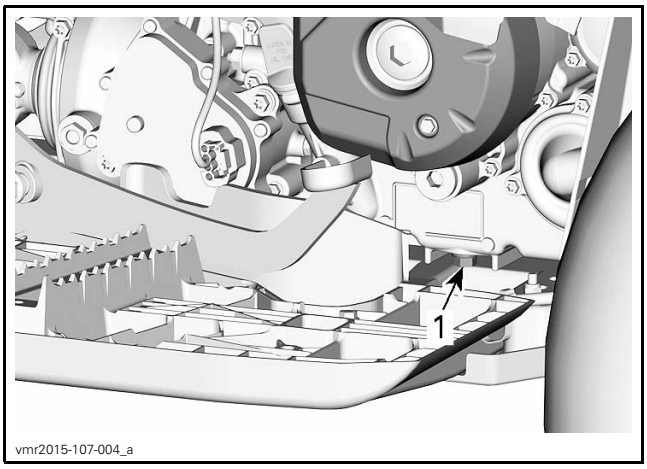
NOTE: Do not overfill. Wipe off any spillage.

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	
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
2 L (2.1 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

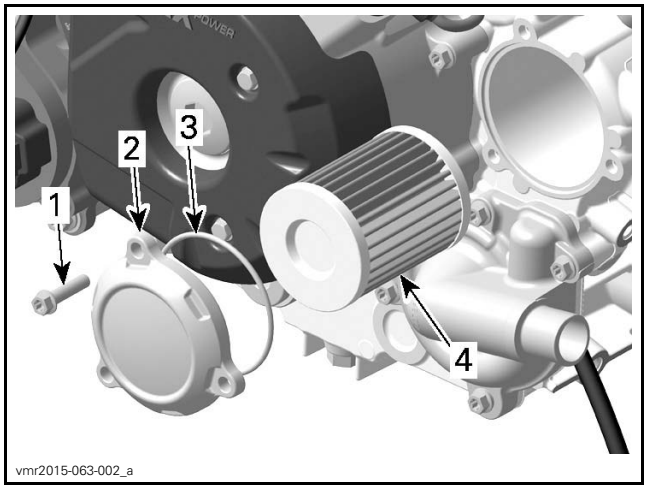
Engine Oil Filter Access

To reach oil filter, refer to *BODY* subsection and remove the following parts:

– Seat
– Console
– RH side panel
– RH footrest panel.

Engine Oil Filter Removal

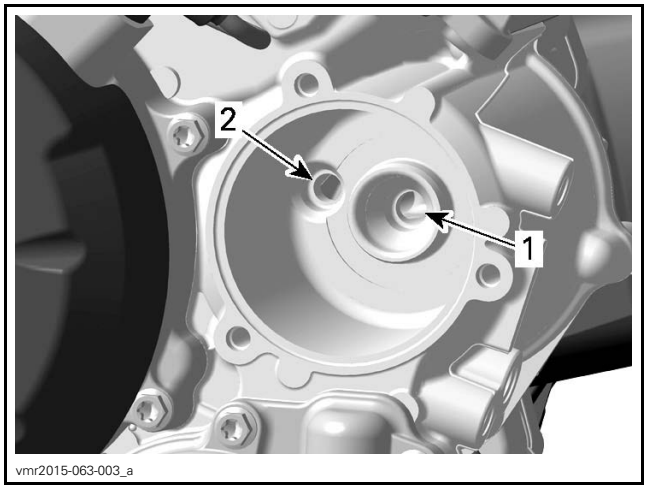
1. Clean oil filter area.
2. Remove oil filter cover screws.
3. Remove oil filter cover.
4. Remove oil filter.



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

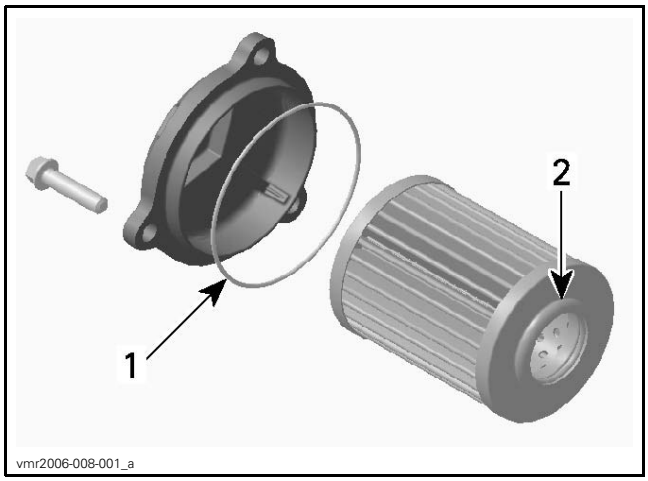
Engine Oil Filter Installation

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



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

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.

COOLING SYSTEM

Recommended Engine Coolant

COOLANT		
BRP recommended product	Finland, Norway and Sweden	LONG LIFE ANTIFREEZE(F) (P/N 619 590 204)
	All Other Countries	LONG LIFE ANTIFREEZE (P/N 219 702 685)
Alternative, or if not available	–	Distilled water and antifreeze solution (50% distilled water, 50% antifreeze)

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

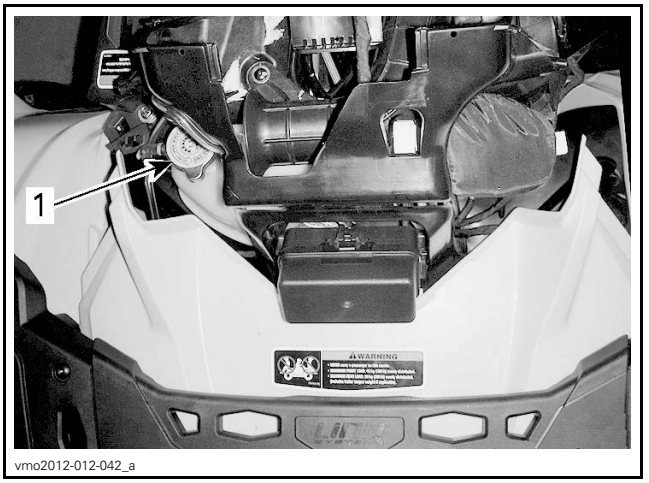
Engine Coolant Level Verification

⚠ 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.



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.

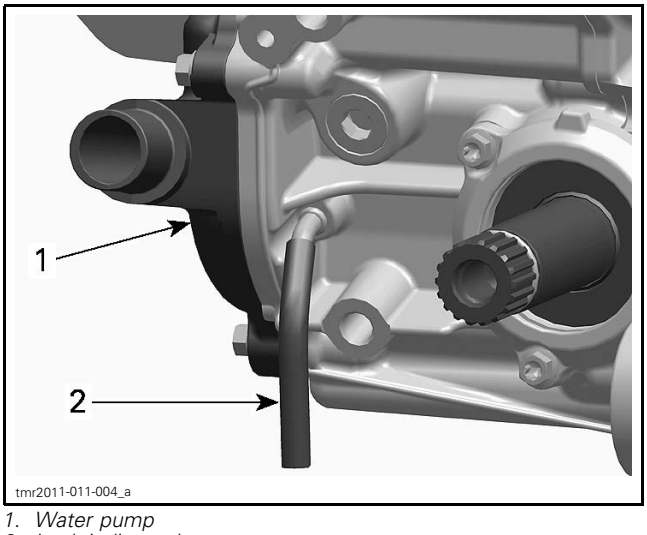
3. Using an antifreeze tester, test coolant strength.

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

Engine Cooling System Inspection

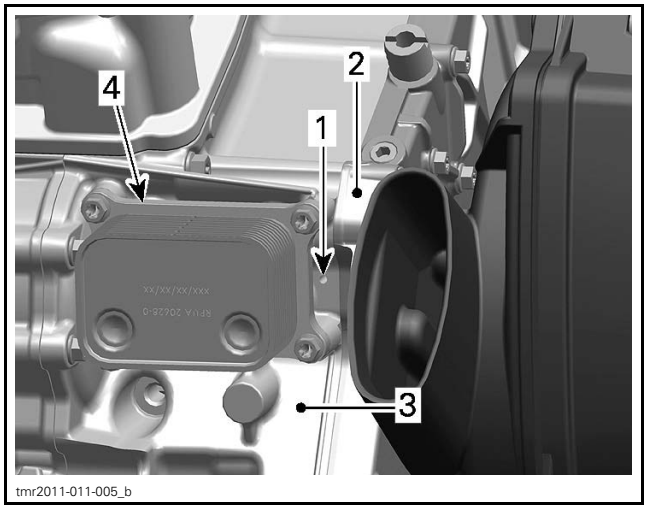
1. Check general condition of hoses and clamps for tightness.
2. Check the leak indicator hose for oil or coolant.

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.



1. Water pump
2. Leak indicator hose

NOTE: Another leak indicator hole is visible on the PTO side. It provides an indication of the PTO gasket condition. If a liquid leaks from this hole, PTO gasket replacement is necessary.



1. Leak indicator hole
2. PTO cover
3. Crankcase PTO, front side
4. Oil cooler

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.

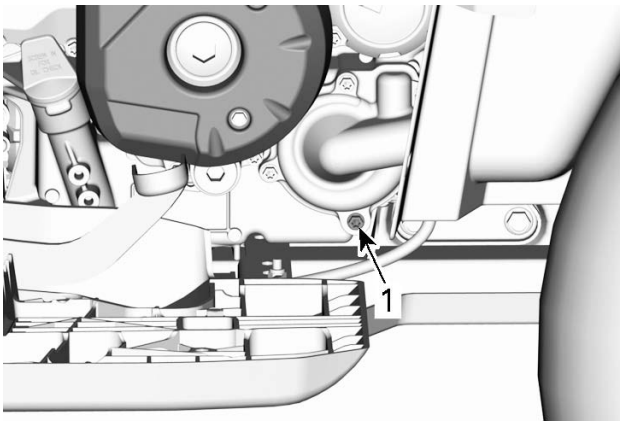


vmo2012-012-042_a

1. Cooling system pressure cap

3. Unscrew coolant drain plug.

NOTE: Coolant drain plug is accessible from underneath RH footrest panel.



vmr2015-107-005_a

SOME PARTS REMOVED FOR CLARITY
1. Coolant drain plug

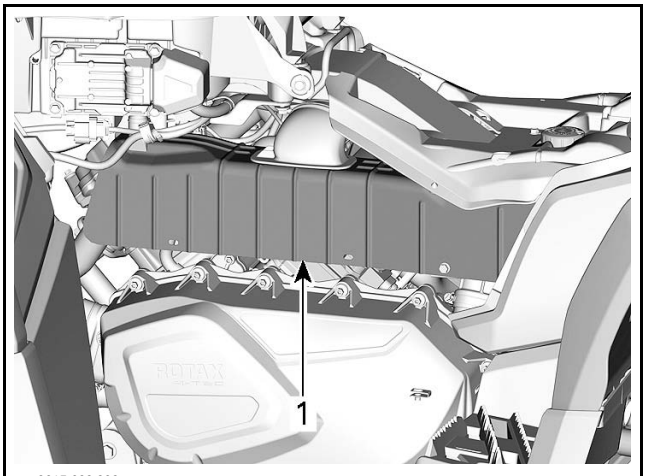
4. Drain cooling system into a suitable container.
5. Reinstall coolant drain plug with a NEW sealing ring.
6. Tighten coolant drain plug to specification.

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

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

Engine Cooling System Filling and Bleeding

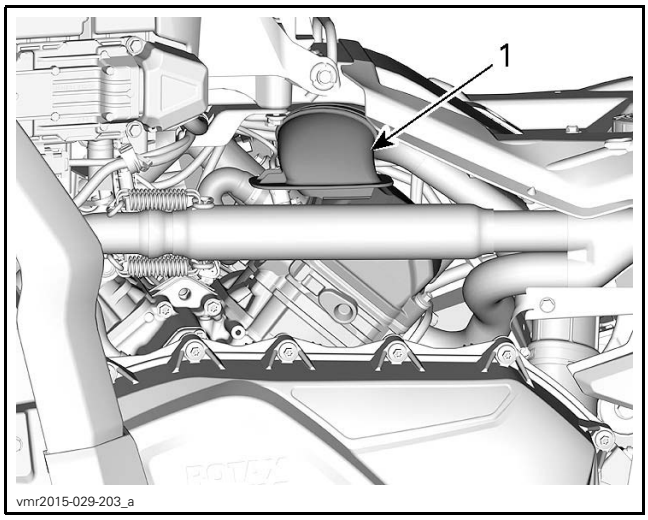
1. Remove cooling system pressure cap.
2. Remove RH and LH side panels. Refer to *BODY* subsection.
3. On LH side of engine, remove outer exhaust heat shield. Refer to *EXHAUST SYSTEM* subsection.



vmr2015-029-202_a

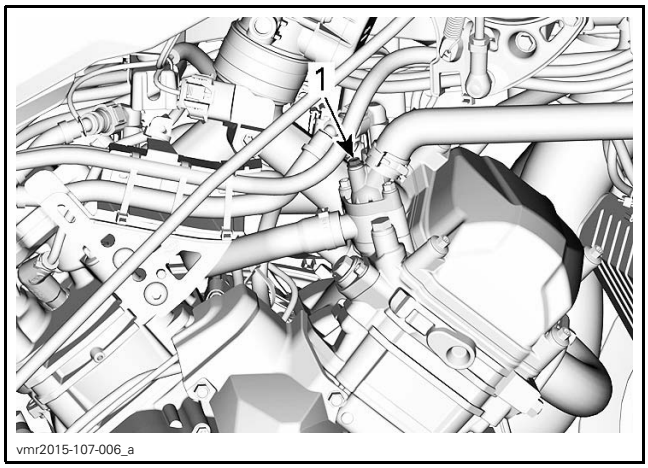
1. Outer exhaust heat shield

4. Remove CVT duct outlet.

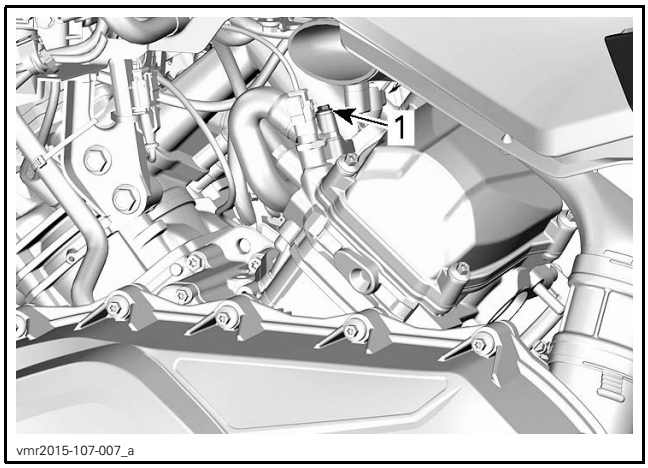


1. CVT duct outlet

5. Unscrew bleed screws on thermostat housing covers of both front and rear cylinders.



RH SIDE OF VEHICLE
1. Front cylinder bleed screw



LH SIDE OF VEHICLE
1. Rear cylinder bleed screw

6. Fill cooling system until coolant comes out of bleed screws.
7. Install bleed screws using **NEW** gasket rings.
8. Tighten bleed screws to specification.

HOLDING STRIP SCREWS	
Gasket	NEW
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening torque	4 N•m ± 0.5 N•m (35 lbf•**in** ± 4 lbf•**in**)

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

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

⚠ WARNING

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

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

CYLINDER HEAD

Engine Valve Clearance Inspection and Adjustment

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

1. Remove valve covers, refer to *TOP END* subsection.
2. Before checking or adjusting the valve clearance, turn crankshaft clockwise to TDC ignition of the respective cylinder, refer to *CAMSHAFT TIMING GEAR* in the *TIMING CHAIN* subsection.

NOTICE **Crankshaft must be turned clockwise only to avoid loosening the magneto retaining bolt.**

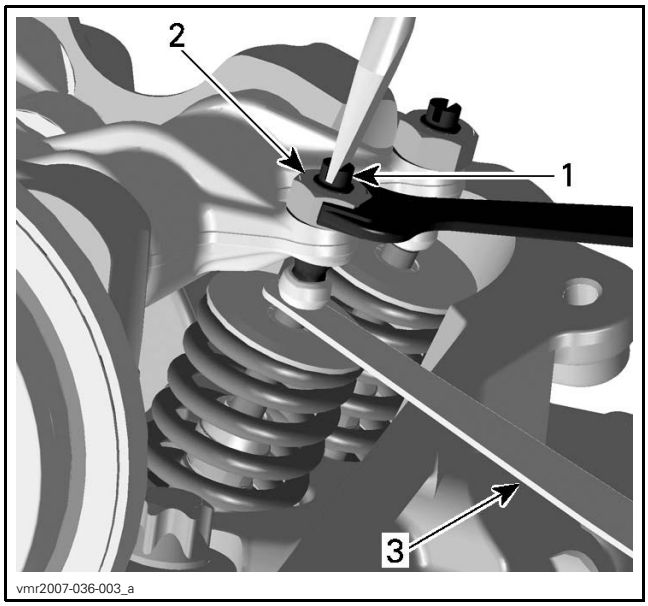
3. Using a feeler gauge, check the valve clearance.

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.

GEARBOX

Recommended Gearbox Oil

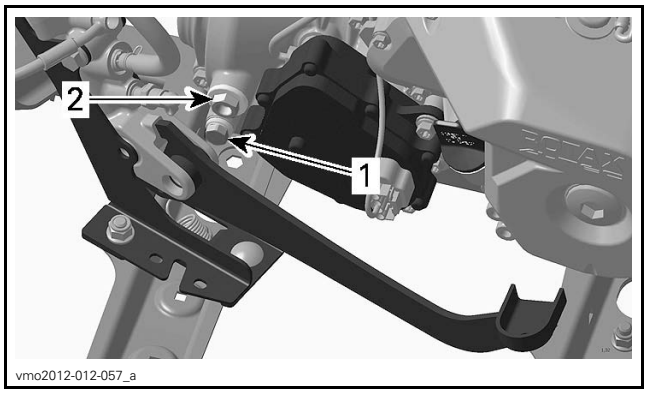
RECOMMENDED PRODUCT	QUANTITY
XPS SYNTHETIC GEAR OIL (75W 140) (P/N 293 600 140)	Approximately 450 ml (15.22 U.S. oz)

If the recommended oil is not available, use a 75W140 gearbox oil that meets the API GL-5 specification.

Gearbox Oil Level Verification

NOTE: Prior checking the gearbox oil level, ensure vehicle is on a level surface.

1. To access gearbox oil level plug, refer to *BODY* subsection and remove the following parts:
   - Seat
   - Console
   - RH side panel
   - RH footrest panel.
2. Remove the gearbox oil level plug.



1. Drain plug
2. Oil level plug

3. Check oil level.

The oil should be level with the bottom of the oil level hole.

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

Gearbox Oil Replacement

Gearbox Oil Draining Procedure

1. Start engine and operate vehicle to warm-up the gearbox oil.

NOTE: Running engine at idle is not sufficient, vehicle transmission must be operated.

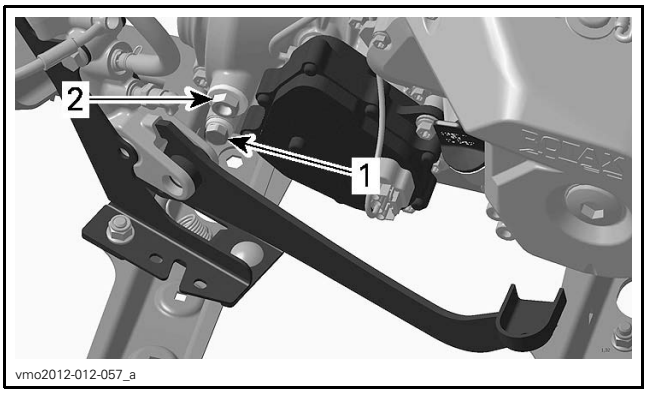
2. Position vehicle on a level surface.
3. Place a drain pan under the gearbox drain plug area.
4. Clean drain plug area.
5. Remove magnetic drain plug and sealing ring. Discard sealing ring.

⚠ WARNING

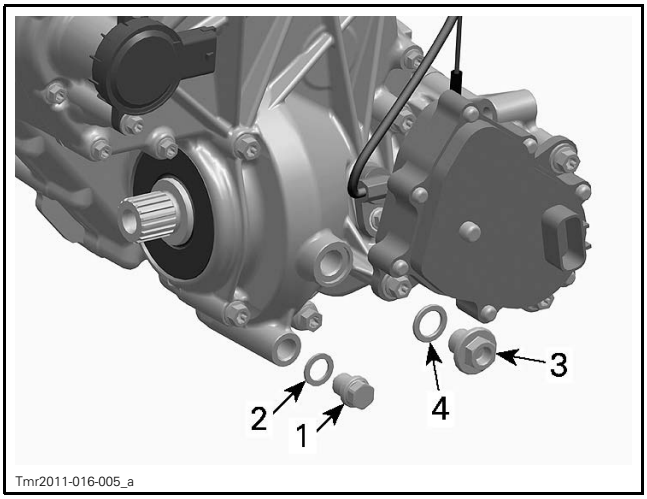
The gearbox oil can be very hot.

6. Remove oil level plug and its O-ring.

NOTE: Allow oil to completely flow out of gearbox.



1. Magnetic drain plug
2. Oil level plug



TYPICAL
1. Magnetic drain plug
2. Sealing ring
3. Oil level plug
4. O-ring

7. Clean magnetic drain plug and pay attention to any debris present on drain plug.

NOTE: Presence of excessive debris provides an indication of a gearbox problem.

8. Reinstall magnetic drain plug with a NEW sealing ring.

DRAIN PLUG	
Gasket	NEW
Tightening torque	20 N•m ± 2 N•m (15 lbf•ft ± 1 lbf•ft)

9. Dispose gearbox oil as per your local environmental regulations.

Gearbox Oil Filling Procedure

1. Fill the gearbox through the oil level hole until the oil reaches the bottom of the oil level hole.
2. Install the oil level plug with its O-ring. Tighten plug as per table.

OIL LEVEL PLUG	
Tightening torque	5 N•m ± 0.6 N•m (44 lbf•**in** ± 5 lbf•**in**)

Vehicle Speed Sensor (VSS) Cleaning

Remove the VSS. Refer to *GEARBOX AND COUPLING UNIT* subsection.

Remove all metal particles and oil from the VSS magnet.

NOTE: A dirty VSS will cause erratic speedometer readings.

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.

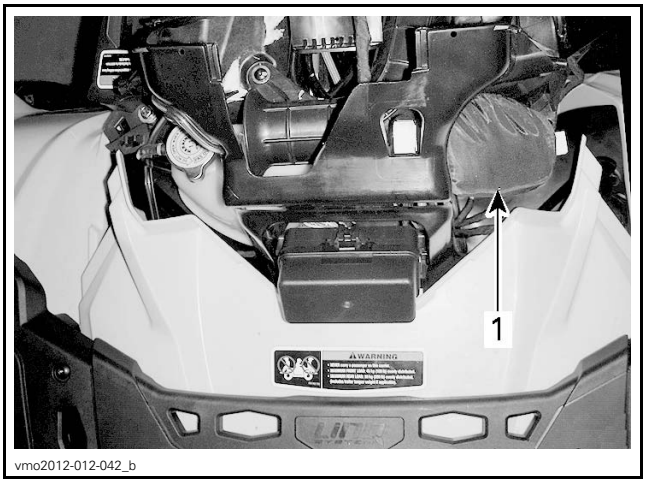
NOTE: If a lot of debris or grime are found in the CVT system, it may be necessary to remove the ducts and thoroughly clean them.

4. Reinstall CVT cover.

CVT Air Filter Cleaning

CVT Air Filter Removal

1. Remove gauge support, refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.
2. Remove air filter from CVT air inlet by stretching its sides.



1. CVT air filter

CVT Air Filter Cleaning

1. Remove CVT air filter.
2. Inspect filter and replace if damaged.
3. Gently clean filter using a solution of soft soap and tap water, then rinse thoroughly.
4. Dry filter completely.
5. Clean inside the CVT air inlet duct.

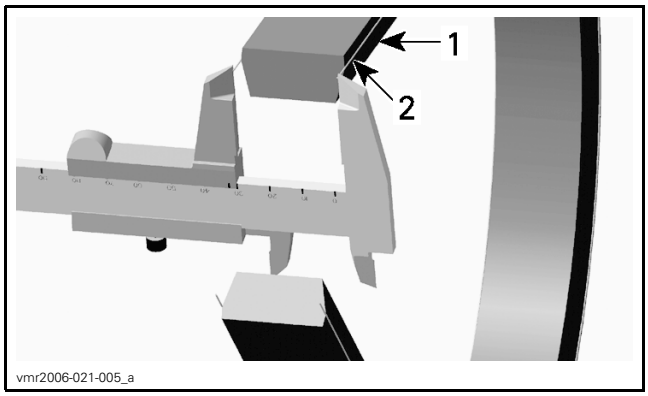
CVT Air Filter Installation

1. Install air filter on CVT inlet.
2. Install gauge support.

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
2. Cord in drive belt

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 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)* subsection.

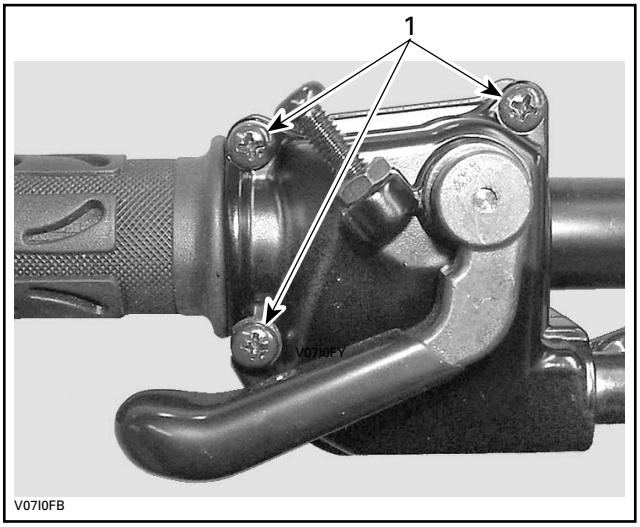
Throttle Cable Lubrication

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.

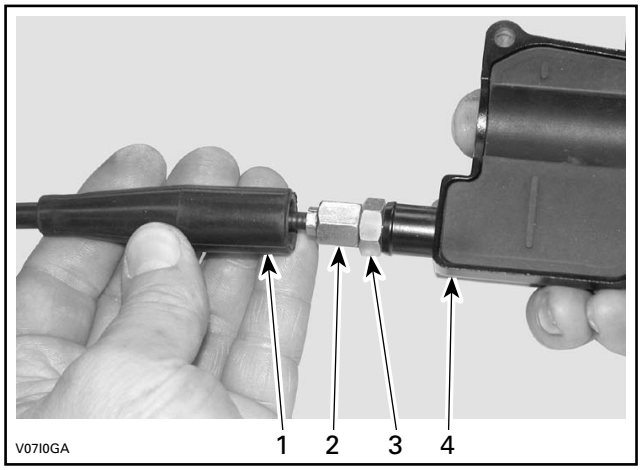
Open the throttle lever housing.



1. Remove these screws

Separate the housing.

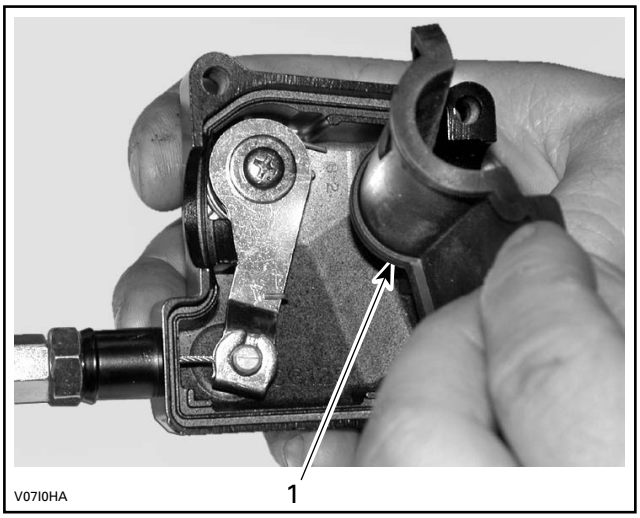
Slide rubber protector back to expose throttle cable adjuster.



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

Screw in the throttle cable adjuster.

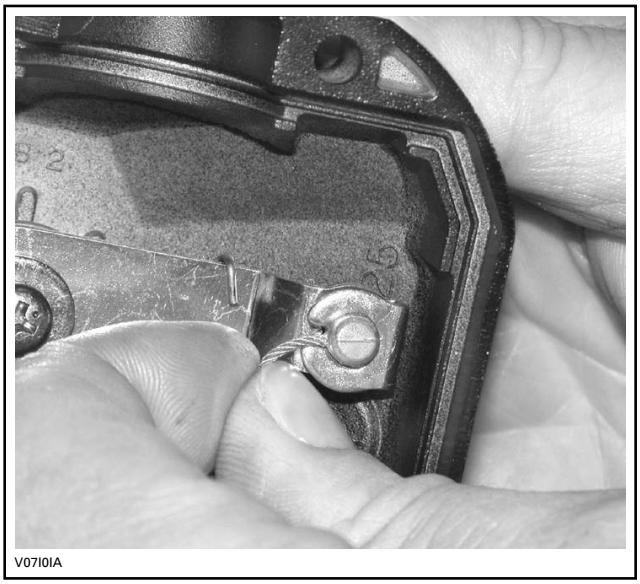
Remove inner housing protector.



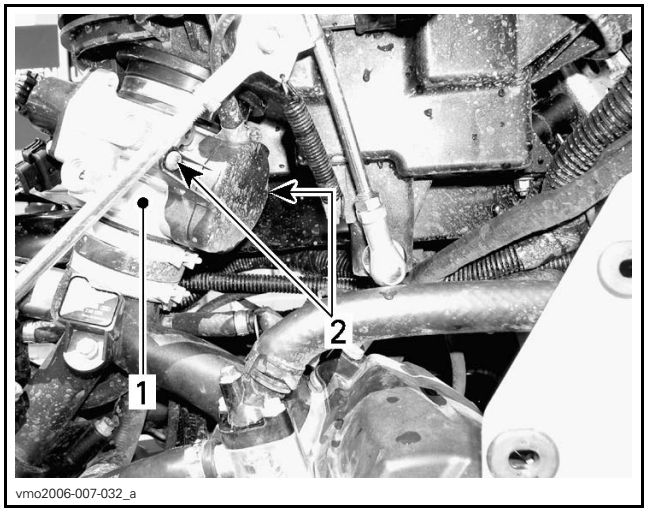
1. Inner housing protector

Remove the cable from the throttle lever housing.

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



Remove the throttle body side cover.



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.



TYPICAL

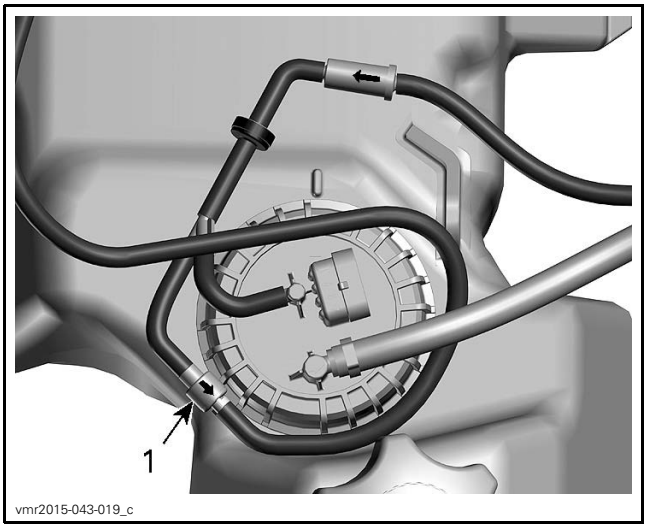
NOTE: Place a rag around the throttle cable adjuster to prevent the lubricant from splashing.

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

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

Fuel Tank Vent Breather Filter Replacement

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



1. Pressure relief valve flow direction arrow

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 recommended service product and low pressure air.

RECOMMENDED SERVICE PRODUCT
XPS BRAKES AND PARTS CLEANER (P/N 219 701 776)
XPS BRAKES AND PARTS CLEANER (USA) (P/N 219 701 705)

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

For access to the LH spark plug, remove the aft inner fender panel from the front LH fender.

For access to the RH spark plug, remove the RH side panel.

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.

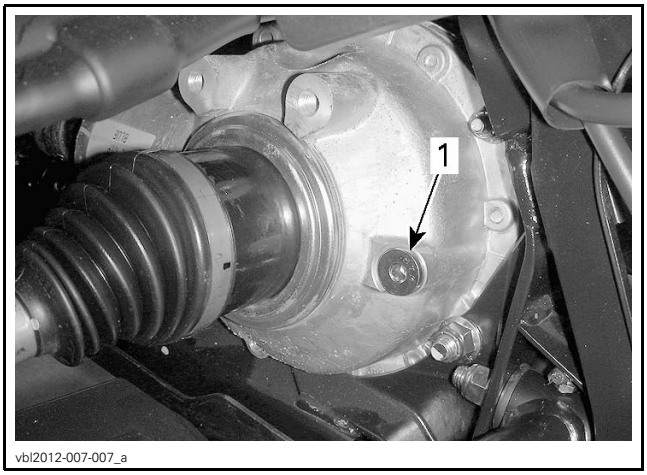
3. Hand screw spark plug into cylinder head, then tighten to specification using a torque wrench and an appropriate socket.

SPARK PLUG	
Tightening torque	20 N•m ± 2 N•m (15 lbf•ft ± 1 lbf•ft)

DRIVE SYSTEM

Front Differential Oil Level Verification

1. Clean filler plug prior to checking oil level.



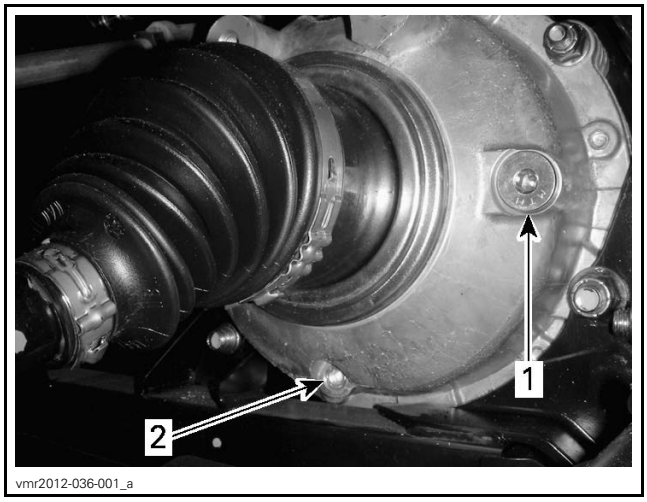
RH SIDE OF VEHICLE
1. Filler plug

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.

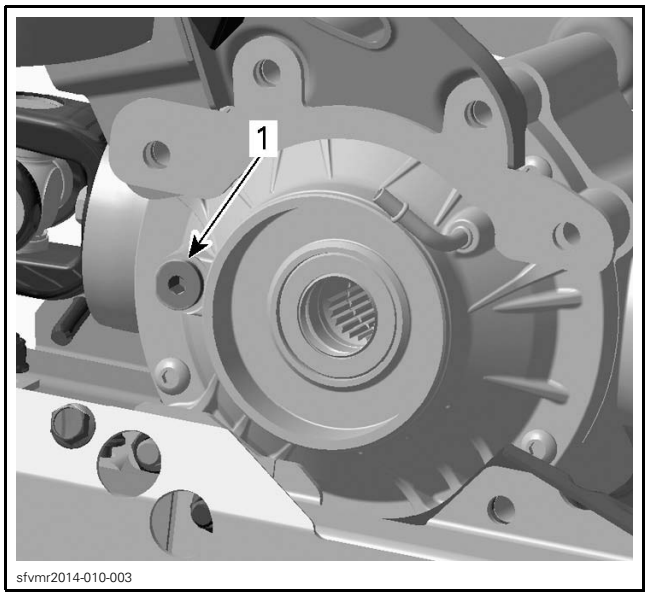
CAPACITY	RECOMMENDED OIL
500 ml (17 U.S. oz)	XPS SYNTHETIC GEAR OIL (75W 90) (P/N 293 600 043) or a 75W 90 (API GL-5) gear oil

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

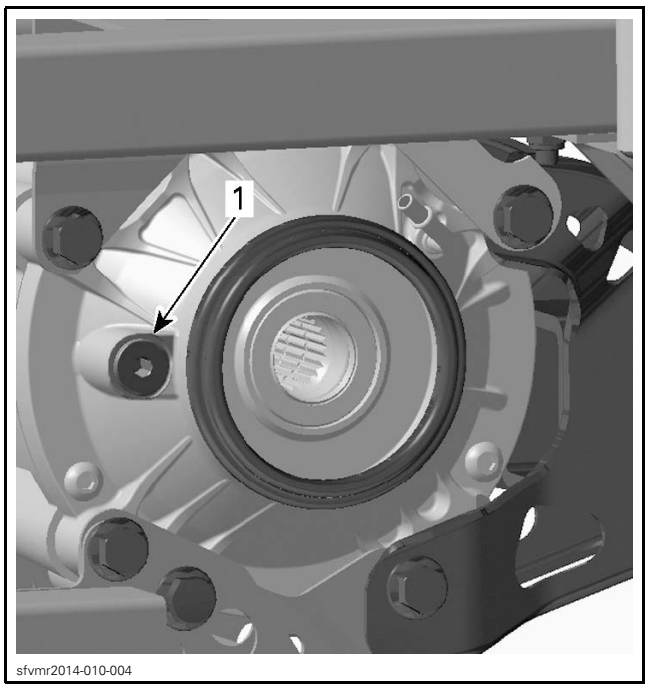
FILLER PLUG	
Gasket	NEW
Tightening torque	22.5 N•m ± 2.5 N•m (17 lbf•ft ± 2 lbf•ft)

Middle and Rear Final Drive Oil Level Verification

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



MIDDLE DRIVE, LH SIDE OF VEHICLE
1. Filler plug



REAR FINAL DRIVE, LH 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.

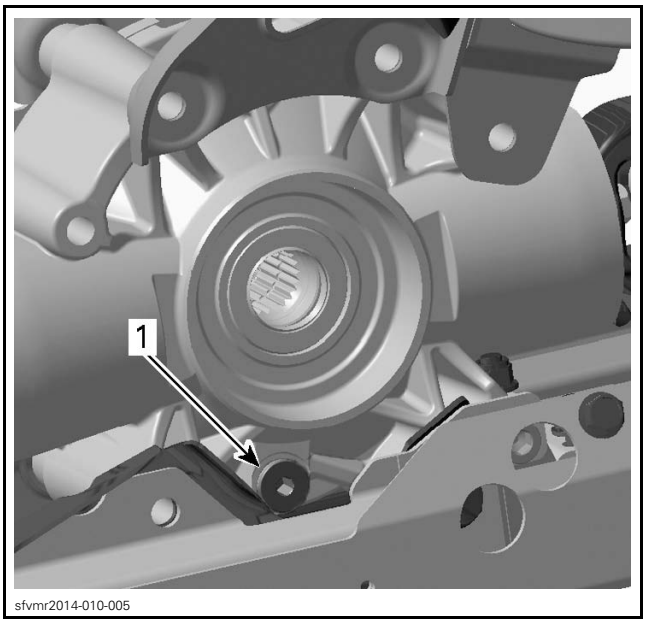
OIL LEVEL	
Middle drive	13 mm ± 5 mm (.512 in ± .197 in)
Rear final drive	20 mm ± 5 mm (9/16 in ± 3/16 in)

6. Reinstall filler plug with a **NEW** sealing ring.

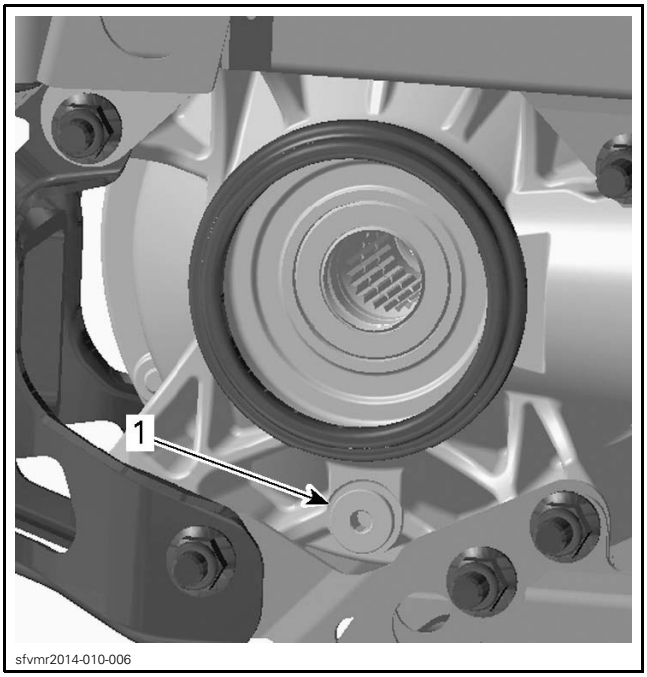
FILLER PLUG	
Gasket	NEW
Tightening torque	22.5 N•m ± 2.5 N•m (17 lbf•ft ± 2 lbf•ft)

Middle and 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.



MIDDLE DRIVE, LH SIDE OF VEHICLE
1. Drain plug



REAR FINAL DRIVE, RH SIDE OF VEHICLE
1. Drain 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 middle or rear final drive.

RECOMMENDED OIL		QUANTITY
Middle Drive	XPS SYNTHETIC GEAR OIL (75W 140) (P/N 293 600 140) or a 75W 140 (API GL-5) gear oil	400 ml (14 U.S. oz)
Rear Final Drive	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

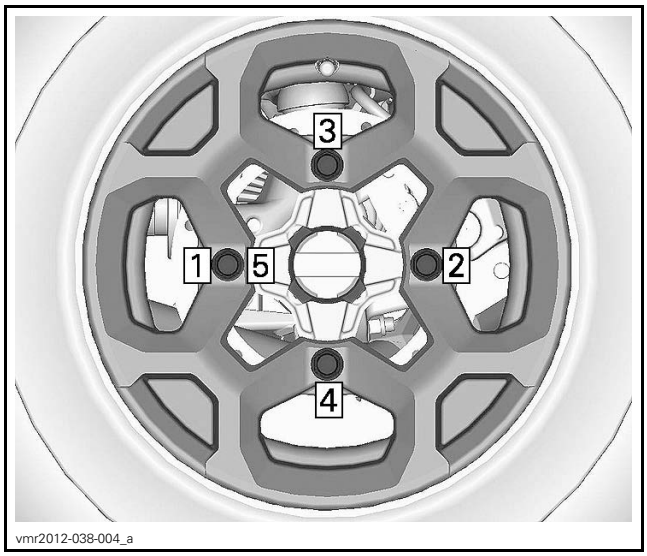
PROPELLER SHAFT U-JOINT LUBRICATION
Use Hi-temp bearing grease NLGI-2 or an equivalent

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.

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.

SUSPENSION

Shock Absorber Inspection

Check shock absorber for any leaks, replace if necessary.

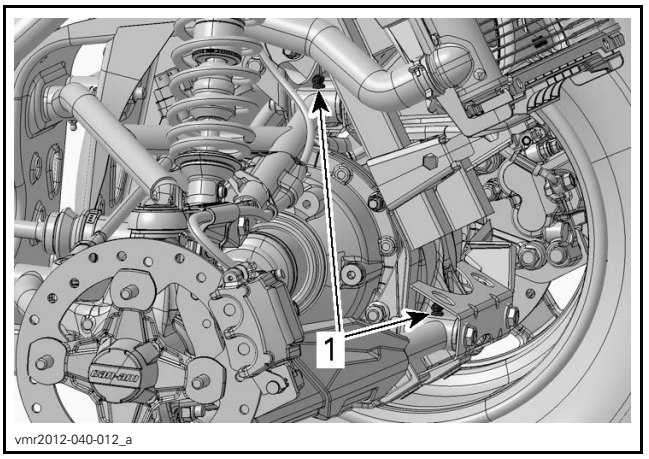
Check shock absorber for abnormal play:
– Front to back
– Up and down.

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

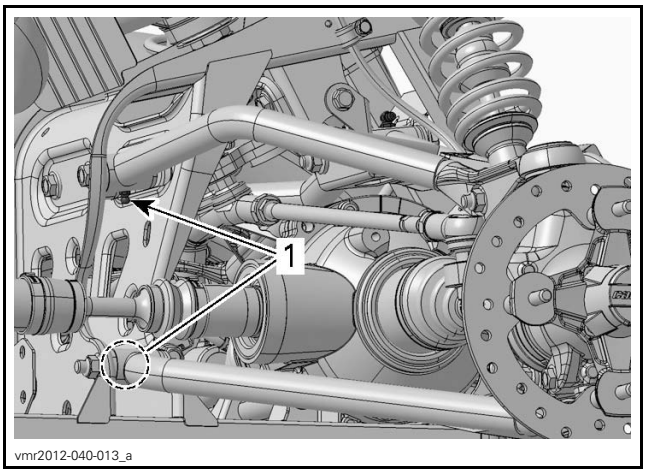
Front Suspension Arm Lubrication

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:
   – Bushings
   – Cushions.
4. Check ball joint for:
   – Damage
   – Pitting
   – Play.

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

Middle and 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:
   – Bushings
   – Cushions.
4. Check ball joint for:
   – Damage
   – Pitting
   – Play.
5. Check ball joint bellows for:
   – Damage
   – Cracks.

Rear Anti-Sway Bar Bushing Inspection and Lubrication

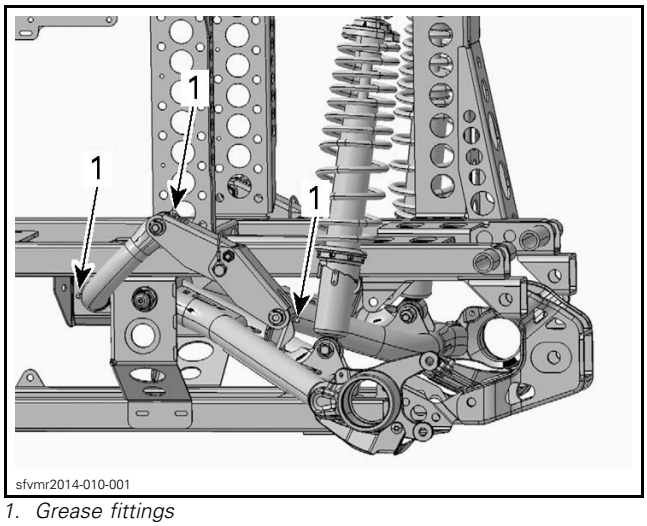
Rear Anti-Sway Bar Bushing Inspection

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)



1. Grease fittings

BRAKES

Brake System Inspection and Cleaning

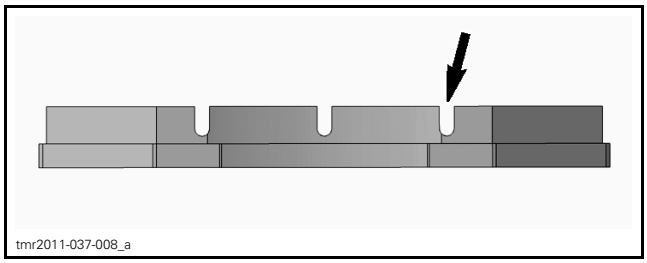
NOTICE Do not clean brake components in petroleum based solvent. Use brake system cleaner only. Soiled brake pads must be replaced with new ones.

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 the recommended service product:
   – Brake pads
   – Caliper support and slider
   – Caliper pistons and pin.

RECOMMENDED SERVICE PRODUCT
XPS BRAKES AND PARTS CLEANER (P/N 219 701 776)
XPS BRAKES AND PARTS CLEANER (USA) (P/N 219 701 705)

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 the following recommended service product.

RECOMMENDED SERVICE PRODUCT
XPS BRAKES AND PARTS CLEANER (P/N 219 701 776)
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

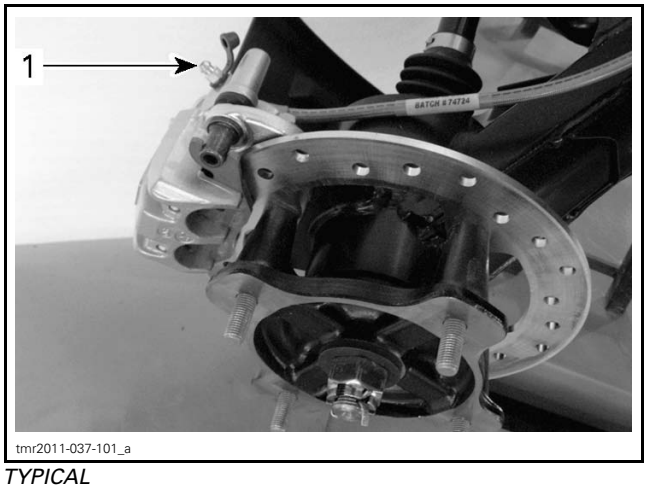
Check hoses for leaks, crushed, deformations, cracking or scrapes.

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.



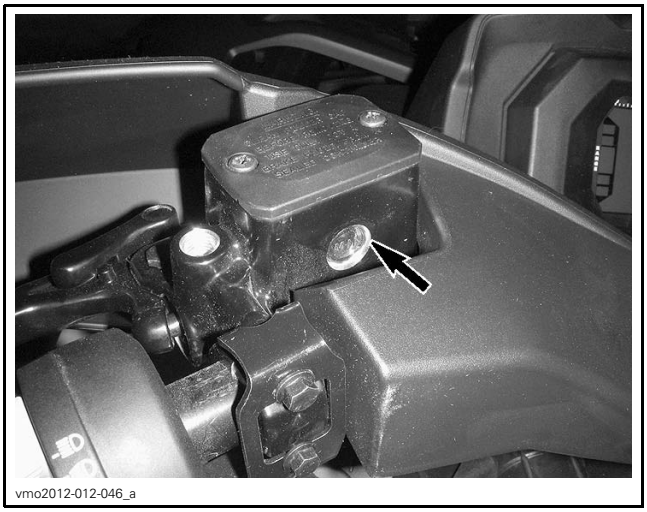
TYPICAL
1. Caliper bleeder

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.

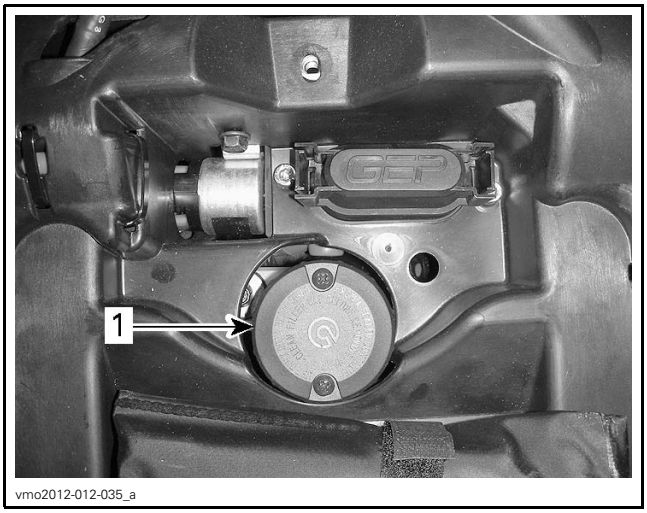
NOTE: To locate all bleeders according to vehicle configuration, refer to *EXPLODED VIEW* and *BRAKE CIRCUIT CONFIGURATIONS*. See *BRAKES* subsection.

Brake Fluid Filling

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


vmo2012-012-046_a

TYPICAL - BRAKE FLUID RESERVOIR



vmo2012-012-035_a

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.

BODY

Seat Latch Inspection and Operation

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

Rear Cargo Compartment Latch Inspection and Operation

Ensure cargo compartment latch functions properly and that compartment panel is properly secured when latched.

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	63
XPS ALL PURPOSE CLEANER	219 701 709	63
XPS ATV CLEANING KIT	219 701 713	63
XPS ATV FINISHING SPRAY	219 701 704	63
XPS ATV WASH	219 701 702	62
XPS FUEL STABILIZER	413 408 601	61
XPS LUBE	293 600 016	61, 63
XPS STORAGE OIL (EXCEPT U.S. COUNTRY)	413 711 600	61
XPS STORAGE OIL (U.S. COUNTRY ONLY)	413 711 900	61

GENERAL

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

Where applicable, refer to the appropriate subsections in this manual for 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).

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. 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.

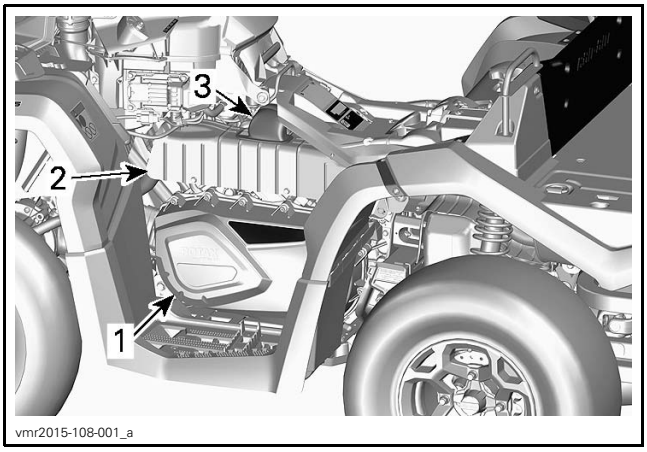
Block engine air inlet hose using a rag to prevent intrusion of small animals.

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.

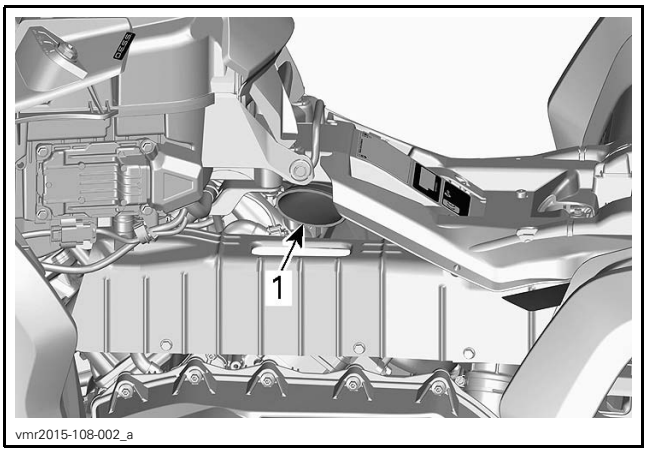
NOTE: Do not reinstall drive belt.

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



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

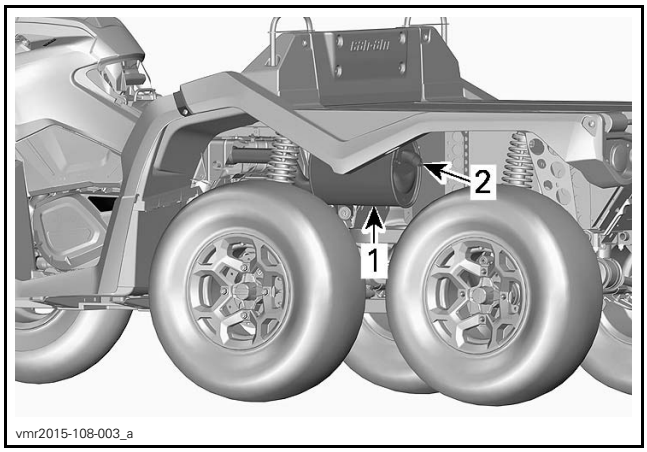
6. Block CVT outlet hose using a rag.



1. CVT outlet hose

Exhaust System

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



1. Muffler
2. Block with rag here

ELECTRICAL SYSTEM

Battery Removal

Remove battery from ATV.

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

DRIVE SYSTEM

Lubricate all propeller shaft U-joints.

CHASSIS

Lubrication

Lubricate front and rear suspension.

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.

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).

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

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.

Independently of operating conditions of the vehicle, perform all items listed in the maintenance schedule table beginning by EVERY 3 000 km (2,000 mi) OR 100 HOURS OF OPERATION...

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

vmr2015-109-001

TABLE TO BE USED

NOTE: If the next maintenance service beginning by EVERY 6 000 km (4,000 mi) OR 200 HOURS OF OPERATION 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	68

GENERAL

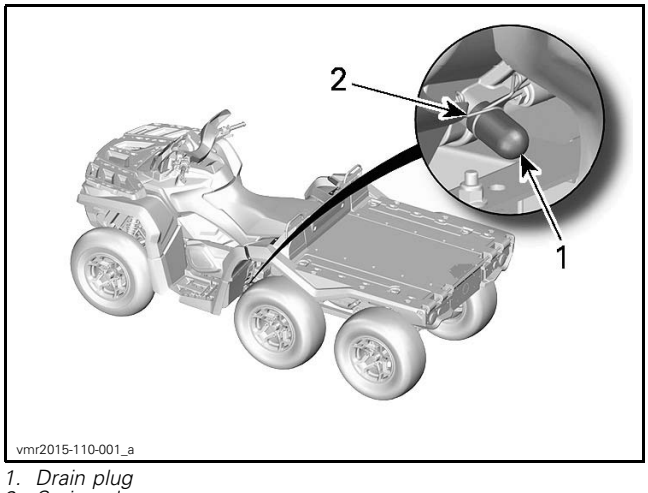
NOTE: Component failures resulting from these events are not warrantable.

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 rear portion of the CVT cover. It is accessible from the rear LH fender.

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



1. Drain plug
2. Spring clamp

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

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

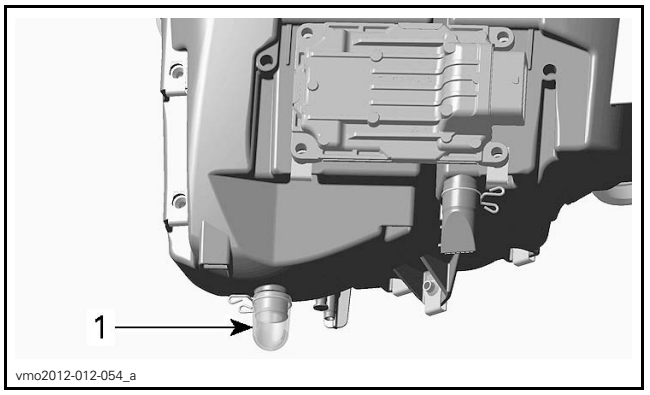
Reinstall the drain plug and secure it using the spring clamp.

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

If an appreciable amount of water is drained from the CVT cover, remove the cover and properly service the CVT.

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, middle and rear final drive vents. Clean or replace as necessary.

Drain muffler and exhaust pipes (removal required).

Clean muffler spark arrester.

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

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

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 plugs. Crank engine in drowned mode to expel any water.

⚠ CAUTION **Keep away from spark plug holes to avoid being splashed when cranking engine.**

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

Install spark plugs (replace if required).

NOTICE **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 oil from the front differential and from the final drives (middle and rear)

Lubricate front and rear suspensions and propeller shaft joints.

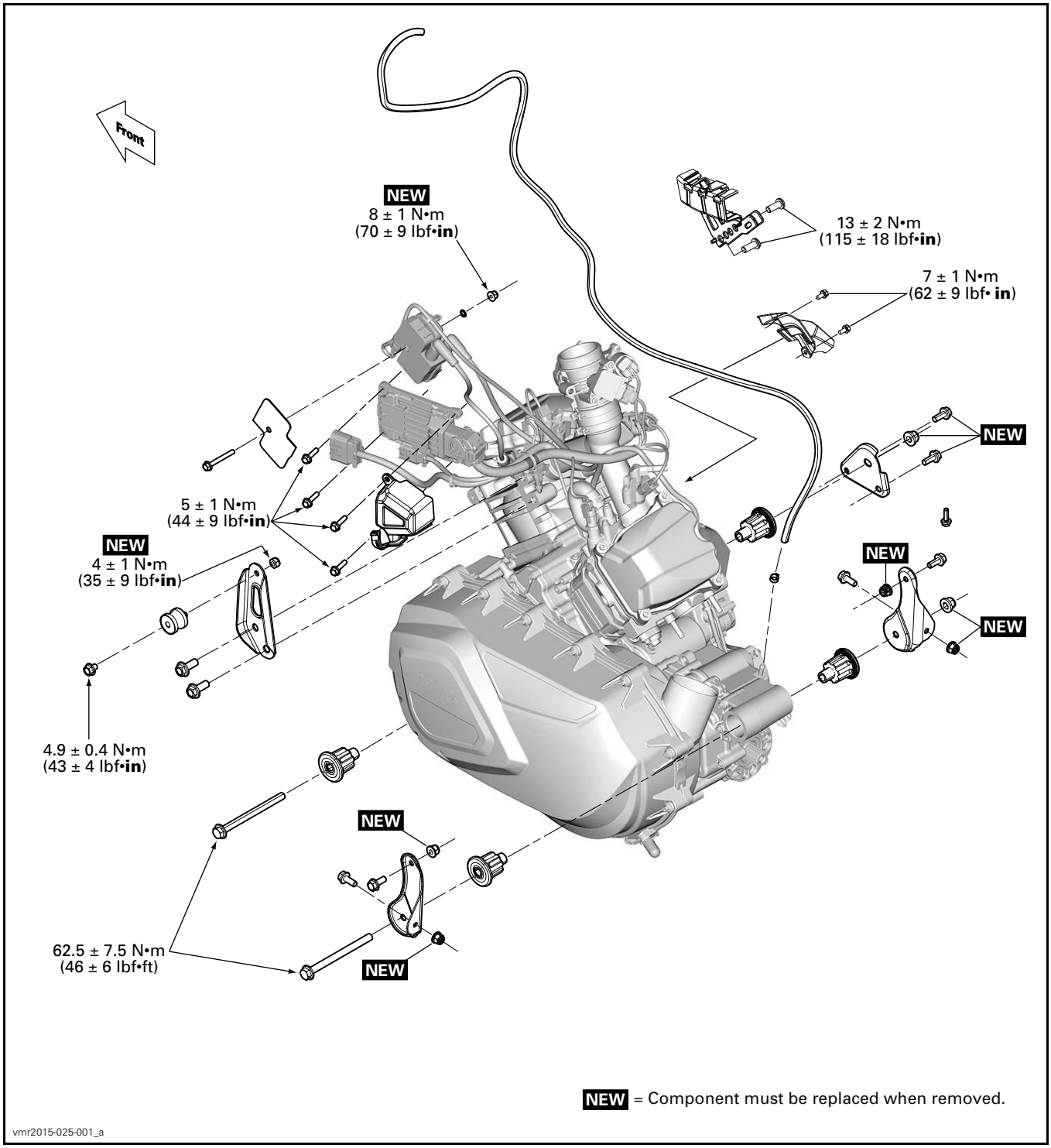
Spray all metal parts with XPS LUBE (P/N 293 600 016).

Test drive to confirm proper operation.

ENGINE REMOVAL AND INSTALLATION

SERVICE TOOLS

Description	Part Number	Page
ENGINE LIFTING TOOL	529 036 022	73



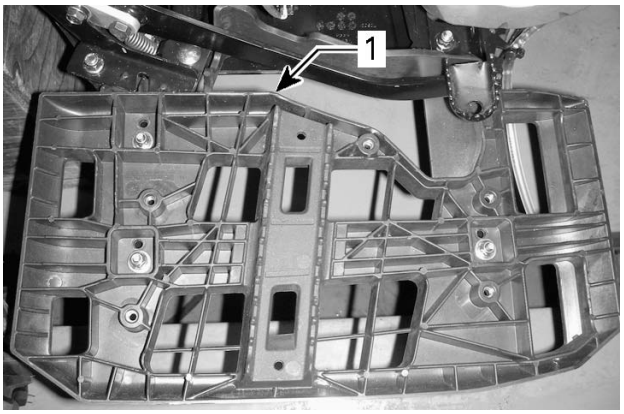
PROCEDURES

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 the following operations. Refer to table.

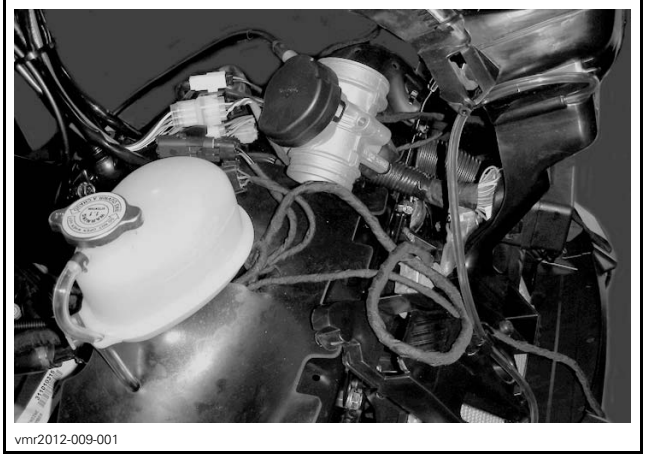
OPERATIONS	REFERENCES (SUBSECTION)
Release fuel pressure	*FUEL TANK AND FUEL PUMP*
Remove battery from vehicle	*CHARGING SYSTEM*
Drain engine coolant	*PERIODIC MAINTENANCE PROCEDURES*
Remove front body module	*BODY*
Remove RH footrest panel	
Remove air filter housing	*AIR INTAKE SYSTEM*
Remove muffler	*EXHAUST SYSTEM*
Remove exhaust pipes	
Remove CVT air inlet adapter	*CONTINUOUSLY VARIABLE TRANSMISSION (CVT)*
Remove CVT air outlet adapter	
Disconnect starter cable	*STARTING SYSTEM*
Disconnect TPS and IACV connectors from throttle body	*ELECTRONIC FUEL INJECTION (EFI)*
Disconnect MAPTS connector from intake manifold	
Remove intake manifold	*INTAKE MANIFOLD*
Remove spark plug cables	*IGNITION SYSTEM*

4. Remove RH footrest support.



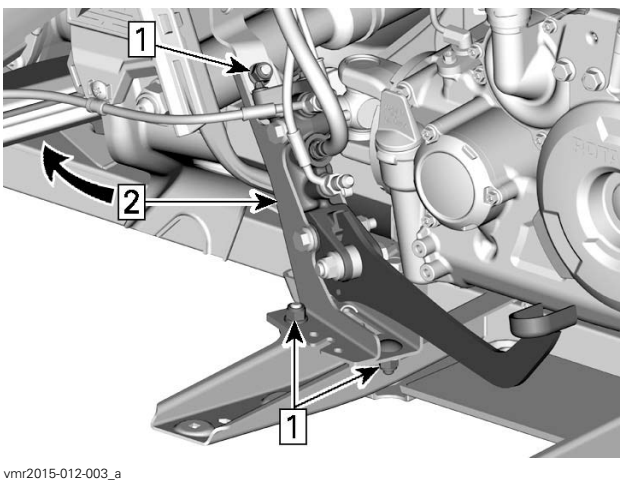
1. RH footrest support

5. Move throttle body aside to make room.

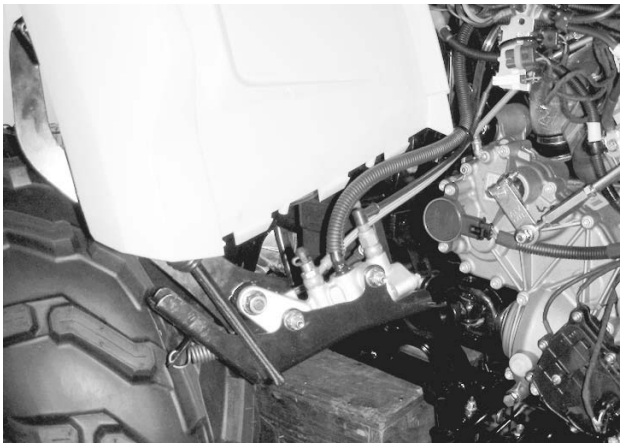


TYPICAL - THROTTLE BODY SECURED TO FRAME

6. Move the master cylinder backwards.

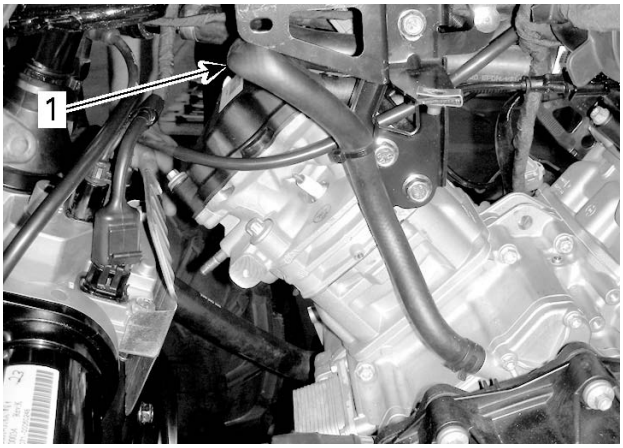


Step 1: Remove these fasteners
Step 2: Move master cylinder assembly back


vmr2012-009-002

TYPICAL - MASTER CYLINDER SECURED TO REAR FENDER

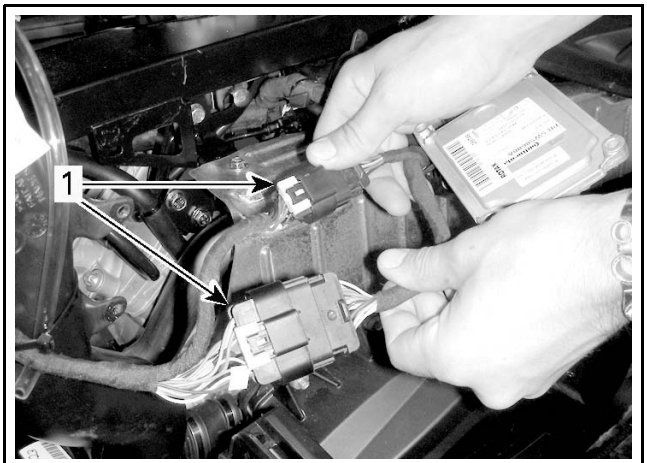
7. Move crankcase vent hose as illustrated.



vmr2012-009-004_a

TYPICAL - LH SIDE OF ENGINE
1. Crankcase vent hose

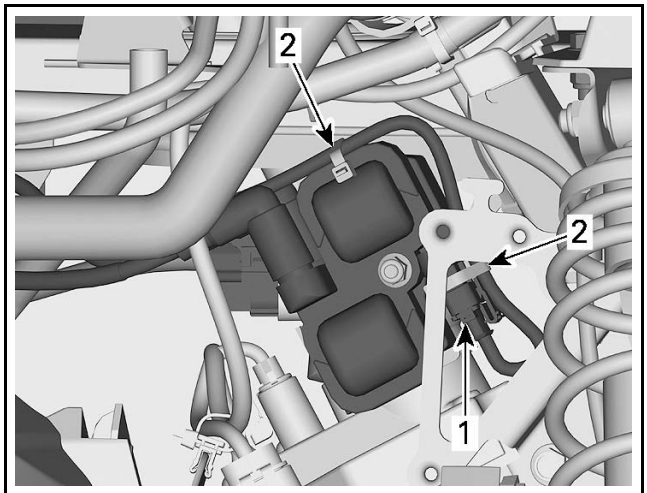
8. Disconnect both engine harness connectors (HIC).



vmr2012-009-005_a

TYPICAL - LH SIDE OF VEHICLE
1. Engine harness connectors (HIC)

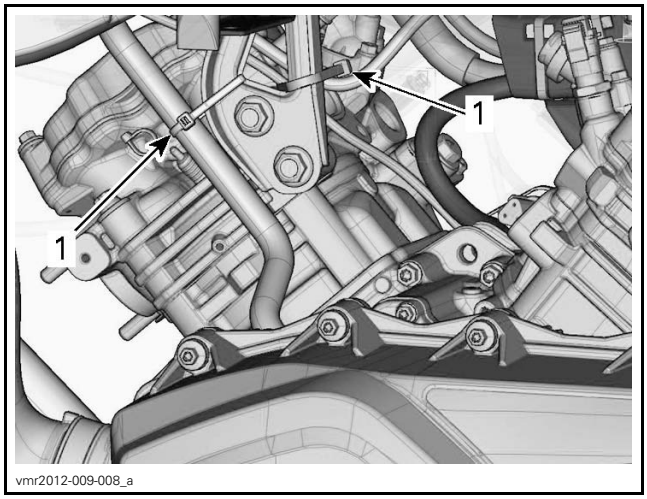
9. Disconnect ignition coil connector.



vmr2015-025-003_a

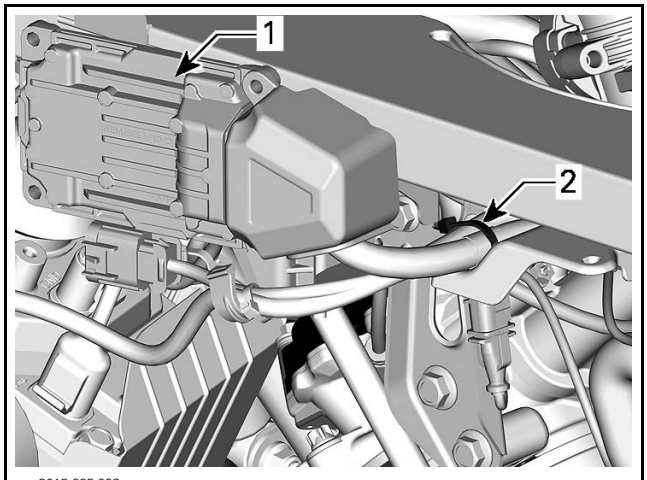
TYPICAL - FROM LH SIDE
1. Ignition coil connector
2. Locking ties to cut

10. Remove the following locking ties.



vmr2012-009-008_a

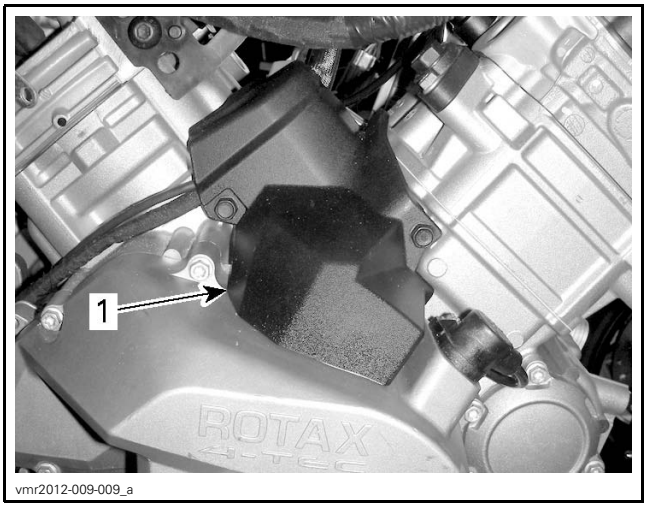
TYPICAL - UPPER ENGINE MOUNTING BRACKET.
1. Locking ties to cut



vmr2015-025-002_a

1. ECM
2. Locking tie to cut

11. On RH side of engine, remove oil pressure switch cover.



vmr2012-009-009_a

TYPICAL - RH SIDE OF ENGINE
1. Oil pressure switch cover

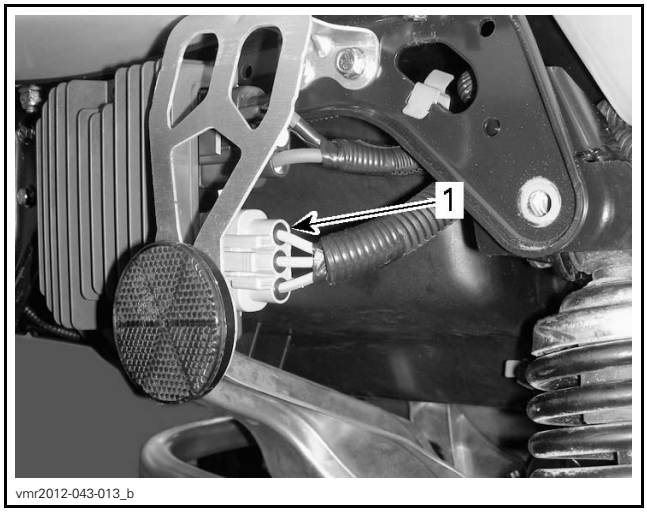
12. Cut locking ties and remove electrical harnesses from harness support.



vmr2012-009-010_a

TYPICAL - RH SIDE OF ENGINE
1. Harnesses support

13. Disconnect magneto connector from voltage regulator rectifier.

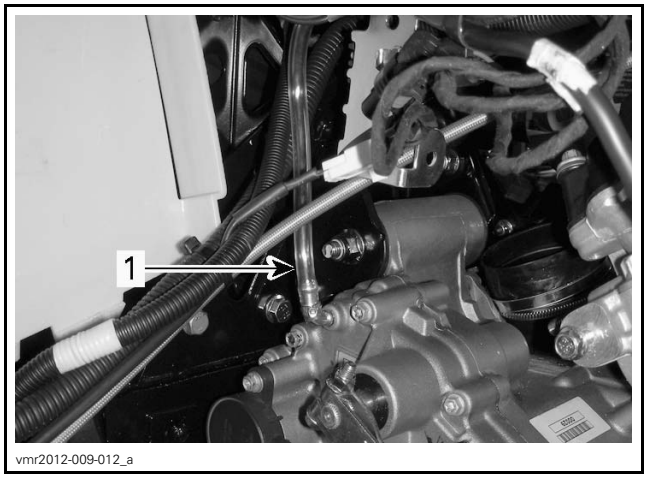


vmr2012-043-013_b

TYPICAL
1. Magneto connector

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

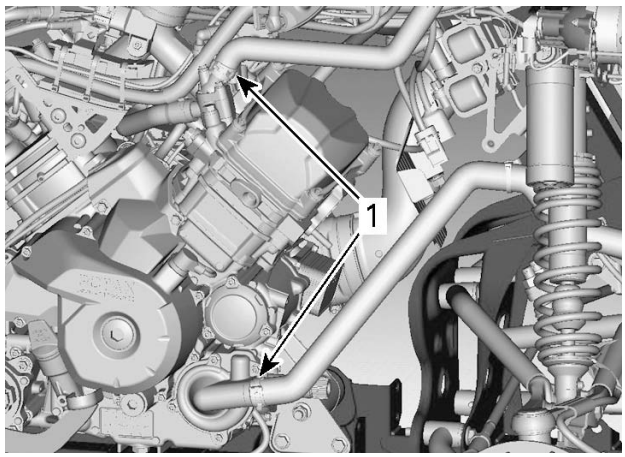
15. Disconnect vent hose from gearbox.



vmr2012-009-012_a

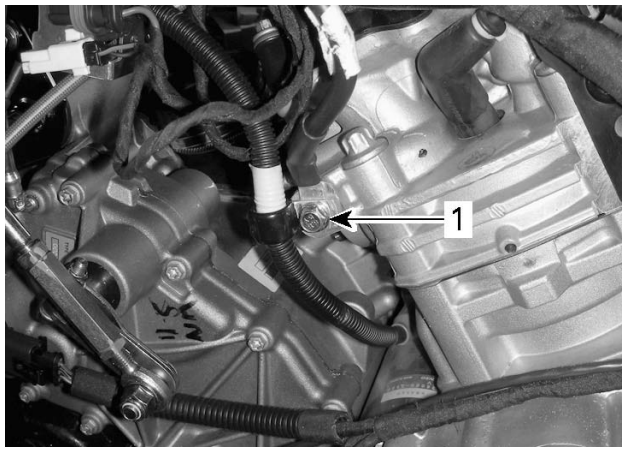
TYPICAL
1. Vent hose

16. Disconnect coolant hoses as illustrated.



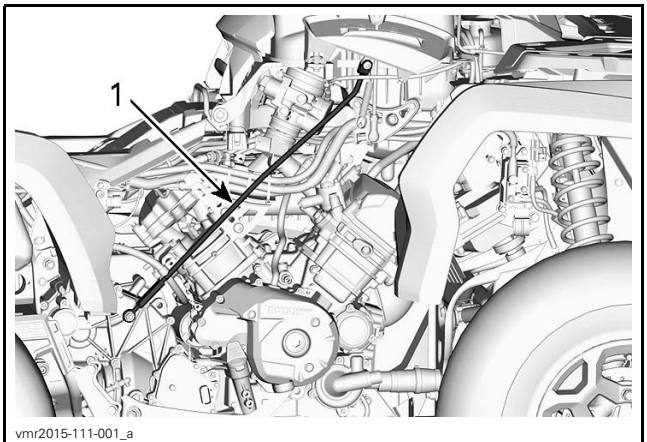
SOME PARTS REMOVED FOR CLARITY
1. Disconnect the following coolant hoses

17. Remove main ground wire from engine.



TYPICAL - RH SIDE AFT CYLINDER
1. Main ground wire

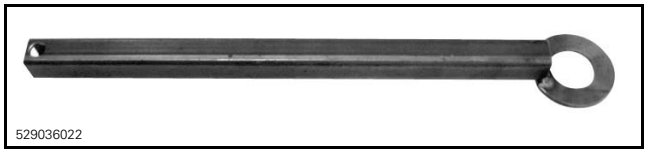
18. Remove the shift rod. Refer to *SHIFTER* subsection.

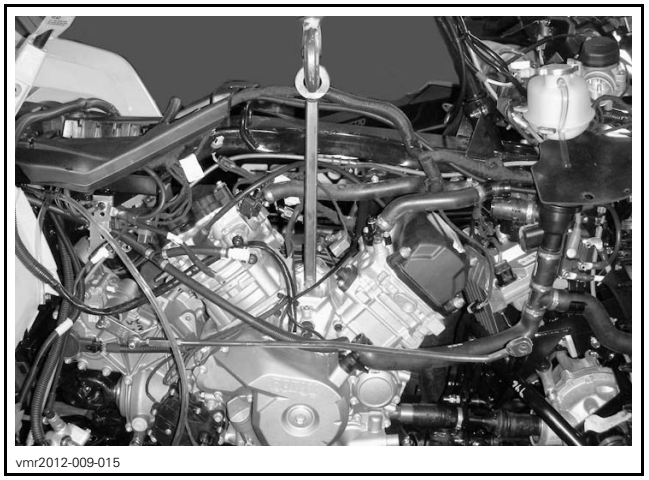


1. Shift rod

Engine Lifting

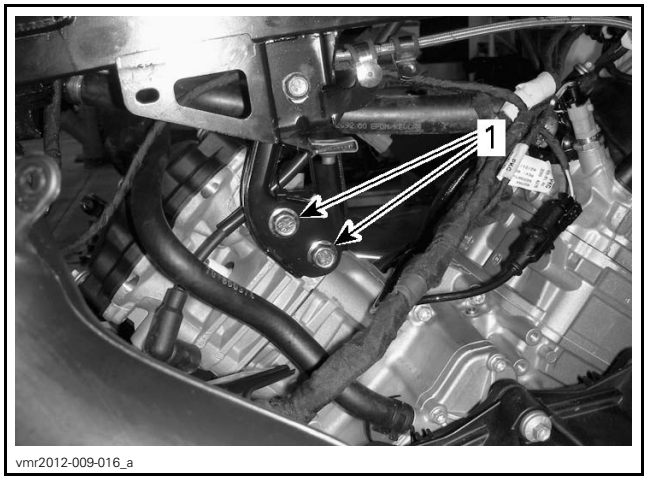
1. Install the ENGINE LIFTING TOOL (P/N 529 036 022) on engine.





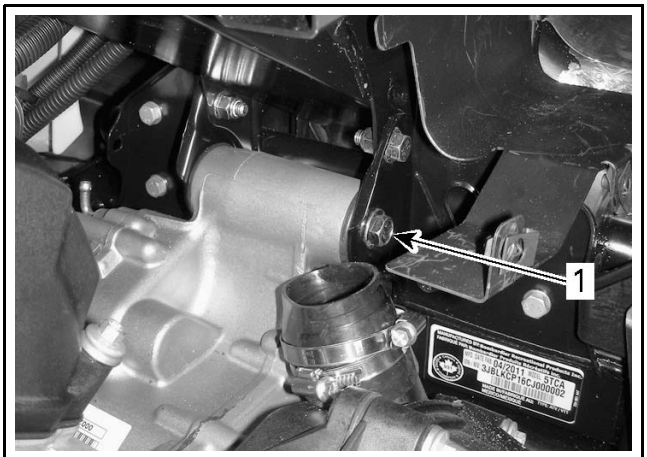
TYPICAL

2. Attach hoist to engine lifting tool and pick up some of the engine weight with the hoist.
3. Remove retaining screws from upper engine mount.



TYPICAL - LH SIDE
1. Upper retaining screws

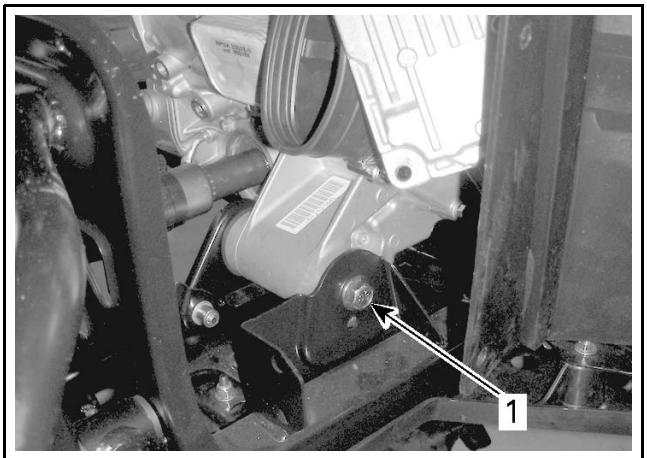
4. Remove retaining bolt from rear engine mount.



vmr2012-009-017_a

TYPICAL - LH SIDE
1. Rear engine mount retaining bolt

5. Remove retaining bolt from front engine mount.

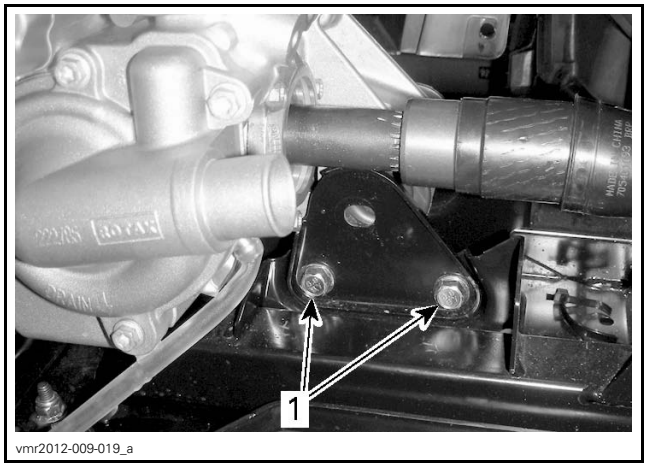


vmr2012-009-018_a

TYPICAL - LH SIDE
1. Front engine mount retaining bolt

6. At forward RH end of engine, remove engine support plate from frame.

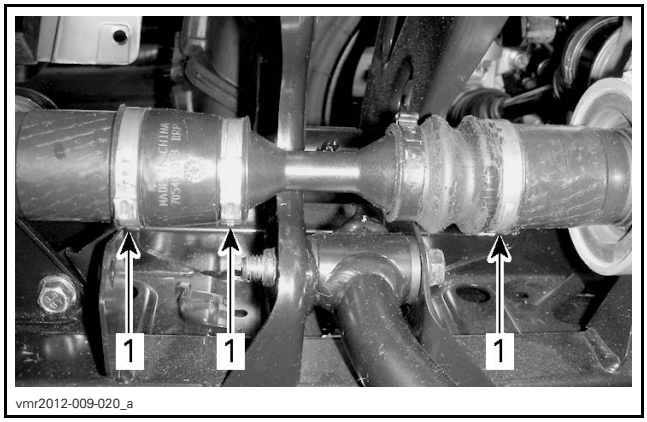
NOTICE Heat screws in order to release threadlocker prior to attempting to unscrew them. If not done, the welded nuts may break away from the frame bracket.



vmr2012-009-019_a

RH SIDE
1. Engine support plate screws

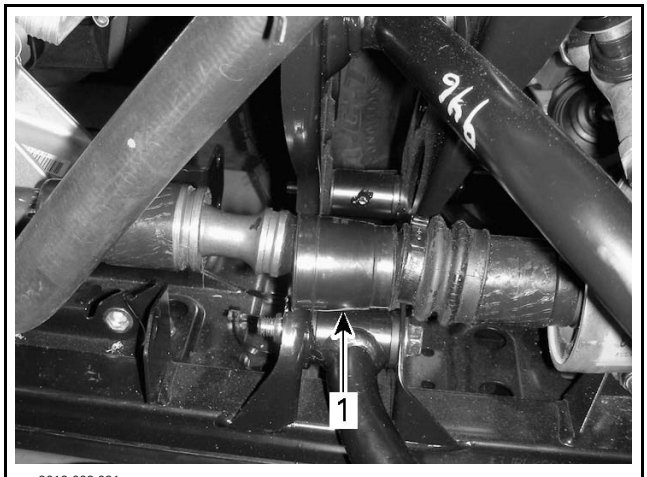
7. Remove the following Oetiker clamps from front propeller shaft.



vmr2012-009-020_a

RH SIDE
1. Oetiker clamps

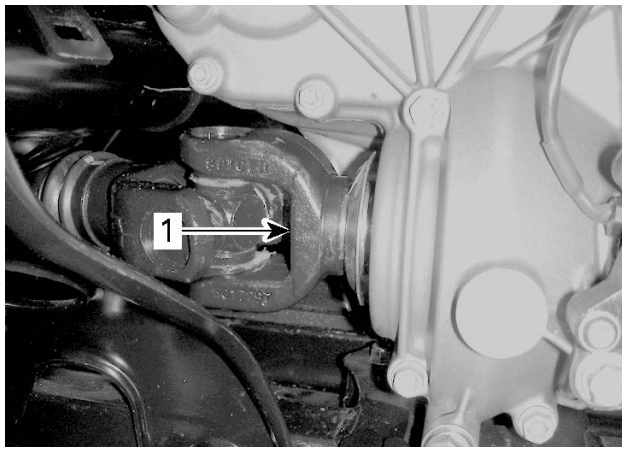
8. Move front propeller shaft bellows forward.



vmr2012-009-021_a

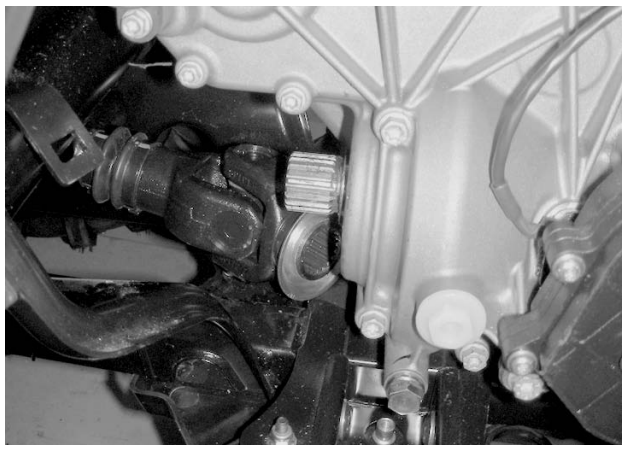
RH SIDE
1. Front propeller shaft bellows

9. Remove rear propeller shaft screw from gearbox output shaft.



TYPICAL - RH SIDE
1. Rear propeller shaft screw

10. Slightly lift engine and move it forward to disconnect rear propeller shaft from engine.
11. Move rear propeller shaft yoke downwards to make room.



TYPICAL

12. Move engine rearward to disconnect front propeller shaft from engine.
13. Remove engine from RH side of vehicle.



TYPICAL

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 *PERIODIC MAINTENANCE PROCEDURE* subsection.

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

Check for any leaks.

Install all remaining removed parts.

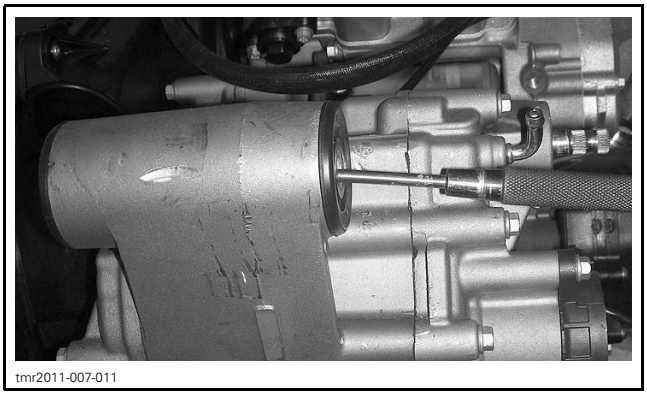
Test drive vehicle to confirm proper operation.

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.



tmr2011-007-011

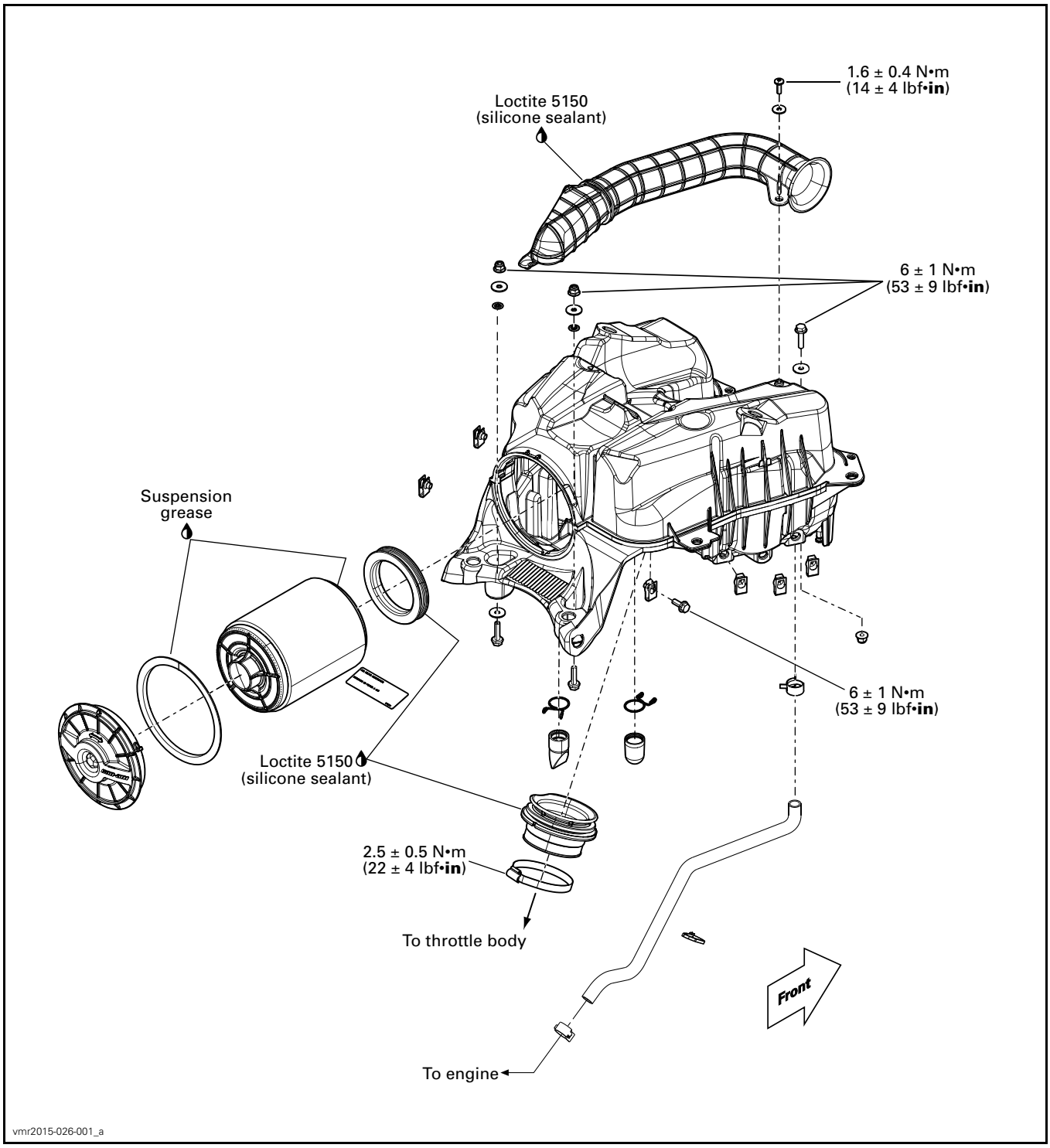
TYPICAL

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

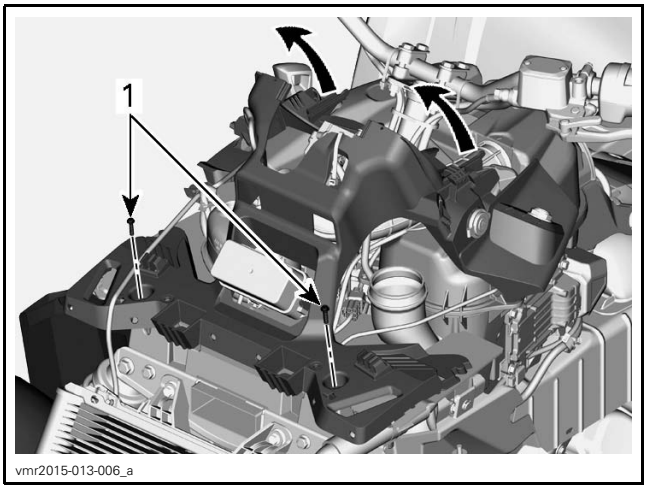
AIR FILTER

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

AIR FILTER HOUSING

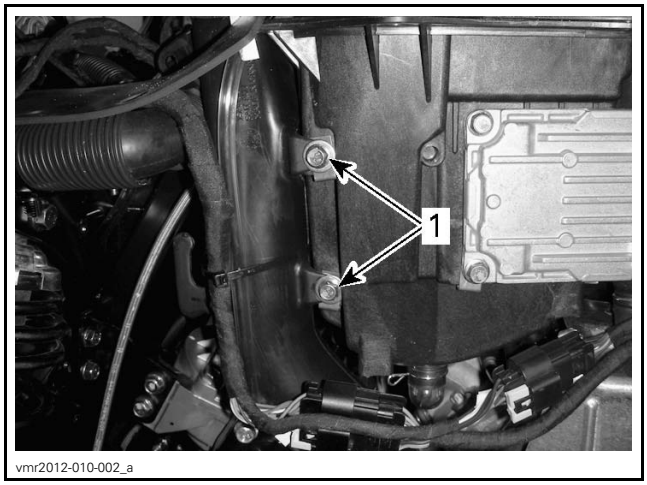
Air Filter Housing Removal

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.



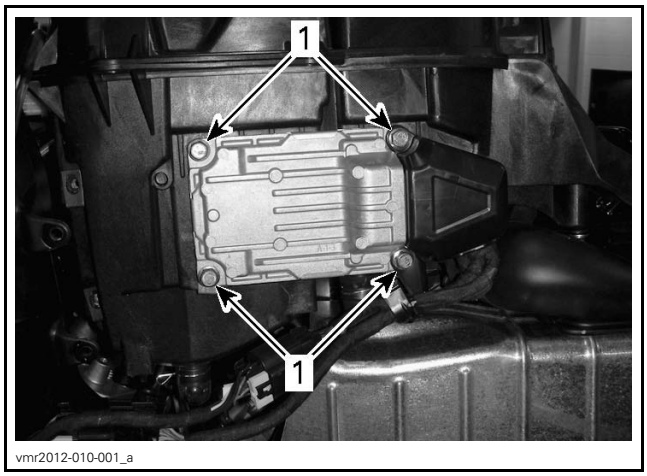
DASHBOARD SUPPORT REMOVAL
1. Screws to remove

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



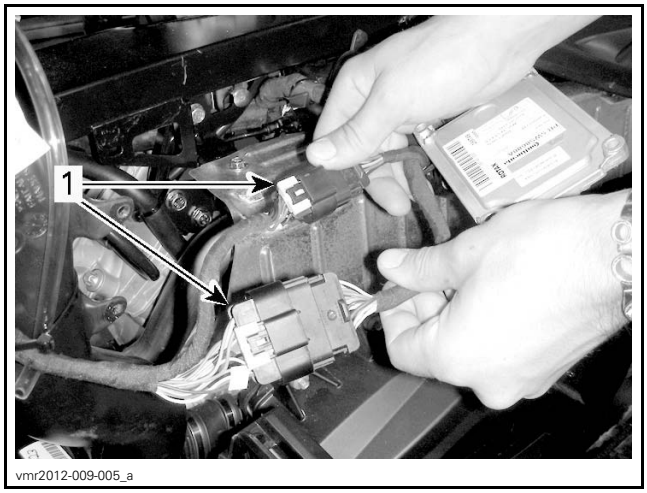
TYPICAL
1. CVT air inlet screws

4. Remove ECM retaining screws.



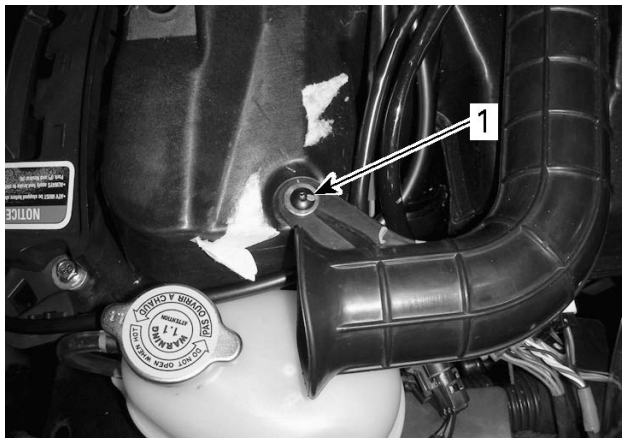
1. ECM retaining screws

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



TYPICAL
1. Engine harness connectors (HIC)

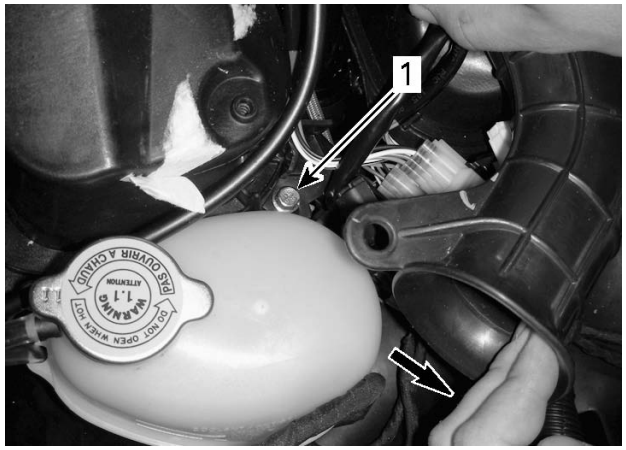
7. Remove air intake tube retaining screw.



vmr2012-010-003_a

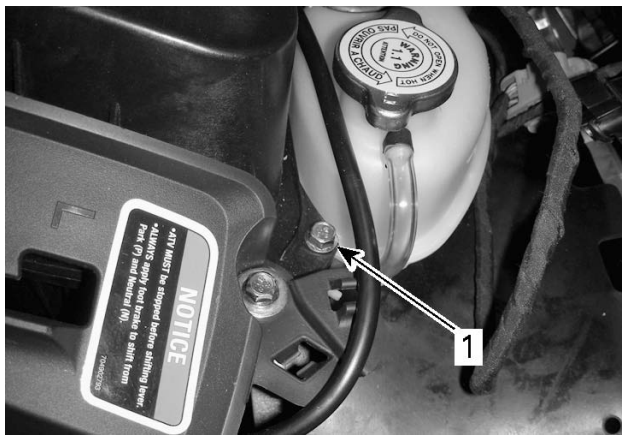
1. Air intake tube retaining screw

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



vmr2012-010-004_a

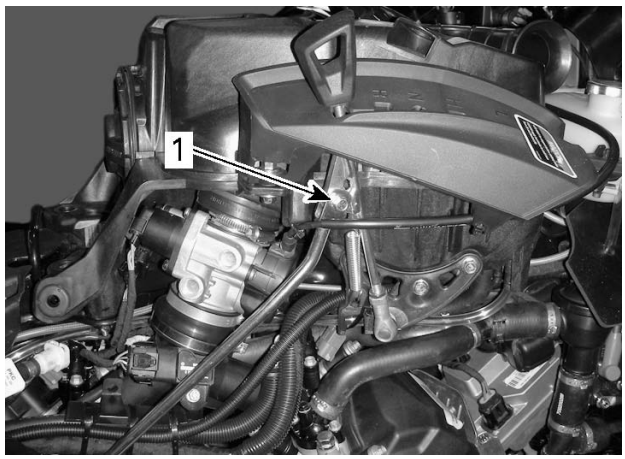
AIR INTAKE TUBE MOVED FOR ACCESS
1. LH coolant tank retaining screw



vmr2012-010-005_a

1. RH coolant tank retaining screw

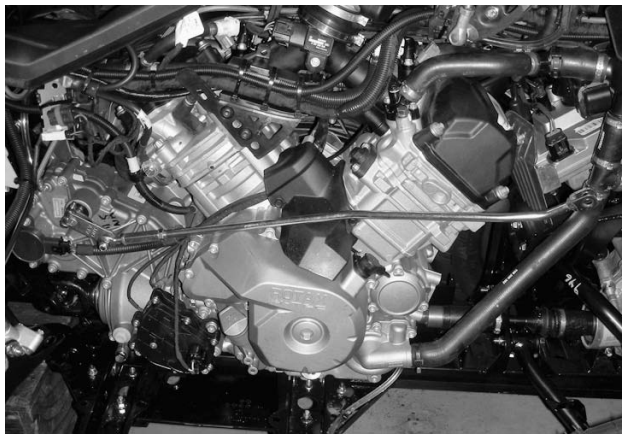
10. Remove link rod from shift lever.



vmr2012-010-006_a

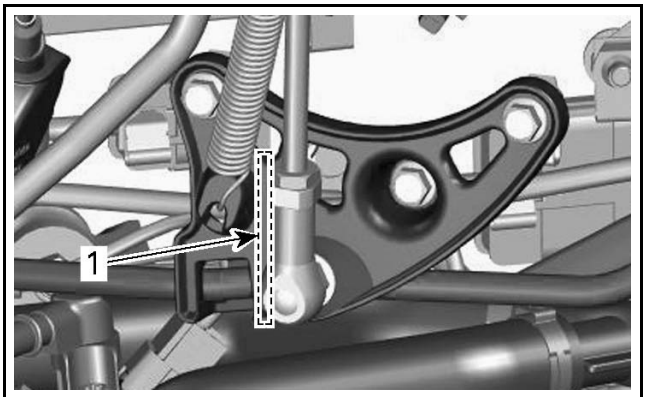
1. Link rod retaining bolt

11. Carefully move link rod downward.


vmr2012-010-007

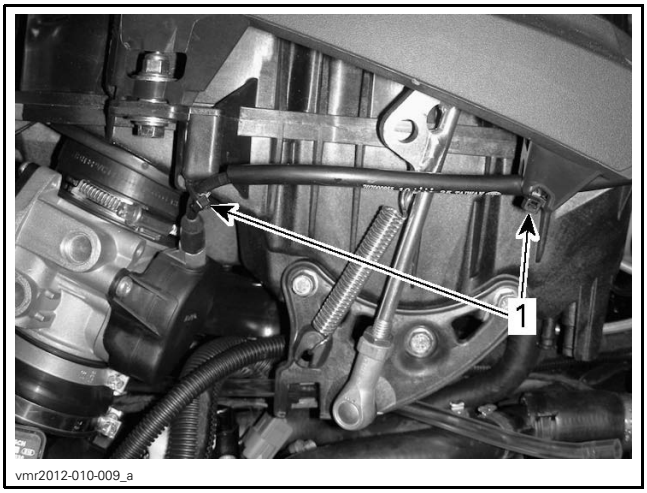
TYPICAL

12. Remove the following locking ties.



vmr2013-010-001_a

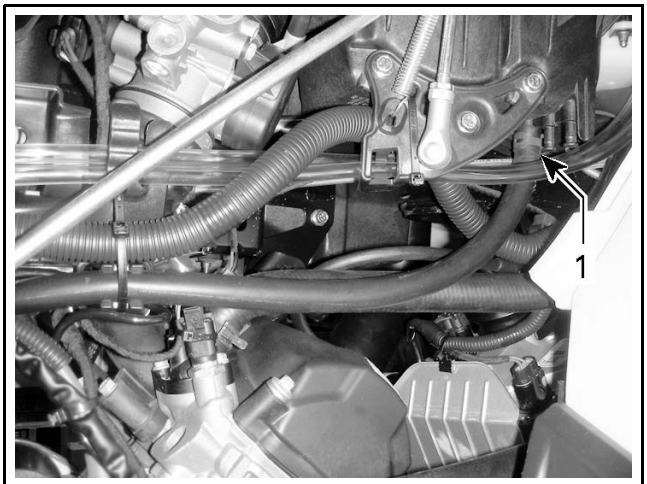
1. Locking tie to remove - location shown



vmr2012-010-009_a

1. Locking ties to remove

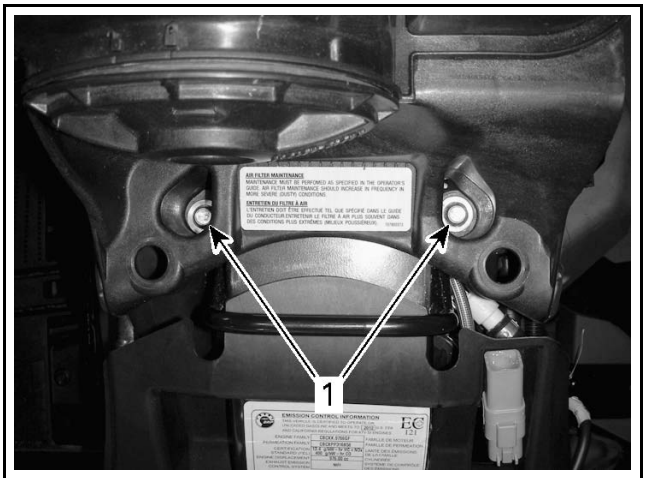
13. Remove crankcase vent hose from air filter housing.



vmr2015-013-002_a

TYPICAL
1. Crankcase vent hose

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



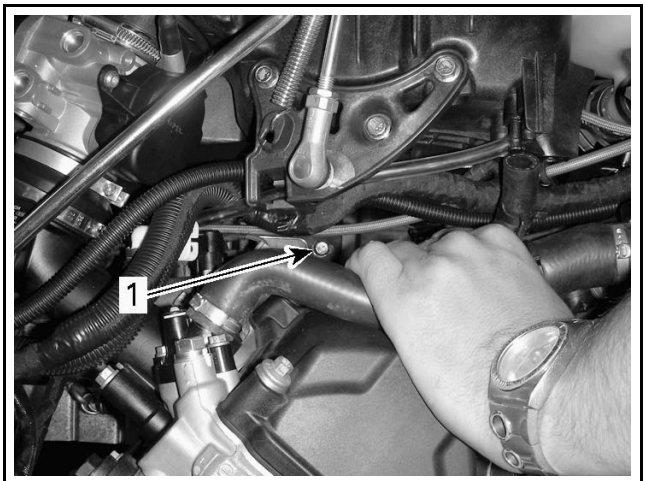
vmr2012-010-012_a

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



vmr2012-010-013_a

SCREW LOCATED UNDER COOLANT TANK
1. Air filter housing retaining screw

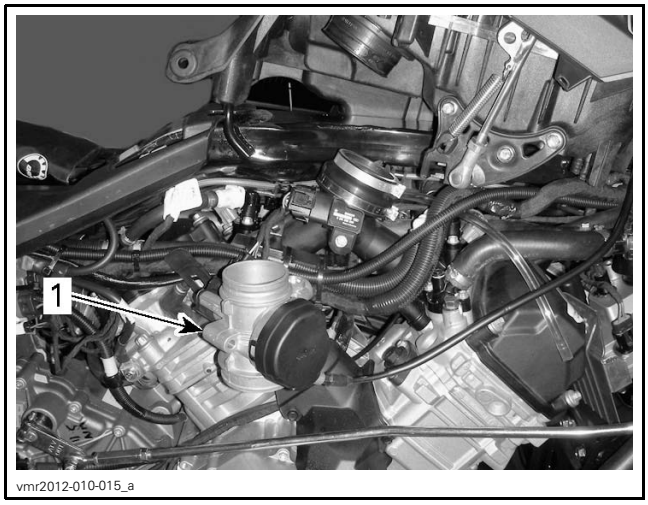


vmr2012-010-014_a

SCREW ACCESSED FROM UNDER SHIFT LEVER
1. Air filter housing retaining screw

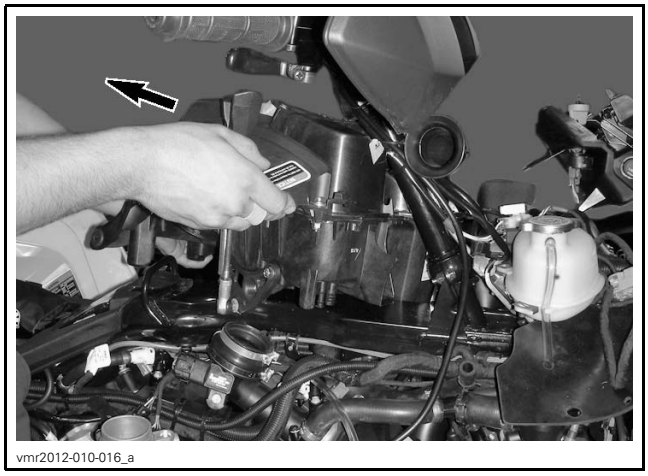
15. Detach throttle body from intake adapter and air filter housing.
16. Slightly lift air filter housing upward.

17. Move throttle body aside to make room.



1. Throttle body

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



AIR FILTER HOUSING REMOVAL

19. Remove remaining components from air filter housing.

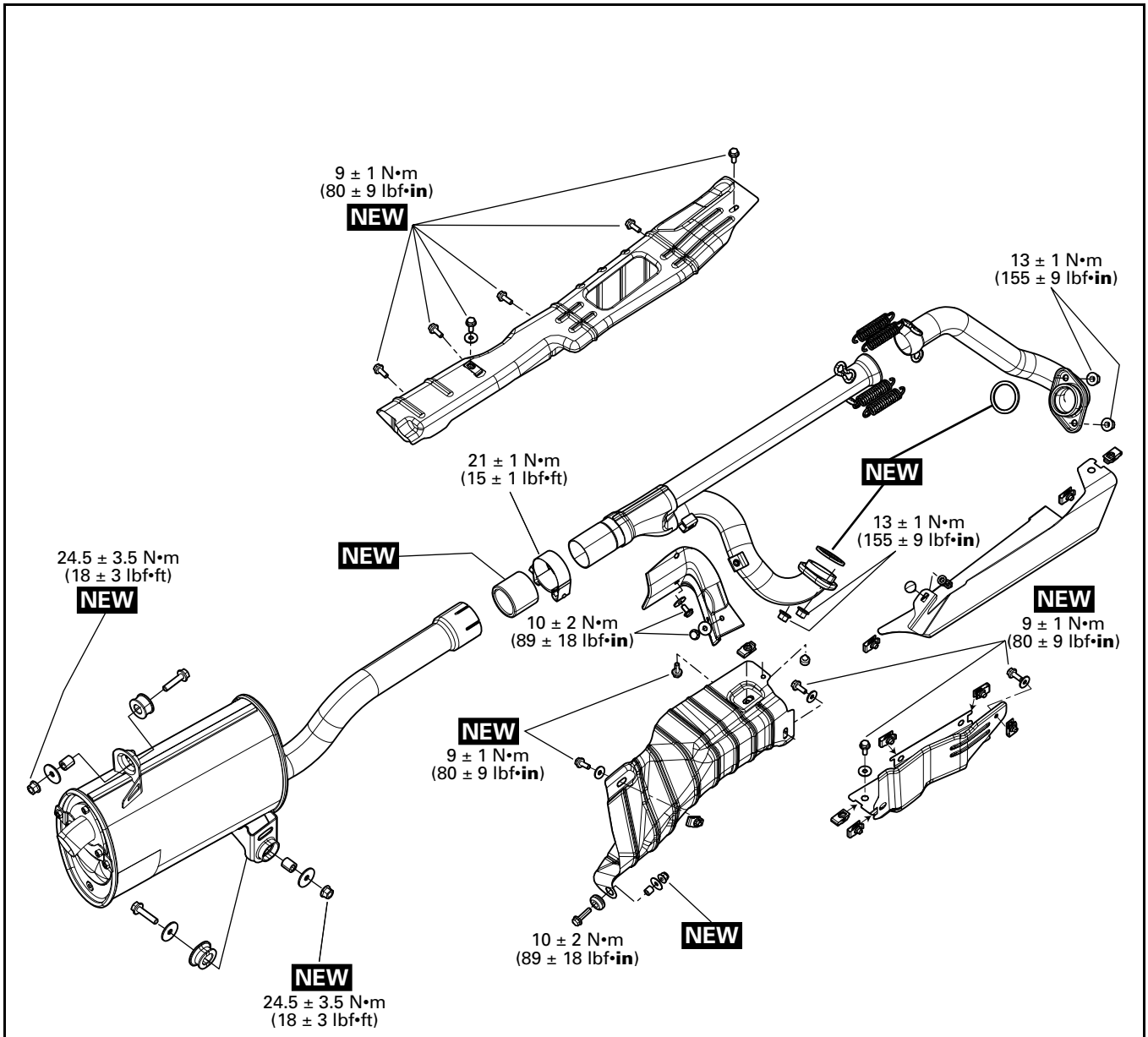
Air Filter Housing Inspection

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

Air Filter Housing Installation

Reverse the removal procedure.

EXHAUST SYSTEM



NEW = Component must be replaced when removed.

vmr2015-113-100_a

GENERAL

⚠ WARNING

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

PROCEDURES

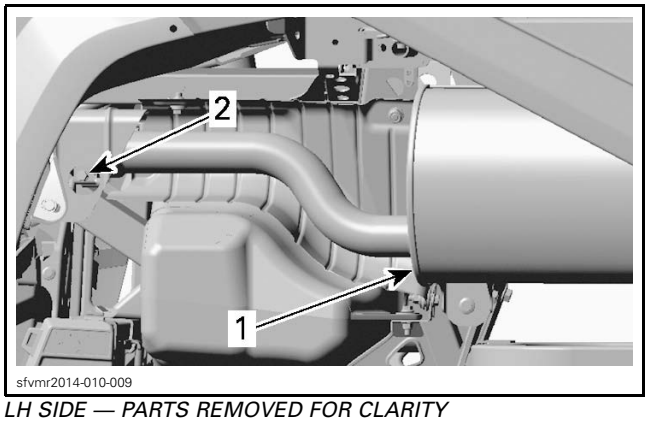
SPARK ARRESTER

For spark arrester servicing, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

MUFFLER

Muffler Removal

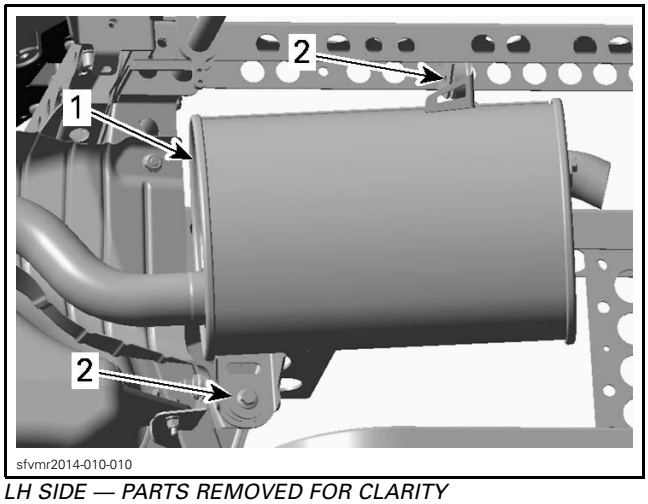
1. Loosen exhaust pipe clamp.



sfvmr2014-010-009

LH SIDE — PARTS REMOVED FOR CLARITY
1. Muffler
2. Loosen clamp

2. Remove muffler retaining bolts.



sfvmr2014-010-010

LH SIDE — PARTS REMOVED FOR CLARITY
1. Muffler
2. Remove bolts

3. Remove the muffler.

Muffler Inspection

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

Check if the rubber support is brittle, hard or otherwise damaged. Replace if needed.

Muffler Installation

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

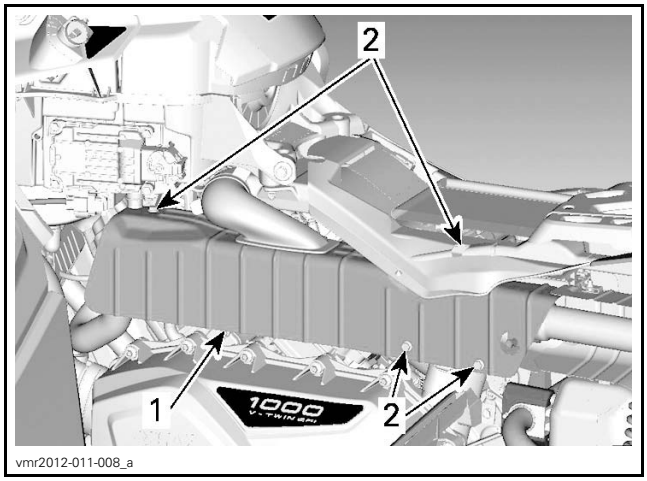
Install new exhaust gasket.

HEAT SHIELD

Heat Shield Removal

1. Refer to *BODY* and remove LH panel.
2. Remove heat shield retaining bolts.

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



vmr2012-011-008_a

LH SIDE — PARTS REMOVED FOR CLARITY
1. Heat shield
2. Remove bolts

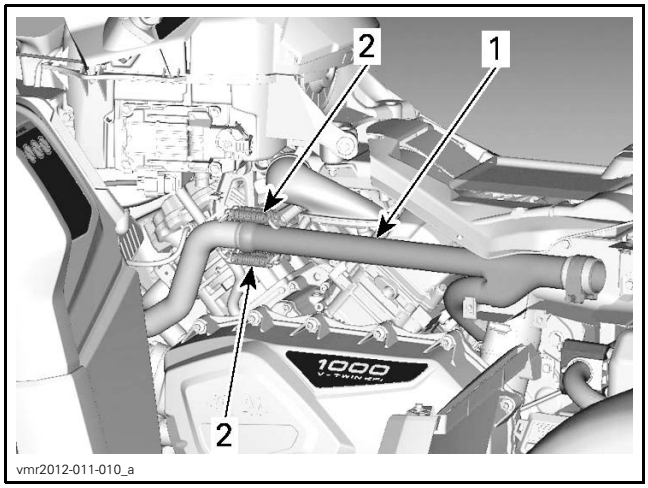
Heat Shield Installation

For the installation, reverse the removal procedure.

"Y" EXHAUST PIPE

"Y" Exhaust Pipe Removal

1. Remove *MUFFLER*. See procedure in this subsection.
2. Remove *HEAT SHIELD*. See procedure in this subsection.
3. Remove the following parts:
   – Springs from head pipe
   – "Y" exhaust pipe from vehicle.



LH SIDE — PARTS REMOVED FOR CLARITY
1. *"Y" exhaust pipe*
2. *Springs*

"Y" Exhaust Pipe Inspection

Check "Y" exhaust pipe for cracks, bending or other damages. Replace if needed.

"Y"Exhaust Pipe Installation

The installation is the reverse of the removal procedure.

Install NEW exhaust gaskets.

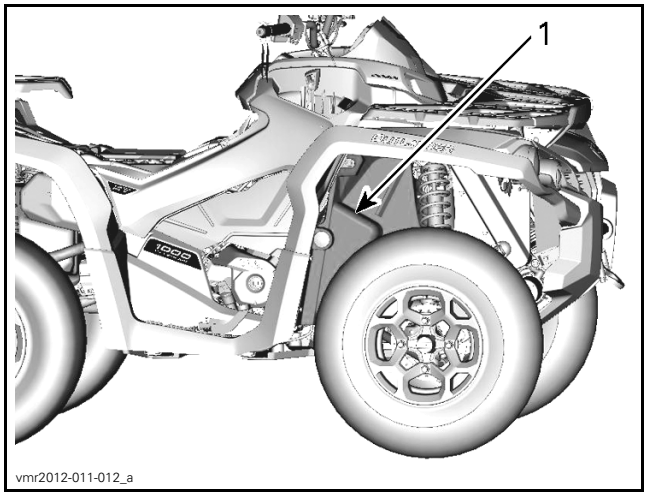
Properly position exhaust pipe before tightening.

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

HEAD PIPE (FRONT CYLINDER)

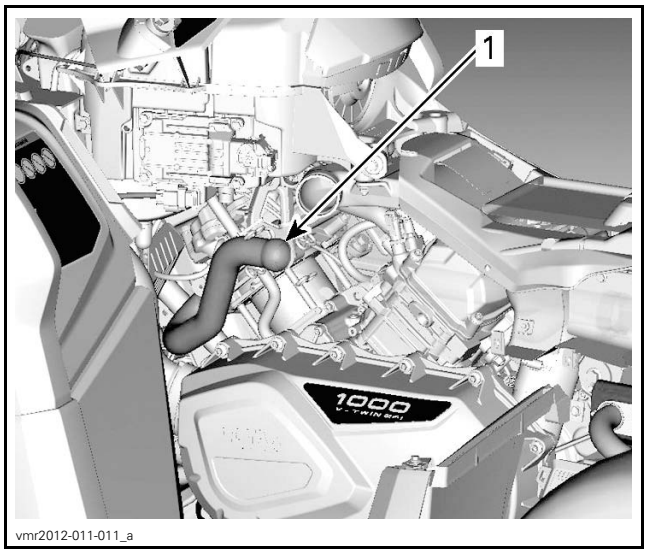
Front Head Pipe Removal

1. Remove *"Y" EXHAUST PIPE* . See procedure in this subsection.
2. Refer to *BODY* and remove rear part of RH inner fender to reach head pipe screws.



1. *Remove*

3. Remove front head pipe from vehicle.



LH SIDE — PARTS REMOVED FOR CLARITY
1. *Head pipe*

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

Front Head Pipe Inspection

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

Check if the rubber support is brittle, hard or otherwise damaged. Replace if needed.

Front Head Pipe Installation

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

Install NEW exhaust gaskets.

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

LUBRICATION SYSTEM

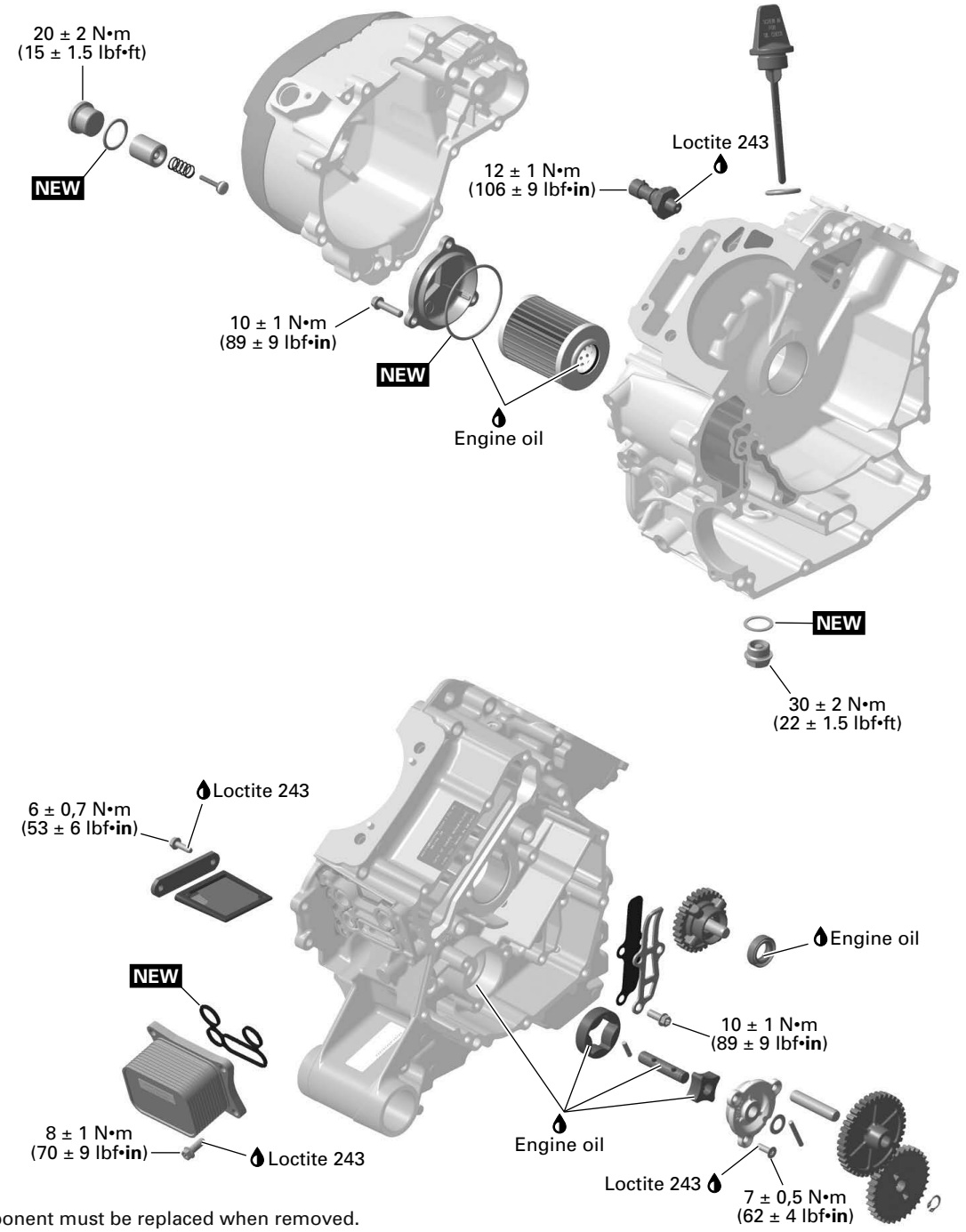
SERVICE TOOLS

Description	Part Number	Page
ADAPTER HOSE	529 035 652	90
DISCONNECT TOOL	529 035 714	90
PRESSURE GAUGE	529 035 709	90

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	93, 96

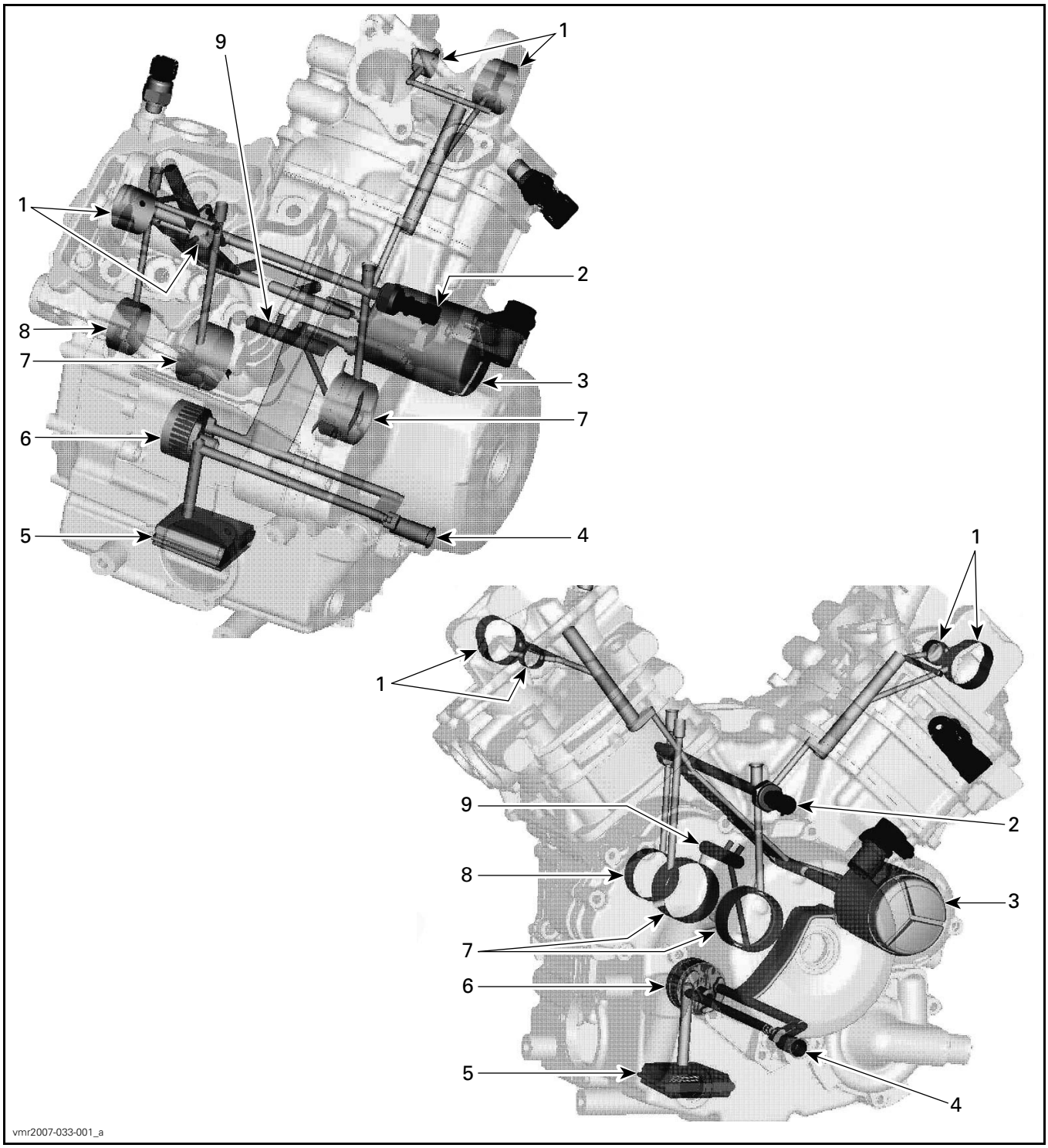
COMPONENTS



NEW = Component must be replaced when removed.

vmr2015-114-001_a

ENGINE LUBRICATION CIRCUIT



1. *Camshaft bearings*
2. *Oil pressure switch*
3. *Oil filter*
4. *Oil pressure regulator valve*
5. *Oil strainer*
6. *Oil pump*
7. *Crankshaft main bearings*
8. *Crankshaft support bearing*
9. *Connecting rod bearings*

INSPECTION

ENGINE OIL PRESSURE

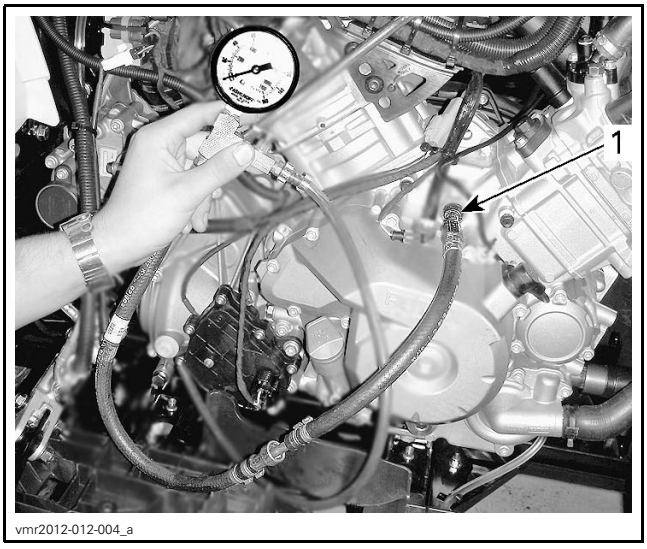
NOTE: The engine oil pressure test should be done with a warm engine 100°C (212°F) and the recommended oil.

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

Use the pressure gauge with the proper adapter hose.

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

Install adapter hose in OPS location.



1. Gauge connected in OPS location

The engine oil pressure should be within the following values.

OIL PRESSURE	1250 RPM	6000 RPM
MINIMAL	70 kPa (10 PSI)	300 kPa (44 PSI)
NOMINAL	150 kPa (22 PSI)	350 kPa (51 PSI)
MAXIMAL	250 kPa (36 PSI)	450 kPa (65 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 and remaining components.

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 hose and 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 near water pump, refer to COOLING SYSTEM INSPECTION in the PERIODIC MAINTENANCE PROCEDURES subsection. Replace seal 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.*
4. Oil cooler gasket leak.
   - *Replace oil cooler gasket and change engine oil.*

HIGH OIL CONSUMPTION

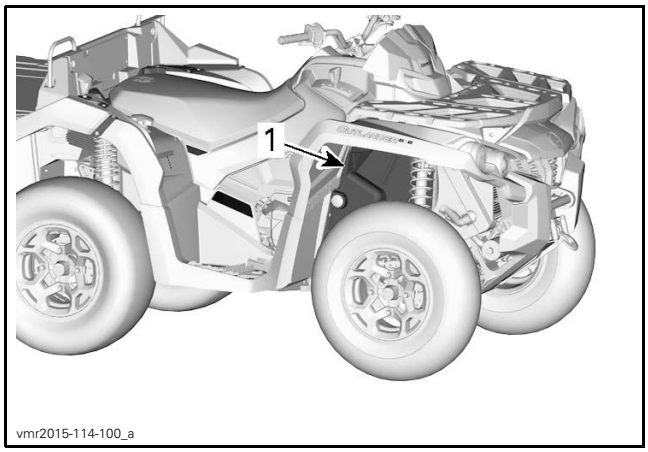
1. Leaking breather oil seal.
   - *Check if the oil seal of the breather is brittle, hard or damaged. Refer to BOTTOM END subsection.*
2. Valve stem seals worn or damaged.
   - *Replace valve stem seals.*
3. Worn piston rings (blue exhaust smoke).
   - *Replace piston rings.*

PROCEDURES

OIL COOLER

Oil Cooler Access

Refer to *BODY* and remove rear part of RH inner fender panel.



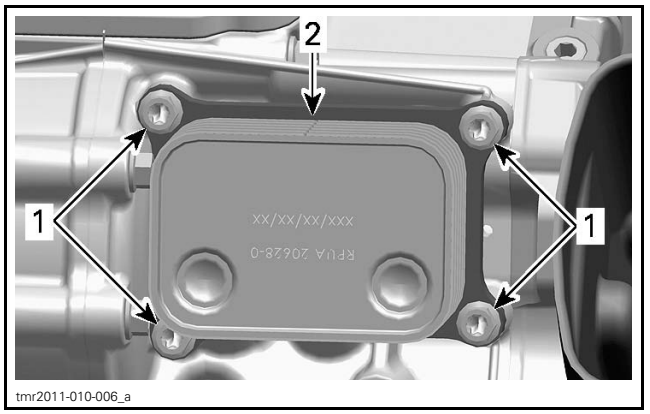
1. Remove

Oil Cooler Removal

Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection to:

– Drain engine oil. Refer to *ENGINE OIL CHANGE*
– Drain coolant. Refer to *ENGINE COOLANT REPLACEMENT*.

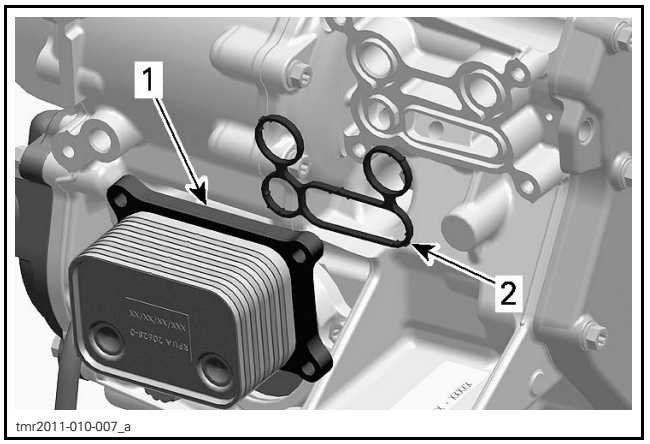
Remove oil cooler retaining screws.



1. Retaining screws
2. Oil cooler

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

Remove oil cooler and discard gasket.



1. Oil cooler
2. Gasket

Oil Cooler Inspection

Check oil cooler for cracks or other damage.

Replace if necessary.

Oil Cooler Installation

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

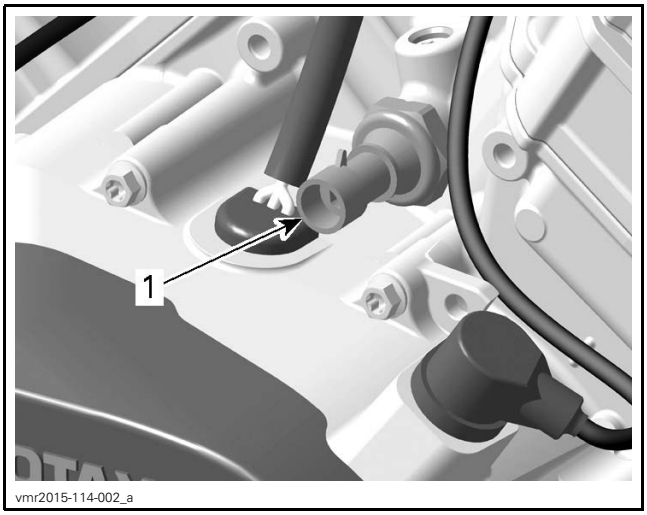
Wipe off any oil and coolant spillage.

Install a NEW gasket.

Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection and carry out the following:

– Refill engine with recommended oil. See *ENGINE OIL CHANGE*.
– Refill and bleed cooling system. See *ENGINE COOLANT REPLACEMENT*.

OIL PRESSURE SWITCH (OPS)

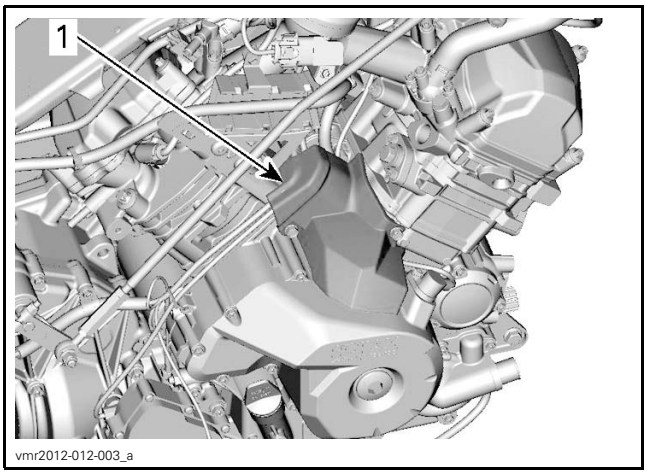


1. Oil pressure switch

Oil Pressure Switch Access

Refer to *BODY* and remove RH panel.

Remove OPS cover.



1. OPS cover

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.

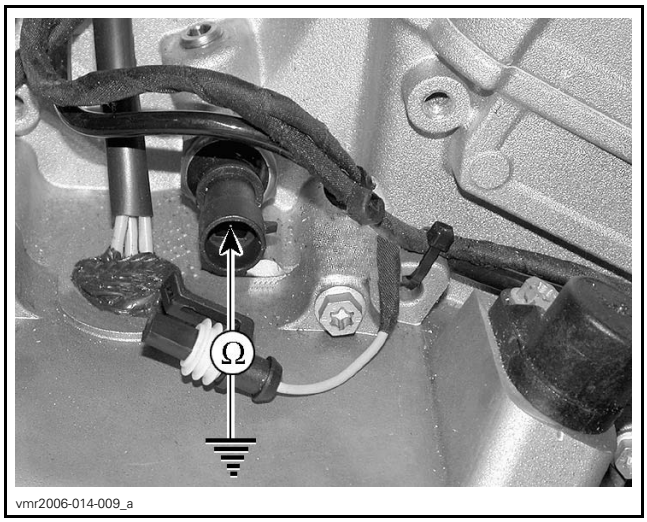
Oil Pressure Switch Resistance Test

Disconnect the connector from the oil pressure switch.

Check resistance as per following tables.

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

OPS CONNECTOR	ENGINE	ENGINE RUNNING
PIN		RESISTANCE (Ω)
1	Engine ground	Infinite (open) when pressure reaches 30 kPa ± 10 kPa (4.35 PSI ± 1.45 PSI)



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

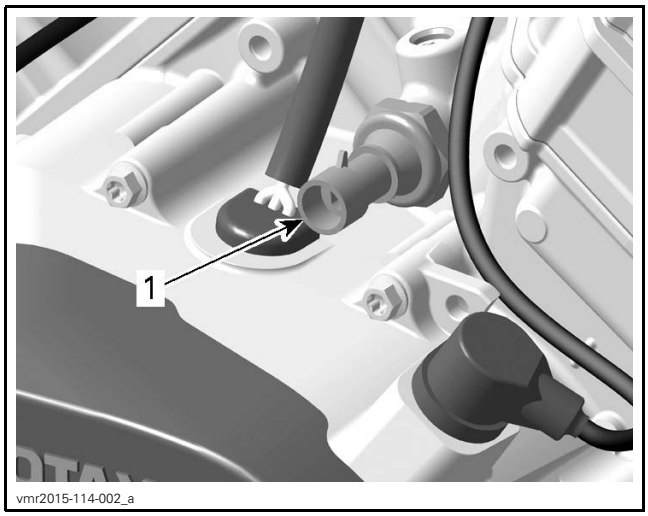
If the values are correct, check wiring.

Oil Pressure Switch Removal

Unplug the oil pressure switch connector.

Unscrew and remove oil pressure switch.

Oil Pressure Switch Installation



1. Oil pressure switch

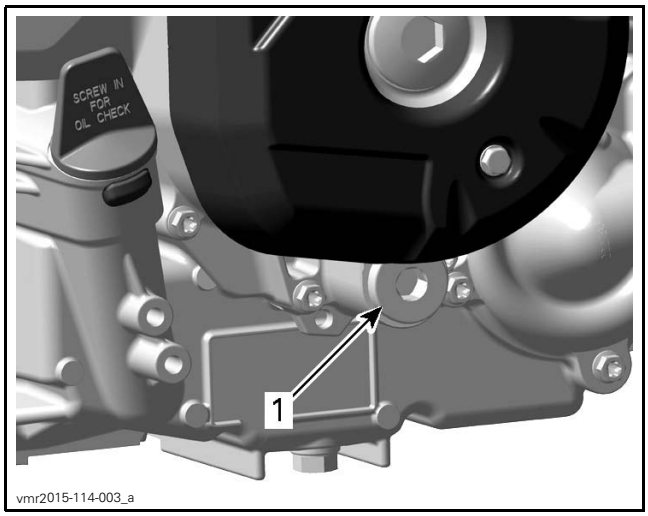
Apply required service product on threads of oil pressure switch.

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**)

ENGINE OIL PRESSURE REGULATOR

The oil pressure regulator is located on the engine magneto side, integrated in the magneto cover.



1. Engine oil pressure regulator

NOTE: The oil pressure regulator system works when the oil pressure exceeds 400 kPa (58 PSI).

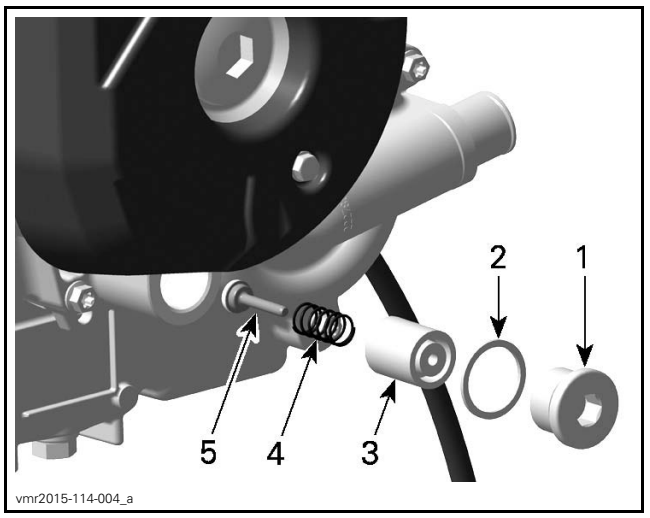
Oil Pressure Regulator Access

To reach the pressure regulator (Outlander series), refer to *BODY* and remove:

– RH side panel
– RH footboard panel.

Oil Pressure Regulator Removal

Remove plug screw and pull oil pressure regulator out.



1. Plug screw
2. Gasket ring
3. Pressure regulator housing
4. Spring
5. Pressure regulator valve

Oil Pressure Regulator Inspection

Inspect pressure regulator housing and valve for scoring or other damages.

Check spring for free length.

SPRING FREE LENGTH	
NEW NOMINAL	39 mm (1.535 in)
SERVICE LIMIT	37 mm (1.457 in)

NOTE: Replace worn or damaged components.

Clean bore and thread in the magneto housing from metal shavings and other contaminations.

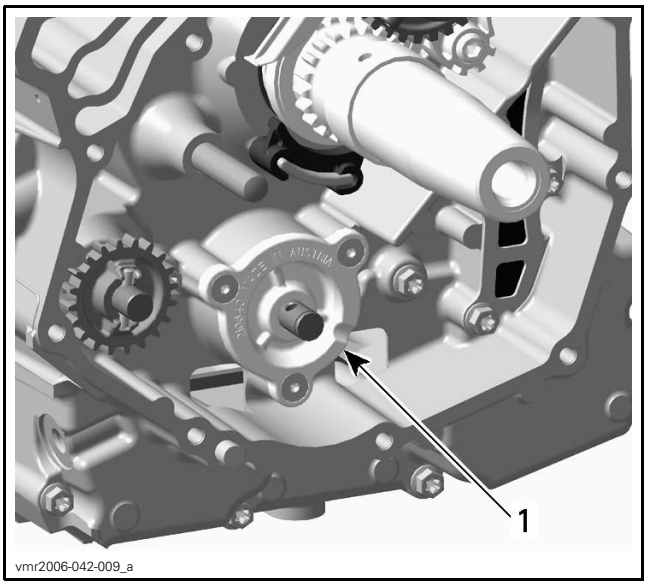
Oil Pressure Regulator Installation

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

NOTE: At installation always replace the gasket ring of the plug screw by a NEW one.

OIL PUMP

The oil pump is located on the engine PTO side (behind PTO cover).

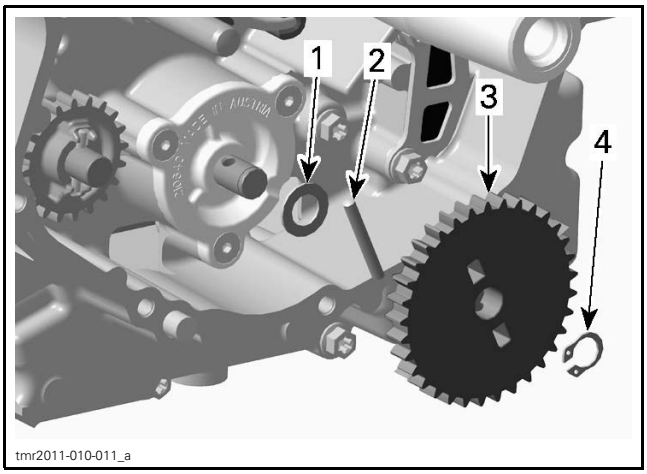


1. Oil pump

Oil Pump Removal

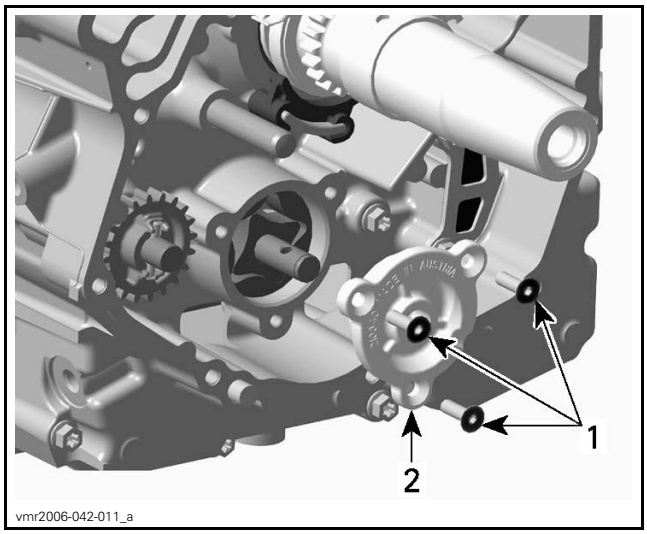
Remove the PTO cover. Refer to *PTO COVER* in the *BOTTOM END* subsection.

1. Remove:
   - Retaining ring
   - Oil pump gear
   - Needle pin
   - Thrust washer.



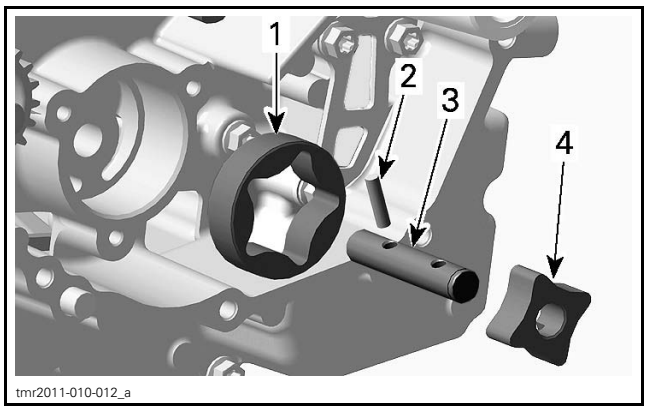
1. Thrust washer
2. Needle pin
3. Oil pump gear
4. Retaining ring

2. Remove oil pump cover screws and pull oil pump cover out.



1. Retaining screws
2. Oil pump cover

3. Remove oil pump shaft with needle pin and inner rotor.
4. Remove outer rotor.

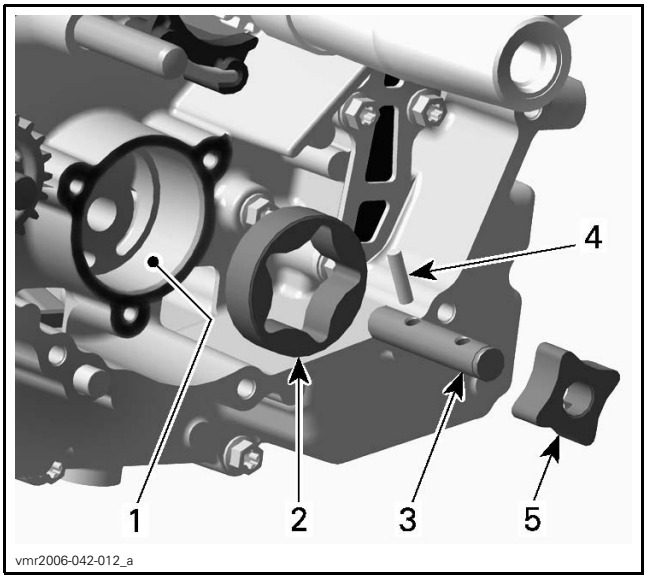


1. Outer rotor
2. Needle pin
3. Oil pump shaft
4. Inner rotor

Oil Pump Inspection

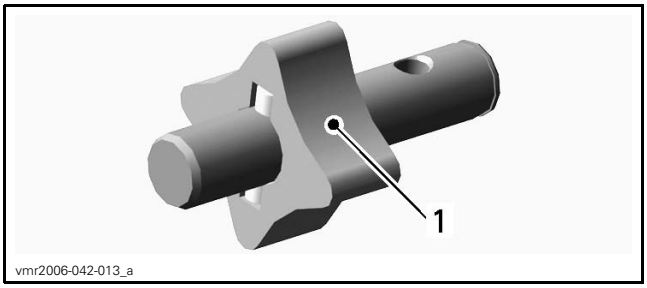
Inspect oil pump and oil pump cover bore for marks, scratches or other damages. Check for scratches in crankcase between outer rotor and oil pump bore. If so, replace damaged parts.

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



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

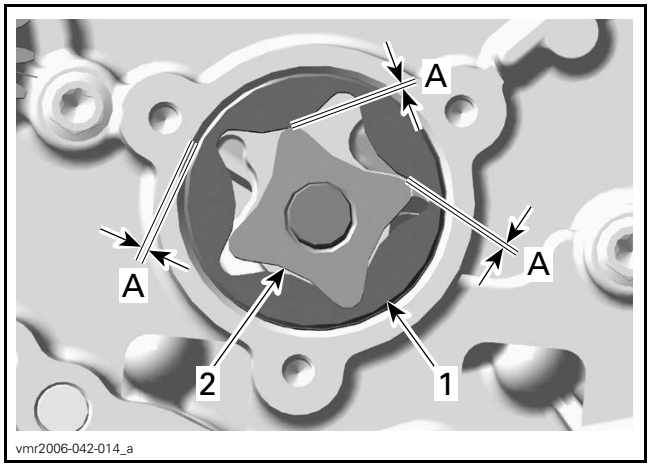
Check inner rotor for corrosion pin holes or other damages. If so, replace oil pump shaft assembly.



1. *Pittings on the teeth*

Using a feeler gauge, measure the clearance of inner and outer rotors as shown.

CLEARANCE OF INNER AND OUTER ROTOR	
SERVICE LIMIT	0.25 mm (.0098 in)



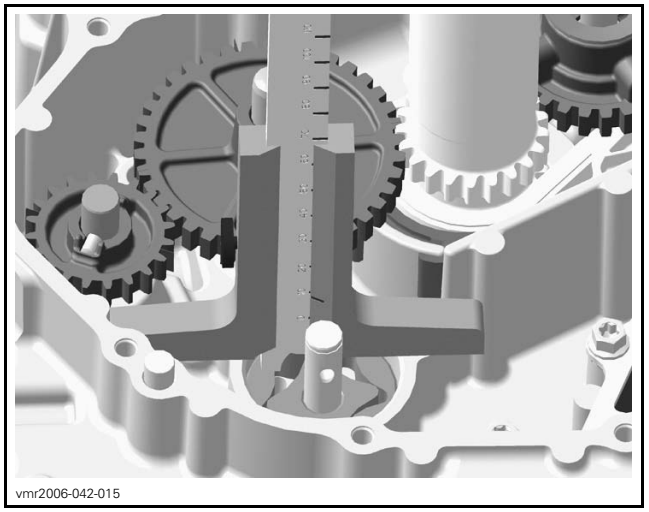
1. *Outer rotor*
2. *Inner rotor*

A. 0.25 mm (.0098 in)

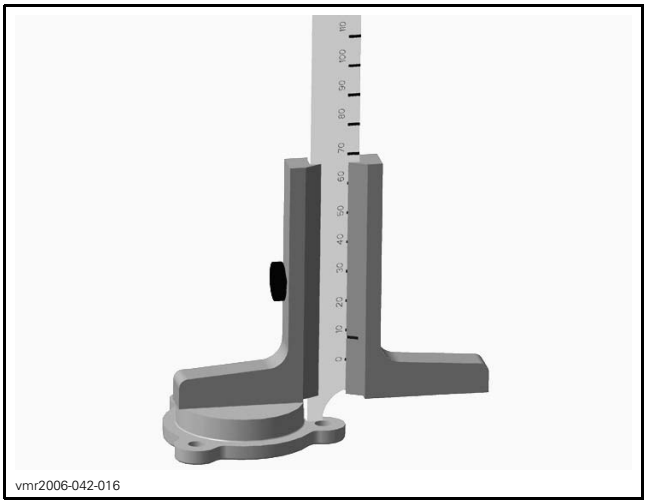
If clearance of inner and outer rotors exceeds the tolerance, replace oil pump rotors. Ensure to also check oil pump cover. If damaged, replace the complete oil pump assembly.

If clearance between outer rotor and its bore in crankcase exceeds the tolerance, replace the complete oil pump rotors and/or the crankcase.

Using a depth gauge, measure the axial clearance of the oil pump as shown.



OIL PUMP — MEASUREMENT "A"


vmr2006-042-016

OIL PUMP COVER — MEASUREMENT "B"

Substract measurement B from measurement A to obtain axial clearance.

OIL PUMP AXIAL CLEARANCE	
SERVICE LIMIT	0.2 mm (.008 in)

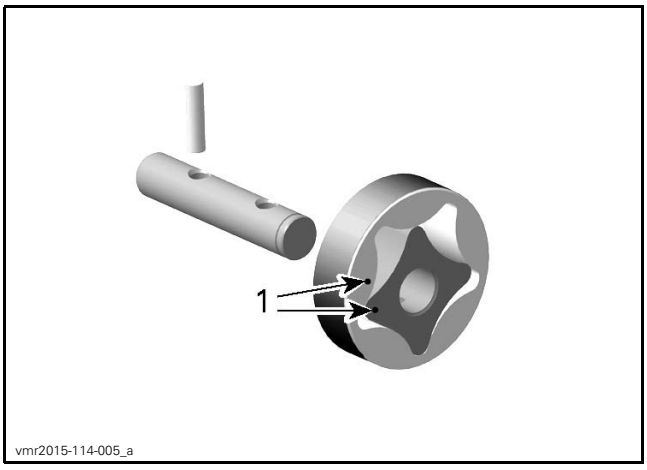
NOTE: When the axial clearance of the oil pump assembly increases, the oil pressure decreases.

Oil Pump Installation

For installation, reverse the removal procedure.

Pay attention to the following details.

NOTE: When installing the oil pump rotors, make sure both markings are on the outer side.



vmr2015-114-005_a

1. Markings on inner and outer rotor

After reinstallation of the remaining parts, check for smooth operation of the oil pump assembly.

Oil Pump Final Test

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

ENGINE OIL STRAINER

Oil Strainer Location

The engine oil strainer is located between both crankcase halves.

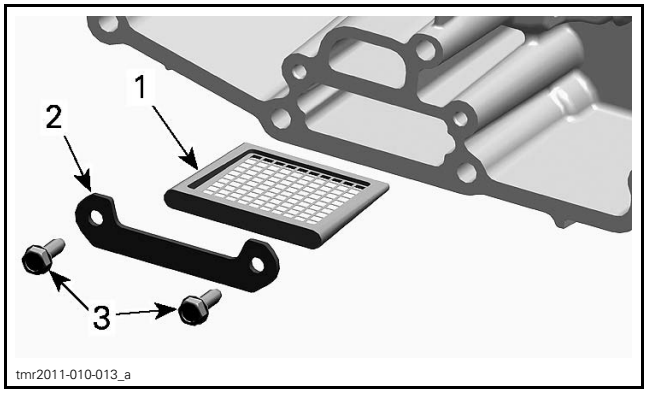
Oil Strainer Removal

Remove engine from vehicle.

Separate crankcase halves. Refer to *BOTTOM END* subsection.

Remove screws and retaining plate.

Pull out engine oil strainer.



tmr2011-010-013_a

1. Engine oil strainer
2. Retaining plate
3. Screws

Oil Strainer Cleaning and Inspection

Clean engine 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 and injure your eyes.

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

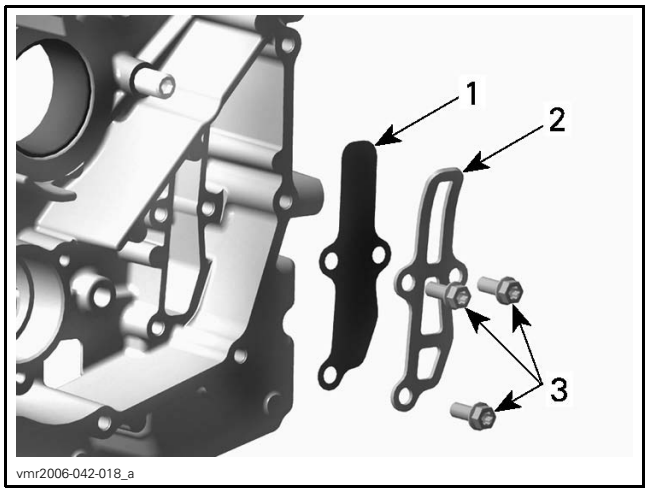
Oil Strainer Installation

The installation is the reverse of the removal procedure.

OIL STRAINER 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**)

REED VALVE

The engine is equipped with a reed valve which prevents accumulation of larger oil quantities in the crankcase. The reed valve is fitted into the crankcase.



1. Reed valve
2. Stopper
3. Screws

Reed Valve Removal

Remove:
- Engine from vehicle
- PTO cover (refer to *PTO COVER* in the *BOTTOM END* subsection)
- Reed valve retaining screws
- Stopper plate
- Reed valve.

Reed Valve Inspection

Check reed valve for cracks or other damage.

Replace reed valve if damaged.

Reed Valve Installation

The installation is the reverse of the removal procedure.

COOLING SYSTEM (1000)

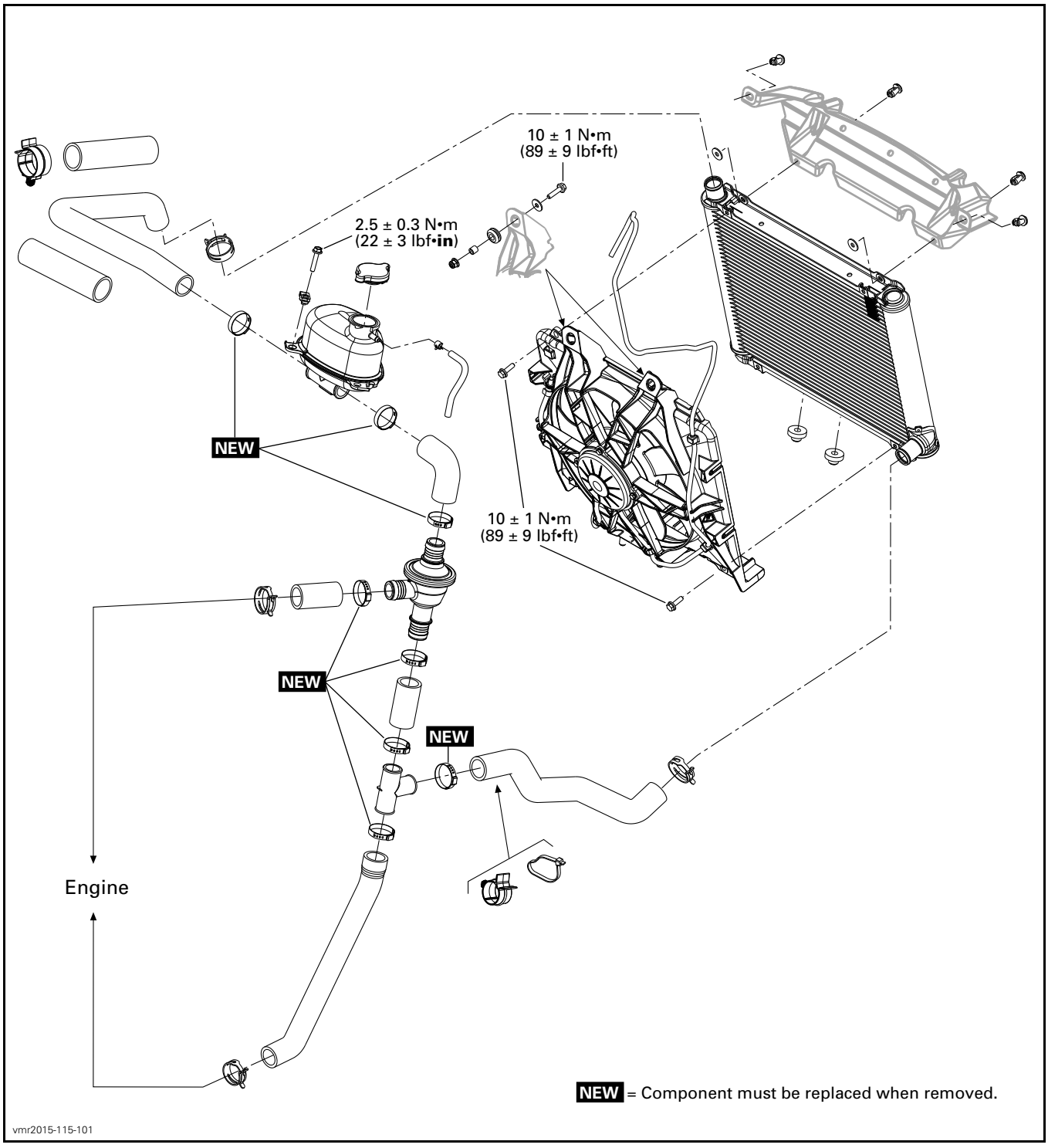
SERVICE TOOLS

Description	Part Number	Page
BLIND HOLE PULLER KIT	529 036 056	132
FLUKE 115 MULTIMETER	529 035 868	124
HANDLE	420 877 650	133
OIL SEAL PUSHER	529 035 757	133
ROTARY SEAL PUSHER PLATE	529 036 130	131
SEAL PUSHER	529 035 766	131, 134

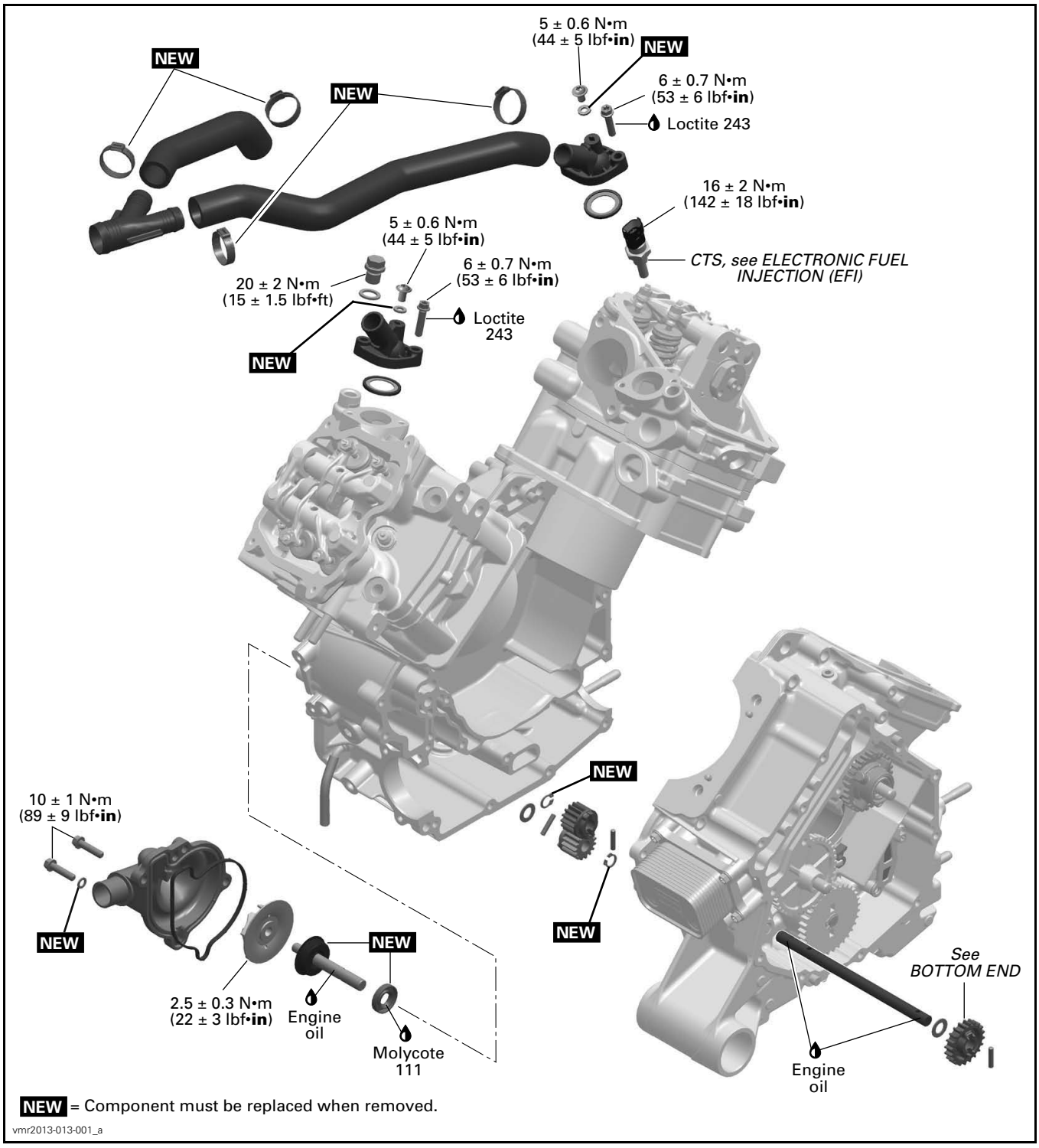
SERVICE PRODUCTS

Description	Part Number	Page
DOW CORNING 111	413 707 000	134

RADIATOR AND THERMOSTAT



WATER PUMP


5 ± 0.6 N•m
(44 ± 5 lbf•in)
NEW
NEW
NEW
6 ± 0.7 N•m
(53 ± 6 lbf•in)
Loctite 243
16 ± 2 N•m
(142 ± 18 lbf•in)
CTS, see ELECTRONIC FUEL INJECTION (EFI)
5 ± 0.6 N•m
(44 ± 5 lbf•in)
20 ± 2 N•m
(15 ± 1.5 lbf•ft)
6 ± 0.7 N•m
(53 ± 6 lbf•in)
Loctite 243
NEW
NEW
NEW
10 ± 1 N•m
(89 ± 9 lbf•in)
NEW
NEW
NEW
2.5 ± 0.3 N•m
(22 ± 3 lbf•in)
Engine oil
Molycote 111
See BOTTOM END
Engine oil
NEW = Component must be replaced when removed.
vmr2013-013-001_a

GENERAL

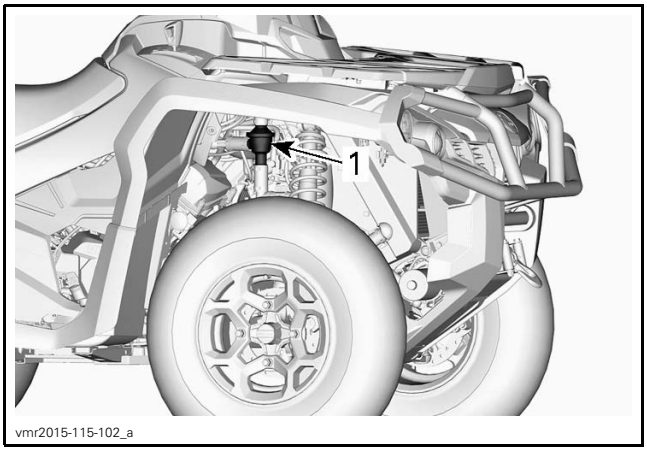
NOTICE Never start engine without coolant. Some engine parts such as the rotary seal on the water pump shaft can be damaged.

PROCEDURES

THERMOSTAT

Thermostat Location

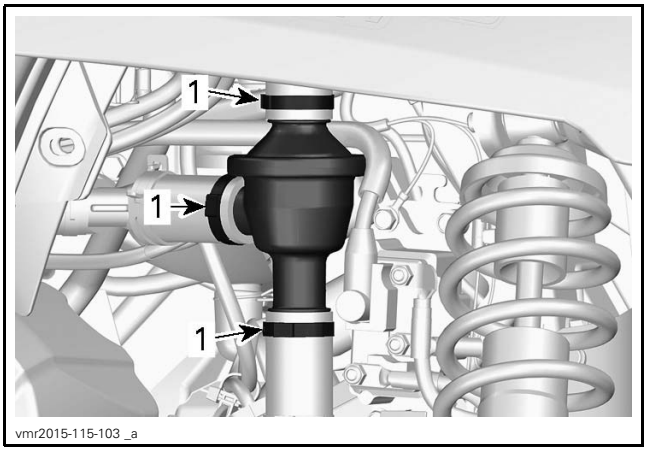
The thermostat is located in-line in the cooling system circuit (RH side).



1. In-line thermostat

Thermostat Removal

1. Drain engine coolant, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
2. Remove Oetiker clamps that secure hoses to thermostat.



1. Oetiker clamps

3. Pull hoses from thermostat housing to remove thermostat.

Thermostat Test

To check 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 if gasket is brittle, hard or damaged. If so, replace gasket.

Thermostat Installation

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

Reverse the removal procedure.

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

Check cooling system for leaks.

RADIATOR

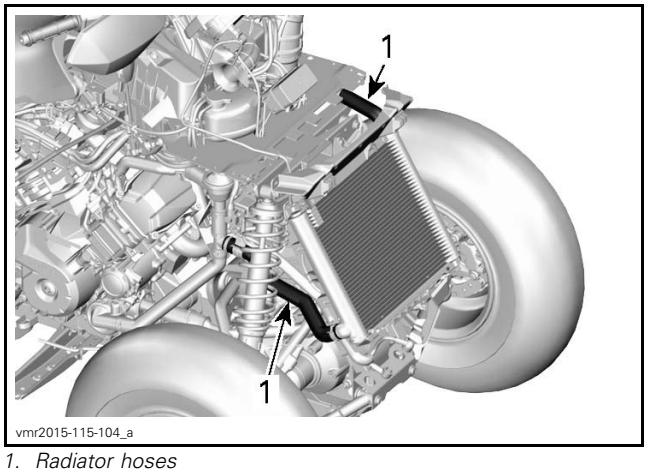
Radiator

Check radiator fins for clogging or damage.

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

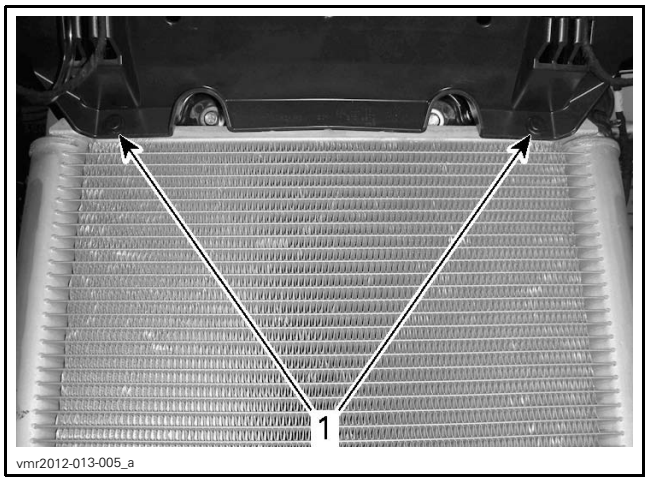
Radiator Removal

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



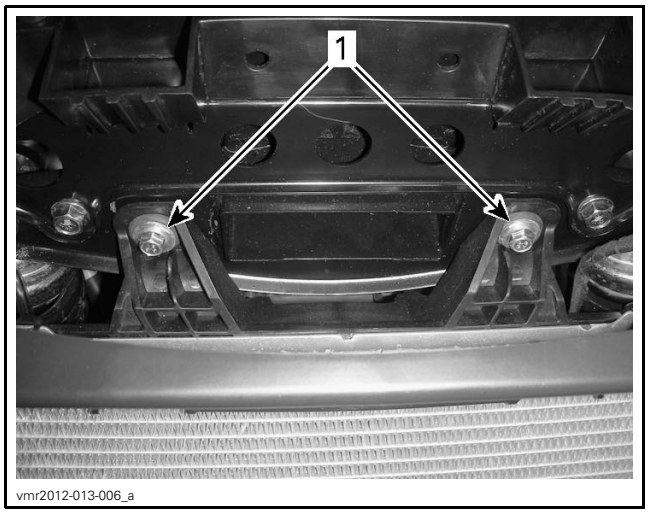
1. Radiator hoses

4. On applicable models, remove the following plastic rivets.



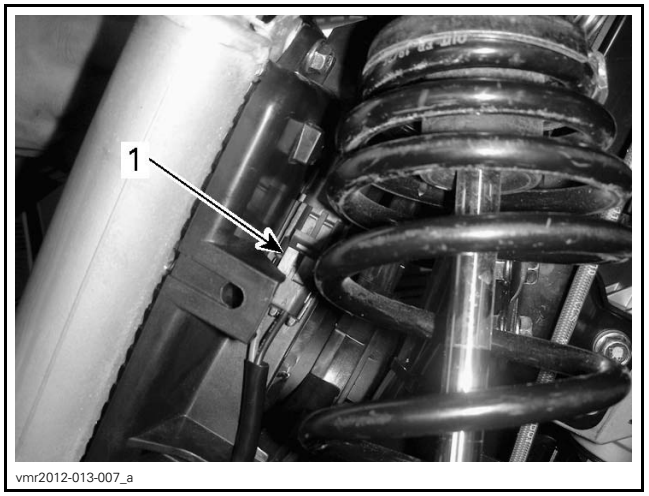
TYPICAL
1. Plastic rivets

5. Remove upper retaining bolts from radiator.



TYPICAL
1. Upper retaining bolts

6. Disconnect cooling fan connector.



FROM LH SIDE
1. Cooling fan connector

7. Remove cooling fan vent hose from vehicle.

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

8. Pull radiator upwards to release it from rubber bushings.

Radiator Installation

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

Ensure that rubber bushings are properly installed between frame and radiator.

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.

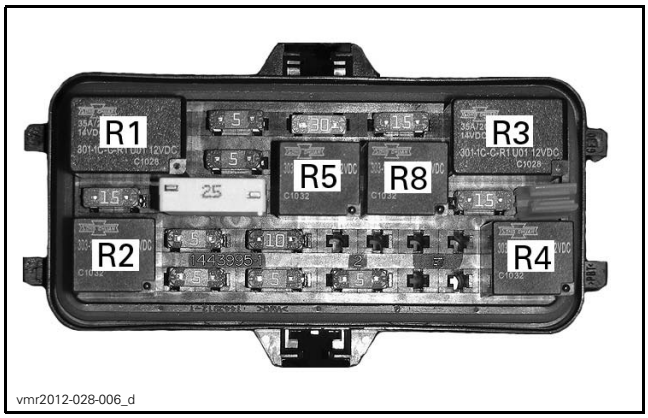
COOLANT TEMPERATURE SENSOR (CTS)

Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.

RADIATOR COOLING FAN RELAY (R1)

Relay Location (Radiator Cooling Fan)

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



R1: RADIATOR COOLING FAN RELAY

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.

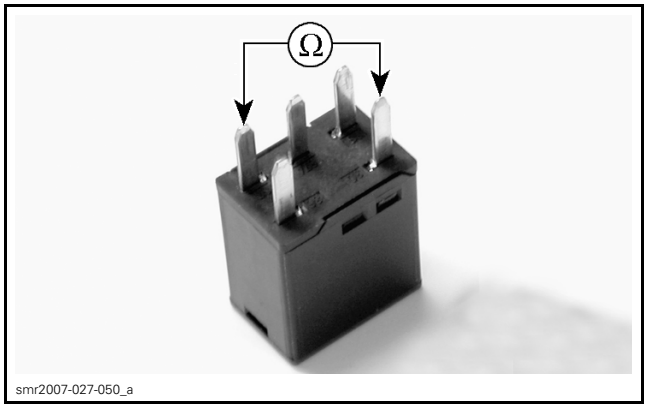
Relay Continuity Test (Radiator Cooling Fan)

1. Remove relay.
2. Set multimeter to Ω.

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

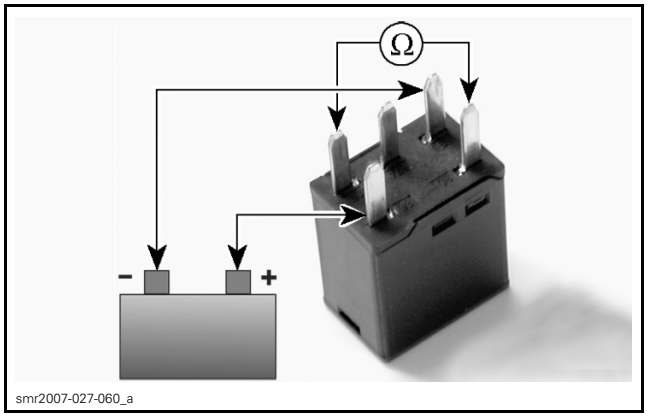
3. Probe relay as follows.

TERMINAL		RESISTANCE
30	87	Open circuit (OL)



4. Connect battery as shown and probe relay again as follows.

TERMINAL		RESISTANCE
30	87	0.5 Ω max. (continuity)



If relay failed any test, replace it.

RADIATOR COOLING FAN

Radiator Cooling Fan Operation

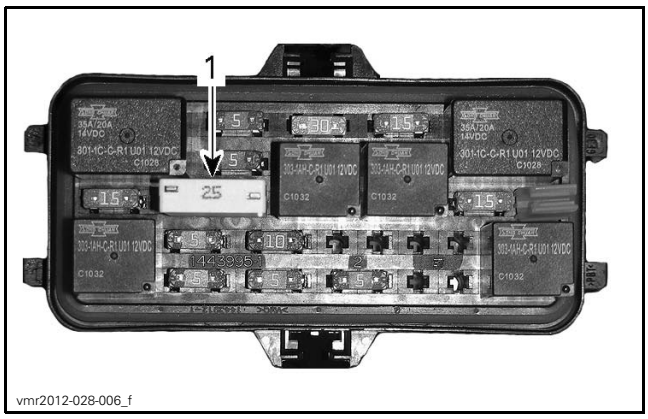
The ECM controls the radiator cooling fan via the input of the coolant temperature sensor (CTS) and the manifold air pressure and temperature sensor (MAPTS). Refer to the following tables.

AIR INTAKE TEMPERATURE	COOLING FAN
88°C (190°F)	Turns ON
85°C (185°F)	Turns OFF

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 Auto-Reset Breaker Fuse Location

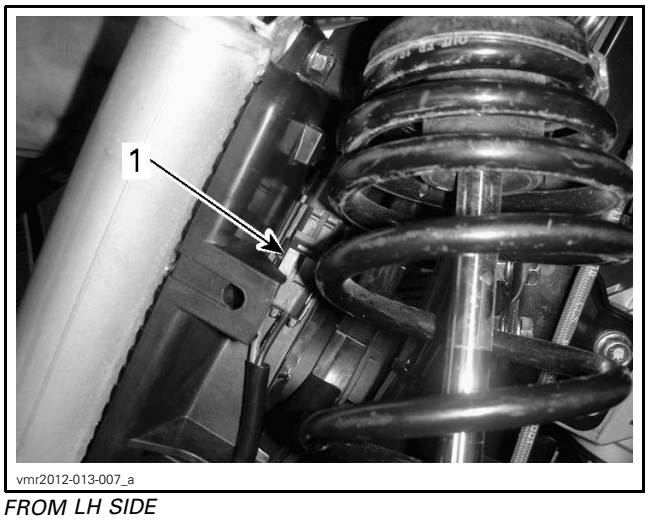
The auto-reset breaker fuse (F9) is located in front fuse box under gauge support.



1. Cooling fan auto-reset breaker fuse (F9)

Radiator Cooling Fan Test

1. Disconnect radiator cooling fan connector.



FROM LH SIDE
1. Cooling fan connector

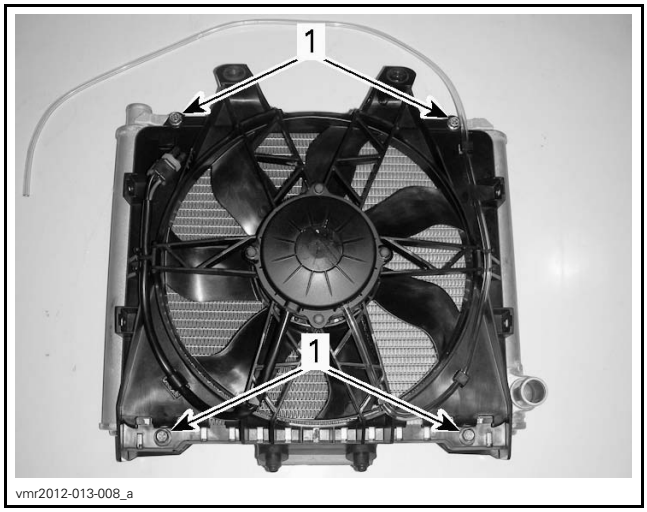
2. Connect cooling fan connector pin B (BU wire) to a 20 A suitable fuse jumper and then directly to the positive battery post.
3. Connect cooling fan connector pin A (BK wire) directly to the negative battery post.
4. Check if cooling fan works properly.
   - If cooling fan does not work, replace it.
   - If cooling fan works properly, refer to *RADIATOR COOLING FAN TROUBLESHOOTING CHART*.
5. Reconnect radiator cooling fan connector.

Radiator Cooling Fan Troubleshooting Chart

COOLING FAN TROUBLESHOOTING CHART		
Is fan working?	YES →	Everything is OK
NO ↓		
Check ECM fuse (F6) Check FAN fuse (F9) Is fuse burnt?	YES →	Replace fuse Is fan working?
NO ↓		
Bypass fan relay R1		
↓		
Fan turns?	YES →	Replace relay Is fan working?
NO ↓		
Apply 12 Vdc to fan connector		
↓		
Fan turns?	NO →	Replace fan Is fan working?
YES ↓		
Check CTS		
↓		
CTS works?	NO →	Replace CTS Is fan working?
YES ↓		
Check wiring harness and connectors		
↓		
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.



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**)

WATER PUMP HOUSING

Water Pump Housing Access

The water pump housing is located on the engine MAG side.

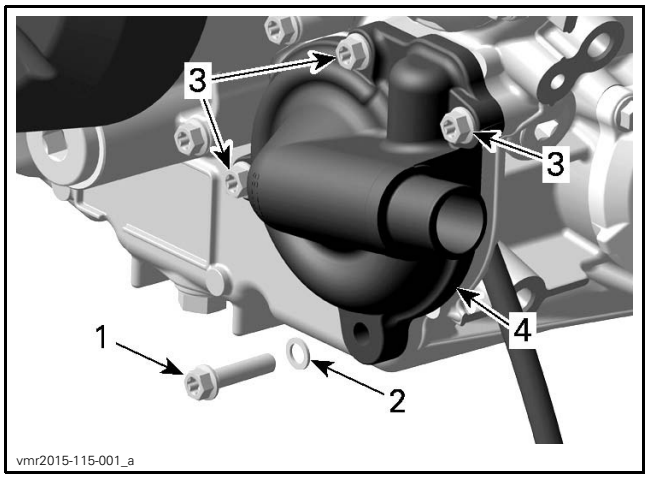
Remove RH footrest panel, refer to *BODY* subsection.

Water Pump Housing Removal

⚠ WARNING

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

1. Drain engine coolant. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
2. Remove radiator outlet hose from water pump housing.
3. Remove screws retaining water pump housing.

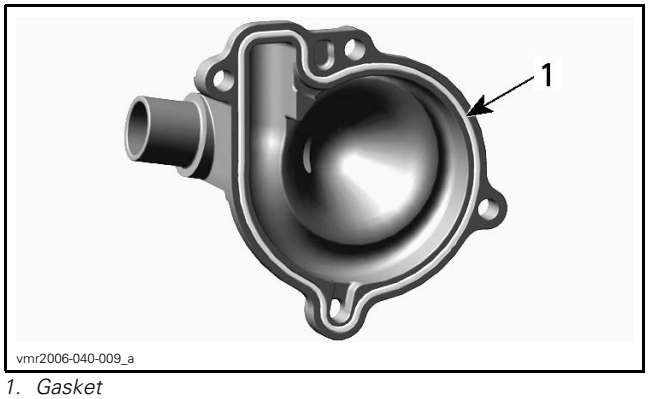


1. Coolant drain plug
2. Sealing ring
3. Screws
4. Water pump housing

4. Pull water pump housing to remove it.

Water Pump Housing Inspection

Check if gasket is brittle, hard or damaged and replace as necessary.



1. Gasket

Water Pump Housing Installation

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

NOTICE To prevent leaking, take care that the gasket is exactly in groove when you reinstall the water pump housing.

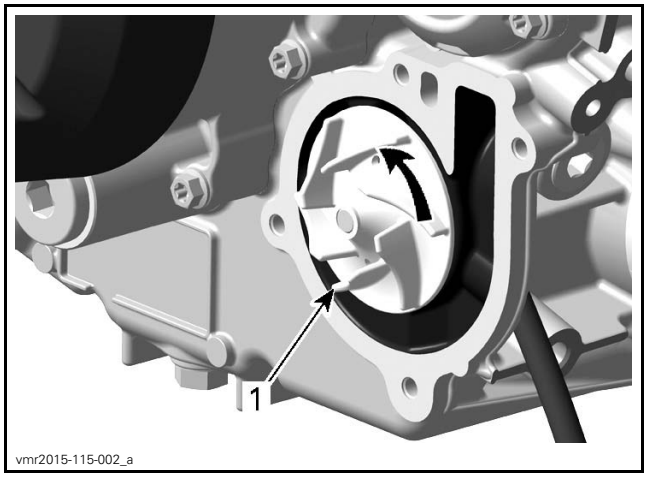
Tighten screws of water pump housing in a crisscross sequence to specification.

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

WATER PUMP IMPELLER

Water Pump Impeller Removal

1. Proceed with *WATER PUMP HOUSING REMOVAL*. See procedure in this subsection.
2. Remove impeller by unscrewing it counterclockwise.



1. Turn counterclockwise to unscrew

NOTICE Water pump shaft and impeller have right-hand threads.

Water Pump Impeller Inspection

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

Water Pump Impeller Installation

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

NOTICE Be careful not to damage impeller fins during installation.

WATER PUMP SHAFT AND SEALS

Use these guidelines to service these parts.

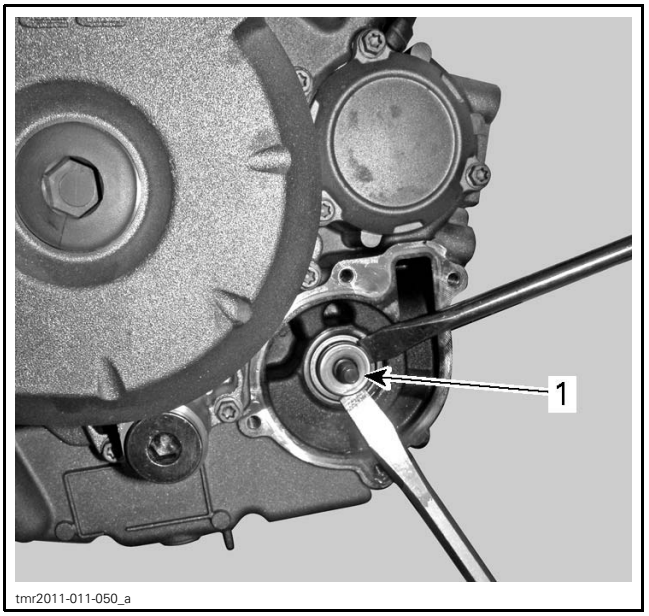
DEFECTIVE PART	ACTION
Rotary seal	Replace: - Rotary seal - Oil seal (assembled engine)
Oil seal	Replace: - Rotary seal - Oil seal (assembled engine)
Water pump shaft	Replace: - Water pump shaft assembly (including rotary seal) - Oil seal (engine disassembled)

Water Pump Seals Replacement (Assembled Engine)

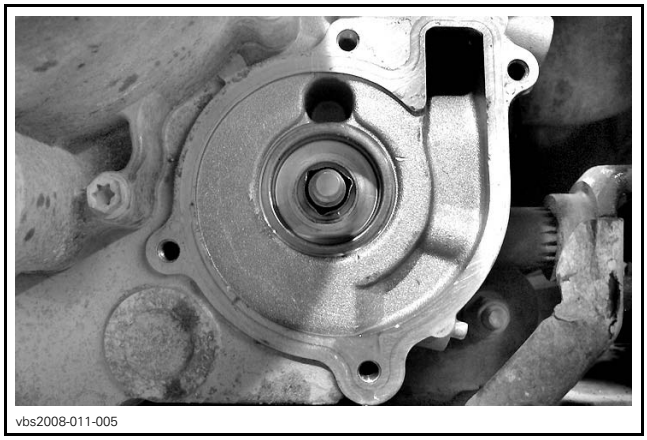
NOTE: Read and thoroughly understand the entire procedure before starting it.

Seals Removal

1. Remove the following parts, see procedure in this subsection.
   – *WATER PUMP HOUSING*
   – *WATER PUMP IMPELLER*.
2. Carefully pry out inner part of the rotary seal using 2 screwdrivers.

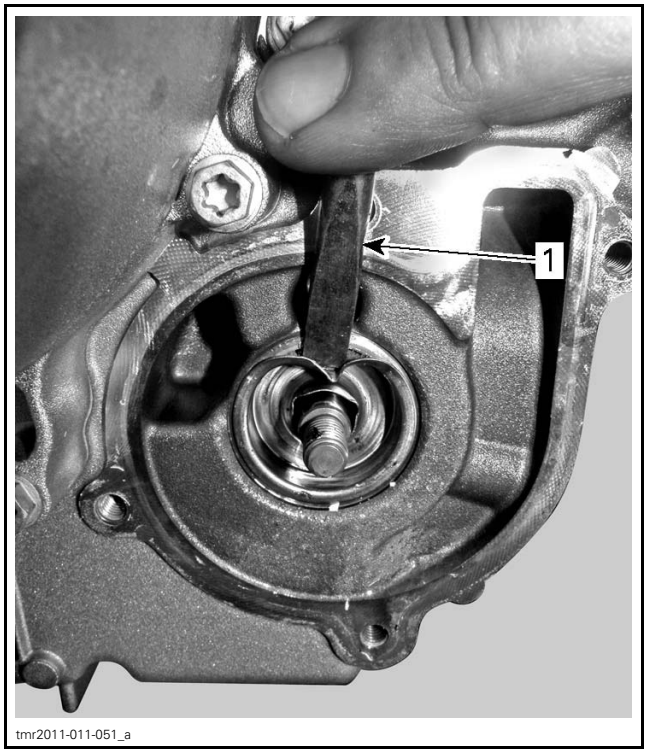


1. Inner part of rotary seal



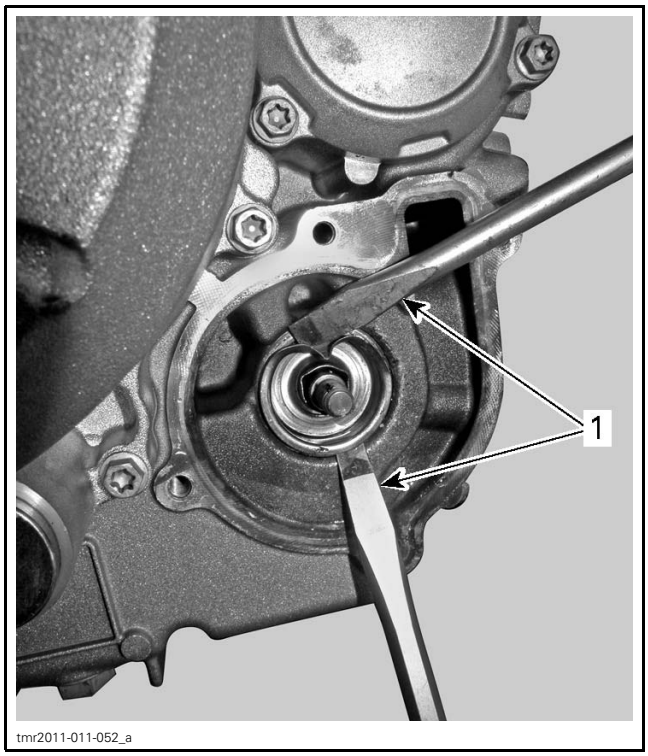
TYPICAL - INNER PART OF ROTARY SEAL REMOVED

3. Carefully bend down the outer part of rotary seal lip using a small chisel.



1. Small chisel

4. Use 2 screwdrivers and carefully remove the outer part of the rotary seal.

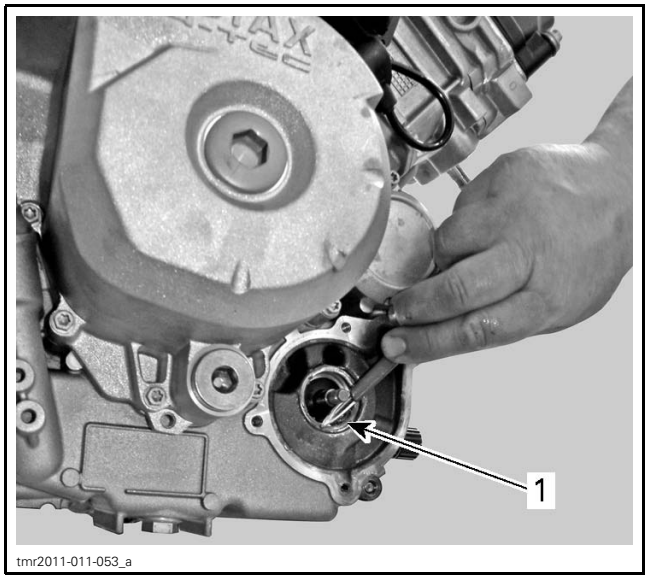


1. Screwdrivers

NOTICE Be careful not to damage the crankcase while removing outer part of the rotary seal.

