



VersaPlanetary User Guide

Base VersaPlanetary 1:1

Picture	Name	QTY	Kit
	CIM Motor Output Shaft in VersaPlanetary Output Housing	1	217-3560
	3/8" Hex Output Shaft in VersaPlanetary Output Housing	1	217-3561
	1/2" Round Output Shaft in VersaPlanetary Output Housing	1	217-3562
	1/2" Hex Output Shaft in VersaPlanetary Output Housing	1	217-3563
	VersaPlanetary Input Housing	1	
	VP RS-550 Motor Mounting Plate	1	
	VP RS-775 Motor Mounting Plate	1	

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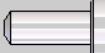


A black rectangular plate with a central circular hole and four mounting holes around its perimeter.	VP BAG Motor Mounting Plate	1	
A black rectangular plate with a central circular hole and four mounting holes around its perimeter, similar to the BAG plate but with a slightly different profile.	VP AM9015 Motor Mounting Plate	1	
A cylindrical component with a gear-like texture on one end and a smooth cylindrical body.	VP Input Coupler	1	
A black rectangular plate with a central circular hole and four mounting holes around its perimeter, similar to the BAG and AM9015 plates.	VP Motor Plate	1	
A grey cylindrical coupling with a central hole and a flange on one side.	BAG Motor Shaft Coupling	1	
A grey cylindrical coupling with a central hole and a flange on one side.	RS-550 Motor Coupling	1	
A grey cylindrical coupling with a central hole and a flange on one side.	RS-775 Motor Coupling	1	
A grey cylindrical coupling with a central hole and a flange on one side.	AM-9015 Motor Coupling	1	
A dark grey cylindrical spacer with a flange on one side.	FP Motor Plate Spacer	4	
A dark grey cylindrical spacer with a flange on one side.	AM-9015 Plate Spacer	4	
A silver screw with a flat head and a length of 1/2 inch.	#8-32 x 1/2" Screw	4	
A silver screw with a flat head and a length of 7/8 inch.	#8-32 x 7/8" Screw	4	
A silver screw with a flat head and a length of 1-1/4 inches.	#8-32 x 1-1/4" Screw	2	
A silver screw with a Phillips head and a length of 8mm.	M3 x 8mm Screw	2	
A silver screw with a Phillips head and a length of 10mm.	M4 x 10mm Screw	2	
A silver set screw with a hexagonal head and a length of 1/2 inch.	#10-32 Set Screw	2	

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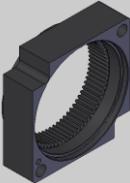
VersaPlanetary Motor Mounting Hardware Kit

217-4649

Picture	Name	QTY
	BAG Motor Shaft Coupling	1
	RS-550 Motor Coupling	1
	RS-775 Motor Coupling	1
	AM-9015 Motor Coupling	1
	#8-32 x 1/2" Screw	2
	#8-32 x 7/8" Screw	2
	#8-32 x 1-1/4" Screw	2
	M3 x 8mm Screw	2
	M4 x 10mm Screw	2
	VP Input Coupler	1
	2mm Short CIM Key	2
	#10-32 Set Screw	2

Ring Gear Add-On Kit

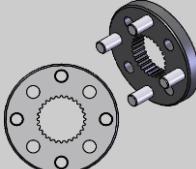
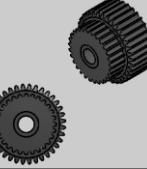
217-2816

Picture	Name	QTY
	Ring Gear	1
	#8-32 x 1-3/4" Screw	2

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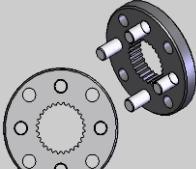
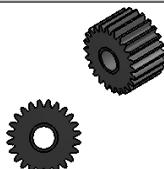
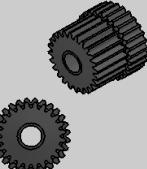
3:1 Gear Kit

217-2817

Picture	Name	QTY
	VP 3:1 Carrier Plate	1
	18 Tooth Planet Gear	4
	36 Tooth Sun Gear	1

4:1 Gear Kit

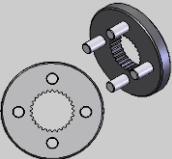
217-2818

Picture	Name	QTY
	VP 4:1 Carrier Plate	1
	24 Tooth Planet Gear	4
	24 Tooth Sun Gear	1

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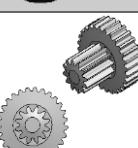
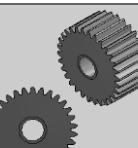
5:1 Gear Kit

217-2819

Picture	Name	QTY
	VP 5:1 Carrier Plate	1
	27 Tooth Planet Gear	4
	18 Tooth Sun Gear	1

7:1 Gear Kit

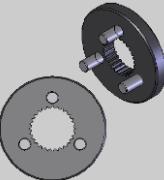
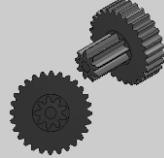
217-3102

Picture	Name	QTY
	VP 7:1 Carrier Plate	1
	12 Tooth Planet Gear	3
	30 Tooth Sun Gear	1

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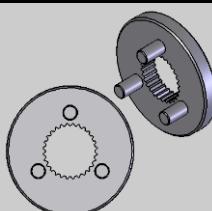
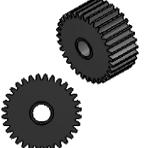
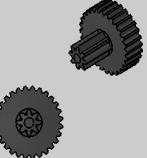
9:1 Gear Kit

217-3106

Picture	Name	QTY
	VP 9:1 Carrier Plate	1
	31 Tooth Planet Gear	3
	9 Tooth Sun Gear	1

10:1 Gear Kit

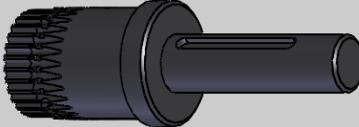
217-2820

Picture	Name	QTY
	VP 10:1 Carrier Plate	1
	32 Tooth Planet Gear	3
	8 Tooth Sun Gear	1

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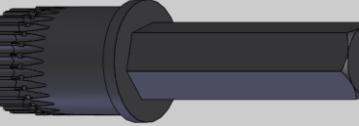
CIM Motor Output Shaft Kit

217-2893

Picture	Name	QTY
	CIM Motor Output Shaft	1

3/8" Hex Output Shaft Kit

217-2894

Picture	Name	QTY
	CIM Motor Output Shaft	1

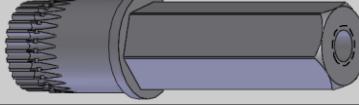
1/2" Round Output Shaft Kit

217-2895

Picture	Name	QTY
	CIM Motor Output Shaft	1

1/2" Hex Output Shaft Kit

217-2897

Picture	Name	QTY
	CIM Motor Output Shaft	1



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VersaPlanetary Single Stage Exploded View



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VersaPlanetary Assembly

You will need:

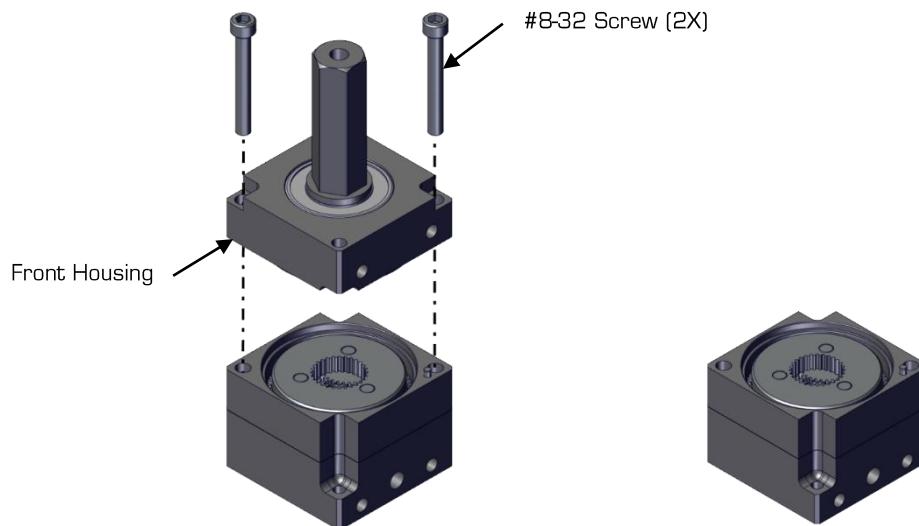
- 9/64" Hex Key
- Base VersaPlanetary 1:1 (P/N 217-3560, 217-3561, 271-3562, 217-3563)
- VersaPlanetary Ring Gear Add-on Kit (P/N 217-2816)
- VersaPlanetary Gear Kit (P/N 217-2817, 217-2818, 217-2819, 217-3102, 217-3106, 217-2820)

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VersaPlanetary Multiple Stage Assembly

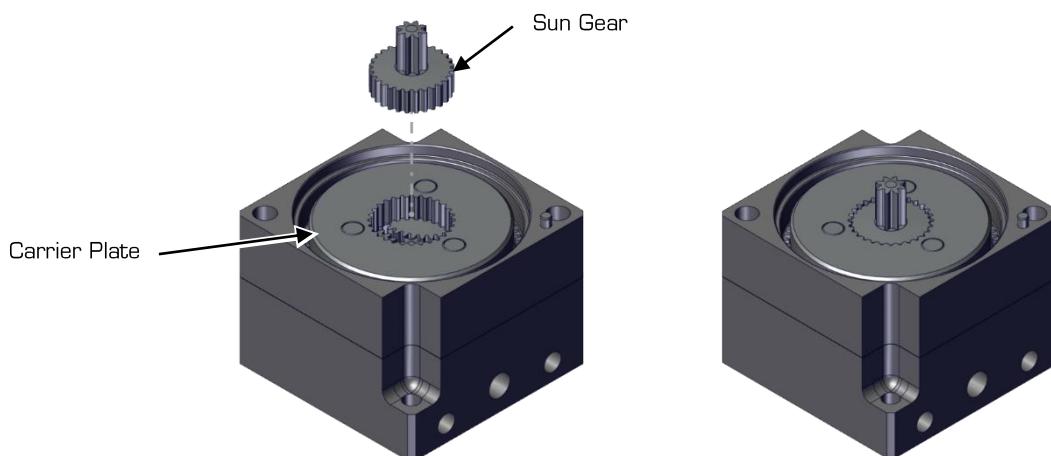
You will need:

- 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, 217-3102, 217-3106, 217-2820)



Step 1:

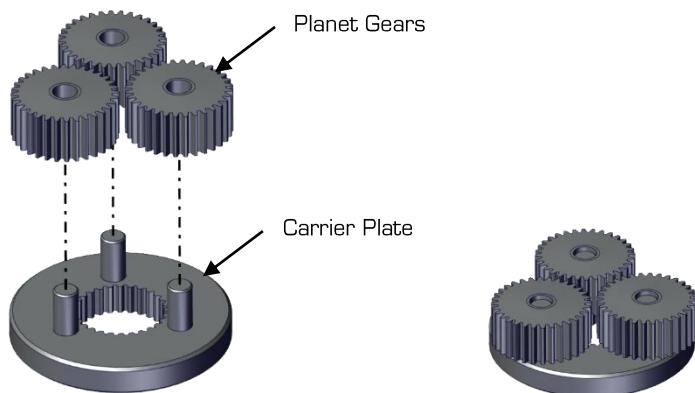
Remove (2X) #8-32 Screws from the VersaPlanetary Front Housing. Set aside the Front Housing.



