HAYDON: 203 756 7441
KERK: 603 213 6290
www.haydonkerkpittman.com

AMETEK®
ADVANCED MOTION SOLUTIONS

Haydon kerk® Motion Solutions

Linear Rail Slides: LRS™ Linear Rail Systems Motorized and Non-Motorized

LRS™ Linear Rail Systems available with a Haydon® Hybrid 43000 Series Size 17 single and double stack linear actuator stepper motor or as an non-motorized linear rail

The LRS Linear Rail System in a variety of configurations, both motorized and non-motorized. These precision linear rail systems consist of a stationary base and a load bearing carriage that travels along a rigid extruded aluminum rail. The LRS Linear Rail System is available with several in-line motor options including a single stack or double stack size 17 stepper motor, a stepper motor with an integral chopper drive, or the IDEA™ programmable linear actuator, consisting of the stepper motor, drive, and controller programmed through a graphic user interface (GUI). The LRS is also available without a motor, easily allowing the designer flexibility to integrate with a variety of motor types and belt and pulley configurations.

LRS with Size 17 Double Stack Hybrid Linear Actuator with IDEA programmable Drive and Black Ice® TFE Lead-screw.

LRS with Size 17 Double Stack Hybrid Linear Actuator

LRS non-motorized

Key Product Features

- "T" slots integrated into exterior rail bottom and sides that accommodate full length support and various mounting options.
- Loads easily attach to the compact, moving carriage with four or six M4 x 0.7 size screws.
- Load bearing carriage moves efficiently and smoothly within the internal rail geometry of this specially designed aluminum extrusion.
- Rail provides end-to-end axial stability and precise motion system accuracy.
- Automatic adjustments of slide bearing play with a patent pending "anti-backlash" linear bearing.
- Rated life equals that of the existing lead-screws of similar size.
- Lead-screw end configurations adapt to various rotary motion sources.
- Kerkote® or Black Ice® TFE coatings on a 303 stainless steel lead-screw.
- Designed to Metric global engineering standards.
- For extreme control, LRS can be used with CMP or WDG high-precision anti-backlash nuts, as well as a freewheeling general purpose nut.

Haydon kerk Express℠
Standard products available 24-hrs. at
www.haydonkerkexpress.com

Identifying the LRS part number codes when ordering

LR	W	04	B	–	M	0025	–	XXX

Prefix
LR = Linear Rail System (LRS)

Frame Style
B = BFW nut
C = CMP nut
W = WDG nut
G = Guide only

Frame Size Load
04 = Max. static load 50 lbs (222 N)

Coating
S = Uncoated
B = Black Ice® TFE
N = No screw

Drive / Mounting
A = None

M = Motorized 43000 Series Size 17 Hybrid

G = Motor with IDEA™ integrated programmable drive - USB communications

J = Motor with IDEA™ integrated programmable drive - RS485 communications

Nominal Thread Lead Code
0000 = No screw

0025 = .25-in (.635)
0031 = .03125-in (.794)
0039 = .0394-in (1.0)
0050 = .05-in (1.27)
0063 = .0625-in (1.588)
0079 = .0787-in (2.0)
0100 = .01-in (2.54)
0125 = .125-in (3.175)
0197 = .1969-in (5.0)
0250 = .25-in (6.35)
0394 = .3937-in (10.0)
0500 = .5-in (12.7)
0750 = .75-in (19.05)
1000 = 1.0-in (25.4)

Unique Identifier
Proprietary suffix assigned to a specific customer application. The identifier can apply to either a standard or custom part.

Carriage holes available in Metric sizes
M3
M4
M5
M6

NOTE: Dashes must be included in Part Number (–) as shown above. For assistance or order entry, call our engineering team at 203 756 7441.

Technical specifications for Size 17 Hybrid Linear Actuator Stepper Motors are on page 3.

