

# BOXER

*Performance*

## ROCKET SPROCKET

Installation Guide

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# Rocket Sprocket Install Guide

## Overview

Rocket sprockets are precision CNC machined cam sprockets designed to advance the cam timing 9 degrees on BMW Boxer R259 and K25 series single cam engines for the R850, R1100, R1150 and R1200. The timing advance moves the engines peak torque between 800 to 1000 rpm lower dependant on the model whilst maintaining the existing profile. This places peak engine torque within a rev range more usable in day to day riding and markedly improves engine responsiveness at low to medium revs.

Prior to installing the sprockets:

1. Print a copy of this guide.
2. Read the summary and the complete step-by-step guide until you are sure you understand it. The summary is an overview of the steps at the high level and the steps provide specifics.
3. Text that is in a box and prefaced by a **WARNING** is important. If you ignore it, you risk **VERY** expensive damage to the engine.

The installation is nearly identical for both sides with the exception being the position of the cam chain tensioners. This difference is explained at Step 8.

## Summary

The installation process is the same for each cylinder with the exception of the removal of the throttle body on the left hand side because the cam chain tensioner is more difficult to access with its positioning behind the throttle body.

### **WARNING**

**Do one side at a time, rotate the engine to Top Dead Centre (TDC) for each cylinder before removing the cam chain tensioner. Rotate the cam to locate the pin and seat the sprocket on the cam correctly. Reinstall the cam chain tensioner before rotating the engine and make sure the cam timing arrows line up with the mark on the chain. Check the timing by rotating the engine one or more full cycles before moving on to the other side.**

**IF YOU FEEL ANY RESISTANCE, SOMETHING IS WRONG. STOP AND DO NOT FORCE THE ENGINE PAST THIS POINT.**

Ensure that whichever side you are working ON is positioned to Top Dead Centre (TDC). When the timing chain sprocket covers have been removed you will see the arrows on the sprocket will be parallel to the ground at the 3 o'clock and 9 o'clock positions (in line with the motion of the pistons.)

### **WARNING**

Always remove the cam chain tensioner first.

Ensure that you use good quality allen / torx bits to reduce the risk of damage to the cam retaining bolt

**WARNING**

**Failure to remove the tensioner can result in the migration of parts into the body of the engine requiring and expensive engine tear down to repair.**

After cleaning the cam chain place a dab of white out or paint **onto the cam chain** at position 1 where the timing arrow points at the chain shown on the diagram **before** removing the stock sprocket. The arrow marked on the sprocket points to the space between the teeth.  
(see Notice in the install section in relation to the R1100/R1150 and R1200)

Tie a piece of strong thread onto the replacement sprocket to prevent it from being lost during installation.

Remove the stock sprocket and replace it with the Rocket Sprocket in EXACTLY THE SAME POSITION matching the paint mark on the chain to the arrow on the sprocket.

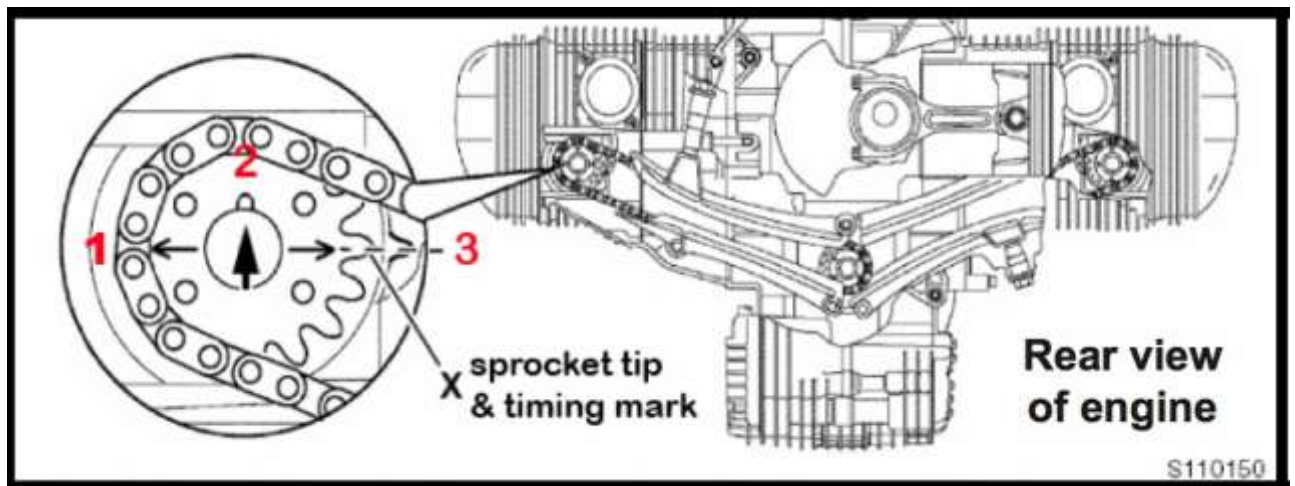
The cam location pin is located at the 12 o'clock position for the left side and 6 o'clock position for the right side. This is shown in the diagram below just above the bold black vertical arrow and below the number 2. With the sprocket loosely in place on the shaft gently move the camshaft slot to the 12 o'clock position and push the pin into the slot.

