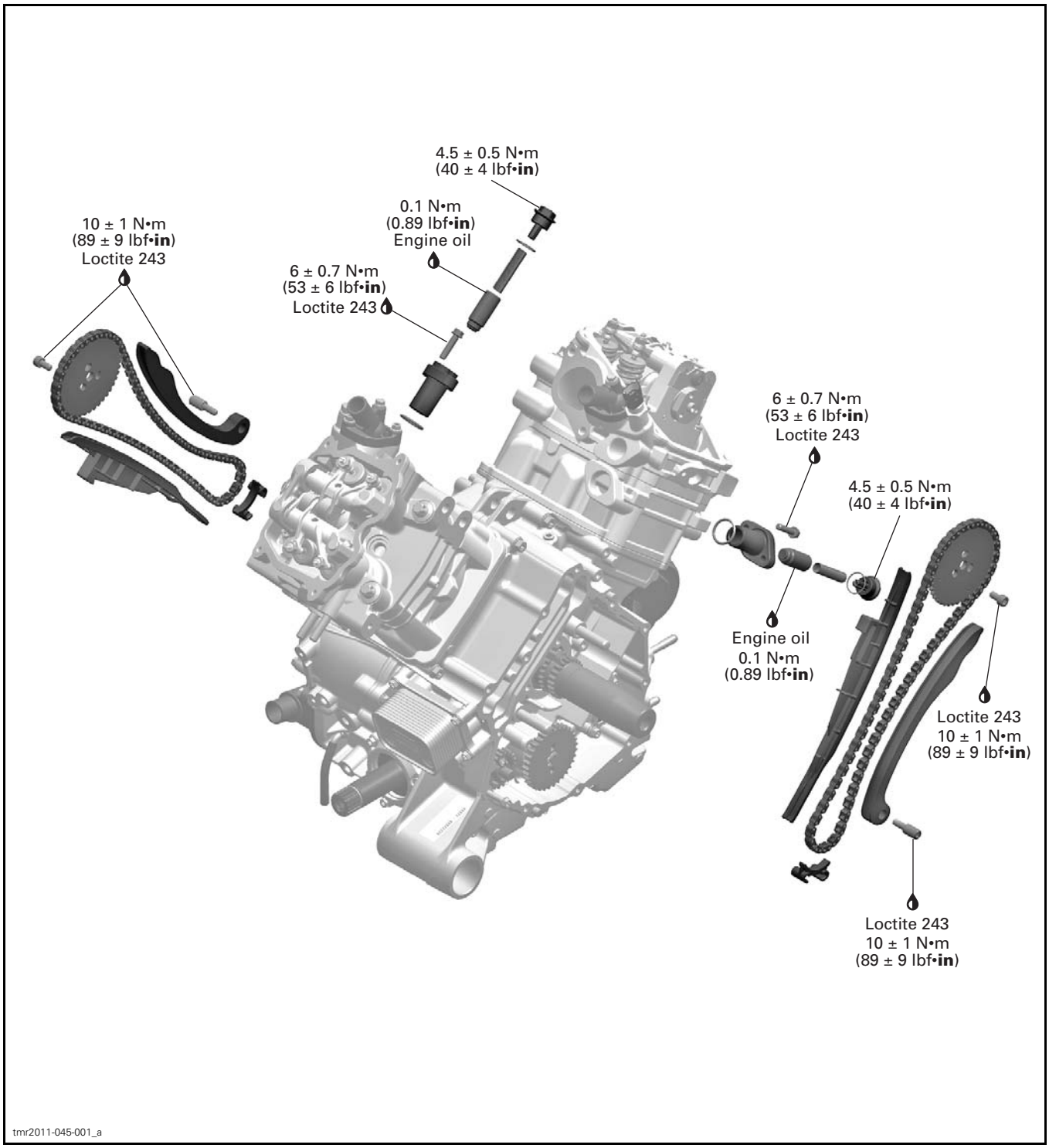
TIMING CHAIN

SERVICE TOOLS

Description	Part Number	Page
CAMSHAFT TIMING TOOL	529 036 231	5
CRANKSHAFT TDC POSITION TOOL	529 036 201	5, 9

SERVICE PRODUCTS

Description	Part Number	Page
LOCTITE 243 (BLUE)	293 800 060	6


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

GENERAL

During assembly/installation, use the torque values and service products as shown in the exploded view(s).

Clean threads before applying a threadlocker. Refer to *SELF-LOCKING FASTENERS* and *LOCTITE APPLICATION* in *INTRODUCTION* subsection.

