

PTO HOUSING, MAGNETO AND STARTER

SERVICE TOOLS

Description	Part Number	Page
3-PIN MAGNETO HARNESS ADAPTER.....	529 036 016	8
HANDLE	420 877 650	12
IMPELLER REMOVER/INSTALLER.....	529 035 820	7
OETIKER PLIER.....	295 000 070	6
STARTER DRIVE SEAL PUSHER.....	420 876 502	12

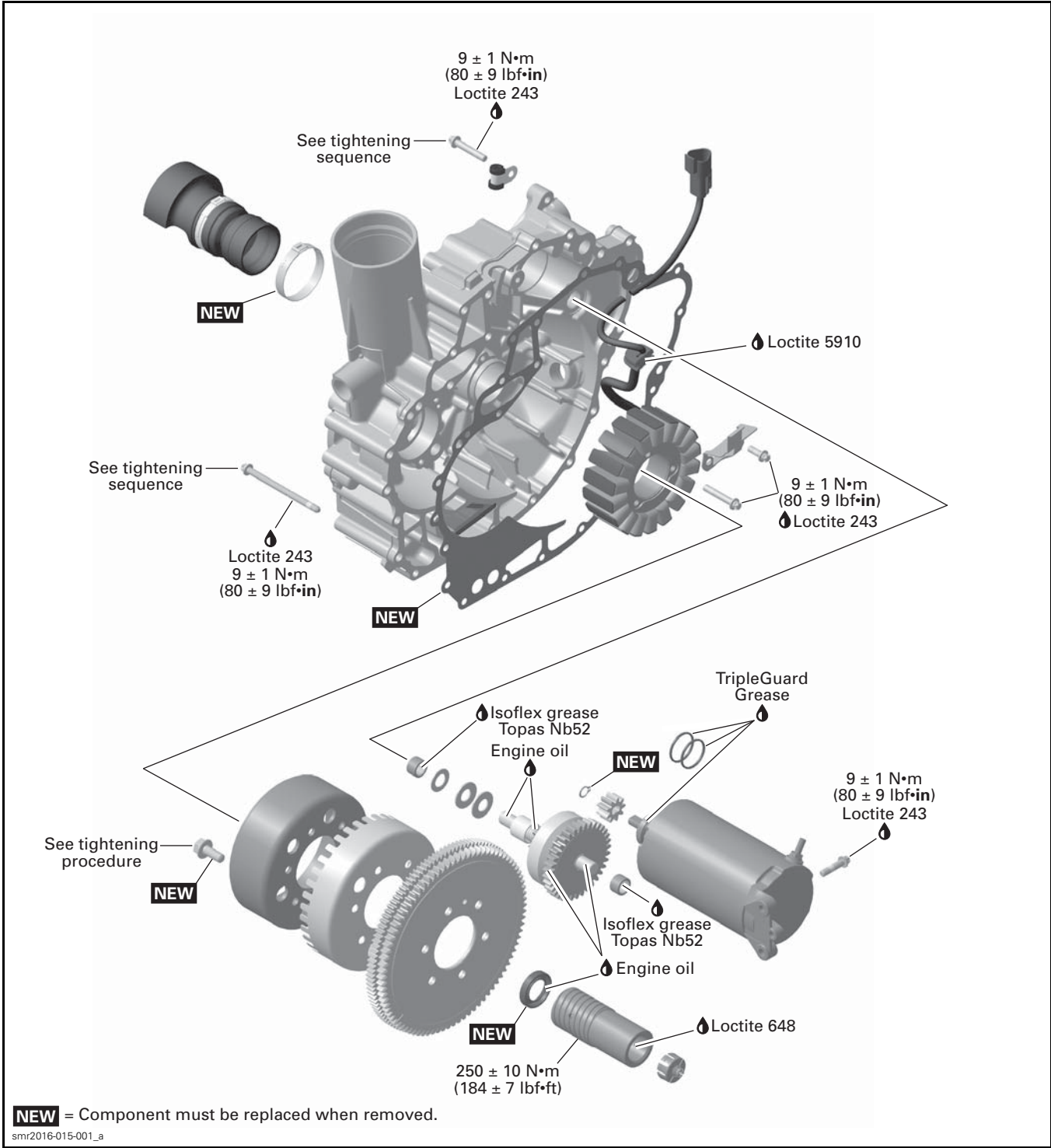
SERVICE TOOLS – OTHER SUPPLIER

Description	Part Number	Page
PULLEY FLANGE CLEANER	413 711 809	7

SERVICE PRODUCTS

Description	Part Number	Page
DIELECTRIC GREASE	293 550 004	14
ISOFLEX GREASE TOPAS NB 52	293 550 021	12
LOCTITE 243 (BLUE).....	293 800 060	5, 9, 14
LOCTITE 648 (GREEN)	413 711 400	7

Subsection XX (PTO HOUSING, MAGNETO AND STARTER)



GENERAL

NOTE: It is good practice to check for fault codes using the BRP diagnostic software BUDS2 as a first troubleshooting step. Refer to the *DIAGNOSTIC AND FAULT CODES* subsection.

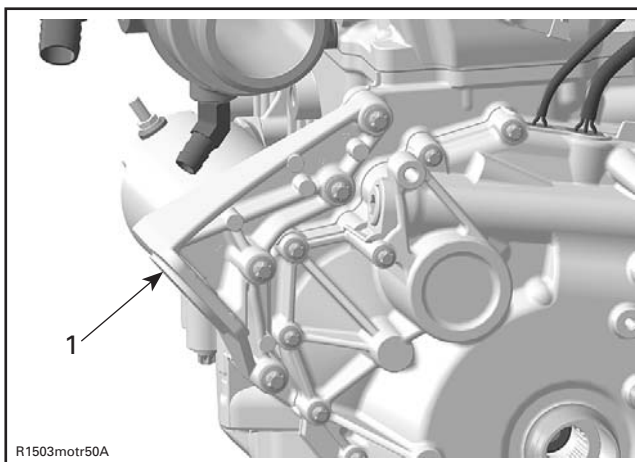
Always carry out electrical tests on components before removing or installing them.

PROCEDURES

PTO HOUSING

Removing the PTO Housing

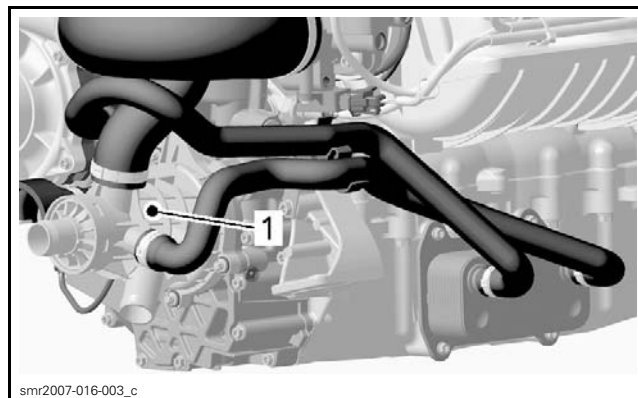
1. Remove the engine from the watercraft. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
2. Drain the engine oil. Refer to *LUBRICATION SYSTEM* subsection.
3. Remove the supercharger. Refer to *SUPERCHARGER* subsection
4. Remove LH rear engine support.



