

WCP Flipped Gearboxes- User Guide (Rev 1)

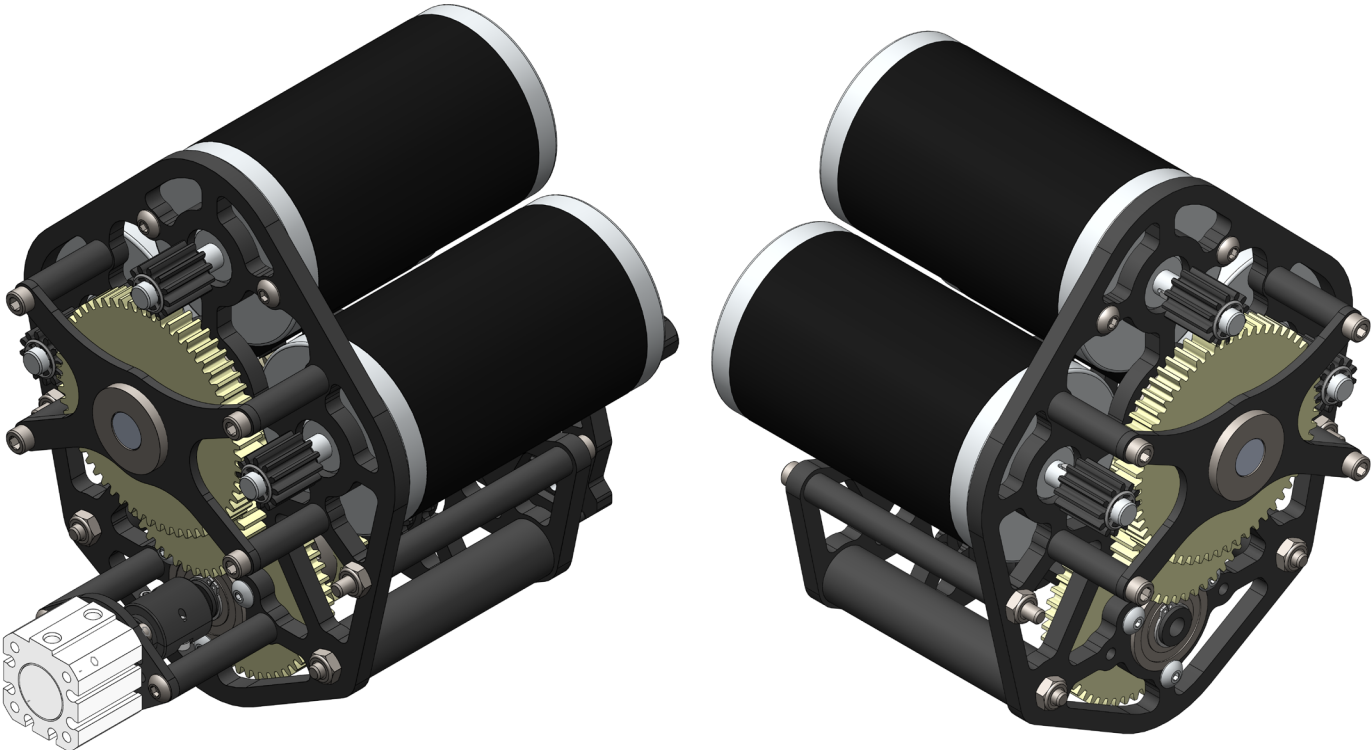




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What are the WCP Flipped Gearboxes?

Universal Multi-Motor Flipped Gearbox

- Compact Shifting Gearbox
- Designed for 3.5" -8" Wheels
- Quick change exterior reduction
- Supports Single Speed & Two Speed







Selecting Gear Ratios (Single Speed)



Selecting Gear Ratios (Dog Shifter)



Recommended Tools

Picture	Name
	Allen Wrench Set
	3/8" Wrench
	Snap Ring Pliers
	Loctite 248 Stick (McMaster P/N 1004A12)



WCP Flipped Gearboxes (Single and Dog Shifter) Assembly Instructions

Steps 1 through 3 are the same for both the single speed and dog shifter versions of this gearbox.

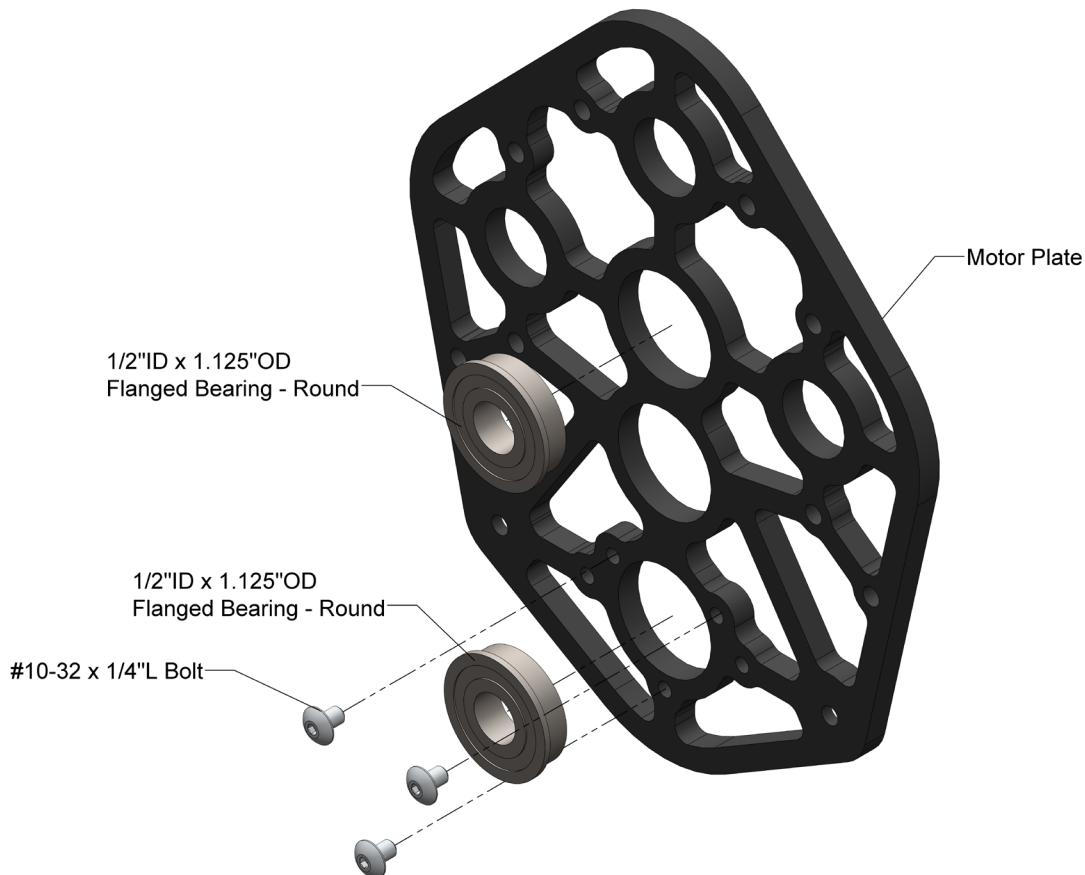


Step 1 (Single and Dog Shifter)

Press both 1/2" round bearing into the motor plate. Retain the lower bearing with three #10-32 x 1/4"L bolts. Bearing flanges should be opposite the c-bore in the plate.

The 3 Motor Plate may be substituted with the 2 Motor Plate at this step. All remaining steps will be the same. This plate does not affect the assembly after this step.

Note: Use Loctite to help retain the bolts.





Step 2 (Single and Dog Shifter)

Press the 1/2" ThunderHex bearing into the motor plate from the same side as the c-bores.



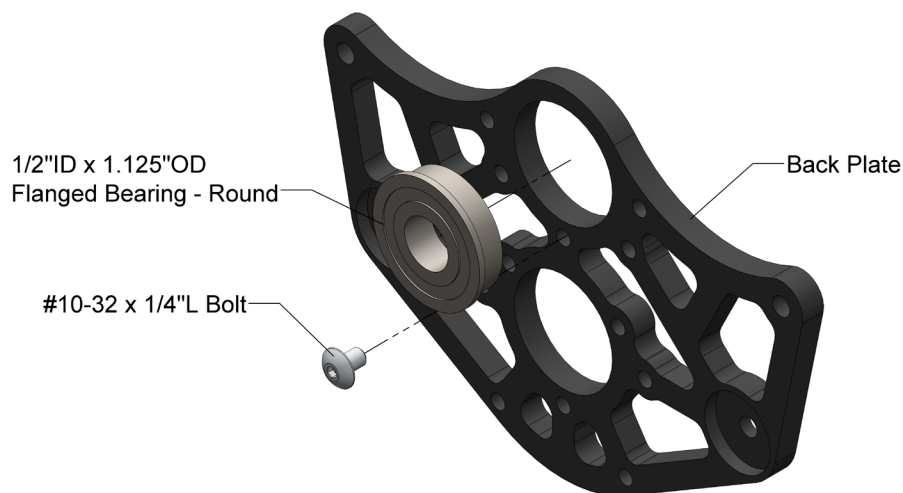


Step 3 (Single and Dog Shifter)

Press 1/2" round bearing into the Gearbox Mounting Plate from the same side as the c-bores.

Use one #10-32 x 1/4"L bolt to retain the bearing.

Note: Use Loctite to help retain the bolts.





WCP Flipped Gearboxes (Dog Shifter) Assembly Instructions

Dog shifter instructions follow until page 24. Single Speed instructions begin on page 26.

Be sure to complete Steps 1-3 before continuing onto this section.



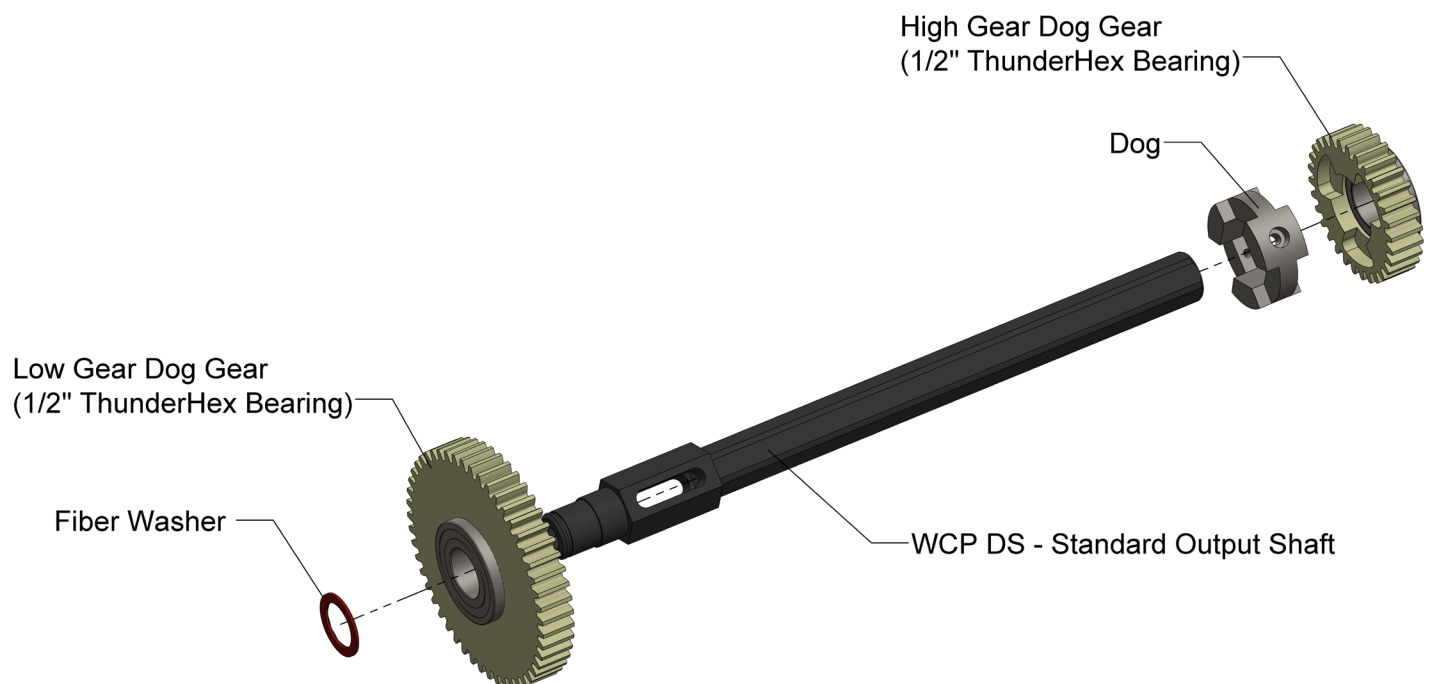
Step 4 (Dog Shifter)

The dog gears will come with the bearings pre-pressed into them.

Slide the dog and dog gears into place. The dog gears should have the pockets for the dog facing each other with the dog between them when they are in place. The bolt hole in the dog should align with the slot in the output shaft so that a bolt may pass through.

The fiber washer must be on the outside of the dog gear that is on the rounded down side of the output shaft.

Note: Forgetting to install the washer or installing on the wrong side of the dog gear may cause excess friction in the gearbox. This may lead to motors becoming excessively hot or have the gearbox not spin at all.

