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## System Integration™ (Si) Hollowgram Cranksets & Bottom Brackets

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### INTRODUCTION

This owner's manual supplement contains technical information for System Integration (Si) Hollowgram bottom bracket and crankarm assemblies. This supplement is not a comprehensive service or shop manual for your bike and it is not a replacement for your *Cannondale Bicycle Owner's Manual*.

### TOOLS & SUPPLIES

The following is a list of Cannondale special tools required for the service described in this manual as well as other common tools and necessary supplies.

Cannondale P/N	DESCRIPTION	See
KT010/	A 3-piece set of mandrels needed to install replacement bearings	Fig. 4A
KT011/	A 1-piece bearing remover to remove bottom bracket bearings from the shell	Fig. 2A
KT012/	A special socket to remove/install the spider/crankarm lockring	Fig. 7A-C
KT013/	A 2-piece tool (2 pieces) needed to remove crankarms from spindle ends	Fig. 1
1. Headset cup bearing press with 1" adapters, such as Park HHP-1. See <a href="http://www.parktool.com/">http://www.parktool.com/</a> . 2. Calibrated torque wrench 3. Metric hex wrench set 4. 15mm open-ended wrench 5. Punch or drift 6. High-quality bike bearing grease		

**⚠ WARNING:** As a reasonable person would expect, we cannot predict the mechanical skill of anyone in the field, and cannot teach bicycle mechanics. Please understand that the information provided here is intended for competent, experienced bicycle mechanics familiar with bicycle terminology, service techniques and equipped with proper tools.

Via our website, or on paper, information is also available to Cannondale owners. While Cannondale strongly recommends that all mechanical work be performed by a retailer, we encourage owners to understand the mechanics of their bicycles.

Inexperienced mechanics or owners attempting to perform the procedures described can damage their bicycle. Improper mechanical work increases the risk of an accident. Any bicycle accident has risk of serious injury or death. To minimize these risks, we strongly recommend that owners always have mechanical work done by an authorized Cannondale retailer.

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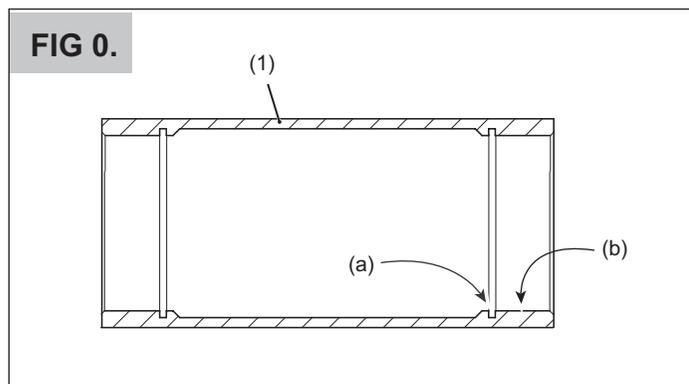
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## BOTTOM BRACKET SHELL PREPARATION

The bottom bracket shell is accurately machined at our factory. You should never mill or machine the bottom bracket for any reason. Doing so can result in serious damage. You can end up with a ruined bike frame. When installing replacement bearings or during reassembly of the bottom bracket, your preparation steps should include:

1. A thorough cleaning of the interior of the bottom bracket shell (1).
2. An inspection of the circlip groove (a) and the bearing seats (b) on both sides of the bracket.
3. An inspection of the outer and inner bracket shell and frame surfaces for evidence of fatigue cracking.
4. An inspection of all installed components.

Replace damaged parts with new ones. See the Part Kit information at the end of this supplement for more information.



1. Bottom Bracket Shell  
a. Circlip groove  
b. Bearing seats

**CAUTION:** Do not REAM, MILL, or "FACE" the bottom bracket shell!

## CRANKARM REMOVAL

Removing both the left and right side crankarms is accomplished through the use of a special Cannondale service tool - KT013/.

See Fig. 1.

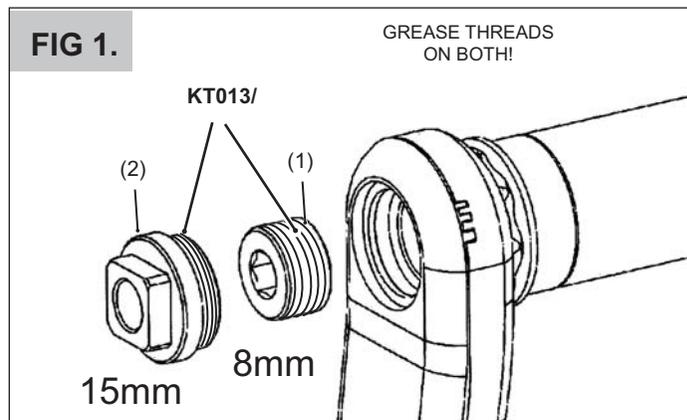
The threads of the spindle, crankarm, and tool parts should be absolutely clean and well greased before the removal process starts. Dirt and grime can cause damage to the relatively soft and light-weight metals.