TYPICAL

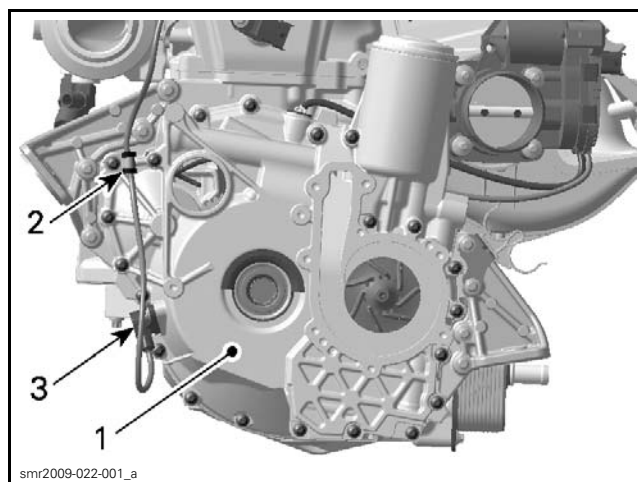
1. Engine support

5. Remove water pump housing, refer to *COOLING SYSTEM* subsection.



1. Water pump housing

6. Remove PTO housing retaining screws and CPS harness retaining clamp.



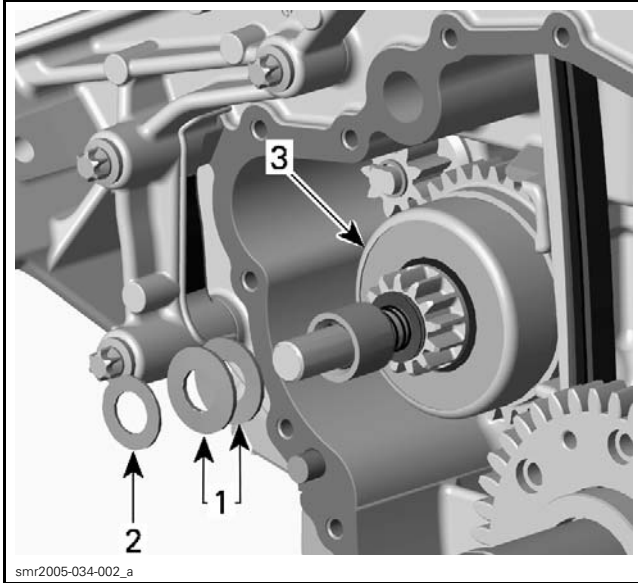
1. PTO housing
2. CPS harness retaining clamp
3. CPS

7. Pry off the PTO housing using two flat screwdrivers.

NOTICE Avoid scoring or damaging contact surfaces.

NOTE: Be careful not losing the disc springs and thrust washer located on the starter drive shaft.

Subsection XX (PTO HOUSING, MAGNETO AND STARTER)



- 1. Disc springs
- 2. Thrust washer
- 3. Starter drive

8. Remove PTO housing gasket and discard it.

If necessary remove following parts from PTO housing:

- Stator, refer to procedure in this subsection
- Oil filter, refer to *LUBRICATION SYSTEM*
- Oil pressure pump, refer to *LUBRICATION SYSTEM*
- Engine oil pressure regulator, refer to *LUBRICATION SYSTEM*
- Crankshaft position sensor (CPS)

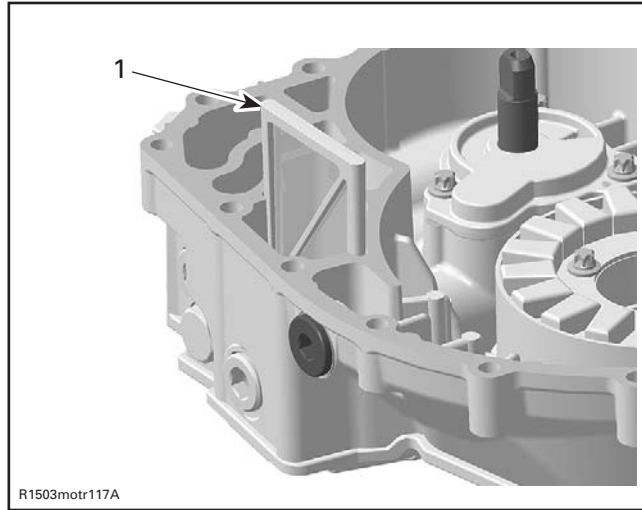
Inspecting the PTO Housing

Inspect PTO housing for cracks or any other damages. Replace if necessary.

Inspect the starter drive needle bearing in the PTO housing.

NOTE: Clean all disassembled metal components in a non-ferrous metal cleaner.

Inspect oil strainer for contaminants, debris or other particles. Clean as required.



1. PTO oil strainer

Installing the PTO Housing

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

Install disc springs and thrust washer of starter drive, see *INSTALLING THE STARTER DRIVE* in this subsection.

Install a **NEW** PTO housing gasket.

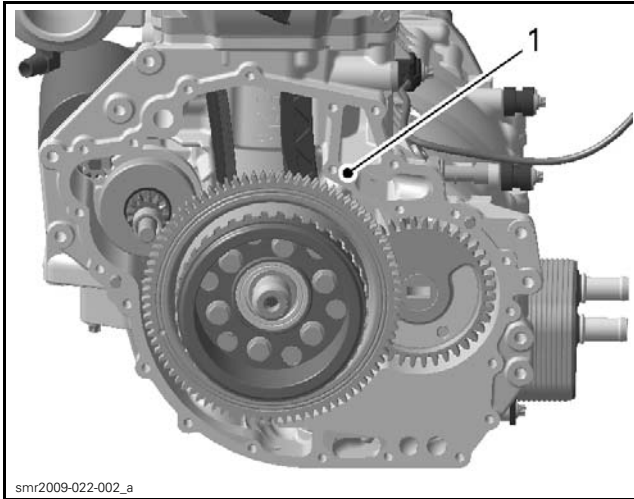
Clean stator cable grommet and cylinder block to remove all remaining silicone residues in oil strainer area.

Apply sealing compound on:

- Stator cable grommet
- PTO oil strainer.

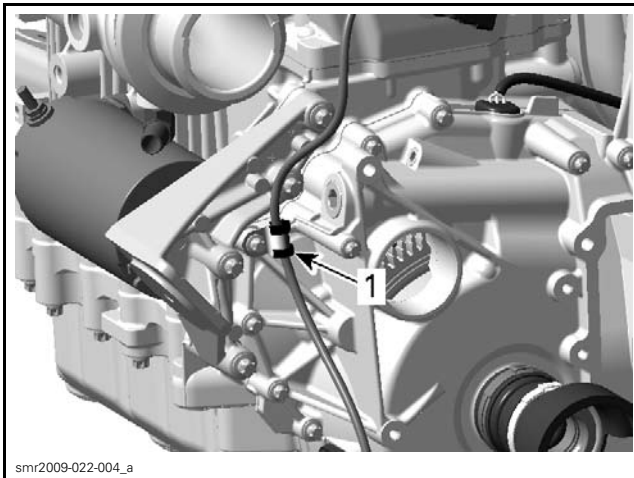
NOTICE During installation ensure:

- That thrust washer and spring discs are placed on starter drive shaft
- Oil/water pump shaft alignment with balance shaft (rotate shaft slightly)
- Starter drive gear alignment with needle bearing
- Proper PTO housing gasket alignment.



