

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.

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CARTRIDGE-INSTALLATION PROCEDURE

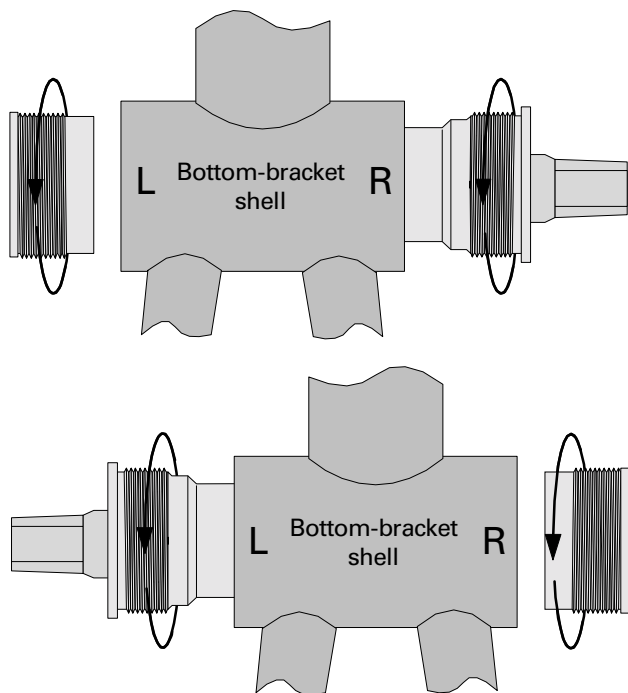
Considerations

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.

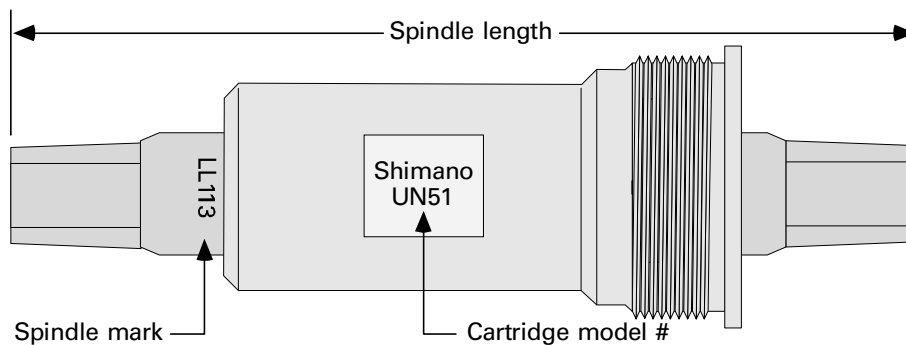
INTERCHANGEABILITY

Use the following table to replace adjustable-cup bottom brackets with Shimano cartridge bottom brackets, or one cartridge with another. 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 is sometimes 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 different versions of most cartridge models that fit 68mm and 73mm bottom-bracket shells. Always use the cartridge that matches the shell size.

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, but instead shows the relative amount the chainline will change if using an unmatched replacement; 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 MM 107 has a relative chainline value of 1mm. Using the UN90 marked LL113 (with a relative chainline value of 2mm) will position the chainrings 1mm further out from the frame than would the UN90 marked MM 107.



SHIMANO CARTRIDGE BOTTOM BRACKET INTERCHANGEABILITY (table 10-1)