Seat the sprocket on the cam shaft with the locating pin positioned in the cam slot before re-installing the bolt. This can be done by lightly tapping the sprocket with a hammer and socket. The cam flange will be close to the internal edge of the chamfer in the sprocket cam mounting hole.

Retighten the sprocket a little more than hand tight so you can check the cam timing as stated above.

Manually spin the engine one or more revolutions to check the alignment of the timing marks, **IGNORE THE PAINT MARKS** it is the position of the timing marks that is now important they should be as shown in the diagram below (number 1 and 3) when the engine is at TDC for the cylinder being worked on. - Parallel to the ground and Parallel to the motion of the pistons.

The right hand side is exactly the same except the cam location pin and camshaft slot are at the 6 o'clock position.



If the timing is correct tighten the mounting bolt to a torque setting of 48 f/p or 60 Nm. This will be easier if an assistant firmly depresses the rear brake

#### Required equipment

- A workshop manual.
- A set of metric tools (including sockets, ring and open ended spanners.)
- A torque wrench capable of delivering 48f/p or 60Nm of torque.
- Canned or compresses air to clean the spark plug wells prior to removing the plugs.
- Anti-seize – Apply when replacing the plugs or any steel bolts that mate to alloy surfaces.
- Silicon spray - To lubricate the left hand side throttle body O-rings during re-assembly.
- Thin strong thread – Tied to the replacement sprocket.
- Cable ties or lock wire – To anchor the cam chain during work.
- Magnetic probe – To retrieve dropped parts from the engine casing.
- A well-lit work area.
- A good flashlight or mobile work lights.
- An assistant.
- About two to four hours.

## Installation.

### Step 1 – Removing the valve and cam chain covers.

- Place the bike on the centre stand.
- Remove the front engine cover to access the pulley bolt to rotate the engine for the install.
- Remove the valve covers and the cam sprocket covers on both sides following the standard “shop manual” directions.



### Note:

In picture shown above the engine is NOT at TDC. The indicator is the position of the timing arrows they should be parallel to the ground and parallel to the motion of the pistons rather than at the 5 and 11 o'clock positions as shown.

## Step 2 - Prepare the sprocket for removal

- Select 5<sup>th</sup> or 6<sup>th</sup> gear and ensure you take up all driveline lash by turning the rear wheel with the transmission in gear.
- Place the rear wheel of the bike on the ground.
- Have your assistant apply the rear brake.
- Loosen BOTH **left and right** side sprocket bolts with an 8mm hex or torx socket USING HIGH QUALITY TOOLS. **Ensure you support the pivot point to keep the tool square to the centre of the cam and DO NOT use an extension bar for the allen/torx bit.**
- Ensure you support the pivot point to keep the tool square to the centre of the cam and DO NOT use an extension bar for the allen/torx bit.
- The sprockets are tight so don't be alarmed if they loosen with a loud cracking sound.
- Leave the fastener in place.





### Step 3 - Removing the Throttle body to access the cam chain tensioner.

- On the right side of the bike the cam chain tensioner screw is below the head and simple to remove. Use a pan to capture and oil that will drain from the tensioner hole.
- On the left side, the throttle body will need to be moved out of the way to access the cam chain tensioner.
- Unscrew the air tube and slide it up into the air box.
- Unscrew the throttle body (two screws mating the throttle body to the inlet manifold) and move it clear of the work area.



