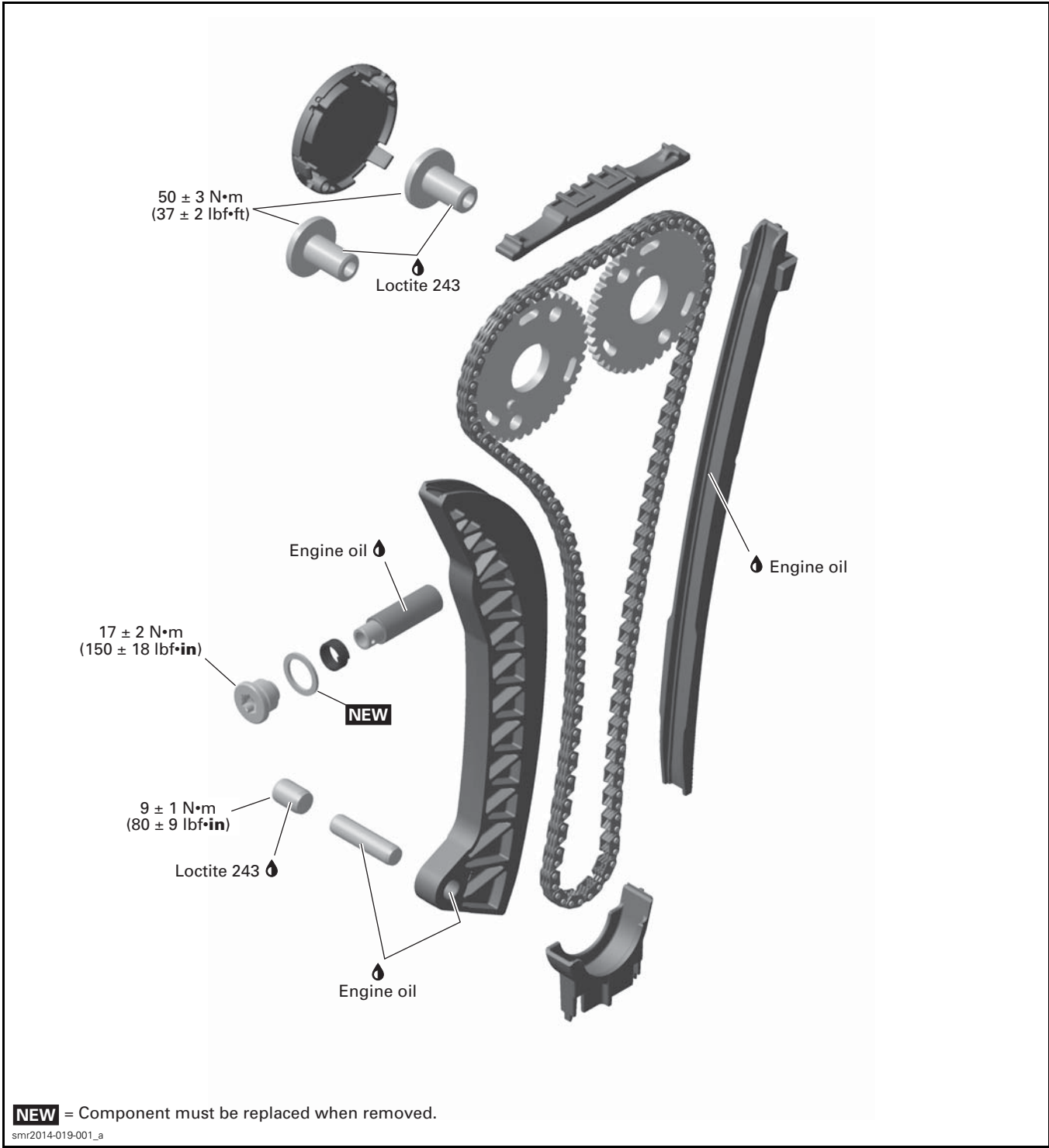


TIMING CHAIN

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE).....	293 800 060	4, 8



GENERAL

Engine removal is necessary to work on the following components:

- Timing chain
- Timing chain guide (tensioner side).

Always disconnect BLACK (-) cable from the battery, then RED (+) cable before working on the engine.