⚠ WARNING

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

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

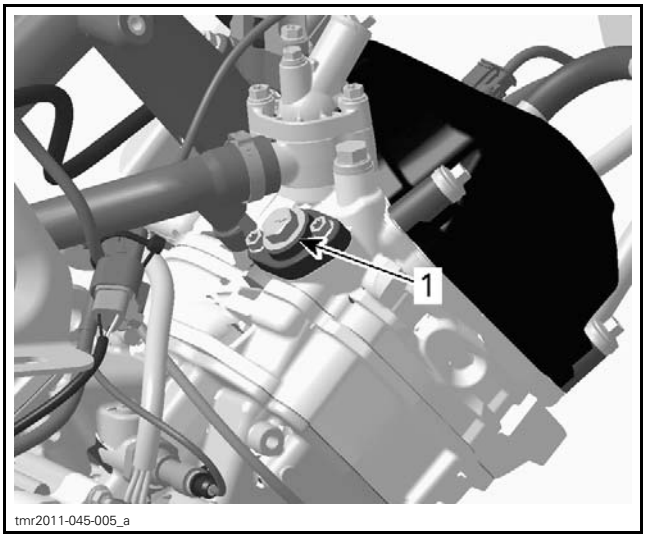
1. INCORRECT CAMSHAFT TIMING
   - *Replace damaged components and readjust camshaft timing.*

PROCEDURES

TIMING CHAIN TENSIONERS

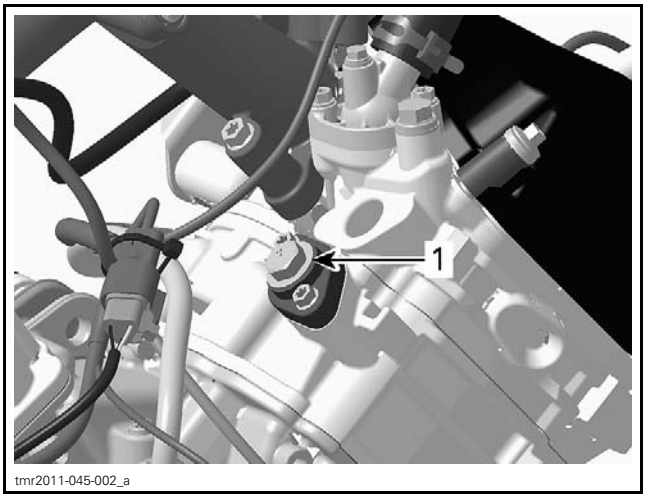
Timing Chain Tensioner Location

800R Engine



800R ENGINE - CYLINDER HEAD (FRONT CYLINDER)
1. Timing chain tensioner

1000 Engine



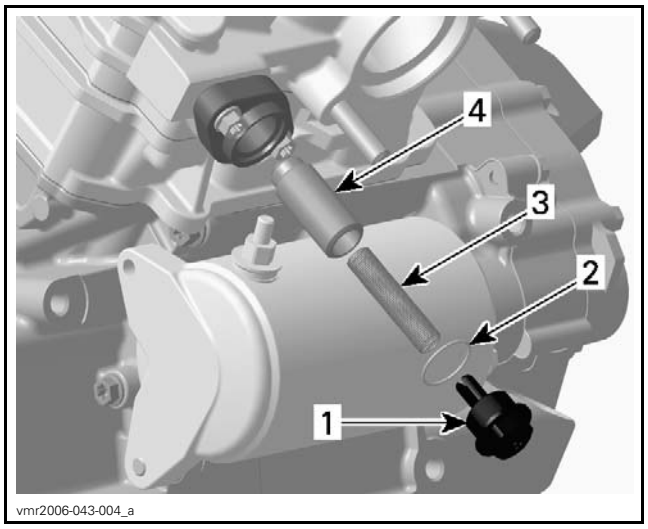
1000 ENGINE - FRONT CYLINDER
1. Timing chain tensioner

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.

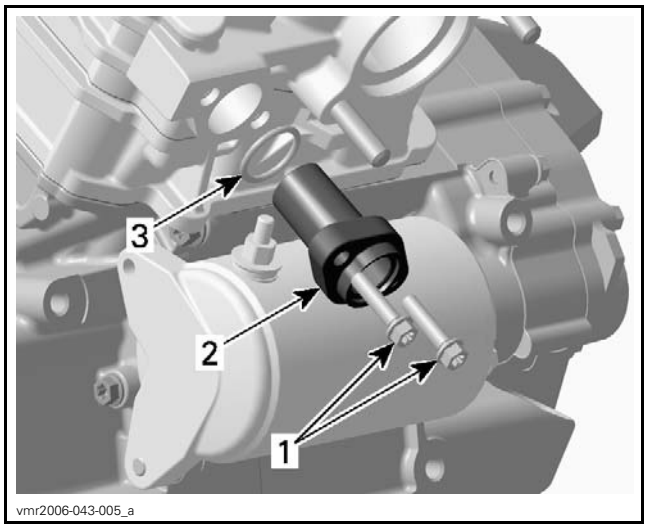
⚠ CAUTION Tensioner is spring loaded.

3. Remove O-ring, spring and chain tensioner plunger.



1. Chain tensioner screw plug
2. O-ring
3. Spring
4. Chain tensioner plunger

4. Remove chain tensioner housing retaining screws.
5. Remove chain tensioner housing and 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.

