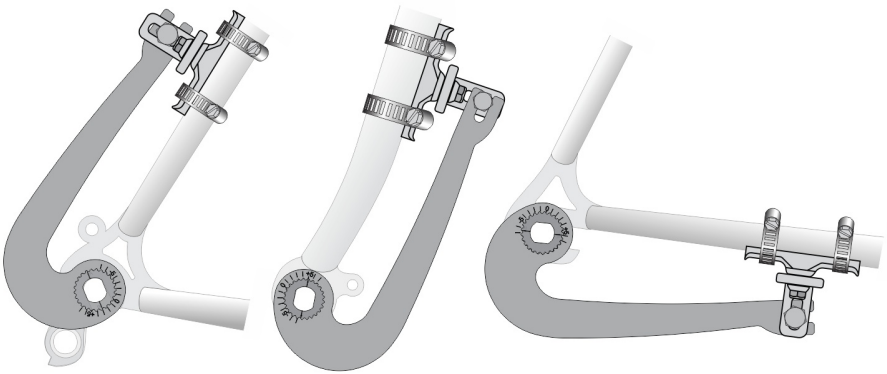
The Torque Arm V6 Installation Guide

Rev 0



Splined Design with Universal Front and Rear Compatibility

Grin Technologies Ltd
Vancouver, BC, Canada
ph: (604) 569-0902
email: info@ebikes.ca
web: www.ebikes.ca

1 Introduction

Thank you for the purchase of a Grin Technologies Torque Arm V6! This device will help secure hub motors with M12 or M14 threaded axles against the counter rotation caused by motor torque. This universal design uses a clamping bracket with two hose clamps to safely transfer motor torque to the frame tubing on almost any bike geometry.

1.1 Features

- Hardened 17-4 Alloy inserts increase spinout strength by 80%
- Splined interface allows 50 angular positions for orientation of axle flats
- Clamping bracket can both swivel and slide for any tube position
- Works equally well with both front and rear motors
- Deep 'J' curve avoids interference with fender and rack eyelets
- All stainless steel for excellent corrosion resistance
- Designed, tested, and manufactured in Canada

1.2 Parts

The following hardware is included in your kit.

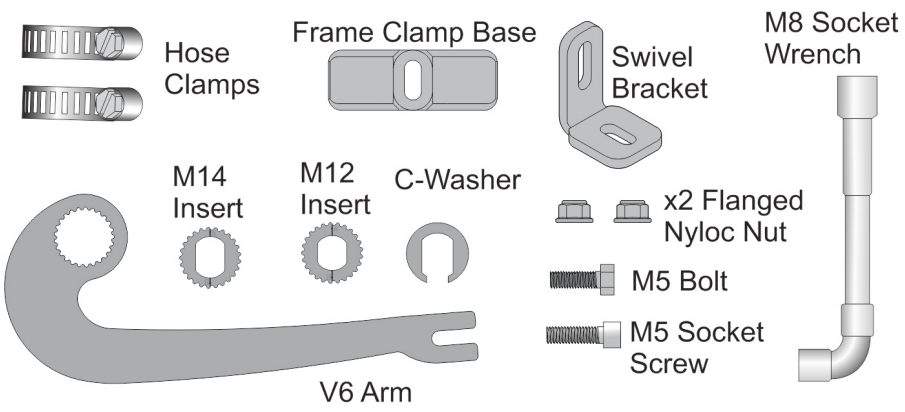


Figure 1: Parts included in V6 Torque Arm package

2 Principles of Operation

All hub motors generate a strong reaction torque on the motor axle that must be restrained for the axle not to spin. Most hub motors designed in China rely on an oversized (M12 or M14) axle with flat faces 10mm apart to fit inside a slotted bicycle dropout, and count on the flat axle not being able to rotate. This puts a tremendous spreading force on the faces of the dropout, which can deform or break entirely and allow the axle to spin out, sometimes with severe consequences.