1. Pay attention that gasket remains properly positioned on this surface

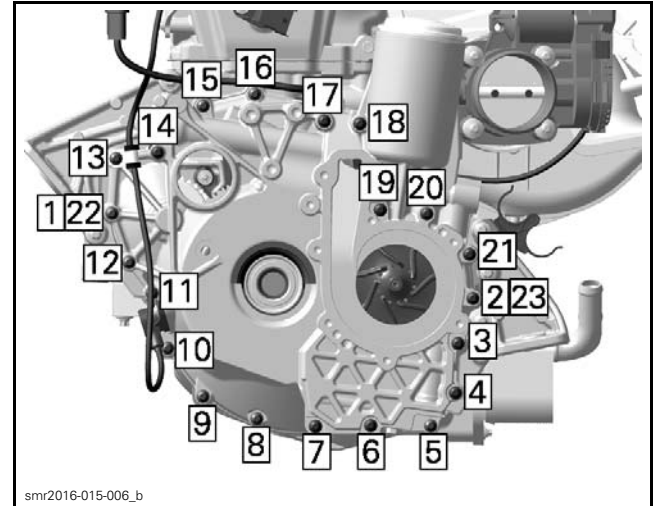
Install the CPS harness retaining clamp.



1. CPS harness retaining clamp

Tighten PTO housing screws as per following sequence.

TIGHTENING TORQUE	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
PTO housing screws	9 N•m (80 lbf•in)



Reinstall LH engine support as per following table.

TIGHTENING TORQUE	
LH engine support screws	23 N•m (17 lbf•ft) + LOCTITE 243 (BLUE) (P/N 293 800 060)

Reinstall the engine, Refer to *ENGINE REMOVAL AND INSTALLATION* subsection

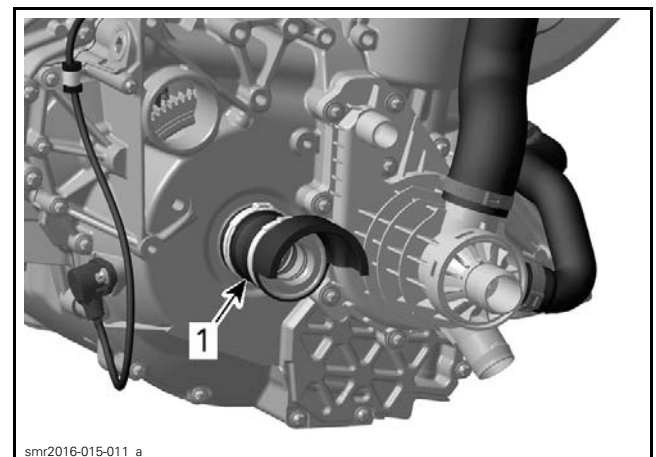
Install all remaining parts, reconnect hoses and electrical connectors. Refer to applicable subsections for procedures.

Refill engine oil and coolant. Refer to *LUBRICATION SYSTEM* and *COOLING SYSTEM* subsections.

PTO SEAL

PTO Seal Location

The PTO seal is located over the PTO coupling.



1. PTO seal

Subsection XX (PTO HOUSING, MAGNETO AND STARTER)

Inspecting the PTO Seal

Inspect the PTO seal on the PTO housing. If brittle, hard, damaged or leaking, replace it.

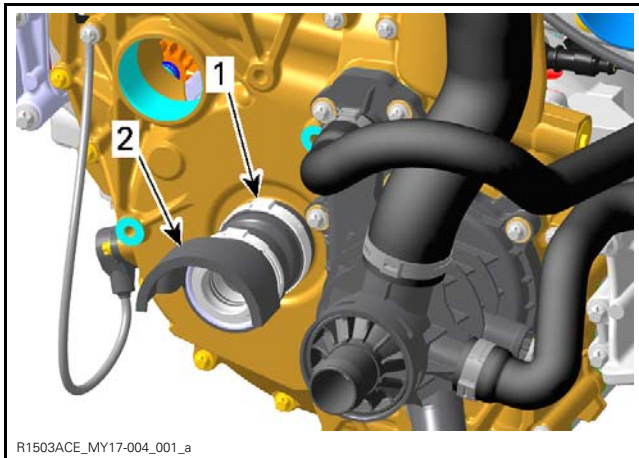
Inspect ball bearing within PTO seal for excessive play and smooth operation.

Replace PTO seal if oil seal or ball bearing is damaged.

Removing the PTO Seal

Remove the drive shaft. Refer to *STEERING AND PROPULSION* section.

Remove the Oetiker clamp retaining the seal to the PTO housing.



TYPICAL

1. Oetiker clamps
2. PTO seal

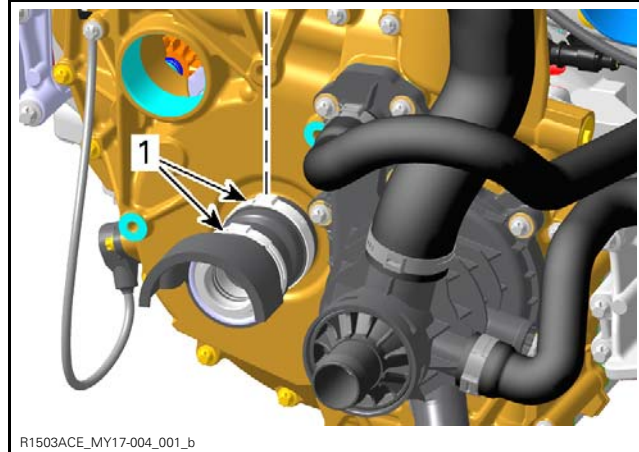
Pull seal from PTO housing.

Installing the PTO Seal

Insert a **NEW** Oetiker clamp over the seal.

Push seal onto PTO housing. Be sure to align seal and clamp as noted at removal.

NOTICE Ensure to position the Oetiker clamps as illustrated.

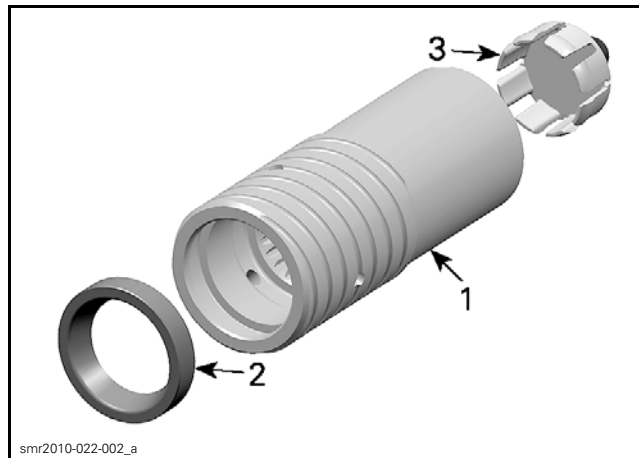


1. Oetiker clamps

Crimp Oetiker clamp.

