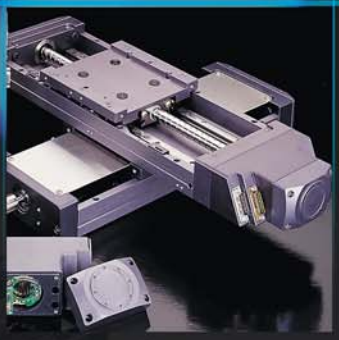
Linear & Rotary Positioning Stages

Servo Motors & Drives

Gearmotors & Gearheads



PRECISION GEARHEAD & GEARMOTOR for the Motion Control Industry

BAYSIDE® Motion Group

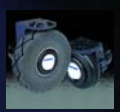
PRECISION IN MOTION

Gearmotors & Gearheads

Stealth® Planetary Gearmotors

5 **GM Servo Gearmotors**
Brushless servo motor integrated with a helical planetary gearhead

19 **DX Servo Wheel**
Brushless servo motor integrated with planetary gearhead and polyurethane wheel



Stealth® Planetary Gearheads

27 **PS Advanced In-Line**
Helical planetary technology for low backlash and high torque requirements

35 **PX In-Line**
Helical planetary technology in a lower cost package for less demanding servo applications

39 **RS Advanced Right Angle**
Delivers “The Helical Advantage” in a compact, right angle package

47 **RX Right Angle**
Helical planetary technology in a lower cost package for less demanding servo applications

51 **MultiDrive Right Angle**
MultiDrive models include Low Ratio (RB), Dual Shaft (RD) and Hollow Shaft (RT) options in a compact, right angle package

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47 **RX** Right Angle

51 **MultiDrive** Right Angle

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NEMA Spur Gearheads

59 **NE In-Line NEMA**
High efficiency spur gear design, in a light, compact package

63 **NR Right Angle NEMA**
High efficiency spur gear design in a lightweight right angle compact package

Gearmotors & Gearheads

Gearmotors & Gearheads:
Application Solutions

Stealth Gearmotors for Office Automation

APPLICATION CHALLENGE

A manufacturer of Pressure Form-Folder/Sealers, Bri-Lin, had a desire to develop a new product to replace their current table top model. The current model is typically used in the production of W2 , Wage, and Education Grade report forms. The success of their new model was dependent on a number of design criteria required for an office setting inclusive of size, quiet operation with little to no maintenance. On the mechanical side, the requirements for speed control and constant torque was a must; but the critical objective of the new model would be a major productivity improvement over the 5,000 to 7,000 forms per hour offered by their present model.

Design Change Criteria:

- Existing machine frame width must be maintained as these models are designed for desk top use utilizing 8½ x 11 inch sheets. To maintain registration and speed control a DC servo is required. A brushless motor would be preferred for low maintenance and a "no dust" environment. This frame size does not accommodate an in-line or right angle gearbox even if the cost could allow it.
- A Gearmotors option would meet the speed/torque and size requirements, but the cable cost and connector size would be an issue.
- Cut the one month delivery cycle of complete machine in half by utilizing a JIT component supplier with less than two week lead times.

Stealth Gearheads on High Speed Milling Machines

APPLICATION CHALLENGE

The manufacturer of high speed milling machines used in the Aerospace industry. These milling machines are becoming more commonplace in the aerospace and automotive industry because it allows large structural components to be machined from one piece, where before they were assembled from many smaller subcomponents. In high speed milling, spindle heads are operating at speeds ranging from 18,000 to 40,000 RPM, so that the cutting is above the resonant frequency of the machine. Because of this, many characteristics become more critical than in standard machines. The extremely large size of the spindle head also posed problems for the customer in trying to keep it accurately positioned during the milling stage.

Low Stiffness

The spindle head was moved rotationally by 2 bull gears, driving a large ring gear. Because of the system characteristics, it was difficult to keep the spindle head absolutely stiff during the milling process. The problems associated with low stiffness are:

1. Poor surface finish 2. Accuracy errors 3. Excessive tool chatter 4. Reduced tool life

Stealth Gearheads on a Bottling Application

APPLICATION CHALLENGE

The manufacturer of high performance plastic extrusion equipment. They needed a drop-in replacement gearhead for an existing worm gearbox used with their motor without having to alter the design of their machine. The gearhead/motor combination is being used to drive the machine's rollers. It controls the speed at which the plastic is extruded into high quality plastic sheets. The smoothness of the rollers is critical to the quality of the plastic sheets being produced.

- **High Transmission Error and Velocity Ripple.**
  The customer used worm gearheads to control the rollers. Worm gears exhibit a sliding action, of involute gears instead of a rolling action, contributing to the lack of smoothness of the machine rollers. Due to the high transmission error and velocity ripple from the worm drive, the rollers operated at differing speeds. This produced small lines and imperfections on the plastic sheets, rendering it unusable.
- **High Wear and Low Efficiency**
  The high level of rubbing (sliding action) between the worm and wheel teeth in the worm gearhead caused a high gear tooth wear rate and a lower efficiency (70%) than other major gear types.

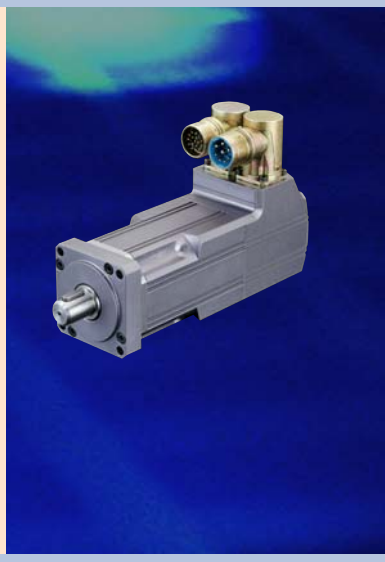
BAYSIDE SOLUTION

GM90-D1A2F Brushless Servo Gearmotors with 10:1 ratio, with flying leads option.

- The Bayside solution provided a cost effective package of less than 8 inch overall length with a speed/torque capability that offered a 4 X productivity improvement, raising rates of production to 20,000 forms/hour. The incremental cost was nearly zero with reduced noise and need for routine maintenance. The one-piece Gearmotors design with the rotor, sun gear and motor magnets attached, reduces the need for multiple seals and bearings. The resulting package of the helical planetary Brushless DC Gearmotors was a small, quiet, powerful machine that runs clean and cool. The IP65 and stainless steel output shaft also lends itself to wet applications.

- Plans are now underway for the next generation. A 30,000 form/hour unit on the drawing board utilizing Bayside's next step up in Gearmotors frame size, based on success of the tested 20,000/hour Form Folder/Sealer.

- This solution can be used in a variety of applications including:
  1. Packaging Industry 2. Printing/Graphics Industry 3. Medical/Pharmaceutical 4. Office Automation



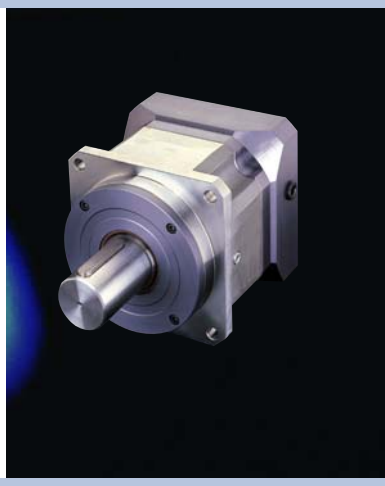
BAYSIDE SOLUTION

(2) Stealth PS142 Helical Planetary Gearheads

- The above Stealth Gearheads were used in tandem to create a stiff platform for the spindle machine head. One gearhead, acting as the master, and the other as the slave, were attached to the bull gears to simultaneously turn the ring gear which positioned the machine head. While the master gearhead moved the ring, the slave was taking up the backlash. In this way, the precision gears allowed for spindle to be moved accurately, while the two gearhead combination maintained maximum system stiffness.

- Bayside's Stealth PS gearhead features an all helical planetary gear design. Helical gears have a much higher tooth contact ratio and greater face width than straight spur gears, providing higher loads, smoother tooth engagement and quieter operation. The Stealth's HeliCrown Gear Tooth design provides extremely high gear tooth accuracy, while minimizing tooth wear. Bayside's Plasma Nitriding heat-treating process further heightens the gear tooth's wear resistance.

- This solution can be used in the aerospace and automotive industries.



BAYSIDE SOLUTION

(1) Stealth PS Gearhead and (1) Stealth RT MultiDrive (throughbore) Gearhead

- The above Stealth Gearhead products were used in combination to provide the required 120:1 ratio. The result was high quality plastics sheets that exceeded the customers specifications.

- The Stealth's all helical planetary design **(HeliCrown Gear Tooth)** features extremely high gear tooth accuracy, minimizing transmission error and velocity ripple. The Helicrown design features extremely high efficiency (98%) while minimizing tooth wear by providing a pure rolling action. Bayside's Plasma Nitriding heat-treating process further heightens the gear tooth's wear resistance.

- The Stealth MultiDrive gearhead features a space saving thru-bore (hollow shaft) option, eliminating compliance that occurs when coupling a gearhead shaft to the rollers being driven.

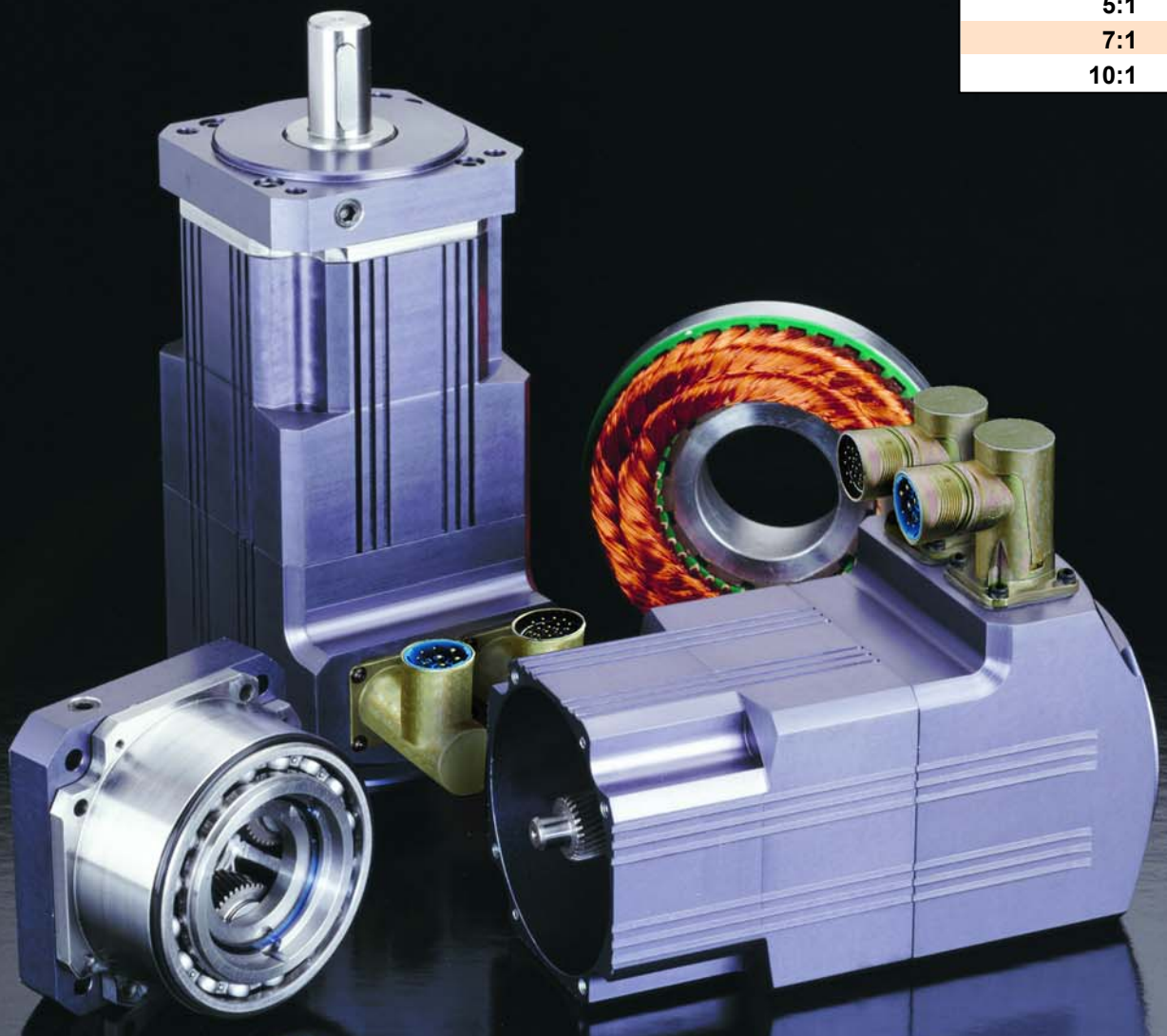
- This solution can be used for a variety of applications including:
  1. Packaging 2. Food 3. Semiconductor 4. Automotive 5. Medical

Stealth® GM Gearmotors Series

Bayside's Stealth® Gearmotors (GM) represents the first time a brushless servo motor and a helical planetary gearhead have been integrated into a single product.

3 Frame Sizes	
GM60	GM23
GM90	GM34
GM115	GM40

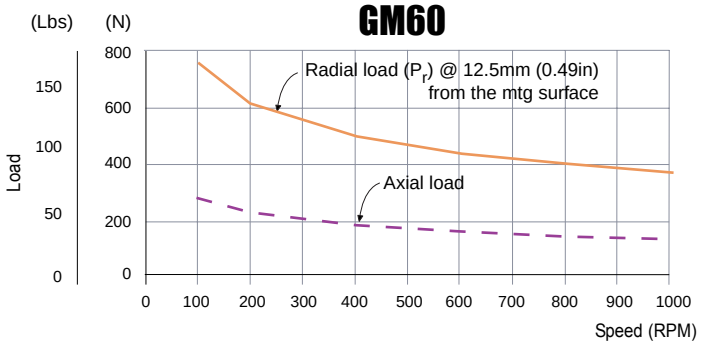
Ratios
5:1
7:1
10:1



Stealth® GM Gearmotors Series:
Output Shaft Load Rating

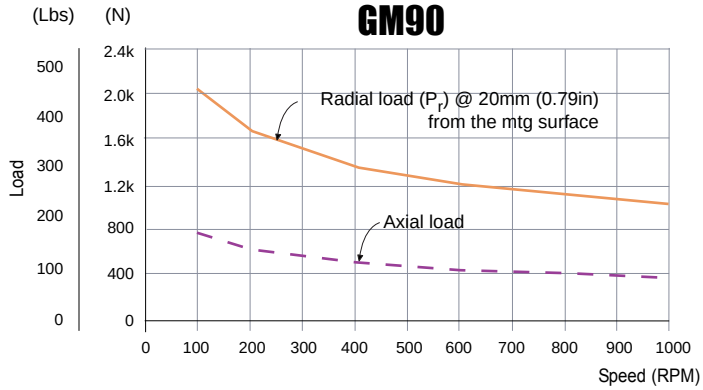
Formulas to calculate Radial Load (P_{rx}) at any distance "X" from the gearhead mounting surface.

GM60



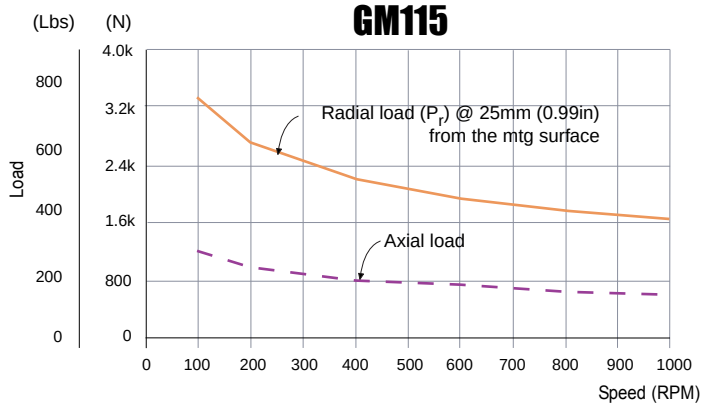
$P_{rx} = (P_r)(\mathbf{54mm}) / (\mathbf{41mm} + X)$
$P_{rx} = (P_r)(2.13in) / (1.61in + X)$

GM90



$P_{rx} = (P_r)(\mathbf{73mm}) / (\mathbf{52mm} + X)$
$P_{rx} = (P_r)(2.87in) / (2.05in + X)$

GM115



$P_{rx} = (P_r)(\mathbf{89mm}) / (\mathbf{63mm} + X)$
$P_{rx} = (P_r)(3.5in) / (2.48in + X)$

Stealth® GM Gearmotors Series:
An Integrated Step Forward

Bayside's Stealth® Gearmotors represents the first time a brushless servo motor and a helical planetary gearhead have been integrated into a single product. Previously, engineers needing a gear drive with servo motor were forced to purchase the gearhead and motor separately. Bayside manufactures precision gearheads and brushless motors under one roof. This provides us with the unique ability to design and supply a precision integrated gearmotors.

Stealth® Gearmotors combine both mechanical and electronic parts into a compact, powerful package. The motor magnets are attached directly to the input gearshaft, eliminating the extra couplings, shafts and bearings required when the two components are separate. Eliminating these extra parts means that Stealth Gearmotors are more reliable, have higher performance and cost less than traditional motor/gearhead assemblies.

When to Use:

- High torque in compact package
- Reduce mechanical complexity
- Cost reduction

Applications:

- Automotive
- Machine Tool
- Material Handling
- Medical
- Packaging
- Paper Converting
- Robotics
- Semiconductor

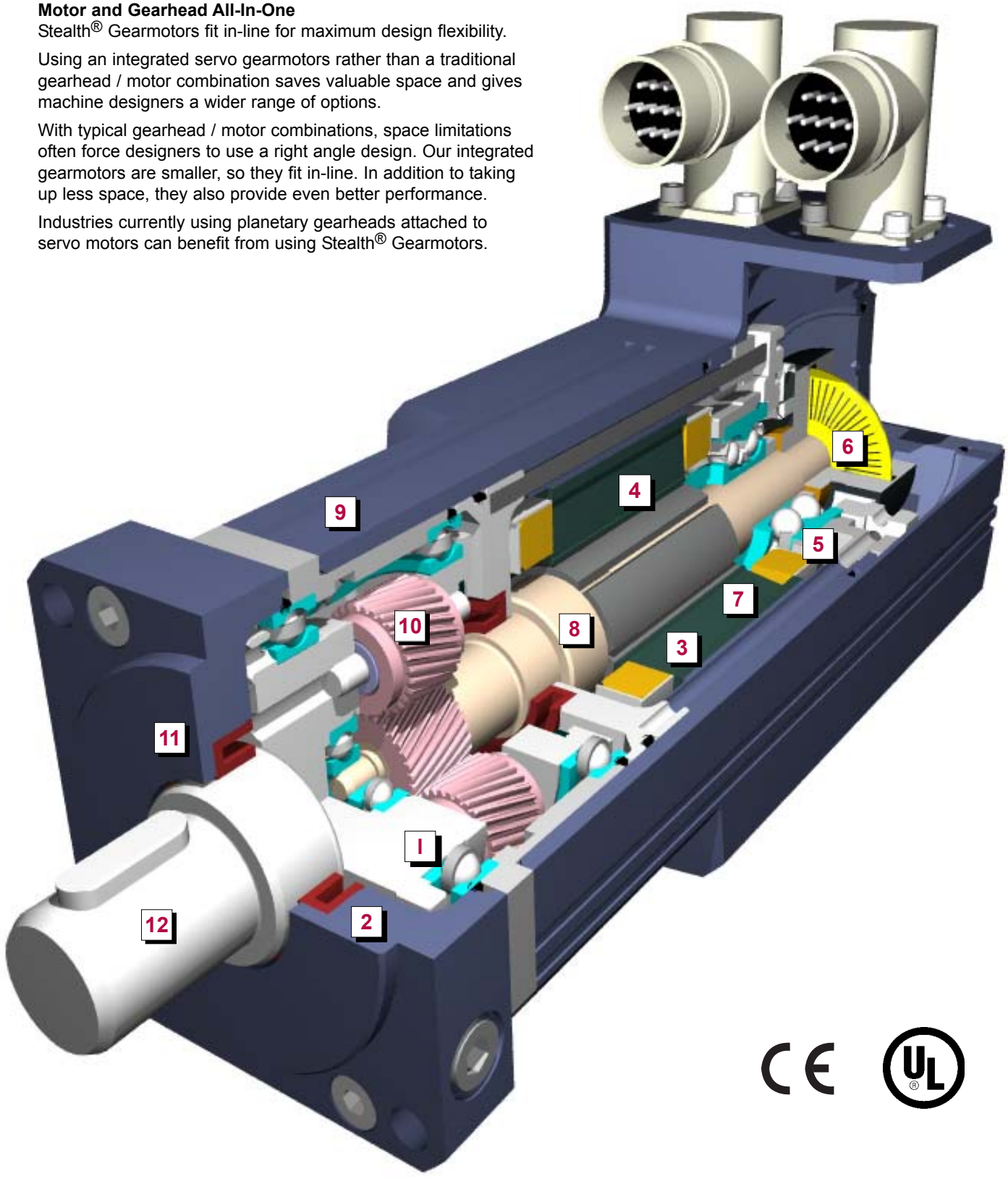
1. **Large Output Bearings** for high radial loads
2. **IP65 Protection** with Viton seals, DIN-type connectors, O-rings and an anodized aluminum alloy housing for use in harsh environments
3. **High Density Copper Windings and Rare-Earth Magnets** provides maximum torque and efficiency
4. **Skewed Laminations with Odd Slot Counts** reduce cogging
5. **Duplex Angular Contact Bearing** for optimum motor assembly stiffness
6. **Modular Encoders, Resolvers and Brakes** offered standard without increasing package size
7. **Two Winding Options, Single or Double Stack Motors and Multiple Gear Ratios** for a wide range of torques and speeds
8. **Single Piece Construction** of rotor and sun gear guarantees alignment for smooth operation
9. **Motor, Gearhead and Encoder** in one compact package eliminates extra parts, improving reliability and erformance
10. **Stealth® Helical Planetary Output** provides high torques, low backlash and quiet, reliable performance
11. **Innovative Thermal Design** runs 20% cooler than a separate motor/gearhead assembly
12. **Stainless Steel Output Shaft** won't rust in corrosive environments

Motor and Gearhead All-In-One
Stealth® Gearmotors fit in-line for maximum design flexibility.

Using an integrated servo gearmotors rather than a traditional gearhead / motor combination saves valuable space and gives machine designers a wider range of options.

With typical gearhead / motor combinations, space limitations often force designers to use a right angle design. Our integrated gearmotors are smaller, so they fit in-line. In addition to taking up less space, they also provide even better performance.

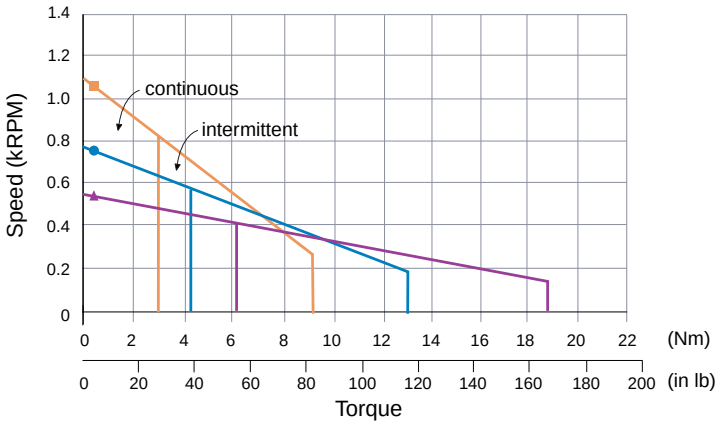
Industries currently using planetary gearheads attached to servo motors can benefit from using Stealth® Gearmotors.



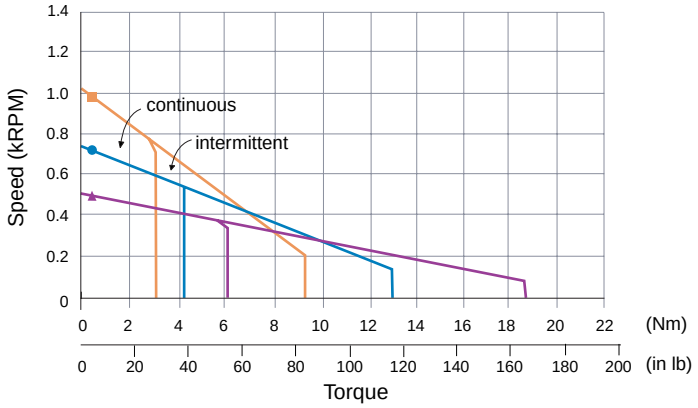
Gearmotors & Gearheads

Stealth® GM Gearmotors Series:
GM60 Speed / Torque Curves

Single Stack - 160 volt

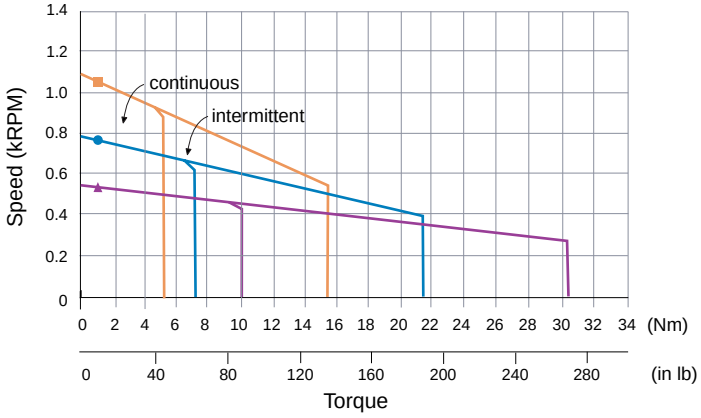


Single Stack - 300 volt

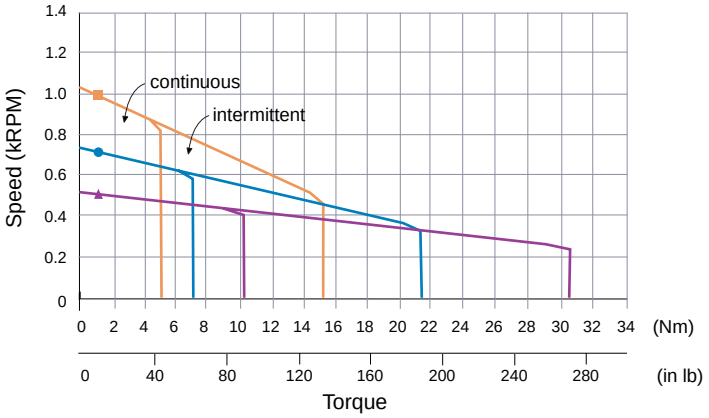


5:1 7:1 10:1

Double Stack - 160 volt



Double Stack - 300 volt



Stealth® GM Gearmotors Series:
GM60

Performance Specifications (six step/trapezoidal commutation)

Mechanical Specifications

Frame Size	Stack Length	Weight without Brake		Maximum Radial Load		Torsional Stiffness		Standard Backlash *	Low Backlash *
		(kg)	(lb)	(N)	(lb)	(Nm/arc min)	(in lb/arc min)	(arc min)	(arc min)
GM060	Single	**2.1**	4.7	**1,300**	292	**6**	53	15	10
GM060	Double	**2.8**	6.2	**1,300**	292	**6**	53	15	10

* Measured at 2% of rated torque

Single Stack Specifications

Frame Size	Ratio	Max. Speed[1]	Cont. Stall Torque[1] T_C		Peak Torque[1] T_P		Winding C:160 Vdc D:300 Vdc	Voltage Constant[1][3] K_{EL-L}	Torque Constant[1][3] K_{TL-L}		Induct L_{L-L}	Cold Resistance R_{L-L}	Cont. Current I_C	Peak Current I_P	Inertia[2]	
		(RPM)	(Nm)	(in lb)	(Nm)	(in lb)		(V/kRPM)	(Nm/amp)	(in lb/amp)	(mH)	(ohms)	(amps)	(amps)	(gm cm sec^2)	(lb in sec^2)
GM060	5:1	1,100	**3.1**	27.5	**9.3**	82.5	C	146.5	**1.40**	12.5	12.5	11.8	2	7	**0.23**	0.00019
GM060	5:1	1,000	**3.1**	27.5	**9.3**	82.5	D	296.5	**2.85**	25.0	51.2	48.3	1	3	**0.23**	0.00019
GM060	7:1	780	**4.3**	38.5	**13.0**	115.5	C	205.1	**1.96**	17.5	12.5	11.8	2	7	**0.19**	0.00016
GM060	7:1	720	**4.3**	38.5	**13.0**	115.5	D	415.1	**3.99**	35.0	51.2	48.3	1	3	**0.19**	0.00016
GM060	10:1	540	**6.2**	55.0	**18.6**	165.0	C	293.0	**2.80**	25.0	12.5	11.8	2	7	**0.19**	0.00016
GM060	10:1	500	**6.2**	55.0	**18.6**	165.0	D	593.0	**5.70**	50.0	51.2	48.3	1	3	**0.19**	0.00016

Double Stack Specifications

Frame Size	Ratio	Max. Speed[1]	Cont. Stall Torque[1] T_C		Peak Torque[1] T_P		Winding C:160 Vdc D:300 Vdc	Voltage Constant[1][3] K_{EL-L}	Torque Constant[1][3] K_{TL-L}		Induct L_{L-L}	Cold Resistance R_{L-L}	Cont. Current I_C	Peak Current I_P	Inertia[2]	
		(RPM)	(Nm)	(in lb)	(Nm)	(in lb)		(V/kRPM)	(Nm/amp)	(in lb/amp)	(mH)	(ohms)	(amps)	(amps)	(gm cm sec^2)	(lb in sec^2)
GM060	5:1	1,100	**5.1**	45.0	**15.2**	135.0	C	146.5	1.40	12.5	6.2	4.8	4	11	**0.29**	0.00025
GM060	5:1	1,000	**5.1**	45.0	**15.2**	135.0	D	293.0	2.80	25.0	25	19	2	5	**0.29**	0.00025
GM060	7:1	780	**7.1**	63.0	**21.3**	189.0	C	205.6	1.96	17.5	6.2	4.8	4	11	**0.25**	0.00022
GM060	7:1	720	**7.1**	63.0	**21.3**	189.0	D	410.2	3.92	35.0	25	19	2	5	**0.25**	0.00022
GM060	10:1	540	**10.1**	90.0	**30.4**	270.0	C	293.0	2.80	25.0	6.2	4.8	4	11	**0.25**	0.00022
GM060	10:1	500	**10.1**	90.0	**30.4**	270.0	D	586.0	5.60	50.0	25	19	2	5	**0.25**	0.00022

Note: Pole Count for GM060 is 6

Thermal Resistance for GM060 is 1.5 °C/W

Stator winding thermal resistance (winding to ambient) is for the unit, mounted to a 254mm x 254mm x 12.7mm (10in x 10in x 0.5in) aluminum plate.

(1) These specifications refer to the output of the GM assembly.
When programming a digital amplifier for use with a GM assembly, these specifications must be adjusted by the ratio to create actual motor performance

(2) Inertia = Motor Rotor + Gear Selection. External Inertia must be divided by the square of the ratio.

