

## Introduction

Welcome to wheel building with Berd Spokes! We are excited for you to try this exciting new technology, which offers superior performance to traditional metal spokes. Wheel building with Berd spokes is similar to building with metal spokes, but there are differences. The main differences are the way in which non-Berd hubs are prepared, the lacing process, and the tensioning process. While these steps are not difficult, they will take extra time at first. Practice will lead to more time-efficient wheel building.

\*Special instructions exist within this manual for building with Short/BMX spokes, which are defined as spokes having a length less than 250 mm. The loop of Short/BMX spokes is slightly larger in diameter than standard Berd spokes. Hub holes must be enlarged using a 2.9 mm (or 33 gauge) drill bit prior to performing the hub preparation process (drill bit included with Short/BMX spoke orders). Short/BMX spokes are only compatible with standard J-bend hubs and hook flange hubs designed specifically for Berd spokes. Short/BMX specific instructions are marked by an asterisk (\*) throughout this document.

Berd spokes will stretch more than metal spokes during the wheel building process. You can expect 5 to 7 mm of stretching as the spokes are brought up to tension. Because of this, Berd spokes will appear too short (compared to metal spokes) when lacing the rim until tension is applied. Additionally, the spoke tension will decrease significantly over the first two days, so we have outlined the recommended multi-day process at the end of this manual. We hope you enjoy building with Berd spokes. Please contact us at any time for assistance.

If you are building wheels with straight pull hubs we recommend that you build these wheels with white spokes and then use our [Black Berd Spoke Coloring Kit](#) to dye your spokes once the wheel is tensioned. The black coloring can make it difficult to pull through Straight Pull spoke holes.

Below are the contents of the Berd Builder's Tool Kit (one-time purchase; required for building Berd wheels with classic flanges), Berd Spoke Replacement Tool Kit (one-time purchase; substitute for Berd Builder's kit for replacing spokes only or for building wheels with straight pull hubs), and the Berd Builder's Kit Consumables (White or Black; one kit required per set of 64 spokes. Included with spoke orders from berdspokes.com. May need to be purchased separately if spokes are purchased through a distributor.)

### Berd Builder's Tool Kit Contents (6 items)



**Corner Rounding Tool**  
The Corner Rounding Tool is used to remove sharp corners from classic flanged hub holes.



**Awl**  
The Awl is used to open the spoke loop after pulling the loop through a hub hole.



**Spoke Pulling Tool**  
The Spoke Pulling Tool is used to pull the wire loop and spoke through the hub hole.



**Insert Pushing Tool**  
The Insert Pushing Tool is used to push the tangential insert onto the spoke.



**Thin Nipple Wrench**  
The Thin Nipple Wrench is used to turn the nipple when truing from the hub side of the rim.



**Spoke Holding Tool**  
The spoke holding tool is used to prevent spoke twisting while truing the wheel and can help with lacing.

### Berd Spoke Replacement Tool Kit Contents (7 items)



#### Wire with Loop Ends (2 per kit)

The wire loop is used to pull the spoke loop through the hub hole.



#### Awl

The Awl is used to open the spoke loop after pulling the loop through a hub hole.



#### Spoke Pulling Tool

The Spoke Pulling Tool is used to pull the wire loop and spoke through the hub hole.



#### Insert Pushing Tool

The Insert Pushing Tool is used to push the tangential insert onto the spoke.



#### Thin Nipple Wrench

The Thin Nipple Wrench is used to turn the nipple when truing from the hub side of the rim.



#### Spoke Holding Tool

The spoke holding tool is used to prevent spoke twisting while truing the wheel and can help with lacing.



#### Spoke Holding Rods (4 each of white and black per kit)

The rods are used to secure each loop in the hub after pulling the spoke through the hub hole.

### Berd Builder's Kit Consumables (White or Black; 4 items)



#### Rubber Polishing Bit (3 per kit)

The polishing bit is used to polish classic flange hub holes prior to lacing.



#### Wire with Loop Ends (4 per kit)

The wire loop is used to pull the spoke loop through the hub hole.