⚠ WARNING

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

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

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

⚠ WARNING

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

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

When disassembling parts that are duplicated in the engine, (e.g.: valves, springs, etc.), it is strongly recommended to note their position and to keep the parts of the same assembly as a "group". If you find a defective component, it will be much easier to find the cause of the failure. Since parts were broken-in together during engine operation, they will maintain their matched fit when reassembled together within their "group".

TROUBLESHOOTING

The following is provided to help in diagnosing the probable source of troubles. It is a guideline and should not be assumed to provide solutions to every cause of all problems.

UNUSUAL ENGINE NOISE OR VIBRATIONS

1. Faulty chain tensioner.
 - Replace chain tensioner.

2. Chain guide(s) worn out.
 - Replace chain guide(s).
3. Stretched timing chain or worn sprockets.
 - Replace timing chain and sprockets.
4. Camshaft timing gear screws loose.
 - Retighten screws to recommended torque.
5. Incorrect camshaft timing adjustment.
 - Replace damaged components and readjust camshaft timing.

ENGINE LACKS ACCELERATION OR POWER

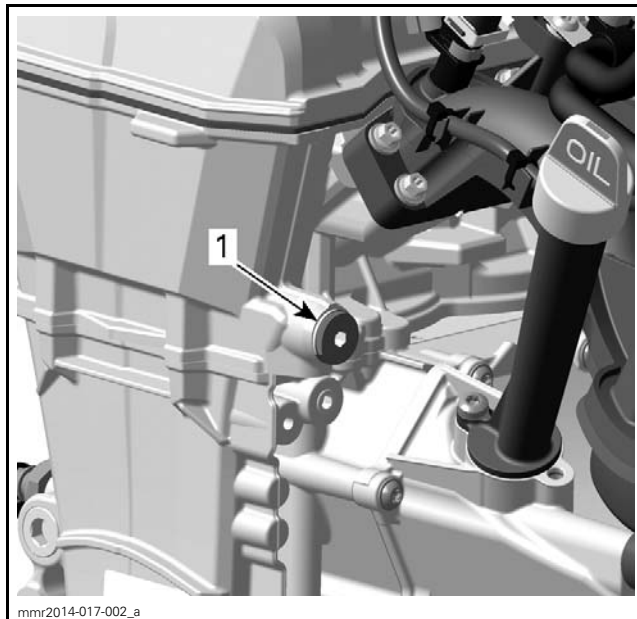
1. Incorrect camshaft timing adjustment.
 - Replace damaged components and readjust camshaft timing.

PROCEDURES

TIMING CHAIN TENSIONER

Timing Chain Tensioner Location

The timing chain tensioner is located in the cylinder head beside the intake port of the PTO cylinder.



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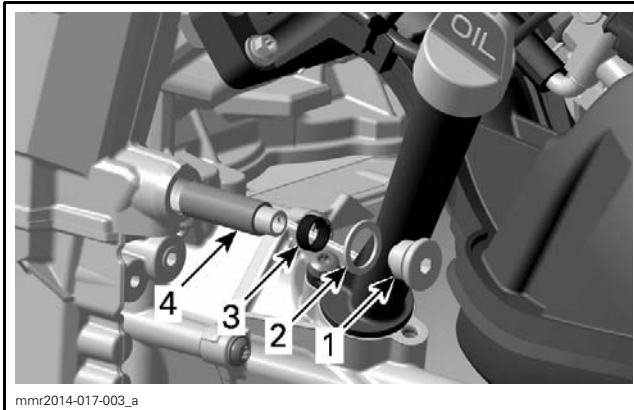
1. Screw plug location, timing chain tensioner

Timing Chain Tensioner Access

Remove countershaft. Refer to *COUNTERSHAFT REMOVAL* in *DRIVEN PULLEY AND COUNTERSHAFT* subsection.

Timing Chain Tensioner Removal

1. Lock crankshaft, refer to *CYLINDER BLOCK* subsection.
2. Remove screw plug and discard the sealing washer.
3. Pull out spring and chain tensioner.