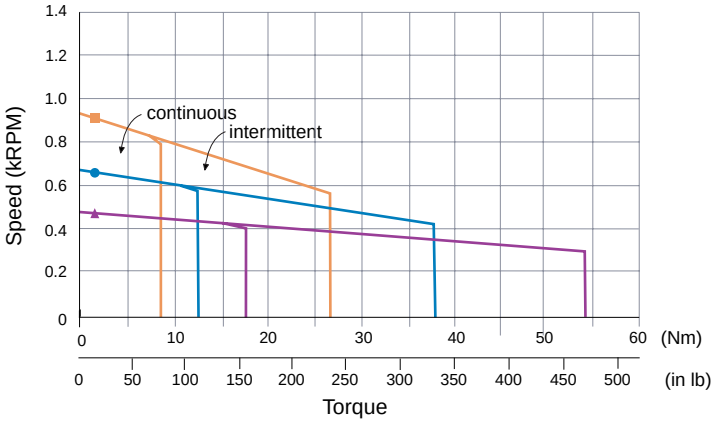
(3) Peak of sine wave

* For Motor Selection calculations see page 194

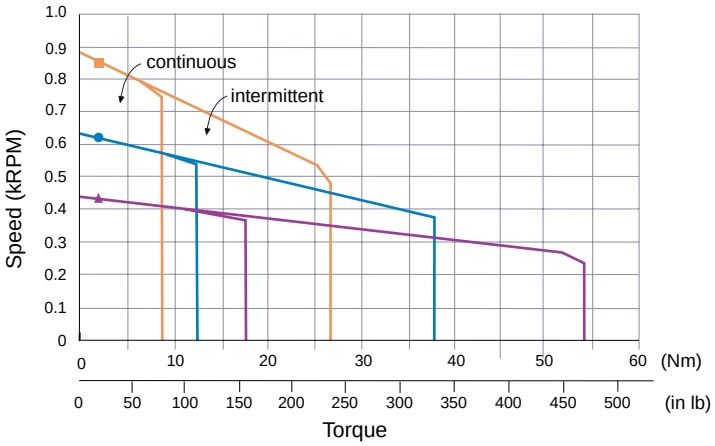
Specification are subject to change without notice

Stealth® GM Gearmotors Series:
GM90 Speed / Torque Curves

Single Stack - 160 volt

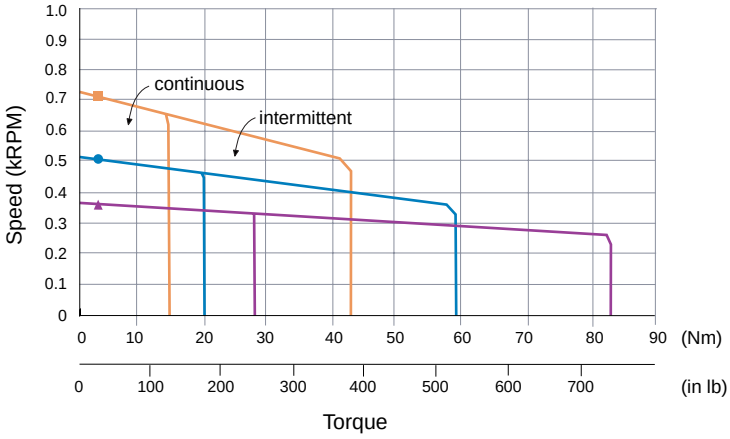


Single Stack - 300 volt

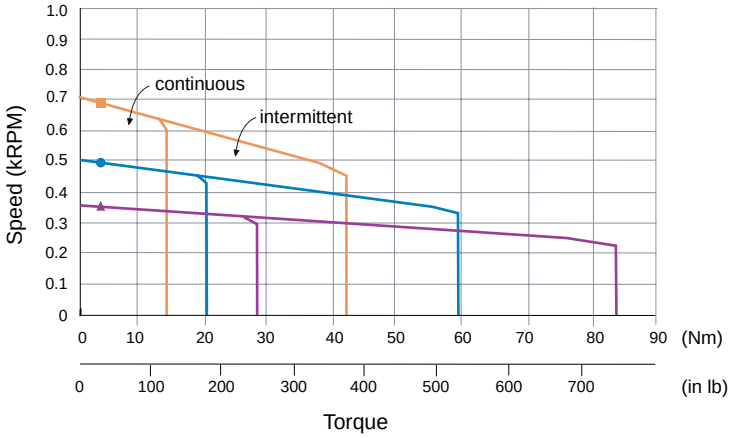


5:1 7:1 10:1

Double Stack - 160 volt



Double Stack - 300 volt



Stealth® GM Gearmotors Series:
GM90

Performance Specifications (six step/trapezoidal commutation)

Mechanical Specifications

Frame Size	Stack Length	Weight without Brake		Maximum Radial Load		Torsional Stiffness		Standard Backlash	Low Backlash
		(kg)	(lb)	(N)	(lb)	(Nm/arc min)	(in lb/arc min)	(arc min)	(arc min)
GM090	Single	**6.0**	13.2	**2,600**	584	**11**	87	15	10
GM090	Double	**7.4**	16.3	**2,600**	584	**11**	87	15	10

* Measured at 2% of rated torque

Single Stack Specifications

Frame Size	Ratio	Max. Speed[1]	Cont. Stall Torque[1] T_C		Peak Torque[1] T_P		Winding C:160 Vdc D:300 Vdc	Voltage Constant[1][3] K_{EL-L}	Torque Constant[1][3] K_{TL-L}		Induct L_{L-L}	Cold Resistance R_{L-L}	Cont. Current I_C	Peak Current I_P	Inertia[2]	
		(RPM)	(Nm)	(in lb)	(Nm)	(in lb)		(V/kRPM)	(Nm/amp)	(in lb/amp)	(mH)	(ohms)	(amps)	(amps)	(gm cm sec^2)	(lb in sec^2)
GM090	5:1	900	**8.7**	77.0	**26.0**	231.0	C	170.5	**1.65**	14.5	4.5	2.5	5	16	**1.16**	0.00100
GM090	5:1	870	**8.7**	77.0	**26.0**	231.0	D	341.0	**3.25**	29.0	18.1	10.1	3	8	**1.16**	0.00100
GM090	7:1	670	**12.0**	107.0	**36.1**	321.0	C	238.7	**2.31**	20.3	4.5	2.5	5	16	**0.94**	0.00081
GM090	7:1	620	**12.0**	107.0	**36.1**	321.0	D	477.9	**4.55**	40.6	18.1	10.1	3	8	**0.94**	0.00081
GM090	10:1	450	**17.2**	153.0	**51.7**	459.0	C	341.0	**3.30**	29.0	4.5	2.5	5	16	**0.94**	0.00081
GM090	10:1	430	**17.2**	153.0	**51.7**	459.0	D	682.0	**6.50**	58.0	18.1	10.1	3	8	**0.94**	0.00081

Double Stack Specifications

Frame Size	Ratio	Max. Speed[1]	Cont. Stall Torque[1] T_C		Peak Torque[1] T_P		Winding C:160 Vdc D:300 Vdc	Voltage Constant[1][3] K_{EL-L}	Torque Constant[1][3] K_{TL-L}		Induct L_{L-L}	Cold Resistance R_{L-L}	Cont. Current I_C	Peak Current I_P	Inertia[2]	
		(RPM)	(Nm)	(in lb)	(Nm)	(in lb)		(V/kRPM)	(Nm/amp)	(in lb/amp)	(mH)	(ohms)	(amps)	(amps)	(gm cm sec^2)	(lb in sec^2)
GM090	5:1	720	**14.0**	124.0	**41.9**	372.0	C	221.5	**2.10**	18.5	3.8	1.6	7	20	**1.31**	0.00113
GM090	5:1	700	**14.0**	124.0	**41.9**	372.0	D	426.0	**4.05**	36.0	14.1	6.3	3	10	**1.31**	0.00113
GM090	7:1	500	**19.5**	173.0	**58.4**	519.0	C	310.1	**2.94**	25.9	3.8	1.6	7	20	**1.10**	0.00094
GM090	7:1	500	**19.5**	173.0	**58.4**	519.0	D	596.4	**5.67**	50.4	14.1	6.3	3	10	**1.10**	0.00094
GM090	10:1	360	**27.8**	247.0	**83.4**	741.0	C	443.0	**4.20**	37.0	3.8	1.6	7	20	**1.10**	0.00094
GM090	10:1	350	**27.8**	247.0	**83.4**	741.0	D	852.0	**8.10**	72.0	14.1	6.3	3	10	**1.10**	0.00094

Note: Pole Count for GM090 is 8

Thermal Resistance for GM090 is 1.2 °C/W

Stator winding thermal resistance (winding to ambient) is for the unit, mounted to a 254mm x 254mm x 12.7mm (10in x 10in x 0.5in) aluminum plate.

(1) These specifications refer to the output of the GM assembly.
When programming a digital amplifier for use with a GM assembly, these specifications must be adjusted by the ratio to create actual motor performance

(2) Inertia = Motor Rotor + Gear Selection. External Inertia must be divided by the square of the ratio.

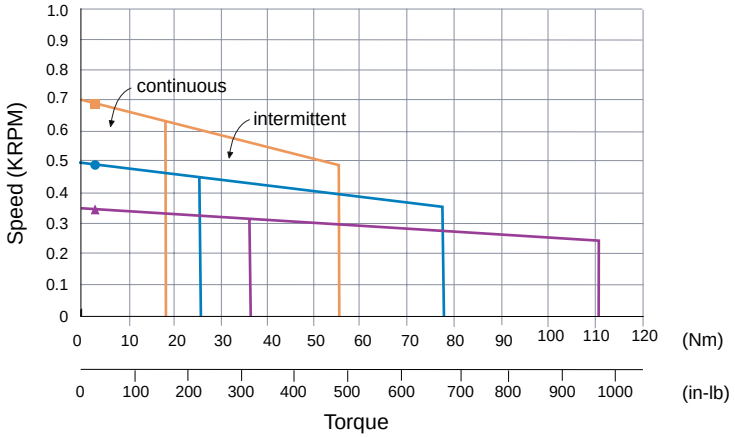
(3) Peak of sine wave

* For Motor Selection calculations see page 194

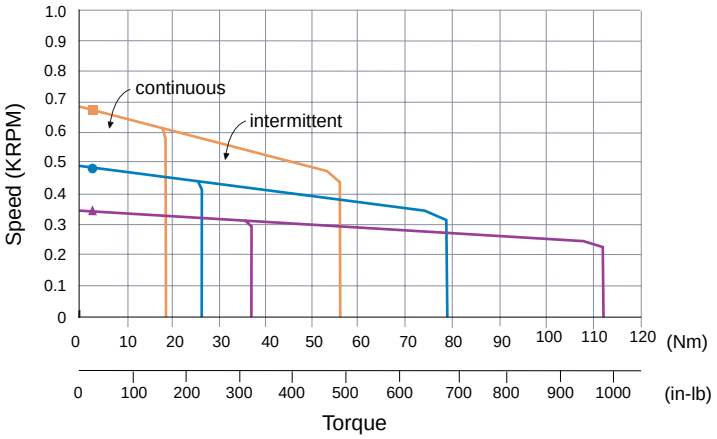
Specification are subject to change without notice

Stealth® GM Gearmotors Series:
GM115 Speed / Torque Curves

Single Stack - 160 volt

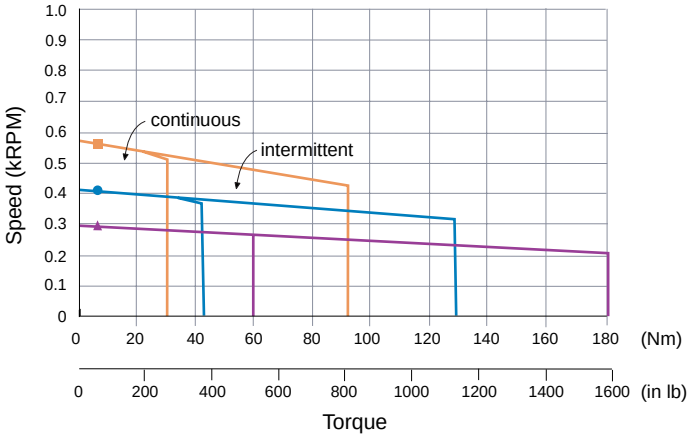


Single Stack - 300 volt

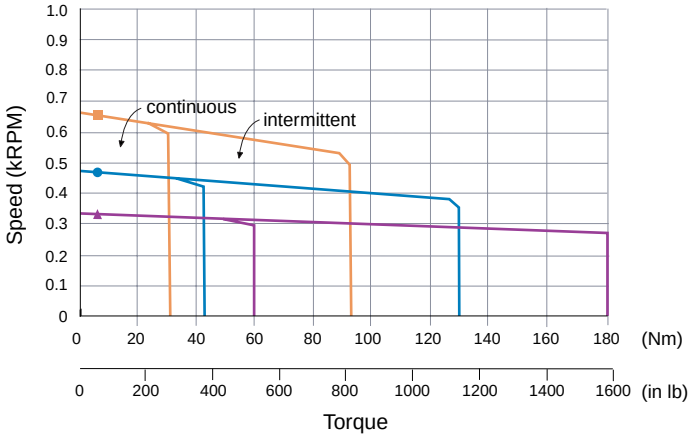


5:1 7:1 10:1

Double Stack - 160 volt



Double Stack - 300 volt



Stealth® GM Gearmotors Series:
GM115

Performance Specifications (six step / trapezoidal commutation)

Mechanical Specifications

Frame Size	Stack Length	Weight without Brake		Maximum Radial Load		Torsional Stiffness		Standard Backlash	Low Backlash
		(kg)	(lb)	(N)	(lb)	(Nm/arc min)	(in lb/arc min)	(arc min)	(arc min)
GM115	Single	**8.4**	18.5	**3,900**	876	**20**	177	15	10
GM115	Double	**10.6**	23.4	**3,900**	876	**20**	177	15	10

* Measured at 2% of rated torque

Single Stack Specifications

Frame Size	Ratio	Max. Speed[1]	Cont. Stall Torque [1] T_C		Peak Torque[1] T_P		Winding C:160 Vdc D:300 Vdc	Voltage Constant[1][3] K_{EL-L}	Torque Constant[1][3] K_{TL-L}		Induct L_{L-L}	Cold Resistance R_{L-L}	Cont. Current I_C	Peak Current I_P	Inertia [2]	
		(RPM)	(Nm)	(in lb)	(Nm)	(in lb)		(V/kRPM)	(Nm/amp)	(in lb/amp)	(mH)	(ohms)	(amps)	(amps)	(gm cm sec^2)	(lb in sec^2)
GM115	5:1	700	**18.2**	162	**54.7**	486	C	228.0	**2.15**	19.5	2.9	1.2	8	25	**4.33**	0.00375
GM115	5:1	680	**18.2**	162	**54.7**	486	D	438.0	**4.15**	37.0	10.7	4.7	4	13	**4.33**	0.00375
GM115	7:1	500	**25.4**	227	**76.6**	681	C	319.2	**3.01**	27.3	2.9	1.2	8	25	**3.54**	0.00306
GM115	7:1	480	**25.4**	227	**76.6**	681	D	613.2	**5.81**	51.8	10.7	4.7	4	13	**3.54**	0.00306
GM115	10:1	350	**36.5**	324	**109.4**	972	C	456.0	**4.30**	39.0	2.9	1.2	8	25	**3.54**	0.00306
GM115	10:1	340	**36.5**	324	**109.4**	972	D	876.0	**8.30**	74.0	10.7	4.7	4	13	**3.54**	0.00306

Double Stack Specifications

Frame Size	Ratio	Max. Speed[1]	Cont. Stall Torque [1] T_C		Peak Torque[1] T_P		Winding C:160 Vdc D:300 Vdc	Voltage Constant[1][3] K_{EL-L}	Torque Constant[1][3] K_{TL-L}		Induct L_{L-L}	Cold Resistance R_{L-L}	Cont. Current I_C	Peak Current I_P	Inertia [2]	
		(RPM)	(Nm)	(in lb)	(Nm)	(in lb)		(V/kRPM)	(Nm/amp)	(in lb/amp)	(mH)	(ohms)	(amps)	(amps)	(gm cm sec^2)	(lb in sec^2)
GM115	5:1	570	**30.1**	267	**90.2**	801	C	280.5	**2.70**	23.5	2.2	0.73	11	34	**6.28**	0.00544
GM115	5:1	650	**30.1**	267	**90.2**	801	D	455.5	**4.35**	38.5	5.8	1.9	7	21	**6.28**	0.0054
GM115	7:1	400	**42.0**	373	**125.9**	1,119	C	392.7	**3.78**	32.9	2.2	0.73	11	34	**5.50**	0.00475
GM115	7:1	470	**42.0**	373	**125.9**	1,119	D	637.7	**6.09**	53.9	5.8	1.9	7	21	**5.50**	0.00475
GM115	10:1	280	**60.0**	533	**179.9**	1,599	C	561.0	**5.40**	47.0	2.2	0.73	11	34	**5.50**	0.00475
GM115	10:1	320	**60.0**	533	**179.9**	1,599	D	911.0	**8.70**	77.0	5.8	1.9	7	21	**5.50**	0.00475

Note: Pole Count for GM115 is 12

Thermal Resistance for GM115 is 0.95 °C/W

Stator winding thermal resistance (winding to ambient) is for the unit, mounted to a 254mm x 254mm x 12.7mm (10in x 10in x 0.5in) aluminum plate.

(1) These specifications refer to the output of the GM assembly.
When programming a digital amplifier for use with a GM assembly, these specifications must be adjusted by the ratio to create actual motor performance

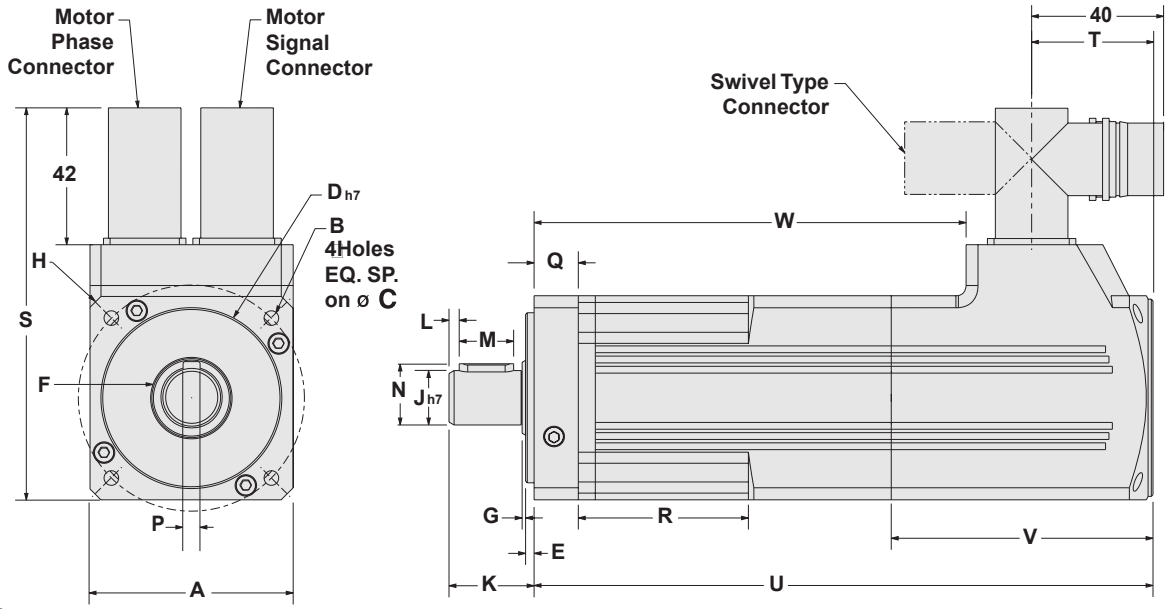
(2) Inertia = Motor Rotor + Gear Selection. External Inertia must be divided by the square of the ratio.

(3) Peak of sine wave

* For Motor Selection calculations see page 194

Specification are subject to change without notice

Dimensions



METRIC SIZES

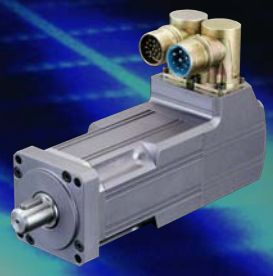
Frame Size	A Square Flange		B Bolt Hole		C Bolt Circle Diameter		D Pilot Diameter		E Pilot Thick.		F Shoulder Diameter		G Shoulder Height		H Housing Diameter		J Shaft Diameter	
	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)
GM060	60	2.36	5.5	0.22	70	2.756	50	1.969	2.5	0.1	23	0.91	1.0	0.04	80	3.15	16	0.63
GM090	90	3.54	6.5	0.26	100	3.94	80	3.15	3.0	0.12	36	1.42	1.0	0.04	116	4.57	20	0.79
GM115	115	4.53	8.5	0.33	130	5.12	110	4.33	3.5	0.14	36	1.42	1.5	0.6	152	5.95	24	0.94

Frame Size	K Shaft Length		L Dist From Shaft End		M Keyway Length		N Keyway Height		P Keyway Width		Q Flange Thick.		R Recess Length		S Height		T Connector Location	
	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)
GM060	25.0	0.98	3	0.118	16	0.630	18.0	0.709	5	0.20	13	0.51	50.0	1.969	117	4.60	37	1.457
GM090	40.0	1.57	5	0.20	28	1.10	22.5	0.886	6	0.24	17	0.67	54.5	2.15	147	5.79	39	1.535
GM115	50.0	1.97	7	0.28	32	1.26	27.0	1.063	8	0.32	20	0.79	55.5	2.18	175	6.89	46	1.811

NEMA SIZES

Frame Size	B Bolt Hole		C Bolt Circle		D Pilot Diameter		J Output Shaft Diameter		K Output Shaft Length		M Keyway Length		N Keyway Height		P Keyway Width	
	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)
GM023	0.195	5.0	2.625	66.7	1.500	38.1	0.375	9.5	1.000	25.4	0.750 flat	19.1 flat	0.015 flat	0.4 flat	—	—
GM034	0.218	5.5	3.875	98.4	2.875	73.0	0.500	12.7	1.250	31.8	1.063	27.0	0.072	1.8	0.125	3.2
GM042	0.281	7.1	4.950	125.7	2.187	55.5	0.625	15.9	1.500	38.1	1.130	28.7	0.108	2.7	0.188	4.8

Stealth® GM Gearmotors Series:
Options



Options	U Length		V Rear Cover Length		W Flange Offset	
	(mm)	(in)	(mm)	(in)	(mm)	(in)
GM060 Single Stack – Encoder or Resolver	178	7.01	70	2.76	121	4.76
GM060 Single Stack – Encoder or Resolver and Brake	203	7.99	95	3.74	143	5.63
GM060 Double Stack – Encoder or Resolver	216	8.5	70	2.76	159	6.26
GM060 Double Stack – Encoder or Resolver and Brake	241	9.46	95	3.74	181	7.12
GM090 Single Stack – Encoder or Resolver	202.3	7.96	83	3.27	143.3	5.64
GM090 Single Stack – Encoder or Resolver and Brake	230.3	9.07	111	4.37	171	6.73
GM090 Double Stack – Encoder or Resolver	240.4	9.46	83	3.27	181.4	7.14
GM090 Double Stack – Encoder or Resolver and Brake	268.4	10.57	111	4.37	209.1	8.23
GM115 Single Stack – Encoder or Resolver	207.2	8.16	70	2.76	147.3	5.8
GM115 Single Stack – Encoder or Resolver and Brake	240.2	9.46	103	4.06	170.3	6.7
GM115 Double Stack – Encoder or Resolver	245.3	9.66	70	2.76	185.4	7.3
GM115 Double Stack – Encoder or Resolver and Brake	278.3	10.96	103	4.06	208.4	8.2

Encoder Specifications (All GM Frame Sizes)

Resolution	2,000 Line (8,000 ppr)
Electrical Input:	5 Vdc, 125 ma maximum (plus interface loads)
Encoder Output:	A, B, I, $\overline{A}$, $\overline{B}$, $\overline{I}$ Differential, TTL compatible Frequency Response 500 Khz

Resolver Specification (All Frame Sizes)

Frequency	Hz	5,000
Input Voltage	Vrms	4.0
Input Current	ma max.	23
Input Power	Watts nom.	0.045
Transformation Ratio	± 10%	0.50
Output voltage	Vrms	2.0
Sensitivity	mv / Deg	35

Brake Specification

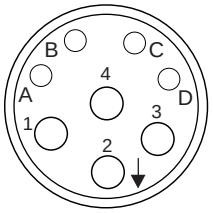
Frame Size	Static Holding Torque		Voltage	Current	Resistance	Inertia	
	(Nm)	(in lb)	(V)	(amps)	(ohms)	(gm cm sec^2)	(oz in sec^2)
GM060	**0.33**	3.0	24 Vdc	0.19	131	**4.32 x 10^{-8}**	6.0 x 10^{-10}
GM090	**5.64**	50	24 Vdc	0.30	65	**4.32 x 10^{-8}**	6.0 x 10^{-10}
GM115	**5.64**	50	24 Vdc	0.30	65	**2.5 x 10^{-7}**	3.5 x 10^{-9}

Specification are subject to change without notice

Stealth® GM Gearmotors Series:
Motor Connections & Cables

DIN Motor Power Connection

Pin Number	Function
3	U
1	V
4	W
2	Chassis Gnd.
A	Thermistor +
B	Thermistor -
C	Brake +
D	Brake -
–	Shield



Power

Motor Power Mating Connector

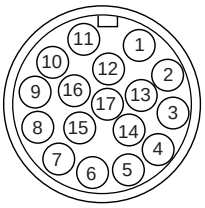
Manufacturer	Part Number	Description
Hypertac	LPNA08BFRKB170	Body
	020.232.2000	4 Pins Female 18-26 AWG
	020.090.1020	4 Pins Female 16-20 AWG

Motor Power Cable

Part Number	Length	Used With
10963093	3 meter	Flying Leads
10963117	8 meter	Flying Leads

DIN Sensor Connector Details

Pin Number	Function		Mating Cable
	Encoder	Resolver	i-Drive Conn. Pin Number
1	A +	S1 (SIN+)	1
2	B +	S4 (COS+)	2
7	+5V	R2 (Ref+)	7
8	Shield	Shield	8
9	A -	S3 (SIN-)	9
10	B -	S2 (COS-)	10
15	Gnd	R1 (REF-)	15
12	Spare	Spare	—
5	I +	—	5
13	I -	—	13
3	Hall 1 (S1)	—	—
11	Hall 2 (S2)	—	—
4	Hall 3 (S3)	—	—
16	Thermistor +	Thermistor +	—
17	Thermistor -	Thermistor -	—
6 & 14	No Connection		



Sensor

Motor Sensor Mating Connector

Manufacturer	Part Number	Description
Hypertac	SPNA17HFRON	Body
	020.256.1020	17 Pins Female

Mating Sensor Cable

Part Number	Length	Used With
10963094	3 meter	Flying Leads
10963096	3 meter	i-Drive
10963123	8 meter	Flying Leads
10963118	8 meter	i-Drive
10963136[1]	—	i-Drive / Controller

(1) NOTE: When an external controller is used in a closed loop mode an additional sensor cable, part number 10963136, is required.

Flying Leads from out of the Motor (All GM Frame Sizes)

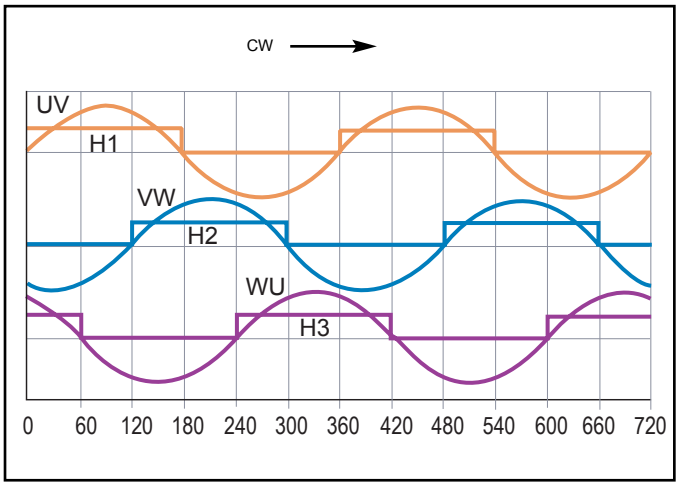
Power

Function	Color Code
U	Red
V	Black
W	White
Ground	Green

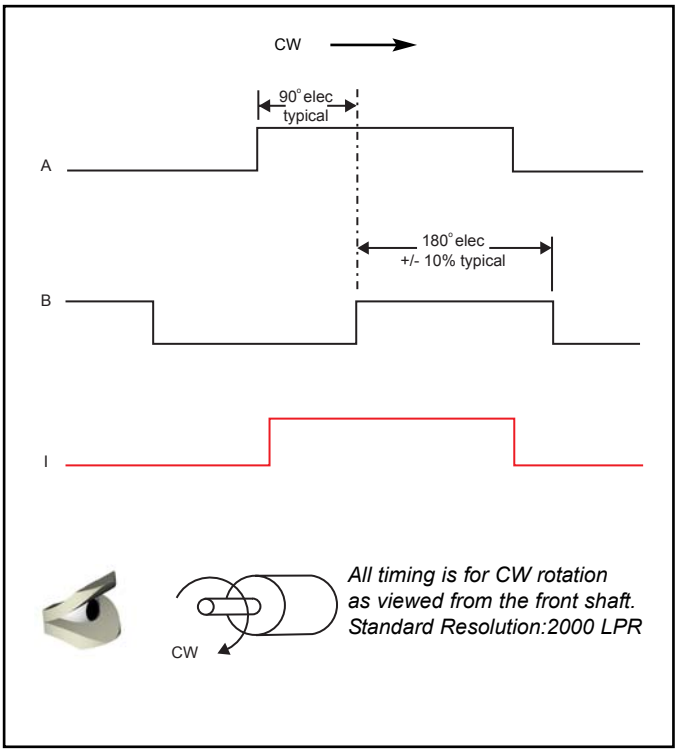
Encoder

Function	Color Code
A-	White
A+	Brown
B-	Green
B+	Blue
I-	Yellow
I+	Orange
S2	Violet
S1	White / Brown
S3	White / Orange
+5V	Red
GND	Black
T1	White / Red
T2	White / Black

Motor Signal Timing (C/D winding)
at motor connector



Encoder Timing



Specifications are subject to change without notice.

How to Order

Order Numbering Example: G M 0 6 0 – B 1 C 1 D

FRAME SIZE

Metric	NEMA
060	023
090	034
115	042

RATIO
B = 5:1
C = 7:1
D = 10:1

STACK LENGTH
1 = Single
2 = Double

WINDING
C = 160Vdc
D = 300Vdc

OPTIONS
1 = 2000 Line (1) Encoder
2 = 2000 Line (1) Encoder, Brake
3 = Resolver
4 = Resolver, Brake

CONNECTOR
B = MIL Connector
D = DIN Connector
F = Flying Leads (450mm/18in)

(1) Includes commutation signals

Gearmotors are supported by a worldwide network of offices and local distributors. Call **1-800-305-4555** for application engineering assistance or for the name of your local distributor. Information can also be obtained at **www.baysidemotion.com**.

Servo Wheel Series:

Compact Wheel Drives for Electric Vehicles

The Servo Wheel™ combines a brushless dc motor with planetary gears in a lightweight, aluminum housing to provide a compact solution for vehicle control. The Power Wheel's unique design makes system integration easy. You no longer have to purchase the motor, gearhead, wheel, electronics and bracket from different sources. Bayside does all of the work for you. From component sourcing to actual assembly, Bayside engineers designed the Power Wheel with your application in mind.
All you have to do is bolt it up and go!

Servo Wheel Series:
Design Features

Single Piece Construction Motor Shaft

The first stage's planetary section sun gear is integrated into the single piece construction motor shaft, to provide higher reliability in a compact package.

Planetary Gears

The planetary input stage provides a first pass reduction that is capable of carrying high torques with high input speeds in a small package.

Integrated Output Stage

The second stage planetary's unique design uses two planets for higher efficiency. Built entirely into the wheel, it utilizes an otherwise wasted area to provide a compact, space-saving package. Two large diameter bearings support the weight, protecting the gears from shock loading and dramatically increasing the radial load carrying capacity of the wheels.

