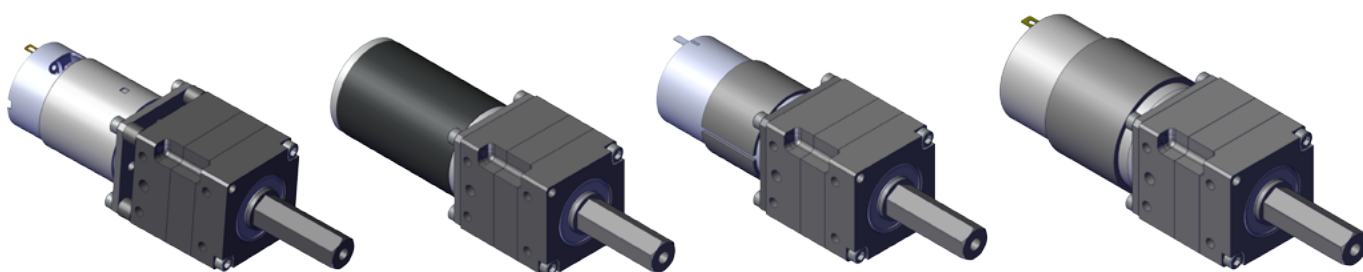
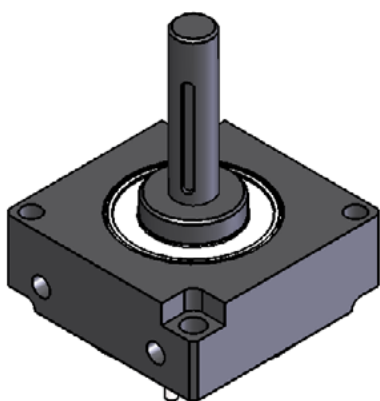


VersaPlanetary User's Guide

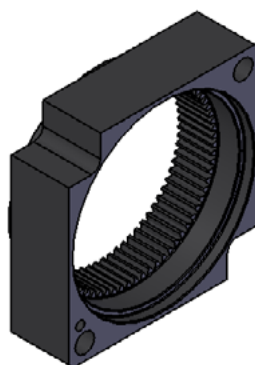


What's Included

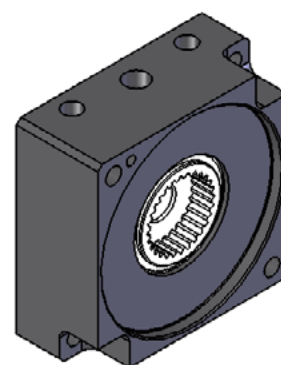
3:1 VersaPlanetary P/N 217-2724



Front Housing With CIM
Motor Output Shaft (1X)



Ring Gear (1X)



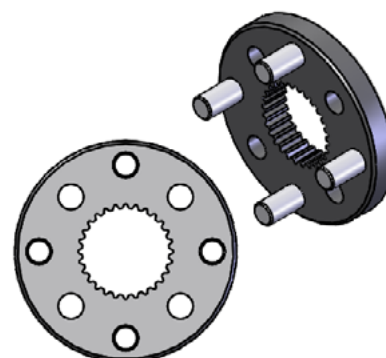
Back Housing (1X)



8-32 x 1-1/4" Screw (2X)



36 Tooth Sun Gear (1X)

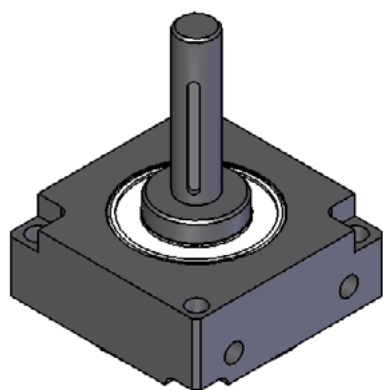


3:1 Carrier Plate (1X)

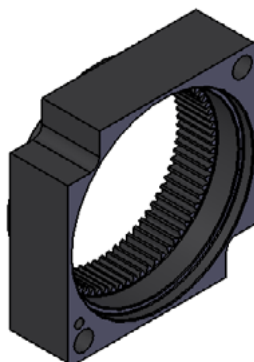


18 Tooth Planet Gear (4X)

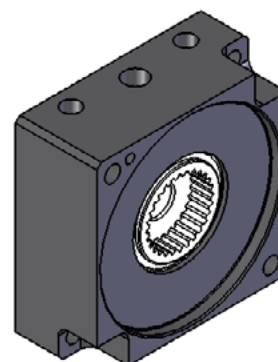
4:1 VersaPlanetary P/N 217-2725



Front Housing With CIM
Motor Output Shaft (1X)



Ring Gear (1X)



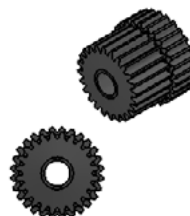
Back Housing (1X)



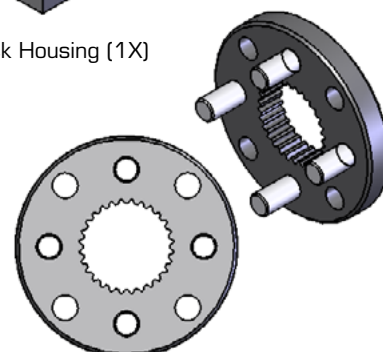
8-32 x 1-1/4" Screw (2X)



24 Tooth Planet Gear (4X)

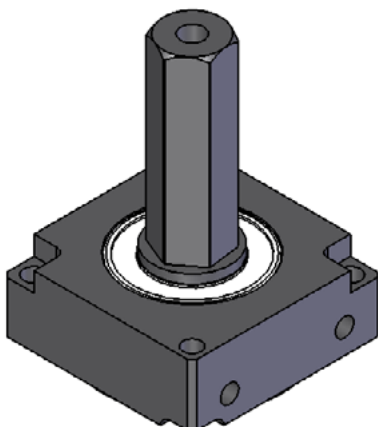


36 Tooth Sun Gear (1X)

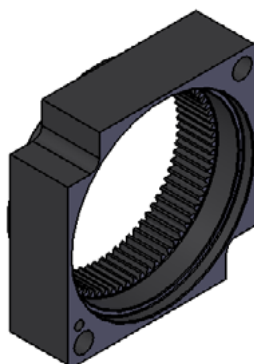


4:1 Carrier Plate (1X)

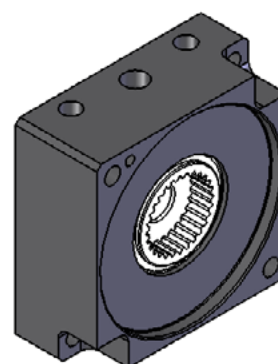
5:1 VersaPlanetary P/N 217-2526



Front Housing With 1/2"
Hex Output Shaft (1X)



Ring Gear (1X)



Back Housing (1X)



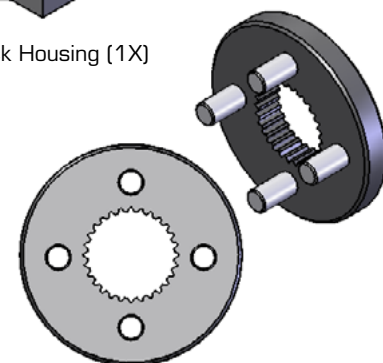
8-32 x 1-1/4"
Screw (2X)



18 Tooth Sun Gear (1X)

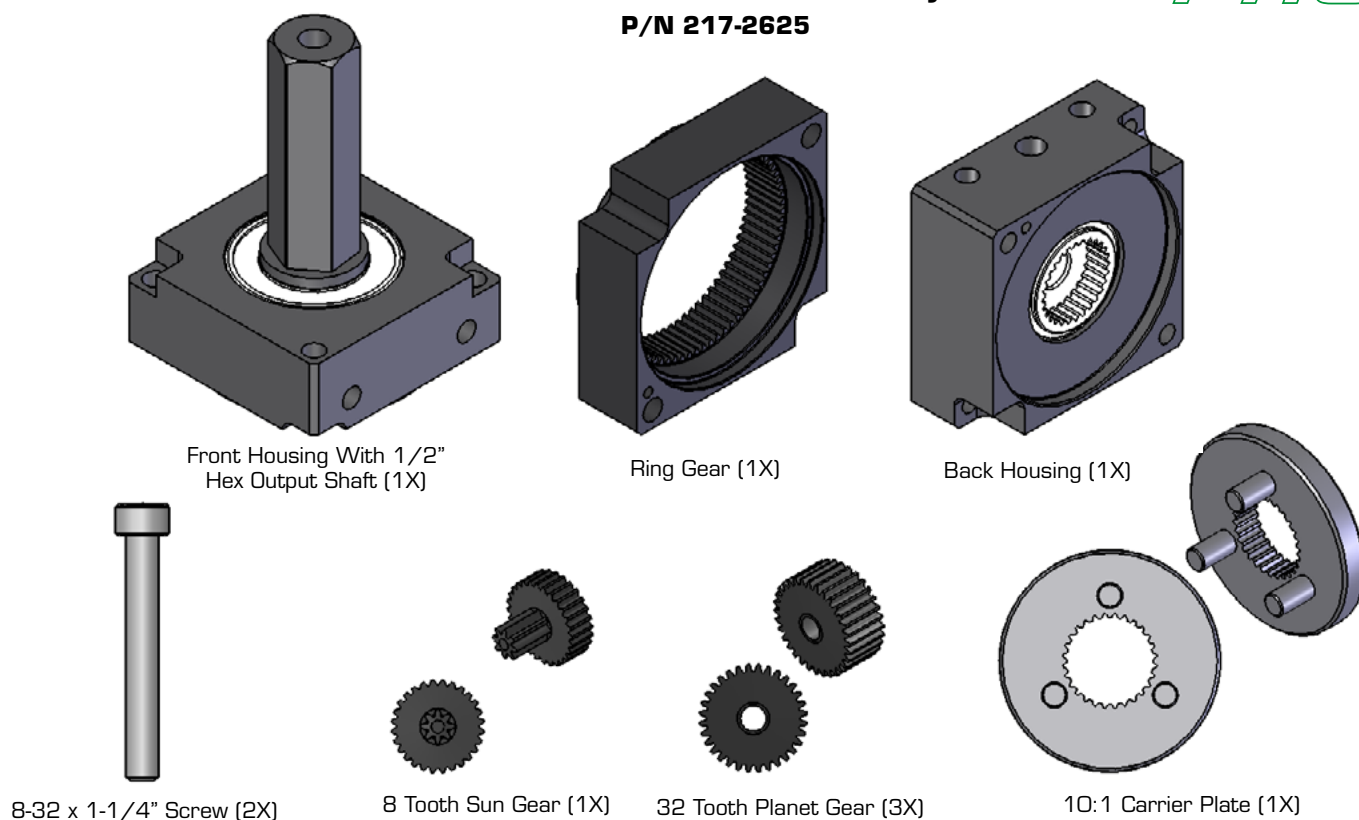


27 Tooth Planet Gear (4X)

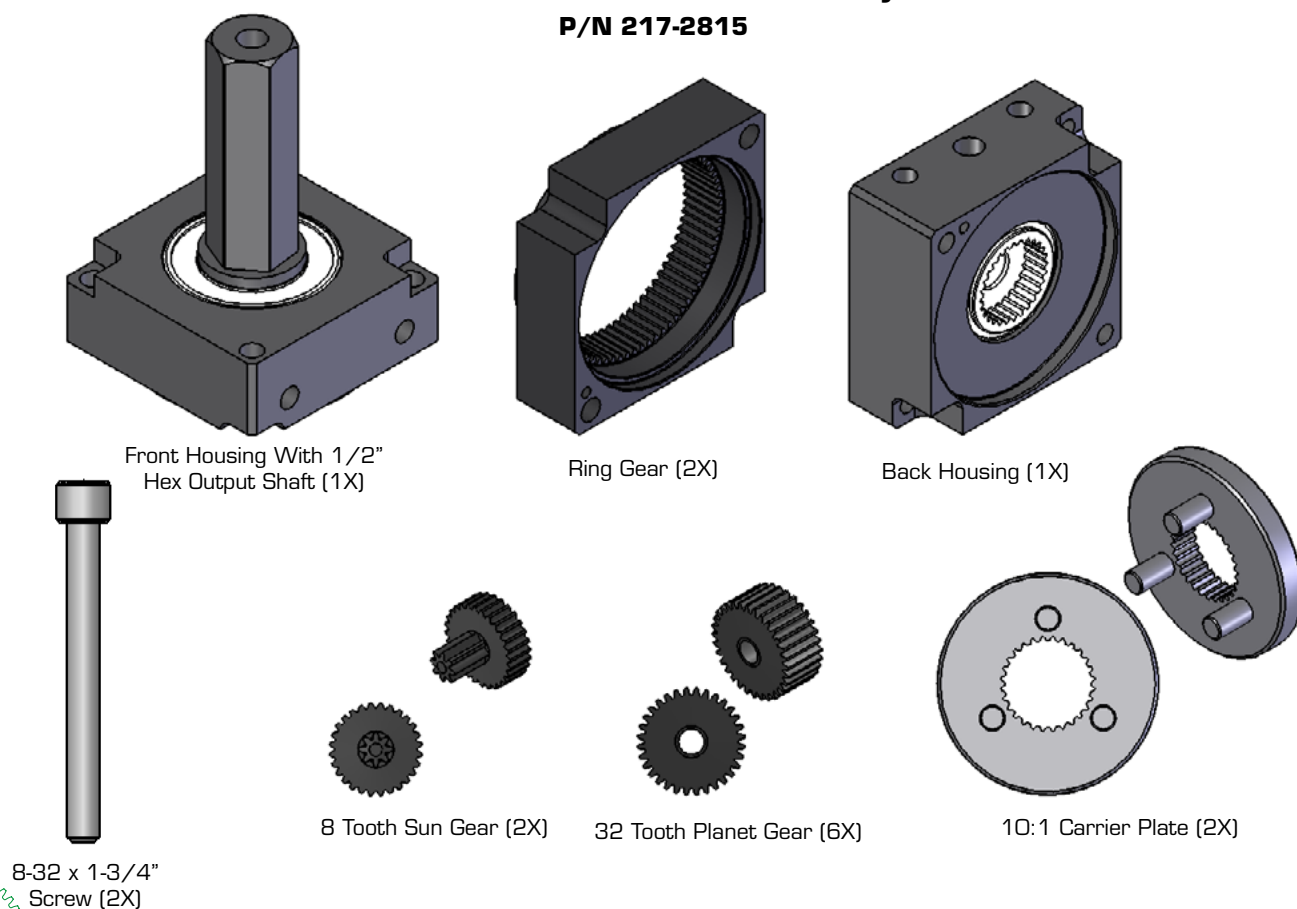


5:1 Carrier Plate (1X)