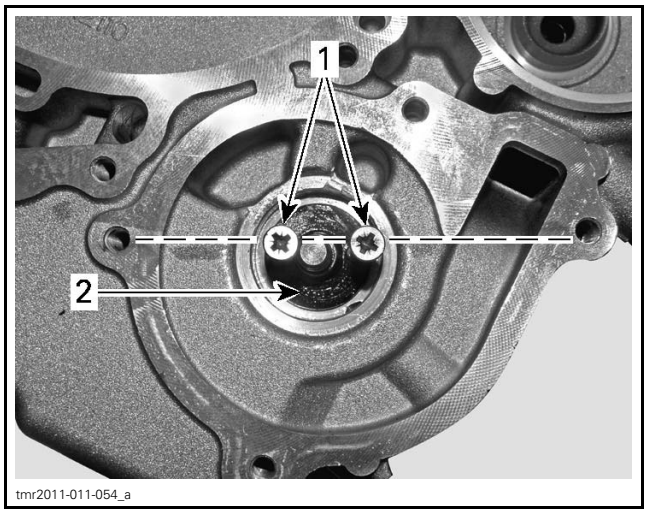
5. Thoroughly remove sealing residue and burr of rotary seal using a scraper.

NOTICE Be careful not to damage water pump shaft.



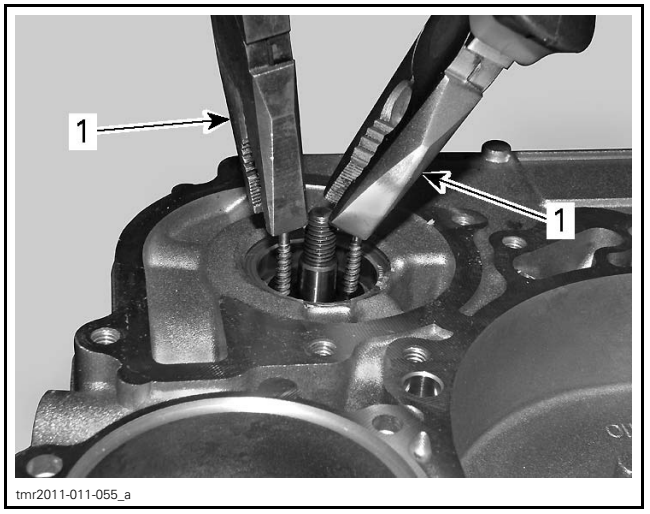
1. Scraper

6. Install 2 wooden screws in the seal.



1. Wooden screws
2. Oil seal

7. Remove oil seal from crankcase by pulling screws with pliers.

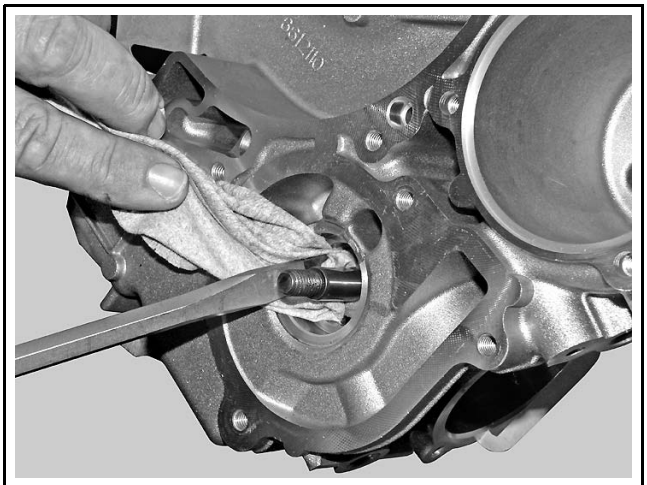


1. Pull on screws to remove seal

8. Check water pump shaft axial play.

NOTE: If axial play is not adequate, engine must be disassembled to replace water pump shaft.

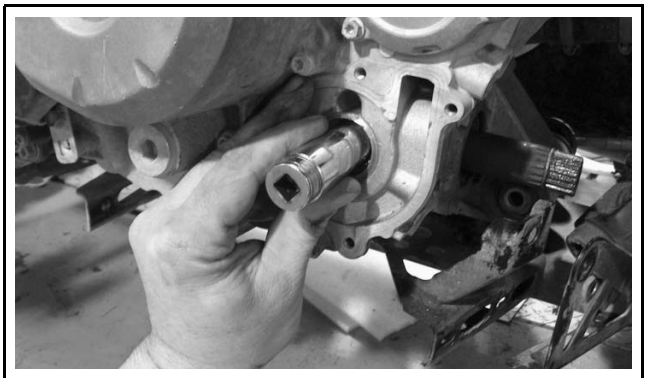
9. Clean oil seal seat.


tmr2011-011-056_a

Seals Installation

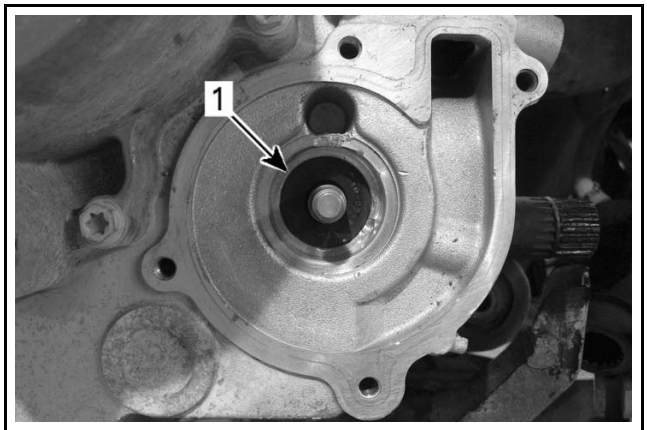
1. Apply engine oil on water pump shaft.
2. Apply grease on the lips of the oil seal.
3. Carefully install oil seal over the water pump shaft.
4. Push oil seal into the water pump cavity.

REQUIRED TOOL
17 mm (11/16 in) deep socket


vbs2008-011-034

OIL SEAL INSTALLATION

5. Ensure that the oil seal is properly seated in water pump cavity.



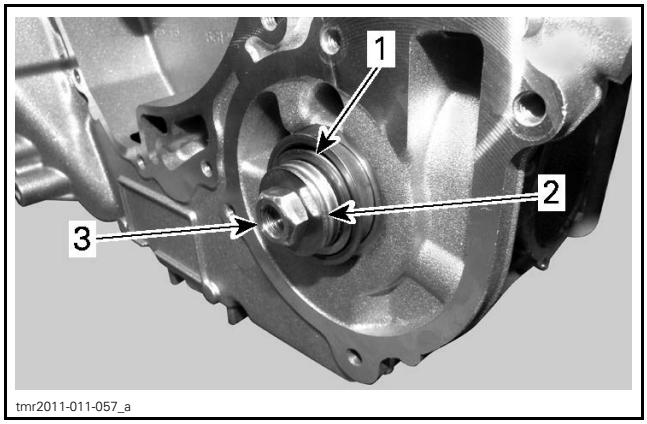
vbs2008-011-035_a

TYPICAL
1. Oil seal properly seated

6. Apply engine oil on water pump shaft.
7. Place rotary seal onto water pump shaft and pull out water pump shaft by hand.

NOTICE **Do not install the rotary seal completely into the crankcase to prevent the water pump shaft plastic gear from breaking. Push it partially in, then pull the shaft.**

8. Place a robust M8 flat washer (P/N 420 227 935) onto water pump shaft.
9. Install a M8 nut (P/N 233 281 414) onto water pump shaft by hand.
10. Thread nut **1-1/2 turns** to pull the shaft into rotary seal.



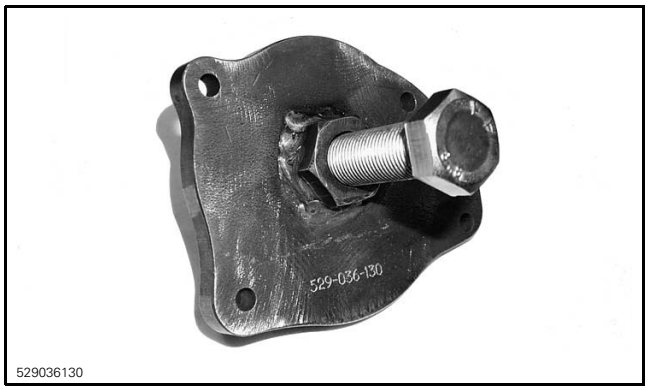
tmr2011-011-057_a

1. Rotary seal
2. M8 robust flat washer
3. M8 nut

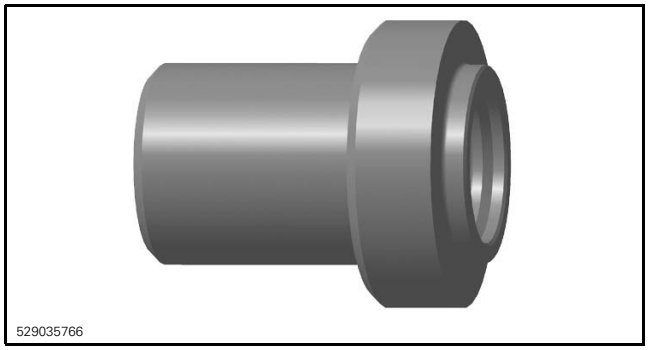
11. Remove M8 nut.

NOTE: The robust M8 flat washer must remain on water pump shaft.

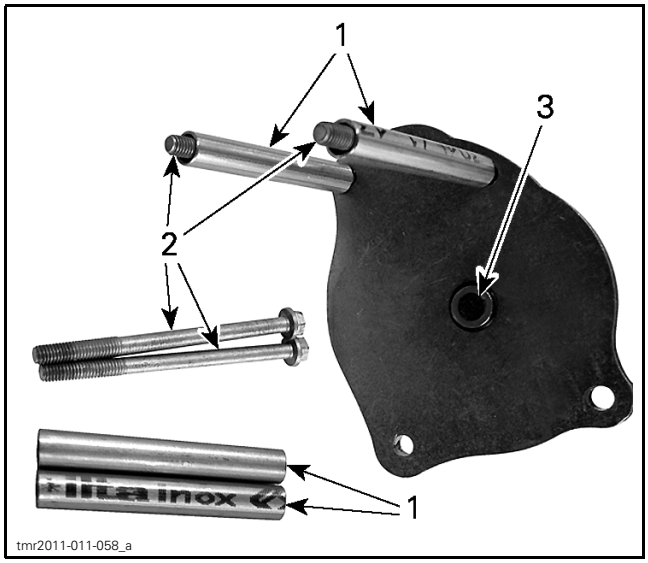
REQUIRED TOOLS
ROTARY SEAL PUSHER PLATE (P/N 529 036 130)
4x M6 x 85 screws (P/N 420 440 347)
4x tubes 70 mm (2.75 in)
SEAL PUSHER (P/N 529 035 766)



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



SEAL PUSHER (P/N 529 035 766)



ROTARY SEAL PUSHER PLATE ASSEMBLY
1. *4 x tubes (70 mm (2.75 in) length)*
2. *4 x screws M6 x 85*
3. *Plane surface on pusher bolt*

12. Install rotary seal installation tools on crankcase as follows.

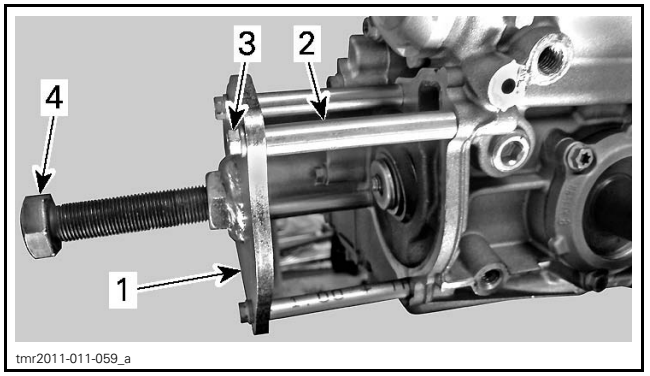
    NOTE: Make sure pusher bolt has a plane surface.

    12.1 Apply a little grease at the end of tool pusher bolt.

    12.2 Ensure that pusher bolt is completely unscrewed.

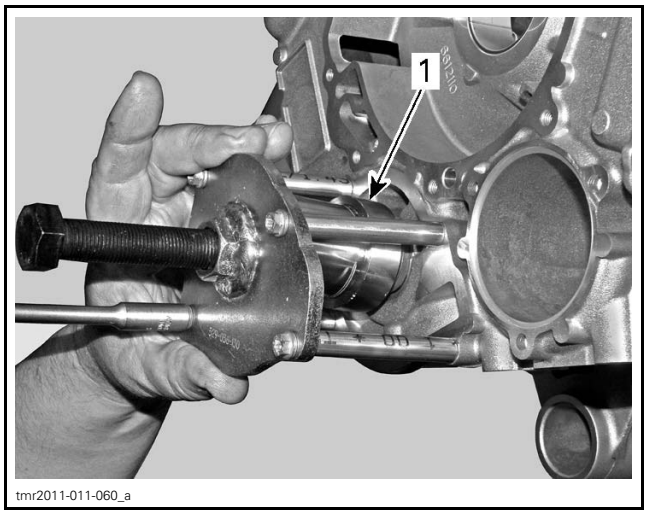
    12.3 Install rotary seal pusher plate on crankcase by tightening M6 screws.

    NOTICE **Do not use pneumatic or electric tools for tightening screws.**



ROTARY SEAL PUSHER PLATE INSTALLATION
1. *Rotary seal pusher plate*
2. *Tube (70 mm (2.75 in) length)*
3. *M6 x 85 screw*
4. *Pusher bolt*

    12.4 Install seal pusher between rotary seal pusher plate and water pump shaft.



SEAL PUSHER INSTALLATION
1. *Seal pusher aligned with pusher bolt*

    12.5 Tighten the pusher bolt by hand until it stops against the seal pusher.

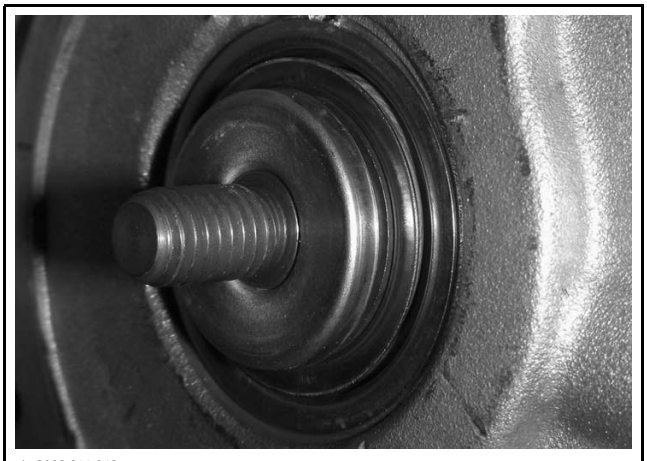
13. Carefully thread the pusher bolt **1-1/2 turns**.

14. Ensure that the rotary seal is going straight into crankcase.
15. Remove rotary seal installation tools from crankcase.
16. Repeat steps *9 TO 15* until rotary seal is completely seated in the crankcase.


vbs2008-011-037

ROTARY SEAL PROPERLY SEATED ON CRANKCASE

17. Carry out the final adjustment of the water pump shaft as follows.
    17.1 Install M8 nut (P/N 233 281 414) onto water pump shaft.
    17.2 Carefully thread M8 nut until the rotary seal is flush with the end of water pump shaft threads.


vbs2008-011-040

WATER PUMP SHAFT PROPERLY ADJUSTED WITH ROTARY SEAL

NOTICE The water pump shaft must be properly adjusted with rotary seal. The water pump shaft must move freely while pushing it toward the crankcase.

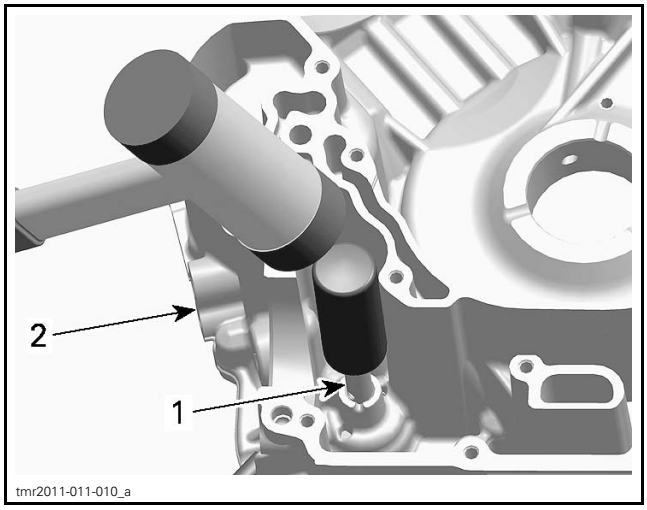
18. Install the following parts, see procedure in this subsection.
    – *WATER PUMP IMPELLER*
    – *WATER PUMP HOUSING*.
19. Refill and bleed cooling system. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
20. Check cooling system for leaks.

Water Pump Shaft and Seals Replacement (Disassembled Engine)

Water Pump Shaft and Seals Removal

1. Remove the following parts, see procedure in this subsection:
    – *WATER PUMP HOUSING*
    – *WATER PUMP IMPELLER*
    – *WATER PUMP GEARS*.
2. Push out water pump shaft with inner portion of rotary seal from inside of crankcase MAG side.

REQUIRED TOOL
Soft hammer



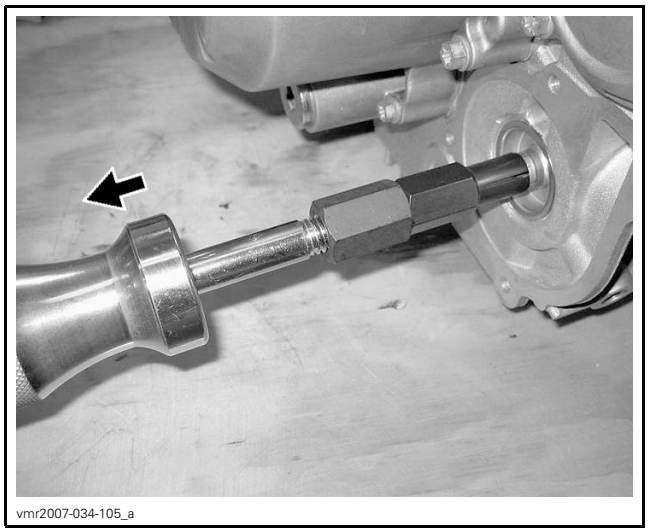
tmr2011-011-010_a

1. Water pump shaft
2. Crankcase MAG side

3. Remove outer part of rotary seal using an expander.

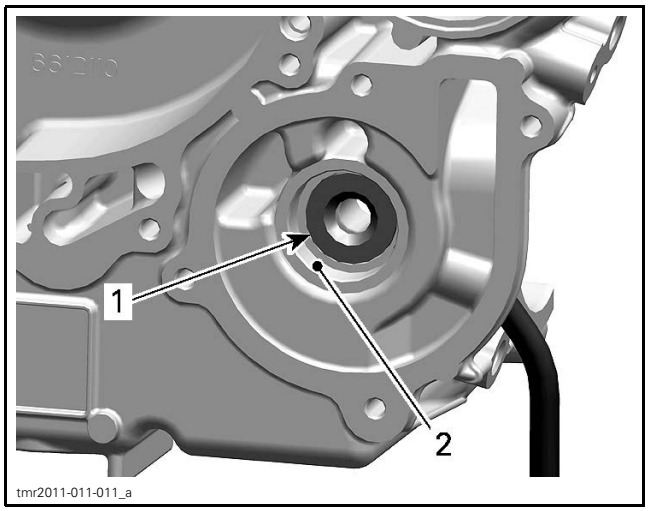
REQUIRED TOOL	
BLIND HOLE PULLER KIT (P/N 529 036 056)	

4. Install expander snugly against outer part of rotary seal and pull seal out.


vmr2007-034-105_a

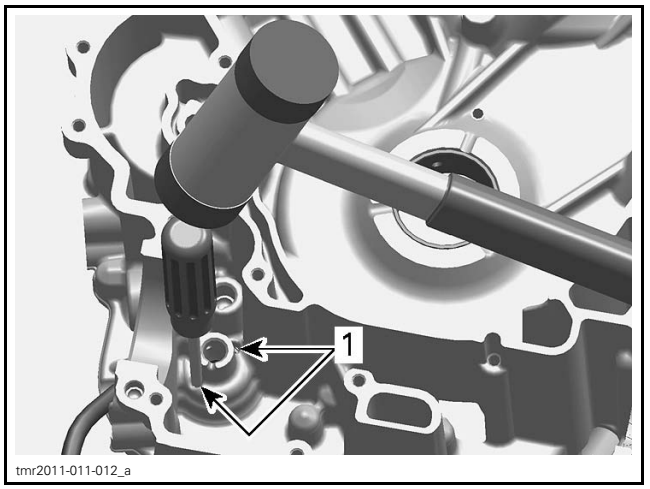
5. Remove oil seal from inside of crankcase MAG side using a pusher tool.

NOTICE Be careful not to damage the rotary seal surface in crankcase.



tmr2011-011-011_a

1. *Oil seal*
2. *Machined surface for rotary seal*



tmr2011-011-012_a

OIL SEAL REMOVAL - VIEW FROM INSIDE CRANKCASE MAG SIDE
1. *Orifices for oil seal removal*

Water Pump Shaft and Seals Installation

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

Use tightening torque values specified in the exploded view.

NOTE: Never apply oil on the press fit area of the oil seal and rotary seal.

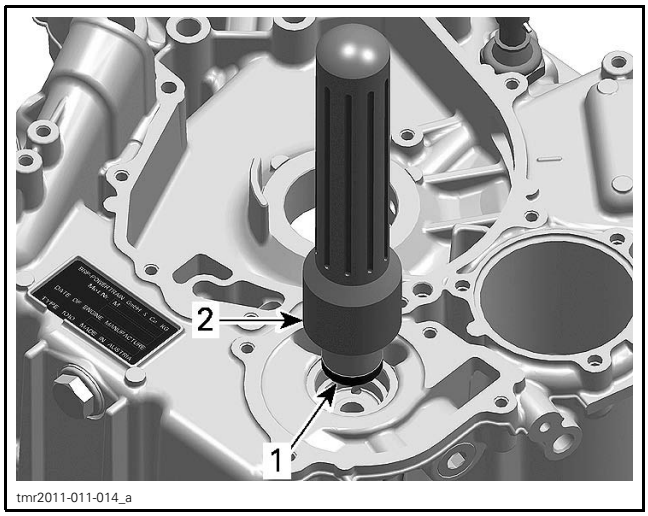
Clean rotary seal surface of any old sealant.

Install oil seal.

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

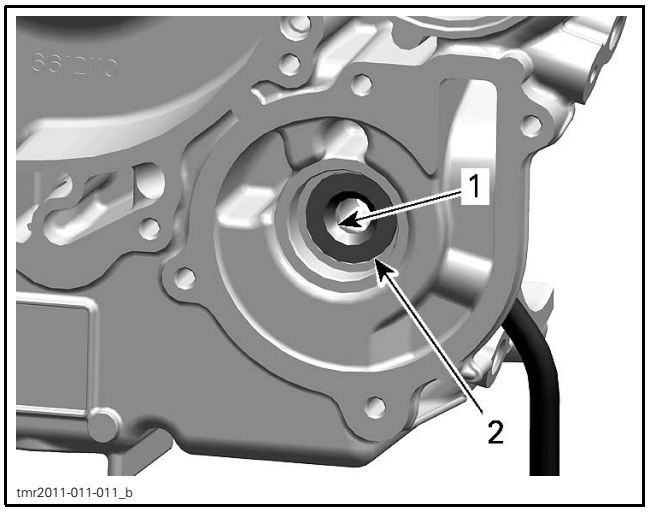
When installing the oil seal on the pusher, make sure the sealing lip points outwards.

Push NEW oil seal in place.



1. Oil seal
2. Installer handle with oil seal pusher

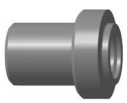
Apply DOW CORNING 111 (P/N 413 707 000) on sealing lip of the oil seal.

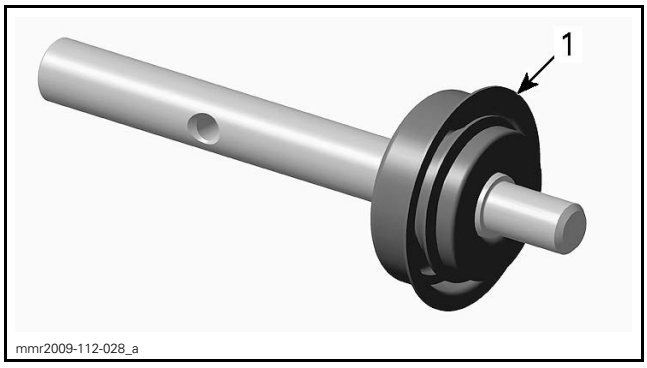


1. Sealing lip
2. Oil seal properly installed

Apply engine oil on the water pump shaft and intermediate shaft.

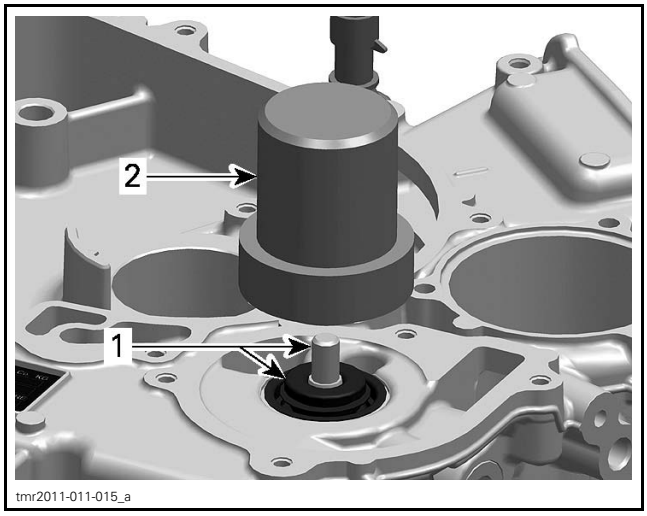
Slide **NEW** water pump shaft assembly into crankcase.

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



WATER PUMP SHAFT ASSEMBLY
1. Surface where rotary seal is pushed by tool

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

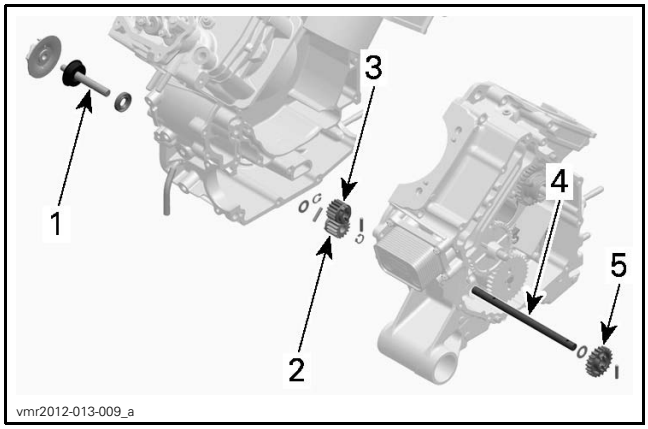


1. Water pump shaft with rotary seal
2. Water pump seal installer

NOTICE After installation, water pump shaft with rotary seal must rotate freely.

WATER PUMP GEARS

Water Pump Gears Identification

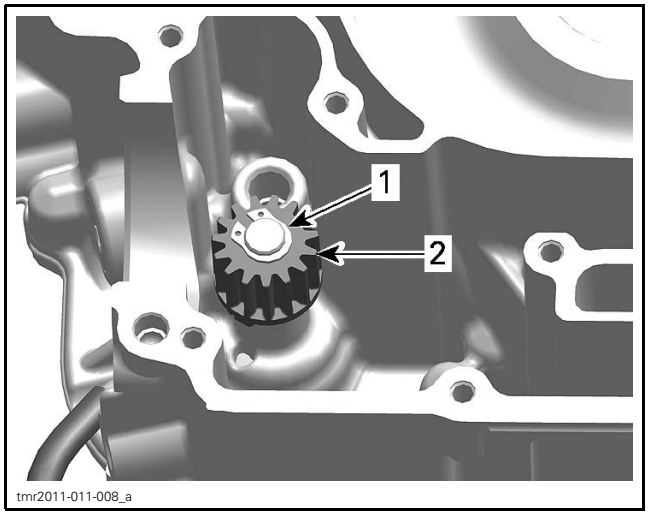


1. *Water pump shaft*
2. *Water pump gear*
3. *Water pump* **intermediate drive** *gear*
4. *Water pump* **intermediate** *shaft*
5. *Water pump* **drive** *gear (See BOTTOM END subsection)*

Water Pump Gears Inspection

Water Pump Gear

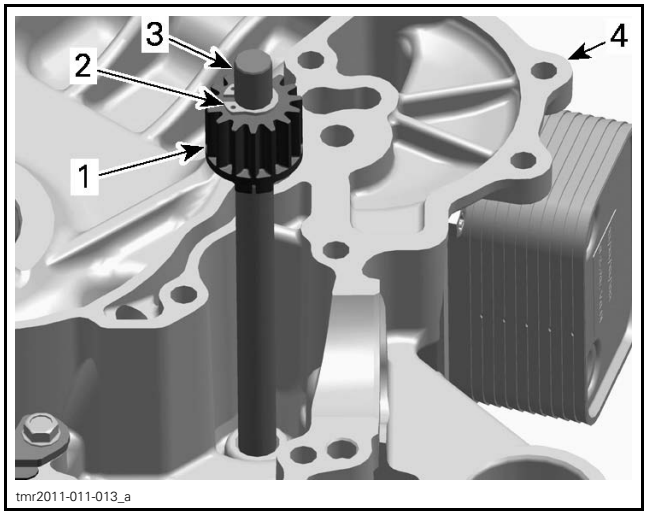
Inspect water pump gear for wear and damage on the snap mechanism to the needle pin. Replace if damaged.



CRANKCASE MAG SIDE
1. *Circlip*
2. *Water pump gear*

Water Pump Intermediate Drive Gear

Check water pump intermediate drive gear for wear or broken teeth. Replace if damaged.



CRANKCASE PTO SIDE
1. *Water pump intermediate drive gear*
2. *Circlip*
3. *Water pump intermediate shaft*
4. *Crankcase PTO side*

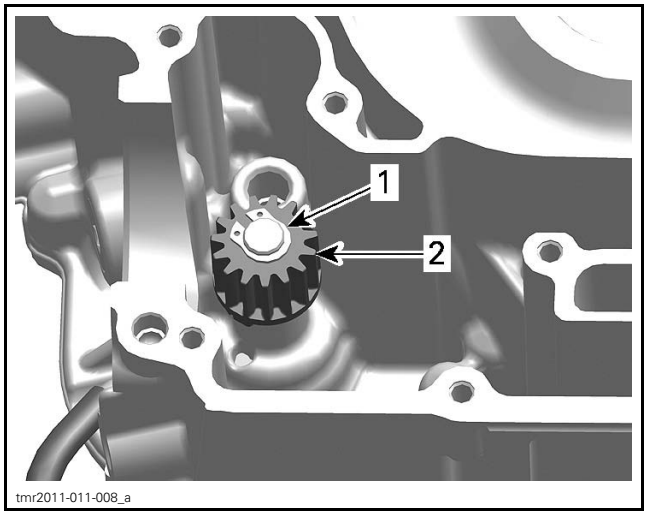
Water Pump Drive Gear

See *BOTTOM END* subsection.

Water Pump Gears Removal

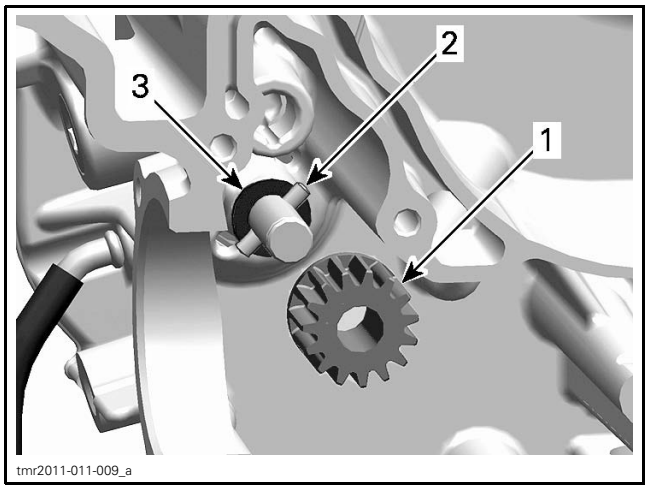
Water Pump Gear

1. Remove circlip retaining water pump gear and discard it.



CRANKCASE MAG SIDE
1. *Circlip*
2. *Water pump gear*

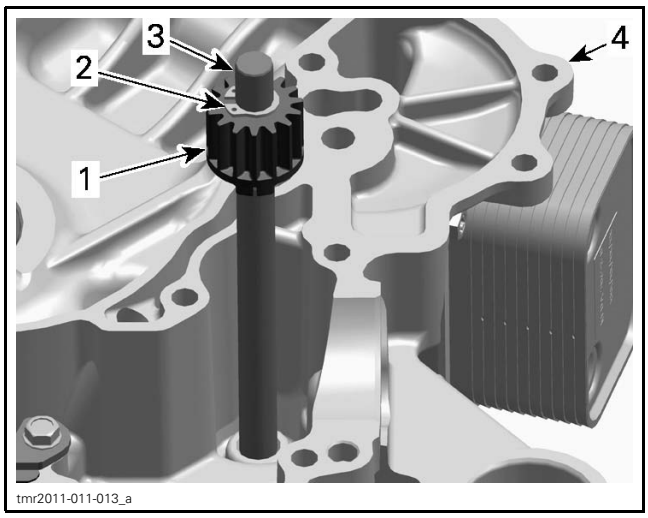
2. Remove the following parts:
   - Water pump gear
   - Needle pin
   - Thrust washer.



CRANKCASE MAG SIDE
1. *Water pump gear*
2. *Needle pin*
3. *Thrust washer*

Water Pump Intermediate Drive Gear

1. Remove circlip retaining water pump intermediate drive gear and discard it.



CRANKCASE PTO SIDE
1. *Water pump intermediate drive gear*
2. *Circlip*
3. *Water pump intermediate shaft*
4. *Crankcase PTO side*

2. Remove the following parts:
   – Water pump intermediate drive gear
   – Needle pin.

Water Pump Drive Gear

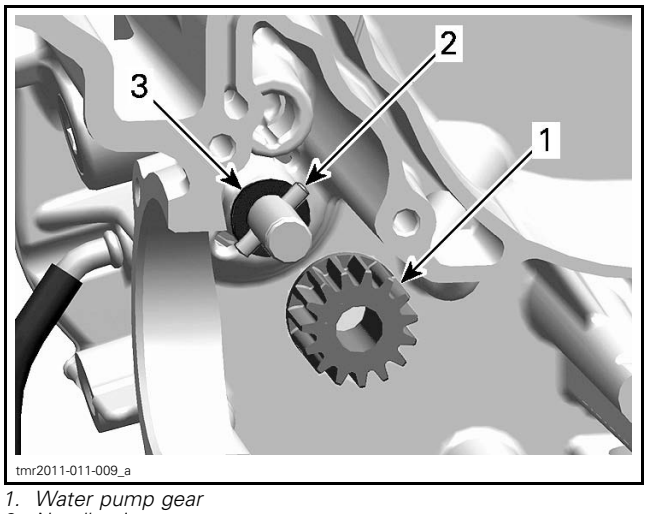
See *BOTTOM END* subsection.

Water Pump Gears Installation

Water Pump Gear

Install the following parts on water pump shaft.
– Thrust washer
– Needle pin
– Water pump gear.

NOTICE A missing thrust washer will cause a leaking rotary seal.

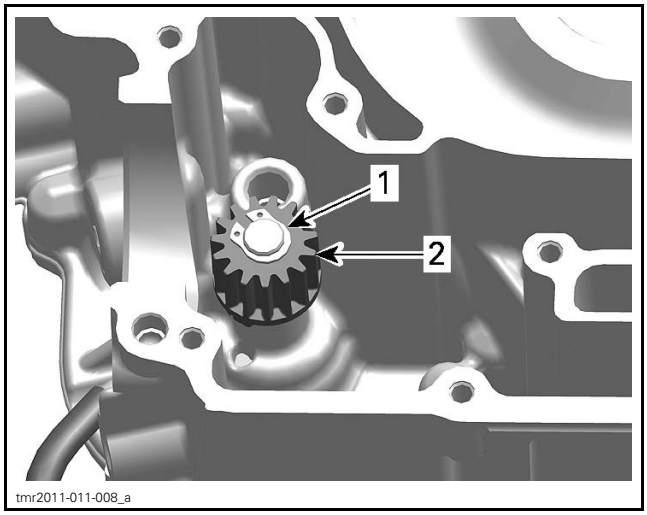


1. *Water pump gear*
2. *Needle pin*
3. *Thrust washer*

NOTE: Ensure water pump gear snaps properly onto needle pin.

Install NEW circlip to retain water pump gear.

NOTICE Never use the circlip a second time. Always install a NEW one.



1. *Circlip*
2. *Water pump gear*

Water Pump Intermediate Drive Gear

Install the following parts on water pump intermediate shaft.
– Needle pin
– Water pump intermediate drive gear.

Install NEW circlip to retain water pump intermediate drive gear.

NOTICE Never use the circlip a second time. Always install a NEW one.

Water Pump Drive Gear

See *BOTTOM END* subsection.

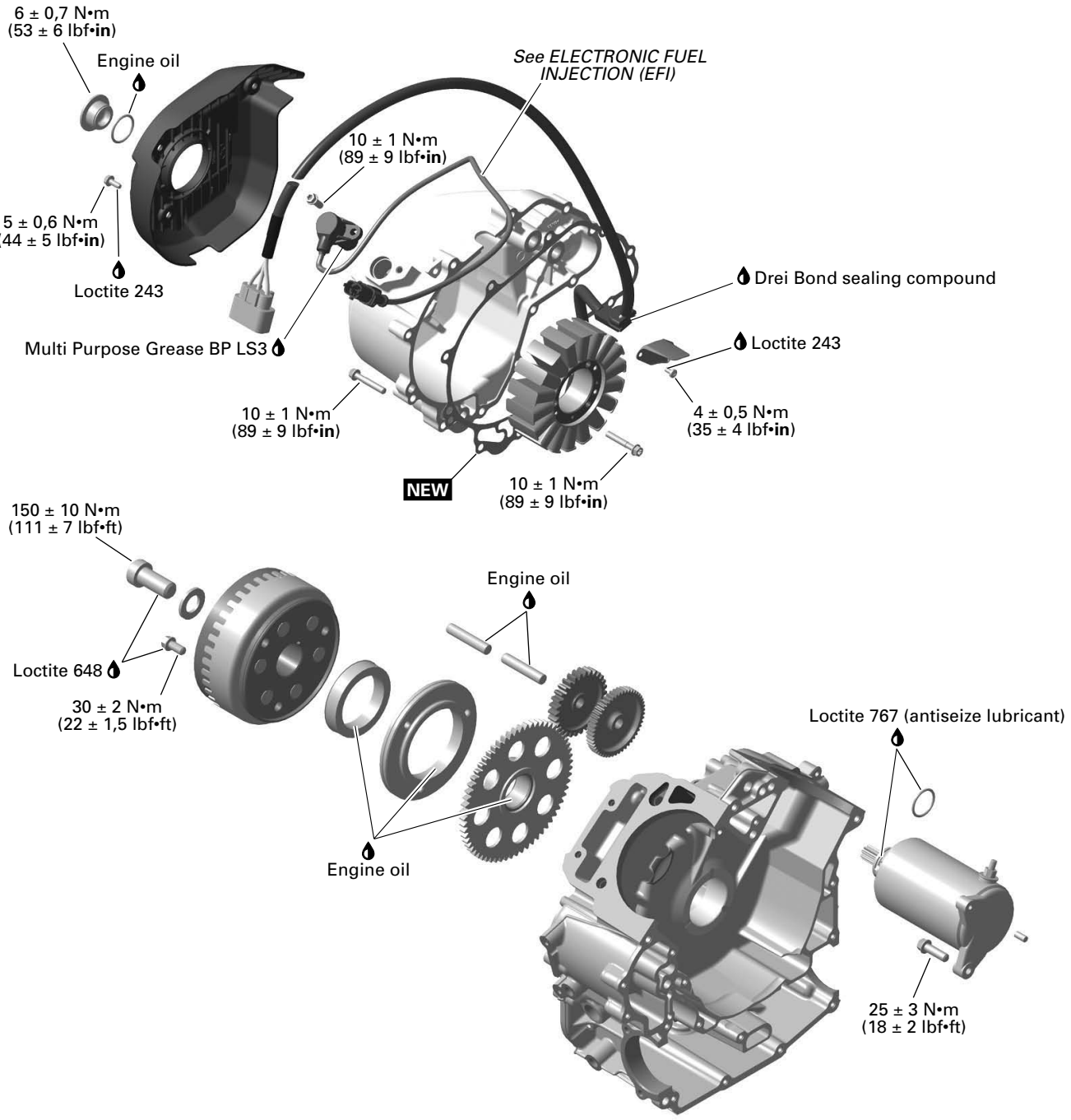
MAGNETO AND STARTER

SERVICE TOOLS

Description	Part Number	Page
CRANKSHAFT LOCKING BOLT	529 035 617	144
CRANKSHAFT PROTECTOR	529 036 034	144
FLUKE 115 MULTIMETER	529 035 868	141
MAGNETO PULLER	529 035 748	144

SERVICE PRODUCTS

Description	Part Number	Page
DREI BOND SEALING COMPOUND	420 297 906	142
LOCTITE 243 (BLUE)	293 800 060	143
LOCTITE 648 (GREEN)	413 711 400	145–146
LOCTITE 767 (ANTISEIZE LUBRICANT)	293 800 070	147
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	141
PULLEY FLANGE CLEANER	413 711 809	144



NEW = Component must be replaced when removed.

vmr2015-030-001_a

GENERAL

All electrical test have been performed using the FLUKE 115 MULTIMETER (P/N 529 035 868).



Results may vary when another multimeter is used.

PROCEDURES

MAGNETO COVER

Magneto Cover Access

Refer to *BODY* and remove:
– RH side panel
– RH footboard panel.

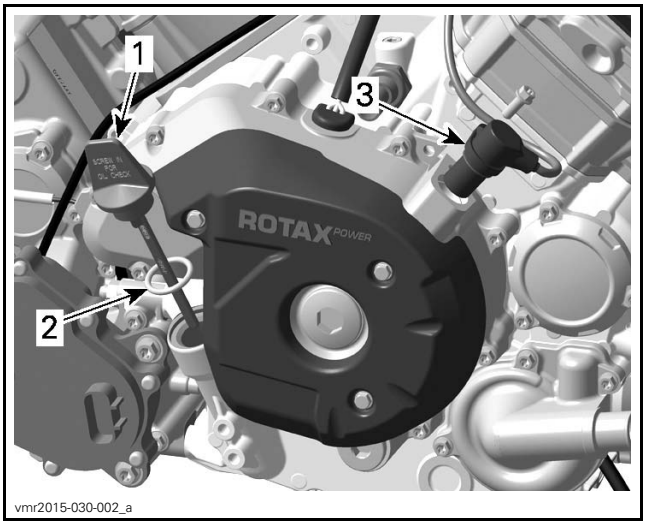
Magneto Cover Removal

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

Remove crankshaft position sensor (CPS) and cut tie raps.

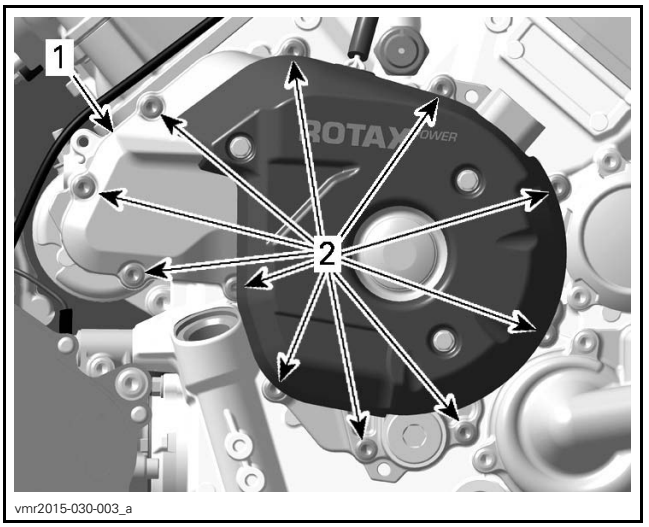
Disconnect the stator connector on the voltage regulator/rectifier, refer to *STATOR CONNECTOR ACCESS* in this subsection.

Remove dipstick with O-ring.



1. Dipstick
2. O-ring
3. Crank position sensor (CPS)

Remove magneto cover retaining screws.



1. Magneto cover
2. Retaining screws

Pull out magneto cover.

Magneto Cover Inspection and Cleaning

Check magneto cover for cracks or other damage. Replace if necessary.

Clean all metal components in a non- ferrous metal cleaner. Use LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500), or suitable equivalent.

⚠ WARNING

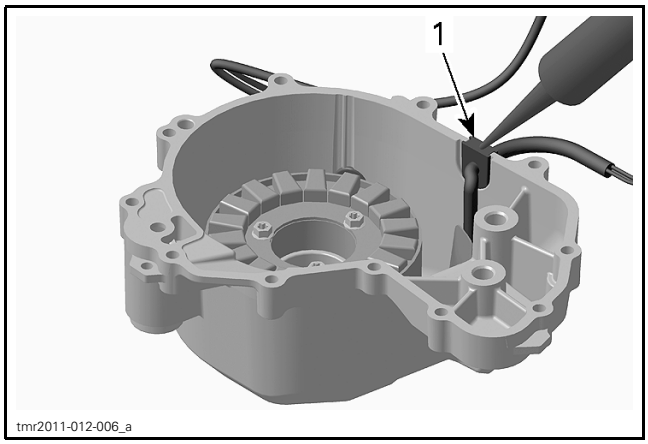
Wear safety glasses and work in a well ventilated area when working with strong chemical products. Also wear suitable non-absorbent gloves to protect your hands.

Magneto Cover Installation

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

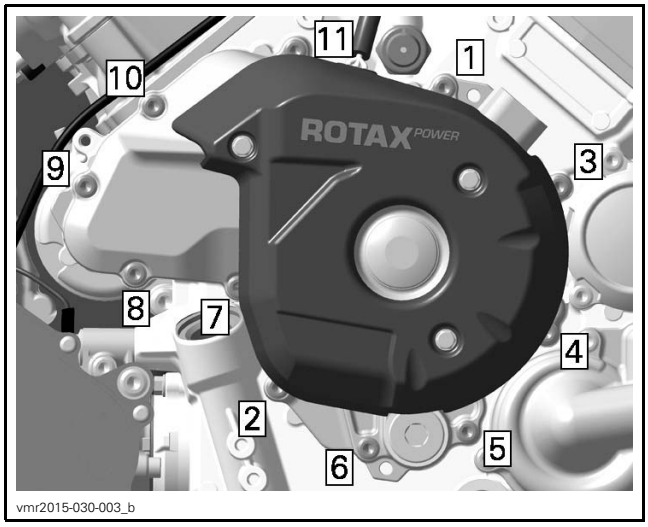
Install a **NEW** magneto cover gasket.

Apply DREI BOND SEALING COMPOUND (P/N 420 297 906) on stator cable grommet as shown in next illustration.



1. Stator cable grommet (apply Drei Bond sealing compound)

Tighten screws using the following sequence.



TIGHTENING SEQUENCE

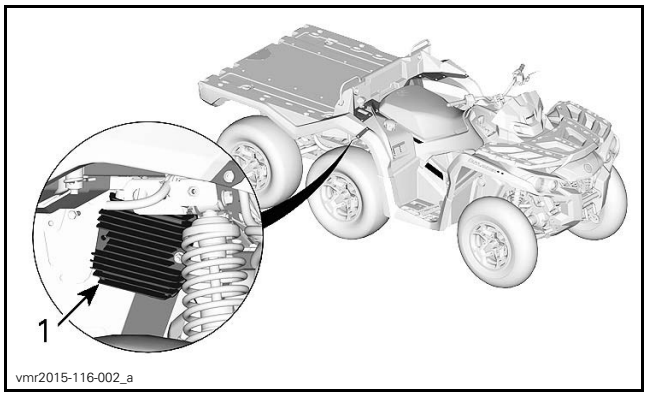
MAGNETO COVER SCREWS	
Tightening torque	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

Refill engine with recommended oil.

STATOR

Stator Connector Access

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

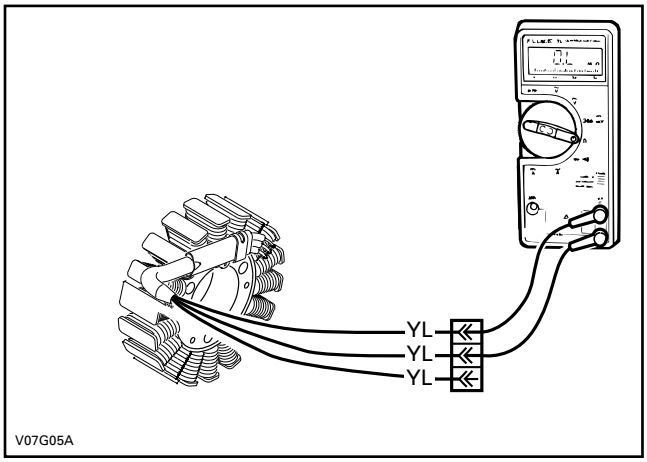


1. Voltage regulator/rectifier

Stator Static Test: Continuity

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



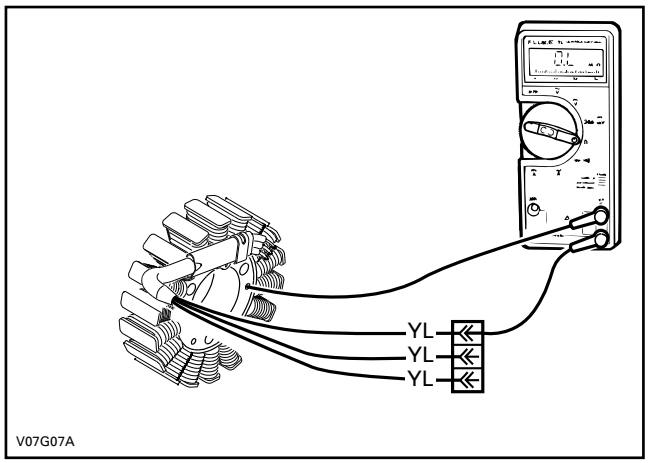
TYPICAL

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

Stator Static Test: Insulation

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

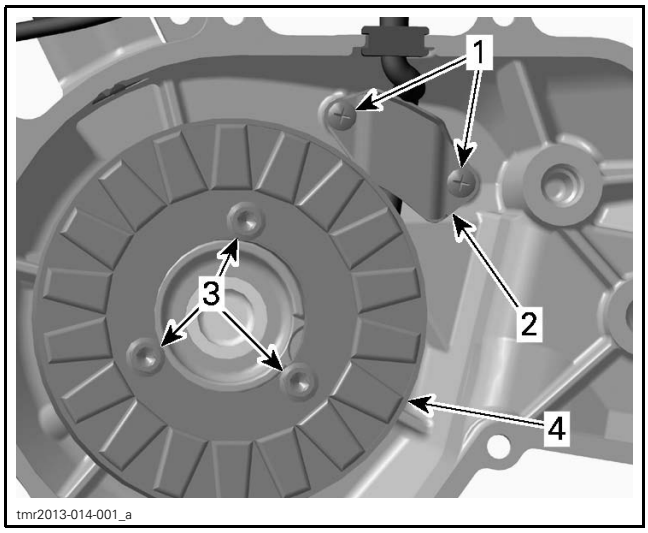
4. If there is a resistance or continuity, the stator coils and/or the wiring is shorted to ground and needs to be repaired or replacked.
5. Re-plug connectors properly.

Stator Removal

Remove *MAGNETO COVER*. See procedure in this subsection.

Remove screws securing the wire holding strip.

Remove stator retaining screws then the stator.



1. *Holding strip screws*
2. *Wire holding strip*
3. *Stator retaining screws*
4. *Stator*

Stator Inspection

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

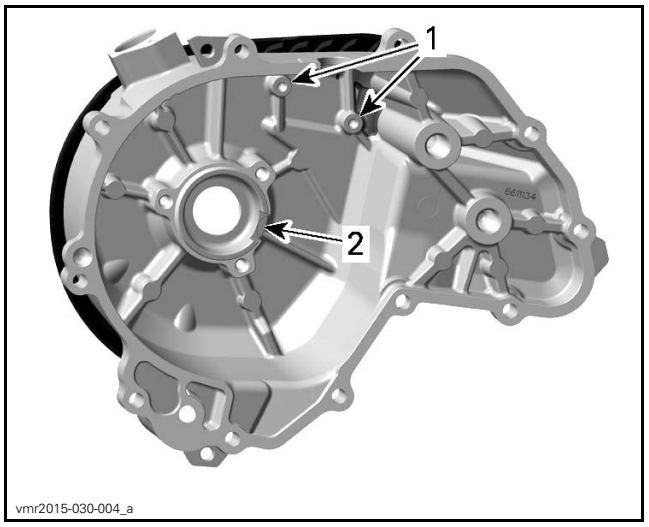
Check if stator wires are brittle, hard or otherwise damaged.

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 retaining strip.**

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



1. *Threads for cable holding strip*
2. *Notch for stator*

HOLDING STRIP SCREWS	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening torque	4 N•m ± 0.5 N•m (35 lbf•**in** ± 4 lbf•**in**)

STATOR RETAINING SCREWS	
Tightening torque	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

ROTOR

Rotor Removal

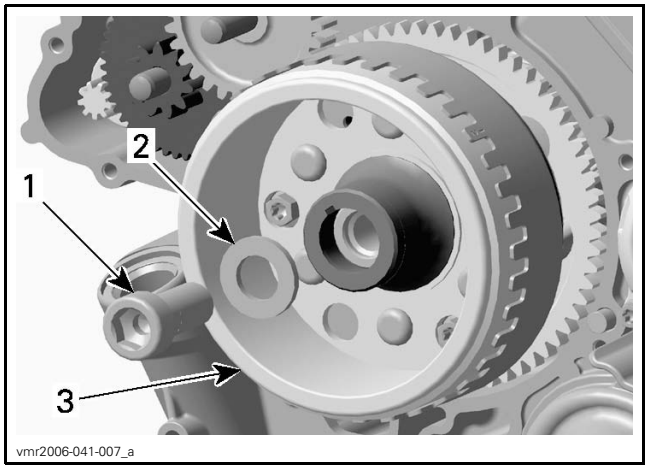
Remove *MAGNETO COVER*. See procedure in this subsection.

Lock crankshaft (refer to *CRANKSHAFT LOCKING PROCEDURE* in the *BOTTOM END* subsection).

REQUIRED TOOL	
CRANKSHAFT LOCKING BOLT (P/N 529 035 617)	

Heat screw in order to break the Loctite.

Remove screw and washer securing rotor to crankshaft.

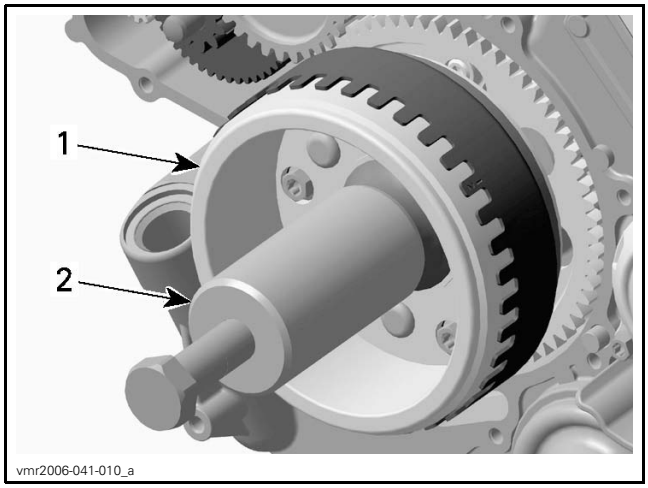


1. *Screw M16*
2. *Washer*
3. *Rotor*

Remove rotor.

REQUIRED TOOL	
CRANKSHAFT PROTECTOR (P/N 529 036 034)	
MAGNETO PULLER (P/N 529 035 748)	

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



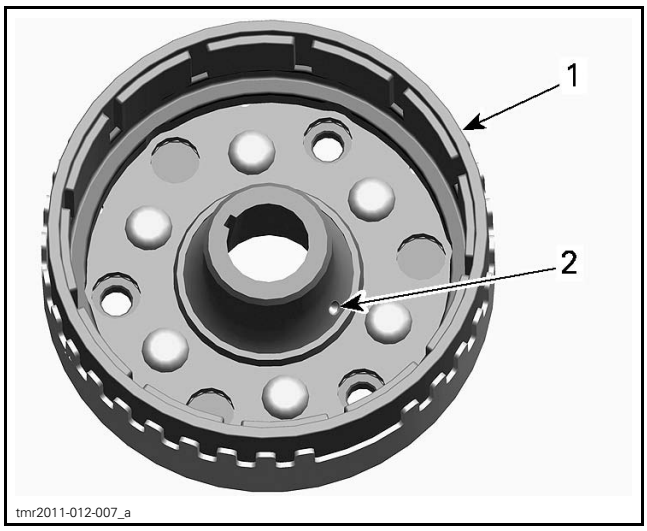
1. *Rotor*
2. *Magneto puller*

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.



1. *Rotor*
2. *Oil bore*

Check keyway of the rotor for wear or damages.

Check if trigger wheel teeth are bent or otherwise damaged.

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

Replace parts as necessary.

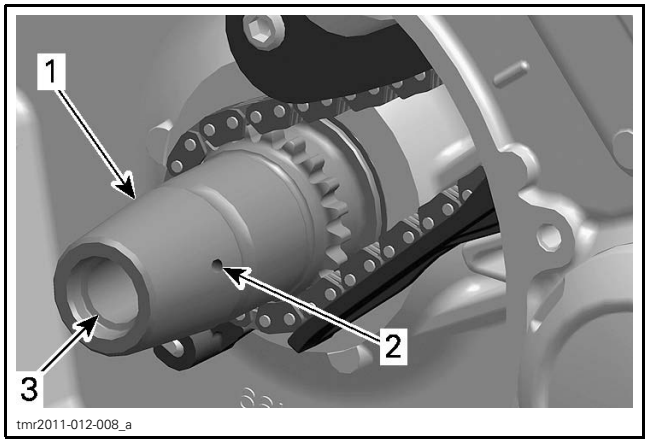
Rotor Installation

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:

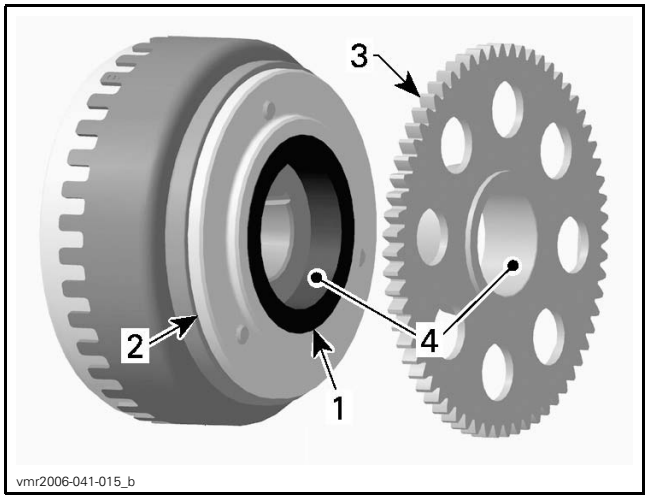
- Crankshaft taper
- Oil passage in crankshaft taper
- Thread in crankshaft
- Rotor taper
- Oil bore in rotor.

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



1. *Crankshaft (MAG side)*
2. *Oil passage*
3. *Threads*

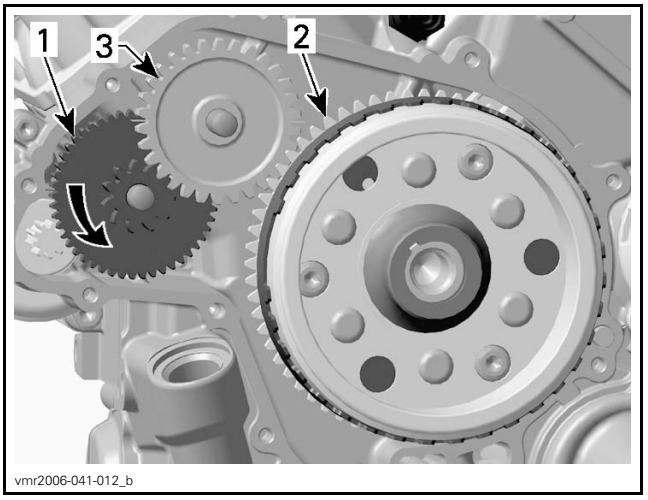
Oil sprag clutch and install sprag clutch gear.



1. *Sprag clutch*
2. *Sprag clutch housing*
3. *Sprag clutch gear*
4. *Apply engine oil here*

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

Rotate starter double gear counterclockwise to align intermediate gear teeth with sprag clutch gear.



1. *Starter double gear*
2. *Sprag clutch gear*
3. *Intermediate gear*

ROTOR RETAINING SCREW	
Service product	LOCTITE 648 (GREEN) (P/N 413 711 400)
Tightening torque	150 N•m ± 10 N•m (111 lbf•ft ± 7 lbf•ft)

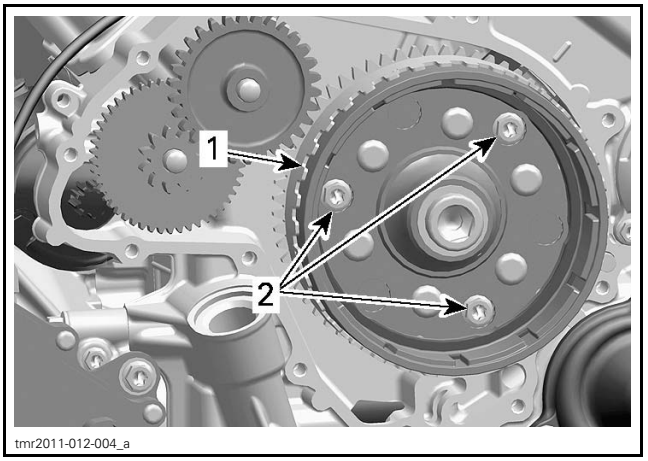
SPRAG CLUTCH

Sprag Clutch Removal

Remove *MAGNETO COVER*. See procedure in this subsection.

Heat screws in order to break the Loctite.

Loosen sprag clutch housing screws located inside rotor.

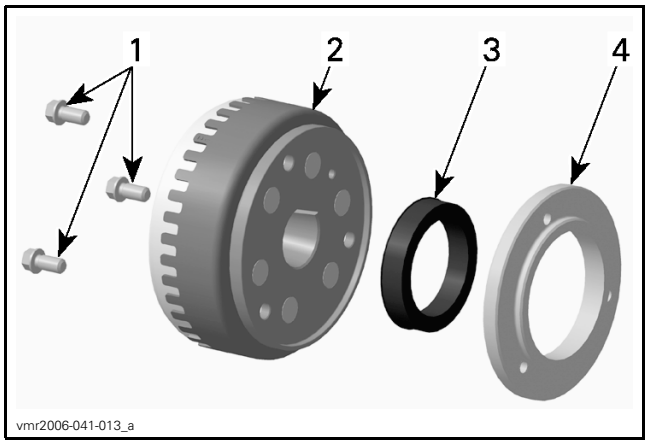


1. *Rotor*
2. *Sprag clutch housing screws*

Remove rotor (refer to *ROTOR* in this subsection).

Remove sprag clutch gear.

Remove sprag clutch housing screws and sprag clutch housing.



1. *Sprag clutch housing screws*
2. *Rotor*
3. *Sprag clutch*
4. *Sprag clutch housing*

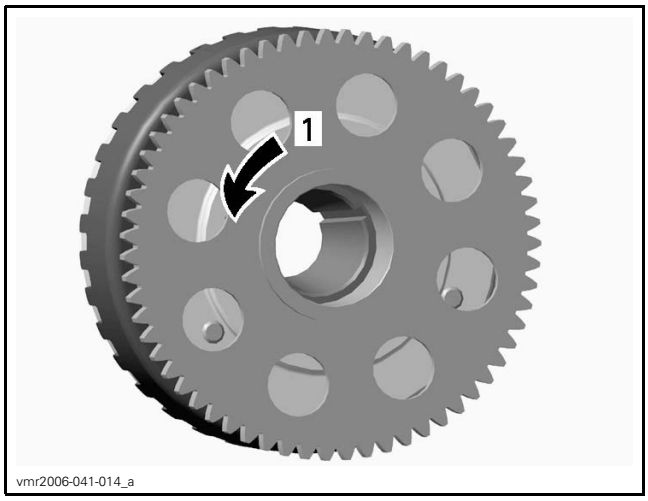
Sprag Clutch Inspection

Inspect sprag clutch and sprag clutch housing for wear and damage.

Also check the collar of the sprag clutch gear.

Rotate sprag clutch gear in sprag clutch.

NOTE: Sprag clutch must lock in counterclockwise direction.



SPRAG CLUTCH FUNCTIONAL TEST
1. *Lock*

NOTE: Sprag clutch, housing and gear must be replaced at the same time, if damaged.

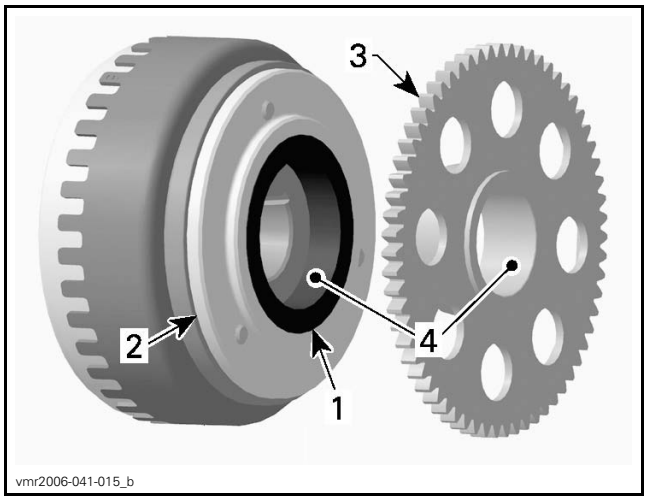
Sprag Clutch Installation

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

Apply LOCTITE 648 (GREEN) (P/N 413 711 400) on threads of sprag clutch housing screws.

Install screws but do not torque yet.

Apply engine oil on sprag clutch and sprag clutch gear needle bearing.



1. *Sprag clutch*
2. *Sprag clutch housing*
3. *Sprag clutch gear*
4. *Apply engine oil here*

Install rotor, refer to *ROTOR* in this subsection.

Tighten sprag clutch housing screws to specification.

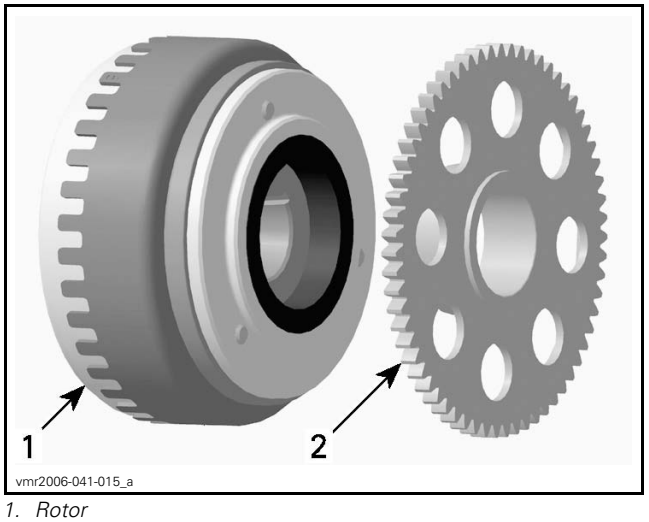
SPRAG CLUTCH HOUSING SCREWS	
Tightening torque	30 N•m ± 2 N•m (22 lbf•ft ± 1 lbf•ft)

SPRAG CLUTCH GEAR

Sprag Clutch Gear Removal

Remove *ROTOR*. See procedure in this subsection.

Pull sprag clutch gear out of the rotor.

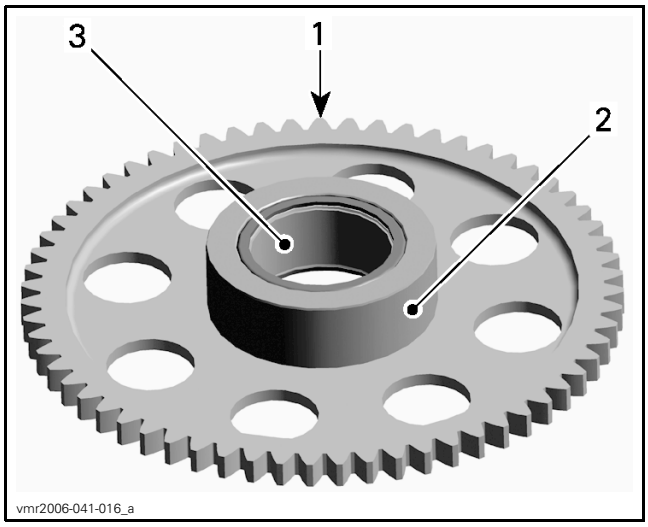


1. *Rotor*
2. *Sprag clutch gear*

Sprag Clutch Gear Inspection

Inspect gear, especially teeth and sprag clutch collar, for wear and other damage.

Check needle bearing condition. Replace sprag clutch gear if necessary.



INSPECT
1. *Teeth*
2. *Collar*
3. *Needle bearing*

Sprag Clutch Gear Installation

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

NOTE: Apply engine oil on needle bearing and collar of sprag clutch gear.

STARTER DRIVE GEARS

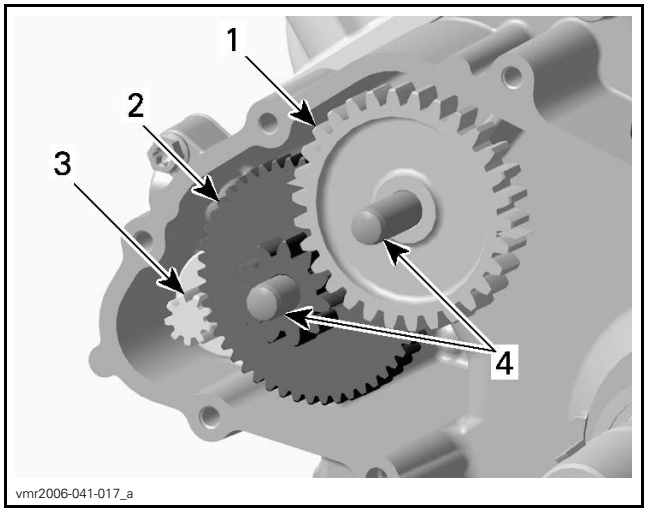
Starter Drive Gear Location

The starter drive gears are located on the engine MAG side behind the magneto cover.

Starter Drive Gear Removal

Remove *MAGNETO COVER*. See procedure in this subsection.

Remove location pins, starter double gear and intermediate gear.



1. *Intermediate gear*
2. *Starter double gear*
3. *Starter gear*
4. *Location pins*

Starter Drive Gear Inspection

Inspect gears and location pins for wear and damage.

Replace parts as necessary.

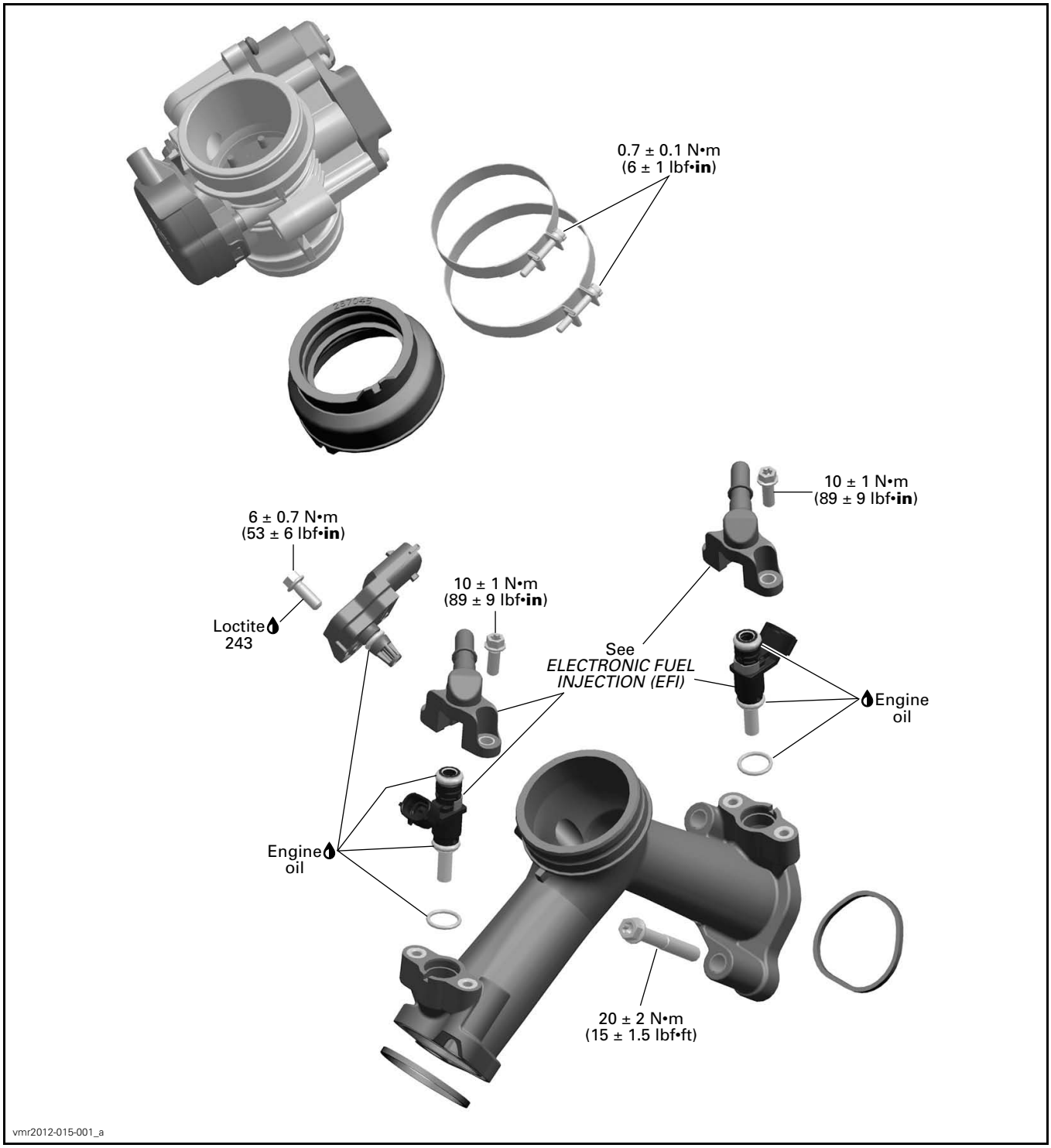
Starter Drive Gear Installation

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

Apply LOCTITE 767 (ANTISEIZE LUBRICANT) (P/N 293 800 070) on starter gear before installing the starter double gear.

Apply engine oil on location pins.

INTAKE MANIFOLD



PROCEDURES

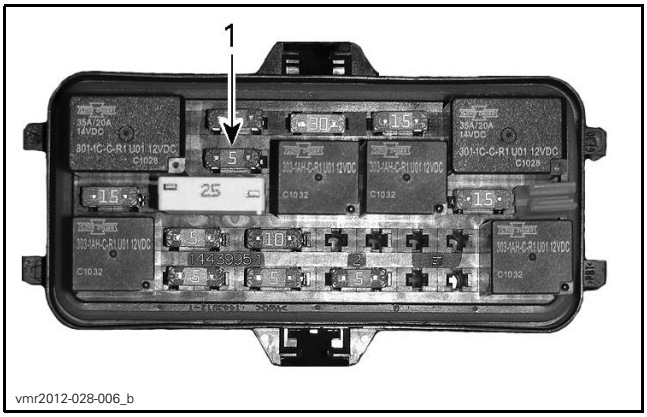
INTAKE MANIFOLD

Intake Manifold Access

Refer to *BODY* and remove the RH side panel.

Intake Manifold Removal

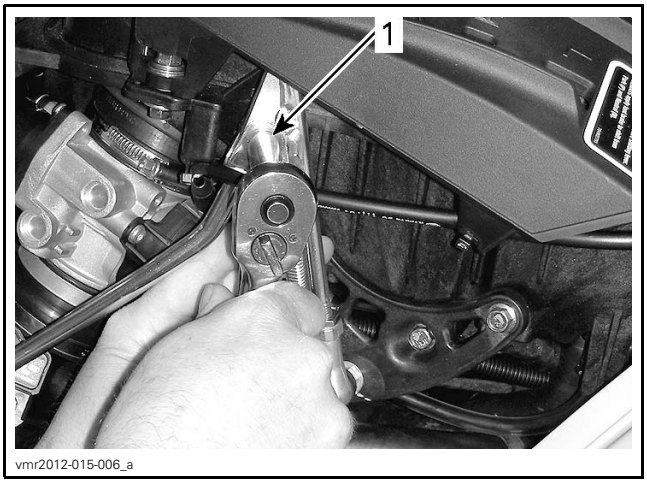
1. Remove pressure from the fuel system.
   1.1 Remove the fuel pump relay fuse (F15) in the front fuse box.



vmr2012-028-006_b

1. Fuel pump relay fuse

   1.2 Release fuel pressure by running engine until it runs out of gas.
2. Remove shift rod nut.



vmr2012-015-006_a

1. Remove nut

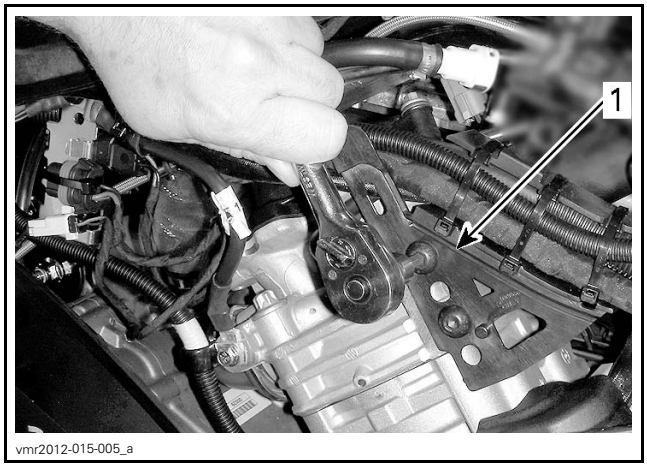
3. Disconnect the fuel hoses at the fuel injectors, refer to *ELECTRONIC FUEL INJECTION (EFI).*

⚠ CAUTION The fuel hose may still be under pressure.

4. Disconnect fuel injector electrical connectors.
5. Disconnect MAPTS connector.
6. Pull off throttle body from intake manifold and air intake silencer. Refer to *ELECTRONIC FUEL INJECTION (EFI).*

NOTE: Do not disconnect throttle cable needlessly.

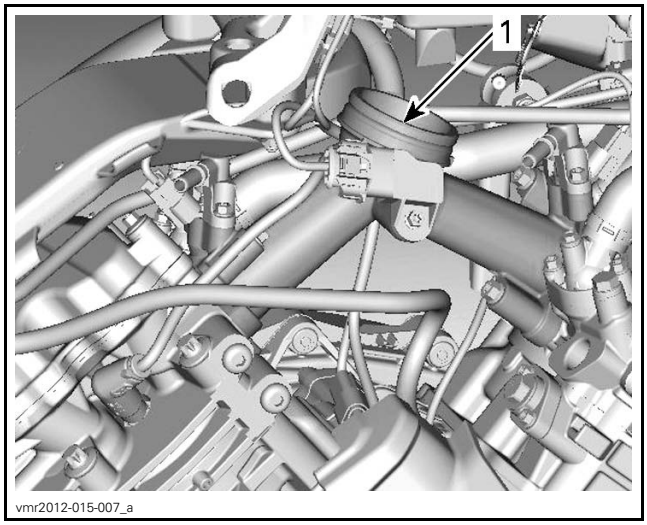
7. Remove wiring harness support from engine.



vmr2012-015-005_a

1. Remove

8. Remove intake manifold from engine.



vmr2012-015-007_a

1. Remove

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 one cylinder at a time.

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

Reinstall the fuel pump relay fuse (F15).

TOP END (1000)

SERVICE TOOLS

Description	Part Number	Page
CRANKSHAFT LOCKING BOLT	529 035 617	196
ENGINE LEAK DOWN TEST KIT	529 035 661	182
PISTON CIRCLIP INSTALLER	529 036 153	199
PISTON RING COMPRESSOR	529 035 919	195
TDC DIAL INDICATOR	414 104 700	182
VALVE GUIDE INSTALLER	529 036 140	194
VALVE GUIDE REMOVER 5 MM	529 035 924	194
VALVE SPRING COMPRESSOR CUP	529 035 764	190
VALVE SPRING COMPRESSOR	529 035 724	190

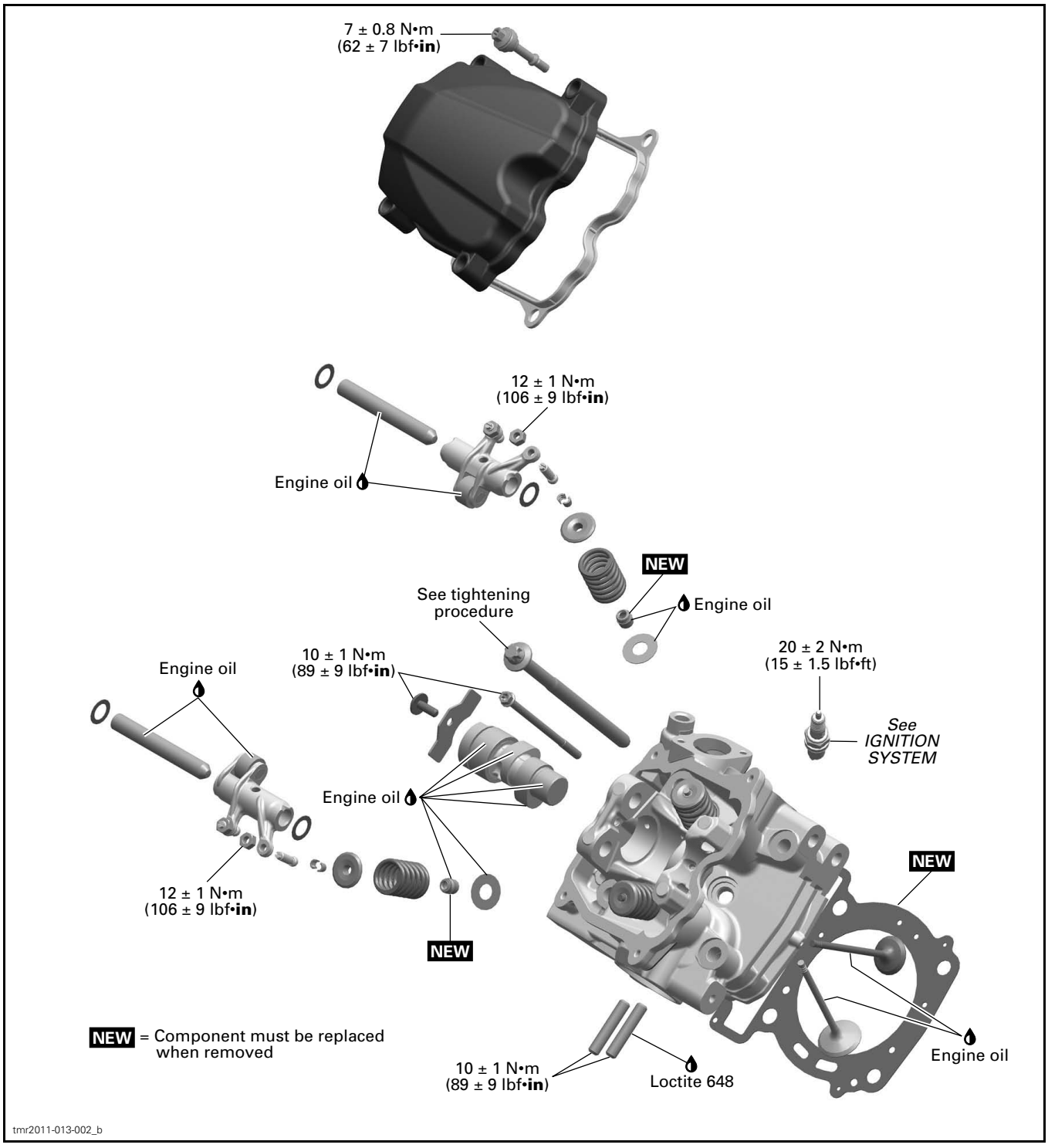
SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
SNAP-ON PLIERS	YA 8230	191

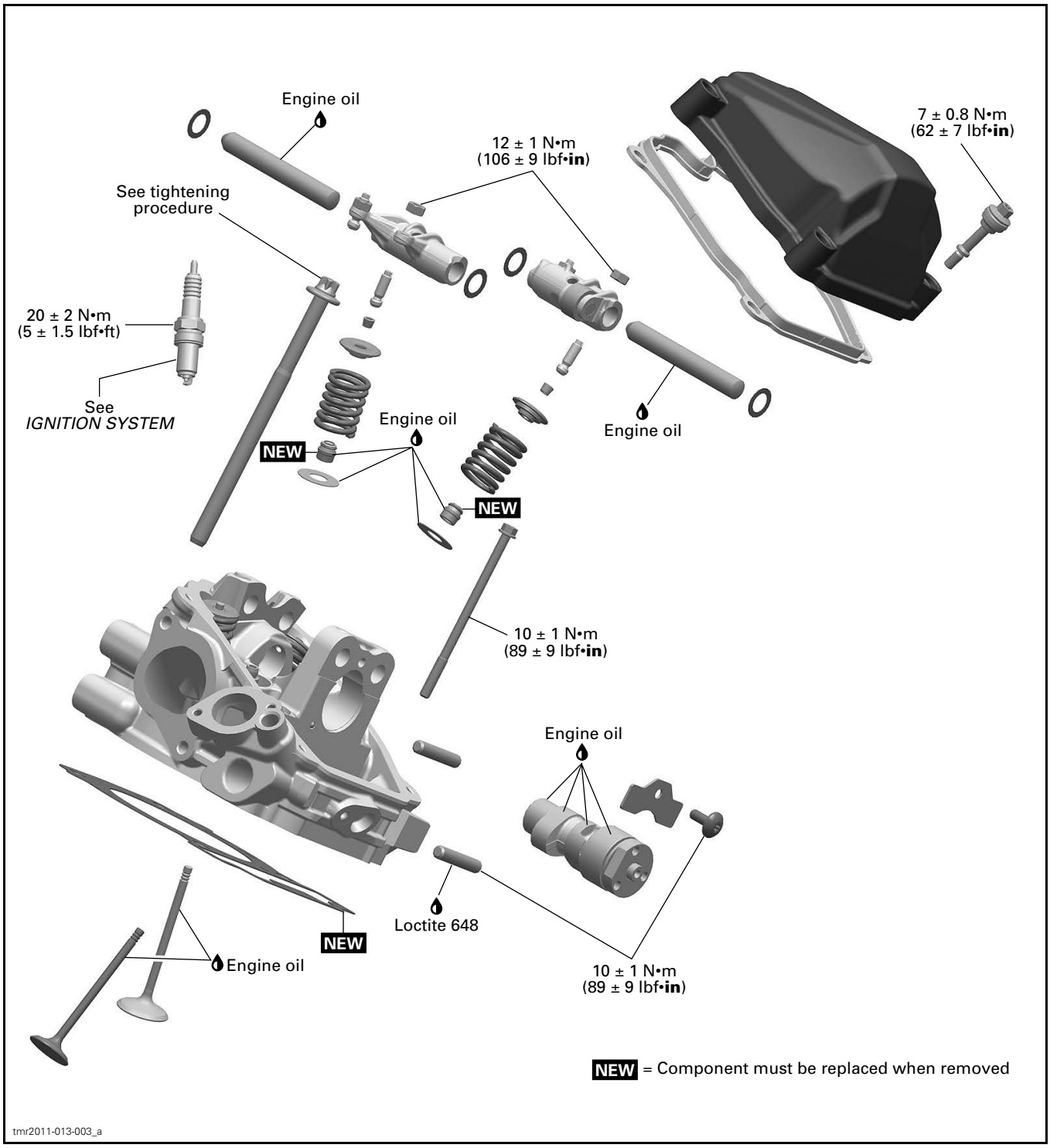
SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 767 (ANTISEIZE LUBRICANT)	293 800 070	194

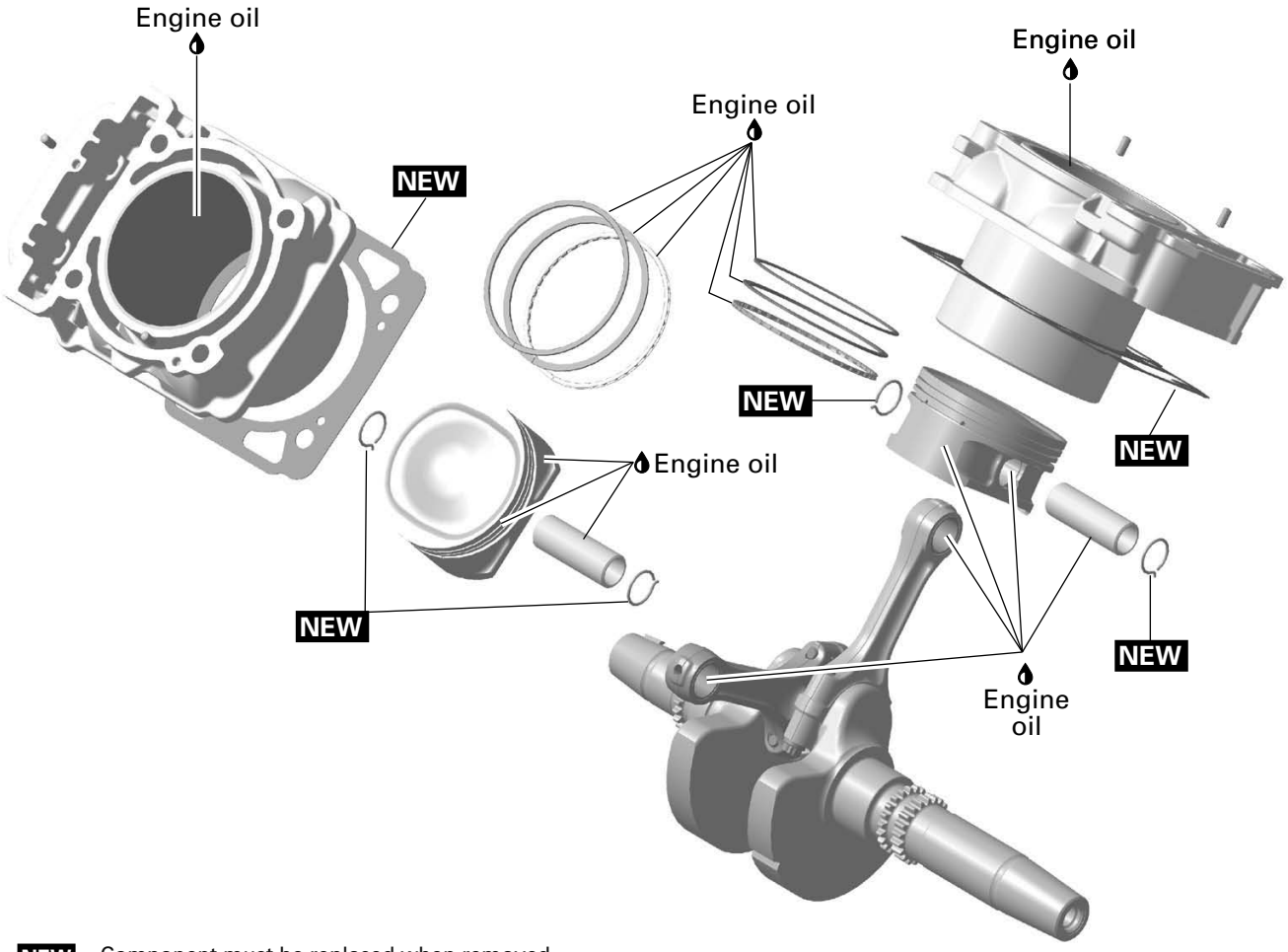
CYLINDER HEAD NO. 1



CYLINDER HEAD NO. 2



CYLINDERS AND PISTONS

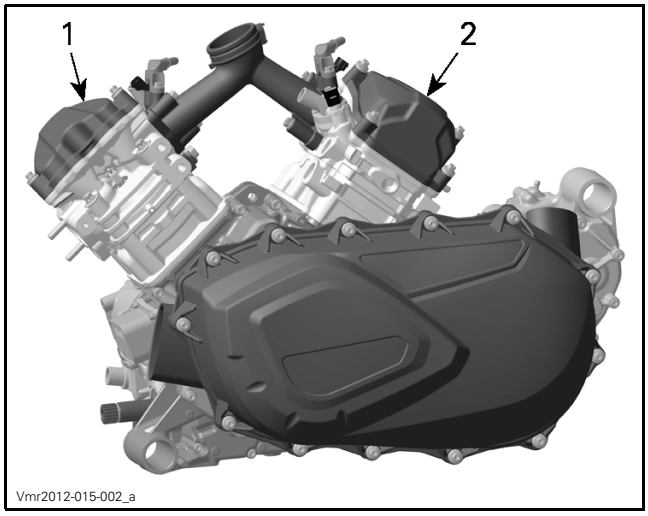


NEW = Component must be replaced when removed.

vmr2015-118-001_a

GENERAL

Special reference are made in the text for procedures which are different for cylinder no. 1 and cylinder no. 2.



1. *Cylinder 1 (front)*
2. *Cylinder 2 (rear)*

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 upon 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.

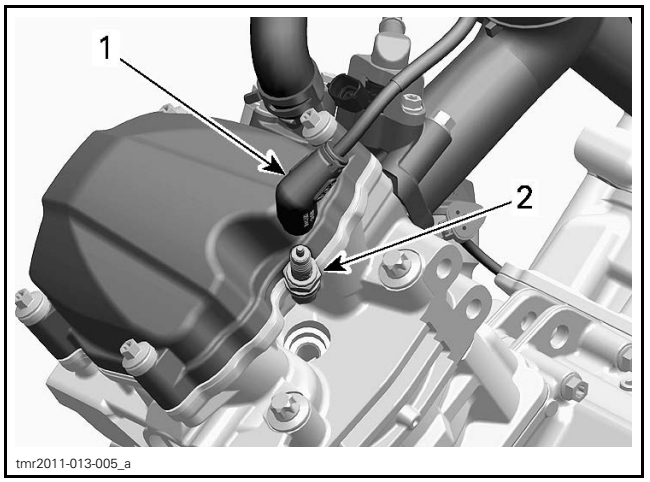
Remove radiator cap.

⚠ 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*. See procedure in this subsection.

Rotate crankshaft until piston is at ignition TDC.

To turn crankshaft, there are two possible procedures.

First Procedure

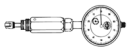
Turn the drive pulley.

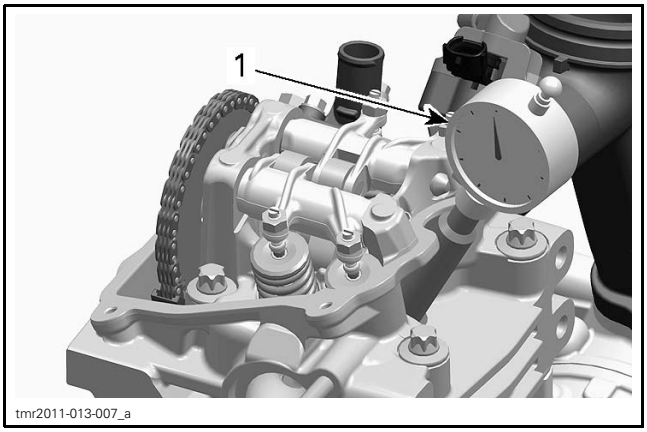
Second Procedure

1. Remove plug screw with O-ring from magneto cover.
2. Use a 14 mm Allen key and turn crankshaft.

NOTICE **Turn only clockwise to avoid loosening of magneto flywheel Allen screw.**

Set the piston to precisely ignition TDC.

REQUIRED TOOL	
TDC DIAL INDICATOR (P/N 414 104 700)	

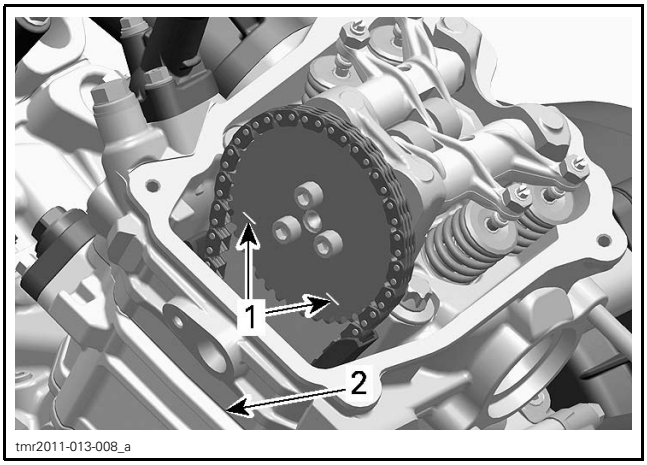


1. TDC dial indicator

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

NOTICE Do not scratch or damage piston/cylinder surface.

At ignition TDC 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

Install gauge adapter into spark plug hole.

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

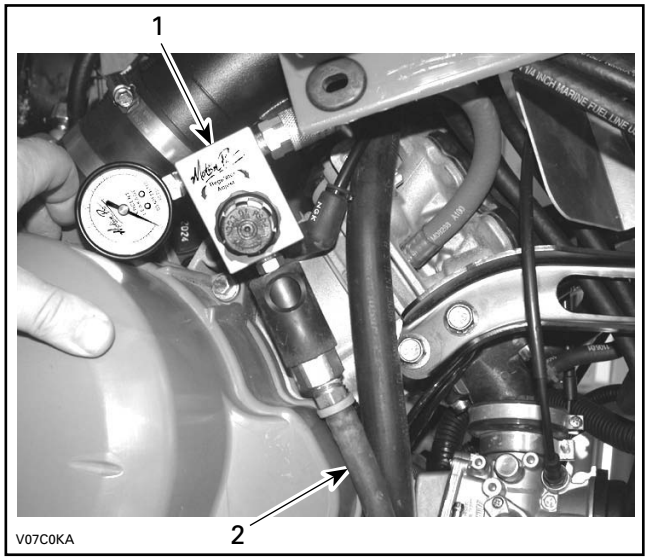
Connect to adequate air supply.

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.



TYPICAL
1. Leak tester
2. 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 arm) 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.

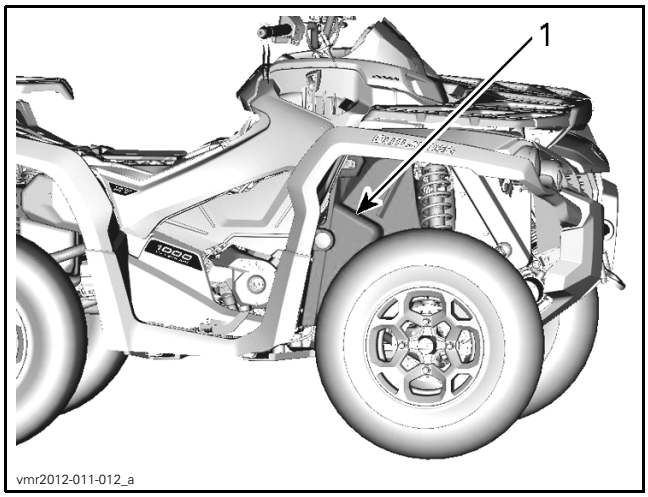
PROCEDURES

VALVE COVER

Valve Cover Access

Front Cylinder

Refer to *BODY* and remove:
– RH side panel
– Rear part of RH inner fender.



1. Rear part of RH inner fender

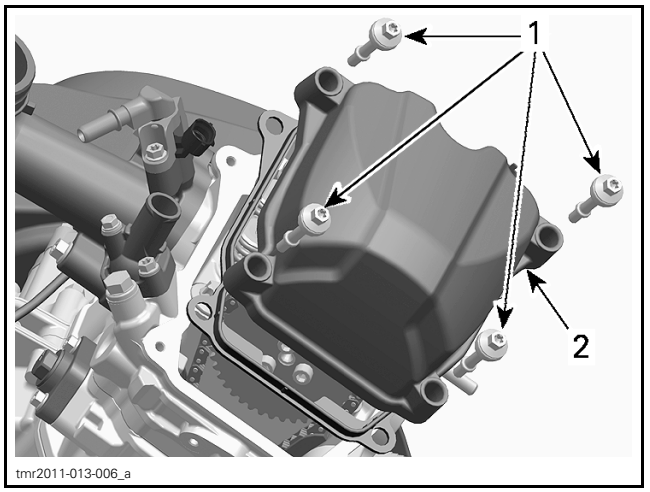
Rear Cylinder

Refer to *BODY* and remove:
– RH side panel
– LH side panel.

Refer to *EXHAUST SYSTEM* and remove exhaust pipe.

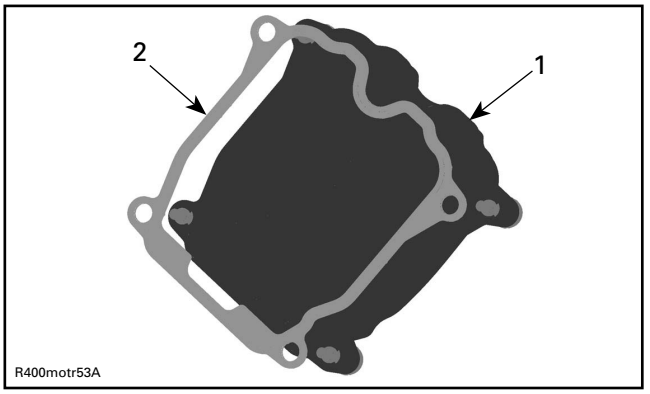
Valve Cover Removal

Remove valve cover screws.



TYPICAL — FRONT CYLINDER SHOWN
1. Valve cover screws
2. Valve cover

Remove valve cover and gasket.



1. Valve cover
2. 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

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

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**)

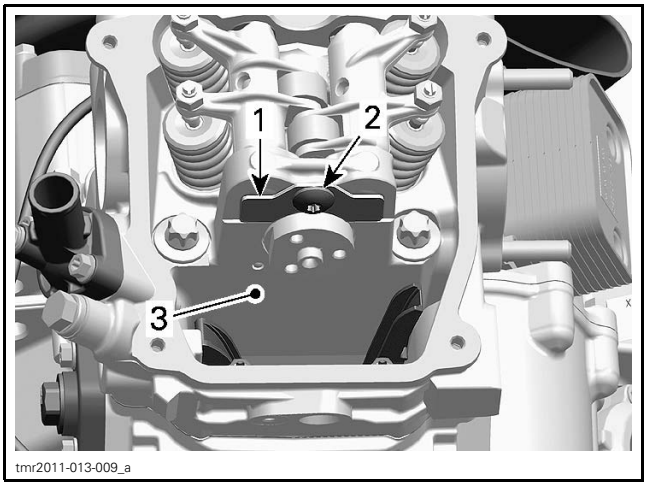
ROCKER ARM

Rocker Arm Removal

Remove *VALVE COVER*. See procedure in this subsection.

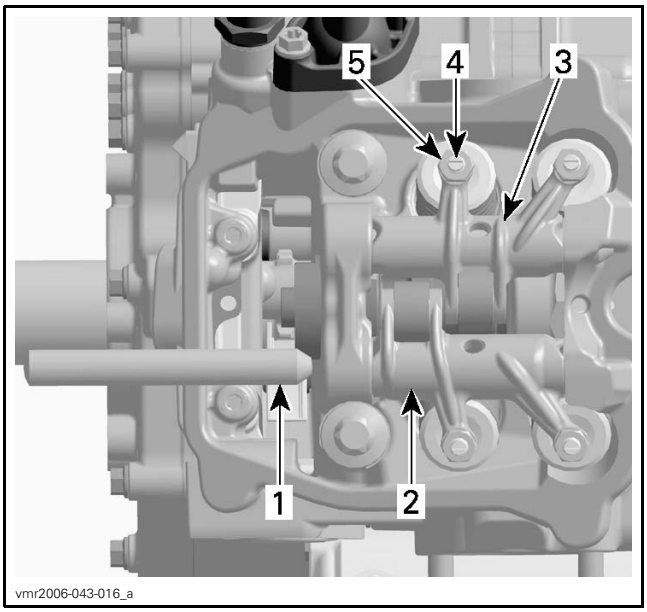
Refer to *TIMING CHAIN* subsection and remove following parts:
– Timing chain tensioner
– Camshaft timing gear.

Remove pan head screw and camshaft retaining plate.



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

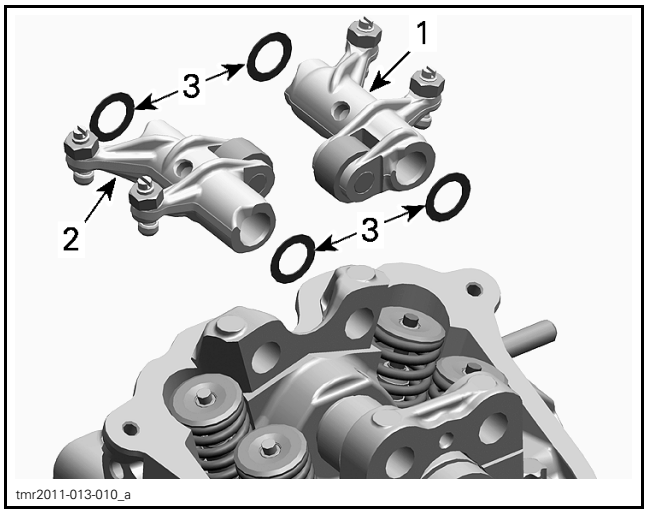
Remove rocker arm shafts.



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

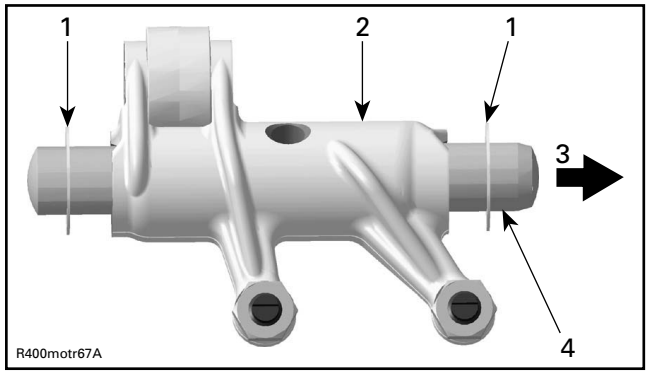
Remove rocker arm assembly (exhaust side and intake side) with adjustment screws and lock nuts.

Remove 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.

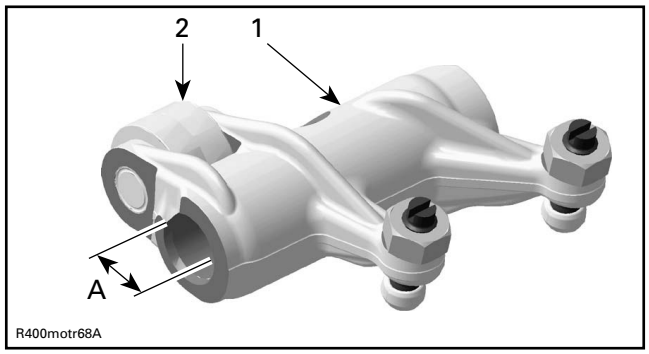


1. 2 thrust washers
2. Rocker arm (exhaust side)
3. Cylinder head (spark plug side)
4. Big taper to spark plug side

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.

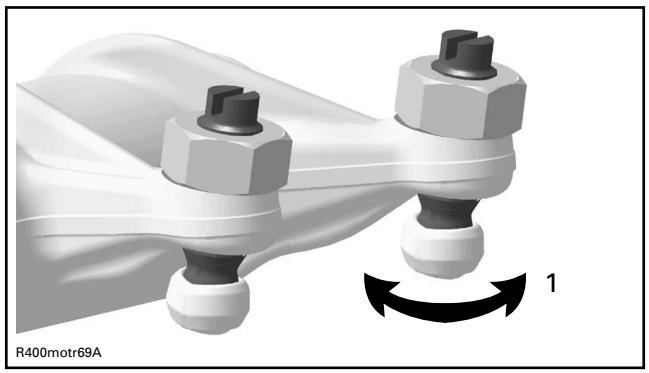


1. Rocker arm (exhaust side)
2. Roller
A. Bore for rocker arm shaft

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.

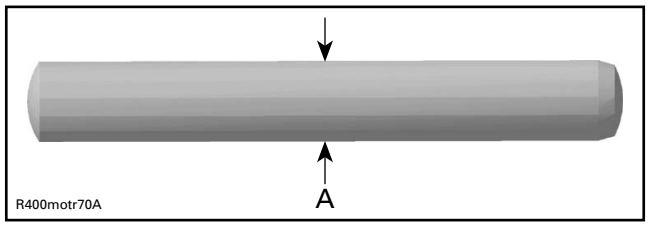


1. Free movement of adjustment screw top

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

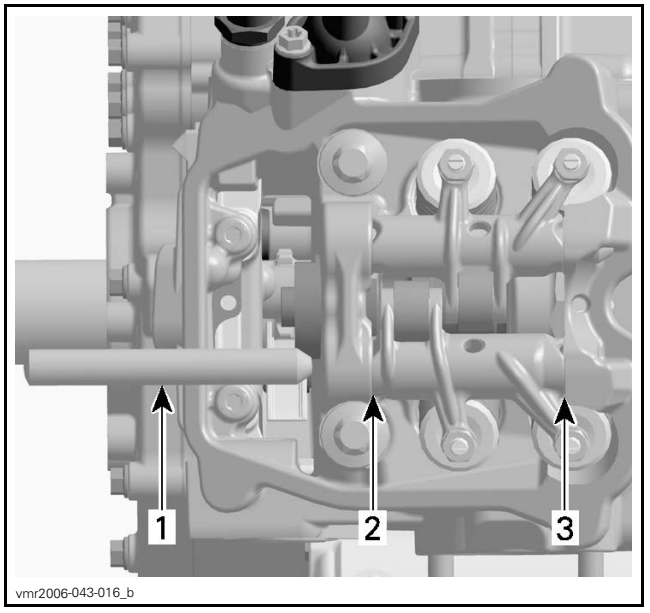
NOTE: Use the same procedure for exhaust and intake rocker arm.

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)

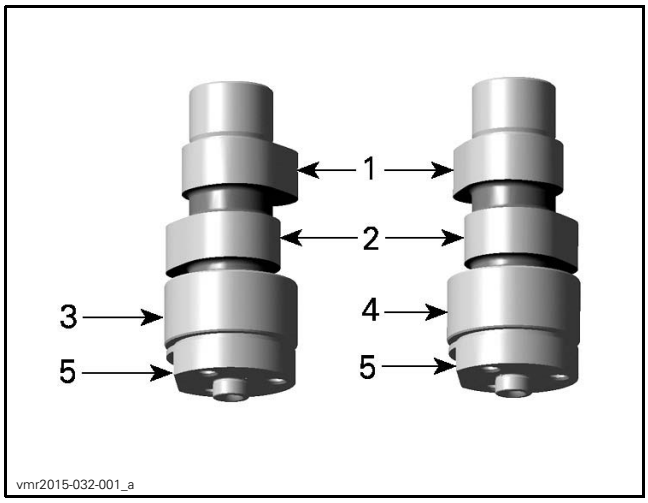
Place the other thrust washer and push rocker arm shaft to end position.

Install the camshaft retaining plate.

Adjust valve clearance, refer to *PERIODIC MAINTENANCE PROCEDURE*.

CAMSHAFT

NOTE: The engine is equipped with two different camshafts.



1. *Intake cam*
2. *Exhaust cam*
3. *Camshaft of cylinder 1*
4. *Camshaft of cylinder 2*
5. *Flat spot*

Camshaft Removal

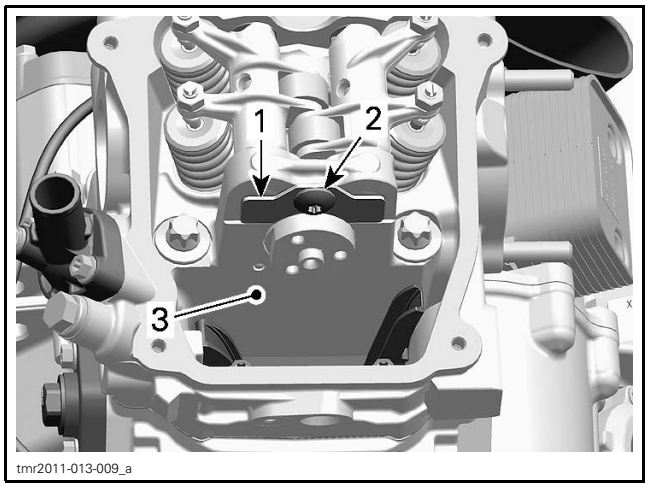
The removal procedure is the same for both camshafts.

NOTICE **Each camshaft is different in design. Thus, it is important not to mix up any parts of the camshaft assembly with that of the other cylinder. Keep parts as a group.**

Remove valve cover (see *VALVE COVER* in this subsection).

Refer to the *TIMING CHAIN* subsection to remove the following parts:
– Chain tensioner
– Camshaft timing gear.

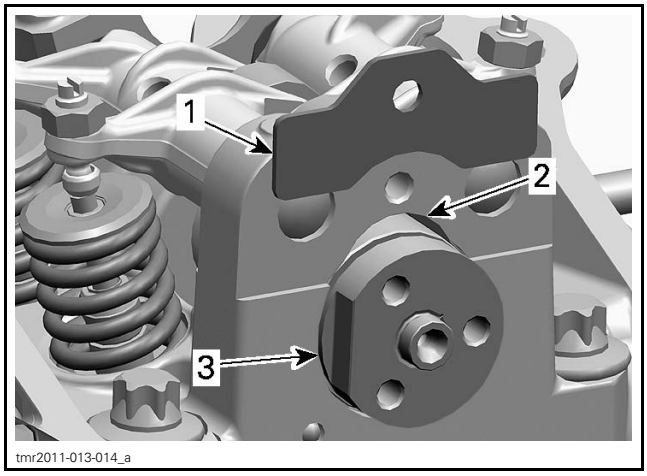
Remove the camshaft retaining plate.



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

Remove rocker arms (see *ROCKER ARM* in this subsection).

Remove the camshaft.



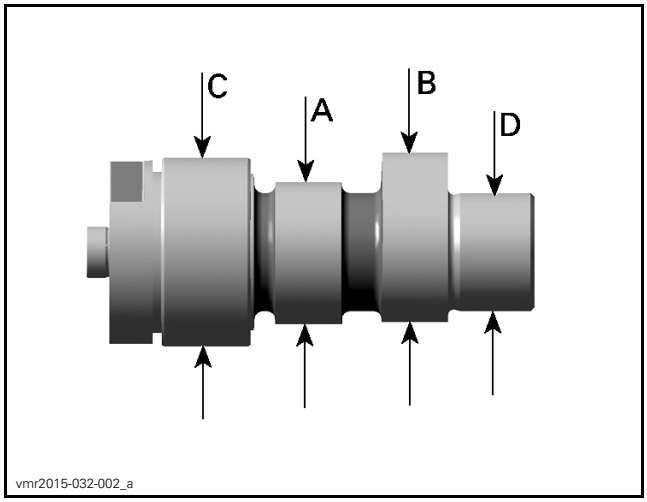
1. *Camshaft retaining plate*
2. *Area for camshaft lobes*
3. *Camshaft*

Camshaft Inspection

Camshaft Lobe Inspection

Check each lobe for scoring, scuffing, cracks or other signs of wear.

Measure camshaft lobe height using a micrometer.



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	32.860 mm to 33.060 mm (1.294 in to 1.302 in)
SERVICE LIMIT	32.840 mm (1.293 in)

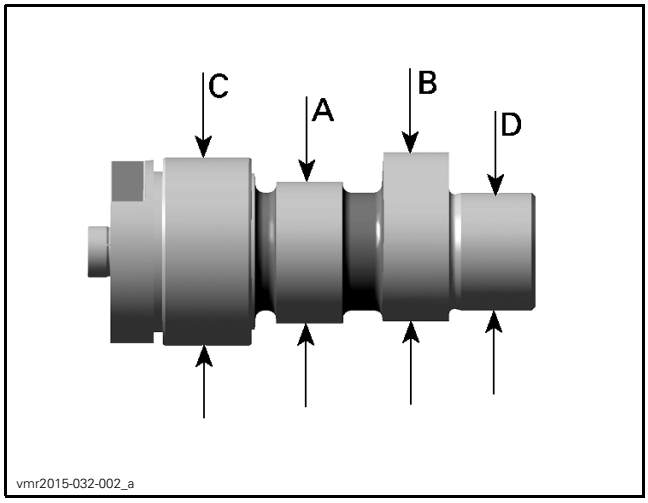
CAMSHAFT LOBE (INTAKE)	
NEW	32.960 mm to 33.160 mm (1.298 in to 1.306 in)
SERVICE LIMIT	32.940 mm (1.297 in)

Measure camshaft bearing in cylinder head. Refer to *CYLINDER HEAD INSPECTION* in this subsection.

Camshaft Journal Inspection

Check each journal for scoring, scuffing, cracks or other signs of wear.

Measure camshaft journal using a micrometer.



A. Camshaft lobe (exhaust valves)
B. Camshaft lobe (intake valves)
C. Camshaft journal (timing chain side)
D. Camshaft journal (spark plug side)

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)

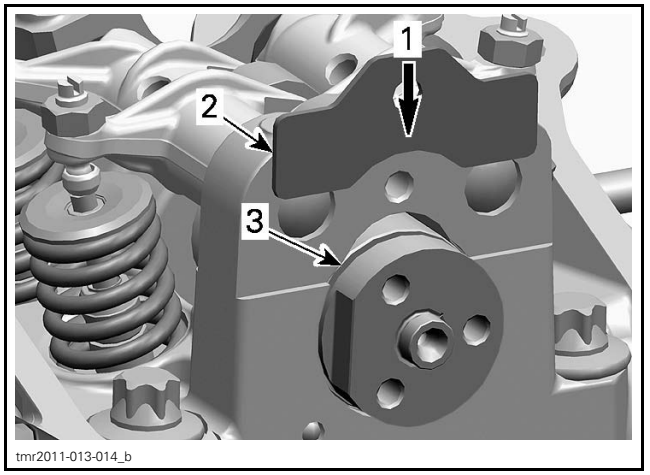
CAMSHAFT JOURNAL (SPARK PLUG SIDE)	
NEW	21.959 mm to 21.980 mm (.8645 in to .8654 in)
SERVICE LIMIT	21.950 mm (.8642 in)

Camshaft Installation

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

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

For other parts, refer to proper installation procedure.

CYLINDER HEAD

Cylinder Head Access

Refer to *VALVE COVER* in this subsection.

Cylinder Head Removal

The removal procedure is the same for both cylinder heads.

Drain coolant (refer to *PERIODIC MAINTENANCE PROCEDURES* subsection).

NOTE: Before removing cylinder head, blow out remaining coolant by air pressure. During cylinder head removal, the remaining coolant in cylinder head could overflow into the engine and a little quantity of coolant could drop into the engine. In this case, the engine oil will be contaminated.

Disconnect spark plug wire.

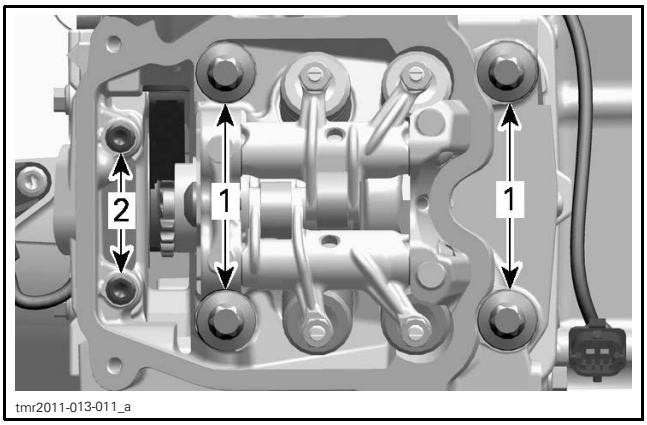
Disconnect temperature sensor connector, located at rear cylinder head.

Remove the intake manifold. Refer to *INTAKE MANIFOLD* subsection.

Remove the valve cover and its gasket (see *VALVE COVER* in this subsection).

Refer to the *TIMING CHAIN* subsection to remove the following parts:
– Chain tensioner
– Camshaft timing gear.

First remove the M6 cylinder head screws, then the cylinder head screws M10.

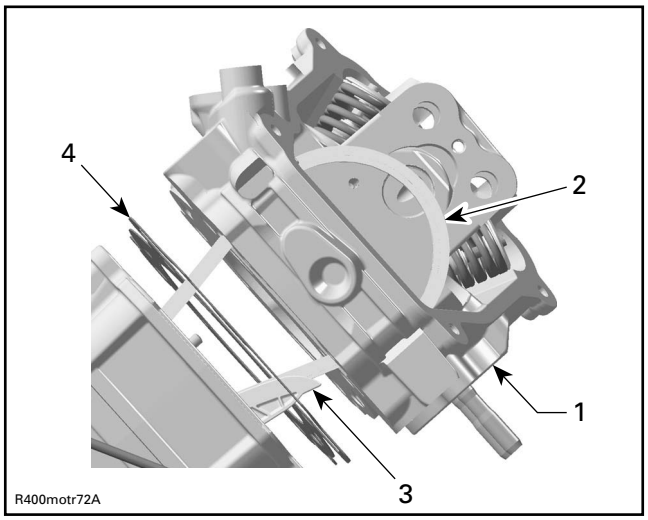


1. Cylinder head screws M10
2. Cylinder head screws M6

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

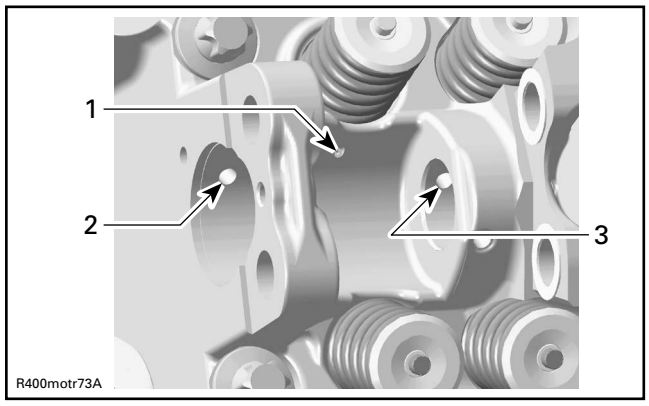
Cylinder Head Inspection

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.

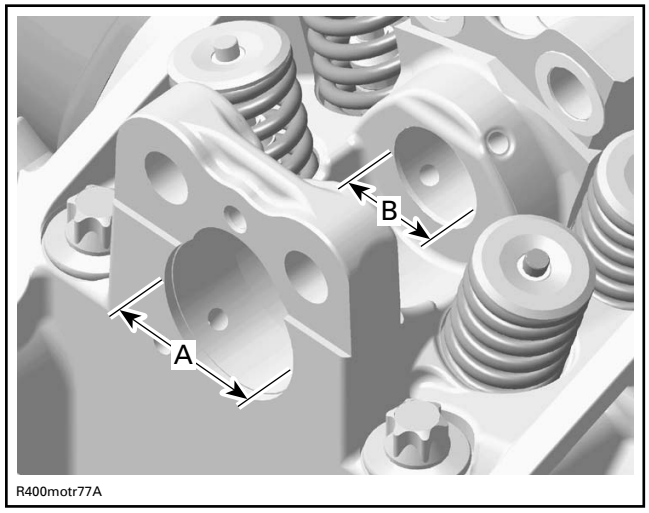
Clean oil support through the cylinder head from contamination.



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)

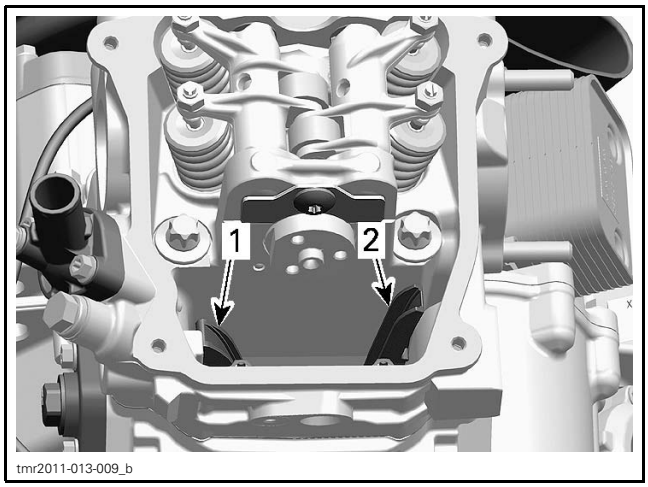
Cylinder Head Installation

NOTE: Never invert front and rear cylinder heads. On the 650 engine, cylinder heads are not identical.

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

Ensure dowel pins are in place.

NOTICE Timing chain guide (fixed) has to be fixed between cylinder and cylinder head.

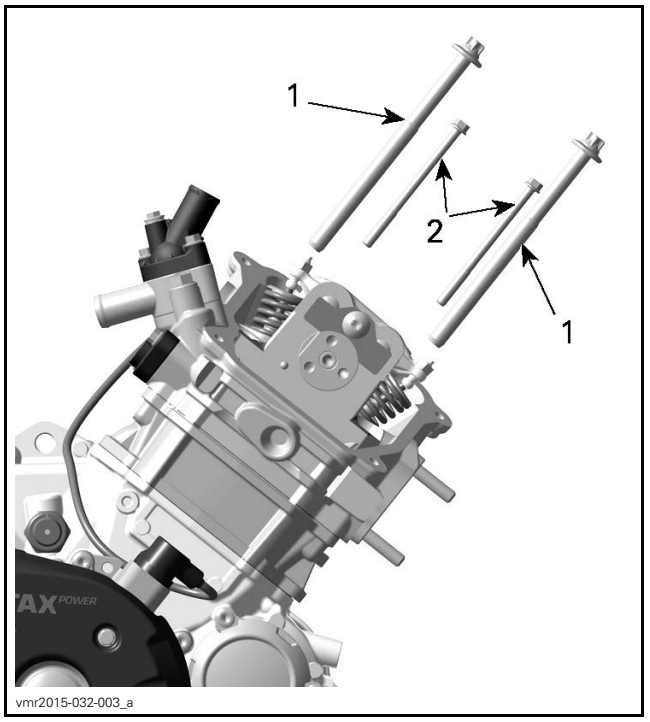


TYPICAL
1. *Timing chain guide (tensioner side) mounted in crankcase*
2. *Timing chain guide (fixed) between cylinder and cylinder head*

Install a NEW cylinder head gasket.

Install cylinder head screws in correct position.

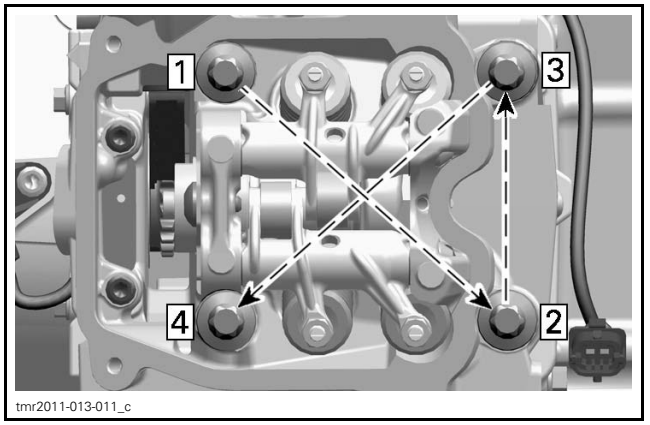
NOTICE Cylinder head screws have different sizes and lengths.



TYPICAL
1. *Location no. 1*
2. *Location no. 2*

CYLINDER HEAD SCREW IDENTIFICATION	
Location no. 1	M10 x 159
Location no. 2	M6 x 105

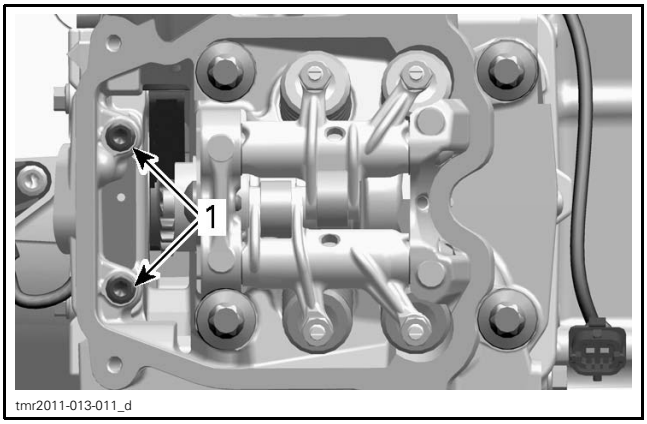
Tighten M10 cylinder head screws FIRST as per following specifications.



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.

VALVE SPRINGS

Valve Spring Removal

Refer to following procedures in this subsection to remove:

– *CAMSHAFT*

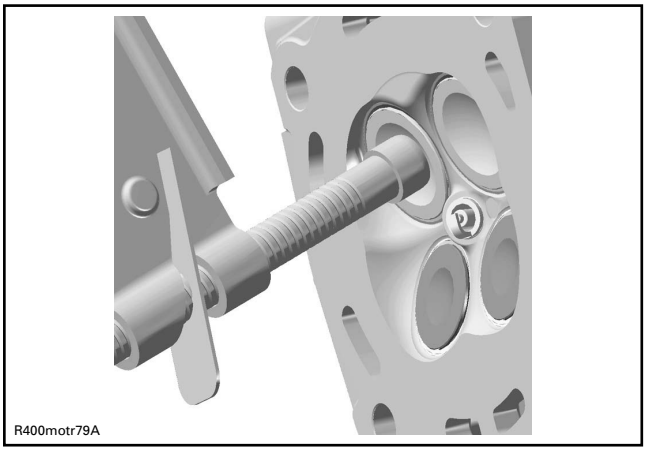
– *CYLINDER HEAD*.

Remove valve spring.

REQUIRED TOOL	
VALVE SPRING COMPRESSOR (P/N 529 035 724)	
VALVE SPRING COMPRESSOR CUP (P/N 529 035 764)	

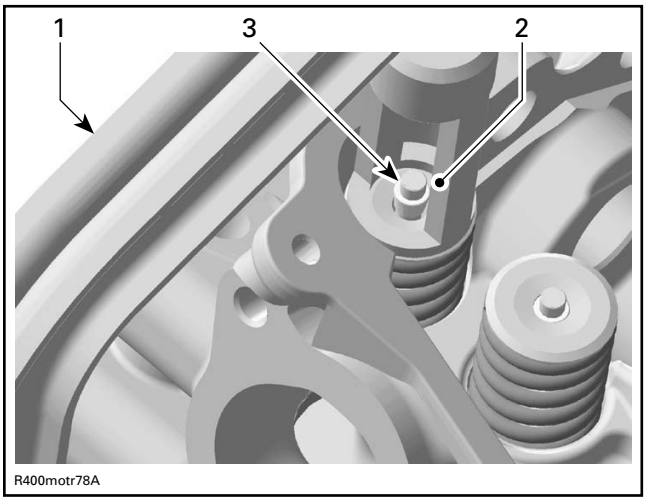
⚠ WARNING

Always wear safety glasses when disassembling valve springs. Be careful when unlocking valves. Components could fly away because of the strong spring preload.



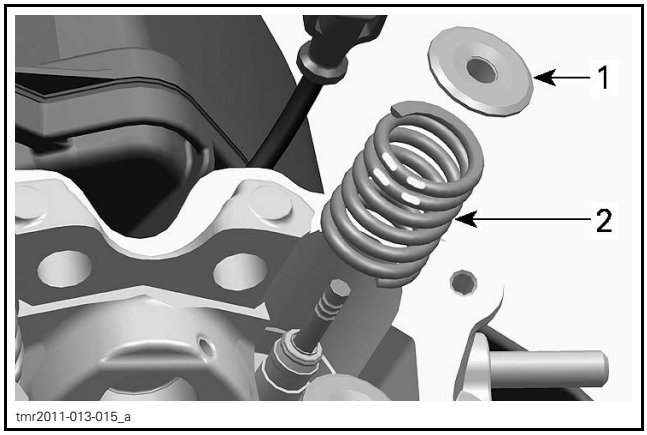
LOCATE VALVE SPRING COMPRESSOR CLAMP IN CENTER OF THE VALVE

Remove valve cotters.



1. Valve spring compressor clamp
2. Valve spring compressor cup
3. Valve cotter

Remove tools and withdraw valve spring retainer and valve spring.

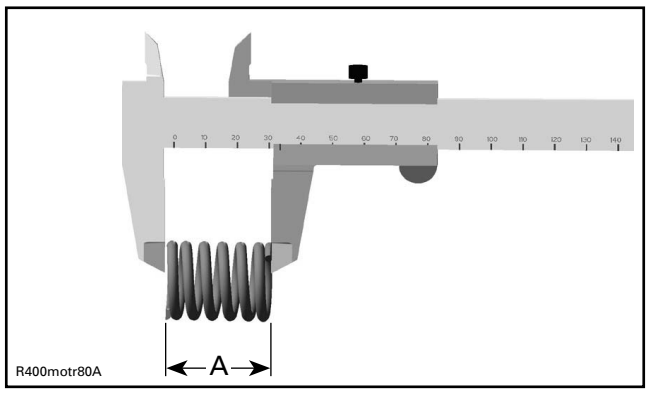


1. Valve spring retainer
2. Valve spring

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	
NOMINAL NEW	40.81 mm (1.607 in)
SERVICE LIMIT	39.00 mm (1.535 in)

Replace valve springs if not within specifications.

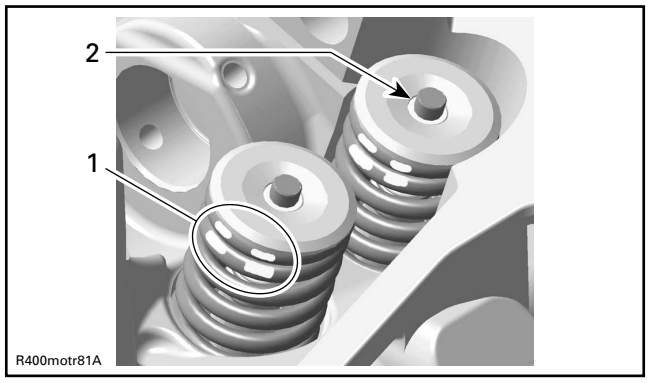
Valve Spring Installation

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

Colored area of the valve spring must be placed on top.

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. 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.

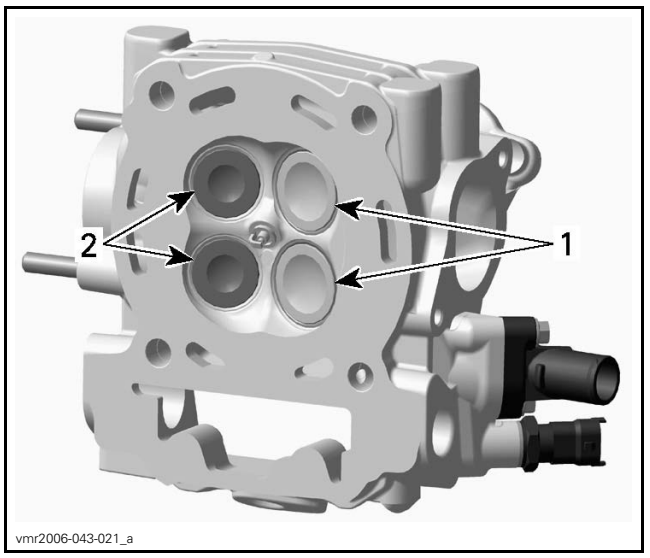
NOTICE **An improperly locked valve spring will cause engine damage.**

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 31 mm
2. Exhaust valves 27 mm

Remove valve stem seal and discard it.

REQUIRED TOOL
SNAP-ON PLIERS (P/N YA 8230)


vmr2006-043-023

Valve Inspection

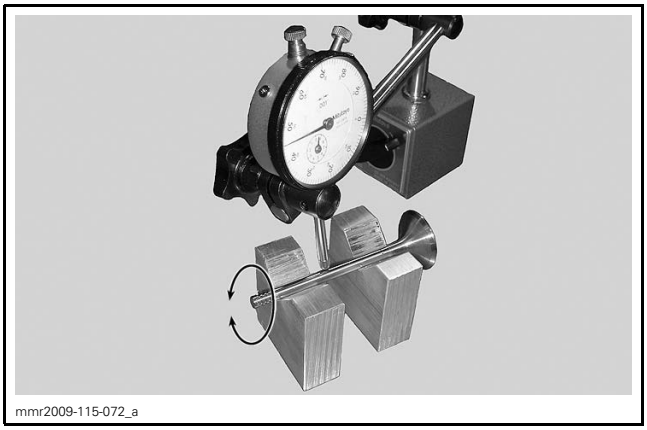
Whenever valves are removed always inspect valve guides. Refer to *VALVE GUIDES* in this subsection.

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.

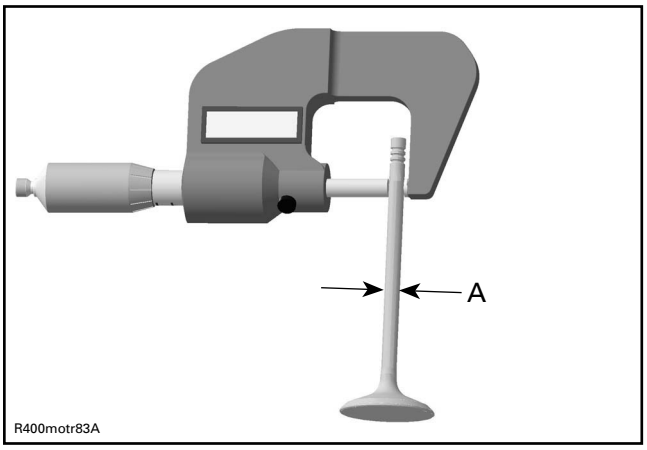

mmr2009-115-072_a

VALVE OUT OF ROUND (INTAKE AND EXHAUST VALVES)	
NEW	0.005 mm (.0002 in)
SERVICE LIMIT	0.06 mm (.0024 in)

Valve Stem

Measure valve stem in three places using a micrometer.

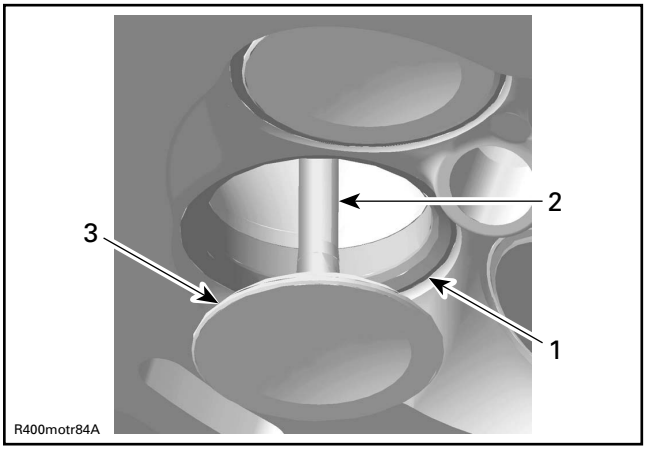
Replace valve if valve stem is out of specification or has other damages such as wear or friction surface.



A. Valve stem diameter

VALVE STEM DIAMETER	
EXHAUST VALVE	
NEW	4.956 mm to 4.970 mm (.1951 in to .1957 in)
SERVICE LIMIT	4.930 mm (.1941 in)
INTAKE VALVE	
NEW	4.966 mm to 4.980 mm (.1955 in to .1961 in)
SERVICE LIMIT	4.930 mm (.1941 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).

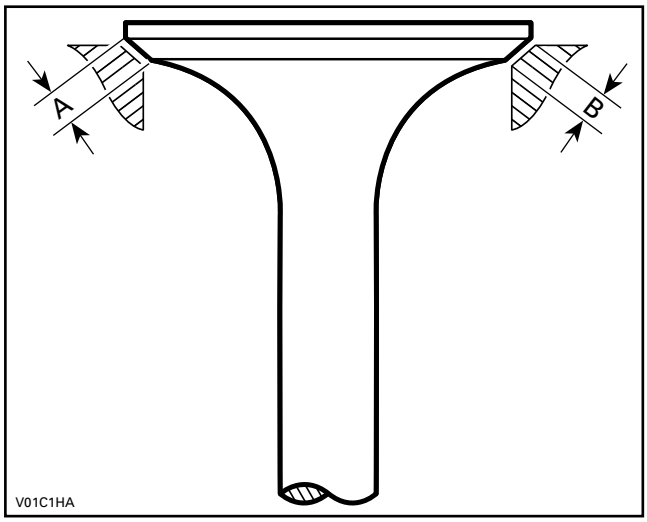
Measure valve face contact width.

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

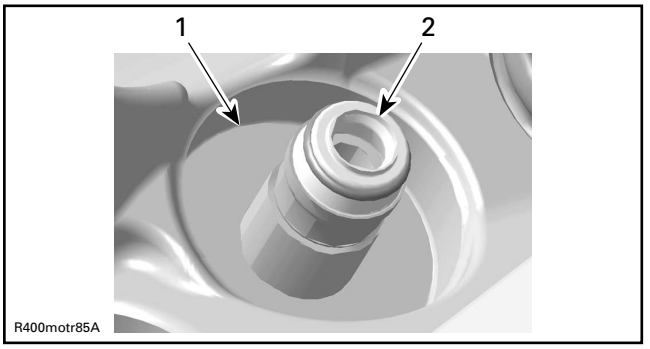
Valve Installation

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

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

To ease installation of cotters, apply oil or grease on them so that they remain in place while releasing the spring.

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.**

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	4.998 mm to 5.018 mm (.1968 in to .1976 in)
SERVICE LIMIT	5.050 mm (.1988 in)

Valve Guide Removal

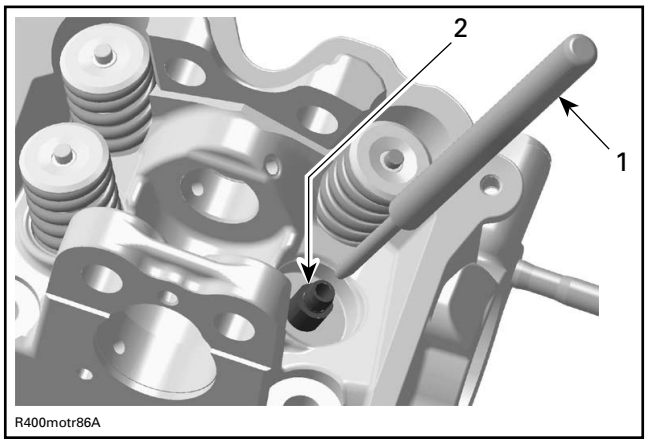
Remove cylinder head (see *CYLINDER HEAD* in this subsection).

Remove valves (see *VALVES* in this subsection).

NOTE: Clean valve guide area from contamination before removal.

Drive the valve guide out of cylinder head.

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



1. Valve guide remover
2. Valve guide

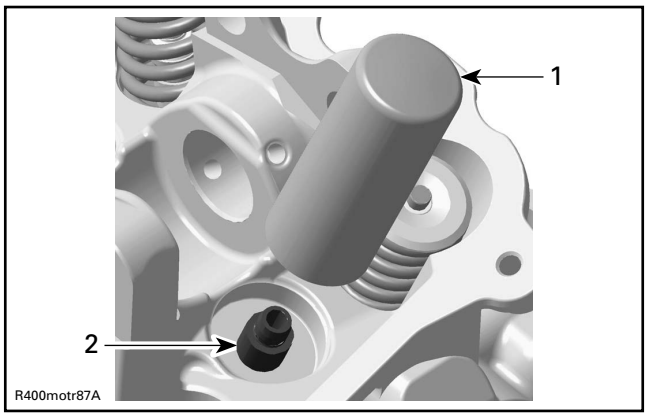
Valve Guide Installation

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

Clean the valve guide bore before reinstalling the valve guide into cylinder head.

Install valve guide.

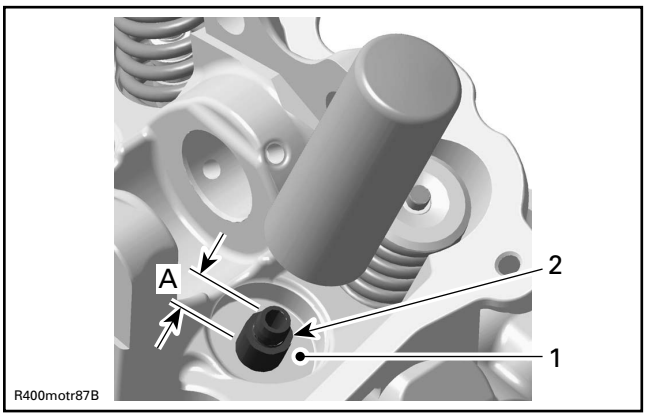
REQUIRED TOOL	
VALVE GUIDE INSTALLER (P/N 529 036 140)	



1. Valve guide installer
2. Valve guide

NOTE: Apply LOCTITE 767 (ANTISEIZE LUBRICANT) (P/N 293 800 070) on valve guide prior to install it into the cylinder head.

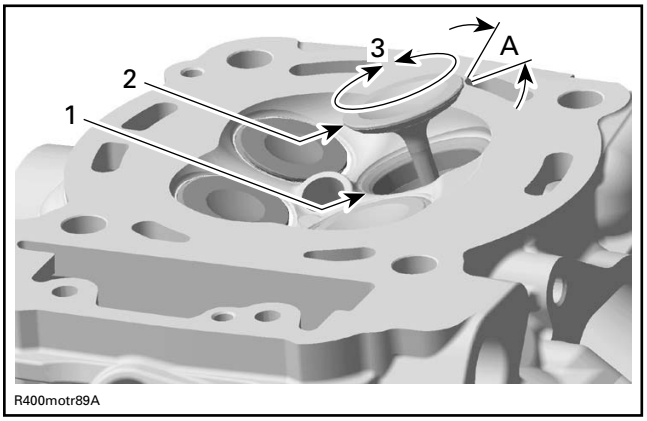
NOTICE Push valve guide in the cold cylinder head as per following illustration.



1. Thrust surface of cylinder head
2. Valve guide
A. Measurement from thrust surface to valve guide top

VALVE GUIDE (MEASUREMENT A)	
NEW	14.00 mm to 14.40 mm (.5512 in to .5669 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

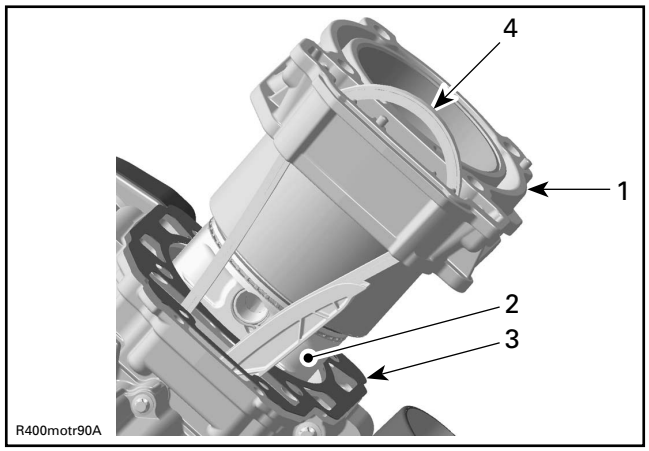
Refer to the *TIMING CHAIN* subsection to remove the following parts:

– Chain tensioner
– Camshaft timing gear.

Remove the cylinder head (see *CYLINDER HEAD* in this subsection).

Pull cylinder.

Discard cylinder base gaskets.



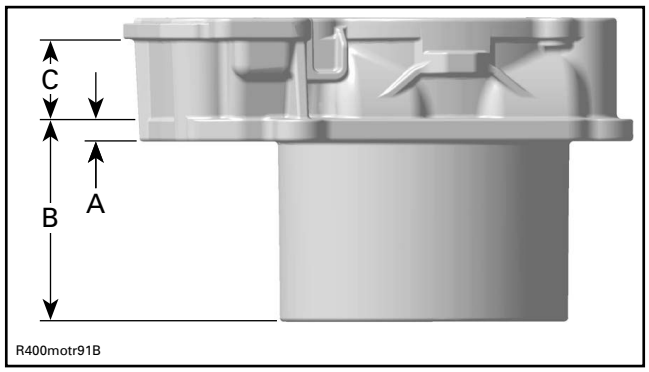
1. Cylinder
2. Piston assembly
3. Cylinder base gasket
4. Camshaft timing chain

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 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)

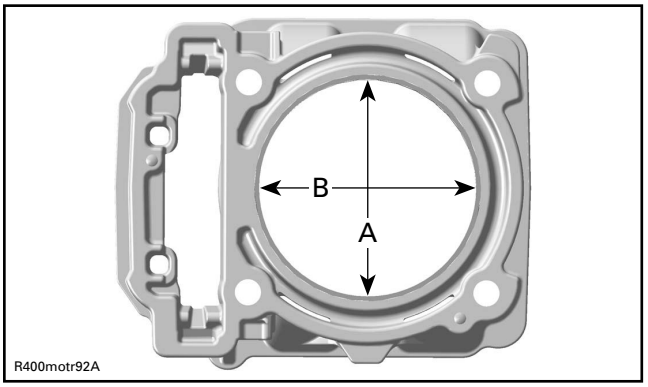
CYLINDER TAPER SPECIFICATION	
NEW (MAXIMUM)	0.038 mm (.0015 in)
SERVICE LIMIT	0.090 mm (.0035 in)

Distance between measurements should not exceed the service limit. 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

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

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 and on piston rings.

Apply engine oil on the compressor tool.

Compress piston rings.

REQUIRED TOOL
PISTON RING COMPRESSOR (P/N 529 035 919)

First mount cylinder 2.

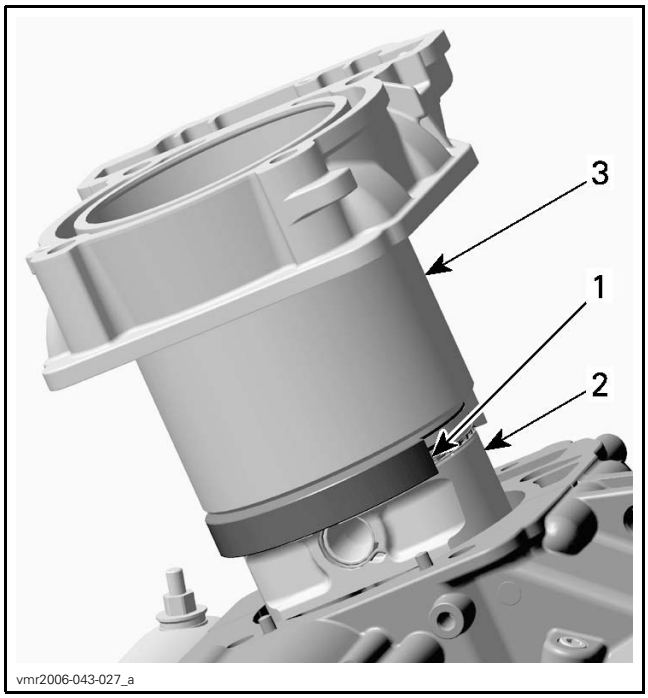
NOTE: The cylinder can not be pushed fully over the piston unless the piston is located at TDC.

Then remove the CRANKSHAFT LOCKING BOLT (P/N 529 035 617).

Crank the engine further and position piston 1 at TDC.

Mount cylinder 1.

Put timing chain through the chain passage, then slide cylinder over piston.



1. *Piston ring compressor tool*
2. *Piston*
3. *Cylinder*

NOTICE **Chain guide has to be fixed between cylinder and cylinder head.**

NOTE: After both cylinders are installed, turn crankshaft until piston of cylinder 2 is at TDC and lock crankshaft. Refer to *CRANKSHAFT* in the *BOTTOM END* subsection.

Install cylinder head and the other parts in accordance with the proper installation procedures.

PISTON

Piston Removal

Refer to following procedures in this subsection and remove following parts:

– Cylinder head

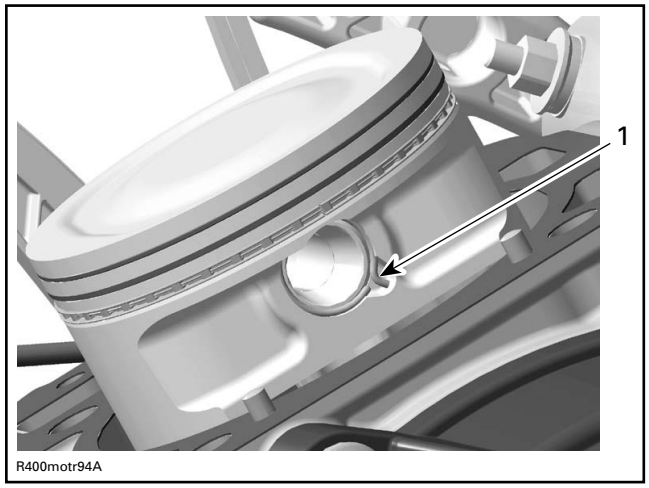
– Cylinder.

Place a rag under piston and in the area of timing chain compartment.

⚠ WARNING

Piston circlips are spring loaded.

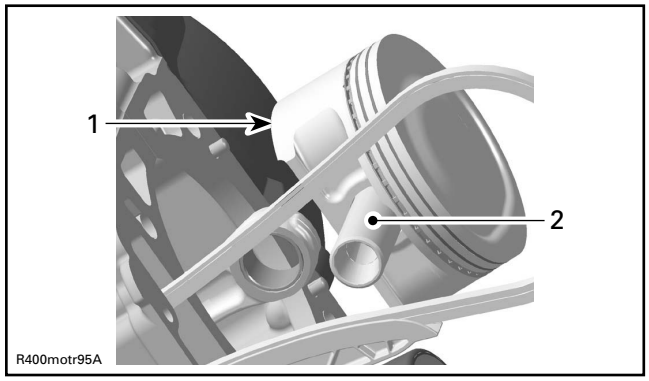
Remove one piston circlip and discard it.



1. *Piston circlip*

NOTE: The removal of both piston circlips is not necessary to remove piston pin.

Push piston pin out of piston.



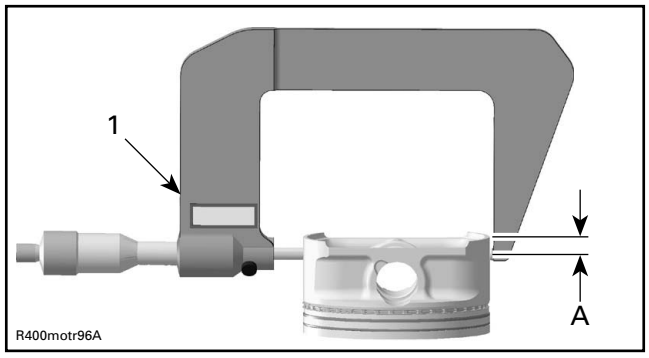
1. *Piston*
2. *Piston pin*

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.



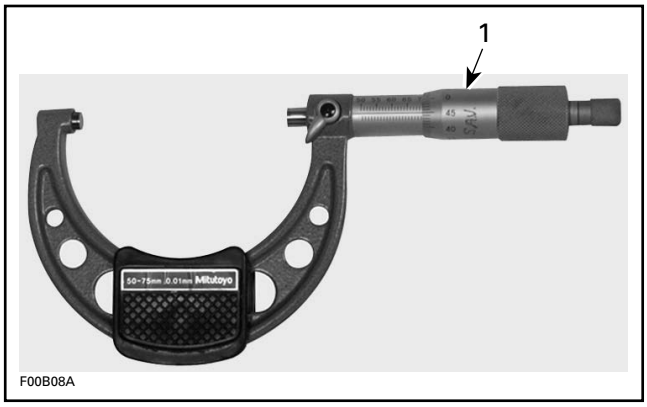
1. Measuring perpendicularly (90°) to piston pin
A. 8 mm (.315 in)

The measured dimension should be as described in the following tables. If not, replace piston.

PISTON MEASUREMENT	
NEW	90.950 mm to 90.966 mm (3.5807 in to 3.5813 in)
SERVICE LIMIT	90.850 mm (3.577 in)

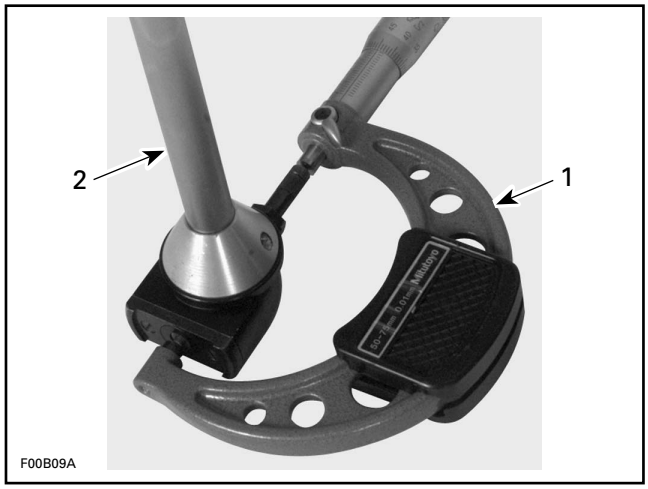
Piston/Cylinder Clearance

Adjust and lock a micrometer to the piston dimension.

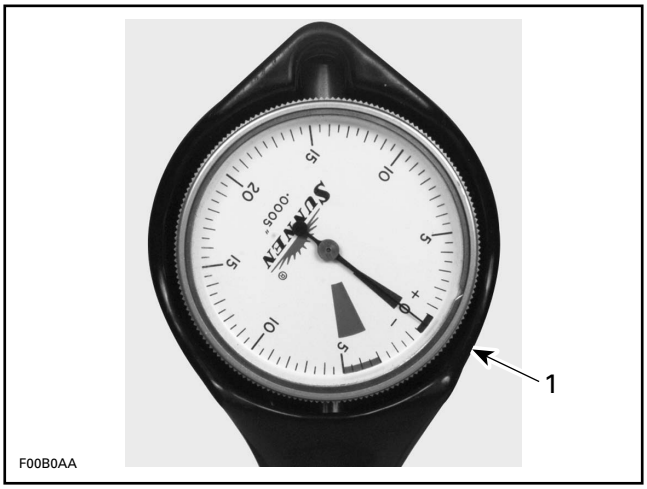


1. Micrometer set to the piston dimension

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.

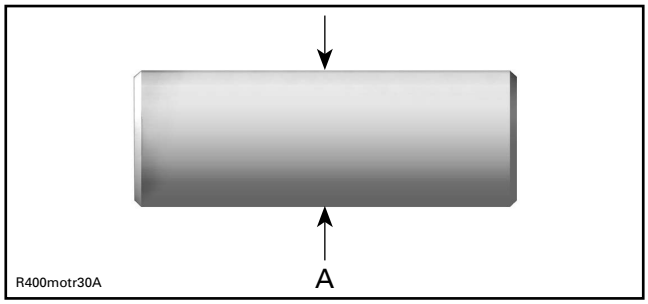
NOTE: Make sure the cylinder bore gauge indicator is set exactly at the same position as with the micrometer, otherwise the reading will be false.

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.

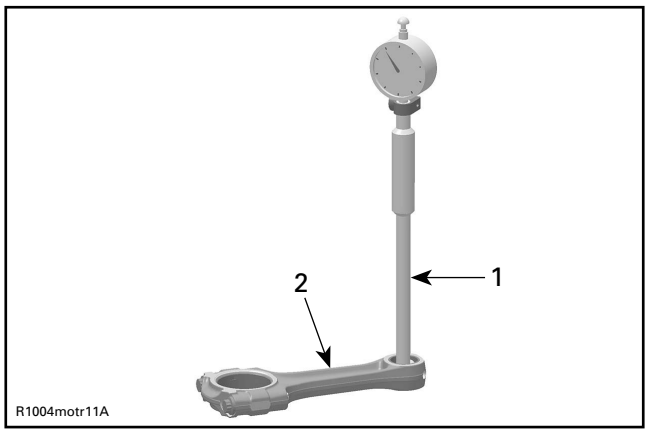


A. Piston pin diameter

PISTON PIN DIAMETER	
NEW	21.996 mm to 22.000 mm (.866 in to .8661 in)
SERVICE LIMIT	21.980 mm (.8654 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	22.010 mm to 22.020 mm (.8665 in to .8669 in)
SERVICE LIMIT	22.050 mm (.8681 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

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

Apply engine oil on the piston pin.

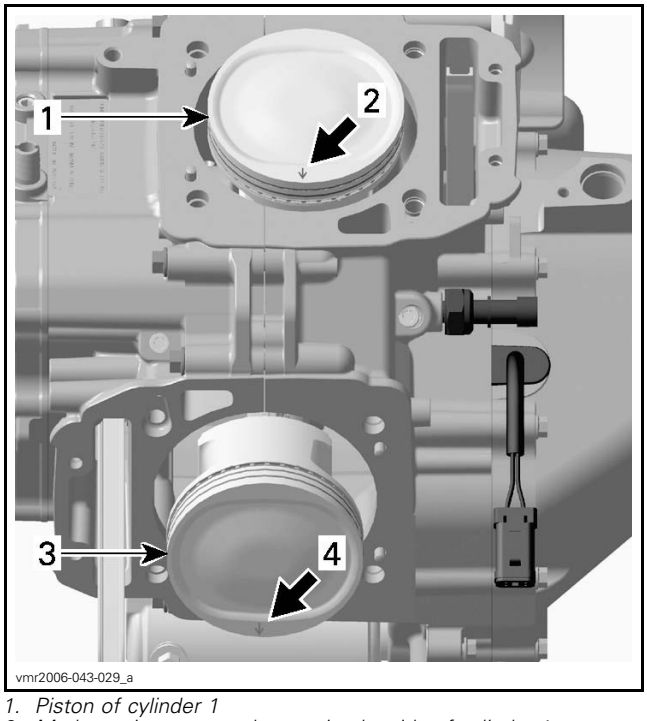
Insert piston pin into piston and connecting rod.

⚠ CAUTION The mounting direction of the pistons is different between the 650 engine and the 1000 engine.

For each cylinder, install piston with the punched arrow on piston dome is pointing toward the rear side of the engine.

Front cylinder: Mark on top of piston must show to intake side.

Rear cylinder: Mark on top of piston must show to exhaust side.



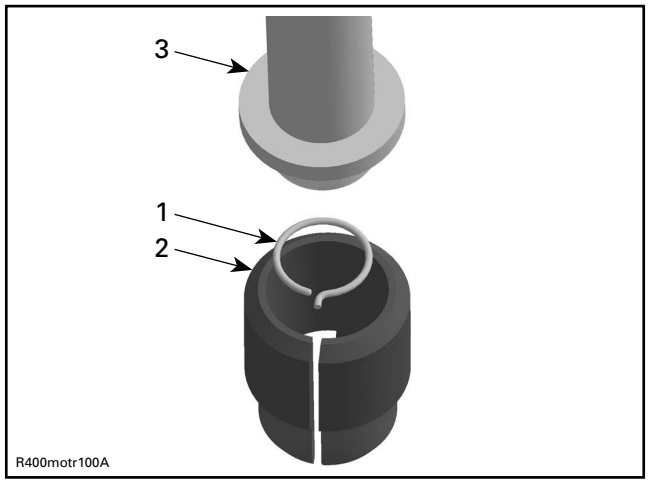
1. Piston of cylinder 1
2. Mark on piston must show to intake side of cylinder 1
3. Piston of cylinder 2
4. Mark on piston must show to exhaust side of cylinder 2

Use the piston appropriate circlip installer to assemble the NEW piston circlip as per following procedure:

REQUIRED TOOL
PISTON CIRCLIP INSTALLER (P/N 529 036 153)

NOTICE Always replace disassembled piston circlip(s) by NEW ones. Place a rag on cylinder base to avoid dropping the circlip inside the engine.

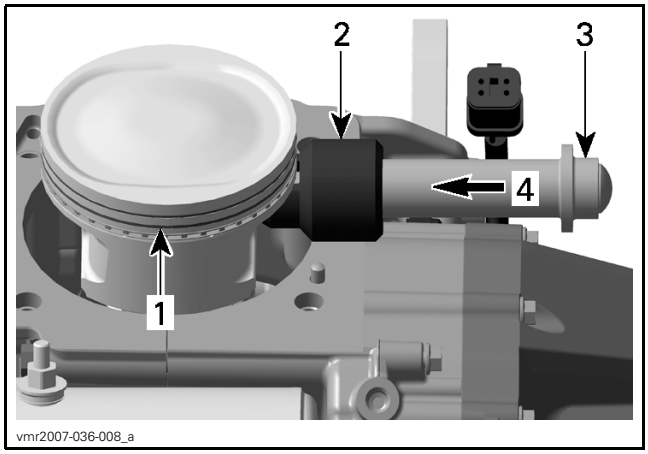
Place circlip in sleeve as per following illustration.



1. *Circlip*
2. *Sleeve*
3. *Assembly jig from piston clip installer*

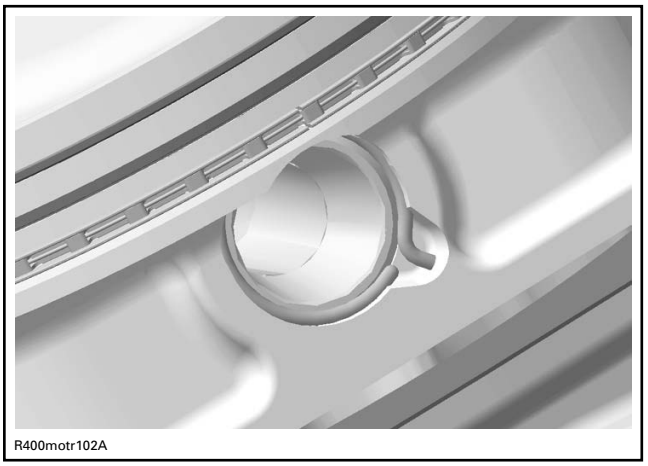
Push taper side of assembly jig until circlip reaches middle of sleeve.

Align sleeve with piston pin axis and push assembly jig until circlip engages in piston.



1. *Hold piston while pushing circlip in place*
2. *Sleeve*
3. *Assembly jig*
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

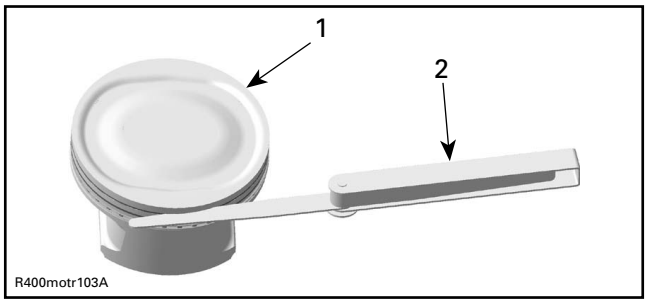
Remove the piston (see *PISTON* in this subsection).

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 0.40 mm (.008 in to .016 in)
SERVICE LIMIT	0.60 mm (.024 in)
LOWER COMPRESSION RING	
NEW	0.20 mm to 0.40 mm (.008 in to .016 in)
SERVICE LIMIT	0.70 mm (.028 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 specified tolerance.

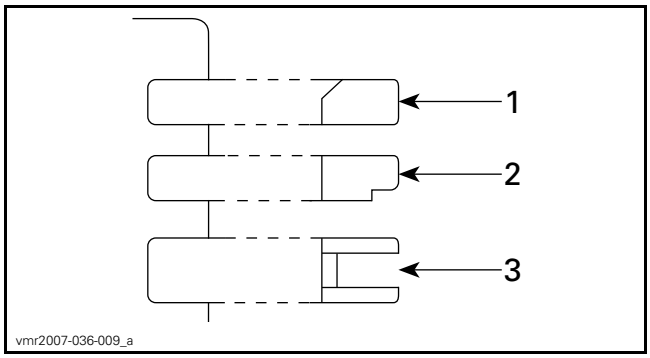
Ring Installation

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

First install spring and then rings of oil scraper ring.

NOTICE **Use a ring expander to prevent breakage during installation. The oil ring must be installed by hand.**

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.

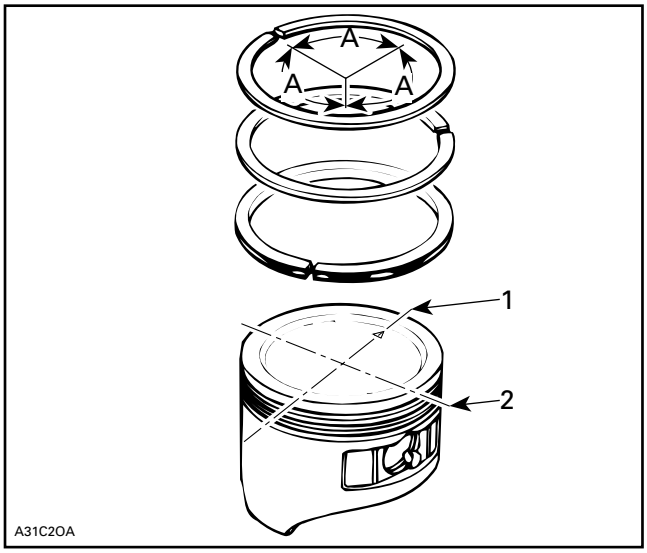


1. Upper compression ring
2. Lower compression ring
3. Oil scraper ring

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°

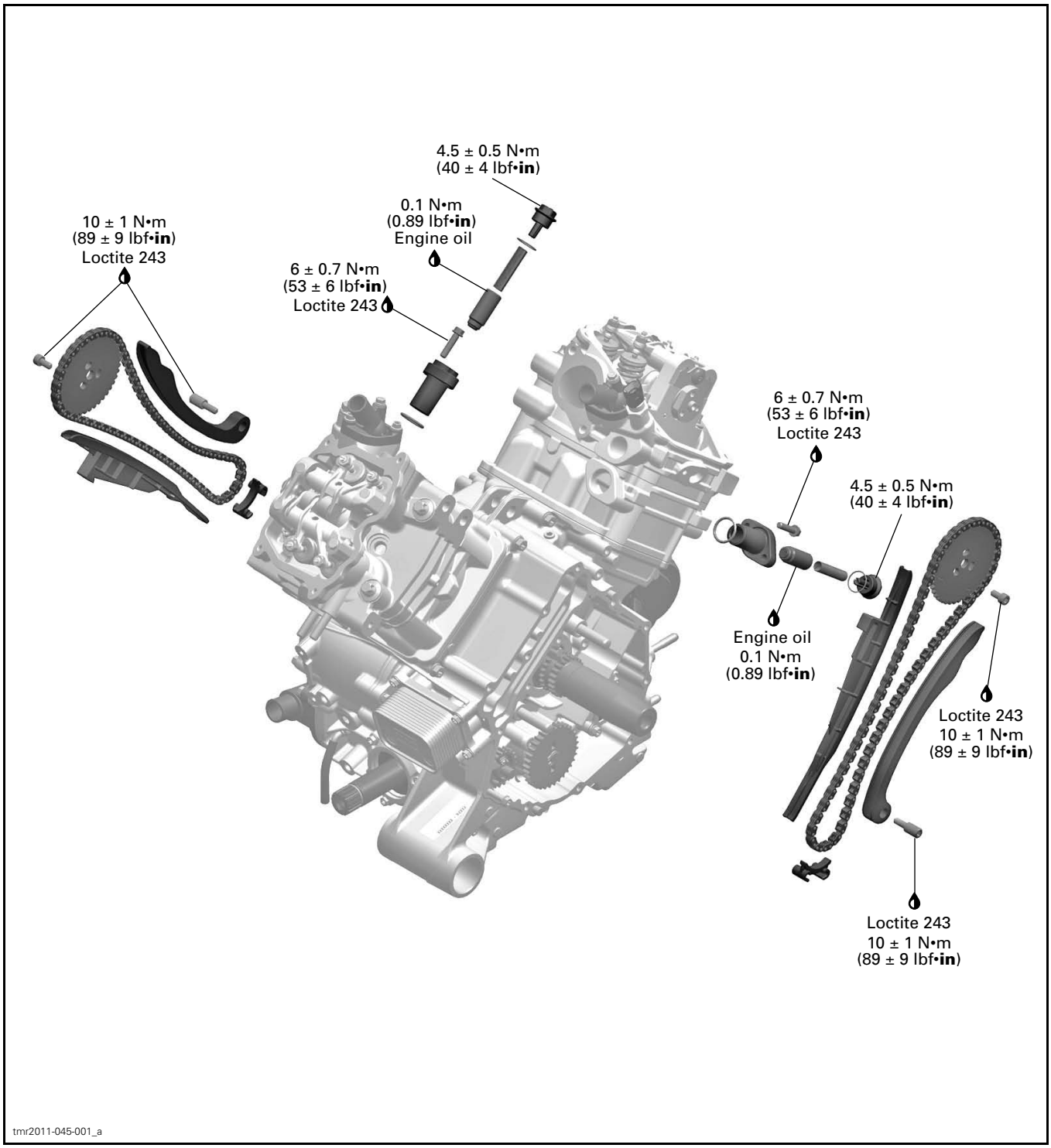
TIMING CHAIN (1000)

SERVICE TOOLS

Description	Part Number	Page
CAMSHAFT TIMING TOOL	529 036 268	217
CRANKSHAFT TDC POSITION TOOL	529 036 201	217, 221

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	218, 223


4.5 ± 0.5 N•m
(40 ± 4 lbf•in)
0.1 N•m
(0.89 lbf•in)
Engine oil
10 ± 1 N•m
(89 ± 9 lbf•in)
Loctite 243
6 ± 0.7 N•m
(53 ± 6 lbf•in)
Loctite 243
6 ± 0.7 N•m
(53 ± 6 lbf•in)
Loctite 243
4.5 ± 0.5 N•m
(40 ± 4 lbf•in)
Engine oil
0.1 N•m
(0.89 lbf•in)
Loctite 243
10 ± 1 N•m
(89 ± 9 lbf•in)
Loctite 243
10 ± 1 N•m
(89 ± 9 lbf•in)
tmr2011-045-001_a

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

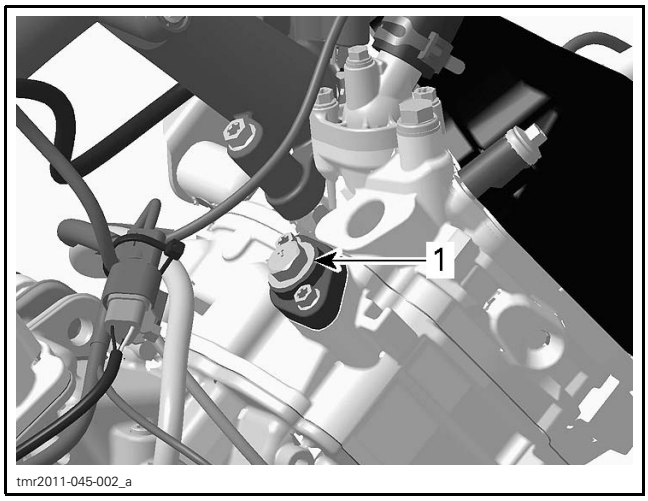
1. INCORRECT CAMSHAFT TIMING
   - *Replace damaged components and readjust camshaft timing.*

PROCEDURES

TIMING CHAIN TENSIONER

Timing Chain Tensioner Location

The timing chain tensioner is located in the cylinder.



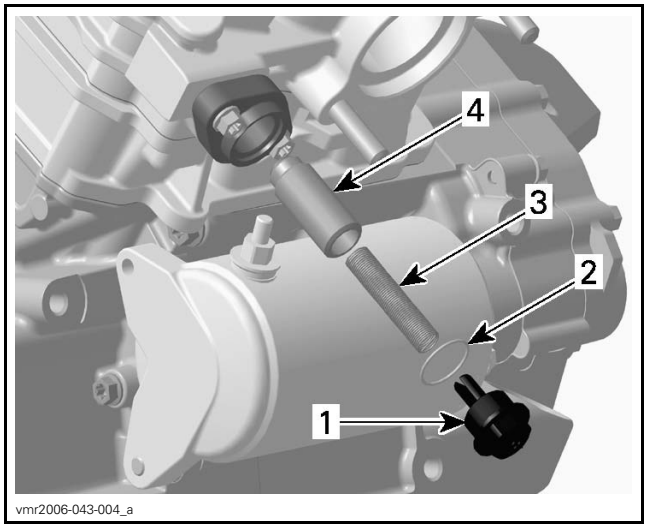
FRONT CYLINDER SHOWN
1. Timing chain tensioner

Timing Chain Tensioner Removal

1. Make sure the applicable cylinder is set to TDC ignition. Refer to *CAMSHAFT TIMING GEARS* in this subsection.
2. Carefully remove chain tensioner screw plug and release spring tension.

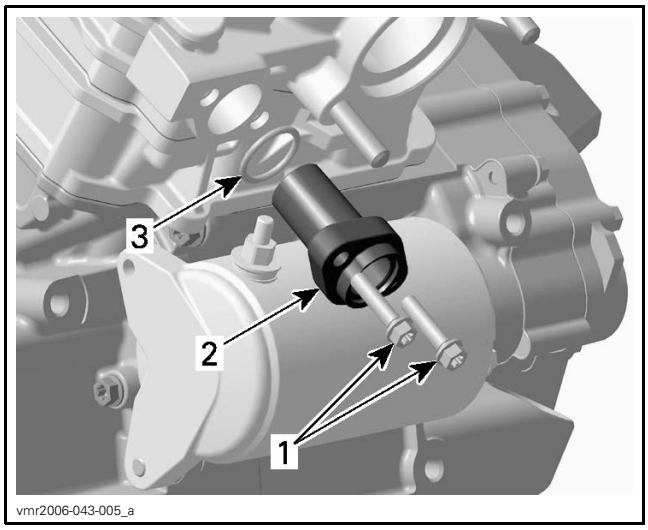
⚠ CAUTION **Tensioner is spring loaded.**

3. Remove:
   – O-ring
   – Spring
   – Chain tensioner plunger.



1. Chain tensioner screw 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 chain tensioner housing and screw plug for cracks or other damages. Replace if necessary.

Check chain tensioner plunger for freedom of movement and/or scoring.

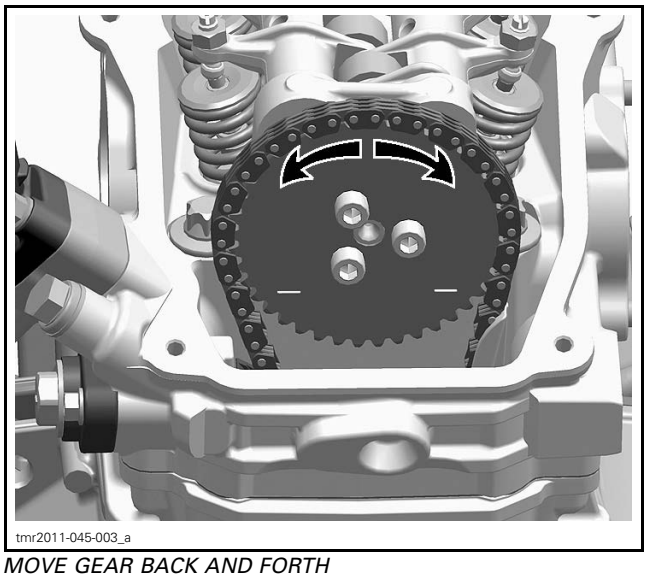
Ensure O-rings are not brittle, cracked or hard. Replace if necessary.

Check spring condition. Replace if bent, broken or worn.

Timing Chain Tensioner Installation

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

NOTE: Before installing the chain tensioner, make sure the camshaft timing gear can be moved back and forth.



MOVE GEAR BACK AND FORTH

1. Apply engine oil on the chain tensioner plunger before installation.
2. Slightly turn the camshaft timing gear in order to move the timing chain excess play to the tensioner side.
3. Slightly screw in the plunger until the timing chain does not allow back and forth movement of the camshaft timing gear.
4. Screw the plunger in an additional 1/8 turn to obtain the required specified torque.

TIMING CHAIN TENSIONER ADJUSTMENT (TIGHTENING TORQUE)
0.1 N•m (.9 lbf•**in**)

NOTICE **Improper adjustment of the timing chain will lead to severe engine damage.**

5. Insert the spring on one side into the slot of the chain tensioner screw plug, and on the other side, into the plunger.

NOTICE **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.**

NOTE: Do not forget to place the O-ring on chain tensioner screw plug.

6. Then compress the spring and screw the plug in.

NOTE: To avoid overstressing the timing chain, the chain tensioner screw plug must engage in the tensioner bore threads within the first full turn.

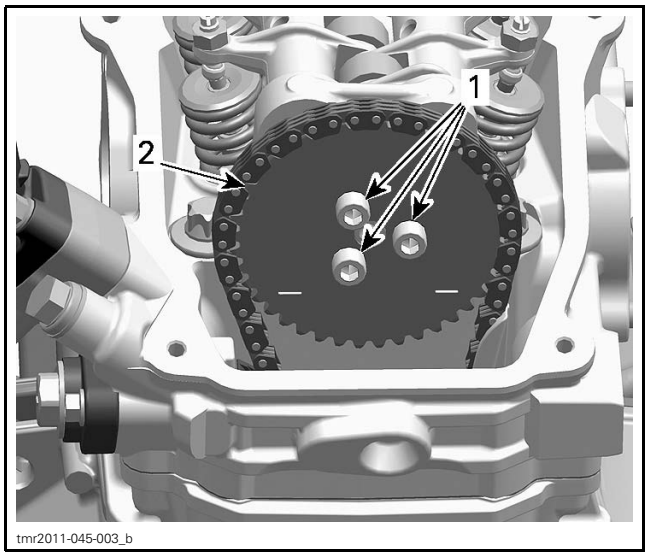
7. Remove locking tool and install all other removed parts.

8. Tighten the chain tensioner screw plug.

CAMSHAFT TIMING GEARS

Camshaft Timing Gear Removal

1. Remove valve cover, refer to *TOP END* subsection.
2. Set applicable piston to TDC ignition and lock magneto flywheel. Refer to *CAMSHAFT TIMING* in this subsection.
3. Remove timing chain tensioner. Refer to *TIMING CHAIN TENSIONERS* in this subsection.
4. Remove camshaft timing gear retaining screws.



TYPICAL
1. *Camshaft timing gear retaining screws*
2. *Camshaft timing gear*

5. Remove the camshaft timing gear.

Secure timing chain with a piece of wire.

Camshaft Timing Gear Inspection

Check camshaft timing gear for wear or deterioration.

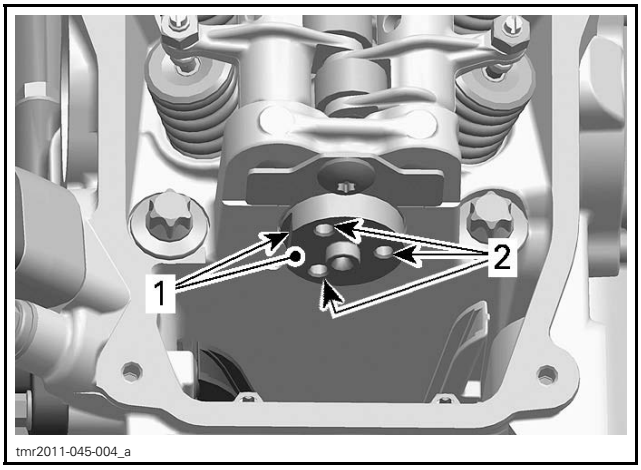
If timing gear is worn or damaged, replace it as a set with the timing chain.

For crankshaft gear inspection, refer to *CRANKSHAFT* in the *BOTTOM END* subsection.

Camshaft Timing Gear Installation

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

1. Clean camshaft mating surface and threads prior to installing camshaft timing gear.



1. *Camshaft mating surface*
2. *Camshaft screw threads*

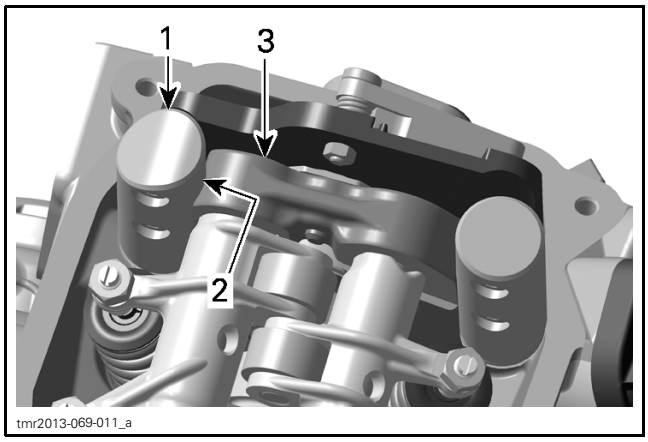
2. Set applicable piston to TDC ignition position and install the crankshaft position tool, refer to *CAMSHAFT TIMING* in this subsection.

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

3. Install camshaft timing tool on the cylinder head.

REQUIRED TOOL	
Camshaft timing toolCAMSHAFT TIMING TOOL (P/N 529 036 268)	

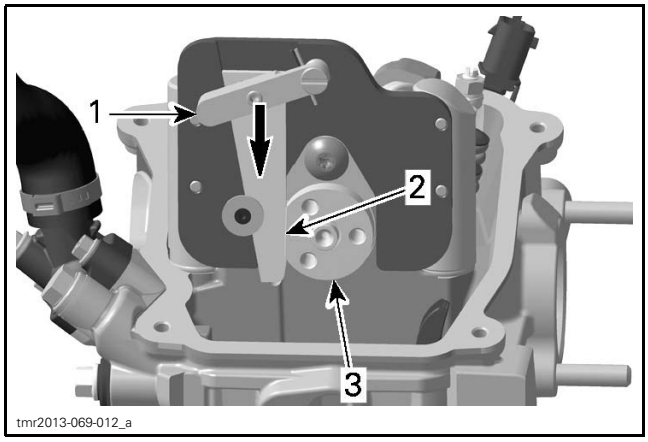
4. Properly align tube of camshaft timing tool with machined radius on cylinder head.



CAMSHAFT TIMING TOOL INSTALLED
1. *Tube (camshaft timing tool)*
2. *Machined radius (camshaft timing tool)*
3. *Cylinder head*

5. Set camshaft to TDC ignition position by aligning the flat portion on the camshaft flange with the tool lever.

In addition, to ensure proper camshaft timing, press camshaft timing tool lever downwards.

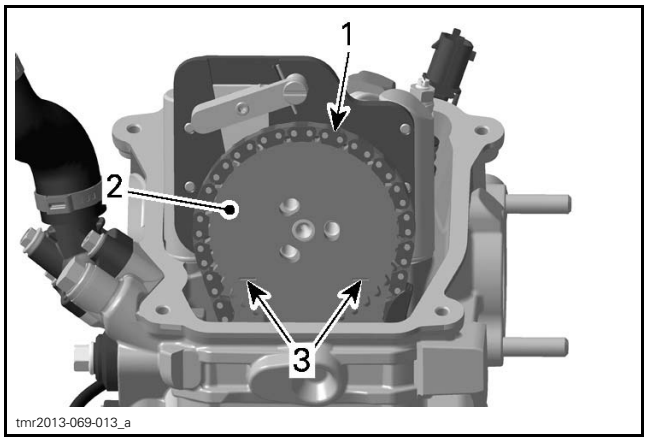


PRESS TOOL LEVER DOWN
1. *Lever*
2. *Flat spot*
3. *Camshaft*

NOTICE **Crankshaft and camshaft must be locked at TDC ignition position to place camshaft timing gear and timing chain in the proper position.**

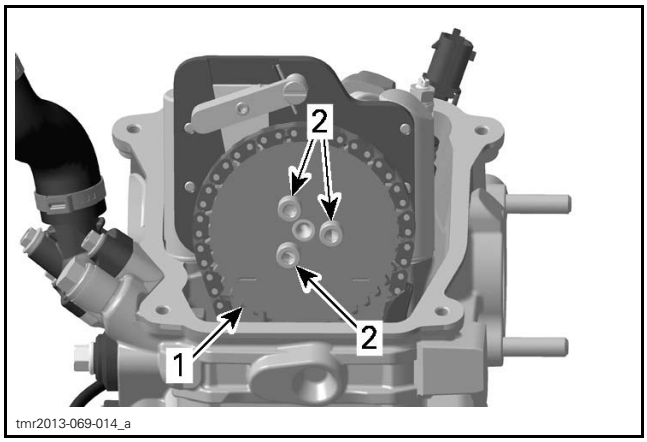
6. Place camshaft timing gear and timing chain on the camshaft.

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*

7. Install and adjust timing chain tensioner, refer to *TIMING CHAIN TENSIONER* in this subsection.
8. Install and tighten camshaft timing gear retaining screws to specified torque.



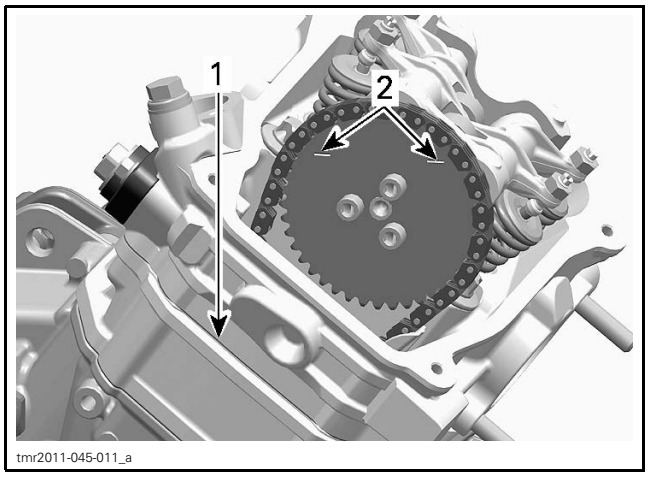
1. *Camshaft timing gear*
2. *Timing gear retaining screws*

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**)

9. Remove the camshaft timing tool.

Camshaft Timing

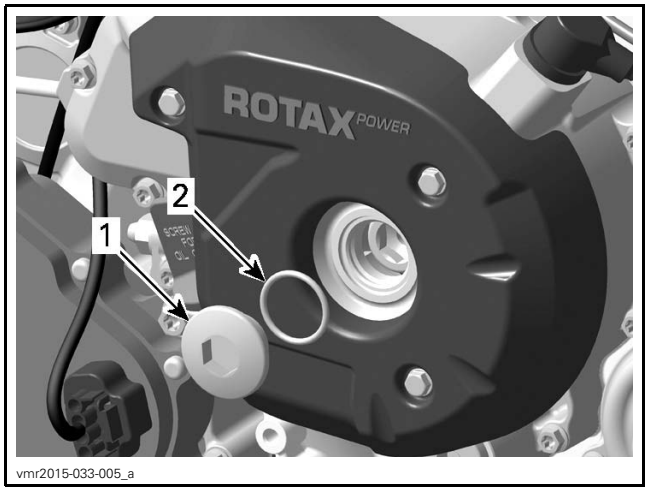
NOTE: If a piston (cylinder 1 or 2) is set to TDC ignition, the camshaft timing gear of the opposite cylinder must be in the following position.



TYPICAL
1. *Cylinder head base*
2. *Marks on timing gear of the opposite cylinder*

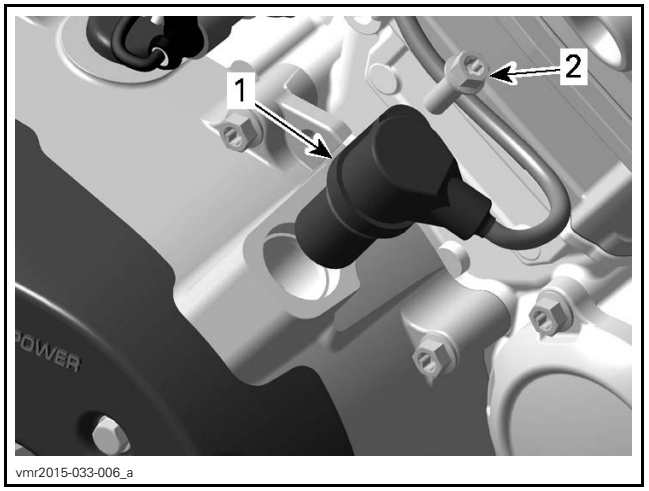
Camshaft Timing Piston No. 2 (rear)

1. Remove spark plugs of both cylinders.
2. Remove valve covers of both cylinders.
3. Remove the screw plug and O-ring from magneto cover.



1. *Screw plug*
2. *O-ring*

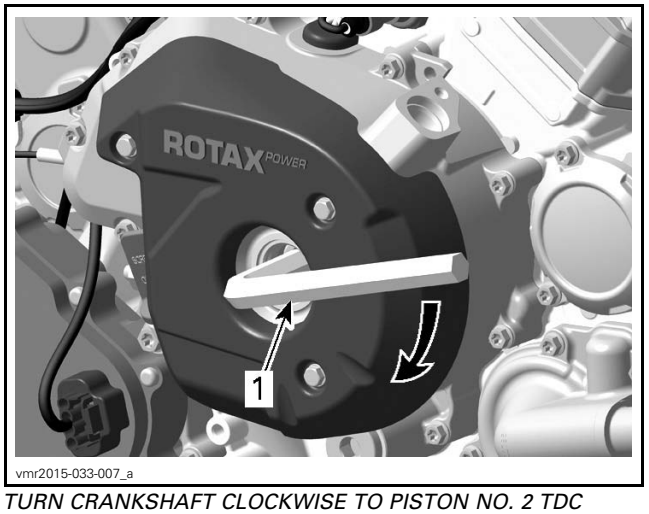
4. Remove the crankshaft position sensor (CPS).



1. *CPS*
2. *Screw*

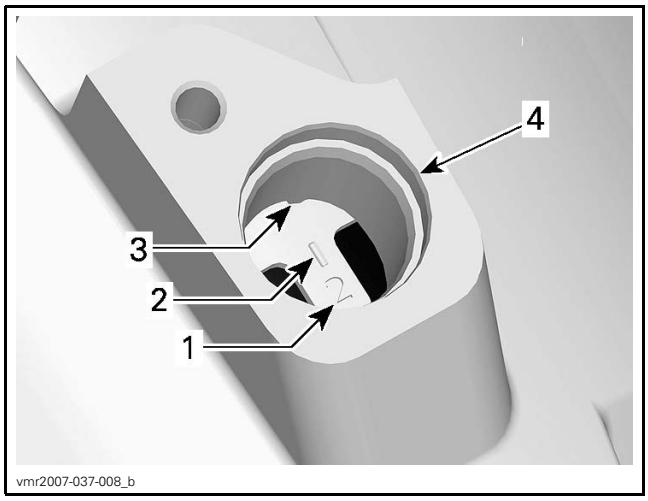
5. Set rear piston no. 2 to TDC ignition by turning the crankshaft clockwise.

REQUIRED TOOL
Allen key 14 mm



TURN CRANKSHAFT CLOCKWISE TO PISTON NO. 2 TDC
1. *Allen key 14 mm*

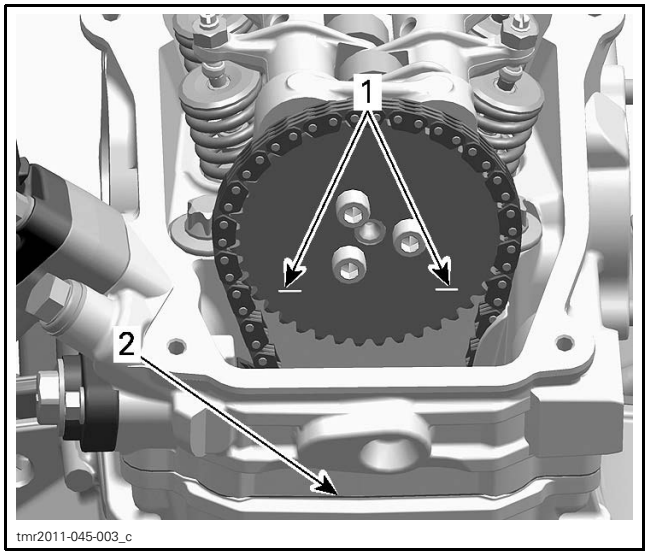
5.1 The rear piston is at TDC when it's index mark on the magneto flywheel is aligned with the notch in the magneto cover.



PISTON NO. 2 AT TDC
1. *Piston no. 2 identifier*
2. *Index mark on magneto flywheel*
3. *Notch on magneto cover*
4. *CPS bore in magneto cover*

5.2 Confirm printed marks on the camshaft timing gear are parallel with cylinder head base, in the lowest position. In this position the piston is set to TDC ignition.

NOTE: If marks on camshaft timing gear are not as specified, turn crankshaft 360°.



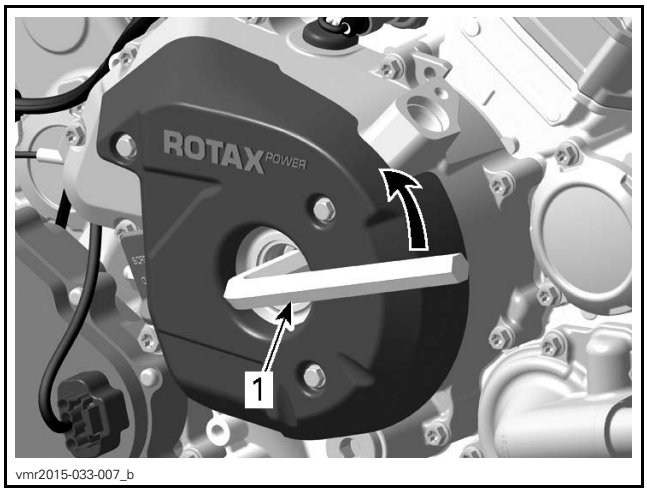
TYPICAL - PISTON AT TDC IGNITION
1. *Printed marks on camshaft timing gear*
2. *Cylinder head base*

6. Install the crankshaft TDC position tool to lock crankshaft in position. Refer to *CRANKSHAFT TDC POSITION TOOL* in this subsection.

Camshaft Timing Piston No. 1 (front)

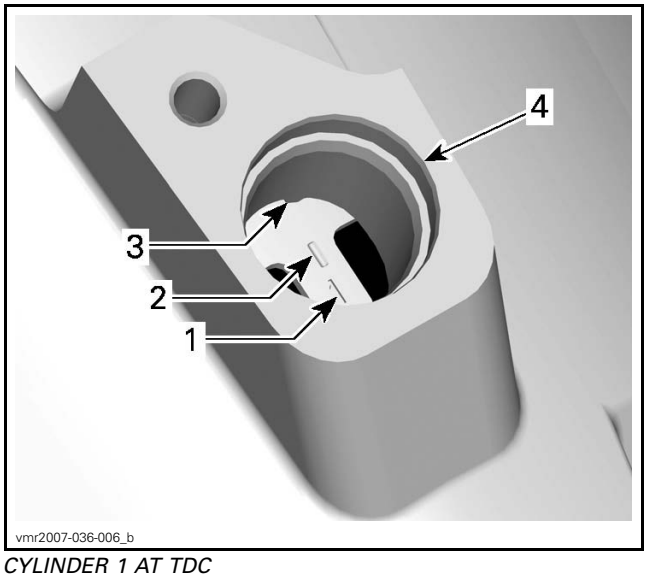
1. Set rear piston no. 2 to TDC ignition, see *CAMSHAFT TIMING PISTON NO. 2 (REAR)* in this subsection.
2. Remove crankshaft TDC position tool.
3. To set front piston no. 1 to TDC ignition turn crankshaft 280° counterclockwise.

REQUIRED TOOL
Allen key 14 mm



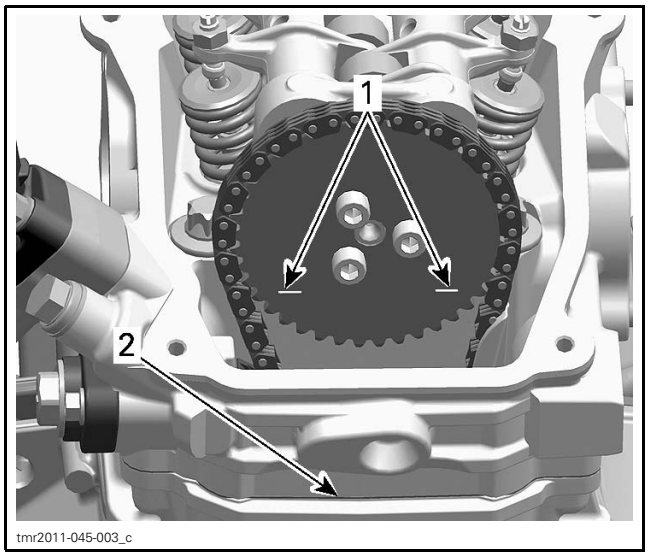
TURN COUNTERCLOCKWISE 280° TO NUMBER 1 PISTON TDC
1. *Allen key 14 mm*

3.1 The front piston is at TDC when it's index mark on the magneto flywheel is aligned with the notch in the magneto cover.