*An elastic “bungie” cord or long cable tie can be used to hold it whilst you work.*



## Left hand side installation.

### Step 4 – Remove the left hand side cam chain tensioner.

- Rotate the engine using the crank pulley bolt at the front of the engine until the left side is at TDC and the cam sprocket timing arrows are at the 3 o'clock and 9 o'clock positions. Also you will need to check that all valves rockers are loose to confirm TDC.
- The left hand side cam chain tensioner is concealed behind the throttle body and below the A-Arm at the point where the arm is bolted to the engine casing.
- Loosen the bolt and unscrew it by hand.



There is very little clearance on the left hand side tensioner.

- Lift the tensioner,
- Turn it slightly toward the rear of the bike and slide it free removing the inner tensioner.



### **IMPORTANT NOTE**

The OEM sprockets and the Rocket Sprockets both have timing arrows stamped on them.

The current Rocket Sprockets were made using the later R1200 sprockets and the timing arrows are the same and will install easily for the R1200 models.

The stock R850/R1100/R1150 sprockets have the timing arrows in reverse of the R1200 sprockets (see photo below). The Rocket Sprocket is on the left and the stock sprocket on the right.

The standard timing arrow on the outer (left) side points at the cam chain side plate and not the roller pin like the R1200.

The install for the left side requires that the white paint is applied to the roller pin above the arrow of the stock sprocket (see white arrow on left side of the Rocket Sprocket on left) so that the install of the Rocket Sprockets align with the white paint. The alternative is to use the black texta mark as supplied and align this with the side plate marked with the white paint.



**WARNING**

It is imperative to re-install exactly the same link of chain onto the same arrow stamped on the new sprockets. Failure to do this will result in incorrect valve timing and damage to the valve stems.

The chain must be placed on the same guiding arrow on the new sprocket as it was on the OEM sprocket.

The following two steps will make this easier.

1. Clean the OEM sprocket and the section of timing chain that it is contact with the chain using a cleaning chemical that will remove any oil such as automotive paint thinner or carburettor cleaner.
2. Using a white paint pen or liquid paper correction, paint the cam chain as per the next section below so that the new sprockets "arrow" should align with this paint.

Allow the painted guide marks to **dry completely**.

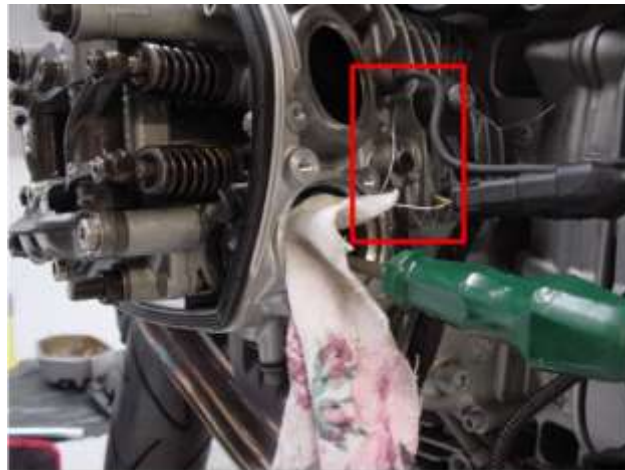
## Step 5 – Removing the OEM sprocket

Secure the cam chain in the following two positions.

1. Position 1
  - a. Inside the cam sprocket access cover loop a length of lock wire through a link in the chain at about 1 o'clock to the cam chain but 3 or 4 links toward the crank and secure to the chain. Secure this lock wire to a bolt on the outside of the engine.
2. Position 2
  - a. Loop a second piece of lock wire through the cam chain via the rocker cover side at about 10 o'clock and secured to the rocker gear.

Securing the sprocket

- Loop a piece of lock wire through one of the crank side holes in the sprocket and twist so that you can make sure the sprocket will not fall into the engine casing. Unscrew the 8mm bolt and thick washer securing the sprocket to the cam. The sprocket will generally remain in position but hold it to prevent it from falling into the engine casing.
- With a screw driver inserted into the cam bolt hole:
- Remove the sprocket from the cam (the chain remains attached)
- Remove the chain from the sprocket and slide the sprocket out through the area of the valve train or the cam sprocket access hole.
- The image below shows this from the left hand side but the steps are the same for both.
- Note the lock wires securing the cam chain.