REQUIRED TOOL	
OETIKER PLIER (P/N 295 000 070)	

PTO COUPLING



1. PTO coupling
2. Seal
3. Stop sleeve

Inspecting the PTO Coupling

Inspect seal within coupling, if it is brittle, cracked or hard, replace it.

Check coupling for worn or damaged splines. Replace as required.

Removing the PTO Coupling

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

Lock crankshaft. Refer to *CYLINDER BLOCK* subsection for the procedure.

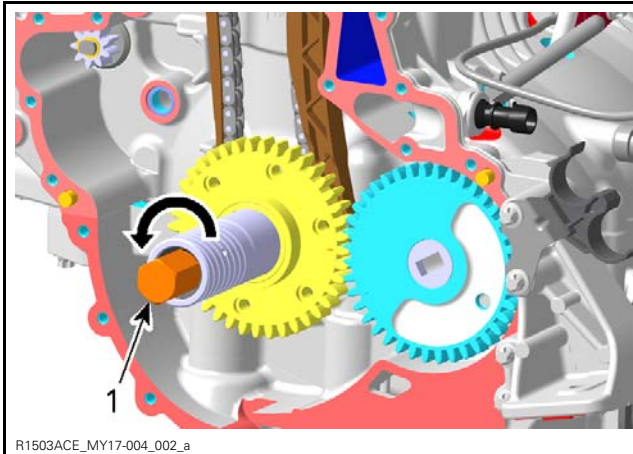
Refer to procedures in this subsection and remove:

- PTO housing
- Rotor and trigger wheel
- Ring gear
- Starter drive

Heat up PTO coupling with a heat gun to break threadlocker.

Unscrew coupling from crankshaft.

REQUIRED TOOL	
IMPELLER REMOVER/INSTALLER (P/N 529 035 820)	



TYPICAL – TURN COUNTERCLOCKWISE TO REMOVE
1. Impeller removal tool

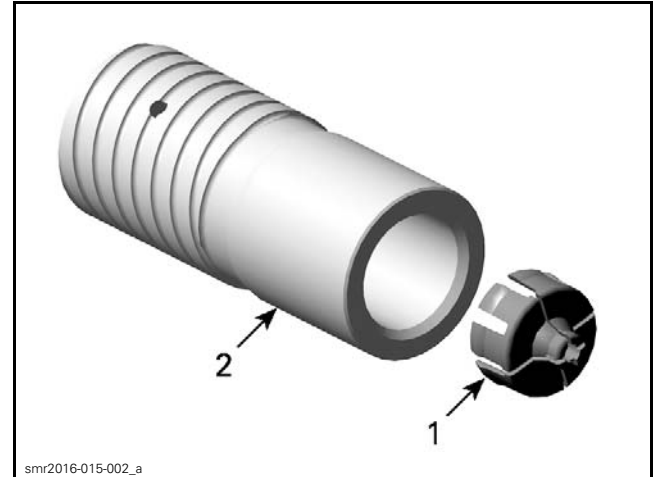
Installing the PTO Coupling

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

Use PULLEY FLANGE CLEANER (P/N 413 711 809) to clean following:

- Thread inside PTO coupling
- Thread on crankshaft.

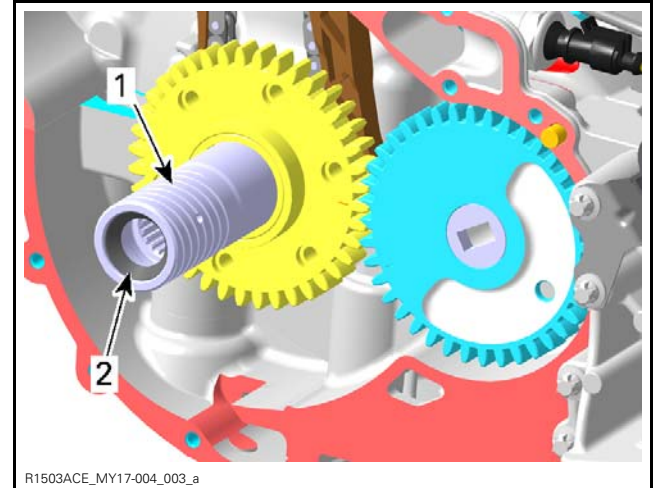
Install stop sleeve into PTO coupling.



1. Stop sleeve
2. PTO coupling

TIGHTENING TORQUE	
PTO Coupling	250 N•m (184 lbf•ft) + LOCTITE 648 (GREEN) (P/N 413 711 400)

NOTE: Always install a **NEW** oil seal into PTO coupling.

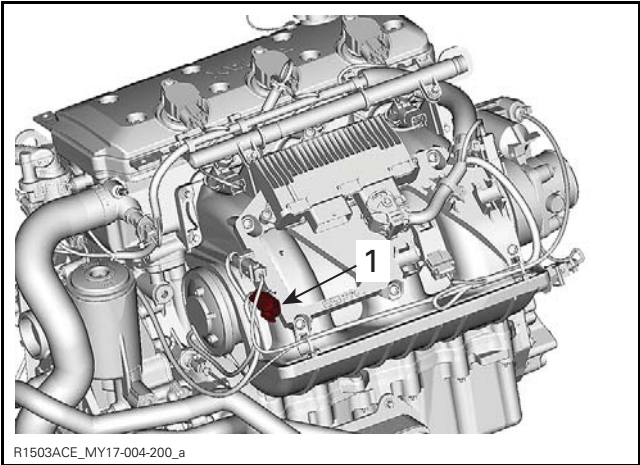


1. PTO coupling
2. Oil seal

STATOR

Stator Connector Location

The stator connector is located at the rear of the ECM support.



1. Stator connector

Testing the Stator Continuity

Install harness adapter onto the stator connector (engine side).

REQUIRED TOOL	
3-PIN MAGNETO HARNESS ADAPTER (P/N 529 036 016)	

Connect multimeter between each pair of YELLOW wires.

Read resistance.

STATOR CONTINUITY TEST	
TERMINAL	RESISTANCE @ 20°C (68°F)
1 and 2	0.1 - 1 Ω
1 and 3	
2 and 3	

If any result is out of specification, replace stator.

Testing the Stator Insulation

Install harness adapter onto the stator connector (engine side).

REQUIRED TOOL	
3-PIN MAGNETO HARNESS ADAPTER (P/N 529 036 016)	

Connect multimeter between any YELLOW wire and engine ground.

Read resistance.

