



## Table of Contents

Guide Notes .....	1
What is the WCP 2 CIM Flipped DS .....	2
1. Design Notes .....	3
1.1 Tools Needed.....	4
1.2 BOM (Bill of Materials) .....	5
1.3 Encoders.....	7
2. WCD Setups with Chain & Timing Belts .....	8
3. Assembly of Base Kit .....	9
3.1 Front Plate Bearings .....	10
3.2 Back Plate Bearings .....	11
3.3 Input Shaft Assembly .....	12
3.4 Input Shaft Assembly (Side View).....	13
3.5 Shifting Shaft Assembly .....	14
3.6 Bottom Spacer Assembly .....	16
3.7 Idler Plate Sub-Assembly .....	17
3.8 Idler Plate Full Assembly .....	19
3.9 Idler Plate Full Assembly (Side View).....	21
3.10 Output Shaft Assembly.....	22
3.11 Output Shaft Assembly (Side View) .....	24
4. Assembly of the WCD Add On Kit.....	25
4.1 WCD Add On Kit (Side View).....	26
4.2 WCD Add On Kit (BackSide Iso View).....	27
5. Pneumatic Setup NonWCD .....	28
6. Pneumatic Setup WCD.....	30
6.1 BackFlip Shifter Kit Assembly .....	32
6.2 Pneumatic Cylinder Assembly.....	33
7. Revision History .....	34

### **Guide Notes**

This guide is designed to help teams use and integrate the WCP 2 CIM Flipped DS into their robots. Please email [support@wcproducts.net](mailto:support@wcproducts.net) for any questions.



## ***What is the WCP 2 CIM Flipped DS***

The WCP 2 CIM Flipped DS is the ultimate solution to space saving in FRC. Through its precision-engineered inverted motor and shifting cylinder setup and versatile idler gear technology, up to 5.5 inches of space can be freed from the center of your drivetrain, paving the way for game objects, electronics, and mechanisms to be positioned in previously unusable space.

FRC has evolved into an era of smaller, more compact robots, and in this age every cubic inch of free space counts. Not only does this gearbox remove volume limitations that teams were almost stuck with previously, but it also provides nearly endless options for gear ratios by means of a customizable third stage, allowing teams to find the perfect ratio for any wheel as small as 3.25" and as large as 8"! While designed with a West Coast Drive in mind, this shifting transmission is designed with an internal sprocket/pulley location that makes dead-axle chain runs simple and effective. The WCP 2 CIM Flipped DS is the pinnacle of compact shifting transmissions, and a must-have for any team looking to make the most out of their robot.



## ***1. Design Notes***

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



## **1.1 Tools Needed**

To assemble and create the Flipped DS, Teams will need:

1. Allen Wrenches
  1. 1/8" (McMaster Carr P/N: 5419A33)
  2. 5/32" (McMaster Carr P/N: 5419A35)
  
2. 3/8" Open Ended Wrench (McMaster Carr P/N: 5163A14)
  1. **NOTE: Any 3/8" wrench may be used**
  
3. Loctite GlueStick - Blue (McMaster Carr P/N: 1004A12)
  1. **NOTE: Apply on ALL screws that do not have 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. Multi Tool set of Allen Wrenches



## 1.2 BOM (Bill of Materials)

### Base Kit:

- **Kit #1**
  - 1 x CIM Motor Plate
  - 4 x 1/2" Round x 1.125" OD Bearing
  - 1 x Back Plate
  - 1 x 3/8" Round x .875" OD Bearing
  
- **Kit #2**
  - 2 x 28T 1/2" Hex Gear
  - 4 x Flanged 1/4" Round x .500" OD Bearing
  - 1/4" Red Fiber Washer
  - 2 x Idler Pin
  - 1 x Batman Plate
  - 1 x 44T 1/2" Hex Gear
  - 1 x 3/8" Hex Input Shaft
  - 2 x 1/4" Snap Ring (Low Profile)
  
- **Kit #3**
  - 4 x #10-32 BHCS x .250" Length Bolt
  - 2 x #10-32 BHCS x 1.25." Length Bolt
  - 2 x #10-32 SHCS x 3.250" Length Bolt
  - 2 x #10-32 SHCS x 4" Length Bolt
  - 4 x #10-32 Thin Lock Nuts
  
- **Kit #4**
  - 3 x 1/2" Snap Ring
  - 2 x 3/8" Hex Spacers (Yellow or Black)
  - 1 x 1/2" Red Fiber Washer
  - 1 x 3/8" Hex to 1/2" Hex Adapter
  - 1 x 1/2" Hex Collar
  - 1 x 3/8" Snap Ring
  
- **Kit #5**
  - 1 x DOG
  - 1 x #4-40 SHCS x 1" Length Bolt



- 1 x DOG Shifter Shaft
- **Kit #6**
  - 1 x Long Output Shaft with Encoder Hole
  - 2 x Large Bottom Spacers
  - 2 x Long Top Spacers
  - 4 x Short Spacers

## WCD Add On Kit:

- **Kit #1**
  - 2 x Lower Spacer
  - 2 x Upper Spacer
  - 1 x WCD Plate
- **Kit #2**
  - 2 x #10-32 SHCS x 1.75" Length Bolt
  - 2 x #10-32 SHCS x 5" Length Bolt
  - 2 x #10-32 Thin LockNut

## BackFlip Shifter Kit

- 2 x 1/4" Round x 1/2" OD Bearing
- 3 x #4-40 BHCS x .375" Length Bolt
- 1 x BackFlip Shifter Cone
- 1 x BackFlip Shifter Shaft



## **1.3 Encoders**

The Flipped CIM DS Supports any encoder with a 1/4" Shaft. We recommend the use of the S4T Encoder by US Digital or SRX Mag Encoder by CTRE.

2073 has created a 3D Printable Mount and Magnet setter. They can be [downloaded here](#) or under the Tech Specs section.



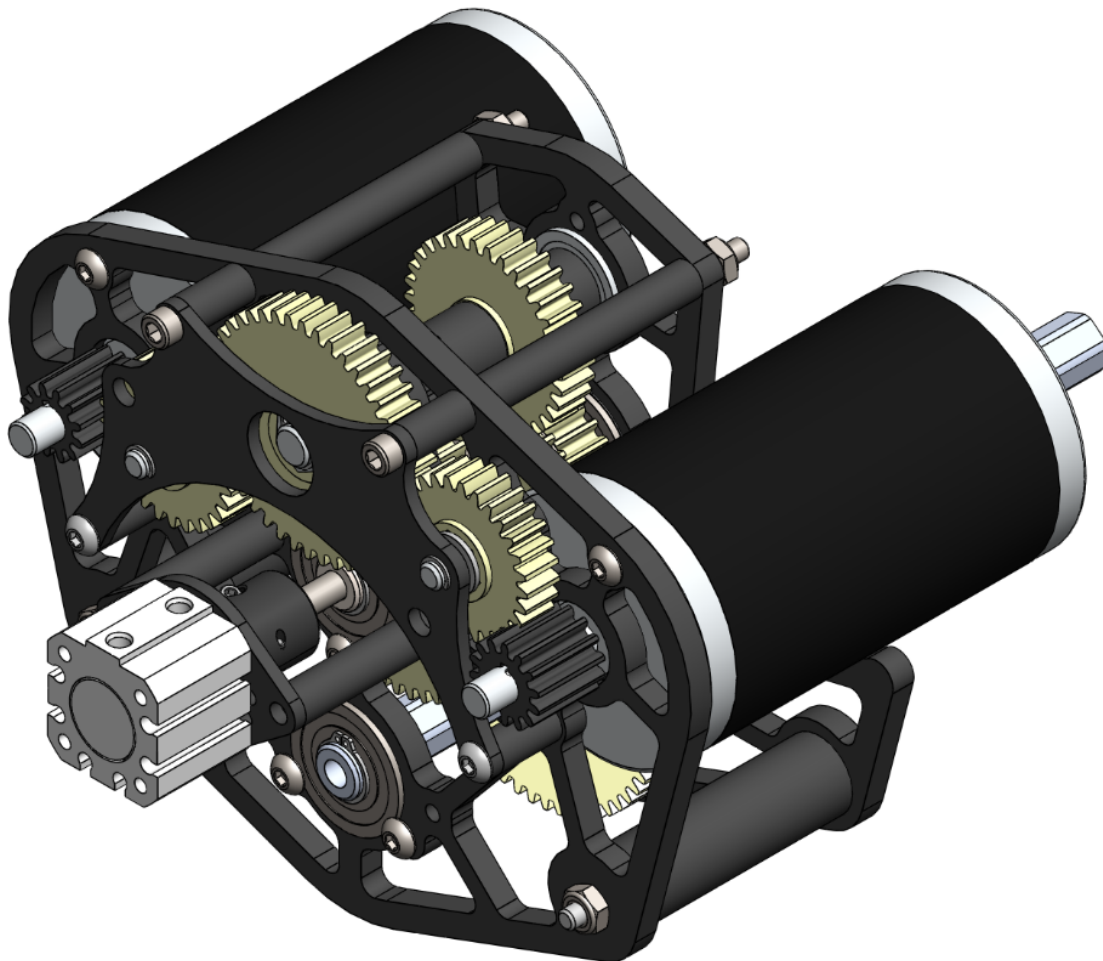
## ***2. WCD Setups with Chain & Timing Belts***

This Section in the future will include spacing and recommended Setups. This section is TBD.