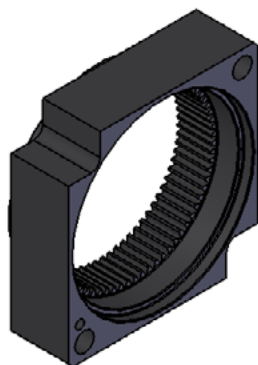
10:1 VersaPlanetary P/N 217-2625



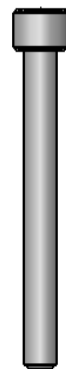
100:1 VersaPlanetary P/N 217-2815



Ring Gear Add-On Kit P/N 217-2816



Ring Gear (2X)



8-32 x 1-3/4"
Screw (2X)

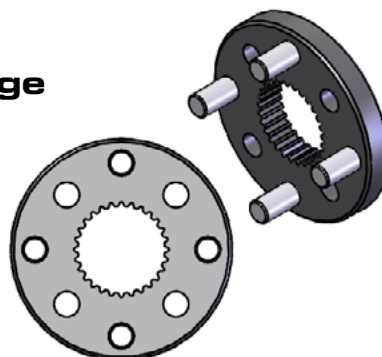
3:1 Gear Change P/N 217-2817



36 Tooth Sun Gear (1X)



18 Tooth Planet Gear (4X)

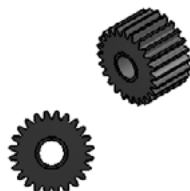


3:1 Carrier Plate (1X)

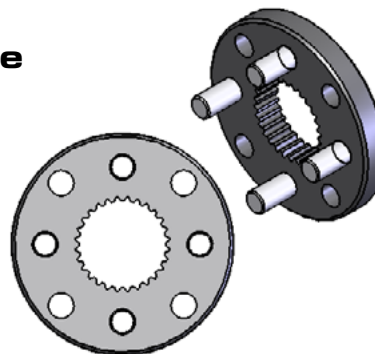
4:1 Gear Change P/N 217-2818



36 Tooth Sun Gear (1X)



24 Tooth Planet Gear (4X)

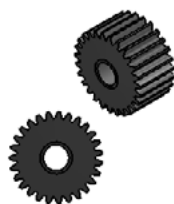


4:1 Carrier Plate (1X)

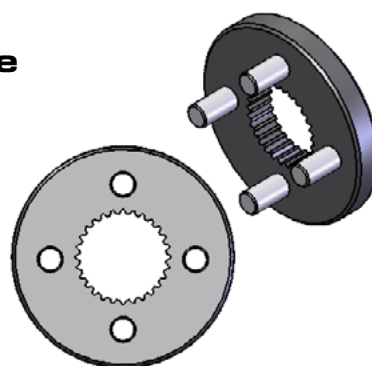
5:1 Gear Change P/N 217-2819



18 Tooth Sun Gear (1X)

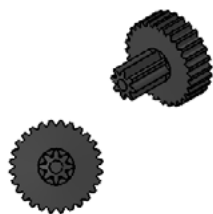


27 Tooth Planet Gear (4X)

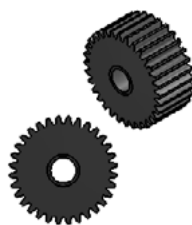


5:1 Carrier Plate (1X)

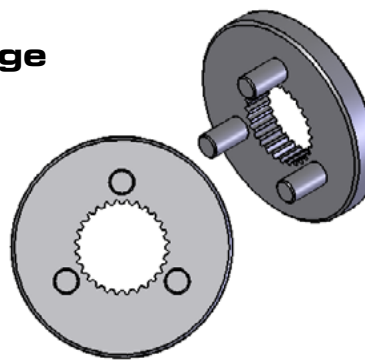
10:1 Gear Change P/N 217-2820



8 Tooth Sun Gear (1X)



32 Tooth Planet Gear (3X)



10:1 Carrier Plate (1X)

Motor Mount Kit P/N 217-2822



M3 x 8mm (2X)



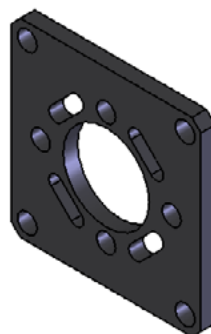
M4 x 10mm (2X)



8-32 x 1/2" (4X)



8-32 x 7/8" (4X)



Motor Mounting
Plate (2X)



3/8" Motor Plate
Spacer (4X)



1/4" Motor Plate
Spacer (4X)



BAG Motor Collar (1X)



RS-550 Motor Collar (1X)



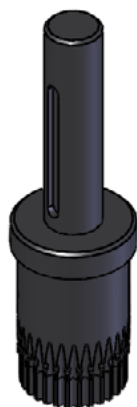
RS-775 Motor Collar (1X)



AM-9015 Motor Collar (1X)

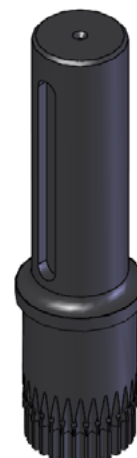
Note: The RS-550 Collar and AM-9015 Collar are very similar. Check to see which fits best on your motor shaft. Use the tightest one that still fits.

**CIM Motor
Output Shaft Kit**
P/N 217-2893



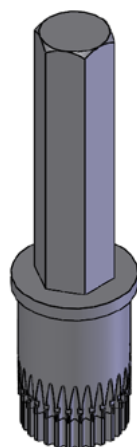
CIM Motor
Output Shaft (1X)

**1/2" with 1/8" Keyway
Output Shaft Kit**
P/N 217-2895



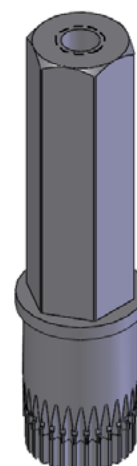
1/2" with 1/8" Keyway
Output Shaft (1X)

**3/8" Hex
Output Shaft Kit**
P/N 217-2894



3/8" Output Shaft
(1X)

**1/2" Hex Output
Shaft Kit**
P/N 217-2897



1/2" Output Shaft
(1X)

Motor Mounting with BAG, RS-775, RS-550 or AM-9015 Motors

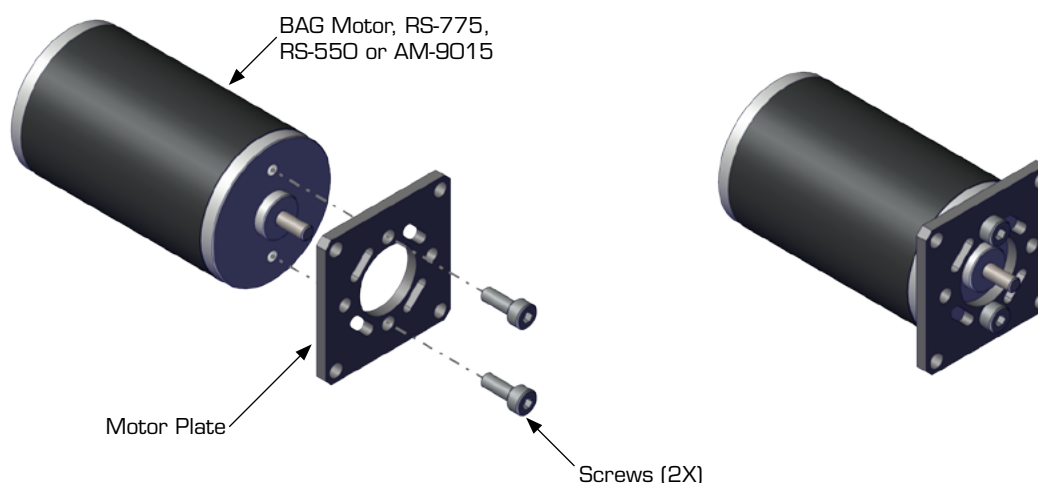
What you will need:

2mm or 2.5mm Hex Key

3/32" Hex Key

Compatible Motor

Note: VEXPro VersaPlanetary Gearboxes are not designed for use without grease. Users should add a coating of white lithium grease before use to ensure performance and maximize product life.

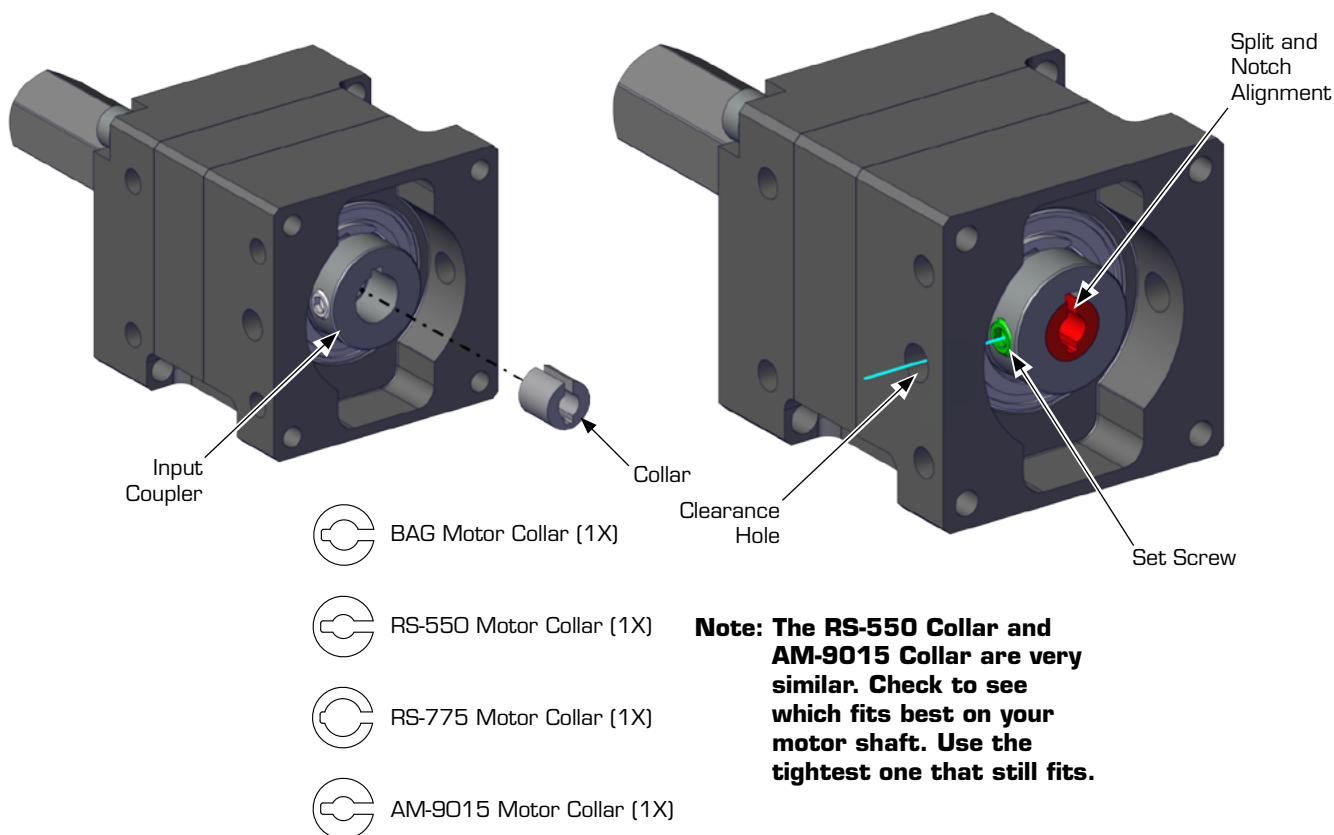


Step 1:

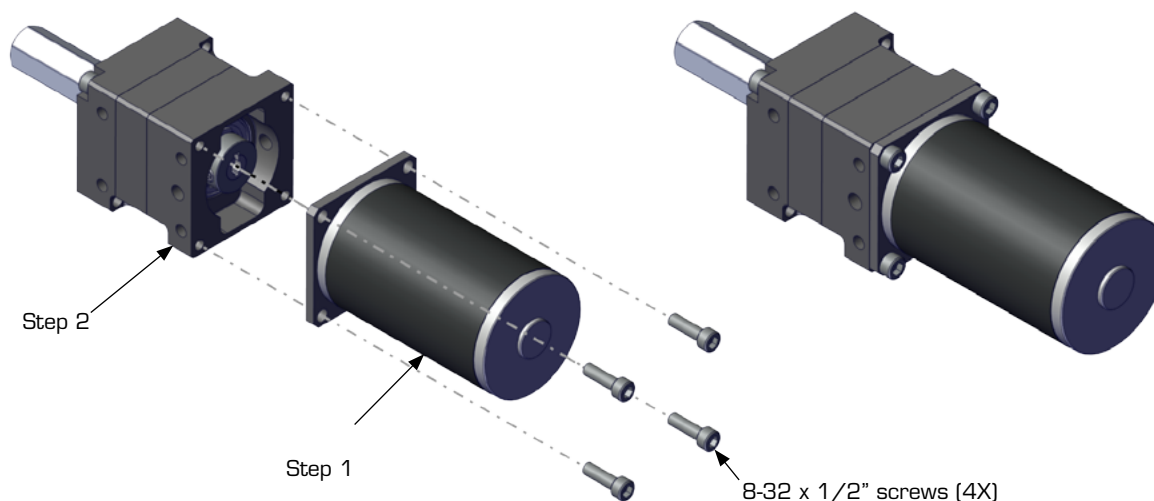
Note: If Using an AM-9015 motor with a VersaPlanetary 10:1 as the first stage, proceed to "VersaPlanetary Assembly with AM-9015 Motor and 10:1 First Stage" on page 3.

Use (2X) Screws to mount the Motor to the Motor Plate as shown.

Motor	Screws
BAG Motor	M4 x 10mm
RS-550	M3 x 8mm
RS-775	M4 x 10mm
AM-9015	M3 x 8mm

**Step 2:**

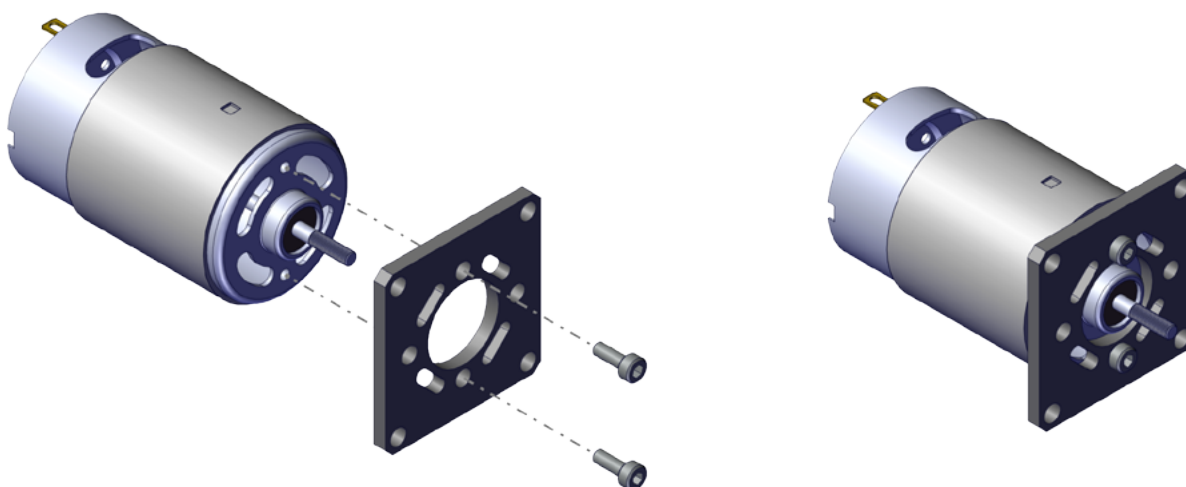
Insert the appropriate Collar into the Input Coupler as shown. Take note of the orientation of the Collar (highlighted Red) and the Set Screw (highlighted green). The "split" in the Collar should align with the notch in the Input Coupler as shown. The Set Screw should align with the Clearance Hole on side of the Input Housing as illustrated by the blue line. **DO NOT TIGHTEN THE SET SCREW.**

**Step 3:**

To ensure Motor concentricity it is critical that the following processes are done in order.

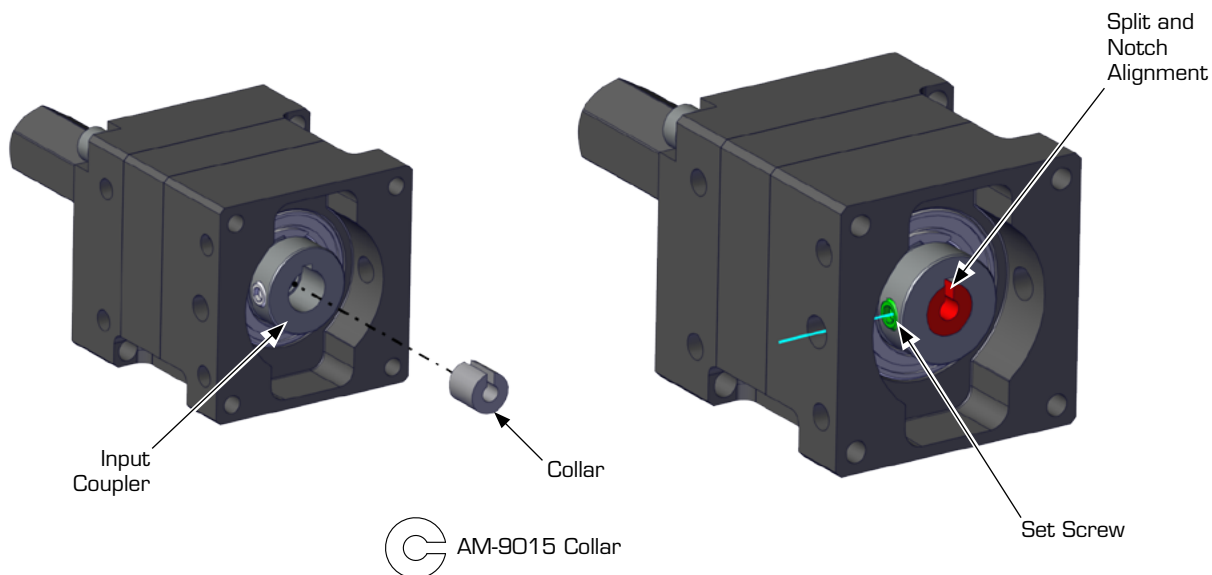
1. Insert the Motor Output Shaft into the Collar. Take care not to rotate the Collar or the Input Coupler.
2. Mount the Step 1 Assembly with (4X) 8-32 x 1/2" Screws.
3. Use a 3/32" Hex Key to tighten the Set Screw.
4. Loosen the (4X) 8-32 x 1/2" Mounting Screws by about 1/4 turn.
5. Re-tighten the (4X) 8-32 x 1/2" Mounting Screws.

VersaPlanetary Assembly with AM-9015 Motor and 10:1 First Stage



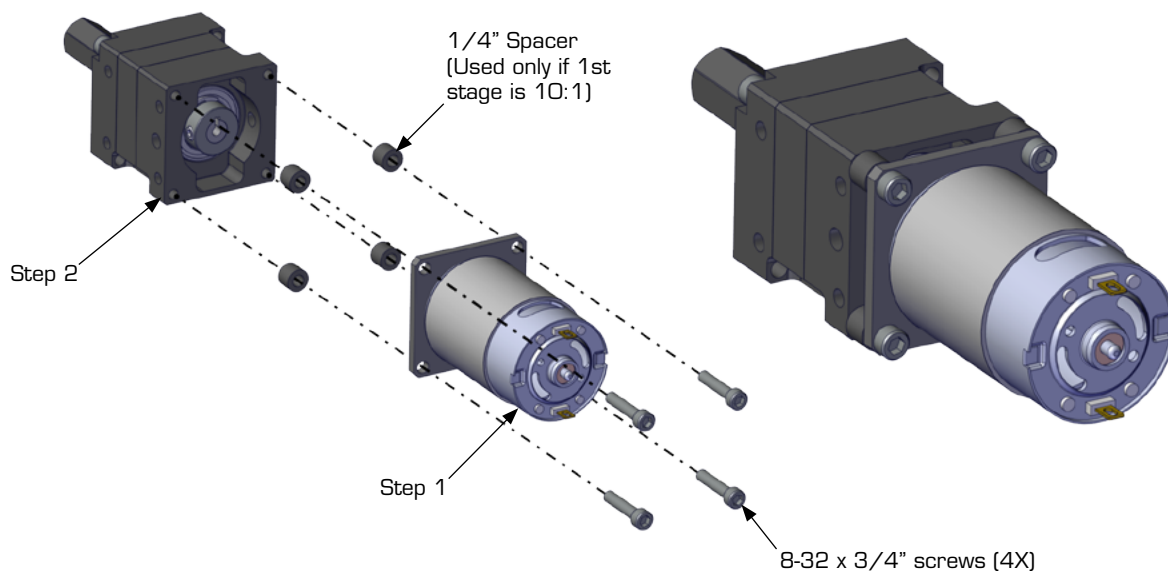
Step 1:

Use (2X) M3 x 8mm screws to mount an AM-9015 Motor to the Motor Plate as shown.



Step 2:

Insert the AM-9015 Collar into the Input Coupler as shown. Take note of the orientation of the Collar and the Set Screw (highlighted green). The "split" in the Collar should align with the notch in the Input Coupler as shown. The Set Screw should align with the Clearance Hole on side of the Input Housing as illustrated by the blue line. **DO NOT TIGHTEN THE SET SCREW.**

**Step 3:**

To ensure Motor concentricity it is critical that the following processes are done in order.

1. Insert the Motor Output Shaft into the Collar. Take care not to rotate the Collar or the Input Coupler.
2. Mount the Step 1 Assembly with (4X) 8-32 x 3/4" Screws and (4X) 1/4" Spacers as shown.
3. Use a 3/32" Hex Key to tighten the Set Screw.
4. Loosen the (4X) 8-32 x 3/4" Mounting Screws by about 1/4 turn.
5. Re-tighten the (4X) 8-32 x 3/4" Mounting Screws.

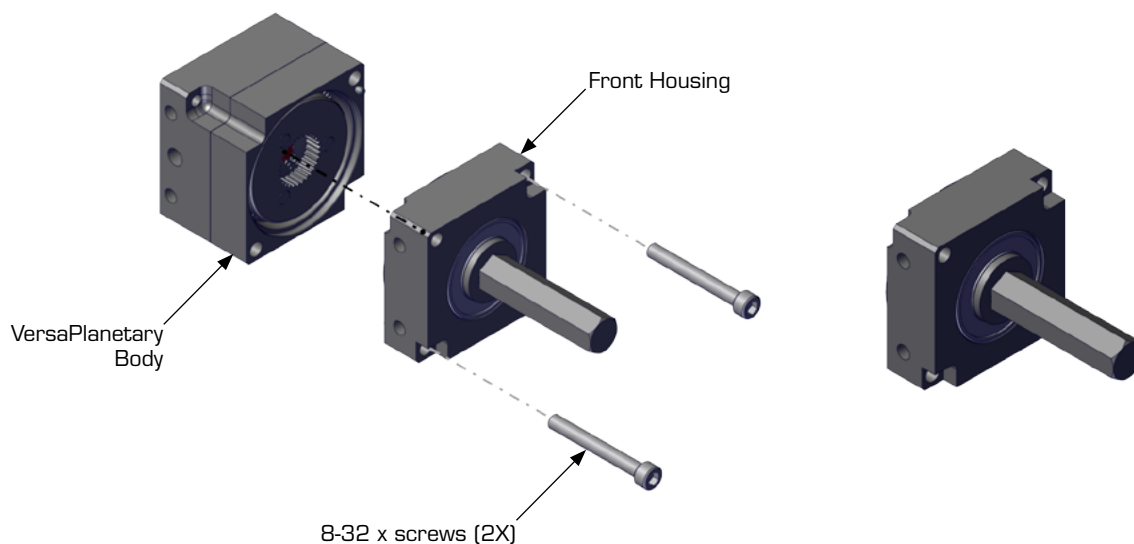
VersaPlanetary Shaft Change

What you will need:

Snap Ring Pliers with tips smaller than .055"