1. To remove the crankarms, first remove the crankarm fixing bolt and the washer from the crankarm. Be sure to insert the 8mm wrench completely into the fixing bolt before attempting to loosen it. And, take care not to lose the washer under the bolt head.
2. With the bolt and washer removed, apply grease to the threads of the tool stud (1) and insert through the crankarm and into the bottom bracket spindle. Screw it in until the top of the stud is flush with the face of the spindle.
3. Next, apply grease to the threads of the tool body (2) and

exposed face of the nut. Install the body into the crankarm completely and tighten it securely with a 15mm wrench.

4. Insert the 8mm hex wrench through the hole in the body and into the stud counter-clockwise. The nut will back out against the body exerting force and drive the crankarm off of the bottom bracket spindle. Turn until the crankarm can be removed. Repeat the above process for the other crankarm.

**NOTE:** Before reinstalling the crankarm, be sure to thoroughly clean and regrease the crankarm and spindle mating surfaces.



## BEARING INSPECTION

The inner bearing races of both bearings should rotate smoothly and quietly with only the force of your finger. It should not move side-to-side.

The rotation should not stick or feel gritty.

There should not be any play detected in the inner race and the bearing should not be free to slide in the bottom bracket shell.

The bearings are a press fit and if they move in the shell, this is an indication of damage to either the bearings or bottom bracket shell.

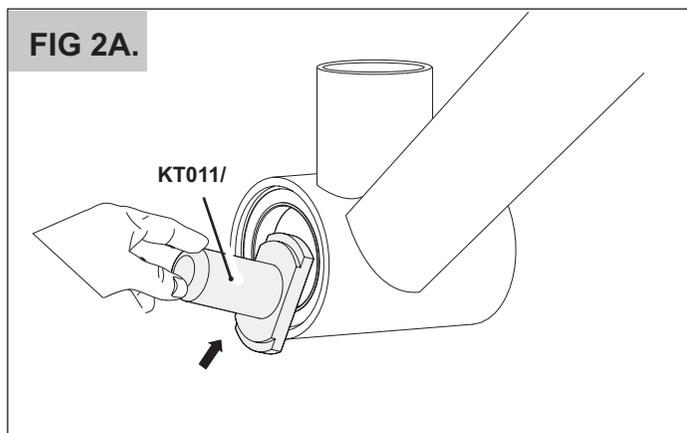
**NOTE:** Loose bearings can be a cause of "creaking."

## BEARING REMOVAL

The two bottom brackets bearings are a sealed type. Mountain bike bottom bracket assemblies have an added seal mated to the bearing shield. However, should the bearing suffer damage due to wear or contamination, they can be replaced easily using Cannondale service tool - KT011/. See Fig. 2A.

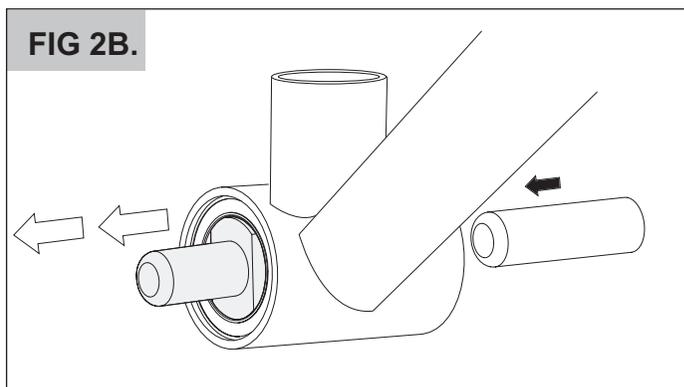
**CAUTION:** The removal tool applies significant force to the inner race of the bearing. Since this often results in damage to bearings, we recommend installing new bearings anytime they are removed. Replace both bearings as a new set. The two circlips in the bottom bracket shell can be left in place. Should they need to be removed, use a flat blade screwdriver. Starting at the hooked end, lift the circlip out of the internal groove in the bottom bracket shell.

1. To remove the bearings, remove the right crankarm. It is not necessary to remove the left side crankarm arm.
2. Remove the wave washer, plastic shims, and the metal bearing shield from the bottom bracket spindle. See "Crankarm Removal."
3. Hold the left crankarm and carefully tap the spindle through the bearings using a rubber mallet from the right side.
4. Locate the special tool (KT011/) on the inside inner race of the bearing. See Fig. 2A.



5. From the other side, locate a punch or drift on the back of the tool and drive out the bearing. Repeat for the other bearing. See Fig. 2B.

**NOTE:** Now would be a good time to remove, clean, and regrease the circlip groove and circlips. Doing this will help prevent "creaking."



