

10 – CARTRIDGE-BEARING BOTTOM BRACKETS

ABOUT THIS CHAPTER

Unlike many chapters in this book, this chapter deviates from the worksheet approach used in other chapters. The procedures for cartridge-bearing bottom brackets are relatively simple, and do not require most of the same structure for recording data. Instead of procedures being written in **bold** type with check-boxes, they are written just as numbered steps. There are no comparable worksheets in the **WORKSHEETS** section at the back of the book.

Sections

This chapter has sections covering: Shimano cartridge bottom brackets, Fisher cartridge bottom brackets, Mavic cartridge bottom brackets, and multiple brands of bottom brackets that have threaded cups with cartridge bearings inside the cups.

Threads

All threaded cartridge-sealed-bearing bottom brackets fit the same bottom-bracket-shell threads as adjustable-cup bottom brackets. For thread information, see the **BOTTOM-BRACKET THREADS** table (page 9-5) in the **ADJUSTABLE-CUP BOTTOM BRACKETS** chapter.

Prerequisites

For all types of bottom brackets, the only prerequisite is crank-arm removal and installation.

If changes in the effective spindle length creates changes in the chainring position, then front derailleur adjustment would also be required.

Tools

The special tools needed for each type of cartridge bottom bracket are mentioned in each section as part of the procedure for servicing that bottom bracket.

SHIMANO CARTRIDGE BOTTOM BRACKETS

ASSEMBLING NEW BIKES

The plastic and aluminum threaded rings provided with Shimano cartridge bottom brackets have proven to be very intolerant of poor thread quality in the shell, resulting in stripped threads. If the pieces do not thread in and out easily, tap the bottom-bracket shell.

When assembling new bikes, the only other concern is whether the factory installed and secured the main cartridge unit and adapter ring correctly.

In order to check this, crank-arm removal is required. Use the Park BBT-2 to secure the main cartridge unit in the frame and secure the lockring. A standard 32mm headset spanner will fit the Park BBT-2, but the Park tool can be driven with a 3/8" drive ratchet or torque wrench, as well. The torque specification is 260–350in-lbs.

The Shimano specification is that no grease should be put on the main body threads or on the adapter-ring threads. In many climates, corrosion between metal threads on the bottom bracket and metal threads inside the shell is a genuine concern. If concerned about this, remove the bottom bracket and treat the threads with Loctite #222 or #242. There have been some reports of problems with the plastic adapter ring loosening. It would be of no harm, and perhaps some benefit, to treat these threads with Loctite #222 or #242 as well. When either the bottom-bracket shell or an adapter ring is aluminum, use anti-seize compound.

The only tool needed is the Park BBT-2.

When making sure the unit is secure, follow these steps exactly:

1. Loosen the adapter ring (the side with no flange, possibly either side).
2. Use a Park BBT-2 to snug the main body into the bottom-bracket shell. The flange may be left up to 1mm from the end of the shell if desired, to improve chainring position.
3. Secure the adapter ring to 260–350in-lbs.

CARTRIDGE-INSTALLATION PROCEDURE

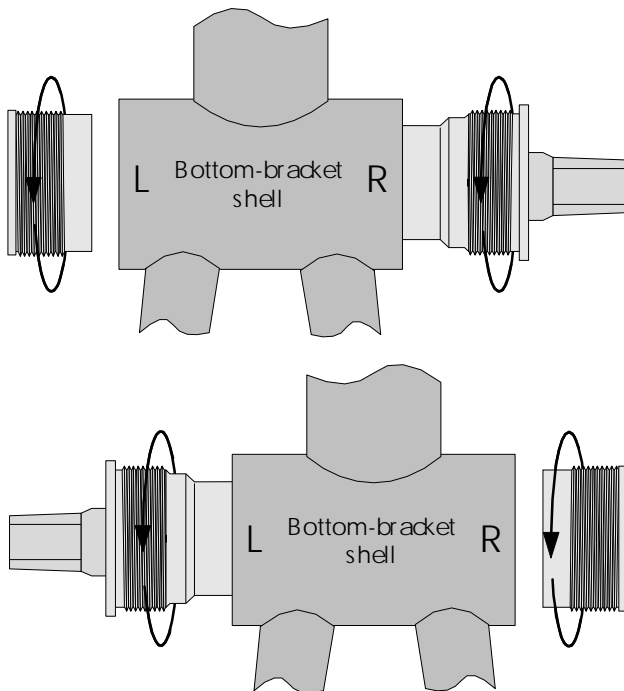
Considerations

The only tool needed is the Park BBT-2.

