LoPro® Linear Motion Systems

built with DualVee® Motion Technology®

Complete Actuated Linear Guidance Systems

bwc®

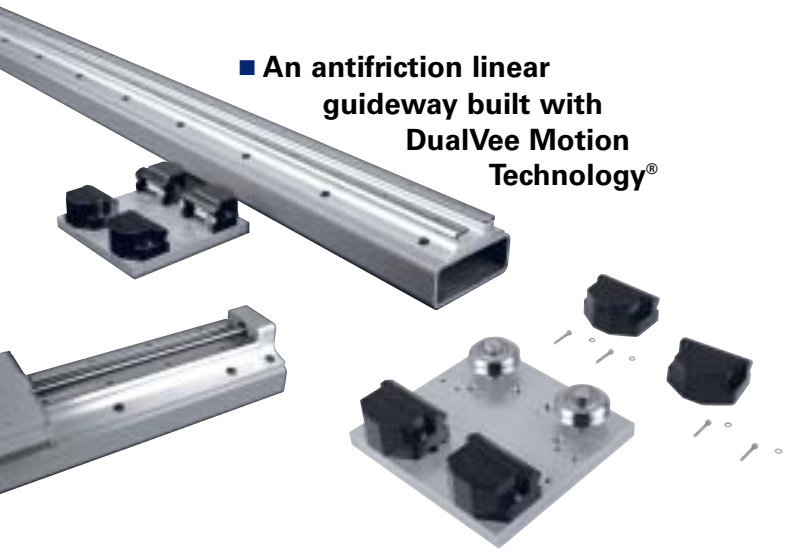
Bishop-Wisecarver Corporation

Motion without limits.™

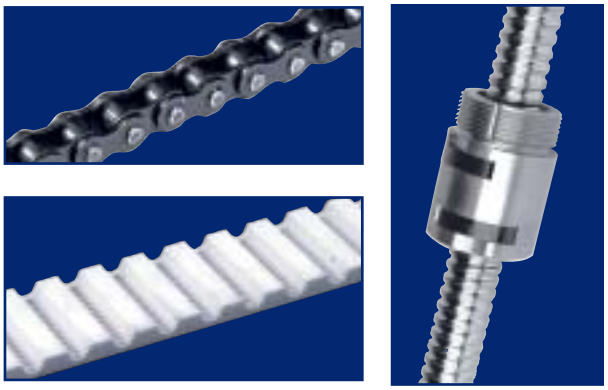
Guided Linear Motion Systems - Overview

Guided linear motion systems from the Bishop-Wisecarver Corporation® (BWC) consist of two main design elements:

■ **An antifriction linear guideway built with DualVee Motion Technology®**



■ **A thrust producing linear actuator**



DualVee® Motion Technology (DMT™) is an antifriction, "guide wheel-based" linear bearing design. DualVee® wheels are built with double row, angular contact, ball bearing construction and are characterized by their unique "double vee" outer race profile. DualVee® wheels engage with a mating 90 degree mating track producing a rigid, yet smooth running, antifriction linear guide. Pioneered and perfected over a 30 year period , DMT™ offers "motion without limits" for actuated linear transport and positioning applications.

DualVee-Based Linear Motion Systems Features and Benefits

Complete Integrated System Package

A complete actuated system design eliminates the effort associated with integration of lower level components and assemblies. By specifying complete actuated linear systems, equipment designers are able to accelerate machine design and fabrication while reducing overall installed cost.

Proven Technology ■ High Reliability

DMT™ has been successfully employed in industrial linear motion systems for over 30 years.

Broad Product Range

A wide range of options including numerous standard actuator sizes and types (ball screw, acme screw, belt, and chain drives). Standard systems include 4 sizes of linear guide, each including options such as structural support beams, corrosion resistant bearing elements, and multiple wheel plate designs. Guide wheels can be supplied in 52100 bearing steel or 440C stainless, with either sheilds or seals, and can be internally lubricated with standard or special greases. Additional options include high temperature or clean room compatible wheels, and various wheel cover and lubricator configurations.

High Speed Capacity

Speeds up to 10 meters / second and accelerations to 5g can be achieved due to the circular raceway design of the DualVee® guide wheel.

Smooth, Antifriction Operation

Rolling contact interface, retained bearing balls, and dual circular raceway design produces smooth, antifriction operation.

Long Stroke Lengths

The ability to butt join DualVee® track allows for long system stroke lengths, limited only by the actuator technology. Belt driven systems in excess of 80 feet have been succesfully employed.

Low Noise / Low Vibration

DMT exhibits up to 50% lower noise than alternative round or square rail ball guides consiting of ball tracks that recirculate thru sharp 180 degree endcap deflectors. Guide wheel-based systems have circular raceways and retained bearing balls eliminating the collisons which produce both noise and vibration.

Impervious To Contaminated Environments

DualVee® guide wheels translating along a mating 90 degree vee way produces an inherent surface velocity gradient along the rolling contact surface. This acts to sweep debris aside, ejecting particulates from the interface as the wheel travels along the rail. Recirculating elements are protected from the environment in a well contained, radial bearing construction, eliminating the need for expensive bellows or way covers which are often required for alternative recirculating bearing technologies.

Low Profile Designs

Standard BWC system designs are configured with a very low profile footprint, made possible by the the thin cross section of DualVee® componentry.

Flexibility And Simplicity In Design

DMT allows for flexibility in linear bearing construction, permitting optimized engineered solutions for specific application requirements. Wheel-to-track fitup is accomplished via eccentric bushings or studs, making assembly and field maintenance easy to perform.

About Bishop-Wisecarver Corporation®

Bishop-Wisecarver Corporation® is a family owned manufacturing company specializing in guide wheels and motion control technologies. DualVee® was designed as a problem solver for automotive, machine tool, paper processing, textile, and general industrial automation applications where traditional guidance technologies proved ineffective. DualVee Motion Technology® (DMT™) has continued to evolve into an ideal technology for today's cutting edge industries such a laboratory equipment, bio-medical, semiconductor, and electronics assembly.

BWC® invented the DualVee® guide wheel and has been a world leader in guide wheel technology since 1970. DMT™ integrates three main components, the DualVee® guide wheel, its mating DualVee® track with patented mounting shoulder, and the DualVee® support bushing. Our product line includes components, linear guides, linear systems, rotary guides and systems, and aluminum machine framing.

Actuated Linear Motion Systems

Since its introduction into the industrial equipment marketplace over thirty years ago, DualVee Motion Technology® has become an industry standard linear guidance solution. The LoPro® linear motion system is a modular, actuated system design, available in screw, belt, and chain driven configurations. Its low cost, ease of installation, and unique design characteristics make it the system of choice for many linear bearing applications.

Developed over 8 years ago, LoPro® belt, chain, and screw drive systems have been implemented in virtually every industry covering a wide range of applications. This catalog is an introduction to the revised LoPro® design, which includes a wider range of options and many new design enhancements.

From factory automation projects to OEM equipment designs, LoPro® linear systems offer a level of reliability unmatched in the industry. This is particularly true considering the wide range of environments in which it can be employed. Known primarily for it's ability to operate in harsh, contaminated environments, LoPro® linear systems are just as often employed in laboratory and clean room-grade equipment designs. When reliable, smooth, low friction guidance is mandatory, LoPro® linear systems perform well, even in the most challenging conditions.

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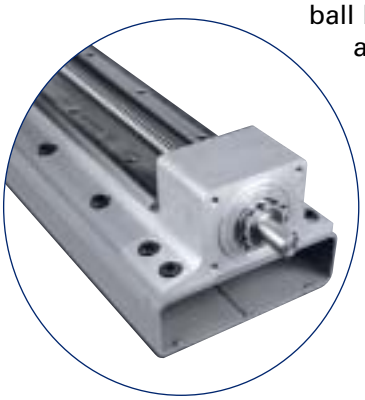
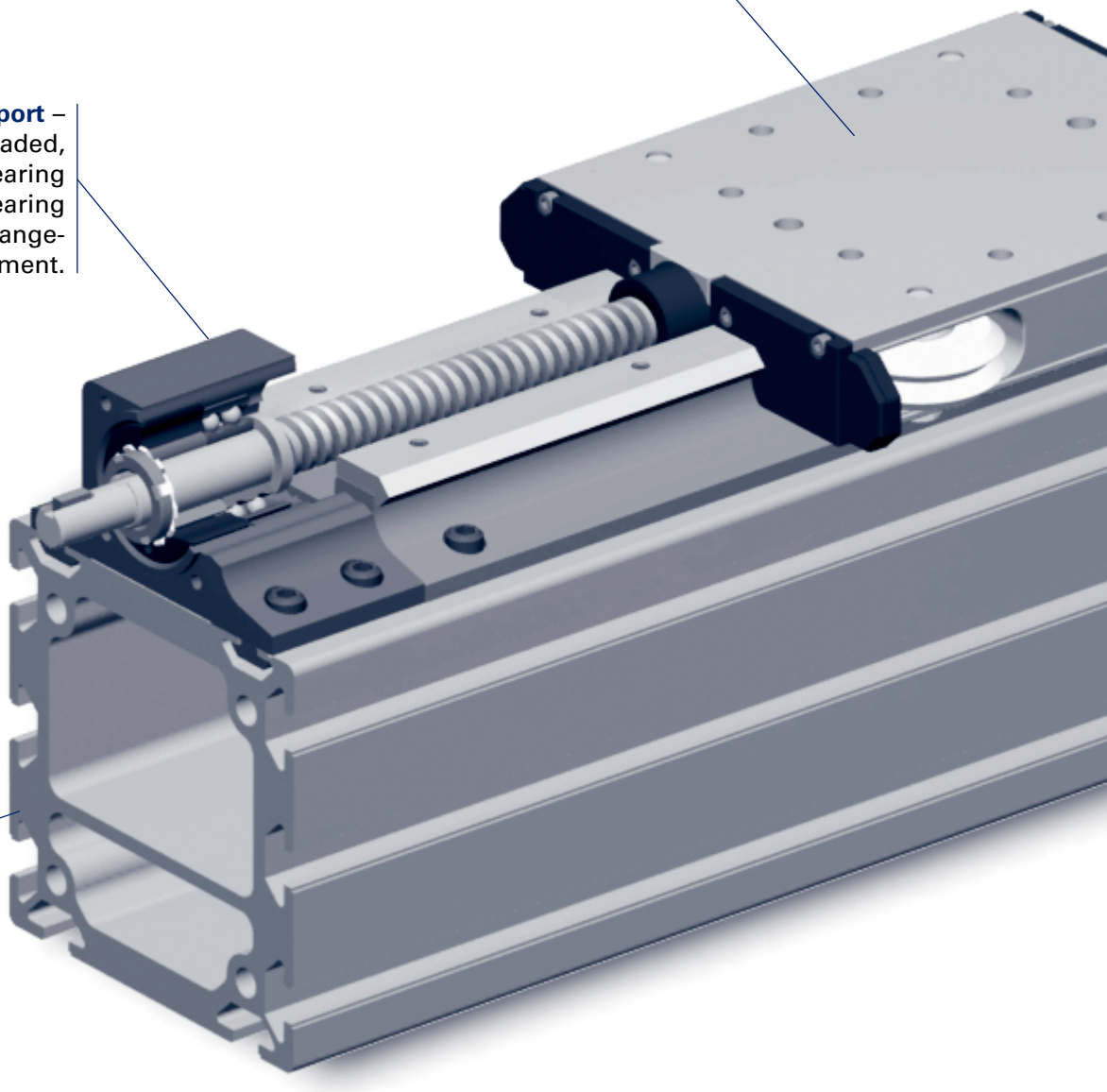
Screw Driven LoPro® Linear Motion System mounted to an optional aluminum support beam

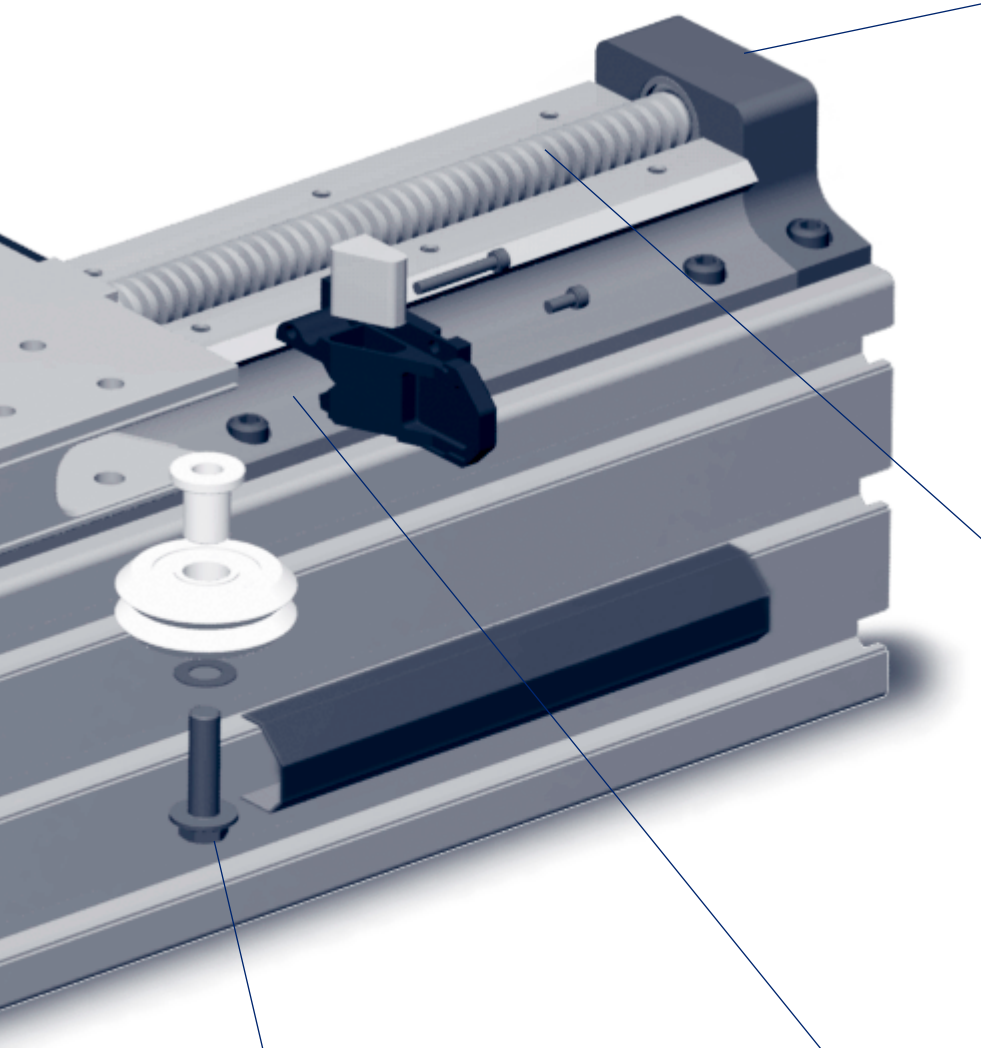
The **LoPro® Wiper Wheel Plate** - High performance, low profile wheel plate design with four pre-mounted DualVee® guide wheels and lubricating wiper caps.

Fixed end bearing support – Double row, preloaded, angular contact bearing ball bearing arrange-ment.





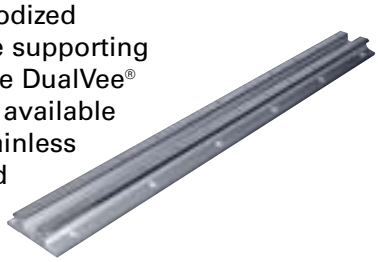
Aluminum support beam - Clear anodized structural support member complete with industry-standard cross section and T-slot configuration.



Simple end bearing support for ball or lead screw driven systems.

Ball or lead screw actuation available – Ball screw actuation is available in seven standard diameter and lead combinations. Lead screw systems are available in 23 standard combinations of screw diameter and leads – choice of pre-loaded and non-preloaded lead screw nuts.

LoPro® Track Plate Assembly – Low profile, anodized aluminum plate supporting twin single edge DualVee® tracks – track is available in carbon or stainless steel, as formed or induction hardened.

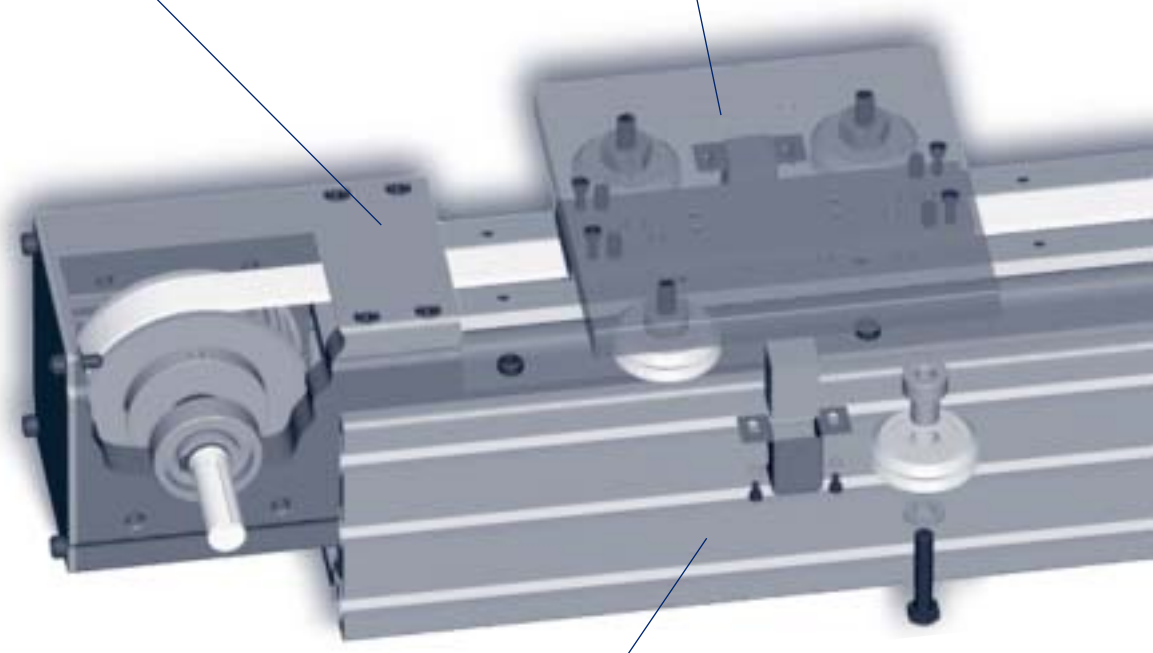


Exploded view showing **guide wheel mounting construction** – Mounting hardware includes a wheel bolt, a bushing, and a washer. Also shown is a wiper cap, including oil saturated felt lubricator, and side guard.

Belt Driven LoPro® Linear Motion System mounted to an optional aluminum support beam

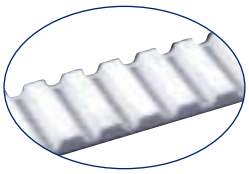
Basic wheel plate – Carriage design includes a wheel cover or lubricator option. Exploded view below shows the DualVee® guide wheel mounting arrangement, with wheel bolt, bushing (concentric or eccentric) and a washer. There is a wide range of guide wheel options to choose from. Also shown in the exploded view is a stainless steel lubricator with oil saturated felts. Belt driven basic wheel plates have a reliable belt clamp design which engages up to four teeth at both attachment points on each end of the carriage.

Drive end – Constructed with anodized aluminum housing, and hardened, stainless steel drive shaft. The pulley and shaft are supported by twin radial bearings.

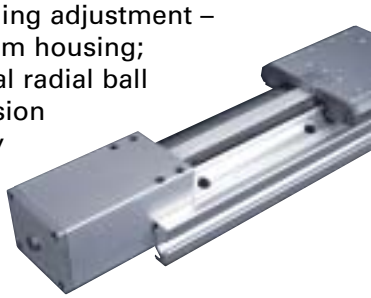


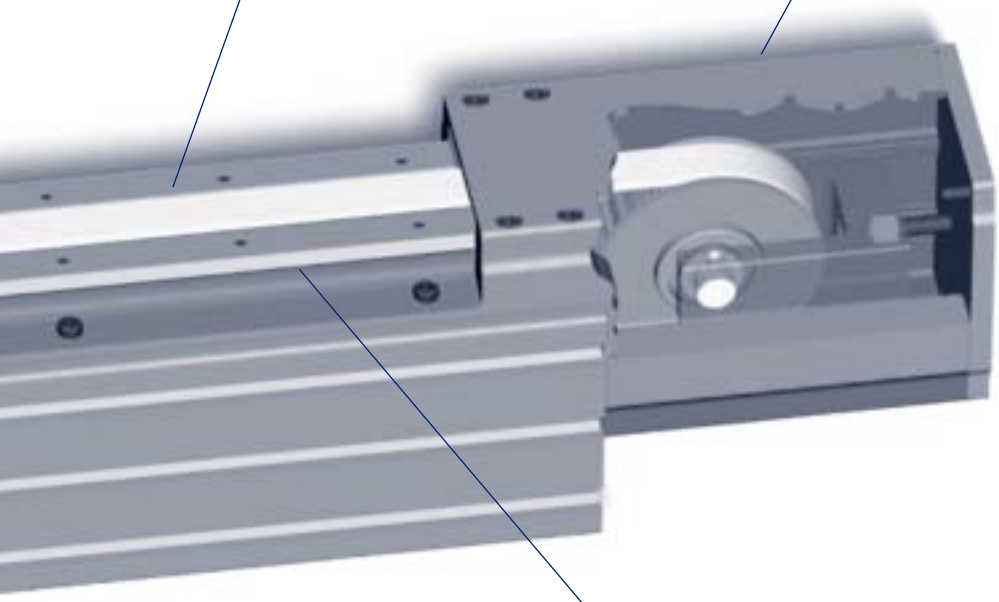
High strength anodized aluminum support beam with industry standard cross section and T-slot configuration.

Steel cable reinforced, high performance polyurethane timing belt, ideal for high speed / high cycling applications.

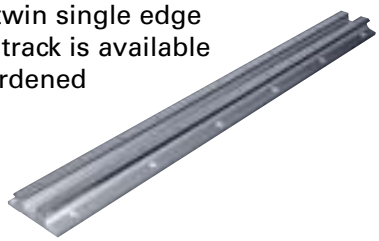


Idler end with belt tensioning adjustment – Rugged anodized aluminum housing; pulley is supported by dual radial ball bearing arrangement. Tension adjustment screw is easily accessed on the back plate of the assembly.





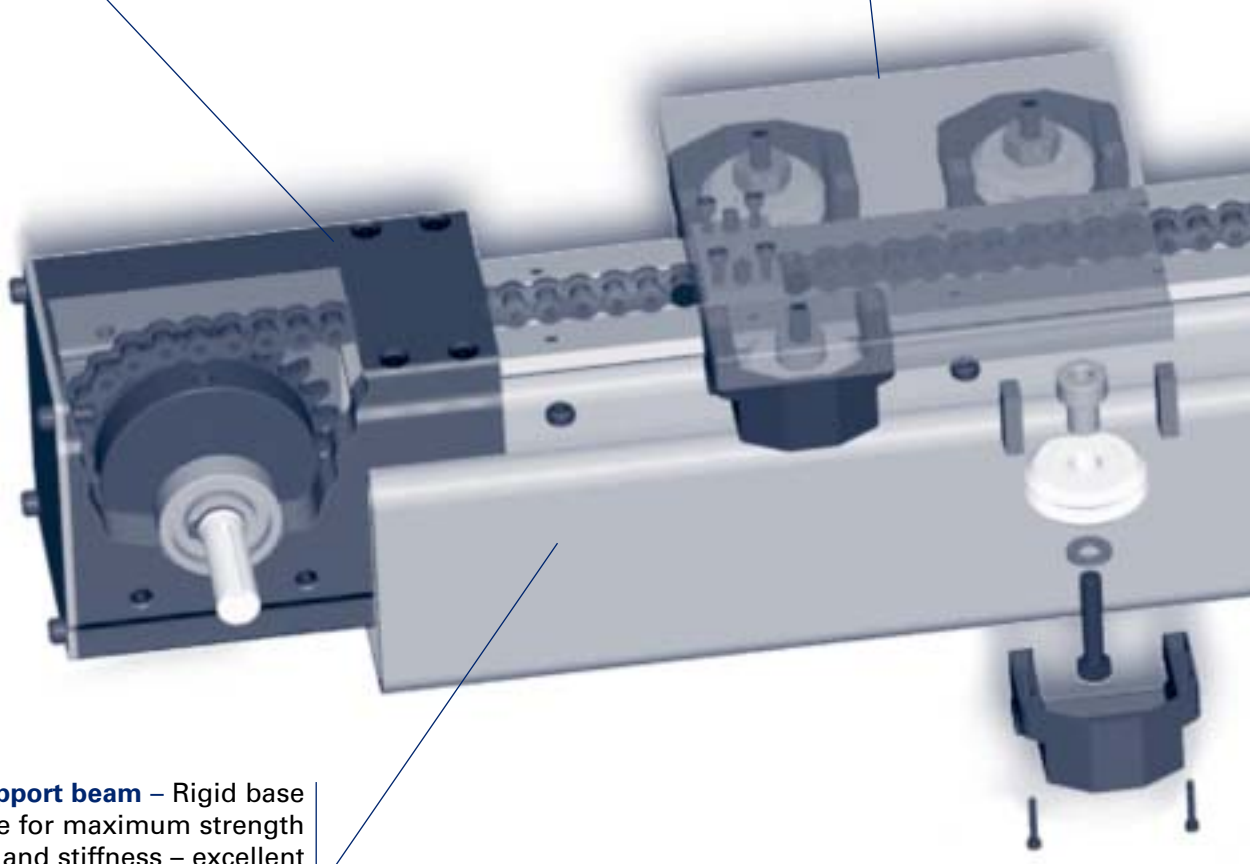
LoPro® track plate assembly – Low profile, anodized aluminum plate supporting twin single edge DualVee® tracks – track is available with induction hardened veeways in either carbon or stainless steel.



Chain Driven LoPro® Linear Motion System mounted to a steel support beam

Basic wheel plate – Carriage with four DualVee® guide wheels. The exploded view shows the guide wheel and mounting hardware, incluing wheel bolt, washer, guide wheel, and bushing. This particular assembly includes lubricating wheel covers. Rugged chain coupling design firmly affixes chain to wheel plate.

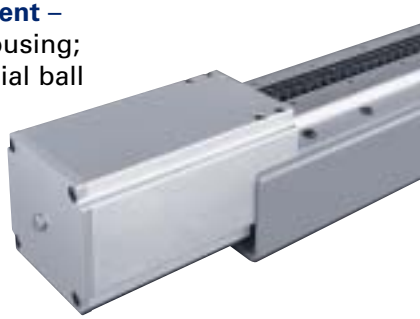
Drive end - Constructed with anodized aluminum housing, and hardened, stainless steel input drive shaft. Sprocket and shaft are supported by twin radial bearings.

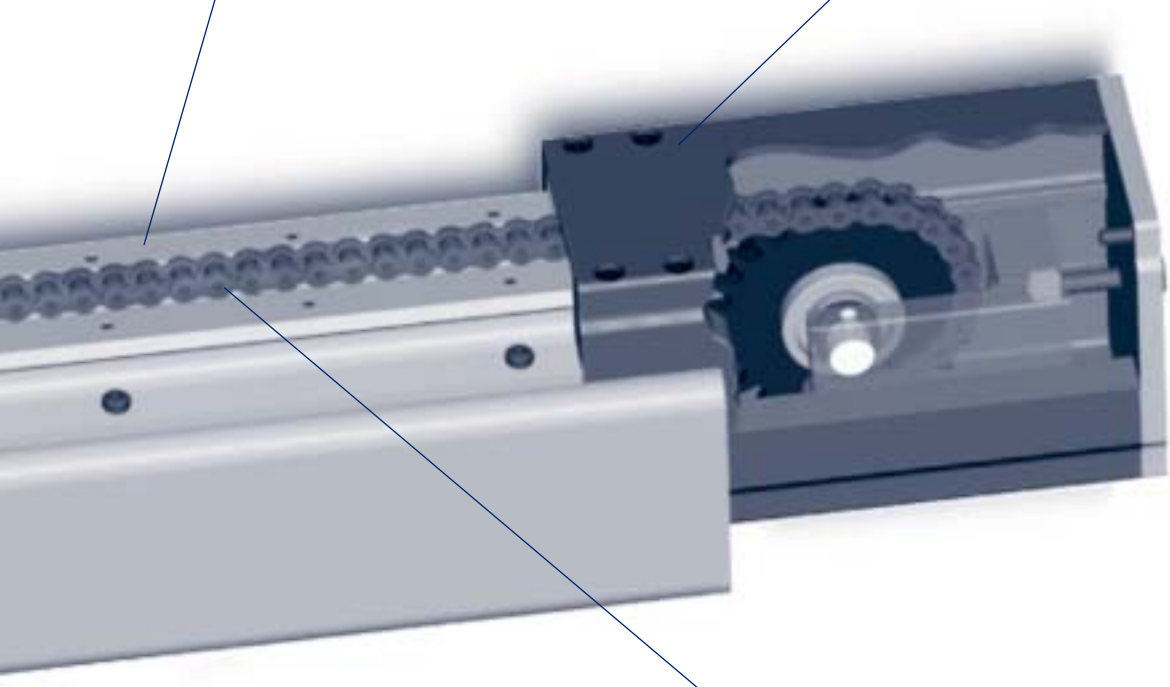


Steel support beam – Rigid base structure for maximum strength and stiffness – excellent support beam for high and rapidly changing loads.

Chain drive – Choose from five standard single strand chain sizes.

Idler end with tension adjustment – Rugged anodized aluminum housing; sprocket supported by dual radial ball bearing arrangement. Chain tension adjustment screw is easily accessed on the back plate of the assembly.





Track plate assembly – Anodized aluminum plate with hardened steel DualVee® track.

System Configurations

All BWC® linear motion products are based on DualVee Motion Technology® which are available in various configurations, and are primarily characterized by their level of integration.

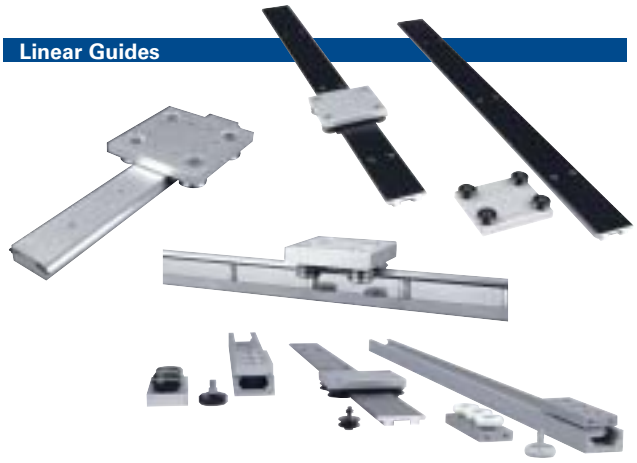
The three major DualVee® categories include:

- Components
- Linear Guides
- Actuated Linear Systems

Components

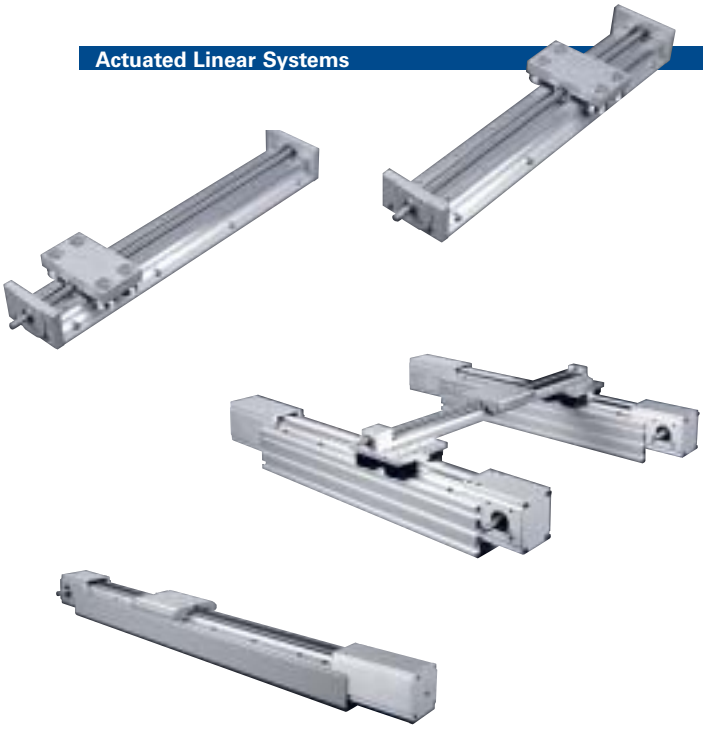
- DualVee® componentry offers the ultimate in design flexibility for ground up linear motion design projects
- Choose from a variety of guide wheel, track, and mounting hardware configurations
- Accessories include wheel covers and lubricators
- Material options include stainless steel and carbon steel
- DualVee® track is available with optional black oxide finish, thin dense chrome plating, or electroless nickel plating (other platings and treatments are available - consult BWC Applications Engineering)
- Consult BWC Applications Engineering for special materials, configurations, and designs
- Covered in the Components and Linear Guides Catalog

Linear Guides



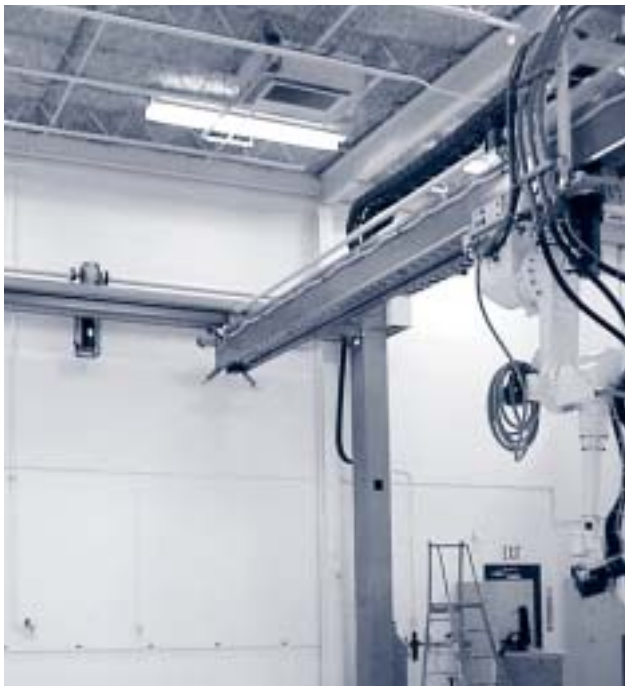
- Standalone linear guides consist of pre-matched carriage and track assemblies
- Eliminates the design work associated with component integration
- Linear guides are easy to specify and even easier to install
- Bill of material control is simplified and the number of purchased items is consolidated
- Carriages come complete with adjustable wheels for track fitup and options such as wheel covers and track lubricators
- Standard prematched linear guides include either a 4-wheeled or a 3-wheeled carriage assembly, both consisting of DualVee® componentry
- Mating track assemblies are available in standard lengths with various options
- Covered in the Components and Linear Guides Catalog

Actuated Linear Systems



- Covered on pages 12 thru 52
- Actuated linear systems are linear guides integrated with linear actuators
- Minimizes the integration design effort with minimal lead time (typical lead time: 2 weeks or less)
- Further reduces the number of elements within a machine design's bill of materials
- The LoPro® actuated linear motion system is the BWC standard; LoPro® integrates a 4-wheeled DualVee® carriage and a prematched track assembly with one of several standard actuator options
- Standard LoPro® actuators include belt, chain, ball screw and lead screw
- Custom engineered actuated linear systems are also available (consult applications engineering)

Multi-Industrial Applications



Large gantry assembly built with LoPro® linear guidance systems. Special steel beam mounted configurations provided complete from BWC. Photo courtesy of SWRi.