1. Screw plug
2. Sealing washer
3. Spring
4. Chain tensioner

Timing Chain Tensioner Inspection

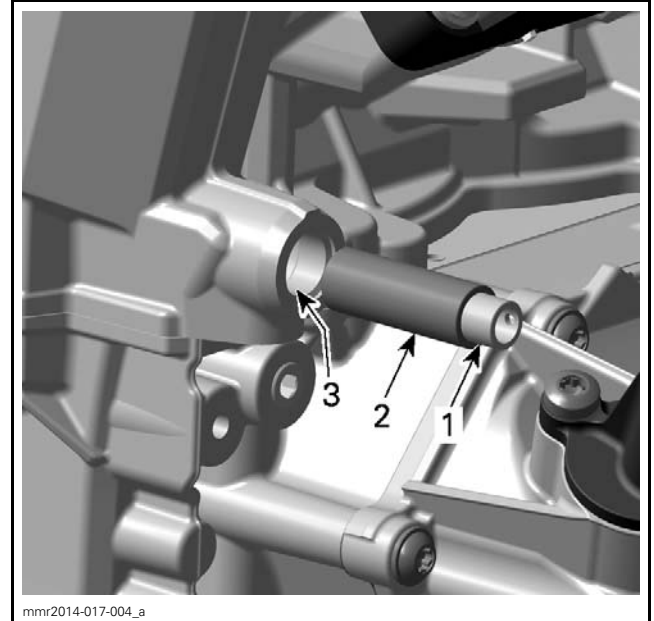
1. Check chain tensioner for scoring and freedom of movement in bore.
2. Compress chain tensioner and check for proper operation.

NOTE: The chain tensioner is difficult to compress when properly charged with oil, and easily compressed when it is not.

3. Check spring for straightness, corrosion and other visible damage.

Timing Chain Tensioner Installation

1. Apply engine oil on chain tensioner.
2. Insert chain tensioner in its bore with the plunger pointing outwards.



TIMING CHAIN TENSIONER INSTALLATION

1. Plunger
2. Chain tensioner
3. Tensioner bore in cylinder head

3. Install spring on chain tensioner.
4. Tighten screw plug to specified torque.

SCREW PLUG TIMING CHAIN TENSIONER	
Sealing washer	NEW
Tightening torque	17 N•m ± 2 N•m (150 lbf•in ± 18 lbf•in)

5. Install all other removed parts.

CAMSHAFT TIMING GEARS

Camshaft Timing Gear Removal

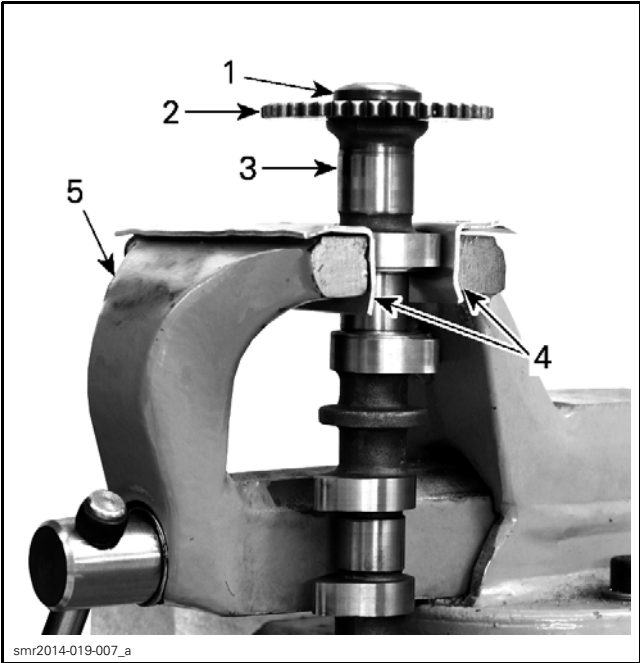
Remove camshaft assembly. Refer to *CYLINDER HEAD* subsection.

Clamp camshaft in a vice using aluminium protectors.

NOTICE Take care not damaging the cams.

Unscrew and remove camshaft timing gear screw.

Remove camshaft timing gear.



- 1. Camshaft timing gear screw
- 2. Camshaft timing chain gear
- 3. Camshaft
- 4. Aluminium protectors
- 5. Vice

Camshaft Timing Gear Inspection

Check camshaft timing gears for wear or deterioration. If a gear is worn or damaged, replace camshaft timing gears and timing chain as a set.

NOTE: For crankshaft timing gear inspection, refer to *CYLINDER BLOCK* subsection.