The plastic and aluminum threaded rings provided with the Shimano cartridge bottom brackets have proven to be very intolerant of poor thread quality in the shell, resulting in stripped threads. If the pieces do not thread in and out easily, tap the bottom-bracket shell. Thread damage on the adapter rings sometimes occurs at the factory due to over-tightening or cross-threading.

When installing a new cartridge-bottom-bracket unit, always install the main body completely before installing and securing the lockring.

On the low end models (CS, LP, etc.), the main body has a right-hand thread and installs into the left side of the bottom-bracket shell. The adapter ring (currently made of black plastic, but there is no guarantee it will remain so) has a left-hand thread and installs from the right side of the shell.



10.1 Depending on the model, the Shimano cartridge may install from the left or right.

All the other models (UN series) have a left-hand thread on the main body, which installs into the right side of the shell. The adapter ring is right-hand threaded and installs into the left side of the shell. The adapter ring currently is, depending on the model, gray plas-

tic or silver aluminum. It is important to understand these distinctions because there are no thread-direction marks, and because the plastic adapter rings will readily install if put in the wrong side of the shell, quickly destroying the adapter-ring threads.

Installation

There is no worksheet for this procedure in the **WORKSHEETS** section of this book. To install a Shimano cartridge bottom bracket in the bottom-bracket shell:

1. Treat the main-body threads with Loctite #222 or #242 (or anti-seize whenever there are any aluminum threads).
2. Install the main body fully in the correct side and snug gently.
3. Treat the adapter-ring threads with Loctite #222 or #242 (or anti-seize whenever there are any aluminum threads).
4. Install the adapter ring from the opposite side.
5. Secure the adapter ring to 260–350in-lbs.

Fixing creaking Shimano cartridges

Shimano cartridge bottom brackets often develop an annoying creak. The source of this creak could be lack of enough torque on the adapter ring, but the source is just as likely to be looseness between the inside of the adapter ring and the portion of the cartridge shell that the adapter ring engages. This can be fixed by using Loctite #242 between the adapter ring and the cartridge shell. The same problem may develop if the fixed ring that is supposed to be a permanent part of the main body works loose. It can be fixed in the same way.

MAINTENANCE

Shimano designed these bottom brackets with the intent that they be maintenance free. This does not mean that they will last forever, but that during their life, no maintenance is needed.

The inexpensive (CS and LP) series models have soft neoprene seals that can easily be pried out with a small screwdriver, or seal pick, with little risk of damaging the seals. Once the seals are removed, it is an easy matter to flush the old grease with solvent, and/or squeeze more grease in from a tube.

Once the seals are out, the wrench flats on a locknut and cone will easily be seen. Do not attempt to use the locknut and cone for further disassembly or adjustment! The only way to disassemble or adjust the cartridge is with a Park BBT-6, a tool that is not recommended due to high tool expense. Replacing these inexpensive cartridges is cheaper than servicing them.

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Shimano generally warrants bottom brackets with excessively tight or loose bearings, within normal bottom-bracket life.

The UN series units have snugly fitting seals with thin metal parts that are instantly damaged when any attempt to remove the seals is made.

