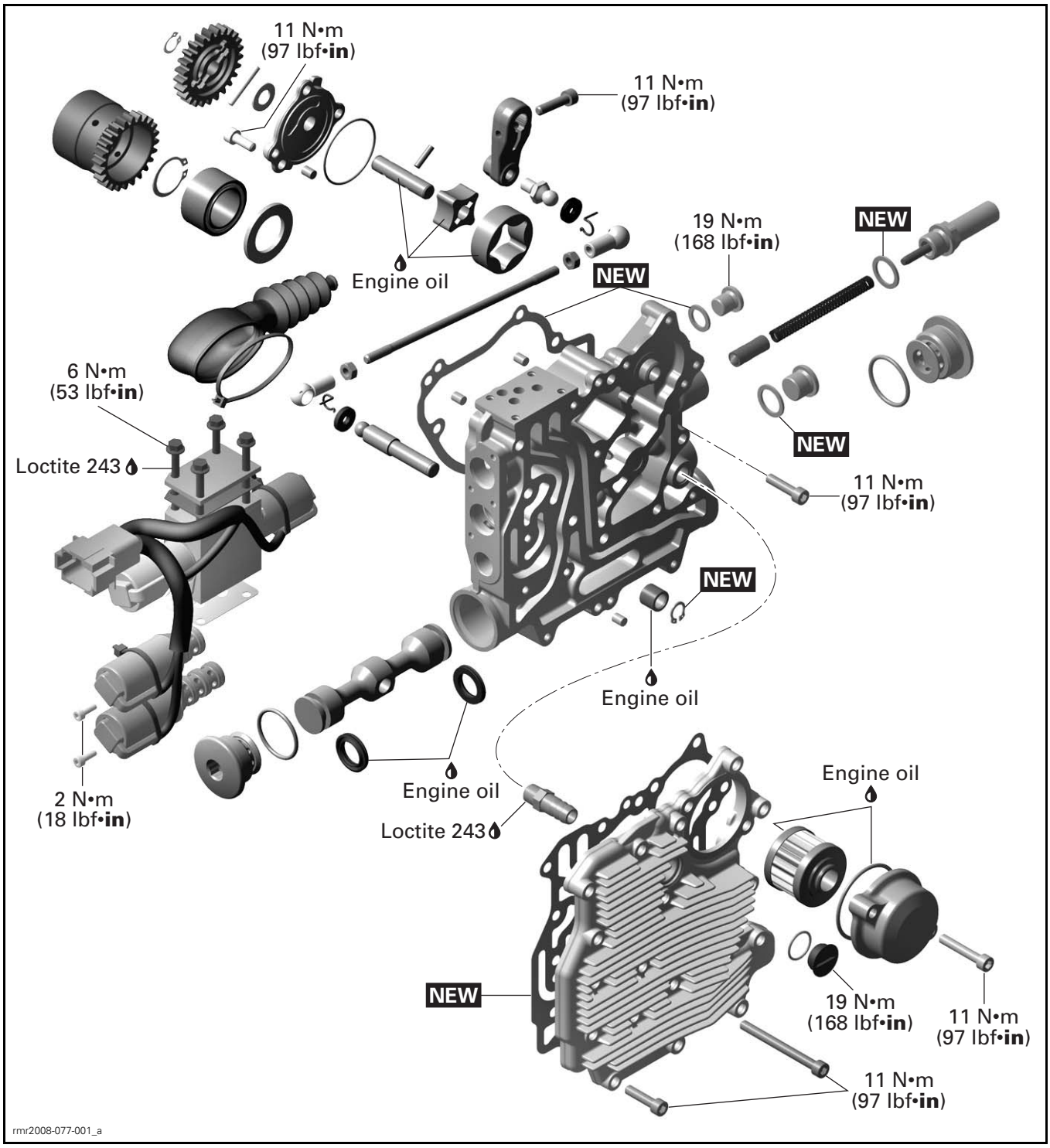
HYDRAULIC CONTROL MODULE (SE5)

SERVICE TOOLS

SERVICE PRODUCTS


11 N•m
(97 lbf•in)
11 N•m
(97 lbf•in)
Engine oil
19 N•m
(168 lbf•in)
NEW
NEW
6 N•m
(53 lbf•in)
Loctite 243
NEW
11 N•m
(97 lbf•in)
NEW
Engine oil
Engine oil
2 N•m
(18 lbf•in)
Loctite 243
Engine oil
NEW
19 N•m
(168 lbf•in)
11 N•m
(97 lbf•in)
11 N•m
(97 lbf•in)
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GENERAL

Always disconnect the negative battery cable before working on the engine.

⚠ WARNING

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

Always carry out electrical tests on components before removing or installing them to ensure their state of operation.

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

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

⚠ WARNING

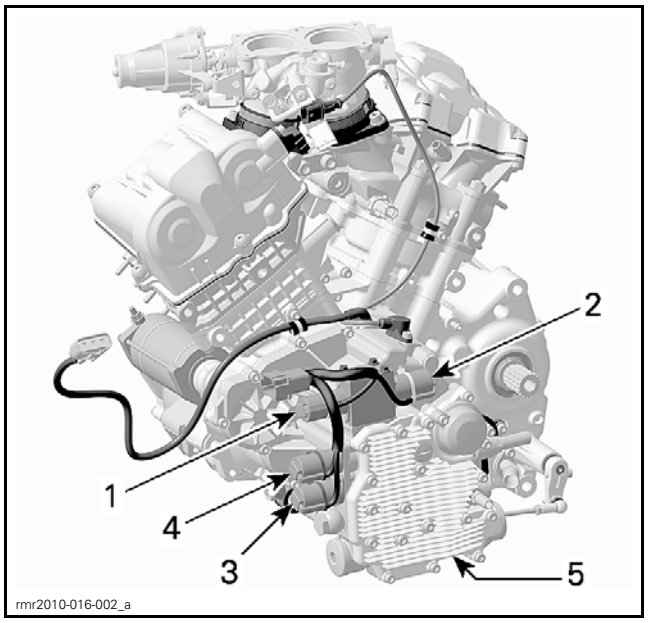
Torque wrench tightening specifications must be strictly adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, cotter pins, etc.) must be replaced with new ones.

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

SYSTEM DESCRIPTION (COMPONENTS)

The transmission control module (TCM) manages 4 solenoid valves located on the hydraulic control module (HCM) which control and activate the gear shifting process.

NOTE: Consult also the *ELECTRONIC SHIFT SYSTEM (SE5)* subsection for an overview of the gearshift operation and troubleshooting.



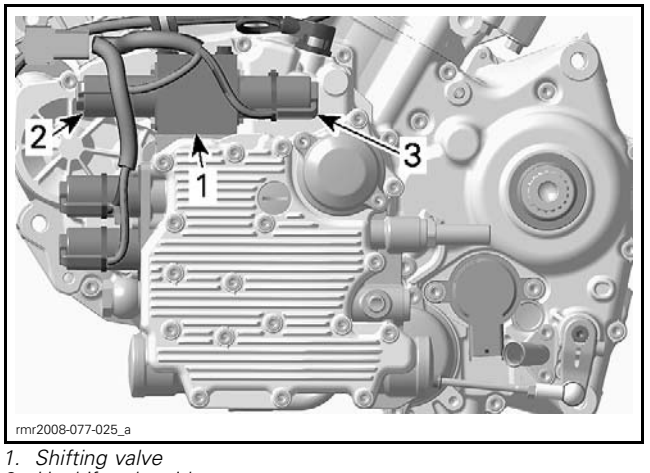
1. Upshift solenoid
2. Downshift solenoid
3. Clutch solenoid
4. Clutch modulation solenoid
5. Hydraulic control module (HCM)

Shift Solenoids

The shift solenoids are located on top of the HCM module.

The LH side solenoid function is to upshift to a higher gear.

The RH side solenoid function is to downshift to a lower gear.

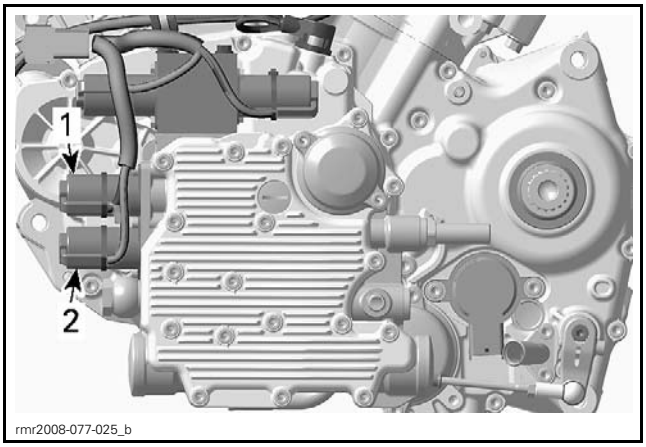


1. Shifting valve
2. Upshift solenoid
3. Downshift solenoid

Clutch Solenoids

The clutch solenoid function is to disengage and engage the clutch when shifting occurs by allowing HCM oil pressure to reach the clutch piston (for disengagement only).

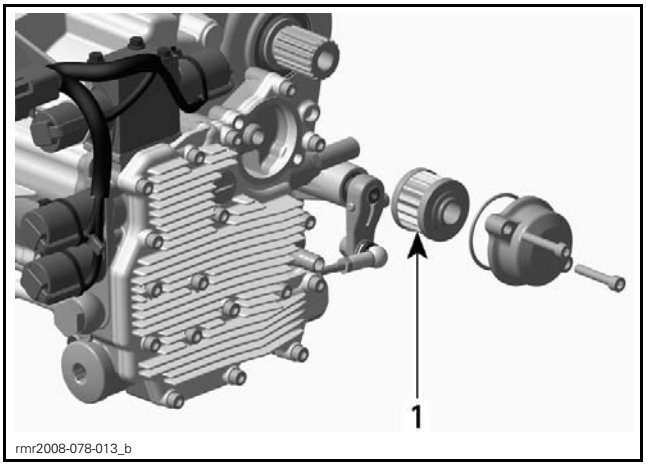
The clutch modulation solenoid function is to bleed the oil pressure from the clutch piston (through the clutch solenoid) to control the clutch engagement speed. For this reason, it is the clutch modulation solenoid.



1. Clutch modulation solenoid
2. Clutch solenoid

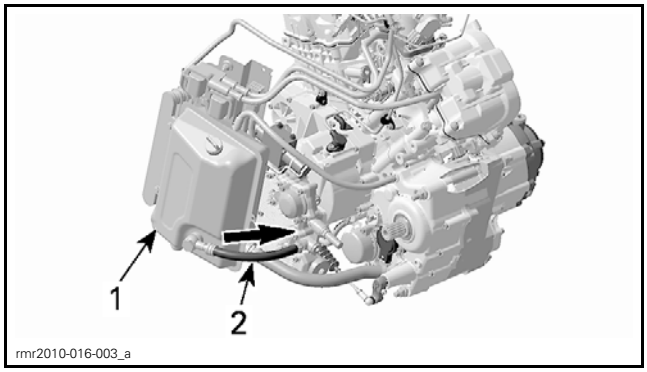
Hydraulic Control Module (HCM)

The HCM shares its oil with the engine. The HCM uses its own oil filter to protect the hydraulic components.



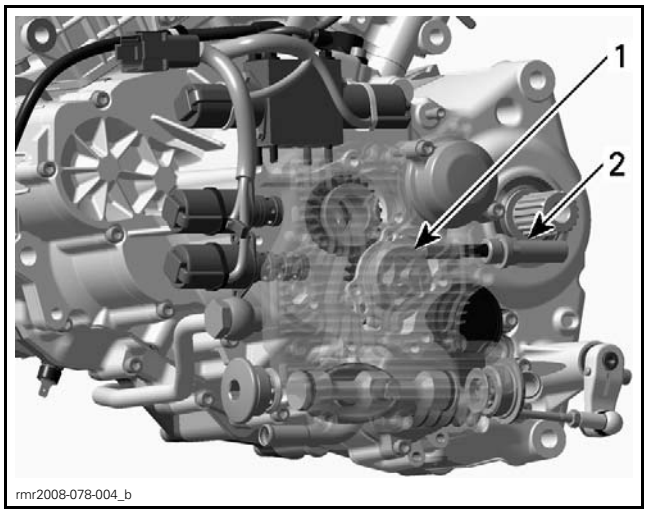
1. Oil filter

The oil tank supplies oil to the hydraulic control module (HCM).



TYPICAL
1. Oil tank
2. Oil supply line to HCM

The HCM includes its own oil pump specifically used for the clutching and gear shifting.