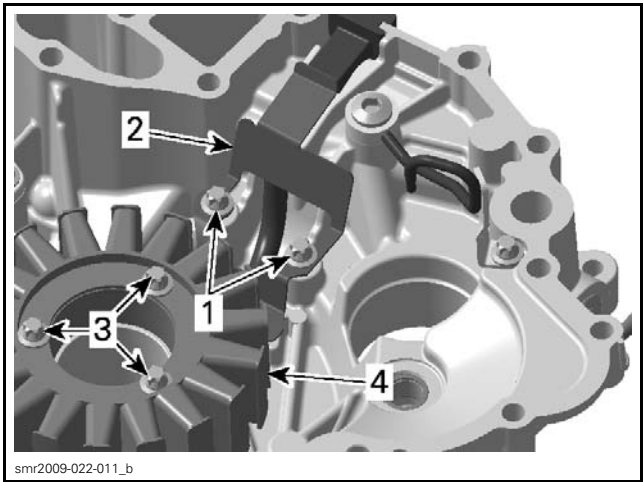
STATOR INSULATION TEST	
TERMINAL	RESISTANCE @ 20°C (68°F)
Any YELLOW wire and engine ground	Infinity (open circuit)

If there is a resistance or continuity to engine ground, the stator coils and/or the wiring is grounded and need to be repaired or replaced.

Removing the Stator

Remove PTO housing, see procedure in this subsection.

Remove the following components:



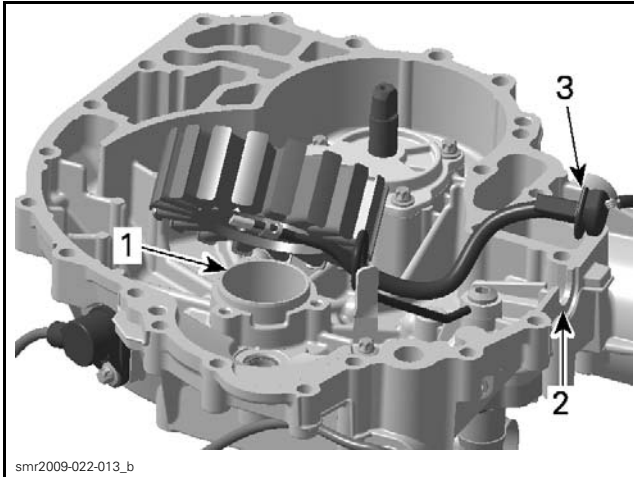
- TYPICAL
- 1. Screws
 - 2. Holding plate
 - 3. Stator screws
 - 4. Stator

Clean cable grommet from sealing compound.

Installing the Stator

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

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



1. Notch for stator
2. PTO housing notch
3. Stator cable grommet

TIGHTENING TORQUE	
Stator retaining screws	9 N•m (80 lbf•in)
Cable holding screws	+ LOCTITE 243 (BLUE) (P/N 293 800 060)

Install PTO housing as per procedures in this subsection.

ROTOR AND TRIGGER WHEEL

Rotor and Trigger Wheel Access

Remove PTO housing, see procedure in this subsection.

Inspecting the Rotor and the Trigger Wheel

Inspect rotor and trigger wheel condition. Pay particular attention to the inside of the rotor for:

- Cracks
- Rub marks
- Discoloration.

If damaged, replace faulty part.

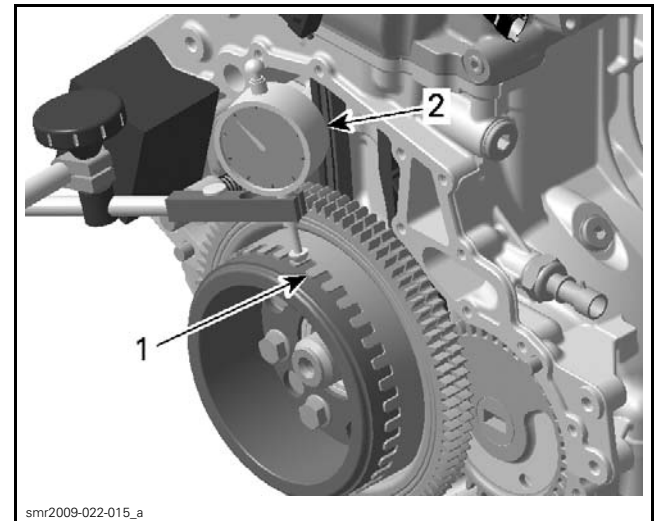
Check the trigger wheel for bent teeth using the following procedure.

1. Install a dial indicator on crankcase casting.
2. Position the gauge on a tooth and set it to zero (0). Be sure to lock the indicator dial to prevent movement of the dial during the remainder of the procedure.
3. Mark the first measured tooth (reference tooth).
4. Gently lift the gauge contact point off the tooth and rotate the rotor to the next tooth.

NOTE: When lifting contact point off the tooth for rotor rotation, be careful not to move gauge position or test readings taken on next tooth will not be accurate with reference to the reference tooth.

5. Gently set the gauge contact point on the next tooth and read the dial indicator.
6. Repeat this procedure taking a reading at each tooth.
7. Recheck reading on reference tooth to ensure gauge has not changed position (gauge should still read zero).

TRIGGER WHEEL TEETH INSPECTION	
Maximum allowable difference	0.15 mm (.006 in)



1. Trigger wheel
2. Dial indicator

If the reading exceeds the maximum allowable tolerance, straighten the tooth or replace the trigger wheel.

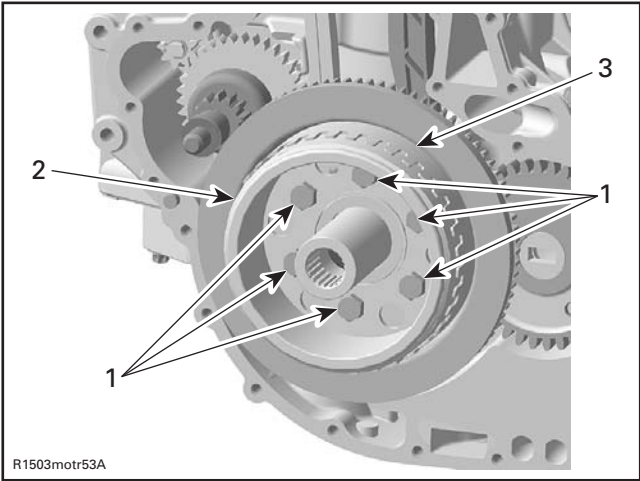
8. Properly reinstall PTO housing.

Removing the Rotor and the Trigger Wheel

Lock crankshaft, refer to *CYLINDER BLOCK* subsection for procedure.

Remove:

- Rotor retaining screws (discard them)
- Rotor
- Trigger wheel.