## INSTALLING BOTTOM BRACKET CIRCLIPS AND BEARINGS

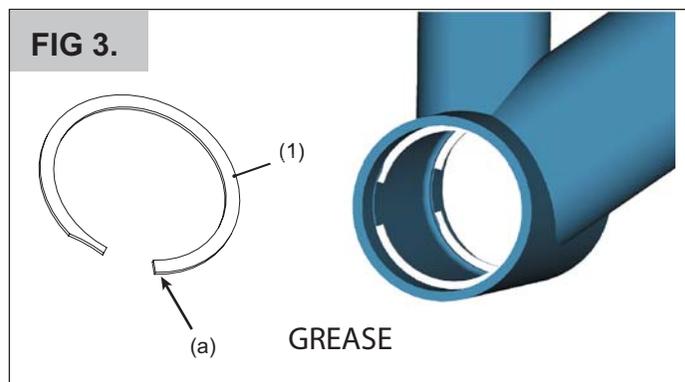
The following steps are required to install bearings into a bottom bracket shell for road or mountain bike frame. Installing the bearings into the shell is accomplished with Cannondale service tool KT010/ , a 3-piece driver set. The set is designed for use with a headset cup bearing press with 1" adapters, such as Park Tool HHP-2 (Bearing Cup Press).

Before installing new bearing into the shell, thoroughly clean the inside of the bottom bracket shell with a dry shop towel. Pay extra attention to the circlip groove. Inspect the bottom bracket shell inside and out for any damage such as cracks or dents before continuing.

And, for added corrosion protection, apply a coating of bearing grease to the inside face and outside diameter of the bearings.

1. To install circlips and bearings, start by applying a thin film of bearing grease in to the circlip groove of the bottom bracket shell.
2. Install the flat end (a) if a circlip (1) into the groove (2) first, then moving clockwise, push the clip into the groove until it is fully seated in the groove. Install the other circlip the same way. See Fig. 3.

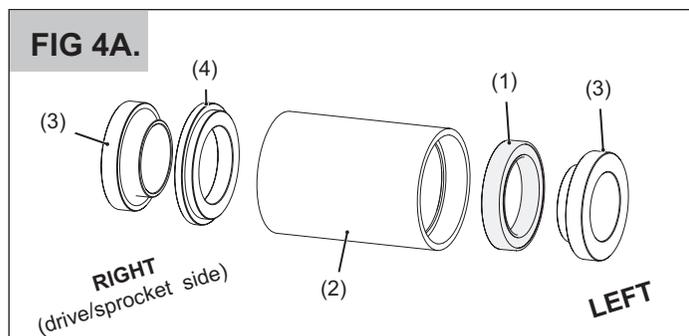
**⚠ WARNING:** Circlips may have sharp edges that can cut your fingers. A circlip can cause serious eye injury if it springs out of your hands or the work unexpectedly. Handle them carefully, wear hand and eye protection.



3. Lightly grease the inside of the bottom bracket shell up to

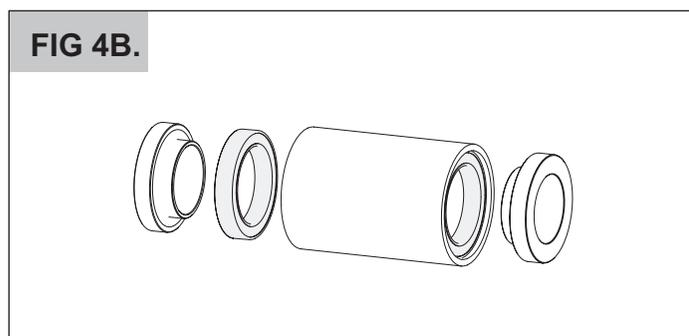
the circlips. Place a bearing (1) into the left side of the bottom bracket shell (2). Install a mandrel (3) (Cannondale tool KT010/) into the bearing. On the right side of the bottom bracket, place the small end of the mandrel ring (4) into the bottom bracket and install the small end of the other mandrel into the ring.

**See Fig. 4A.** Install a headset bearing cup press with 1" adapters through the mandrels and bottom bracket and press the left bearing until it bottoms against the circlip.



4. Remove the headset press and special tools.

5. Now, place another bearing into the bottom bracket install the two mandrels on both sides of the bottom bracket without the mandrel ring. **See Fig. 4B.**



6. Insert the bearing press through the parts as before and press the bearing into the bottom bracket. Remove the tools and press.

7. Apply a light coat of good quality bicycle grease to the outside faces and inside race surfaces of the installed bearings, to provide corrosion protection.

## INSTALLING THE SPINDLE ASSEMBLY AND CRANKARMS

The spindle assemblies used for road and mountain bike equipped with System Integration bottom brackets are slightly different. **Be sure to consult the Figures 5A (road bikes) or 5B (mountain bikes) closely and note the part differences of each type of assembly.** The following steps describe how to install the spindle, crankarms and other parts after the circlips and bearing are installed into the bottom bracket shell. Generally speaking, all parts should be cleaned, inspected, free of corrosion, and greased at mating surfaces before assembly and installation into the bottom bracket.

1. To install the spindle and crankarm into the bottom bracket

shell, start by sliding a bearing shield (8) onto the spindle (12) with the flat side (a) of the shield facing the ridge (b) on the spindle. Grease the interface between the spindle and shield. For mountain assemblies, grease and install the bearing seal (15) onto the inside face of the shield.