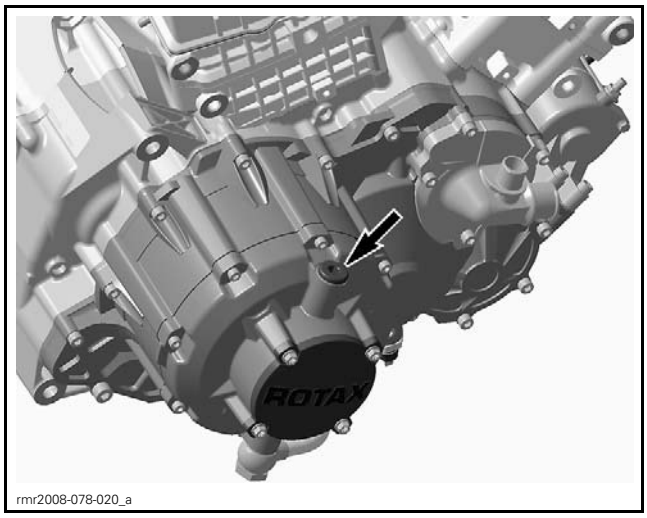


1. Oil pump
2. Oil pressure regulator

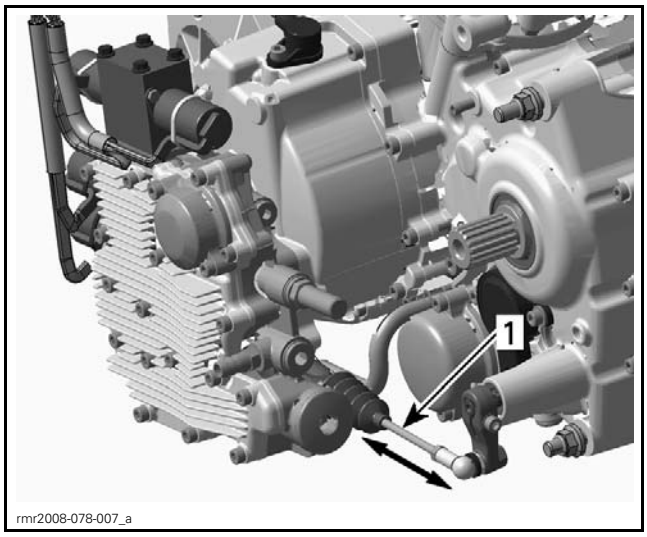
The mechanically-driven pump continuously turn, when engine is running, to feed the oil in the system.

The hydraulic system works at approximately 1 200 kPa (174 PSI) when shifting. An oil pressure regulator is used to stabilize the pressure.

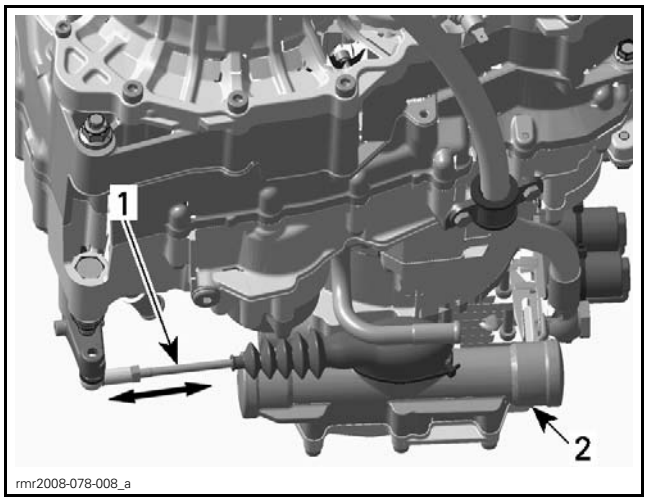
A self bleeding regulator valve, located at the highest point of the shifting system, is used to bleed away air trapped in the system back the to crankcase.



The shift shaft is attached by a mechanical link to the HCM. A hydraulic piston moves the link rod to either upshift or downshift. The piston moves when oil is sent through shift solenoids when energized by the TCM.



1. Link rod between HCM and shift shaft



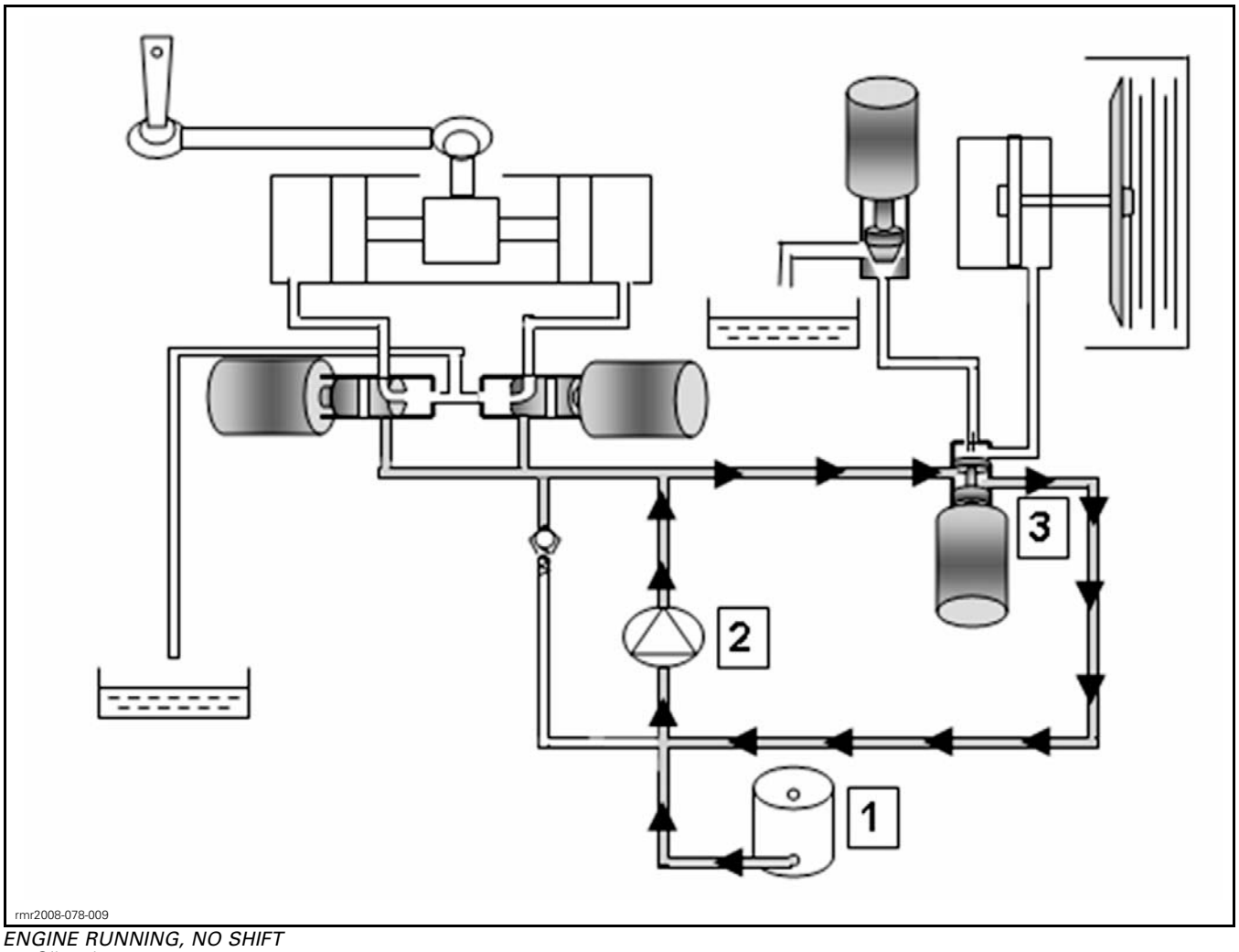
1. Link rod
2. Hydraulic piston location

SYSTEM DESCRIPTION (PRINCIPLE OF OPERATION)

Hydraulic Operation When No Shifting Occurs

When the engine is running and there is no shift selected, oil is supplied from the oil tank to the HCM oil pump.

Oil is then circulated through a passageway in the clutch solenoid back through the HCM oil pump in a continuous loop to maintain the oil flow ready for any upcoming shift request.



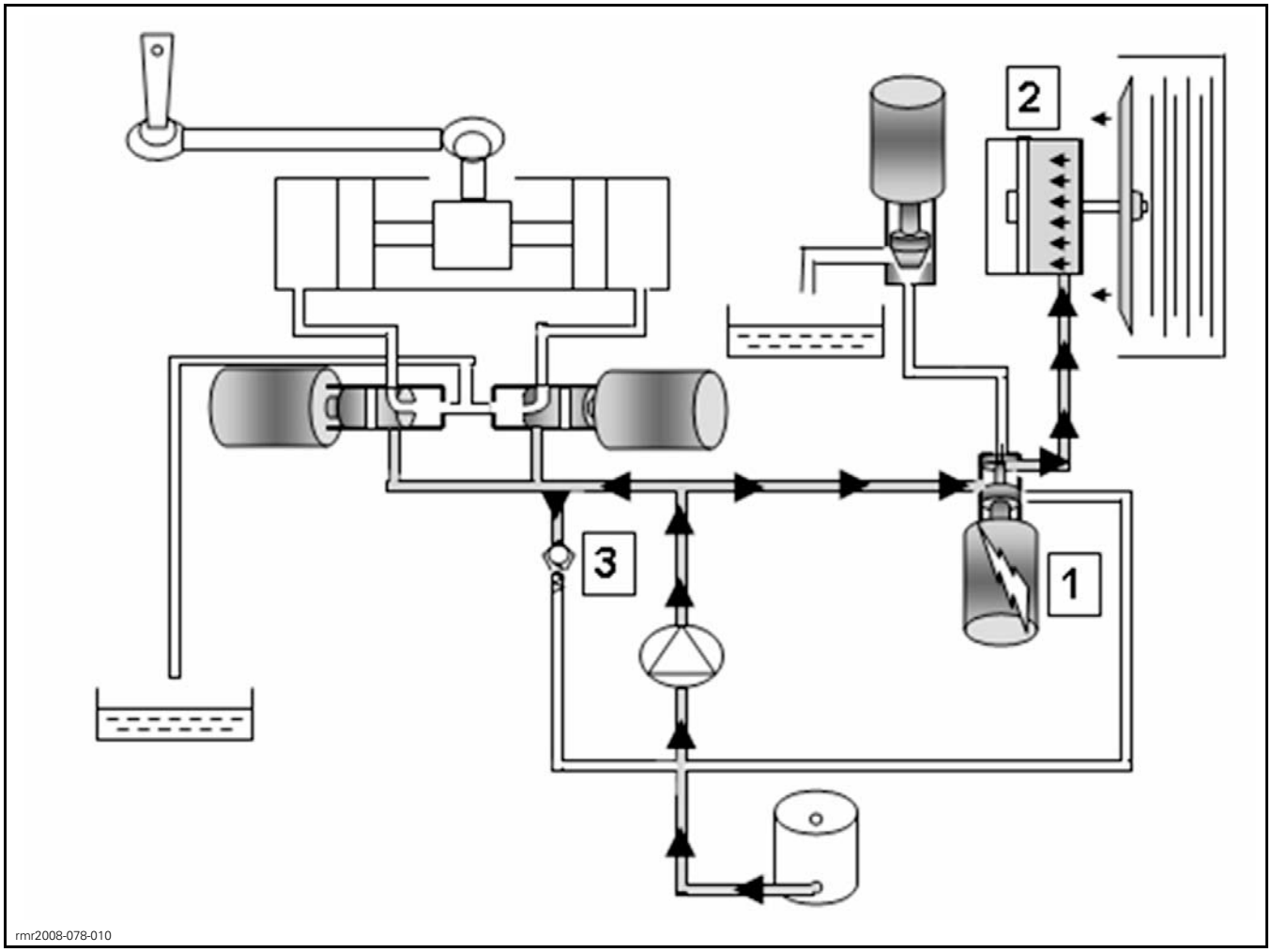
ENGINE RUNNING, NO SHIFT
1. *Oil tank*
2. *HCM oil pump*
3. *Clutch solenoid*

Hydraulic Operation When Shifting Occurs

When a shift is selected, the clutch solenoid is activated by the TCM and oil from the pressure line is directed to the clutch servo.

At the same time oil pressure builds and is limited to 1 200 kPa (174 PSI) by the HCM oil pressure regulator.

That oil, under the same pressure is also available at the shift solenoid valves.



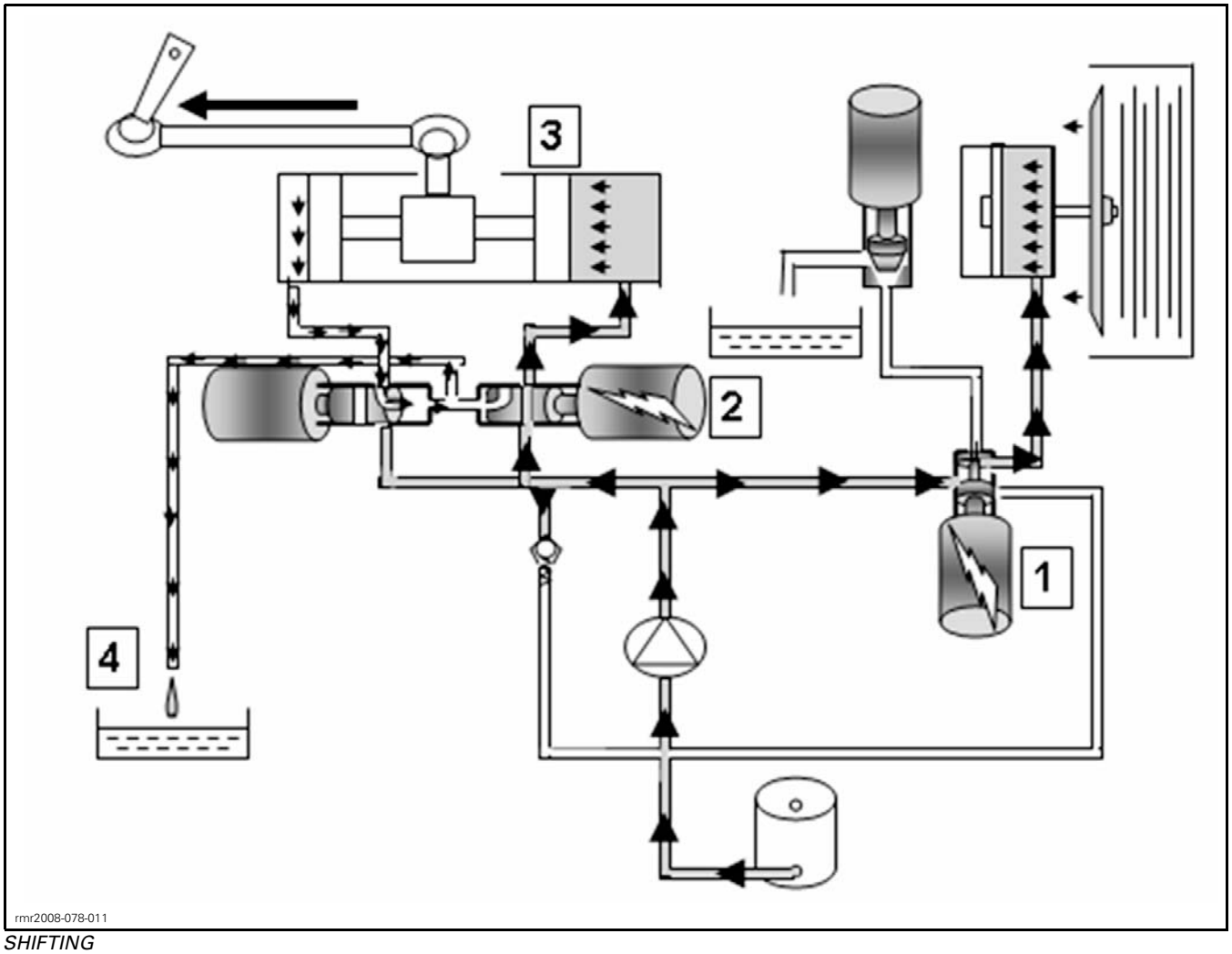
CLUTCH DISENGAGEMENT
1. *Clutch solenoid*
2. *Clutch servo*
3. *HCM oil pressure regulator*

After the clutch solenoid is activated and the clutch is disengaged, one of the shift solenoid is then activated by the TCM.

