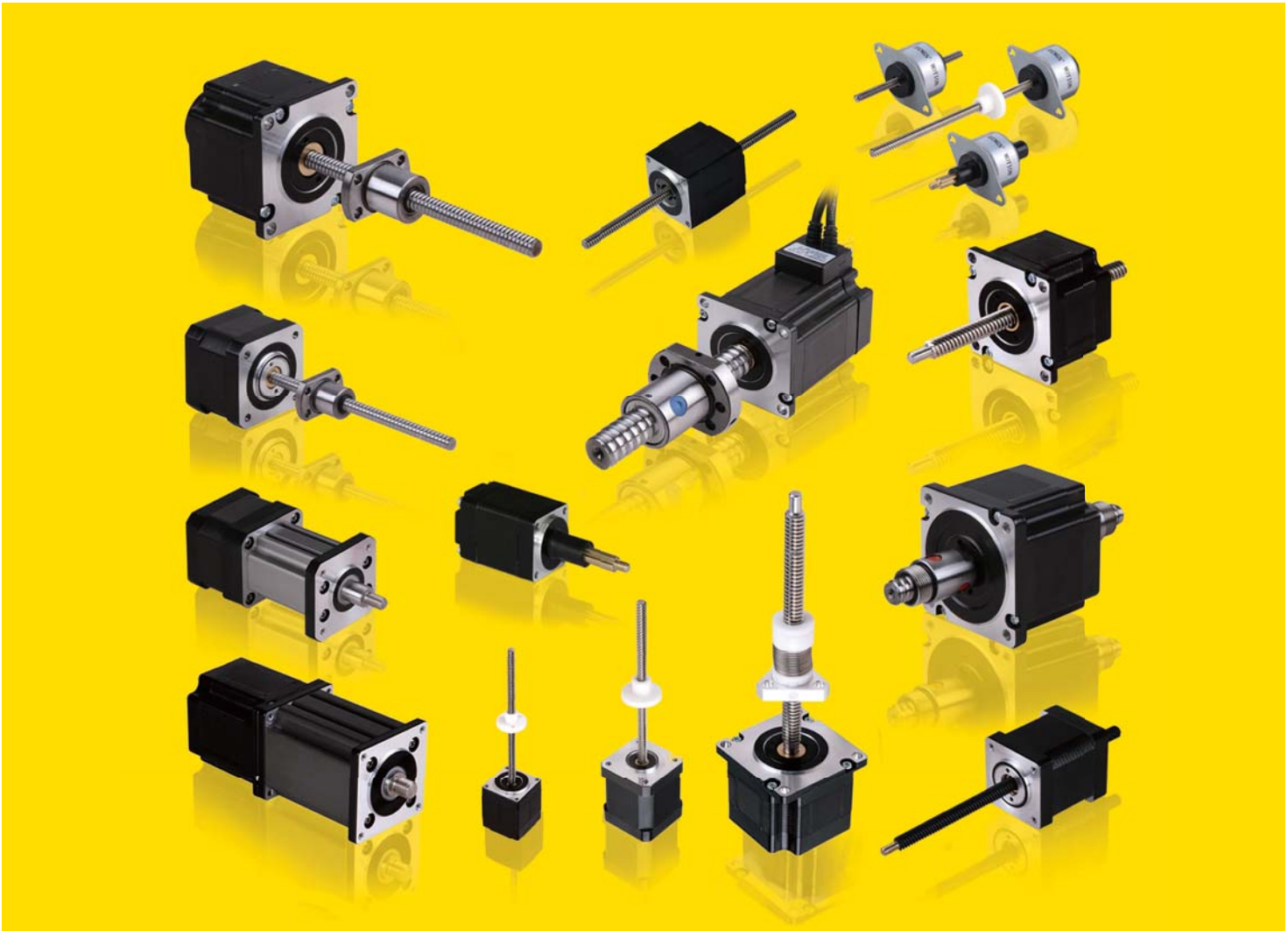
Ezi-LinearStep®

Precision Hybrid Stepper Linear Actuators

- Durable Compact Linear Actuator
- Precision Hybrid Stepper Motor Drive
- High Precision Positioning (0.001mm/Step)
- High Speed Linear Motion (Max. 300mm/s)
- Max. Thrust Force (2000N)



FASTECH
Fast, Accurate, Smooth Motion

DINGS

System Overview

Hybrid Stepper Linear Actuator Overview

NEMA Size	Available Versions	Motor Length & Available Currents(Voltage)	Max. Thrust	Recommended Load Limit *1	Screw Lead Range
1.8 Degree NEMA8 Stepper		Single Stack(27mm): 0.5A(2.5V)	78N (17.5lbs)	43N (9.7lbs)	0.012″- 0.315″ (0.30mm - 8.00mm)
		Double Stack(38mm): 0.5A(4.4V)	84N (18.9lbs)		
1.8 Degree NEMA11 Stepper		Single Stack(34mm): 0.5A(4.5V), 1.0A(2.2V)	230N (51lbs)	150N (34lbs)	0.025″- 0.400″ (0.635mm - 10.16mm)
		Double Stack(45mm): 0.95A(3.9V)	340N (76lbs)		
1.8 Degree NEMA14 Stepper		Single Stack(34mm): 0.5A(6.6V), 1.0A(3.3V), 1.5A(2.2V)	450N (100lbs)	230N (52lbs)	0.024″- 0.500″ (0.6096mm - 12.7mm)
		Double Stack(46mm): 0.5A(12.0V), 1.0A(6.0V), 1.5A(4.0V)	610N (135lbs)		
1.8 Degree NEMA17 Stepper		Single Stack(34mm): 0.5A(7.2V), 1.0A(3.6V), 1.5A(2.4V)	710N (160lbs)	230N (52lbs)	0.024″- 0.500″ (0.6096mm - 12.7mm)
		Double Stack(48mm): 0.5A(11.0V), 1.2A(4.5V), 2.5A(2.2V)	900N (200lbs)		
1.8 Degree NEMA23 Stepper		Single Stack(45mm): 1.0A(6.4V), 2.0A(3.2V), 3.0A(2.1V)	1400N (315lbs)	920N (210lbs)	0.025″- 1.000″ (0.635mm - 25.4mm)
		Double Stack(65mm): 1.0A(10.8V), 2.5A(4.2V), 4.0A(2.4V)	1800N (405lbs)		
1.8 Degree NEMA34 Stepper		Single Stack(76mm): 1.3A(12.0V), 3.0A(5.1V), 5.5A(2.85V)	2400N (540lbs)	2160N (485lbs)	0.100″- 1.000″ (2.54mm - 24.4mm)

*1 : These are nominal load limits. Operating above these limits may decrease useful life of the system.

Technology Overview

One of the most common methods of moving a load from point A to point B is through linear translation of a motor by a mechanical lead screw and nut. This section is here to ass ist and refresh your understanding of the basic principles of lead screw technology prior to selecting the system t hat is best for your application. Please also reference the Glossary(page 85 of the catalog) to support your understanding.

Some basic design considerations are as follows :

1. What is the load of your system?
2. what is the required speed to go from point A to point B?
3. What is the distance you need to travel?
4. What is the required time to move from point A to point B?
5. What accuracy does your application require?
6. What repeatability does your application require?
7. Horizontal vs vertical orientation?

An Explanation of the Basics

1. Leads vs Pitch

Pitch is the axial distance between threads. Pitch is equal to lead in a single start screw. Unless otherwise noted, all lead screws in this catalogue are single start. Lead is the axial distance the nut advances on one revolution of the screw. Throughout this catalog, lead will be the term used for specifying a screw as it is the linear distance travelled for one revolution of the screw. The larger the lead, the more linear distance travelled per one revolution of the screw.

2. Load

Typically quanti fied as either lbs or Kg to move or pounds force(lbsF) or kgf for thrust.

3. Velocity(V)

Typically quanti fied as either inches/second(mm/sec) required for your application.

4. Distance

Typically quanti fied as either inches or mm, is the required move distance.

5. Time(t)

Typically quanti fied in seconds. Time period required for a given distance defines the velocity, acceleration(A), and deceleration needed to reach commanded position.

6. Horizontal or Vertical Application

Vertical orientation applications add the potential problem of backdriving when power to the motor is off and without an installed brake. Vertical applications also have an additional gravity factor that must be part of the load/force calculation.

7. Accuracy of Screw

Specified as a measurement over a given length of the screw.
For example: 0.0006 in per inch. Lead accuracy is the difference between the actual distance travelled versus the theoretical distance travelled based on the lead. For example: A screw with a 0.5 inch lead and 0.004 inch per foot lead accuracy rotated 24 times theoretically moves the nut 12 inches. However, with a lead accuracy of 0.004 inch per foot, actual travel could be from 11.996 to 12.004 inches.

8. Total Indicated Runout

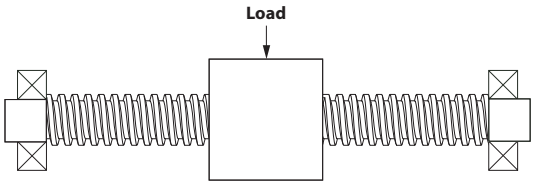
The amount of wobble around the centerline of the screw.

9. Repeatability

Most motion applications put the most significance on the repeatability(vs accuracy of screw) of a system to reach the same commanded position over and over again. For example: A repeatability of ± 0.005 inch means that after repeated commands to reach the same target position, the linear error will be no more than ± 0.005 inch.

10. Radial Load

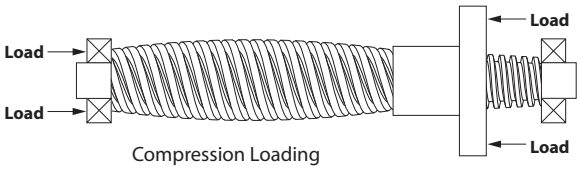
A load perpendicular to the screw. This is not recommended unless additional mechanical support such as a linear guide is used.screw in tension utilizes the axial strength of the screw versus column loading.



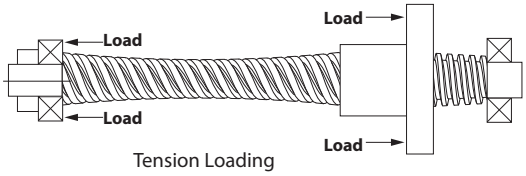
Radial Loading(Avoid Minimize)

11. Tension or Compression Loading

A load that tends to stretch the screw is called a tension load. A load that tends to squeeze or compress the screw is called a compression load. Depending on the size of the load, designing the screw in tension utilizes the axial strength of the screw versus column loading.



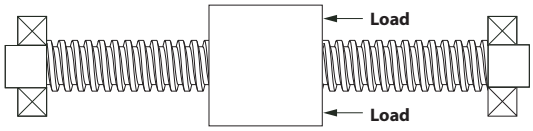
Compression Loading



Tension Loading

12. Axial Load

A load that exerted at the center line of the lead screw.



Axial Center Loading(best)

13. Static Load

The maximum thrust load, including shock load, that should be applied to a non-moving screw.

14. Dynamic Load

The maximum recommended thrust load which should be applied to the screw while in motion.

15. Backdriving

Backdriving is the result of the load pushing axially on the screw or nut to create rotary motion. Generally, a nut with an effi ciency greater than 50% will have a tendency to backdrive. Selecting a lead screw with an efficiency below 35% may prevent backdriving. The smaller lead, the less chance for backdriving or free wheeling. Vertical application are more prone to backdriving due to gravity.

16. Torque

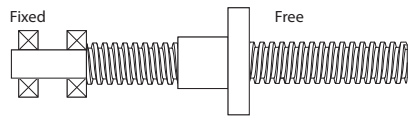
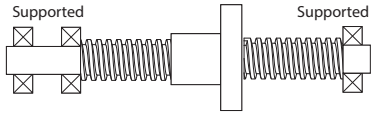
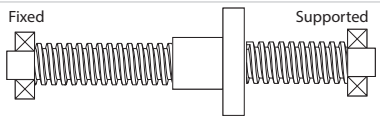
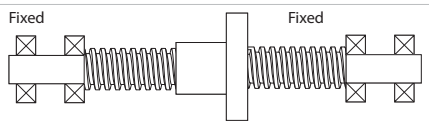
The required motor torque to drive just the lead screw assembly is the total of:

1. Inertial Torque
2. Drag Torque
3. Torque to move load

Drag Torque = Friction of the nut and screw in motion

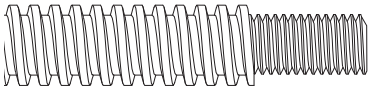
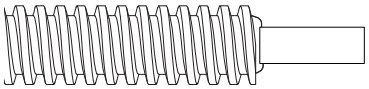
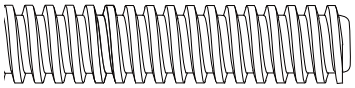
18. Fixity

The performance(speed and effi ciency) of the screw system is affected by how the screw ends are attached and supported.

Type of End Fixity	Relative Rigidity	Critical Speed Factor	Critical Load Factor
	Less Rigid	32	25
	Rigid	1.00	1.00
	More Rigid	1.55	2.00
	Most Rigid	2.24	4.00

19. End Machining of the Screw

Standard metric or English options are available. Custom end machining specifi cations are also available on request.

	Threaded End	Please refer to individual NEMA Size section for standard options. Custom machined ends are also available.	**Example:** UNC End : #8-32 UNC Thread Metric End : M4 x 0.7mm thread
	Smooth end		**Example:** Ø 0.1967″ ±0.001 Ø 5 mm ±0.025
	None		-

20. Column Strength

When a screw is loaded in compression its limit of elastic stability can be exeeded and the screw will fail through bending or buckling.

21. Critical Speed

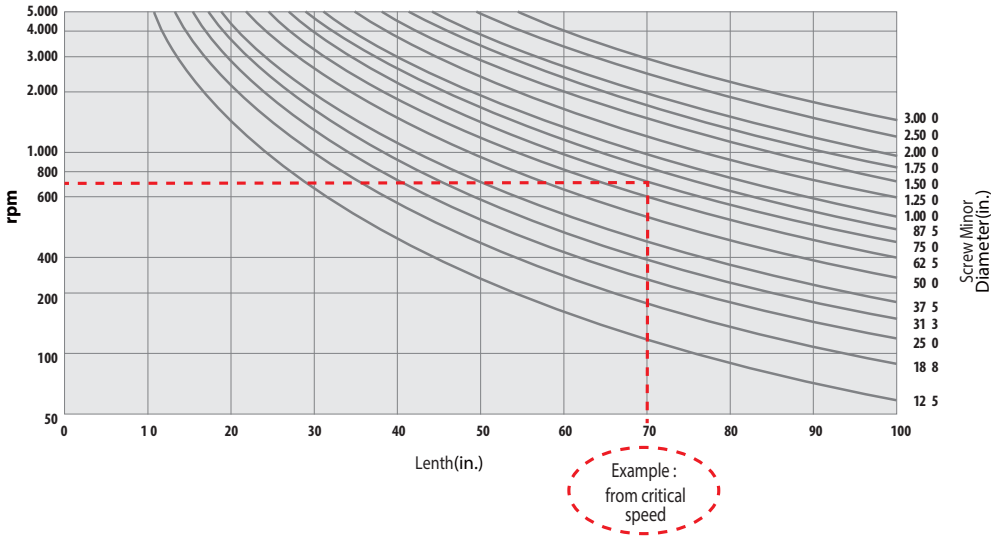
Critical speed is the rotational speed of the screw at which the first harmonic of resonance is reached due to defection of the screw.
A system will vibrate and become unstable at these speeds.

Several variables affect the speed at which a system will reach critical speed:

1. The lead of the screw
2. The rotational speed
3. End fixity
4. The thrust load
5. Diameter of the screw
6. Tension or compression loading

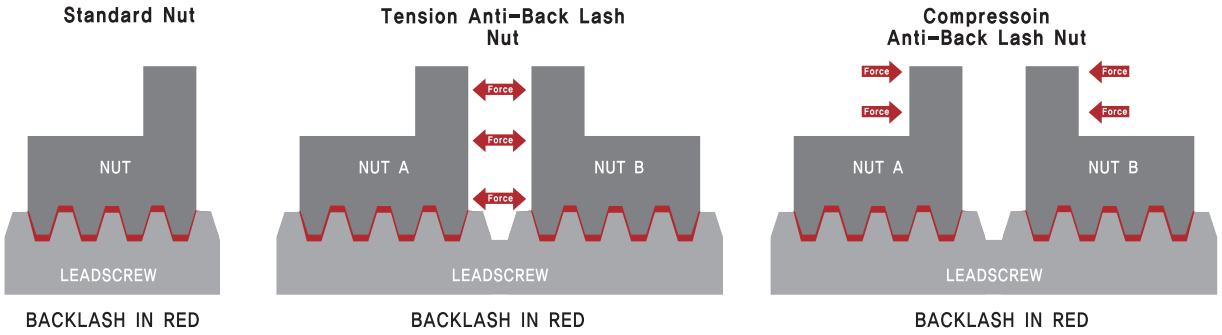
For example, the following chart shows that for a screw with a 3/4 inch diameter and 70 inch length, the threshold for critical speed is 700[rpm]

Critical Rotation Speed[rpm] VS. Unsupported Screw Length for Various Screw Diameters(IN.)



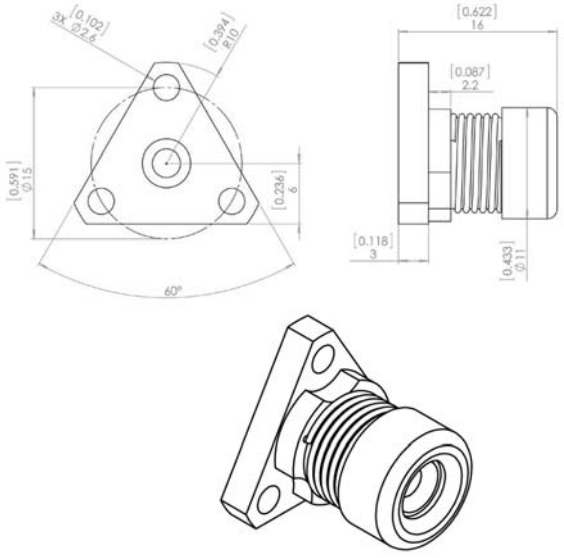
22. Backlash

Backlash is the relative axial movement between a screw an nut at standstill. It is normal for backlash to increase with wear over time. Blacklash compensation or correction can be accomplished through the application of an anti-backlash nut. Backlash is usually only concern with bi-directional positioning.

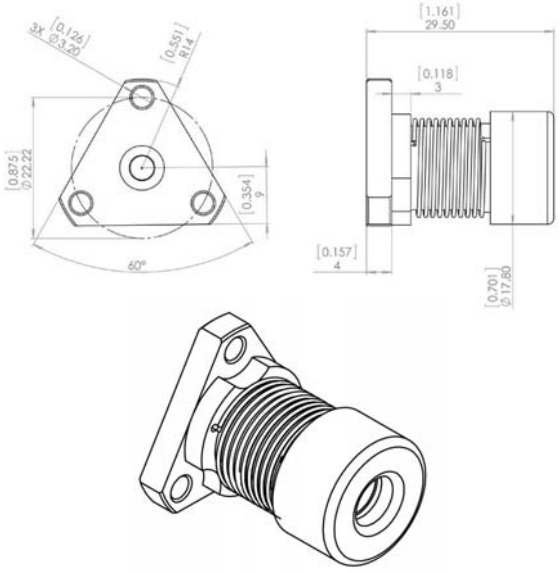


Anti-backlash Nuts Available upon Request

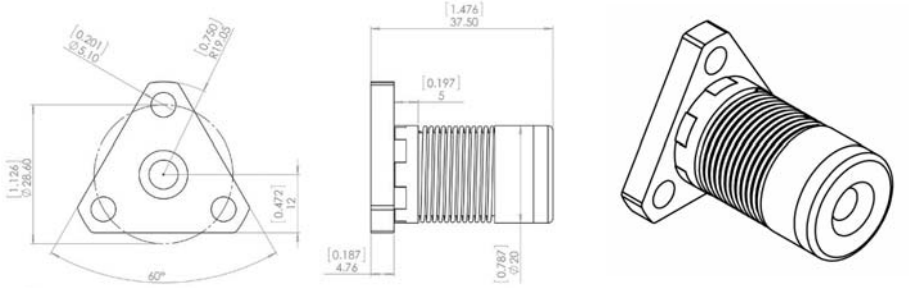
1. NEMA SIZE 8 and NEMA SIZE 11 Anti-Backlash Nut



2. NEMA SIZE 14 and NEMA SIZE 17 Anti-Backlash Nut



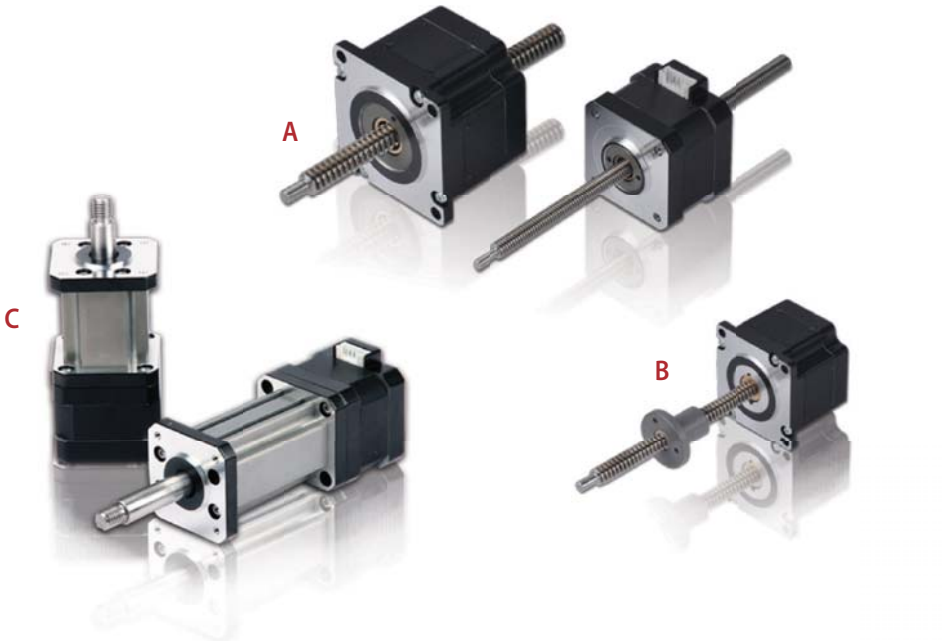
3. NEMA SIZE 23 Anti-Backlash Nut



Product Selection Standard

Linear Motion System Types

A. Non-Captive
B. External Linear
C. Captive



Why choose one form factor over the other?

1. What is the best mechanical fit for your application?
2. How do you plan to attach the screw?
3. Is rotation of the screw acceptable?
4. Does your application require an encoder or brake?
5. What is the stroke of your application?

What environmental considerations do you have?

Fastech linear motion systems are designed to operate in dry and non-corrosive environments. Standard products do not have an IP rating. Operating non-IP rated linear systems in dirty or corrosive environments will signifi cantly reduce product life.

Temperature

Very high or low temperatures may cause significant changes in the nut fit or drag torque.

Maximum dynamic load

Each Nema frame size motor has a mechanical load maximum that should not be exeeded. See Speed / Torque curves for the individual frame sizes.

Motor Selection

In order to select the right motor combination with the lead screw several factors should be considered:

1. How much torque is required?
2. What is the desired step angle?
3. Detend or holding torque requirements?
4. Physical size restrictions?
5. What type of drive(amplifier) are you using?

Product Selection Guide

To reduce complexity and cost of a design, it is important to accurately size a motor / lead screw combination. Below are a few simple steps in selecting the necessary components for a given application.

Step1 - Choosing a motor NEMA size(Force requirements)

Here is a general overview of the output thrust vs. NEMA size:

NEMA Sizes	Max. Thrust	Recommended Load Limit
NEMA 8	78N(17.5lbs)	43N(9.7lbs)
NEMA 11	230N(51lbs)	150N(34lbs)
NEMA 14	450N(100lbs)	230N(52lbs)
NEMA 17	710N(160lbs)	230N(52lbs)
NEMA 23	1400N(315lbs)	920N(210lbs)
NEMA 34	2400N(540lbs)	2160N(485lbs)

※ As the NEMA size of the motor is increased, the output thrust of the actuator is consequently increased.

Step2 - Choosing a screw lead(Force and Speed requirements)

After estimating the required thrust and choosing a NEMA size that may fi t your application, the speed and acceleration of the load must be considered and evaluated to choose an appropriate screw lead.
Due to the nature of lead screws, the output speed and output thrust achievable by a motor/lead screw combination are two inversely proportional variables(i.e., increasing the required thrust will lower the achievable speed for a motor/lead screw combination). Therefore, the maximum output force of a system is lowered for applications that require higher speeds.
For complete motor/lead screw selection data, please refer to the speed/thrust curves for each NEMA size.

Step3 - Lead Screw Material

There are many inter-related variables to consider when selecting the right linear motion system for your application. Your load and speed requirements will determine other variables such as the size of motor, the lead of the screw and ultimately the voltage and current requirements of your electronic motor drive. Depending on your application, trade-offs can be made with many variables as your finalize the system that will meet your performance, form factor and cost specifications.

Selection

Quantify these basic variables first : 1. Load that you need to move(or push – Thrust)
2. Velocity
3. Distance to travel(Stroke)
4. Time required to move from point A to point B(Acceleration required)
5. Torque requirements of your entire system
6. How much backlash is acceptable in your system?
7. What is the required positional repeatability?
8. Is this a Vertical or Horizontal orientation?

Using the Product Selection System along with the associated Nema motor frame size pages in the next sections, you will then be able to drill down to specific c part numbers for both the lead screw and the associated step motor. The linear system is ordered as two part numbers.

※ Note : A linear ststem must be ordered as two part numbers.

Basic Specifications for FASTECH Linear Systems

Unless otherwise noted, all reference to lead screws in this catalog have the following characteristics:

Lead Screw Material	303 Stainless precision cold rolled steel
Screw Coating	Tefion coating is optional
Standard screw accuracy(Lead accuracy)	0.0006 in/inch
Screw repeatability	±0.006 inch
System repeatability(Motor and Screw)	Nominally the same as screw repeatability, motor variance adds ±6 micro steps.
Screw straightness	.003 in/fit, measured as Total Indicated Runout(TIR) All screws are carefully checked for straightness before shipment.
Screw Efficiency	From 35% to 85% dependent on lead Also depends on the usage of an anti-backlash nut with screw. The larger the lead, the higher the efficiency of the screw.
Operating temperature	0˚ ~ 93˚C(32˚F ~ 200˚F)
Screw backlash	Depends on lead(nominally ±0.005 in)
System backlash	Includes screw, motor and attached mechanics. This will be the sum of all the backlash in your motion axis.
Nut Material	Polyacetal with lubricating additive Standard is a free-wheeling nut.[Anti-backlash version is available]
Wear life of screw and nut	Depends on load, speed, duty cycle and environmental factors(typically> 5 million cycles)

※ Note : Fastech linear systems are manufactured from high quality materials.
Because of the variable effects of friction, lubrication and cleanliness, an exact life cannot be predicted for a given application.