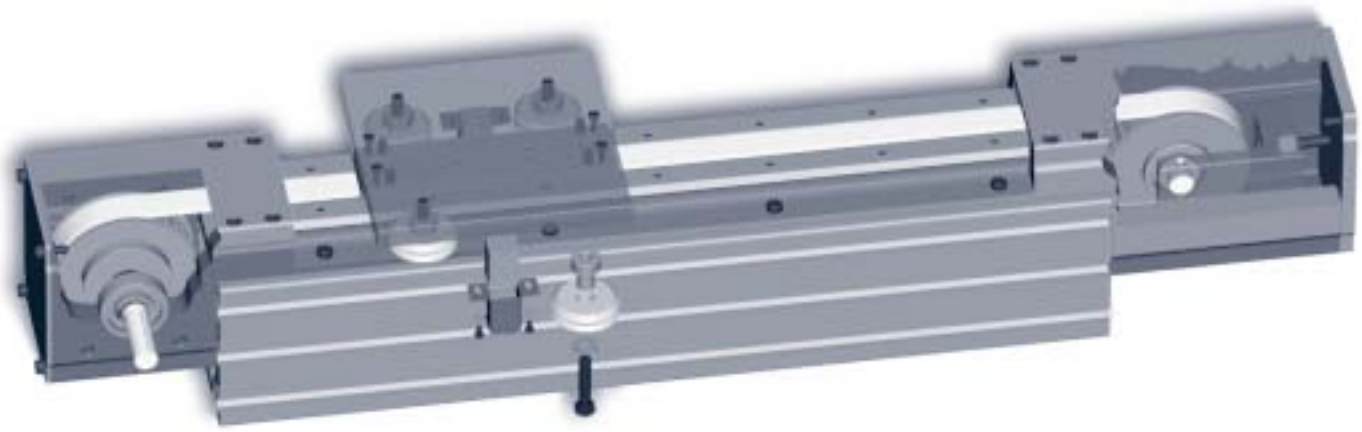
DualVee®-based linear mechanisms are popular worldwide and used throughout a broad range of industries:

- Machine tool
- Laboratory equipment
- Automotive production equipment
- General industrial automation
- Biomedical equipment
- Inspection equipment
- Material handling equipment
- Textile machinery
- Linear slides
- Paper processing and converting equipment
- Semiconductor equipment
- Packaging machinery
- Electronics assembly equipment
- Non-contact machining equipment

Visit our website at www.bwc.com to view specific application examples and success stories.

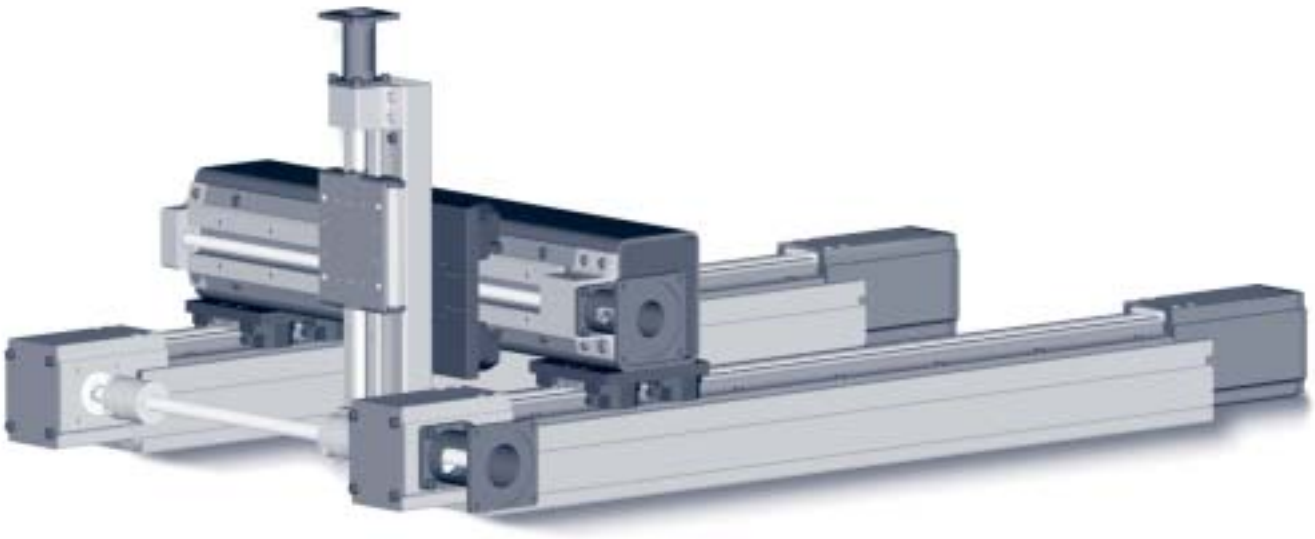
Typical Configurations

Single Axis Linear Motion

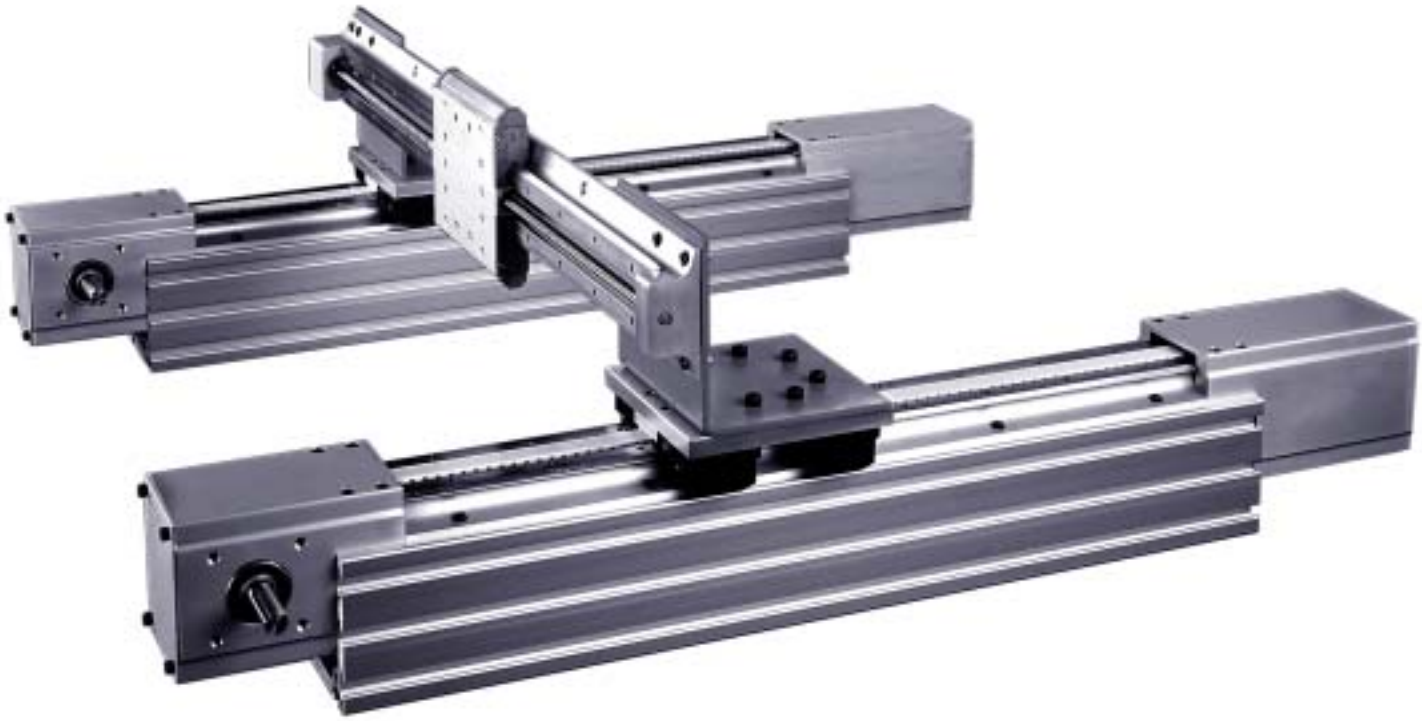


X-Y Gantry Arrangement

X-Y-Z Multi Axis arrangement



Specifications



Customized, vertically oriented, LoPro® linear system including chain counterbalance and rack drive, configured for use in a gantry robot application. Photo courtesy of SWRi.

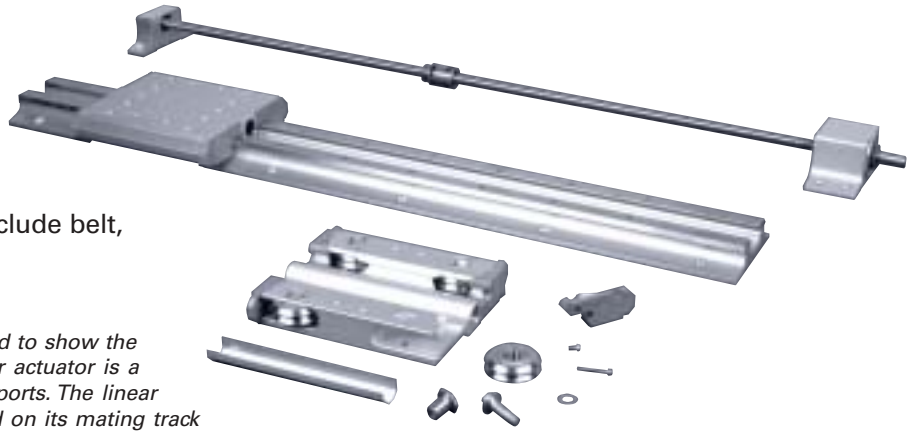
Contents

LoPro® Linear Motion Systems

Overview

LoPro® Linear Systems consist of two main design elements:

- **A linear guide** - built with DualVee Motion Technology®
- **A linear actuator** - standards include belt, screw, and chain drive units



LoPro® linear motion system, disassembled to show the major components. In this case, the linear actuator is a ball screw assembly and its two end supports. The linear guide is shown with wheel plate mounted on its mating track assembly. In the foreground is a partially disassembled wiper wheel plate, showing guide wheel, wiper cap, side guard, and mounting hardware. This particular system is unsupported (has no steel or aluminum beam supporting the track plate). The low profile of the LoPro® linear system is particularly evident in an unsupported arrangement.

Linear Guide

Linear guidance in a LoPro® linear motion system is achieved using DualVee Motion Technology® (DMT™). DMT™ is a low profile, guide wheel-based linear bearing arrangement which uses DualVee® guide wheels and 90 degree, induction hardened, vee-shaped rails. DualVee® guide wheels are characterized by their double vee outer race geometry including a 90 degree vee groove along the outermost diameter.

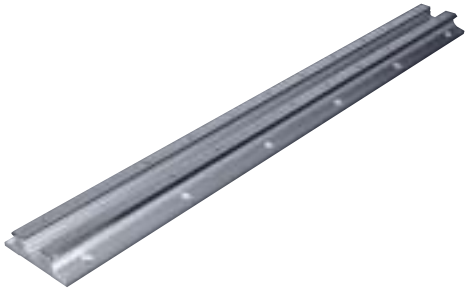
Profile of a DualVee® guide wheel sitting atop an induction hardened stainless steel DualVee® track. Note that the recirculating bearing elements are not exposed to the environment at the track interface

In the LoPro® linear guide, guide wheels are configured into wheel plate assemblies, each containing four DualVee® wheels. Wheel plates are designed with two eccentrically mounted wheels opposing two fixed position wheels. This arrangement allows for easy wheel-to-track fitup adjustment.

LoPro® systems come with two wheel plate options, basic and wiper. The wiper wheel plate design captures the guide wheel on both sides of the bearing, and encapsulates the contact region with lubricating wiper caps and side guards.

LoPro® Linear Motion Systems

Two lengths of hardened steel track is mounted to a low profile aluminum track plate with veeways pre-aligned and parallel to within 0.002" (0.05mm). Track plate is available in single piece lengths up to 10 feet (3m), but are routinely butt joined with a staggered track arrangements for longer stroke length requirements (in some cases, in excess of 100 feet).



LoPro® trackplate assembly consisting of two lengths of induction hardened steel track mounted to an anodized aluminum substrate

Four different sizes of LoPro® wheel plate and track plate assemblies make up the main design element of the LoPro® linear motion system. DMT™ offers a tough, low friction, low profile package, built to withstand a wide range of operating environments.

DualVee® guide wheels are built to tight tolerance specifications (ABEC 5, double row angular contact). All recirculating bearing elements remain tucked away within the radial bearing design which are proven to operate well in difficult, contaminated environments. This is in contrast to alternative recirculating element designs, specifically round and square rail linear bearing designs. In the round rail ball bushing, for example, recirculating elements are in direct contact with the shaft for the entire stroke length of the system. Such designs often require bellows or other costly methods of protection, to prevent the ingression of contaminants into the recirculating ball pathways. Contamination of the pathways interrupts smooth ball recirculation, which leads to premature, and ultimately, catastrophic bearing failure.

As a result of the differential surface velocity, the mesh between a DualVee® guide wheel and a mating 90 degree track remains largely unaffected by contaminants. As the carriage traverses along the track plate assembly, debris is simply swept aside.

DualVee® guide wheels employ a double row, angular contact radial bearing construction. DMT™ performs reliably in difficult operating environments due to the sealed ball races.

Alternative linear guidance technologies have recirculating elements in direct contact with the rail entire stroke. This arrangement is susceptible to contamination in the recirculating pathways, which could lead to premature failure.

DualVee® guide wheels and track are available in carbon steel or 400 series stainless steel. Wheel plates and track plates are anodized aluminum. Corrosion resistant versions of LoPro® are also available.

Linear Actuator

LoPro® linear motion systems are available with the following standard actuator options:

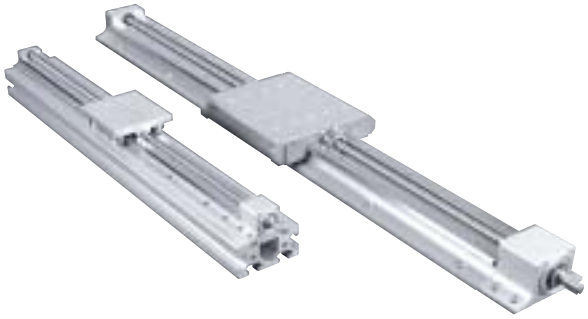
- Belt Drive
- Chain Drive
- Lead screw Drive
- Ball screw Drive

Belt driven LoPro® linear system. System as shown includes an aluminum support beam and a basic wheel plate with wheel covers.

Drive ends and carriage attachment features are designed for high performance, high cycling motion. High quality radial bearings are combined with a sleek, high strength, anodized aluminum housing. Belt and chain drive units include a 400 series stainless steel shaft, with pulleys and sprockets keyed into place. The key / keyway arrangement provides a reliable locking configuration with good rigidity. Bearing fits in the drive end construction are tightly controlled, ensuring smooth and rigid thrust capability. Belt and chain tensioning can be adjusted at the idler drive end. Adjustments are made via an easy to access hex nut that is located on the back of the idler end.

Idler end of a LoPro® chain driven system. This particular system includes a steel support beam . Note the tension adjustment feature on the back plate of the Idler end.

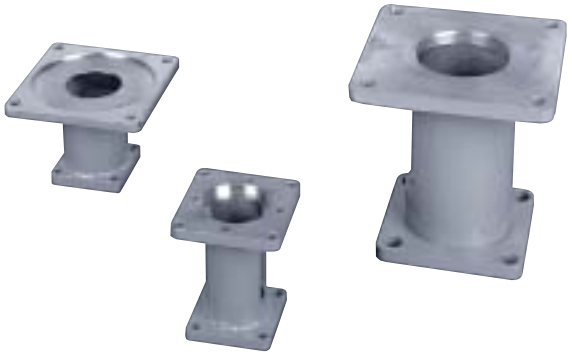
LoPro® screw driven units utilize a fixed - simple bearing support configuration. The fixed end to which the drive motor is coupled, employs a double row, angular contact bearing mounted in a rigid, anodized aluminum housing. The simple end houses a Conrad style, radial ball bearing.



Aluminum support beam mounted, size 1 lead screw driven LoPro® with basic wheel plate (left). Unsupported, size 3 ball screw driven LoPro® (right) shows a wiper wheel plate driven by a non-preloaded ball screw assembly.

Motor Mounts

Standard flanges are available for NEMA and IEC motor faces.

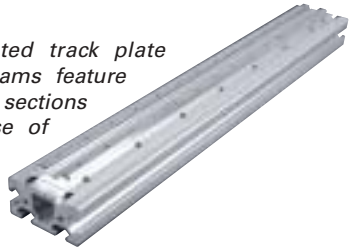


Motor mount adapter flanges are available for all four sizes of LoPro®. Standard motor flanges include Nema and IEC. Other motor faces can also be accommodated.

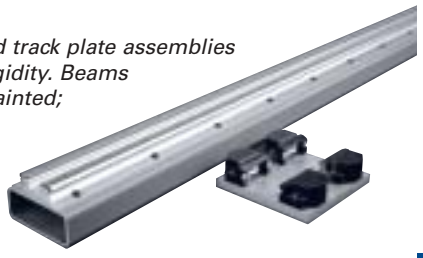
Support Beam Options

LoPro® linear systems are available with two different standard support beam options. Support beams are convenient when the application calls for a self supported linear system. In a beam mounted LoPro® linear system, drive ends, actuator, and linear guide are bundled into a complete, integrated system. All design elements are rigidly affixed to the support beam, and therefore requires minimal preparation for mounting.

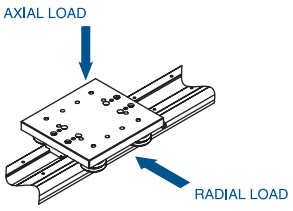
Aluminum beam mounted track plate assembly. Aluminum beams feature industry standard cross sections including t-slots for ease of mounting.



Steel beam mounted track plate assemblies offer high system rigidity. Beams are predrilled and painted; custom shapes are available.



- Complete belt actuated linear system, ready for immediate installation
- Standard aluminum and steel support beam options available
- Two standard available wheel plate options
- Available in standard and corrosion resistant versions
- High speed and acceleration capacity
- Long stroke length capability
- Nema and IEC motor mounts available
- Guide system constructed with DualVee Motion Technology®



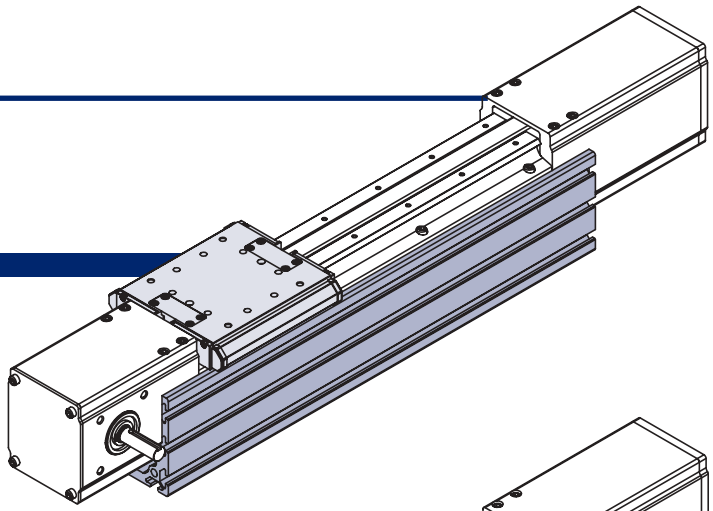
CARRIAGE ASSEMBLY LOAD CAPACITIES				
System Size	Axial Load Capacity		Radial Load Capacity	
	N	lbs	N	lbs
1	988	222	1166	262
2S/2L	2449	551	2805	631
3	6668	1499	6026	1355
4	15682	3525	9220	2073

LOPRO SYSTEM BELT LOAD CAPACITIES					
System Size	Belt Part Number	Working Load		Ultimate Tensile Strength	
		N	lbs	N	lbs
1	10AT5	630	142	2539	571
2S	16AT5	1008	227	4063	913
2L	16AT10	2085	469	8463	1902
3	20AT10	2606	586	10579	2378
4	32AT10	4170	937	16926	3805

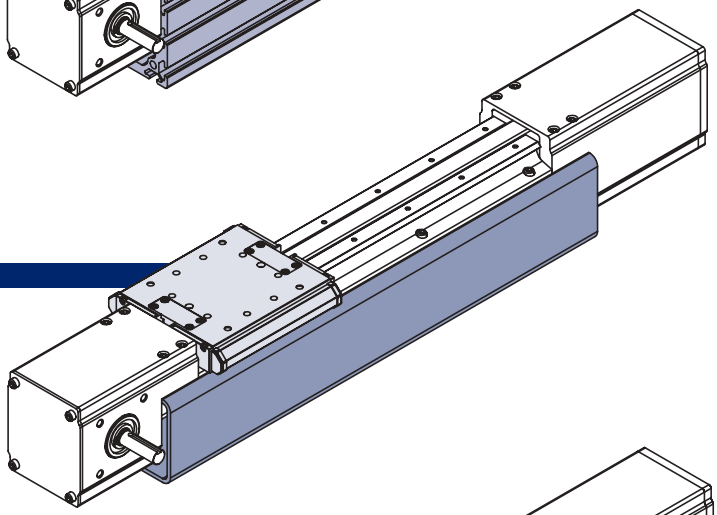
System Size	Belt Size	DRIVE END PULLEYS		
		Pitch Diameter	No. of Teeth	Material
1	10AT5	28.7 mm 1.128 in	18	Aluminum Alloy Bodies with Aluminum or Plated Steel Flanges
2S	16AT5	38.2 mm 1.504 in	24	
2L	16AT10	79.6 mm 3.133 in	25	
3	20AT10	95.5 mm 3.759 in	30	
4	32AT10	95.5 mm 3.759 in	30	

Beam-Mounted System Varieties

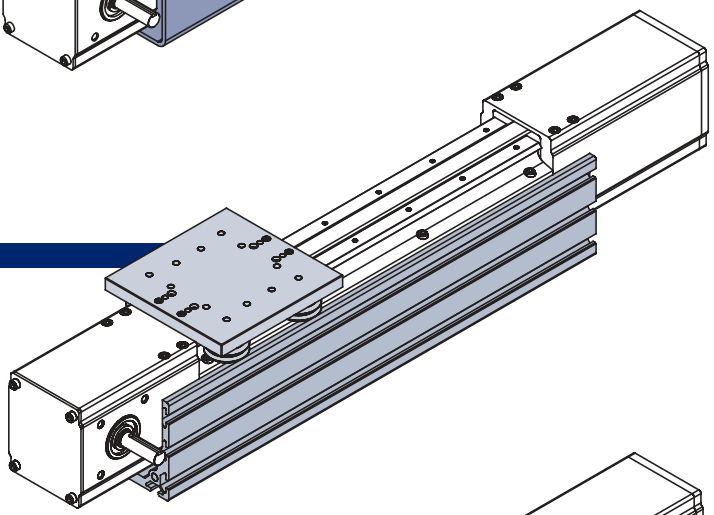
Wiper Wheel Plate System on Aluminum Beam



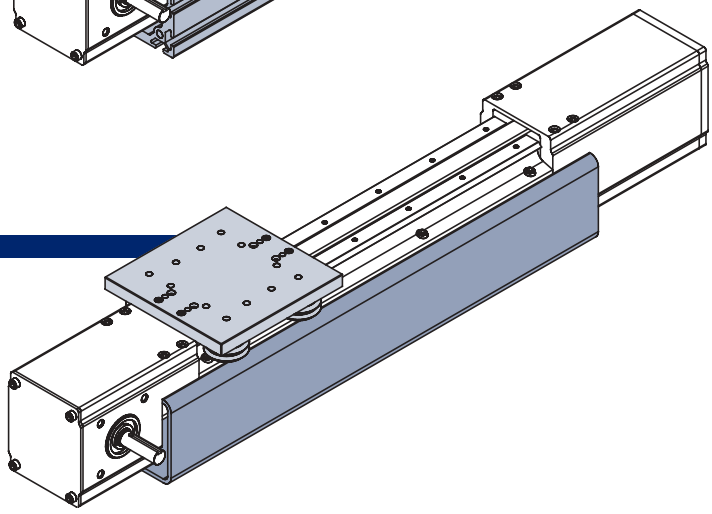
Wiper Wheel Plate System on Steel Beam



Basic Wheel Plate System on Aluminum Beam



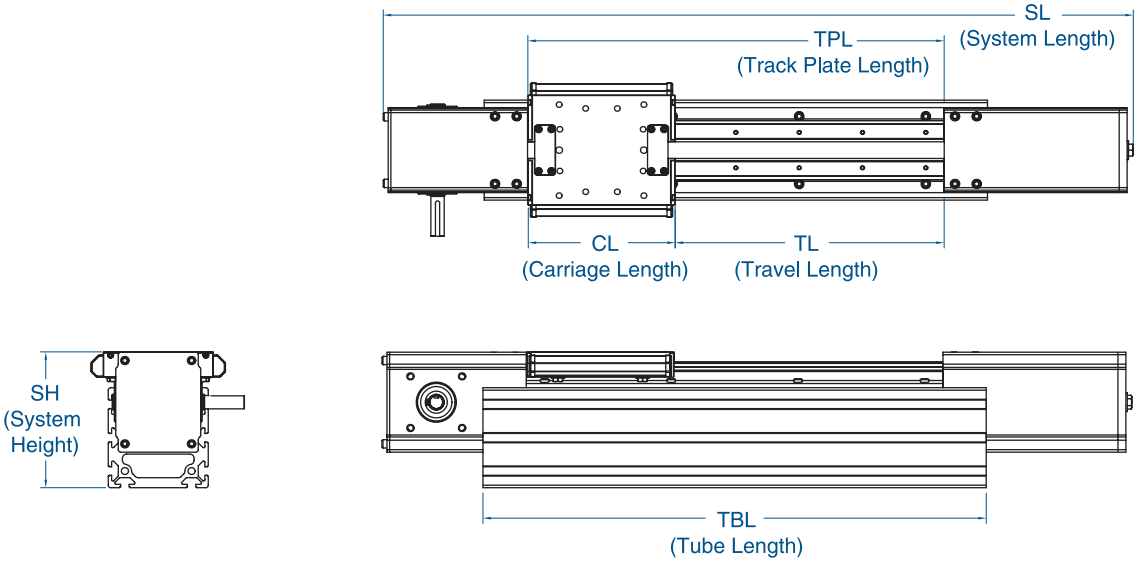
Basic Wheel Plate System on Steel Beam



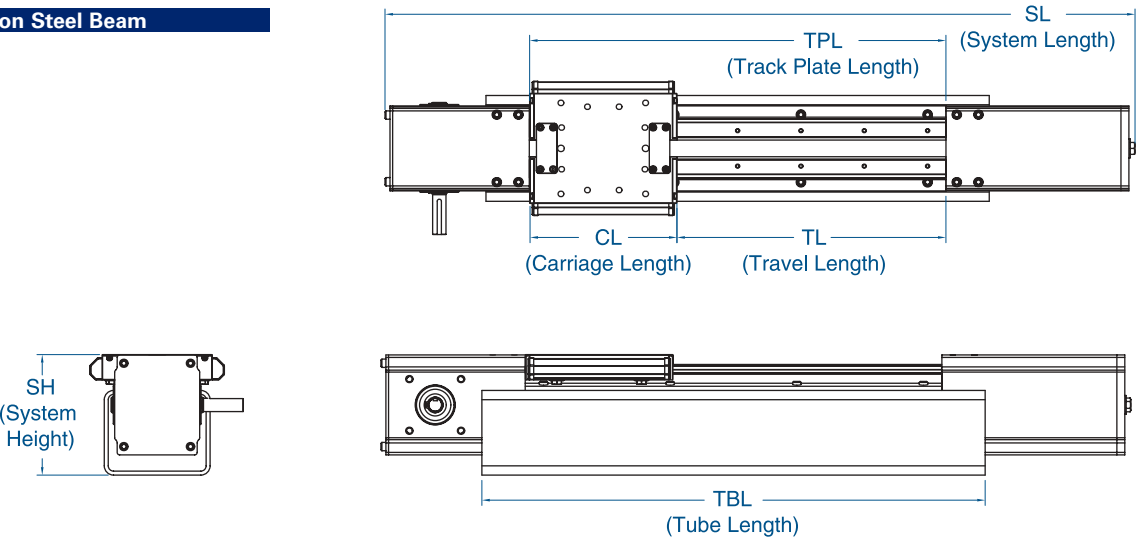
Note: Carriage starting positions may vary. Pictures do not necessarily represent the starting positions of all the lead screw systems, i.e. not all systems' starting positions have the carriage in intimate contact with the drive end housing as shown.