Pressurized oil can then pass through the solenoid valve to one side of the shift hydraulic piston.

The hydraulic piston moves the linkage and a shift is initiated.

As the hydraulic piston moves, oil on the opposite side of the piston is pushed out through the shift solenoid to the crankcase sump.



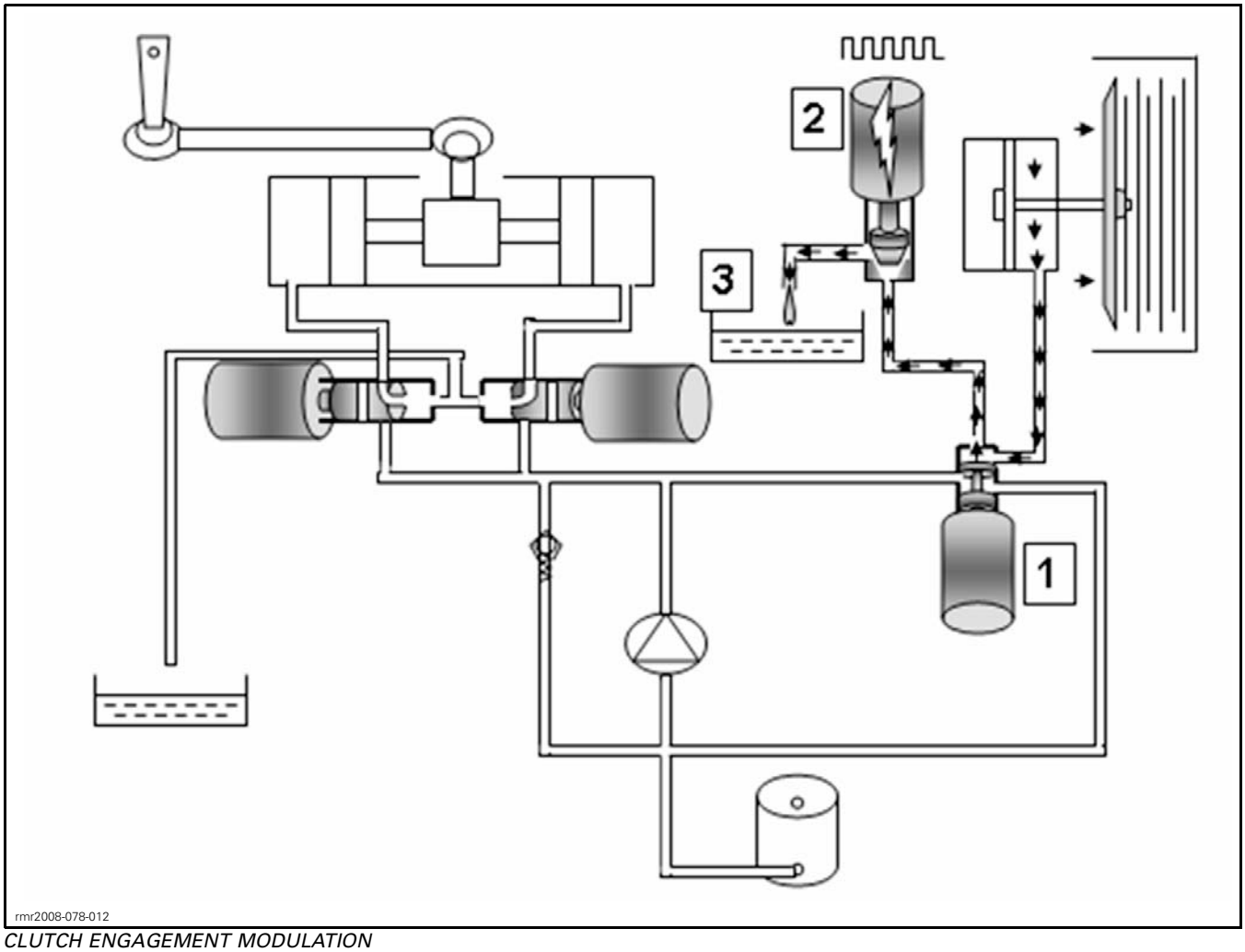
SHIFTING
1. *Clutch solenoid*
2. *Shift solenoid*
3. *Hydraulic piston*
4. *Crankcase sump*

When the TCM determines that the shift has been initiated by the position of the gearbox position sensor (GBPS), it turns off the shift solenoid and the clutch solenoid.

The TCM then sends a pulse width modulated (PWM) signal to the clutch modulation solenoid.

Oil is then bled off of the clutch servo through a passageway in the clutch solenoid and the clutch modulation solenoid to the crankcase sump.

The clutch is then smoothly engaged.



CLUTCH ENGAGEMENT MODULATION
1. *Clutch solenoid*
2. *Clutch modulation solenoid*
3. *Crankcase sump*

MAINTENANCE

HCM OIL FILTER

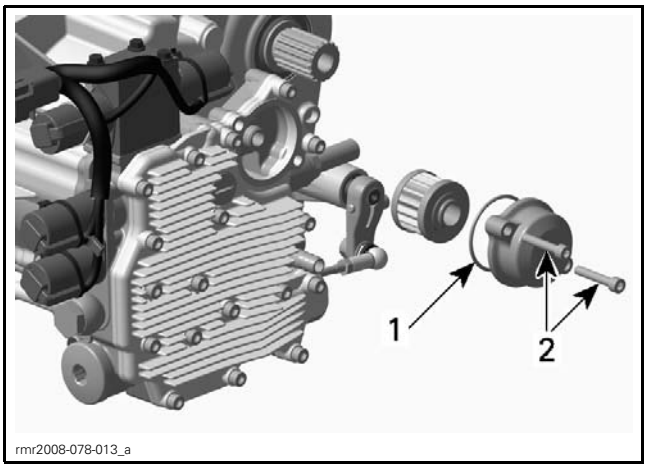
NOTE: The HCM uses the same oil as the engine, but has its own oil filter.

HCM Oil Filter Removal

NOTE: Replace HCM oil filter and engine oil filter at the same time. Refer to *MAINTENANCE SCHEDULE* for frequency.

Drain engine oil. Refer to *LUBRICATION SYSTEM* subsection.

Remove oil filter cover screws.



1. *Oil filter cover*
2. *Cover screws*

Remove oil filter cover with O-ring. Discard O-ring.

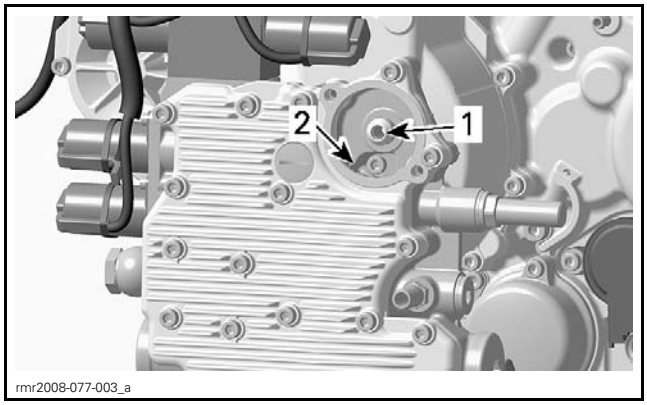
Remove oil filter.

Dispose filter as per your local environmental regulations.

HCM Oil Filter Installation

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

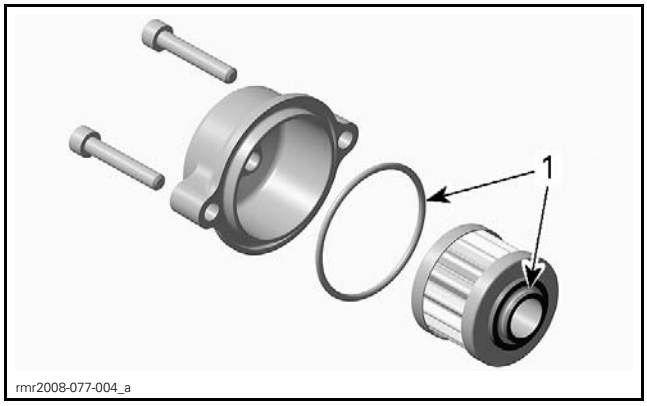
Check and clean the oil inlet and outlet orifices in hydraulic control module for dirt and contaminations.



1. *Oil outlet orifice to the hydraulic control module lubrication system*
2. *Oil inlet orifice to the oil pump*

Install a NEW O-ring on oil filter cover.

To ease assembly and prevent displacement of the O-ring during installation, slightly oil filter and O-ring, refer to following illustration.



1. *Apply oil here*

INSPECTION

HCM OIL PRESSURE TEST

Oil pressure test prerequisite:
- Warm engine (80°C (176°F))
- The recommend oil in engine
- The proper oil level.

Remove the following LH body panels, refer to *BODY* subsection:
- Top side panel
- Rear side panel.

Remove plug screw located behind HCM oil filter housing.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TYPICAL

Install the OIL PRESSURE GAUGE (P/N 529 036 142) in HCM oil pressure threaded tap hole.

Connect the latest version of B.U.D.S. and logon.

Make sure TCM is operational. Refer to *TCM STATUS VALIDATION* in the *ELECTRONIC SHIFT SYSTEM (SE5)* subsection.

Select the **Activation** page and **TCM** folder. Look at the **Routine** section of the page.

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ACTIVATION PAGE, TCM FOLDER

Start engine.

Let engine idle.

NOTE: If more than 400 kPa (58 PSI) is read when the engine is idling, check for blockage in clutch solenoid valve and in HCM passageways.

Select **Clutch activation** on the **Routine** section of the B.U.D.S. **Activation** page.

While clutch is activating , watch pressure gauge and note the value.


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TYPICAL

NOTE: The nominal oil pressure is only achieved during clutch activation or shifting

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TYPICAL

The oil pressure should be within the following values.

OIL PRESSURE	IDLE SPEED, WHILE SHIFTING
MINIMUM	900 kPa (131 PSI)
NOMINAL	1 200 kPa (174 PSI)
MAXIMUM	1 600 kPa (232 PSI)

If oil pressure is not within the specifications, check the following:

- Oil leaks (internal or external)
- HCM oil filter
- HCM oil pressure regulator
- HCM self bleeding valve
- Hydraulic valve(s) and solenoid(s)

– HCM oil pump
– HCM.

Drain pressure gauge into oil tank.

Reinstall removed parts.

Disconnect B.U.D.S.

PROCEDURES

SHIFT AND CLUTCH SOLENOIDS

Solenoid Activation Test with B.U.D.S

Connect the latest version of B.U.D.S. and logon.

Make sure TCM is operational. Refer to *TCM STATUS VALIDATION* in the *ELECTRONIC SHIFT SYSTEM (SE5)* subsection.

Select the **Activation** page and **TCM** folder. Look at the **Routine** section of the page.

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ACTIVATION PAGE, TCM FOLDER

Clutch to activate each solenoids on the **Activation** section of the B.U.D.S. **Activation** page. Activate the solenoids in the following order while listening and feeling the solenoids

– Upshift solenoid
– Downshift solenoid
– Clutch solenoid
– Modulation solenoid.

Use the following electrical tests if any solenoids did not activated.

Solenoid Test

Remove LH upper side panel. Refer to *BODY* subsection.

Disconnect TCM connector.


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Disconnect the 8-pin solenoid connector.


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Solenoid Resistance

Use the FLUKE 115 MULTIMETER (P/N 529 035 868) and select the position Ω.

Measure the resistance between the following pins.

