

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

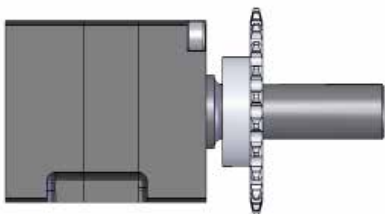
There are two types of rating tables in this guide:

- (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.

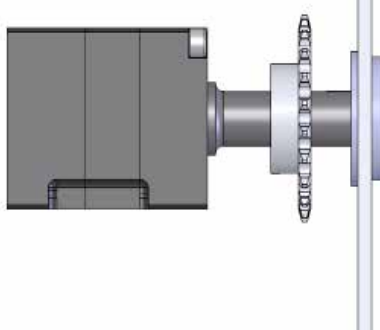
Most users are recommended to mount their VersaPlanetary gearboxes in such a way that they can use the "Simple Load Ratings" table.

IMPORTANT NOTE:

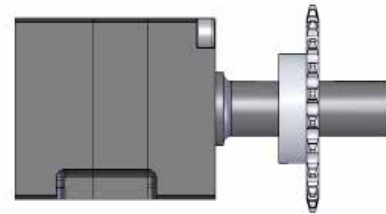
The "Simple Loading Ratings" tables assume that the output of your shaft has minimal overhung loading (i.e. your sprocket is really close to the base of the shaft, or you support the tip of the shaft). See below examples.



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.

Simple Load Ratings Tables

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

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

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

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

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

Table 5 – 3 Stage Max Gear Ratio w/ ½" Hex Shaft

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

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

Table 5 – 3 Stage Max Gear Ratio w/ ½" Hex Shaft (Continued)

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

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

Table 6 – 3 Stage Max Gear Ratio w/ ½" Round Shaft

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

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

Table 6 – 3 Stage Max Gear Ratio w/ ½" Round Shaft (Continued)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

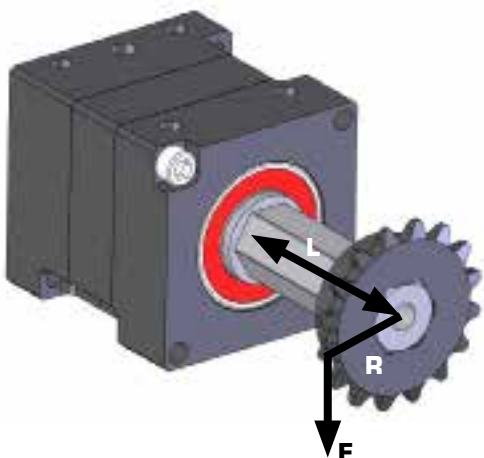
Combined Load Ratings Tables

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.