Adjustable-cup bottom bracket Spindle types	Cartridge model (not all available for both 68mm and 73mm shell)	Mark/Length	Relative chainline
For 68 shell: D-3K	UN51	MM 107	0mm
	UN51, LP 25	MM 110	
For 68 shell: 3I-B	UN52, UN71, UN72, UN90, UN91	MM 107	1mm
	UN52, UN 72	MM 110	
For 68 shell: 3H, D-3H, 3H-B For 73 shell: 7H, D-7H	UN51, UN 90	LL 113	2mm
For 68 shell: 3J, 3J-B, 3L, D-3L, 3L-B For 73 shell: 7L	UN52, UN71, UN72, UN91, LP20, LP30 CS10, CS11, CS20, CS21, UN50, UN51, UN70, UN71, UN91	LL 113 D-H 115	3mm
For 68 shell: 3A, D-3A, 3A-B, 3K, 3K-B, 3P, D-3P, 3P-B For 73 shell: 7P-B, 7NL, D-7NL, 7NL-B	UN50, UN51, UN52, UN71, LP26	XL 118	5mm
For 68 shell: 3N, 3N-B, 3NL, D-3NL, 3NN For 73 shell: 7EL, D-7EL, 7EL-B	CS10, CS11, CS21, UN50, UN51, UN70, UN71	D-NL 122.5	7mm
For 68 shell: 3SS, D-3SS, 3SS-B, 3S, D-3S, 3S-B For 73 shell: D-7S	UN52, UN72	D-NL 122.5	8mm
For 68 shell: 3T, D-3T, 3T-B, 3TM-B, 3TS, D-3TS For 73 shell: 7T-B, D-7TL	CS21	D-EL 127.5	10mm
For 68 shell: 3U, 3U-B, D-3U, 3XA, 3X	UN50, UN51, UN52, UN70, UN71, UN72	D-EL 127.5	11mm

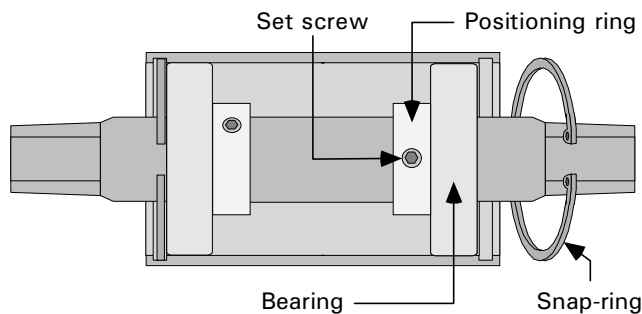
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FISHER CARTRIDGE BOTTOM BRACKETS

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

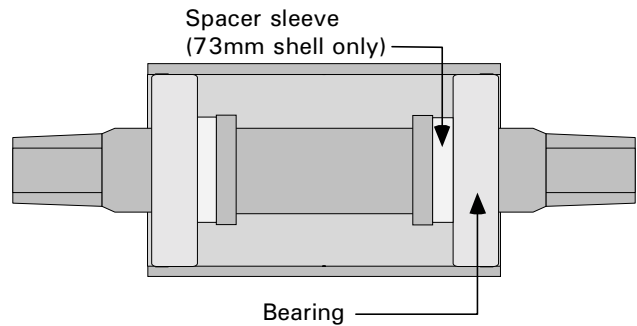
Fishers have cartridge bearings held in by a mild press fit and retained by snap rings in a groove in the bottom-bracket shell. After removing the snap ring with a snap-ring plier, use a plastic hammer to drive the spindle out of the shell. One bearing will also come out. After removing the bearing from 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

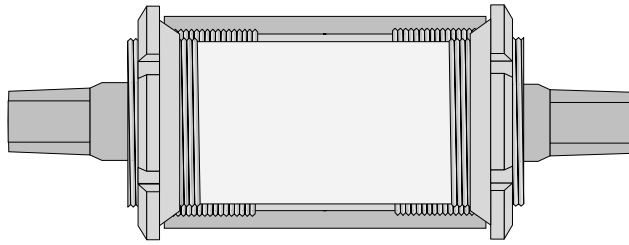
Mavic bottom brackets require no threads in the shell to install, and are a viable alternative for repair of moderate-to-expensive bikes that have damaged bottom-bracket threads. The shell must be prepared for installation of the bottom bracket by facing it with the Mavic tool 65234. This tool faces 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 lockring 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 lockring. 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 lockring 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").