SOLENOID	SOLENOID CONNECTOR PIN (WIRE COLOR)		RESISTANCE AT 20°C (68°F)
Upshift	1 (RED)	8 (WHITE)	2.50 – 2.80 Ω
Downshift	2 (RED)	7 (WHITE)	2.50 – 2.80 Ω
Clutch	3 (RED)	6 (WHITE)	2.50 – 2.80 Ω
Clutch modulation	4 (ORANGE)	5 (WHITE)	1.00 – 1.50 Ω

If the resistance measuring is not within the specification replace faulty parts.

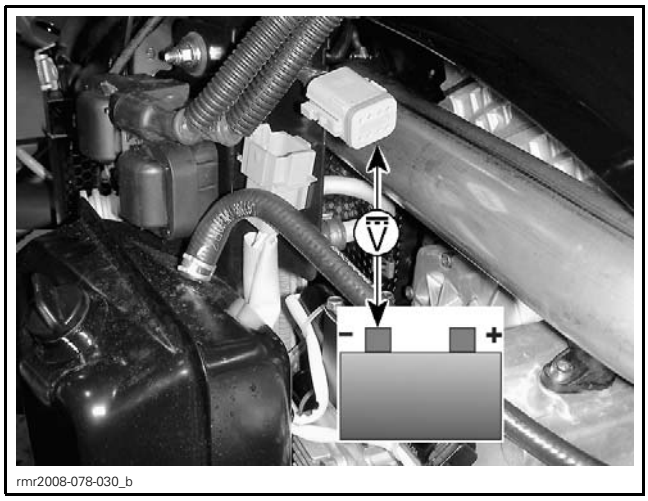
Power Circuit

Turn ignition switch ON.

Set multimeter to Vdc.

Read voltage as follows.

SWITCH	SOLENOID CONNECTOR PIN	VOLTAGE
Upshift	8 and battery ground	No voltage
	1 and battery ground	Battery voltage
Downshift	7 and battery ground	No voltage
	2 and battery ground	Battery voltage
Clutch	3 and battery ground	Battery Voltage
	6 and battery ground	No voltage
Clutch modulation	4 and battery ground	Battery voltage
	5 and battery ground	No voltage



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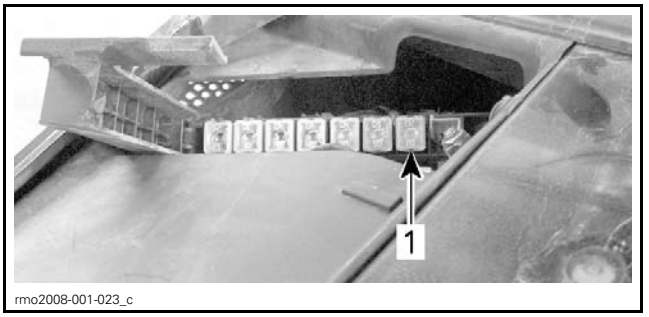
If a solenoid test failed, check sol + TCM fuse (2) in rear fuse box. If it is good, check wiring and connectors between TCM and battery.



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REAR FUSE BOX
1. Sol + TCM fuse

If solenoid test succeeded, continue testing.

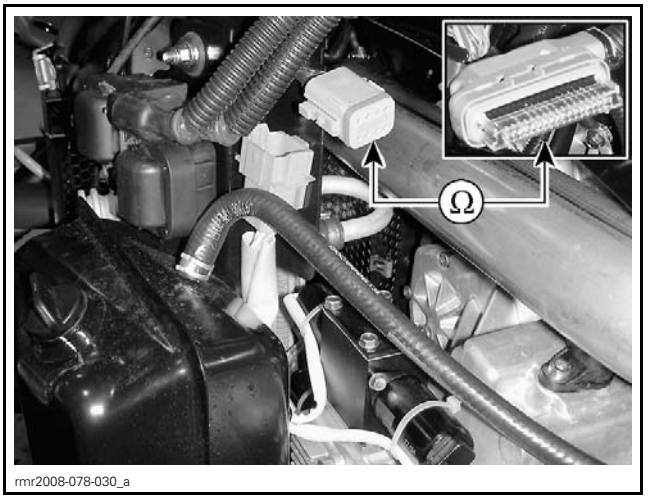
Contact Circuit

Turn ignition switch OFF.

Set multimeter to Ω.

Check continuity as follows.

SWITCH	TCM CONNECTOR PIN	SOLENOID CONNECTOR PIN	RESISTANCE
Upshift	32	8	Close to 0 Ω
Downshift	33	7	
Clutch	34	6	
Clutch modulation	30	5	



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If a resistance failed, check wiring and connectors between TCM and solenoid connector.

Solenoid Removal

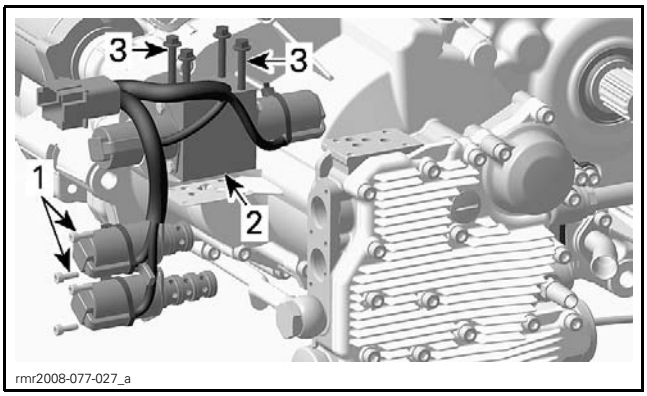
Remove body panels, refer to the *BODY* subsection.

Disconnect solenoid connector from wiring harness.

Remove screws retaining solenoid valve body to HCM.

Remove Allen screws securing the modulation and the clutch solenoids from the side of HCM.

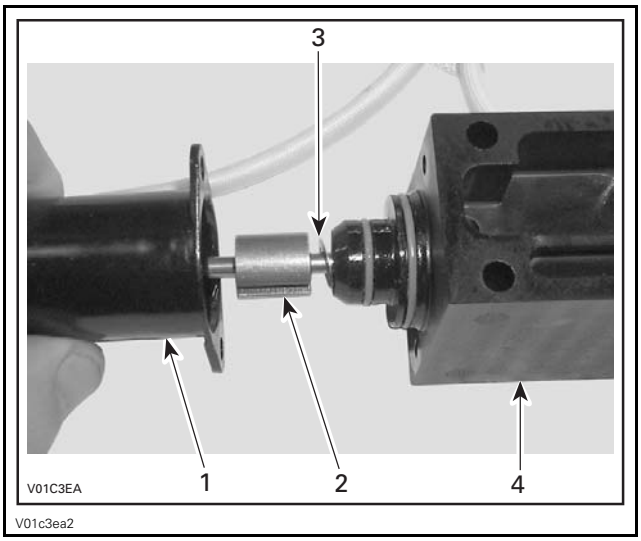
NOTE: Solenoids are available as single parts, replace complete solenoid valve set only if necessary. For removing pins of the connector refer to *CONNECTOR INFORMATION* subsection.



1. Allen screws
2. Solenoid valve body
3. Solenoid valve screws

Remove solenoids from HCM.

NOTE: Use caution when pulling the shifting solenoid from the body as engagement pin and washer may fall out.



TYPICAL

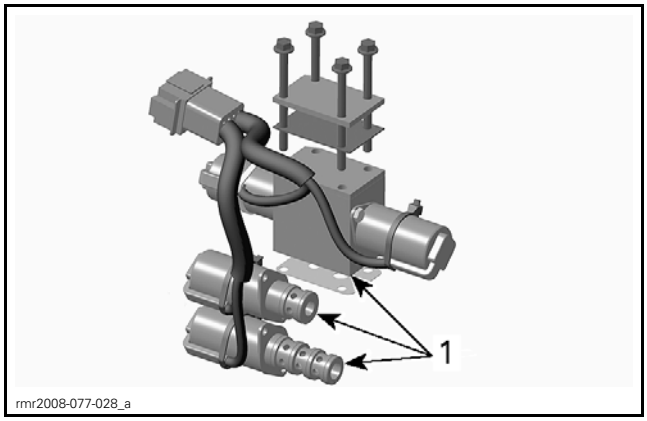
1. Shifting solenoid
2. Engagement pin
3. Washer
4. Valve body

Solenoid Inspection

Check solenoids and gaskets for any damage. Replace if necessary.

Solenoid Cleaning

Clean tip of clutch and modulation solenoids with a contact cleaner.



1. Clean this area with contact cleaner

Solenoid Installation

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

Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on threads of solenoid valve screws.

Torque solenoid valve body screws to 6 N•m (53 lbf•**in**).

Torque Allen screw to 2 N•m (18 lbf•**in**).

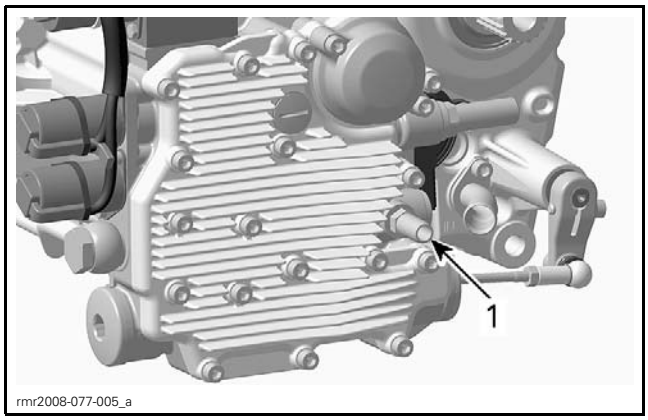
Check oil level in oil tank and refill with recommended oil if necessary. Refer to *LUBRICATION SYSTEM* subsection.

Install pins of the solenoid valves in the correct place of the connector, refer to following table:

SOLENOID	WIRE IDENTIFICATION NUMBER AT CONNECTOR (WIRE COLOR)	
Upshift	1 (RED)	8 (WHITE)
Downshift	2 (RED)	7 (WHITE)
Clutch	3 (RED)	6 (WHITE)
Clutch modulation	4 (ORANGE)	5 (WHITE)

OIL HOSE NIPPLE

The oil hose nipple is located on the front of the HCM.



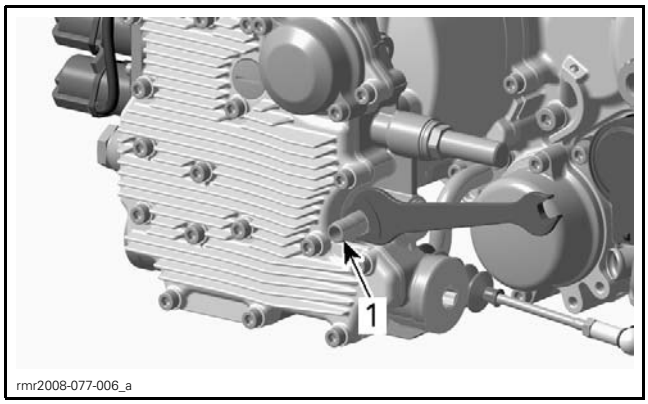
1. Oil hose nipple "IN"

Oil Hose Nipple Removal

Drain engine oil, refer to *LUBRICATION SYSTEM* subsection.

Remove oil hose from nipple.

Unscrew oil hose nipple.



1. Oil hose nipple

Oil Hose Nipple Inspection

Clean oil hose nipple with a part cleaner, then use air pressure to dry it.

⚠ WARNING

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

Check if threads of the oil hose nipple is damaged. Replace if necessary.

Check oil hose nipple for cracks. Replace if necessary.

Oil Hose Nipple Installation

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

Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on hose nipple threads.

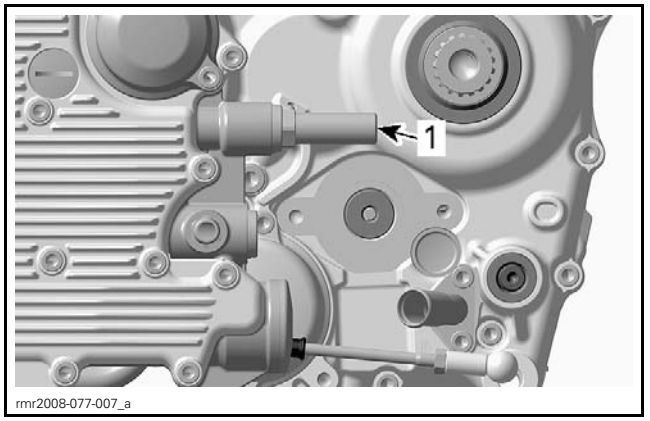
Torque oil hose nipple to 11 N•m (97 lbf•**in**).

Install oil hose.

Refill oil tank with recommended oil and check engine oil level. Refer to *LUBRICATION SYSTEM* subsection.

HCM OIL PRESSURE REGULATOR

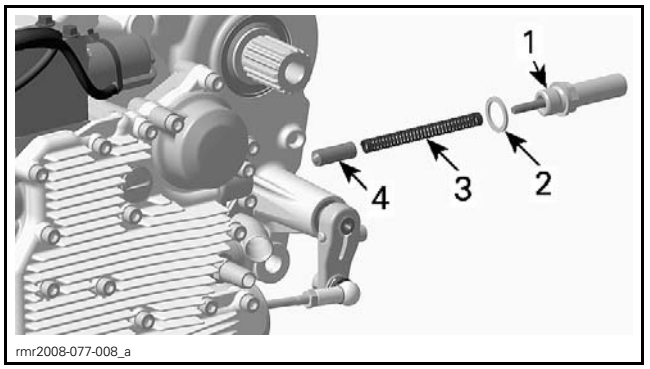
The HCM oil pressure regulator is located inside the hydraulic control module.