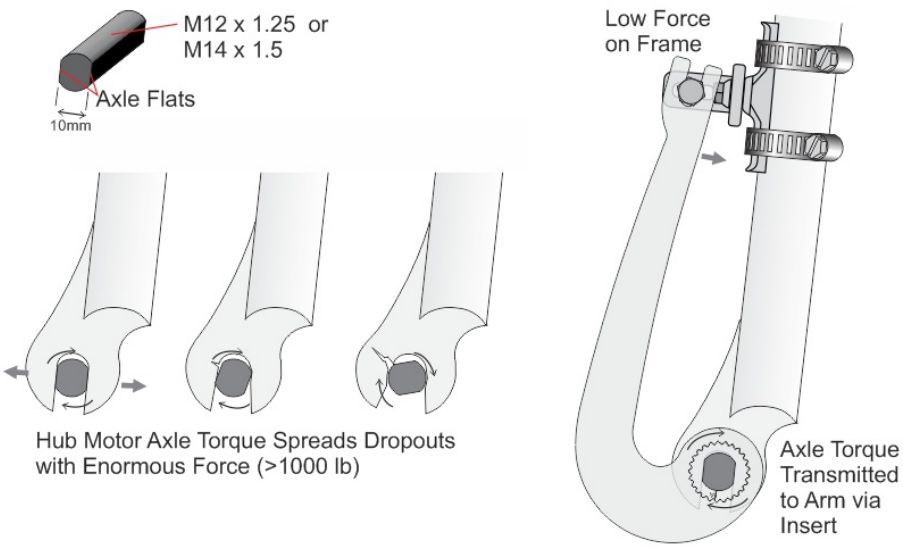


Figure 2: Illustration of axle spinout and effects of torque arm

By mounting a torque arm to the axle, this rotational torque is instead absorbed by a tight-fitting plate that transfers the torque to the frame tubing at a much lower force. This greatly reduces the stress on the dropout and results in a safer and more secure motor installation.

3 Installation

Please read these installation steps first before attempting to install the arm to save yourself potential grief.

3.1 Determine Install Position

There are many potential orientations for our Torque Arm V6. It can fit on either the left or right side, and either in front of or behind your tubing.

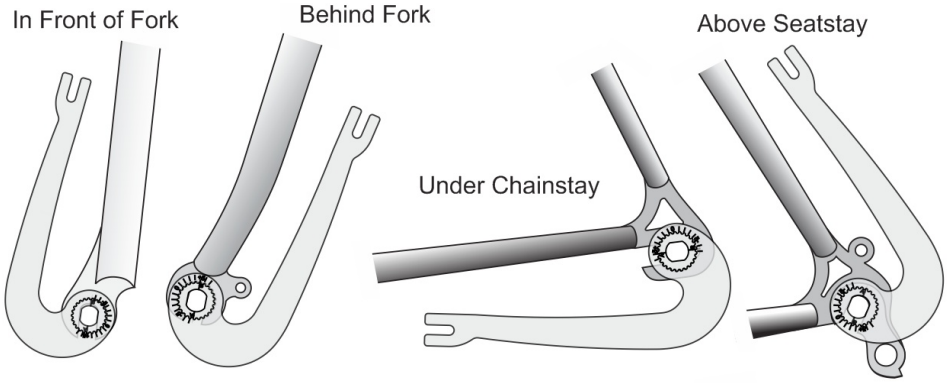


Figure 3: Examples of possible torque arm positions

The position of disk brake calipers, fender and rack hardware, kickstands, or other interfering geometry may dictate a certain placement. If possible, the torque arm should also be on the opposite side of the motor cable exit. The axle is strongest on the side without a cable channel.

3.2 Assemble Frame Clamp

Prepare the frame clamp by mounting the swivel bracket onto the clamp base, using the M5 Bolt and flanged nut. Loosely attach this to your bicycle frame tubing with the two hose clamps. The 8mm socket wrench conveniently fits both fasteners.

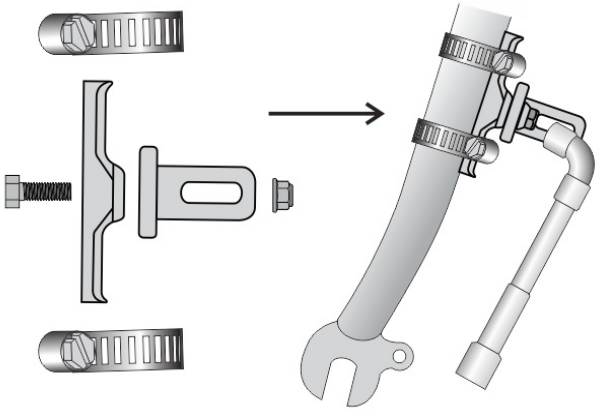


Figure 4: Frame Clamp loosely in place

3.3 Determine Insert Angle

Slide the V6 arm on the motor axle with the end positioned at the swivel bracket, and then slide either the M12 or M14 insert over the axle. Note the angular position of the insert in the splines. If the best fit appears in between two spline locations, then rotate the insert 180 degrees to achieve a half spline rotation. There are markings to facilitate identifying this position.