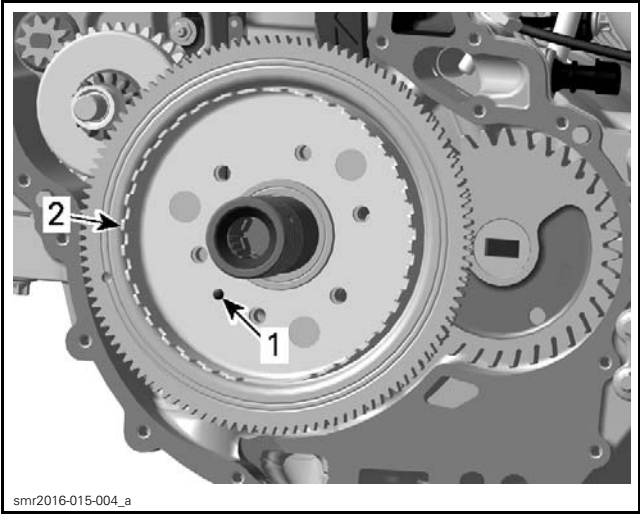


TYPICAL
1. Rotor retaining screws
2. Rotor
3. Trigger wheel

Installing the Rotor and the Trigger Wheel

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

1. Align the trigger wheel with the location pin on the crankshaft end.



TYPICAL
1. Location pin
2. Trigger wheel

2. Install **NEW** OEM rotor screws and torque them as per following table.

NOTE: Always perform step A on all rotor screws before going to the step B.

TIGHTENING TORQUE		
Rotor screws	STEP A	15 N•m ± 1 N•m (133 lbf•in ± 9 lbf•in)
	STEP B	Additional 50° ± 5°

NOTICE Always use **NEW** OEM screws and strictly adhere to the tightening procedure.

RING GEAR

Removing the Ring Gear

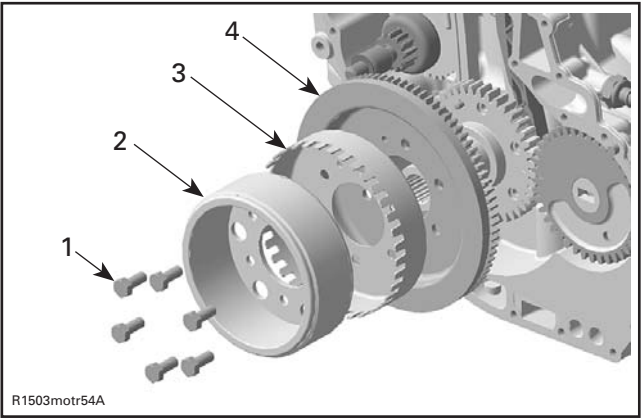
Lock crankshaft. Refer to *CYLINDER BLOCK* subsection for procedure.

Remove the PTO housing, see procedure in this subsection.

Remove thrust washer disc springs from starter drive shaft.

Remove:

- Rotor retaining screws (discard them)
- Rotor
- Trigger wheel
- Ring gear.



1. Rotor retaining screws
2. Rotor
3. Trigger wheel
4. Ring gear

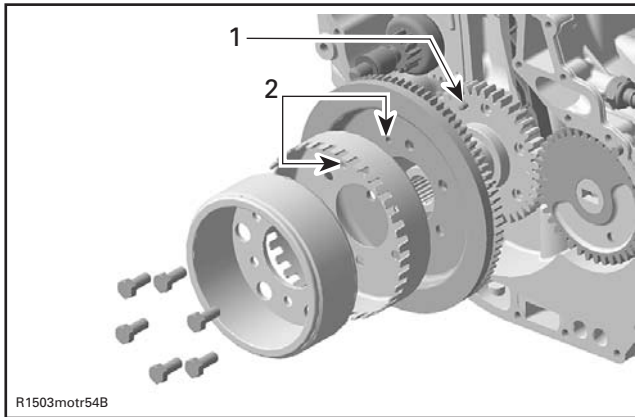
Inspecting the Ring Gear

Inspect ring gear for damages. Pay particular attention to teeth condition. If badly worn, cracked, or broken teeth are found, replace ring gear.

Installing the Ring Gear

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

Align the ring gear and trigger wheel with the location pin on the crankshaft end.



1. Location pin
2. Location pin holes

Install rotor and trigger wheel, refer to the procedures in this subsection.

Install disc springs and thrust washers of starter drive, see *INSTALLING THE STARTER DRIVE* in this subsection.

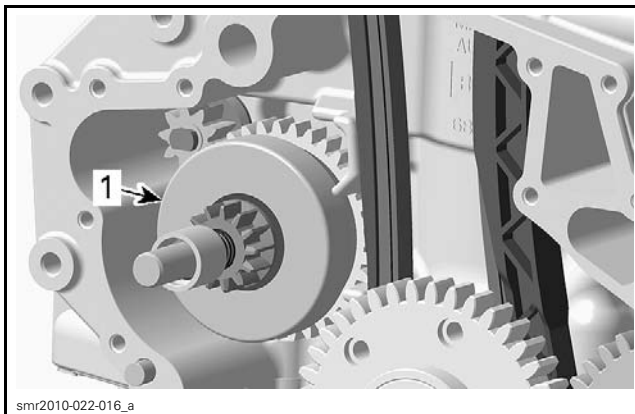
STARTER DRIVE

Removing the Starter Drive

Refer to the procedures in this subsection and remove:

- PTO housing
- Rotor and trigger wheel
- Ring gear.

Remove starter drive.



1. Starter drive

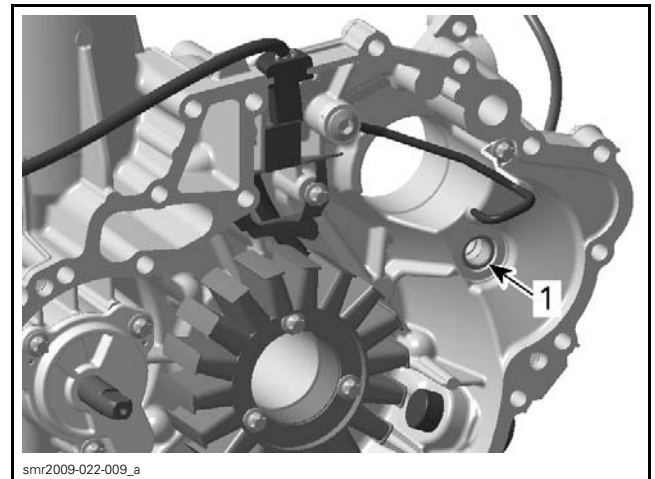
Inspecting the Starter Drive

Inspect all starter drive parts for excessive wear, cracks and other defects. Pay attention to the condition of the drive gear teeth.

Ensure proper operation of the starter drive sprag clutch.

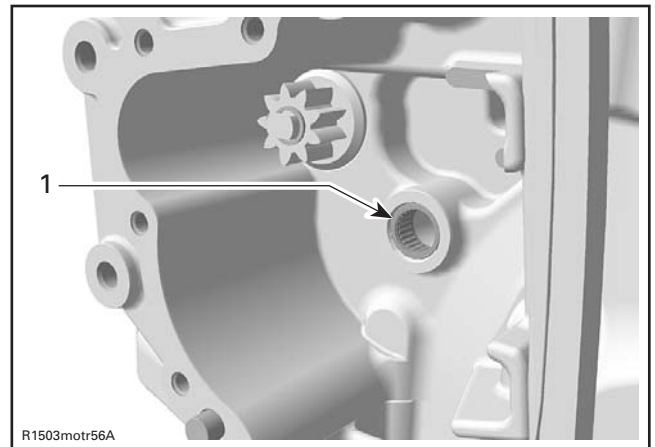
If any part of the assembly shows signs of abnormal wear, cracks, broken teeth or malfunction (sprag clutch), replace the faulty part.