**See Fig. 5B, DETAIL A.** Next, lightly grease the spindle bearing seats (c) and insert the spindle, shield, and seal through the bearings in the bottom bracket.

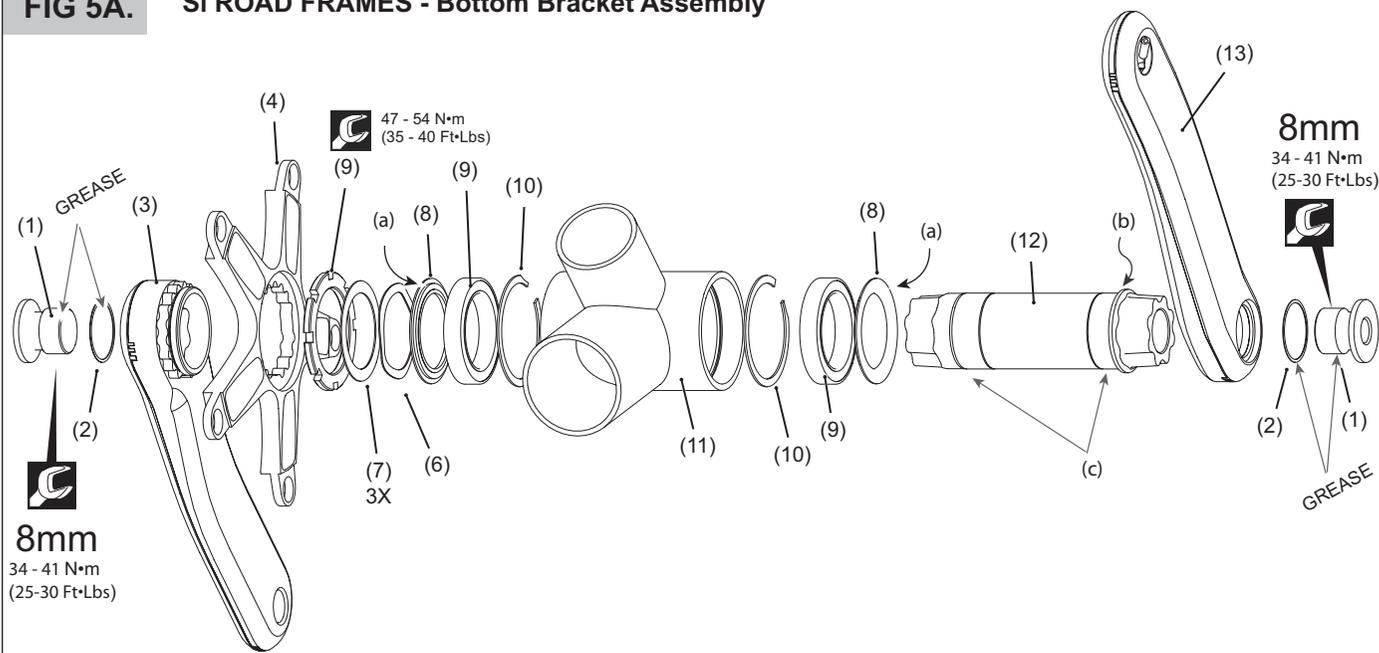
2. On the right side of the bottom bracket, install the bearing shield (8) onto the spindle with the flat side facing out (toward the crankarm). If you have a mountain assembly be sure to install a bearing seal as in the previous step. Next, if you have a road bike install the wave washer (6) and three shims (7), if you have a mountain bike install the 12mm spacer the wave washer and shims. Please note that the correct number of shims is determined by the compression of the wave washer after the right crankarm is installed and the fixing bolt tightened to the correct torque. See step 4.

3. Now, grease the spindle splines and install the right (drive side) crankarm assembly (spider and chainrings) onto the spindle. Grease the threads of the crank arm bolt (1), the underside of the bolt head, and the steel washer (2). and install through crankarm assembly into the spindle. Use the left crankarm (13) to hold the spindle and tighten the crankarm fixing bolt to the specified torque.

4. Check the compression of the wave washer; the wave washer (3) should be nearly flat (0.3-0.5mm of compression left is ideal). If you can easily fit the edge of a 0.5mm shim into the wave, then add another shim. If the wave washer has more than 1mm of compression left then the spindle could move from side-to-side and creak. You should be able to see the waves of the wave washer when you rotate the cranks. This means that the bearings are preloaded by the wave washer alone without being overloaded by the force of the crank bolt.