Step 2:

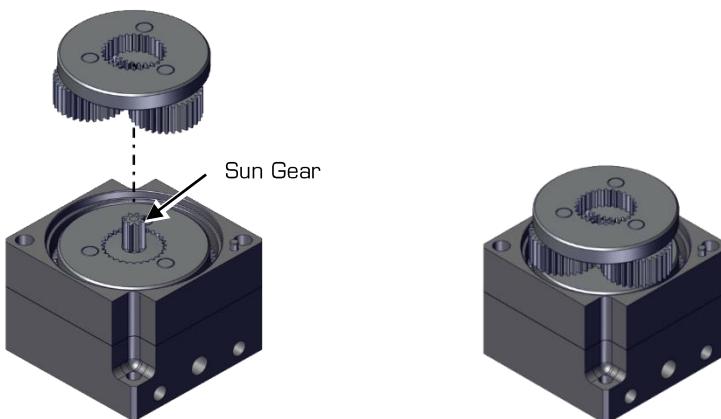
Insert the Sun Gear (included with the user selected Gear Kit) into the Carrier Plate.

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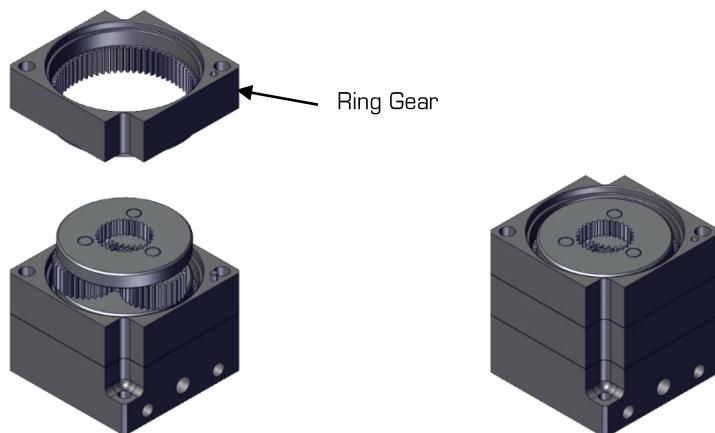
Step 3:

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



Step 4:

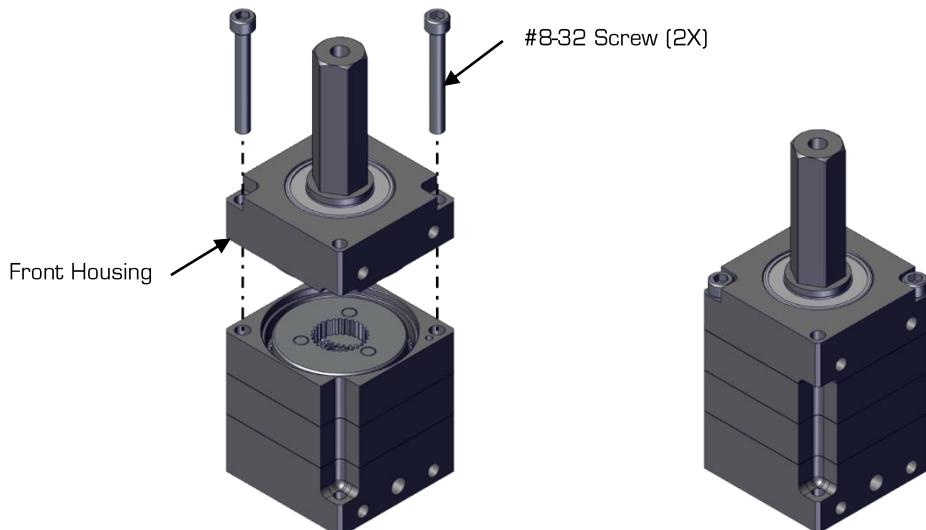
Slide the assembly from Step 3 onto the Sun Gear as shown.



Step 5:

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

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Step 6:

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

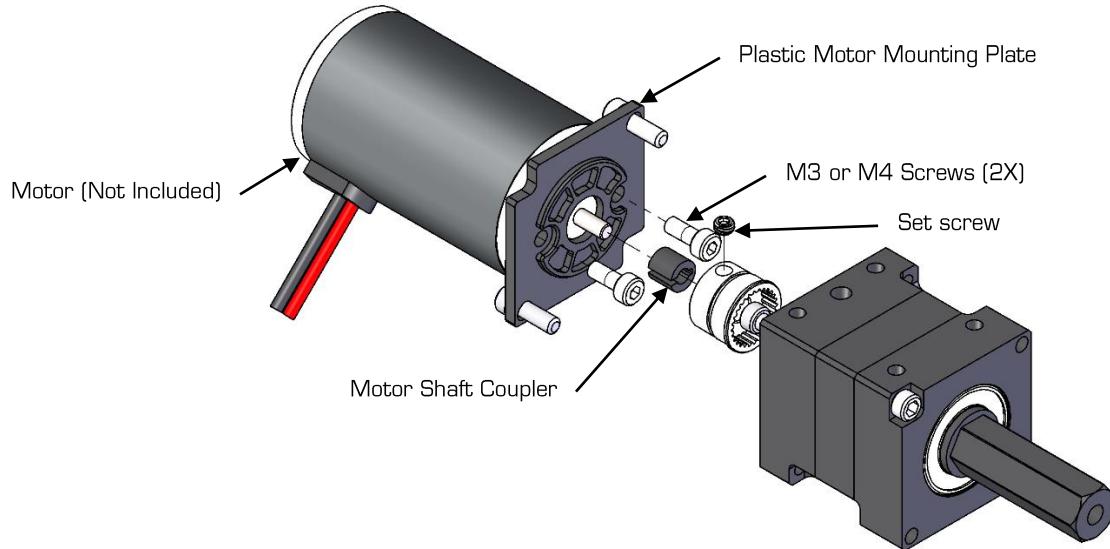
Note: A liberal application of white lithium grease is required on all gears.

#8-32 Screw length can be determined from the following chart:

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

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VersaPlanetary Motor Mounting



Step 1:

Attach motor (BAG, RS-550, RS-775, or AM-9015) to its appropriate mounting plate using the provided M3 or M4 screws.

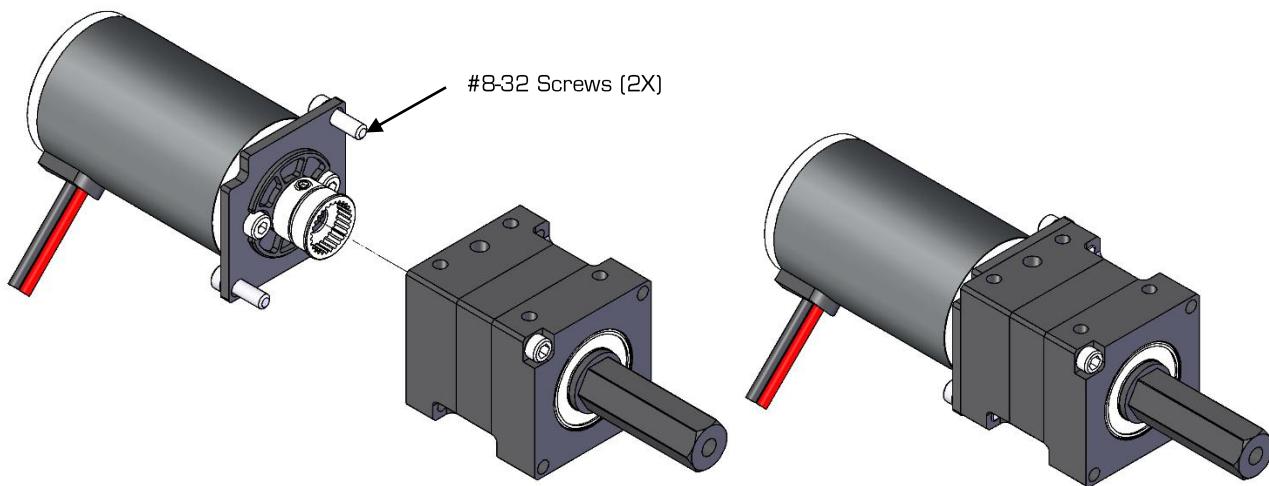


Step 2:

Slide coupler onto motor shaft using the appropriate motor coupler type. Use the tightest coupler that fits on the motor shaft. Align the coupler groove with the input coupler groove. Apply thread locker and tighten the set screw.

Be sure to leave a small gap between the input coupler and the plastic mounting plate.

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Step 3:

Attach the motor assembly to the VersaPlanetary using the provided #8-32 screws

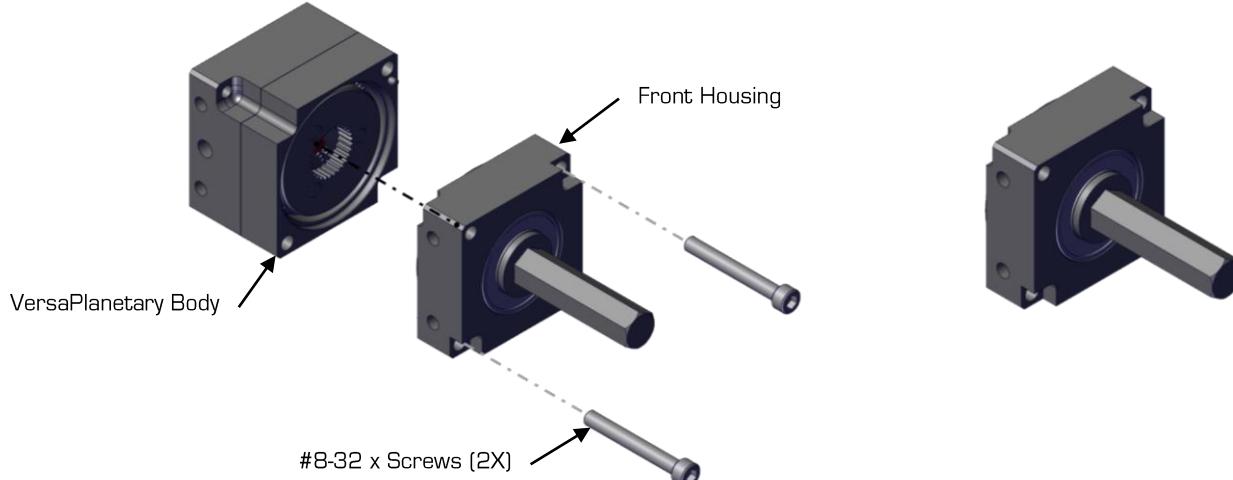
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VersaPlanetary Shaft Change