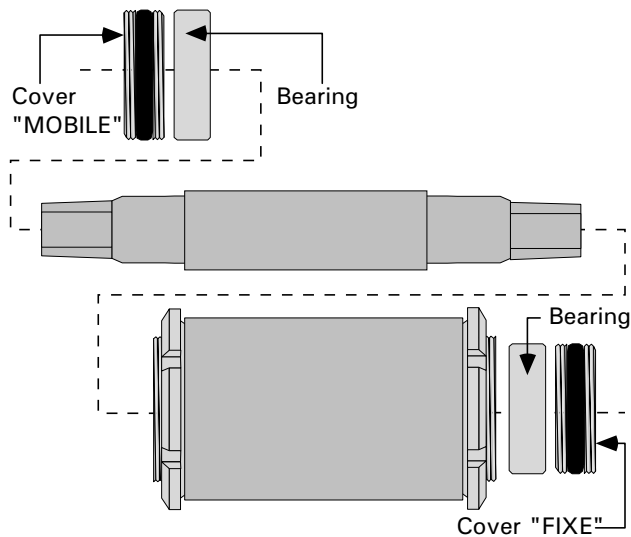


10.5 A Mavic cartridge bottom bracket in a cross-section of a bottom-bracket shell.

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

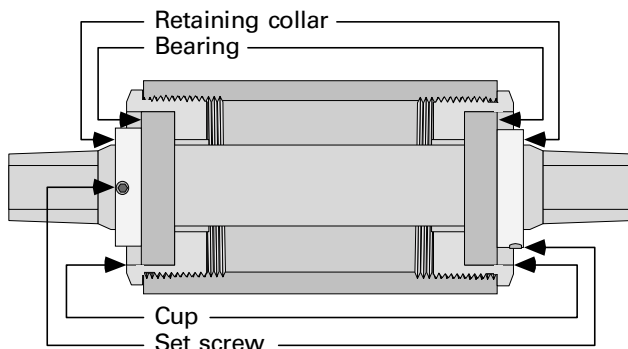
STRONGLIGHT, AMERICAN CLASSIC, AND SUGINO

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.

SHIMANO SPLINED-SPINDLE BOTTOM BRACKETS

TERMINOLOGY

Splines: An alternating arrangement of axially aligned lands (ridges) and flutes (grooves) around a cylinder.

Splined spindle: A bottom-bracket spindle that is splined on the ends, as opposed to the traditional squared taper.

VARIETIES

There are three basic varieties of Shimano bottom brackets that have splined spindles. Each variety requires somewhat different technique to properly install and service.

The first variety includes the Dura-Ace model BB-7700 and the XTR model BB-M950. Other than the model numbers, the distinguishing visual characteristic of these varieties is the fact that the right-side threaded cylinder has a notched flange that resembles a conventional locking for the left side of an adjustable-cup bottom bracket. At first glance, these models may appear to be simple cartridge-bearing bottom brackets. When the bottom bracket is in the package it comes in, the parts are securely fit together in a way that makes it appear as though it is a cartridge-bearing bottom bracket. In fact, this bottom bracket consists of a spindle with two cone races, two threaded cups with cup races, and a lockring just like an adjustable-cup bottom bracket. Directions for servicing this configuration appear under the heading **ADJUSTABLE SPLINED-SPINDLE BOTTOM BRACKETS** (page 10-8).

The second variety includes the Dura-Ace model BB-7710 (track), the Ultegra model BB-6500, the 105 model BB-5500, and the XTR model BB-M952. At first glance they appear very similar to the adjustable variety described in the previous paragraph, but the right-side threaded cylinder lacks the notched flange and can only be fit by the splined tool normally used to install and remove regular Shimano cartridge-bearing bottom brackets (Park BBT-2 or Shimano TL-UN74). Functionally, these bottom brackets are the same as the squared-taper models. The difference is in the spindle configuration and which crank arms will fit it. One other minor difference is that the left-side mounting ring (on the BB-M952) has a notched-flange configuration in addition to the internal spline that fits the splined tools. Additional information on this variety appears under the heading **CARTRIDGE-BEARING SPLINED-SPINDLE BOTTOM BRACKETS** (page 10-10).

The third variety includes the year 2000 Deore XT/LX model BB-ES70. This is a simple cartridge-bearing bottom bracket that is serviced just like all other squared-taper Shimano bottom brackets. This model is separate because it has different spline dimensions and does not interchange with any other models listed earlier. Additional information is under the heading **LONG-SPLINED SPINDLES** (page 10-11).