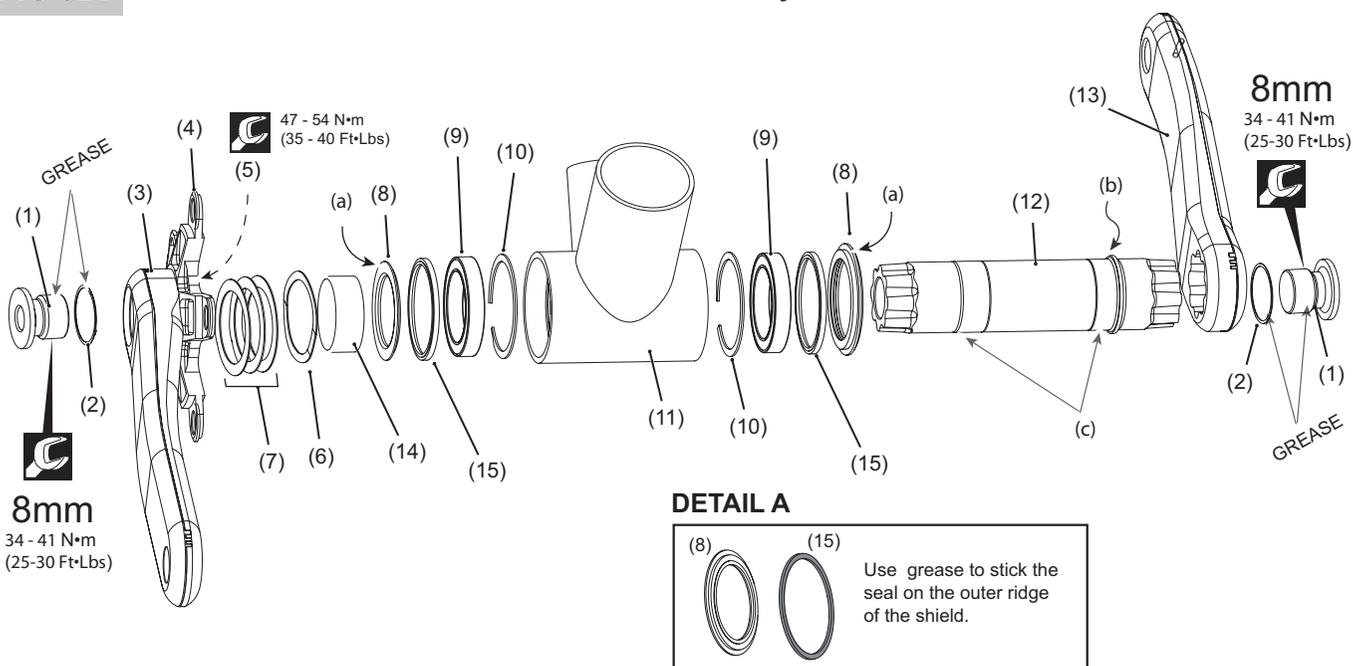
5. With the correct number of shims and right crankarm installed, proceed by greasing the left (non-drive) side bottom bracket splines, install the left crank (13) opposed 180° degrees (opposite) the right arm. Once more, grease the fixing bolt threads, the underside of the bolt head, and the steel washer install into the crankarm and tighten to the specified torque.

