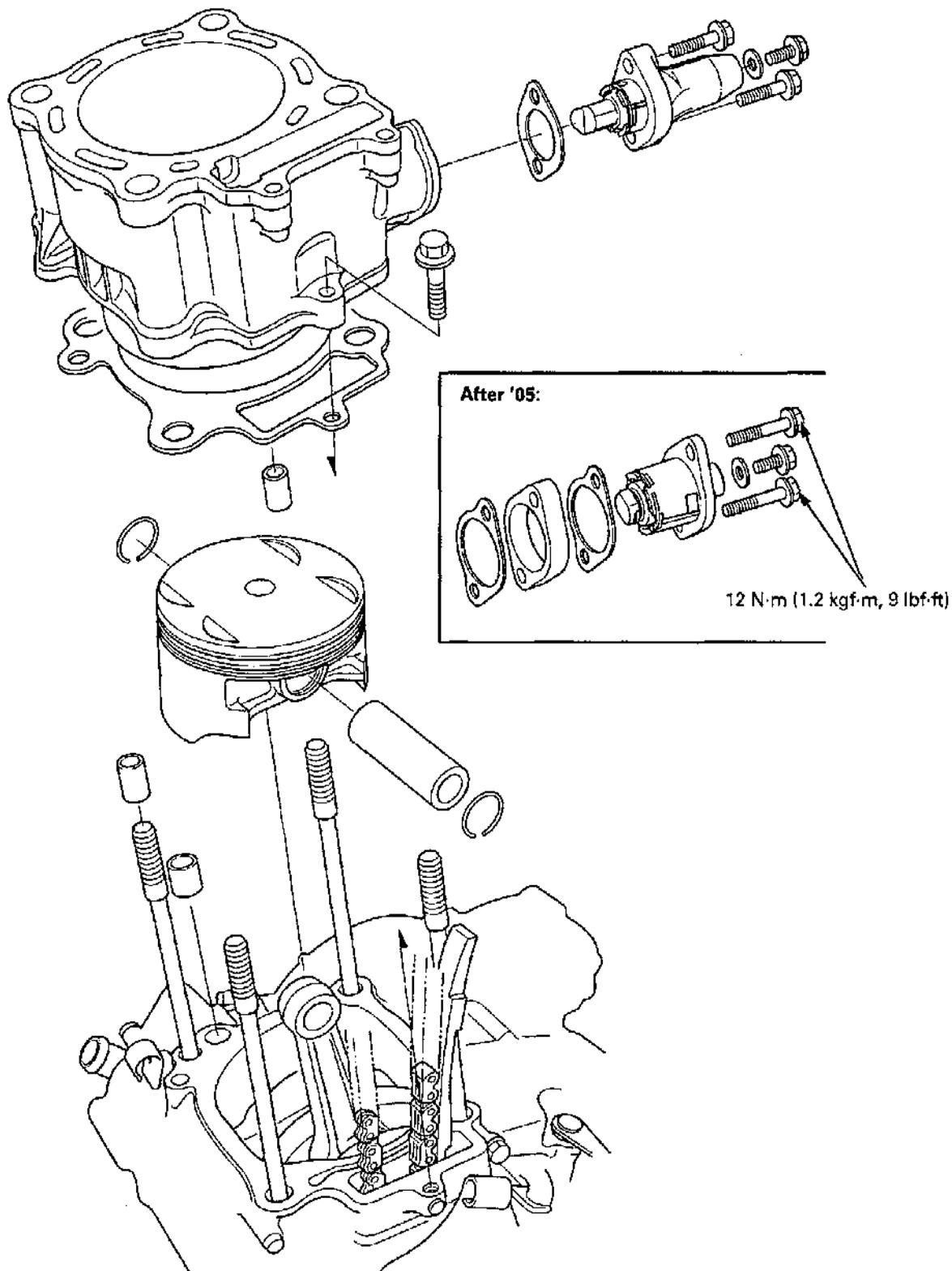


# 12. CYLINDER/PISTON

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SYSTEM COMPONENTS .....	12-2	CYLINDER/PISTON REMOVAL .....	12-5
SERVICE INFORMATION .....	12-3	CYLINDER/PISTON INSTALLATION .....	12-10
TROUBLESHOOTING .....	12-4		

SYSTEM COMPONENTS



# SERVICE INFORMATION

## GENERAL

- The cylinder and piston can be serviced with the engine installed in the frame.
- Take care not to damage the cylinder wall and piston.
- Be careful not to damage the mating surfaces when removing the cylinder.
- Camshaft and rocker arm lubricating oil is fed through an oil passage in the cylinder. Clean the oil passage before installing cylinder.