Camshaft Timing Gear Installation

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

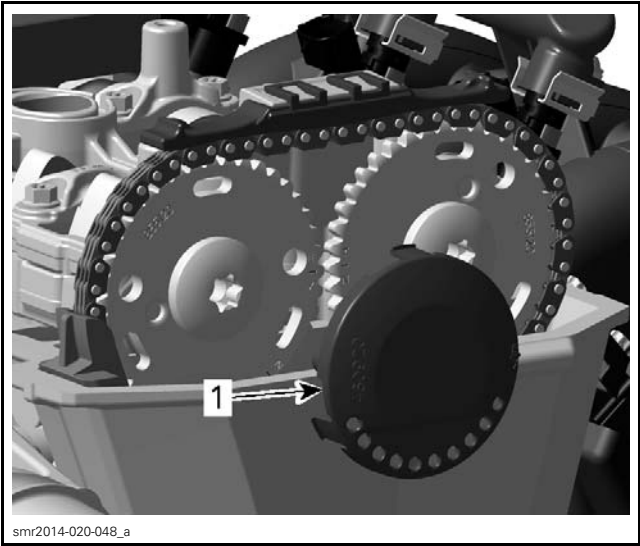
Tighten camshaft timing gear screw to specification.

NOTICE Do not torque timing gear screws when camshafts are installed in cylinder head to avoid overstressing timing chain.

TIMING GEAR SCREWS	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening torque	50 N•m ± 3 N•m (37 lbf•ft ± 2 lbf•ft)

NOTICE Improper camshaft timing will damage engine components. Make sure camshafts and crankshaft are still locked. If not, lock them before beginning this procedure. Refer to *CAMSHAFTS* in the *CYLINDER HEAD* subsection.

Install breather cover on exhaust camshaft.



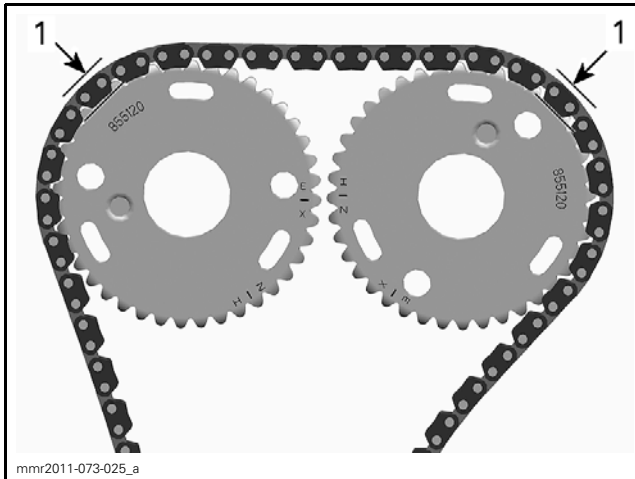
- 1. Breather cover

Install remaining parts.

TIMING CHAIN

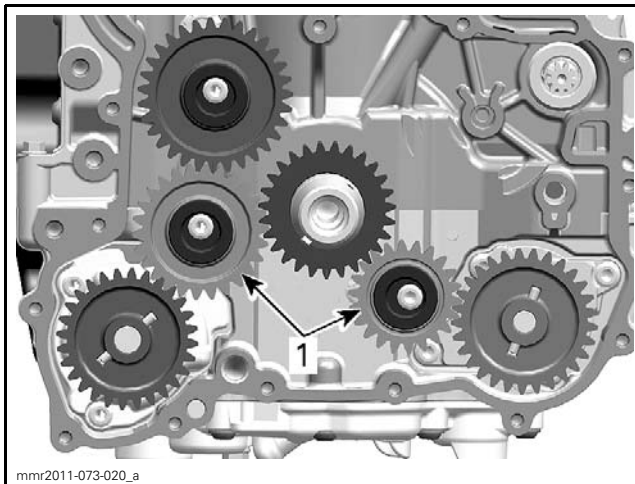
Timing Chain Removal

1. Remove engine from vehicle. Refer to *ENGINE REMOVAL AND INSTALLATION* subsection.
2. Remove air intake manifold, refer to *AIR INTAKE SYSTEM* subsection.
3. Remove valve cover, refer to *CYLINDER HEAD* subsection.
4. Refer to *LUBRICATION SYSTEM* subsection and remove the following parts:
 - Oil tank
 - Oil pressure regulator valve
 - Oil cooler
 - Oil sump cover.
5. Refer to *COOLING SYSTEM* subsection and remove following parts:
 - Water pump housing
 - Thermostat.
6. Check timing chain for excessive radial play while still installed on timing gears.