**FIG 5A. Si ROAD FRAMES - Bottom Bracket Assembly**

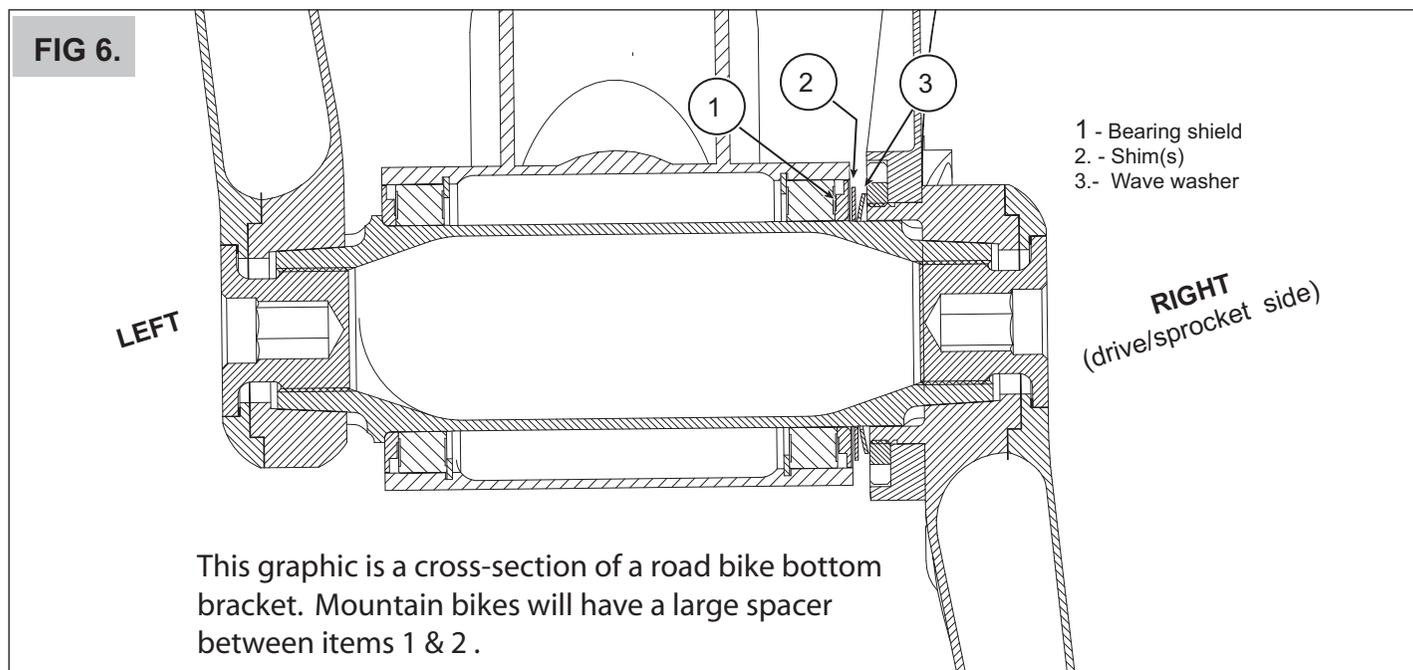


- |                   |                   |                                  |                   |
|-------------------|-------------------|----------------------------------|-------------------|
| 1. Crankarm bolt  | 5. Lockring       | 9. Bearing                       | 13. Left crankarm |
| 2. Steel washer   | 6. Wave washer    | 10. Circlip                      | a. Flat side      |
| 3. Right crankarm | 7. Shim(s)        | 11. Bottom Bracket Shell (frame) | b. ridge          |
| 4. Spider         | 8. Bearing shield | 12. Spindle                      | c. Bearing seats  |

**FIG 5B. Si MOUNTAIN FRAMES - Bottom Bracket Assembly**



- |                   |                   |                                  |                  |
|-------------------|-------------------|----------------------------------|------------------|
| 1. Crankarm bolt  | 6. Wave washer    | 11. Bottom Bracket Shell (frame) | a. Flat side     |
| 2. Steel washer   | 7. Shim(s)        | 12. Spindle                      | b. ridge         |
| 3. Right crankarm | 8. Bearing shield | 13. Left crankarm                | c. Bearing seats |
| 4. Spider         | 9. Bearing        | 14. Spacer                       |                  |
| 5. Lockring       | 10. Circlip       | 15. Bearing seal                 |                  |