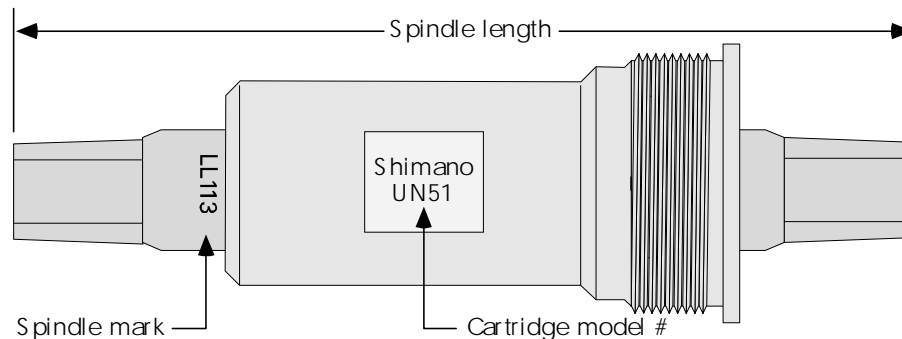
INTERCHANGEABILITY

Use the following table to replace adjustable-cup bottom brackets with Shimano cartridge bottom brackets. If the bike is equipped with newer Shimano crank arms it is *never* appropriate to replace a Shimano cartridge bottom bracket with an adjustable-cup bottom bracket! A single variety of Shimano cartridge bottom bracket sometimes is suitable to replace several lengths of conventional spindles; this is possible because the main body of the cartridge can be fixed in a variety of positions. The CS and LP series can be moved up to 1mm to the left, shortening the effective right-side length by up to 1mm. The UN series can be moved up to 1mm to the right, lengthening the effective right-side length by up to 1mm.

Shimano makes only one width of cartridge shell, but they make different lengths of adapter rings for 68mm, 70mm, and 73mm bottom-bracket shells.

The spindle mark cannot always be found on the spindle, in which case measure the overall spindle length. Use the overall-spindle-length measurement in combination with the model name of the cartridge shell to identify the specific cartridge. For example, a cartridge is marked with the name CS10 and has an overall spindle length of 115mm. According to table 10-1, this cartridge would be a CS10 (D-H).

The **Relative chainline** column (table 10-1) does not show the actual chainline; by determining the difference between the relative chainline values for two different cartridges, the amount the chainline will change can be determined. For example, a UN90 cartridge marked LL113 has a relative chainline value of 1.5. Using the UN90 (LL113) will position the chainrings 1.5mm further out from the frame than a UN90 cartridge marked MM107 (which has a relative chainline value of 0.0mm).



**INTERCHANGEABILITY OF SHIMANO CARTRIDGE BOTTOM BRACKETS
WITH SPINDLES FROM ADJUSTABLE-CUP BOTTOM BRACKETS (table 10-1)**

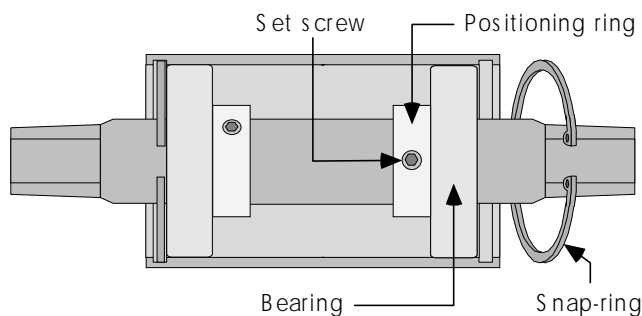
Conventional spindle code (generic if not board noted)	Shimano cartridge model #	Cartridge spindle mark	Spindle length	Relative chainline
Shimano D-3K, Sugino MS-68 & MS-70	UN90, UN 91, UN51, UN71	MM107	107mm	0.0
Shimano D-3K, Sugino MS-68	LP25	MM110	110mm	0.0
3H, D-3H, 3H-B, 3J, 3J-B, 3L, 3L-B, D-3L, 7H, D-7H, Sugino MW-70, 5H, D-5H, 5J-B, 5L, D-5L, 5LL, D-5A	UN90, UN 91, UN51, UN71	LL113	113mm	1.5
3H, D-3H, 3H-B, 5H, D-5H	LP20, LP30, LP25	LL113	113mm	1.5
3J, 3J-B, 3L, 3L-B, D-3L, 7L	UN50, UN70, UN51, UN71, UN91	D-H	115mm	2.0
3A, D-3A, 3A-B, 3K, 3K-B, Sugino MW68, 7NL, D-7NL, 7NL-B, 7-PB, 5P, D-5P	CS10, CS20, CS11, CS21	D-H	115mm	3.0
3P, D-3P, 3P-B, 5N, 5N-B, D-5NL	UN51, UN71,	XL118	118mm	5.0
3N, 3N-B, 3NL, D-3NL, 3NN, 3NN-B, Sugino MT-68 & MT-70, 3SS, D-3SS, 3SS-B, 3S, D-3S, 3S-B, 7EL, D-7EL, 7EL-B, D-7S, D-5SP, 5SP-B, 5SS, 5SS-B, 5S, 5S-B	UN50, UN70, UN51, UN71, CS10, CS11, CS21	D-NL	122.5mm	7.0
3T, D-3T, 3T-B, 3TM-B, 3TS, D-3TS, 7-TB, D-7TL, 5T, D-5T	UN50, UN70, UN51, UN71, CS11, CS21	D-EL	127.5mm	9.0