Product Selection System

17 N 2 1 15 K 4 - 101.6 T M S

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

① NEMA Size

NEMA Code	8	11	14	17	23	34
Motor Size(mm)	20	28	35	42	57	86

② Lead Screw Shaft Style

N = Non-Captive Linear
E = External Linear
C = Captive Linear

③ Step Angle

2 = 2 Phase with 1.8°
4 = 2 Phase with 0.9°
3 = 3 Phase with 1.2°
5 = 5 Phase with 0.72°

④ Motor Length / Stack

1 = Single Stack
2 = Double Stack

⑤ Rated Current/Phase

XX = X.X(A)/Phase

⑥ Lead Screw Code

A-Z, AA, AF

⑦ Number of Lead Wires

4 = Qty 4 Flying Leads
6 = Qty 6 Flying Leads
8 = Qty 8 Flying Leads

⑧ Lead Screw Length/Stroke

XXX = XXX mm Lead Length(For External Linear/Non-Captive Linear)
XXX = X.XX inch Stroke(For Captive Linear)

※ Please define the length of lead screw for Captive Linear Type as inch. And the length of lead screw of Captive Linear is standardized so please refer to specification in detail.(Example : Please refer to Page 718 to check specifications of Captive Linear Screw Lenght of 35mm motor)

⑨ Lead Screw Surface

T = Teflon Coating
S = Standard(No Teflon Coating)

⑩ End Machining

M = Metric
U = UNC
S = Smooth
N = None

⑪ Nut Style

S = Standard Flange Nut
A = Anti-backlash Nut

Motor Lead Screw Code Structure

Lead Code	1.8° Motor Step Length	Motor Size							
		Size 8	Size 11	Size 14	Size 17		Size 23		Size 34
		Screw Diameter							
		3.5 (0.138″)	4.775 (0.188″)	5.56 (0.218″)	6.35 (0.25″)	6.35 (0.25″)	8 (0.315″)	9.525 (0.375″)	15.875 (0.625″)
AF	0.0015 (0.00006″)	0.30 (0.012″)							
AA	0.003048 (0.00012″)	0.6096 (0.024″)			0.6096 (0.024″)	0.6096 (0.024″)			
A	0.003175 (0.000125″)		0.635 (0.025″)					0.635 (0.025″)	
AD					1 (0.039″)	1 (0.039″)			
B	0.006096 (0.00024″)	1.2192 (0.048″)			1.2192 (0.048″)	1.2192 (0.048″)			
D	0.00635 (0.00025″)		1.27 (0.05″)		1.27 (0.05″)	1.27 (0.05″)		1.27 (0.05″)	
F	0.0079375 (0.0003125″)				1.5875 (0.0625″)	1.5875 (0.0625″)		1.5875 (0.0625″)	
G	0.01 (0.000395″)	2.0 (0.079″)					2.0 (0.079″)		
H	0.010541 (0.000415″)							2.1082 (0.083″)	
J	0.012192 (0.00048″)				2.4384 (0.096″)	2.4384 (0.096″)			
K	0.0127 (0.0005″)		2.54 (0.1″)		2.54 (0.1″)	2.54 (0.1″)		2.54 (0.1″)	2.54 (0.1″)
L	0.015875 (0.000625″)							3.175 (0.125″)	3.175 (0.125″)
M	0.02 (0.00079″)	4.0 (0.158″)					4.0 (0.158″)		
P	0.021209 (0.000835″)							4.2418 (0.167″)	
Q	0.024384 (0.00096″)				4.8768 (0.192″)	4.8768 (0.192″)			
AQ				4.8768 (0.192″)					
R	0.0254 (0.001″)		5.08 (0.2″)					5.08 (0.2″)	5.08 (0.2″)
S	0.03175 (0.00125″)				6.35 (0.25″)	6.35 (0.25″)		6.35 (0.25″)	6.35 (0.25″)
T	0.04 (0.001575″)	8.0 (0.315″)					8.0 (0.315″)		
U	0.042291 (0.001665″)				8.382 (0.33″)	8.382 (0.33″)			
V	0.047625 (0.001875″)							9.525 (0.375″)	
W	0.048768 (0.00192″)				9.7536 (0.384″)	9.7536 (0.384″)		9.7536 (0.384″)	
X	0.0508 (0.002″)		10.16 (0.4″)					10.16 (0.4″)	
Y	0.0635 (0.0025″)				12.7 (0.5″)	12.7 (0.5″)		12.7 (0.5″)	12.7 (0.5″)
Z	0.127 (0.005″)							25.4 (1.0″)	25.4 (1.0″)

Motor Size(20mm)

NEMA Size 8(20mm)
Hybrid Motor Linear Actuators

The NEMA 8 is our smallest hybrid linear actuator. This compact unit can be integrated into various applications to provide precise linear positioning while occupying less than 1 in2 of mounting footprint and providing up to 10lbsF(44.5N) of continuous thrust. Ball Screw versions are also available.

1. Parameters

Please contact FASTECH or your local FASTECH representative about custom products.

Motor	Voltage (V)	Current (A)	Resistance (Ω)	Inductance (mH)	Lead Wire No.	Motor Length (mm)
8-2105	2.5	0.5	5.0	1.2	4	27
8-2205	4.4	0.5	8.8	2.7	4	38

2. Available Lead Screws and Travel per Step

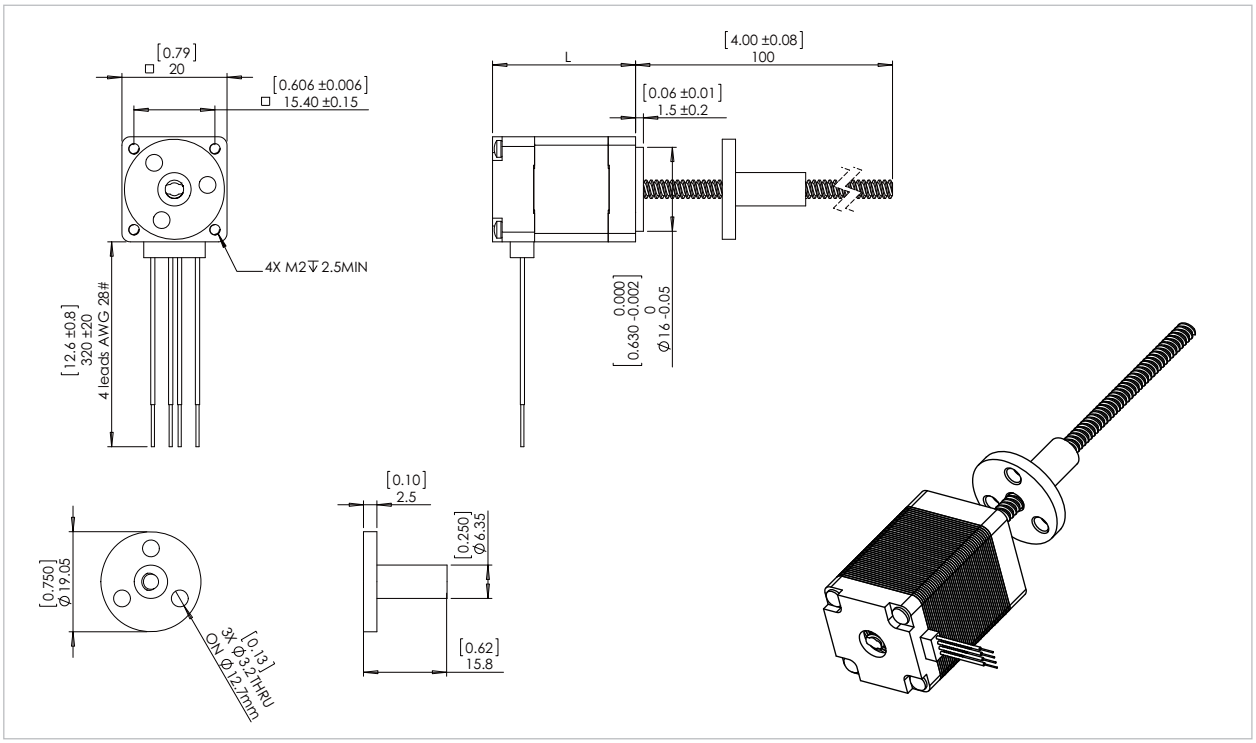
Please contact FASTECH or your local FASTECH representative about custom products.

Screw Dia. (in.)	Screw Dia. (mm)	Lead (in.)	Lead (mm)	Lead Code	Travel Per Step @ 1.8 deg(mm)*
0.138	3.5052	0.012	0.30	AF	0.0015
0.138	3.5052	0.024	0.6096	AA	0.003
0.138	3.5052	0.048	1.2192	B	0.0061
0.138	3.5052	0.079	2.0	G	0.01
0.138	3.5052	0.158	4.0	M	0.02
0.138	3.5052	0.315	8.0	T	0.04

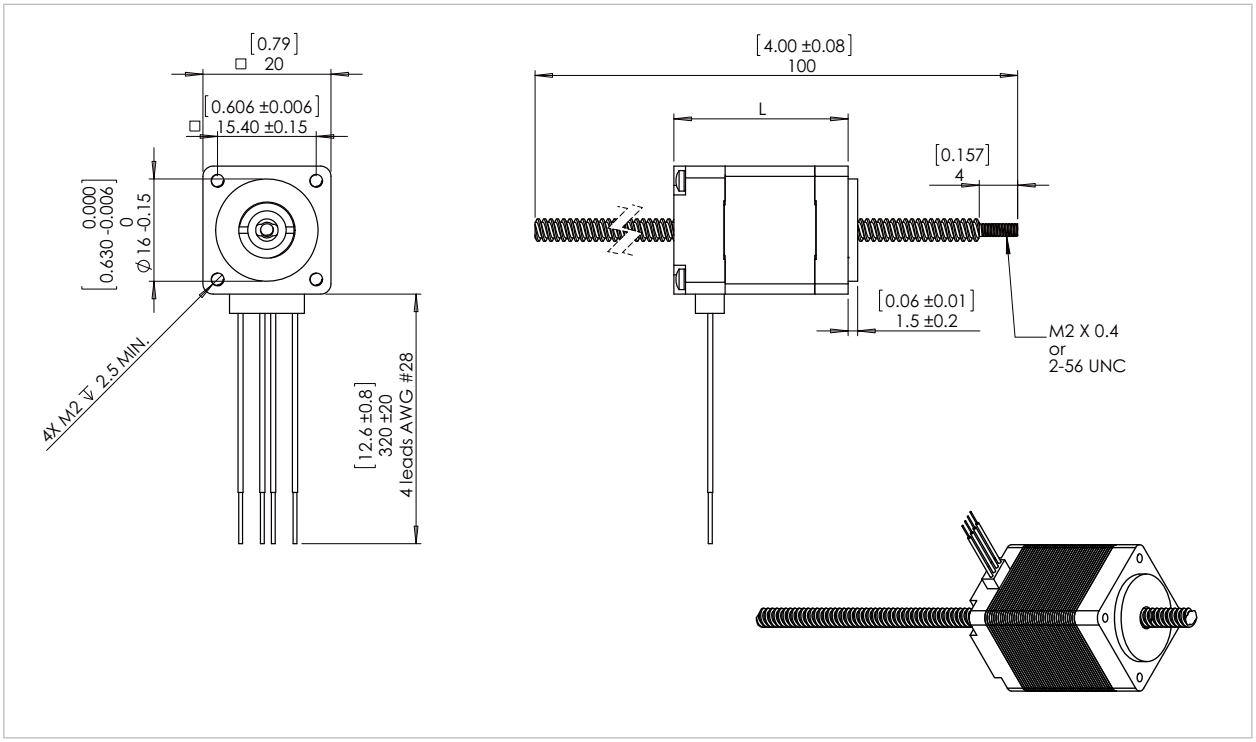
※ values truncated

Dimensions

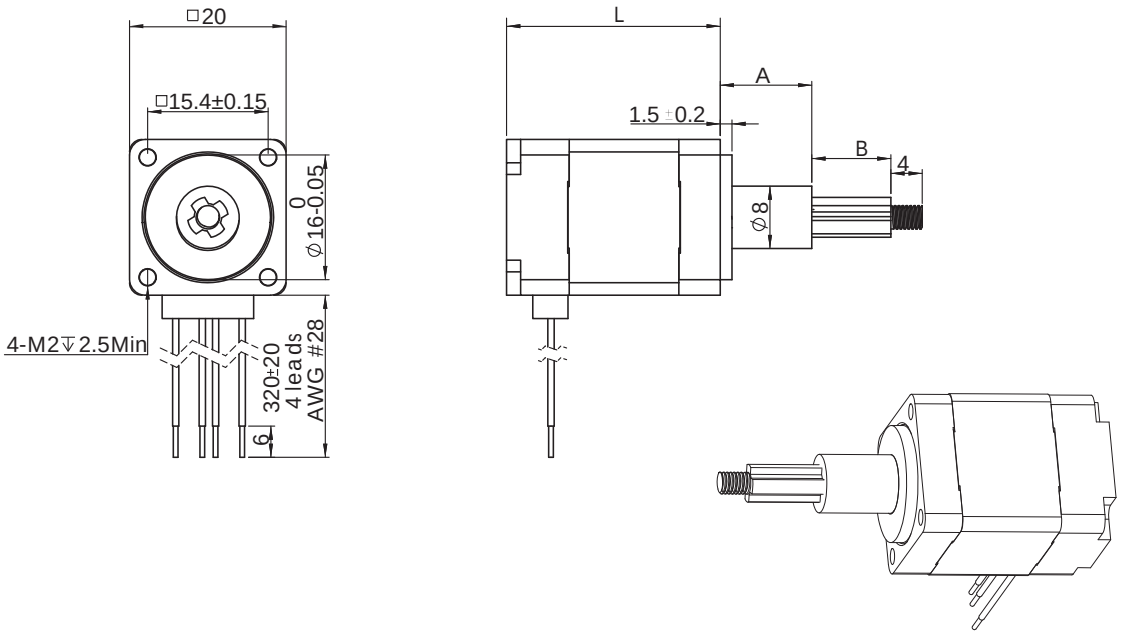
NEMA Size 8 EXTERNAL Linear Actuator



NEMA Size 8 NON-CAPTIVE Linear Actuator



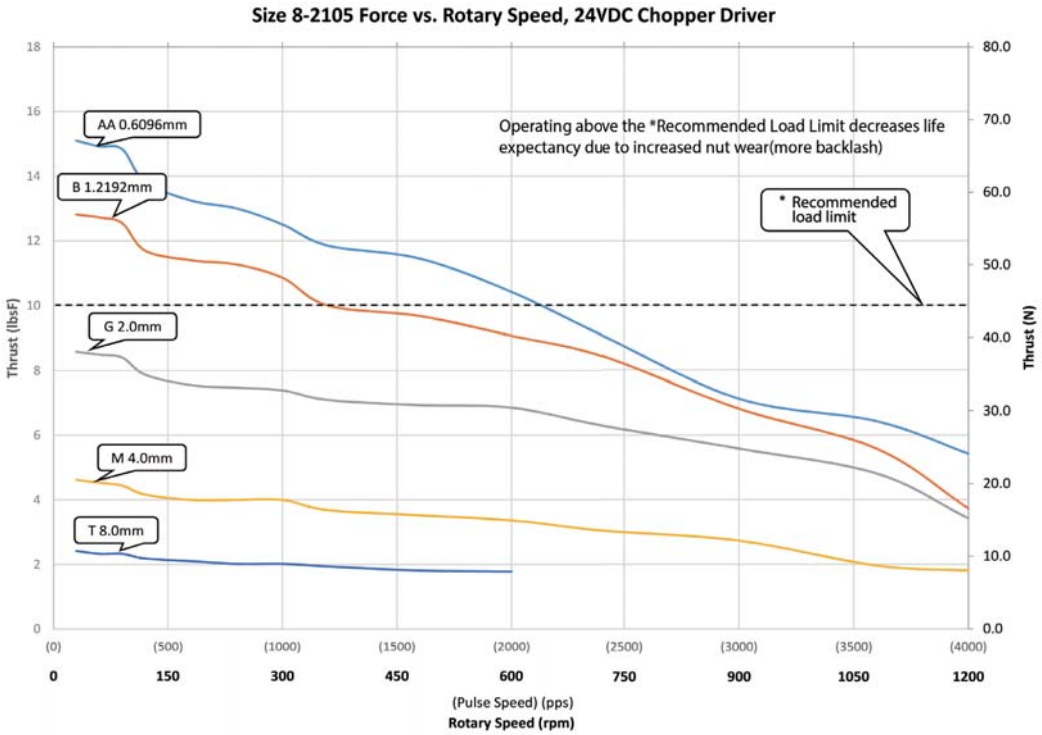
NEMA Size 8 CAPTIVE Linear Actuator



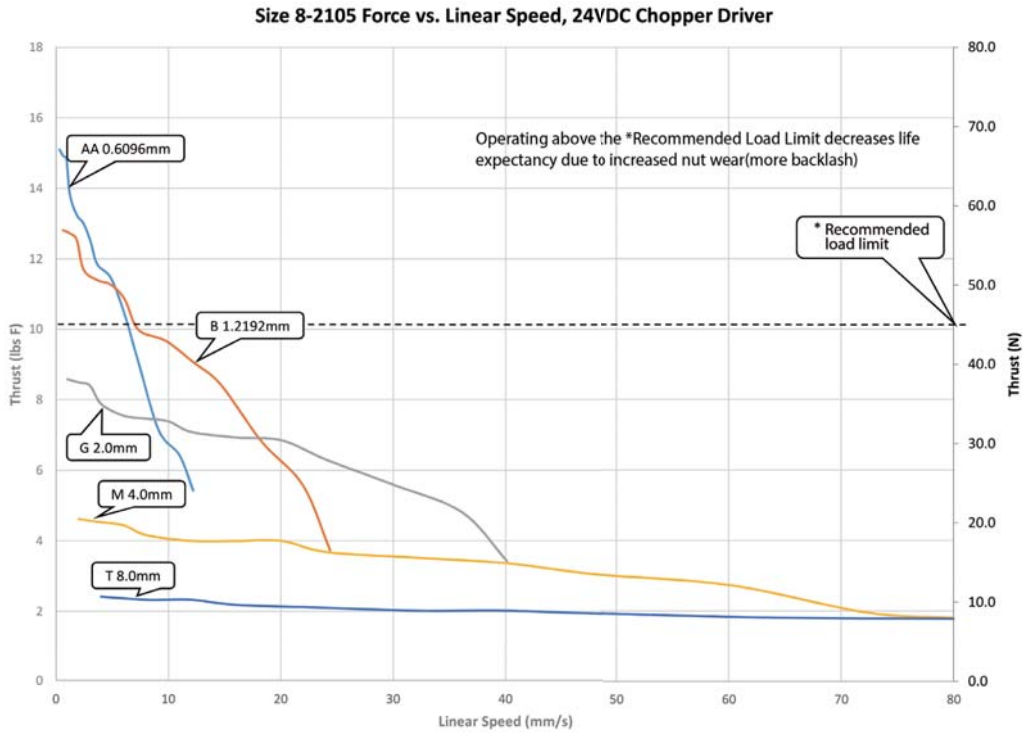
Stroke B(mm)	Size A(mm)	Size L(mm)	
5	5.2	Single Stack Motor 27mm	Double Stack Motor 38mm
10	11.7		

Speed Thrust Curves

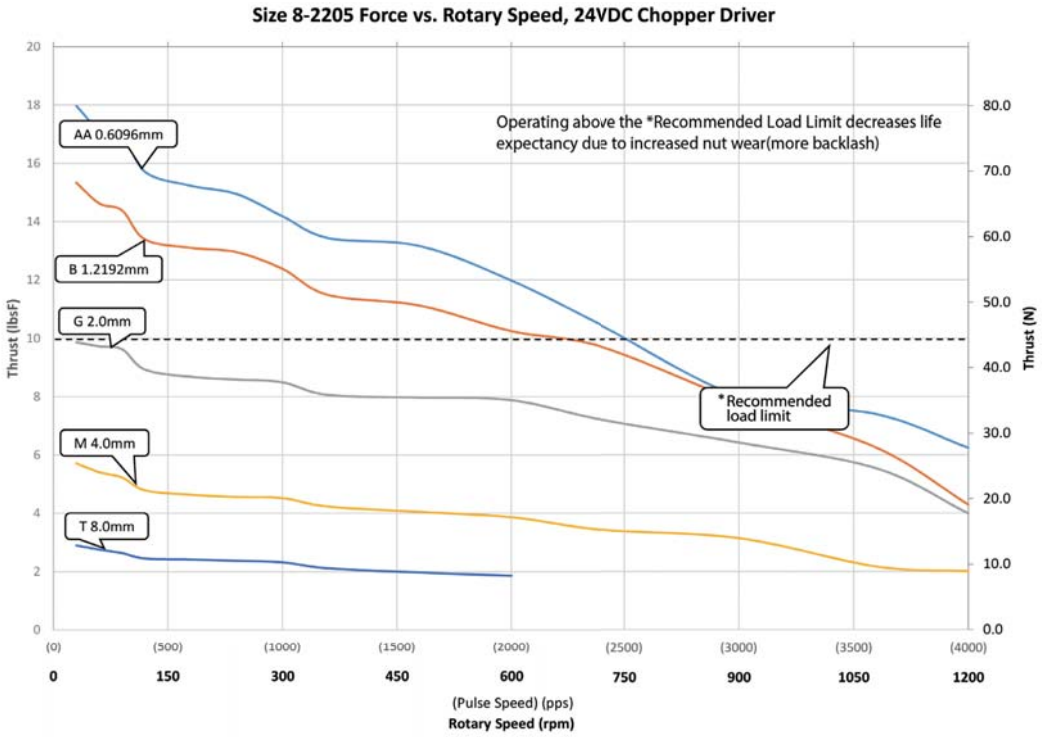
NEMA 8 Single-Stack Rotary Speed



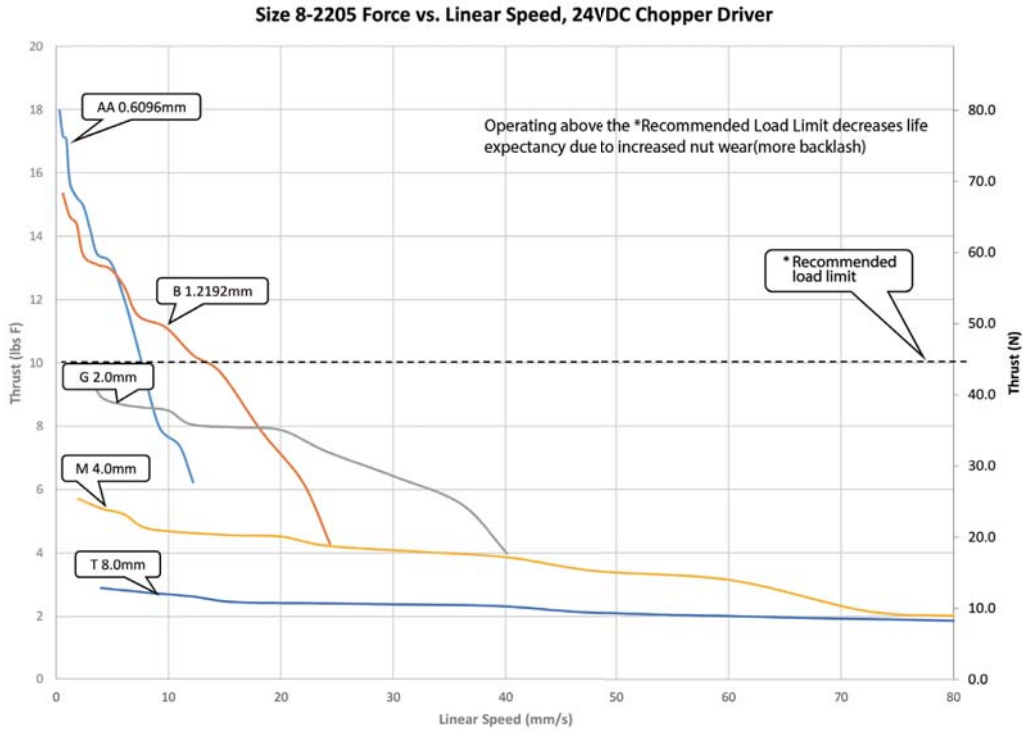
NEMA 8 Single-Stack Linear Speed



NEMA 8 Double-Stack Rotary Speed

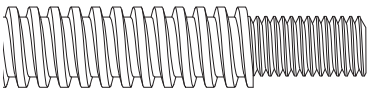
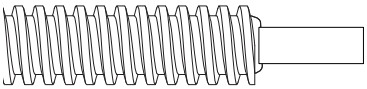
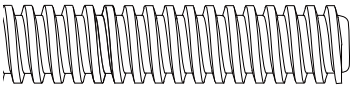


NEMA 8 Double-Stack Linear Speed

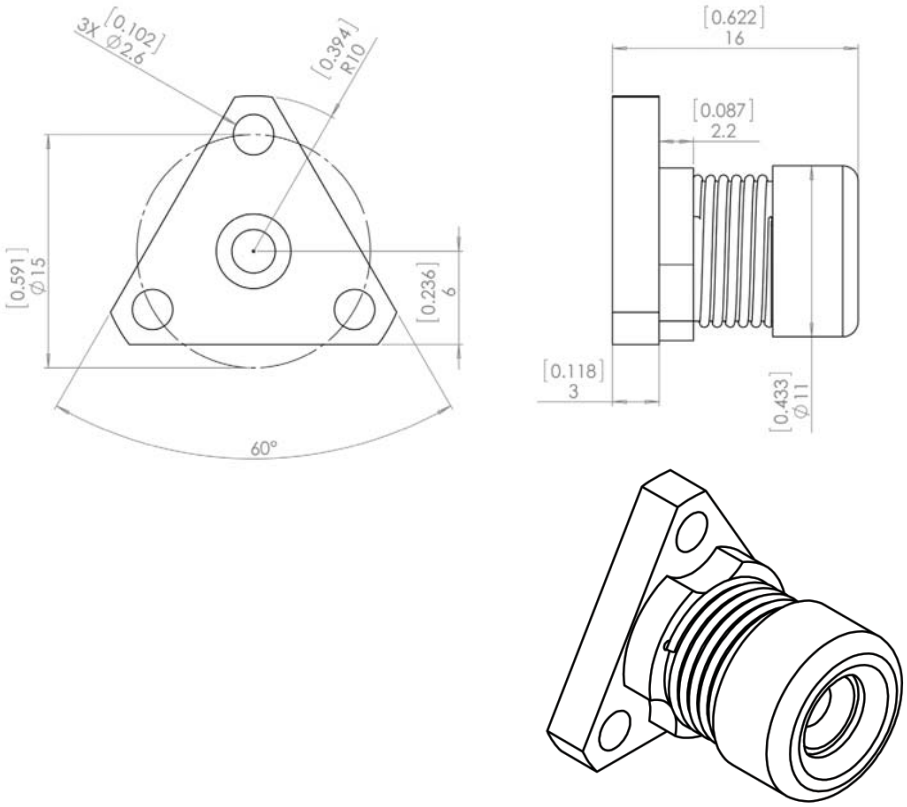


Option & Anti-backlash Nut

End Machining Option

Standard Lead Screw End Machining		
	Threaded End	Metric End : M2 x 0.4mm UNC End : 2-56 UNC
	Smooth end	Ø2 mm ±0.025 Ø0.0787″ ±0.0010
	None	-

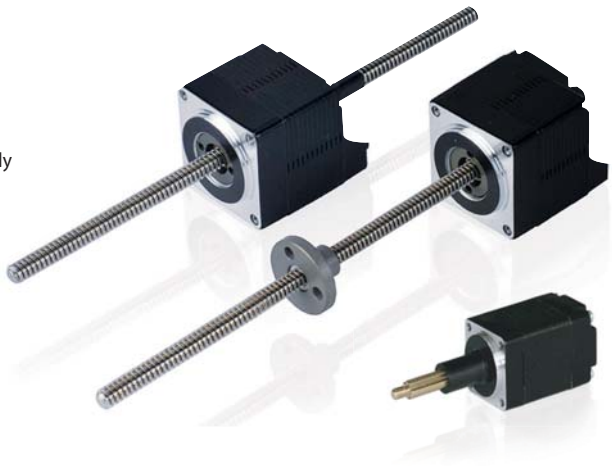
Anti-backlash Nut



Motor Size(28mm)

NEMA Size 11(28mm)
Hybrid Motor Linear Actuators

The NEMA 11 hybrid linear actuator occupies a mounting footprint of slightly above 1 in2 but provides over 3X the continuous thrust(33lbsF/150N) of the NEMA 8. Ball Screw versions are also available.



1. Parameters

Please contact FASTECH or your local FASTECH representative about custom products.

Motor	Voltage (V)	Current (A)	Resistance (Ω)	Inductance (mH)	Lead Wire No.	Motor Length (mm)
11-2105	4.5	0.5	9.1	6	4	34
11-2110	2.2	1	2.2	1.5	4	34
11-2209	3.9	0.95	4.1	4	4	45
11-2216	2.25	1.6	1.45	1.1	4	45

2. Available Lead Screws and Travel per Step

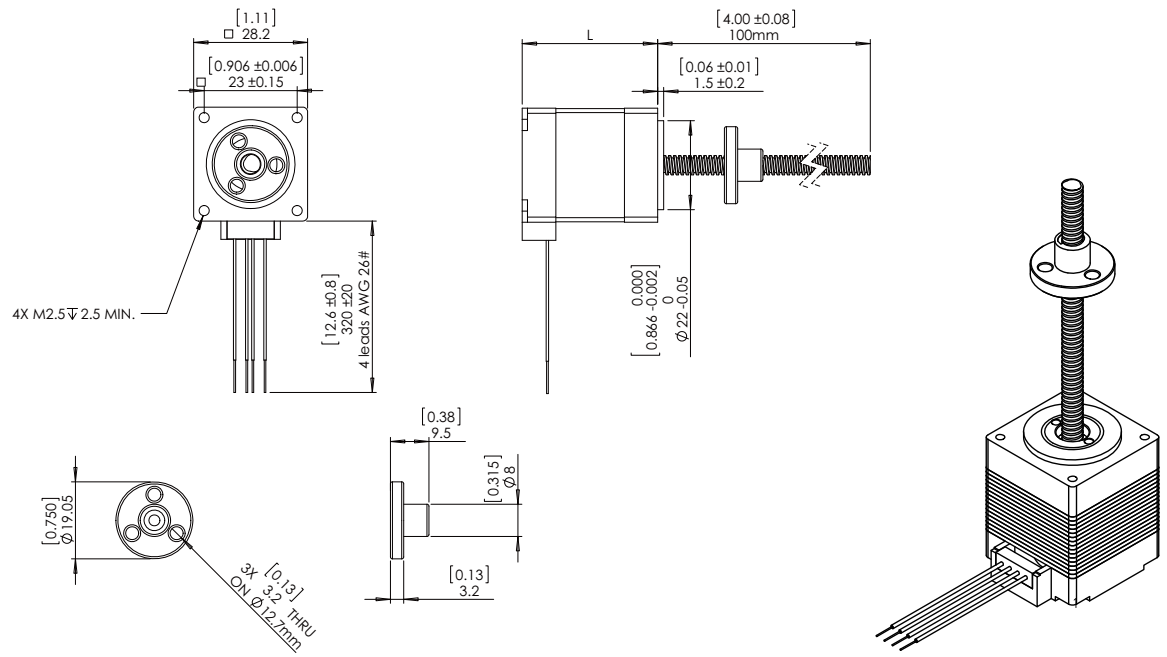
Please contact FASTECH or your local FASTECH representative about custom products.