Check needle bearings for excessive play and smooth operation. If damaged see *REPLACING THE STARTER DRIVE BEARING* in this subsection.



PTO HOUSING

1. Starter drive bearing



CYLINDER BLOCK

1. Starter drive bearing

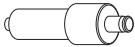
Replacing the Starter Drive Bearing

Remove starter drive bearing from PTO housing and/or cylinder block.

REQUIRED TOOL
Blind hole bearing puller set

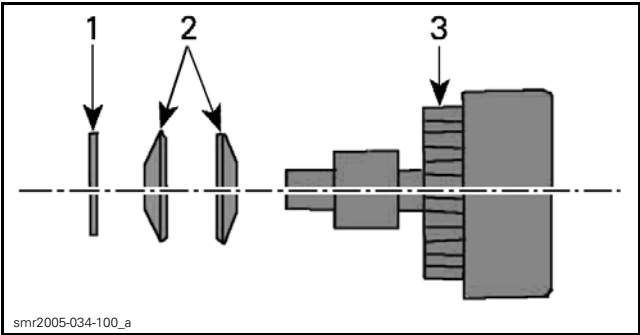
Install starter drive bearing in the PTO housing or in the cylinder block.

Subsection XX (PTO HOUSING, MAGNETO AND STARTER)

REQUIRED TOOLS	
STARTER DRIVE SEAL PUSHER (P/N 420 876 502)	
HANDLE (P/N 420 877 650)	

Installing the Starter Drive

The installation is the reverse of the removal procedure. However, pay attention to the following. Position the spring discs and thrust washer onto the starter drive shaft as per following illustration.



- TYPICAL**
- 1. Thrust washer
 - 2. Spring discs
 - 3. Starter drive

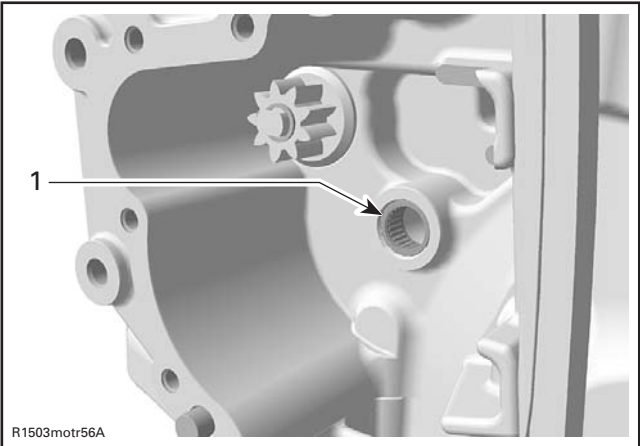
When installing a **NEW** starter drive lubricate:

- Shaft
- Gear teeth
- Splines.

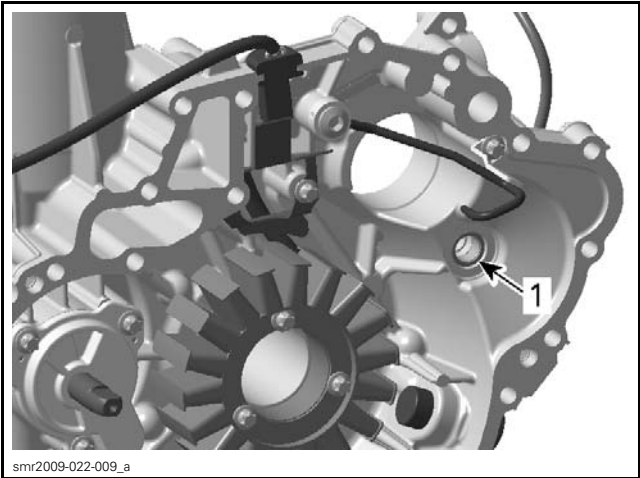
STARTER DRIVE	
Service product	Engine oil

Lubricate starter drive needle bearings.

STARTER DRIVE NEEDLE BEARINGS	
Service product	ISOFLEX GREASE TOPAS NB 52 (P/N 293 550 021)



CYLINDER BLOCK
1. Starter drive bearing



PTO HOUSING
1. Starter drive bearing

STARTER

Starter Quick Test

To easily bypass the starter solenoid and the start control circuits, proceed as follows.

- Use a fully charged 12 V battery with a capacity of at least 30 A-h.
- Use a set of booster cables to power the starter.

This procedure tests the following:

- Electric starter
- Starter power cable
- Battery to engine ground cable.

⚠ WARNING

Fuel, oil, or electrolyte vapors are flammable and may become explosive if certain conditions are met. These vapors may collect near the bottom of the hull when present. All types of ignition including electrical sparks are to be avoided when maintaining or testing vehicle.

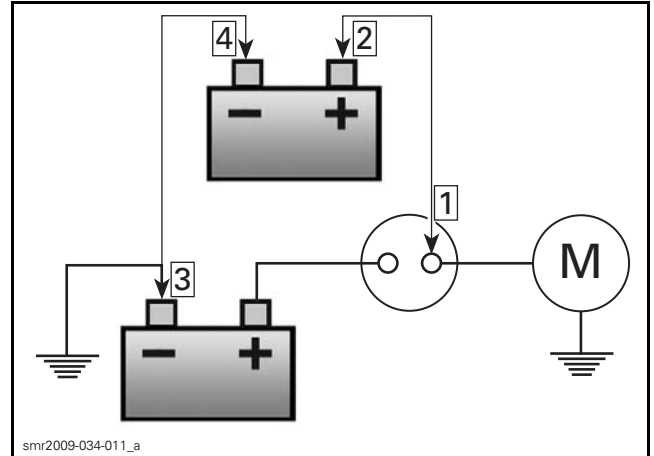
⚠ WARNING

Always wear safety glasses when working with or around batteries. Be sure to leave the booster battery out of the watercraft.

1. Connect booster cables in this strict order:
2. Connect one **RED** clip to the starter post on the starter solenoid.
3. Connect the other **RED** clip to the positive (+) terminal on the external battery.
4. Connect one **BLACK** clip to the negative (-) battery terminal in the **vehicle**.
5. Momentarily apply the second **BLACK** clip to the negative (-) terminal of the **external** battery.

⚠ WARNING

Always use an **external** battery for this test to prevent any electrical sparks from occurring within the hull. Always make the final connection to the external battery negative (-) terminal using the **BLACK** booster cable clip. Do not short starter solenoid contacts across the main power connections on the relay with a tool that would cause electrical sparks. Failure to follow this procedure may result in an explosion.