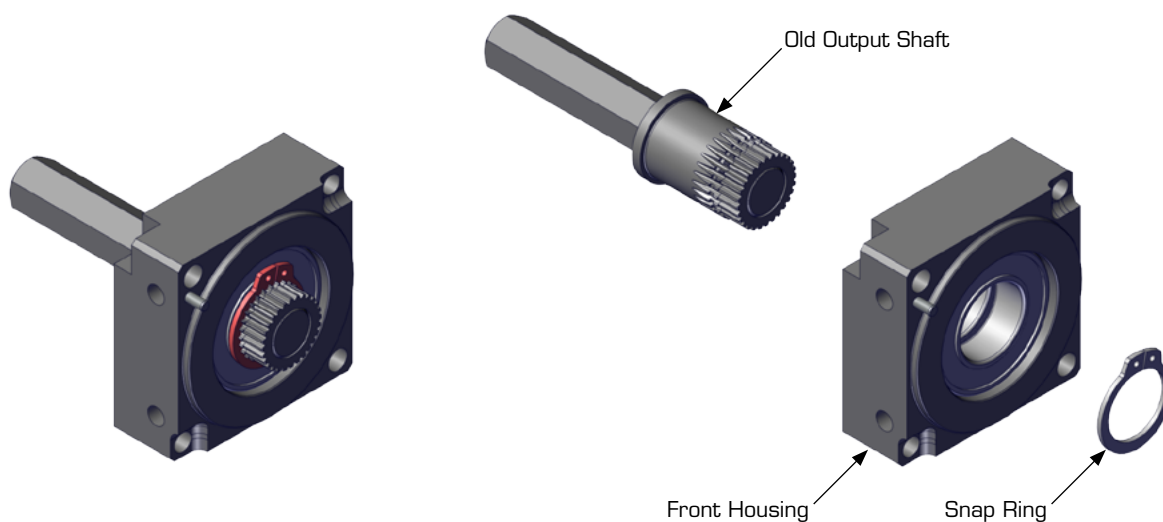
9/64" Hex Key

Alternate VersaPlanetary Output Shaft



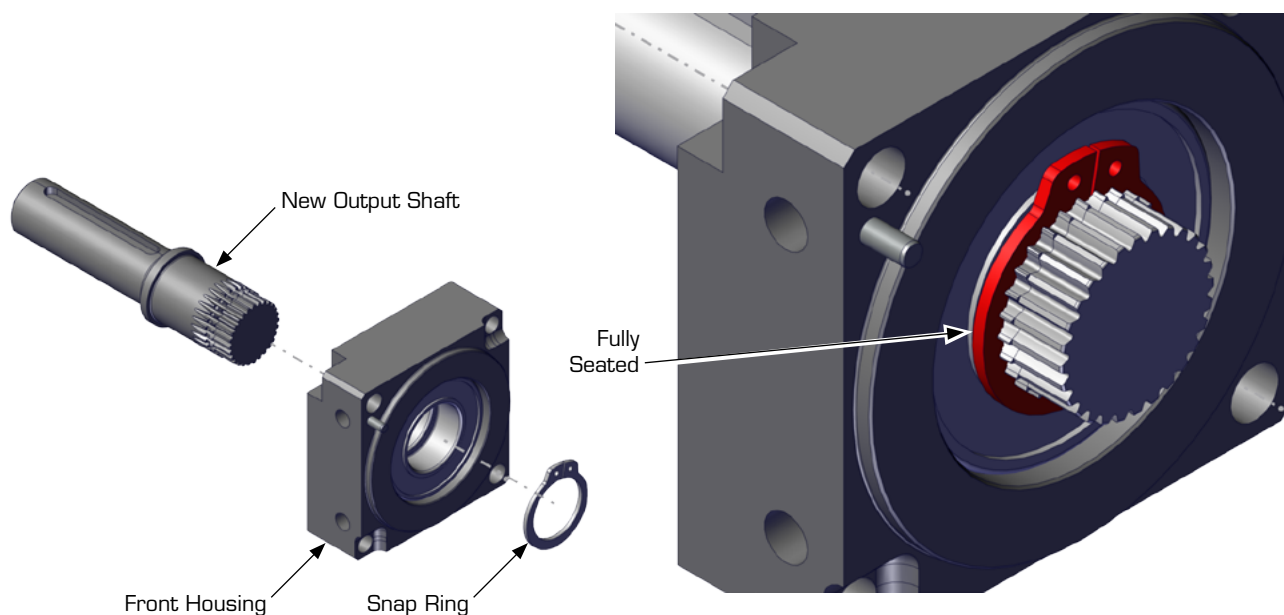
Step 1:

Remove (2X) 8-32 screws from the Front Housing and set the VersaPlanetary Body aside.

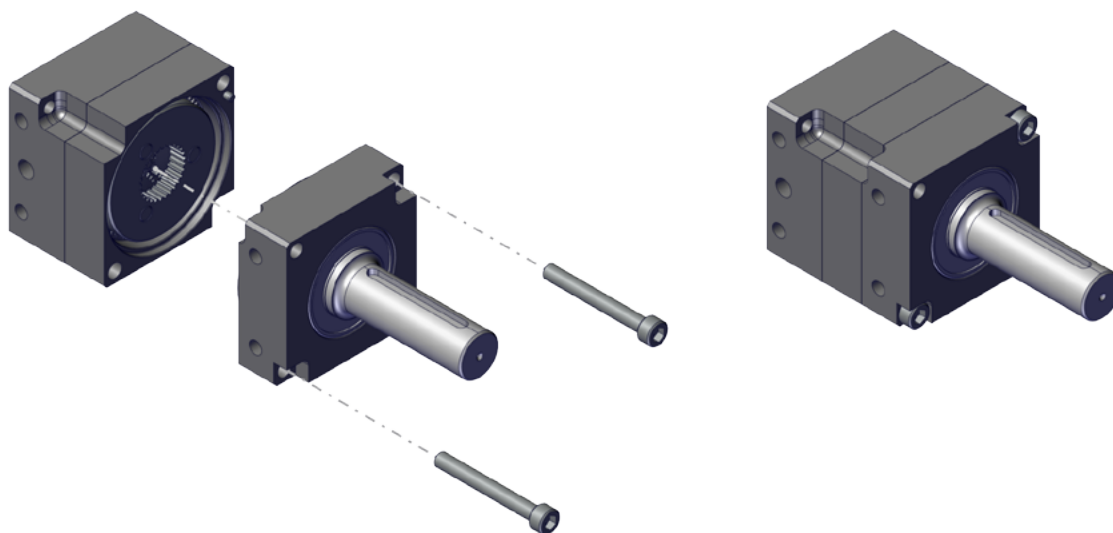


Step 2:

Use Snap Ring Pliers to remove the Snap Ring. Set aside the old output shaft. Take care not to let the bearings slide out of the Front Housing.

**Step 3:**

Insert new Output Shaft and install Snap Ring using Snap Ring Pliers. Ensure that the snap ring is fully seated in the Snap Ring Groove.

**Step 4:**

Mount the Front Housing to the VersaPlanetary Body using the (2X) 8-32 Screws removed in Step 1.

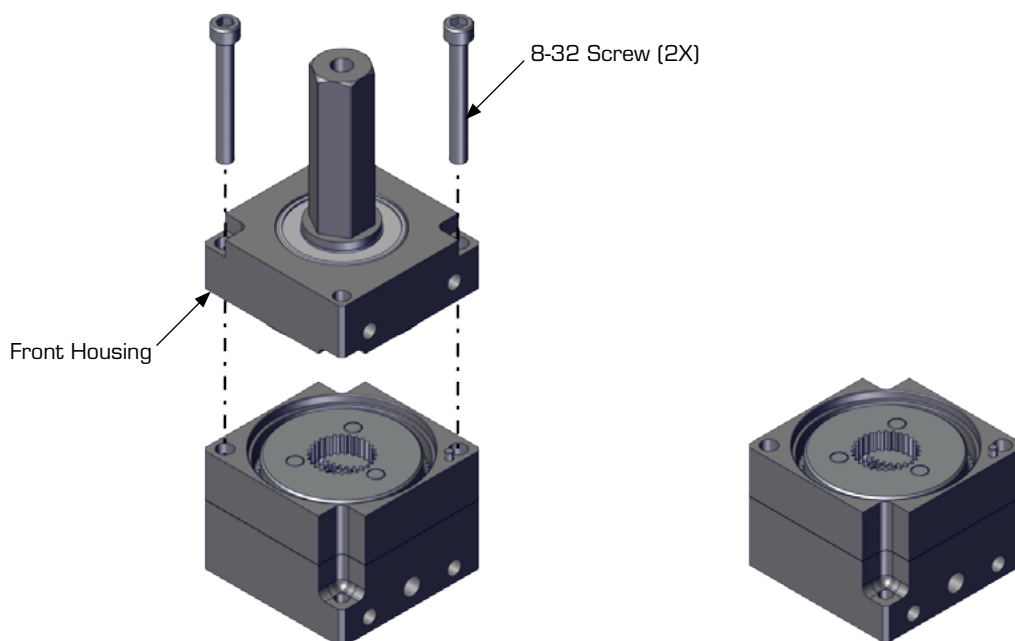
VersaPlanetary Multiple Stage Assembly

What you will need:

9/64" Hex Key

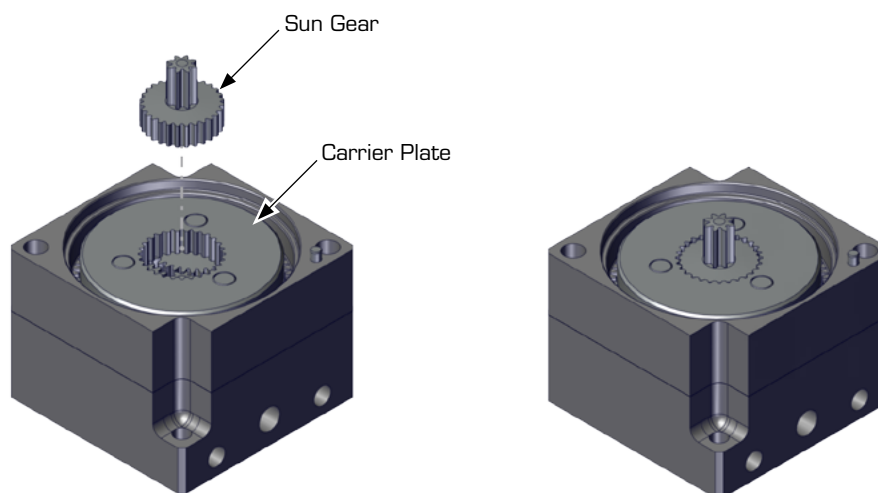
VersaPlanetary Ring Gear Add-On Kit (P/N 217-2816)

VersaPlanetary Gear Kit (P/N 217-2817, 217-2818, 217-2819, 217-2820)



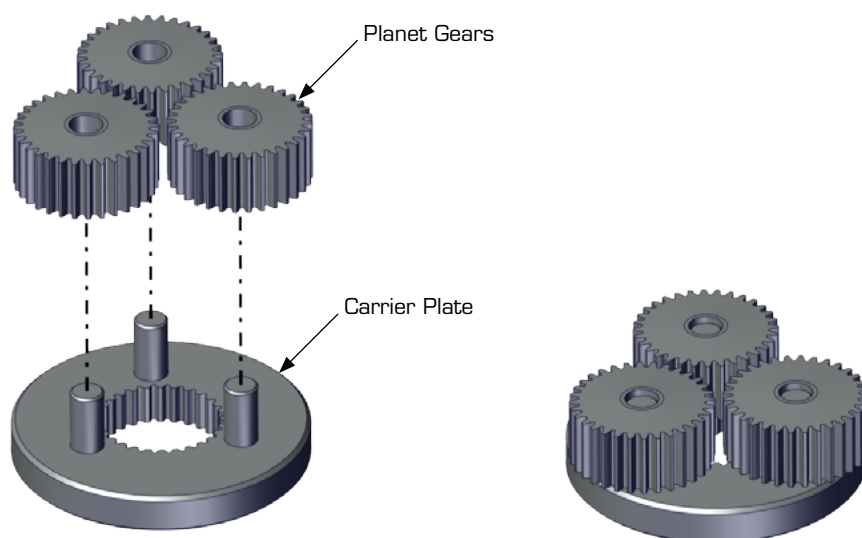
Step 1:

Remove (2X) 8-32 Screws from the VersaPlanetary Front Housing. Set aside the Front Housing.