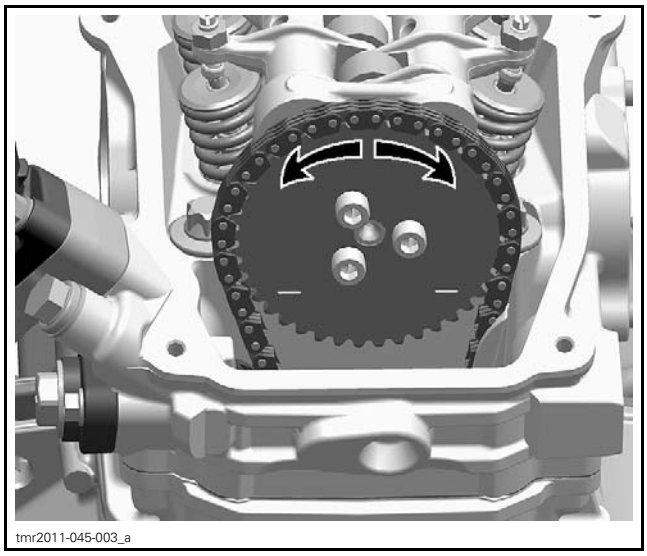
Ensure O-rings are not brittle, cracked or hard. Replace if necessary.

Check spring condition. Replace if 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 (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.

NOTE: Turn spring only clockwise in order to fit the spring end into the notch of the plunger and 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.

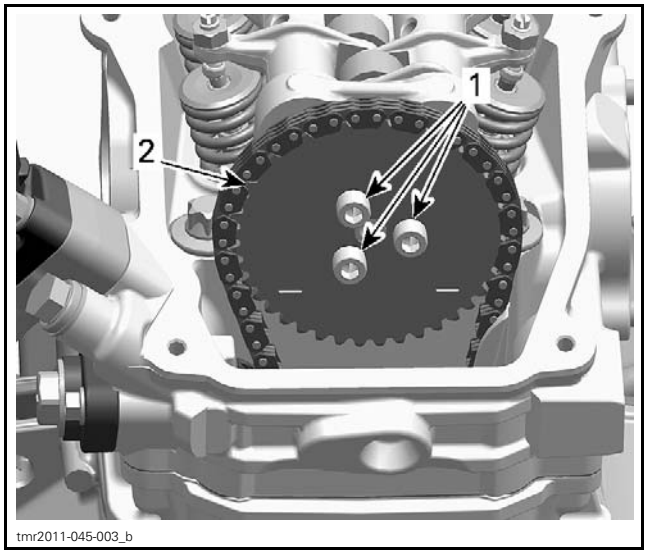
NOTE: To avoid overstressing the timing chain, the chain tensioner screw plug must engage in the tensioner bore threads within the first full turn.

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.

NOTE: Secure timing chain with a piece of wire.

Camshaft Timing Gear Inspection

Check camshaft timing gear for wear or deterioration.

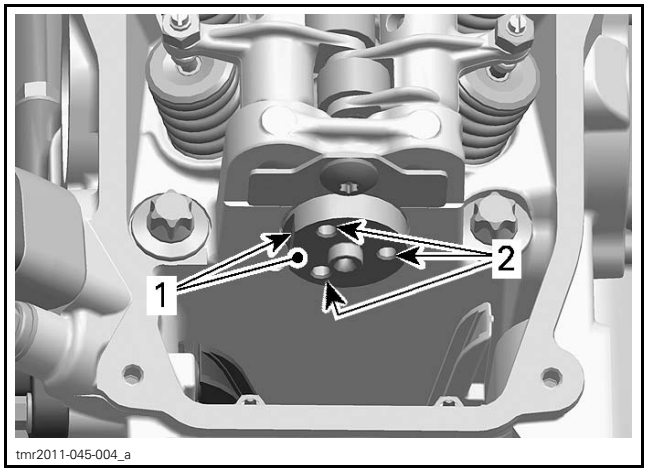
If timing gear is worn or damaged, replace it as a set with the timing chain).

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

Camshaft Timing Gear Installation

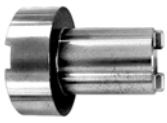
For installation, reverse the removal procedure. Pay attention to the following details.

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



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

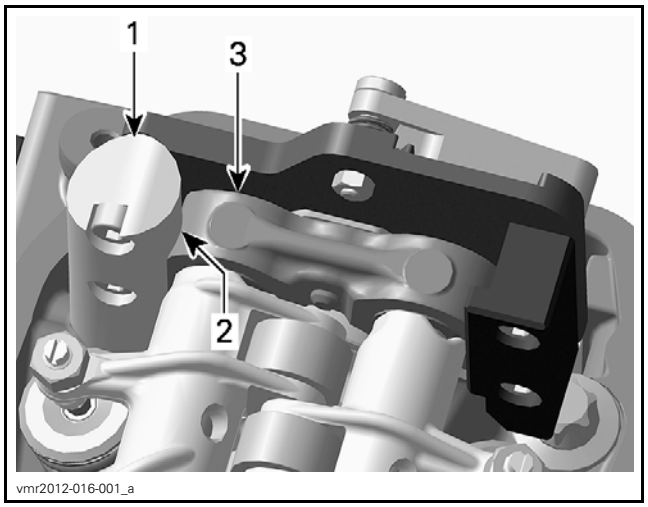
2. Set applicable piston to TDC ignition position and install the crankshaft position tool, refer to *CAMSHAFT TIMING* in this subsection.