TOOL CHOICES

The design or model of the bottom bracket will determine the tools needed. The following list covers tools for all varieties of Shimano splined-spindle bottom brackets. This list covers all the tools for the job. The preferred choices are in **bold**. A tool is preferred because of a balance among: ease of use, quality, versatility, and economy. When more than one tool for one function is **bold**, it means that several tools are required for different configurations of parts.

SHIMANO SPLINED-SPINDLE BOTTOM-BRACKET TOOLS (table 10-2)

Tool	Fits and Considerations
Park BBT-2	Installs all non-adjustable models, allows use of 3/8" drive wrenches. Older versions might not fit over splined spindles.
Shimano TL-UN74-S	Installs all non-adjustable models, does not permit use of 3/8" drive wrenches.
VAR 966/PRO2	Installs all non-adjustable models, does not permit use of 3/8" drive wrenches. Includes retaining bolt to improve security for difficult bottom bracket removal.
Park BBT-8	Required to install Dura-Ace BB-7700 and XTR BB-M950 (adjustable models).
Park TWB-368	Crow foot adapter that allows use of torque wrench with BBT-8.
Shimano TL-UN96	Required to install Dura-Ace BB-7700 and XTR BB-M950 (adjustable models). Torque wrench cannot be used.
Lockring spanner	Required to secure lockring on BB-7700 and BB-M950. Assorted varieties available. See table 9-1 (page 9-3).

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ADJUSTABLE SPLINED-SPINDLE BOTTOM BRACKETS

There are two versions of this design, designated Type 1 and Type 2 by Shimano, and these designations only appear in the Shimano parts catalog. The XTR model BB-M950 exists in both types, but the Dura-Ace model BB-7700 is the Type 1 configuration only. To distinguish Type 1 from Type 2 when the bottom bracket is already installed, remove the right-side crank arm, and then look inside the notched ring on the right-side “cup.” If there is a black plastic cap, the bottom bracket is Type 1. If there is a silver metal plate, then the bottom bracket is Type 2. To distinguish the type when removing it from the packaging, the same observation could be made, or you could inspect the plastic sleeve between the two “cups.” If the sleeve is obviously dumbbell-shaped, with a center diameter approximately 5mm less than the cup diameters, then the bottom bracket is Type 1. If the sleeve is a uniform diameter and just slightly smaller in diameter than the cups, then the bottom bracket is Type 2.

Regardless of the type, this bottom bracket style (Dura-Ace BB-7700 or XTR BB-M950) is fundamentally the same as a conventional adjustable-cup bottom bracket, but there are some differences. These differences include: what tools fit, the nature of the seals, the removable nature of the spindle cones, and the presence of an additional set of bearings (needle type) in addition to the cup-and-cone ball bearing set.

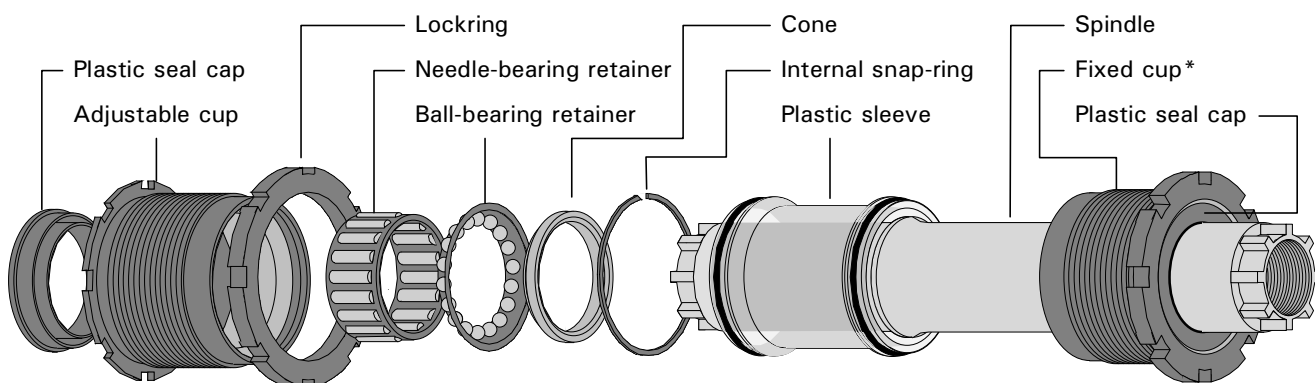
The tools required are listed on page 10-7 in table 10-2. These tools are used to install and remove the fixed cup, and to adjust the adjustable cup. Additionally, the same tools are used to install and remove the locking that holds the chainring arms to the crank arm on many Shimano crank models.