CYLINDER 1 AT TDC
1. *Number 1 piston identifier*
2. *Index mark "1" on magneto flywheel*
3. *Notch on magneto cover*
4. *Crankshaft position sensor bore*

3.2 Confirm printed marks on the camshaft timing gear are parallel with cylinder head base, in the lowest position. 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*

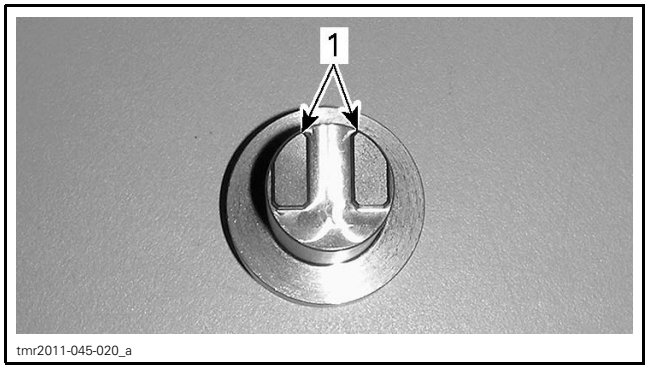
4. Insert the crankshaft TDC position tool to lock crankshaft in position. Refer to *CRANKSHAFT TDC POSITION TOOL INSTALLATION* in this subsection.

Crankshaft TDC Position Tool Installation

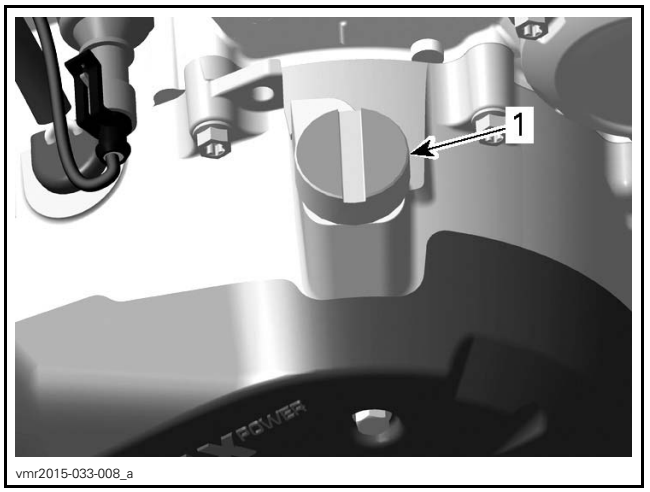
Install tool in magneto cover CPS bore.

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

NOTE: Make sure to match the teeth on the crankshaft TDC position tool with the magneto rotor.

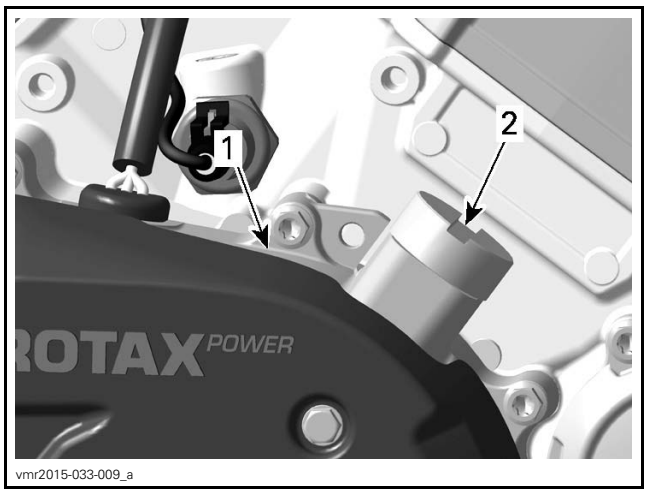


1. *Crankshaft TDC position tool teeth (end view)*



MAGNETO COVER
1. *Crankshaft TDC position tool installed in CPS bore*

NOTICE Tool must be fully inserted.



1. *Magneto cover*
2. *TDC position tool*

TIMING CHAIN

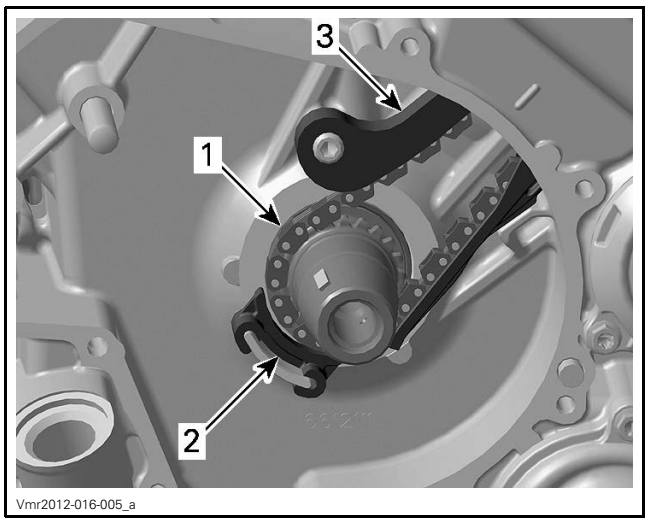
Timing Chain Location

The engine is equipped with two timing chains.
- MAG side timing chain is located behind the magneto cover.
- PTO side timing chain is located behind the PTO cover.

Timing Chain Removal (MAG Side)

1. Refer to *MAGNETO SYSTEM* subsection and remove following parts:
   - Magneto cover
   - Rotor
   - Sprag clutch gear.
2. Refer to *TOP END* subsection and remove the following part:
   - Valve cover.

3. Refer to following procedures in this subsection and remove following parts:
   – Chain tensioner
   – Camshaft timing gear.
4. Remove timing chain guide (tensioner side) and lower timing chain guide.



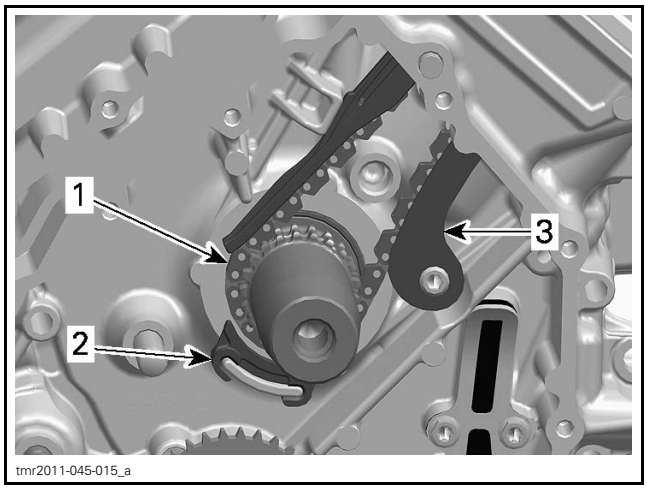
1. Timing chain
2. Lower timing chain guide
3. Timing chain guide (tensioner side)

NOTE: Mark the operating direction of the timing chain and check for excessive radial play before removal. Refer to *TIMING CHAIN INSPECTION*.

5. Carefully pull the timing chain downwards and sideways, then out of the crankcase.

Timing Chain Removal (PTO Side)

1. Refer to *BOTTOM END* subsection and remove following parts:
   – PTO cover
   – Breather gear
   – Intermediate gear.
2. Refer to *TOP END* subsection and remove following part:
   – Valve cover.
3. Refer to applicable procedures in this subsection and remove following parts:
   – Chain tensioner
   – Camshaft timing gear.
4. Remove timing chain guide (tensioner side) and lower timing chain guide.



1. Timing chain
2. Lower timing chain guide
3. Timing chain guide (tensioner side)

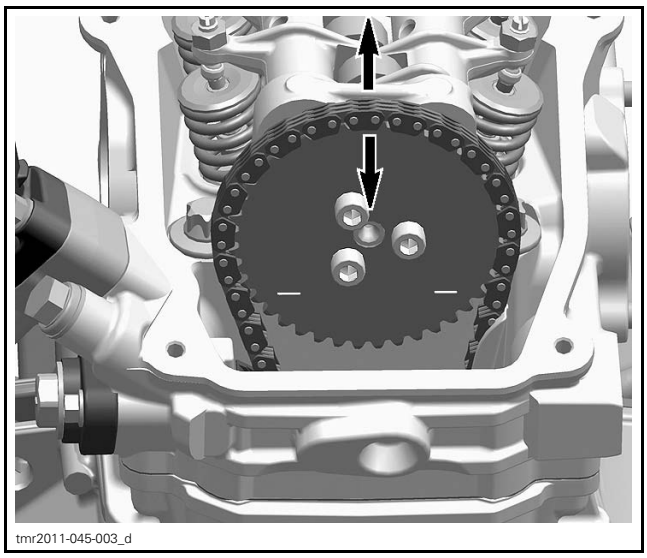
NOTE: Mark the operating direction of the timing chain and check for excessive radial play before removal. Refer to *TIMING CHAIN INSPECTION*.

5. Carefully pull the timing chain sideward and down from the crankcase.

Timing Chain Inspection

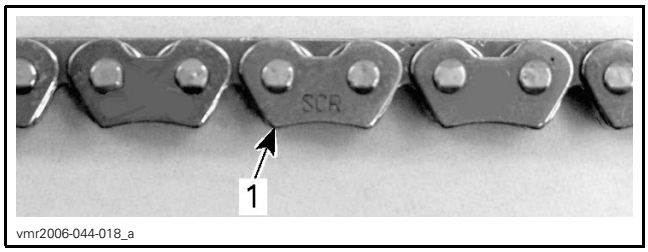
Inspection is the same for both timing chains.

Check timing chain on camshaft timing gear for excessive radial play.



CHECKING TIMING CHAIN RADIAL PLAY

Check chain condition for wear and teeth condition.



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 deformation. Replace as required.

NOTE: Check also the timing chain guide (tensioner side).

Timing Chain Installation

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

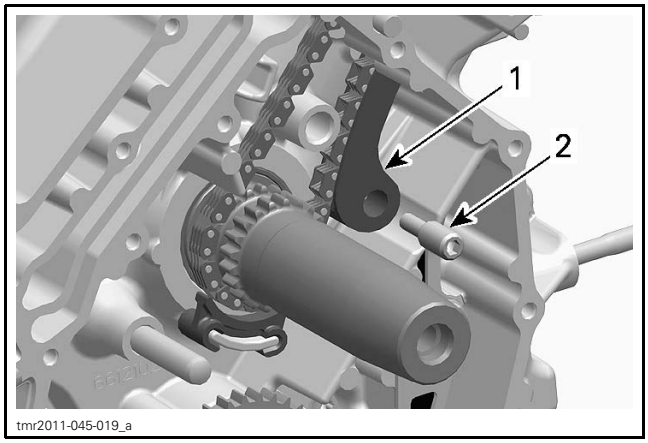
NOTE: Installation is the same for both timing chains.

Install timing chain with camshaft timing gear.

NOTE: Ensure to carry out proper valve timing, refer to *CAMSHAFT TIMING GEARS* in this subsection.

NOTICE **Improper valve timing will damage engine components.**

TIMING CHAIN GUIDE (TENSIONER SIDE)



1. Timing chain guide (tensioner side)
2. Bearing screw

Timing Chain Guide Removal (Tensioner Side)

Refer to *TIMING CHAIN* in this subsection.

Timing Chain Guide Inspection (Tensioner Side)

Check timing chain guide for wear, cracks or deformation. 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 (1000)

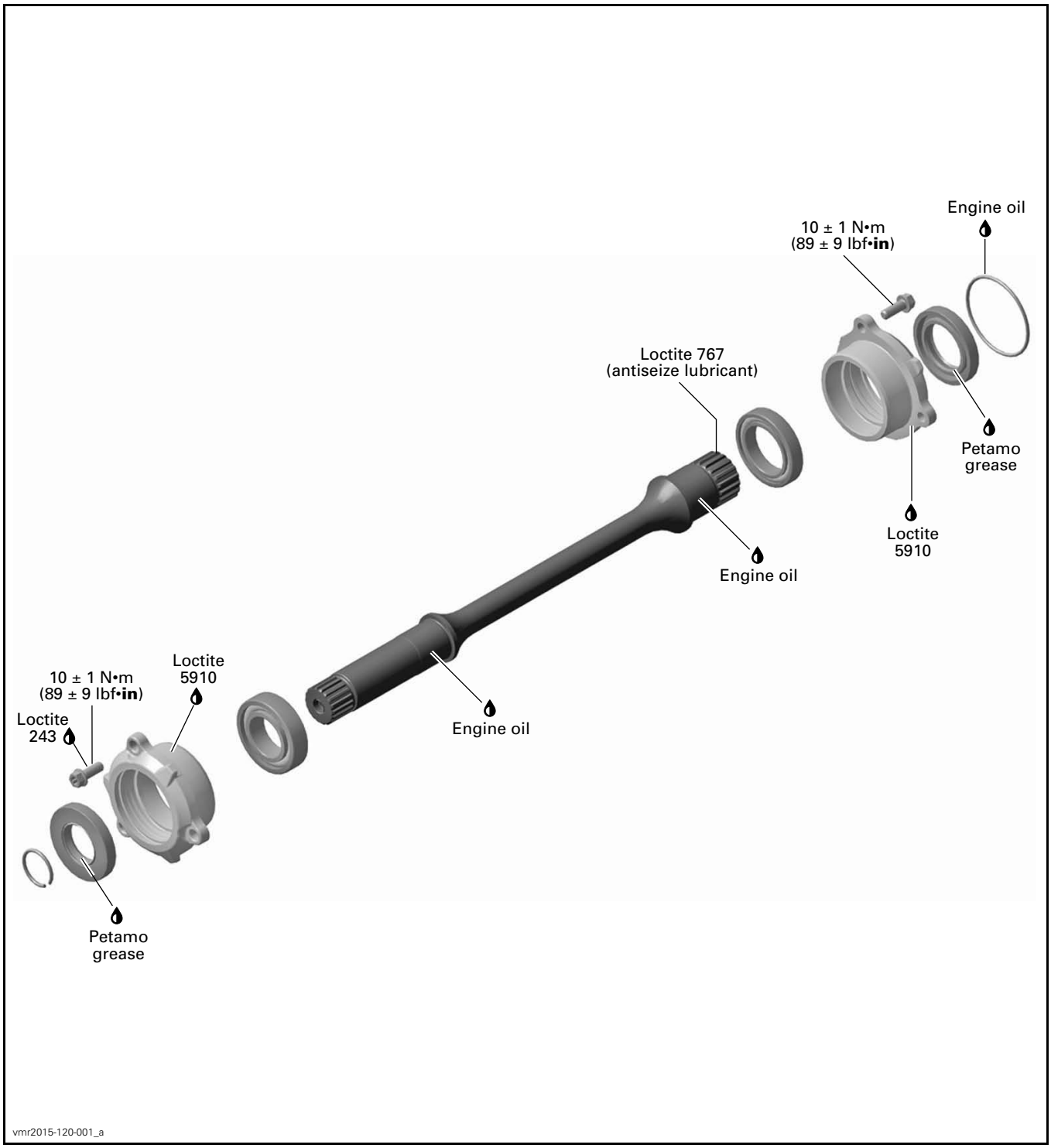
SERVICE TOOLS

Description	Part Number	Page
CRANKCASE SUPPORT MAG/PTO	529 036 031	263
CRANKSHAFT LOCKING BOLT	529 035 617	266
DRIVE SHAFT OIL SEAL INSTALLER	529 036 028	255–256
DRIVE SHAFT OIL SEAL PROTECTOR	529 036 029	254
PLAIN BEARING REMOVER/INSTALLER	529 035 917	263
PLAIN BEARING REMOVER/INSTALLER	529 036 032	258
PTO COVER OIL SEAL INSTALLER	529 036 033	257

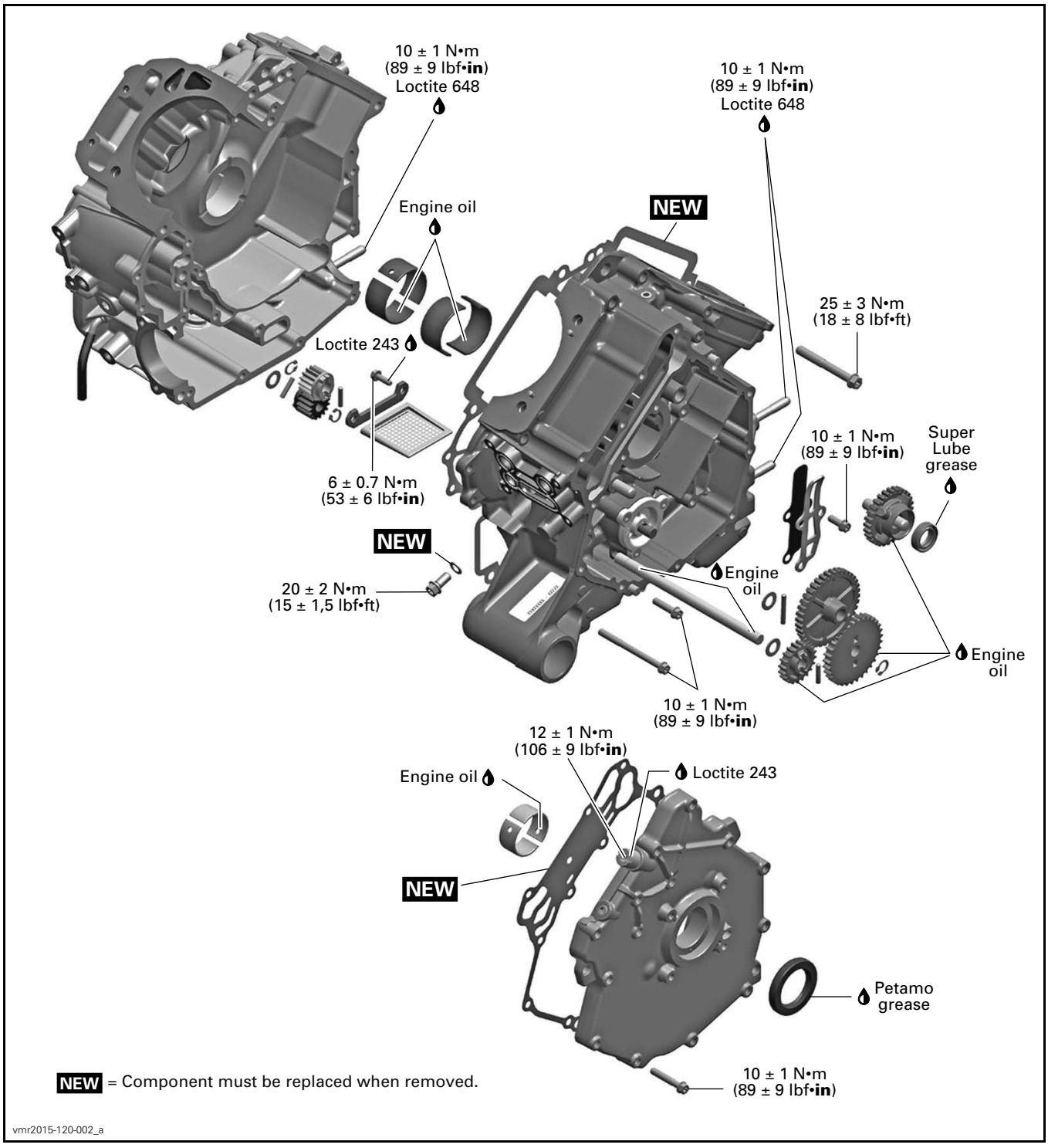
SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	255
LOCTITE 5910	293 800 081	254
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	254

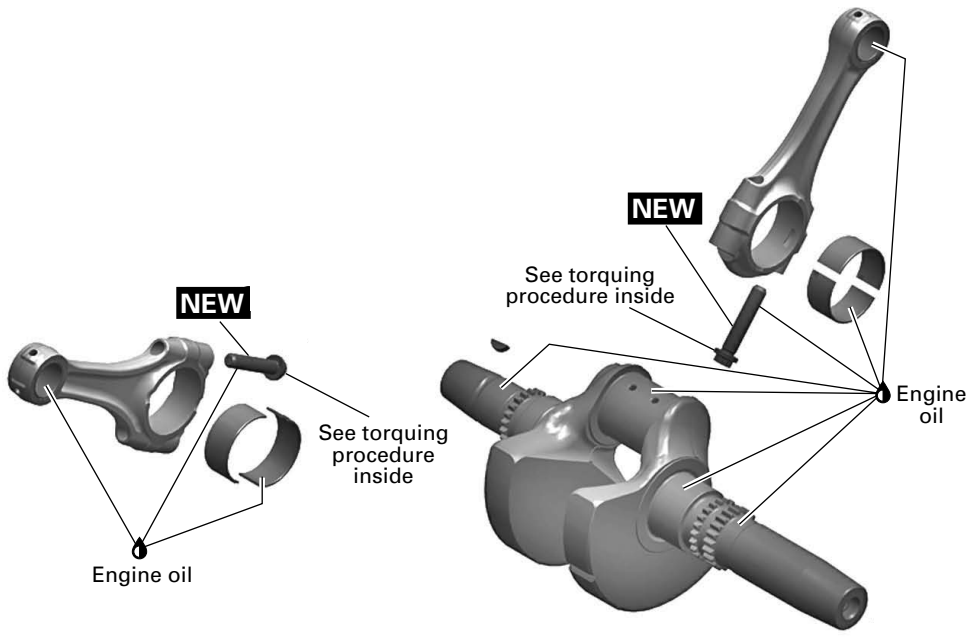
ENGINE DRIVE SHAFT



CRANKCASE AND PTO COVER



CRANKSHAFT



NEW = Component must be replaced when removed.

vmr2015-120-003_a

GENERAL

The engine drive shaft transmits the power from the gearbox to the front differential and is located inside the crankcase.

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.

PROCEDURES

ENGINE DRIVE SHAFT

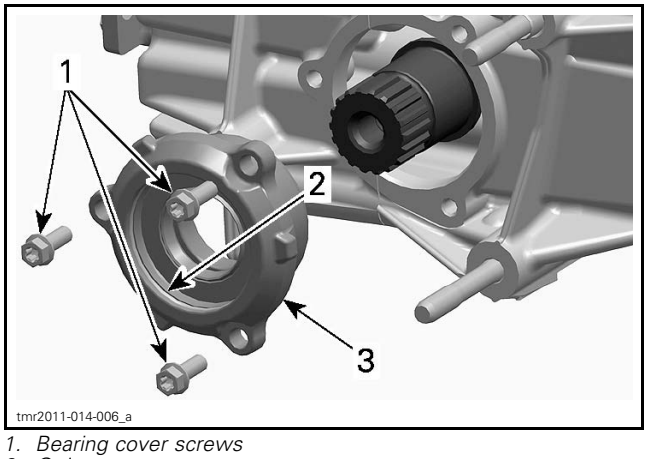
Engine Drive Shaft Removal

Remove the engine. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.

Rear Bearing Cover Removal

Detach gearbox from engine, refer to *GEARBOX AND COUPLING UNIT* subsection.

At rear of engine, remove the bearing cover and its O-ring.

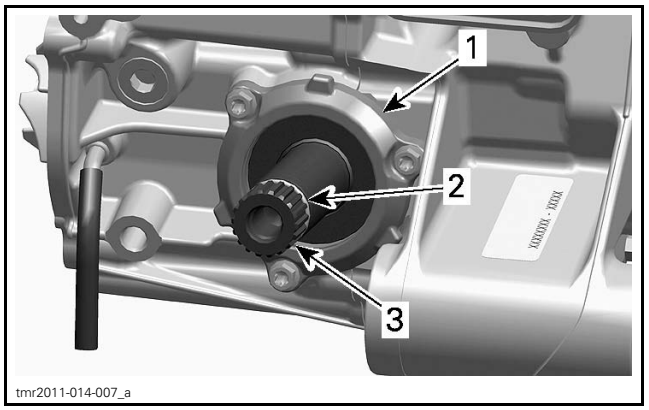


1. Bearing cover screws
2. O-ring
3. Bearing cover gearbox side

Front Bearing Cover Removal

Remove the bearing cover at the front of the engine.

NOTICE Check ends of the circlip for sharp edges or burrs before removing the drive shaft, to avoid damaging the oil seal.

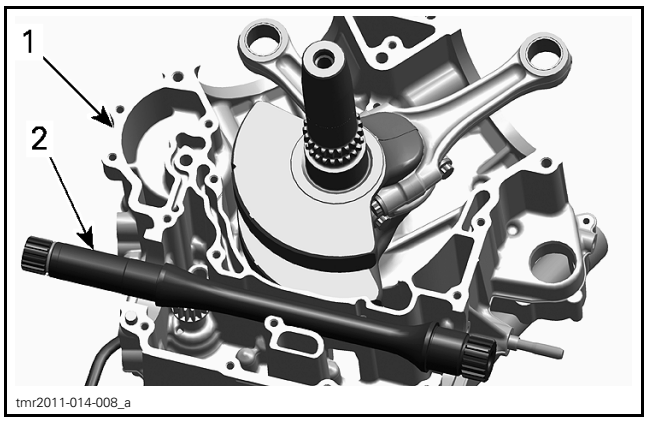


1. Bearing cover front drive side
2. Circlip
3. Drive shaft

Engine Drive Shaft Removal

Split crankcase, refer to *CRANKCASE* in this subsection.

Remove engine drive shaft from the crankcase.

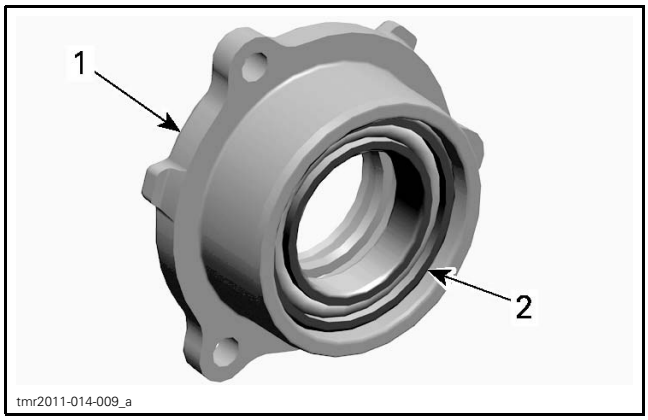


1. Crankcase MAG side
2. Engine drive shaft

Engine Drive Shaft Inspection

Replace oil seals and/or O-ring (bearing cover gearbox side) if they are brittle, hard or damaged.

Check drive shaft bearings for contamination and/or metal shavings. Check if bearings turn freely and smoothly. Replace if necessary.



1. Bearing cover
2. Drive shaft bearing

Check drive shaft for cracks, bend, pitting or other visible damages.

Check drive shaft splines for wear or damages.

Check oil seal running surface of the drive shaft for scratches. Replace if necessary.

Engine Drive Shaft Installation

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

Clean all metal components in solvent.

Clean crankcase surfaces and bearing covers 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.

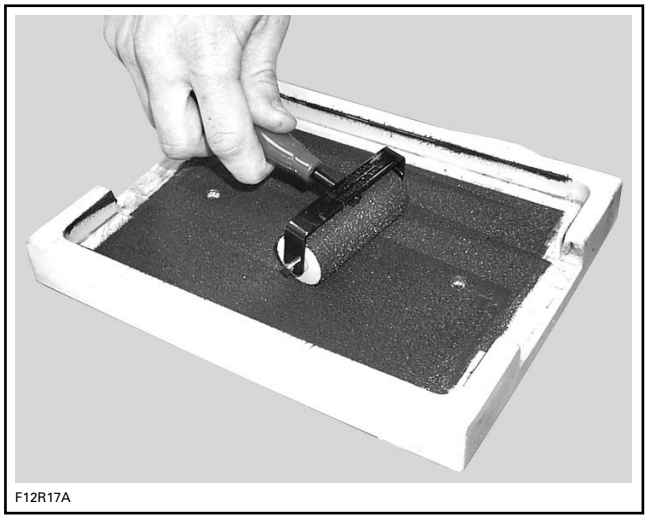
NOTICE **Do not wipe with rags. Use a new clean hand towel only.**

Use a suitable installer for installing bearings.

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

IMPORTANT: When beginning the application of the bearing cover 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 plexiglass plate and apply some sealant on it. Use a soft rubber roller 50 mm - 75 mm (2 in - 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 bearing cover surfaces.



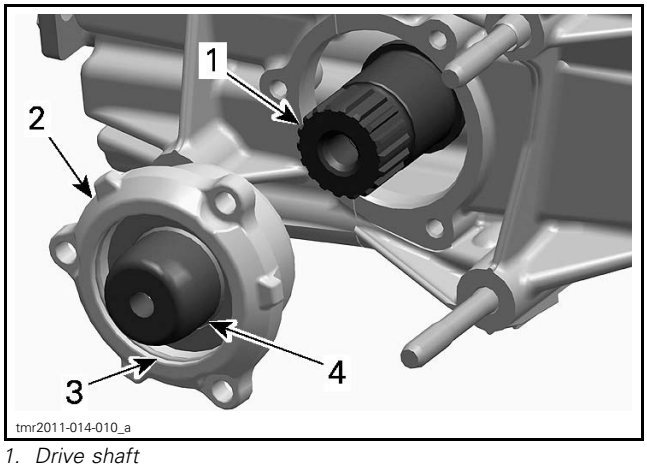
Do not apply in excess as it will spread out inside crankcase.

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).

Rear Bearing Cover Installation

For bearing cover installation on gearbox side, protect the oil seal to avoid damaging the sealing lip.

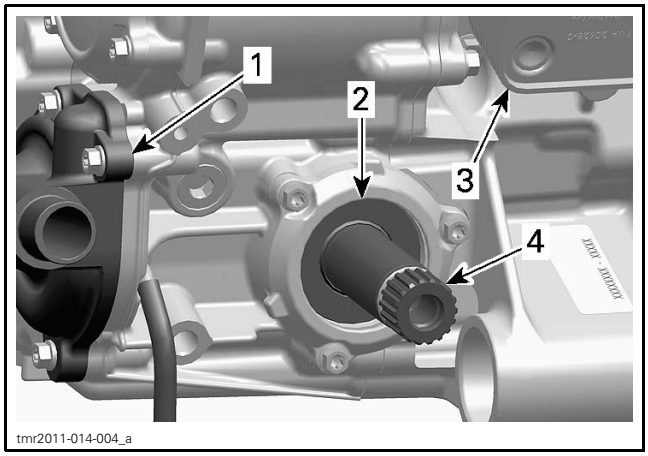
REQUIRED TOOL	
DRIVE SHAFT OIL SEAL PROTECTOR (P/N 529 036 029)	



1. Drive shaft
2. Bearing cover gearbox side
3. O-ring
4. Protection sleeve

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

Front Bearing Cover Installation



FRONT OF ENGINE
1. *Water pump cover*
2. *Oil seal front side*
3. *Oil cooler*
4. *Drive shaft*

FRONT BEARING COVER 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**)

Engine Drive Shaft Installation

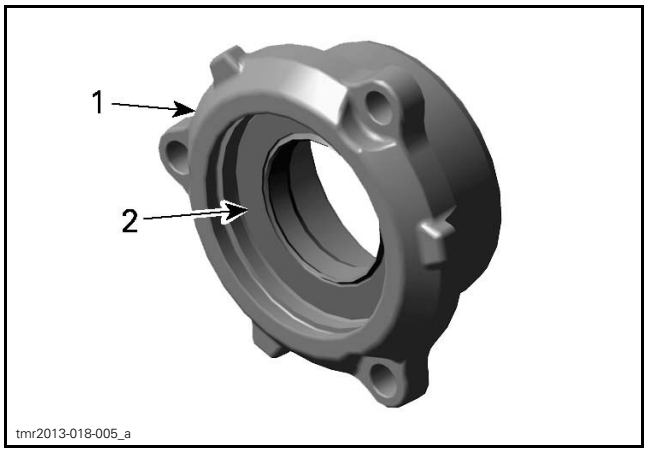
Finally check for axial play of the drive shaft.

FRONT OIL SEAL (ENGINE DRIVE SHAFT)

Front Oil Seal Replacement (Engine Drive Shaft)

NOTE: The front oil seal can be replaced with the engine installed.

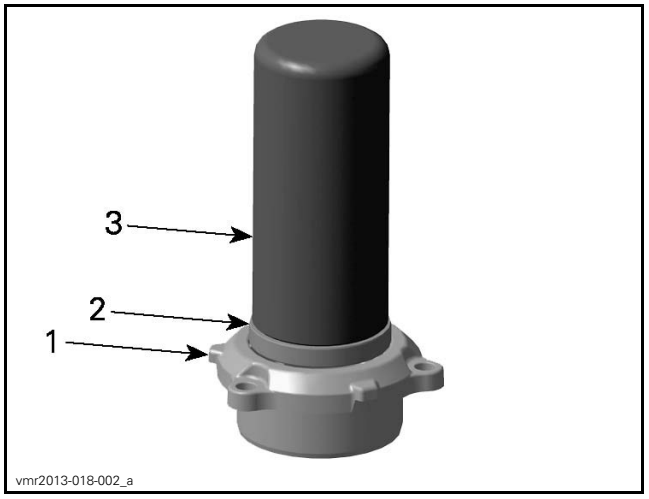
1. Remove front propeller shaft.
2. Remove adapter sleeve between propeller shaft and front engine drive shaft.
3. Remove the front bearing cover, refer to *ENGINE DRIVE SHAFT REMOVAL/INSTALLATION* in this subsection.
4. Remove drive shaft seal from bearing cover.



1. *Bearing cover*
2. *Oil seal*

5. Install drive shaft oil seal using the following tool.

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



1. *Bearing cover*
2. *Oil seal*
3. *Oil seal installer*

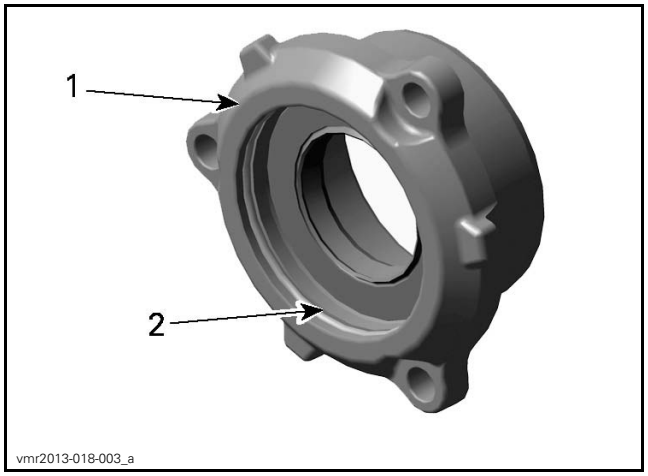
6. Reinstall remaining parts in the reverse order of removal.

REAR OIL SEAL (ENGINE DRIVE SHAFT)

Rear Oil Seal Replacement (Engine Drive Shaft)

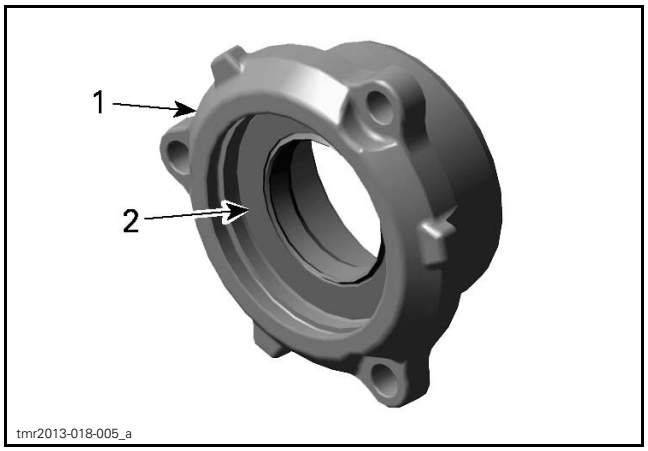
1. Remove gearbox from the engine, refer to *GEARBOX AND COUPLING UNIT* subsection.
2. Remove rear bearing cover, refer to *ENGINE DRIVE SHAFT REMOVAL/INSTALLATION* in this subsection.

3. Remove O-ring from bearing cover.



1. Bearing cover
2. O-ring

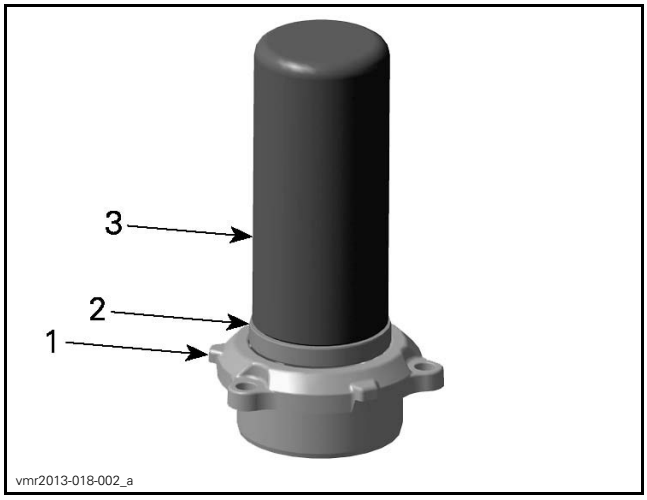
4. Remove drive shaft seal from bearing cover.



1. Bearing cover
2. Oil seal

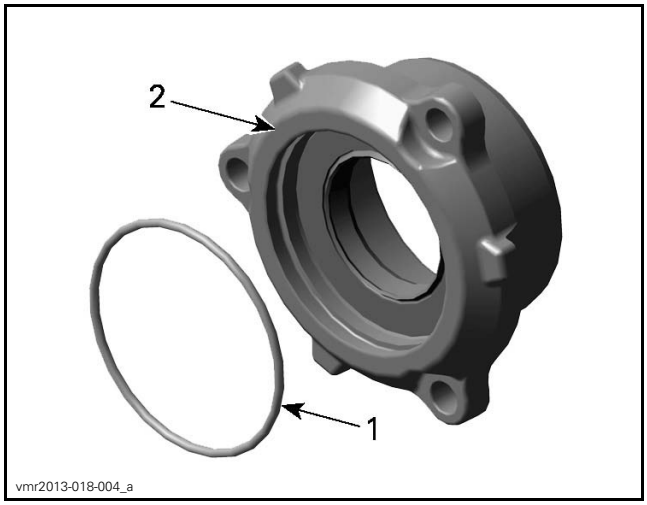
5. Install drive shaft oil seal using the following tool.

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



1. Bearing cover
2. Oil seal
3. Oil seal installer

6. Install O-ring in rear bearing cover.



1. O-ring
2. Bearing cover

7. Reinstall remaining parts in the reverse order of removal.

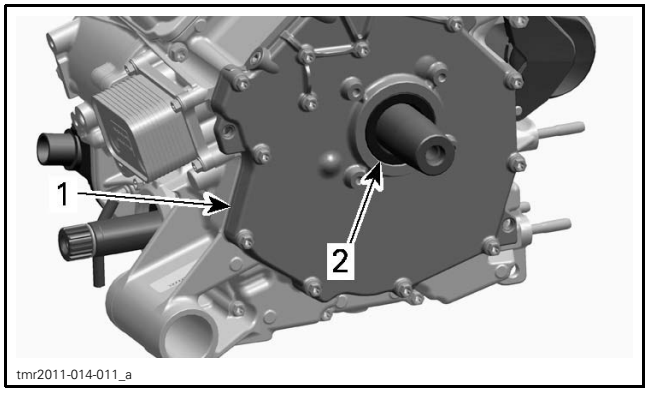
PTO COVER OIL SEAL

NOTE: To replace oil seal it is not necessary to remove engine from vehicle.

PTO Oil Seal Removal

1. Refer to *CONTINUOUSLY VARIABLE TRANSMISSION (CVT)* subsection and remove the following parts:
   – CVT cover
   – Drive pulley
   – Driven pulley
   – CVT air guide.
2. Remove oil seal using a small flat screwdriver.

NOTICE Avoid scoring surfaces with tool.



1. PTO cover
2. Oil seal

PTO Oil Seal Inspection

Check oil seal running surface of crankshaft PTO side for grooves. Replace if necessary.

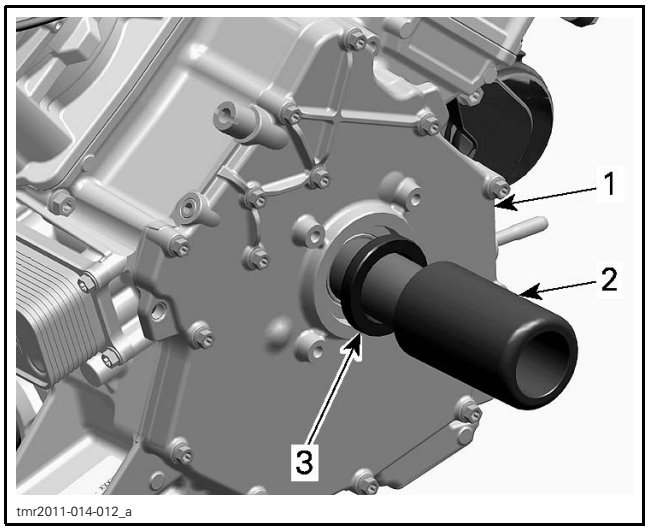
PTO Oil Seal Installation

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

NOTICE Oil seal must be installed with sealing lip toward the engine.

Push oil seal in place using the following tool.

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

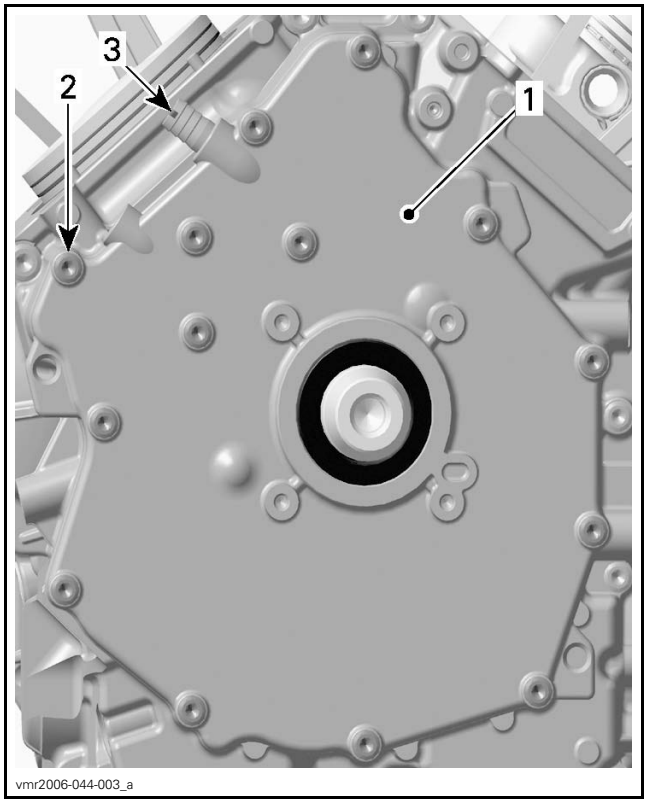


1. PTO cover
2. Oil seal installer
3. Oil seal

PTO COVER

PTO Cover Removal

1. Refer to *CONTINUOUSLY VARIABLE TRANSMISSION (CVT)* subsection to remove the following parts:
   - CVT cover
   - Drive pulley
   - Driven pulley
   - CVT air guide.
2. Disconnect vent hose.
3. Remove PTO cover screws and pull on PTO cover to remove it.



1. PTO cover
2. PTO cover screws
3. Vent hose nipple

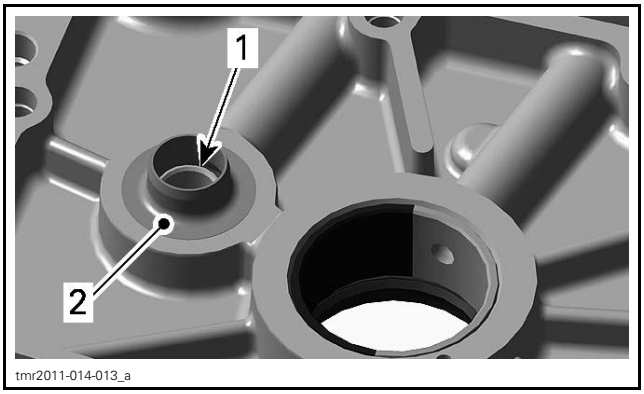
PTO Cover Inspection

1. Check the PTO cover for cracks or other damage.
2. Replace PTO cover if damaged.
3. Clean oil breather bore in PTO cover from contaminations with a parts cleaner then use pressurized air to dry it.

⚠ WARNING

Always wear skin and eye protection. Chemicals can cause skin rash, skin burns and severe eye injury.

4. Check surface of sealing sleeve for wear or other damages. Replace PTO cover if damaged.

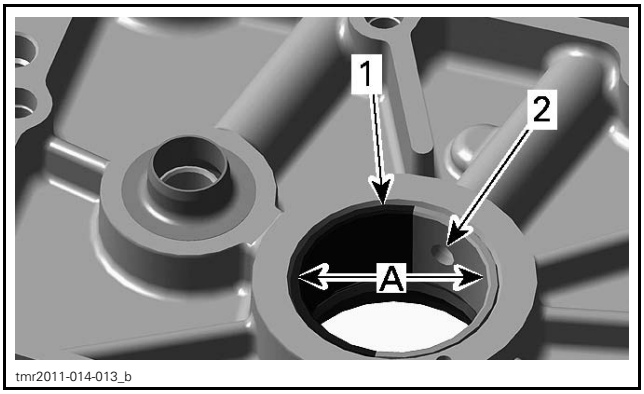


tmr2011-014-013_a

1. Oil breather bore
2. Surface of sealing sleeve

5. Check plain bearings for scoring or other damages.

NOTE: Measure plain bearing inside diameter (PTO cover) and compare to crankshaft bearing journal diameter (PTO cover bearing). Refer to *CRANKSHAFT* in this subsection. Replace if the measurement is out of specification.



tmr2011-014-013_b

1. Plain bearing
2. Oil bore
A. Measure plain bearing inside diameter

PLAIN BEARING INSIDE DIAMETER (PTO COVER)	
SERVICE LIMIT	33.998 mm (1.3385 in)

Plain Bearing Replacement (PTO Cover)

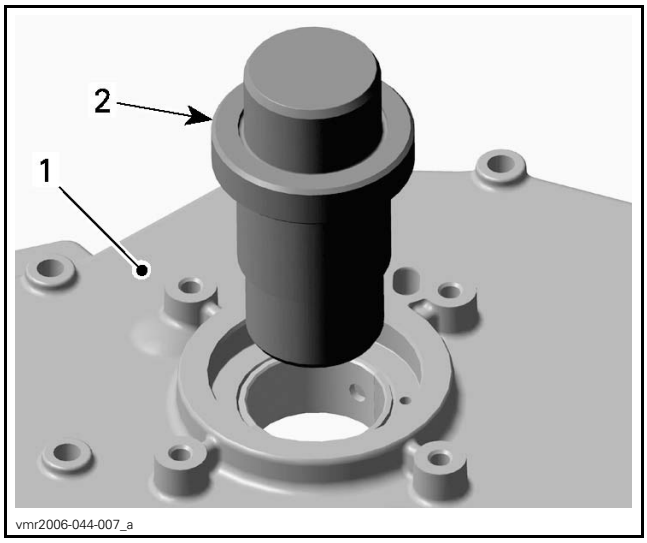
Plain Bearing Removal

NOTICE Unless otherwise instructed, never use a hammer to install plain bearings. Always use a press.

1. Carefully remove the PTO oil seal with a screwdriver, without damaging the PTO cover.
2. Press out the plain bearings from the outside towards the inside.

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

NOTE: The PTO cover has to be supported from below on a suitable support with straight surface in order to prevent damage of the sealing surface.



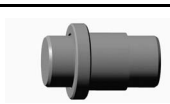
vmr2006-044-007_a

1. PTO cover
2. Plain bearing remover/installer

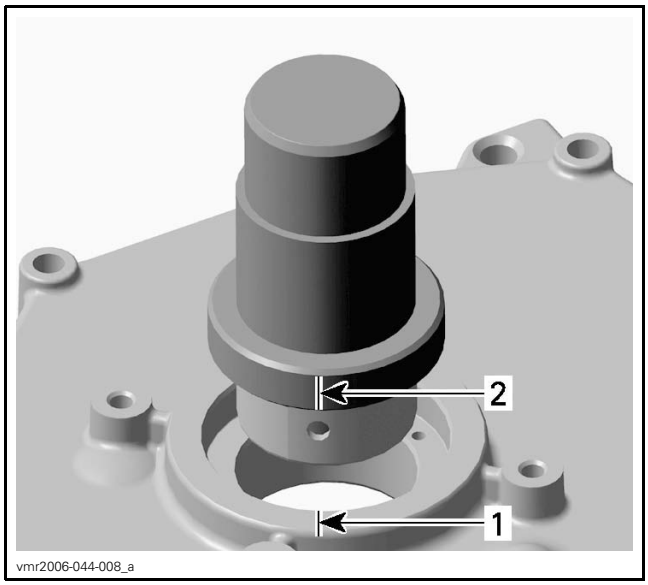
Plain Bearing Installation

NOTE: Do not lubricate plain bearings or PTO cover for installation.

Install plain bearings in a cold PTO cover.

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

1. Mark position of oil bore on PTO cover and on plain bearing remover/installer.
2. Align mark on plain bearing remover/installer with mark on PTO cover.



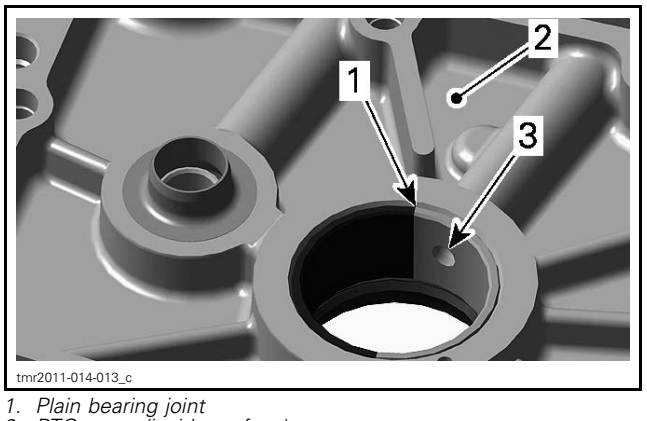
1. *Mark position of oil bore on PTO cover*
2. *Mark position of oil bore on plain bearing remover/installer*

NOTICE Misalignment of plain bearing and PTO cover oil bores will prevent proper oil supply to plain bearings.

3. Carefully press in the plain bearings in the same direction as during disassembly, from the outside towards the inside.

NOTE: Support PTO cover using a suitable support with a straight surface to prevent damage of the sealing surface.

NOTICE The joining surfaces of the plain bearings must be positioned near the oil bore in a counterclockwise direction.



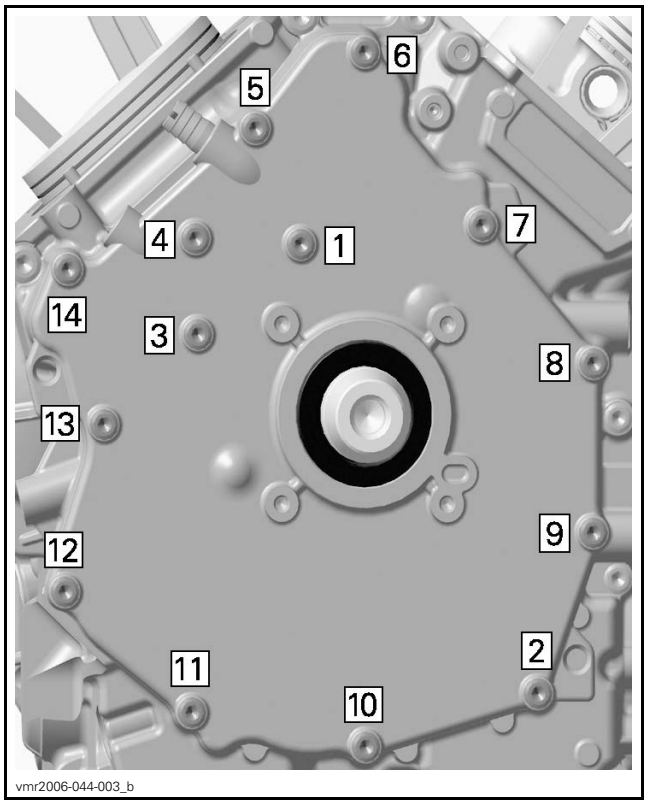
1. *Plain bearing joint*
2. *PTO cover (inside surface)*
3. *Oil bore*

PTO Cover Installation

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

NOTE: At installation, replace PTO cover gasket and oil seal.

Tighten PTO cover screws following the sequence illustrated.



TIGHTENING SEQUENCE

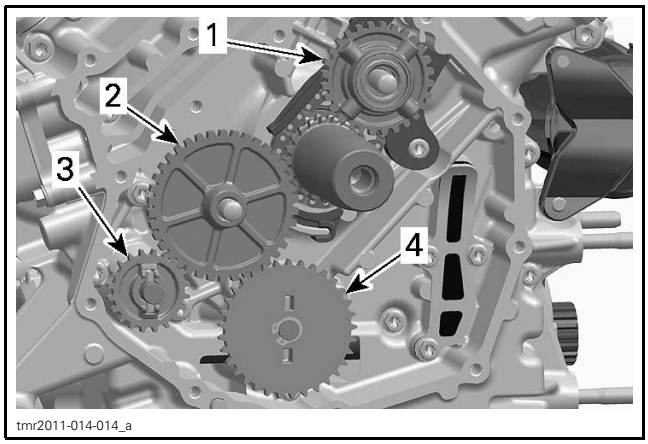
PTO COVER SCREWS	
Tightening torque	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

DRIVE GEARS

Drive Gears Location

The engine is equipped with a breather gear which prevents engine oil from seeping out through the breathing system into the air intake system.

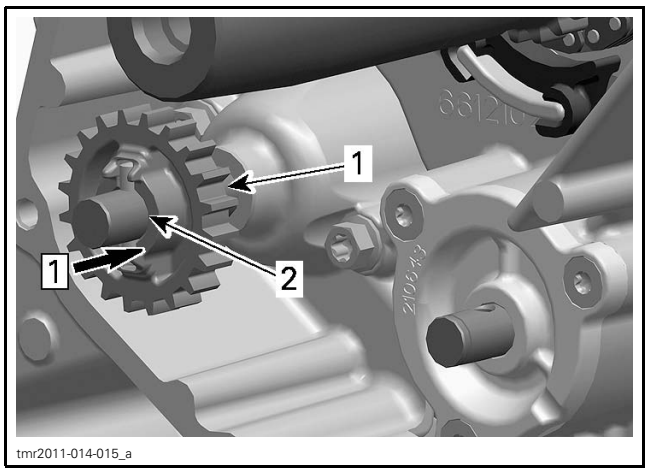
The drive gears are located on the engine PTO side behind the PTO cover.



1. Breather gear
2. Intermediate gear
3. Water pump drive gear
4. Oil pump drive gear

Drive Gears Removal

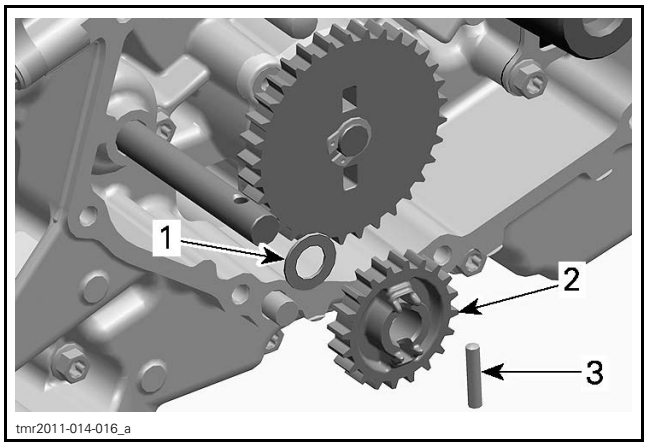
1. Remove PTO cover, refer to *PTO COVER* in this subsection.
2. Withdraw intermediate gear and breather gear.
3. Remove oil pump drive gear, refer to *OIL PUMP* in the *LUBRICATION SYSTEM* subsection.
4. To remove water pump drive gear, pull the shaft assembly slightly out and turn it about one tooth until it stays out.
5. Then push water pump drive gear in.



Step 1: Push gear in

1. Water pump drive gear
2. Intermediate shaft

6. Remove needle pin and pull water pump drive gear out.
7. Remove thrust washer from intermediate shaft.



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

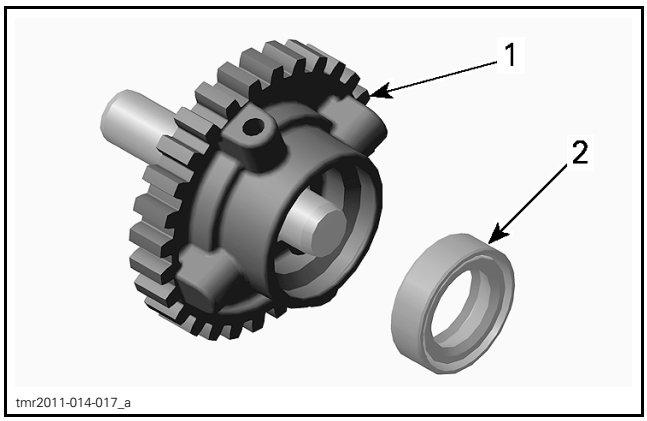
Drive Gears Inspection

Intermediate Gear/Oil Pump Drive Gear/Water Pump Drive Gear

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

Breather Gear

Check if oil seal is brittle, hard or damaged. Replace if necessary.



1. Breather gear
2. Oil seal

Inspect gear for wear or other damage.

Check ball bearing for excessive play and smooth operation. Replace breather gear assembly if necessary.

Drive Gears Installation

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

Adequately oil the ball bearing of the breather gear.

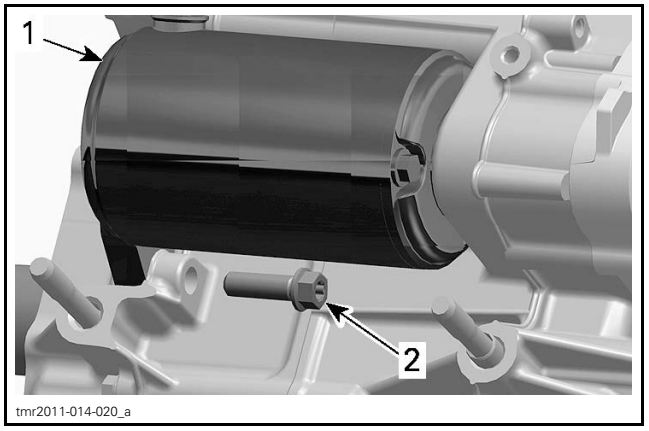
CRANKCASE

Crankcase Disassembly

1. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection and carry out the following:
   1.1 Drain cooling system.
   1.2 Drain engine oil.
   1.3 Drain gearbox oil.
2. Lock crankshaft. Refer to *CRANKSHAFT LOCKING PROCEDURE* in the this subsection.
3. Refer to *CONTINUOUSLY VARIABLE TRANSMISSION (CVT)* subsection and remove the following parts:
   – CVT cover
   – Drive pulley
   – Driven pulley
   – CVT air guide.
4. Remove engine from vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
5. Remove gearbox from engine.
6. Refer to *MAGNETO SYSTEM* subsection and remove the following parts:
   – Magneto cover
   – Rotor with sprag clutch gear
   – Starter drive gears.
7. Refer to applicable procedures in this subsection and remove the following parts:
   – PTO cover
   – Drive gears
   – Bearing covers of engine drive shaft.
8. Refer to *TIMING CHAIN* subsection and remove the following parts:
   – Chain tensioners
   – Camshaft timing gears
   – Timing chains
   – Timing chain guides.
9. Refer to *TOP END* subsection and remove the following parts:
   – Front cylinder head
   – Rear cylinder head
   – Cylinders.
10. Refer to *COOLING SYSTEM* subsection and remove the following parts:
    – Water pump housing.
11. Refer to *LUBRICATION SYSTEM* subsection and remove the following parts:
    – Oil filter
    – Oil cooler
    – Oil pump drive gear.

NOTE: Oil pump removal from crankcase is not necessary, but recommended to see condition of oil pump. Refer to *LUBRICATION SYSTEM* subsection.

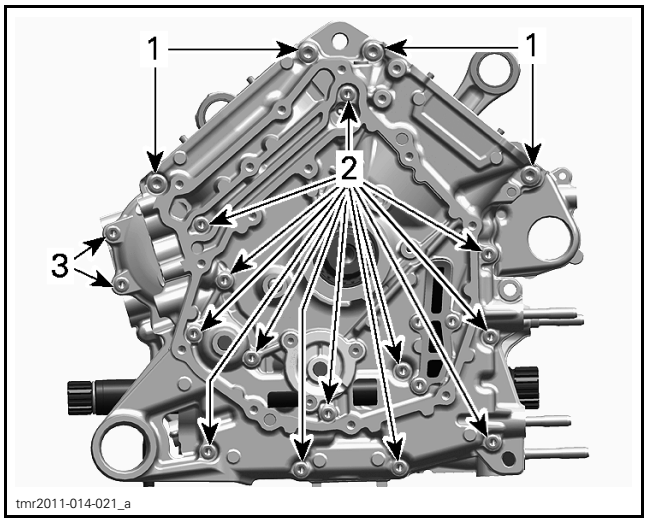
12. Remove electric starter.



1. Electric starter
2. Screw

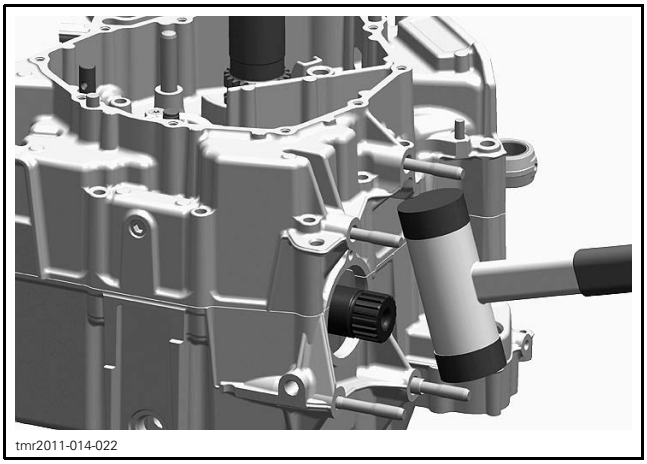
NOTE: Before splitting the crankcase, measure crankshaft axial play. Refer to *CRANKSHAFT* in this subsection.

13. Remove crankcase retaining screws.



1. Four screws M8 x 65
2. 13 screws M6 x 75
3. Two screws M6 x 25

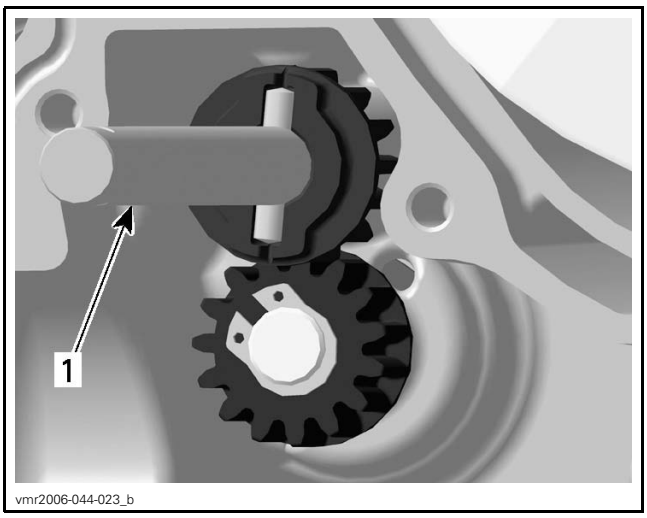
14. Carefully split crankcase halves using a screwdriver and a soft hammer.


tmr2011-014-022

NOTE: During disassembly, do not damage the sealing surfaces of the crankcase halves.

15. Pull crankshaft out of crankcase.

16. Remove the water pump intermediate shaft.

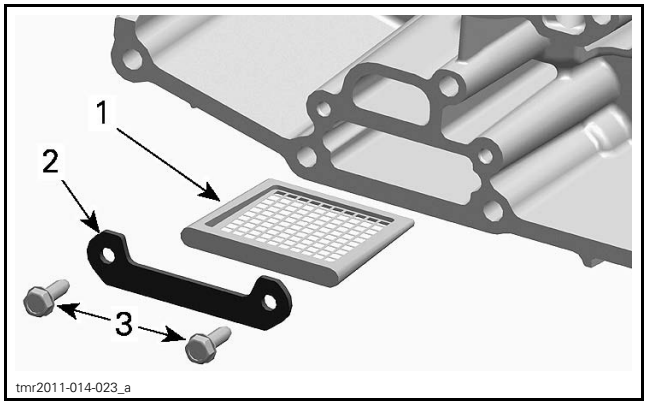


vmr2006-044-023_b

1. Water pump intermediate shaft

17. Remove engine oil strainer.

NOTE: Oil strainer removal for inspection and cleaning is recommended. Refer to *LUBRICATION SYSTEM* subsection.



tmr2011-014-023_a

1. Engine oil strainer
2. Retaining plate
3. Screws

Crankcase Cleaning

Clean crankcase using a part cleaner.

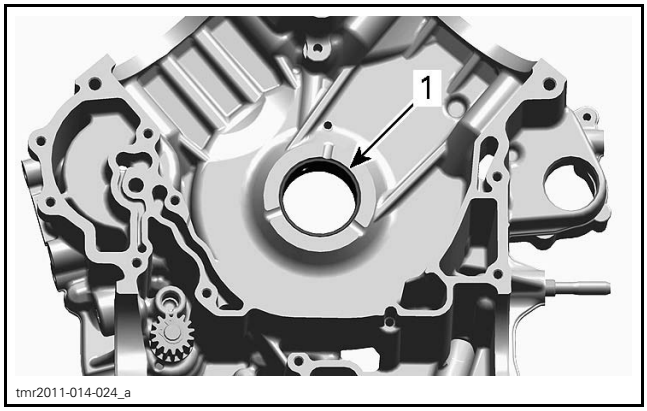
Dry crankcase using compressed air.

Blow low pressure filtered air through the oil supply lines.

Crankcase Inspection

Check crankcase halves for cracks or other damage. Replace if damaged.

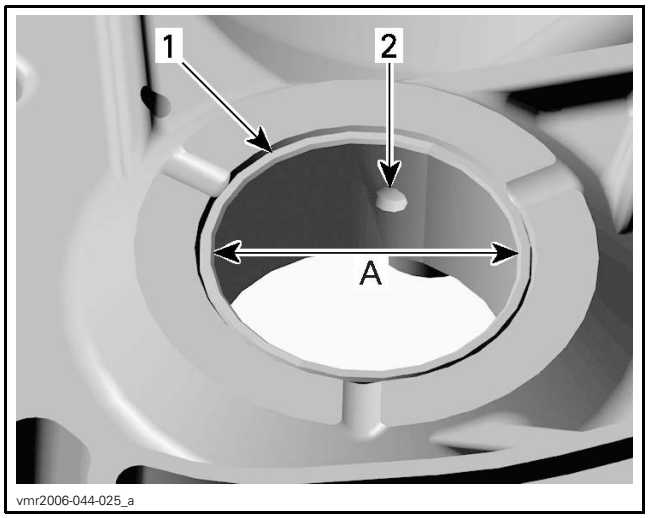
Check MAG and PTO plain bearings for scoring or other damages.



tmr2011-014-024_a

1. Plain bearing

Measure plain bearing inside diameter and compare to PTO/MAG main journal diameters of crankshaft, refer to *CRANKSHAFT* in this subsection. Replace if the measurements are out of specification.



1. Plain bearing
2. Oil bore
A. Measure plain bearing inside diameter

MAIN BEARING INSIDE DIAMETER (PTO/MAG)	
SERVICE LIMIT	42.100 mm (1.6575 in)

Plain Bearing Replacement (Main)

Plain Bearing Removal

NOTICE Always properly support crankcase halves when removing plain bearings. Damage to crankcase halves may occur if this procedure is not performed correctly.

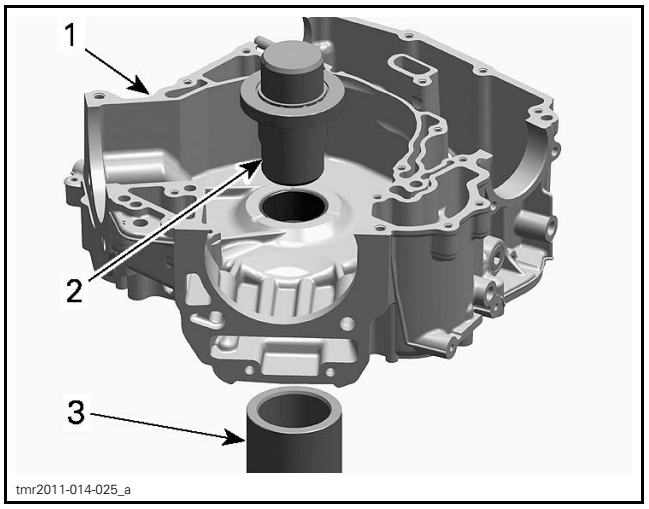
NOTE: Always use a press for removal of plain bearings.

Carefully press the plain bearings out from the crankcase half from the inside towards the outside.

NOTE: Place an appropriate support under crankcase halves before removing plain bearings.

REQUIRED TOOLS	
CRANKCASE SUPPORT MAG/PTO (P/N 529 036 031)	
PLAIN BEARING REMOVER/INSTALLER (P/N 529 035 917)	

NOTE: During disassembly, make sure not to damage the sealing surfaces of the crankcase halves.



PRESS PLAIN BEARINGS OUTSIDE
1. Crankcase half
2. Plain bearing remover/installer
3. Crankcase support sleeve (P/N 529 036 031)

Plain Bearing Installation (Main)

NOTICE Unless otherwise instructed, never use a hammer to install plain bearings. Aways use a press.

During reassembly, make sure not to damage the sealing surfaces of the crankcase halves.

NOTE: Place the proper crankcase support sleeve under crankcase halves before installing the plain bearings, refer to *PLAIN BEARING REMOVAL PROCEDURE* in this subsection.

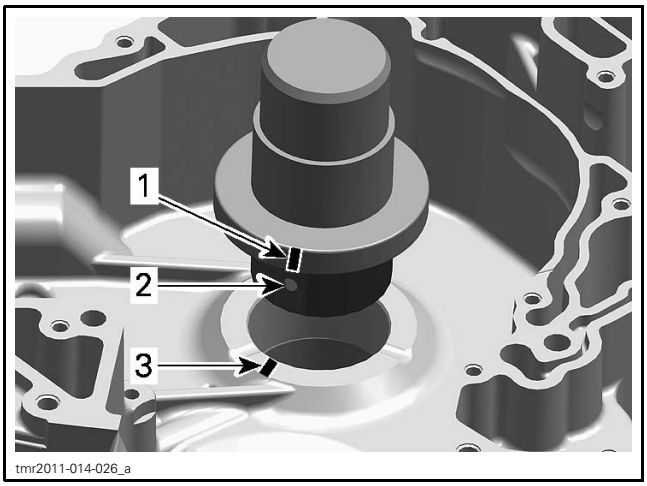
Install plain bearings in a cold crankcase.

NOTE: Do not lubricate plain bearings and/or crankcase for installation.

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

NOTE: Use an O-ring (Ø 42 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.

1. Mark position of plain bearing oil bore on plain bearing remover/installer.
2. Mark position of oil bore on crankcase half.
3. Align mark on plain bearing remover/installer with mark on crankcase half.

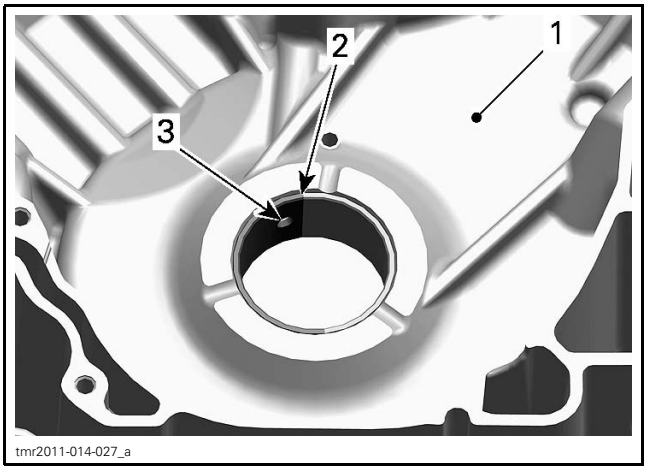


1. *Oil bore position marked on plain bearing remover/installer*
2. *Plain bearing oil bore*
3. *Oil bore position marked on crankcase*

NOTICE Misalignment of the plain bearing and crankcase oil bores will prevent proper oil supply to plain bearings.

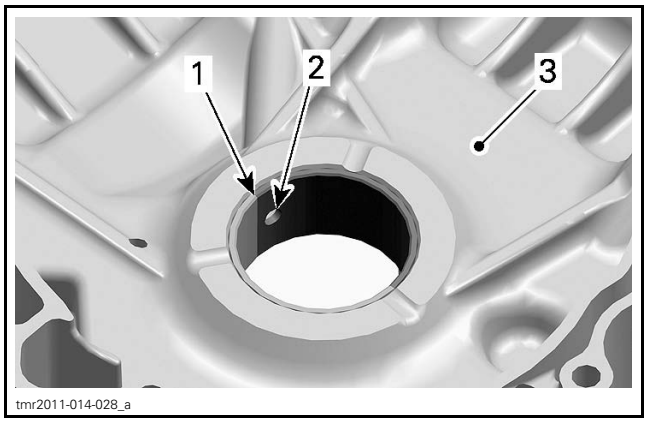
4. Carefully press in the plain bearings from inside the crankcase towards the outside.

NOTICE The joint of the plain bearings in crankcase half MAG side must be positioned near the oil bore in a clockwise direction.



1. *Crankcase half MAG (inside surface)*
2. *Partition*
3. *Oil bore*

NOTICE The joint of the plain bearings in the crankcase half PTO side must be positioned near the oil bore in the counterclockwise direction.



1. *Plain bearing joint*
2. *Oil bore*
3. *Crankcase half PTO (inside surface)*

Crankcase Assembly

The assembly of crankcase is essentially the reverse of removal procedure. However, pay attention to the following details.

Clean oil passages and make sure they are not clogged.

Clean all metal components in a solvent.

Install a NEW crankcase gasket.

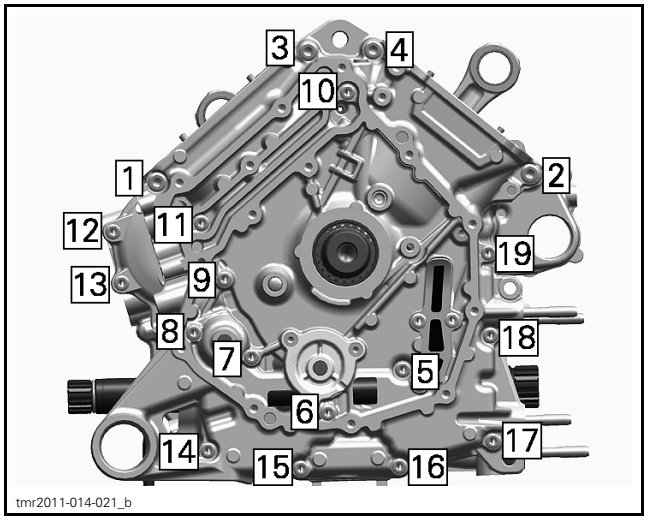
Oil the plain bearings before mounting the crankshaft.

Reinstall crankshaft, see procedure in this subsection

Properly reinstall engine oil strainer and screws. Refer to *LUBRICATION SYSTEM* subsection.

Reinstall water pump intermediate shaft and gears, refer to *WATER PUMP GEARS* in the *COOLING SYSTEM* subsection.

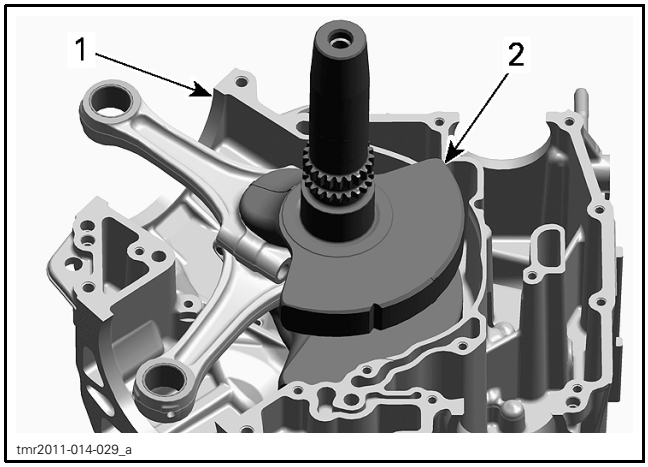
Tighten crankcase retaining screws as per tightening sequence in following illustration.



TIGHTENING SEQUENCE

CRANKCASE SCREWS	
Tightening torque - M6	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)
Tightening torque - M8	25 N•m ± 3 N•m (18 lbf•ft ± 2 lbf•ft)

CRANKSHAFT



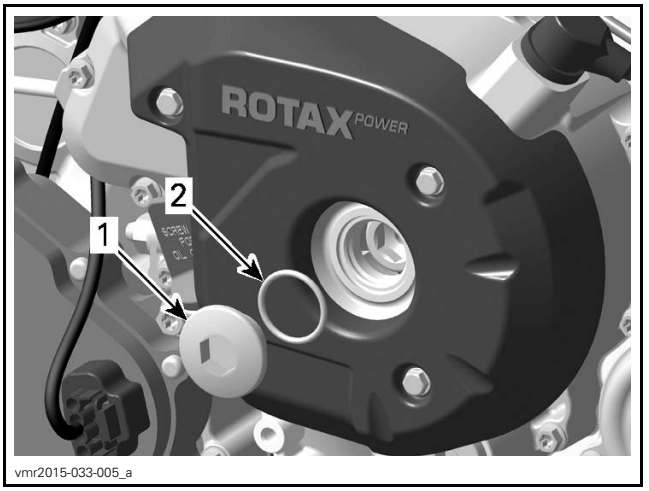
1. Crankcase MAG
2. Crankshaft

Crankshaft Locking Procedure

NOTE: When the crankshaft is locked, the rear piston no. 2 is at TDC (top dead center). The crankshaft cannot be locked with front piston no. 1 at TDC.

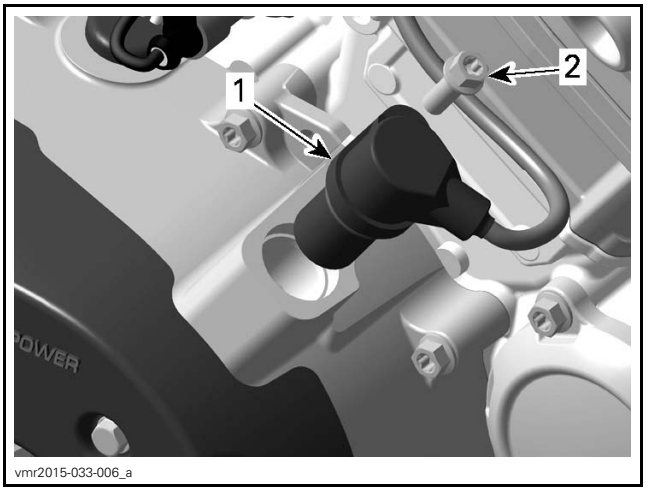
NOTICE To see if the rear piston no. 2 is at TDC ignition, refer to *CAMSHAFT TIMING GEAR* in the *TIMING CHAIN* subsection.

1. Remove spark plug cables and spark plugs from both cylinders.
2. Remove screw plug and O-ring from magneto cover.



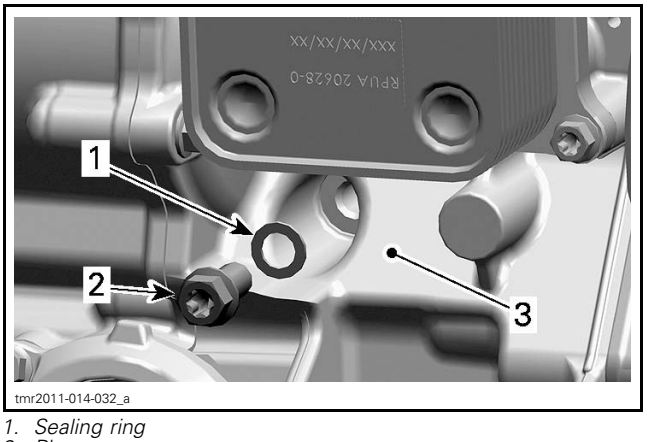
1. Plug screw
2. O-ring

3. Remove crankshaft position sensor.



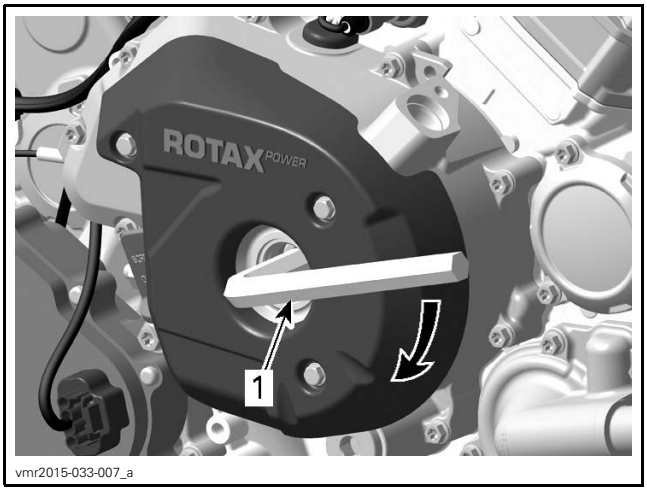
1. Crankshaft position sensor
2. Screw

4. Remove screw plug and discard sealing ring.



1. Sealing ring
2. Plug screw
3. Crankcase PTO side, front side

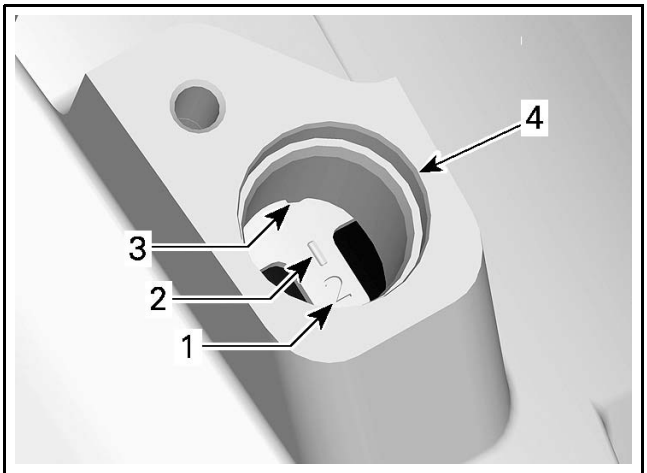
5. Use a 14 mm Allen key to turn crankshaft until the rear piston no. 2 is at TDC.



vmr2015-033-007_a

1. Allen key 14 mm

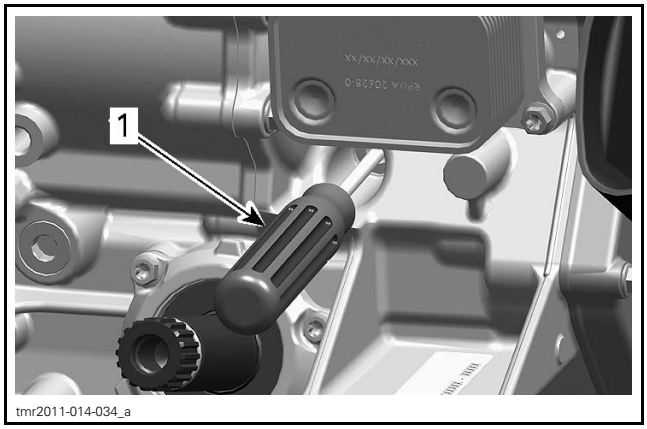
NOTE: When the piston no. 2 is at TDC, the number 2 piston index mark on the magneto flywheel and the notch on the magneto cover are aligned.



vmr2007-037-008_b

CYLINDER 2 AT TDC
1. Number 2 piston identifier
2. Index mark on magneto flywheel
3. Notch on magneto cover
4. CPS bore in magneto cover

6. Use a screwdriver to check if the groove in the crankshaft is aligned with the crankshaft locking tool orifice.

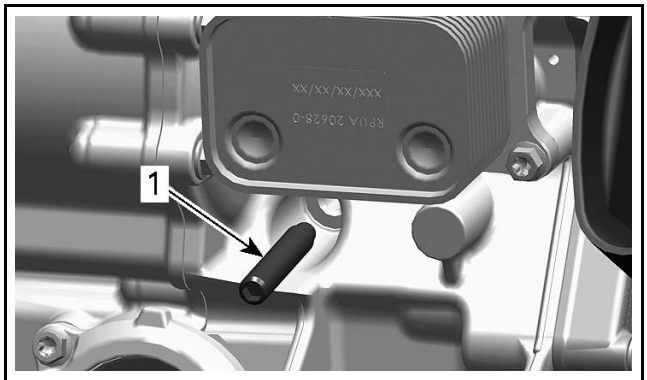


tmr2011-014-034_a

1. Screwdriver

7. Lock crankshaft.

REQUIRED TOOL	
CRANKSHAFT LOCKING BOLT (P/N 529 035 617)	



tmr2011-014-035_a

1. Crankshaft locking bolt

8. Gradually insert the tool in the crankshaft groove. Make sure that the tool tip enters the groove and does not jam on the crankshaft balancer surface.

Crankshaft Removal

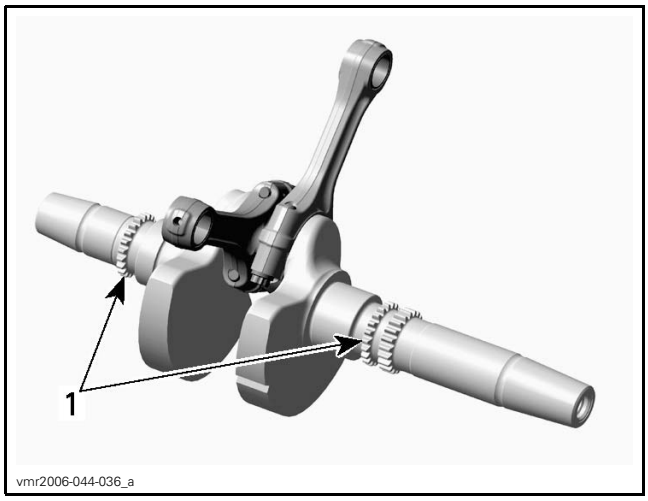
Refer to *CRANKCASE*.

Crankshaft Inspection

NOTE: Check each crankshaft bearing journal for scoring, scuffing, cracks or other signs of wear.

NOTE: Replace crankshaft if the crankshaft timing gears are worn or otherwise damaged.

NOTICE **Components out of specifications must always be replaced. If this is not observed, severe damage may be caused to the engine.**



1. Crankshaft timing gears

Crankshaft Axial Play

NOTE: Axial play must be measured before splitting the crankcase.

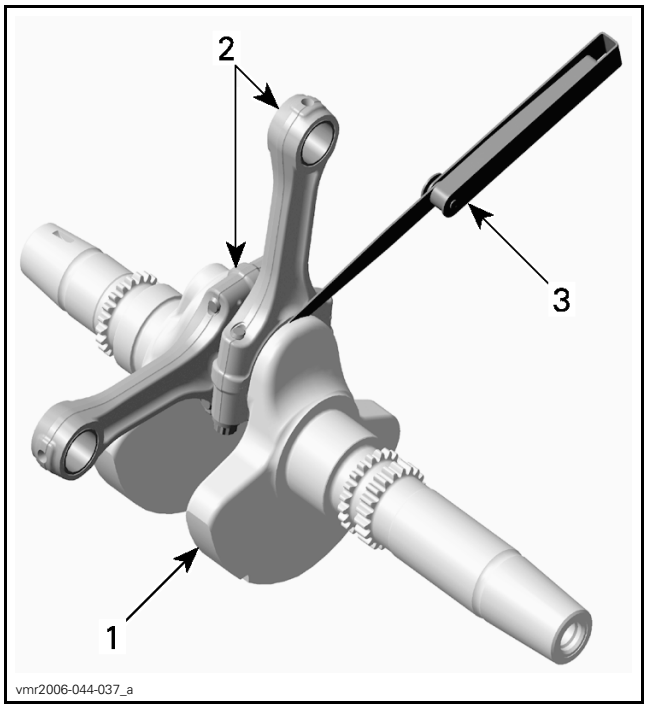
Measure axial play on PTO end of crankshaft using a dial indicator.

CRANKSHAFT AXIAL PLAY	
NEW	0.200 mm to 0.500 mm (.008 in to .02 in)
SERVICE LIMIT	0.600 mm (.024 in)

If axial play is out of specification, replace crankcase and/or crankshaft.

Connecting Rod Big End Axial Play

Using a feeler gauge, measure between face of connecting rods and crankshaft counterweight. If the measurement exceeds specified tolerance, replace the crankshaft.



1. Crankshaft
2. Connecting rods
3. Feeler gauge

CONNECTING ROD BIG END AXIAL PLAY	
650 ENGINES	
NEW	0.200 mm to 0.500 mm (.008 in to .02 in)
SERVICE LIMIT	0.600 mm (.024 in)
1000 ENGINE	
NEW	0.250 mm to 0.550 mm (.01 in to .022 in)
SERVICE LIMIT	0.600 mm (.024 in)

Connecting Rod/Piston Pin Clearance

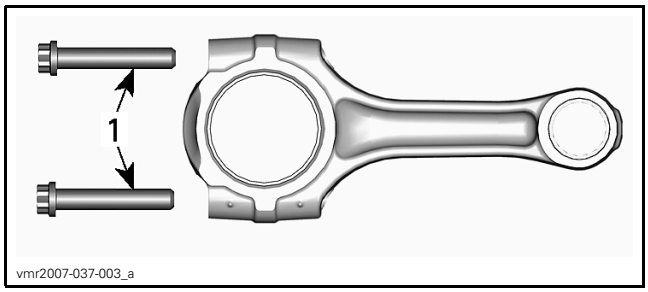
Refer to *TOP END* subsection.

Connecting Rod Big End Radial Play

NOTE: Prior to removing connecting rod from the crankshaft, mark big end halves together to ensure a correct reinstallation (cracked surface fits in only one position).

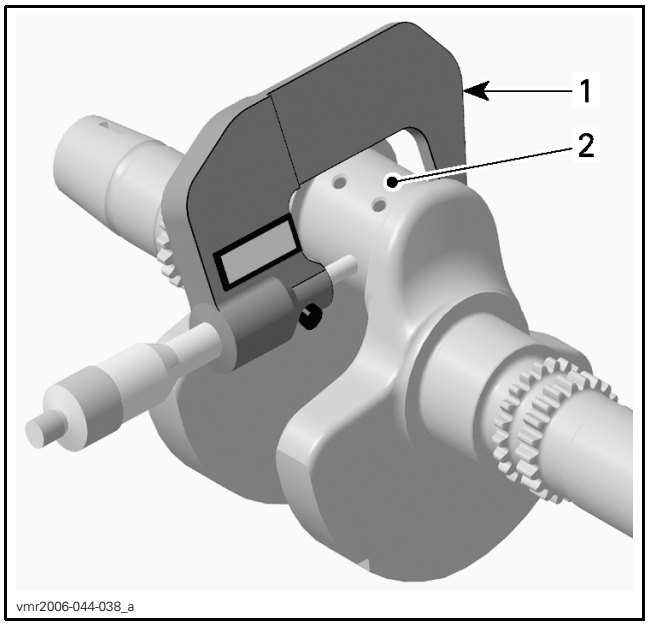
1. Remove connecting rods from crankshaft.

NOTICE Connecting rod screws are not reusable. Always discard screws and replace with NEW ones. It is recommended to install new plain bearings when reinstalling connecting rods.



1. Connecting rod screws

2. Measure crankpin. Compare to inside diameter of connecting rod big end.



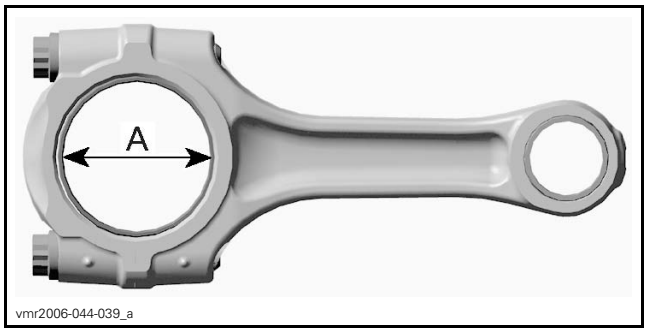
1. Micrometer
2. Crankpin

CRANK PIN DIAMETER	
650 ENGINE	
NEW	40.009 mm to 40.025 mm (1.5752 in to 1.5758 in)
SERVICE LIMIT	39.990 mm (1.5744 in)
1000 ENGINE	
NEW	41.986 mm to 42.010 mm (1.653 in to 1.6539 in)
SERVICE LIMIT	41.967 mm (1.6522 in)

If the crank pin diameter is out of specification, replace crankshaft.

NOTE: To measure the connecting rod big end diameter, use the OLD connecting rod screws.

3. Install the OLD plain bearings as they were mounted initially.
4. Carry out the tightening procedure described in *CRANKSHAFT ASSEMBLY* in this subsection.



A. Connecting rod big end plain bearing

CONNECTING ROD BIG END DIAMETER	
650 ENGINE	
SERVICE LIMIT	40.100 mm (1.5787 in)
1000 ENGINE	
SERVICE LIMIT	42.100 mm (1.6575 in)

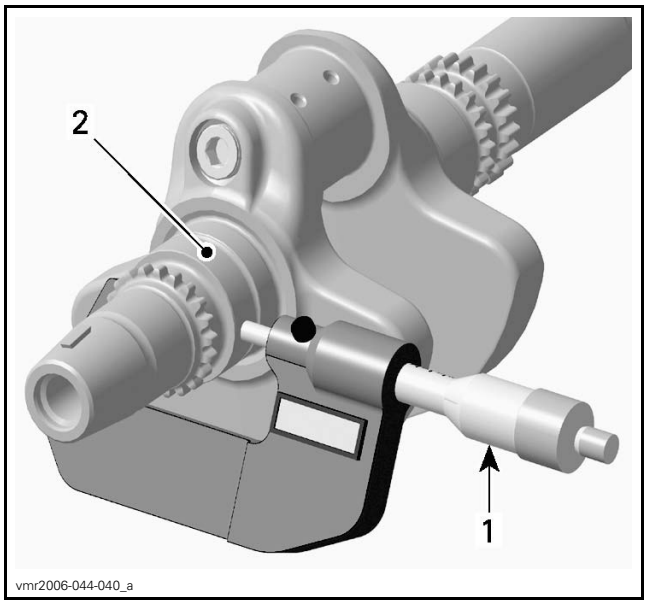
If connecting rod big end diameter is out of specification, replace plain bearings and recheck.

CONNECTING ROD BIG END RADIAL CLEARANCE	
ALL ENGINES	
SERVICE LIMIT	0.09 mm (.0035 in)

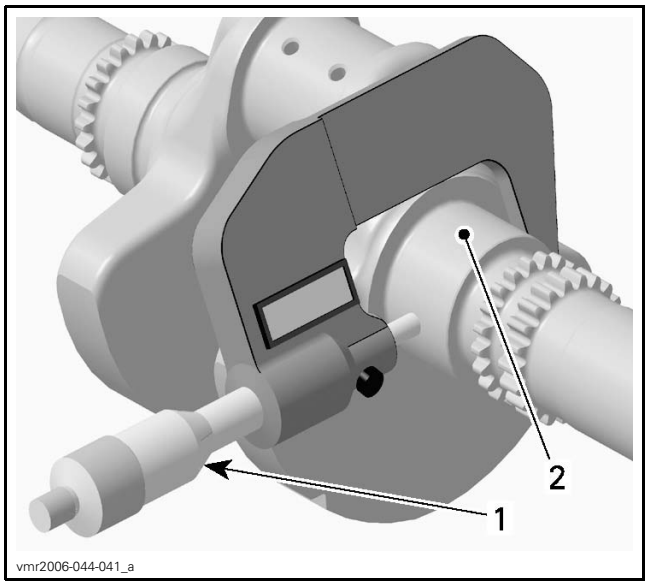
If connecting rod big end radial clearance is out of specification, replace plain bearings and recheck.

Crankshaft Radial Play MAG/PTO Side

Measure crankshaft main bearing journals on MAG and PTO sides. Compare to inside diameter of MAG and PTO plain bearings, refer to *CRANKCASE* in this subsection.



1. Micrometer
2. Crankshaft MAG side main bearing journal



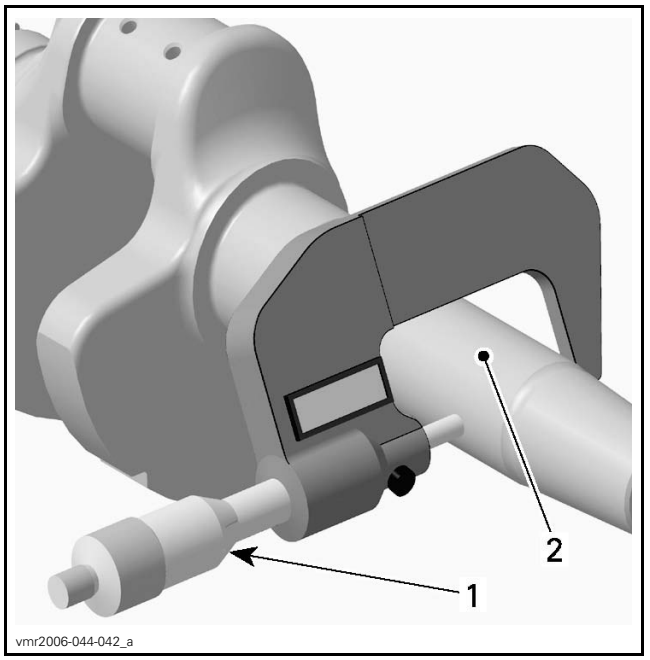
1. Micrometer
2. Crankshaft PTO side main bearing journal

CRANKSHAFT MAIN BEARING 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)

CRANKSHAFT RADIAL PLAY (MAG/PTO SIDE)	
SERVICE LIMIT	0.07 mm (.0028 in)

Crankshaft Radial Play (PTO Cover Bearing)

Measure crankshaft journal diameter (PTO cover bearing). Compare to plain bearing inside diameter (PTO cover). Refer to *PTO COVER* in this subsection.



1. Micrometer
2. Crankshaft journal (PTO support bearing)

CRANKSHAFT JOURNAL DIAMETER (PTO COVER BEARING)	
NEW	34.004 mm to 34.020 mm (1.3387 in to 1.3394 in)
SERVICE LIMIT	33.998 mm (1.3385 in)

CRANKSHAFT RADIAL PLAY (PTO COVER BEARING)	
SERVICE LIMIT	0.10 mm (.0039 in)

If crankshaft journal diameter is out of specification, replace crankshaft.

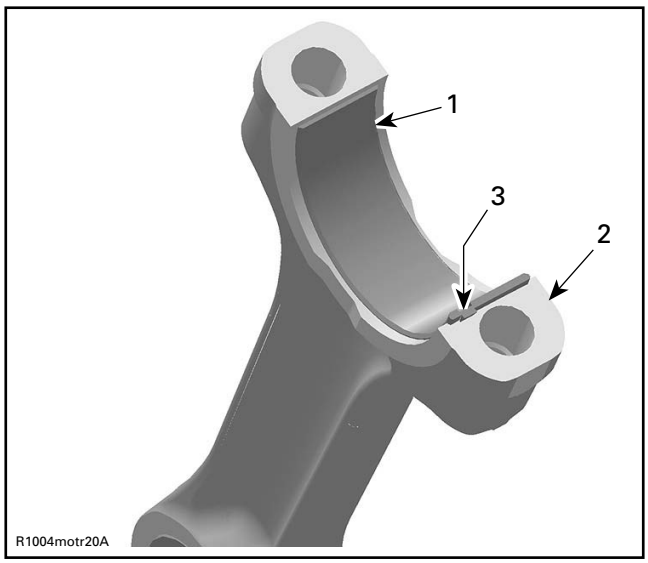
If crankshaft radial play (PTO cover bearing) is out of specification, replace plain bearings and recheck.

Crankshaft Assembly

For assembly, reverse the disassembly procedure however, pay attention to following details.

Clean the split surface on both sides (cracked area) carefully with compressed air.

Insert plain bearings in the connecting rods as illustrated.



1. *Half plain bearing of connecting rod big end*
2. *Mating surface of the connecting rod*
3. *Joining surface of plain bearing in line with connecting rod groove*

Oil the plain bearing surface of the connecting rod and crankshaft pin before installation.

NOTICE Lower cap and rod must match together since there is a cracked surface.

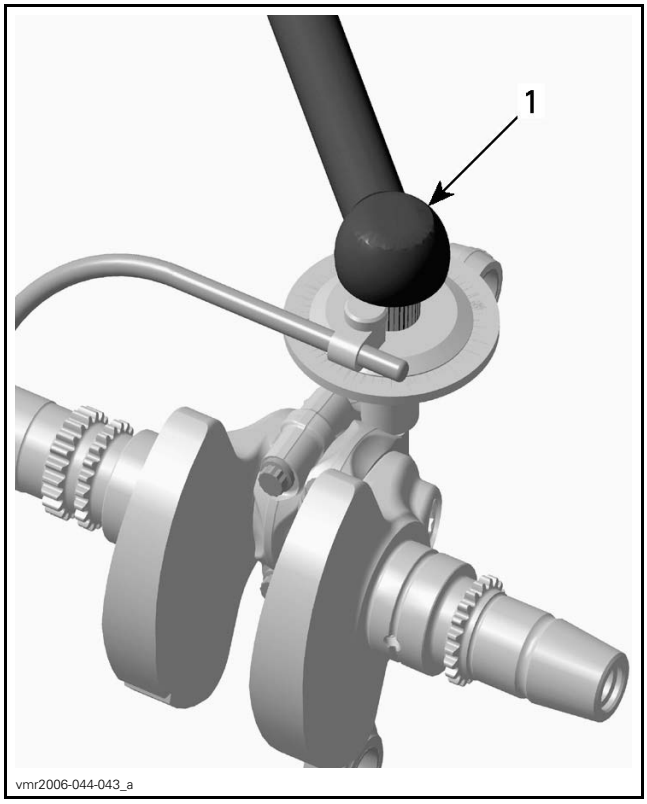
Oil NEW connecting rod screws.

Thread screws in the connecting rods, then tighten as per following procedure.

NOTICE Strictly adhere following instructions:

- Always use NEW connecting rod screws at final assembly. They are not reusable.
- 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 TOOLS
Torque wrench
Angle torque wrench



1. *Angle torque wrench*

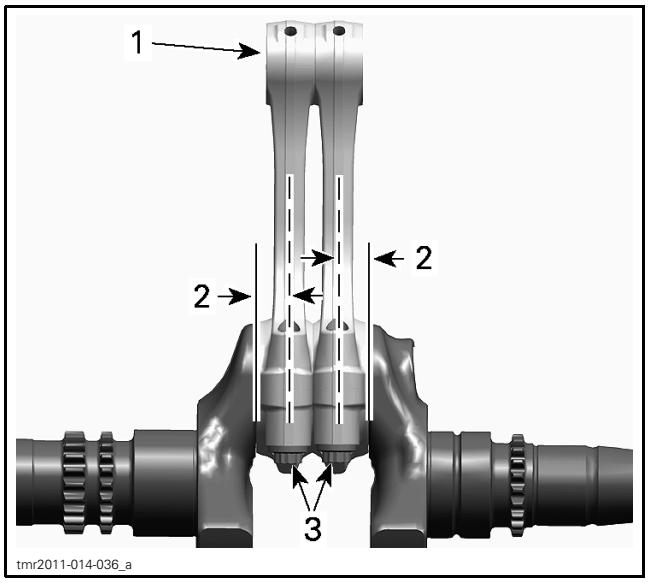
650 Engine

NEW connecting rods can be installed either way.

CONNECTING ROD SCREW 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 an additional 60 ± 5° turn using an angle torque wrench

1000 Engine

NOTICE Connecting rods are asymmetrical. There must be no gap between the small ends when they face each other.



1. Connecting rod small ends
2. Connecting rod offset
3. Connecting rod screws

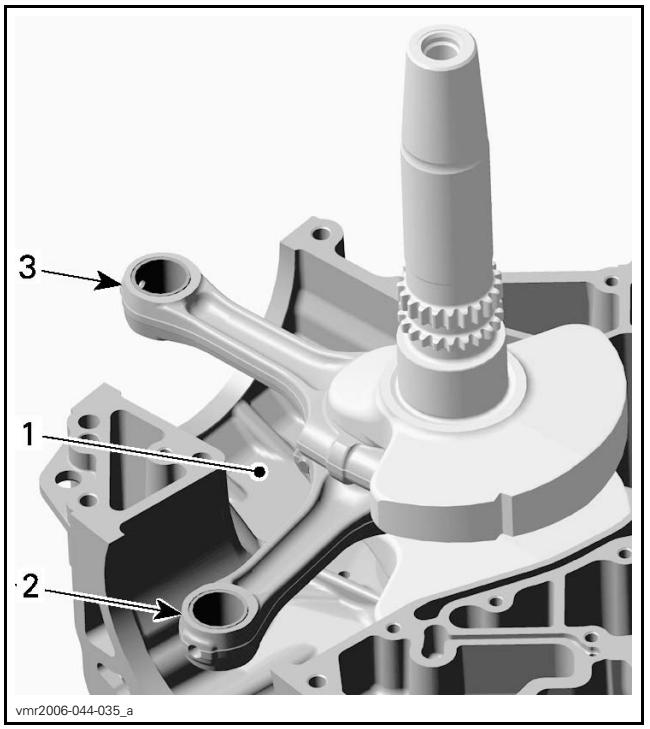
CONNECTING RODS SCREWS TIGHTENING SEQUENCE	
STEP 1	Tighten to 1/2 of specified torque
STEP 2	Tighten to 30 N•m ± 2 N•m (22 lbf•ft ± 1 lbf•ft)
STEP 3	Torque by an additional 90 ± 5° turn using an angle torque wrench

Crankshaft Installation

For installation of crankshaft in crankcase reverse the removal procedure. However, pay attention to the following details.

Do not interchange the connecting rods of pistons 1 and 2 during installation.

NOTICE **Observe the correct installation position when fitting the crankshaft with the connecting rods. The connecting rod MAG side has to face cylinder no. 1.**



1. Crankcase half MAG side
2. Connecting rod cylinder 1
3. Connecting rod cylinder 2

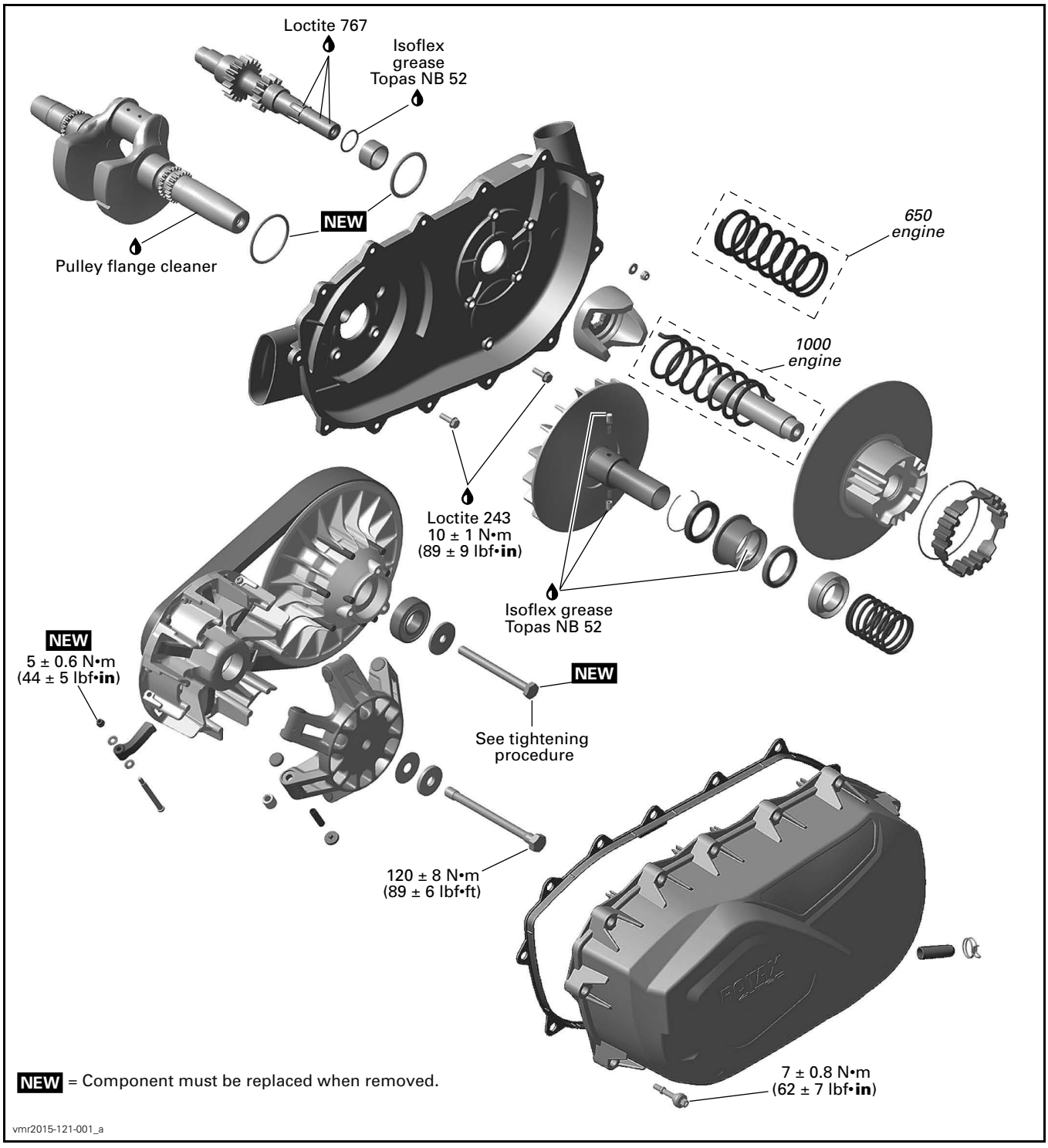
CONTINUOUSLY VARIABLE TRANSMISSION (CVT) (1000)

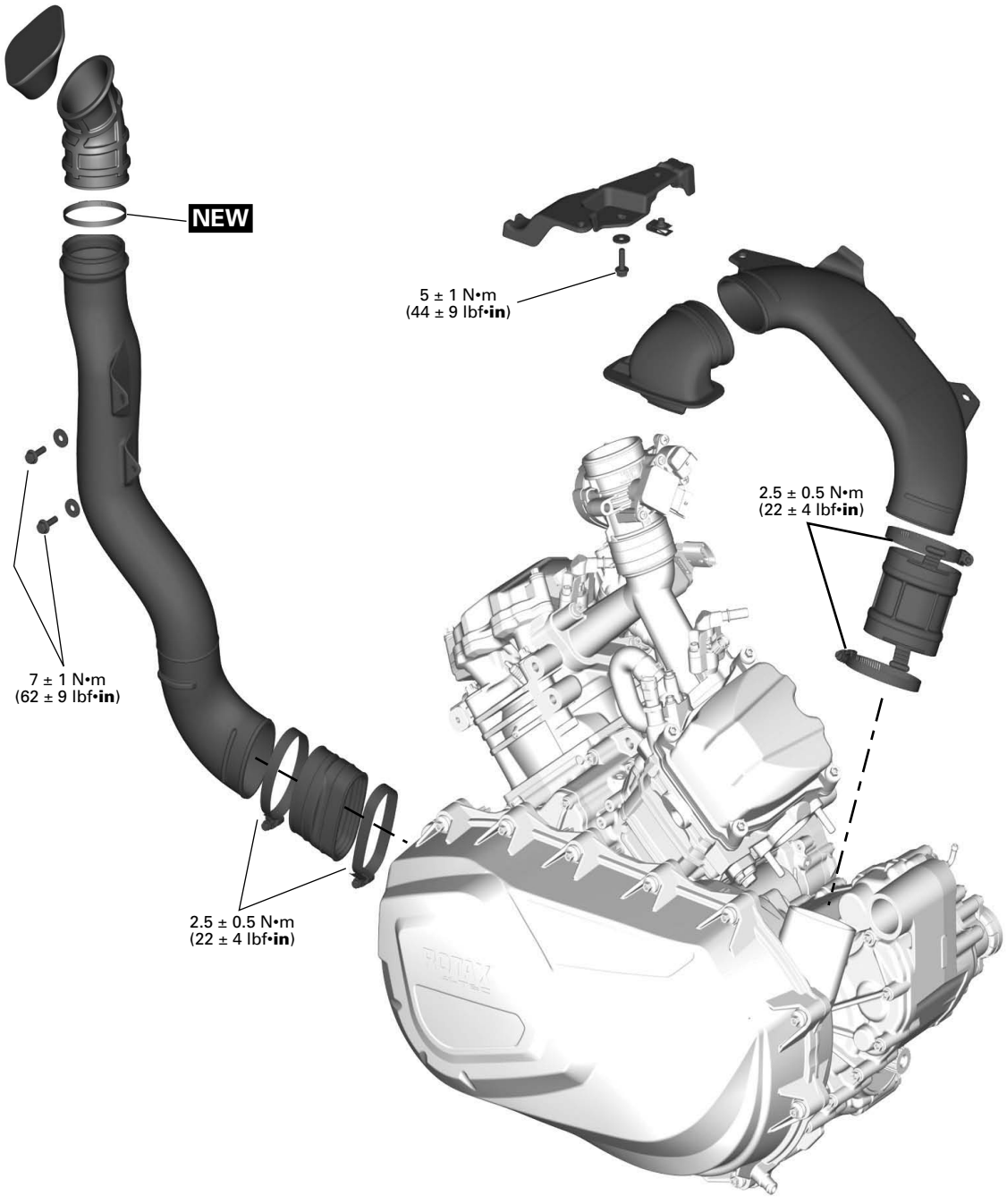
SERVICE TOOLS

Description	Part Number	Page
CLUTCH HOLDER	529 036 238	298, 305, 311–312
CLUTCH PULLER	529 035 746	298
PULLER/LOCKING TOOL	529 036 098	297, 312

SERVICE PRODUCTS

Description	Part Number	Page
ISOFLEX GREASE TOPAS NB 52	293 550 021	304
PULLEY FLANGE CLEANER	413 711 809	300, 307, 310


Loctite 767
Isoflex grease Topas NB 52
NEW
Pulley flange cleaner
650 engine
1000 engine
Loctite 243
10 ± 1 N•m
(89 ± 9 lbf•in)
Isoflex grease Topas NB 52
NEW
5 ± 0.6 N•m
(44 ± 5 lbf•in)
NEW
See tightening procedure
120 ± 8 N•m
(89 ± 6 lbf•ft)
7 ± 0.8 N•m
(62 ± 7 lbf•in)
NEW = Component must be replaced when removed.
vmr2015-121-001_a



NEW = Component must be replaced when removed.

vmr2015-121-205_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.

⚠ 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.

⚠ WARNING

The clutch assembly is a precisely balanced unit. Never replace parts with used parts from another clutch assembly.

PROCEDURES

CVT COVER

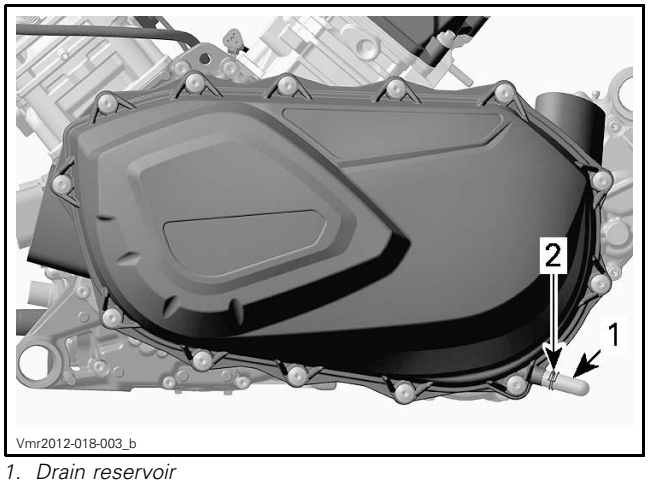
CVT Cover Access

Remove LH footrest panel, refer to *BODY* subsection.

CVT Cover Draining

If water is present in CVT cover, it can be drained as follows:

1. Remove drain reservoir from CVT cover.



1. Drain reservoir
2. Spring clip

2. Let water drain from CVT cover.

3. Reinstall drain reservoir.

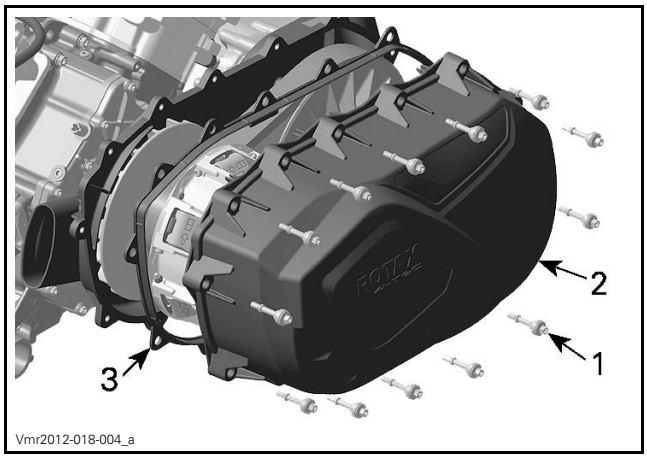
NOTICE If an appreciable amount of water or any debris entered the CVT cover, CVT must be cleaned and inspected.

CVT Cover Removal

Remove CVT cover screws.

NOTE: Do not use and impact tool to remove CVT cover screws. To support the CVT cover remove the top center screw last.

Remove the CVT cover and its gasket.



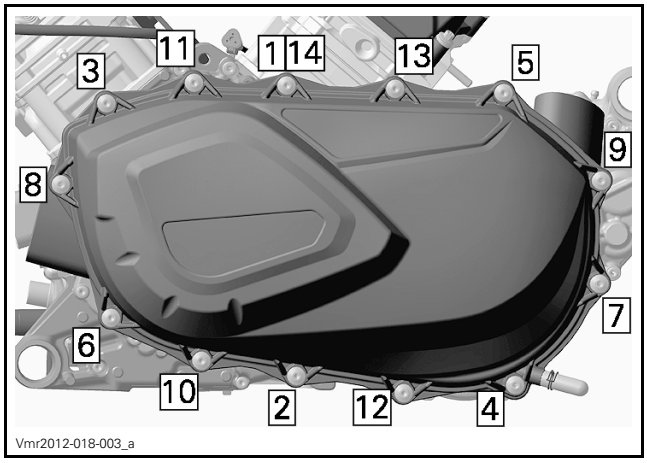
1. CVT cover screw
2. CVT cover
3. Gasket

CVT Cover Installation

Install the top center screw of first.

NOTE: Do not use and impact tool to install CVT cover screws.

Tighten the CVT cover screws as per following sequence.



CVT COVER TIGHTENING SEQUENCE

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

DRIVE BELT

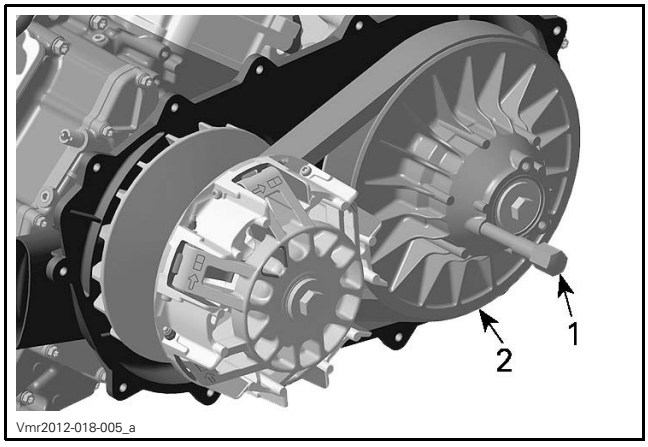
Drive Belt Removal

NOTICE In case of a drive belt failure, the CVT, cover, drain reservoir and air outlet must be cleaned and inspected for obstruction.

1. Remove *CVT COVER*.
2. Open driven pulley.

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

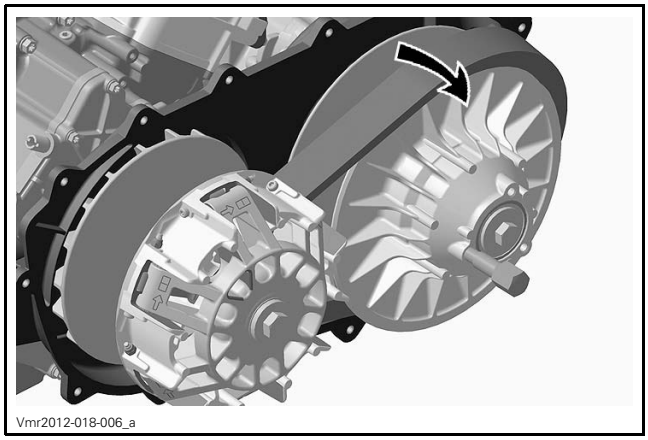
3. Screw tool in the threaded hole of driven pulley and tighten to open the pulley.



Vmr2012-018-005_a

1. Puller/locking tool
2. Fixed sheave of driven pulley

4. Slide the belt over the top edge of fixed sheave to remove it.


Vmr2012-018-006_a

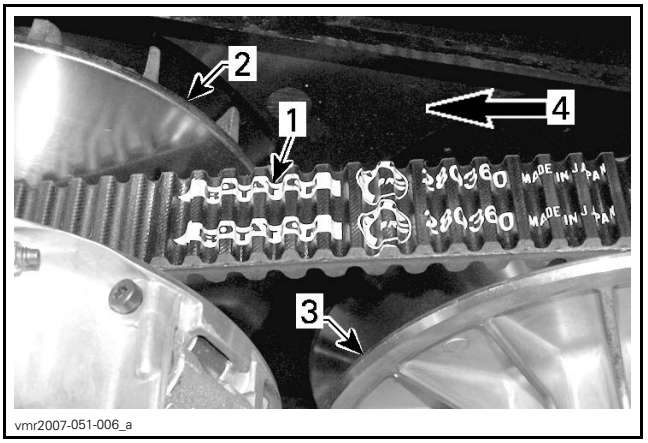
Drive Belt Inspection

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 front of the vehicle, viewed from top.



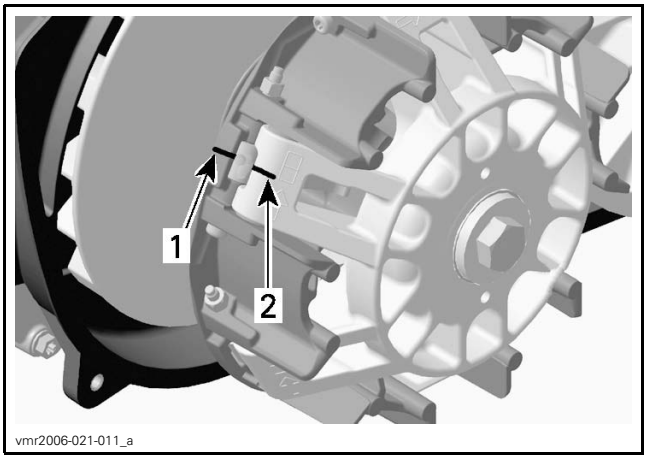
vmr2007-051-006_a

1. Arrow printed on belt
2. Drive pulley (front)
3. Driven pulley (rear)
4. Rotation direction

DRIVE PULLEY

Drive Pulley Removal

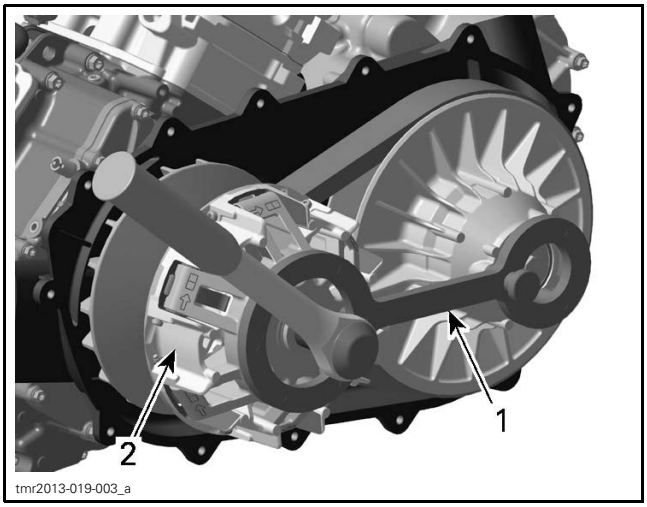
1. Remove *DRIVE BELT*, see procedure in this subsection.
2. Prior to removing the drive pulley, mark sliding sheave and governor cup to ensure correct indexation at reinstallation.



1. Mark on drive pulley sliding sheave
2. Mark on governor cup

3. Lock the drive pulley.

REQUIRED TOOL	
CLUTCH HOLDER (P/N 529 036 238)	



1. Clutch holder
2. Drive pulley sliding sheave

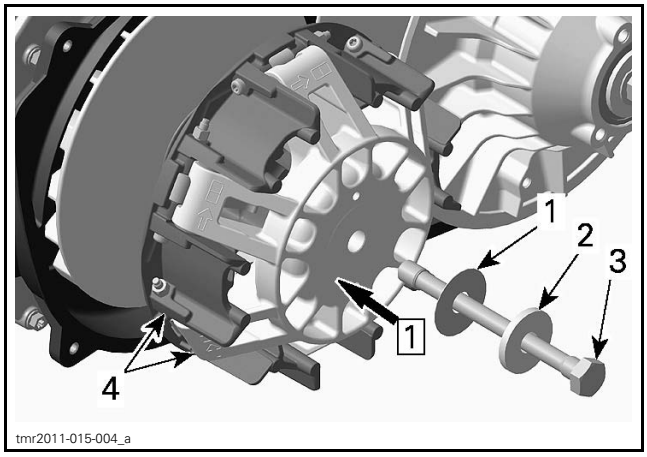
4. Loosen the drive pulley screw.

NOTICE Never use any type of impact wrench for drive pulley removal.

NOTE: Do not unscrew the drive pulley screw completely. If governor cup is stuck, hit it using a soft hammer.

5. Remove service tool.
6. Apply axial pressure with your hand on the sliding sheave and governor cup.
7. Remove drive pulley screw with its conical spring washer and thrust washer.

CAUTION Sliding sheave of drive pulley is spring loaded.



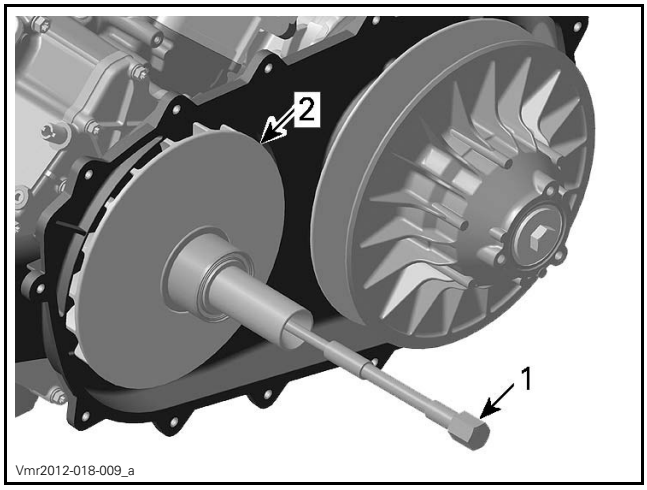
Step 1: Push

1. Thrust washer
2. Conical spring washer
3. Drive pulley screw
4. Sliding sheave with governor cup

8. Slowly release and remove sliding sheave.
9. Screw clutch puller in fixed sheave to remove fixed pulley.

NOTICE Use only recommended tool.

REQUIRED TOOL	
CLUTCH PULLER (P/N 529 035 746)	

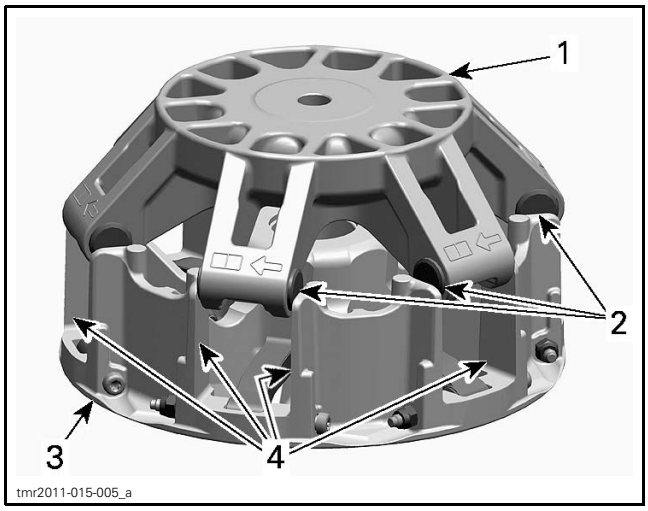


1. Drive pulley puller
2. Fixed sheave

Drive Pulley Disassembly

Governor Cup

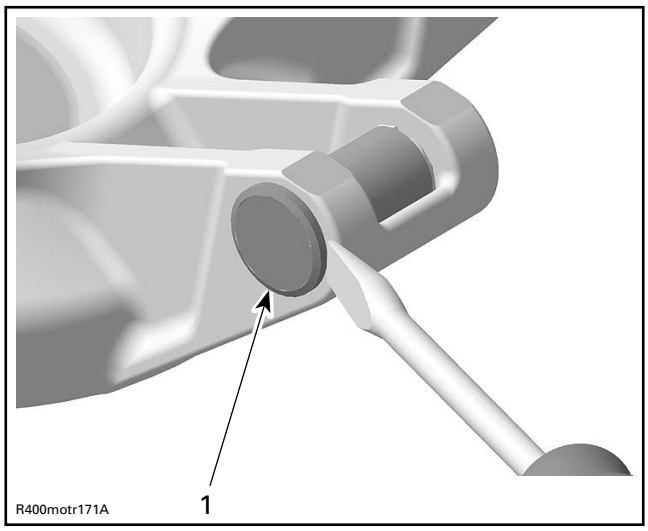
1. Carefully lift governor cup until slider shoes move to their highest position in the guides.



1. *Governor cup*
2. *Slider shoes*
3. *Sliding sheave*
4. *Guides*

NOTE: The following steps are not necessary except if roller must be removed. Refer to *INSPECTION* before proceeding.

2. Remove slider shoes from governor cup arm. Use a flat screwdriver if necessary.



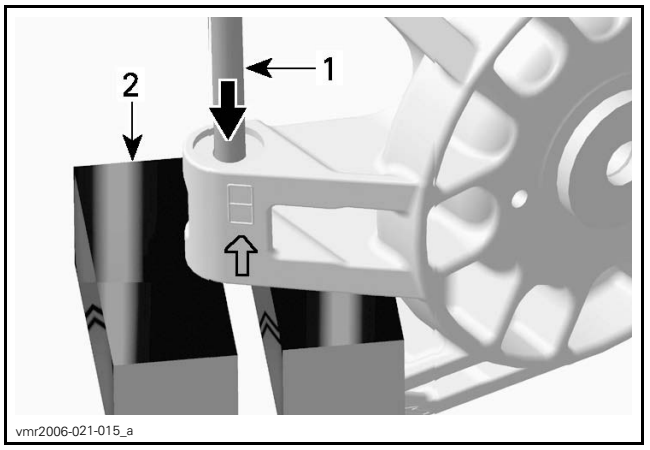
1. *Slider shoe*

3. Place the governor cup on a vice to push out the roller sleeve in the direction illustrated (against insertion arrow marked on governor cup arm). Use an appropriate punch (diameter of punch must be smaller than the diameter of the sleeve bore in the governor cup arm).

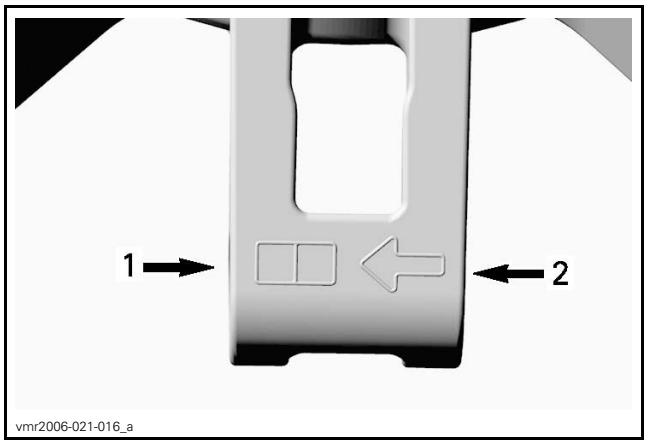
NOTICE **Do not clamp the governor cup in the vice to push out roller sleeve. Governor cup will be damaged.**

NOTE: Use protection plates to avoid marks and/or damages to the governor cup.

NOTICE Always replace all rollers as a set. Partly worn rollers may cause damage to the CVT system.

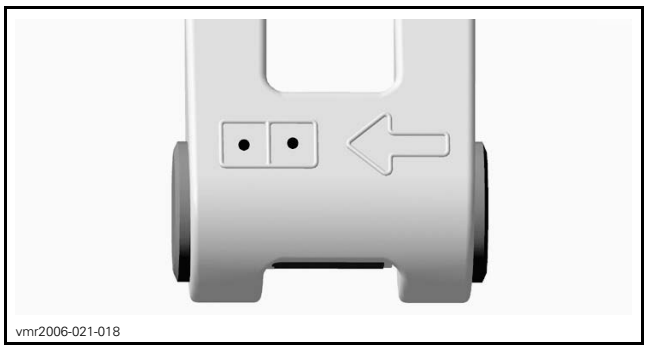


1. *Punch*
2. *Vice*



1. *Removal direction*
2. *Assembly direction*

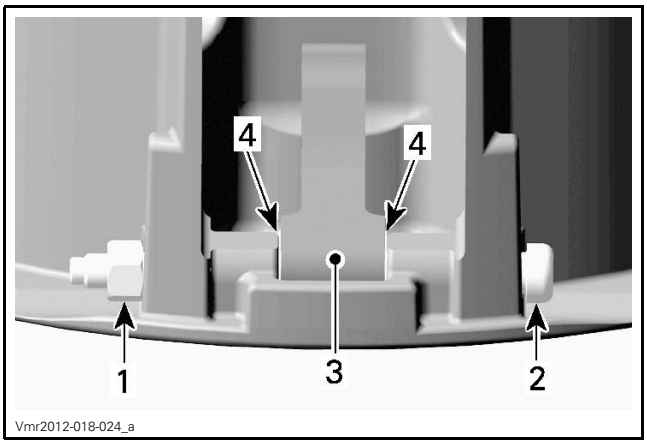
NOTE: Whenever removing a governor cup which already has two marked boxes, replace it by a new one.



Sliding Sheave

Unscrew lock nut and remove centrifugal lever pivot bolt. This drive pulley is equipped with 6 levers.

Remove centrifugal lever and both thrust washers.



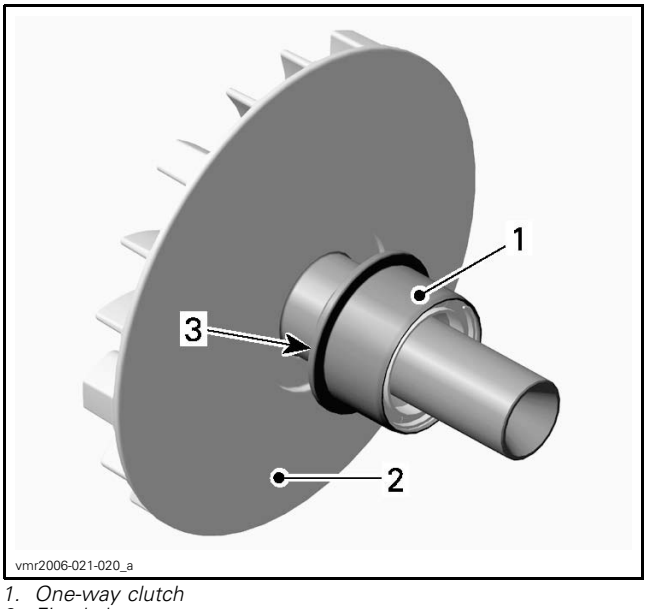
1. Lock nut
2. Centrifugal lever pivot bolt
3. Centrifugal lever
4. Thrust washers

Fixed Sheave

⚠ WARNING

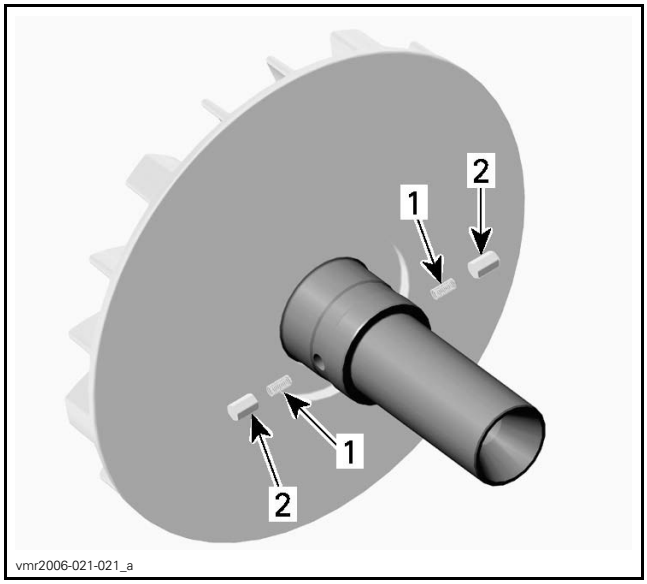
Always wear safety glasses to remove spring sleeves.

Pull and rotate one-way clutch slowly until the spring sleeves are visible.



1. One-way clutch
2. Fixed sheave
3. Spring sleeve area

Hold both spring sleeves with fingers and carefully remove them when the one-way clutch is disengaged.



1. Springs
2. Spring sleeves

Drive Pulley Cleaning

Clean pulley faces and shaft with fine steel wool and a dry cloth.

Using a paper towel with the recommended cleaning solvent, clean:
– Crankshaft tapered end
– Taper inside the fixed sheave of the drive pulley
– Crankshaft threads
– Drive pulley screw threads.

REQUIRED PRODUCT
PULLEY FLANGE CLEANER (P/N 413 711 809)

NOTICE **Avoid contact between cleaner and crankshaft seal as damage may occur.**

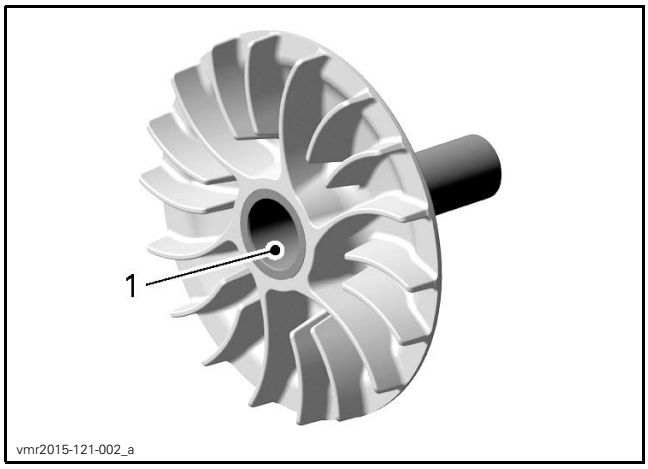
Remove all hardened oil deposits that have baked on the crankshaft and pulley tapered surfaces using coarse or medium steel wool, and/or sand paper no. 600.

NOTICE **Do not use any other type of abrasive.**

Reclean mounting surfaces with paper towel and PULLEY FLANGE CLEANER (P/N 413 711 809).

Wipe off the mounting surfaces with a clean, dry paper towel.

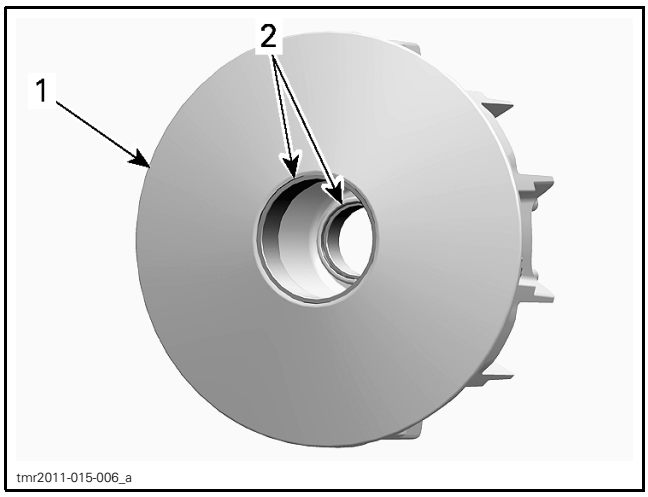
NOTICE **Mounting surfaces must be free of any oil, cleaner or towel residue.**



1. Taper of fixed sheave

Only use petrol base cleaner when cleaning sliding sheave bushings.

NOTICE Do not use acetone to clean bushing.



1. Sliding sheave
2. Bushings

Drive Pulley Inspection

Bushings

For bushing inspection, refer to *SLIDING SHEAVE* in this subsection.

Governor Cup

Check governor cup for cracks or other visible damage. Replace if necessary.

Roller and Slider Shoe

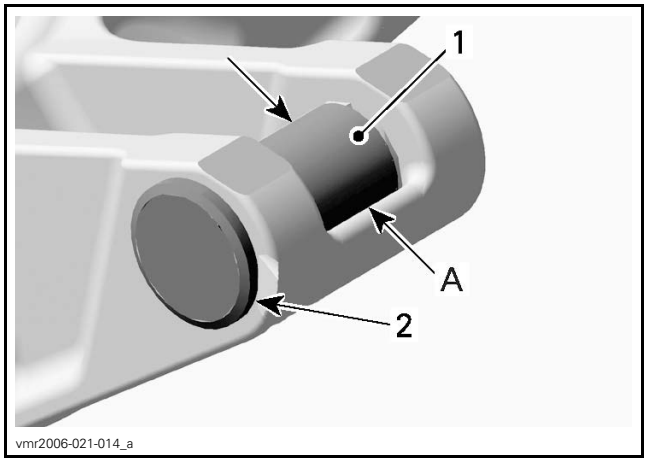
Check each roller for roundness of external diameter.

Check if rollers move freely.

NOTICE Whenever replacing rollers and slider shoes, always replace all rollers and slider shoes as a set.

Check slider shoes for visible wear and replace if damaged.

NOTE: If necessary, use a screwdriver to remove slider shoes.

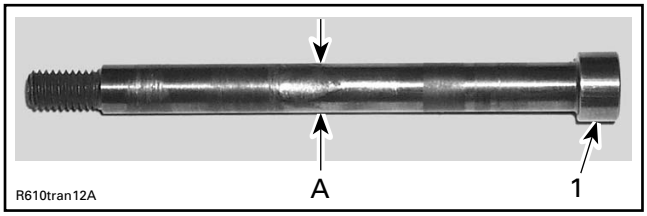


1. Roller
2. Slider shoe
A. Roller outer diameter

ROLLER OUTER DIAMETER	
NEW	13.70 mm to 13.80 mm (.539 in to .543 in)
SERVICE LIMIT	13.20 mm (.519 in)
ROLLER INNER DIAMETER	
NEW	8.05 to 8.15 mm (.317 to .321 in)
SERVICE LIMIT	9.00 mm (.354 in)

Centrifugal Lever Pivot Bolt

Measure diameter of centrifugal lever pivot bolt; replace if out of specification.

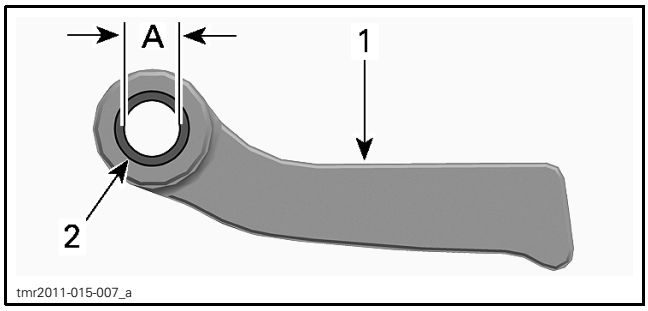


1. Centrifugal lever pivot bolt
A. Measure diameter here

CENTRIFUGAL LEVER PIVOT BOLT DIAMETER	
NEW	6.078 mm to 6.100 mm (.239 in to .24 in)
SERVICE LIMIT	6.00 mm (.236 in)

Centrifugal Lever

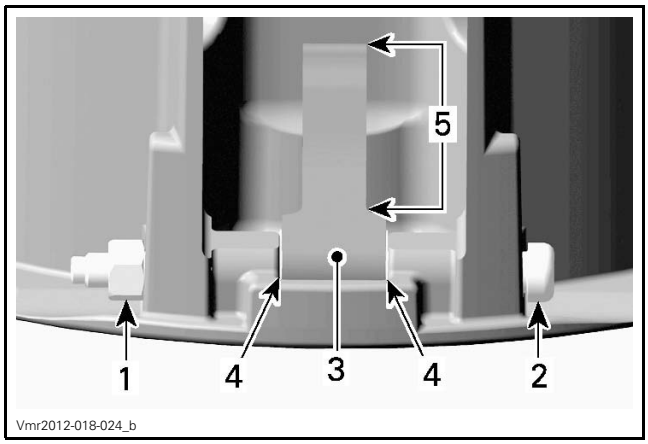
Check bushing diameter in the centrifugal lever for wear. Replace centrifugal lever if necessary.



1. Centrifugal lever
2. Bushing
A. Bushing inner diameter

CENTRIFUGAL LEVER BORE DIAMETER	
NEW	6.035 mm to 6.078 mm (.238 in to .239 in)
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

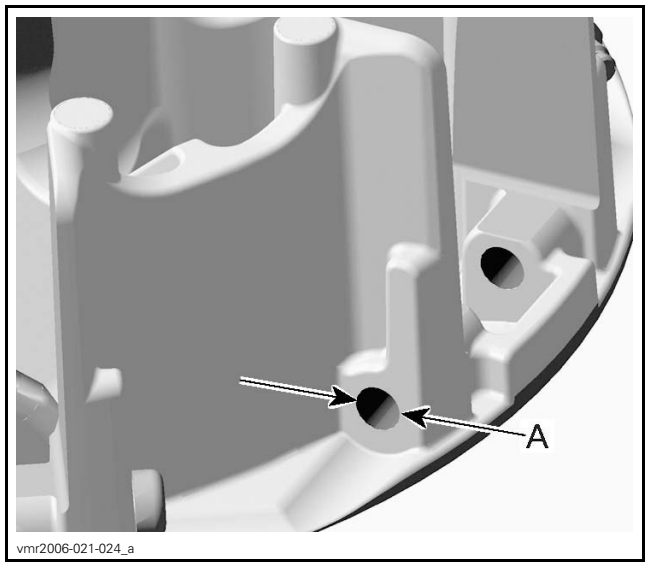
⚠ WARNING

Whenever replacing centrifugal levers, always replace all levers as a set. Otherwise, drive pulley unbalance will occur.

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 otherwise damaged.



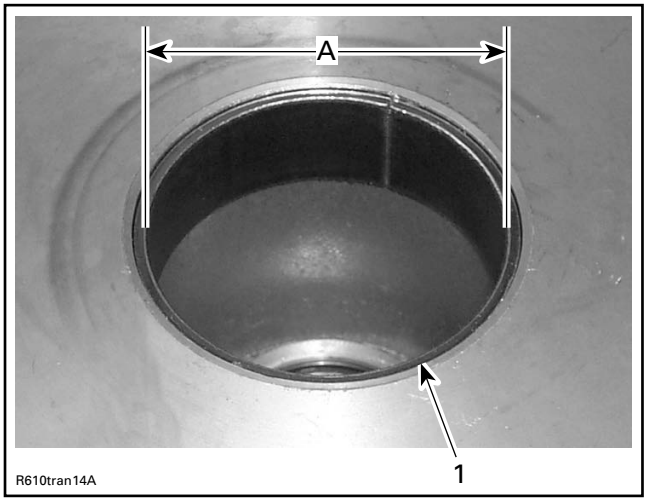
A. Centrifugal lever pivot bolt bore diameter

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.

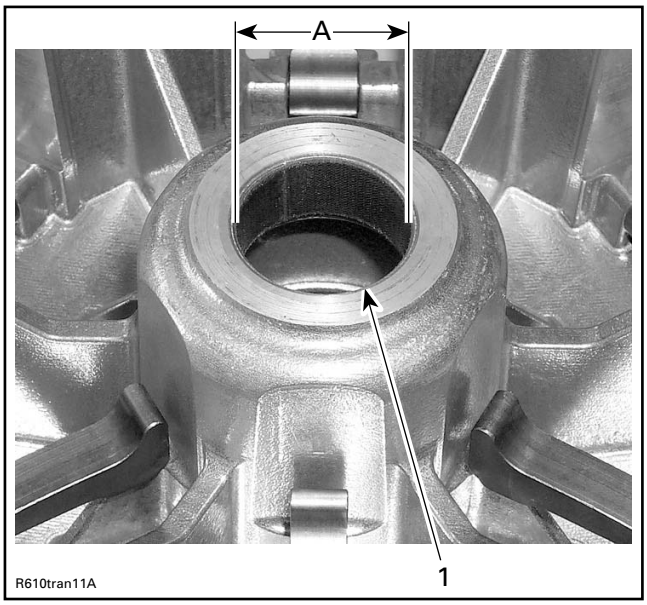
REQUIRED TOOL
Dial bore gauge

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)



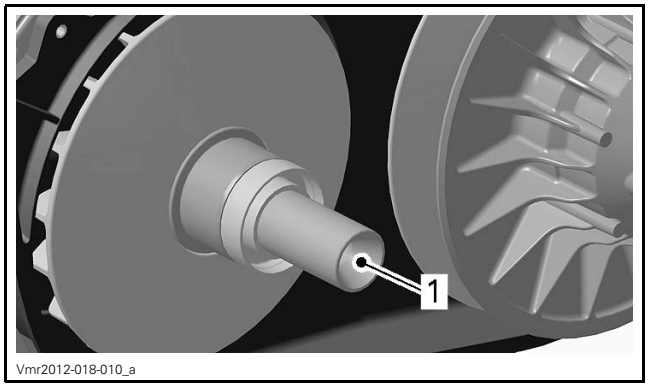
1. Bushing on governor cup side
A. Bore diameter of bushing

SLIDING SHEAVE SMALL BUSHING	
NEW	32.000 mm to 32.040 mm (1.26 in to 1.261 in)
SERVICE LIMIT	32.200 mm (1.268 in)

Replace sliding sheave if one of the bushings is out of specification. Visually inspect coatings for wear.

Fixed Sheave

Check fixed sheave contact surface to the governor cup for scratches or other damages. If damaged, replace fixed sheave.



1. Visually check here

Check for any marks on fixed sheave plate. Replace if necessary.

Spring

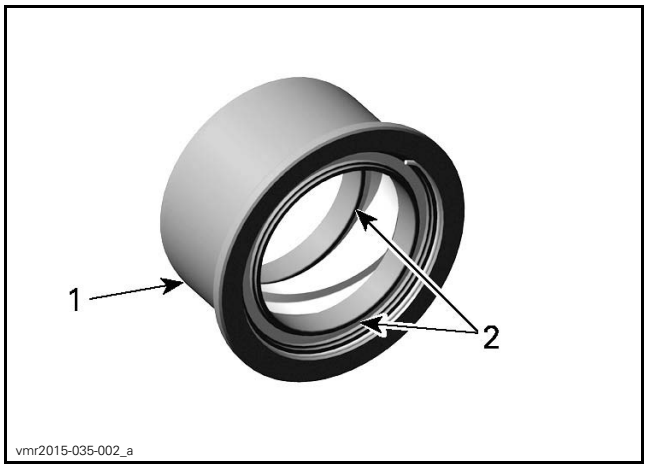
Measure spring free length and squareness. If spring is out of specification, replace by a new one.

CLUTCH SPRING FREE LENGTH
SERVICE LIMIT
105 MM (4.134 IN)
CLUTCH SPRING SQUARENESS
SERVICE LIMIT
4 MM (.157 IN)

One-Way Clutch

Check bearings for excessive play and smooth operation. Replace bearings if necessary.

NOTICE Be careful not to damage the inside of one-way clutch during bearing removal.



1. One-way clutch
2. Bearings

Measure length of spring sleeves and check if edges on top of the spring sleeve are excessively worn. If out of specification, replace both spring sleeves 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

Clean parts.

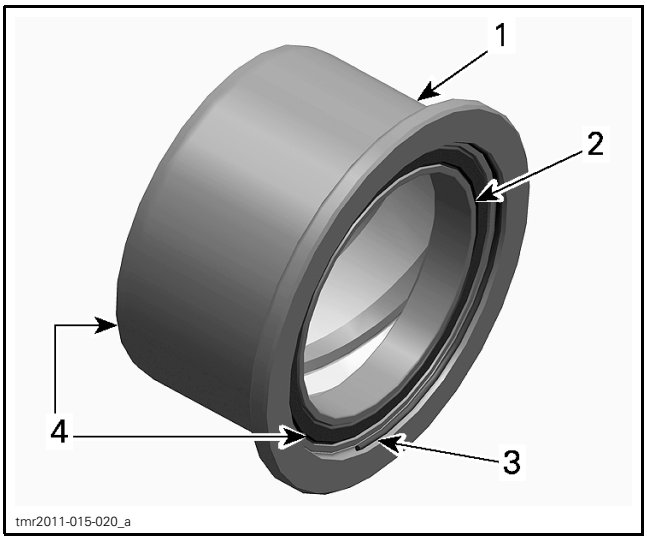
Lubricate springs, spring sleeves and between one way clutch bearings using recommended product.

REQUIRED PRODUCT
ISOFLEX GREASE TOPAS NB 52 (P/N 293 550 021)

1000 Engine

NOTE: Ball bearings have a seal on one side only. Install bearings with the seal towards the outside of the one-way clutch.

NOTE: Apply ISOFLEX GREASE TOPAS NB 52 (P/N 293 550 021) inside ball bearings to ensure adequate lubrication.



1. *One-way clutch*
2. *Bearing*
3. *Retaining ring*
4. *Seal*

Sliding Sheave

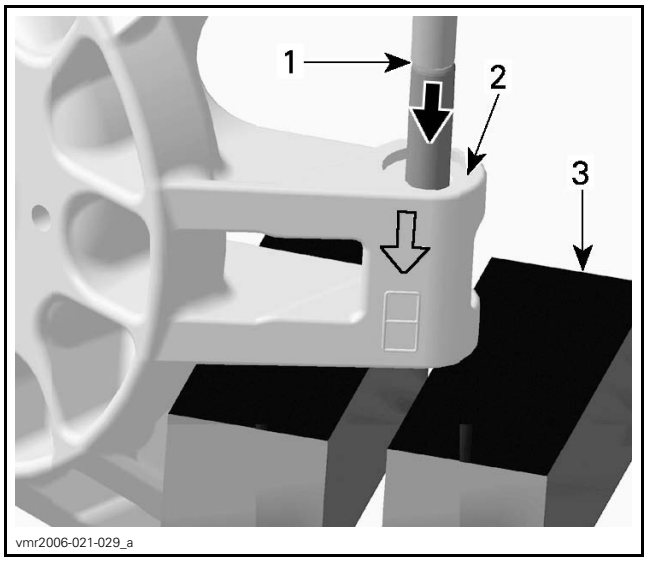
Install centrifugal levers with their thrust washers.

NOTICE Centrifugal levers must move easily after installation.

Governor Cup

Rebuild governor cup with new roller sleeves, rollers and slider shoes.

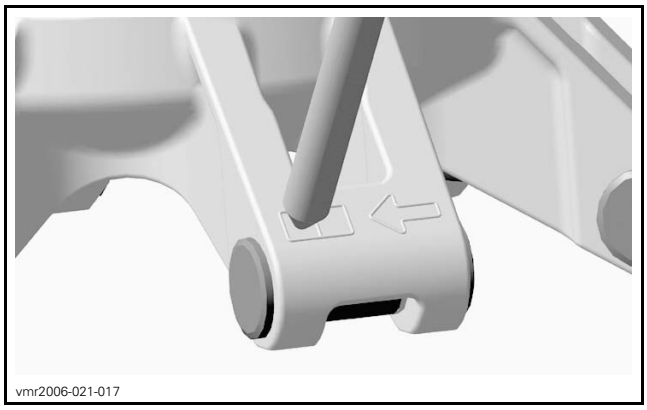
NOTICE Final position of roller sleeves must be flush with the sleeve bore in the governor cup arm (no protrusion).



1. *Top edge of roller sleeve*
2. *Mating surface of slider shoes*
3. *Vice*

Whenever replacing the roller sleeves, make a mark in the box on the governor arm using a punch.

NOTICE Do not tap too hard. Severe damage to the governor cup may appear.



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.

Drive Pulley Installation

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

⚠ WARNING

Do not apply antiseize or any lubricant on crankshaft and drive pulley tapers.

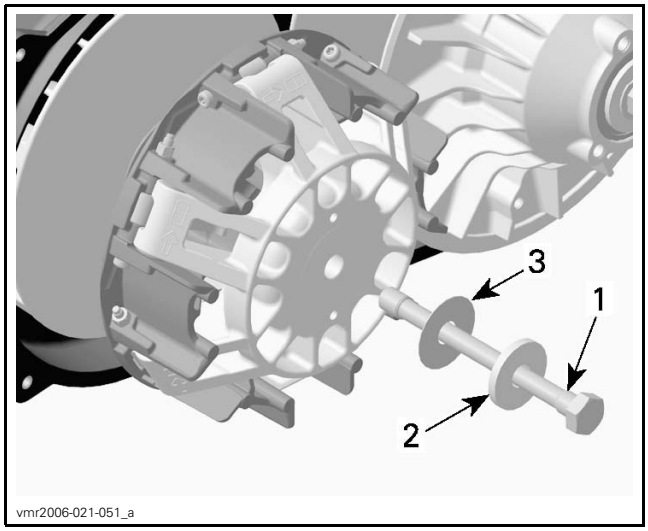
NOTICE Never use any type of impact wrench for drive pulley removal and installation.

Clean mounting surfaces as described in *DRIVE PULLEY CLEANING*.

Install drive pulley on crankshaft extension.

NOTICE Do not forget to install thrust washer and conical spring washer as per illustration that follows.

NOTE: Install conical spring washer with its concave side towards drive pulley.



1. *Drive pulley screw*
2. *Conical spring washer*
3. *Thrust washer*

⚠ WARNING

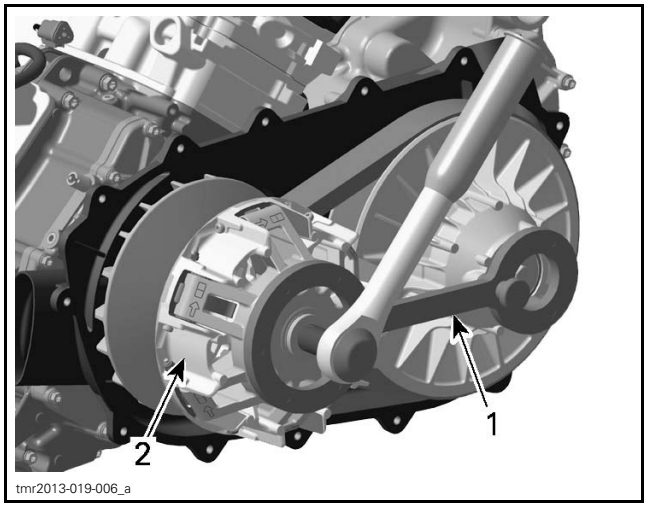
Never substitute conical spring washer and/or screw with aftermarket parts. Always use genuine BRP parts.

Lock the drive pulley as per removal procedure.

Tighten drive pulley screw to specification.

NOTICE Never use any type of impact wrench for drive pulley installation.

DRIVE PULLEY SCREW	
Tightening torque	120 N•m ± 8 N•m (89 lbf•ft ± 6 lbf•ft)



1. *Clutch holder (P/N 529 036 238)*
2. *Drive pulley*

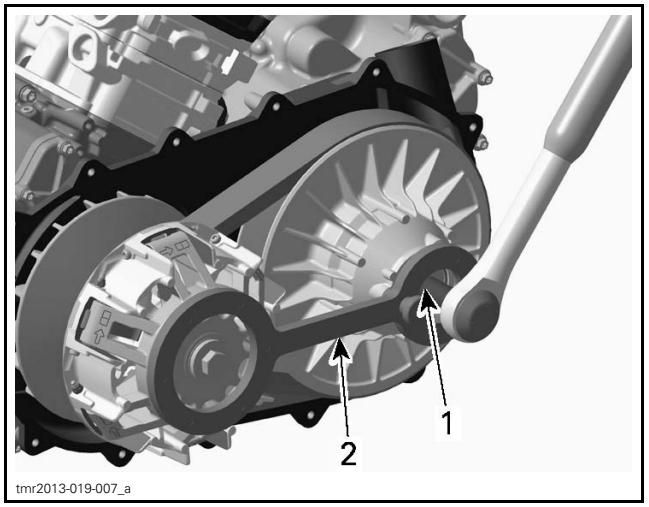
DRIVEN PULLEY

Driven Pulley Removal

1. Remove drive belt, refer to *DRIVE BELT REMOVAL* in this subsection.
2. Hold the driven pulley and loosen the driven pulley screw.

NOTE: Do not completely remove the driven pulley screw.

REQUIRED TOOL	
CLUTCH HOLDER (P/N 529 036 238)	

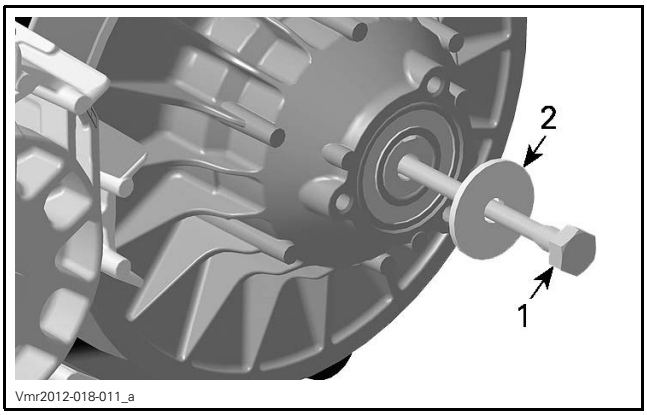


1. *Driven pulley screw*
2. *Clutch holder (P/N 529 036 238)*

3. Remove service tool.
4. Apply axial pressure with your hand on driven pulley and maintain during screw removal.

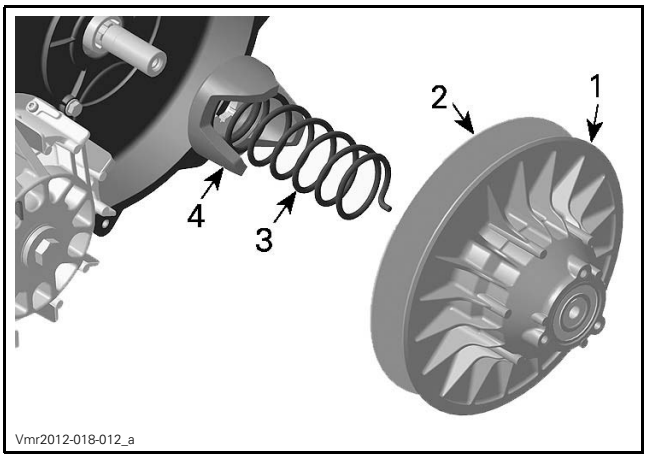
5. Remove driven pulley screw and washer. Discard driven pulley screw.

⚠ CAUTION Driven pulley is spring loaded. Hold driven pulley tight and slowly remove the driven pulley screw to release spring tension.



1. Driven pulley screw
2. Thrust washer

6. Remove the driven pulley with the spring and the cam.

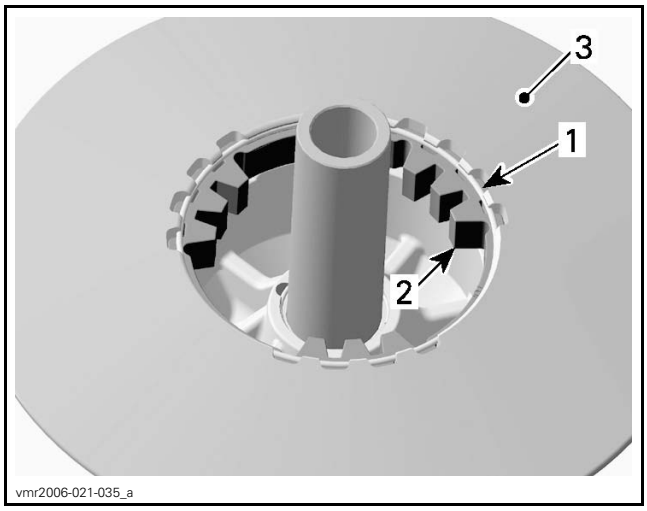


1. Fixed sheave of driven pulley
2. Sliding sheave of driven pulley
3. Spring
4. Cam

Driven Pulley Disassembly

Fixed Sheave

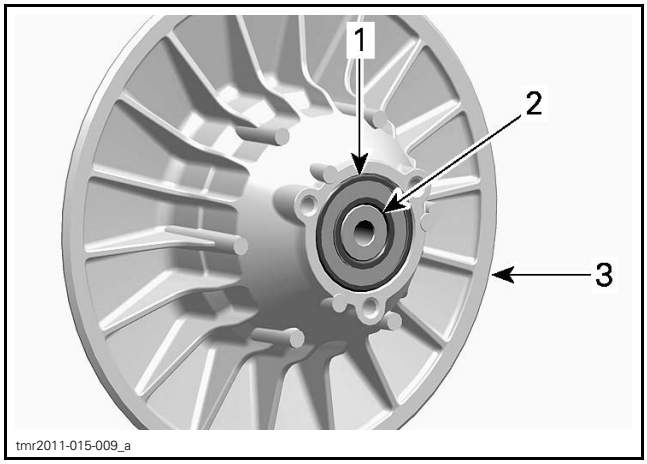
1. Remove retaining ring and lift torque gear.



1. Retaining ring
2. Torque gear
3. Fixed sheave of driven pulley

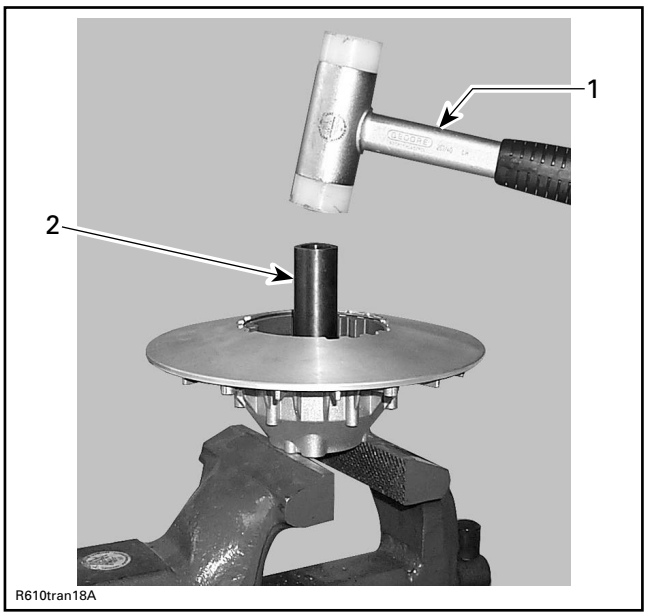
NOTE: The following procedure is not necessary except if ball bearing or shaft must be removed. Refer to *INSPECTION* before proceeding.

2. Heat ball bearing area up to 100°C (212°F) before removing ball bearing.



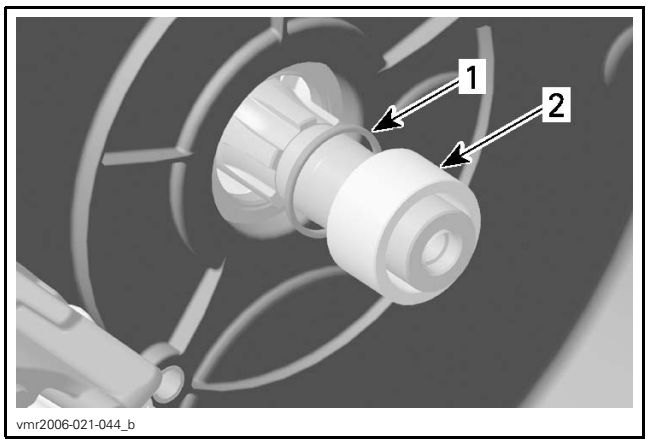
1. Ball bearing
2. Shaft
3. Fixed sheave of driven pulley

3. Use a soft hammer to push shaft and bearing out of fixed sheave.



1. *Soft hammer*
2. *Shaft*

4. Remove shaft from ball bearing.
5. Remove distance sleeve and O-ring from countershaft.
6. Replace O-ring if brittle, hard or damaged.



1. *O-ring*
2. *Distance sleeve*

Driven Pulley Cleaning

When a dust deposit has to be removed from the cam or the shaft, use a dry cloth.

Clean pulley faces and shaft using fine steel wool and a dry cloth.

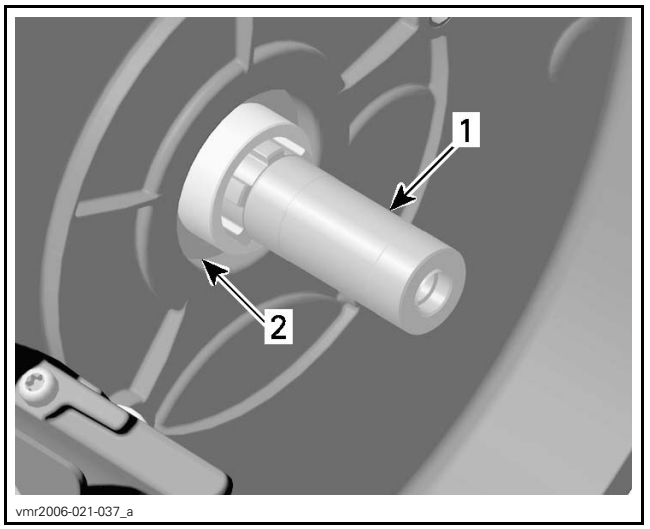
Clean driven pulley using the recommended product.

RECOMMENDED PRODUCT
PULLEY FLANGE CLEANER (P/N 413 711 809)

Clean the CVT air guide area from contamination.

Using a paper towel with PULLEY FLANGE CLEANER (P/N 413 711 809), clean countershaft end and shaft bore.

NOTICE To avoid damage, make sure cleaner does not contact the countershaft oil seal.



1. *Countershaft support*
2. *Countershaft oil seal*

Driven Pulley Inspection

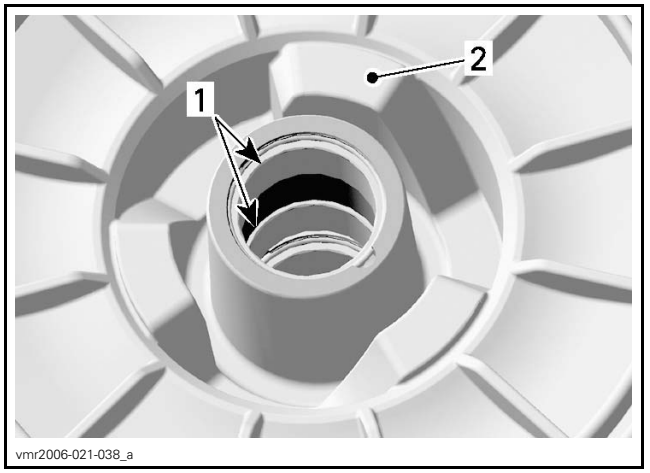
Sliding Sheave

Check sliding sheave for cracks and sliding contact surface for excessive wear. Replace sliding sheave if necessary.

Check bushings for cracks, scratches and for freedom of movement when assembled to sliding sheave.

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 of driven pulley*

REQUIRED TOOL
Dial bore gauge

MEASURING POINT
At least 5 mm (1/4 in) from bushing edge

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)

Fixed Sheave

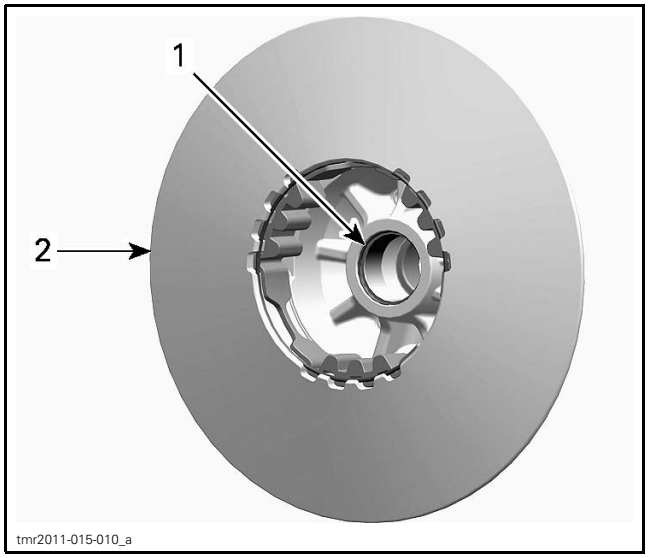
Check fixed sheave for cracks and excessive wear. Replace fixed sheave if necessary.

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.



1. Bushing
2. Fixed sheave of driven pulley

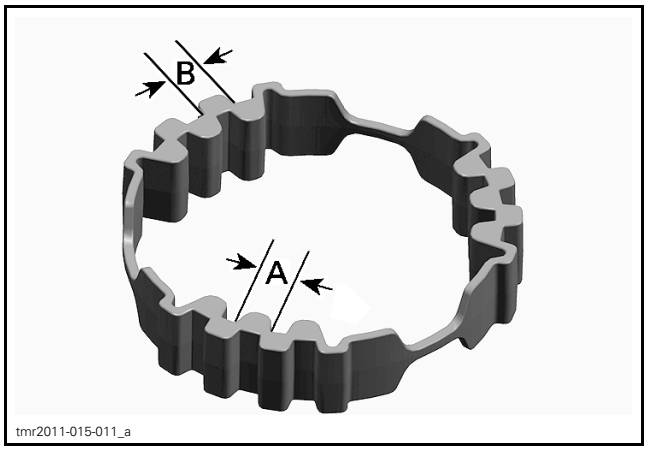
REQUIRED TOOL
Dial bore gauge

MEASURING POINT
At least 5 mm (1/4 in) from bushing edge

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.

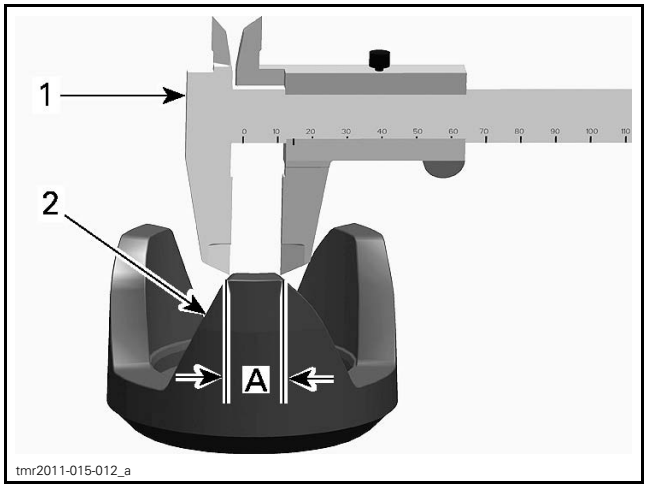


A. Measurement inside
B. Measurement outside

WEAR ON TEETH (BOTH SIDES)	
SERVICE LIMIT	7.500 mm (.295 in)

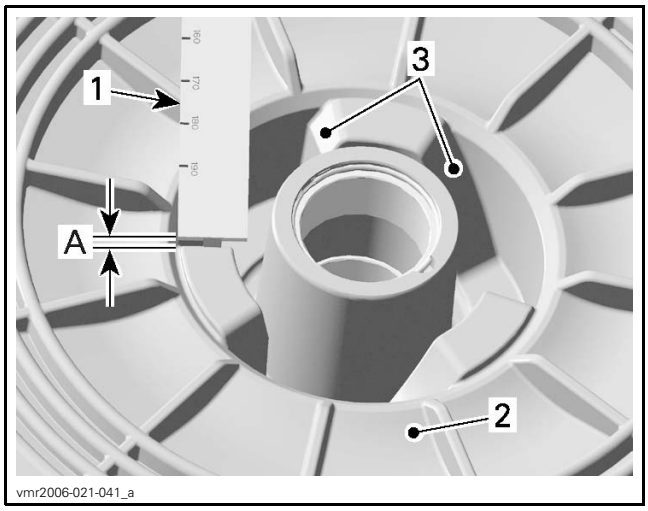
Cam

Check cam for visible damage and measure for wear using a caliper.



1. Caliper
2. Contact surface
A. Width to be measured due to wear on contact surface

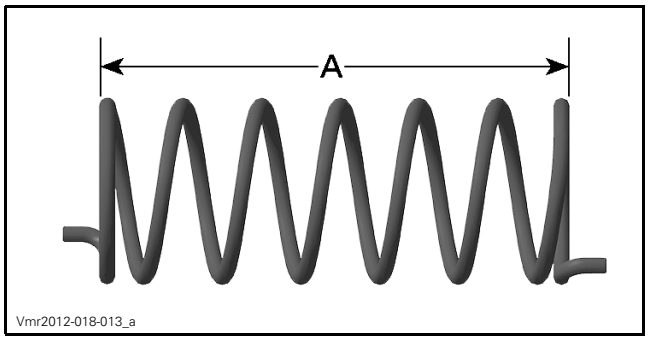
WIDTH ON TOP SURFACE	
SERVICE LIMIT	9.00 mm (.354 in)



1. Caliper
2. Sliding sheave
3. Contact surface
A. Wear to be measured

WEAR ON CONTACT SURFACE	
SERVICE LIMIT	1.00 mm (.039 in)

Spring



CVT DRIVEN SPRING (1000 ENGINE)
A. Spring free length

Measure spring free length and squareness. If spring is out of specification, replace by a new.

SPRING FREE LENGTH	
SERVICE LIMIT	125 mm (4.921 in)
CLUTCH SPRING SQUARENESS	
SERVICE LIMIT	3.8 mm (.15 in)

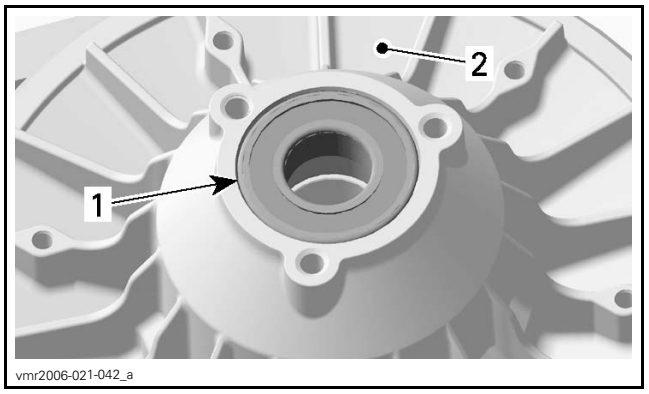
Driven Pulley Assembly

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.

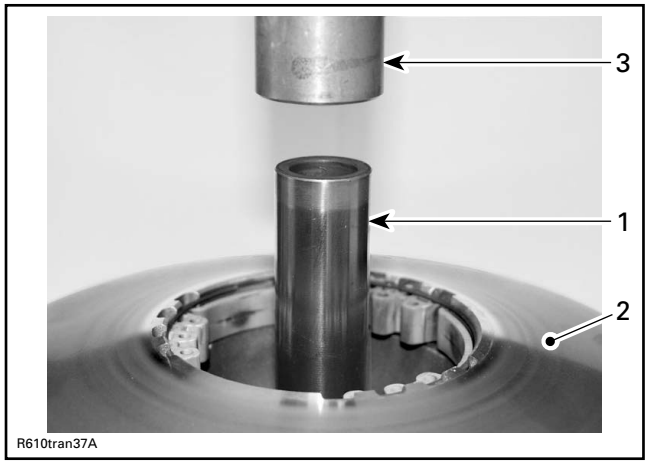
NOTE: Place new ball bearing in a freezer for 10 minutes before installation.

Install ball bearing with the writing on top and press it in using only the outer race.



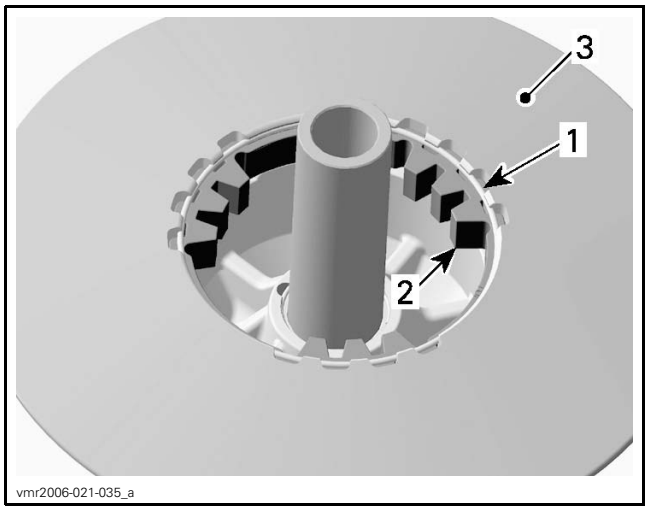
1. Ball bearing
2. Fixed sheave of driven pulley

NOTICE Do not use a hammer, bearing must be pressed in only.



1. Shaft
2. Fixed sheave
3. Press machine

Install torque gear then secure it with the retaining ring.



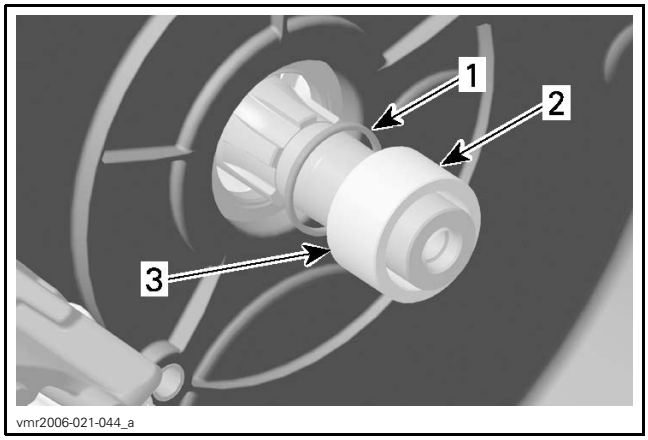
1. Retaining ring
2. Torque gear
3. Fixed sheave of driven pulley

Driven Pulley Installation

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

Place O-ring on countershaft splines and move it and the distance sleeve into position.

NOTICE Chamfer on inside diameter of the distance sleeve must face to gearbox side.



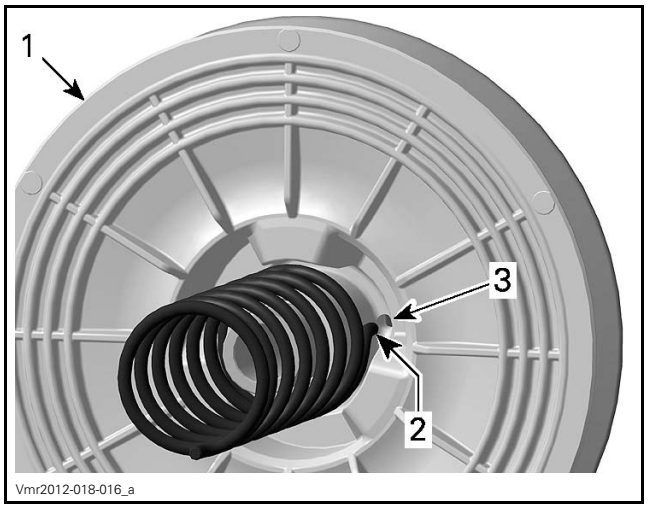
1. O-ring
2. Distance sleeve
3. Chamfered area of distance sleeve

NOTICE Threads of gearbox countershaft and driven pulley screw must be free of oil and grease. Lubricants in threads will create too high preload to tightened driven pulley screw.

Clean threads using PULLEY FLANGE CLEANER (P/N 413 711 809).

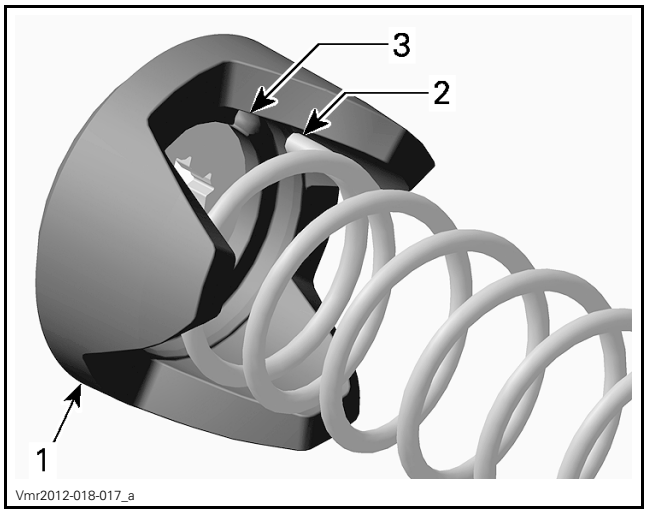
Insert the sliding sheave in the fixed sheave.

Place spring behind sliding sheave and engage spring end in the sliding sheave spring bore.



1. Sliding sheave
2. Spring end
3. Spring bore

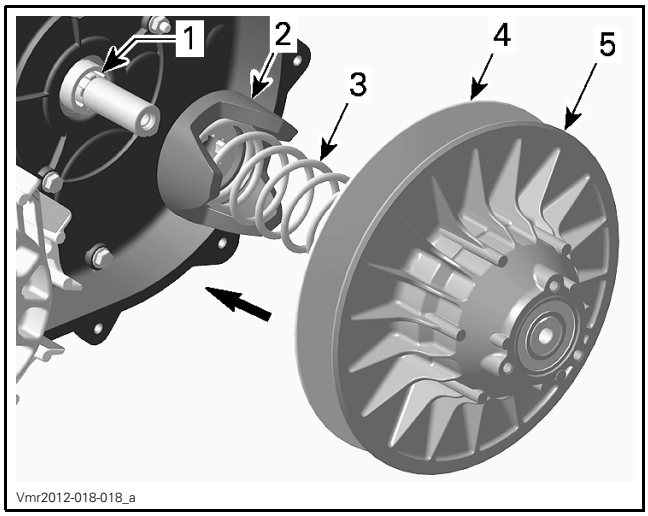
Place cam on the opposite end of the spring and engage the other spring end in the cam spring bore.



1. Cam
2. Spring end
3. Spring bore

Install pre-assembled cam with spring and driven pulley on countershaft end.

NOTICE Cam must engage on countershaft splines.



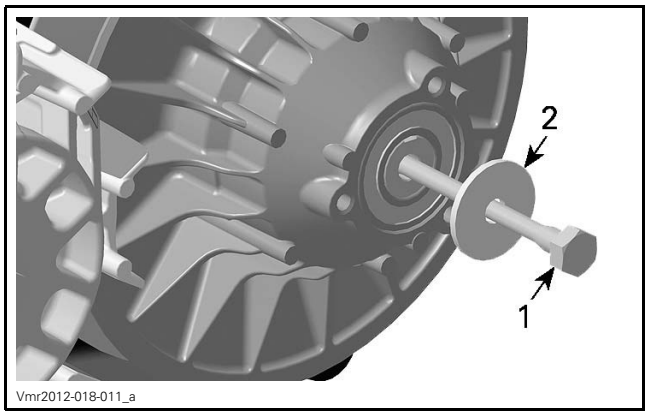
1. *Countershaft splines*
2. *Cam*
3. *Spring*
4. *Sliding sheave*
5. *Fixed sheave*

With your hand, push the driven pulley onto the shaft to compress the spring.

As you hold the pulley in, install a NEW driven pulley screw and thrust washer.

NOTICE **This assembly uses a stretch screw. Always install a NEW screw.**

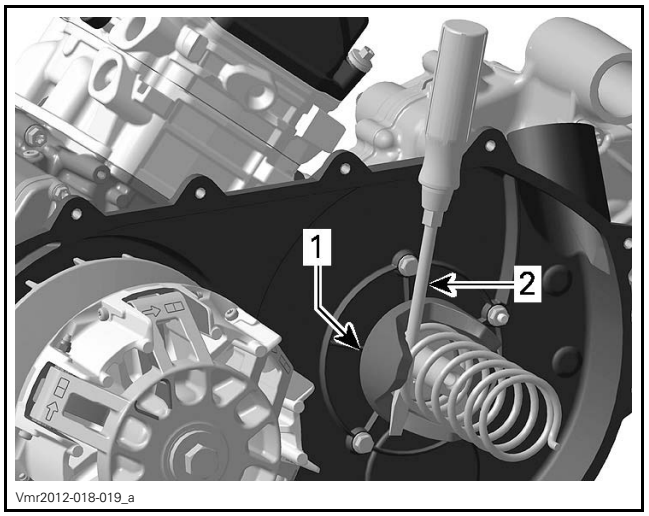
NOTE: Tighten the screw with your hand approximately 3 to 4 turns.



1. *Driven pulley screw*
2. *Thrust washer*

Insert a screwdriver of approximately 5 mm (.197 in) diameter in the cam.

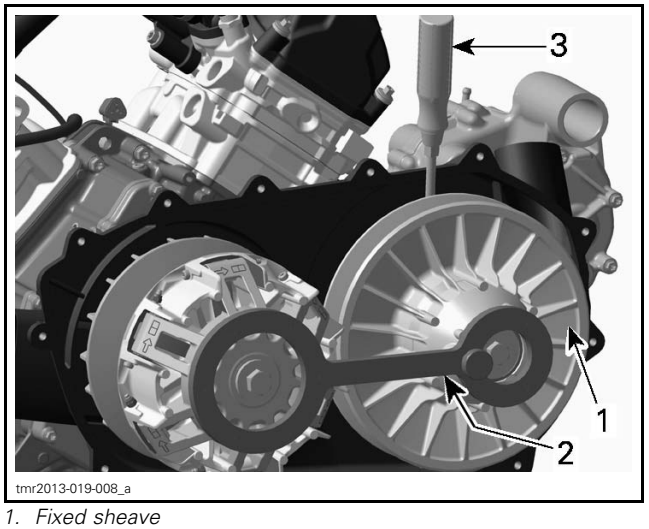
NOTE: For clarity of understanding, some parts not shown in the following illustration.



1. *Cam*
2. *Screwdriver, diameter 5 mm (.197 in)*

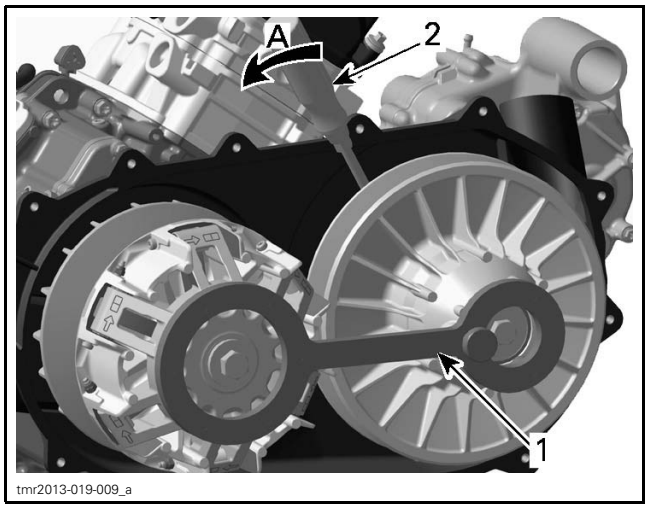
Hold the driven pulley in a fix position.

REQUIRED TOOL	
CLUTCH HOLDER (P/N 529 036 238)	



1. *Fixed sheave*
2. *Clutch holder*
3. *Screwdriver*

Turn the screwdriver approximately 20° counterclockwise until cam engages in the driven pulley sliding sheave and hold it in this position (spring preload).



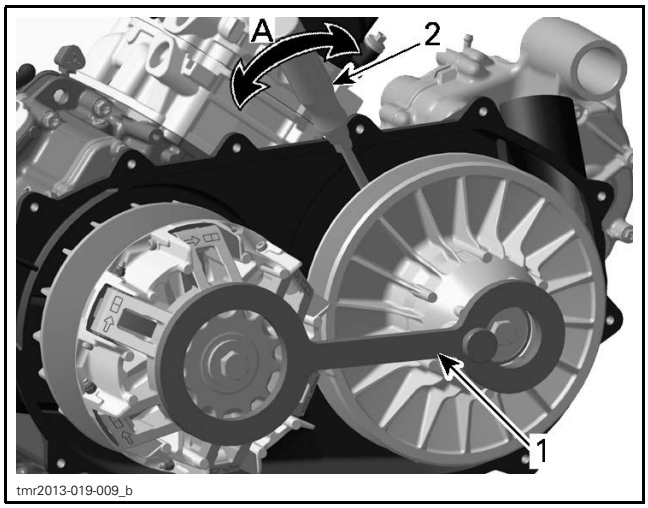
1. Clutch holder
2. Screwdriver
A. Turn counterclockwise

Using a socket and extension, hand tighten the driven pulley screw.

NOTE: **Do not** apply specified torque at this time.

Move the screwdriver back and forth to check cam for free movement.

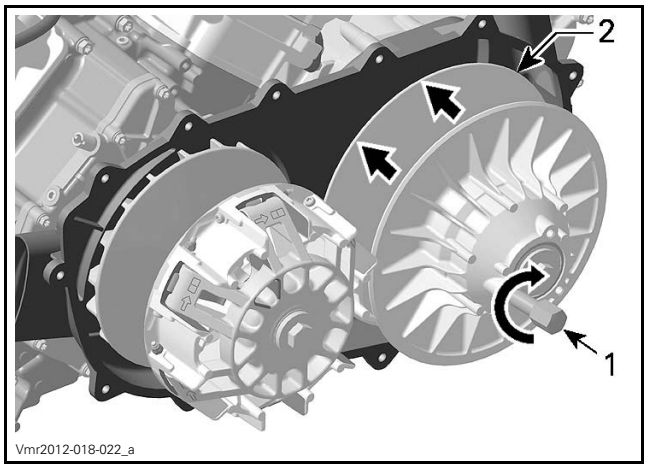
NOTICE **A cam not correctly engaged will cause damage to the driven pulley and cam.**



1. Clutch holder
2. Screwdriver
A. Cam freedom of movement

Install drive belt. Refer to *DRIVE BELT* in this subsection.

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



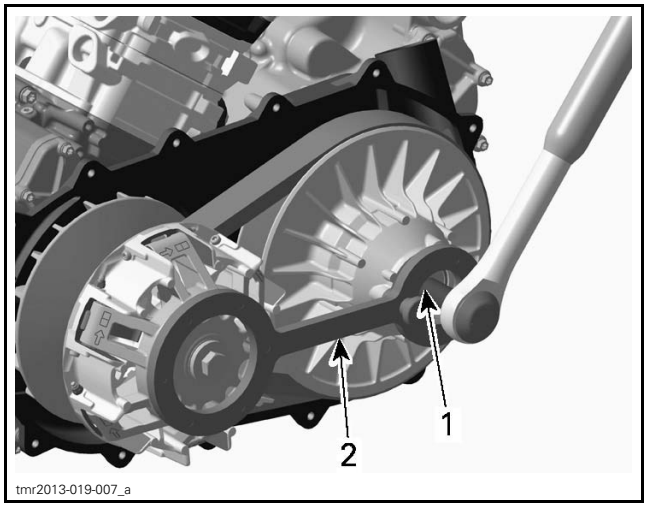
1. Puller/locking tool
2. Sliding sheave

NOTE: If driven pulley sheaves can to be opened when the service tool is screwed in, the cam is not correctly engaged in the sliding sheave.

Tighten driven pulley screw as specified.

REQUIRED TOOL	
CLUTCH HOLDER (P/N 529 036 238)	

TIGHTENING SEQUENCE (DRIVEN PULLEY SCREW)	
STEP 1	20 N•m ± 1 N•m (15 lbf•ft ± 1 lbf•ft)
STEP 2	180° ± 5°



1. Driven pulley screw
2. Clutch holder

Check driven pulley end play.

SPECIFICATION	
Driven pulley end play	0 mm (0 in)

CVT AIR GUIDE

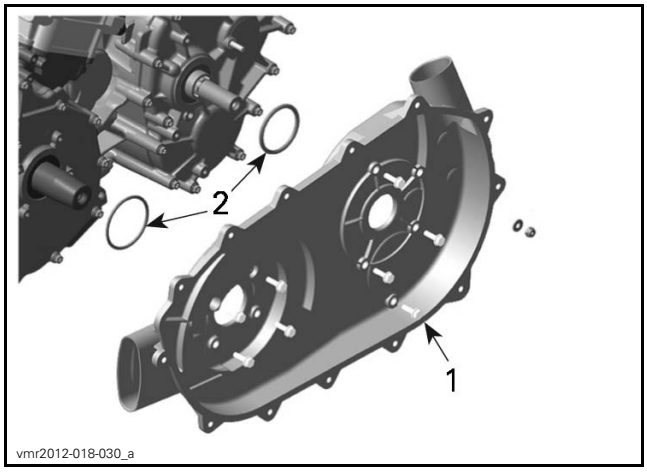
CVT Air Guide Removal

1. Remove the *DRIVE PULLEY* and the *DRIVEN PULLEY*.
2. Unscrew the clamps retaining the CVT air hoses.
3. Remove CVT air guide.

CVT Air Guide Inspection

Clean CVT air guide from contamination

Check O-rings. If brittle, hard or damaged, replace as necessary.



1. CVT air guide
2. O-rings

CVT Air Guide Installation

For installation reverse the removal procedure.