1. HCM oil pressure regulator location

HCM Oil Pressure Regulator Removal

Remove oil pressure regulator from HCM.

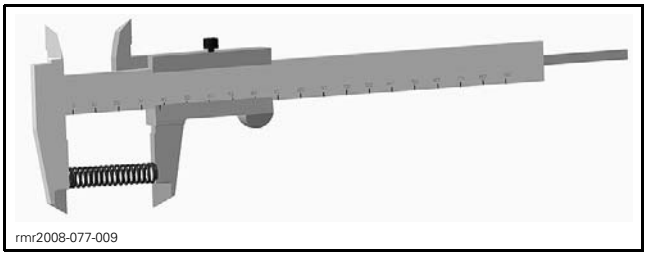


1. Plug screw
2. Sealing washer
3. Spring
4. Pressure regulator piston

HCM Oil Pressure Regulator Inspection

Inspect oil pressure regulator bore (where the regulator piston fits) and regulator piston for scoring or other damages. Check if piston moves easily in hydraulic control module bore.

Inspect compression spring for any deformation and free length.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SPRING FREE LENGTH	
SERVICE LIMIT	110 mm (4.331 in)

Replace worn or damaged components.

Clean bore and thread in the hydraulic control unit from metal shavings and other contaminations.

HCM Oil Pressure Regulator Installation

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

Always install a NEW sealing washer.

Torque plug screw to 19 N•m (168 lbf•**in**).

Refill oil tank with recommended oil and check engine oil level. Refer to *LUBRICATION SYSTEM* subsection.

HYDRAULIC CONTROL MODULE (HCM)

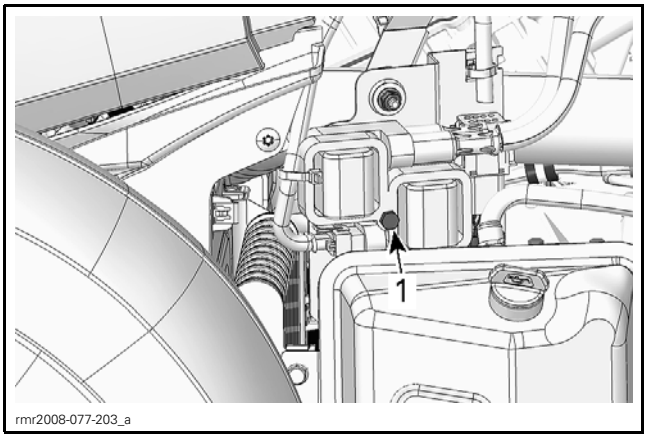
HCM Removal

Make sure gearbox is on N position.

Remove the LH lower side panel. Refer to *BODY* subsection.

Drain engine oil. Refer to *LUBRICATION SYSTEM* subsection.

Unscrew bolt securing the ignition coil.



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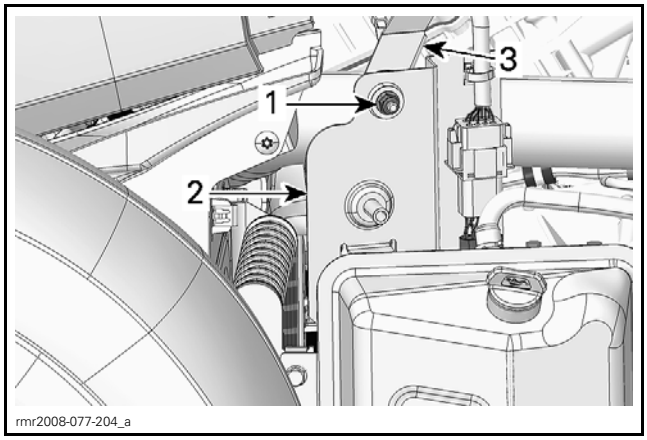
1. Ignition coils bolt

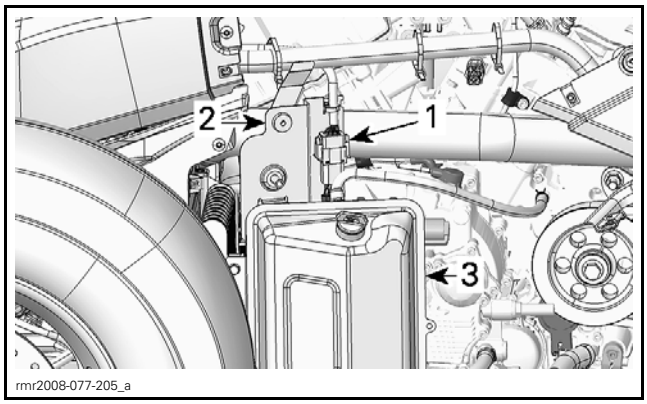
Remove bolt retaining ignition coil support to lateral support.



rmr2008-077-204_a

1. Remove this bolt
2. Ignition coils support
3. Lateral support

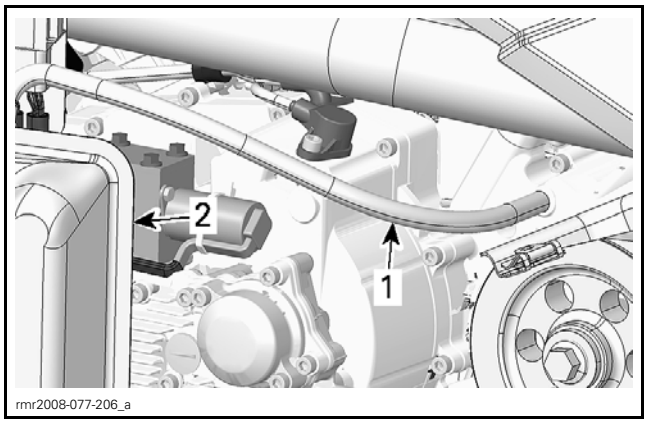
Unplug the solenoids connector and remove connector housing from the ignition coils support.



rmr2008-077-205_a

TYPICAL
1. Solenoid connector
2. Ignition coils support
3. Oil tank

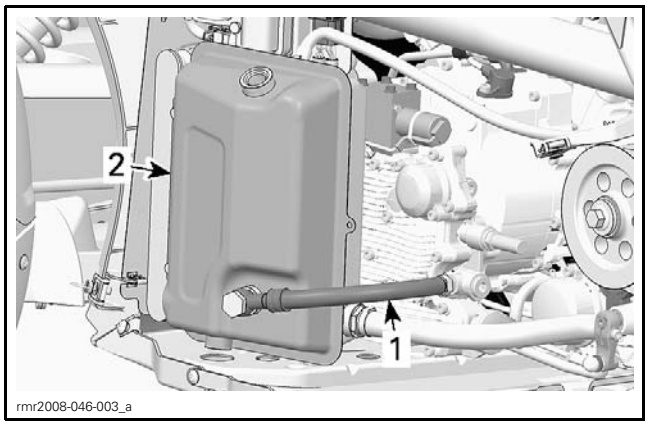
Disconnect the oil tank vent from crankcase.



rmr2008-077-206_a

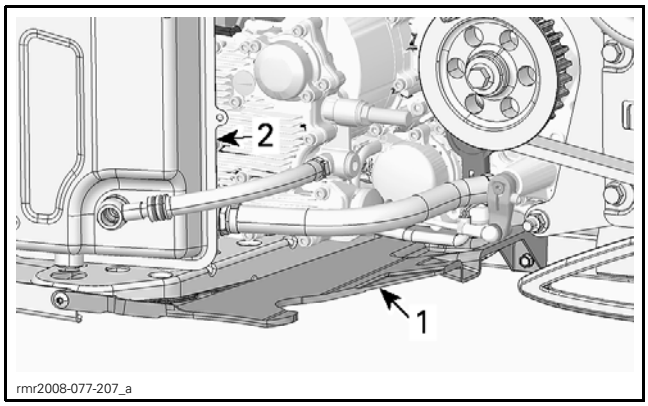
TYPICAL
1. Oil tank vent
2. Oil tank

Detach the clutch servo hose from the bottom of oil tank.



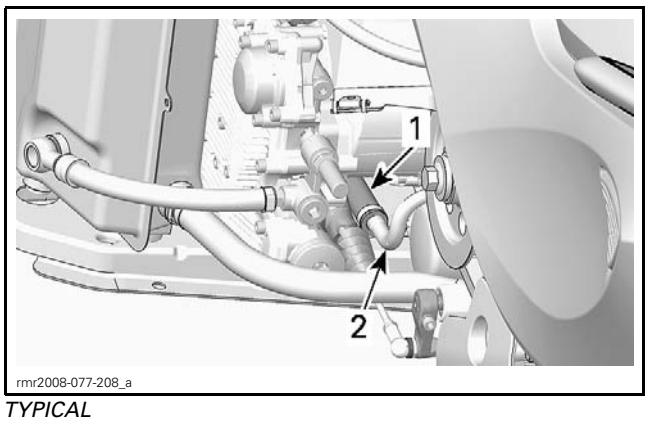
TYPICAL
1. *Clutch servo hose*
2. *Oil tank*

Remove the bottom plate under oil tank.



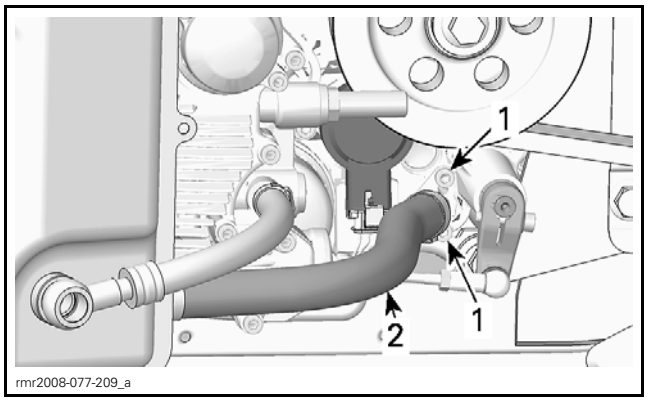
TYPICAL
1. *Bottom plate*
2. *Oil tank*

Disconnect oil cooler inlet hose from engine outlet connector tube.



TYPICAL
1. *Oil cooler inlet hose*
2. *Engine outlet connector tube*

Remove engine inlet connector tube from crankcase. Discard O-rings.

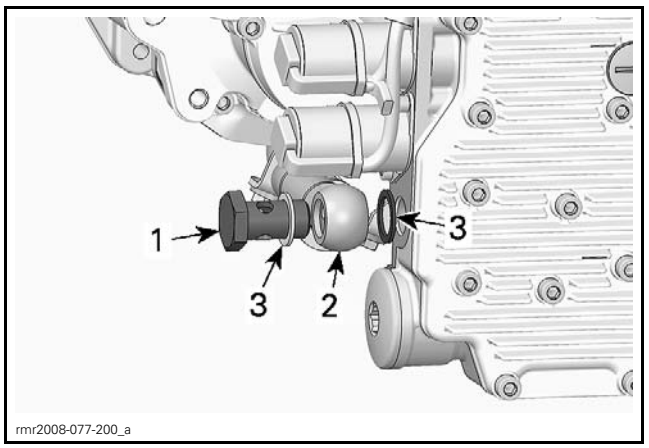


TYPICAL
1. *Engine inlet connector tube bolts*
2. *Oil cooler outlet hose*

Move oil tank and oil cooler aside to make room.

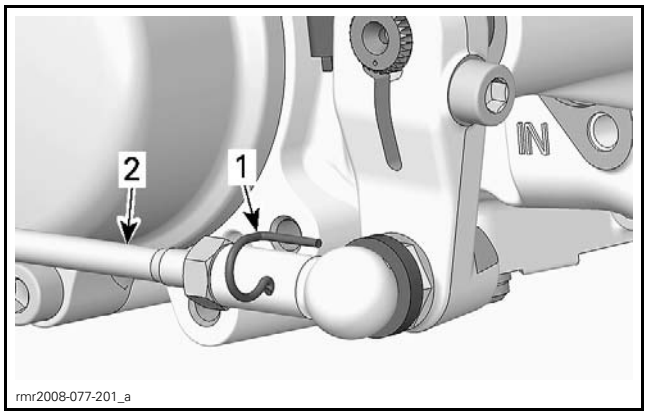
Remove *HCM OIL FILTER*, see procedure above in this subsection.

Unscrew the Banjo fitting securing the clutch hose to HCM. Discard sealing washers.



1. *Banjo fitting*
2. *Clutch hose*
3. *Sealing washers*

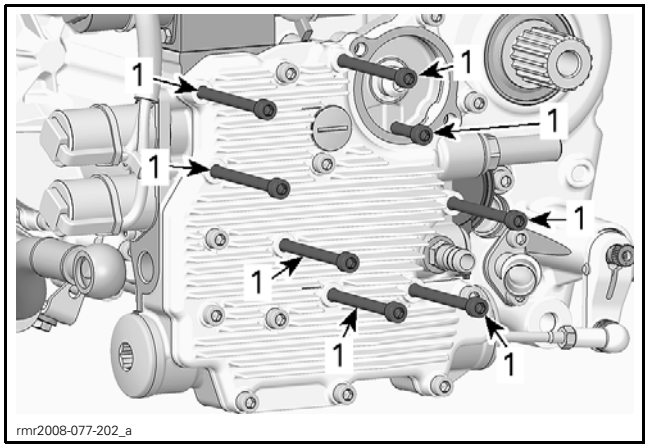
Remove circlip of shift linkage.



1. *Circlip*
2. *Shift linkage*

NOTE: For easier removal of plug screws, loosen them before removing the HCM from the engine.