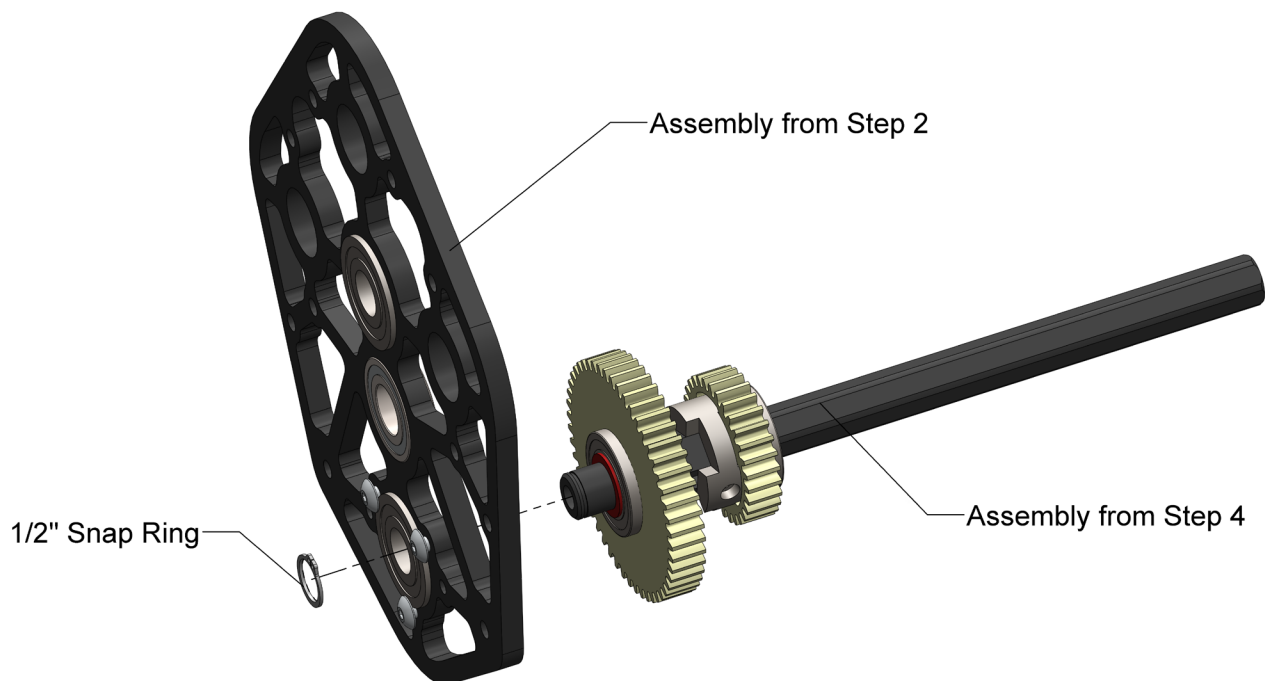




Step 5 (Dog Shifter)

The assembly from Step 4 is installed into the Gearbox Motor Plate assembly from Step 2 from the side of the plate that has the c-bores.

The output shaft slides into the lowest 1/2" round bearing and is retained with a 1/2" snap ring.



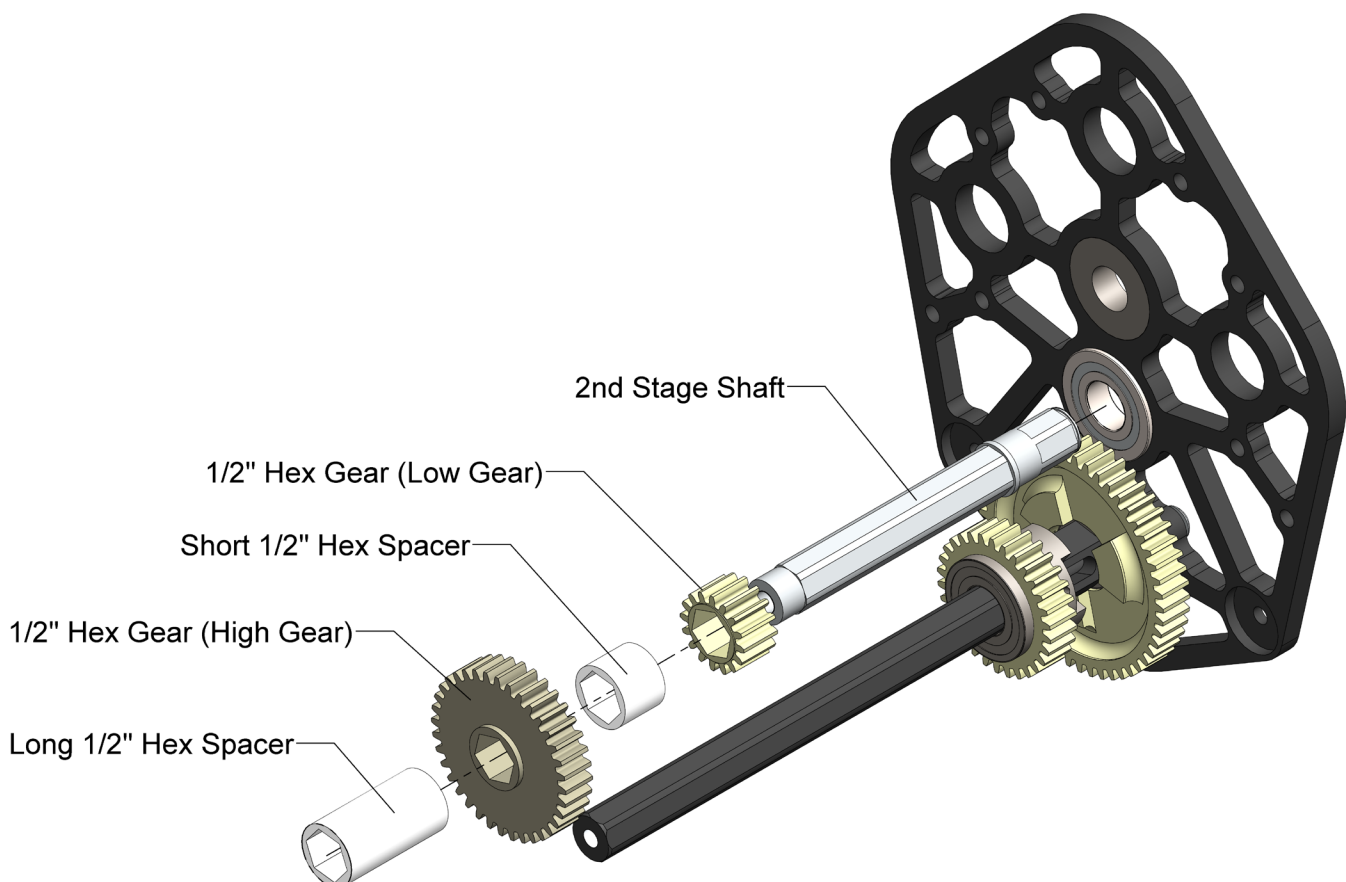


Step 6 (Dog Shifter)

Slide the 2nd Stage Shaft into the 1/2" ThunderHex bearing as seen below.

Slide the desired gears and spacers into place.

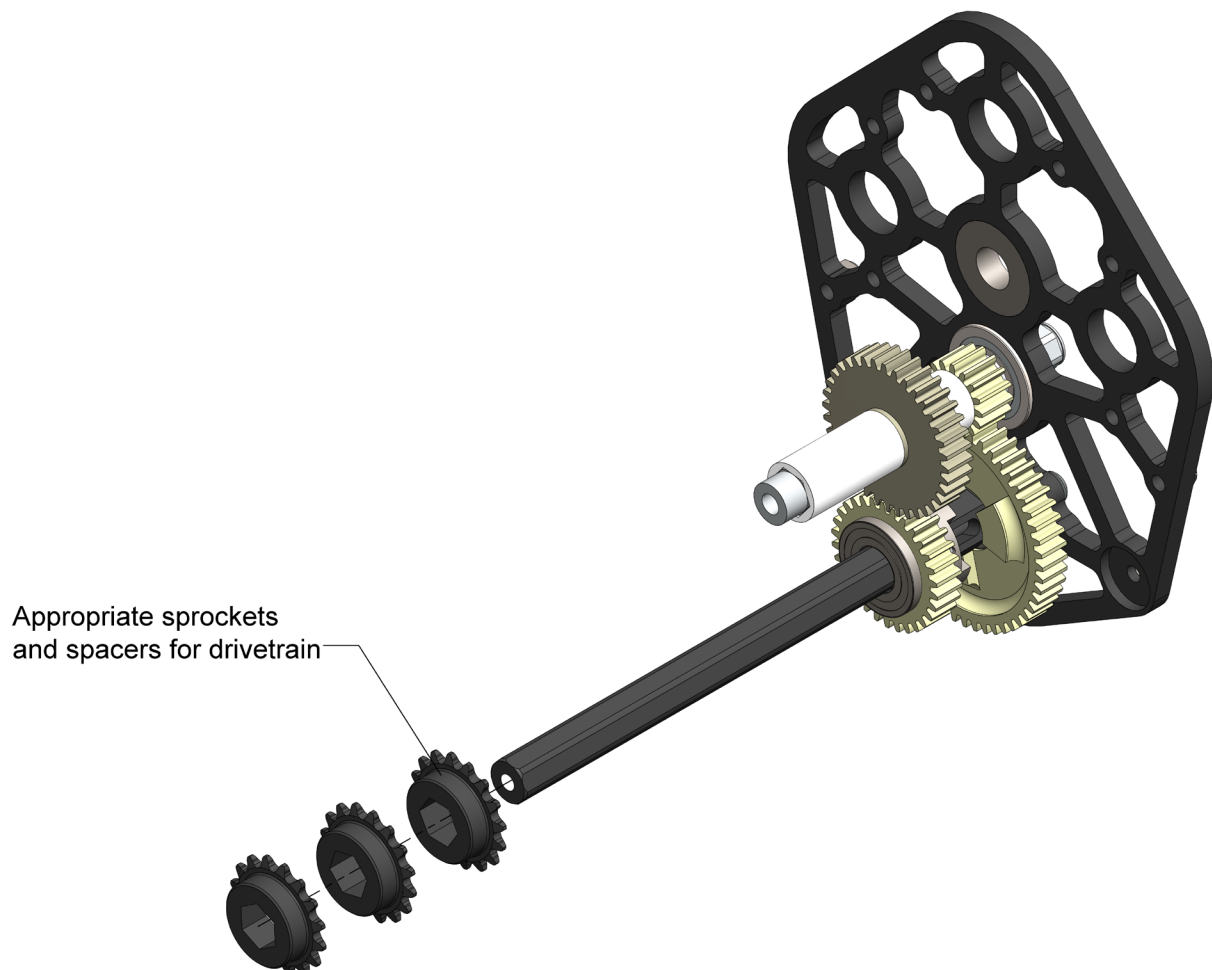
Note: Spacers are not included in the kit. Teams are responsible for buying/making the appropriate spacers. It is recommended for teams the 3d print these so multiple spacers need not be stacked.





Step 7 (Dog Shifter)

Install sprockets/pulleys with the appropriate spacers to achieve the alignment needed in the drive-train.



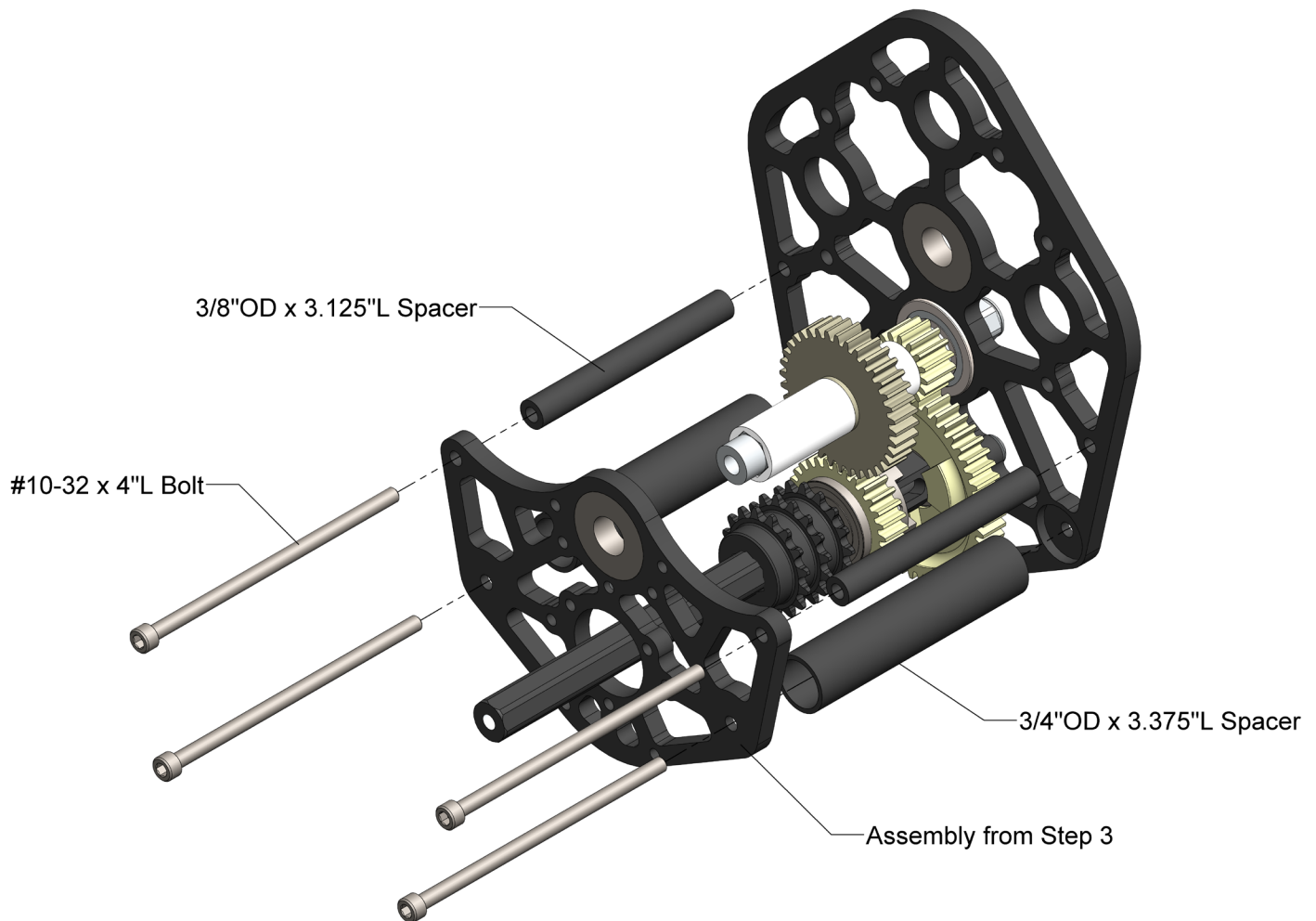


Step 8 (Dog Shifter)

Install spacers and the Gearbox Mounting Plate assembly from Step 3.

