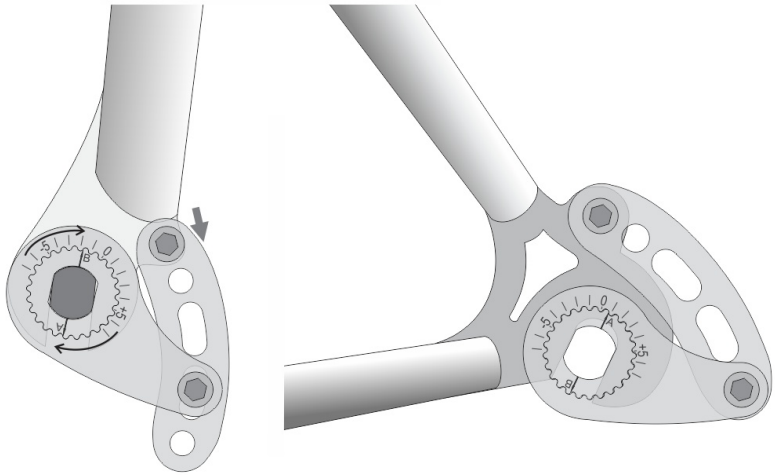
The Torque Arm V5 Installation Guide

Rev 0

Universal Front/Rear Design for Eyelet Mounts



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1 Introduction

Thank you for the purchase of Grin Technologies Torque Arm V5! This device will help secure hub motors with M12 or M14 threaded axles against the counter rotation caused by motor torque. The design secures to existing eyelets near the front or rear dropouts for a clean installation without hose clamps.

1.1 Features

- Hardened 17-4 Alloy inserts increase spinout strength by 80%
- Splined interface allows 50 angular positions for orientation of axle flats
- 2 piece arm design can accommodate wide range of eyelet positions
- Works equally well with both front and rear motors
- All stainless steel for excellent corrosion resistance
- Designed, tested, and manufactured in Canada

1.2 Parts

The following hardware is included in your kit.

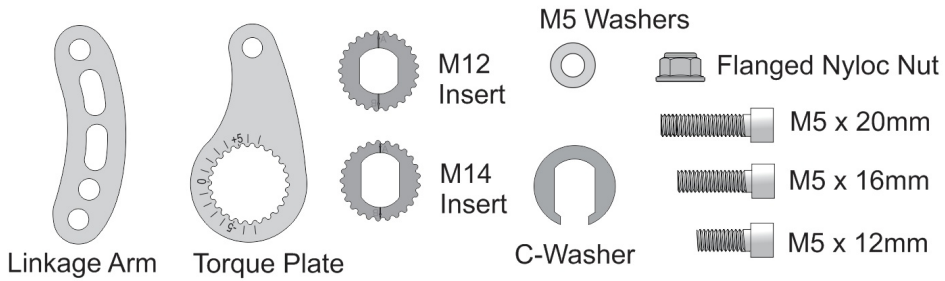

Figure 1: Parts included in Torque Arm V5 Package

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.

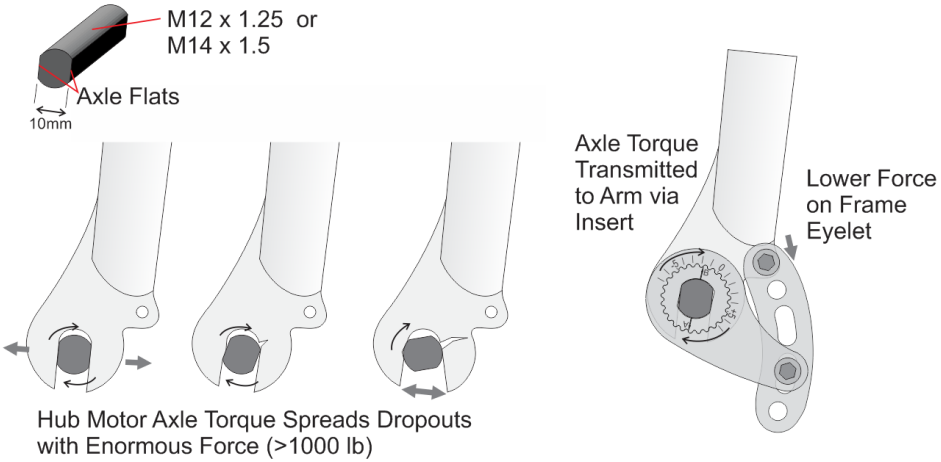

Figure 2: Illustration of axle spinout and protection provided with torque arm

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 clamp bracket 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 usually several potential orientations for our V5 Torque Arm that will work for any given dropout and eyelet position. Dry fit the torque arm hardware on your bike frame to see what fits best. The linkage arm has several holes and short slots to accommodate a 10mm to 40mm distance to the torque plate, while the plate can rotate in 50 angular positions relative to the axle flats.