#### Spoke Holding Rods (68 white or black per kit)

The rods are used to secure each loop in the hub after pulling the spoke through the hub hole.



#### Berd Wheel Stickers (2 per kit)

Berd wheel stickers (1"x2") should be applied after building to let everyone know the wheels were built with genuine Berd spokes.

## 1. Measuring Hubs and Rims and Calculating Spoke Lengths (Click for Video)

Berd spoke lengths must be calculated differently than metal spoke lengths. To calculate the correct lengths, the [Berd Spoke Calculator](#) must be used:

### Determine the Effective Rim Diameter (ERD) for external nipple rims:

- Use Wheelsmith Rim Rods (highly recommended), **OR**
- Measure to the distance between the bottom of the slot of standard 12mm external nipples on opposite sides of the rim

### Determine the Effective Rim Diameter (ERD) for internal nipple rims:

- Method A: Measure the distance between the ends of 10 mm internal nipples on opposite sides of the rim and subtract 3 mm, **OR**
- Method B: Measure the diameter of the internal spoke bed and add 17 mm

Using other methods may result in an incorrect Effective Rim Diameter and spokes that are the wrong length. Please measure the ERD on **each** rim in multiple places and do not rely on manufacturer published values.

### For classic flange hub measurement:

- Instructions are listed within the [Berd Spoke Calculator](#)
- This [Park Tool method](#) for measuring hubs works well.

### For straight pull flange hub measurement:

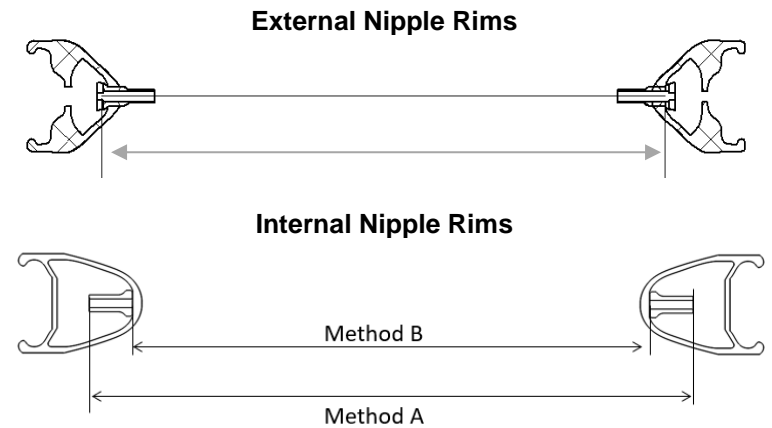
- Instructions are listed within the [Berd Spoke Calculator](#)
- Instructions for measuring straight pull spoke offset are listed [here](#) on our website.

### For hook flange hub measurement (YouTube Video):

- Select the “Berd Hook Flange” Radio Button
- The number of intersections (crossings) must be 2 for 24 spokes, 3 for 28 spokes, 3 for 32 spokes, and 3 for 36 spokes.
- Hook flange hub measurements are located [here](#) on our website.

### **Berd recommends building ONLY with 16 mm Double Square Sapim Secure Lock Nipples:**

- We do not recommend building with any other type of nipple (i.e., 12 mm hex or slotted nipples). Berd spokes will extend past the end of 12 mm nipples due to the large amount of stretch during the build. Compensating by using spokes shorter than recommended by the Berd Calculator may make it impossible to start the spokes into the nipples.
- If you will use nipples without a mechanical locking mechanism, apply Loctite 242 to the spoke threads prior to building, or apply Loctite 290 to the spoke/nipple interface after building (**do not apply Loctite 290 prior to building to avoid seizure**).



Classic flange hub



Straight Pull flange hub



Hook flange hub



Nipple with Secure Lock

## 2. Hub Preparation for J-Bend Hubs (Click for Video)

Standard hub machining leaves corners sharp enough to cut Berd spokes. If not smoothed properly, sharp corners will cause spoke fraying and breakage during the build or while riding on the wheels. Hub preparation should not be performed on hook flange hubs (hubs without holes) designed specifically for Berd spokes.