Beam-Mounted Systems: Wiper Wheel Plates

Wiper Wheel Plate on Aluminum Beam



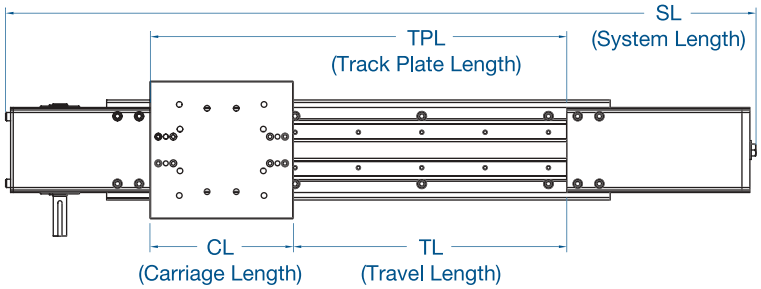
Wiper Wheel Plate on Steel Beam

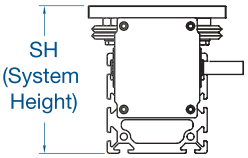


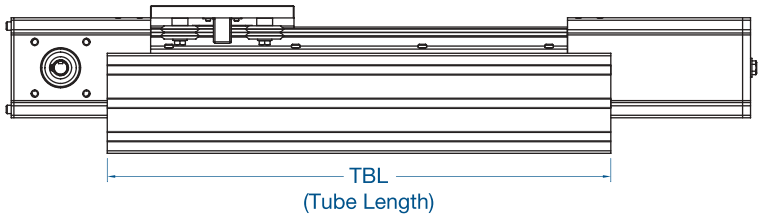
	Size	Track Plate Length TPL = TL + CL	System Length	Tube Length TBL	System Height SH	
		TPL	SL	ALUMINUM/STEEL	ALUMINUM	STEEL
Wiper Wheel Plate	1	TL + 94.0 mm TL + 3.701 in	TPL + 173.6 mm TPL + 6.835 in	TL + 154.0 mm TL + 6.063 in	63.0 mm 2.480 in	61.1 mm 2.406 in
	2S	TL + 129.9 mm TL + 5.114 in	TPL + 227.5 mm TPL + 8.960 in	TL + 209.9 mm TL + 8.264 in	73.0 mm 2.874 in	71.1 mm 2.799 in
	2L	TL + 129.9 mm TL + 5.114 in	TPL + 318.1 mm TPL + 12.522 in	TL + 209.9 mm TL + 8.264 in	113.0 mm 4.449 in	109.2 mm 4.299 in
	3	TL + 177.6 mm TL + 6.992 in	TPL + 400.1 mm TPL + 15.752 in	TL + 281.6 mm TL + 11.087 in	163.0 mm 6.417 in	144.6 mm 5.693 in
	4	TL + 243.8 mm TL + 9.599 in	TPL + 440.9 mm TPL + 17.358 in	TL + 351.8 mm TL + 13.851 in	N/A	156.6 mm 6.165 in

Beam-Mounted Systems: Basic Wheel Plates

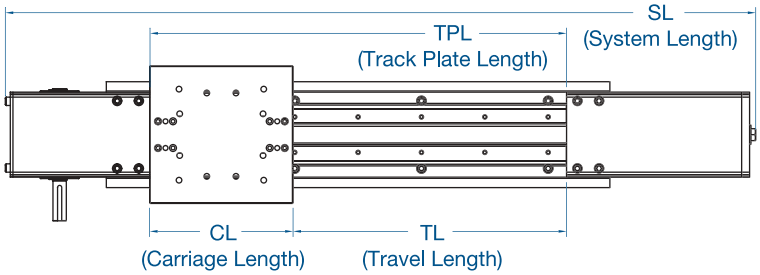
Basic Wheel Plate on Aluminum Beam

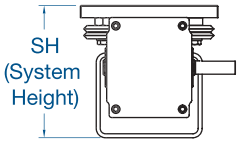


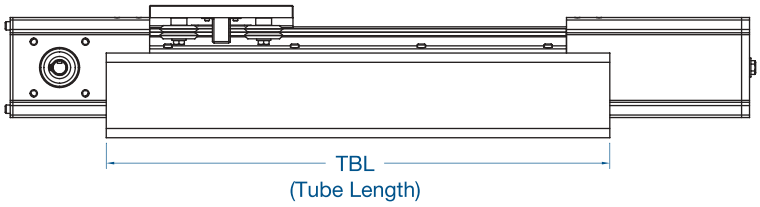




Basic Wheel Plate on Steel Beam



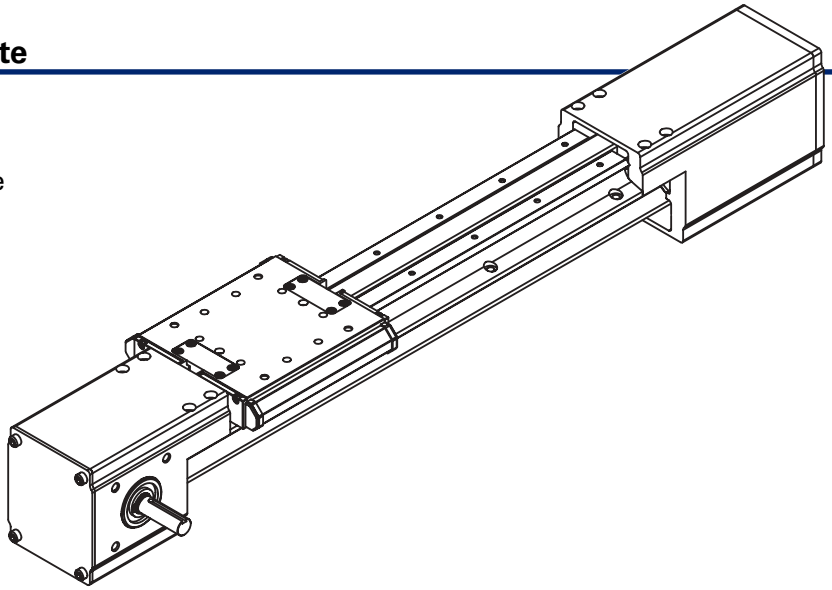


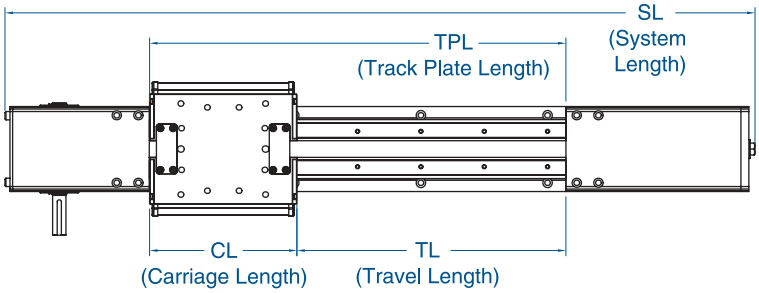


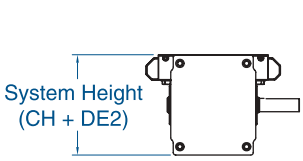
	Size	Track Plate Length	System Length	Tube Length TBL	System Height SH	
		TPL	SL	ALUMINUM/STEEL	ALUMINUM	STEEL
Wiper Wheel Plate	1	TL + 90.0 mm TL + 3.543 in	TPL + 173.6 mm TPL + 6.835 in	TL + 150.0 mm TL + 5.906 in	72.1 mm 2.823 in	69.8 mm 2.750 in
	2S	TL + 127.0 mm TL + 5.000 in	TPL + 227.6 mm TPL + 8.960 in	TL + 207.0 mm TL + 8.150 in	83.5 mm 3.268 in	81.1 mm 3.194 in
	2L	TL + 127.0 mm TL + 5.000 in	TPL + 318.1 mm TPL + 12.582 in	TL + 207.0 mm TL + 8.150 in	123.5 mm 4.862 in	119.2 mm 4.694 in
	3	TL + 172.0 mm TL + 6.772 in	TPL + 400.1 mm TPL + 15.753 in	TL + 276.0 mm TL + 10.886 in	177.0 mm 6.969 in	158.6 mm 6.244 in
	4	TL + 242.0 mm TL + 9.528 in	TPL + 440.9 mm TPL + 17.358 in	TL + 350.0 mm TL + 13.780 in	N/A	170.6 mm 6.717 in

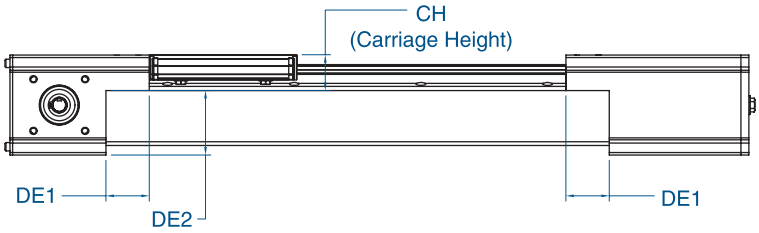
Unmounted Systems: Wiper Plate

- Designed to be mounted to a customer-supplied mounting surface
- System straightness and flatness is determined by mounting surface accuracy
- System is designed for continuous support along entire track plate length





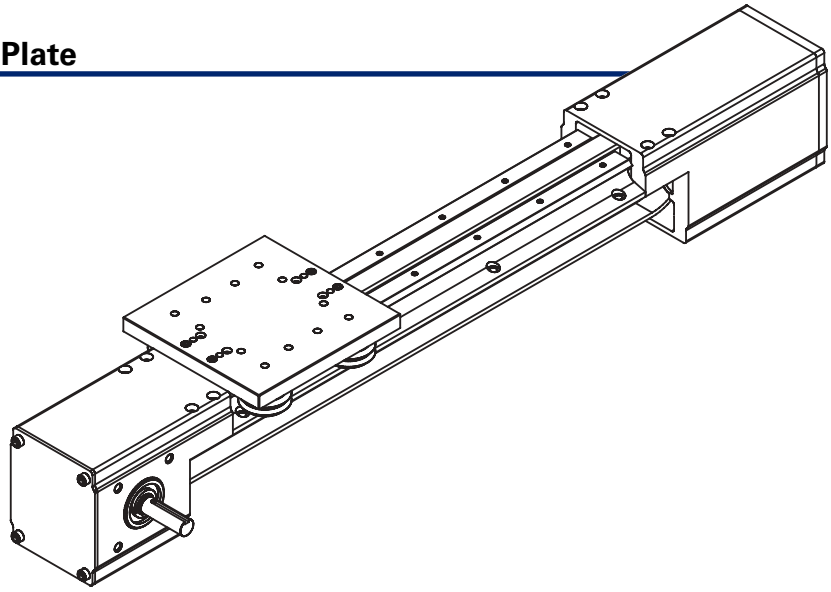


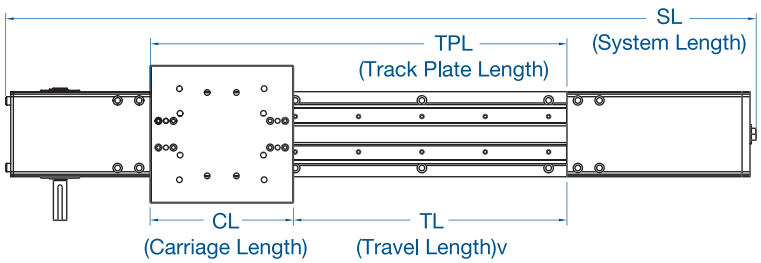


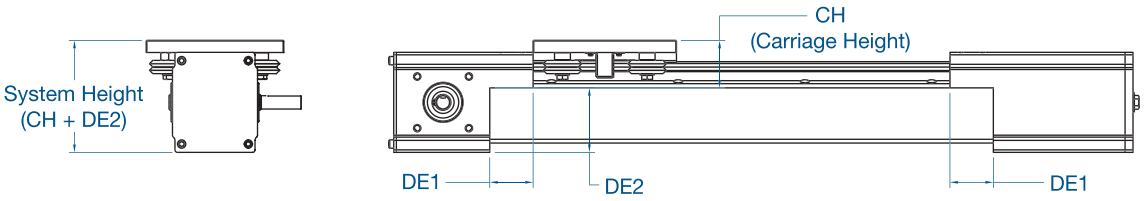
	Size	Track Plate Length TPL	System Length SL	Carriage Height CH	DE1	DE2
Wiper Wheel Plate	1	TL + 94.0 mm TL + 3.701 in	TPL + 173.6 mm TPL + 6.835 in	23.0 mm 0.906 in	30.0 mm 1.181 in	16.0 mm 0.630 in
	2S	TL + 129.9 mm TL + 5.114 in	TPL + 227.6 mm TPL + 8.960 in	33.0 mm 1.299 in	40.0 mm 1.575 in	27.5 mm 1.083 in
	2L	TL + 129.9 mm TL + 5.114 in	TPL + 318.1 mm TPL + 12.522 in	33.0 mm 1.299 in	40.0 mm 1.575 in	68.0 mm 2.677 in
	3	TL + 177.6 mm TL + 6.992 in	TPL + 400.1 mm TPL + 15.753 in	43.0 mm 1.693 in	52.0 mm 2.047 in	77.4 mm 3.047 in
	4	TL + 243.8 mm TL + 9.599 in	TPL + 440.9 mm TPL + 17.358 in	55.0 mm 2.165 in	54.0 mm 2.126 in	75.0 mm 2.953 in

Unmounted Systems: Basic Wheel Plate

- Designed to be mounted to a customer-supplied mounting surface
- System straightness and flatness is determined by mounting surface accuracy
- System is designed for continuous support along entire track plate length

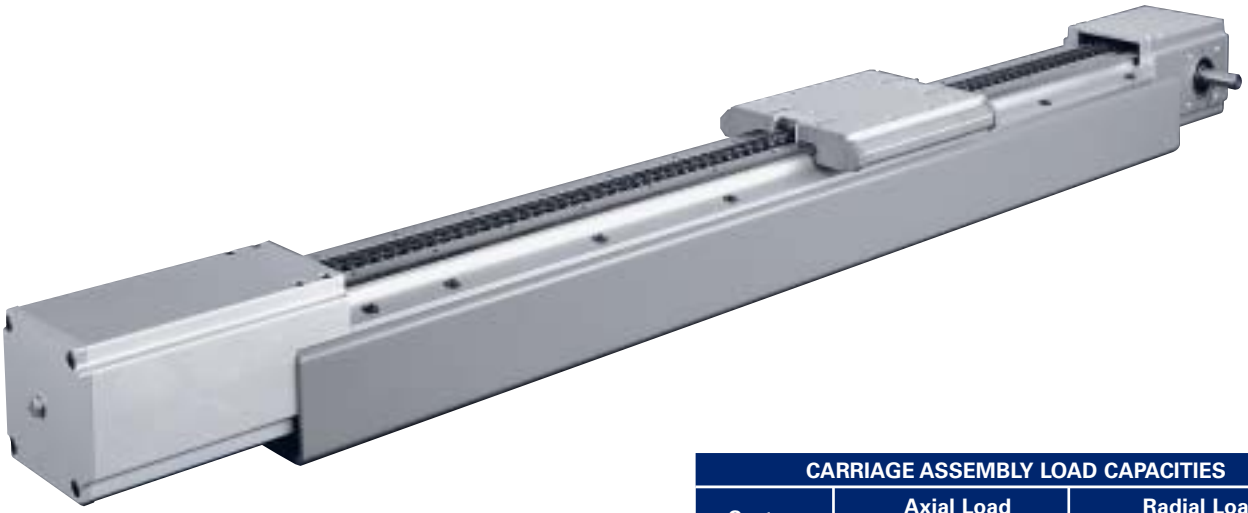


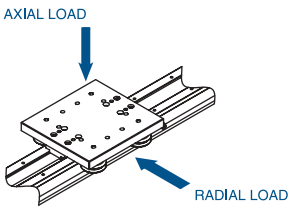




	Size	Track Plate Length TPL	System Length SL	Carriage Height CH	DE1	DE2
Wiper Wheel Plate	1	TL + 90.0 mm TL + 3.543 in	TPL + 173.6 mm TPL + 6.835 in	31.7 mm 1.250 in	30.0 mm 1.181 in	16.0 mm 0.630 in
	2S	TL + 127.0 mm TL + 5.000 in	TPL + 227.6 mm TPL + 8.960 in	43.0 mm 1.694 in	40.0 mm 1.575 in	27.5 mm 1.083 in
	2L	TL + 127.0 mm TL + 5.000 in	TPL + 318.1 mm TPL + 12.522 in	43.0 mm 1.694 in	40.0 mm 1.575 in	68.0 mm 2.677 in
	3	TL + 172.0 mm TL + 6.772 in	TPL + 400.1 mm TPL + 15.753 in	57.0 mm 2.244 in	52.0 mm 2.047 in	77.4 mm 3.047 in
	4	TL + 242.0 mm TL + 9.528 in	TPL + 443.2 mm TPL + 17.358 in	69.0 mm 2.717 in	54.0 mm 2.126 in	75.0 mm 2.953 in

- Complete chain-actuated linear system, ready for immediate installation
- Standard aluminum and steel support beam options available
- Two standard available wheel plate options
- Available in standard and corrosion-resistant versions
- High load-carrying capacity
- Long stroke length capacity
- Standard NEMA and IEC motor mounts available
- Guide system constructed with DualVee Motion Technology®





CARRIAGE ASSEMBLY LOAD CAPACITIES

System Size	Axial Load Capacity		Radial Load Capacity	
	N	lbs	N	lbs
1	988	222	1166	262
2S/2L	2449	551	2805	631
3	6668	1499	6026	1355
4	15682	3525	9220	2073

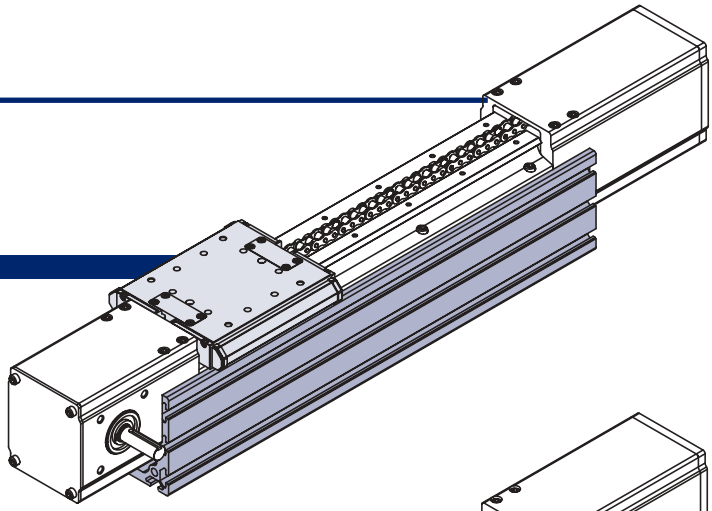
LOPRO SYSTEM CHAIN LOAD CAPACITIES

System Size	Chain Size	Average Tensile Strength		Working Load	
	Single Strand	N	lbs	N	lbs
1	25	3892	875	625	141
2S	35	9341	2100	2135	480
2L	35	9341	2100	2135	480
3	40	16458	3700	3600	809
4	50	27134	6100	6225	1399

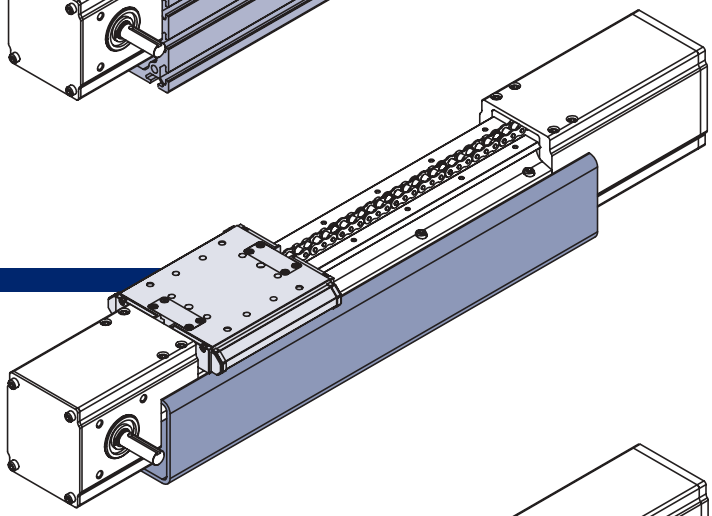
System Size	Chain Size	DRIVE END SPROCKETS		
		Pitch Diameter	No. of Teeth	Material
1	25	24.5 mm 0.966 in	12	Steel or Stainless Steel
2S	35	36.8 mm 1.449 in	12	
2L	35	79.0 mm 3.111 in	26	
3	40	97.3 mm 3.831 in	24	
4	50	91.4 mm 3.599 in	18	

Beam-Mounted Systems

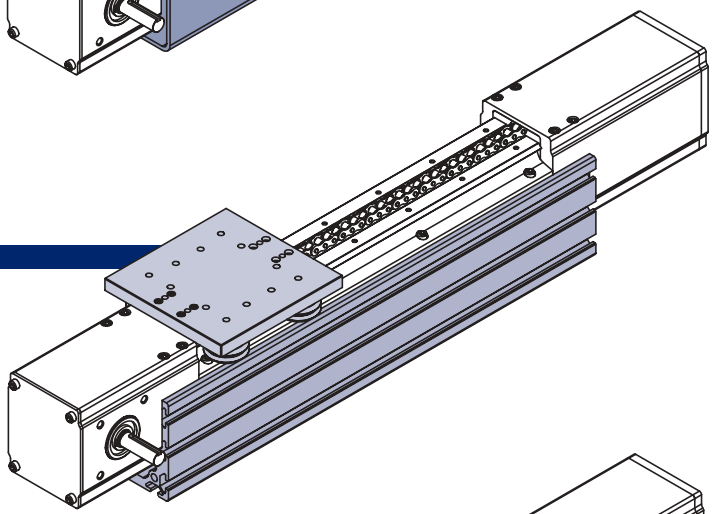
Wiper Wheel Plate System on Aluminum Beam



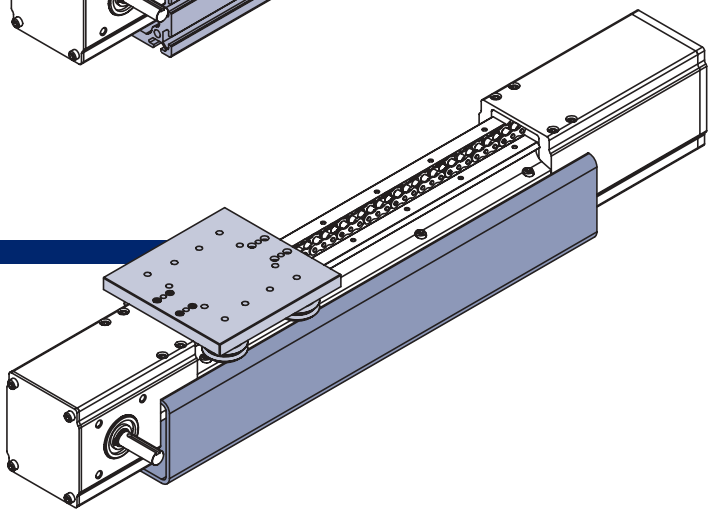
Wiper Wheel Plate System on Steel Beam



Basic Wheel Plate System on Aluminum Beam



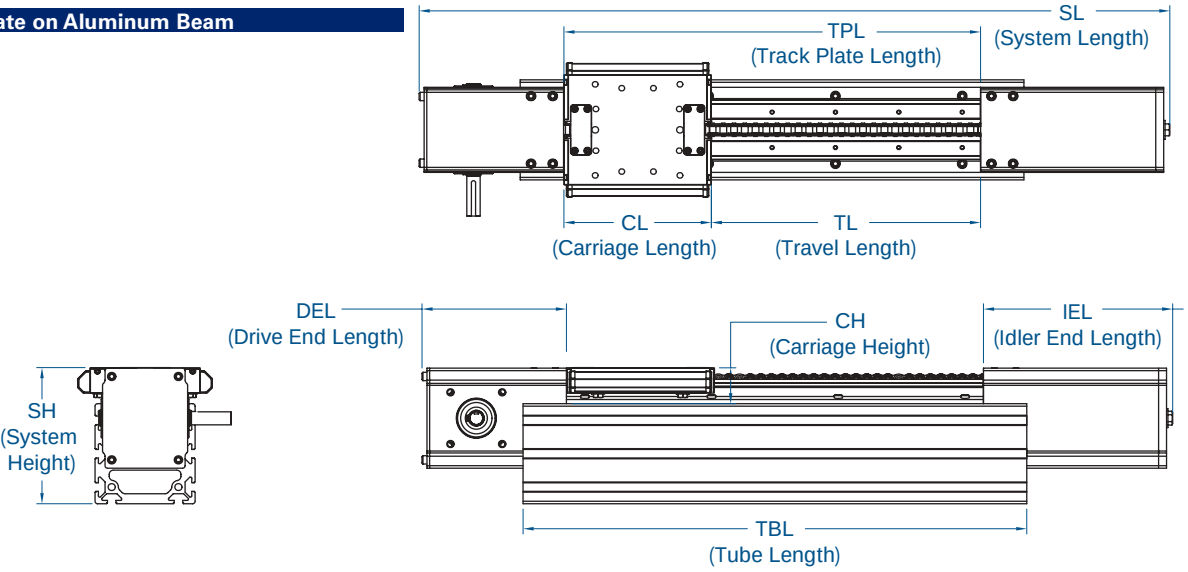
Basic Wheel Plate System on Steel Beam



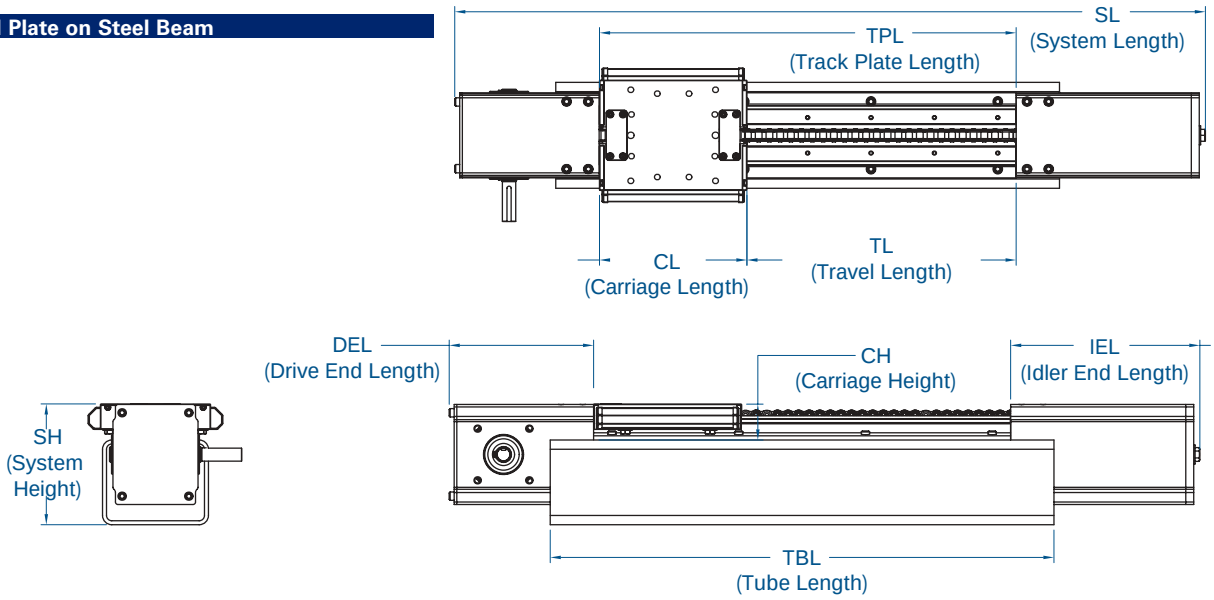
Note: Carriage starting positions may vary. Pictures do not necessarily represent the starting positions of all the lead screw systems, i.e. not all systems' starting positions have the carriage in intimate contact with the drive end housing as shown.

Beam-Mounted Systems: Wiper Wheel Plate

Wiper Wheel Plate on Aluminum Beam



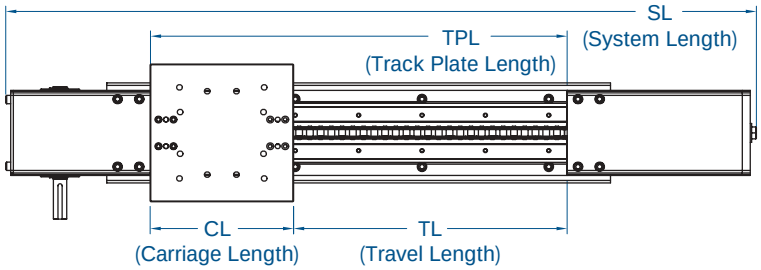
Wiper Wheel Plate on Steel Beam

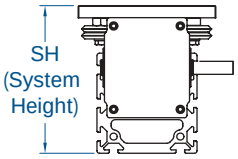


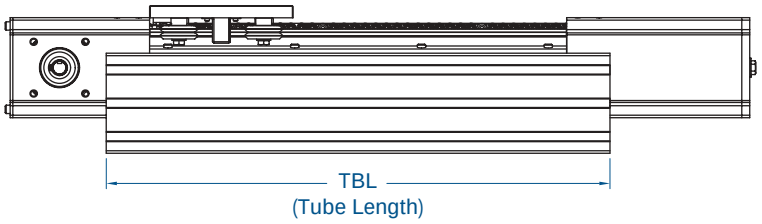
	Size	Track Plate Length TPL	System Length SL	Tube Length TBL ALUMINUM/STEEL	System Height SH ALUMINUM	System Height SH STEEL
Wiper Wheel Plate	1	TL + 94.0 mm TL + 3.701 in	TPL + 173.6 mm TPL + 6.835 in	TL + 154.0 mm TL + 6.063 in	63.0 mm 2.480 in	61.1 mm 2.406 in
	2S	TL + 129.9 mm TL + 5.114 in	TPL + 227.6 mm TPL + 8.960 in	TL + 209.9 mm TL + 8.264 in	73.0 mm 2.874 in	71.1 mm 2.799 in
	2L	TL + 129.9 mm TL + 5.114 in	TPL + 318.1 mm TPL + 12.522 in	TL + 209.9 mm TL + 8.264 in	113.0 mm 4.449 in	109.2 mm 4.299 in
	3	TL + 177.6 mm TL + 6.992 in	TPL + 400.1 mm TPL + 15.753 in	TL + 281.6 mm TL + 11.087 in	163.0 mm 6.417 in	144.6 mm 5.693 in
	4	TL + 243.8 mm TL + 9.599 in	TPL + 443.2 mm TPL + 17.449 in	TL + 351.8 mm TL + 13.851 in	N/A	156.6 mm 6.165 in

Beam-Mounted Systems: Basic Wheel Plate

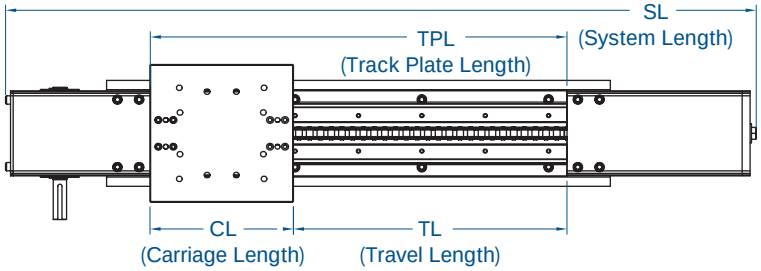
Basic Wheel Plate on Aluminum Beam

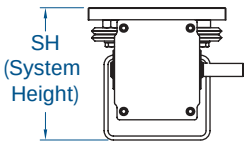


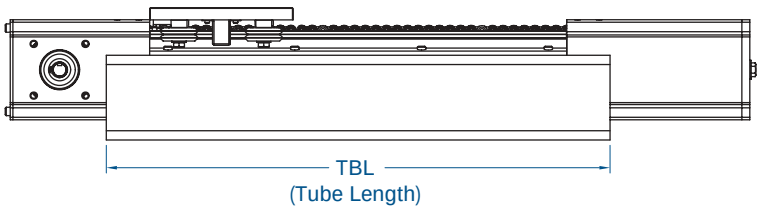




Basic Wheel Plate on Steel Beam

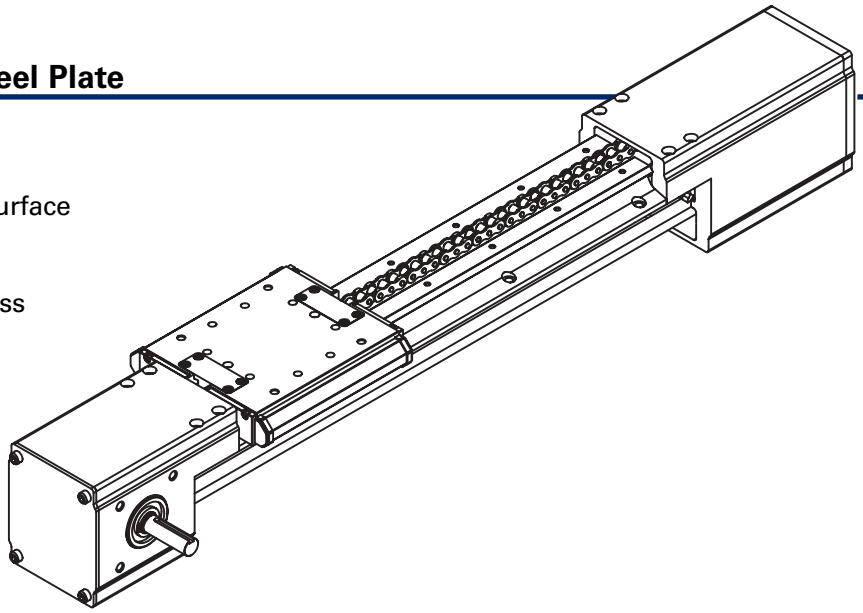




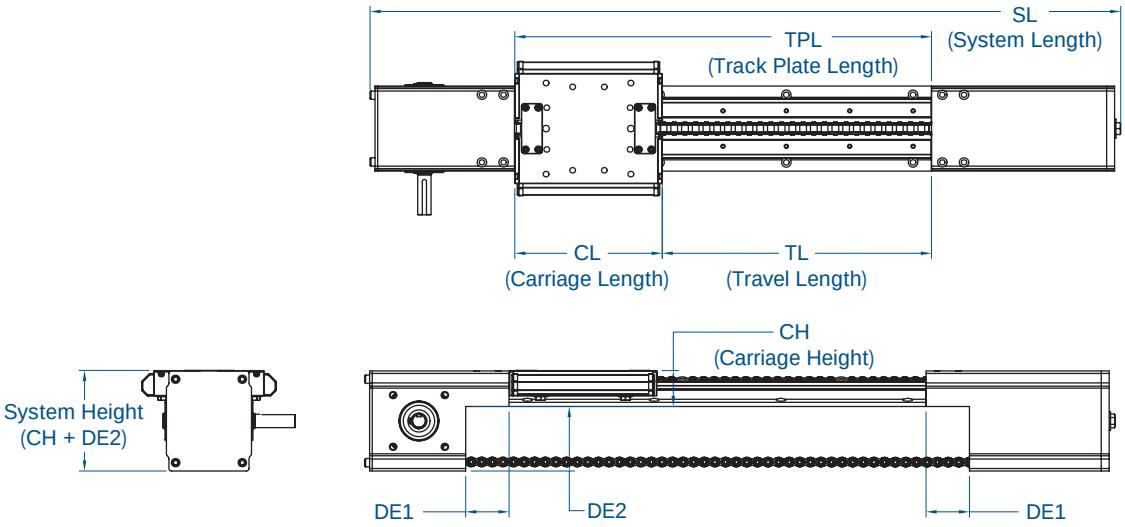


	Size	Track Plate Length TPL	System Length SL	Tube Length TBL ALUMINUM/STEEL	System Height SH ALUMINUM	System Height SH STEEL
Wiper Wheel Plate	1	TL + 90.0 mm TL + 3.543 in	TPL + 173.6 mm TPL + 6.835 in	TL + 150.0 mm TL + 5.906 in	71.7 mm 2.825 in	69.8 mm 2.750 in
	2S	TL + 127.0 mm TL + 5.000 in	TPL + 227.6 mm TPL + 8.960 in	TL + 207.0 mm TL + 8.150 in	83.0 mm 3.268 in	81.1 mm 3.194 in
	2L	TL + 127.0 mm TL + 5.000 in	TPL + 318.1 mm TPL + 12.522 in	TL + 207.0 mm TL + 8.150 in	123.0 mm 4.843 in	119.2 mm 4.694 in
	3	TL + 172.0 mm TL + 6.772 in	TPL + 400.1 mm TPL + 15.753 in	TL + 276.0 mm TL + 10.886 in	177.0 mm 6.969 in	158.6 mm 6.244 in
	4	TL + 242.0 mm TL + 9.528 in	TPL + 440.9 mm TPL + 17.358 in	TL + 350.0 mm TL + 13.780 in	N/A	170.6 mm 6.717 in

Unmounted Systems: Wiper Wheel Plate



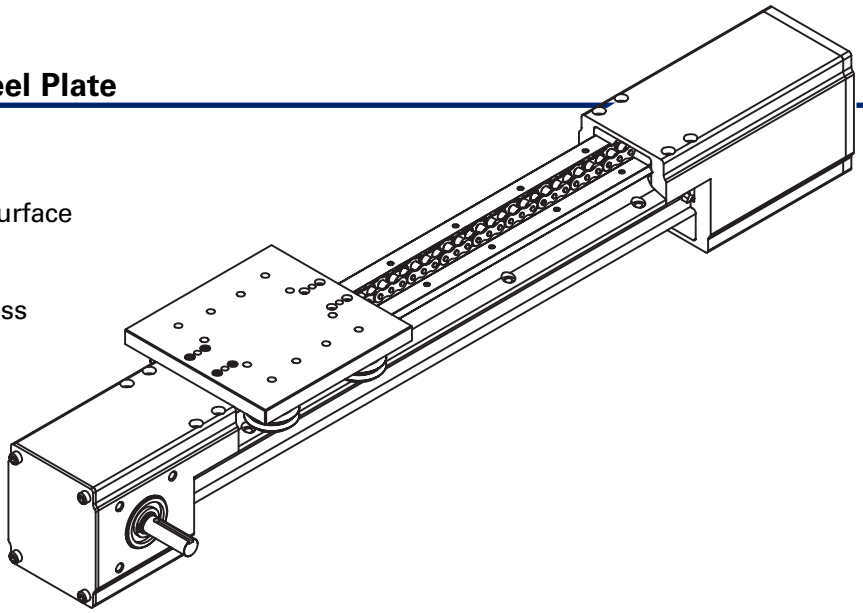
- Designed to be mounted to a customer-supplied mounting surface
- System straightness and flatness is determined by mounting surface accuracy
- System is designed for continuous support along entire track plate length