Step 2:

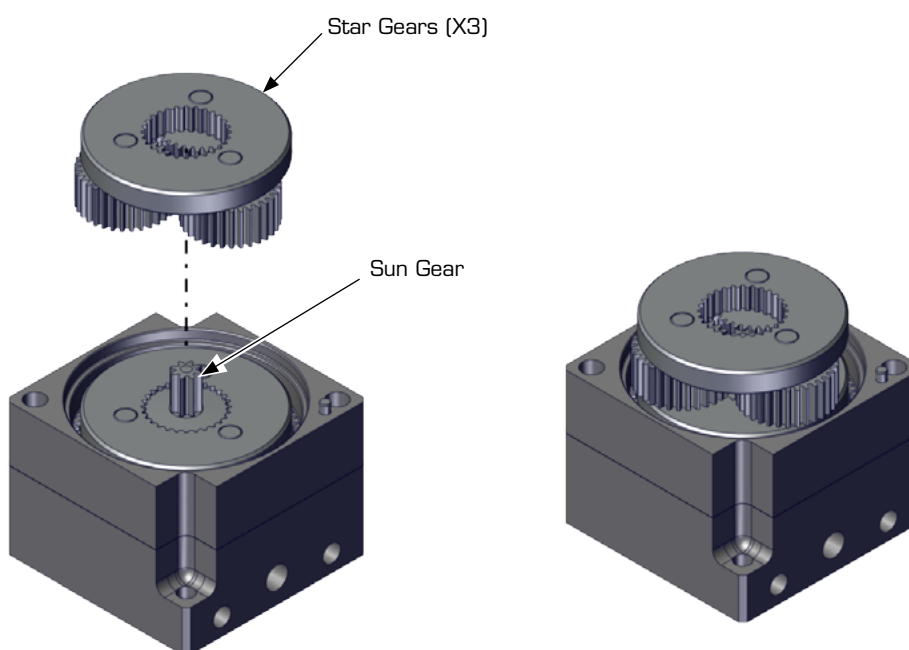
Insert the Sun Gear (included with the user selected Gear Kit) into the Carrier Plate.



Step 3:

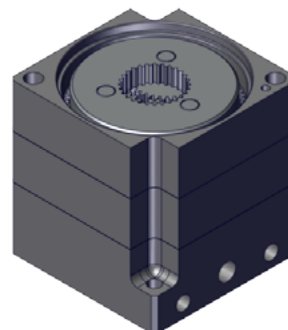
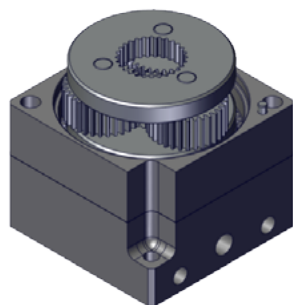
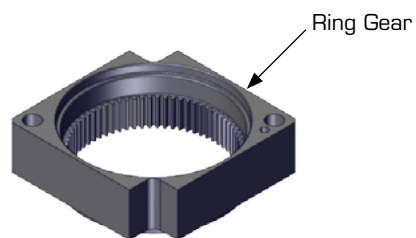
Slide all included Planet Gears onto the Carrier Plate (included with the user selected Gear Kit) as shown.

Step 4:

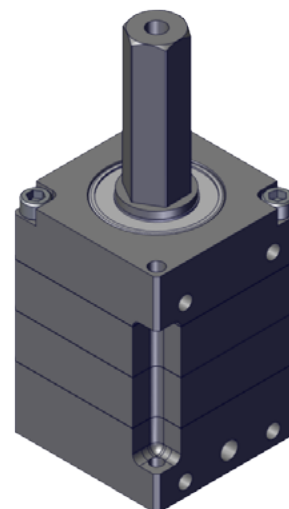
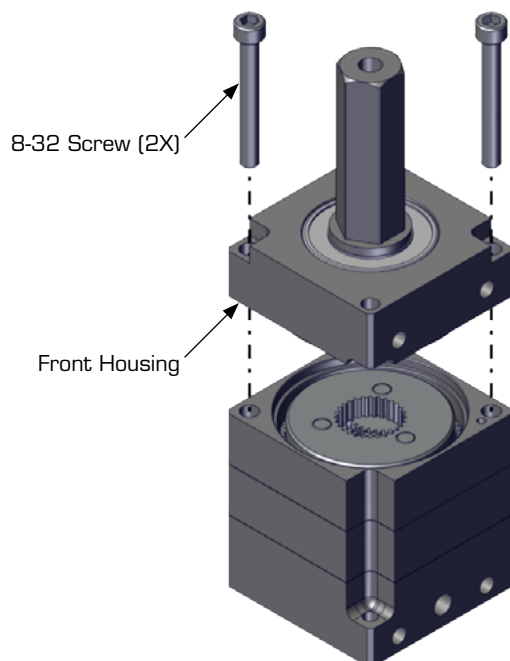


Step 4:

Slide the assembly from Step 3 onto the Sun Gear as shown.

**Step 5:**

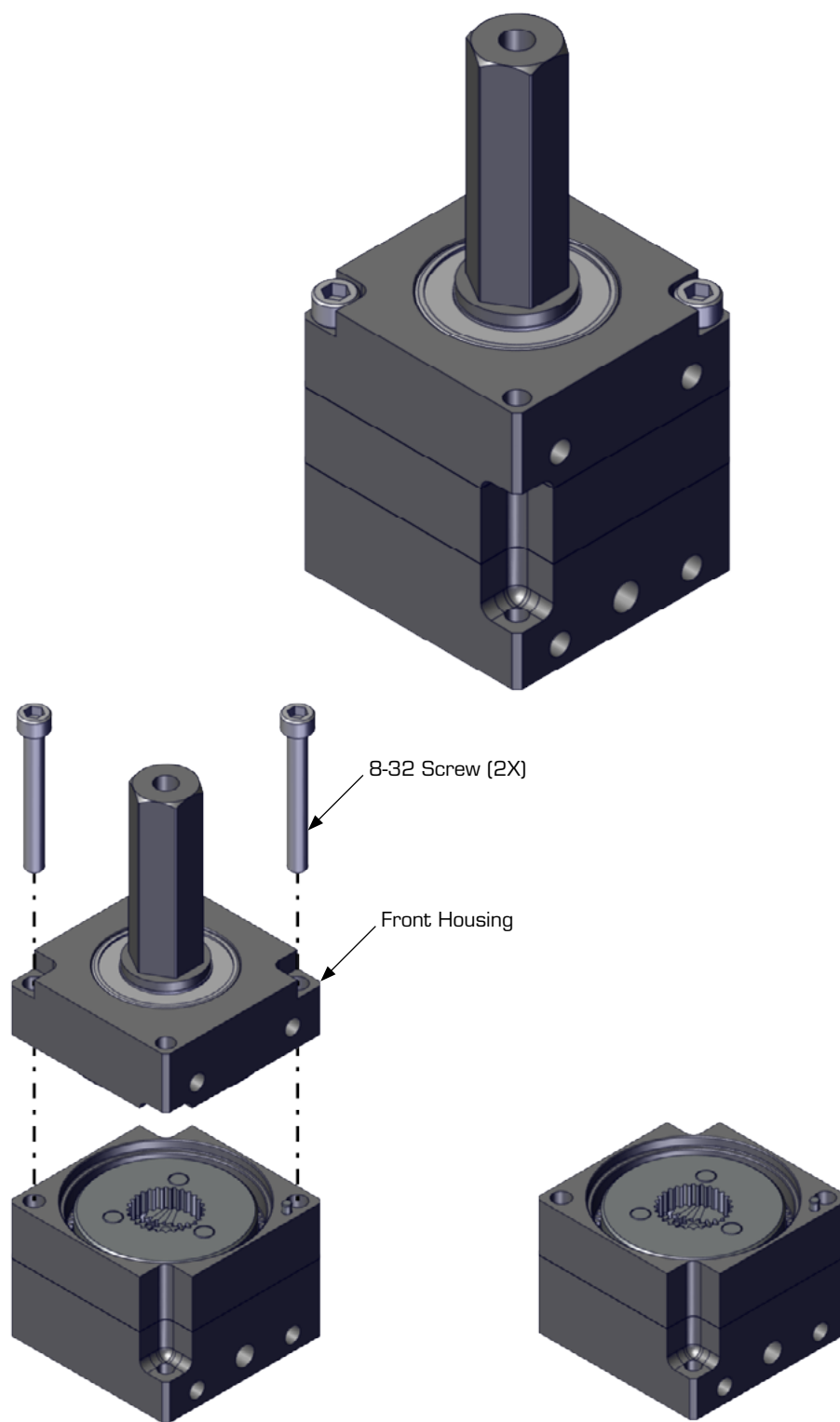
Slide the Ring Gear (included with the VersaPlanetary Ring Gear Add-on Kit) onto the assembly as shown.

**Step 6:**

For a 3 Stage VersaPlanetary, repeat Steps 4 & 5. Otherwise, use (2X) 8-32 Screws to mount the Front Housing as shown.

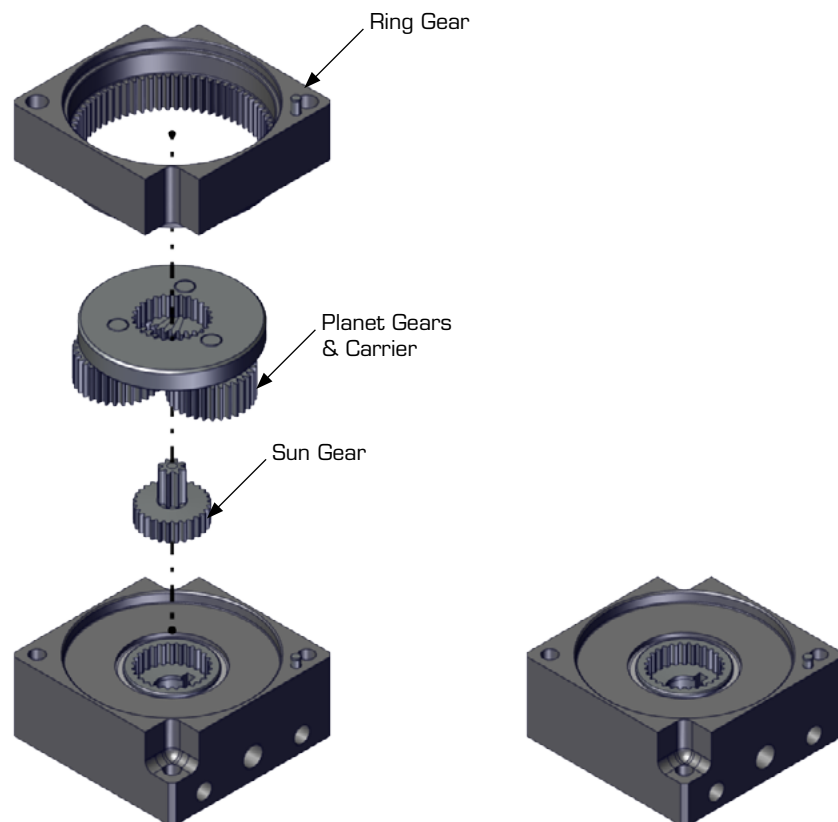
# of Stages	Screw
1	8-32 x 1-1/4"
2	8-32 x 1-3/4"
3	8-32 x 2-1/4"

VersaPlanetary Gear Change

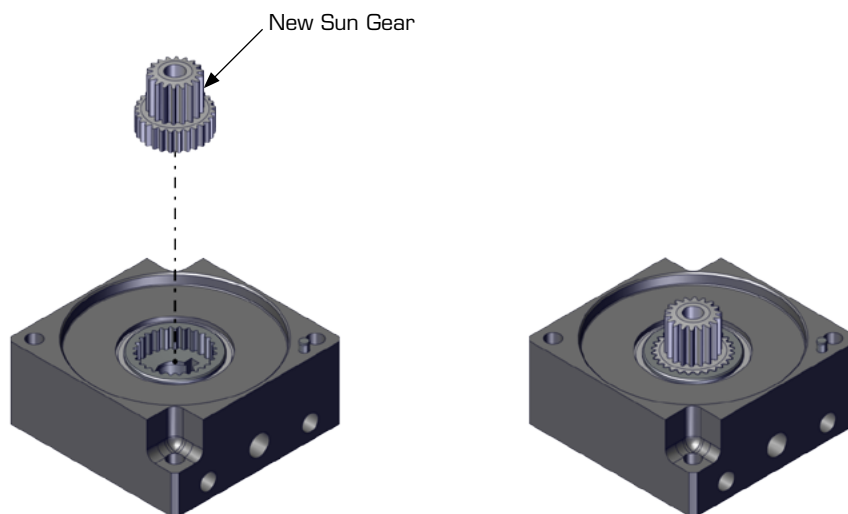


Step 1:

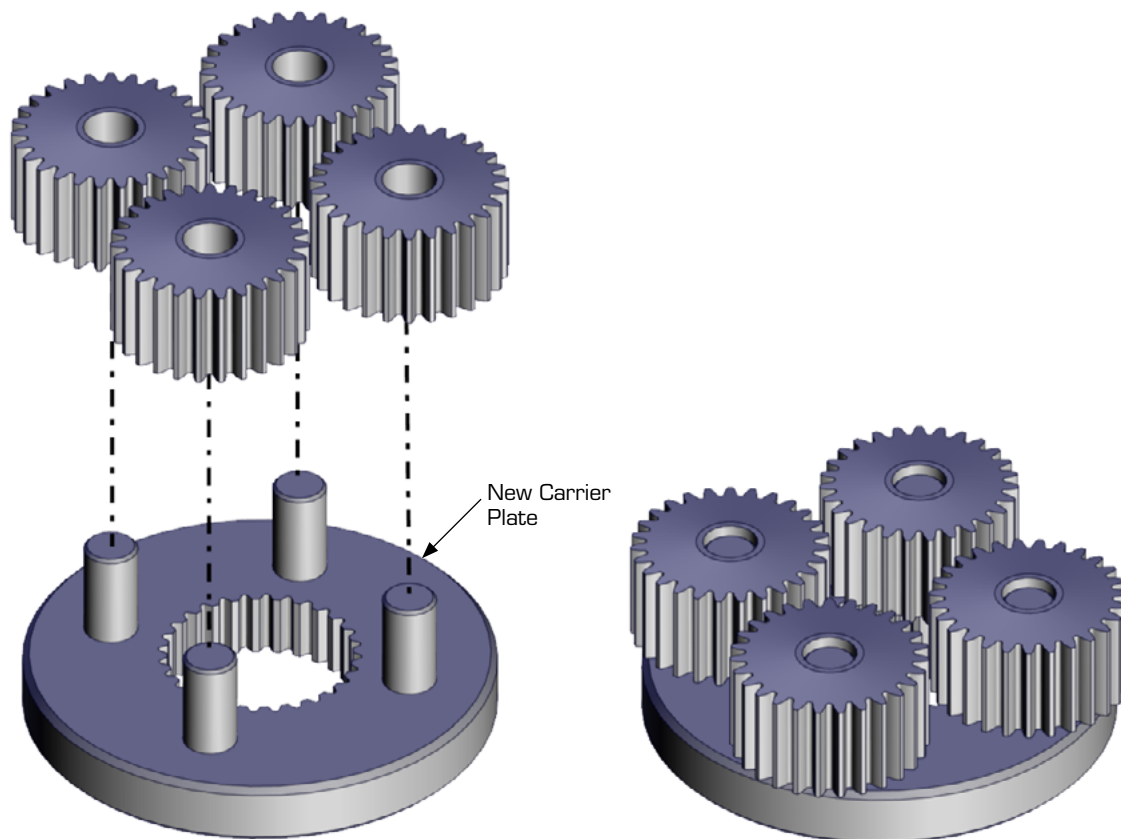
Remove (2X) 8-32 Screws and the Front Housing.

**Step 2:**

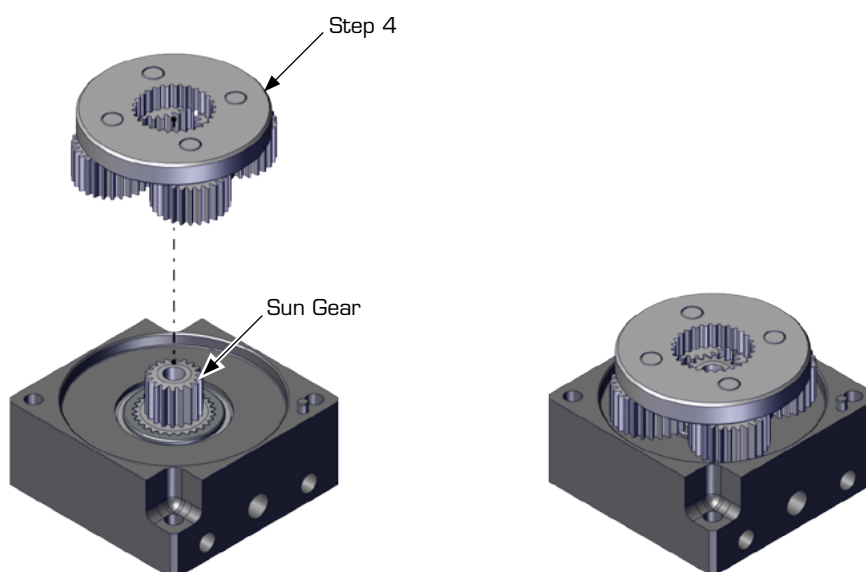
Remove the old Ring Gear, Carrier Plate, Planet Gears and the Sun Gear.

**Step 3:**

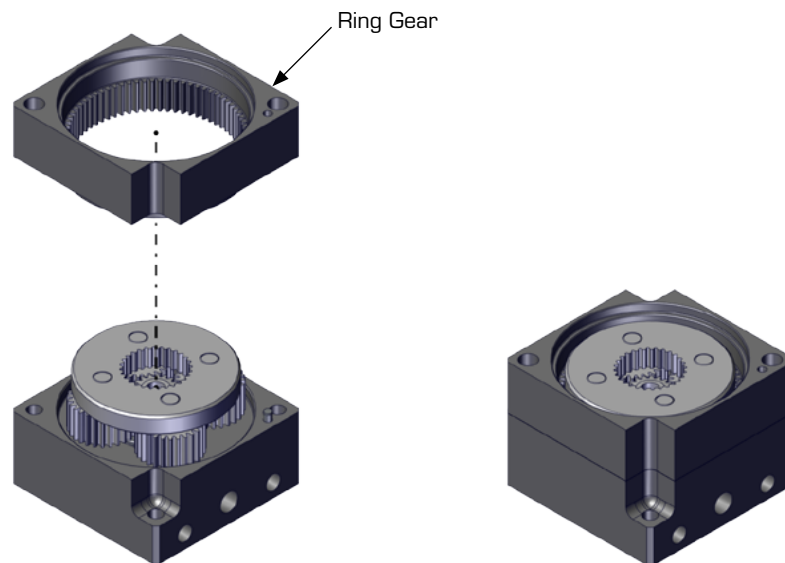
Insert the new Sun Gear into the Carrier Plate as shown.

**Step 4:**

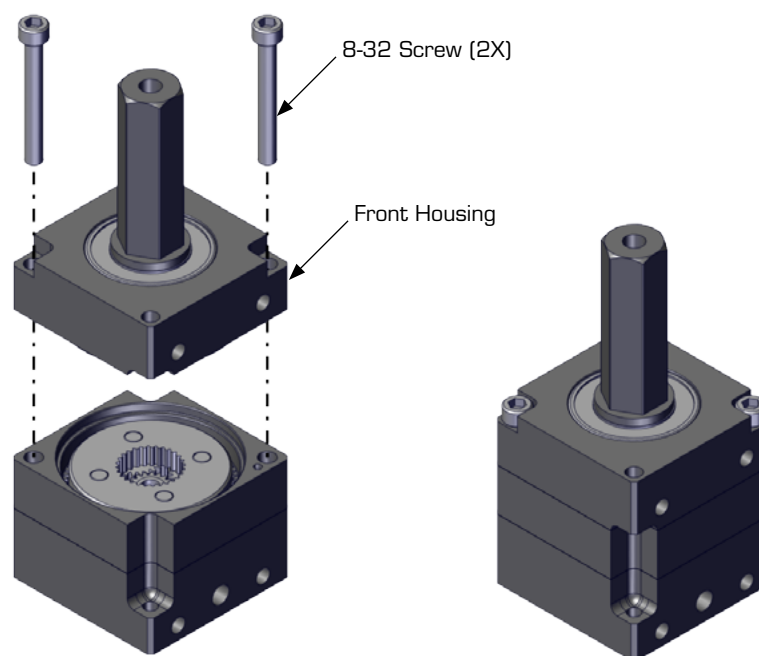
Slide the new Sun Gears onto the new Carrier Plate.

**Step 5:**

Slide the assembly from Step 4 onto the Sun Gear as shown.

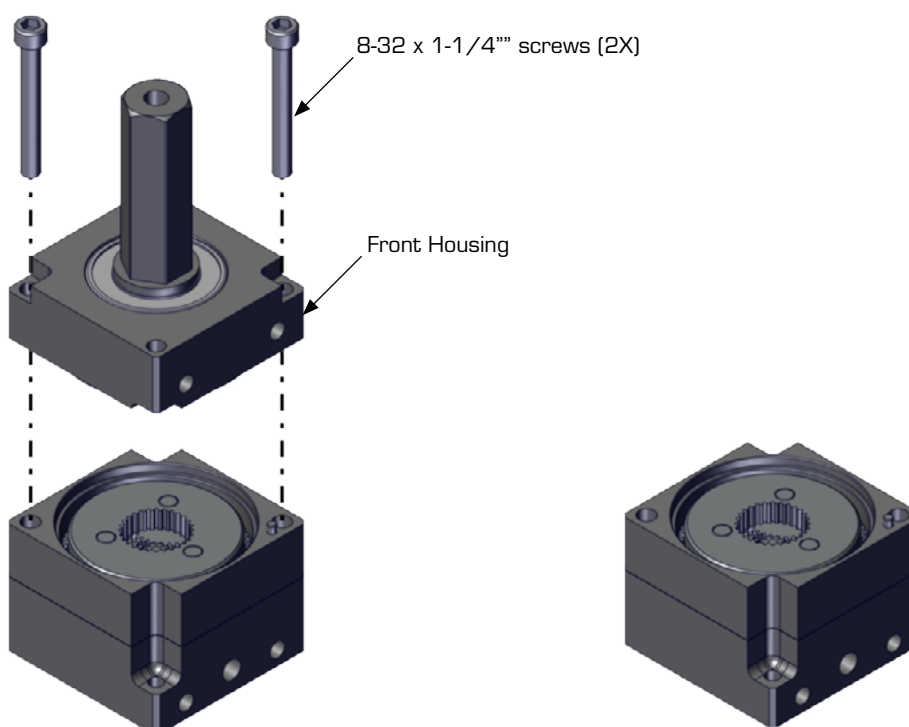
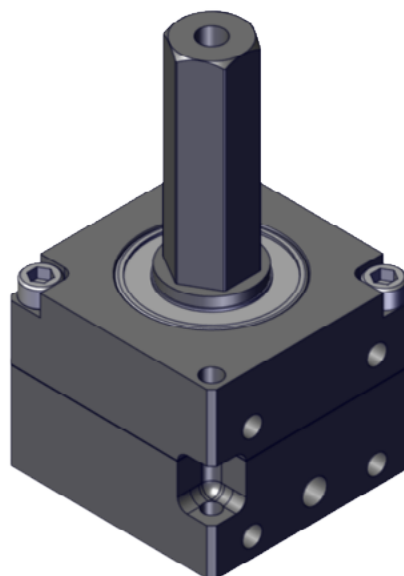
**Step 6:**

Slide the Ring Gear onto the assembly as shown.

**Step 7:**

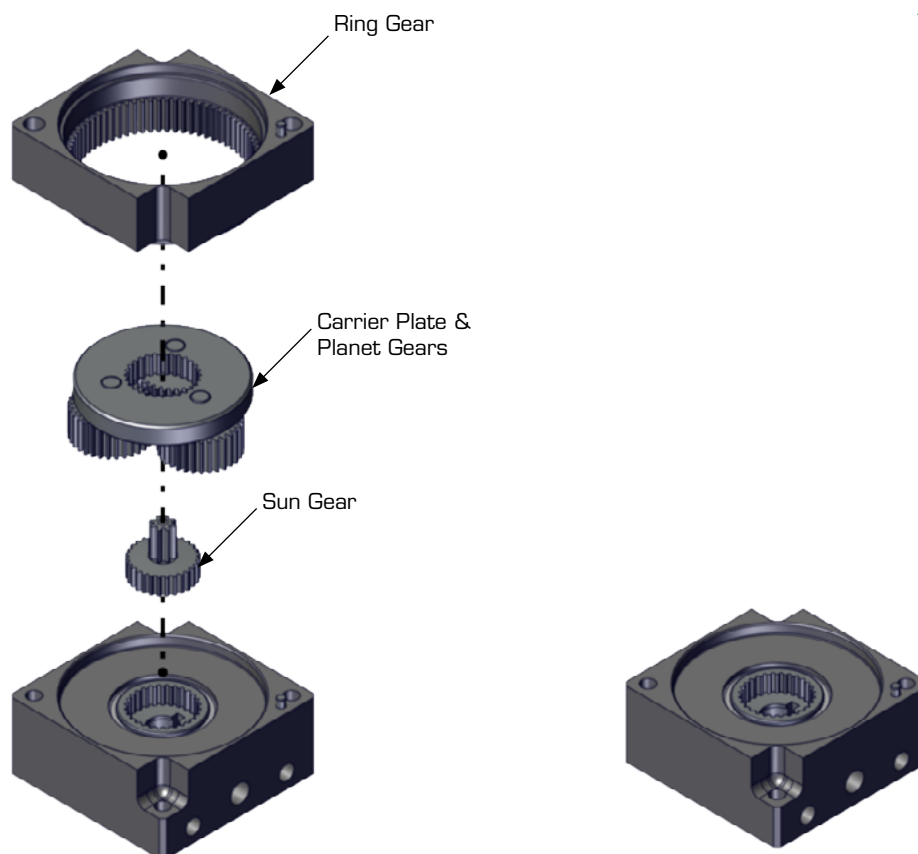
Use (2X) 8-32 screws to mount the Front Housing as shown.

