WCP SS Swerve - User Guide (Rev 1)

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What is the WCP SS Swerve?

The WCP SS Swerve is the most robust and ease of use COTS swerve module available on the market. Through its precision-engineered main rotation gear and easy to change drive wheel, it makes it easy to service the module and make changes very quickly.

This module was based off of an Aren Hill design and later modified by FRC Team 1323.

1. Design Notes

The following pages will explain tools needed to assemble the gearbox and other various tidbits of information.

Disclaimer: Teams are responsible for purchasing or making the hex shaft spacers shown as they are not included in the kit

1.1 Tools Needed

To assemble the WCP SS Swerve, it is recommended teams use:

1. Allen Wrenches
    1. 1/8” (McMaster P/N: 37095A22)
    2. 5/32” (Mcmaster Carr P/N: 5419A35)

2. 7/16” Ratcheting Combination Wrench (McMaster P/N: 5163A15)
    1. Note: Any 7/16” wrench may be used

3. Loctite GlueStick - Blue (McMaster Carr P/N: 1004A12)
    1. Note: Apply to ALL screws that do not a Lock Nut

4. Snap Ring Pliers
    1. 1/2” (McMaster Carr P/N: 5449A81)
    2. 3/8” (McMaster Carr P/N: 5449A79)

Optional Tools for Assembly

1. Arbor Press
2. Drill Bits
3. Drill
4. Multi Tool Set of Allen Wrenches

1.2 BOM (Bill of Materials)

Base Kit:

Steering Components:
- 1 x Base Plate
- 1 x Motor Plate
- 1 x FR4
- 2 x FR6
- 1 x FR8
- 1 x CIM Motor Shaft
- 2 x 1st Stage Rotation Shaft
- 2 x 2nd Stage Rotation Shaft
- 4 x Module Spacers
- 1 x FR6 Washer
- 1 x 1/2” Hex 3mm Length Spacer
- 1 x 1/4” ID .085” Length Spacer
- 1 x FR8 Washer
- 2 x 1/2” Snap Ring
- 2 x 3/8” Snap Ring
- 1 x 1/4” Snap Ring
- 1 x 8mm Push Nut
- 4 x 3/8” BHCS #10-32 Bolt
- 14 x 1/4” BHCS #10-32 Bolt
- 4 x 2” BHCS #10-32 Bolt
- 2 x 1/2” BHCS #10-32 Bolt
- 2 x 2mm Machine Keys

Wheel Module Components:
- 1 x 15T Bevel Gear
- 1 x 45T Bevel Gear
- 1 x 72T Rotation Gear
- 2 x Forks
- 1 x Dead Axle Wheel Shaft
- 1 x 4” Aluminum Wheel

- 1 x 1st Stage Shaft
- 4 x 1/8” Rolled Pins
- 1 x FR4
- 1 x FR6
- 2 x FR8
- 1 x 8mm Skateboard Bearing
- 1 x 80mm ID Bearing
- 1 x 8mm Thrust Bearing
- 3 x 1/2” SnapRing
- 1 x 8mm Snapring
- 1 x 3.25” BHCS 1/4”-20 Bolt
- 1 x 3/8” BHCS #10-32 Bolt
- 1 x 1.75” SHCS #10-32 BOlt
- 1 x 1/4-20” Thin Lock Nut

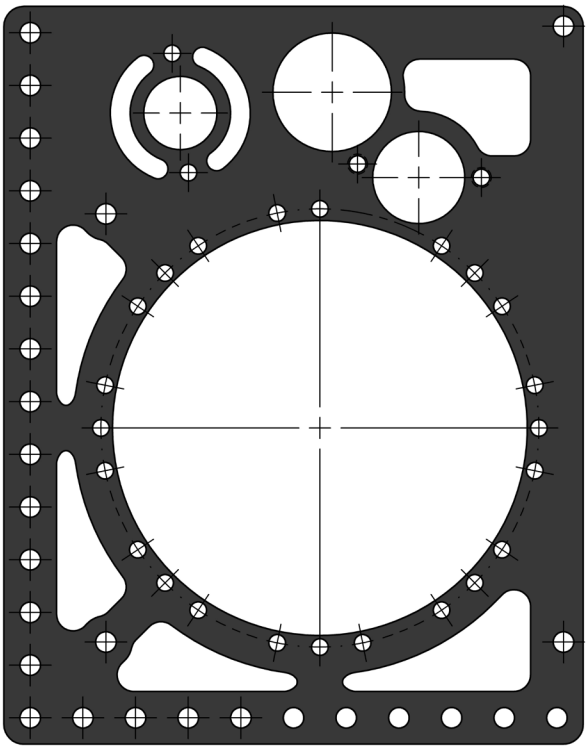
1.3 Encoders

The WCP SS Swerve only natively supports the SRX Mag Encoder by CTRE.

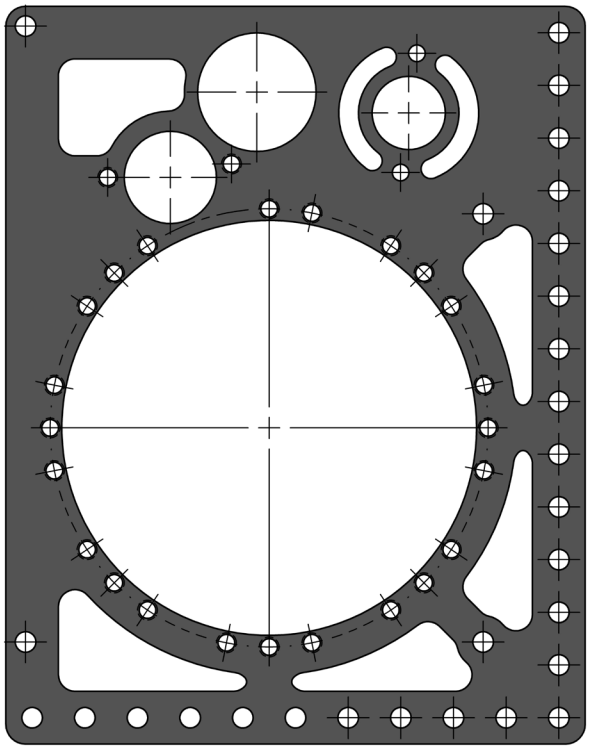
Note: Distance and Rotation hardware are sold separately. It is highly recommended to purchase these hardware kits as they are designed around the WCP SS Swerve module.

2. Left and Right Module Setup

The assembly instructions are the same for each side of the module in terms of the steps, but in order to get the left or right side modules you must start with the base plate face up or face down.

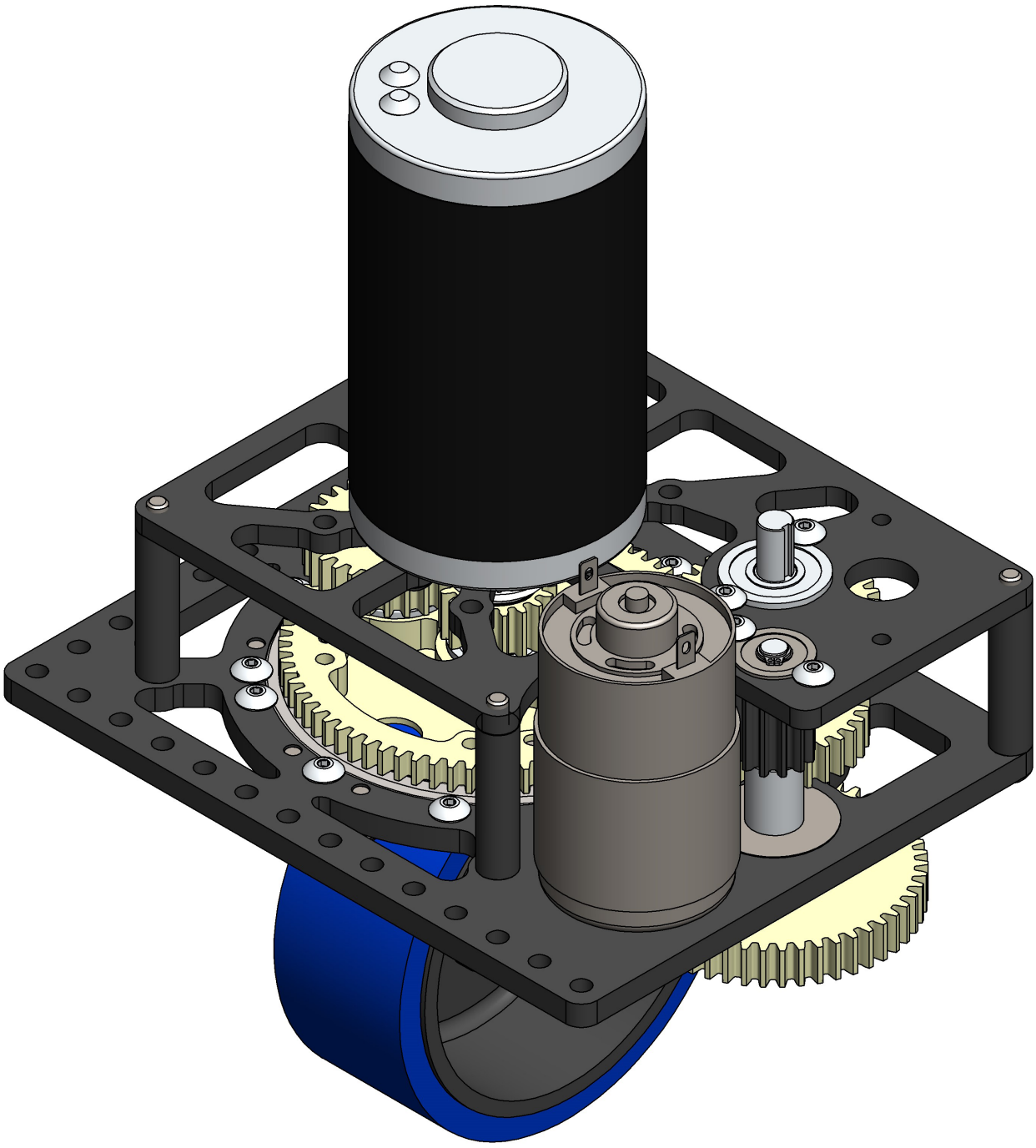


Left Side



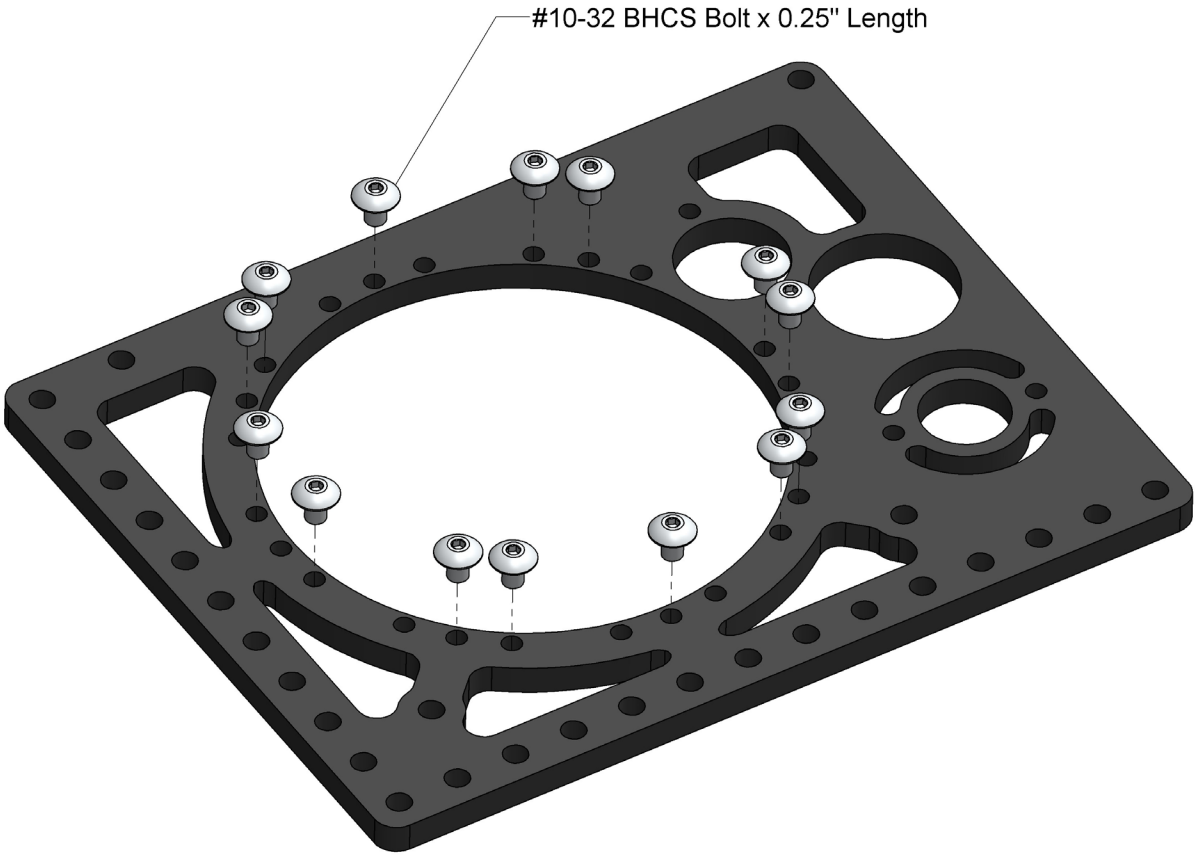
Right Side

3. Assembly of Base Kit



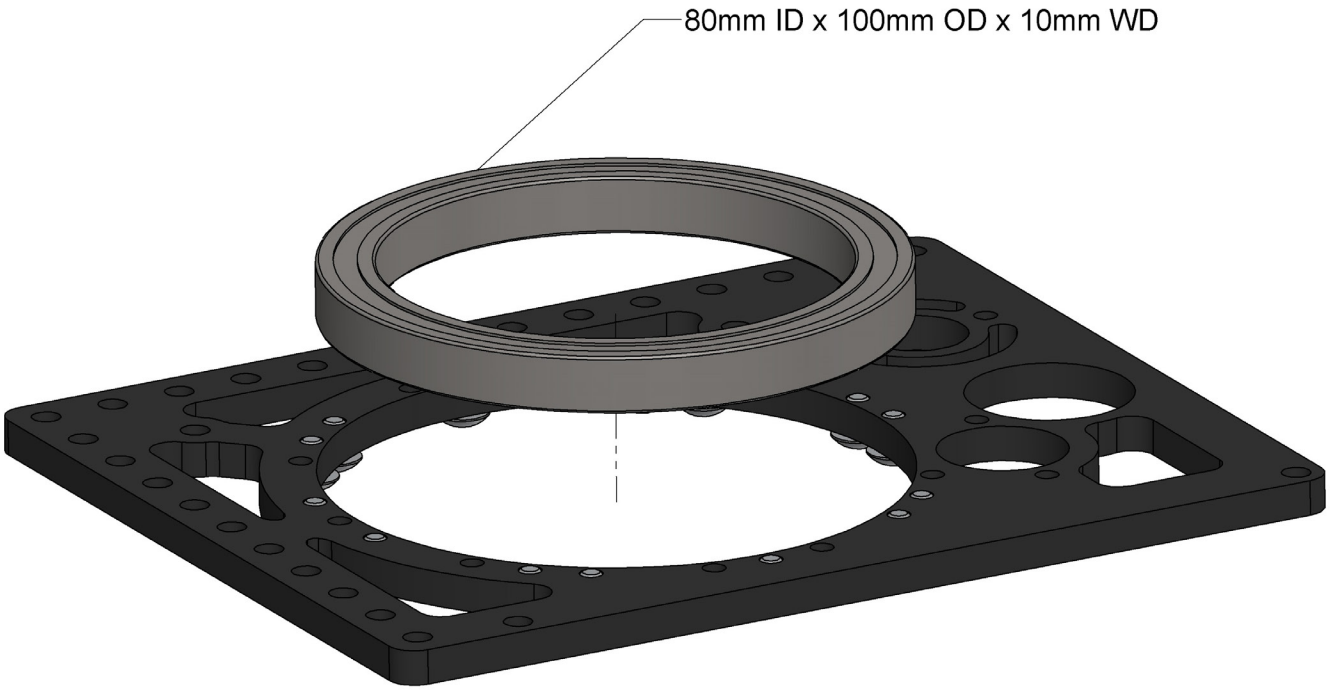
3.1 Top Rotation Bearing Retaining Bolts

Insert 14 of the #10-32 BHCS Bolt x 0.25” Length into the threaded holes shown. Tighten all the bolts down.



3.2 Insert Rotation Bearing

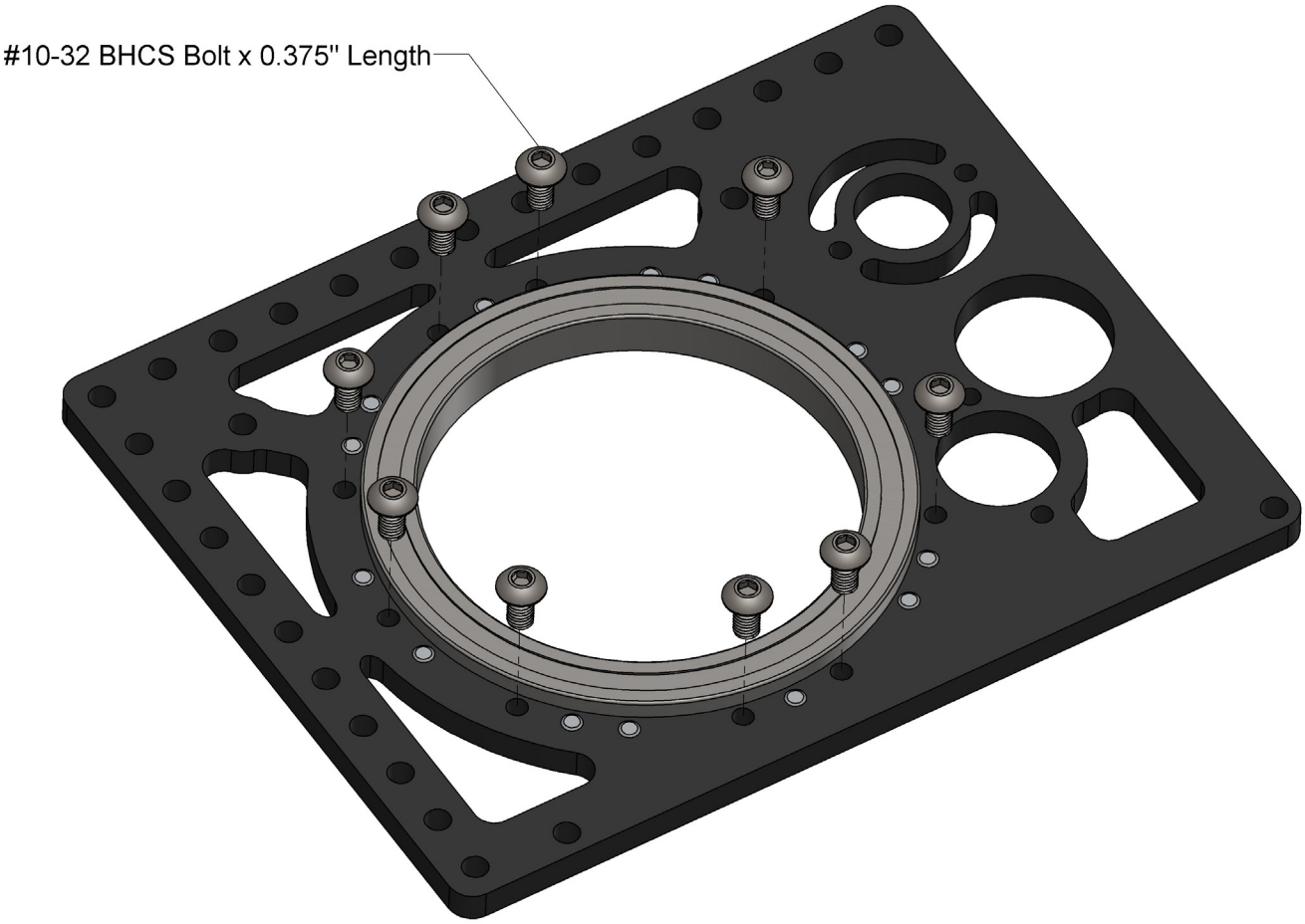
Insert main large circular cutout as shown. This should require a little force as it is a snug fit for the bearing. If necessary tap lightly and evenly with a deadblow.