Servo Wheel Series:

Compact Wheel Drives for Electric Vehicles

Baysides NEW Servo Wheel™ Drive System features state-of-the-art technology to provide motion for small, battery-powered, electric vehicles including:

- **Automated Cleaning Equipment**
- **Robotic/Material Handling Equipment**
- **Healthcare Equipment**
- **AGV's**

Bayside's Servo Wheel™ features:

BRUSHLESS DC MOTOR AMPLIFIERS designed for common motion profiles in battery powered vehicles to provide:

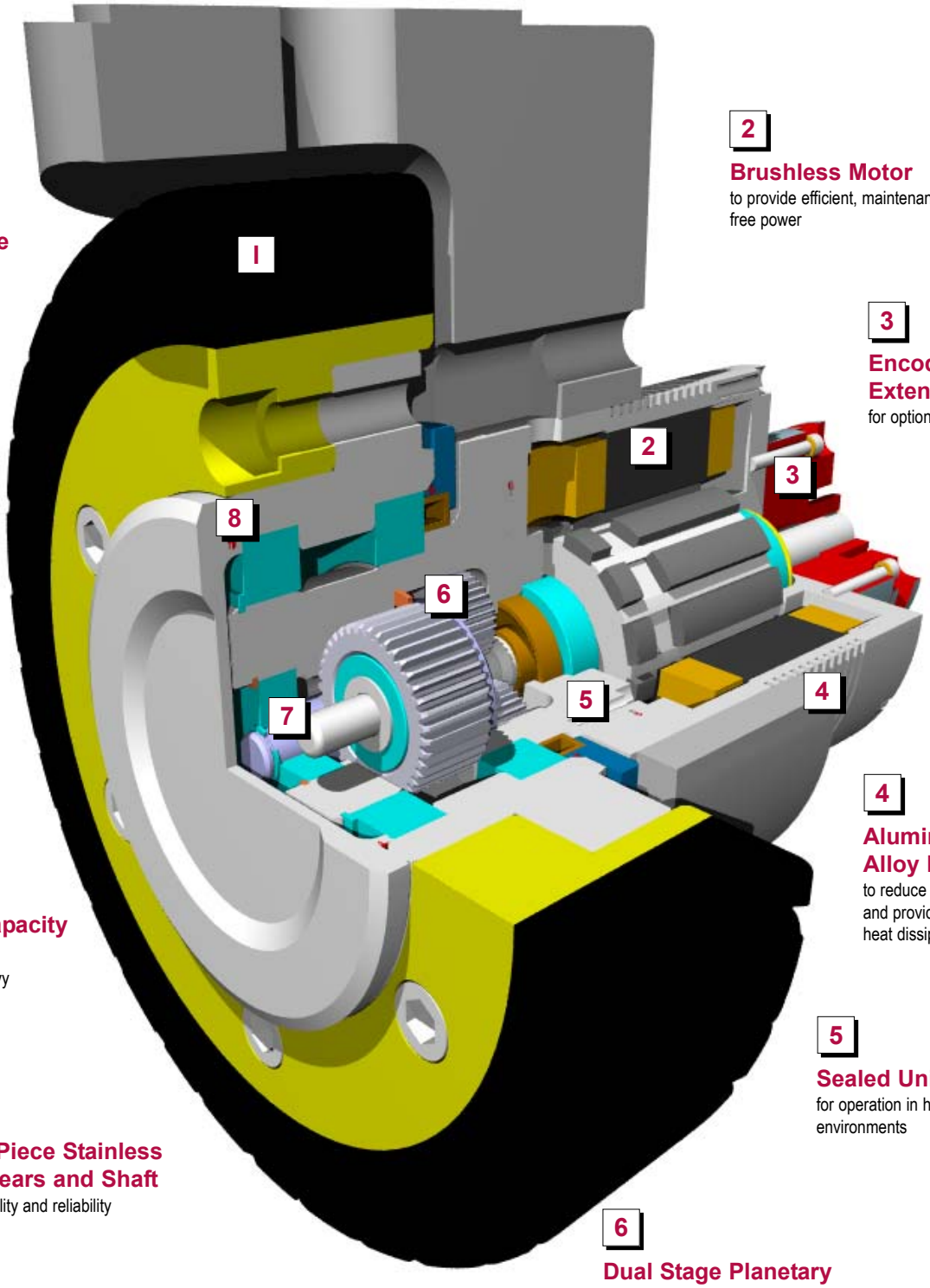
- 12, 24, 36 and 48 volt operation
- Synchronized steering - accurate digital control for differential steering applications
- Current and temperature feedback control for safe, reliable operation
- Multiple input architectures for easy communication with higher level controllers and navigation systems

PERMANENT MAGNET BRUSHLESS MOTORS to provide:

- High efficiency for longer run times between battery charges
- Greater power to size ratio for a compact package
- Internal position feedback eliminating the need for an encoder
- Long life and maintenance free operation
- High input speeds in excess of 10,000 RPM
- No internal sparking – safe in explosive environments
- Low EMI, eliminating the need for heavy shielding

PLANETARY GEARS to provide high torque-carrying capability in a small package. The gears are built into the hub of the wheel, making the package compact and lightweight. This design also increases the radial load-carrying and shock loading capacity of the entire system.

TIRES Polyurethane is ideal for applications in hospitals, schools, and airports – any place requiring non-marking materials. This material is also ideal for high load carrying applications like material handling.



1
Polyurethane Tires
for all types of surfaces

2
Brushless Motor
to provide efficient, maintenance-free power

3
Encoder/Brake Extension
for optional ad-ons

4
Aluminum Alloy Housing
to reduce weight and provide optimum heat dissipation

5
Sealed Unit
for operation in hostile or wet environments

6
Dual Stage Planetary Gear Design
to deliver high torque and high efficiency in a compact package

7
Single Piece Stainless Steel Gears and Shaft
for high quality and reliability

8
High Load Capacity Ball Bearings
to accommodate heavy vehicle loads

Servo Wheel Series:
Performance Specifications

Performance Specifications

Tire Diameter				152mm (6in)				203mm (8in)			
Speed Code				20	25	30	36	20	25	30	36
Motor Code	Power										
1	150	Speed	Km/hr	**6.3**	**5.0**	**4.2**	**3.5**	**8.4**	**6.8**	**5.6**	**4.7**
			MPH	3.9	3.1	2.6	2.2	5.2	4.2	3.5	2.9
		Peak Torque	Nm	**65**	**81**	**97**	**116**	**65**	**81**	**97**	**116**
			in lb	578	722	866	1,040	578	722	866	1,040
		Continuous Torque	Nm	**20**	**24**	**29**	**35**	**20**	**24**	**29**	**35**
			in lb	174	217	260	312	174	217	260	312
2	300	Speed	Km/hr	**5.8**	**4.7**	**3.9**	**3.2**	**7.7**	**6.3**	**5.2**	**4.3**
			MPH	3.6	2.9	2.4	2.0	4.8	3.9	3.2	2.7
		Peak Torque	Nm	**88**	**110**	**132**	**158**	**88**	**110**	**132**	**158**
			in lb	784	980	1,176	1,411	784	980	1,176	1,411
		Continuous Torque	Nm	**26**	**33**	**40**	**48**	**26**	**33**	**40**	**48**
			in lb	235	294	353	423	235	294	353	423
3	746	Speed	Km/hr	**5.5**	**4.4**	**3.6**	**3.0**	**7.3**	**5.9**	**4.9**	**4.1**
			MPH	3.4	2.7	2.2	1.8	4.5	3.6	3.0	2.5
		Peak Torque	Nm	**235**	**294**	**353**	**423**	**235**	**294**	**353**	**423**
			in lb	2,100	2,625	3,150	3,780	2,100	2,625	3,150	3,780
		Continuous Torque	Nm	**70**	**88**	**106**	**127**	**70**	**88**	**106**	**127**
			in lb	630	788	945	1,134	630	788	945	1,134
ALL TIRES		Load Capacity	kg	**454**				**454**			
			lb	1,000				1,000			

Tire Composition

Code		
	P	Polyurethane Clear Smooth
	Q	Polyurethane Clear x Thread
	R	Polyurethane Black Smooth
	S	Polyurethane Black x Thread

Operating Voltages

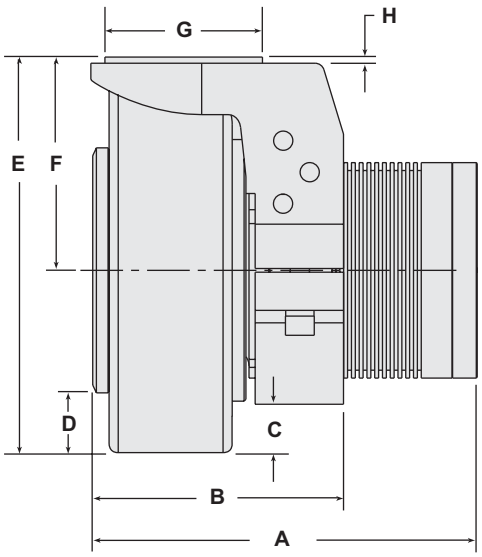
Code	K	M
Volts	24	48

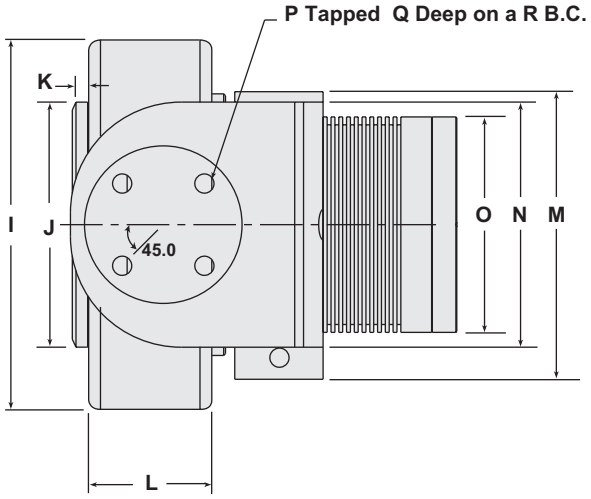
Brake

Code	0	None
	3	50 in-lb

Servo Wheel: Dimensions

Dimensions





Model Number	Motor Power	A with out Brake		B		C		D		E		F	
		(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)
	150	158.75	6.25	104.1	4.1	20.3	0.8	25.4	1.0	165.1	6.5	87.9	3.46
DX6	300	175.26	6.90	104.1	4.1	20.3	0.8	25.4	1.0	165.1	6.5	87.9	3.46
	746	191.77	7.55	104.1	4.1	20.3	0.8	25.4	1.0	165.1	6.5	87.9	3.46
	150	158.75	6.25	104.1	4.1	45.7	1.8	50.8	2.0	218.4	8.6	116.8	4.60
DX8	300	175.26	6.90	104.1	4.1	45.7	1.8	50.8	2.0	218.4	8.6	116.8	4.60
	746	191.77	7.55	104.1	4.1	45.7	1.8	50.8	2.0	218.4	8.6	116.8	4.60

Model Number	Motor Power	G		H		I		J		K		L	
		(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)
	150	65.0	2.559	2.54	0.1	152.4	6.0	101.1	3.98	6.86	0.27	50.8	2.0
DX6	300	65.0	2.559	2.54	0.1	152.4	6.0	101.1	3.98	6.86	0.27	50.8	2.0
	746	65.0	2.559	2.54	0.1	152.4	6.0	101.1	3.98	6.86	0.27	50.8	2.0
	150	65.0	2.559	2.54	0.1	203.2	8.0	101.1	3.98	6.86	0.27	50.8	2.0
DX8	300	65.0	2.559	2.54	0.1	203.2	8.0	101.1	3.98	6.86	0.27	50.8	2.0
	746	65.0	2.559	2.54	0.1	203.2	8.0	101.1	3.98	6.86	0.27	50.8	2.0

Model Number	Motor Power	M		N		O		P		Q		R	
		(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)
	150	118.6	4.67	101.1	3.98	88.9	3.5	7.94	5.16	25.4	1.0	47.98	1.889
DX6	300	118.6	4.67	101.1	3.98	88.9	3.5	7.94	5.16	25.4	1.0	47.98	1.889
	746	118.6	4.67	101.1	3.98	100	3.94	7.94	5.16	25.4	1.0	47.98	1.889
	150	118.6	4.67	101.1	3.98	88.9	3.5	7.94	5.16	25.4	1.0	47.98	1.889
DX8	300	118.6	4.67	101.1	3.98	88.9	3.5	7.94	5.16	25.4	1.0	47.98	1.889
	746	118.6	4.67	101.1	3.98	100	3.94	7.94	5.16	25.4	1.0	47.98	1.889

Servo Wheel Series:
Selection Guide & How to Order

5 Step Procedure

1 **Motor Code Selection**

Based on the application requirement, select the appropriate motor power from the second column in the "Performance Specifications" table. The number to the left of it in the first column is the motor code.

2 **Speed Code Selection**

Find the intersection of the column with the selected tire diameter and the row with the motor code to give you the available speed ranges. From the four given speeds (in mph), select the one that meets your application needs. Proceed to the top of that column to find the speed code just under the tire diameter you have selected in step 1.

3 **Voltage Code Selection**

From the "Operating Voltages" table, select the correct voltage code based on the power supply available for the application.

4 **Tire Composition Code Selection**

Servo Wheels™ are available for a wide variety of applications. Some require a smooth ride or high load carrying capacity, or a combination of both. From the tire composition table, select the appropriate material for you application. The letter in the first column is the tire composition code.

5 **Compose part number based on the codes selected**

Specifications are subject to change without notice.

How to Order

Order Numbering Example: **D X C A – R M V T B**

CLEAN ROOM RATING (Optional)	TIRE DIAMETER	GEARBOX RATIO	MOTOR SIZE	VOLTAGE	TIRE MATERIAL	BRAKE SIZE
0 = None	A = 6 in.	1 = 20	1 = 150W	K = 24V	P = Polyurethane clear	0 = No Brake
3 = Class 1,000	B = 8 in.	2 = 24	2 = 300W		Q = Polyurethane clear x thread	3 = 50 in-lb
4 = Class 10,000		3 = 30	4 = 746W		R = Polyurethane black	
		4 = 36			S = Polyurethane black x thread	

Call **1-800-305-4555** for application engineering assistance or for the name of your local distributor.

Motor Amplifier Board

How to Order

TB1

1	Motor Phase A
2	Motor Phase B
3	Motor Phase C

TB2

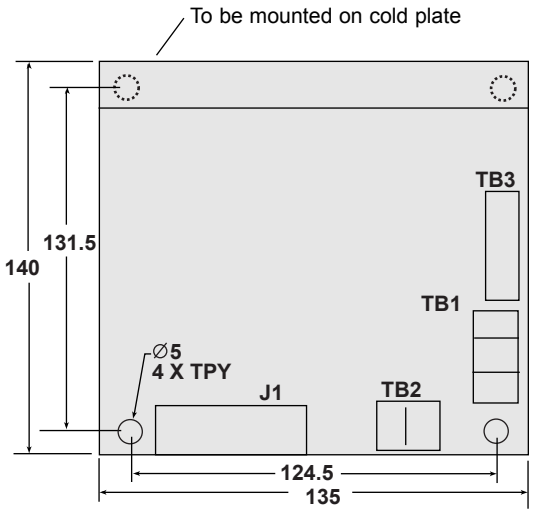
1	Battery Ground
2	Battery Voltage

TB3

1	Hall Sensor Ground
2	Hall Sensor +6.5V
3	Hall Sensor C
4	Hall Sensor B
5	Hall Sensor A

J1

	1	Digital Host Ground
	2	Digital Host Voltage
Digital Control I/ O Interface	3	Distance Feedback
	4	Direction Feedback
	5	Lost Pulse count Warning
	6	Reset Computer / Motor Off
	7	Distance Input
	8	Direction Input
	9	Motor On / Off
+ / - 10V or Joy Stick	10	Analog Host Power
	11	Analog Host Ground
	12	Analog Signal Input
	13	Analog Direction Output
	14	Frequency Output
Available Voltage	15	Motor Ref. A. +15V
	16	Motor Ref. B. +6.5V
	17	Motor Ground
	18	Not Used
	19	Not Used
	20	Not Used



P / N 11802007

Input Voltage	24V (Battery 17V to 37V)
Continuous Current	37 Amps (1)
Peak Current	100 Amps (2)
PWM Frequency	60KHz
Pulse Rate or # of Hall Sensor State Change Rate	20KHz
Operating Temperatures	0 to 50 deg C

(1) With Cold Plate @ 50 deg C

(2) For 2 sec

Specifications are subject to change without notice.

How to Order

Order Numbering Example: **MA 1 – 24V – 100B**

Call **1-800-305-4555** for application engineering assistance or for the name of your local distributor.

MODEL
1 = Single Axis

VOLTAGE OPTIONS
24 = 24V

PEAK CURRENT
100 = 100 Amps

OPERATION
B = CLOSED LOOP

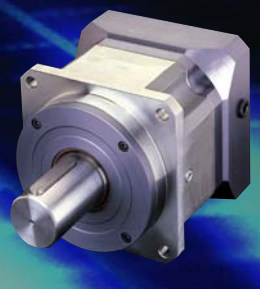
Stealth® PS Advanced Series:
The Ultimate in Gearhead Performance

Stealth® Advanced PS is Bayside's highest performance servo gearhead. Available in 8 frame sizes and 12 gear ratios, you are guaranteed to find a Stealth® PS to fit your high performance servo applications.

8 Frame Sizes	
PS40	PS142
PS60	PS180
PS90	PS220
PS115	PS300

Ratios *	
3:1	25:1
4:1	30:1
5:1	40:1
7:1	50:1
10:1	70:1
15:1	100:1
20:1	* For PS40 & PS300 see Note (3)

Stealth® PS Advanced Series



Performance Specifications

	Units	Ratio	Frame Size							
			PS40	PS60	PS90	PS115	PS142	PS180	PS220	PS300
Nominal Output Torque, $T_{nom\ r}$	**Nm**	3-10	**5**	**25**	**74**	**170**	**294**	**735**	**1,413**	**3,616**
	in lb		42	220	650	1,500	2,600	6,500	12,500	32,000
	Nm	15-50	**9**	**34**	**107**	**226**	**396**	**1,017**	**1,808**	**4,520**
	in lb		75	300	950	2,000	3,500	9,000	16,000	40,000
	Nm	70-100	**8**	**28**	**90**	**203**	**339**	**893**	**1,582**	**4,181**
	in lb		67	250	800	1,800	3,000	7,900	14,000	37,000
Maximum Acceleration Output Torque, $T_{acc\ r}$	**Nm**	3-10, 70-100	**8**	**34**	**105**	**232**	**367**	**972**	**1,763**	**4,825**
	in lb		74	300	930	2,050	3,250	8,600	15,600	42,700
	Nm	15-50	**10**	**42**	**130**	**283**	**452**	**1,198**	**2,011**	**5,492**
	in lb		92	370	1,150	2,500	4,000	10,600	17,800	48,600
Emergency(1) Stop Output Torque, $T_{em\ r}$	**Nm**	3-10, 70-100	**19**	**78**	**243**	**537**	**853**	**2,237**	**4,068**	**11,119**
	in lb		170	690	2,150	4,750	7,550	19,800	36,000	98,400
	Nm	15-50	**24**	**96**	**299**	**655**	**1,040**	**2,757**	**4,520**	**12,656**
	in lb		210	850	2,650	5,800	9,200	24,400	40,000	112,000
Nominal Input Speed, $N_{nom\ r}$	RPM	3-5	3,600	3,200	2,800	2,400	2,000	1,600	1,200	1,000
	RPM	7-10	4,100	3,700	3,300	2,900	2,500	2,000	1,500	1,250
	RPM	15-50	4,600	4,200	3,800	3,400	3,000	2,400	1,800	1,500
	RPM	70-100	5,100	4,700	4,300	3,900	3,500	2,800	2,100	1,750
Max. Input Speed, N_{maxr}	RPM	3-100	6,000	6,000	5,300	4,500	3,800	3,000	2,300	1,900
Standard Backlash (2)	arc min	3-10	10	6	6	4	4	4	4	4
	arc min	15-100	14	8	8	6	6	6	6	6
Low Backlash (2)	arc min	3-10	—	4	4	3	3	3	3	3
	arc min	15-100	—	6	6	5	5	5	5	5
Efficiency at Nominal Torque	%	3-10	97	97	97	97	97	97	97	97
	%	15-100	94	94	94	94	94	94	94	94
Noise Level(3) at:										
3,000 RPM	dB	3-100	68	68	68	68	70	—	—	—
2,000 RPM	dB	3-100	—	—	—	—	—	70	70	70
Torsional Stiffness	**Nm / arc min**	3-100	**2**	**3**	**12**	**23**	**44**	**110**	**210**	**360**
	in lb / arc min		16	26	106	204	389	973	1,858	3,185
Maximum Weight	**kg**	3-10	**0.4**	**1.3**	**3**	**7**	**14**	**26**	**49**	**103**
	lb		1.0	2.8	7	15	30	57	108	228
	kg	15-100	**0.6**	**1.7**	**5**	**10**	**20**	**35**	**71**	**149**
	lb		1.4	3.7	10	22	43	77	157	330
Maximum Allowable Case Temperature	°C	3-100	← 100 →							
			For applications requiring lower case temperature, consult factory							

(1) Maximum of 1,000 stops
(2) Measured at 2% of rated torque
(3) Measured at 1 meter

(4) PS40 is available in Ratios of: 4, 5, 7, 10, 16, 20, 25, 40, 50, 70 & 100:1
PS300 is available in Ratios of: 4, 5, 7, 10, 20, 50, 70 & 100:1

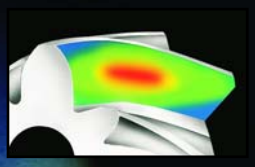
Specification are subject to change without notice

Stealth® PS Advanced Series:
Get the Helical Advantage!

Stealth® Advanced in the PS / RS Models incorporates the latest enhancement in gearhead technology:

- Latest technology in seals…reduce heat and wear
- Oil lubrication…reduces, friction and operating temperature
- Front output seal cover…captures and protects output seal

Helical Planetary Design - Helical gears have more tooth contact and greater face width than spur gears. This results in higher loads, smoother tooth engagement, quieter operation and lower backlash.



HeliCrown® - Bayside developed the HeliCrown gear tooth to further optimize Stealth's® performance. Since most vibration occurs at the entry and exit points of a gear tooth, HeliCrown eliminates metal only in these areas, *without sacrificing gear strength,* producing a quieter and stronger gear.

Plasma Nitriding - Bayside's in-house Plasma Nitriding process results in an ideal gear tooth. The surface is very hard (65 Rc) and the core is strong, but flexible (36 Rc). The result is a wear-resistant gear tooth that can withstand heavy shock, ensuring high accuracy for the life of the gearhead.

ServoMount® - Bayside's patented ServoMount design features a balanced input gear supported by a floating bearing. This unique design compensates for motor shaft runout and misalignment, ensuring TRUE alignment of the input sun gear with the planetary section, and allowing input speeds up to 6,000 RPM. ServoMount ensures error-free installation to any motor, in a matter of minutes.

Stealth's® superior design and construction deliver "The Helical Advantage":

- Strong…30% More Torque
- Fast…6,000 RPM Input Speeds
- Accurate…Less Than 3 Arc minutes Backlash
- Quiet…Less Than 68dB Noise **For Applications Requiring Lower dB, Consult Factory**

Plus... Over 97% Efficiency

11

Front Output Seal Cover

Completely captures and protects output seal and allows in-field seal replacement.

10

Output Wave Seal Technology

Creates a hydrodynamic film between seal and shaft and reducing heat and wear.

9

Magnetic Oil Fill Drain Plug

The magnetic plug attracts normal wear particles keeping them away from the gear mesh.

1

Helical Planetary

Provides smooth, quiet operation, high torque and high accuracy.

2

ServoMount®

Patented motor mounting design ensures error-free installation and the balanced pinion allows higher input speeds.

3

Precision Bearings

Large, deep groove bearings provide high speed capacity and radial loads.

4

HeliCrown®

Bayside's proprietary gear tooth geometry ensures quieter operation and higher loads than conventional gears.

5

Sealed Unit

Vition seals and O-Rings provide IP65 protection to prevent leaks and protect against harsh environments.

6

Rigid Sun Gear

Perfectly aligned between two large bearings for maximum stiffness and strength.

7

Integral Ring Gear

Cutting the ring gear directly into the housing allows for larger bearing and planet gears, delivering maximum power and stiffness in a minimum package.

8

Oil Lubrication

Oil provides better lubrication, reduces friction and operating temperatures.

Stealth® PS Advanced Series:
Moment of Inertia

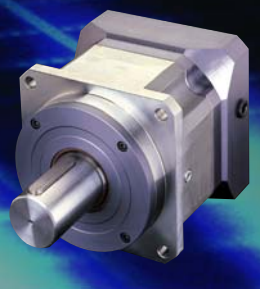
MOMENT OF INERTIA

Specifications:	Units	Ratio	Frame Size							
			PS40	PS60	PS90	PS115	PS142	PS180	PS220	PS300
Small Motor Shaft Diameter Range	**mm**	3-100	**3-8**	**6-12.7**	**6-16**	**9-19**	**12.7-24**	**15.9-35**	**24-48**	**28-65**
	in		0.118-0.315	0.236-0.500	0.236-0.630	0.354-0.748	0.500-0.944	0.626-1.378	0.945-1.89	1.10-2.56
	gm cm sec²	3	**—**	**0.176**	**0.784**	**2.34**	**7.81**	**28.6**	**—**	**—**
	oz in sec²		**—**	0.002	0.011	0.033	0.109	0.397	**—**	**—**
	gm cm sec²	4,5	**0.0140**	**0.101**	**0.486**	**1.87**	**4.92**	**17.6**	**62.6**	**284**
	oz in sec²		0.0002	0.001	0.007	0.026	0.068	0.244	0.869	3.95
	gm cm sec²	7,10	**0.0092**	**0.063**	**0.298**	**0.960**	**2.68**	**9.24**	**34.3**	**136**
	oz in sec²		0.0001	0.001	0.004	0.013	0.037	0.128	0.476	1.88
	gm cm sec²	15	**—**	**0.092**	**0.420**	**1.60**	**4.17**	**15.8**	**51.0**	**—**
	oz in sec²		**—**	0.001	0.006	0.022	0.058	0.219	0.708	**—**
	gm cm sec²	16,20,25	**0.0131**	**0.098**	**0.444**	**1.73**	**4.50**	**16.7**	**53.3**	**219**
	oz in sec²		0.0002	0.001	0.006	0.024	0.063	0.232	0.741	3.05
	gm cm sec²	30-100	**0.0083**	**0.054**	**0.247**	**0.760**	**2.18**	**7.450**	**27.1**	**93.9**
	oz in sec²		0.0001	0.001	0.003	0.011	0.030	0.104	0.377	1.30
Large Motor Shaft Diameter Range	**mm**	3-100	**8-10**	**12.7-16**	**16-19**	**19-24**	**24-35**	**35-42**	**48-55**	**—**
	in		0.135-0.394	0.500-0.630	0.630-0.748	0.748-0.944	0.944-1.38	1.38-1.65	1.89-2.17	**—**
	gm cm sec²	3	**—**	**0.253**	**1.07**	**3.25**	**10.6**	**37.8**	**111**	**—**
	oz in sec²		**—**	0.004	0.015	0.045	0.148	0.526	1.54	**—**
	gm cm sec²	4,5	**0.0483**	**0.185**	**0.745**	**2.70**	**7.51**	**25.6**	**72.4**	**—**
	oz in sec²		0.0007	0.003	0.010	0.038	0.104	0.356	1.01	**—**
	gm cm sec²	7,10	**0.0414**	**0.143**	**0.566**	**1.70**	**5.01**	**15.8**	**44.1**	**—**
	oz in sec²		0.0006	0.002	0.008	0.024	0.070	0.219	0.613	**—**
	gm cm sec²	15	**—**	**0.176**	**0.685**	**2.43**	**6.76**	**23.8**	**60.8**	**—**
	oz in sec²		**—**	0.002	0.010	0.034	0.094	0.331	0.845	**—**
	gm cm sec²	16,20,25	**0.0474**	**0.182**	**0.715**	**2.56**	**7.09**	**24.7**	**62.9**	**—**
	oz in sec²		0.0007	0.003	0.010	0.036	0.099	0.344	0.874	**—**
	gm cm sec²	30-100	**0.0405**	**0.134**	**0.507**	**1.50**	**4.50**	**14.0**	**37.0**	**—**
	oz in sec²		0.0006	0.002	0.007	0.021	0.063	0.195	0.513	**—**

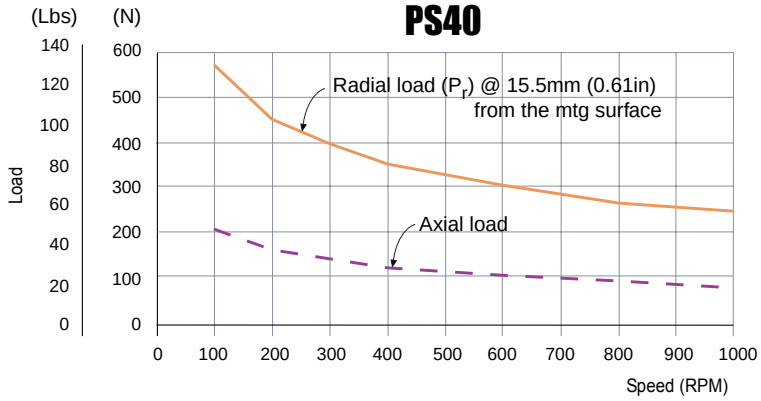
Note: All Moment of Inertia values are as reflected at the input shaft of the gearhead.

Specification are subject to change without notice

Stealth® PS Advanced Series:
Output Shaft Load Rating



PS40



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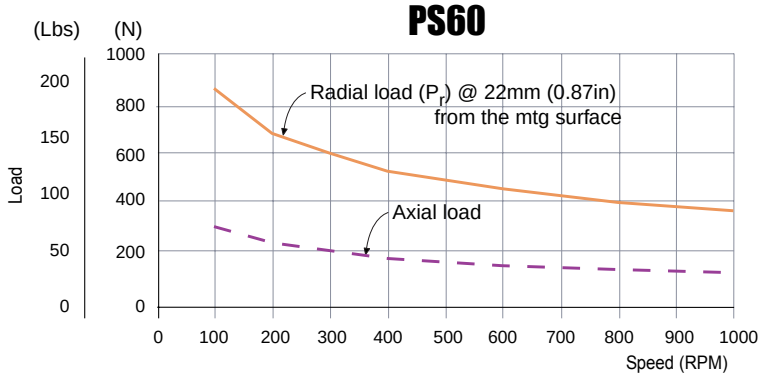
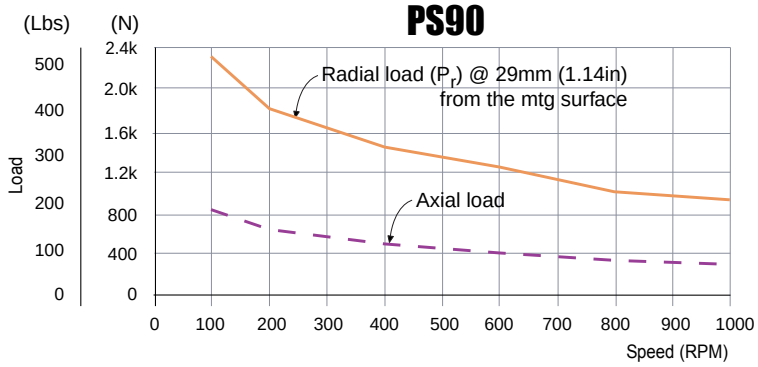
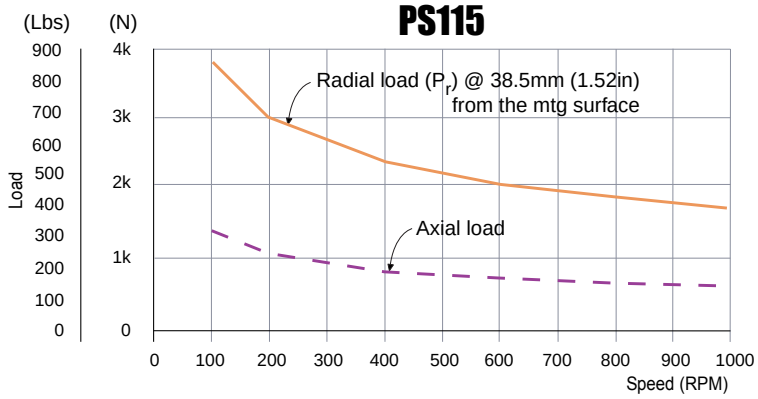


PS90



PS115



Formulas to calculate Radial Load (P_{rx}) at any distance "X" from the gearhead mounting surface.