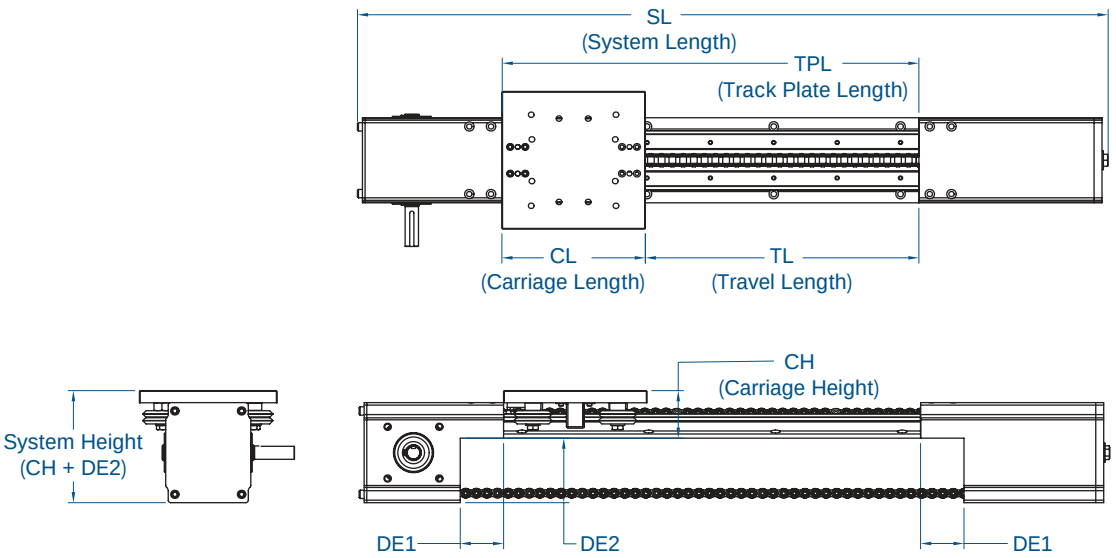


	Size	Track Plate Length TPL		System Length SL		Carriage Height CH		DE1		DE2	
Wiper Wheel Plate	1	TL + 94.0	mm	TPL + 173.6	mm	23.0	mm	30.0	mm	16.0	mm
		TL + 3.701	in	TPL + 6.835	in	0.906	in	1.181	in	0.630	in
	2S	TL + 129.9	mm	TPL + 227.6	mm	33.0	mm	40.0	mm	27.5	mm
		TL + 5.114	in	TPL + 8.960	in	1.299	in	1.575	in	1.083	in
	2L	TL + 129.9	mm	TPL + 318.1	mm	33.0	mm	40.0	mm	68.0	mm
		TL + 5.114	in	TPL + 12.522	in	1.299	in	1.575	in	2.677	in
	3	TL + 177.6	mm	TPL + 400.1	mm	43.0	mm	52.0	mm	77.4	mm
		TL + 6.992	in	TPL + 15.752	in	1.693	in	2.047	in	3.047	in
	4	TL + 243.8	mm	TPL + 440.9	mm	55.0	mm	54.0	mm	75.0	mm
		TL + 9.599	in	TPL + 17.358	in	2.165	in	2.126	in	2.953	in

Unmounted Systems: Basic Wheel Plate

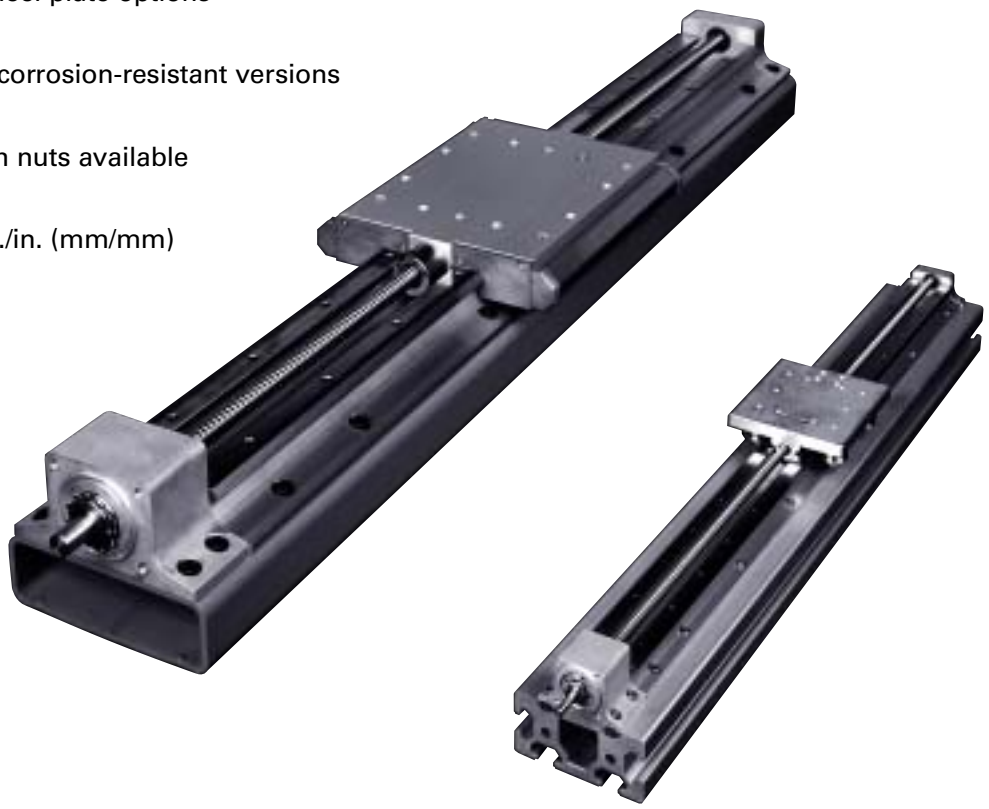
- Designed to be mounted to a customer-supplied mounting surface
- System straightness and flatness is determined by mounting surface accuracy
- System is designed for continuous support along entire track plate length





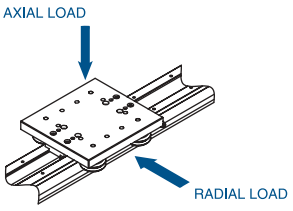
	Size	Track Plate Length TPL		System Length SL		Carriage Height CH		DE1		DE2	
Wiper Wheel Plate	1	TL + 90.0	mm	TPL + 173.6	mm	31.7	mm	30.0	mm	16.0	mm
		TL + 3.543	in	TPL + 6.835	in	1.250	in	1.181	in	0.630	in
	2S	TL + 127.0	mm	TPL + 227.6	mm	43.0	mm	40.0	mm	27.5	mm
		TL + 5.000	in	TPL + 8.960	in	1.694	in	1.575	in	1.083	in
	2L	TL + 127.0	mm	TPL + 318.1	mm	43.0	mm	40.0	mm	68.0	mm
		TL + 5.000	in	TPL + 12.522	in	1.694	in	1.575	in	2.677	in
	3	TL + 172.0	mm	TPL + 400.1	mm	57.0	mm	52.0	mm	77.4	mm
		TL + 6.772	in	TPL + 15.752	in	2.244	in	2.047	in	3.047	in
	4	TL + 242.0	mm	TPL + 440.9	mm	69.0	mm	54.0	mm	75.0	mm
		TL + 9.528	in	TPL + 17.358	in	2.717	in	2.126	in	2.953	in

- Complete lead screw actuated linear system, ready for immediate installation
- Standard aluminum and steel support beam options available
- Two standard available wheel plate options
- Available in standard and corrosion-resistant versions
- Standard and anti backlash nuts available
- Lead accurate to 0.0006 in./in. (mm/mm)
- Standard NEMA and IEC motor mounts available
- Guide system constructed with DualVee Motion Technology®
- Stock lead screw lengths: up to 4000 mm. Longer lengths available - consult factory.



CARRIAGE ASSEMBLY LOAD CAPACITIES				
System Size	Axial Load Capacity		Radial Load Capacity	
	N	lbs	N	lbs
1	988	222	1166	262
2S/2L	2449	551	2805	631
3	6668	1499	6026	1355
4	15682	3525	9220	2073

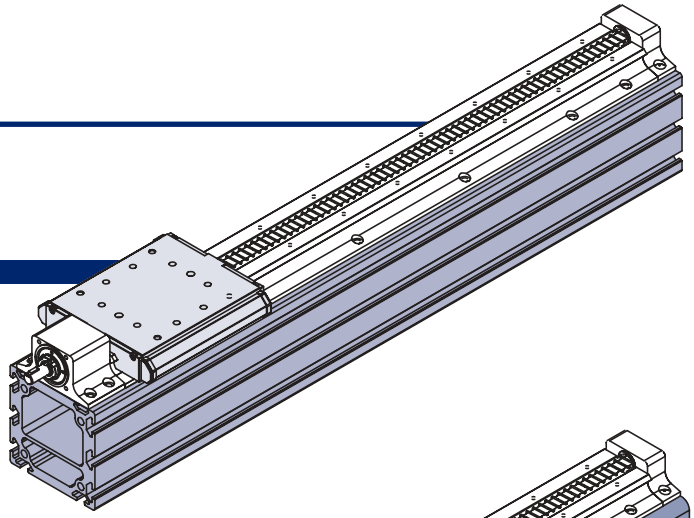
LOPRO LEAD SCREW THRUST CAPACITIES				
Size	Screw Diameter	Nut Type	Dynamic Load Capacity	
	IN		N	lbs
1	1/4	BY	196	44.0
		NTBY	44	9.9
2	3/8	BY	343	77.1
		NTBY	89	20.0
3	1/2	NTBY	446	100.3
	5/8	BY	981	220.5
4	3/4	BY	1570	352.9
		VHDY	1560	350.7



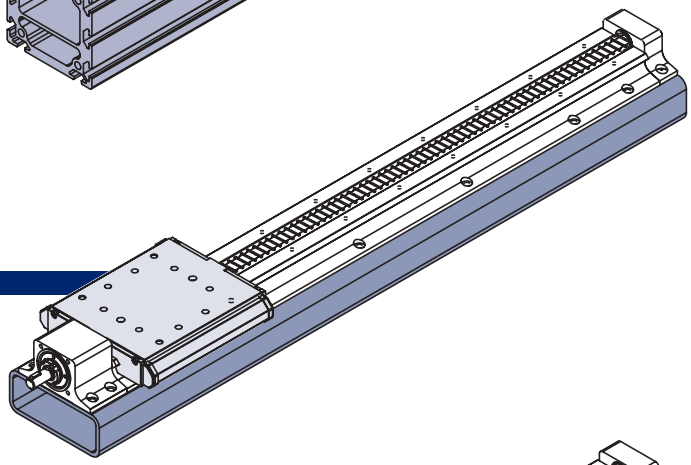
Note: NTBY and VHDY are anti-backlash nuts.

Beam-Mounted Lead Screw System

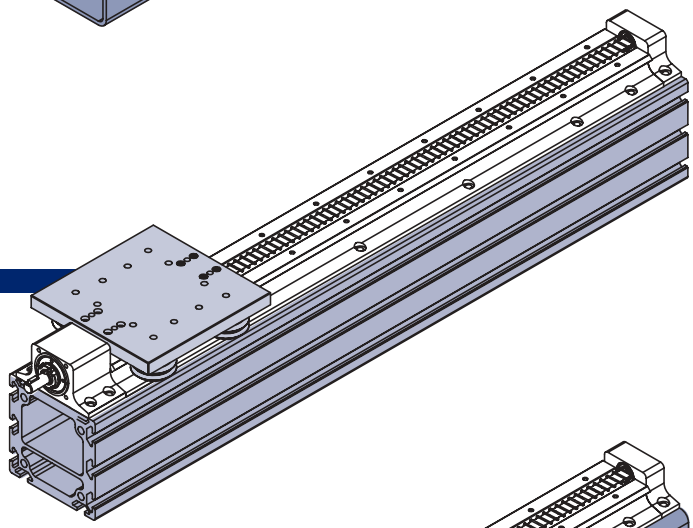
Wiper Wheel Plate System on Aluminum Beam



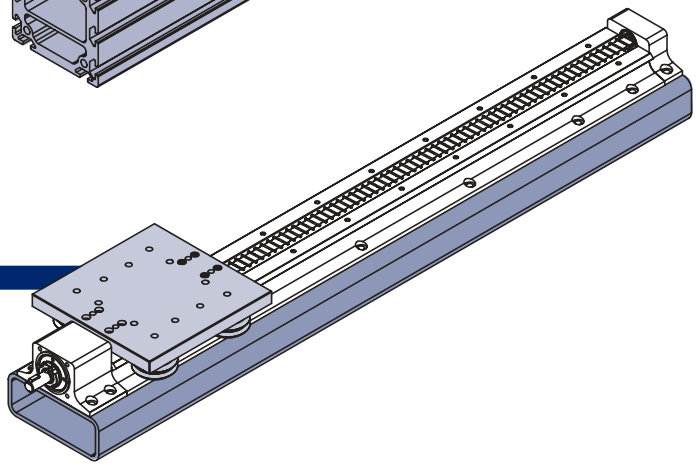
Wiper Wheel Plate System on Steel Beam



Basic Wheel Plate System on Aluminum Beam



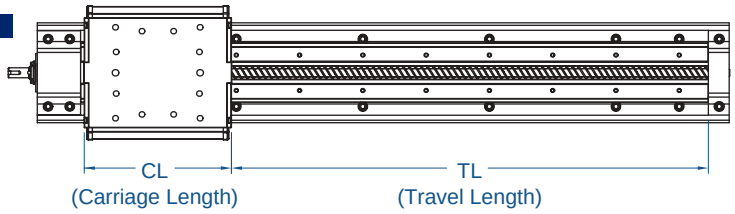
Basic Wheel Plate System on Steel Beam

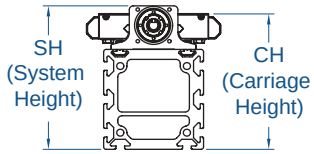


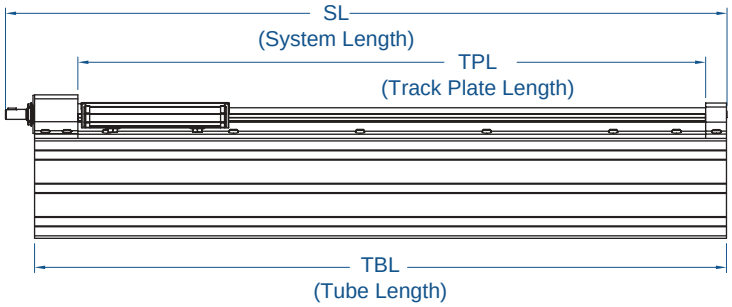
Note: Carriage starting positions may vary. Pictures do not necessarily represent the starting positions of all the lead screw systems, i.e. not all systems' starting positions have the carriage in intimate contact with the drive end housing as shown.

Beam Mounted Systems: Wiper Wheel Plate

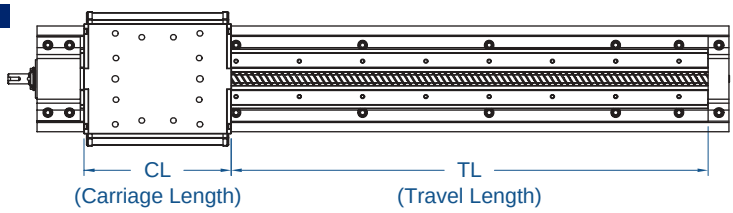
Wiper Wheel Plate on Aluminum Beam

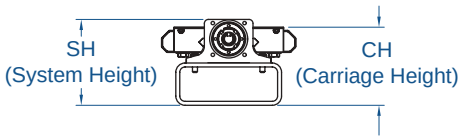


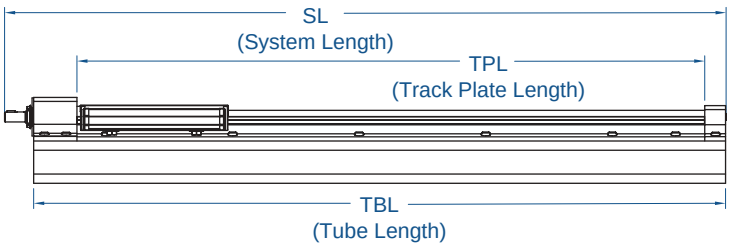




Wiper Wheel Plate on Steel Beam





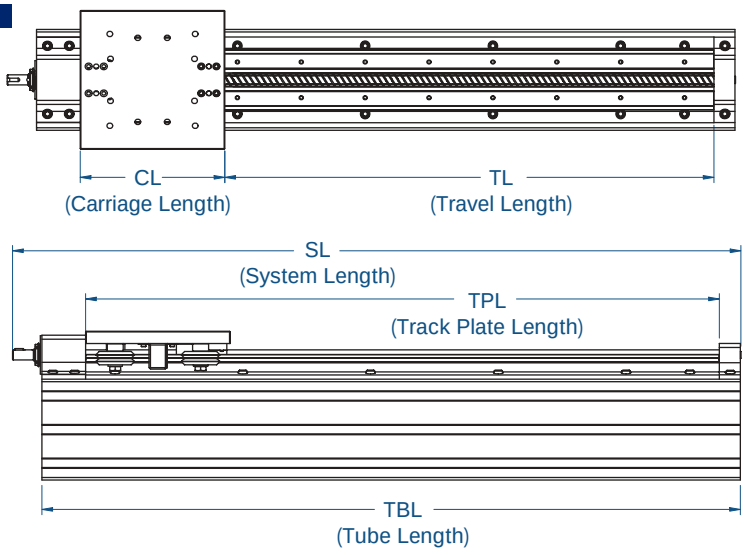


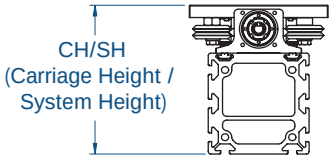
	Size	Screw Dia.	Nut Type	Track Plate Length TPL*	System Length SL	Tube Length TBL ALUMINUM/STEEL	Carriage Height CH ALUMINUM	Carriage Height CH STEEL	System Height SH ALUMINUM	System Height SH STEEL
Wiper Wheel Plate	1	1/4	BY	TL + 95.8 mm TL + 3.771 in	TPL + 65.7 mm	TPL + 43.0 mm	63.0 mm	61.1 mm	70.5 mm	68.6. mm
			NTBY	TL + 99.2 mm TL + 3.906 in	TPL + 2.588 in	TPL + 1.693 in	2.480 in	2.406 in	2.776 in	2.701 in
	2	3/8	BY	TL + 129.9 mm TL + 5.114 in	TPL + 91.8 mm	TPL + 59.0 mm	73.0 mm	71.1 mm	83.2 mm	81.3 mm
			NTBY	TL + 146.9 mm TL + 5.785 in	TPL + 3.615 in	TPL + 2.323 in	2.874 in	2.799 in	3.276 in	3.201 in
	3	1/2	NTBY	TL + 206.6 mm TL + 8.134 in	TPL + 108.1 mm	TPL + 77.0 mm	163.0 mm	93.8 mm	172.2 mm	103.0 mm
		5/8	BY	TL + 180.4 mm TL + 7.101 in	TPL + 4.354 in	TPL + 3.031 in	6.417 in	3.693 in	6.780 in	4.055 in
	4	3/4	BY	TL + 270.0 mm TL + 10.628 in	TPL + 121.7 mm	TPL + 86.0 mm	N/A	105.8 mm	N/A	119.4 mm
			VHDY	TL + 298.4 mm TL + 11.748 in	TPL + 4.792 in	TPL + 3.386 in	N/A	4.165 in	N/A	4.701 in

* Track plate length (TPL) = track length (TL) + carriage length (CL) + nut protrusion.

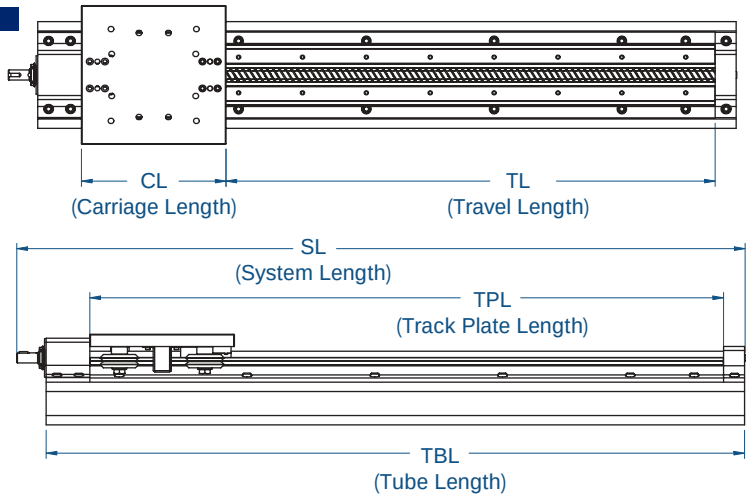
Beam-Mounted System: Basic Wheel Plate

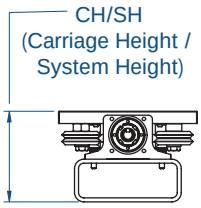
Basic Wheel Plate on Aluminum Beam





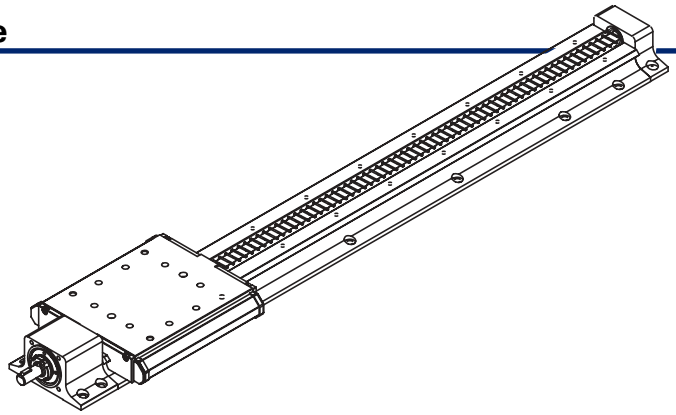
Basic Wheel Plate on Steel Beam



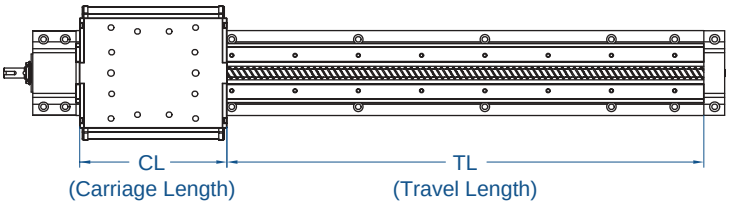


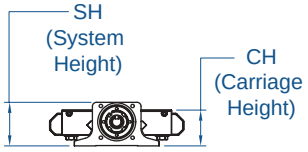
	Size	Screw Dia.	Nut Type	Track Plate Length TPL	System Length SL	Tube Length TBL ALUMINUM/STEEL	Carriage Height CH/SH ALUMINUM	Carriage Height CH/SH STEEL
Wiper Wheel Plate	1	1/4	BY	TL + 90.0 mm TL + 3.543 in	TPL + 65.7 mm	TPL + 43.0 mm	71.8 mm	69.8. mm
			NTBY	TL + 90.0 mm TL + 3.543 in	TPL + 2.588 in	TPL + 1.693 in	2.825 in	2.750 in
	2	3/8	BY	TL + 137.0 mm TL + 5.394 in	TPL + 91.8 mm	TPL + 59.0 mm	83.0 mm	81.1 mm
			NTBY	TL + 154.0 mm TL + 6.063 in	TPL + 3.615 in	TPL + 2.323 in	3.269 in	3.194 in
	3	1/2	NTBY	TL + 204.5 mm TL + 8.052 in	TPL + 108.1 mm	TPL + 77.0 mm	177.0 mm	107.8 mm
		5/8	BY	TL + 180.4 mm TL + 7.101 in	TPL + 4.254 in	TPL + 3.031 in	6.968 in	4.244 in
	4	3/4	BY	TL + 270.0 mm TL + 10.628 in	TPL + 121.7 mm	TPL + 86.0 mm	N/A	119.8 mm
			VHDY	TL + 296.6 mm TL + 11.677 in	TPL + 4.792 in	TPL + 3.386 in	N/A	4.717 in

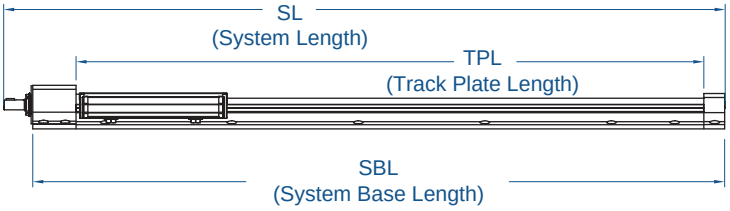
Unmounted Systems: Wiper Wheel Plate



- Designed to be mounted to a customer-supplied mounting surface
- System straightness and flatness is determined by mounting surface accuracy
- System is designed for continuous support along entire track plate length
- System is shipped with temporary mounting plates affixing drive ends to track plate

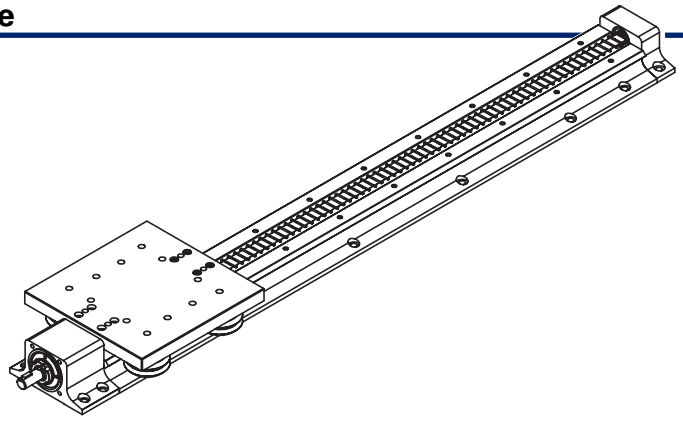




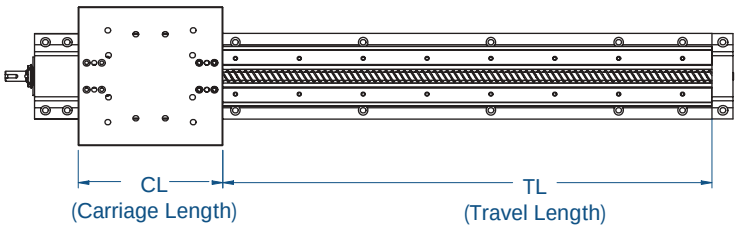


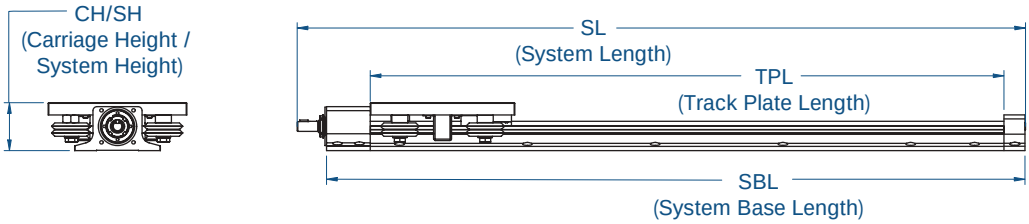
	Size	Screw Dia.	Nut Type	Track Plate Length TPL	System Length SL	System Base Length SBL	Carriage Height CH	System Height SH
Wiper Wheel Plate	1	1/4	BY	TL + 95.8 mm TL + 3.771 in	TPL + 65.7 mm	TPL + 43.0 mm	23.0 mm	30.5 mm
			NTBY	TL + 96.7 mm TL + 3.808 in	TPL + 2.588 in	TPL + 1.693 in	0.906 in	1.201 in
	2	3/8	BY	TL + 129.9 mm TL + 5.114 in	TPL + 91.8 mm	TPL + 59.0 mm	33.0 mm	43.2 mm
			NTBY	TL + 146.9 mm TL + 5.785 in	TPL + 3.615 in	TPL + 2.323 in	1.299 in	1.701 in
	3	1/2	NTBY	TL + 195.5 mm TL + 7.696 in	TPL + 108.1 mm	TPL + 77.0 mm	43.0 mm	52.2 mm
		5/8	BY	TL + 180.4 mm TL + 7.101 in	TPL + 4.234 in	TPL + 3.031 in	1.693 in	2.055 in
	4	3/4	BY	TL + 270.0 mm TL + 10.638 in	TPL + 121.9 mm	TPL + 86.0 mm	55.0 mm	68.6 mm
			VHDY	TL + 298.4 mm TL + 11.748 in	TPL + 4.792 in	TPL + 3.386 in	2.165 in	2.701 in

Unmounted Systems: Basic Wheel Plate



- Designed to be mounted to a customer-supplied mounting surface
- System straightness and flatness is determined by mounting surface accuracy
- System is shipped with temporary mounting plates affixing drive ends to track plate

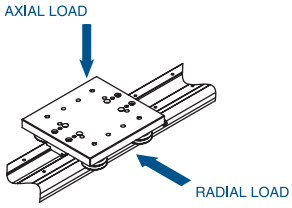




	Size	Screw Dia.	Nut Type	Track Plate Length TPL	System Length SL	System Base Length SBL	Carriage Height/ System Height CH/SH
Wiper Wheel Plate	1	1/4	BY	TL + 90.0 mm TL + 3.543 in	TPL + 65.7 mm	TPL + 43.0 mm	31.7 mm
			NTBY	TL + 90.0 mm TL + 3.543 in	TPL + 2.588 in	TPL + 1.693 in	1.250 in
	2	3/8	BY	TL + 137.0 mm TL + 5.394 in	TPL + 91.8 mm	TPL + 59.0 mm	43.0 mm
			NTBY	TL + 154.0 mm TL + 6.063 in	TPL + 3.615 in	TPL + 2.323 in	1.694 in
	3	1/2	NTBY	TL + 204.5 mm TL + 8.052 in	TPL + 108.1 mm	TPL + 77.0 mm	57.0 mm
		5/8	BY	TL + 172.0 mm TL + 6.772 in	TPL + 4.254 in	TPL + 3.031 in	2.244 in
	4	3/4	BY	TL + 270.0 mm TL + 10.628 in	TPL + 121.7 mm	TPL + 86.0 mm	69.0 mm
			VHDY	TL + 296.6 mm TL + 11.677 in	TPL + 4.792 in	TPL + 3.386 in	2.717 in

- Complete ball screw actuated linear system, ready for immediate installation
- Standard aluminum and steel support beam options available
- Two standard available wheel plate options
- Available in standard and corrosion-resistant versions
- Nut operating temperatures: 32°F - 200°F (0°C - 93°C)
- Accurate to 0.004 in./ft. (0.1 mm/300 mm)
- Standard NEMA and IEC motor mounts available
- Guide system constructed with DualVee Motion Technology®
- Maximum ball screw lengths:
  Size 2: 3,000 mm
  Size 3: 1,500 mm
  Size 4: 1,500 (for ø 16 mm)
  1,800 (for ø 20 mm)

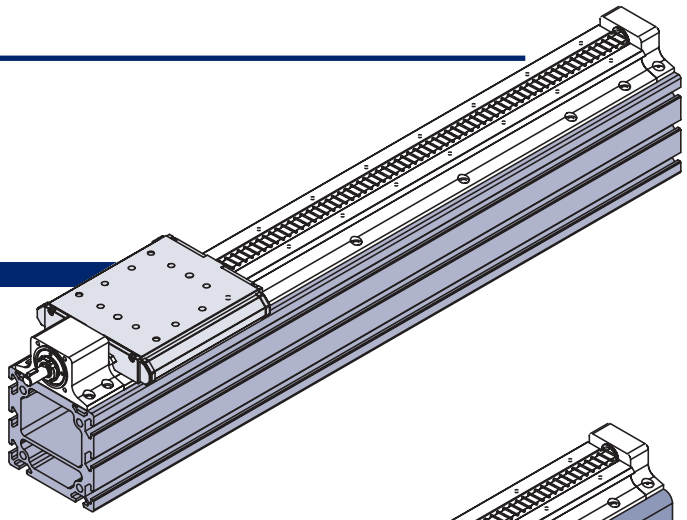
CARRIAGE ASSEMBLY LOAD CAPACITIES				
System Size	Axial Load Capacity		Radial Load Capacity	
	N	lbs	N	lbs
1	988	222	1166	262
2S/2L	2449	551	2805	631
3	6668	1499	6026	1355
4	15682	3525	9220	2073



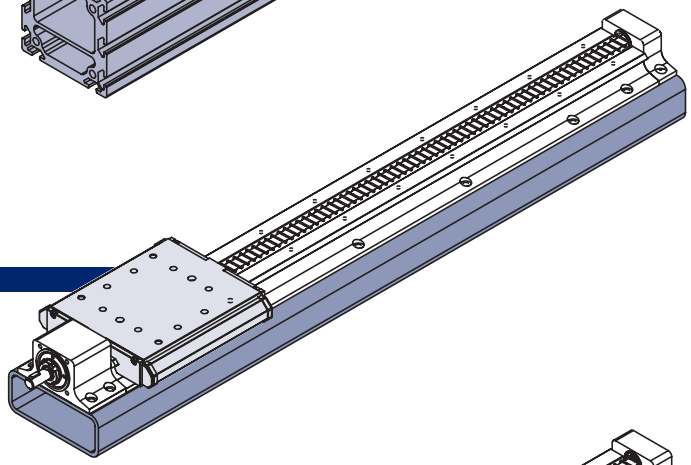
LOPRO BALL SCREW THRUST CAPACITIES					
System Size	Screw Diameter	Maximum Length	Lead	Dynamica Load Capacity	
	mm	mm	mm	N	lbs
1	N/A	-	-	-	-
2	10	3000	2	1250	281.0
			3	2800	629.4
3	12	1500	5	2300	517.0
			10	1500	337.2
4	16	1500	5	5600	1258.9
			10	5800	1303.8
	20	1800	5	8600	1933.3

Beam-Mounted Ball Screw Systems

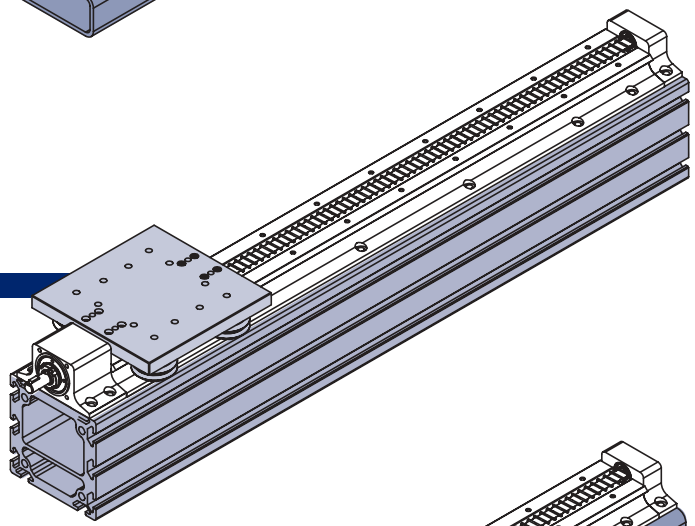
Wiper Wheel Plate System on Aluminum Beam



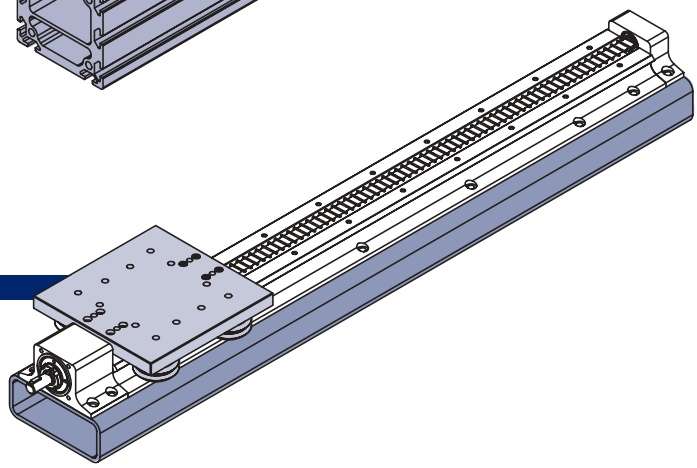
Wiper Wheel Plate System on Steel Beam



Basic Wheel Plate System on Aluminum Beam



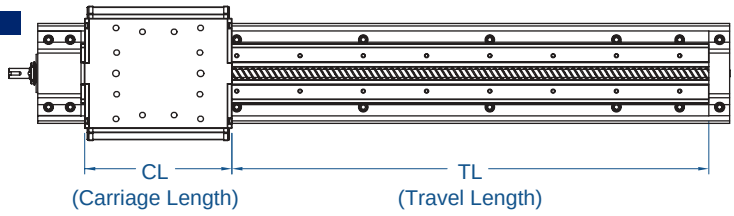
Basic Wheel Plate System on Steel Beam

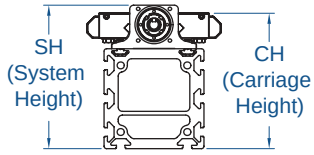


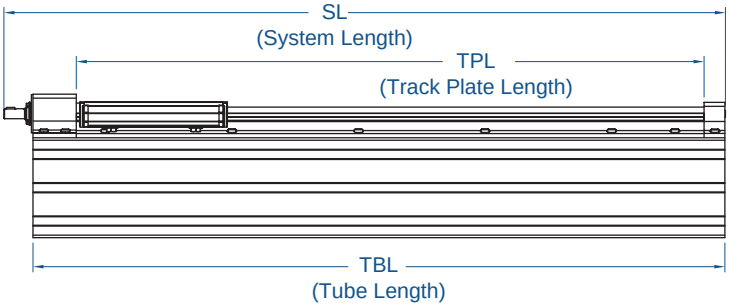
Note: Carriage starting positions may vary. Pictures do not necessarily represent the starting positions of all the ball screw systems, i.e. not all systems' starting positions have the carriage in intimate contact with the drive end housing as shown.