## SPECIFICATIONS

'04 - '05:

Unit: mm (in)

ITEM		STANDARD	SERVICE LIMIT	
Cylinder	I.D.	94.000 – 94.015 (3.7008 – 3.7014)	94.05 (3.703)	
	Out-of-round	-	0.05 (0.002)	
	Taper	-	0.05 (0.002)	
	Warpage	-	0.05 (0.002)	
Piston, piston pin, piston ring	Piston O.D. at 20 (0.8) from bottom	93.960 – 93.990 (3.6992 – 3.7004)	93.86 (3.695)	
	Piston pin hole I.D.	21.002 – 21.008 (0.8268 – 0.8271)	21.03 (0.828)	
	Piston pin O.D.	20.994 – 21.000 (0.8265 – 0.8268)	20.98 (0.826)	
	Piston-to-piston pin clearance	0.002 – 0.014 (0.0001 – 0.0006)	0.04 (0.002)	
	Piston ring end gap	Top	0.20 – 0.35 (0.008 – 0.014)	0.50 (0.020)
		Second	0.35 – 0.50 (0.014 – 0.020)	0.65 (0.026)
		Oil (side rail)	0.20 – 0.70 (0.008 – 0.028)	0.9 (0.04)
	Piston ring-to-ring groove clearance	Top	0.065 – 0.100 (0.0026 – 0.0039)	0.115 (0.0045)
Second		0.030 – 0.060 (0.0012 – 0.0024)	0.075 (0.0030)	
Cylinder-to-piston clearance		0.010 – 0.055 (0.0004 – 0.0022)	0.19 (0.007)	
Connecting rod small end I.D.		21.016 – 21.034 (0.8274 – 0.8281)	21.04 (0.828)	
Connecting rod-to-piston pin clearance		0.016 – 0.040 (0.0006 – 0.0016)	0.06 (0.002)	

After '05:

Unit: mm (in)

ITEM		STANDARD	SERVICE LIMIT	
Cylinder	I.D.	96.000 – 96.015 (3.7795 – 3.7801)	96.05 (3.781)	
	Out-of-round	-	0.05 (0.002)	
	Taper	-	0.05 (0.002)	
	Warpage	-	0.05 (0.002)	
Piston, piston pin, piston ring	Piston O.D. at 10 (0.4) from bottom	95.970 – 95.980 (3.7783 – 3.7787)	95.87 (3.774)	
	Piston pin hole I.D.	19.002 – 19.008 (0.7481 – 0.7483)	19.03 (0.749)	
	Piston pin O.D.	18.994 – 19.000 (0.7478 – 0.7480)	18.98 (0.747)	
	Piston-to-piston pin clearance	0.002 – 0.014 (0.0001 – 0.0006)	0.04 (0.002)	
	Piston ring end gap	Top	0.25 – 0.31 (0.010 – 0.012)	0.45 (0.018)
		Second	0.23 – 0.33 (0.009 – 0.013)	0.48 (0.019)
		Oil (side rail)	0.20 – 0.70 (0.008 – 0.028)	0.90 (0.035)
	Piston ring-to-ring groove clearance	Top	0.065 – 0.100 (0.0026 – 0.0039)	0.115 (0.0045)
Second		0.065 – 0.100 (0.0026 – 0.0039)	0.115 (0.0045)	
Cylinder-to-piston clearance		0.020 – 0.045 (0.0008 – 0.0018)	0.18 (0.007)	
Connecting rod small end I.D.		19.016 – 19.034 (0.7487 – 0.7494)	19.04 (0.750)	
Connecting rod-to-piston pin clearance		0.016 – 0.040 (0.0006 – 0.0016)	0.06 (0.002)	

## TORQUE VALUES

Cylinder stud bolt

See page 12-9

Cam chain tensioner lifter bolt (After '05)

12 N·m (1.2 kgf·m, 9 lbf·ft)

Apply locking agent to the threads.

### TROUBLESHOOTING

#### Compression too low, hard starting or poor performance at low speed

- Leaking cylinder head gasket
- Worn, stuck or broken piston ring
- Worn or damaged cylinder and piston

#### Compression too high, overheating or knocking

- Excessive carbon built-up on piston head or combustion chamber

#### Excessive smoke

- Worn cylinder, piston or piston rings
- Improper installation of piston rings
- Scored or scratched piston or cylinder wall

#### Abnormal noise

- Worn piston pin or piston pin hole
- Worn connecting rod small end
- Worn cylinder, piston or piston rings