The c-bores on the Gearbox Mounting Plate should face the c-bores on the Motor Mounting Plate. The larger OD spacers need to be fully seated in these c-bores for the plates to be spaced correctly apart.

Install the four #10-32 x 4"L bolts.

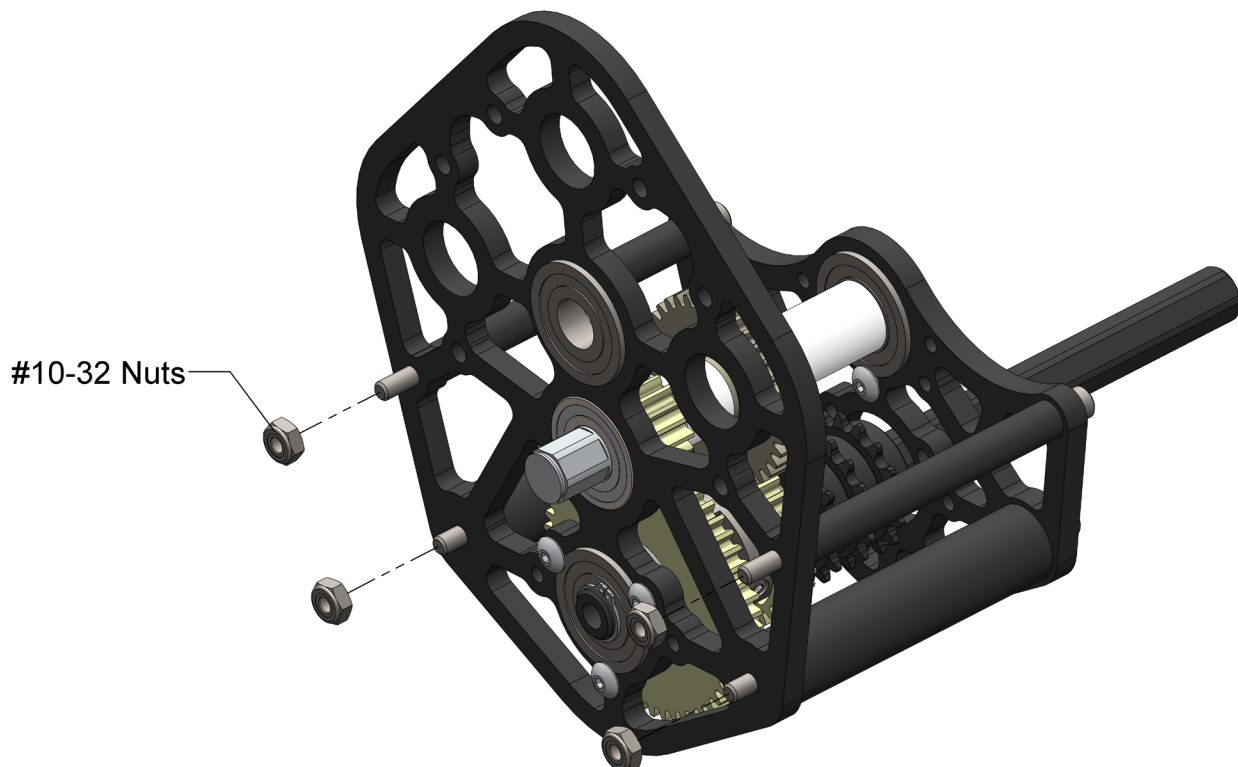




Step 9 (Dog Shifter)

Install the four #10-32 nuts. Tighten the top two nuts fully.

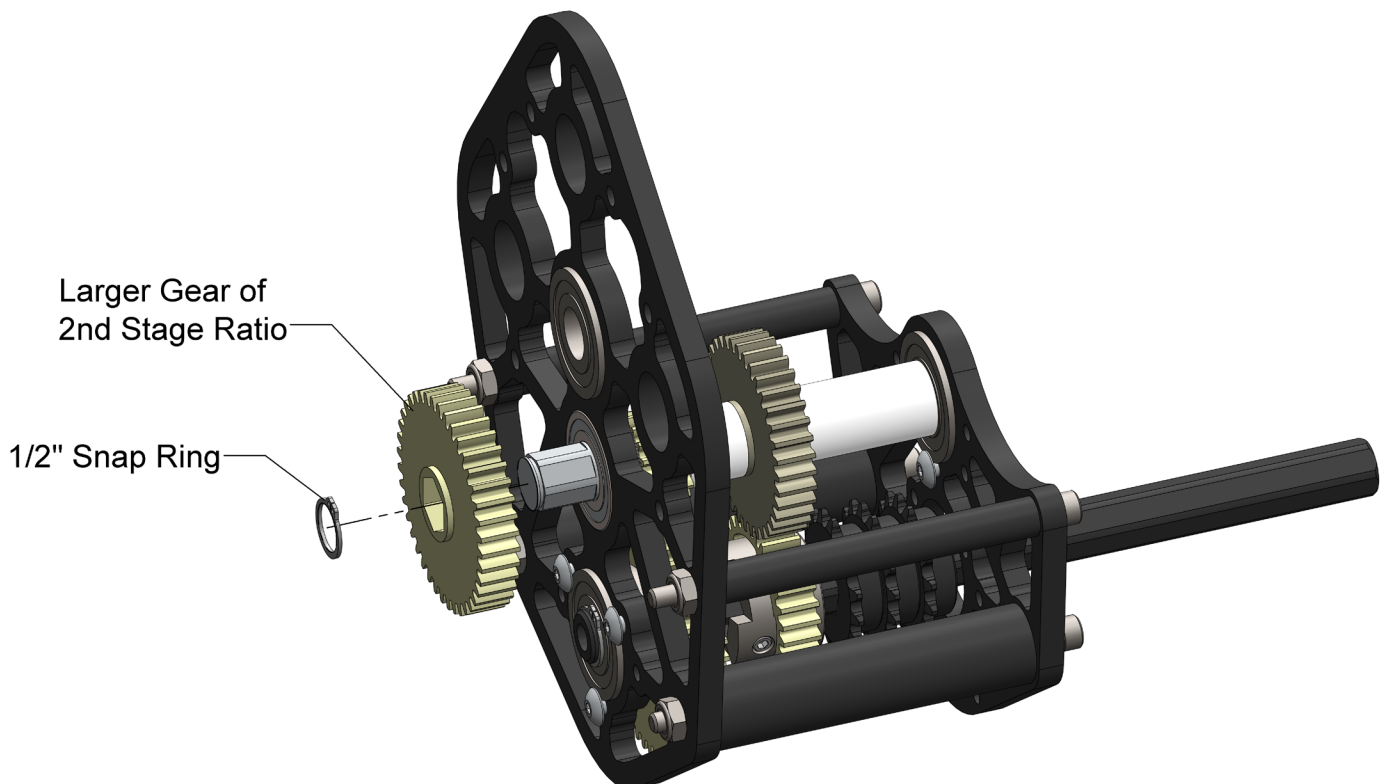
Leave the bottom nuts loose as they will have to be removed when the gearbox is installed into the drive-train.





Step 10 (Dog Shifter)

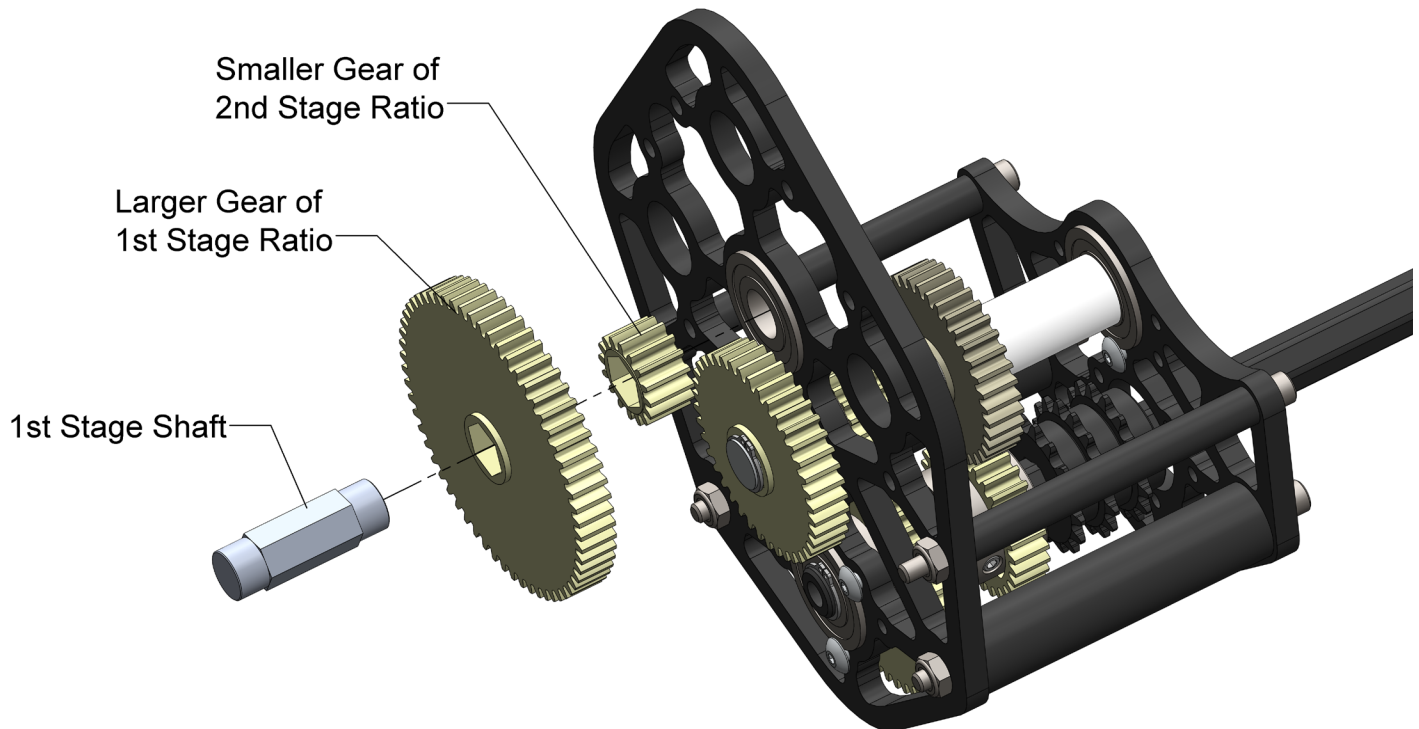
Install the larger gear for the 2nd stage ratio onto the 2nd stage shaft. Retain with a 1/2" snap ring.





Step 11 (Dog Shifter)

Install the 1st Stage Shaft with the appropriate gears.



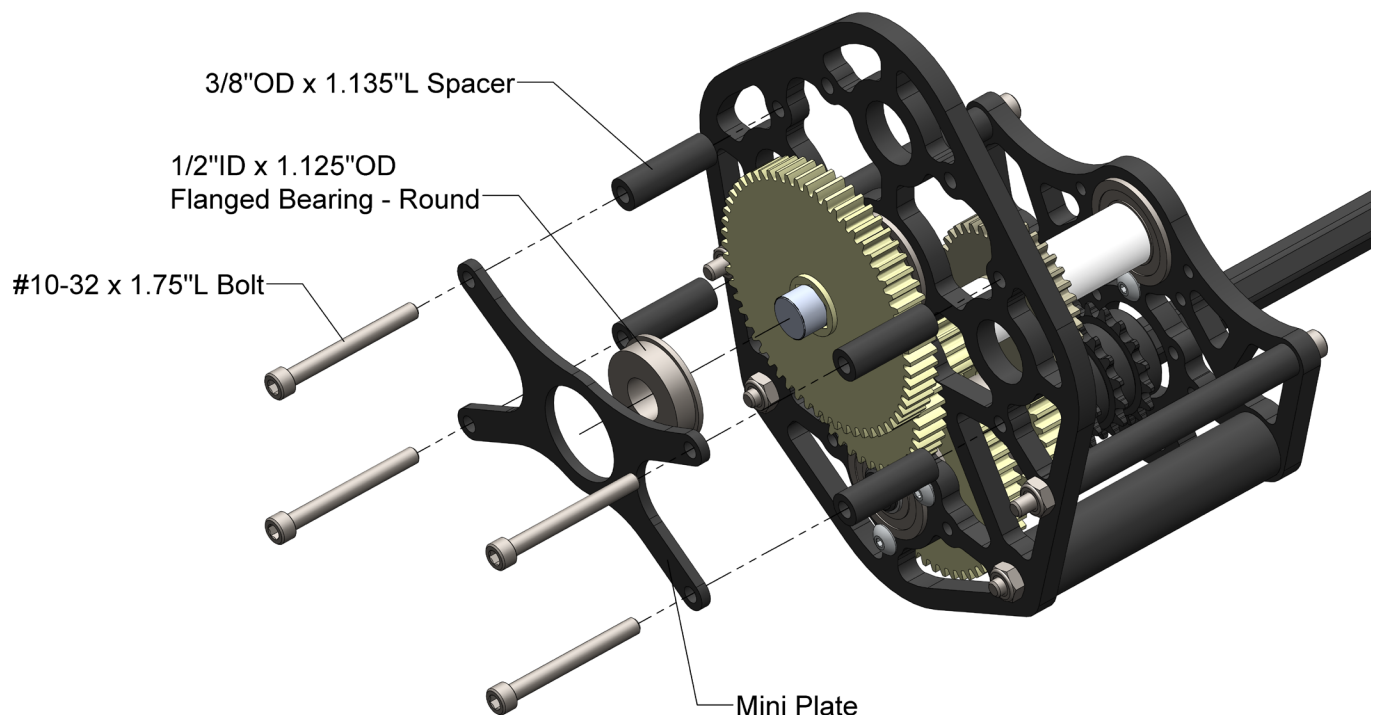


Step 12 (Dog Shifter)

Press 1/2" Round Bearing into 1st Stage Plate.

The 1st Stage Plate only lines up in one position. Bolts will not line up properly with the correct holes if the plate is in the wrong orientation.

Install the four #10-32 x 1.75"L bolts and spacers. The bolts will thread into the motors.