## Step 6 – Fitting the new sprocket.

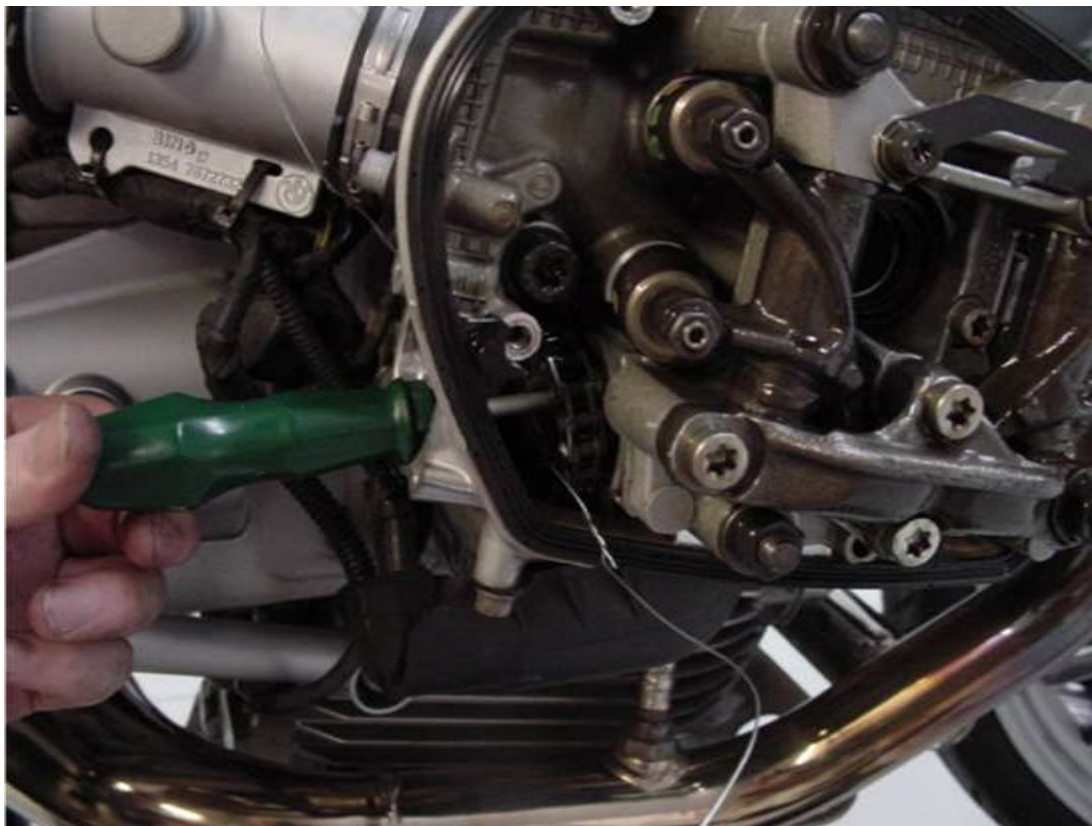
### Note

Place at least 18" or 45cm length of heavy thread or lock wire (dental floss or similar) through one of the holes on the crank side of the sprocket. This will allow you to retrieve the sprocket if it comes loose and falls into the engine casing.

The sprockets have a pin on the rear face designed to align the sprocket with the cam. When the new sprocket is on the chain look directly behind it to visualize where the pin fits into cam.

Rocket sprockets are design to advance the timing this means the pin won't align in exactly the same position. It will be offset by approximately 1.5mm compared to the OEM sprocket.

- Install the sprocket via the rocker cover, insert the Phillips screwdriver into the cam-mounting hole and re-thread the cam chain onto the sprocket aligning the timing arrow with the paint on the cam chain prior to securing the sprocket to the cam.
- Insert the Phillips screwdriver into the cam mounting bolt hole and mount the sprocket onto the cam loosely so that the sprocket locating pin can be aligned with the locating slot in cam.