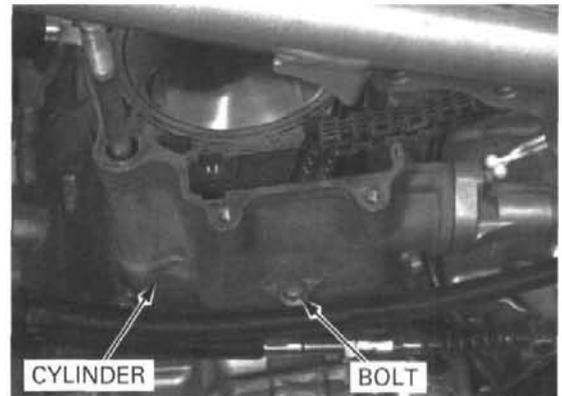
## CYLINDER/PISTON REMOVAL

### CYLINDER REMOVAL

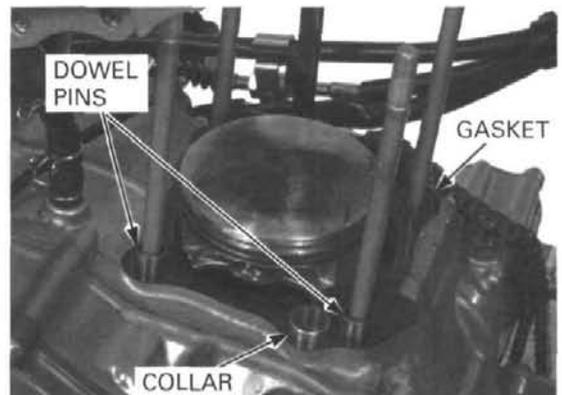
Remove the cylinder head (page 11-15).

Remove the following:

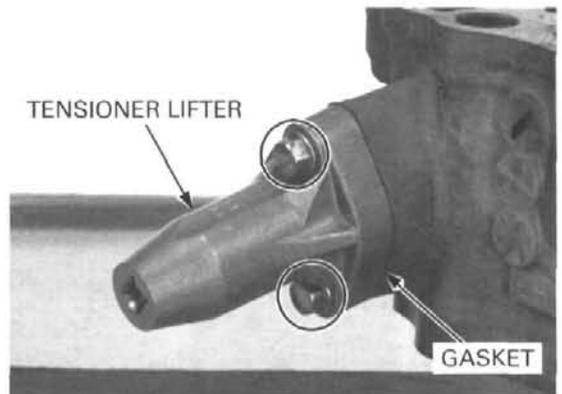
- bolt
- cylinder (being careful not to damage the piston with the stud bolts)



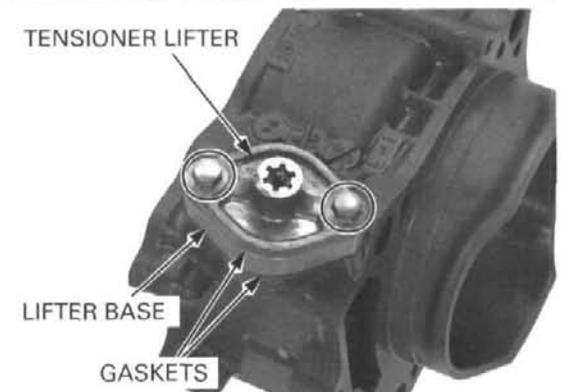
- joint collar
- dowel pins
- gasket



- '04 - '05:
- two bolts
  - cam chain tensioner lifter
  - gasket

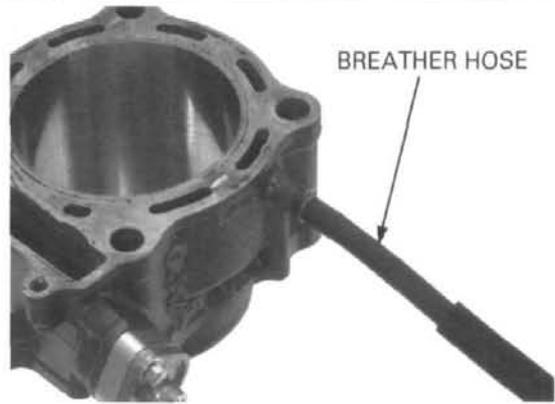


- After '05:
- two bolts
  - cam chain tensioner lifter
  - gaskets
  - lifter base



## CYLINDER/PISTON

After '05: Disconnect the breather hose from cylinder.