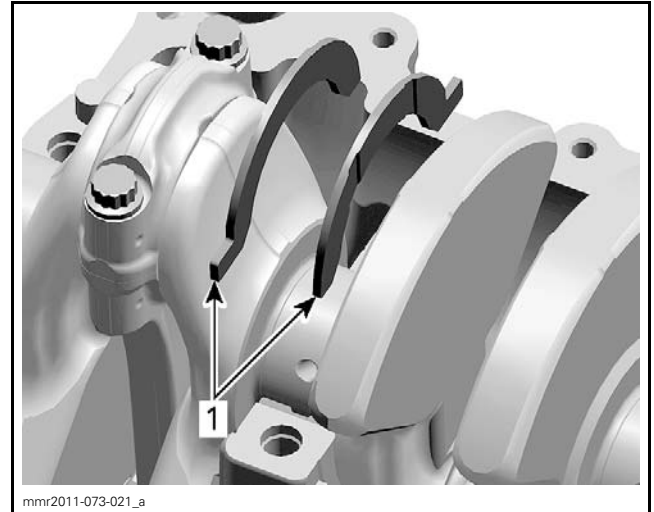
1. Radial play

7. Remove the *CAMSHAFTS*, refer to *CYLINDER HEAD* subsection.
8. Refer to *MAGNETO AND STARTER* subsection and remove the following parts:
 - Magneto cover
 - Rotor
 - Starter drive gears.
9. Remove oil pump intermediate gears, refer to *LUBRICATION SYSTEM* subsection.



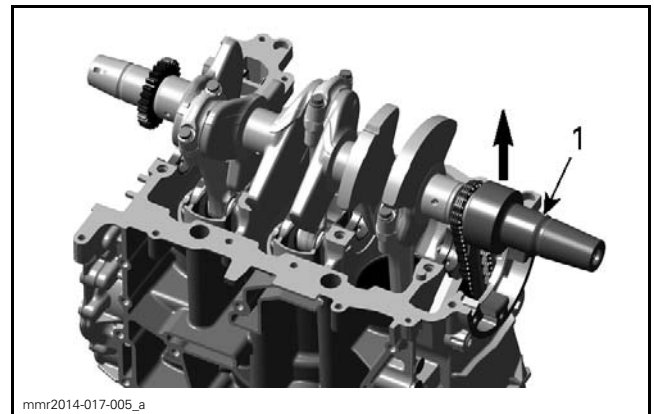
1. Oil pump intermediate gears

10. Remove crankshaft locking bolt.
11. Separate cylinder block, refer to *CYLINDER BLOCK* subsection.
12. Remove crankshaft thrust washers.



1. Crankshaft thrust washers

13. Slightly lift the crankshaft.



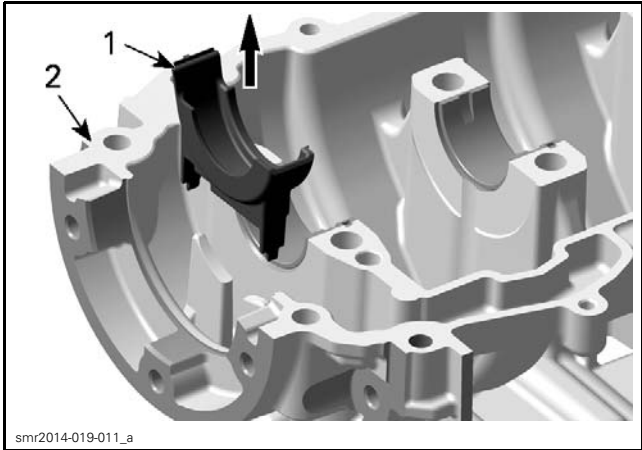
LIFT CRANKSHAFT

1. Crankshaft

14. Remove timing chain.

NOTE: Make a mark on the timing chain to indicate the operating direction of the chain before removal.