3.3 Bottom Rotation Bearing Retaining Bolts

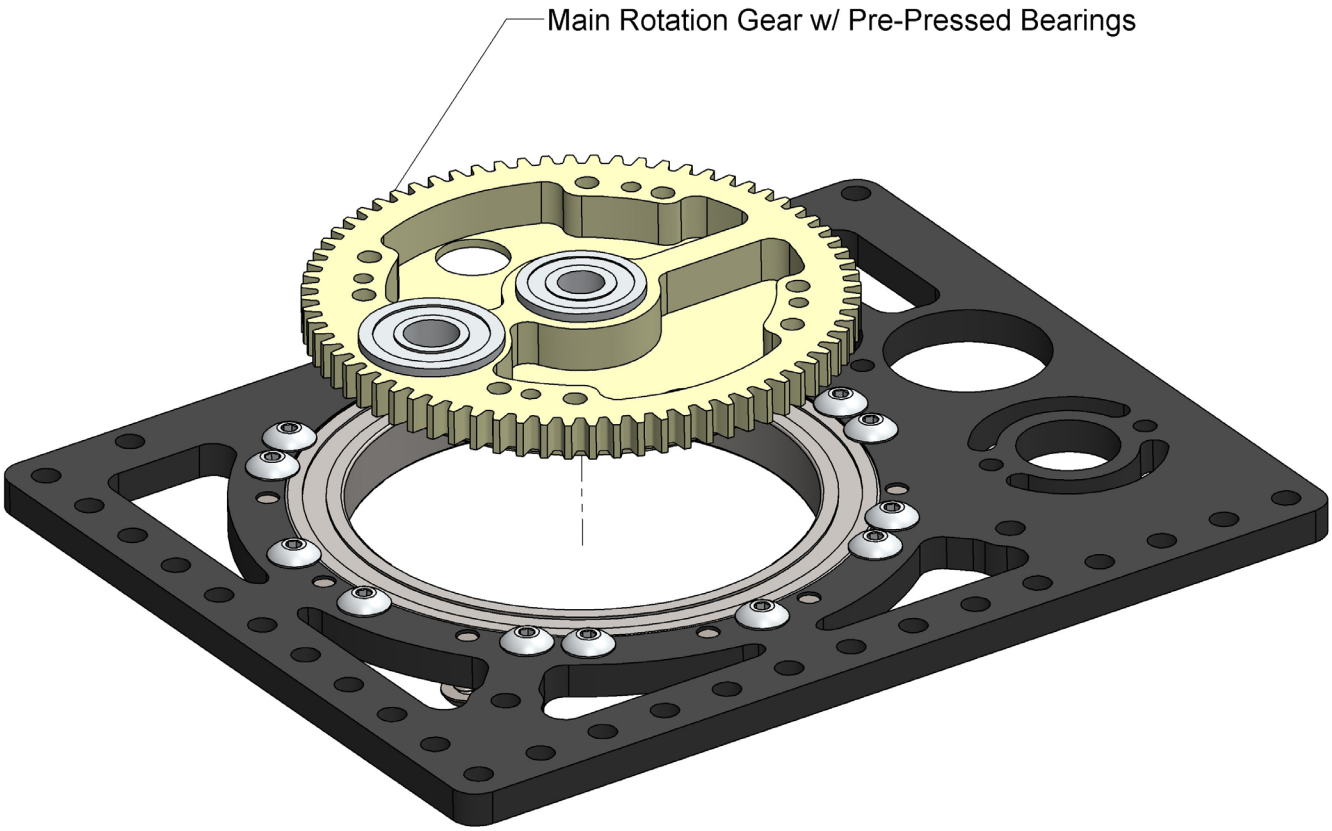
Insert 9 of the #10-32 BHCS x 0.375” Length bolts into the threaded holes as shown below.

Note: Bolts will not be able to thread all the way into the plate as the bearing will stop this from happening



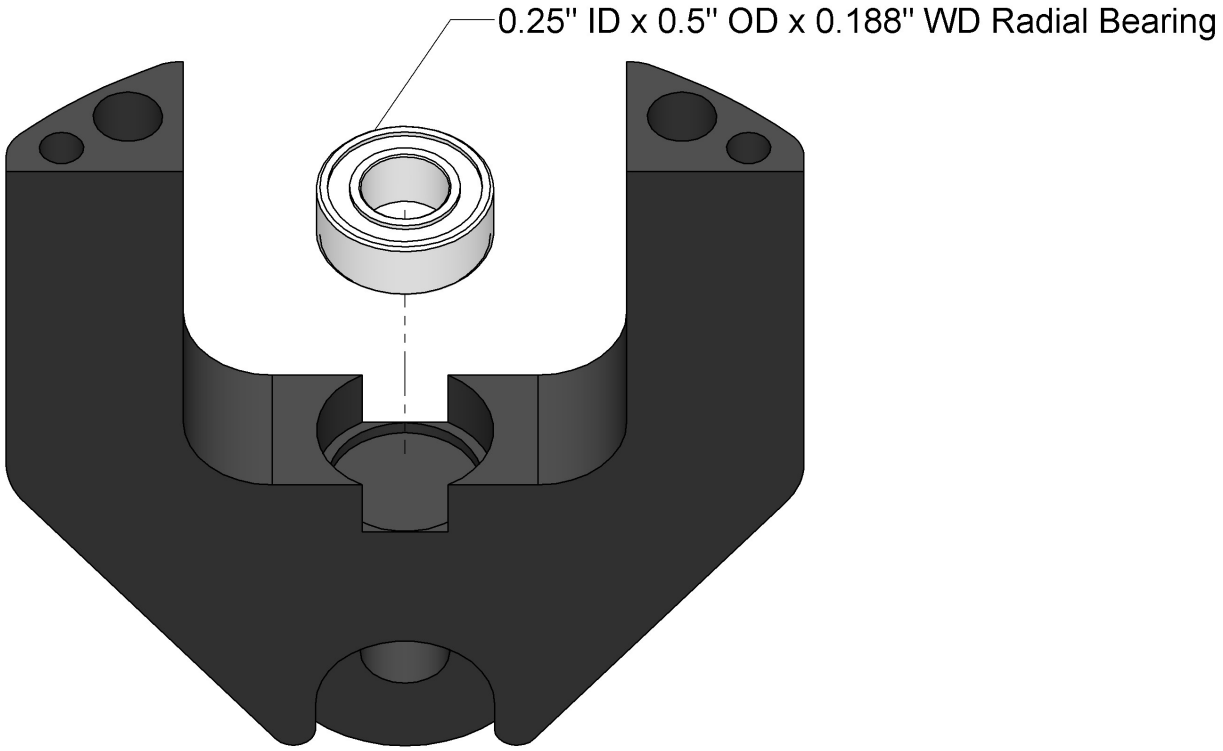
3.4 Main Rotation Gear and Rotation Bearing

Push the main rotation gear onto the large rotation bearing as shown below. Ensure that you are putting the gear on the side of the bearing where the bolts are flush with the plate.



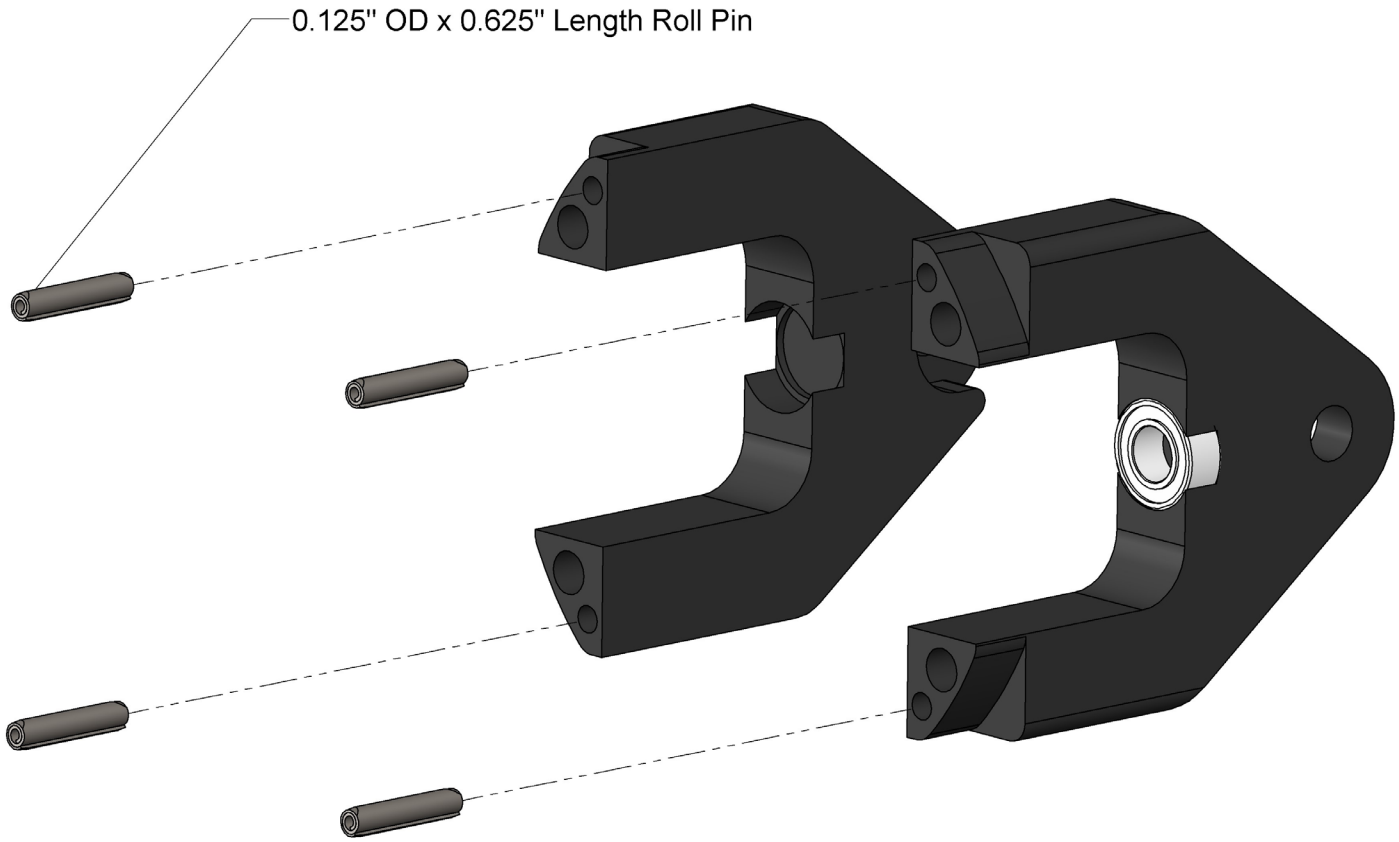
3.5 Insert Bearing into Wheel Fork

Push bearing into the small circular cutout as shown below. Ensure that the bearing is seated properly.



3.6 Insert Roll Pins into Wheel Fork

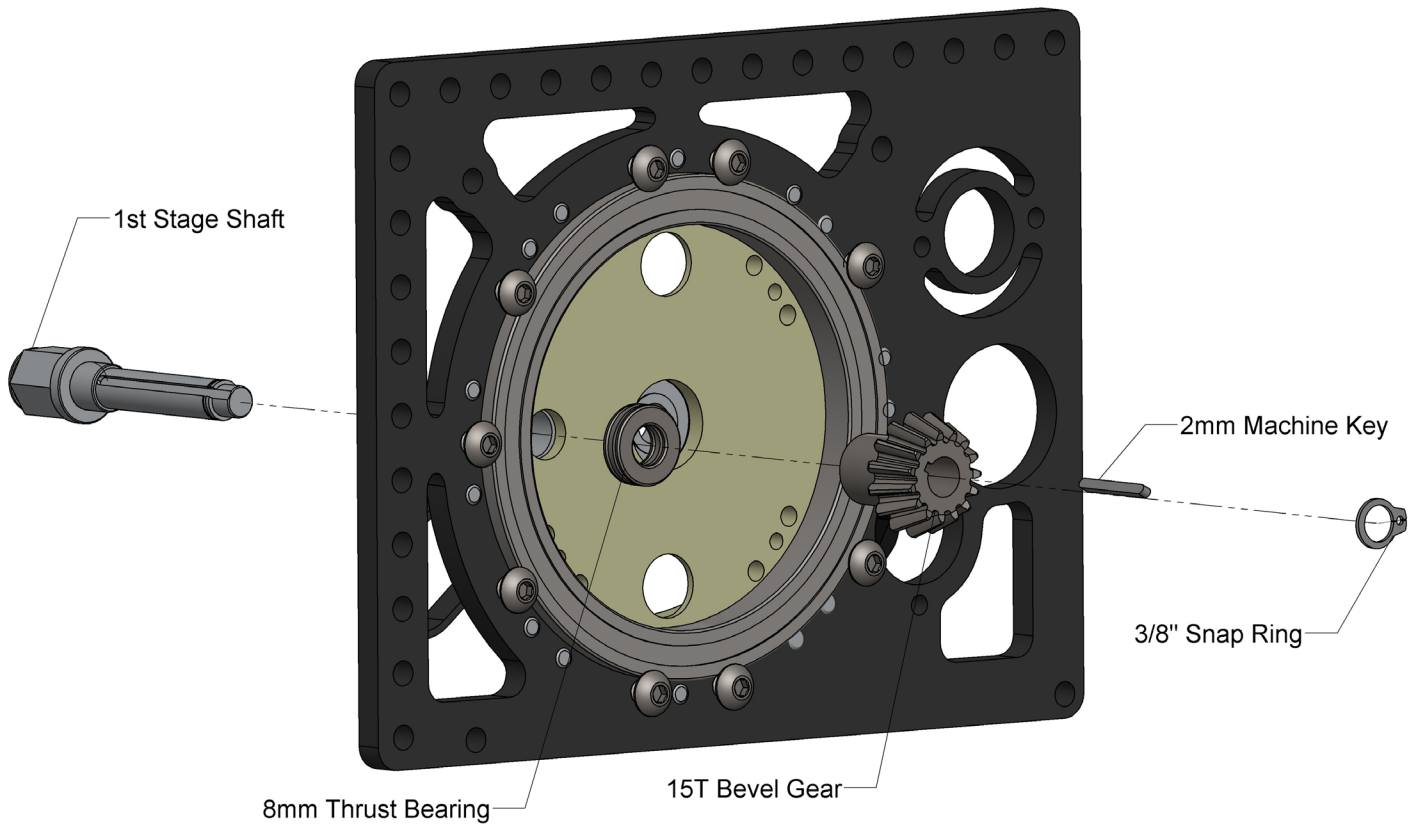
Push the 4 roll pins into the smaller set of holes on both forks.



3.7 1st Stage Shaft Assembly

Insert the 1st Stage Shaft from the top of the rotation gear. Slide the thrust washer onto the shaft so that it touches the face of the gear. Slide the 15T bevel gear onto the shaft and then slide the 2mm machine key into the grove. Finally, install the 3/8” snap ring to hold it all together.

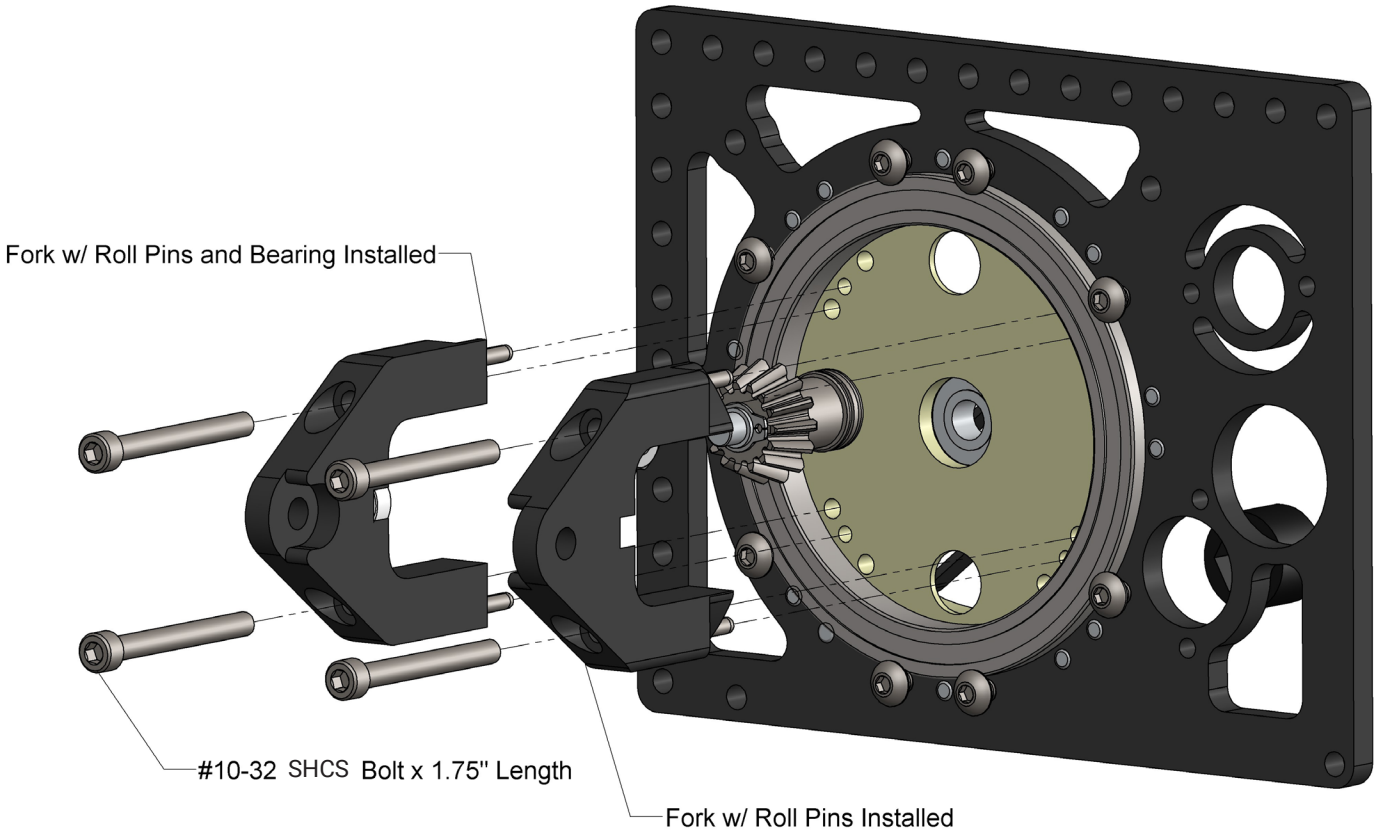
Note: It may be easier to insert the 2mm machine key into the grove on the shaft then slide the 15T bevel gear over the machine key and shaft.