$P_{rx} = (P_r)(\mathbf{37mm}) / (\mathbf{22mm} + X)$
$P_{rx} = (P_r)(1.46in) / (0.87in + X)$

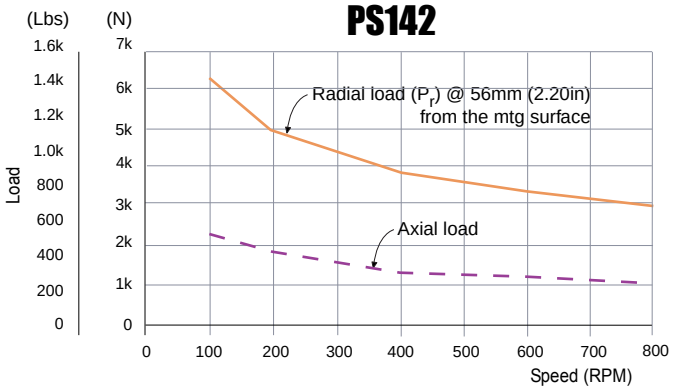
$P_{rx} = (P_r)(\mathbf{57mm}) / (\mathbf{35mm} + X)$
$P_{rx} = (P_r)(2.24in) / (1.38in + X)$

$P_{rx} = (P_r)(\mathbf{74mm}) / (\mathbf{45mm} + X)$
$P_{rx} = (P_r)(2.91in) / (1.77in + X)$

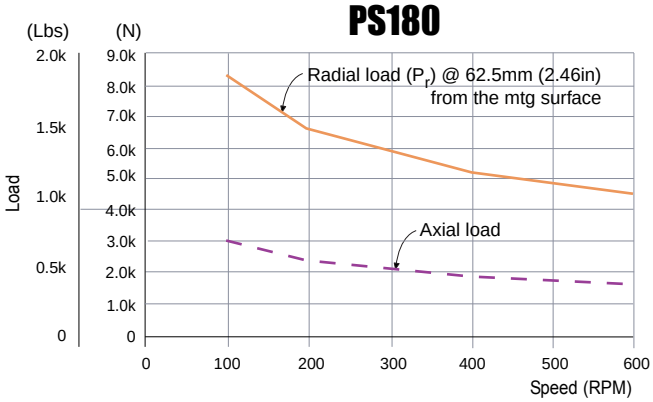
$P_{rx} = (P_r)(\mathbf{95mm}) / (\mathbf{57mm} + X)$
$P_{rx} = (P_r)(3.74in) / (2.24in + X)$

Stealth® PS Advanced Series:
Output Shaft Load Rating

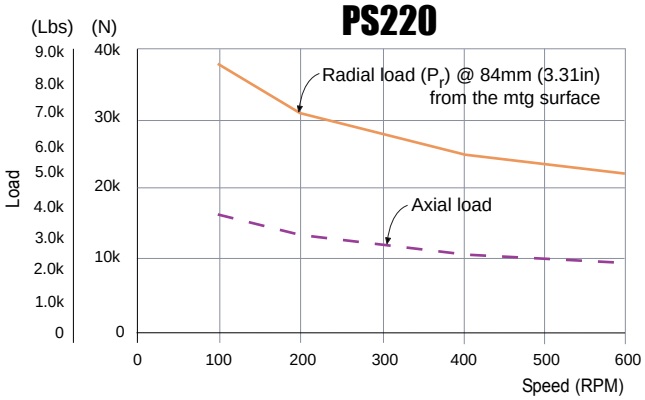
PS142



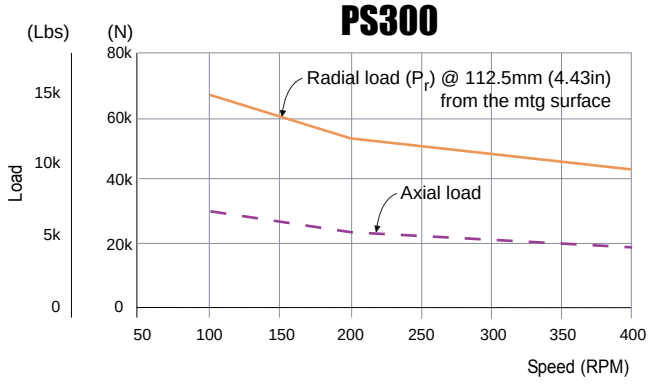
PS180



PS220



PS300



Formulas to calculate Radial Load (P_{rx}) at any distance "X" from the gearhead mounting surface.

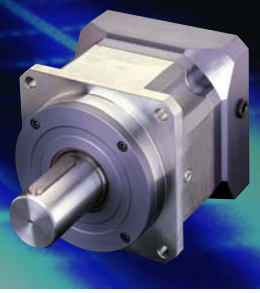
$P_{rx} = (P_r)(\mathbf{127mm}) / (\mathbf{71mm} + X)$
$P_{rx} = (P_r)(5in) / (2.79in + X)$

$P_{rx} = (P_r)(\mathbf{138mm}) / (\mathbf{76mm} + X)$
$P_{rx} = (P_r)(5.43in) / (2.99in + X)$

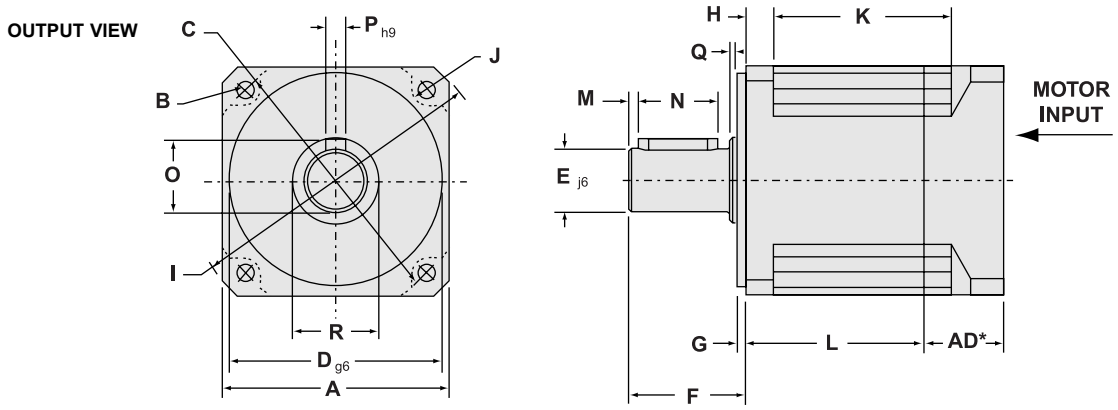
$P_{rx} = (P_r)(\mathbf{190mm}) / (\mathbf{106mm} + X)$
$P_{rx} = (P_r)(7.48in) / (4.17in + X)$

$Prx = (Pr)(\mathbf{268mm}) / (\mathbf{156mm} + X)$
$Prx = (Pr)(10.55in) / (6.14in + X)$

Stealth® PS Advanced Series



Dimensions



Frame Size	A Square Flange (mm)	(in)	B Bolt Hole (mm)	(in)	C Bolt Circle (mm)	(in)	D Pilot Diameter (mm)	(in)	E Output Shaft Diameter (mm)	(in)	F Output Shaft Length (mm)	(in)	G Pilot Thickness (mm)	(in)	H Flange Thickness (mm)	(in)	I Housing Diameter (mm)	(in)	J Housing Recess (mm)	(in)
PS40	42	1.654	3.4	0.134	50	1.969	35	1.378	13	0.512	26	1.024	5.5	0.217	5	0.197	56	2.205	3.5	0.138
PS60	60	2.362	5.5	0.217	70	2.756	50	1.969	16	0.630	37	1.457	8	0.315	8	0.315	80	3.150	5	0.197
PS90	90	3.543	6.5	0.256	100	3.937	80	3.150	22	0.866	48	1.890	11	0.433	10	0.394	116	4.567	6.5	0.256
PS115	115	4.528	8.5	0.335	130	5.118	110	4.331	32	1.260	65	2.559	13	0.512	14	0.551	152	5.984	7.5	0.295
PS142	142	5.591	11	0.433	165	6.496	130	5.118	40	1.575	97	3.819	15	0.591	15	0.591	185	7.283	10	0.394
PS180	182	7.165	13	0.512	215	8.465	160	6.299	55	2.165	105	4.134	20	0.787	16	0.630	240	9.449	16	0.630
PS220	220	8.661	17	0.669	250	9.843	180	7.087	75	2.953	138	5.433	30	1.181	22	0.866	290	11.417	16	0.630
PS300	305	12.008	21	0.827	350	13.780	250	9.843	100	3.937	190	7.480	35	1.378	26	1.024	400	15.748	18	0.709

Frame Size	K1 Recess Length (For Ratio ≤ 10:1) (mm)	(in)	K2 Recess Length (For Ratio > 10:1) (mm)	(in)	L1 Length (For Ratio ≤ 10:1) (mm)	(in)	L2 Length (For Ratio > 10:1) (mm)	(in)	M Dist. From Shaft End (mm)	(in)	N Keyway Length (mm)	(in)	O Key Height (mm)	(in)	P Keyway Width (mm)	(in)	Q Shoulder Height (mm)	(in)	R Shoulder Diameter (mm)	(in)
PS40	32	1.260	53	2.087	30	1.181	50.7	1.996	2	0.079	16	0.630	15	0.591	5	0.197	1	0.039	15	0.591
PS60	37	1.457	67	2.638	36.7	1.445	66.7	2.626	2	0.079	25	0.984	18	0.709	5	0.197	0.5	0.020	22	0.866
PS90	48	1.890	88	3.465	49.5	1.949	89	3.504	3	0.118	32	1.260	24.5	0.965	6	0.236	0.5	0.020	35	1.378
PS115	62	2.441	110	4.331	61.7	2.429	109.5	4.311	5	0.197	40	1.575	35	1.378	10	0.394	1	0.039	45	1.772
PS142	82	3.228	143	5.630	76.5	3.012	138	5.433	5	0.197	63	2.480	43	1.693	12	0.472	3	0.118	55	2.165
PS180	88	3.465	158	6.220	83.5	3.287	153.5	6.043	6	0.236	70	2.756	59	2.323	16	0.630	3	0.118	70	2.756
PS220	116	4.567	218	8.583	108	4.252	210.5	8.287	6	0.236	90	3.543	79.5	3.130	20	0.787	3	0.118	95	3.740
PS300	160	6.299	332	13.071	158	6.220	292	11.496	7	0.276	140	5.512	106	4.173	28	1.102	3	0.118	140	5.512

*AD=Adapter Length. Adapter will vary, depending on motor.
Consult Internet (www.baysidemotion.com) for details or call Bayside.

Specifications are subject to change without notice.

How to Order

1. Pick frame size and ratio.
2. Pick backlash and orientation.
3. Specify motor make and model for mounting kit.

P	S	1	4	2	-	0	0	3	-	X	X	X	L	H

FRAME SIZE
40** 142
60 180
90 220
115 300***

RATIO
003 010 030
004 015 040
005 020 050
007 025 070
100

SPECIAL
(Factory Issued)

BACKLASH
L = Low
S = Standard

ORIENTATION
H = Horizontal orientation
U = Output shaft pointing up
D = Output shaft pointing down

(For other orientations consult the factory)

PS Gearheads are supported by a worldwide network of offices and local distributors. Call **1-800-305-4555** for application engineering assistance or for the name of your local distributor. Information can also be obtained at **www.baysidemotion.com**.

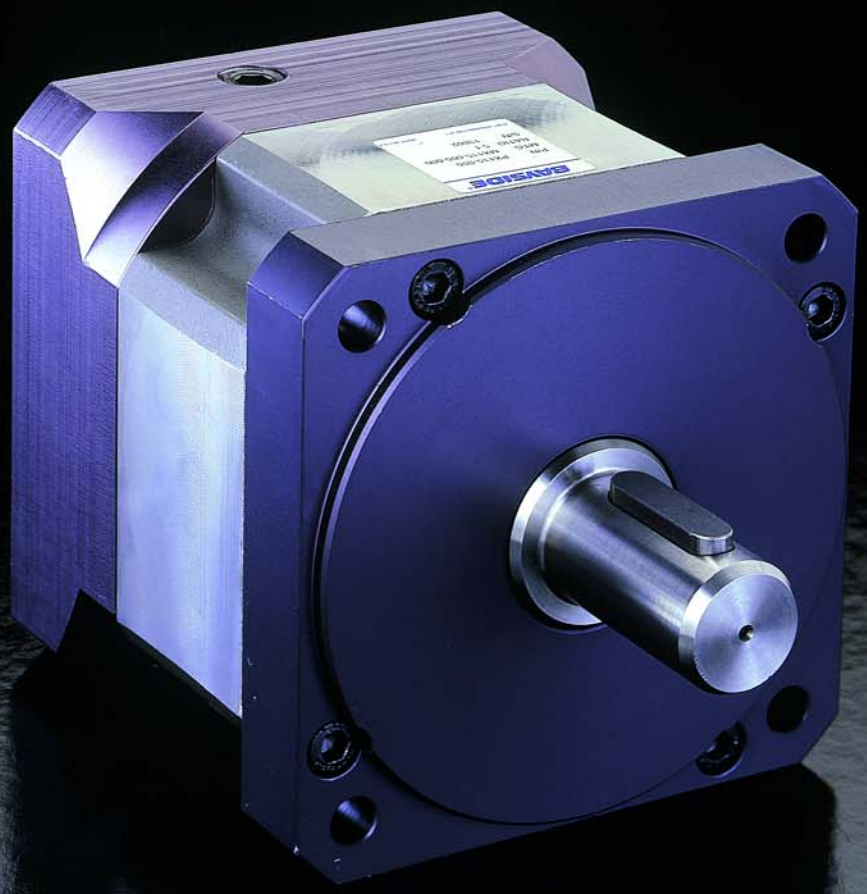
** PS40 is available in Ratios of : 4, 5, 7, 10, 16, 20, 25, 40, 50, 70 & 100:1*** PS300 is available in Ratios of: 4, 5, 7, 10, 20, 50, 70 & 100:1

Stealth® PX Series:
Best Technology . . Best Value

Stealth® PX incorporates Bayside's helical planetary technology in a lower cost package. Available in NEMA and Metric frame sizes, Stealth® PX delivers high torque and quiet, smooth operation for less demanding servo applications.

3 Frame Sizes	
PX60	PX23
PX90	PX34
PX115	PX42

Ratios		
3:1	10:1	30:1
4:1	15:1	50:1
5:1	20:1	70:1
7:1	25:1	100:1



Stealth® PX Series

Performance Specifications

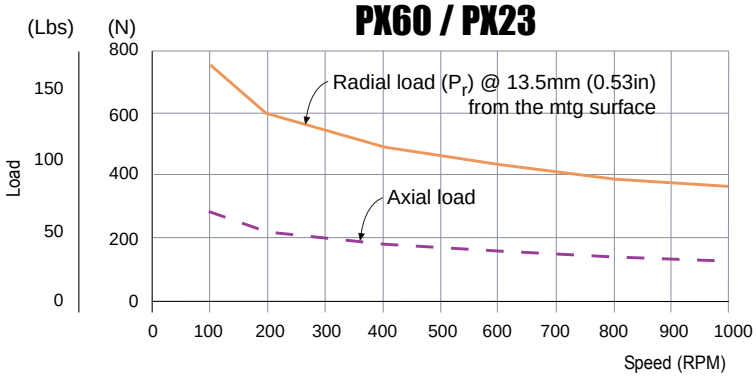
	Units	Ratio	Frame Size PX60	PX90	PX115
Nominal Output Torque, $T_{nom\ r}$	**Nm**	3-5	**18**	**45**	**124**
	in lb		160	400	1,100
	Nm	7-15	**22**	**57**	**147**
	in lb		190	500	1,300
	Nm	20-50	**28**	**74**	**181**
	in lb		250	650	1,600
	Nm	70-100	**23**	**57**	**158**
	in lb		200	500	1,400
Max. Acceleration Output Torque, $T_{acc\ r}$	**Nm**	3-15, 70-100	**26**	**71**	**175**
	in lb		230	630	1,550
	Nm	20-50	**32**	**86**	**215**
	in lb		280	760	1,900
Emergency(1) Stop Output Torque, $T_{em\ r}$	**Nm**	3-15, 70-100	**60**	**164**	**407**
	in lb		530	1,450	3,600
	Nm	20-50	**74**	**198**	**497**
	in lb		650	1,750	4,400
Nominal Input Speed, $N_{nom\ r}$	RPM	3-5	3,200	2,800	2,400
	RPM	7-15	3,700	3,300	2,900
	RPM	20-50	4,200	3,800	3,400
	RPM	70-100	4,700	4,300	3,900
Maximum Input Speed, N_{maxr}	RPM	3-100	6,000	5,300	4,500
Standard Backlash (2)	arc min	3-10	14	14	12
	arc min	15-100	16	16	14
Low Backlash (2)	arc min	3-10	10	10	8
	arc min	15-100	12	12	10
Efficiency at Nominal Torque	%	3-10	96	96	96
	%	15-100	93	93	93
Noise Level(3) at: 3,000 RPM	dB	3-100	70	70	70
Torsional Stiffness	**Nm / arc min**	3-100	**3**	**10**	**20**
	in lb / arc min		22	88	177
Maximum Weight	**kg**	3-10	**1**	**3**	**7**
	lb		3	7	15
	kg	15-100	**2**	**5**	**10**
	lb		4	10	21
Max. Allowable Case Temperature	°C	3-100	←	100	→

Specifications:	Units	Ratio	Frame Size PX60	PX90	PX115
Moment of Inertia(4)	**gm cm sec²**	3	**0.212**	**0.918**	**2.53**
	oz in sec²		0.003	0.013	0.035
	gm cm sec²	4,5	**0.134**	**0.590**	**1.92**
	oz in sec²		0.002	0.008	0.027
	gm cm sec²	7,10	**0.092**	**0.372**	**1.12**
	oz in sec²		0.001	0.005	0.016
	gm cm sec²	15	**0.122**	**0.524**	**1.64**
	oz in sec²		0.002	0.007	0.023
	gm cm sec²	20,25	**0.128**	**0.548**	**1.78**
	oz in sec²		0.002	0.008	0.025
	gm cm sec²	30-100	**0.083**	**0.322**	**0.924**
	oz in sec²		0.001	0.004	0.013

(1) Maximum of 1,000 stops
(2) Measured at 2% of rated torque.
(3) Measured at 1 meter
Specification are subject to change without notice
(4) All Moment of Inertia values are as reflected at the input shaft of the gearhead.

Stealth® PX Series:
Output Shaft Load Rating

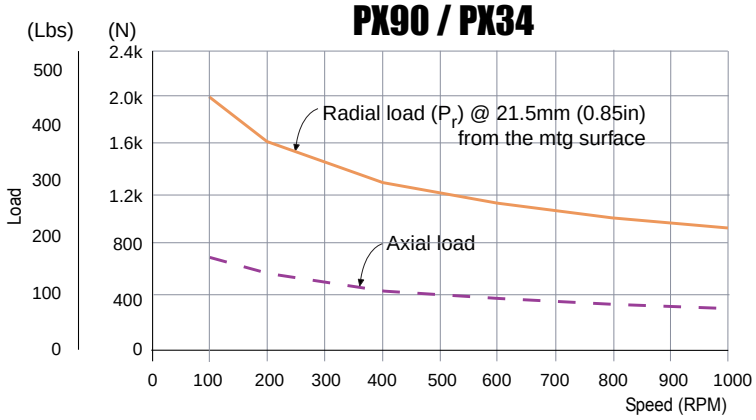
PX60 / PX23



Formulas to calculate Radial Load (P_{rx}) at any distance "X" from the gearhead mounting surface.

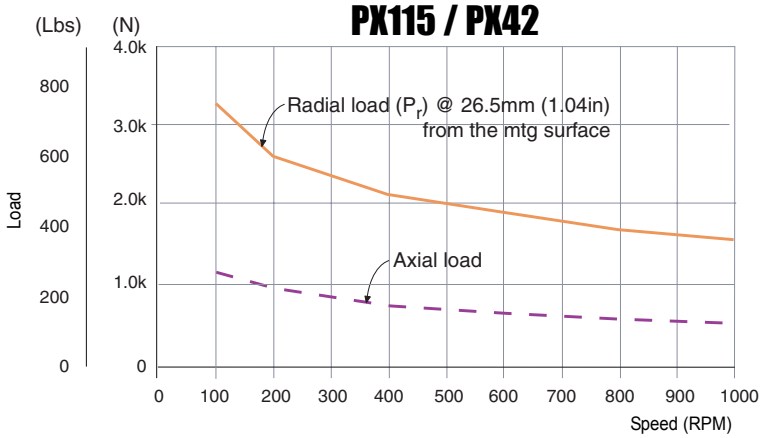
$P_{rx} = (P_r)(\mathbf{54mm}) / (\mathbf{41mm} + X)$
$P_{rx} = (P_r)(2.13in) / (1.61in + X)$

PX90 / PX34



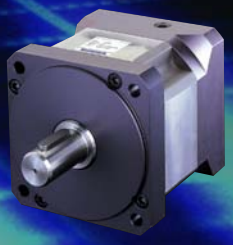
$P_{rx} = (P_r)(\mathbf{73mm}) / (\mathbf{52mm} + X)$
$P_{rx} = (P_r)(2.87in) / (2.05in + X)$

PX115 / PX42



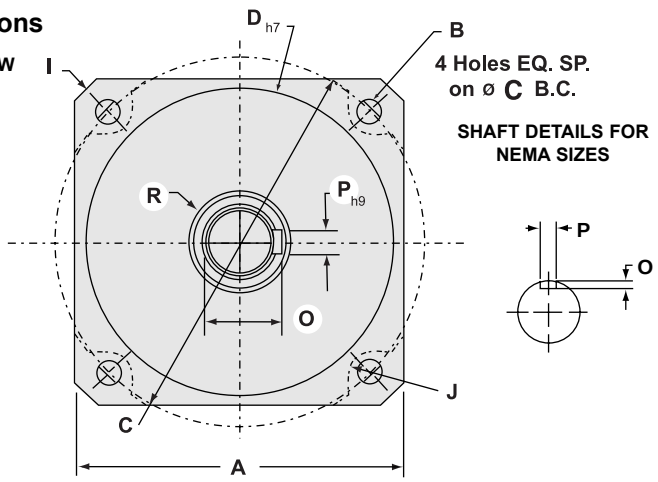
$P_{rx} = (P_r)(\mathbf{89mm}) / (\mathbf{63mm} + X)$
$P_{rx} = (P_r)(3.5in) / (2.48in + X)$

Stealth® PX Series



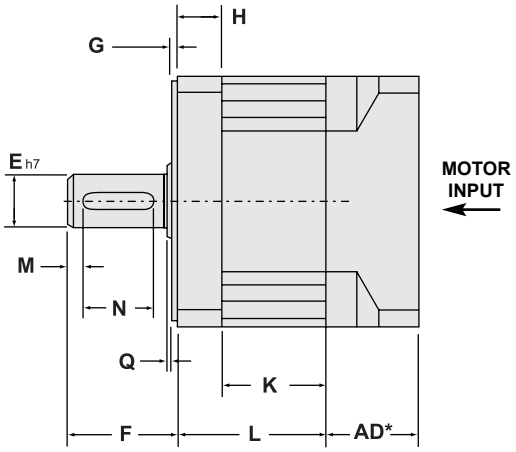
Dimensions

OUTPUT VIEW



SHAFT DETAILS FOR NEMA SIZES

SIDE VIEW



METRIC SIZES

Frame Size	A Square Flange (mm)	A (in)	B Bolt Hole (mm)	B (in)	C Bolt Circle (mm)	C (in)	D Pilot Diameter (mm)	D (in)	E Output Shaft Diameter (mm)	E (in)	F Output Shaft Length (mm)	F (in)	G Pilot Thickness (mm)	G (in)	H Flange Thickness (mm)	H (in)	I Housing Diameter (mm)	I (in)	J Housing Recess (mm)	J (in)
PX60	60	2.362	5.5	0.217	70	2.756	50	1.969	16	0.630	25	0.984	2.5	0.098	13	0.512	80	3.150	5.5	0.217
PX90	90	3.543	6.5	0.256	100	3.937	80	3.150	20	0.787	40	1.575	3	0.118	17	0.669	116	4.567	6.5	0.256
PX115	115	4.528	8.5	0.335	130	5.118	110	4.331	24	0.945	50	1.969	3.5	0.138	20	0.787	152	5.984	7.5	0.295

Frame Size	K1 Recess Length (For Ratio ≤ 10:1) (mm)	K1 (in)	K2 Recess Length (For Ratio > 10:1) (mm)	K2 (in)	L1 Length (For Ratio ≤ 10:1) (mm)	L1 (in)	L2 Length (For Ratio > 10:1) (mm)	L2 (in)	M Dist. From Shaft End (mm)	M (in)	N Keyway Length (mm)	N (in)	O Key Height (mm)	O (in)	P Keyway Width (mm)	P (in)	Q Shoulder Height (mm)	Q (in)	R Shoulder Diameter (mm)	R (in)
PX60	30	1.181	60	2.362	43	1.693	73	2.874	3	0.118	16	0.630	18	0.709	5	0.197	1	0.039	22	0.866
PX90	39.5	1.555	79	3.110	56.5	2.224	96	3.780	5	0.197	28	1.102	22.5	0.886	6	0.236	1	0.039	35	1.378
PX115	47.8	1.882	95.6	3.764	67.8	2.669	115.6	4.551	7	0.276	32	1.260	27	1.063	8	0.315	1.5	0.059	35	1.378

*AD=Adapter Length. Adapter will vary, depending on motor. Consult Internet (www.baysidemotion.com) for details or call Bayside.

NEMA SIZES

Frame Size	B Bolt Hole (in)	B (mm)	C Bolt Circle (in)	C (mm)	D Pilot Diameter (in)	D (mm)	E Output Shaft Diameter (in)	E (mm)	F Output Shaft Length (in)	F (mm)	N Keyway Length (in)	N (mm)	O Keyway Depth (in)	O (mm)	P Keyway Width (in)	P (mm)
PX23	0.195	4.953	2.625	66.675	1.5	38.100	0.375	9.525	1	25.400	0.75 flat	19.050 flat	0.015 flat	0.381 flat	—	—
PX34	0.217	5.512	3.875	98.425	2.875	73.025	0.5	12.700	1.25	31.750	1.063	27.000	0.072	1.829	0.125	3.175
PX42	0.281	7.137	4.95	125.730	2.187	55.550	0.625	15.875	1.5	38.100	1.142	29.007	0.094	2.388	0.188	4.775

NOTE: NEMA sizes have 20% lower torque/stiffness ratings due to smaller output shaft diameter.

Specifications are subject to change without notice.

How to Order

Order Numbering Example: **PX115-010-XXXLB**

1. Pick frame size and ratio.
2. Pick options.
3. Specify motor make and model for mounting kit.

FRAME SIZE (Metric Sizes)	FRAME SIZE (NEMA Sizes)
60	23
90	34
115	42
142 (1)	56 (1)

RATIO		
003	010	030
004	015	050
005	020	070
007	025	100

SPECIAL (Factory Issued)

OPTIONAL LOW BACKLASH

(1) Available upon request . Please contact Bayside for more information.

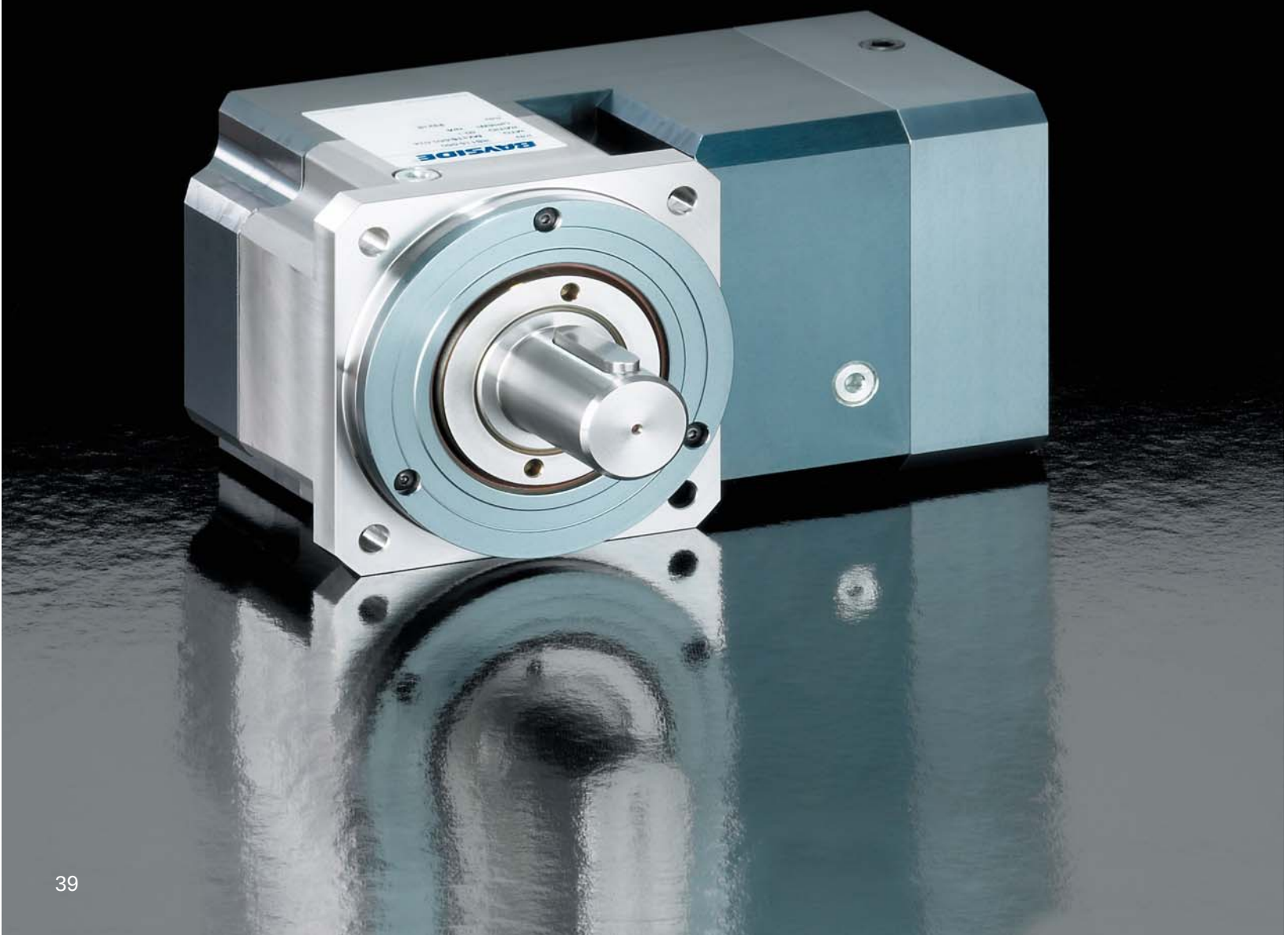
PX Gearheads are supported by a worldwide network of offices and local distributors. Call **1-800-305-4555** for application engineering assistance or for the name of your local distributor. Information can also be obtained at **www.baysidemotion.com**.