Beam Mounted Systems: Wiper Wheel Plate

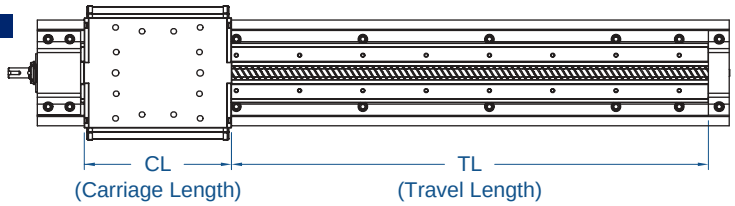
Wiper Wheel Plate on Aluminum Beam

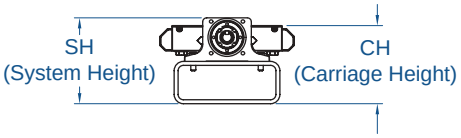


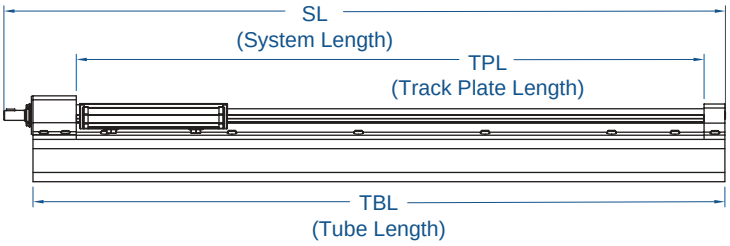




Wiper Wheel Plate on Steel Beam



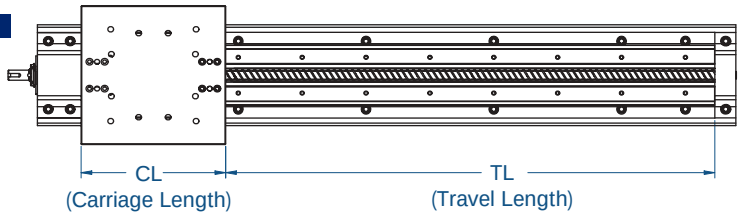


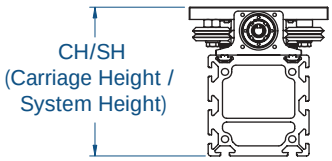


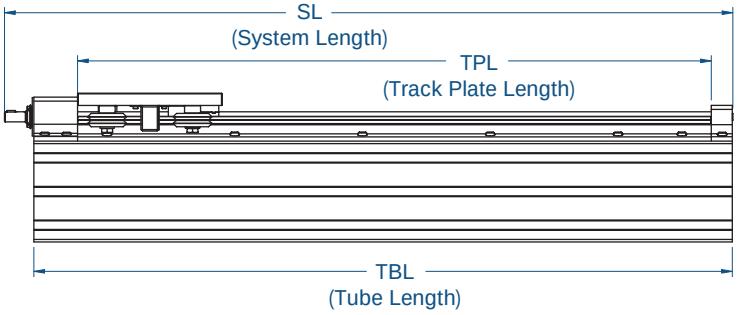
	Size	Screw Dia. mm	Lead mm	Track Plate Length TPL	System Length SL	Tube Length TBL ALUMINUM/STEEL	Carriage Height CH ALUMINUM	Carriage Height CH STEEL	System Height SH ALUMINUM	System Height SH STEEL
Wiper Wheel Plate	2	10	2	TL + 129.9 mm TL + 5.114 in	TPL + 91.8 mm	TPL + 59.0	73.0 mm	71.1 mm	83.2 mm	81.3 mm
			3	TL + 129.9 mm TL + 5.114 in	TPL + 3.615 in	TPL + 2.323 in	2.874 in	2.799 in	3.276 in	3.201 in
	3	12	5	TL + 181.6 mm TL + 7.150 in	TPL + 108.1 mm	TPL + 77.0 mm	163.0 mm	93.8 mm	172.2 mm	103.1 mm
			10	TL + 185.6 mm TL + 7.308 in	TPL + 4.254 in	TPL + 3.031 in	6.417 in	3.693 in	6.780 in	4.055 in
	4	16	5	TL + 259.9 mm TL + 10.232 in	TPL + 121.7 mm	TPL + 86.0 mm	N/A	105.8 mm	N/A	119.4 mm
			10	TL + 272.9 mm TL + 10.742 in	TPL + 4.792 in	TPL + 3.386 in	N/A	4.165 in	N/A	4.701 in
		20	5	TL + 267.9 mm TL + 10.546 in						

Beam-Mounted Systems: Basic Wheel Plate

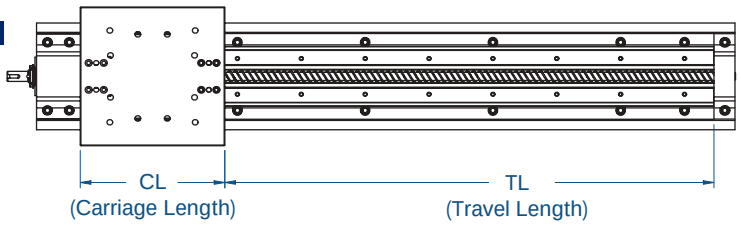
Basic Wheel Plate on Aluminum Beam

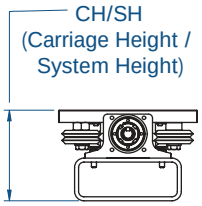


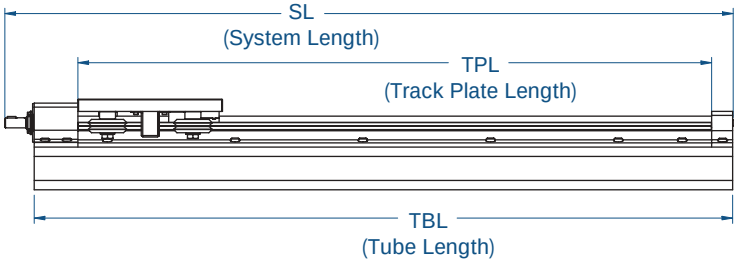




Basic Wheel Plate on Steel Beam

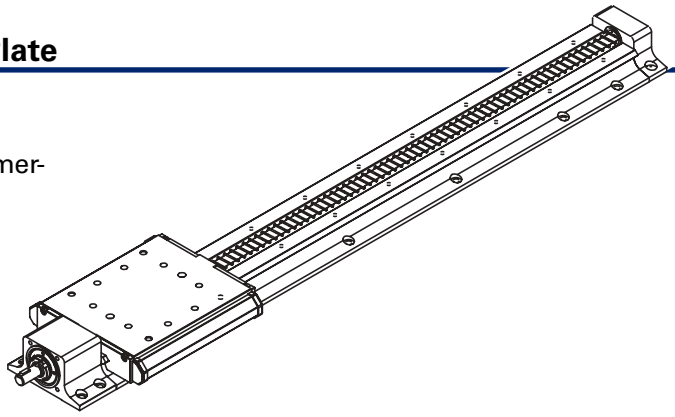




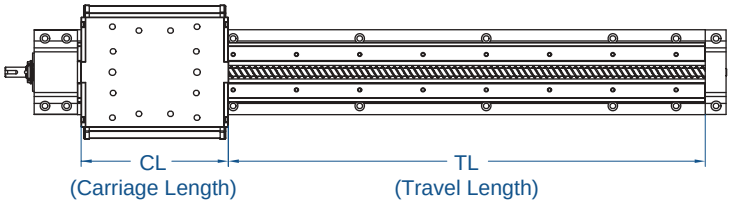


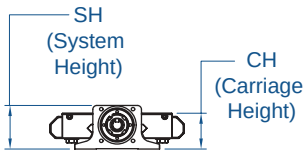
	Size	Screw Dia. mm	Lead mm	Track Plate Length TPL	System Length SL	Tube Length TBL ALUMINUM/STEEL	Carriage Height/System Height CH/SH ALUMINUM	CH/SH STEEL
Wiper Wheel Plate	2	10	2	TL + 131.9 mm TL + 5.193 in	TPL + 91.8 mm	TPL + 59.0 mm	83.0 mm	81.1 mm
			3	TL + 151.9 mm TL + 5.981 in	TPL + 3.615 in	TPL + 2.323 in	3.269 in	3.194 in
	3	12	5	TL + 172.0 mm TL + 7.356 in	TPL + 108.1 mm	TPL + 77.0 mm	177.0 mm	107.8 mm
			10	TL + 190.8 mm TL + 6.772 in	TPL + 4.254 in	TPL + 3.031 in	6.968 in	4.244 in
	4	16	5	TL + 258.1 mm TL + 10.160 in	TPL + 121.7 mm	TPL + 86.0 mm	N/A	119.8 mm
				TL + 272.1 mm TL + 10.711 in				
		20	5	TL + 266.0 mm TL + 10.474 in	TPL + 4.792 in	TPL + 3.386 in	N/A	4.717 in

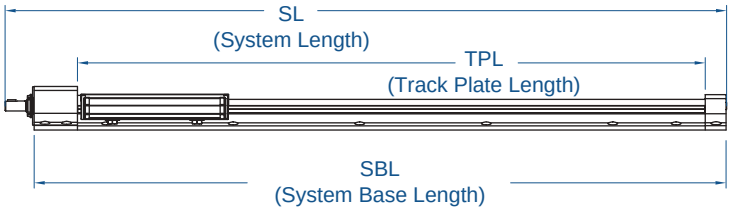
Unmounted Systems: Wiper Wheel Plate



- Designed to be mounted to a customer-supplied mounting surface
- System straightness and flatness is determined by mounting surface accuracy
- System is designed for continuous support along entire track plate length
- System is shipped with temporary mounting plates affixing drive ends to track plate

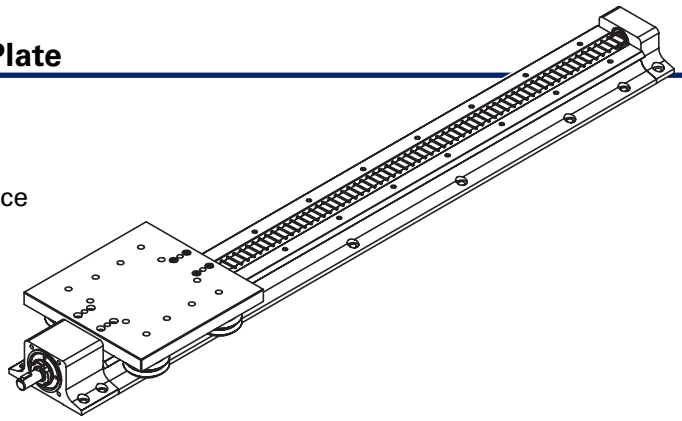




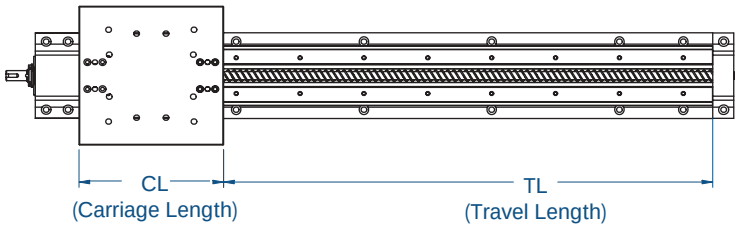


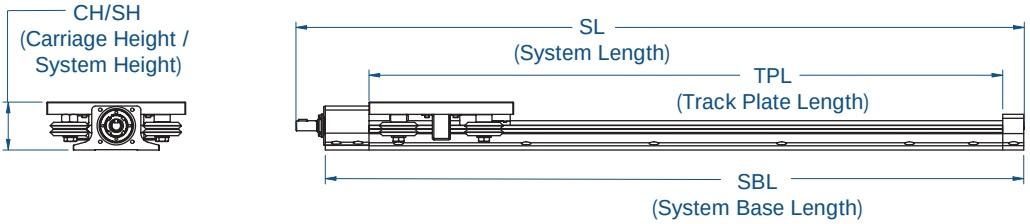
	Size	Screw Dia. mm	Lead mm	Track Plate Length TPL	System Length SL	Tube Length TBL	Carriage Height CH	System Height SH
Wiper Wheel Plate	2	10	2	TL + 129.9 mm TL + 5.114 in	TPL + 91.8 mm	TPL + 59.0 mm	33.0 mm	43.2 mm
			3	TL + 129.9 mm TL + 5.114 in	TPL + 3.615 in	TPL + 2.323 in	1.299 in	1.701 in
	3	12	5	TL + 181.6 mm TL + 7.150 in	TPL + 108.1 mm	TPL + 77.0 mm	43.0 mm	52.2 mm
			10	TL + 185.6 mm TL + 7.308 in	TPL + 4.254 in	TPL + 3.031 in	1.693 in	2.055 in
	4	16	5	TL + 259.9 mm TL + 10.232 in	TPL + 121.7 mm	TPL + 86.0 mm	55.0 mm	68.6 mm
			10	TL + 272.9 mm TL + 10.742 in				
		20	5	TL + 267.9 mm TL + 10.546 in	TPL + 4.792 in	TPL + 3.386 in	2.165 in	2.701 in

Unmounted Systems: Basic Wheel Plate



- Designed to be mounted to a customer-supplied mounting surface
- System straightness and flatness is determined by mounting surface accuracy
- System is designed for continuous support along entire track plate length
- System is shipped with temporary mounting plates affixing drive ends to track plate





	Size	Screw Dia. mm	Lead mm	Track Plate Length TPL	System Length SL	System Base Length SBL	Carriage Height/ System Height CH/SH
Wiper Wheel Plate	2	10	2	TL +131.9 mm TL + 5.193 in	TPL + 91.8 mm	TPL + 59.0 mm	43.0 mm
			3	TL +151.9 mm TL + 5.980 in	TPL + 3.615 in	TPL + 2.323 in	1.694 in
	3	12	5	TL +172.0 mm TL + 7.354 in	TPL +108.1 mm	TPL + 77.0 mm	57.0 mm
			10	TL +190.8 mm TL + 6.772 in	TPL + 4.254 in	TPL + 3.031 in	2.244 in
	4	16	5	TL +258.1 mm TL + 10.161 in	TPL +121.7 mm	TPL + 86.0 mm	69.0 mm
			10	TL +272.1 mm TL + 10.713 in			
		20	5	TL +266.0 mm TL + 10.472 in	TPL + 4.792 in	TPL + 3.386 in	2.717 in

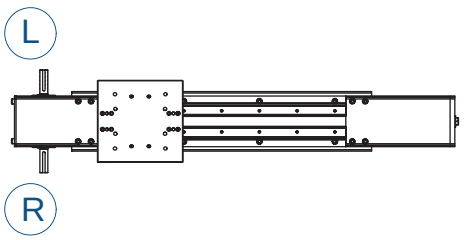
Ordering - General Codes

System	Size	Carriage Type	Drive System	Shaft Configuration For Belt/Chain Drive Systems Only or Lead/Ball Screw Configurations	Support Beam	Corrosion Resistance
❶	❷	❸	❹	❺	❻	❼
LP = LoPro	**1** **2** Lead / Ball Screw Drive Systems **2S** Belt / Chain Drive Systems **2L** Belt / Chain Drive Systems **3** **4**	**W** = Wiper Wheel Plate **BL** = Basic Wheel Plate w/Track Lubricators **BC** = Basic Wheel Plate w/Wheel Covers	**B** = Belt **C** = Chain **LS** = Lead Screw **BS** = Ball Screw	**(blank)** = Single Drive Shaft **D** = Dual Drive Shaft **XXX** = See Matrix for Lead/Ball Screw Configuration	**(blank)** = Un-mounted **A** = Aluminum Beam **S** = Steel Beam	**(blank)** = Standard Steel Components **CR** = Corrosion Resistant Components

Examples	❶	❷	❸	❹	❺	❻	❼	Travel Length	Shaft Pos.	Description
1	LP	1	W	C	D	A	CR	2500 mm	L	**LP1WCDACR, 2500mm***, L** LoPro Size 1, Wiper Wheel Plate Chain Drive System with Dual Drive Shaft, on an Aluminum Support Beam, Corrosion Resistant Components, 2500 mm carriage travel Shaft Position Left
2	LP	2	BL	LS	3GB	S	(blank)	24 in.	-	**LP2BLLS3GBS, 24 inches*** LoPro Size 2, Basic Wheel Plate with Track Lubricator, Lead Screw Drive System, 3/8" x 5.0mm BY NUT, on a Steel Support Beam, 24 inch carriage travel

* Length denotes carriage travel, which is used to calculate track plate length and overall system length. Refer to the appropriate system drive option section for details.

**"L" or "R" designations applicable only for belt or chain driven systems.



WHEN ORDERING SINGLE DRIVE SHAFT SYSTEMS, INDICATE DESIRED POSITION* OF DRIVE SHAFT, L OR R.

*Note:
L indicates drive input on the left hand side as seen from the drive end
R indicates drive input on the right hand side as seen from the drive end

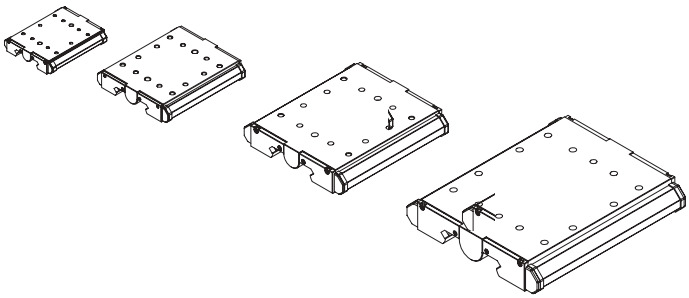
Lead Screw Configuration Code

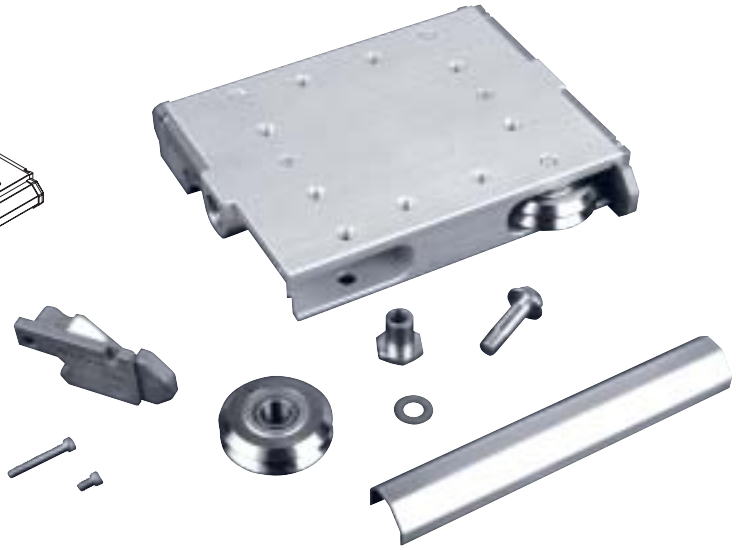
SIZE 1	Configuration Code, [XXX]	2CB	2CN	2IB	2IN				
	DESCRIPTION	1/4" x 2.0mm BY NUT	1/4" x 2.0mm NT BY NUT	1/4" x 10.0mm BY NUT	1/4" x 10.0mm NTBY NUT				
SIZE 2	Configuration Code, [XXX]	3GB	3GN	3JB	3JN	3PB	3PN		
	DESCRIPTION	3/8" x 5.0mm BY NUT	3/8" x 5.0mm NTBY NUT	3/8" x 12.0mm BY NUT	3/8" x 12.0mm NTBY NUT	3/8" x 25.0mm BY NUT	3/8" x 25.0mm NTBY NUT		
SIZE 3	Configuration Code, [XXX]	4GN	4IN	4PN	5GB	5LB			
	DESCRIPTION	1/2" x 5.0mm NTBY NUT	1/2" x 10.0mm NTBY NUT	1/2" x 25.0mm NTBY NUT	5/8" x 8.0mm BY NUT	5/8" x 16.0mm BY NUT			
SIZE 4	Configuration Code, [XXX]	6GB	6GV	6IB	6IV	6OB	6OV	6QB	6QV
	DESCRIPTION	3/4" x 5.0mm BY NUT	3/4" x 5.0mm VHDY NUT	3/4" x 10.0mm BY NUT	3/4" x 10.0mm VHDY NUT	3/4" x 24.0mm BY NUT	3/4" x 24.0mm VHDY NUT	3/4" x 50.0mm BY NUT	3/4" x 50.0mm VHDY NUT

Ball Screw Configuration Code

SIZE 2	Configuration Code, [XXX]	CCN	CEN	
	DESCRIPTION	10mm x 2.0mm Non Preloaded Nut	10mm x 3.0mm Non Preloaded Nut	
SIZE 3	Configuration Code, [XXX]	DGN	DIN	
	DESCRIPTION	12mm x 5.0mm FEM-E-B Mod. Flange Non Preloaded Nut	12mm x 10.0mm FEM-E-B Mod. Flange Non Preloaded Nut	
SIZE 4	Configuration Code, [XXX]	GGN	GIN	HGN
	DESCRIPTION	16mm x 5.0mm FEM-E-B Mod. Flange Non Preloaded Nut	16mm x 10.0mm FEM-E-B Mod. Flange Non Preloaded Nut	20mm x 5.0mm FEM-E-B Mod. Flange Non Preloaded Nut

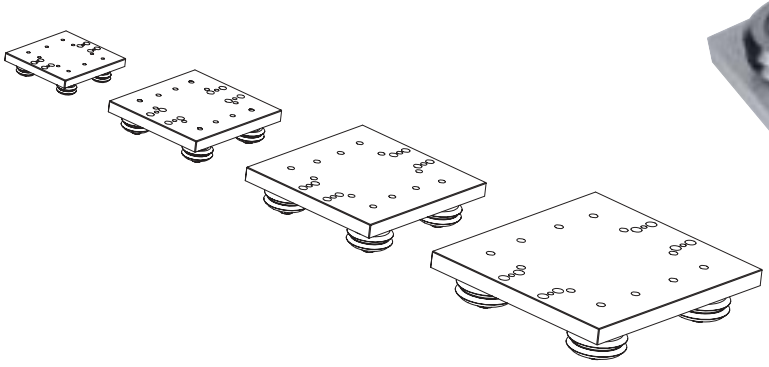
Wiper Wheel Plates





- Available in four sizes (1, 2, 3, & 4)
- Includes four wiper caps with oil-impregnated felt inserts which continuously lubricate track vee ways
- Wheels are captured via low profile bushings on both sides of the guide wheel for maximum system stiffness
- Wheels are completely enclosed minimizing the affect of contamination
- Offers lowest profile envelope

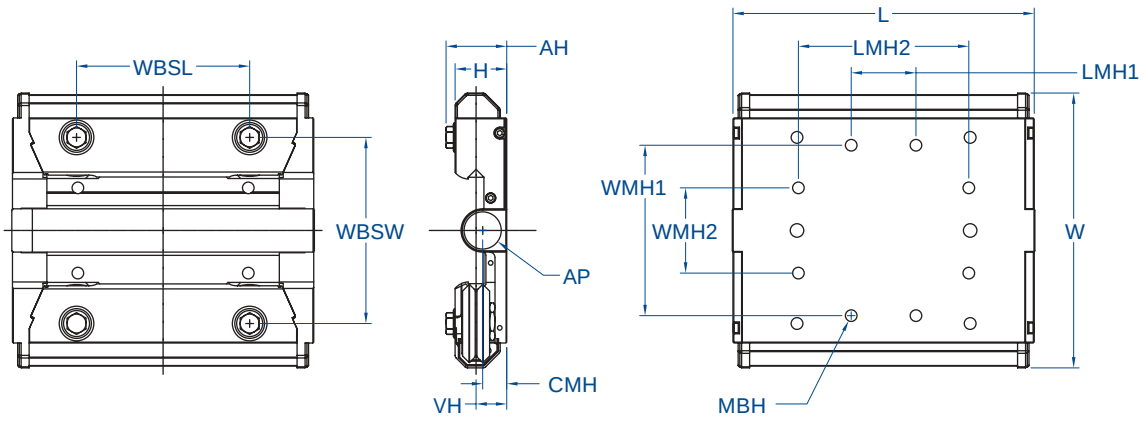
Basic Wheel Plates



- Available in four sizes (1, 2, 3, & 4)
- Options include lubricators and wheel covers, both of which distribute lubricant along the vee ways via oil-saturated felt inserts
- Wheel covers provide extra protection from contaminants at the wheel/track interface
- Lower cost option to the wiper wheel plate

Wheel Plates: Wiper-Style

- Pre-assembled carriage plate with lubricating wiper caps
- Includes four DualVee® guide wheels and stainless steel low profile bushings and mounting hardware
- LoPro® carriage assemblies come standard with sealed 52100 or 440C stainless steel, and high temperature or clean room compatible wheels

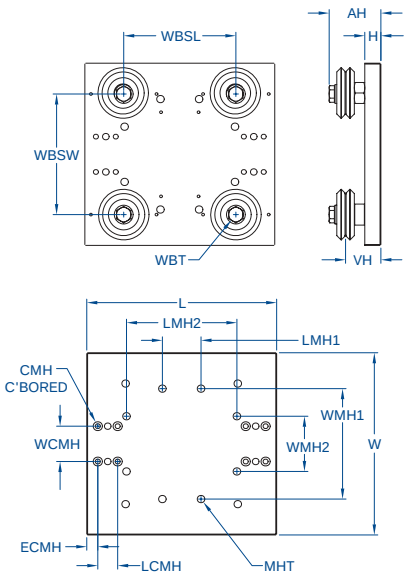


Size	Part Number	Overall Length		Overall Width		Wheel Plate Assembly Height		Wheel Plate Height		Mounting Hole Length		Mounting Hole Width		Mounting Hole Length 2	
		L		W		AH		H		LMH1		WMH1		LMH2	
1	M1AWPW	94.0	mm	78	mm	18.5	mm	16.5	mm	-	-	50.0	mm	50.0	mm
		3.70	in	3.07	in	0.730	in	0.650	in	-	-	1.969	in	1.969	in
2	M2AWPW	129.8	mm	115.3	mm	26.4	mm	23.3	mm	30.0	mm	76.0	mm	76.0	mm
		5.11	in	4.54	in	1.041	in	0.916	in	1.181	in	2.992	in	2.992	in
3	M3AWPW	177.5	mm	161.8	mm	35.6	mm	30.3	mm	38.0	mm	100.0	mm	100.0	mm
		6.99	in	6.37	in	1.403	in	1.193	in	1.496	in	3.937	in	3.937	in
4	M4AWPW	243.8	mm	213.1	mm	45.7	mm	39.4	mm	66.0	mm	152.0	mm	152.0	mm
		9.60	in	8.39	in	1.798	in	1.553	in	2.598	in	5.984	in	5.984	in

Size	Part Number	Mounting Hole Width 2		Mounting Hole Thread	Wheel Bolt Spacing Length		Wheel Bolt Spacing Width		Vee Height		Coupler Mounting Hole Height		Coupler Attachment Feature - Maximum Diameter	
		WMH2		MBH	WBSL		WBSW		VH		CMH		AP	
1	M1AWPW	25.0	mm	M4 X .7	50.8	mm	53.3	mm	9.5	mm	7.1	mm	11.0	mm
		0.984	in		2.000	in	2.098	in	0.374	in	0.281	in	0.433	in
2	M2AWPW	38.0	mm	M6 X 1.0	76.2	mm	80.0	mm	14.0	mm	10.7	mm	17.0	mm
		1.496	in		3.000	in	3.150	in	0.550	in	0.422	in	0.669	in
3	M3AWPW	50.0	mm	M8 X 1.25	101.6	mm	109.2	mm	18.0	mm	14.1	mm	22.0	mm
		1.969	in		4.000	in	4.300	in	0.709	in	0.556	in	0.866	in
4	M4AWPW	66.0	mm	M10 X 1.5	152.4	mm	146.7	mm	24.0	mm	19.3	mm	32.0	mm
		2.598	in		6.000	in	5.774	in	0.945	in	0.758	in	1.260	in

Wheel Plates: Basic

Basic Wheel Plate Profile	Dual Vee Size	Coupler Mounting Hole Length	Coupler Mounting Hole Description	Coupler Mount Hole to Edge	Coupler Mount Hole Width
		LCMH	CMH[1]	ECMH	WCMH
Standard Height	1	0.394 (10.0 mm)	0.090 thru Ø 0.173 Ø C'BORE x 0.080 DP	0.236 (6.0 mm)	0.551 (14.0 mm)
	2	0.709 (18.0 mm)	0.161 thru Ø 0.290 Ø C'BORE x 0.170 DP	0.394 (10.0 mm)	0.944 (24.0 mm)
	3	0.709 (18.0 mm)	0.177 thru Ø 0.325 Ø C'BORE x 0.157 DP	0.394 (10.0 mm)	1.260 (32.0 mm)
	4	0.866 (22.0 mm)	0.256 thru Ø 0.430 Ø C'BORE x 0.236 DP	0.472 (12.0 mm)	2.047 (52.0 mm)
Low Profile	1	0.394 (10.0 mm)	0.090 thru Ø 0.173 Ø C'BORE x 0.080 DP	0.236 (6.0 mm)	0.551 (14.0 mm)
	2	0.709 (18.0 mm)	0.161 thru Ø 0.290 Ø C'BORE x 0.170 DP	0.394 (10.0 mm)	0.944 (24.0 mm)
	3	0.709 (18.0 mm)	0.177 thru Ø 0.325 Ø C'BORE x 0.157 DP	0.394 (10.0 mm)	1.260 (32.0 mm)
	4	0.866 (22.0 mm)	0.256 thru Ø 0.430 Ø C'BORE x 0.236 DP	0.472 (12.0 mm)	2.047 (52.0 mm)



Basic Wheel Plate Profile	Dual Vee Size	Part Number 1.	Overall Length	Overall Width	Wheel Plate Assembly Height	Wheel Plate Height	Wheel Vee Height	Wheel Bolt Space Length	Wheel Bolt Space Width	Wheel Bolt Thread
			L	W	AH	H	VH	WBSL	WBSW	WBT
Standard Height	1	BWP1_DV	90.0 mm 3.54 in	80.0 mm 3.150 in	24.6 mm 0.970 in	8.5 mm 0.333 in	18.2 mm 0.718 in	50.8 mm 2.000 in	53.3 mm 2.098 in	M4 X 0.7
	2	BWP2_DV	127.0 mm 5.00 in	116.0 mm 4.57 in	34.0 mm 1.340 in	11.8 mm 0.465 in	24.0 mm 0.946 in	76.2 mm 3.000 in	80.0 mm 3.150 in	M6 X 1.0
	3	BWP3_DV	172.0 mm 6.77 in	165.0 mm 6.50 in	46.8 mm 1.844 in	14.6 mm 0.574 in	32.0 mm 1.260 in	101.6 mm 4.000 in	109.2 mm 4.300 in	M8 X 1.25
	4	BWP4_DV	242.0 mm 9.53 in	222.0 mm 8.740 in	55.6 mm 2.187 in	17.3 mm 0.683 in	38.0 mm 1.495 in	152.4 mm 6.000 in	146.7 mm 5.774 in	M10 X 1.5
Low Profile	1	BWP1_LP	90.0 mm 3.543 in	80.0 mm 3.150 in	20.5 mm 0.808 in	8.5 mm 0.333 in	14.1 mm 0.556 in	50.8 mm 2.000 in	53.3 mm 2.098 in	M4 X 0.7
	2	BWP2_LP	127.0 mm 5.000 in	116.0 mm 4.57 in	30.0 mm 1.182 in	11.8 mm 0.465 in	20.0 mm 0.788 in	76.2 mm 3.000 in	80.0 mm 3.150 in	M6 X 1.0
	3	BWP3_LP	172.0 mm 6.772 in	165.0 mm 6.50 in	40.8 mm 1.608 in	14.6 mm 0.574 in	26.0 mm 1.024 in	101.6 mm 4.000 in	109.2 mm 4.300 in	M8 X 1.25
	4	BWP4_LP	242.0 mm 9.53 in	222.0 mm 8.74 in	47.5 mm 1.872 in	17.3 mm 0.683 in	30.0 mm 1.180 in	152.4 mm 6.000 in	146.7 mm 5.774 in	M10 X 1.5

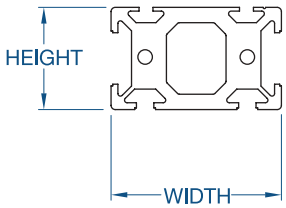
Basic Wheel Plate Profile	Dual Vee Size	Part Number 1.	Mounting Hole Length	Mounting Hole Width	Mounting Hole Length 2	Mounting Hole Width 2	Mounting Hole Thread
			LMH1	WMH1	LMH2	WMH2	MHT
Standard Height	1	BWP1_DV	- -	50.0 mm 1.969 in	50.0 mm 1.969 in	25.0 mm 0.984 in	M4 X 0.7
	2	BWP2_DV	25.0 mm 0.984 in	76.0 mm 2.992 in	76.0 mm 2.992 in	38.0 mm 1.496 in	M6 X 1.0
	3	BWP3_DV	35.0 mm 1.378 in	100.0 mm 3.937 in	100.0 mm 3.937 in	50.0 mm 1.969 in	M8 X 1.25
	4	BWP4_DV	56.0 mm 2.205 in	152.0 mm 5.984 in	152.0 mm 5.984 in	66.0 mm 2.599 in	M10 X 1.5
Low Profile	1	BWP1_LP	- -	50.0 mm 1.969 in	50.0 mm 1.969 in	25.0 mm 0.984 in	M4 X 0.7
	2	BWP2_LP	25.0 mm 0.984 in	76.0 mm 2.992 in	76.0 mm 2.992 in	38.0 mm 1.496 in	M6 X 1.0
	3	BWP3_LP	35.0 mm 1.378 in	100.0 mm 3.937 in	100.0 mm 3.937 in	50.0 mm 1.969 in	M8 X 1.25
	4	BWP4_LP	56.0 mm 2.205 in	152.0 mm 5.984 in	152.0 mm 5.984 in	66.0 mm 2.599 in	M10 X 1.5

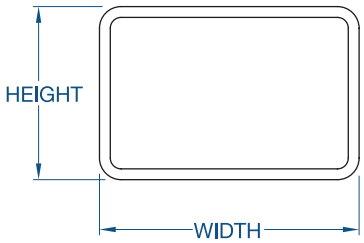
Note: Low profile carriages are for non-driven systems only.