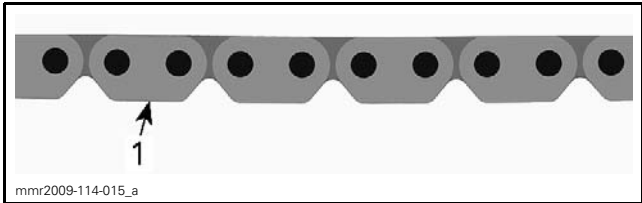
15. Remove lower timing chain guide from lower half of cylinder block.



1. Lower timing chain guide
2. Lower half of cylinder block

Timing Chain Inspection

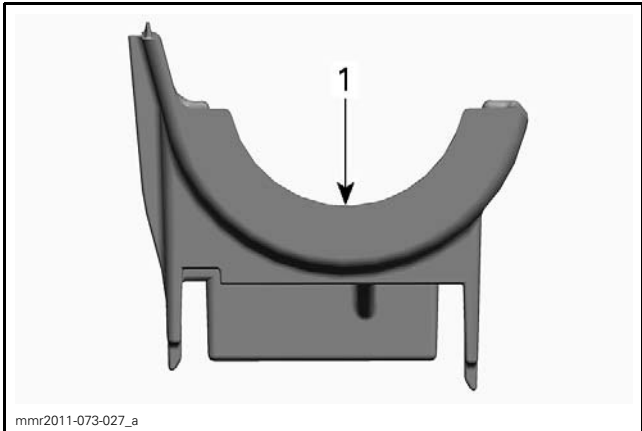
Check timing chain for wear and teeth condition.



1. Check teeth condition

NOTICE If timing chain is excessively worn or damaged, replace timing chain and camshaft timing gears as a set.

Check lower chain guide for wear, cracks or deformation. Replace as required.



1. Lower chain guide

Replace lower chain guide if timing chain wear grooves are visible.

CHAIN GUIDE GROOVE DEPTH	
SERVICE LIMIT	No timing chain wear groove allowed

NOTE: Also check the chain guide, tensioner side. Refer to *CHAIN GUIDE INSPECTION (TENSIONER SIDE)* in this subsection.

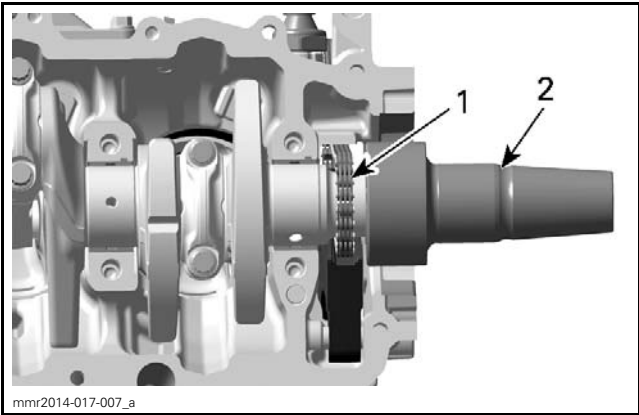
Timing Chain Installation

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

1. Install timing chain on crankshaft timing gear.

NOTE: If the same timing chain is reinstalled, be sure to reinstall it in the same operating direction as marked during removal procedure.

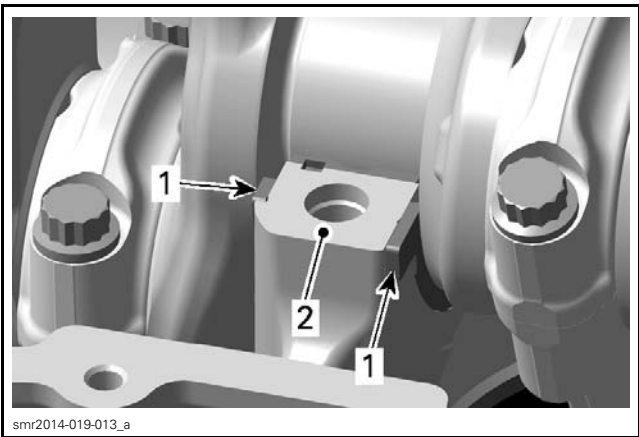
2. Install crankshaft.