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

3. Install camshaft timing tool.

REQUIRED TOOL	
CAMSHAFT TIMING TOOL (P/N 529 036 231)	

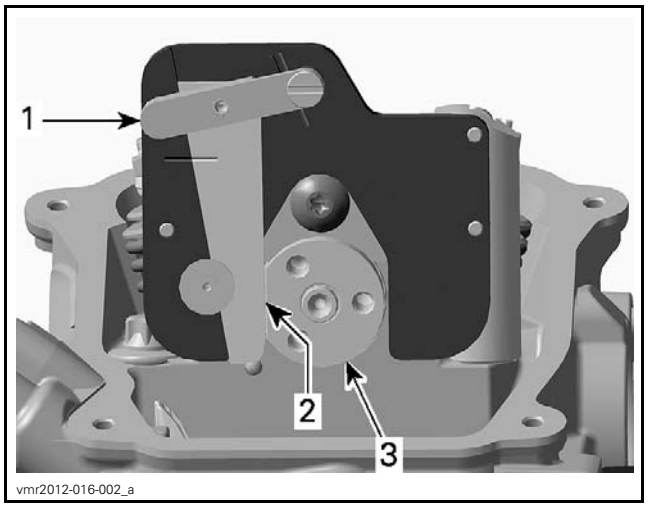
NOTE: Properly align tube of camshaft timing tool with machined radius on cylinder head.



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

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

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

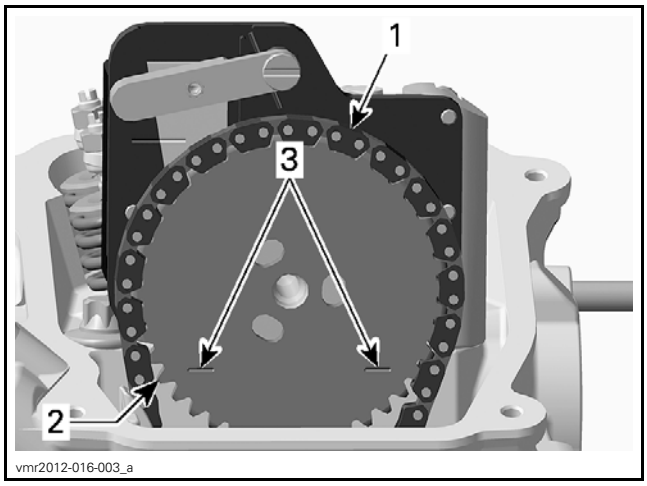


PRESS TOOL LEVER DOWN
1. *Lever*
2. *Flat portion*
3. *Camshaft*

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

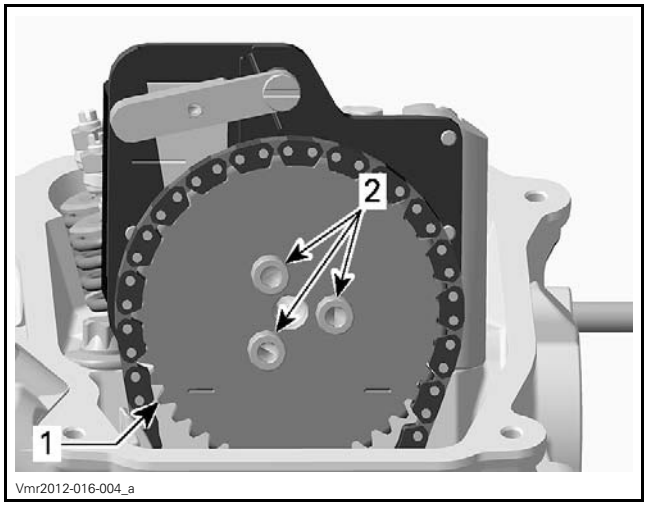
5. Place camshaft timing gear and timing chain on the camshaft.

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*

6. Install and adjust timing chain tensioner, refer to *TIMING CHAIN TENSIONER* in this subsection.
7. Apply LOCTITE 243 (BLUE) (P/N 293 800 060) on the camshaft timing gear retaining screw threads.
8. Install and tighten camshaft timing gear retaining screws to specified torque.



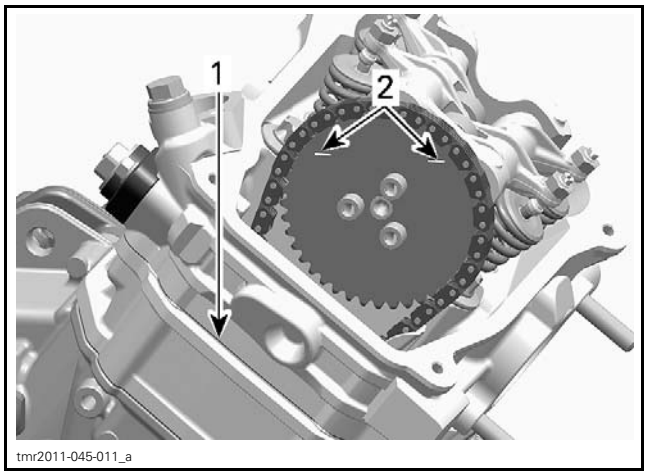
1. *Camshaft timing gear*
2. *Timing gear retaining screws*