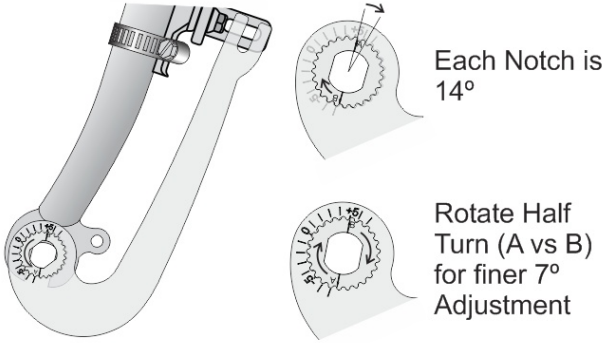


Figure 5: Orient the insert to line up with axle flats. Laser markings help facilitate and recall alignment

3.4 Set Insert into Arm at Orientation Noted in 3.3

The fit between the hardened insert and arm piece is intentionally quite snug. Remove the arm and insert from the bike and use either a hammer or a vise to fully set the insert all the way into the arm.

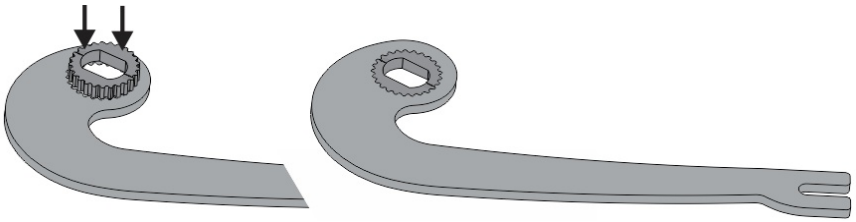


Figure 6: Pound in insert until flush with a hammer or vise

The tight fit ensures that both pieces act as one, conveniently staying together in the right position if the torque arm needs to be removed and reinstalled.

3.5 Reinstall Hardware

If the dropout slot has lawyer lips (see Figure 7), slide the included 'C' washer as a spacer directly over the dropouts. This ensures that the wider torque arm piece clears the protruding lip and sits flat.

Next, install the assembled torque arm followed by the original washer and nut from the motor axle. Slide the swivel bracket to lay flat against the torque arm and secure together with the M5 Screw and Nut.

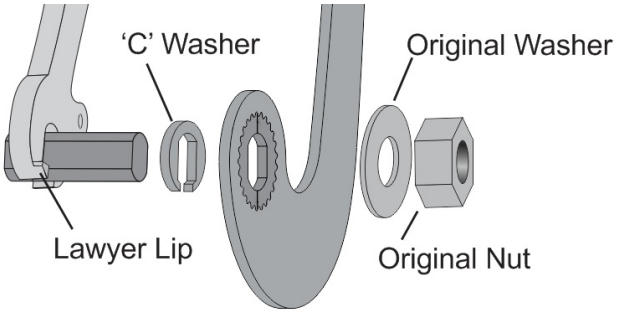
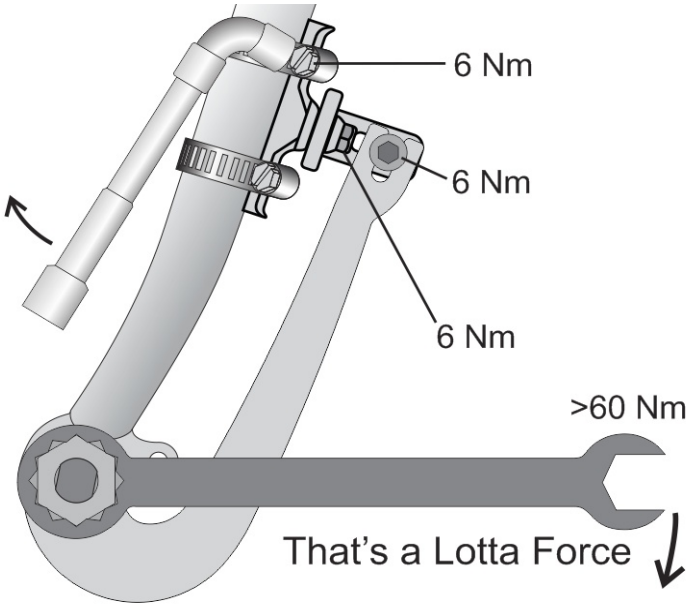