HAYDON: 203 756 7441
KERK: 603 213 6290
www.haydonkerkpittman.com
AMETEK®
ADVANCED MOTION SOLUTIONS

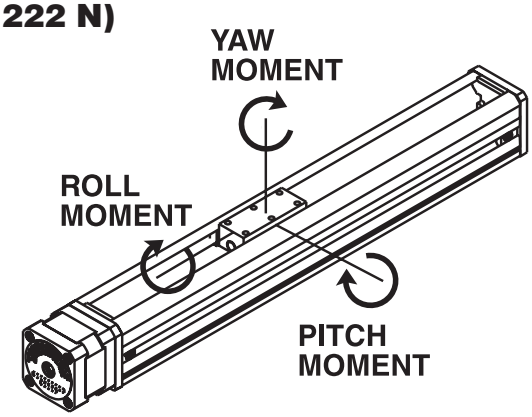
LRS™ Linear Rail with Hybrid 43000 Size 17 linear motors are recommended for horizontal loads up to 50 lbs (222 N)

Specifications

Width	Length of Stroke (max)	Speed (max)	Straight Line Accuracy	Twist
1-5/8-in square (4.3 cm square)	40-in (1000 mm)	20-in/sec (0.5 M/sec)	+/- 0.012-in/ft (+/- 1.0 mm/M)	+/- 0.25°/ft (+/- 0.75°/M)

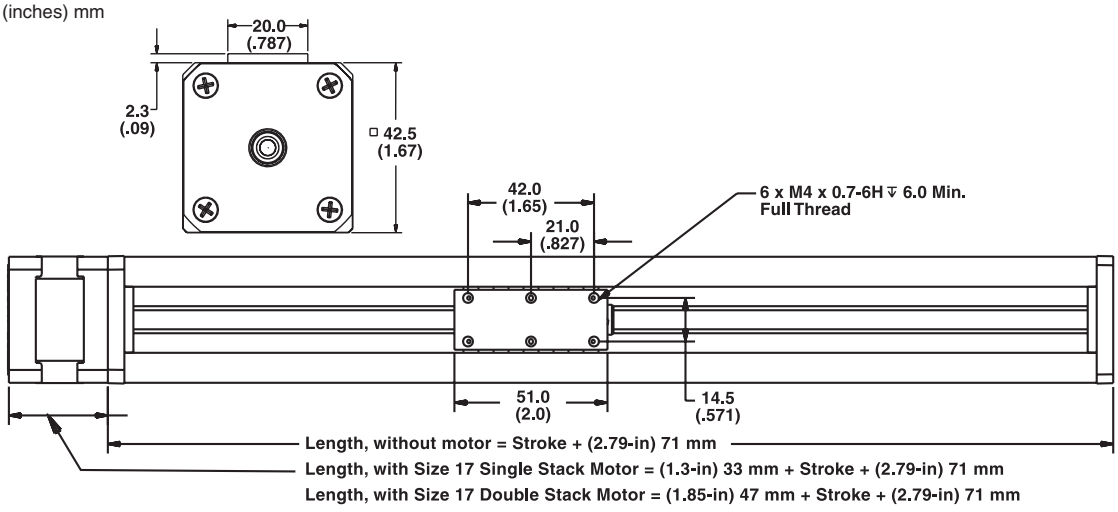
Load Ratings *(max)*

Top Load "Z" Direction	Hanging / Gantry	Max. Pitch Moment	Max. Moment Roll	Max. Moment Yaw
50 lbs (225 N)	50 lbs (225 N)	75-in – lbs (8.5 N – M)	75-in – lbs (8.5 N – M)	75-in – lbs (8.5 N – M)