## ***3. Assembly of Base Kit***

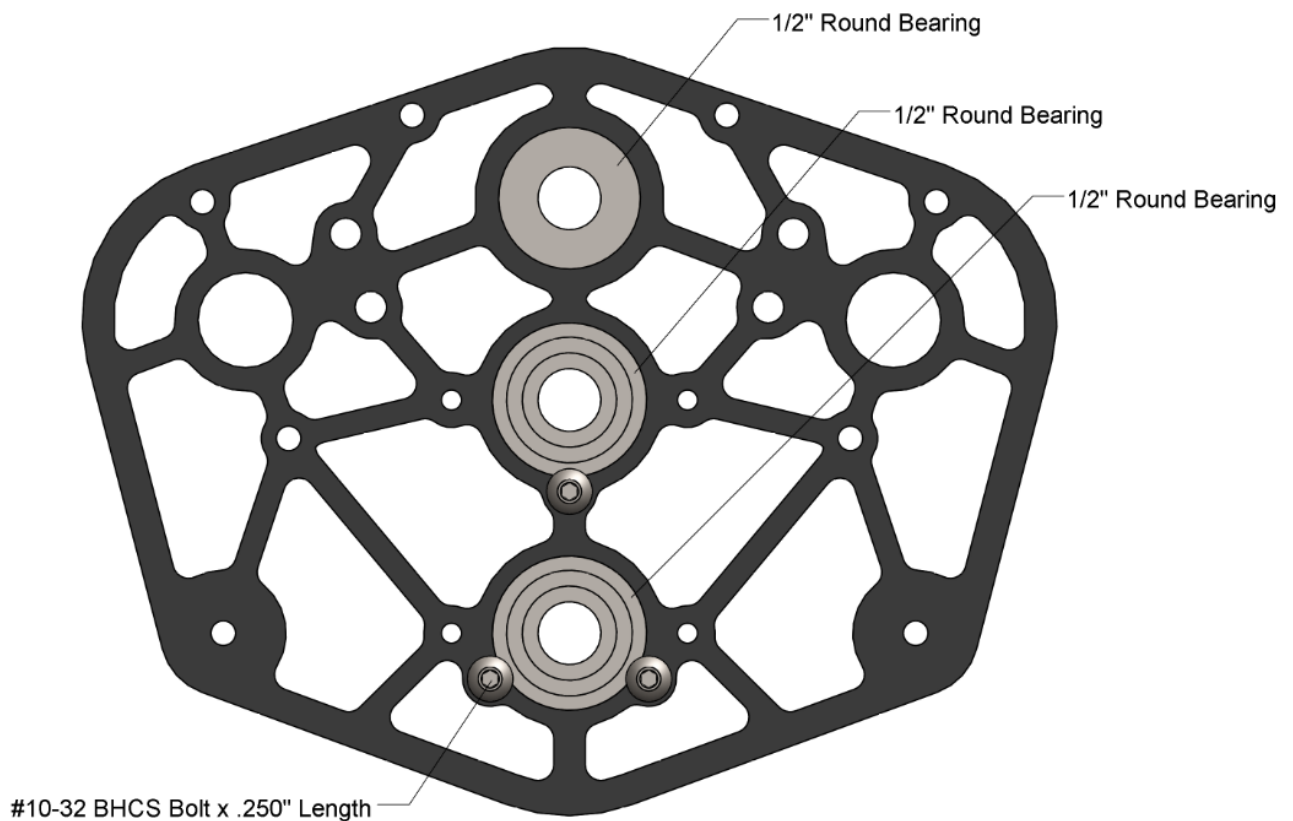
This is the Standard Base Kit configuration and is designed for Non WCD drivetrains.





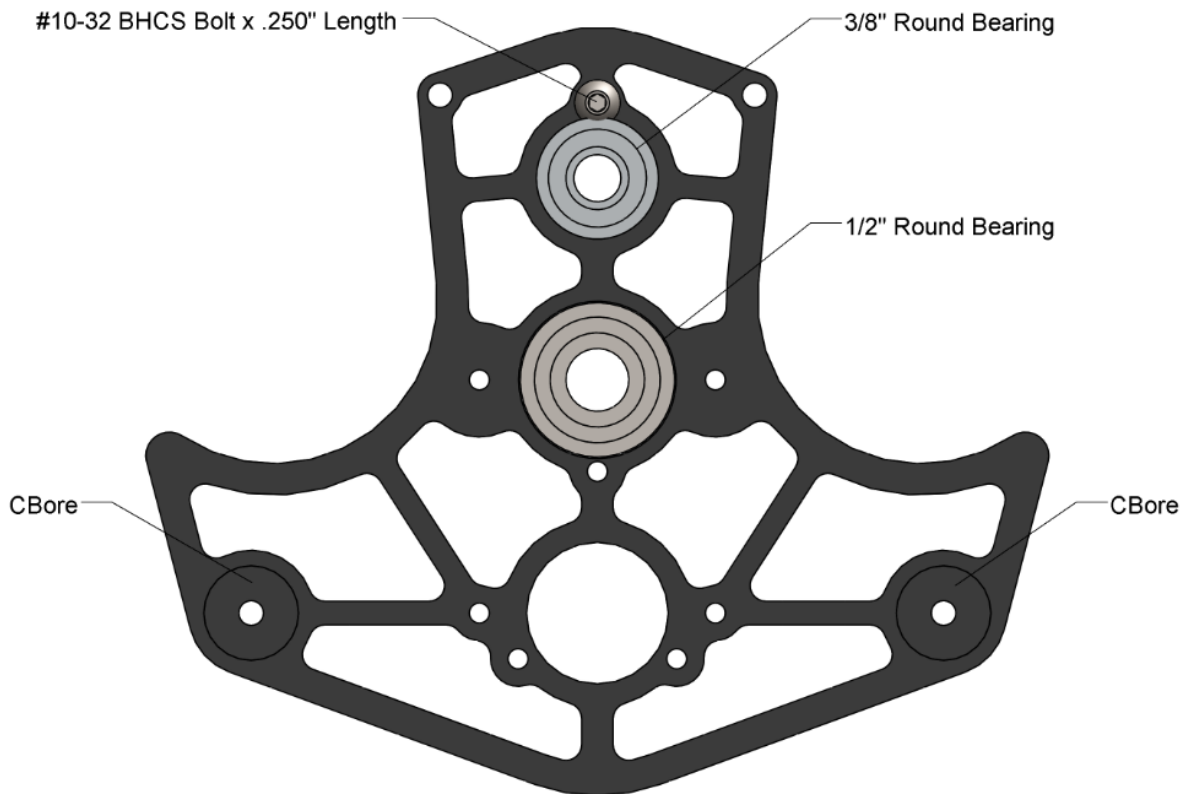
## 3.1 Front Plate Bearings

The CIM Input Plate should come with Bearings pressed in. The top bearing should have flange facing the cbore side. The two bearings below should have flange facing the opposite side. Insert three #10-32 BHCS Bolts x .250" Into the 3 Holes shown.



## 3.2 Back Plate Bearings

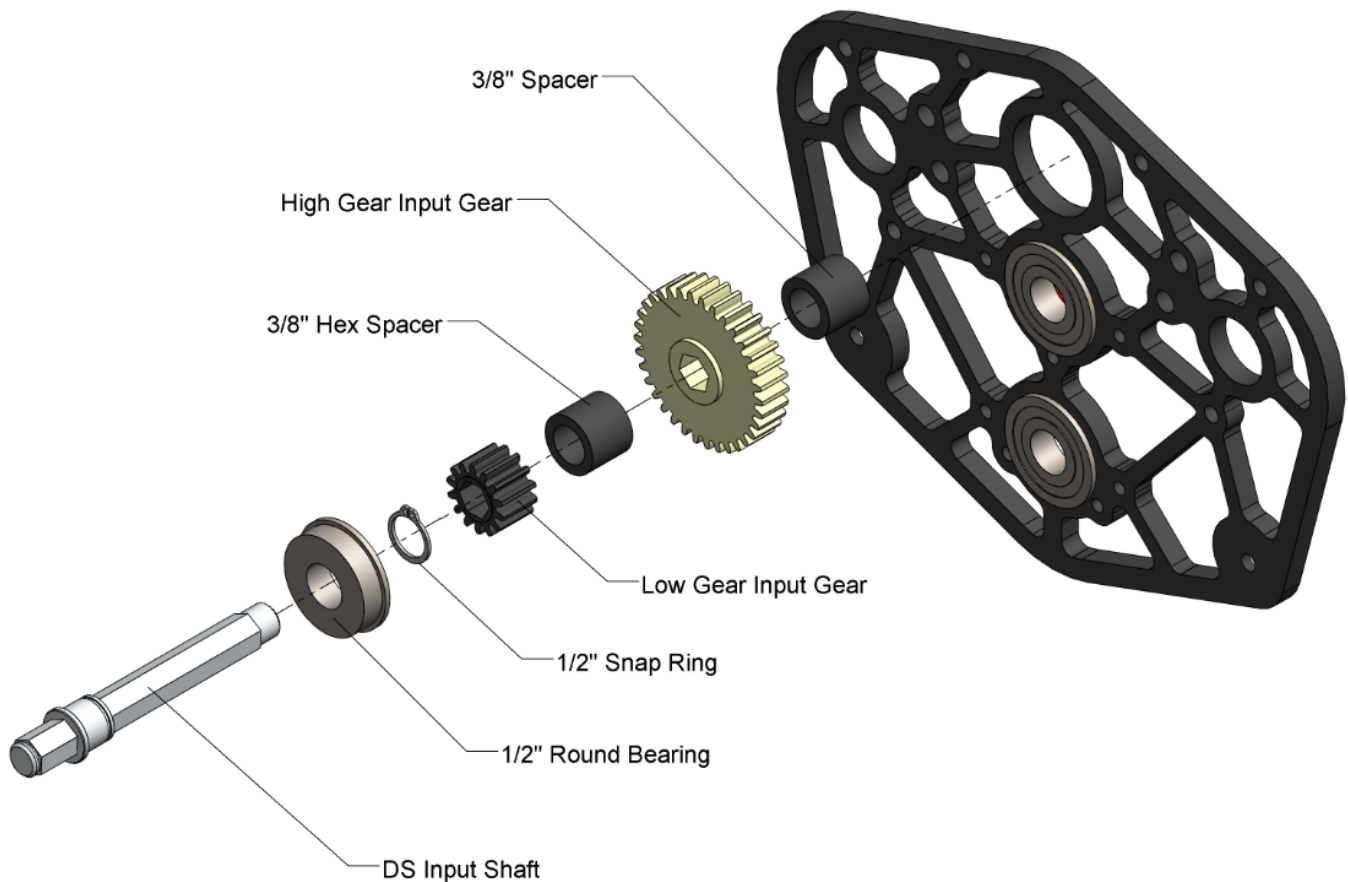
The Back Plate should come with Bearings pressed in. Both Bearing Flanges should face the side with only two cbores. Insert one #10-32 BHCS Bolt x .250" into the Hole shown.