Screw Dia. (in.)	Screw Dia. (mm)	Lead (in.)	Lead (mm)	Lead Code	Travel Per Step @ 1.8 deg(mm)*
0.188	4.7752	0.025	0.635	A	0.0032
0.188	4.7752	0.05	1.27	D	0.0063
0.188	4.7752	0.1	2.54	K	0.0127
0.188	4.7752	0.2	5.08	R	0.0254
0.188	4.7752	0.4	10.16	X	0.0508

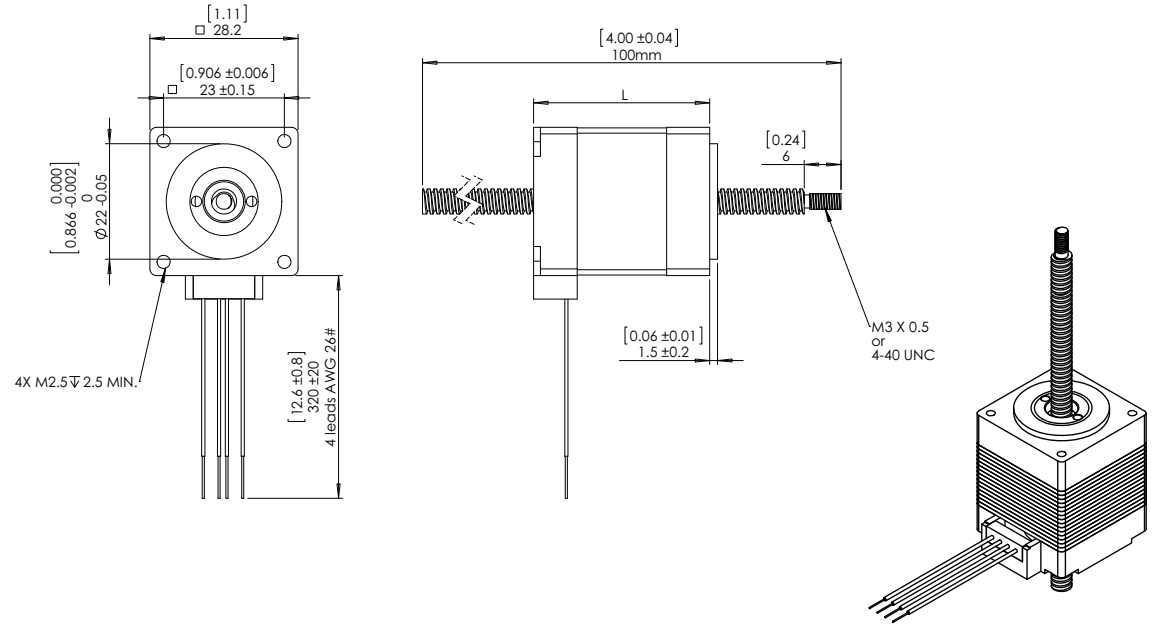
* Values truncated

Dimensions

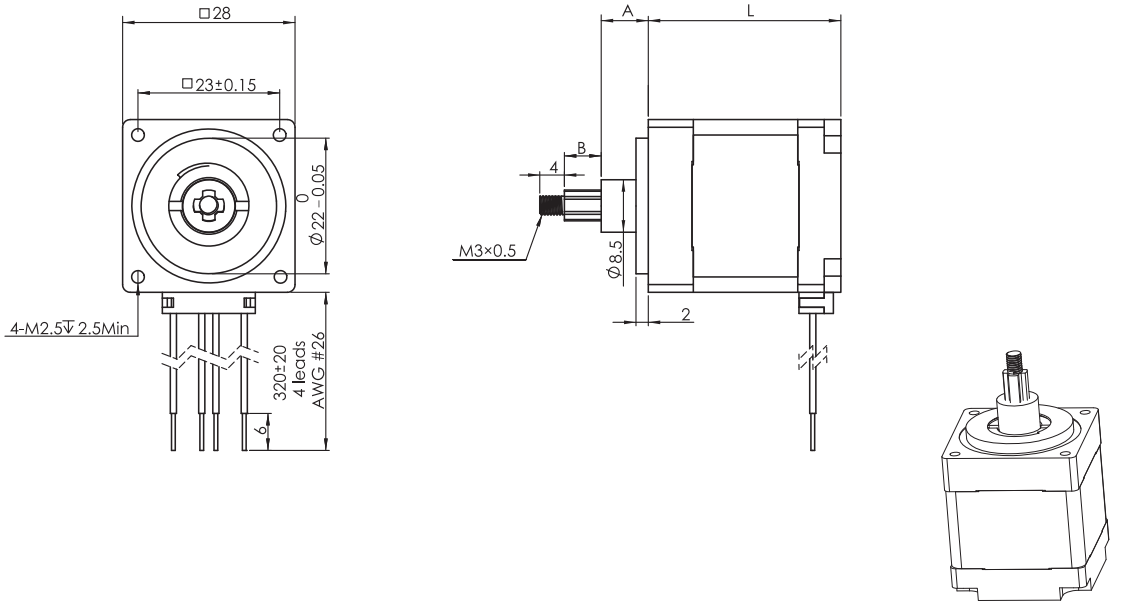
NEMA Size 11 EXTERNAL Linear Actuator



NEMA Size 11 NON-CAPTIVE Linear Actuator



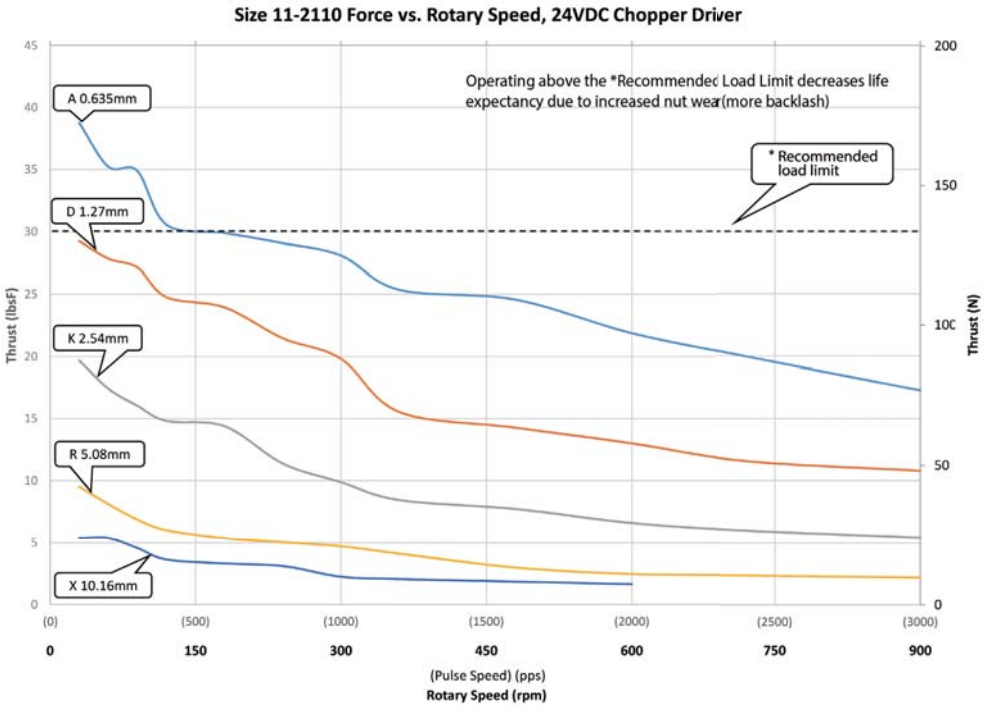
NEMA Size 11 CAPTIVE Linear Actuator



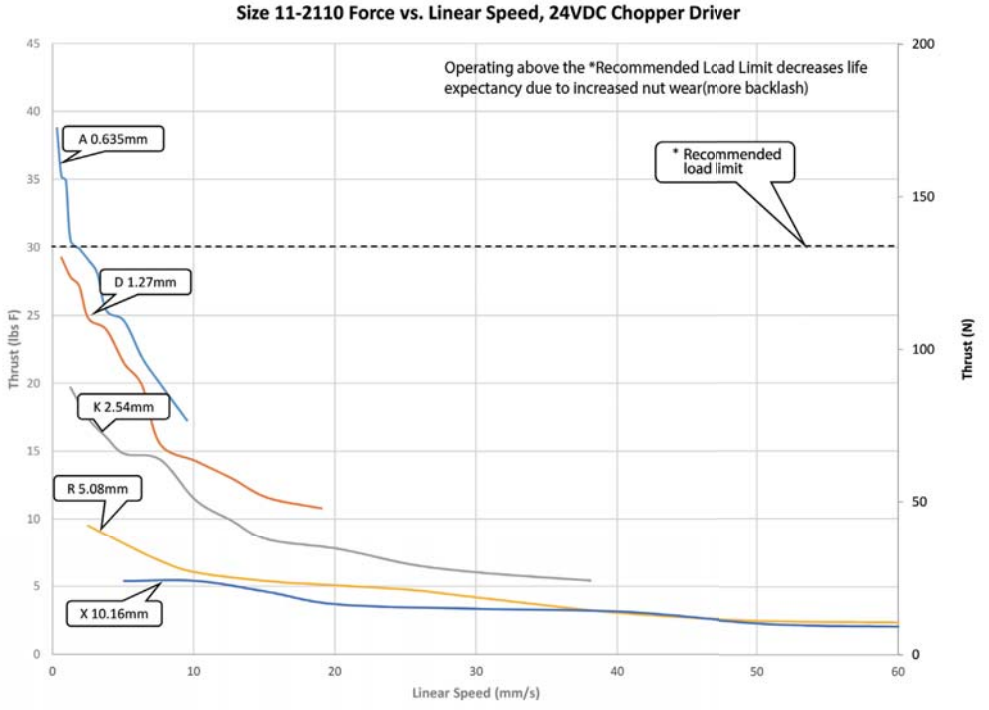
Stroke B(mm)	Size A(mm)	Size L(mm)	
5	7.65	Single Stack Motor 34mm	Double Stack Motor 45mm

Speed Thrust Curves

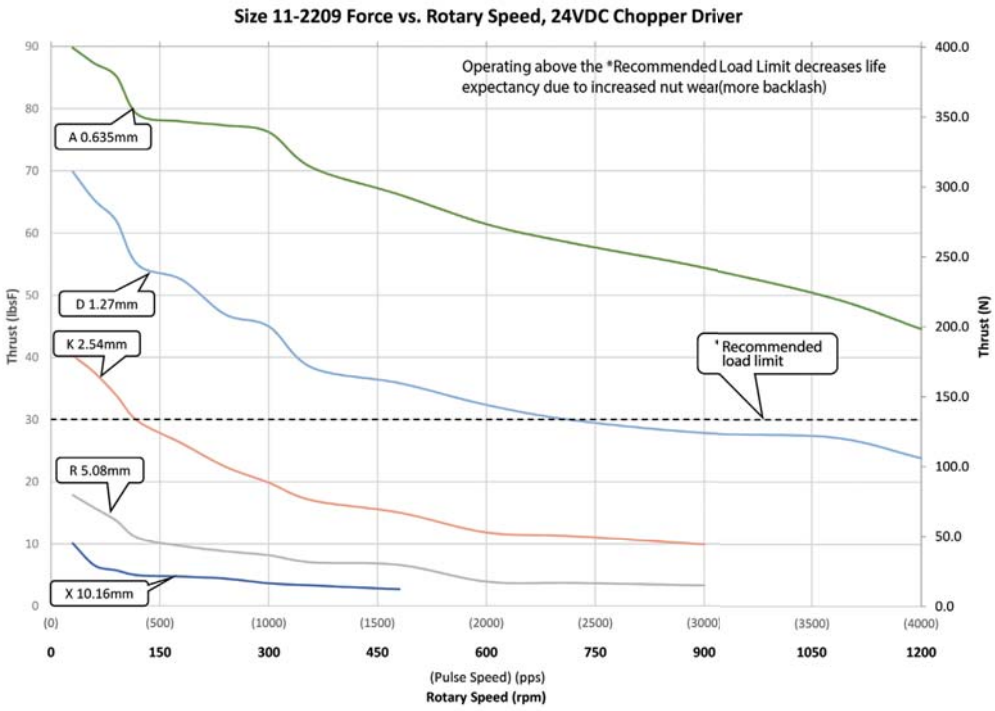
NEMA 11 Single-Stack Rotary Speed



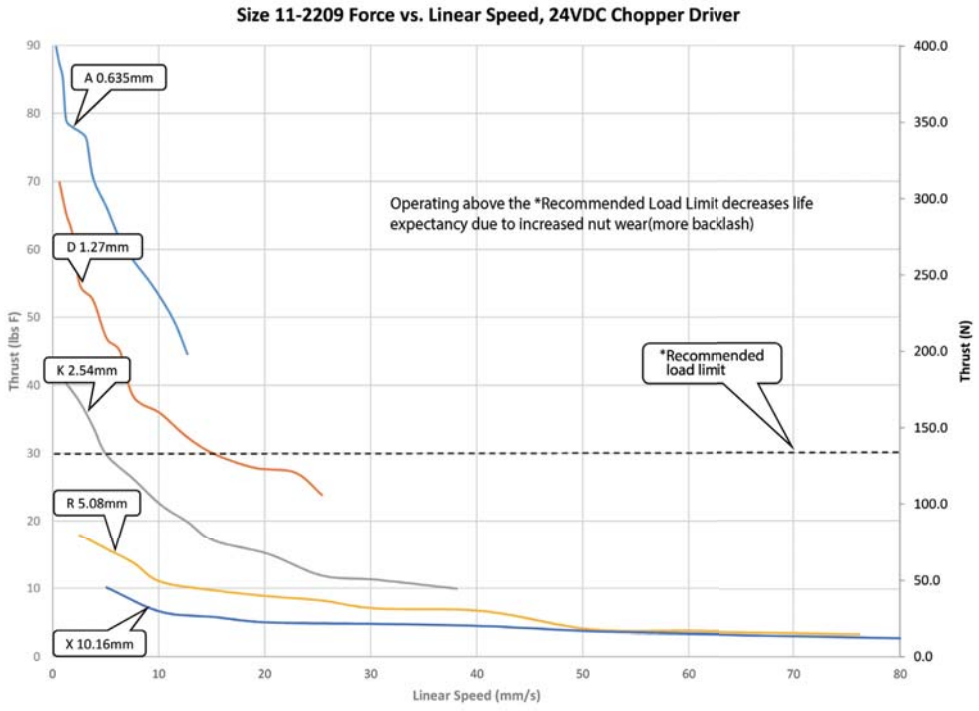
NEMA 11 Single-Stack Linear Speed



NEMA 11 Double-Stack Rotary Speed

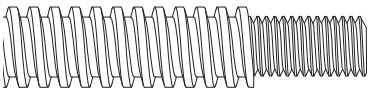
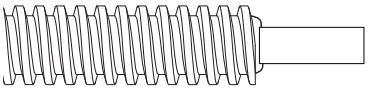
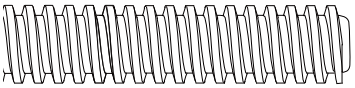


NEMA 11 Double-Stack Linear Speed

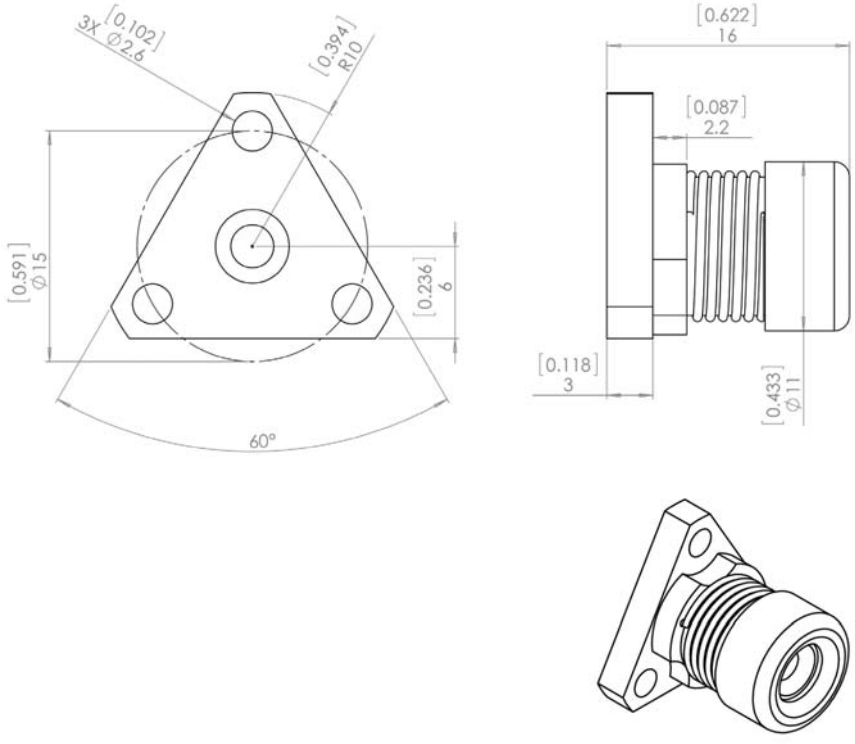


Option & Anti-backlash Nut

End Machining Option

Standard Lead Screw End Machining		
	Threaded End	Metric End : M3 x 0.4mm UNC End : 4-40 UNC
	Smooth End	Ø3mm ±0.025 Ø0.1181˝ ±0.0010
	None	-

Anti-backlash Nut



Motor Size(35mm)

NEMA Size 14(35mm)
Hybrid Motor Linear Actuators

The NEMA 14 hybrid precision linear actuator provides up to 52lbsF(230N) of continuous thrust. A Captive version is available in this frame size. Ball Screw versions are also available.

1. Parameters

Please contact FASTECH or your local FASTECH representative about custom products.

Motor	Voltage (V)	Current (A)	Resistance (Ω)	Inductance (mH)	Lead Wire No.	Motor Length (mm)
14-2105	6.6	0.5	13.2	14	4	34
14-2110	3.3	1	3.3	3.6	4	34
14-2115	2.2	1.5	1.5	1.6	4	34
14-2205	12	0.5	24	29	4	46
14-2210	6	1	6	7.2	4	46
14-2215	4	1.5	2.7	1.8	4	46

2. Available Lead Screws and Travel per Step

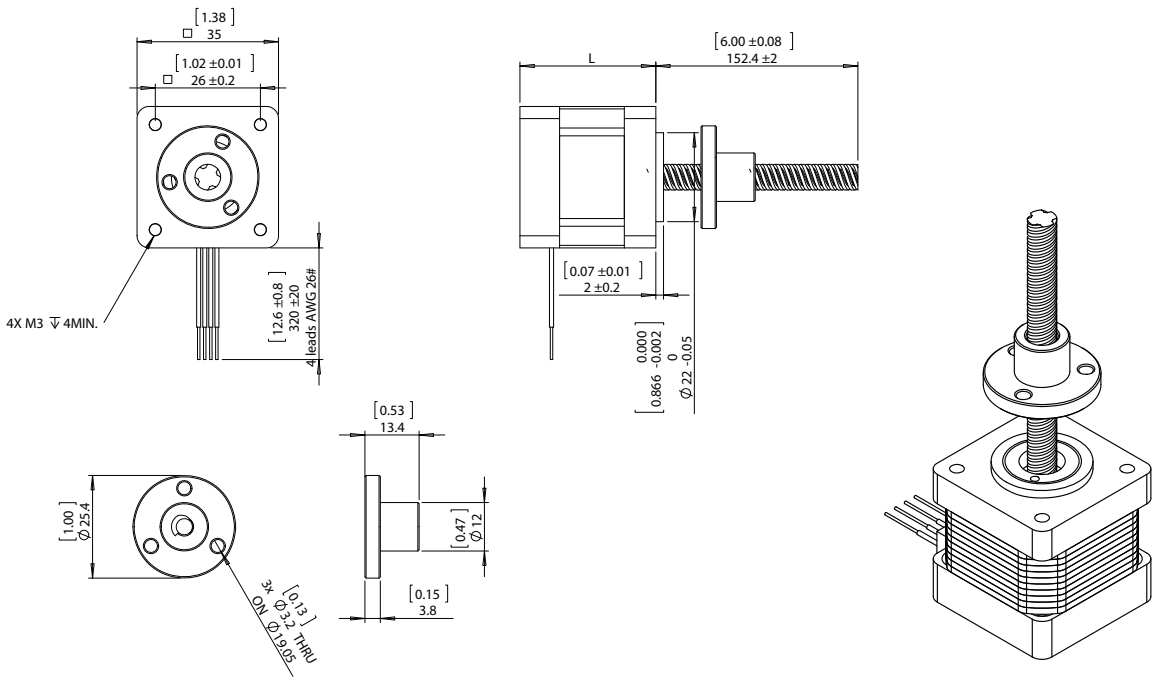
Please contact FASTECH or your local FASTECH representative about custom products.

Screw Dia. (in.)	Screw Dia. (mm)	Lead (in.)	Lead (mm)	Lead Code	Travel Per Step @ 1.8 deg(mm)*	Travel Per Step @ 0.9 deg(mm)*
0.25	6.35	0.024	0.6096	AA	0.003	0.0015
0.25	6.35	0.048	1.2192	B	0.006	0.003
0.25	6.35	0.05	1.27	D	0.006	0.0032
0.25	6.35	0.0625	1.5875	F	0.0079375	0.0039688
0.25	6.35	0.096	2.4384	J	0.012	0.0061
0.25	6.35	0.1	2.54	K	0.012	0.0064
0.25	6.35	0.192	4.8768	Q	0.024	0.0122
0.25	6.35	0.25	6.35	S	0.031	0.0159
0.25	6.35	0.33	8.382	U	0.041	0.021
0.25	6.35	0.384	9.7536	W	0.048	0.0244
0.25	6.35	0.5	12.7	Y	0.0635	0.03175