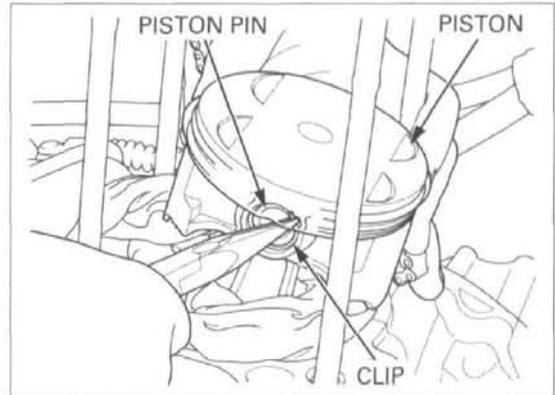


### PISTON REMOVAL

*Place a clean shop towel over the crankcase to prevent the clip from falling into the crankcase.*

Remove the piston pin clip with pliers.

Push the piston pin out of the piston and connecting rod, and remove the piston.



*Do not damage the piston rings by spreading the ends too far.*

Spread each piston ring and remove it by lifting up at a point opposite the gap.



*Never use a wire brush; it will scratch the groove.*

Clean carbon deposits from the piston ring grooves with a ring that will be discarded.



**INSPECTION****CYLINDER**

Inspect the cylinder wall for scratches or wear. Measure the cylinder I.D. at three levels in the X and Y axis. Take the maximum reading to determine the cylinder wear.

**SERVICE LIMITS:**

'04 - '05; 94.05 mm (3.703 in)

After '05; 96.05 mm (3.781 in)

Calculate the cylinder-to-piston clearance. Refer to page 12-8 for measurement of the piston O.D.

**SERVICE LIMITS:**

'04 - '05; 0.19 mm (0.007 in)

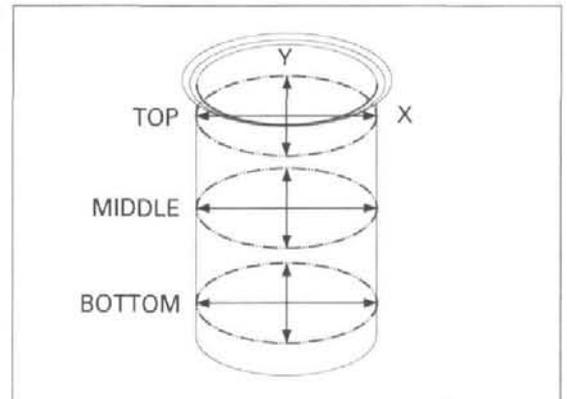
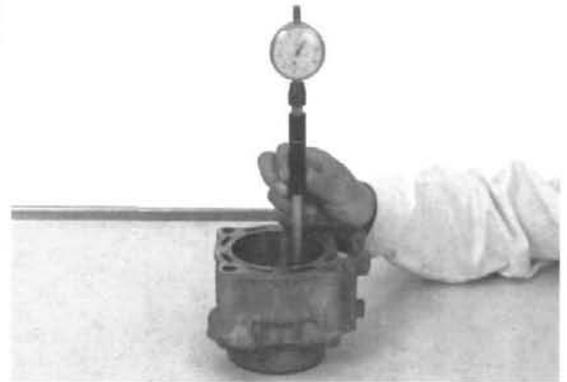
After '05; 0.18 mm (0.007 in)

Calculate the cylinder for taper and out-of-round at three levels in an X and Y axis. Take the maximum reading to determine the taper and out-of-round.

**SERVICE LIMITS:**

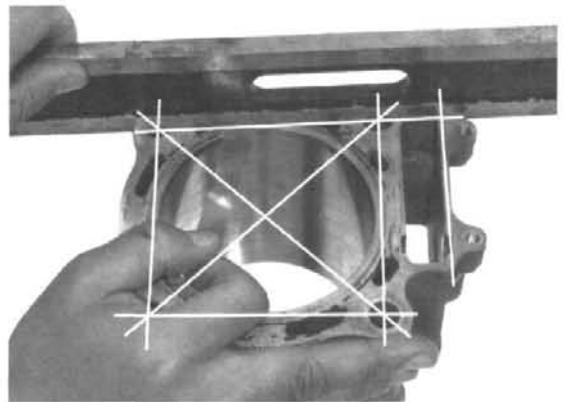
Taper: 0.05 mm (0.002 in)

Out-of-round: 0.05 mm (0.002 in)



Check the top of the cylinder for warpage with a straight edge and feeler gauge across the stud holes.

**SERVICE LIMIT:** 0.05 mm (0.002 in)

**PISTON/PISTON RING**

Inspect the piston rings for smooth movement by rotating them. The rings should be able to move in their grooves without catching.

Push the ring until the outer surface of the piston ring is nearly flush with the piston and measure the ring-to-ring groove clearance.