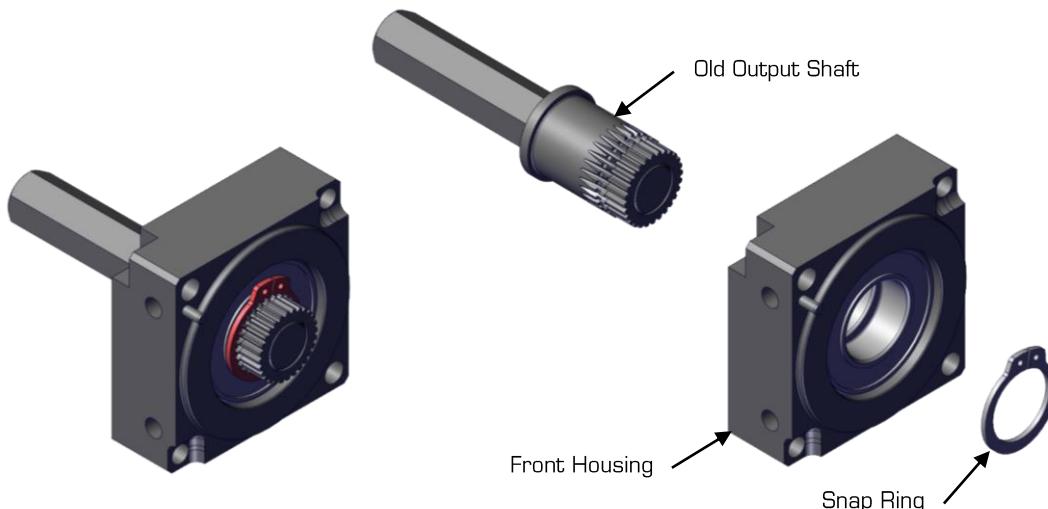
You will need:

- Snap Ring Pliers with tips smaller than .055"
- 9/64" Hex Key
- VersaPlanetary Output Shaft (P/N 217-2893, 217-2894, 217-2895, 217-2897)



Step 1:

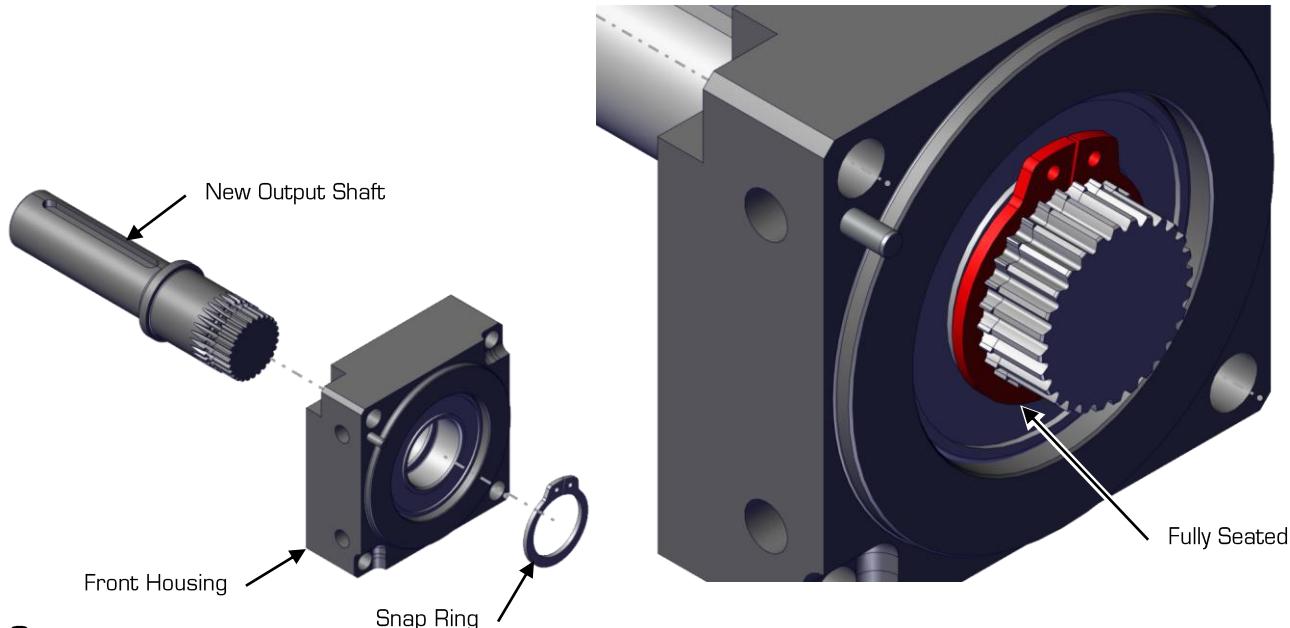
Remove (2X) #8-32 screws from the Front Housing and set the VersaPlanetary body aside



Step 2:

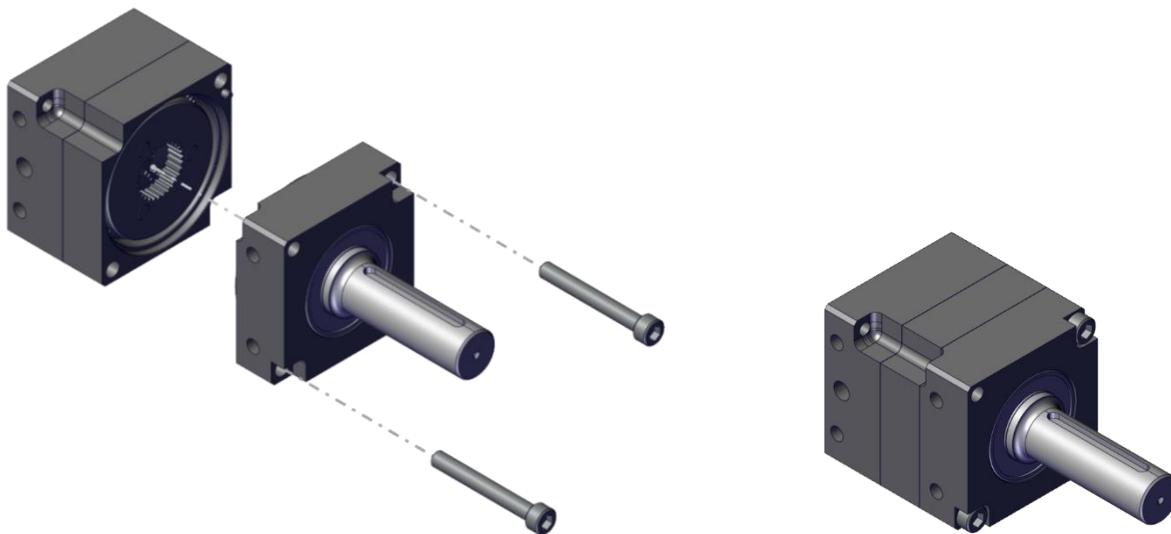
Use Snap Ring Pliers to remove the Snap Ring. Set aside the Old Output Shaft. Take care not to let the bearings slide out of the Front Housing.

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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:

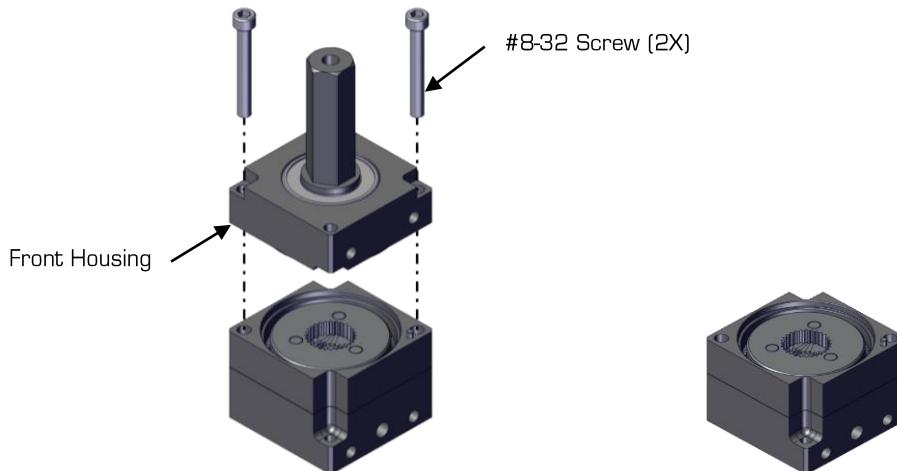
Mount the Front Housing to the VersaPlanetary Body using the (2X) 8-32 Screws removed in Step 1.

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VersaPlanetary Gear Change

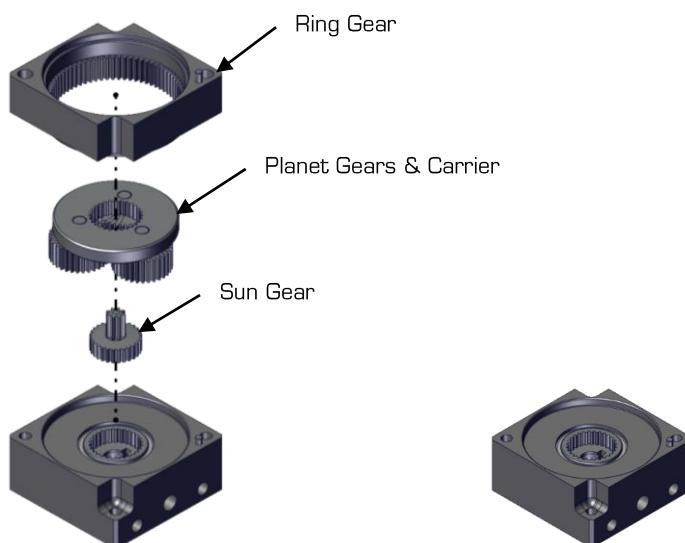
You will need:

- 9/64" Hex Key
- VersaPlanetary Gear Kit (P/N 217-2817, 217-2818, 217-2819, 217-3102, 217-3106, 217-2820)



Step 1:

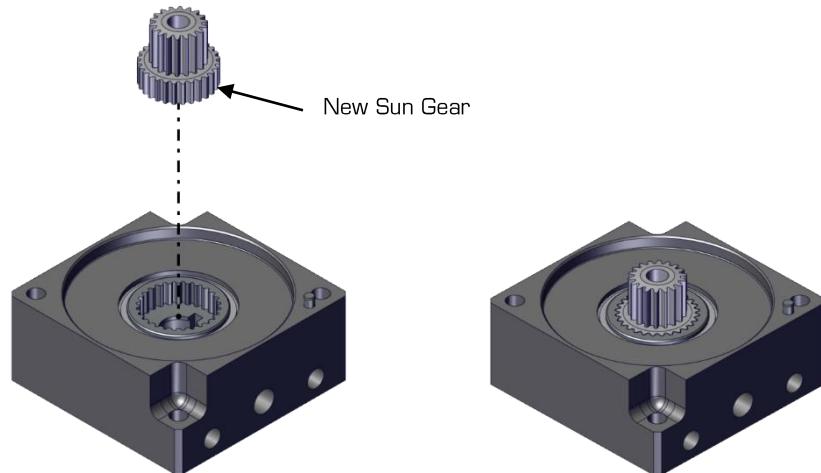
Remove (2X) 8-32 Screws and the Front Housing.



Step 2:

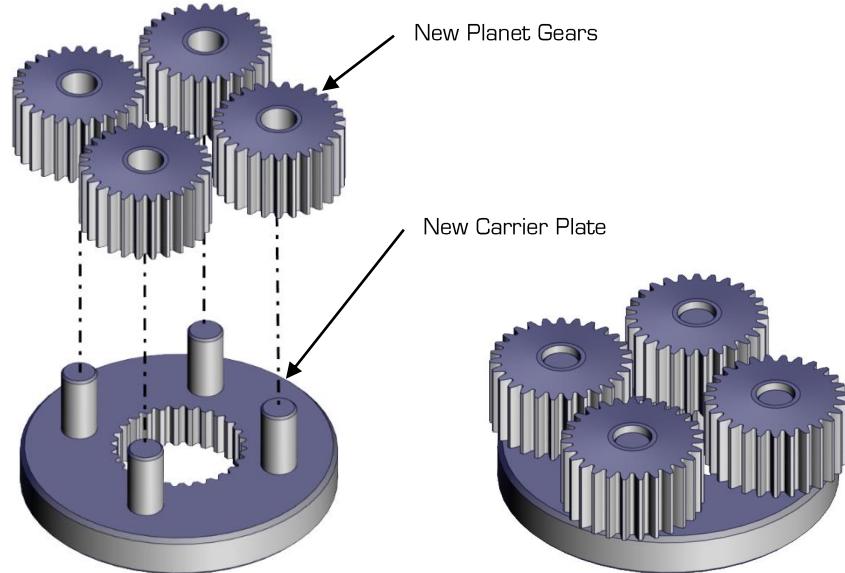
Remove the old Ring Gear, Carrier Plate, Planet Gears and the Sun Gear.