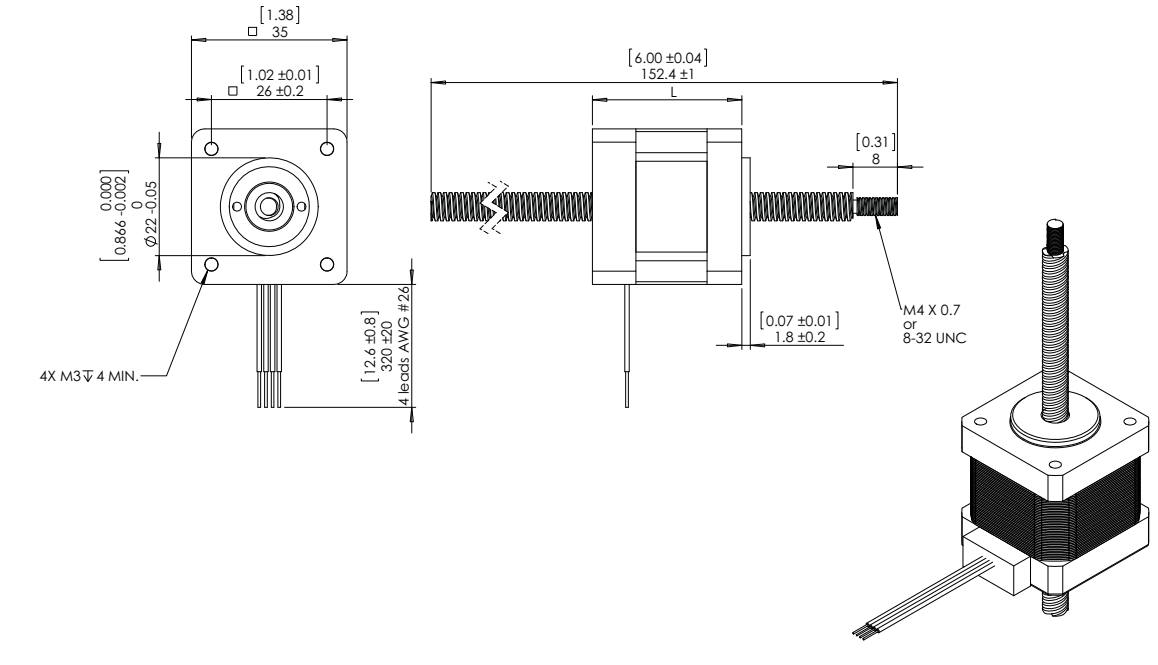
* Values truncated

Dimensions

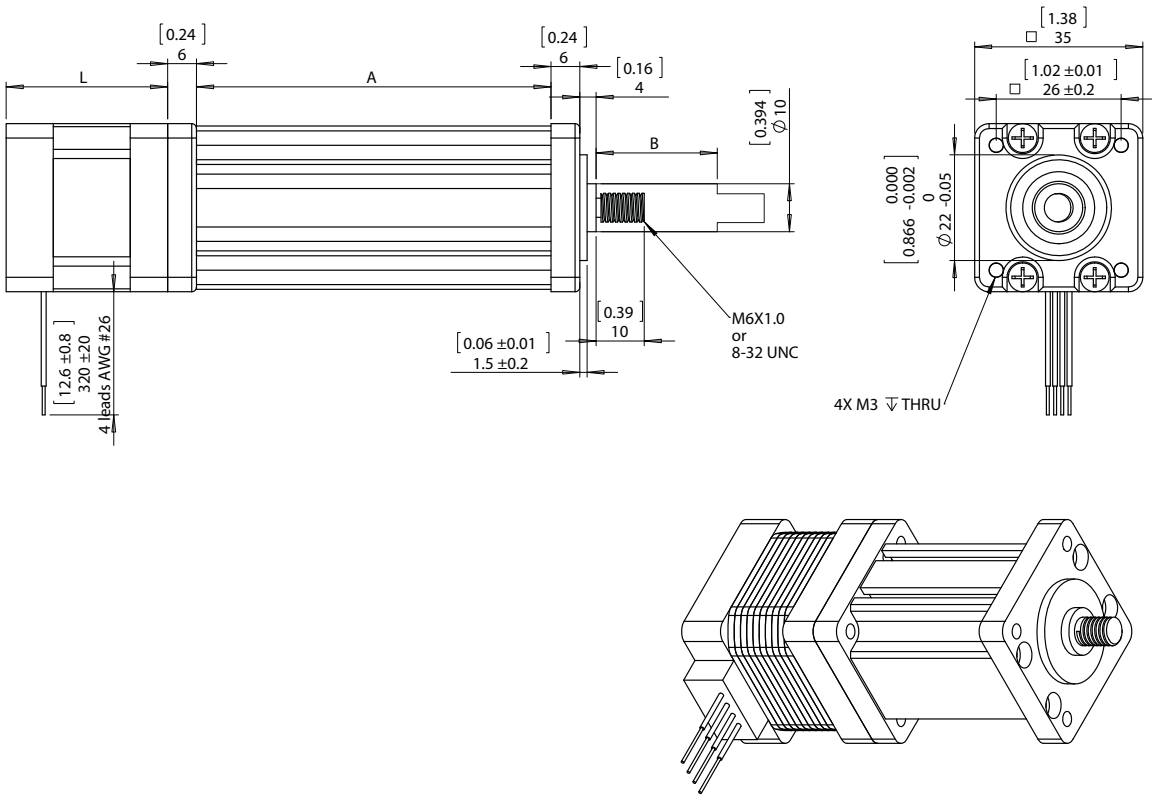
NEMA Size 14 EXTERNAL Linear Actuator



NEMA Size 14 NON-CAPTIVE Linear Actuator



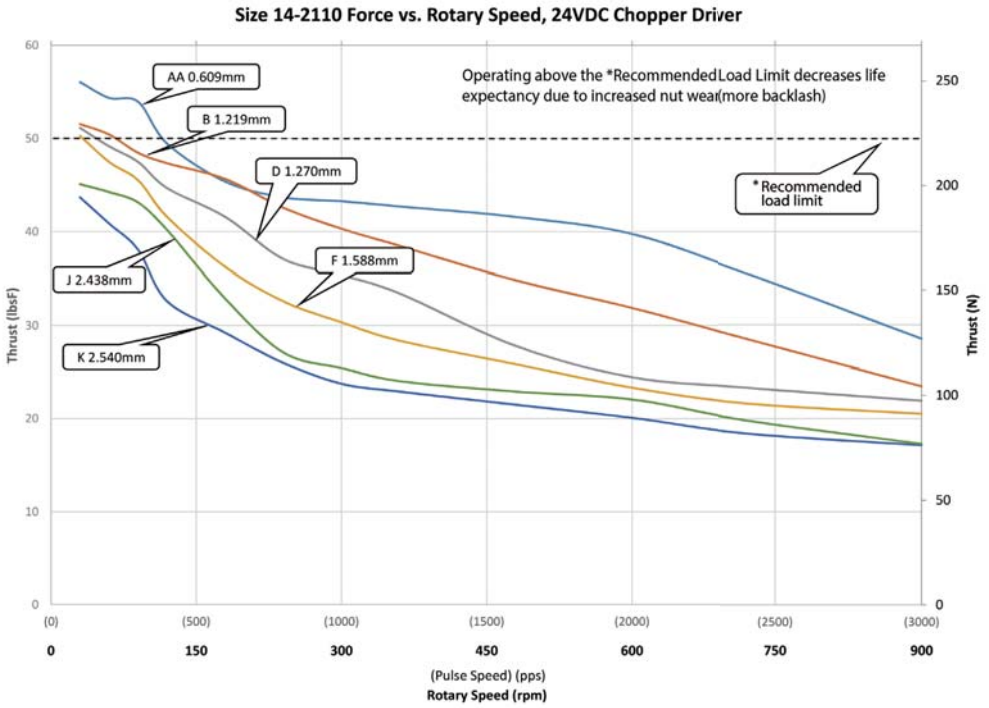
NEMA Size 14 CAPTIVE Linear Actuator



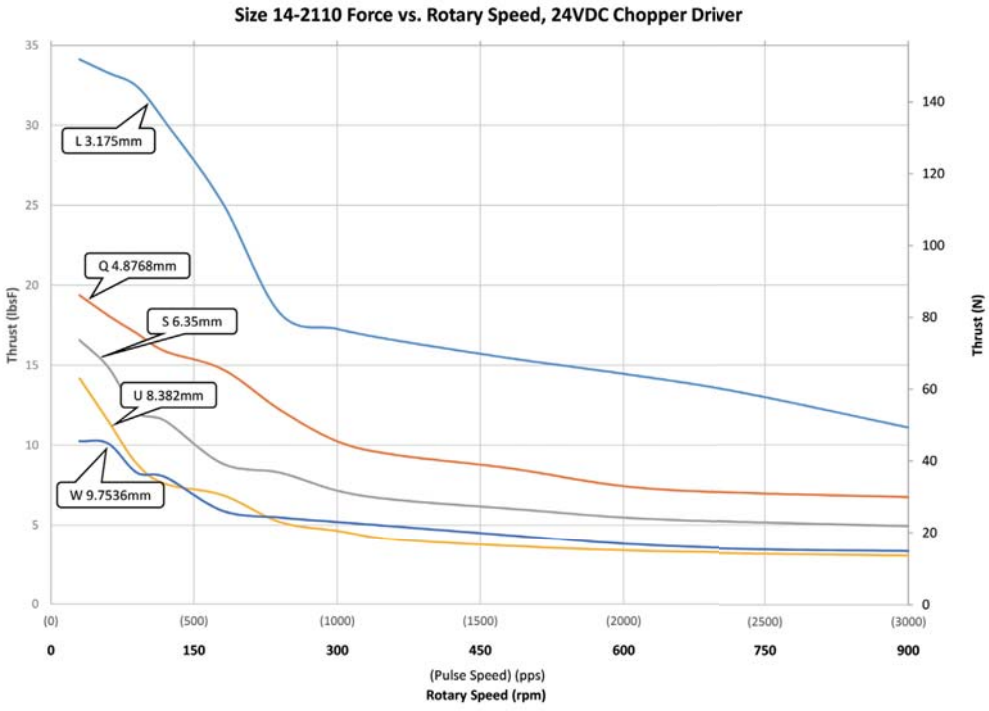
Stroke B inch(mm)	Dimension A(mm)	Dimension L(mm)	
0.5(12.7)	36.7	Single Stack Motor 35mm	Double Stack Motor 49mm
0.75(19.05)	43.05		
1.0(25.4)	49.4		
1.25(31.8)	55.8		
1.5(38.1)	62.1		
2.0(50.8)	74.8		
2.5(63.5)	87.5		

Speed Thrust Curves

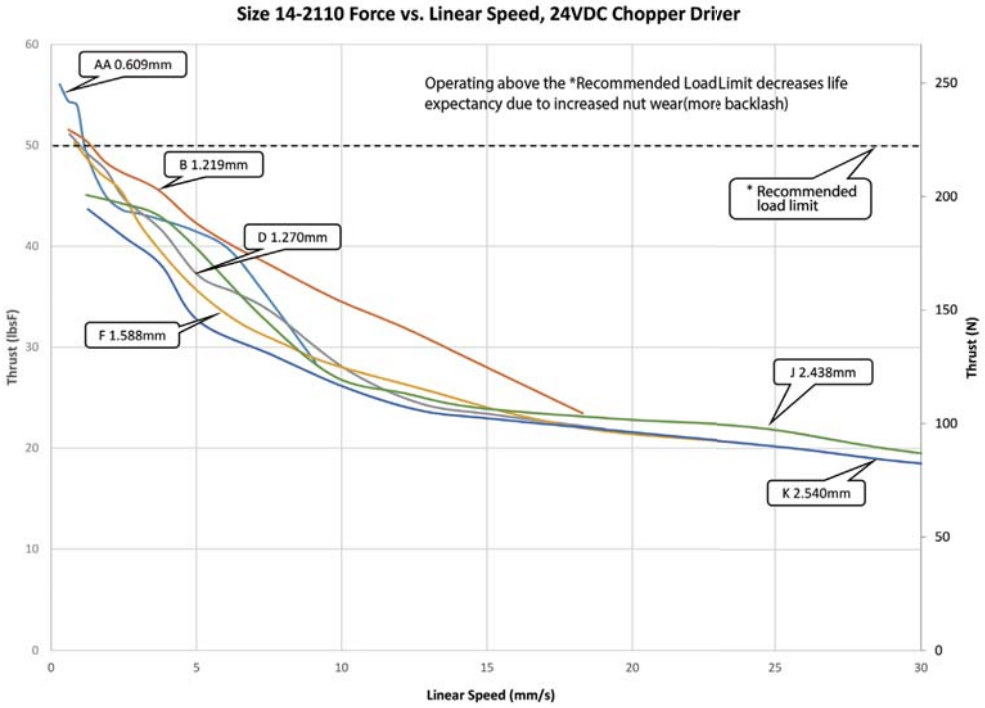
NEMA 14 Single-Stack Rotary Speed



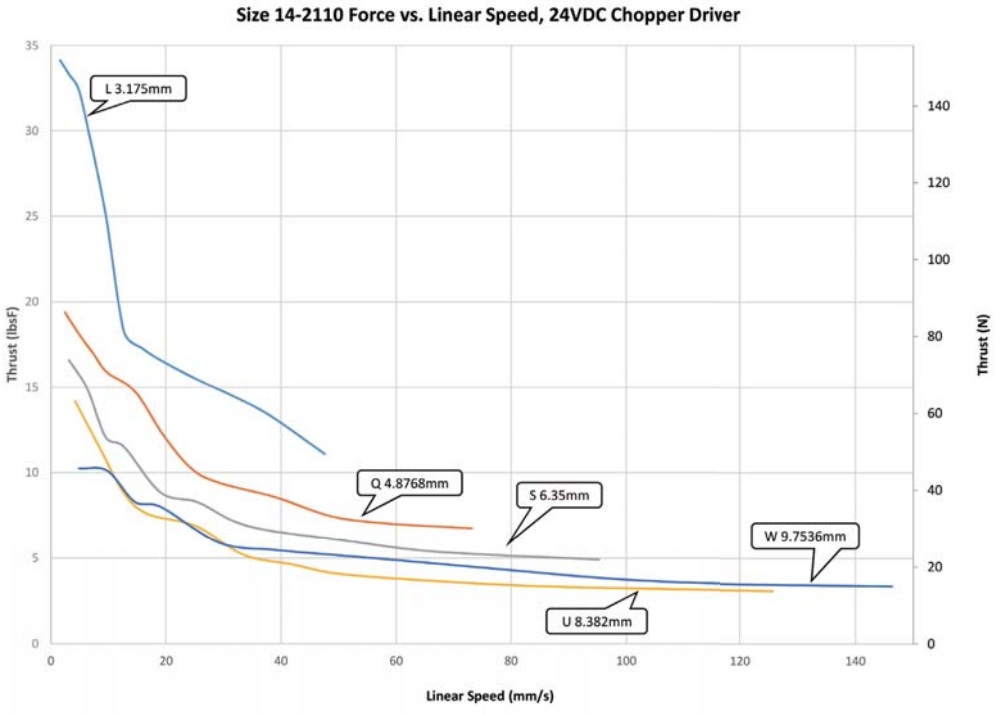
NEMA 14 Single-Stack Rotary Speed



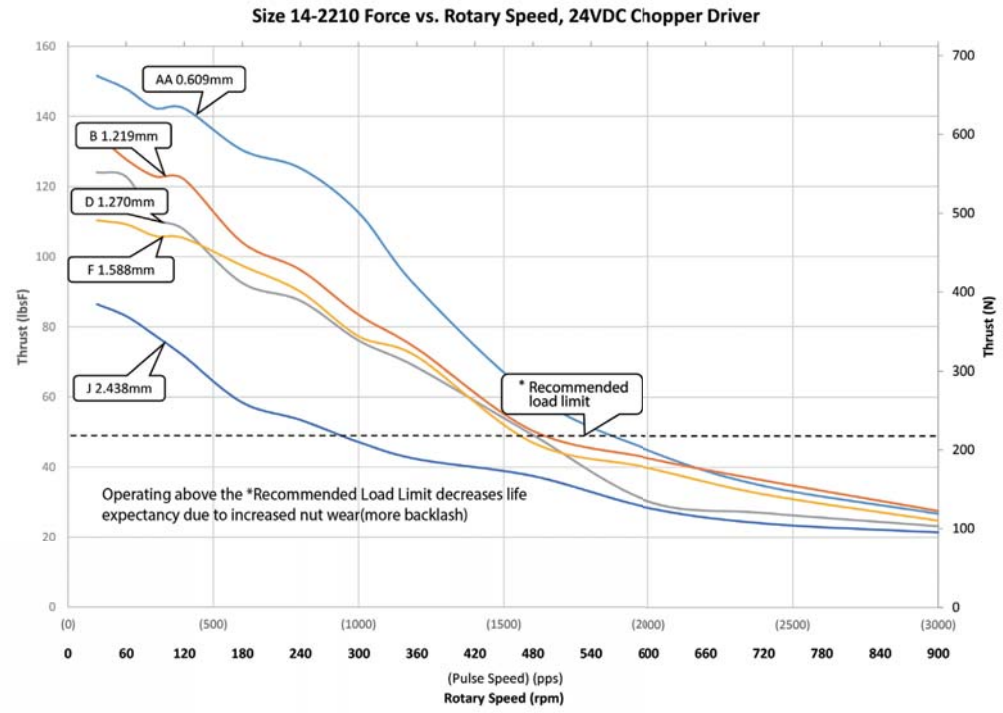
NEMA 14 Single-Stack Linear Speed



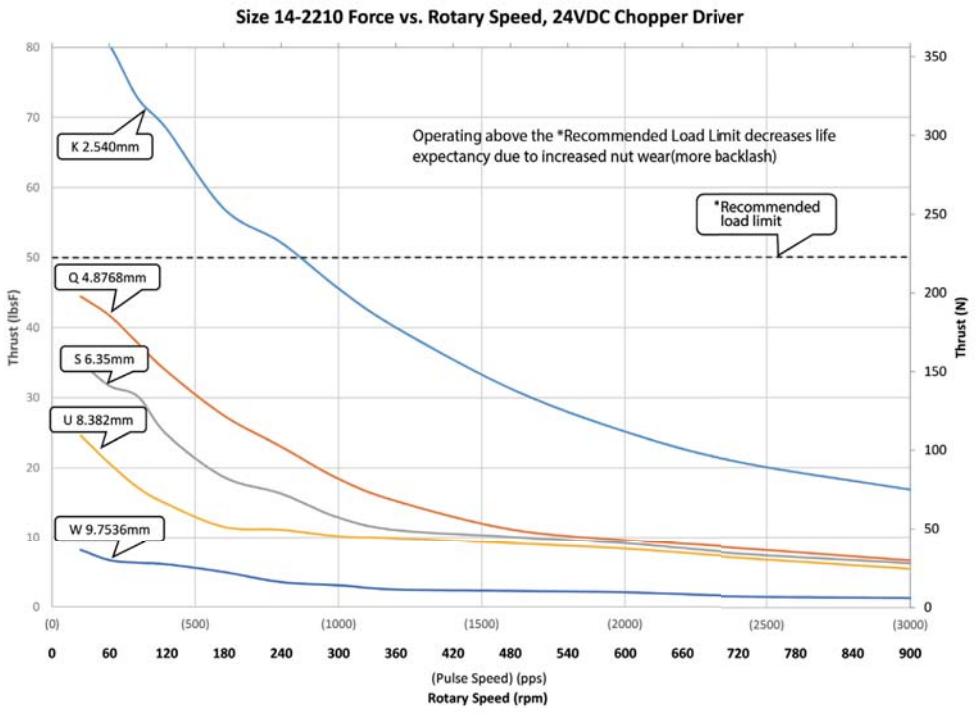
NEMA 14 Single-Stack Linear Speed



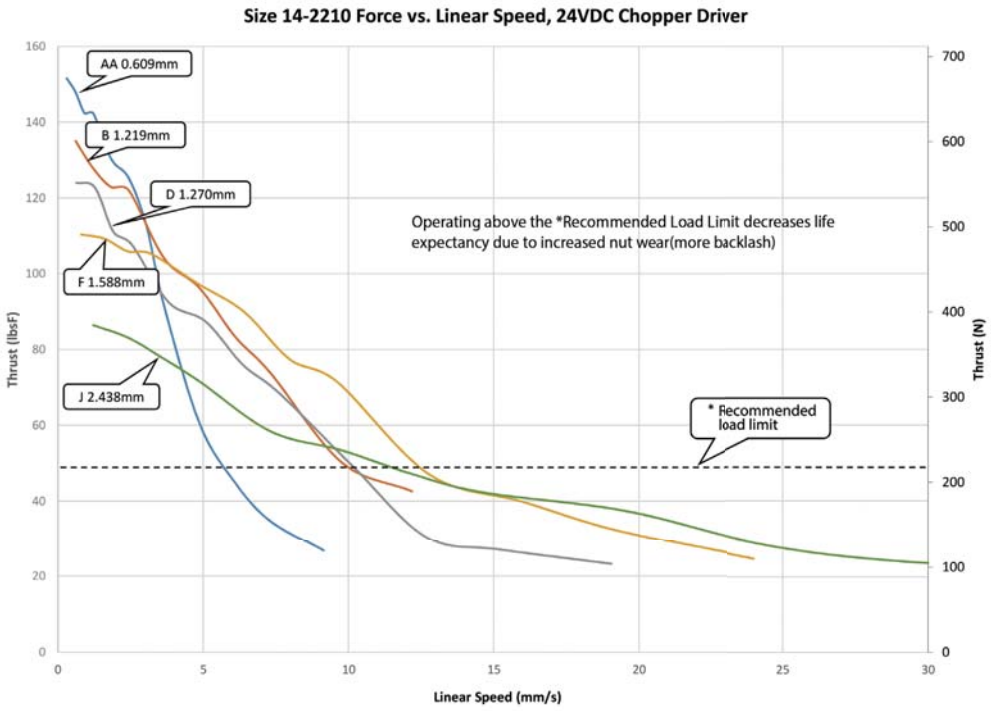
NEMA 14 Double-Stack Rotary Speed



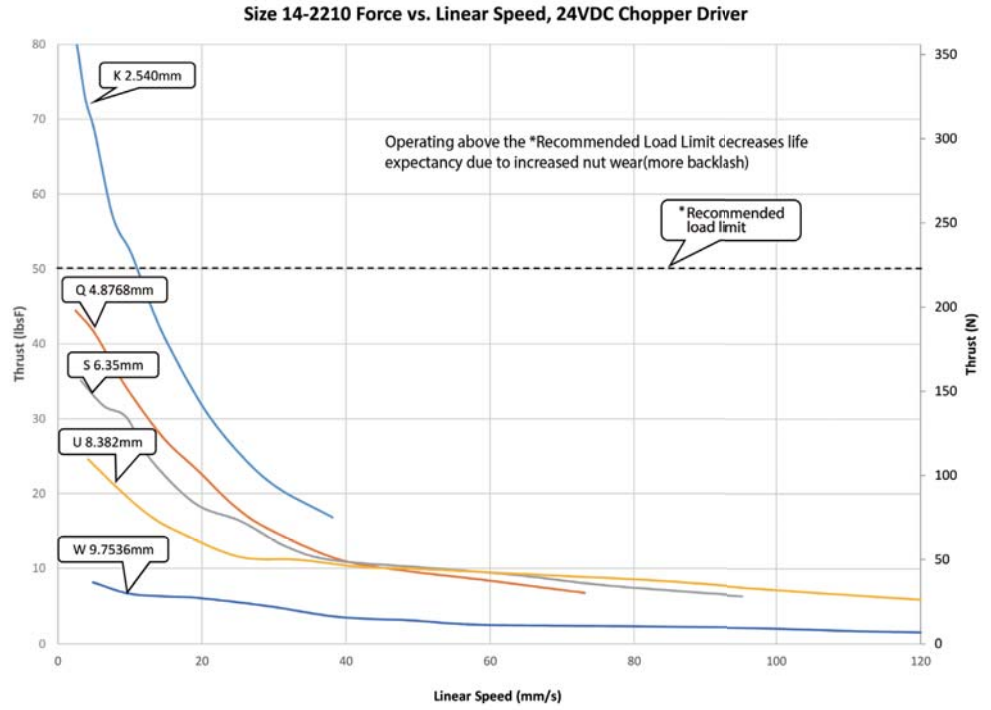
NEMA 14 Double-Stack Rotary Speed



NEMA 14 Double-Stack Linear Speed

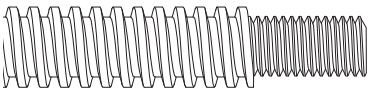
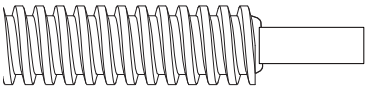
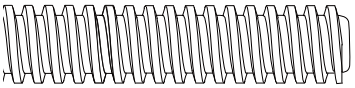


NEMA 14 Double-Stack Linear Speed



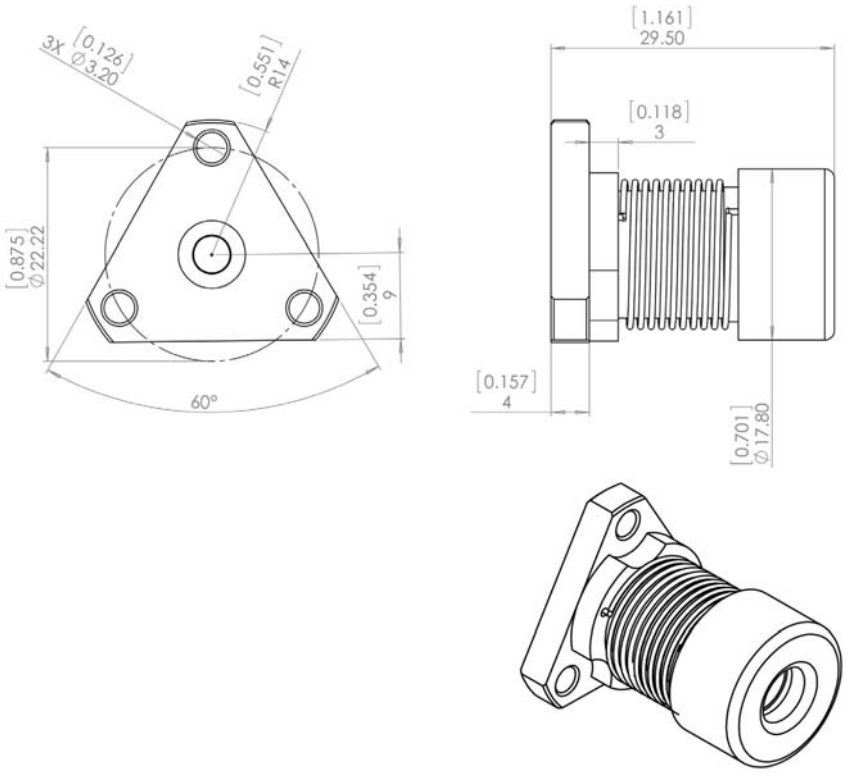
Option & Anti-backlash Nut

End Machining Option

Standard Lead Screw End Machining		
	Threaded End	Metric End : M4 x 0.7mm UNC End : 8-32 UNC
	Smooth End	Ø4mm ±0.025 Ø0.1575″ ±0.0010
	None	-

End Machining
Metric End : M6 x 1.0mm UNC End : 8-32 UNC

Anti-backlash Nut



Motor Size(42mm)

NEMA Size 17(42mm)
Hybrid Motor Linear Actuators

The NEMA 17 hybrid precision linear actuator provides up to 60lbsF(266N) of continuous thrust. A Captive version is available in this frame size. Ball Screw versions are also available.

1. Parameters

Please contact FASTECH or your local FASTECH representative about custom products.

Motor	Voltage (V)	Current (A)	Resistance (Ω)	Inductance (mH)	Lead Wire No.	Motor Length (mm)
17-2105	7.2	0.5	14.4	19.8	4	34
17-2110	3.6	1	3.6	5	4	34
17-2115	2.4	1.5	1.6	2.2	4	34
17-2205	11	0.5	22	46	4	48
17-2212	4.5	1.2	3.8	8	4	48
17-2225	2.2	2.5	0.87	1.8	4	48

2. Available Lead Screws and Travel per Step

Please contact FASTECH or your local FASTECH representative about custom products.

Screw Dia. (in.)	Screw Dia. (mm)	Lead (in.)	Lead (mm)	Lead Code	Travel Per Step @ 1.8 deg(mm)*	Travel Per Step @ 0.9 deg(mm)*
0.25	6.35	0.024	0.6096	AA	0.003	0.0015
0.25	6.35	0.048	1.2192	B	0.006	0.003
0.25	6.35	0.05	1.27	D	0.006	0.0032
0.25	6.35	0.0625	1.5875	F	0.0079375	0.0039688
0.25	6.35	0.096	2.4384	J	0.012	0.0061
0.25	6.35	0.1	2.54	K	0.012	0.0064
0.25	6.35	0.192	4.8768	Q	0.024	0.0122
0.25	6.35	0.25	6.35	S	0.031	0.0159
0.25	6.35	0.33	8.382	U	0.041	0.021
0.25	6.35	0.384	9.7536	W	0.048	0.0244
0.25	6.35	0.5	12.7	Y	0.0635	0.03175

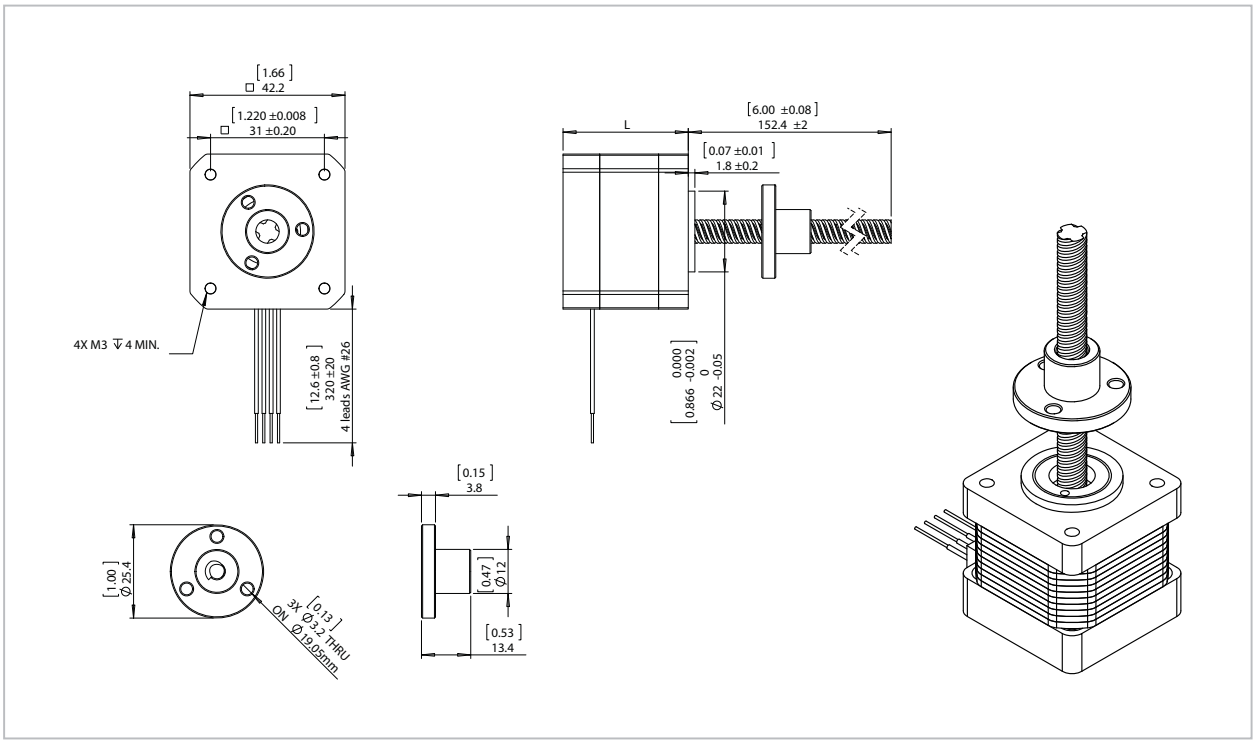
* Values truncated

3. NEMA 17 Custom Lead Screw DIA Available for

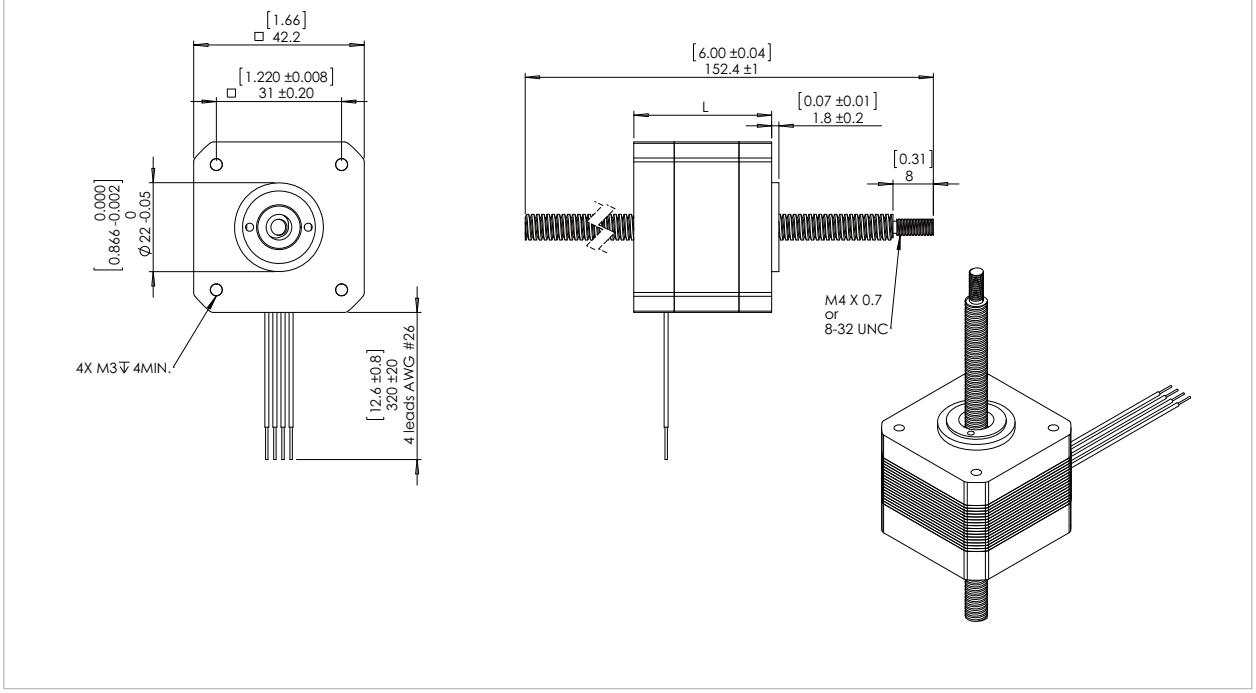
0.375" DIA shaft available with external shaft version