3.8 Install Wheel Forks

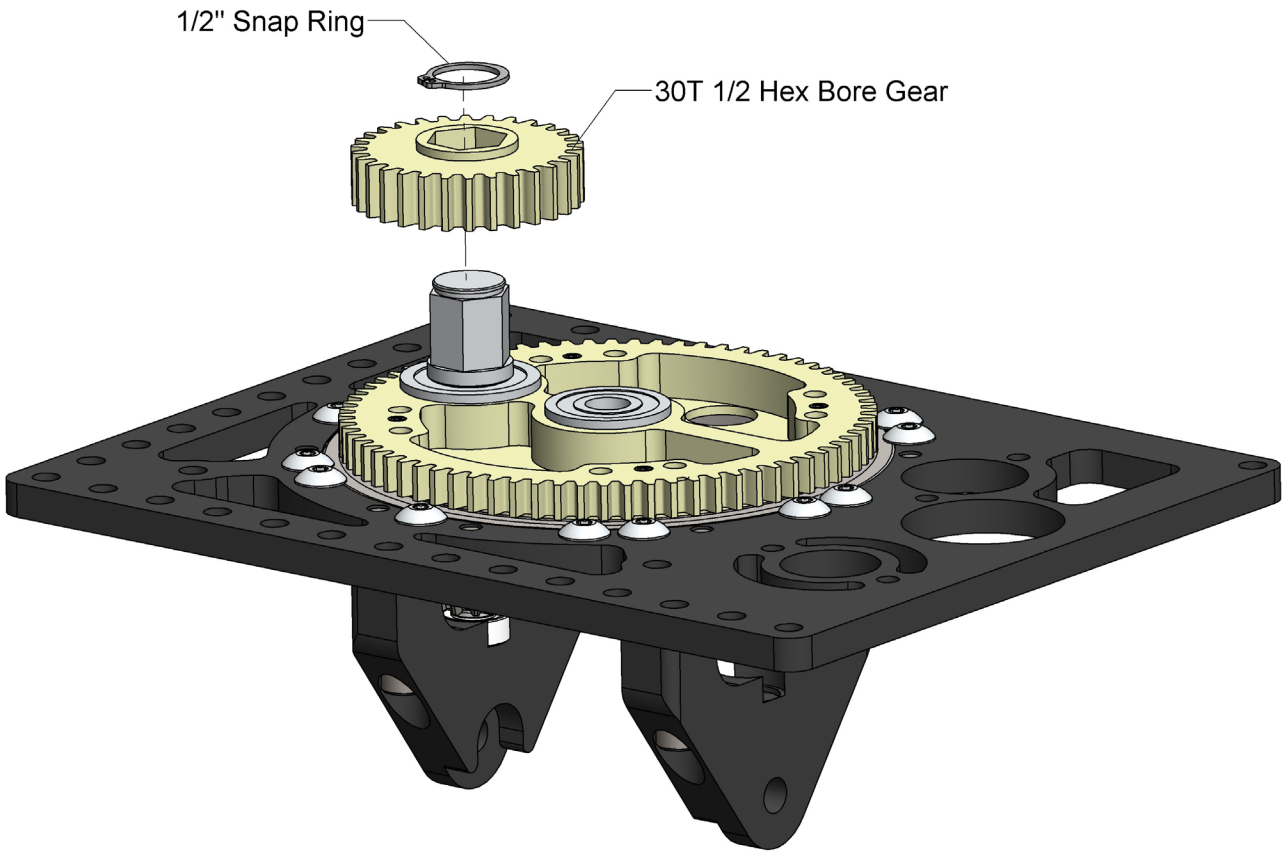
Align roll pins with the small set of holes on the main rotation gear as shown. Then bolt the forks in from the bottom with the #10-32 SHCS x 1.75” Length bolts.

Note: The roll pins are there to aid in assembly and alignment. If difficult to push roll pins into holes you can drill out the 0.125” holes to the next size up and this will not affect performance.



3.9 Finish Assembly of 1st Stage Shaft

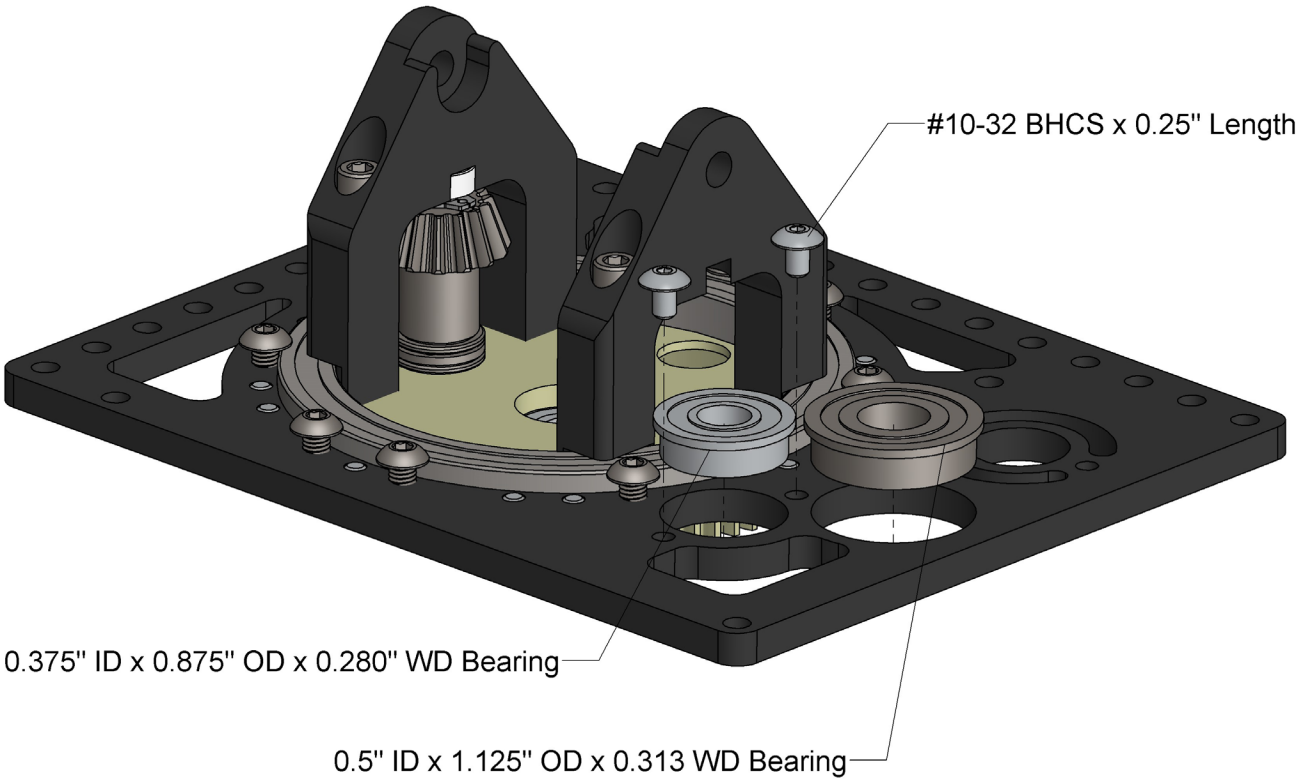
Assemble 30T or your chosen driven gear for the distance set of gears and put 1/2” snap ring onto shaft to retain the gear.



3.10 Insert Base Plate Rotation Bearings

Insert bearings as shown and thread in the bolts into the plate so that they retain the bearing.

Note: These bolts will not sit flush with the plate as they are meant to only retain the bearing.

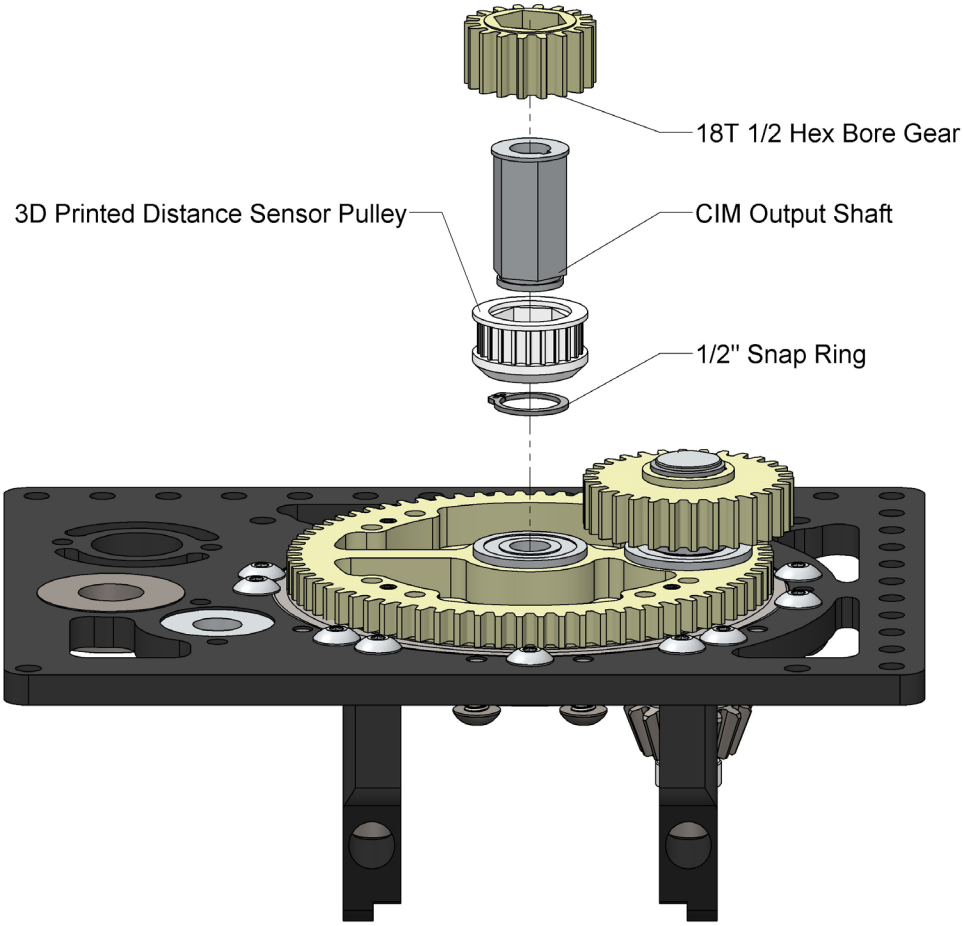


3.11 CIM Output Shaft

Slide 3D printed distance sensor pulley onto the shaft from the snap ring grove to the flat at the top of the shaft. Follow that by the 18T 1/2 hex bore gear such that the gear is closest to the snap ring grove. If gear is above pulley then the gear will not mesh with the already assembled gear. Once pulley and gear are on shaft secure them with the 1/2” snap ring.

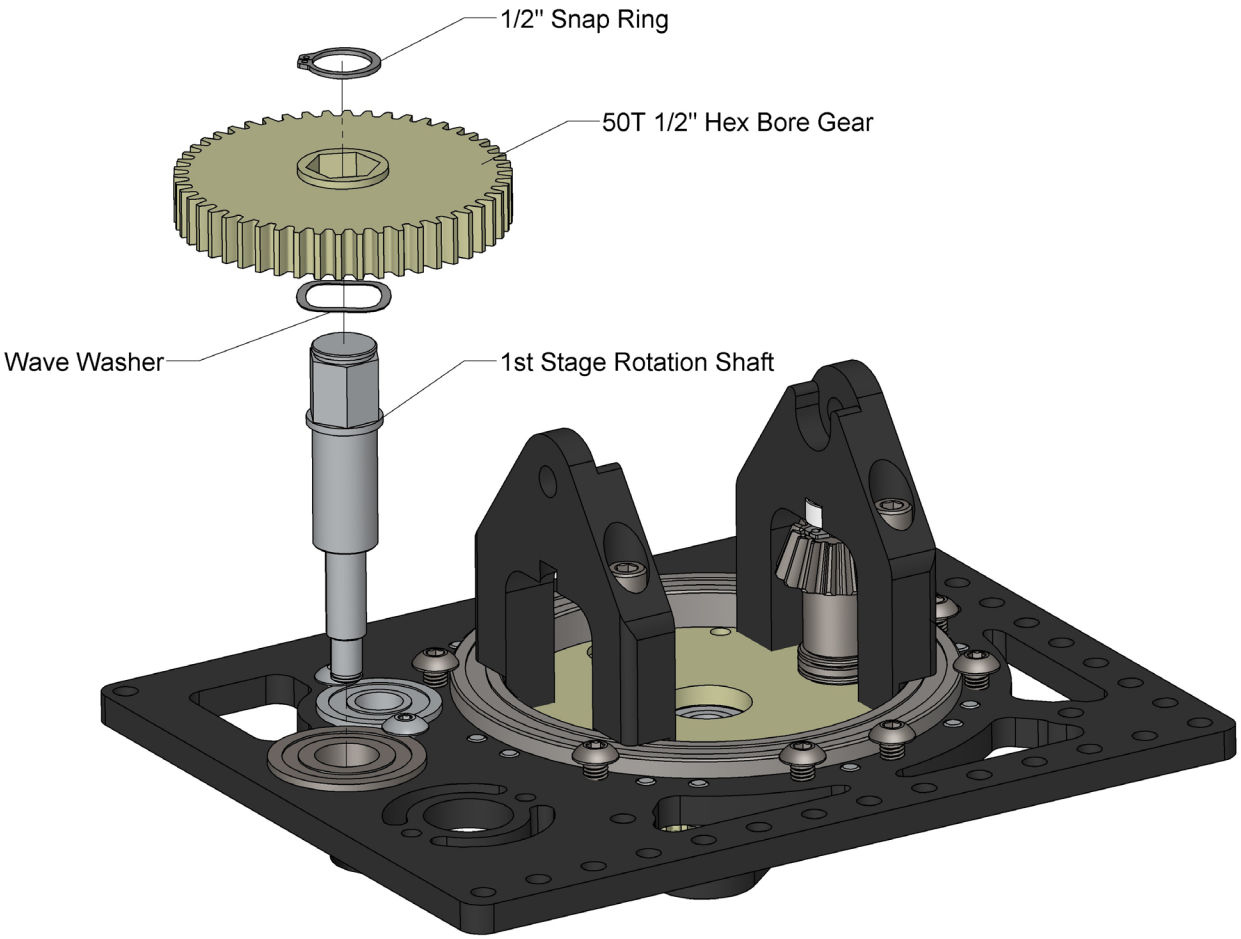
Note: If you didn’t purchase the distance sensor hardware or have not 3D printed your own then you can put a spacer there until replaced with a pulley.

Disclaimer: If you are using a CIM or Mini CIM as the distance motor you will not be able to get how far you have driven unless you use a Falcon 500 or another method to track distance.



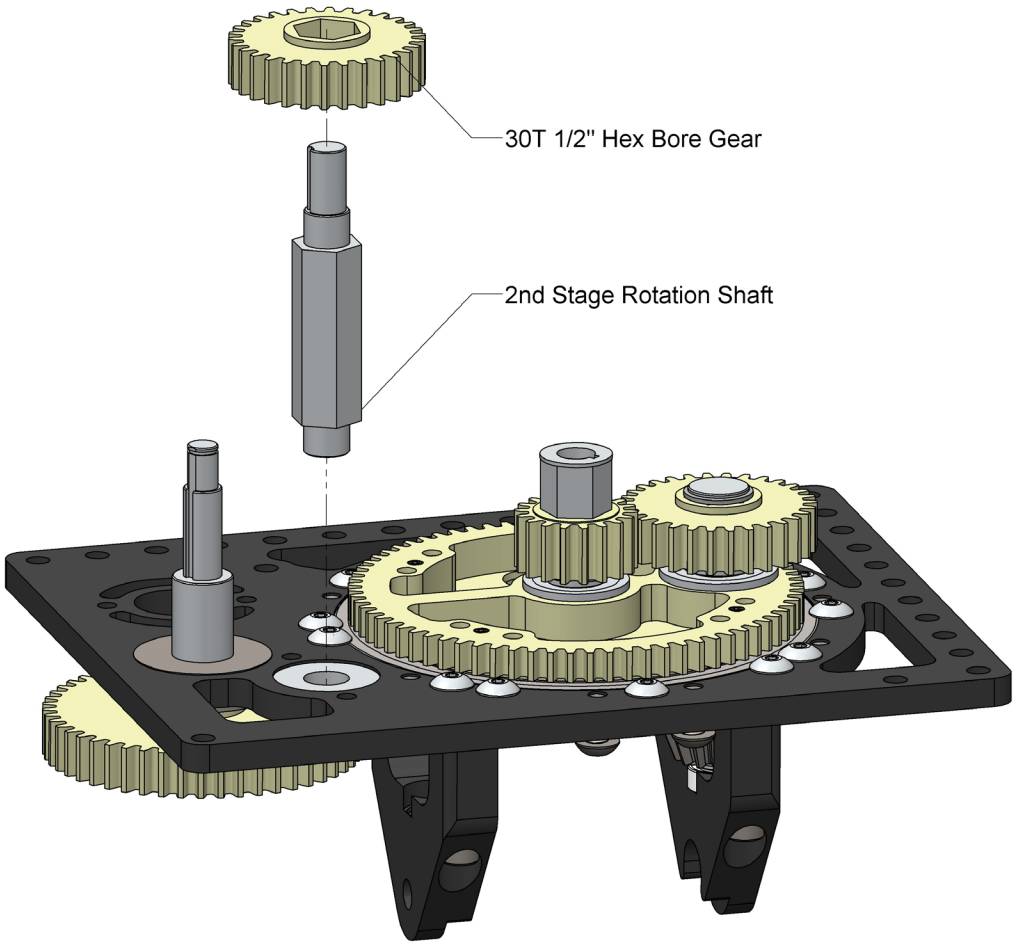
3.12 1st Stage Rotation Shaft

Insert the 1st stage rotation shaft from the bottom of the base plate. Slide the wave washer onto the shaft followed by your 1st stage rotation gear, in our case we chose the 50T 1/2” hex bore gear for example. Retain the gear and wave washer via the 1/2” snap ring.



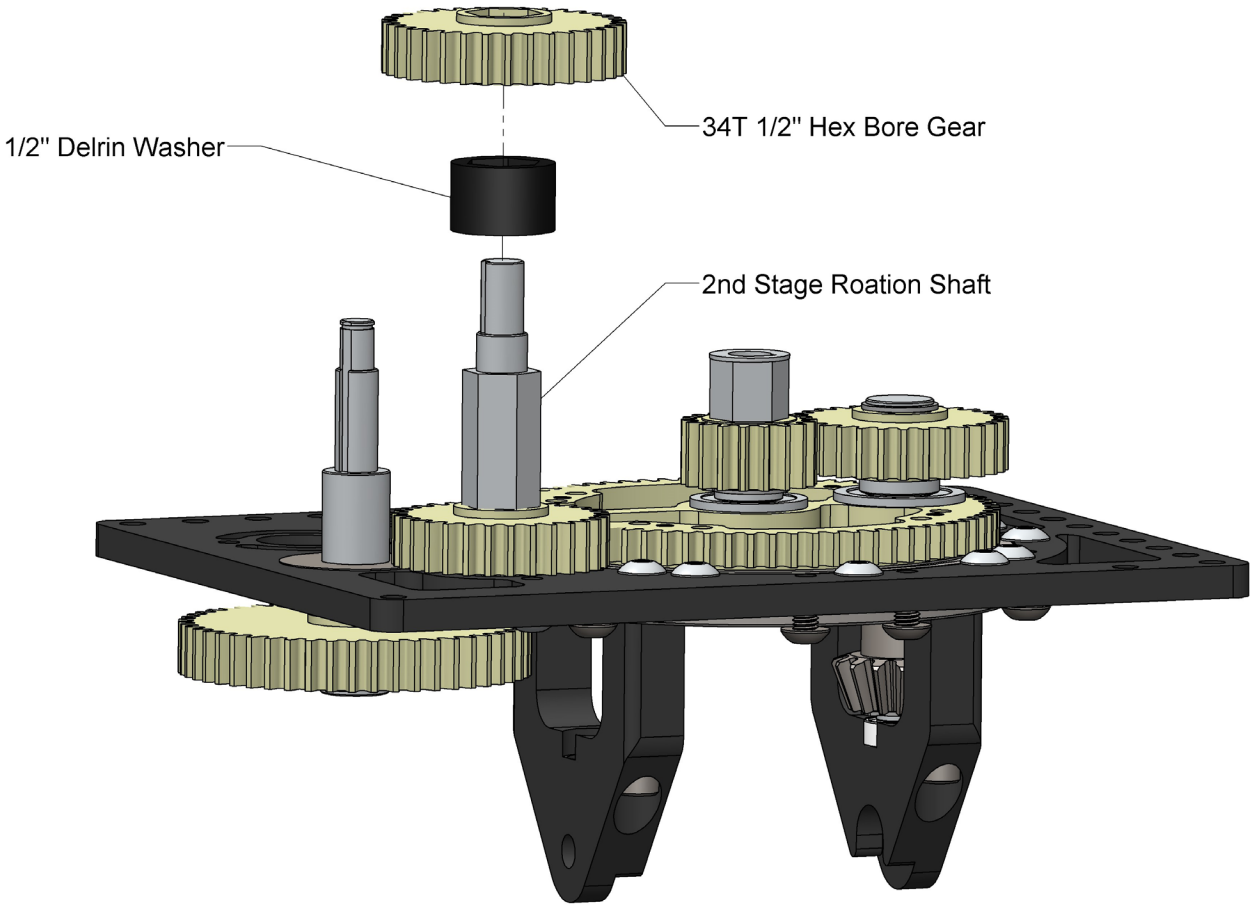
3.13 2nd Stage Shaft Install

Slide 2nd stage shaft into the bearing installed in 3.10 then slide the 30T 1/2” hex bore gear onto the shaft such that it mates with the main rotation gear.