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Step 3:

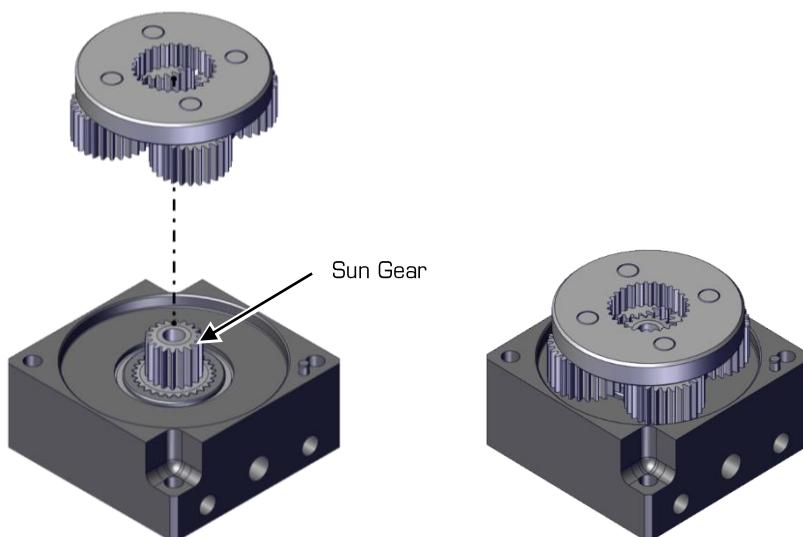
Insert the new Sun Gear into the Carrier Plate as shown



Step 4:

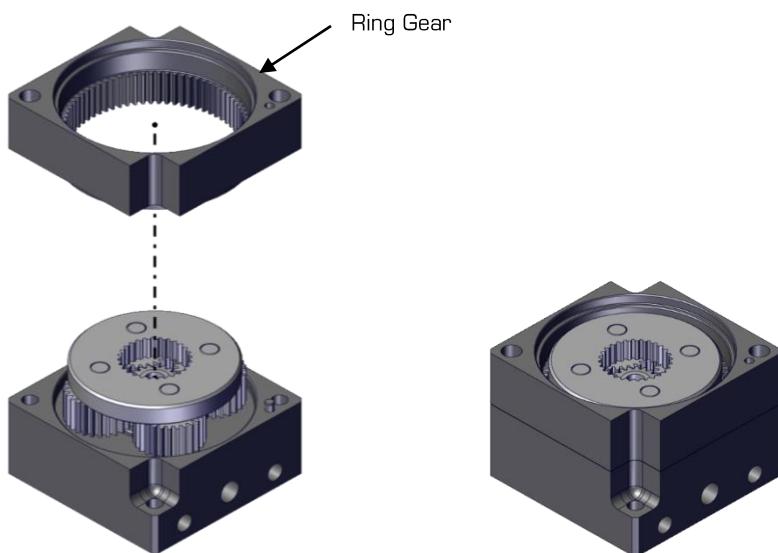
Slide the New Planet Gears onto the New Carrier Plate.

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Step 5:

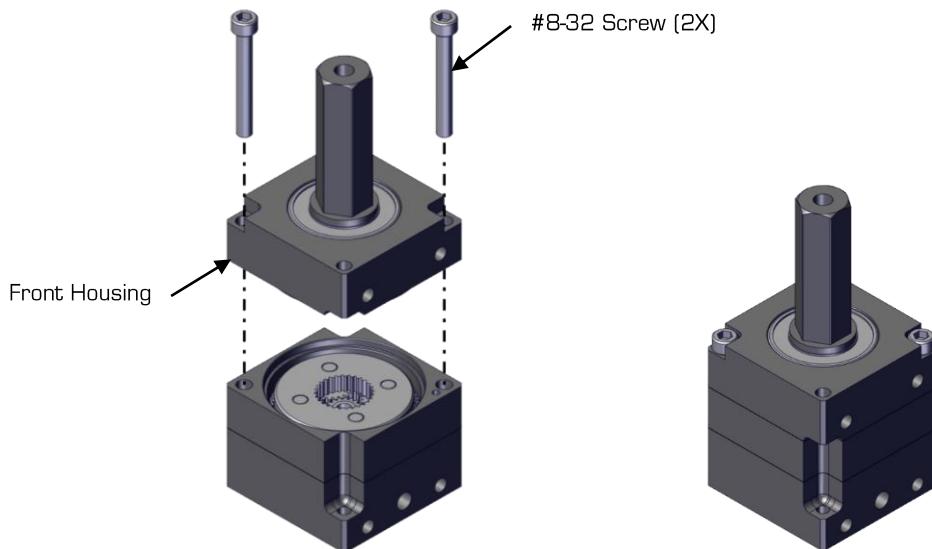
Slide the assembly from Step 4 onto the Sun Gear as shown.



Step 6:

Slide the Ring Gear onto the assembly as shown

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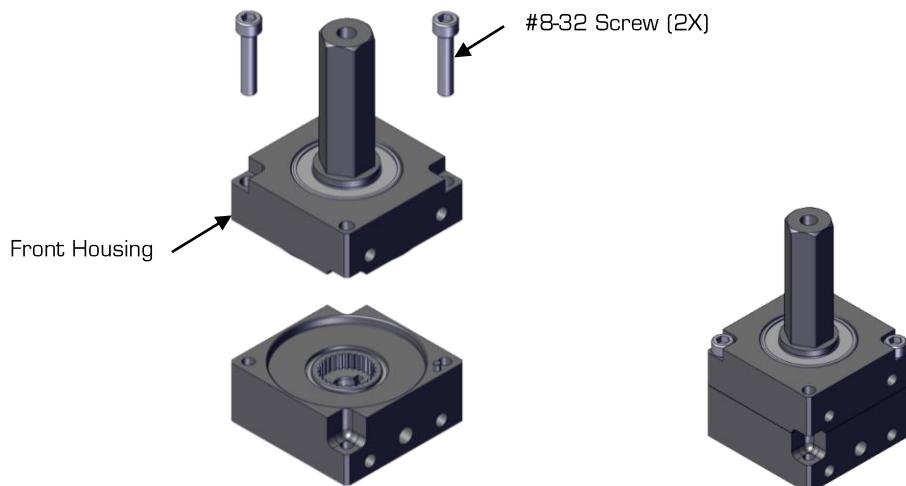


Step 7:

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

Note: A liberal application of white lithium grease is required on all gears.

VersaPlanetary Direct Drive

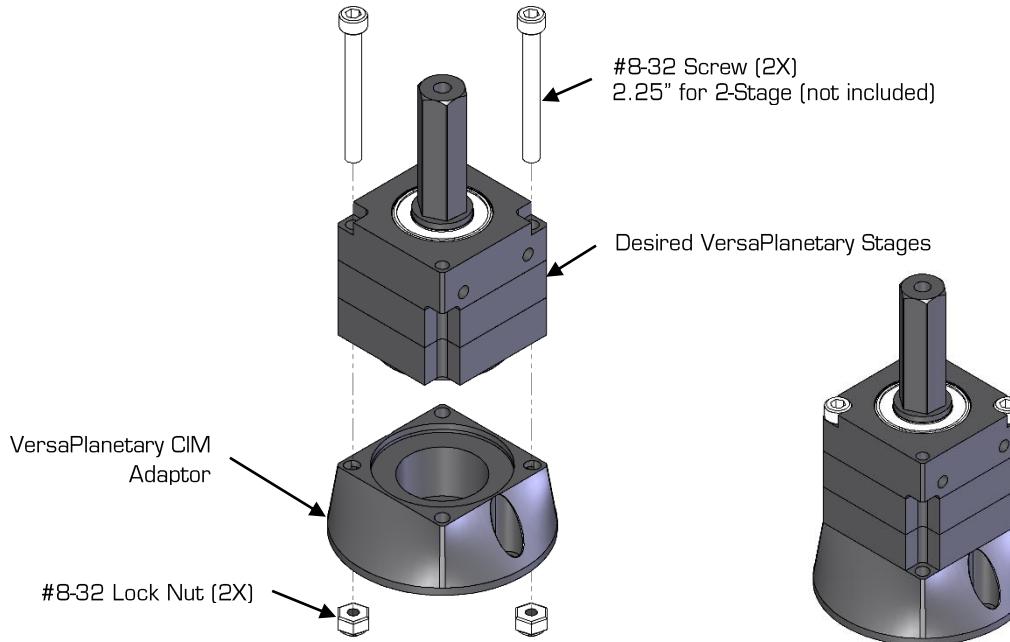


Step 1:

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

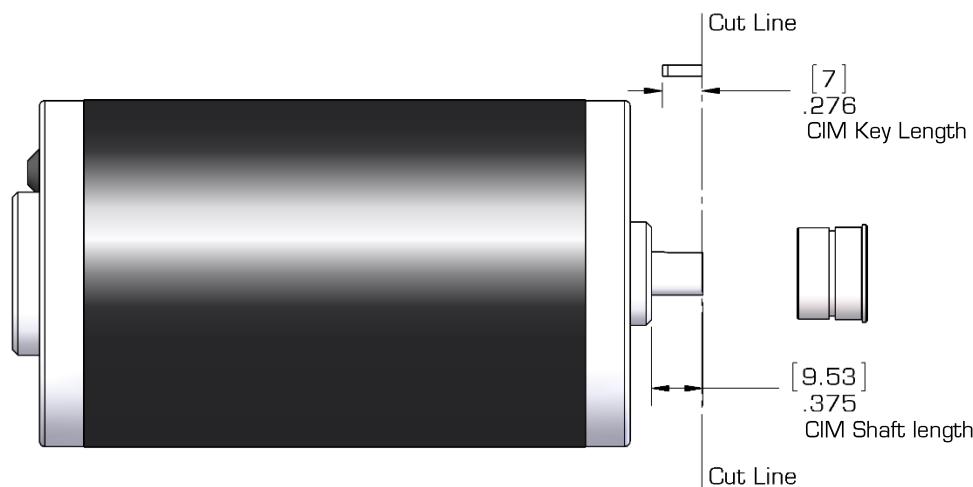
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VersaPlanetary CIM Adaptor Instructions



Step 1:

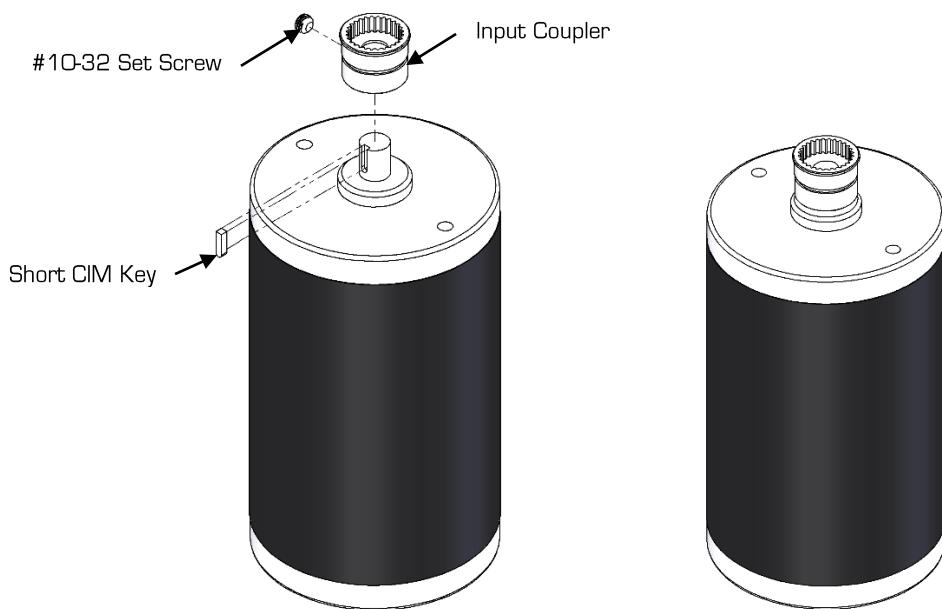
Attach VersaPlanetary CIM Adaptor to desired VersaPlanetary Gearbox Stages



Step 2:

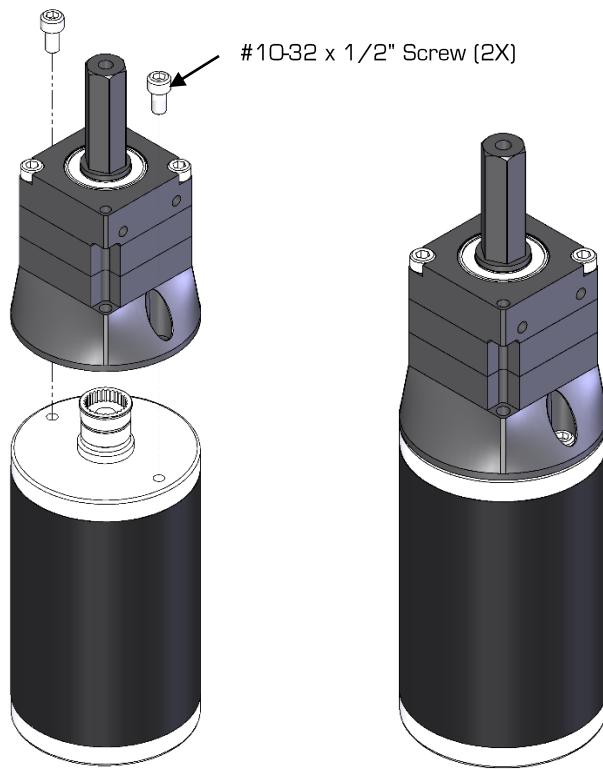
Cut the CIM Shaft and the CIM Key to the lengths shown.

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Step 3:

Insert short CIM Key into keyway. Slide on Input Coupler and tighten the Set Screw



Step 4:

Attach VersaPlanetary CIM Adapter and desired VersaPlanetary stages to Modified CIM



VersaPlanetary Load Ratings Guide

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

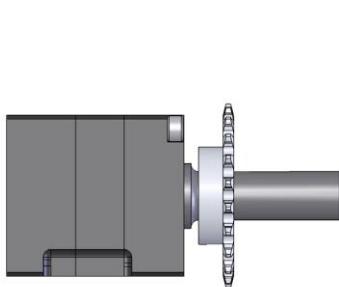
There are two types of rating tables in this guide:

- (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

It is recommended to mount the VersaPlanetary gearbox such that “Simple Load Ratings” may be used.

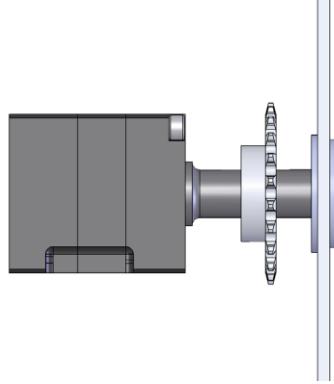
Important Note:

The “Simple Load Ratings” tables assume that the output of the shaft has minimal overhung loading (i.e. the sprocket is mounted close to the base of the shaft, or the tip of the shaft is supported). See below examples.



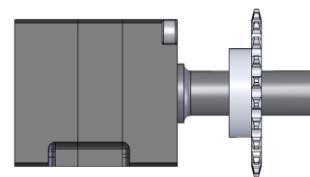
Sprocket close to transmission

Use Simple Load Ratings



Sprocket tip supported

Use Simple Load Ratings



Sprocket NOT close to transmission
and sprocket tip is unsupported

Use Combined Load Ratings

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The “Simple Load Ratings” tables use a red/green rating system. If the motor/gear ratio/output shaft combination selected is highlighted green, then it is within the 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.

Final gear ratio is indicated in the colored cells.

Example: User wants to use a Mini CIM 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 below), that combination is not recommended as indicated in red.

However, any gear ratio less than 40:1 is recommended.

Motor	Stage 1	Stage 2					
		3:1	4:1	5:1	7:1	9:1	10:1
BAG Motor	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
Mini CIM	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
CIM	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
775pro	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100

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Simple Load Ratings Tables

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

Motor	Stage 1	Stage 2					
		3:1	4:1	5:1	7:1	9:1	10:1
AM-9015	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
BB RS-550	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
BB RS-775	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
BAG Motor	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
Mini CIM	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
CIM	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
775pro	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	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	7:1	9:1	10:1
AM-9015	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
BB RS-550	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
BB RS-775	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
BAG Motor	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
Mini CIM	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
CIM	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
775pro	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100

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

Motor	Stage 1	Stage 2					
		3:1	4:1	5:1	7:1	9:1	10:1
AM-9015	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
BB RS-550	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
BB RS-775	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
BAG Motor	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
Mini CIM	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
CIM	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
775pro	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100

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

Motor	Stage 1	Stage 2					
		3:1	4:1	5:1	7:1	9:1	10:1
AM-9015	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
BB RS-550	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
BB RS-775	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
BAG Motor	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
Mini CIM	3:1	9	12	15	21	28	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
CIM	3:1	9	12	15	21	28	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100
775pro	3:1	9	12	15	21	27	30
	4:1	12	16	20	28	36	40
	5:1	15	20	25	35	45	50
	7:1	21	28	35	49	63	70
	9:1	27	36	45	63	81	90
	10:1	30	40	50	70	90	100

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

Motor	Stage 1 & 2	Stage 3						Stage 3					
		3:1	4:1	5:1	7:1	9:1	10:1	3:1	4:1	5:1	7:1	9:1	10:1
AM-9015	9:1	27	36	45	63	81	90	9:1	27	36	45	63	81
	12:1	36	48	60	84	108	120	12:1	36	48	60	84	108
	15:1	45	60	75	105	135	150	15:1	45	60	75	105	135
	16:1	48	64	80	112	144	160	16:1	48	64	80	112	144
	20:1	60	80	100	140	180	200	20:1	60	80	100	140	180
	21:1	63	84	105	147	189	210	21:1	63	84	105	147	189
	25:1	75	100	125	175	225	250	25:1	75	100	125	175	225
	27:1	81	108	135	189	243	270	27:1	81	108	135	189	243
	28:1	84	112	140	196	252	280	28:1	84	112	140	196	252
	30:1	90	120	150	210	270	300	30:1	90	120	150	210	270
	35:1	105	140	175	245	315	350	35:1	105	140	175	245	315
	36:1	108	144	180	252	324	360	36:1	108	144	180	252	324
	40:1	120	160	200	280	360	400	40:1	120	160	200	280	360
	45:1	135	180	225	315	405	450	45:1	135	180	225	315	405
	49:1	147	196	245	343	441	490	49:1	147	196	245	343	441
	50:1	150	200	250	350	450	500	50:1	150	200	250	350	450
	63:1	189	252	315	441	567	630	63:1	189	252	315	441	567
	70:1	210	280	350	490	630	700	70:1	210	280	350	490	630
	81:1	243	324	405	567	729	810	81:1	243	324	405	567	729
	90:1	270	360	450	630	810	900	90:1	270	360	450	630	810
	100:1	300	400	500	700	900	1000	100:1	300	400	500	700	900
BB RS-550	9:1	27	36	45	63	81	90	9:1	27	36	45	63	81
	12:1	36	48	60	84	108	120	12:1	36	48	60	84	108
	15:1	45	60	75	105	135	150	15:1	45	60	75	105	135
	16:1	48	64	80	112	144	160	16:1	48	64	80	112	144
	20:1	60	80	100	140	180	200	20:1	60	80	100	140	180
	21:1	63	84	105	147	189	210	21:1	63	84	105	147	189
	25:1	75	100	125	175	225	250	25:1	75	100	125	175	225
	27:1	81	108	135	189	243	270	27:1	81	108	135	189	243
	28:1	84	112	140	196	252	280	28:1	84	112	140	196	252
	30:1	90	120	150	210	270	300	30:1	90	120	150	210	270
	35:1	105	140	175	245	315	350	35:1	105	140	175	245	315
	36:1	108	144	180	252	324	360	36:1	108	144	180	252	324
	40:1	120	160	200	280	360	400	40:1	120	160	200	280	360
	45:1	135	180	225	315	405	450	45:1	135	180	225	315	405
	49:1	147	196	245	343	441	490	49:1	147	196	245	343	441
	50:1	150	200	250	350	450	500	50:1	150	200	250	350	450
	63:1	189	252	315	441	567	630	63:1	189	252	315	441	567
	70:1	210	280	350	490	630	700	70:1	210	280	350	490	630
	81:1	243	324	405	567	729	810	81:1	243	324	405	567	729
	90:1	270	360	450	630	810	900	90:1	270	360	450	630	810
	100:1	300	400	500	700	900	1000	100:1	300	400	500	700	900
BB RS-775	9:1	27	36	45	63	81	90	9:1	27	36	45	63	81
	12:1	36	48	60	84	108	120	12:1	36	48	60	84	108
	15:1	45	60	75	105	135	150	15:1	45	60	75	105	135
	16:1	48	64	80	112	144	160	16:1	48	64	80	112	144
	20:1	60	80	100	140	180	200	20:1	60	80	100	140	180
	21:1	63	84	105	147	189	210	21:1	63	84	105	147	189
	25:1	75	100	125	175	225	250	25:1	75	100	125	175	225
	27:1	81	108	135	189	243	270	27:1	81	108	135	189	243
	28:1	84	112	140	196	252	280	28:1	84	112	140	196	252
	30:1	90	120	150	210	270	300	30:1	90	120	150	210	270
	35:1	105	140	175	245	315	350	35:1	105	140	175	245	315
	36:1	108	144	180	252	324	360	36:1	108	144	180	252	324
	40:1	120	160	200	280	360	400	40:1	120	160	200	280	360
	45:1	135	180	225	315	405	450	45:1	135	180	225	315	405
	49:1	147	196	245	343	441	490	49:1	147	196	245	343	441
	50:1	150	200	250	350	450	500	50:1	150	200	250	350	450
	63:1	189	252	315	441	567	630	63:1	189	252	315	441	567
	70:1	210	280	350	490	630	700	70:1	210	280	350	490	630
	81:1	243	324	405	567	729	810	81:1	243	324	405	567	729
	90:1	270	360	450	630	810	900	90:1	270	360	450	630	810
	100:1	300	400	500	700	900	1000	100:1	300	400	500	700	900
BAG Motor	9:1	27	36	45	63	81	90	9:1	27	36	45	63	81
	12:1	36	48	60	84	108	120	12:1	36	48	60	84	108
	15:1	45	60	75	105	135	150	15:1	45	60	75	105	135
	16:1	48	64	80	112	144	160	16:1	48	64	80	112	144
	20:1	60	80	100	140	180	200	20:1	60	80	100	140	180
	21:1	63	84	105	147	189	210	21:1	63	84	105	147	189
	25:1	75	100	125	175	225	250	25:1	75	100	125	175	225
	27:1	81	108	135	189	243	270	27:1	81	108	135	189	243
	28:1	84	112	140	196	252	280	28:1	84	112	140	196	252
	30:1	90	120	150	210	270	300	30:1	90	120	150	210	270
	35:1	105	140	175	245	315	350	35:1	105	140	175	245	315
	36:1	108	144	180	252	324	360	36:1	108	144	180	252	324
	40:1	120	160	200	280	360	400	40:1	120	160	200	280	360
	45:1	135	180	225	315	405	450	45:1	135	180	225	315	405
	49:1	147	196	245	343	441	490	49:1	147	196	245	343	441
	50:1	150	200	250	350	450	500	50:1	150	200	250	350	450
	63:1	189	252	315	441	567	630	63:1	189	252	315	441	567
	70:1	210	280	350	490	630	700	70:1	210	280	350	490	630
	81:1	243	324	405	567	729	810	81:1	243	324	405	567	729
	90:1	270	360	450	630	810	900	90:1	270	360	450	630	810
	100:1	300	400	500	700	900	1000	100:1	300	400	500	700	900