To orient the sprocket pin with the pin recess of the cam you will need to:

- Move the orientation of the cam to the sprocket to allow the pin to seat onto the cam by moving the cam itself.
- Using a small flat blade screwdriver, install it into the slot in the cam and rotate the cam in the direction of the pin so that the slot and the pin line up. When they are aligned, gently tap the sprocket onto the cam ensuring that the pin engages into the slot.
- Seat the sprocket on the cam shaft with the locating pin positioned in the cam slot before re-installing the bolt. This can be done by lightly tapping the sprocket with a hammer and socket. The cam flange will be close to the internal edge of the chamfer in the sprocket cam mounting hole (see photo below).
- Finger tighten the bolt then torque to 10 ft lbs so that the sprocket seats against the cam.
- Remove all of the lock wire from the cam chain and sprocket.
- Tighten the bolt with the allen/torx with a light torque to ensure it is secured.



## Step 7 – Replace the cam chain tensioner and check cam timing.

- Replace the cam chain tensioner and tighten securely.
- Rotate the engine slowly using the crank pulley bolt at the front of the engine and ensure there is no interference of piston to valves and **IF THERE IS ANY RESISTANCE, STOP**. If no resistance, continue to rotate the wheel with someone watching to establish when the piston has reached TDC. Alternatively, use a long Phillips screwdriver in the spark plug hole and check for TDC when the piston is stops movement.
- When the piston is at TDC the arrow marks on the sprocket must be parallel to the ground i.e aligned like the cylinders on the bike at 3 o'clock and 9 o'clock positions.
- There may be a need depending on the model (R1200) to remove the bolt and the paddle wheel (left side) and the cam position sensor (right) to check that the cam timing is correct.
- If the cam timing is correct reinstall the paddle wheel (R1200 left) or cam position sensor (R1200 right) and tighten the mounting bolt to the required torque setting of 48 ft/lbs or 60nm.) cam timing is correct and tighten the mounting bolt to the required torque setting of 48 ft/lbs or 60nm.).
- Support the pivot point to keep the tool square to the centre of the cam and DO NOT use an extension bar for the allen/torx bit.

**DO NOT REPLACE THE TIMING CHAIN OR VALVE COVERS YET.**

Take a short break now! Have a drink and a light snack. It will be tempting to have a beer, avoid the temptation, and hold off until after the job is finished and you have road tested the bike.



## Right hand side installation

The right hand side installation replicates the procedure for the left with the single difference being that the cam chain tensioner is in a different position

### **Step 8 – Remove the right hand side cam chain tensioner.**

Unlike the left hand side the right side cam tensioner is accessed and comes out below the head.

Depending upon the model of your bike it may be obstructed by the exhaust header. If this is case loosen it as far as possible.

On the right hand side it does not need to be completely removed to complete the installation.



**When the tensioner has been removed or loosened follow the procedure outlined for the left hand side installation to complete the job.**

### **IMPORTANT NOTE**

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The stock R850/R1100/R1150 sprockets have the timing arrows in reverse of the R1200 sprockets (see photo below). The Rocket Sprocket is on the left and the stock sprocket on the right.

The standard timing arrow on the outer (right) side points at the cam chain side plate and not the roller pin like the R1200.

The install for the right side requires that the white paint is applied to the roller pin below the arrow of the stock sprocket (see white arrow on right side of the Rocket Sprocket on the right) so that the install of the Rocket Sprockets align with the white paint. The alternative is to use the black texta mark as supplied and align this with the side plate marked with the white paint.



### **Finishing up.**

- If you have followed this guide you should have thoroughly tested both sides.
- Re-assemble the valve and cam chain covers.
- Re-install bolts, use some anti-seize! Steel to aluminium electrolysis is nobody's friend.
- When re-attaching the plastic spark plug covers, ensure they are put on from the **back to the front**, this will seat them properly.
- Do a quick visual check, and you are ready to go.
- Take the bike for a spin and enjoy having the power where you want it. When you are finished, come back and take satisfaction in a job well done!

**Now** you can have that beer!

Please send us any feedback you have about either this guide or your impressions of the bikes performance after the installation. You can contact us at:

[lennie@boxer-performance.com](mailto:lennie@boxer-performance.com)