Step 13 (Dog Shifter)

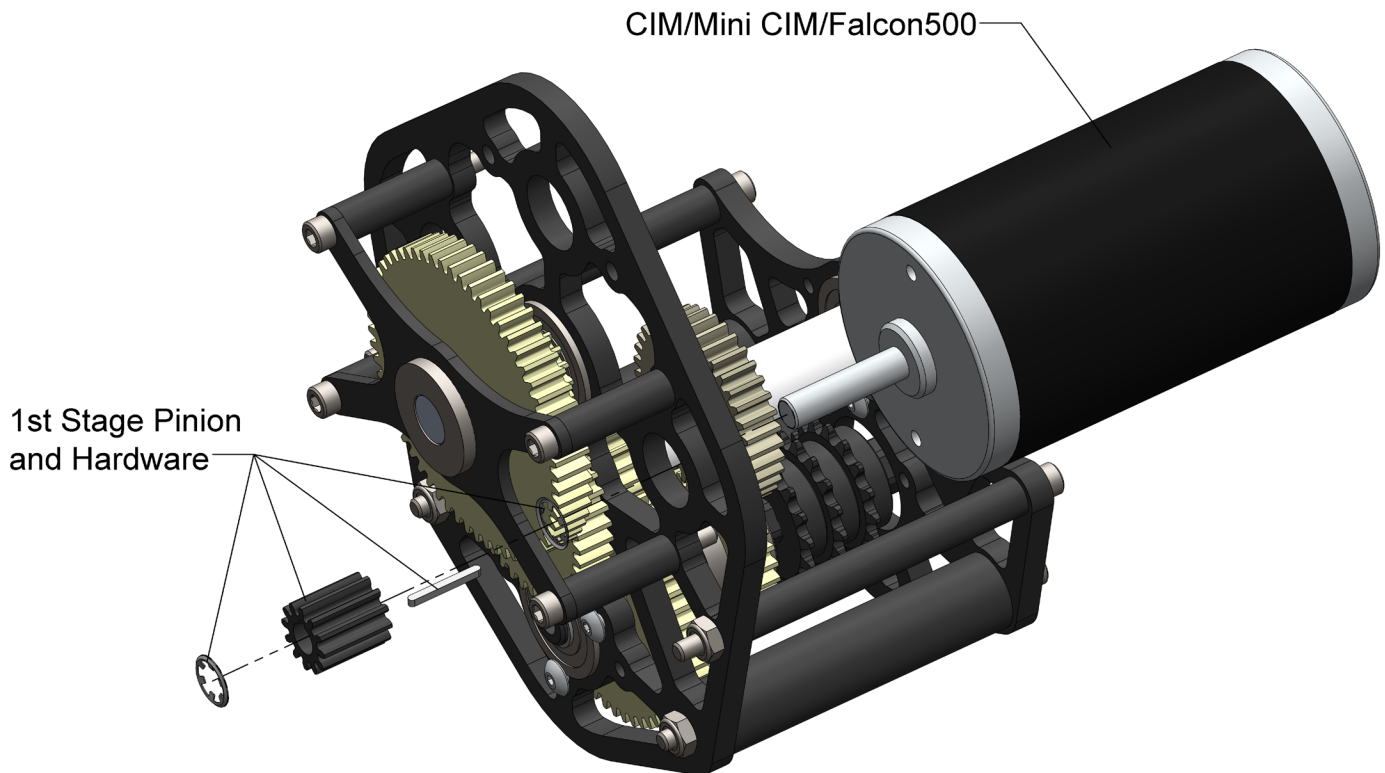
Install the desired motor and pinion options. If the pinions are smaller than the boss of the motor, they may be installed before the motor is bolted to the gearbox.

Install the desired amount of motors and their corresponding hardware.

If only two motors are used, install them so that they use the bolts that hold the 1st stage shaft in place.

The 3rd motor will need two additional #10-32 x 1/2" L bolts.

Note: Use Loctite to help retain the bolts.





Shifter Cone Options

The WCP Flipped DS gearbox has two options for the shifter cone.

1. Standard
 - i. WCP DS - Pneumatic Hardware Kit (217-3496)
 - ii. WCP DS - Shifter Dog Kit (217-3628)
2. Metal Shifter Cone
 - i. WCP Metal Shifter Cone (DOG Shifter) (WCP-0350)
 - ii. WCP DS - Pneumatic Hardware Kit (217-3496)
 - iii. WCP DS - Shifter Dog Kit (217-3628)

The following steps will be separated into “Standard” for the first option and “Metal” for the second.

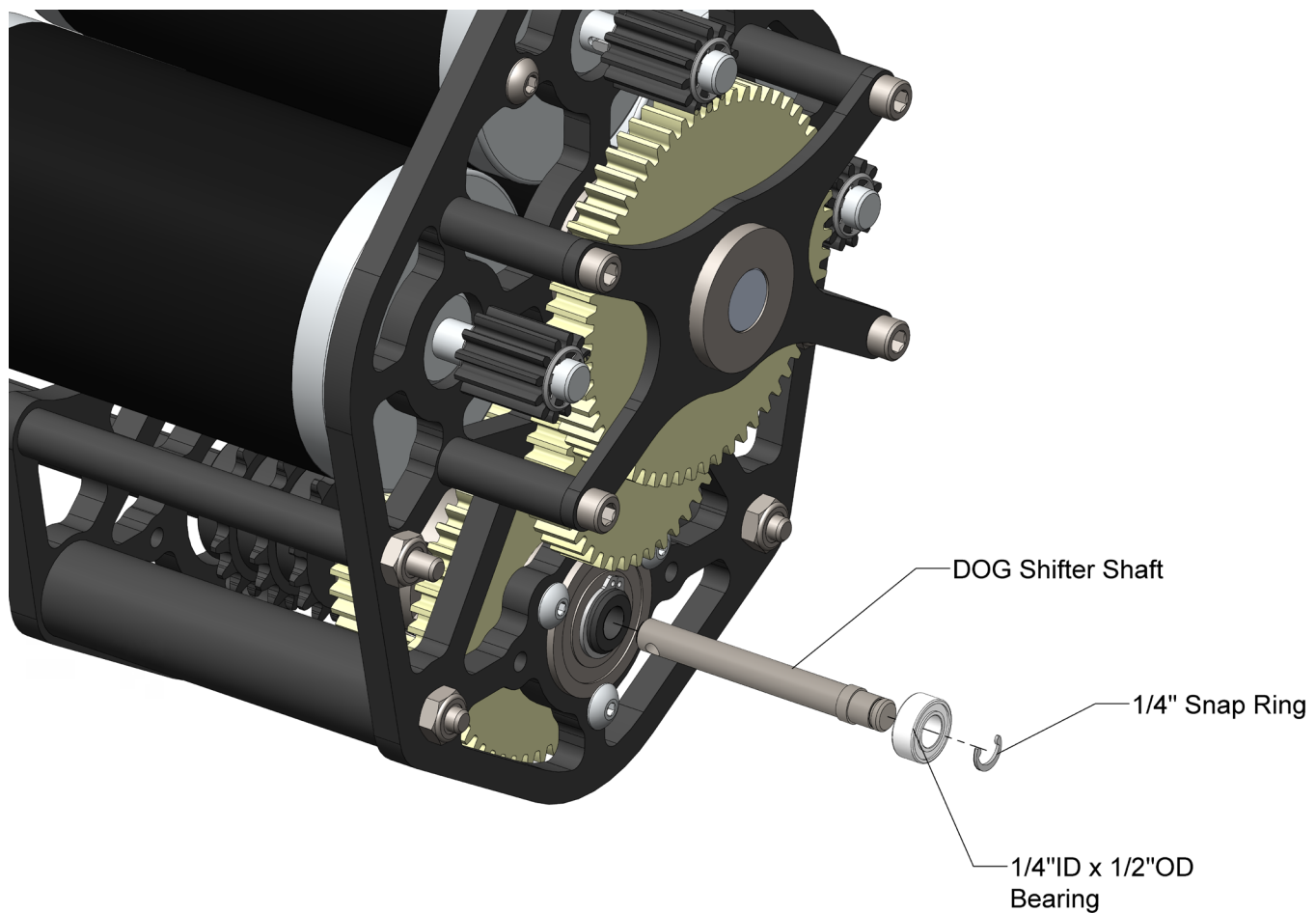


Step 14 (Dog Shifter) - Standard

Components in this step can be found:

1. WCP DS - Shifter Dog Kit
 - i. Dog Shifter Shaft
2. WCP DS - Pneumatic Hardware Kit
 - i. 1/4" Snap Ring
 - ii. 1/4" ID x 1/2" OD Bearing

Slide the bearing on the end of the Dog Shifter Shaft that does not have the cross drilled hole. Retain with the 1/4" snap ring. Slide this assembly into the hole in the Output Shaft.

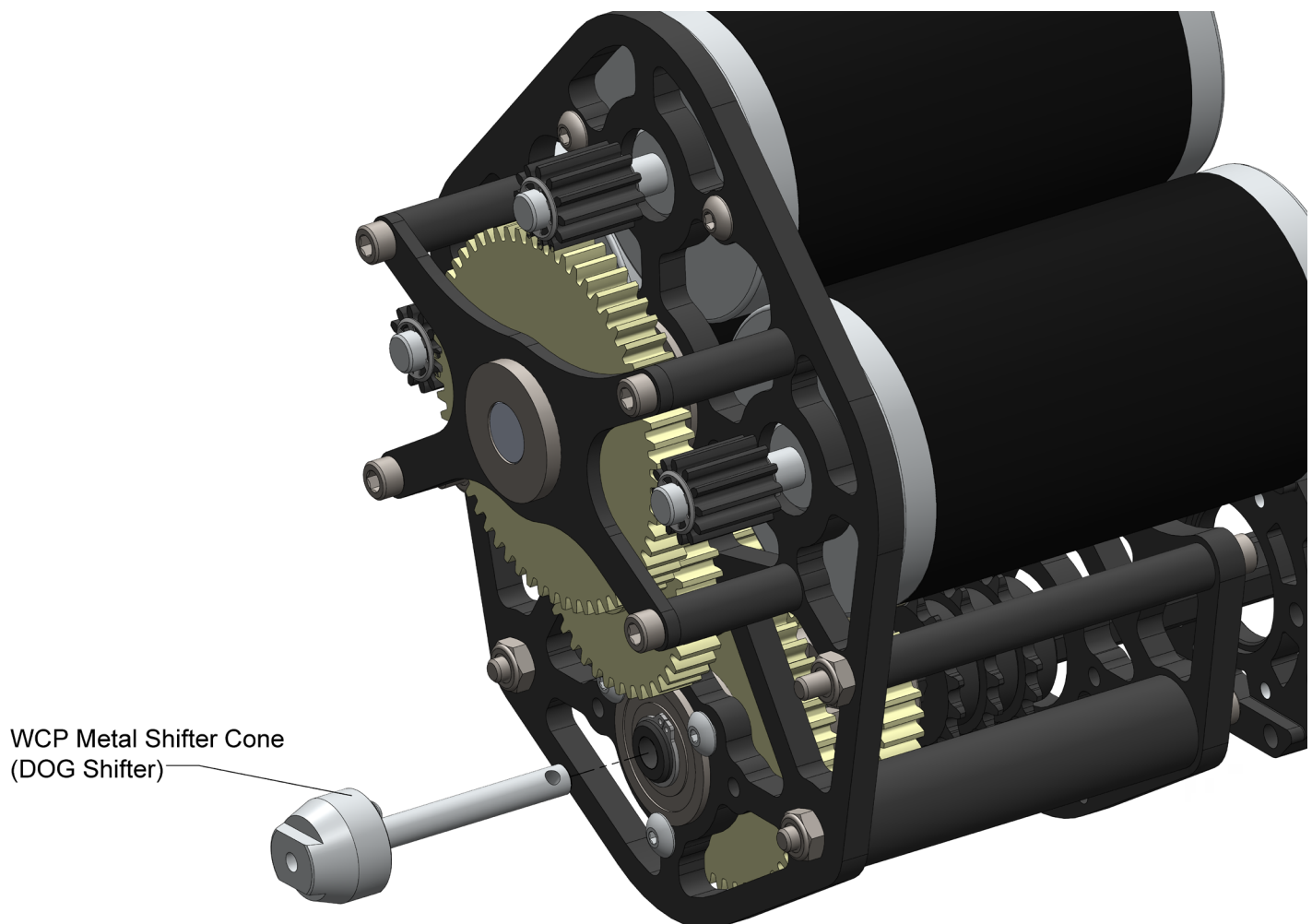




Step 14 (Dog Shifter) - Metal

The WCP Metal Shifter Cone will come with the shaft and bearings pre-installed into the cone.

Slide the WCP Metal Shifter Cone into the hole in the Output Shaft.