Remove screws retaining the HCM to the magneto cover.



1. HCM screws

Pull the HCM and discard its gasket.

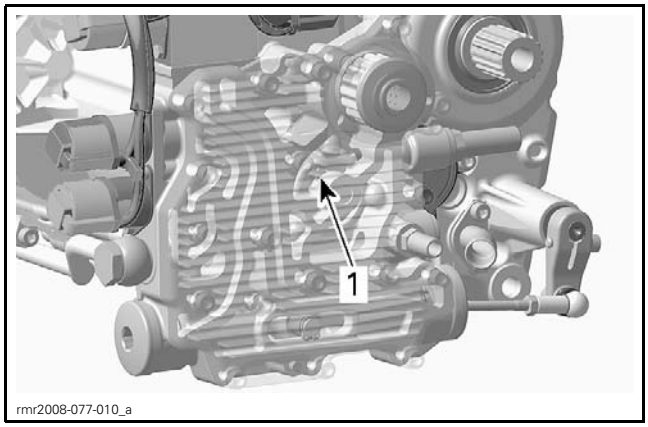
HCM Installation

The installation is the reverse of the removal procedure.

OIL PUMP

The oil pump is located inside the hydraulic control module (HCM).

The HCM is equipped with its own oil pump.

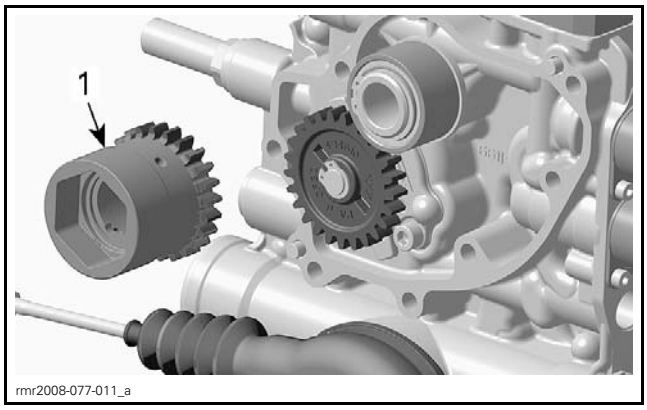


1. Oil pump

Oil Pump Removal

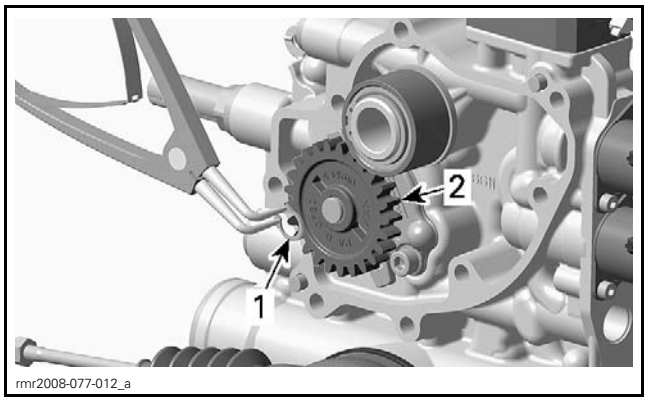
Remove the HCM from the engine, refer to *HYDRAULIC CONTROL MODULE (HCM)* in this subsection.

Remove intermediate oil pump gear.



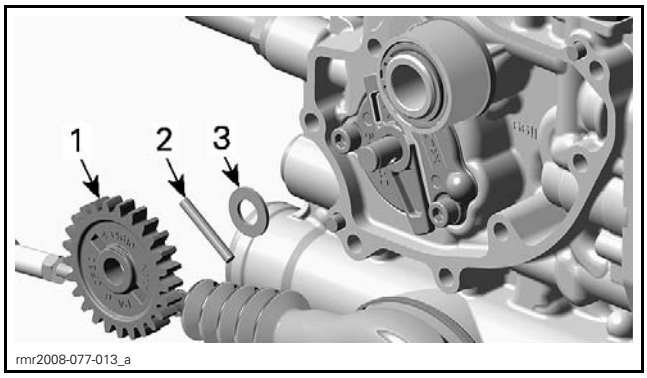
1. Intermediate oil pump gear

Remove retaining ring.



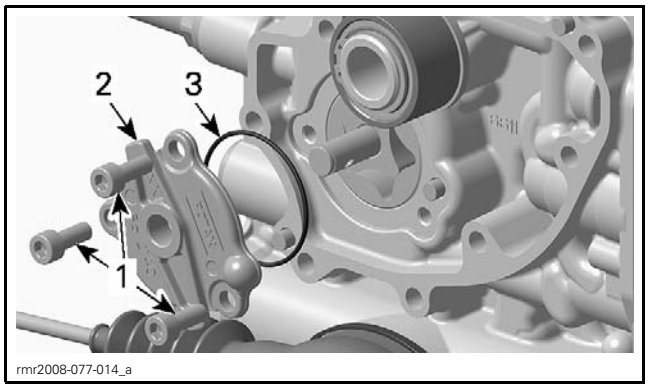
1. Retaining ring
2. Oil pump gear

Remove oil pump gear, needle pin and thrust washer.



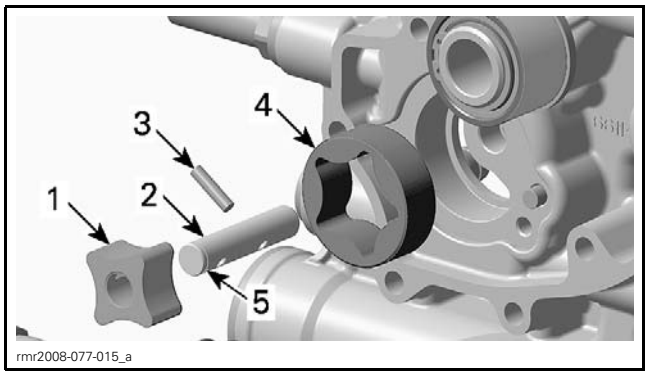
1. Oil pump gear
2. Needle pin
3. Thrust washer

Remove oil pump cover. Discard the O-ring.



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

Remove oil pump shaft with rotor set.



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

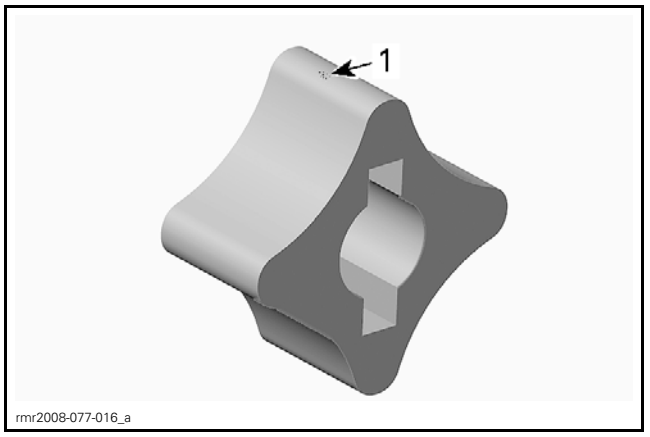
Oil Pump Inspection

Check oil pump cover and hydraulic control module surface (where the oil pump cover fits) for damage.

Inspect rotor set and oil pump bore for serious marks, scratches or other damages. If so, replace damaged parts.

NOTE: Minimal imperfections or scratches are allowed.

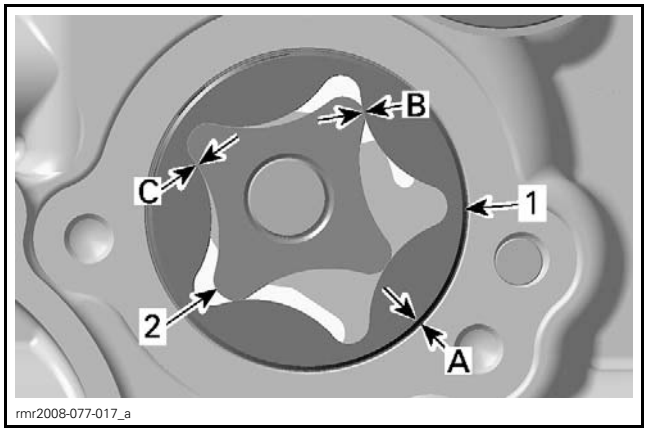
Check inner rotor for corrosion pin holes, pitting or other damages. If defects or damages are found, replace oil pump inner and outer rotor.



TYPICAL
1. *Pitting on the teeth*

Radial Clearance

Using a feeler gauge, measure the radial clearance as illustrated. Refer to table following illustration for service limits.



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

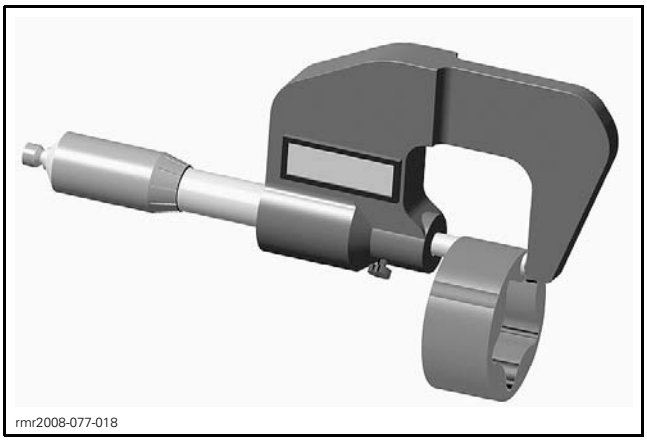
OUTER AND INNER ROTOR CLEARANCE	
SERVICE LIMIT	
A	0.25 mm (.0098 in)
B	
C	

If clearance between inner and outer rotors exceeds the tolerance, replace the oil pump.

If clearance between outer rotor and its bore in hydraulic control module exceeds the tolerance, replace the complete oil pump assembly and/or the hydraulic control module.

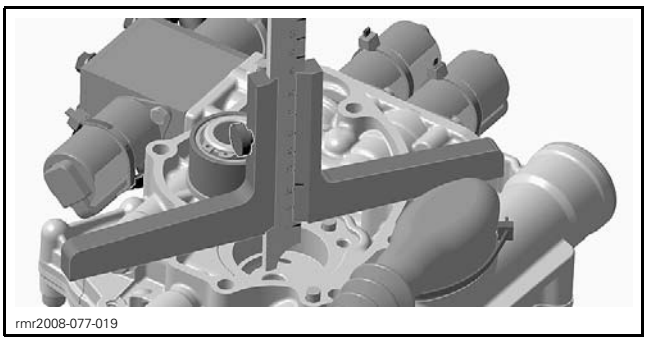
Axial Clearance

Measure outer rotor thickness with micrometer.


rmr2008-077-018

OUTER ROTOR THICKNESS

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


rmr2008-077-019

OIL PUMP BORE DEPTH (HYDRAULIC CONTROL MODULE)

Difference between measurements should not exceed 0.15 mm (.0059 in). If the clearance is out of tolerance, replace the complete oil pump assembly.

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

Check oil pump gear for serious marks and damage. If so, replace damaged part.

NOTE: Minimal imperfections or scratches are allowed.

Oil Pump Installation

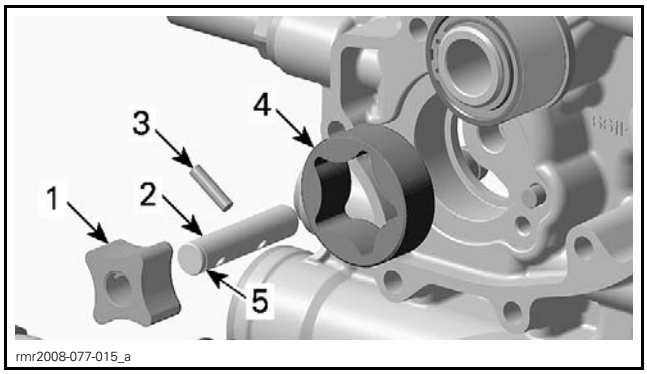
For installation, reverse the removal procedure. Pay attention to the following details.

Clean all metal components in a solvent.

Coat inner and outer rotors with oil.

Install oil pump shaft.

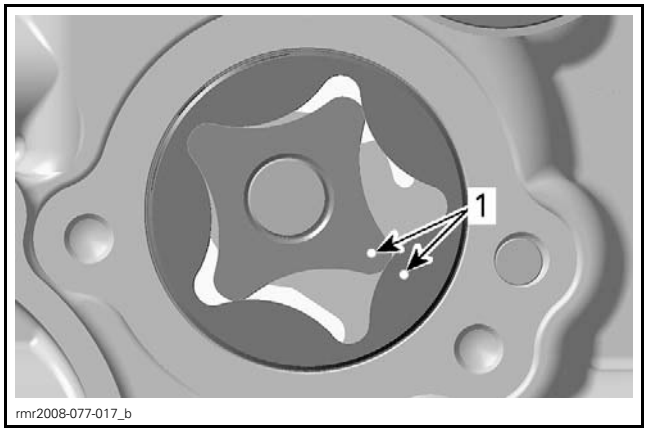
NOTE: The groove must face outwards and be visible when installing oil pump cover.



rmr2008-077-015_a

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

Assemble oil pump into hydraulic control module. Markings on inner and outer rotor must face toward oil pump cover and aligned.