TORQUE	
Camshaft Timing Gear Retaining Screws	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

9. Remove the camshaft timing tool.

Camshaft Timing

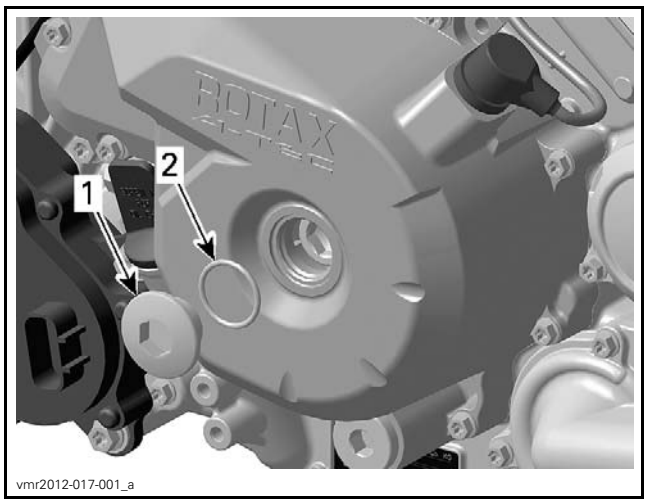
NOTE: If a piston (cylinder 1 or 2) is set to TDC ignition, the camshaft timing gear of the opposite cylinder must be in the following position.



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

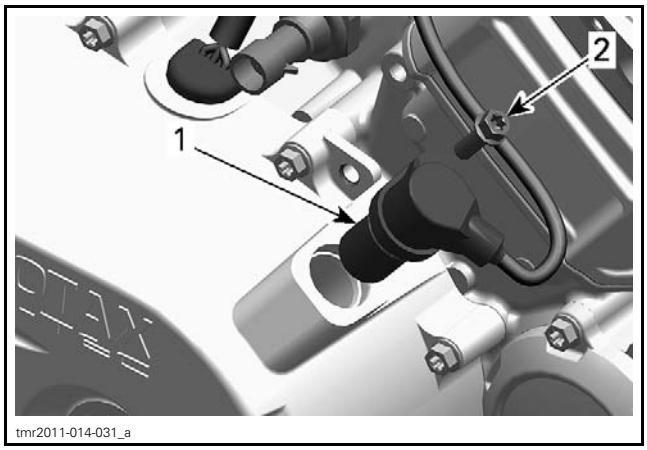
Camshaft Timing Piston No. 2 (rear)

1. Remove spark plugs from both cylinders.
2. Remove valve covers from 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).

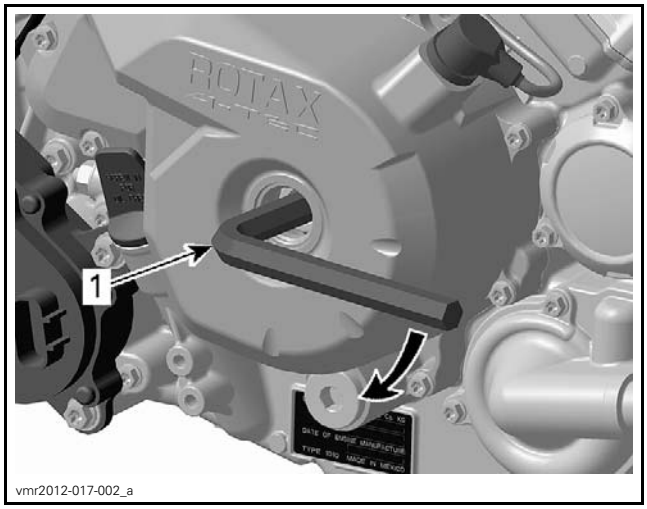


1. *CPS*
2. *Screw*

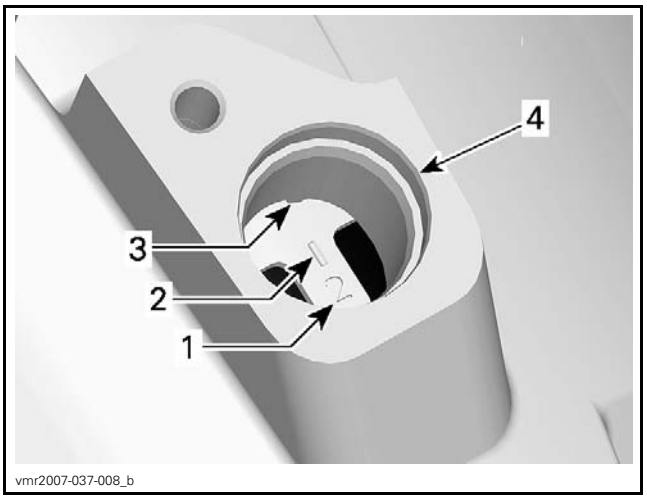
5. Set rear piston (number 2) to TDC ignition by turning the crankshaft clockwise until the following marks are aligned.