GEARBOX AND COUPLING UNIT

SERVICE TOOLS

Description	Part Number	Page
BLIND HOLE BEARING PULLER SET	529 036 117	332
COUNTERSHAFT OIL SEAL PUSHER	529 036 222	325
ECM ADAPTER TOOL	529 036 166	321
FLUKE 115 MULTIMETER	529 035 868	318, 322
HANDLE	420 877 650	325
OIL SEAL INSTALLER (GEARBOX)	529 035 758	325
OIL SEAL INSTALLER	529 036 204	326

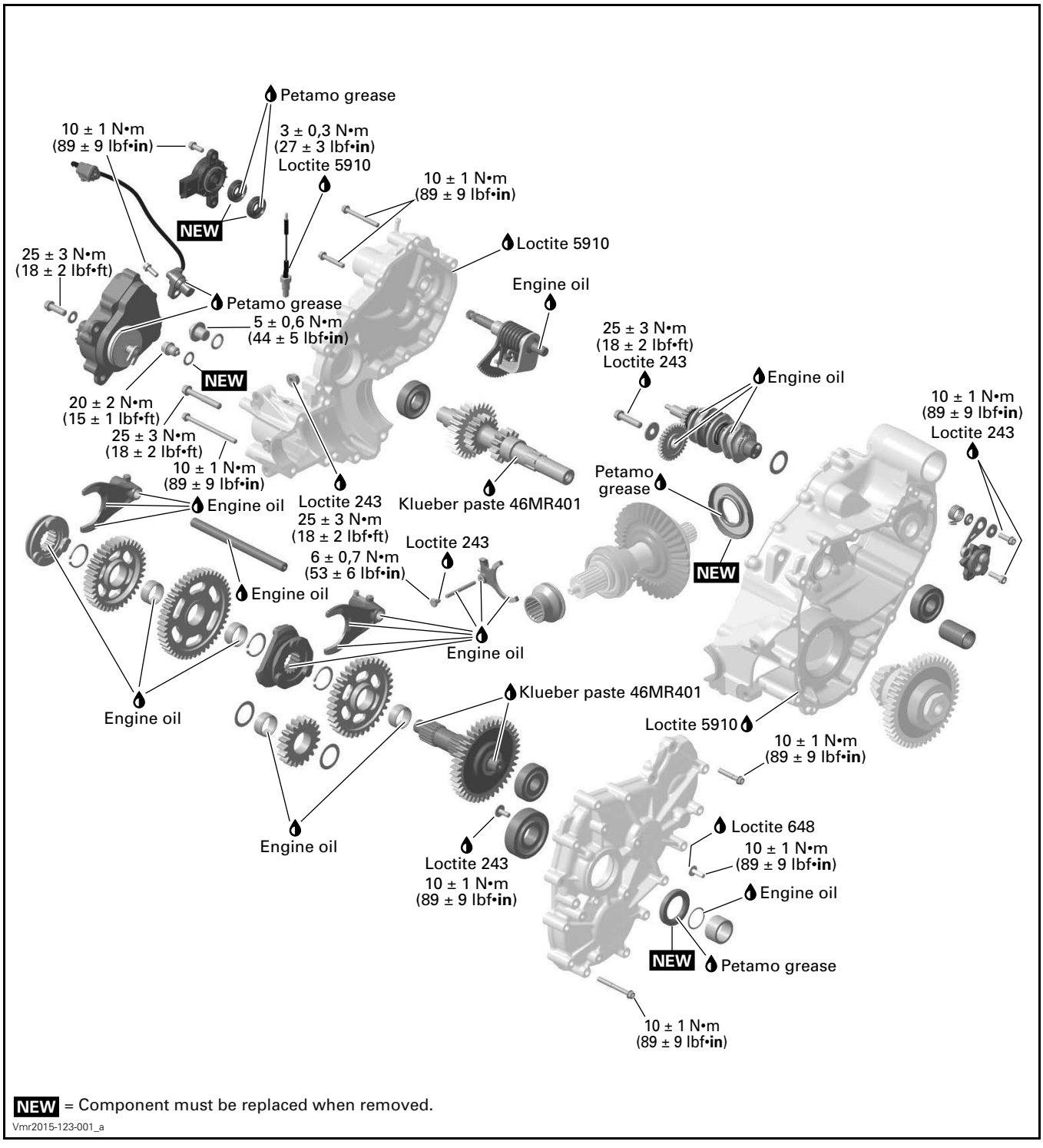
SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
FLUKE RIGID BACK-PROBE	TP88	318, 320

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 5910	293 800 081	322, 338
LOCTITE CHISEL (GASKET REMOVER)	413 708 500	338
PETAMO GREASE GHY 133N	420 899 271	324, 326
SUPER LUBE GREASE	293 550 030	319, 323

GEARBOX COMPONENTS AND COUPLING MECHANISM

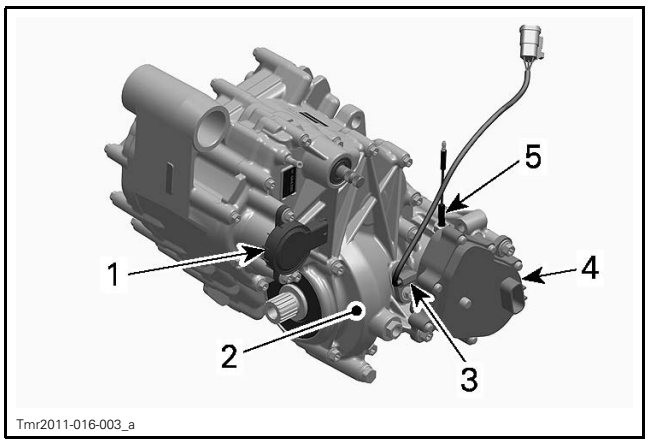


NEW = Component must be replaced when removed.

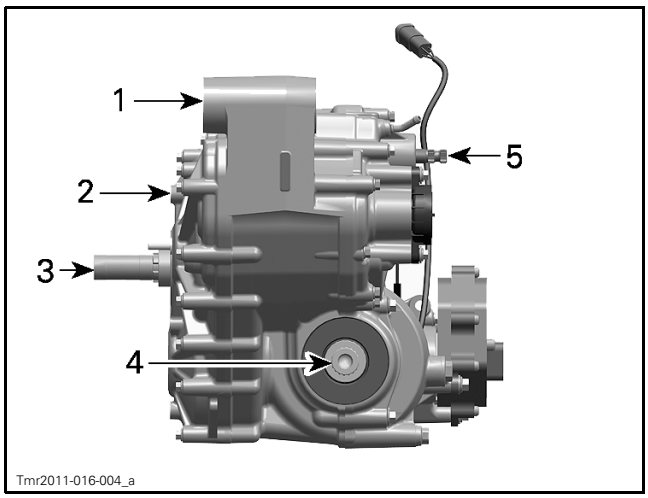
Vmr2015-123-001_a

GENERAL

GEARBOX OVERVIEW



1. *Gearbox position sensor (GBPS)*
2. *Right cover*
3. *Vehicle speed sensor (VSS)*
4. *Actuator*
5. *4WD indicator switch*



1. *Center housing*
2. *Left cover*
3. *Countershaft*
4. *Output shaft*
5. *Shift shaft*

TROUBLESHOOTING

UNUSUAL GEARBOX NOISE AND/OR VIBRATIONS

1. Low oil level in gearbox.
   - *Oil leakage from gearbox. Replace damaged gasket(s) and/or oil seal(s).*
2. Defective bearings.
   - *Bearing(s) do(es) not turn smoothly. Replace bearing(s).*
3. Damaged or worn gears.
   - *Inspect gears for damages or missing teeth. Replace respective gears.*

GEAR INDICATION FAILS

1. Defective gearbox position sensor (GBPS).
   - *Perform a gearbox position sensor test.*
   - *Damaged wires. Repair as required.*

GEAR(S) IS (ARE) HARD TO SHIFT

1. Incorrect shift rod adjustment.
   - *Adjust shift rod (refer to SHIFT ROD in SHIFTER subsection.*

4 WHEEL DRIVE INDICATION FAILS

1. 4WD indicator switch failure.
   - *Test 4WD indicator switch. Replace as required.*
   - *Bad contact. Check for corrosion or loose connector.*
   - *Damaged wires. Repair as required.*

4 WHEEL DRIVE DOES NOT ENGAGE OR DISENGAGE

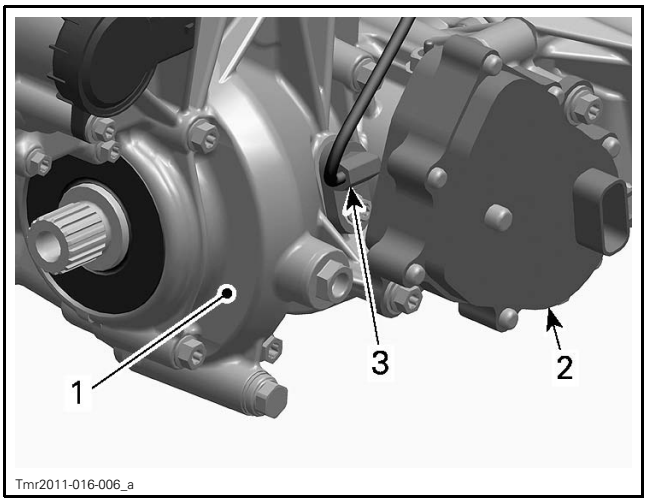
1. Defective 4WD switch.
   - *Check 4WD switch operation.*
2. Defective actuator.
   - *Test actuator.*
3. Damaged or worn shifting fork or sleeve.
   - *Remove actuator and inspect shifting fork and sleeve.*

PROCEDURES

VEHICLE SPEED SENSOR (VSS)

VSS Location

The vehicle speed sensor is located on the right housing of the gearbox behind the actuator.



1. Right housing of gearbox
2. Actuator
3. VSS (Vehicle Speed Sensor)

VSS Access

To reach the VSS, refer to *BODY* subsection and remove the following parts:

– Seat
– Console
– RH side panel.

VSS Wire Identification

FUNCTION	PIN	COLOR - SENSOR CONNECTOR	COLOR - WIRING HARNESS CONNECTOR
12-volt input from fuse F5	A	RED	VIOLET/BLUE
Speed signal (to cluster pin 9)	B	WHITE	PINK
Ground (to ECM C3)	C	BLACK	GREEN/ BROWN

VSS Circuit Protection

CONDITION	CIRCUIT PROTECTION
Supplied with main relay activated	Fuse 5 of fuse block 1 (from main relay R2)

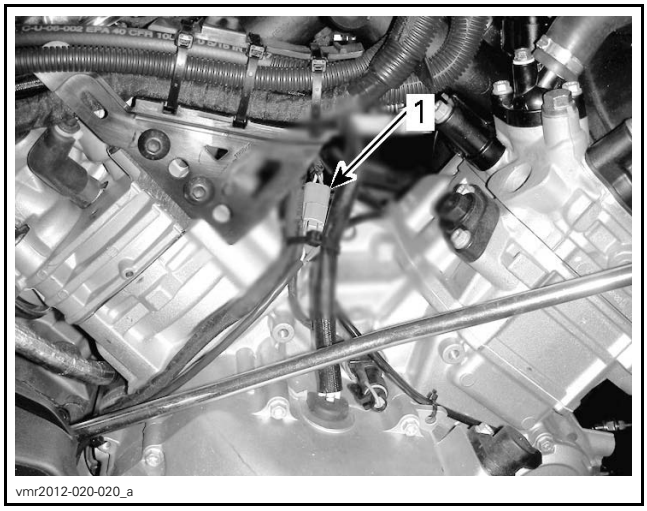
VSS Input Voltage Test

1. Remove VSS connector cover.
2. Set multimeter to Vdc.

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

3. Turn ignition switch ON.
4. Set emergency engine stop switch to RUN.
5. Back-probe the VSS connector.

REQUIRED TOOL
FLUKE RIGID BACK-PROBE (P/N TP88)



1. VSS connector

6. Measure voltage as per following table.

VEHICLE SPEED SENSOR INPUT VOLTAGE TEST		
TEST PROBES		RESULT (KEY ON)
PIN A VIOLET/BLUE wire	PIN C GREEN/BROWN wire	Battery voltage

If voltage is not as specified, test positive and ground circuits separately.

VSS Signal Test

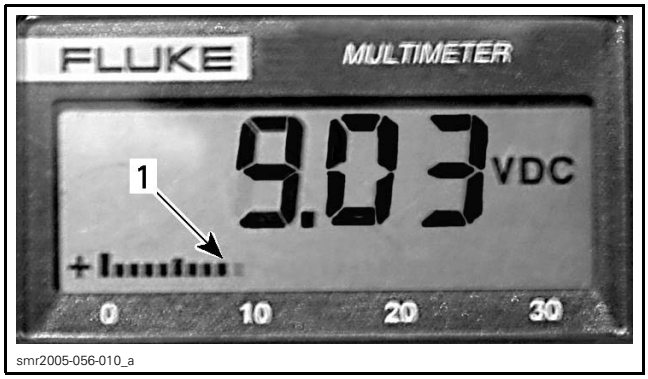
1. Lift rear of vehicle so that rear wheels are off the ground.
2. Set transmission to 2WD and to NEUTRAL.
3. Back-probe the VSS connector.

REQUIRED TOOL
FLUKE RIGID BACK-PROBE (P/N TP88)

4. Turn ignition switch ON.
5. Set emergency engine stop switch to RUN.
6. Set multimeter to Vdc.
7. Measure voltage while slowly rotating rear wheels by hand.

VEHICLE SPEED SENSOR SIGNAL TEST		
TEST PROBES		RESULT (WHILE ROTATING WHEELS)
PIN B WHITE wire	PIN C BLACK wire	Alternate reading between battery voltage and 0 Vdc

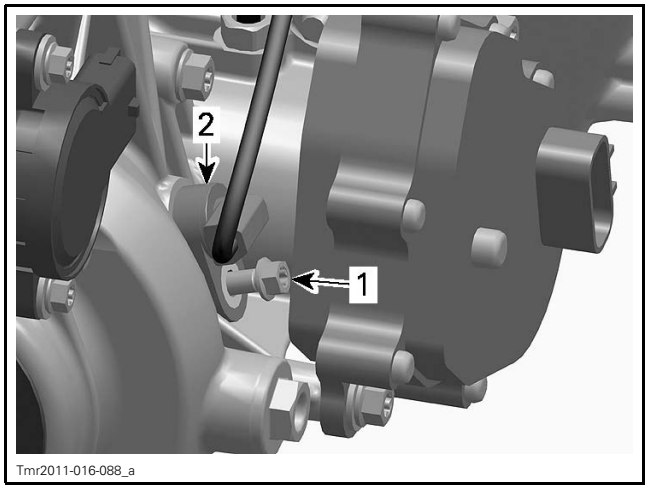
NOTE: Since we measure pulsating voltage, the numeric display will continuously change. The analog display may be easier to follow.



1. Analog display

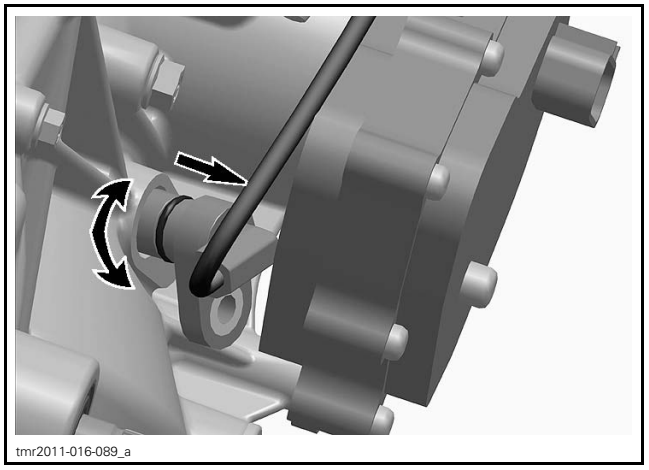
VSS Removal

Remove screw retaining the VSS.



1. Screw
2. VSS

Turn sensor and weave it out of the gearbox right cover.



VSS Installation

For installation, reverse the removal procedure. Pay attention to the following.

Lubricate VSS O-ring.

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

Tighten VSS retaining screw to specification.

VSS RETAINING SCREW	
Tightening torque	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

GEARBOX POSITION SENSOR (GBPS)

GBPS Reset

When replacing the gearbox position sensor (GBPS), it is required to reset (re-zero) its values for proper operation.

A reset must be carried out each time any of the following parts has been replaced:

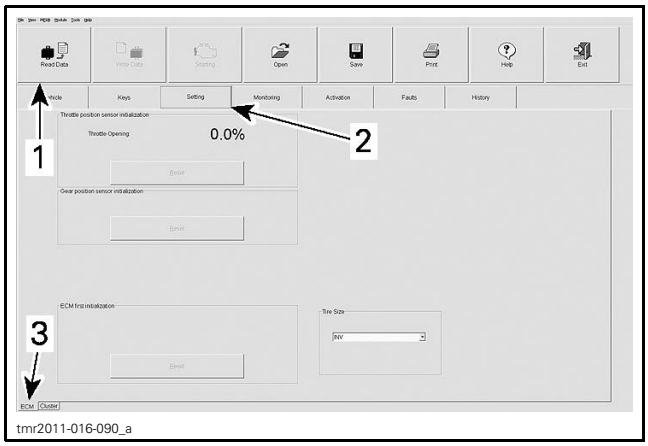
– Gearbox assembly
– Shift drum
– GBPS
– ECM.

1. Connect vehicle to the latest applicable version of B.U.D.S. software, refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.

NOTE: Ignition key must stay ON and emergency engine stop switch must remain to RUN during the reset procedure. Otherwise, the procedure must be carried out again.

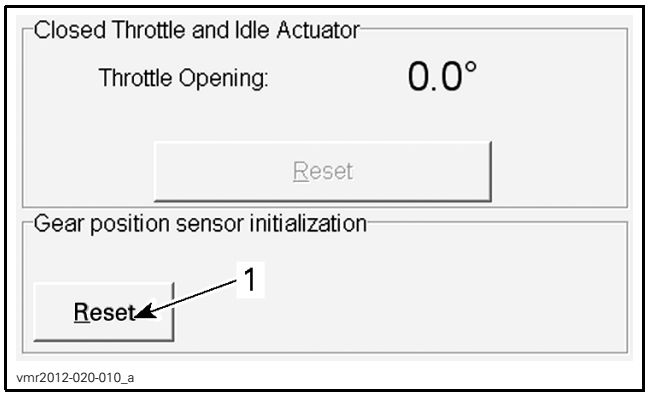
2. In B.U.D.S., select the following:
   – Read Data button

– Setting tab
– ECM tab.



TYPICAL
1. Read data button
2. Setting tab
3. ECM tab

3. Make sure that gearbox is set to NEUTRAL position.
4. In the Gear Position Sensor Initialization area, click on the Reset button.



GEAR POSITION SENSOR INITIALIZATION
1. Reset button

A message will be displayed if the operation is successful.

5. Close and disconnect B.U.D.S.

NOTE: Do not turn ignition key to OFF and do not set emergency engine stop switch to STOP.

6. Verify gears engagement.
   6.1 With the vehicle on ground and in NEUTRAL position, start engine.
   6.2 During 4-5 seconds, rev engine to 2500 ± 200 RPM.
   6.3 Let engine returns to idle.
   6.4 Repeat substeps 6.2 and 6.3 for all other gear positions.

NOTE: The vehicle must be in movement to complete the procedure on R, H and L positions.

GBPS Access

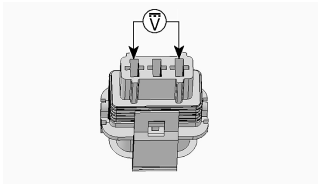
To reach the GBPS sensor, refer to *BODY* and remove the following parts:
– Seat
– Console
– RH side panel.

GBPS Input Voltage Tes t

NOTE: Prior to conduct testing, check fault codes in B.U.D.S.

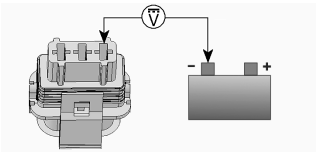
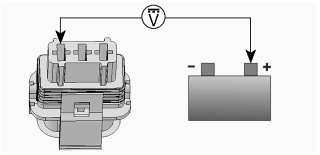
Back-probe the GBPS connector using FLUKE RIGID BACK-PROBE (P/N TP88) or equivalent.

Test as follow:

MULTIMETER PROBE POSITIONS	VOLTAGE
PIN 1 and PIN 3 of the GBPS connector 	5 volts

If voltage is adequate, check GBPS signal wire.

If there is no voltage, check each GBPS input as follows.

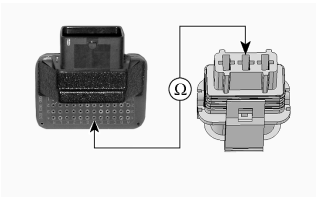
MULTIMETER PROBE POSITIONS	VOLTAGE
GBPS connector (pin 1) and battery ground 	5 volts
GBPS connector (pin 3) and battery + terminal 	Battery voltage

If there is no voltage, check wires and connector pins. Replace or repair defective parts and reset fault codes.

GBPS Signal Wire Continuity Test

Unplug ECM connector and connect it to the adapter tool.

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

MULTIMETER PROBE POSITIONS	RESISTANCE @ 20°C (68°F)
GBPS connector (pin 2) and ECM adapter tool (pin D2) 	Below 1 Ω

If resistance is out of specification, check wires and connectors. Repair and reset fault codes.

If resistance is good and the other tests succeeded, replace the GBPS and reset fault codes.

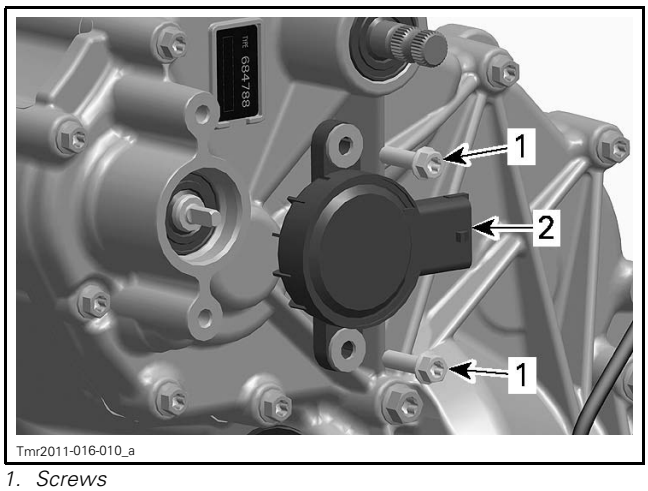
NOTE: The GBPS must be reset.

GBPS Removal

Set shift lever in NEUTRAL position.

Unplug GBPS connector.

Remove screws and withdraw GBPS.



Tmr2011-016-010_a

1. *Screws*
2. *Gearbox Position Sensor (GBPS)*

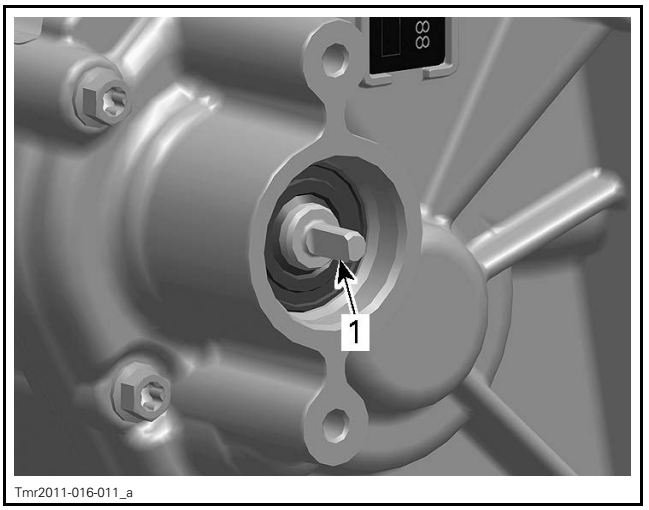
GBPS Installation

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

Shift lever must be in the NEUTRAL position.

Align GBPS with the flat on the shift drum shaft.

IMPORTANT: Do not force to install GBPS if shaft flat is not properly aligned. If alignment is incorrect, check shift rod adjustment.



Tmr2011-016-011_a

1. *Flat on shift drum shaft*

Reset the GBPS. Refer to *GBPS RESET* in this subsection.

4WD INDICATOR SWITCH

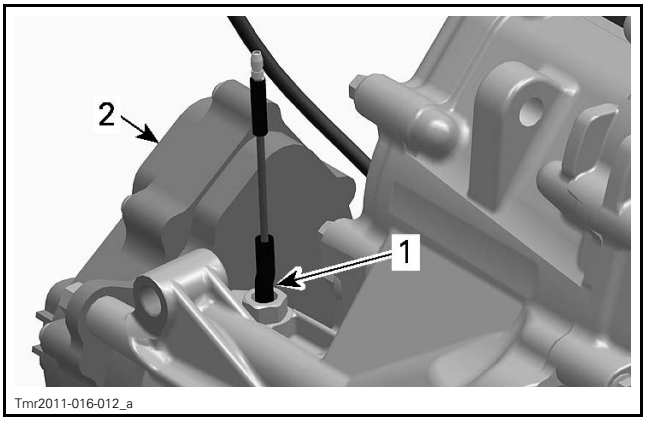
4WD Indicator Switch Access

To reach the 4WD indicator switch, refer to *BODY* and remove the following parts:

- Seat
- Console
- RH side panel.

4WD Indicator Switch Removal

Disconnect 4WD indicator switch connector.



Tmr2011-016-012_a

1. *4 WD indicator switch*
2. *Actuator*

4WD Indicator Switch Test

Measure switch resistance as follows.

SWITCH POSITION	SWITCH WIRE		RESISTANCE
2WD	BLACK/ BEIGE	Engine ground	Infinite (OL)

If the resistance is out of specification, replace the 4WD indicator switch.

4WD Indicator Switch Installation

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

Take care do not damage indicator switch threads during installation.

Apply carefully some LOCTITE 5910 (P/N 293 800 081) on threads of indicator switch.

NOTICE **Do not apply Loctite 5910 on switch plunger, as it will lead to switch malfunction.**

ACTUATOR

Actuator Access

To access the actuator, refer to *BODY* and remove the following parts:
- Seat
- Console
- RH side panel
- RH footrest panel.

Actuator Test

Check if the 2WD/4WD selector works properly.

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

Unplug actuator connector.

Turn ignition key ON.

Set emergency engine stop switch to RUN.

Measure voltage as follows.

SWITCH POSITION	SWITCH WIRE		VOLTAGE
2WD	WHITE/BLUE	WHITE	Battery voltage
4WD	WHITE/BLACK		

If the selector is out of specifications, check wires, connectors and replace the selector if necessary.

If the selector is good, check the vehicle harness.

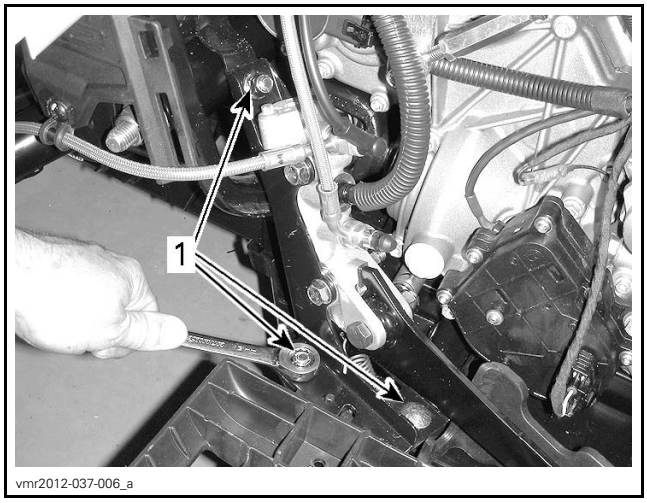
If the vehicle harness is good, replace the actuator.

Actuator Removal

NOTE: Before beginning any servicing on the actuator, make sure the vehicle is in 4WD position. No need to remove engine from vehicle.

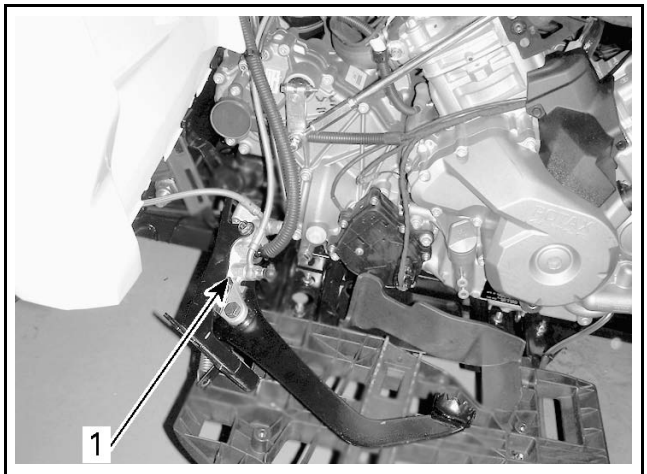
Place a drain pan under actuator.

Detach brake master cylinder from frame.



vmr2012-037-006_a

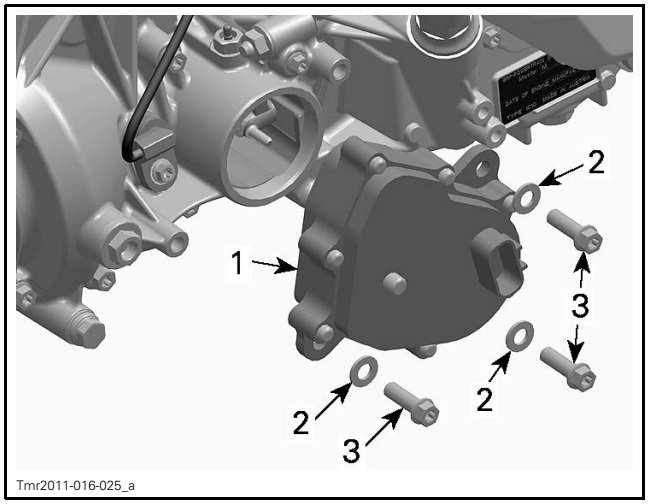
1. Remove retaining screws from master cylinder support



vmr2012-037-007_a

1. Master cylinder moved apart

Remove actuator screws.



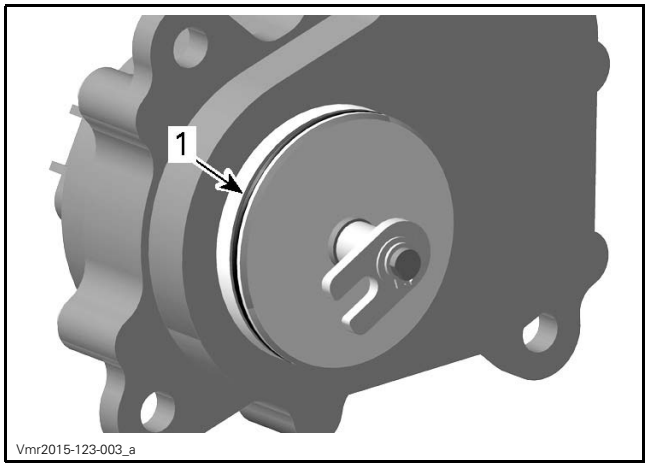
1. *Actuator*
2. *Washer*
3. *Screw*

Pull the actuator out of housing.

Actuator Installation

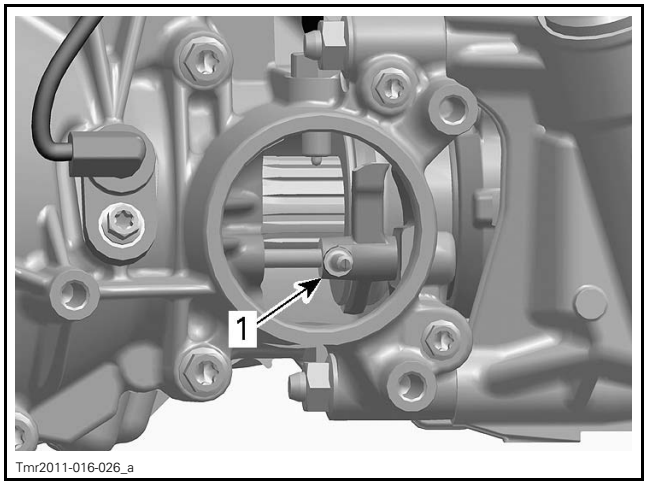
Lubricate actuator O-ring.

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



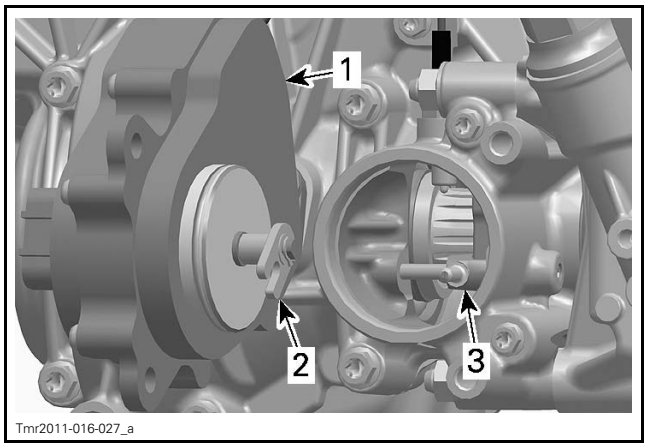
1. *Actuator O-ring*

Ensure coupling fork is in 4WD position (positioned toward the front of vehicle).



1. *Coupling fork in 4WD position*

Align the actuator fork with the pin on coupling fork then push the actuator in the housing. See the following illustration to position the actuator correctly.



1. *Actuator*
2. *Actuator fork*
3. *Coupling fork*

Rotate the actuator counterclockwise until it orients itself to mounting position.

NOTICE **Do not cut or break the actuator O-ring.**

Install all actuator screws and tighten them.

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

Connect actuator.

Lift the front of vehicle.

Turn front wheels. 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.

Set ignition switch to ON.

Set emergency engine stop switch to RUN.

Select the 2WD position.

Turn front wheel again. The front propeller shaft should turn easily.

If the front propeller shaft does not turn, the actuator is not installed correctly. Remove actuator and reinstall it.

NOTICE Refill gearbox, refer to *GEARBOX OIL FILLING PROCEDURE* in *PERIODIC MAINTENANCE PROCEDURES* subsection.

Install all other removed parts.

GEARBOX OIL SEALS

Gearbox Oil Seal Replacement

Replace oil seals if they are brittle, hard or damaged.

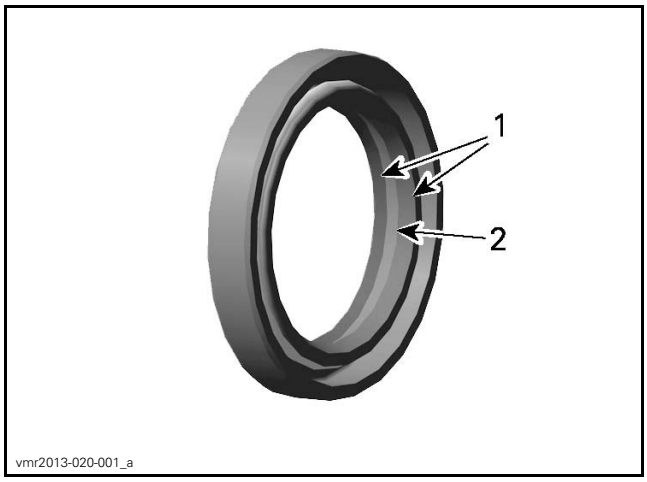
A small flat screwdriver can be used to remove most of these oil seals.

NOTICE Avoid scoring parts during oil seal removal.

When replacing an oil seal, take this opportunity to inspect the following:
- Check bearings behind each oil seal for contamination and/or metal shavings.
- Check oil seal running surfaces for scratches.

Oil Seal Lubrication

When installing oil seals, use PETAMO GREASE GHY 133N (P/N 420 899 271) to:
- Lubricate sealing lips all around.
- Fill up the room between sealing lips halfway around the perimeter.

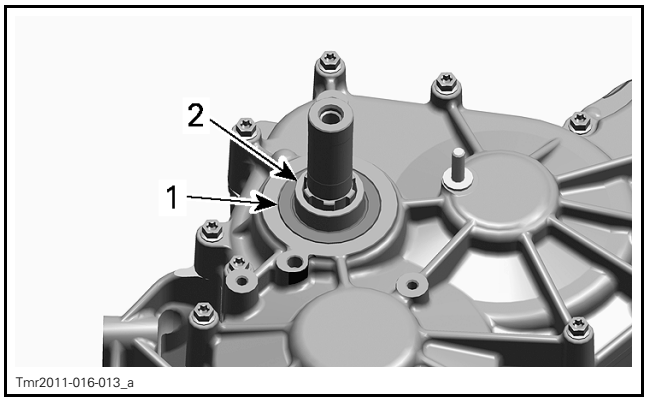


1. Sealing lips
2. Room between sealing lips

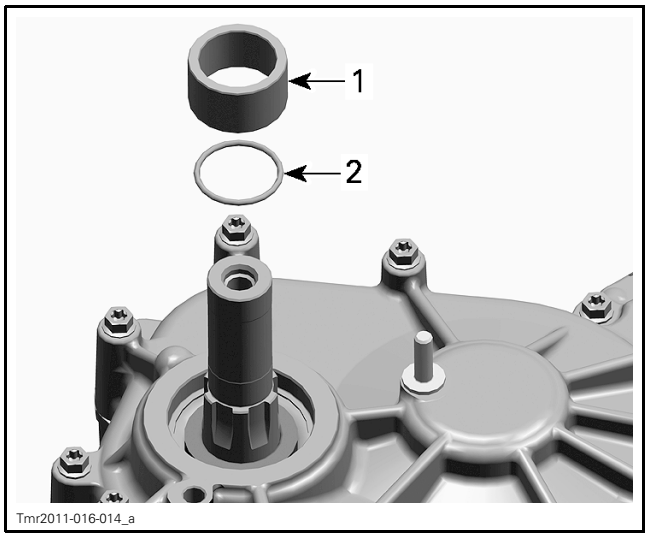
Countershaft Oil Seal

To replace the countershaft oil seal, remove:
- Drive and driven pulleys
- CVT air guide.

NOTE: When oil seal is removed also inspect O-ring behind distance sleeve.



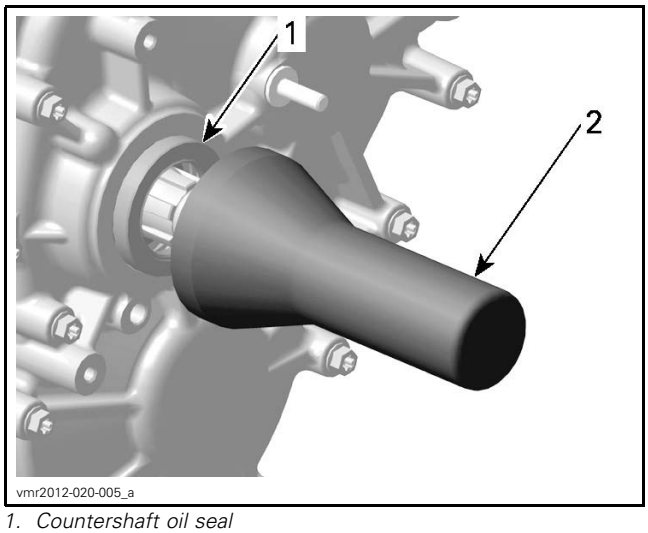
1. Countershaft oil seal
2. Distance sleeve



1. Distance sleeve
2. O-ring

Install countershaft oil seal tool.

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



1. Countershaft oil seal
2. Oil seal pusher

Shift Shaft Oil Seal

The shift shaft oil seal can be removed without removing the gearbox from the vehicle.

To replace the shift shaft oil seal, refer to *BODY* and remove:

– Seat
– Console
– RH side panel
– RH footrest panel
– Shift plate from shift shaft (refer to *SHIFTER*).

Use a suitable tube with the proper diameter to install the oil seal.

If gearbox housing is apart, use following tools for shift shaft oil seal installation.

REQUIRED TOOL	
OIL SEAL INSTALLER (GEARBOX) (P/N 529 035 758)	
HANDLE (P/N 420 877 650)	

NOTICE Oil seal must be installed with sealing lip toward gearbox.

Shift Drum Shaft Oil Seal

To replace the shift drum shaft oil seal, remove the *GBPS (GEARBOX POSITION SENSOR)*. See procedure in this subsection.

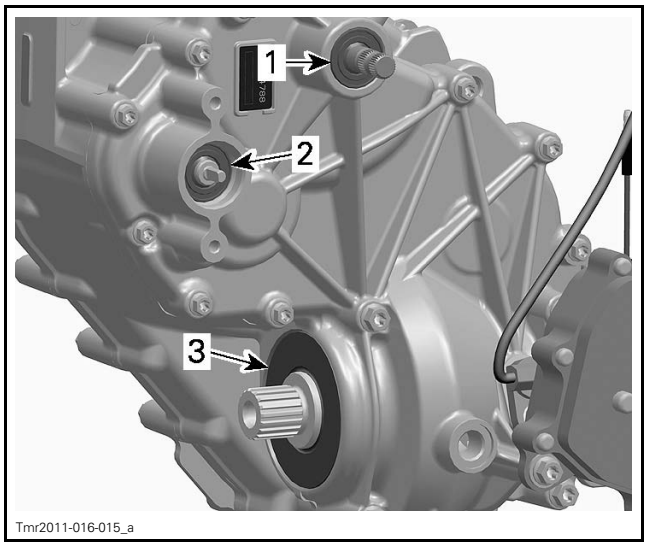
Use a suitable tube with the proper diameter to install the oil seal.

NOTICE Oil seal must be installed with sealing lip toward gearbox.

Output Shaft Oil Seal

To replace the output shaft oil seal, proceed as follows:

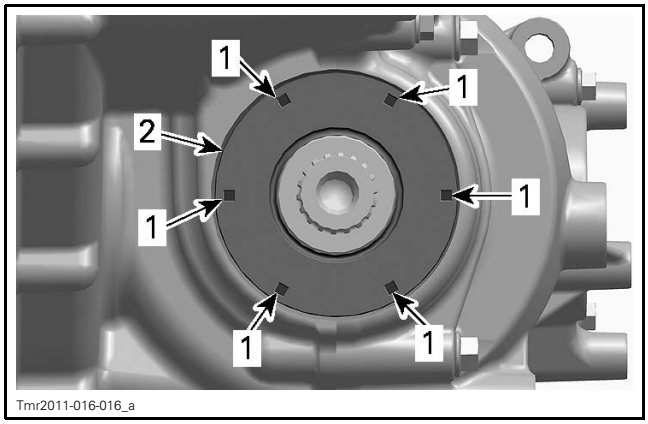
Remove propeller shaft. Refer to *REAR DRIVE* subsection.



1. Shift shaft oil seal
2. Shift drum shaft oil seal
3. Output shaft oil seal

Punch a sharp screwdriver through oil seal for removal.

NOTE: Position screwdriver only in marked areas to avoid damaging the ball bearing behind oil seal during removal.



1. Marked areas for removal
2. Output shaft oil seal

Before beginning the installation ensure gearbox is set to PARK position.

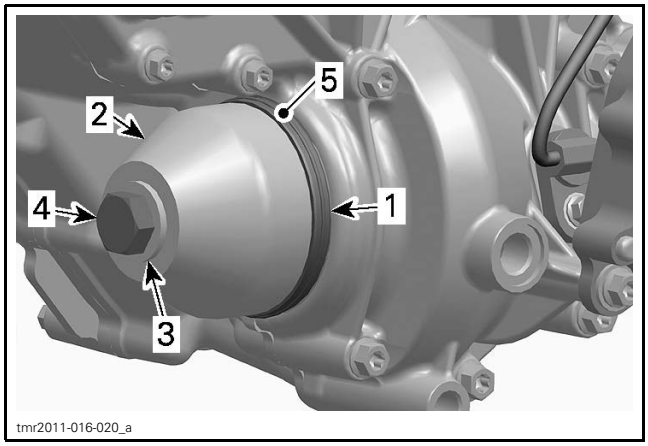
Apply grease all around lips of the sealing seal

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

Apply engine oil on outer diameter of oil seal to avoid damaging it during installation.

Place oil seal on output shaft and install it using the following tools.

REQUIRED TOOL	
OIL SEAL INSTALLER (P/N 529 036 204)	
Flat washer (P/N 250 200 102)	
M12 x 1.25 x 35 hexagonal screw (P/N 207 683 544)	



1. Output shaft oil seal
2. Oil seal installer
3. Flat washer
4. M12 x 1.25 x 35 hexagonal screw
5. Apply engine oil on outer diameter of oil seal

GEARBOX

Gearbox Removal

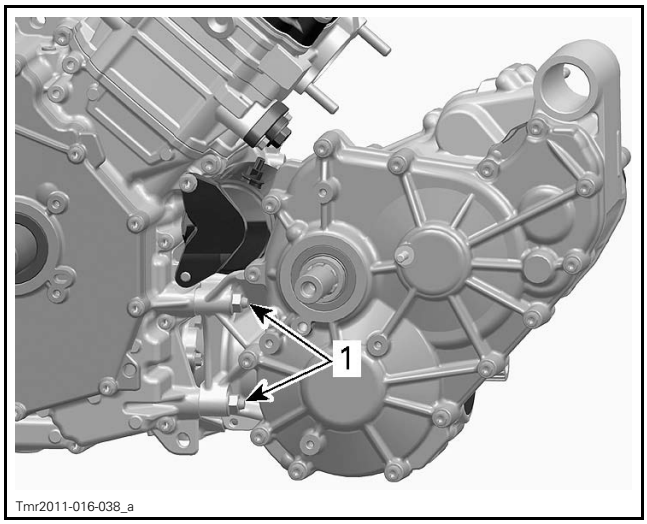
Remove engine from vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* for the procedure.

Refer to *CONTINUOUSLY VARIABLE TRANSMISSION (CVT)* subsection to remove following parts:
– CVT cover
– Drive and driven pulleys
– CVT air guide.

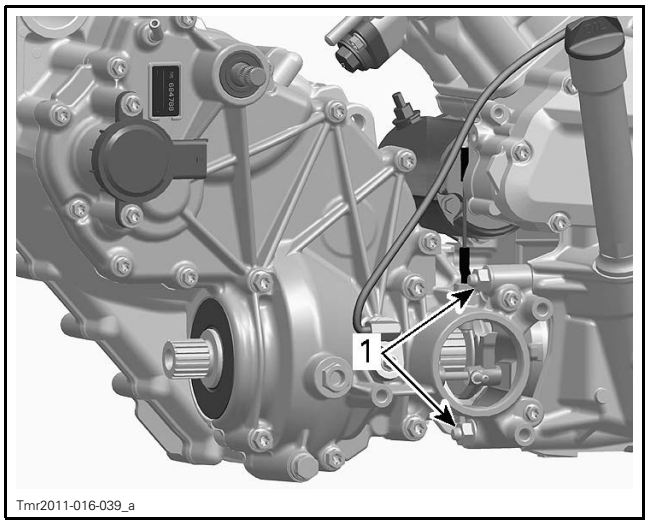
Drain gearbox. Refer to *GEARBOX OIL DRAINING PROCEDURE* in *PERIODIC MAINTENANCE PROCEDURES* subsection.

Remove *ACTUATOR*, see procedure in this subsection.

Unscrew the four (4) nuts that attach the gearbox to the engine.



LH SIDE OF ENGINE
1. Nut M8



RH SIDE OF ENGINE
1. Nut M8

Pull gearbox to separate it from engine.

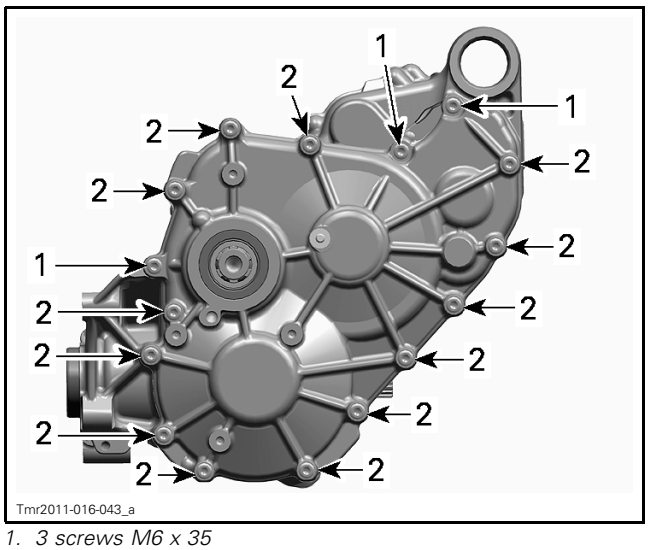
Gearbox Disassembly

NOTE: During gearbox disassembly, inspect the condition of each part closely.

Gearbox Left Cover

Set gearbox to NEUTRAL position.

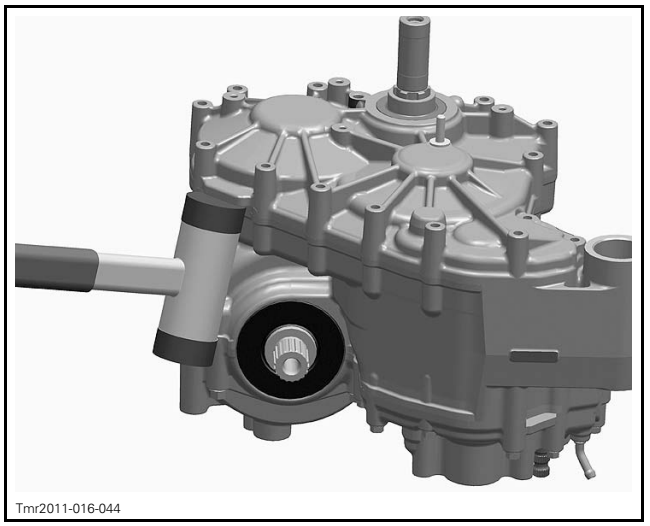
Unscrew all bolts retaining the gearbox left cover.



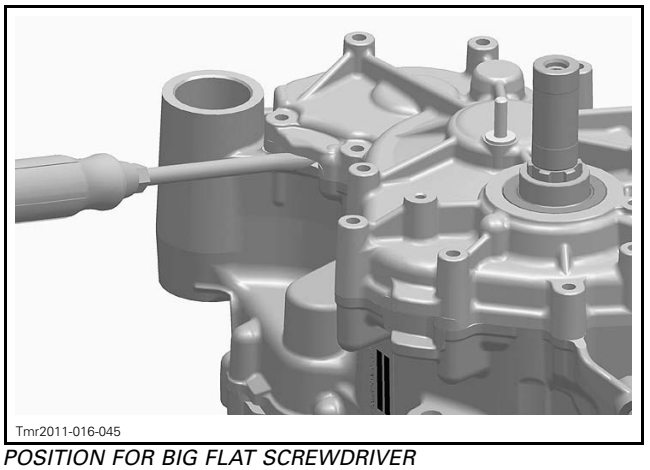
1. 3 screws M6 x 35
2. 13 screws M6 x 55

Place the center housing on a wood stand, left cover pointing upwards.

Use a big flat screwdriver and a soft hammer to lift the left cover.



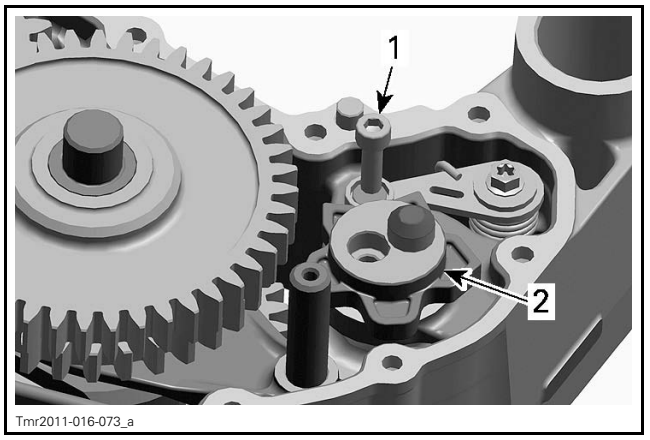
POSITION FOR SOFT HAMMER



POSITION FOR BIG FLAT SCREWDRIVER

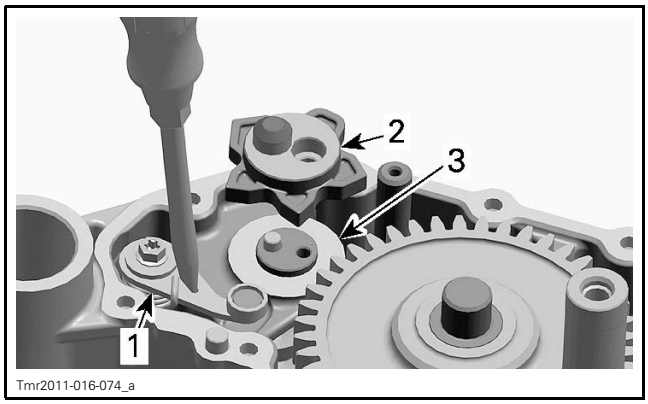
Index Lever and Index Washer

Remove screw retaining the index washer to the shift drum.



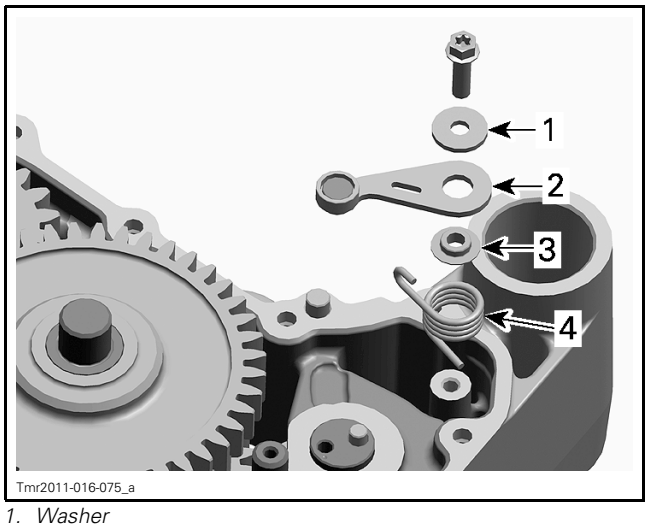
1. Screw
2. Index washer

Insert a flat screwdriver in the slot of index lever. Turn screwdriver clockwise and remove index washer.



1. *Index lever*
2. *Index washer*
3. *Shift drum*

Remove the index lever with washer, step ring and spring.

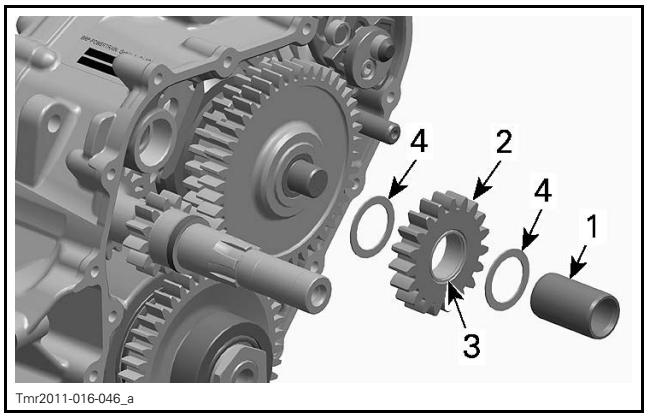


1. *Washer*
2. *Index lever*
3. *Step ring*
4. *Index spring*

Main Shaft and Shift Forks

Remove bearing pin, reverse intermediate gear and thrust washers.

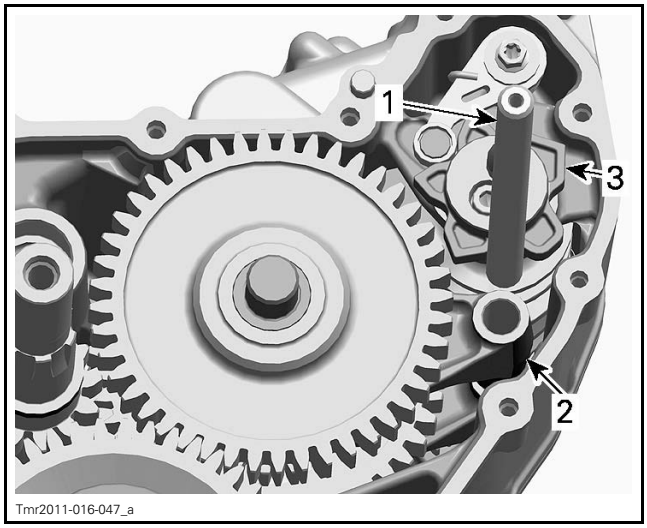
NOTE: Take care not to lose lower thrust washer during removal.



1. *Bearing pin*
2. *Reverse intermediate gear*
3. *Needle bearing*
4. *Thrust washers*

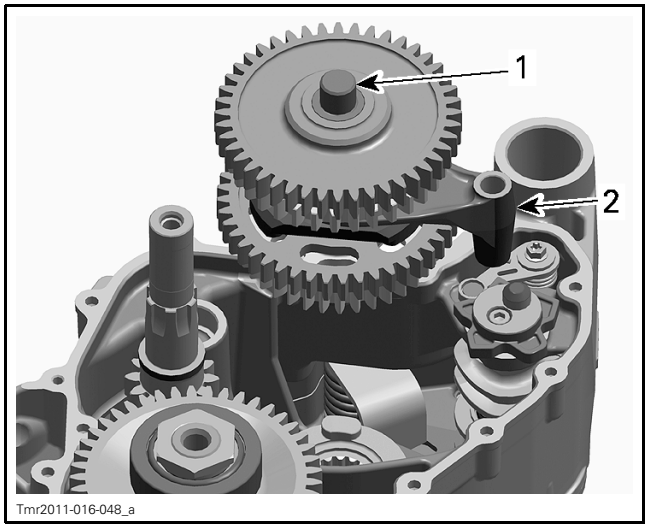
Remove shift fork shaft.

Disengage shift forks from shift drum.



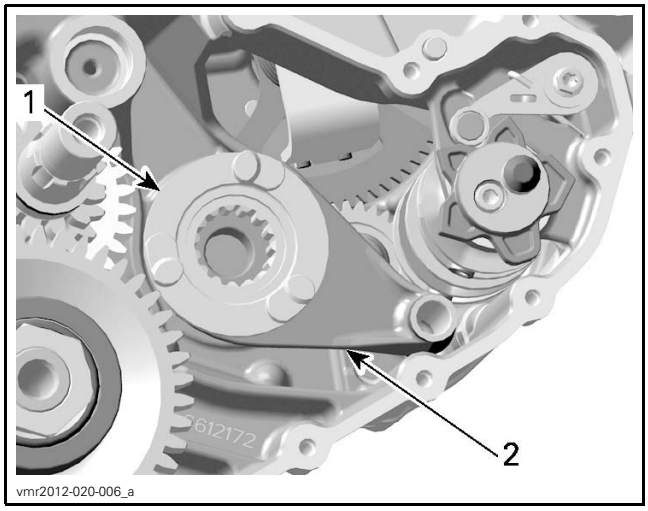
1. *Shift fork shaft*
2. *Shift fork*
3. *Shift drum*

Remove main shaft assembly with shift fork.



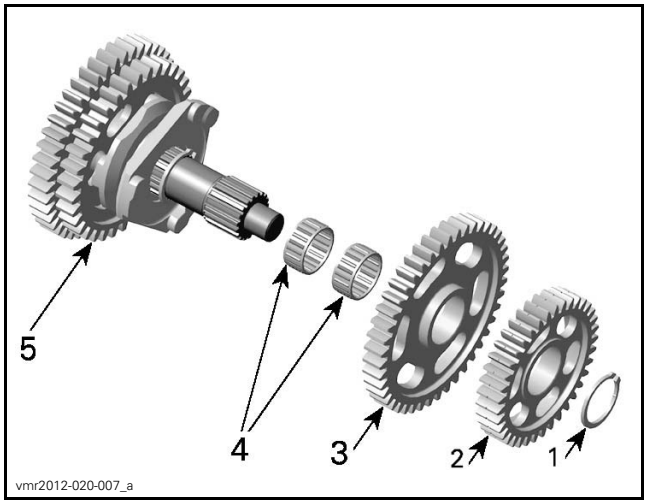
1. Main shaft assembly
2. Shift fork

Remove shifting sleeve (HIGH range gear) and shift fork.



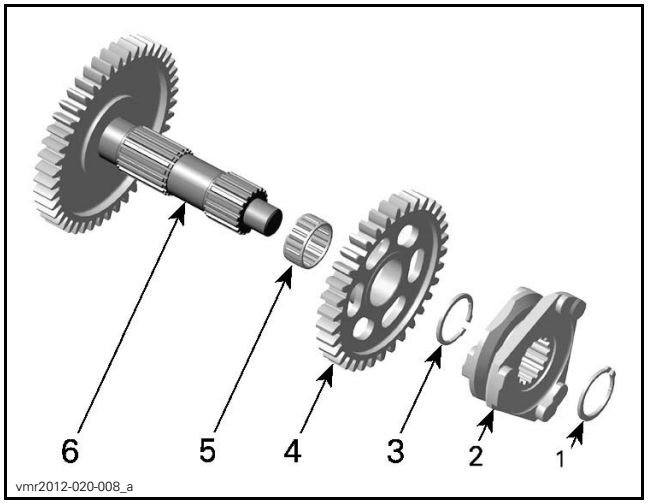
1. Shifting sleeve (HIGH range gear)
2. Shift fork

When required, remove from main shaft assembly:
– Snap ring (discard)
– HIGH range gear
– LOW range gear
– Needle bearings.



1. Snap ring
2. Free pinion (HIGH range gear)
3. Free pinion (LOW range gear)
4. Needle bearing
5. Main shaft assembly

Remove from main shaft assembly:
– Snap ring (discard)
– Shifting sleeve (LOW/REVERSE range gear)
– Snap ring (discard)
– REVERSE range gear
– Needle bearing.

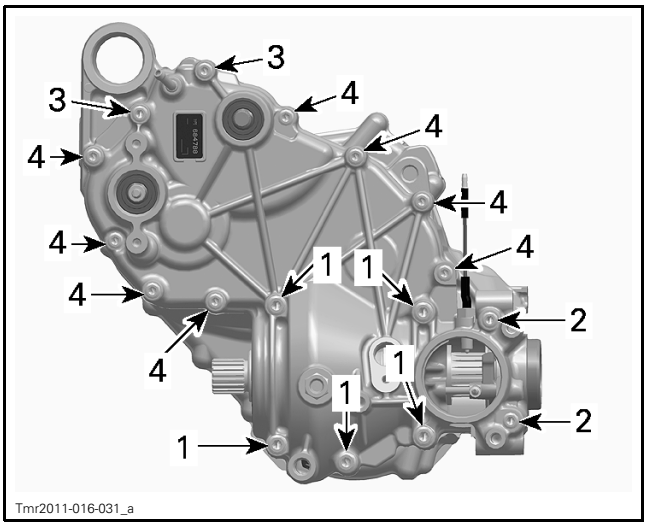


1. Snap ring
2. Shifting sleeve (LOW/REVERSE range gear)
3. Snap ring
4. Free pinion (REVERSE range gear)
5. Needle bearing
6. Main shaft assembly

Gearbox Right Cover

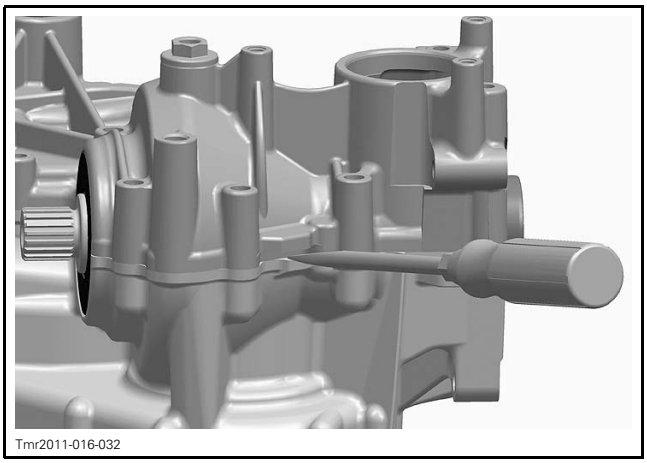
Remove *ACTUATOR* and *GBPS (GEARBOX POSITION SENSOR)*, see procedures in this subsection.

Unscrew all bolts retaining the gearbox right cover.

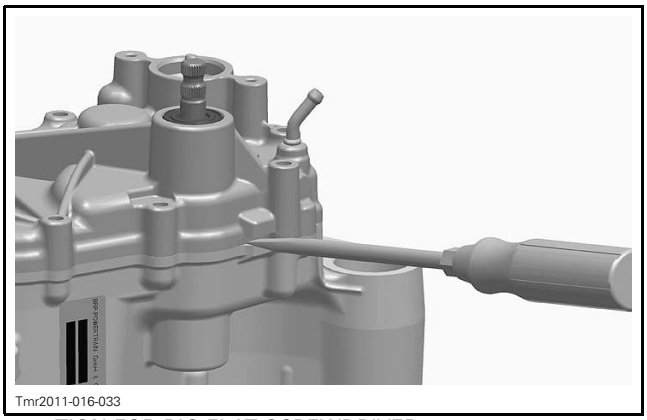


1. *5 screws M8 x 55*
2. *2 screws M6 x 85*
3. *2 screws M6 x 55*
4. *8 screws M6 x 35*

To remove cover, use 2 big screwdrivers.



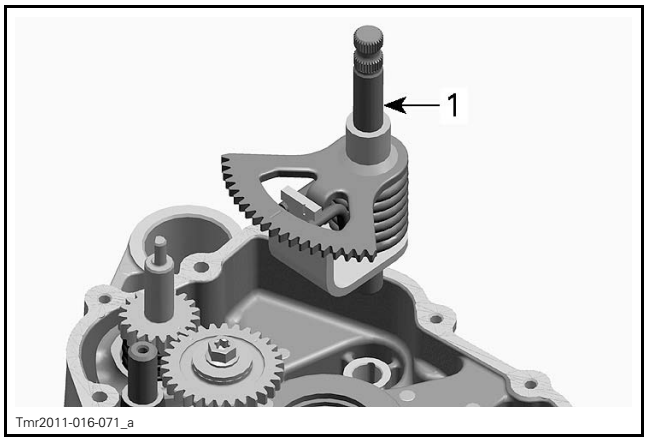
POSITION FOR BIG FLAT SCREWDRIVER



POSITION FOR BIG FLAT SCREWDRIVER

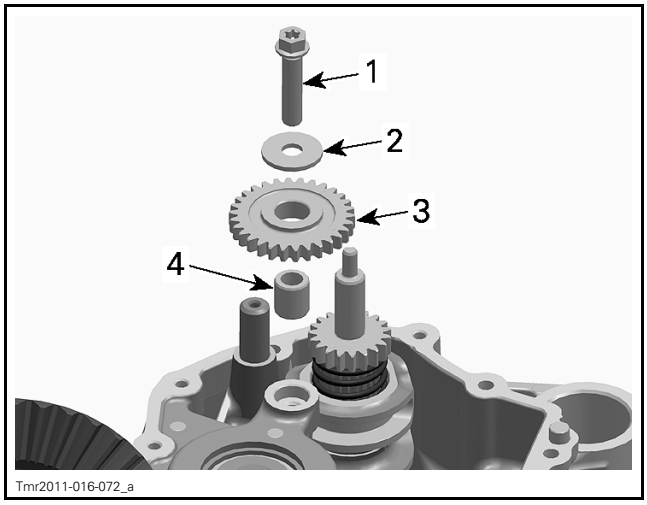
Shift Shaft and Shift Drum

Withdraw shift shaft assembly.



1. *Shift shaft assembly*

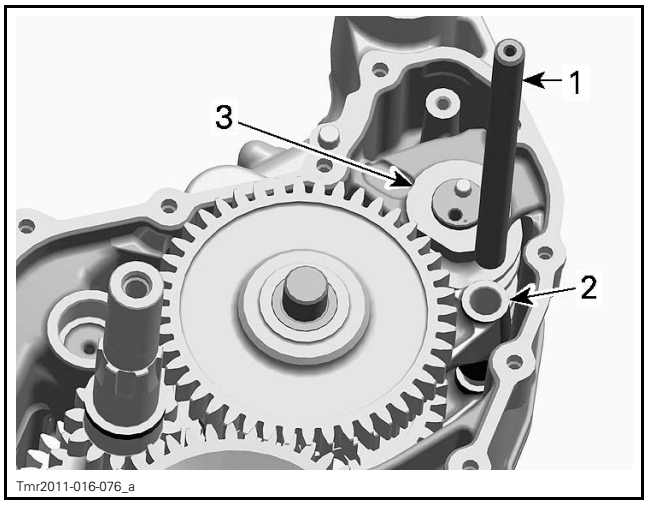
Remove screw retaining the shifting intermediate gear.



1. *Screw*
2. *Washer*
3. *Intermediate gear*
4. *Dowel pin*

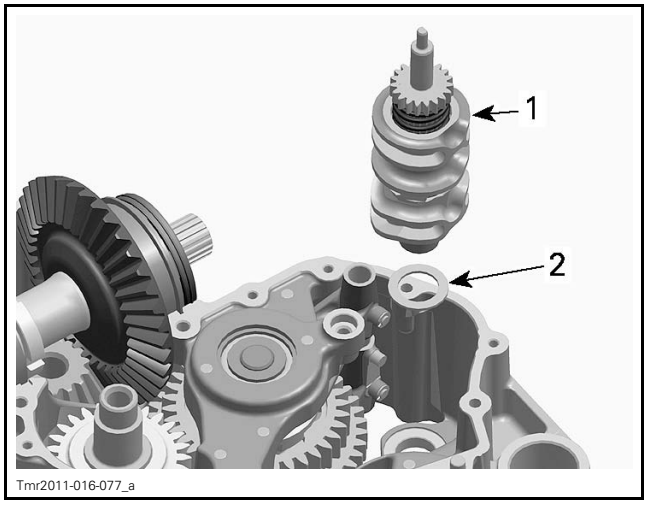
Remove shift fork shaft.

Disengage shift forks from shift drum.



1. Shift fork shaft
2. Shift fork
3. Shift drum

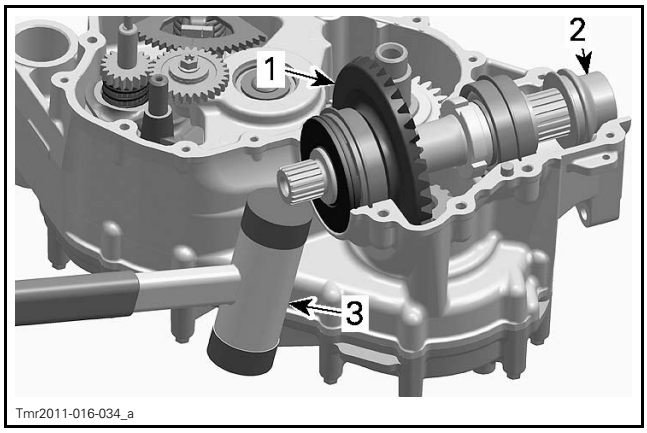
Remove shift drum and thrust washer.



1. Shift drum
2. Thrust washer

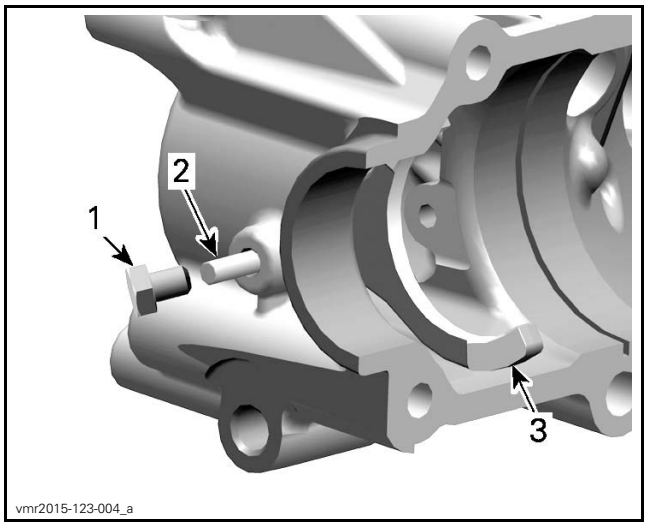
Output Shaft and Coupling Mechanism

Remove output shaft from center housing and withdraw coupling sleeve.



1. Output shaft
2. coupling sleeve
3. Soft hammer

Remove hexagonal screw, coupling fork shaft and coupling fork from right cover.

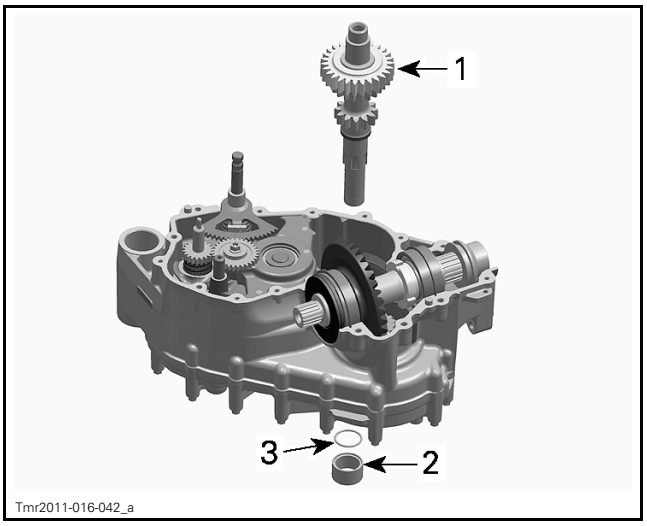


1. Hexagonal screw
2. Coupling fork shaft
3. Coupling fork

Countershaft

Use a soft hammer to push out countershaft from gearbox CVT side.

Remove distance sleeve and O-ring.



1. *Countershaft*
2. *Distance sleeve*
3. *O-ring*

Gearbox Bearings

If necessary heat housing up to 100°C (212°F) before removing ball bearings.

⚠ WARNING

Clean oil, outside and inside, from housing before heating.

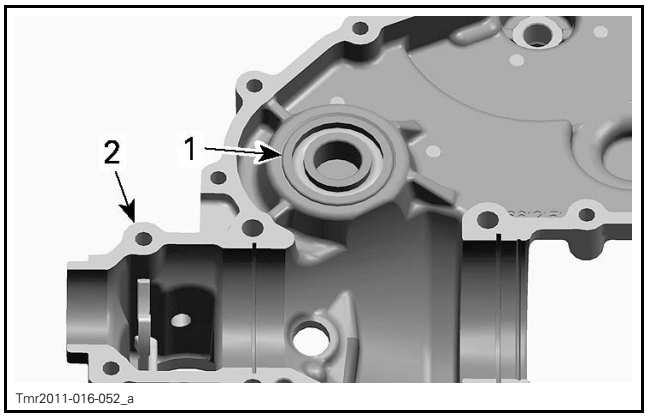
NOTICE **Always support gearbox housings properly when ball bearings are removed. Housing damages may occur if this procedure is not performed correctly.**

To remove ball bearings of countershaft (right cover) and main shaft (left cover) use following tool.

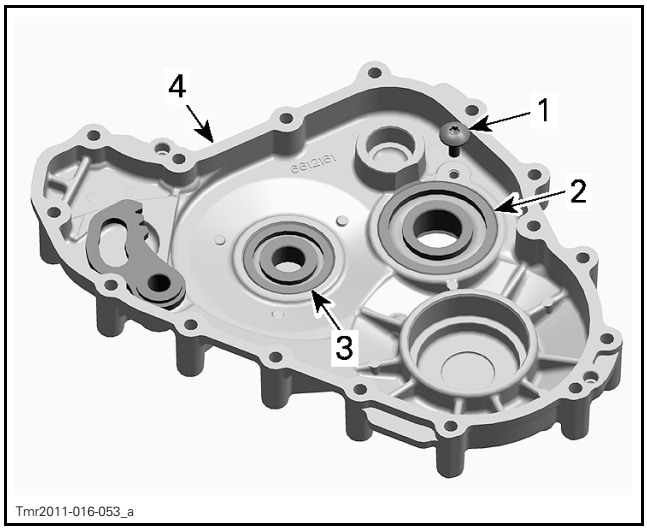
REQUIRED TOOL	
BLIND HOLE BEARING PULLER SET (P/N 529 036 117)	

Remove screw securing the countershaft bearing in the left cover.

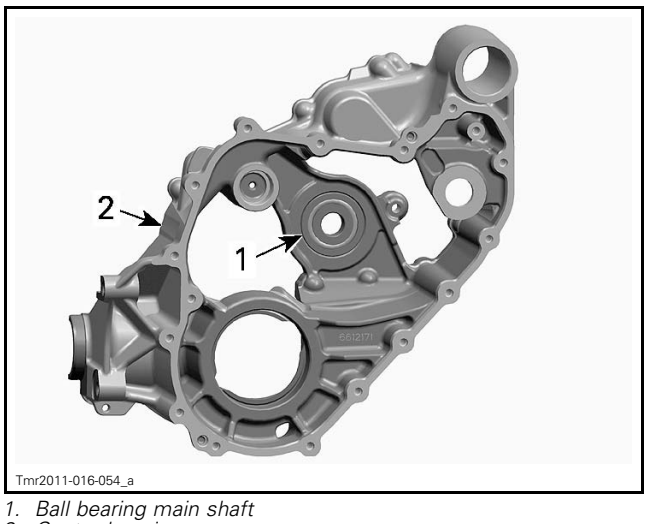
For ball bearings of countershaft (left cover) and main shaft (center housing) push with a suitable puller from outside in.



1. *Ball bearing countershaft*
2. *Right cover*



1. *Screw*
2. *Ball bearing countershaft*
3. *Ball bearing main shaft*
4. *Left cover*



1. *Ball bearing main shaft*
2. *Center housing*

Gearbox Inspection

Always verify for the following when inspecting gearbox components:

– Gear teeth damage
– Worn or scoured bearing surfaces
– Rounded engagement dogs and slots
– Worn shift fork engagement groove
– Worn splines on shafts and shifting sleeves.

Bearings

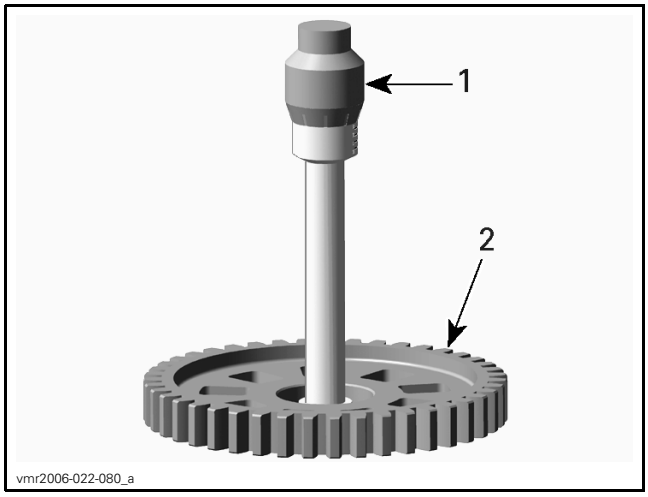
Check if ball bearings turn freely and smoothly.

Check all bearings, bearing points, tooth flanks and taper grooves.

Free Pinions

NOTE: Always replace snap rings and use special pliers to install them.

Check free pinions for wear.

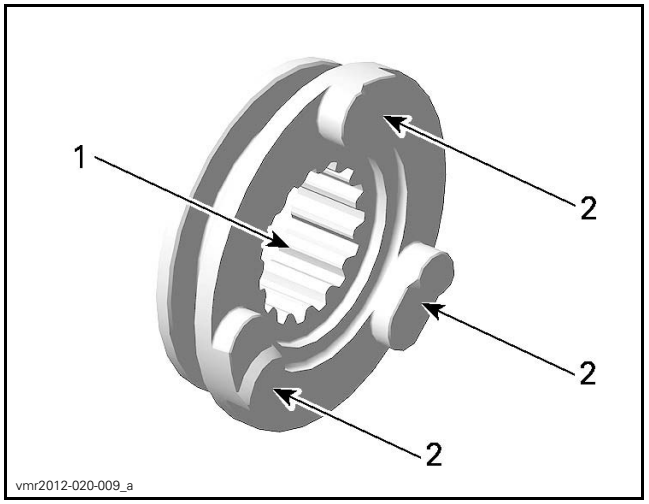


TYPICAL
1. Micrometer
2. Free pinion

DIAMETER FREE PINION	
NEW	29.000 mm to 29.013 mm (1.1417 in to 1.1422 in)
SERVICE LIMIT	29.015 mm (1.1423 in)

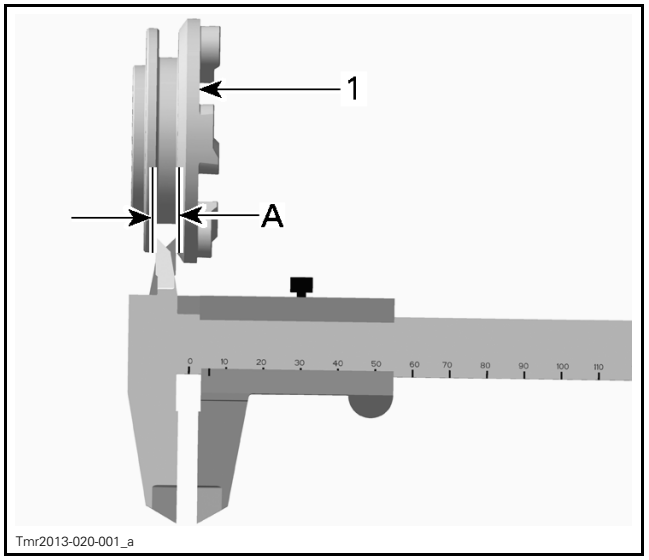
Shifting Sleeves

Check shifting sleeves for worn inner splines and rounded or damaged engagement dogs.



TYPICAL
1. Inner splines
2. Engagement dogs

Measure the width of shift fork engagement groove.

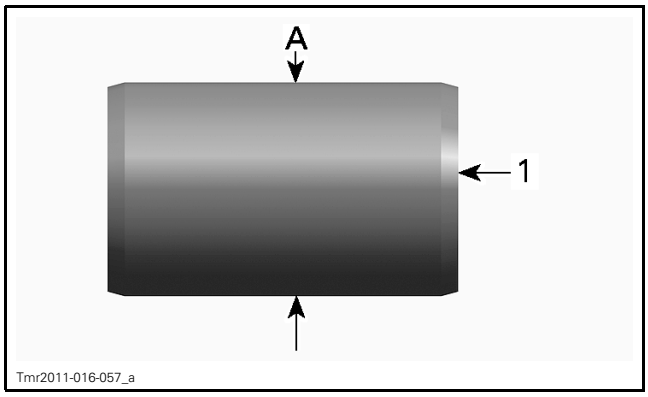


TYPICAL
1. Shifting sleeve
A. Width of shift fork engagement groove

WIDTH OF SHIFT FORK ENGAGEMENT GROOVE	
NEW	5.30 mm to 5.40 mm (.209 in to .213 in)
SERVICE LIMIT	5.50 mm (.217 in)

Shafts

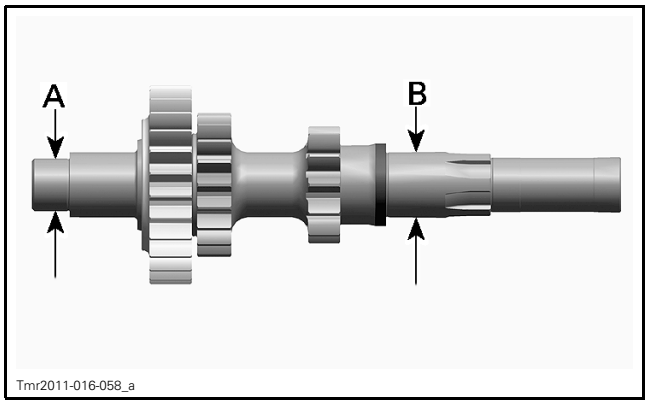
Check bearing pin of reverse intermediate gear for wear.



1. Bearing pin
A. Outer diameter

BEARING PIN OUTER DIAMETER	
NEW	24.987 mm to 25.000 mm (.984 in to .984 in)
SERVICE LIMIT	24.977 mm (.9833 in)

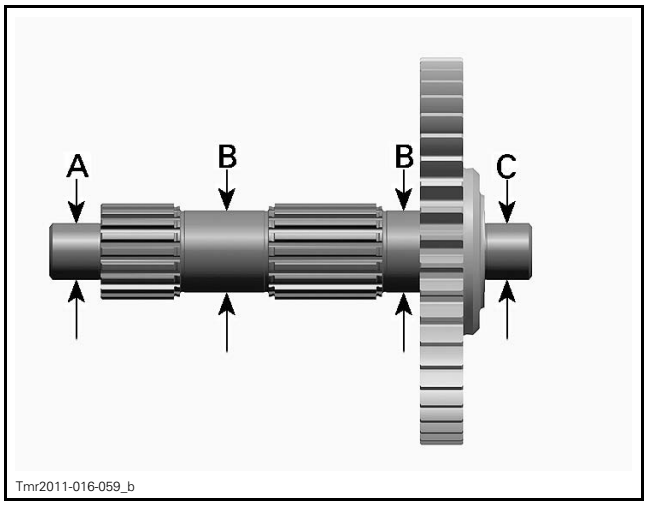
Check countershaft bearing journals for wear.



A. MAG side
B. Bearing journal CVT side

COUNTERSHAFT BEARING JOURNALS	
MAG SIDE	
NEW	19.977 mm to 19.990 mm (.786 in to .787 in)
SERVICE LIMIT	19.973 mm (.786 in)
CVT SIDE	
NEW	24.977 mm to 24.990 mm (.983 in to .984 in)
SERVICE LIMIT	24.970 mm (.983 in)

Check main shaft for wear.



A. Bearing journal MAG side
B. Free pinion bearing
C. Bearing journal CVT side

MAIN SHAFT	
FREE PINION BEARING	
NEW	24.987 mm to 25.000 mm (.984 in to .984 in)
SERVICE LIMIT	24.984 mm (.984 in)
BEARING JOURNAL CVT/MAG SIDE	
NEW	16.980 mm to 16.991 mm (.669 in to .669 in)
SERVICE LIMIT	16.976 mm (.668 in)

Shift Shaft

Check shift shaft for worn splines and gears.

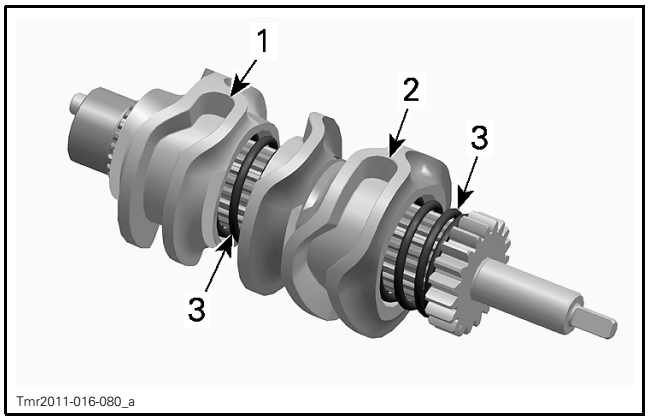
Check shift shaft spring for damages.

Shift Drum

NOTICE Do not disassemble shift drum.

Check if shifting gates move easily on shift drum splines and check condition of springs.

Check shift drum tracks for scouring or heavy wear, like rounded engagement slots.



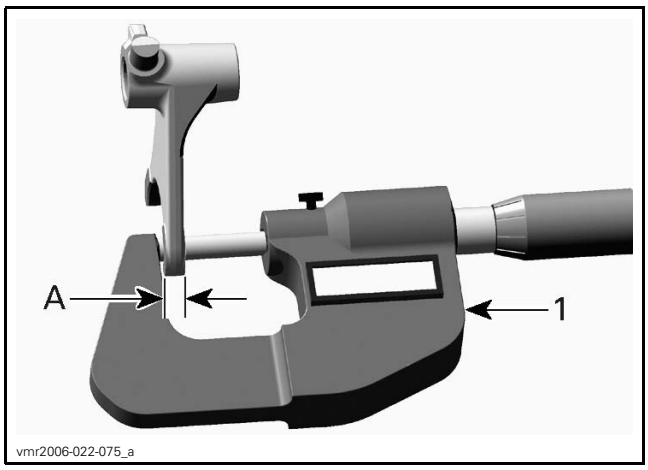
1. Track for the low/reverse range gear shift fork
2. Track for the high range gear shift fork
3. Springs

Shift Forks

Check both shift forks for visible damage, wear or bent shift fork claws.

Check engagement rollers for wear and smooth movement.

Measure the shift fork claw thickness.



1. Micrometer
A. Shift fork claw thickness

SHIFT FORK CLAW THICKNESS	
NEW	5.10 mm to 5.20 mm (.201 in to .205 in)
SERVICE LIMIT	5.00 mm (.197 in)

Shift Fork Shaft

Check shift fork shaft for visible damage or wear.

Check if shift fork shaft is straight.

Index Lever and Parking Lever

Index lever with roller must move freely.

Check parking lever for cracks or other damages.

Output Shaft

Check output shaft and its gear for cracks, bend, pitting or other visible damages.

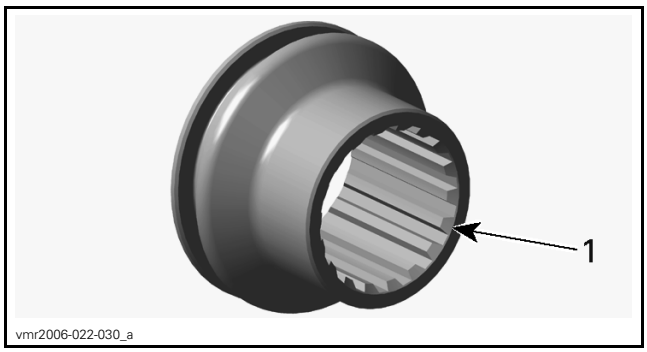
Check output shaft splines for wear or other damages.

Check if the output shaft bearings turn freely and smoothly.

Replace oil seal if brittle, hard or damaged.

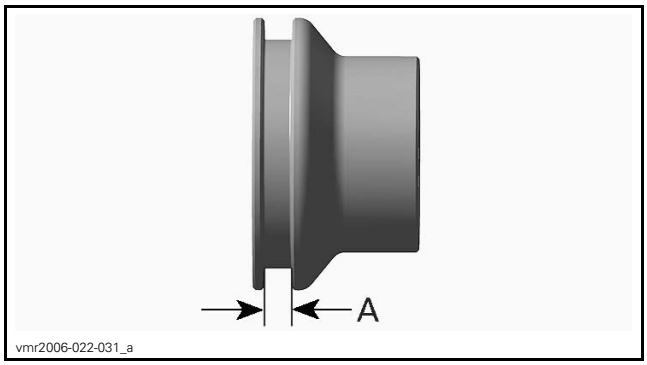
Coupling Sleeve

Check splines of coupling sleeve for wear or other damages.



1. Inspect splines

Measure the coupling sleeve groove width.



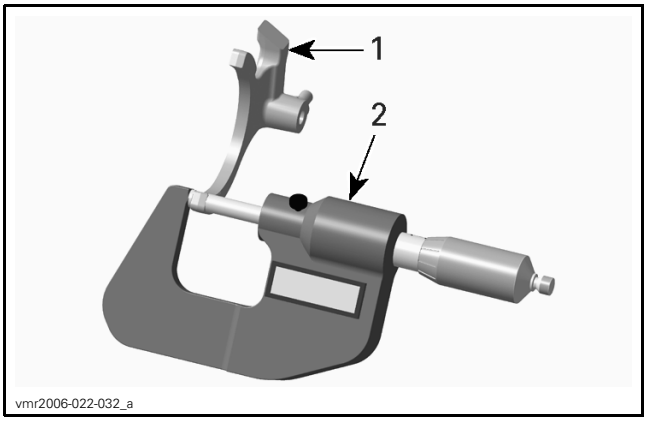
A. Groove width

COUPLING SLEEVE GROOVE WIDTH	
NEW	5.25 mm to 5.35 mm (.207 in to .211 in)
SERVICE LIMIT	5.50 mm (.217 in)

Coupling Fork

Check coupling fork for visible damage, wear or bent coupling fork claws.

Check coupling fork claw thickness.



1. Coupling fork
2. Micrometer

COUPLING FORK CLAW THICKNESS	
NEW	4.95 mm to 5.05 mm (.195 in to .199 in)
SERVICE LIMIT	4.80 mm (.189 in)

Gearbox Assembly

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

Gearbox Bearings

NOTICE **Unless otherwise instructed, never use hammer to install ball bearings. Use press machine only.**

If necessary heat housings up to 100°C (212°F) before installing ball bearings.

⚠ WARNING

Clean oil, outside and inside, from housing before heating.

Place new bearing in freezer for 10 minutes before installation.

Use a suitable installer for installing ball bearings of countershaft and main shaft.

NOTE: Place gearbox housings on a wood stand before installing ball bearings.

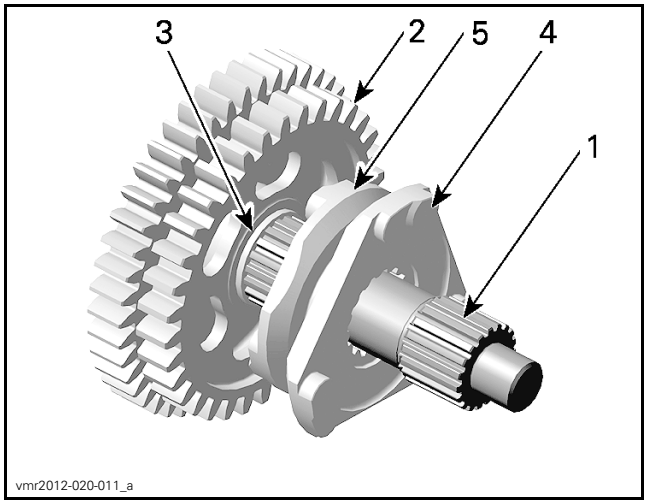
Install new oil seals with the proper installer (refer to *OIL SEALS* in this subsection).

Main Shaft and Shift Forks

Install NEW snap rings.

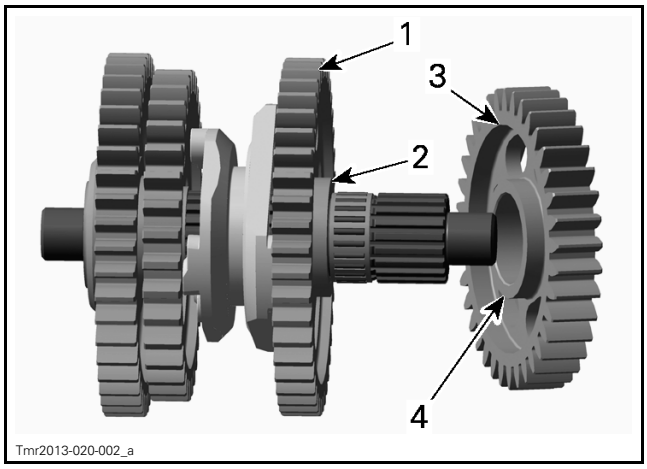
NOTE: Ensure snap rings are installed in the grooves properly.

Install free pinion (REVERSE range gear) and shifting sleeve (LOW/REVERSE range gear) properly.



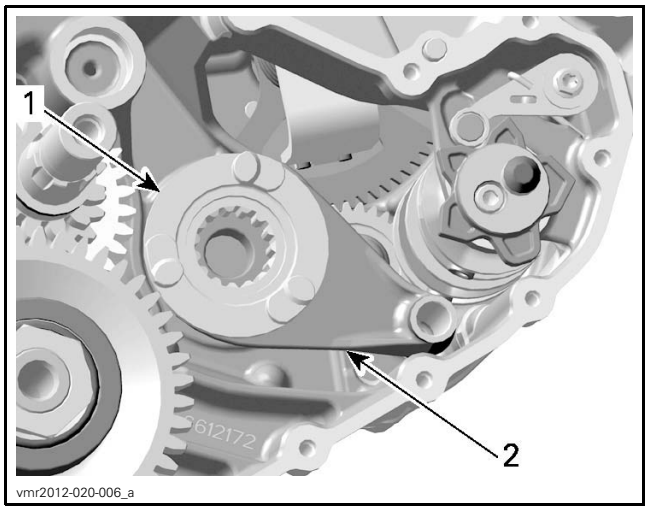
1. Main shaft
2. Free pinion (REVERSE range gear)
3. Snap ring
4. Shifting sleeve (LOW/REVERSE range gear)
5. Shifting dogs (REVERSE range gear)

Collars of free pinion (LOW range gear) and free pinion (HIGH range gear) must point together.



1. Free pinion (LOW range gear), 44 T
2. Collar
3. Free pinion (HIGH range gear), 36 T
4. Collar

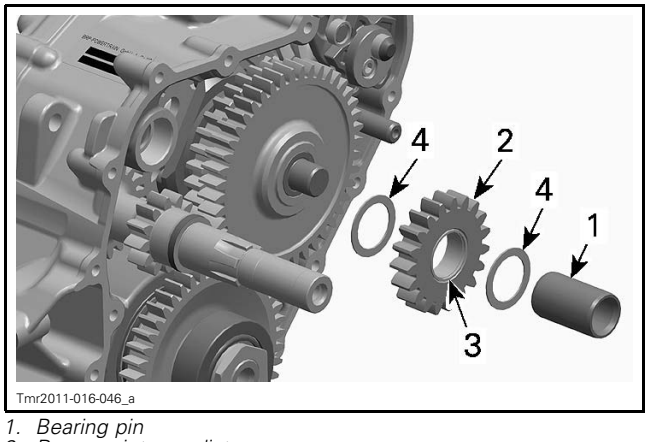
Place shifting sleeve (HIGH range gear) with shift fork in the center of on main shaft bearing in center housing.



1. Shifting sleeve (HIGH range gear)
2. Shift fork

Carefully fit main shaft assembly with shift fork (LOW/REVERSE range gear) into inner splines of shifting sleeve (HIGH range gear).

Install reverse intermediate gear.



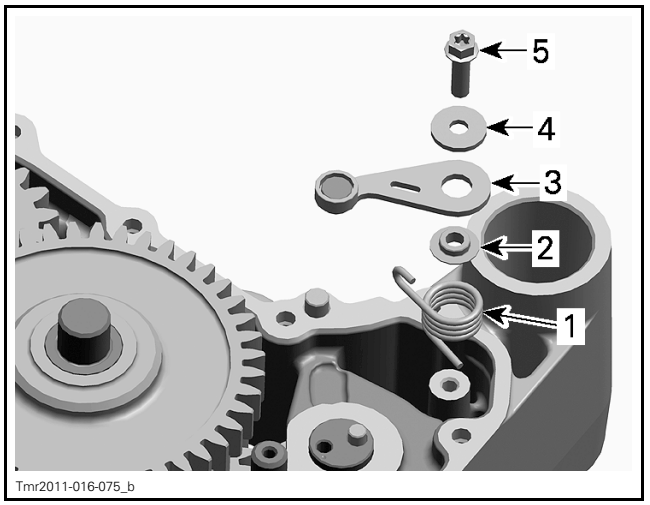
1. Bearing pin
2. Reverse intermediate gear
3. Needle bearing
4. Thrust washers

Finally engage shift forks in shift drum and install shift fork shaft.

NOTE: Run all gears as a final function check before installing left housing.

Index Lever and Index Washer

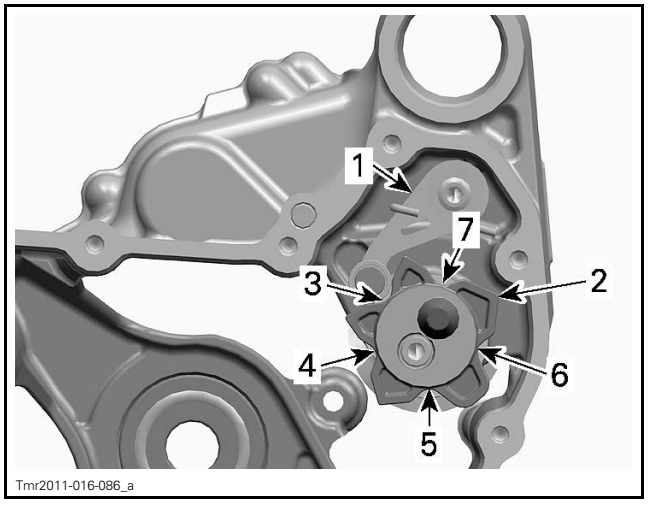
Fit step ring into index lever.



1. Index spring
2. Step ring
3. Index lever
4. Washer
5. Screw

Install index washer on shift drum.

Insert a flat screwdriver in the slot of the index lever, turn screwdriver clockwise and engage lever in index washer in NEUTRAL position as per following illustration.



1. Index lever
2. Index washer
3. Neutral position
4. High range gear position
5. Low range gear position
6. Parking position
7. Reverse range gear position

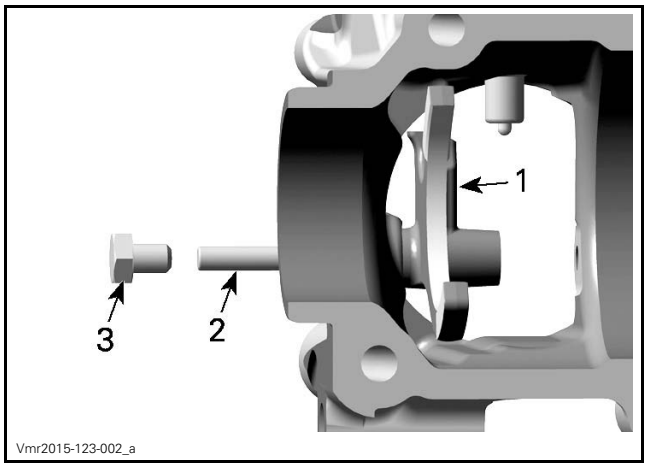
Output Shaft and Coupling Mechanism

Install coupling sleeve onto the output shaft.

Place the output shaft with oil seal and coupling sleeve into the center housing.

NOTE: If same oil seal is installed, turn oil seal 90° offset to its original position to avoid leakage at housing mating surface.

Install coupling fork, coupling fork shaft and hexagonal screw in right cover before applying sealant to the mating surface.

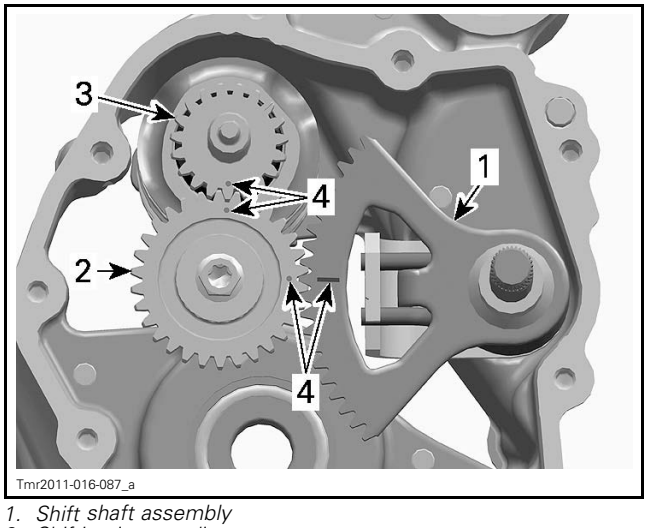


1. *Coupling fork*
2. *Coupling fork shaft*
3. *Hexagonal screw*

Shift Shaft and Shift Drum

Install shift drum and shift shaft.

Install shifting intermediate gear. Align its marks with the marks on shift drum gear and shift shaft.



1. *Shift shaft assembly*
2. *Shifting intermediate gear*
3. *Shift drum gear*
4. *Marks*

Engage both shift fork pins in their corresponding groove on the shift drum.

Install shift fork shaft.

NOTE: Turn gears to validate proper operation.

Sealing Compound Application

NOTE: Unless otherwise specify, the procedure to apply the sealant is the same for right or left cover.

Clean all metal components in a solvent.

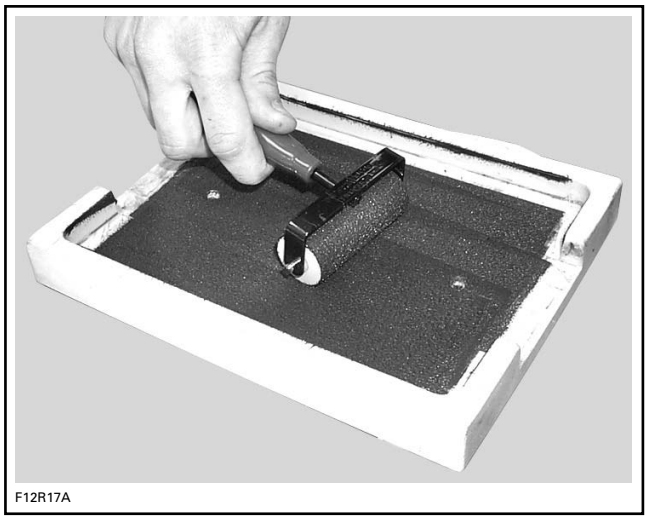
Gearbox housing mating surfaces are best cleaned using a combination of LOCTITE CHISEL (GASKET REMOVER) (P/N 413 708 500) and a brass brush. Brush a first pass in one direction then make the final brushing perpendicularly (90°) to the first pass cross (hatch).

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

IMPORTANT: When beginning the application of the gear housing 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 LOCTITE 5910 (P/N 293 800 081) on mating surfaces.

Use a plexiglass plate and apply some sealant on it. Use a soft rubber roller (50 mm - 75 mm (2 in - 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 gear housing mating surfaces.



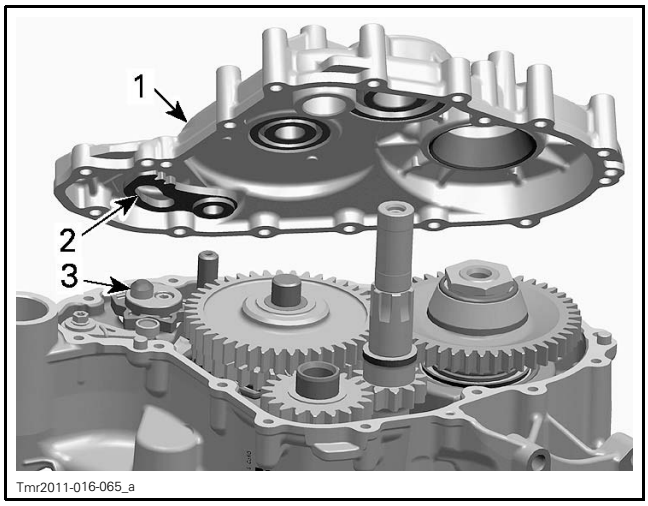
Do not apply in excess as it will spread out inside gear housing.

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).

Left Cover

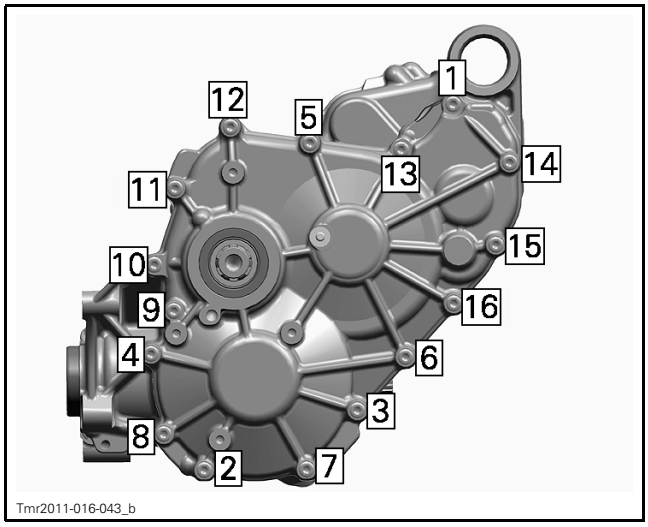
Apply sealing compound on mating surfaces of central housing. Refer to *SEALING COMPOUND APPLICATION*.

At installation of left cover, engage parking lock lever slot onto index washer pin.



1. *Left cover*
2. *Parking lock lever slot*
3. *Index washer pin*

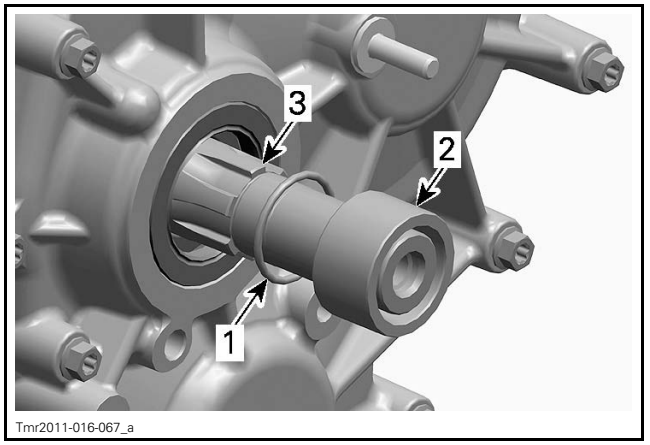
Install all screws on left cover and tighten them as per following sequence.



M6 SCREWS - LEFT COVER	
Tightening torque	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

Install O-ring including distance sleeve on countershaft CVT side.

NOTICE **Place O-ring including distance sleeve right away. Chamfered bore of distance sleeve has to face the gearbox.**



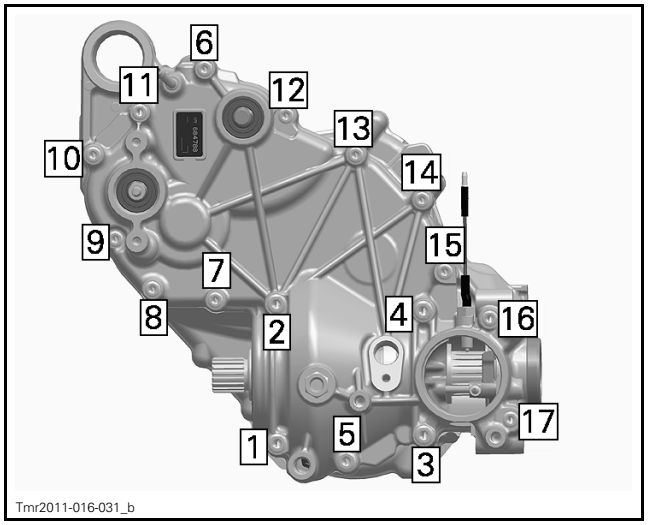
COUNTERSHAFT END CVT SIDE
1. *O-ring*
2. *Distance sleeve*
3. *Countershaft end CVT side*

Right Cover

Apply sealing compound on mating surfaces of central housing. Refer to *SEALING COMPOUND APPLICATION*.

To install the right cover align the coupling fork with the groove in the coupling sleeve.

Install all screws on right cover and tighten them as per following sequence.



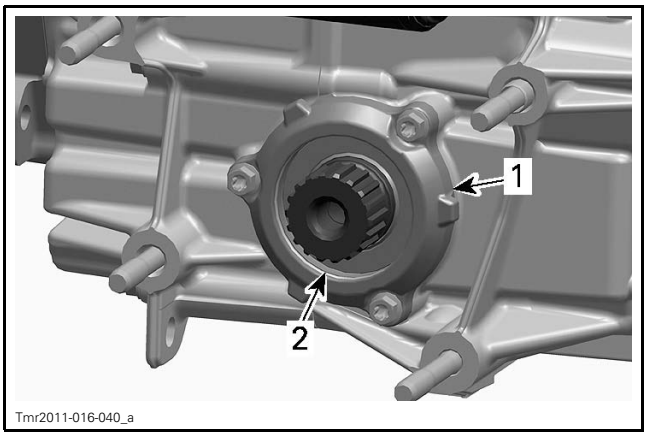
SCREWS - RIGHT COVER	
Tightening torque - M6	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)
Tightening torque - M8	25 N•m ± 3 N•m (18 lbf•ft ± 2 lbf•ft)

Install the actuator, refer to *ACTUATOR*.

Gearbox Installation

For installation reverse the removal procedure. Pay attention to following.

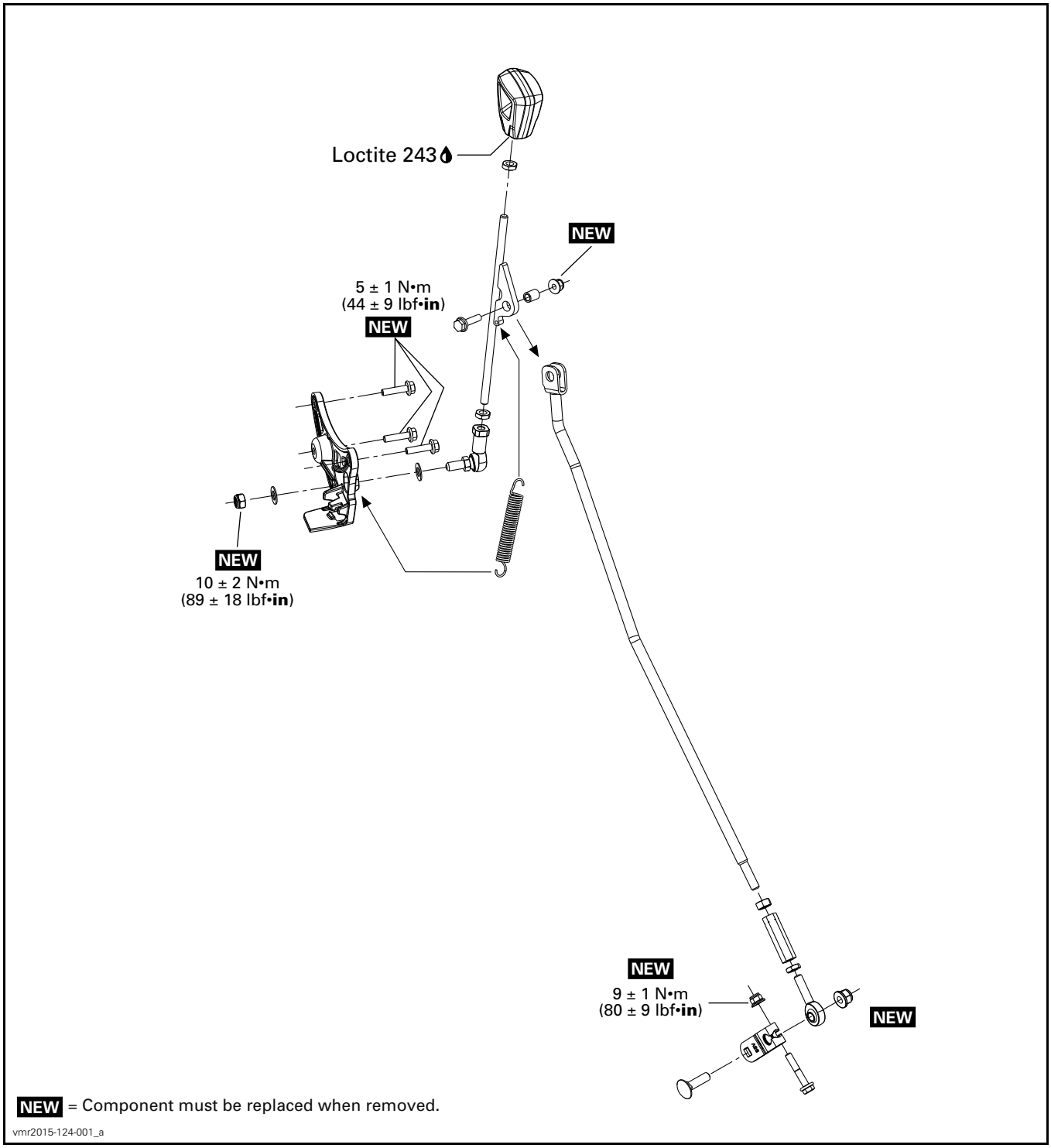
Before gearbox installation check O-ring in bearing cover if brittle, hard or damaged. Replace if necessary.



1. Bearing cover
2. O-ring

After installation, refill gearbox oil. Refer to *PERIODIC MAINTENANCE PROCEDURES*.

SHIFTER


Loctite 243
NEW
5 ± 1 N•m
(44 ± 9 lbf•in)
NEW
NEW
10 ± 2 N•m
(89 ± 18 lbf•in)
NEW
9 ± 1 N•m
(80 ± 9 lbf•in)
NEW
NEW = Component must be replaced when removed.
vmr2015-124-001_a

PROCEDURES

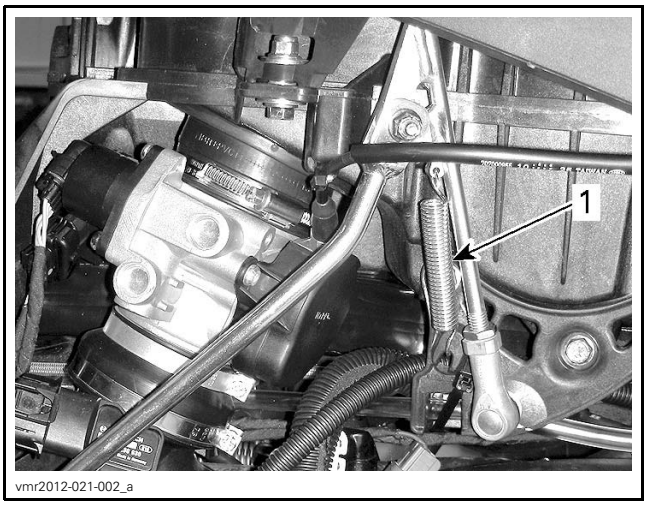
SHIFT LEVER

Shift Lever Access

1. Refer to *BODY* subsection and remove the following components:
   – Seat
   – Console
   – RH side panel.

Shift Lever Removal

1. Remove body parts as required. Refer to *SHIFT LEVER ACCESS* in this subsection.
2. Place shift lever in **NEUTRAL** position.
3. Secure vehicle using wheel blocks.
4. Unscrew shift lever handle.
5. Unhook spring.



vmr2012-021-002_a

1. Unhook

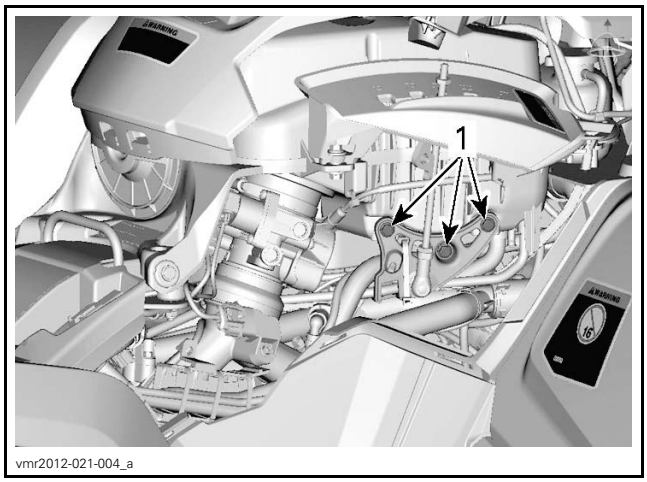
6. Detach shift rod from shift lever.



vmr2012-021-003_a

1. Detach

7. Detach shift lever support.



vmr2012-021-004_a

1. Remove bolts

8. Remove shift lever.

Shift Lever Inspection

Check shift lever for bending or cracks.

Check spring and bushing condition.

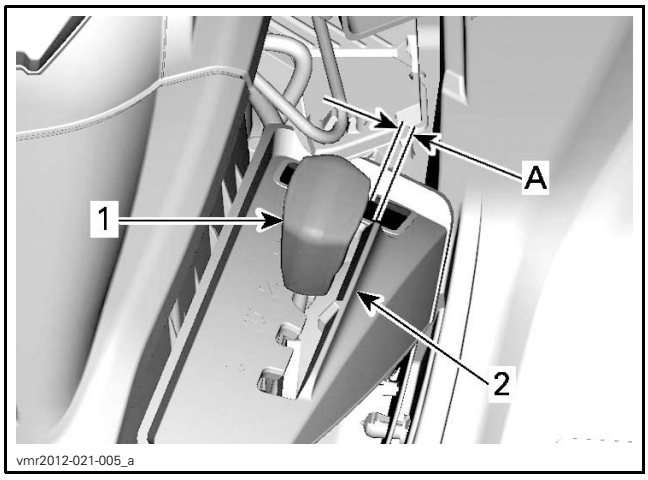
Check ball joint condition.

Replace all damaged parts.

Shift Lever Installation

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

Adjust shift lever handle as per the following illustration.



SHIFT LEVER HANDLE ALIGNMENT
1. Handle
2. Ridge
A. Handle parallel with ridge

Check if shift lever works properly in all positions.

– Shift lever must be perfectly centered with the neutral mark when transmission is engaged in neutral.
– If adjustment is required, refer to *SHIFT ROD ADJUSTMENT* in this subsection.

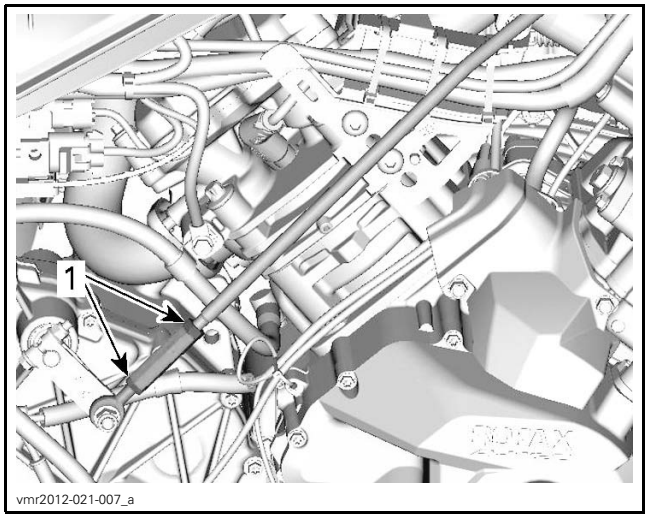
SHIFT ROD

Shift Rod Adjustment

1. Place shift lever in NEUTRAL position.

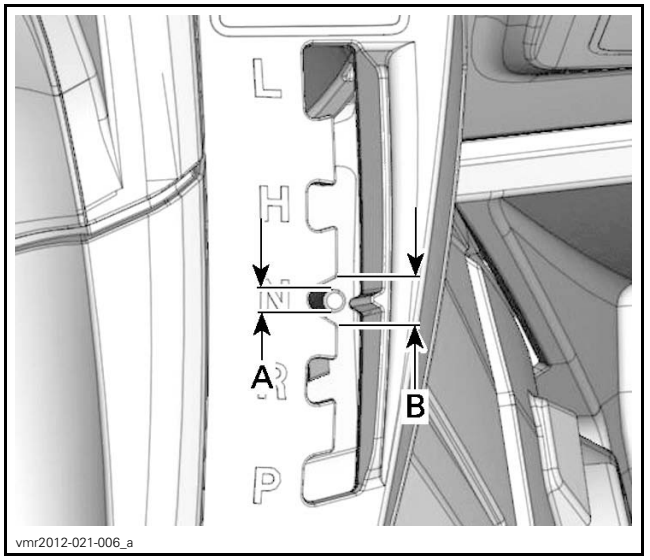
NOTICE **Move vehicle back and forth to ensure gearbox is set in neutral position.**

2. Secure vehicle using wheel blocks.
3. Remove body parts as required. Refer to *SHIFT LEVER ACCESS* in this subsection.
4. Loosen shift rod adjustment nuts.



TYPICAL — SOME PARTS REMOVED FOR CLARITY
1. Adjustment nuts

5. Turn rod adjuster to center shift lever in neutral notch.
   – Ensure there is the same threaded length each side of rod adjuster.
   – Be aware that a nut has LH threads.



SHIFT LEVER CENTERED WITHIN NEUTRAL NOTCH
A. Shift lever
B. Neutral notch

6. Move shift lever in R position then in 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.

NOTE: Make sure the ball joint is properly aligned with the shift plate. It may be necessary to realign shift rod ball joints to allow easy movement.

⚠ WARNING

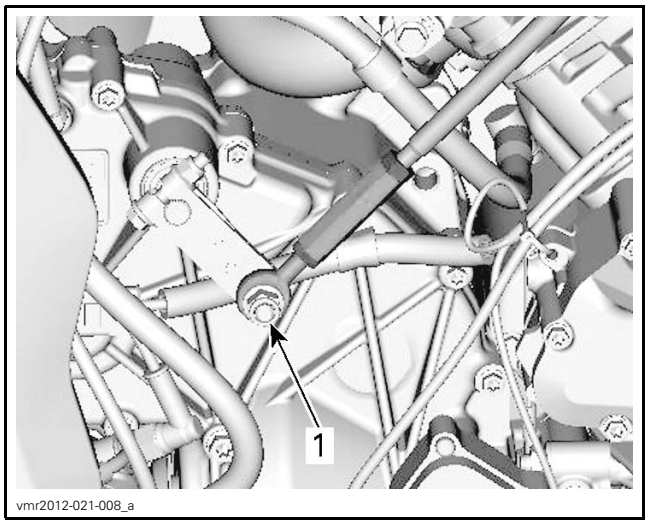
After adjustment, make sure that PARK position works properly.

SHIFT PLATE

Shift Plate Removal

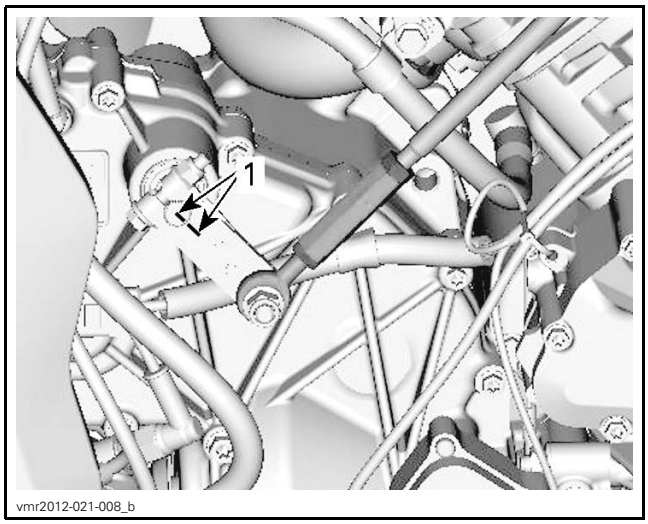
Do not remove shift plate needlessly.

1. Refer to *BODY* subsection and remove the following components:
   – Seat
   – Console
   – RH side panel
   – RH footrest panel.
2. Remove shift rod from shift plate.



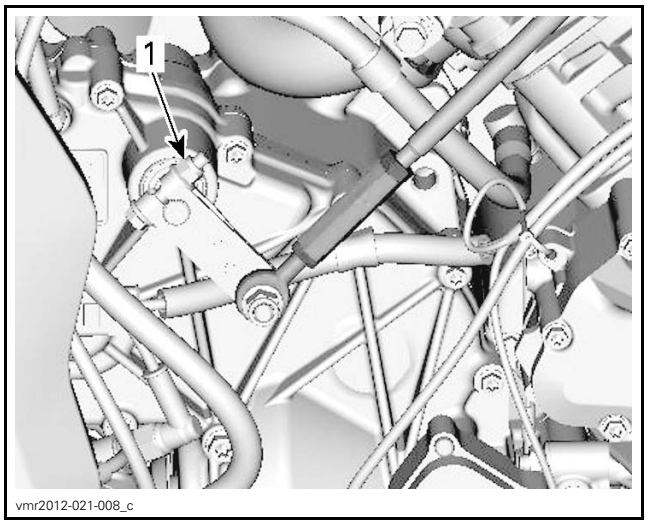
1. Remove nut

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

5. Remove shift plate.

Shift Plate Inspection

Check shift plate for:
– Cracks
– Bending
– Spline condition.

Shift Plate Installation

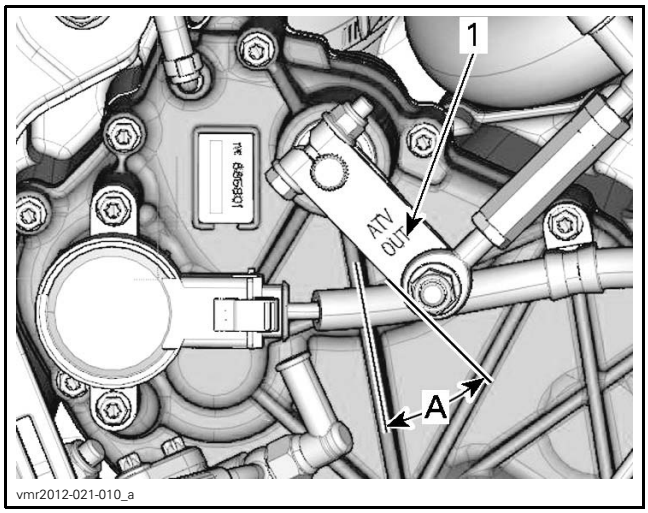
The installation is the reverse of the removal procedure. However, pay attention to the following.

Place gearbox in NEUTRAL position before shift plate installation.

Position shift plate with the marking "ATV OUT" visible outward.

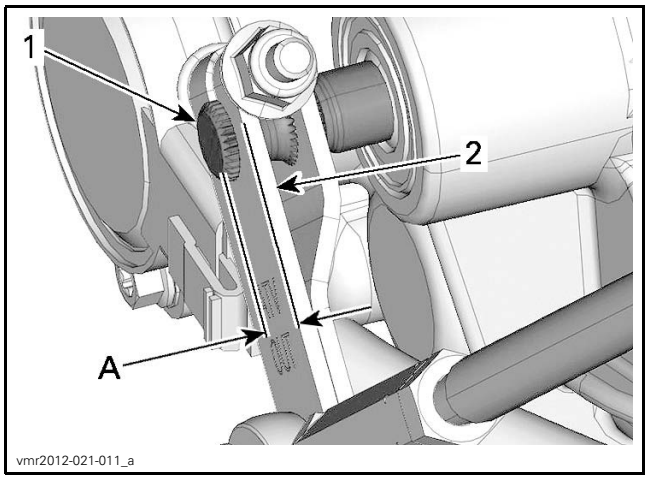
Align shift plate using marks previously traced.

If there is no mark, adjust shift plate as per following illustrations.



SHIFT PLATE ANGLE FROM THE SHOWN RIB
1. "ATV OUT" marking this side
A. 34°

Ensure that shift shaft protrudes shift plate as per illustration.



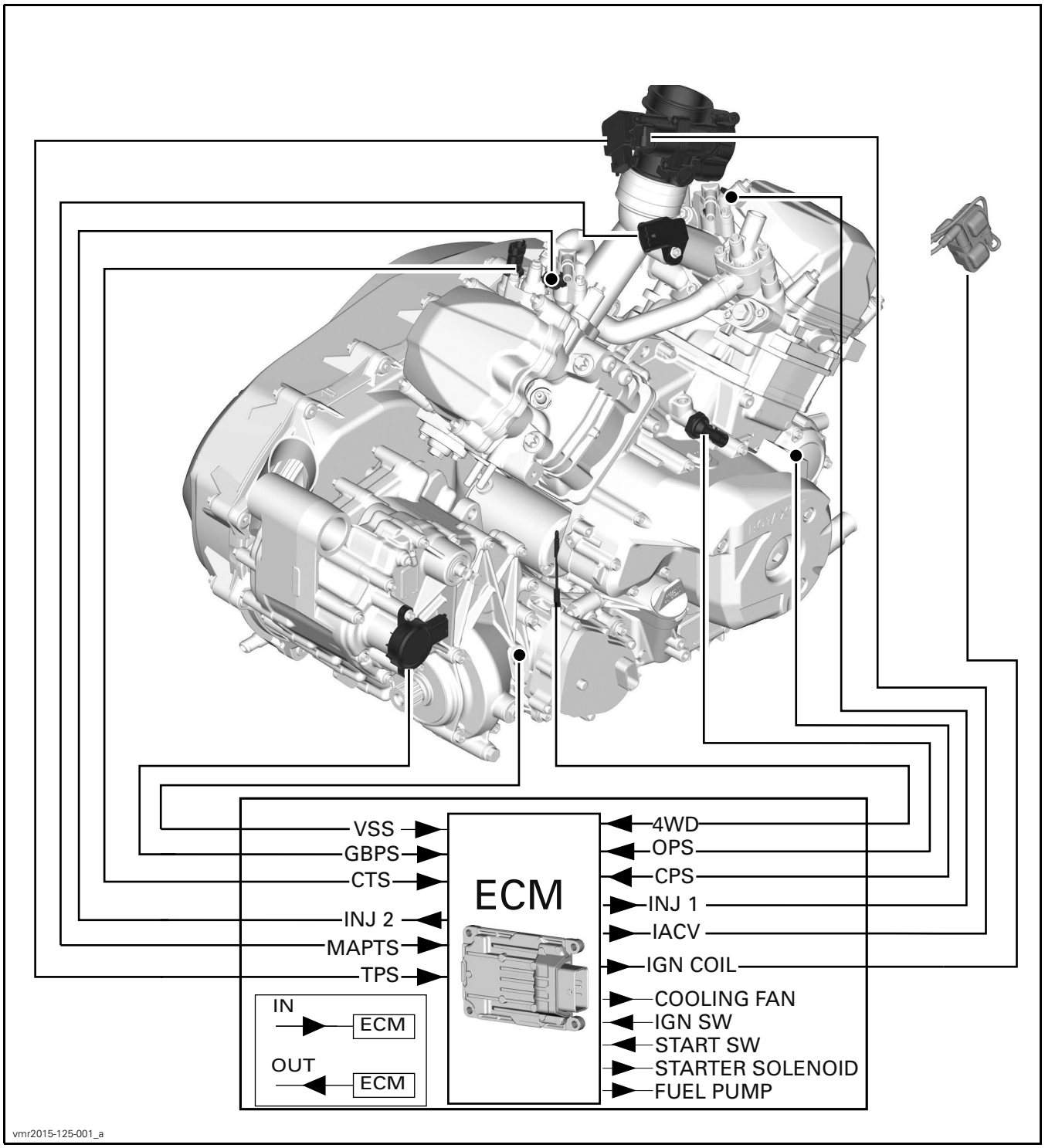
1. Shift shaft end
2. Shift plate
A. 2.5 mm ± 1 mm (.1 in ± .040 in)

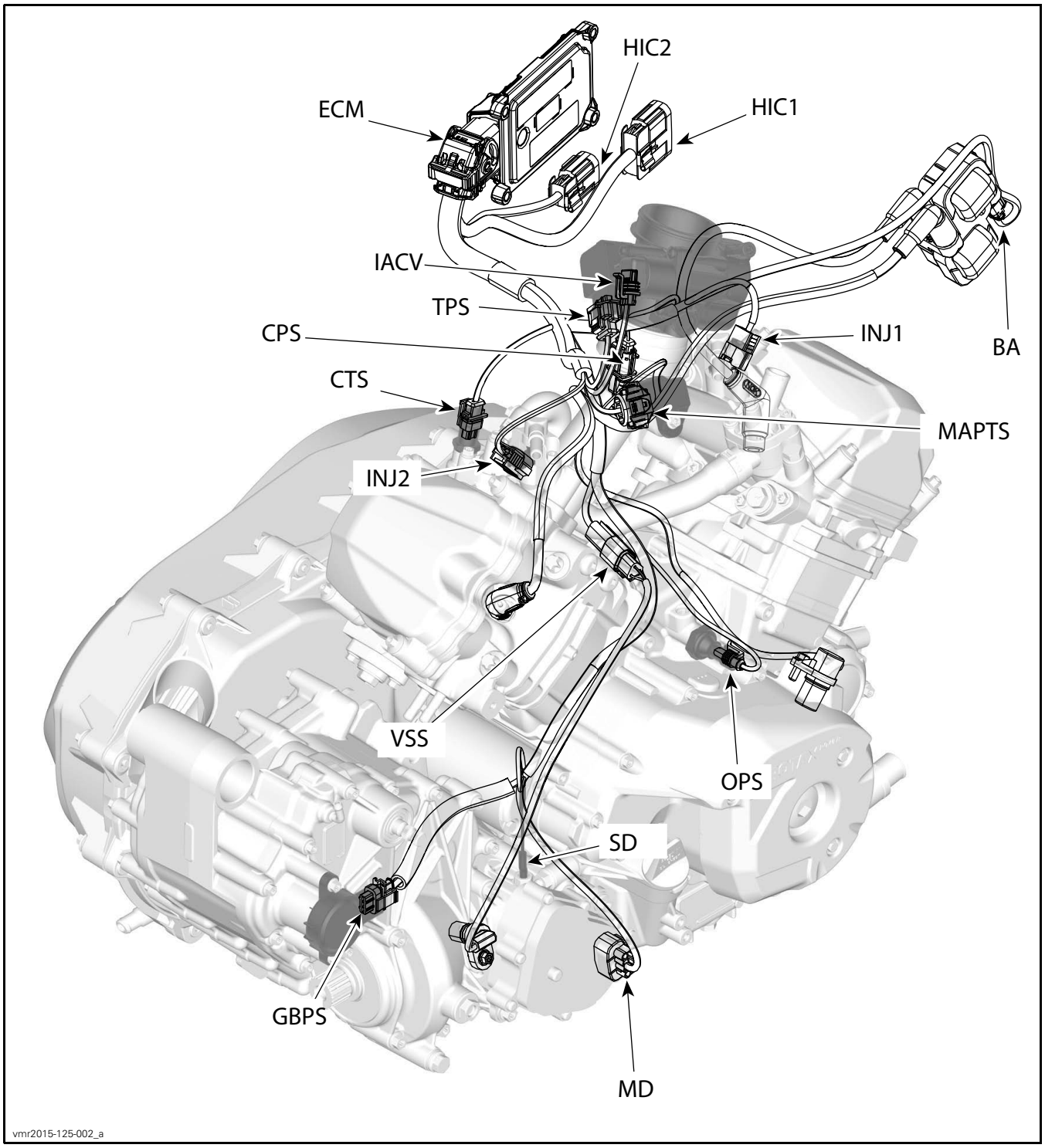
Adjust shift rod, refer to *SHIFT ROD ADJUSTMENT* in this subsection.

Tighten shift plate nut to specification.

TIGHTENING TORQUE	
Shift Plate Nut	9 N•m ± 1 N•m (80 lbf•**in** ± 9 lbf•**in**)

ENGINE MANAGEMENT SYSTEM (EMS)





ABBREVIATION	DEFINITION
BA1	Ignition coil
CPS	Crankshaft position sensor
CTS	Coolant temperature sensor
ECM	Electronic control module
GBPS	Gear box position sensor

ABBREVIATION	DEFINITION
HIC1‡	Harness interconnect 1
HIC2‡	Harness interconnect 2
IACV	Idle air control valve
INJ1	Injector 1 (front)
INJ2	Injector 2 (rear)
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.	

GENERAL

SYSTEM DESCRIPTION

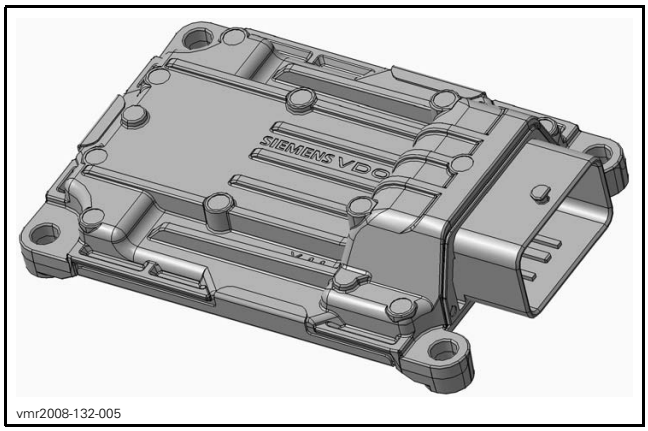
The HIC# connectors connect the vehicle harness to the powertrain harness.

There are 6 main systems that are controlled by the engine management system (EMS):

1. Electronic Fuel Injection (EFI)
2. Cooling system (cooling fan)
3. Ignition system
4. Starting system
5. Fuel pump system
6. D.E.S.S. system.

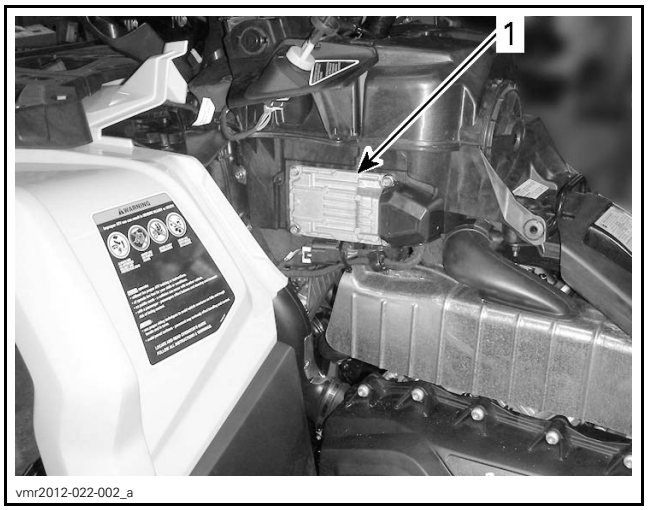
NOTE: For further information related to these systems, refer to the applicable subsection.

The ECM (Engine Control Module) is the central point of the engine management system.



TYPICAL - ECM

The ECM is located behind the LH panel.



LH PANEL REMOVED
1. ECM location

The ECM reads input signals from various switches, controls, and sensors, that it compares to pre-determined parameters, makes computations, and provides control signal outputs required for proper engine management.

The ECM also interacts through CAN bus with the gauge module for various functions, information exchange and display of messages. Refer to *CONTROLLER AREA NETWORK (CAN)* and *LIGHTS, GAUGE AND ACCESSORIES* subsections.

The ECM also features a permanent memory that will store the information on the various ignition keys programmed to the vehicle, fault codes, cus-

tomer information, and other engine information, even when the battery is removed from the vehicle.

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 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. Refer to the *DIAGNOSTIC AND FAULT CODES* subsection.

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.

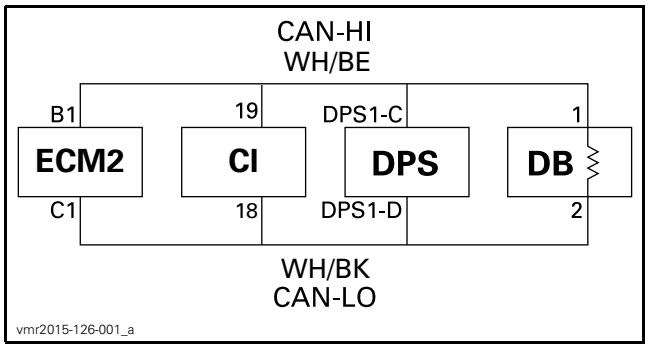
CONTROLLER AREA NETWORK (CAN)

GENERAL

SYSTEM DESCRIPTION

The CAN (Controller Area Network) 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 (WHITE/BEIGE for all CAN HI and WHITE/BLACK for all CAN LO except from ECM to HIC1-R).

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.



CLUSTER: Multifunction Gauge
DB: Diagnostic Connector
ECM: 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	355
MPI-2 INTERFACE CARD	529 036 018	355

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
MALE-FEMALE EXTENSION SERIAL CABLE	DB9	355

GENERAL

Refer to *PROCEDURES* for instructions on the communication tools.

If communication problems occur, refer to *TROUBLESHOOTING* in this subsection.

TROUBLESHOOTING

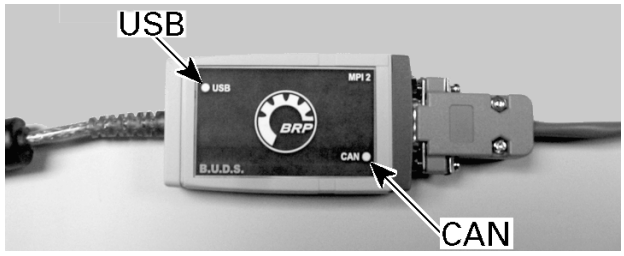
DIAGNOSTIC TIPS

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.

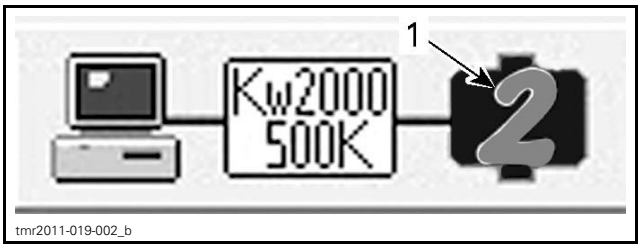
CAN LIGHT	
STATUS	WHAT TO DO
Light is OFF	Check connection between MPI-2 and diagnostic connector on vehicle
Light is RED	Check CAN wires/connectors on vehicle
Light is GREEN	Connections are GOOD. Communication can take place on CAN side

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)

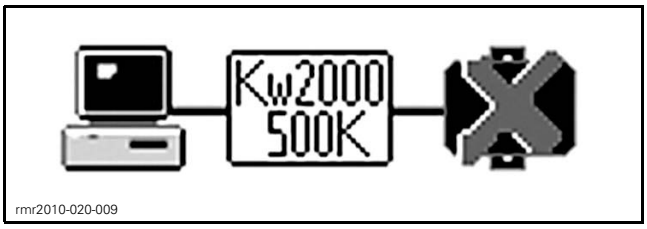


TYPICAL
1. Number of modules

If one or more "ECU" is not communicating with the MPI, refer to *DIAGNOSTIC SYSTEM AND FAULT CODES*.

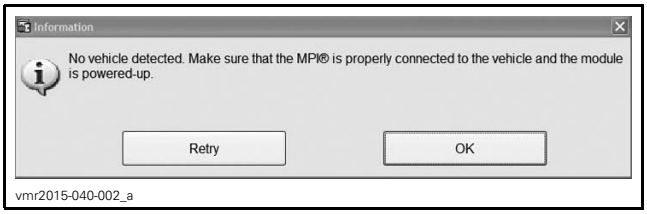
No Vehicle is Detected

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.



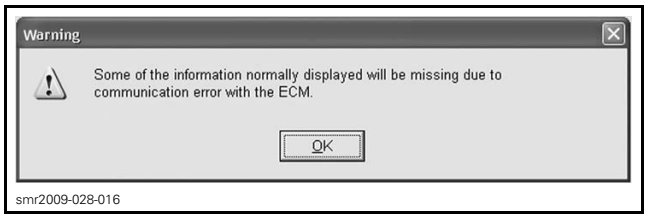
Check the following:
- Connections between the PC computer and the vehicle.
- The multifunction gauge is powered up.

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)

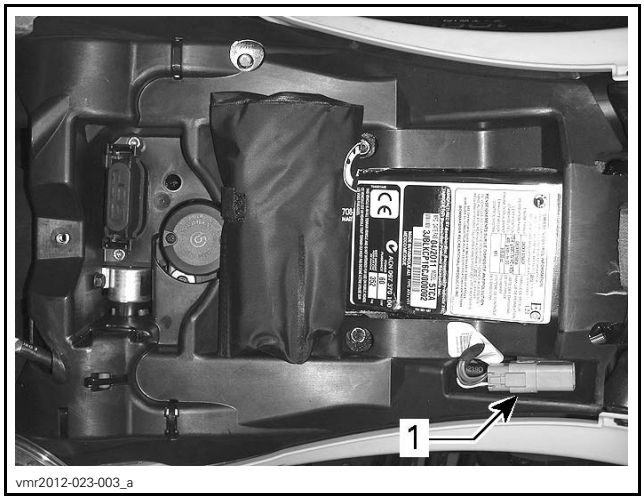
The MPI-2 (Multi-Purpose Interface-2) in conjunction with the MPI-2 diagnostic cable is used with B.U.D.S. to communicate with the ECM (engine control module) and other modules.

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.



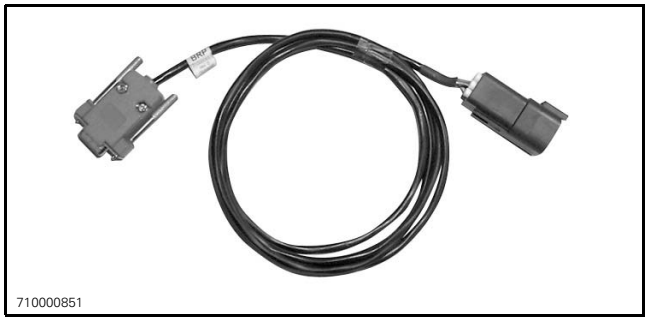
1. Diagnostic connector

Connecting the PC to the Vehicle

⚠ WARNING

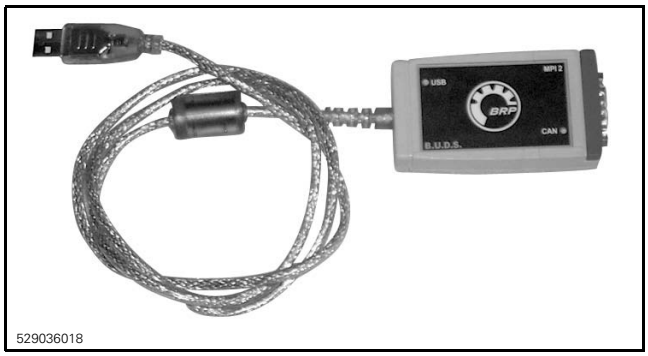
If the computer you are using is connected to the 110 Vac power outlet, there is a potential risk of electrocution when working in contact with water. Be careful not to touch water while working with the VCK.

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.

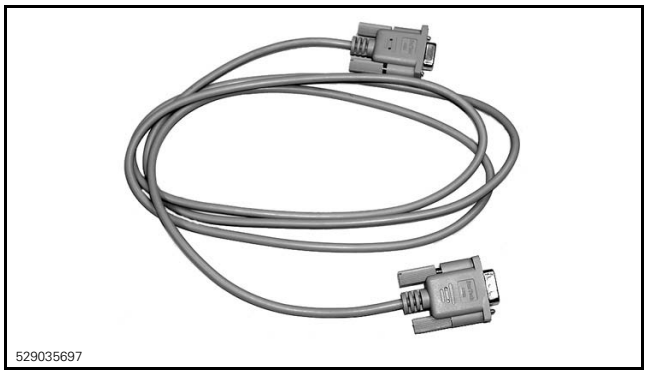


DIAGNOSTIC CABLE CONNECTED TO VEHICLE

4. Connect the other end of diagnostic cable to the MPI-2 INTERFACE CARD (P/N 529 036 018).

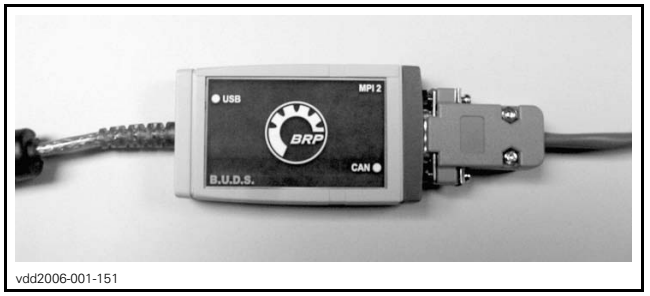


NOTE: An optional MALE-FEMALE EXTENSION SERIAL CABLE (P/N DB9) available at electronic retail outlets can be used between diagnostic cable and MPI-2 interface. Do not exceed 7.6 m (25 ft).

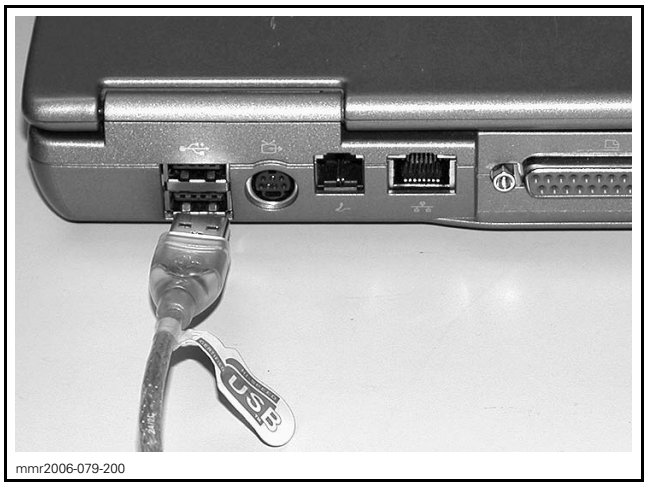


OPTIONAL MALE-FEMALE EXTENSION SERIAL CABLE

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.

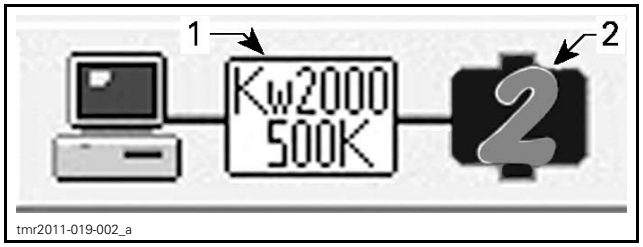
Always use the latest applicable B.U.D.S. version available on BOSSWeb.

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.

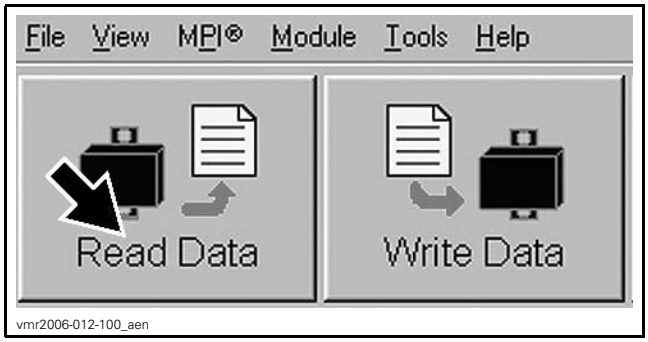
VEHICLE MODEL	PROTOCOL	NUMBER OF MODULES
Models without DPS	Kw2000 (500K)	2
Models with DPS		3



tmr2011-019-002_a

TYPICAL - SUCCESSFUL CONNECTION
1. Connection protocol
2. Number of modules read

5. Read ECUs by clicking the **Read Data** button.



vmr2006-012-100_aen

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.



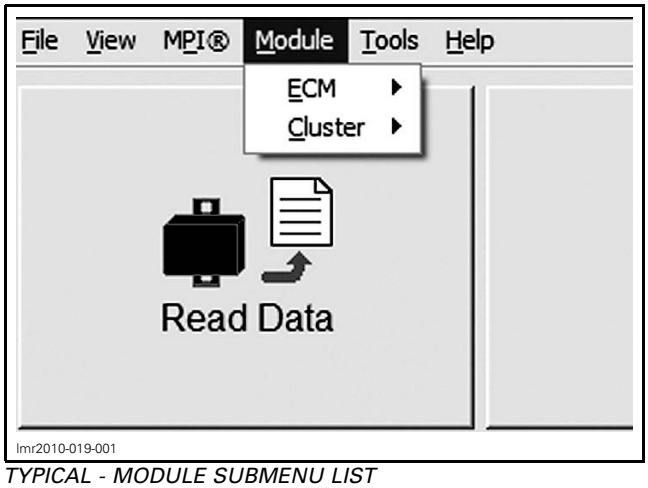
smr2010-030-002_a

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:

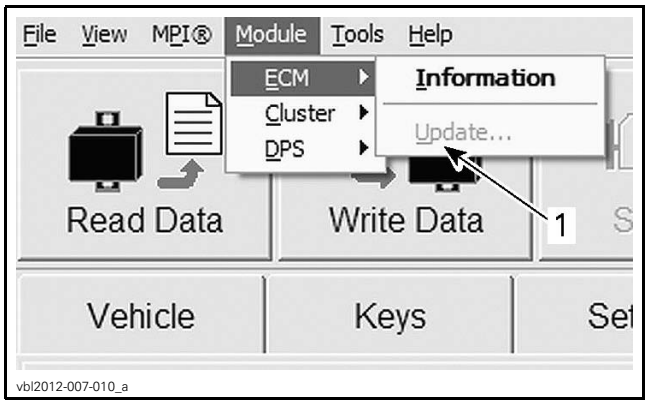
NOTE: If an update file is available on BOSSWeb but the B.U.D.S. software being used is not up to date, the update icon will not appear. Refer to the *SERVICE BULLETINS* to see if there is an update available.

Use the **Module** submenu and check all modules one at a time to see which module(s) can be updated.



TYPICAL - MODULE SUBMENU LIST

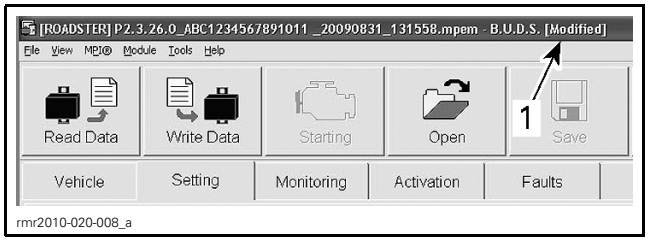
1. If the **Update** option is **greyed out**, no update file is available for this module.
2. If the **Update** option is **black**, an update file is available for this module.



1. Greyed out: No update to perform
Black: Update file available

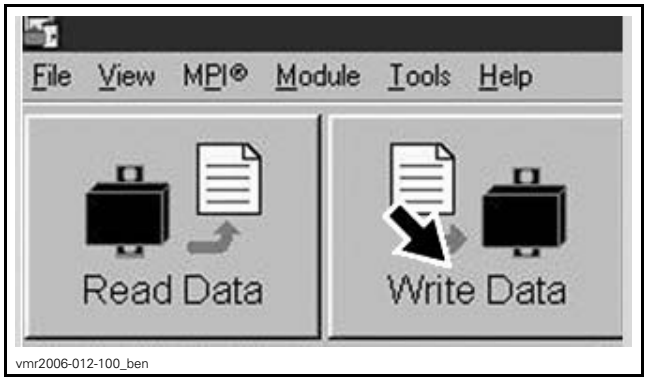
Writing Changes (Saving) in a Module

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.

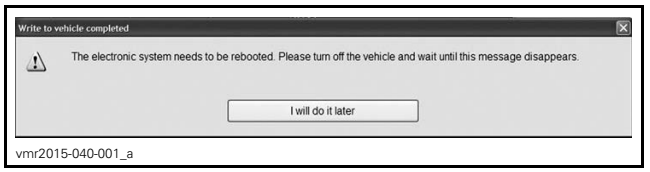


TYPICAL
1. Indicate setting or data modified; Write Data to save

Click the **Write Data** button.

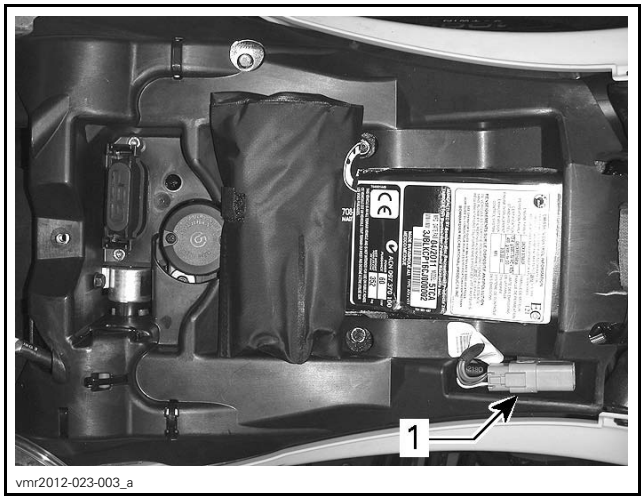


After clicking on **Write Data**, the following message may appear.



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 SYSTEM 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
	DESS KEY NOT RECOGNIZED	Module unable to read the key
	BAD KEY	Key not programmed for the vehicle
	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
	TPS FAULT PRESS OVERRIDE BUTTON TO LIMP HOME	TPS malfunction
	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 Engine Management System (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 and DPS	P0116
From U0 to U3	Communication between module and sensors	U0073

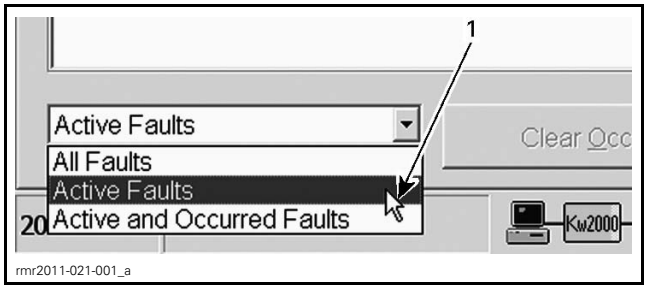
RELATED MODULE AND FAULTS	
MODULE	FAULT CODE CATEGORY
ECM	P and U
DPS	P and U
Cluster	P and U

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

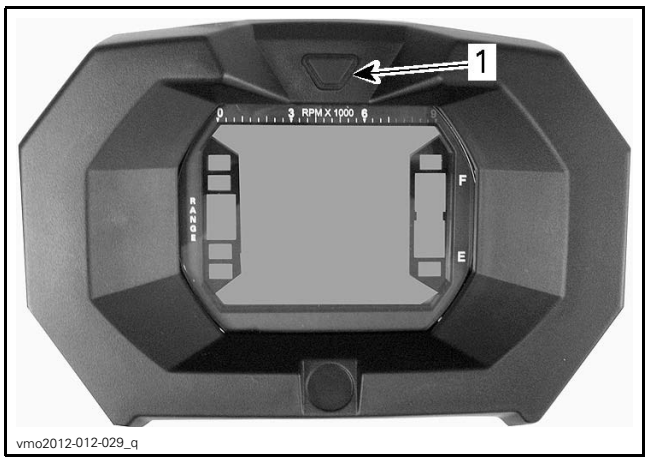
An inactive fault code represents a fault code that is neither active, nor occurred. It is simply part of a list of all possible faults that can be monitored

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.



MULTIFUNCTION GAUGE LCD - OUTLANDER
1. Mode button

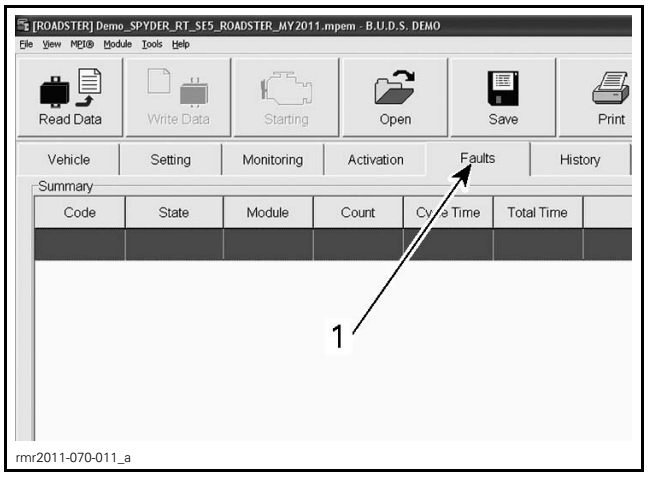
2. Press and HOLD mode button while QUICKLY toggling HI - LO beam.

NOTE: A minimum of 3 HI - LO toggles must be completed within 2 seconds.

How to Read Fault Codes Using B.U.D.S.

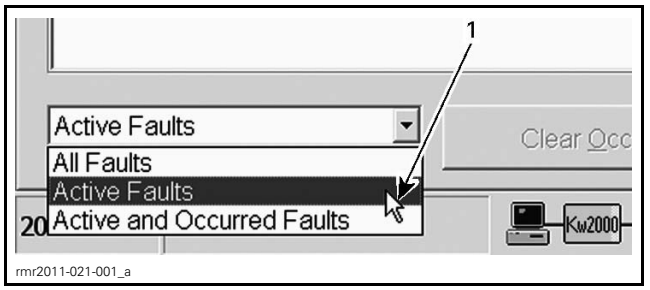
NOTE: All fault code (regardless of their state) can be read with B.U.D.S.

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.



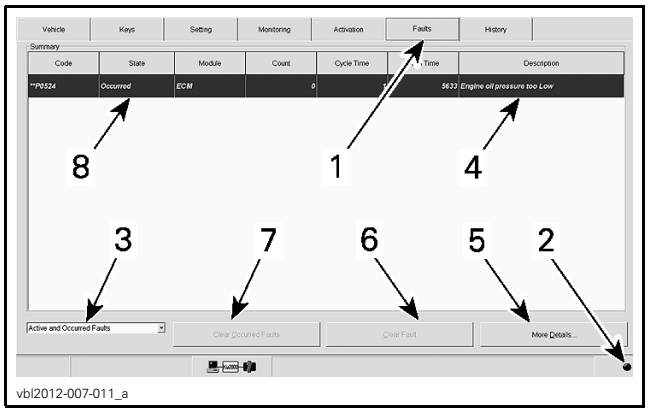
1. Fault tab

4. Click on the drop-down list on the LH lower corner.
5. Choose the fault state to display.



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



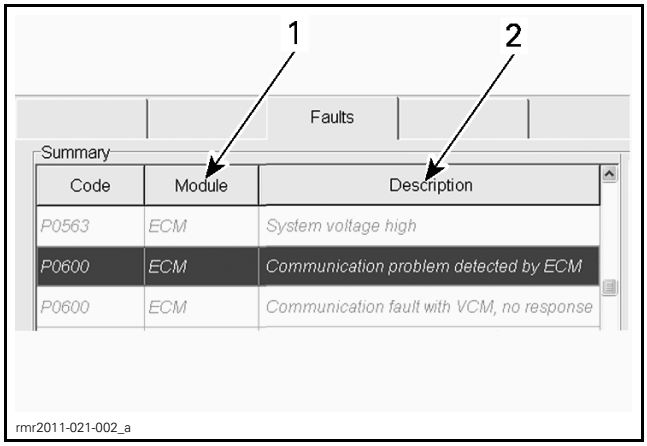
FAULT PAGE
1. **Fault** *tab*
2. *Fault indicator light*
3. *Fault code state drop box*
4. *Fault description*
5. *More Details button*
6. *Clear Fault button*
7. *Clear Occurred Faults button*
8. *Selected fault*

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)
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

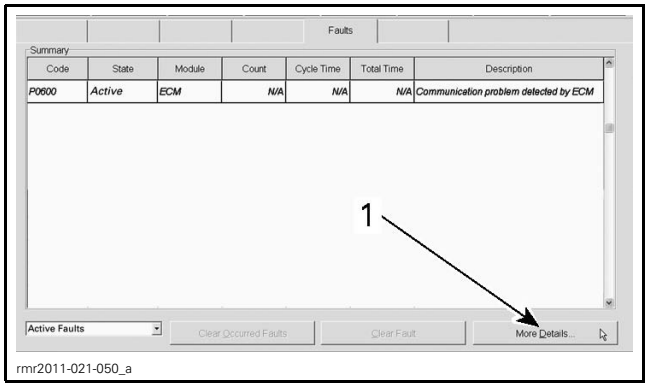
When reading a fault code in B.U.D.S., pay particular attention to which module reports a fault. It is indicated in the **Module** column.

The **Description** column gives a short description of the fault.

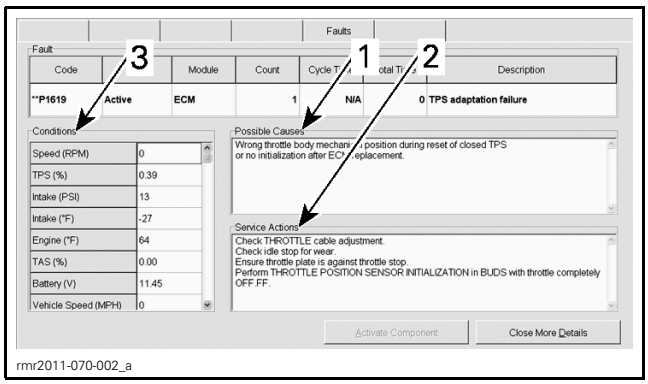


SOME COLUMNS REMOVED FOR CLARITY PURPOSE
1. *Module that reports a fault*
2. *Fault description*

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



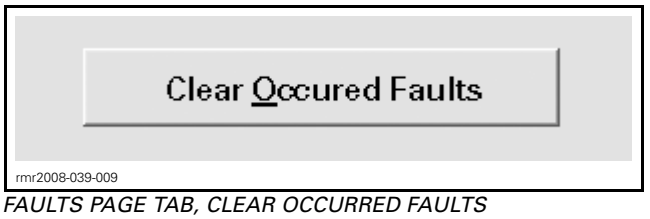
MORE DETAILS PAGE
1. Possible causes related to the selected fault
2. Service actions
3. Operating conditions when fault occurred

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.

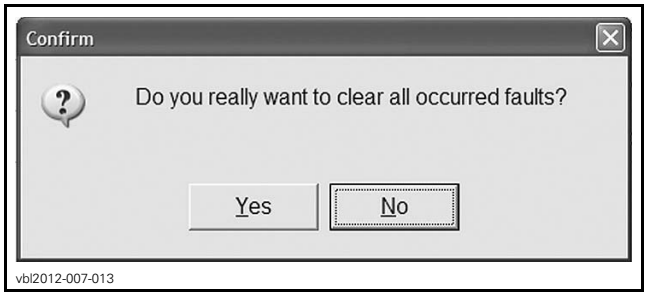
1. Connect vehicle to the latest applicable B.U.D.S. software. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Click on the **Read Data** button.
3. Click on the **Faults** tab.

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.

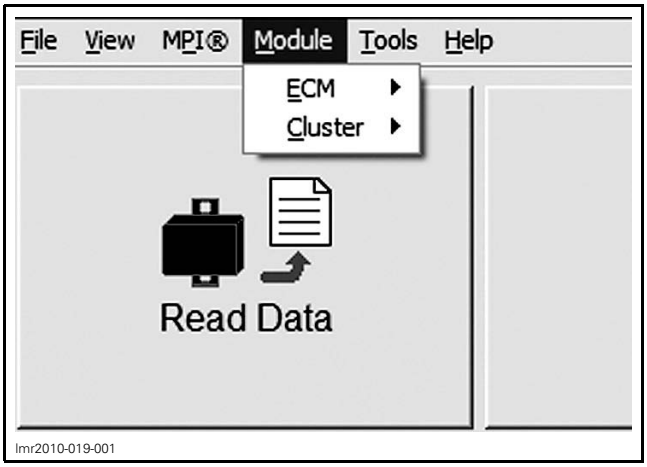
FAULT CODE DIAGNOSTIC

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

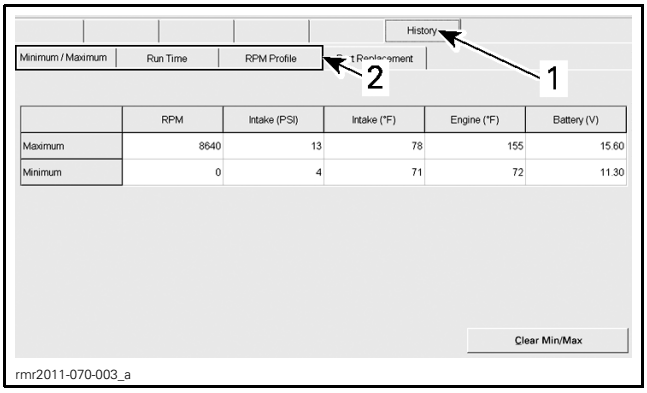
6. Refer to the following table to find the appropriate subsection in this manual to diagnose the missing module.

MISSING MODULE	SECTION TO REFER TO
ECM	*ELECTRONIC FUEL INJECTION (EFI)*
Cluster	*LIGHTS, GAUGE AND ACCESSORIES*
DPS	*STEERING (DPS) AND FRONT WHEELS*

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".
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 buss 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.

GENERAL GUIDELINES TO SOLVE FAULT CODES	
CONDITION	ACTION
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
SCM	Suspension Control Module

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 (EFI)

SERVICE TOOLS

Description	Part Number	Page
ECM ADAPTER TOOL	529 036 166	371
FLUKE 115 MULTIMETER	529 035 868	371
OETIKER PLIERS	295 000 070	377

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	383, 387
XPS SYNTHETIC GREASE	293 550 010	384

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 *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.

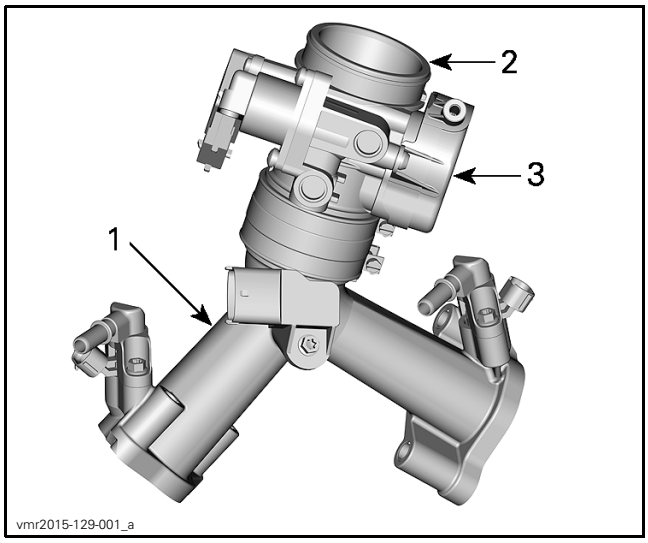
Air Intake System

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. Intake manifold
2. Throttle body
3. Idle air control valve (IACV)

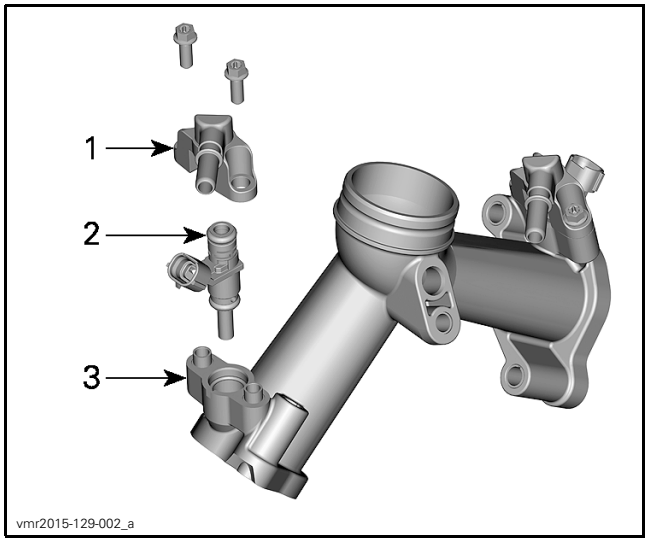
Fitted on the throttle body, a throttle plate regulates the amount of air that enters the engine.

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

Two fuel rails, one for each injector, are mounted on the intake manifold. The fuel rails, which are used to secure the injectors to the manifold, also provide to the injectors the fuel pressure that they receive from the fuel pump.

The fuel pressure applied to the fuel rails is regulated by the fuel pressure regulator located in the fuel pump module.

Fuel Injectors

The fuel injectors are used to inject fuel into the intake ports of the cylinder head. One injector is used per cylinder.

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

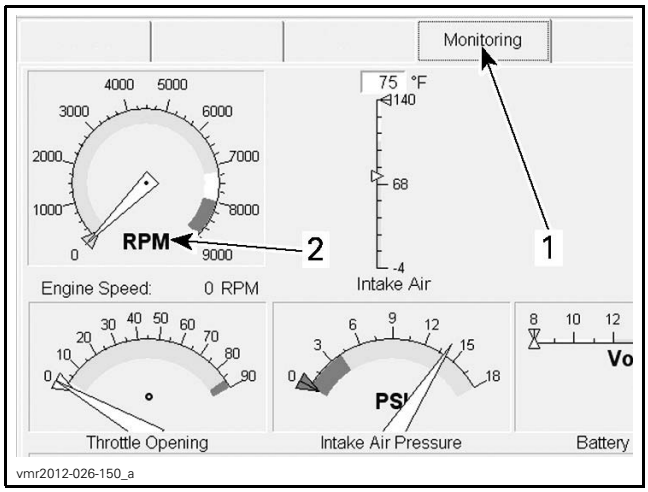
Idle speed is not adjustable. The ECM controls the idle speed of the engine primarily through control of the throttle plate position.

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.

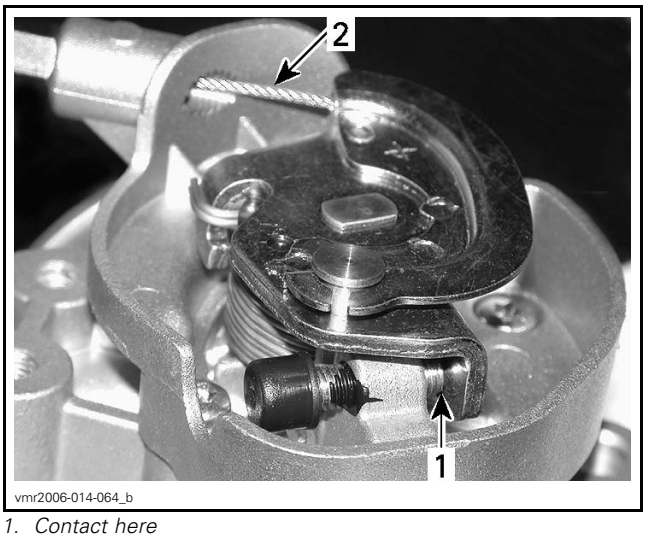
This reset is very important. The setting of the TPS will determine the basic parameters for all fuel mapping and several ECM calculations and the setting of the idle air control valve will determine the basic parameters for the idle speed control of the engine.

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.



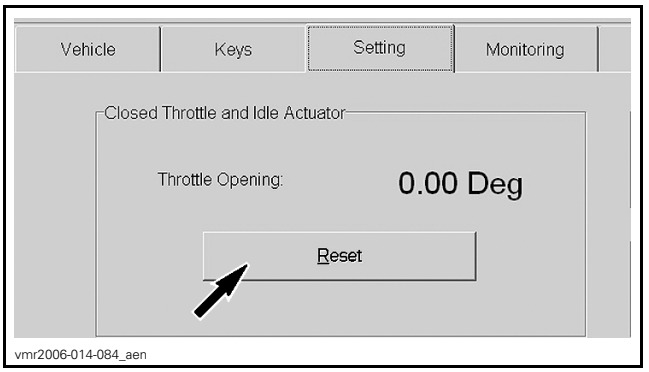
1. *Contact here*
2. *Free-play here*

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 fuse (PF1 F6) and key switch fuse (FP1 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).



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 the ECM adapter on the ECM connector.
3. Install a jumper wire between K1 and M4 on the ECM adapter tool.
4. Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and check voltage as per following table.



ECM ADAPTER	BATTERY	VOLTAGE
L1	Negative post	Battery voltage

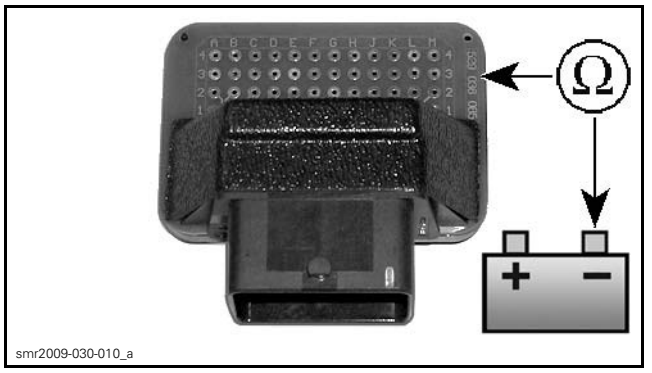
If voltage is not measured, check the following:

– 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 on the ECM connector.
3. Using a multimeter, check resistance as per following table.

ECM ADAPTER	BATTERY POST	RESISTANCE
Pins G1, M3 and M4	Ground	Close to 0 Ω (continuity)

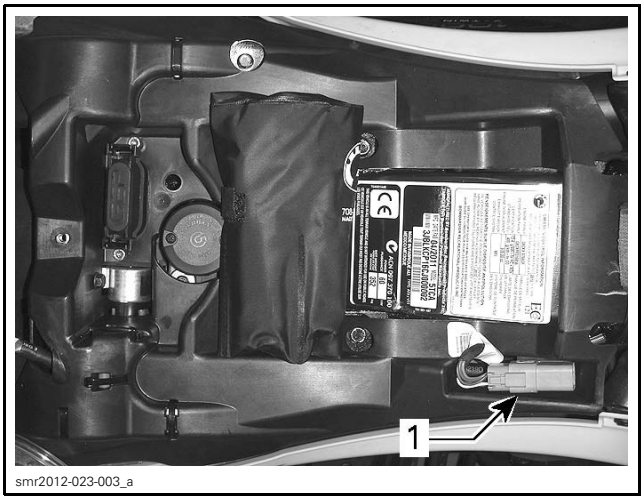


If any measurement is out of specification, refer to *POWER DISTRIBUTION* and check all grounds.

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.



TYPICAL
1. Diagnostic link connector (DB)

3. .

4. Using a multimeter, 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.

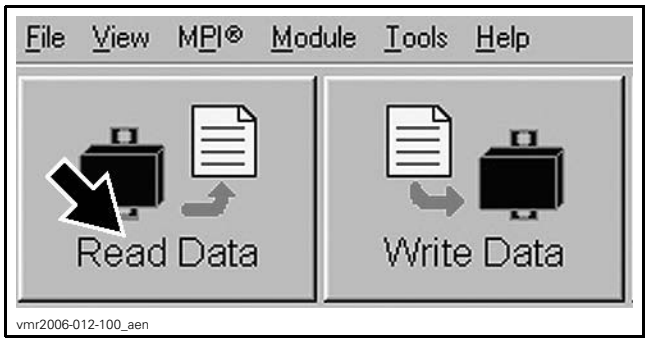
NOTE: Proceed with the *CLOSED THROTTLE AND IDLE ACTUATOR RESET* as it may resolve the problem.

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.

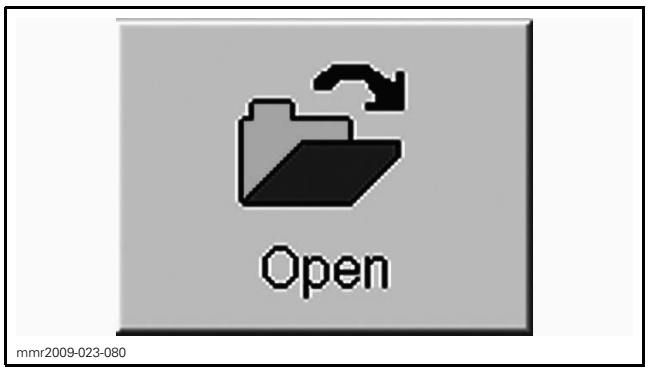


vmr2006-012-100_aen

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.

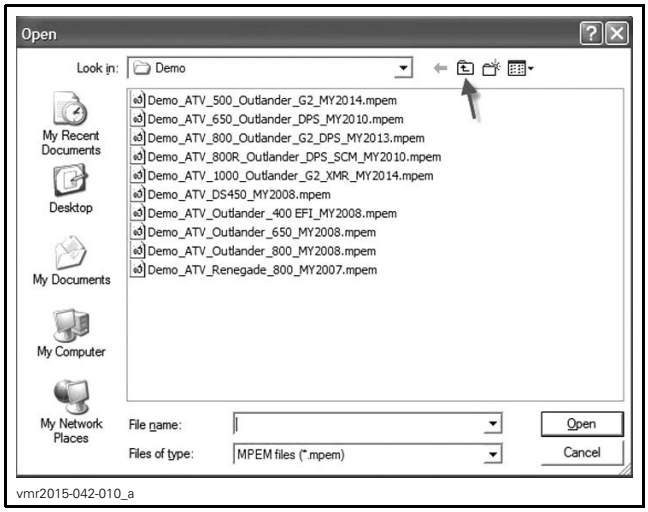
3. Get the Data from the saved .mpem file.

3.1 Click on the Open button.



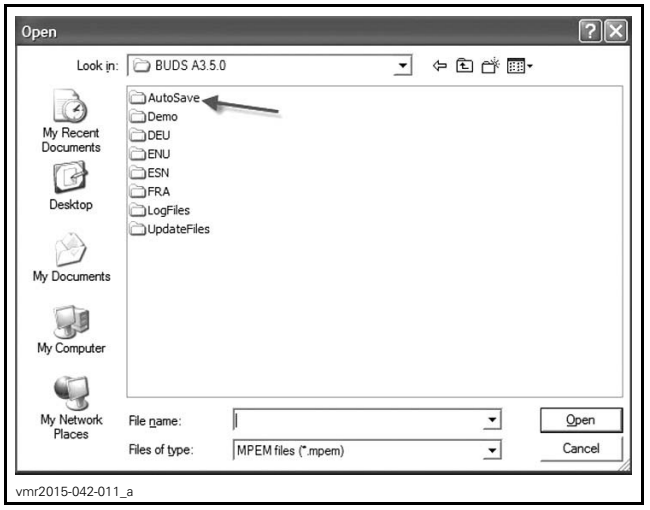
mmr2009-023-080

3.2 Click once on the Folder Up button in the open box.



vmr2015-042-010_a

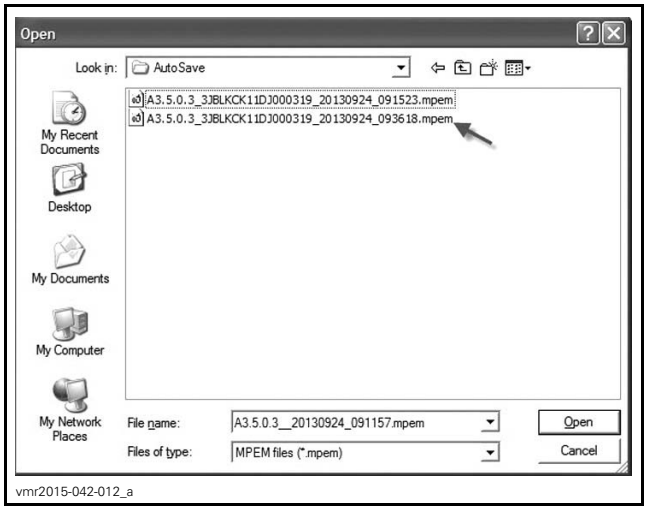
3.3 Double click on the AutoSave folder.



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.



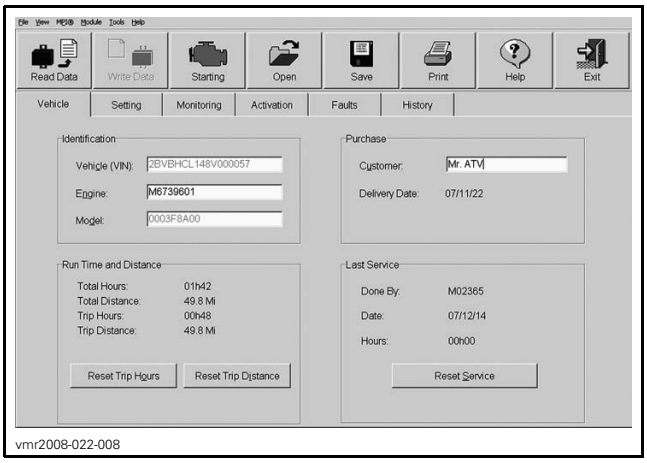
vmr2015-042-012_a

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

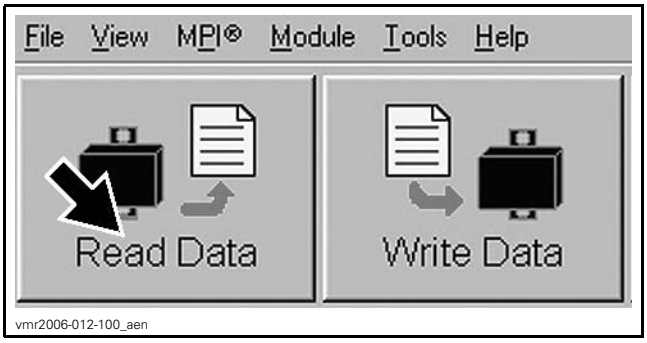
4. Go to the Vehicle tab and record the following information.
   - Vehicle (V.I.N.) number
   - Engine number (without the leading "M")

– Model number
– Customer.



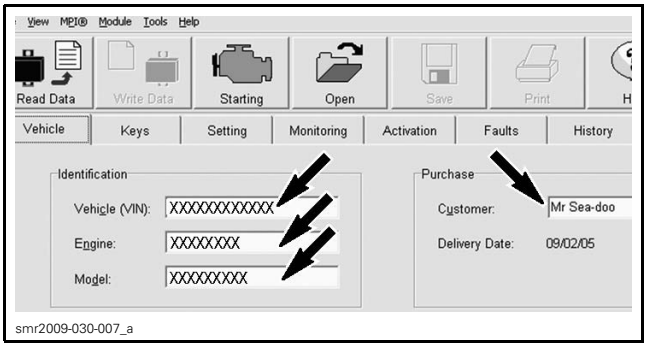
vmr2008-022-008

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.



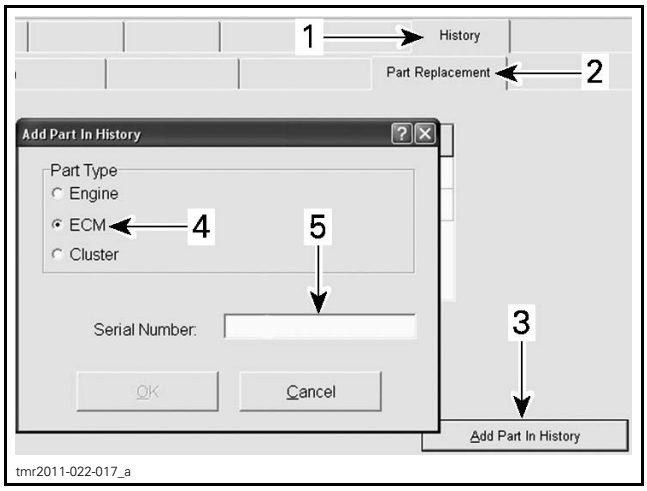
vmr2006-012-100_aen

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.



smr2009-030-007_a
VEHICLE TAB

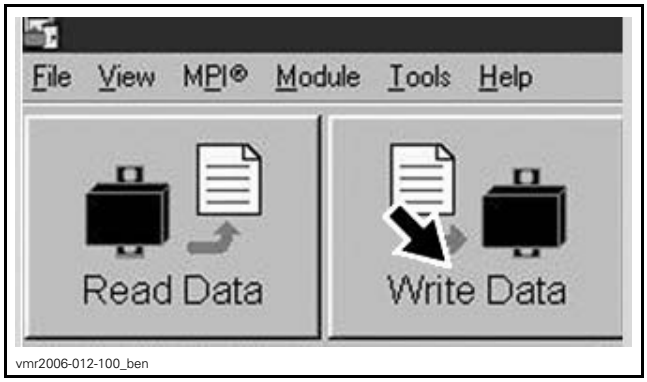
9. Click on the following tabs:
   – **History**
   – **Part Replacement**
   – **Add Part in History**.
10. Enter the **old** ECM serial number in the Add Part In History window.



tmr2011-022-017_a
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.



vmr2006-012-100_ben

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.

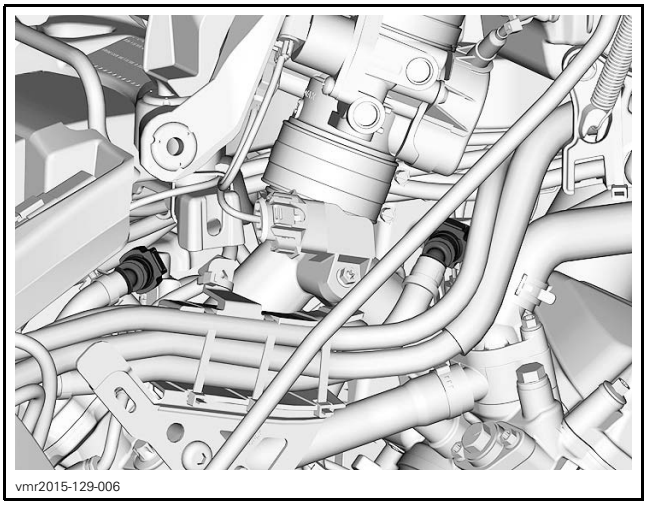
Fuel Injector Leak Test

Carry out the *FUEL PUMP PRESSURE TEST* as detailed in the *FUEL TANK AND FUEL PUMP* subsection.

Fuel Injector Input Voltage Test

Remove the RH side panel. Refer to *BODY* subsection.

To reach the rear injector, disconnect the fuel line. Refer to *FUEL TANK AND FUEL PUMP* subsection.



vmr2015-129-006

Disconnect the fuel injector electrical connector.

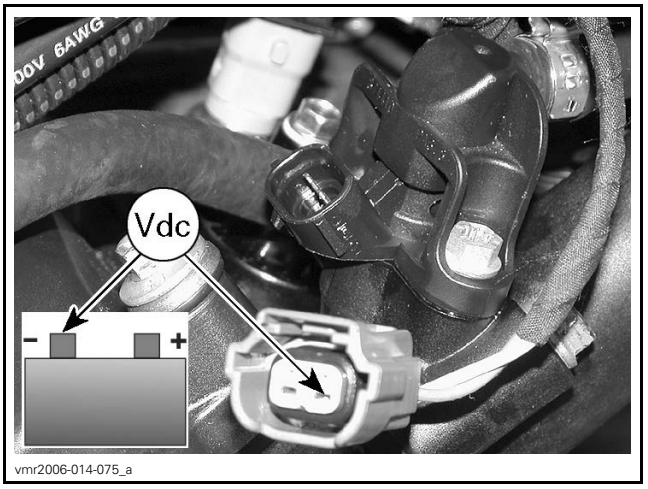
Turn on ignition switch.

Set emergency engine stop switch to RUN.

NOTE: Ensure to read voltage before ECM automatically turns off.

Using a multimeter, read voltage as per following table.

CYLINDER	INJECTOR CONNECTOR		MEASUREMENT
	WIRE		
FRONT	INJ1-2	BAT2 (-)	Battery voltage
REAR	INJ2-2		



vmr2006-014-075_a

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

Remove main relay.

Disconnect the fuel injector connector.

Using a multimeter, read resistance as per following table.

CYLINDER	INJECTOR CIRCUIT		MEASUREMENT
	WIRE		
FRONT	INJ1-2	PF1-2B	Close to 0 Ω
REAR	INJ2-2		

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 adapter on the ECM connector.

Connect the fuel injector connector.

Using a multimeter, check resistance value between terminals as per following table.

FUEL INJECTOR RESISTANCE TEST AT ECM ADAPTER			
INJECTOR	**FUSE BOX TERMINAL**	**ECM ADAPTER**	**RESISTANCE @ 20°C (68°F)**
FRONT	PF1-2B	K4	11.4 - 12.6 Ω
REAR		L4	

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 the ECM adapter on the ECM connector.

Using a multimeter, check resistance value between terminals as per following table.

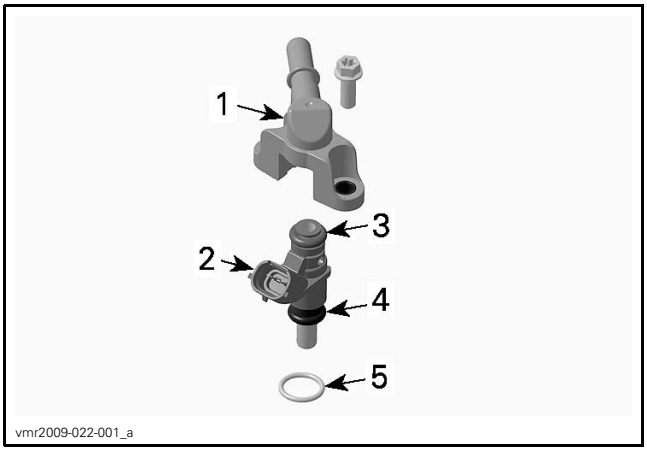
CYLINDER	INJECTOR GROUND CIRCUIT		MEASUREMENT
	WIRE	**ECM ADAPTER**	
FRONT	INJ1-1	K4	Close to 0 Ω
REAR	INJ2-1	L4	

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 ASS'Y
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

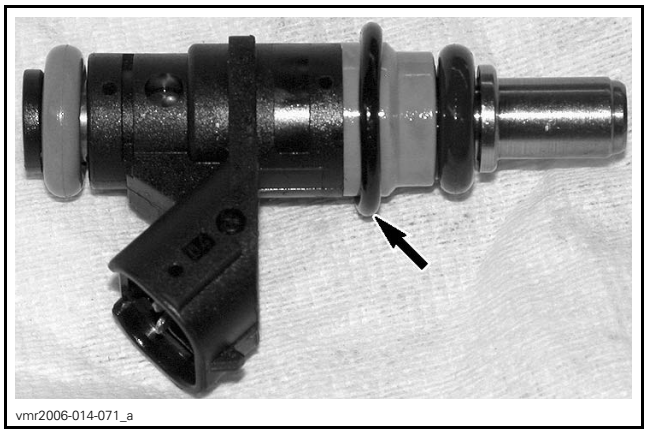
The installation is the reverse of the removal procedure. However, pay attention to the following.

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

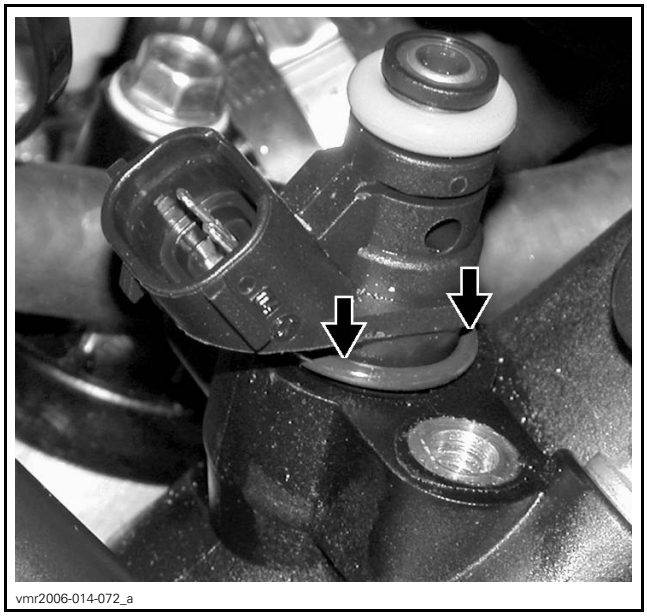
Position the manifold O-ring on injector as in following illustration.



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.

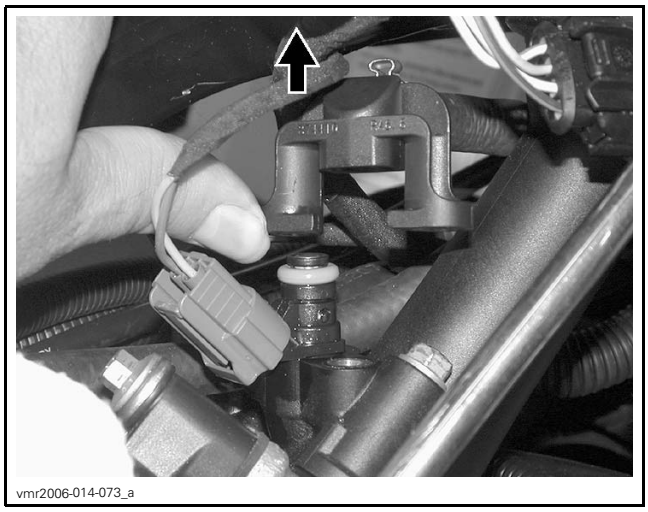
Reinstall fuel rail.

FUEL RAIL

Fuel Rail Replacement

Fuel Rail Removal

1. Disconnect fuel line to reach the rear injector. Refer to *FUEL TANK AND FUEL PUMP* subsection.
2. Unscrew rail retaining screws.
3. 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.

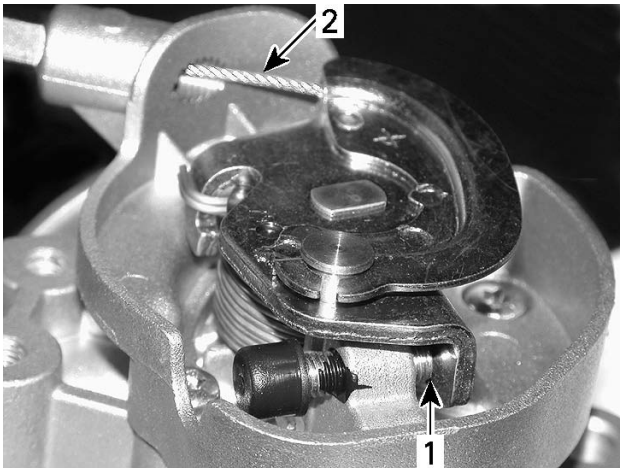
Proceed with *THROTTLE CABLE ADJUSTMENT* in this subsection.

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.



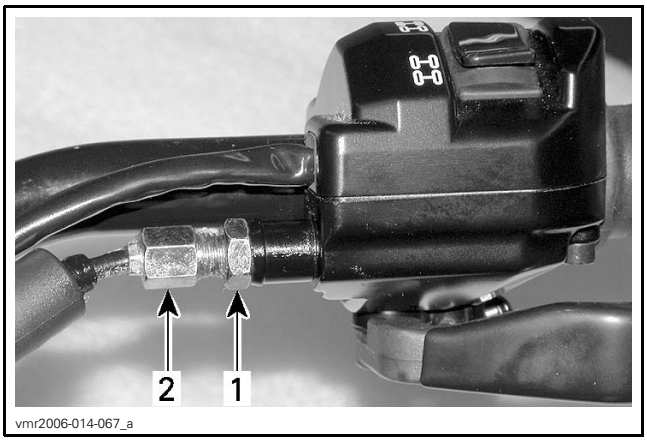
1. *Contact here*
2. *Free-play here*

⚠ 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.

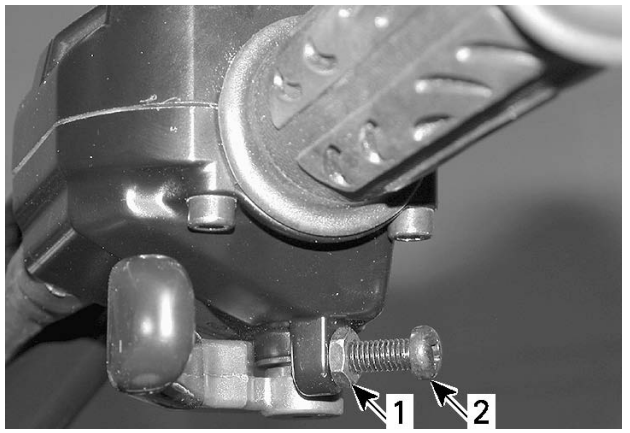


vmr2006-014-067_a

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.



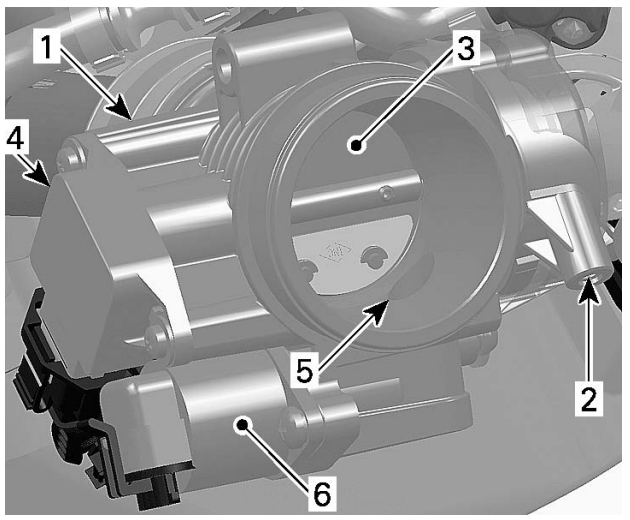
vmr2006-014-068_a

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.