The seals in this bottom bracket are different because they are a multi-part design. Each cup has a soft rubber seal fixed to the inner perimeter of the hole where the spindle goes through. The fit between the rubber seals and the spindle is somewhat loose. The second part of each seal set is a plastic cap (metal on the right side of the Type 2) that is a very tight fit to the spindle. The rubber seal and the cap engage each other in such a way as to create a labyrinth seal, which is highly effective at keeping out grit.

Both the Type 1 and Type 2 versions of these bottom brackets have bearing cones that are separate from the spindle. They slip onto the spindle and seat against flanges on the spindle that fix the position of the cone. On the Type 1 spindle, these cones are a mild press fit. On the Type 2 spindle, the cones are a loose fit. Because of this difference, when disassembling the Type 1 bottom bracket, the cones tend to remain in place on the spindle during disassembly. By nature of the design of the Type 2 version, the cone stays with the left-side cup and bearing assembly when they are removed from the spindle. On the right side of the Type 2 version, the cone may stay on the spindle or may stay with the cup when separating the right-side cup and spindle.

The final feature of these bottom brackets that sets them apart from conventional adjustable-cup bottom brackets is that there are two sets of needle bearings in addition to the two sets of cup-and-cone ball bearings. The function of the needle bearings is to support most of the radial loads (which tend to be high). Since the ball bearings are not supporting these high loads, they are much smaller than normal bottom-bracket ball bearings (1/8" instead of 1/4"). With the needle bearings supporting the primary radial loads, the only function of the ball bearings is to enable adjustment of play so that the spindle does not move laterally.

TYPE 1



*Includes snap-ring, ball-bearing retainer, and needle-bearing retainer

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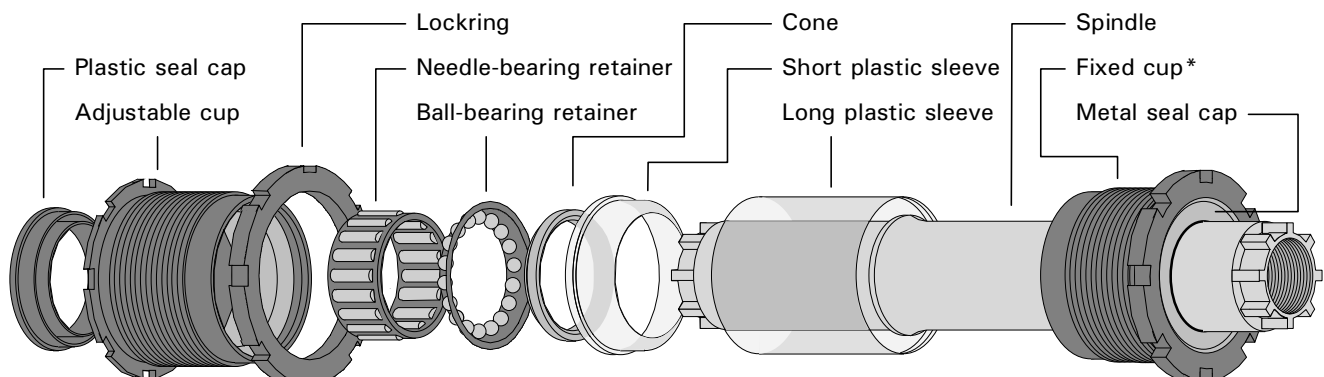
Type 1 disassembly