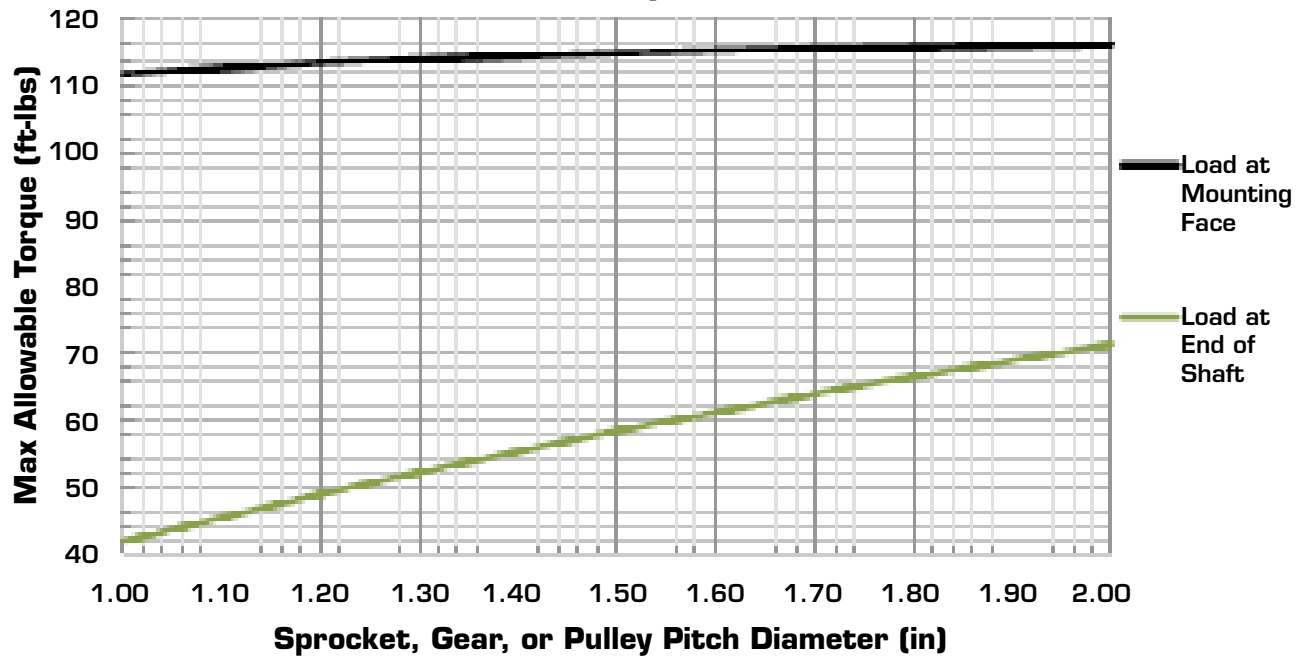
Failure mode #1 depends upon distance from the mounting face, gear / sprocket diameter, and torque load. Users should reference table 9 and the below charts to determine the maximum allowable loading for your design.



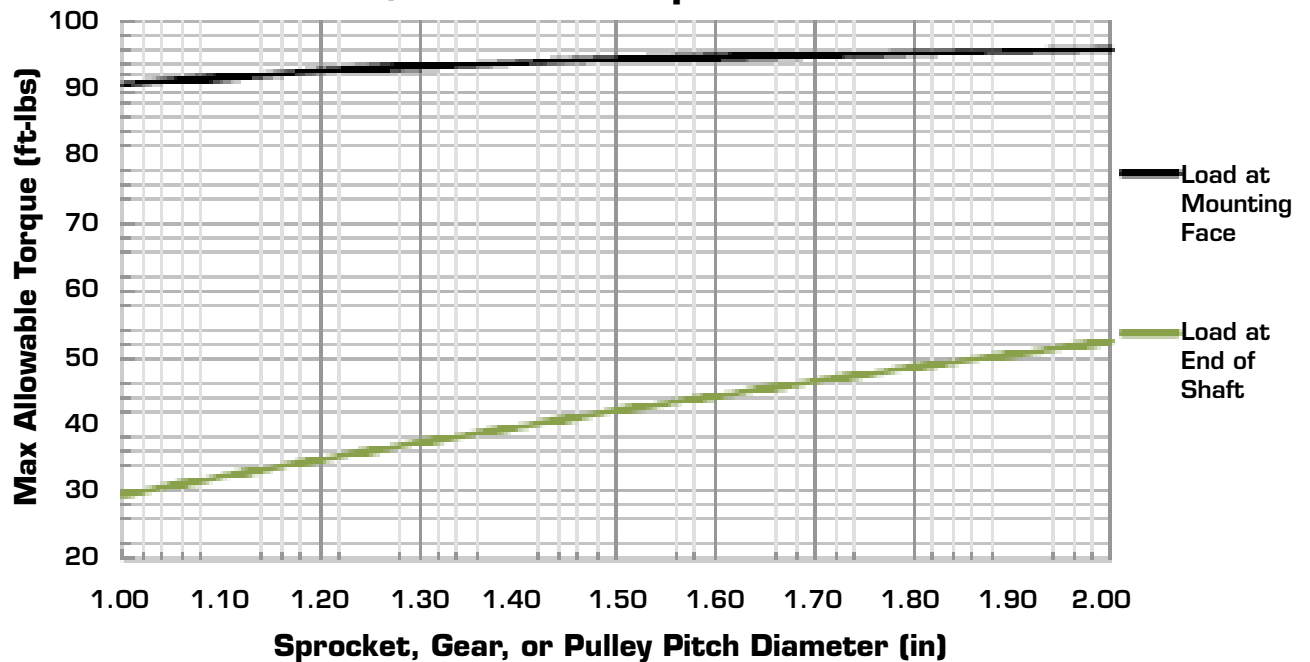
Failure Mode	Rated Load – Pure Torsion	
	N-m	ft-lbs
1/2" Hex Shaft Yield Stress	157	116
1/2" Round Shaft Yield Stress	130	96
3/8" Hex Shaft Yield Stress	57	42
CIM Motor Shaft Yield Stress	29	21
7:1, 9:1, 10:1 Carrier Plate Yield Stress	100	74