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

REQUIRED TOOL
Allen key 14 mm



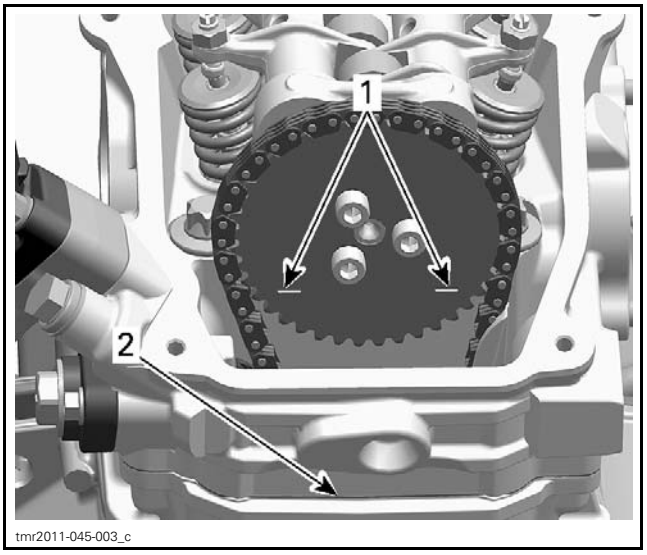
TURN CRANKSHAFT CLOCKWISE TO PISTON NO. 2 TDC
1. *Allen key 14 mm*



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*

6. Confirm printed marks on the camshaft timing gear are aligned parallel with cylinder head base.

NOTE: If marks are not as specified, turn crankshaft 360°.



TYPICAL
1. *Printed marks on camshaft timing gear*
2. *Cylinder head base*

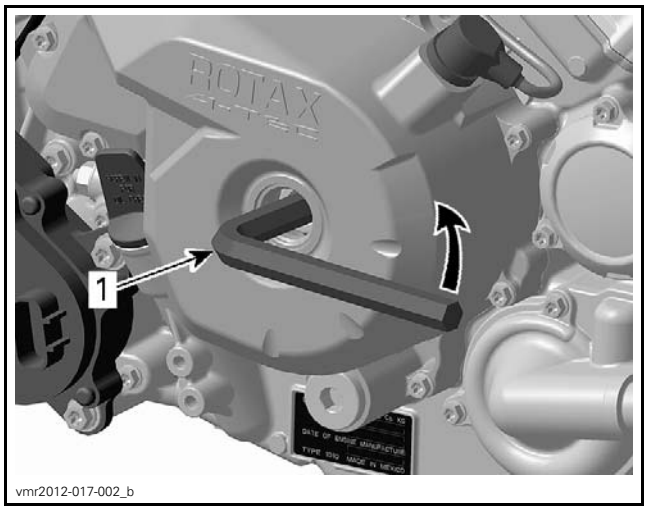
7. Install the crankshaft TDC position tool to lock crankshaft in position. Refer to *CRANKSHAFT TDC POSITION TOOL* in this subsection.

Camshaft Timing Piston No. 1 (front)

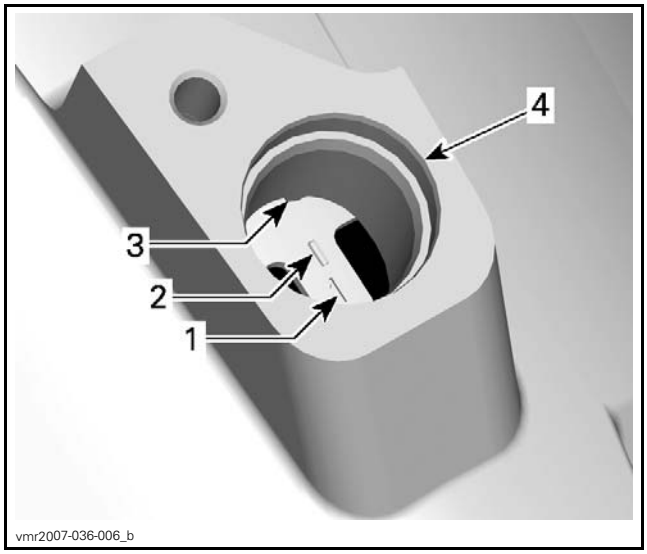
1. Set rear piston no. 2 to **TDC ignition**, see *CAMSHAFT TIMING CYLINDER 2 (REAR)* in this subsection.
2. Remove crankshaft TDC position tool.
3. Turn crankshaft 440° **clockwise**, until the following marks are aligned.