3.14 2st Stage Shaft Final Gear Assembly

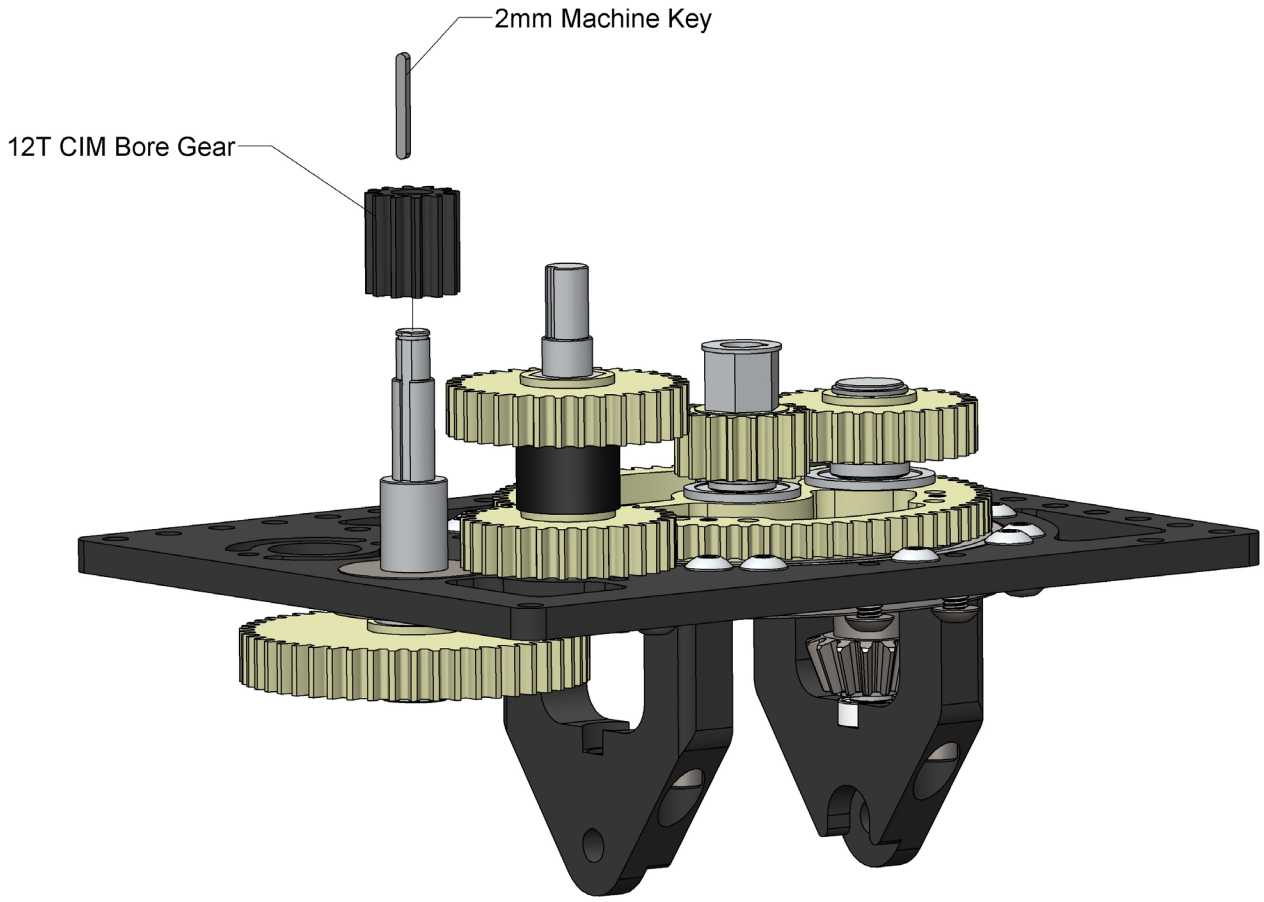
Slide a 1/2” spacer onto the shaft followed by the 34T 1/2” hex bore gear.



3.15 1st Stage Rotation Shaft Final Gear Install

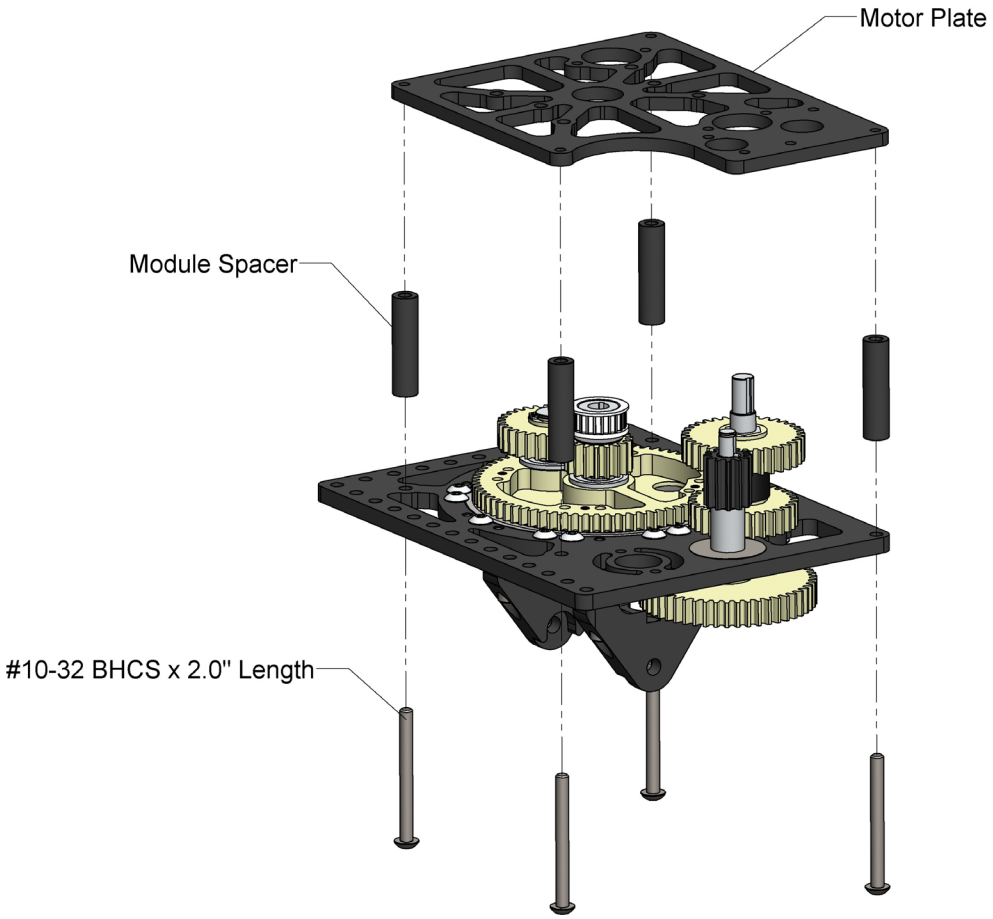
Put the 12T CIM bore gear onto the shaft and then slide they 2mm machine key into the grove.

Note: Some may find it easier to push the 2mm machine key into the grove then slide the 12T CIM bore gear onto the shaft after the key is installed.



3.16 Secure Motor Plate

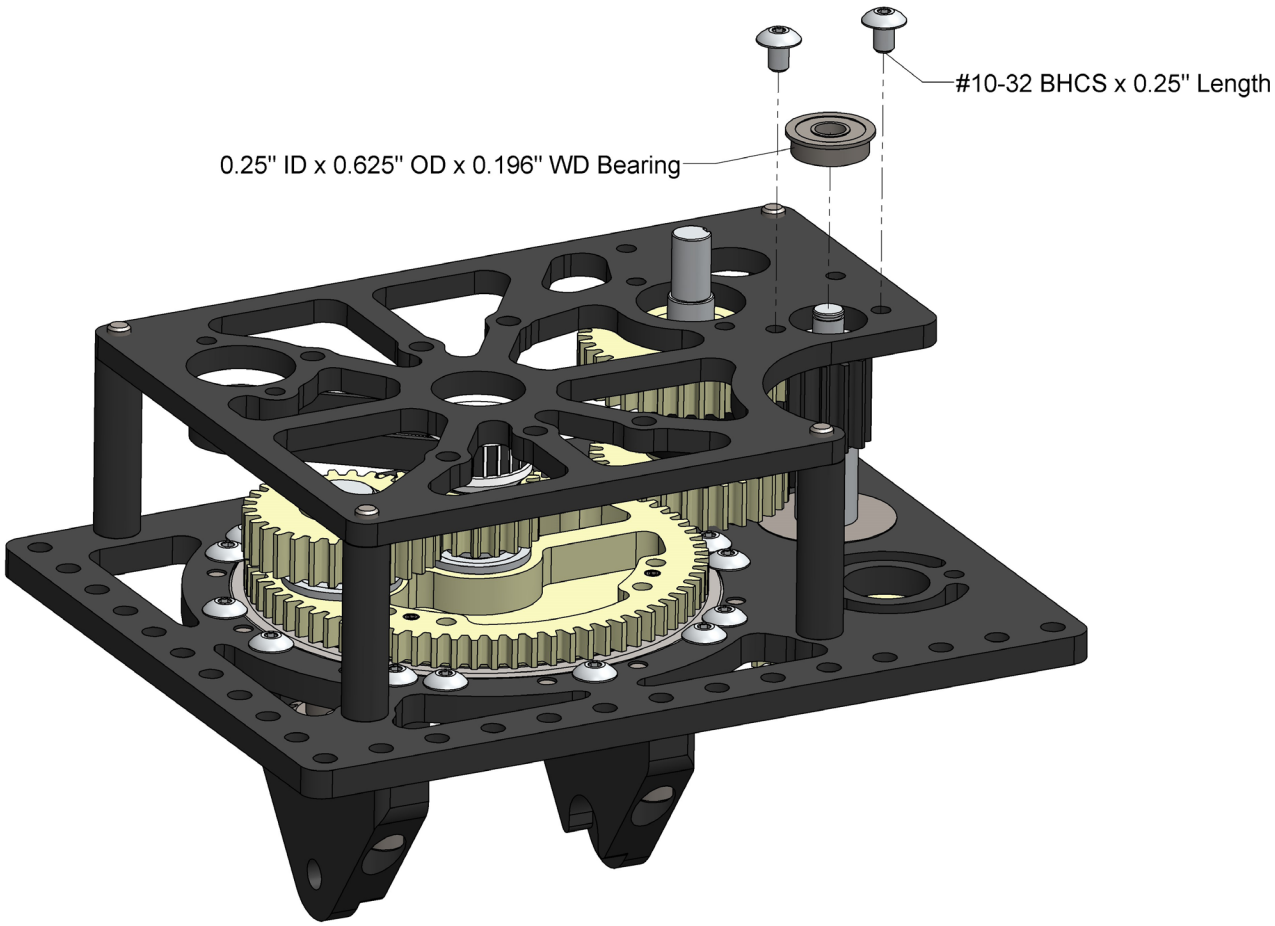
Push the 4 x #10-32 BHCS x 2.0” length from the holes in the base plate and then slip module spacers over the bolts and finally thread the bolts into the holes located on the motor plate as shown below.



3.17 1st Stage Rotation Shaft Motor Plate Bearing

Insert 0.25” ID x 0.625” OD x 0.196” WD bearing into specified hole on the motor plate and secure with the 2 x #10-32 BHCS x 0.25” Length bolts.

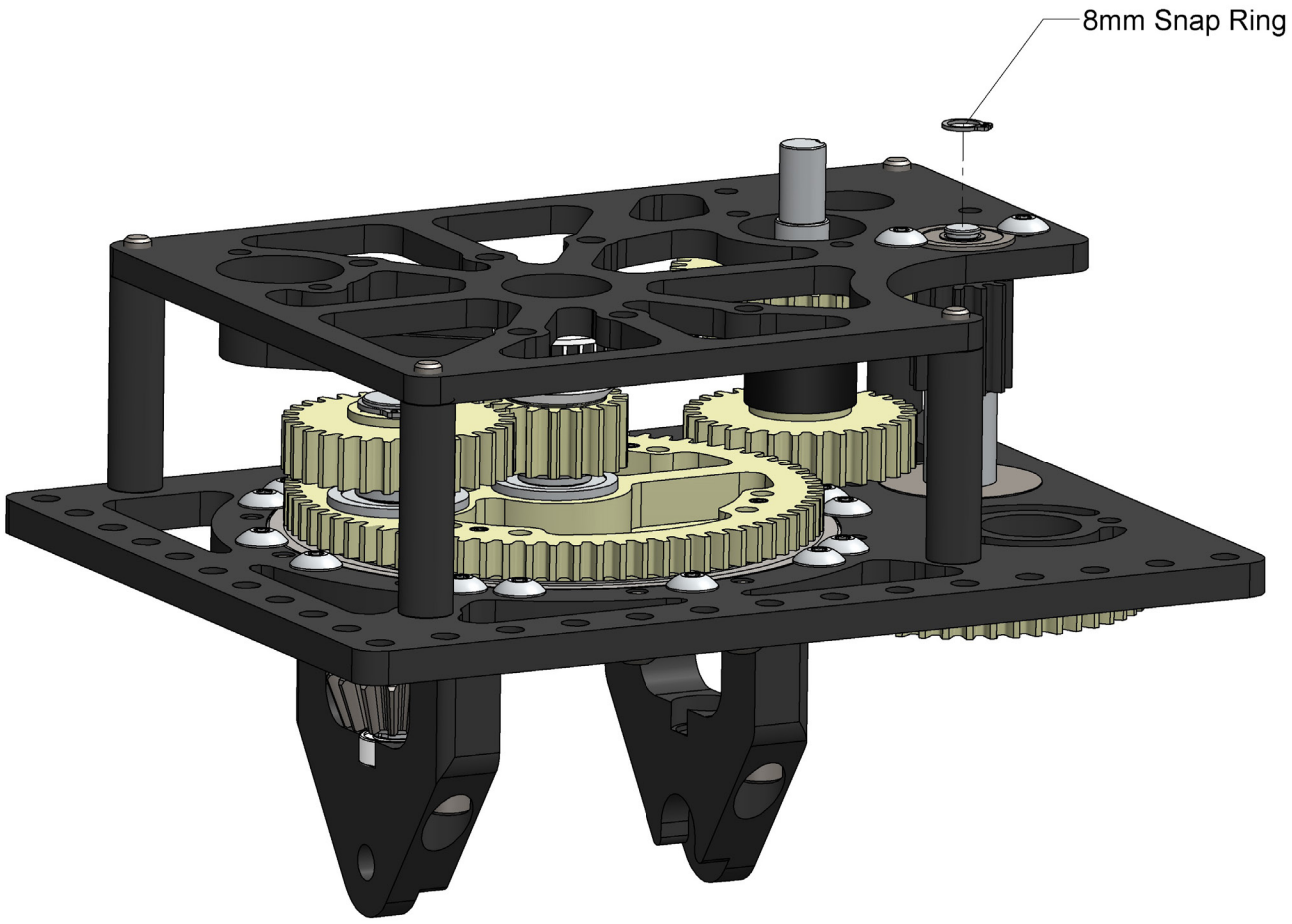
Note: These bolts will not sit flush with the plate as they are meant to only retain the bearing.



3.18 Retaining the 1st Stage Rotation Shaft

Clip the 8mm snap ring onto the 1st stage rotation shaft in-order to properly retain the shaft.

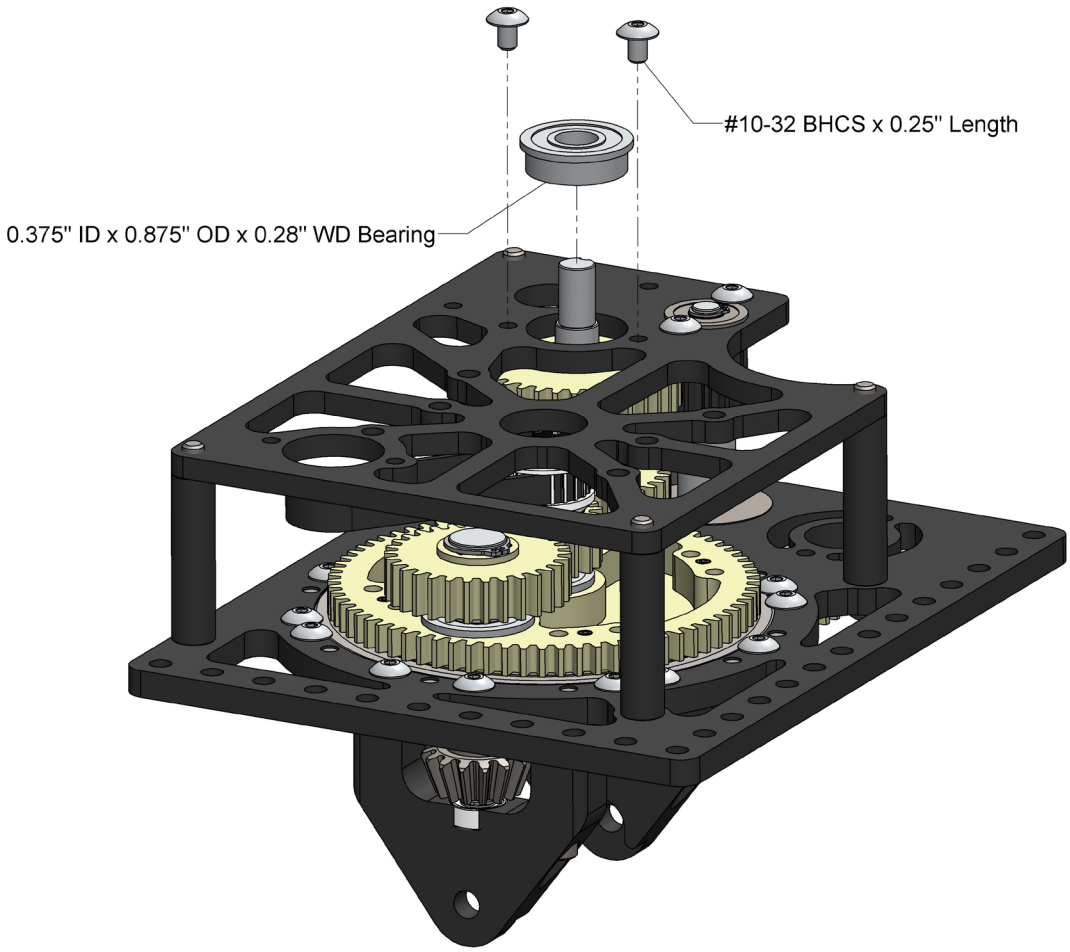
Note: The shaft may not fully show the snap ring grove and this is normal. Please push on the bottom of the shaft so that the wave washer compresses and then the snap ring grove will be fully present.