For classic hubs: \*

- Use the Corner Rounding Tool (Builder's Kit) in a power drill to first create a uniform rounding around each side of each hub hole.
- Then, use a green Rubber Polishing Bit in a power drill to lightly polish in a rotating motion each side of each hub hole.

\* Prior to lacing Short/BMX spokes (spokes with length <250 mm) only, hub holes must be enlarged with a 2.9 mm (or 33 gauge) drill bit in a power drill (drill bit included with order of Short/BMX spokes) prior to using the Corner Rounding Tool.

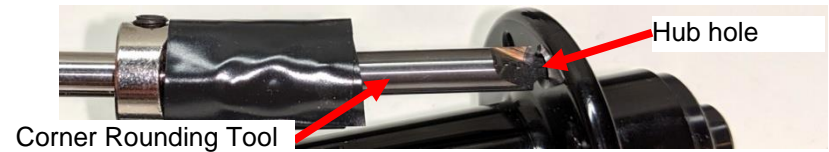
Classic hub preparation should leave a continuous, smooth surface. The area should appear silver and be polished with the polishing bit as seen in the 'good' figure to the right. In the 'bad' figure to the right, sharp corners can still be seen; the hole requires more work.

**Be careful not to remove excessive material.** Going too deep will create a lip and make the corner sharp again. See the 'bad' figure farthest on the right.

For tangential straight pull hubs:

- Install Berd tangential straight pull inserts (sold separately) when installing spokes (see Step 3.2 below). No hub preparation is required.
- If the spokes are still difficult to pull through the hub holes, the hole size of the hub can be increased with a 2.6 mm drill bit in a power drill.

Berd spokes are not recommended for use in radial straight pull hubs where [Berd Tangential Straight Pull](#) Inserts cannot be used.



Corner Rounding Tool

Rounded hole of classic flange hub:



**Good**  
(uniform rounding)



**Bad**  
(incomplete rounding)



**Bad**  
(excessive rounding)

### 3. Lacing Hubs (Click for Video)

#### Classic Flange Hub Lacing

Only lace hubs after Hub Preparation (Step 2) is complete

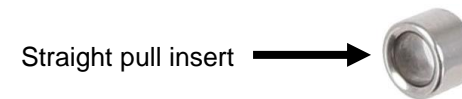
- Prepare a wire loop from the consumables kit by bending in half and flattening the ends to fit through the hub holes with pliers.
- Thread the wire loop through the spoke loop and pinch the spoke loop to hold the wire loop at the top-center position.
- Insert the wire loop through the hub hole and use the pulling tool (builder's kit) to pull the loop and spoke through the hole.
- Use the awl (Builder's Kit) to open the spoke loop and remove the wire loop.
- Insert the spoke holding rod into the spoke loop, and firmly pull the spoke to seat it into place. Check to make sure the spoke holding rod is in the center of the spoke loop.



#### Tangential straight pull hub lacing

No hub modification is required for tangential straight pull hub hole.

- Prepare a wire loop (consumables kit) by bending in half and flattening the ends to fit through a hub hole (see Step 3.1, figure A).
- Thread the wire loop through the spoke loop and pinch the spoke loop to hold the wire loop at the top, center position.
- Insert the wire loop through the hub hole (see Step 3.1, figure C).
- Place a tangential hub insert (sold separately) and the pushing tool (Builder's Kit) onto the wire loop.
- Use the pulling tool (Builder's Kit) to pull the loop and spoke through the hole.
- Use the pushing tool to push the insert fully onto the spoke loop and remove the pushing tool and pulling tool.
- Use the awl (Builder's Kit) to open the spoke loop and remove the wire loop.
- Insert the spoke holding rod into the spoke loop, and firmly pull the spoke to seat it into place. Check to make sure the spoke holding rod is in the center of the spoke loop.