## 3.3 Input Shaft Assembly

Slide the DS Input Shaft into the 1/2" Round Bearing, insert the 1/2" Snap Ring into the Groove. Then place the components in the following order:

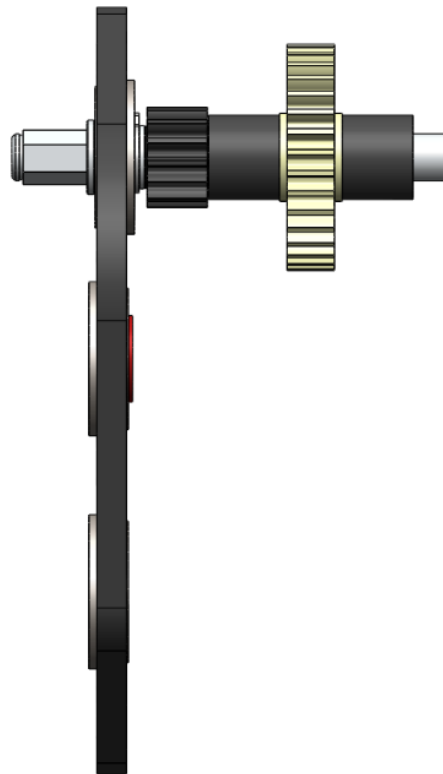
1. Low Gear (Input Gear)
2. 3/8" Hex Spacer, may be yellow.
3. High Gear (Input Gear)
4. 3/8" Hex Spacer, may be yellow





## **3.4 Input Shaft Assembly (Side View)**

1. Side View of the previous step

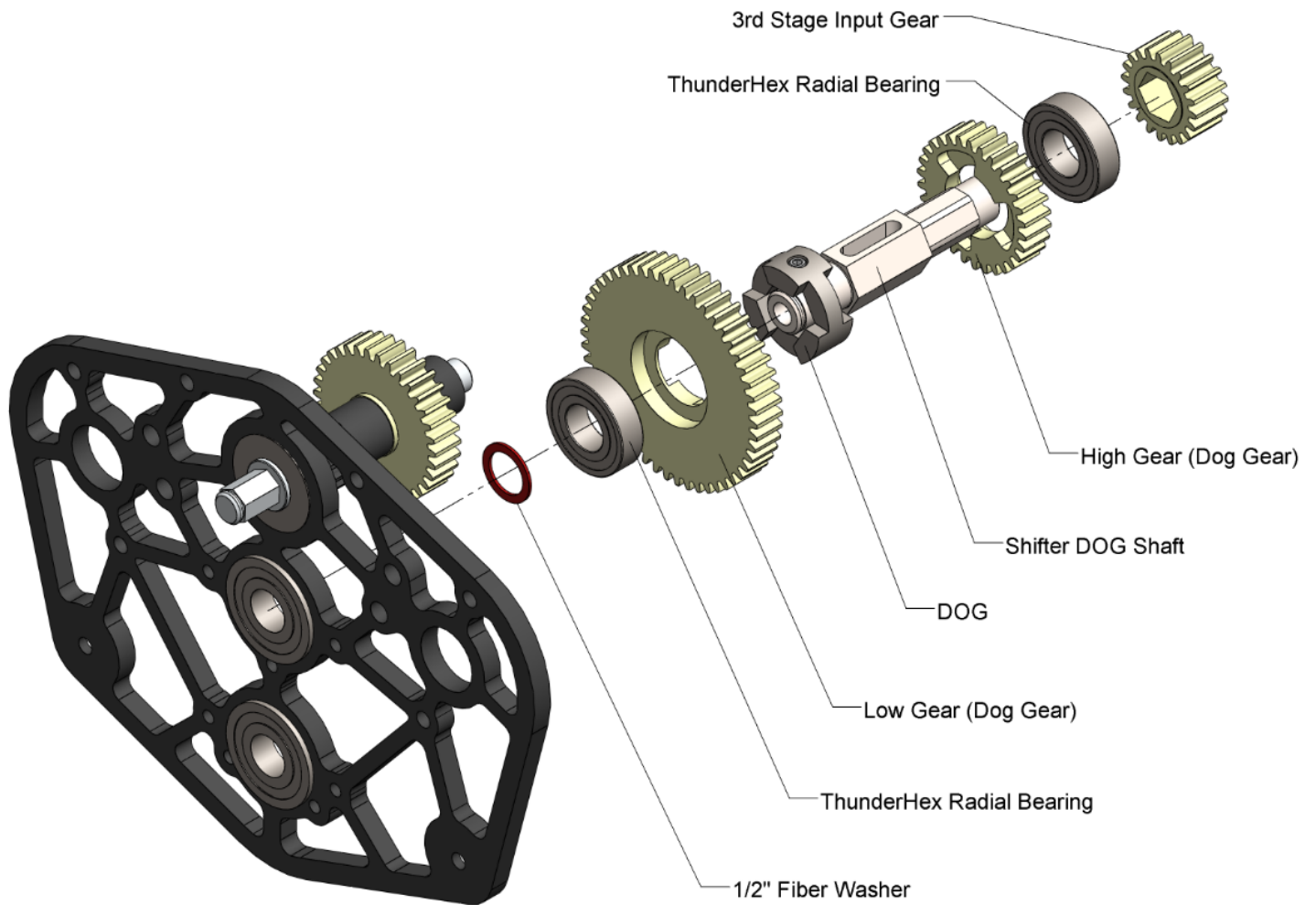




## **3.5 Shifting Shaft Assembly**

The Shifter DOG Shaft comes assembled with the DOG and #4-40 bolt. To assemble the rest of the DOG Shaft, follow the steps in order below:

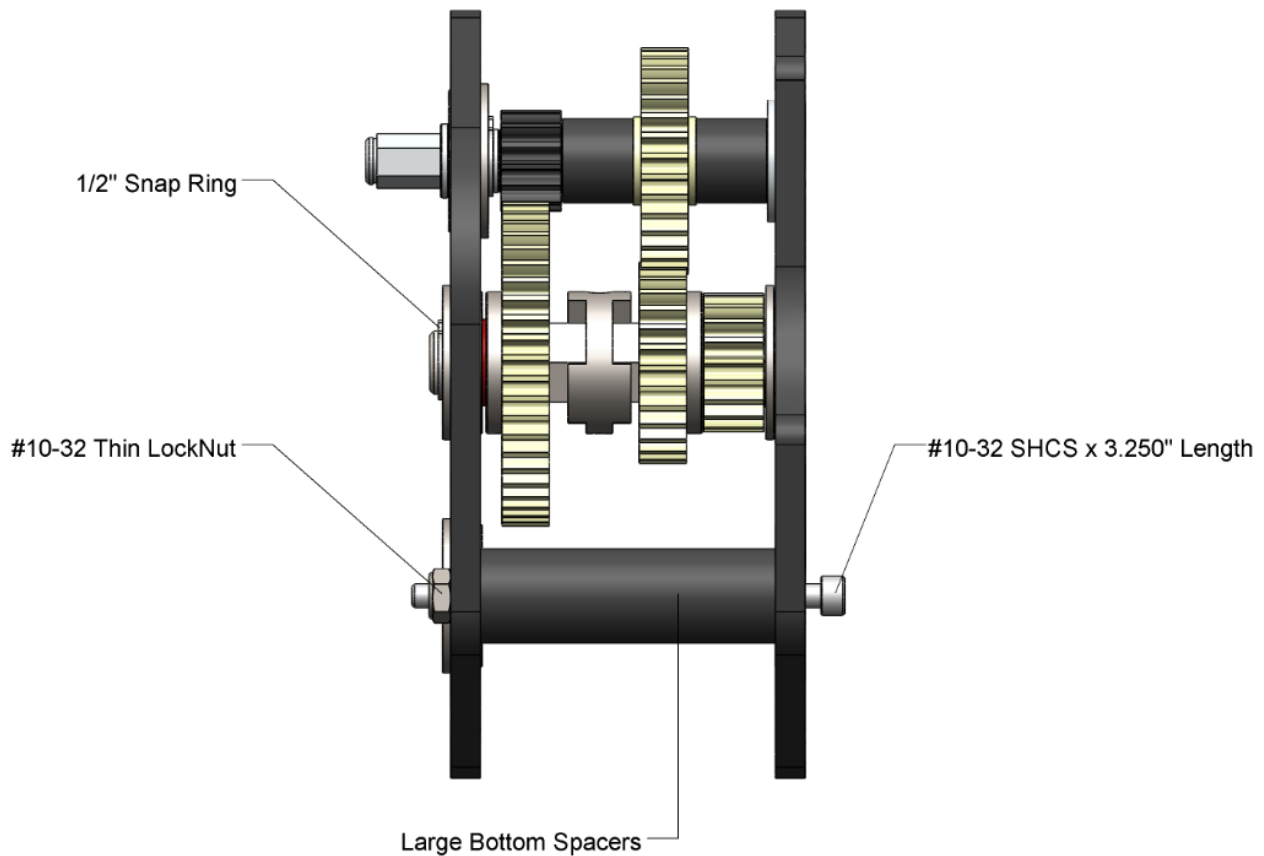
1. On the side closest to the plate, slide the Low Gear (Dog Gear) onto the shaft and the 1/2" fiber washer behind the Dog gear.
  1. **NOTE: The fiber washer is very important and must be used.**
  2. **NOTE: DOG Gears come assembled with ThunderHex Bearings**
2. On the opposite side place the High Gear (Dog Gear) onto the shaft
3. Slide the 3rd stage input gear on last.





## 3.6 Bottom Spacer Assembly

Place the 1/2" Snap ring on the back side of the Shifter Shaft Assembly. Then sandwich the large spacers between the two plates and tighten the gearboxes together using 2 x #10-32 SHCS x 3.250" Bolts and 2 x #10-32 Thin LockNuts.







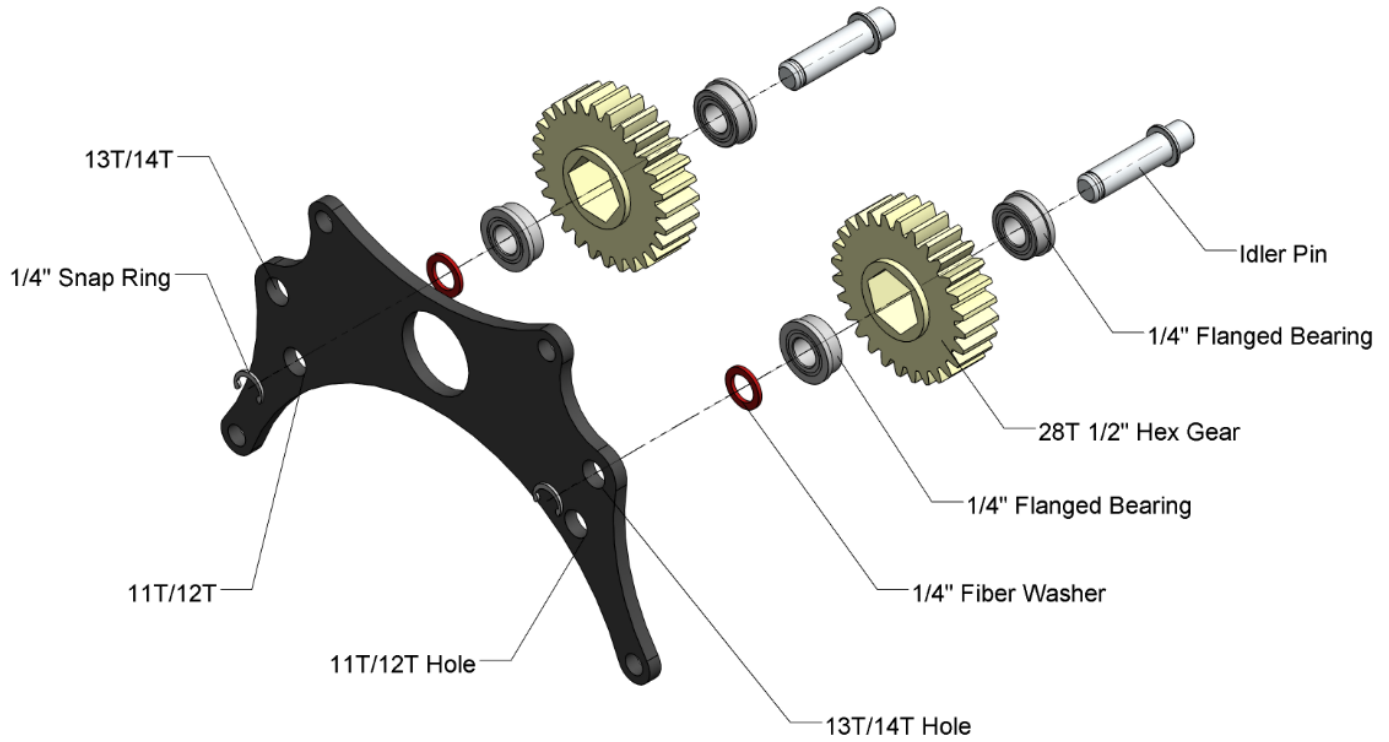
## **3.7 Idler Plate Sub-Assembly**

The Idler Plate should come assembled as well. To assemble this plate, you must work backwards.

1. Start from the idler pin and slide the 1/4" flange bearing over it with the flange facing the nub on the idler shaft.
2. Next place the 28T 1/2" Hex Gear.
3. Then the 1/4" flanged bearing & the 1/4" fiber washer.

After the pin is semi finished slide it through one of the two holes. The Top hole or the shaft assembly to the right will create a 13/14T setup. The Bottom or the left shaft assembly will create a 11T/12T shaft assembly.

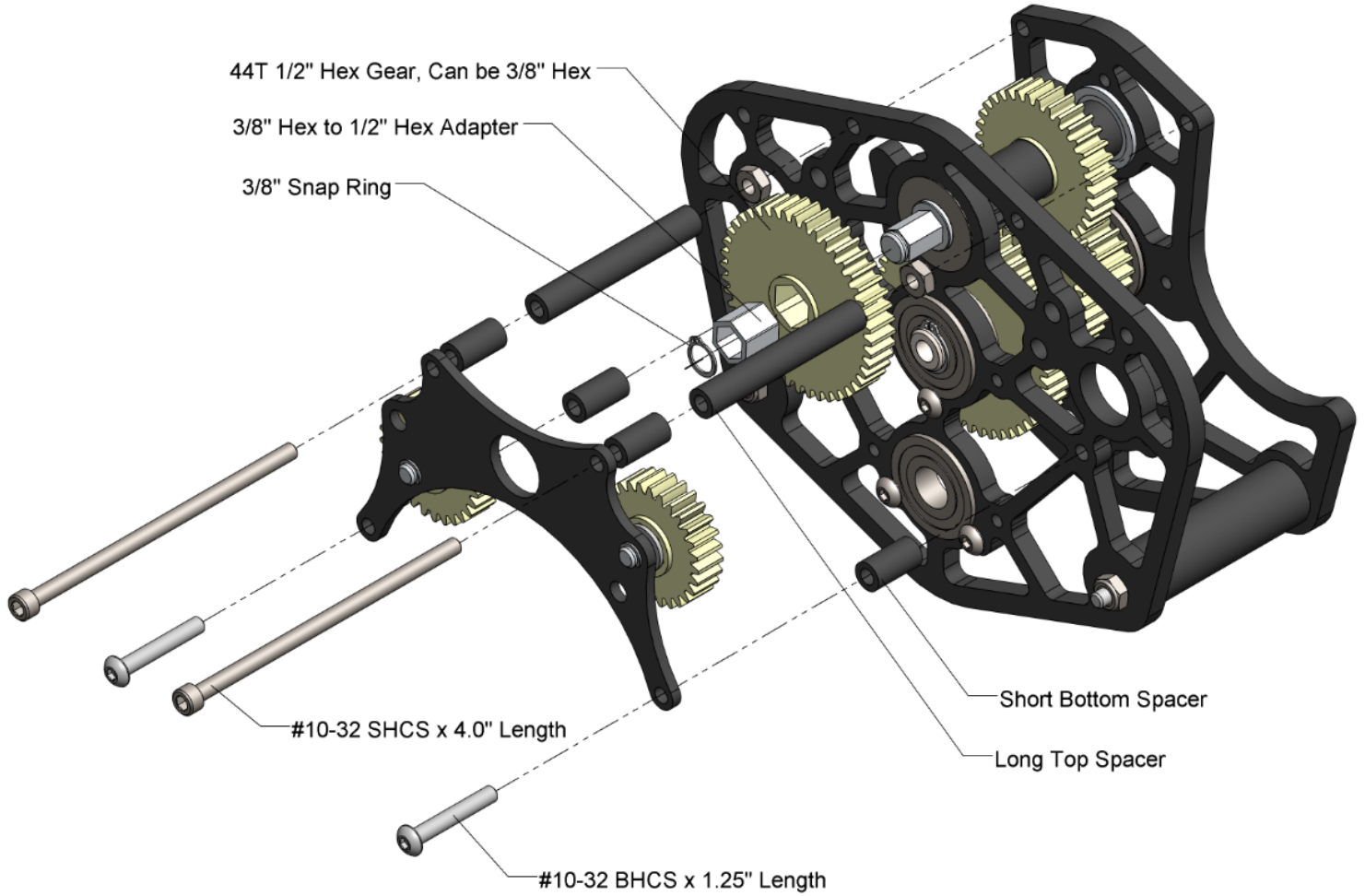
- **NOTE:** You must use either 11/12T setup or 13/14T setup, you cannot mix and match.