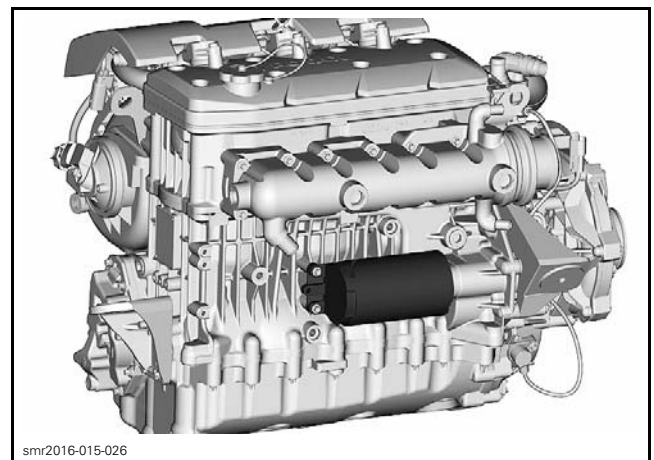
Step 1: Connect cable to solenoid starter post
 Step 2: Connect cable to external battery positive post
 Step 3: Connect cable to vehicle battery negative post
 Step 4: Make a momentary contact

If engine does not crank (or cranks slowly), check the following:

- Booster cable connections
- Vehicle battery ground cable connections to engine
- Starter power cable/connections from solenoid to starter
- Carry out a *SOLENOID DYNAMIC TEST*.

If the above items all test good, replace the starter.

Starter Location



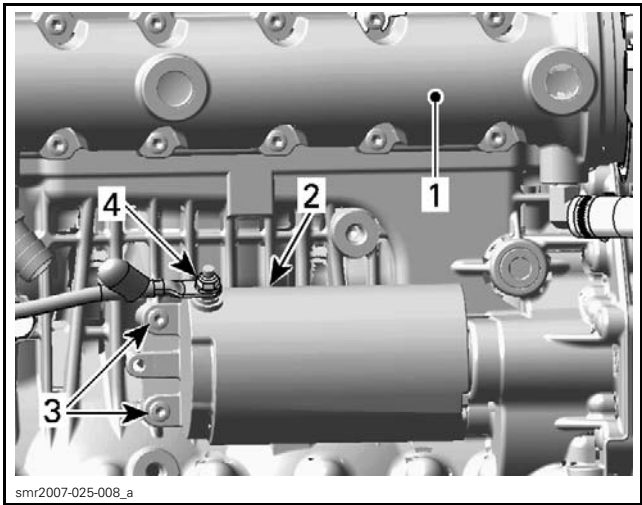
TYPICAL

Removing the Starter

1. Disconnect battery. Refer to *CHARGING SYSTEM* subsection.

NOTE: For better access to the starter, work from RH side and lay across the watercraft.

2. Disconnect starter power cable.
3. Remove starter retaining screws.

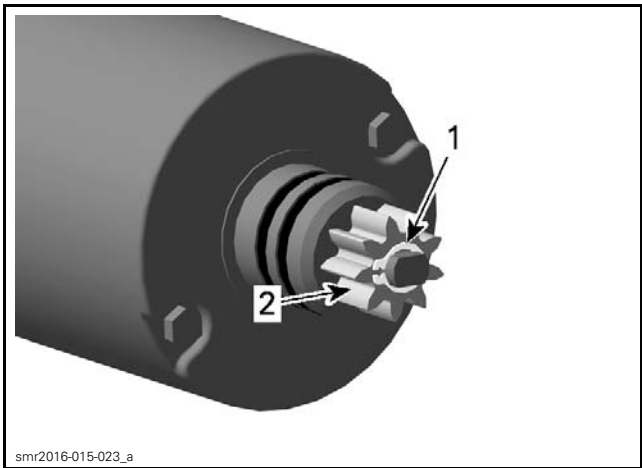


- 1. Exhaust manifold
- 2. Starter
- 3. Starter retaining screws
- 4. Starter power cable retaining nut

Removing the Starter Gear

Remove:

- Circlip
- Starter gear.



- 1. Retaining circlip
- 2. Starter gear

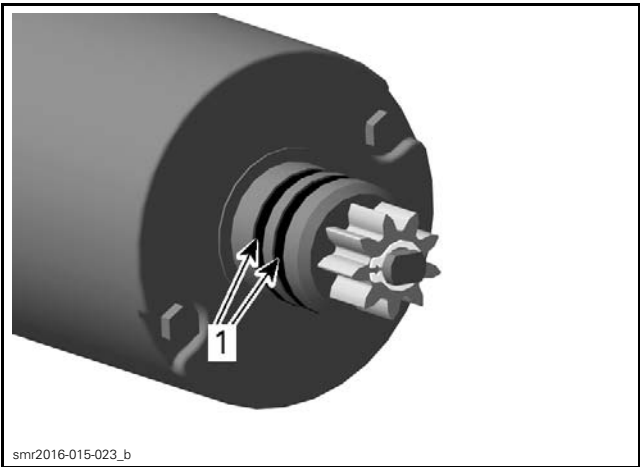
Installing the Starter Gear

Installation is the reverse of removal procedure. However, pay particular attention to the following.
Install a new circlip.

Installing the Starter

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

- 1. Ensure starter and engine mating surfaces are free of debris. Serious problems may arise if starter is not properly aligned.
- 2. Lubricate starter O-rings.



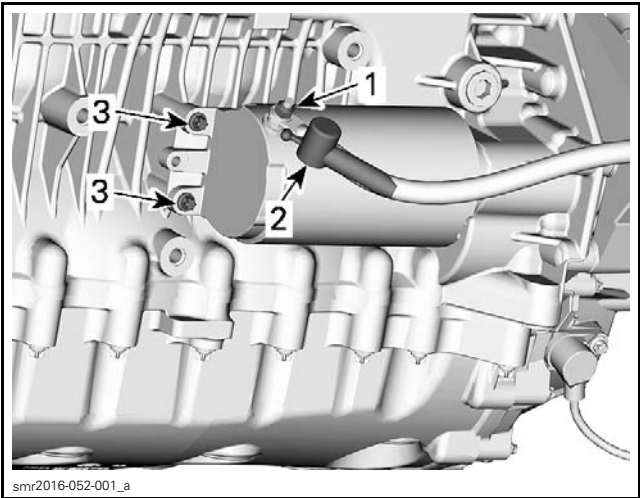
1. Lubricate starter O-rings

TIGHTENING TORQUE	
Starter retaining screws	9 N•m (80 lbf•in)
	+ LOCTITE 243 (BLUE) (P/N 293 800 060)

 **WARNING**

To prevent electric shock whenever connecting the RED power cable to the starter motor, ensure the BLACK (-) battery cable is disconnected.

- 3. Apply DIELECTRIC GREASE (P/N 293 550 004) on terminal and nut.
- 4. Install rubber protector over starter power cable retaining nut.



- 1. Power cable retaining nut
- 2. Rubber protector
- 3. Starter retaining screws

- 5. Reinstall all remaining removed parts.