FISHER CARTRIDGE BOTTOM BRACKETS

Fisher used to have its own design of cartridge-bearing bottom brackets. Fisher no longer does this; it uses threaded bottom-bracket shells like most other manufacturers.

SNAP-RING STYLE

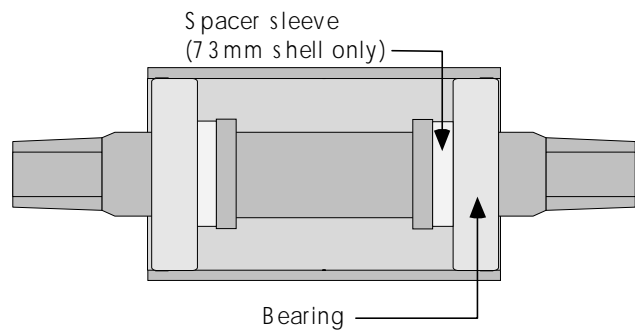
Fishers have cartridge bearings held in by a mild press fit and retained by snap rings in a groove in the bottom-bracket shell. After removing the snap ring with a snap-ring plier, use a plastic hammer to drive the spindle out of the shell. One bearing will also come out. After removing the bearing from the spindle, the spindle is reinserted to drive out the remaining bearing on the opposite side of the bottom-bracket shell. Positioning rings are held to the spindle with set screws to position the bearings on the spindle. Use Loctite RC680 between the spindle and bearings, and bearings and frame, when reassembling. Cartridge bearings can be replaced separately, or cleaned and re-greased while removed.



10.3 Cross-section of an old-style Fisher bottom bracket.

NO SNAP-RING STYLE

Newer Fisher bottom brackets have the following features: the positioning rings on the spindles are fixed instead of adjustable; spacing sleeves slip onto the spindle to mount between the positioning rings and the bearings, so that the same spindle can fit in the original-width bottom-bracket shell and the newer 73mm bottom-bracket shell. Fisher's most recently made models may not have snap rings retaining the bearings in the shell, instead relying entirely on the Loctite for security.



10.4 Cross-section of a new-style Fisher bottom bracket.

MAVIC CARTRIDGE BOTTOM BRACKETS

Advantages

The Mavic bottom bracket does not use the bottom-bracket-shell threads. This makes it a viable way to salvage a frame that has stripped shell threads. Different models have spindle lengths of 112, 114, 116, 119, 123, 124, and 134 millimeters.