## **3.8 Idler Plate Full Assembly**

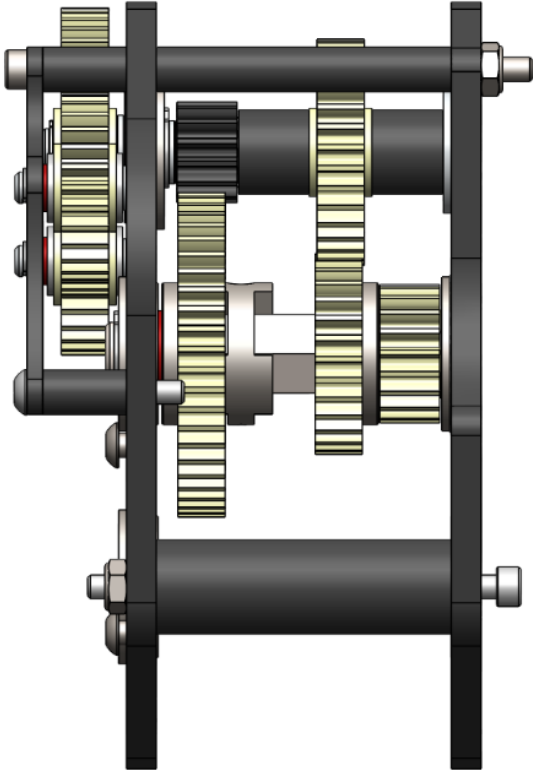
1. First put the 3/8" to 1/2" Hex adapter into the 44T gear and slide it on the 3/8" hex shaft.
2. Then use a 3/8" Snap ring to retain the Gear.
  1. **NOTE:** Teams can use loctite or any other adhesive to ensure that the gear can't slide past the snap ring. In our testing we noticed no issue, the future edition will have a 3/8" Hex gear provided or the shaft will be changed to 1/2" Hex.
3. Then slide the bolts through their recommended spacers and tighten the nut.
  1. **NOTE:** The 1.25" length bolt is for the cim, this can float there for now or be added later down the road. It is shown here to get a feel for what the assembly should be.





### 3.9 Idler Plate Full Assembly (Side View)

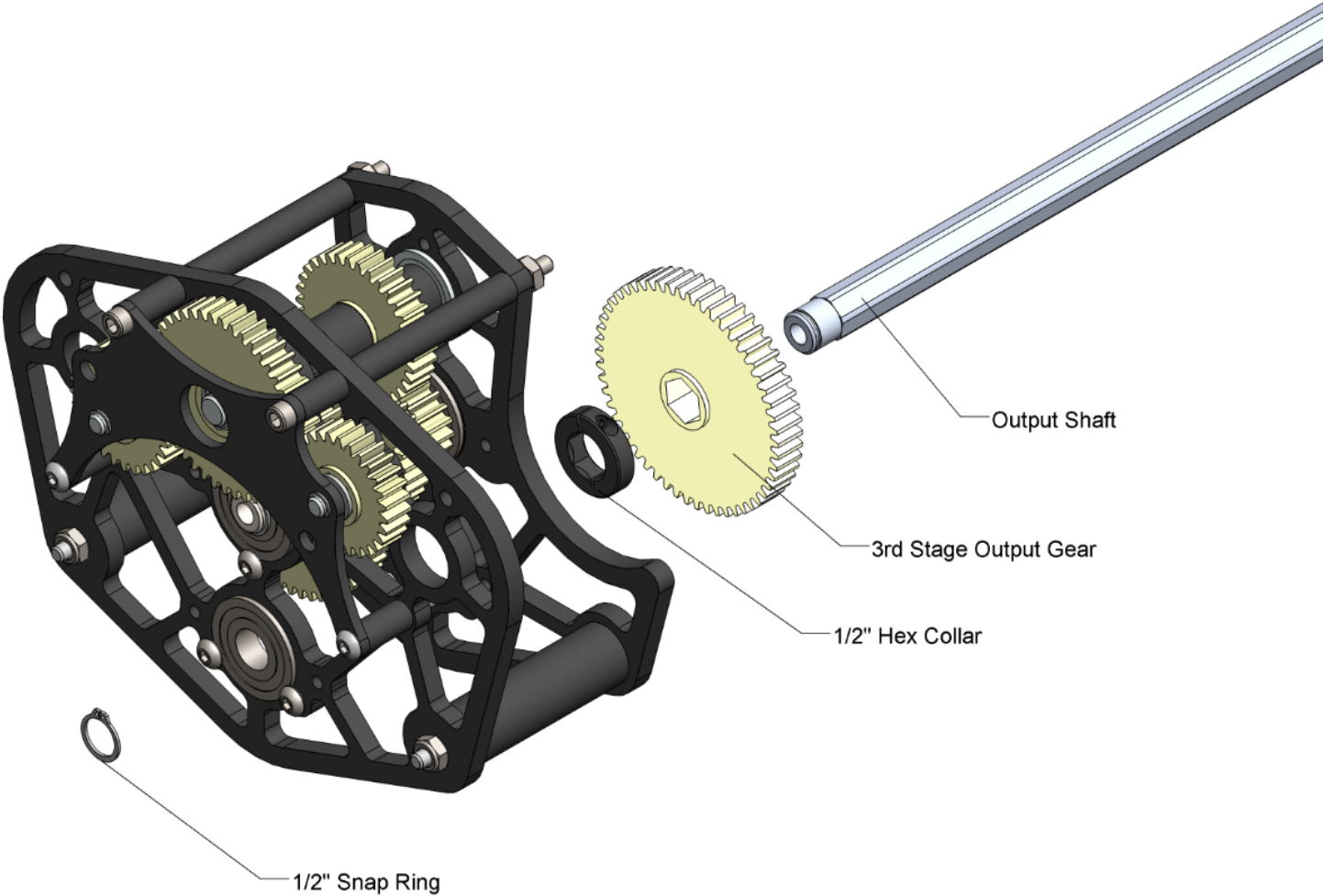
Side View of Assembly





## **3.10 Output Shaft Assembly**

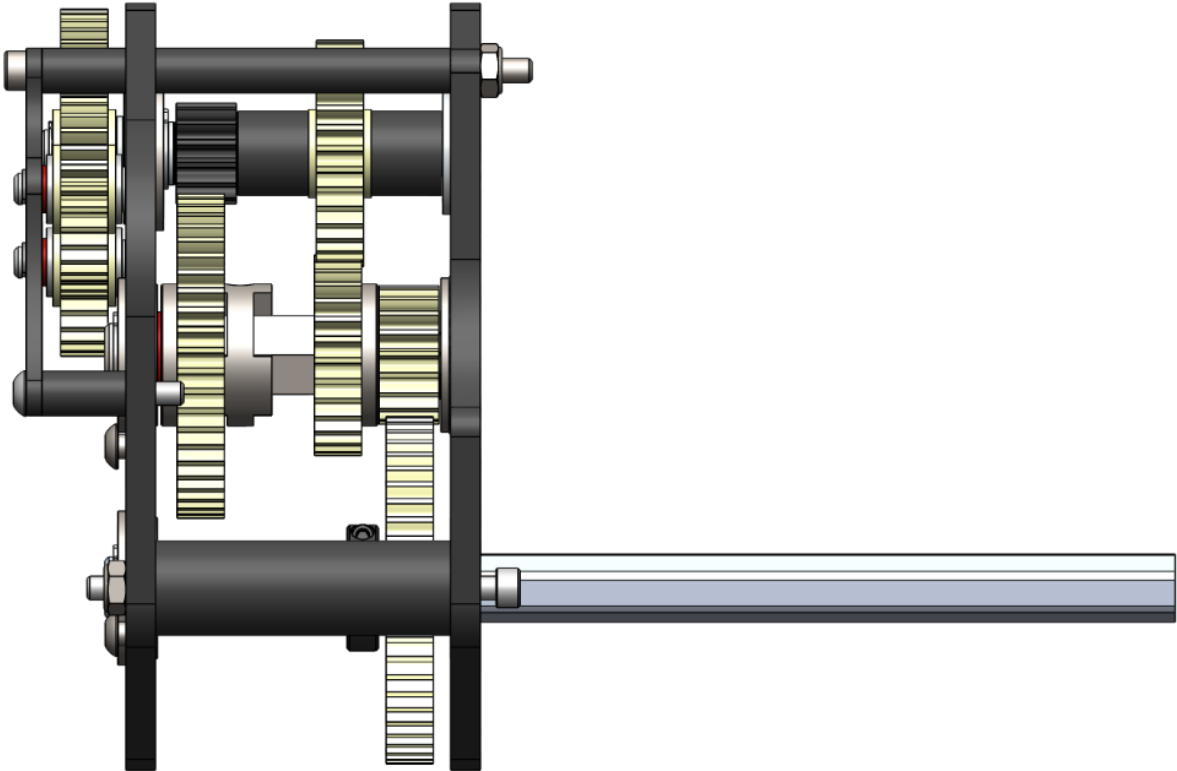
1. Place the Gears and 1/2" Hex Collar between the two plates, then slide the Output shaft into the back bearing while going through both components.
2. Use the Snap ring in the back to hold the Shaft in place.
3. Tighten the collar so the gear cannot go any further towards the 1/2" Round Bearing.
  1. **NOTE: This position will depend on your design.**
  2. **NOTE: We do not supply an end support Bearing since teams can use 1/2" round, 1/2" ThunderHEX, or 1/2" Hex Bearing.**
  3. **NOTE: The ThunderHex fit on the shaft is extremely tight and needs to be sanded down.**
4. The Hole in the output shaft allows teams to use any Encoder with a 1/4" Shaft Size. If teams would like to use the CTRE Mag Encoder, the magnet must be installed before inserting it into the assembly.