Dimensions

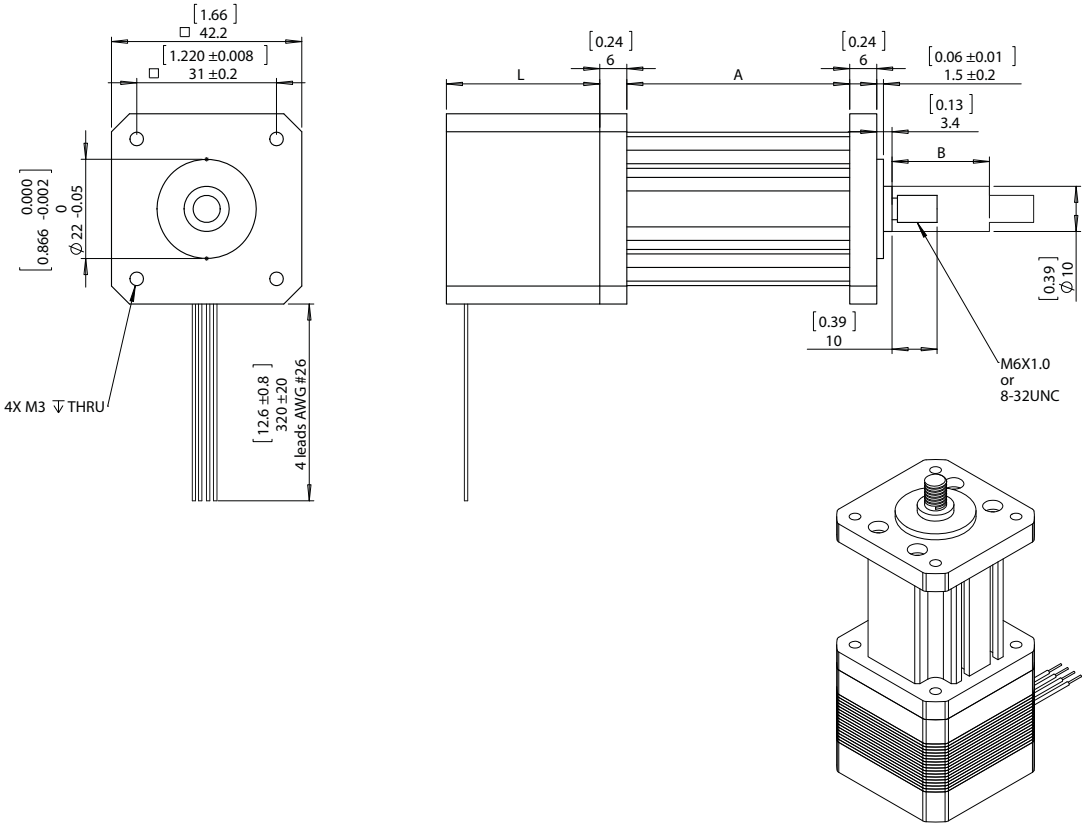
NEMA Size 17 EXTERNAL Linear Actuator



NEMA Size 17 NON-CAPTIVE Linear Actuator



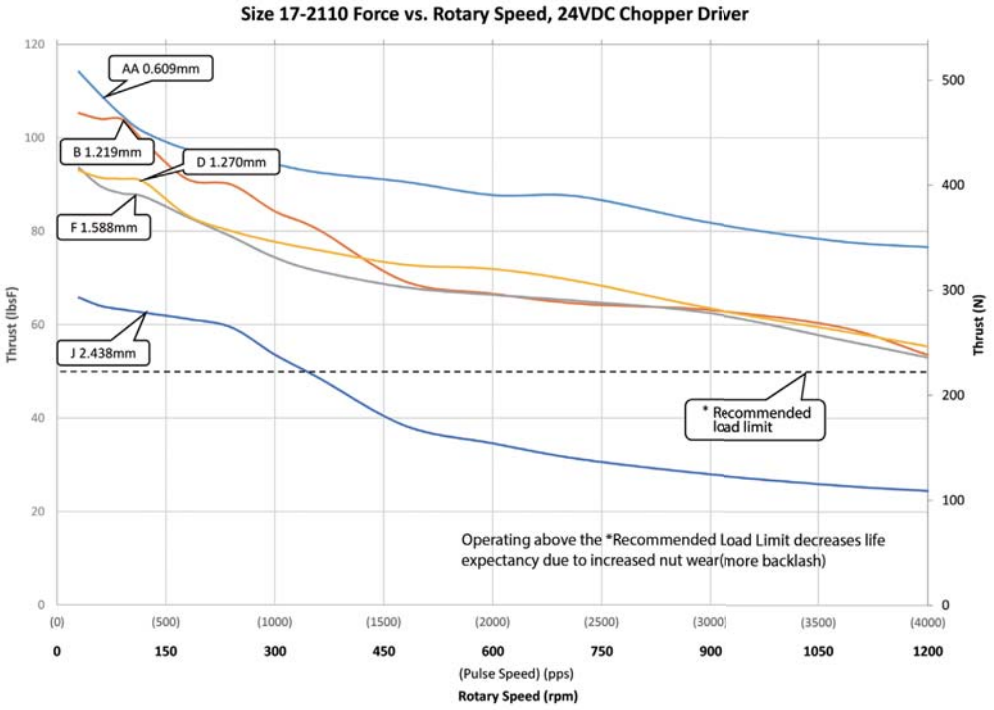
NEMA Size 17 CAPTIVE Linear Actuator



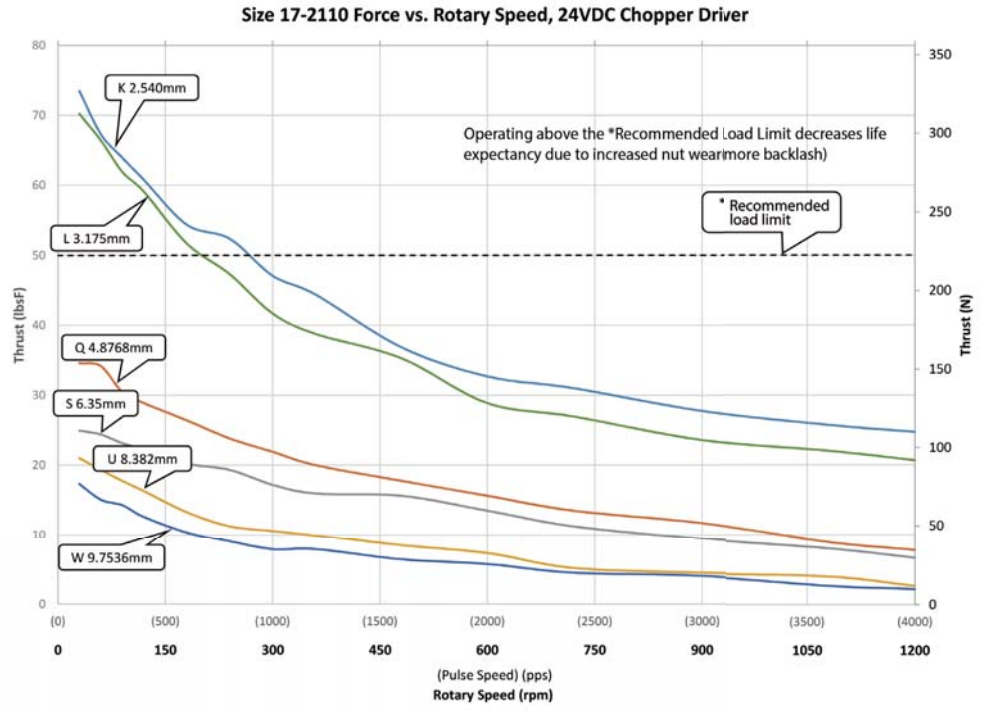
Stroke B inch(mm)	Dimension A(mm)	Dimension L(mm)	
0.5(12.7)	36.7	Single Stack Motor 35mm	Double Stack Motor 49mm
0.75(19.05)	43.05		
1.0(25.4)	49.4		
1.25(31.8)	55.8		
1.5(38.1)	62.1		
2.0(50.8)	74.8		
2.5(63.5)	87.5		

Speed Thrust Curves

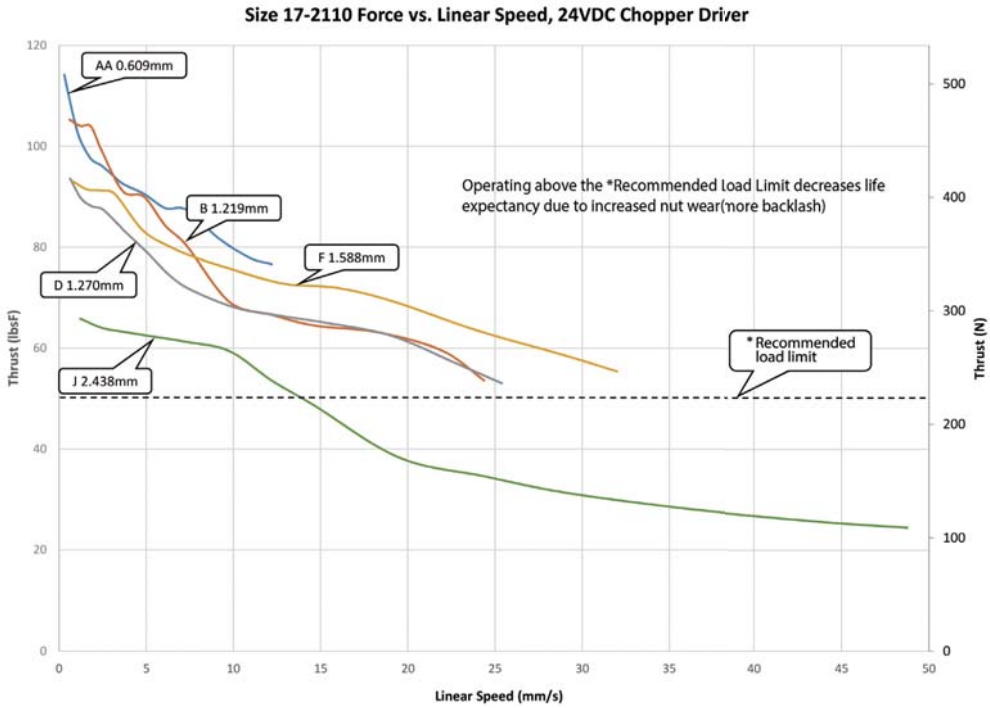
NEMA 17 Single-Stack Rotary Speed



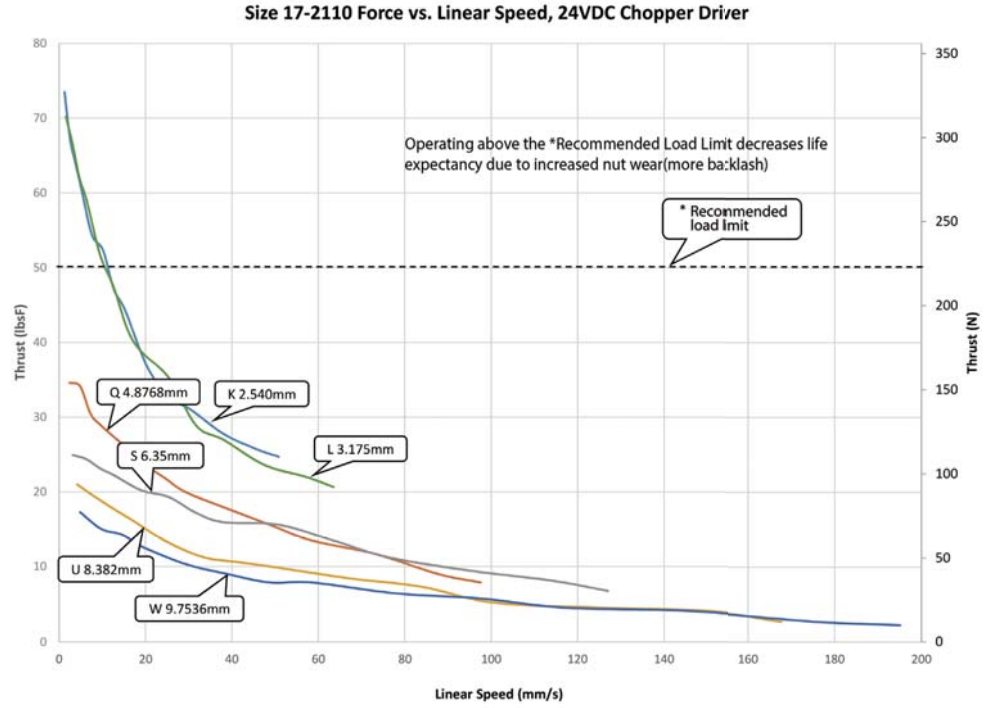
NEMA 17 Single-Stack Rotary Speed



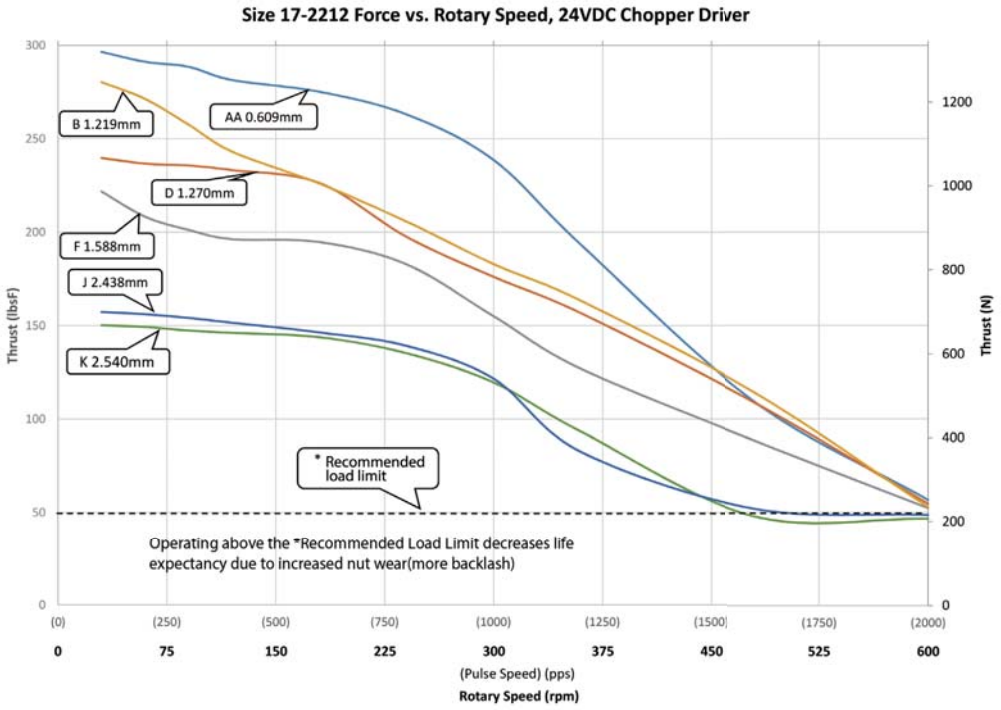
NEMA 17 Single-Stack Linear Speed



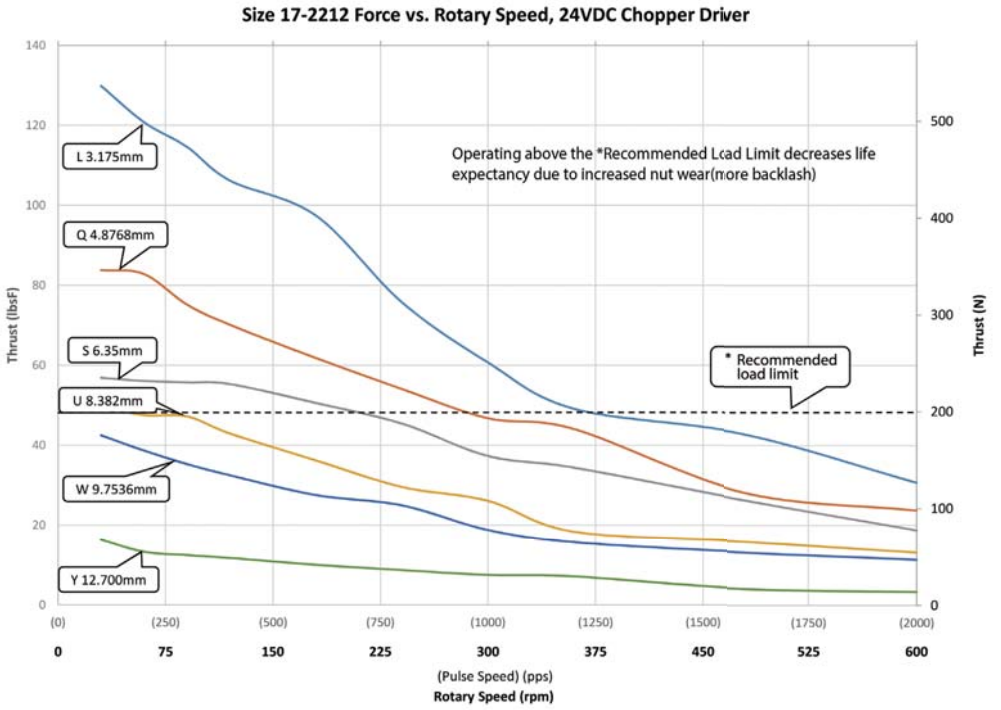
NEMA 17 Single-Stack Linear Speed



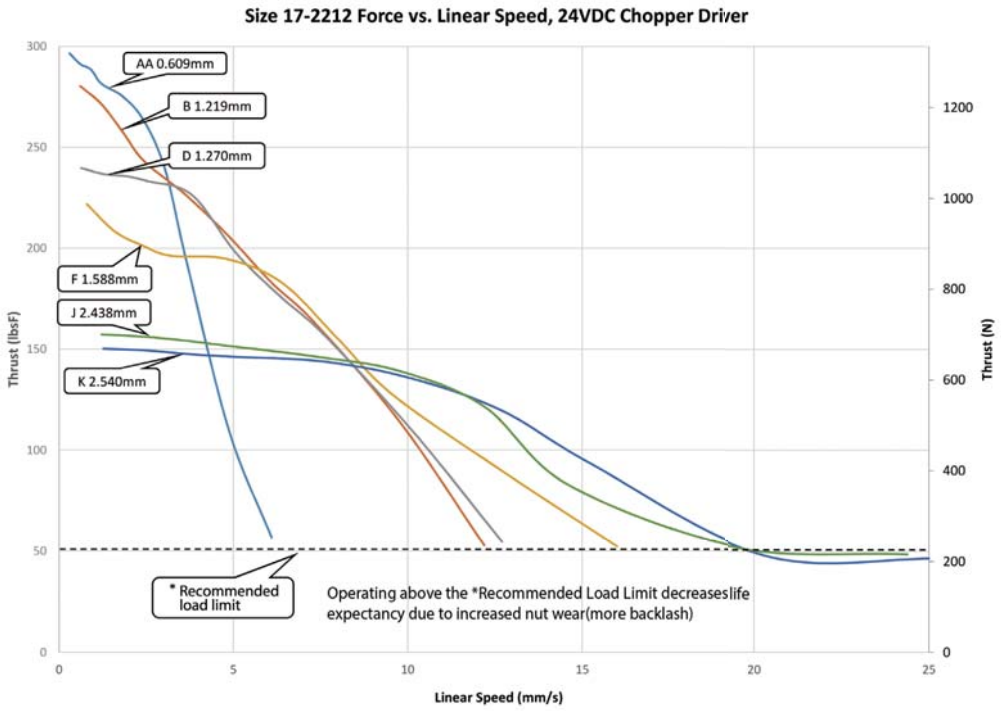
NEMA 17 Double-Stack Rotary Speed



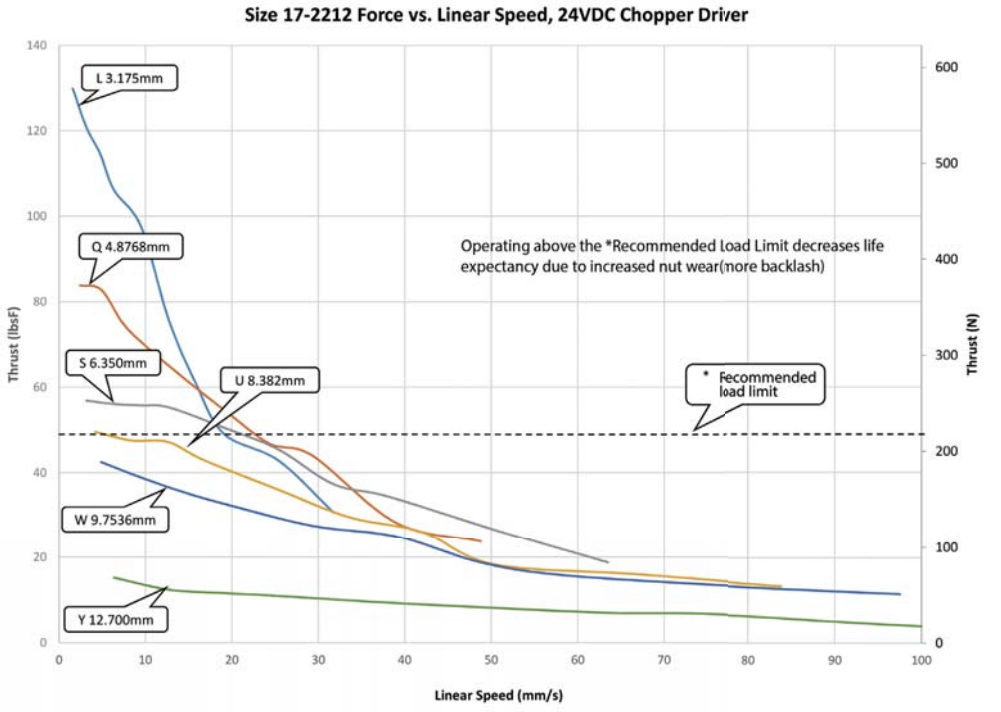
NEMA 17 Double-Stack Rotary Speed



NEMA 17 Double-Stack Linear Speed

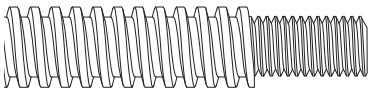
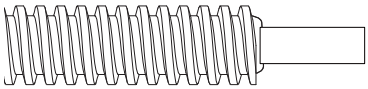
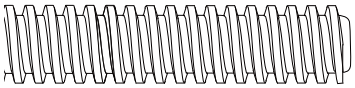


NEMA 17 Double-Stack Linear Speed



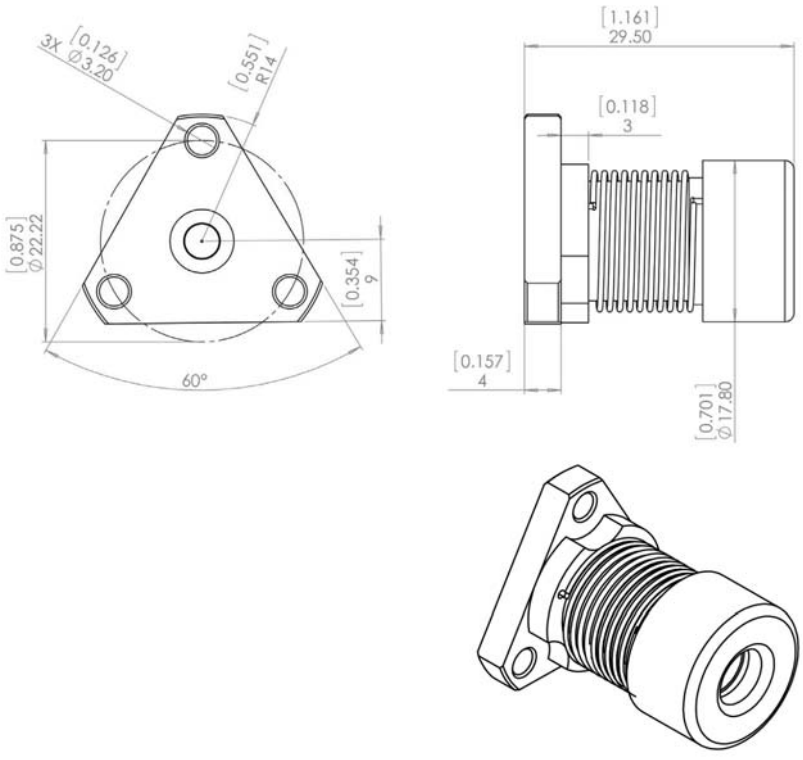
Option & Anti-backlash Nut

End Machining Option

Standard Lead Screw End Machining		
	Threaded End	Metric End : M4 x 0.7mm UNC End : 8-32 UNC
	Smooth End	Ø4mm ±0.025 Ø0.1575˝ ±0.0010
	None	-

End Machining
Metric End : M6 x 1.0mm UNC End : 8-32 UNC

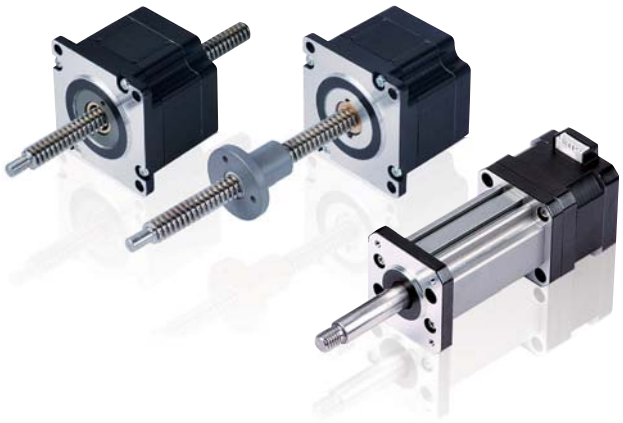
Anti-backlash Nut



Motor Size(57mm)

NEMA Size 23(57mm)
Hybrid Motor Linear Actuators

The NEMA 23 hybrid precision linear actuator is capable of 200lbsF(890N) of continuous thrust. A Captive version is available in this frame size. Ball Screw versions are also available.



1. Parameters

Please contact FASTECH or your local FASTECH representative about custom products.

Motor	Voltage (V)	Current (A)	Resistance (Ω)	Inductance (mH)	Lead Wire No.	Motor Length (mm)
23-2110	6.4	1	6.4	16.4	4	45
23-2120	3.2	2	1.6	4.1	4	45
23-2130	2.1	3	0.7	1.7	4	45
23-2210	10.8	1	10.8	32	4	65
23-2225	4.2	2.5	1.7	5.2	4	65
23-2240	2.4	4	0.65	2	4	65

2. Available Lead Screws and Travel per Step

Please contact FASTECH or your local FASTECH representative about custom products.