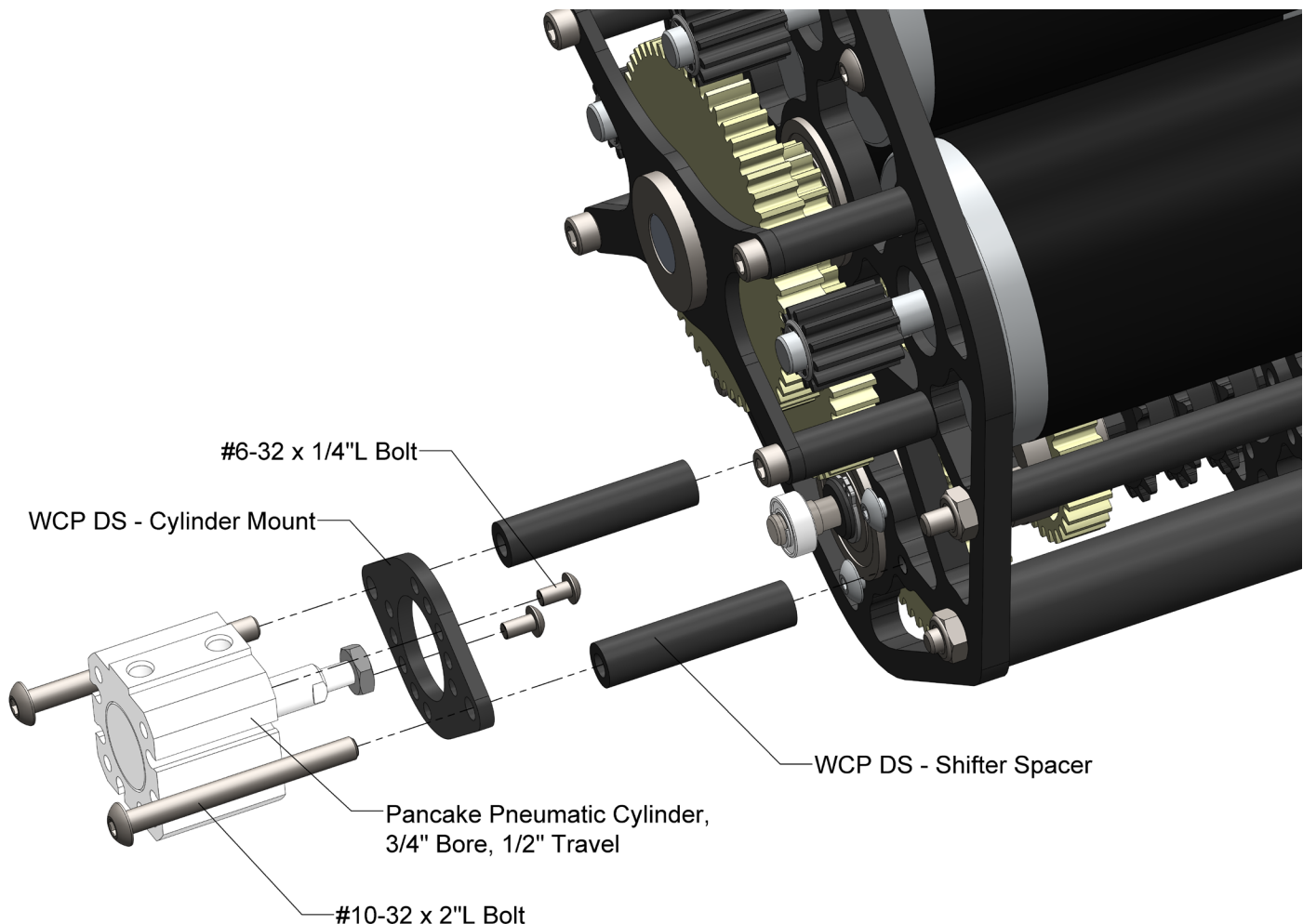


Step 15 (Dog Shifter) - Standard

Components in this step can be found:

1. WCP DS - Pneumatic Hardware Kit
 - i. WCP DS - Cylinder Mount
 - ii. WCP DS - Shifter Spacer x 2
 - iii. #10-32 x 2" L Bolt x 2
 - iv. #6-32 x 1/4" L Bolt x 2
2. Pancake Pneumatic Cylinder, 3/4" Bore, 1/2" Travel

Bolt the Pancake Pneumatic Cylinder to the WCP DS - Cylinder Mount using the two #6-32 x 1/4" L bolts. Use the two #10-32 x 2" L bolts and two WCP DS - Shifter Spacer to attach the Cylinder and Cylinder Mount to the gearbox.





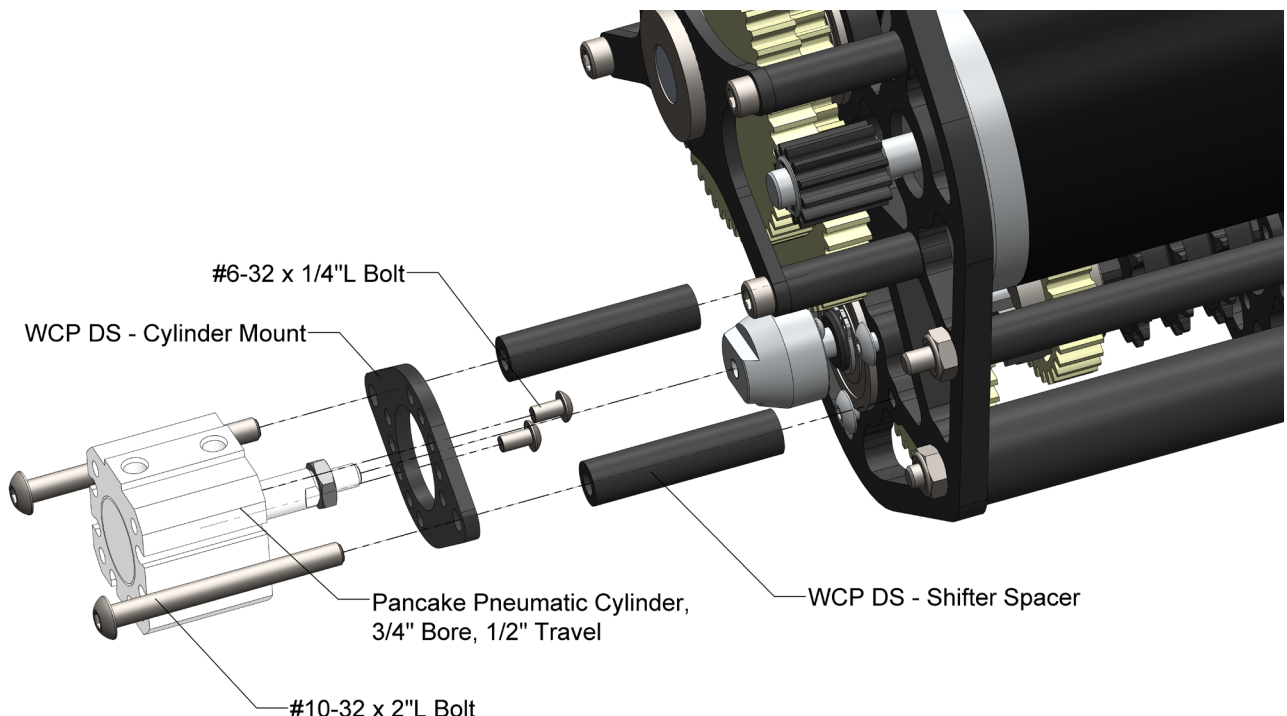
Step 15 (Dog Shifter) - Metal

Components in this step can be found:

1. WCP DS - Pneumatic Hardware Kit
 - i. WCP DS - Cylinder Mount
 - ii. WCP DS - Shifter Spacer x 2
 - iii. #10-32 x 2" L Bolt x 2
 - iv. #6-32 x 1/4" L Bolt x 2
2. Pancake Pneumatic Cylinder, 3/4" Bore, 1/2" Travel

Bolt the Pancake Pneumatic Cylinder to the WCP DS - Cylinder Mount using the two #6-32 x 1/4" L bolts. Use the two #10-32 x 2" L bolts and two WCP DS - Shifter Spacer to attach the Cylinder and Cylinder Mount to the gearbox.

Thread the Pancake Pneumatic Cylinder into the WCP Metal Shifter Cone. The hex nut should be threaded against the rod of the pneumatic cylinder before threading into the shifter cone. Once the rod is fully threaded into the shifter cone, tighten the hex nut against the shifter cone.





Step 16 (Dog Shifter) - Standard

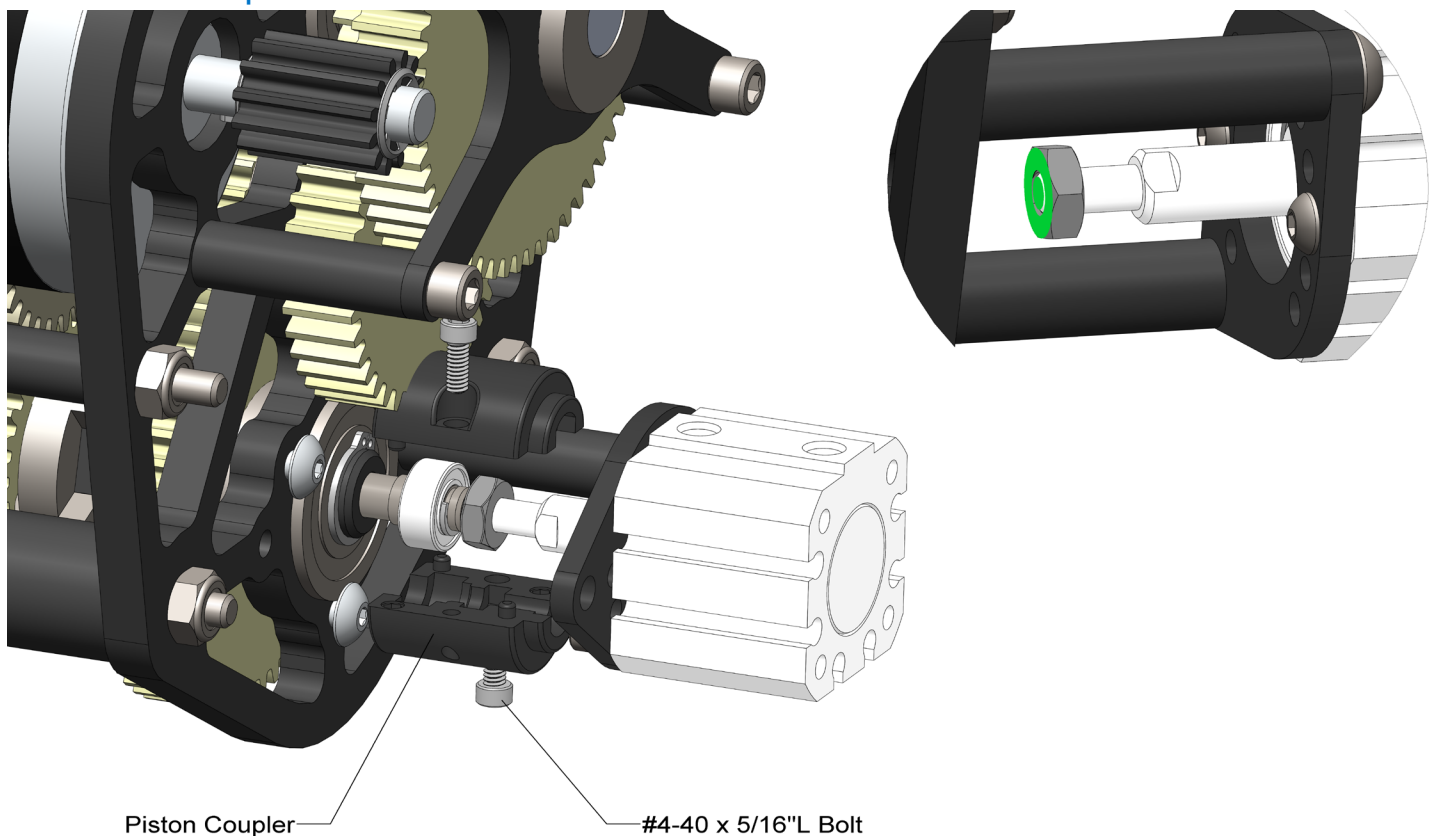
Components in this step can be found:

1. WCP DS - Pneumatic Hardware Kit
 - i. Piston Coupler x 2
 - ii. #4-40 x 5/16" L Bolt x 2

Before installing the Piston Couple be sure to have the hex nut on the Pancake Pneumatic Cylinder flush with the end of the threaded portion, as seen in the image below.

Use both halves of the Piston Couple to capture the hex nut and bearing. Be sure to have the hex nut aligned with the hex pocket in the Piston Coupler. Use the two #4-40 x 5/16" bolts to attach the two halves. There should be no visible gap between the halves when this is done.

Note: Some components have been removed from this assembly to aid in the visualization of this steps.





Step 16 (Dog Shifter) - Metal

There is no Step 16 for the aluminum dog shifter cone. This page can be skipped.

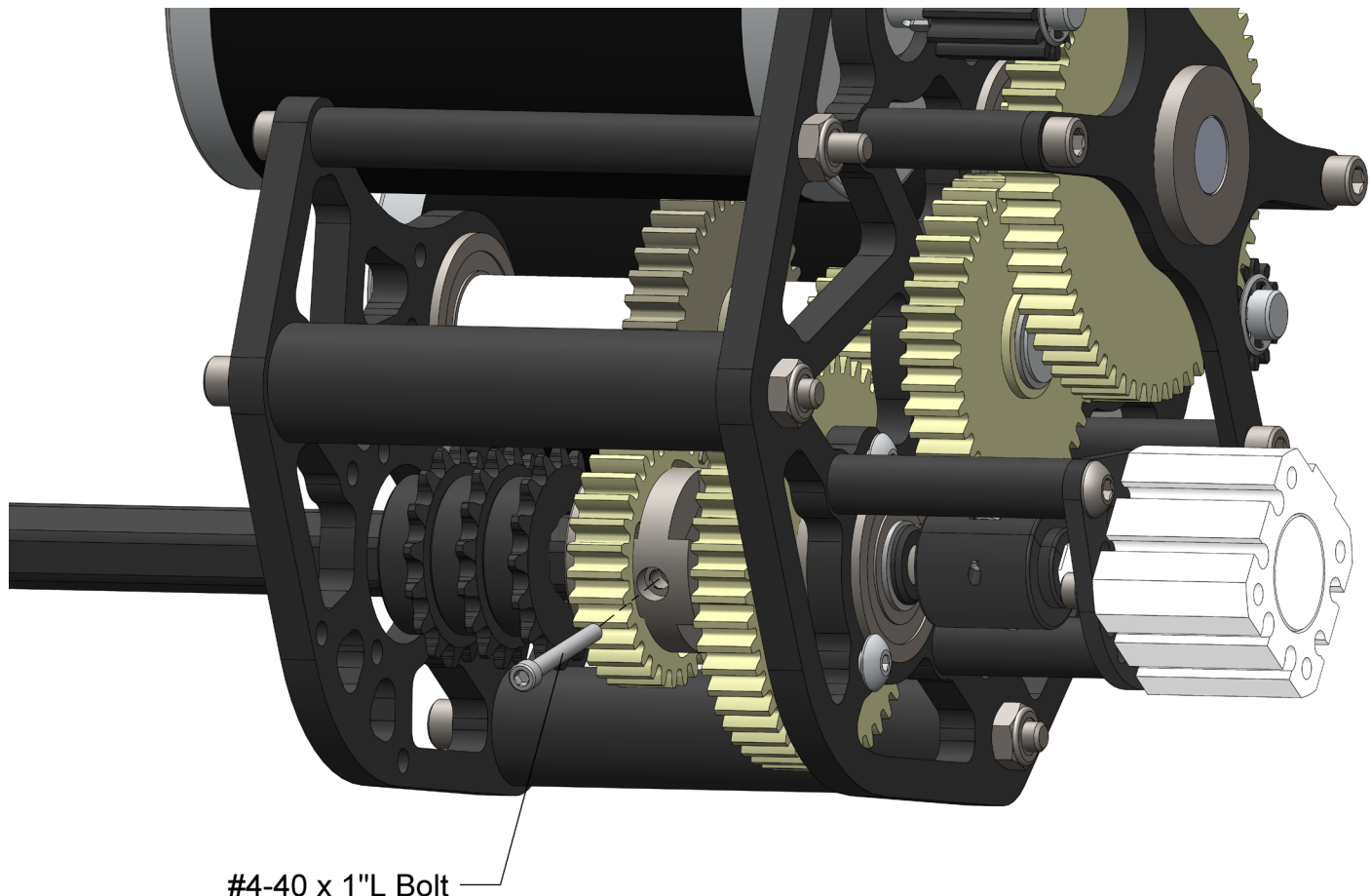


Step 17 (Dog Shifter)

This step is the same for both types of shifter cones.