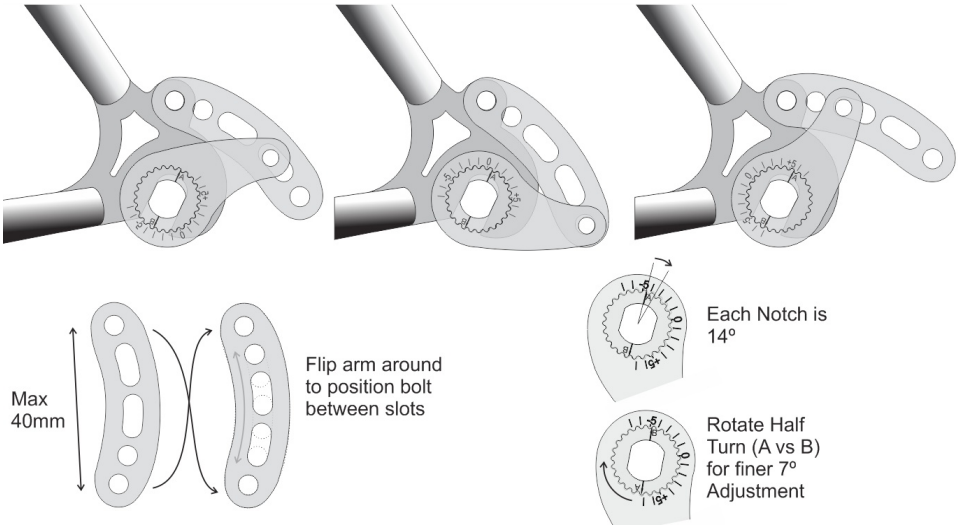

Figure 3: Example of various viable installation options for the same dropout

If one side of your motor axle is solid, and the other side is hollow with a cable exit, then place the torque arm on the solid axle side for maximum strength.

3.2 Set Insert into Arm

Once you have confirmed the installation orientation, remove the arm from the bike and use either a hammer or a vise to fully set the insert all the way into the torque plate. The fit between the hardened insert and plate is intentionally quite snug.

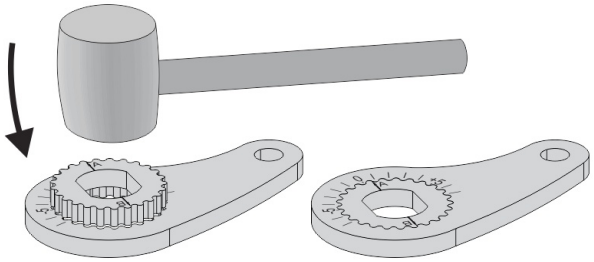

Figure 4: Pound in insert until flush, using hammer or vise

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

3.3 Reinstall Hardware

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

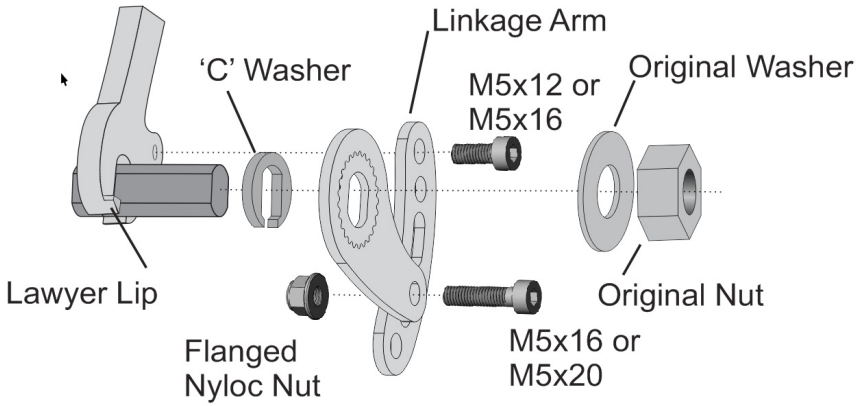

Figure 5: Choice of M5 screw length depends on need for washers and other hardware using the eyelet

Slide on the assembled torque arm followed by the original washer and nut from the motor axle. Use the 16mm or 20mm M5 screw and nyloc nut to fasten torque plate to the linkage arm, and use the 12mm or 16mm M5 screw to secure the linkage arm to the threaded bicycle eyelet. Additional 5mm washers are included in case any additional shims are needed to filli gaps at the linkage arm in order for it to sit flat.

3.4 Secure All Fasteners

Tighten the M5 screw on the eyelet to 6 Nm of torque and the M5 screw on the linkage arm to 8 Nm. Ensure that all components sit flat and snug with no play, with the motor axle fully seated into the dropouts.

Tighten up the motor axle nuts to a minimum of 60 Nm. In general more is better, as long as you don't strip the threads! Since the quality of the axle threads and nut varies from manufacturer to manufacturer, we cannot give a universal recommendation here.

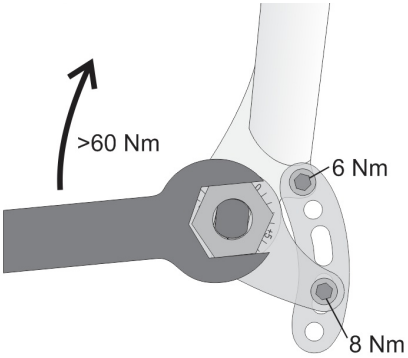

Figure 6: The 8 Nm Torque at the Linkage Arm Prevents Slippage in Slot

4 Additional Notes

4.1 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.

4.2 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 filing away a bit of metal.

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.

4.3 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 V5. The arm eliminates most spreading force from the dropouts and as a result it does not matter what material they are made from.

4.4 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, and they rarely have fender mounting eyelets either.

4.5 Regen Systems

Hub motors that do regenerative braking have an extra complexity as the torque direction reverses between regen and acceleration. While the V5 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 V5 in a hub motor that does regen, it is imperative to use Nyloc axle 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 V5 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 itself 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 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.