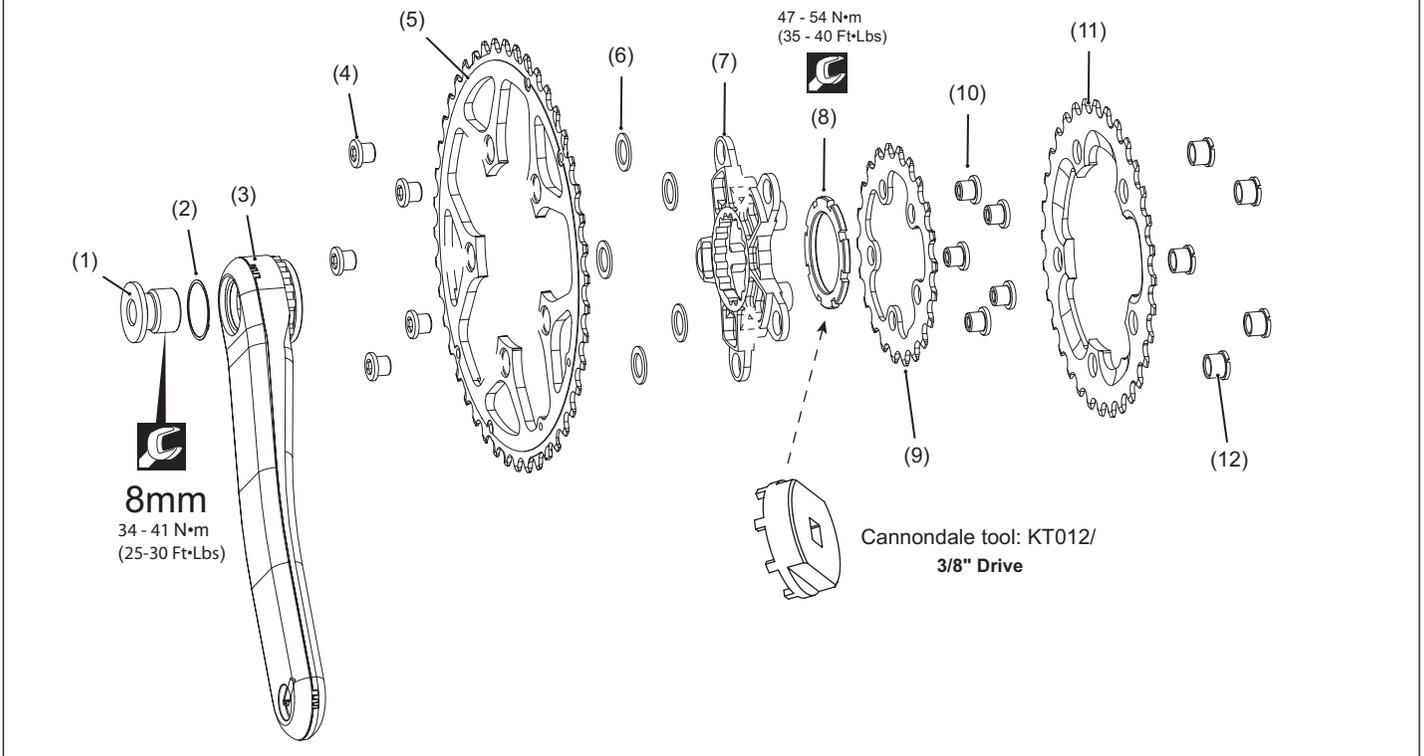


### CHAINRINGS & RIGHT CRANKARM

The outer and middle chainrings must be installed with the correct orientation to provide the best shifting possible. Each ring has a countersunk bolt hole for the five chainring bolts, and the countersunk side of each ring must face away from the five tabs on the spider to which the rings are bolted. This will allow the chainring bolts and nuts to sit into the recesses on each ring.

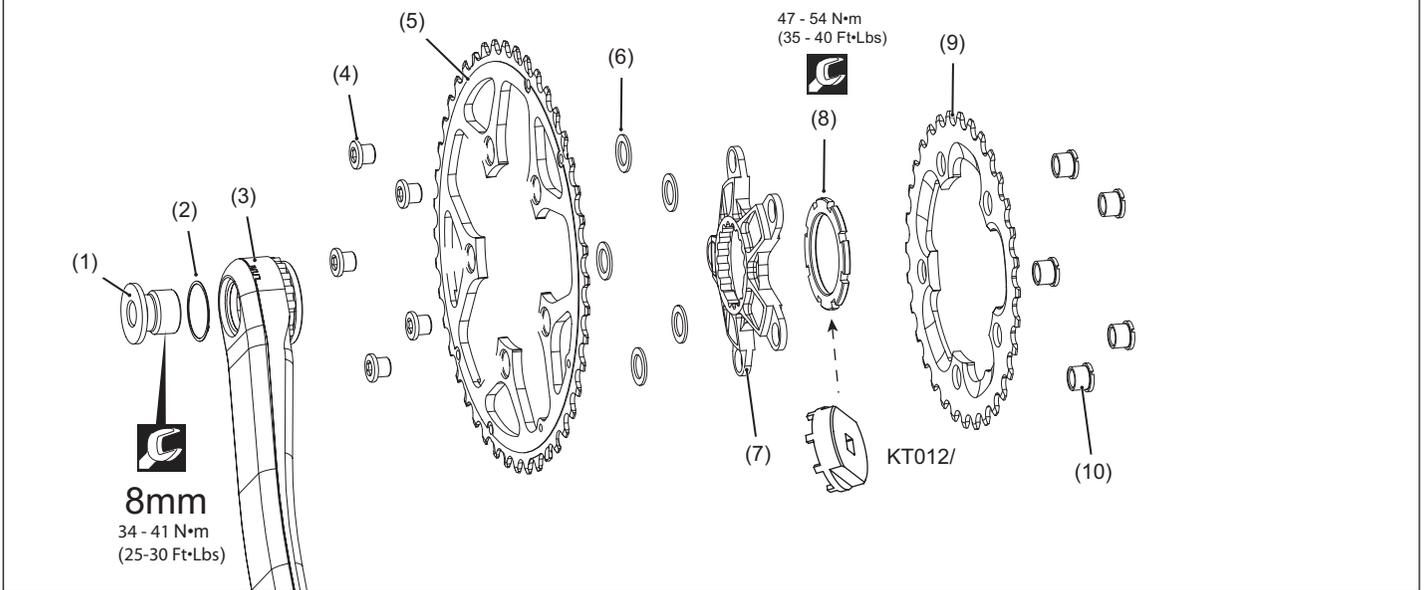
The large chainring has a pin on the outside which will need to be aligned with the right crank arm to prevent a derailed chain from getting jammed between the arm and the large chainring. Also, both the middle and large rings have a mark which needs to be aligned with the right crank arm to provide the best possible shifting.