Stealth® RS Advanced Series:
Compact Right Angle Servo Gearhead

Stealth® RS delivers “The Helical Advantage” in a compact, right angle package. With 7 frame sizes and 9 gear ratios to choose from, you’re guaranteed to find a Stealth® RS to fit your high performance servo applications.

7 Frame Sizes	
RS60	RS180
RS90	RS220
RS115	RS300
RS142	

Ratios*	
5:1	30:1
10:1	40:1
15:1	50:1
20:1	100:1
25:1	* For RS300 see Note (4)



Stealth® RS Advanced Series

Performance Specifications

	Units	Ratio	Frame Size RS60	RS90	RS115	RS142	RS180	RS220	RS300
Nominal Output Torque, $T_{nom\ r}$	**Nm**	5	**11**	**28**	**75**	**141**	**316**	**678**	**2,203**
	in lb		95	250	660	1,250	2,800	6,000	19,500
	Nm	10	**21**	**55**	**147**	**271**	**621**	**1,299**	**2,712**
	in lb		190	490	1,300	2,400	5,500	11,500	24,000
	Nm	15-25	**33**	**85**	**215**	**395**	**938**	**1,808**	**4,181**
	in lb		290	750	1,900	3,500	8,300	16,000	37,000
	Nm	30-100	**28**	**85**	**192**	**316**	**836**	**1,469**	**4,181**
	in lb		250	750	1,700	2,800	7,400	13,000	37,000
Max. Acceleration Output Torque, $T_{acc\ r}$	**Nm**	5	**13**	**33**	**88**	**166**	**373**	**802**	**2,644**
	in lb		115	295	780	1,470	3,300	7,100	23,400
	Nm	10	**26**	**66**	**169**	**333**	**734**	**1,582**	**3,277**
	in lb		230	580	1,500	2,950	6,500	14,000	29,000
	Nm	15-100	**37**	**101**	**260**	**452**	**1,096**	**2,000**	**5,311**
	in lb		330	890	2,300	4,000	9,700	17,700	47,000
Emergency(1) Stop Output Torque, $T_{em\ r}$	**Nm**	5	**31**	**77**	**203**	**384**	**870**	**1,853**	**6,102**
	in lb		270	680	1,800	3,400	7,700	16,400	54,000
	Nm	10	**60**	**153**	**395**	**768**	**1,695**	**3,684**	**7,684**
	in lb		530	1,350	3,500	6,800	15,000	32,600	68,000
	Nm	15-100	**87**	**232**	**599**	**1,040**	**2,520**	**4,588**	**12,316**
	in-lb		770	2,050	5,300	9,200	22,300	40,600	109,000
Nominal Input Speed, $N_{nom\ r}$	RPM	5,10	3,200	2,800	2,400	2,000	1,600	1,200	1,000
	RPM	15-40	3,700	3,300	2,900	2,500	2,000	1,500	1,250
	RPM	50-100	4,200	3,800	3,400	3,000	2,400	1,800	1,500
Maximum Input Speed, $N_{max\ r}$	RPM	5-100	6,000	5,300	4,500	3,800	3,000	2,300	1,900
Standard Backlash (2)	arc min	5,10	14	12	12	10	10	10	10
	arc min	15-100	12	10	10	8	8	8	8
Low Backlash (2)	arc min	5,10	10	8	8	6	6	6	6
	arc min	15-100	8	6	6	4	4	4	4
Efficiency at Nominal Torque	%		94	94	94	94	94	94	94
Noise Level(3) at:									
3,000 RPM	dB	5-100	70	70	70	—	—	—	—
2,000 RPM	dB		—	—	—	72	72	—	—
1,500 RPM	dB		—	—	—	—	—	72	72
Torsional Stiffness	**Nm / arc min**	5-100	**3**	**10**	**19**	**35**	**90**	**170**	**290**
	in lb / arc min		22	84	164	310	800	1,500	2,560
Maximum Weight	**kg**	5-100	**2**	**6**	**11**	**24**	**43**	**80**	**120**
	lb		4	13	25	52	94	177	265
Max. Allowable Case Temp.	°C	5-100	←			100			→

Specifications:	Units	Ratio	Frame Size RS60	RS90	RS115	RS142	RS180	RS220	RS300
Moment of Inertia(4)	**g cm sec^2**	5	**0.197**	**0.745**	**2.68**	**8.94**	**26.5**	**82.2**	**378**
	oz-in-sec^2		0.003	0.010	0.037	0.124	0.368	1.14	5.26
	g cm sec^2	10	**0.095**	**0.489**	**1.67**	**5.87**	**16.7**	**50.4**	**238**
	oz-in-sec^2		0.001	0.007	0.023	0.082	0.232	0.700	3.31
	g cm sec^2	15,30	**0.092**	**0.453**	**1.58**	**5.60**	**15.2**	**47.4**	**158**
	oz-in-sec^2		0.001	0.006	0.022	0.078	0.211	0.658	2.19
	g cm sec^2	20,25,40	**0.083**	**0.358**	**1.13**	**4.17**	**10.7**	**34.3**	**116**
	oz-in-sec^2		0.001	0.005	0.016	0.058	0.149	0.476	1.61
	g cm sec^2	50,100	**0.072**	**0.238**	**0.685**	**2.26**	**6.70**	**21.2**	**95.4**
	oz-in-sec^2		0.001	0.003	0.010	0.031	0.093	0.294	1.32

(1) Maximum of 1,000 stops
(2) Measured at 2% of rated torque
(3) Measured at 1 meter

(4) All Moment of Inertia values are as reflected at the input shaft of the gearhead.

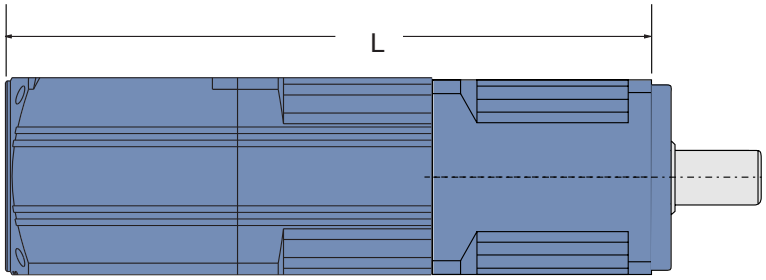
(5) RS300 is available in Ratios of: 4, 6, 10, 15, 20, 24, 30 & 50:1
Specification are subject to change without notice

Stealth® RS Advanced Series:
Space Tight? Turn Right

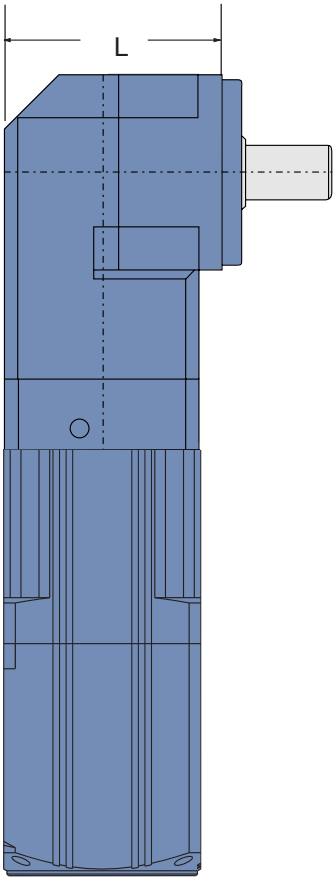
Stealth® Advanced in the PS / RS Models incorporates the latest enhancement in gearhead technology:

- Latest technology in seals…reduce heat and wear
- Oil lubrication…reduces, friction and operating temperature
- Front output seal cover…captures and protects output seal

For space constrained applications Bayside's Right Angle gearheads can offer a two times space savings when compared to inline products.



IN LINE MOUNTING



RIGHT ANGLE MOUNTING

Stealth's superior design and construction deliver "The Helical Advantage":

- Strong…30% More Torque
- Quiet…Less Than 70dB Noise
- Fast…6,000 RPM Input Speeds
- Accurate…Less Than 4 Arc minutes Backlash

Plus... Over 94% Efficiency

1

Stealth Planetary Output

Stealth RS is built into the gearhead to deliver *"The Helical Advantage"* at the load-carrying output section.

2

Spiral Bevel Gears

Deliver high efficiency and high torque in a compact, right angle package.

3

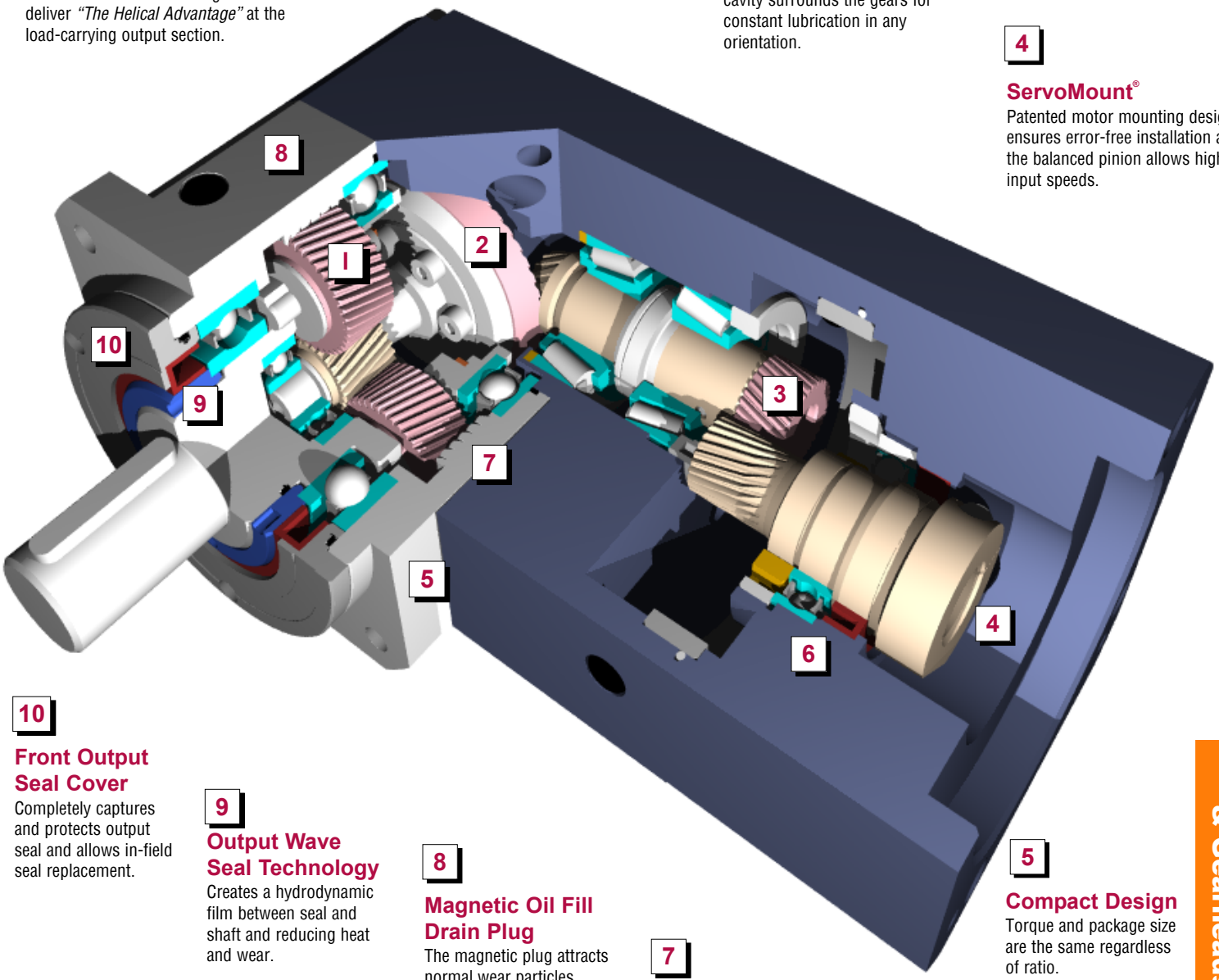
High Speed Input

Helical Stealth gearing provides high input speeds with quiet operation. Input cavity surrounds the gears for constant lubrication in any orientation.

4

ServoMount®

Patented motor mounting design ensures error-free installation and the balanced pinion allows higher input speeds.



10

Front Output Seal Cover

Completely captures and protects output seal and allows in-field seal replacement.

9

Output Wave Seal Technology

Creates a hydrodynamic film between seal and shaft and reducing heat and wear.

8

Magnetic Oil Fill Drain Plug

The magnetic plug attracts normal wear particles keeping them away from the gear mesh.

7

Oil Lubrication

Oil provides better lubrication, reduces friction and operating temperatures.

6

Sealed Unit

Viton seals and O-Rings provide IP65 protection to prevent leaks and protect against harsh environments.

5

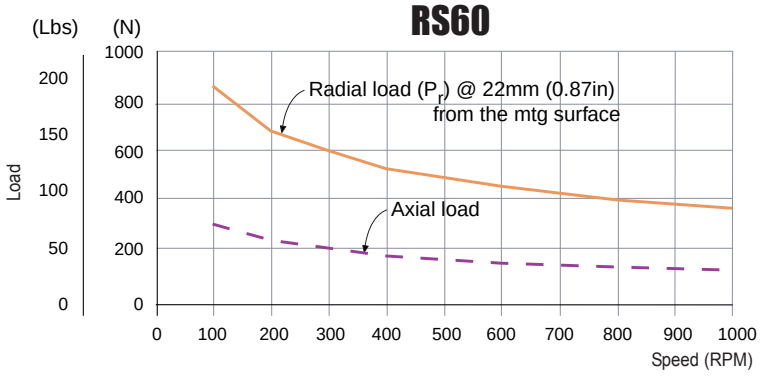
Compact Design

Torque and package size are the same regardless of ratio.

Stealth® RS Advanced Series:
Output Shaft Load Rating

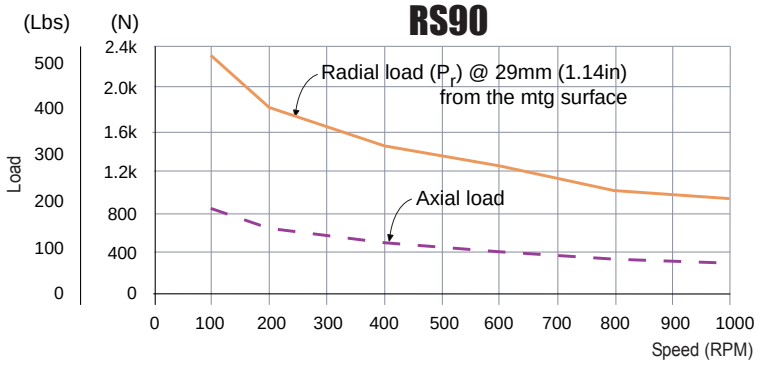
Formulas to calculate Radial Load (P_{rx}) at any distance "X" from the gearhead mounting surface.

RS60



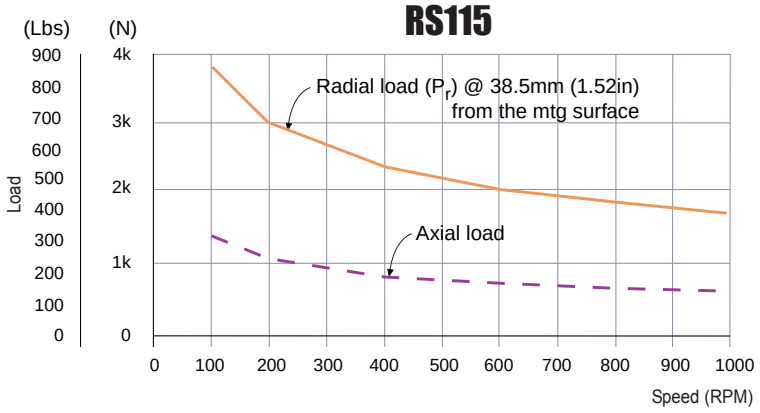
$P_{rx} = (P_r)(\mathbf{57mm}) / (\mathbf{35mm} + X)$
$P_{rx} = (P_r)(2.24in) / (1.38in + X)$

RS90



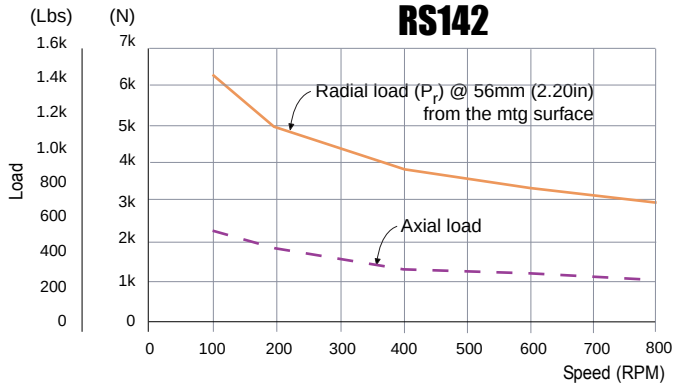
$P_{rx} = (P_r)(\mathbf{74mm}) / (\mathbf{45mm} + X)$
$P_{rx} = (P_r)(2.91in) / (1.77in + X)$

RS115

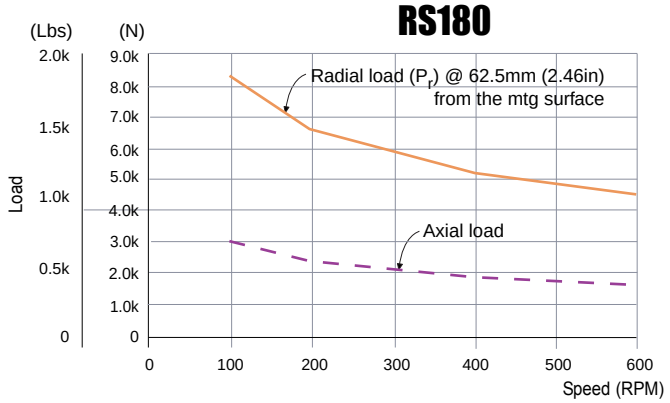


$P_{rx} = (P_r)(\mathbf{95mm}) / (\mathbf{57mm} + X)$
$P_{rx} = (P_r)(3.74in) / (2.24in + X)$

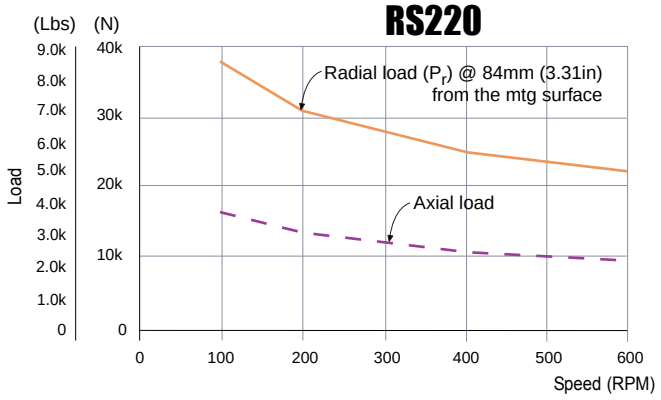
RS142



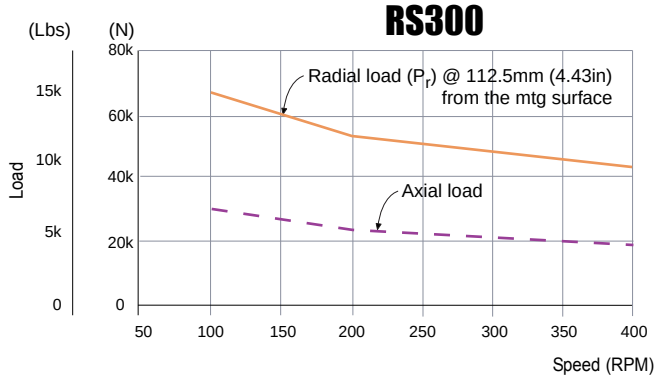
RS180



RS220



RS300



Formulas to calculate Radial Load (P_{rx}) at any distance "X" from the gearhead mounting surface.

$P_{rx} = (P_r)(\mathbf{127mm}) / (\mathbf{71mm} + X)$
$P_{rx} = (P_r)(5in) / (2.79in + X)$

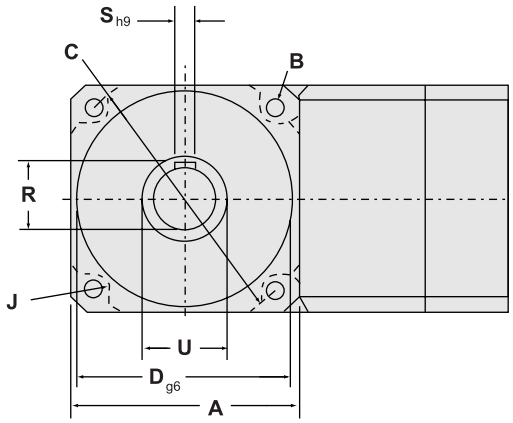
$P_{rx} = (P_r)(\mathbf{138mm}) / (\mathbf{76mm} + X)$
$P_{rx} = (P_r)(5.43in) / (2.99in + X)$

$P_{rx} = (P_r)(\mathbf{190mm}) / (\mathbf{106mm} + X)$
$P_{rx} = (P_r)(7.48in) / (4.17in + X)$

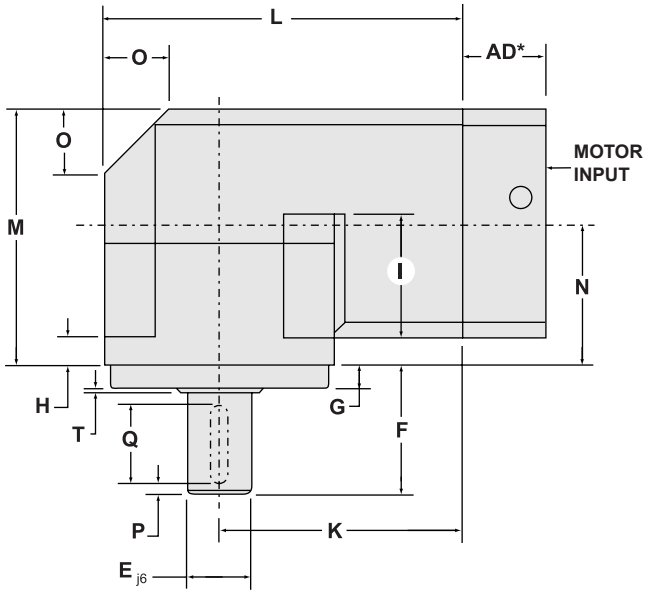
$Prx = (Pr)(\mathbf{268mm}) / (\mathbf{156mm} + X)$
$Prx = (Pr)(10.55in) / (6.14in + X)$

Dimensions

OUTPUT VIEW



SIDE VIEW

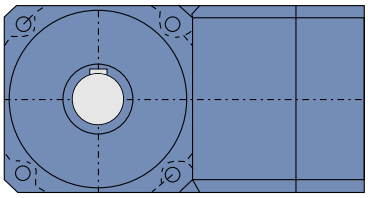


Frame Size	A Square Flange (mm)	A (in)	B Bolt Hole (mm)	B (in)	C Bolt Circle (mm)	C (in)	D Pilot Diameter (mm)	D (in)	E Output Shaft Diameter (mm)	E (in)	F Output Shaft Length (mm)	F (in)	G Pilot Thickness (mm)	G (in)	H Flange Thickness (mm)	H (in)	I Recess Length (mm)	I (in)	J Housing Recess (mm)	J (in)
RS60	60	2.362	5.5	0.217	70	2.756	50	1.969	16	0.630	37	1.457	8	0.315	8	0.315	36	1.417	5	0.197
RS90	90	3.543	6.5	0.256	100	3.937	80	3.150	22	0.866	48	1.890	11	0.433	10	0.394	51.5	2.028	6.5	0.256
RS115	115	4.528	8.5	0.335	130	5.118	110	4.331	32	1.260	65	2.559	13	0.512	14	0.472	63	2.480	7.5	0.295
RS142	142	5.591	11	0.433	165	6.496	130	5.118	40	1.575	97	3.819	15	0.591	15	0.591	81.5	3.209	10	0.394
RS180	182	7.165	13	0.512	215	8.465	160	6.299	55	2.165	105	4.134	20	0.787	16	0.630	97.5	3.839	16	0.630
RS220	220	8.661	17	0.669	250	9.843	180	7.087	75	2.953	138	5.433	30	1.181	22	0.866	101	3.976	16	0.630
RS300	305	12.008	21	0.827	350	13.780	250	9.843	100	3.937	190	7.480	35	1.378	26	1.024	172	6.772	18	0.709

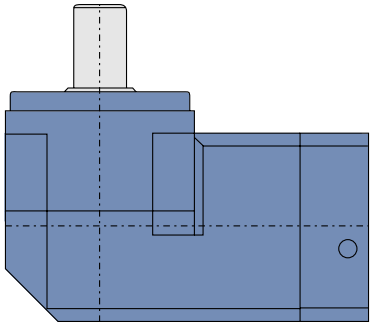
Frame Size	K Dist. to Output Centerline (mm)	K (in)	L Housing Length (mm)	L (in)	M Housing Width (mm)	M (in)	N Dist. to Input Centerline (mm)	N (in)	O Taper Dist. (mm)	O (in)	P Dist. From Shaft End (mm)	P (in)	Q Keyway Length (mm)	Q (in)	R Key Height (mm)	R (in)	S Keyway Width (mm)	S (in)	T Shoulder Height (mm)	T (in)	U Shoulder Diameter (mm)	U (in)
RS60	66	2.598	96	3.780	73	2.874	43	1.693	14	0.551	2	0.079	25	0.984	18	0.709	5	0.197	0.5	0.020	22	0.866
RS90	103	4.055	148	5.827	103	4.055	58	2.283	25	0.984	3	0.118	32	1.260	24.5	0.965	6	0.236	0.5	0.020	35	1.378
RS115	122.5	4.823	180	7.087	129	5.079	71.5	2.815	32	1.260	5	0.197	40	1.575	35	1.378	10	0.394	1	0.039	45	1.772
RS142	159	6.260	230	9.055	162	6.378	91	3.583	40	1.575	5	0.197	63	2.480	43	1.693	12	0.472	3	0.118	55	2.165
RS180	172	6.772	263	10.354	197	7.756	106	4.173	55	2.165	6	0.236	70	2.756	59	2.323	16	0.630	3	0.118	70	2.756
RS220	230	9.055	340	13.386	245	9.646	135	5.315	60	2.362	6	0.236	90	3.543	79.5	3.130	20	0.787	3	0.118	95	3.740
RS300	327.5	12.894	480	18.898	350	13.780	197.5	7.776	80	3.150	7	0.276	140	5.512	106	4.173	28	1.102	3	0.118	140	5.512

*AD=Adapter Length. Adapter will vary, depending on motor. Consult Internet (www.baysidemotion.com) for details or call Bayside.

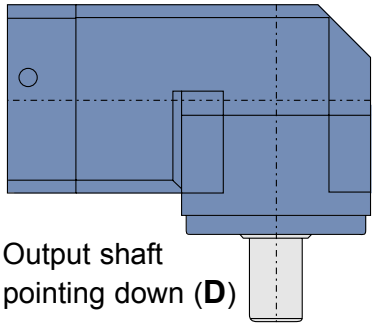
Stealth® RS Advanced Series:
How to Order



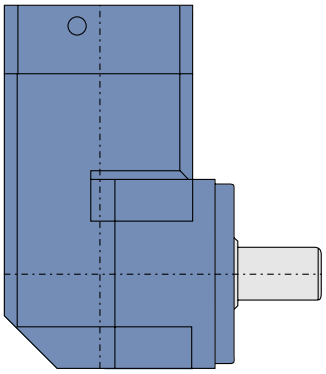
Horizontal orientation (**H**)



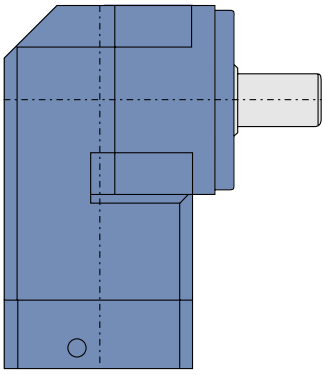
Output shaft pointing up (**U**)



Output shaft pointing down (**D**)



RS input facing up (**E**)



RS input facing down (**F**)

How to Order

Order Numbering Example: R S 1 8 0 - 0 1 0 - X X X L H

1. Pick frame size and ratio.
2. Pick backlash and orientation.
3. Specify motor make and model for mounting kit.

FRAME SIZE	RATIO		SPECIAL	BACKLASH	ORIENTATION
60	005	030	(Factory Issued)	L = Low backlash	H = Horizontal orientation
90	010	040		S = Standard backlash	U = Output shaft pointing up
115	015	050			D = Output shaft pointing down
142	020	100			E = RS input facing up
180	025				F = RS input facing down
220					(For other orientations consult the factory)
300					

RS Gearheads are supported by a worldwide network of offices and local distributors. Call **1-800-305-4555** for application engineering assistance or for the name of your local distributor. Information can also be obtained at **www.baysidemotion.com**.

Stealth® RX Series:
Best Technology . . Best Value

Stealth® RX incorporates Bayside's helical planetary technology in a lower cost package. Available in NEMA and Metric frame sizes, Stealth® RX delivers high torque and quiet, smooth operation for less demanding servo applications.