1. [] Remove both crank arms.
 2. [] Look for black plastic cap on right end of spindle to confirm unit is Type 1. If silver metal cap is found, use Type 2 directions.
 3. [] Loosen lockring by using lockring spanner to turn it fully counter-clockwise (lockring is larger notched ring on left side of bottom bracket).
 4. [] Turn adjustable cup (smaller notched ring) counterclockwise to remove it.
 5. [] Pull plastic seal cap out of outer face of cup.
 6. [] Pull spindle out left side of bottom-bracket shell.
 7. Measure thread diameter of left-side cup to determine if bottom bracket is English/BSC or Italian thread:
 [] Approximate 35mm O.D. is English/BSC
 [] Approximate 36mm O.D. is Italian
 8. [] Use TL-UN96 (or equivalent) to turn fixed cup clockwise to remove (unless Italian thread).
 9. [] Pull plastic seal cap out of outer face of cup.
 10. [] Remove plastic seal cylinder from whichever cup it has remained attached to.
 11. [] Use seal pick to carefully remove plastic split ring from inside end of each cup. *Be prepared for many small bearings to fall out once ring is removed!*
 12. [] Remove ball-bearing retainer from each cup.
 13. [] Remove needle-bearing retainer from each cup.
 14. [] Remove balls and needles from retainers.
3. [] Loosen lockring by using lockring spanner to turn it fully counter-clockwise (lockring is larger notched ring on left side of bottom bracket).
 4. [] Turn adjustable cup (smaller notched ring) counterclockwise to remove it.
 5. [] Pull plastic seal cap out of outer face of cup.
 6. [] Use plastic mallet to tap on right end of spindle to remove it from bottom bracket. Watch for metal seal cap that will fall off right end of spindle as spindle is removed. Observe whether cone remained on spindle.
 7. Measure thread diameter of left-side cup to determine if bottom bracket is English/BSC or Italian thread:
 [] Approximate 35mm O.D. is English/BSC
 [] Approximate 36mm O.D. is Italian
 8. [] Use TL-UN96 (or equivalent) to turn fixed cup clockwise to remove (unless Italian thread).
 9. [] To remove short plastic sleeve cylinder from adjustable cup, carefully pry under inner perimeter with seal pick. *Be prepared for numerous loose parts held in place only by this plastic sleeve, including a cone, a ball bearing retainer, and a needle-bearing retainer to fall out!*
 10. [] To remove long plastic sleeve cylinder from fixed cup, just pull pieces apart with your fingers. *Be prepared for loose parts held in place only by this plastic sleeve, including a cone, a ball bearing retainer, and a needle-bearing retainer to fall out!*
 11. [] Remove cones from each cup assembly (unless right-side cone remained on spindle).
 12. [] Remove ball-bearing retainer from each cup.
 13. [] Remove needle-bearing retainer from each cup.
 14. [] Remove balls and needles from retainers.

Type 2 disassembly

1. [] Remove both crank arms.
2. [] Look for silver metal cap on right end of spindle to confirm unit is Type 2. If black plastic cap is found, use Type 1 directions.

TYPE 2



*Includes cone, ball-bearing retainer, and needle-bearing retainer

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Type 1 & 2 cleaning and parts replacement

15. [] Clean all parts with solvent and dry completely.
16. [] Inspect cones for pitting and replace if necessary.

In the previous step, the cones were inspected. If they need replacing, the XTR Type 1 and 2 cones are interchangeable with each other, but the Dura-Ace cones are unique.

17. [] Inspect cup races for pitting.
18. [] Inspect needle races inside cups for pitting.

In the previous steps, the cups and needle races were inspected. Type 1 cups (XTR or Dura-Ace) are available separately. The Type 2 XTR left-side cup is available separately, but the right-side cup is sold only as part of a cup and spindle assembly. Cups are sold complete with new ball and needle bearings.

19. [] Inspect needle races on spindle for pitting.

In the previous step, the needle races on the spindle were inspected. Type 1 spindles (XTR or Dura-Ace) are available separately. The Type 2 XTR spindle is only available as part of a spindle and right-side cup assembly.