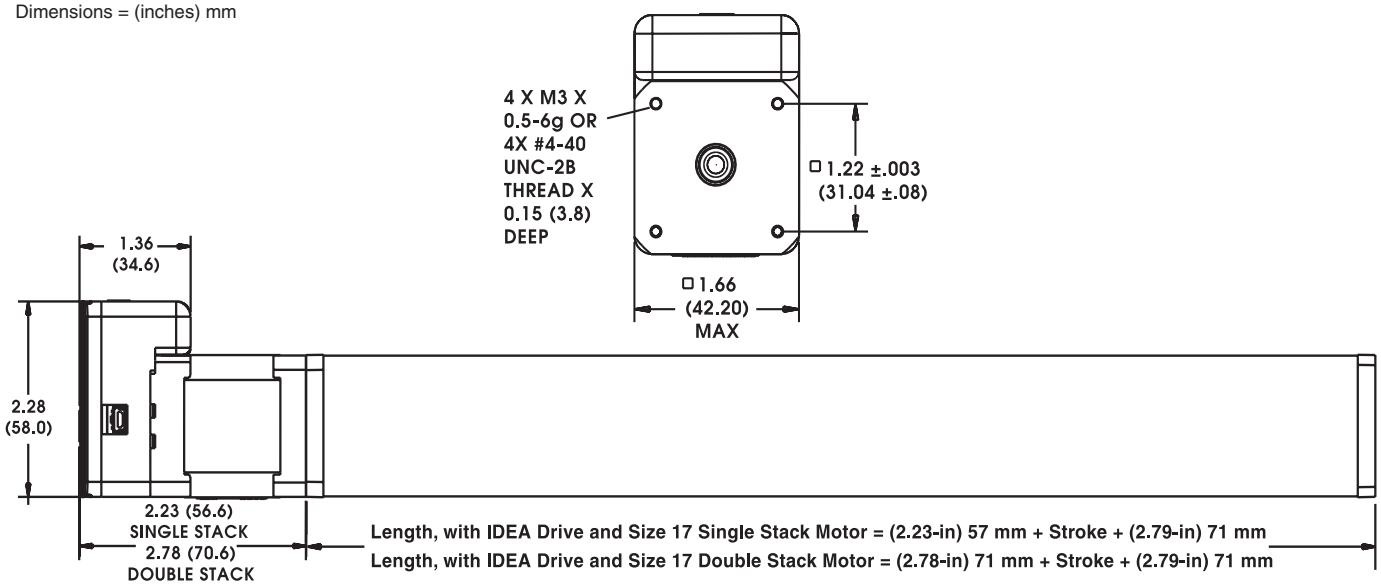
Dimensional Drawing: LRS with 43000 Series Size 17

Dimensions = (inches) mm



Dimensional Drawing: LRS with 43000 Series Size 17 and IDEA™ Drive

Dimensions = (inches) mm



Specifications: Haydon® 43000 Series Size 17 Single Stack

Size 17: 43 mm (1.7-in) Hybrid Linear Actuator (1.8° Step Angle)					
Wiring	Bipolar			Unipolar**	
Programmable Drive	IDEA™ Drive Option Available			Not Applicable	
Winding Voltage	2.33 VDC*	5 VDC	12 VDC	5 VDC	12 VDC
Current (RMS)/phase	1.5 A	700 mA	290 mA	700 mA	290 mA
Resistance/phase	1.56 Ω	7.2 Ω	41.5 Ω	7.2 Ω	41.5 Ω
Inductance/phase	1.9 mH	8.7 mH	54.0 mH	4.4 mH	27.0 mH
Power Consumption	7 W				
Rotor Inertia	37 gcm^2				
Insulation Class	Class B (Class F available)				
Weight	8.5 oz (241 g)				
Insulation Resistance	20 MΩ				

* 43000 Series Single Stack with IDEA programmable drive. Contact Haydon Kerk is higher voltage motor is desired.
** Unipolar drive gives approximately 30% less thrust than bipolar drive.

Size 17 External Linear

Size 17 External Linear with programmable IDEA Drive

IDEA™ Drive software is simple to use with on-screen buttons and easy-to-understand programming guides.