3.19 2nd Stage Rotation Shaft Motor Plate Bearing

Insert the 0.375” ID x 0.875” OD x 0.28” WD bearing into the specified hole shown below and secure the bearing into place by tightening down the 2 x #10-32 BHCS x 0.25” length bolts.

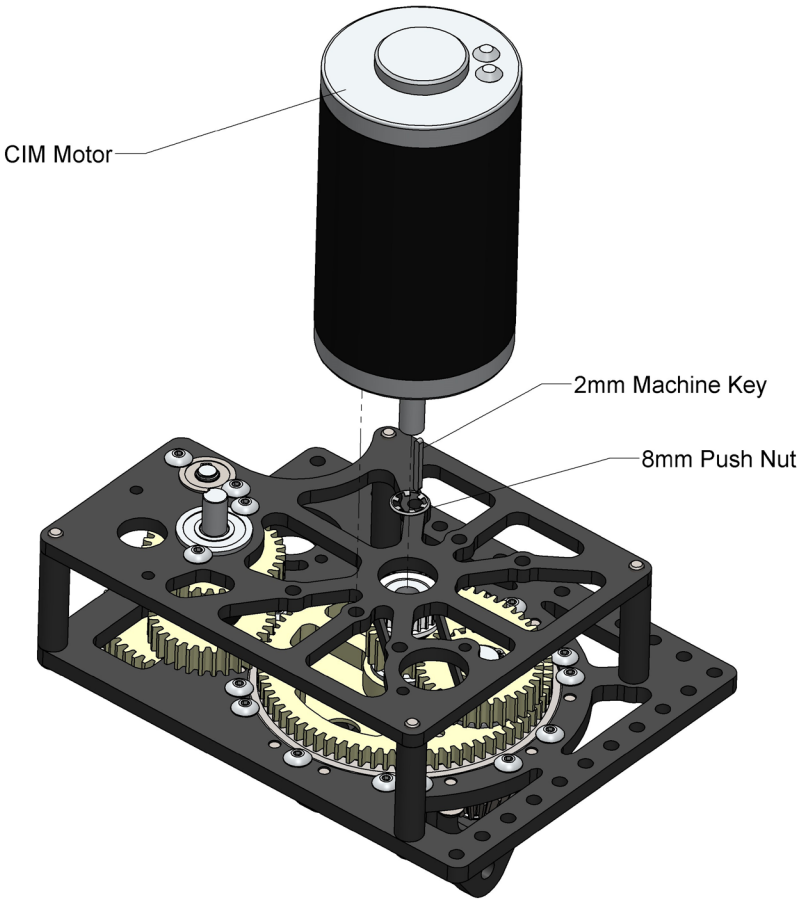
Note: These bolts will not sit flush with the plate as they are meant to only retain the



3.20 Align Drive Motor onto Motor Plate

Install the 2mm machine key into the key slot on the drive motor. Then push on the 8mm push nut so that it is just slightly past the end of the 2mm machine key. The align the 2mm machine key with the key slot on the CIM output shaft then push down so that the motor is flush with the motor plate and this will in turn push the 8mm push nut into the correct location.

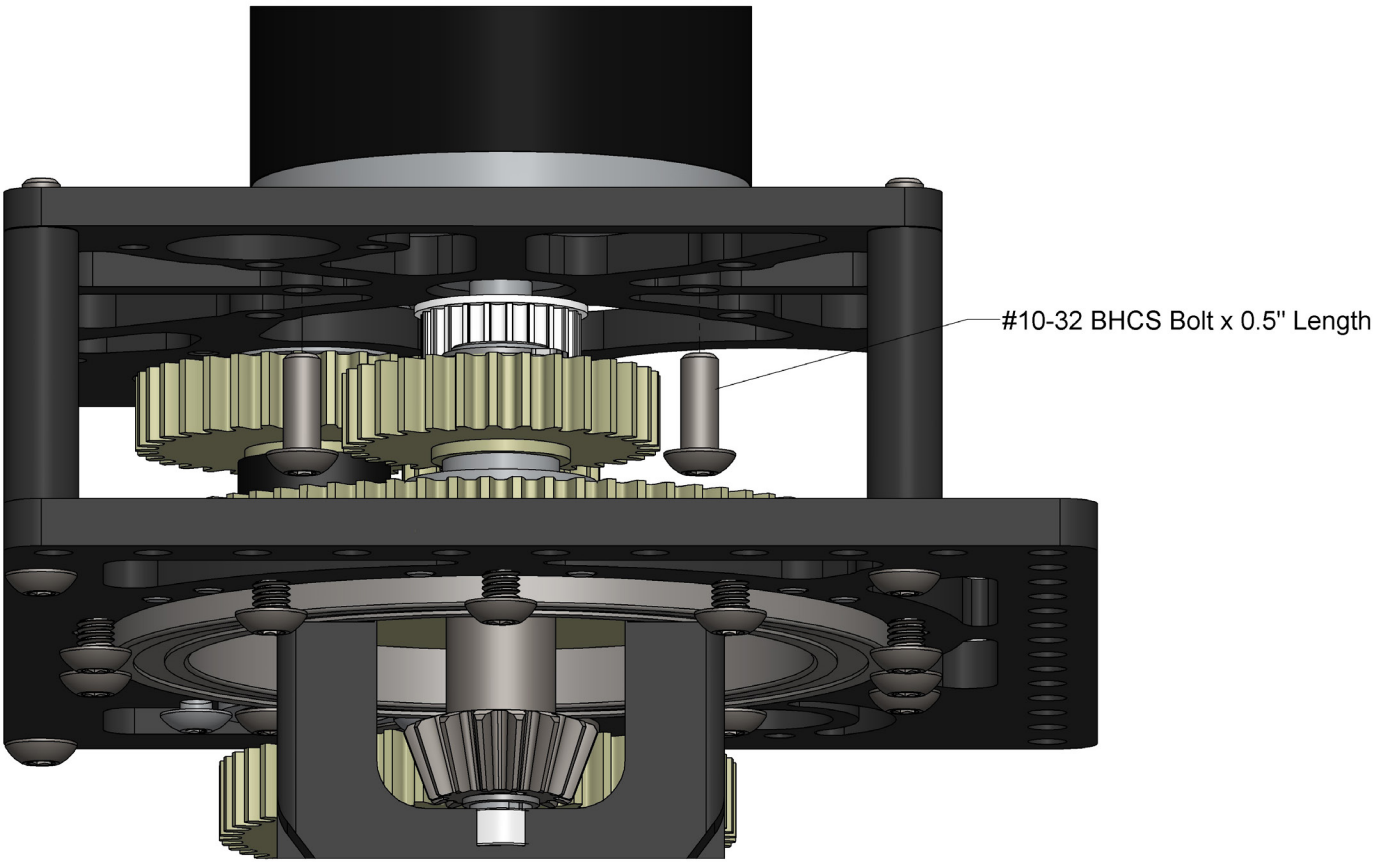
Note: If you are using our distance hardware or have 3D printed your own then it is recommended that the GT2 belt is slipped over the pulley prior to the drive motor being installed as it is difficult to install when the motor is mounted.



3.21 Mounting the Drive Motor

In order to install the 2 x #10-32 BHCS x 0.5” length bolts you will need to rotate the main rotation gear such that the large 2 holes are aligned with the CIM mounting holes. Then use an allen key to go through the holes on the main rotation gear to be able to tighten the drive motor mounting bolts.

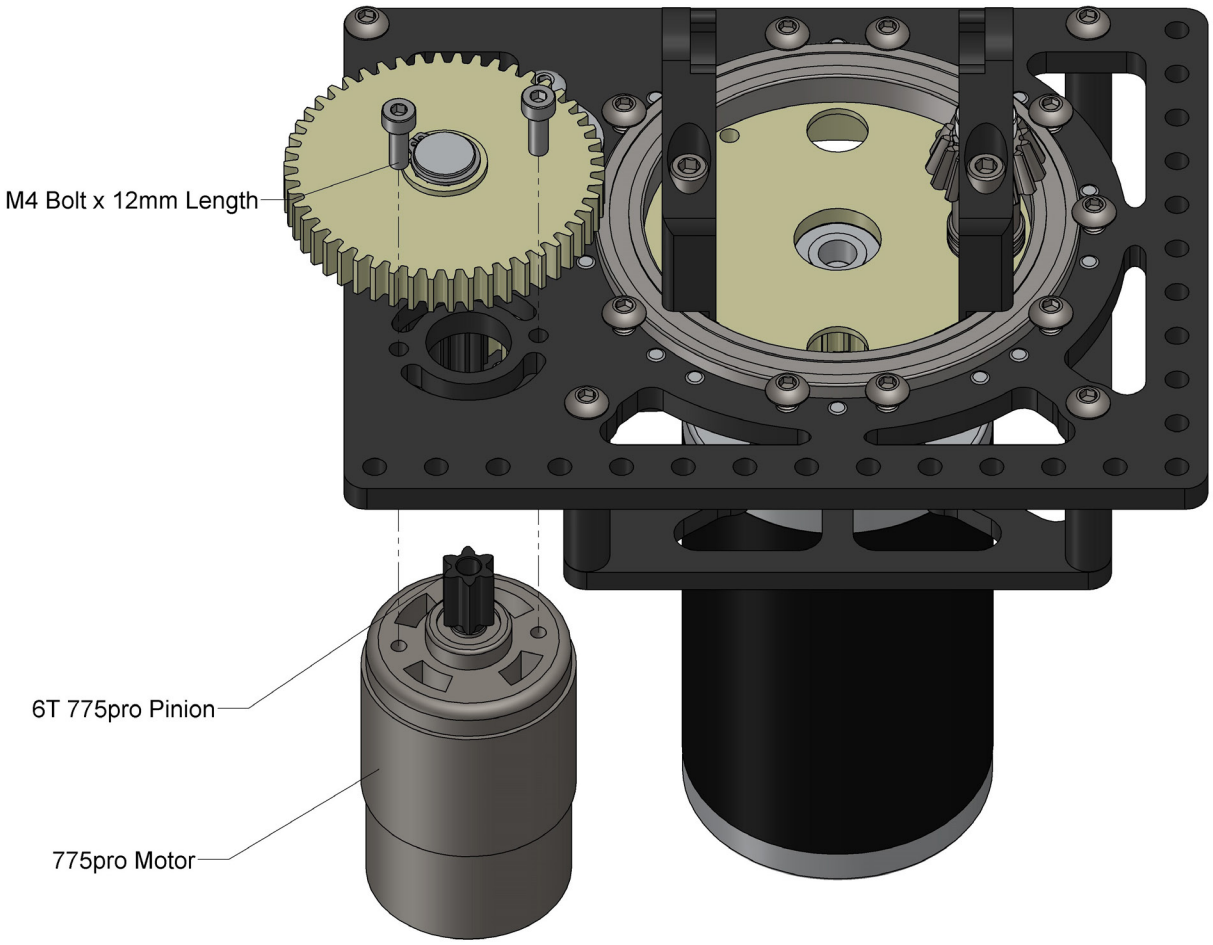
Note: If you need to replace your drive motor for any reason you will have to remove the drive wheel to access these bolts in the future.



3.22 775pro Mounting

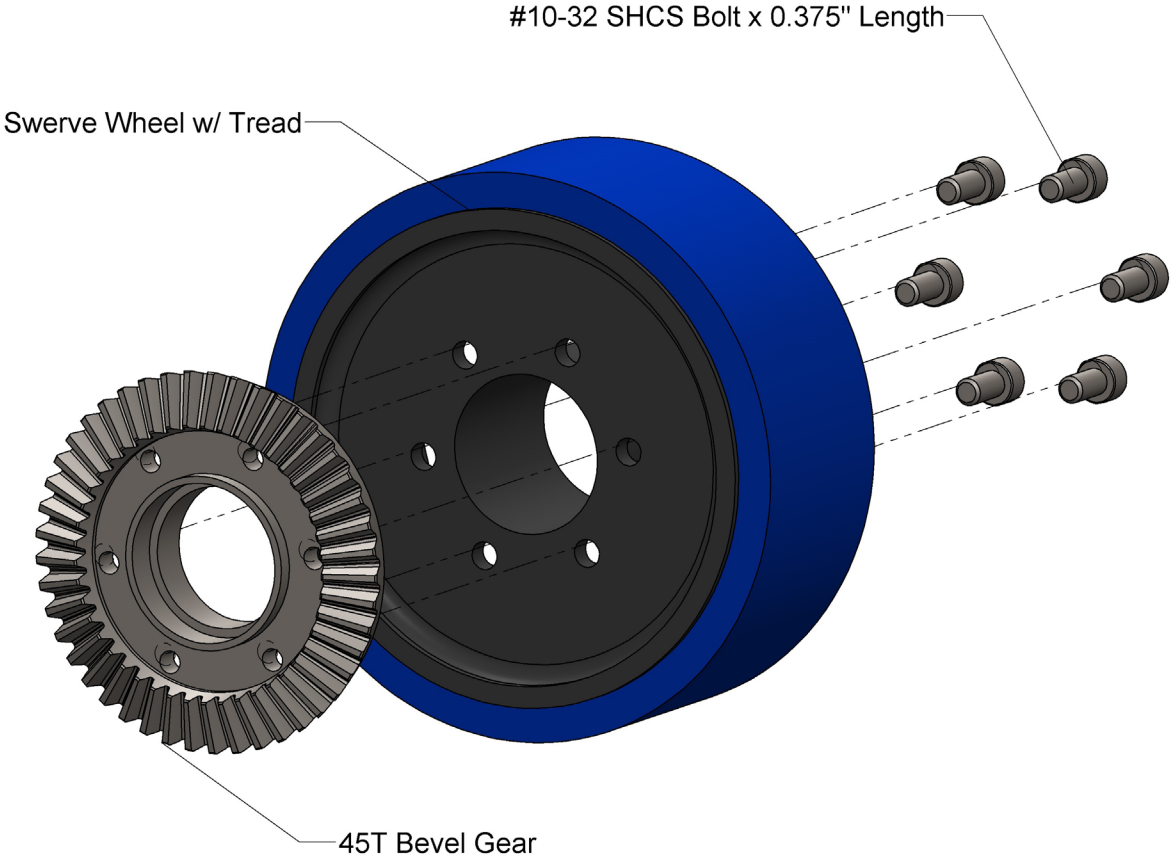
After the pinion of choice is installed on the 775pro, slide the motor into it's location as shown below and secure the motor to the base plate with 2 x M4 bolts x 12mm length.

Note: These M4 bolts are not included



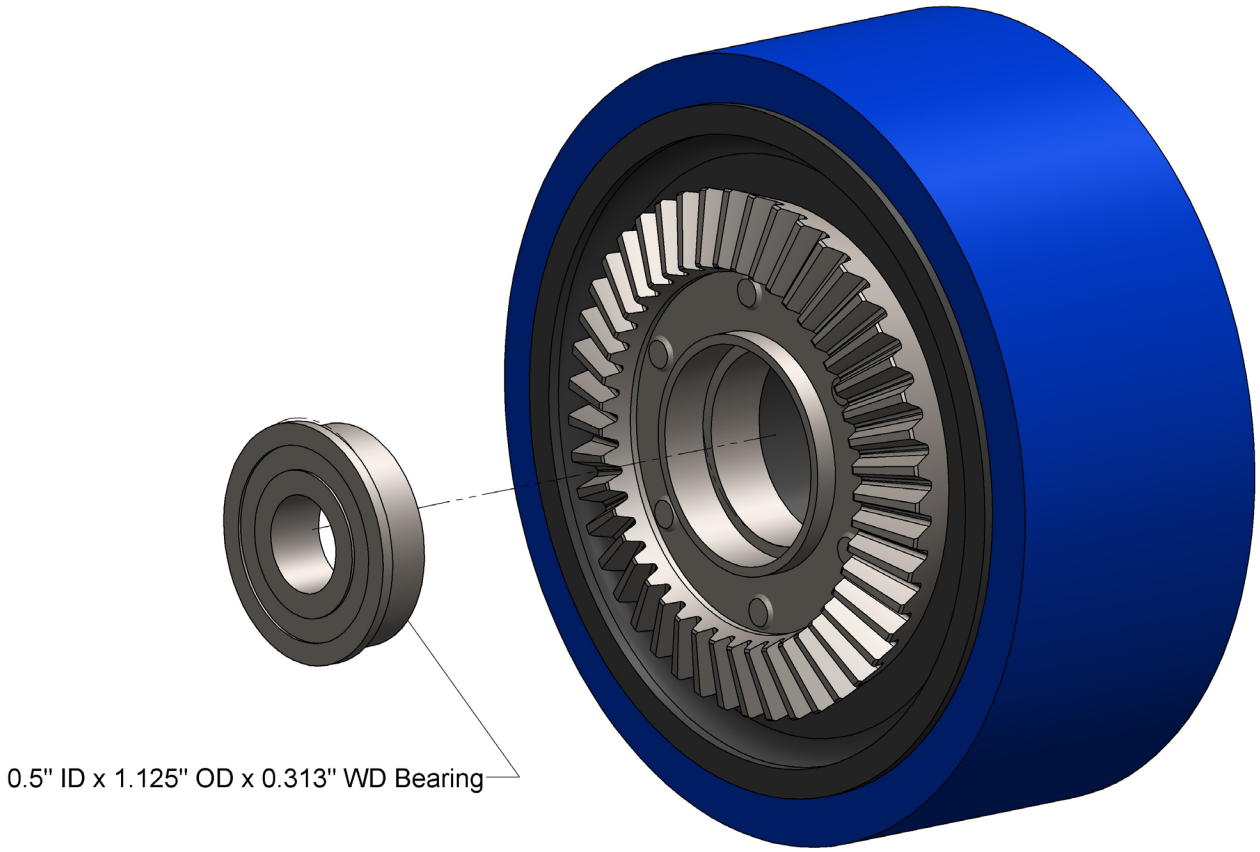
3.23 Secureing 45T Bevel Gear to Wheel

Push the 45T bevel gear into the wheel such that the flat face of the wheel matches the picture below. Then secure the bevel gear to the wheel by tightening the 5 x #10-32 SHCS bolts x 0.375” length from the back side of the wheel so that none of the bolt heads are visible when looking at the 45T bevel gear.