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

REQUIRED TOOL
Allen key 14 mm

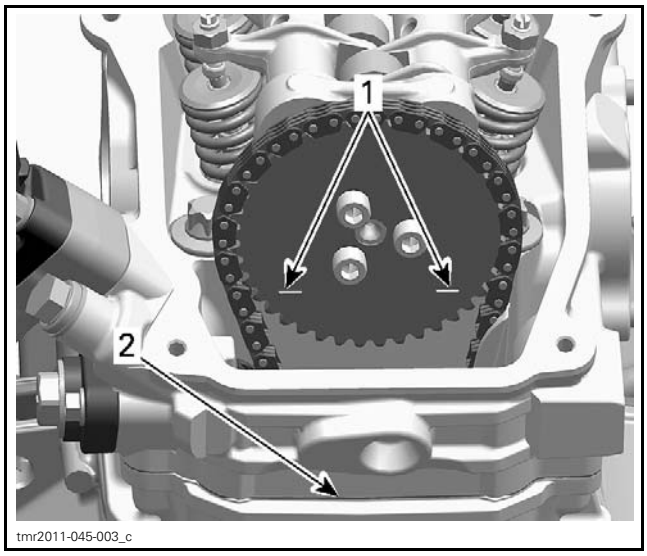


TURN CLOCKWISE 440° TO NUMBER 1PISTON TDC
1. *Allen key 14 mm*



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

NOTE: At **TDC ignition**, the printed marks on the camshaft timing gear must be aligned parallel to cylinder head base as per following illustration.

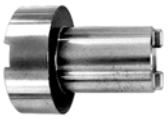


TYPICAL
1. *Printed marks on camshaft timing gear*
2. *Cylinder head base*

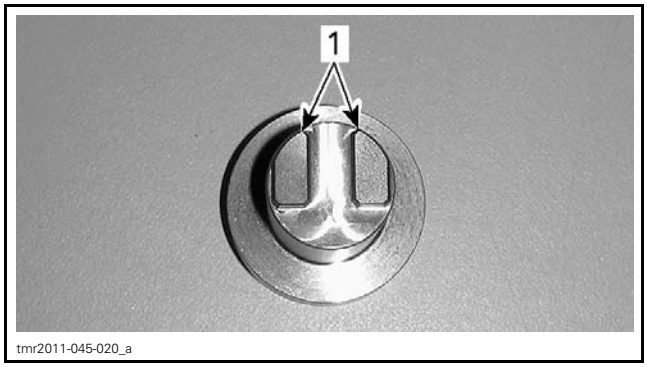
4. Insert the crankshaft TDC position tool to lock crankshaft in position. Refer to *CRANKSHAFT TDC POSITION TOOL INSTALLATION* in this subsection.

Crankshaft TDC Position Tool Installation

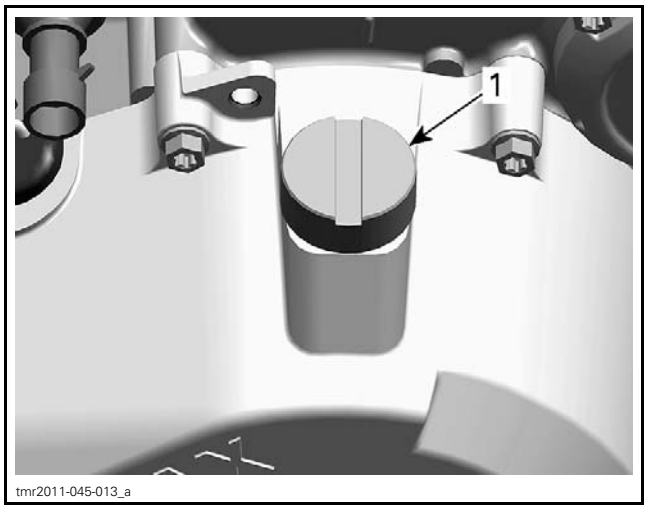
Install tool in magneto cover CPS bore.

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.

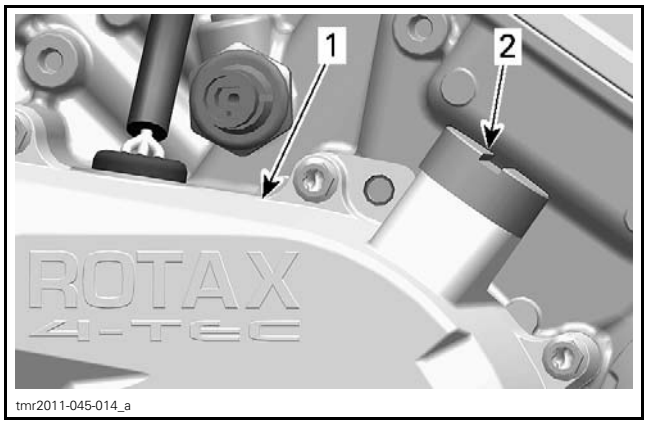


1. *Crankshaft TDC position tool teeth (end view)*



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

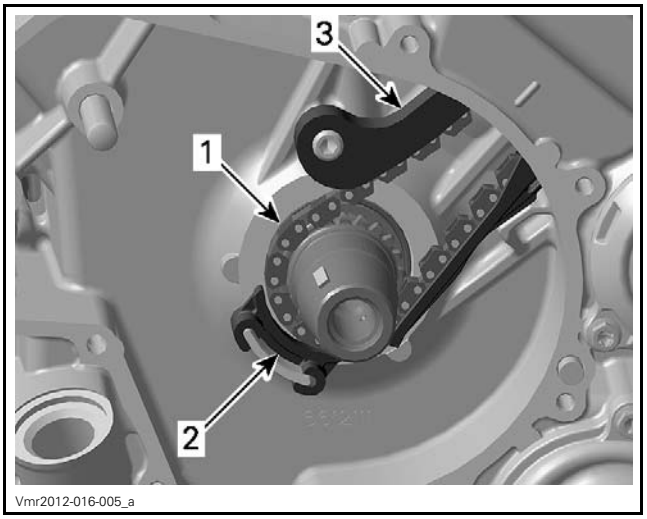
Timing Chain Location

The engine is equipped with two timing chains. One timing chain is located on the engine MAG side, behind the magneto cover. The second timing chain is located on engine PTO side, behind the PTO cover.