- Fully Programmable
- RoHS Compliant
- USB or RS-485 Communication
- Microstepping Capability – Full, 1/2, 1/4, 1/8, 1/16, 1/32, 1/64
- Graphic User Interface
- Auto-population of Drive Parameters
- Programmable Acceleration/Deceleration and Current Control

For more information see the Haydon Kerk **IDEA™ Drive** Data Sheet

Specifications: Haydon® 43000 Series Size 17 Double Stack

Size 17: 43 mm (1.7-in) Double Stack Hybrid Linear Actuator (1.8° Step Angle)			
Wiring	Bipolar		
Programmable Drive	IDEA™ Drive Option Available		
Winding Voltage	2.33 VDC*	5 VDC	12 VDC
Current (RMS)/phase	2.6 A	1.3 A	550 mA
Resistance/phase	0.9 Ω	3.8 Ω	21.9 Ω
Inductance/phase	1.33 mH	8.21 mH	45.1 mH
Power Consumption	10.4 W Total		
Rotor Inertia	78 gcm^2		
Insulation Class	Class B (Class F available)		
Weight	12.5 oz (352 g)		
Insulation Resistance	20 MΩ		

* 43000 Series Single Stack with IDEA programmable drive. Contact Haydon Kerk is higher voltage motor is desired.

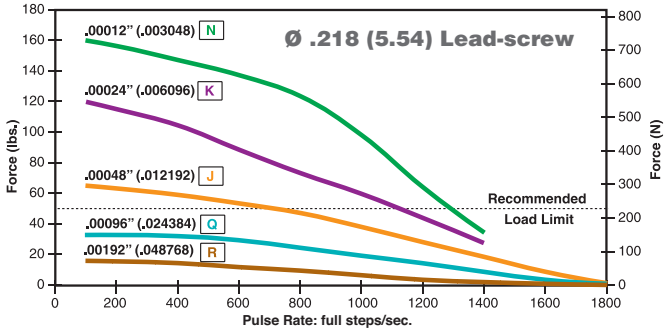
** Unipolar drive gives approximately 30% less thrust than bipolar drive.