### Berd Hook Flange Hubs (Click for Video)

Hook flange hubs designed specifically for Berd Spokes are laced in tandem with the rim. Instead of lacing the entire hub, and then lacing the entire rim, spokes are hooked onto the hub and then connected to the rim immediately, in pairs.

- a) Place hub vertically on a tabletop.
- b) Place the loop of one spoke through the loop of a second spoke and connect both spokes to the hub flange.
- c) Immediately connect both spokes to the rim by placing nipples on the spokes and turning only two full turns. **For a 28-spoke wheel, the spokes must cross a total of 3 times.** The first crossing occurs at the loops at the hub shell.
- d) The spoke which has the loop inside the other loop should always be inside the crossing spokes at each intersection. This is termed “inside/inside/inside” lacing and is the strongest configuration.
- e) After lacing one entire side of the wheel, flip the wheel and lace the second side.
- f) Proceed to step 5.



### 4. Rim Lacing (Click for Video)

Once hub lacing is complete, inspect all rods to make sure they are centered in the loop and the spokes are firmly seated. See ‘good’ and ‘bad’ figures to the right.

For external rims, Berd recommends using 16 mm Sapim Double Square Secure Lock External nipples.

If you will use nipples other than those recommended above and without a mechanical locking mechanism, apply Loctite 242 to the spoke threads prior to building, or apply Loctite 290 to the spoke/nipple interface after building (**do not apply Loctite 290 prior to building to avoid seizure**).

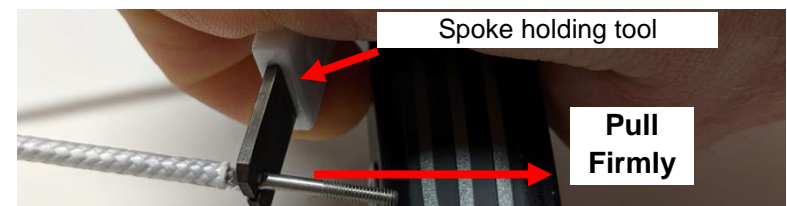
Start with and lace the entire high-tension side of the rim. Only turn each nipple 2 full turns at first. This is important because Berd spokes start short and stretch as tension is increased. Adding more turns will make it difficult/impossible to complete lacing the rim. If lacing a spoke is still difficult, use the spoke holding tool (Builder’s Kit) to pull on the spoke firmly to fully seat it in the hub and pull towards rim (see picture on right).



Good



Bad



## 5. Tensioning and Truing (Click for Video)

After lacing the spokes into the rim, confirm the lacing pattern and crosses.

- a) Because the nipples are only slightly engaged, start by turning each nipple three full turns using a Park Tool SW-15. Use the spoke holding tool to prevent spoke twist.
- b) Recheck the spoke holding rods and adjust as needed.
- c) Build measurable tension (1 - 5 on Park Tool TM-1) on all spokes, true the wheel, and get even tension on the spokes.
- d) Check the spokes for twist by looking down the length of the spokes.
- e) Tension the wheel to 100 kgf (15 on a Park Tool) and dish properly.
- f) Check and equalize tension with a tension meter. True radially and laterally. Squeeze pairs of spokes and ensure the wheel remains true.

Wait overnight to allow tension to stabilize before proceeding to the next steps:

- g) Increase tension back to 100 kgf (15 on a Park Tool meter) by first tightening the tight side (i.e., rear drive or front disc) to 100 kgf then by tightening the other side to bring the wheel into proper dish.
- h) Check for equal tension and true radially and laterally. Squeeze pairs of spokes and ensure the wheel remains true.

Wait overnight again before the final truing steps:

- i) The tension will have stabilized to ~12 on a Park Tool meter. Inspect the wheels and make only very minor adjustments to equalize tension and true. If large adjustments are required, let the wheel sit another day.
- j) If Secure Lock nipples were not used, or if internal nipples were used, add a drop of green Loctite 290 to the threads of each nipple. Failure to complete this step will result in the nipples loosening over time.

Please contact [service@berdspokes.com](mailto:service@berdspokes.com) with any questions.