Screw Dia. (in.)	Screw Dia. (mm)	Lead (in.)	Lead (mm)	Lead Code	Travel Per Step @ 1.8 deg(mm)*	Travel Per Step @ 0.9 deg(mm)*
0.375	9.525	0.025	0.635	A	0.003	0.0016
0.375	9.525	0.05	1.27	D	0.006	0.0032
0.375	9.525	0.0625	1.5875	F	0.0079375	0.0039688
0.375	9.525	0.083	2.1082	H	0.01	0.0053
0.375	9.525	0.1	2.54	K	0.012	0.0064
0.375	9.525	0.125	3.175	L	0.015	0.0079
0.375	9.525	0.167	4.2418	P	0.021	0.0106
0.375	9.525	0.2	5.08	R	0.025	0.0127
0.375	9.525	0.25	6.35	S	0.031	0.0159
0.375	9.525	0.375	9.525	V	0.047	0.0238
0.375	9.525	0.384	9.7536	W	0.048	0.0244
0.375	9.525	0.5	12.7	Y	0.063	0.0318
0.375	9.525	1	25.4	Z	0.127	0.0635

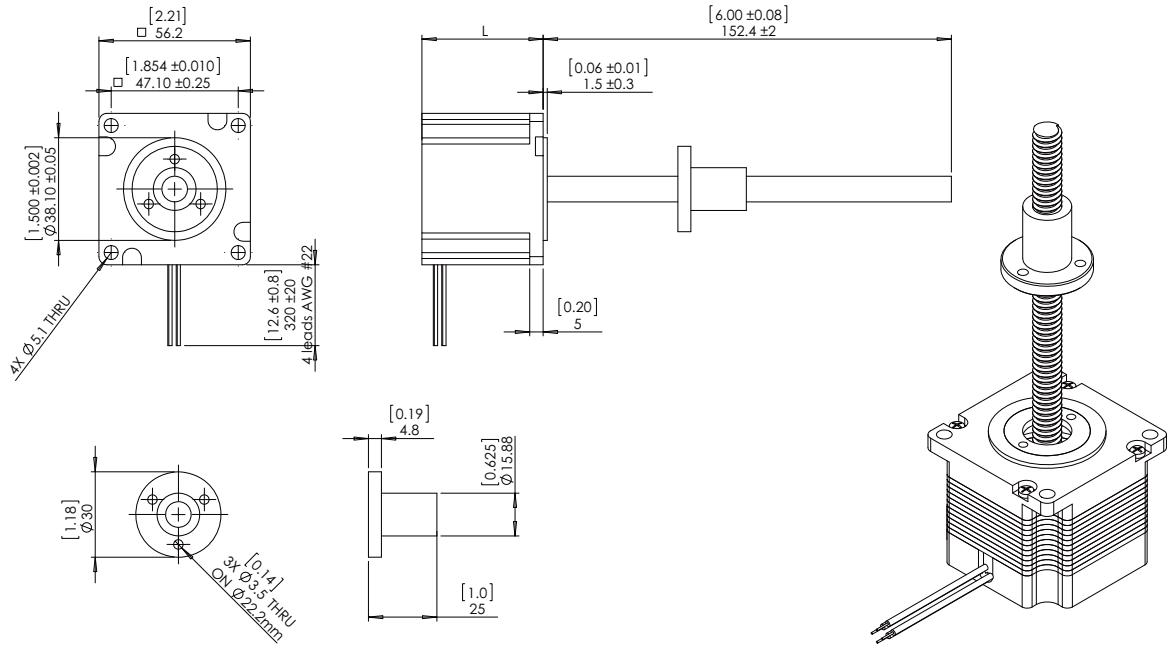
* Values truncated

3. NEMA 23 Custom Lead Screw DIA Available for

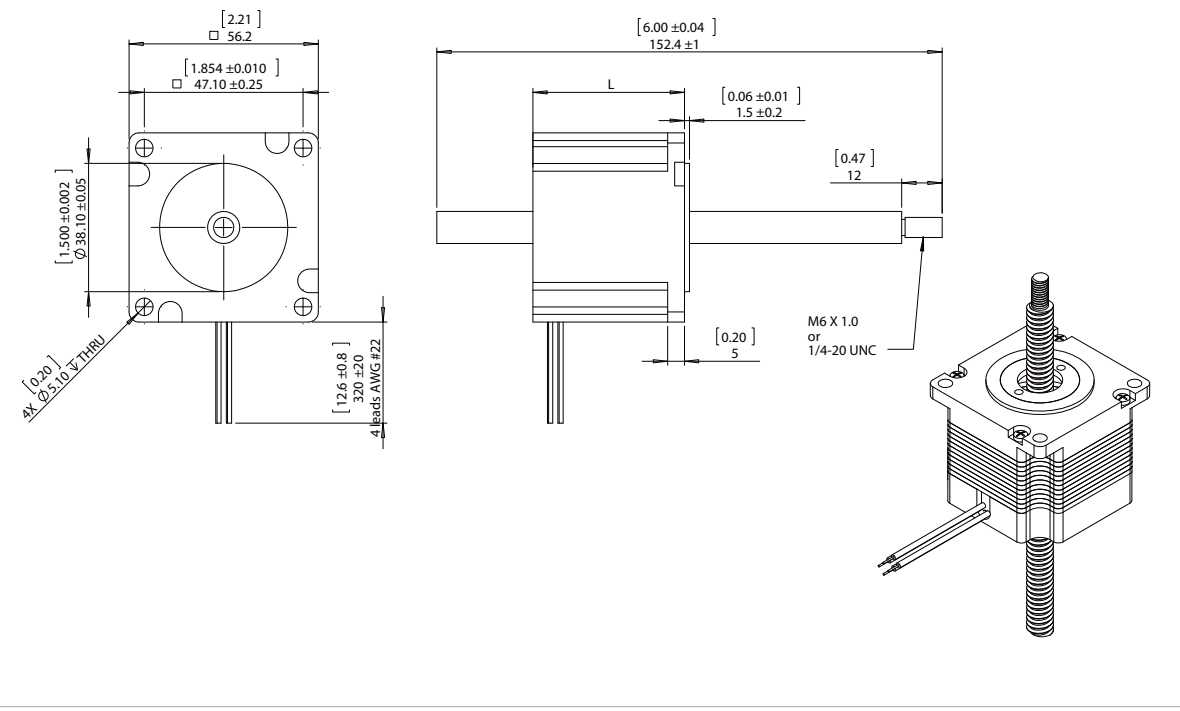
0.625" DIA shaft available with external shaft version

Dimensions

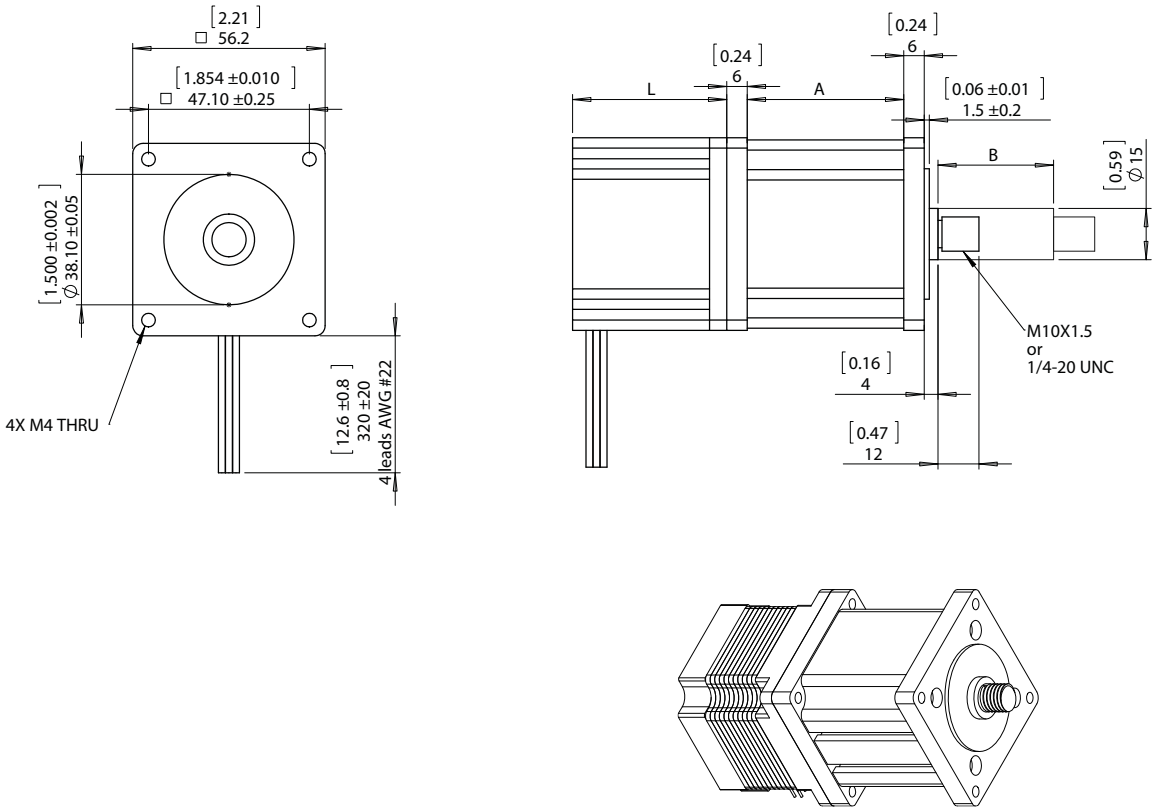
NEMA Size 23 EXTERNAL Linear Actuator



NEMA Size 23 NON-CAPTIVE Linear Actuator



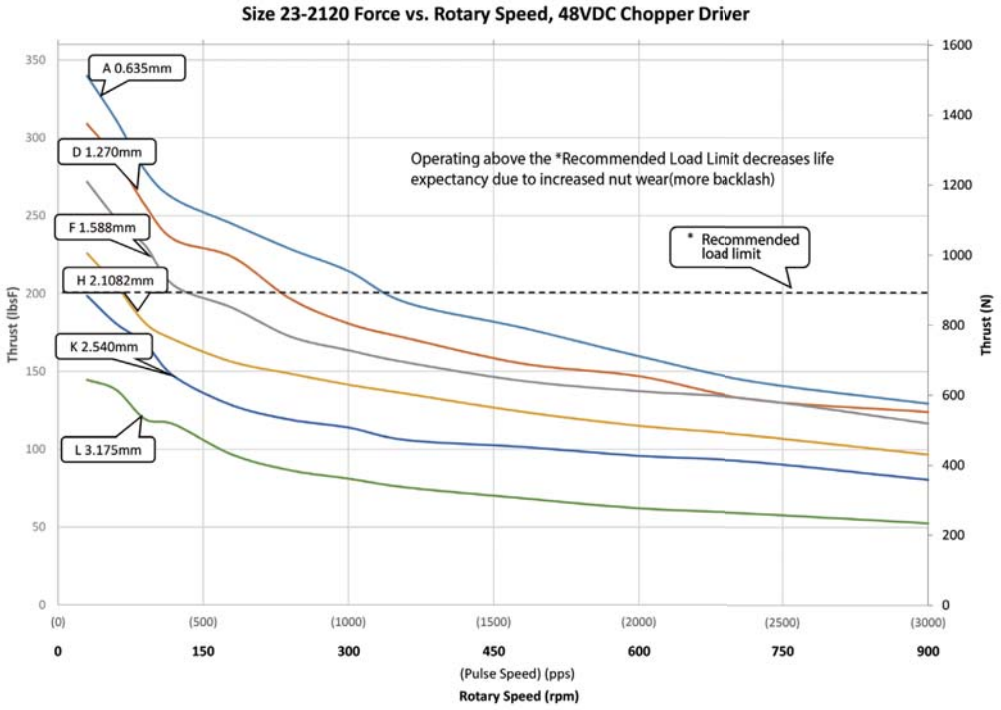
NEMA Size 23 CAPTIVE Linear Actuator



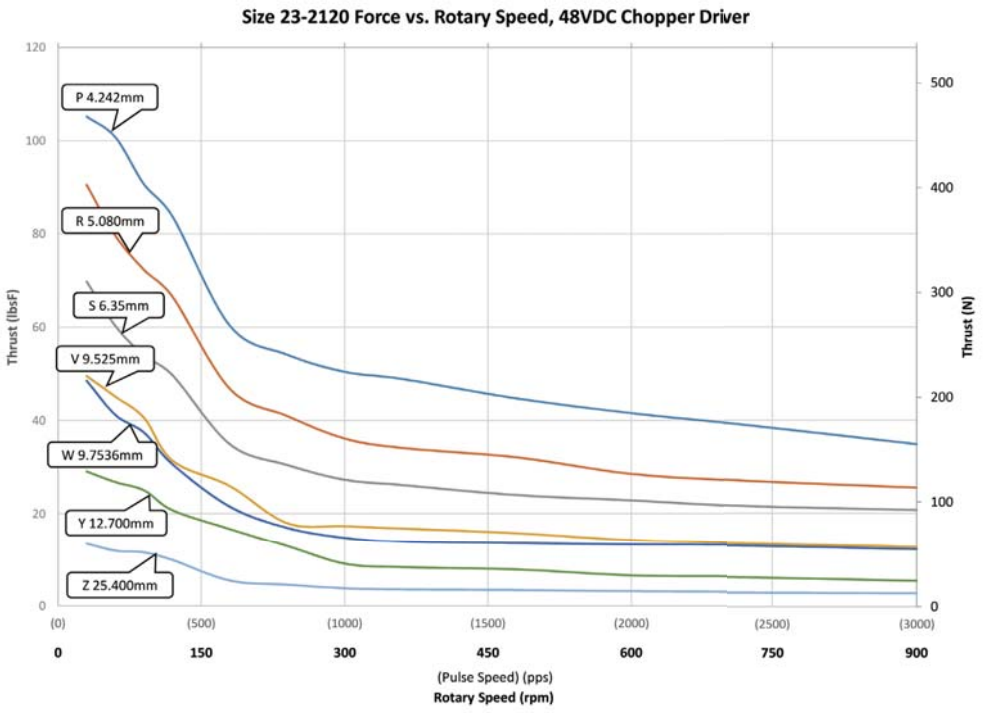
Stroke B inch(mm)	Dimension A(mm)	Dimension L(mm)	
0.5(12.7)	45.7	Single Stack Motor 47mm	Double Stack Motor 66mm
0.75(19.05)	52.05		
1.0(25.4)	58.4		
1.25(31.8)	64.8		
1.5(38.1)	71.1		
2.0(50.8)	83.8		
2.5(63.5)	96.5		

Speed Thrust Curves

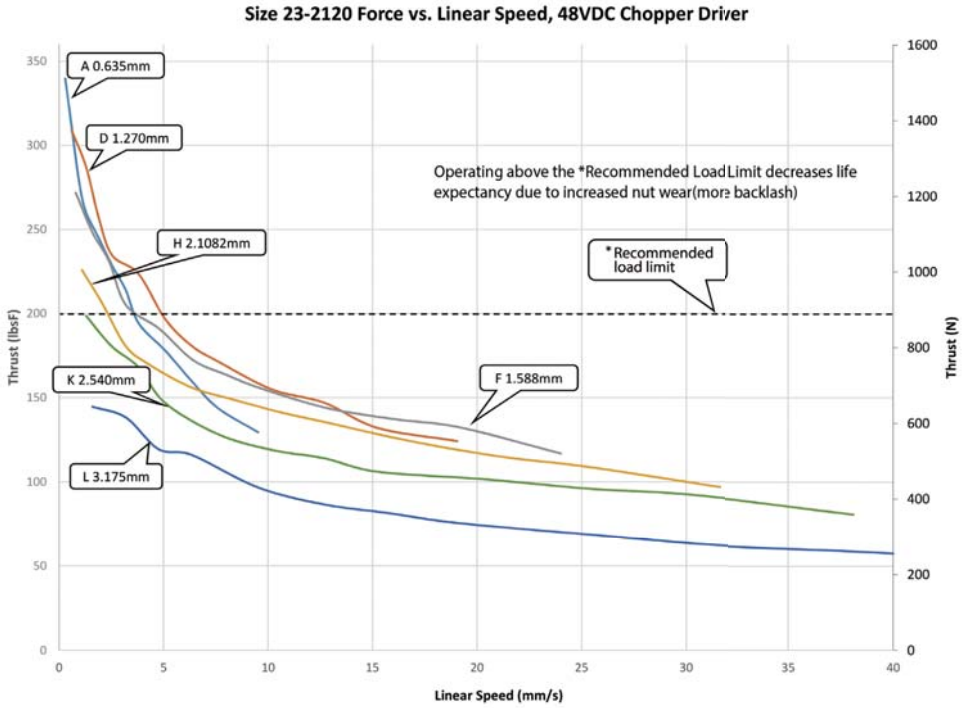
NEMA 23 Single-Stack Rotary Speed



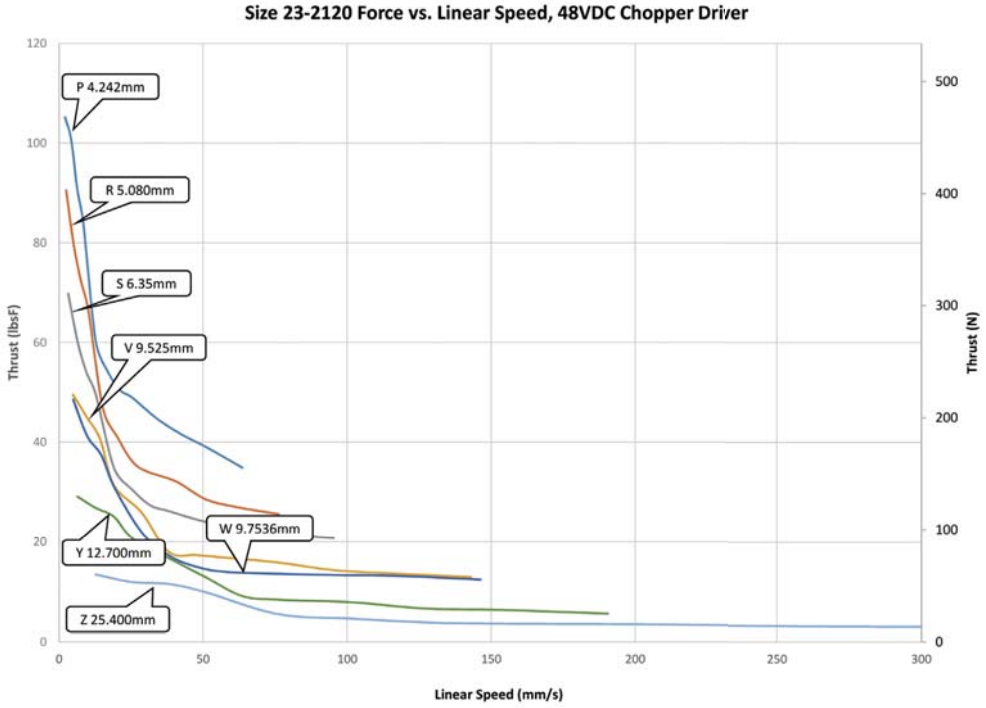
NEMA 23 Single-Stack Rotary Speed



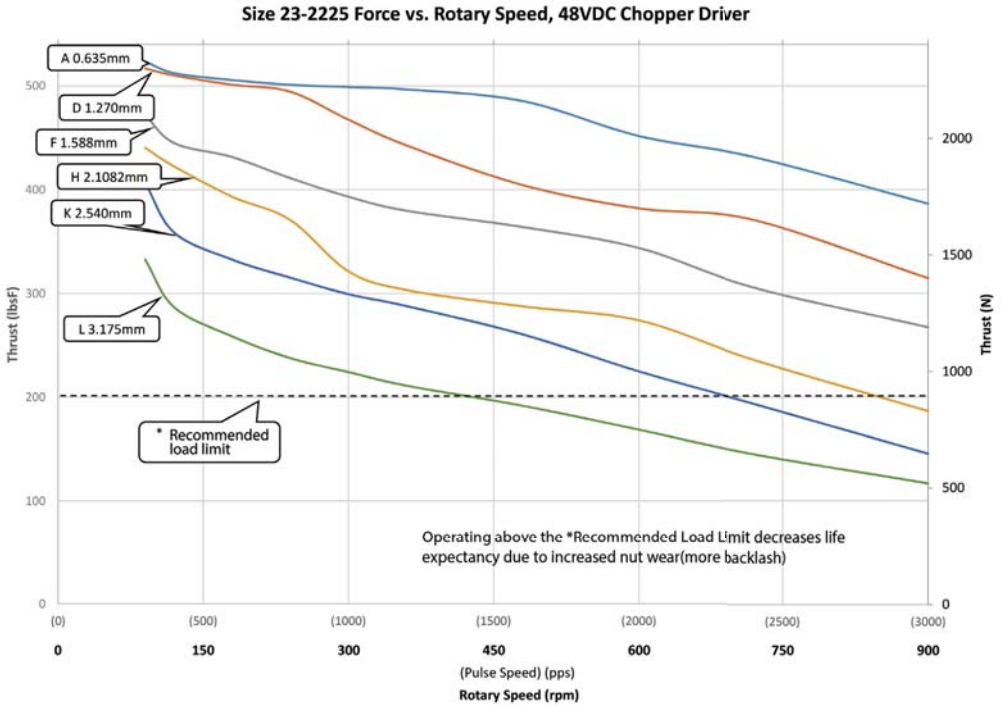
NEMA 23 Single-Stack Linear Speed



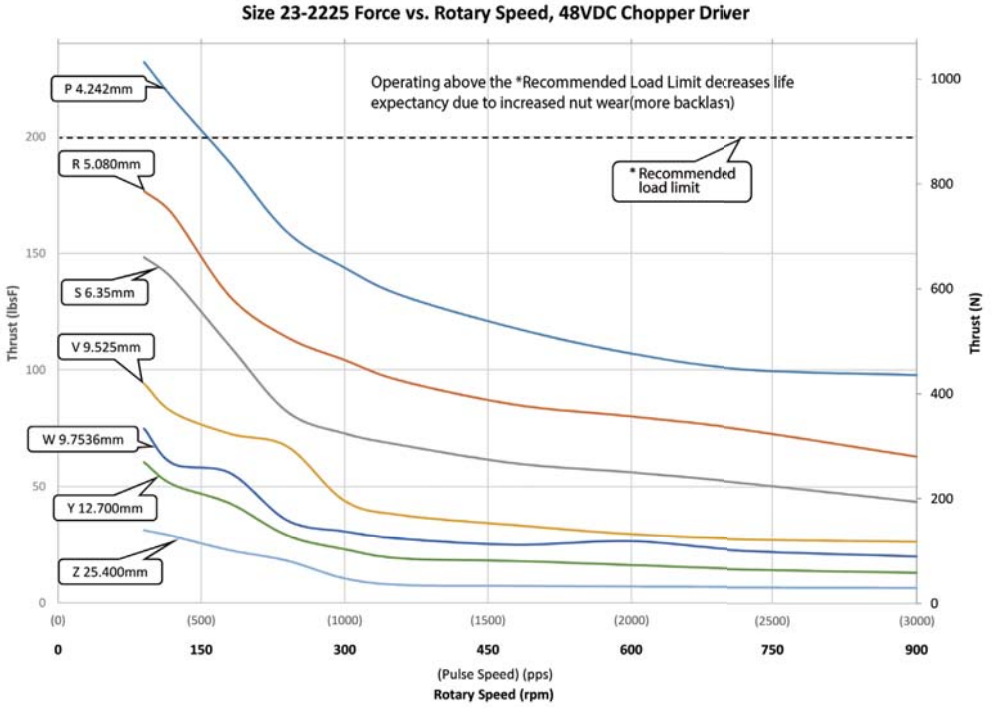
NEMA 23 Single-Stack Linear Speed



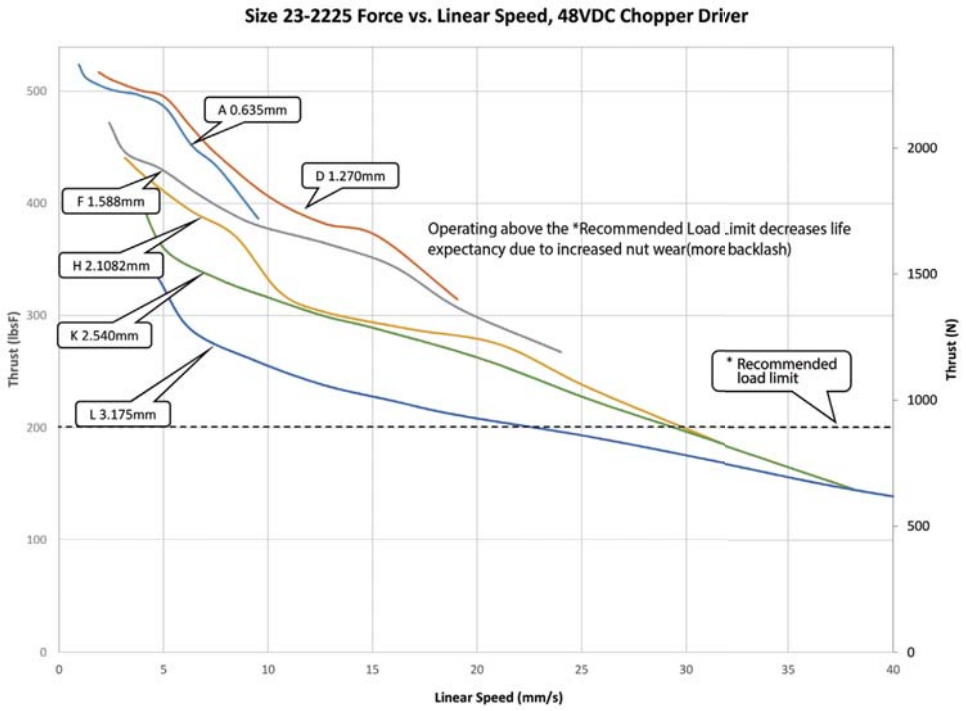
NEMA 23 Double-Stack Rotary Speed



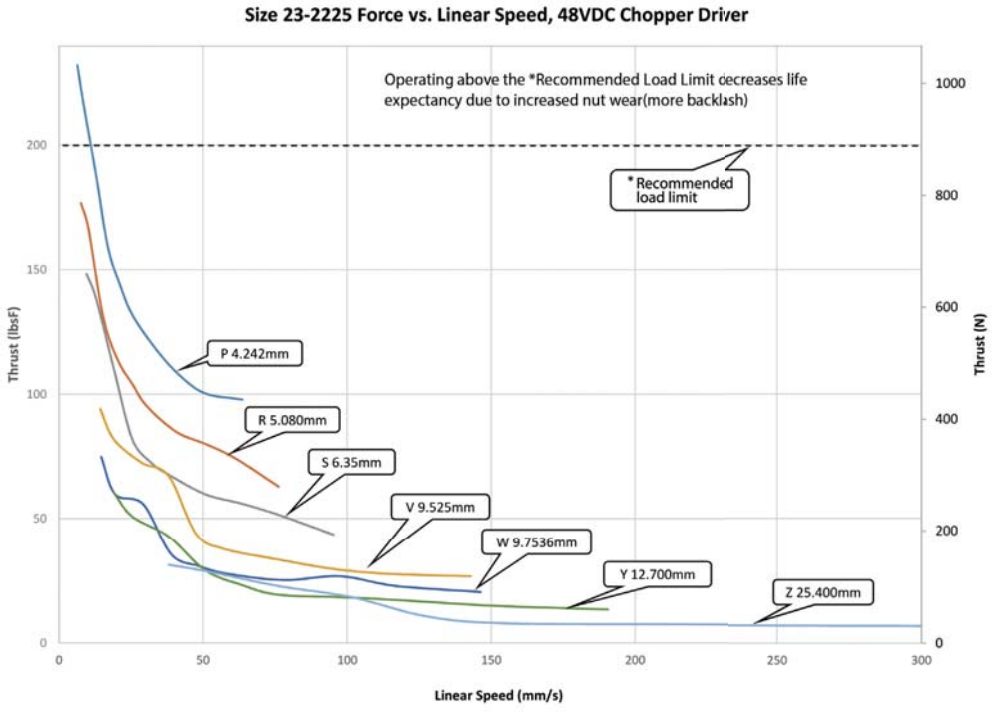
NEMA 23 Double-Stack Rotary Speed



NEMA 23 Double-Stack Linear Speed

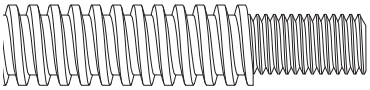
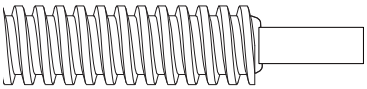
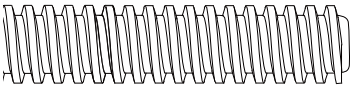


NEMA 23 Double-Stack Linear Speed



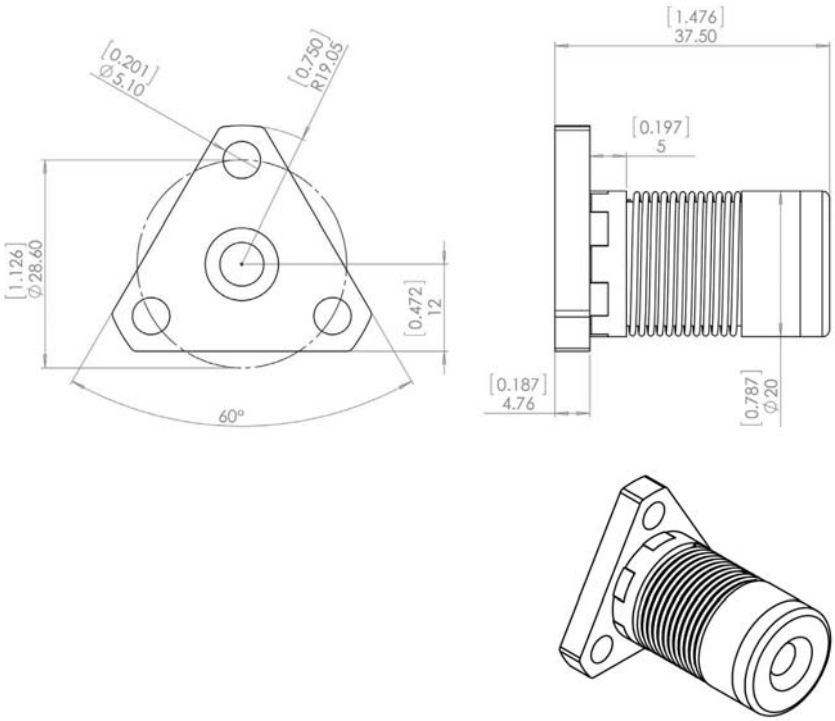
Option & Anti-backlash Nut

End Machining Option

Standard Lead Screw End Machining		
	Threaded End	Metric End : M6 x 1.0mm UNC End : 1/4-20 UNC
	Smooth End	Ø6mm ±0.025 Ø0.2362″ ±0.0010
	None	-

End Machining
Metric End : M10 x 1.5mm UNC End : 1/4-20 UNC

Anti-backlash Nut



Motor Size(86mm)

NEMA Size 34(86mm)
Hybrid Motor Linear Actuators

The NEMA 34 hybrid precision linear actuator is capable of 500lbsF(2,225N) of continuous thrust. Ball Screw versions are also available.