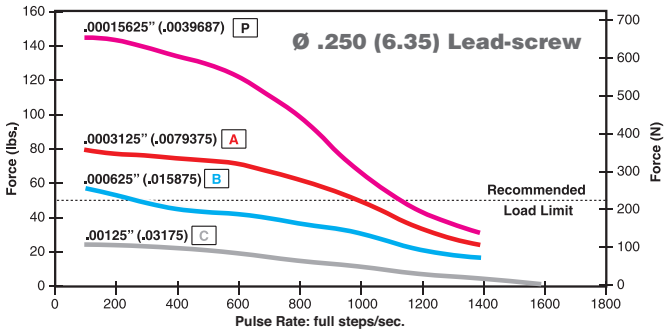
Size 17 Double Stack External Linear

Performance Curves: Haydon® 43000 Series Size 17 Single Stack

FORCE vs. PULSE RATE

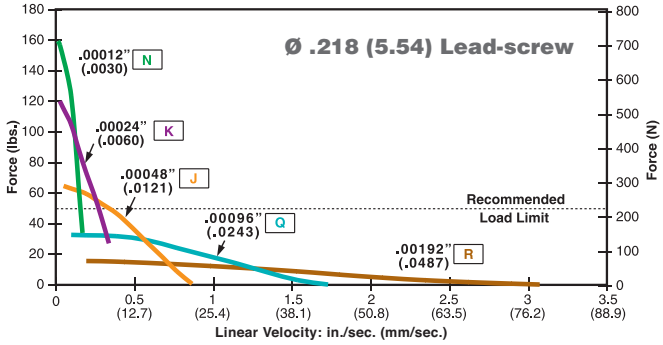
Chopper • Bipolar • 100% Duty Cycle

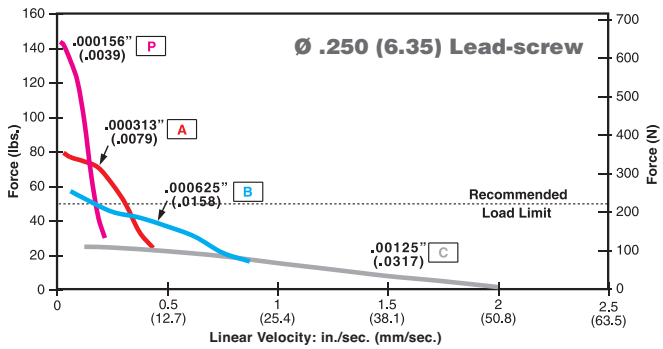




FORCE vs. LINEAR VELOCITY

Chopper • Bipolar • 100% Duty Cycle

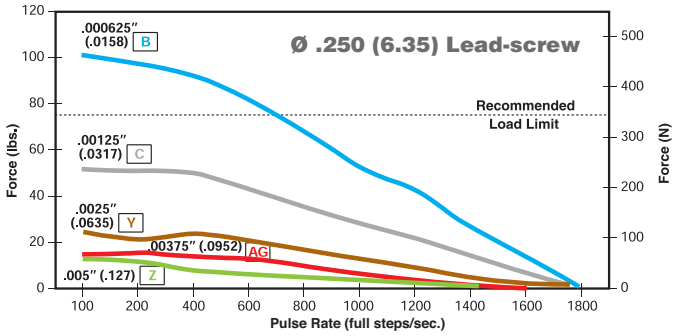




Performance Curves: Haydon® 43000 Series Size 17 Double Stack

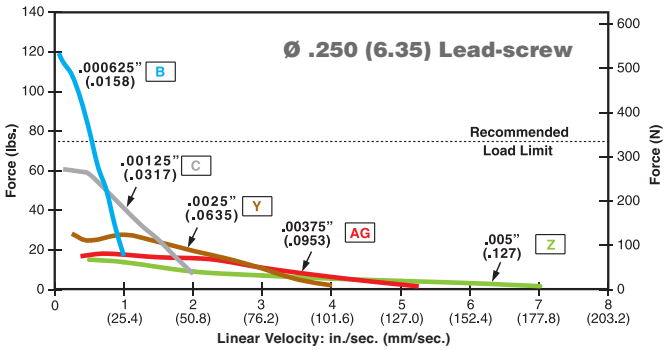
FORCE vs. PULSE RATE

Chopper • Bipolar • 100% Duty Cycle



FORCE vs. LINEAR VELOCITY

Chopper • Bipolar • 100% Duty Cycle



NOTE: All chopper drive curves were created with a 5 volt motor and a 40 volt power supply.

Ramping can increase the performance of a motor either by increasing the top speed or getting a heavier load accelerated up to speed faster. Also, deceleration can be used to stop the motor without overshoot.

With L/R drives peak force and speeds are reduced, using a unipolar drive will yield a further 30% force reduction.

The Haydon® 43000 Series Size 17

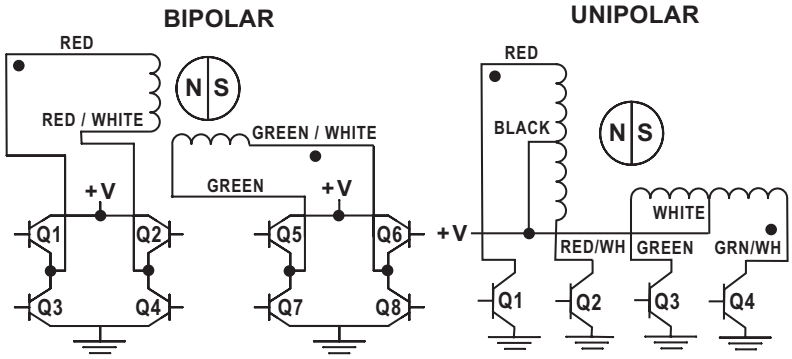
Hybrids: Stepping Sequence

Bipolar	Q2-Q3	Q1-Q4	Q6-Q7	Q5-Q8
Unipolar	Q1	Q2	Q3	Q4
Step				
1	ON	OFF	ON	OFF
2	OFF	ON	ON	OFF
3	OFF	ON	OFF	ON
4	ON	OFF	OFF	ON
1	ON	OFF	ON	OFF

EXTEND CW ↓ RETRACT CCW ↑

Note: Half stepping is accomplished by inserting an off state between transitioning phases.