Support Beams

ALUMINUM BEAMS	
System Size	**Material**
1	6061-T6 Aluminum Alloy
2S	
2L	
3	
4	N/A

STEEL BEAMS	
System Size	**Material**
All Sizes, All Drive Options	Structural Steel Tubing, ASTM A500 Grade A

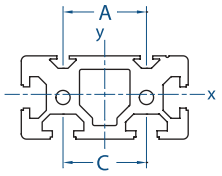
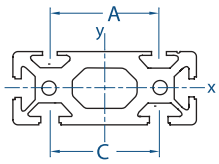
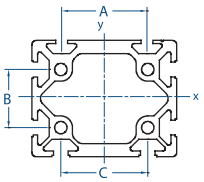
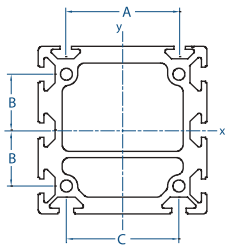




Size	Aluminum		Steel					
	All Drive Configurations		Belt/Chain Drive		Lead Screw Drive		Ball Screw Drive	
	Width	Height	Width	Height	Width	Height	Width	Height
1 N/A for Ball Screw Drive	80.0 mm	40.0 mm	63.5 mm	38.1 mm	63.5 mm	38.1 mm	N/A	N/A
	3.150 in	1.575 in	2.50 in	1.50 in	2.50 in	1.50 in	N/A	N/A
2 Lead/Ball Screw	100.0 mm	40.0 mm	N/A	N/A	76.2 mm	38.1 mm	76.2 mm	38.1 mm
	3.937 in	1.575 in	N/A	N/A	3.00 in	1.50 in	3.00 in	1.50 in
2S Belt/Chain	100.0 mm	40.0 mm	76.2 mm	38.1 mm	N/A	N/A	N/A	N/A
	3.937 in	1.575 in	3.00 in	1.50 in	N/A	N/A	N/A	N/A
2L Belt/Chain	100.0 mm	80.0 mm	76.2 mm	76.2 mm	N/A	N/A	N/A	N/A
	3.937 in	3.150 in	3.00 in	3.00 in	N/A	N/A	N/A	N/A
3	120.0 mm	120.0 mm	127.0 mm	101.6 mm	127.0 mm	50.8 mm	127.0 mm	50.8 mm
	4.724 in	4.724 in	5.00 in	4.00 in	5.00 in	2.00 in	5.00 in	2.00 in
4	N/A	N/A	152.4 mm	101.6 mm	152.4 mm	50.8 mm	152.4 mm	50.8 mm
	N/A	N/A	6.00 in	4.00 in	6.00 in	2.00 in	6.00 in	2.00 in

Support Beams

Aluminum Beam Properties

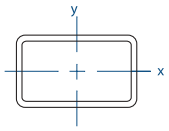
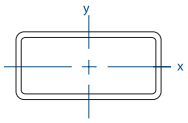
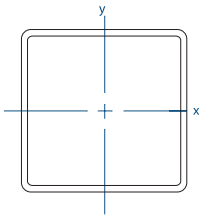
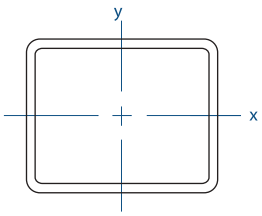
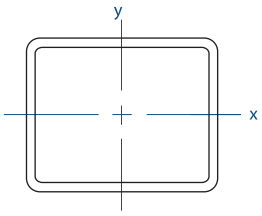
Size	Beam Cross Section	Part Number	Cross-Sectional Area	Moment of Inertia X-Axis	Moment of Inertia y-Axis	LoPro T-Slot A	T-Slot B	T-Slot C	Max Length
1		LP1SBEXTLP	66.9 mm² 2.62 in²	2.776E+05 mm⁴ 0.67 in⁴	1.016E+06 mm⁴ 2.44 in⁴	40.0 mm 1.575 in	N/A	40.0 mm 1.575 in	5.6 m (18.37 ft)
2S		LP2SSBEXT	83.9 mm² 3.30 in²	3.505E+05 mm⁴ 0.84 in⁴	1.773E+06 mm⁴ 4.26 in⁴	59.0 mm 2.322 in	N/A	60.0 mm 2.362 in	5.6 m (18.37 ft)
2L		LP2LSBEXT	106.2 mm² 4.18 in²	2.137E+06 mm⁴ 5.13 in⁴	2.974E+06 mm⁴ 7.15 in⁴	59.0 mm 2.322 in	40.0 mm 1.575 in	60.0 mm 2.362 in	5.6 m (18.37 ft)
3		LP3SBEXT	202.6 mm² 8.01 in²	8.537E+06 mm⁴ 20.51 in⁴	8.490E+06 mm⁴ 20.40 in⁴	81.0 mm 3.190 in	40.0 mm 1.575 in	80.0 mm 3.150 in	5.6 m (18.37 ft)

Notes

- Aluminum support beams are designed with industry standard cross section and t-slot (10 mm) geometry.
- Beams are compatible with BWC's MCS Aluminum frame and machine construction system as well as other industry standard offerings.
- T-Nuts and other accessories are also available (refer to BWC MCS's catalog for detailed accessory specifications).

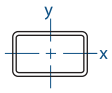
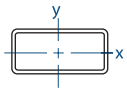
Support Beams

Steel Beam Properties

Size	Beam Cross Section	Part Number	Cross-Sectional Area	Moment of Inertia X-Axis	Moment of Inertia y-Axis	Max Length
1		LP1BSB LP1LSBS LP1SSB	22.3 mm^2 0.88 in^2	1.303E+05 mm^4 0.31 in^4	2.922E+05 mm^4 0.70 in^4	7.3 m (24 Ft.)
2		LP2SBSB LP2SLSBS LP2SSSB	25.2 mm^2 0.99 in^2	1.532E+05 mm^4 0.37 in^4	4.595E+05 mm^4 1.10 in^4	12.2 m (40 Ft.)
		LP2LBSB LP2LLSBS LP2LSSB	34.4 mm^2 1.35 in^2	7.704E+05 mm^4 1.85 in^4	7.704E+05 mm^4 1.85 in^4	7.3 m (24 Ft.)
3		LP3SBSB	79.3 mm^2 3.12 in^2	3.279E+06 mm^4 7.88 in^4	4.622E+06 mm^4 11.11 in^4	14.6 m (48 Ft.)
		LP3LSBS LP3SSB	60.3 mm^2 2.37 in^2	6.560E+05 mm^4 1.58 in^4	2.814E+06 mm^4 6.76 in^4	14.6 m (48 Ft.)

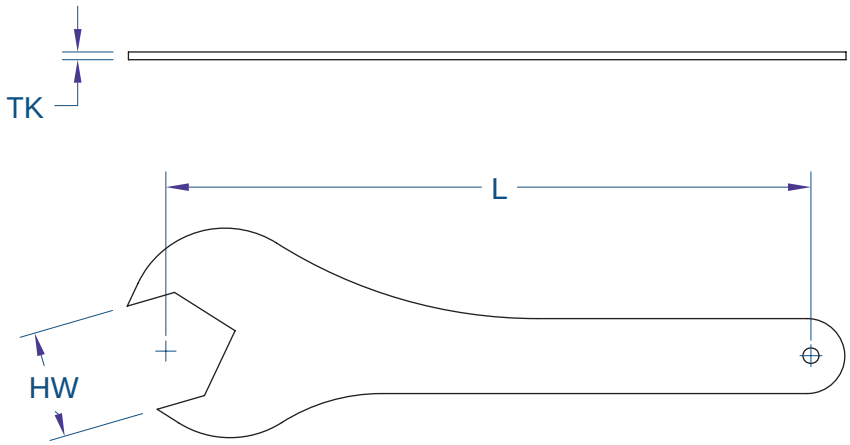
Support Beams

Steel Beam Properties, continued

Size	Beam Cross Section	Part Number	Cross-Sectional Area	Moment of Inertia X-Axis	Moment of Inertia y-Axis	Max Length
4		LP4BSB	116.6 mm²	4.885E+06mm⁴	9.187E+06 mm⁴	14.6 m (48 Ft.)
			4.59 in²	11.74 in⁴	22.07 in⁴	
		LP4LSBS LP4SSB	68.7 mm²	7.709E+05 mm⁴	4.388E+06 mm⁴	14.6 m (48 Ft.)
			2.71 in²	1.85 in⁴	10.54 in⁴	

Fit-up Adjustment Wrenches

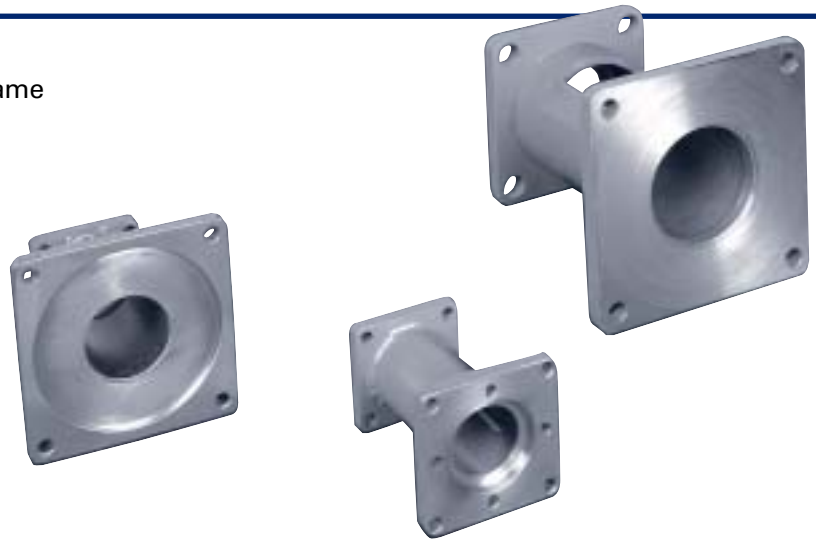
- Eccentric adjustment mounting tools
- Includes bushing wrench and wheel bolt wrench for each wheel plate size (1, 2, 3, and 4)
- Allows for fit-up adjustment between opposing wheels by rotating eccentric bushing



Wrench Type	Size	Part Number	Wrench Size HW		Length L		Thickness TK	
Wheel Bolt	1	1PWRB	5.6	mm	101.3	mm	2.3	mm
			0.220	in	3.99	in	0.09	in
	2	2PWRB	8.7	mm	114.3	mm	3.0	mm
			0.344	in	4.50	in	0.12	in
	3	3PWRB	11.2	mm	127.0	mm	3.4	mm
			0.440	in	5.00	in	0.14	in
	4	4PWRB	12.8	mm	138.9	mm	3.4	mm
			0.503	in	5.47	in	0.14	in
Eccentric Bushing	1	1PWRX	11.2	mm	101.6	mm	1.9	mm
			0.439	in	4.00	in	0.07	in
	2	2PWRX	14.3	mm	114.3	mm	2.3	mm
			0.564	in	4.50	in	0.09	in
	3	3PWRX	19.1	mm	129.5	mm	3.0	mm
			0.752	in	5.10	in	0.12	in
	4	4PWRX	22.3	mm	147.3	mm	3.0	mm
			0.877	in	5.80	in	0.12	in

Motor Mounts

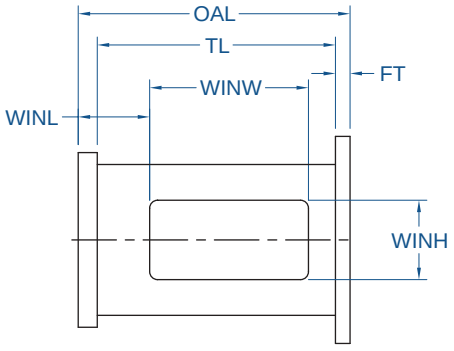
- Designed to adapt standard NEMA frame motors to LoPro Linear Systems
- Standard motor mounts include NEMA sizes 17, 23, 34, and 42
- Other motor faces can be accommodated; consult factory

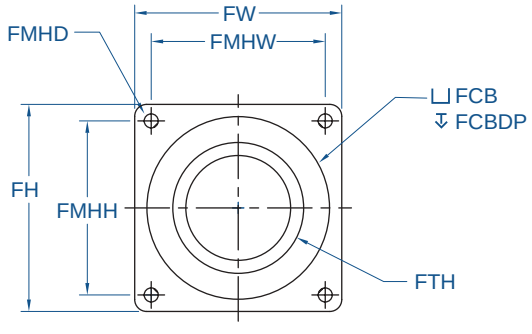


MOTOR MOUNTS	
System Size	**Material**
All Sizes, All Drive Options	Low Carbon Steel

MOTOR MOUNT AVAILABILITY MATRIX

Size	Part Number	Belt/Chain	Lead/Ball Screw	Motor Size			
				NEMA 17	NEMA 23	NEMA 34	NEMA 42
1	M1PMMM17	■		■			
	M1PMMM23	■			■		
	M1PMMLS17		■	■			
	M1PMMLS23		■		■		
2	M2PMMLS23		■		■		
2S	M2PMMM23	■			■		
	M2PMMM34	■				■	
2L	M2PMMG23	■			■		
	M2PMMG34	■				■	
3	M3PMMG23	■			■		
	M3PMMG34	■				■	
	M3PMMG42	■					■
	M3PMMLS23		■		■		
	M3PMMLS34		■			■	
4	M4PMMG34	■				■	
	M4PMMG42	■					■
	M4PMMLS34		■			■	
	M4PMMLS42		■				■





Note: Please contact BWC for motor mounts for use with IEC motors.

Motor Mounts

MOTOR MOUNT DIMENSIONS															
Compatibility	Part Number	OAL		WINW		WINH		WINL		FH		FW		FT	
		mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
1 B/C TO NEMA 17	M1PMMM17	64.5	2.54	31.8	1.25	26.9	1.06	16.5	0.65	44.5	1.75	44.5	1.75	5.8	0.23
1 B/C TO NEMA 23	M1PMMM23	71.9	2.83	38.1	1.50	15.2	0.60	19.1	0.75	57.2	2.25	57.2	2.25	5.8	0.23
2 SMALL B/C TO NEMA 23	M2PMMM23	78.2	3.08	43.2	1.70	22.9	0.90	20.3	0.80	57.2	2.25	57.2	2.25	5.8	0.23
2 SMALL B/C TO NEMA 34	M2PMMM34	106.2	4.18	48.3	1.90	22.9	0.90	25.2	0.99	82.8	3.26	82.8	3.26	5.8	0.23
2 LARGE B/C TO NEMA 23	M2PMMG23	77.0	3.03	35.6	1.40	25.4	1.00	25.4	1.00	57.2	2.25	57.2	2.25	5.8	0.23
2 LARGE B/C TO NEMA 34	M2PMMG34	89.7	3.53	50.8	2.00	25.4	1.00	25.4	1.00	82.8	3.26	82.8	3.26	5.8	0.23
3 B/C TO NEMA 23	M3PMMG23	98.6	3.88	50.8	2.00	25.4	1.00	34.3	1.35	57.2	2.25	57.2	2.25	5.8	0.23
3 B/C TO NEMA 34	M3PMMG34	108.7	4.28	63.5	2.50	31.8	1.25	28.6	1.13	82.8	3.26	82.8	3.26	5.8	0.23
3 B/C TO NEMA 42	M3PMMG42	110.5	4.35	63.5	2.50	31.8	1.25	28.6	1.13	108.0	4.25	108.0	4.25	7.6	0.30
4 B/C TO NEMA 34	M4PMMG34	108.7	4.28	63.5	2.50	31.8	1.25	28.6	1.13	82.8	3.26	82.8	3.26	5.8	0.23
4 B/C TO NEMA 42	M4PMMG42	110.5	4.35	63.5	2.50	31.8	1.25	28.6	1.13	108.0	4.25	108.0	4.25	7.6	0.30
1 LS, BS TO NEMA 17	M1PMMLS17	51.8	2.04	31.8	1.25	12.7	0.50	10.1	0.40	44.5	1.75	44.5	1.75	5.8	0.23
1 LS, BS TO NEMA 23	M1PMMLS23	61.2	2.41	31.8	1.25	13.2	0.52	15.2	0.60	57.2	2.25	57.2	2.25	5.8	0.23
2 LS, BS TO NEMA 23	M2PMMLS23	68.8	2.71	38.1	1.50	15.2	0.60	16.0	0.63	57.2	2.25	57.2	2.25	5.8	0.23
3 LS, BS TO NEMA 23	M3PMMLS23	77.0	3.03	43.2	1.70	22.9	0.90	19.1	0.75	57.2	2.25	57.2	2.25	5.8	0.23
3 LS, BS TO NEMA 34	M3PMMLS34	83.3	3.28	38.1	1.50	15.2	0.60	25.4	1.00	82.8	3.26	82.8	3.26	5.8	0.23
4 LS, BS TO NEMA 34	M4PMMLS34	89.7	3.53	50.8	2.00	31.8	1.25	19.1	0.75	82.8	3.26	82.8	3.26	5.8	0.23
4 LS, BS TO NEMA 42	M4PMMLS42	91.4	3.60	50.8	2.00	31.8	1.25	19.1	0.75	108.0	4.25	108.0	4.25	7.6	0.30

MOTOR INTERFACE FLANGE													
Compatibility	Part Number	FMHH		FMHW		FMHD		FCB		FCBDP		FTH	
		mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
1 B/C TO NEMA 17	M1PMMM17	31.0	1.220	31.0	1.220	3.5	0.136	22.0	0.866	2.0	0.080	20.6	0.810
1 B/C TO NEMA 23	M1PMMM23	47.1	1.856	47.1	1.856	5.1	0.201	38.1	1.500	1.9	0.075	26.9	1.060
2 SMALL B/C TO NEMA 23	M2PMMM23	47.1	1.856	47.1	1.856	5.1	0.201	38.1	1.500	1.9	0.075	34.9	1.375
2 SMALL B/C TO NEMA 34	M2PMMM34	69.6	2.740	69.6	2.740	5.6	0.221	73.0	2.875	1.9	0.075	34.9	1.375
2 LARGE B/C TO NEMA 23	M2PMMG23	47.1	1.856	47.1	1.856	5.1	0.201	38.1	1.500	1.9	0.075	34.9	1.375
2 LARGE B/C TO NEMA 34	M2PMMG34	69.6	2.740	69.6	2.740	5.6	0.221	73.0	2.875	1.9	0.075	41.3	1.625
3 B/C TO NEMA 23	M3PMMG23	47.1	1.856	47.1	1.856	5.1	0.201	38.1	1.500	1.9	0.075	34.9	1.370
3 B/C TO NEMA 34	M3PMMG34	69.6	2.740	69.6	2.740	5.6	0.221	73.0	2.875	1.9	0.075	50.8	2.000
3 B/C TO NEMA 42	M3PMMG42	88.9	3.500	88.9	3.500	8.6	0.339	55.5	2.186	2.0	0.080	50.8	2.000
4 B/C TO NEMA 34	M4PMMG34	69.6	2.740	69.6	2.740	5.6	0.221	73.0	2.875	1.9	0.075	50.8	2.000
4 B/C TO NEMA 42	M4PMMG42	88.9	3.500	88.9	3.500	8.6	0.339	55.5	2.186	2.0	0.080	50.8	2.000
1 LS, BS TO NEMA 17	M1PMMLS17	31.0	1.220	31.0	1.220	3.5	0.136	22.0	0.866	2.0	0.080	20.6	0.810
1 LS, BS TO NEMA 23	M1PMMLS23	47.1	1.856	47.1	1.856	5.1	0.201	38.1	1.500	1.9	0.075	20.6	0.812
2 LS, BS TO NEMA 23	M2PMMLS23	47.1	1.856	47.1	1.856	5.1	0.201	38.1	1.500	1.9	0.075	26.9	1.060
3 LS, BS TO NEMA 23	M3PMMLS23	47.1	1.856	47.1	1.856	5.1	0.201	38.1	1.500	1.9	0.075	34.9	1.375
3 LS, BS TO NEMA 34	M3PMMLS34	69.6	2.740	69.6	2.740	5.6	0.221	73.0	2.875	1.9	0.075	34.9	1.375
4 LS, BS TO NEMA 34	M4PMMLS34	69.6	2.740	69.6	2.740	5.6	0.221	73.0	2.875	1.9	0.075	50.8	2.000
4 LS, BS TO NEMA 42	M4PMMLS42	88.9	3.500	88.9	3.500	8.6	0.339	55.5	2.186	2.0	0.080	50.8	2.000

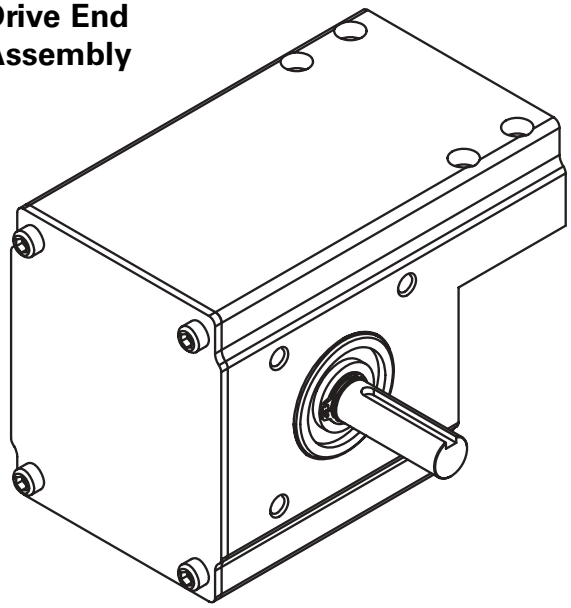
Note:

1. "B/C" = Belt/ Chain
2. "LS" = Lead Screw
3. "BS" = Ball Screw

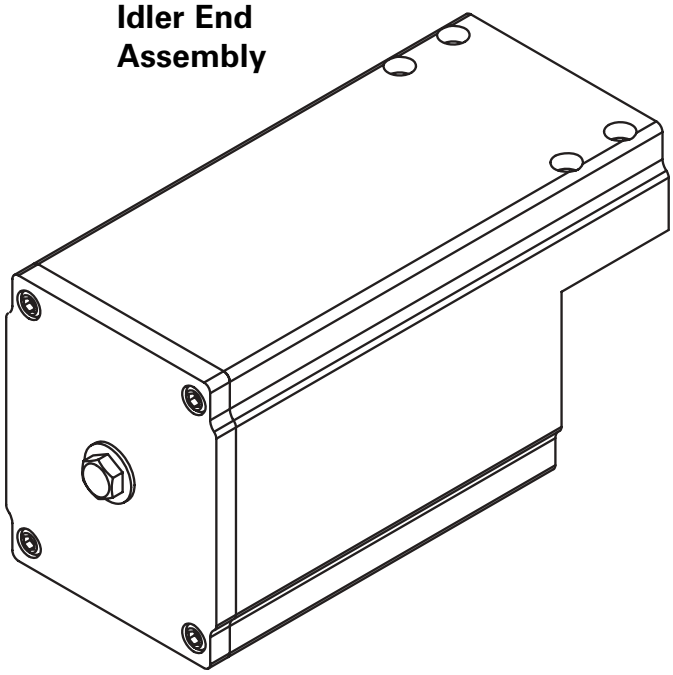
Drive Ends

Belt/Chain Systems

Drive End Assembly

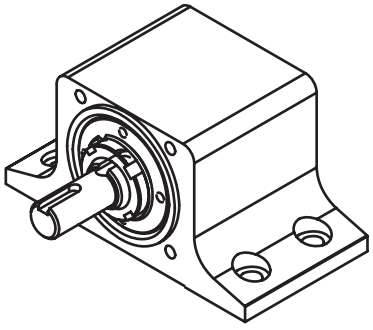


Idler End Assembly

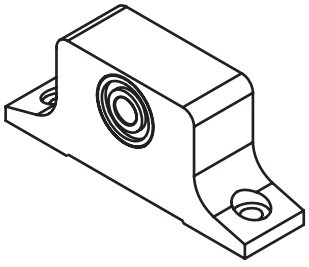


Lead/Ball Screw Systems

Fixed End Assembly

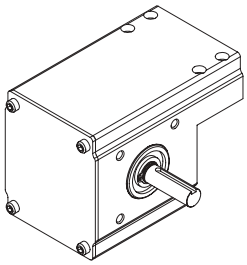


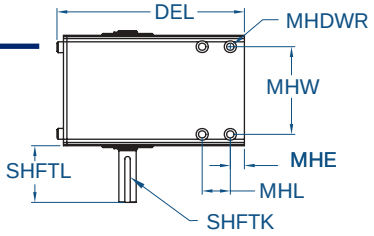
Simple End Assembly

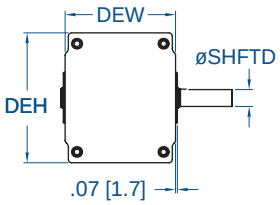


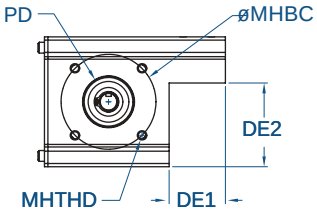
Drive Ends: Belt/Chain Systems

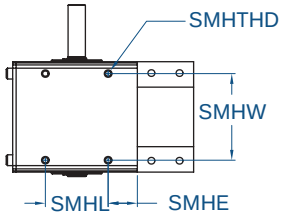
- Designed for high performance, high cycling linear motion
- Incorporates high quality radial bearings with a high strength aircraft grade aluminum housing
- Keyed shaft and pulley arrangement provides rigid, accurate linear motion









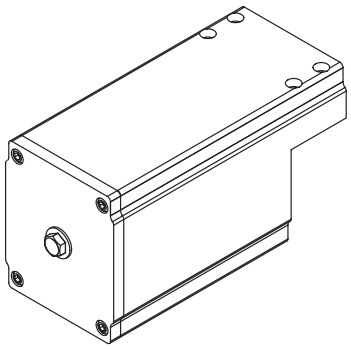


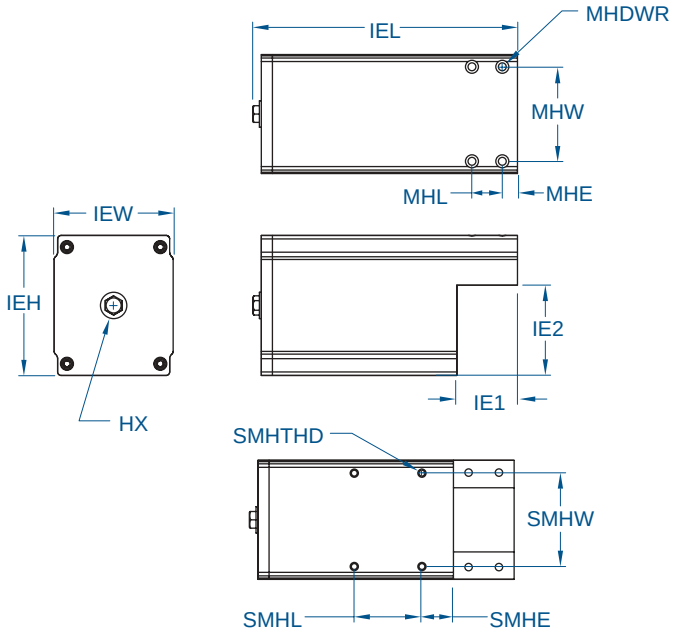
Size	Part Number	Drive End Length	Drive End Width	Drive End Height	BOTTOM VIEW		Square Key	DE1	DE2
					Shaft Length	Shaft Diameter			
		DEL	DEW	DEH	SHFTL	SHFTD	SHFTK		
1	LP1BDE (BELT) LP1CDE (CHAIN)	76.2 mm 2.999 in	50.0 mm 1.969 in	38.0 mm 1.496 in	29.7 mm 1.171 in	9.0 mm 0.354 in	3 mm	30.0 mm 1.181 in	16.0 mm 0.630 in
2S	LP2SBDE (BELT) LP2SCDE (CHAIN)	95.2 mm 3.748 in	72.0 mm 2.835 in	60.0 mm 2.362 in	36.6 mm 1.442 in	12.0 mm 0.472 in	4 mm	40.0 mm 1.575 in	27.5 mm 1.083 in
2L	LP2LBDE (BELT) LP2LCDE (CHAIN)	141.2 mm 5.558 in	80.0 mm 3.150 in	100.0 mm 3.937 in	43.3 mm 1.703 in	15.0 mm 0.591 in	5 mm	40.0 mm 1.575 in	68.0 mm 2.677 in
3	LP3BDE (BELT) LP3CDE (CHAIN)	173.2 mm 6.818 in	102.0 mm 4.016 in	120.0 mm 4.724 in	52.4 mm 2.062 in	16.0 mm 0.630 in	5 mm	52.0 mm 2.047 in	77.4 mm 3.046 in
4	LP4BDE (BELT) LP4CDE (CHAIN)	183.2 mm 7.212 in	140.0 mm 5.512 in	128.0 mm 5.039 in	51.7 mm 2.034 in	20.0 mm 0.787 in	6 mm	54.0 mm 2.126 in	75.0 mm 2.953 in

Size	Mounting Hardware	Mounting Hole Width	Mounting Hole Edge Spacing	Mounting Hole Length	Mounting Hole Bolt Circle Diameter	Pilot Diameter	Motor Mount Mounting Hole Thread	Secondary Mounting Hole Width	Secondary Mounting Hole Length	Secondary Mounting Hole Edge Spacing	Secondary Mounting Hole Thread
	MHDWR	MHW	MHE	MHL	MHBC	PD	MHTHD	SMHW	SMHL	SMHE	SMHTHD
1	M3 x 22 mm MIN	40.0 mm 1.575 in	6.0 mm .236 in	18.0 mm .709 in	42.4 mm 1.669 in	24.0 mm .945 in	M4 x .7	42.0 mm 1.654 in	-	30.0 mm 1.181 in	M4 x .7
2S	M5 x 30 mm MIN	59.0 mm 2.323 in	10.0 mm .394 in	20.0 mm .787 in	50.9 mm 2.004 in	28.4 mm 1.102 in	M5 x .8	60.0 mm 2.362 in	-	30.0 mm 1.181 in	M5 x .8
2L	M5 x 35 mm MIN	59.0 mm 2.323 in	10.0 mm .394 in	20.0 mm .787 in	67.9 mm 2.673 in	42.4 mm 1.654 in	M6 x 1.0	60.0 mm 2.362 in	54.0 mm 2.126 in	19.0 mm .748 in	M5 x .8
3	M6 x 45 mm MIN	81.0 mm 3.189 in	13.0 mm .512 in	26.0 mm 1.024 in	87.7 mm 3.452 in	47.0 mm 1.850 in	M8 x 1.25	80.0 mm 3.150 in	58.0 mm 2.283 in	27.0 mm 1.063 in	M8 x 1.25
4	M8 x 55 mm MIN	111.0 mm 4.375 in	13.5 mm .532 in	27.0 mm 1.063 in	90.5 mm 3.564 in	52.4 mm 2.047 in	M8 x 1.25	110.0 mm 4.331 in	64.0 mm 2.520 in	27.0 mm 1.063 in	M8 x 1.25

Idler Ends: Belt/Chain Systems

- Belt and chain tensioning is easily accomplished via rotation of single, easy-to-access fastener
- High quality radial bearings and high strength aluminum housing provides smooth, accurate linear motion