1. Motor Characteristics

Please contact FASTECH or your local FASTECH representative about custom products.

Motor	Voltage (V)	Current (A)	Resistance (Ω)	Inductance (mH)	Lead Wire No.	Motor Length (mm)
34-2113	12	1.3	9.2	71	4	76
34-2130	5.1	3	1.7	15	4	76
34-2155	2.85	5.5	0.52	4.5	4	76

2. Available Lead Screws and Travel per Step

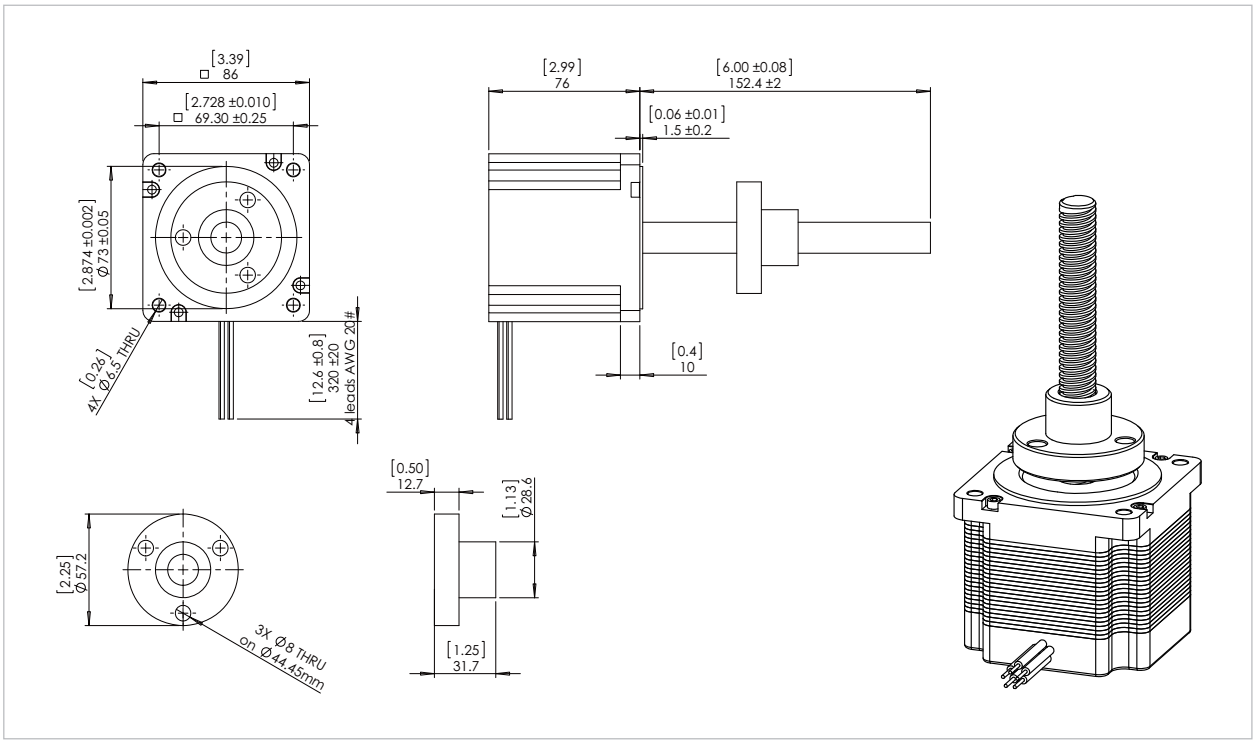
Please contact FASTECH or your local FASTECH representative about custom products.

Screw Dia. (in.)	Screw Dia. (mm)	Lead (in.)	Lead (mm)	Lead Code	Travel Per Step @ 1.8 deg(mm)*	Travel Per Step @ 0.9 deg(mm)*
0.625	15.875	0.1	2.54	K	0.012	0.0051
0.625	15.875	0.125	3.175	L	0.015	0.0064
0.625	15.875	0.2	5.08	R	0.025	0.0102
0.625	15.875	0.25	6.35	S	0.031	0.0127
0.625	15.875	0.5	12.7	Y	0.0635	0.03175
0.625	15.875	1	25.4	Z	0.127	0.0508

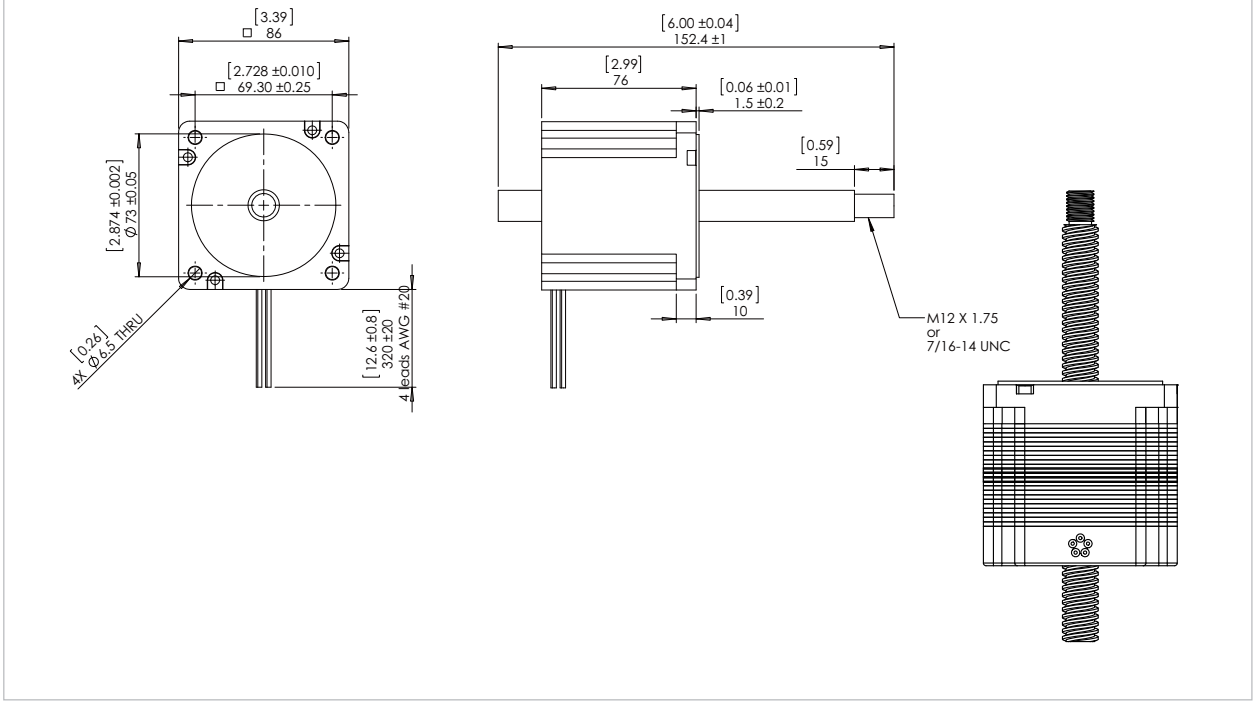
* Values truncated

Dimensions

NEMA Size 34 EXTERNAL Linear Actuator

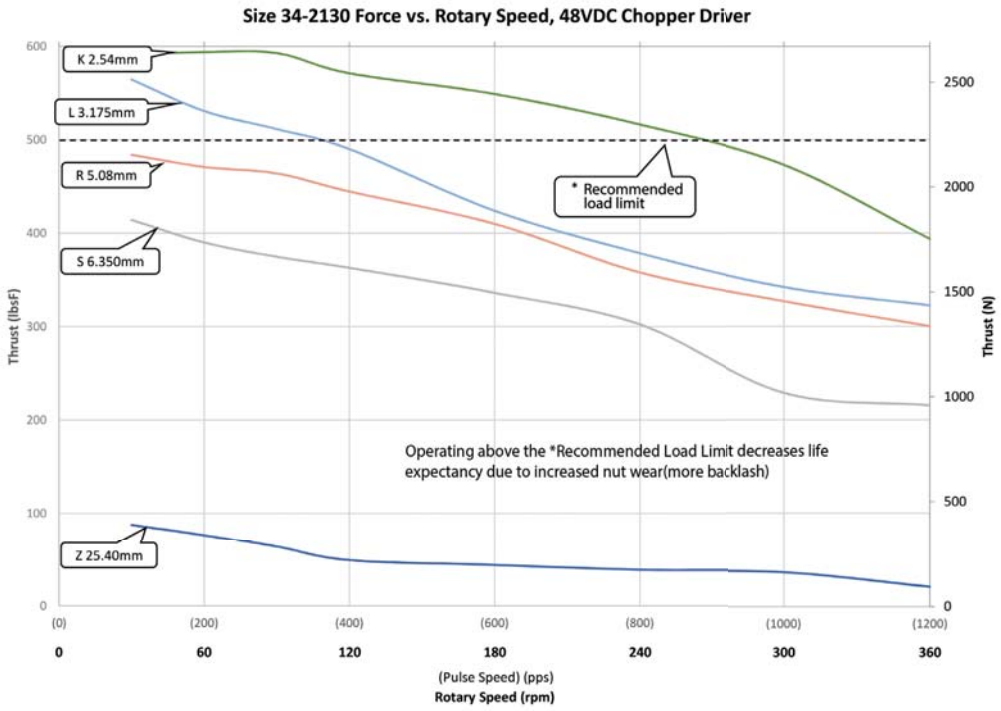


NEMA Size 34 NON-CAPTIVE Linear Actuator

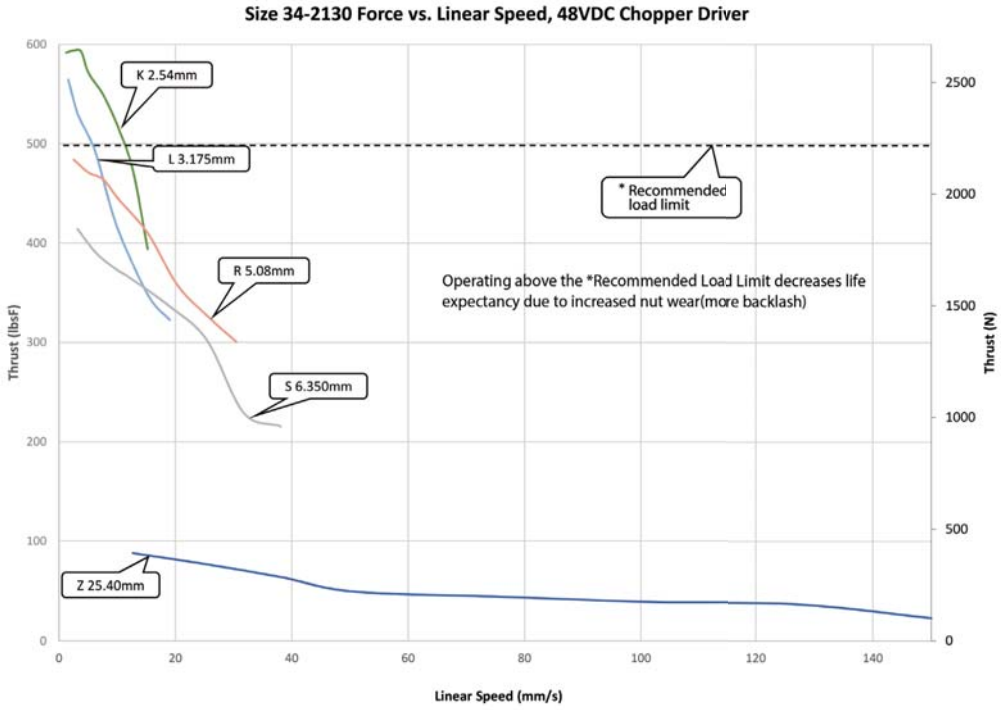


Speed Thrust Curves

NEMA 34 Single-Stack Rotary Speed

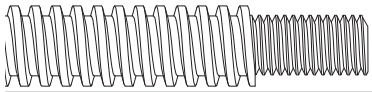
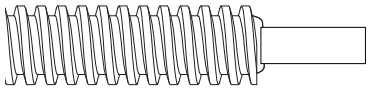
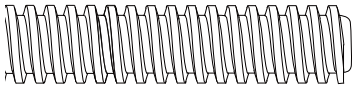


NEMA 34 Single-Stack Linear Speed



Option

End Machining Option

Standard Lead Screw End Machining		
	Threaded End	Metric End : M12 x 1.75mm UNC End : 7/16-14 UNC
	Smooth End	Ø12mm ±0.025 Ø0.4724″ ±0.0010
	None	-

PM Stepper Motor Linear Actuators

Product Profile

1. PM Motor Specification and Characteristic

Motor Size (mm)	Max. Thrust (V)	Travel per Step (A)	Rated Power (Ω)
Ø20	23	0.00625 - 0.1667	3.4
Ø25	65	0.00625 - 0.3333	3.9
Ø36	115	0.0132 - 0.2117	5.6

2. PM Motor Available Lead Screws and Motor Combination Guideline

Motor Size	Screw Dia. (mm)	Step Angle	Lead(mm)	Travel per Step(mm)	Lead Code
Ø20	3.5	7.5/15	0.3	0.00625 / 0.0125	AF
		7.5/15	0.6096	0.0127 / 0.0254	AA
		7.5/15	1.2192	0.0254 / 0.0508	B
		7.5/15	2	0.0417 / 0.0833	G
		7.5/15	4	0.0833 / 0.1667	M
Ø25	3.5	7.5/15	0.3	0.00625 / 0.0125	AF
		7.5/15	0.6096	0.0127 / 0.0254	AA
		7.5/15	1.2192	0.0254 / 0.0508	B
		7.5/15	2	0.0417 / 0.0833	G
		7.5/15	4	0.0833 / 0.1667	M
		7.5/15	8	0.1667 / 0.3333	T
Ø36	4.775	7.5/15	0.635	0.0132 / 0.0265	A
		7.5/15	1.27	0.0265 / 0.0529	D
		7.5/15	2.54	0.0529 / 0.1058	K
		7.5/15	5.08	0.1058 / 0.2117	R

Part Numbering Method

E 25 P 1 4 A 05 - 001 - X

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

① Motor Type

E = External drive
N = Non-captive drive
C = Captive drive

② Motor Size

20 / 25 / 36

③ PM Motor Abbr.

④ Motor Step Angle

⑤ Motor Polarity

4 = Bipolar / 6 = Unipolar

⑥ Lead

AF - T / AA - A
B - D / G - K
M - R

⑦ Motor Winding Voltage

05=5V / 12=12V

⑧ Customer Code

⑨ Captive motor travel code

1 / 2 / 3 / 4
Uncaptive motor-Blank

※ Example **Part No.** E25P14A05-00X
Introduction Ø25mm •External drive type motor •2 phase 7.5° •5V/phase • "A"lead(0.025˝/0.635 mm) •4 wires

20PM Stepper Motor Linear Actuators

Product Specification

1. Parameters

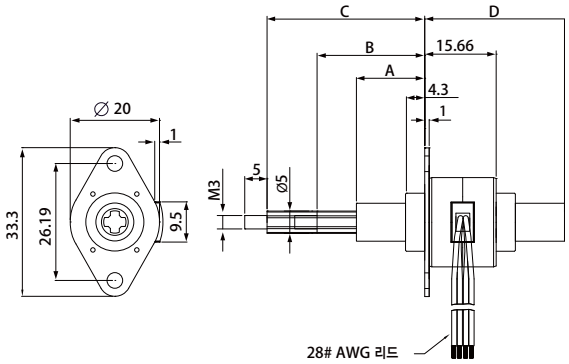
	Ø20mm motor			
Winding Type	Bipolar			
Motor Method	Captive, Non-Captive, External Drive			
Step Angle	7.5°		15°	
Voltage	5V	12V	5V	12V
Current per phase	350mA	160mA	350mA	160mA
Resistance per phase	14Ω	74.5Ω	14Ω	74.5Ω
Inductance per phase	6.24mH	31.2mH	6.84mH	37.8mH
Power	3.38W			
Rotator Inertia	1.05gcm^2			
Insulation class	B Class			
Insulation resistance	20MΩ			
Weight	35g			

2. Step Length Type

Step Angle	Step Length		Lead Code
	mm	inch	
7.5°	0.00625	0.00025	AF
	0.0127	0.00050	AA
	0.0254	0.00100	B
	0.0417	0.00200	G
	0.0833	0.00410	M
15°	0.0125	0.0005	AF
	0.0254	0.00100	AA
	0.0508	0.00210	B
	0.0833	0.00410	G
	0.3333	0.00830	M

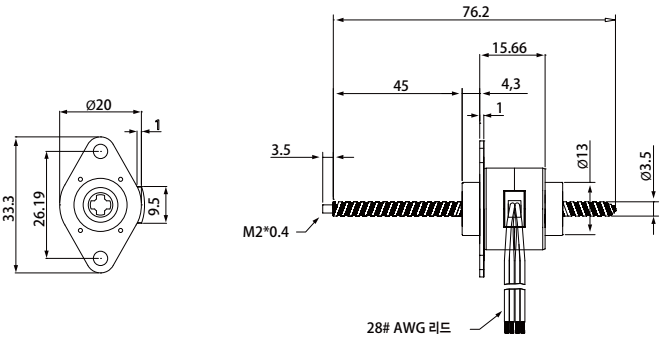
Motor Dimension and Examples

1. Captive Linear actuator

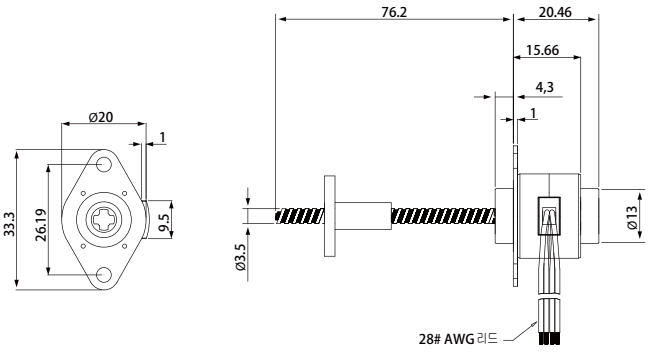


Min. Stroke(mm)	Front Cover A	Retraction B	Stretch C	D(MAX)	Stroke Code
14	14.75 ±0.25	19.99 ±0.64	33.76 ±0.38	28	1
18	20.05 ±0.25	25.25 ±0.64	43.76 ±0.38	33	2
25	27.05 ±0.25	32.23 ±0.64	57.76 ±0.38	40	3
31	33.05 ±0.25	38.23 ±0.64	69.76 ±0.38	46	4

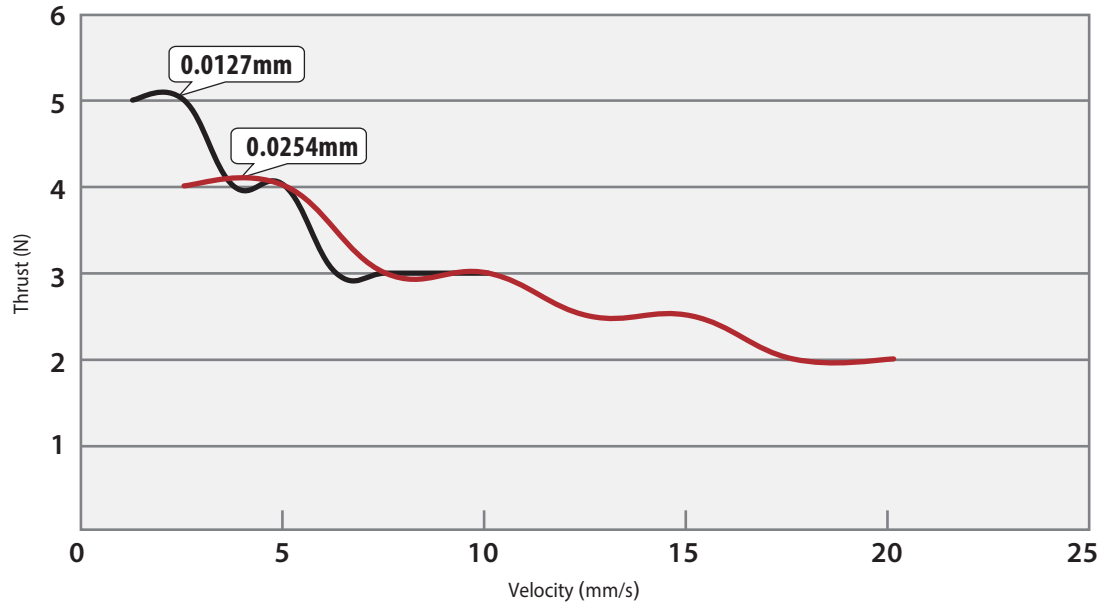
2. Non-Captive Linear actuator



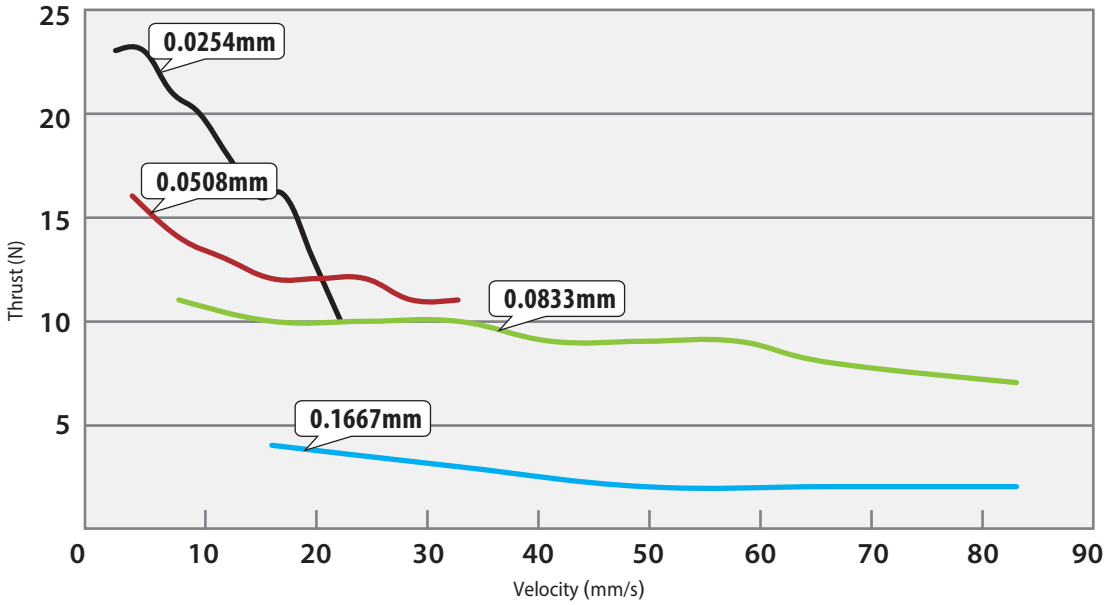
3. External Linear actuator



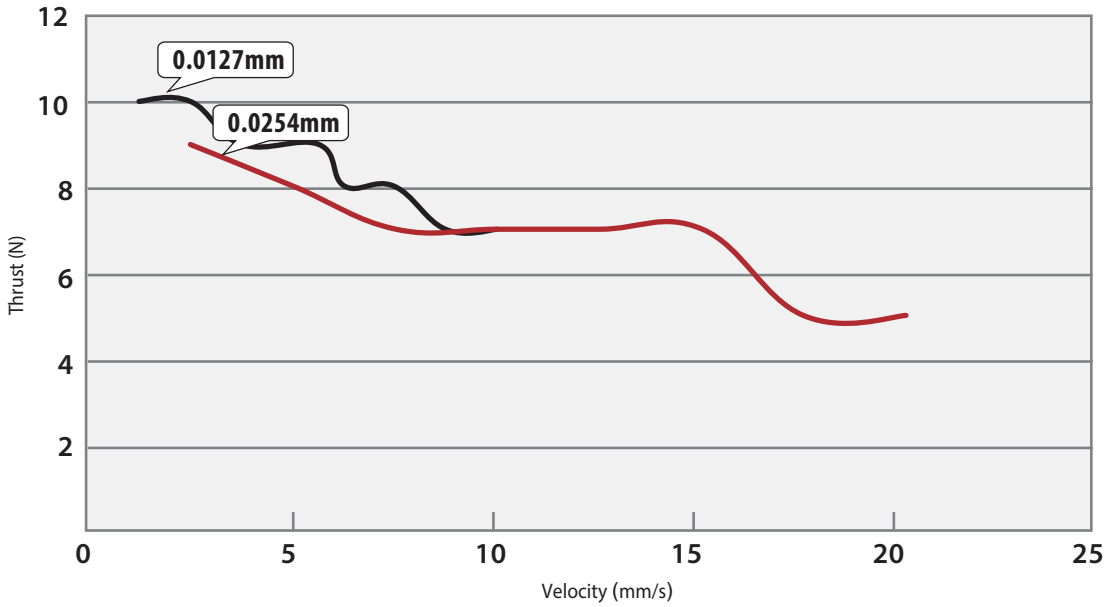
20PM Bipolar Motor(5V / 7.5°) Thrust and Linear Velocity Curve, 24VDC Constant-current Drive



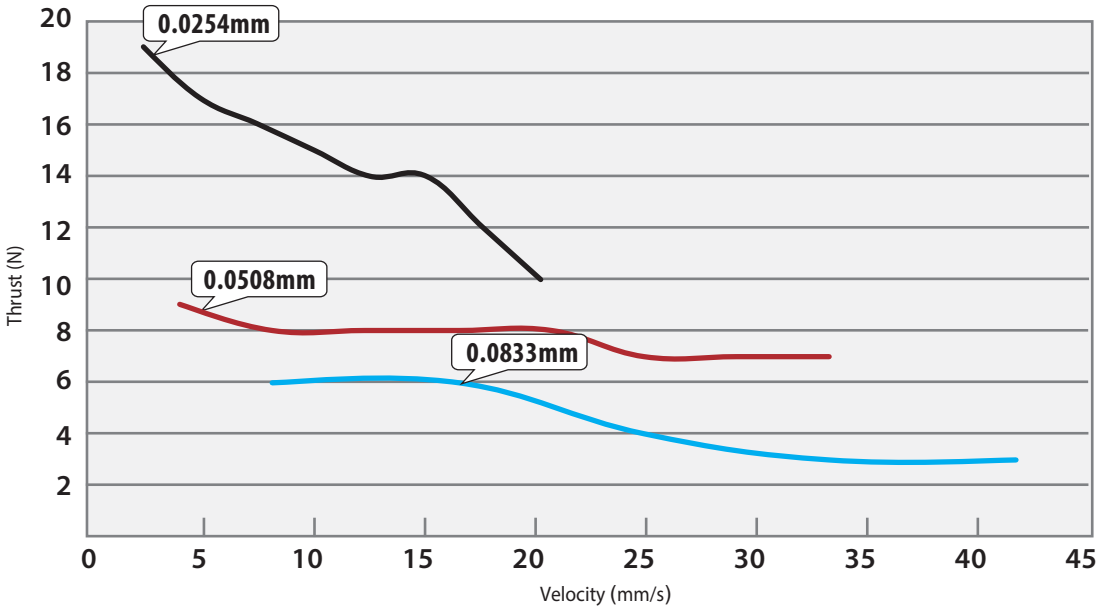
20PM Bipolar Motor(5V / 15°) Thrust and Linear Velocity Curve, 24VDC Constant-current Drive



20PM Bipolar Motor(12V / 7.5°) Thrust and Linear Velocity Curve, 24VDC Constant-current Drive



20PM Bipolar Motor(12V / 15°) Thrust and Linear Velocity Curve, 24VDC Constant-current Drive