Hybrids: Wiring



Integrated Connectors for 43000 Series Size 17

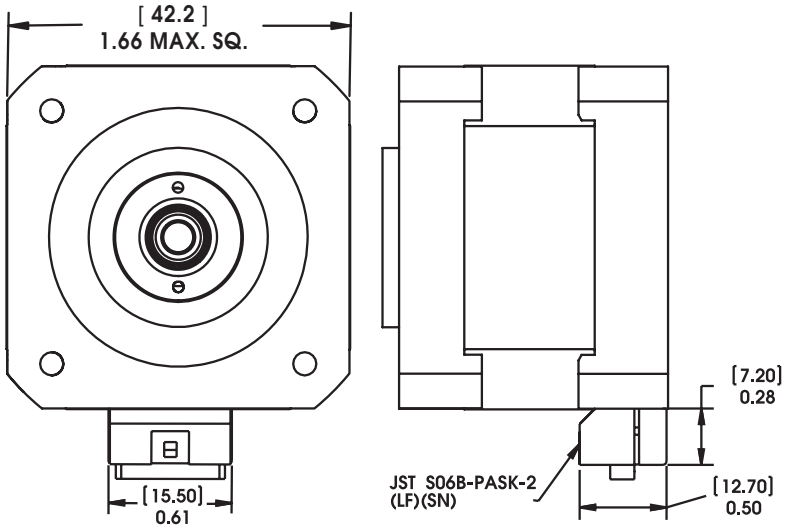
Hybrid Size 17 linear actuators are available with an integrated connector. Offered alone or with a harness assembly, this connector is RoHS compliant and features a positive latch in order for high connection integrity. The connector is rated up to 3 amps and the mating connector will handle a range of wire gauges from 22 to 28. This motor is ideal for those that want to plug in directly to pre existing harnesses. In addition to standard configurations, Haydon Kerk Motion Solutions can custom design this motor to meet your specific application requirements.

Motor Connector:
JST part # S06B-PASK-2
Mating Connector:
JST part # PAP-06V-S
Haydon Kerk Part #56-1210-5 (12 in. Leads)
Wire to Board Connector:
JST part number SPHD-001T-P0.5

Pin #	Bipolar	Unipolar	Color
1	Phase 2 Start	Phase 2 Start	G/W
2	Open	Phase 2 Common	–
3	Phase 2 Finish	Phase 2 Finish	Green
4	Phase 1 Finish	Phase 1 Finish	R/W
5	Open	Phase 1 Common	–
6	Phase 1 Start	Phase 1 Start	Red

Dimensional Drawing: 43000 Series Size 17 with Integrated Connector

Dimensions = (mm) inches



LRS Anti-Backlash and "Freewheeling" Nut Assembly Options

WDG Series

WDG Series
Anti-Backlash Assembly
– For moderate loads.
An exceptionally compact design to provide stiffness and balanced accuracy for precise positioning. A self-lubricating acetal nut, axially preloaded, the patented wedge design locks the nut at the correct preload without excessive drag.

CMP Series

CMP Series
Anti-Backlash Assembly
– For light loads.
Exceptionally compact, self-lubricating acetal nut; ideally suited for applications using oil or grease.

BFW Series

BFW Series
For applications that do not require anti-backlash or wear compensation Long life at minimal cost.

Kerkite® Composite Polymer Nuts

In addition to the Kerk® self-lubricating acetal nut material, Haydon Kerk Motion Solutions offers a variety of custom compounded Kerkite composite polymers. Kerkite polymers are a family of high performance materials that offer exceptional wear properties with the cost and design advantages afforded through injection molding. Kerkite polymers offer a variety of mechanical, thermal and electrical properties and are compatible with many chemicals and environmental conditions.

Kerkite Composite Polymers are available options for most Kerk Lead-screw Nuts and are standard materials for Linear Rail and Spline Shaft bushings, RGS® Carriages and Screwrail® Bushings and End Supports. Each member of the Kerkite family is compounded with lubricants, reinforcements and thermoplastic polymers formulated to provide optimum performance in its target conditions and applications, resulting in superior performance and extended life.