**SERVICE LIMITS:**

'04 - '05;

Top: 0.115 mm (0.0045 in)

Second: 0.075 mm (0.0030 in)

After '05;

Top: 0.115 mm (0.0045 in)

Second: 0.115 mm (0.0045 in)



## CYLINDER/PISTON

Insert the piston ring into the bottom of the cylinder squarely using the piston crown.

Measure the ring end gap.

### SERVICE LIMITS:

'04 - '05;

Top: 0.50 mm (0.020 in)

Second: 0.65 mm (0.026 in)

Oil (side rail): 0.9 mm (0.04 in)

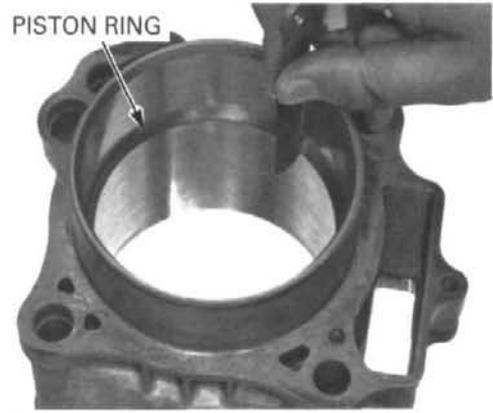
After '05;

Top: 0.45 mm (0.018 in)

Second: 0.48 mm (0.019 in)

Oil (side rail): 0.90 mm (0.035 in)

PISTON RING



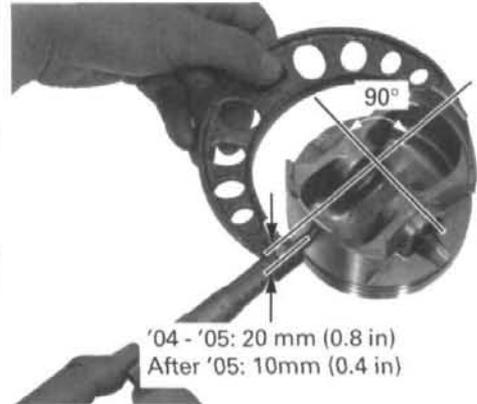
'04 - '05: Measure the piston O.D. at a point 20 mm (0.8 in) from the bottom and 90° to the piston pin hole.

**SERVICE LIMIT: 93.86 mm (3.695 in)**

After '05: Measure the piston O.D. at a point 10 mm (0.4 in) from the bottom and 90° to the piston pin hole.

**SERVICE LIMIT: 95.87 mm (3.774 in)**

Compare this measurement against the maximum cylinder I.D. measurement and calculate the cylinder-to-piston clearance (page 12-7).



Measure the piston pin hole I.D. Take the maximum reading to determine the I.D.

### SERVICE LIMITS:

'04 - '05; 21.03 mm (0.828 in)

After '05; 19.03 mm (0.749 in)

Measure the piston pin O.D. at three points.

### SERVICE LIMITS:

'04 - '05; 20.98 mm (0.826 in)

After '05; 18.98 mm (0.747 in)

Calculate the piston-to-piston pin clearance.

**SERVICE LIMIT: 0.04 mm (0.002 in)**



### CONNECTING ROD

Measure the connecting rod small end I.D.

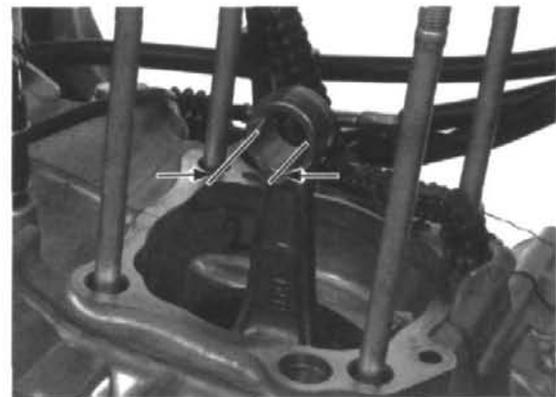
### SERVICE LIMITS:

'04 - '05; 21.04 mm (0.828 in)

After '05; 19.04 mm (0.750 in)

Calculate the connecting rod-to-piston pin clearance.

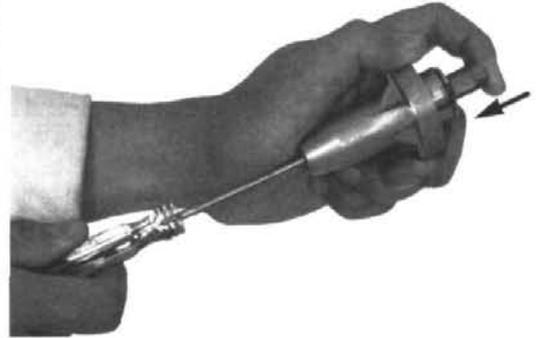
**SERVICE LIMIT: 0.06 mm (0.002 in)**



**CAM CHAIN TENSIONER LIFTER**

The lifter shaft should not go into the lifter body when it is pushed.