1. Timing chain
2. Crankshaft

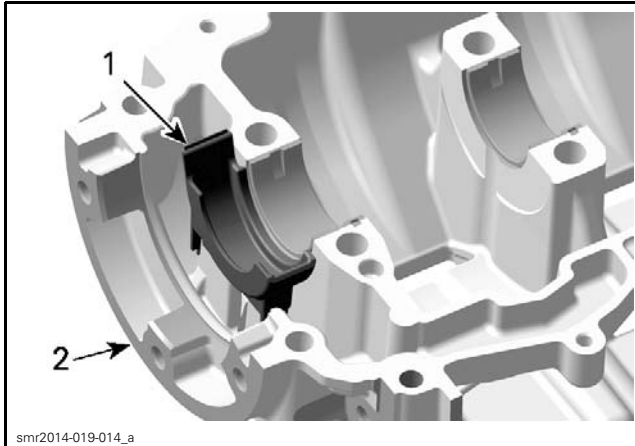
3. Properly install the crankshaft thrust washers with the slots facing against crankshaft counterweights.

NOTE: Crankshaft thrust washers must be flush with the cylinder block sealing surface.



1. Crankshaft thrust washers
2. Sealing surface

4. Reinstall lower chain guide in lower half of cylinder block.



1. Lower chain guide
2. Lower half of cylinder block

5. Reassemble cylinder block, refer to *CYLINDER BLOCK* subsection.
6. Lock crankshaft, refer to *CRANKSHAFT LOCKING PROCEDURE* in the *CYLINDER BLOCK* subsection.
7. Reinstall timing chain properly on camshaft timing gears. Refer to *CAMSHAFT INSTALLATION* in the *CYLINDER HEAD* subsection.

NOTICE Improper camshaft timing will damage engine components.

8. Install all other removed parts.

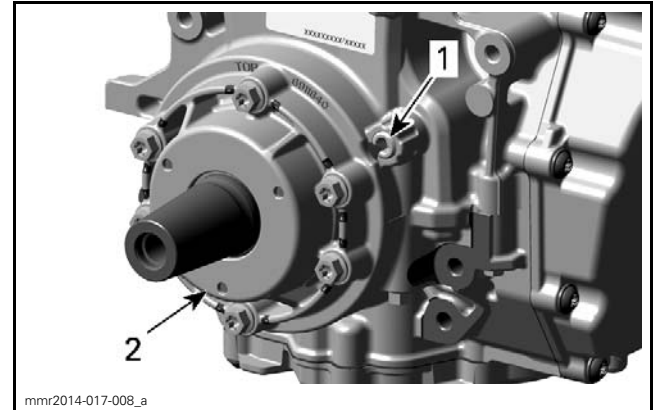
NOTE: Be sure to remove camshaft and crankshaft locking tools when timing chain is completely installed.

CHAIN GUIDE (TENSIONER SIDE)

Chain Guide Removal (Tensioner Side)

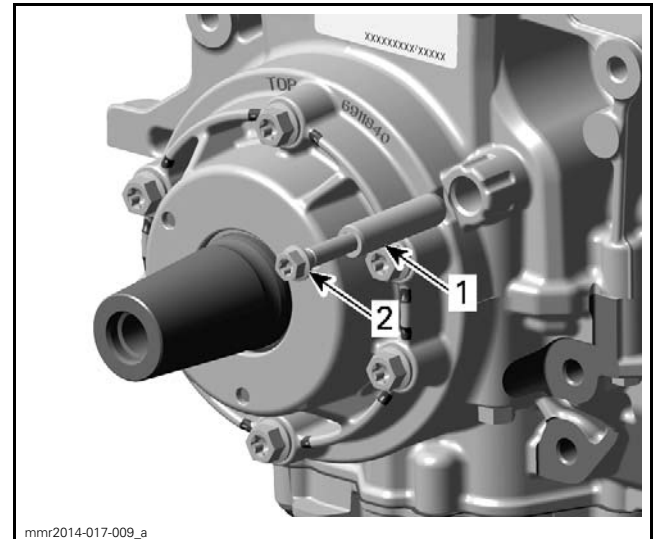
NOTE: Removal of chain guide is not recommended if there is no need for replacement.

1. Remove the *CAMSHAFTS*. Refer to *CYLINDER HEAD* subsection.
2. Remove screw plug that covers the chain guide bearing pin.