20. [] Pack all four retainers with grease suitable for high-quality bearings.
21. [] Put 18 new 1/8" ball bearings into each ball bearing retainer (insert from outside).
22. [] Put 18 roller bearings into each roller bearing retainer (insert from outside).
23. [] Inspect seals and seal caps for damage and replace as necessary.

The rubber seals are available only as part of the cup assembly. The plastic seal caps are available separately, but the metal seal cap on the right side of the Type 2 bottom bracket is only available as part of a spindle and right-side cup assembly.

Type 1 assembly

24. [] Insert roller-bearing retainers into each cup.
25. [] Insert ball-bearing retainers into each cup with smaller-diameter end going in first.
26. [] Install plastic split ring into each cup until securely engaged in groove.
27. [] Press cones onto spindle until they are seated against flanges.
28. [] Press either end of plastic seal cylinder firmly into end of fixed cup.
29. [] Insert spindle into fixed cup, then press plastic seal cap over right end of spindle until it bottoms against seal and cup.

Type 2 assembly

24. [] Insert roller-bearing retainers into each cup.
25. [] Insert ball-bearing retainers into each cup with smaller-diameter end going in first.
26. [] Install cone into left-side cup.
27. [] Snap short plastic cylinder into left-side cup, and snap long plastic cylinder into right-side cup.
28. [] Press remaining cone onto right end of spindle until it seats against flange.
29. [] Insert spindle into fixed cup, then press metal seal cap over right end of spindle until it bottoms against seal and cup.

Types 1 & 2 installation and adjustment

30. [] If installing new unit, separate left-side cup assembly from clear plastic seal cylinder and remove black plastic seal cap from outer face of left-side adjustable cup.
31. [] Thread adjustable-cup lockring inward, then coat threads that were covered by lockring with anti-seize, then thread lockring back out to end of cup.
32. [] Coat all exposed threads on both cups with anti-seize.

The bottom bracket comes with several spacer washers, which change location depending on the configuration. The variables are the shell width (68mm or 73mm), the spindle length (112.5mm or 116mm), and whether the front derailleur being used is an E-type (mounts by means of bracket secured behind the fixed-cup flange). Use the following guide for the spacer thickness used with each configuration:

- 68mm shell/112.5mm spindle—2.5mm each side
- 68mm shell/116mm spindle—3.5mm each side
- 73mm shell/112.5mm spindle—no spacers
- 73mm shell/116mm spindle—1mm each side
- All combinations, right side, with E-type derailleur—bracket only on right, no spacers
- 68/112.5mm setup with E-type—2.5mm on left
- 73/116mm setup with E-type—nothing on left
33. [] Install correct spacer or bracket on each cup.
34. [] Carefully thread right-side cup and spindle assembly into right side of bottom-bracket shell (counterclockwise for English/BSC, clockwise for Italian).
35. [] Using Park BBT-8 and TWB-368, secure fixed cup to 435in-lbs.
36. [] Double-check that lockring is threaded all the way out on adjustable cup, then thread adjustable cup in until it gently contacts bearings.

37. [] Place BBI bottom bracket tape on shell so that “0” mark lines up with one edge of a notch in the adjustable-cup flange (not a notch in the lockring).

In the next step, you simultaneously stabilize the adjustable cup and secure the lockring. The adjustable cup can be fit by the TL-UN96 or equivalent, but this type of tool requires a second tool for leverage, such as a headset spanner. Since you also have to use another lockring spanner on the lockring, you would end up with three tools, none of which securely attach to each other or the part they engage. Consequently, the best technique is to use two lockring spanners and no TL-UN96 or equivalent. This technique is much less awkward.

38. [] Use one lockring spanner to stabilize adjustable cup, and another to secure lockring.
39. [] Jerk vigorously on end of right crank arm at a variety of positions to check for knock.
40. [] Tighten adjustment (clockwise) by one mark to eliminate knock, or loosen (counterclockwise) to create knock. Final adjustment is first setting clockwise of adjustment with knock that eliminates knock.
41. [] Press black plastic seal cap onto left end of spindle until it is fully seated against seal and cup.