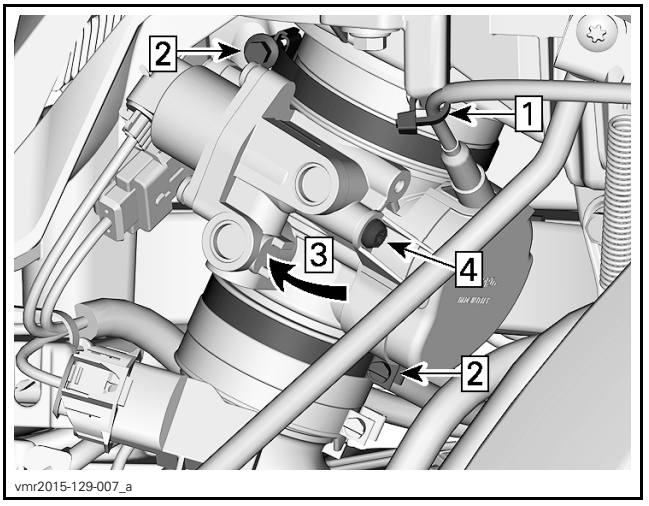
Throttle Body Removal

1. Remove the RH side panel. Refer to *BODY* subsection.
2. Remove the air intake silencer retaining screws.



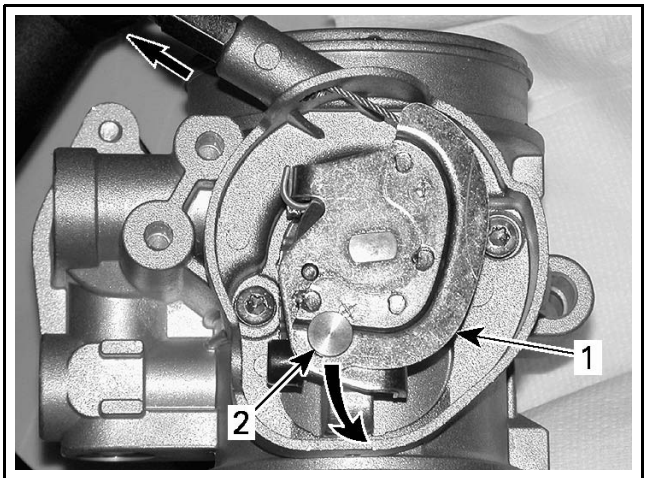
1. Remove these screws

3. Lift rear of air intake silencer as much as possible and block in this position.
4. Unplug connectors from TPS and IACV.
5. Cut the locking tie securing the throttle cable.
6. Loosen both throttle body clamps.
7. Rotate throttle body to gain access to throttle cable.
8. Remove throttle cable cover.



Step 1: Cut
Step 2: Loosen
Step 3: Rotate
Step 4: Remove

9. Rotate throttle lever and pull out cable barrel.



vmr2006-014-060_b

1. Throttle lever
2. Cable barrel

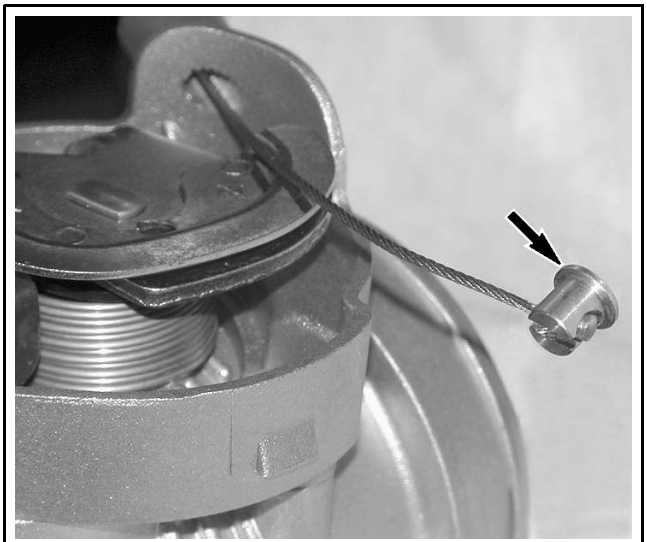
10. Remove barrel from cable.
11. Pull out throttle cable.
12. Pull out throttle body.

Throttle Body Installation

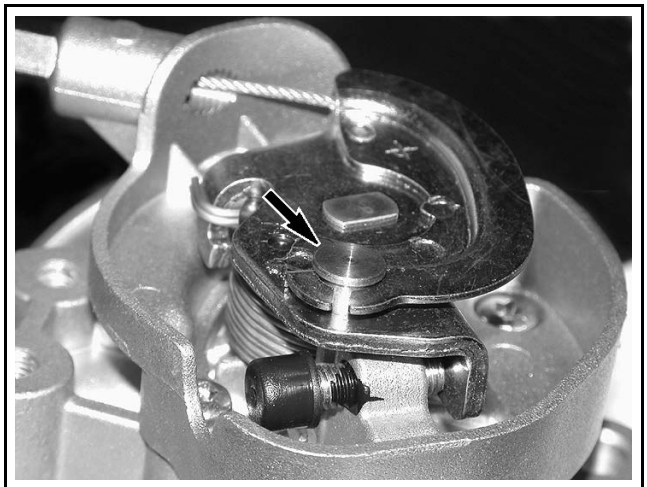
Installation of the throttle body is the reverse of the removal procedure. However, pay attention to the following.

Temporarily install throttle body into position.

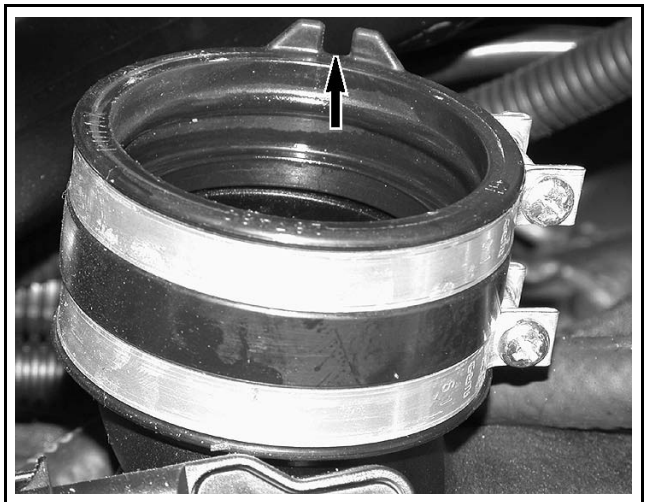
Properly install cable barrel to throttle cable end.

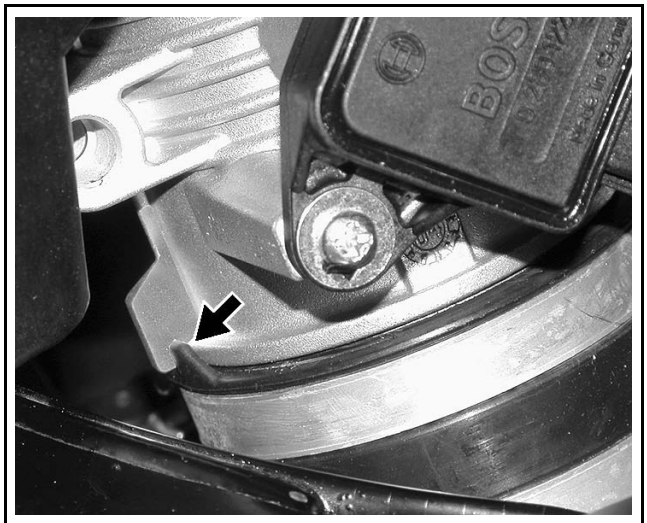

vmr2006-014-063_a

Hook cable to throttle lever.


vmr2006-014-064_a

Rotate throttle body into position and ensure to index throttle body tab with boot notch.


vmr2006-014-065_a


vmr2006-014-65_a

Tighten clamps.

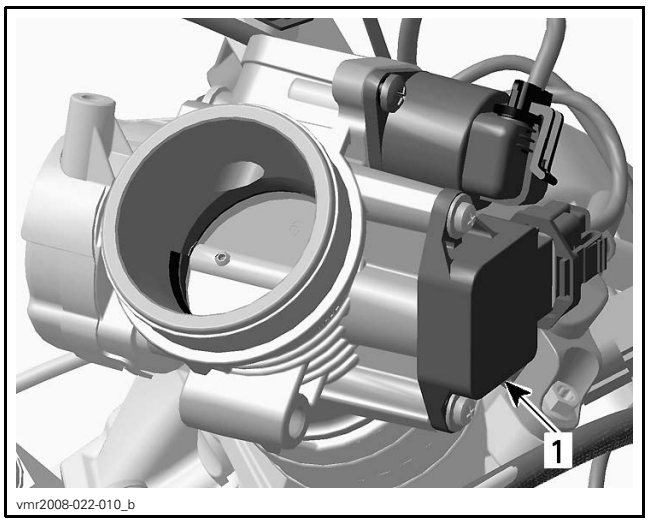
– Check throttle cable adjustment. Refer to *THROTTLE CABLE* in this subsection.
– If throttle body was replaced, perform the **Closed Throttle And Idle Actuator Reset** procedure. Refer to *CLOSED THROTTLE AND IDLE ACTUATOR RESET* in this subsection.

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.



1. Throttle position sensor (TPS)

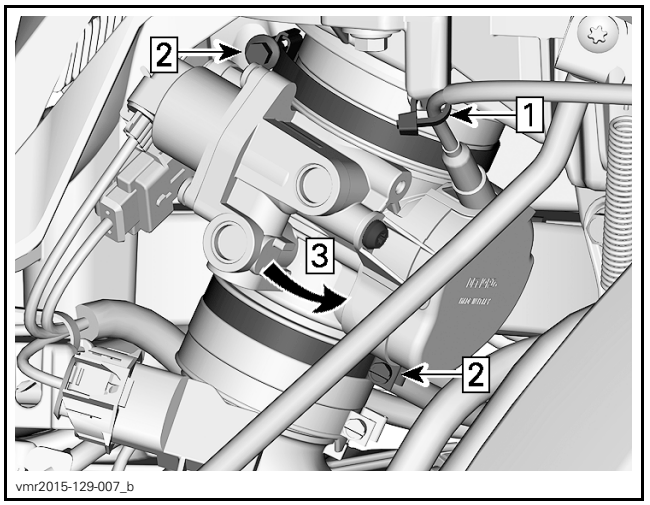
The ECM may generate several fault codes pertaining to the TPS. Refer to *DIGANOSTIC AND FAULT CODES* subsection for more information.

TPS Access

Remove the RH side panel. Refer to *BODY* subsection.

Loosen both throttle body clamps.

Rotate throttle body to gain access to TPS.



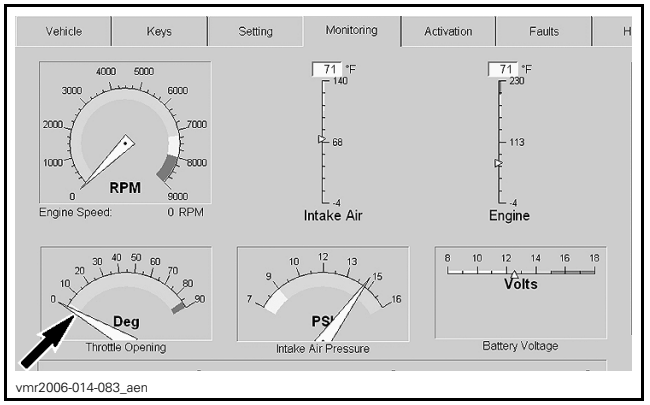
Step 1: Cut
Step 2: Loosen
Step 3: Rotate

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.



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.

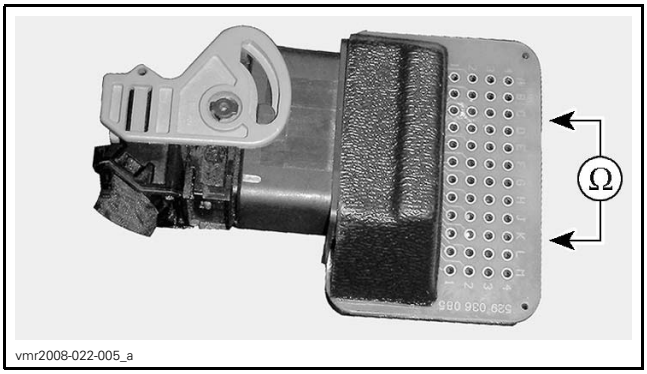
TPS Resistance Test

Ensure TPS is connected to wiring harness.

Disconnect the ECM connector and connect to ECM adaptor.

Using a multimeter, check resistance values as per following table.

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

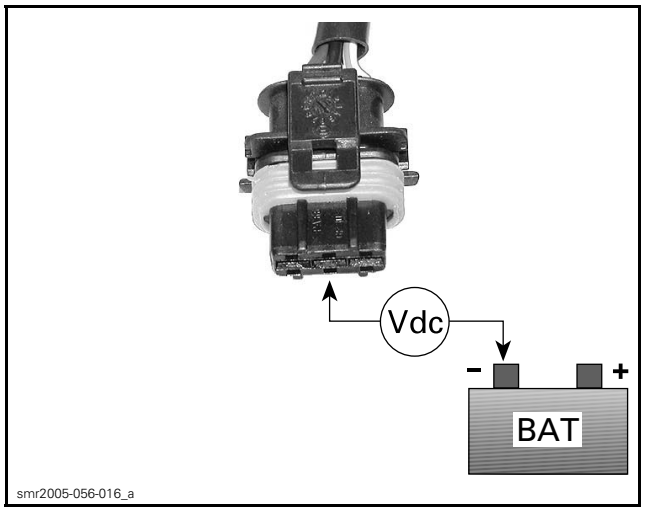
Disconnect connector from TPS.

Turn ignition key ON.

Set emergency engine stop switch to RUN.

Using a multimeter, check the voltage from harness connector as per following table.

CONNECTION	VOLTAGE
Pin 1 with battery ground	5.0 V
Pin 2 with battery ground	0 V



smr2005-056-016_a

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).

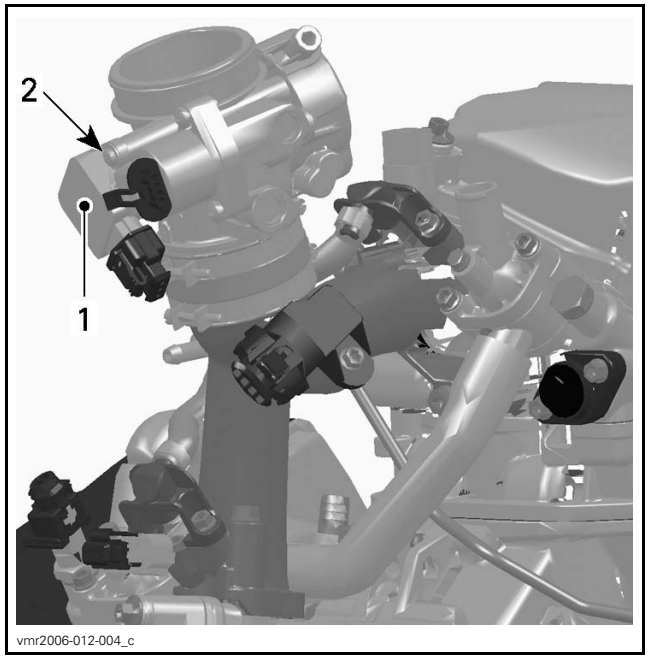
TPS Replacement

Refer to *TPS ACCESS* in this subsection to gain access to TPS.

Unplug connector from TPS.

Loosen TPS retaining screws.

Remove TPS.



vmr2006-012-004_c

TYPICAL – THROTTLE BODY
1. TPS
2. Screws

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

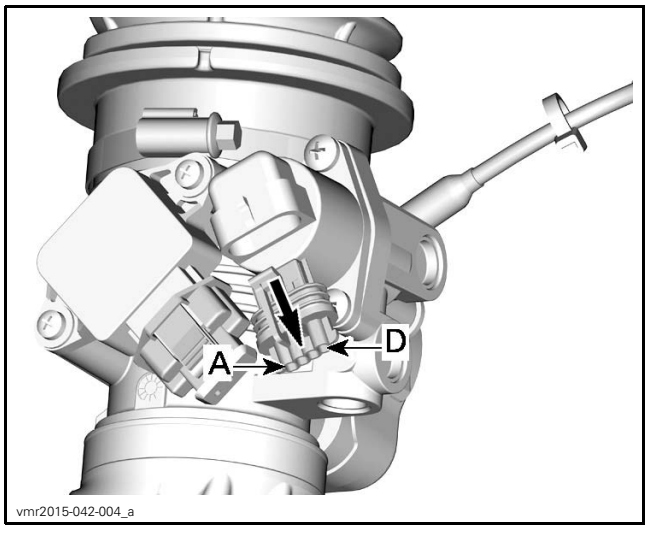
Refer to *TPS ACCESS* in this subsection to gain access to IACV.

IACV Resistance Test

Disconnect IACV from the wiring harness.

Using a multimeter, check the resistance between pins as per following table.

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 as per following table. If not good, check/repair wiring/connectors.

IACV CIRCUIT CONTINUITY TEST	
ECM ADAPTER	IACV CONNECTOR
D3	A
E4	B
C4	C
D4	D

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.

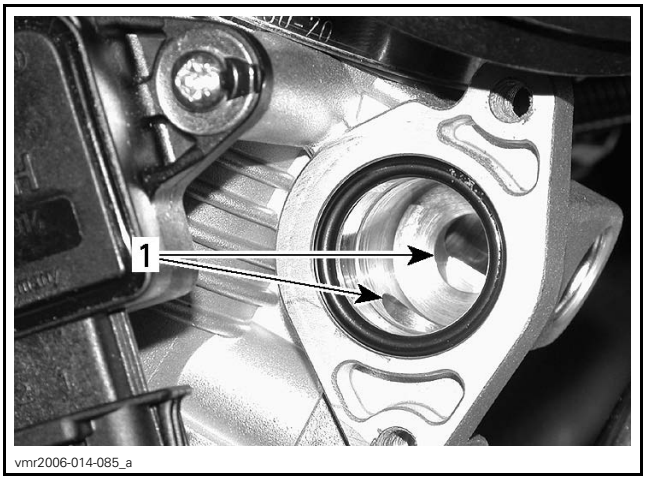
NOTICE **Always keep the ignition key turned OFF, while the idle air control valve is removed.**

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)

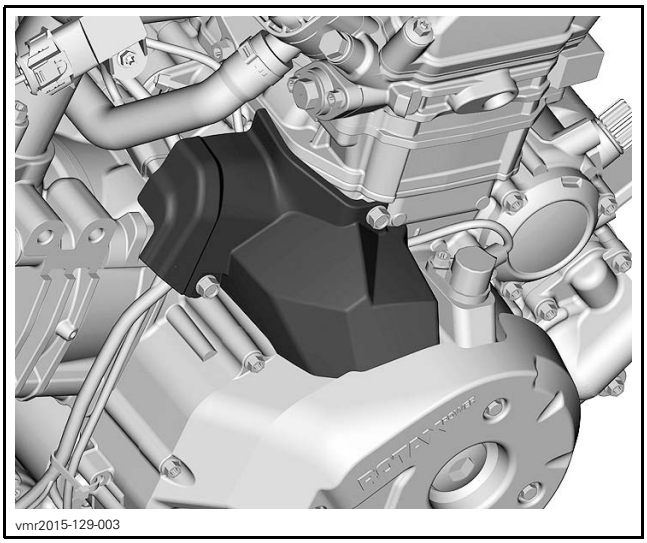
Refer to the *ENGINE MANAGEMENT SYSTEM* subsection for component and connector locations.

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* subsection.

CPS Access

Remove the RH side panel. Refer to *BODY* subsection.

To reach the CPS connector, remove protector from engine.


vmr2015-129-003

CPS Resistance Test

Disconnect the ECM connector.

Install the ECM adapter on the ECM connector.

Using a multimeter, measure resistance as per following table.

ECM ADAPTER		MEASUREMENT
PIN		RESISTANCE Ω @ 20°C (68°F)
D1	E1	700 - 900 Ω

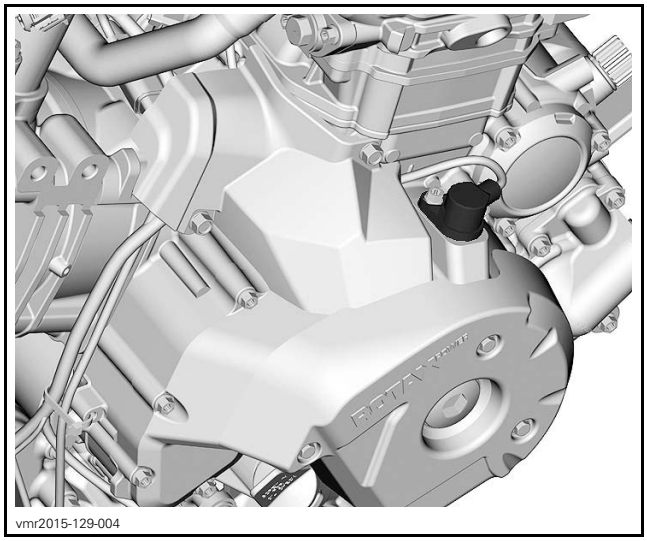
If resistance value is incorrect, check or repair the connectors and the wiring harness between ECM connector and the CPS. If resistance value is still incorrect, replace CPS.

CPS Replacement

Refer to *CPS ACCESS* in this subsection to reach CPS.

Disconnect CPS connector and cut harness locking tie (if applicable).

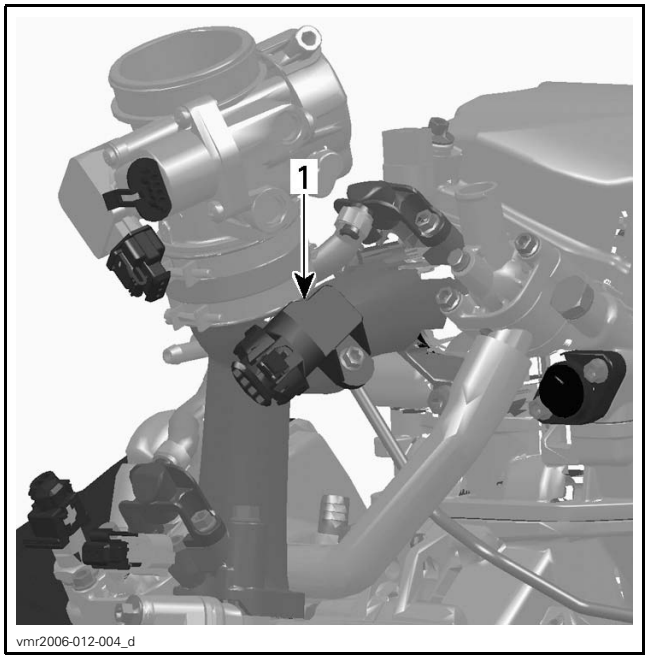
Remove CPS retaining screw and pull up on CPS to remove it.


vmr2015-129-004

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)
SENSOR SCREW	TIGHTENING TORQUE
	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

MANIFOLD ABSOLUTE PRESSURE AND TEMPERATURE SENSOR (MAPTS)



1. Manifold absolute pressure and temperature sensor (MAPTS)

NOTE: This sensor is a multifunction device.

MAPTS Access

Remove the RH side panel. Refer to *BODY* subsection.

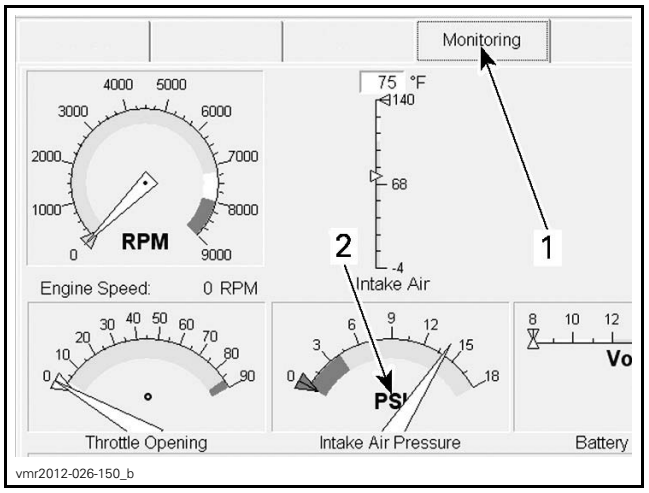
MAPTS Pressure Function

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 multimeter, measure 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 the ECM adapter on the ECM connector.
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	

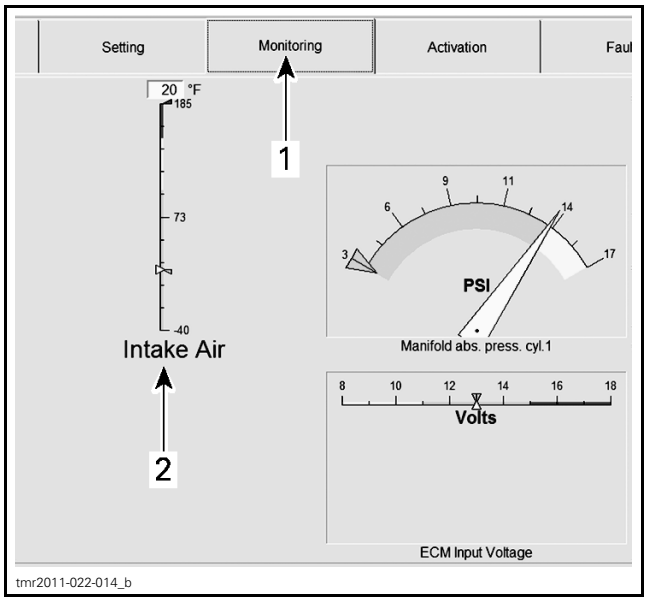
If resistance is not within specification, repair or replace the wiring harness between ECM connector and the MAPTS.

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 a multimeter, check the resistance of the sensor itself as per following table.

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 the ECM adaptor on the ECM-A connector.


529036166

Using a multimeter, recheck resistance value as per following table.

ECM ADAPTER		MEASUREMENT
PIN		RESISTANCE Ω @ 20°C (68°F)
F3	G2	2280 - 2740

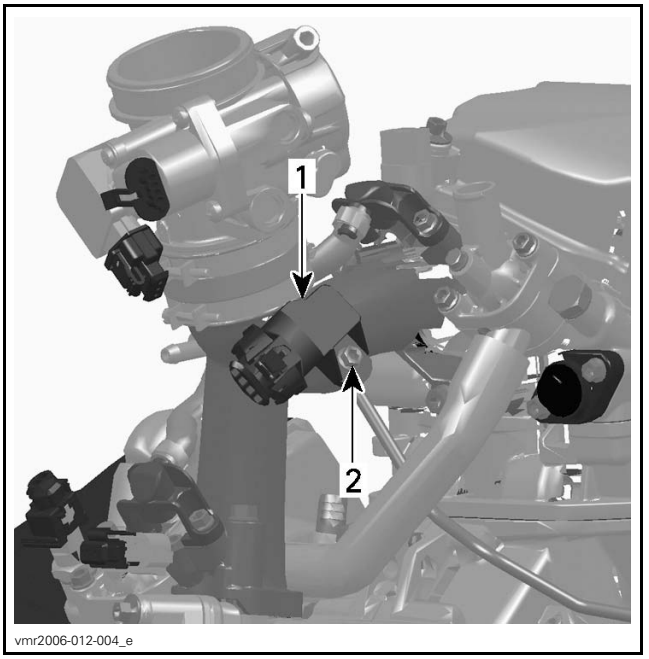
MAPTS TEMPERATURE SENSOR TEST RESULTS			
RESULT	SERVICE ACTION		
NO READING	Circuit Continuity Test of MAPTS Temperature Function	MAPTS Input Voltage Test	Repair or replace wiring
INCORRECT RESISTANCE VALUE	Replace MAPTS		

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.



vmr2006-012-004_e

1. MAPTS
2. Retaining screw

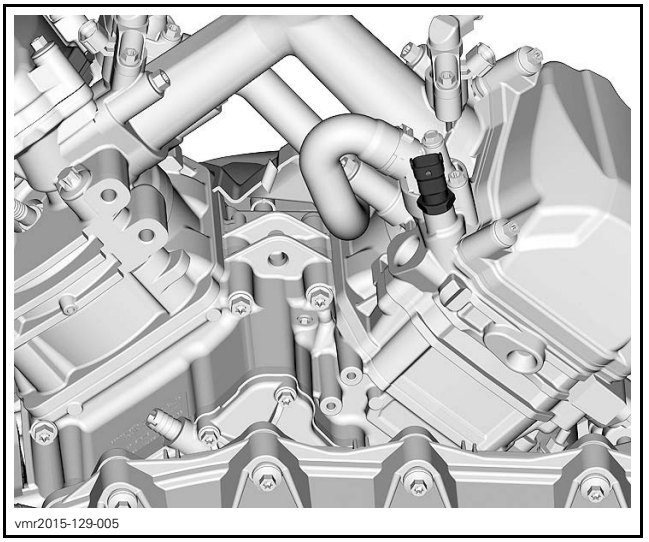
Disconnect MAPTS connector and remove the MAPTS.

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.

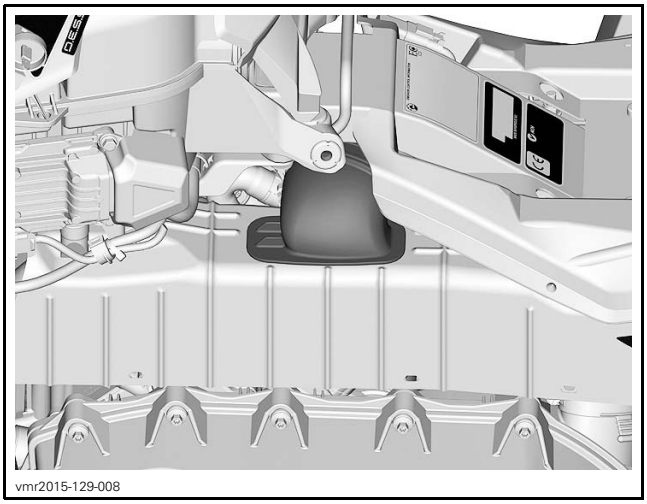

vmr2015-129-005

CTS - LH SIDE OF VEHICLE

CTS Access

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

Remove the CVT duct.



vmr2015-129-008

CTS Resistance Test

1. Disconnect the ECM connector.
2. Install the ECM adaptor on the ECM connector.
3. Using a multimeter, check resistance as per following table.

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.

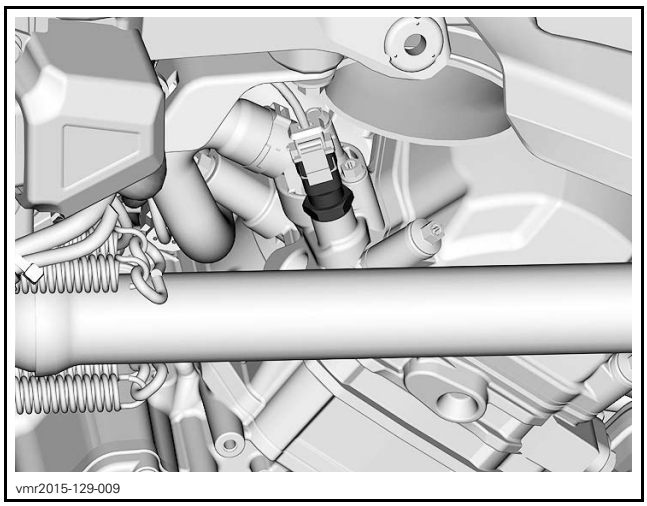
CTS CIRCUIT CONTINUITY TEST		
ECM ADAPTER	CTS CONNECTOR	RESISTANCE VALUE
Pin F4	Pin 1	Close to 0 Ω
Pin C3	Pin 2	

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. Remove heat shield over exhaust pipe to expose CTS. Refer to *EXHAUST SYSTEM*.



vmr2015-129-009

3. Disconnect CTS connector and remove CTS.
4. Install the new CTS and torque as specified.

CTS TORQUE
16 N•m ± 2 N•m (142 lbf•**in** ± 18 lbf•**in**)

5. Reinstall remaining removed parts.
6. Refill and bleed the cooling system. Refer to *COOLING SYSTEM* subsection.

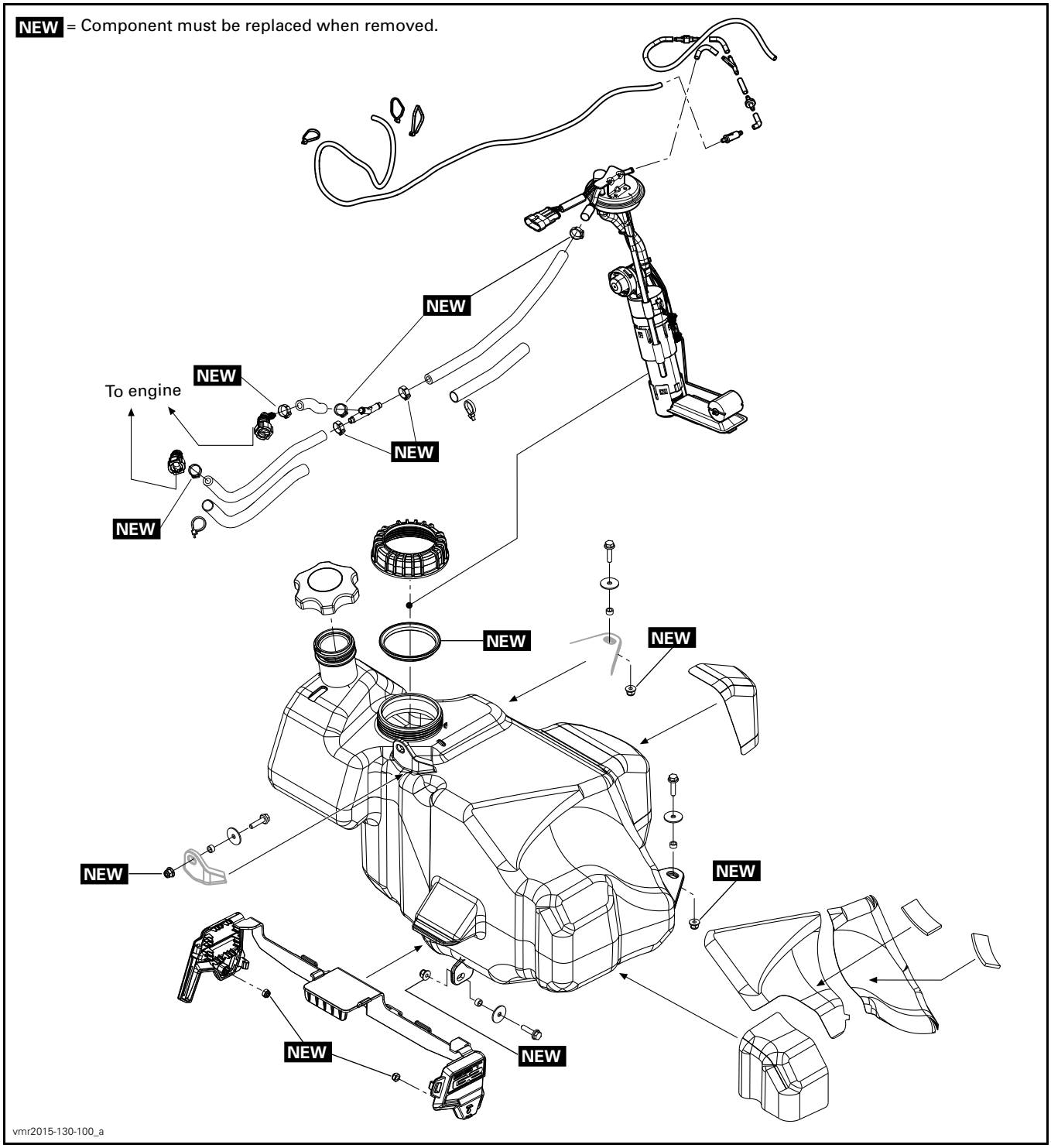
FUEL TANK AND FUEL PUMP

SERVICE TOOLS

Description	Part Number	Page
FLUKE 115 MULTIMETER	529 035 868	399
FUEL HOSE ADAPTER	529 036 023	393
FUEL PUMP NUT TOOL	529 035 899	401
OETIKER PLIERS	295 000 070	396
PRESSURE GAUGE	529 035 709	393
SMALL HOSE PINCHER	295 000 076	404
VACUUM/PRESSURE PUMP	529 021 800	392, 405

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
FLUKE RIGID BACK PROBE	TP88	399


NEW = Component must be replaced when removed.
NEW
NEW
To engine
NEW
NEW
NEW
NEW
NEW
NEW
NEW
NEW
vmr2015-130-100_a

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.

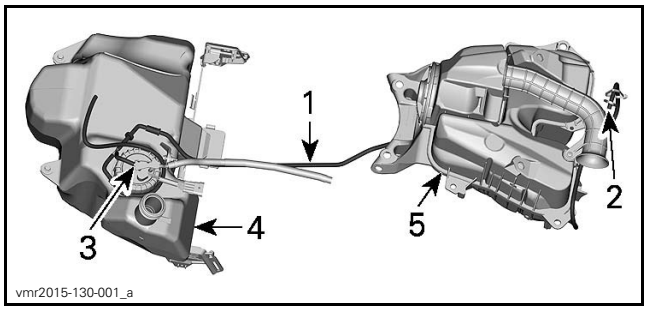
Use the B.U.D.S. software or disconnect the fuel pump electrical connector to disable fuel pump and crank engine to release fuel pressure prior to disconnecting any fuel hose.

Cover the fuel hose connections with an absorbent shop rag and carefully disconnect them to minimize spilling.

SYSTEM DESCRIPTION

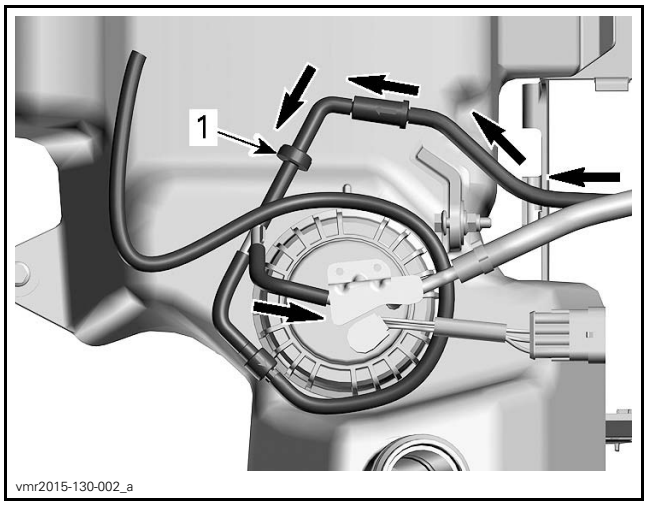
Fuel Tank Vent System

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*

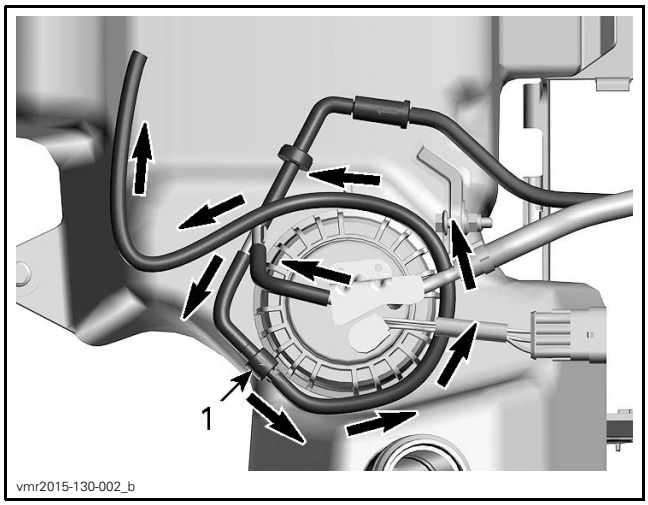
Air can enter the fuel tank at all times through the vent system INLET check valve. This prevents negative pressure within the fuel tank which could cause fuel starvation.



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.

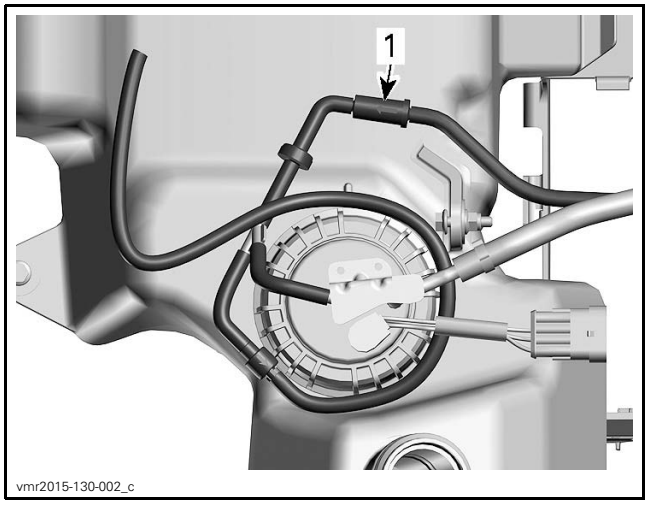


OVER PRESSURE RELIEF
1. Outlet pressure relief valve

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 between the vent inlet "Y" fitting and 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 pump filter (integrated)
– Fuel pressure regulator
– Fuel level sender.

Fuel Filters

The system comprises two levels of filtration:

– A replaceable prefilter element attached to the bottom of the fuel pump.
– A non-replaceable fine filter element that is integral to the fuel pump module.

Fuel Pump Pressure Regulator

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

INSPECTION

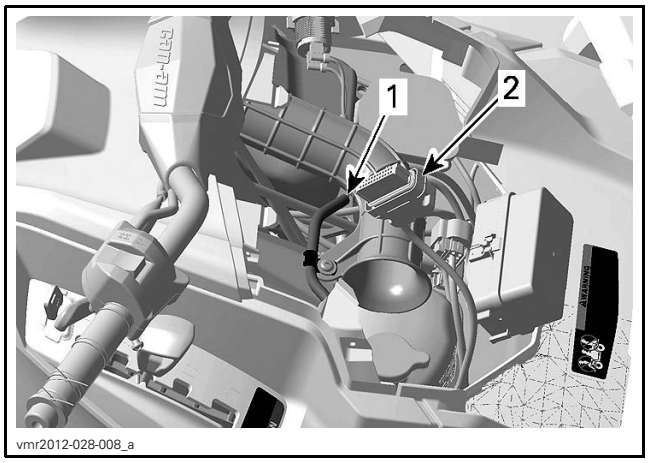
FUEL TANK LEAK TEST

⚠ 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)	



vmr2012-028-008_a

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).

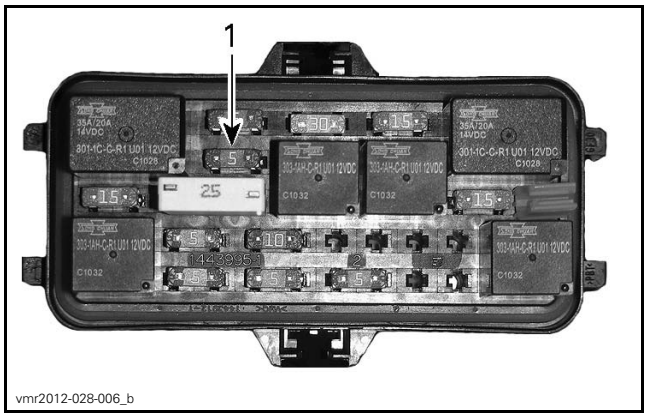
NOTE: For access to the fuel tank vent system, refer to *FUEL PUMP ACCESS* in this subsection.

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 RH side body panel, refer to *BODY* subsection.
5. Remove the fuel pump relay fuse (F15) in the front fuse box.

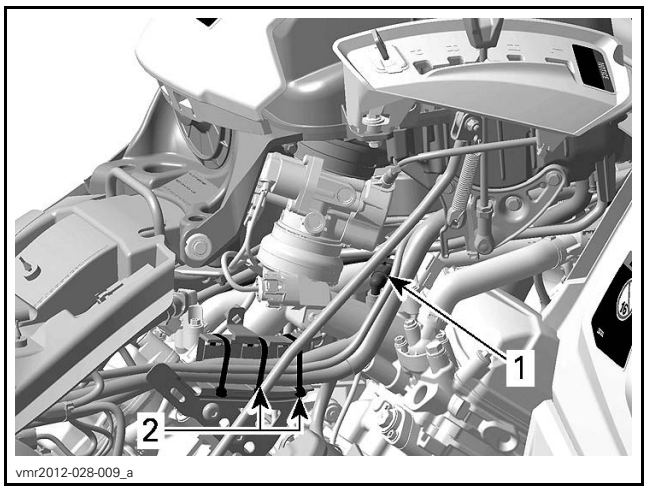


vmr2012-028-006_b

1. *Fuel pump relay fuse*

6. Release fuel pressure by running engine until it runs out of gas.
7. Carefully disconnect the fuel hose fitting from the injector fuel rail by pressing on the release tab of the quick disconnect fitting.
8. Remove the 2 most forward locking ties securing the fuel hose to the upper cable support.

NOTE: This is required to provide more hose length for proper connection to test equipment.

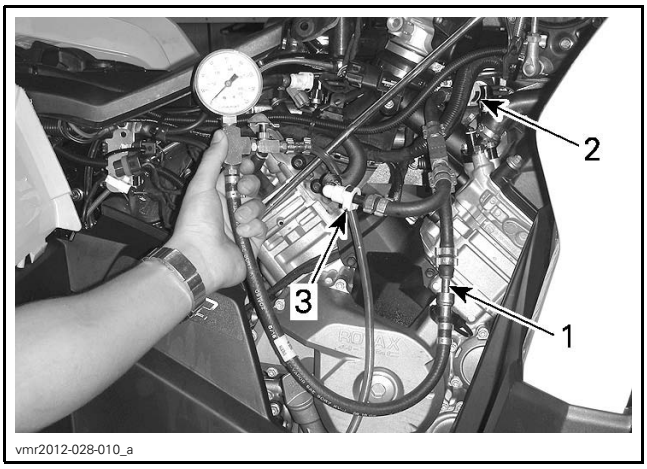


vmr2012-028-009_a

1. *Forward injector rail fitting*
2. *Locking ties*

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)	



PRESSURE GAUGE SETUP
1. *Pressure gauge to fuel hose adapter*
2. *Fuel hose adapter to fuel rail*
3. *Fuel hose adapter to fuel pump pressure hose*

10. Reinstall the fuel pump relay fuse (F15) 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:

– A fuel hose
– A 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

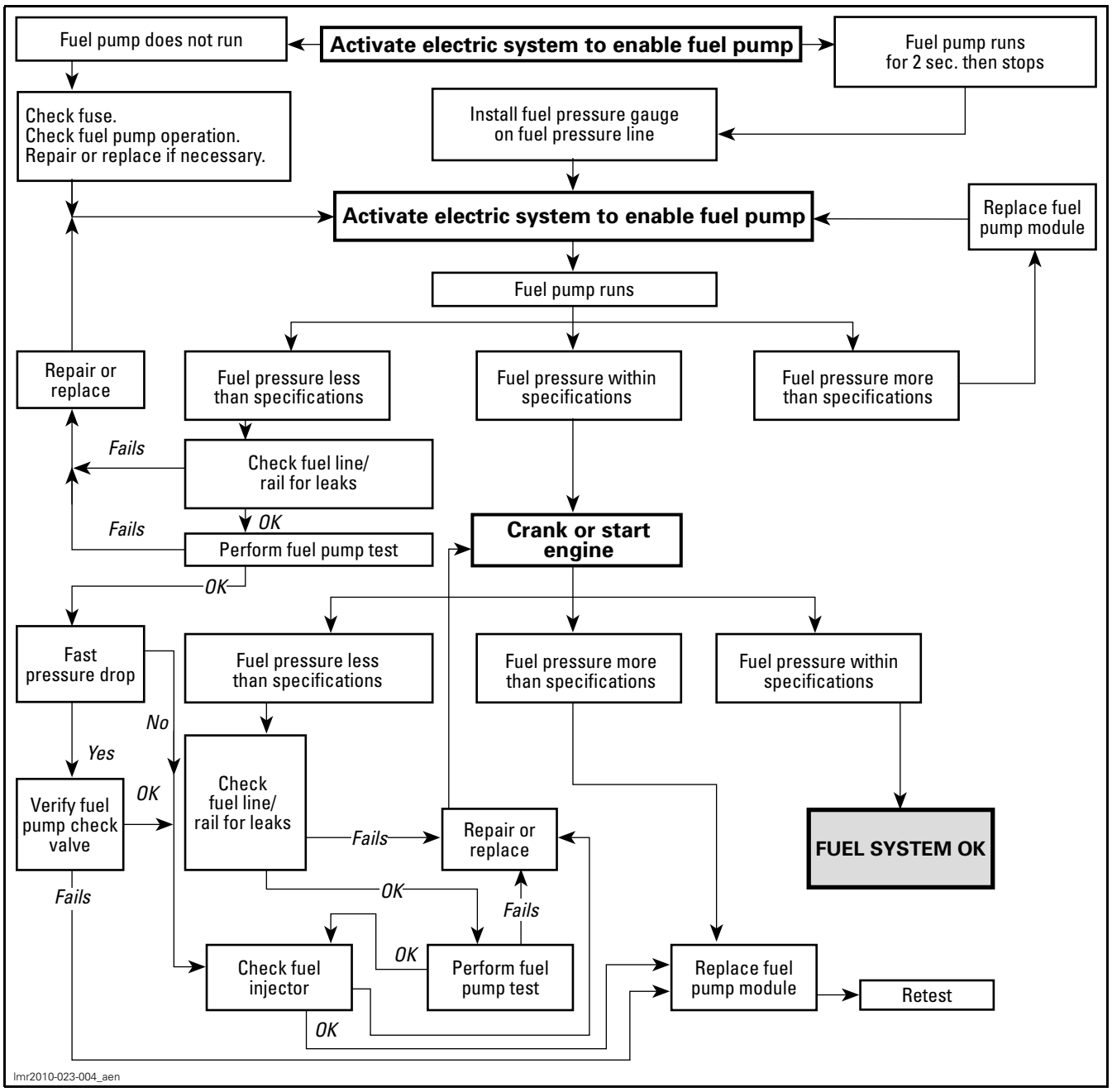
If there is a slow pressure drop after the engine is stopped, check for a fuel injector leak. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.

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.

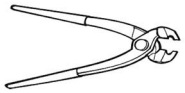
⚠ WARNING

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)	

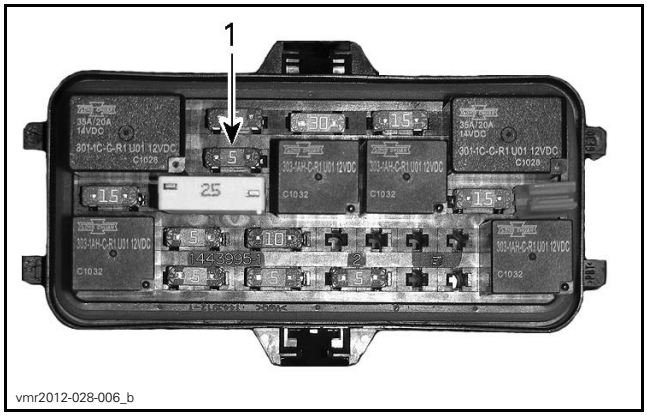
FUEL TANK

Fuel Tank Draining

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

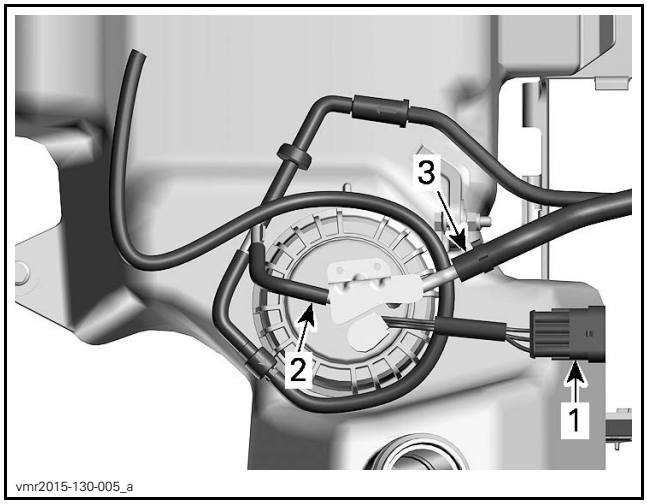
Fuel Tank Removal

1. Drain fuel tank. Refer to *FUEL TANK DRAINING* in this subsection.
2. Remove the fuel pump relay fuse (F15) in the front fuse box.



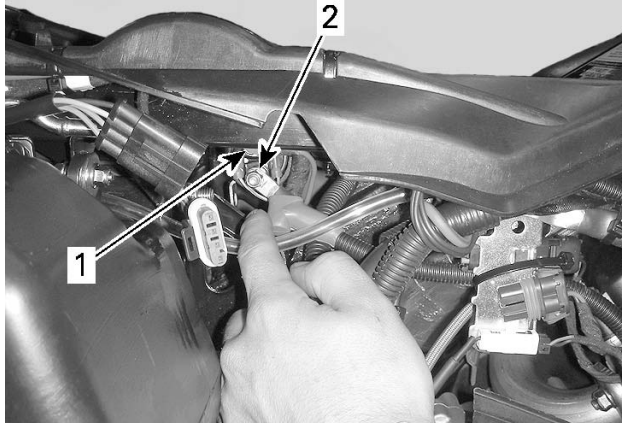
1. Fuel pump relay fuse

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 panels, refer to *BODY* subsection.
6. Refer to *EXHAUST SYSTEM* and remove the following:
   – Muffler assembly
   – Muffler/exhaust pipe heat shield.
7. Remove rear frame. Refer to *FRAME* subsection.
8. Disconnect the following from the fuel pump module:
   – Fuel pump electric connector
   – Fuel system vent hose
   – Fuel pump pressure hose.



1. Fuel pump connector
2. Vent hose
3. High pressure fuel hose

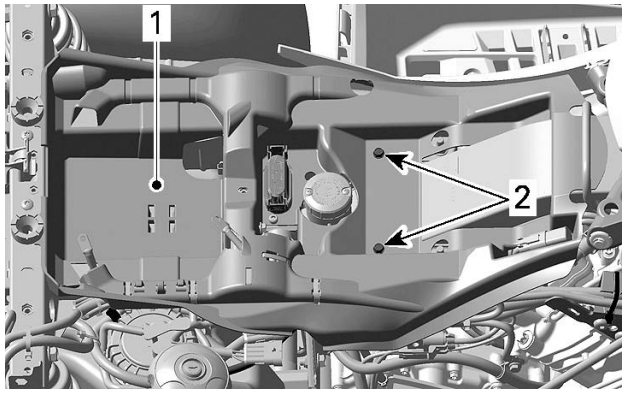
9. Disconnect the positive (+) battery cable from the starter solenoid.



vmr2012-028-012_a

TYPICAL
1. *Starter solenoid*
2. *Positive (+) battery cable to disconnect*

10. Remove the 2 screws that secure the front of the battery support.

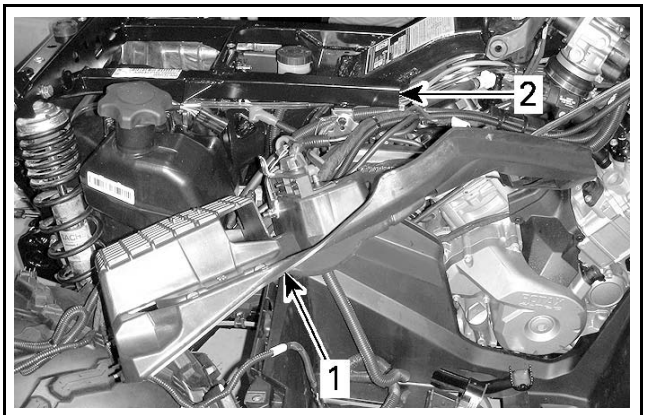


vmr2012-028-013_a

1. *Battery support*
2. *Support retaining screws*

NOTE: It is not necessary to remove the wiring harness or other components from the battery support.

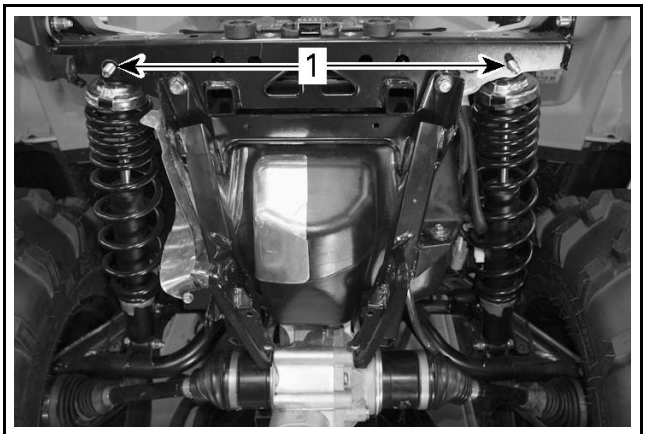
11. Flip the battery support over towards the RH side of the vehicle for access to the rear frame extension.



vmr2012-028-014_a

TYPICAL
1. *Battery support*
2. *Rear frame extension*

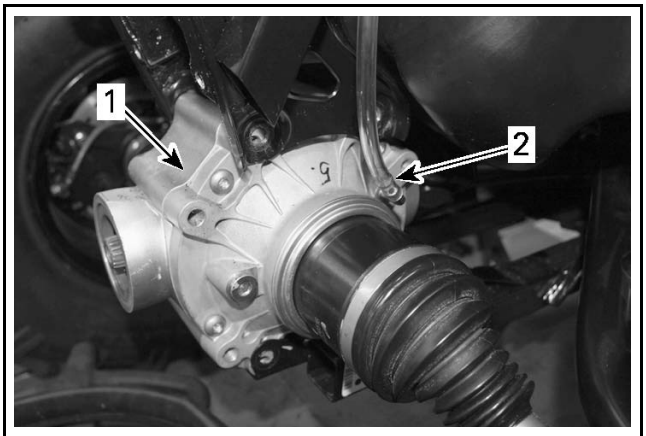
12. Remove the upper mounting bolt from both rear shock absorbers.



sfvmr2014-010-071_a

1. *Upper shock mounting bolts*

13. Remove vent tube from middle drive.

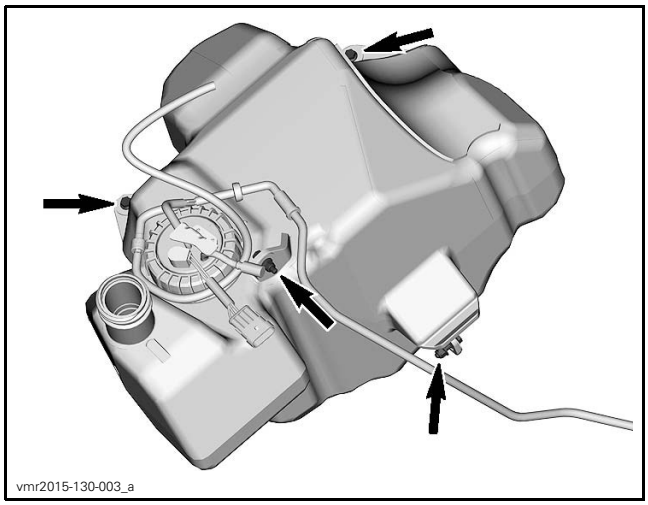


sfvmr2014-010-073_a

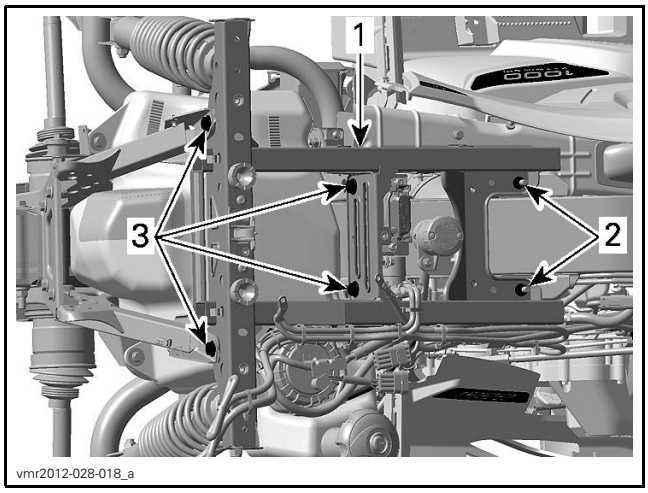
1. *Middle drive unit*
2. *Vent tube to remove*

14. Remove fuel tank retaining screws (4).

NOTE: Note position of washers and bushings on each screw.


vmr2015-130-003_a

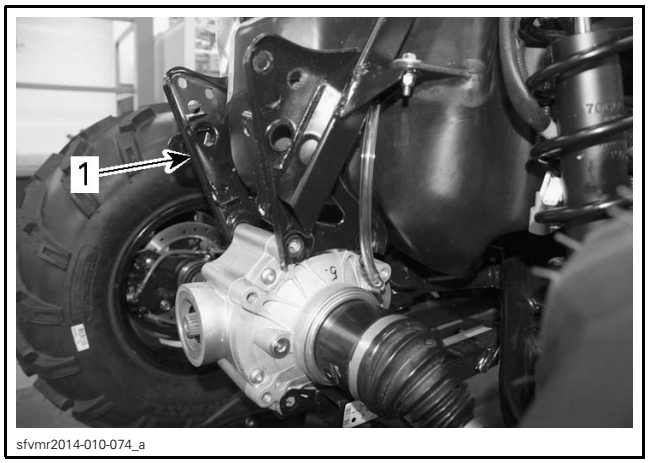
15. Loosen the front 2 nuts and remove the 4 bolts retaining the frame extension.



vmr2012-028-018_a

1. Frame extension
2. Loosen these 2 nuts
3. Remove these 4 bolts

16. Remove upper frame support.

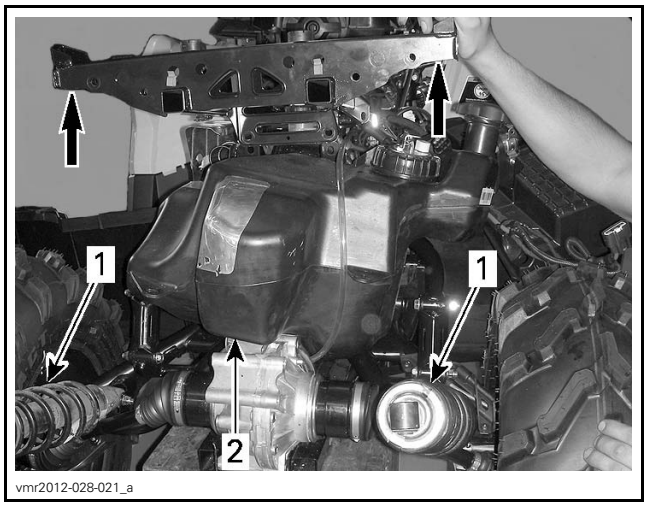


sfvmr2014-010-074_a

1. Upper frame support (welded)

17. Lift up on frame extension and pull fuel tank out of vehicle.

NOTE: When lifting up on the frame extension, the shock absorbers will fall backwards.



vmr2012-028-021_a

TYPICAL
1. Rear shock absorbers
2. Fuel tank

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 (F15), refer to *POWER DISTRIBUTION* subsection.

Start and run engine until it runs out of fuel.

Fuel Pump Pressure Test

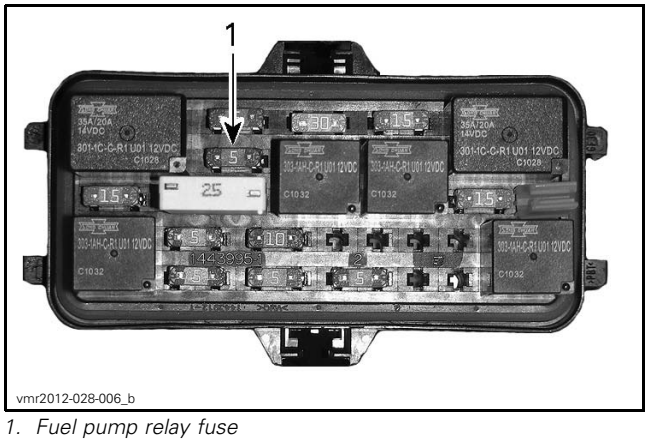
Refer to *INSPECTION* in this subsection.

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.

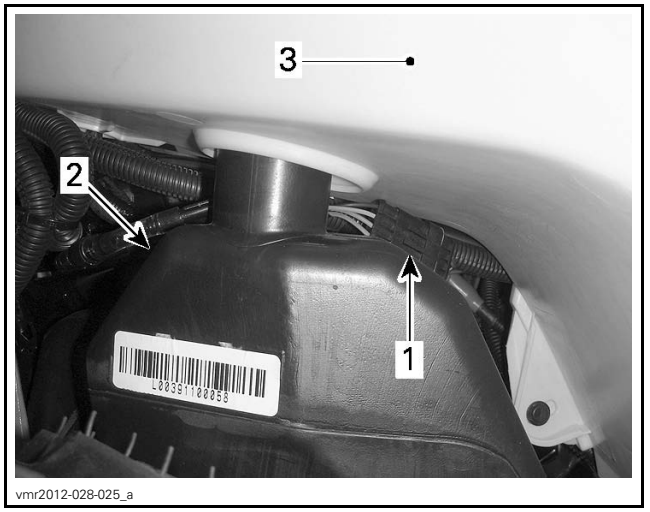
If fuel pump does not come ON, carry out the following:
– Check fuel pump relay fuse (F15).
– Check in B.U.D.S. for applicable fault codes. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
– Carry out a fuel pump input voltage test.



1. Fuel pump relay fuse

Fuel Pump Connector Access

The fuel pump connector can be accessed from under the RH rear fender, just above the forward end of the fuel tank.



TYPICAL
1. Fuel pump connector
2. Fuel tank
3. Underside of RH rear fender

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.

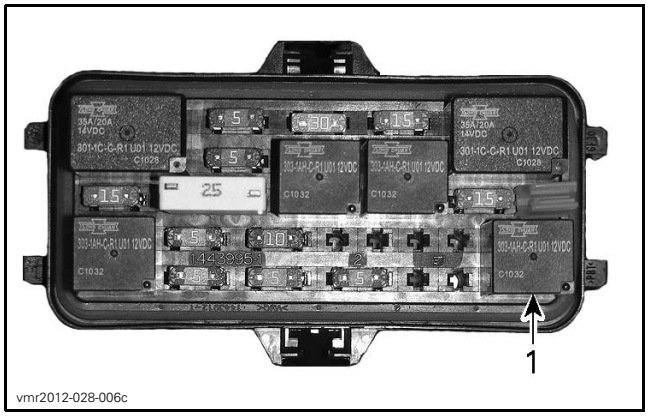
FUEL PUMP POWER WIRE TEST		
TEST PROBES		VOLTAGE READING
Fuel pump connector Pin 3	Battery ground	Battery voltage

If battery voltage is now read, check fuel pump ground circuit between fuel pump connector 5-FP-4 and battery ground.

If battery voltage is still not read, check fuel pump:
- Fuse (F15)
- 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

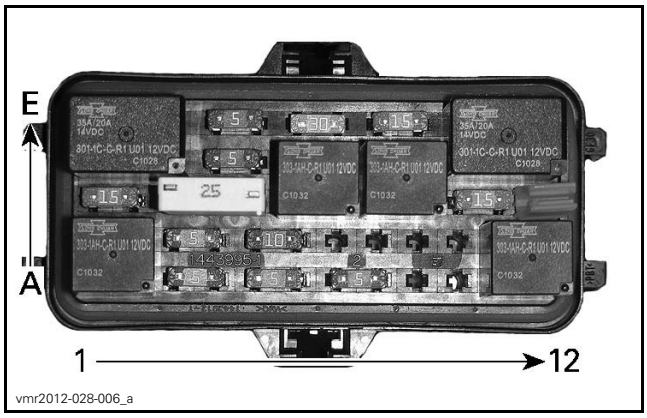
1. Ensure fuel pump connector is properly connected.
2. Remove fuel pump relay (R4).



1. Fuel pump relay

3. Measure fuel pump resistance as follows.

FUEL PUMP RESISTANCE TEST (AT FUSE BOX)		
TEST PROBES		RESISTANCE Ω @ 20°C (68°F)
Fuse box contact 11A	Battery ground	Approximately 2 Ω



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.

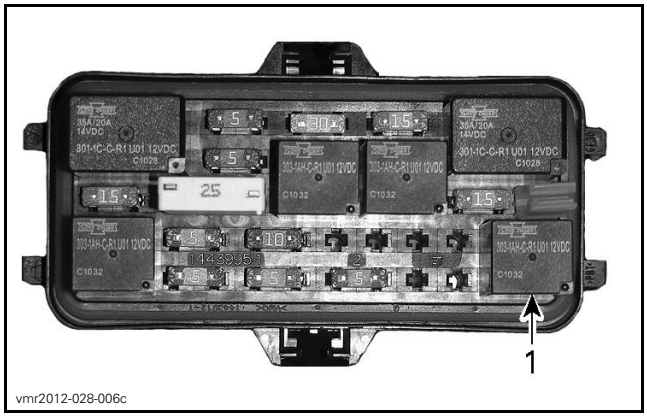
Repair or replace as necessary.

Fuel Pump Access

Remove rear body module, refer to *BODY* subsection.

Fuel Pump Removal

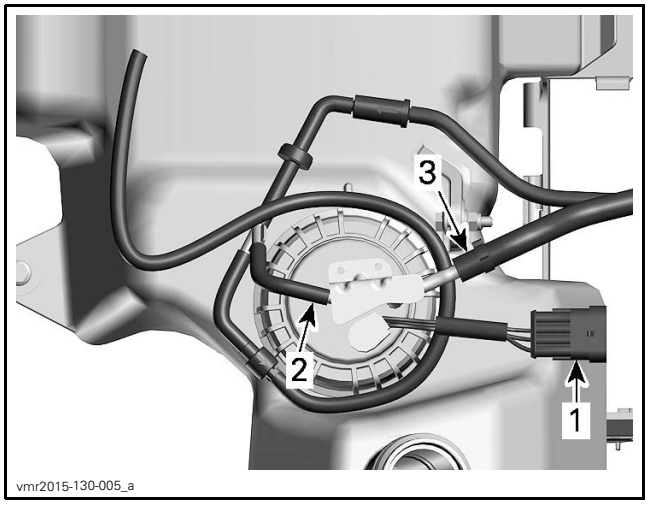
1. Remove the fuel pump relay fuse (F15) to disable fuel pump:



1. Fuel pump relay

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

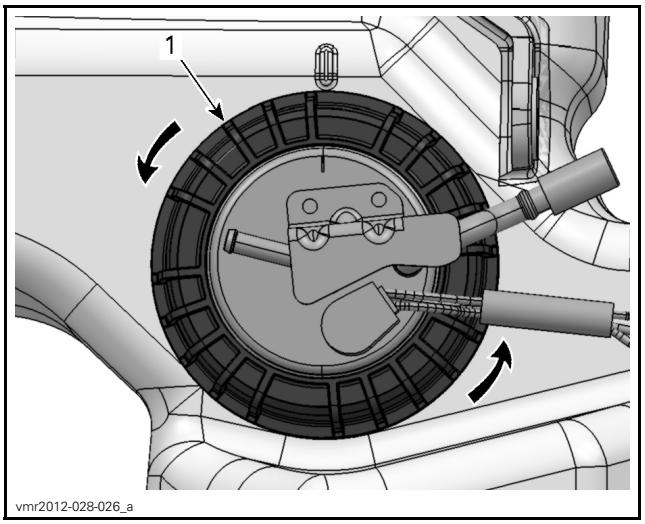
4. Remove fuel pump retaining nut.

⚠ 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.

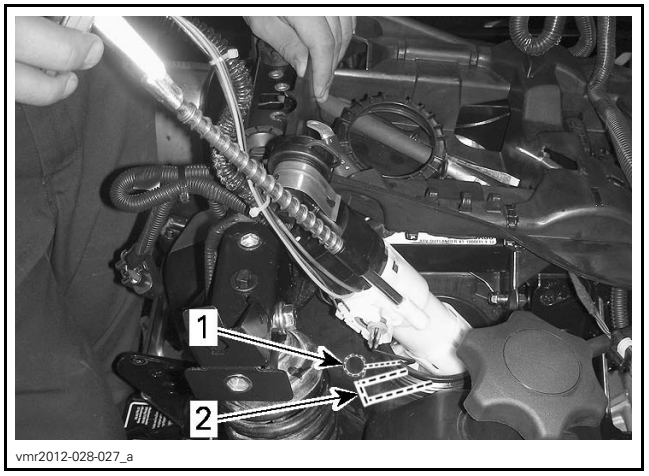
REQUIRED TOOL	
FUEL PUMP NUT TOOL (P/N 529 035 899)	



FUEL PUMP REMOVAL
1. Fuel pump retaining nut

5. Carefully pull out and rotate fuel pump as required.

NOTICE Pay attention not to damage fuel sender and fuel pump prefilter.



1. Approximate float orientation
2. Approximate prefilter orientation

6. Discard gasket ring.
7. Wipe off any fuel spillage.

Fuel Pump Installation

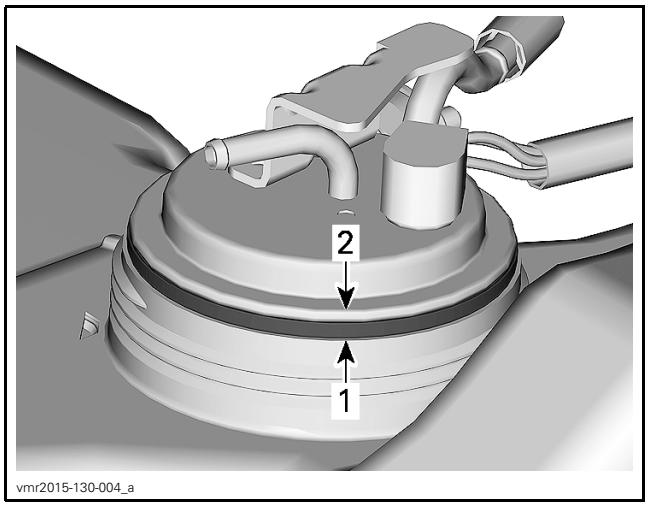
The installation is the reverse of the removal procedure. However, pay attention to the following.

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.

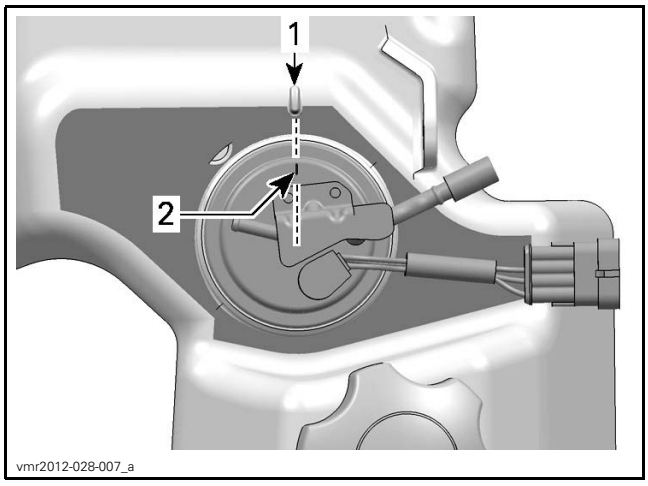


1. Gasket ring here
2. Fuel pump flange

⚠ 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.



1. Fuel tank pump index
2. Fuel pump index

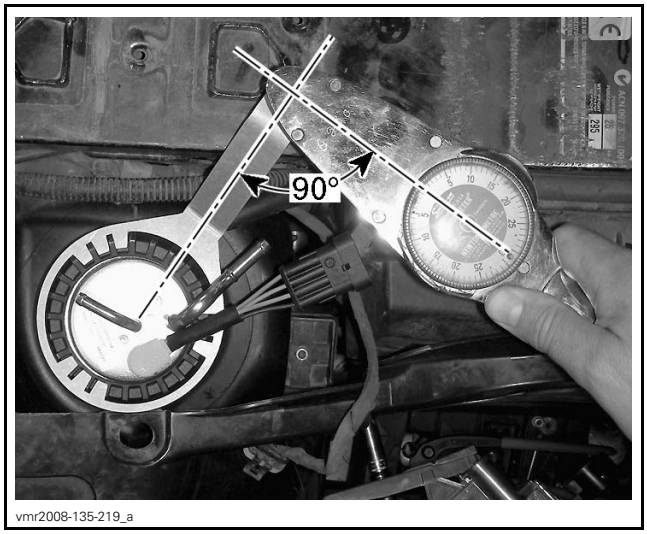
4. Insert fuel pump retaining nut over the fuel pressure hose and electrical wiring connector.
5. While firmly holding pump against tank, engage fuel pump retaining nut on fuel tank flange.

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.



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.

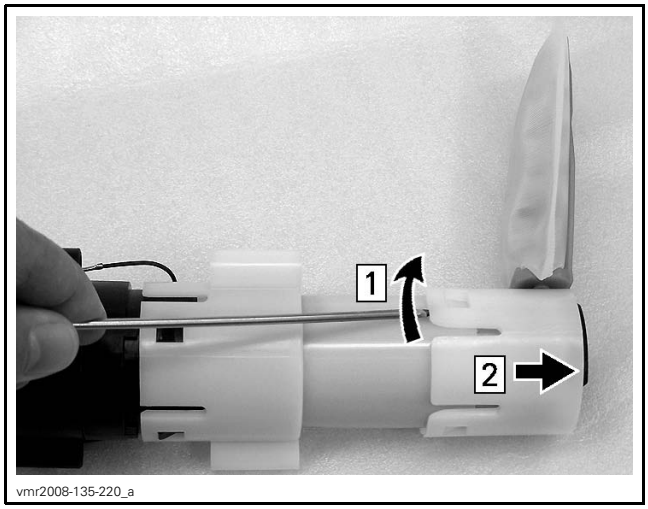
7. Install fuel pressure hose on fuel pump using a NEW Oetiker clamp.
8. Install fuel vent tube on fuel pump.
9. Install electrical connector on fuel pump.
10. Install fuel pump relay fuse.
11. Refuel tank and ensure there are no leaks by performing a *FUEL TANK LEAK TEST* and a *FUEL PUMP PRESSURE TEST* as described in this subsection.
12. Check fuel level sender operation.

FUEL PUMP PREFILTER (STRAINER)

Fuel Pump Prefilter Replacement

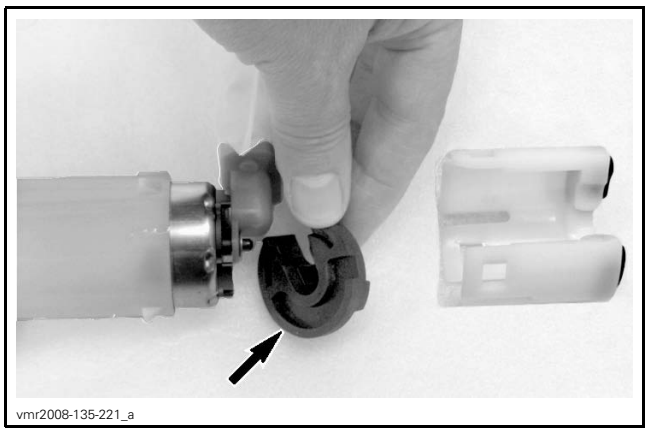
1. Remove *FUEL PUMP*, see *FUEL PUMP REMOVAL* in this subsection.

2. Unlock 3 tabs on strainer plastic ring.

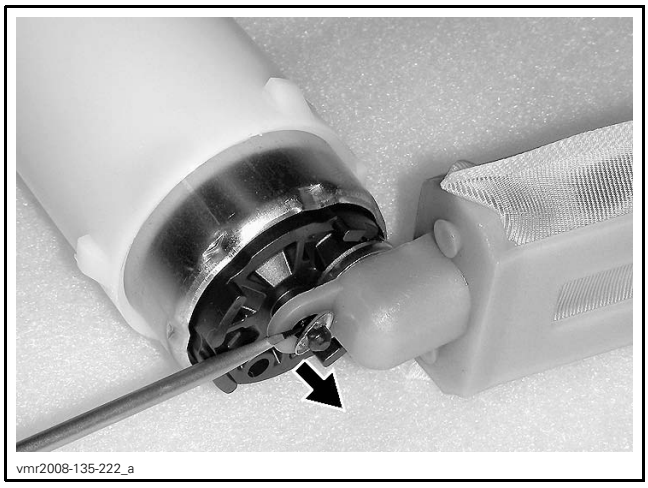


Step 1: Lift these tabs to unlock ring
Step 2: Pull ring off pump inlet

3. Remove rubber pad.



4. Remove push nut securing strainer to fuel pump. Be careful not to break the plastic pin.



5. Pull strainer off fuel pump.

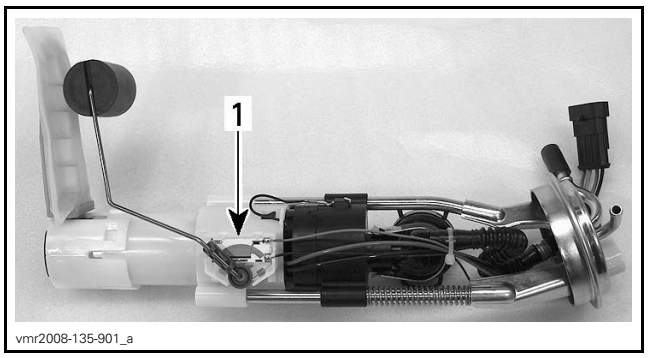


NOTE: A non-serviceable filter is located within the fuel pump module. If it is clogged, replace fuel pump.

6. Insert the new strainer on fuel pump making sure to press it in tightly against the fuel pump surface.
7. Press in a NEW push nut to secure strainer.
8. 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.

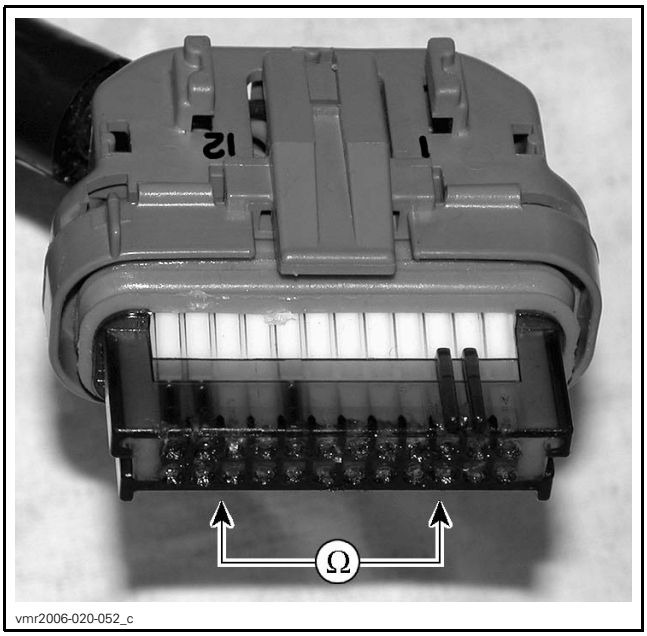


FUEL PUMP
1. Fuel level sender

Fuel Level Sender Resistance Test (Fuel Pump Module Installed)

1. Disconnect multifunction gauge, refer to the *LIGHTS/GAUGE/ACCESSORIES* subsection.
2. 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. Measure for 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

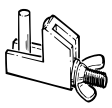
Replace fuel pump. Refer to *FUEL PUMP* in this subsection.

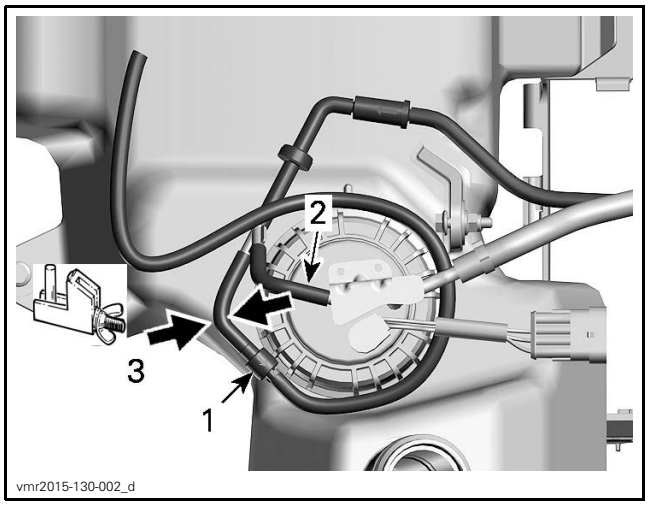
FUEL TANK VENT VALVES

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.

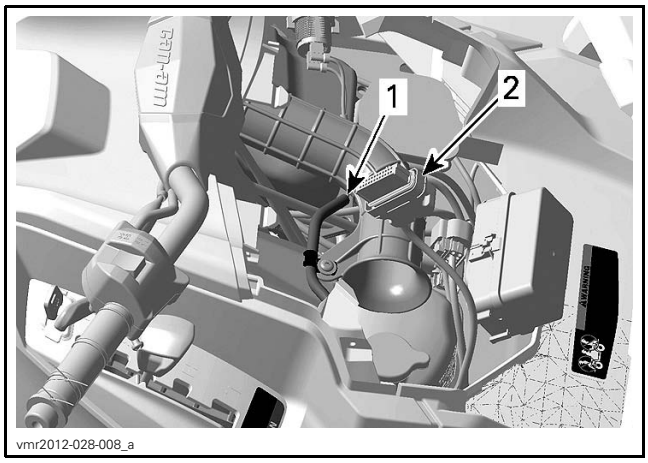
REQUIRED TOOL	
SMALL HOSE PINCHER (P/N 295 000 076)	



1. Pressure relief valve
2. Fuel pump vent inlet
3. Install small hose pincher here

4. Connect the vacuum/pressure pump to the fuel tank vent hose inlet.

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



1. Fuel tank vent hose inlet
2. Gauge connector

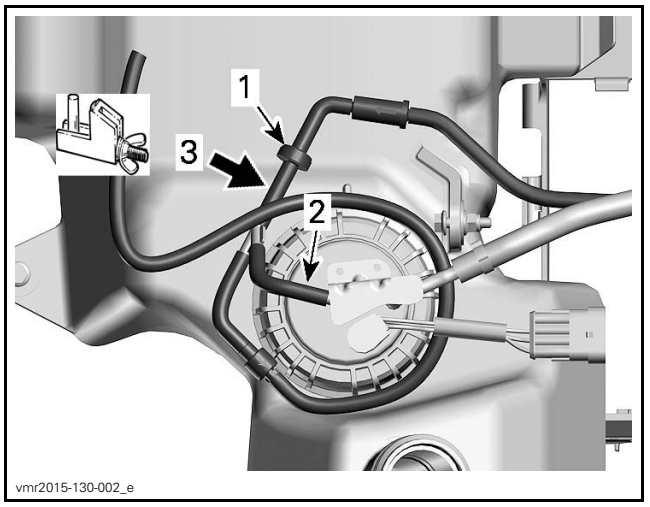
5. Remove fuel tank cap.
6. Set vacuum/pressure pump to **PRESSURE** and activate pump. The gauge on the pump **should not change in reading**.
7. Set vacuum/pressure pump to **VACUUM** and activate pump. The **gauge should increase in reading**.

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.

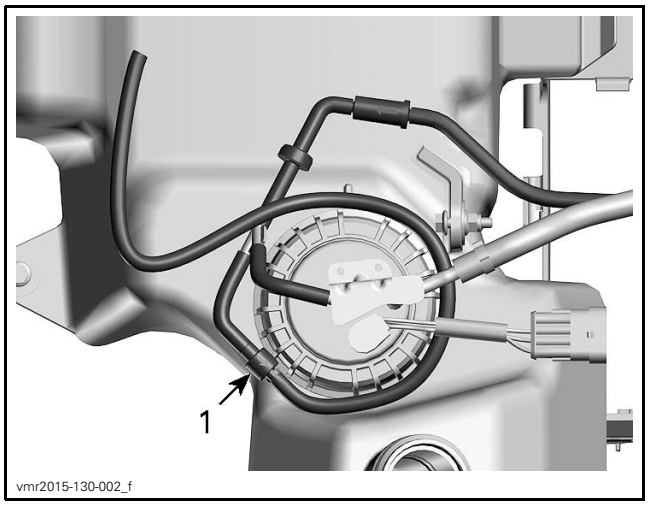


1. Inlet check valve
2. Fuel pump vent inlet fitting
3. Install small hose pincher here

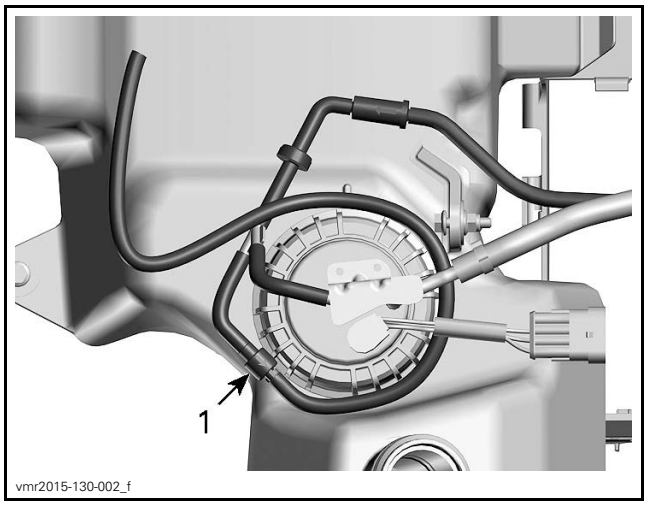
2. Set vacuum/pressure pump to **PRESSURE** and activate pump. The **gauge should increase in reading**.
3. Set vacuum/pressure pump to **VACUUM** and activate pump. The gauge on the pump **should not change in reading**.

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

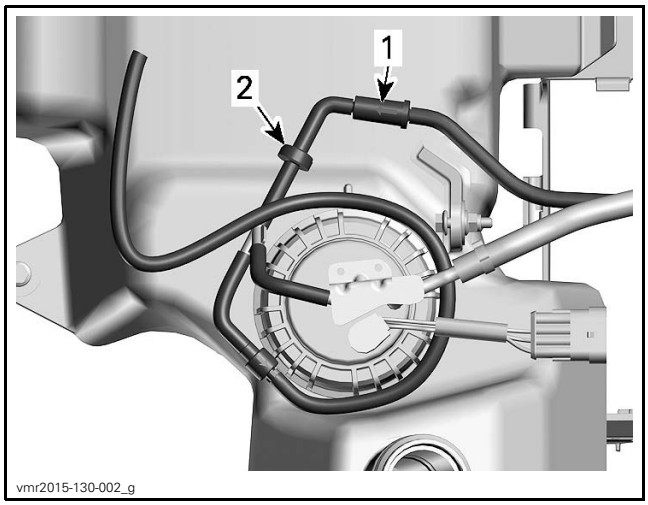


1. Pressure relief valve flow direction arrow

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

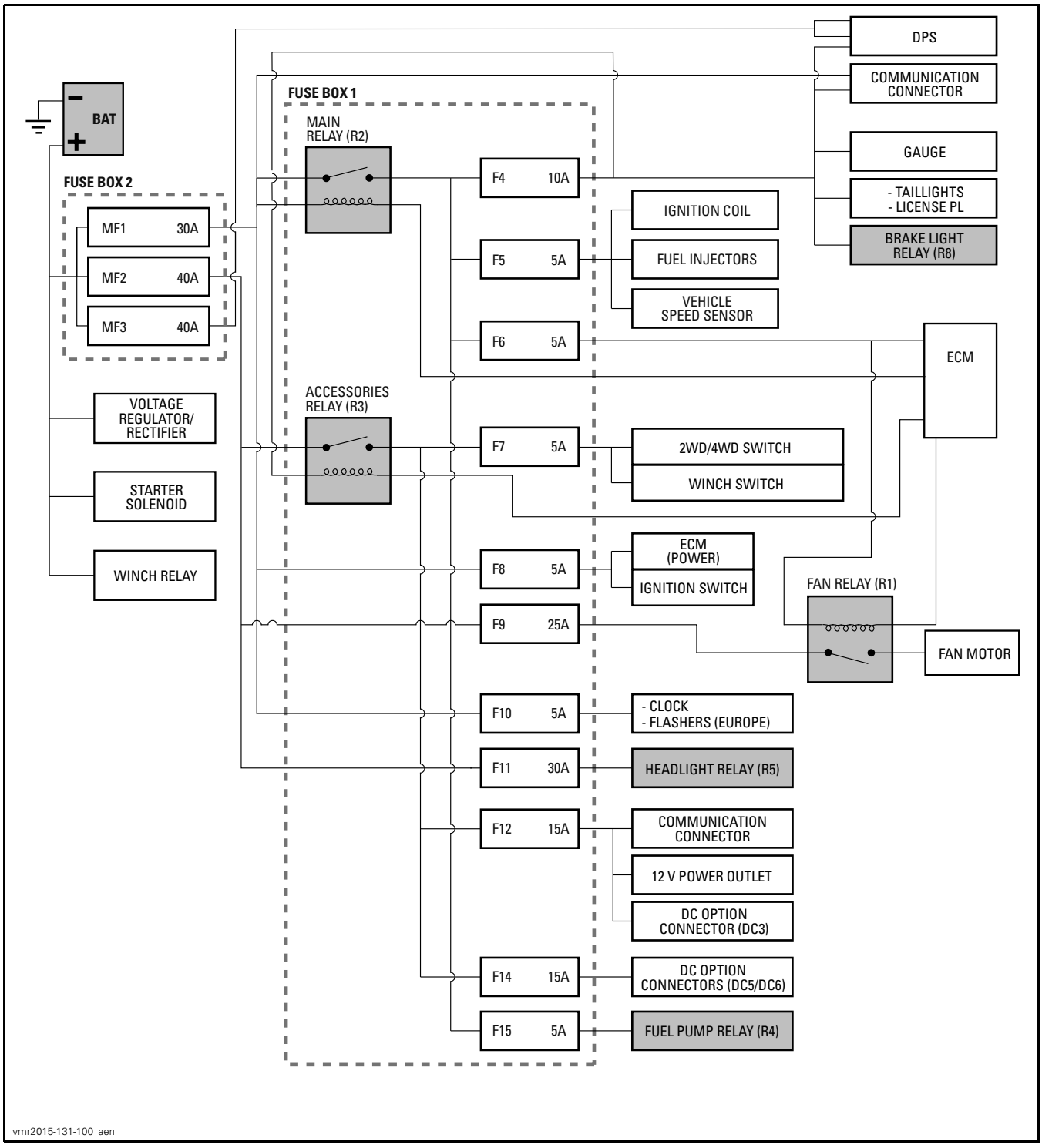
Pressure Relief Valve Installation

Ensure pressure relief valve flow arrow is pointing away from fuel pump vent fitting.

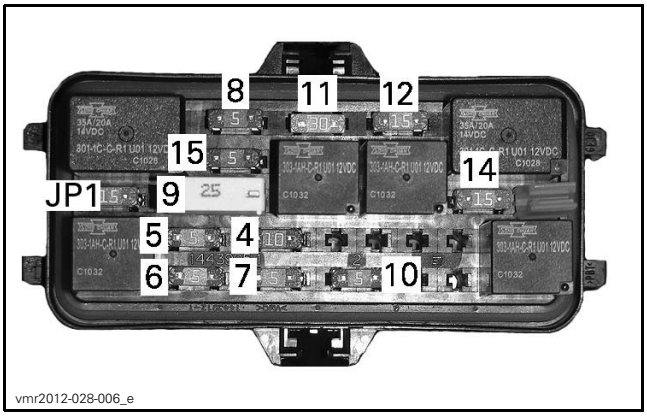
POWER DISTRIBUTION AND GROUNDS

GENERAL

POWER DISTRIBUTION DIAGRAM

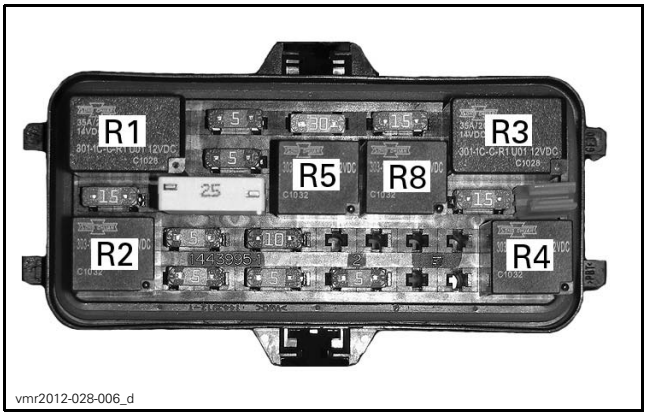


FUSE BOX 1



FUSES

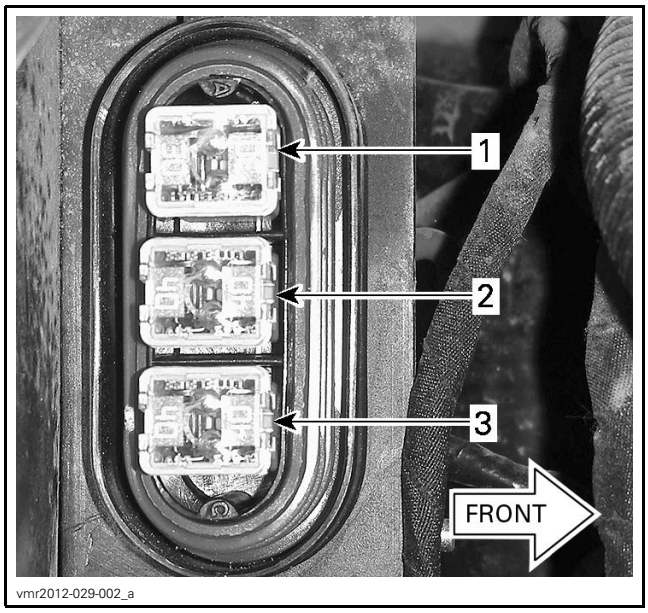
FUSE IDENTIFICATION		
Fuse	4	10 A
	5	5 A
	6	5 A
	7	5 A
	8	5 A
	9	25 A
	10	5 A
	11	30 A
	12	15 A
	14	15 A
	15	5 A
	JP1	Jumper 15 A



RELAYS

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
R3	Accessories	Same as main relay	When ignition key is turned OFF **OR** When engine speed is less than 1000 RPM for at least 50 minutes
R4	Fuel pump	See *FUEL TANK AND FUEL PUMP*	
R5	Headlights	Same as main relay	When ignition key is turned OFF **OR** When engine speed is less than 1000 RPM for at least 50 minutes
R8	Brake lights	See *BRAKES*	

FUSE BOX 2

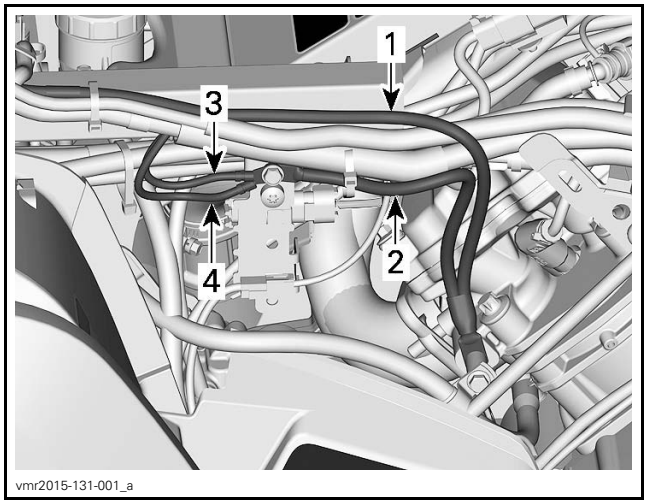


vmr2012-029-002_a

FUSE IDENTIFICATION			
Fuse	1	Main	30 A
	2	Fan/accessories	40 A
	3	DPS (dynamic power steering)	40 A

GROUNDS

All grounds are grouped at the same location on RH side of frame.



vmr2015-131-001_a

RH SIDE
1. *Battery ground*
2. *Engine ground*
3. *DPS ground*
4. *Wiring harness ground*

WIRING HARNESS AND CONNECTORS

SERVICE TOOLS

Description	Part Number	Page
CRIMPING TOOL (HEAVY GAUGE WIRE)	529 035 730	426
ECM ADAPTER TOOL	529 036 166	423
ECM TERMINAL REMOVER 2.25	529 036 175	424
ECM TERMINAL REMOVER 3.36	529 036 174	424

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
GM TERMINAL EXTRACTOR	12094430	425
SNAP-ON TERMINAL REMOVER TOOL	TT600-4	421

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.

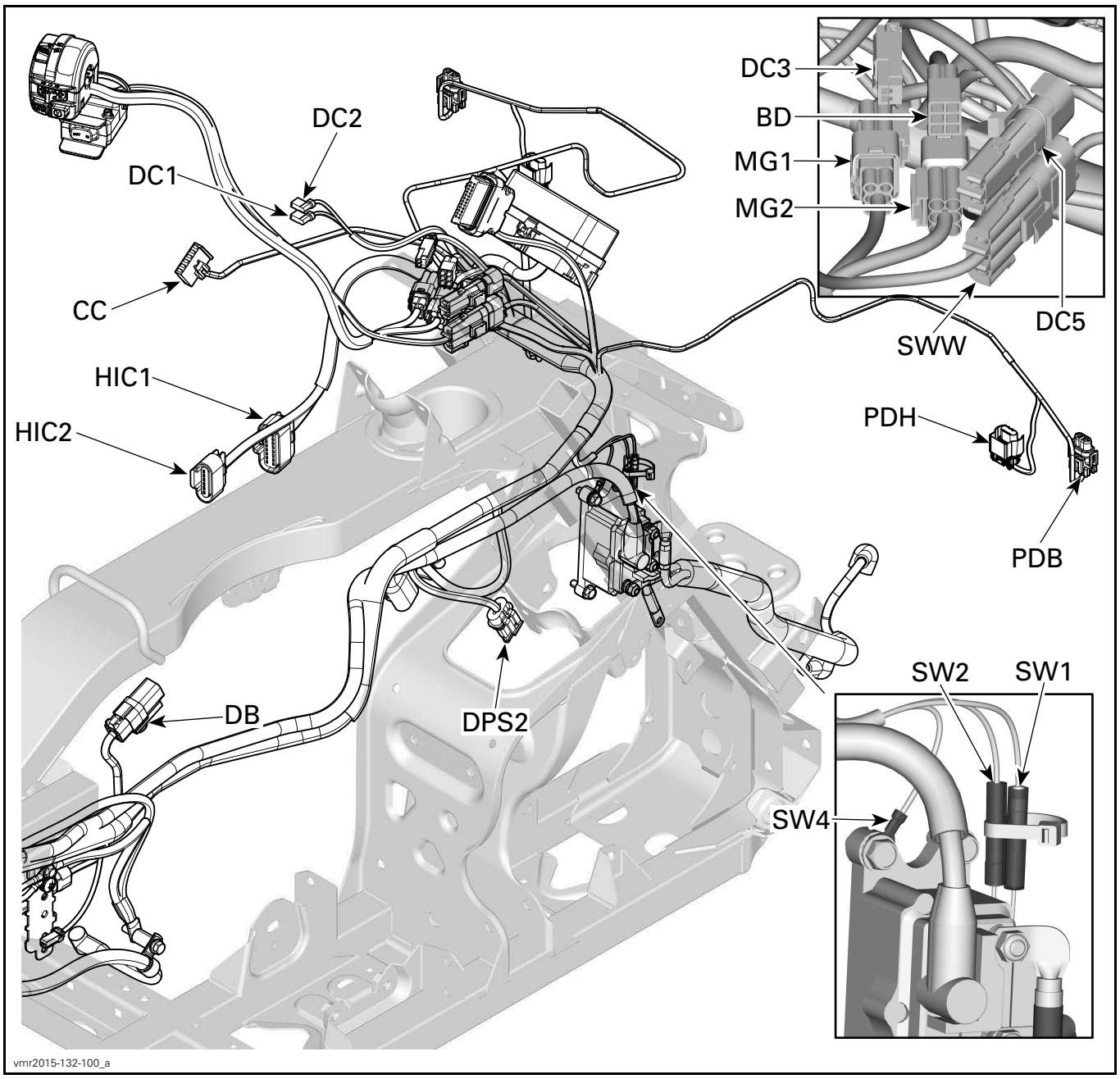
CONNECTOR ABBREVIATION DESCRIPTION

ABBREVIATION	DESCRIPTION
BD	RH multifunction switch
BN1	Ground terminal
BN2	Ground terminal
BN4	Ground terminal
BP1	Positive terminal to PF2
BP2	Positive terminal from battery
BP3	Positive terminal to SM
CC	Ignition switch
CL	Cluster
CRD	Rear RH turn light (Used on European models only)
CRG	Rear LH turn light (Used on European models only)
DB	Diagnostic connector
DC1	Accessory outlet
DC2	Accessory outlet
DC3	Accessory outlet
DC5	Accessory outlet
DC6	Accessory outlet
DC7	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
HIC2	Harness interconnect
HICa	Harness interconnect (Used on European models only)
MG1	LH multifunction switch
MG2	LH multifunction switch
PDB	RH lower headlight
PDH	RH upper headlight
PF1	Front Fuse box
PF2	Rear fuse holder
PGB	LH LO beam headlight
PGH	LH HI beam headlight
PL	License plate light (Used on European models only)

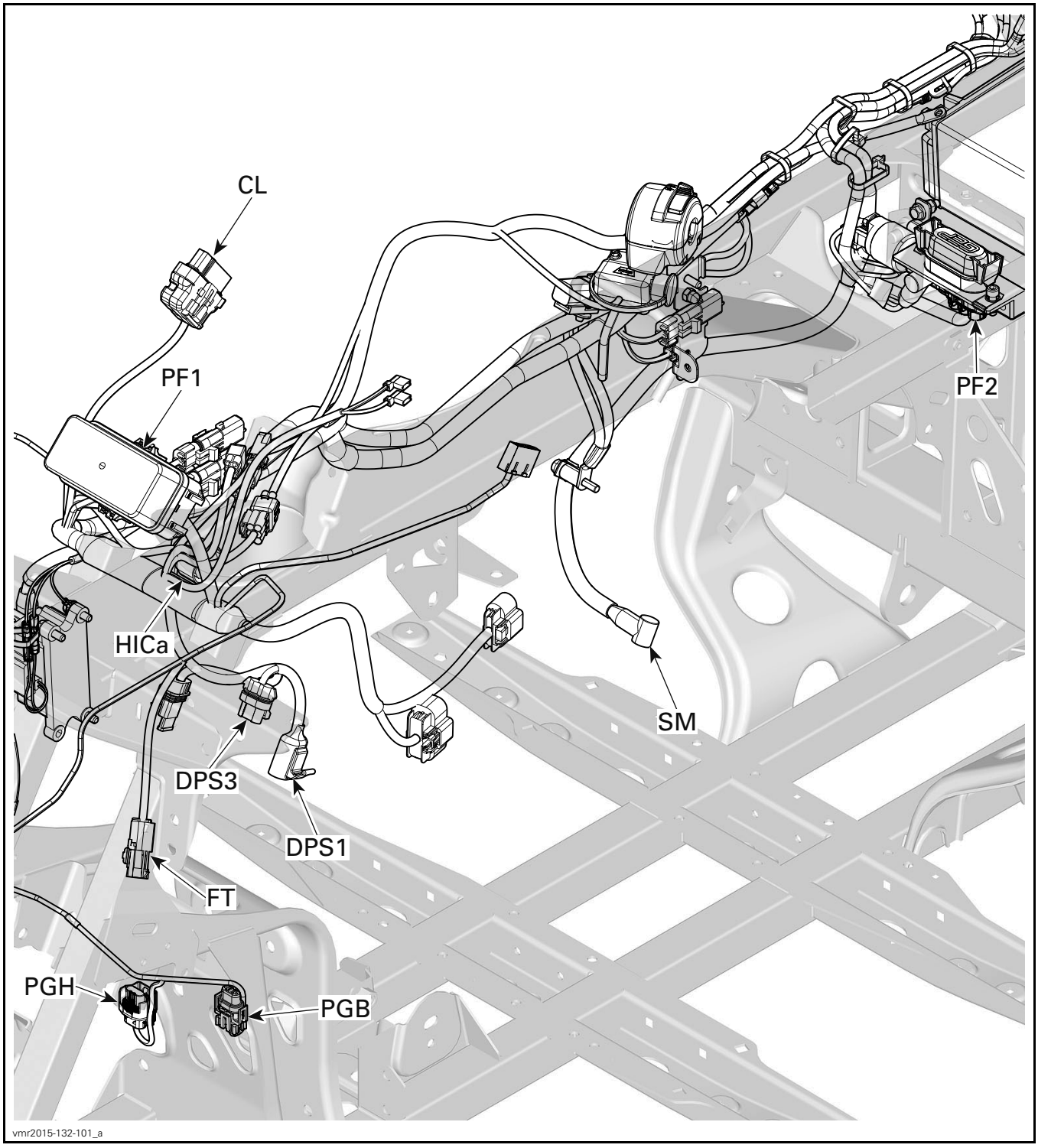
ABBREVIATION	DESCRIPTION
PLD	RH License plate light (Used on European models only)
PLG	LH License plate light (Used on European models only)
PRD	Rear RH light
PRG	Rear LH light
RBL	Trailer harness (Used on European models only)
RD1	Voltage regulator/rectifier
SM	Starter motor
SS1	Starter solenoid
SS2	Starter solenoid
SW1	Winch relay
SW2	Winch relay
SW4	Winch relay
SWW	Winch remote switch

WIRING HARNESS ROUTING

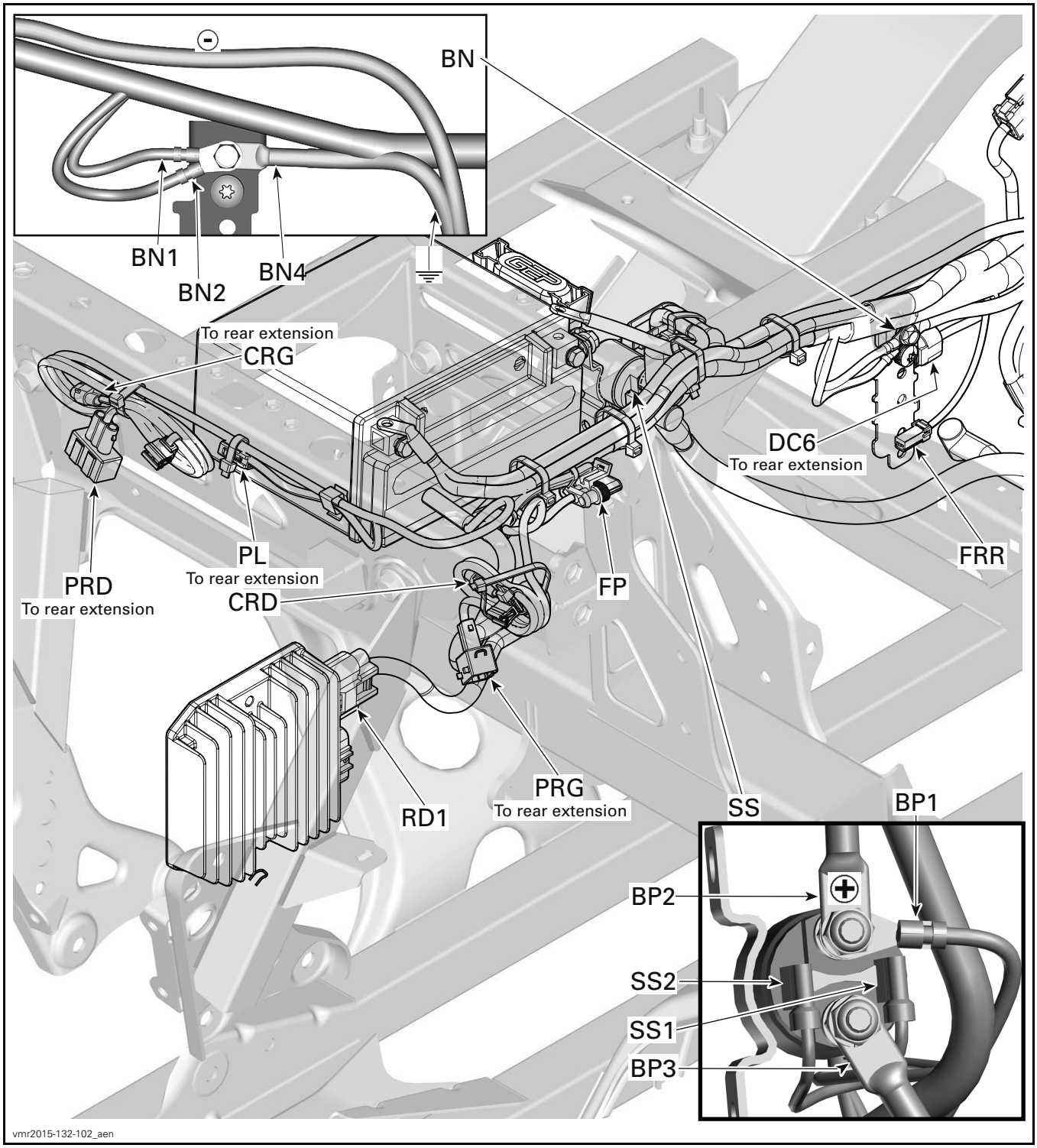
Main Harness (Front 1/2)



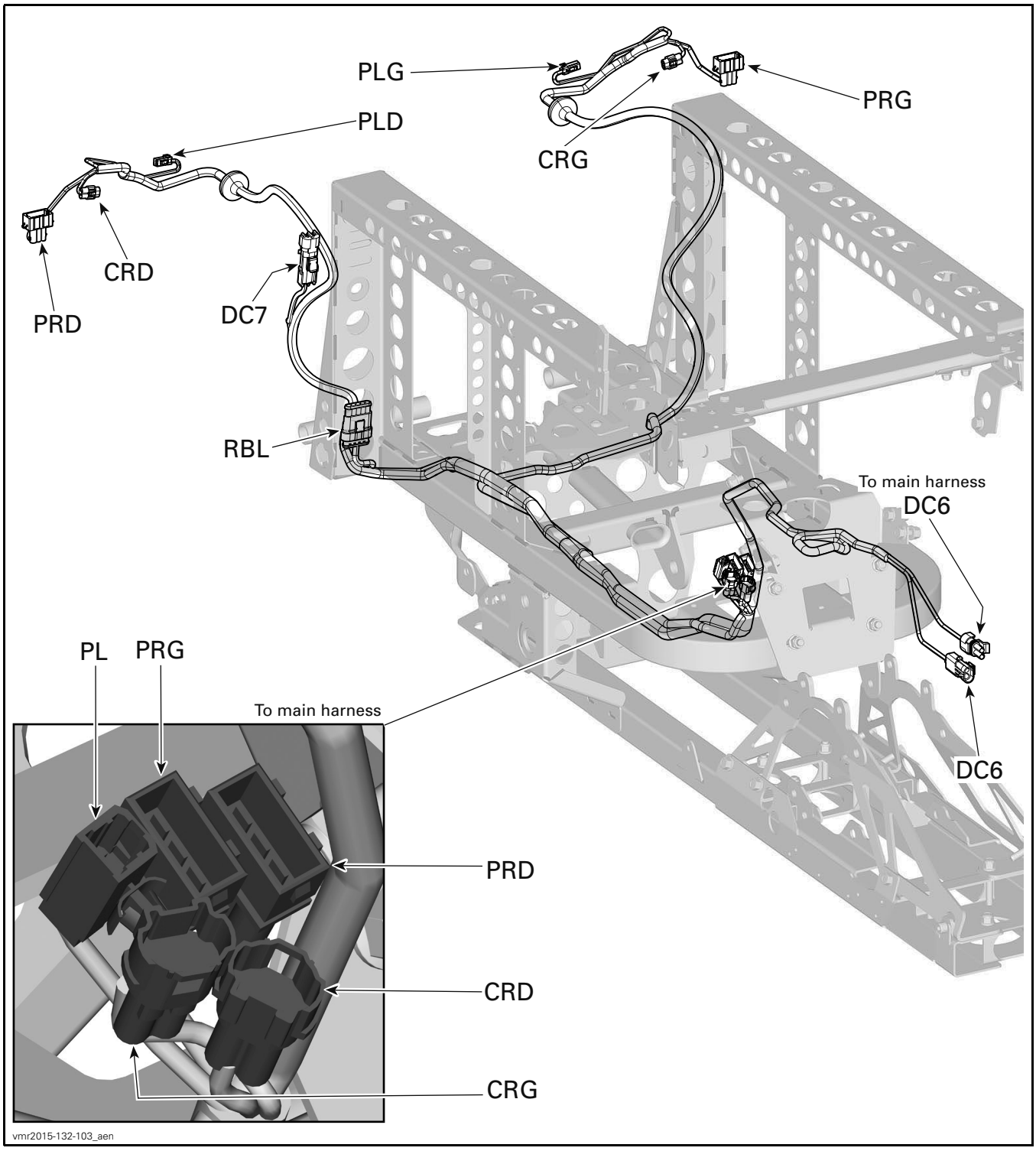
Main Harness (Front 2/2)



Main Harness (Rear)

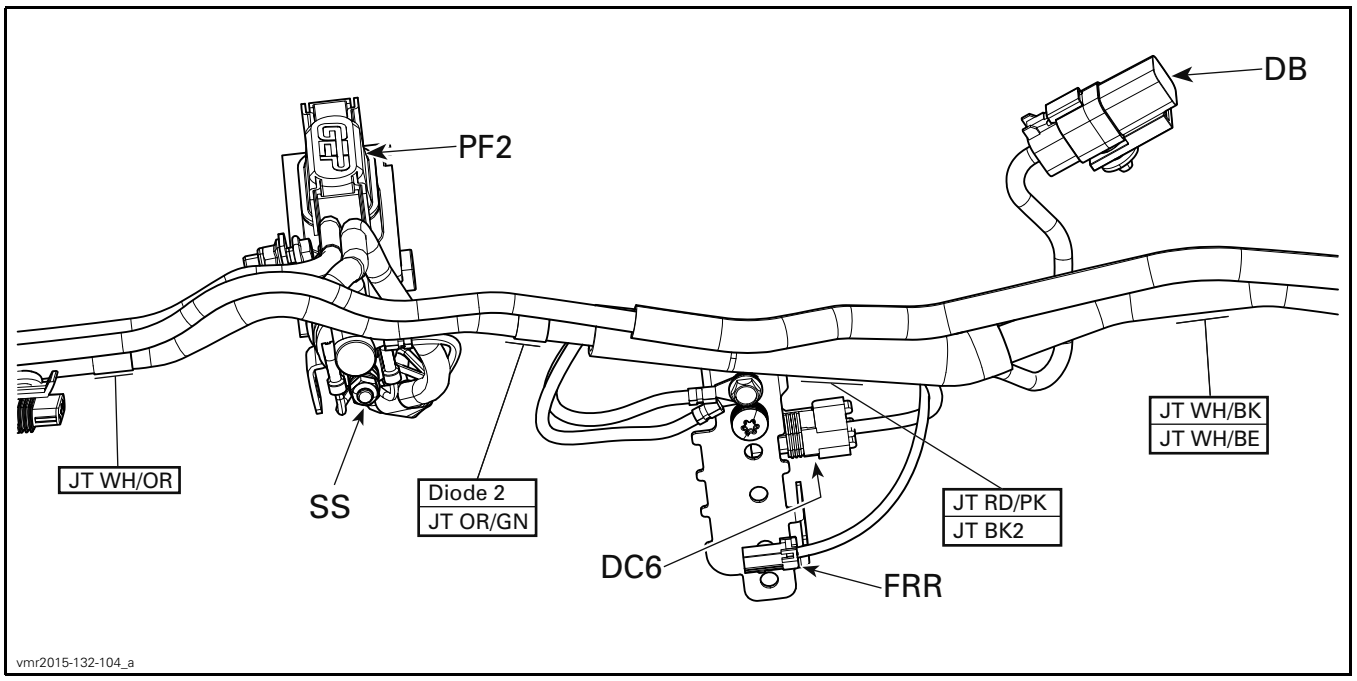


Rear Extension Harness

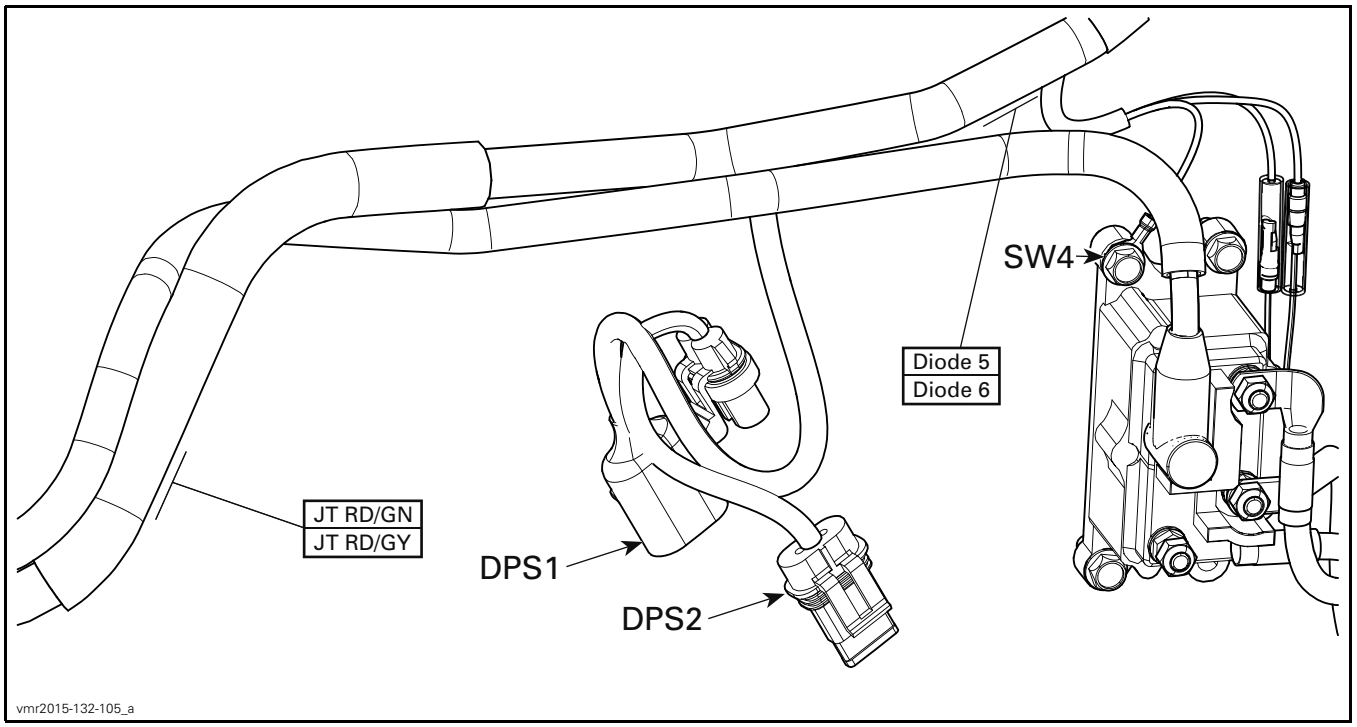


WIRING HARNESS SPLICE LOCATION

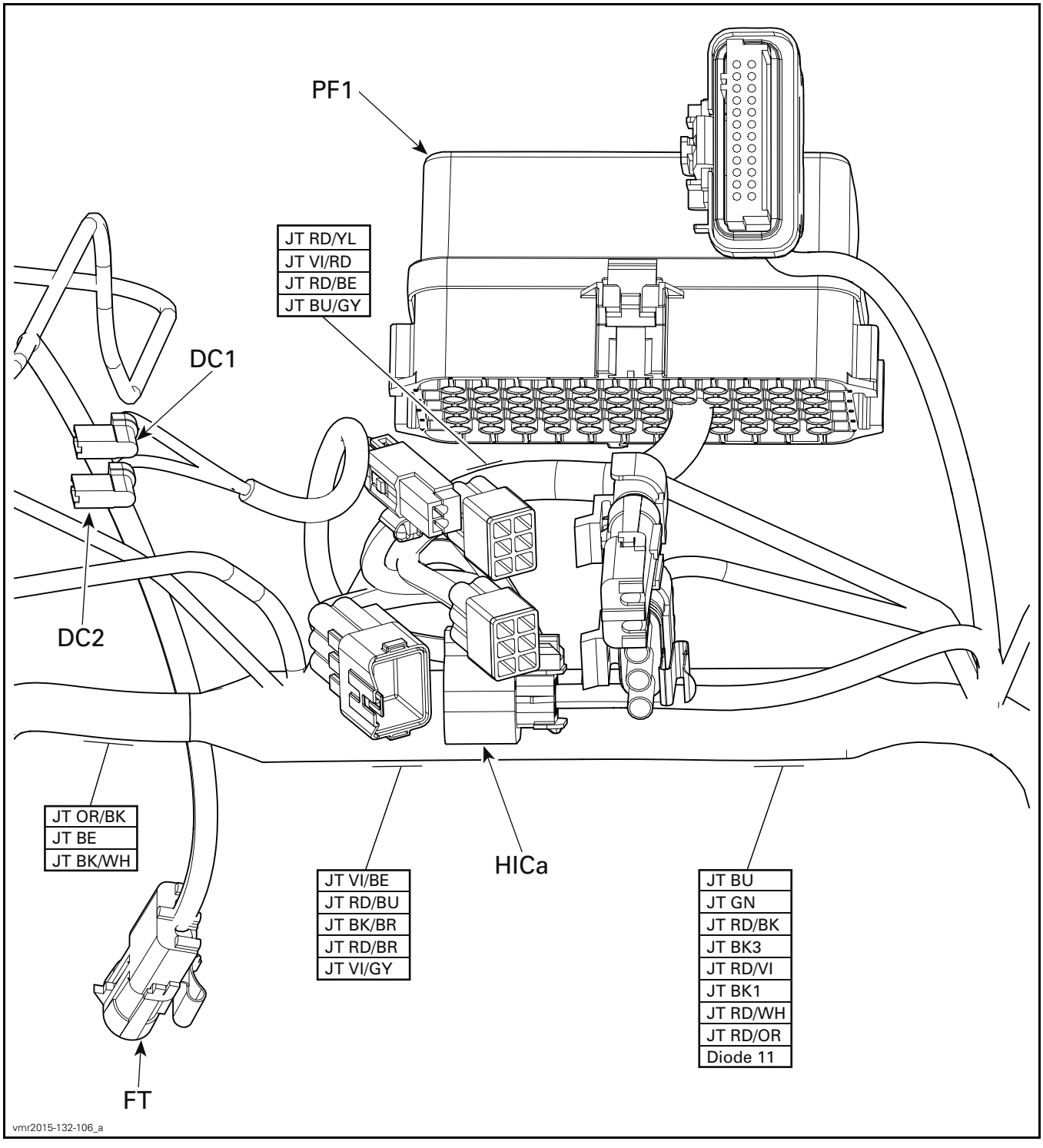
Main Harness (Rear Part)



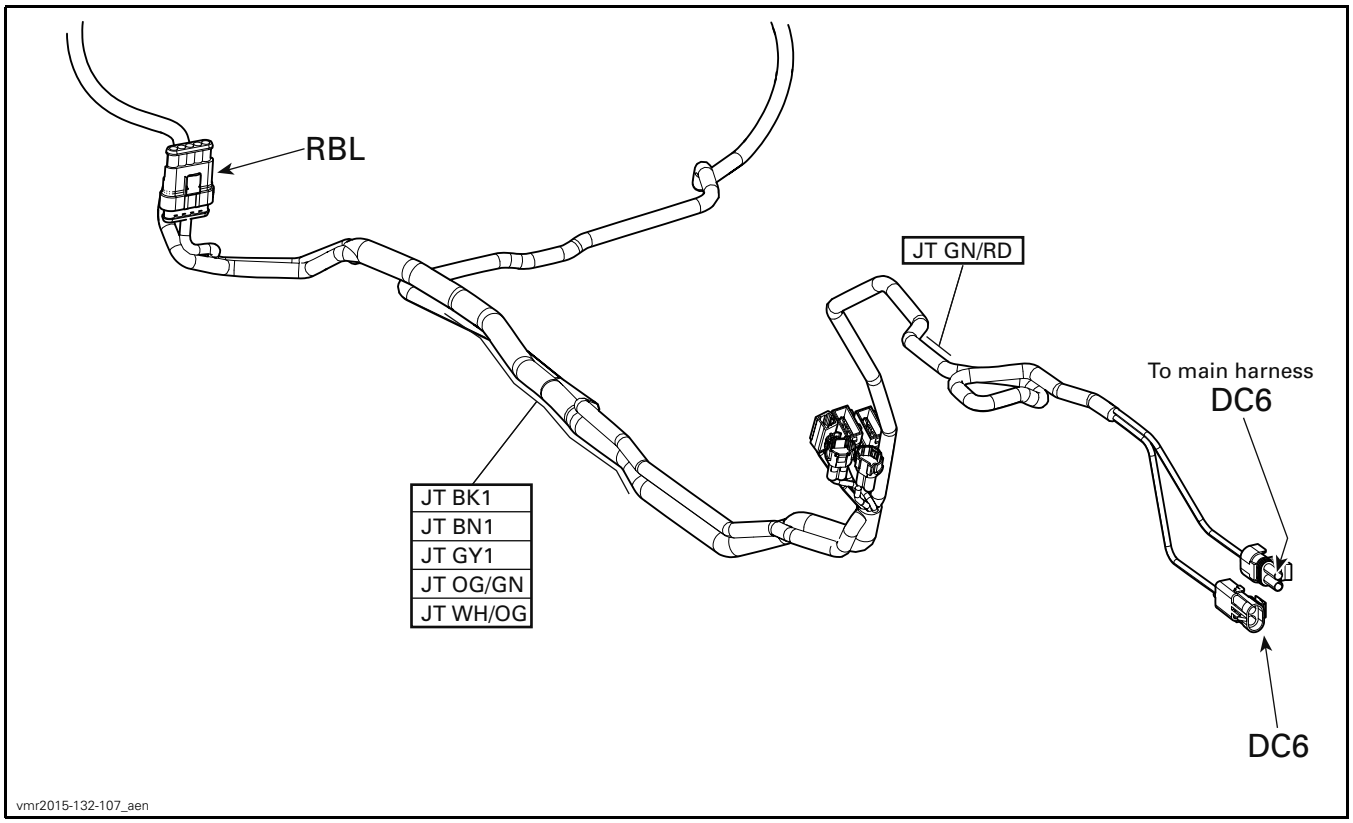
Main Harness (Front Part 1/2)



Main Harness (Front Part 2/2)



Rear Extension Harness



PROCEDURES

DEUTSCH CONNECTORS

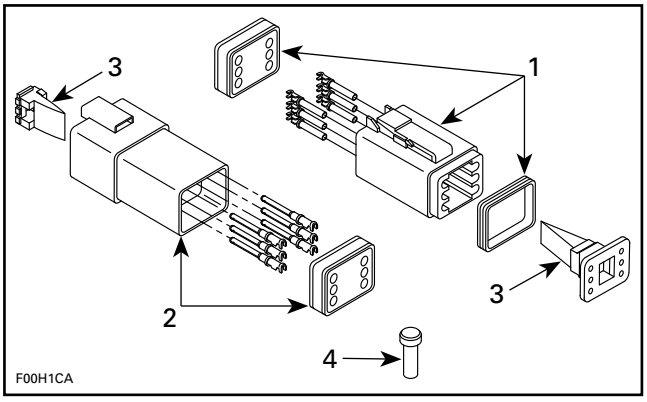
Deutsch Connector Application

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



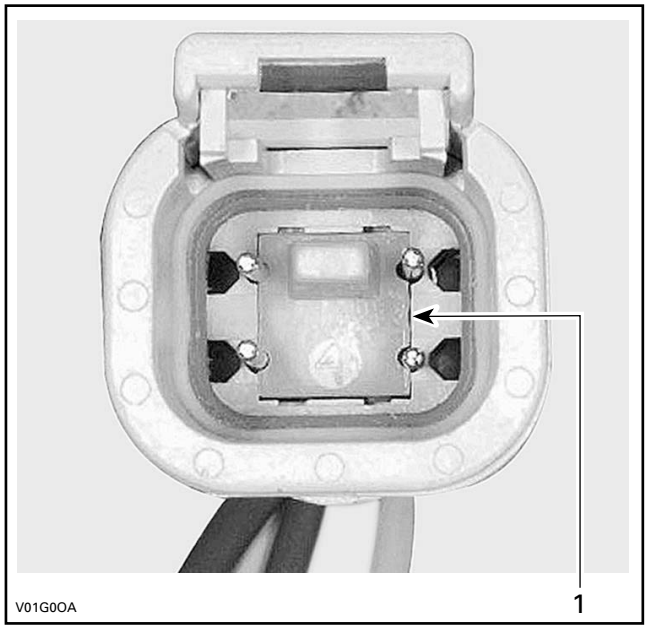
TYPICAL —DEUTSCH CONNECTOR
1. *Male connector*
2. *Female connector*
3. *Secondary lock*
4. *Sealing cap*

NOTICE Do not apply dielectric grease on terminal inside connector.

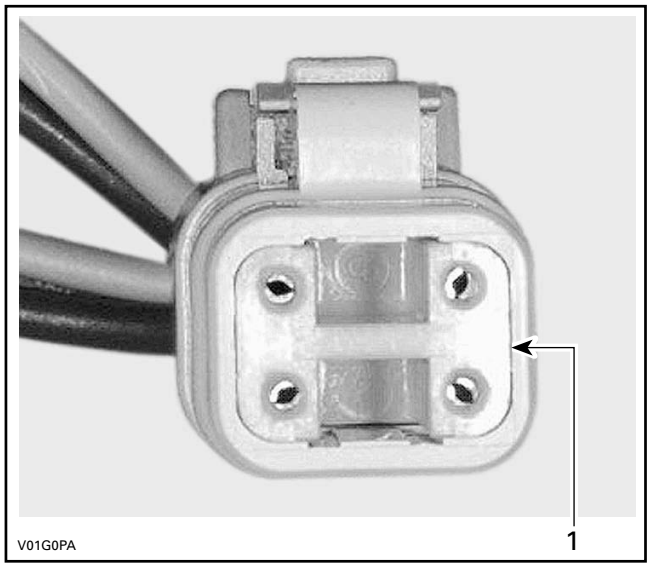
Terminal Removal

To remove terminals from connector, proceed as follows:

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



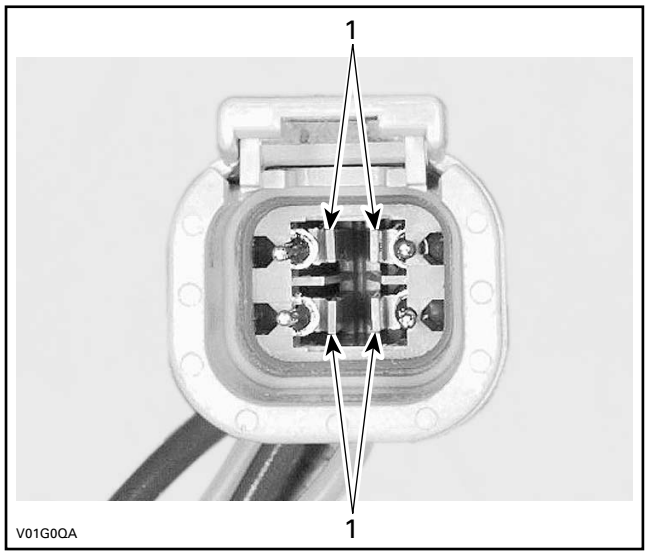
TYPICAL — FEMALE CONNECTOR
1. Female lock



TYPICAL — MALE CONNECTOR
1. Male lock

NOTE: Before pin extraction, push wire forward to relieve pressure on retaining tab.

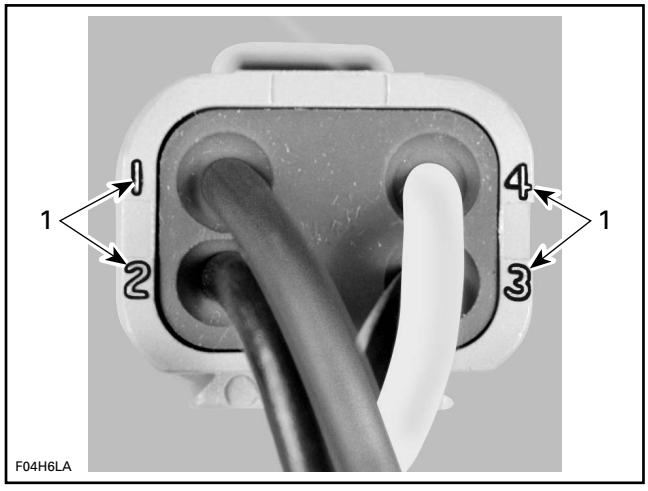
2. Insert a 4.8 mm (.189 in) wide screwdriver blade inside the front of the terminal cavity.
3. Pry the retaining tab away from the terminal while gently pulling the wire and terminal out of the back of the connector.



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.



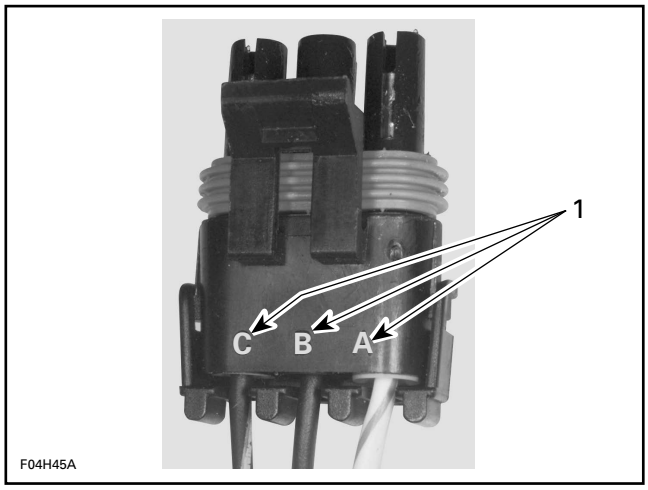
TYPICAL — CONNECTOR PIN-OUT
1. Terminal position identification numbers

PACKARD CONNECTORS

Packard Connector Application

Packard connectors are used to connect:
- Electrical harnesses
- Gauges.

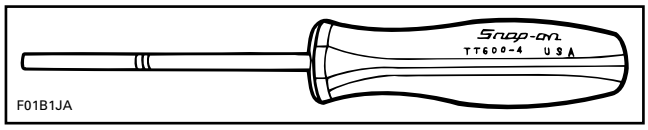
3-Pin Packard Connector



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).

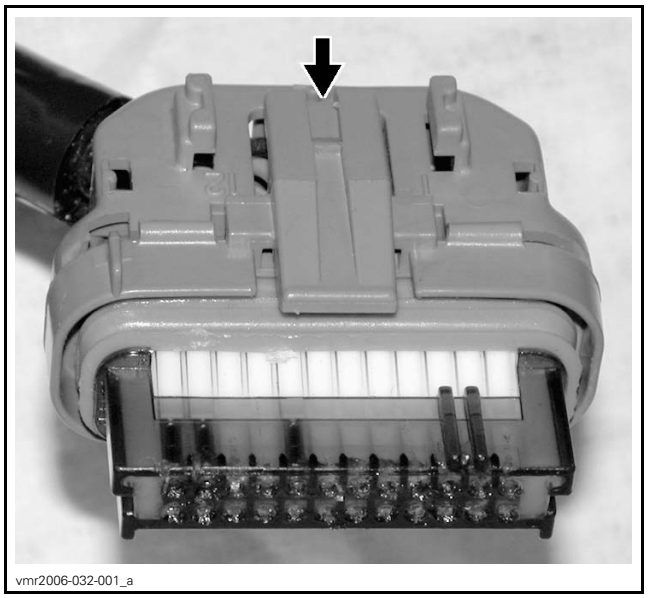


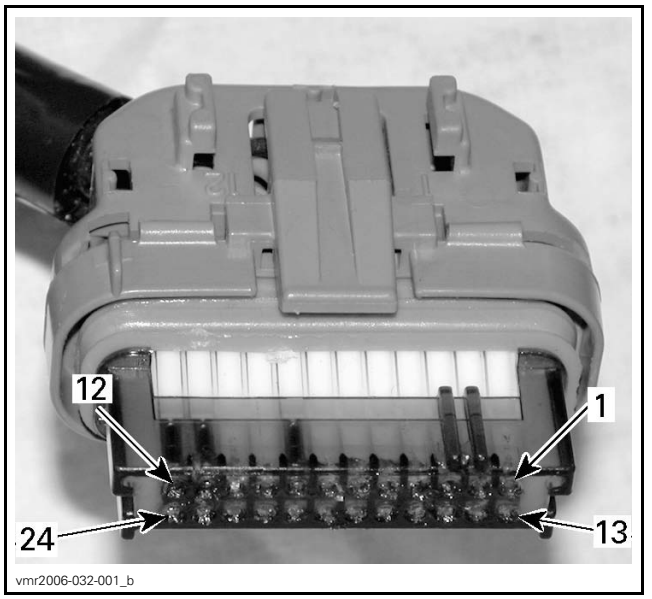
⚠ WARNING

Ensure all terminals are properly crimped on wires and connectors are properly fastened.

PACKARD CONNECTOR (MULTIFUNCTION GAUGE)

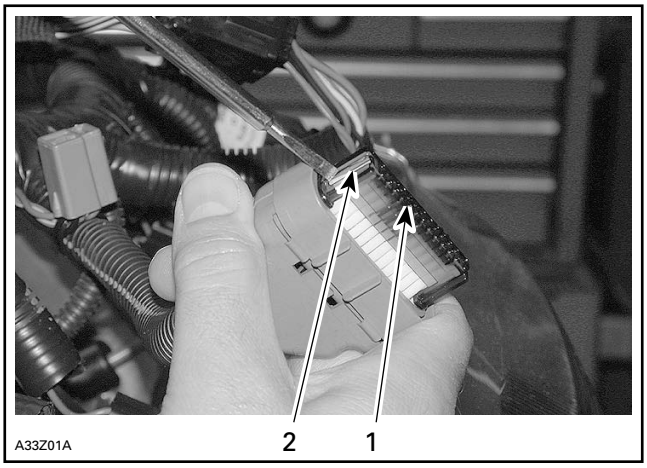
Firmly push down tab and hold to unlock connector while pulling it out.





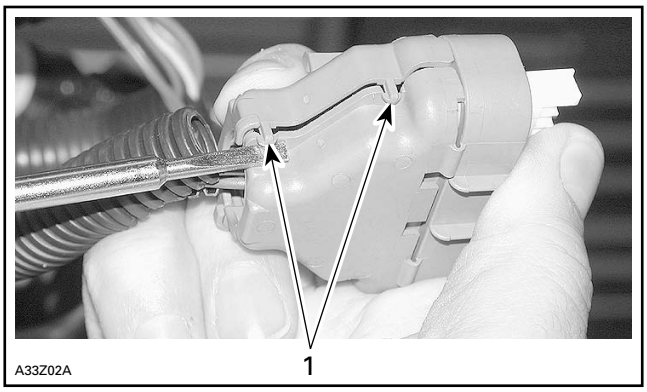
CONNECTOR PINOUT

Push on both tabs to remove retainer.



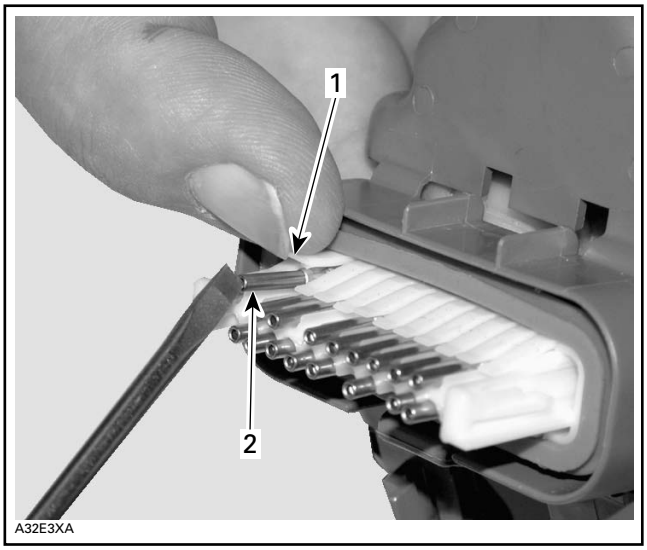
TYPICAL
1. Retainer
2. Tab (one on each side)

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:

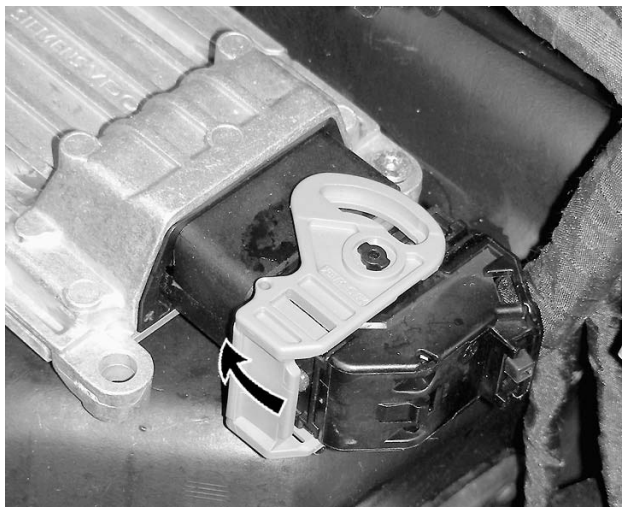
– ECM

Molex Connector Removal

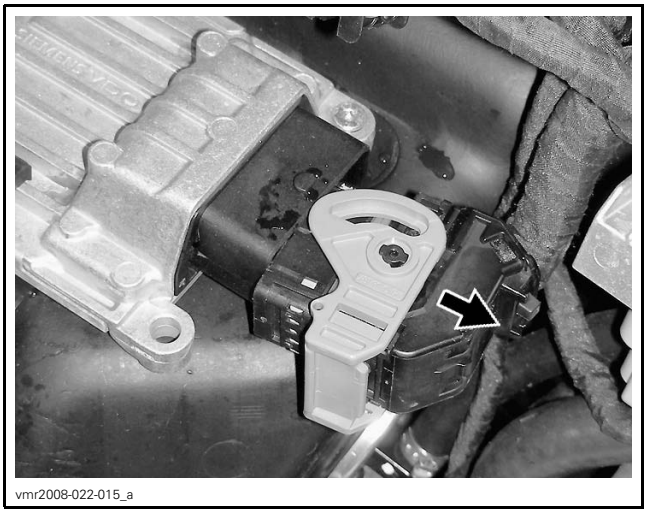
Push and hold the locking tab.



Rotate connector lock until it stops.

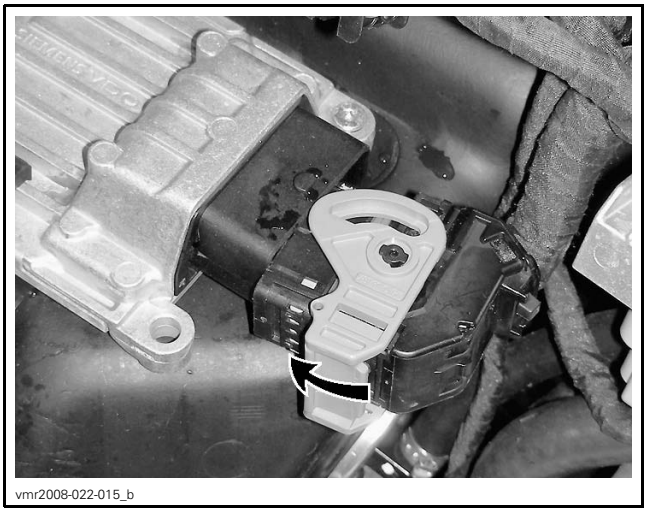

vmr2008-022-014_a

Pull out connector.


vmr2008-022-015_a

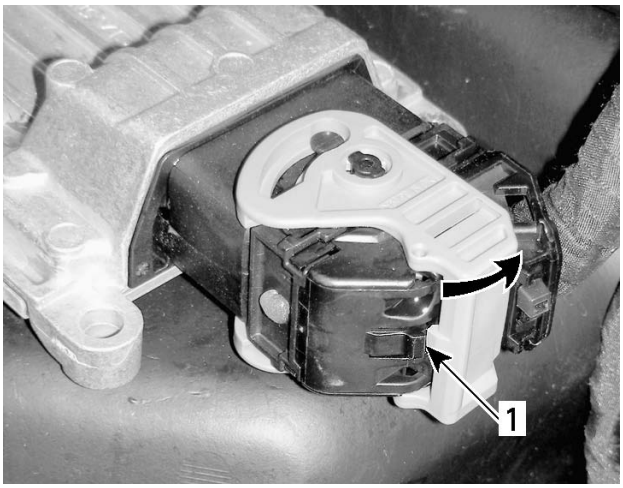
Molex Connector Installation

Fully open connector lock.


vmr2008-022-015_b

Install connector to ECM.

Rotate connector lock until it snaps locked.



vmr2008-022-013 _b

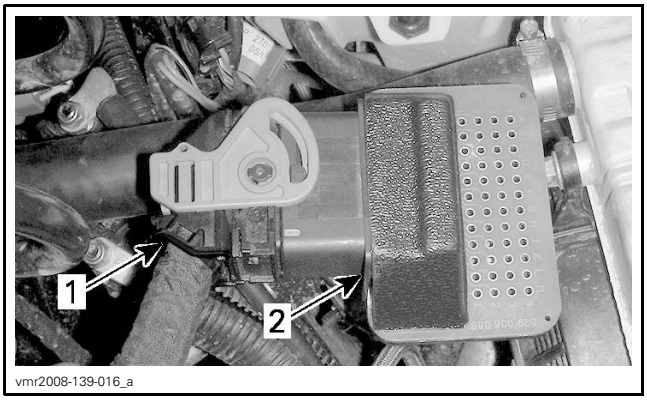
1. Locked here

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.


529036166

Disconnect the ECM connector and reconnect on the tool connector. Probe required terminals directly in the tool holes.



vmr2008-139-016_a

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.

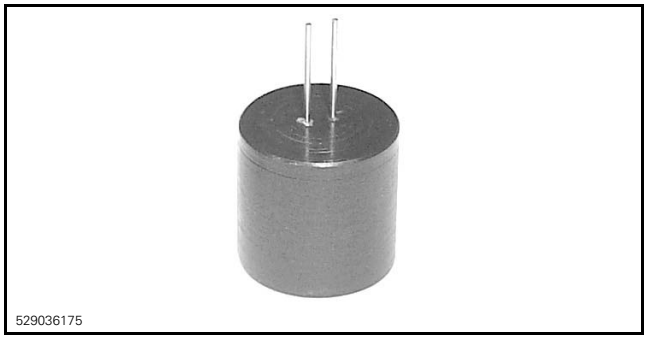
NOTE: A "defective ECM module" could possibly be repaired simply by disconnecting and reconnecting it.

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

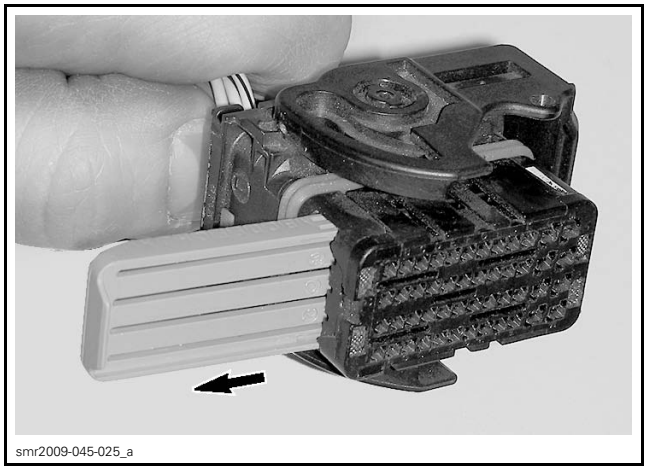
Molex Connector Terminal Removal (Harness Connector)

To remove a signal terminal from the ECM harness connector, use the ECM TERMINAL REMOVER 2.25 (P/N 529 036 175).

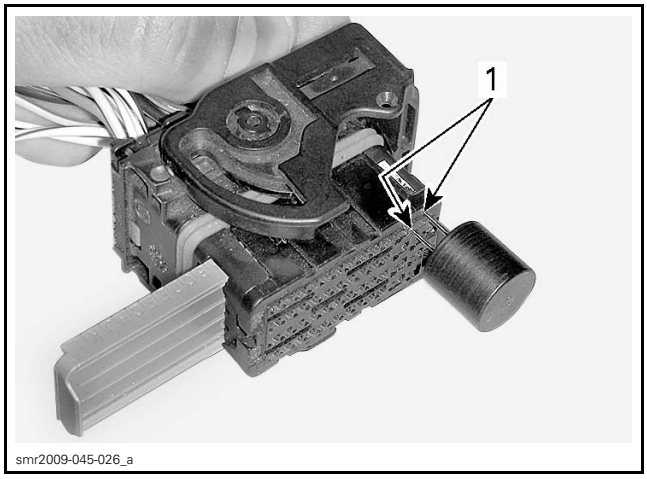
To remove a power terminal, use the ECM TERMINAL REMOVER 3.36 (P/N 529 036 174).


529036175

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


smr2009-045-025_a

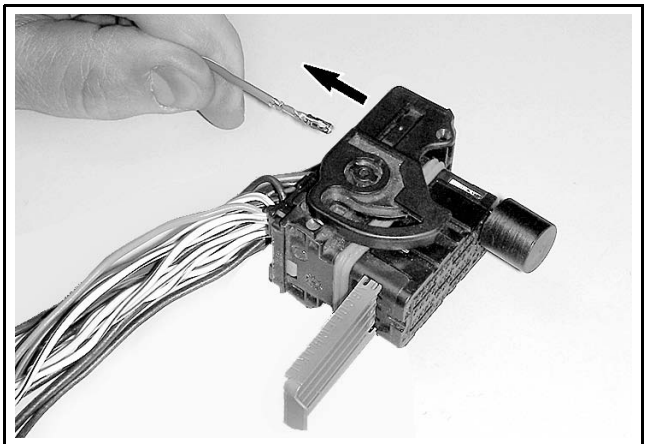
3. Insert tool to unlock terminal.



smr2009-045-026_a

1. Unlock here

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


smr2009-045-027_a

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

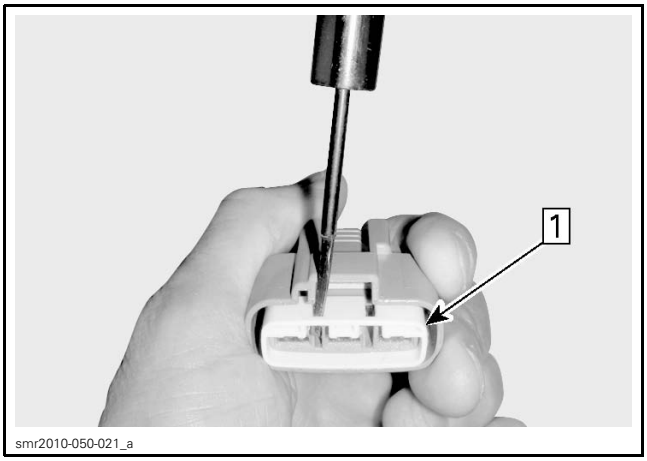
FURUKAWA CONNECTOR

Furukawa Connector Application

Voltage regulator/rectifier.

Terminal Removal

1. Remove the secondary lock (plastic insert).



smr2010-050-021_a

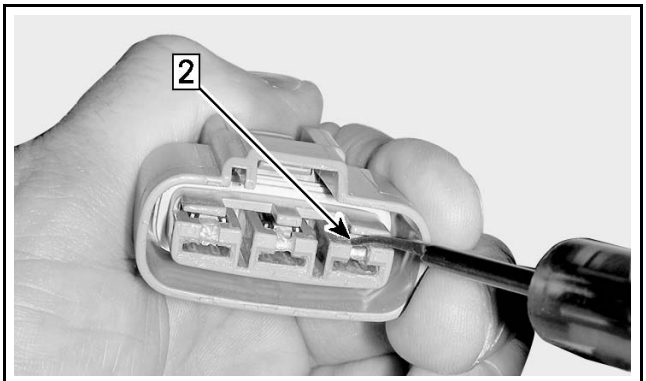
Step 1: Remove the secondary lock

2. Carefully insert the GM TERMINAL EXTRACTOR (P/N 12094430) between the lock and the pin to release the pin.



smr2010-052-003

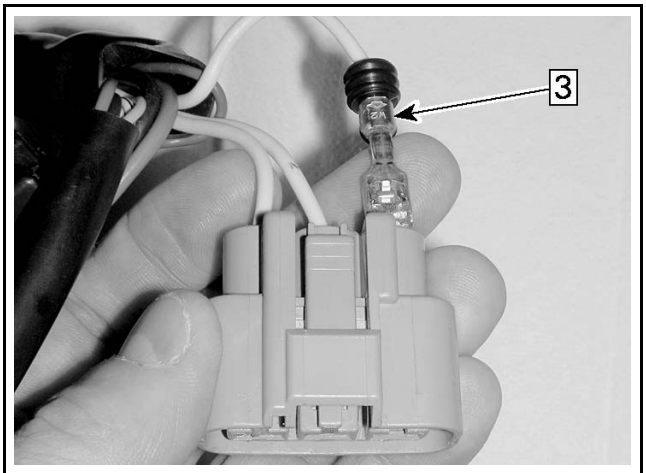
GM TERMINAL EXTRACTOR (P/N 12094430)



smr2010-050-022_a

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.



smr2010-050-023_a

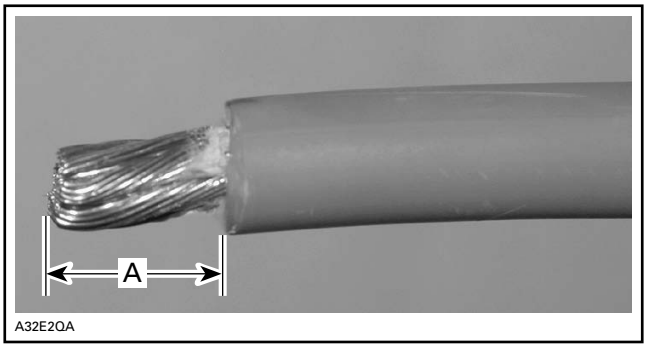
Step 3: Pull wire to extract pin

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.

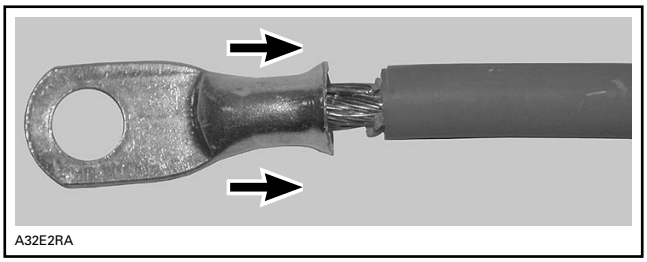


A32E2QA

A. 10 mm (3/8 in)

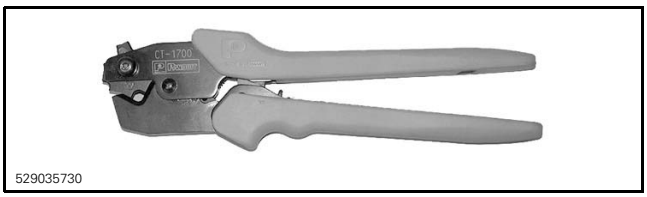
NOTE: Make sure not to cut wire strands while stripping the wire.

Install the appropriate terminal on the wire according to the requirement. Refer to appropriate *PARTS CATALOG*.

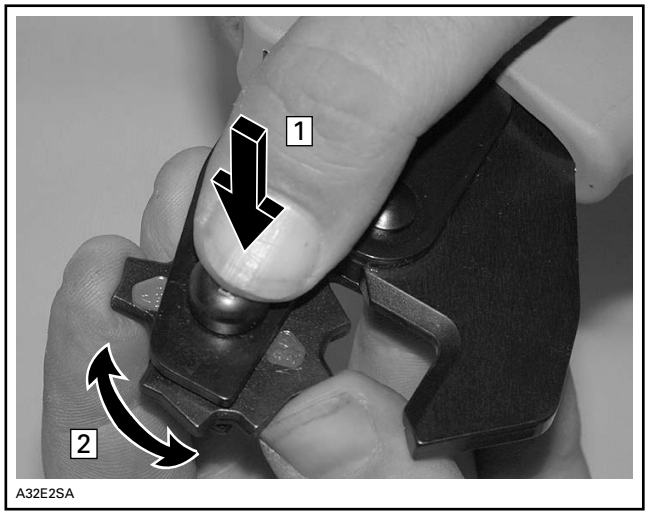

A32E2RA

INSTALLATION OF TERMINAL

Follow the instructions provided with the CRIMPING TOOL (HEAVY GAUGE WIRE) (P/N 529 035 730) to select the proper position of the tool.


529035730

NOTE: Different wires require different crimping pliers settings.



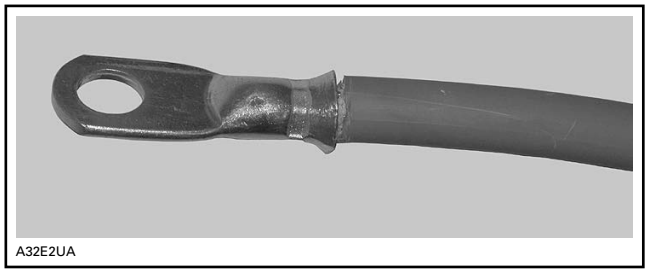
A32E2SA

POSITIONING THE CRIMPING PLIERS
Step 1: Press
Step 2: Rotate

After positioning the crimping pliers, crimp the terminal already installed on wire.


A32E2TA

CRIMPING OF WIRE


A32E2UA

PROPERLY CRIMPED WIRE

To verify, if the wire is properly crimped, apply some pulling force on wire and the terminal at the same time from both directions.

NOTICE Never weld the wire to the terminal. Welding can change the property of the wire and it can become brittle and break.

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

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

IGNITION SYSTEM

SERVICE TOOLS

Description	Part Number	Page
ECM ADAPTER TOOL	529 036 166	430, 433–434
FLUKE 115 MULTIMETER	529 035 868	433

GENERAL

SYSTEM DESCRIPTION

The battery supplies the primary side of ignition coil through the main relay (R2) while the ECM completes the circuit for each cylinder by switching it to ground at the right moment. The ECM can detect an open and short circuit in the primary winding but it does not check the secondary winding.

The EMS controls the ignition system. For more information, refer to *ENGINE MANAGEMENT* subsection.

Ignition Timing

Ignition timing is not adjustable.

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.

Always refer to the *WIRING DIAGRAM* when troubleshooting an electrical circuit.

Refer to *POWER DISTRIBUTION AND GROUNDS* for fuse and relay information.

DIAGNOSTIC GUIDELINES

The following is provided to help in diagnosing the probable cause of a problem. It is a guideline and should not be assumed to list all possible causes.

ENGINE WILL NOT START (ENGINE TURNS OVER)

1. Fouled or defective spark plug
   - *Replace.*
2. Defective CPS
   - *Check operation of CPS and replace if necessary. Refer to ELECTRONIC FUEL INJECTION (EFI) subsection.*
3. Defective trigger wheel
   - *Inspect trigger wheel. Refer to MAGNETO SYSTEM subsection.*
4. Defective ignition circuit
   - *Check fuse 5 of fuse box 1, ignition coil and wiring condition.*
5. Defective fuel pump
   - *Check fuel pump, refer to FUEL SYSTEM subsection.*
6. Defective fuel injectors or circuit
   - *Check fuel injectors, refer to ENGINE MANAGEMENT subsection.*

ENGINE HARD TO START

1. Spark plug faulty, fouled or worn out
   - *Check spark plug condition. Replace if necessary.*
2. Low fuel pressure
   - *Test fuel pressure, refer to FUEL SYSTEM subsection.*

ENGINE MISFIRES, RUNS IRREGULARLY

1. Fouled, defective, worn spark plugs
   - *Check/verify heat range/gap/replace.*
2. Damaged trigger wheel/loose CPS
   - *Inspect trigger wheel. Refer to MAGNETO SYSTEM subsection.*
3. Defective ignition circuit
   - *Check ignition coil, fuse 5, and wiring condition.*
4. Poor engine grounds
   - *Check/clean/repair.*

ENGINE CONTINUALLY BACKFIRES

1. Fouled, defective spark plugs
   - *Clean/replace spark plugs.*
2. Damaged trigger wheel/defective or loose CPS
   - *Inspect trigger wheel and CPS, refer to MAGNETO SYSTEM and ELECTRONIC FUEL INJECTION (EFI) subsections.*

PROCEDURES

IGNITION SWITCH

Ignition Switch Quick Test

Turn ignition switch to ON position.

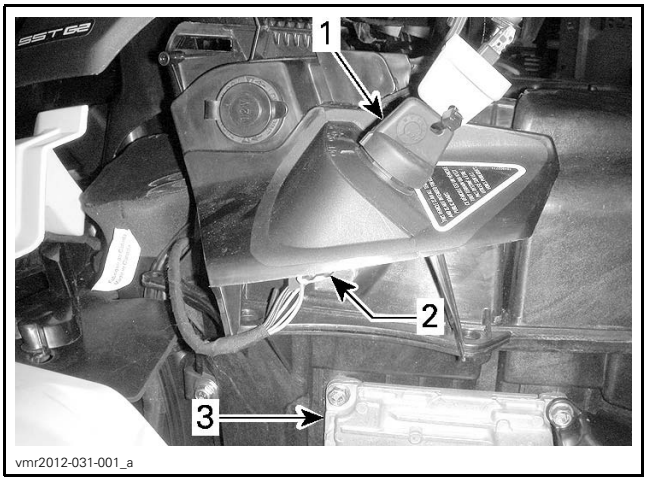
If multifunction gauge turns on (assuming it works), the ignition switch is good.

If multifunction gauge does not turn on, check the following in this order:

– Battery
– Fuses 1 of fuse box 2
– Fuse 4 and 8 of fuse box 1
– ECM is properly powered (refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection)
– Ignition switch
– Emergency engine stop switch.

Ignition Switch Access

Refer to *BODY* subsection and remove the LH side panel.



vmr2012-031-001_a

1. Ignition key
2. Ignition switch connector
3. ECM

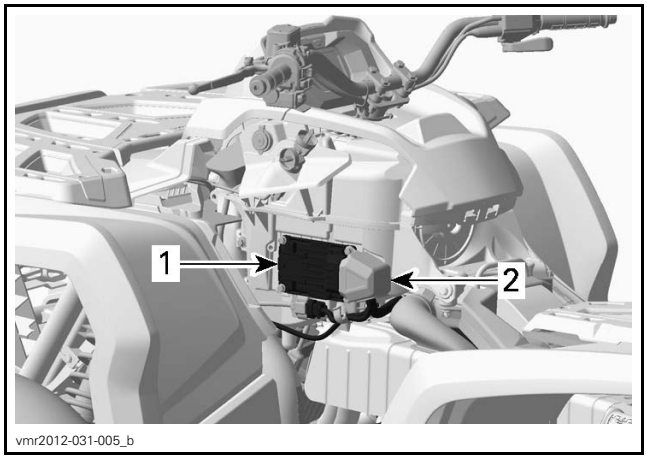
Ignition Switch Wire Identification

FUNCTION	PIN	WIRE COLOR
12 Vdc output (lights)	A	YELLOW/BLUE
12 Vdc input	B	BEIGE/WHITE
Ground (through ECM)	C	BLACK/BROWN
Ground signal to ECM in OFF position	D	BLACK/WHITE
D.E.S.S. signal	E	ORANGE/RED
12 Vdc output to ECM (through emergency engine stop switch) 12 Vdc output to starter solenoid (through emergency engine stop switch and start switch)	F	ORANGE/VIOLET

EMERGENCY ENGINE STOP SWITCH

Emergency Engine Stop Switch Test at ECM

1. Disconnect ECM connector and install it on the ECM adapter tool, refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.



vmr2012-031-005_b

TYPICAL
1. ECM
2. ECM connector cover

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

2. Remove Key switch fuse (F8), refer to *POWER DISTRIBUTION AND GROUNDS* subsection.
3. Turn ignition key to ON position.
4. Test for continuity as per following table.

EMERGENCY ENGINE STOP SWITCH TEST AT ECM			
FUNCTION	FUSE BOX CONTACT	ECM ADAPTER	RESULT
RUN position	5E	A4	Close to 0 Ω
	—	G2 to K3	Open circuit
STOP position	5E	A4	
	—	G2 to K3	Close to 0 Ω

If switch fails the test, refer to *EMERGENCY ENGINE STOP SWITCH TEST AT MULTIFUNCTION SWITCH CONNECTORS*.

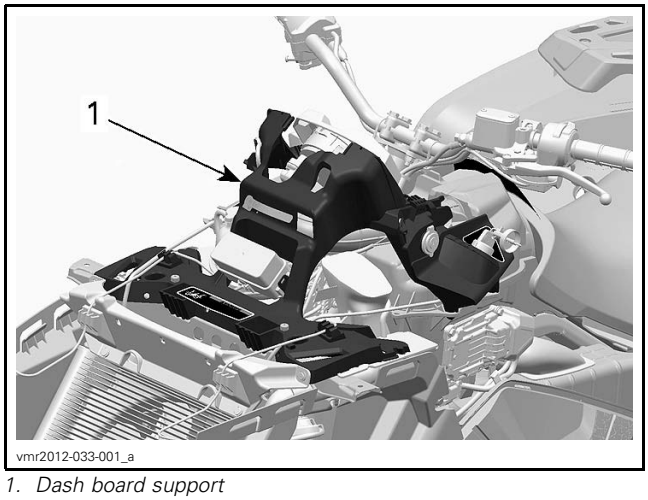
Emergency Engine Stop Switch Test at Multifunction Switch Connectors

The emergency engine stop switch is wired into the LH multifunction switch connectors (MG1 and MG2).

1. Remove gauge support, refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.
2. Refer to *BODY* subsection and remove:
   – Console panel
   – Front body module.

Outlander Models

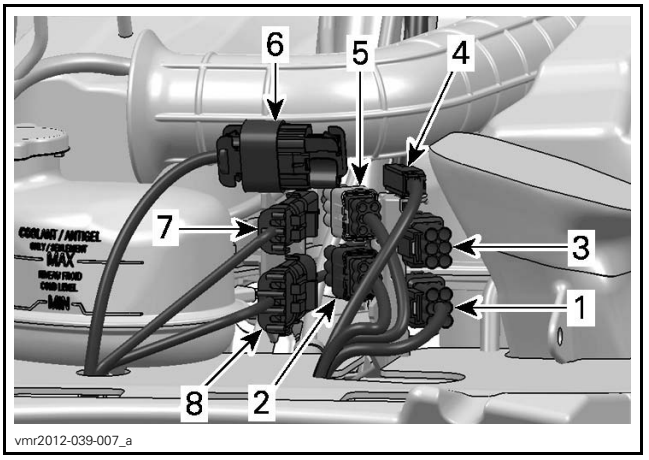
3. Remove dashboard support.



1. Dash board support

All Models

4. Disconnect MG1 and MG2 connectors.



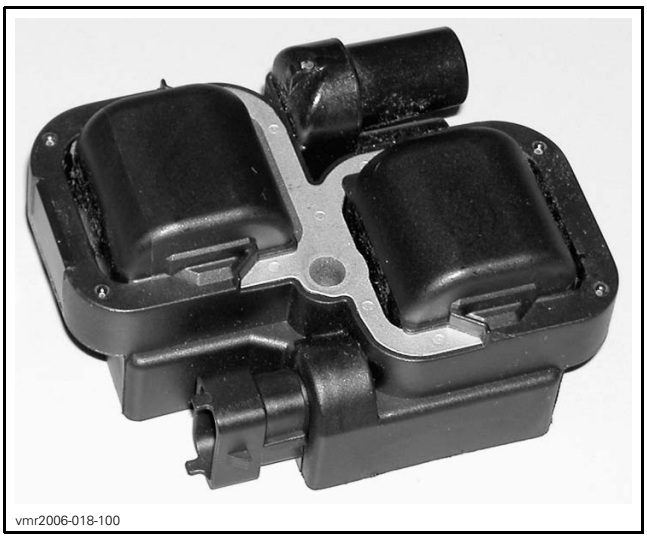
STEERING CONNECTOR IDENTIFICATION
1. MG1 (LH multifunction switch)
2. MG2 (LH multifunction switch)
3. MG3 (LH multifunction switch)
4. DC3 (DC power connector)
5. HIC1 (Engine interconnect)
6. HICA (Accessory interconnect)
7. SWW 2 (Switch winch)
8. SWW 1 (Switch winch)

5. Test switch continuity as per following table.

EMERGENCY ENGINE STOP SWITCH PIN-OUT		
FUNCTION	PROBE	RESULT
RUN position	MG1-3 to MG2-3	Open circuit
	MG1-1 to MG1-2	Close to 0 Ω
STOP position	MG1-3 to MG2-3	
	MG1-1 to MG1-2	Open circuit

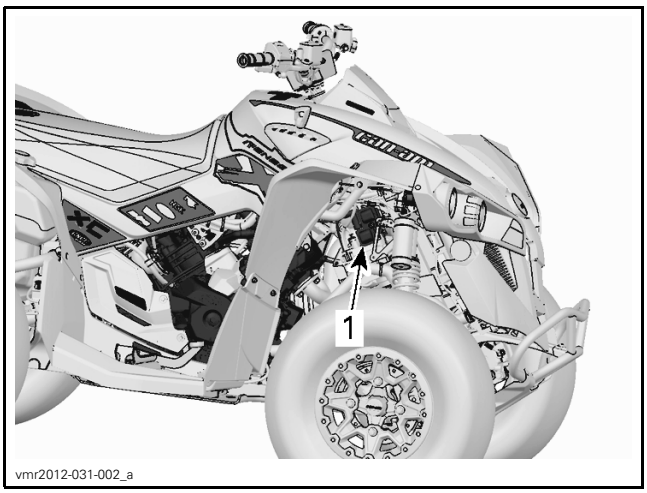
If switch tests good, test continuity of wiring. Refer to *WIRING DIAGRAM*.

IGNITION COIL


vmr2006-018-100

Ignition Coil Access

Refer to *BODY* subsection and remove RH inner fender panel(s) for access to the ignition coil.



vmr2012-031-002_a

TYPICAL
1. *Ignition coil location*

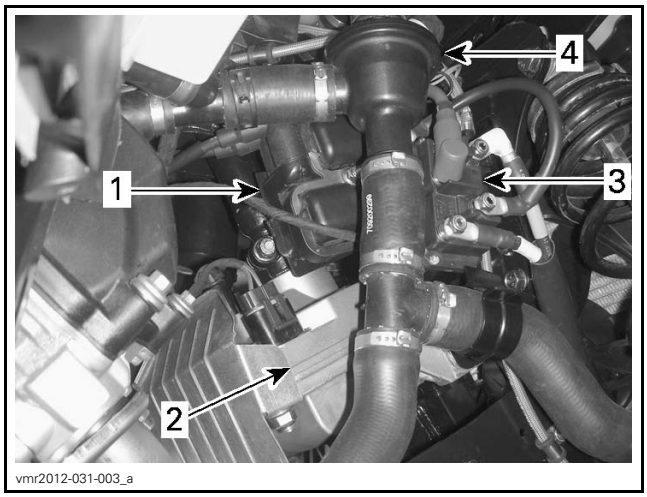
Ignition Coil Connector Access

800R Models Without a DPS or Winch

Ignition coil connector is accessible from the RH side.

All Other Models

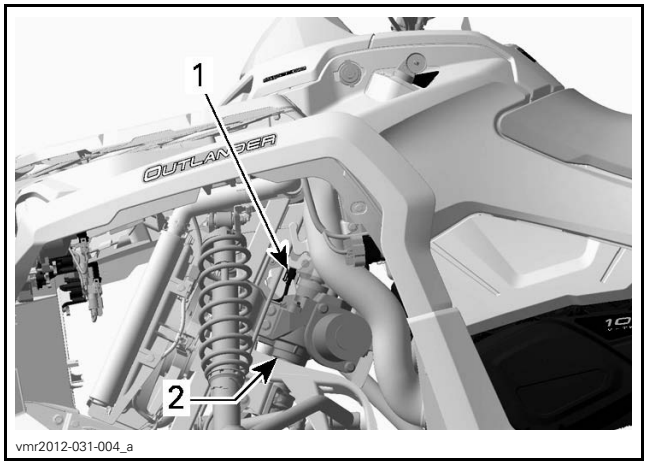
Ignition coil connector is accessible from the LH side.



vmr2012-031-003_a

VIEW RH SIDE OF VEHICLE, OUTLANDER XT 1000 MODEL
1. *Ignition coil*
2. *DPS*
3. *Winch relay*
4. *Cooling system thermostat (1000 engine)*

Remove the LH inner fender panel(s) for access to the ignition coil connector.



vmr2012-031-004_a

VIEW LH SIDE OF VEHICLE, OUTLANDER XT 1000 MODEL
1. *Ignition coil connector*
2. *DPS*

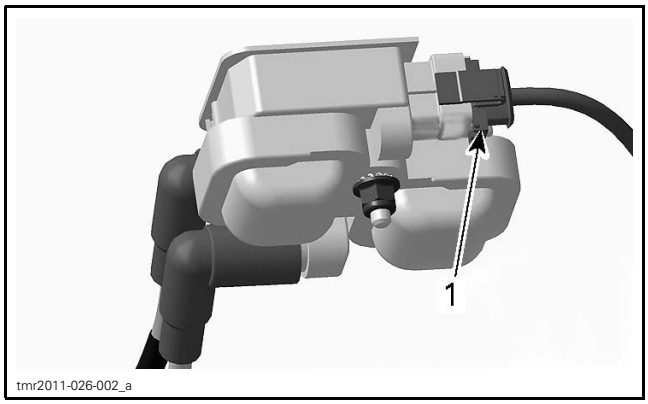
Ignition Coil Installation

Install a new elastic nut and tighten to the specified torque.

IGNITION COIL RETAINING BOLT TIGHTENING TORQUE
8 N•m ± 1 N•m (71 lbf•**in** ± 9 lbf•**in**)

Ignition Coil Input Voltage Test

1. Disconnect the 3-pin connector from the ignition coil. Refer to *IGNITION COIL CONNECTOR ACCESS*.



1. Ignition coil connector

2. Set emergency engine stop switch to RUN.
3. Turn ignition switch to ON.
4. Read voltage as per following table.

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

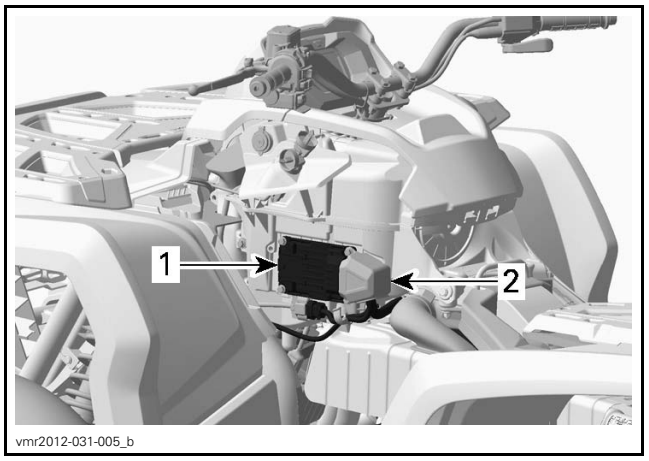
IGNITION COIL INPUT VOLTAGE TEST	
IGNITION COIL CONNECTOR	VOLTAGE
Pin 2 with battery ground	Battery voltage

Battery voltage should be read.

If Battery voltage is NOT read, check continuity of ignition coil supply circuit. Refer to *WIRING DIAGRAM*.

Ignition Coil Ground Circuit Continuity Test

1. Disconnect the ECM connector and connect it to the ECM adapter tool. Refer to *ELECTRONIC FUEL INJECTION (EFI)* subsection.



TYPICAL
1. ECM
2. ECM connector cover

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

2. Check wiring continuity as per following table.

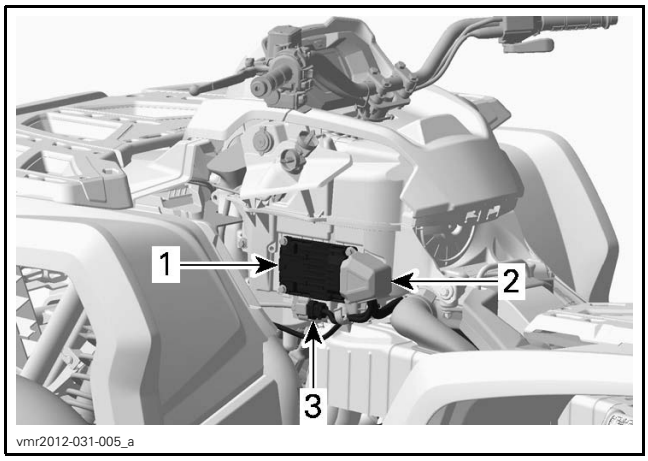
IGNITION COIL GROUND CIRCUIT CONTINUITY TEST		
COMPONENT	PIN (IGNITION COIL CONNECTOR)	PIN (ECM CONNECTOR)
Cylinder 1 (front)	1	M1
Cylinder 2 (rear)	3	M2

Ignition Coil Resistance Test

An ignition coil with good resistance measurement can still be faulty. Voltage leakage can occur at high voltage levels which is not detectable with an ohmmeter. Replacing the ignition coil may be necessary as a test.

Primary Windings

1. Disconnect HIC2 connector.



TYPICAL
1. *ECM*
2. *ECM connector cover*
3. *HIC2 connector*

2. Disconnect ECM connector and connect it to the ECM adapter tool.

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

3. Using a multimeter set to Ω, check resistance in primary windings as follows.

IGNITION COIL RESISTANCE TEST			
PRIMARY CIRCUIT	ENGINE CONNECTOR (HIC)	ECM CONNECTOR	RESISTANCE @ 20°C (68°F)
Cylinder 1 (front)	Pin C	M1	.3 - .6 Ω
Cylinder 2 (rear)		M2	

If any resistance is not good, measure resistance directly on coil. If second test is ok, check wiring.

Secondary Windings

Due to the integrated diode, it is not possible to take any resistance measurement of the secondary winding.

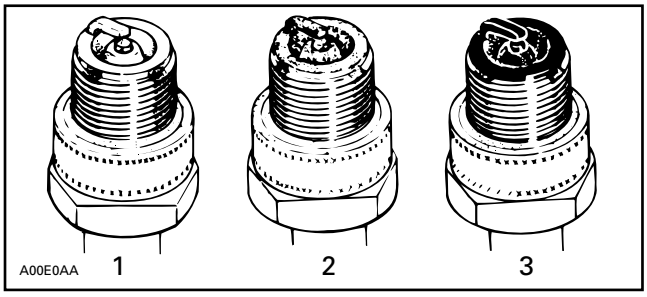
SPARK PLUG

For spark plug replacement procedure, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

Troubleshooting Fouled Spark Plug

Fouling of the spark plug is indicated by irregular running of the engine, decreased engine speed due to misfiring, reduced performance, and increased fuel consumption. This is due to a loss of compression. Other possible causes are: prolonged idling or low-speed riding, a clogged air filter, incorrect fuel, defective ignition system, incorrect spark plug gap, lubricating oil entering the combustion chamber, or too cold spark plug. The plug face of a fouled spark plug has either a wet black deposit or a black carbon fouling. Such coatings form a conductive connection between the center electrode and ground.

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 regular 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	436
NAPA ULTRA PRO BATTERY LOAD TESTER	95260	436–438

GENERAL

SYSTEM DESCRIPTION

The purpose of the charging system is to keep the battery at a full state of charge.

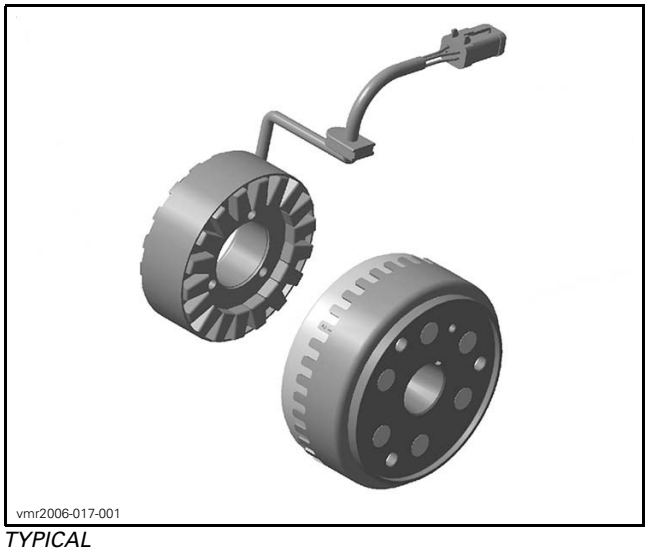
NOTE: For an overview of the vehicle electrical system, refer to *ENGINE MANAGEMENT SYSTEM* section.

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.



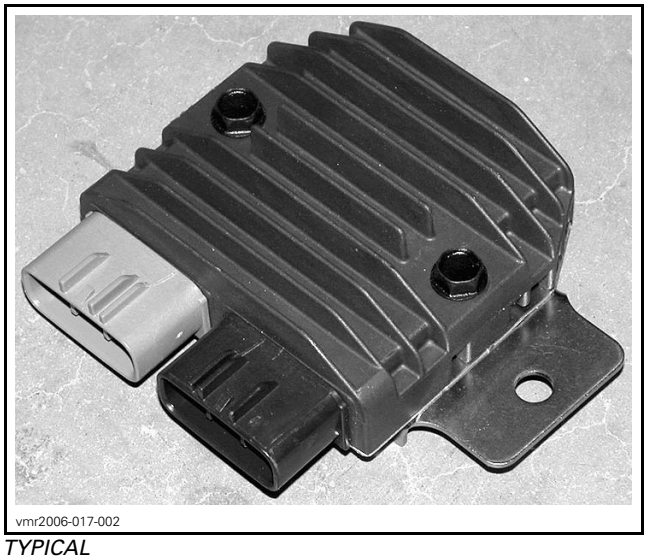
TYPICAL

Voltage Regulator

The regulator receives AC current from the magneto and transforms it into direct current (DC).

The voltage regulator 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

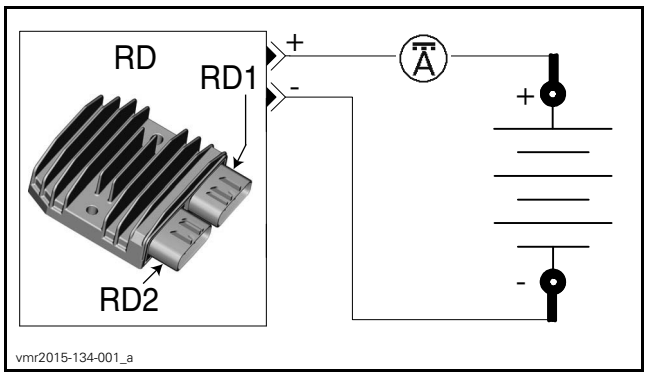
1. Remove seat.
2. Connect a battery load tester such as the NAPA ULTRA PRO BATTERY LOAD TESTER (P/N 95260).
3. Ensure proper test conditions.

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

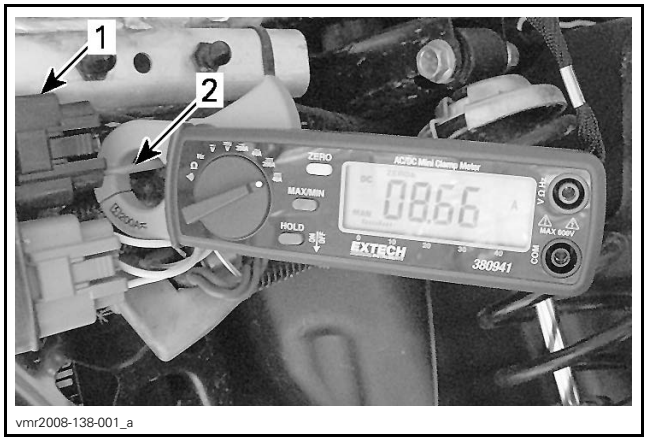


1. Remove seat.
2. Connect a battery load tester such as the NAPA ULTRA PRO BATTERY LOAD TESTER (P/N 95260).
3. Start vehicle and read voltage on tester.

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
All models	50 ± 5 Amps

NOTE: With a fully charged battery and no electrical loads, specification is less than 7A.

If amperage or voltage is not within specification, verify magneto and wires. Refer to *MAGNETO AND STARTER* subsection. Replace:

– Voltage regulator if magneto test is within specifications.
– Magneto if magneto test is not within specifications.

VOLTAGE REGULATOR (RD)

Voltage Regulator Access

The voltage regulator/rectifier is accessible on the RH rear side of the vehicle.

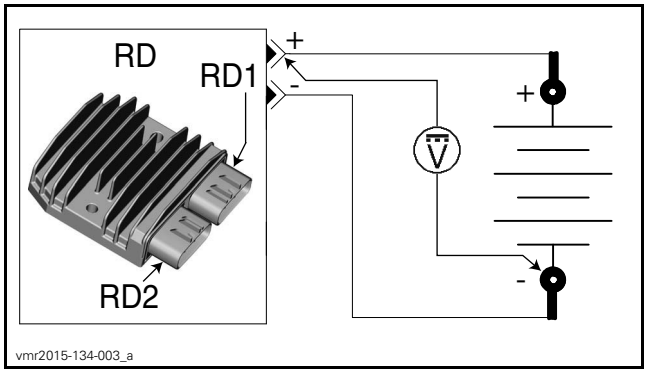


Voltage Regulator Continuity Test

Due to internal circuitry, there is no static test available.

Voltage Regulator Power Test

1. Check voltage at RD1-1.



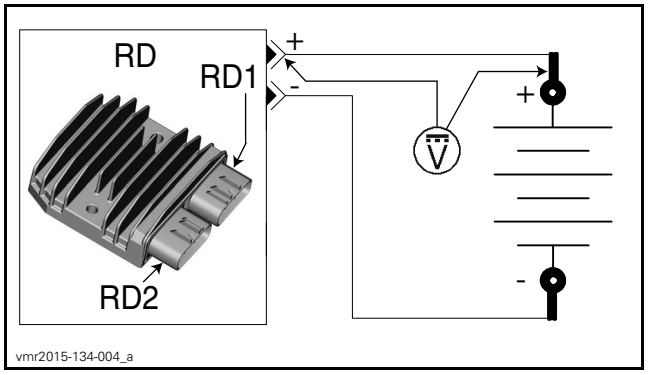
TEST CONDITIONS	
RD1-1	Hot at all times

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.

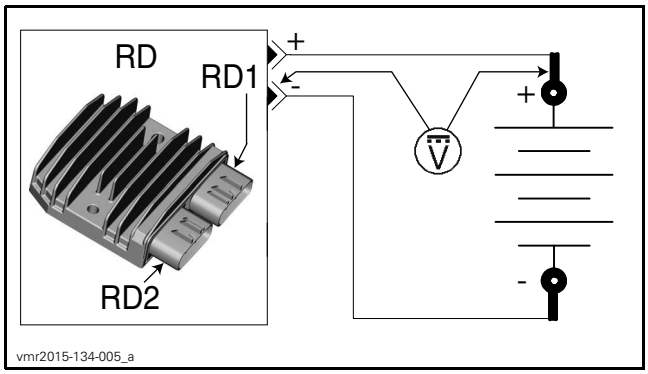


BACKPROBE	PROBE	SPECIFICATION
RD1-1	BAT1 (+)	Under 0.2 Vdc

If voltage drop is above specification, locate and repair damaged connector/wire.

Voltage Regulator Ground Test

1. Check ground at RD1-3.



vmr2015-134-005_a

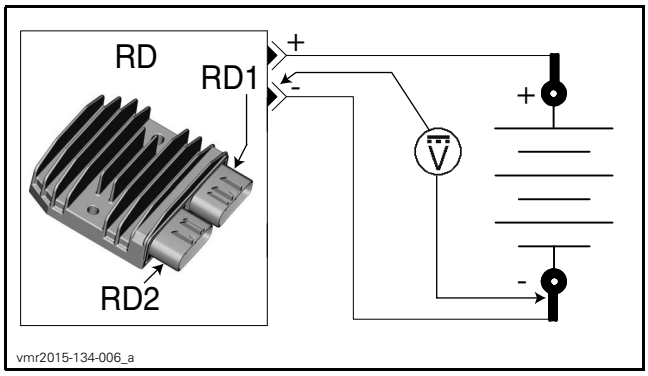
TEST CONDITIONS	
RD1-3	Permanent ground

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.



vmr2015-134-006_a

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.

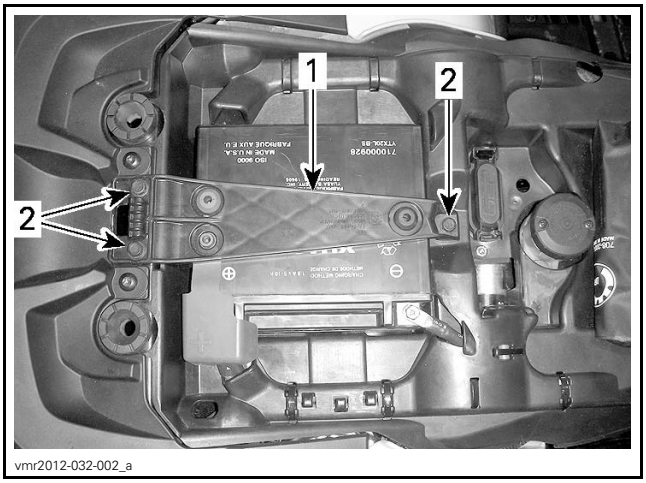
Refer to battery manufacturer's instructions for proper filling, activation and routine charging procedures.

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.



vmr2012-032-002_a

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	443
FLUKE 115 MULTIMETER	529 035 868	445

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 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.

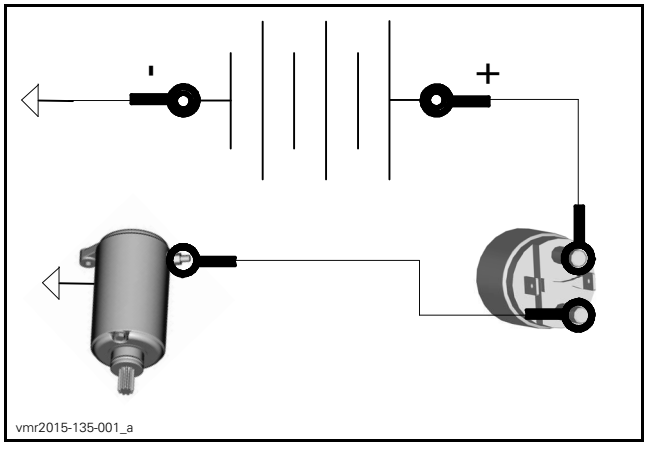
Refer to applicable *WIRING DIAGRAM* for additional information.

⚠ WARNING

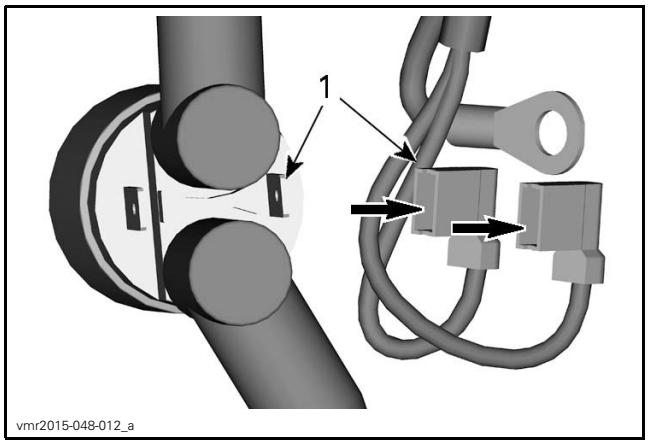
Ensure vehicle is in PARK when performing starting system tests.

STARTING SYSTEM TESTS

Starter Solenoid

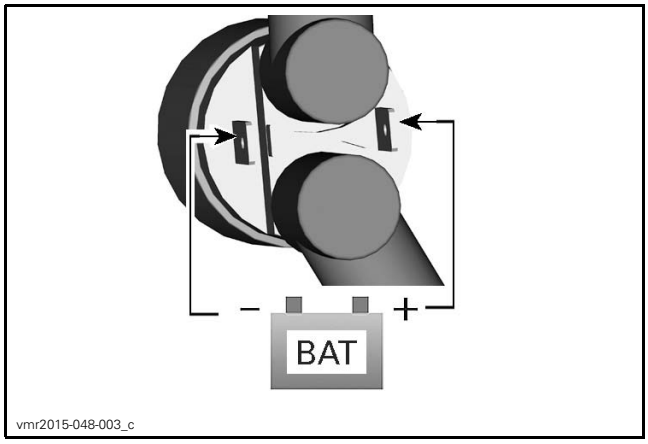


1. Disconnect SS1 and SS2



1. SS1

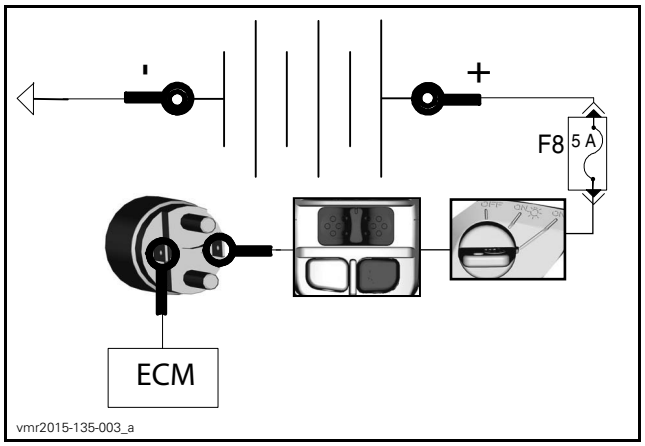
2. Activate the starter solenoid.
   2.1 Apply 12Vdc to SS1
   2.2 Ground SS2



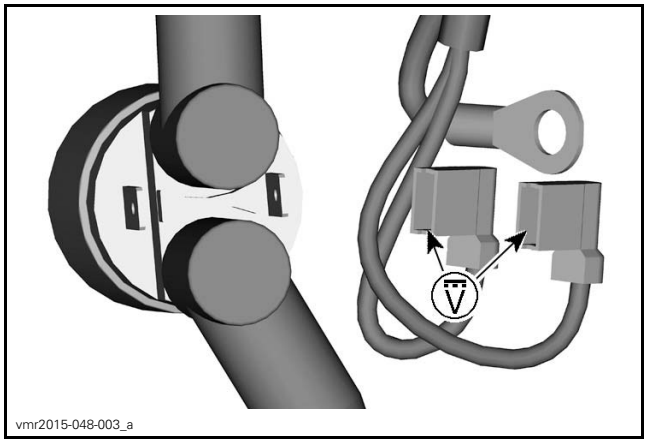
SS1 IS ON THE RIGHT

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 and ground are as per specification replace starter solenoid.

1. If voltage is not as per specification:
   1. Check fuse(s)
   2. Test start button.
   3. Test engine stop switch. Refer to *IGNITION SYSTEM* subsection
   4. Test ignition switch Refer to *IGNITION SYSTEM* subsection.
2. If ground is not as per specification, verify harness to ECM.

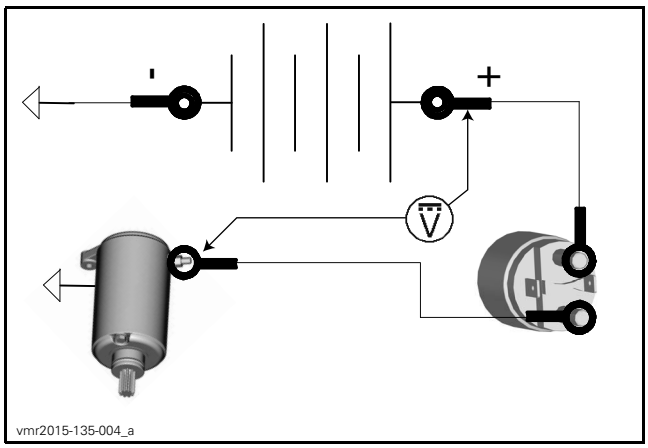
Starter Power Circuit Voltage Drop

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

TEST CONDITION	
Start button	Pressed
Engine	Cranking
‡ Will prevent engine from starting	

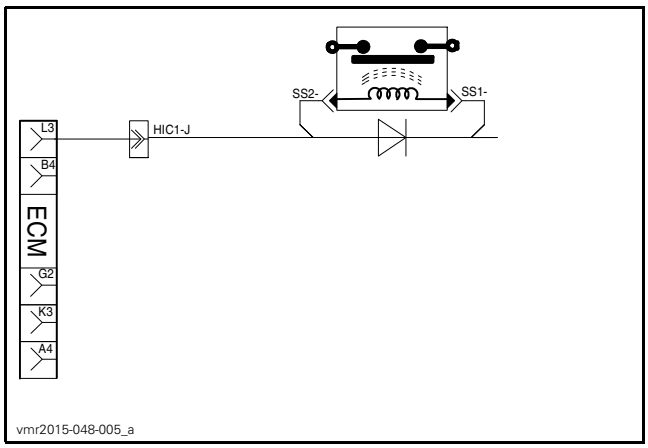
1. Measure voltage drop.