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Table 5 – 3 Stage Max Gear Ratio w/1/2" Hex Output Shaft (Continued)

Motor	Stage 1 & 2	Stage 3					
		3:1	4:1	5:1	7:1	9:1	10:1
Mini CIM	9:1	27	36	45	63	81	90
	12:1	36	48	60	84	108	120
	15:1	45	60	75	105	135	150
	16:1	48	64	80	112	144	160
	20:1	60	80	100	140	180	200
	21:1	63	84	105	147	189	210
	25:1	75	100	125	175	225	250
	27:1	81	108	135	189	243	270
	28:1	84	112	140	196	252	280
	30:1	90	120	150	210	270	300
	35:1	105	140	175	245	315	350
	36:1	108	144	180	252	324	360
	40:1	120	160	200	280	360	400
	45:1	135	180	225	315	405	450
	49:1	147	196	245	343	441	490
	50:1	150	200	250	350	450	500
	63:1	189	252	315	441	567	630
	70:1	210	280	350	490	630	700
	81:1	243	324	405	567	729	810
	90:1	270	360	450	630	810	900
	100:1	300	400	500	700	900	1000
CIM	9:1	27	36	45	63	81	90
	12:1	36	48	60	84	108	120
	15:1	45	60	75	105	135	150
	16:1	48	64	80	112	144	160
	20:1	60	80	100	140	180	200
	21:1	63	84	105	147	189	210
	25:1	75	100	125	175	225	250
	27:1	81	108	135	189	243	270
	28:1	84	112	140	196	252	280
	30:1	90	120	150	210	270	300
	35:1	105	140	175	245	315	350
	36:1	108	144	180	252	324	360
	40:1	120	160	200	280	360	400
	45:1	135	180	225	315	405	450
	49:1	147	196	245	343	441	490
	50:1	150	200	250	350	450	500
	63:1	189	252	315	441	567	630
	70:1	210	280	350	490	630	700
	81:1	243	324	405	567	729	810
	90:1	270	360	450	630	810	900
	100:1	300	400	500	700	900	1000

Motor	Stage 1 & 2	Stage 3					
		3:1	4:1	5:1	7:1	9:1	10:1
775pro	9:1	27	36	45	63	81	90
	12:1	36	48	60	84	108	120
	15:1	45	60	75	105	135	150
	16:1	48	64	80	112	144	160
	20:1	60	80	100	140	180	200
	21:1	63	84	105	147	189	210
	25:1	75	100	125	175	225	250
	27:1	81	108	135	189	243	270
	28:1	84	112	140	196	252	280
	30:1	90	120	150	210	270	300
	35:1	105	140	175	245	315	350
	36:1	108	144	180	252	324	360
	40:1	120	160	200	280	360	400
	45:1	135	180	225	315	405	450
	49:1	147	196	245	343	441	490
	50:1	150	200	250	350	450	500
	63:1	189	252	315	441	567	630
	70:1	210	280	350	490	630	700
	81:1	243	324	405	567	729	810
	90:1	270	360	450	630	810	900
	100:1	300	400	500	700	900	1000

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

Motor	Stage 1 & 2	Stage 3						Motor	Stage 1 & 2	Stage 3					
		3:1	4:1	5:1	7:1	9:1	10:1			3:1	4:1	5:1	7:1	9:1	10:1
AM-9015	9:1	27	36	45	63	81	90	BB RS-775	9:1	27	36	45	63	81	90
	12:1	36	48	60	84	108	120		12:1	36	48	60	84	108	120
	15:1	45	60	75	105	135	150		15:1	45	60	75	105	135	150
	16:1	48	64	80	112	144	160		16:1	48	64	80	112	144	160
	20:1	60	80	100	140	180	200		20:1	60	80	100	140	180	200
	21:1	63	84	105	147	189	210		21:1	63	84	105	147	189	210
	25:1	75	100	125	175	225	250		25:1	75	100	125	175	225	250
	27:1	81	108	135	189	243	270		27:1	81	108	135	189	243	270
	28:1	84	112	140	196	252	280		28:1	84	112	140	196	252	280
	30:1	90	120	150	210	270	300		30:1	90	120	150	210	270	300
	35:1	105	140	175	245	315	350		35:1	105	140	175	245	315	350
	36:1	108	144	180	252	324	360		36:1	108	144	180	252	324	360
	40:1	120	160	200	280	360	400		40:1	120	160	200	280	360	400
	45:1	135	180	225	315	405	450		45:1	135	180	225	315	405	450
	49:1	147	196	245	343	441	490		49:1	147	196	245	343	441	490
	50:1	150	200	250	350	450	500		50:1	150	200	250	350	450	500
	63:1	189	252	315	441	567	630		63:1	189	252	315	441	567	630
	70:1	210	280	350	490	630	700		70:1	210	280	350	490	630	700
	81:1	243	324	405	567	729	810		81:1	243	324	405	567	729	810
	90:1	270	360	450	630	810	900		90:1	270	360	450	630	810	900
	100:1	300	400	500	700	900	1000		100:1	300	400	500	700	900	1000
BB RS-550	9:1	27	36	45	63	81	90	BAG Motor	9:1	27	36	45	63	81	90
	12:1	36	48	60	84	108	120		12:1	36	48	60	84	108	120
	15:1	45	60	75	105	135	150		15:1	45	60	75	105	135	150
	16:1	48	64	80	112	144	160		16:1	48	64	80	112	144	160
	20:1	60	80	100	140	180	200		20:1	60	80	100	140	180	200
	21:1	63	84	105	147	189	210		21:1	63	84	105	147	189	210
	25:1	75	100	125	175	225	250		25:1	75	100	125	175	225	250
	27:1	81	108	135	189	243	270		27:1	81	108	135	189	243	270
	28:1	84	112	140	196	252	280		28:1	84	112	140	196	252	280
	30:1	90	120	150	210	270	300		30:1	90	120	150	210	270	300
	35:1	105	140	175	245	315	350		35:1	105	140	175	245	315	350
	36:1	108	144	180	252	324	360		36:1	108	144	180	252	324	360
	40:1	120	160	200	280	360	400		40:1	120	160	200	280	360	400
	45:1	135	180	225	315	405	450		45:1	135	180	225	315	405	450
	49:1	147	196	245	343	441	490		49:1	147	196	245	343	441	490
	50:1	150	200	250	350	450	500		50:1	150	200	250	350	450	500
	63:1	189	252	315	441	567	630		63:1	189	252	315	441	567	630
	70:1	210	280	350	490	630	700		70:1	210	280	350	490	630	700
	81:1	243	324	405	567	729	810		81:1	243	324	405	567	729	810
	90:1	270	360	450	630	810	900		90:1	270	360	450	630	810	900
	100:1	300	400	500	700	900	1000		100:1	300	400	500	700	900	1000

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Table 6 – 3 Stage Max Gear Ratio w/1/2" Round Output Shaft (Continued)

Motor	Stage 1 & 2	Stage 3					
		3:1	4:1	5:1	7:1	9:1	10:1
Mini CIM	9:1	27	36	45	63	81	90
	12:1	36	48	60	84	108	120
	15:1	45	60	75	105	135	150
	16:1	48	64	80	112	144	160
	20:1	60	80	100	140	180	200
	21:1	63	84	105	147	189	210
	25:1	75	100	125	175	225	250
	27:1	81	108	135	189	243	270
	28:1	84	112	140	196	252	280
	30:1	90	120	150	210	270	300
	35:1	105	140	175	245	315	350
	36:1	108	144	180	252	324	360
	40:1	120	160	200	280	360	400
	45:1	135	180	225	315	405	450
	49:1	147	196	245	343	441	490
	50:1	150	200	250	350	450	500
	63:1	189	252	315	441	567	630
	70:1	210	280	350	490	630	700
	81:1	243	324	405	567	729	810
	90:1	270	360	450	630	810	900
	100:1	300	400	500	700	900	1000
CIM	9:1	27	36	45	63	81	90
	12:1	36	48	60	84	108	120
	15:1	45	60	75	105	135	150
	16:1	48	64	80	112	144	160
	20:1	60	80	100	140	180	200
	21:1	63	84	105	147	189	210
	25:1	75	100	125	175	225	250
	27:1	81	108	135	189	243	270
	28:1	84	112	140	196	252	280
	30:1	90	120	150	210	270	300
	35:1	105	140	175	245	315	350
	36:1	108	144	180	252	324	360
	40:1	120	160	200	280	360	400
	45:1	135	180	225	315	405	450
	49:1	147	196	245	343	441	490
	50:1	150	200	250	350	450	500
	63:1	189	252	315	441	567	630
	70:1	210	280	350	490	630	700
	81:1	243	324	405	567	729	810
	90:1	270	360	450	630	810	900
	100:1	300	400	500	700	900	1000