25PM Stepper Motor Linear Actuators

Product Specification

1. Parameters

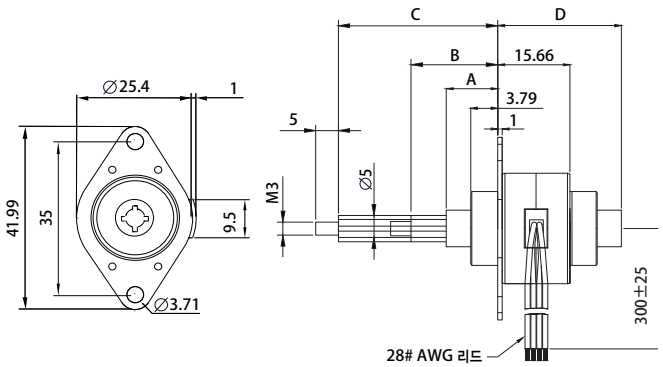
Ø25mm motor				
Winding Type	Bipolar			
Motor Method	Captive, Non-Captive, External Drive			
Step Angle	5°		15°	
Voltage	5V	12V	5V	12V
Current per phase	380mA	160mA	380mA	160mA
Resistance per phase	12.5Ω	70Ω	12.5Ω	70Ω
Inductance per phase	10.5mH	60mH	8.1mH	50mH
Power	3.8W			
Rotator Inertia	1.05gcm^2			
Insulation class	B Class			
Insulation resistance	20MΩ			
Weight	48g			

2. Step Length Type

Step Angle	Step Length		Lead Code
	mm	inch	
7.5°	0.00625	0.00025	AF
	0.0127	0.0005	AA
	0.0254	0.001	B
	0.0417	0.0016	G
	0.0833	0.0033	M
	0.1667	0.0066	T
15°	0.0125	0.0005	AF
	0.0254	0.001	AA
	0.0508	0.002	B
	0.0833	0.0033	G
	0.1667	0.0066	M
	0.3333	0.0131	T

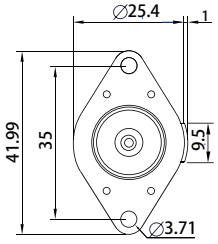
Motor Dimension and Examples

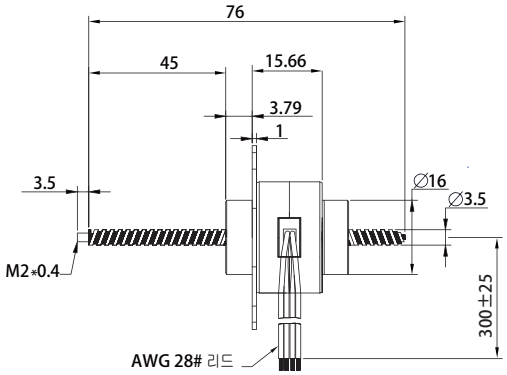
1. Captive Linear actuator



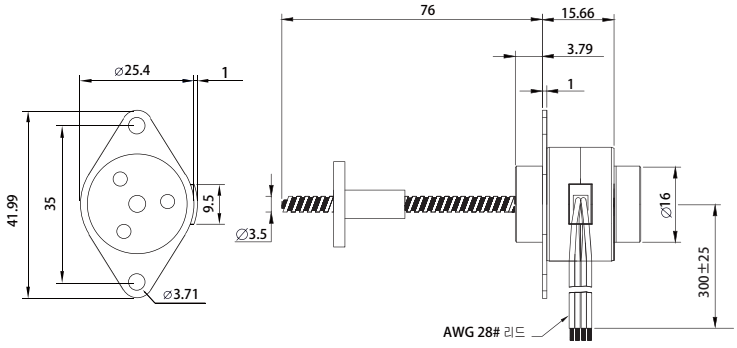
Min. Stroke(mm)	Front Cover A	Retraction B	Stretch C	D(MAX)	Stroke Code
14	12.89 ±0.25	19.99 ±0.64	33.76 ±0.38	28	1
18	17.28 ±0.25	25.25 ±0.64	43.76 ±0.38	33	2
25	24.26 ±0.25	32.23 ±0.64	57.76 ±0.38	40	3
31	30.25 ±0.25	38.23 ±0.64	69.76 ±0.38	46	4

2. Non-Captive Linear actuator



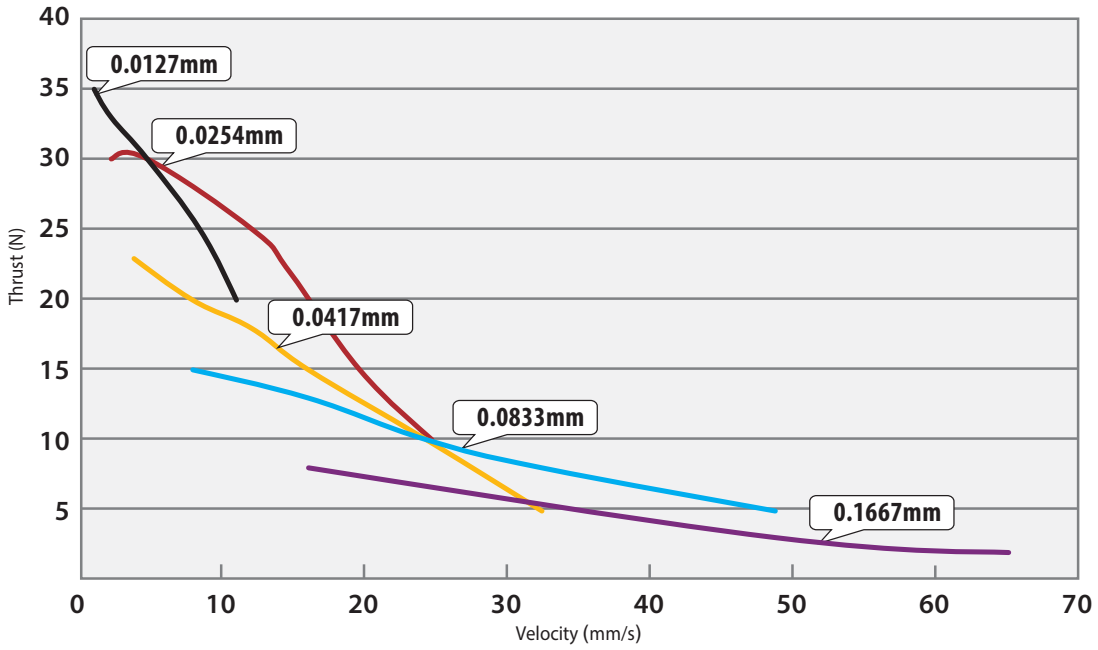


3. External Linear actuator

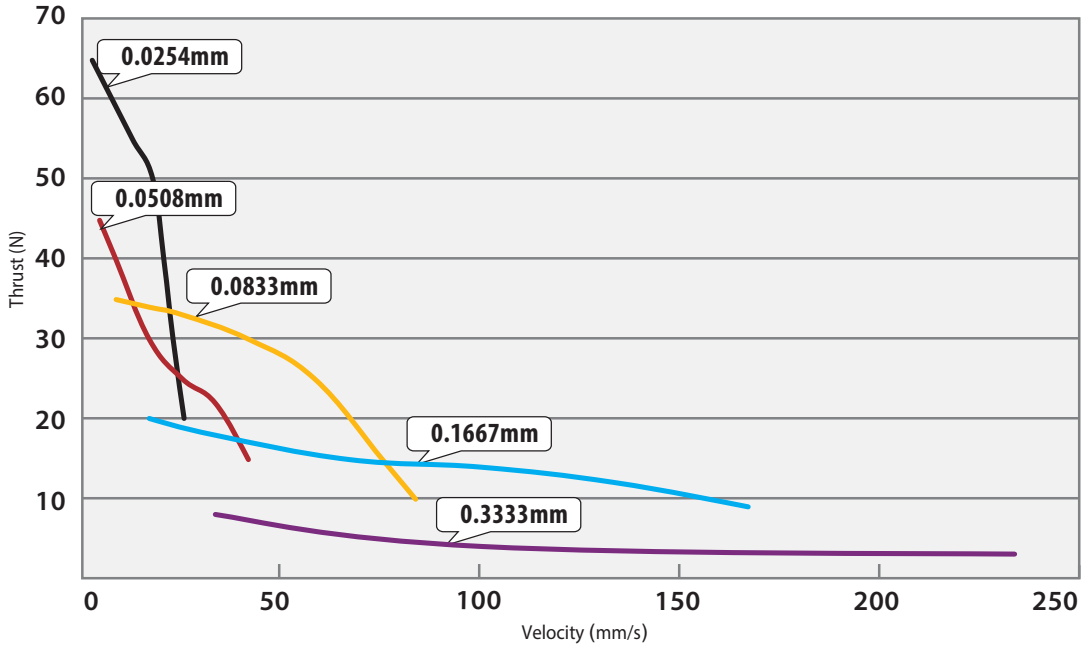


Stepper Motor Linear Actuators

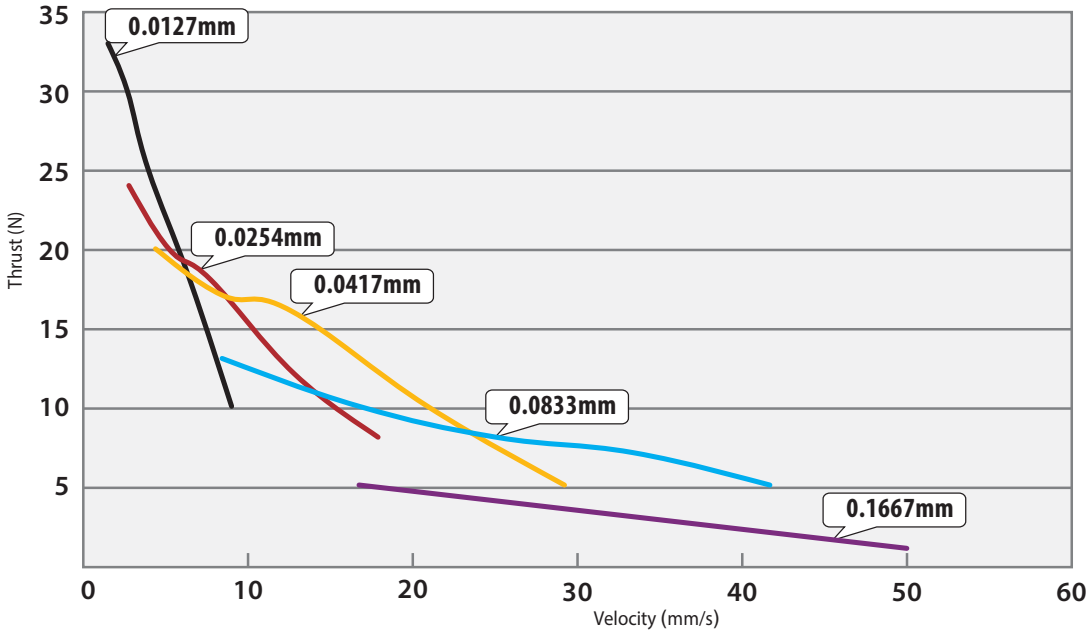
25PM Bipolar Motor(5V / 7.5°) Thrust and Linear Velocity Curve, 24VDC Constant-current Drive



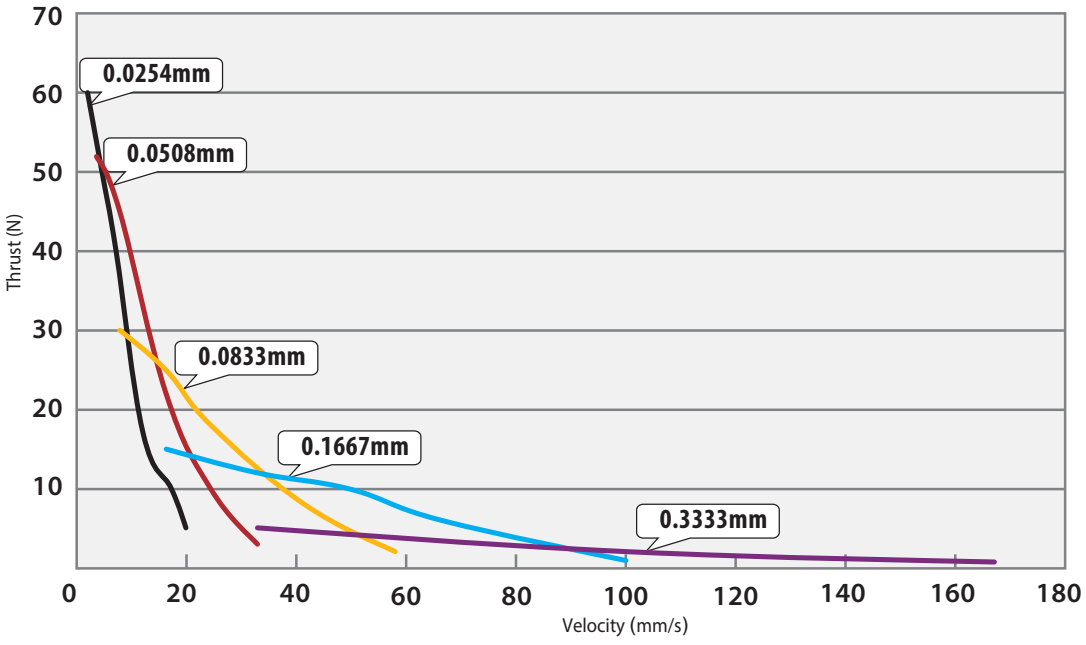
25PM Bipolar Motor(5V / 15°) Thrust and Linear Velocity Curve, 24VDC Constant-current Drive



25PM Bipolar Motor(12V / 7.5°) Thrust and Linear Velocity Curve, 24VDC Constant-current Drive



25PM Bipolar Motor(12V / 15°) Thrust and Linear Velocity Curve, 24VDC Constant-current Drive



35PM Stepper Motor Linear Actuators

Product Specification

1. Parameters

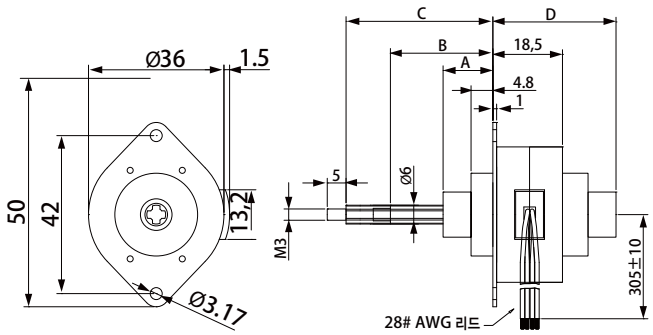
	Ø35mm motor			
Winding Type	Bipolar			
Motor Method	Captive, Non-Captive, External Drive			
Step Angle	7.5°		15°	
Voltage	5V	12V	5V	12V
Current per phase	560mA	230mA	560mA	230mA
Resistance per phase	8.9Ω	52Ω	8.9Ω	52Ω
Inductance per phase	11.6mH	65mH	8.5mH	46mH
Power	56W			
Rotator Inertia	8.5gcm^2			
Insulation class	B Class			
Insulation resistance	20MΩ			
Weight	50g			

2. Step Length Type

Step Angle	Step Length		Lead Code
	mm	inch	
7.5°	0.0132	0.0005	A
	0.0265	0.001	D
	0.0529	0.002	K
	0.1058	0.0041	R
15°	0.0265	0.001	A
	0.0529	0.0021	D
	0.1058	0.0041	K
	0.2117	0.0083	R

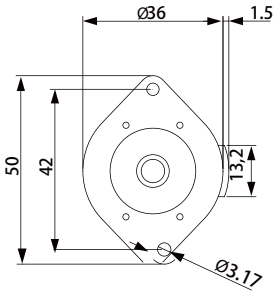
Motor Dimension and Examples

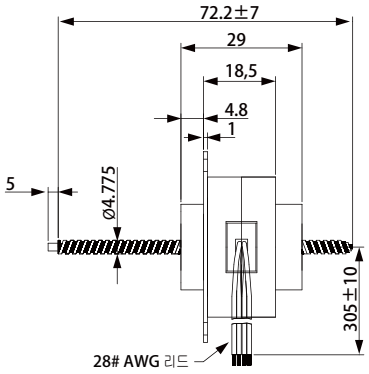
1. Captive Linear actuator



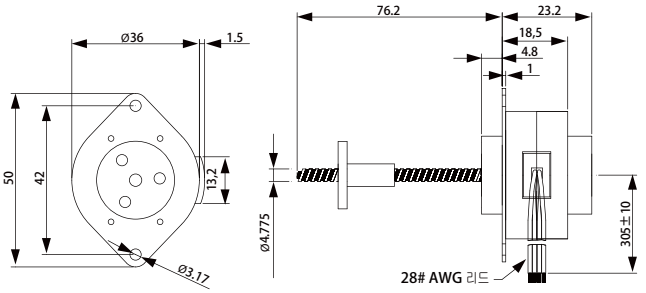
Min. Stroke(mm)	Front Cover A	Retraction B	Stretch C	D(MAX)	Stroke Code
16	13.67 ±0.25	17.2 ±0.64	34.24 ±0.38	33	1
25	26.37 ±0.25	29.9 ±0.64	56.94 ±0.38	46	2
38	39.07 ±0.25	39.07 ±0.64	85.04 ±0.38	59	3

2. Non-Captive Linear actuator

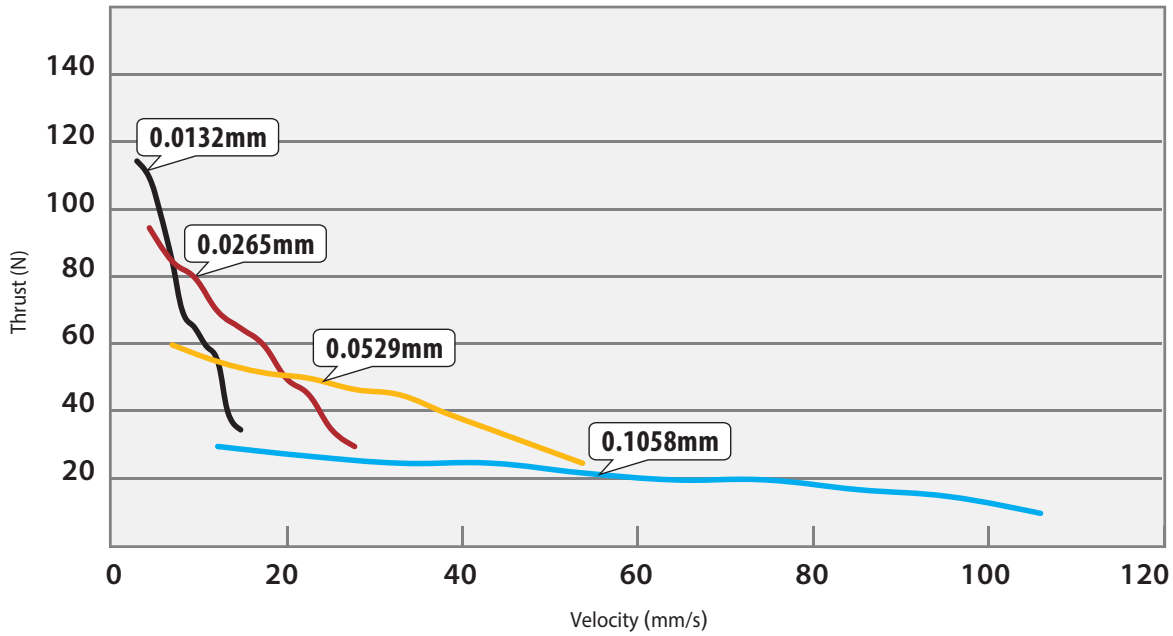




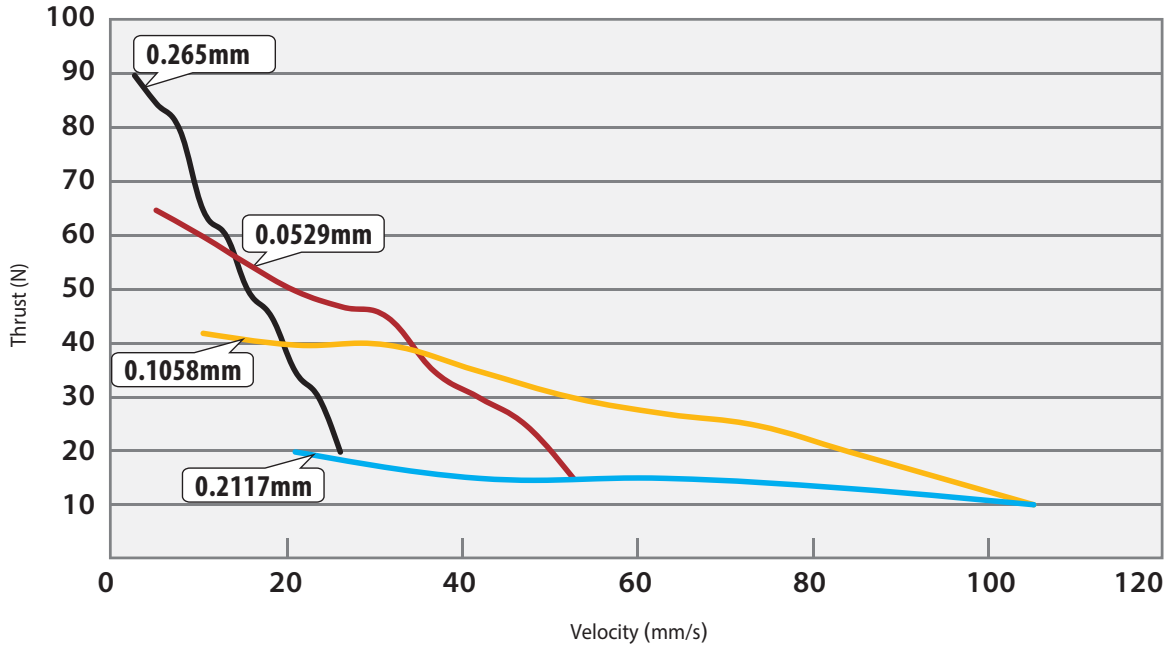
3. External Linear actuator



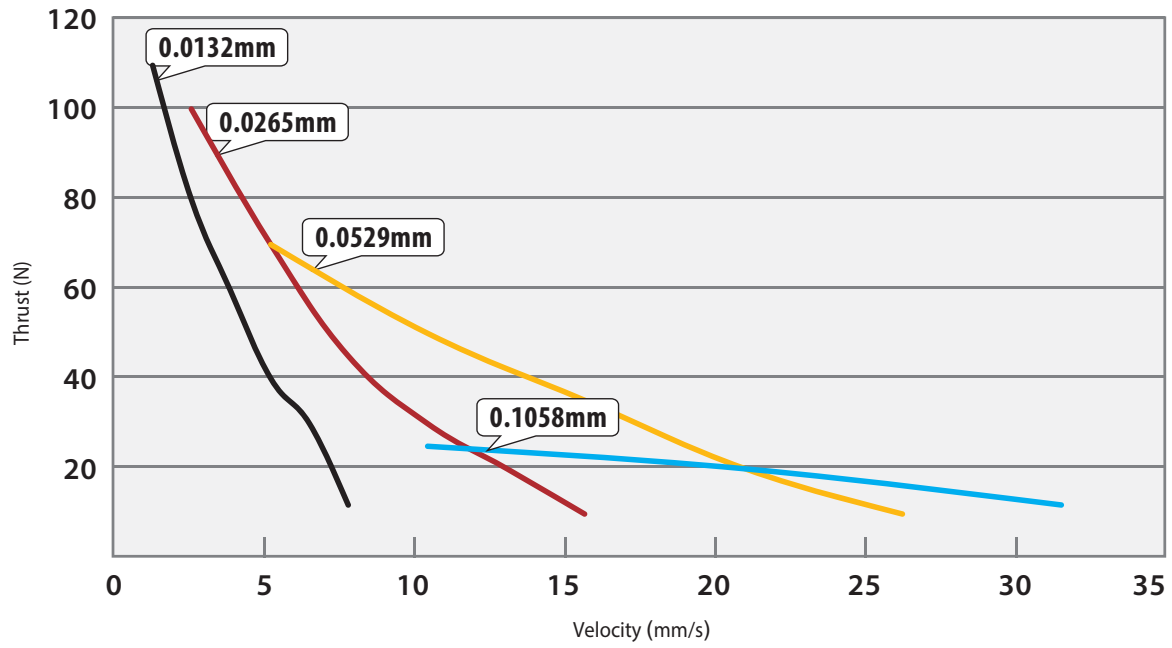
35PM Bipolar Motor(5V / 7.5°) Thrust and Linear Velocity Curve, 24VDC Constant-current Drive



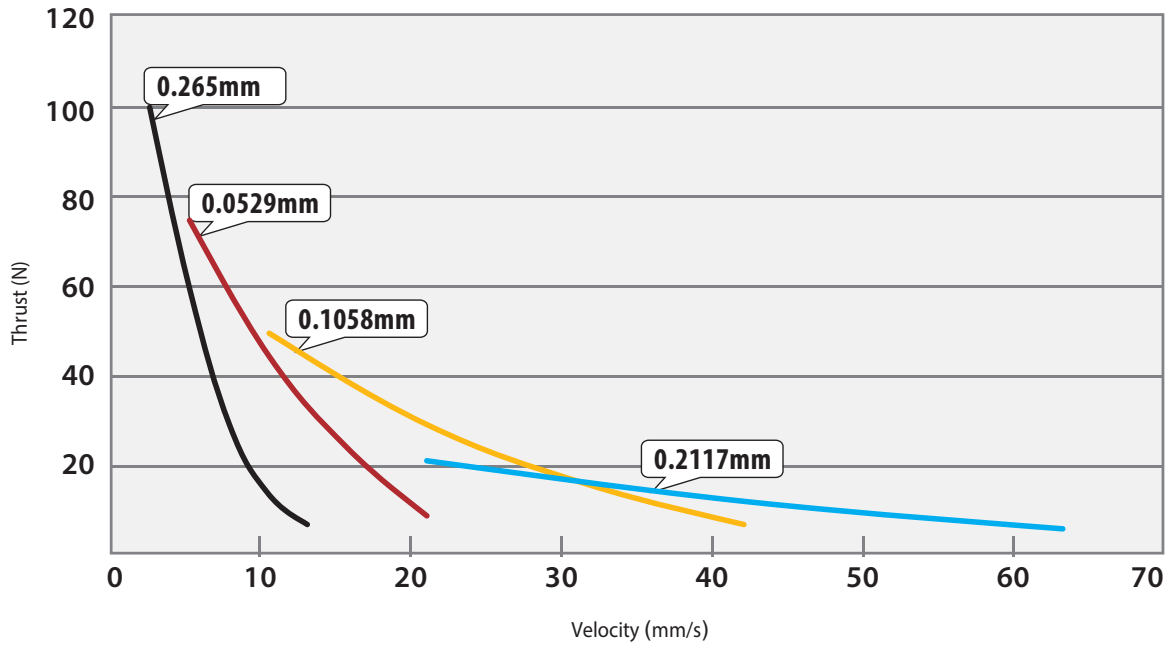
35PM Bipolar Motor(5V / 15°) Thrust and Linear Velocity Curve, 24VDC Constant-current Drive



35PM Bipolar Motor(12V / 7.5°) Thrust and Linear Velocity Curve, 24VDC Constant-current Drive



35PM Bipolar Motor(12V / 15°) Thrust and Linear Velocity Curve, 24VDC Constant-current Drive



Glossary

Accuracy	The difference between the actual distance travelled versus the theoretical distance travelled based on the lead
Axial Load	A load that is exerted at the center line of the screw
Backdriving	Freewheeling of the nut and screw as a result of the load pushing axially on the screw
Backlash	The relative axial movement between the screw and nut
Chopper Drive	A constant current drive is usually bipolar. The chopper drive gets its name from the technique of rapidly switching the power on and off to control motor current. A chopper drive allows a step motor to maintain greater torque of force at higher speeds.
Column Strength	The ability of a screw to withstand a load in compression
Critical Speed	The rotational speed of the screw at which the first harmonic of resonance is reached
Drag Torque	The amount of torque to overcome the friction of a system
Dynamic Load	Load applied to the screw while in motion
Efficiency	The ability of a mechanical system to translate an input to an equal output
Fixity(End)	The method by which the ends of the screw secured or supported
Lead	The linear travel at one revolution of the screw
Left Hand Thread	Counter clockwise rotation
Pitch	The axial distance between threads
Radial Load	A load exerted at 90 degrees or perpendicular to a screw
Repeatibility	The capability of a screw and nut system to reach the same commanded position continously
Rerolution	Incremental linear distance the actuator's(motor) output shaft will move per input pulse
Resonance	Vibration occuring when a system is a mechanical system is in an unstable range
Right Hand Thread	Clockwise rotation
Sideloading	Same as a radial load(very undesirable)
Static Load	Load applied to the screw at standstill
Straightness	Linear uniformity of a screw
Total Indicated Runout	A measurement of the amount of straightness of a screw
Ttavel per Step	Linear translation of one full step of the motor

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Fast, Accurate, Smooth Motion

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