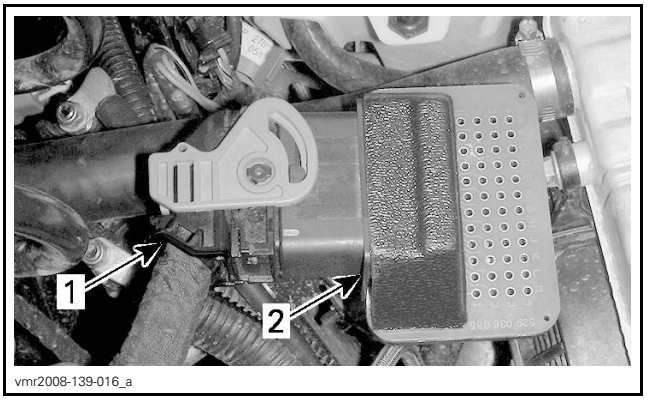
PROBE	PROBE	SPECIFICATION
BAT1	Starter B+ terminal	Below 0.4 Vdc

If voltage drop is above specification, repair or replace sources of high resistance in circuit.

Starter Solenoid 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

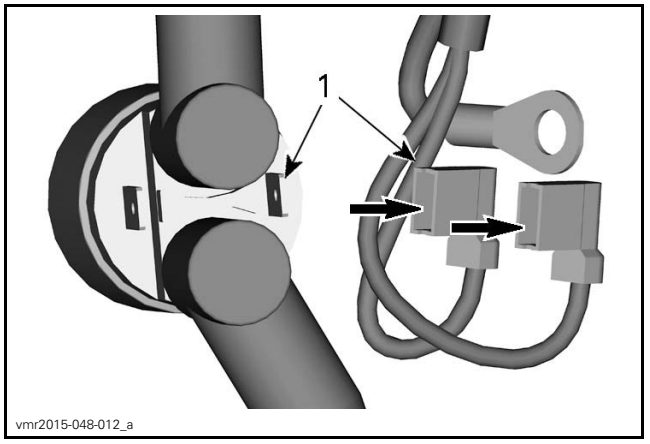
If resistance is not as specified, repair or replace wiring/connections.

If solenoid power control circuit and ground control circuit both test good, test ECM ground circuits. Refer to *ELECTRONIC FUEL INJECTION (EFI)* section.

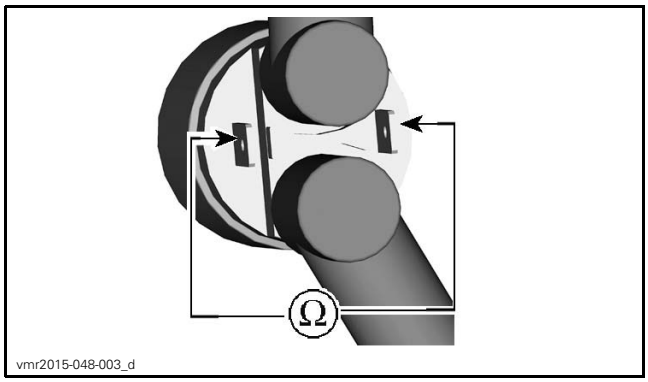
NOTE: Supply a ground with a jumper wire if you suspect that the ECM is not supplying a ground to the solenoid.

Starter Solenoid Continuity

1. Disconnect the black (-) negative battery cable.
2. Disconnect SS1 and SS2



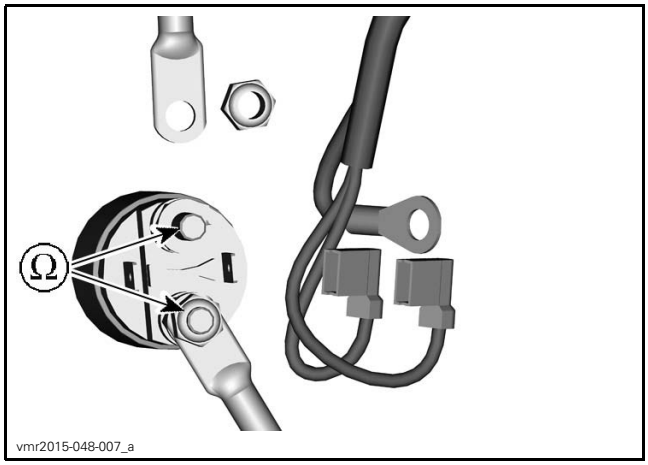
1. SS1



PROBE	PROBE	SPECIFICATION @ 20°C (68°F)
SS1	SS2	Close to 6Ω

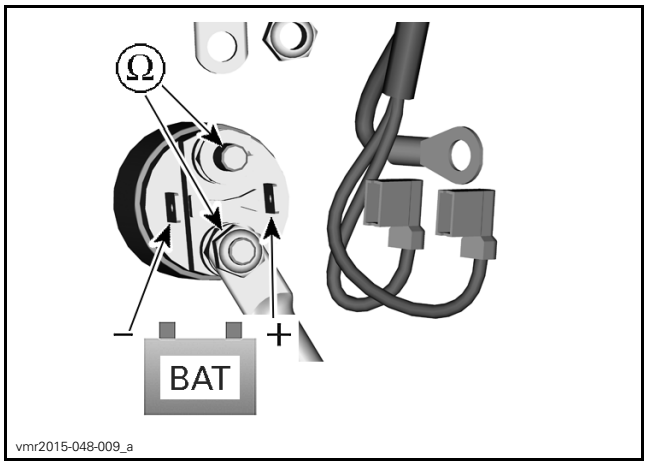
If resistance is not as per specification, replace the solenoid.

3. Disconnect BP1 and BP2.



PROBE	PROBE	SPECIFICATION
BP3	Terminal to starter motor	O.L.

4. Jump starter solenoid.



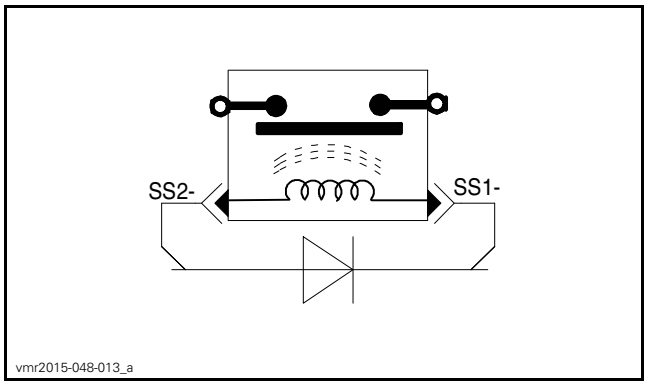
SS1 IS ON THE RIGHT

PROBE	PROBE	SPECIFICATION
Terminal from battery	Terminal to starter motor	Close to 0Ω

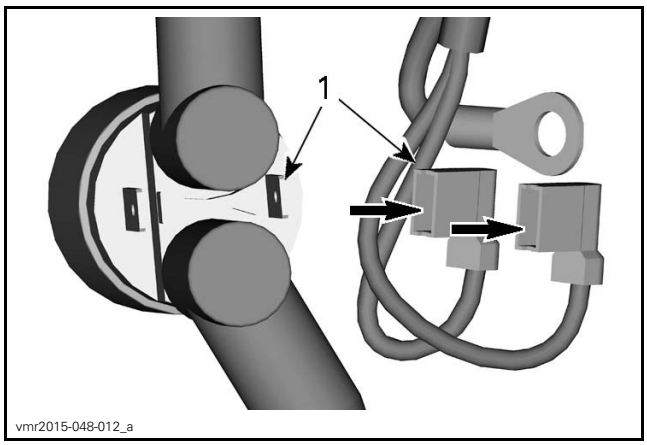
If resistance is not as per specification, replace the solenoid.

5. If starter power and ground circuits are good, refer to *MAGNETO AND STARTER* subsection for starter diagnosis and replacement.

Solenoid Diode Test

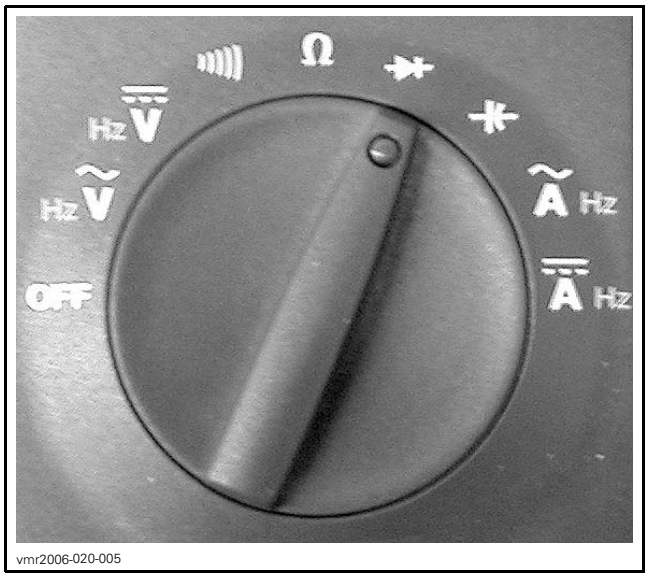


Disconnect SS1 and SS2 from starter solenoid.



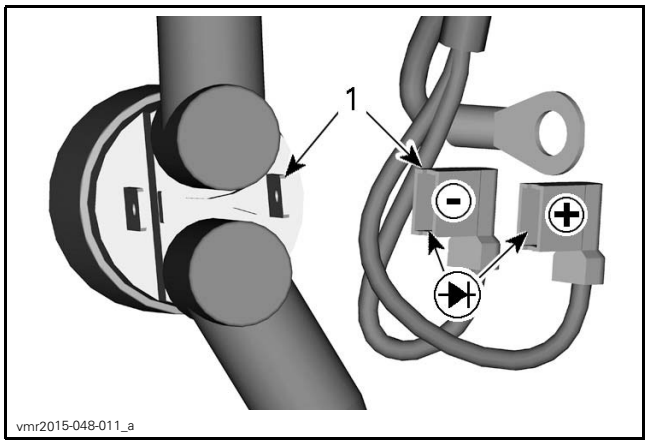
1. SS1

Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and set it to the diode symbol as shown.



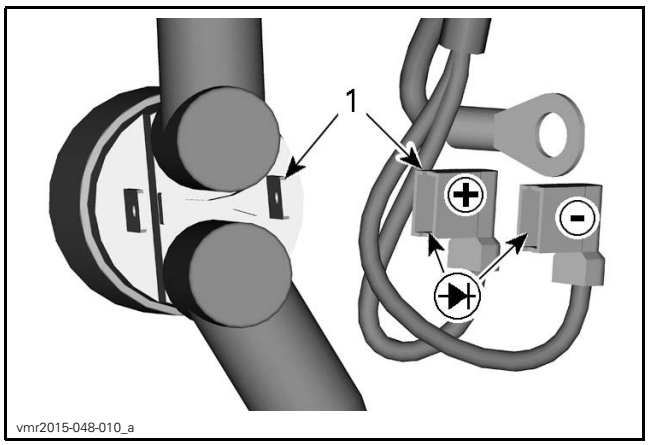
vmr2006-020-005

Probe wires while paying attention to the diode polarity.



vmr2015-048-011_a

FORWARD POLARITY, MUST BE AROUND 0.5 V



vmr2015-048-010_a

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.

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

GENERAL

SYSTEM DESCRIPTION

The ignition key contains a ROM chip with a unique digital code that is the equivalent of a unique teeth pattern on a conventional key.

When the ignition key is turned ON, the ECM reads the ignition key and, if it is not recognized, no engine starting will be possible.

NOTE: When a key is not recognized by the ECM, INVALID KEY will be displayed in the multifunction speedometer.

NOTE: All ignition keys have the same teeth pattern. Therefore, they can be used and turned in the switch of any D.E.S.S.-equipped vehicle. However, unless the D.E.S.S. system recognizes (in the ECM) a valid programmed key, the engine starting will not be allowed.

NOTE: Actually, it is the memory of the ECM that is programmed to recognize the digital code of the ignition key.

Up to 10 ignition keys may be programmed in the memory of the ECM. They can also be erased individually or all at once.

Note that the D.E.S.S. circuitry is already activated on all new ECM.

TROUBLESHOOTING

DIAGNOSTIC TIPS

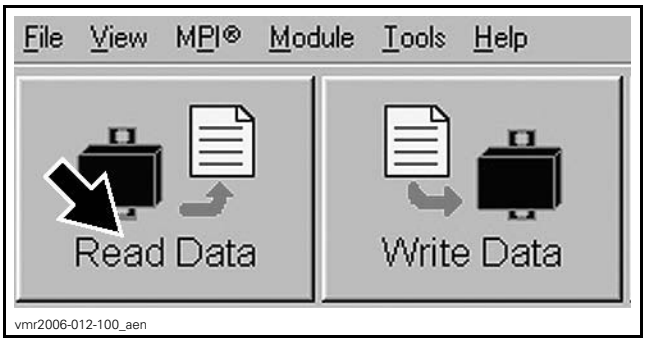
NOTE: It is a good practice to check for fault codes using B.U.D.S. as a first troubleshooting step.

If D.E.S.S. key is not recognized by the ECM, key is defective or there is a wiring problem, CHECK ENGINE light will turn on and a message will be displayed in the multifunction speedometer.

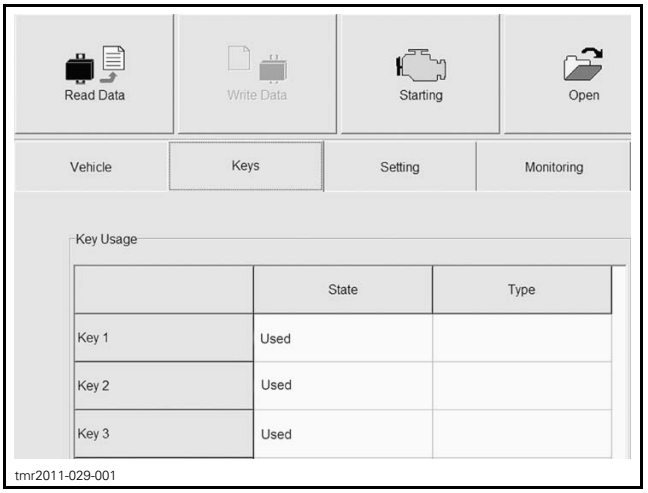
PROCEDURES

KEY PROGRAMMING

1. Connect to the latest applicable B.U.D.S. version. Refer to *COMMUNICATION TOOLS AND B.U.D.S.* subsection.
2. Turn ignition switch to ON using any of the key provided with the vehicle. DO NOT start the engine.
3. Click the **Read Data** button in B.U.D.S.

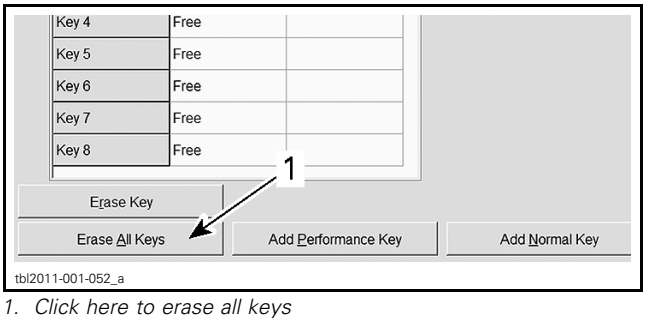


4. Click on **Keys** tab.



KEYS TAB

5. Click on **Erase All Keys** button.

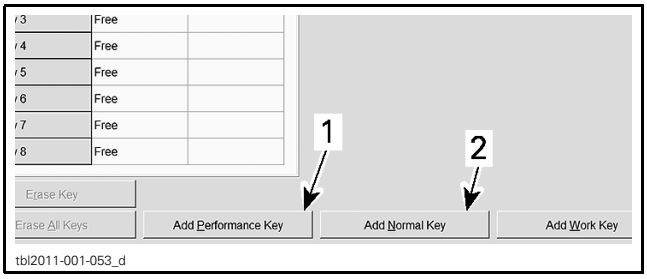


1. Click here to erase all keys

6. Click "YES" to confirm the action.
7. Check the color of the key to be programmed.

KEY	KEY TYPE
BLACK key	Performance key
GRAY key	Normal key

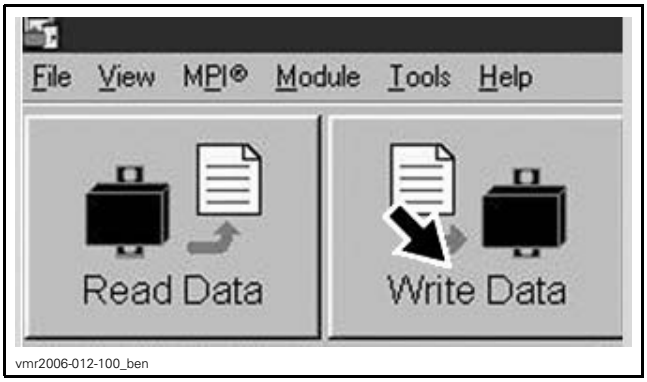
8. Click on the appropriate **Add Key** button.



1. Add Performance Key button
2. Add Normal Key button

NOTE: The **Add Work Key** button is not used for these vehicles.

9. Turn ignition switch to OFF.
10. Remove the key.
11. Insert the next key to be programmed.
12. Turn ignition key to ON position.
13. Click on the appropriate **Add Key** button.
14. Repeat to program more keys if needed.
15. Click on **Write Data** button to transfer new settings and information to the ECM.



WRITE DATA BUTTON

When new data is written in the ECM, a message that says "Remove key from vehicle" is displayed in the gauge. When this occurs, remove the key from ignition switch and wait until the message disappears.

16. Turn ignition key to ON position.
17. Erase occurred fault(s) in the fault tabs.
18. Turn ignition switch to OFF.
19. Click on EXIT button to end session.
20. Disconnect all cables and hardware from vehicle.
21. Ensure to reinstall the connector into its housing.

LIGHTS, GAUGE AND ACCESSORIES

SERVICE TOOLS

Description	Part Number	Page
FLUKE 115 MULTIMETER	529 035 868	455

SERVICE PRODUCTS

Description	Part Number	Page
DIELECTRIC GREASE	293 550 004	451

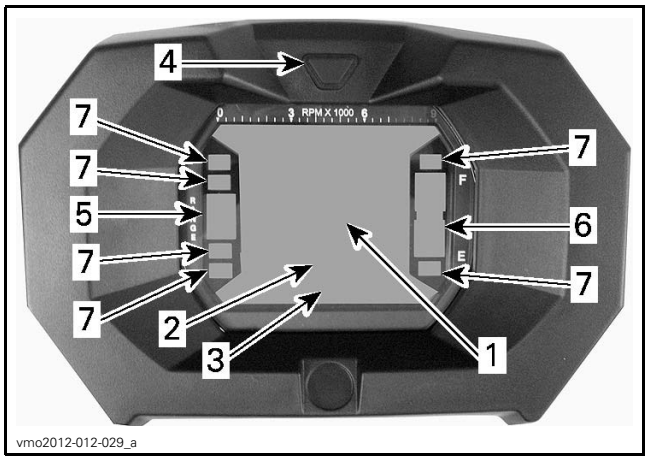
GENERAL

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 - LCD

Multifunction Gauge Description

The multifunction gauge is located in the middle of the handlebar.

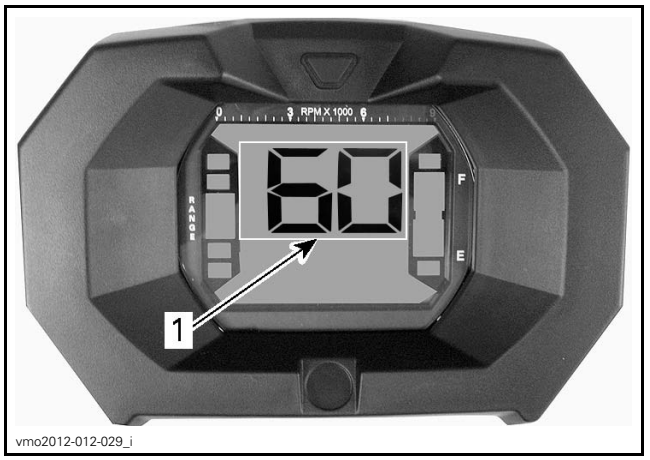


vmo2012-012-029_a

1. *Display 1*
2. *Display 2*
3. *Display 3*
4. *Display selector button*
5. *Transmission position display*
6. *Fuel level display*
7. *Indicator lamps*

Speedometer

This display will show vehicle speed.



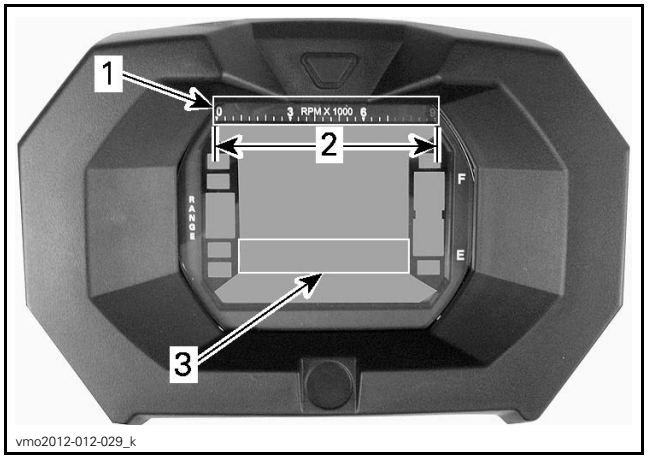
vmo2012-012-029_i

1. *Vehicle speed (Display 1)*

Tachometer

Measures engine revolutions per minute (RPM). Multiply by 1000 to obtain the actual revolutions.

NOTE: RPM may also be displayed via Display 2 display.

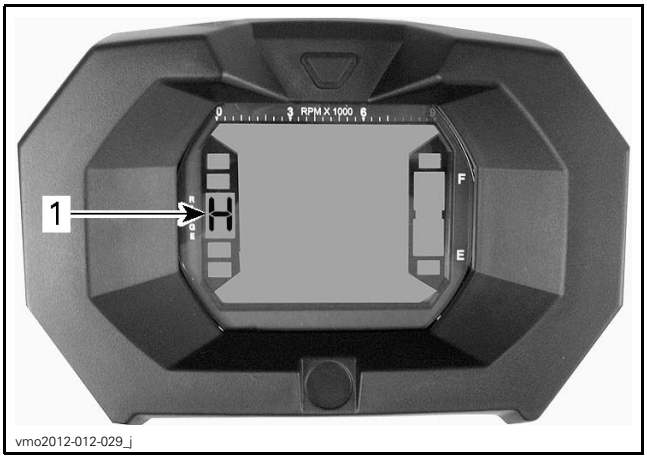


vmo2012-012-029_k

1. *Tachometer*
2. *Operating range*
3. *Tachometer via Display 2*

Transmission Position Display

This display will show transmission position.



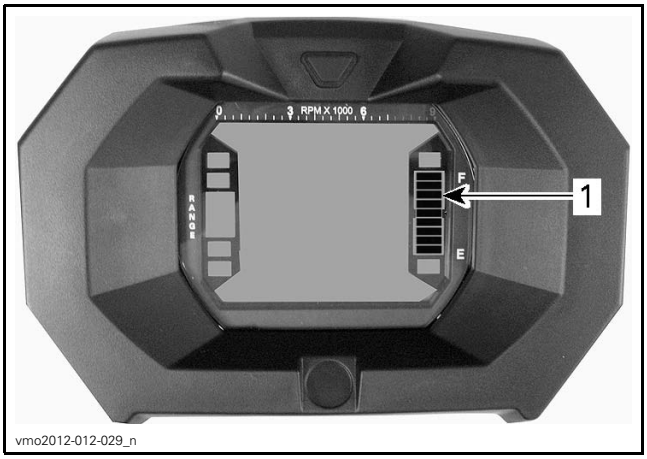
1. Transmission position

DISPLAY	FUNCTION
P	Park
R	Reverse
N	Neutral
H	High gear
L	Low gear

NOTE: If the letter "E" is displayed in the transmission position display, it means that there is a electrical communication error..

Fuel Level Display

Bar gauge continuously indicates the fuel level in the fuel tank.



1. Fuel level display

Low fuel level Indicator Lamp



When this indicator turns ON, it indicates that there is approximately 5 L (1.3 U.S. gal.) of fuel left in fuel tank.

6WD Indicator Lamp



When this indicator is ON, it indicates the **6WD** system is activated.

Brake Lock Indicator Lamp



When this indicator is ON, it indicates the brake is activated for more than 15 seconds (while riding).

High Beam Indicator Lamp



When this indicator is ON, it indicates that **high beam** is selected.

Check Engine Indicator Lamp



When this indicator is ON, it indicates an engine fault code, look for a message at the LCD display.

Refer to *TROUBLESHOOTING* section for more details.

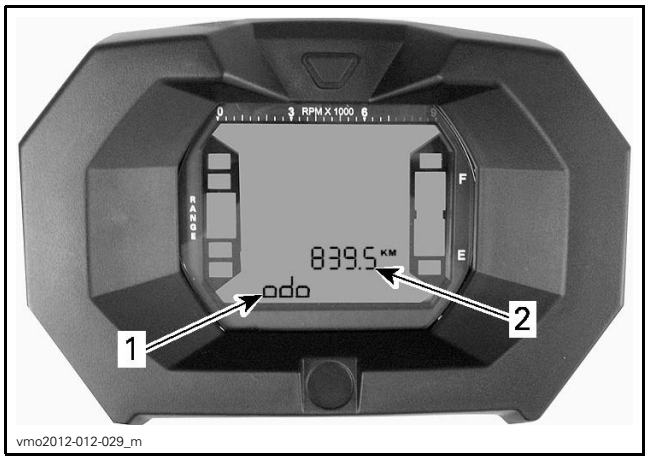
Multifunction Display Modes

⚠ WARNING

Never adjust or set functions on the multifunction gauge while riding the vehicle.

The available modes may be displayed by pressing the display selector button.

NOTE: An abbreviation of the mode selected will also be displayed in Display 3.



1. Display 2 (mode)
2. Display 3 (mode/message)

A) Odometer

Records the total distance travelled.

B) Clock

Shows current time.

Press and HOLD the display selector button to set clock.

C) Trip Meter

Records the distance travelled since it has been reset.

Press and HOLD the display selector button to reset.

D) Hour Meter (Trip Time)

Records the vehicle running time when the electrical system is activated since it has been reset.

Press and HOLD the display selector button to reset.

E) Engine Hour Meter

Records engine running time.

F) Engine RPM

Measures engine revolutions per minute (RPM).

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 diode D11, refer to WIRING DIAGRAM.*
   - *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)

LOW AND HIGH BEAM HEADLIGHTS WILL NOT COME ON SIMULTANEOUSLY

1. Jumper JP1 is open circuit or missing.
   - *Check jumper (fuse) JP1 in front fuse box, refer to POWER DISTRIBUTION subsection.*

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.*

PROCEDURES

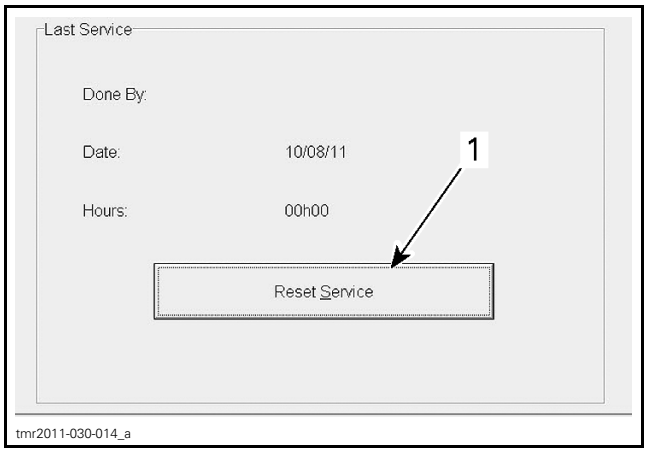
MULTIFUNCTION GAUGE

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/YL
12 volt input from fuse F10 (Clock)	16	RD/WH
Ground	20	BK
CAN LO	18	BE/GN
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

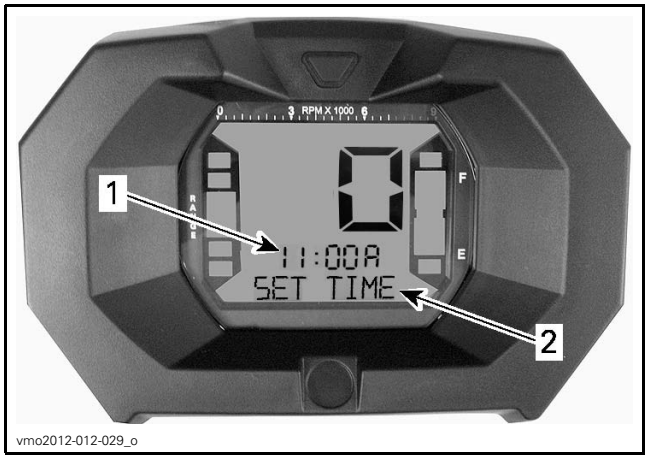
Multifunction Gauge Circuit Protection

CONDITION	CIRCUIT PROTECTION
Supplied at all times	Fuse 10 of fuse block 1 (from fuse 1 of fuse block 2)
Supplied with main relay activated	Fuse 4 of fuse block 1 (from main relay R2)

Clock Setting Using Gauge Selector Button

To set current time, proceed as follows:

1. Select the clock display.



1. Time (Display 2)
2. Message (Display 3)

2. Press and HOLD selector button.

NOTE: SET TIME will appear on display 3.

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.

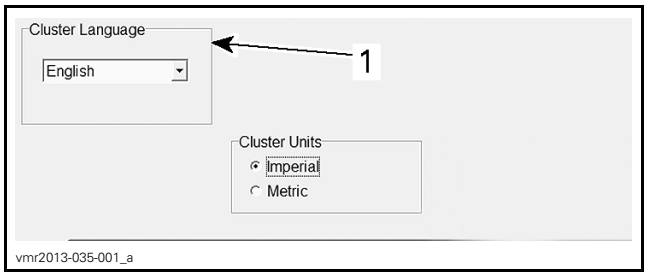
Multifunction Gauge Set-Up Using B.U.D.S.

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.

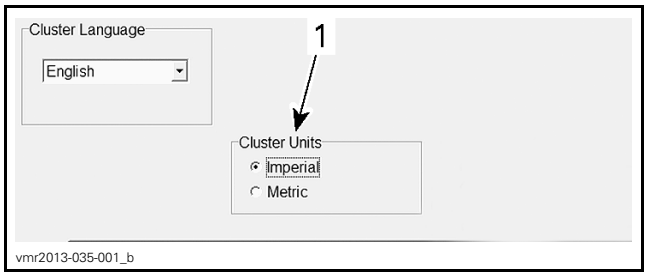


TYPICAL
1. Cluster Language box

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

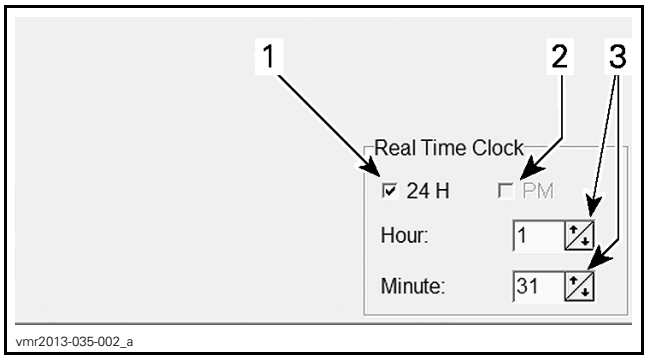
Clock Setting

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.

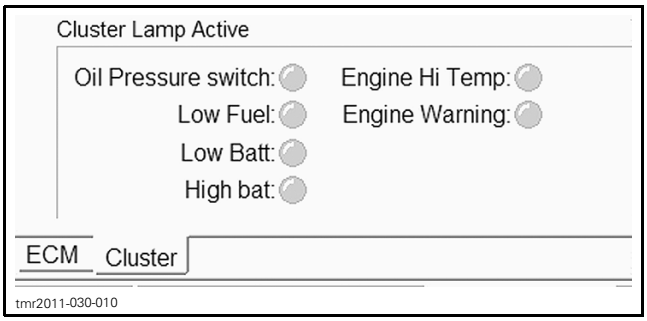
In B.U.D.S., select the:
- Activation page
- Cluster tab.

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.



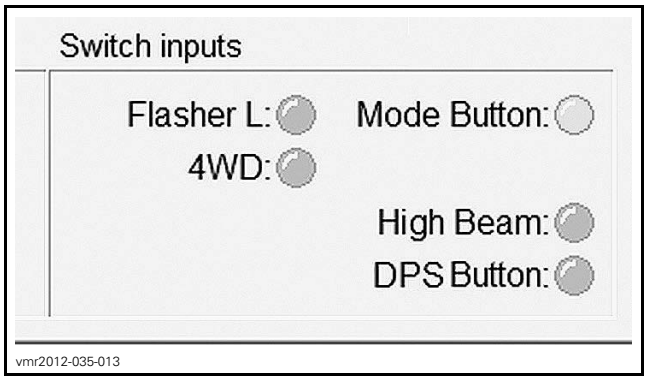
TYPICAL - CLUSTER LAMP ACTIVE BOX

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

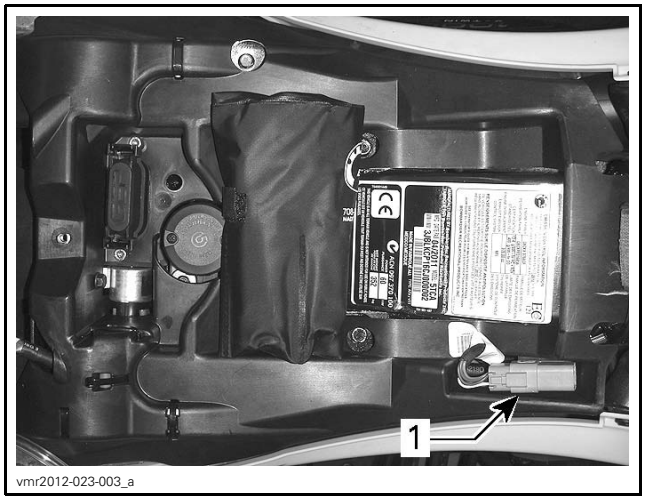
In B.U.D.S., select the:
- Monitoring page
- Cluster tab.

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.



vmr2012-023-003_a

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 CAN wire to ECM open CLUSTER CAN resistor open ECM CAN resistor open
Infinite (open circuit)	CAN wire to DB connector open circuit

Multifunction Gauge Removal

1. Remove gauge support.
   1.1 Push in on both sides of its leading edge to disengage it.
   1.2 Lift up and pull forward to remove.

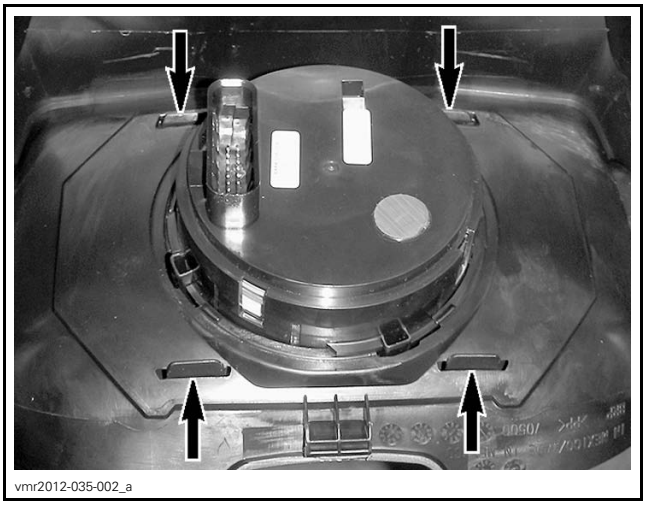
NOTE: There are a total of 6 tabs that retain the gauge support.



vmr2012-035-001_a

1. Push in and lift up here (both sides)

2. Disconnect gauge connector.
3. From the back of the gauge support, release the bezel retaining tabs and remove the bezel.


vmr2012-035-002_a

BEZEL RETAINING TABS

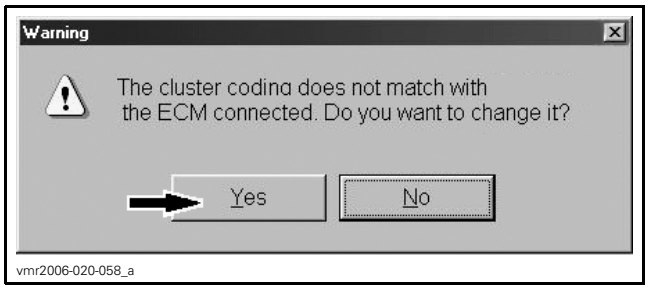
4. From back of gauge support, rotate the gauge clockwise to release it from its support.

Multifunction Gauge Installation

The installationis the reverse of 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.



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

Remove the gauge support, refer to *MULTIFUNCTION GAUGE REMOVAL* in this subsection.

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	RED/BROWN
Ground (to ground terminal BK3)	1	BLACK

12 Volt Power Outlet Circuit Protection

CONDITION	CIRCUIT PROTECTION
Supplied with accessories relay activated	Fuse 12 of fuse block 1 (from accessories relay R3)

HEADLIGHTS

Headlight Wire Identification

HEADLIGHTS RELAY (R5)		
FUNCTION	PIN	COLOR
12 volt input from fuse F11 (headlights power)	C6	YELLOW/BLACK

HEADLIGHTS RELAY (R5)		
FUNCTION	PIN	COLOR
12 volt input from ignition switch pin A (relay winding input)	D6	YELLOW/BLUE
12 volt output to headlights low beam and low/high beam switch	D7	RED/BLUE
Relay winding ground (from ECM K2)	C7	ORANGE/BLACK

HEADLIGHT LOW/HIGH BEAM SWITCH		
FUNCTION	PIN	COLOR
12 volt input from headlights relay	MG2-4	RED/YELLOW
12 volt output to high beam headlights	MG2-5	BLUE
12 volt output to low beam headlights	MG2-2	GREEN

Headlights Circuit Protection

CONDITION	CIRCUIT PROTECTION
Supplied when headlights relay (R5) activated	Fuse 11 of fuse block 1 (from fuse 2 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.

SWITCH POSITION	WIRE COLOR		VOLTAGE
LO beam or HI beam	GREEN (Low beam connector)	BLACK	Battery voltage
HI beam	BLUE (Hi beam connector)		

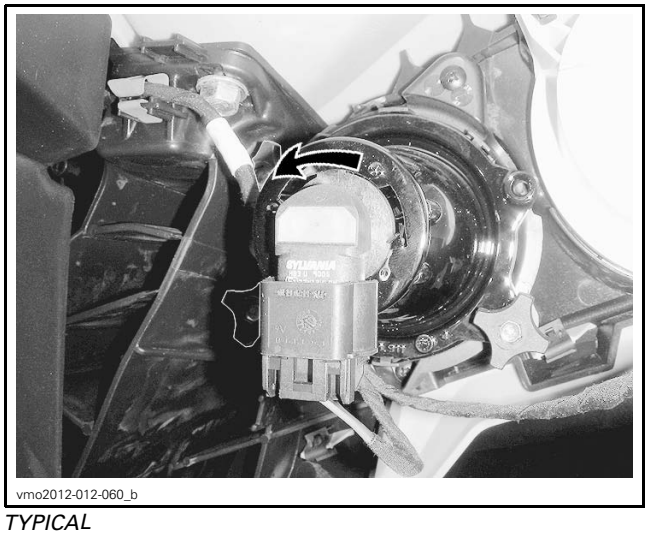
4. Remove the JP1 jumper/fuse in fuse box 1, refer to *POWER DISTRIBUTION* subsection.
5. Measure the voltage on headlight connector as follows.

SWITCH POSITION	WIRE COLOR		VOLTAGE
LO beam	GREEN (Low beam connector)	BLACK	Battery voltage
HI beam			No voltage
HI beam	BLUE (Hi beam connector)		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. Unplug connector from bulb.
2. Rotate bulb.



TYPICAL

3. Pull bulb out.
4. Properly reinstall removed parts in the reverse order of their removal.
5. Validate headlight operation.

Headlamp Beam Aiming

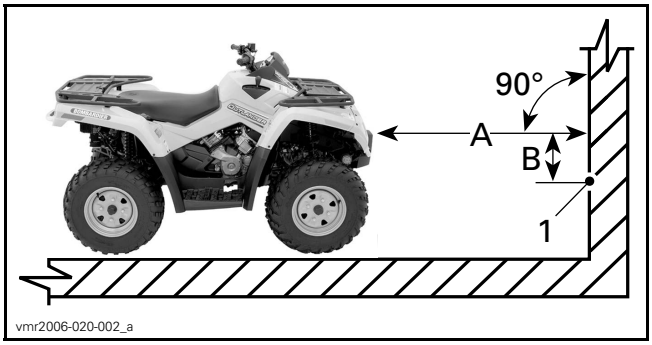
NOTE: Load vehicle as per normal use.

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).

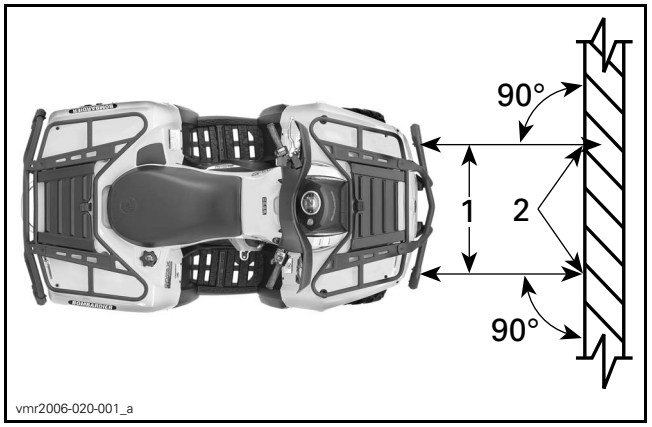
Low beam aiming is correct when the crest of the low beam is **below** the applicable horizontal center line traced on the test surface as per specification.

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)	



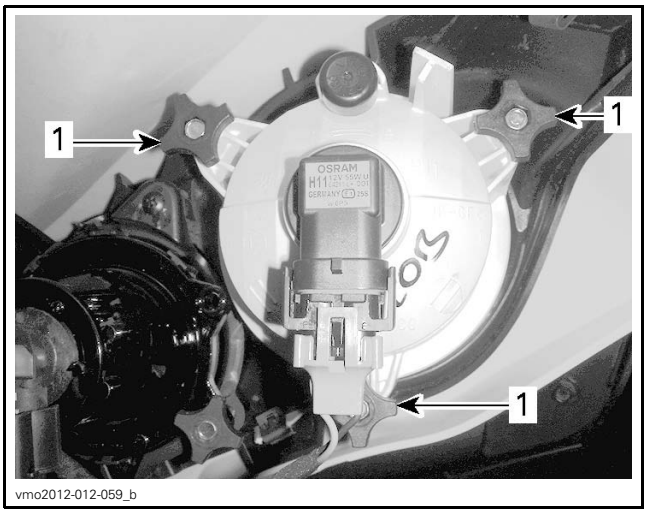
TYPICAL
1. Light beam center
A. 5 m (17 ft)
B. Beam aiming specification



TYPICAL
1. Headlight center lines
2. Light beam center

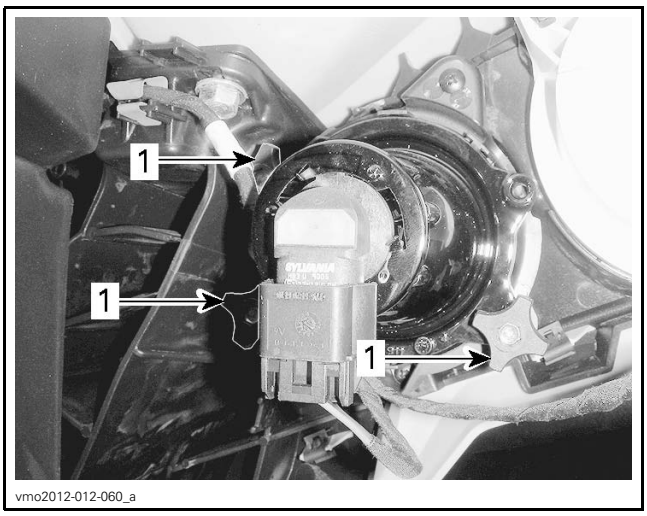
Beam Aiming Adjustment (Outlander)

Turn adjustment knobs to adjust beam height and side orientation to specification.



vmo2012-012-059_b

LOW BEAM
1. Adjustment knobs

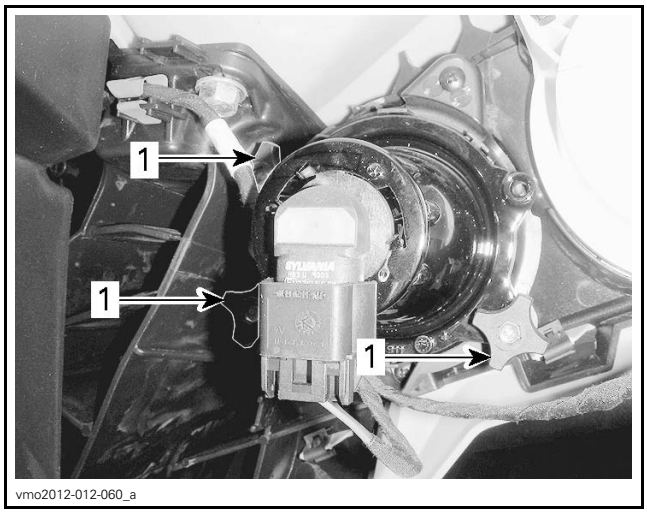


vmo2012-012-060_a

HIGH BEAM
1. Adjustment knobs

Beam Aiming Adjustment (Renegade)

Turn adjustment knobs to adjust beam height and side orientation to specification.



vmo2012-012-060_a

LOW AND HIGH BEAMS
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	ORANGE/GREEN
12 volt input from F4 (relay winding input)	D8	ORANGE/GREEN
12 volt output to LH and RH brake lights	D9	WHITE/ORANGE
Relay winding ground (from brake light switch(es))	C9	RED/ORANGE

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

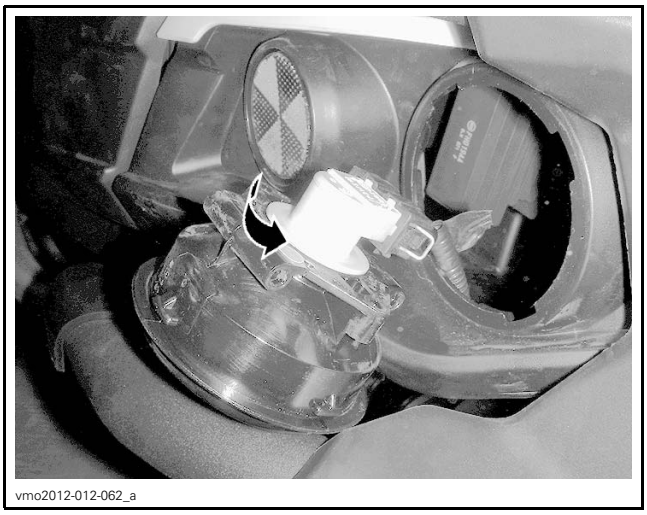
FUNCTION	PIN	CIRCUIT PROTECTION
Supplied when main relay R2 activated	3	ORANGE/GREEN
Ground from BK2	2	BLACK

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.


vmo2012-012-062_a

ROTATE BULB COUNTERCLOCKWISE

3. Remove bulb socket from taillight.

Installation is the reverse of the removal procedure.

WINCH

Winch Wire Identification

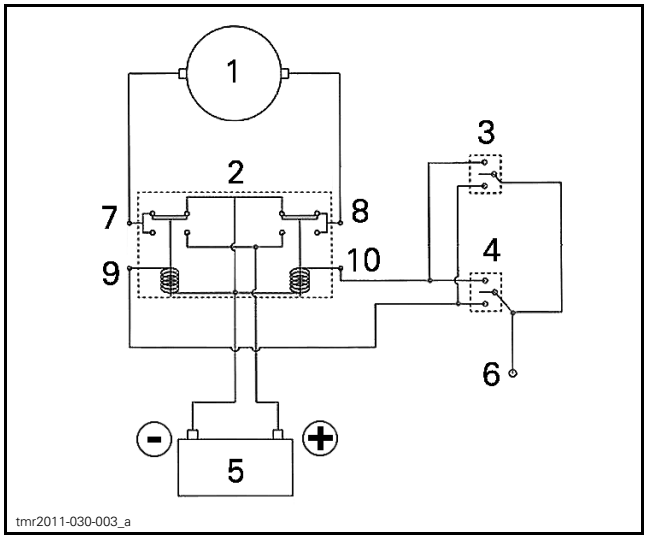
WINCH RELAY		
FUNCTION	PIN	COLOR
12 volt input from battery (winch power)	BP4	RED
Ground	BN4	BLACK
12 volt input from switch (IN)	SW1	GREEN/BLUE
12 volt input from switch (OUT)	SW2	LIGHT BLUE
Motor power (switches polarity depending on rotation direction)	SW3	RED (with blue sleeve)
Motor power (switches polarity depending on rotation direction)	SW5	RED (with yellow sleeve)

NOTE: The small black wire at terminal BN4 connected to the diodes are used to prevent electric arcs in the switch.

WINCH SWITCH		
FUNCTION	PIN	COLOR
12 volt input from fuse 7	A	RED/BLACK
12 volt output to relay winding (IN)	C	GREEN/BLUE
12 volt output to relay winding (OUT)	B	LIGHT BLUE

⚠ WARNING

Before testing, make sure the winch is in FREESPOOL mode (Freespool clutch disengaged).



tmr2011-030-003_a

SIMPLIFIED WINCH WIRING DIAGRAM
1. *Winch motor*
2. *Winch relay*
3. *Winch remote control*
4. *Winch switch*
5. *Battery*
6. *12 volt input to switch (switch pin 2 - from fuse 7)*
7. *Winch motor power (SW3)*
8. *Winch motor power (SW5)*
9. *12 volt input to relay winding (IN - SW1)*
10. *12 volt input to relay winding (OUT - SW2)*

Winch Switch Circuit Protection

CONDITION	CIRCUIT PROTECTION
Supplied when accessories relay activated	Fuse 7 of fuse block 1 (from accessories relay R3)

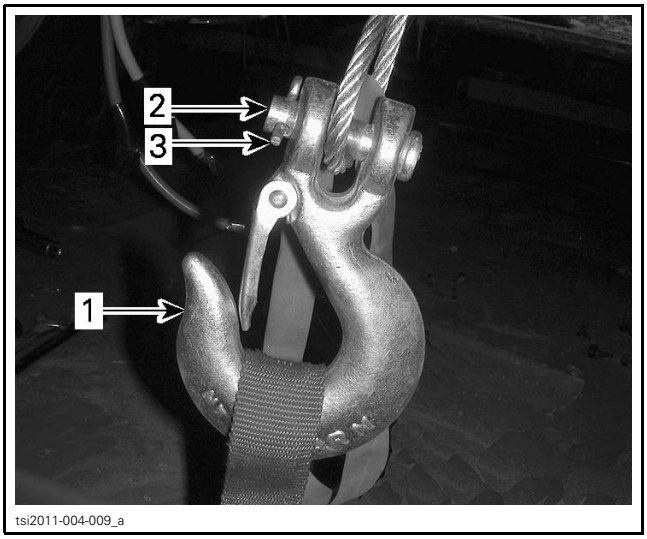
Winch Removal

1. Disconnect, the battery BLACK (-) cable first, then the RED (+) cable.

⚠ WARNING

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

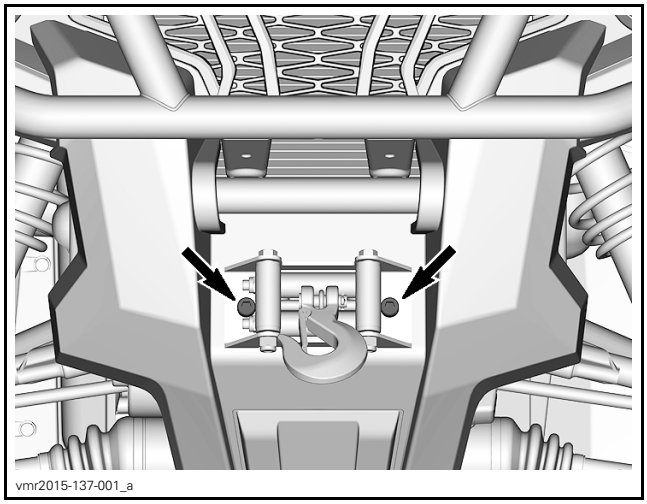
2. Remove the hook.
   2.1 Remove and discard the cotter pin.
   2.2 Remove the hook pin.



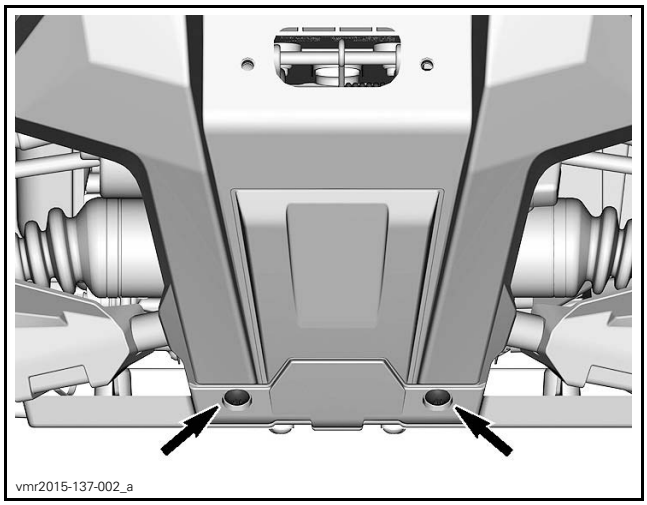
tsi2011-004-009_a

1. Hook
2. Hook pin
3. Cotter pin

3. Remove the winch cable fairlead.

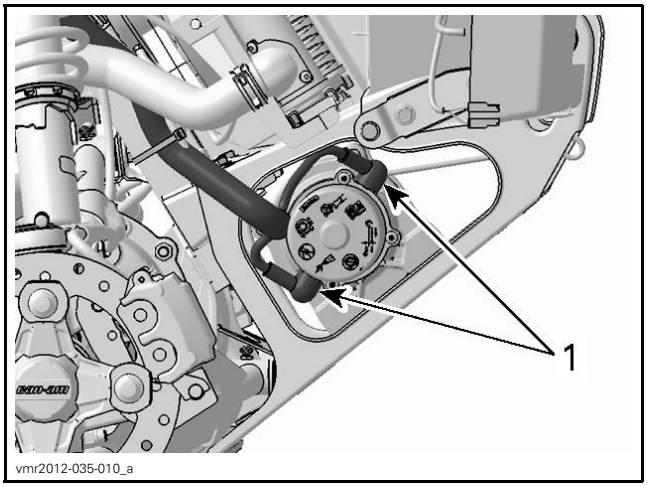

vmr2015-137-001_a

4. Remove the front skid plate.


vmr2015-137-002_a

5. Disconnect both winch power cables.

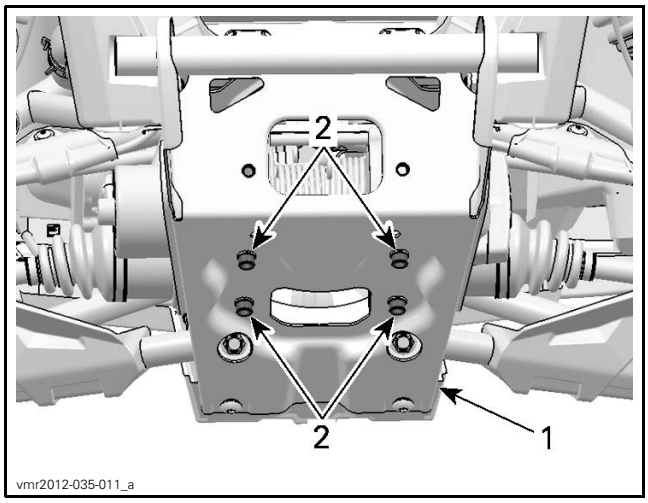
NOTE: Note the position of the power cables for reinstallation.



vmr2012-035-010_a

1. Winch power cables

6. Remove the four winch retaining screws from the front bumper support.



1. Front bumper support
2. Winch retaining screws

7. Remove winch.

Winch Installation

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

Connect winch power cables as noted at removal.

NOTE: If the winch power cables are not connected correctly, the winch motor will operate in the reverse direction of selection.

TIGHTENING TORQUE	
WINCH RETAINING SCREWS	16 N•m ± 2 N•m (142 lbf•**in** ± 18 lbf•**in**)
WINCH POWER CABLES	7 N•m ± .5 N•m (62 lbf•**in** ± 4 lbf•**in**)
WINCH FAIRLEAD ELASTIC NUTS	4.5 N•m ± .5 N•m (40 lbf•**in** ± 4 lbf•**in**)

Install a **new** cotter pin on the hook pin.

FRONT DRIVE

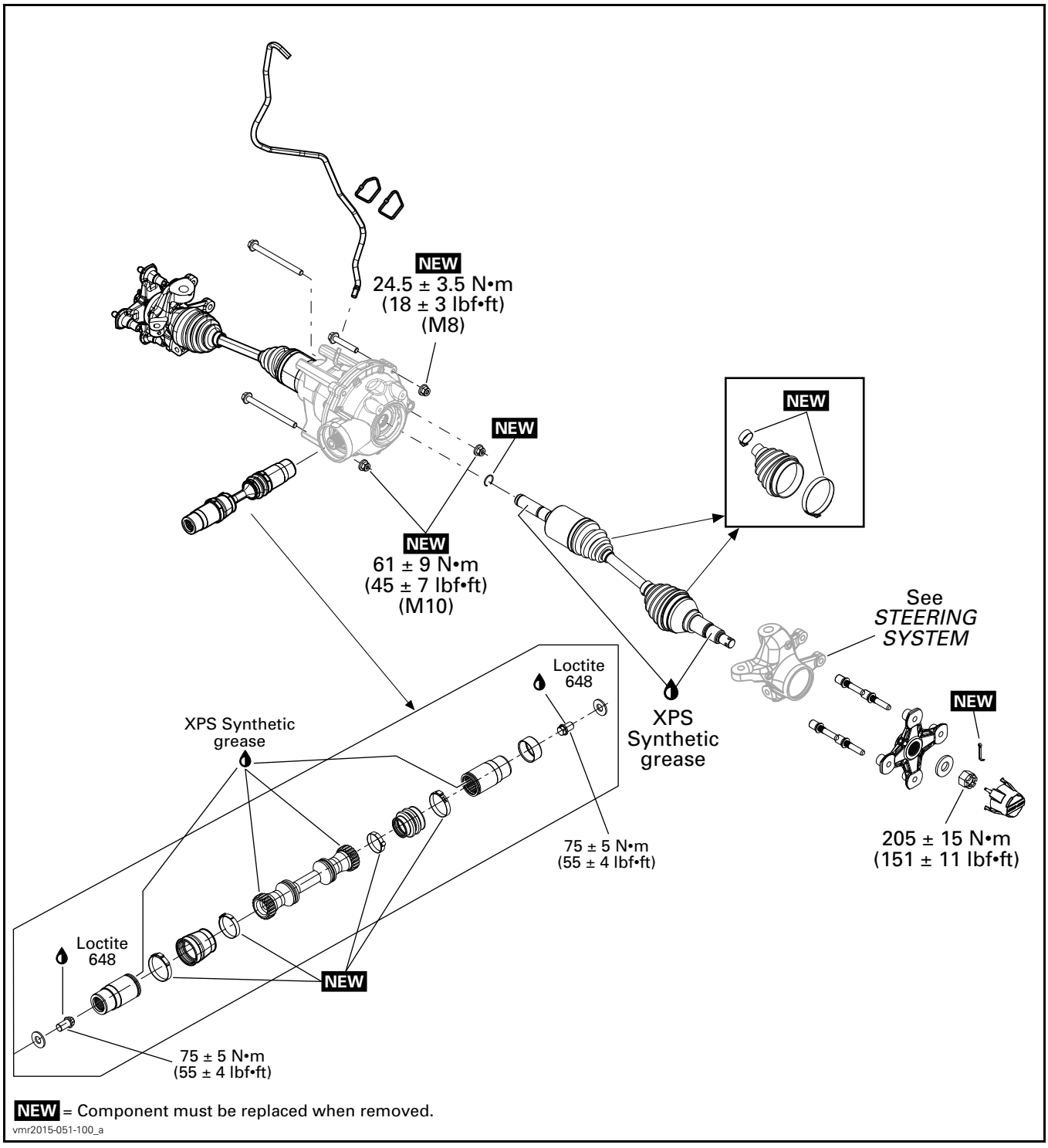
SERVICE TOOLS

Description	Part Number	Page
BACKLASH MEASUREMENT TOOL	529 035 665	469
CV BOOT CLAMP PLIER	529 036 120	467
CV JOINT EXTRACTOR	529 036 005	467
SPANNER SOCKET	529 035 649	471

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 277	293 800 073	473
LOCTITE 648 (GREEN)	413 711 400	475
XPS SYNTHETIC GREASE	293 550 010	467, 473, 475

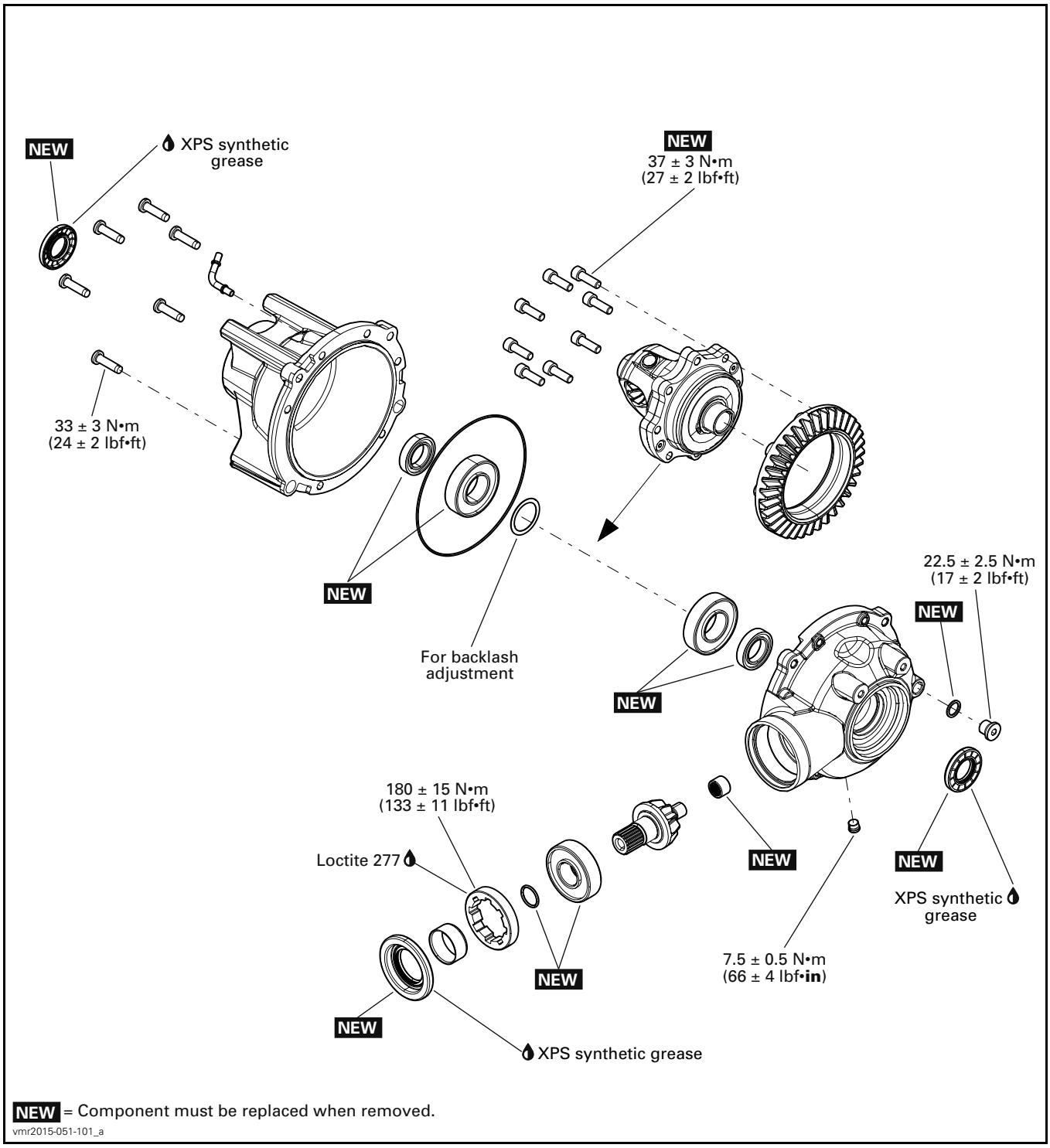
FRONT DRIVE SHAFTS AND FRONT PROPELLER SHAFT



NEW = Component must be replaced when removed.

vmr2015-051-100_a

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

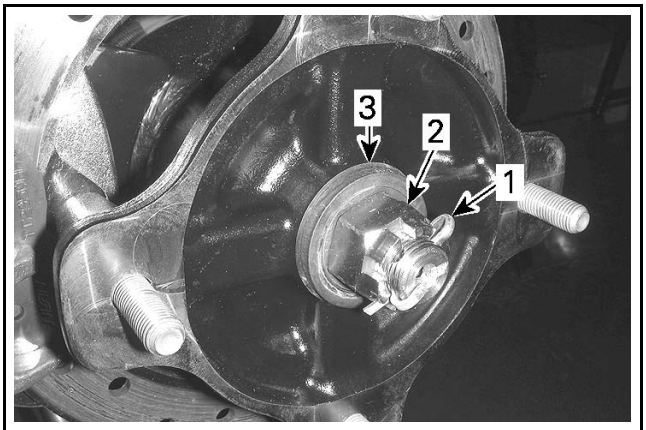
Wheel Hub Removal

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.

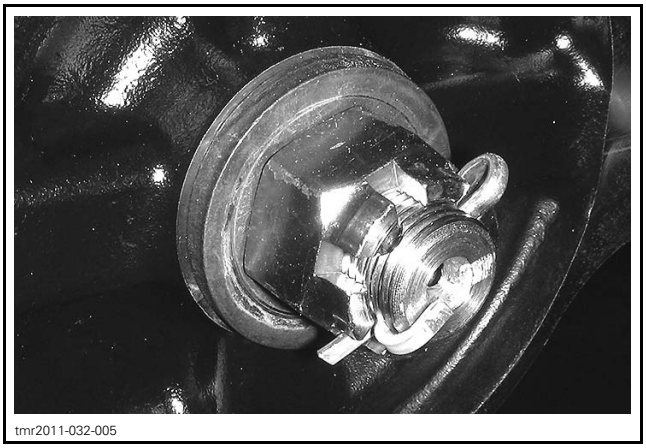
Install Belleville washer with its convex side outwards.

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.

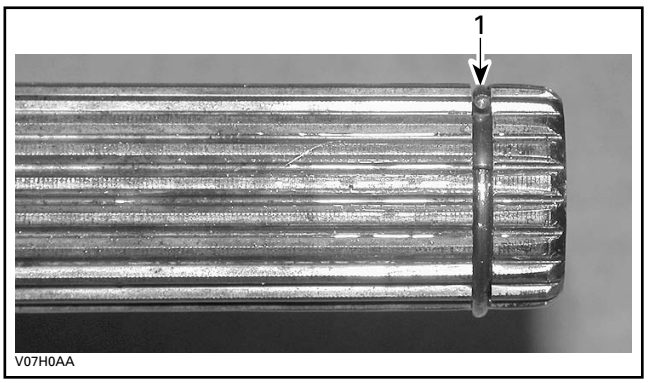
Check splines for excessive wear. Replace if necessary.

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.

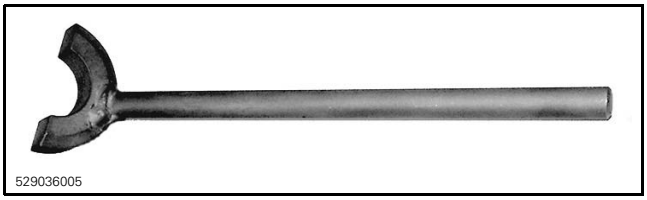
Remove and discard the circlip. A new one is included in the boot kit.

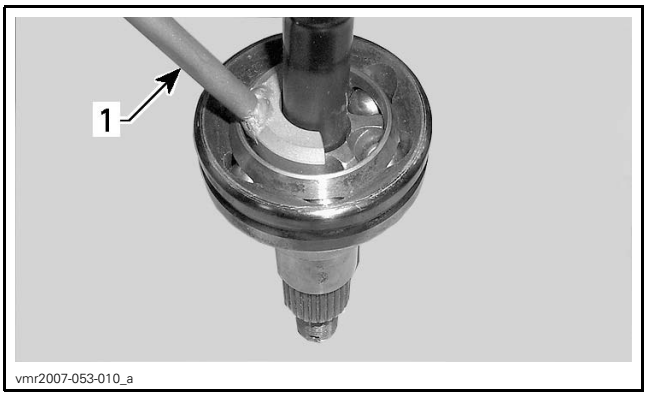
With the Special Tool

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).

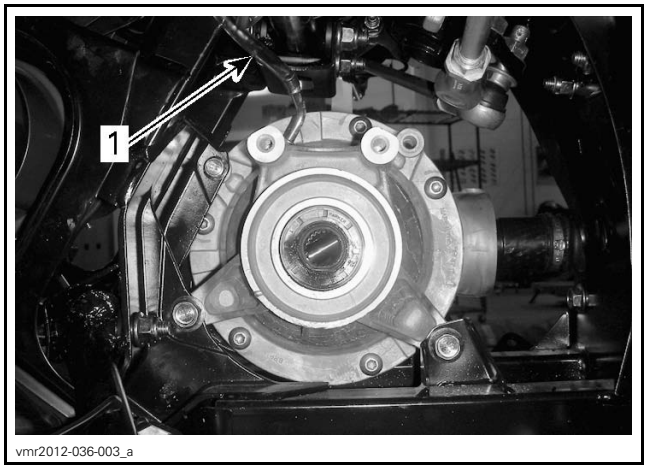
NOTE: Do not use or add other grease.

Install NEW drive shaft boot clamps.

FRONT DIFFERENTIAL

Front Differential Removal

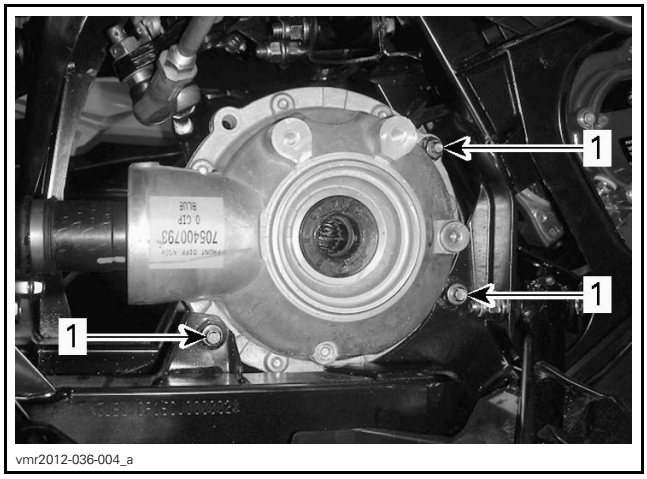
1. Drain front differential. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
2. Remove both front drive shafts. Refer to *FRONT DRIVE SHAFT* in this subsection.
3. Detach vent hose from front differential.



vmr2012-036-003_a

FROM LH SIDE
1. Vent hose

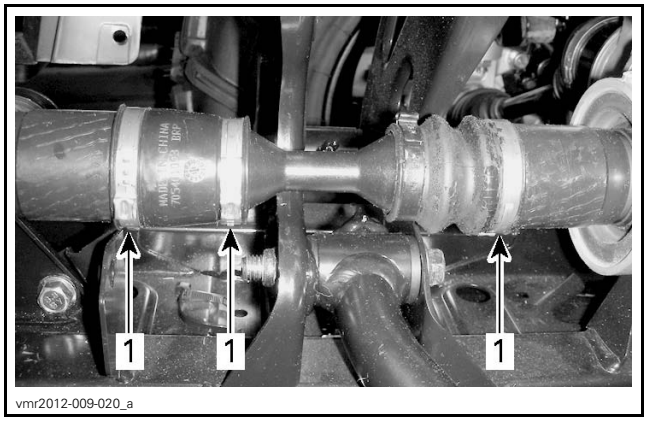
4. Remove bolts securing front differential to frame.



vmr2012-036-004_a

1. Bolts securing front differential to frame

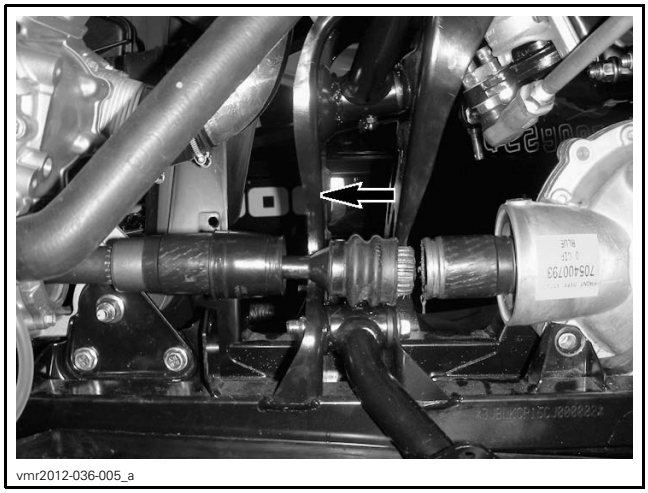
5. Remove the following Oetiker clamps from front propeller shaft.



vmr2012-009-020_a

1. Oetiker clamps

6. Detach front propeller shaft from front differential by moving it rearward.


vmr2012-036-005_a

FRONT PROPELLER SHAFT MOVED REARWARD

7. Remove front differential by pulling it from RH side.

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.

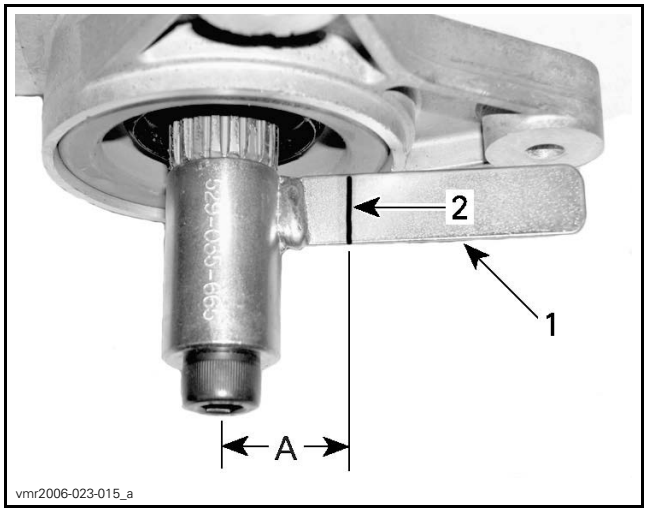
Backlash Inspection

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.

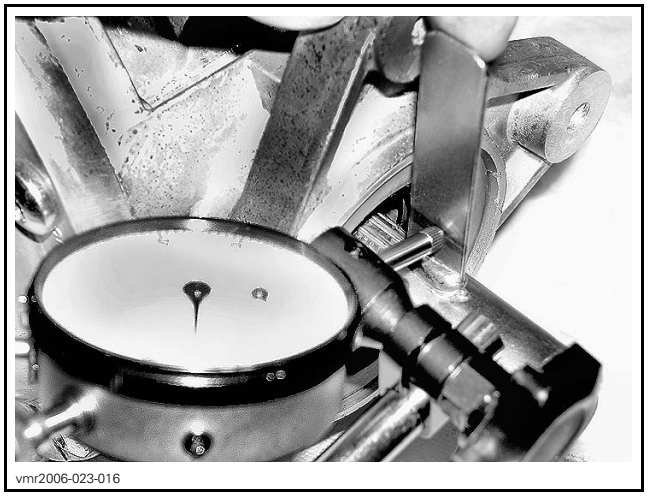


vmr2006-023-015_a

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

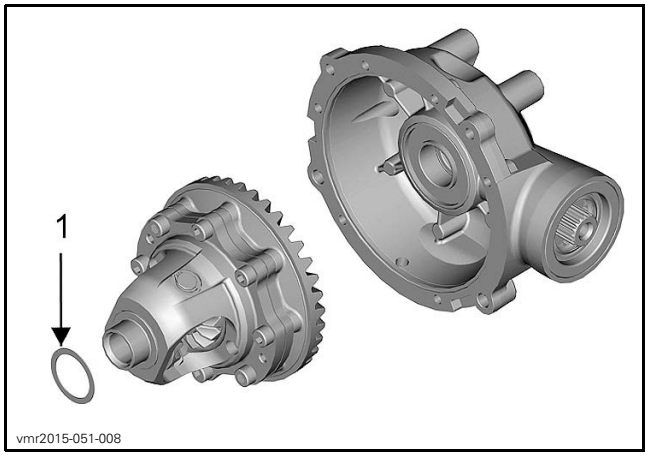
Rotate pinion gear 1/2 turn and recheck backlash. Note the result.

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.

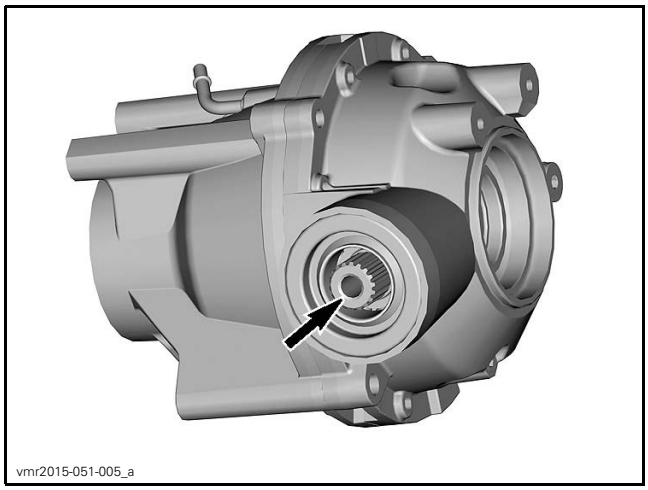
BACKLASH ADJUSTMENT GUIDELINE	
BACKLASH MEASUREMENT	WHAT TO DO
Below 0.1 mm (.004 in)	Remove shim(s) and recheck backlash
Above 0.25 mm (.01 in)	Add shim(s) and recheck backlash



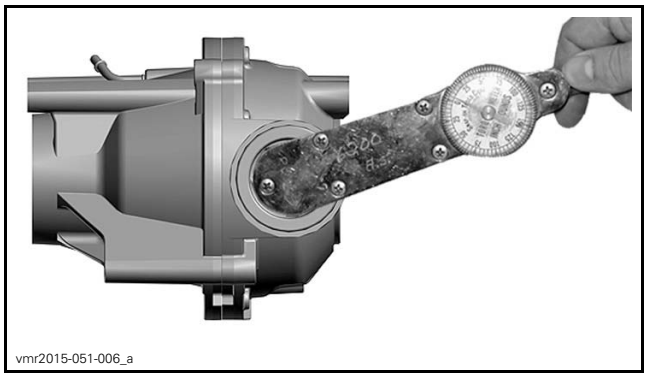
1. Backlash shim

Preload Inspection

Screw the propeller shaft screw in pinion gear.



Using a needle torque wrench, measure the preload.



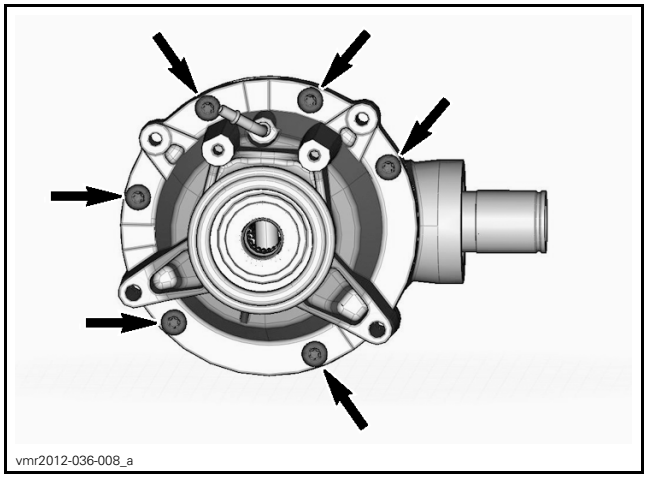
PRELOAD SPECIFICATION
Maximum 0.50 N•m (4 lbf•**in**)

If preload is out of specification, split front differential housing and check all bearings conditions.

Front Differential Disassembly

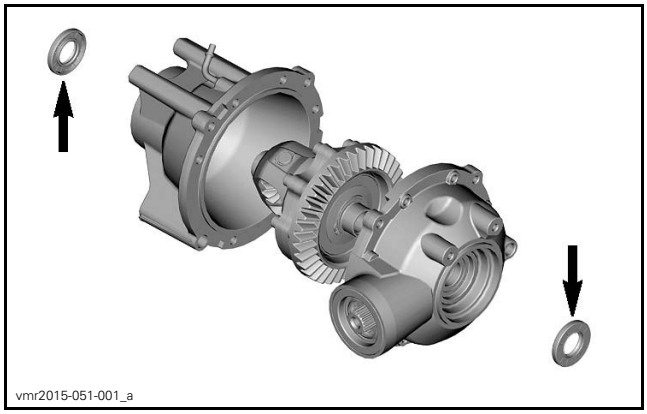
Differential Housing

Remove front differential housing screws.



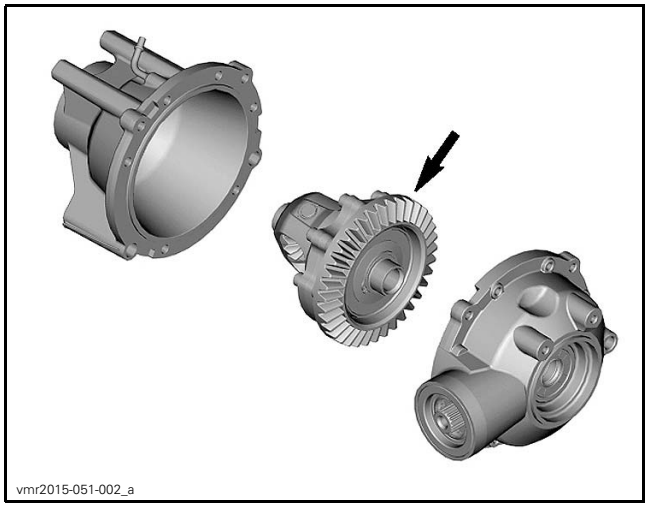
Separate half housings.

Remove oil seals.

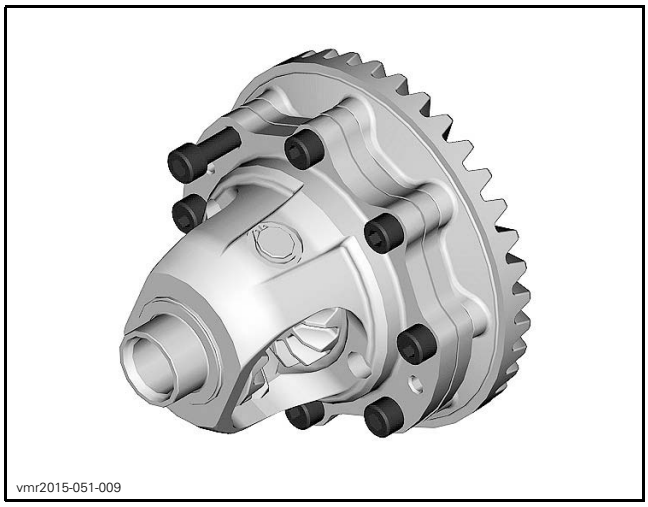


Visco-Lok Carrier/Ring Gear

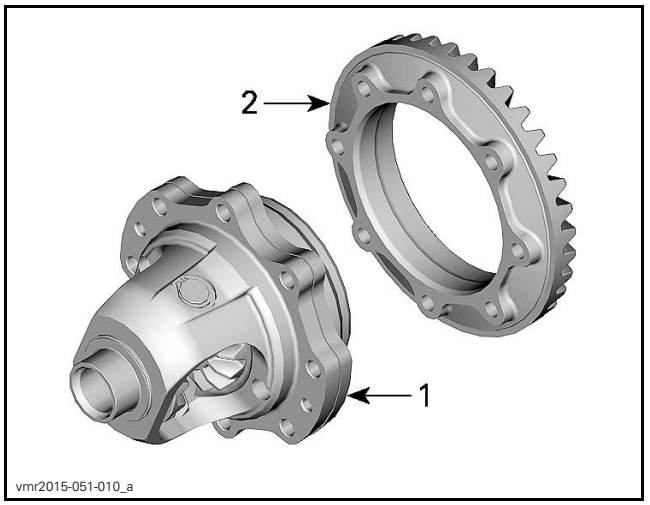
Remove Visco-Lok carrier/ring gear out of half housing.



Remove screws securing ring gear to Visco-Lok unit.



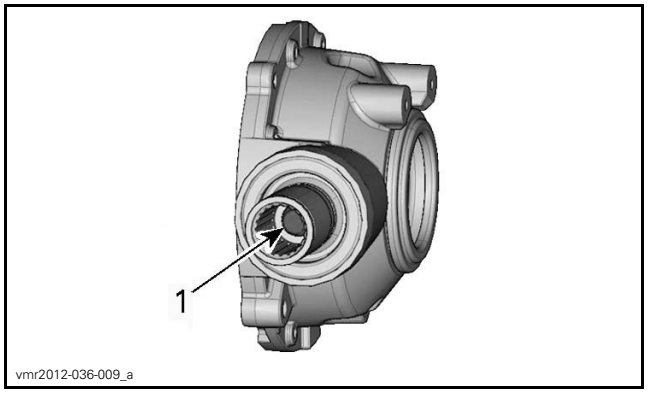
Separate ring gear from Visco-Lok unit.



1. Visco-Lok unit
2. Ring gear

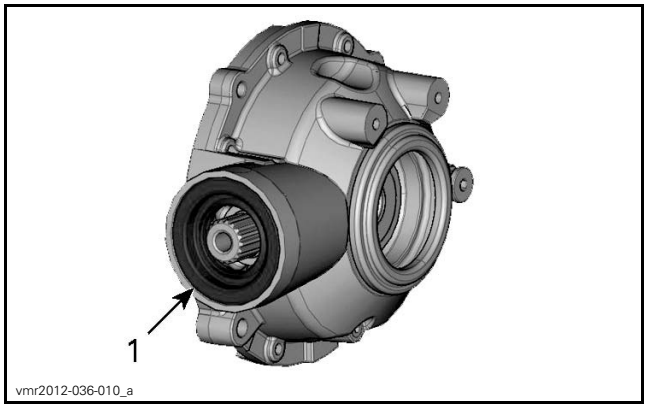
Pinion Gear

Remove screw retaining front propeller shaft adapter.



1. Retaining screw

Remove and discard oil seal.

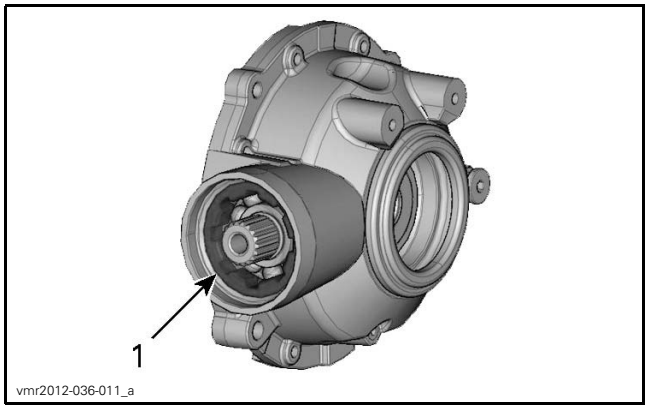


1. Oil seal

Unscrew the pinion nut.

REQUIRED TOOL
SPANNER SOCKET (P/N 529 035 649)

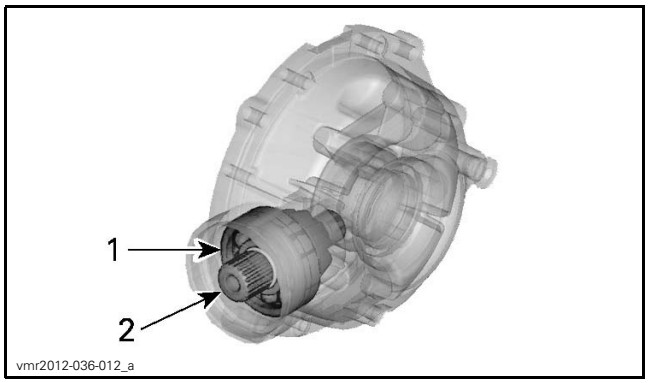




1. Pinion nut

Remove bearing and pinion gear together.

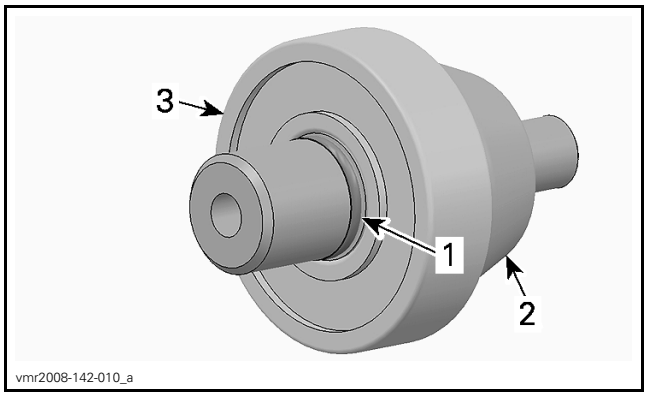
RECOMMENDED TOOLS	QTY
Pipe: 78 mm (3-1/16 in) diameter x 127 mm (5 in) in length	1
Threaded rod: M10 x 1.25, 178 mm (7 in) length	1
M10 x 1.25 nut	3
Flat bar	1



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.

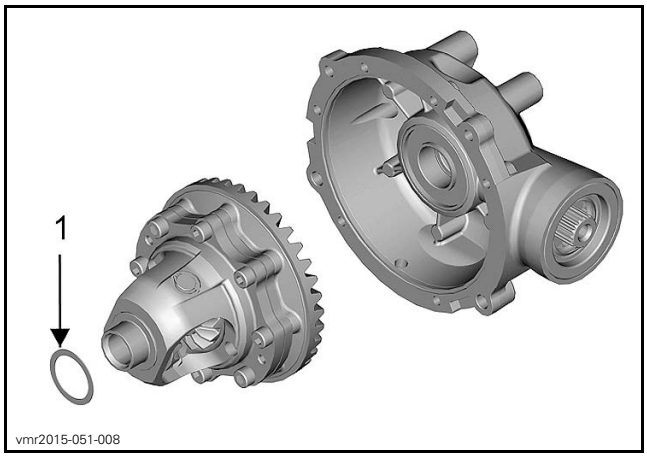
Front Differential Assembly

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.

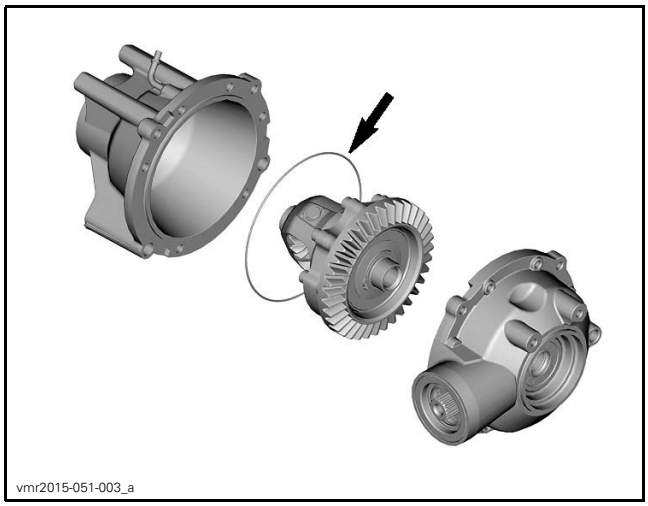
Visco-Lok Carrier/Ring Gear

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

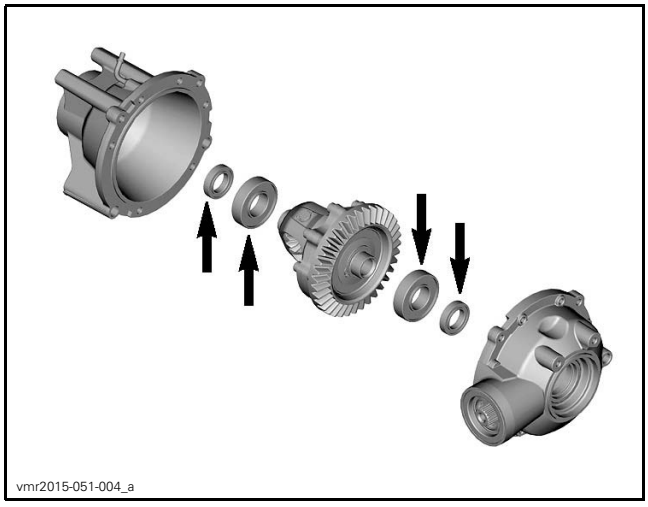
Tighten Visco-Lok / ring gear screws to specification.

TIGHTENING TORQUE	
Visco-Lok / ring gear screws	37 N•m ± 3 N•m (27 lbf•ft ± 2 lbf•ft)

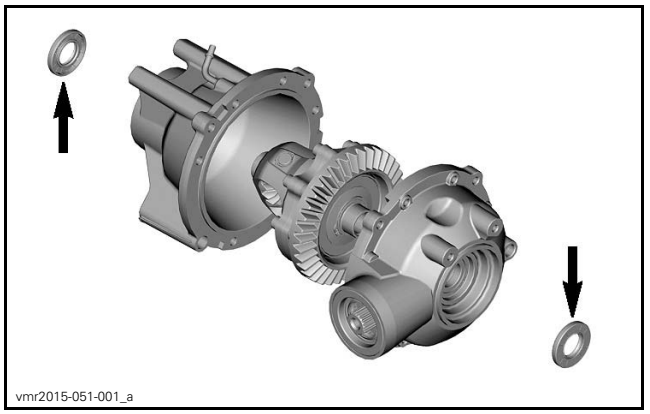
Check condition of seal. Replace if damaged.


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.

When inserting the small portion of propeller shaft into propeller shaft boot, make sure both parts of propeller shaft are well indexed.

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)

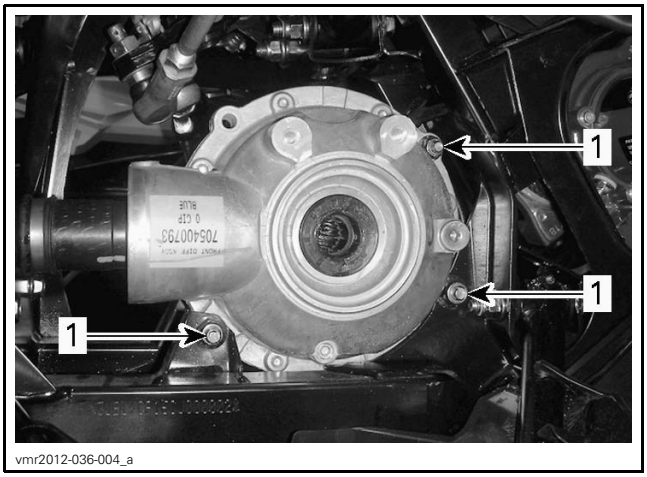
Install **NEW** Oetiker clamps.

Refill front differential with recommended oil. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

FRONT PROPELLER SHAFT

Front Propeller Shaft Removal

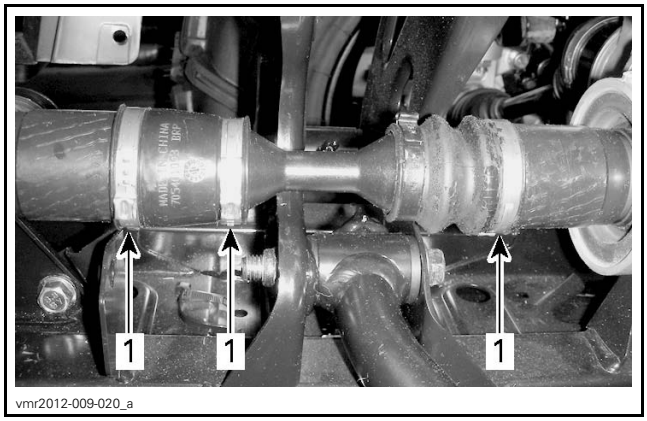
1. Lift and support vehicle.
2. Remove front wheel. Refer to *WHEELS AND TIRES* subsection.
3. Remove inner fender panel(s). Refer to *BODY* subsection.
4. Remove bolts securing front differential to frame.



vmr2012-036-004_a

1. Bolts securing front differential to frame

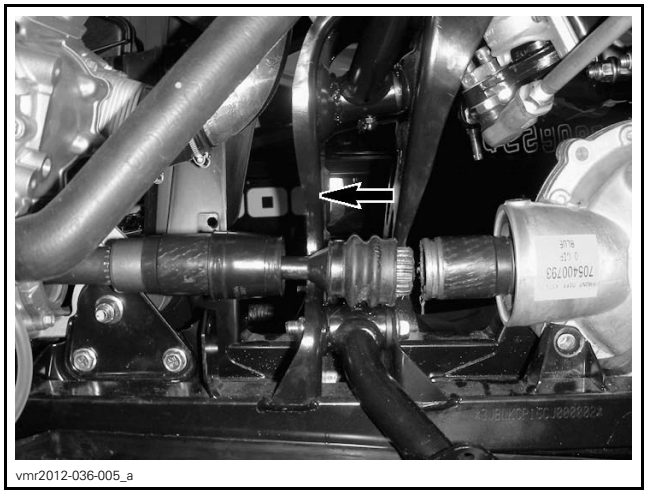
5. Remove the following Oetiker clamps from front propeller shaft.



vmr2012-009-020_a

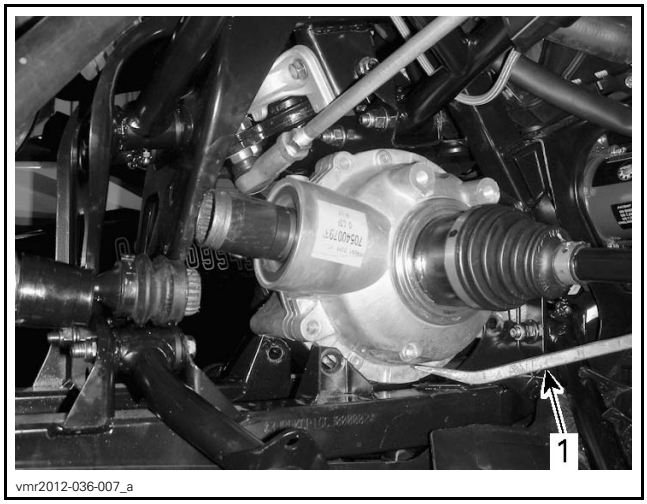
1. Oetiker clamps

6. Detach front propeller shaft from front differential by moving it rearward.


vmr2012-036-005_a

FRONT PROPELLER SHAFT MOVED REARWARD

7. Pry front differential upwards to make room.



vmr2012-036-007_a

1. Pry bar

8. Remove front propeller shaft by pulling it forward.

9. Remove front propeller shaft adapters from engine and from front differential.

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.

Tighten propeller shaft adapter screw to specification.

TIGHTENING TORQUE	
Propeller shaft adapter screw **(differential side: M10x16)**	75 N•m ± 5 N•m (55 lbf•ft ± 4 lbf•ft) **+** LOCTITE 648 (GREEN) (P/N 413 711 400)
Propeller shaft adapter screw **(engine side: M12x20)**	75 N•m ± 5 N•m (55 lbf•ft ± 4 lbf•ft) **+** LOCTITE 648 (GREEN) (P/N 413 711 400)

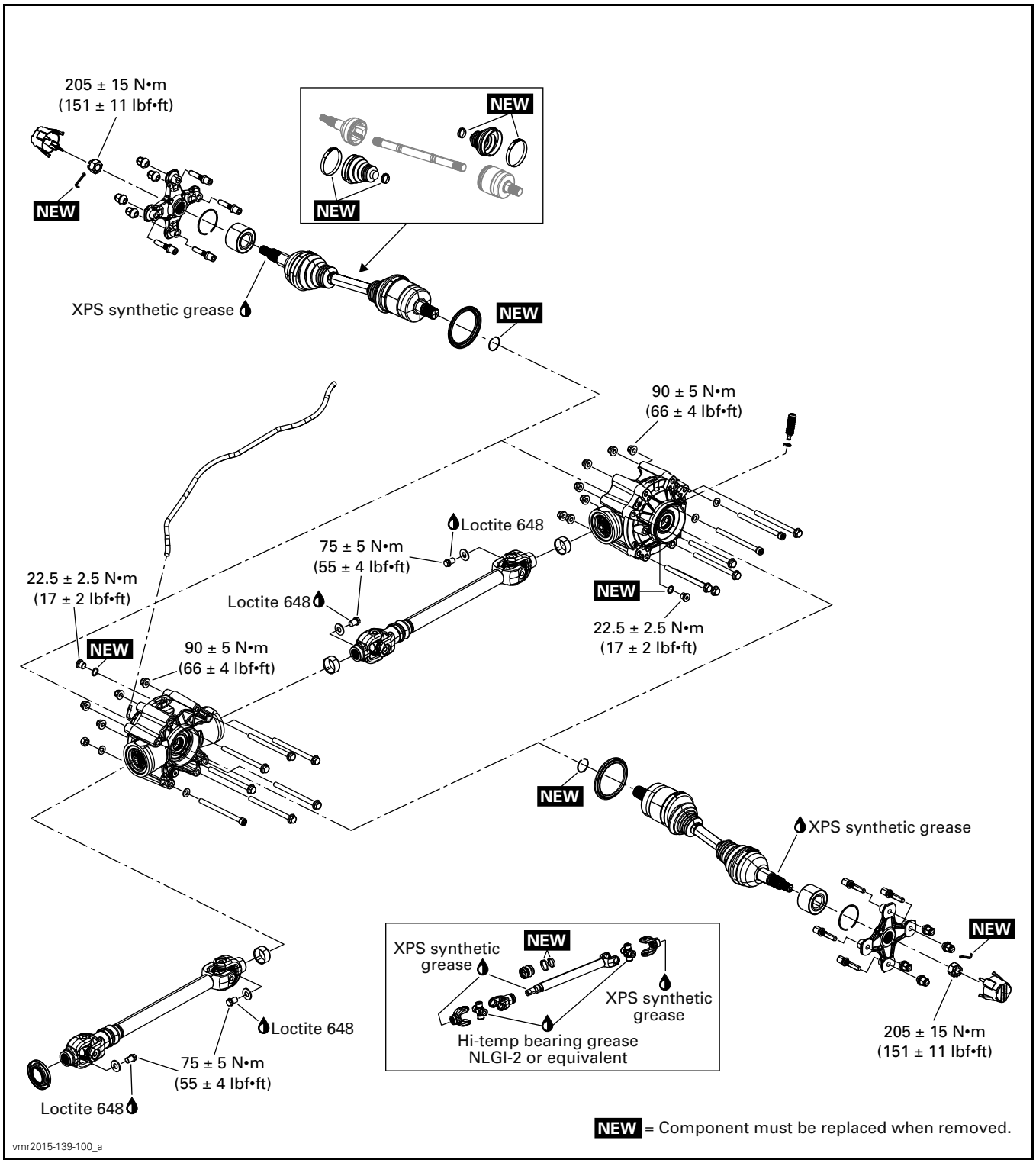
MIDDLE AND REAR FINAL DRIVE

SERVICE TOOLS

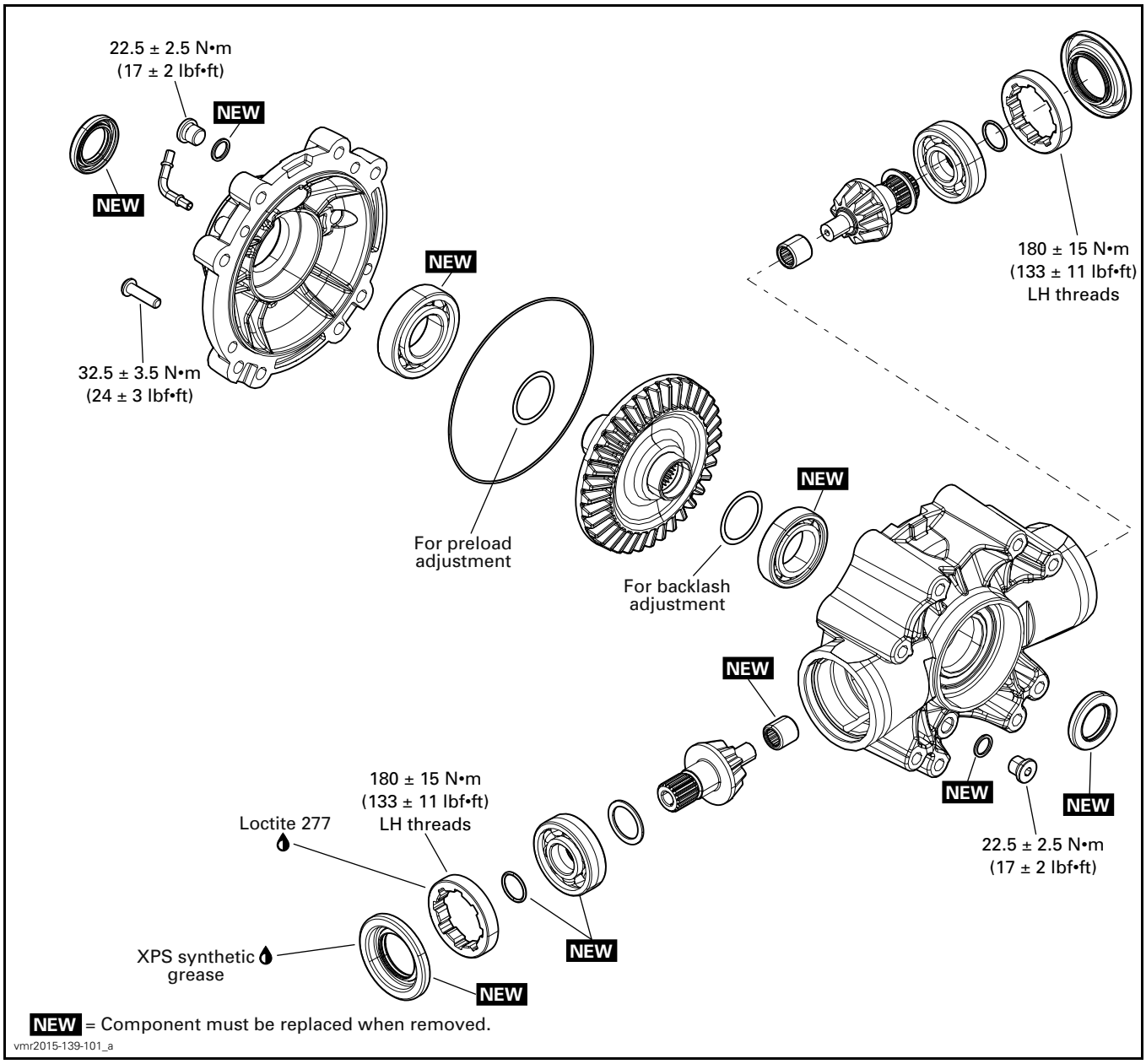
Description	Part Number	Page
BACKLASH MEASUREMENT TOOL	529 035 665	486, 491
CV BOOT CLAMP PLIER	529 036 120	482
CV JOINT EXTRACTOR	529 036 005	483
SPANNER SOCKET	529 035 649	488, 494

SERVICE PRODUCTS

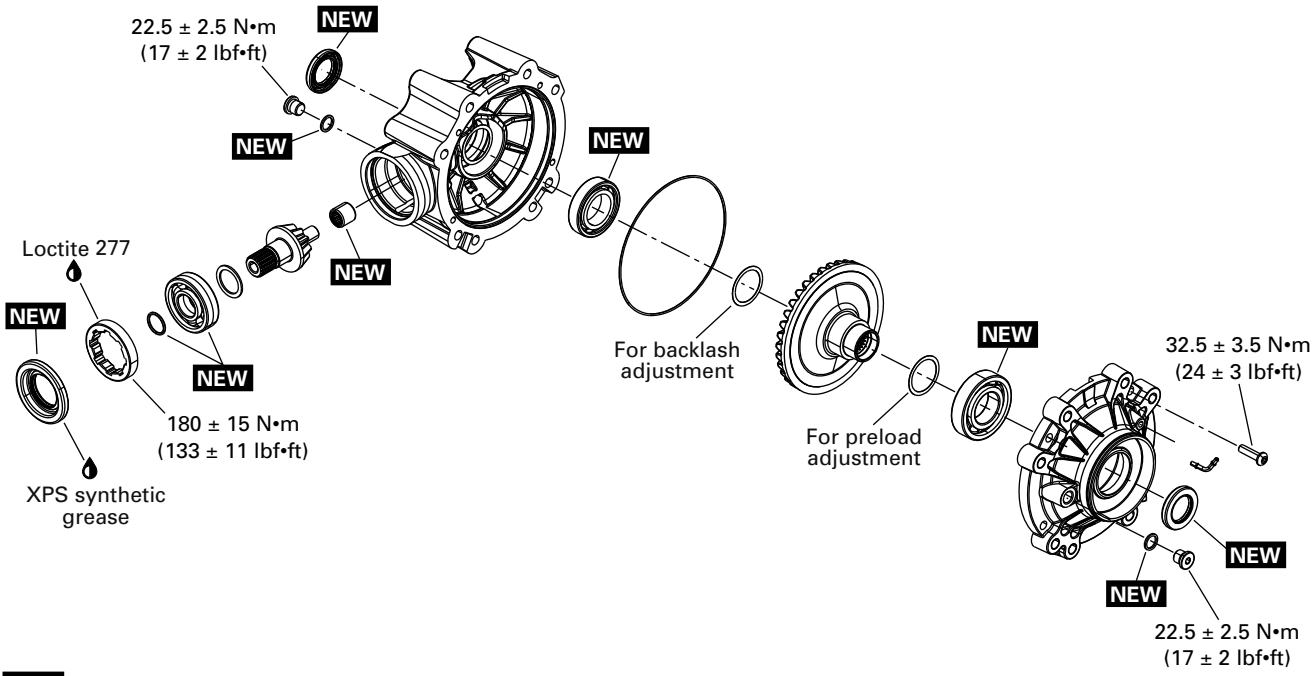
Description	Part Number	Page
LOCTITE 277	293 800 073	490–491, 496
LOCTITE 648 (GREEN)	413 711 400	485
XPS SYNTHETIC GREASE	293 550 010	481, 485


205 ± 15 N•m
(151 ± 11 lbf•ft)
NEW
NEW
NEW
NEW
XPS synthetic grease
90 ± 5 N•m
(66 ± 4 lbf•ft)
Loctite 648
75 ± 5 N•m
(55 ± 4 lbf•ft)
22.5 ± 2.5 N•m
(17 ± 2 lbf•ft)
Loctite 648
NEW
NEW
22.5 ± 2.5 N•m
(17 ± 2 lbf•ft)
90 ± 5 N•m
(66 ± 4 lbf•ft)
NEW
XPS synthetic grease
NEW
XPS synthetic grease
NEW
XPS synthetic grease
Hi-temp bearing grease
NLGI-2 or equivalent
205 ± 15 N•m
(151 ± 11 lbf•ft)
Loctite 648
75 ± 5 N•m
(55 ± 4 lbf•ft)
Loctite 648
NEW = Component must be replaced when removed.
vmr2015-139-100_a

MIDDLE DRIVE



REAR DRIVE



NEW = Component must be replaced when removed.

vmr2015-139-102_a

PROCEDURES

WHEEL HUB

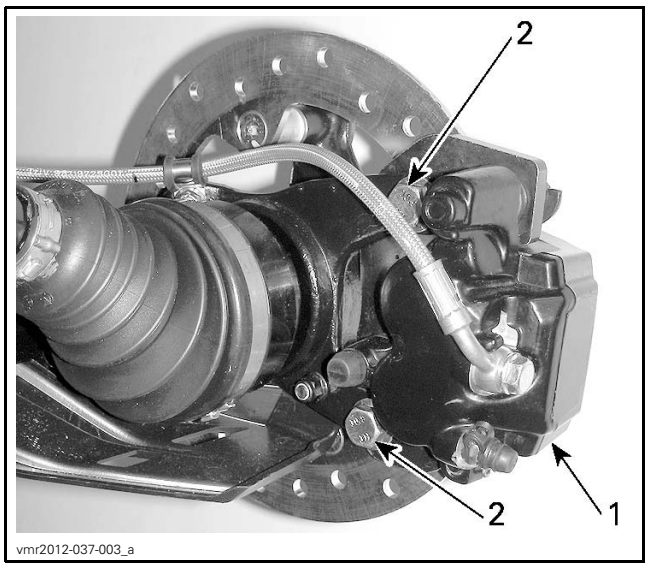
Wheel Hub Removal

Lift and support vehicle.

Remove the wheel. Refer to *WHEELS AND TIRES* subsection.

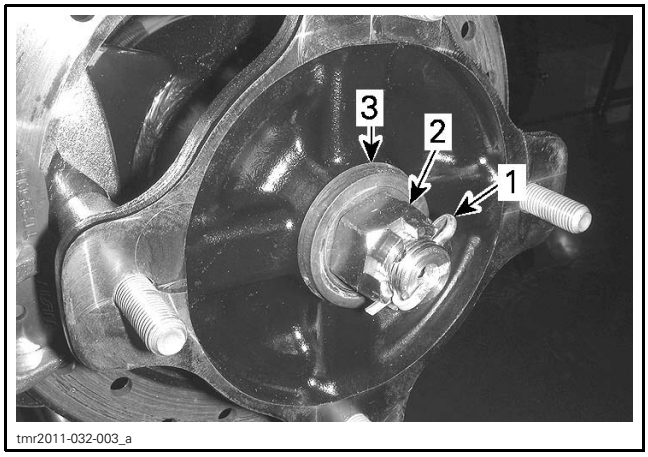
Remove the following parts:

– Caliper mounting bolts (if applicable), refer to *BRAKES* subsection
– Hub cap
– Cotter pin
– Wheel hub nut
– Belleville washer.



vmr2012-037-003_a

1. Caliper
2. Remove bolts



tmr2011-032-003_a

TYPICAL
1. Cotter pin
2. Wheel hub nut
3. Belleville washer

Remove wheel hub.

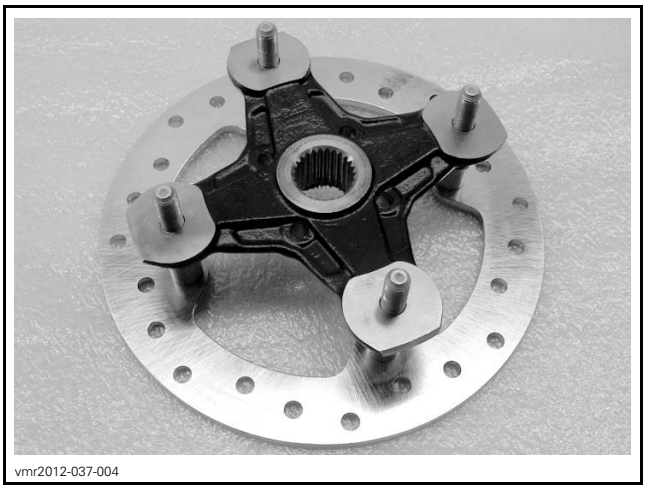
Wheel Hub Inspection

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.

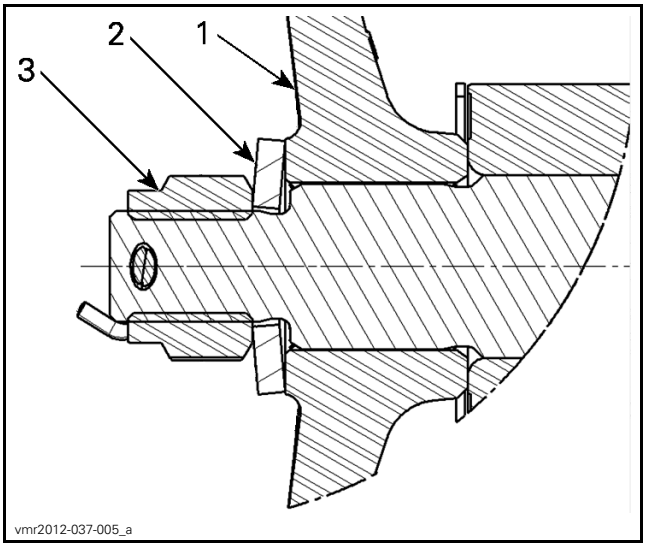

vmr2012-037-004

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.



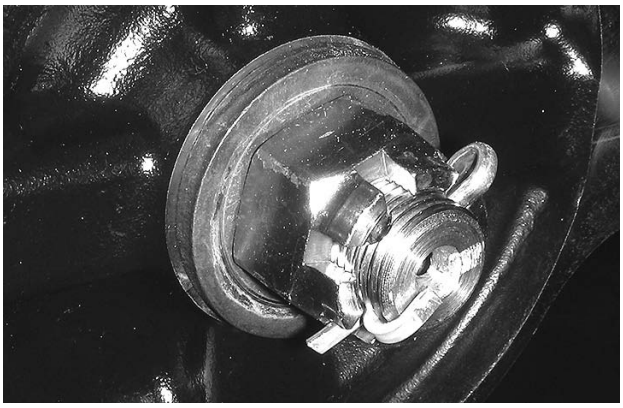
vmr2012-037-005_a

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)

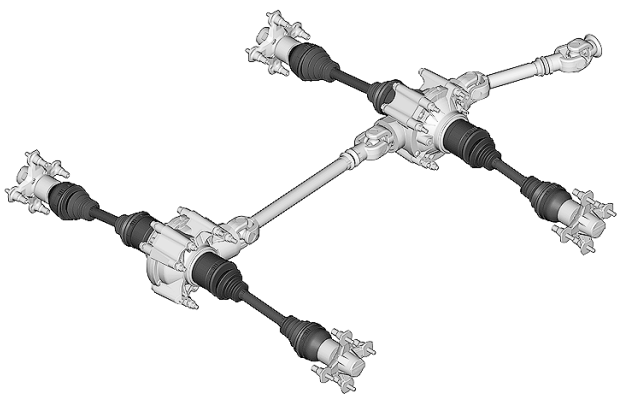
NOTE: If required, tighten castellated nut further to align grooves with drive shaft hole.

Install a NEW cotter pin.


tmr2011-032-005

DRIVE SHAFT

Drive Shaft Removal


vmr2015-139-001

Remove the wheel hub. See procedure in this subsection.

Drain oil from applicable differential. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

Remove trailing arm. Refer to *REAR SUSPENSION* subsection.

Strongly pull drive shaft out of differential.

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*.

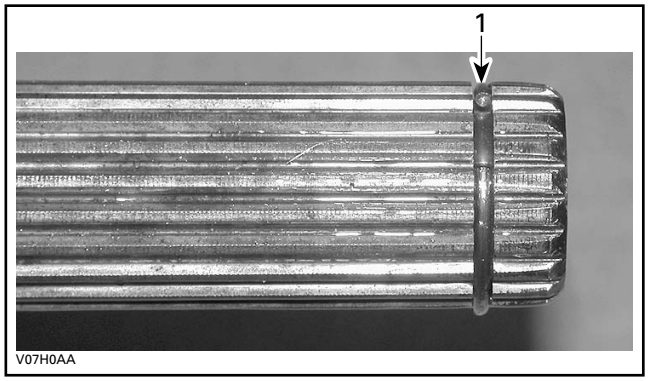
Check shaft splines. Replace drive shaft if necessary.

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.



TYPICAL
1. NEW stop ring

After drive shaft insertion in rear final drive, validate if properly locked.

Refill rear final drive. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

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.

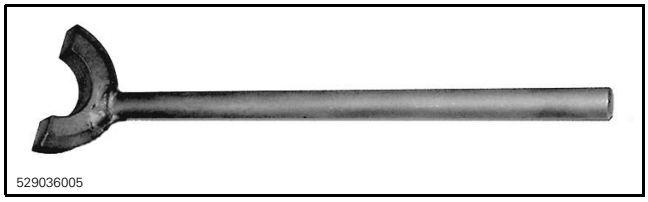
Remove boot from drive shaft.

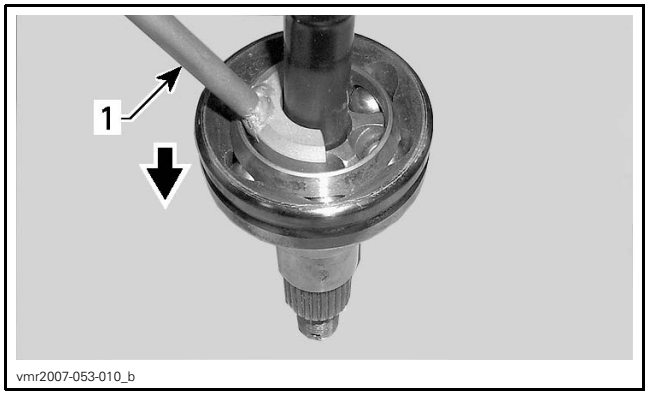
Remove and discard the circlip. A new one is included in the boot kit.

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

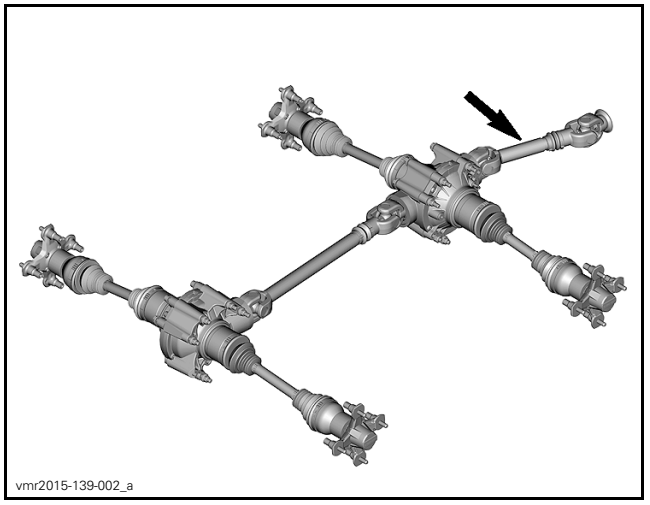
The installation is the reverse of the removal procedure. However, pay attention to the following:

Pack bearing area with grease (included with the new boot kit).

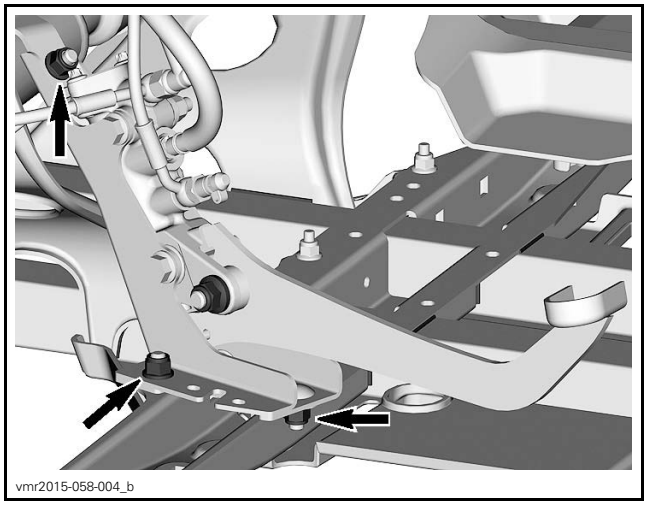
NOTE: Do not use any other grease.

PROPELLER SHAFT

Middle Propeller Shaft Removal

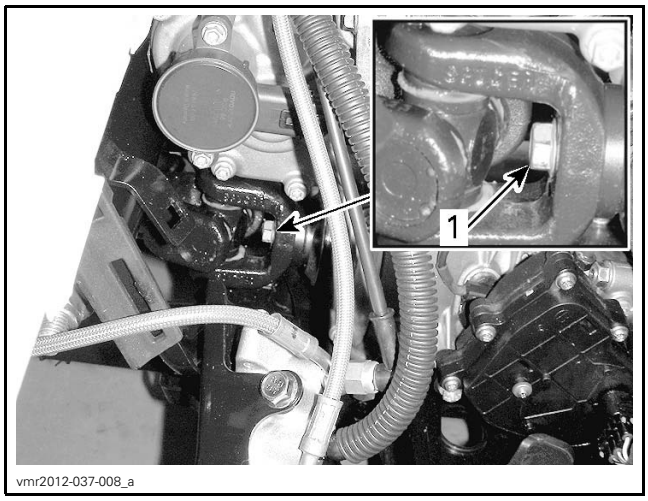


1. Remove middle drive. Refer to *MIDDLE DRIVE REMOVAL* in this subsection.
2. Detach brake master cylinder from frame.



3. From RH side of vehicle, remove propeller shaft screw from gearbox output shaft.

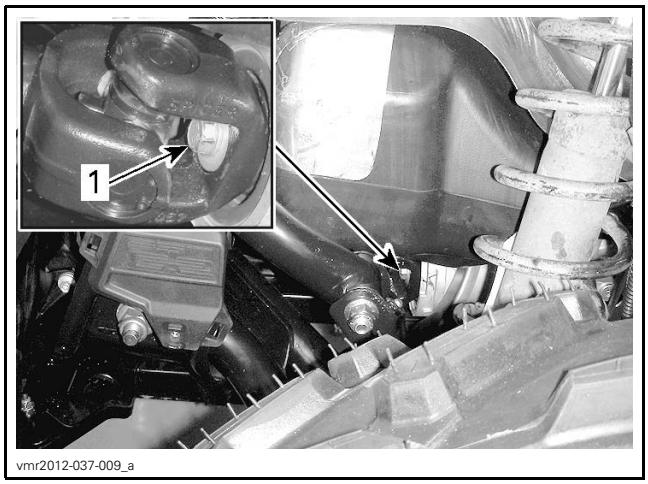
NOTE: Heat screw to break the threadlocker bond prior to removal.



TYPICAL — RH SIDE OF VEHICLE
1. Propeller shaft screw

4. From LH side of vehicle, remove middle propeller shaft screw from middle drive yoke.

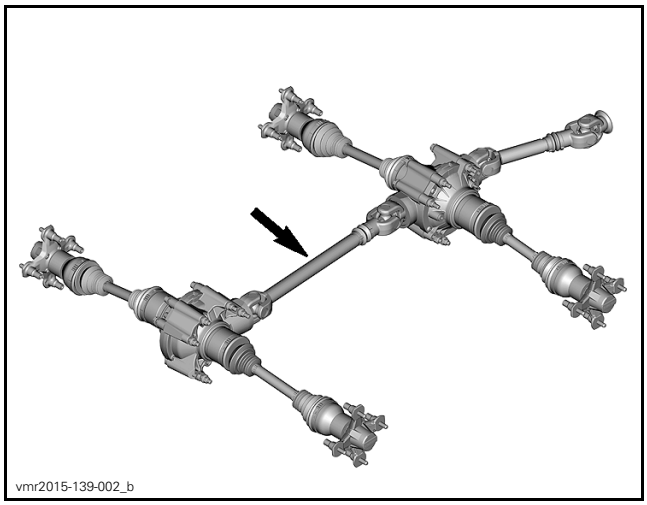
NOTE: Heat screw to break the threadlocker bond prior to removal.



TYPICAL — LH SIDE OF VEHICLE
1. Propeller shaft screw

5. Remove the propeller shaft.

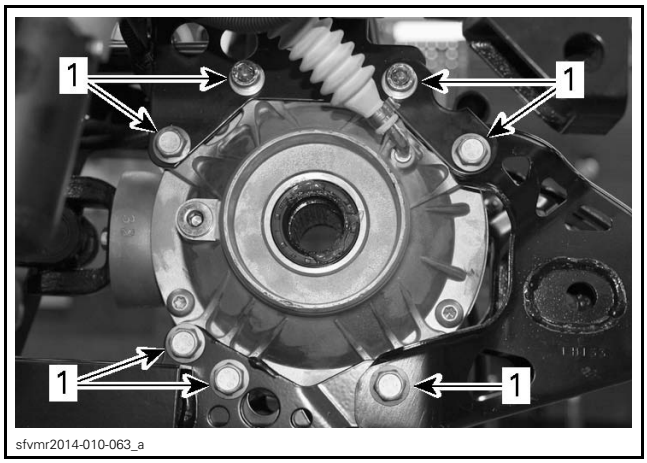
Rear Propeller Shaft Removal



1. Remove middle and rear wheels. Refer to *WHEELS AND TIRES* subsection.
2. Drain oil from middle and rear final drive. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
3. Remove rear propeller shaft screws from middle and rear drive yoke.

NOTE: Heat screw to break the threadlocker bond prior to removal.

4. Remove rear final drive retaining screws and nuts. Refer to *REAR FINAL DRIVE* in this subsection.



TYPICAL - SOME PARTS REMOVED FOR CLARITY
1. Retaining screws

5. Move the rear final drive rearward to allow dislodging the propeller shaft.
6. Dislodge the propeller shaft from middle drive.
7. Remove the 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.

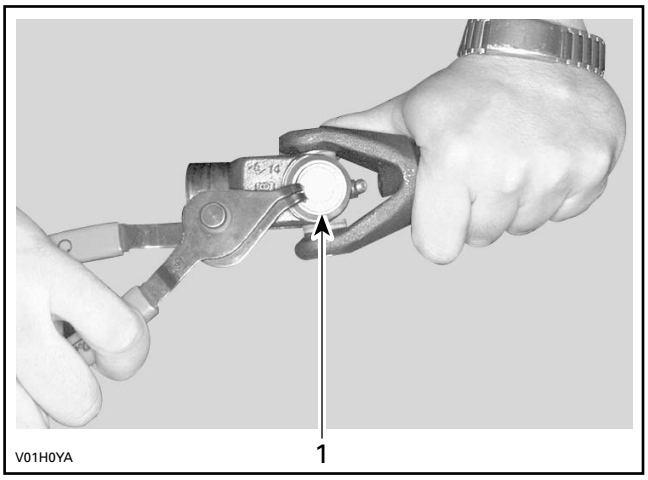
PARTS	TORQUE
Propeller shaft screw	75 N•m ± 5 N•m (55 lbf•ft ± 4 lbf•ft) + LOCTITE 648 (GREEN) (P/N 413 711 400)

Refill rear final drive. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

PROPELLER SHAFT U-JOINTS

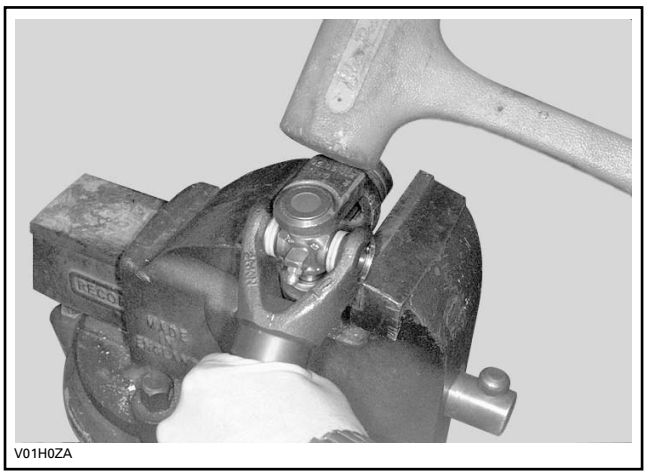
Propeller Shaft U-Joint Removal

Remove internal snap ring from bearing caps.



1. Snap ring

Support inner yoke in vice and drive other yoke down with a soft hammer.



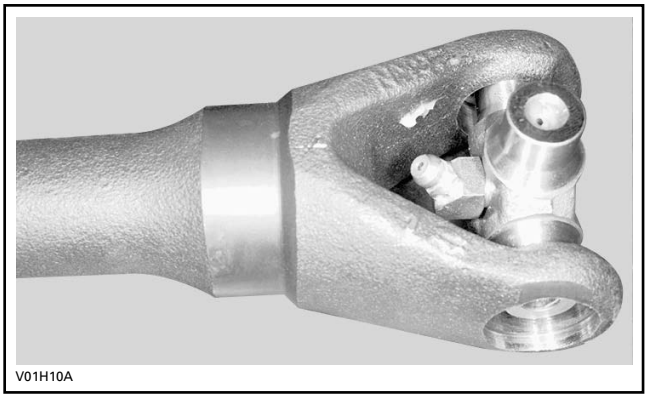
Support U-joint in vice and drive inner yoke down to remove remaining bearing caps.

Remove U-joint cross.

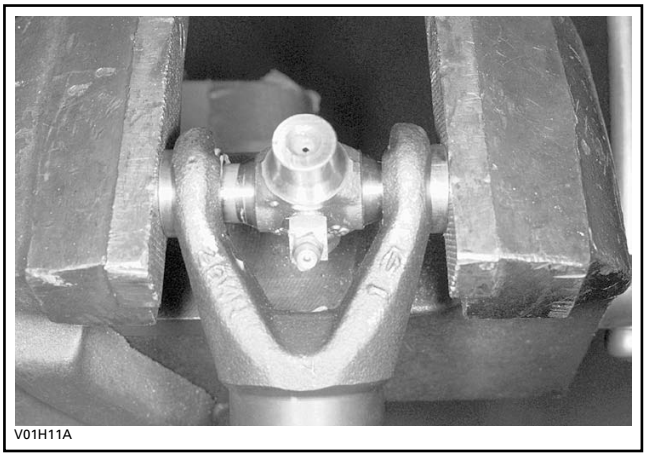
Propeller Shaft U-Joint Installation

Install a **NEW** U-joint in inner yoke.

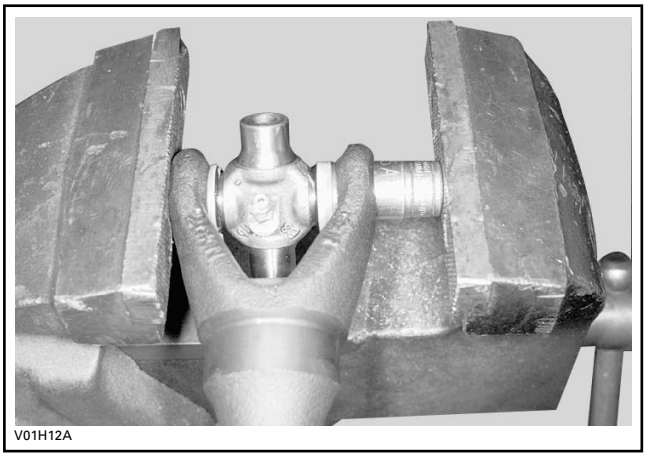
NOTE: Position propeller shaft U-joint as shown for proper grease fitting location.



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.

MIDDLE DRIVE

Middle Drive Removal

Remove drive shafts. See procedure in this subsection.

Remove rear frame.Refer to *FRAME* subsection.

Remove the middle drive.

Middle Drive Inspection (Assembled)

Manually turn rear middle gear; it should turn smoothly. Repair if necessary.

Check if oil seals are brittle, hard or damaged. Replace if necessary.

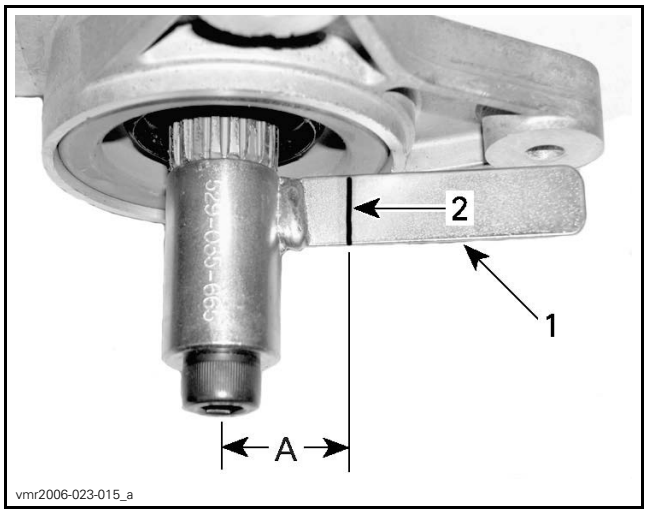
Backlash Inspection

Using a dial indicator and the BACKLASH MEASUREMENT TOOL (P/N 529 035 665), measure the backlash.

NOTE: Measure both pinion gears.

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.

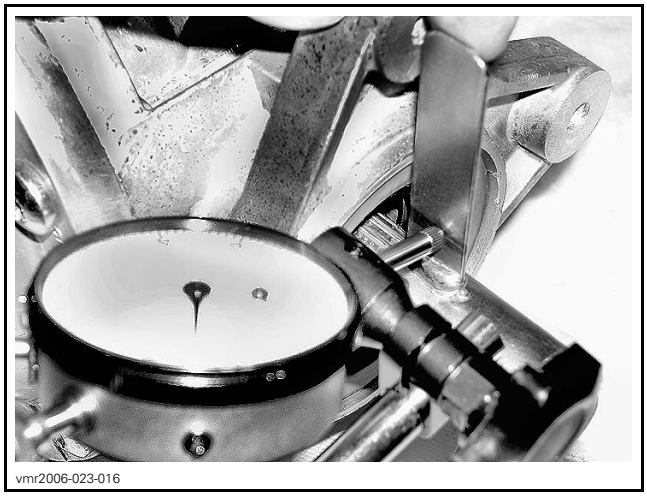


vmr2006-023-015_a

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

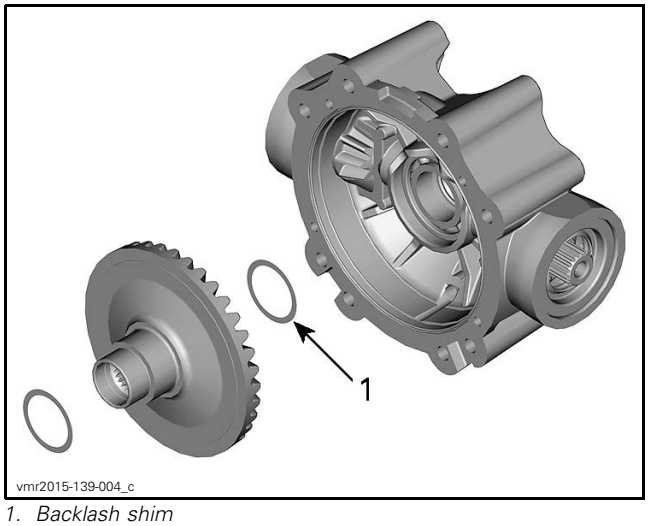
Rotate pinion gear 1/2 turn and recheck backlash. Note the result.

Rotate pinion gear 1 turn and recheck backlash.

BACKLASH SPECIFICATION
0.05 mm (.002 in) to 0.36 mm (.014 in)

If backlash is out of specification, split middle drive housing and adjust shim thickness as per following guideline.

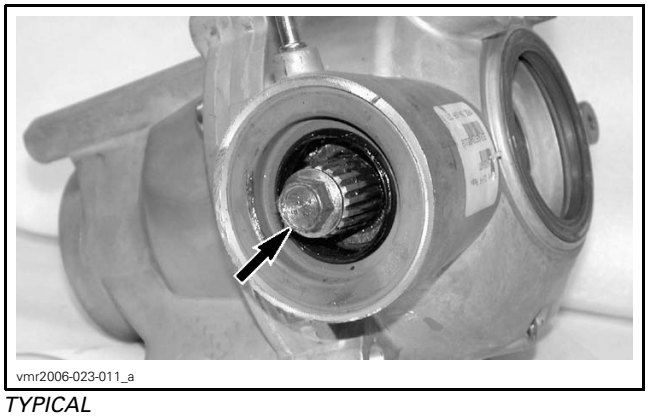
BACKLASH ADJUSTMENT GUIDELINE	
BACKLASH MEASUREMENT	WHAT TO DO
Below 0.05 mm (.002 in)	Add shim(s) and recheck backlash
Above 0.36 mm (.014 in)	Remove shim(s) and recheck backlash



1. Backlash shim

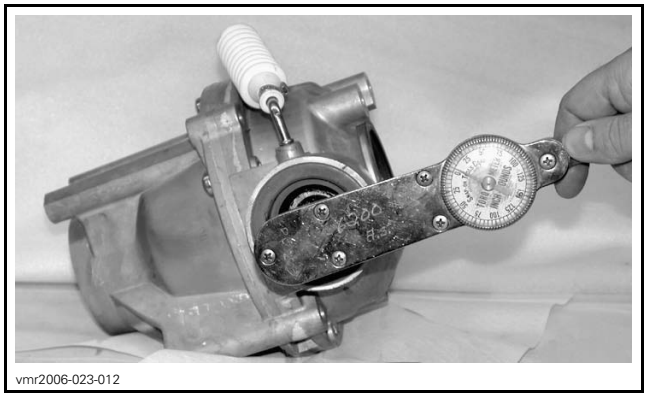
Preload Inspection

Screw the propeller shaft screw in pinion gear.



TYPICAL

Using a needle torque wrench, measure the preload.

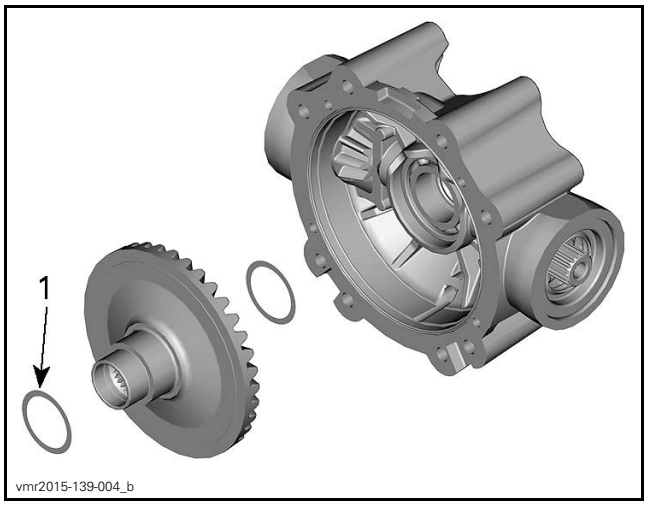


TYPICAL

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

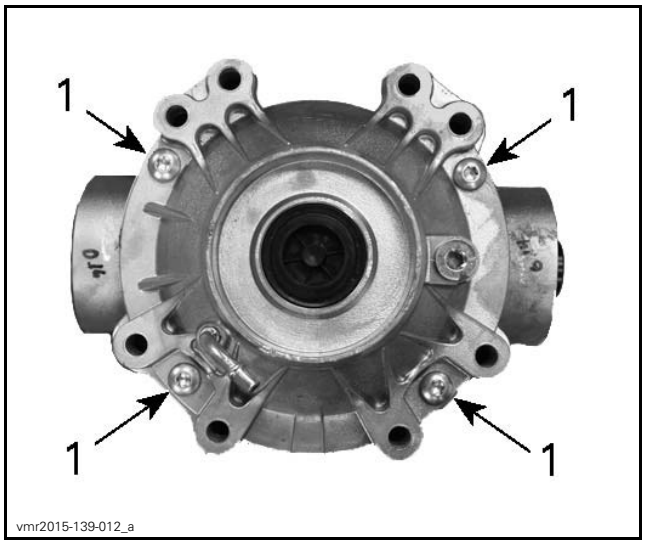


1. Preload shim

Middle Drive Disassembly

Ring Gear Removal

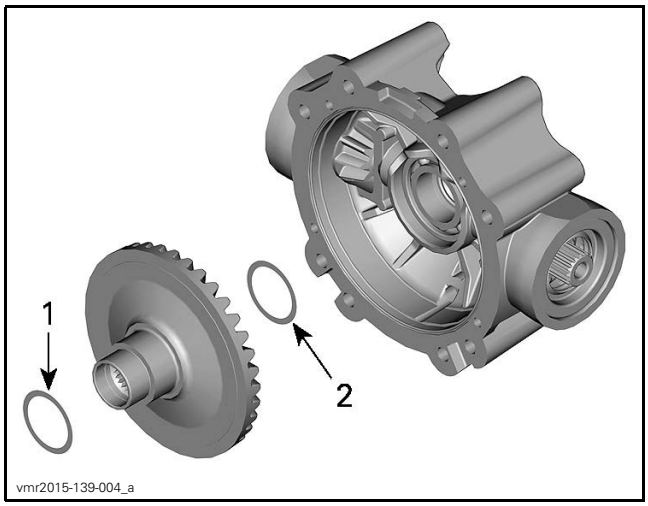
Remove the middle drive housing screws.



1. Housing screws

Split middle drive housings.

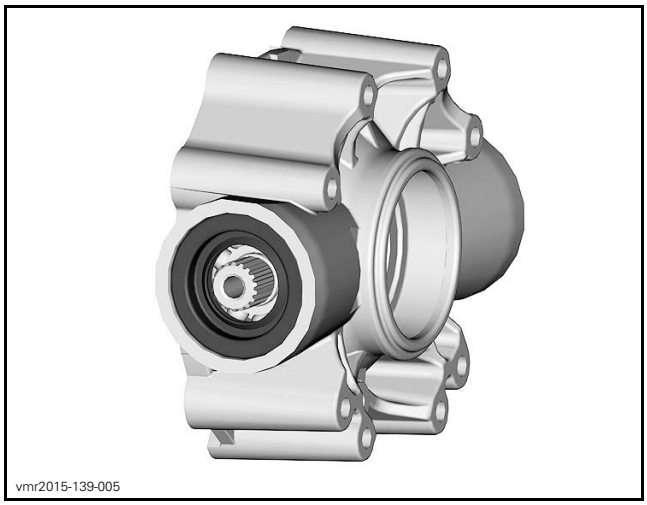
NOTE: Be careful to keep track of shims on ring gear.



Extract ring gear out of half housing.

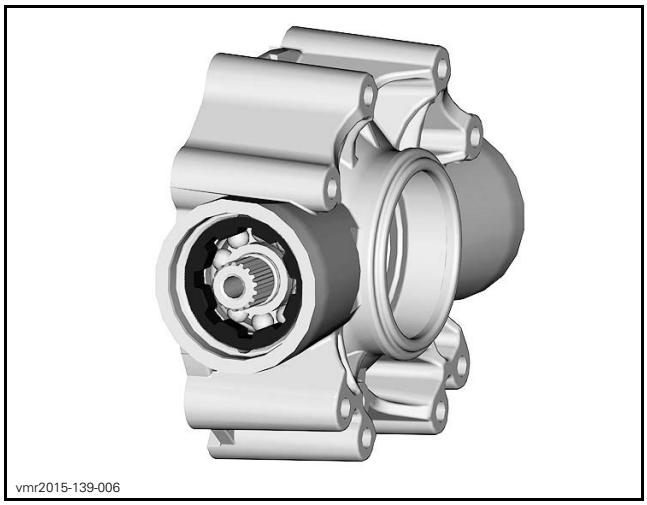
Pinion Gear Removal

Remove and discard oil seal.



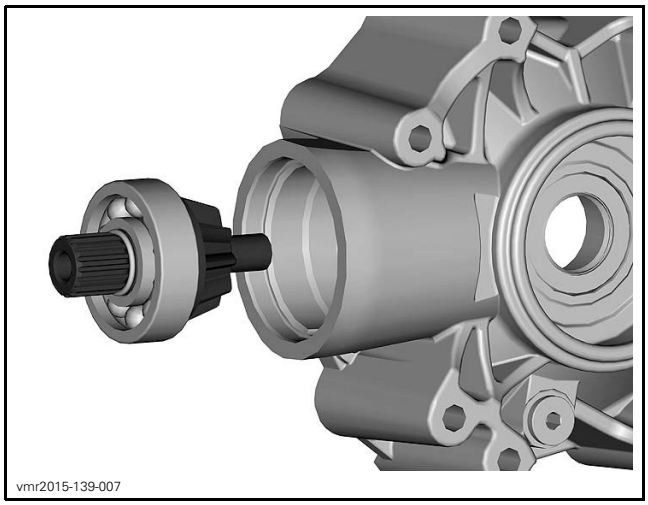
Unscrew the pinion nut. Use the SPANNER SOCKET (P/N 529 035 649).

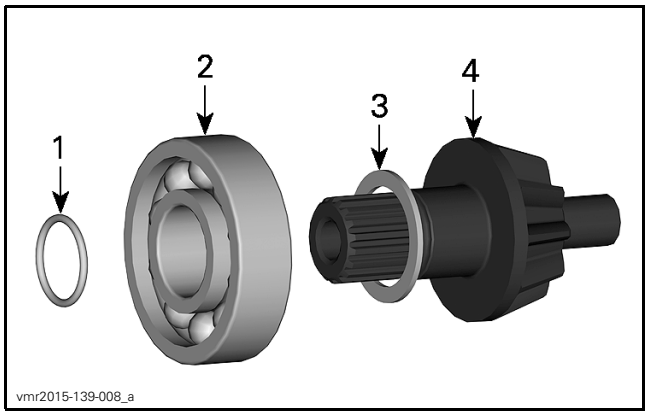




NOTE: The pinion nut is left hand threaded. Unscrew by turning clockwise.

Remove the bearing along with the pinion gear. Be careful to keep track of shims. Discard bearing.


vmr2015-139-007



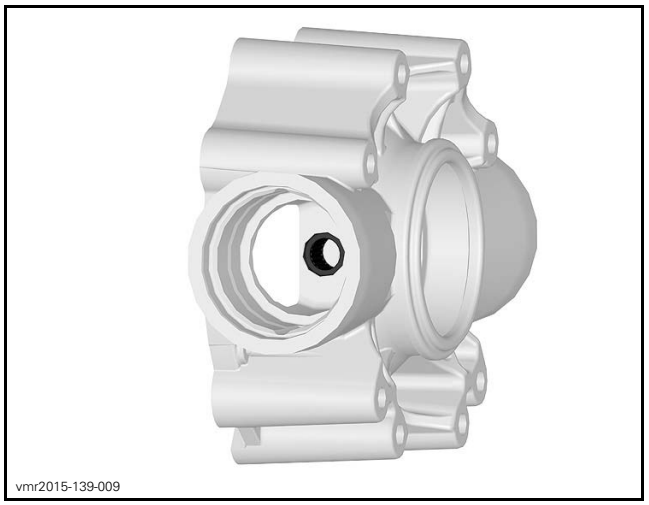
vmr2015-139-008_a

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: 89 mm (3-1/2 in) diameter x 127 mm (5 in)	1
Threaded rod: M12 x 1.25 x 178 mm (7 in)	1
M12 x 1.25 nut	3
Flat bar	1

Remove and discard the needle bearing.


vmr2015-139-009

Middle Drive Assembled

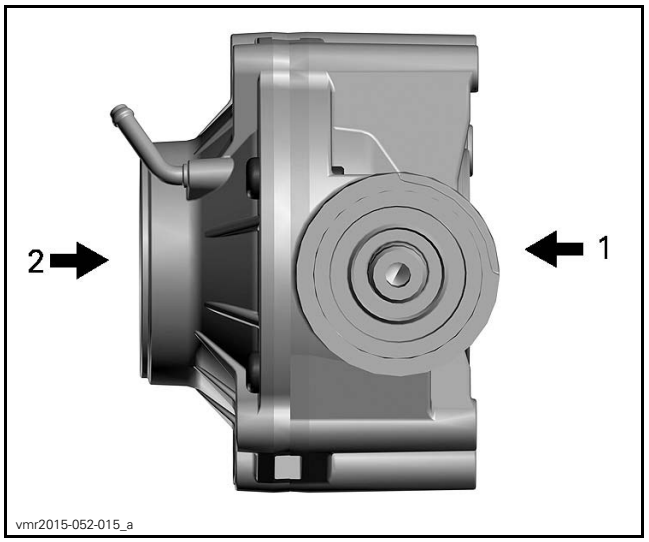
Adjustment is required when any of the following part is changed.

– Pinion gear
– Ring gear
– Housing.

As a preliminary setup, install shims according to the following table.

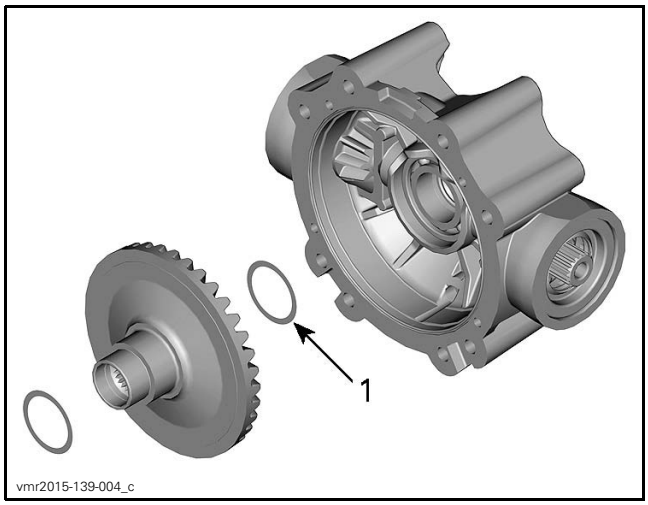
RECOMMENDED SHIM THICKNESS	
PINION GEAR (1)	1.67 mm ± 0.04 mm (.066 in ± .002 in)
BACKLASH	0.5 mm (.02 in) (as a preliminary adjustment)
PRELOAD	

(1) The pinion gear shim thickness should never be altered. Any adjustment should be done on preload and/or backlash shims.

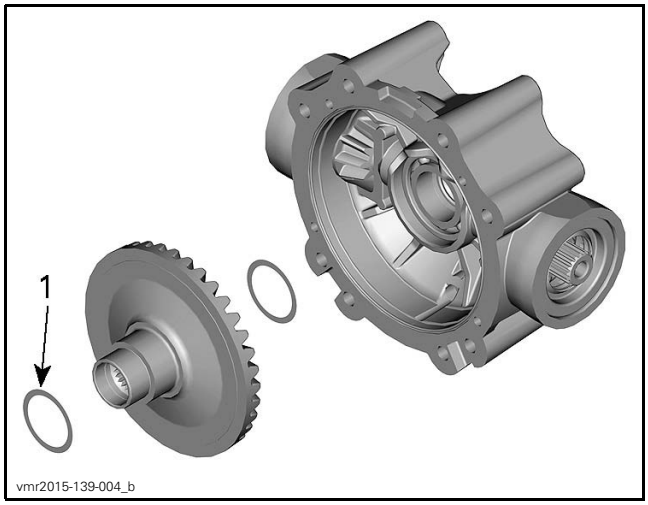


vmr2015-052-015_a

1. *Backlash side*
2. *Preload side*



1. Backlash shim



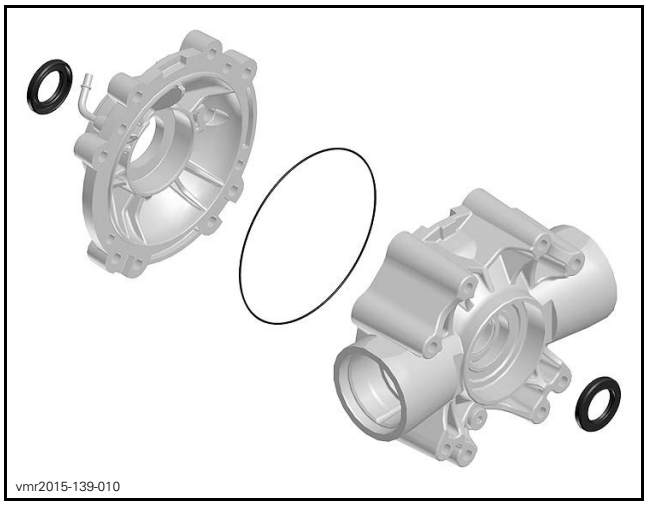
1. Preload shim

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.

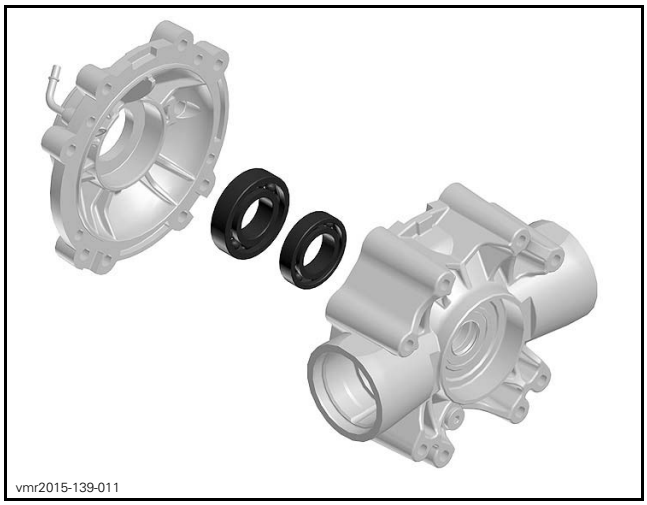
Ring Gear Installation

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

Check condition of seals. Replace if damaged.



Install **NEW** bearings.



Tighten middle drive housing screws to specification.

TIGHTENING TORQUE	
Middle drive housing screws	32 N•m ± 3 N•m (24 lbf•ft ± 2 lbf•ft)

Pinion Gears Installation

NOTE: The procedure is the same for both pinions.

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 to 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.

Middle Drive Installation

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

INSTALLATION TIPS
Begin by installing the lowest middle drive retaining bolt. Pay attention to inserting middle drive retaining bolts through all the bracket holes. At some places there is 2 brackets thick. Loosely install all bolts prior to tightening bolts.

Tighten middle drive retaining nuts to specification.

PART	TORQUE
Middle drive retaining nuts	90 N•m ± 5 N•m (66 lbf•ft ± 4 lbf•ft)

Refill the middle drive with recommended oil. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

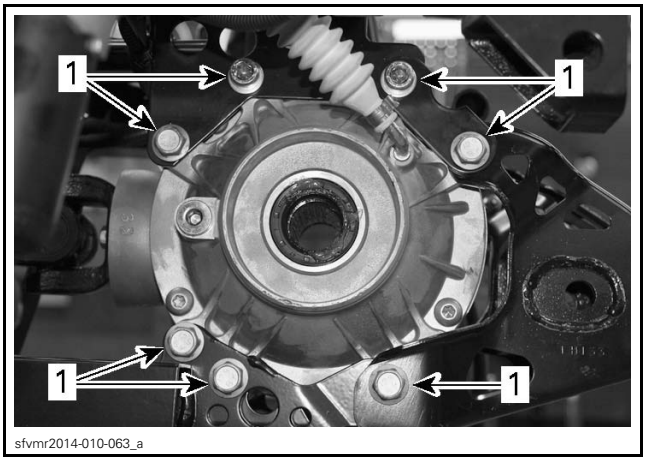
REAR FINAL DRIVE

Rear Final Drive Removal

Remove drive shafts. Refer to *DRIVE SHAFT REMOVAL* 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).



TYPICAL
1. Retaining screws

Unplug the vent hose from final drive.

Remove the final drive.

Rear Final Drive Inspection (Assembled)

Manually turn rear final drive gear; it should turn smoothly. Repair if necessary.

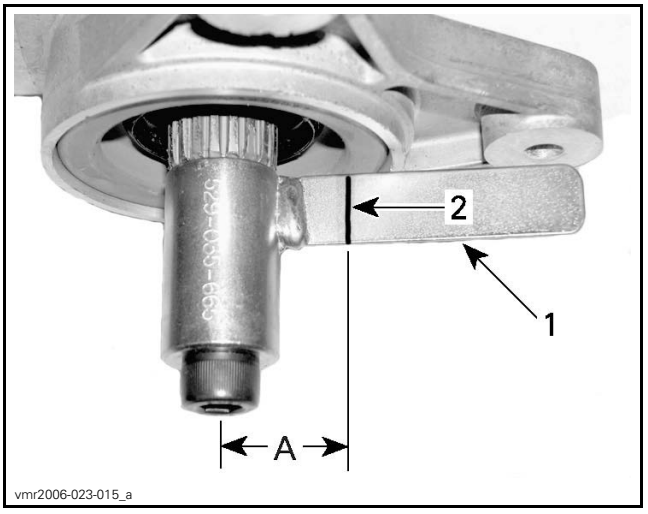
Check if oil seals are brittle, hard or damaged. Replace if necessary.

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.

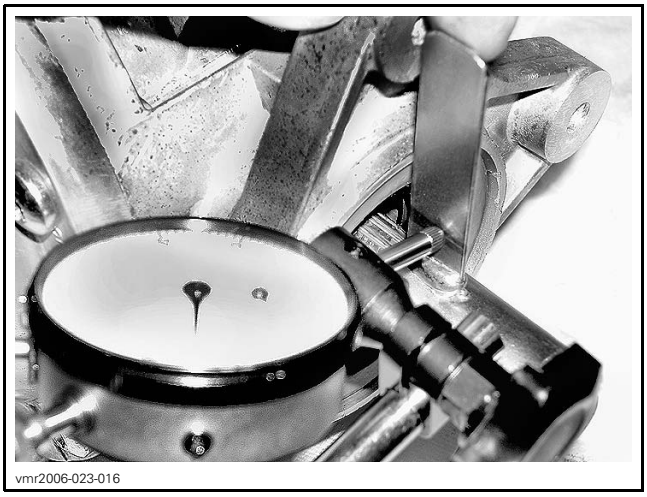
From center of tool bolt, measure 25.4 mm (1 in) and scribe a mark on the tab.



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.


vmr2006-023-016

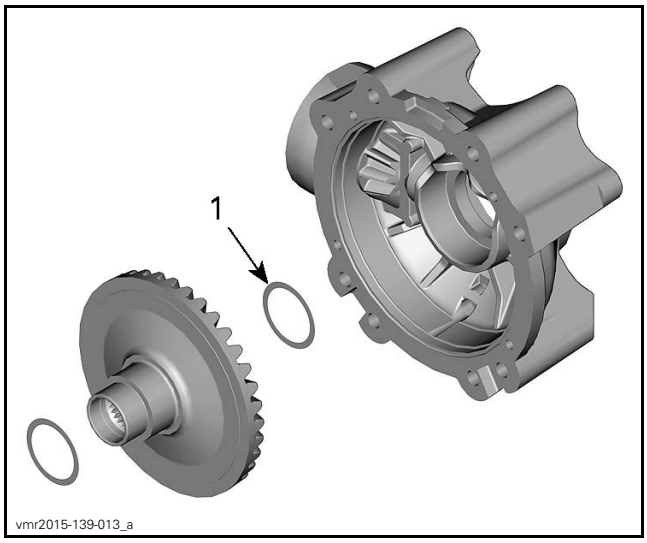
Rotate pinion gear 1/2 turn and recheck backlash. Note the result.

Rotate pinion gear 1 turn and recheck backlash.

BACKLASH SPECIFICATION
0.05 mm to 0.36 mm (.002 in to .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 0.05 mm (.002 in)	Add shim(s) and recheck backlash
Above 0.36 mm (.014 in)	Remove shim(s) and recheck backlash

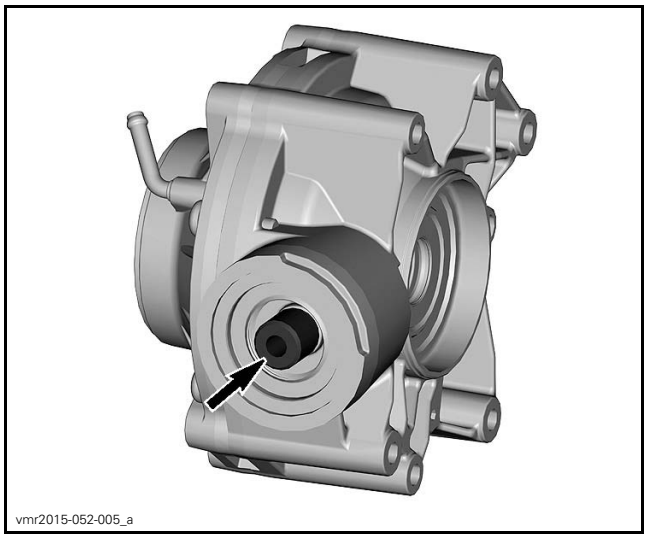


vmr2015-139-013_a

1. Backlash shim

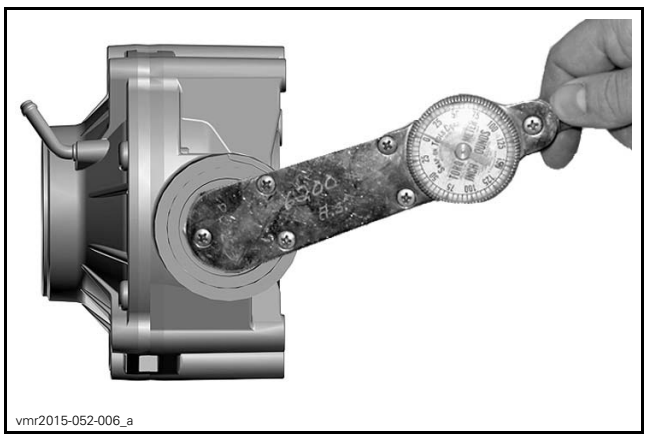
Preload Inspection

Screw the propeller shaft screw in pinion gear.


vmr2015-052-005_a

TYPICAL

Using a needle torque wrench, measure the preload.

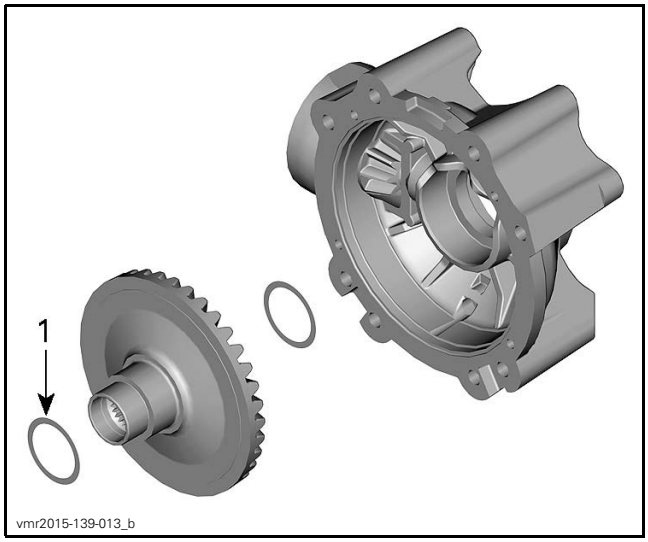

vmr2015-052-006_a

TYPICAL

PRELOAD SPECIFICATION
0.06 N•m to 0.5 N•m (1 lbf•**in** to 4 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

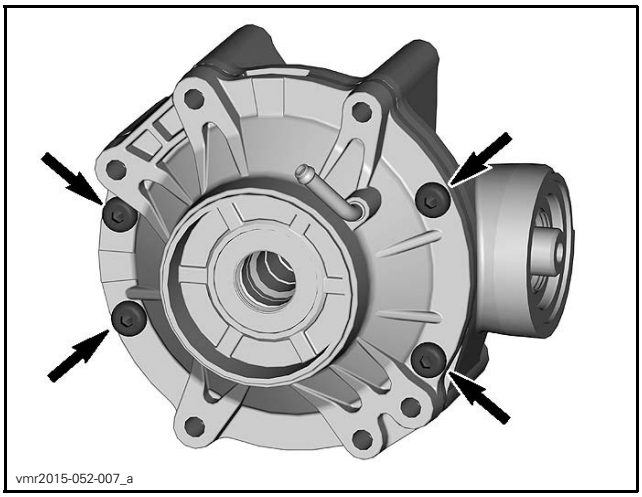


1. Preload shim

Rear Final Drive Disassembly

Ring Gear Removal

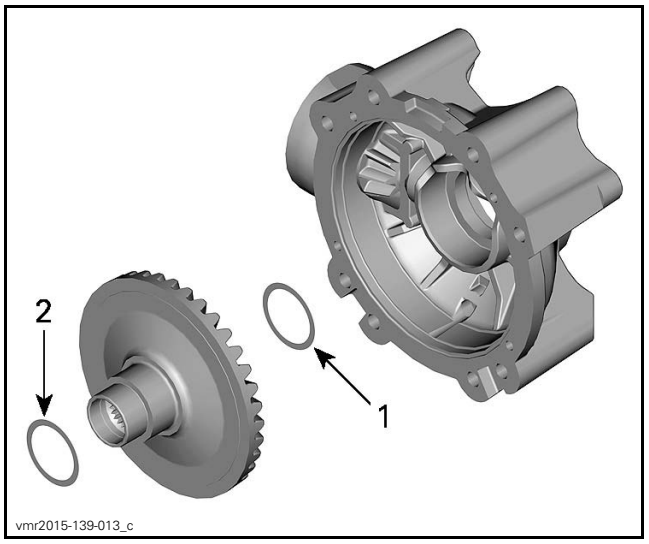
Remove the final drive housing screws.



TYPICAL

Split final drive housings.

NOTE: Be careful to keep track of shims on ring gear.

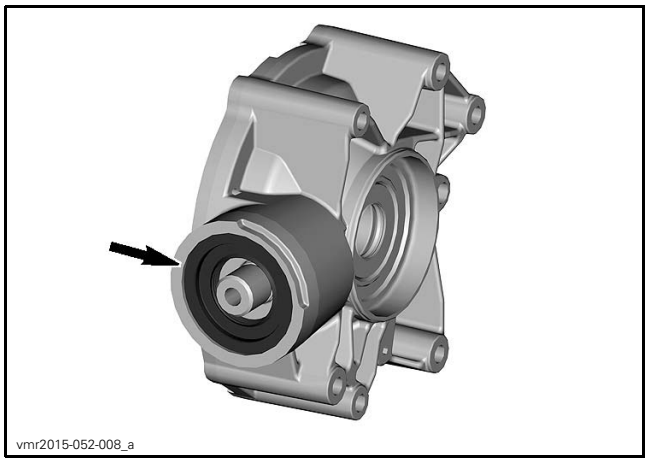


1. Backlash shim
2. Preload shim

Extract ring gear out of half housing.

Pinion Gear Removal

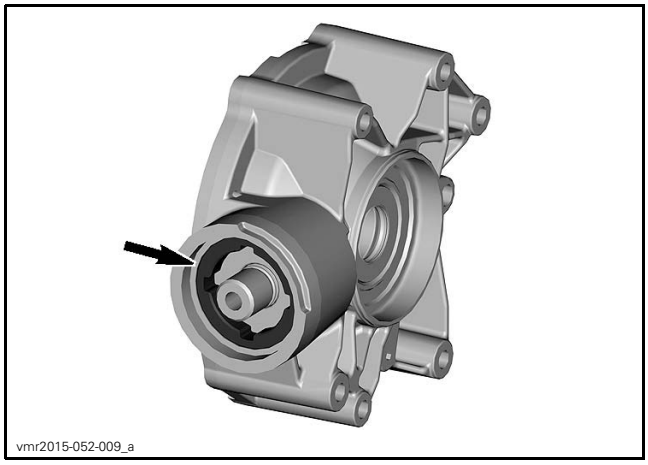
Remove and discard oil seal.



TYPICAL

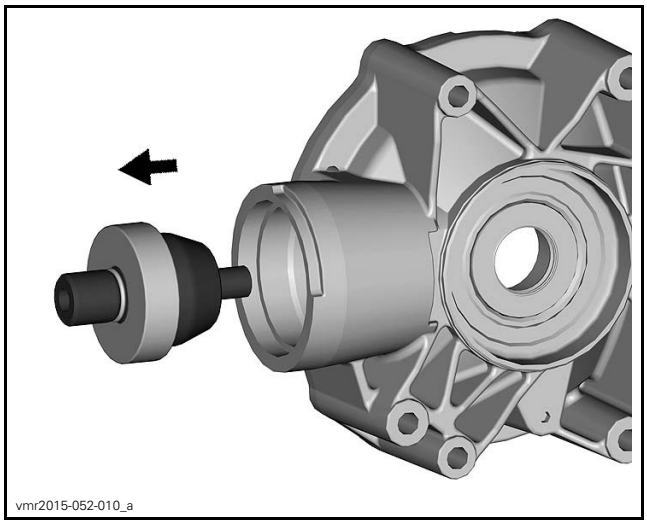
Unscrew the pinion nut. Use the SPANNER SOCKET (P/N 529 035 649).



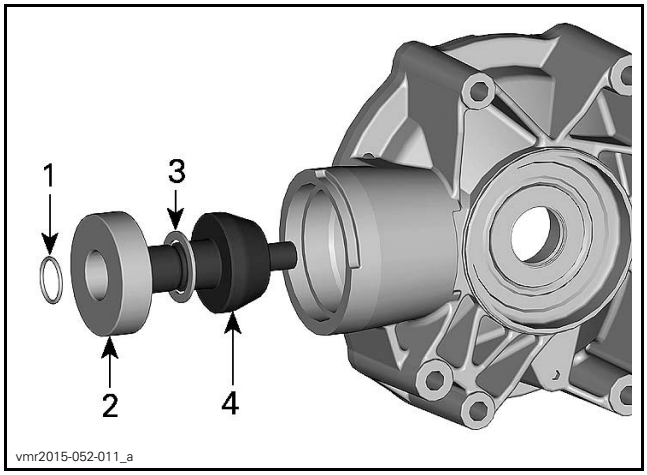


TYPICAL

Remove the bearing along with the pinion gear. Be careful to keep track of shims. Discard bearing.



TYPICAL



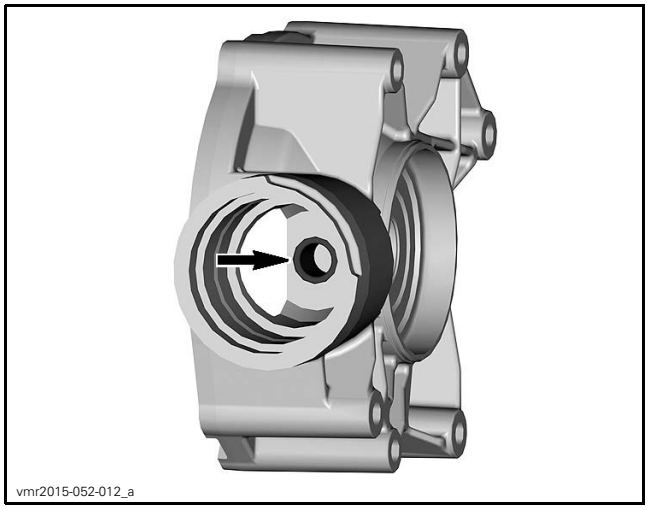
TYPICAL

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.



TYPICAL

Rear Final Drive Assembly

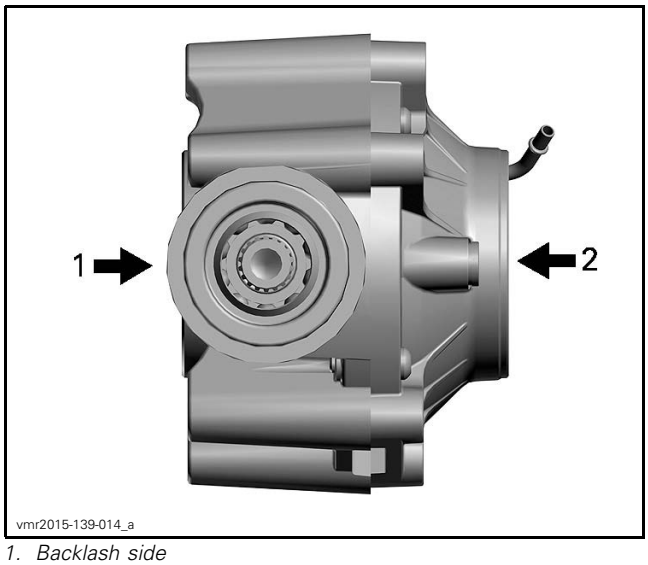
Adjustment is required when any of the following part is changed.

- Pinion gear
- Ring gear
- Housing.

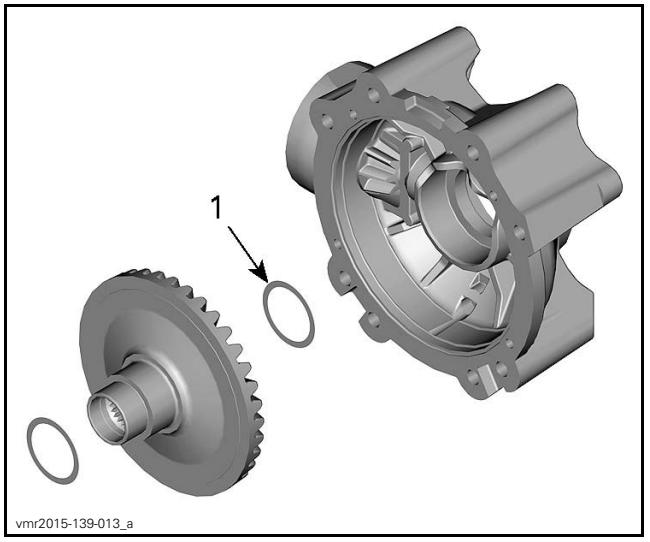
As a preliminary setup, install shims according to the following table.

RECOMMENDED SHIM THICKNESS	
PINION GEAR (1)	1.67 mm ± 0.04 mm (.066 in ± .002 in)
BACKLASH	0.5 mm (.02 in) (as a preliminary adjustment)
PRELOAD	

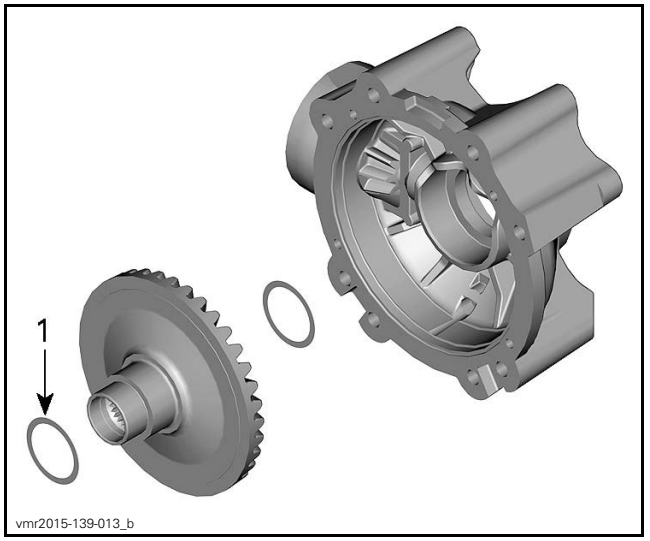
(1) The pinion gear shim thickness should never be altered. Any adjustment should be done on preload and/or backlash shims.



1. *Backlash side*
2. *Preload side*



1. *Backlash shim*



1. *Preload shim*

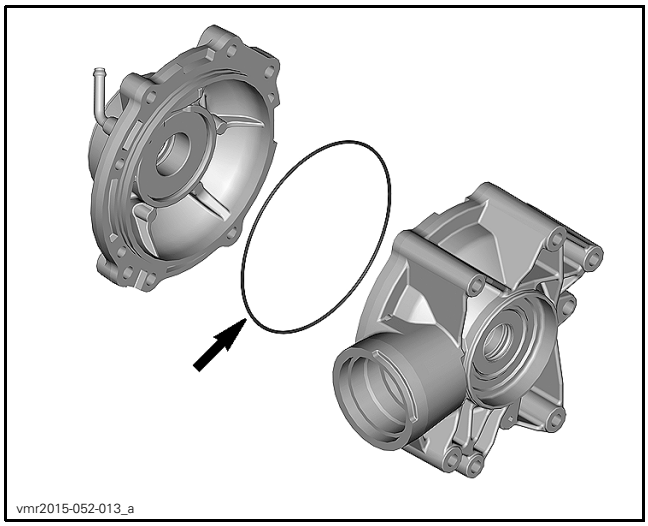
Prior to finalizing assembly, proceed in this order:

- 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 Installation

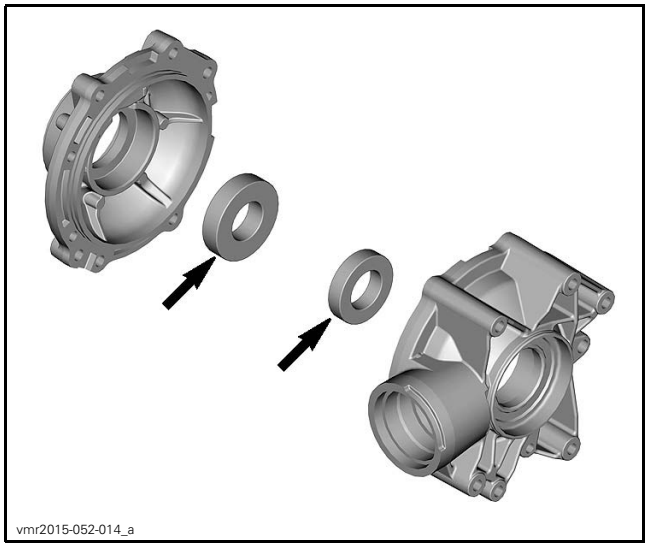
The installation is the reverse of the removal procedure. However, pay attention to the following:

Check condition of seal. Replace if damaged.



TYPICAL

Install NEW bearings.



TYPICAL

Tighten final drive housing screws to specification.

TIGHTENING TORQUE	
Final drive housing screws	32 N•m ± 3 N•m (24 lbf•ft ± 2 lbf•ft)

Pinion Gear Installation

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 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)

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	497

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.	34.5 kPa (5 PSI)	34.5 kPa (5 PSI)
MAX. Use when total load is greater than 131.5 kg (290 lb)	48.3 kPa (7 PSI)	48.3 kPa (7 PSI)

Tire Inspection

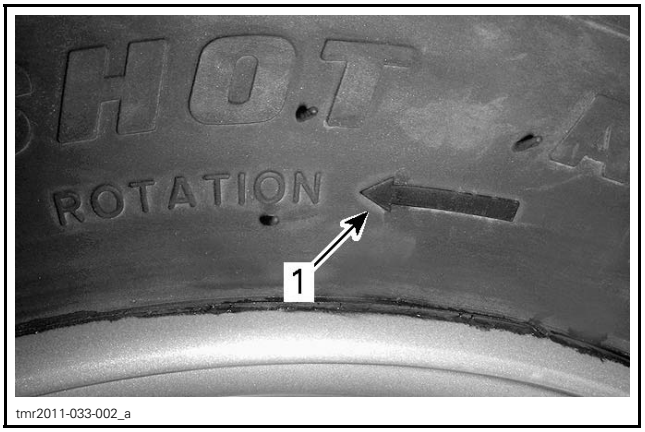
Check tire for presence of slits, bulges, wear or other damage. Replace if necessary.

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.

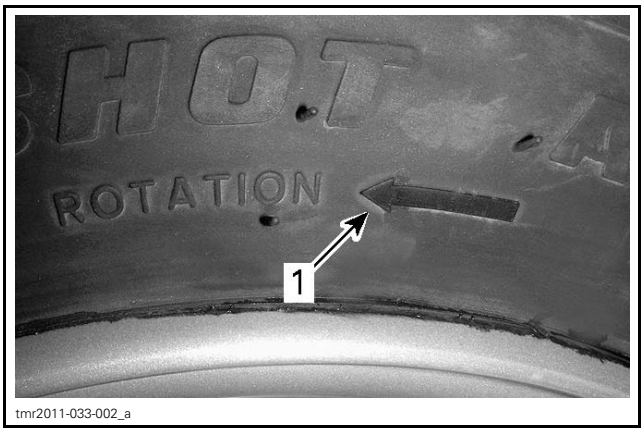
Wheel Inspection

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.



tmr2011-033-002_a

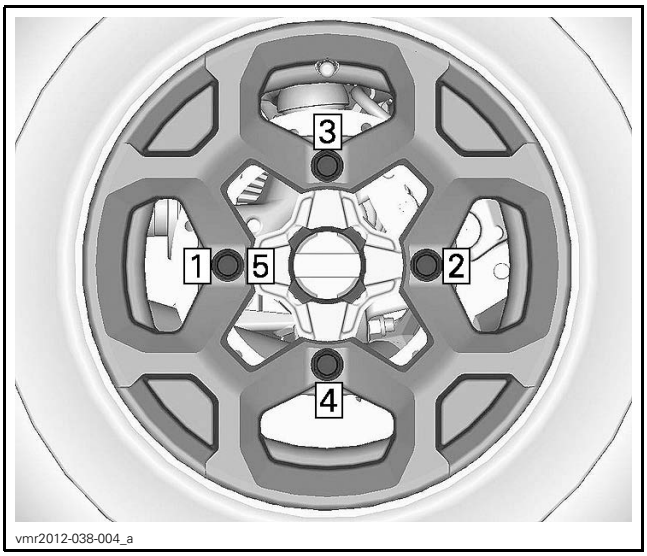
TYPICAL
1. Direction of rotation

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

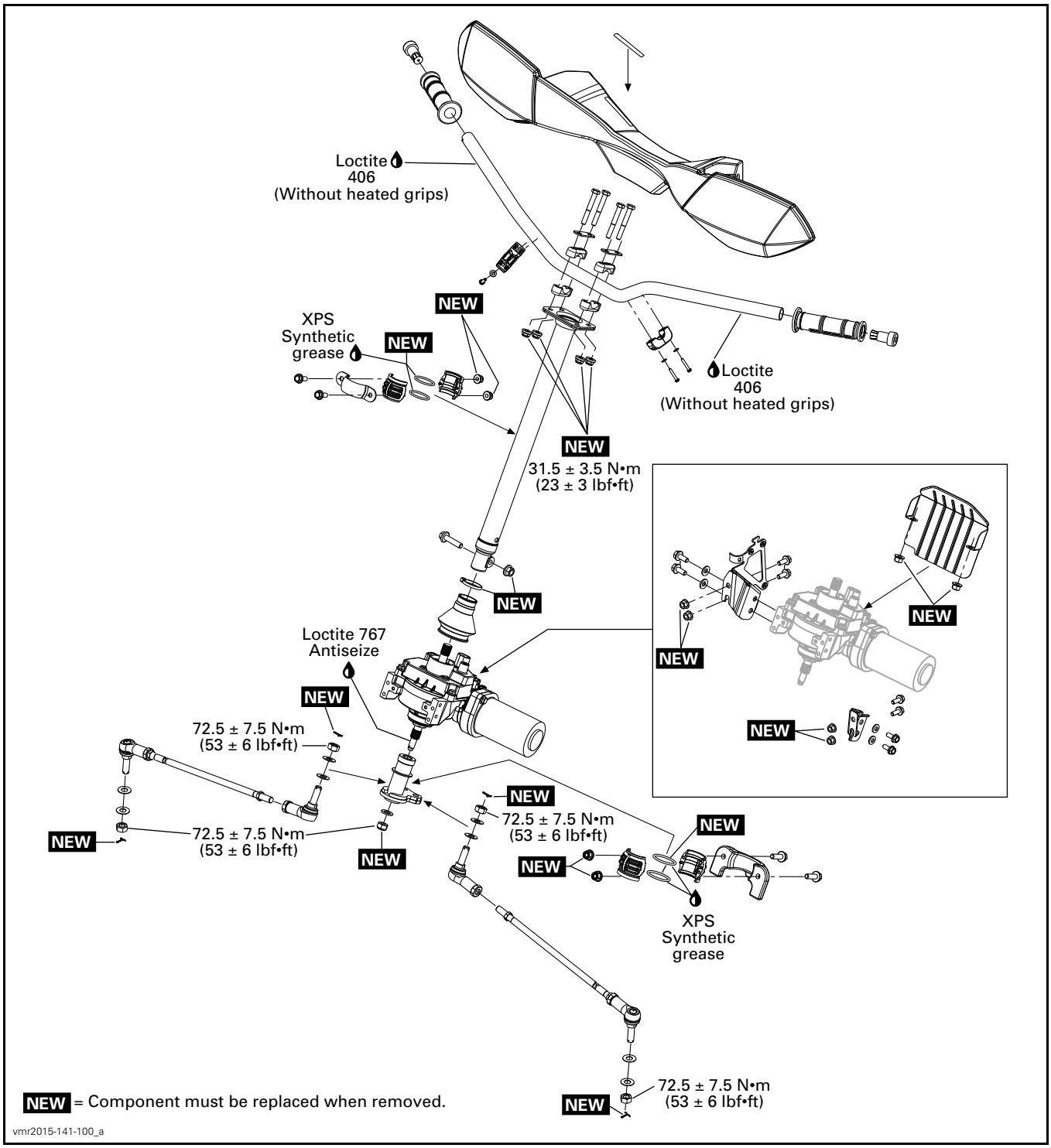
Description	Part Number	Page
STEERING ALIGNMENT TOOL	529 036 059	501

SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
SMOOTHFLOW™ TAPERED TIP	16 ga #511 rtt-b	502

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 406 (GLUE)	293 800 100	502
LOCTITE 767 (ANTISEIZE LUBRICANT)	293 800 070	507
PULLEY FLANGE CLEANER	413 711 809	502
XPS SYNTHETIC GREASE	293 550 010	507


Loctite 406
(Without heated grips)
NEW
XPS Synthetic grease
NEW
Loctite 406
(Without heated grips)
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.
vmr2015-141-100_a

GENERAL

The procedures described below are the same for the RH and LH sides, unless otherwise instructed.

ADJUSTMENT

STEERING ALIGNMENT

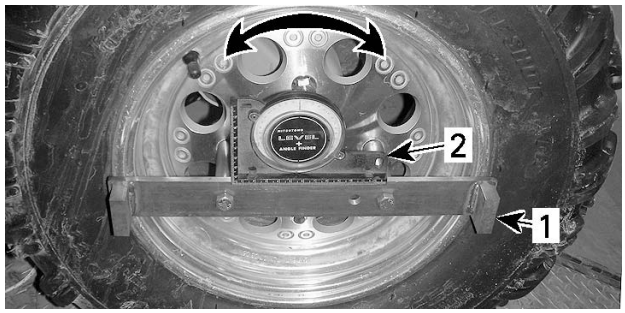
1. Place vehicle on a level surface.
2. Check pressure in each tire. Adjust to recommended pressure.
3. Lift and secure vehicle off the ground so that the suspension is fully extended.
4. Position and secure handlebar in the straight ahead position.
5. Remove two wheel nuts on the LH rear wheel and install 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.

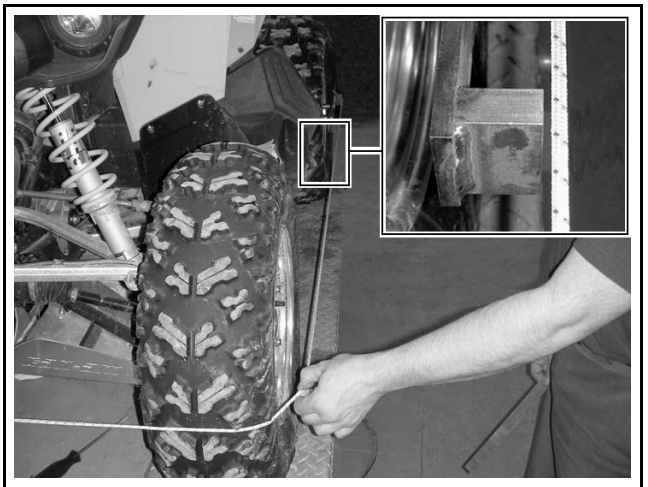


vmr2008-068-006_a

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:

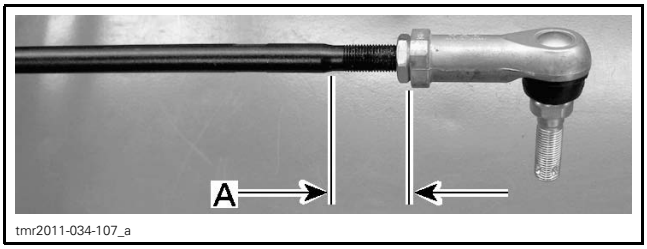
    12.1 Loosen tie-rod end lock nuts.

    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

If equipped with heated grips, refer to *OPTION PACKAGE* subsection.

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).

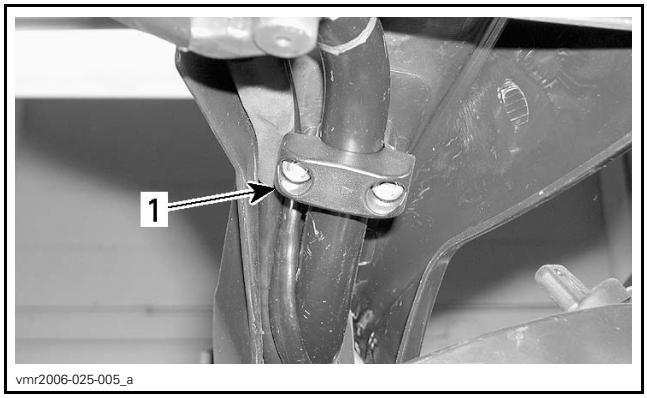
NOTE: The glue dries quickly. Do not apply it before installing grip.

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

Unscrew both plastic U-clamps that attach handlebar cover to the handlebar.



vmr2006-025-005_a

TYPICAL
1. Plastic U-clamp

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.

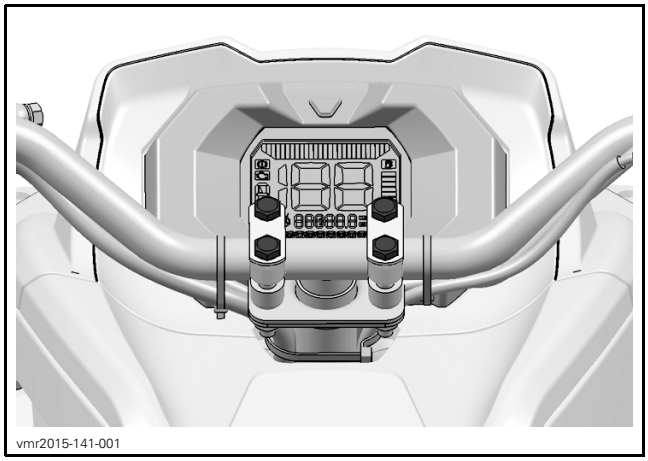
HANDLEBAR

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.


vmr2015-141-001

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. However, pay attention to the following.

NOTE: Ensure handlebar "U" clamps are tightened equally (equal distance on each side of clamps).

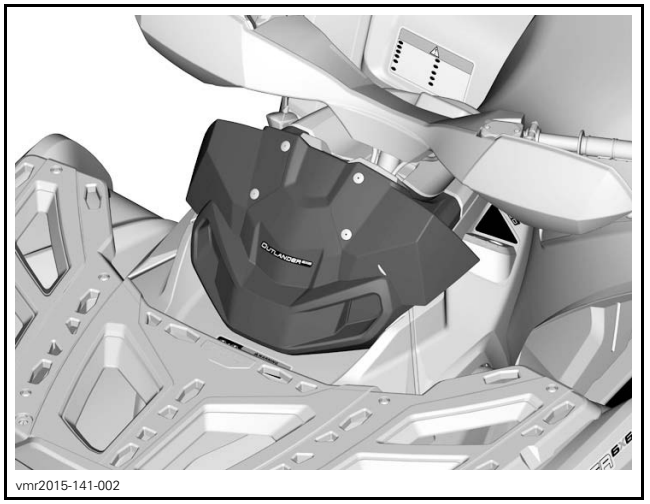
Tighiten clamp screws to specification

TIGHTENING TORQUE	
Clamp nuts	31.5 N•m ± 3.5 N•m (23 lbf•ft ± 3 lbf•ft)

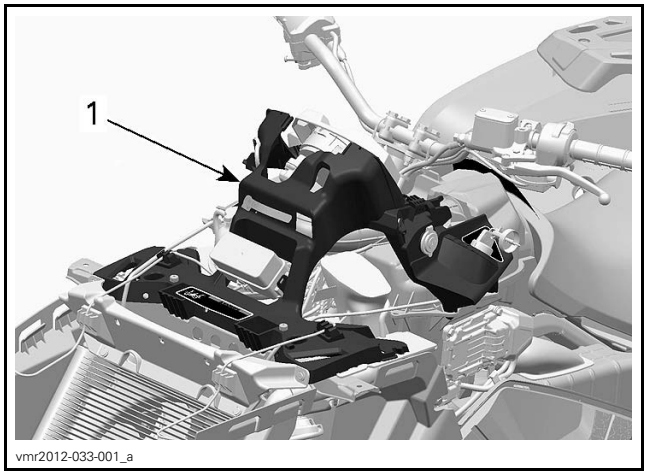
STEERING CONNECTORS

Steering Connector Access

1. Remove gauge support, refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.


vmr2015-141-002

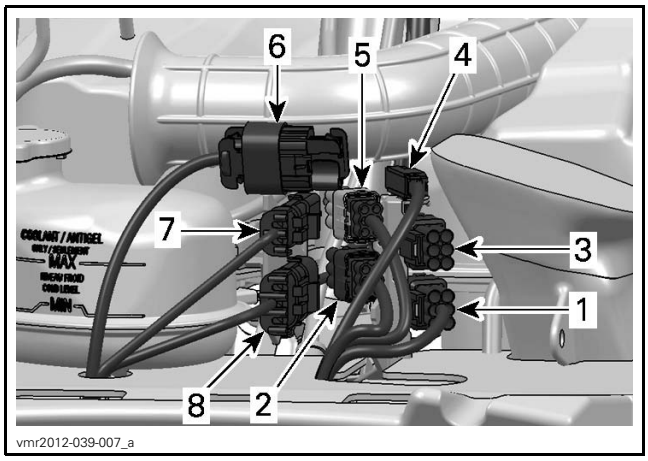
2. Remove front body module, refer to body subsection.
3. Remove dash board support.



vmr2012-033-001_a

1. Dash board support

Steering Connector Identification



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)*
6. *HICA (Accessory interconnect)*
7. *SWW 2 (Switch winch)*
8. *SWW 1 (Switch winch)*

MULTIFUNCTION SWITCH

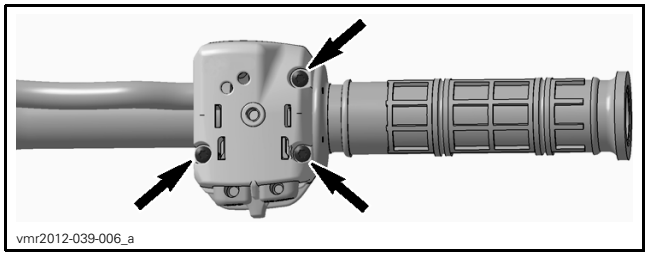
Multifunction Switch Removal (From Vehicle)

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

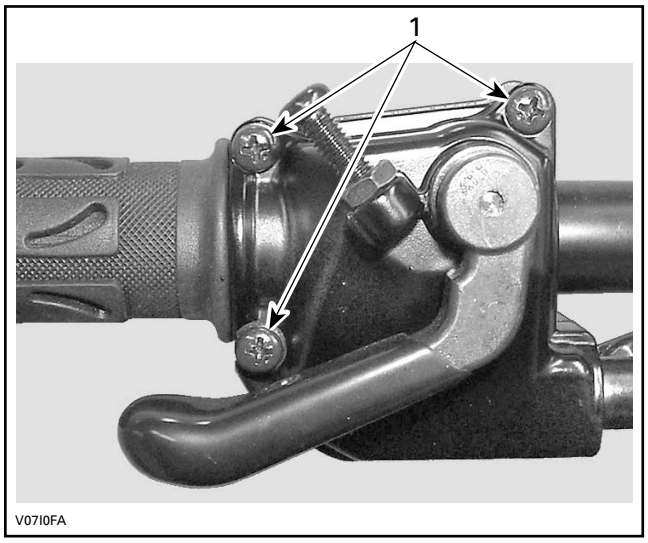
For installation, reverse the removal procedure.

NOTICE **Be sure to route and secure the multifunction switch steering harness as noted prior to removal.**

THROTTLE LEVER

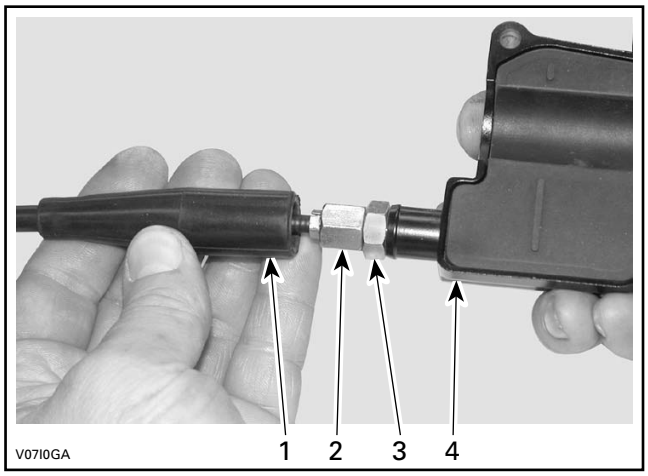
Throttle Lever Removal

1. Disconnect the HIC1 connector (2/4WD switch), refer to *STEERING CONNECTORS* in this subsection.
2. Remove throttle lever housing retaining screws.