Table 9 – VersaPlanetary Output Torque Limits

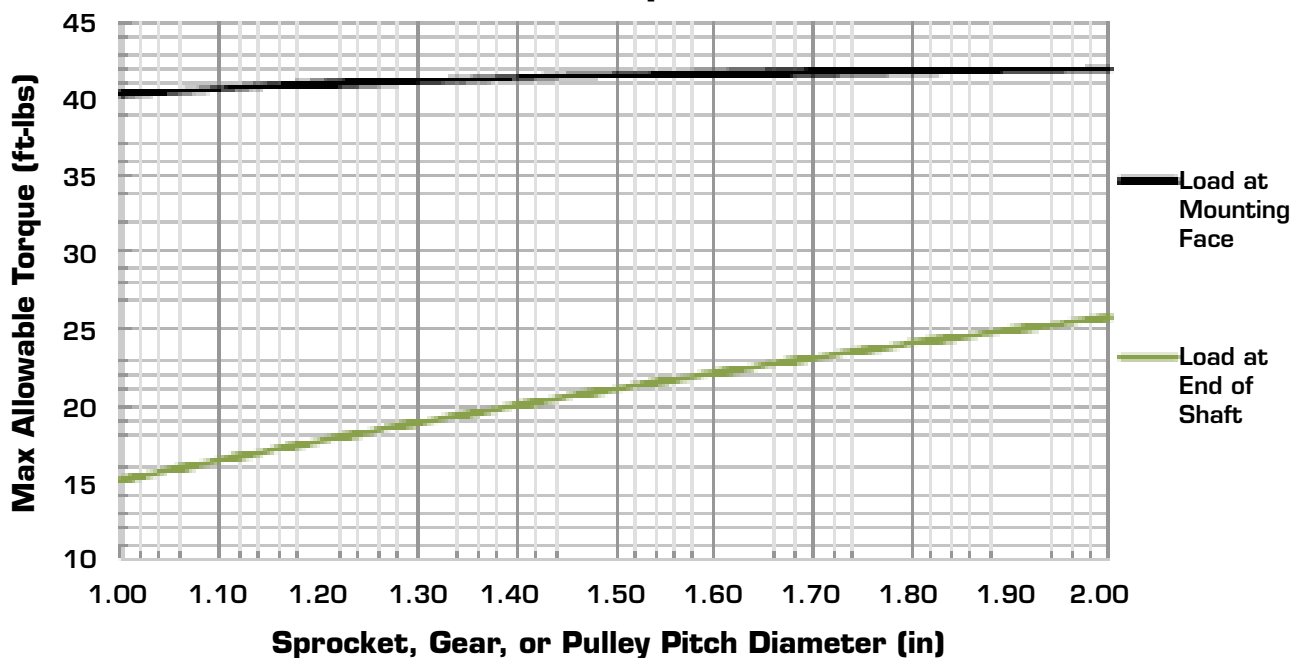
**Max Output Torque vs. Pitch Diameter
1/2" Hex Output Shaft**



**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