Install the #4-40 x 1" L bolt into the dog. Be sure to align the hole in the dog shifter shaft with the hole in the dog before installing the bolt.

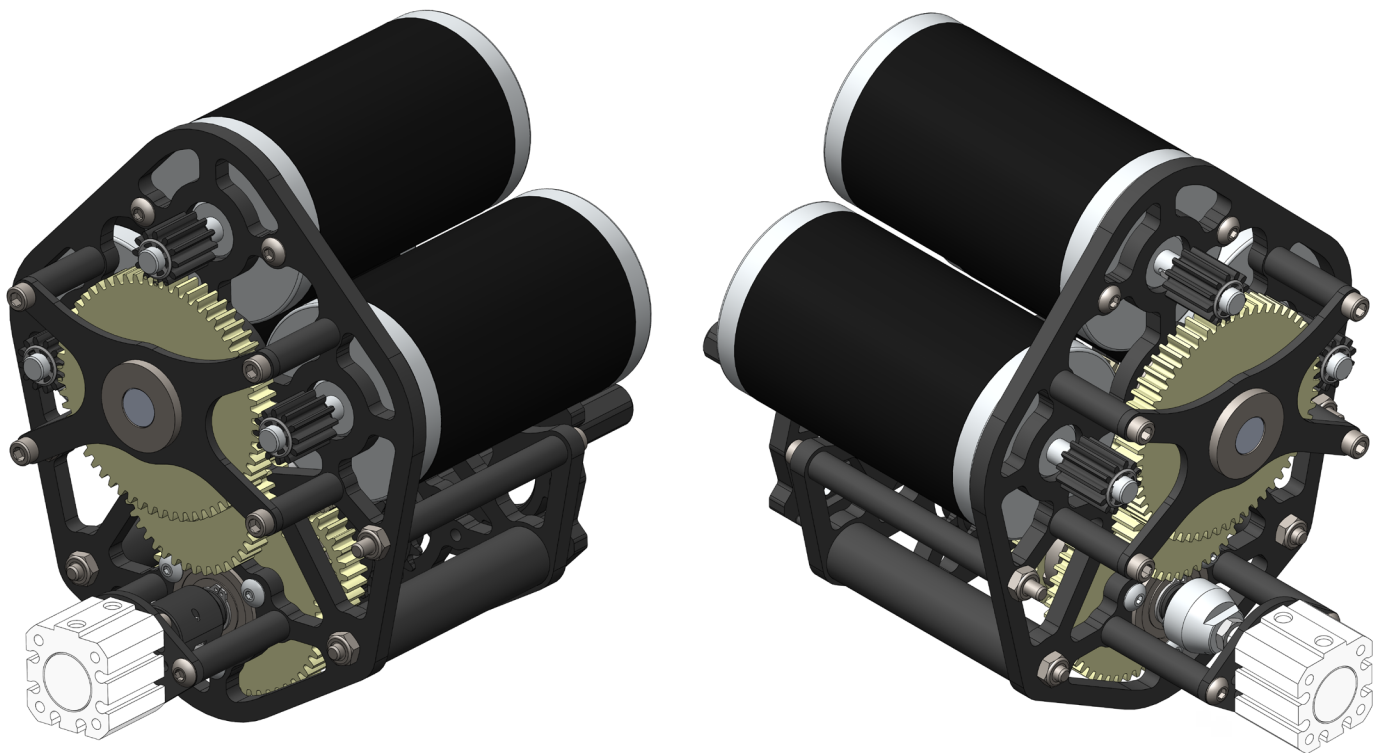
Tighten the bolt and then ensure that the dog still slides by manual shifting with the shifter cone.





Dog Shifter Final

Before installing into the drive train, spin the output shaft by hand to ensure that the gearbox spins smoothly. Also shift between the high and low gear. It is recommended to apply the desired grease or lubricant now as opposed to after final installation in the robot.





WCP Flipped Gearboxes (Single Speed) Assembly Instructions

Single Speed instructions follow.

Be sure to complete Steps 1-3 before continuing onto this section.

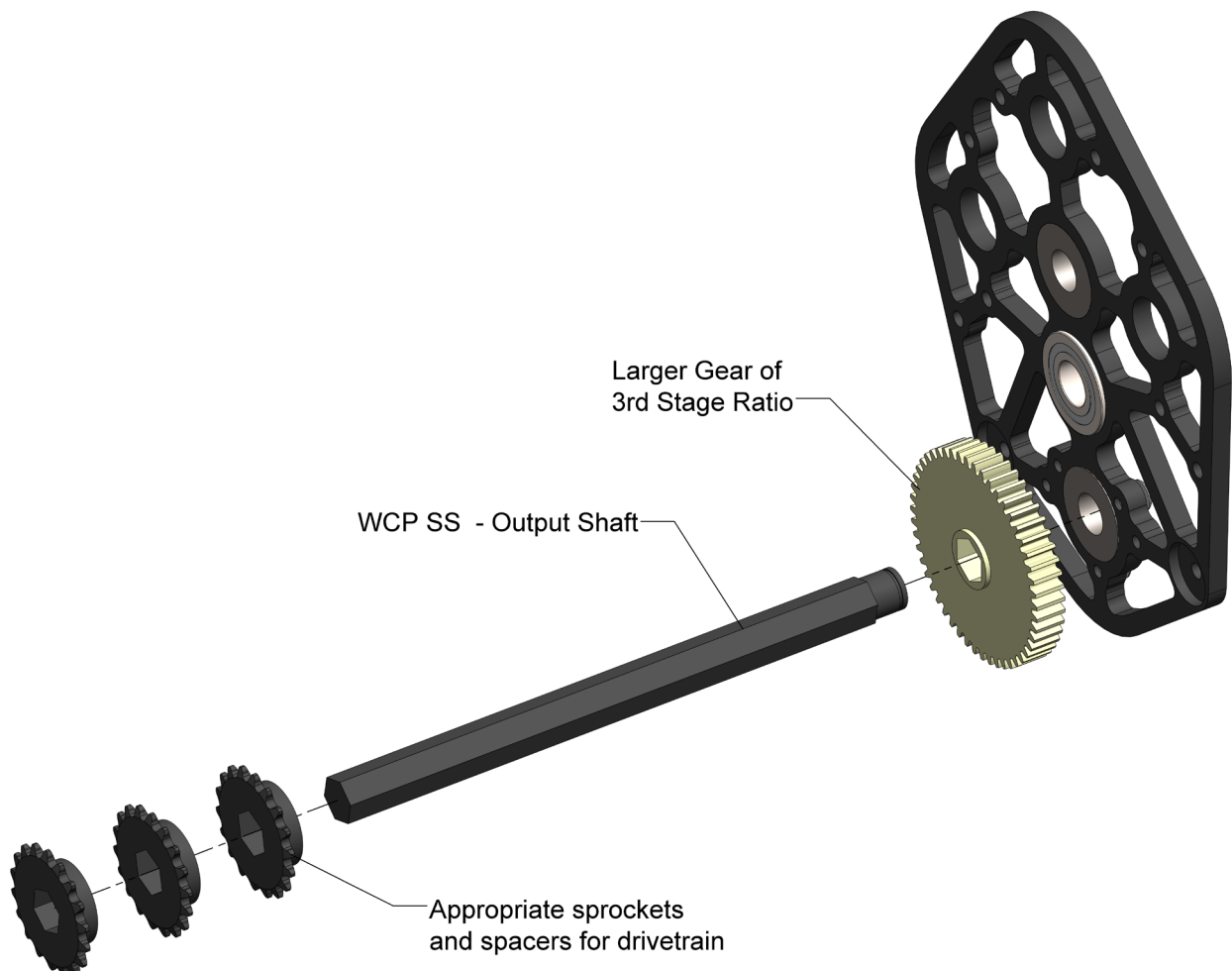


Step 4 (Single Speed)

Slide the Output Shaft into the lowest 1/2" round bearing in the Motor Mounting Plate. The Output Shaft is installed on the same side as the c-bores in the plate.

Slide the larger gear of the 3rd stage ratio onto the Output Shaft. This gear should sit against the bearing in the plate.

Slide all necessary spacers and sprockets/pulleys onto the Output Shaft.





Step 5 (Single Speed)

Retain Output Shaft with a 1/2" snap ring.



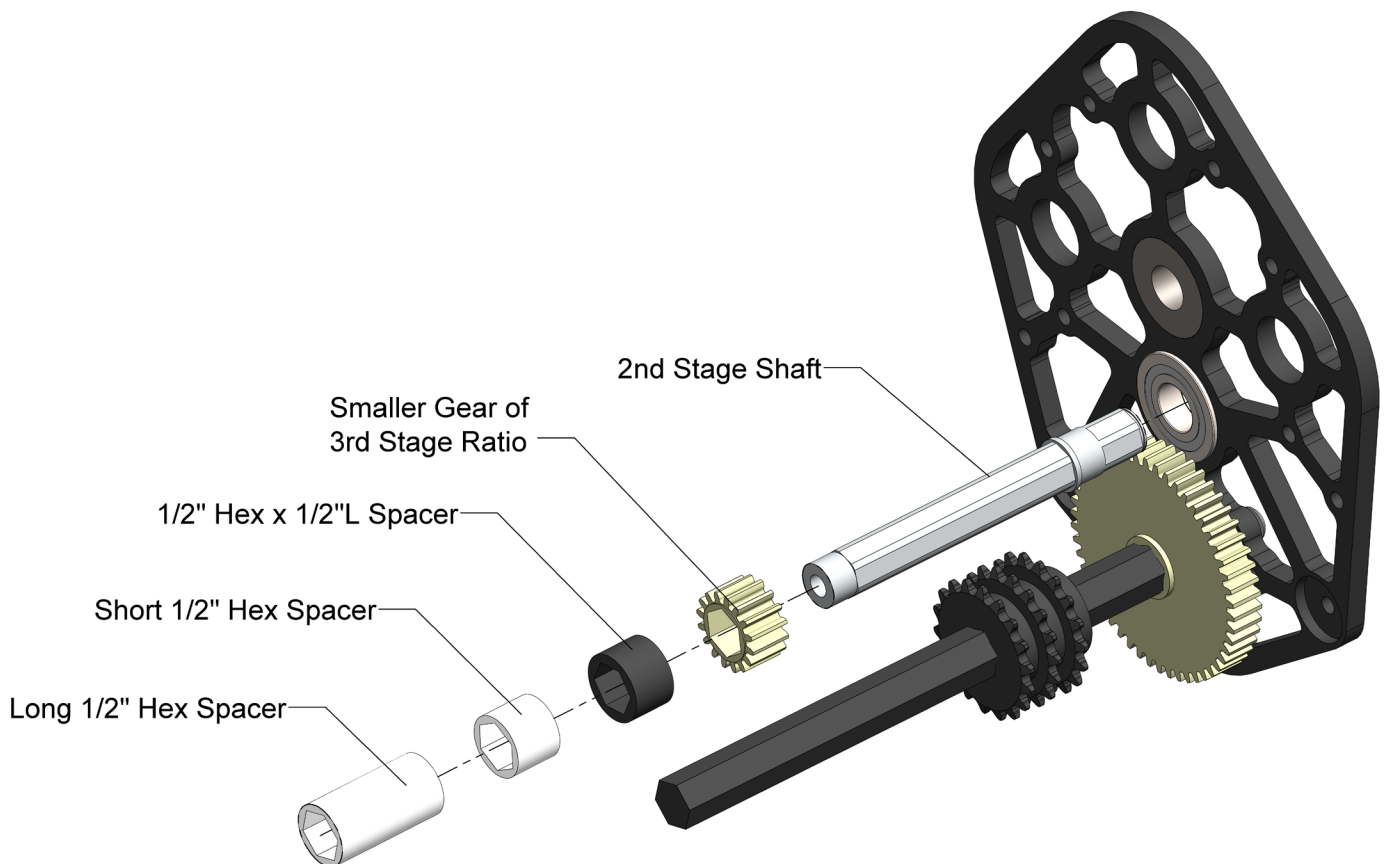


Step 6 (Single Speed)

Slide the 2nd Stage Shaft into the 1/2" ThunderHex bearing as seen below.

Slide the desired gear and spacers into place.