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

		Stage 3						Stage 3							
Motor	Stage 1 & 2	3:1	4:1	5:1	7:1	9:1	10:1	Motor	Stage 1 & 2	3:1	4:1	5:1	7:1	9:1	10:1
AM-9015	9:1	27	36	45	63	81	90	BB RS-775	9:1	27	36	45	63	81	90
	12:1	36	48	60	84	108	120		12:1	36	48	60	84	108	120
	15:1	45	60	75	105	135	150		15:1	45	60	75	105	135	150
	16:1	48	64	80	112	144	160		16:1	48	64	80	112	144	160
	20:1	60	80	100	140	180	200		20:1	60	80	100	140	180	200
	21:1	63	84	105	147	189	210		21:1	63	84	105	147	189	210
	25:1	75	100	125	175	225	250		25:1	75	100	125	175	225	250
	27:1	81	108	135	189	243	270		27:1	81	108	135	189	243	270
	28:1	84	112	140	196	252	280		28:1	84	112	140	196	252	280
	30:1	90	120	150	210	270	300		30:1	90	120	150	210	270	300
	35:1	105	140	175	245	315	350		35:1	105	140	175	245	315	350
	36:1	108	144	180	252	324	360		36:1	108	144	180	252	324	360
	40:1	120	160	200	280	360	400		40:1	120	160	200	280	360	400
	45:1	135	180	225	315	405	450		45:1	135	180	225	315	405	450
	49:1	147	196	245	343	441	490		49:1	147	196	245	343	441	490
	50:1	150	200	250	350	450	500		50:1	150	200	250	350	450	500
	63:1	189	252	315	441	567	630		63:1	189	252	315	441	567	630
	70:1	210	280	350	490	630	700		70:1	210	280	350	490	630	700
	81:1	243	324	405	567	729	810		81:1	243	324	405	567	729	810
	90:1	270	360	450	630	810	900		90:1	270	360	450	630	810	900
	100:1	300	400	500	700	900	1000		100:1	300	400	500	700	900	1000
BB RS-550	9:1	27	36	45	63	81	90	BAG Motor	9:1	27	36	45	63	81	90
	12:1	36	48	60	84	108	120		12:1	36	48	60	84	108	120
	15:1	45	60	75	105	135	150		15:1	45	60	75	105	135	150
	16:1	48	64	80	112	144	160		16:1	48	64	80	112	144	160
	20:1	60	80	100	140	180	200		20:1	60	80	100	140	180	200
	21:1	63	84	105	147	189	210		21:1	63	84	105	147	189	210
	25:1	75	100	125	175	225	250		25:1	75	100	125	175	225	250
	27:1	81	108	135	189	243	270		27:1	81	108	135	189	243	270
	28:1	84	112	140	196	252	280		28:1	84	112	140	196	252	280
	30:1	90	120	150	210	270	300		30:1	90	120	150	210	270	300
	35:1	105	140	175	245	315	350		35:1	105	140	175	245	315	350
	36:1	108	144	180	252	324	360		36:1	108	144	180	252	324	360
	40:1	120	160	200	280	360	400		40:1	120	160	200	280	360	400
	45:1	135	180	225	315	405	450		45:1	135	180	225	315	405	450
	49:1	147	196	245	343	441	490		49:1	147	196	245	343	441	490
	50:1	150	200	250	350	450	500		50:1	150	200	250	350	450	500
	63:1	189	252	315	441	567	630		63:1	189	252	315	441	567	630
	70:1	210	280	350	490	630	700		70:1	210	280	350	490	630	700
	81:1	243	324	405	567	729	810		81:1	243	324	405	567	729	810
	90:1	270	360	450	630	810	900		90:1	270	360	450	630	810	900
	100:1	300	400	500	700	900	1000		100:1	300	400	500	700	900	1000

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Table 7 – 3 Stage Max Gear Ratio w/3/8" Hex Output Shaft (Continued)

		Stage 3						Stage 3							
Motor	Stage 1 & 2	3:1	4:1	5:1	7:1	9:1	10:1	Motor	Stage 1 & 2	3:1	4:1	5:1	7:1	9:1	10:1
Mini CIM	9:1	27	36	45	63	81	90	775pro	9:1	27	36	45	63	81	90
	12:1	36	48	60	84	108	120		12:1	36	48	60	84	108	120
	15:1	45	60	75	105	135	150		15:1	45	60	75	105	135	150
	16:1	48	64	80	112	144	160		16:1	48	64	80	112	144	160
	20:1	60	80	100	140	180	200		20:1	60	80	100	140	180	200
	21:1	63	84	105	147	189	210		21:1	63	84	105	147	189	210
	25:1	75	100	125	175	225	250		25:1	75	100	125	175	225	250
	27:1	81	108	135	189	243	270		27:1	81	108	135	189	243	270
	28:1	84	112	140	196	252	280		28:1	84	112	140	196	252	280
	30:1	90	120	150	210	270	300		30:1	90	120	150	210	270	300
	35:1	105	140	175	245	315	350		35:1	105	140	175	245	315	350
	36:1	108	144	180	252	324	360		36:1	108	144	180	252	324	360
	40:1	120	160	200	280	360	400		40:1	120	160	200	280	360	400
	45:1	135	180	225	315	405	450		45:1	135	180	225	315	405	450
	49:1	147	196	245	343	441	490		49:1	147	196	245	343	441	490
	50:1	150	200	250	350	450	500		50:1	150	200	250	350	450	500
	63:1	189	252	315	441	567	630		63:1	189	252	315	441	567	630
	70:1	210	280	350	490	630	700		70:1	210	280	350	490	630	700
	81:1	243	324	405	567	729	810		81:1	243	324	405	567	729	810
	90:1	270	360	450	630	810	900		90:1	270	360	450	630	810	900
	100:1	300	400	500	700	900	1000		100:1	300	400	500	700	900	1000
CIM	9:1	27	36	45	63	81	90		9:1	27	36	45	63	81	90
	12:1	36	48	60	84	108	120		12:1	36	48	60	84	108	120
	15:1	45	60	75	105	135	150		15:1	45	60	75	105	135	150
	16:1	48	64	80	112	144	160		16:1	48	64	80	112	144	160
	20:1	60	80	100	140	180	200		20:1	60	80	100	140	180	200
	21:1	63	84	105	147	189	210		21:1	63	84	105	147	189	210
	25:1	75	100	125	175	225	250		25:1	75	100	125	175	225	250
	27:1	81	108	135	189	243	270		27:1	81	108	135	189	243	270
	28:1	84	112	140	196	252	280		28:1	84	112	140	196	252	280
	30:1	90	120	150	210	270	300		30:1	90	120	150	210	270	300
	35:1	105	140	175	245	315	350		35:1	105	140	175	245	315	350
	36:1	108	144	180	252	324	360		36:1	108	144	180	252	324	360
	40:1	120	160	200	280	360	400		40:1	120	160	200	280	360	400
	45:1	135	180	225	315	405	450		45:1	135	180	225	315	405	450
	49:1	147	196	245	343	441	490		49:1	147	196	245	343	441	490
	50:1	150	200	250	350	450	500		50:1	150	200	250	350	450	500
	63:1	189	252	315	441	567	630		63:1	189	252	315	441	567	630
	70:1	210	280	350	490	630	700		70:1	210	280	350	490	630	700
	81:1	243	324	405	567	729	810		81:1	243	324	405	567	729	810
	90:1	270	360	450	630	810	900		90:1	270	360	450	630	810	900
	100:1	300	400	500	700	900	1000		100:1	300	400	500	700	900	1000

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

		Stage 3						Stage 3							
Motor	Stage 1 & 2	3:1	4:1	5:1	7:1	9:1	10:1	Motor	Stage 1 & 2	3:1	4:1	5:1	7:1	9:1	10:1
AM-9015	9:1	27	36	45	63	81	90	BB RS-775	9:1	27	36	45	63	81	90
	12:1	36	48	60	84	108	120		12:1	36	48	60	84	108	120
	15:1	45	60	75	105	135	150		15:1	45	60	75	105	135	150
	16:1	48	64	80	112	144	160		16:1	48	64	80	112	144	160
	20:1	60	80	100	140	180	200		20:1	60	80	100	140	180	200
	21:1	63	84	105	147	189	210		21:1	63	84	105	147	189	210
	25:1	75	100	125	175	225	250		25:1	75	100	125	175	225	250
	27:1	81	108	135	189	243	270		27:1	81	108	135	189	243	270
	28:1	84	112	140	196	252	280		28:1	84	112	140	196	252	280
	30:1	90	120	150	210	270	300		30:1	90	120	150	210	270	300
	35:1	105	140	175	245	315	350		35:1	105	140	175	245	315	350
	36:1	108	144	180	252	324	360		36:1	108	144	180	252	324	360
	40:1	120	160	200	280	360	400		40:1	120	160	200	280	360	400
	45:1	135	180	225	315	405	450		45:1	135	180	225	315	405	450
	49:1	147	196	245	343	441	490		49:1	147	196	245	343	441	490
	50:1	150	200	250	350	450	500		50:1	150	200	250	350	450	500
	63:1	189	252	315	441	567	630		63:1	189	252	315	441	567	630
	70:1	210	280	350	490	630	700		70:1	210	280	350	490	630	700
	81:1	243	324	405	567	729	810		81:1	243	324	405	567	729	810
	90:1	270	360	450	630	810	900		90:1	270	360	450	630	810	900
	100:1	300	400	500	700	900	1000		100:1	300	400	500	700	900	1000
BB RS-550	9:1	27	36	45	63	81	90	BAG Motor	9:1	27	36	45	63	81	90
	12:1	36	48	60	84	108	120		12:1	36	48	60	84	108	120
	15:1	45	60	75	105	135	150		15:1	45	60	75	105	135	150
	16:1	48	64	80	112	144	160		16:1	48	64	80	112	144	160
	20:1	60	80	100	140	180	200		20:1	60	80	100	140	180	200
	21:1	63	84	105	147	189	210		21:1	63	84	105	147	189	210
	25:1	75	100	125	175	225	250		25:1	75	100	125	175	225	250
	27:1	81	108	135	189	243	270		27:1	81	108	135	189	243	270
	28:1	84	112	140	196	252	280		28:1	84	112	140	196	252	280
	30:1	90	120	150	210	270	300		30:1	90	120	150	210	270	300
	35:1	105	140	175	245	315	350		35:1	105	140	175	245	315	350
	36:1	108	144	180	252	324	360		36:1	108	144	180	252	324	360
	40:1	120	160	200	280	360	400		40:1	120	160	200	280	360	400
	45:1	135	180	225	315	405	450		45:1	135	180	225	315	405	450
	49:1	147	196	245	343	441	490		49:1	147	196	245	343	441	490
	50:1	150	200	250	350	450	500		50:1	150	200	250	350	450	500
	63:1	189	252	315	441	567	630		63:1	189	252	315	441	567	630
	70:1	210	280	350	490	630	700		70:1	210	280	350	490	630	700
	81:1	243	324	405	567	729	810		81:1	243	324	405	567	729	810
	90:1	270	360	450	630	810	900		90:1	270	360	450	630	810	900
	100:1	300	400	500	700	900	1000		100:1	300	400	500	700	900	1000

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Table 8 – 3 Stage Max Gear Ratio w/CIM Motor Output Shaft (Continued)