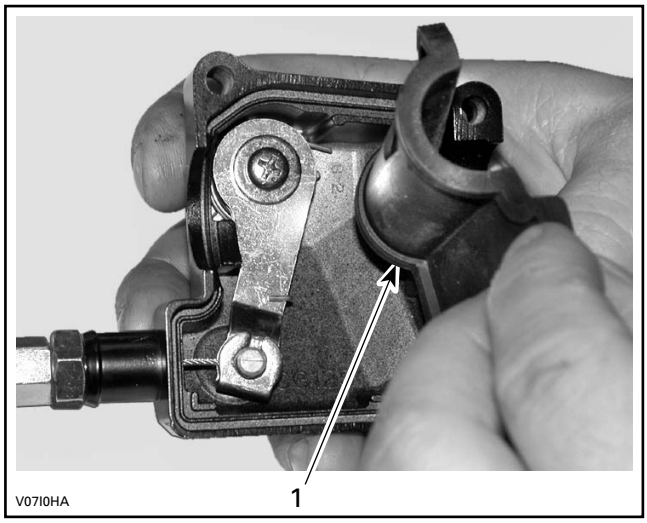
TYPICAL - THROTTLE LEVER HOUSING
1. *Remove retaining screws*

3. Separate throttle lever housing from handlebar.
4. Slide rubber protector back to expose throttle cable adjuster.



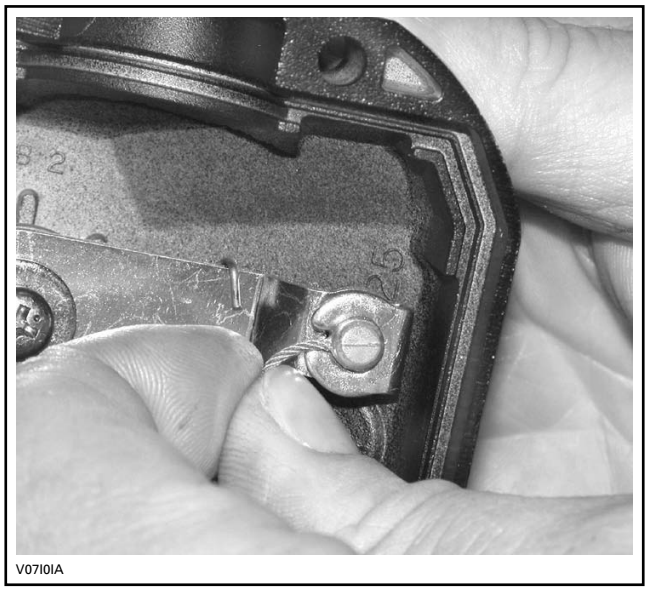
1. Cable protector
2. Throttle cable adjuster
3. Lock nut
4. Throttle lever housing

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)

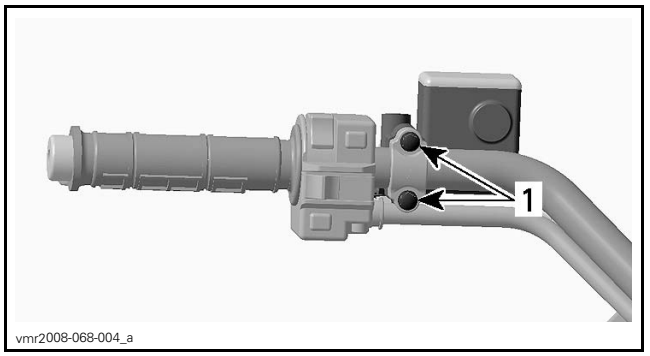
1. Carry out steps in *BRAKE LEVER REMOVAL (FROM HANDLEBAR)*.

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**)

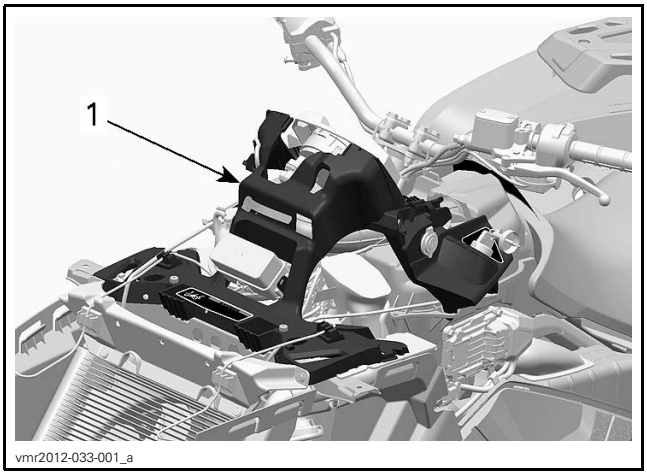
⚠ WARNING

If brake hose was disconnected, bleed brake system. Refer to *BRAKES* subsection.

STEERING COLUMN

Steering Column Removal

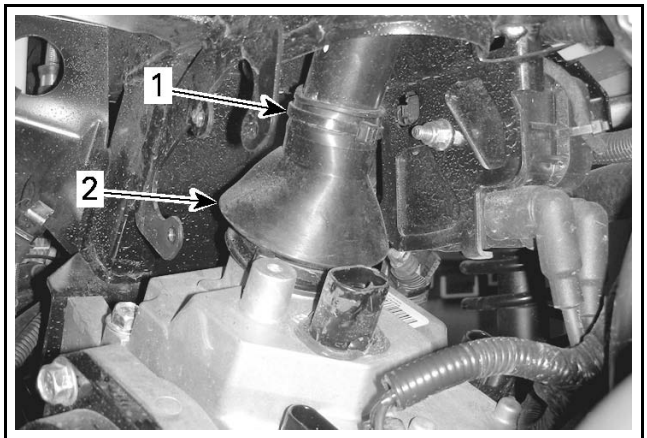
1. Remove gauge support, refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.
2. Refer to *BODY* subsection and remove the following:
   – Front body module
   – Inner fender panels
3. Remove dash board support.



vmr2012-033-001_a

1. Dash board support

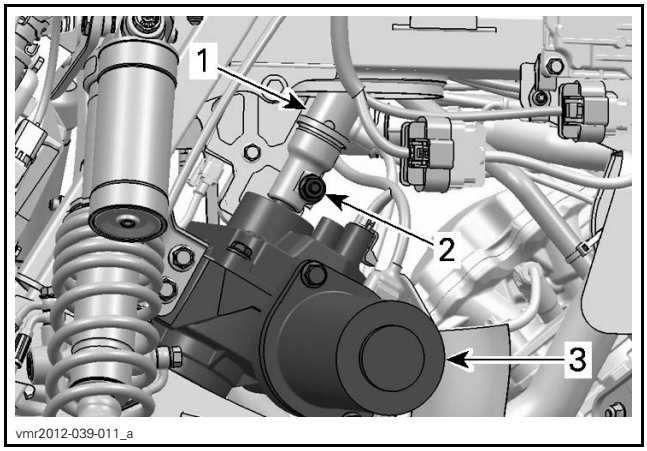
4. Remove the air intake silencer. Refer to *AIR INTAKE SYSTEM* subsection.
5. Remove handlebar, refer to *HANDLEBAR REMOVAL* in this subsection. Also remove locking ties and separate wiring harnesses and hoses from the steering column.
6. Cut the locking tie securing the bellows at the bottom of steering column near the DPS unit, and pull the bellows upwards sufficiently to access the steering column pinch screw.



vmr2010-003-016_a

TYPICAL
1. Cut this locking tie
2. Steering column bellows

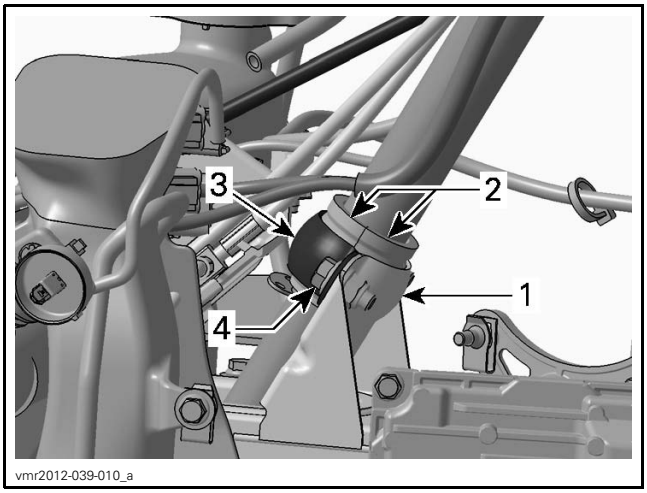
7. Remove steering column lower pinch screw and nut. Discard the nut.



vmr2012-039-011_a

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.

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.

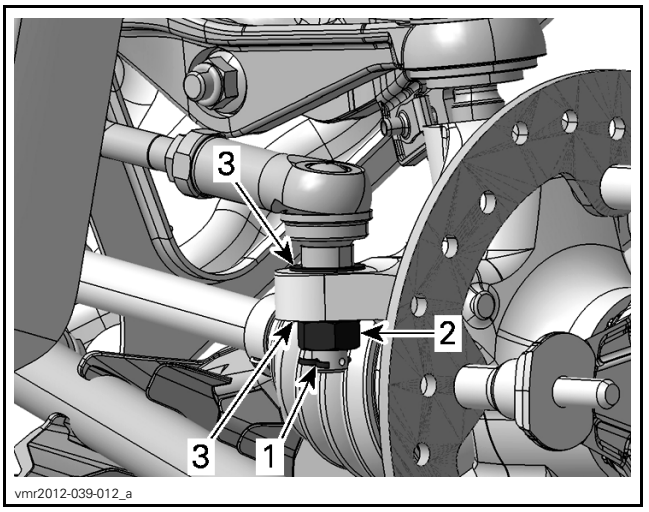
Carry out a *TORQUE OFFSET RESET* procedure. Refer to *DYNAMIC POWER STEERING* subsection.

TIE-ROD

NOTE: Use the same procedure for RH and LH side.

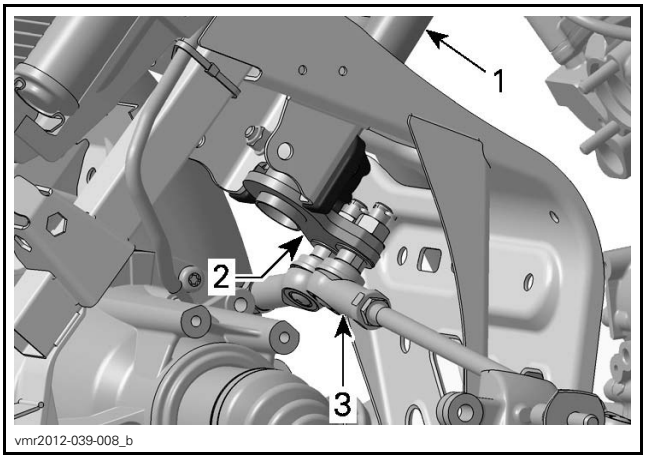
Tie-Rod Removal

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.



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.



TYPICAL
1. Steering column
2. Pitman arm
3. Tie-rod end

Tie-Rod Inspection

Inspect tie-rod for straightness, cracks and other damages. Replace as required.

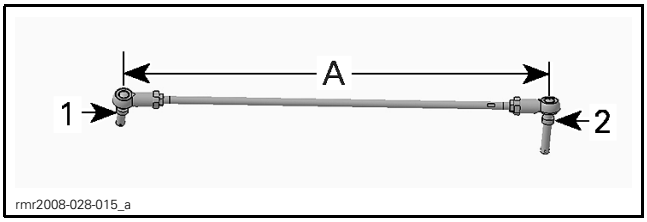
Inspect tie-rod ends for wear or excessive play. If excessive, replace the tie-rod end.

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)

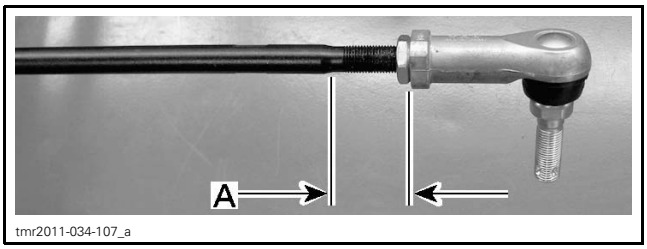


NOMINAL LENGTH
1. Pitman arm side
2. Knuckle side
A. 416.4 mm (16-3/8 in)

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.

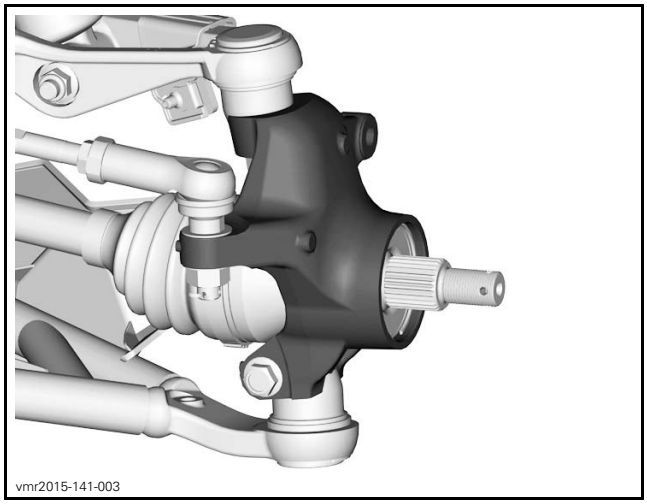
Apply specified torques.

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.



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.

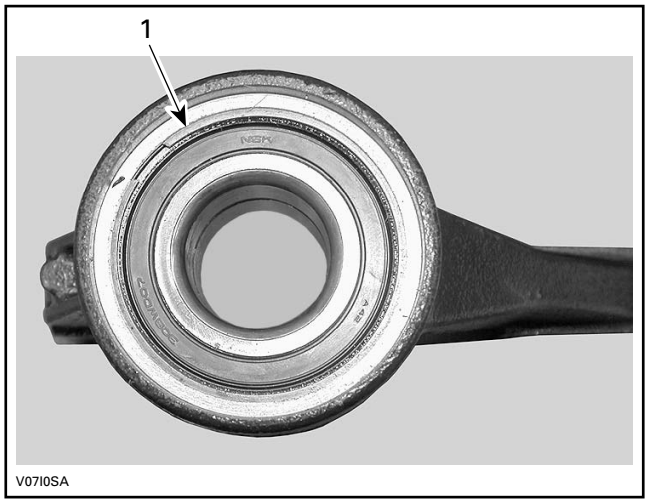
Wheel Bearing Inspection (During Component Removal)

Whenever the drive axle or knuckle is removed, check if wheel bearing turns freely and smoothly.

Replace if necessary.

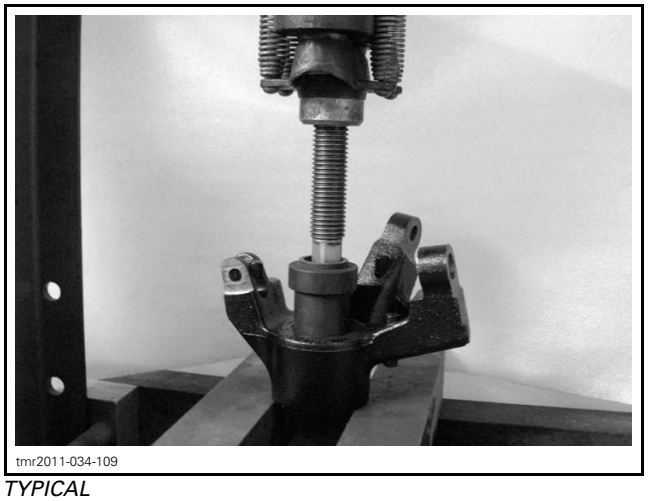
Wheel Bearing Removal

1. Remove knuckle from vehicle, refer to *KNUCKLE REMOVAL* in this subsection.
2. Remove the circlip.



TYPICAL
1. Circlip

3. Install knuckle on a press.
4. Remove bearing from knuckle using an appropriate bearing remover.



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 (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	520
PITMAN ARM JIG	529 036 225	532, 534
PITMAN ARM PULLER	529 036 227	533
POSITIONING ADAPTOR	529 036 230	532

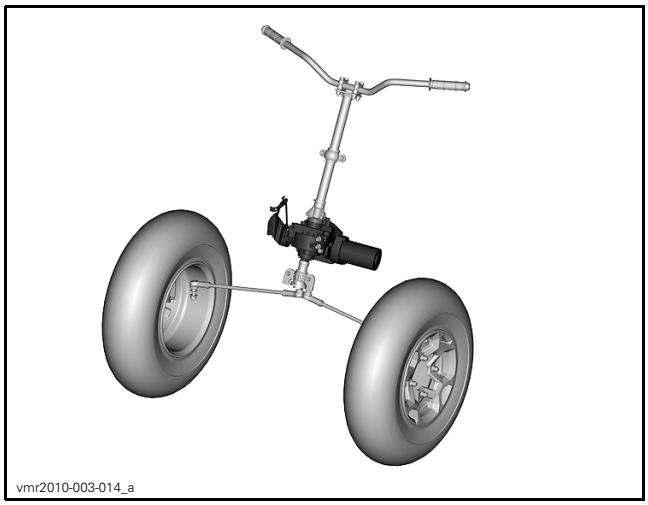
SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 767 (ANTISEIZE LUBRICANT)	293 800 070	534
XPS SYNTHETIC GREASE	293 550 010	527

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.

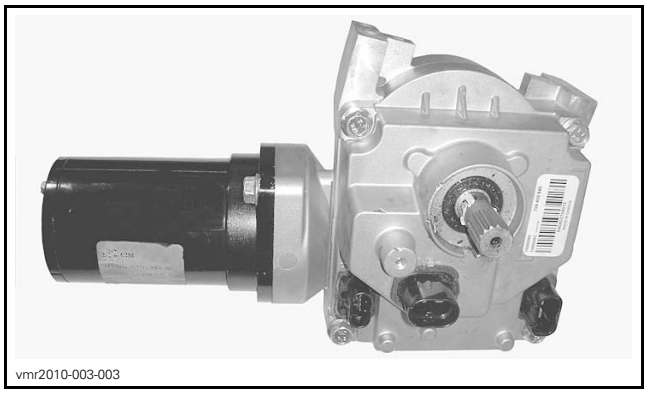
The internal protection system decreases the assistance level available to protect its electronic board. The normal assistance level will return when riding conditions are back to normal and the internal temperature decrease and/or when the ripples in the electric circuit decreases.

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.

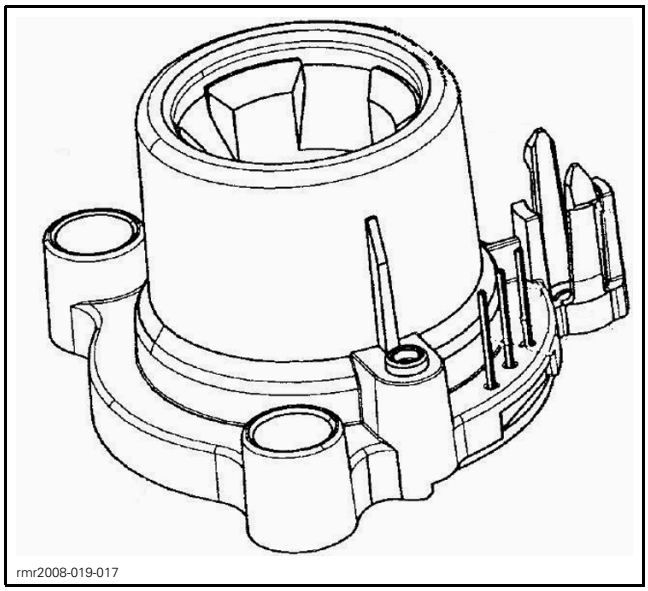
DPS Unit Protection

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

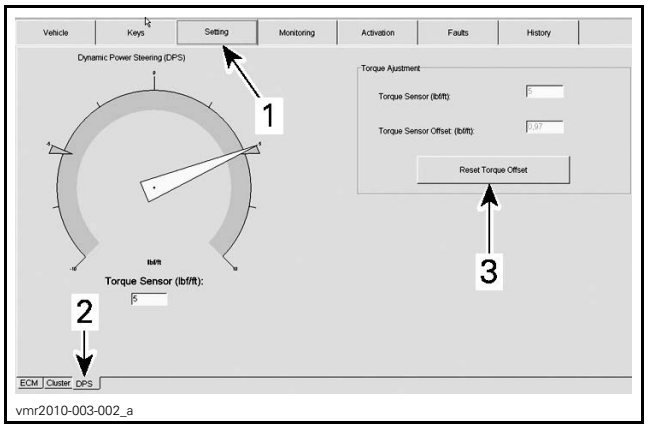
When replacing the following parts or adjusting steering alignment, the sensor torque offset must be reset to zero) for proper system operation.

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.



vmr2010-003-002_a

DPS TORQUE OFFSET RESET
1. *Setting page tab*
2. *DPS tab*
3. *Reset Torque Offset button*

DPS ASSIST MODE

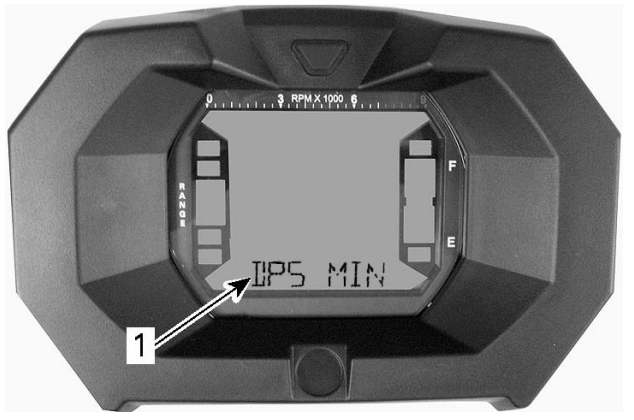
1. **To view** the active DPS ASSIST mode, momentarily press and release the OVERRIDE/DPS button on the LH multifunction switch assembly.



vmo2012-012-014_b

1. OVERRIDE/DPS/ACS button

The active DPS mode will be displayed in the lower portion of multifunction gauge.



LCD gauge
1. DPS mode indication

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

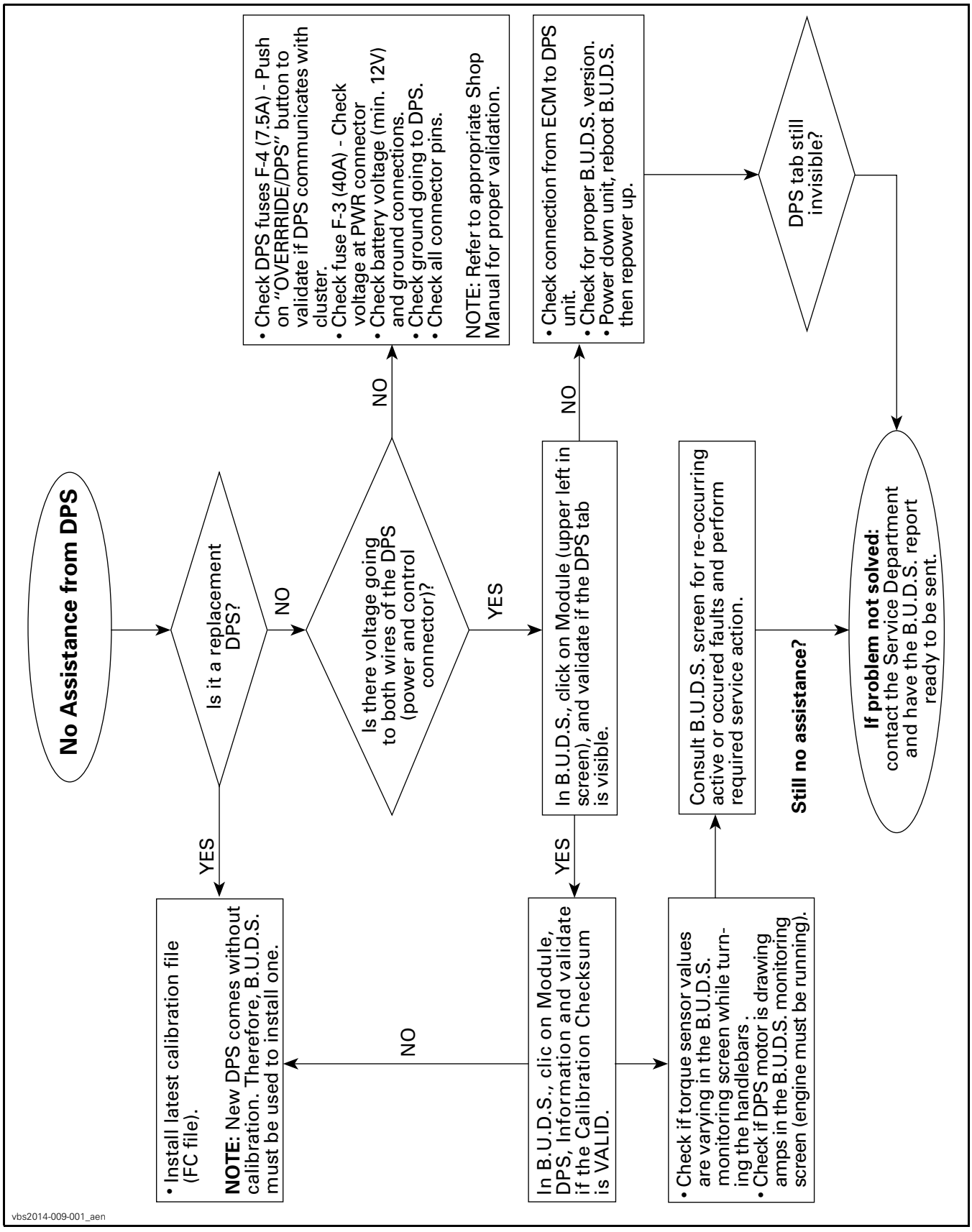
TROUBLESHOOTING FLOW CHARTS

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.

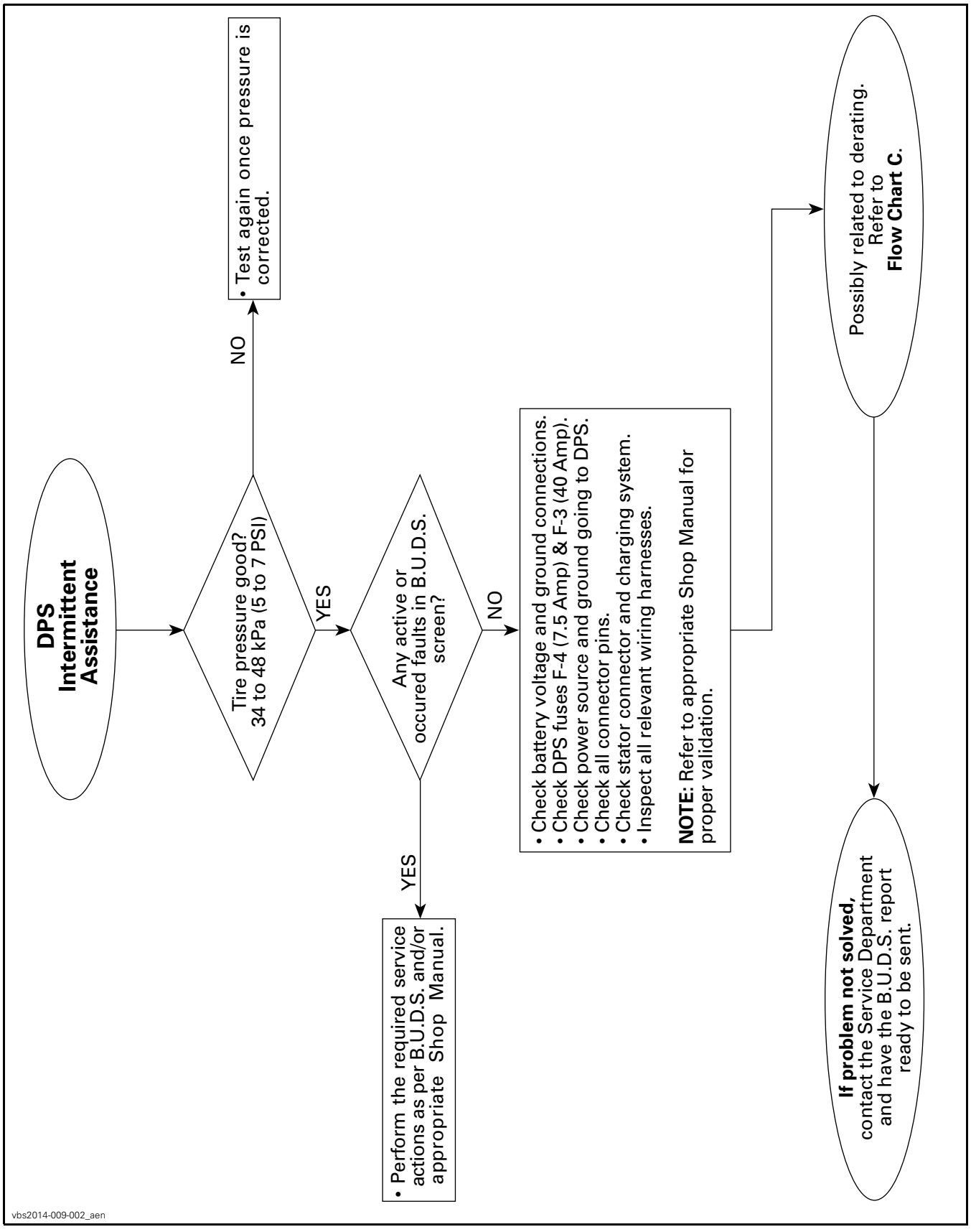
Here is the list of provided flow charts:

– 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.

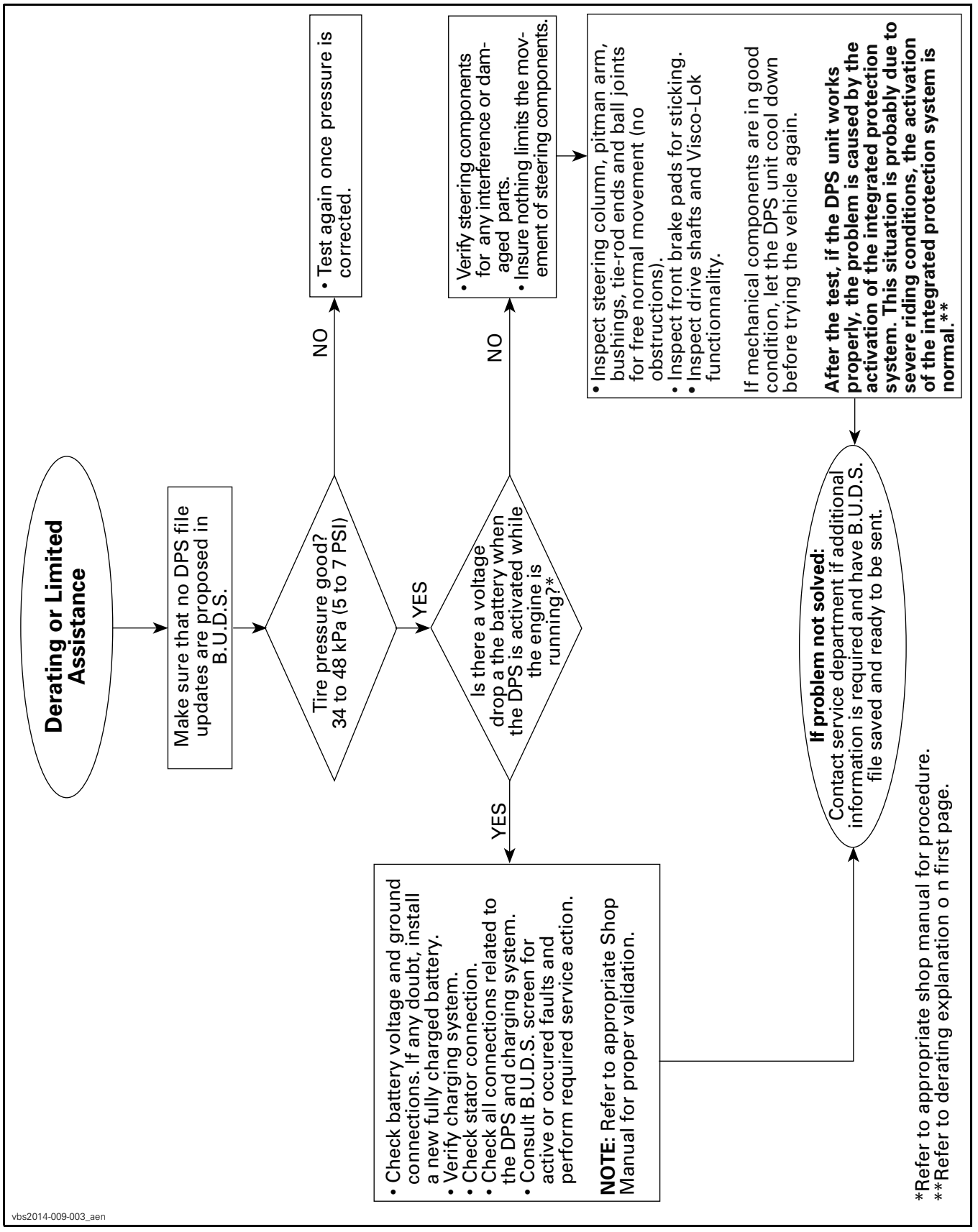
Flow Chart A


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)?
YES
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.
In B.U.D.S., click on Module (upper left in screen), and validate if the DPS tab is visible.
YES
NO
In B.U.D.S., clic on Module, DPS, Information and validate if the Calibration Checksum is VALID.
• 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.
• 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.
DPS tab still invisible?
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

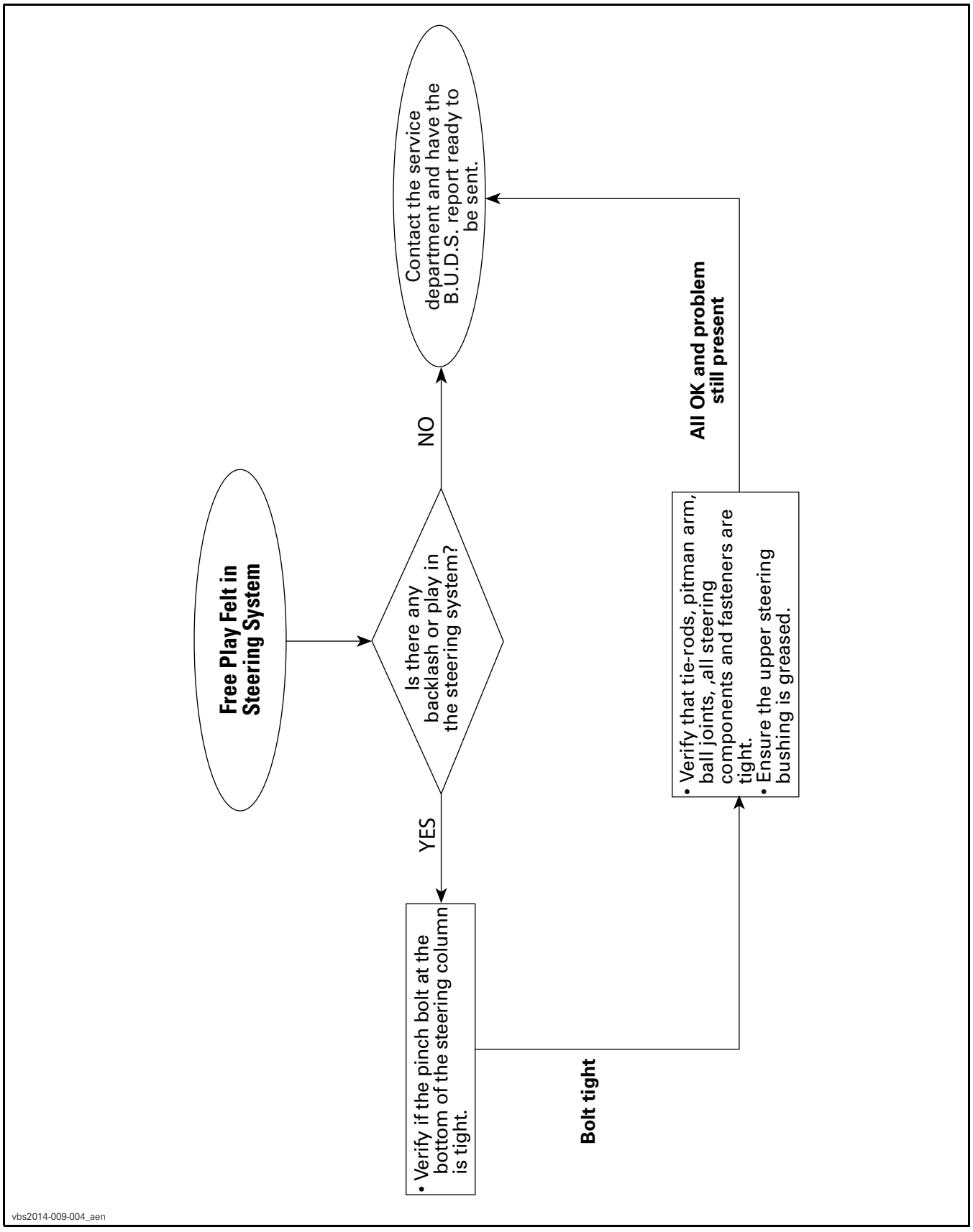
Flow Chart B


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.
vbs2014-009-002_aen

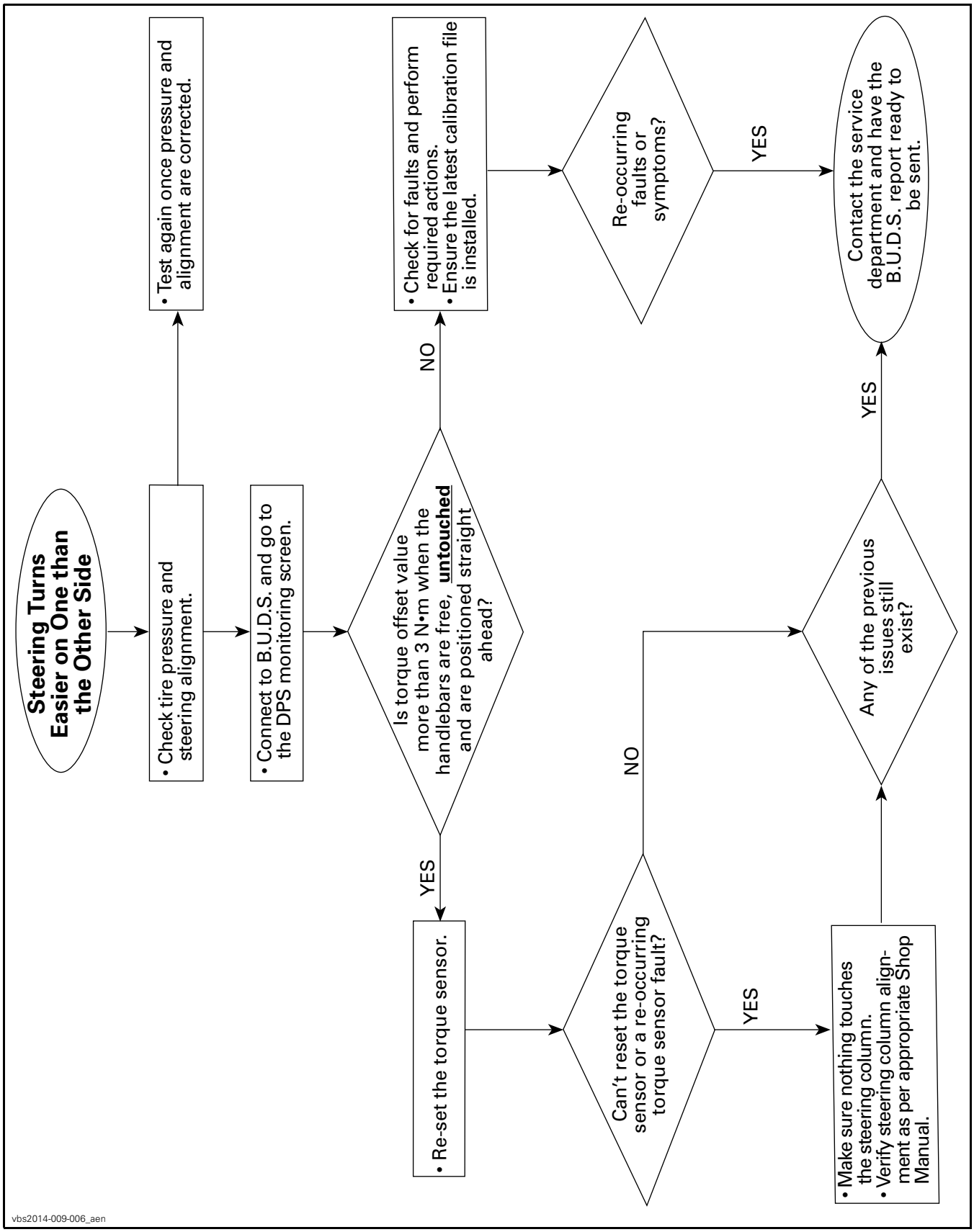
Flow Chart C


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

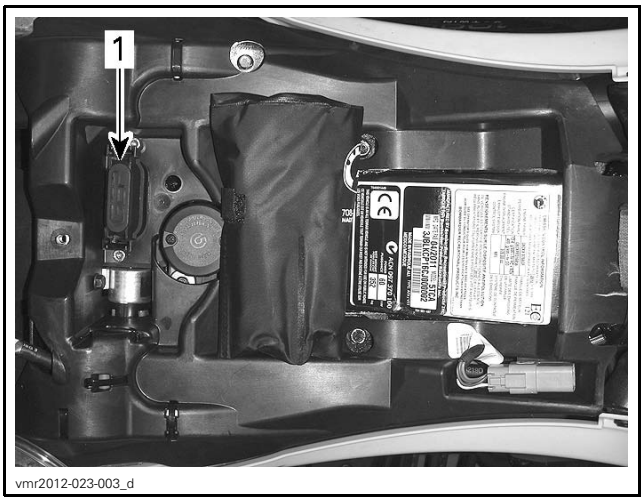

Steering Turns Easier on One than the Other Side
• Check tire pressure and steering alignment.
• Test again once pressure and alignment are corrected.
• Connect to B.U.D.S. and go to the DPS monitoring screen.
Is torque offset value more than 3 N•m when the handlebars are free, untouched and are positioned 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.

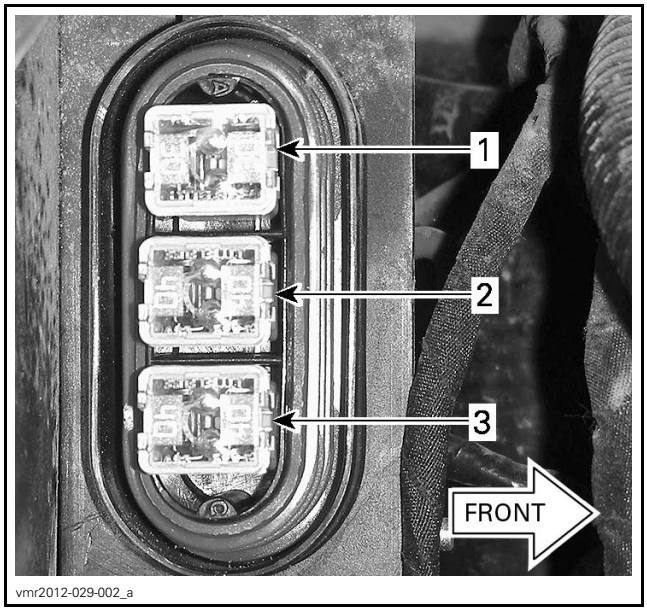


vmr2012-023-003_d

TYPICAL
1. Rear fuse box (PF2)

1. Test DPS fuse (PF2-F3) using a multimeter.

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



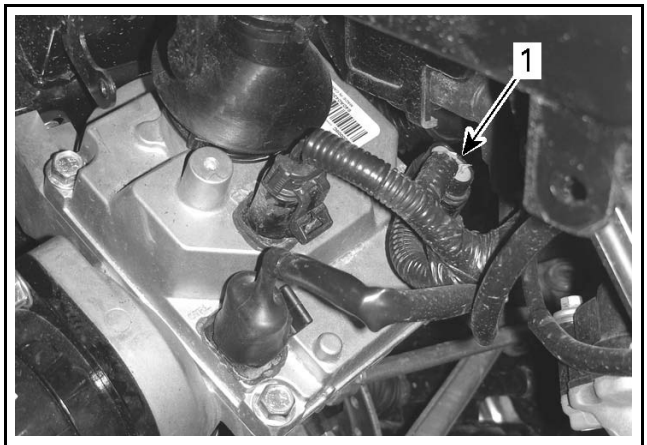
vmr2012-029-002_a

TYPICAL
1. 30 A Main
2. 40 A Fan/accessories
3. 40 amp DPS fuse

2. Replace fuse as required.

DPS Unit Input Voltage Test (Power Side)

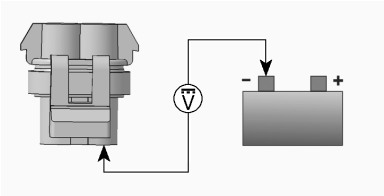
1. Disconnect the DPS PWR (power) connector.



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		

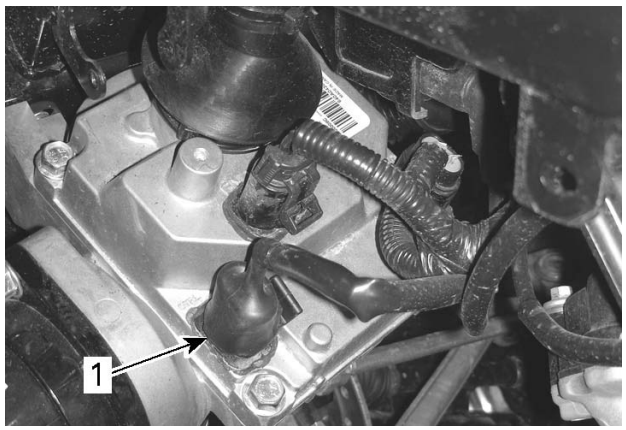
If NO voltage is measured, test the 40 A DPS fuse in the rear fuse holder (PF2-F3). If good, check wires and connector pins. Replace or repair defective parts and reset fault codes.

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)

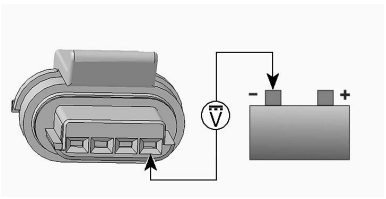
1. Disconnect DPS CTRL (control) connector.



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	

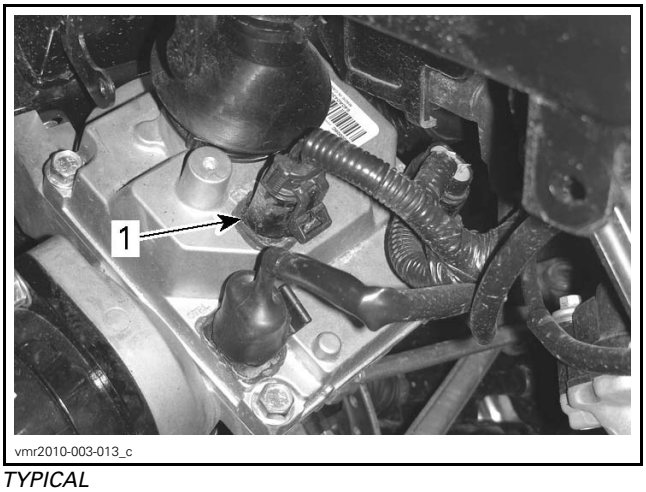
If NO voltage is measured, check wires and connector pins from DPS unit to the Relays/Speedo fuse in front fuse box (PF1-F4). Replace or repair defective parts and reset fault codes.

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.

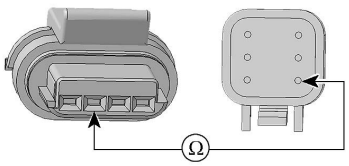
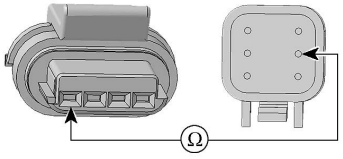
If there is good continuity, carry out the following *DPS UNIT COMMUNICATION LINK (CAN) CONTINUITY TEST*.

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.

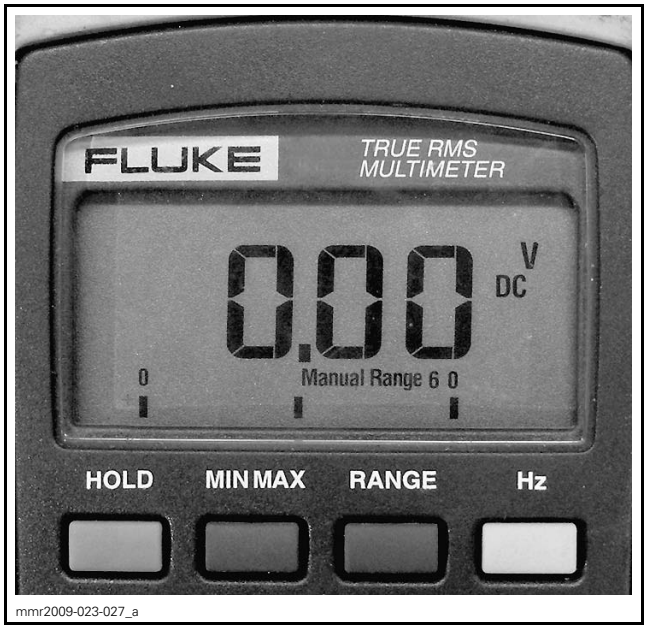
DPS System Load Test

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.

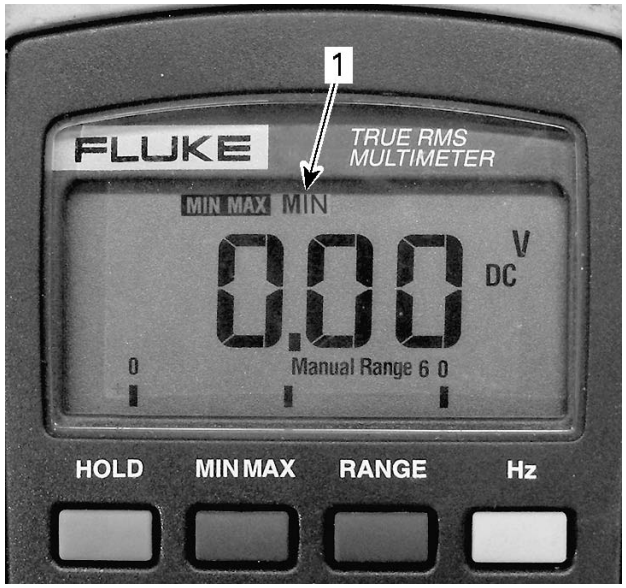
2. Ensure the vehicle transmission is set to PARK.
3. Start the engine.
4. Note the voltage on the multimeter with the engine running (charging system voltage).
5. Press the RANGE button repeatedly to select Manual Range 6 0.



mmr2009-023-027_a

VDC SELECTED TO MANUAL RANGE 6 0

6. Press the MIN MAX button on the multimeter to engage the MIN function.



mmr2009-023-027_e

1. MIN function selected

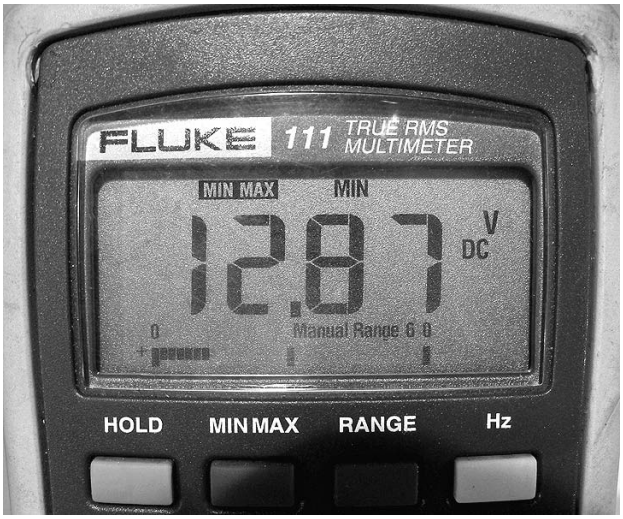
7. Turn the handlebar **momentarily** against the steering frame stops to each side.

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.



vmr2010-003-007

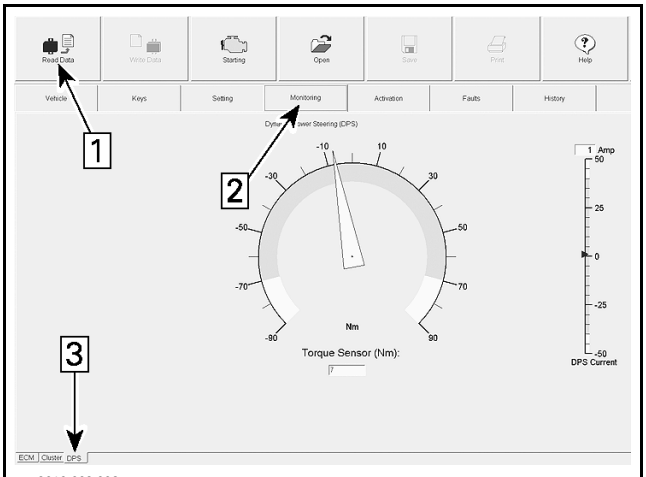
If the electrical system cannot sustain at least 12 Vdc, check the following:

– 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.



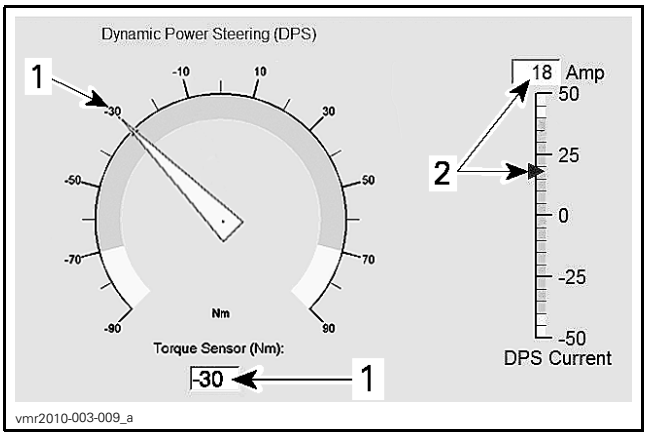
vmr2010-003-008_a

Step 1: Press Data button
Step 2: Select Monitoring page tab
Step 3: Select DPS tab

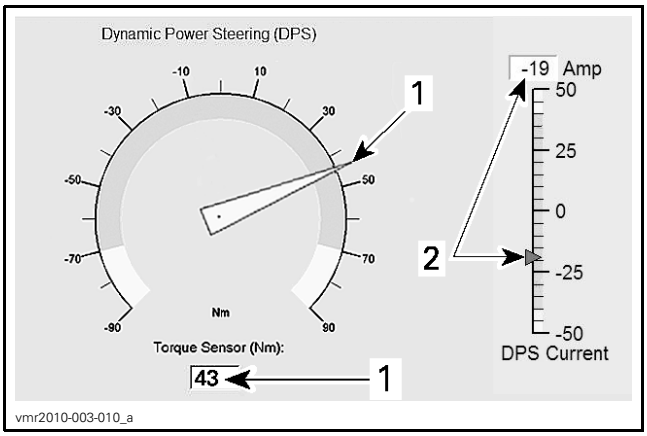
5. With the vehicle engine running in PARK, turn the handlebar side to side, momentarily against each stop and observe the indications on the B.U.D.S. DPS **Monitoring** page.

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.



TYPICAL - LH TURN
1. *Torque sensor indication (negative)*
2. *DPS current indication (positive)*



TYPICAL - RH TURN
1. *Torque sensor indication (positive)*
2. *DPS current indication (negative)*

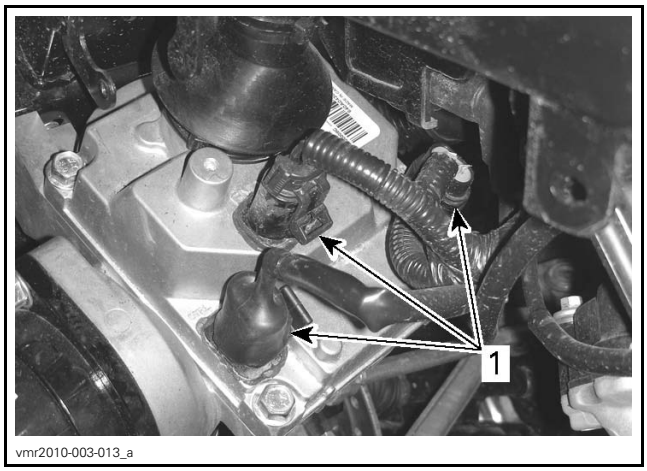
NOTE: Increase and decrease in torque and current readings is very brief as steering assist is quickly provided. Current draw should remain within green scale but may momentarily peak to 60 amps, then drop off close to 0 amps as torque applied is nulled out by steering assist. A residual torque of 2 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.

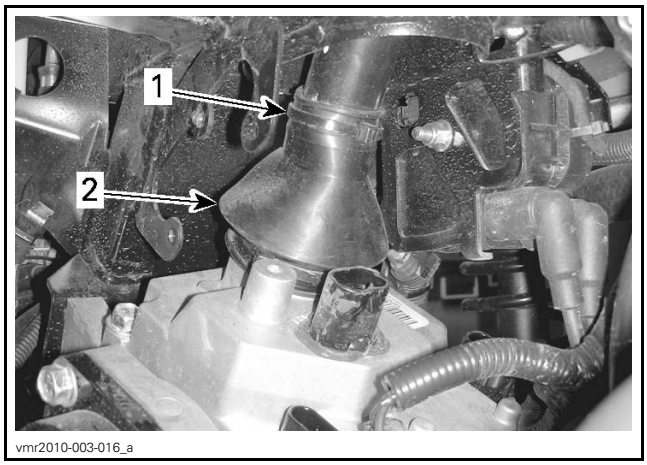
DPS Unit Removal

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.



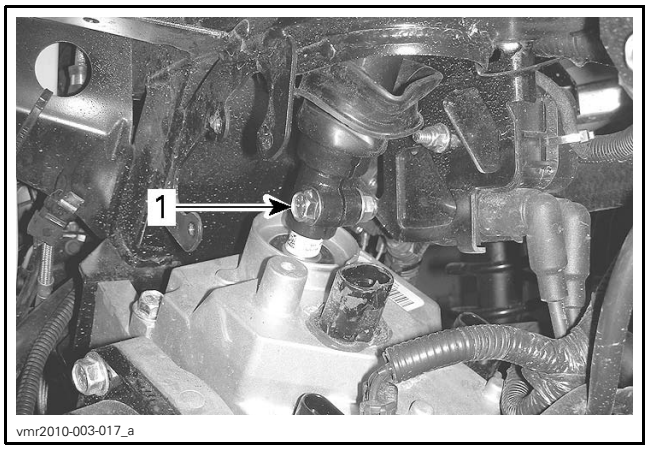
TYPICAL
1. *DPS connectors (3x)*

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.



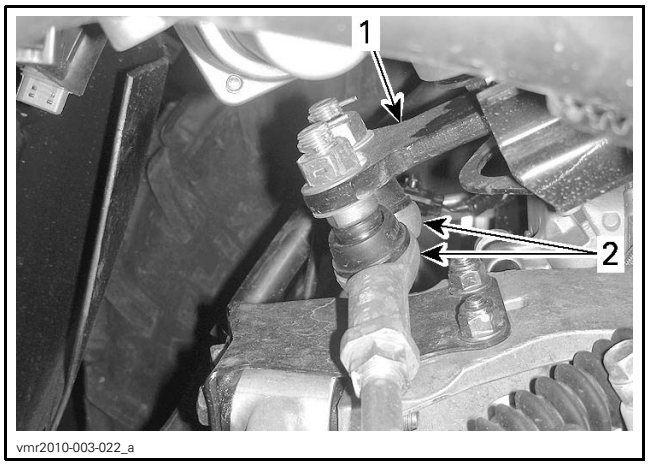
TYPICAL
1. *Cut this locking tie*
2. *Steering column bellows*

6. Remove the steering column pinch bolt and retaining nut. Discard the retaining nut.



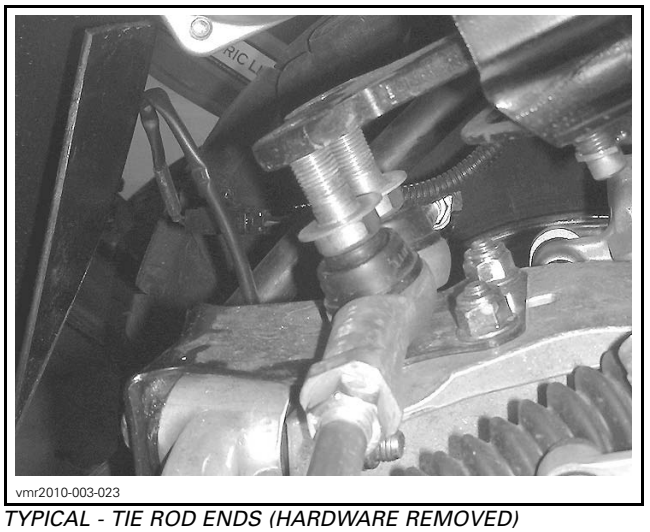
TYPICAL
1. Steering column pinch bolt

7. Remove the hardware that secures both tie-rod ends to the pitman arm (steering lever). Discard cotter pins.



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.

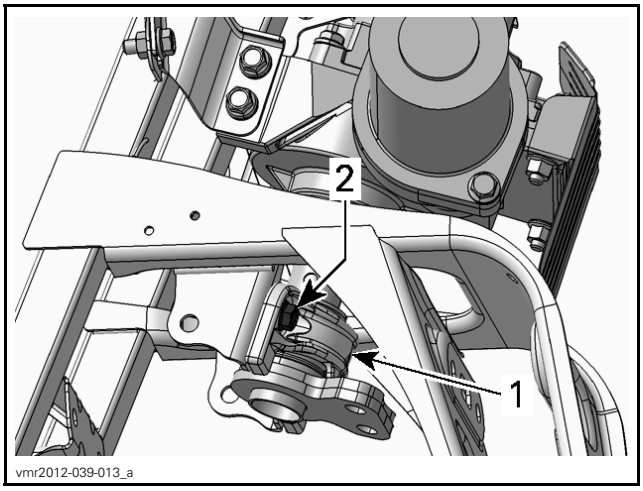


TYPICAL - TIE ROD ENDS (HARDWARE REMOVED)

9. Pull up on the steering column to partly disengage it from the DPS unit.

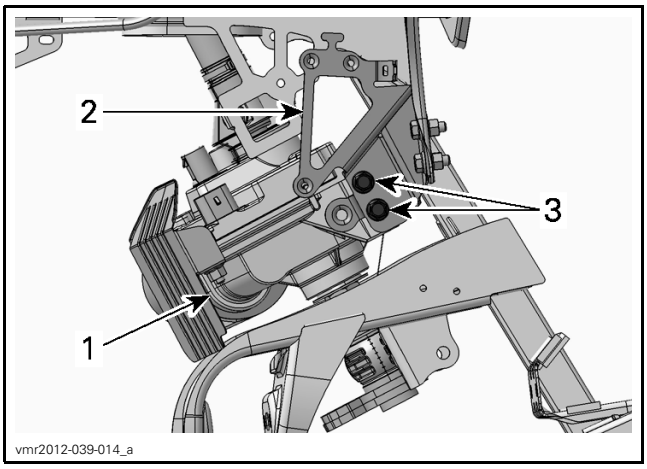
NOTE: A mechanical stop on the steering column will prevent you from fully disengaging the steering column.

10. Remove the lower half bushing retainer that secures the steering shaft to the frame.



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.



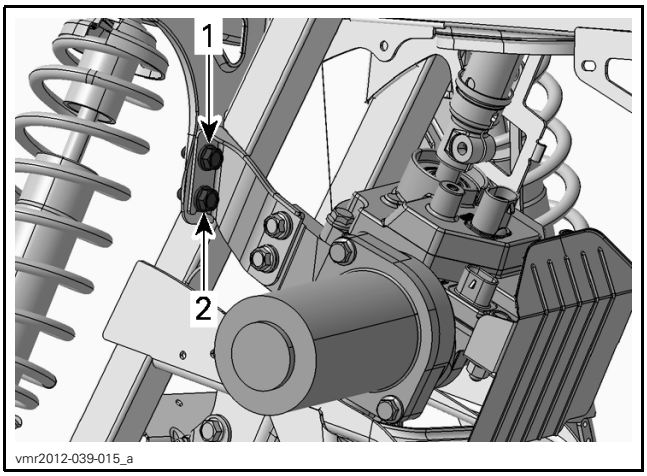
DPS REMOVAL - RH SIDE
1. *DPS*
2. *RH DPS support bracket*
3. *Remove these screws (2)*

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:

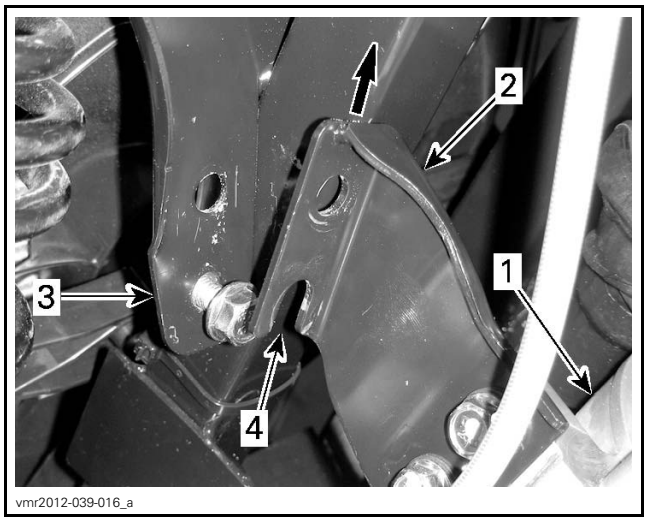
    12.1 Remove the top retaining screw.

    12.2 Loosen the lower retaining screw sufficiently for the bracket to become loose on the frame.



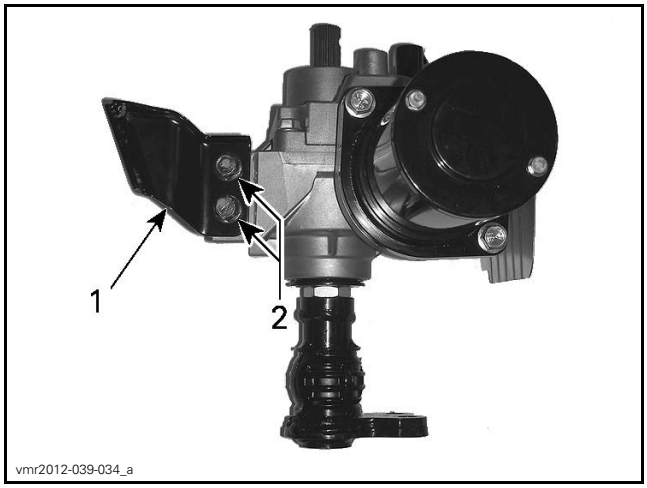
DPS REMOVAL - LEFT SIDE
Step 1: Remove DPS retaining screws (2 each side)
Step 2: Discard conical washers under screw head

13. Pull up on DPS unit to remove the DPS unit and support bracket from the frame.



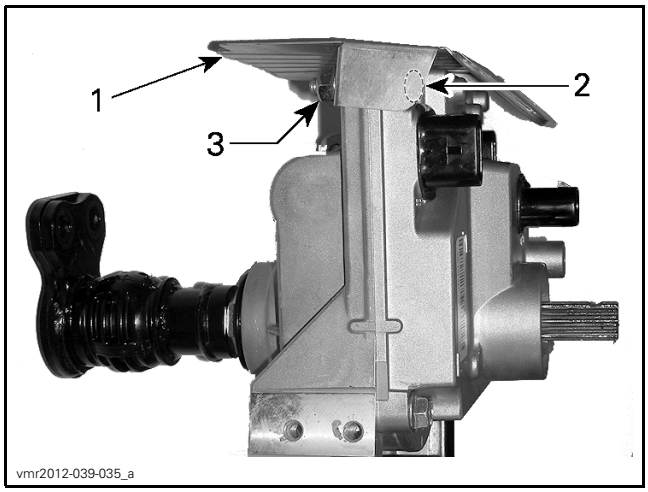
TYPICAL - LH DPS SUPPORT BRACKET
1. *DPS unit*
2. *DPS support bracket*
3. *Vehicle frame*
4. *Slotted hole in DPS support bracket*

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.



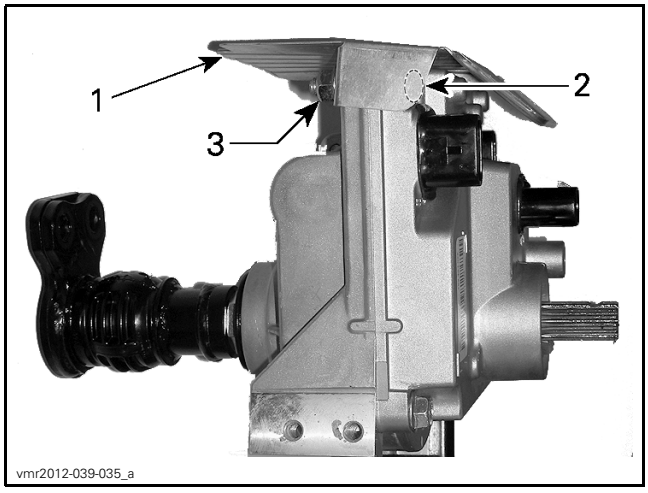
1. *DPS heat shield*
2. *Retaining screws to hold steady (2 not visible)*
3. *Retaining nuts to remove*

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.



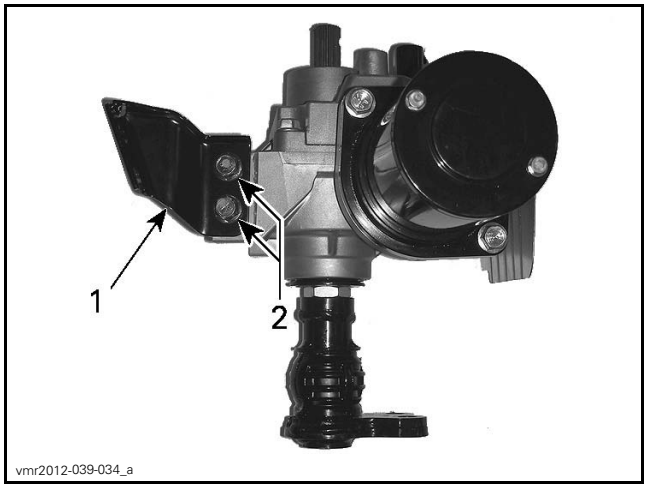
1. *DPS heat shield*
2. *Retaining screws to hold steady (2 not visible)*
3. *Retaining nuts to remove (2)*

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)

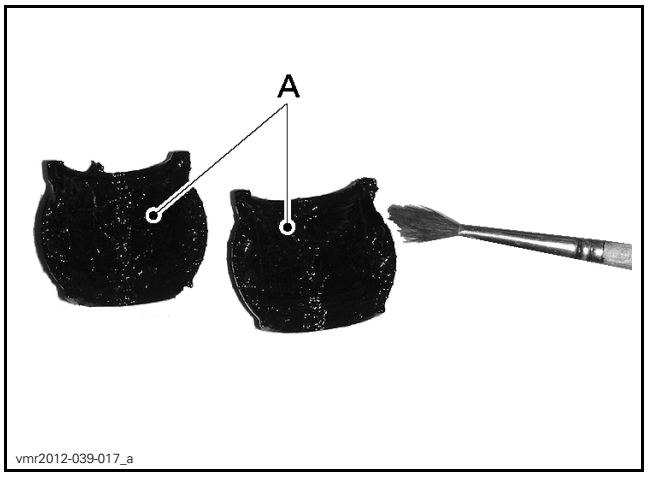
2. Install LH DPS support bracket loosely using **NEW** fasteners.

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.

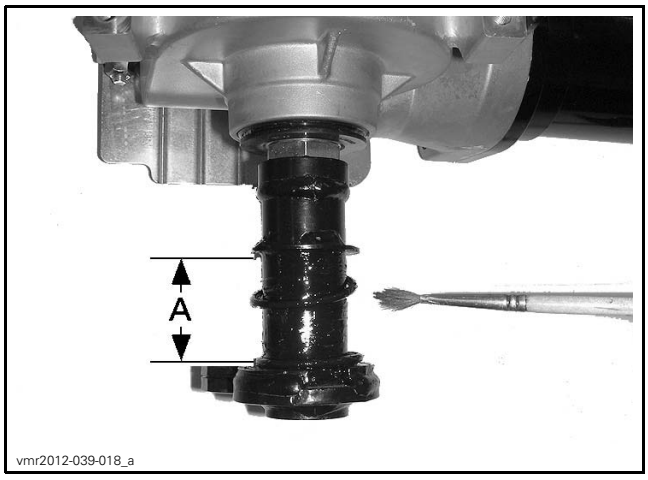


1. *LH DPS support bracket*
2. *Retaining screws*

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.

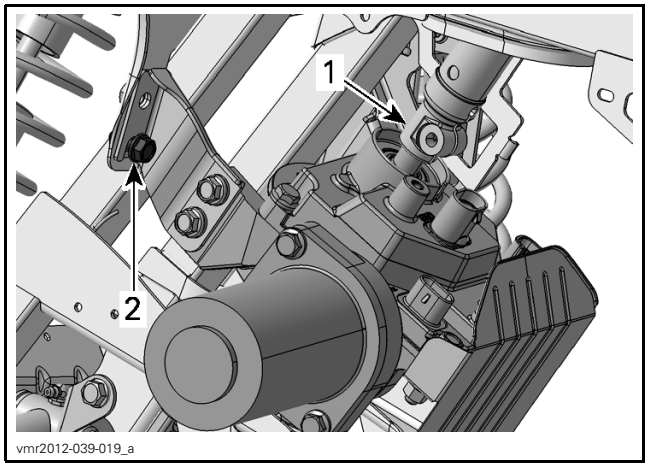


A. XPS synthetic grease (P/N 293 550 010) here



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.



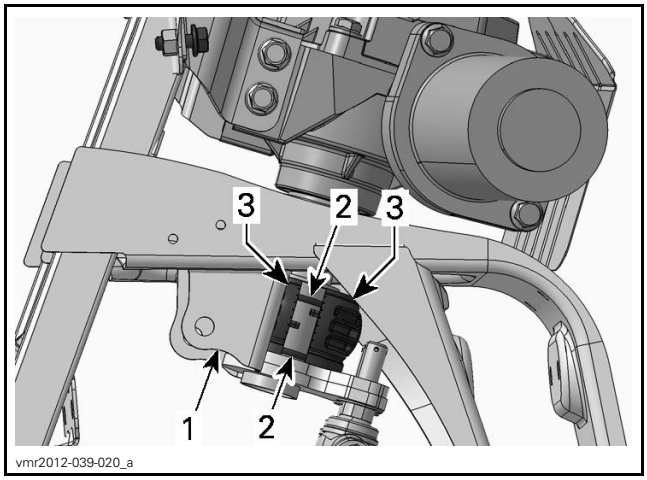
1. Steering column onto the DPS input shaft here
2. LH DPS support bracket onto the hexagonal forming screw here

NOTE: The DPS shaft splines have a key which **must be aligned** with the keyway in the steering column.



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.

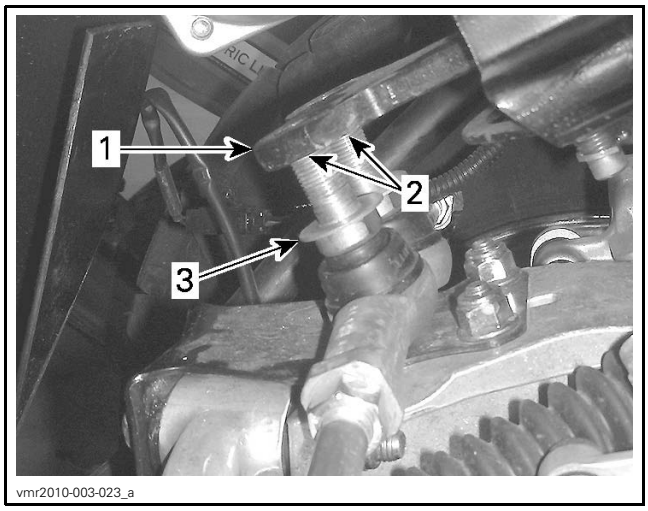


1. Lower steering shaft mount
2. O-rings
3. Steering shaft half bushings

8. Install the 3 remaining hexagonal forming screws that secure the DPS unit **loosely** using **NEW** fasteners.

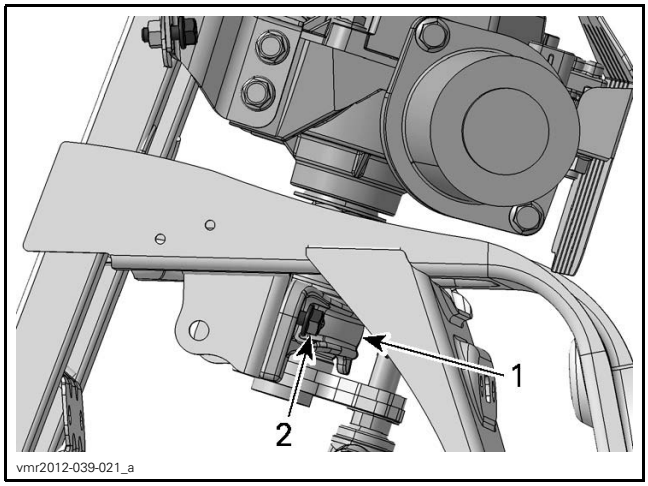
NOTE: **Ensure** the support bracket retaining screws have a **NEW** conical spring washer between the screw head and the DPS frame support.

Ensure both tie rod ends have a hardened steel washer on them, then insert the tie-rod ends onto the pitman arm.



TYPICAL
1. *Pitman arm*
2. *Tie rod ends inserted in pitman arm*
3. *Hardened steel washer on tie rod end*

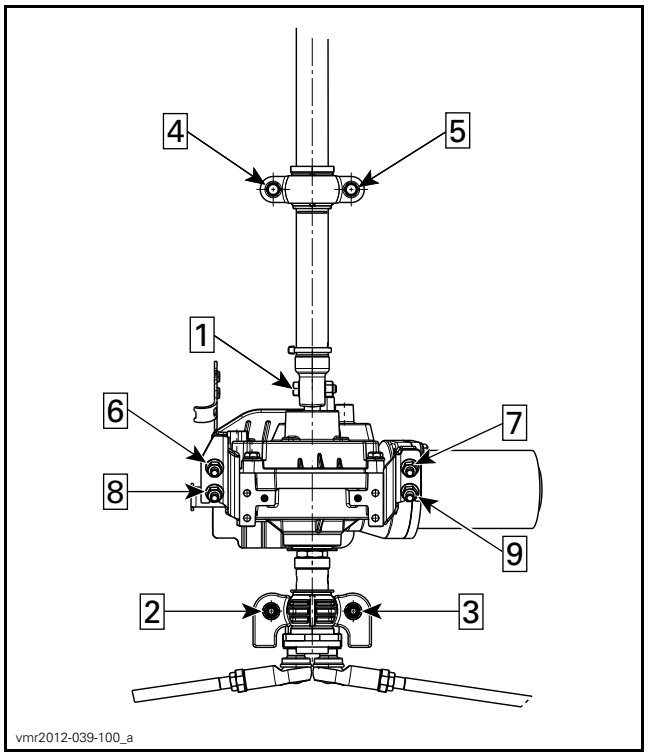
9. Install the lower half bushing retainer **loosely** using **NEW** fasteners.



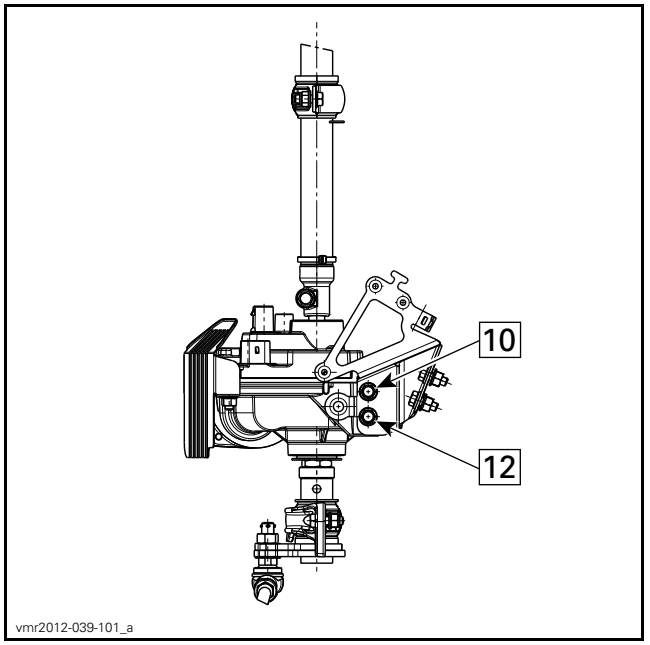
1. *Lower half bushing retainer*
2. *Hexagonal forming screws installed loosely*

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.

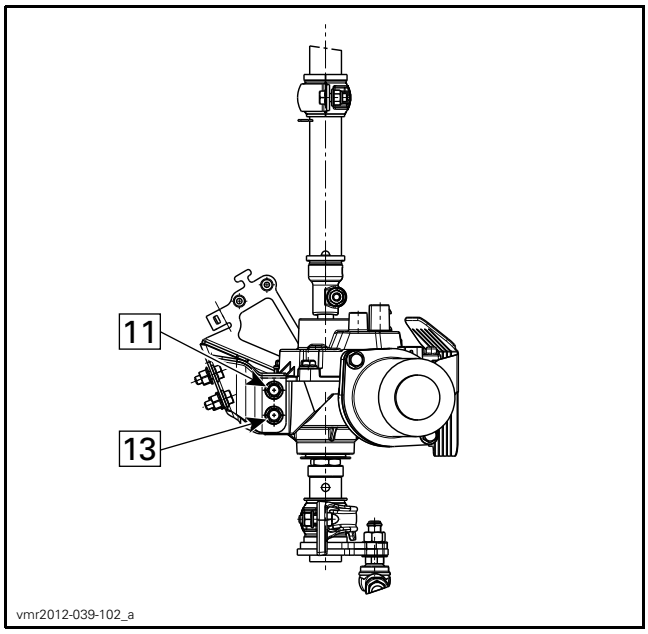
TIGHTENING TORQUE	
DPS retaining screws	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)
DPS bracket retaining screws	
Steering column retainer	
Steering column pinch bolt	



DPS AND STEERING TORQUE SEQUENCE (1 OF 3)



DPS AND STEERING TORQUE SEQUENCE (2 OF 3)

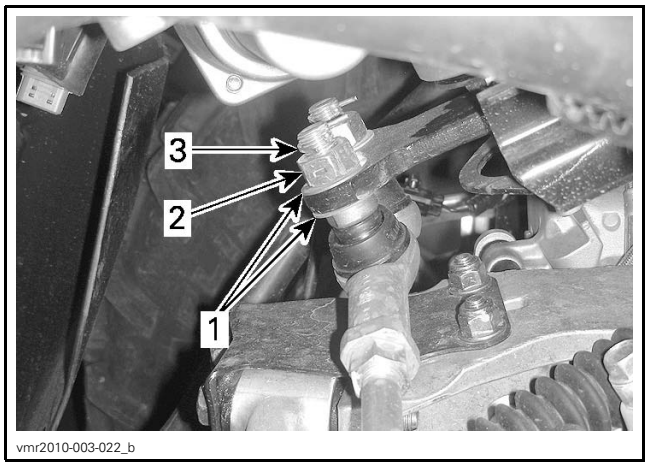


DPS AND STEERING TORQUE SEQUENCE (3 OF 3)

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)

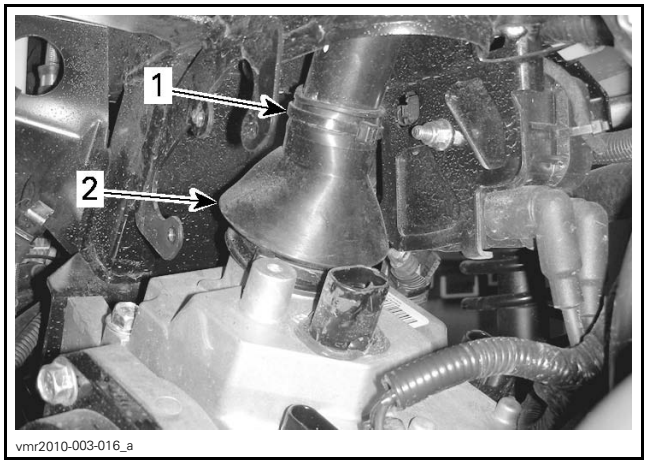
13. Install NEW cotter pins on the tie-rod ends.



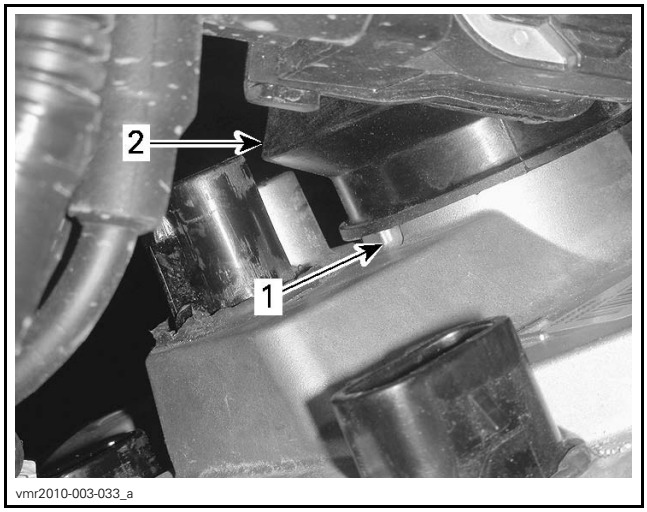
TYPICAL
1. *Hardened steel washers (one each side of pitman arm)*
2. *Tie rod end retaining nut (torque applied)*
3. *NEW cotter pin installed*

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.

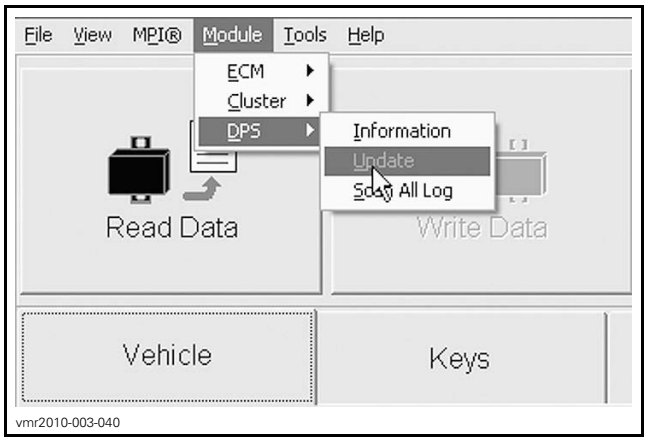
16. Reconnect DPS electrical connectors.
17. Perform a *STEERING ALIGNMENT* as described in the applicable Shop Manual subsection.
18. If installing a replacement DPS unit, refer to *DPS REPLACEMENT* in this subsection.
19. Perform the torque offset reset. Refer to *TORQUE OFFSET RESET* in this subsection.
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

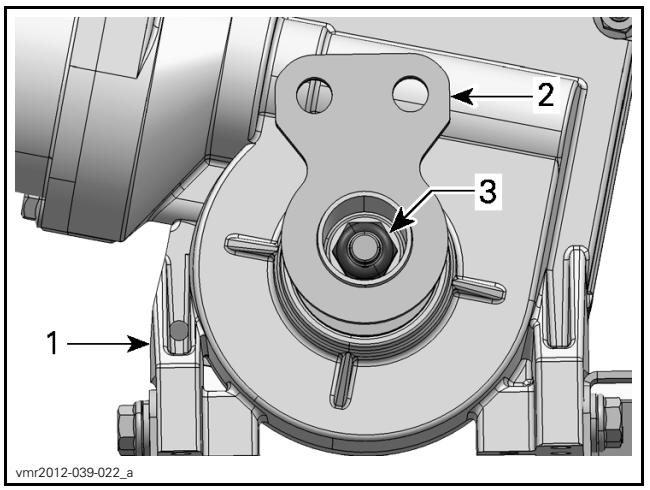
4. Once the correct DPS software file is installed, go to the **Faults** page and clear the fault codes.
5. Carry out the *TORQUE OFFSET RESET* procedure as described in this subsection.
6. Test drive the ATV to ensure proper DPS operation.

PITMAN ARM

NOTE: On models without a DPS, the pitman arm is replaced with the steering column. Refer to STEERING COLUMN in this subsection.

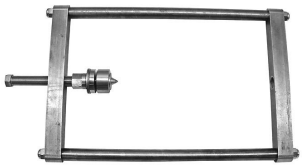
Pitman Arm Removal

1. Remove DPS unit from vehicle, refer to *DPS REMOVAL* in this subsection.
2. Remove Pitman arm retaining nut and washer.

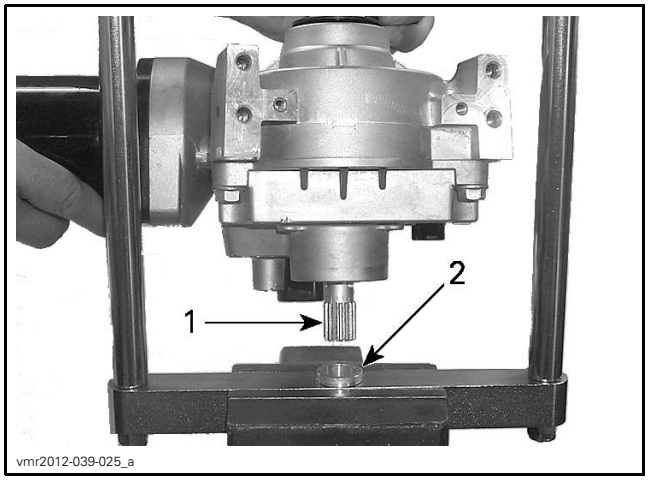


1. *DPS*
2. *Pitman arm*
3. *Pitman arm nut and washer*

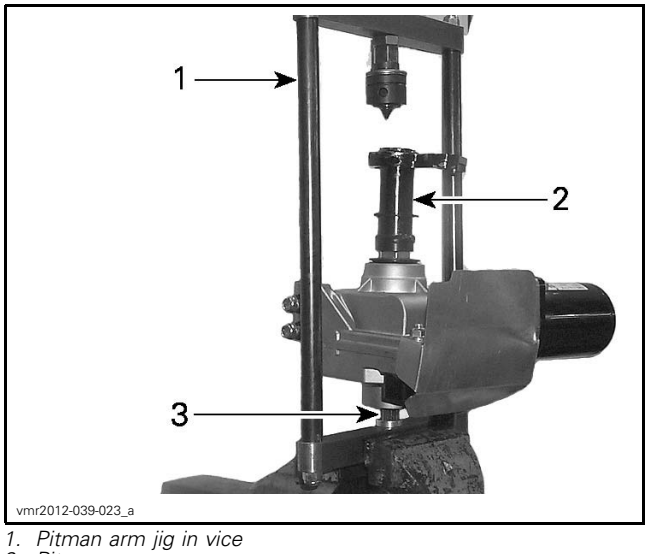
3. Install the pitman arm jig in a vise with the positioning screw upward.

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.



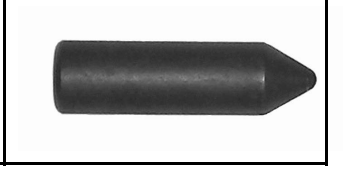
1. DPS input shaft
2. Shaft receptacle in Pitman arm jig

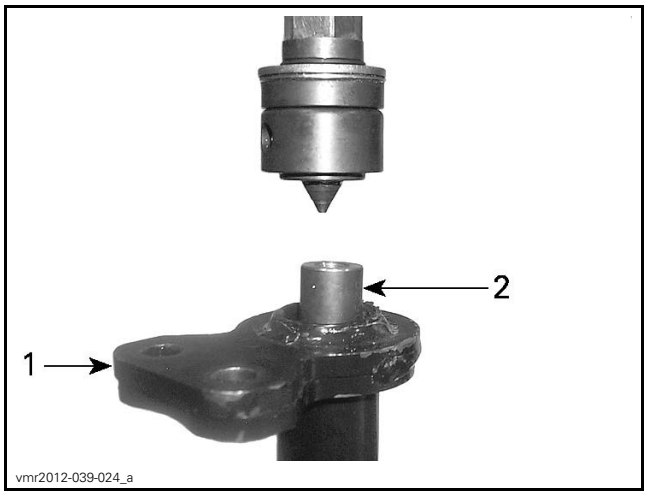


1. Pitman arm jig in vice
2. Pitman arm up
3. DPS input shaft inserted in jig

5. Insert the positioning adapter in the Pitman arm so its point rests in the DPS output shaft.

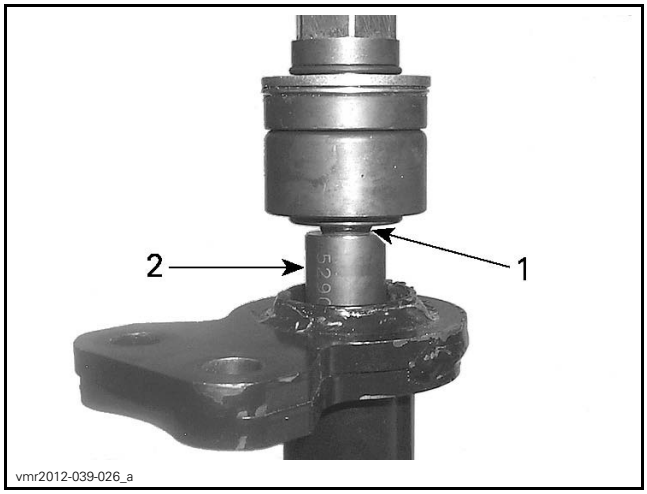
NOTE: A countersunk hole is machined in tip of the DPS output shaft to accept and center the positioning adapter point.

REQUIRED TOOL	
POSITIONING ADAPTOR (P/N 529 036 230)	



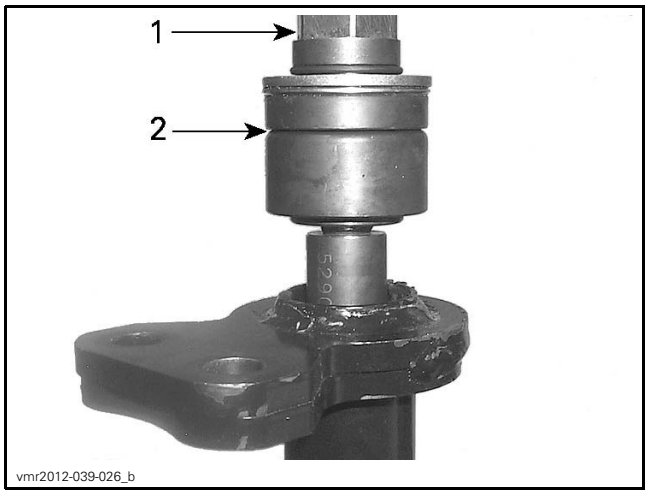
1. Pitman arm
2. Positioning adapter

6. Turn the jig positioning screw until the screw tip rests snugly in the positioning adapter.



1. Jig screw tip
2. Positioning adapter

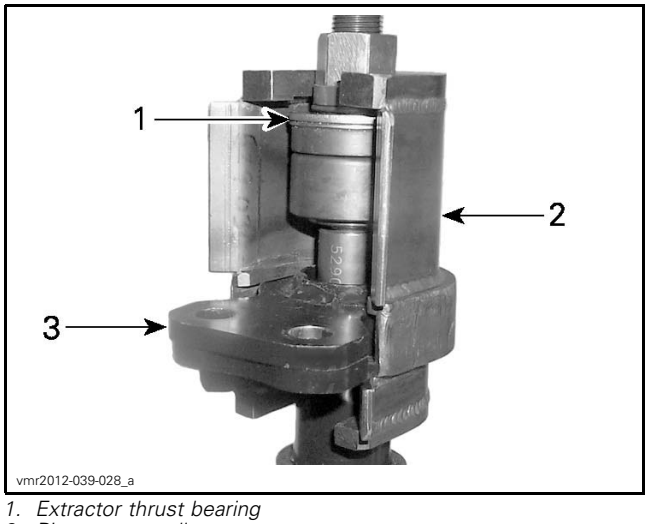
7. Turn the extractor nut down until their is no space between the extractor and the positioning tip.



1. Extractor nut
2. No space here

8. Install the universal Pitman arm puller over the Pitman arm and the extractor thrust bearing.

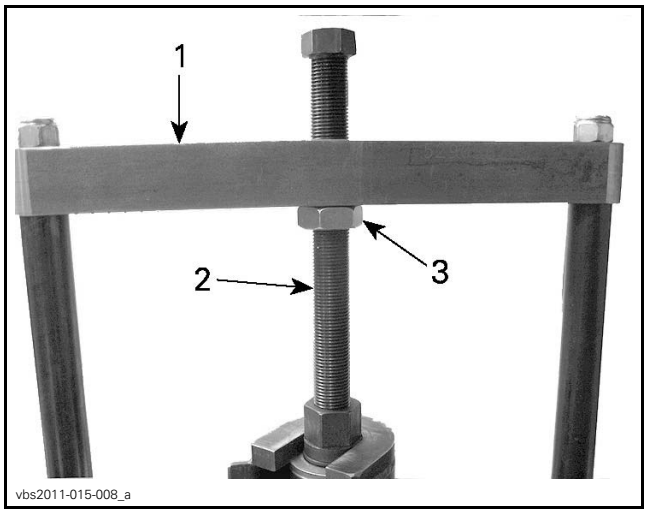
REQUIRED TOOL	
PITMAN ARM PULLER (P/N 529 036 227)	



1. Extractor thrust bearing
2. Pitman arm puller
3. Pitman arm

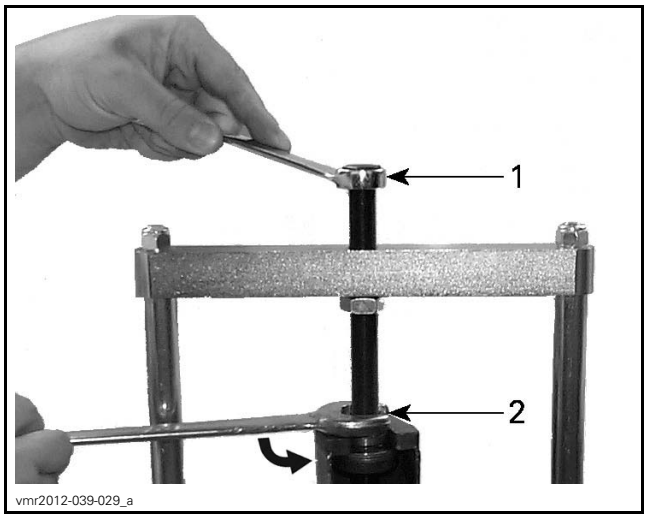
9. Lock the positioning screw by screwing the lock nut tightly against jig upper bar.

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.

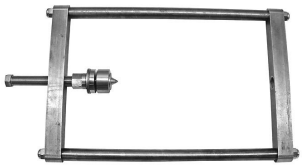


1. Positioning screw (held steady)
2. Extractor nut (turned up)

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)	

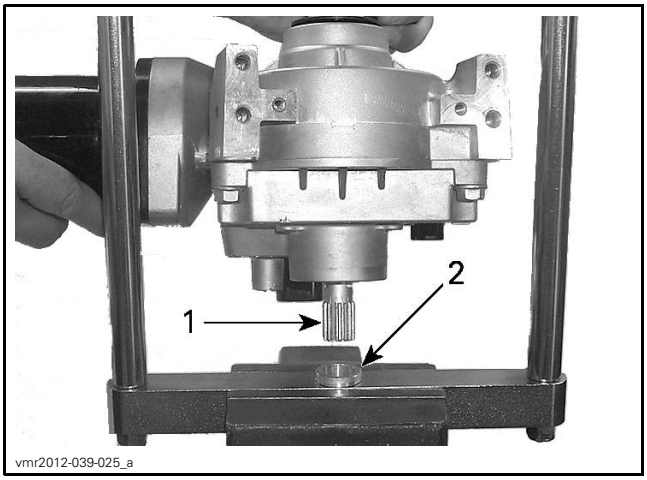
2. Apply antizeize lubricant on DPS output shaft splines; completely cover all the splines with a light coat.

PRODUCT	
DPS output shaft splines	LOCTITE 767 (ANTISEIZE LUBRICANT) (P/N 293 800 070)

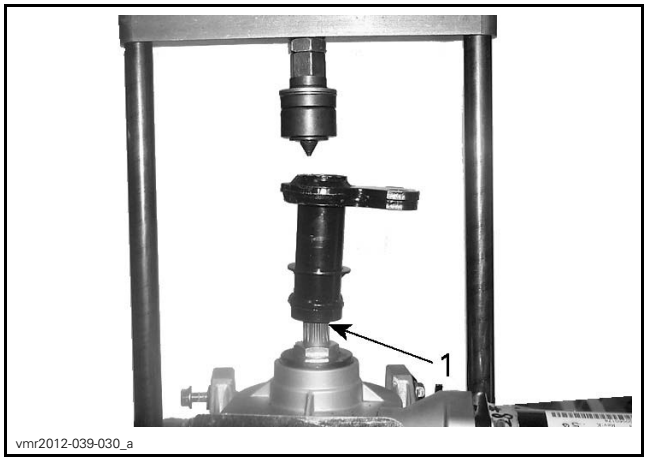
3. Place Pitman arm on DPS shaft as per following illustration.

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.



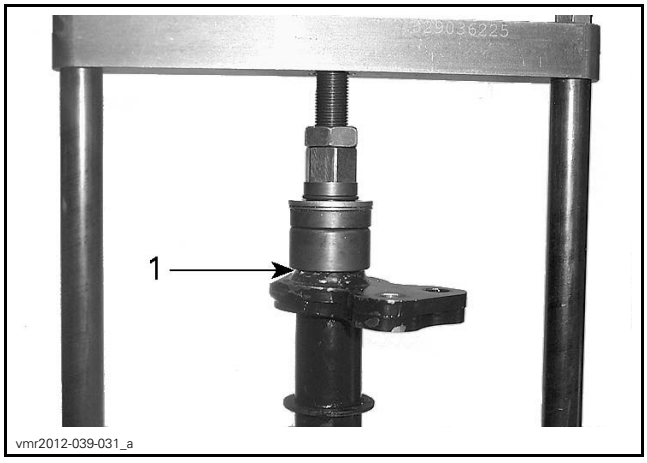
1. DPS input shaft
2. Shaft receptacle in Pitman arm jig



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.

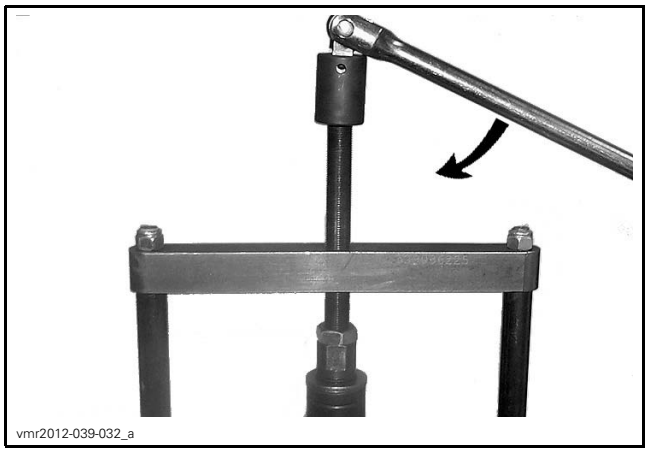


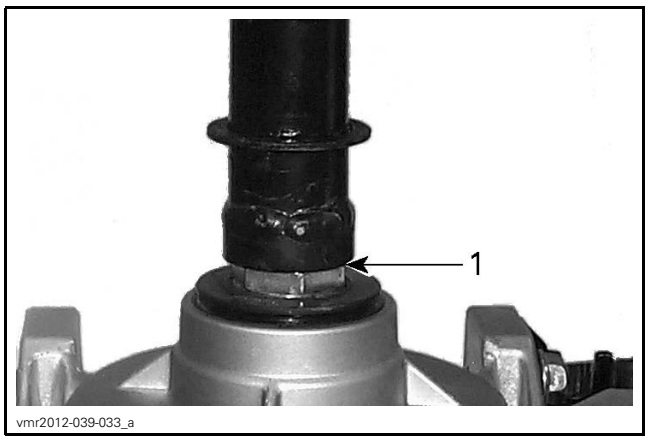
1. Ensure proper contact here

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.

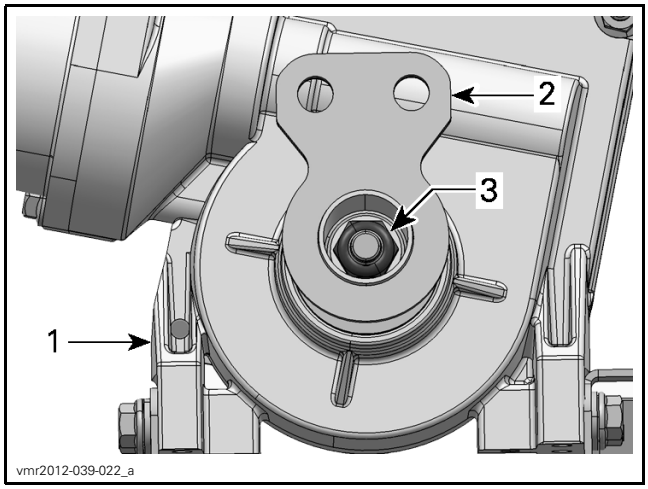
TIGHTENING TORQUE	
Positioning screw torque	50 N•m (37 lbf•ft)





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)

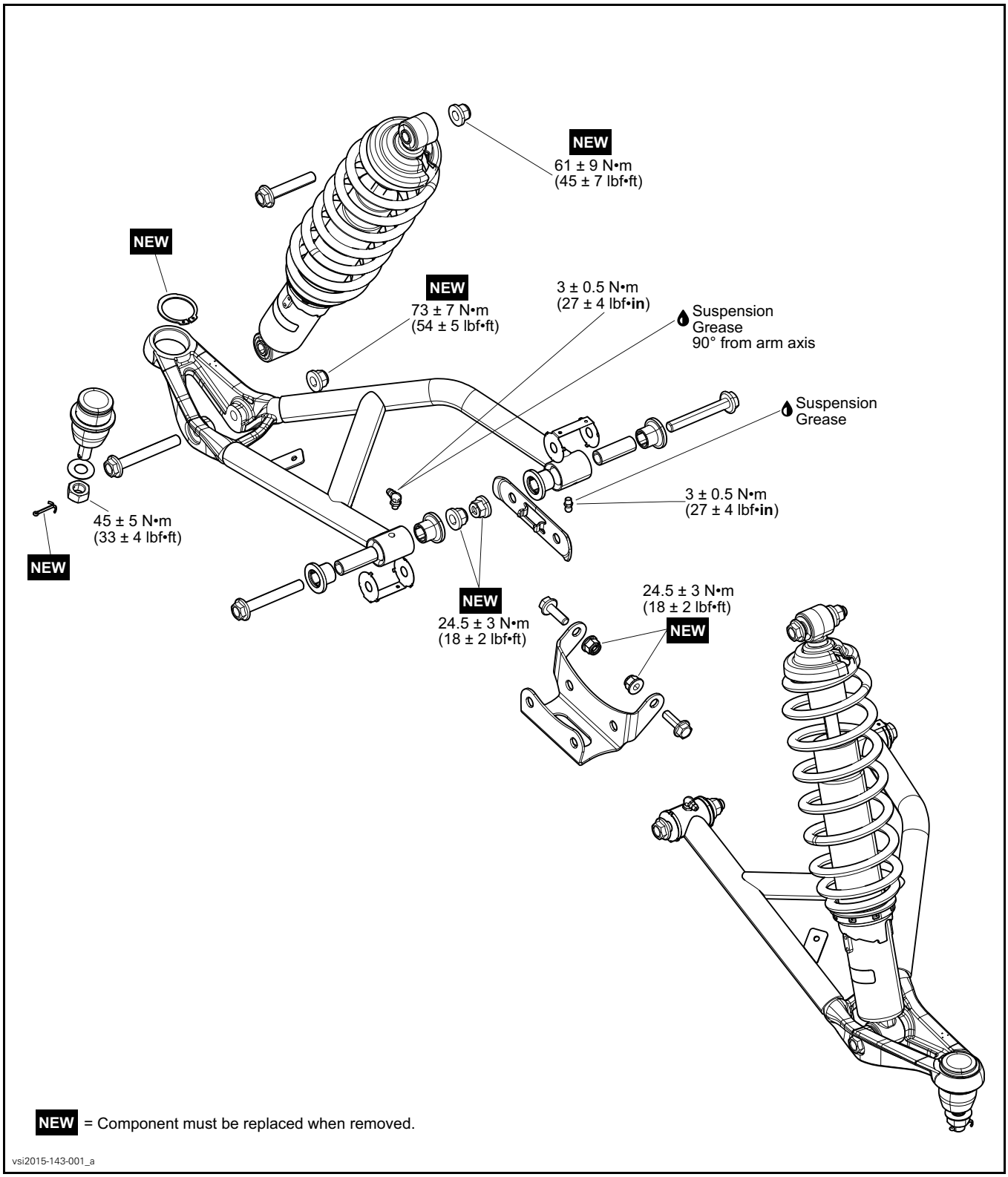
9. Carry out a steering alignment as described in this subsection.

FRONT SUSPENSION

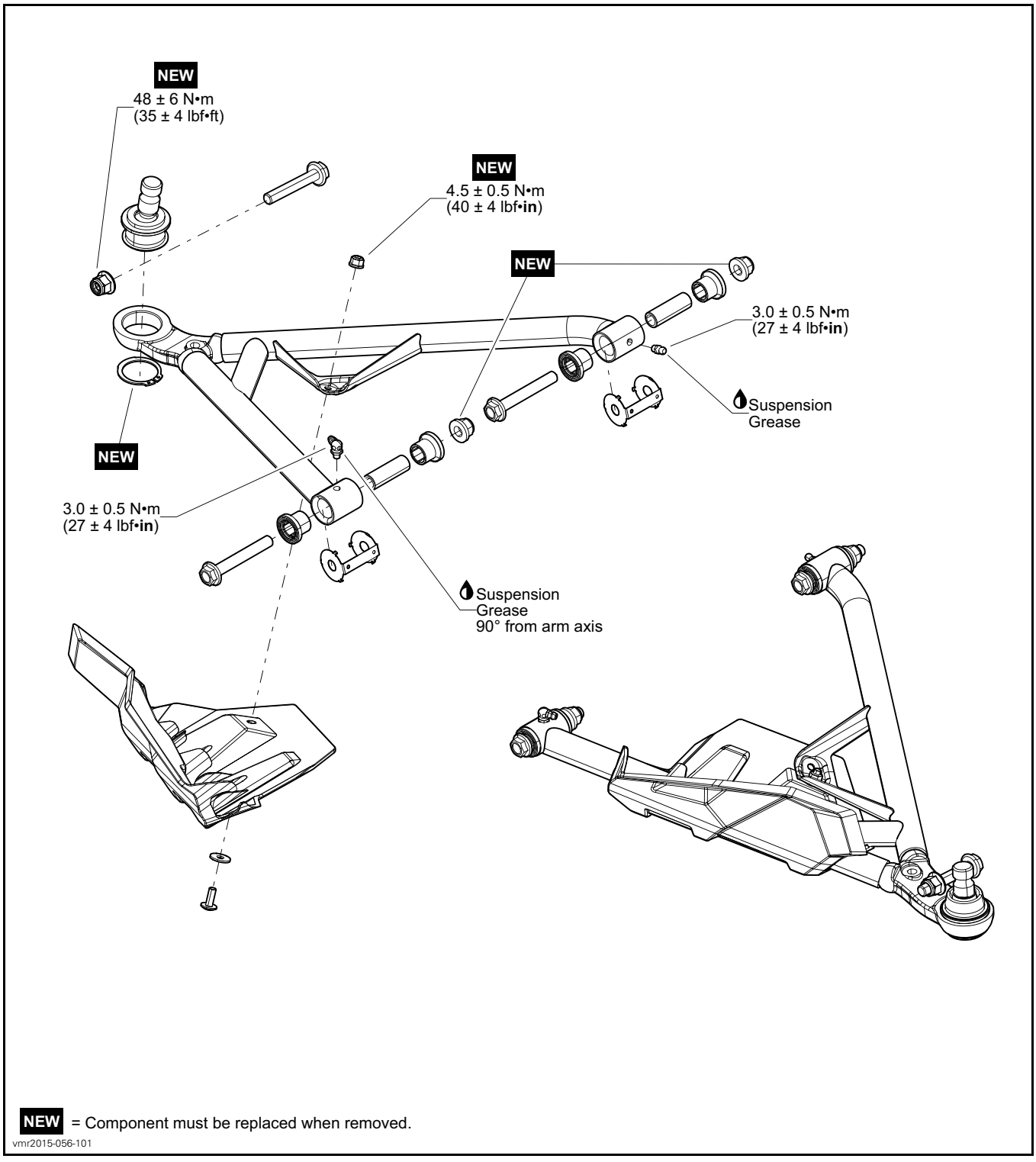
SERVICE TOOLS

Description	Part Number	Page
BALL JOINT REMOVAL TOOL	529 036 310	543

UPPER SUSPENSION ARMS AND COMPONENTS



LOWER SUSPENSION ARMS AND COMPONENTS



GENERAL

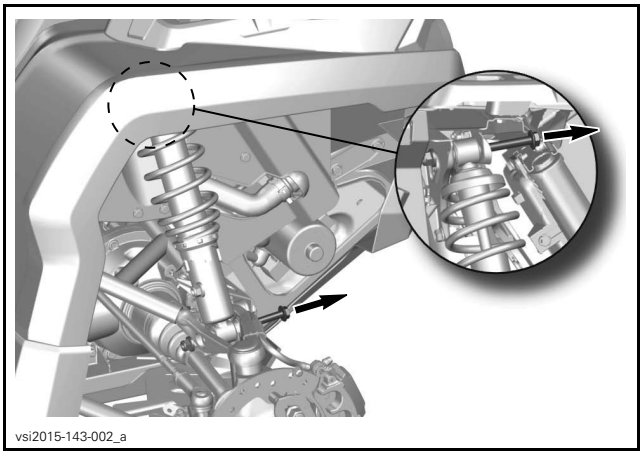
The procedure explained below is the same for the RH and LH sides unless otherwise noted.

PROCEDURES

SHOCK ABSORBER

Shock Absorber Removal

1. Safely lift and support the vehicle of the ground.
2. Remove screws and nuts retaining shock absorber.

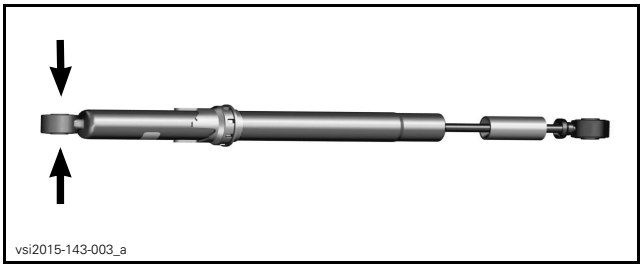

vsi2015-143-002_a

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.

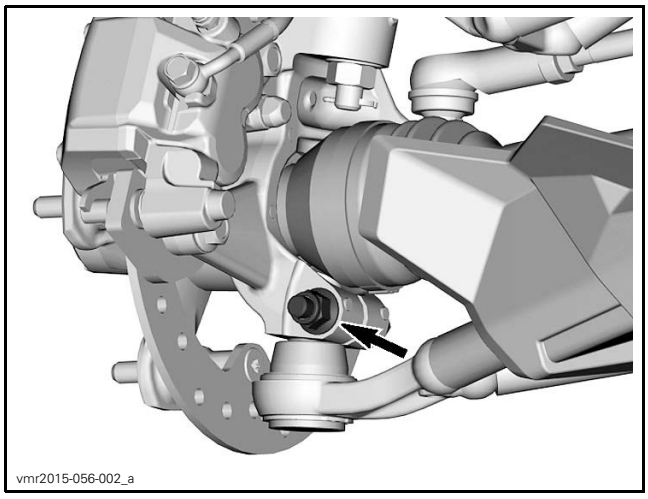
SPRINGS

Refer to *SPRINGS* in *REAR SUSPENSION* subsection for complete procedures.

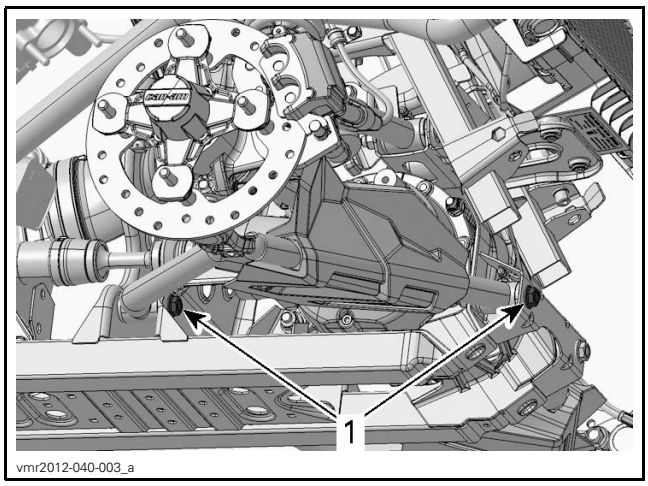
LOWER SUSPENSION ARM

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

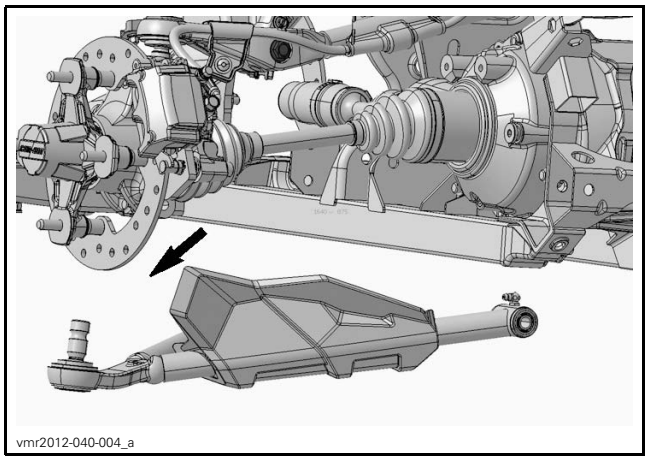
4. Remove screws and nuts securing suspension arm to frame.



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.

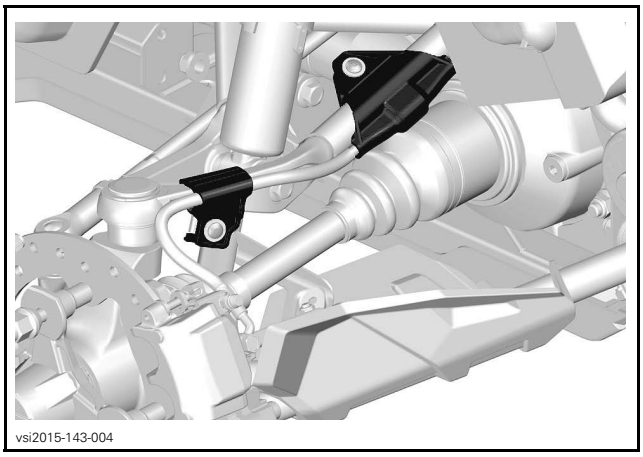
TIGHTENING TORQUE	
Nut securing ball joint to knuckle	48 N•m ± 6 N•m (35 lbf•ft ± 4 lbf•ft)

Perform steering alignment procedure. Refer to *STEERING ALIGNMENT* subsection.

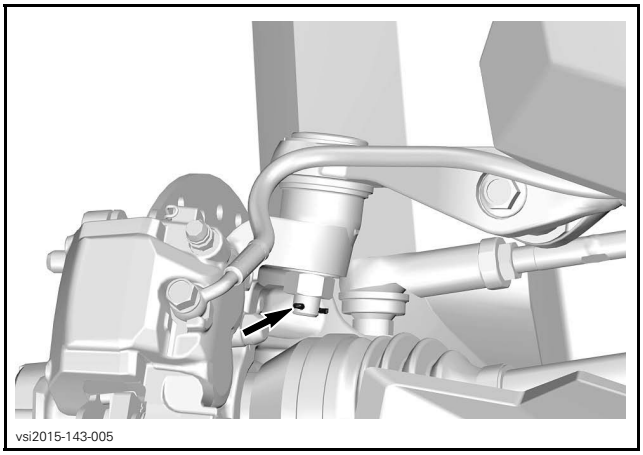
UPPER SUSPENSION ARM

Upper Suspension Arm Removal

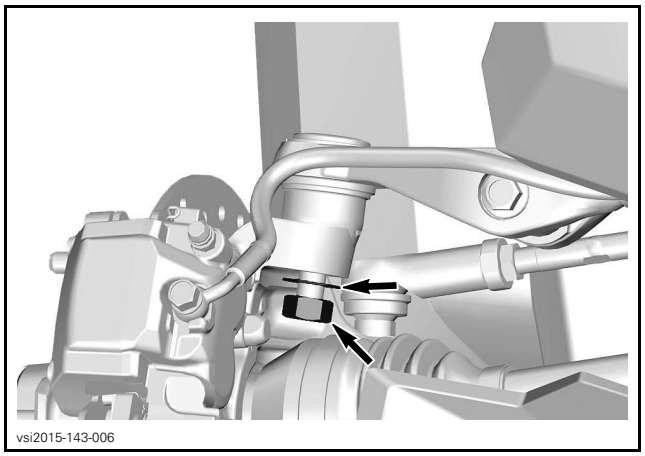
1. Safely lift and support the vehicle off the ground.
2. Remove wheel, refer to *WHEELS AND TIRES* subsection.
3. Remove fasteners retaining brake hose to vehicle.


vsi2015-143-004

4. Remove and discard cotter pin retaining ball joint.


vsi2015-143-005

5. Remove ball joint nut and washer.


vsi2015-143-006

6. Carefully move brake hose aside.
7. Using a plastic hammer, carefully hit on the knuckle side to separate ball joint from knuckle.

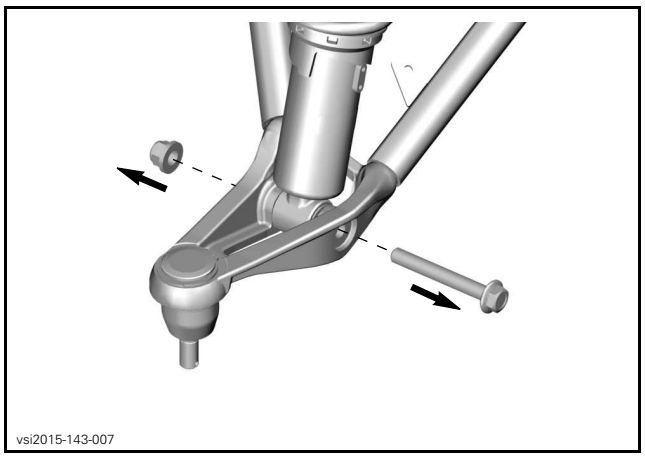
NOTE: A ball joint remover can be used if the ball joint is jammed into knuckle.

NOTICE **Never hit on suspension arm to avoid damaging it permanently.**

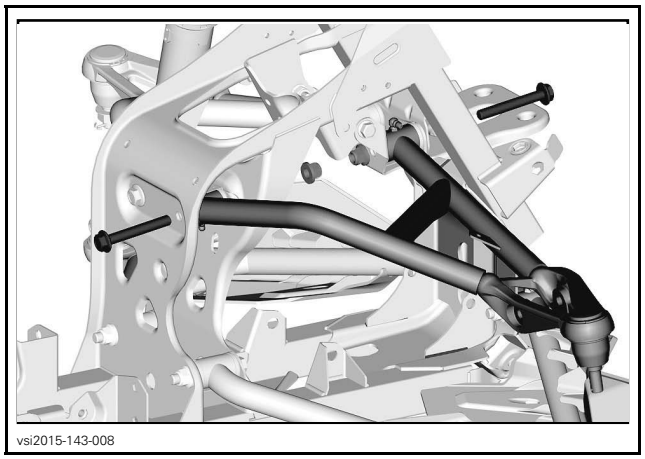

tmr2011-035-020

TYPICAL - CAREFULLY HIT ON KNUCKLE SIDE

8. Remove screw and nut securing suspension arm to shock absorber.


vsi2015-143-007

9. Remove screws and nuts securing suspension arm to frame.


vsi2015-143-008

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.

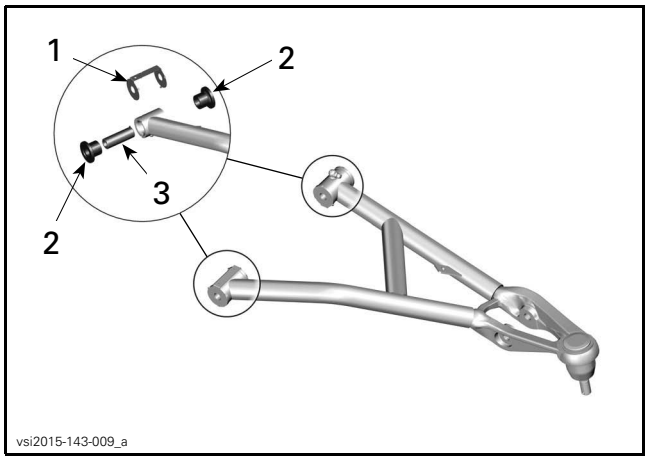
TIGHTENING TORQUE	
Ball joint nut	45 N•m ± 5 N•m (33 lbf•ft ± 4 lbf•ft)

Perform steering alignment procedure. Refer to *STEERING ALIGNMENT* subsection.

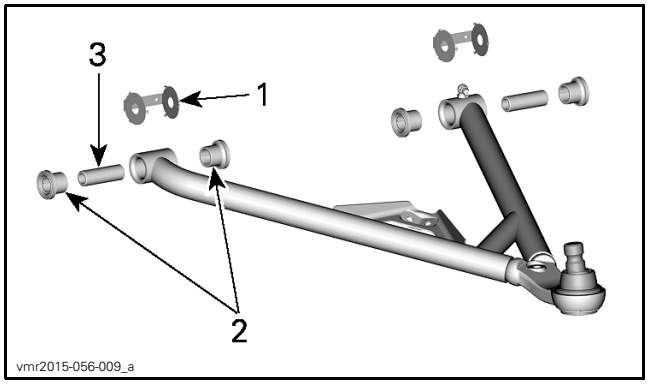
SUSPENSION ARM BUSHINGS

Suspension Arm Bushings Removal

1. Remove wear plates, bushings and sleeves from suspension arm.



UPPER SUSPENSION ARM
1. *Wear plates*
2. *Bushings*
3. *Sleeves*



LOWER SUSPENSION ARM
1. *Wear plates*
2. *Bushings*
3. *Sleeves*

Suspension Arm Bushings Installation

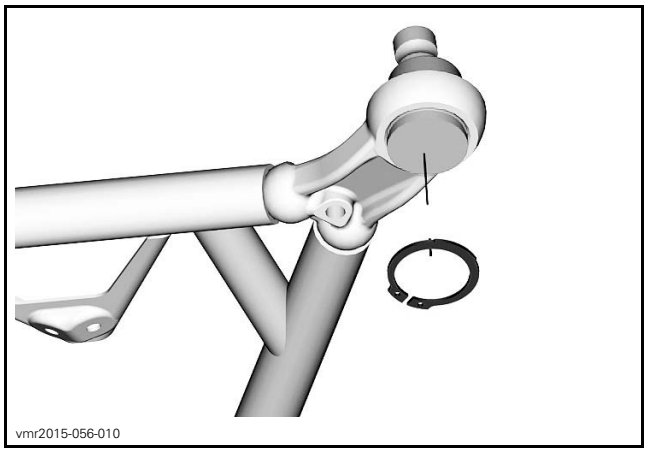
The installation is the reverse of the removal procedure. However, pay attention to the following.

Lubricate suspension arm. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

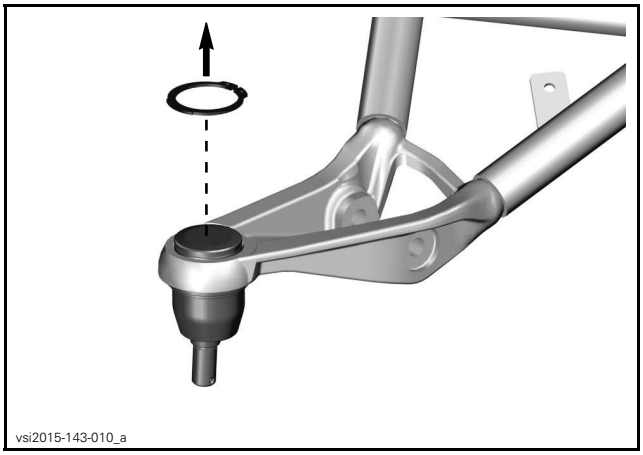
BALL JOINTS

Ball Joint Removal

1. Remove suspension arm from vehicle. Refer to *SUSPENSION ARM REMOVAL* in this subsection.
2. Remove circlip from ball joint.



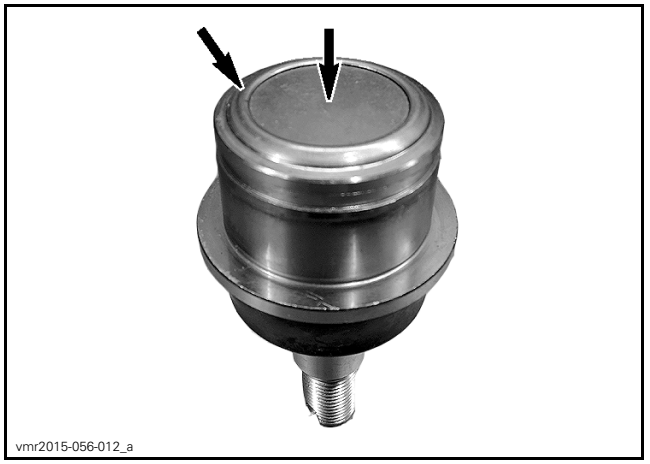
LOWER BALL JOINT



UPPER BALL JOINT

3. Install suspension arm on a press.

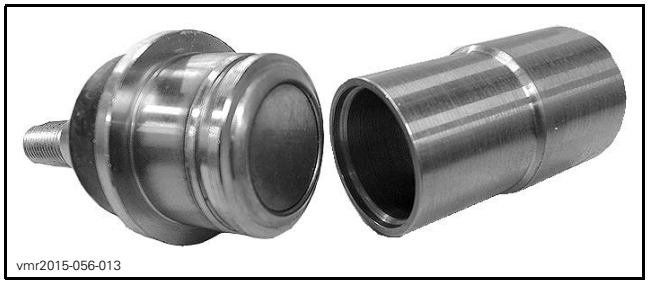
NOTICE Pressing on the center or on the lip of the ball joint will damage it.

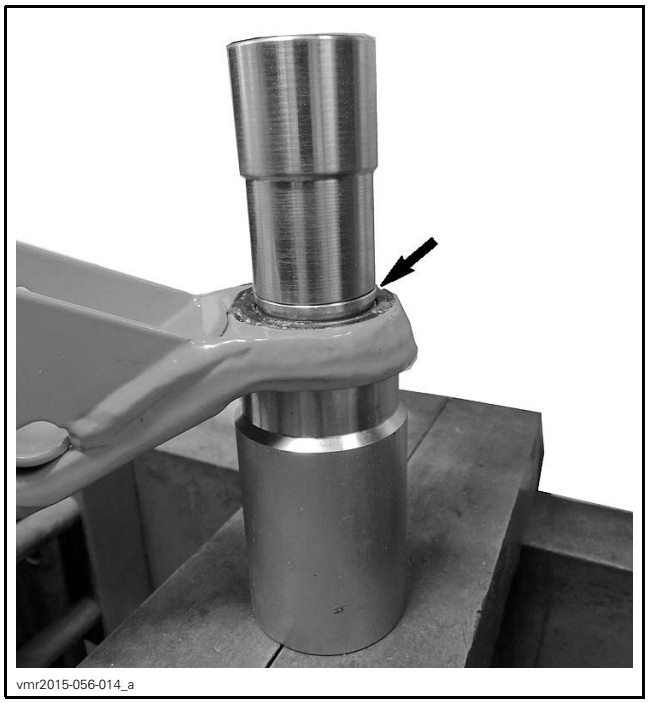


DO NOT PRESS THERE

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

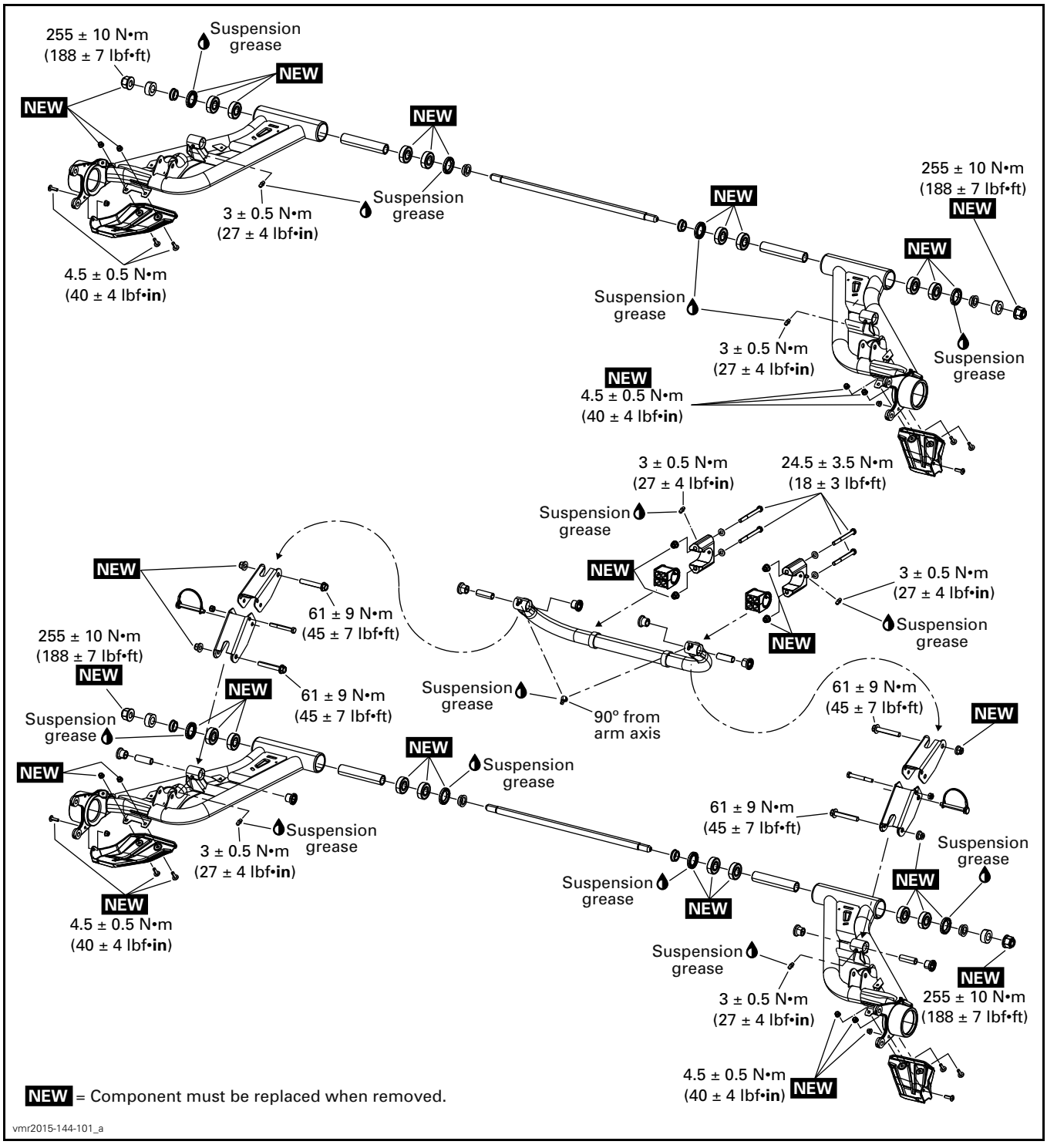
SERVICE TOOLS

Description	Part Number	Page
SPRING COMPRESSOR	529 036 184	548

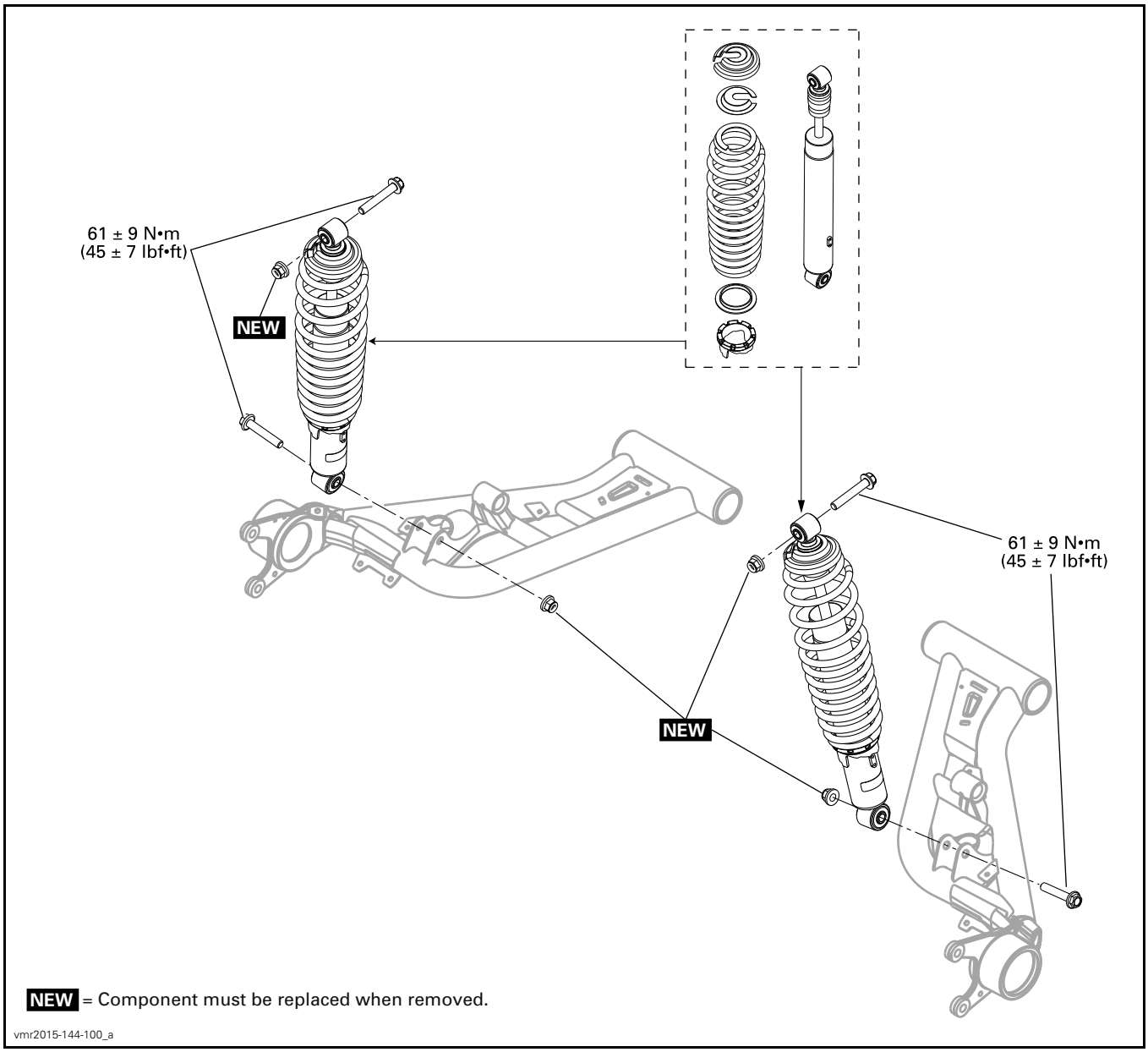
SERVICE PRODUCTS

Description	Part Number	Page
SUSPENSION GREASE	293 550 033	552

TRAILING ARMS AND ANTI-SWAY BAR



SHOCK ABSORBERS



GENERAL

The procedure described below is the same for the RH and LH sides, unless otherwise instructed.

PROCEDURES

SHOCK ABSORBERS

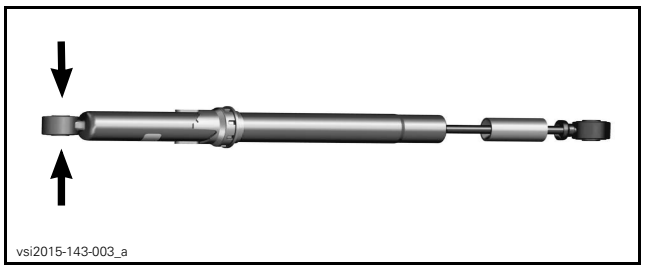
Shock Absorber Removal

1. Safely lift and support the vehicle off the ground.
2. Remove bolts and nuts retaining shock absorber.
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.



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.

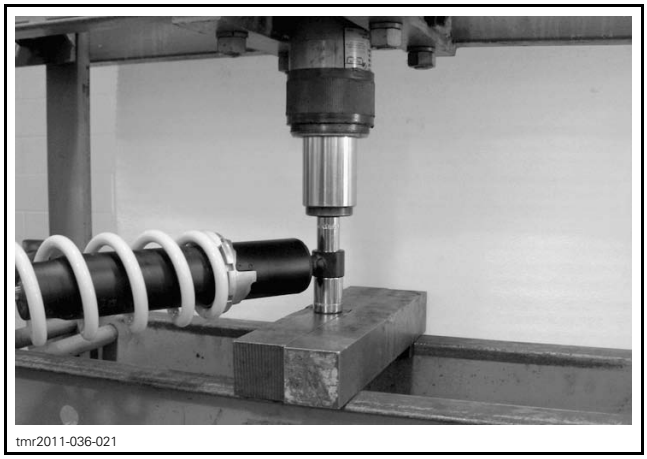
TIGHTENING TORQUE	
Shock absorber nuts	61 N•m ± 9 N•m (45 lbf•ft ± 7 lbf•ft)

SHOCK ABSORBER BUSHINGS

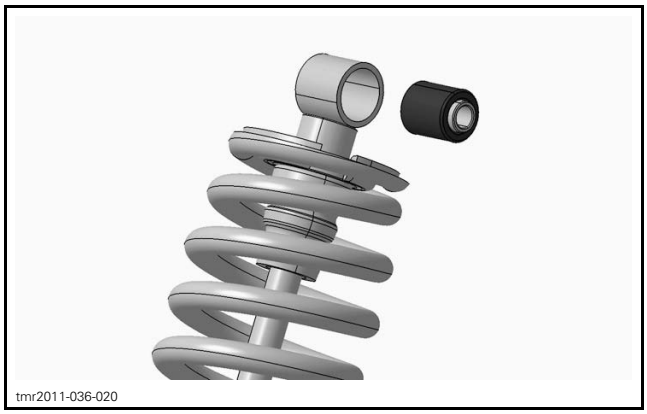
Shock Absorber Bushing Replacement

All Shock Absorbers

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 out of shock absorber end.



TYPICAL



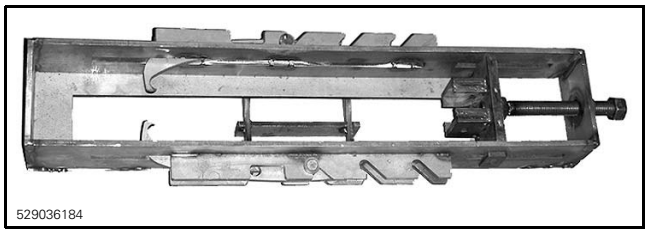
TYPICAL

4. Install a **NEW** bushing as the reverse of removal.
5. Install shock absorber on vehicle.

SPRINGS

Spring Removal

1. Install the SPRING COMPRESSOR (P/N 529 036 184) in a vice.



2. Position the shock absorber in the tool.
3. Install the spring compressor pins.
4. Tighten spring remover screw until the spring is sufficiently compressed to remove spring cap.
5. Remove spring cap from shock absorber.
6. Release spring remover screw.
7. Remove spring from shock absorber.

Spring Inspection

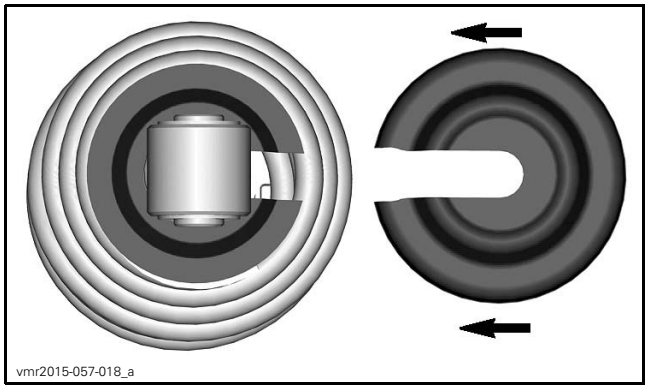
Inspect the spring for damage.

Replace if necessary.

Spring Installation

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

Install spring cap opening at 180° from spring stopper opening.

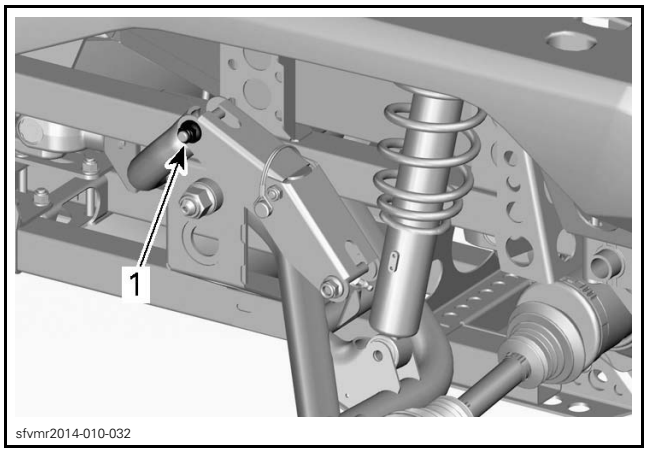


CAP OPENING AT 180°

ANTI-SWAY BAR

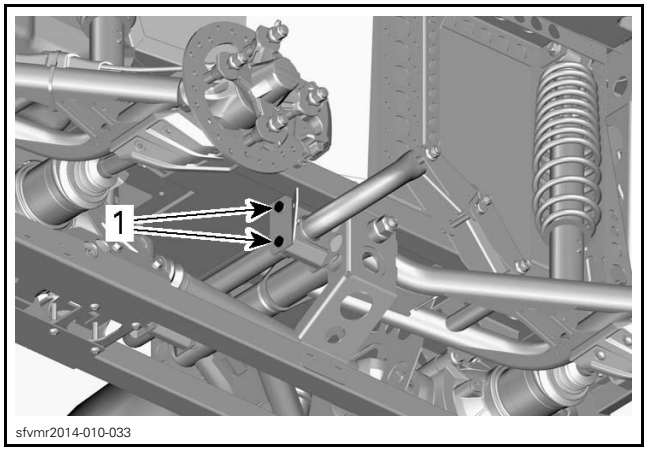
Anti-Sway Bar Removal

1. Safely lift and support the vehicle off the ground.
2. Remove rear wheels, refer to *WHEELS AND TIRES* subsection.
3. Detach anti-sway bar from link arm (both sides).



RH SIDE SHOWN - SOME PARTS REMOVED FOR CLARITY
1. Bolt securing anti-sway bar

4. Remove bolts and nuts securing anti-sway bar to frame (both sides).



RH SIDE SHOWN - SOME PARTS REMOVED FOR CLARITY
1. Bolts securing anti-sway bar

5. Remove rear propeller shaft screw from the middle drive yoke. Refer to *PROPELLER SHAFT* subsection.
6. Remove rear final drive. Refer to *REAR FINAL DRIVE* subsection
7. Remove anti-sway bar.

Anti-Sway Bar Inspection

Check anti-sway bar for cracks, bending or other damages.

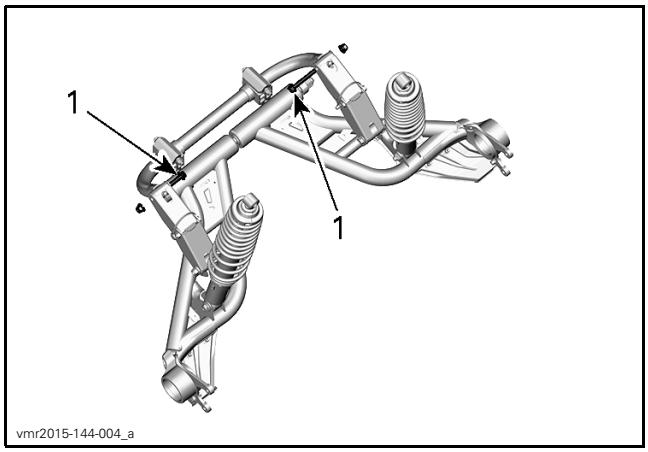
Replace if necessary.

Anti-Sway Bar Installation

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

Install all retaining bolts of anti-sway bar loosely first.

Position link arm bolts with their heads towards inside.



TYPICAL
1. Head towards inside

Tighten anti-sway bar retaining bolts to specification.

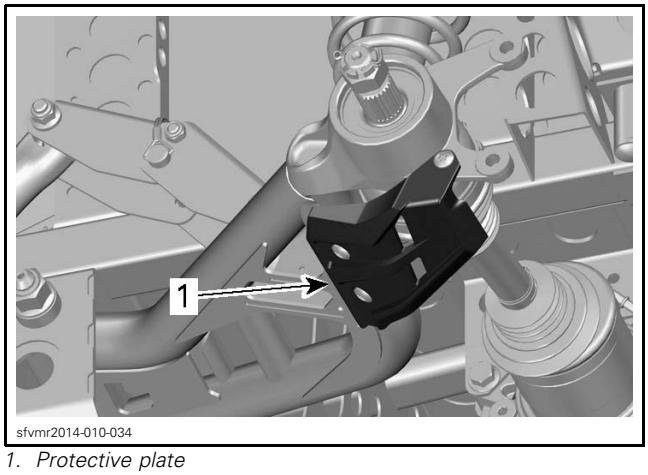
TIGHTENING TORQUE	
Bolts securing anti-sway bar to frame	24.5 N•m ± 3.5 N•m (18 lbf•ft ± 3 lbf•ft)
Bolts securing anti-sway bar to link arm	61 N•m ± 9 N•m (45 lbf•ft ± 7 lbf•ft)

Lubricate anti-sway bar. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

TRAILING ARM

Trailing Arm Removal

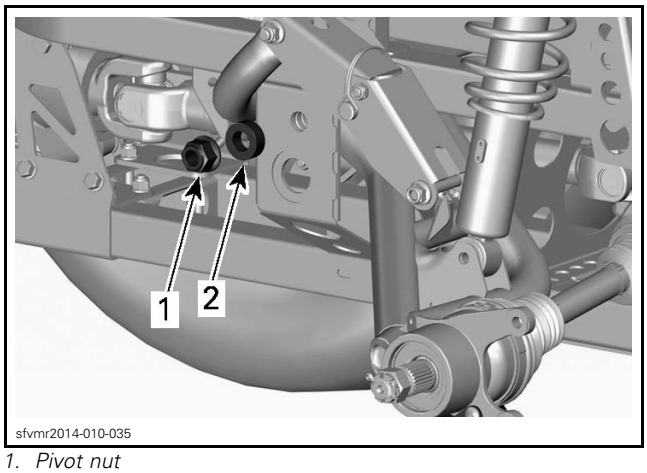
1. Safely lift and support the vehicle off the ground.
2. Remove wheel hub, refer to *REAR FINAL DRIVE* subsection.
3. Remove protective plate from trailing arm.



1. Protective plate

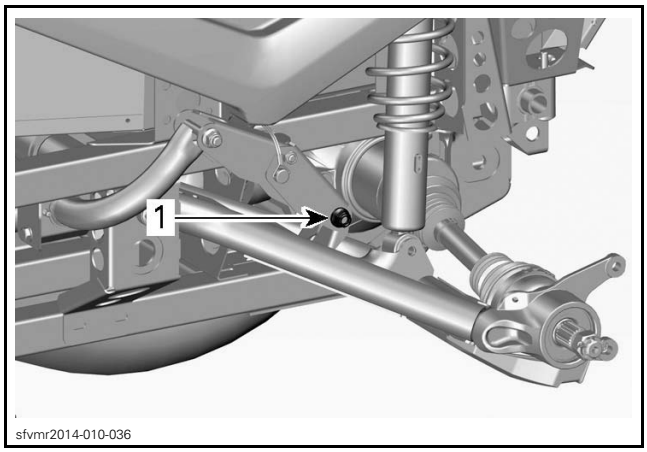
NOTE: If applicable, remove fasteners retaining brake hose to vehicle.

4. Remove nut and washer securing trailing arm pivot shaft.



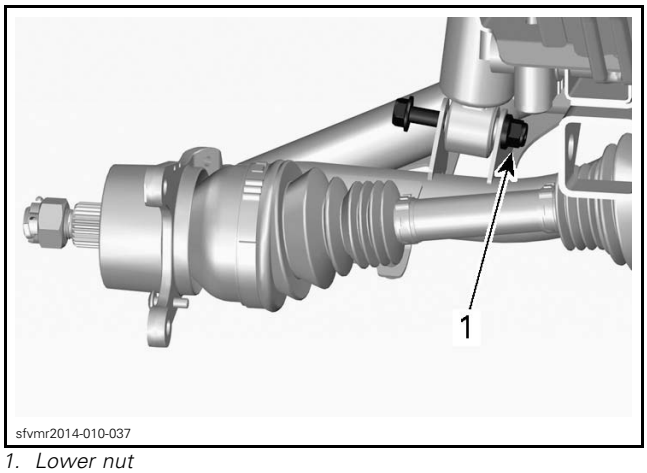
1. Pivot nut
2. Pivot washer

5. Detach trailing arm from link arm (both sides).



1. Bolt securing trailing arm

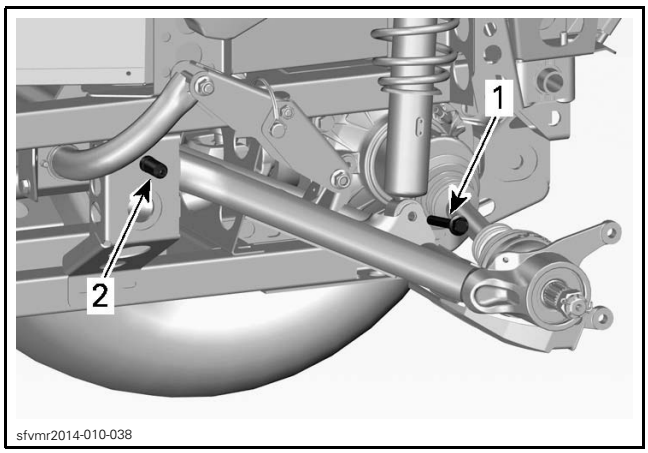
6. Remove lower nut retaining shock absorber.



1. Lower nut

7. Firmly hold trailing arm then remove:
   – Shock absorber lower bolt
   – 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.



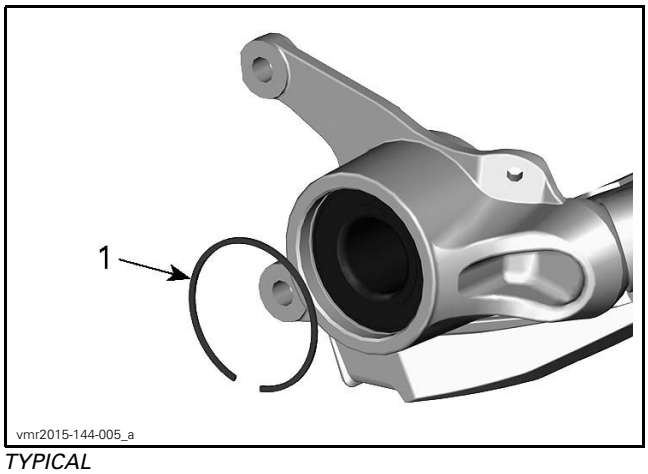
1. Shock absorber lower bolt
2. Trailing arm pivot shaft

8. Remove trailing arm from vehicle.

Trailing Arm Disassembly

Drive Shaft Bearing Removal

1. Remove circlip securing bearing into trailing arm.

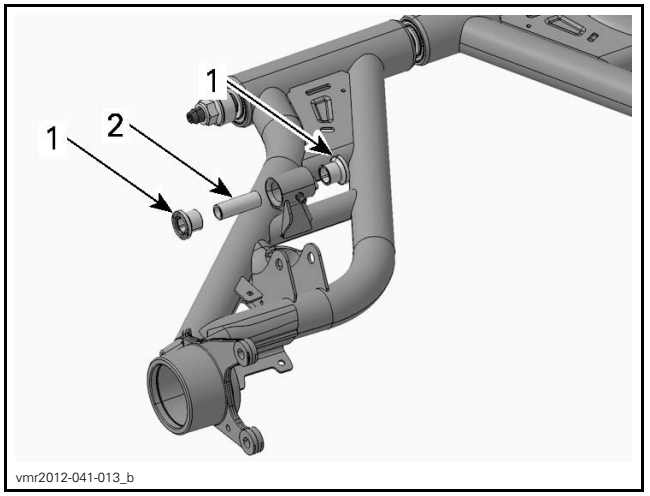


TYPICAL
1. Circlip

2. Install trailing arm on a press.
3. Use an appropriate bearing remover.
4. Remove drive shaft bearing from trailing arm.

Link Arm Inner Sleeve Removal

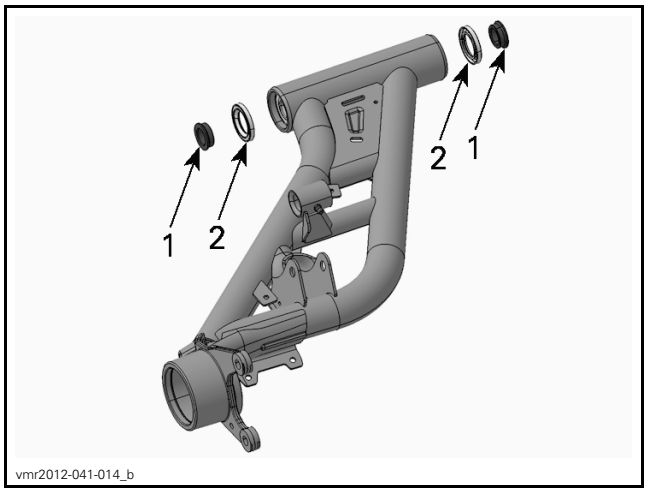
Remove both bushings and inner sleeve from trailing arm.



1. Bushings
2. Inner sleeve

Trailing Arm Pivot Bearing Removal

1. Remove both spacers and seals from trailing arm pivot.

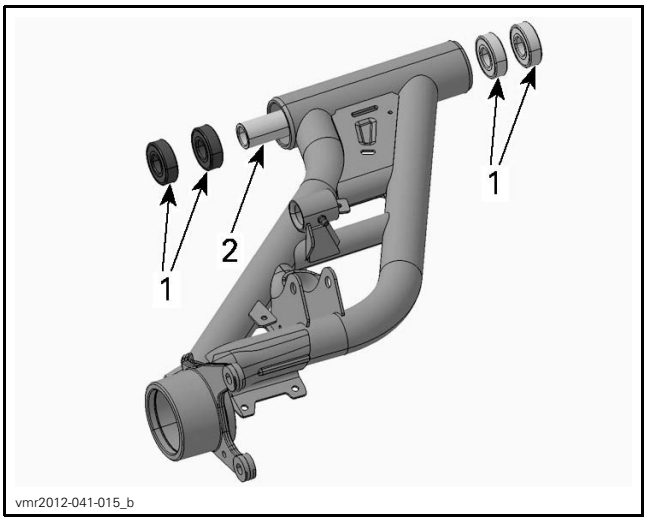


1. Spacers
2. Seals

2. Remove pivot bearings by pulling it outwards.

NOTE: Remove one bearing at a time.

3. Remove inner spacer from trailing arm.



1. *Pivot bearings*
2. *Inner spacer*

Trailing Arm Inspection

Check trailing arms for:
– Cracks
– Bending.

Check inner race of each pivot bearing with your finger:
– Bearings should turn smoothly and quietly.

Replace all damaged parts.

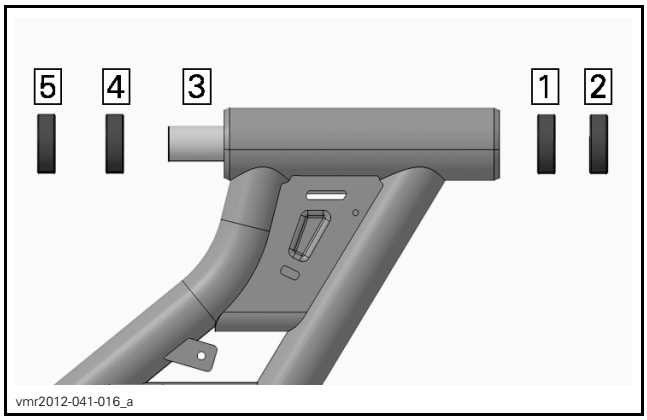
Trailing Arm Assembly and Installation

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.

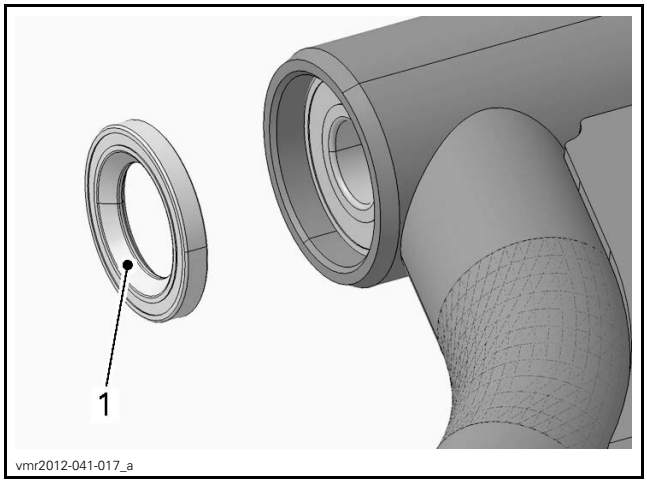


TYPICAL - LH TRAILING ARM
Step 1: Insert inner bearing on RH side
Step 2: Insert outer bearing on RH side
Step 3: Center inner spacer with RH side bearings using a shaft
Step 4: Insert inner bearing on LH side
Step 5: Insert outer bearing on LH side

Lubricate trailing arm pivot seals.

LUBRICATION	
Pivot seals	SUSPENSION GREASE (P/N 293 550 033)

Install trailing arm pivot seal with its taper face outwards.



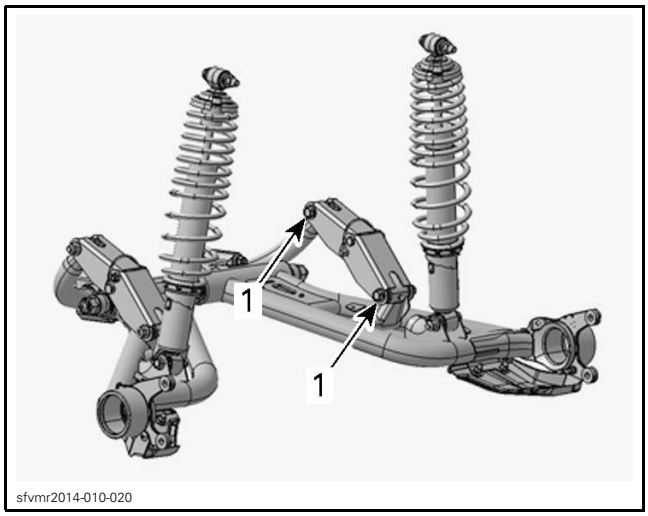
1. *Taper face*

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.



TYPICAL
1. Head 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

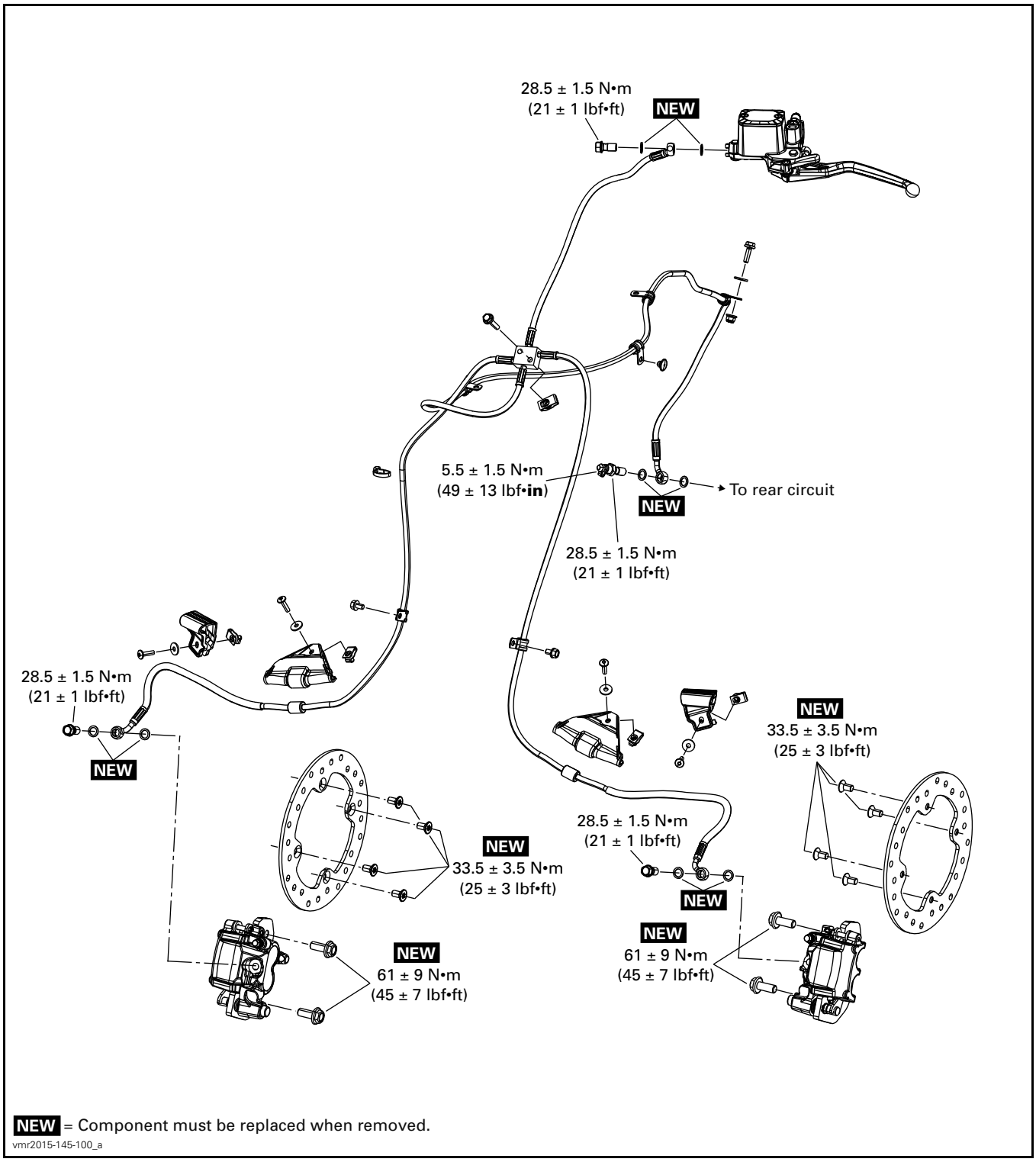
SERVICE TOOLS

Description	Part Number	Page
ECM ADAPTER TOOL	529 036 166	560

SERVICE PRODUCTS

Description	Part Number	Page
XPS BRAKES AND PARTS CLEANER (USA)	219 701 705	563
XPS SYNTHETIC GREASE	293 550 010	561

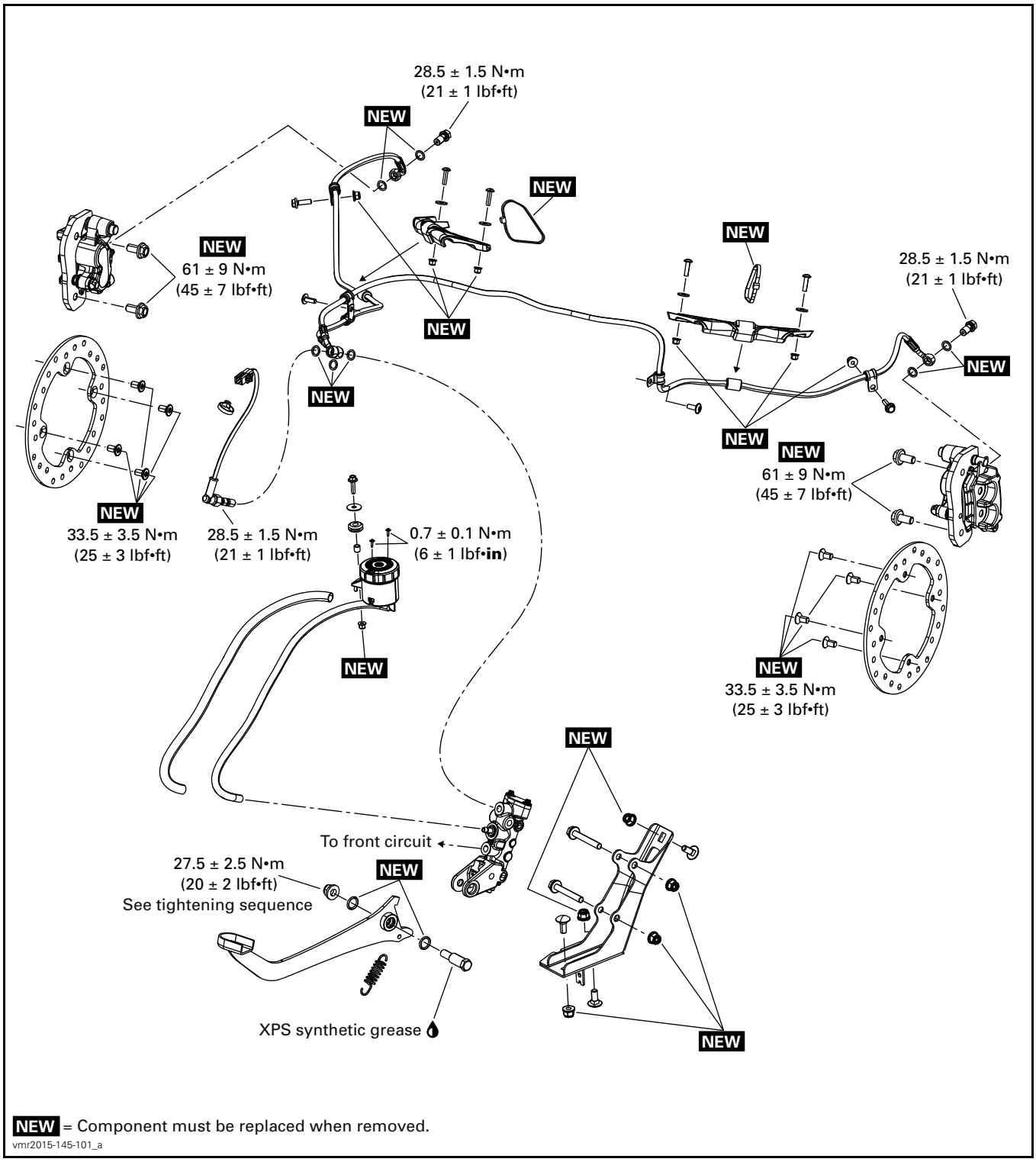
FRONT CIRCUIT



NEW = Component must be replaced when removed.

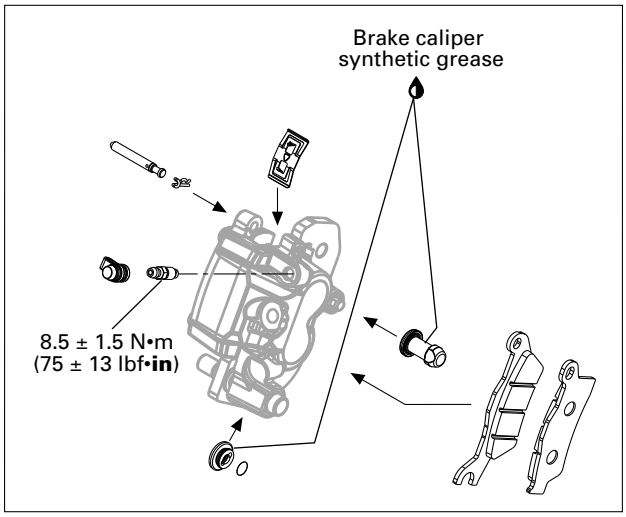
vmr2015-145-100_a

REAR CIRCUIT

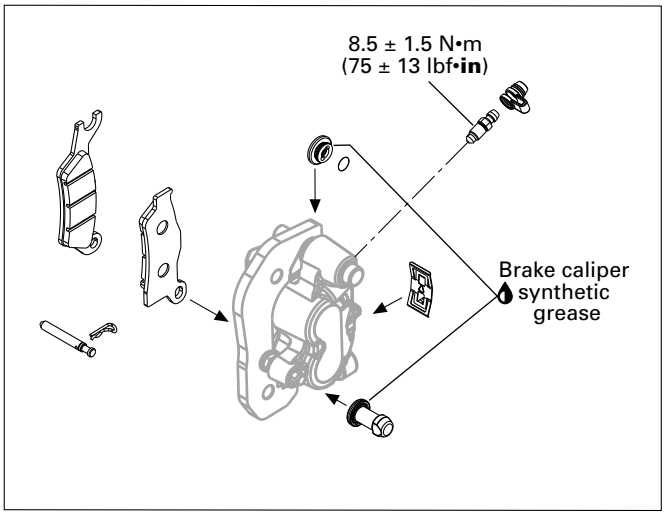


CALIPERS AND BRAKE LEVERS

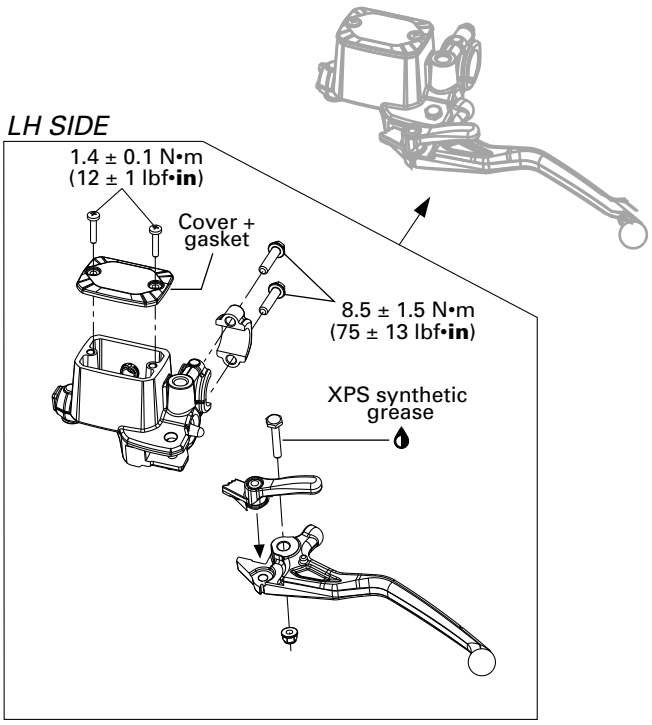
FRONT



REAR



LH SIDE



sfvmr2014-010-129

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.

Sealing washers must be discarded and replaced with new ones every time a Banjo bolt is unscrewed.

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

NUMBER OF DISC BRAKES	
FRONT	REAR
2	2

Brake Controls and Circuit Configurations

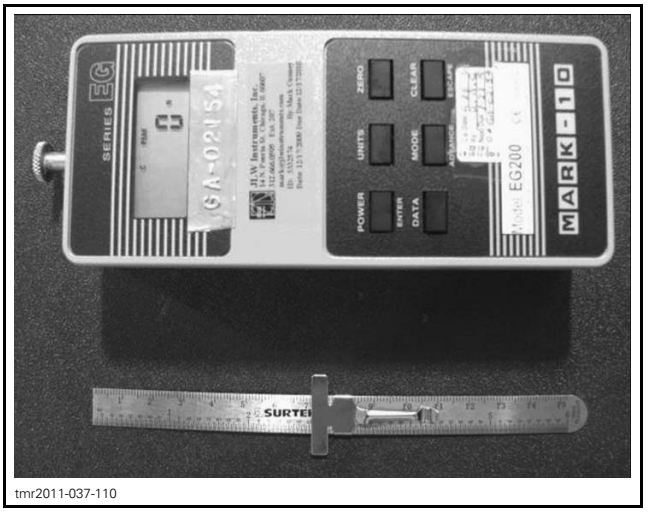
LH BRAKE LEVER	BRAKE PEDAL
Controls front and rear brakes	Controls rear brakes

INSPECTION

BRAKE SYSTEM PRESSURE VALIDATION

Required Tools

Use an appropriate compression force gauge such as *MARK-10 EG-200* and a ruler.



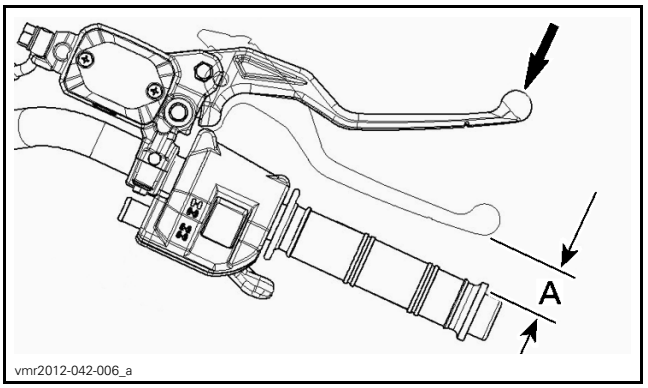
tmr2011-037-110

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.



vmr2012-042-006_a

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)	160 N (36 lbf)

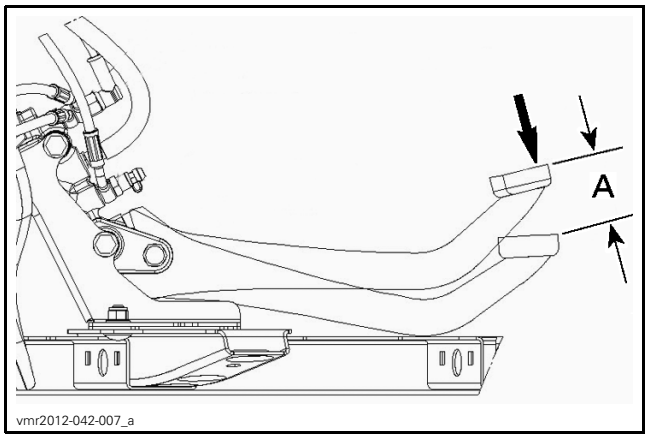
6. If load reading is not in accordance with the specification:
   - 6.1 Perform a brake system inspection and cleaning.
   - 6.2 Bleed brake system.

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	
DISTANCE **A**	MINIMUM LOAD
55 mm (2-5/32 in)	220 N (49 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.

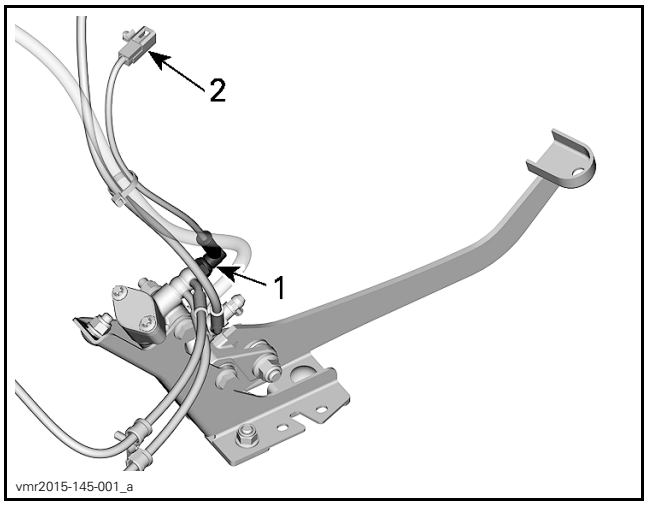
NOTE: Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

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

Brake Light Switch Located on Brake Lever

1. Disconnect brake light switch connector.
2. Replace brake light switch by a new one.
3. Connect brake light switch connector.

Brake Light Switch Located on Master Cylinder or Manifold

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.

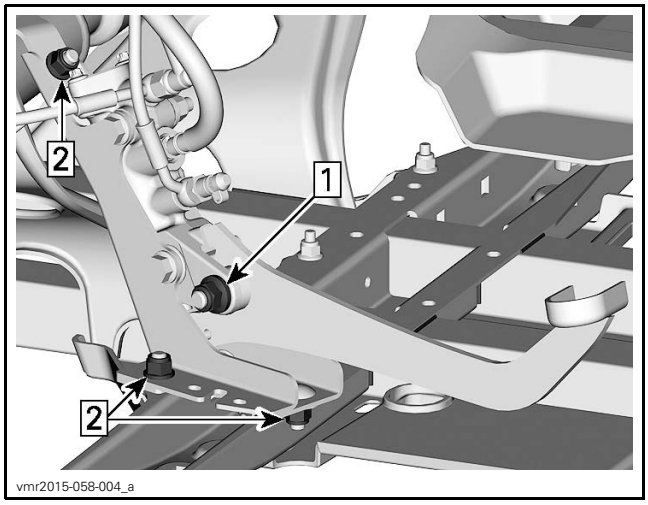
BRAKE PEDAL

Brake Pedal Removal

1. Drain brake system, refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
2. Remove RH footrest panel. Refer to *BODY* subsection.

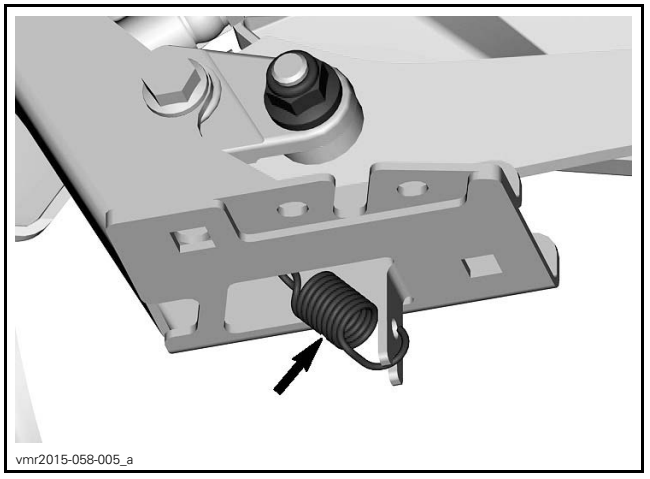
NOTE: Loosen brake pedal bolt before removing support from frame.

3. Remove master cylinder support from frame.

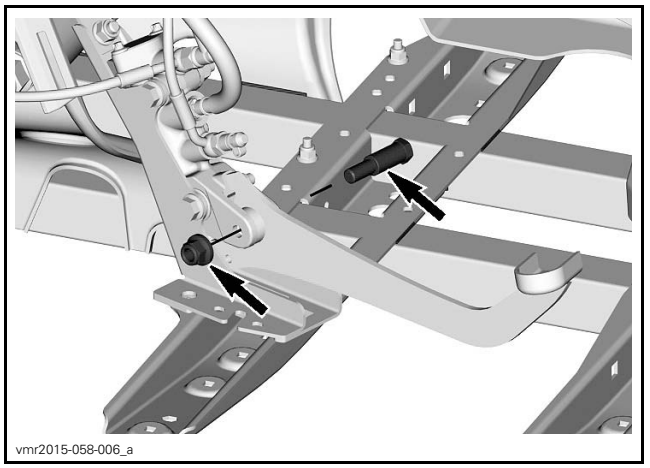


Step 1: Loosen brake pedal pivot
Step 2: Remove nuts

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.

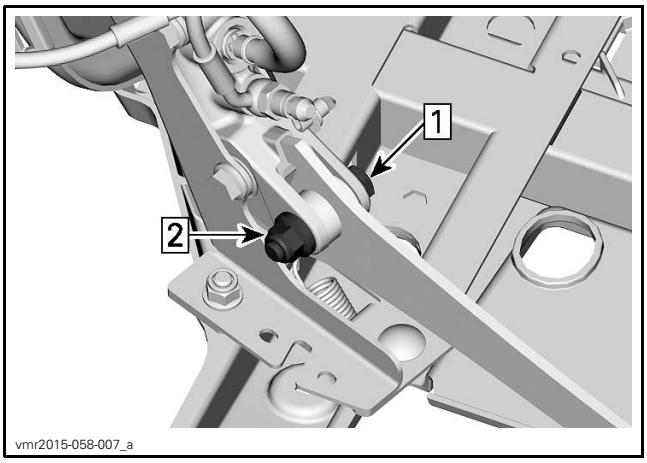
Install NEW brake pedal O-ring.

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)

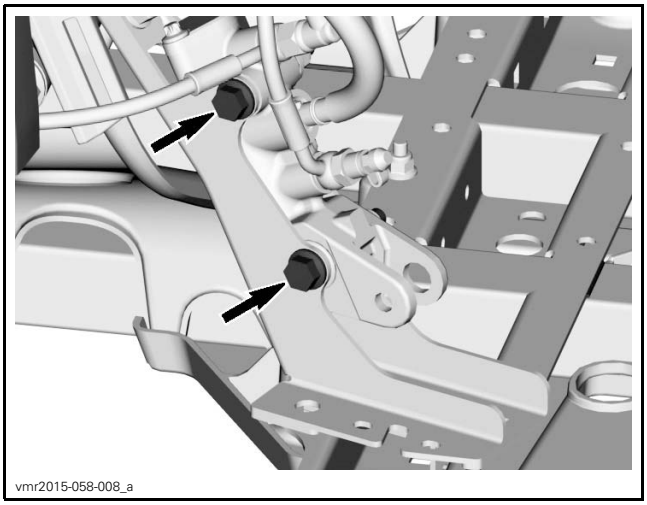


TIGHTENING SEQUENCE
Step 1: Tighten bolt
Step 2: Hold bolt then tighten nut

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.

Install NEW sealing washers.

Tighten brake hoses and bleeder to specification.

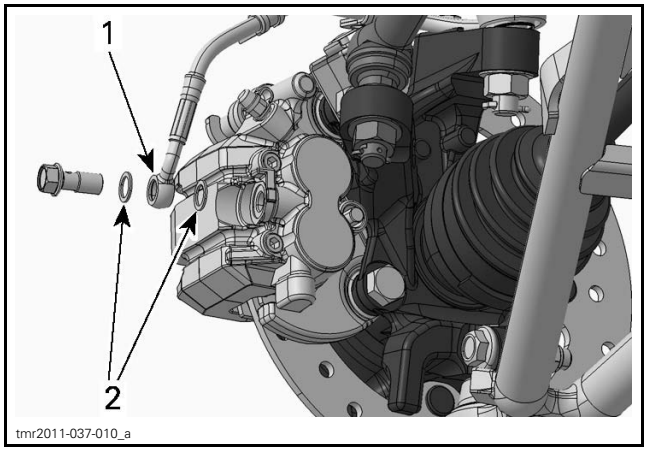
TIGHTENING TORQUE	
Brake hose screw (banjo fitting)	28.5 N•m ± 1.5 N•m (21 lbf•ft ± 1 lbf•ft)
Bleeder	8.5 N•m ± 1.5 N•m (75 lbf•**in** ± 13 lbf•**in**)

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

CALIPER

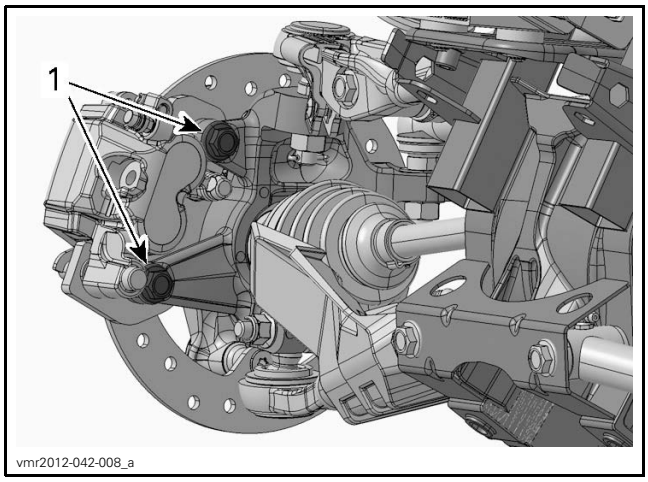
Caliper Removal

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.



TYPICAL
1. Brake hose
2. Sealing washers

4. Remove fasteners retaining brake hose.
5. Remove screws securing caliper support.



TYPICAL
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.

Install **NEW** caliper retaining screws.

Install **NEW** sealing washers.

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

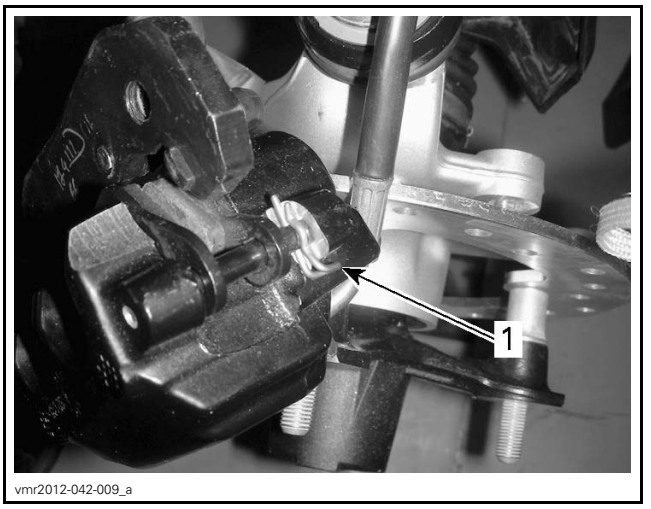
Tighten caliper retaining screws to specification.

TIGHTENING TORQUE	
Caliper retaining screws	61 N•m ± 9 N•m (45 lbf•ft ± 7 lbf•ft)

BRAKE PADS

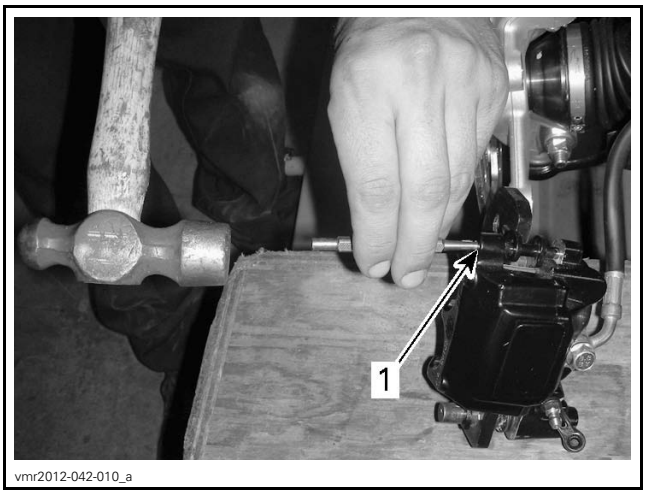
Brake Pads Replacement

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.

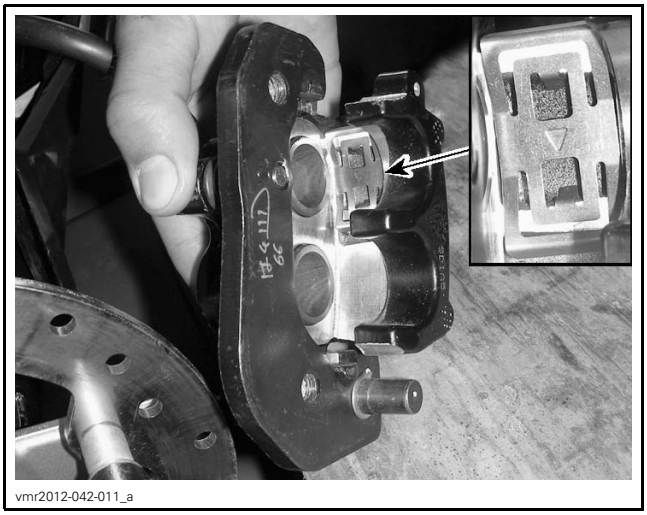


TYPICAL
1. Brake pad pin

4. Carefully remove brake pads.
5. Clean pistons end using XPS BRAKES AND PARTS CLEANER (USA) (P/N 219 701 705).
6. Push caliper pistons inward.

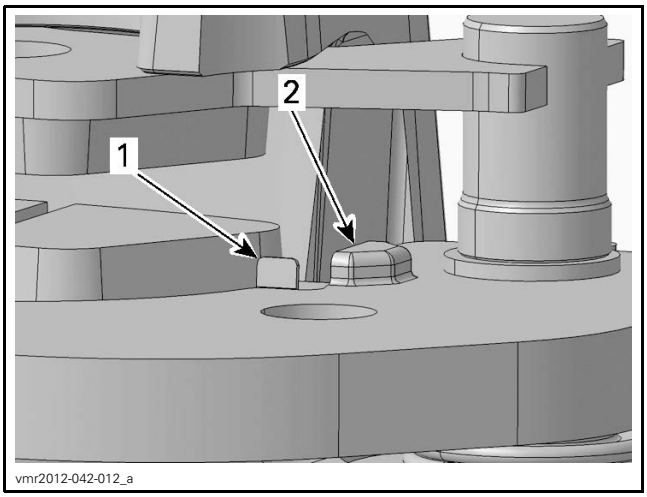
NOTE: To avoid damaging pistons, use an old pad to push it into the caliper using a C-clamp.

7. Ensure brake pad spring is properly positioned onto caliper and not damaged.


vmr2012-042-011_a

BRAKE PAD SPRING

8. Ensure pad stopper is properly aligned with caliper support protrusion.

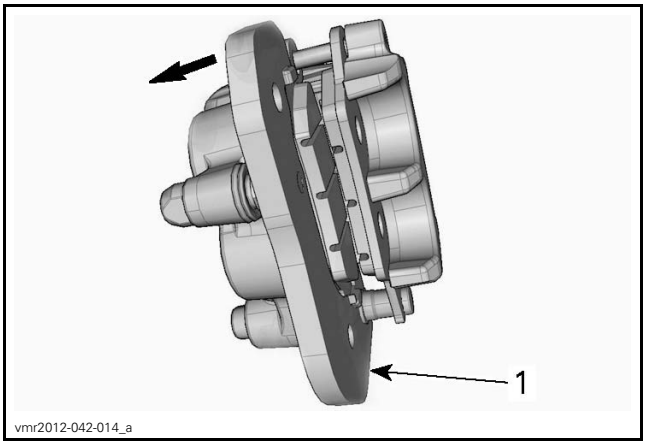


vmr2012-042-012_a

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.



vmr2012-042-014_a

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)

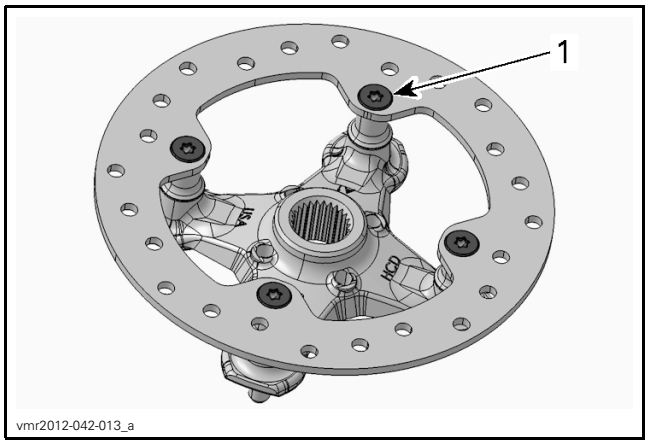
NOTICE Brake discs must never be machined.

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 FINAL 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)

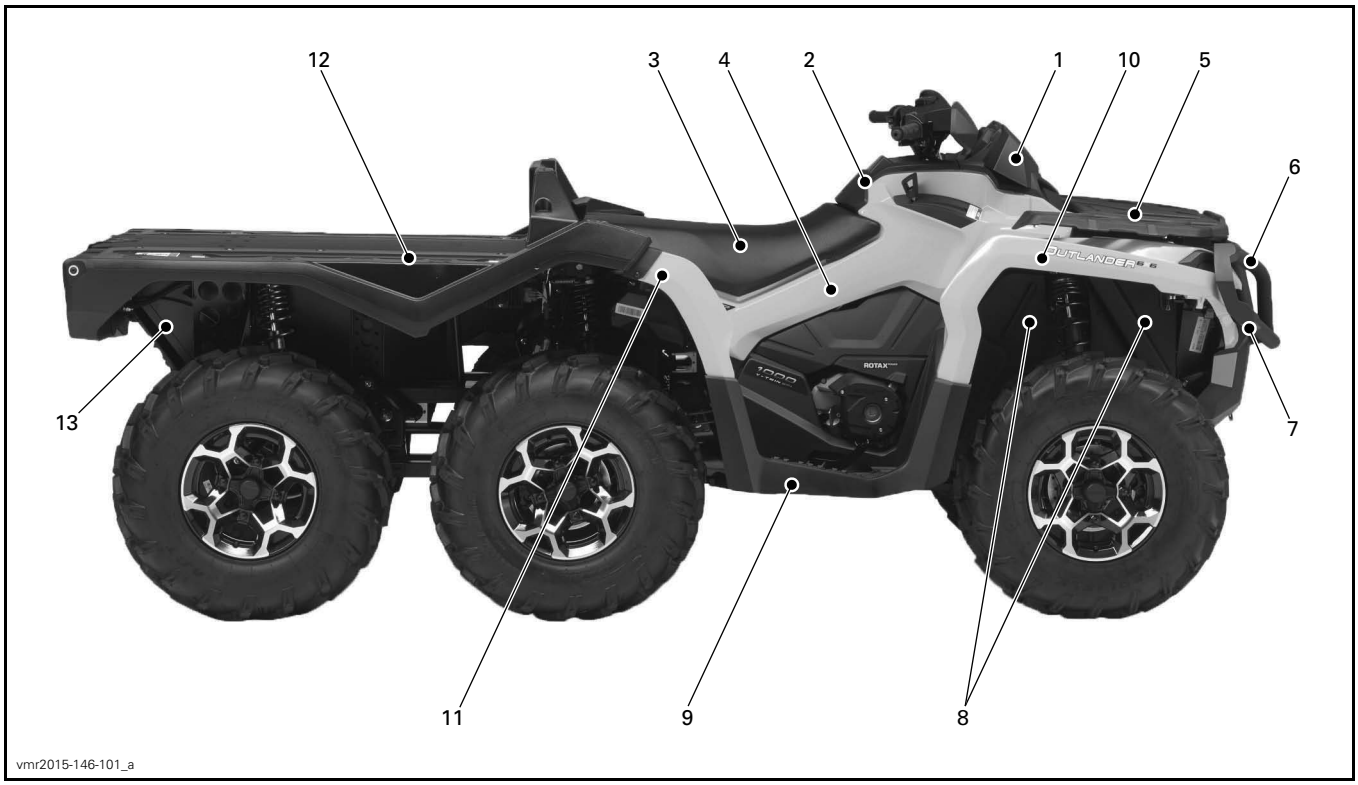
7. Install wheel hub then caliper.
8. Install **NEW** cotter pin to secure wheel hub nut.