CARTRIDGE-BEARING SPLINED-SPINDLE BOTTOM BRACKETS

Tool compatibility

These bottom brackets include the Dura-Ace model BB-7710 (track), the Ultegra model BB-6500, the 105 model BB-5500, and the XTR model BB-M952. These are all simple cartridge-bearing bottom brackets such as the UN, LP, or CS series. The only difference is that the spindle configuration is splined instead of a squared taper. However, this difference can cause problems with the fit of earlier versions of the tools for this type of bottom bracket. Older versions of the Park BBT-2 or the Shimano tools will not work. Specifically, the BBT-2 with 20mm hex flats on the smaller diameter of the tool is not compatible. The newer BBT-2 has 32mm hex flats on the larger portion of the tool, and is compatible. The Shimano TL-UN65 or TL-UN74-S will clear the larger-diameter splined spindles. The older Shimano tool models TL-UN50, TL-UN52, TL-UN70, and TL-UN70 either are incompatible with the splines in the mounting rings, or lack the internal clearance to clear the larger-diameter splined spindles.

Service

The service techniques are the same as all Shimano UN-series cartridge bottom brackets (pages 10-1 through 10-3). Note, the recommended torques on these pages are less than the Shimano recommendations. They have been well proven in the field, and are preferred on the bottom brackets that have a plastic-mounting ring on the left side. The Shimano recommended torque often leads to damage of the plastic splines. The bottom brackets with splined spindles all have metal splines in the mounting rings, and can easily withstand Shimano's recommended minimum torque of 435in-lbs.

The bottom bracket comes with several spacer washers, which change location depending on the configuration. The variables are the shell width (68mm or 73mm), the spindle length (112.5mm or 116mm), and whether the front derailleur being used is an E-type (mounts by means of bracket secured behind the fixed-cup flange). Use the following guide for the spacer thickness used with each configuration:

- 68mm shell/112.5mm spindle—2.5mm each side
- 68mm shell/116mm spindle—3.5mm each side
- 73mm shell/112.5mm spindle—no spacers
- 73mm shell/116mm spindle—1mm each side
- All combinations, right side, with E-type derailleur—bracket only on right, no spacers
- 68/112.5mm setup with E-type—2.5mm on left
- 73/116mm setup with E-type—nothing on left

Fit to crank arms

These models of bottom brackets all have a uniform spindle-spline pattern. The critical spline dimensions are that the eight lands (ridges) are 2.2mm thick and 5mm long. As long as the spindle length is suitable, any bottom brackets with these spline dimension are interchangeable. Shimano has another bottom-bracket type (model BB-ES70) with eight lands that are each 2.8mm thick and 9mm long that is not interchangeable with the 2.2mm × 5mm pattern.

LONG-SPLINED SPINDLES

The Shimano model BB-ES70, introduced in 2000, is a simple cartridge-bearing bottom bracket with a different spline pattern than previously introduced splined-spindle models. The service tools and techniques are identical to the sealed splined bottom brackets described in the immediately previous section, **CARTRIDGE-BEARING SPLINED-SPINDLE BOTTOM BRACKETS** (page 10-10).

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Fit to crank arms

This model of bottom bracket has a new spindle-spline pattern. The critical spline dimensions are that the eight lands (ridges) are 2.8mm thick and 9mm long. As long as the spindle length is suitable, any bottom brackets with these spline dimension are interchangeable. Shimano has another bottom-bracket type with eight lands that are each 2.2mm thick and 5mm long that is not compatible. The difference between the 5mm and 9mm long lands is obvious without measurement once you have seen both, so distinguishing between the two spline patterns should not be difficult.

The BB-ES70 is made to fit 2000 model crank arms including Deore XT and LX models with splined arm holes (model numbers FC-M751 and FC-M571). Deore LX model FC-M570 is also considered a 2000 model, but it fits a squared spindle. Deore XT and LX models from 1999 and earlier (1999 model numbers FC-M750 and FC-M570, respectively) both fit squared spindles.