3 Frame Sizes	
RX60	RX23
RX90	RX34
RX115	RX42

Ratios		
5:1	20:1	40:1
10:1	25:1	50:1
15:1	30:1	100:1

Stealth® RX Series

Performance Specifications

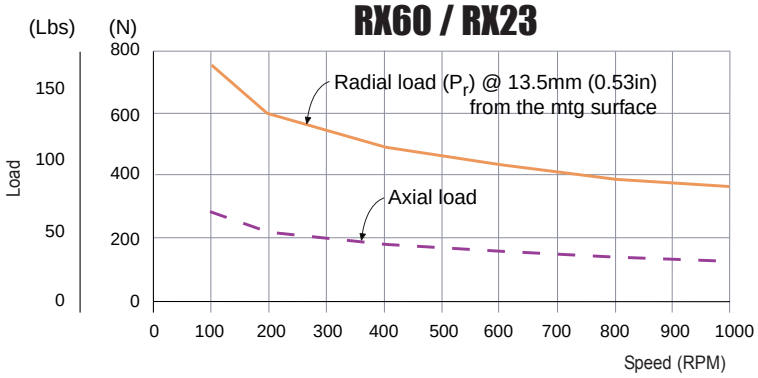
	Units	Ratio	Frame Size RX60	RX90	RX115
Nominal Output Torque, $T_{nom\ r}$	**Nm**	5	**7**	**17**	**45**
	in lb		58	149	484
	Nm	10	**13**	**33**	**88**
	in lb		112	292	484
	Nm	15-25	**20**	**51**	**129**
	in lb		175	451	1,238
	Nm	30-100	**17**	**51**	**115**
	in lb		149	451	1,323
Max. Acceleration Output Torque, $T_{acc\ r}$	**Nm**	5	**8**	**20**	**53**
	in lb		69	175	587
	Nm	10	**16**	**40**	**101**
	in lb		138	350	1,140
	Nm	15-100	**22**	**61**	**156**
	in lb		196	536	1,748
Emergency(1) Stop Output Torque, $T_{em\ r}$	**Nm**	5	**19**	**46**	**122**
	in lb		165	409	1,362
	Nm	10	**46**	**92**	**237**
	in lb		409	812	2,653
	Nm	15-100	**67**	**139**	**359**
	in lb		594	1,232	4,022
Nominal Input Speed, $N_{nom\ r}$	RPM	5, 10	3,200	2,800	2,400
	RPM	15-40	3,700	3,300	2,900
	RPM	50-100	4,200	3,800	3,400
Maximum Input Speed, N_{maxr}	RPM	5-100	6,000	5,300	4,500
Standard Backlash (2)	arc min	5, 10	20	18	18
	arc min	15-100	20	18	16
Low Backlash (2)	arc min	5, 10	18	16	16
	arc min	15-100	16	14	12
Efficiency at Nominal Torque	%	5-100	94	94	94
Noise Level(3) at: 3,000 RPM	dB	5-100	70	70	70
Torsional Stiffness	**Nm / arc min**	5-100	**2.5**	**9.5**	**18.5**
	in lb / arc min		22	84	164
Maximum Weight	**kg**	5-100	**2.01**	**5.74**	**11.35**
	lb		4.42	12.65	25
Max. Allowable Case Temperature	°C	5-100	← 100 →		

Specifications:	Units	Ratio	Frame Size RX60	RX90	RX115
Moment of Inertia(4)	**gm cm sec²**	5	**0.1970**	**0.7450**	**2.6820**
	oz in sec²		0.0030	0.0100	0.0373
	gm cm sec²	10	**0.0950**	**0.4890**	**1.6688**
	oz in sec²		0.0013	0.0068	0.0232
	gm cm sec²	15, 30	**0.0920**	**0.4530**	**1.5794**
	oz in sec²		0.0013	0.0063	0.0219
	gm cm sec²	20-40	**0.0830**	**0.3576**	**1.1324**
	oz in sec²		0.0012	0.0050	0.0157
	gm cm sec²	50-100	**0.0720**	**0.2384**	**0.6854**
	oz in sec²		0.0010	0.0033	0.0095

(1) Maximum of 1,000 stops
(2) Measured at 2% of rated torque
(3)Measured at 1 meter
Specification are subject to change without notice
(4) All Moment of Inertia values are as reflected at the input shaft of the gearhead.

Stealth® RX Series:
Output Shaft Load Rating

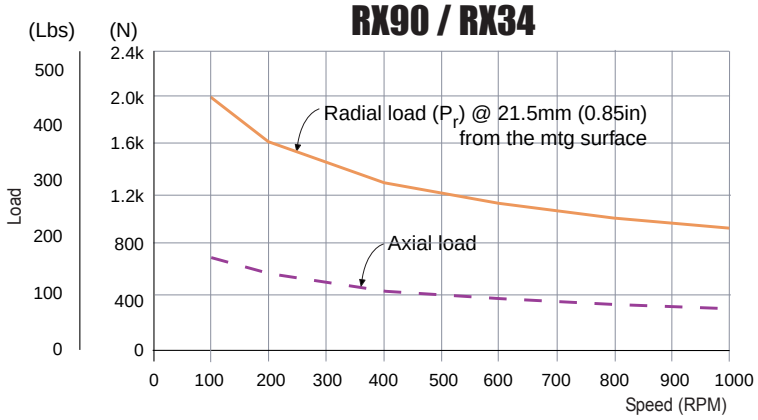
RX60 / RX23



Formulas to calculate Radial Load (P_{rx}) at any distance "X" from the gearhead mounting surface.

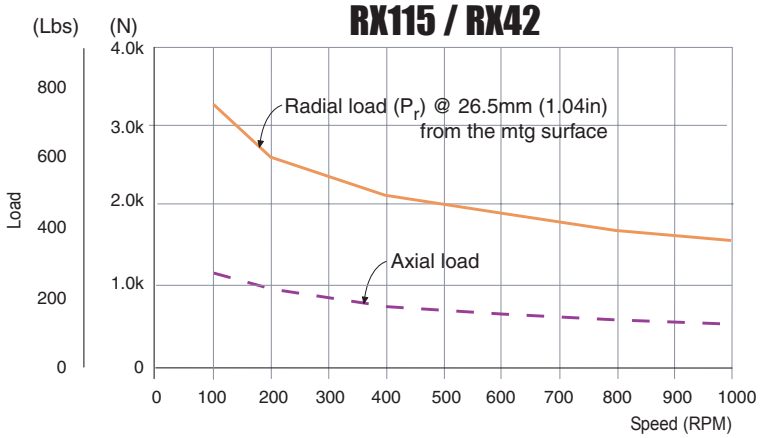
$P_{rx} = (P_r)(\mathbf{54mm}) / (\mathbf{41mm} + X)$
$P_{rx} = (P_r)(2.13in) / (1.61in + X)$

RX90 / RX34



$P_{rx} = (P_r)(\mathbf{73mm}) / (\mathbf{52mm} + X)$
$P_{rx} = (P_r)(2.87in) / (2.05in + X)$

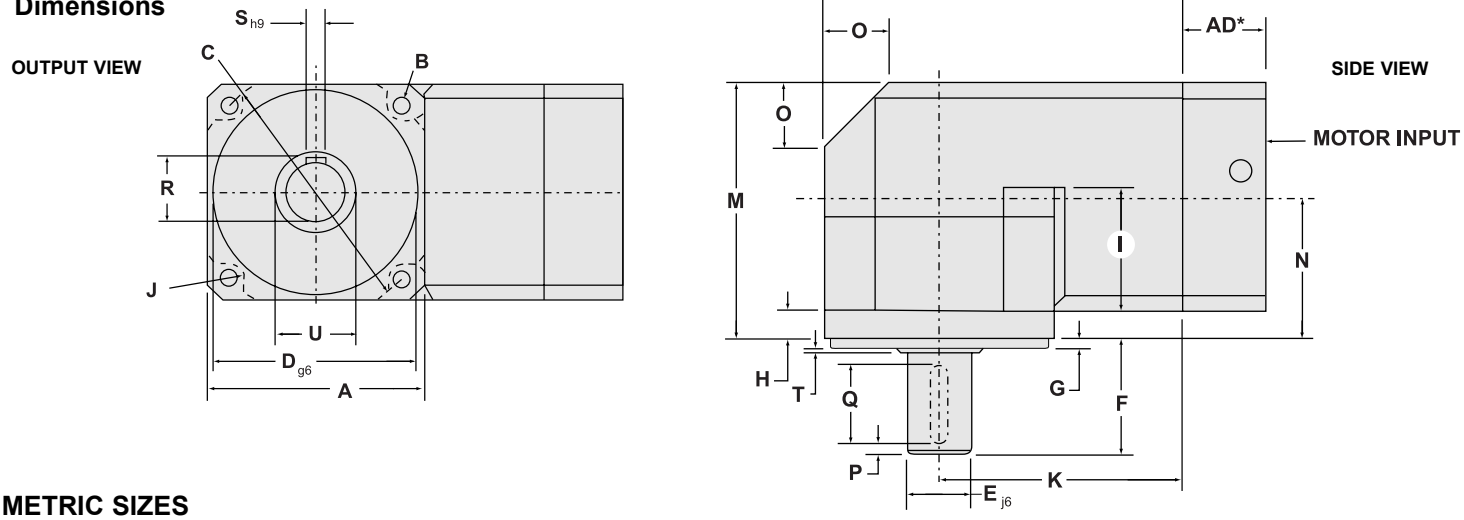
RX115 / RX42



$P_{rx} = (P_r)(\mathbf{89mm}) / (\mathbf{63mm} + X)$
$P_{rx} = (P_r)(3.5in) / (2.48in + X)$

Stealth® RX Series

Dimensions



METRIC SIZES

Frame Size	A Square Flange (mm)	A (in)	B Bolt Hole (mm)	B (in)	C Bolt Circle (mm)	C (in)	D Pilot Diameter (mm)	D (in)	E Output Shaft Diameter (mm)	E (in)	F Output Shaft Length (mm)	F (in)	G Pilot Thickness (mm)	G (in)	H Flange Thickness (mm)	H (in)	I Recess Length (mm)	I (in)	J Housing Recess (mm)	J (in)
RX60	**60**	2.362	**5.5**	0.217	**70**	2.756	**50**	1.969	**16**	0.630	**25**	0.984	**2.5**	0.098	**13**	0.512	**36**	1.417	**5**	0.197
RX90	**90**	3.543	**6.5**	0.256	**100**	3.937	**80**	3.150	**20**	0.787	**40**	1.575	**3**	0.118	**17**	0.669	**51.5**	2.028	**6.5**	0.256
RX115	**115**	4.528	**8.5**	0.335	**130**	5.118	**110**	4.331	**24**	0.945	**50**	1.969	**3.5**	0.138	**20**	0.787	**63**	2.480	**7.5**	0.295

Frame Size	K Dist. to Output Centerline (mm)	K (in)	L Housing Length (mm)	L (in)	M Housing Width (mm)	M (in)	N Dist. to Input Centerline (mm)	N (in)	O Taper Dist. (mm)	O (in)	P Dist. From Shaft End (mm)	P (in)	Q Keyway Length (mm)	Q (in)	R Key Height (mm)	R (in)	S Keyway Width (mm)	S (in)	T Shoulder Height (mm)	T (in)	U Shoulder Diameter (mm)	U (in)
RX60	**66**	2.598	**96**	3.780	**79.3**	3.122	**43**	1.693	**14**	0.551	**5**	0.197	**16**	0.630	**18**	0.709	**5**	0.197	**0.5**	0.020	**22**	0.866
RX90	**103**	4.055	**148**	5.827	**110**	4.330	**58**	2.283	**25**	0.984	**6**	0.238	**28**	1.102	**24.5**	0.965	**6**	0.236	**0.5**	0.020	**35**	1.378
RX115	**122.5**	4.823	**180**	7.087	**186**	7.323	**77.6**	3.055	**32**	1.260	**8**	0.315	**32**	1.260	**27**	1.063	**8**	0.315	**1**	0.039	**45**	1.772

NEMA SIZES

*AD=Adapter Length. Adapter will vary, depending on motor. Consult Internet (www.baysidemotion.com) for details or call Bayside.

Frame Size	B Bolt Hole (in)	B (mm)	C Bolt Circle (in)	C (mm)	D Pilot Diameter (in)	D (mm)	E Output Shaft Diameter (in)	E (mm)	F Output Shaft Length (in)	F (mm)	N Keyway Length (in)	N (mm)	O Keyway Depth (in)	O (mm)	P Keyway Width (in)	P (mm)
RX23	**0.195**	4.953	**2.625**	66.675	**1.5**	38.100	**0.375**	9.525	**1**	25.400	**0.75 flat**	19.050 flat	**0.015 flat**	0.381 flat	—	—
RX34	**0.217**	5.512	**3.875**	98.425	**2.875**	73.025	**0.5**	12.700	**1.25**	31.750	**1.063**	27.000	**0.072**	1.829	**0.125**	3.175
RX42	**0.281**	7.137	**4.95**	125.730	**2.187**	55.550	**0.625**	15.875	**1.5**	38.100	**1.142**	29.007	**0.094**	2.388	**0.188**	4.775

NOTE: NEMA sizes have 20% lower torque/stiffness ratings due to smaller output shaft diameter.

Specifications are subject to change without notice.

How to Order

Order Numbering Example: R X 1 1 5 - 0 1 0 - X X X L B

1. Pick frame size and ratio.
2. Pick options.
3. Specify motor make and model for mounting kit.

FRAME SIZE
(Metric Sizes): 60, 90, 115
(NEMA Sizes): 23, 34, 42

RATIO: 005, 010, 015, 020, 025, 030, 040, 050, 100

SPECIAL: (Factory Issued)

OPTIONAL: LOW BACKLASH

RX Gearheads are supported by a worldwide network of offices and local distributors. Call **1-800-305-4555** for application engineering assistance or for the name of your local distributor. Information can also be obtained at **www.baysidemotion.com**.

Stealth® MultiDrive Series:
The Flexible Right Angle

Stealth® MultiDrive™ (MD) offers three different output options for true flexibility. MultiDrive models include Low Ratio, Dual Shaft and Hollow Shaft options in a compact, right angle package. With 5 frame sizes and multiple ratios to choose from, you are guaranteed to find a Stealth® MultiDrive to fit your servo motor application.

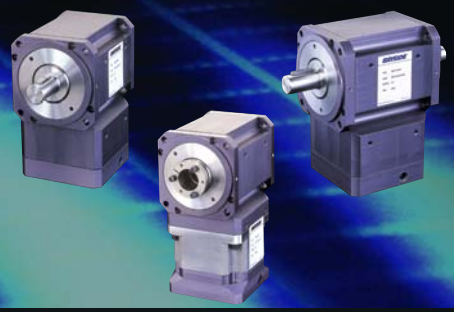
MultiDrive™ features Stealth® helical gearing for high torque, high accuracy and quiet operation in a compact, right angle package.

- **Low Backlash**
  Standard as low as 8 arc minutes and 4 arc minutes optional
- **Space Saving**
  compact, right angle design saves space in many applications
- **Smooth, Quiet Operation and Long Life**
  hardened, precision spiral bevel gears ensure quiet operation.
- **Quick, Error-Free Mounting**
  to any servo or stepper motor using Bayside's patented ServoMount® design.
- **Sealed Unit**…
  seals and o-rings provide IP65 protection to prevent leaks and to protect against harsh environments.

RT Model
Hollow Shaft

Hollow Shaft Model
5 Frame Sizes
RT90
RT115
RT142
RT180
RT220

Ratios
3:1
9:1
15:1
21:1
30:1

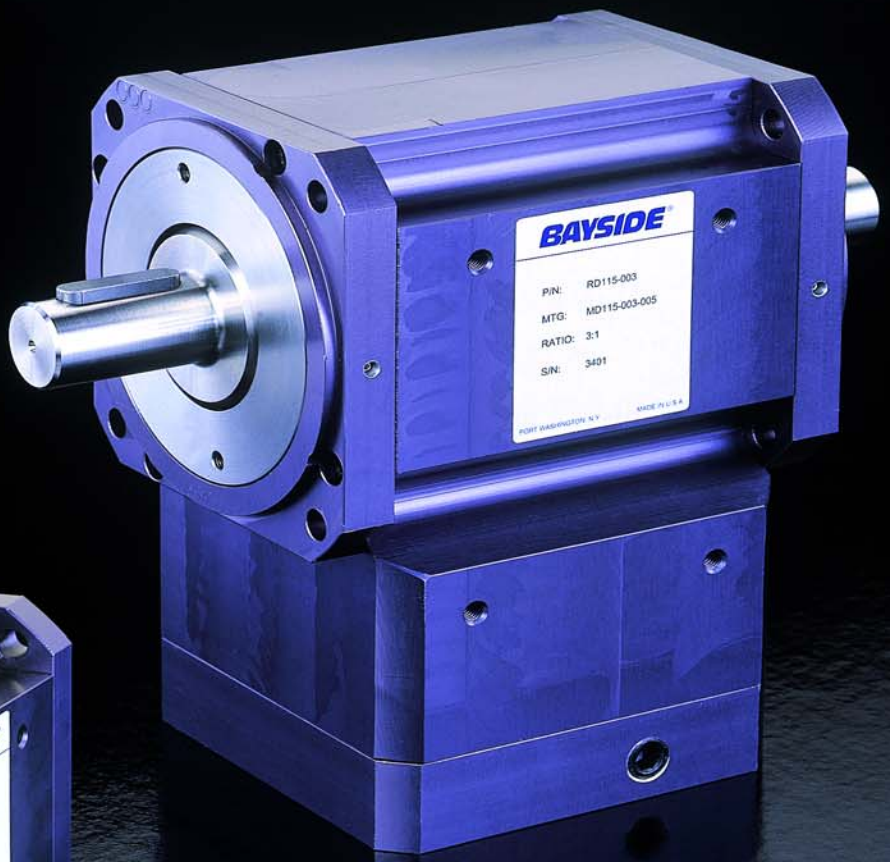


Dual Shaft Model

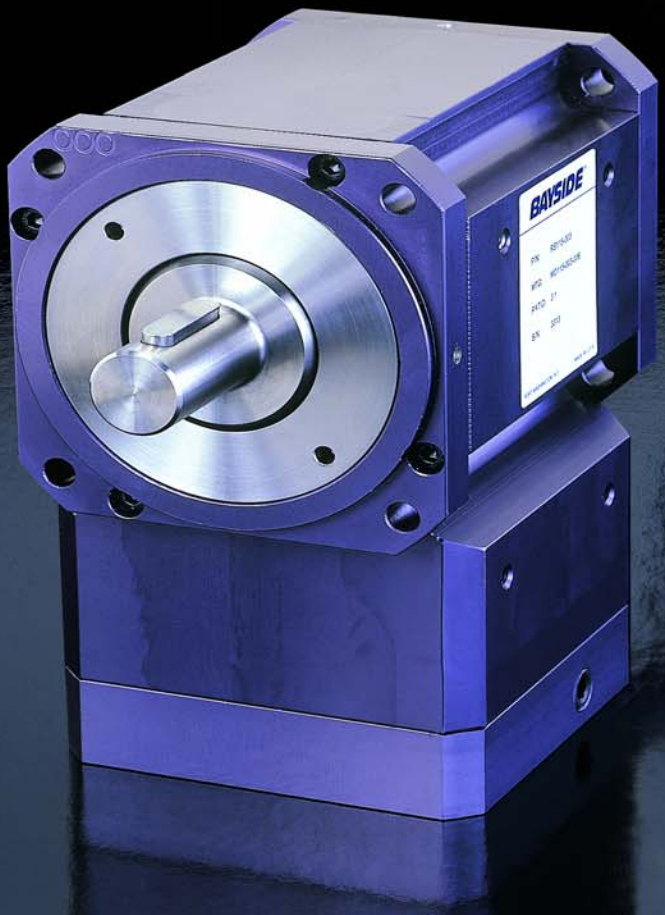
5 Frame Sizes
RD90
RD115
RD142
RD180
RD220

Ratios	
1:1	15:1
2:1	21:1
3:1	30:1
9:1	

RD Model
Dual Shaft



RB Model
Low Ratio



Low Ratio Model

5 Frame Sizes
RB90
RB115
RB142
RB180
RB220

Ratios
1:1
2:1
3:1

Stealth® MultiDrive Series:

Performance Specifications

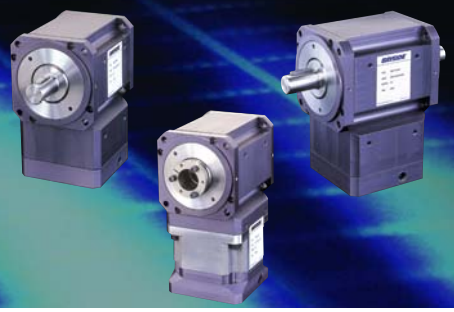
	Units	Ratio	Frame Size (RT, RD, RB) R_90	R_115	R_142	R_180	R_220
Nominal Output Torque, $T_{nom\ r}$	**Nm**	1	**23**	**45**	**113**	**192**	**508**
	in lb		200	400	1,000	1,700	4,500
	Nm	2-30	**34**	**90**	**136**	**260**	**565**
	in lb		300	800	1,200	2,300	5,000
Max. Acceleration Output Torque, $T_{acc\ r}$	**Nm**	1	**28**	**56**	**141**	**240**	**636**
	in lb		250	500	1,250	2,125	5,625
	Nm	2-30	**42**	**113**	**169**	**324**	**636**
	in lb		375	1,000	1,500	2,875	5,625
Emergency(1) Stop Output Torque, $T_{em\ r}$	**Nm**	1	**45**	**90**	**226**	**384**	**1,017**
	in lb		400	800	2,000	3,400	9,000
	Nm	2-30	**68**	**181**	**271**	**520**	**1,130**
	in lb		600	1,600	2,400	4,600	10,000
Nominal Input Speed, $N_{nom\ r}$	RPM	1,2,3	3,000	2,600	2,200	1,800	1,400
	RPM	9,15,21,30	3,800	3,400	3,000	2,400	1,800
Max. Input Speed, N_{maxr}	RPM	1,2,3	4,000	3,500	2,900	2,500	1,600
	RPM	9,15,21,30	5,300	4,500	3,800	3,000	2,300
Standard Backlash	arc min	1,2,3	10	9	9	8	8
	arc min	9,15,21,30	12	11	11	10	10
Low Backlash	arc min	1,2,3	6	5	5	4	4
	arc min	9,15,21,30	8	7	7	6	6
Efficiency at Nominal Torque	%	1,2,3	95	95	95	95	95
	%	9,15,21,30	92	92	92	92	92
Noise Level(2) at:							
2,500 RPM	dB	All	70	70	70	—	—
1,500 RPM	dB		—	—	—	72	72
Torsional Stiffness	**Nm/arc min**	All	**3**	**6**	**16**	**43**	**90**
	in lb/arc min		28	56	140	380	800
Maximum Weight	**kg**	All	**7**	**13**	**25**	**54**	**114**
	lb		16	28	56	120	250
Maximum Allowable Case Temperature	°C	All	◄ 100 ►				

Specifications:	Units	Ratio	Frame Size (RT, RD, RB) R_90	R_115	R_142	R_180	R_220
Moment of Inertia(3)	**gm cm sec²**	1	**3.28**	**11.0**	**38.7**	**101**	**444**
	oz in sec²		0.046	0.153	0.538	1.41	6.17
	gm cm sec²	2	**4.17**	**11.3**	**32.8**	**95.4**	**274**
	oz in sec²		0.058	0.157	0.455	1.32	3.81
	gm cm sec²	3	**2.68**	**7.75**	**22.3**	**65.6**	**191**
	oz in sec²		0.037	0.108	0.311	0.911	2.65
	gm cm sec²	9	**1.07**	**3.28**	**10.4**	**35.8**	**119**
	oz in sec²		0.015	0.046	0.145	0.497	1.66
	gm cm sec²	15 - 30	**0.566**	**2.09**	**5.36**	**17.9**	**62.6**
	oz in sec²		0.008	0.029	0.075	0.248	0.869

(1) Maximum of 1,000 stops
(2) Measured at 1 meter
(3) All Moment of Inertia values are as reflected at the input shaft of the gearhead.

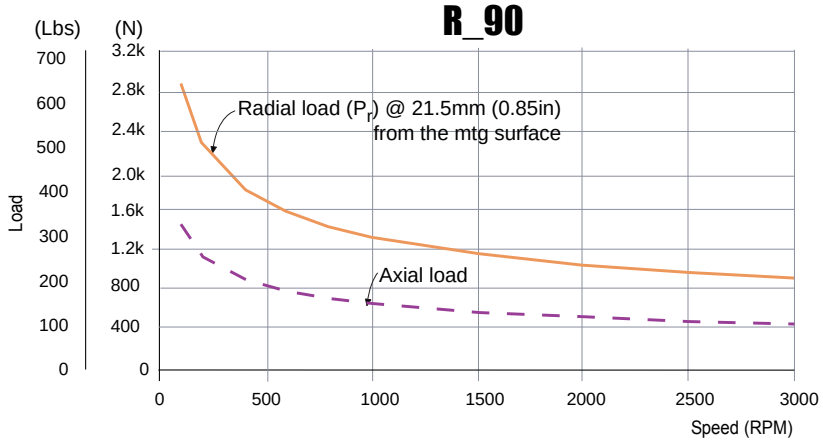
Specification are subject to change without notice

Stealth® MultiDrive Series:
Output Shaft Load Rating



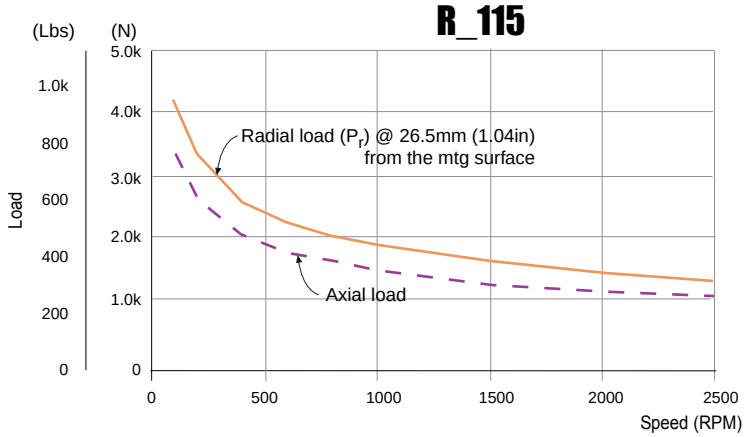
Formulas to calculate Radial Load (P_{rx}) at any distance "X" from the gearhead mounting surface.

R_90



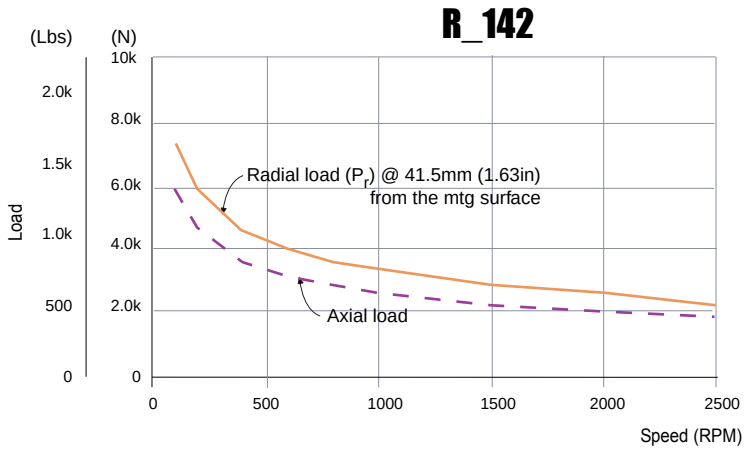
$P_{rx} = (P_r)(\mathbf{121mm}) / (\mathbf{100mm} + X)$
$P_{rx} = (P_r)(4.76in) / (3.94in + X)$

R_115



$P_{rx} = (P_r)(\mathbf{151mm}) / (\mathbf{125mm} + X)$
$P_{rx} = (P_r)(5.94in) / (4.92in + X)$

R_142

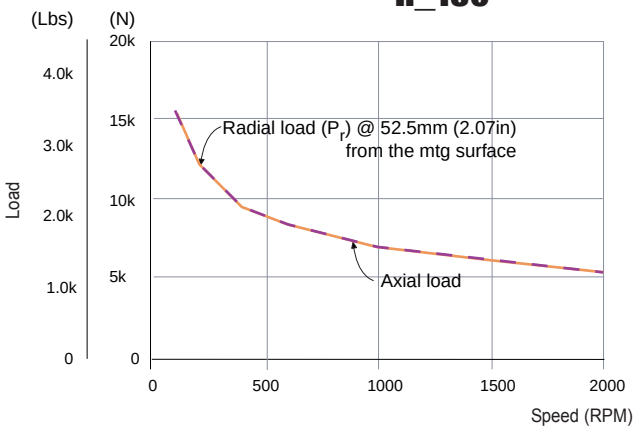


$P_{rx} = (P_r)(\mathbf{201mm}) / (\mathbf{160mm} + X)$
$P_{rx} = (P_r)(7.91in) / (6.30in + X)$

Stealth® MultiDrive Series:
Output Shaft Load Rating

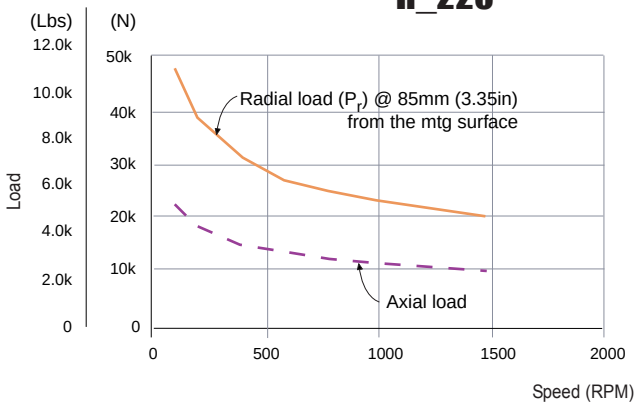
Formulas to calculate Radial Load (P_{rx}) at any distance "X" from the gearhead mounting surface.

R_180



$P_{rx} = (P_r)(\mathbf{260mm}) / (\mathbf{208mm} + X)$
$P_{rx} = (P_r)(10.24in) / (8.19in + X)$

R_220

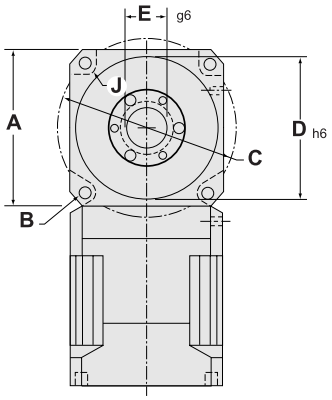


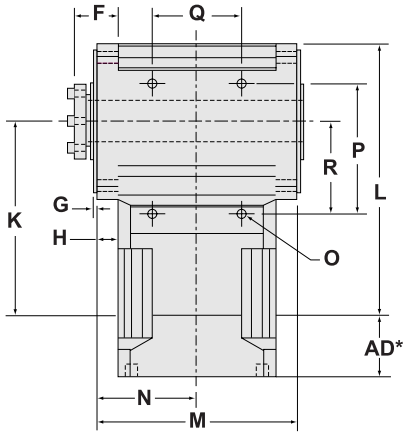
$P_{rx} = (P_r)(\mathbf{352mm}) / (\mathbf{267mm} + X)$
$P_{rx} = (P)(13.86in) / (10.5in + X)$

Stealth® MultiDrive Series:
RT Hollow Shaft

Dimensions

OUTPUT VIEW





SIDE VIEW

Frame Size	A Square Flange (mm)	(in)	B Bolt Hole (mm)	(in)	C Bolt Circle (mm)	(in)	D Pilot Diameter (mm)	(in)	E Thru Bore Diameter** (mm)	(in)	F Taper Bushing Extension (mm)	(in)	G Pilot Thickness (mm)	(in)	H Flange Thickness (mm)	(in)
RT90	**90**	3.543	**6.5**	0.256	**100**	3.937	**80**	3.150	**22**	0.866	**26.5**	1.043	**3**	0.118	**12**	0.472
RT115	**115**	4.528	**8.5**	0.335	**130**	5.118	**110**	4.331	**30**	1.181	**31**	1.220	**3.5**	0.138	**14**	0.551
RT142	**142**	5.591	**11**	0.433	**165**	6.496	**130**	5.118	**38**	1.496	**43**	1.693	**3.5**	0.138	**20**	0.787
RT180	**182**	7.165	**13**	0.512	**215**	8.465	**160**	6.299	**48**	1.890	**54.2**	2.134	**10**	0.394	**25**	0.984
RT220	**220**	8.661	**17**	0.669	**250**	9.843	**180**	7.087	**60**	2.362	**74.1**	2.917	**15**	0.591	**35**	1.378

Frame Size	J Housing Recess (mm)	(in)	K Dist. to Output Centerline (For ratio = 3:1) (mm)	(in)	K2 Dist. to Output Centerline (For ratio > 3:1) (mm)	(in)	L1 Housing Length (For ratio = 3:1) (mm)	(in)	L2 Housing Length (For ratio > 3:1) (mm)	(in)	M Housing Width (mm)	(in)	N Dist. to Input Centerline (mm)	(in)
RT90	**6.6**	0.260	**95**	3.740	**117**	4.606	**140**	5.512	**162**	6.378	**114**	4.488	**57**	2.244
RT115	**7.9**	0.311	**116**	4.567	**144.2**	5.677	**173.5**	6.831	**201.7**	7.941	**143**	5.630	**71.5**	2.815
RT142	**10.5**	0.413	**134**	5.276	**179**	7.047	**205**	8.071	**250**	9.843	**182**	7.165	**91**	3.583
RT180	**10**	0.394	**169**	6.654	**209.1**	8.228	**260**	10.236	**300.1**	11.815	**232**	9.134	**116**	4.567
RT220	**16**	0.630	**206**	8.110	**266**	10.472	**316**	12.441	**376**	14.803	**290**	11.417	**145**	5.709

Both output flanges have identical dimensions.
*AD=Adapter Length. Adapter will vary, depending on motor. Consult Internet (www.baysidemotion.com) for details or call Bayside.
**Maximum bushing bore diameter. Actual through bore of output shaft is larger. For additional bore diameter, contact Bayside's Application Engineers for information.