VersaPlanetary Direct Drive

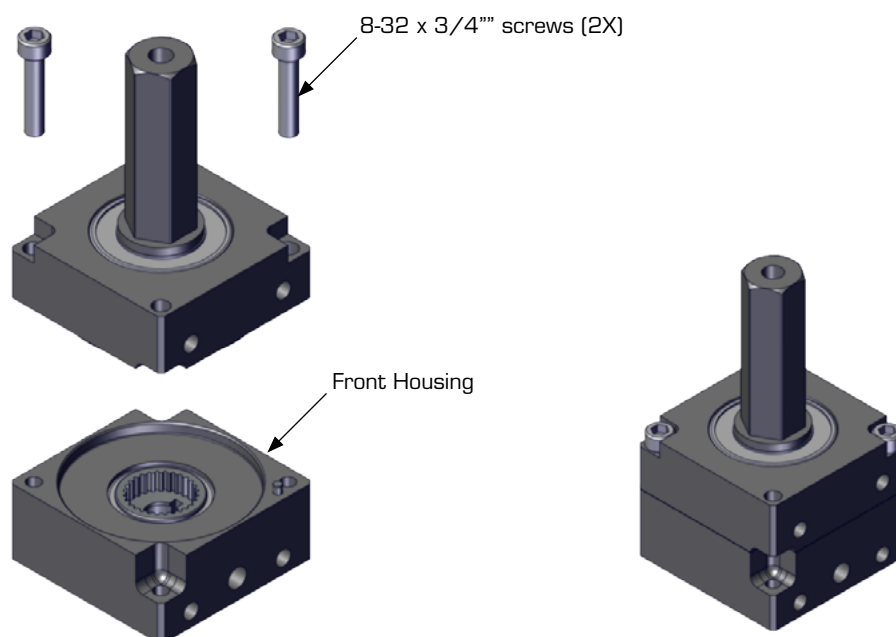


Step 1:

Remove (2X) 8-32 Screws and the Front Housing.

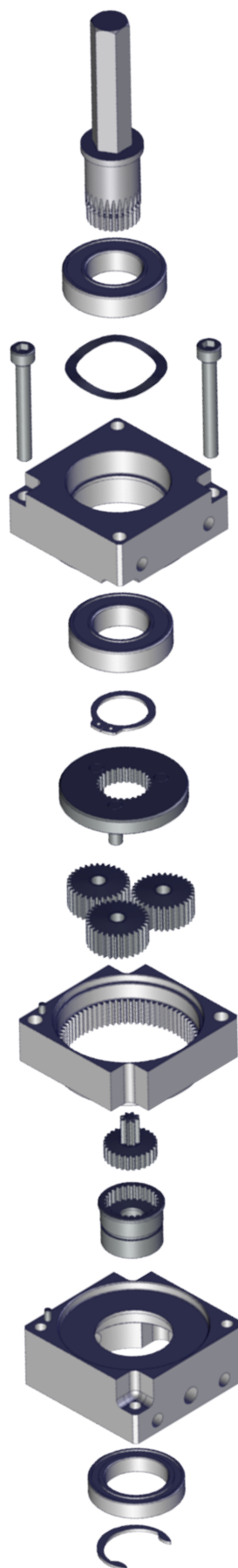
**Step 2:**

Remove the Ring Gear, Carrier Plate, Planet Gears, and the Sun Gear.

**Step 3:**

Use (2X) 8-32 screws to mount the Front Housing as shown.

VersaPlanetary Single Stage Exploded View



VersaPlanetary Load Ratings

Introduction

The ratings in this guide are based on actual test data conducted by VEX Robotics on the final product versions of the VersaPlanetary gear box. All load ratings are based on a Safety Factor (SF) of 1.2 to accommodate manufacturing tolerance differences.

How to Use the Rating Tables

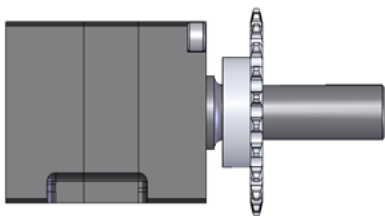
There are two types of rating tables in this guide:

- (1) Simple-Load Ratings
 - a. Conservative ratings based on a simplified loading case using just torsion.
- (2) Combined-Load Ratings
 - a. Load ratings that take bending loads into account as well as torsion.

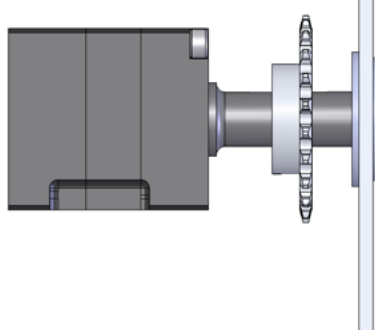
Most users are recommended to mount their VersaPlanetary gearboxes in such a way that they can use the "Simple Load Ratings" table.

IMPORTANT NOTE:

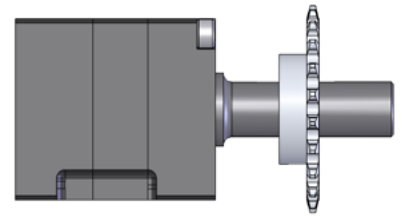
The "Simple Loading Ratings" tables assume that the output of your shaft has minimal overhung loading (i.e. your sprocket is really close to the base of the shaft, or you support the tip of the shaft). See below examples.



Sprocket close to transmission
Use Simple-Load Ratings



Sprocket Tip is supported
Use Simple-Load Ratings



Sprocket NOT close to transmission
Sprocket Tip is un-supported
Use Combined-Load Ratings

The "Simple Load Ratings" tables use a red/green rating system. If the motor / gear ratio / output shaft combination you want to use is highlighted **green**, then it is within our maximum gear ratio recommendations. If the motor / gear ratio / output shaft combination is highlighted **red**, then the maximum motor torque will be capable of damaging the gearbox (with a significant enough load on the output shaft) and should be used with caution.

Example: User wants to use a RS-775 motor with a 2 stage gearbox with a 100:1 gear ratio and a 3/8" Hex Shaft. Is this combination recommended?

Using Table 3 (excerpt shown below), that combination is not recommended as indicated in red. However, all other gear ratio combinations are recommended for that motor.

Motor	Stage 1	Stage 2			
		3:1	4:1	5:1	10:1
AM-9015	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100
BB RS-550	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100
BB RS-775	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100

Simple Load Ratings Tables

Motor	Stage 1	Stage 2			
		3:1	4:1	5:1	10:1
AM-9015	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100
BB RS-550	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100
BB RS-775	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100
FP-0673	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100
BAG Motor	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100

Table 1 - 2 Stage Max Gear Ratio w/ 1/2" Hex Output Shaft

Motor	Stage 1	Stage 2			
		3:1	4:1	5:1	10:1
AM-9015	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100
BB RS-550	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100
BB RS-775	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100
FP-0673	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100
BAG Motor	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100

Table 2 - 2 Stage Max Gear Ratio w/ 1/2" Round Output Shaft

Motor	Stage 1	Stage 2			
		3:1	4:1	5:1	10:1
AM-9015	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100
BB RS-550	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100
BB RS-775	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100
FP-0673	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100
BAG Motor	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100

Table 3 - 2 Stage Max Gear Ratio w/ 3/8" Hex Output Shaft

Motor	Stage 1	Stage 2			
		3:1	4:1	5:1	10:1
AM-9015	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100
BB RS-550	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100
BB RS-775	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100
FP-0673	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100
BAG Motor	3:1	9	12	15	30
	4:1	12	16	20	40
	5:1	15	20	25	50
	10:1	30	40	50	100

Table 4 - 2 Stage Max Gear Ratio CIM Motor Output Shaft

Motor	Stage 1 & 2	Stage 3			
		3:1	4:1	5:1	10:1
AM-9015	9:1	27	36	45	90
	12:1	36	48	60	120
	15:1	45	60	75	150
	16:1	48	64	80	160
	20:1	60	80	100	200
	25:1	75	100	125	250
	30:1	90	120	150	300
	40:1	120	160	200	400
	50:1	150	200	250	500
	100:1	300	400	500	1000
BB RS-550	9:1	27	36	45	90
	12:1	36	48	60	120
	15:1	45	60	75	150
	16:1	48	64	80	160
	20:1	60	80	100	200
	25:1	75	100	125	250
	30:1	90	120	150	300
	40:1	120	160	200	400
	50:1	150	200	250	500
	100:1	300	400	500	1000
BB RS-775	9:1	27	36	45	90
	12:1	36	48	60	120
	15:1	45	60	75	150
	16:1	48	64	80	160
	20:1	60	80	100	200
	25:1	75	100	125	250
	30:1	90	120	150	300
	40:1	120	160	200	400
	50:1	150	200	250	500
	100:1	300	400	500	1000
FP-0673	9:1	27	36	45	90
	12:1	36	48	60	120
	15:1	45	60	75	150
	16:1	48	64	80	160
	20:1	60	80	100	200
	25:1	75	100	125	250
	30:1	90	120	150	300
	40:1	120	160	200	400
	50:1	150	200	250	500
	100:1	300	400	500	1000
BAG Motor	9:1	27	36	45	90
	12:1	36	48	60	120
	15:1	45	60	75	150
	16:1	48	64	80	160
	20:1	60	80	100	200
	25:1	75	100	125	250
	30:1	90	120	150	300
	40:1	120	160	200	400
	50:1	150	200	250	500
	100:1	300	400	500	1000

Table 5 – 3 Stage Max Gear Ratio w/ 1/2" Hex Shaft

Ratio	Motor	Stage 1 & 2	Stage 3			
			3:1	4:1	5:1	10:1
9	AM-9015	9:1	27	36	45	90
12		12:1	36	48	60	120
15		15:1	45	60	75	150
16		16:1	48	64	80	160
20		20:1	60	80	100	200
25		25:1	75	100	125	250
30		30:1	90	120	150	300
40		40:1	120	160	200	400
50		50:1	150	200	250	500
100		100:1	300	400	500	1000
9	BB RS-550	9:1	27	36	45	90
12		12:1	36	48	60	120
15		15:1	45	60	75	150
16		16:1	48	64	80	160
20		20:1	60	80	100	200
25		25:1	75	100	125	250
30		30:1	90	120	150	300
40		40:1	120	160	200	400
50		50:1	150	200	250	500
100		100:1	300	400	500	1000
9	BB RS-775	9:1	27	36	45	90
12		12:1	36	48	60	120
15		15:1	45	60	75	150
16		16:1	48	64	80	160
20		20:1	60	80	100	200
25		25:1	75	100	125	250
30		30:1	90	120	150	300
40		40:1	120	160	200	400
50		50:1	150	200	250	500
100		100:1	300	400	500	1000
9	FP-0673	9:1	27	36	45	90
12		12:1	36	48	60	120
15		15:1	45	60	75	150
16		16:1	48	64	80	160
20		20:1	60	80	100	200
25		25:1	75	100	125	250
30		30:1	90	120	150	300
40		40:1	120	160	200	400
50		50:1	150	200	250	500
100		100:1	300	400	500	1000
9	BAG Motor	9:1	27	36	45	90
12		12:1	36	48	60	120
15		15:1	45	60	75	150
16		16:1	48	64	80	160
20		20:1	60	80	100	200
25		25:1	75	100	125	250
30		30:1	90	120	150	300
40		40:1	120	160	200	400
50		50:1	150	200	250	500
100		100:1	300	400	500	1000

Table 6 – 3 Stage Max Gear Ratio w/ 1/2" Round Shaft

Motor	Stage 1 & 2	Stage 3			
		3:1	4:1	5:1	10:1
AM-9015	9:1	27	36	45	90
	12:1	36	48	60	120
	15:1	45	60	75	150
	16:1	48	64	80	160
	20:1	60	80	100	200
	25:1	75	100	125	250
	30:1	90	120	150	300
	40:1	120	160	200	400
	50:1	150	200	250	500
	100:1	300	400	500	1000
BB RS-550	9:1	27	36	45	90
	12:1	36	48	60	120
	15:1	45	60	75	150
	16:1	48	64	80	160
	20:1	60	80	100	200
	25:1	75	100	125	250
	30:1	90	120	150	300
	40:1	120	160	200	400
	50:1	150	200	250	500
	100:1	300	400	500	1000
BB RS-775	9:1	27	36	45	90
	12:1	36	48	60	120
	15:1	45	60	75	150
	16:1	48	64	80	160
	20:1	60	80	100	200
	25:1	75	100	125	250
	30:1	90	120	150	300
	40:1	120	160	200	400
	50:1	150	200	250	500
	100:1	300	400	500	1000
FP-0673	9:1	27	36	45	90
	12:1	36	48	60	120
	15:1	45	60	75	150
	16:1	48	64	80	160
	20:1	60	80	100	200
	25:1	75	100	125	250
	30:1	90	120	150	300
	40:1	120	160	200	400
	50:1	150	200	250	500
	100:1	300	400	500	1000
BAG Motor	9:1	27	36	45	90
	12:1	36	48	60	120
	15:1	45	60	75	150
	16:1	48	64	80	160
	20:1	60	80	100	200
	25:1	75	100	125	250
	30:1	90	120	150	300
	40:1	120	160	200	400
	50:1	150	200	250	500
	100:1	300	400	500	1000