When the shaft (inside of the body) is turned clockwise with a screwdriver, the lifter shaft should be pulled into the lifter body. The shaft should spring out of the body as soon as the screwdriver is released.

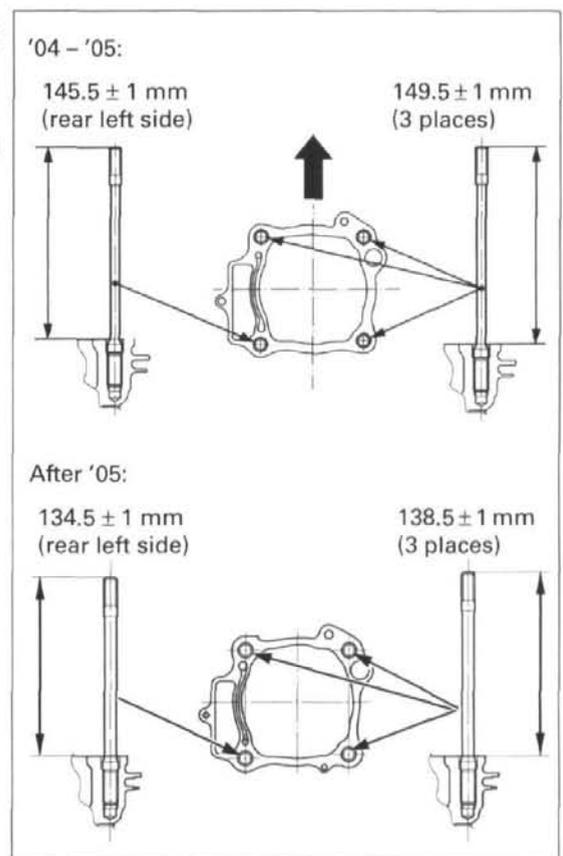
**CYLINDER STUD BOLT REPLACEMENT**

Thread two nuts onto the stud and tighten them together, and use the wrench on them to turn the stud bolt out.

Install new stud bolts in the direction as shown.

Be sure to verify the stud height from the crankcase surface.

Adjust the height if necessary.



## CYLINDER/PISTON INSTALLATION

### PISTON RING INSTALLATION

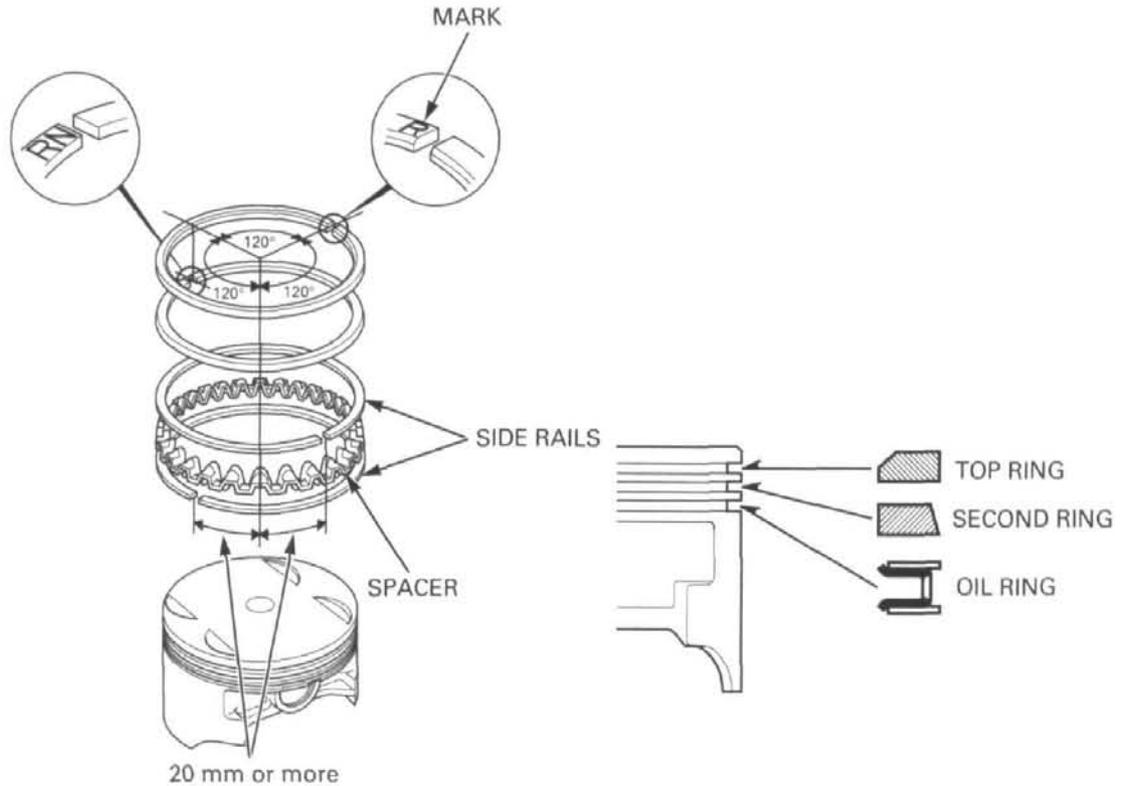
Carefully install the piston rings into the piston ring grooves with the marks facing up.