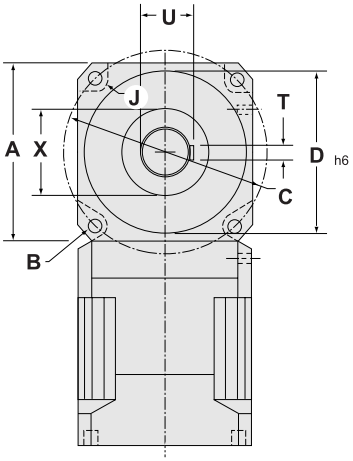
Foot Mounting Holes Location (RT, RD, RB)

Frame Size	O Thread Size x Depth	P (mm)	(in)	Q (mm)	(in)	R (mm)	(in)
R__90	M4x6	**80**	3.150	**60**	2.362	**60**	2.362
R__115	M6x9	**100**	3.937	**70**	2.756	**75**	2.953
R__142	M8x12	**120**	4.724	**80**	3.150	**85**	3.346
R__180	M10x15	**160**	6.299	**100**	3.937	**110**	4.331
R__220	M12x20	**195**	7.677	**130**	5.118	**136**	5.354

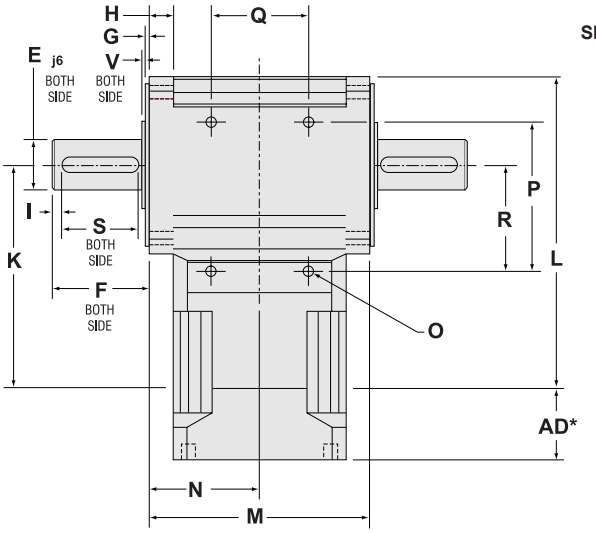
Stealth® MultiDrive Series:
RD Dual Shaft

Dimensions

OUTPUT VIEW



SIDE VIEW



Frame Size	A Square Flange (mm)	(in)	B Bolt Hole (mm)	(in)	C Bolt Circle (mm)	(in)	D Pilot Diameter (mm)	(in)	E Output Shaft Diameter (mm)	(in)	F Output Shaft Length (mm)	(in)	G Pilot Thickness (mm)	(in)	H Flange Thickness (mm)	(in)	I Dist. From Shaft End (mm)	(in)	J Housing Recess (mm)	(in)
RD90	**90**	3.543	**6.5**	0.256	**100**	3.937	**80**	3.150	**20**	0.787	**40**	1.575	**3**	0.118	**12**	0.472	**5**	0.197	**6.6**	0.260
RD115	**115**	4.528	**8.5**	0.335	**130**	5.118	**110**	4.331	**24**	0.945	**50**	1.969	**3.5**	0.138	**14**	0.551	**7**	0.276	**7.9**	0.311
RD142	**142**	5.591	**11**	0.433	**165**	6.496	**130**	5.118	**40**	1.575	**80**	3.150	**3.5**	0.138	**20**	0.787	**8**	0.315	**10.5**	0.413
RD180	**182**	7.165	**13**	0.512	**215**	8.465	**160**	6.299	**50**	1.969	**95**	3.740	**10**	0.394	**25**	0.984	**6**	0.236	**10**	0.394
RD220	**220**	8.661	**17**	0.669	**250**	9.843	**180**	7.087	**75**	2.953	**155**	6.102	**15**	0.591	**35**	1.378	**8**	0.315	**16**	0.630

Frame Size	K1 Dist. to Output Centerline (For ratio <= 3:1) (mm)	(in)	K2 Dist. to Output Centerline (For ratio > 3:1) (mm)	(in)	L1 Housing Length (For ratio <= 3:1) (mm)	(in)	L2 Housing Length (For ratio > 3:1) (mm)	(in)	M Housing Width (mm)	(in)	N Dist. to Input Centerline (mm)	(in)	S Keyway Length (mm)	(in)	T Keyway Thickness (mm)	(in)	U Keyway Height (mm)	(in)	V Shoulder Height (mm)	(in)	X Shoulder Diameter (mm)	(in)
RD90	**95**	3.740	**117**	4.606	**140**	5.512	**162**	6.378	**114**	4.488	**57**	2.244	**28**	1.102	**6**	0.236	**22.5**	0.886	**2.5**	0.098	45	1.575
RD115	**116**	4.567	**144.2**	5.677	**173.5**	6.831	**201.7**	7.941	**143**	5.630	**71.5**	2.815	**32**	1.260	**8**	0.315	**27**	1.063	**2.5**	0.098	**50**	1.969
RD142	**134**	5.276	**179**	7.047	**205**	8.071	**250**	9.843	**182**	7.165	**91**	3.583	**63**	2.480	**12**	0.472	**43**	1.693	**2.5**	0.098	**50**	1.969
RD180	**169**	6.654	**209.1**	8.232	**260**	10.236	**300.1**	11.815	**232**	9.134	**116**	4.567	**70**	2.756	**14**	0.551	**53.5**	2.106	**2.5**	0.098	**55**	2.165
RD220	**206**	8.110	**266**	10.472	**316**	12.441	**376**	14.803	**290**	11.417	**145**	5.709	**100**	3.937	**20**	0.787	**79.5**	3.130	**2.5**	0.098	**100**	3.937

Both output flanges have identical dimensions. Contact Bayside's Application Engineers for information.
*AD=Adapter Length. Adapter will vary, depending on motor. Consult Internet (www.baysidemotion.com) for details or call Bayside.

Encoder Mounting Option	Dimensions For All Frame Sizes (mm)	(in)
Shaft Diameter	**9.525**	0.375
Shaft Length	**19.050**	0.750
Bolt Circle	**74.981**	2.952
Tapped Holes	**M4x6** (Min. Depth)	
Encoder (Not Supplied)	**DRC C25, BEI E25, RENCO C2520**	

An additional flange is required on the gearhead for encoder mounting.
It will increase the thickness of one output flange by 10mm.

Foot Mounting Holes Location (RT, RD, RB)

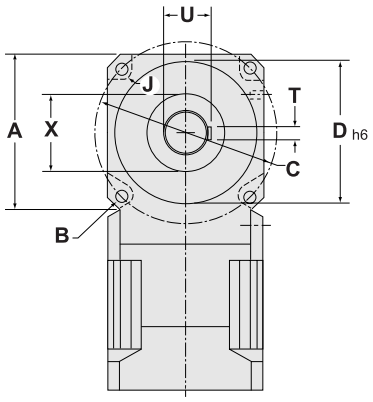
Frame Size	O Thread Size x Depth	P (mm)	(in)	Q (mm)	(in)	R (mm)	(in)
R__90	M4x6	**80**	3.150	**60**	2.362	**60**	2.362
R__115	M6x9	**100**	3.937	**70**	2.756	**75**	2.953
R__142	M8x12	**120**	4.724	**80**	3.150	**85**	3.346
R__180	M10x15	**160**	6.299	**100**	3.937	**110**	4.331
R__220	M12x20	**195**	7.677	**130**	5.118	**136**	5.354

Stealth® MultiDrive Series:

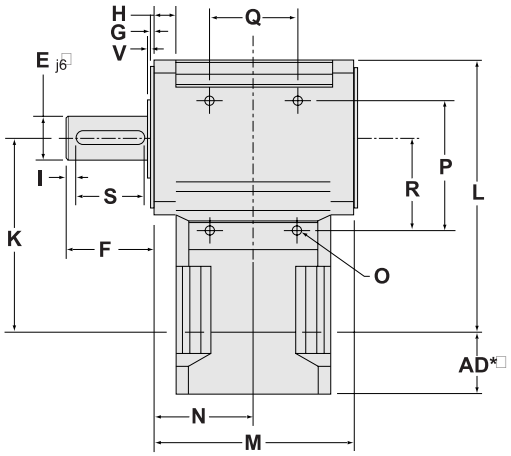
RB Low Ratio

Dimensions

OUTPUT VIEW



SIDE VIEW



Frame Size	A Square Flange (mm)	A (in)	B Bolt Hole (mm)	B (in)	C Bolt Circle (mm)	C (in)	D Pilot Diameter (mm)	D (in)	E Output Shaft Diameter (mm)	E (in)	F Output Shaft Length (mm)	F (in)	G Pilot Thickness (mm)	G (in)	H Flange Thickness (mm)	H (in)	I Dist. From Shaft End (mm)	I (in)	J Housing Recess (mm)	J (in)
RB90	**90**	3.543	**6.5**	0.256	**100**	3.937	**80**	3.150	**20**	0.787	**40**	1.575	**3**	0.118	**12**	0.472	**5**	0.197	**6.6**	0.260
RB115	**115**	4.528	**8.5**	0.335	**130**	5.118	**110**	4.331	**24**	0.945	**50**	1.969	**3.5**	0.138	**14**	0.551	**7**	0.276	**7.9**	0.311
RB142	**142**	5.591	**11**	0.433	**165**	6.496	**130**	5.118	**40**	1.575	**80**	3.150	**3.5**	0.138	**20**	0.787	**8**	0.315	**10.5**	0.413
RB180	**182**	7.165	**13**	0.512	**215**	8.465	**160**	6.299	**50**	1.969	**95**	3.740	**10**	0.394	**25**	0.984	**6**	0.236	**10.0**	0.394
RB220	**220**	8.661	**17**	0.669	**250**	9.843	**180**	7.087	**75**	2.953	**155**	6.102	**15**	0.591	**35**	1.378	**8**	0.315	**16.0**	0.630

Frame Size	K Dist. to Output Centerline (mm)	K (in)	L Housing Length (mm)	L (in)	M Housing Width (mm)	M (in)	N Dist. to Input Centerline (mm)	N (in)	S Keyway Length (mm)	S (in)	T Keyway Thickness (mm)	T (in)	U Keyway Height (mm)	U (in)	V Shoulder Height (mm)	V (in)	X Shoulder Diameter (mm)	X (in)
RB90	**95**	3.740	**140.6**	5.512	**114**	4.488	**57**	2.244	**28**	1.102	**6**	0.236	**22.5**	0.886	**2.5**	0.098	45	1.575
RB115	**116**	4.567	**173.5**	6.831	**143**	5.630	**71.5**	2.815	**32**	1.260	**8**	0.315	**27**	1.063	**2.5**	0.098	**50**	1.969
RB142	**134**	5.276	**205**	8.071	**182**	7.165	**91**	3.583	**63**	2.480	**12**	0.472	**43**	1.693	**2.5**	0.098	**50**	1.969
RB180	**169**	6.654	**260**	10.236	**232**	9.134	**116**	4.567	**70**	2.756	**14**	0.551	**53.5**	2.106	**2.5**	0.098	**55**	2.165
RB220	**206**	8.110	**316**	12.441	**290**	11.417	**145**	5.709	**100**	3.937	**20**	0.787	**79.5**	3.130	**2.5**	0.098	**100**	3.937

Both output flanges have identical dimensions.
*AD=Adapter Length. Adapter will vary, depending on motor. Consult Internet (www.baysidemotion.com) for details or call Bayside.
*Additional hollow shaft bore diameters are available. Contact Bayside's Application Engineers for information.

Specifications are subject to change without notice.

How to Order

Order Numbering Example: R D 1 4 2 E 0 1 0 - X X X L B

1. Pick frame size and ratio.
2. Pick options.
3. Specify motor make and model for mounting kit.

MODEL
RB= Low Ratio
RD= Dual-Shaft
RT= Hollow Shaft

FRAME SIZE
090
115
142
180
220

OPTIONAL ENCODER MOUNT
RD Only

RATIOS

RB	RD	RT
001	001	-
002	002	-
003	003	003
-	009	009
-	015	015
-	021	021
-	030	030

SPECIAL
(Factory Issued)

OPTIONAL LOW BACKLASH

MultiDrive Gearheads are supported by a worldwide network of offices and local distributors. Call **1-800-305-4555** for application engineering assistance or for the name of your local distributor. Information can also be obtained at **www.baysidemotion.com**.

NE NEMA Series:
Lightweight, Compact and Low Friction

Bayside's NEMA gearheads feature a high efficiency spur gear design, in a light, compact package. Designed to mount directly to the face of NEMA face stepper and servo motors, NEMA gearheads are ideal for applications requiring smooth operation and low starting torque. Ratios from 3:1 to 100:1 are available in NEMA 23, 34 and 42 frame sizes.

3 Frame Sizes
NE23
NE34
NE42

Ratios	
3:1	20:1
5:1	30:1
8:1	50:1
10:1	100:1
15:1	

NE NEMA Series

Performance Specifications

	Units	Ratio	Frame Size NE23	NE34	NE42
Nominal Output Torque, $T_{nom\ r}$	**in-lb**	3	**16**	**64**	**123**
	Nm		2	7	14
	in lb	5	**27**	**107**	**205**
	Nm		3	12	23
	in lb	8-10	**40**	**142**	**250**
	Nm		5	16	28
	in lb	15	**46**	**170**	**300**
	Nm		5	19	34
	in lb	20-100	**50**	**180**	**350**
	Nm		6	20	40
Max. Acceleration Output Torque, $T_{acc\ r}$	**in lb**	3	**24**	**95**	**185**
	Nm		3	11	21
	in lb	5	**40**	**160**	**307**
	Nm		5	18	35
	in lb	8-10	**60**	**210**	**375**
	Nm		7	24	42
	in lb	15	**70**	**255**	**450**
	Nm		8	29	51
	in lb	20-100	**75**	**270**	**525**
	Nm		9	31	59
Nominal Input Speed, $N_{nom\ r}$	RPM	All	4,000	4,000	4,000
Max. Input Speed, N_{maxr}	RPM	All	5,500	5,000	4,500
Standard Backlash (1)	arc min	3, 5, 8, 10	30	25	25
	arc min	15-100	20	20	20
Low Backlash (1)	arc min	3, 5, 8, 10	15	15	15
	arc min	15-100	10	10	10
Efficiency at Nominal Torque	%	All	98%	98%	98%
Moment of Inertia	**oz in sec^2**	All	**0.00007**	**0.0005**	**0.004**
	gm cm sec^2		0.0051	0.0408	0.306
Maximum Weight	**lb**	All	**1.0**	**3.0**	**6.0**
	kg		0.5	1.4	3.0
Radial Load (2)	**lb**	All	**20**	**80**	**200**
	N		90	350	890
Axial Load	**lb**	All	**10**	**30**	**60**
	N		45	135	265

(1) Measured at 2% of rated torque

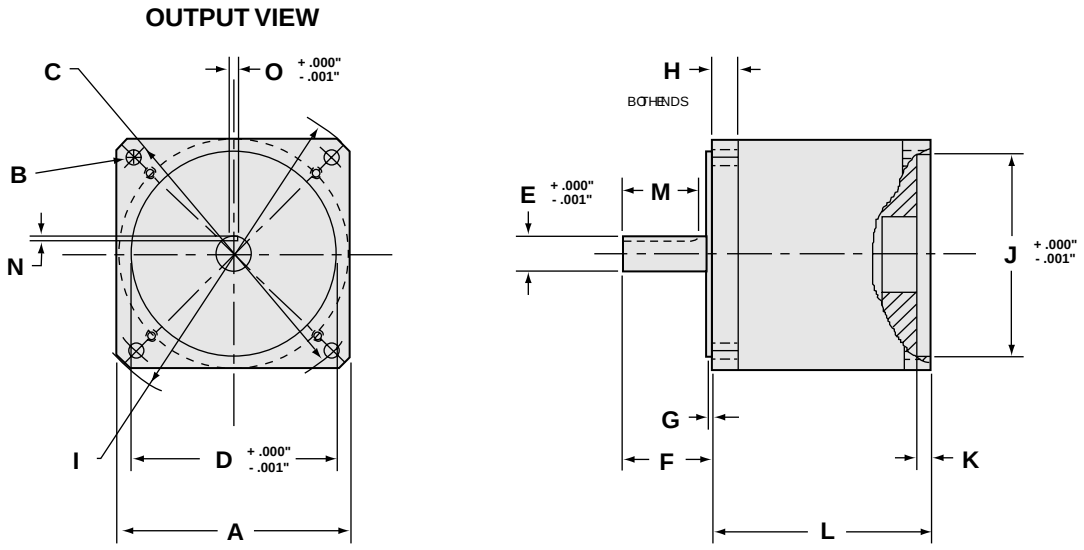
(2) Radial Loads are measured at 12.7mm (0.5in) from the gearhead mounting surface. These ratings are based on gearhead making more than one revolution on output shaft.

Specification are subject to change without notice

NE NEMA Series

Dimensions

OUTPUT VIEW SIDE VIEW



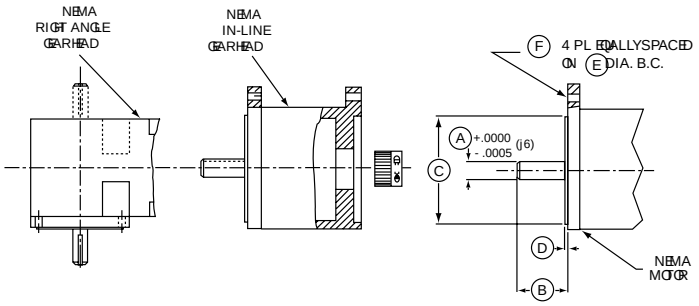
Frame Size	A Square Flange (in)	A (mm)	B Bolt Hole (in)	B (mm)	C Bolt Circle (in)	C (mm)	D Pilot Diameter (in)	D (mm)	E Output Shaft Diameter (in)	E (mm)	F Output Shaft Length (in)	F (mm)	G Pilot Thickness (in)	G (mm)	H Flange Thickness (in)	H (mm)
NE 23	**2.27**	58	**0.195**	5.0	**2.625**	66.7	**1.500**	38.1	**0.375**	9.5	**1.00**	25.4	**0.062**	1.6	**0.19**	5
NE 34	**3.25**	83	**0.218**	5.5	**3.875**	98.4	**2.875**	73.0	**0.500**	12.7	**1.25**	31.8	**0.067**	1.7	**0.38**	10
NE 42	**4.20**	107	**0.281**	7.1	**4.950**	125.7	**2.187**	55.5	**0.625**	15.9	**1.50**	38.1	**0.093**	2.4	**0.50**	13

Frame Size	I Housing Diameter (in)	I (mm)	J Input Pilot Diameter (in)	J (mm)	K Input Pilot Depth (in)	K (mm)	L Housing Length (in)	L (mm)	M Keyway Length (in)	M (mm)	N Keyway Depth (in)	N (mm)	O Keyway Width (in)	O (mm)
NE 23	**3.00**	76	**1.501**	38.13	**0.125**	3.2	**2.30**	58	**0.75 flat**	19 flat	**0.015 flat**	0.4 flat	—	—
NE 34	**4.38**	111	**2.876**	73.05	**0.200**	5.1	**3.00**	76	**1.06**	27	**0.072**	1.8	**0.124**	3.15
NE 42	**5.63**	143	**2.188**	55.58	**0.187**	4.7	**3.75**	95	**1.13**	29	**0.108**	2.7	**0.187**	4.75

NE NEMA Series:
How to Order

MOUNTING TO NEMA FRAMED MOTORS: DIRECT MOUNT

Gearheads attach directly to motors with NEMA mounting dimensions (see table). Bayside's Clamp-on-Pinion and mounting hardware is included with gearheads, so your motor can be up and running in a matter of minutes.



NEMA DIMENSIONS

	Dimension	Motor Mounting Dimensions					
		NE23		NE34		NE42	
		in	(mm)	in	(mm)	in	(mm)
A	Motor Shaft Diameter	0.250	(6.4)	.375/.500	(9.5/12.7)	0.625	(15.9)
B	Motor Shaft Length	0.810	(20.6)	1.250	(31.8)	1.380	(35.1)
C	Pilot Diameter	1.500	(38.1)	2.875	(73.0)	2.186	(55.5)
D	Pilot Length	0.063	(1.6)	0.063	(1.6)	0.093	(2.4)
E	Mounting Bolt Circle	2.625	(66.7)	3.875	(98.4)	4.950	(125.7)
F	Bolt Hole Size	0.195	(5.0)	0.218	(5.5)	0.281	(7.1)

All dimensions are in inches (millimeters).

MOUNTING TO NON-NEMA FRAMED MOTORS: ADAPTER MOUNT

For motors with non-NEMA dimensions, Bayside supplies a mounting kit including a Clamp-On-Pinion, adapter plate and all necessary hardware. When ordering, simply provide the part number or outline drawing of your motor, and the gearhead will be shipped ready-to-mount.

How to Order

Order Numbering Example: N E 3 4 - 0 1 0 - X X X L B

FRAME SIZE
23
34
42

RATIO
003 020
005 030
008 050
010 100
015
(all ratios are exact)

SPECIAL
(Factory Issued)

OPTIONAL
LOW BACKLASH

1. Pick frame size and ratio.
2. Pick options.
3. Specify motor make and model for mounting kit.

NEMA Gearheads are supported by a worldwide network of offices and local distributors. Call **1-800-305-4555** for application engineering assistance or for the name of your local distributor. Information can also be obtained at **www.baysidemotion.com**.

Specifications are subject to change without notice.

NR NEMA Series

Lightweight, Compact Right Angle

The Right Angle version of Bayside's NEMA gearheads provides smooth operation, low starting torque and high efficiency in a lightweight, compact package. And with a dual output shaft option, they're flexible enough to work well in a variety of stepper or servo motor applications. Ratios from 1:1 to 100:1 are available in NEMA 23, 34 and 42 frame sizes.

3 Frame Sizes
NR23
NR34
NR42

Ratios	
1:1	15:1
3:1	20:1
5:1	30:1
8:1	50:1
10:1	100:1

NR NEMA Series

Performance Specifications

	Units	Ratio	Frame Size NR23	NR34	NR42
Nominal Output Torque, $T_{nom\ r}$	**in lb**	1-3	**16**	**64**	**123**
	Nm		2	7	14
	in lb	5	**27**	**107**	**205**
	Nm		3	12	23
	in lb	8-10	**40**	**142**	**250**
	Nm		5	16	28
	in lb	15	**46**	**170**	**300**
	Nm		5	19	34
	in lb	20-100	**50**	**180**	**350**
	Nm		6	20	40
Max. Acceleration Output Torque, $T_{acc\ r}$	**in lb**	1-3	**24**	**95**	**185**
	Nm		3	11	21
	in lb	5	**40**	**160**	**307**
	Nm		5	18	35
	in lb	8-10	**60**	**210**	**375**
	Nm		7	24	42
	in lb	15	**70**	**255**	**450**
	Nm		8	29	51
	in lb	20-100	**75**	**270**	**525**
	Nm		9	31	59
Nominal Input Speed, $N_{nom\ r}$	RPM	All	4,000	4,000	4,000
Max. Input Speed, N_{maxr}	RPM	All	5,500	5,000	4,500
Standard Backlash (1)	arc min	1, 3, 5, 8, 10	30	25	25
	arc min	15-100	20	20	20
Low Backlash (1)	arc min	1, 3, 5, 8, 10	15	15	15
	arc min	15-100	10	10	10
Efficiency at Nominal Torque	%	All	95%	95%	95%
Moment of Inertia	**oz in sec^2**	All	**0.0001**	**0.0009**	**0.007**
	gm cm sec^2		0.0072	0.065	0.503
Maximum Weight	**lb**	All	**1.0**	**3.0**	**6.0**
	kg		0.5	1.4	3.0
Radial Load (2)	**lb**	All	**150**	**250**	**500**
	N		670	1,100	2,200
Axial Load	**lb**	All	**75**	**125**	**250**
	N		335	550	1,100

(1) Measured at 2% of rated torque

(2) Radial Loads are measured at 12.7mm (0.5in) from the gearhead mounting surface. These ratings are based on gearhead making more than one revolution on output shaft.

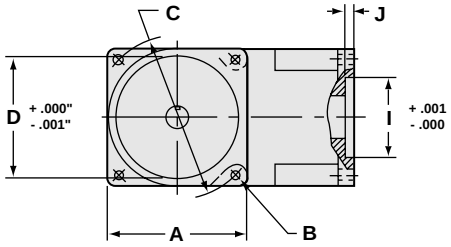
Note: Ratio 1:1 is available with coupling drive only.

Specification are subject to change without notice

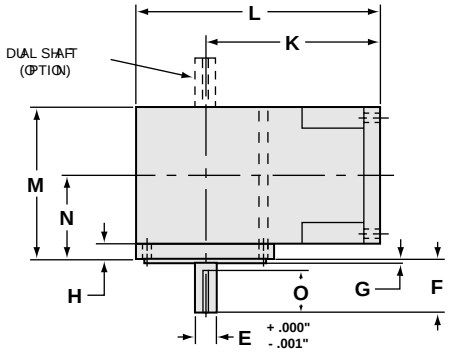
NR NEMA Series

Dimensions

OUTPUT VIEW

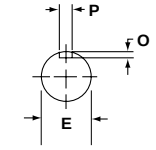


SIDE VIEW



DUAL OUTPUT SHAFT (OPTIONS)

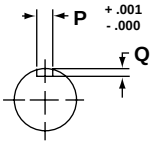
1) DRIVE OPTION "D"



2) ENCODER OPTION "E"
ENCODER MOUNTING DIMENSIONS

	NR23 in	NR23 (mm)	NR34, NR42 in	NR34, NR42 (mm)
SHAFT DIAMETER	.375	(9.5)	.375	(9.5)
SHAFT LENGTH	.750	(19.1)	.750	(19.1)
BOLT CIRCLE	1.812	(46.0)	2.952	(75.0)
TAPPED HOLES	4.40 x .25 Min Depth (2PI)		8.32 x .33 Min. Depth (4PI)	
ENCODER	DRC H5, RENCO M1		DRC C25, BEI E25, RENCO C2520	

SHAFT DETAILS



Frame Size	A Square Flange (in)	A (mm)	B Bolt Hole (in)	B (mm)	C Bolt Circle (in)	C (mm)	D Output Pilot Diameter (in)	D (mm)	E Output Shaft Diameter (in)	E (mm)	F Output Shaft Length (in)	F (mm)	G Output Pilot Thickness (in)	G (mm)	H Flange Thickness (in)	H (mm)	I Input Pilot Diameter (in)	I (mm)
NR 23	**2.27**	58	**0.195**	5.0	**2.625**	66.7	**1.500**	38.1	**0.375**	9.5	**1.00**	25.4	**0.062**	1.6	**0.22**	6	**1.501**	38.13
NR 34	**3.25**	83	**0.218**	5.5	**3.875**	98.4	**2.875**	73.0	**0.500**	12.7	**1.25**	31.8	**0.065**	1.7	**0.38**	10	**2.876**	73.05
NR 42	**4.25**	108	**0.281**	7.1	**4.950**	125.7	**2.187**	55.5	**0.625**	15.9	**1.50**	38.1	**0.093**	2.4	**0.50**	13	**2.188**	55.58

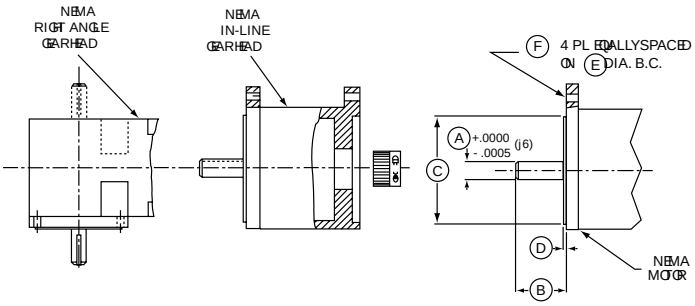
Frame Size	J Input Pilot Depth (in)	J (mm)	K Dist. to Output Centerline (in)	K (mm)	L Housing Length (in)	L (mm)	M Housing Width (in)	M (mm)	N Dist. to Input Centerline (in)	N (mm)	O Keyway Length (in)	O (mm)	P Keyway Width (in)	P (mm)	Q Keyway Depth (in)	Q (mm)
NR 23	**0.080**	2.0	**3.09**	78	**4.22**	107	**2.49**	63	**1.36**	35	**0.75 flat**	19 flat	**—**	**—**	**0.015 flat**	0.4 flat
NR 34	**0.200**	5.1	**4.33**	110	**5.96**	151	**3.63**	92	**2.00**	51	**1.13**	29	**0.124**	3.15	**0.072**	1.8
NR 42	**0.187**	4.7	**5.38**	137	**7.50**	191	**4.75**	121	**2.63**	67	**1.13**	29	**0.187**	4.75	**0.108**	2.7

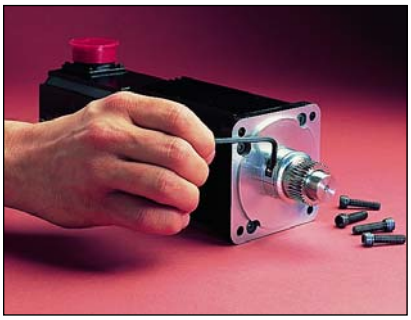
Specifications are subject to change without notice.

NR NEMA Series:
How to Order

MOUNTING TO NEMA FRAMED MOTORS: DIRECT MOUNT

Gearheads attach directly to motors with NEMA mounting dimensions (see table). Bayside's Clamp-on-Pinion and mounting hardware is included with gearheads, so your motor can be up and running in a matter of minutes.





NEMA DIMENSIONS

	Dimension	Motor Mounting Dimensions					
		NR23		NR34		NR42	
		in	(mm)	in	(mm)	in	(mm)
A	Motor Shaft Diameter	0.250	(6.4)	.375/.500	(9.5/12.7)	0.625	(15.9)
B	Motor Shaft Length	0.810	(20.6)	1.250	(31.8)	1.380	(35.1)
C	Pilot Diameter	1.500	(38.1)	2.875	(73.0)	2.186	(55.5)
D	Pilot Length	0.063	(1.6)	0.063	(1.6)	0.093	(2.4)
E	Mounting Bolt Circle	2.625	(66.7)	3.875	(98.4)	4.950	(125.7)
F	Bolt Hole Size	0.195	(5.0)	0.218	(5.5)	0.281	(7.1)

All dimensions are in inches (millimeters).

MOUNTING TO NON-NEMA FRAMED MOTORS: ADAPTER MOUNT

For motors with non-NEMA dimensions, Bayside supplies a mounting kit including a Clamp-On-Pinion, adapter plate and all necessary hardware. When ordering, simply provide the part number or outline drawing of your motor, and the gearhead will be shipped ready-to-mount.