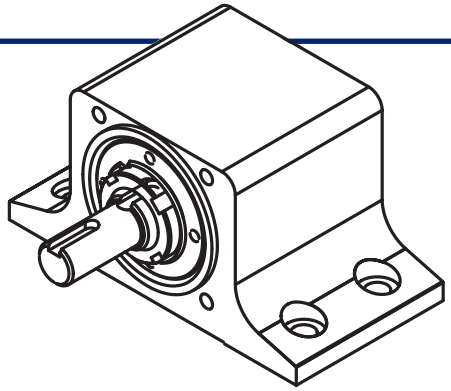




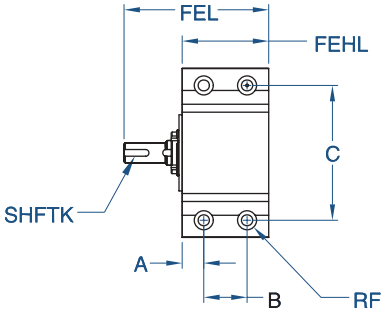
Size	Part Number	Idler End Length	BOTTOM VIEW		IE1 and IE2	Shaft Diameter
			Idler End Width	Idler End Height		
		IEL	IEW	IEH		SHFTD
1	LP1BIE (BELT) LP1CIE (CHAIN)	97.4 mm 3.834 in	50.0 mm 1.969 in	38.0 mm 1.496 in	30.0 mm 1.181 in	16.0 mm 0.630 in
2S	LP2SBIE (BELT) LP2SCIE (CHAIN)	132.4 mm 5.212 in	72.0 mm 2.835 in	60.0 mm 2.362 in	40.0 mm 1.575 in	27.5 mm 1.083 in
2L	LP2LBIE (BELT) LP2LCIE (CHAIN)	176.9 mm 6.964 in	80.0 mm 3.150 in	100.0 mm 3.937 in	40.0 mm 1.575 in	68.0 mm 2.677 in
3	LP3BIE (BELT) LP3CIE (CHAIN)	226.9 mm 8.933 in	102.0 mm 4.016 in	120.0 mm 4.724 in	52.0 mm 2.047 in	77.4 mm 3.046 in
4	LP4BIE (BELT) LP4CIE (CHAIN)	257.7 mm 10.146 in	140.0 mm 5.512 in	128.0 mm 5.039 in	54.0 mm 2.126 in	75.0 mm 2.953 in

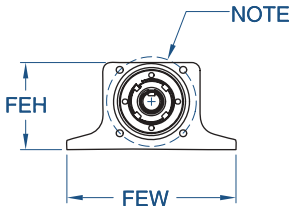
Size	Mounting Hardware	Mounting Hole Width	Mounting Hole Edge Spacing	Mounting Hole Length	Hex Head Adjustment Screw	Secondary Mounting Hole Width	Secondary Mounting Hole Length	Secondary Mounting Hole Edge Spacing	Secondary Mounting Hole Thread
	MHDWR	MHW	MHE	MHL	HX	SMHW	SMHL	SMHE	SMHTHD
1	M3 x 22 mm MIN	40.0 mm 1.575 in	6.0 mm .236 in	18.0 mm .709 in	1/4 in	42.0 mm 1.654 in	-	30.0 mm 1.181 in	M4 x .7
2S	M5 x 30 mm MIN	59.0 mm 2.323 in	10.0 mm .394 in	20.0 mm .787 in	1/4 in	60.0 mm 2.362 in	-	30.0 mm 1.181 in	M5 x .8
2L	M5 x 35 mm MIN	59.0 mm 2.323 in	10.0 mm .394 in	20.0 mm .787 in	5/16 in	60.0 mm 2.362 in	54.0 mm 2.126 in	19.0 mm .748 in	M5 x .8
3	M6 x 45 mm MIN	81.0 mm 3.189 in	13.0 mm .512 in	26.0 mm 1.024 in	5/16 in	80.0 mm 3.150 in	58.0 mm 2.283 in	27.0 mm 1.063 in	M8 x 1.25
4	M8 x 55 mm MIN	111.0 mm 4.375 in	13.5 mm .532 in	27.0 mm 1.063 in	3/8 in	110.0 mm 4.331 in	64.0 mm 2.520 in	27.0 mm 1.063 in	M8 x 1.25

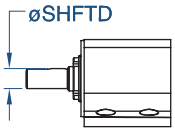
Fixed Ends: Lead/Ball Screw Systems



- Designed for high performance, high cycling linear motion
- Incorporates high quality radial bearings with a high strength aircraft grade aluminum housing
- Employs a single double-row angular contact beaming (size 1 employs two radial ball bearings).
- Shaft Key Sizes
  (square keys)
  Sizes 1 and 2 - n/a
  Size 3 - 4 mm, 10 mm long
  Size 4 - 5 mm, 10 mm long





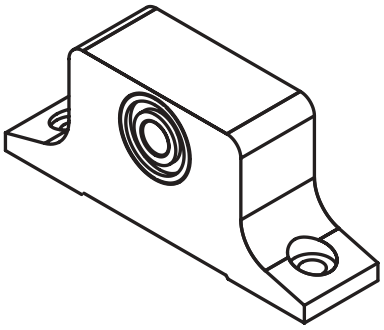


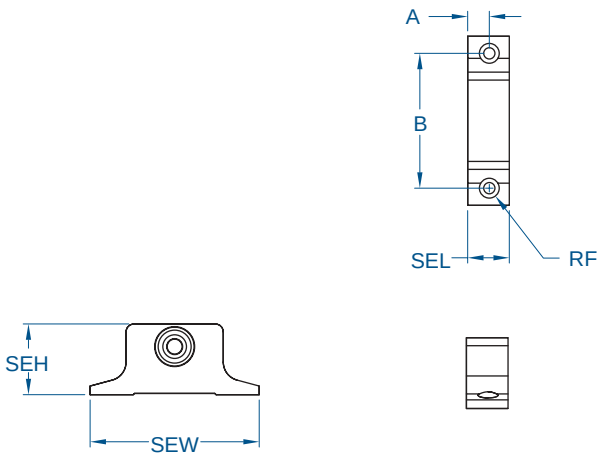
Size	Part Number	Fixed End Length	Fixed End Width	Fixed End Height	Fixed End Housing Length	Shaft Diameter	A	B	C	Mounting Hardware
		FEL	FEW	FEH	FEHL	SHFTD				RF
1	LP1LSCE	52.0 mm 2.048 in	50.8 mm 2.000 in	30.5 mm 1.200 in	30.0 mm 1.181 in	5.0 mm 0.197 in	6.0 mm 0.236 in	18.0 mm 0.709 in	40.0 mm 1.575 in	M3
2	LP2LSCE	72.0 mm 2.835 in	72.4 mm 2.850 in	43.2 mm 1.700 in	40.0 mm 1.575 in	6.0 mm 0.236 in	10.0 mm 0.394 in	20.0 mm 0.787 in	59.0 mm 2.323 in	M5
3	LP3LSCE	86.9 mm 3.422 in	101.6 mm 4.000 in	52.3 mm 2.060 in	52.0 mm 2.047 in	12.0 mm 0.472 in	13.0 mm 0.511 in	26.0 mm 1.024 in	81.0 mm 3.189 in	M6
4	LP4LSCE	89.0 mm 3.502 in	139.7 mm 5.500 in	68.6 mm 2.700 in	54.0 mm 2.126 in	15.0 mm 0.591 in	13.5 mm 0.531 in	27.0 mm 1.063 in	111.0 mm 4.370 in	M8

NOTE: Contact BWC Sales for bolt circle diameter and hole size.

Idler End: Lead/Ball Screw Systems

- High strength anodized aluminum housing and high quality Conrad style radial bearing provides simple end screw support
- Offers rigid, low profile lead or ball screw support

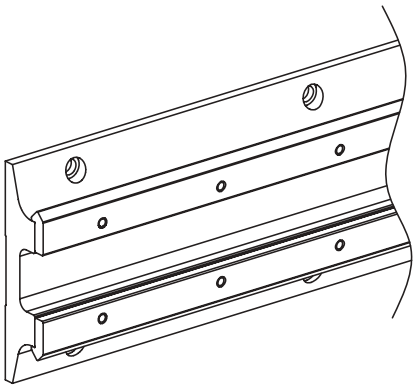


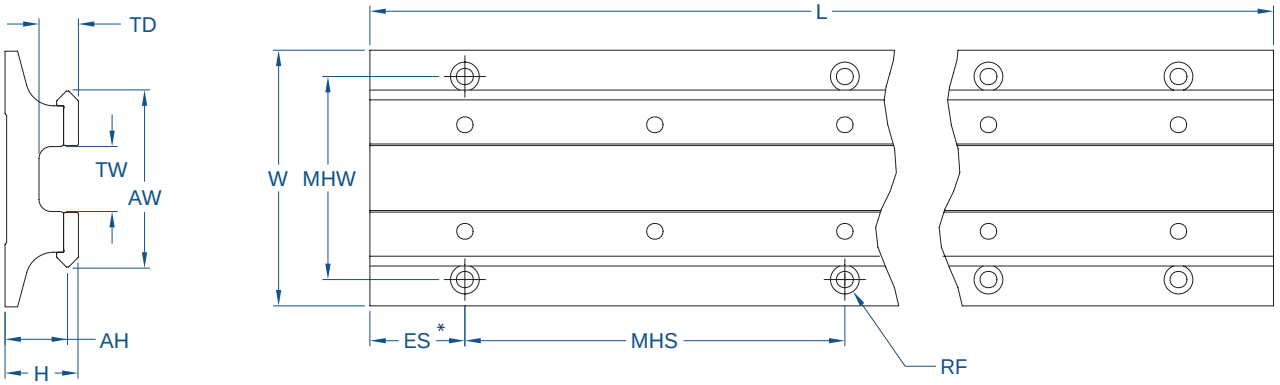


Size	Part Number	Simple End Length	Simple End Width	Simple End Height	A	B	Mounting Hardware
		SEL	SEW	SEH			RF
1	LP1LSCE	13.0 mm 0.512 in	50.8 mm 2.000 in	22.8 mm 0.896 in	7.0 mm 0.276 in	40.0 mm 1.575 in	M3
2	LP2LSCE	19.0 mm .748 in	72.4 mm 2.850 in	32.5 mm 1.280 in	9.0 mm 0.356 in	59.0 mm 2.323 in	M5
3	LP3LSCE	25.0 mm .984 in	101.6 mm 4.000 in	42.5 mm 1.673 in	9.3 mm 0.368 in	81.0 mm 3.189 in	M6
4	LP4LSCE	32.0 mm 1.260 in	139.7 mm 5.500 in	54.5 mm 2.146 in	13.5 mm 0.531 in	111.0 mm 4.370 in	M8

Track Plate Assemblies

- Provides the lowest profile linear guidance
- Induction-hardened, single edge track is available in either carbon steel or stainless steel
- Track plate assemblies are butt joinable for long stroke requirements
- Lightweight anodized aluminum substrate





Size	Part Number	Width	Overall Height	Vee Height	Vee Width	Inner Width	Inner Depth
		W	H	AH	AW	TW	TD
1	M1ATP	50.0 mm 1.969 in	15.9 mm 0.625 in	13.5 mm 0.532 in	37.4 mm 1.473 in	12.7 mm 0.500 in	9.3 mm 0.365 in
2	M2ATP	72.0 mm 2.835 in	22.2 mm 0.873 in	19.0 mm 0.748 in	54.6 mm 2.150 in	20.3 mm 0.799 in	12.9 mm 0.508 in
3	M3ATP	102.0 mm 4.016 in	29.4 mm 1.156 in	25.0 mm 0.985 in	71.1 mm 2.799 in	25.9 mm 1.020 in	15.8 mm 0.622 in
4	M4ATP	140.0 mm 5.512 in	36.6 mm 1.440 in	31.0 mm 1.222 in	95.8 mm 3.773 in	39.4 mm 1.550 in	22.9 mm 0.900 in

Size	Part Number	Mounting Hole Width	Mounting Hole Length Spacing	Mounting Hardware
		MHW	MHS	RF- Low Head Cap Screws
1	M1ATP	40.0 mm	76.0 mm	M3
		1.575 in	2.992 in	M3
2	M2ATP	59.0 mm	126.0 mm	M5
		2.323 in	4.961 in	M5
3	M3ATP	81.0 mm	152.0 mm	M6
		3.189 in	5.984 in	M6
4	M4ATP	111.0 mm	178.0 mm	M8
		4.370 in	7.008 in	M8

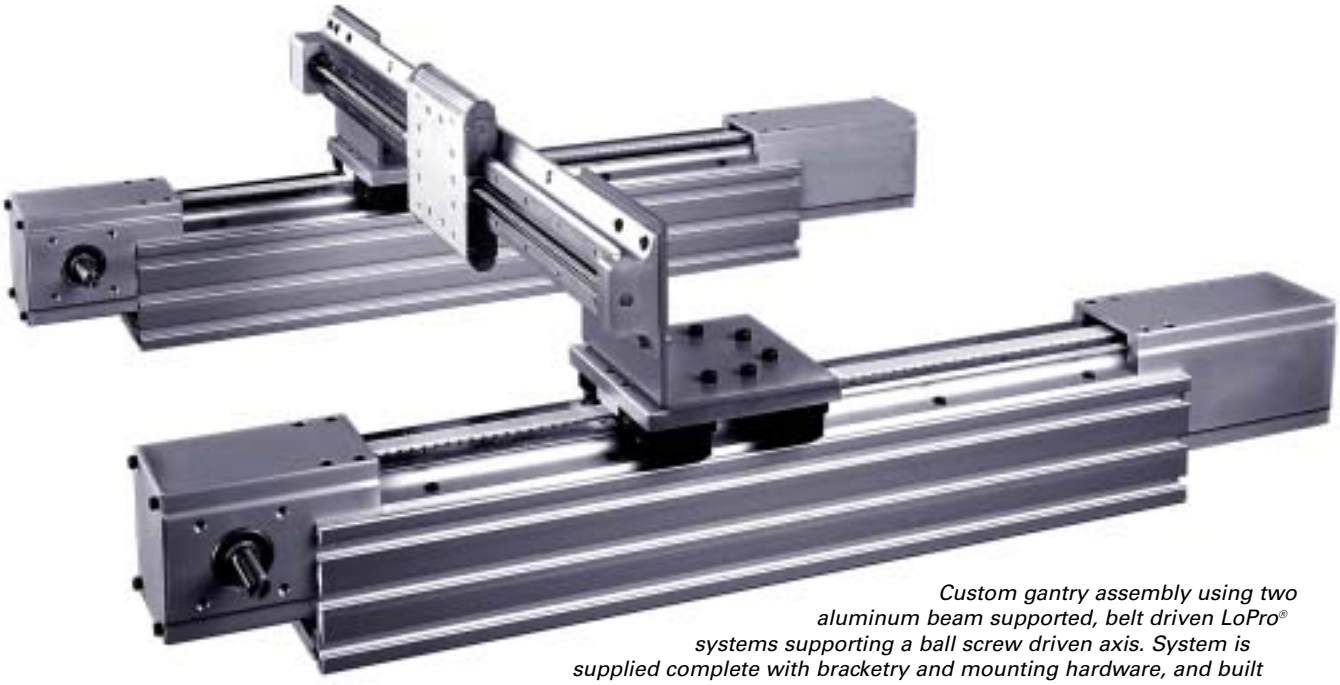
*ES = End Spacing; Dimension is contingent upon Track Plate Length.

In addition to the standard line of LoPro® linear system products, BWC's capabilities extend beyond these standard systems and into the realm of custom engineered products. Custom engineered solutions from BWC range from slight modifications made to standard systems to complete ground-up system designs using DualVee® components and / or linear guides.

Value added modifications and capabilities include but are not limited to:

- Multi Axis Bracketry
- Limit Switches
- Shock Absorption
- Special Motor Adaptation
- Special Actuators / Drive End Supports
- Foot Mounts for Steel Support Beams
- Bellows
- Special Machining
- Rack or Cable Driven Solutions
- Special Track and Wheel Plate Designs
- Pneumatic Actuation

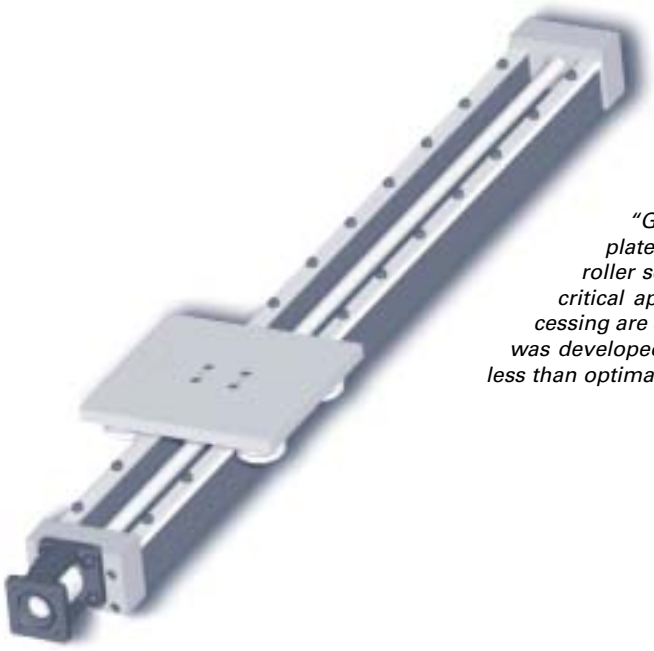
Custom engineered products are typically designed in collaboration with the customer's design team, taking into account the major design parameters including envelope restrictions, material considerations, accuracy, repeatability, thrust requirements, duty cycle, and service life objectives. Non-recurring engineering fees may apply depending on the level of customization involved. Typical projects entail varying levels of prototype sketching, detailing, and prototype design modification as the system specifications are refined. Prior to fabrication, prototype designs are formally detailed & documented for "sign-off" approval by the customer. JIT or Kanban-type arrangements can be accommodated for custom engineered OEM requirements.



Custom gantry assembly using two aluminum beam supported, belt driven LoPro® systems supporting a ball screw driven axis. System is supplied complete with bracketry and mounting hardware, and built to the customer's requirements.

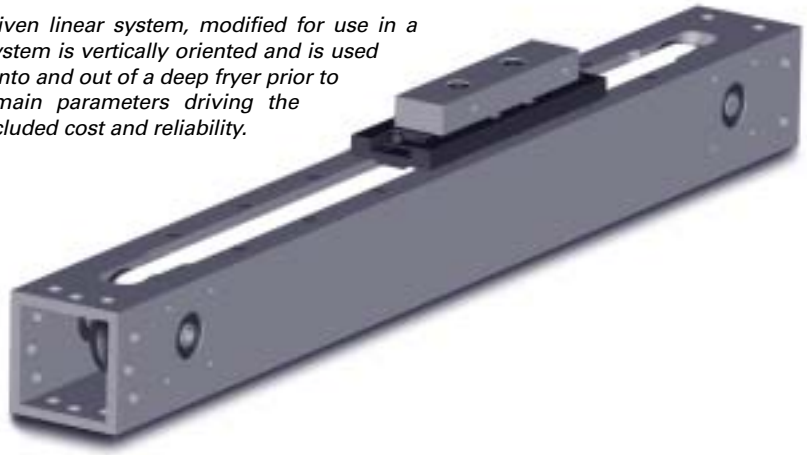
Screw driven LoPro® systems with custom designed wheel plates and drive ends. Units were modified so as to provide the necessary stroke length within a compact over-all length envelope. Drive ends were simplified to reduce cost and save space. Wheel plate assemblies use size 0 DualVee® guide wheels used with size/track plate assemblies. Systems are used in a laboratory grade biomedical analysis application to transport samples through an automated test process.

Rendering of a "ground-up" custom engineered solution for a printing application. The actuator supports the horizontal motion of a print head which traverses a continuous web feed in a food packaging / printing operation. Critical application parameters include repeatability, system stiffness, and reliability.



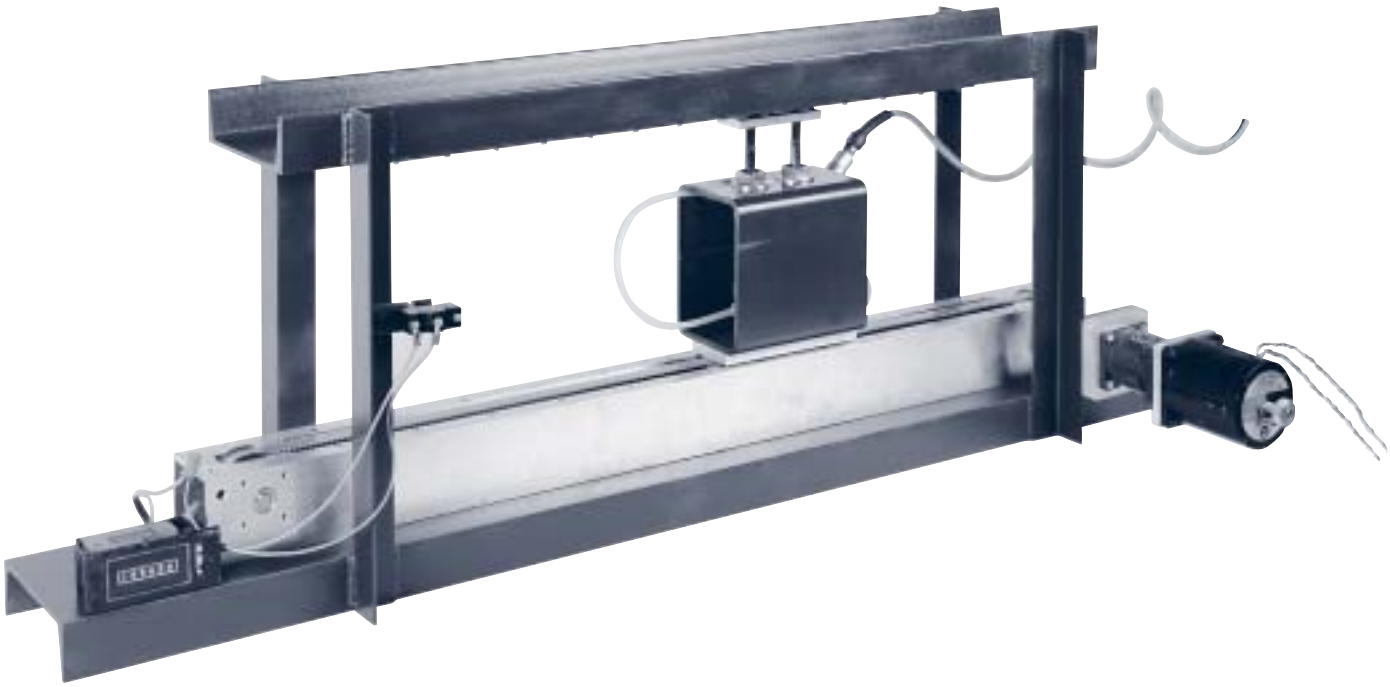
"Ground-up" design employing a custom designed track and wheel plate assembly. The system is actuated via a high performance planetary roller screw, with a dynamic thrust capacity in excess of 8000 pounds. The critical application parameters in this application for flat panel display processing are smoothness of travel, low vibration, and high reliability. The solution was developed to increase throughput and yield in a dipping process which had less than optimal mechanical stability.

Customized UtiliTrak® driven linear system, modified for use in a vending machine. This system is vertically oriented and is used to transport a food item into and out of a deep fryer prior to being dispensed. The main parameters driving the design of this product included cost and reliability.



This system is comprised of linear guidance elements built from our QuickTrak® product line. QuickTrak® employs an aluminum double edge track and a carriage assembly built with high performance polymer wheels. Polymer wheels are supported by a double row, stainless steel, radial bearing arrangement. Polymer wheel technology offers the advantages of very smooth motion, inherent corrosion resistance, and low cost.

Notes



Pneumatically loaded test rig used to quantify load vs. service life in a DualVee®-based linear guidance system. Test stand is designed to assess the load / life relationship of two discrete products including the belt driven UtiliTrak® system (below) and an unactuated SW series guide (above).

Contents

Load/Life Relationship

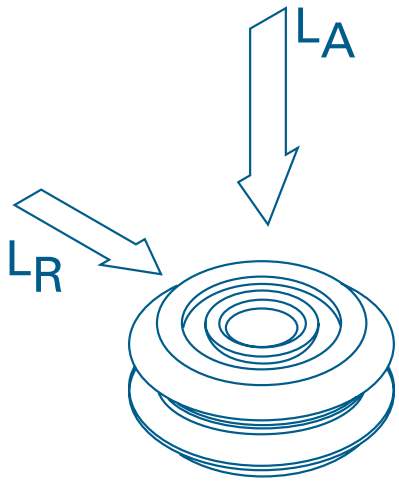
When considering the service life of a LoPro® linear motion system, one must consider two discrete calculations. First is the load / life relationship of the linear bearing system; second is the service life of the actuator and drive end supports under the applicable load / velocity profile and duty cycle.

Several factors will influence the service life of the linear bearing in a LoPro® system. Through research and development spanning over thirty years, BWC has devised a simple method to estimate the load/life relationship for a specific DualVee®-based guide mechanism under defined loading conditions. The methodology accounts for the size of the DualVee® bearing elements, the relative spacing between these elements, and the orientation, location, and magnitude of the load. The curve is based upon clean, well lubricated track conditions, so for applications where lubrication is prohibitive, a derating factor must be applied (see below).

It is important to note that secondary considerations such as maximum velocity, acceleration rates, duty cycle, stroke length, environmental conditions, the presence of shock and vibration, and extreme temperature ranges can all impact bearing service life to varying degrees. As such, the sizing method outlined below should be used conservatively, and be considered only a guideline for the sizing of LoPro® linear systems. When time and budget permits, the prototyping of a LoPro® linear system is recommended to confirm service life expectations.

The Load / Life Equation - Linear Guide Sizing and Selection

The load/life estimation requires a basic understanding of the principles of statics, the ability to work with free body diagrams, and the capacity to resolve externally applied forces on a carriage assembly into the radial and axial reaction forces at each guide wheel in the design.



Step 1: Calculate the resultant radial and axial loads reflected to each bearing element in the system design

All standard considerations involved in statics calculations must be accounted for, including inertial forces, gravitational forces, external forces such as tool pressure, bearing element spacing, and magnitude and direction of the payload. Any external forces that generate a reaction through the wheel / track interface need to be considered. Refer to pages 67 - 71 for established load resolution equations for popular loading conditions. If assistance is required in resolving specific loads into the resultant reaction forces at the guide wheel / track interface, contact our applications engineering staff for support. It is recommended that the Application data sheet on page 75 be submitted beforehand, with as much application information detailed as possible.

Step 2: Calculate the load factor for the most heavily loaded guide wheel in the system

$$L_F = L_A / L_{Amax} + L_R / L_{Rmax}$$

Where L_F = Load Factor

L_A = Resultant axial load on the guide wheel

L_{Amax} = The maximum axial working load capacity

L_R = Resultant radial load on the guide wheel

L_{Rmax} = The maximum radial working load capacity

The most heavily loaded bearing in the system will have the highest load factor (L_F). Bearing system elements should be sized such that $L_F < 1$.

Due to the varying application load and speed parameters and environmental conditions, the appropriate adjustment factor must be applied to the maximum axial and radial working load capacities (LAmax and LRmax) as follows:

Application Conditions	Adjustment Factor
Clean, well lubricated, low shock, low vibration.	1.0 - 0.7
Moderate contaminants, medium duty cycle, medium shock, low to medium vibration, moderate speed.	0.7 - 0.4
Heavy contamination, high duty cycle, high acceleration, high velocity, medium to high shock, high vibration, no lubrication	0.4 - 0.1

Oscillating motion resulting in less than one full revolution of the wheel under load can cause accelerated wear on the internal bearing elements. Testing of such systems is recommended to verify compatibility of the design with the load/life requirements of the application.

Load / Life Relationship, cont.

Step 3: Apply the load factor to the load/life equation below:

$$\text{Life} = L_C / (L_F)^3$$

Where L_F = Load Factor

L_C = Life Constant

Life constants and DualVee® guide wheel load ratings are provided in both inch and metric as tabulated below:

LoPro Size	Life Constant	
	inches of travel life	kilometers of travel life
1	2.19×10^6	55
2	3.47×10^6	87
3	5.19×10^6	130
4	6.84×10^6	171

LoPro® linear guides are available with a wide range of guide wheel options.
The table below provides load capacity data for each of the standard available LoPro guide wheel options:

Guide Wheel	DUALVEE GUIDE WHEEL LOAD CAPACITY (lb_f)						DUALVEE GUIDE WHEEL LOAD CAPACITY (N)					
	Radial Working Load Capacity	Axial Working Load Capacity	BDLA RADIAL	BSLR RADIAL	BDLR AXIAL	BSLR AXIAL	Radial Working Load Capacity	Axial Working Load Capacity	BDLA RADIAL	BSLR RADIAL	BDLR AXIAL	BSLR AXIAL
	$L_{Rmax}(lbs_f)$ 3.	$L_{Amax}(lbs_f)$ 3.	(lbs_f) 1.	(lbs_f) 2.	(lbs_f) 3.	(lbs_f) 2.	$L_{Rmax}(N)$ 3.	$L_{Amax}(N)$ 3.	(N) 1.	(N) 2.	(N) 3.	(N) 2.
W1	134	157	490	250	245	234	595	252	2180	1110	1090	1040
W2	322	140	1057	625	535	591	1431	625	4700	2780	2380	2630
W3	691	382	2057	1135	1012	1079	3074	1701	9150	5050	4500	4800
W4	1058	899	2878	1776	1428	1675	4704	4001	12800	7900	6350	7450
WØX	59	28	236	112	119	106	265	123	1050	500	530	470
W1X	134	157	490	250	245	234	595	252	2180	1110	1090	1040
W2X	322	140	1057	625	535	591	1431	625	4700	2780	2380	2630
W3X	691	382	2057	1135	1012	1079	3074	1701	9150	5050	4500	4800
W4X	1058	899	2878	1776	1428	1675	4704	4001	12800	7900	6350	7450
W4XXL	1702	1473	4631	3215	2338	3035	7571	6552	20600	14300	10400	13500
W1SSX	134	157	490	250	245	234	595	252	2180	1110	1090	1040
W2SSX	322	140	1057	625	535	591	1431	625	4700	2780	2380	2630
W3SSX	691	382	2057	1135	1012	1079	3074	1701	9150	5050	4500	4800
W4SSX	1058	899	2878	1776	1428	1675	4704	4001	12800	7900	6350	7450
W4SSC	1702	1473	4631	3215	2338	3035	7571	6552	20600	14300	10400	13500
W1SS227	111	47	407	207	202	196	494	208	1810	920	900	870
W2SS227	267	117	877	519	445	490	1188	520	3900	2310	1980	2180
W3SS227	574	314	1709	944	832	899	2554	1399	7600	4200	3700	4000
W4SSCR	876	746	2383	1475	1185	1389	3896	3320	10600	6560	5270	6180

Notes:

1. Basic Dynamic Load Rating, According to AFBMA STD 9-1990. Based on industry standard bearing calculations and are for comparison purposes only. Maximum working load figures should be used for component sizing and selection.
2. Basic Static Load Rating, According to AFBMA STD 9-1990. Based on industry standard bearing calculations and are for comparison purposes only. Maximum working load figures should be used for component sizing and selection.
3. Working load capacities reflect lubricated wheel/track interface.

Notes

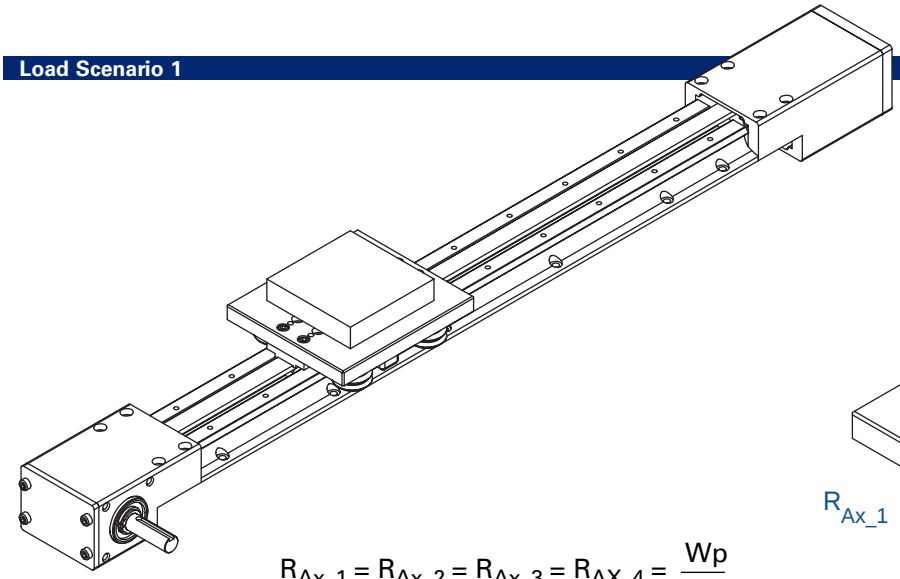
Governing Equations of Motion

Equations of motion are described herein to determine the axial and radial loads applied to the carriage assembly when subjected to typical load scenarios, which can then be utilized to determine "Load/Life" characteristics.

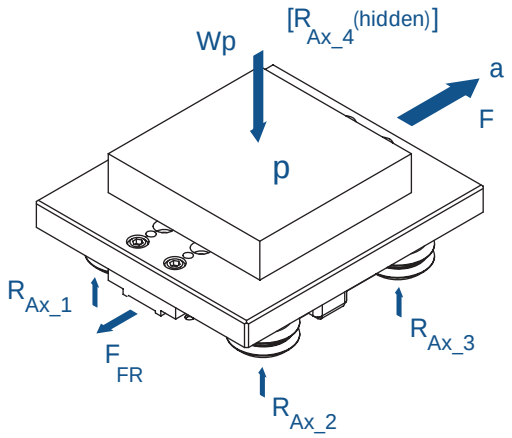
a	=	acceleration, [m/s^2]
c	=	Carriage
d	=	Horizontal distance of payload center of gravity from carriage center, [m]
F	=	Force applied by belt (belt working load) or chain (avg. tensile strength), [N]
F_{Ax}	=	Axial / Thrust Load Capacity of Dual Vee Wheel, [N]
F_{Fr}	=	Frictional force, [N] =μg(Mc+ Mp)
F_{Ra}	=	Radial Load Capacity of Dual Vee Wheel, [N]
g	=	Gravitational Acceleration = 9.81 m/s^2
h	=	Vertical distance of payload center of gravity from carriage center. [m]
Mp	=	Payload Mass, [kg]
n	=	Carriage Wheel Track (distance between track vees), [m]
p	=	Payload
R_{Ax}	=	Wheel Axial Reaction Force, [N]
R_{Ra}	=	Wheel Radial Reaction Force, [N]
μ	=	Coefficient of Friction, [N/N] = .015
Wp	=	Payload Weight, [N]
WALC	=	Wheel Axial Load Capacity
WRLC	=	Wheel Radial Load Capacity
x	=	Carriage Wheel Base, [m]
T_P	=	Torque applied to carriage induced by payload.