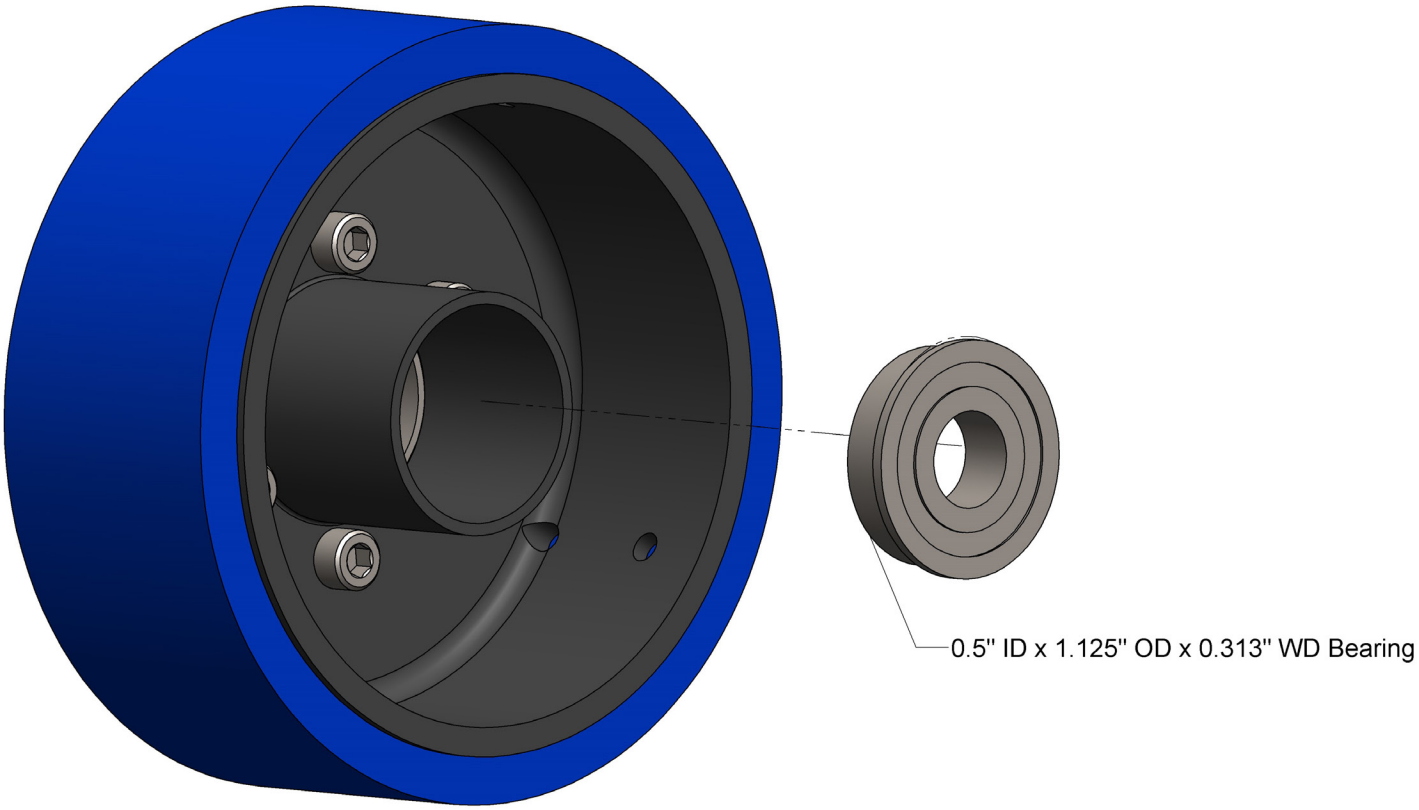
3.24 Install Bevel Gear Bearing

Push the 0.5” ID x 1.125” OD x 0.313” WD Flanged Bearing into the bevel gear so that the flange of the bearing is flush with the outside lip on the bevel gear.



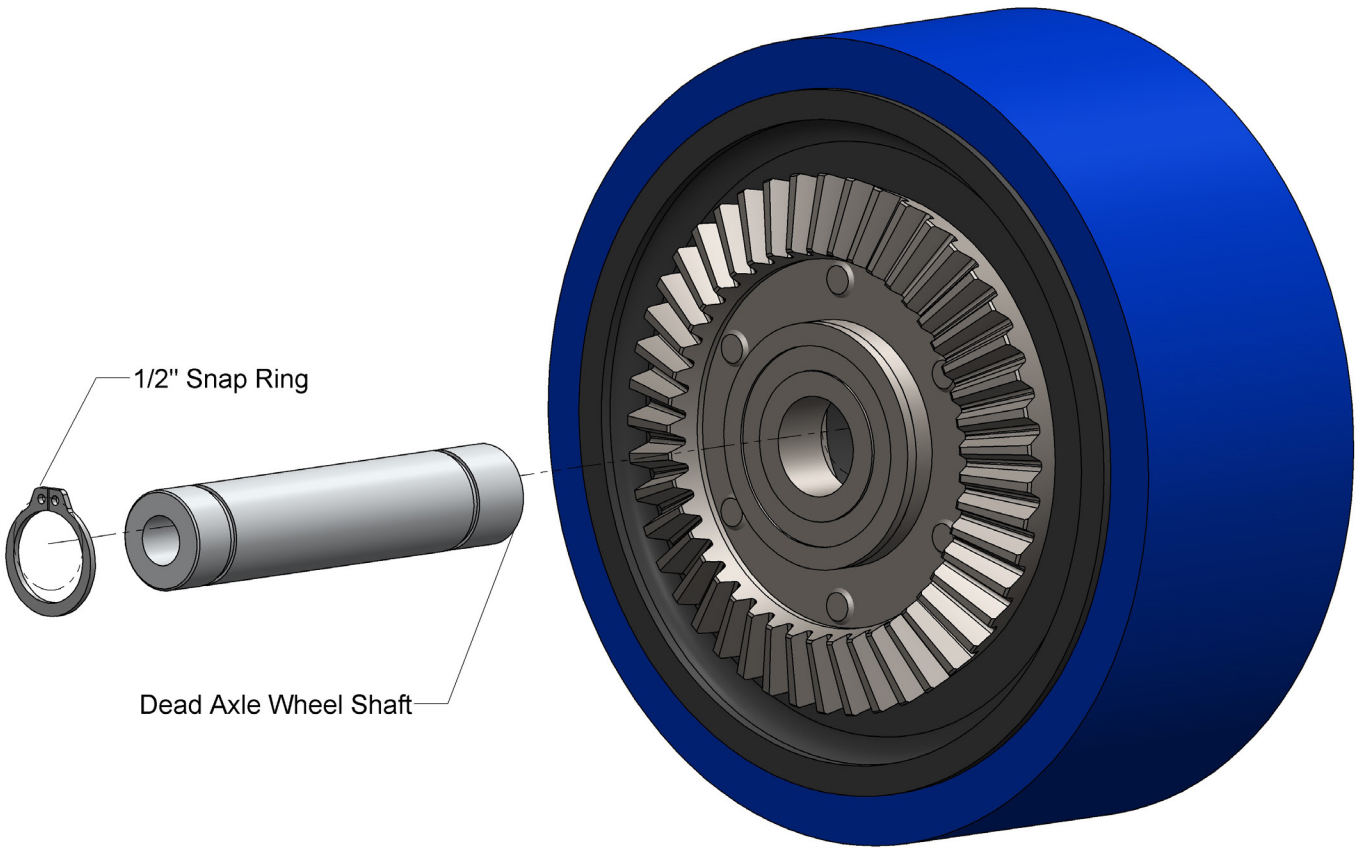
3.25 Install Backside Wheel Bearing

Push the 0.5” ID x 1.125” OD x 0.313” WD Flanged Bearing into the extruded feature on the rear of the wheel as shown below.



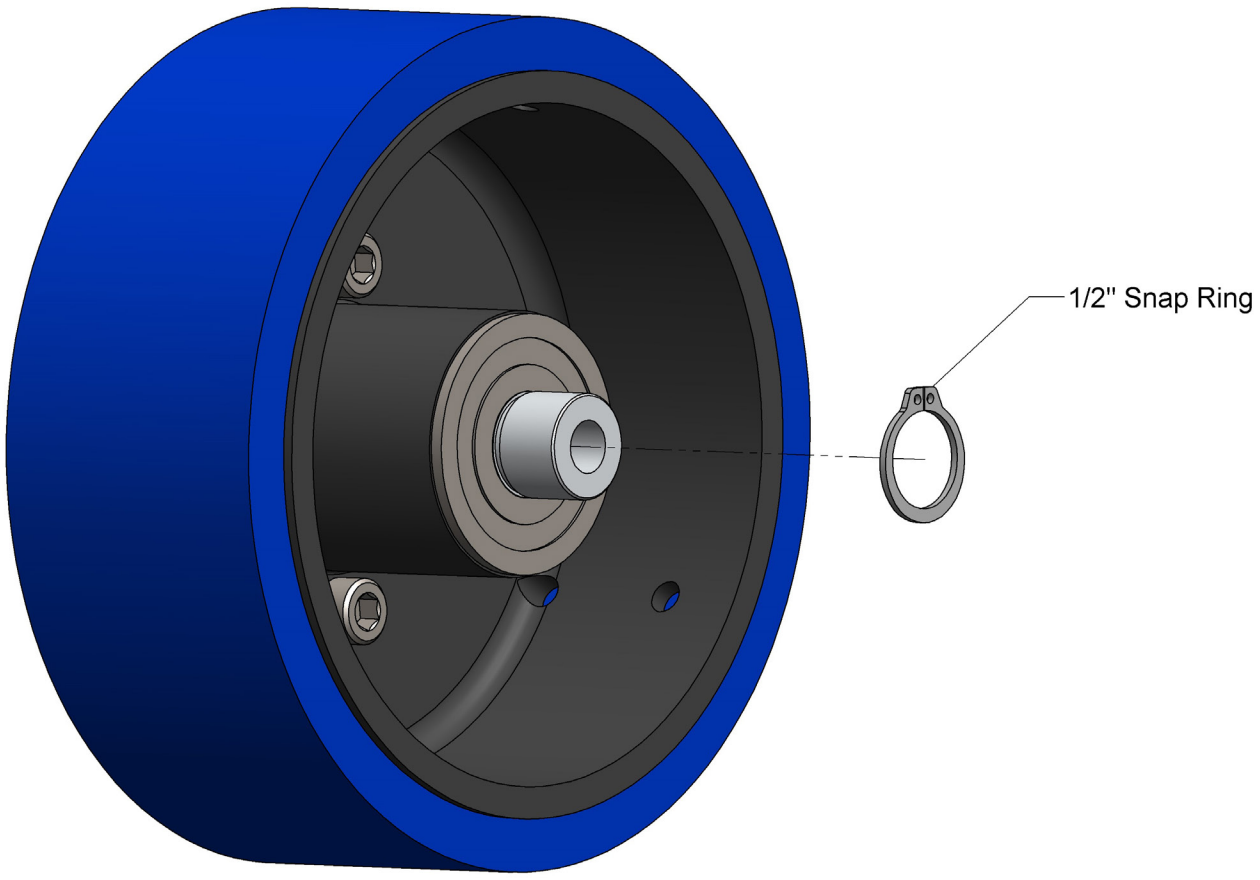
3.26 Installing the Dead Axle Pt. 1

Slide the dead axle wheel shaft into the bearing from the bevel gear side and secure with the 1/2” snap ring.



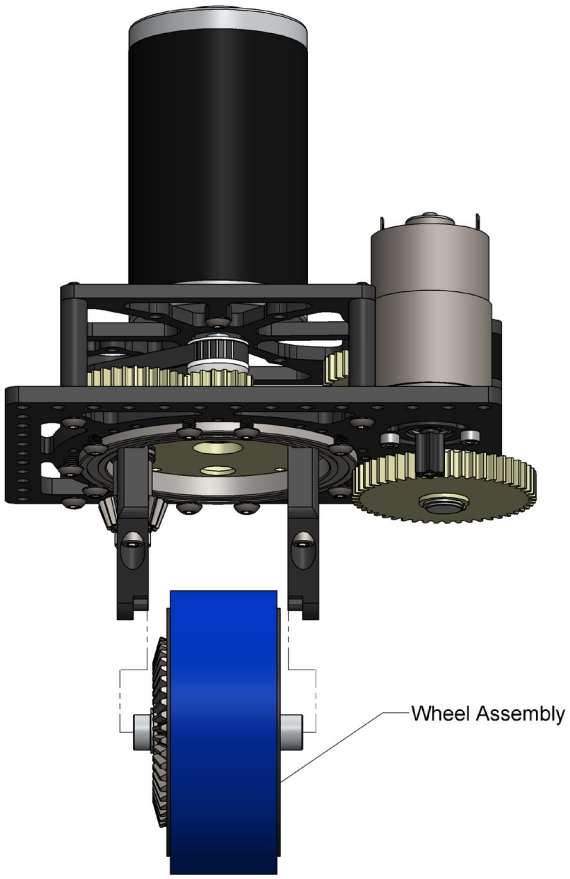
3.27 Installing the Dead Axle Pt. 2

Push the shaft all the way through the wheel until it comes out of the other bearing as shown below. Secure the shaft to the wheel by installing the 1/2” snap ring on to the end of the shaft. The dead axle should not be able to separte from the wheel once this snap ring is intalled.



3.28 Installing Completed Wheel into Module

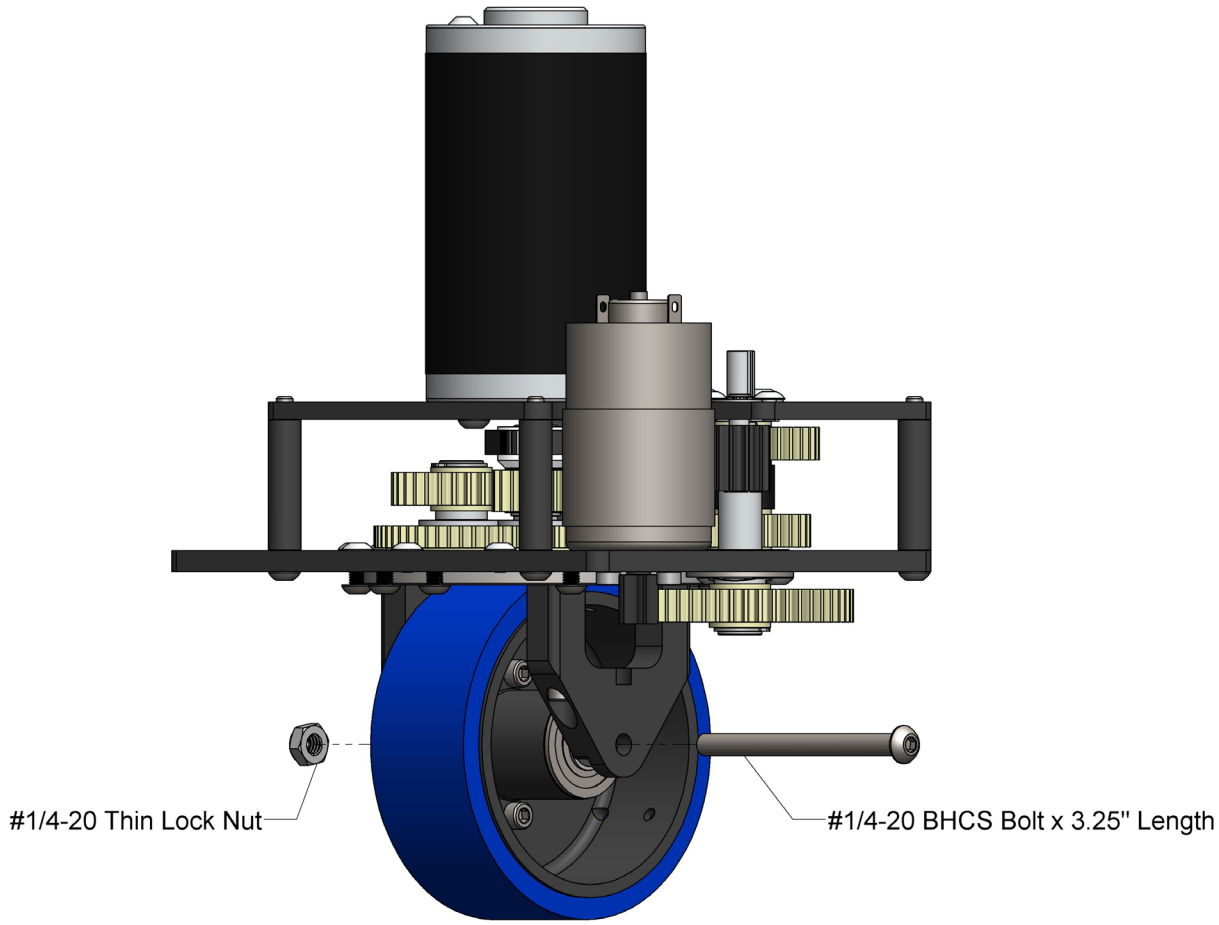
Slide the completed wheel into the the forks so that the cutouts on the forks surround the dead axle wheel shaft.



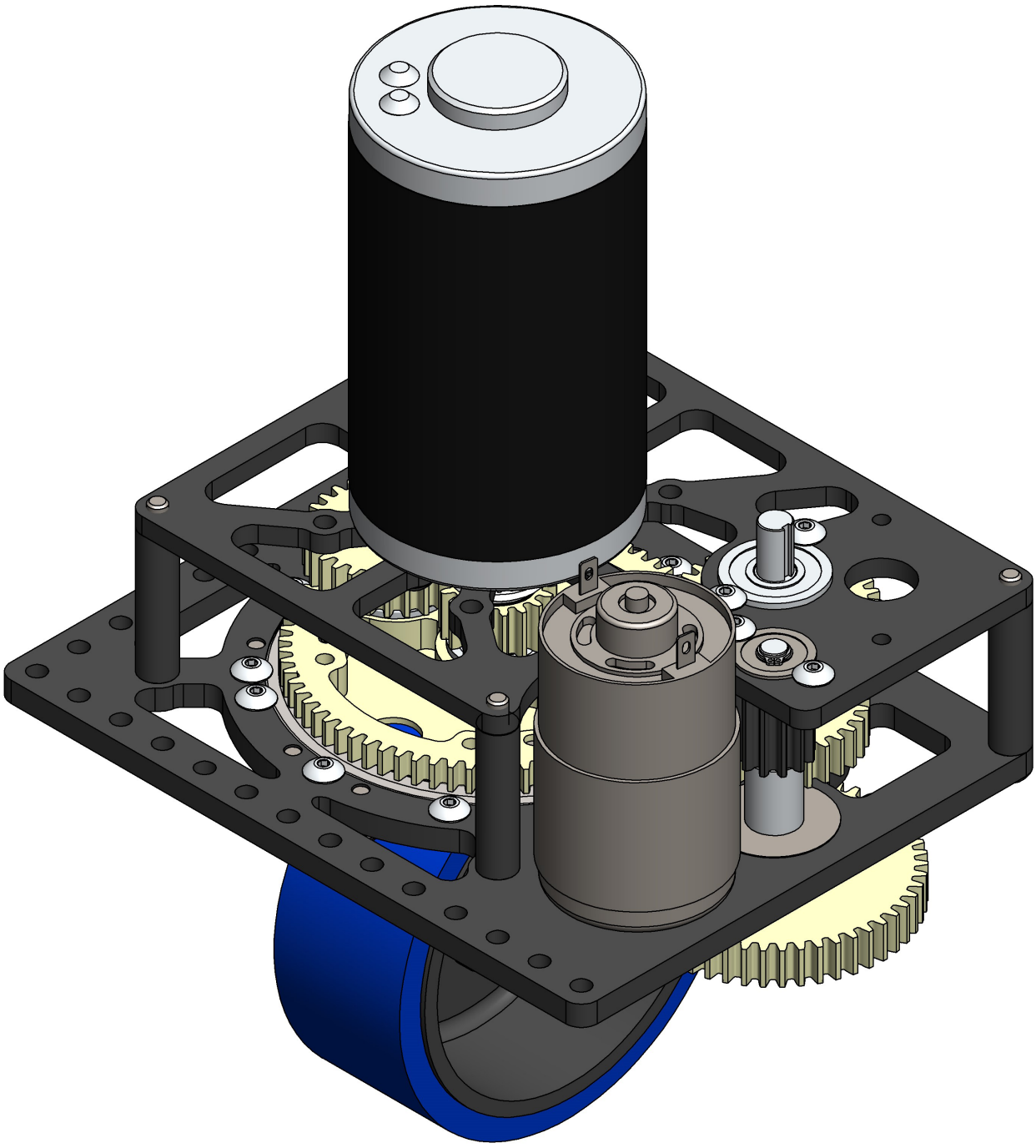
3.29 Securing Wheel To Module

Push the #1/4-20 BHCS bolt x 3.25” length through the whole in the fork into the dead axle wheel shaft and then out the other hole on the opposing fork. Secure the bolt in place with the #1/4-20 thin lock nut.