### 3.11 Output Shaft Assembly (Side View)

Side View of Assembly

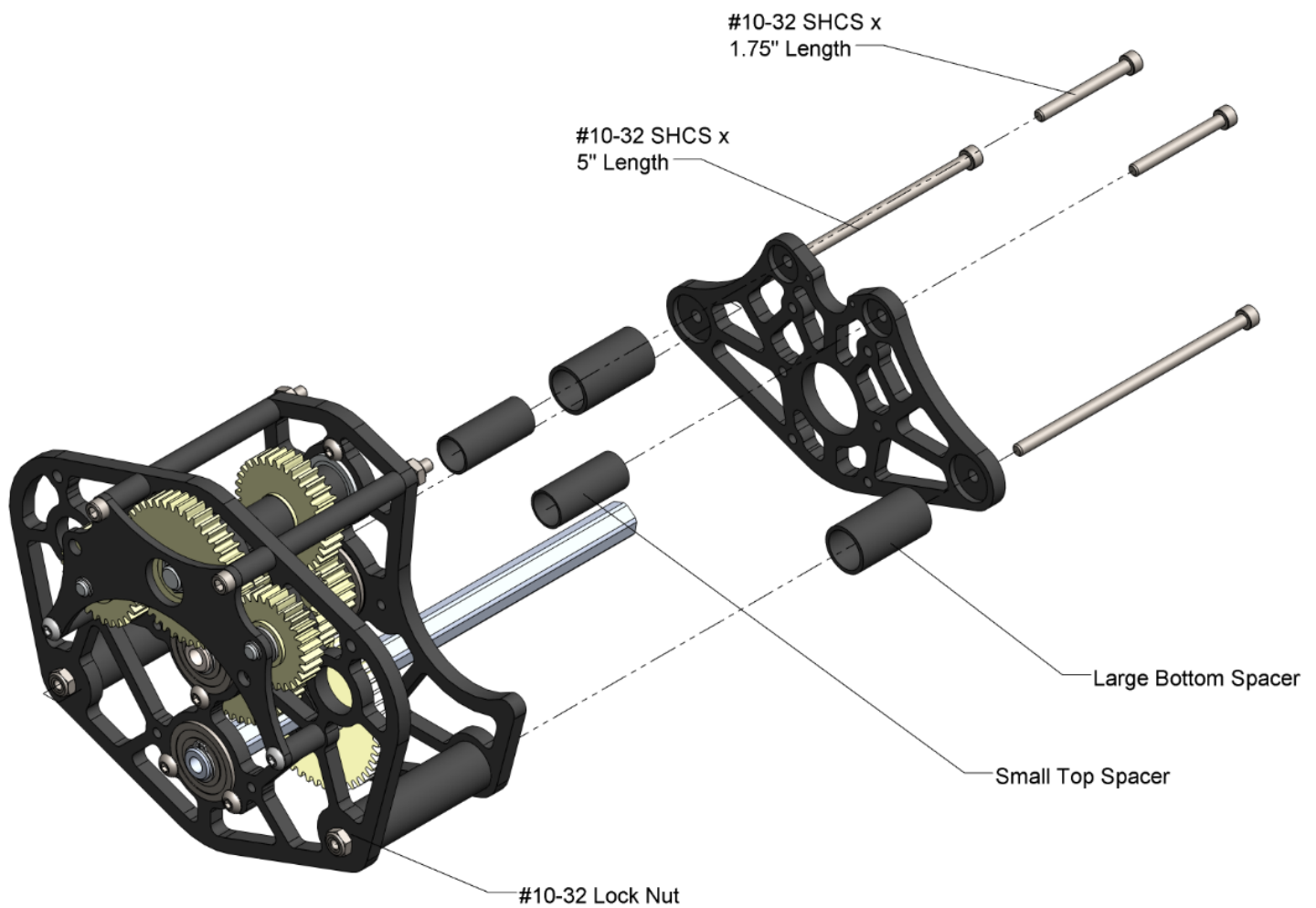




## 4. Assembly of the WCD Add On Kit

To transform the Flipped CIM DS Gearbox into a WCD Compatible Gearbox, simply follow the steps below.

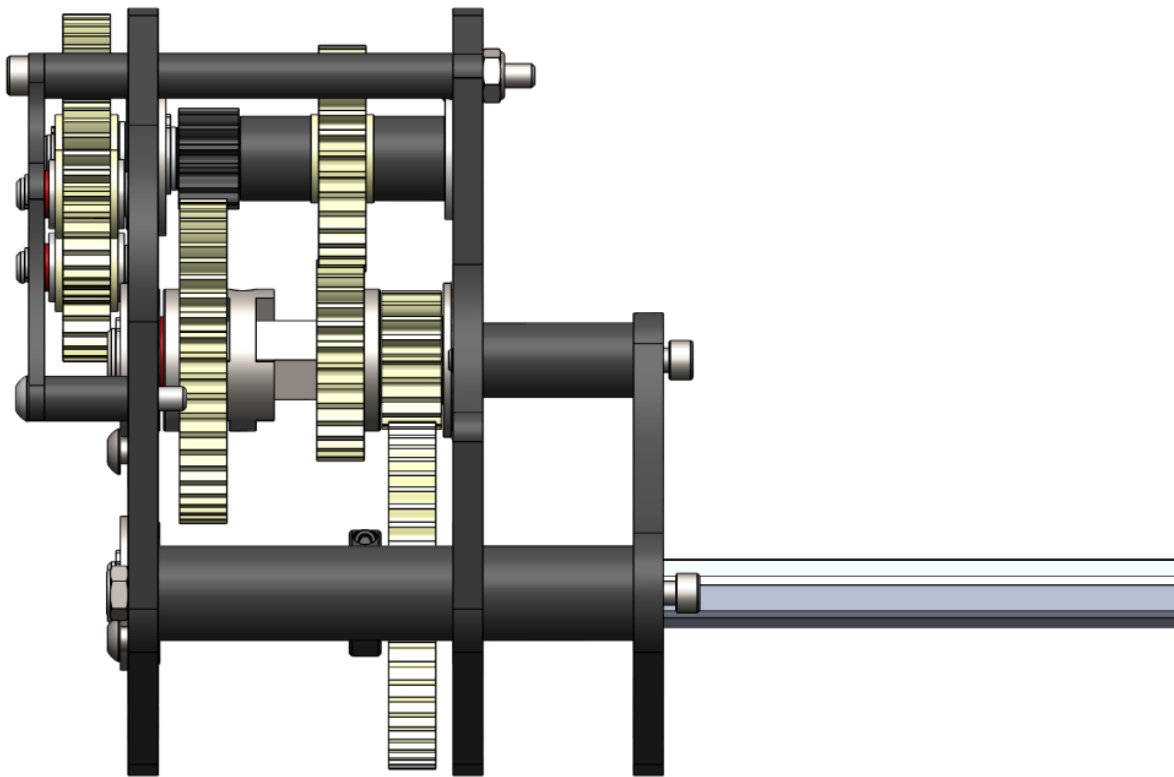
1. Remove the shorter bolts from the Base Kit
2. Line up the spacers to their counter bore sizes and simply snap together the spacers/plates.
3. Add bolts into the 4 holes shown below.
  1. NOTE: The 1.75" bolt will require Loctite (Threadlocker)