Motor	Stage 1 & 2	Stage 3						Motor	Stage 1 & 2	Stage 3					
		3:1	4:1	5:1	7:1	9:1	10:1			3:1	4:1	5:1	7:1	9:1	10:1
Mini CIM	9:1	27	36	45	63	81	90	775pro	9:1	27	36	45	63	81	90
	12:1	36	48	60	84	108	120		12:1	36	48	60	84	108	120
	15:1	45	60	75	105	135	150		15:1	45	60	75	105	135	150
	16:1	48	64	80	112	144	160		16:1	48	64	80	112	144	160
	20:1	60	80	100	140	180	200		20:1	60	80	100	140	180	200
	21:1	63	84	105	147	189	210		21:1	63	84	105	147	189	210
	25:1	75	100	125	175	225	250		25:1	75	100	125	175	225	250
	27:1	81	108	135	189	243	270		27:1	81	108	135	189	243	270
	28:1	84	112	140	196	252	280		28:1	84	112	140	196	252	280
	30:1	90	120	150	210	270	300		30:1	90	120	150	210	270	300
	35:1	105	140	175	245	315	350		35:1	105	140	175	245	315	350
	36:1	108	144	180	252	324	360		36:1	108	144	180	252	324	360
	40:1	120	160	200	280	360	400		40:1	120	160	200	280	360	400
	45:1	135	180	225	315	405	450		45:1	135	180	225	315	405	450
	49:1	147	196	245	343	441	490		49:1	147	196	245	343	441	490
	50:1	150	200	250	350	450	500		50:1	150	200	250	350	450	500
	63:1	189	252	315	441	567	630		63:1	189	252	315	441	567	630
	70:1	210	280	350	490	630	700		70:1	210	280	350	490	630	700
	81:1	243	324	405	567	729	810		81:1	243	324	405	567	729	810
	90:1	270	360	450	630	810	900		90:1	270	360	450	630	810	900
	100:1	300	400	500	700	900	1000		100:1	300	400	500	700	900	1000
CIM	9:1	27	36	45	63	81	90		9:1	27	36	45	63	81	90
	12:1	36	48	60	84	108	120		12:1	36	48	60	84	108	120
	15:1	45	60	75	105	135	150		15:1	45	60	75	105	135	150
	16:1	48	64	80	112	144	160		16:1	48	64	80	112	144	160
	20:1	60	80	100	140	180	200		20:1	60	80	100	140	180	200
	21:1	63	84	105	147	189	210		21:1	63	84	105	147	189	210
	25:1	75	100	125	175	225	250		25:1	75	100	125	175	225	250
	27:1	81	108	135	189	243	270		27:1	81	108	135	189	243	270
	28:1	84	112	140	196	252	280		28:1	84	112	140	196	252	280
	30:1	90	120	150	210	270	300		30:1	90	120	150	210	270	300
	35:1	105	140	175	245	315	350		35:1	105	140	175	245	315	350
	36:1	108	144	180	252	324	360		36:1	108	144	180	252	324	360
	40:1	120	160	200	280	360	400		40:1	120	160	200	280	360	400
	45:1	135	180	225	315	405	450		45:1	135	180	225	315	405	450
	49:1	147	196	245	343	441	490		49:1	147	196	245	343	441	490
	50:1	150	200	250	350	450	500		50:1	150	200	250	350	450	500
	63:1	189	252	315	441	567	630		63:1	189	252	315	441	567	630
	70:1	210	280	350	490	630	700		70:1	210	280	350	490	630	700
	81:1	243	324	405	567	729	810		81:1	243	324	405	567	729	810
	90:1	270	360	450	630	810	900		90:1	270	360	450	630	810	900
	100:1	300	400	500	700	900	1000		100:1	300	400	500	700	900	1000

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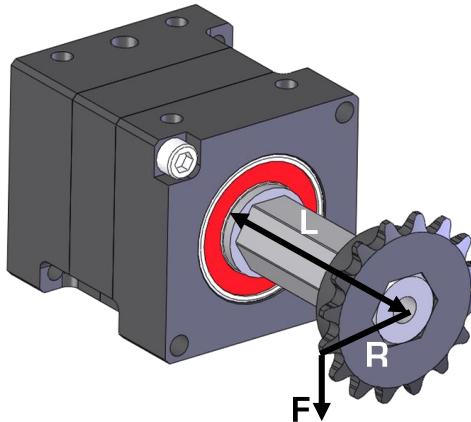
Combined Load Ratings Tables

The VersaPlanetary gearbox is designed to accommodate significant overhung loading with an unsupported shaft. However, 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) 7:1, 9:1, or 10:1 carrier plate ultimate stress failure. However, improper lubrication combined with typical FRC practice robot driving time would also result in eventual gear failure. 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.

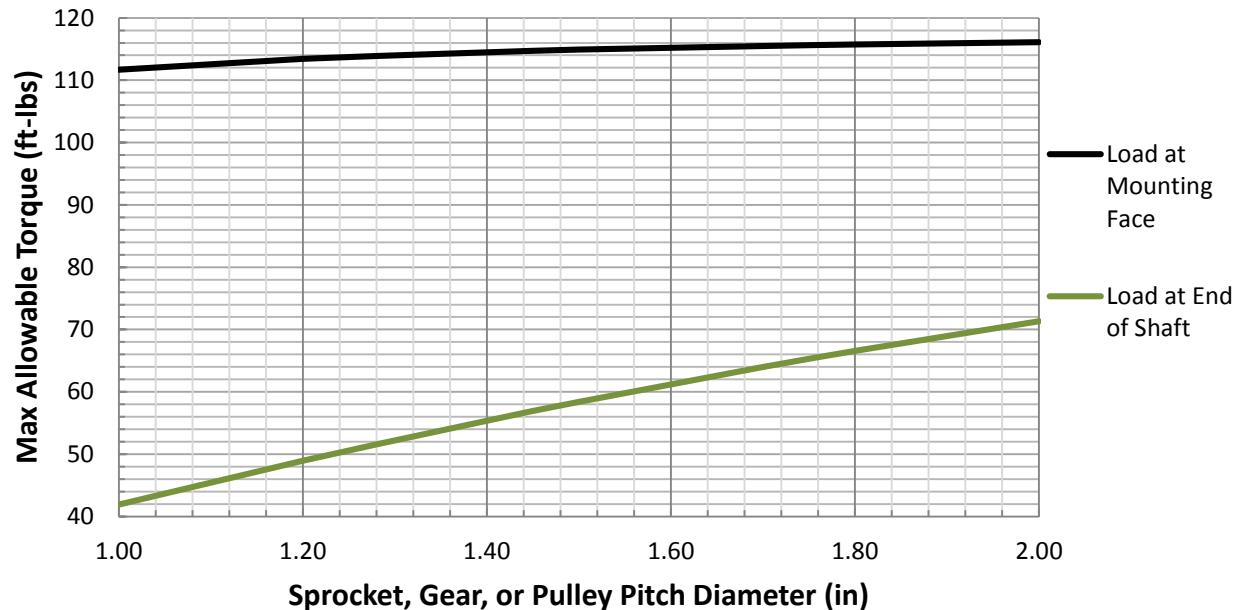


Failure Mode	N-m	ft-lbs
1/2" Hex Shaft Yield Stress	157	116
1/2" Round Shaft Yield Stress	130	96
3/8" Hex Shaft Yield Stress	57	42
CIM Motor Shaft Yield Stress	29	21
7:1, 9:1, 10:1 Carrier Plate Yield Stress	100	74

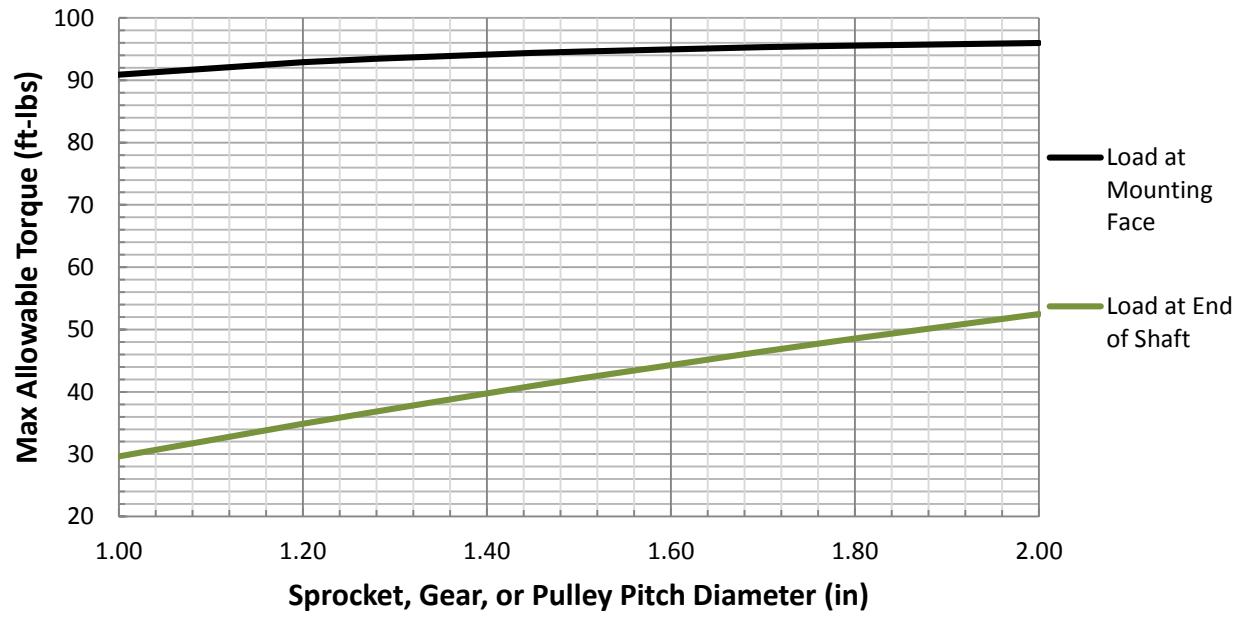
Table 9 – VersaPlanetary Output Torque Limits (Pure Torsion)



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

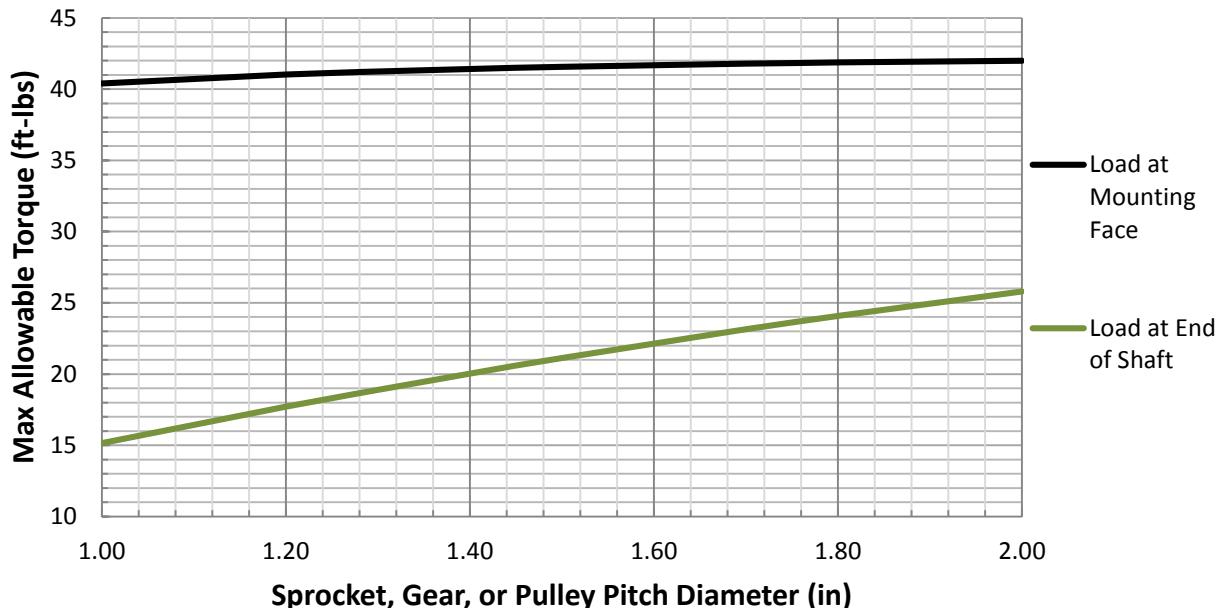


Max Output Torque vs. Pitch Diameter 1/2" Round Output Shaft





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



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