Installation and removal

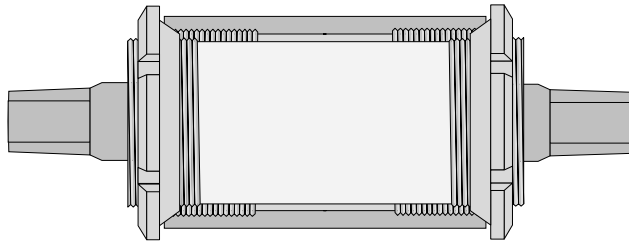
Mavic bottom brackets require no threads in the shell to install, and are a viable alternative for repair of moderate-to-expensive bikes that have damaged bottom-bracket threads. The shell must be prepared for installation of the bottom bracket by facing it with the Mavic tool 65234. This tool faces the ends of the shell to be conical, to match the conical-faced bottom-bracket mounting rings. Face the shell until the face is chamfered to a depth of 2–2.5mm (chamfering is to cut the inside edge of the bottom-bracket-shell face at an angle).

To install a Mavic bottom bracket, grease the threads on the outside of the cartridge-shell unit. Put a locking onto the end of the cartridge with the dust cap marked "Fixe." Slip a conical plastic fixing washer over the cartridge so that it is against the inside face of the locking. Older versions of the bottom bracket will not necessarily have this ring. Slide the bottom bracket into the shell from the right side of the bike. If it will not slide in effortlessly, remove obstructions inside the bottom-bracket shell. Do not force!

Slip the other conical plastic fixing washer onto the left end of the bottom bracket (older bottom brackets may not have one). Attach the other locking to

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the left end of the unit. Use one lockring spanner to hold one of the lockrings, and another to tighten the other lockring. Secure to 240–300in-lbs (13–17lbs@8").

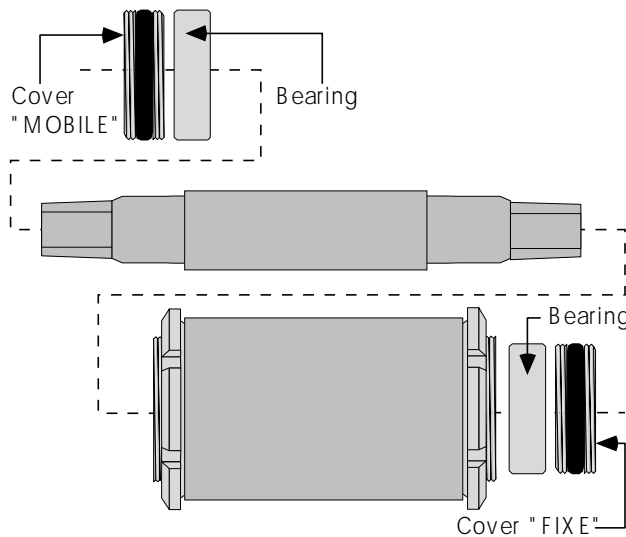


10.5 A Mavic cartridge bottom bracket in a cross-section of a bottom-bracket shell.

Install the right crank arm and check the chainline. If it needs adjustment, remove the crank arm, break loose the left lockring, adjust the right lockring in or out to move the bottom bracket, and then resecure the lockrings.

To remove the bottom bracket, remove either or both lockrings with a lockring spanner and slip the unit out of the shell.

Bearing replacement



10.6 Blow-up of a Mavic bottom bracket.

There is no worksheet for this procedure in the **WORKSHEETS** section of this book.

1. With the cartridge mounted securely in the bottom-bracket shell, use Mavic 670 to unthread the cover marked “MOBILE” and the cover marked “FIXE.” A crank-arm bolt can be used to retain the 670 to the cover marked “FIXE.”
2. Tap the axle out with a plastic mallet. One bearing will remain in the cartridge and one will be on the axle.
3. Use a drift punch or Mavic 670-3 to drive the bearing out of the cartridge shell.
4. Use a plastic mallet to tap the bearing off the axle.
5. Use Mavic 6702 to tap a bearing (black rubber seal facing out) into the chainring side of the cartridge shell until it is deep enough to expose most of the cover threads inside the end of the cartridge shell.
6. Install the “FIXE” cover into the right end of the shell with the Mavic 670.
7. Insert the spindle into the left side with the desired long or short end (if not symmetrical) on the right side and tap into place with a plastic mallet.
8. With black rubber seal facing out, use Mavic 6702 to tap a bearing into the left side until it is deep enough to expose most of the cover threads.
9. Use the Mavic 670 to thread the “MOBILE” cover into the shell and seat the bearing all the way.
10. Loosen the “MOBILE” cover 1/4 turn.
11. Tap gently on the right end of the spindle with a soft mallet, if it seems tight when rotated.