How to Order

Order Numbering Example: N R 3 4 - S 0 1 0 - X X X L B

1. Pick frame size and ratio.
2. Pick options.
3. Specify motor make and model for mounting kit.

FRAME SIZE	SHAFT	RATIO	SPECIAL	OPTIONAL
23	**S** = Single shaft	001 015	(Factory	LOW BACKLASH
34	**D** = Double shaft	003 020	Issued)	
42	**E** = Double shaft with encoder mounting	005 030		
		008 050		
		010 100		
		(all ratios are exact)		

NEMA Gearheads are supported by a worldwide network of offices and local distributors. Call **1-800-305-4555** for application engineering assistance or for the name of your local distributor. Information can also be obtained at **www.baysidemotion.com**.

Specifications are subject to change without notice.

Specials are Standard at Bayside

Bayside has geared our design and manufacturing capabilities to make custom or modified gearheads quickly and inexpensively.

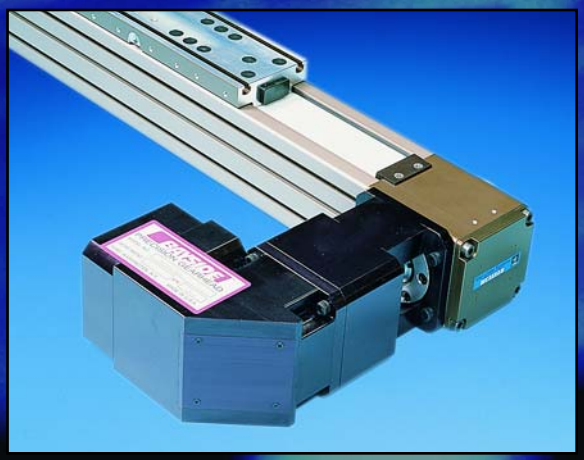
'Standard' specials include many of the products shown on this page. In addition, we have designed hundreds of gearheads for a wide variety of applications including military, aerospace, food processing, paper mills and other specialized applications. Or, if you simply need a smaller shaft or a different gear ratio, we can accommodate modifications quickly and easily.

Linear Slide

Gearheads ready-to-mount to linear slides.

Most belt driven linear slides need a gearhead to reduce inertia. Bayside has pre-engineered in-line and right angle gearheads to mount directly to most popular linear slides, eliminating the need for couplings or adapters. Standard gearheads are available for the following linear slides: (partial list)

- Bishop Wiscarver
- Daedal
- Hauser
- IKO
- Item Products
- INA
- NSK
- Star Linear
- THK
- Tol-o-Matic
- Warner Rapidtrak
- Warner Tollo



Input Shaft / Speed Reducer

Increased design flexibility.

Stealth gearheads are available with an input shaft option. The input shaft option allows more design flexibility, as options like brakes, encoders, or safety couplings can be used between the motor and the gearhead. Also, non-standard or oversized motors can be easily attached to a Stealth gearhead via an input shaft. Standard input shaft options are available for each model and frame size.

Bayside Gearheads mount to motors from the following companies: (partial list)

AEG	DIGIPLAN	KOLLMORGEN	RELIANCE
AEROTECH	EASTERN AIR DEVICES	MAGNETEK	ROCKWELL AUTOMATION
ALLEN BRADLEY	ELAU	MAVILOR	SANYO DENKI
AMERICAN PRECISION	EMERSON	MITSUBISHI	SEIDEL
AMK	FANUC	MOOG	SEM
ANAHEIM AUTOMATION	GETTYS	NIKKI DENSO	SHINKO
APPLIED MOTION PRODUCTS	GIDDINGS & LEWIS	NUM	SIEMENS
BALDOR	HITACHI	NYDEN	SINANO
BAUTZ	INDRAMAT	OMRON	SONY
BAYSIDE	INDUSTRIAL DEVICES	ORIENTAL MOTOR	SUPERIOR ELECTRIC
BODINE	INDUSTRIAL DRIVES	ORMEC	TAMAGAWA
BOSCH	INDUSTRIAL INDEXING	PACIFIC SCIENTIFIC	TOEI
CMC TORQUE SYSTEMS	INFRANOR	PANASONIC	VICKERS
CONTROL TECHNIQUES	INLAND MOTOR	PARVEX	WARNER
COMPUMOTOR	INTELLICO	PITTMAN	YOKOGAWA
CUSTOM SERVO MOTORS	KEB	PMI	YASKAWA

Patented ServoMount® system for easy mounting to ANY servo motor.

Military Spec Gearheads

Mil-spec quality at commercial prices.

Bayside has extensive experience in military and aerospace applications. The Stealth Bomber, M1 Tank and the Space Shuttle all used Bayside gearheads. Bayside's quality system has been approved by NASA and the US Government to MIL-I-45208A. In today's world of tight military budgets, Bayside can give you a mil-spec gearhead at commercial pricing.

Special Environment

Put A Bayside Anywhere!
Bayside can supply gearheads to operate in the harshest environments:

Vacuum - Available as a standard option to 10^{-7} Torr vacuum ratings.

Clean Room - Special gearheads for Class 100 clean room applications.

High Temperature - Special lubricants and seals for temperatures up to 250° Celsius.

Radiation - Gearheads customized to operate within radioactive environments.

Food Grade - Gearheads customized to operate within food handling environments

Bayside Gearhead Selection

Selecting a gearhead for a particular application involves the consideration of a number of interrelated parameters. These are:

- Speed
- Continuous torque
- Repetitive peak torque or acceleration torque
- Emergency stop torque
- Duty cycle
- Ambient temperature
- Radial and axial shaft load

Bayside has prepared the following procedure that will provide a straight forward method for selecting a gearhead that will provide an L-10 life of 10,000 hours.

In this procedure, two rating factors must be used, which derate the gearhead to compensate for thermal and application related torque effects.

- **K_T** - The Torque Thermal Factor

  This factor derates the transmitted torque to prevent case temperature from exceeding 100 degree C.
  The Thermal Factors given in the table are for ambient temperature 25 degree C, medium size indoor space, with the gearheads mounted to a metal base with a surface area more than 3 times larger than the gearhead surface area.

TORQUE THERMAL FACTOR, K_T

		Output Speed, (RPM)									
Frame Size	**Ratio**	**100**	**200**	**400**	**600**	**800**	**1,000**	**1,500**	**2,000**	**2,500**	**3,000**
PS40		1	1	1	1	1	1	—	—	—	—
PS, PX, RS60		1	1	1	1	1	1	—	—	—	—
PS, PX, RS90		1	1	1	1	1	1.2	—	—	—	—
PS, PX, RS115		1	1	1	1	1.2	1.5	—	—	—	—
PS, RS142		1	1	1	1.3	1.7	—	—	—	—	—
PS, RS180	1 stage (1)	1	1	1.5	2.3	—	—	—	—	—	—
	2 stage (2)	1.1	1.5	—	—	—	—	—	—	—	—
PS, RS220	1 stage (1)	1	1.2	2.1	3.2	—	—	—	—	—	—
	2 stage (2)	1.3	2.5	—	—	—	—	—	—	—	—
PS ,RS300	1 stage (1)	1	1.5	3.1	—	—	—	—	—	—	—
	2 stage (2)	1.9	—	—	—	—	—	—	—	—	—
R_90	1	1	1	1	1	1	1	1	1	1.25	1.5
	2-30	1	1	1	1	1	1	1.1	—	—	—
R_115	1	1	1	1	1	1	1	1	1.3	1.7	—
	2-30	1	1	1	1	1	1.3	2	—	—	—
R_142	1	1	1	1	1	1	1.3	2	2.7	3.4	—
	2-30	1	1	1	1	1.3	1.6	—	—	—	—
R_180	1	1	1	1	1	1.3	1.7	2.5	3.4	—	—
	2-30	1	1	1	1.4	1.8	2.3	—	—	—	—
R_220	1	1	1	1.2	1.8	2.4	3.0	4.5	—	—	—
	2-30	1	1	1.3	2.0	2.6	—	—	—	—	—

(1) Data given for PS 3:1 to 10:1 and all RS ratios (2) Data given for PS ratios above 10:1

- **K_S** - The Shock Factor

  This factor is used to derate the transmitted torque for applications where the application is not well defined, has random duty cycles or experiences varying peak torques subjecting the gear teeth to torques above the estimated torques.

  A K_S has been defined for four general application categories, as shown below, and is independent of gearhead size. If your application does not fit into one of these categories, contact Bayside to discuss your requirements.

	Load Type	**Application**	**K_S**
Known Load Data		All Industries	1.00
Unknown Load Data	Light	Textiles, liquid mixers, can filling, food, conveyors, plastics, fans	1.25
	Moderate	Paper mills, rubber industry, sugar industry, metal mills, lumber, robotics	1.50
	Heavy	Cranes, punching machines, rolling mills	1.75

9 Step Procedure

1 Load Parameters

Evaluate the following requirements of the load:

- Load inertia
- Acceleration time (t_{acc})
- Continuous run time (t_{cont})
- Deceleration time (t_{dec})
- Dwell time (t_{dwell})
- Maximum continuous speed (N_{cont})

From these, calculate:

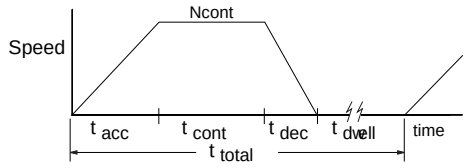
- Acceleration torque (T_{acc})
- Continuous run torque (T_{cont})
- Deceleration torque (T_{dec})
- Dwell torque (T_{dwell})*

*Although not used in the following torque calculations, torque requirements during dwell (zero speed) must be considered when selecting gearhead size.

2 Duty Cycle

Determine if the application is to be considered as **intermittent** or **continuous** by calculating the duty cycle as follows:

$$\text{Duty Cycle} = \frac{(t_{acc} + t_{cont} + t_{dec})}{t_{total}} \times 100$$

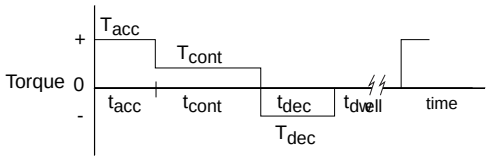


If the duty cycle is< 60%, and $(t_{acc} + t_{cont} + t_{dec})$ is less than 20 minutes, the motion is considered to be **intermittent**.

If the duty cycle is ≥ 60%, or $(t_{acc} + t_{cont} + t_{dec})$ is greater than 20 minutes, the motion is considered to essentially be **continuous**.

3 Calculate the Root Mean Cube Output Torque, T_{mean}.

$$T_{mean} = \sqrt[3]{\frac{\left[\frac{(T_{acc}^3)(N_{cont})(t_{acc})}{2} + (T_{cont}^3)(N_{cont})(t_{cont}) + \frac{(T_{dec}^3)(t_{dec})}{2}\right]}{\left[\frac{(N_{cont})(t_{acc})}{2} + (N_{cont})(t_{cont}) + \frac{(N_{cont})(t_{dec})}{2}\right]}}$$



4 Select a gearhead type; PS, PX, RS, Multi-drive, NE or NR (Match gearhead frame size to motor frame size)

5 Review the catalogue listings and determine the gearhead size (40 thru 300) which can meet the following criteria:

$T_{mean} \leq T_{nomr}$

T_{acc} and $T_{dec} \leq T_{accr}$

6 Determine the maximum rated input speed (N_{maxr}) for the selected gearhead.

7 Using $N_{cont.}$ and N_{maxr} from step 6, determine the maximum allowable ratio as:

$$\text{Max ratio} = \frac{N_{maxr}}{N_{cont.}}$$

8 Select an actual ratio from the catalogue listing and calculate the mean input speed, N_{meani} and the maximum input speed, N_{maxi}, as follows:

$$N_{meani} = \left(\frac{\frac{(N_{cont})(t_{acc})}{2} + (N_{cont})(t_{cont}) + \frac{(N_{cont})(t_{dec})}{2}}{t_{acc} + t_{cont} + t_{dec}} \right) (\text{RATIO})$$

$$N_{maxi} = (N_{cont})(\text{RATIO})$$

Note: Reflected inertia requirement may determine the actual ratio, as long as it does not exceed the maximum value calculated in STEP 7.

9

	CONTINUOUS MOTION	INTERMITTENT MOTION
Select factor	K_T and K_S	K_S
Calculate	$(T_{mean})(K_T)(K_S)$	$(T_{mean})(K_S)$
Determine that	$T_{nomr} > \mathbf{(T_{mean})(K_T)(K_S)}$	$T_{nomr} > \mathbf{(T_{mean})(K_S)}$

- Compare the required accelerate and decelerate torques, T_{acc} / T_{dec}, to the rated accelerate torque, T_{accr} .

T_{accr} must be greater than the larger of T_{acc} or T_{dec}.

- Check the Emergency Stop Torque rating.
- Compare N_{meani} with the nominal rated speed, N_{nomr}.

N_{nomr} must be greater than N_{meani}

- Compare the maximum input speed N_{maxi} with the maximum input speed rating, N_{maxr}.

N_{maxr} must be greater than N_{maxi}

- Verify radial and axial shaft load.
- If any of these comparisons are not met, then:
  - Choose a larger gearhead
  - Reevaluate the ratio
  - Reevaluate the torque
  - Reevaluate the speed
  - Reevaluate the duty cycle
  - Reevaluate shaft load

SELECTION PROCESS IS COMPLETE !

Servo Market and Stealth Objective

Design engineers are continually looking to increase throughput and production requirements. They require their suppliers to anticipate this demand by constantly improving product performance. In the case of servo manufacturers, the need was for motors that could perform more complicated moves, produce higher torques and speeds. With the development of new micro electronic and magnet technology, servo manufacturers were increasing the capabilities of their motors. The market demanded a gearhead that would be able to match these requirements. The Stealth Helical Planetary Gearhead was designed for the needs of today's demanding servo applications. The idea behind Bayside's Stealth gearhead design is to accept high input speeds, deliver constant high output torque, exhibit high torsional stiffness and run quiet.

Gear Design Features

The Stealth is an all-helical planetary gearhead. Helical gearing has several attributes making it advantageous in planetary design, such as higher tooth contact ratio and greater face widths. As a result of this, helical gears are superior to straight spur gears in both load carrying capability and quietness during operation. Together with our advanced heat treating technology, superior gearhead design, and innovative mounting design, the Stealth is the most advanced gearhead on the market.

Our design engineers employed gear design software to optimize tooth geometry. The advanced design features that were developed through the use of this software were:

- Optimized recess approach action
- Lower sliding ratio
- Improved tooth contact pattern

Through software modification, these design improvements were incorporated into the Stealth. The advantages gained were:

- Higher tooth strength
- Increased efficiency
- Reduced noise
- Reduced heat

Helical vs. Straight Spur

In the case of spur gears, the line of contact is parallel to the axis. Helical teeth, which are skewed at an oblique angle to the axis, enter the meshing zone progressively, and therefore have a more gradual engagement than spur gear teeth. The contact line of the meshing teeth progresses diagonally across the face from the tip at one end to the root of the other, reducing vibration and noise. In addition, because the tooth engagement and load distribution is gradual, allowable speeds are greater for helical teeth than for spur gear teeth. This gradual loading of each tooth also reduces wear.

Moreover, the skewed oblique angle creates an extended length of the contact line, which results in a higher tooth contact ratio (between 2 and 3) and the load being distributed over a greater area. This allows helical gears to have superior load carrying capability compared to spur gears. Illustration (a) in Figure 1 shows a helical gear tooth contact line pattern compared to a straight spur tooth (illustration (b)).

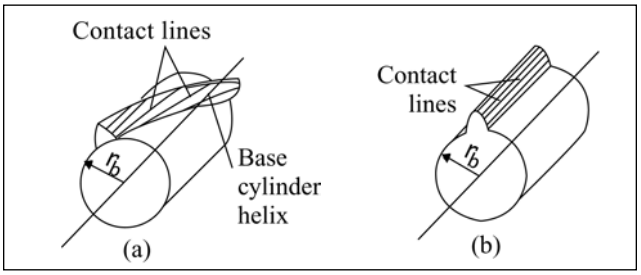


Figure 1 - Helical gear tooth contact pattern versus straight spur tooth.

Integral Ring Gear

All Stealth gearheads feature an integral ring gear, which is cut directly into the main housing (Figure 2). This allows for larger gears and bearings in a similarly sized planetary gearhead where there is a separate ring gear and housing. Because of the larger sized ring gear, the center distance between the carrier and the planet gears in increased, reducing the tangential load seen by each tooth, greatly increasing the torque carrying capacity. In addition, a Stealth planet gear would be approximately 15% to 20% larger in diameter than a standard planetary gearhead. This translates to greater tooth thickness, and consequently higher torques.

Helicrown®

To meet the performance of today's servo motors, the helical gear tooth needed to be enhanced. Bayside's engineers developed *Helicrown*®. *Helicrown*® combines the power of helical gears with the smooth, quiet engagement of tooth crowning and tip relief in an original way. Our engineers determined the optimum location to modify the entry and exit points of the gear tooth. This reduces gear noise without sacrificing strength. The maximum amount of contact still occurs across the face of the gear tooth but the tooth impact is lessened during tooth engagement. *Helicrown*® provides a balance between torque, speed and noise in the gearhead. This gear tooth is 30 - 40% stronger than conventionally modified gears, coupled with quieter operation. The noise level for the overall gearhead does not exceed 68 dB.

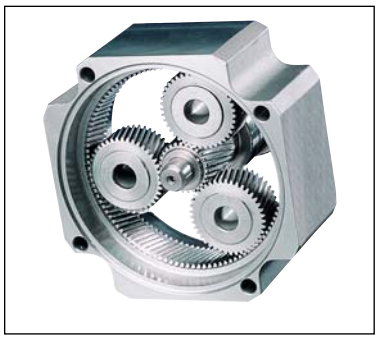


Figure 2 - Ring gear is cut directly into the main housing of a Stealth Planetary gearhead.

Figure 3 - A unique characteristic of Bayside manufacturing capabilities is our in-house plasma nitriding equipment.

Plasma Nitriding

Plasma, or ion, nitriding is a method of surface hardening using an electrical discharge to introduce elemental nitrogen to the gear surface. In a vacuum, high voltage electrical energy is used to form a plasma, or process gas (a mixture of nitrogen and hydrogen). In the presence of this process gas, the load is maintained at a high DC potential with respect to the ion-nitriding vessel. Under the influence of this voltage, the nitrogen gas is dissociated and accelerated to impinge the workpiece, which acts as a cathode. Within a short distance of the workpiece, the positively charged nitrogen ion then acquires an electron from the cathode and emits a photon. The photon emission during the return of the nitrogen ions to their atomic state results in a visible glow (Figure 4). As the nitrogen concentration increases towards the surface, very fine precipitates are formed when the solubility limit of nitrogen is exceeded. These precipitates distort the lattice structure and thereby increase the hardness of the material. The nitriding current, temperature and process time determine the depth of the nitride case. By this process, the gear material's chemical composition can be precisely controlled. The advantages provided by this process are:

- Harder gear case hardness
- Improved control of case thickness and uniformity
- Lower part distortion
- Increased tensile strength of the surface of the gear.

A gear's life rate is directly related to the case hardness. The harder the gear surface, the longer the gear will survive before wearing. Typical gear manufacturers rate their gears for a hardness of approximately 55 Rc. Our plasma nitrided gears have a surface hardness greater than 62 Rc for excellent wear resistance, and consequently longer life.

In addition to hardness and wear resistance, the fatigue strength of the gear tooth is significantly increased. The formation of the precipitates on the case results in lattice expansion. The core, in order to maintain its original dimensions, keeps the nitrided case in compression. This compressive stress lowers the applied tensile stress on the material, increasing the fatigue strength.

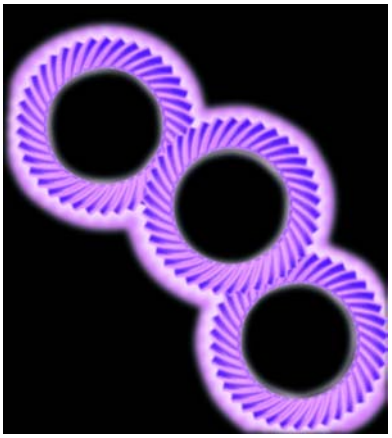


Figure 4 - Distinctive purple glow as a result of photon emission.

Another feature of the plasma nitriding process is the gears inherent lubricity. During the latter phase of the heat treating cycle, the excess nitrides are diffused into the metal, leaving the "white layer". This layer is approximately 0.05 mm thick. The white layer composition formed on the gear provides natural lubricity. Also, the white layer is relatively inert, which provides for corrosion resistance in a variety of environments.

Plasma Nitriding versus Carburizing

Carburizing is the most widely used method of heat treating gears. The gear is placed in the furnace and heated above the critical, or transformation, range temperature. At this point free carbon is introduced into the furnace and is allowed to soak into the case of the gear material. Typically, a low carbon steel of 0.1% - 0.2% carbon is allowed to reach 0.8% - 0.9% range during the carburizing process, providing a soft core of 24 Rc. After achieving the desired case depth, the gear is quenched in a water or oil medium (The carbon content may sometimes go as high as 1.5%, but it is then tempered back to 0.8% - 0.9%). The case depth of the carburized gear is directly proportional to the time it is in the furnace and the temperature at which it is being soaked. The higher the temperature the faster the soaking and deeper the case, but the drawback of that is that quenching from a higher temperature may cause higher distortion. Small parts and fine pitch parts may be difficult to carburize, and a 55 Rc case may be the highest hardness attainable.

During carburizing the gear is red hot. Distortion is caused when the rate of cooling is uneven in the gear as the outside of the gear cools down faster than the inner part. In addition, the carburized case tends to be larger than before as additional carbon atoms are now embedded in the surface. The net result of this distortion is a tendency to end up with a slightly larger pressure angle and the helix angle tends to unwind. Also, the bore shrinks, the outside diameter becomes slightly coned and the part may develop radial and axial runout. For these reasons carburized parts may need post treatment processing such as grinding or hard hobbing with a carbide hob.

Case depth is usually considered the depth to which the hardness is still above 50 rc. It is typically 75% - 90% of the total case. Case depth is a function of the pitch. In general, the coarser the pitch the deeper

the case. Too deep a case will cause the teeth tips to become too brittle and possibly break. This condition is called case-core separation. Too thin a case will reduce teeth strength and cause premature pitting or lead to case crushing.

Unlike carburization, plasma nitrided gears require no rework. The ion nitriding process can be performed at relatively low temperatures, usually between 930 °F to 1,000 °F., way below the transformation temperature. The part is first drawn and tempered to relieve any internal stresses and brittleness, allowing the core to retain it's original hardness value of approximately 36 Rc. The ductile core exhibits very high shear strength, allowing the tooth to handle high shock loads. Due to the low temperature, as well as the gears being gas cooled after nitriding, there is no requirement for post-process machining, such as grinding, after treatment.

ServoMount™

Stealth Planetary gearheads employ Bayside's patented ServoMount™ integrated mounting kit. ServoMount™ features an integrated rear housing adapter and a balanced, pre-installed pinion. The pinion is mounted and supported in it's own "floating" bearing in the rear housing of the gearhead. The unique arrangement of the pinion bearing compensates for any motor shaft run-out or misalignments. ServoMount™ allows for error-free installation of Stealth planetary gearheads to any servo motor. This completely sealed design provides for optimum servo performance and longer life.

Floating the Pinion

Integrating the pinion gear into the gearhead requires a means of support and alignment, independent of the motor. Because the motor shaft is already constrained at two points by the motor bearings, adding another fixed bearing would create a condition of three rigid bearings in a line. Any amount of runout could result in significant stresses on the bearing elements, which could lead to premature bearing failure.

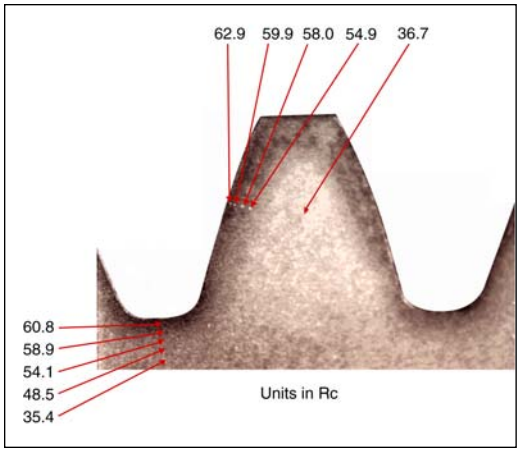


Figure 5 - Cross sectional view of a Stealth gear tooth showing hardness values after Plasma Nitriding.

The solution developed by Bayside's engineers was to "float" the pinion bearing, so that it would compensate for shaft runout or misalignment. An elastomeric O-ring is mounted around a radial ball bearing. The O-ring supports and locates the pinion gear, but does not rigidly fix it. This feature allows for true gear alignment of the pinion, the benefits being:

- Allowable gearhead input speeds of 5,000 RPM
- Dampening of vibrations, extending gearhead life.
- Quieter operation

Clamp-on Pinion

The patented clamp-on pinion design used in the ServoMount™ is a single piece, balanced split collar pinion. The geared pinion is clamped over the motor shaft, allowing for easy, error-free assembly and small package size, resulting in higher system performance:

Low Inertia - The Clamp-on pinion's low mass and small diameter adds minimal inertia to the motor, resulting in less power waste and higher system performance.

High holding force - Split-collar clamps offer holding forces 5 to 25 times greater than the peak torque of most servo motors

Excellent concentricity - During production, the split collar is machined, then the pinion blank is clamped to a precision arbor for gear cutting. The result is excellent concentricity between motor shaft and gear teeth.

Ease of Assembly - Clamping devices with multiple screws require expertise to prevent misalignment. The Clamp-on pinion, with only one screw to tighten, requires no expertise or special tooling. Pre-installed, Clamp-on pinions eliminate the possibility of input misalignment.

Stealth Performance Features

Efficiency

The efficiency of a gearhead is the measurement of lost power transmitted through the gearhead. This is most often stated as a percentage of input power. Losses in power ultimately relate to heat generation, so it is important to maximize the efficiency. While it is common for both helical and spur gears to have high operating efficiencies (95% - 98%), the higher contact ratio of helical gears, along with the smooth rolling action, provides substantial benefit in increasing efficiency over that of spur gears. Given comparable operating conditions, helical gears are more efficient than spur gears.

While it is counter-intuitive for helical gears to have a higher efficiency than spur gears, there is clear operating evidence that supports the theory that a helical tooth geometry can be more efficient. The ultimate performance of a parallel axis gearhead assembly is dependent on factors such as; the accuracy of the gear

teeth, the tooth profile, bearing selection, and lubrication characteristics. The Stealth Helical Planetary Gearhead was designed to optimize these factors.

In parallel axis gears there are several aspects of the gearhead that relate to efficiency losses. According to Dudley, in The Gear Handbook; "The overall efficiency of all gears is dependent on three separate and distinct types of losses. These three types are commonly known as (1) churning losses, (2) bearing losses, and (3) gear-mesh losses." Assuming the lubrication and bearing configurations are common between spur and helical, the primary issue to contend with is the gear-mesh.

Gear-mesh losses relate to the content of sliding versus rolling contact between the gear teeth which are directly related to the tooth profile and gearing technology. In gearheads that operate over a wide range of speeds and loads, it is important to utilize a tooth profile that reduces or eliminates sliding friction. Stealth's Helicrown tooth profile provides a distinct advantage in optimizing efficiency.

The first major benefits come directly from the operating principles of the helical gearing. These are:

1. The higher contact ratio reduces the tooth loading and shares the load over a greater surface area

2. The gradual tooth engagement allows the lubrication to remain
on the teeth and leave a better film, minimizing the friction.

Secondly, the Stealth's *Helicrown*^{R} incorporates a proprietary tooth modification of crowning and tip relief that facilitates a significantly higher percentage of rolling (versus sliding). In addition to the higher efficiency, the Stealth operates with lower noise and temperature, which are also a reflection of the tooth geometry. According to AGMA Gear Consultant, Ray Drago; "When two gear teeth with involute profiles are running together, there is one and only one contact position of those profiles where there is pure rolling action. That position is where the two profiles are in contact at the pitch point. As the contact moves towards or away from the pitch point, one profile slides over that of its mate. The amount of sliding increases in proportion to the distance from the pitch point". The *Helicrown*^{R} profile is specifically designed to address this issue and minimize sliding.

While similar geometry could be generated, the Stealth has additional features which support higher efficiencies. Particularly, Plasma Nitriding as a heat treating method leaves a 'white layer' on the gear teeth that provides inherent lubricity to the gearing. In addition to the many benefits of plasma nitriding within the gearing performance, the white layer lets the teeth run more smoothly, reducing the coefficient of friction of the base materials. This results in less heat build up and higher operating efficiencies

Drago also states "Sliding velocity by itself, gives some important qualitative information about the operation of the gear set. Because it is influenced by the rotational speeds of the gears, which are usually specified by system requirements, and thus not under the designer's direct control, sliding velocity does not provide a ready measure of the level of optimization achieved by a particular configuration." As the actual level of efficiency can vary by application, Bayside takes a very conservative approach to documenting efficiency percentages. This, however, is not indicative of a comparative performance of helical versus spur. Under the same operating conditions, helical gears are more efficient.

Overhung Loading

Radial loading is an important performance specification in the precision gearhead market. In a precision planetary gearhead, the limiting factor is the output carrier bearings. Other manufacturers design their gearheads with both planet carrier bearings mounted in the front part of the housing. While this method increases the ease of assembly of the gearhead, it does not provide for the maximum radial load capacity. Bayside's design incorporates large bearings located on both ends of the planetary carrier. Because the bearings are spaced far apart, it distributes the load seen by each bearing, greatly increasing the radial load rating of the gearhead. Also, each bearing is the maximum size allowable per frame size, providing the ultimate radial load capacity.

Helical Gear Induced Axial Forces

One of the issues raised regarding the use of helical gears in a precision planetary gearhead is the axial forces transmitted. The reason that other manufacturers had not taken advantage of helical gearing is because a suitable solution was never developed. Bayside engineers overcame this problem with a unique pinion design. The floating bearing that supports the input pinion is preloaded with a retaining nut. This nut compresses the deep groove radial ball bearing, eliminating axial clearance. Figure 6 shows the load path created by the retaining nut. This design prevents axial motion from being transmitted to the motor.

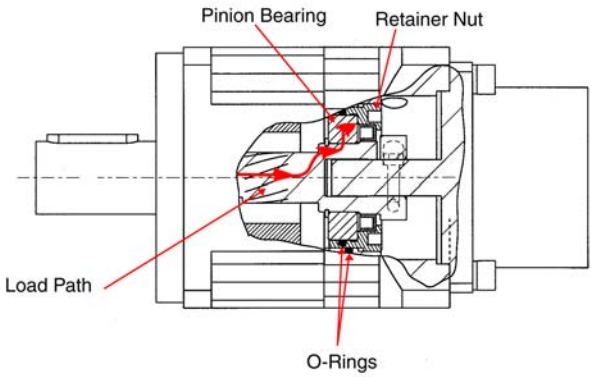


Figure 6 - This retainer nut design prevents axial motion from being transmitted to the motor.

Bayside Motion Group
27 Seaview Boulevard
Port Washington, NY 11050
USA
Tel: (800) 305-4555
Tel: (516) 484-5353
Fax: (516) 484-5496

Bayside Controls Gmbh
Gustav-Winkler Strasse 32
33699 Bielefeld
Germany
Tel: (49) 521-20853-0
Fax: (49) 521-20853-99

Bayside Motion Group UK
3 Melbourne House
Corby Gate Business Park
Priors Haw Road
Corby, Northants NN17-5JG
England
Tel: (44) 1536-267040
Fax: (44) 1536-268866

Bayside Motion Group Pte Ltd
35, Loyang Crescent
Singapore 509012
Tel: (65) 6545-7757
Fax: (65) 6545-9959

Bayside Motion Group Beijing
Room No. 1202, Building B, Huazhan
International Mansions, Road No. 12
Chaoyang District, Beijing City, PRC
Beijing, 100029 China
Phone: (86) 10-8225-4164
Fax: (86) 10-8225-3630

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www.baysidemotion.com