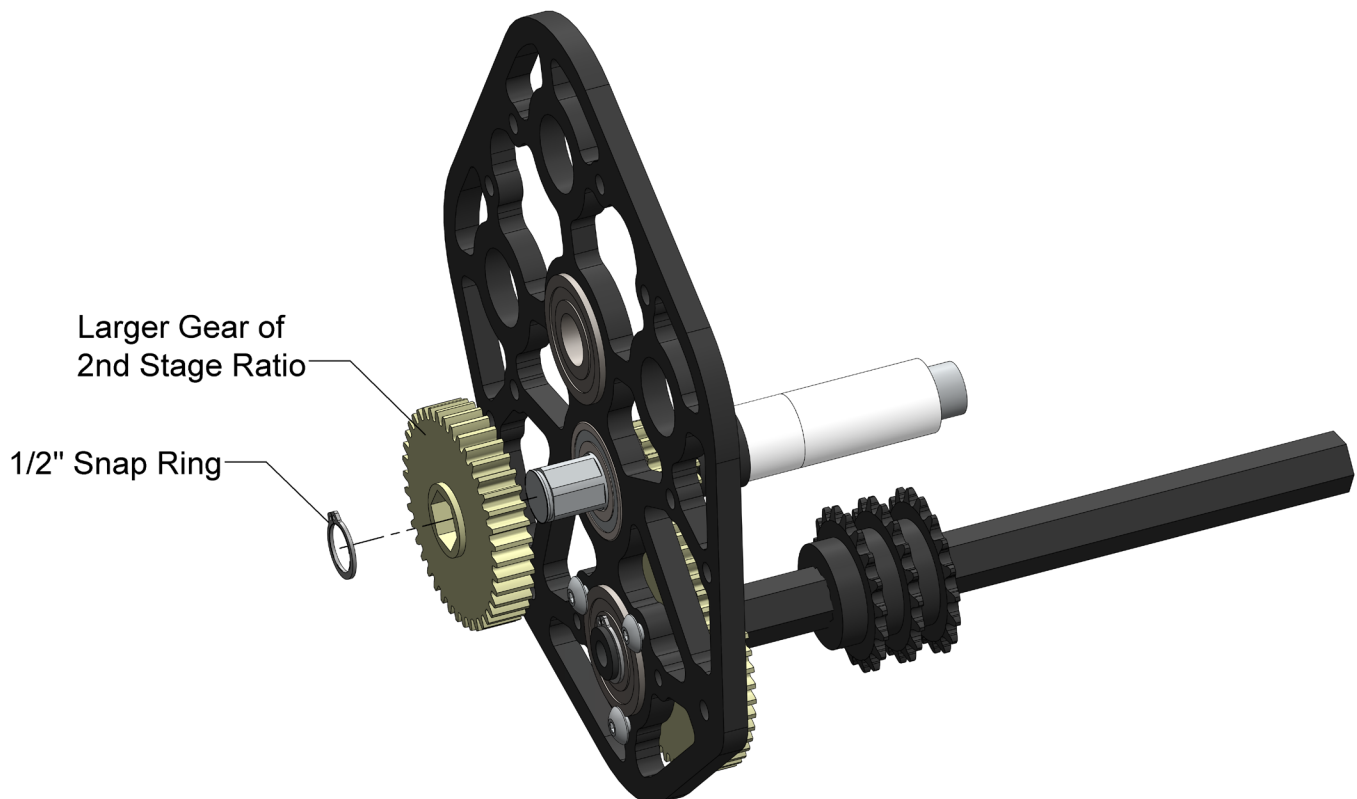
Note: Spacers are not included in the kit. Teams are responsible for buying/making the appropriate spacers. It is recommended for teams the 3d print these so multiple spacers need not be stacked.





Step 7 (Single Speed)

Install the larger gear for the 2nd stage ratio onto the 2nd stage shaft. Retain with a 1/2" snap ring.



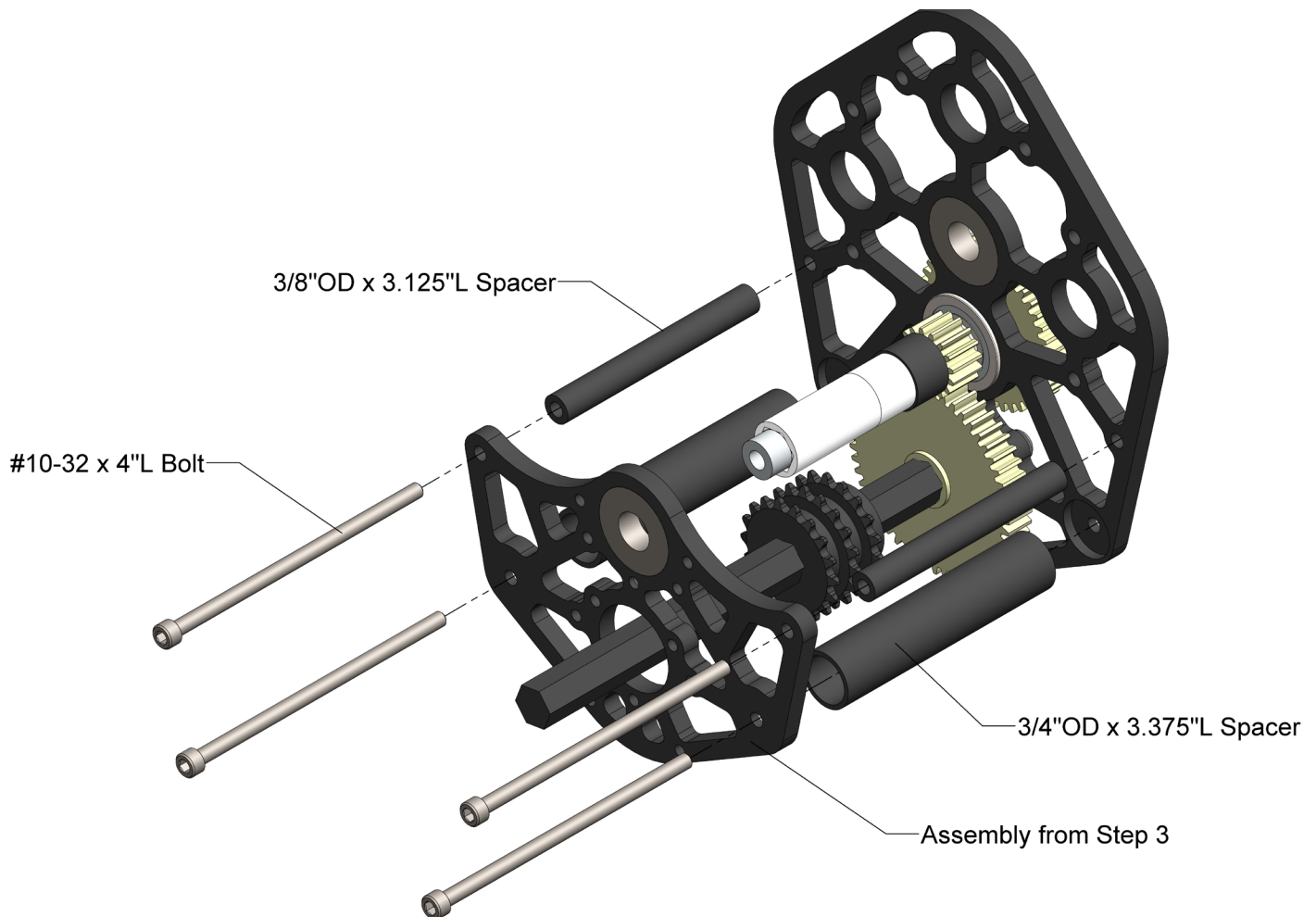


Step 8 (Single Speed)

Install spacers and the Gearbox Mounting Plate assembly from Step 3.

The c-bores on the Gearbox Mounting Plate should face the c-bores on the Motor Mounting Plate. The larger OD spacers need to be fully seated in these c-bores for the plates to be spaced correctly apart.

Install the four #10-32 x 4"L bolts.

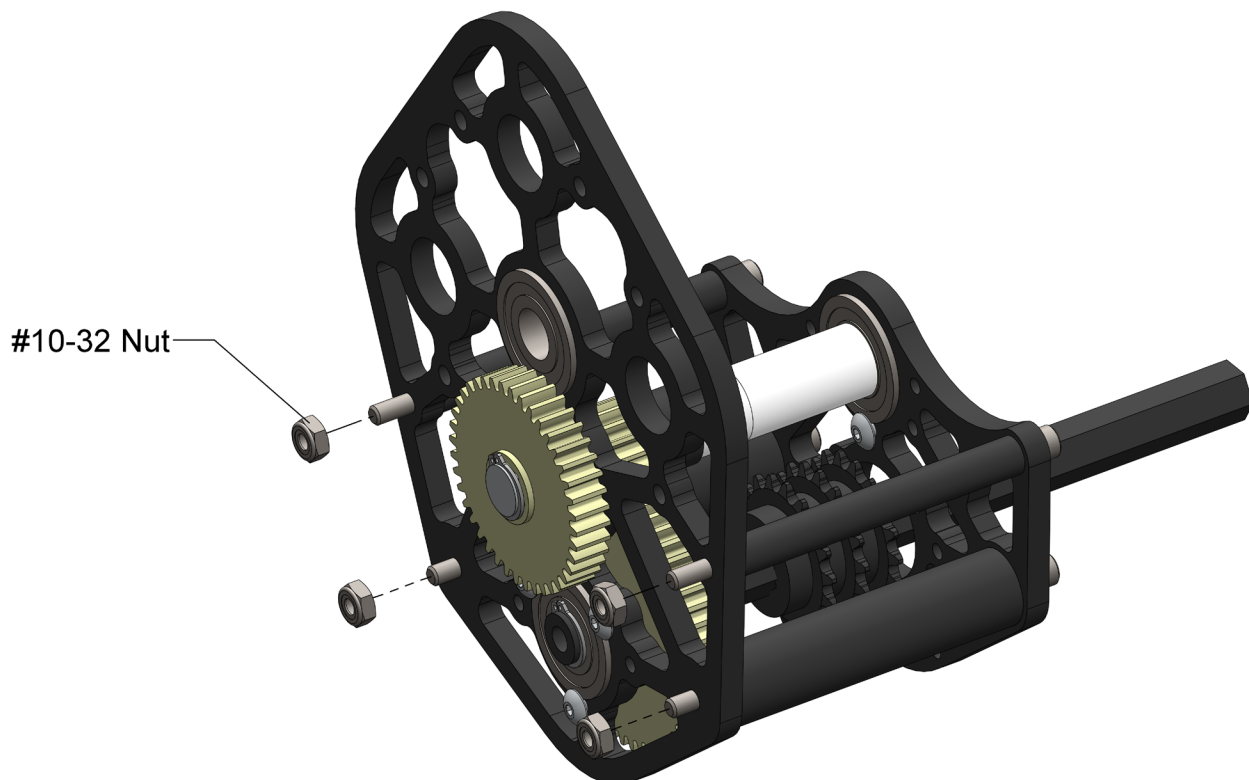




Step 9 (Single Speed)

Install the four #10-32 nuts. Tighten the top two nuts fully.

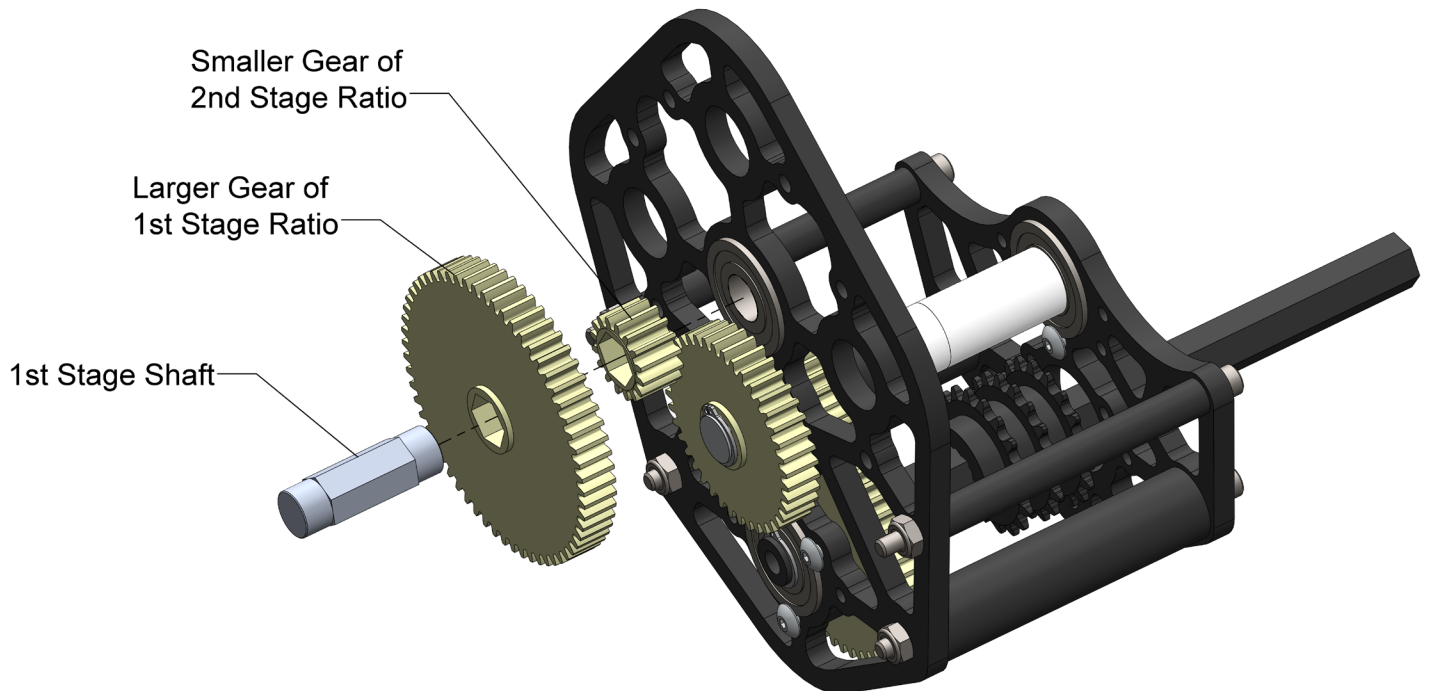
Leave the bottom nuts loose as they will have to be removed when the gearbox is installed into the drive-train.





Step 10 (Single Speed)

Install the 1st Stage Shaft with the appropriate gears.