**NOTE:**

- Do not confuse the top and second rings.
- To install the oil ring, install the spacer first, then install the side rails.

Stagger the piston ring end gaps  $120^\circ$  apart from each other.

Stagger the side rail end gaps as shown.



### PISTON INSTALLATION

Place a clean shop towel over the crankcase to prevent the piston pin clip from falling into the crankcase.

Apply molybdenum oil solution to the connecting rod small end inner surface and piston pin outer surface.



Apply engine oil to the piston pin holes.

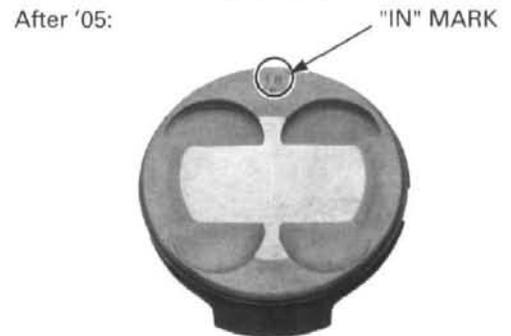
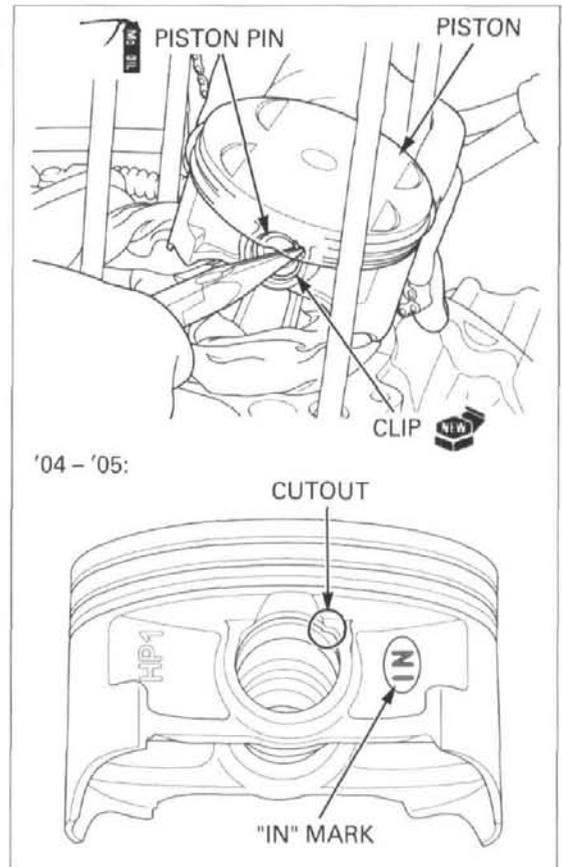
Install the piston with the "IN" mark toward the intake side and insert the piston pin through the piston and connecting rod.

*Do not align the clip end gap with the piston cutout.*

Install new piston pin clips.

**NOTE:**

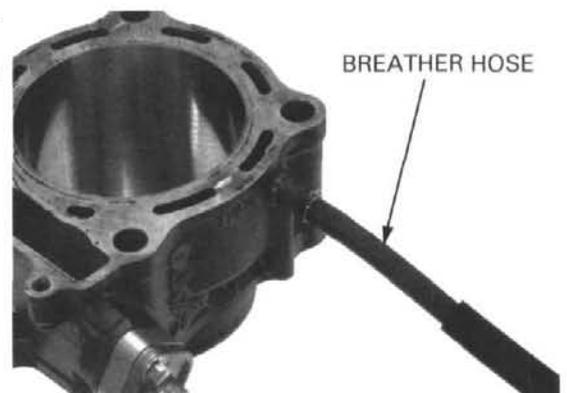
- Make sure the piston pin clips are seated securely.