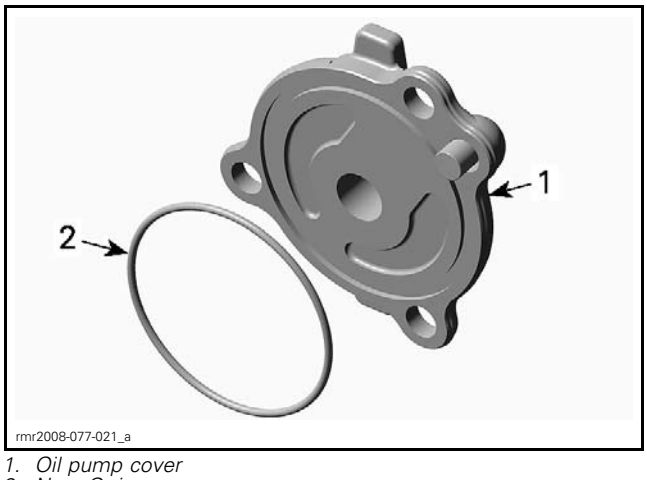


rmr2008-077-017_b

MARKINGS ON INNER AND OUTER ROTOR

1. *Markings*

Install oil pump cover with a NEW O-ring.



rmr2008-077-021_a

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

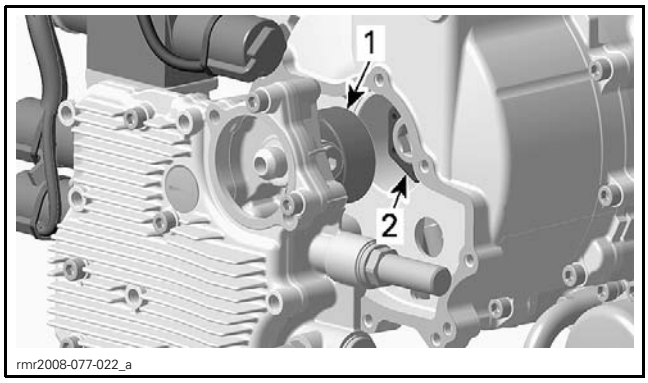
HCM Oil Pressure Test

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

INTERMEDIATE OIL PUMP GEAR

The intermediate oil pump gear is located on the backside of the hydraulic control module.

The intermediate oil pump gear is driven by the hexagonal nut of the crankshaft and drives the oil pump gear.



1. Intermediate oil pump gear
2. Hexagonal nut of crankshaft

Intermediate Oil Pump Gear Removal

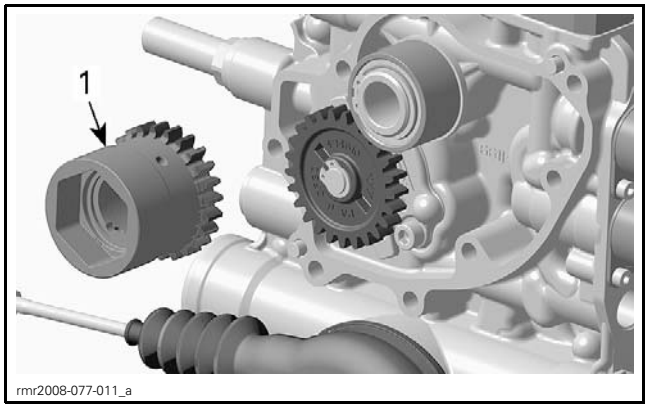
Drain engine oil, refer to *LUBRICATION SYSTEM* subsection.

Disconnect solenoid connector from wiring harness.

Remove oil hose from hydraulic control module nipple.

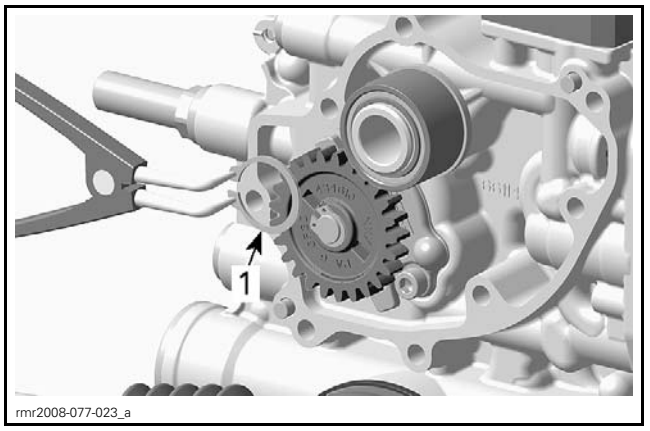
Remove hydraulic control module from engine.

Remove intermediate oil pump gear.



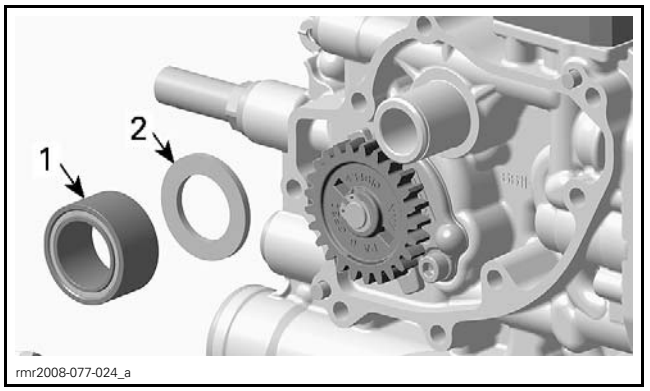
1. Intermediate oil pump gear

Remove circlip of needle bearing



1. Circlip

Remove needle bearing from hydraulic control module.



1. Needle bearing
2. Thrust washer

Intermediate Oil Pump Gear Inspection

Check if teeth and internal hexagon of intermediate oil pump gear are damaged, check intermediate oil pump gear for cracks. Replace if necessary.

Clean needle bearing with a part cleaner and check for any damage. Replace if necessary.

Check needle bearing journal for any damage or abnormal wear. Replace hydraulic control module if necessary.

Intermediate Oil Pump Gear Installation

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

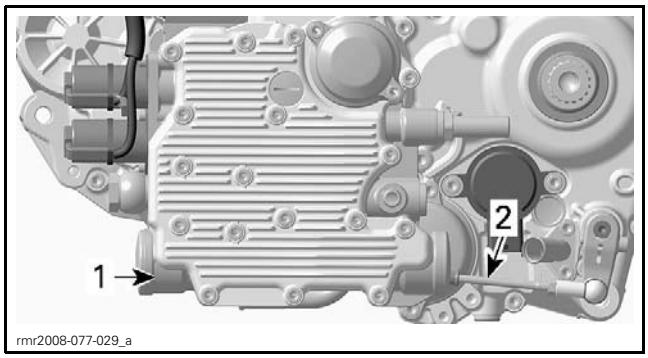
Apply engine oil on needle bearing.

Refill oil tank with recommended oil and check engine oil level. Refer to *LUBRICATION SYSTEM* subsection.

HYDRAULIC PISTON

The hydraulic piston is located on the lower side of the HCM.

The hydraulic piston is activated by the solenoid valves and is shifting the gears via the shifting linkage.



1. Hydraulic piston
2. Shifting linkage

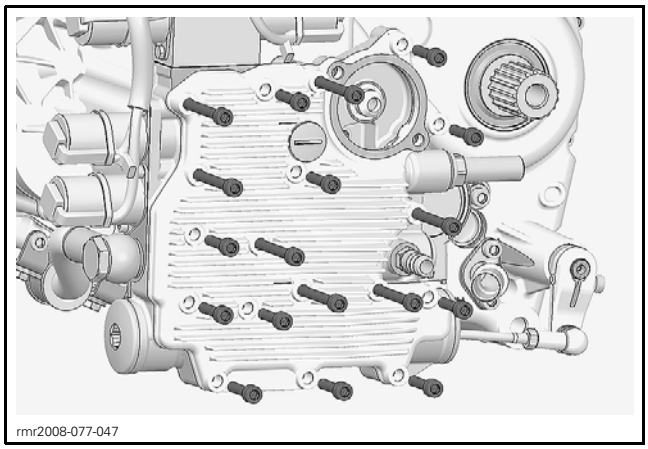
NOTE: Before dissembling the hydraulic piston, check if there is any oil contamination in the area of the bellow. If there is a leakage it is a indication for worn out or damaged piston linings, if necessary replace faulty parts.

Hydraulic Piston Removal

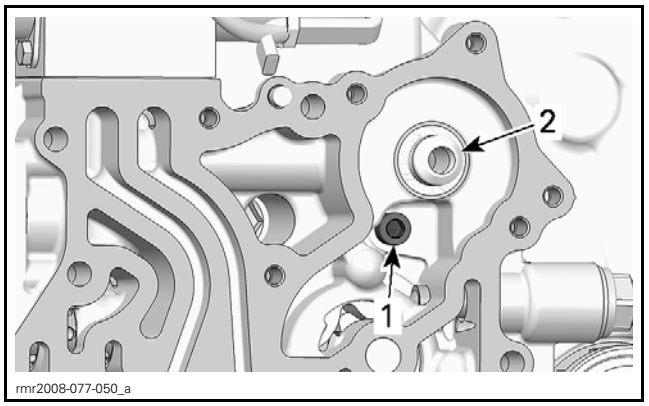
Drain engine oil, refer to *LUBRICATION SYSTEM* subsection.

Remove *HCM OIL FILTER*, see procedure above in this subsection.

Remove the HCM cover by removing the following screws.

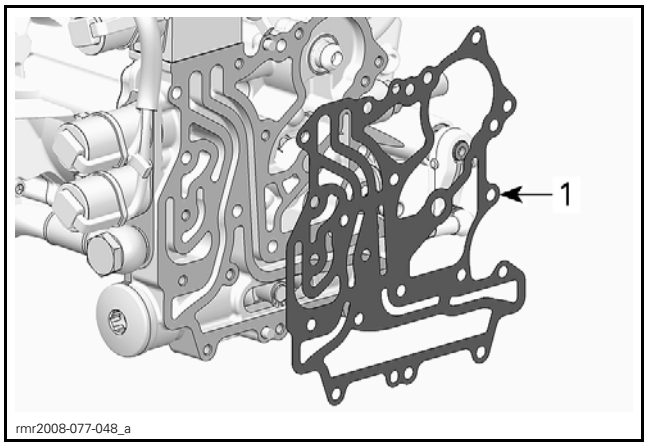


NOTICE The HCM is still retained by one screw. This screw is located below oil filter adaptor. Do not force the HCM to avoid damages.



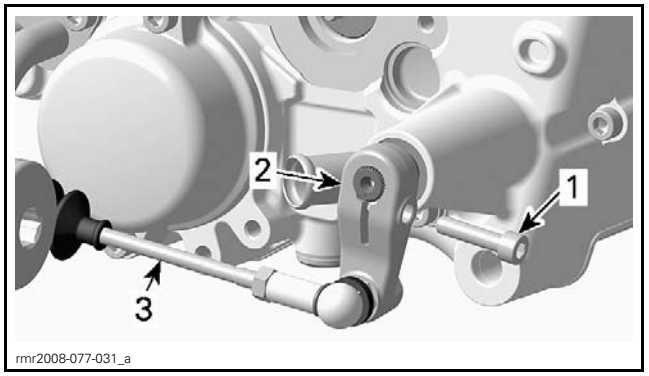
1. HCM retaining screw
2. Oil filter adaptor

Remove and discard the HCM cover gasket.



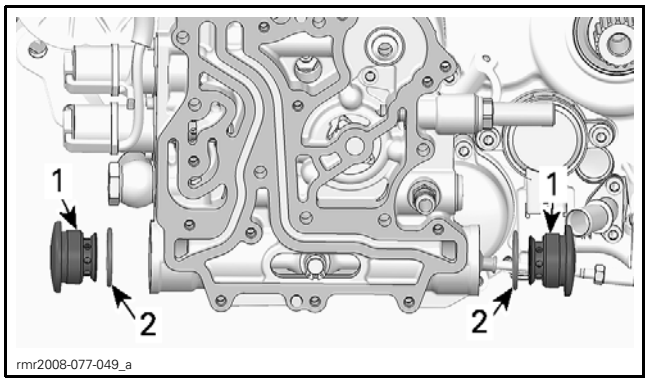
1. HCM cover gasket

Unscrew Allen screw from gear shift lever and remove shift linkage together with gear shift lever from the shift shaft.



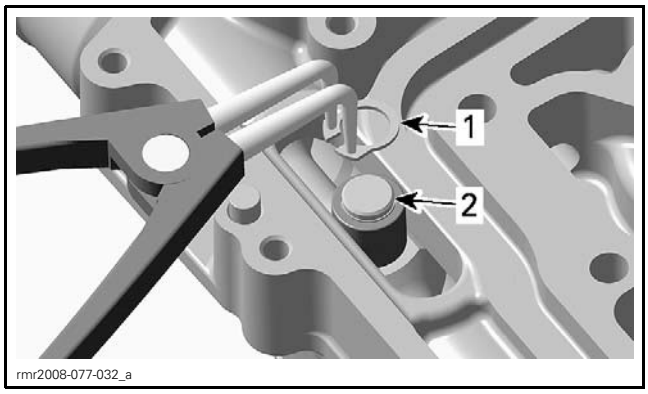
1. Allen screw
2. Gear shift lever
3. Shift linkage

Remove hydraulic piston plug screws.