Figure 7: Recommended order of axle hardware

3.6 Secure All Fasteners

Tighten both the M5 fasteners and hose clamps to least 6 Nm of torque using the 8mm socket wrench. Ensure that all components sit flat and snug with no play, and that the motor axle is fully seated into the dropouts. Then tighten the motor axle nuts to a minimum of 60 Nm. More is better, as long as you don't strip the threads! Since the quality of the axle threads and nut varies by manufacturer, we cannot give a universal recommendation here.



4 Additional Notes

4.1 Heatshrink Tubing

Two lengths of black silicone tubing are supplied with the kit and can be cut to length and slid over the bands of the hose clamp. This both protects the paint on the bicycle tubing and makes the hose clamp itself more discrete. Its use is entirely optional.

4.2 Which Side?

In motors where the cable passes through a hollow center in the middle of the axle, it is always preferable to mount the torque arm on the *opposite side* of the wire exit where the axle is solid. Hollow axles have less than half the strength of solid axles for transmitting torque and more likely to deform or break.

There are some cases where this is not possible due to interference with derailleurs or disk brake calipers, and the torque arm will have to be installed on the same side as the cable exit. In such situations, be extra sure that the axle nuts are on tight so that an appreciable share of the torque transmission is achieved through friction on the dropout face.

4.3 Fit Tightness

While the standard axle is nominally 10.0mm between the flats, there are tolerance variations between manufacturers and even between different motors of the same series. Some axles may seem a bit loose inside the torque plate, while others may be too tight to slide on and require some filing or grinding first.

We empirically sized the slot opening to be a snug fit on the motor axles we deal with at Grin (eZee, Bafang, and Shengyi). Even if the hardened insert might seem loose, it still provides substantial spinout strength.

4.4 Aluminum Dropouts

You should have no issues running a hub motor on a bike frame with aluminum dropouts using with a properly installed Torque Arm V6. The arm eliminates most spreading force from the dropouts so that it does not matter what material they are made from.

4.5 Suspension Forks

Similarly, there is no intrinsic problem using a hub motor with a torque arm on front suspension forks. The main reason people advise against using hub motors on suspension forks is because most suspension forks are aluminum, and aluminum forks *without* torque arms are prone to spreading or breaking. With a torque arm this issue is eliminated.

That said many models of suspension fork are cast with a deep recess for the axle nut, deeper than can be accommodated by the included 'C' washer. In those cases there may be issues fitting the torque arm.

4.6 Regen Systems

Hub motors that do regenerative braking have an extra complexity as the torque direction reverses between regen and acceleration. While the V6 torque arm will prevent the axle from spinning out, the small back and forth rotation that results can cause the axle nuts to gradually loosen over time.

If you are using the Torque Arm V6 in a hub motor that does regen, it is imperative to use Nyloc nuts or threadlocker to prevent this behaviour, and to regularly check that the axle nuts are extremely tight (60Nm or more). For regen systems we recommend using Grin's clamping Torque Arm V7 model instead, which preloads the axle for zero play.

5 Limitations

The Torque Arm V6 greatly increases the safety and security of a hub motor installation. However, given the huge variety of motor models and bike frame standards that exist we cannot guarantee no spinout failures in your setup.

Grin has extensively tested many motor axle and torque arm combinations to failure, and with our use of hardened inserts, it is the axle itself that fails before the torque arm. The ultimate torque that can be resisted depends primarily on the hardness and strength of the axle material of your hub motor and not on our arm.

In our testing with M14 axles, the axle will usually shear in two before the 14mm shaft can rotate in the in the hardened insert. With M12 axles the axle *threads* will smear out of the way with the insert remaining unscathed. The ultimate spinout strength with M12 axles can vary from as low a 60Nm to over 150Nm depending on the quality of metallurgy and whether the axle is solid or hollow. We recommend using controller phase current controls to limit the maximum motor torque with M12 axles to 50 Nm for some safety margin.

For best results always make sure that the axle nuts are well tightened as this ensures that the reaction torque is shared between the torque arm and friction of nuts with the dropout face.

Feel free to contact us at info@ebikes.ca for additional support.