Governing Equations of Motion

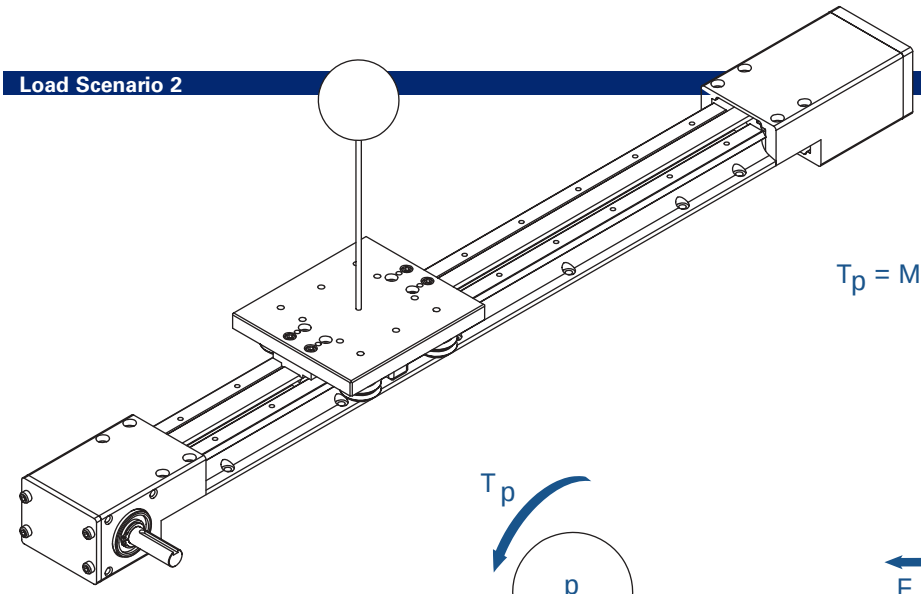
Load Scenario 1



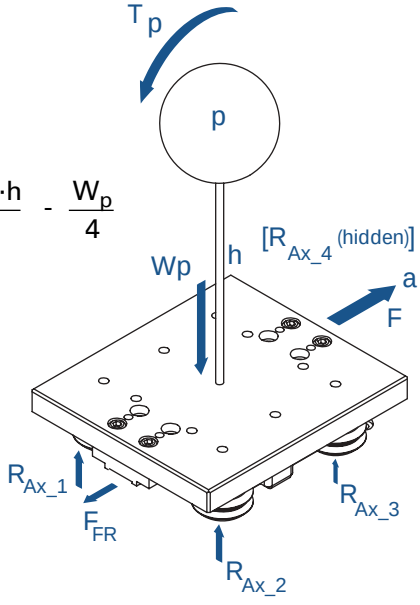
$$R_{Ax\_1} = R_{Ax\_2} = R_{Ax\_3} = R_{AX\_4} = \frac{Wp}{4}$$

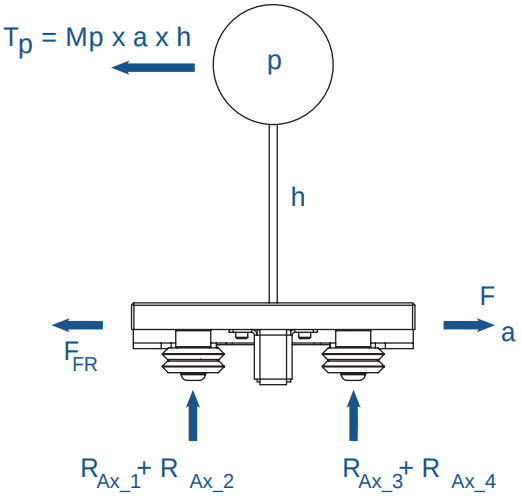


Load Scenario 2



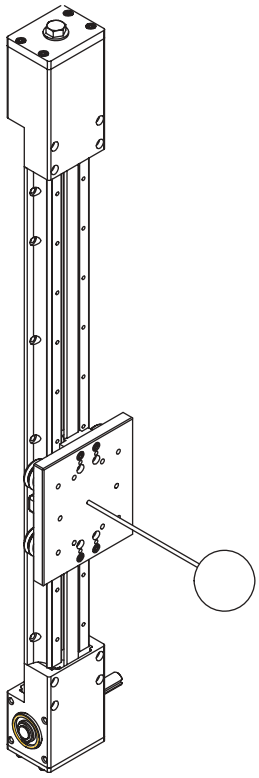
$$R_{Ax\_1} = R_{Ax\_2} = \frac{M_p \cdot a \cdot h}{2 \cdot x} - \frac{W_p}{4}$$

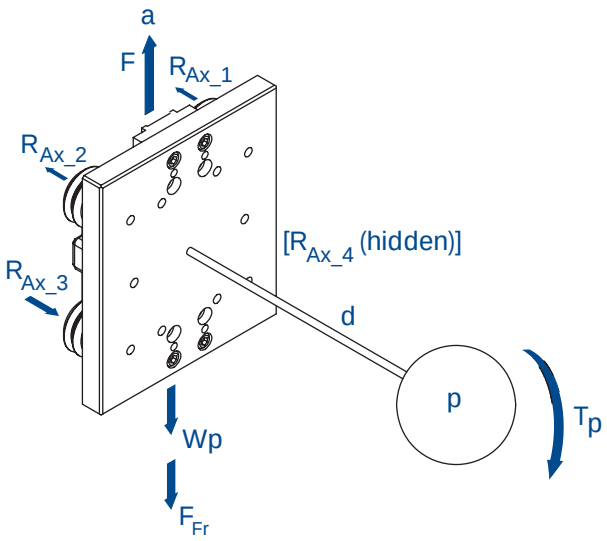




$$R_{Ax\_3} = R_{Ax\_4} = \frac{M_p \cdot a \cdot h}{2 \cdot x} - \frac{W_p}{4}$$

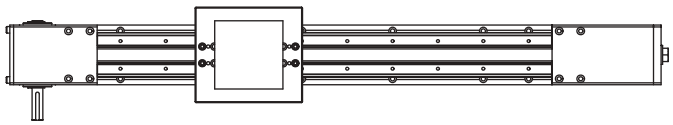
Load Scenario 3



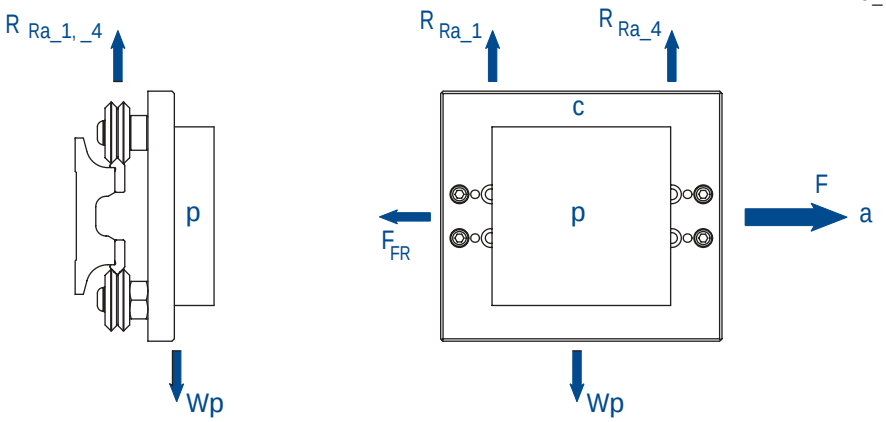


$$R_{Ax\_1} = R_{Ax\_2} = R_{Ax\_3} = R_{AX\_4} = \frac{h \cdot M_p \cdot (g + a)}{2 \cdot x}$$

Load Scenario 4

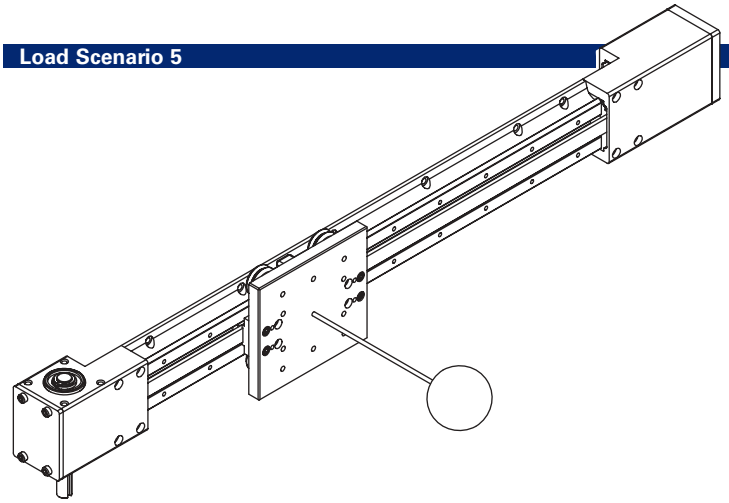


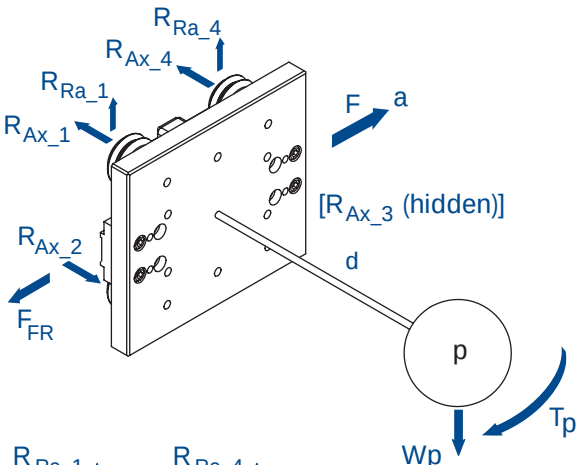
$$R_{Ra\_1} = R_{Ra\_2} = \frac{W_p}{2}$$

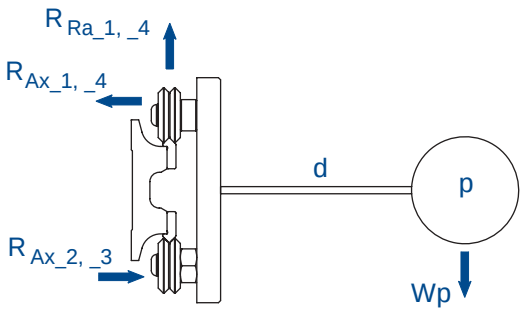


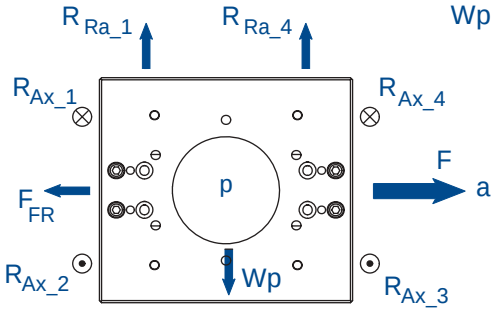
Governing Equations of Motion, cont.

Load Scenario 5









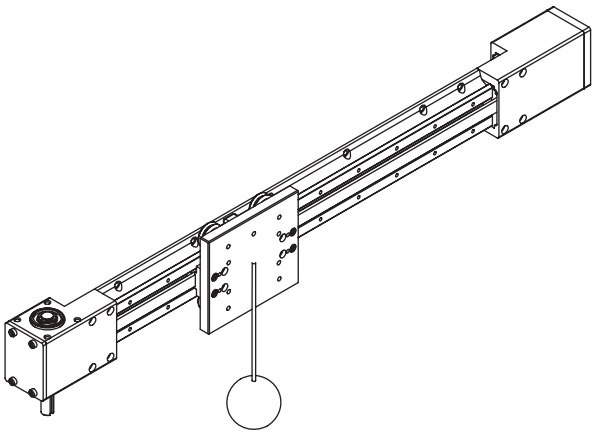
$$R_{Ax\_3} = R_{Ax\_4} = \frac{d}{2} \cdot \left(\frac{W_p}{n} - \frac{M_p \cdot a}{x} \right)$$

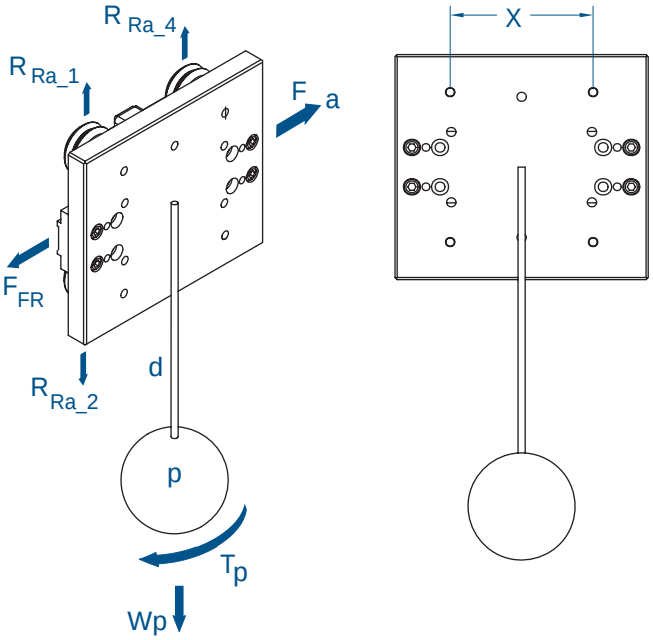
$$R_{Ax\_2} = R_{Ax\_3} = \frac{d}{2} \cdot \left(\frac{W_p}{n} - \frac{M_p \cdot a}{x} \right)$$

Load Scenario 6

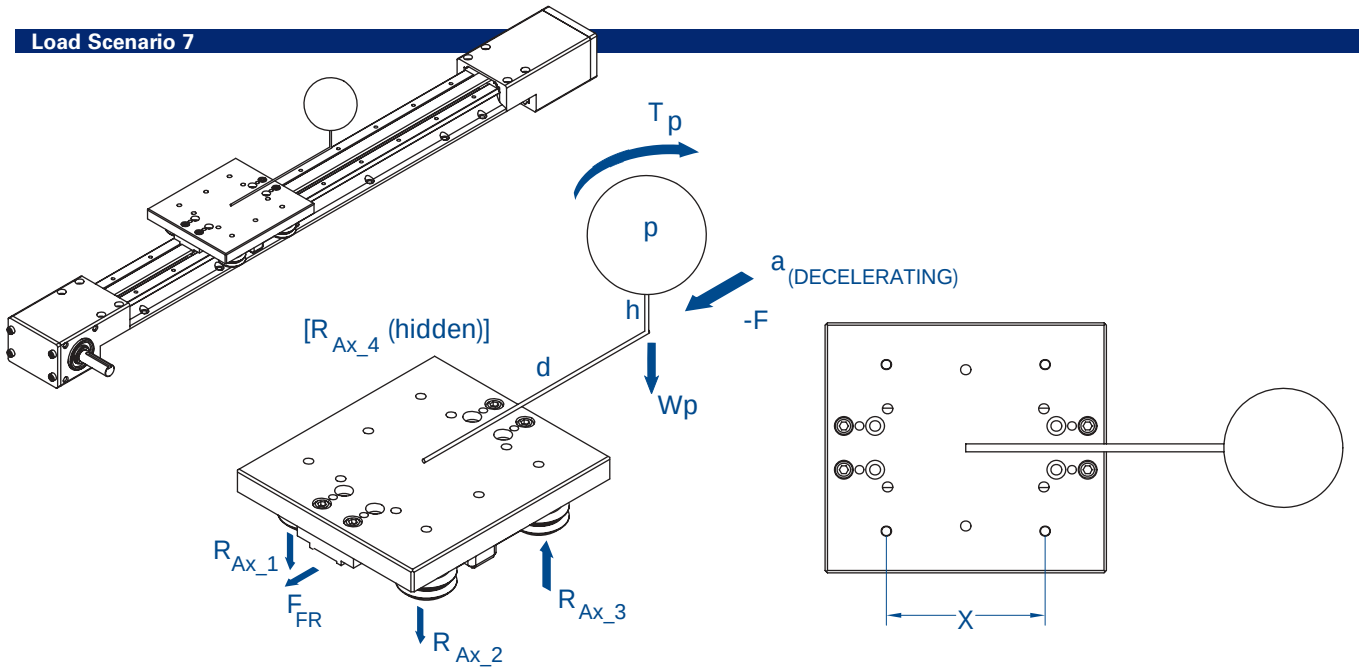
$$R_{Ra\_1} = \frac{W_p}{2} \qquad R_{Ra\_2} = \frac{M_p \cdot a \cdot d}{x}$$

$$R_{Ra\_3} = 0 \qquad R_{Ra\_4} = \frac{W_p}{2} + \frac{M_p \cdot a \cdot d}{x}$$





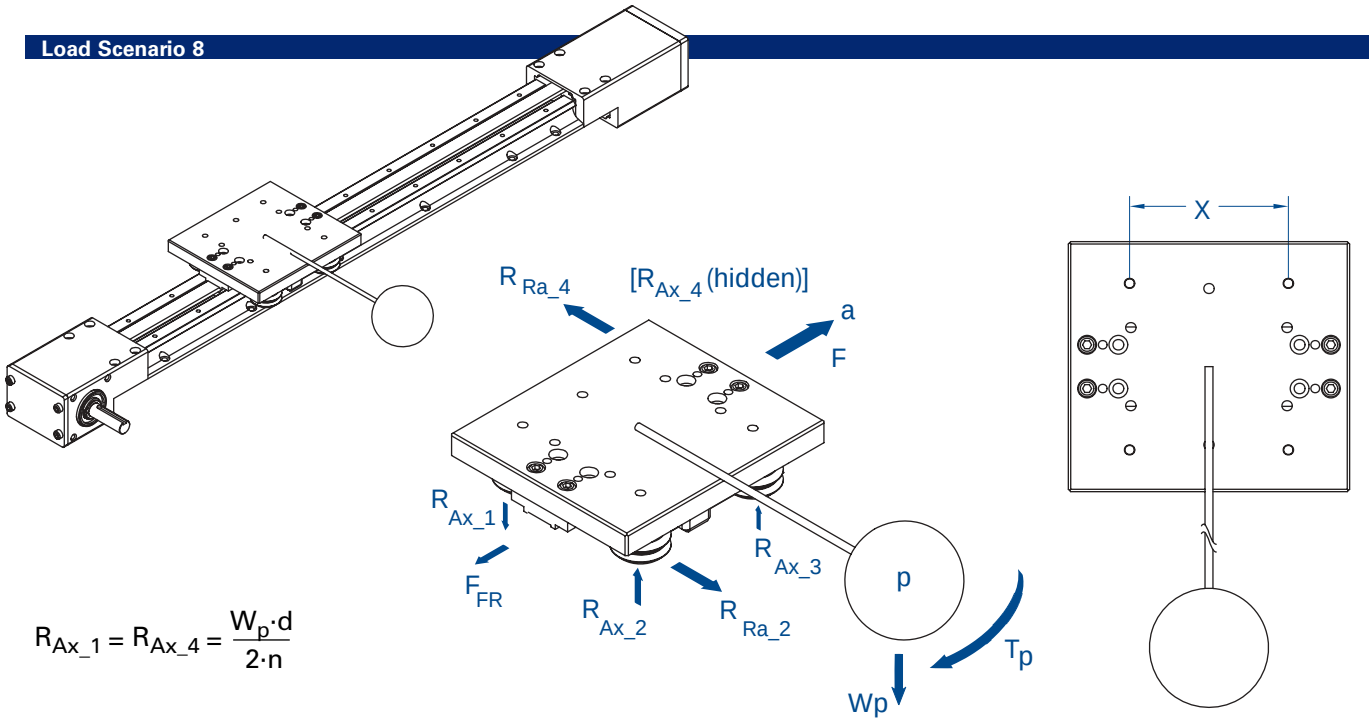
Load Scenario 7



$$R_{Ax\_1} = R_{Ax\_2} = \frac{(W_p \cdot d + M_p \cdot a \cdot h)}{2 \cdot x}$$

$$R_{Ax\_3} = R_{Ax\_4} = \frac{W_p}{2} \cdot \left(1 - \frac{d}{x}\right) - \frac{M_p \cdot a \cdot h}{2 \cdot x}$$

Load Scenario 8



$$R_{Ax\_1} = R_{Ax\_4} = \frac{W_p \cdot d}{2 \cdot n}$$

$$R_{Ra\_2} = R_{Ra\_4} = \frac{M_p \cdot a \cdot \left(d + \frac{n}{2}\right)}{x}$$

$$R_{Ax\_2} = R_{Ax\_3} = \frac{W_p}{2} \cdot \left(1 - \frac{d}{n}\right)$$

Actuator Sizing and Selection

LoPro® systems are available with the following standard actuator options:

- Lead Screw
- Ball Screw
- Belt and Pulley
- Chain and Sprocket

The actuator in a linear motion system functions to provide thrust to the carriage assembly in the direction of motion. The carriage is restricted from movement in the other 5 degrees of freedom by the DualVee®-based linear guide. The actuator drives the carriage and supports reaction forces as dictated by the application. Information regarding sizing and selection of LoPro® actuator technology is provided below.

Belt Drive System Characteristics

- High speed capacity
- Moderate thrust capacity
- Simple design; easy maintenance
- Smooth operation over wide range of speed
- High duty cycle capability
- Repeatable to +/- 0.004" (+/-0.1 mm)
- Accurate to 0.008"/foot (0.2 mm / 300 mm)
- Easily backdrivable
- Low noise
- High efficiency (90%)
- Subject to belt stretch or wear affecting positional accuracy
- Low shock load capacity

Sizing

The maximum load on the belt drive in a LoPro® linear system should be restricted to 80% of the belt's working load capacity. See page 16 for belt performance data. Actual service life of the belt and its respective drive ends are affected by the specific application duty cycle, velocity profile, and thrust loading parameters to which it is subjected. As such, sizing should be done conservatively to assure service life expectations are met.

Chain Driven Systems:

Characteristics

- Low to moderate speed capacity
- High thrust capacity
- Simple design; easy maintenance
- Operates well in harsh environments
- Excellent resistance to heavy shock loads
- Inherently elastic; tends to absorb vibration
- High duty cycle capability
- Repeatable to +/- 0.008" (+/-0.2 mm)
- Accurate to 0.015" / foot (0.4mm / 300 mm)
- High efficiency (80%)
- Easily backdrivable
- High noise
- Subject to chain stretch or wear affecting positional accuracy

Sizing

Average tensile strengths of LoPro® standard chain is published on page 22 in the specifications section. Sizing of a chain driven LoPro® system should be such that the maximum tension exerted on the chain should not exceed 80% of the rated working load capacity. Actual service life of the chain and its respective drive ends are affected by the specific application duty cycle, velocity profile, and thrust loading parameters to which it is subjected. As such, sizing should be done conservatively to assure service life expectations are met.

Lead Screw Driven Systems

Characteristics

- Not easily backdrivable
- Low efficiency / sliding friction (30 – 50%)
- Low duty cycle (60% maximum)
- Low cost
- Quiet operation
- Repeatable to 0.0005" (0.01 mm)
- Accurate to 0.006 in / in (mm / mm)
- Wear is proportional to usage (unpredictable service life)
- Low speed operation
- Medium shock load capacity
- Smooth operation

Sizing

Lead screw systems should be sized such that the maximum axial load on the screw stays within 80% of the dynamic load capacity of the screw assembly. Dynamic load capacities are published on page 28 in the specifications section.

Ball Screw Systems

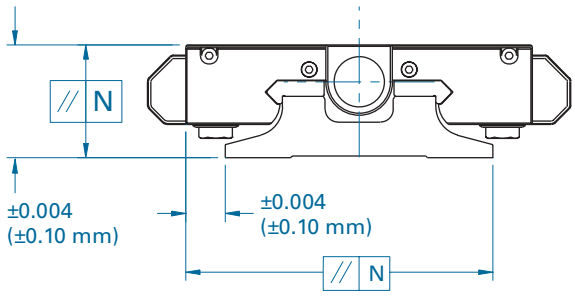
Characteristics

- Easily backdrivable
- High noise
- Moderate resistance to shock loading
- Smooth operation
- Moderate to high speed capacity
- High efficiency (90%)
- Repeatable to 0.0005" (0.01 mm)
- Accurate to 0.004"/foot (0.1mm / 300 mm)
- Predictable service life
- Maintains positional accuracy over screw service life
- High duty cycle capability

Sizing

Ball screw systems should be sized such that the maximum axial load on the screw stays within 80% of the dynamic load capacity of the screw assembly. Dynamic load capacities for ball screw assemblies are published on page 34 in the specifications section. Critical speed of the lead screw must also be considered. See critical speed chart below to verify ball screw velocity limitations.

Accuracy / Repeatability



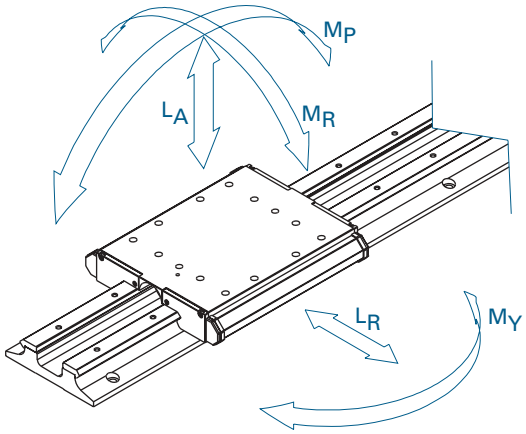
Running parallelism end view of an unsupported LoPro® linear guidance system

The accuracy of a LoPro® linear system is dependent upon the mounting surface preparation and the technique used to align the track. LoPro® systems can achieve straightness and flatness characteristics to within 0.004" / foot (0.1 mm / 300 mm) when mounting surfaces are adequately prepared. Straight line accuracy of beam mounted LoPro® systems are subject to the industry standard straightness and twist tolerances associated with extruded or hot formed sections. As such, highest straight line precision can be achieved by bolting an unsupported LoPro® system to a carefully prepared flat mounting surface. Use of a machined reference edge will help maximize system straightness.

Point–to–point accuracy of a LoPro® linear system is dictated by the accuracy of the actuator. Screw driven systems are most accurate at 0.006 in / in (mm / mm). Belt driven systems are slightly less accurate and chain even less so. In terms of repeatability, screw driven systems are most repeatable at 0.0005". Repeatability in belt and chain drive systems ranges from 0.004" to 0.020" (0.10mm to 0.25 mm). Higher accuracy actuators can be integrated on request.

Preload / Fitup Adjustment

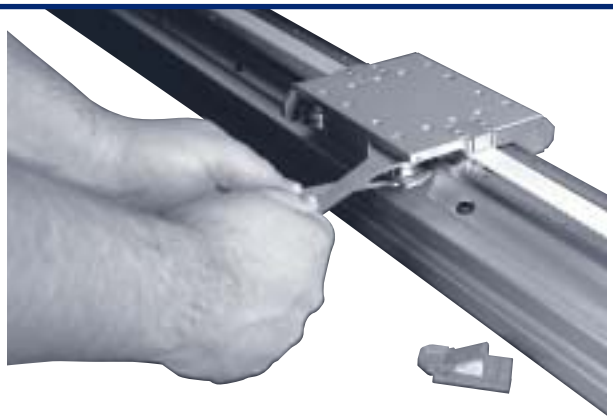
Wheel plate assemblies are built with two fixed position wheels mounted opposite two eccentrically mounted wheels. The stationary bushings determine the alignment of the system. Whenever possible, wheels should be configured so that the load is predominantly radial. Radial loading of the DualVee® guide wheel optimizes load distribution through the bearing elements, minimizing friction, and maximizing smoothness. That's not to say that LoPro® systems cannot be loaded in any other way. LoPro® linear systems can be loaded axially, or in any of the moment orientations as well. It's just good engineering practice to orient the system to accept loads radially, whenever the application allows for it.



LoPro® guide assembly with force and moment load vectors drawn in. Linear guide performance in a LoPro® system is optimized when loads are primarily radial.

Correct adjustment of the wheel to track fit-up will ensure optimum performance and long life from your LoPro® linear motion system.

DualVee® guide wheels are affixed to their respective wheel plates with either a concentric or eccentric bushing and a wheel bolt. The eccentric components are identified by a hexagonal shoulder, which is rotated by a thin profile, open end, wrench. The rotation of the eccentric bushing varies the force with which the wheel is pushed into contact with the track. The ideal adjustment of the eccentric bushings will eliminate free play of the carriage, while not over pre-loading the wheel bearings. The suggested procedure for this adjustment is as follows:



Fitup adjustment being made to a wiper wheel plate in a belt driven LoPro® linear motion system.

1) Check that the concentric mounted wheels are tightly affixed to the carriage plate.

2) Loosen the eccentric mounted wheels just enough to permit rotation of the mounting bushings with an open-end wrench on the hex.
3) Position the carriage plate on the track.
4) Rotate the hex with the wrench until the wheels contact the track.
5) Hold the guide wheel between your fingers, and move the wheel plate along the track. Adjust the hex with the wrench until the wheels will just barely skid on the track. Tighten down the wheel bolt, (or nut) to maintain this adjustment.
6) Repeat this procedure for all of the eccentric mounted wheels.
7) The carriage should ride smoothly and uniformly over the entire length of the track. Further adjust the wheels until this condition is met.

Lubrication

Lubrication is the key to maximizing service life in any rolling contact linear bearing design. Internally, DualVee® guide wheels are lubricated for life with an extreme pressure, corrosion resistant grease. As such, the main consideration with regards to lubrication is the wheel / track interface. Typically, a light machine oil or an extreme pressure grease does well to minimize wear, stick slip, and corrosion.

LoPro® systems are available with two standard wheel plate designs. The wiper wheel plate comes complete with lubricating wiper caps (lubricators consist of an oil saturated felt). The basic wheel plate is available with either wheel covers or lubricators. Both options include lubrication via oil saturated felt.

Lubrication will maximize the load capacity of an individual bearing element. As such, for any specific loading condition, the presence of lubrication on the guide ways will significantly increase the service life over a non-lubricated configuration under the same loads.

Lubrication will also increase the maximum linear velocity that a guide wheel – based bearing arrangement can travel. In high cycling applications where high speed or acceleration rates are present, lubrication of the wheel / track interface is strongly recommended.

Track Splicing Considerations

The aluminum track plate in a LoPro® guide is fabricated in 10 foot lengths. DualVee® track, on the other hand, is fabricated in 20 foot lengths. The fact that LoPro® systems can be fabricated with long lengths demands that DualVee® track must be spliced somewhere. Standard track splicing procedure for systems in excess of 20 feet calls for the joints on parallel tracks to be staggered for greater accuracy and smoothness. Long length systems requiring track splicing are engineered, fabricated, assembled, and quality checked, prior to disassembly, packaging, and shipment. Systems are supplied with clearly marked, pre-matched joints making installation easy.

Contaminated Environments / Wear Resistance

Since the circumference of the wheel is greater at the major diameter than at the minor diameter, there is a constant wiping action on the track surface. This wiping action gives DualVee® – based guidance systems a self cleaning effect. As such, DualVee® guide wheels are employed in a wide variety of harsh environments, including the presence of metal chips, fibers, slurries, etc. It is important to note that such environments will often limit service life of the LoPro® guidance system to some extent. Since environments vary from application to application, it is recommended that a LoPro® system be prototyped before employing on a large scale, particularly in a harsh environment where service life could be unpredictable.

Notes

Application Data Sheet

Company: _____

Contact: _____

Address: _____

City: _____ State: _____ Zip Code: _____

Phone: _____ Fax: _____ e-mail: _____

System Orientation:	_____	☐ horizontal	☐ vertical		
Load:	_____	☐ lbs	☐ N		
Mass Size (l x w x h):	_____	☐ in	☐ m		
Stroke Length:	_____	☐ in	☐ m		
Velocity:	_____	☐ in/s	☐ m/s		
Accel/Decel:	_____	☐ in/s^2	☐ m/s^2		
Linear Accuracy:	_____	☐ in/ft	☐ mm/m		
Repeatability:	_____	☐ in	☐ mm		
Duty Cycle:	_____	☐ in/day	☐ m/day		
Environment:	_____	☐ factory	☐ food grade	☐ clean room	☐ other
Temperature:	_____	☐ °F	☐ °C		
Additional Forces:	_____	☐ lbs	☐ N		

Product/Machine Description: _____

_____

_____

Additional Requirements: _____

_____

_____

Expected Volume: _____ Date Needed: _____

System Sketch

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Internet: www.bwc.com

BWC® Solutions

DualVee® Components and Linear Guides — built with DualVee Motion Technology℠

GV3 Linear Guidance and Transmission System

SL2 Stainless Steel Based Slide System

HDS Heavy Duty Slide System

UtiliTrak® Linear Motion Guide — built with DualVee Motion Technology®

LoPro® Linear Motion System — built with DualVee Motion Technology®

DLS Driven Linear System

HDLS Heavy Duty Driven Linear System

RTS Ring and Track System / DTS Driven Track System

MCS Aluminum Frame and Machine Construction System

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fax 925 439 5931

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Bishop-Wisecarver Corporation warrants, to the original purchaser only, that the products (a) conform to the specifications published in this catalog or as otherwise communicated to the purchaser, and (b) are free from defects in material or workmanship. This warranty expires one year from the date of delivery. Any failure of the products to conform to the foregoing warranty must be communicated to Bishop-Wisecarver Corporation in writing within 13 months after delivery. Bishop-Wisecarver Corporation shall have the option, in its discretion, of correcting any failure or defect, providing replacement products, or providing a full refund of the purchase price. These remedies are the purchaser's exclusive remedies for breach of warranty. Any repair of defective products, including parts and labor, will be performed at Bishop-Wisecarver's expense and at its facilities. All freight must be prepaid by the customer.

The limited warranty and limited remedy set forth above constitute the only warranty of Bishop-Wisecarver Corporation and the purchasers only remedies in the event such warranty is breached. The foregoing limited warranty is exclusive of all other warranties pertaining to the products, written or oral, express or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose, or against patent infringement.

Bishop-Wisecarver Corporation does not warrant (a) defects caused by failure to provide a suitable installation environment for the product, (b) damage caused by use of the product for purposes other than those for which it was designed, (c) damage caused by unauthorized attachments or modifications, (d) products which have been repaired or altered outside of our facility, or (e) any other abuse or misuse by the purchaser. In no event will Bishop-Wisecarver be liable for any special, incidental or consequential damages, including but not limited to claims for injury to or death of persons, or for damage to property, based on breach of warranty, breach of contract, negligence, strict tort or any other legal theory, including loss of profits or revenues, loss of use of the product, cost of any substitute equipment or facilities, and the claims of customers or other third parties. Any action for breach of warranty must be commenced within 15 months following delivery of the product.

The purchaser acknowledges that it is selecting the product and/or system choices for its particular application, and is relying on its own expertise and not the expertise of Bishop-Wisecarver Corporation in making such selections.