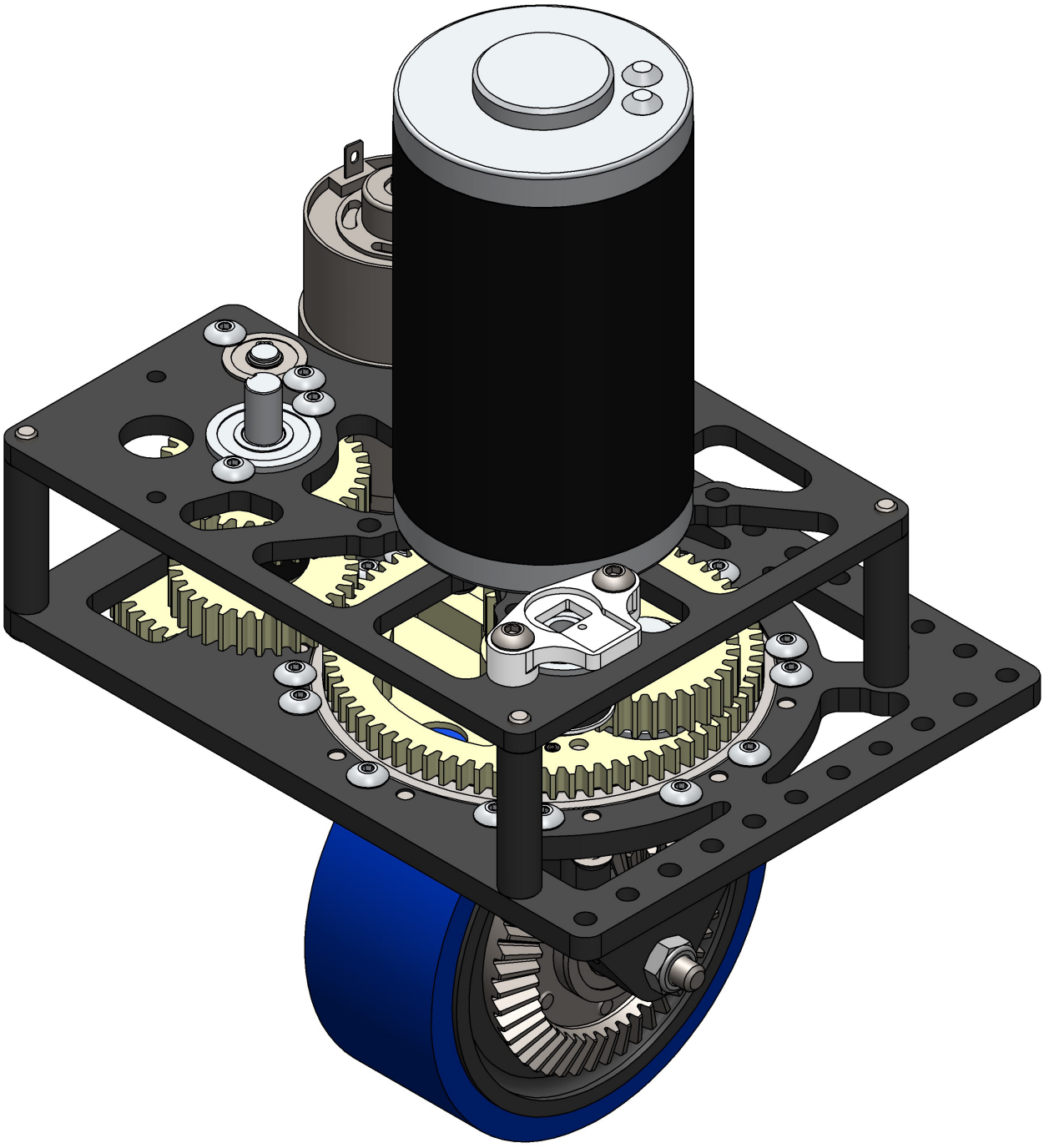
Note: This bolt can be installed with the bolt head is touching the fork shown below or the opposite fork. Installing this bolt the opposite way will not effect performance.



3.30 Base WCP SS Swerve Module Complete

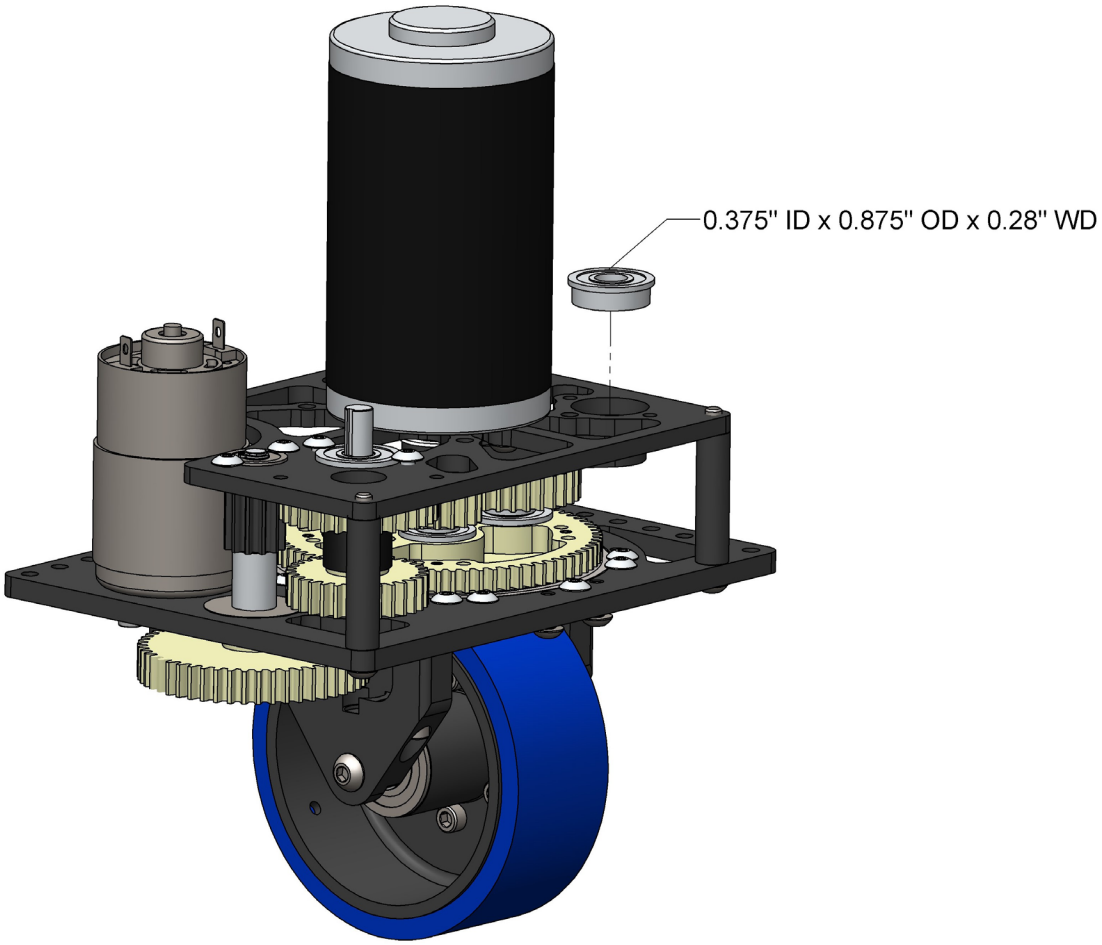


4. Installing Distance Sensor Hardware Kit



4.1 Main Distance Sensor Bearing

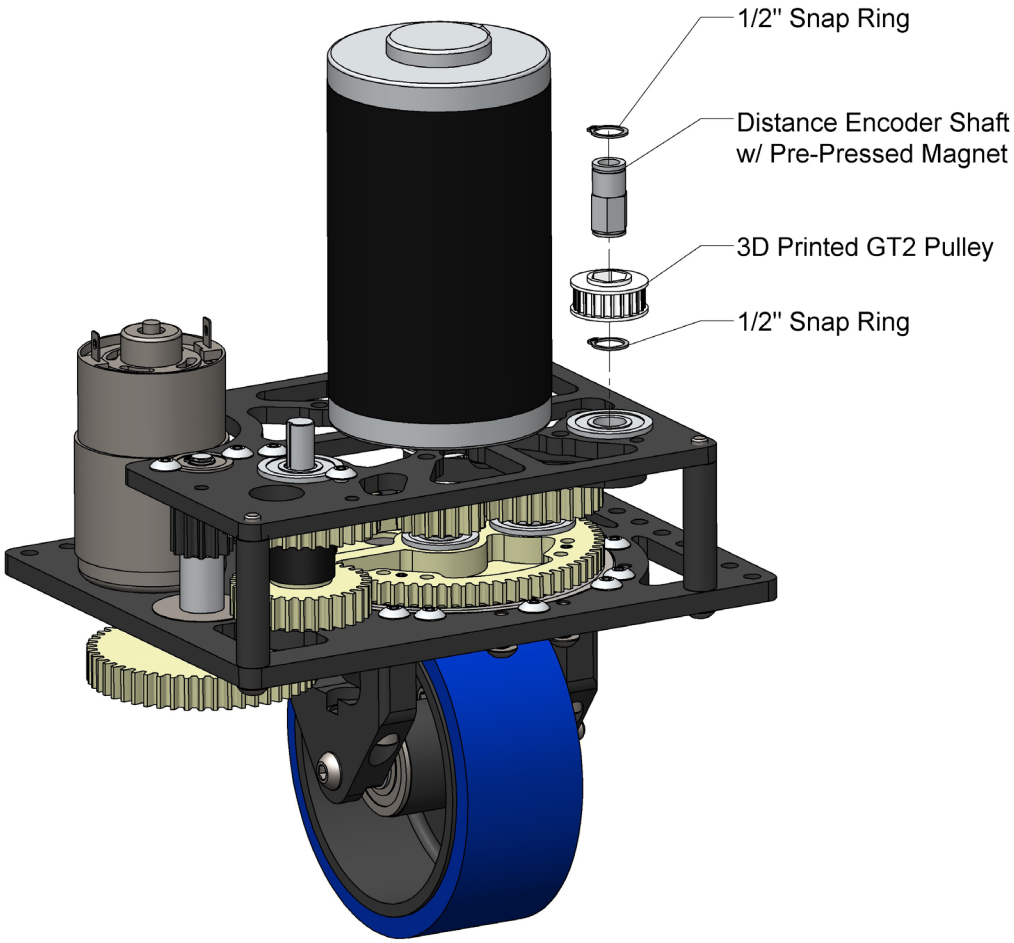
Push the 0.375” ID x 0.875” OD x 0.28” WD bearing into the motor plate as shown below.



4.2 Distance Encoder Shaft and Pulley

From below the motor plate wrap the GT2 belt around the 3D printed GT2 pulley and then slide the pulley onto the hex portion of the distance encoder shaft and secure the pulley with the 1/2” snap ring. Still from under the motor plate slide the round portion of the shaft into the bearing installed in step 4.1 such that only the snap ring grove is exposed on the flanged side of the bearing. Secure the distance encoder shaft to the modue by putting th 1/2” snap ring onto the shaft.

Note: Once installed you should be able to spin the drive wheel and the distance encoder shaft will spin. The shaft is not geared 1:1 with the drive wheel so the shaft will be rotating faster than the wheel rotations. If the distance encoder shaft is not spinning then it has been installed incorrectly.

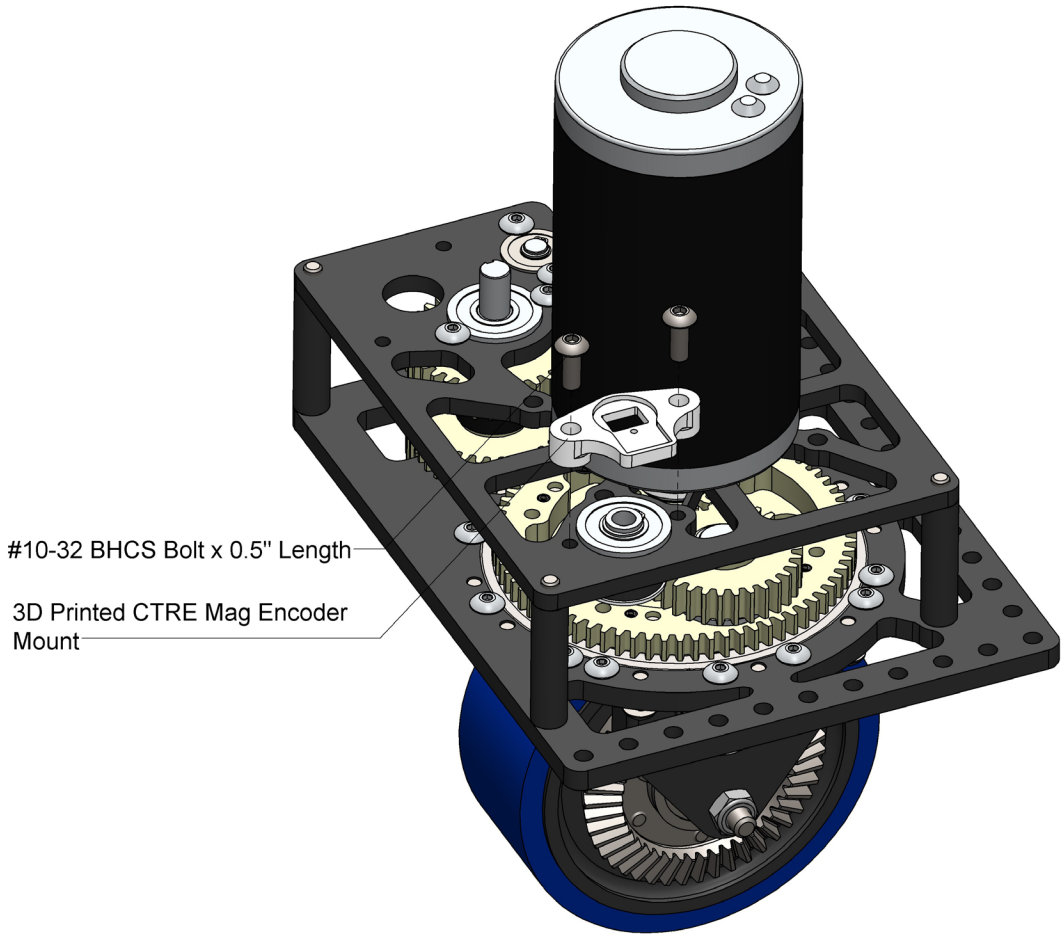


4.3 CTRE Mag Encoder Mount

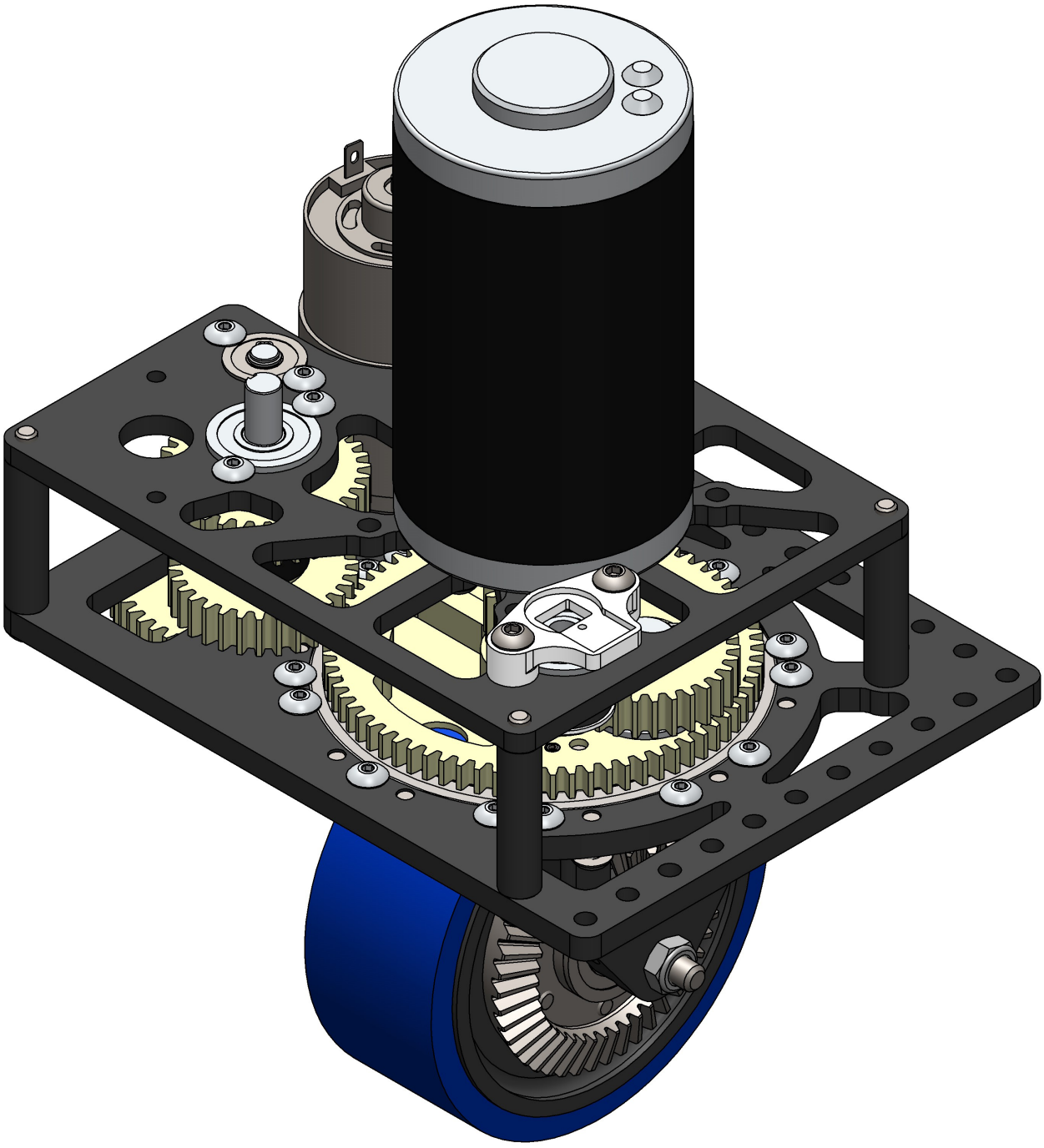
Install the 3D printed CTRE mag encoder mount by aligning the 2 x #10-32 BHCS bolts x 0.5” length and tightening them until secure. Finally take the CTRE mag encoder and place it so that the sensor side is face down and then thread the CTRE mag encoder bolt into the mount.

Note: CTRE mag encoder/CTRE mag encoder bolt is not included in this kit and must be bought separately.