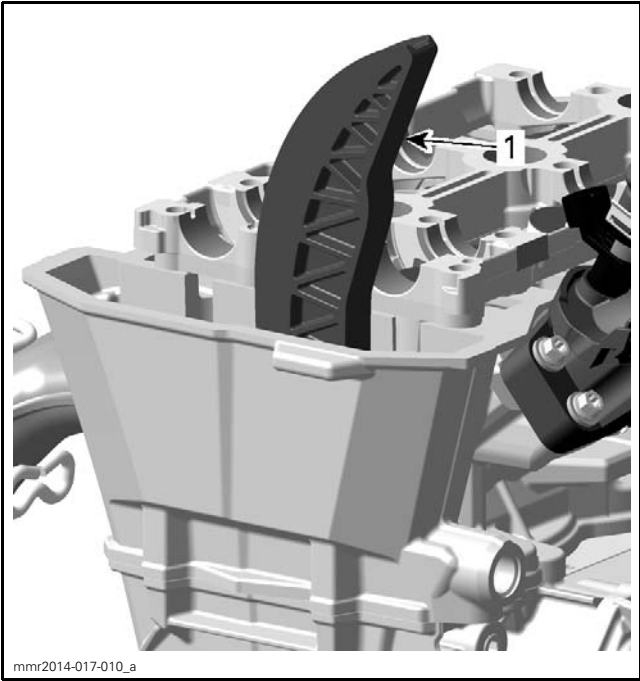
1. Screw plug location
2. PTO cover

3. Use an M6 bolt to pull chain guide bearing pin out of cylinder block.



1. Chain guide bearing pin
2. M6 bolt

4. Remove chain guide (tensioner side).



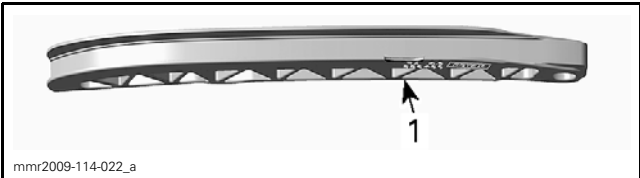
1. Chain guide (tensioner side)

Chain Guide Inspection
(Tensioner Side)

Check chain guide for wear, cracks or deforming. Replace as required.

Replace chain guide if groove depth caused by timing chain exceeds service limit.

CHAIN GUIDE GROOVE DEPTH	
SERVICE LIMIT	1 mm (.039 in)



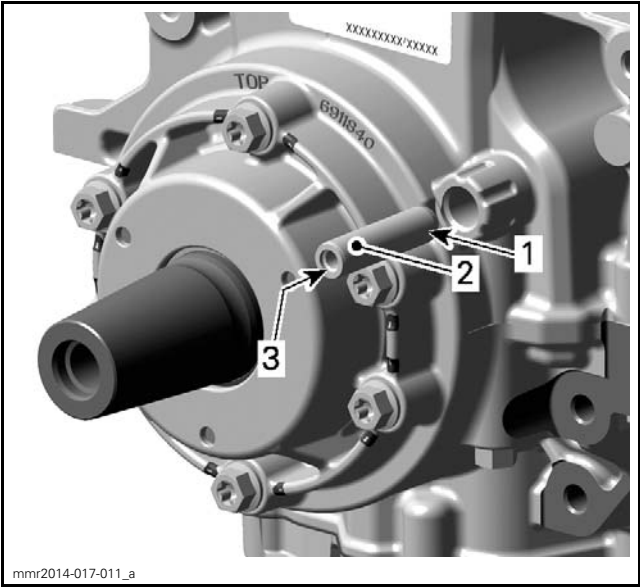
TYPICAL
1. Chain guide

Chain Guide Installation
(Tensioner Side)

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

1. Insert chain guide.
2. Apply engine oil on bearing pin and install it with M6 threads facing outwards.

NOTICE Ensure chain guide bearing pin is properly inserted in the chain guide.



1. Bearing pin
2. Apply engine oil here
3. M6 threads facing outwards

3. Tighten screw plug as specified.

NOTE: Install screw plug only in final assembled cylinder block to avoid warpage of sealing surface.

SCREW PLUG	
Service product	LOCTITE 243 (BLUE) (P/N 293 800 060)
Tightening torque	9 N•m ± 1 N•m (80 lbf•in ± 9 lbf•in)

4. Properly reinstall camshafts. Refer to *CAMSHAFTS* in the *CYLINDER HEAD* subsection.

NOTICE Improper camshaft timing will damage engine components.