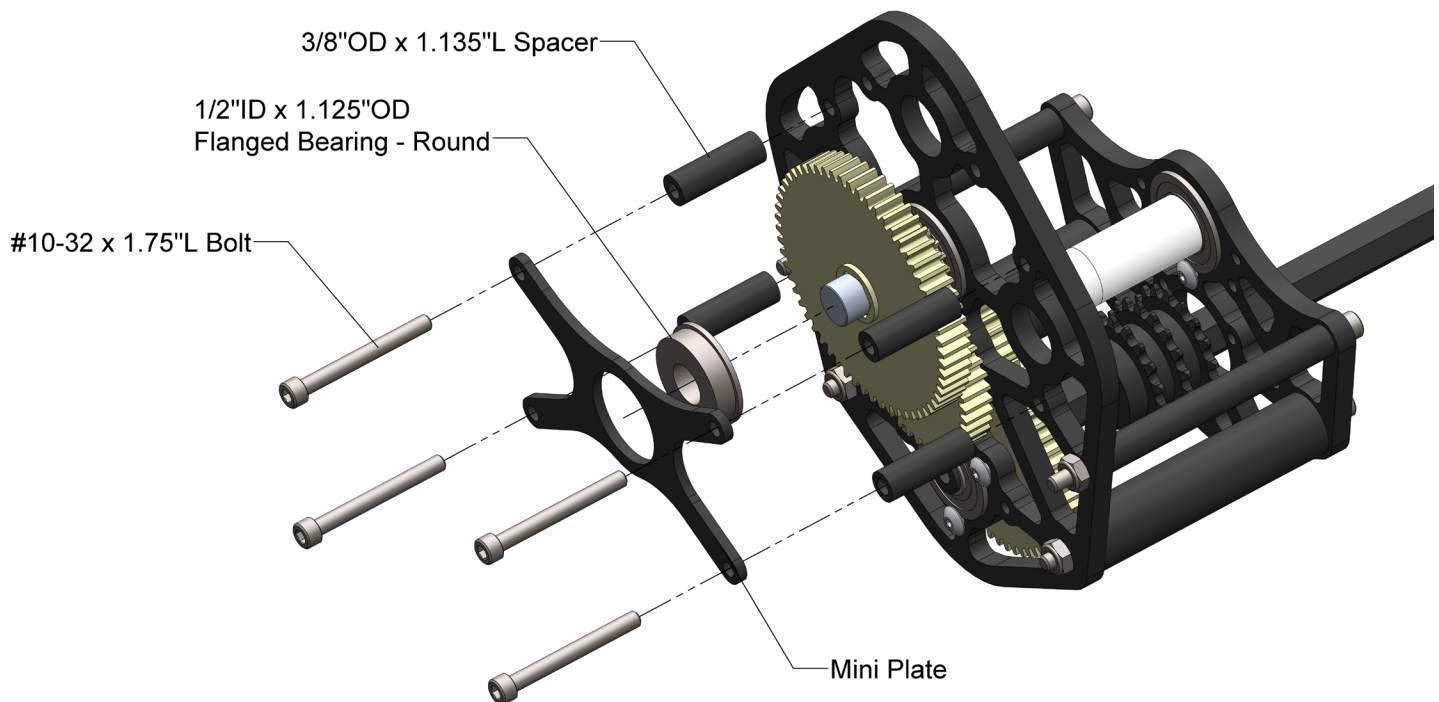


Step 11 (Single Speed)

Press 1/2" Round Bearing into 1st Stage Plate.

The 1st Stage Plate only lines up in one position. Bolts will not line up properly with the correct holes if the plate is in the wrong orientation.

Install the four #10-32 x 1.75"L bolts and spacers. The bolts will thread into the motors.





Step 12 (Single Speed)

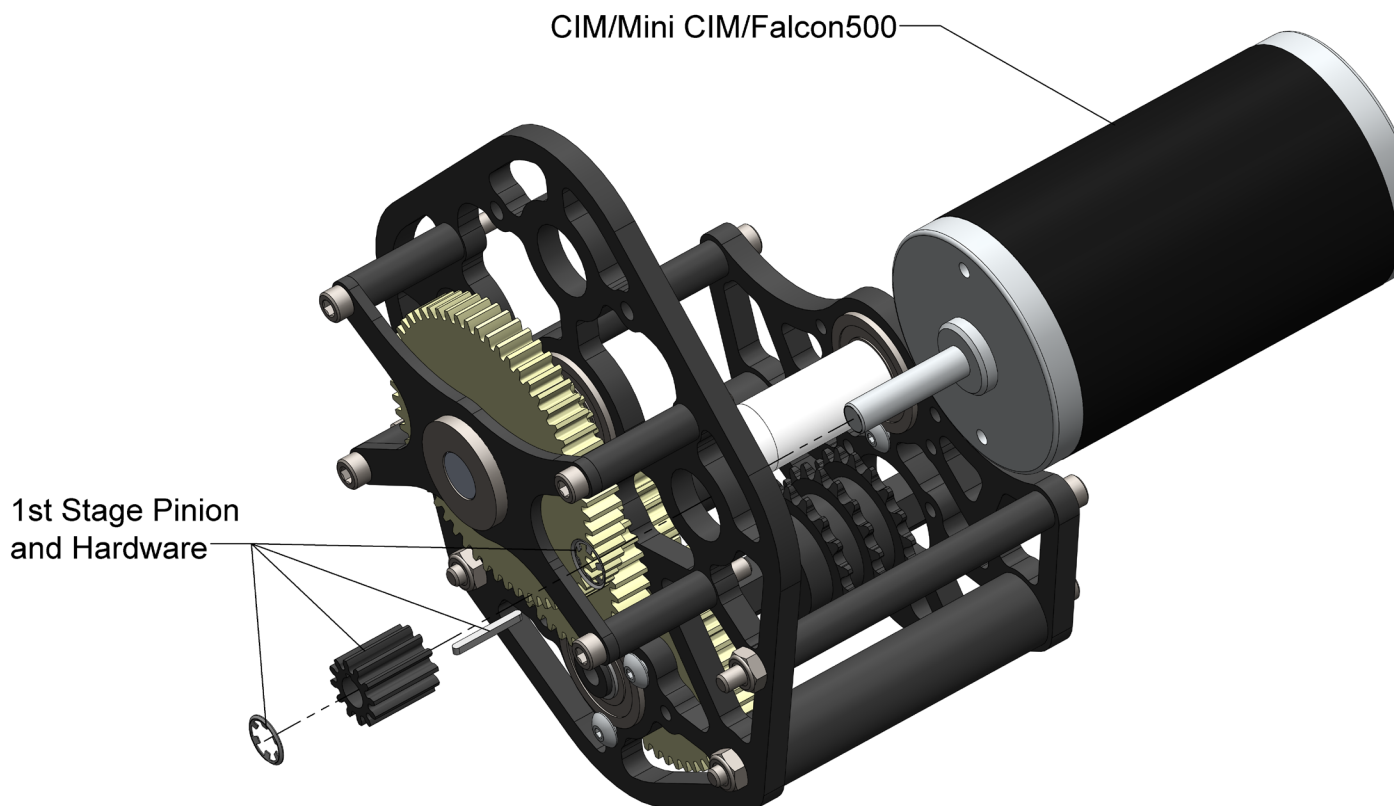
Install the desired motor and pinion options. If the pinions are smaller than the boss of the motor, they may be installed before the motor is bolted to the gearbox.

Install the desired amount of motors and their corresponding hardware.

If only two motors are used, install them so that they use the bolts that hold the 1st stage shaft in place.

The 3rd motor will need two additional #10-32 x 1/2" L bolts.

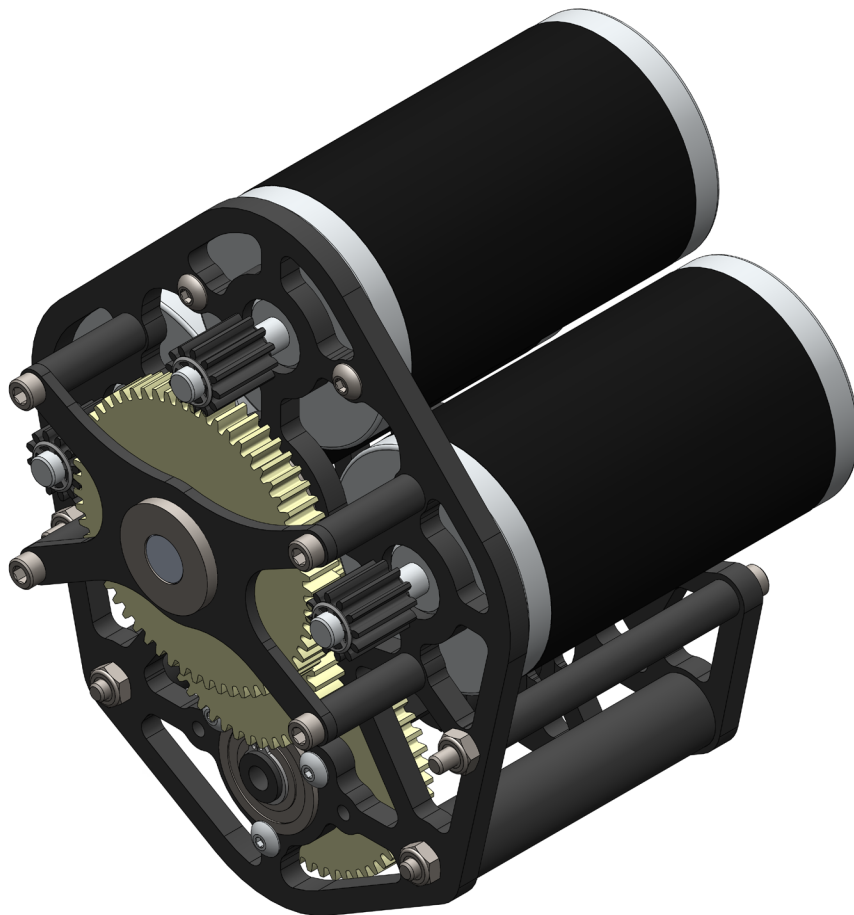
Note: Use Loctite to help retain the bolts.








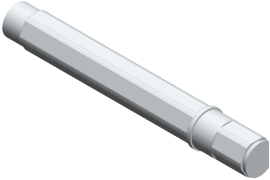
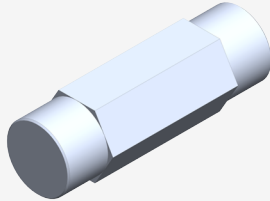
Single Speed Final

Before installing into the drive train, spin the output shaft by hand to ensure that the gearbox spins smoothly. It is recommended to apply the desired grease or lubricant now as opposed to after final installation in the robot.





Kit Contents (Single Speed and Dog Shifter)

Picture	Name	QTY	Kit
	Motor Plate	1	Base Kit
	Back Plate	1	Base Kit
	Mini Plate	1	Base Kit
	2nd Stage Shaft	1	Base Kit
	1st Stage Shaft	1	Base Kit

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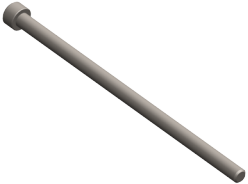
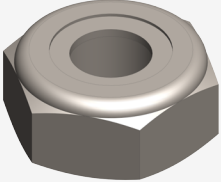
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Picture	Name	QTY	Kit
	Spacer - Long Top (3/8"OD x 3.125"L)	2	Base Kit
	Spacer - Long Bottom (3/4"OD x 3.375"L)	2	Base Kit
	Spacer - Mini Plate (3/8"OD x 1.135"L)	4	Base Kit
	1/2" Round Bearing	4	Base Kit
	1/2" ThunderHex Bearing	1	Base Kit


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Picture	Name	QTY	Kit
	1/2" Snap Ring	2	Base Kit
	#10-32 x 1/4"L Bolt	4	Base Kit
	#10-32 x 1.75"L Bolt	4	Base Kit
	#10-32 x 4"L Bolt	4	Base Kit
	#10-32 Nut	4	Base Kit

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Picture	Name	QTY	Kit
	Fiber Washer	1	Base Kit



Recommended Parts to Buy (DS Version)

Picture	Name	QTY
	Low Gear Dog Gear (1/2" ThunderHex Bearing)	1
	High Gear Dog Gear (1/2" ThunderHex Bearing)	1
	1/2" Hex Gear (Low Gear)	1
	1/2" Hex Gear (High Gear)	1
	Larger Gear of 2nd Stage Ratio	1






Recommended Parts to Buy

Picture	Name	QTY
	Small Gear of 2nd Stage Ratio	1
	Large Gear of 1st Stage Ratio	1
	Motor Pinion w/ Hardware	1-3
	Motor (CIM/Mini CIM/Falcon500)	1-3
	Sprockets	1-3

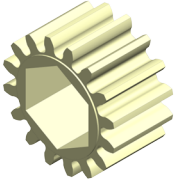
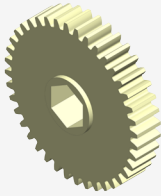
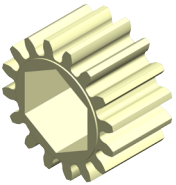
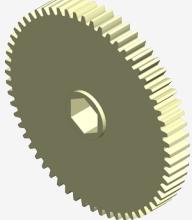


Recommended Parts to Buy

Picture	Name	QTY
	WCP DS - Pneumatic Hardware Kit	1
	WCP DS - Shifter Dog Kit	1
	Pancake Pneumatic Cylinder, 3/4\" Bore, 1/2\" Travel	1
	WCP DS - Standard Output Shaft	1



Recommended Parts to Buy (SS Version)

Picture	Name	QTY
	Large Gear of 3rd Stage Ratio	1
	Small Gear of 3rd Stage Ratio	1
	Large Gear of 2nd Stage Ratio	1
	Small Gear of 2nd Stage Ratio	1
	Large Gear of 1st Stage Ratio	1



Recommended Parts to Buy

Picture	Name	QTY
	Motor Pinion w/ Hardware	1-3
	Motor (CIM/Mini CIM/Falcon500)	1-3
	WCP SS - Output Shaft	1
	1/2" Acetal Spacer - 1/2" Hex (10-pack)	1
	Sprockets	1-3



Optional Accessories

Picture	Name	QTY
	WCP Flipped Gearbox (2 Motor Plate)	1
	WCP Metal Shifter Cone	1
	VersaBlock v2	1
	WCP Gearbox Bearing Block	1



FAQ

Q: Is this gearbox compatible with ball shifter hardware?

A: Currently this is not an option but will be in a future revision.

Q: Can I switch between the dual speed and Single Speed version of this gearbox without purchasing a new gearbox?

A: Yes! The gearbox was designed with teams in mind knowing that they may want to switch between these version during a season or from season to season. There is no need to buy a new gearbox if you want to switch between Single and Dual Speed.



Revision Table

Revision Date	Revision #	Description
8/27/2020	1.1	First revision created.