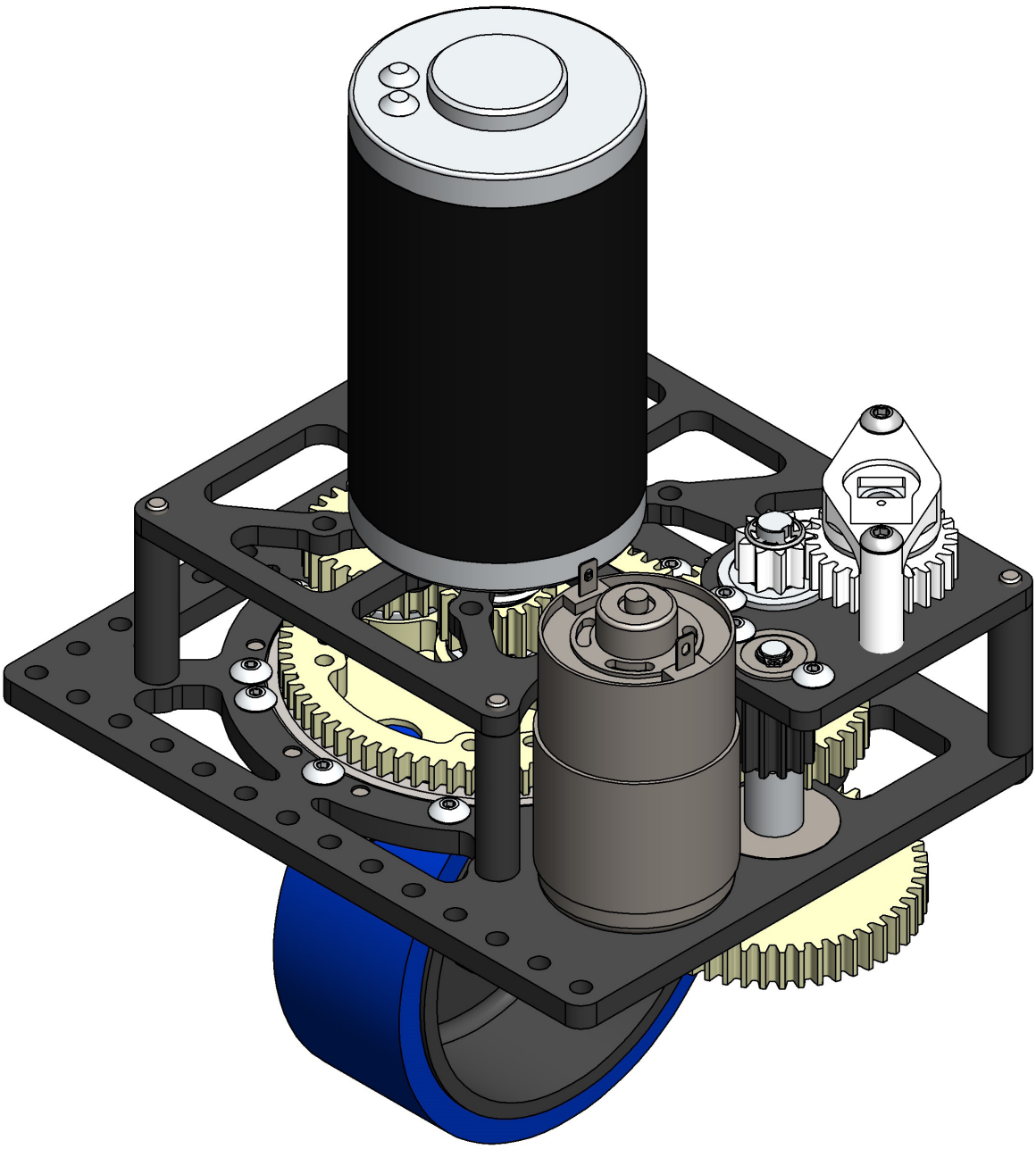
Disclaimer: Do not over tighten the 2x #10-32 BHCS bolts x 0.5” length into the plate as over tightening them can cause the 3D printed part to be deformed.



4.4 Distance Sensor Hardware Kit Complete

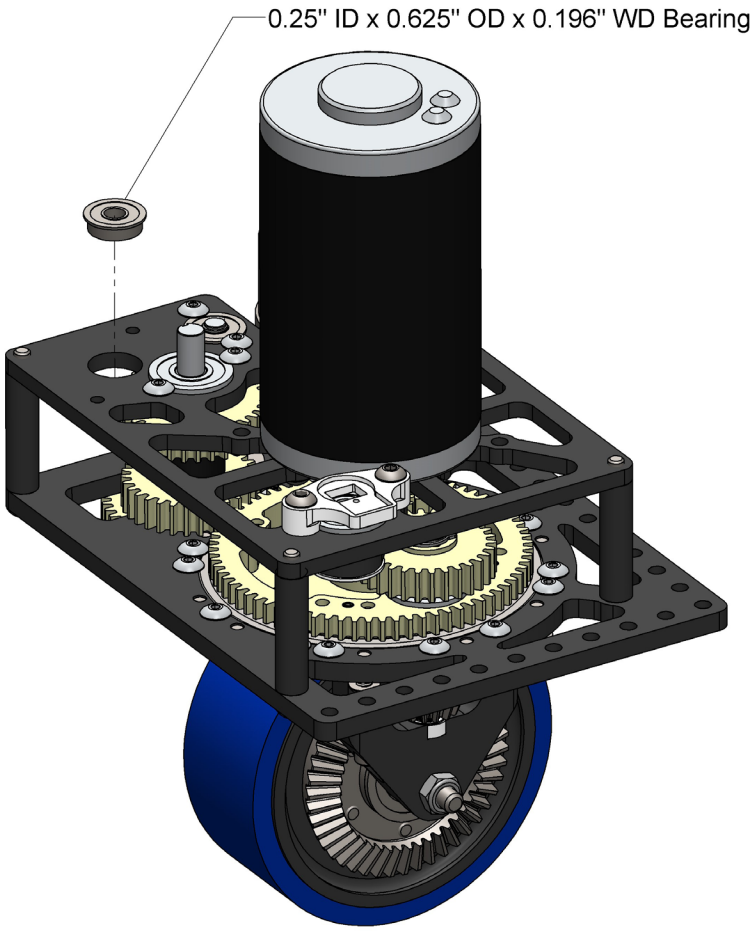


5. Installing Rotation Sensor Hardware Kit



5.1 Main Rotation Sensor Bearing

Push the 0.25 ID x 0.625” OD x 0.196” WD bearing into the hole shown below.

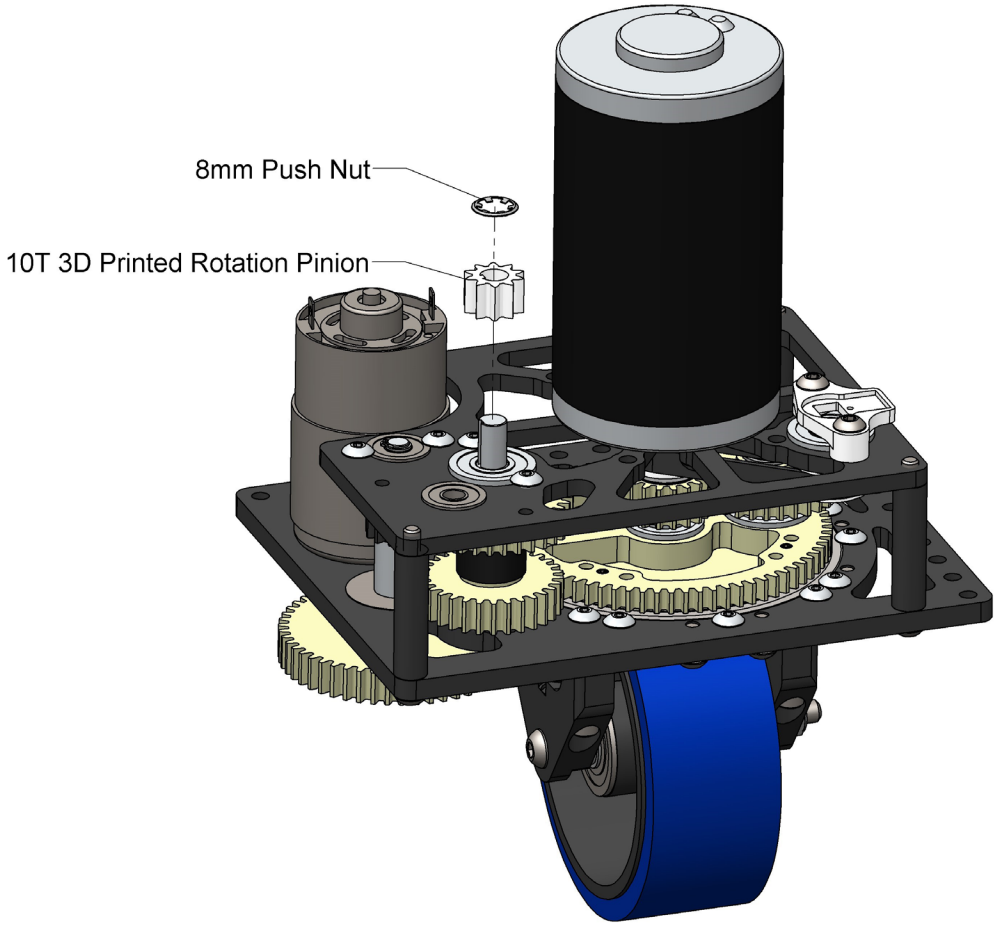


5.2 10T 3D Printed Rotation Pinion

Push the 3D printed rotation pinion onto the 2nd stage rotation shaft. There is a 2mm keyway integrated into the shaft and the 10T 3D printed rotation pinion has a 2mm key integrated into the gear itself. Make sure to align the key in the gear with the keyway on the shaft and then push the pinion onto the shaft. Once installed push the 8mm push nut onto shaft to secure the 10T 3D printed rotation pinion.

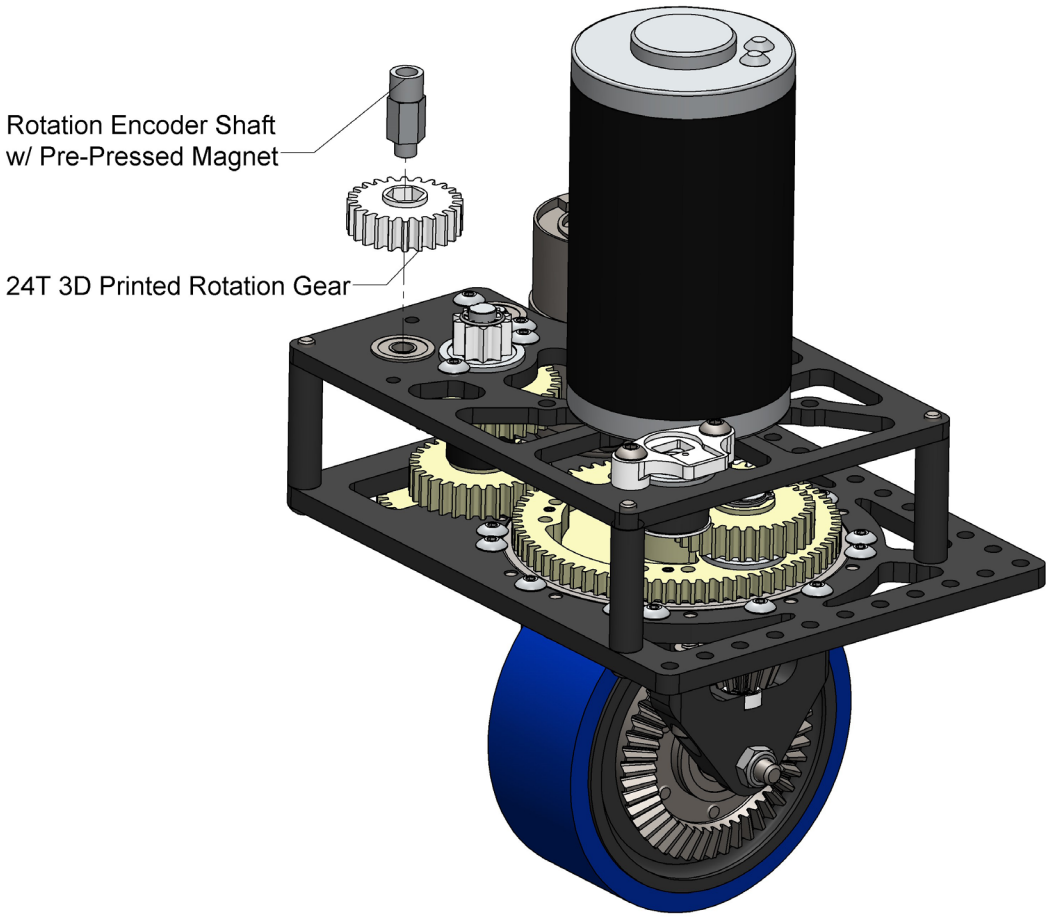
Note: This should require very little force and if a lot of force is required please check the 3D printed part to ensure that it is clean. Also ensure that you have matched the keyway with the key in the gear as mentioned above.

Disclaimer: If the 10T 3D printed rotatin pinion is damaged due to excessive force it will not be replaced by WestCoast Products.



5.3 24T 3D Printed Rotation Gear

Install the rotation encoder shaft by putting the smaller end into the previously installed bearing and then slip the 24T 3D printed rotation gear onto the shaft.

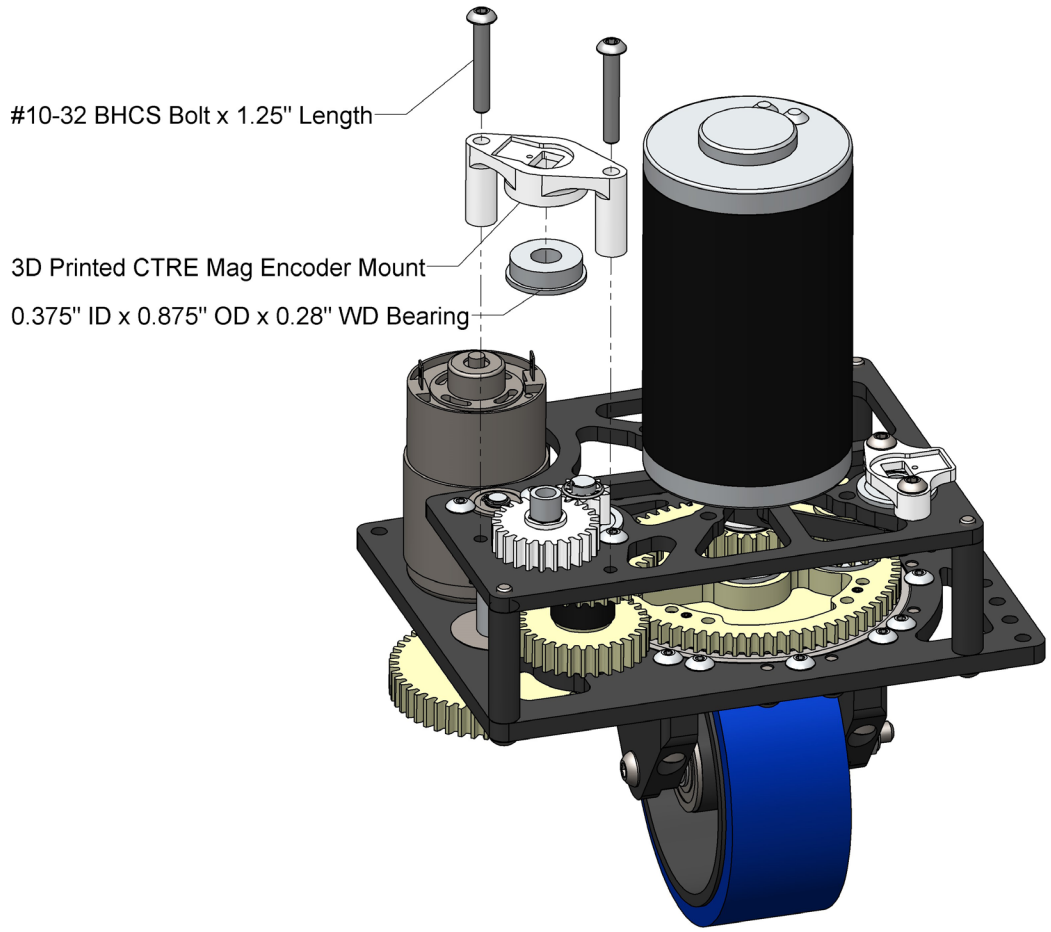
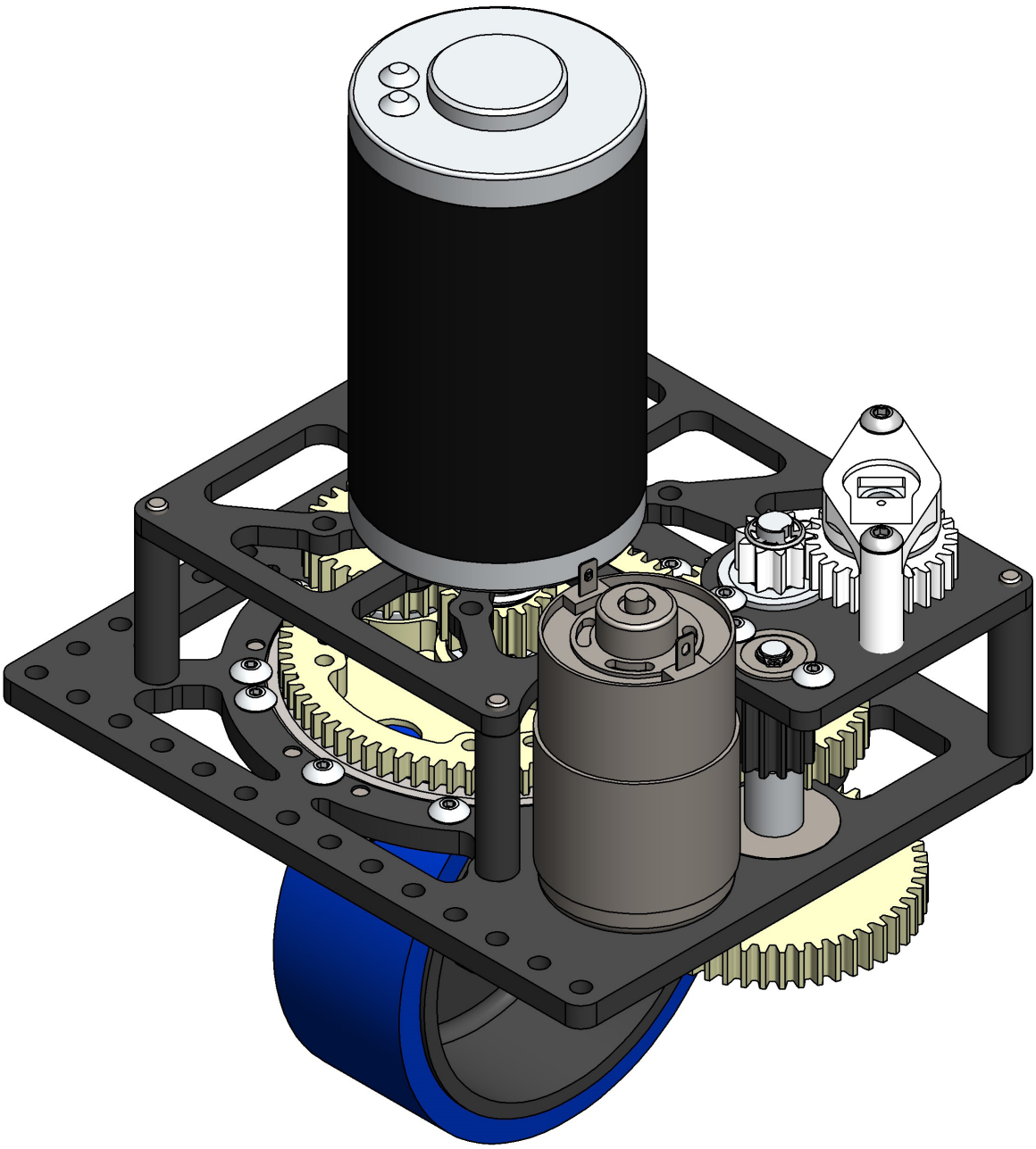


5.4 3D Printed CTRE Mag Encoder Mount

Push the 0.375” ID x 0.875” OD x 0.28” WD bearing into the 3D printed CTRE mag encoder mount. Align the rotation encoder shaft with the hole in the bearing and then secure the mount with the 2x #10-32 BHCS bolts x 1.25” length. Finally take the CTRE mag encoder and place it so that the sensor side is face down and then thread the CTRE mag encoder bolt into the mount.

Note: CTRE mag encoder/CTRE mag encoder bolt is not included in this kit and must be bought separately.

Disclaimer: Do not over tighten the 2x #10-32 BHCS bolts x 1.25” length into the plate as over tightening them can cause the 3D printed part to be deformed.



5.5 Rotation Sensor Hardware Kit Complete