**CYLINDER INSTALLATION**

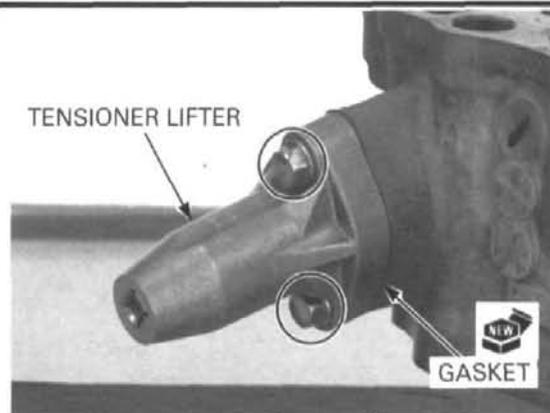
Clean the gasket surface of the crankcase and cylinder thoroughly, being careful not to damage them. Blow through the oil passage in the cylinder with compressed air.

*After '05:* Connect the breather hose to the cylinder.

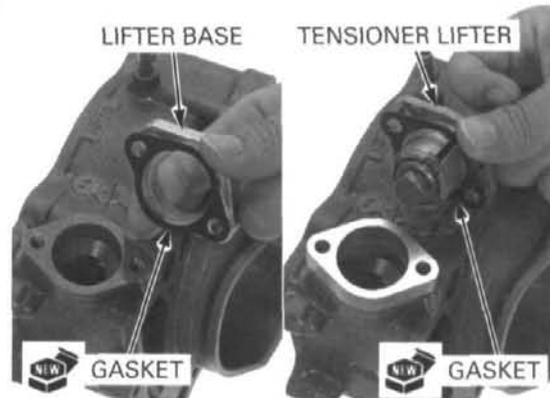


## CYLINDER/PISTON

'04 - '05: Install the cam chain tensioner lifter with a new gasket. Tighten the two socket bolts.

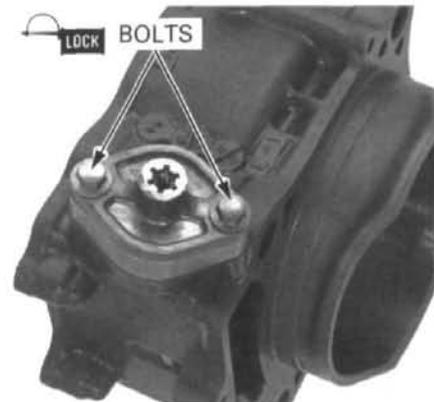


After '05: Install the cam chain tensioner lifter with the lifter base, new gaskets.



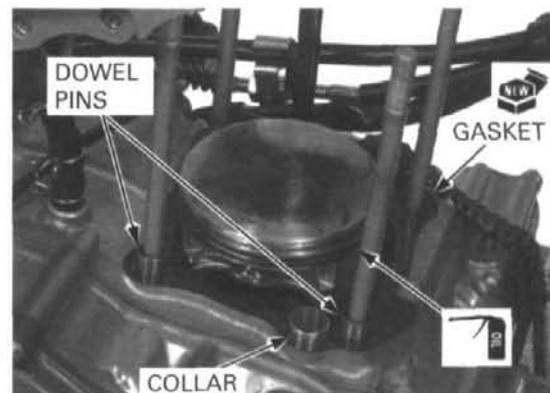
After '05: Apply locking agent to the cam chain tensioner lifter bolt threads. Install the bolts and tighten the bolts to the specified torque.

**TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)**

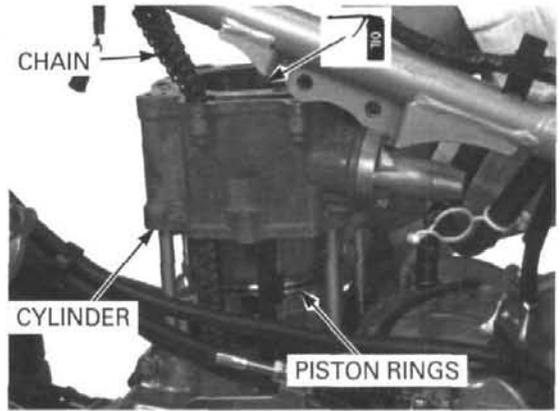


Install the joint collar, two dowel pins and a new gasket.

Apply engine oil to the cylinder wall, piston outer surface and piston rings.



Route the cam chain through the cylinder and install the cylinder over the piston while compressing the piston rings with your fingers.



*Tighten the cylinder bolt after installing the cylinder head.*

**Make sure that the cylinder touches the crankcase evenly. Install the cylinder bolt. Install the cylinder head (page 11-24).**