BODY

SERVICE TOOLS

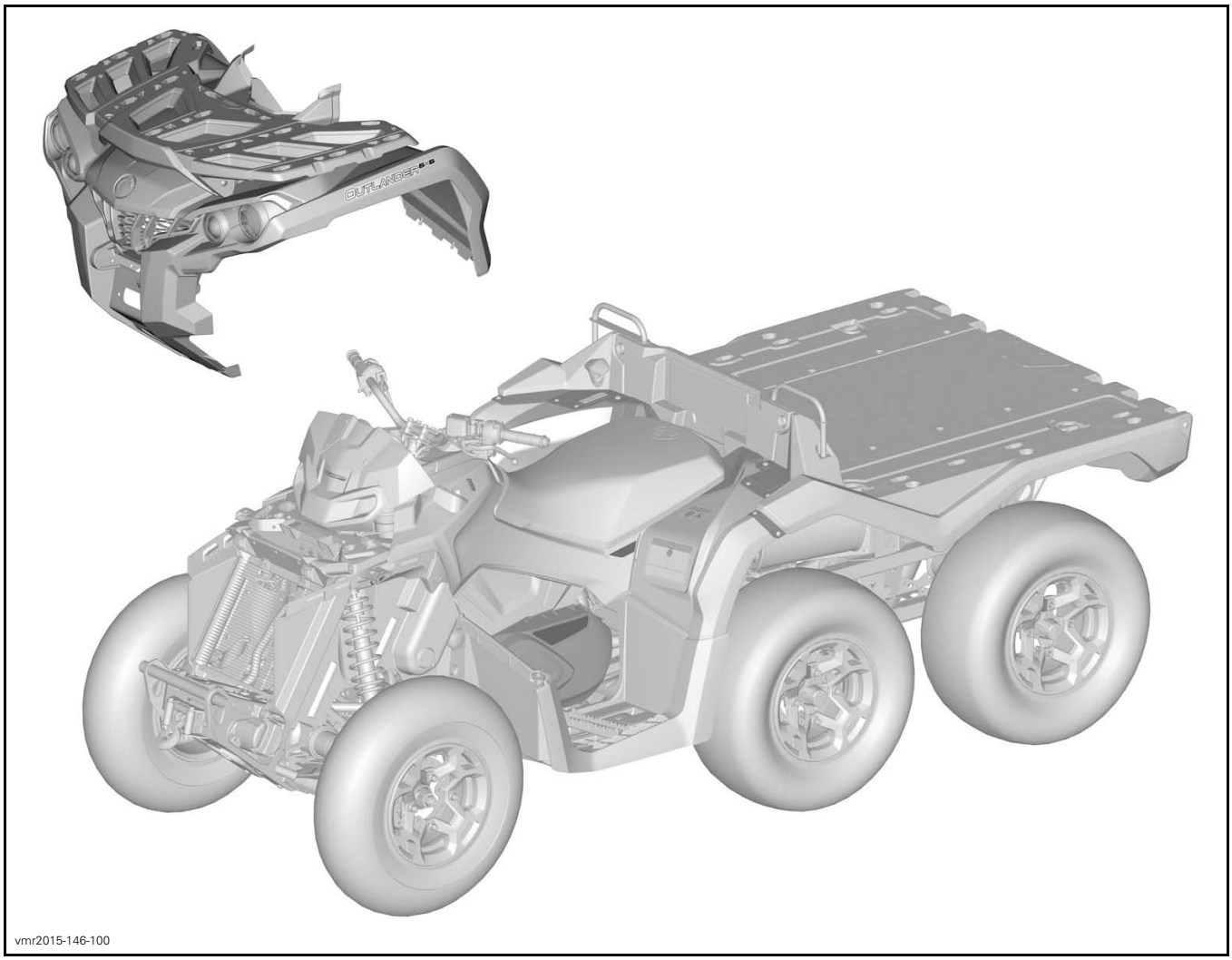
Description	Part Number	Page
OETIKER PLIERS	295 000 070	573

BODY PARTS NOMENCLATURE



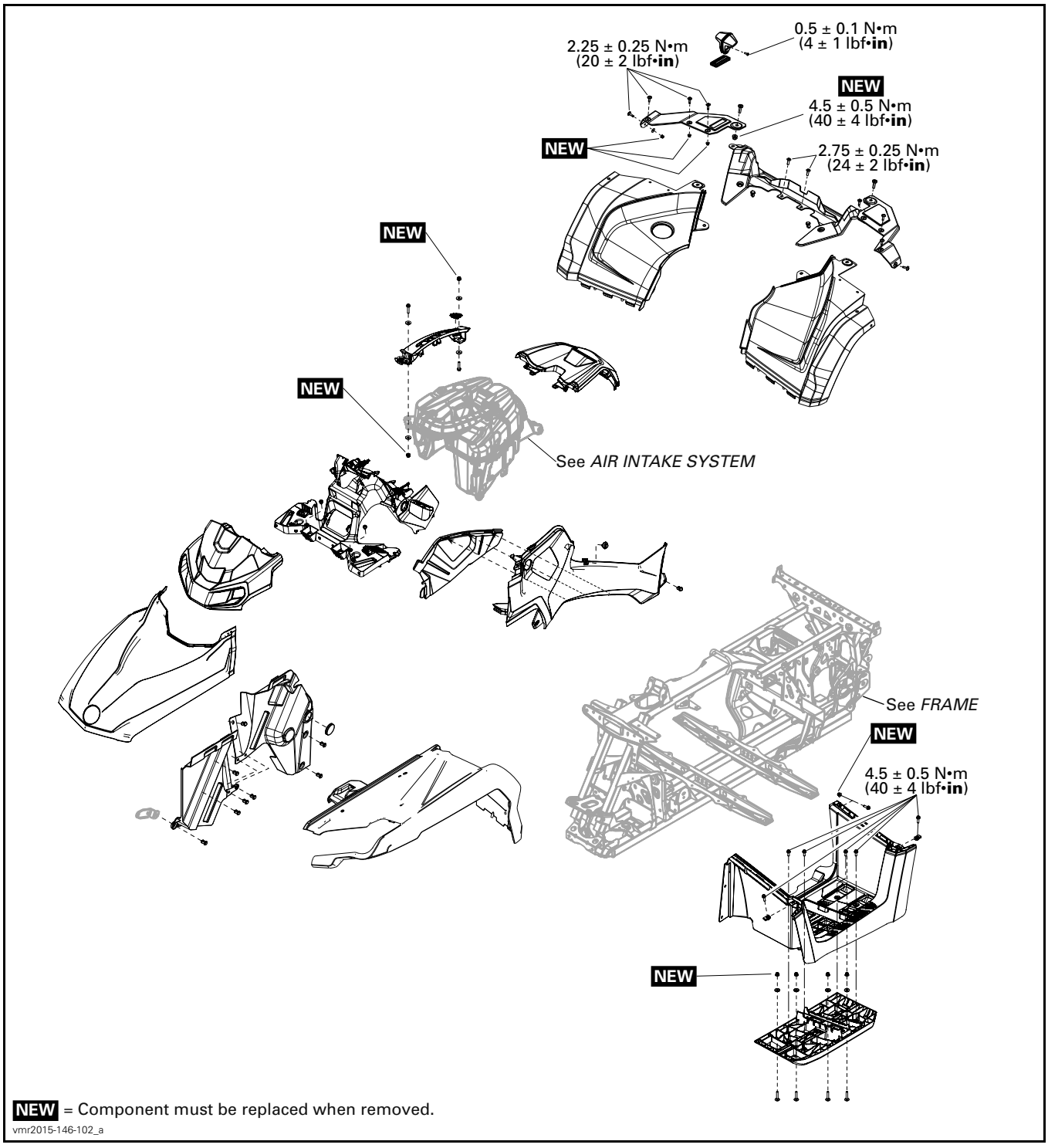
1. *Gauge support*
2. *Console*
3. *Seat*
4. *Side panel*
5. *Front rack*
6. *Front bumper*
7. *Front fascia*
8. *Inner fender panels*
9. *Footrest panel*
10. *Front fender*
11. *Rear fender*
12. *cargo bed*
13. *Rear storage compartment*

FRONT BODY MODULE

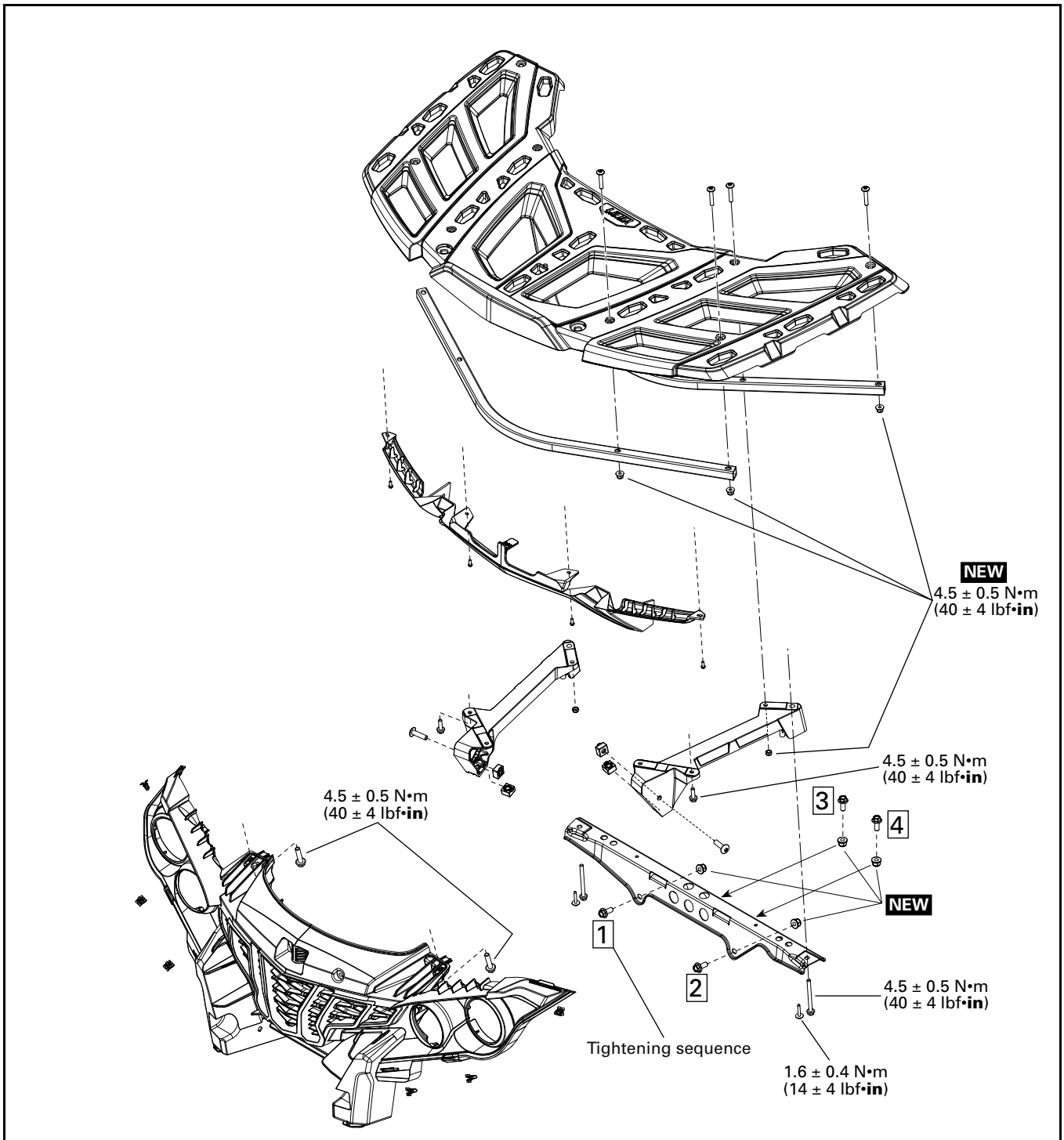


vmr2015-146-100

BODY PARTS

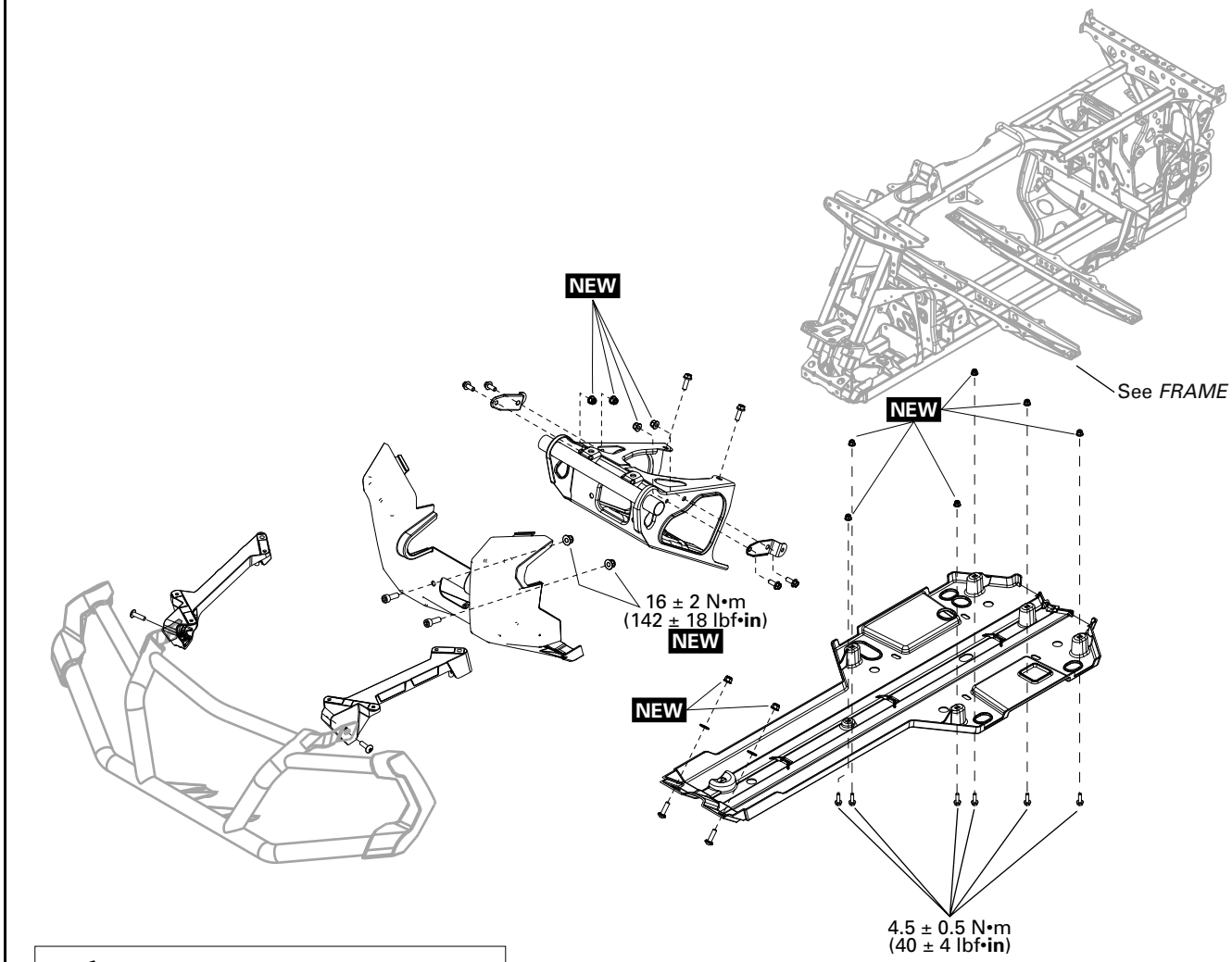

0.5 ± 0.1 N•m
(4 ± 1 lbf•in)
2.25 ± 0.25 N•m
(20 ± 2 lbf•in)
NEW
4.5 ± 0.5 N•m
(40 ± 4 lbf•in)
NEW
2.75 ± 0.25 N•m
(24 ± 2 lbf•in)
NEW
NEW
See AIR INTAKE SYSTEM
See FRAME
NEW
4.5 ± 0.5 N•m
(40 ± 4 lbf•in)
NEW
NEW = Component must be replaced when removed.
vmr2015-146-102_a

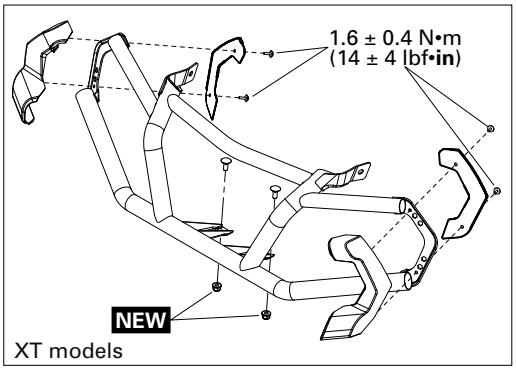
RACKS AND BODY PARTS



NEW = Component must be replaced when removed.

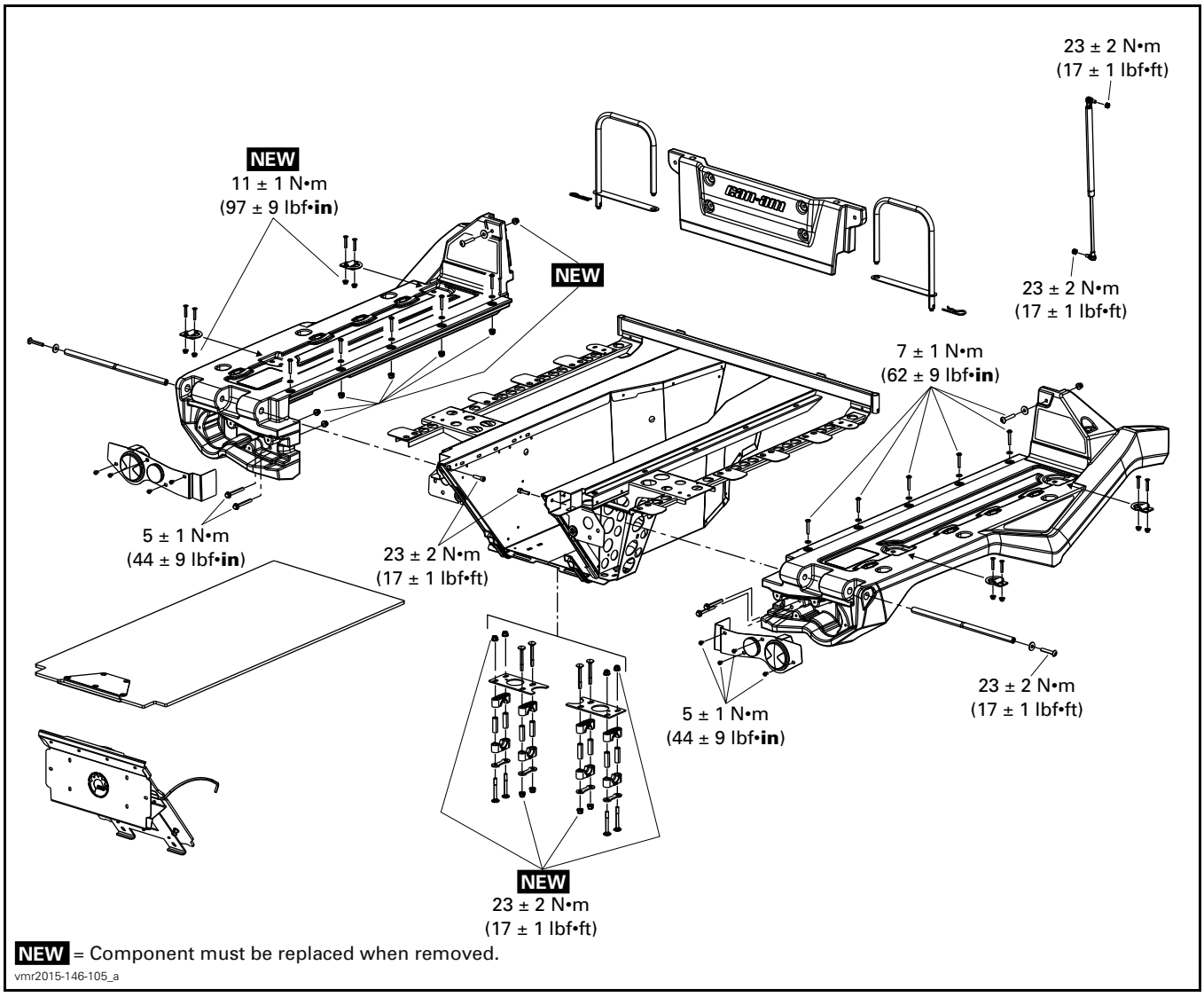
BUMPERS AND BODY PARTS





NEW = Component must be replaced when removed.

CARGO BED



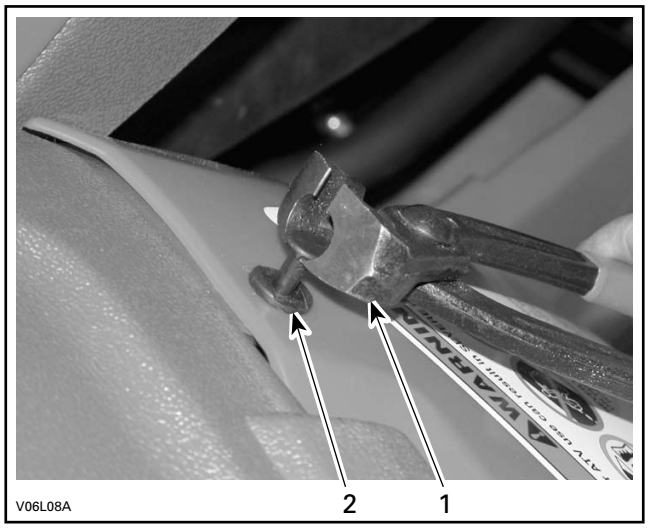
NEW = Component must be replaced when removed.

vmr2015-146-105_a

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.

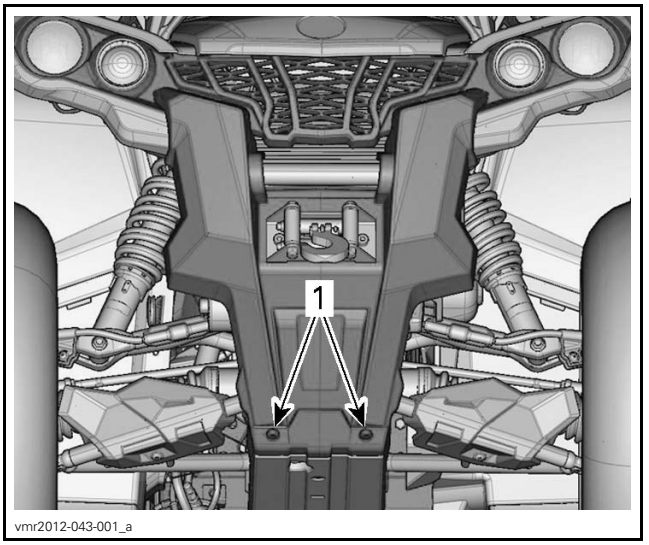
Apply liquid soap to new decal and carefully position it. Using a sponge or a squeegee, remove the air bubbles and surplus water working from the center toward the edges. Allow to air dry.

NOTICE **Do not apply isopropyl alcohol or solvent directly on decals. Use these products in a well ventilated area.**

FRONT BODY MODULE

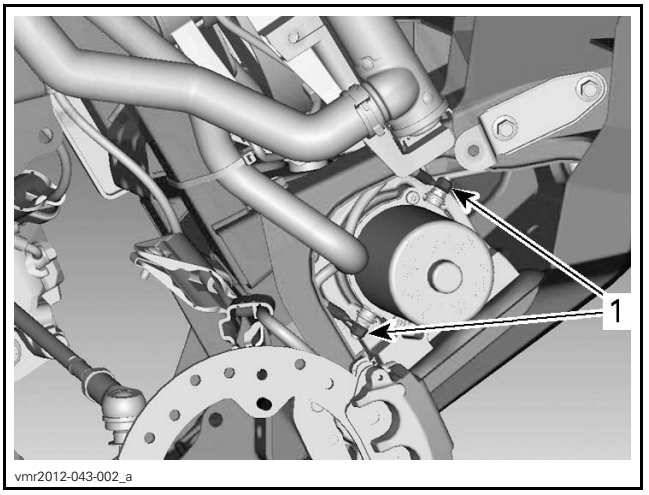
Front Body Module Removal

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.



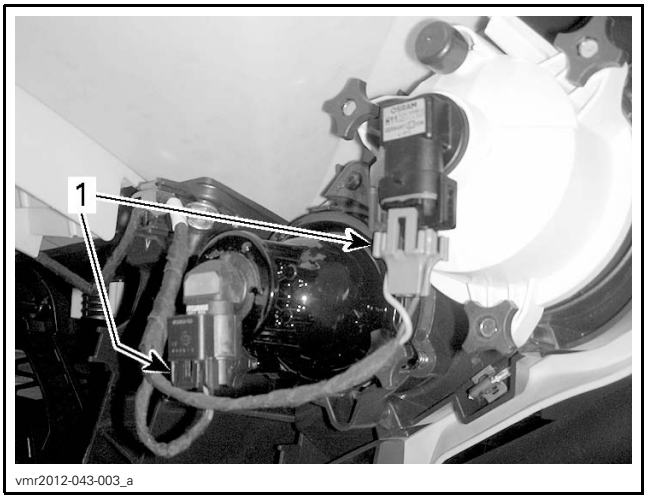
1. *Front skid plate retaining screws*

4. On applicable models, disconnect both winch power cables.



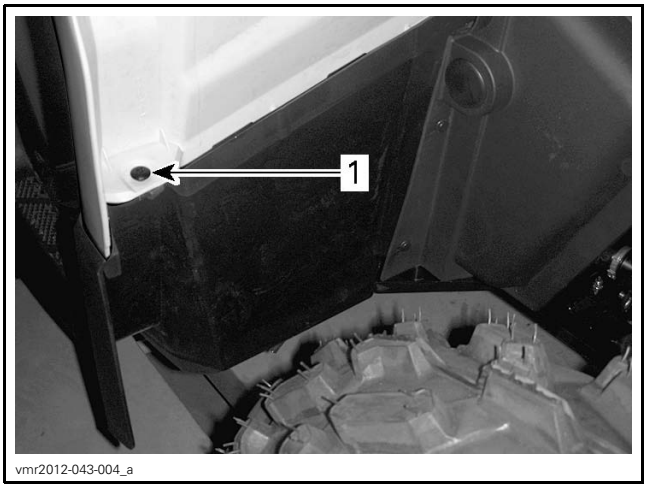
SOME PARTS REMOVED FOR CLARITY
1. *Winch power cables*

5. Disconnect headlight connectors.



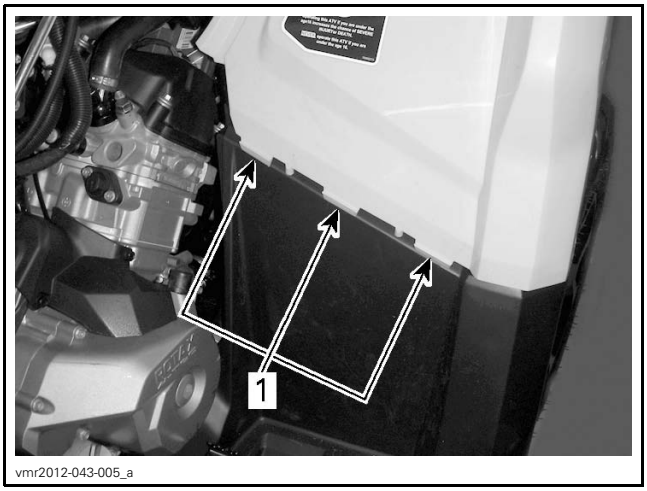
1. Headlight connectors

6. Remove screw securing front fender to footrest panel (on both sides).



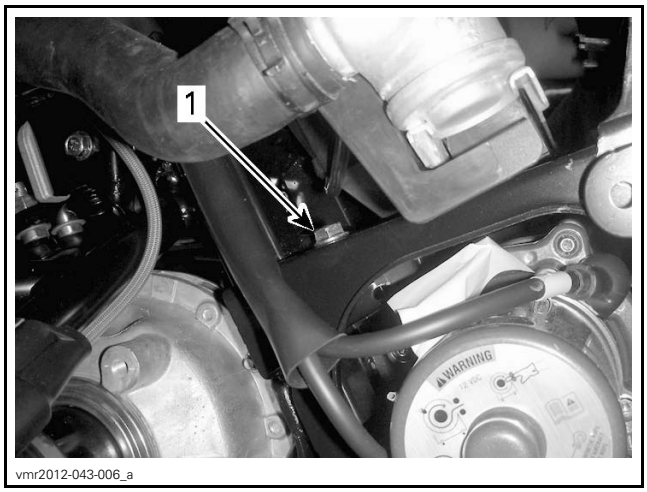
1. Screw securing front fender

7. Detach front fender from footrest panel by releasing retaining tabs (on both sides).

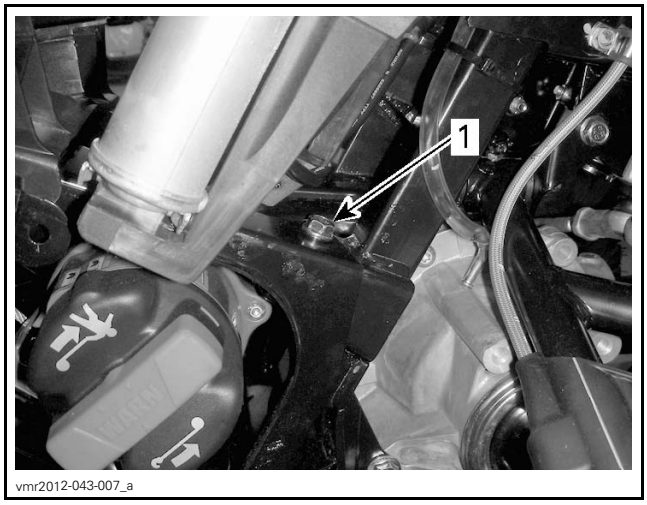


1. Front fender retaining tabs

8. Remove screws securing front body module to frame.

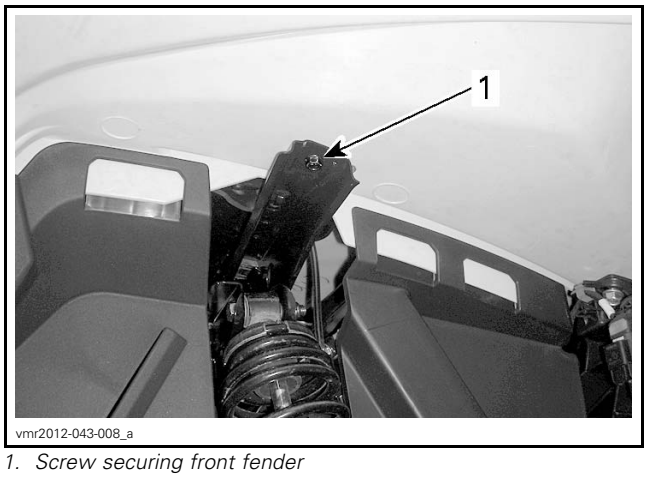


RH SIDE
1. Front body module retaining screw



LH SIDE
1. Front body module retaining screw

9. Remove screws securing front fenders to frame.



1. Screw securing front fender

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.

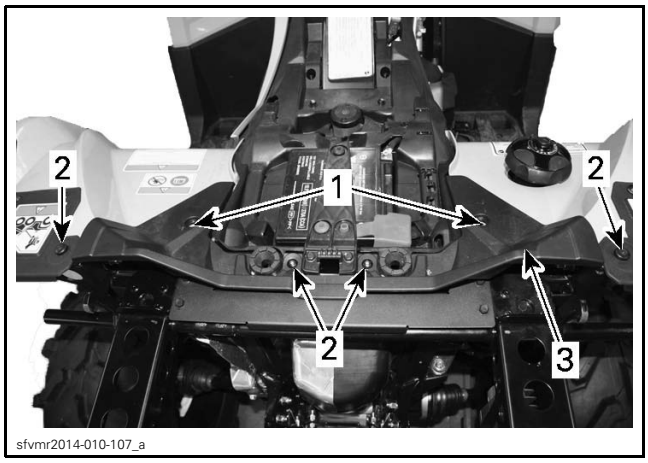
Tighten front fender screws to specification.

TIGHTENING TORQUE	
Screws securing footrest panels to front fenders	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)
Screws securing front fenders to frame	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)

REAR BODY PANELS

Rear Body Panels Removal

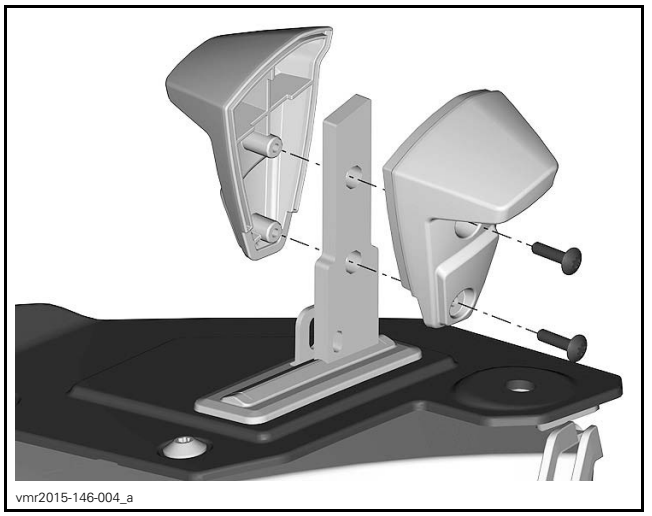
1. Remove seat and open cargo bed.
2. Remove rear top panel retaining screws and plastic rivets.



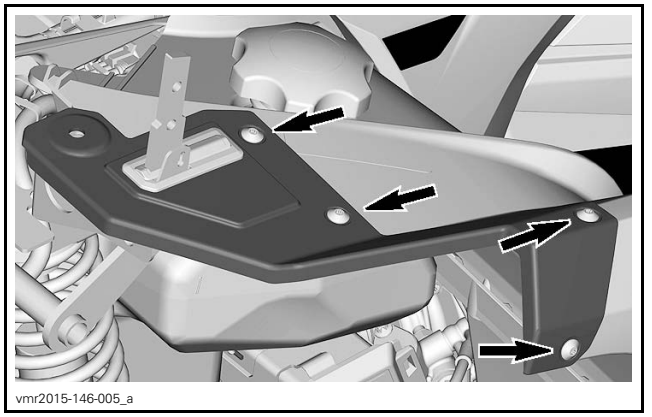
sfvmr2014-010-107_a

1. Plastic rivets
2. Retaining screws
3. Rear top panel

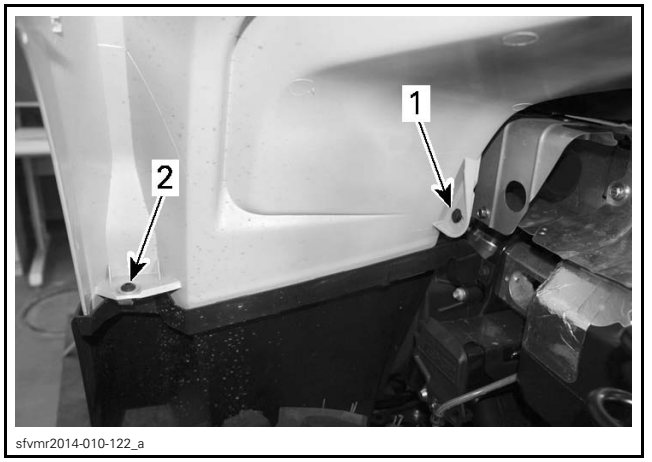
3. Remove retaining screws and remove latch lever handle.


vmr2015-146-004_a

4. Remove rear side panel.


vmr2015-146-005_a

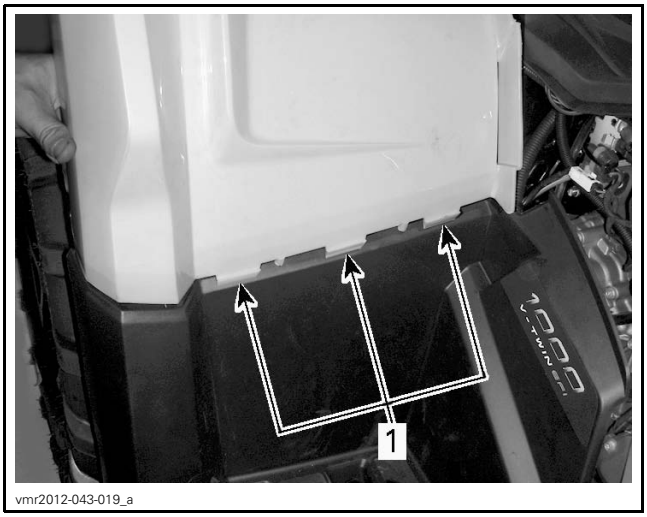
5. Remove plastic rivet and the screw securing rear fender to footrest panel.



sfvmr2014-010-122_a

1. Plastic rivet
2. Screw securing rear fender

6. Detach rear fender from footrest panel by releasing retaining tabs.



TYPICAL
1. Rear fender retaining tabs

7. Remove fuel tank cap.
8. Place a **clean** rag into fuel tank filler tube.
9. Remove rear body panels.
10. 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 Panels Installation

The installation is the reverse of the removal procedure.

CONSOLE

Console Removal

1. Remove seat.
2. Lift rear portion of console upwards.



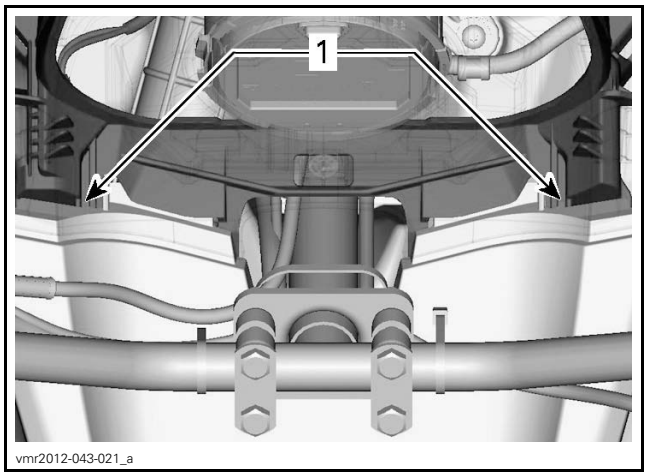
LIFT REAR PORTION

3. Pull console rearwards.

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.



SOME PARTS REMOVED FOR CLARITY
1. Console front tabs

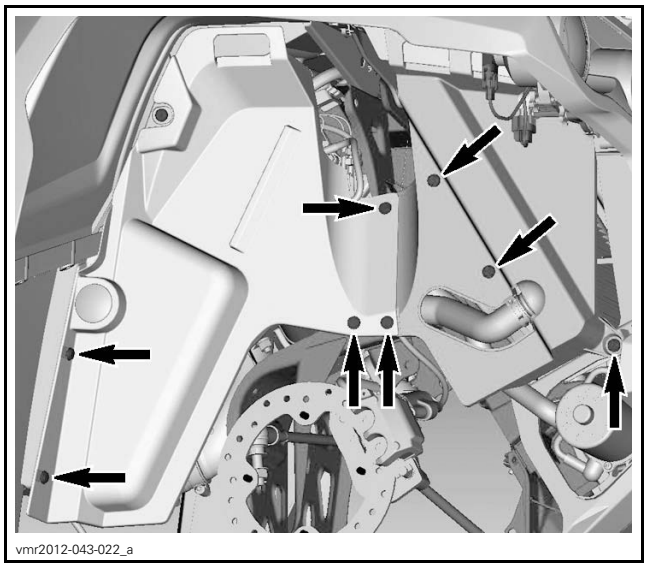
GAUGE SUPPORT

Refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.

INNER FENDER PANELS

Inner Fender Removal and Installation

Remove the following plastic rivets from inner fender panels.



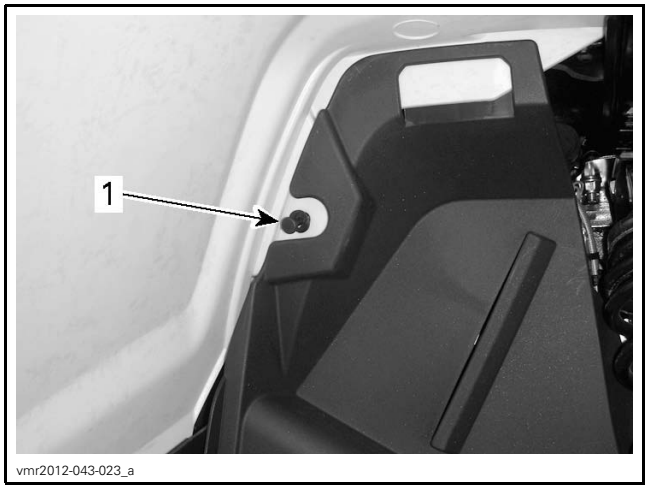
SOME PARTS REMOVED FOR CLARITY

The installation is the reverse of the removal procedure.

SIDE PANELS

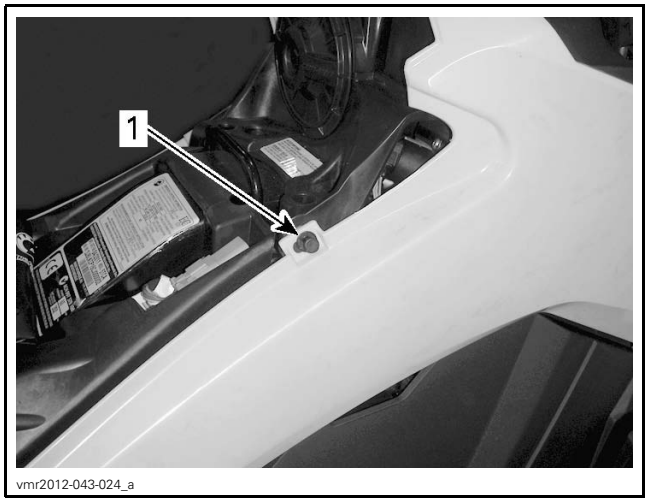
Side Panel Removal

1. Remove *CONSOLE*. See procedure in this subsection.
2. Remove plastic rivet securing side panel to inner fender panel.



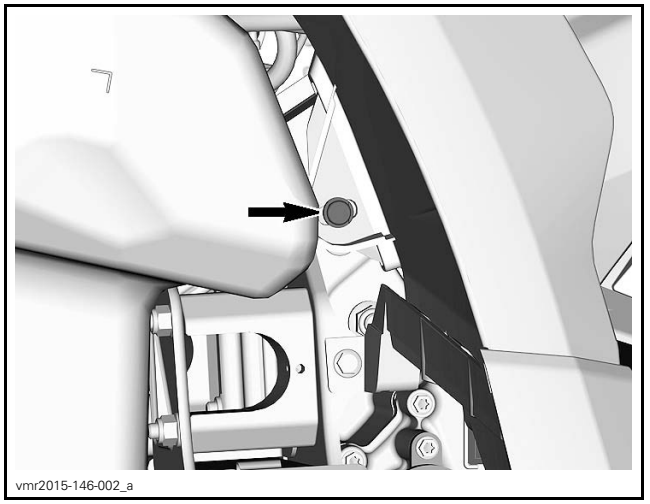
1. Plastic rivet securing side panel

3. Remove plastic rivet securing side panel to air filter housing.

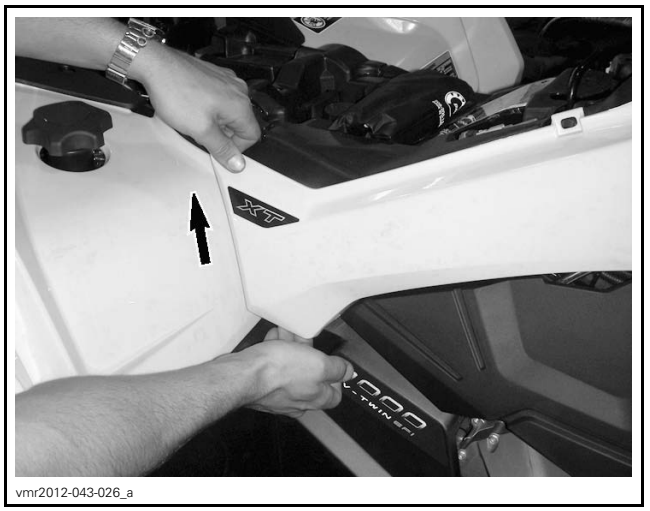


1. Plastic rivet securing side panel

4. Remove plastic rivet securing side panel to rear fender.



5. Lift rear portion of side panel assembly then pull it towards outside.



LIFT REAR PORTION

Side Panel Installation

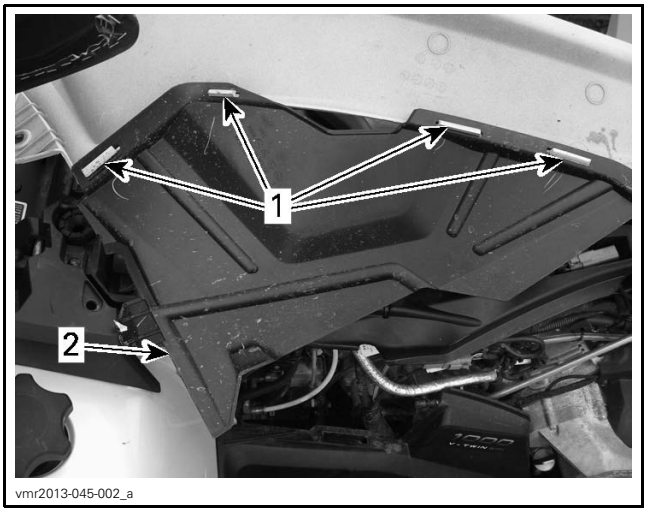
The installation is the reverse of the removal procedure. However, pay attention to the following.

Align side panel front tab with slot, then push side panel forward.

PANEL EXTENSIONS

Panel Extension Removal

1. Remove seat.
2. Remove console. Refer to *CONSOLE REMOVAL*.
3. Remove side panel assembly including side panel, panel extension and rear side panel extension. Refer to *SIDE PANEL REMOVAL*.
4. Undo tabs securing panel extension to side panel.



vmr2013-045-002_a

1. Tabs securing panel extension to side panel
2. Side panel extension

5. Remove panel extension.

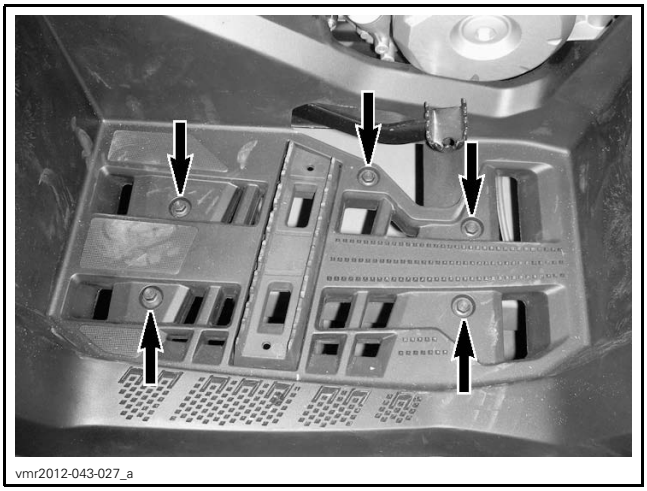
Panel Extension Installation

Installation is the reverse of removal.

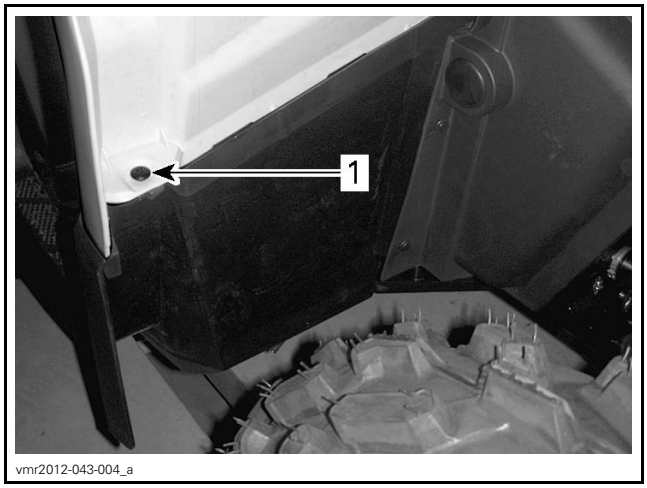
FOOTREST PANELS

Footrest Panel Removal

1. Remove footrest panel retaining screws.


vmr2012-043-027_a

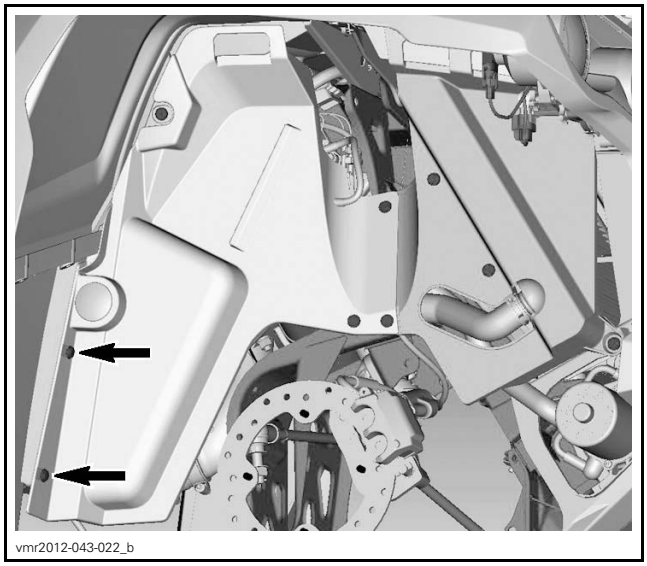
2. Remove screw securing front fender to footrest panel.



vmr2012-043-004_a

1. Screw securing front fender

3. Remove both plastic rivets securing inner fender panel to footrest panel.


vmr2012-043-022_b

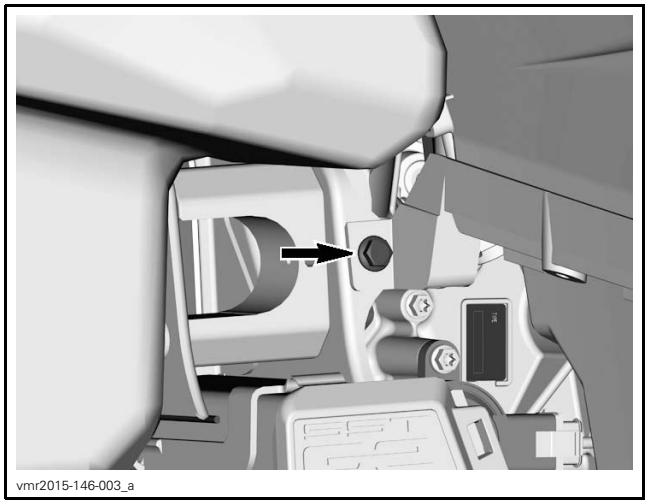
SOME PARTS REMOVED FOR CLARITY

4. Remove screw securing rear fender to footrest panel.

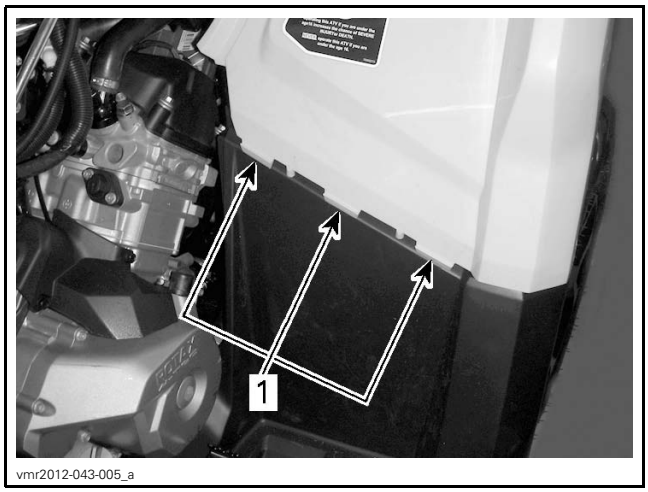


1. Screw securing rear fender

5. Remove screw securing footrest panel to frame.

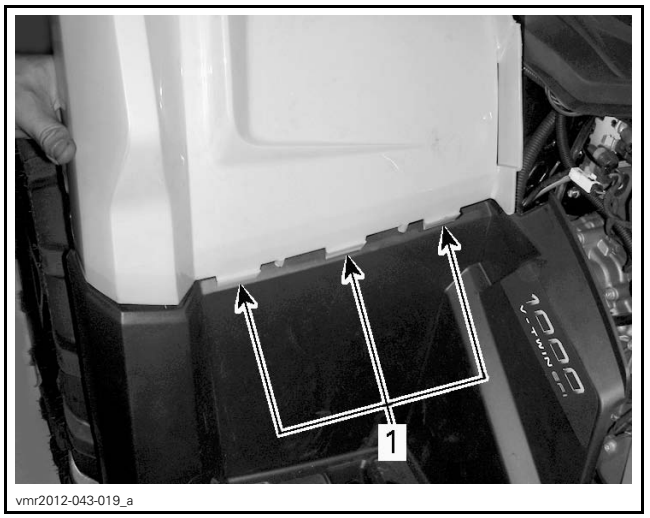


6. Detach front fender from footrest panel by releasing retaining tabs.



1. Front fender retaining tabs

7. Detach rear fender from footrest panel by releasing retaining tabs.



1. Rear fender retaining tabs

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.

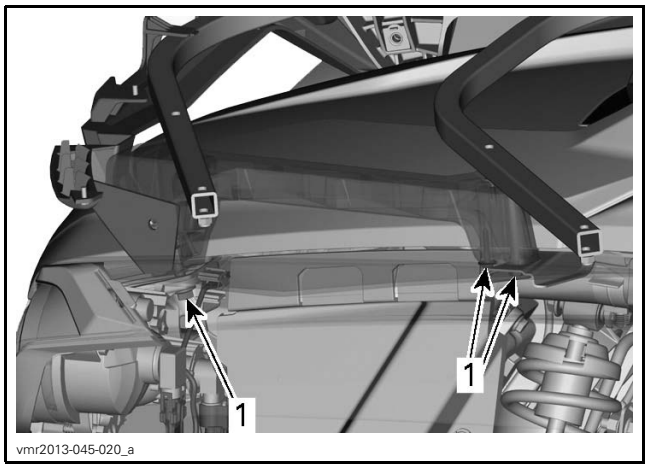
TIGHTENING TORQUE	
Footrest panel retaining screws	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)
Screws securing footrest panel to fenders	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)

FRONT RACK

Front Rack Removal

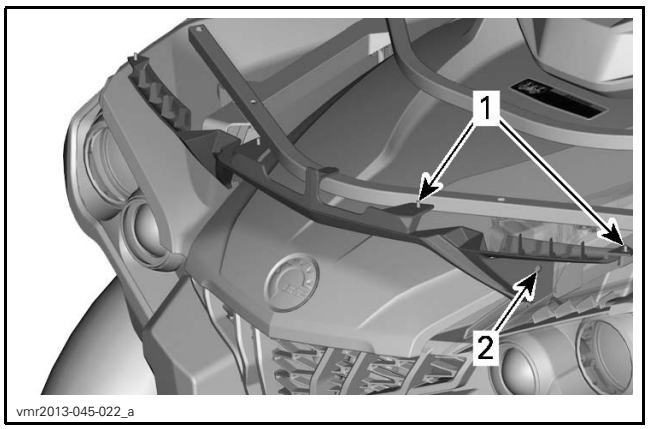
1. Remove retaining bolts securing rack assembly to frame.

NOTE: A small wrench will be needed to remove the retaining screw located between the rack support and fender.



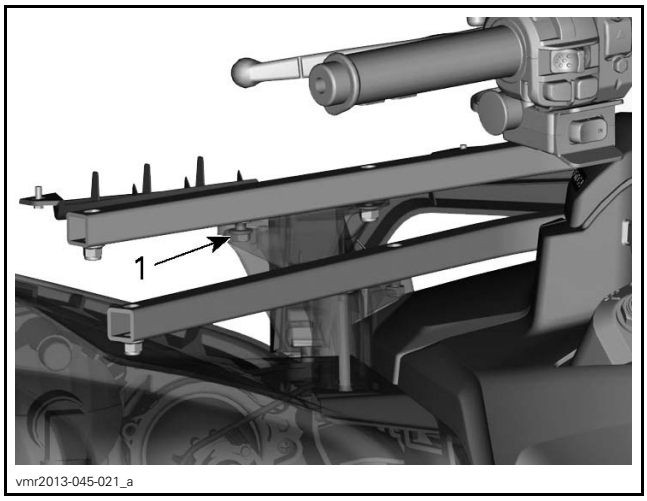
PARTS REMOVED FOR CLARITY
1. Retaining screw locations

2. Remove rack assembly from vehicle.
3. Remove the 4 retaining screws securing rack moulding to rack assembly.
4. Remove both retaining screws securing rack moulding to rack supports.



1. LH side retaining screws securing rack moulding to rack assembly
2. LH side retaining screw securing rack moulding to rack support

5. Remove both retaining bolts securing rack supports to rails.



1. Retaining bolt securing rack support to rail

6. Remove retaining screws securing rack to rails.

Front Rack Installation

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

TIGHTENING TORQUE	
Screws and nuts securing front rack to rail	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)
Bolts securing front rack assembly to frame	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)
Retaining screws securing fender to front rack assembly	1.6 N•m ± 0.4 N•m (14 lbf•**in** ± 4 lbf•**in**)
Screws securing rack moulding to rack assembly	4.5 N•m ± 0.5 N•m (40 lbf•**in** ± 4 lbf•**in**)

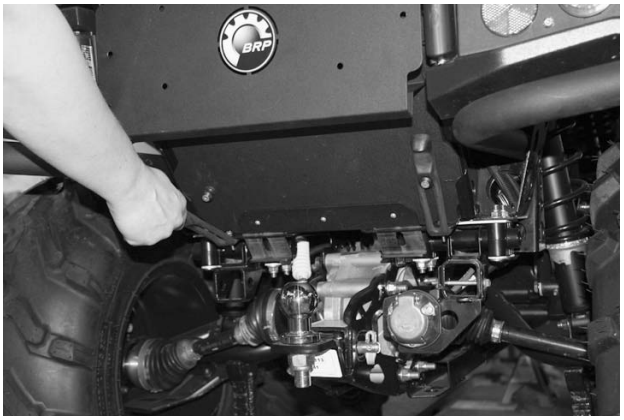
CARGO BED

Cargo Bed Gas Shock Replacement

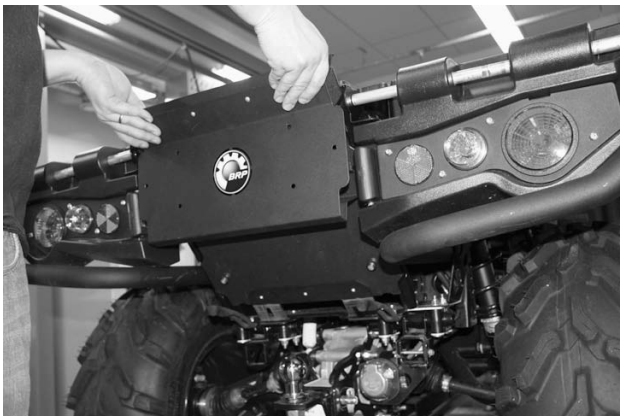
1. Unlock and raise the cargo bed.
2. Secure the cargo bed with wooden blocks (or an equivalent).
3. Remove the upper and lower gas shock bolts.
4. Remove gas shock from vehicle and install the new one.
5. Remove supports and lower the cargo bed.

Cargo Bed Removal

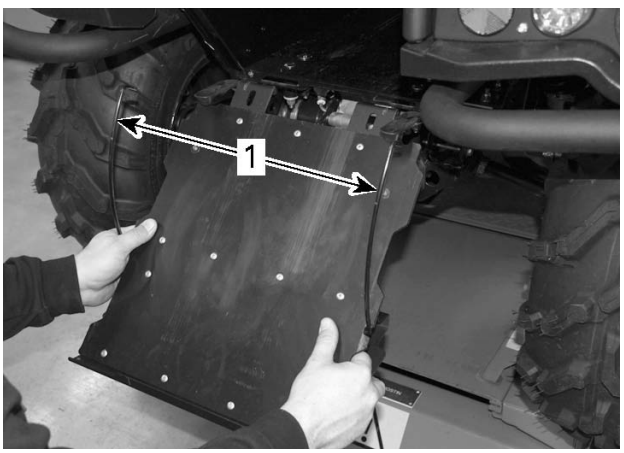
1. Remove the storage compartment hatch.
   1.1 Unlatch storage compartment hatch.


sfvmr2014-010-050

1.2 Lift and tilt it rearwards.


sfvmr2014-010-051

1.3 Lift hatch limiters and open the hatch completely.

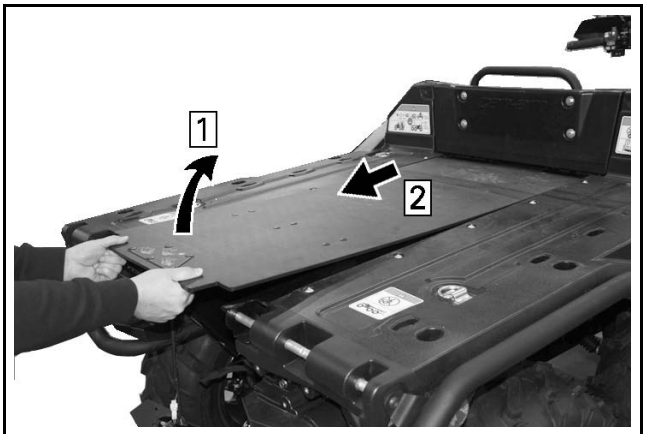


sfvmr2014-010-052

1. Hatch limiters

1.4 Lift and remove the storage compartment hatch.

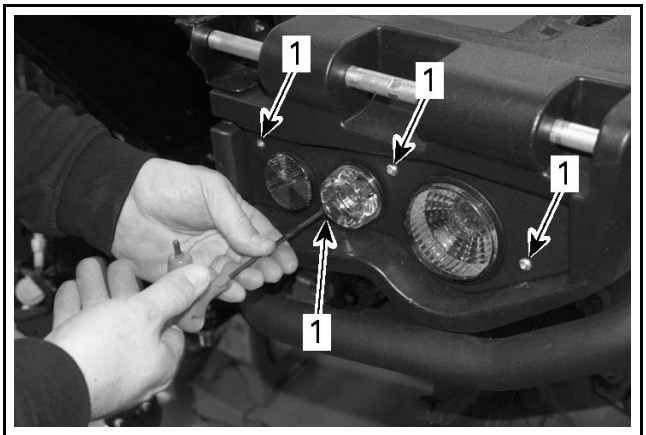
2. Pull, lift and remove the storage compartment cover.



vmr2015-146-001_a

3. Remove the rear lights receiver.

3.1 Remove the rear light retaining screws.



sfvmr2014-010-054_a

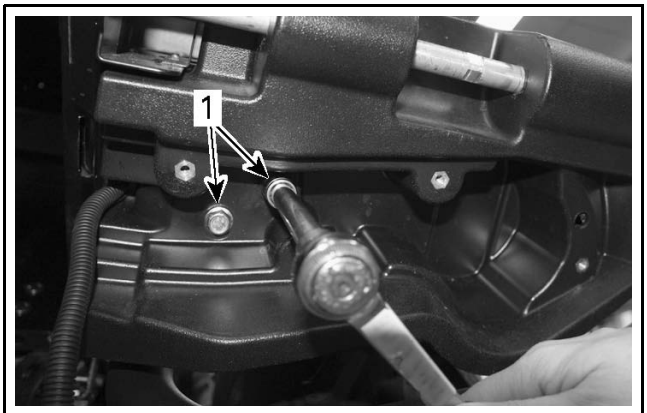
1. Retaining screws

3.2 Pull the rear light receiver out.


sfvmr2014-010-056

3.3 Unplug all light connectors.

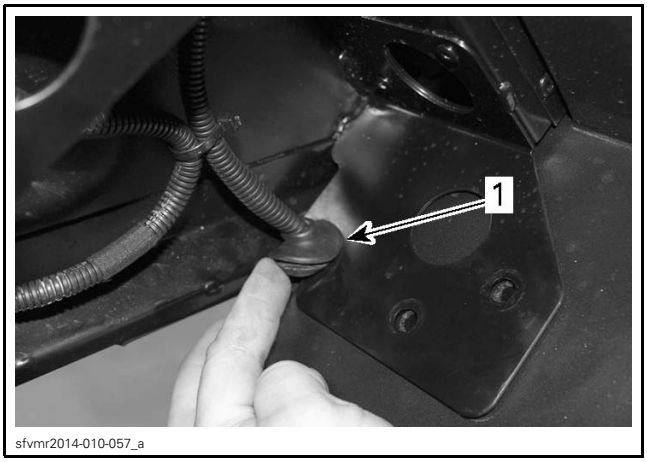
4. Remove the cargo bed retaining screws.



sfvmr2014-010-055_a

1. Cargo bed retaining screws

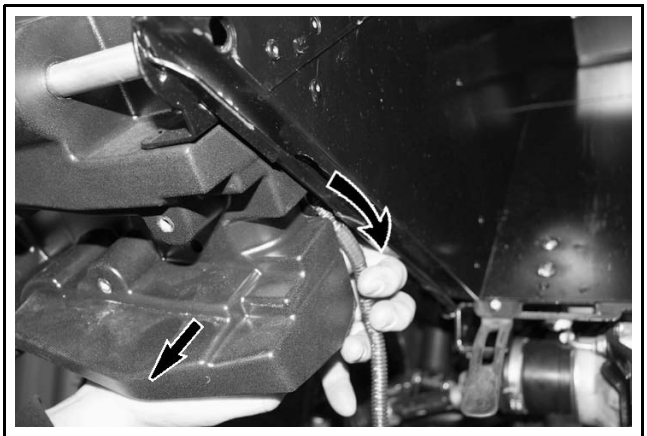
5. Pull out the rubber grommet.



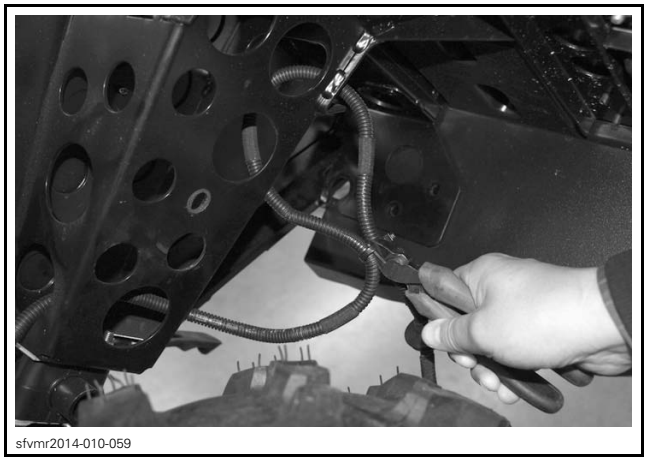
sfvmr2014-010-057_a

1. Rubber grommet

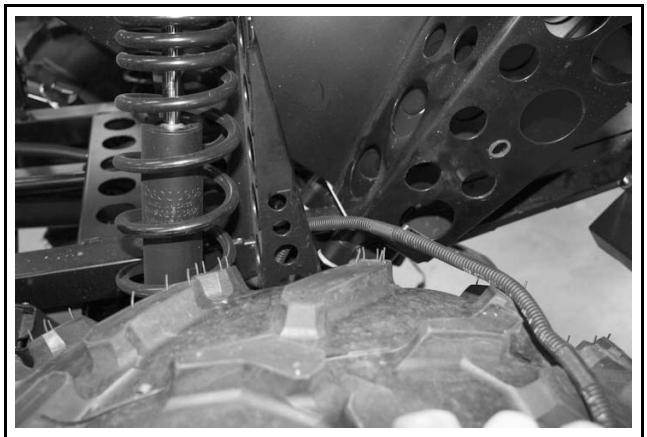
6. Pull from bottom of the cargo bed and slip the harness downward.


sfvmr2014-010-058_a

7. Cut locking ties securing harness to cargo bed´s support frame.


sfvmr2014-010-059

8. Pull the rear light harness out of the cargo bed support frame.


sfvmr2014-010-060

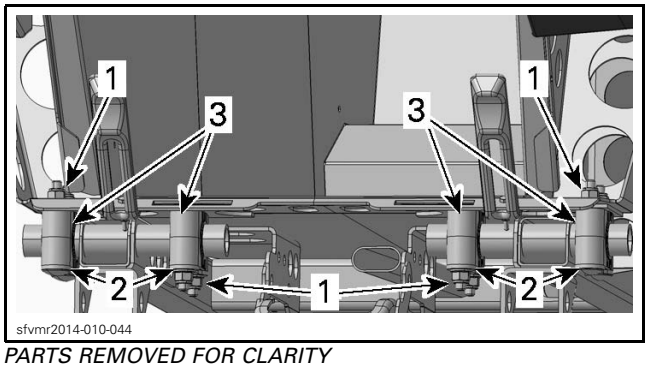
9. Unlock and raise the cargo bed.
10. Secure the cargo bed with wooden blocks (or an equivalent).
11. Remove the gas shock by prying the locking pin with a screwdriver.



sfvmr2014-010-062

TYPICAL

12. Remove supports and lower the cargo bed.
13. From underneath of the cargo bed, remove the following parts.



PARTS REMOVED FOR CLARITY
1. *Retaining nuts*
2. *Support plates*
3. *Half housings*

14. Unlock the cargo bed.
15. Using a hoist or with the help of another person, remove the cargo bed.

⚠ CAUTION To avoid injury or vehicle damages, never handle the cargo bed alone.

Cargo Bed Installation

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

TIGHTENING TORQUE	
Cargo bed retaining nuts	23 N•m ± 2 N•m (17 lbf•ft ± 1 lbf•ft)
Rear light receiver retaining screws	5 N•m ± 1 N•m (44 lbf•**in** ± 9 lbf•**in**)

OPTION PACKAGES

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 271 (RED)	293 800 005	594

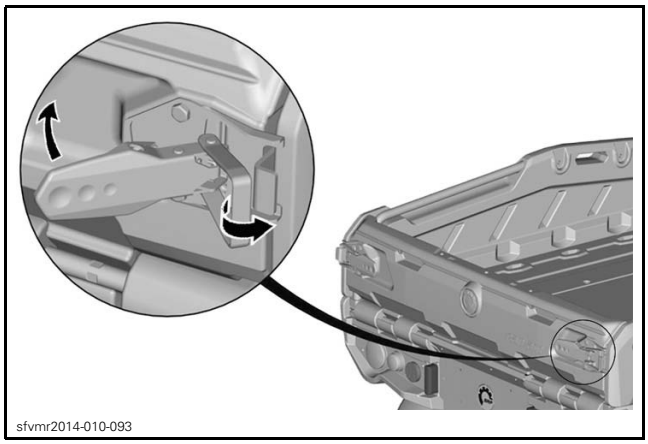
PROCEDURES

This section handles all accessories which are included in forestry, farmer, side walls, cargo and winter packages.

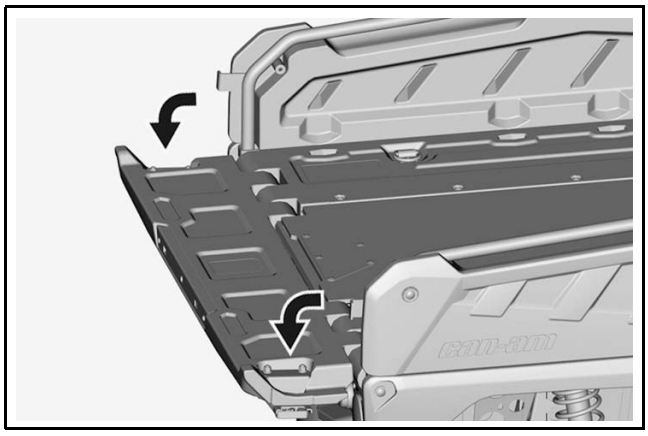
SIDE WALLS

Side Walls And Tail Gate Removal

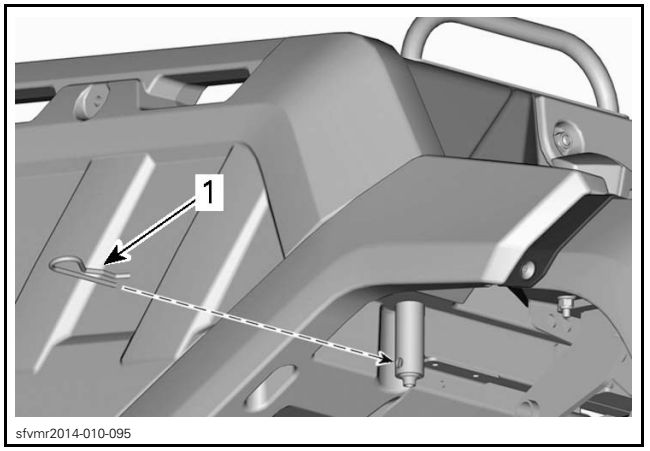
1. Open tail gate latches.


sfvmr2014-010-093

2. Open tail gate.



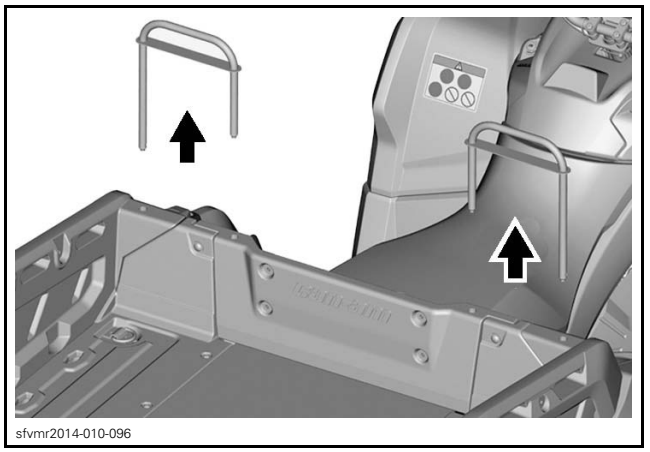
3. Remove cotter pin.



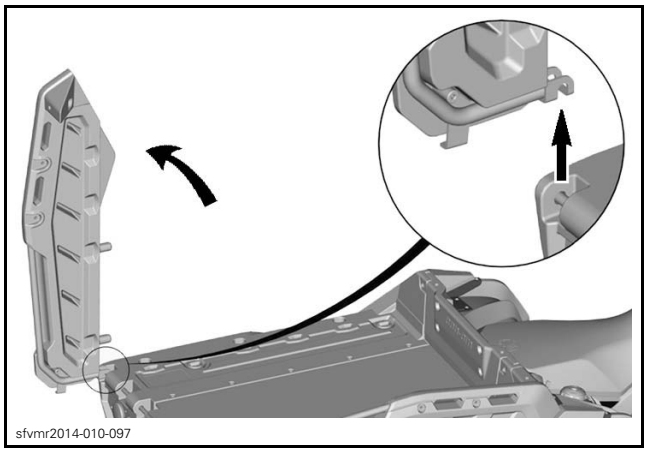
sfvmr2014-010-095

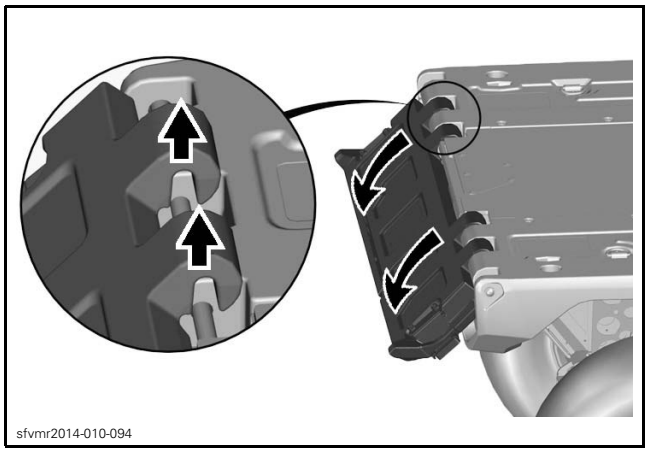
1. Cotter pin

4. Remove locking handles.


sfvmr2014-010-096

5. Lift side wall up and remove it.


sfvmr2014-010-097


sfvmr2014-010-094

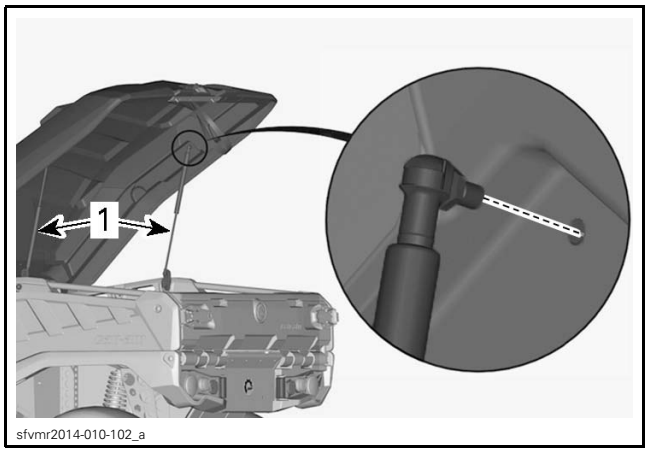
Side Walls And Tail Gate Installation

The installation is the reverse of the removal procedure.

HARD TOP

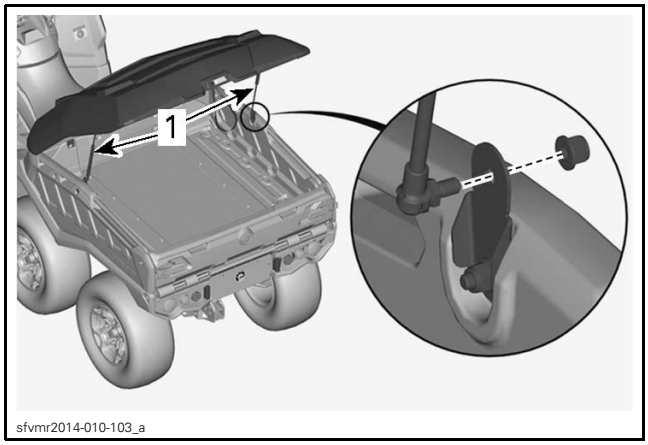
Hard Top Removal

1. Remove gas shocks.



sfvmr2014-010-102_a

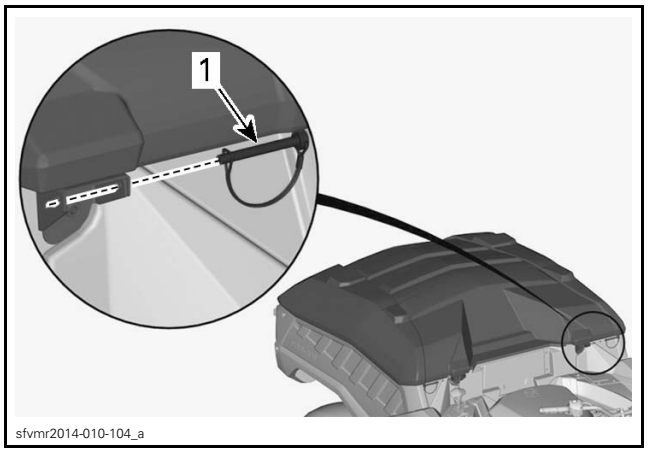
1. Gas shocks



sfvmr2014-010-103_a

1. Gas shocks

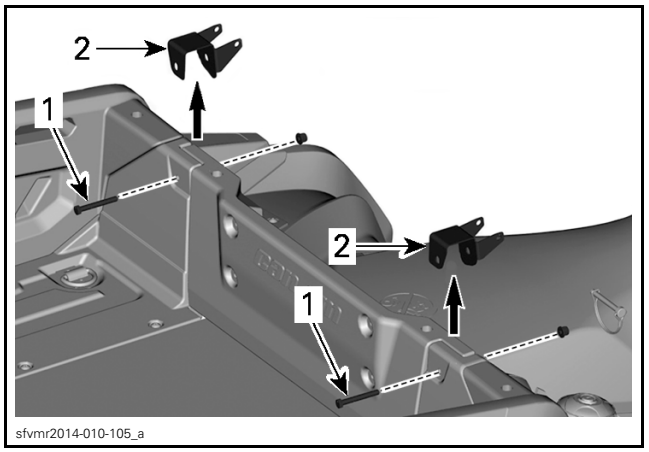
2. Remove pins from the hinges.



sfvmr2014-010-104_a

1. Pin

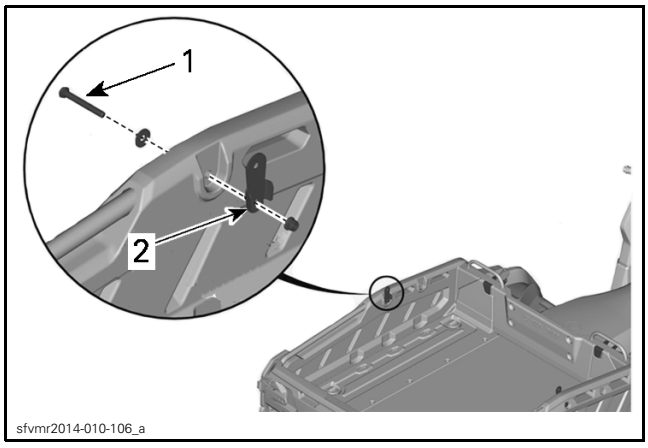
3. Lift and remove the hard top.
4. Remove hinge corner plates.
   4.1 Remove retaining screws.
   4.2 Remove hinge corner plates.



sfvmr2014-010-105_a

1. Retaining screws
2. Hinge corner plates

5. Remove side brackets from side walls.
   5.1 Remove retaining screws.
   5.2 Remove brackets.



1. Retaining screw
2. Bracket

Hard Top Installation

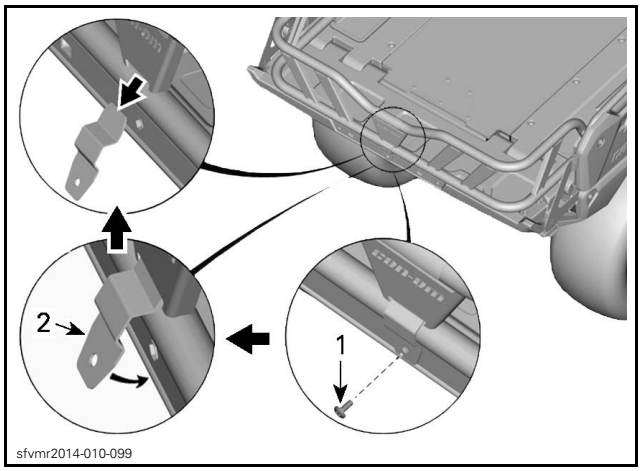
The installation is the reverse of the removal procedure. However, pay attention to the following.

TIGHTENING TORQUE	
Side bracket retaining screws	31 N•m ± 1 N•m (23 lbf•ft ± 1 lbf•ft)
Hinge retaining screws	31 N•m ± 1 N•m (23 lbf•ft ± 1 lbf•ft)
Gas spring retaining nuts	12 N•m ± 1 N•m (106 lbf•**in** ± 9 lbf•**in**)

TAIL GATE EXTENSION

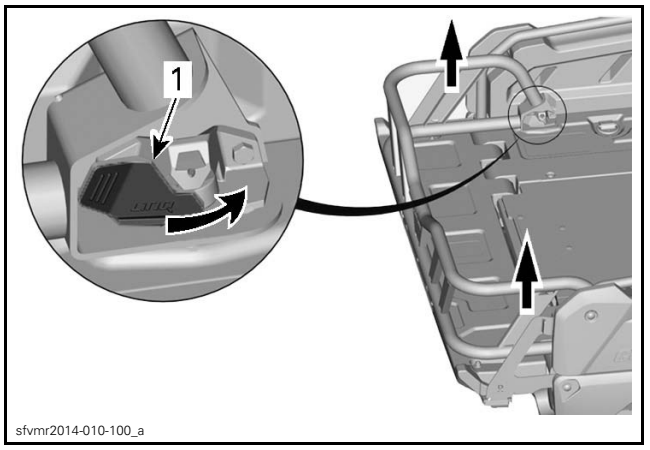
Tail Gate Extension Removal

1. Remove screw securing tail gate extension.
2. Lift bracket and remove it.



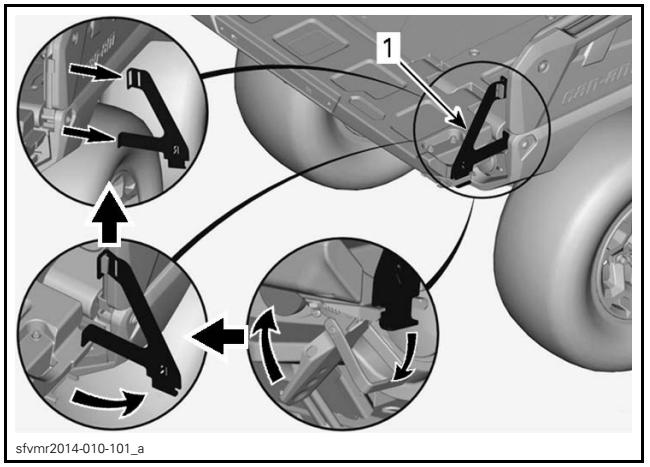
1. Retaining screw
2. Bracket

3. Unlatch LinQ attachments. Lift and remove the tail gate extension.



1. LinQ attchement lever

4. Remove tail gate limiters.
   4.1 Open tail gate limiter latche.
   4.2 Turn tail gate limiter to the side.
   4.3 Remove tail gate limiter



1. Tail gate limiter

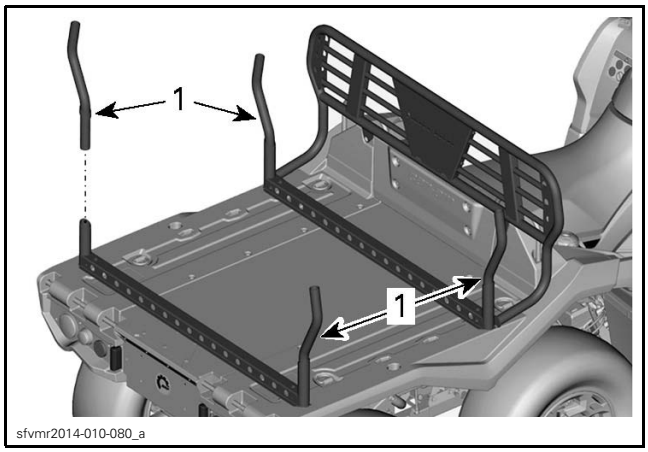
Tail Gate Extension Installation

The installation is the reverse of the removal procedure.

LOG BARS

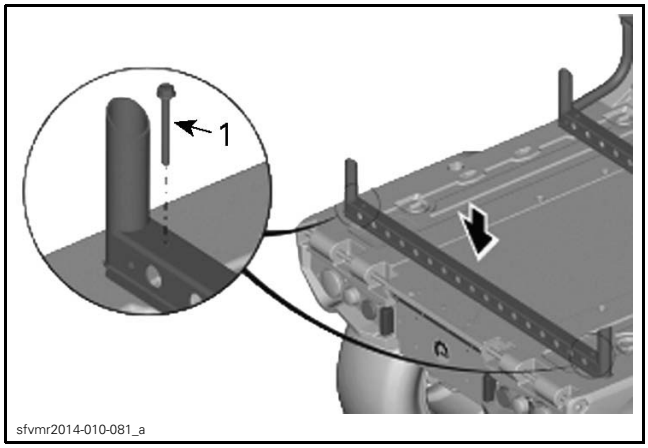
Log Bars Removal

1. Remove supports.

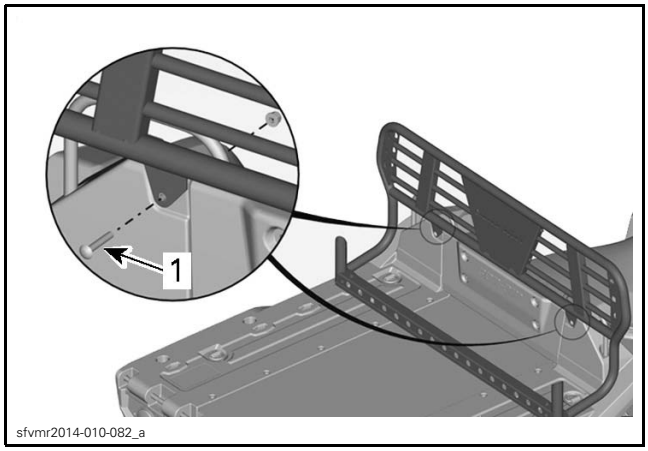


1. Supports

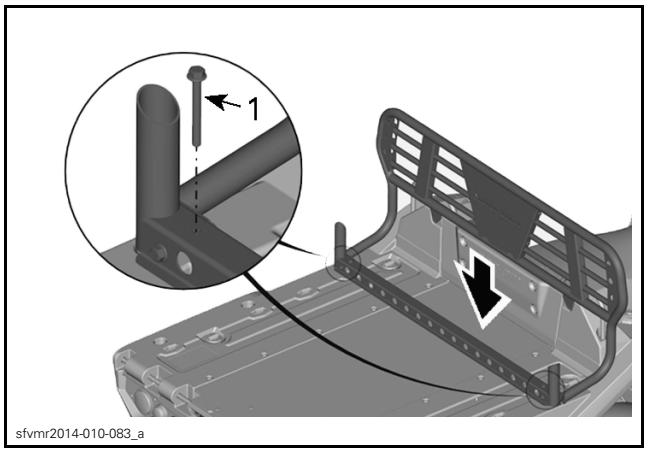
2. Remove retaining screws.



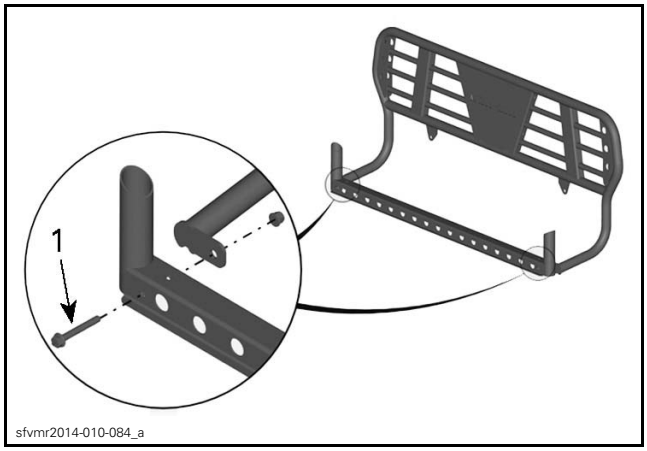
1. Retaining screws



1. Retaining screws

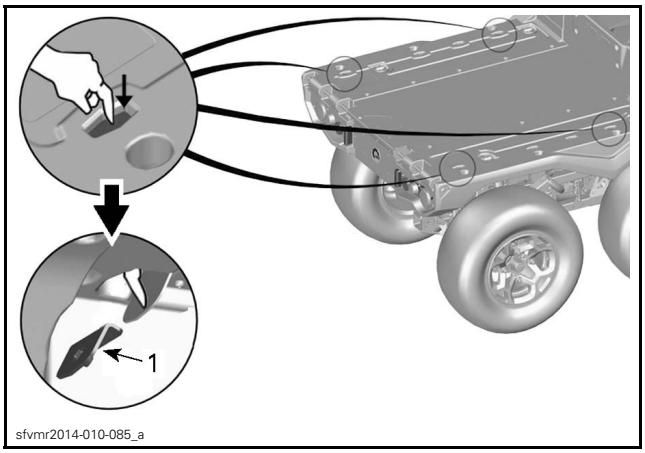


1. Retaining screws



1. Retaining screws

3. Remove mounting plates.



1. Mounting plate

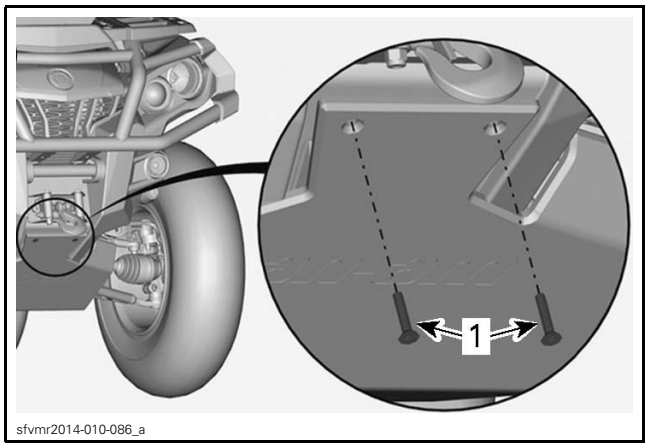
Log Bars Installation

The installation is the reverse of the removal procedure.

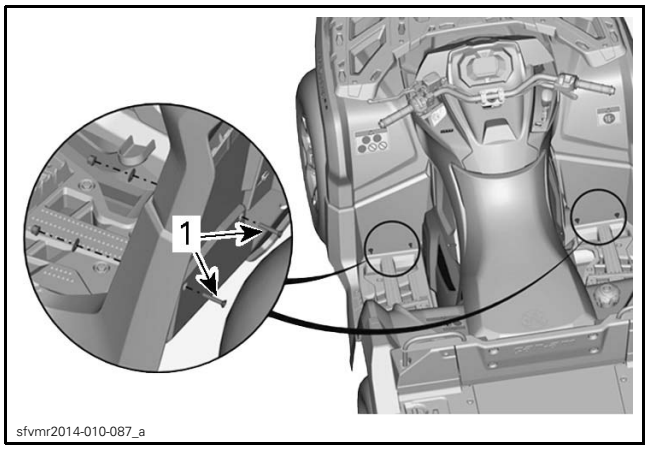
FULL BODY SKID PLATE

Skid Plate Removal

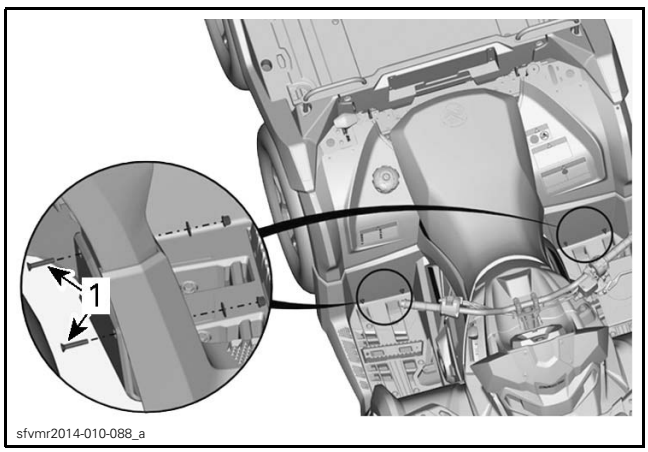
1. Remove the following retaining screws.



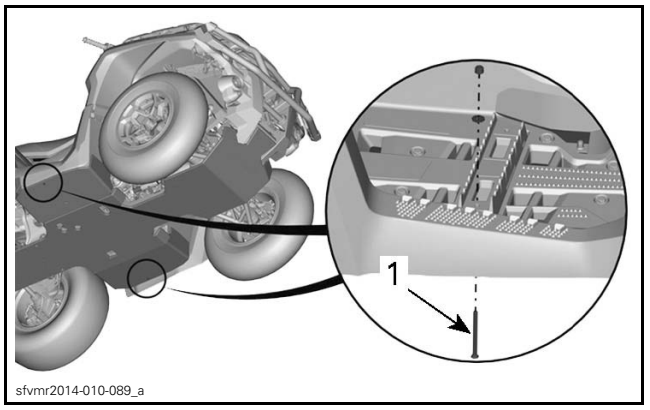
1. Retaining screws



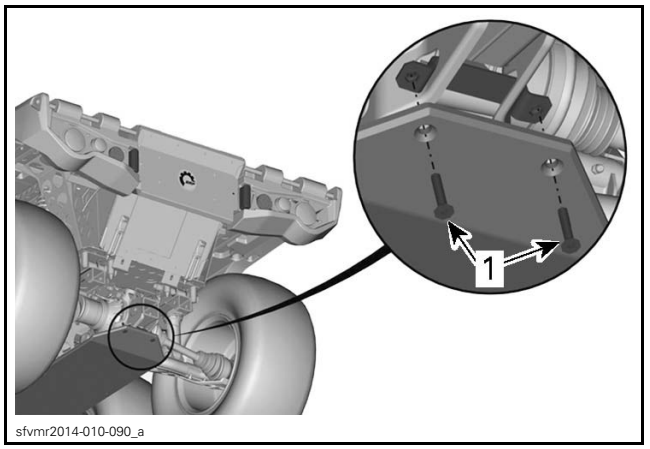
1. Retaining screws



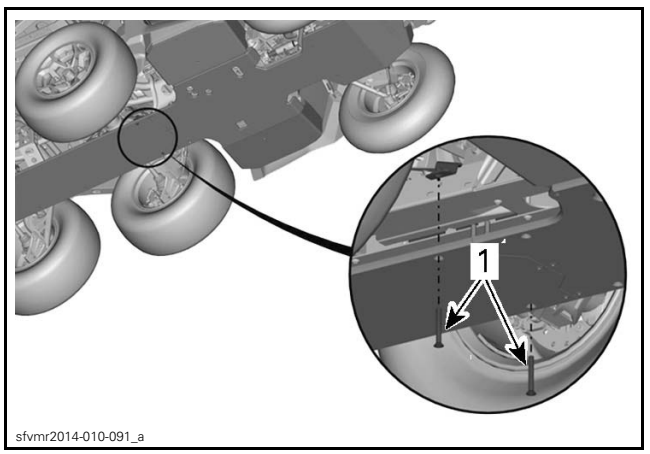
1. Retaining screws



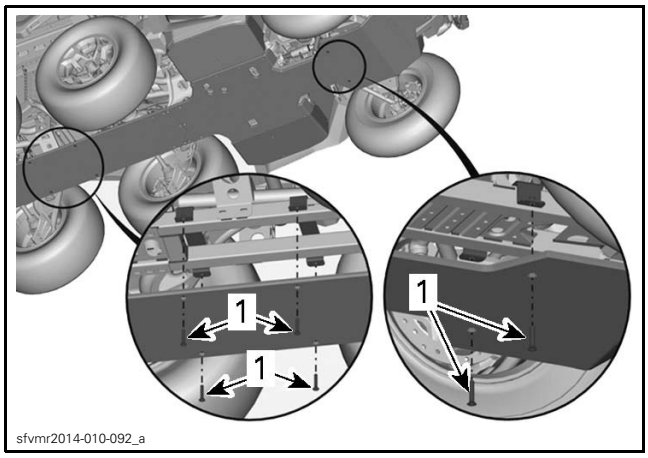
1. Retaining screws



1. Retaining screws



1. Retaining screws



1. Retaining screws

2. Remove skid plate.

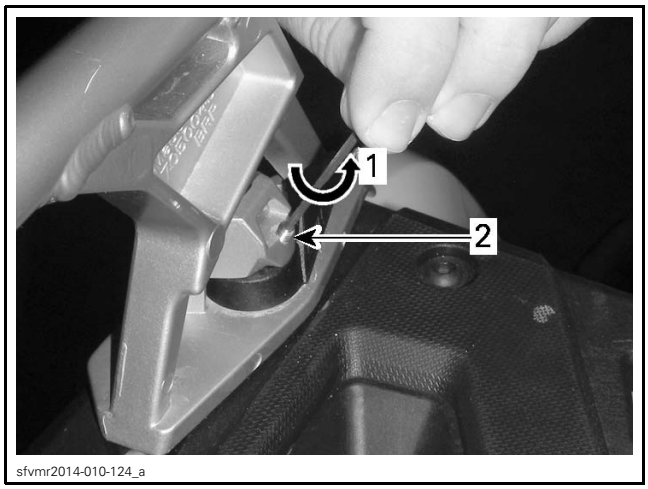
Skid Plate Installation

The installation is the reverse of the removal procedure.

LINQ FRONT RACK

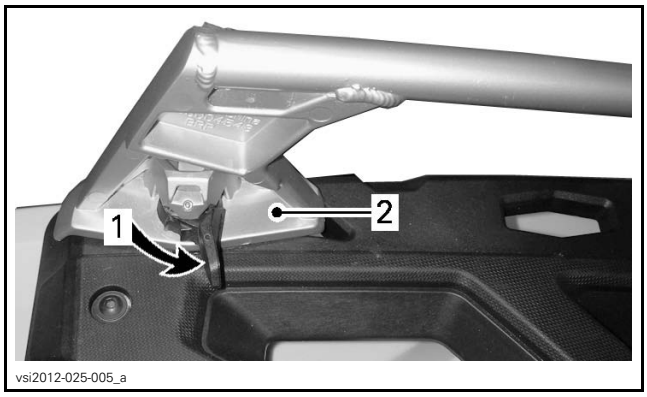
LinQ Front Rack Removal

1. Unlock levers locking screws if used.



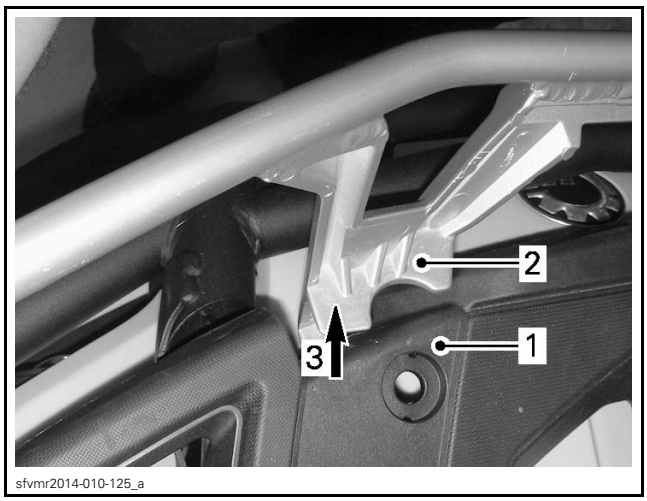
1. Remove locking screw (hand torque)
2. Locking screw

2. Turn lever to unlatched position. Repeat to the other side.



1. Lever in unlatched position
2. Rack extension mount (LH shown)

3. Lift LinQ rack rear mounts out.
4. Pull front mounts out and remove the rack.



1. Vehicle rack
2. Rack extension mount (LH shown)
3. Remove front mount from its rack location

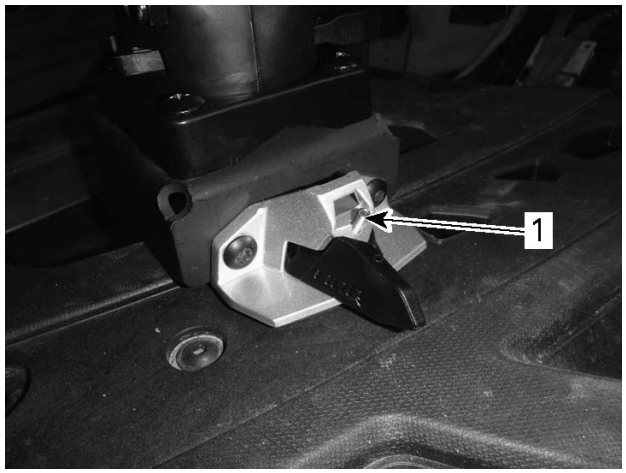
LinQ Front Rack Installation

The installation is the reverse of the removal procedure.

LINQ MOUNTED GEAR GRIPS

LinQ Mounted Gear Grips Removal

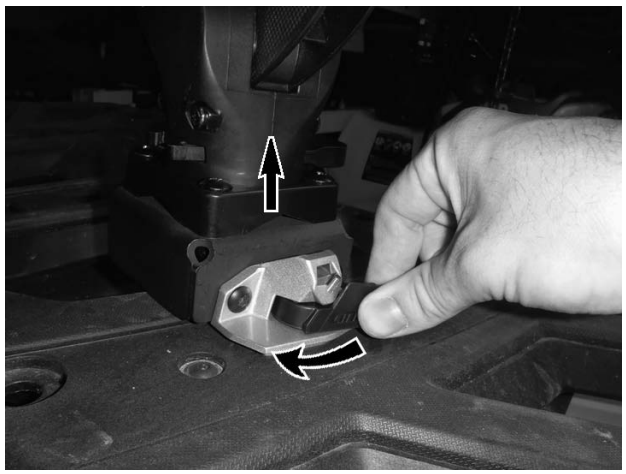
1. Unlock lever locking screws if used.



vsi2012-060-011_a

1. Locking screw

2. Turn lever to unlatched position and lift to remove the LinQ grip.



sfvmr2014-010-126_a

LinQ Mounted Gear Grips Installation

The installation is the reverse of the removal procedure.

HEATED VISOR OUTLET

Heated Visor Removal

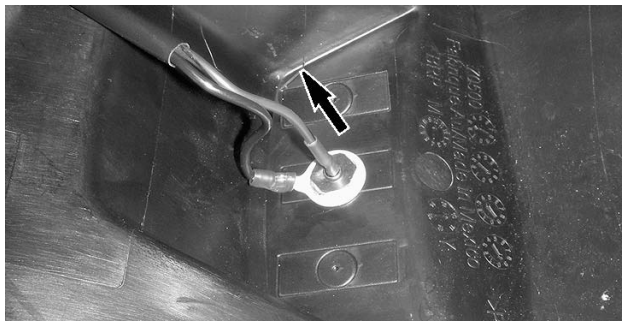
1. Remove seat and console.
2. Unscrew the protective cap.



tsi2012-040-110_a

1. Protective cap

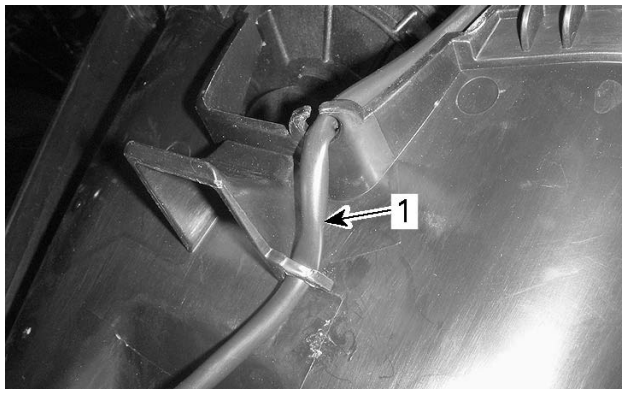
3. From underneath of console, remove the visor jack connector.



sfvmr2014-010-127_a

1. Protective cap

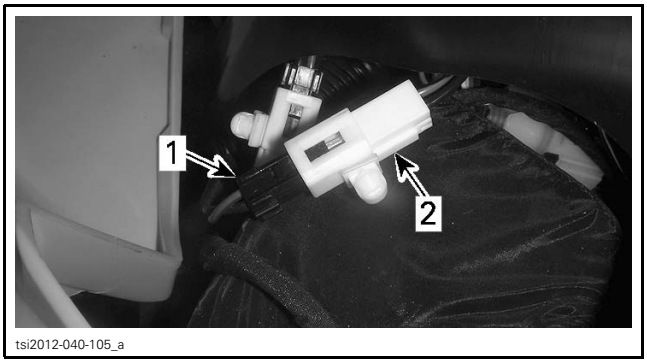
4. Remove the visor jack harness under the console.



tsi2012-040-107_a

1. Visor jack harness

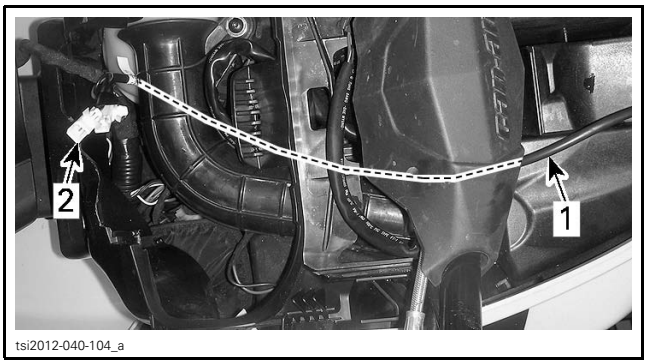
5. Unplug the accessory connector (single black connector) from the visor jack harness connector (white connector)



tsi2012-040-105_a

1. Accessory connector
2. Visor jack harness connector

6. Remove the visor jack harness; pull it off under the air intake hose then by the LH side of steering column.



tsi2012-040-104_a

1. Visor jack harness
2. Visor jack harness connectors

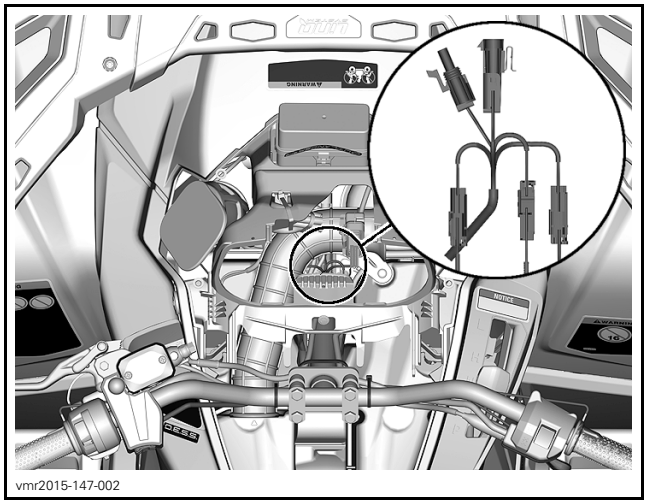
Heated Visor Installation

The installation is the reverse of the removal procedure.

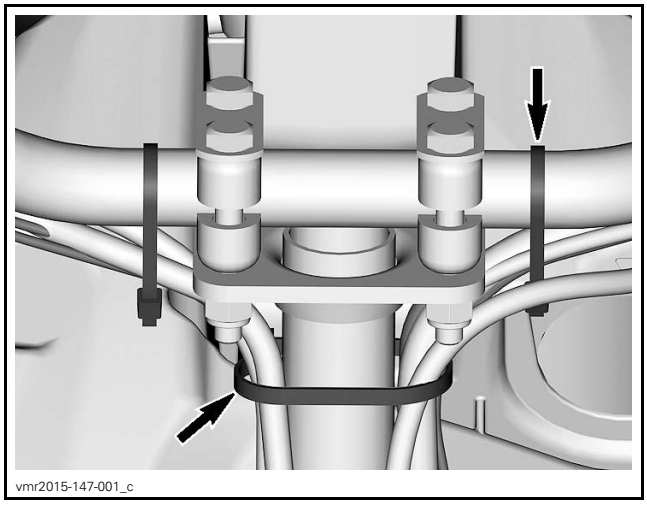
HEATED HAND GRIPS AND THROTTLE COMBO

Heating Control Module Removal

1. Remove the console. Refer to *BODY* subsection.
2. Remove the handlebar cover. Refer to *STEERING SYSTEM* subsection.
3. Remove the gauge support. Refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.
4. Disconnect all heating control module harness connectors (5x) located under the air intake duct.


vmr2015-147-002

5. Cut all locking ties securing wires on the handlebar.


vmr2015-147-001_c

6. Gently pull the heating control module harness out of the console support.
7. Remove heating control module retaining screw.


vsi2012-009-020

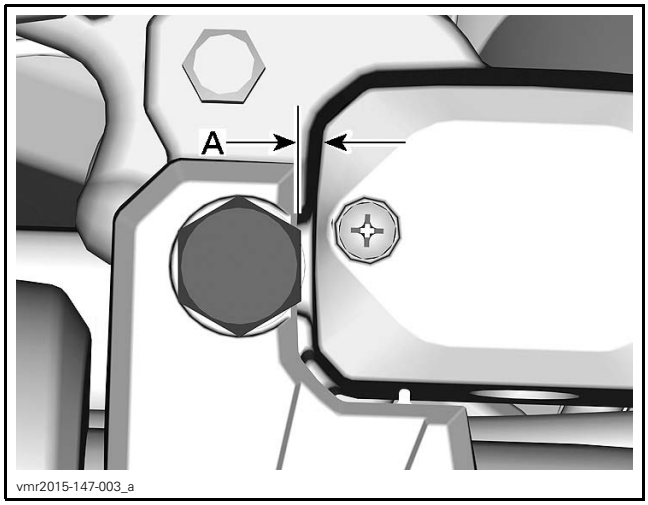
Heating Control Module Installation

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

Install new locking ties.

Gently tighten retaining screw to a snug fit.

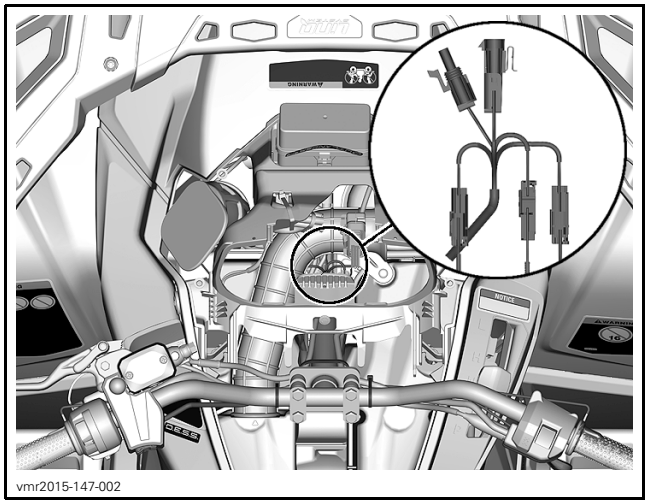
NOTICE **Do not over tighten as it may cause the heating control module to crack.**



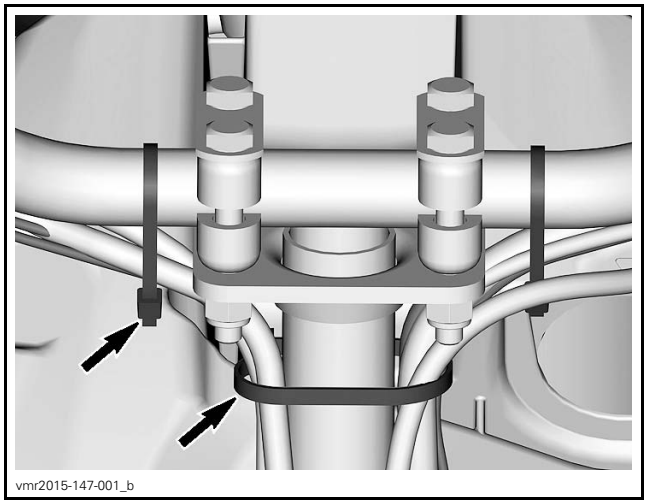
A. 0°

Heated Throttle Lever Removal

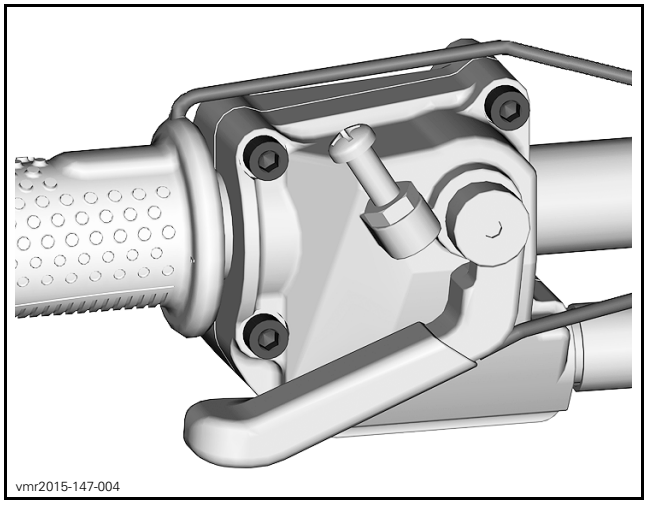
1. Remove the console. Refer to *BODY* subsection.
2. Remove the handlebar cover. Refer to *STEERING SYSTEM* subsection.
3. Remove the gauge support. Refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.
4. Disconnect the heated throttle lever connector (orange wire) located under the air intake duct.



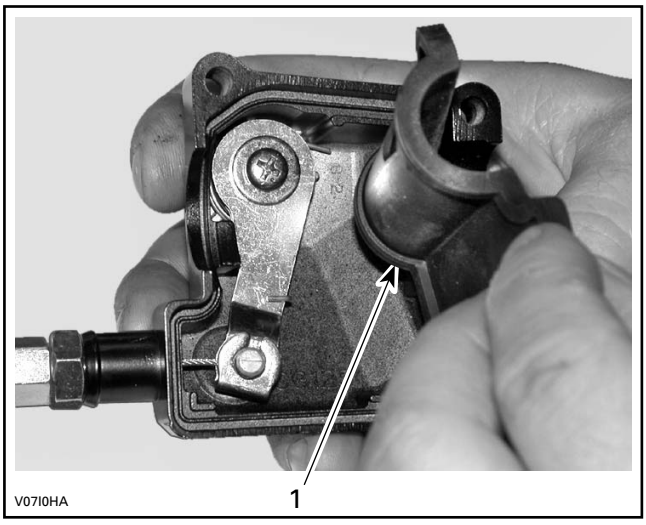
5. Cut RH side and center locking ties.



6. Gently pull the heated throttle lever harness out of the console support.
7. Remove and keep the 3 retaining screws under the throttle lever.

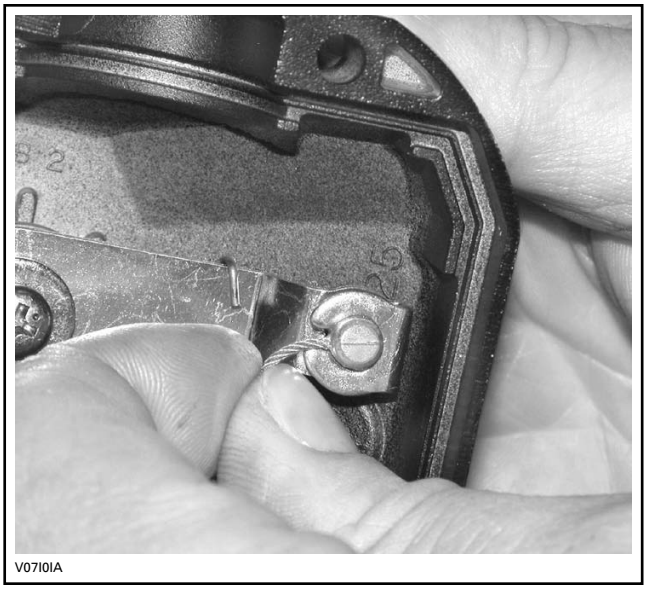


8. Separate housing.
9. Remove and keep inner housing protector.

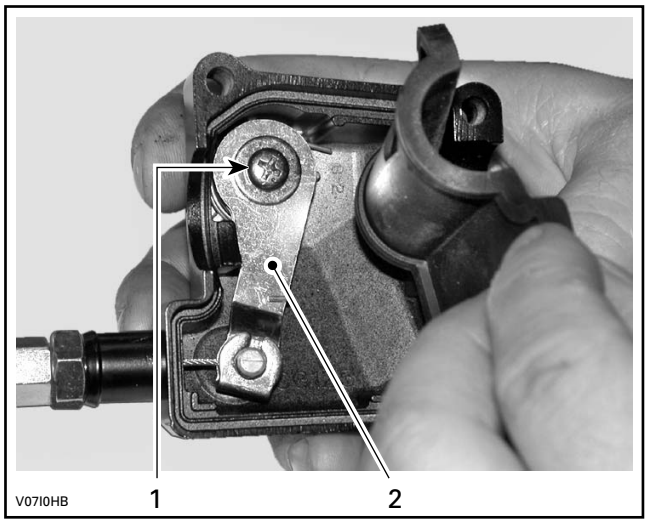


1. Inner housing protector

10. Slide cable in clip slot and remove end of cable from clip.



11. Remove and discard screw retaining throttle cable clip. Keep washer and spring.



1. Retaining screw
2. Throttle cable clip

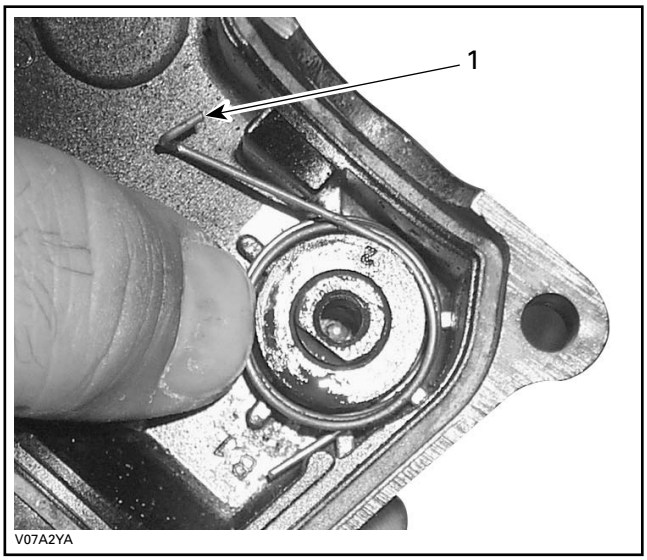
NOTE: Take note of spring and washers location.

12. Remove and discard throttle lever from housing.

Heated Throttle Lever Installation

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

1. Install spring in same position as it was before removal.



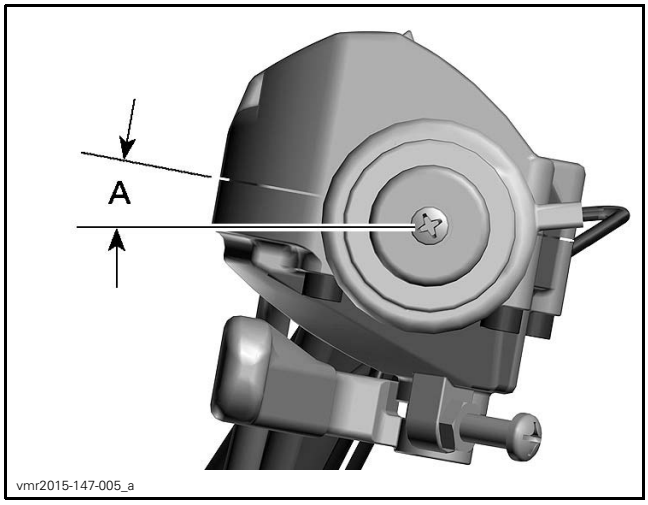
1. Good position

2. Apply LOCTITE 271 (RED) (P/N 293 800 005) on screw threads.
3. Install and secure throttle cable clip on throttle lever using throttle lever retaining screw and the previously removed washer. tighten to specification.

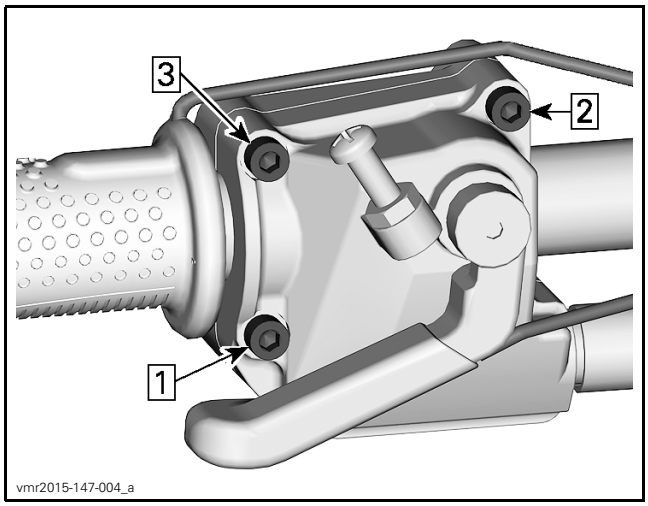
⚠ CAUTION Make sure spring is not squeezed between throttle lever and housing.

TIGHTENING TORQUE	
Throttle Lever Retaining Screw	3.5 N•m ± .5 N•m (31 lbf•**in** ± 4 lbf•**in**)

4. Verify that throttle lever moves freely.
5. Position throttle lever assembly approximately 10° from horizontal of vehicle for thumb comfort.



6. Tightenhousing screws to specification in the following sequence.



TIGHTENING SEQUENCE

⚠ WARNING

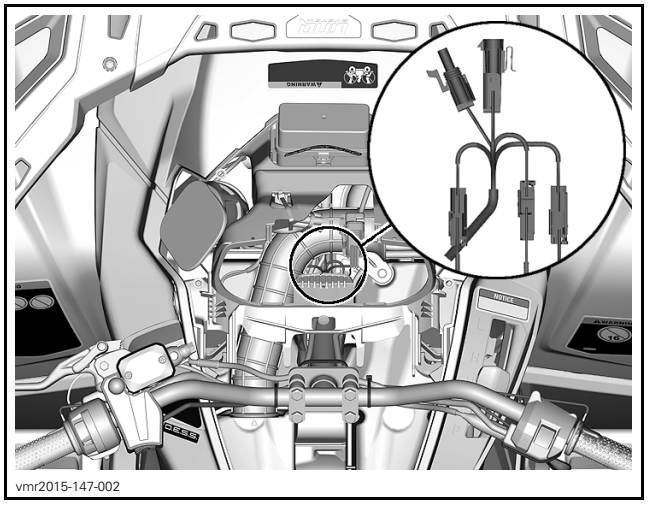
Make sure throttle lever operates freely and returns to its original position once released.

TIGHTENING TORQUE	
Housing Retaining Screws	4.8 N•m ± .7 N•m (42 lbf•**in** ± 6 lbf•**in**)

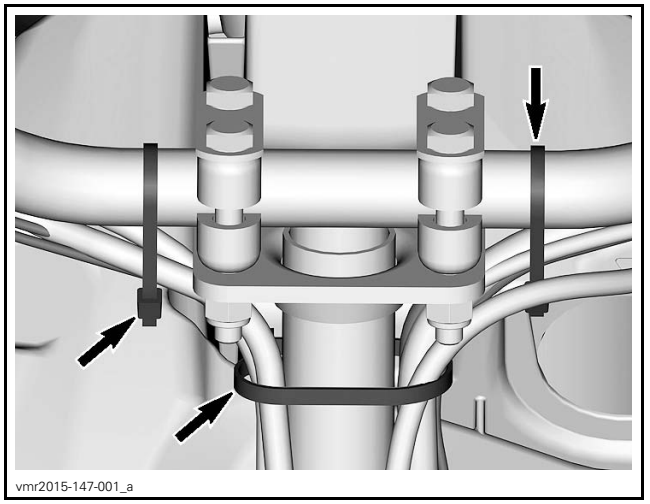
7. Install new locking ties.

Heated Grips Removal

1. Remove the console. Refer to *BODY* subsection.
2. Remove the handlebar cover. Refer to *STEERING SYSTEM* subsection.
3. Remove the gauge support. Refer to *LIGHTS, GAUGE AND ACCESSORIES* subsection.
4. Disconnect the heated hand grip connectors (red wire) located under the air intake duct.



5. Cut all locking ties.

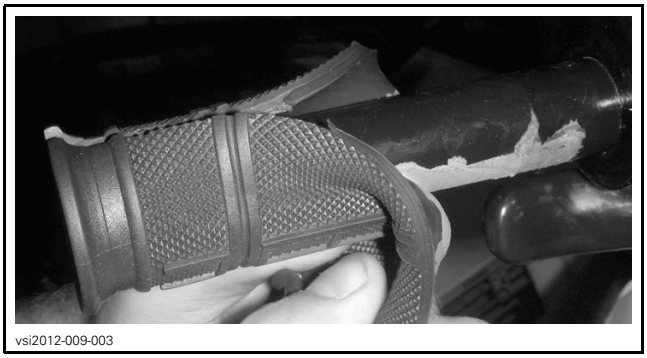


6. Gently pull the heated hand grip harness out of the console support.
7. Remove and keep handlebar grip caps


vsi2012-009-004

8. Carefully cut and remove handlebar grips.

NOTICE Ensure not to cut all the way through as it will scratch the surface of the handlebar and make the insertion of the new grip more difficult.


vsi2012-009-003

Heated Grips Installation

NOTICE Handlebar and new heated grips must be clean before installation.

1. Put a pencil mark at 117.5 mm (4-5/8 in) from the end on each side of handlebar before installing the grips. These marks will indicate how far the grips need to be pushed in.
2. Apply WD-40 generously on the inside of heated grip.

NOTE: Plenty of lubricant is used to soften the inner layer of the grip.

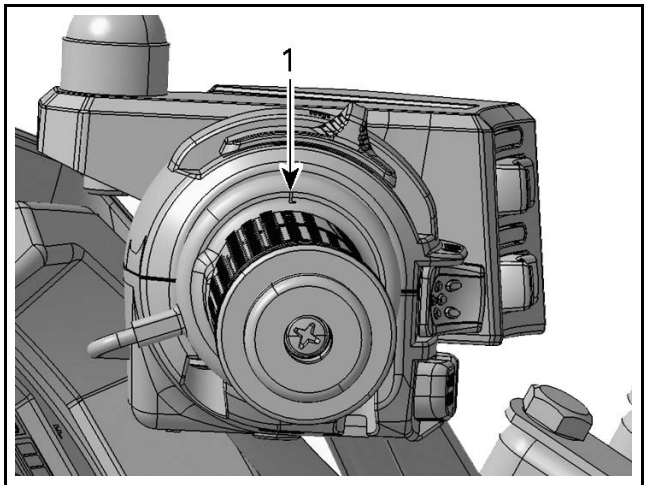
NOTICE Do not use other lubricants than recommended one. Other lubricants can react with grips and cause malfunction of heated elements.

NOTICE Make sure lubricant does not get on body sections, wipe any spillage immediately.


vsi2012-009-023

HEATED GRIPS LUBRICATION

3. Wait 2 minutes and apply more WD-40 on the inside of heated grips.
4. Wait 2 more minutes and apply more WD-40 on the inside of heated grips and on the outside of handlebar.
5. IMMEDIATELY position the left grip so the L for left side (or R for right side) is on top of handlebar. Align the grip and push it onto the handlebar.



vsi2012-009-038_a

1. Letter indication

NOTE: To ease grip installation, twist and turn as you push on it.

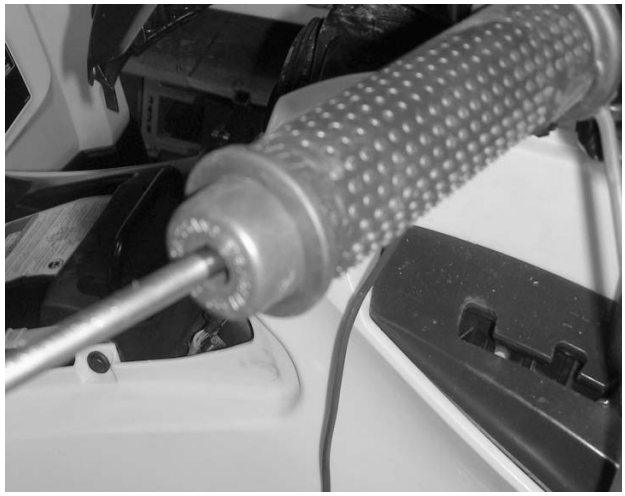
NOTICE If the grip cannot be completely fitted onto the handlebar within 10 seconds of starting the push, remove grip immediately and start over.

NOTE: The grips are quite hard to push over so be prepared to apply a considerable amount of force to install them. It is recommended to turn the handlebars completely to the left or right and to firmly secure them so that they do not move when the grips are installed. The resistance increases the further the grips are pushed in so be prepared to push and twist the grips to finish the installation.

NOTICE **Do not use a tool or hammer to install the grips as this will damage the heater.**

NOTE: If the grip gets stuck halfway through, connect the grip and make it heat. Refer to Heating control module installation step 7 to 10 for instructions. You will need to connect the red wire of the grip to the red wire of the heating control module. Then, plug the 12 V power connector to the one on the vehicle. Once wires are connected, put the key to ON position, use controls and set 4th heating level.

6. Repeat steps 4 to 7 for the RH side grip.
7. Install handlebar caps and tighten to specification.


vsi2012-009-022

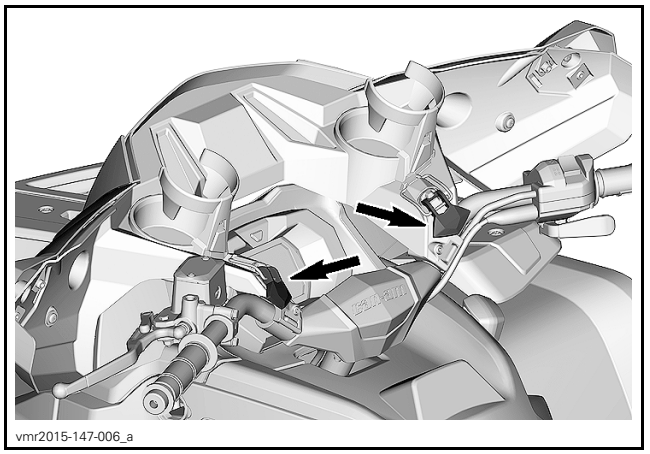
TIGHTENING TORQUE	
Handlebar cap retaining screw	0.4 N•m ± 0.1 N•m (4 lbf•**in** ± 1 lbf•**in**)

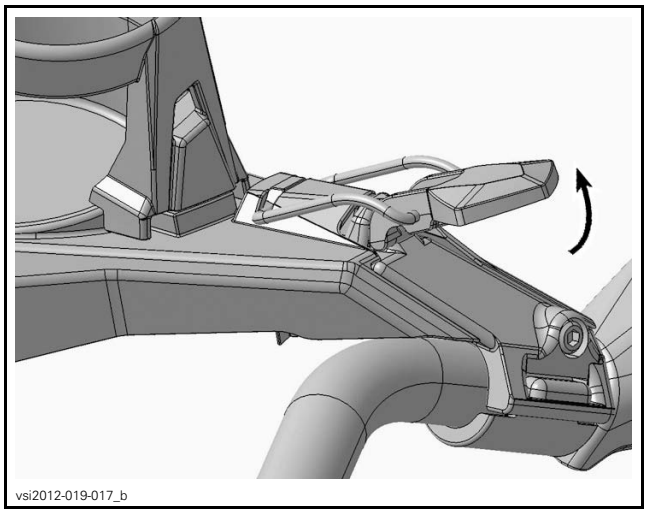
8. Route wires and plug connectors.
9. Install new locking ties.
10. Install gauge support, console and handlebar cover.

DELUXE FAIRING

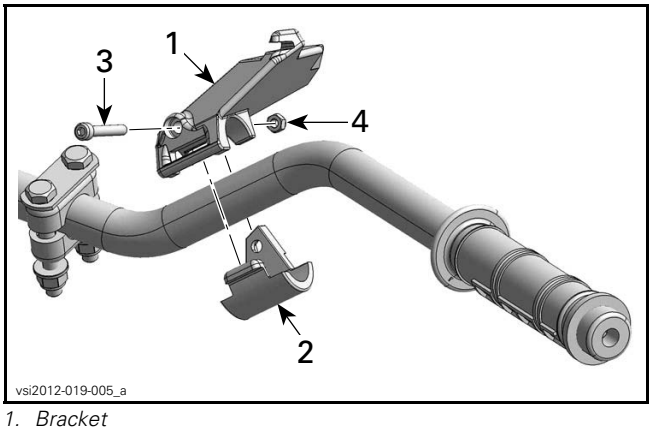
Fairing Removal

1. Release fairing latches.


vmr2015-147-006_a


vsi2012-019-017_b

2. Remove fairing brackets.



vsi2012-019-005_a

1. Bracket
2. Clamp
3. Bracket screw
4. Elastic stop nut

Fairing Installation

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

NOTE: The bracket screw must be tighten just enough so it can be adjusted for final assembly.

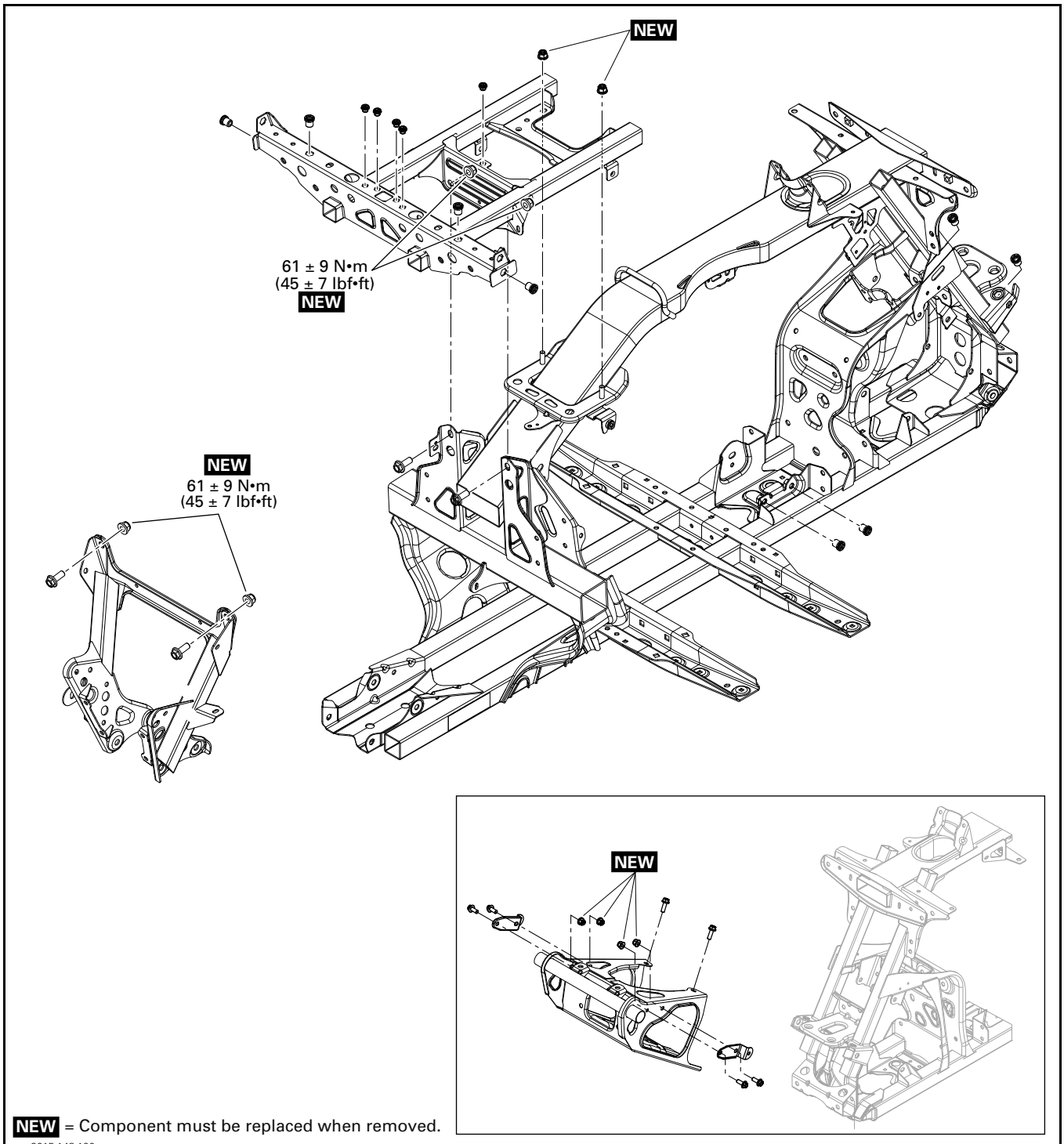
When adjusted, tighten screw to specification.

TIGHTENING TORQUE	
Handlebar cap retaining screw	5 N•m ± 0.5 N•m (44 lbf•**in** ± 4 lbf•**in**)

FRAME

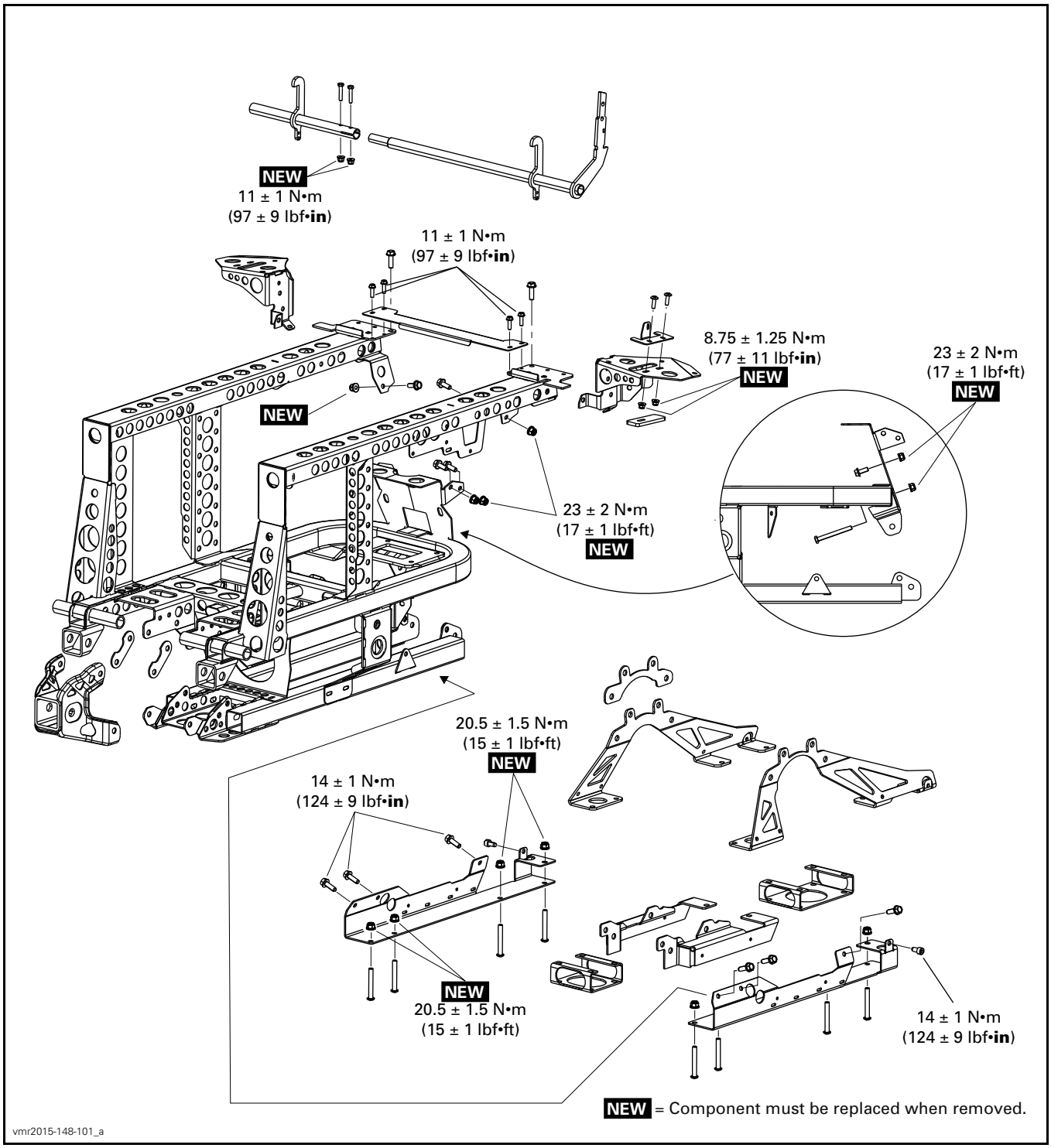
SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
BLIND THREADED INSERT INSTALLER	model 9600	601



NEW = Component must be replaced when removed.

vmr2015-148-100_a

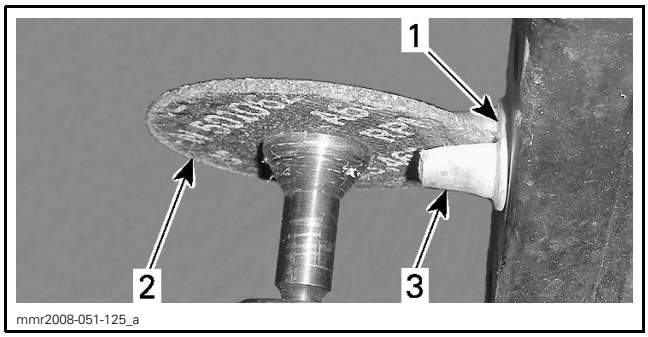

NEW
11 ± 1 N•m
(97 ± 9 lbf•**in**)
11 ± 1 N•m
(97 ± 9 lbf•**in**)
NEW
8.75 ± 1.25 N•m
(77 ± 11 lbf•**in**)
NEW
23 ± 2 N•m
(17 ± 1 lbf•ft)
NEW
23 ± 2 N•m
(17 ± 1 lbf•ft)
NEW
20.5 ± 1.5 N•m
(15 ± 1 lbf•ft)
NEW
14 ± 1 N•m
(124 ± 9 lbf•**in**)
NEW
20.5 ± 1.5 N•m
(15 ± 1 lbf•ft)
14 ± 1 N•m
(124 ± 9 lbf•**in**)
NEW = Component must be replaced when removed.
vmr2015-148-101_a

PROCEDURES

HUCK RIVET REMOVAL

Recommended Method

1. Using a cut-off tool, cut the rivet retainer without touching the retainer's shoulder.



1. Rivet retainer's shoulder
2. Cutter wheel
3. Rivet retainer

NOTE: Apply a thin layer of grease on cutter wheel to increase its durability.

2. Break the rivet retainer's shoulder using a chisel.
3. Use a small punch to drive out the rivet stem.

Alternative Method

1. Measure outside diameter of rivet stem and select appropriate drill bit.
2. Drill the **rivet stem — not the rivet head** using a variable speed drill until rivet retainer is freed.

NOTE: When possible, use an angle grinder to grind rivet head or use an air hammer to cut the rivet retainer.

FRAME

Frame Inspection

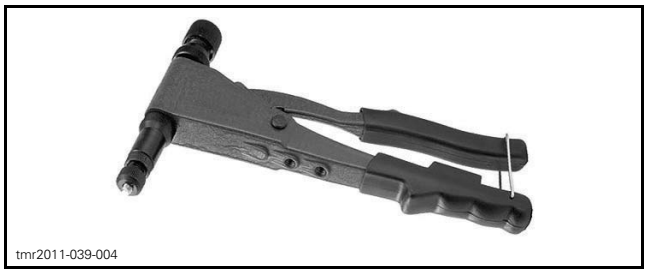
Check frame for bending, cracks, weld damages or any other damage. Replace frame as necessary.

Frame Welding

No welding should be done on frame except if mentioned or required on an approved BRP Bulletin.

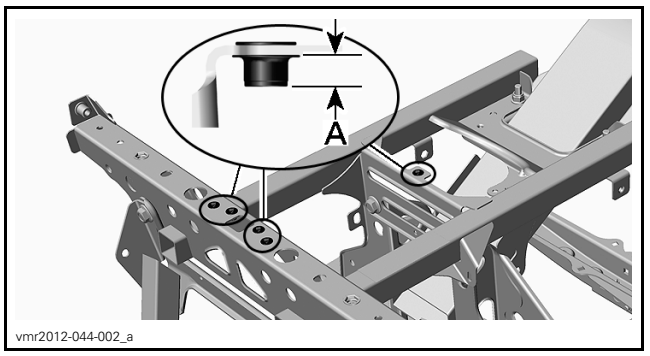
Frame Insert Replacement

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**.



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)



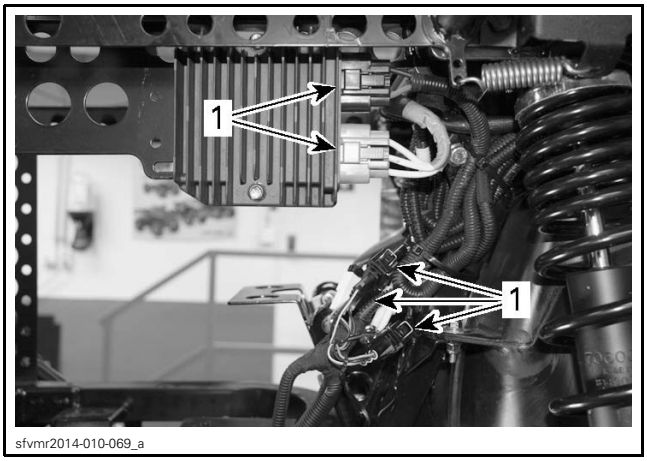
INSERTS FOR M6 BOLT SHOWN
A. 9 mm ± 0.5 mm (.354 in ± .02 in)

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*.

Rear Frame Removal

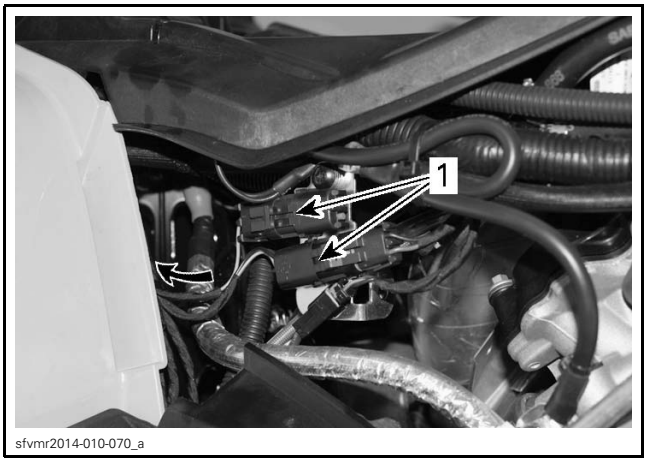
1. Remove cargo bed. Refer to *BODY* subsection.
2. Remove middle wheels. Refer to *WHEELS AND TIRES* subsection.
3. Remove muffler. Refer to *EXHAUST SYSTEM* subsection.
4. Cut locking ties and disconnect electrical connectors.



sfvmr2014-010-069_a

1. Electrical connectors

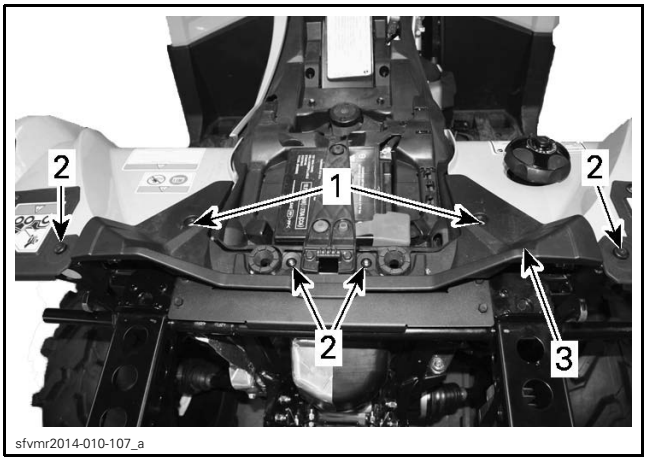
5. Remove seat
6. Remove RH side panel. Refer to *BODY* subsection.
7. Disconnect electrical connectors and pull the harness backwards.



sfvmr2014-010-070_a

1. Electrical connectors

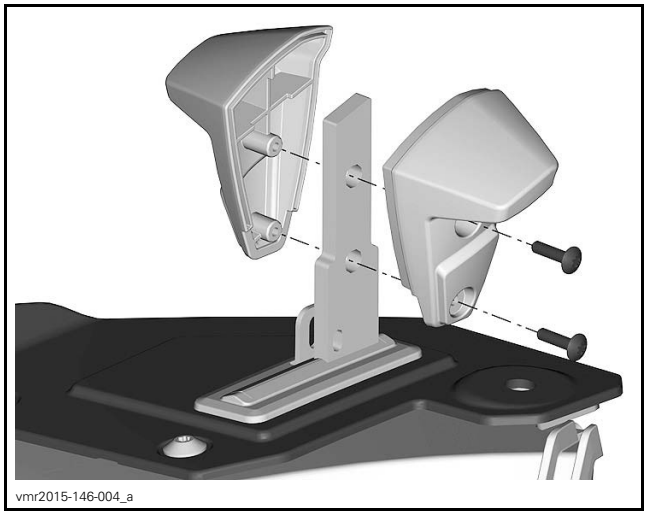
8. Remove rear top panel.



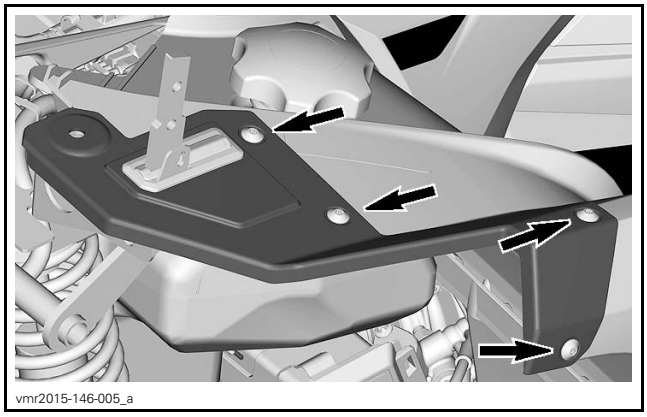
sfvmr2014-010-107_a

1. Plastic rivets
2. Retaining screws
3. Rear top panel

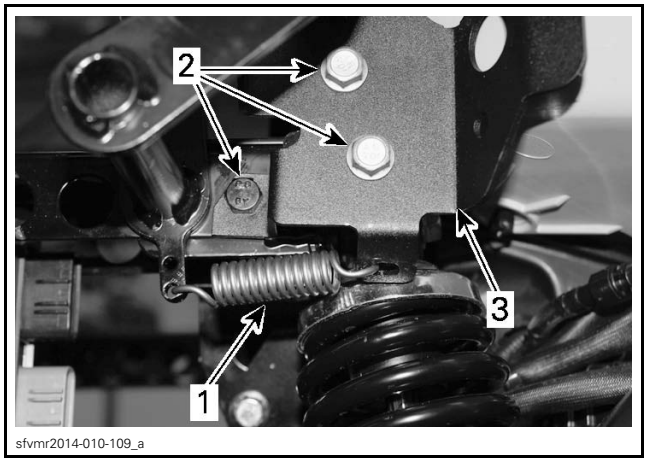
9. Remove cargo bed latch lever handle.


vmr2015-146-004_a

10. Remove rear side panels.


vmr2015-146-005_a

11. Remove spring and retaining screws to loosen the support (both sides).



sfvmr2014-010-109_a

1. Spring
2. Retaining screws
3. Support

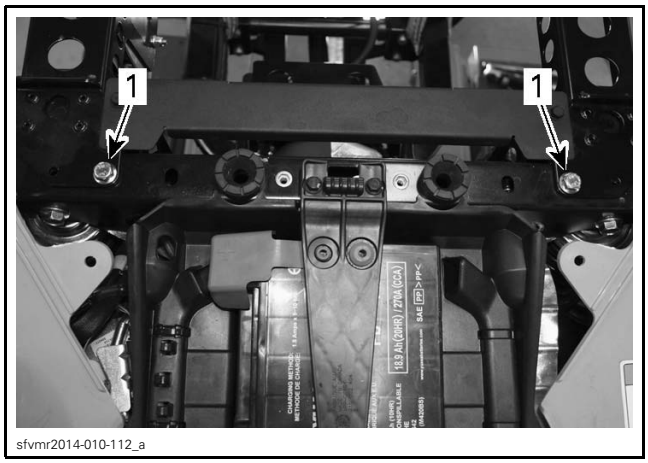
North American Models

12. Remove rivet (both sides). Refer to *HUCK RIVET REMOVAL* in this subsection.


vmr2015-148-001_a

All Models

13. Remove retaining screws.



sfvmr2014-010-112_a

1. Retaining screws

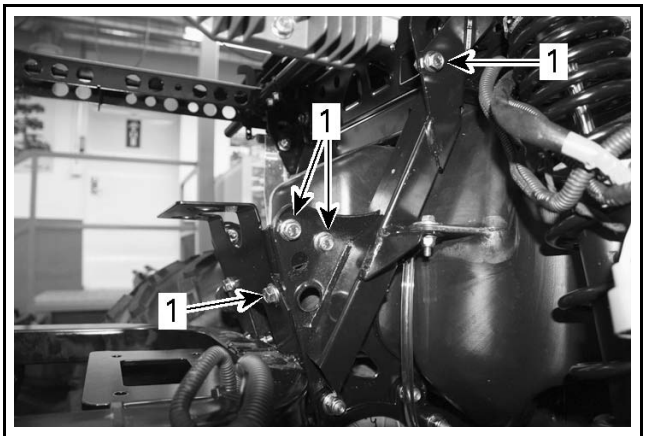
14. Remove retaining nut and leave the screw in place (both sides).



sfvmr2014-010-113_a

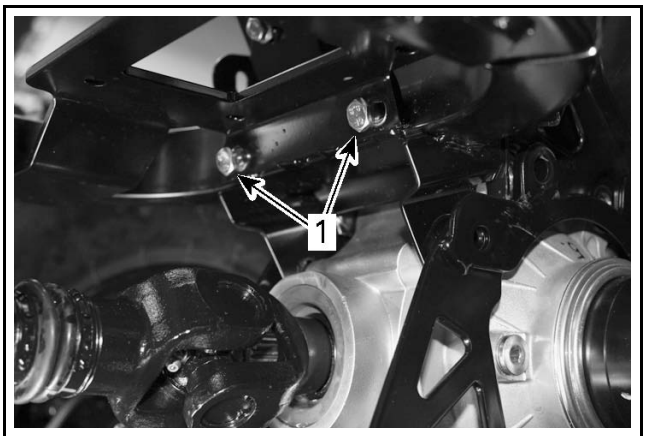
1. Retaining nut

15. Remove retaining screws and nuts (both sides).



vmr2015-148-002_a

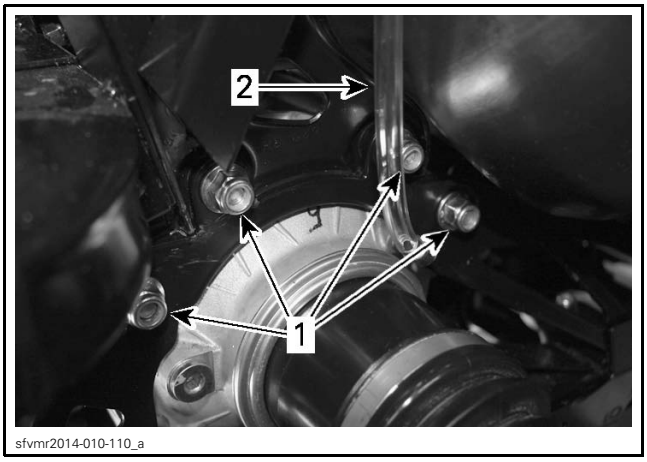
1. Retaining screws and nuts



sfvmr2014-010-115_a

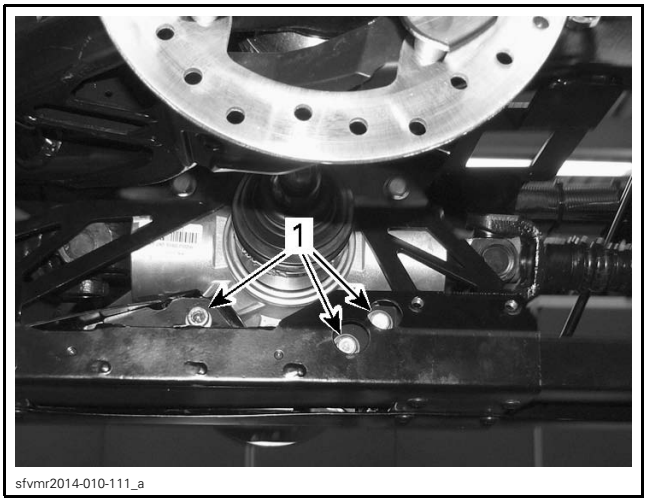
1. Retaining screws and nuts

16. Drain oil from middle drive. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.
17. Unplug the vent hose from middle drive.
18. Remove rear propeller shaft screw from the middle drive yoke. Refer to *PROPELLER SHAFT* subsection.
19. Remove middle drive retaining screws.



sfvmr2014-010-110_a

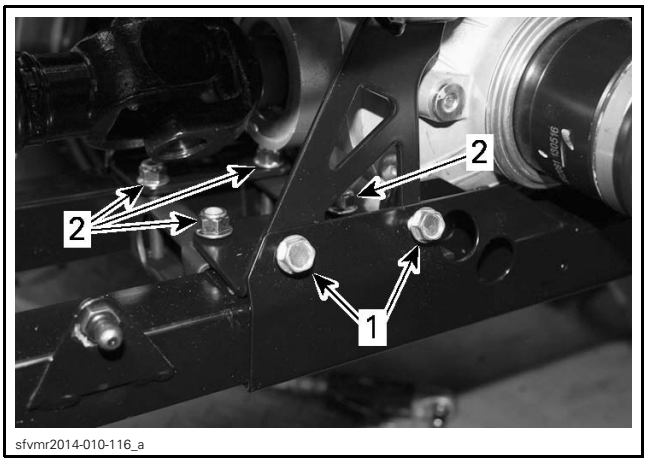
1. Retaining screws
2. Vent hose



sfvmr2014-010-111_a

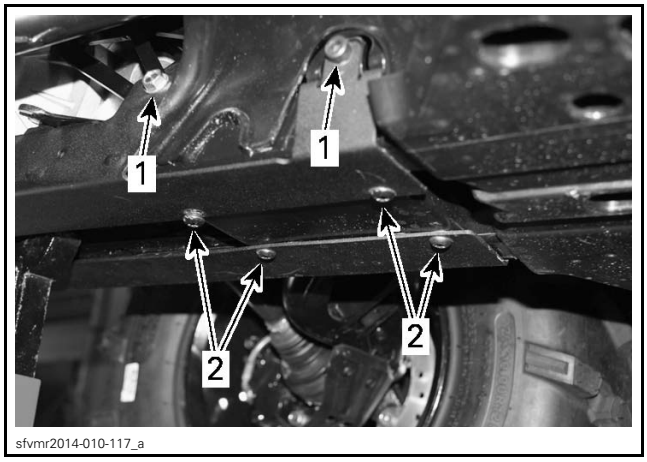
1. Retaining screws

20. Remove retaining screws and nuts (both sides).



sfvmr2014-010-116_a

1. Retaining screws
2. Retaining nuts and screws

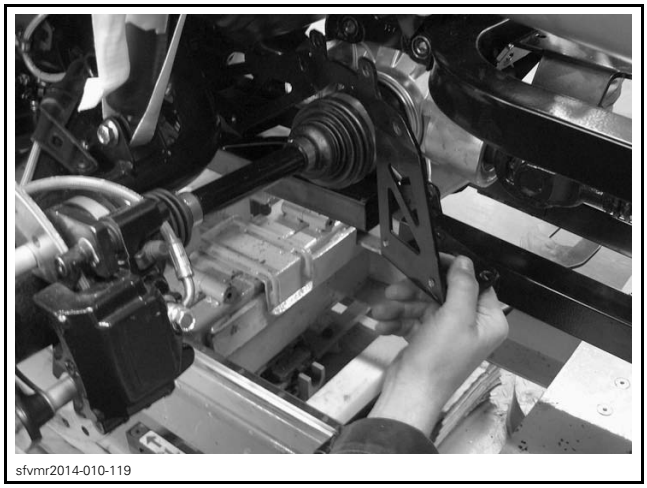


sfvmr2014-010-117_a

1. Retaining screws
2. Retaining screws and nuts

21. Remove all bottom supports.


sfvmr2014-010-118


sfvmr2014-010-119

22. Using a hoist or with the help of another person, remove the rear frame from the vehicle.

⚠ CAUTION To avoid injury or vehicle damages, never handle the rear frame alone.

Rear Frame Installation

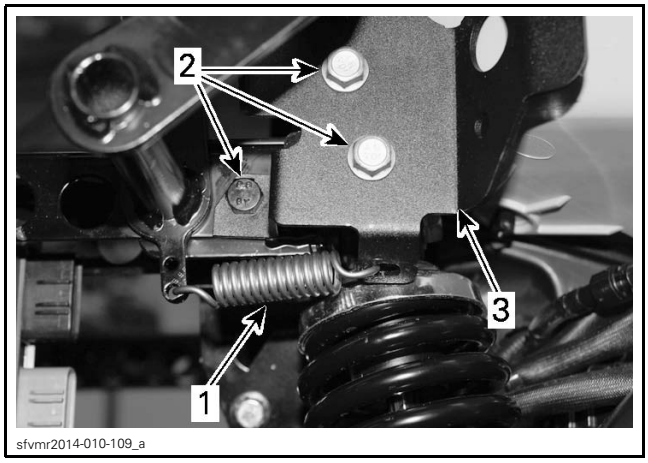
The installation is the reverse of the removal procedure. However, pay attention to the following.

First, fit all the supports, screws and nuts in their proper places. Start tighten the screws and nuts only when everything is set in place.

Refill middle drive with recommended oil. Refer to *PERIODIC MAINTENANCE PROCEDURES* subsection.

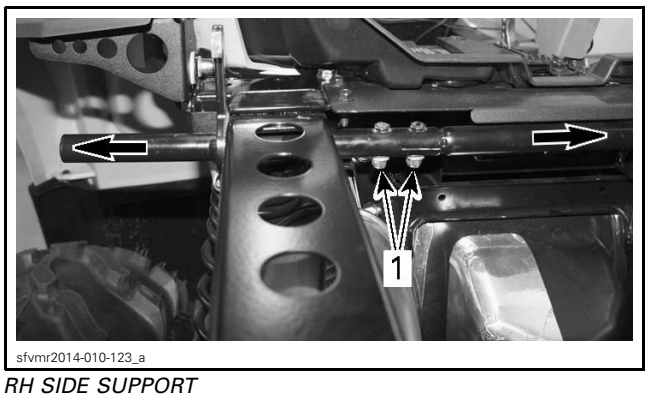
Cargo Bed Latch Lever Removal

1. Remove rear side panel and opening lever handle. Refer to *BODY* subsection.
2. Remove spring and retaining screws to remove support.



RH SIDE SUPPORT
1. Spring
2. Retaining screws
3. Support

3. Remove retaining screws and separate lever rods from each other by pulling them out.



RH SIDE SUPPORT
1. Retaining screws

Latch Lever Installation

The installation is the reverse of the removal procedure.

OUTLANDER 6X6 (1000)

ENGINE			
Engine type			ROTAX 1010, 4-stroke, 2 cylinders (V-twin), liquid cooled
Valve train			4 valves/cylinder (mechanical adjustment), single over head camshaft (SOHC) with timing chain
Bore			91 mm (3.58 in)
Stroke			75 mm (2.95 in)
Displacement			976 cm^3 (59.6 in^3)
Compression ratio			10.5:1
Maximum HP RPM			7000 rpm
Exhaust system			Spark arrestor approved by USDA Forest Service
Air filter			Synthetic paper filter with foam
Intake valve opening			5° BTDC
Intake valve closing			60° 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	4.966 mm to 4.980 mm (.1955 in to .1961 in)
		Service limit	4.930 mm (.1941 in)
	Exhaust	New	4.956 mm to 4.970 mm (.1951 in to .1957 in)
		Service limit	4.930 mm (.1941 in)
Valve out of round	Intake and exhaust	New	0.005 mm (.0002 in)
		Service limit	0.06 mm (.0024 in)
Valve guide diameter		New	4.998 mm to 5.018 mm (.1968 in to .1976 in)
		Service limit	5.050 mm (.1988 in)
Valve spring free length		New	40.81 mm (1.607 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	1.8 mm (.071 in)
	Exhaust	New	1.25 mm to 1.55 mm (.049 in to .061 in)
		Service limit	2 mm (.079 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	12.000 mm to 12.018 mm (.4724 in to .4731 in)
		Service limit	11.990 mm (.472 in)
Piston diameter		New	90.950 mm to 90.966 mm (3.5807 in to 3.5813 in)
		Service limit	90.900 mm (3.5787 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, tapered face
		3rd	Oil scraper ring

ENGINE			
Ring end gap	Rectangular	New	0.20 mm to 0.40 mm (.008 in to .016 in)
		Service limit	0.60 mm (.024 in)
	Tapered face	New	0.20 mm to 0.40 mm (.008 in to .016 in)
		Service limit	0.70 mm (.028 in)
	Oil scraper ring	New	0.20 mm to 0.70 mm (.008 in to .028 in)
		Service limit	1.00 mm (.039 in)
Ring/piston groove clearance	Rectangular	New	0.03 mm to 0.07 mm (.0012 in to .0028 in)
		Service limit	0.15 mm (.0059 in)
	Tapered face	New	0.02 mm to 0.06 mm (.0008 in to .0024 in)
		Service limit	0.15 mm (.0059 in)
	Oil scraper ring	New	0.01 mm to 0.18 mm (.0004 in to .0071 in)
		Service limit	0.25 mm (.0098 in)
Cylinder bore		New	90.993 mm to 91.007 mm (3.5824 in to 3.583 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	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)
	Spark plug side	New	21.959 mm to 21.980 mm (.8645 in to .8654 in)
		Service limit	21.950 mm (.8642 in)
Camshaft main bearing journal bore	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)
	Spark plug side	New	22.000 mm to 22.021 mm (.8661 in to .867 in)
		Wear limit	22.040 mm (.8677 in)
Camshaft lobe	Intake valve	New	32.960 mm to 33.160 mm (1.2976 in to 1.3055 in)
		Service limit	32.940 mm (1.2969 in)
	Exhaust valve	New	32.860 mm to 33.060 mm (1.2937 in to 1.3016 in)
		Service limit	32.840 mm (1.2929 in)
Crankshaft main bearing 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)
Crankshaft radial play (MAG/PTO side)		Service limit	0.07 mm (.0028 in)
Crankshaft bearing journal diameter (in PTO cover)		New	34.004 mm to 34.020 mm (1.3387 in to 1.3394 in)
		Service limit	33.998 mm (1.3385 in)
Crankshaft radial play (PTO cover bearing)		Service limit	0.10 mm (.0039 in)
Crankshaft axial play		New	0.200 mm to 0.500 mm (.0079 in to .0197 in)
		Service limit	0.600 mm (.0236 in)
Crankshaft pin diameter		New	41.986 mm to 42.010 mm (1.653 in to 1.6539 in)
		Service limit	41.967 mm (1.6522 in)
Crankshaft deflection	MAG/PTO side	New	0.050 mm (.002 in)
Crankcase plain bearing	MAG/PTO side	Service limit	42.100 mm (1.6575 in)
PTO cover plain bearing		Service limit	34.120 mm (1.3433 in)
Connecting rod big end diameter		Service limit	42.100 mm (1.6575 in)
Connecting rod big end radial play		Service limit	0.09 mm (.0035 in)

ENGINE		
Connecting rod big end axial play	New	0.250 mm to 0.550 mm (.0098 in to .0217 in)
	Service limit	0.600 mm (.024 in)
Connecting rod small end diameter	New	22.010 mm to 22.020 mm (.8665 in to .8669 in)
	Service limit	22.050 mm (.8681 in)
Piston pin diameter	New	21.996 mm to 22.000 mm (.866 in to .866 in)
	Service limit	21.980 mm (.8654 in)
Connecting rod/piston pin clearance (radial play)	Service limit	0.080 mm (.0031 in)

LUBRICATION SYSTEM		
Type		Wet sump. Replaceable cartridge oil filter
Oil filter		BRP Rotax paper type, replaceable
Engine oil pressure	Minimum	300 kPa (44 PSI) at 6000 RPM
Engine oil	Capacity (oil change with filter)	2.0 L (2.1 qt (U.S. liq.))
	Recommended	For the summer season, use XPS 4-stroke synth. blend oil (summer) (P/N 293 600 121) For the winter season, use XPS 4-stroke synthetic oil (All climate) (P/N 293 600 112). If not available, use a 5W40 motor oil that meets the requirements for API service classification SG, SH or SJ

COOLING SYSTEM		
Coolant	Type	Ethyl glycol/destilled water mix (50%/50%). Use BRP Long life antifreeze (P/N 219 702 685) or coolant specifically designed for aluminum engines
	Capacity	3.5 L (.9 U.S. gal.)
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		1850 ± 100 RPM
Drive belt width	Service limit	30.00 mm (1.181 in)
Governor cup roller outer diameter	New	13.70 mm to 13.80 mm (.539 in to .543 in)
	Service limit	13.20 mm (.52 in)
Governor cup roller inner diameter	New	8.05 mm to 8.15 mm (.317 in to .321 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	New	6.035 mm to 6.078 mm (.2376 in to .2393 in)
	Service limit	6.200 mm (.244 in)
Drive pulley sliding half 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 half 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 half small bushing	New	32.000 mm to 32.040 mm (1.26 in to 1.261 in)
	Service limit	32.200 mm (1.268 in)

TRANSMISSION		
Drive pulley spring free length	Service limit	85 mm (3.346 in)
Drive pulley spring free 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 half 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 sliding fixed 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)
Driven pulley spring free length	Service limit	125 mm (4.921 in)
Driven pulley spring free squareness	Service limit	3.8 mm (.15 in)

GEARBOX		
Type		Dual range (HI-LO) with park, neutral and reverse
Gear ratios	Angle drive sub-transmission	37/15 = 2.467
	Intermediate	45/40 = 1.125
	High	36/27 = 1.33
	Low	46/17 = 2.706
	Reverse	34/12 = 2.833
Overall gear ratios	High	3.700
	Low	7.509
	Reverse	7.863
Gearbox oil	Capacity	450 ml (15.22 U.S. oz)
	Recommended	XPS synthetic gear oil (75W 140) (P/N 293 600 140) or a 75W140 API GL-5 synthetic gear oil
Coupling sleeve groove width	New	5.25 mm to 5.35 mm (.207 in to .211 in)
	Service limit	5.50 mm (.217 in)
Coupling fork claw thickness	New	4.95 mm to 5.05 mm (.195 in to .199 in)
	Service limit	4.80 mm (.189 in)
Shift fork claw thickness (high gear shift fork)	New	5.10 mm to 5.20 mm (.201 in to .205 in)
	Service limit	5.0 mm (.197 in)
Shift fork claw thickness (low and reverse gear shift fork)	New	5.10 mm to 5.20 mm (.201 in to .205 in)
	Service limit	5.0 mm (.197 in)
Width of shift fork engagement groove (low and reverse gear)	New	5.30 mm to 5.40 mm (.209 in to .213 in)
	Service limit	5.50 mm (.217 in)
Width of shift fork engagement groove (high gear)	New	5.30 mm to 5.40 mm (.209 in to .213 in)
	Service limit	5.50 mm (.217 in)
Diameter free pinions	New	29.000 mm to 29.013 mm (1.1417 in to 1.1422 in)
	Service limit	29.015 mm (1.1423 in)
Intermediate gear shaft	New	24.979 mm to 25.000 mm (.9834 in to .9843 in)
	Service limit	24.977 mm (.983 in)

GEARBOX			
Countershaft	MAG side	New	19.977 mm to 19.990 mm (.7865 in to .787 in)
		Service limit	19.973 mm (.7863 in)
	CVT side	New	24.977 mm to 24.990 mm (.9833 in to .9839 in)
		Service limit	24.970 mm (.9831 in)
Bevel gear shaft	Free pinion bearing	Service limit	N.A.
Main shaft	Free pinion bearing	New	24.987 mm to 25.000 mm (.9837 in to .9843 in)
		Service limit	24.984 mm (.9836 in)
	Bearing journal MAG/CVT side	New	16.980 mm to 16.991 mm (.6685 in to .6689 in)
		Service limit	16.976 mm (.6683 in)

ELECTRICAL SYSTEM			
Magneto generator output			650 W @ 6000 RPM
Stator resistance (20°C (68°F))			0.15 to 0.30 Ω
Ignition system type			IDI (Inductive Discharge Ignition)
Ignition timing			Variable
Spark plug		Quantity	2
		Make and type	NGK DCPR8E
		Gap	0.6 mm to 0.7 mm (.024 in to .028 in)
Engine RPM limiter setting	All models	Forward	8000 rpm
		Reverse	15 km/h (9 MPH) (without override)
Battery		Type	Maintenance free
		Voltage	12 volts
		Nominal rating	18 A•h
		Power starter output	0.7 KW
Headlights		High	2 x 60 W
		Low	2 x 55 W
Taillights			2 x 5/21 W

ELECTRICAL SYSTEM			
Fuses	-Main	MF1	30 A
	-Fan -Main accessories power	MF2	40 A
	-DPS motor	MF3	40 A
	-Brake lights relay control -Gauge -Taillights -Brake relay -DPS control	F4	10 A
	-Ignition coils -Fuel injectors -Speed sensor	F5	5 A
	-Engine control module (ECM) -Fan relay control	F6	5 A
	-Winch control -2W/4W control	F7	5 A
	-ECM -Ignition switch	F8	5 A
	-Fan motor	F9	25 A
	-Clock -Accessories relay control	F10	5 A
	-Headlights	F11	30 A
	-Connector DC3 -12 V power outlet	F12	15 A
	-Connectosr DC5, DC6 and DC7	F14	15 A
	-Fuel pump relay	F15	5 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
		Outside North America	91 RON
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 4WD/6WD
Front drive		Visco-lok† front differential
Front drive ratio		3.6:1
Middle and rear drive		Straight bevel gear / final drive
Middle and rear drive ratio		3.6:1
Front differential oil	Capacity	500 ml (17 U.S. oz)
	Type	XPS synthetic gear oil (75W 90) (P/N 293 600 043) or synthetic gear oil 75W90 API GL-5

DRIVE SYSTEM		
Middle drive oil	Capacity	400 ml (13.53 U.S. oz)
	Type	XPS synthetic gear oil (75W 140) (P/N 293 600 140) or synthetic gear oil 75W140 API GL-5
Rear final drive oil	Capacity	300 ml (10.2 U.S. oz)
	Type	XPS synthetic gear oil (75W 140) (P/N 293 600 140) or synthetic gear oil 75W140 API GL-5
CV joint grease		CV grease (P/N 293 550 062)
Propeller shaft grease		Propeller shaft grease (P/N 293 550 063), Hi-temp bearing grease NLGI-2 or an equivalent

STEERING	
Turning radius	430 cm (169.3 in)
Total toe (front wheels off ground)	0.1° to 0.5° toe-out
Camber angle (vehicle on ground)	0°
Tie-rod maximum length unengaged threads	348.5 mm (13.72 in)

FRONT SUSPENSION		
Suspension type		Double suspension-arm with dive-control geometry
Suspension travel		229 mm (9 in)
Shock absorber	Qty	2
	Type	Oil
Spring free length		340 mm (13.39 in)
Preload adjustment type		5 positions cam

MIDDLE AND REAR SUSPENSION		
Suspension type	Middle	Torsional Trailing arm Independant (TTI)
	Rear	Torsional Trailing arm Independant (TTI) with quick release external sway bar
Suspension travel		236 mm (9.3 in)
Shock absorber	Qty	4
	Type	Oil
Spring free length		355.9 mm (14.01 in)
Preload adjustment type		5 position cam

BRAKES		
Front brake	Qty	2
	Type	214 mm cross drilled disc brakes with hydraulic twin-piston calipers
Rear brake	Qty	2
	Type	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 (.04 in)
Minimum brake disc thickness		4.0 mm (.157 in)
Maximum brake disc warpage		0.2 mm (.01 in)

TIRES			
Pressure	Front	UP TO 234 kg (516 lb)	34.5 kPa (5 PSI)
		FROM 234 kg to 460 kg (516 lb to 1,014 lb)	48.2 kPa (7 PSI)
	Middle and rear	UP TO 234 kg (516 lb)	34.5 kPa (5 PSI)
		FROM 234 kg to 460 kg (516 lb to 1,014 lb)	48.2 kPa (7 PSI)
Minimum tire thread depth			3 mm (.118 in)
Size	Front		660 x 203 x 305 mm (26 x 8 x 12 in)
	Middle and rear		660 x 254 x 305 mm (26 x 10 x 12 in)

WHEELS		
Type		Cast aluminum
Rim size	Front	305 x 152 mm (12 x 6 in)
	Middle and rear	305 x 191 (12 x 7.5 in)
Wheel nut torque		100 N•m ± 10 N•m (74 lbf•ft ± 7 lbf•ft)

CHASSIS	
SST G2 6x6	Steel

DIMENSIONS		
Overall length		312 cm (122.8 in)
Overall width		124 mm (4.9 in)
Overall height		125 cm (49.2 in)
Wheelbase		208 cm (81.9 in)
Wheel track	Front	96.5 cm (38 in)
	Middle and rear	91.4 cm (36 in)
Ground clearance		28 cm (11 in)

WEIGHT AND LOADING CAPACITY	
Dry weight	515 kg (1,135 lb)
Weight distribution (front/middle/rear)	23/37/40
Front rack	45 kg (100 lb)
Cargo bed	318 kg (701 lb) of which, at least, 45 kg (99 lb) in the lower storage box
Rear storage compartment loading capacity	10 kg (22 lb)
Total vehicle load allowed (including driver, passenger, all other loads and added accessories)	460 kg (1,014 lb)
Towing capacity	750 kg (1,653 lb)
Tongue capacity	75 kg (165 lb)

WIRING DIAGRAM INFORMATION

GENERAL

WIRING DIAGRAM LOCATION

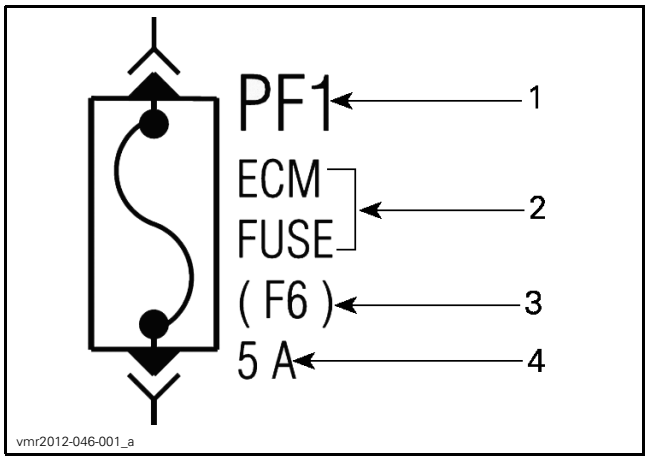
The wiring diagram are located in the back cover pocket.

WIRING DIAGRAM CODES

Fuse Identification

Front Fuse Box

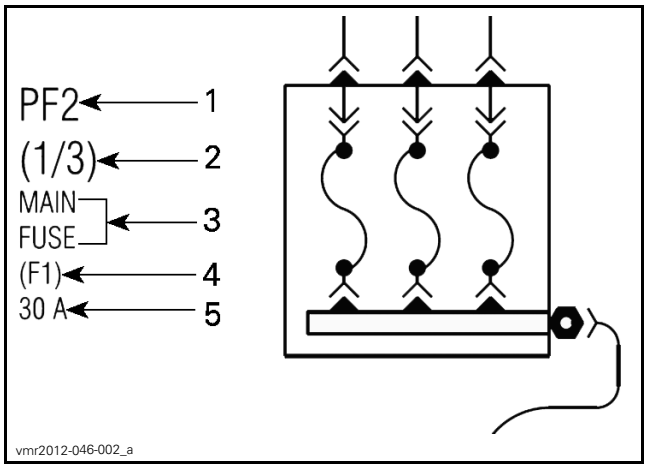
The fuses are identified on the *WIRING DIAGRAM* as per the following example:



FUSE IDENTIFICATION
1. *Fuse location (PF1: front fuse box)*
2. *Fuse identification*
3. *Fuse number (F6)*
4. *Fuse amperage rating*

Rear Fuse Holder

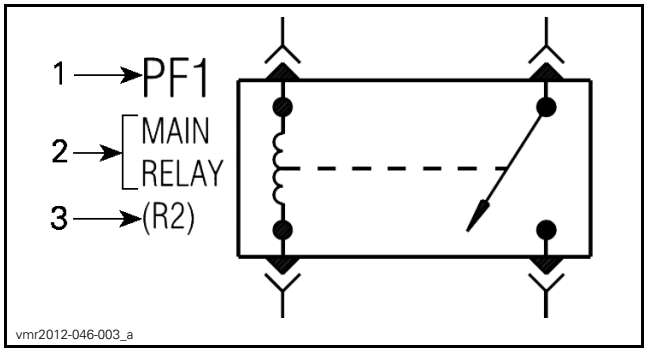
The fuses are identified on the *WIRING DIAGRAM* as per the following example:



FUSE IDENTIFICATION
1. *Fuse location (PF2: rear fuse holder)*
2. *Fuse trio identification (fuse 1 of 3*
3. *Fuse identification*
4. *Fuse number (F1)*
5. *Fuse amperage rating*

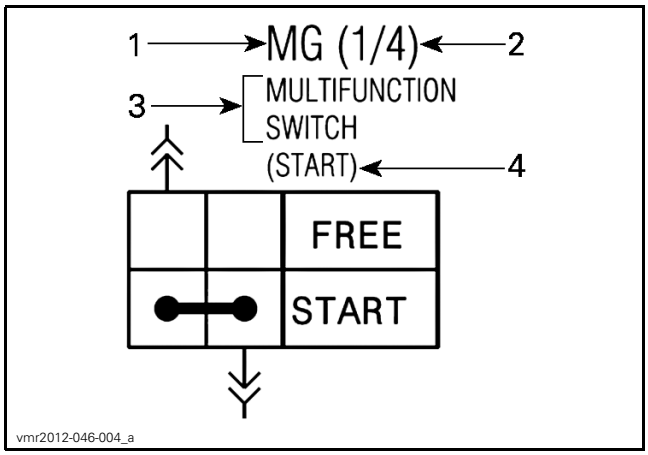
Relay Identification

The relays are identified on the *WIRING DIAGRAM* as per the following example:



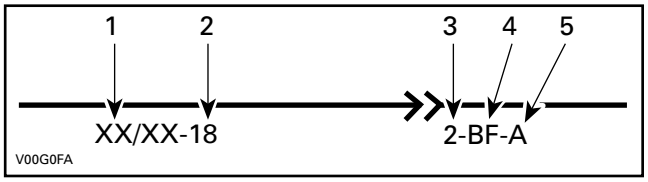
RELAY IDENTIFICATION
1. *Relay location (PF1: front fuse box)*
2. *Relay identification*
3. *Relay number*

Multifunction Switch Identification



MULTIFUNCTION SWITCH IDENTIFICATION
1. *Switch location (MG: left side)*
2. *Switch combo identification (part 1 of 4)*
3. *Switch identification*
4. *Switch function*

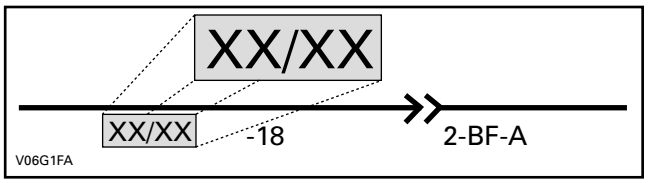
Wiring and Connector Information



1. *Wire colors*
2. *Wire gauge*
3. *Connector housing area*
4. *Connector identification*
5. *Wire 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.

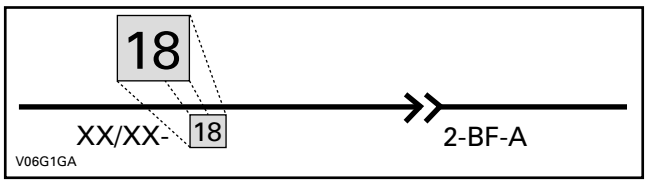


THE SHADED PART INDICATES THE WIRE COLOR

Example: YL/BK is a YELLOW wire with a BLACK stripe.

Wire Gauge

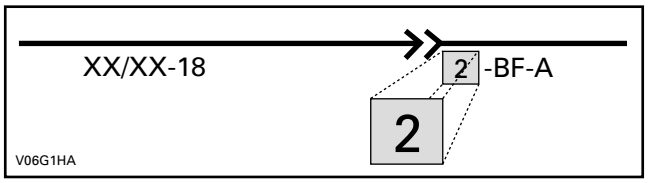
The number after wire color indicates the gauge of a wire.



THE SHADED PART INDICATES THE WIRE GAUGE

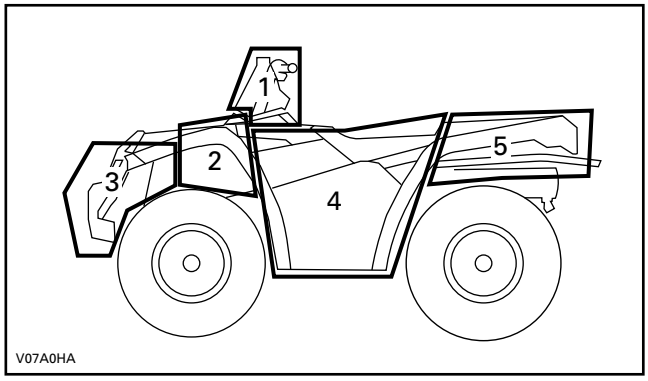
Example: The number that follows the wire color indicates the wire size used, in this case 18 gauge wire.

Connector Housing Location Area



THE SHADED PART INDICATES THE CONNECTOR HOUSING LOCATION AREA

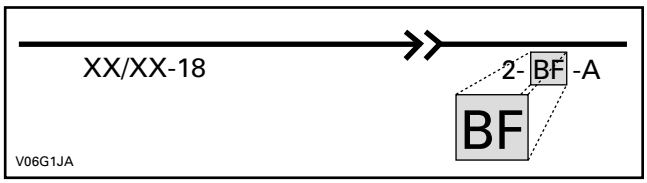
The first number in the connector/pin contact number represents the area in the vehicle where the connector is located.



AREA	LOCATION
1	Steering area
2	Service compartment
3	Front of vehicle
4	Engine area
5	Rear of vehicle

Connector Identification

The letters in the middle of the connector/pin contact number Indicates the connector's function. If there are many connectors in the same area, this helps to identify which wire is in which connector.

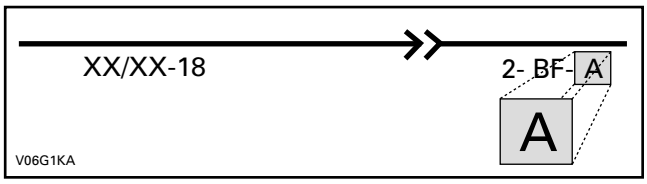


THE SHADED PART INDICATES A CONNECTOR

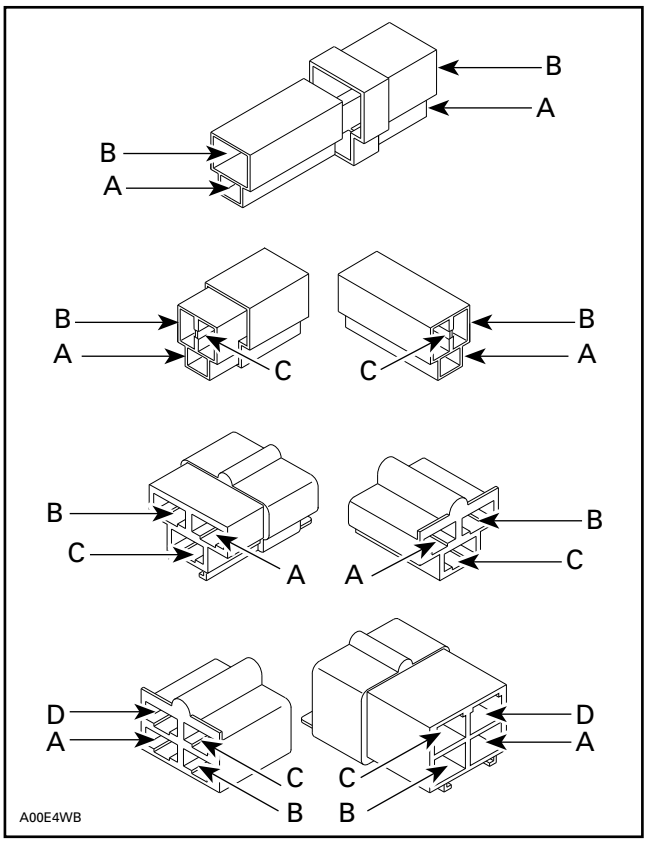
NOTE: For a complete list of the connector identification, refer to *WIRING HARNESS AND CONNECTORS*.

Wire Location in Connector

This is the wire position in the connector. The number or letter given refers to the physical identification stamped or molded on the connector.



THE SHADED PART INDICATES THE CONNECTOR LOCATION IN HOUSING



TYPICAL

TROUBLESHOOTING

DIAGNOSTIC TIPS

IMPORTANT: When trying to solve an electrical problem, check the following:

- The ignition switch is turned ON.
- The engine RUN/STOP switch is in RUN position.
- The battery condition as well as its cables and connections.
- The system fuse condition of the related circuit using an ohmmeter.
- Ensure a positive electrical connection of the fuse to the fuse holder contacts.
- Examine related circuit harness and connections.

Install a battery charger before any tests that involve prolonged "key ON". If system voltage is too low, some accessories will be shut off and test results can be altered.

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

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

If a fault is intermittent and cannot be found through static continuity checks, it may indicate:

- A loose connection
- A bad splice in a harness
- A pin that is unlocked in a connector and barely making contact
- An intermittent electronic component within a module.

Do the following:

- Try moving the harness and connectors to simulate vehicle vibration as you carry out your checks with the multimeter.
- Try spraying water to the harness, connectors or sensors to simulate riding under the rain or high humidity as you carry out your checks with the multimeter.

IMPORTANT: In an electrical circuit, the battery usually provides power to a switch, which then supplies the electric component when the switch contacts are closed (low power circuits). Therefore the switch opens and closes the positive side of the circuit. In circuits controlled by the ECM and other modules, the battery supplies the electric component, and the ECM/module acts as the switch which completes the circuit to ground. A relay acts as a remote switching device for higher power components or for supplying multiple circuits. Take this into account when troubleshooting the electrical system.

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

Simplifying Electrical System Tests

For complex systems where there are electronic modules, sensors, actuators, relays etc., it is often beneficial for diagnosing problems to divide up the system into some basic smaller subsystems, to help narrow down where the problem lies.

Use B.U.D.S. to check for fault codes, refer to *COMMUNICATION TOOLS AND B.U.D.S.* and also *DIAGNOSTIC SYSTEM AND FAULT CODES* subsections. Follow **Service Actions** listed in B.U.D.S.

COMMON SUBSYSTEM		GUIDELINE
POWER AND GROUNDS	– Battery – Fuses – Relays – Connections	– Check if a group of components or systems stopped working or if nothing works (lights, gauge, etc.). – Start from the power source (battery) and move outwards towards the modules, checking for voltage at each connection. – Check grounds and battery (+) using a voltmeter. – Disconnect and test wiring.
INPUTS AND OUTPUTS	– Sensors – Gauges – Actuators – Motors	– View monitoring functions in B.U.D.S. – Activate all possible items and monitor response. – Disconnect and test wiring.
COMMUNICATION	– Between Modules and with B.U.D.S.	– View monitoring functions in B.U.D.S. – Disconnect and test wiring.

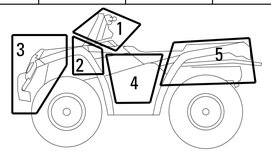
For ALL wiring tests, you need to check for:

POSSIBLE PROBLEM	COMMON CAUSE
– Open circuit – Shorts to ground (battery -) – Shorts to battery (+) – Shorts to other circuits – Higher resistance than desired	– Loose terminals, broken wires. – Wires rubbed through, water in connectors. – Corroded wires and terminals.

OUTLANDER / RENEGADE 2015

GENERAL SYSTEM

NOTE :
HICA CONNECTOR : SEE EUROPE WIRING DIAGRAM
DPS CONNECTOR : SEE DPS WIRING DIAGRAM
FRR CONNECTOR : SEE BRAKE WIRING DIAGRAM



TERMINAL IDENTIFICATION					
	NAME	ZONE-	CONNECTOR NAME-	TERMINAL #/A	
EX:	CI	1 -	CI	-	15
EX:	CV	4 -	CV	-	A
EX:	ME	2 -	ME		

AWG	MAX. CURRENT	MAX. FUSE CURRENT	MAX. WATT
# 6	100 amps	125 amps	1450 watts
# 8	65 amps	80 amps	930 watts
# 10	40 amps	50 amps	580 watts
# 12	25 amps	30 amps	365 watts
# 14	16 amps	20 amps	230 watts
# 16	10 amps	15 amps	145 watts
# 18	6 amps	7.5 amps	85 watts
* AT	50°C MAX		

ZONE #	ZONE DESCRIPTION
1	STEERING AREA
2	MODULE AREA
3	FRONT OF VEHICLE
4	ENGINE AREA
5	REAR OF VEHICLE

	WELDED JOINT
	SHRINKED JOINT
	CROSSED WIRE
	WIRE BUS
	SIMPLE CONDUCTOR WIRE
	FEMALE TERMINAL
	MALE TERMINAL
	STEEL LINK (FRAME)
	TERMINAL

	FRAME GROUND
	EGINE GROUND
	PHILLIPS SCREW
	NUT CONNECTION
	SPLICE CONNECTION
	COMPONENT CONNECTION
	SECTION OF MODULE
	SLOTTED SCREW
	OPTIONAL

COLOR CODE	
BE	BEIGE
BK	BLACK
BU	BLUE
BR	BROWN
GN	GREEN
GY	GREY
OR	ORANGE
RD	RED
VI	VIOLET
WH	WHITE
YL	YELLOW
PK	PINK
LT BU	LIGHT BLUE

JT RD/GN
JT RD/GY
DPS2
MG (1/4) MULTIFUNCTION SWITCH (START)
FREE
START
PF2 (1/3) MAIN FUSE (F1) 30 A
PF2 (2/3) FAN / ACCES. FUSE (F2) 40 A
PF2 (3/3) DPS FUSE (F3) 40 A
PF1 KEY SWITCH (F8) 5 A
JT BE
CC IGNITION KEY (ON & DESS)
OFF
ON W/LIGHT
ON W/O LIGHT
PF1 FREE WEELING DIODE (D2)
SS STARTER SOLENOID
BAT BATTERY 12 VDC 18 AH
SM STARTER MOTOR
MG (3/4) MULTIFUNCTION SWITCH (STOP)
RUN
STOP
PF1 FAN FUSE (F9) 25 A
PF1 FAN RELAY (R1)
FT COOLING FAN
PF1 FUEL PUMP RELAY (F15) 5 A
PF1 RELAYS SPEEDO FUSE (F4) 10 A
PF1 MAIN RELAY (R2)
DPS1
PF1 CLOCK/ HAZARD FUSE (F10) 5 A
JT RD/WH
JT OR/GN
PF1 ECM FUSE (F6) 5 A
JT VI/RD
PF1 INJECTORS & IGNITION FUSE (F5) 5 A
BA IGNITION COIL
JT VI/BU
INJ1 FUEL INJECTOR (FRONT)
INJ2 FUEL INJECTOR (REAR)
SPK2 SPARK PLUG (REAR)
CI SPEEDOMETER & PILOT LAMPS
FUEL
ENGINE
4WD
HI BEAM
FP (2/2) FUEL LEVEL SENSOR
SD 2WD/4WD INDICATOR SWITCH
D11 DIODE
BD 2WD/4WD SWITCH
2WD
4WD
MD 2WD/4WD ACTUATOR
SW WINCH RELAY
D6 ONE-WAY DIODE
D5 ONE-WAY DIODE
WM WINCH MOTOR
PF1 WINCH 2WD/4WD FUSE (F7) 5 A
SWW WINCH SWITCH
OUT
FREE
IN
JT RD/BK
JT RD/BR
PF1 DC OUTLETS FUSE (F12) 15 A
PF1 LIGHT FUSE (F11) 30 A
PF1 BRAKE RELAY (R8)
PF1 ACCESSORIES RELAY (R3)
PF1 LIGHTS RELAY (R5)
JT RD/YL
DB DIAGNOSTIC CONNECTOR
JT WH/BE
JT WH/BK
DC3 DC OPTION
DC DC OUTLET
PF1 ACC 2 FUSE (F14) 15 A
JT RD/VI
JT OR/BK
JT RD/BU
DC6 DC OPTION
DC5 DC OPTION
MG (4/4) MULTIFUNCTION SWITCH (LIGHTS)
LO
HI
JP1 JUMPER FUSE 15 A
JT BU
JT GN
JT WH/OR
JT RD/OR
RD RECTIFIER
U V W –
ECM ENGINE CONTROL MODULE
TO CI-6
MG (2/4) MULTIFUNCTION SWITCH (OVERRIDE)
FREE
OVER RIDE
CA MAGNETO
OPS OIL PRESSURE SWITCH
DPS3
JT BK1
JT BK2
JT BK3
JT BK4
JT BU/GY
PF1 FUEL PUMP RELAY (R4) 10 A
FP (1/2) FUEL PUMP
VSS SPEED SENSOR
HALL
CTS COOLANT TEMP SENSOR
GBPS GEAR BOX POSITION SENSOR
ECM MODULE
GBPS GEAR BOX POSITION SENSOR
TPS TROTTLE POSITION SENSOR
MAPTS MANIFOLD AIR PRESSURE / TEMP SENSOR
IDLE IDLE BYPASS VALVE
CPS CRANK SHAFT POSITION SENSOR
CRG LEFT TURN SIGNAL
CRD RIGHT TURN SIGNAL
PGH LEFT HEAD LIGHT (HI) 55 W
PDH RIGHT HEAD LIGHT (HI) 55 W
PGB LEFT HEAD LIGHT (LO) 55 W
PDB RIGHT HEAD LIGHT (LO) 55 W
PRG LEFT TAIL LIGHT
PRD RIGHT TAIL LIGHT
PL LICENSE PLATE
FRR BRAKE LIGHT SWITCH

Midwest Manuals
Green Mountain Pinecrest Manuals For a Better Tomorrow
If you bought this manual from any other seller please leave them NEGATIVE feedback and notify me at bestshopmanuals@gmail.com

2014/03/14

710003626F1