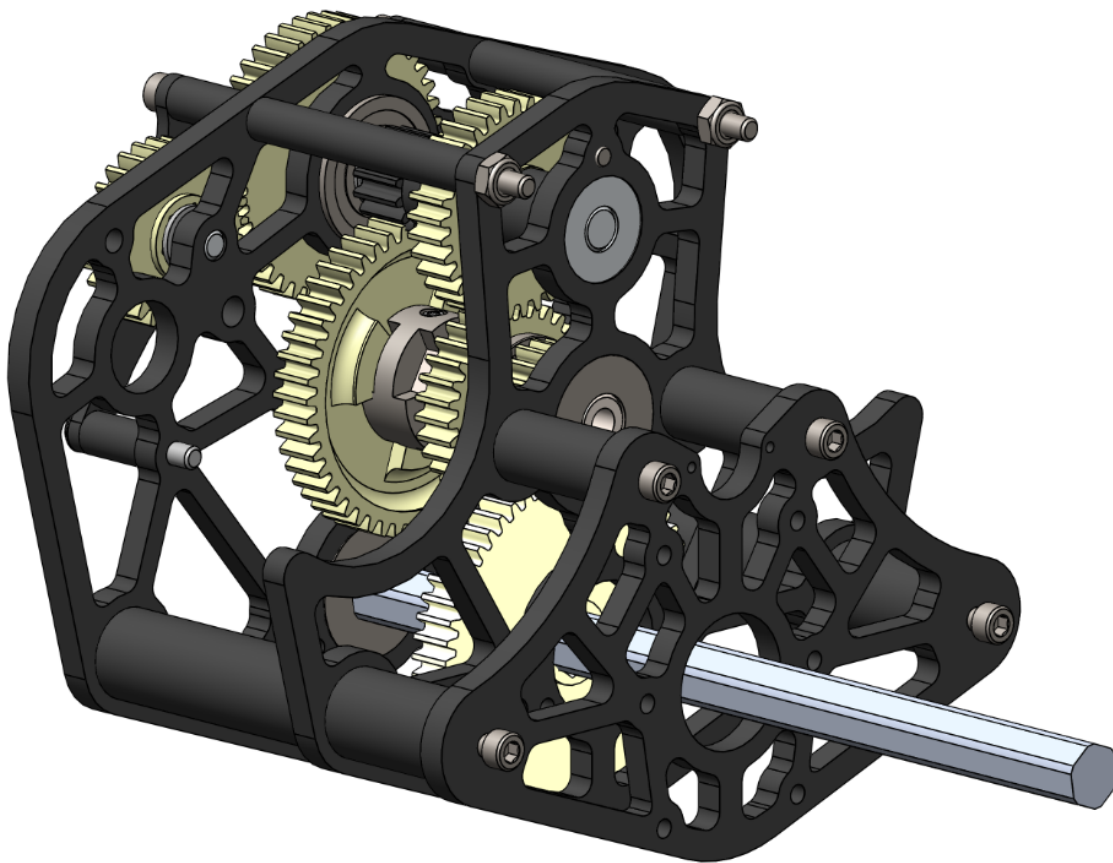
## **4.1 WCD Add On Kit (Side View)**

1. Side View with the WCD Add On Kit installed



## **4.2 WCD Add On Kit (BackSide Iso View)**

1. BackSide Iso with the WCD Add On Kit installed





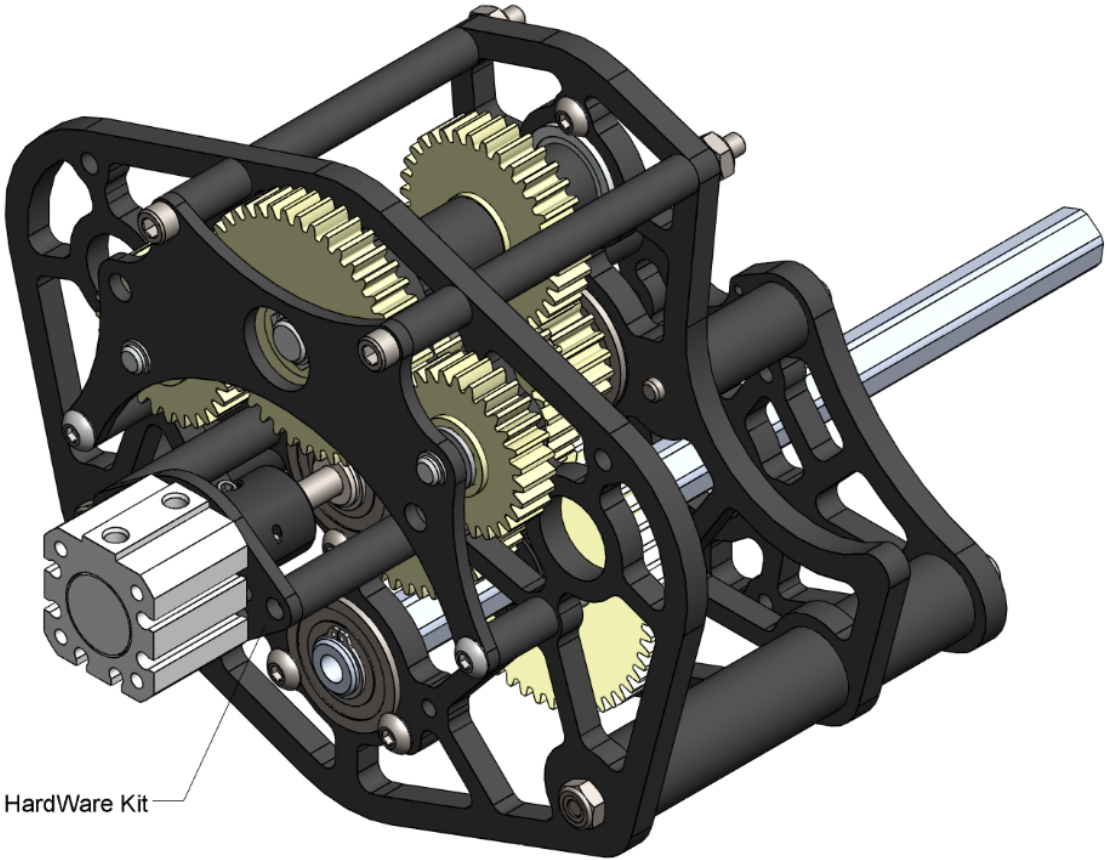
## ***5. Pneumatic Setup NonWCD***

To Install the cylinder setup for the NonWCD setup, please follow the instructions here:

- <https://content.vexrobotics.com/vexpro/pdf/217-3423-WCP-DS-Assy-Instr-Rev2.pdf>

### **NOTE:**

- The Cylinder used on this side of the transmission is the VEXpro (P/N: 217-2778). This is the same as SMC P/N: #NCQ8A075-050M.
- This setup requires:
  - WCP DS - Pneumatic Hardware Kit (P/N: 217-3496)
  - Pancake Pneumatic Cylinder, 3/4" Bore, 1/2" Travel (P/N: 217-2778)



DS Pneumatic HardWare Kit

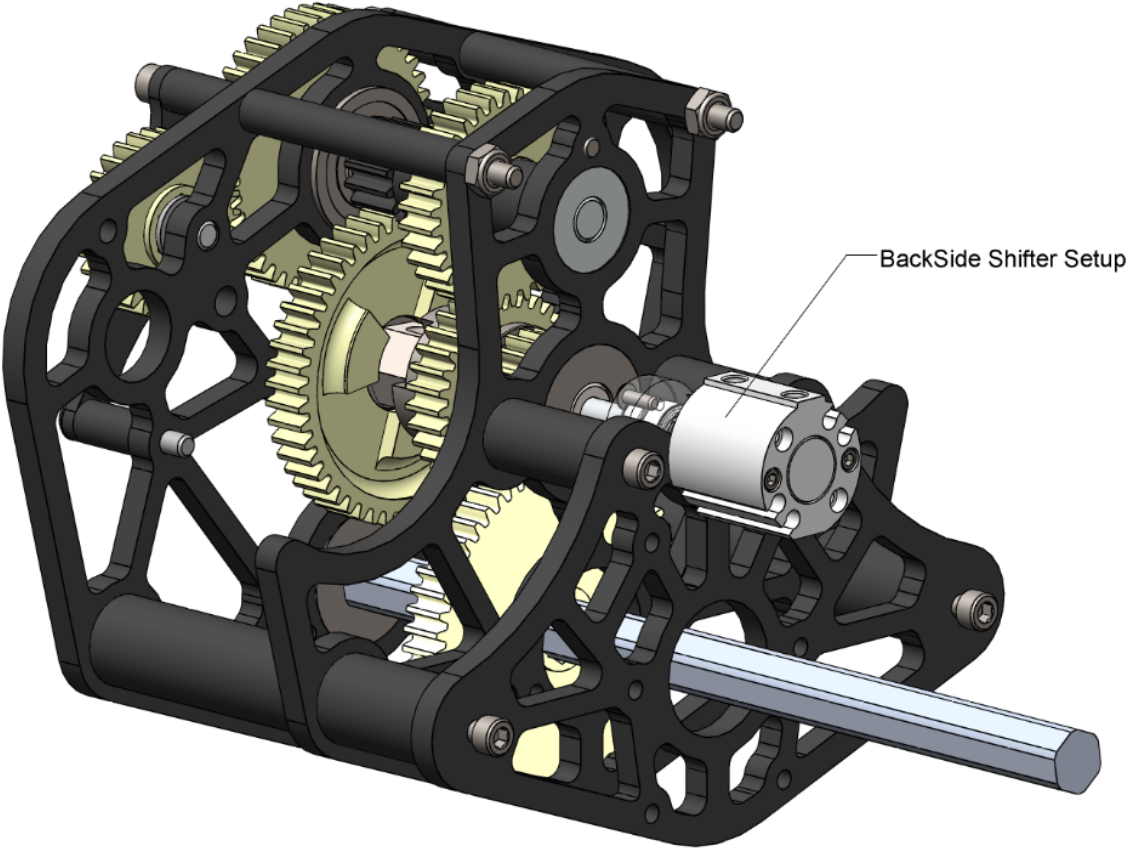


## **6. Pneumatic Setup WCD**

To setup the shifter on the opposite side requires the use of the BackFlip Shifter Kit (WCP-0126) and the use of a 9/16" Bore Pancake Cylinder.