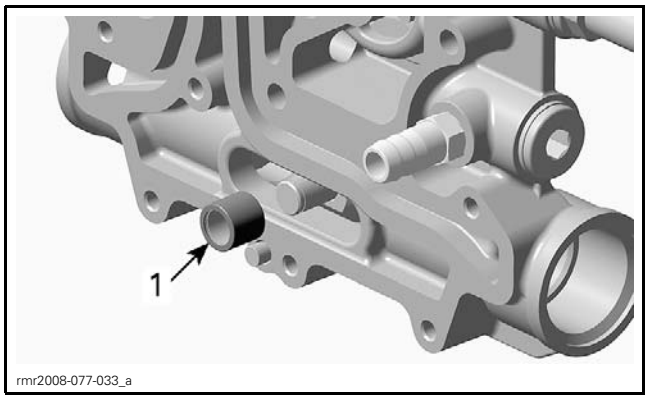
1. *Plug screws*
2. *Plug screw O-rings*

Remove retaining ring from guide pin.



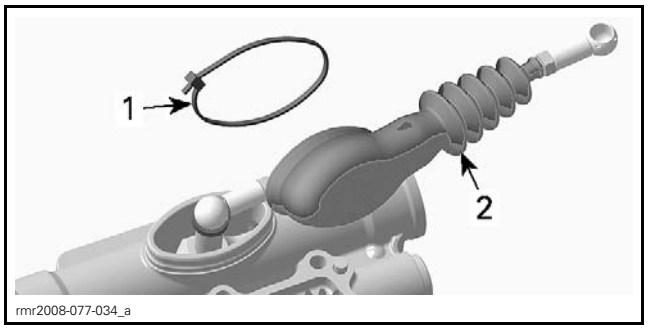
1. *Retaining ring*
2. *Guide pin*

Remove needle bushing from guide pin.



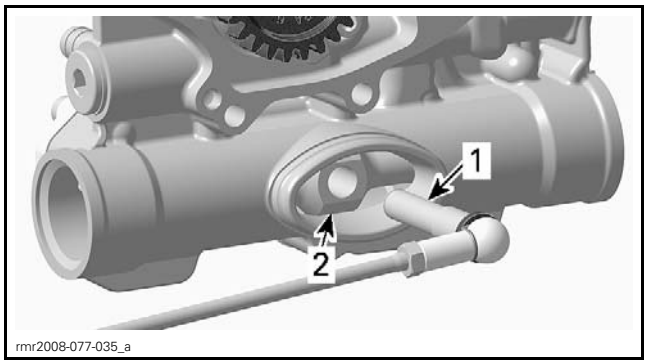
1. *Needle bushing*

Remove locking tie from bellow and slide bellow backwards.



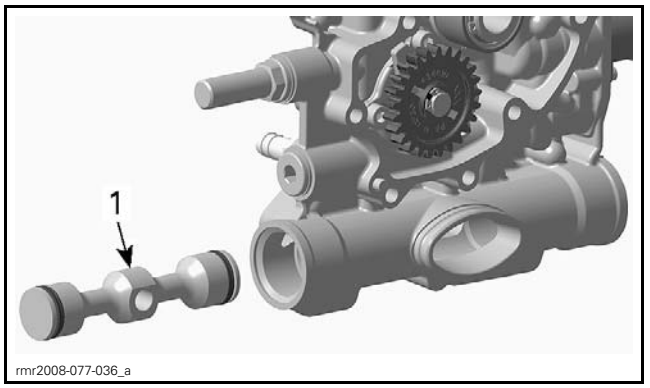
1. *Locking tie*
2. *Bellow*

Remove shift linkage from hydraulic piston.



1. *Shift linkage*
2. *Hydraulic piston*

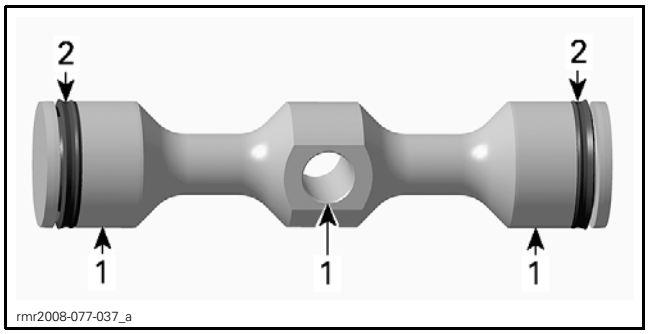
Remove hydraulic piston by sliding it out to either side of the hydraulic module.



1. *Hydraulic piston*

Hydraulic Piston Inspection

Check hydraulic piston and piston linings for any damage, scores or abnormal wear. Replace parts if necessary.

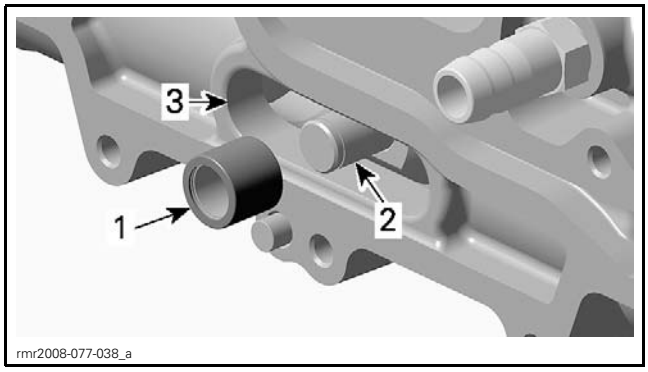


rmr2008-077-037_a

1. Check hydraulic piston in this area for wear
2. Piston linings

Check hydraulic piston bore inside the hydraulic control module for any damage, scores or abnormal wear. Replace parts if necessary.

Check needle bushing, guide pin and sliding slot of needle bushing inside hydraulic control module for wear, scores and abnormal damage. Replace parts if necessary.



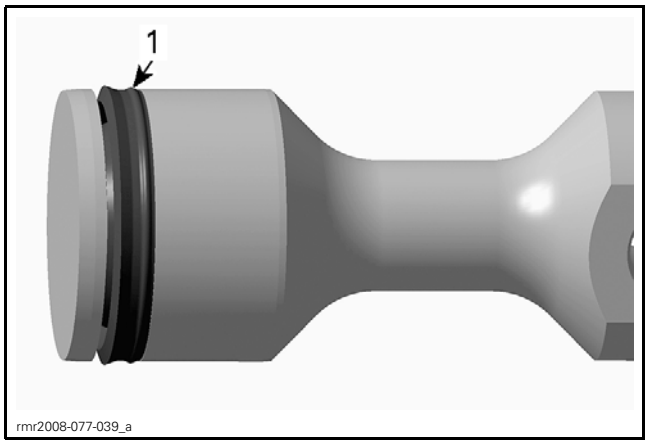
rmr2008-077-038_a

1. Needle bushing
2. Guide pin
3. Sliding slot

Hydraulic Piston Installation

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

NOTE: Sealing lip of piston linings must face away of each other.



rmr2008-077-039_a

1. Position of piston linings

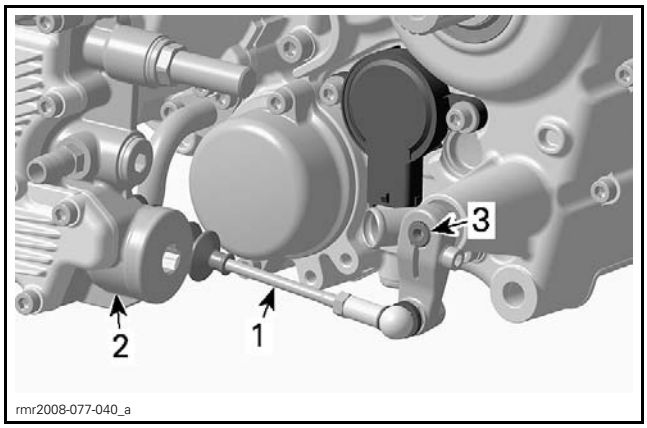
Oil hydraulic piston and piston linings prior of installation.

NOTE: Make sure not to damage the piston linings when installing the hydraulic piston.

After completing the installation check oil level in oil tank and refill with recommended oil if necessary. Refer to *LUBRICATION SYSTEM* subsection.

SHIFT LINKAGE

The shift linkage is the link between the hydraulic piston and the shift shaft.



rmr2008-077-040_a

1. Shifting linkage
2. Hydraulic piston
3. Shift shaft

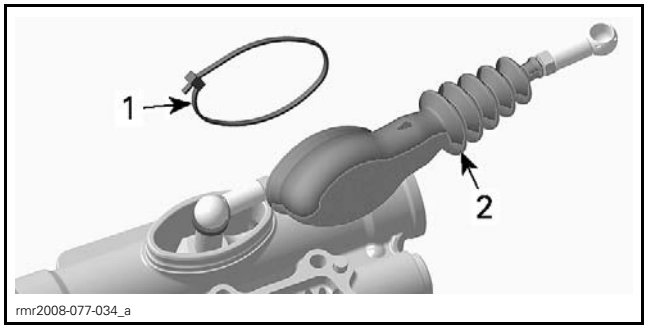
Shift Linkage Removal

NOTE: To carry out the following instruction, it is not necessary to remove the HCM from the engine. For better understanding, many of the following illustrations are taken with the HCM removed from the engine.

Select NEUTRAL position.

Remove body panels, refer to the *BODY* subsection.

Remove locking tie from bellow and slide bellow backwards.



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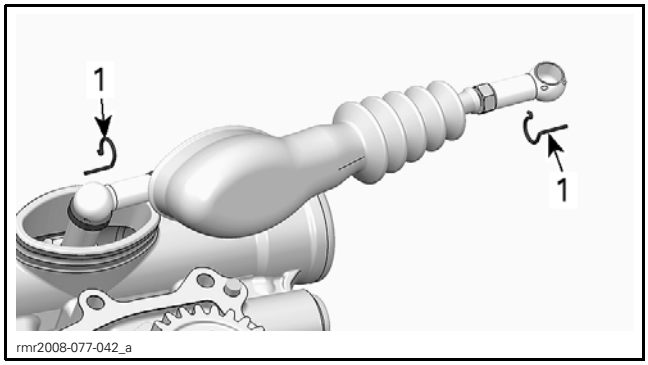
1. Locking tie
2. Bellow

Remove both circlips from shift linkage.



1. Circlips

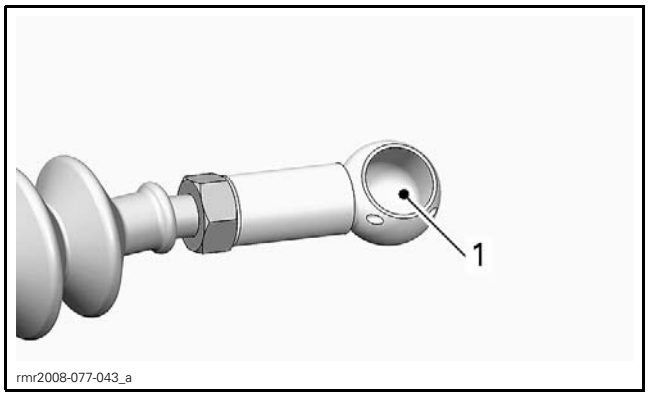
Shift Linkage Inspection

Check shift linkage rod for bending or any other damage.

Check both ball joints for abnormal wear.

Check bellow for brittle and cracks.

Replace parts if necessary.

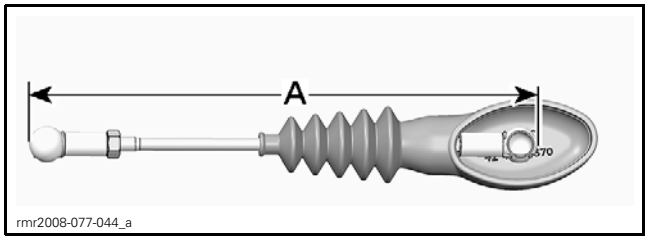


1. Check both ball joints in this area for wear

Shift Linkage Installation

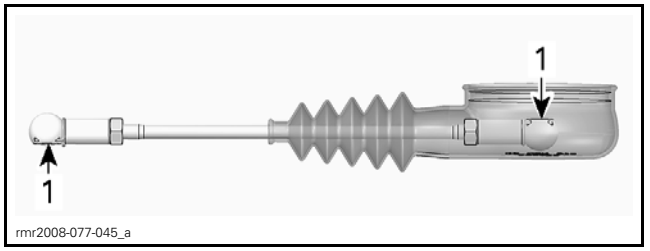
For installation, reverse the removal procedure. Pay attention to the following details.

For basic adjustment assemble the shift linkage to approximately 210 mm (8.268 in).



SHIFT LINKAGE BASIC LENGTH
A. 210 mm (8.268 in)

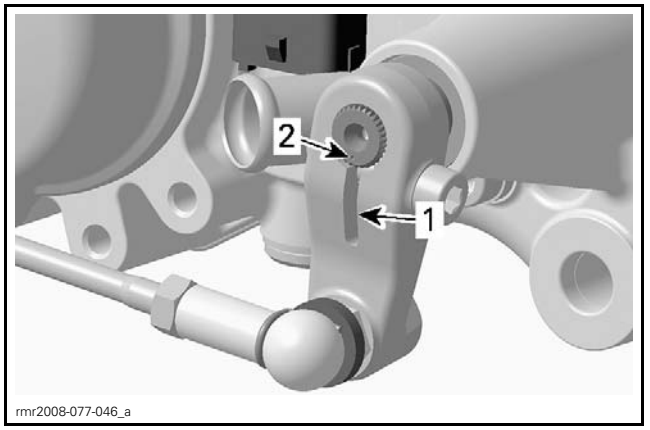
Ball joints must face in opposite direction.



1. Position of ball joints

Install NEW locking tie on bellow.

Install the gear shift lever. Align its slot with the dot on the end of shift shaft.



1. Gear shift lever slot
2. Shift shaft dot