Timing Chain Removal (Magneto 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.



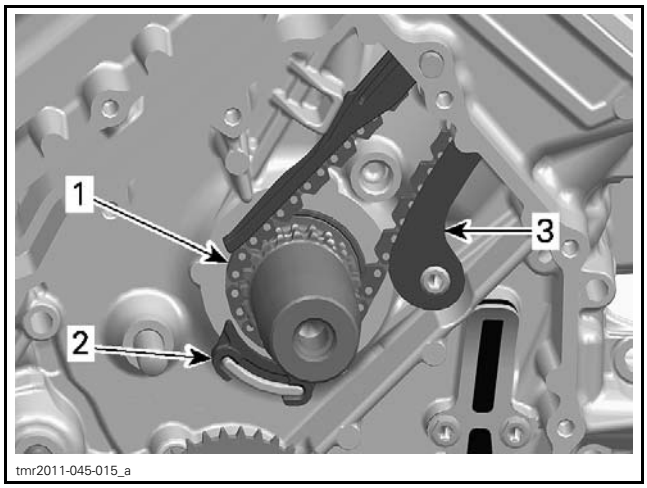
1. Timing chain
2. Lower timing chain guide
3. Timing chain guide (tensioner side)

NOTE: Mark the operating direction of the timing chain before removal.

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)

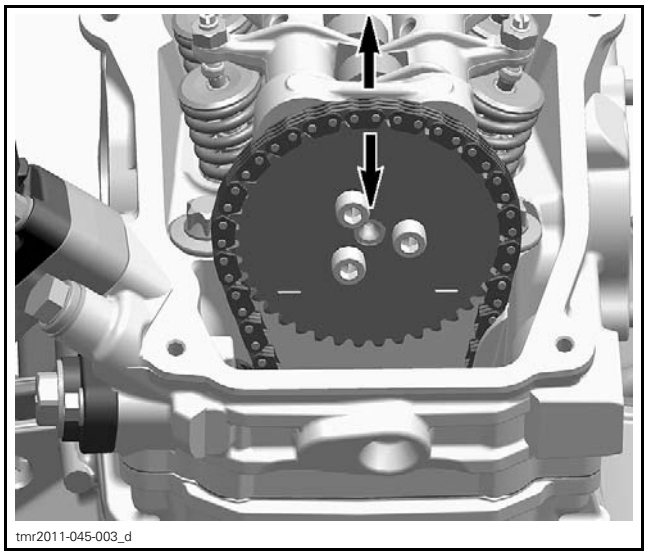
NOTE: Mark the operating direction of the timing chain and check for excessive radial play before removal. Refer to *TIMING CHAIN INSPECTION*.

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

Timing Chain Inspection

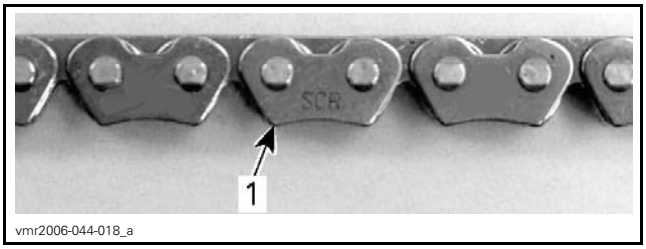
Inspection is the same for both timing chains.

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.

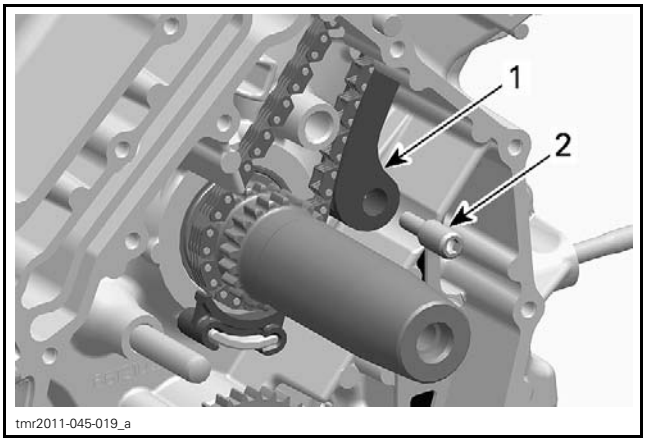
TORQUE	
Timing Chain Guide Bearing Screw	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

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.

TORQUE	
Timing Chain Guide Bearing Screw	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)