**FIG 7B. Si MOUNTAIN - 3X9 Crankarm/Chainrings**

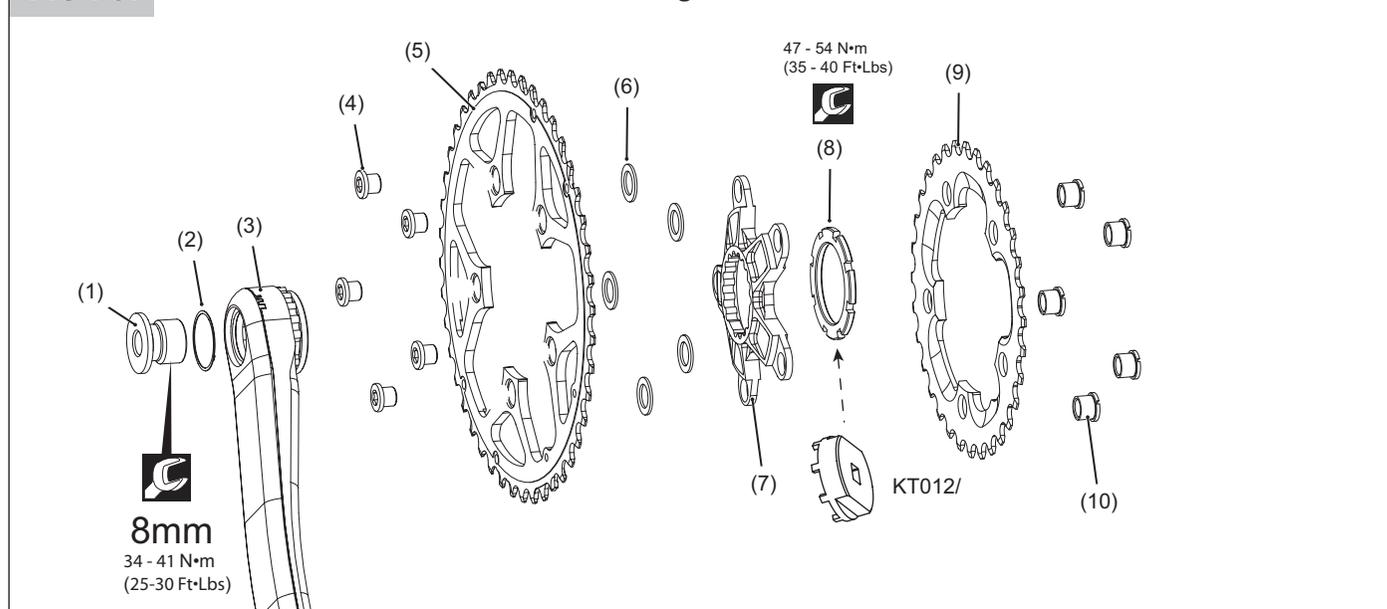


- |                    |                            |                     |                     |
|--------------------|----------------------------|---------------------|---------------------|
| 1. Crankarm bolt   | 4. Chainring bolts (qty 5) | 7. Spider           | 10. Chainring bolts |
| 2. Steel washer    | 5. Outer chainring         | 8. Lockring         | 11. Inner chainring |
| 3. Crankarm, right | 6. Shims (qty5)            | 9. Middle chainring | 12. Chainring nuts  |

**FIG 7C. Si MOUNTAIN - 2X9 Crankarm/Chainrings**



- |                    |                            |                    |                    |
|--------------------|----------------------------|--------------------|--------------------|
| 1. Crankarm bolt   | 4. Chainring bolts (qty 5) | 7. Spider          | 10. Chainring nuts |
| 2. Steel washer    | 5. Outer chainring         | 8. Lockring        |                    |
| 3. Crankarm, right | 6. Shims (qty5)            | 9. Inner chainring |                    |

**FIG 7C. Si MOUNTAIN - 2X9 Crankarm/Chainrings**

- |                    |                            |                    |
|--------------------|----------------------------|--------------------|
| 1. Crankarm bolt   | 4. Chainring bolts (qty 5) | 7. Lockring        |
| 2. Steel washer    | 5. Outer chainring         | 8. Inner chainring |
| 3. Crankarm, right | 6. Spider                  | 9. Chainring nuts  |

## GENERAL CARE & CLEANING

Just like many of the other parts of your bike, System Integration bottom bracket and crankarm assemblies are strong and durable. However, this does not mean that the parts can not wear-out, or become damaged through use. This is why we recommend regular inspection of all the parts of your bike by an experienced bike mechanic.

For the System Integration bottom bracket assembly, a periodic regreasing of mated surfaces and careful disassembly and inspection of the parts is beneficial and can extend the overall service life provided that the service is performed competently. All service to your bike should be done on a schedule that is compatible with your riding habits, the area in which you ride, and the needs of your bike. In general, in dry conditions the period between service is longer than if you ride in wet or humid conditions. This is especially true for bearings and chains. Become familiar with the operation and parts of your bike so that you are more able to identify and ultimately have problems corrected before damage happens. Whenever you clean your bike or perform the Pre-Ride Inspection noted in your *Cannondale Bicycle Owner's Manual*, please take the occasion to examine the bottom bracket, chainrings, and crankarms for damage. Consult your Cannondale Dealer if you see or notice any damage and have it corrected before you ride.

**CAUTION:** Don't use a power washer to clean your bike. Power washing can force dirt or water past seals. This will force grease out promoting corrosion and early part failures.

## REPLACEMENT & RENEWAL PARTS (AVAILABLE THROUGH A CANNONDALE DEALER ONLY)

Cannondale P/N	DESCRIPTION
QC614/	SI crank arm bolts, pack of 2
QC616/	SI bottom bracket shell circlips, pack of 4
QC615/	SI bearing shields, pack of 2
QC617/	SI 0.5mm plastic shims, pack of 5
QC604/	Alloy chainring bolts and nuts, pack of 5
QC612/	SI bottom bracket spindle
QC618/	SI bottom bracket wave washer
KB6180/	SI bottom bracket bearings, pack of 2