CARTRIDGE BEARINGS IN THREADED CUPS

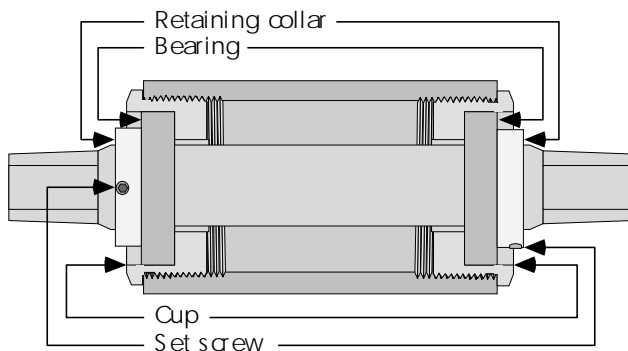
STRONGLIGHT, AMERICAN CLASSIC, AND SUGINO

These bottom brackets are similar to an adjustable-cup bottom bracket, but with cartridge bearings used instead of loose balls. Cartridges may be a slip fit or mild press fit into the cups and onto the spindle and can be replaced without the replacement of the entire assembly. Adjustments should be performed as with an adjustable-cup bottom bracket.

Cartridges can be removed from the assembly (except American Classic). A removed cartridge can have its seal removed and can be cleaned and re-greased in case of moisture contamination, or can be replaced if worn out or damaged. Sugino bottom brackets of this configuration require a special tool, Sugino 214.

COOK BROS.

Although the Cook Bros. bottom bracket has cups that thread into the shell, the bearings are inserted into the cups from the outer face instead of the inner face.



10.7 Cross-section of a Cook Bros. bottom bracket.

This bottom bracket presents two problems. The aluminum cups have very delicate wrench flats that are easily distorted by poor-fitting tools or brutish technique. Once distorted, the lip of the cup may interfere with the retaining collars on the spindle, causing the spindle to rotate roughly. Also, in some cases it may be difficult to access the 7/32" Allen set screw

in the retaining collar. If the Allen set screw is difficult to access, use the edge of a file to notch the lip of the cup 90° from a wrench flat to allow access.

To remove and/or install the bottom bracket, perform the following steps. There is no worksheet for this procedure in the **WORKSHEETS** section of this book.

Removal

1. Use a 7/32" Allen wrench to loosen the set screw in one of the retaining collars on either end of the spindle.
2. Use a Stein FCC2 to retain a Park HCW-2 (35mm) to each cup and break loose both cups without removing.
3. Use a plastic mallet to drive the spindle out the opposite side of the bike from where the set screw was loosened. The spindle and other retaining collar will go out the opposite side. The opposite-side bearing may go out with the spindle or stay in the cup.
4. Use a drift punch or bearing puller to remove the bearing(s) from the cups.
5. Use the Park HCW-2 to remove both cups.

Installation

1. Prepare the cup threads with Loctite 242.
2. Thread both cups into the shell fully and secure gently with the Park HCW-2.
3. Slide a retaining collar onto one end of the spindle and secure the set screw with a 7/32" Allen wrench.
4. Slide a bearing cartridge onto the spindle against the backside of the retaining collar.
5. Slide the spindle/bearing assembly into one side of the bottom bracket.
6. Slide the other bearing onto the other end of the spindle.
7. Tap against the end of the spindle with the retaining collar mounted so that it will drive the bearing into the cup.
8. Use a metal cylinder that clears the spindle and closely matches the outside diameter of the bearing to drive the other bearing into the cup.
9. Rotate the spindle and feel if it rotates smoothly. If it is binding, tap gently on alternating ends of the spindle to eliminate side load.
10. Slide on the remaining retaining collar and secure the set screw.