Table 7 - 3 Stage Max Gear Ratio w/ 3/8" Hex Shaft

Ratio	Motor	Stage 1 & 2	Stage 3			
			3:1	4:1	5:1	10:1
9	AM-9015	9:1	27	36	45	90
12		12:1	36	48	60	120
15		15:1	45	60	75	150
16		16:1	48	64	80	160
20		20:1	60	80	100	200
25		25:1	75	100	125	250
30		30:1	90	120	150	300
40		40:1	120	160	200	400
50		50:1	150	200	250	500
100		100:1	300	400	500	1000
9	BB RS-550	9:1	27	36	45	90
12		12:1	36	48	60	120
15		15:1	45	60	75	150
16		16:1	48	64	80	160
20		20:1	60	80	100	200
25		25:1	75	100	125	250
30		30:1	90	120	150	300
40		40:1	120	160	200	400
50		50:1	150	200	250	500
100		100:1	300	400	500	1000
9	BB RS-775	9:1	27	36	45	90
12		12:1	36	48	60	120
15		15:1	45	60	75	150
16		16:1	48	64	80	160
20		20:1	60	80	100	200
25		25:1	75	100	125	250
30		30:1	90	120	150	300
40		40:1	120	160	200	400
50		50:1	150	200	250	500
100		100:1	300	400	500	1000
9	FP-0673	9:1	27	36	45	90
12		12:1	36	48	60	120
15		15:1	45	60	75	150
16		16:1	48	64	80	160
20		20:1	60	80	100	200
25		25:1	75	100	125	250
30		30:1	90	120	150	300
40		40:1	120	160	200	400
50		50:1	150	200	250	500
100		100:1	300	400	500	1000
9	BAG Motor	9:1	27	36	45	90
12		12:1	36	48	60	120
15		15:1	45	60	75	150
16		16:1	48	64	80	160
20		20:1	60	80	100	200
25		25:1	75	100	125	250
30		30:1	90	120	150	300
40		40:1	120	160	200	400
50		50:1	150	200	250	500
100		100:1	300	400	500	1000

Table 8 - 3 Stage Max Gear Ratio w/ CIM Motor Shaft

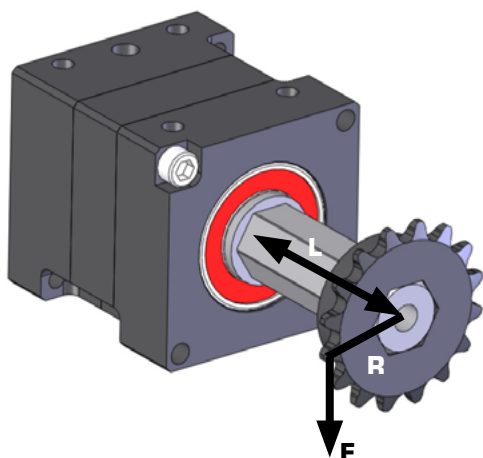
Combined Load Ratings Tables

The VersaPlanetary gearbox is designed to accommodate significant overhung loading with an unsupported shaft. However, as you will determine from this section, the torque carrying capability significantly increases if the gear, sprocket, or pulley is placed close to the mounting face or the end of the shaft is supported with another bearing.

The VersaPlanetary gearbox may fail in one of two different modes: (1) output shaft yield stress failure or (2) 10:1 carrier plate ultimate stress failure. However, improper lubrication combined with typical FRC practice robot driving time would also result in gear failure (eventually). Refer to the "VersaPlanetary User's Guide" for more information on proper maintenance.

Failure mode #2 (carrier plate failure) is not dependent upon the overhung loading and is solely determined by Table 9. However, all other failure modes listed in Table 9 are beam yield failures and that depend on both torsional failure and beam bending failure.

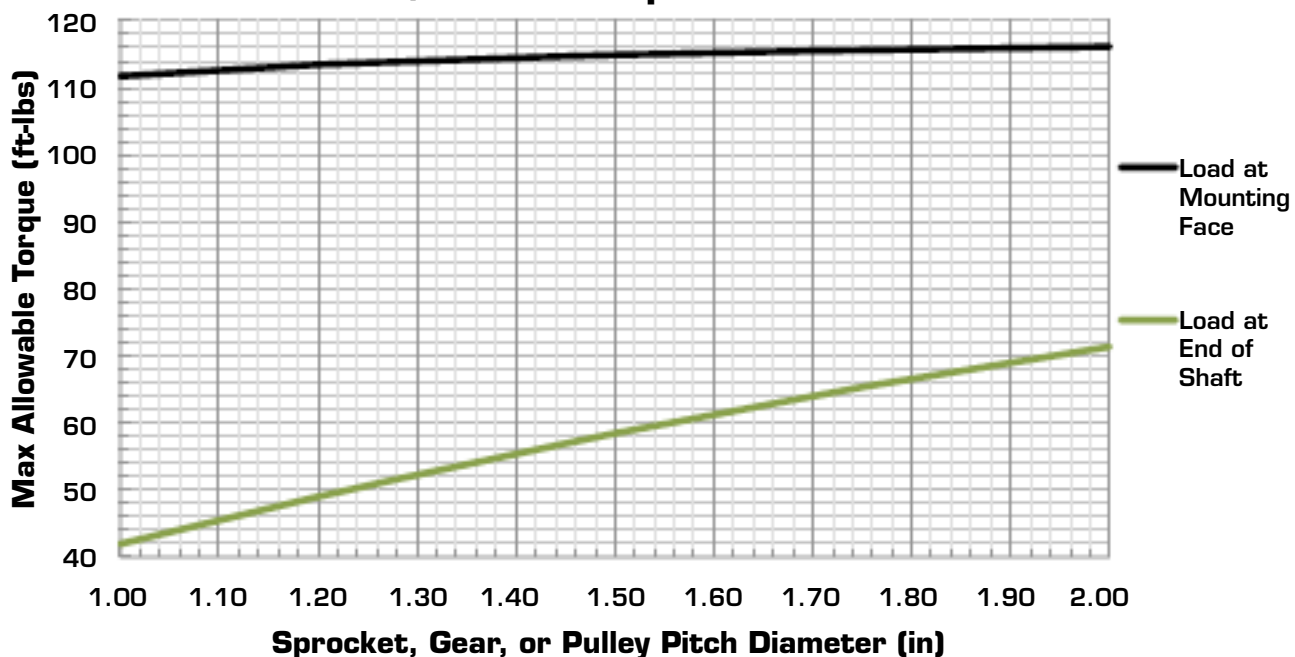
Failure mode #1 depends upon distance from the mounting face, gear / sprocket diameter, and torque load. Users should reference table 9 and the below charts to determine the maximum allowable loading for your design.



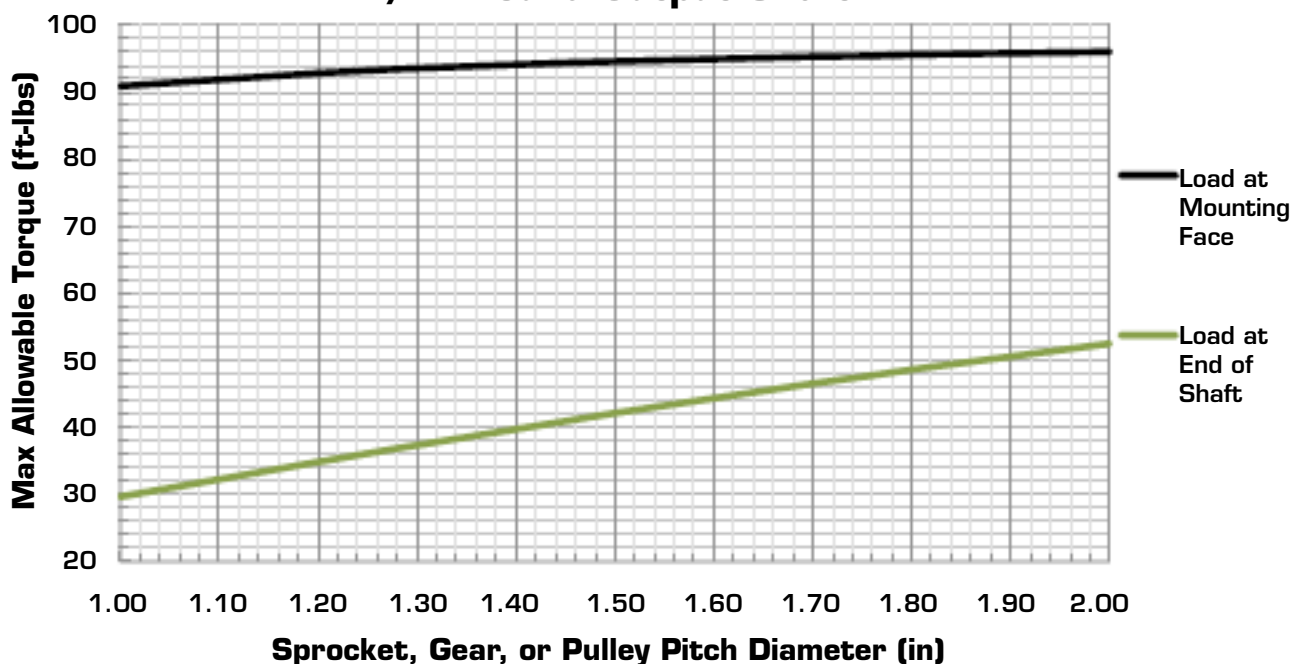
Failure Mode	Rated Load – Pure Torsion	
	N-m	ft-lbs
1/2" Hex Shaft Yield Stress	157	116
1/2" Round Shaft Yield Stress	130	96
3/8" Hex Shaft Yield Stress	57	42
CIM Motor Shaft Yield Stress	29	21
10:1 Carrier Plate Yield Stress	100	74

Table 9 – VersaPlanetary Output Torque Limits

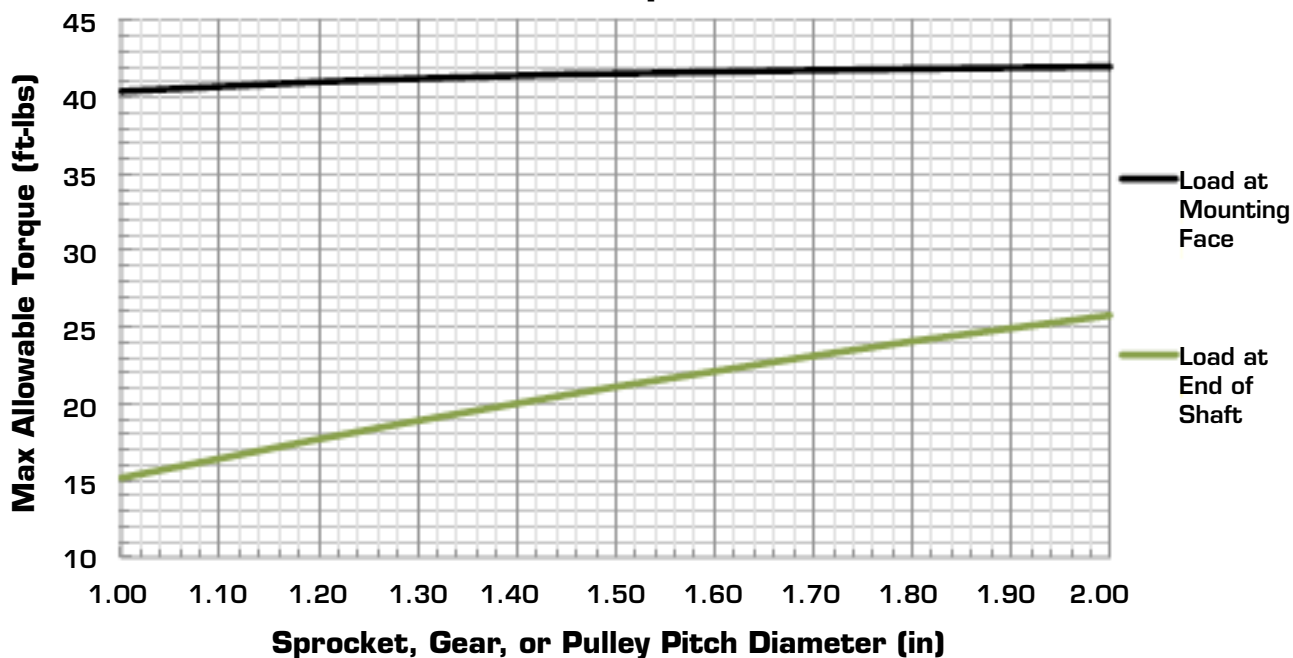
**Max Output Torque vs. Pitch Diameter
1/2" Hex Output Shaft**



**Max Output Torque vs. Pitch Diameter
1/2" Round Output Shaft**



**Max Output Torque vs. Pitch Diameter
3/8" Hex Output Shaft**



**Max Output Torque vs. Pitch Diameter
8mm CIM Motor Output Shaft**