There are 4 Sources for the Cylinder needed on this side

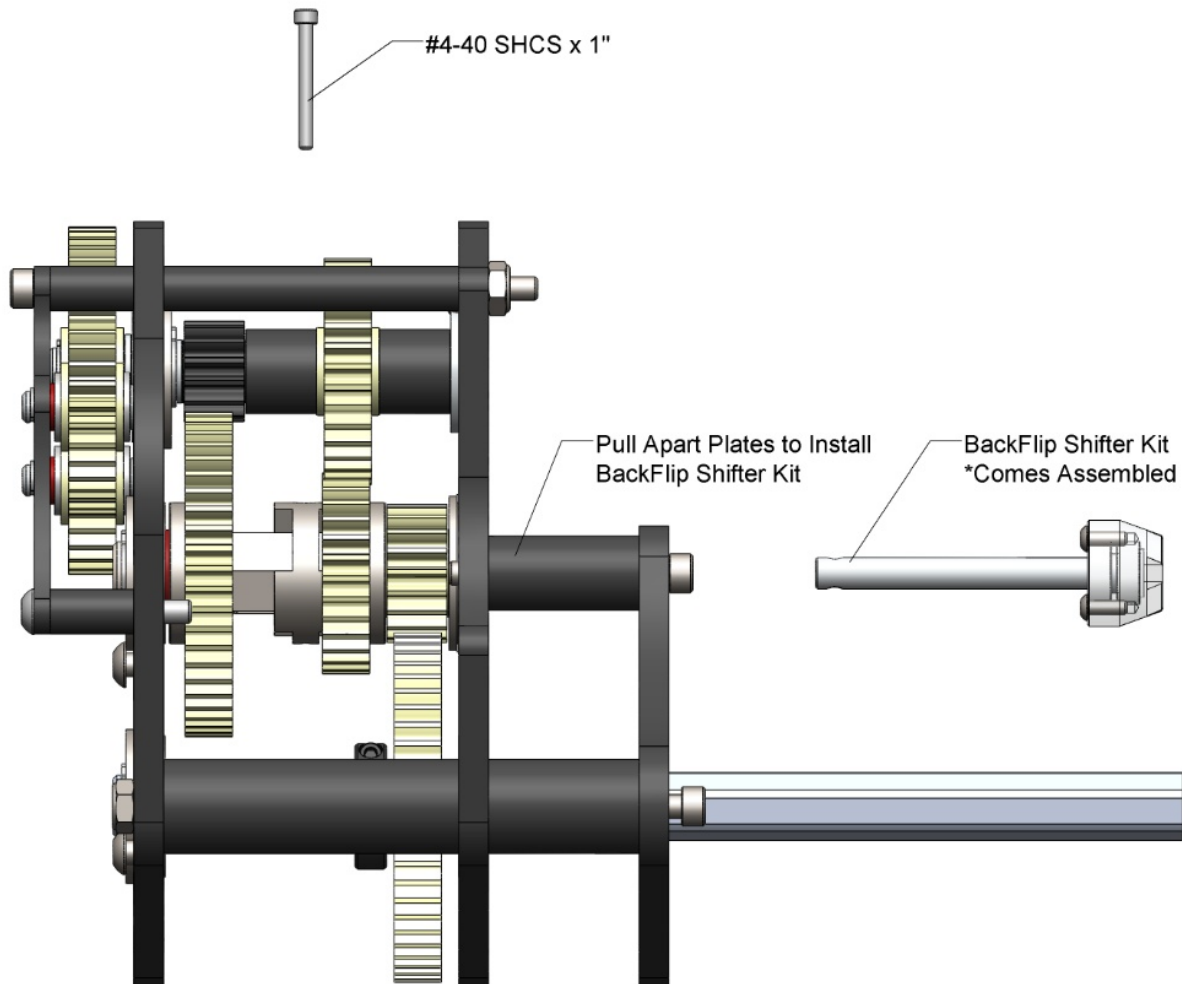
- SMC P/N: NCQ8B056-050M or NCQ8B056-050
  - **NOTE: Using the NCQ8B056-050 version, teams must use McMaster Carr: 92311A197**
  - **The Threaded set screw must be screwed into the cylinder with threadlocker**
- Bimba: FO-020.5-MT
- McMaster: 4208K102 & 92311A197
  - **The Threaded set screw must be screwed into the cylinder with threadlocker**
- WCP will be providing this part on our site when available.



## 6.1 BackFlip Shifter Kit Assembly

To Install the Backflip Shifter Kit:

1. Loosen or remove the WCD add on kit
2. Slide the Shifter Rod into the hole on the backside
3. Align the #4-40 bolt through the DOG and the Rod.
  1. Ensure that when you move the Cone that the DOG moves linearly as well.

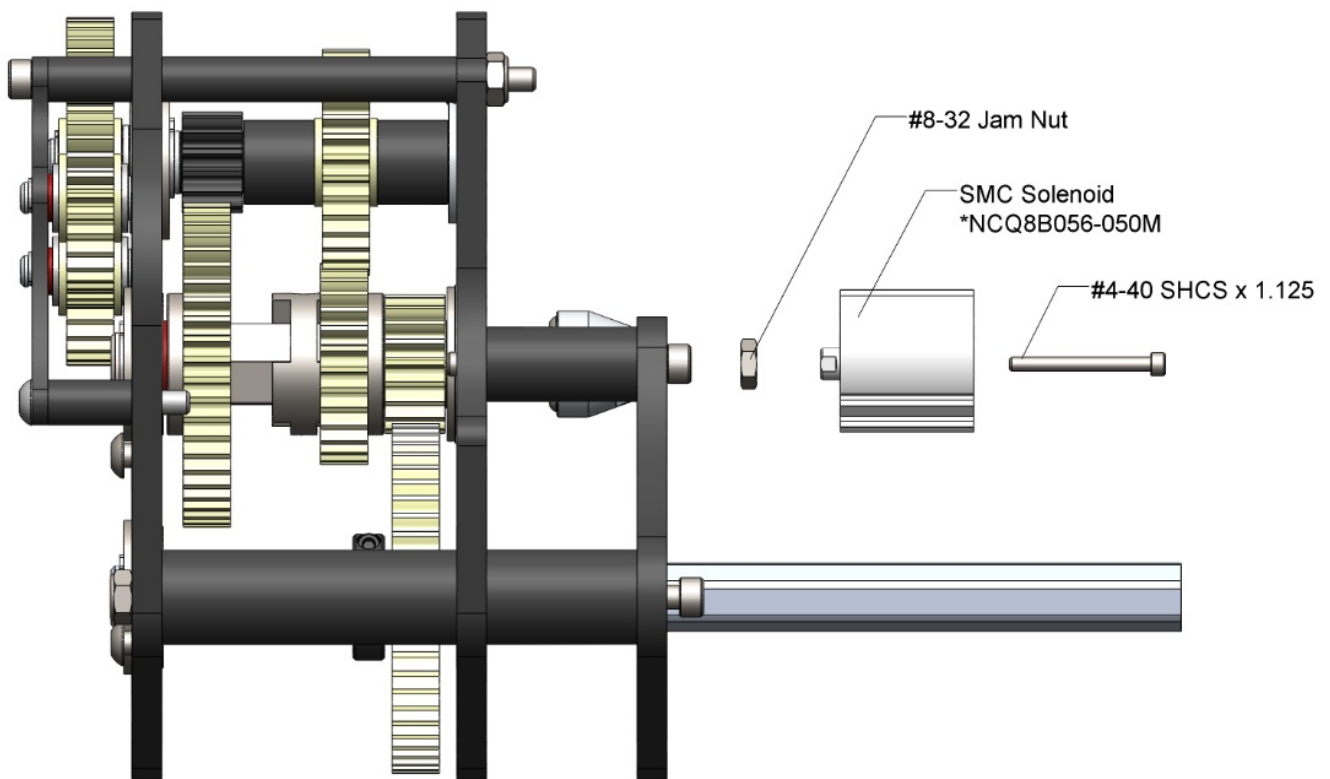




## 6.2 Pneumatic Cylinder Assembly

To assemble the Pneumatic Cylinder:

1. Tighten the Jam Nut onto the SMC Air Cylinder.
2. Thread the SMC Cylinder into the Shifter Cone.
3. Tighten the Jam Nut against the Cone while holding the Cone in place.
4. Use the #4-40 SHCS Bolts and attach the Air Cylinder to the WCD Add On Plate.





## ***7. Revision History***

- Rev 1.1
  - Updated Information about Pneumatic Setup
- Rev 1.0
  - Initial Release