A cornerstone of the Haydon Kerk Motion Solutions advantage is design flexibility. Kerkite Composite Polymers, along with our injection molding and mold making capabilities, offer huge design advantages and cost savings compared with non-moldable materials. Kerkite high performance polymers outperform other plastics and outlast metal bushings and bearings. When combined with Kerkote® or Black Ice® TFE coatings, Kerkite Composite Polymers have been shown to provide hundreds of millions of inches of travel in customer applications while continuing to maintain precise, accurate motion and positioning.

Special Materials

In addition to the Kerk standard material – 303 stainless steel, self lubricating acetal and Kerkite high performance composite polymers – we also work with a vast array of custom materials. Kerk has rolled screws in many other materials, including 316 stainless, 400 series stainless, precipitate hardening materials, carbon steel, aluminum, and titanium. Kerk nuts had been produced in many alternative plastics including PEEK, polyester, Torlon®, Vespel®, PVDF, UHMW, Ertalyte® and customer-supplied specialty materials. We have also provided metal nuts made from bronze, brass, and stainless steel.

With so much flexibility in our manufacturing process, if the material can be molded, machined, ground, or rolled, Haydon Kerk Motion Solutions can likely process it using state of the art machine tools, injection molding and mold making, grinding and thread rolling equipment. Haydon Kerk Motion Solutions excels at supplying the best overall solution to meet our customers' requirements.

Kerkote® TFE Coating

Kerkote TFE coating covering the entire screw surface results in an extremely even lubrication distribution. Test results indicate system torque requirements are consistently low with little or no change in required frictional driving torque, even with changes in motor R.P.M. Haydon Kerk Motion Solutions has developed a custom composition Kerkote TFE specifically for our lead screw and nut materials. It is applied using an automated process and provides extended nut life and smooth operation with little additional cost.

Kerkote TFE is a soft coating, a long-term dry lubricant that is optimized for softer plastics like acetals and nylons, with or without mechanical reinforcement. Lubrication to the nut/screw interface occurs by the nut picking up Kerkote TFE particles from the coating as well as from the migration of the internal lubricant within the plastic nut. Although care is taken to ensure that chips and voids do not occur in the coating, small voids have been shown to have no effect on system performance. The transfer of TFE to the nut continues throughout the operating life of the assembly as long as the nut periodically travels over areas with Kerkote TFE coating. The lubricant, although solid, also has some "spreading" ability as in fluid lubricants. Kerkote TFE coated screws provide the maximum level of self-lubrication and should not be additionally lubricated or used in environments where oils or other lubricant contamination is possible.

Black Ice® TFE Coating

Black Ice TFE coating shares many of the benefits of Kerkote TFE but, in contrast, is a hard coating that offers exceptional durability in all types of environments, with virtually any type of polymer nut. Black Ice TFE coating remains on the screw, offering a low friction surface upon which the nut travels. Rather than acting as a dry lubricant, Black Ice TFE is an anti-friction coating whose surface properties displace the metal to which it is applied. Though it is not intended for use with metal or glass fiber reinforced nuts, Black Ice TFE is bonded securely to the screw's surface and can withstand abrasion from contamination, rigid polymer systems, fluid impingement and wash down applications. Black Ice TFE can be used in the presence of more aggressive environment conditions, or anywhere reduced friction and a permanent coating is desired.

Both Kerkote and Black Ice TFE coatings offer the advantages of dry lubrication. These are maintenance-free coatings that are designed to last the life of the product. They are intended to be used without additional lubricants, thereby further increasing the value of Kerk lead-screw assemblies through elimination of the most common failure of screw driven drives, lubrication failure.

There are certain applications where external lubrication may be desired. These include the use of nut materials such as glass reinforced plastic or metal. Greases, when used properly can provide unique capabilities and Haydon Kerk Motion Solutions does offer a selection of greases developed specifically for these applications. Please contact a sales engineer for assistance selecting the best lubricant for your requirements.

Information needed to properly size a linear rail system

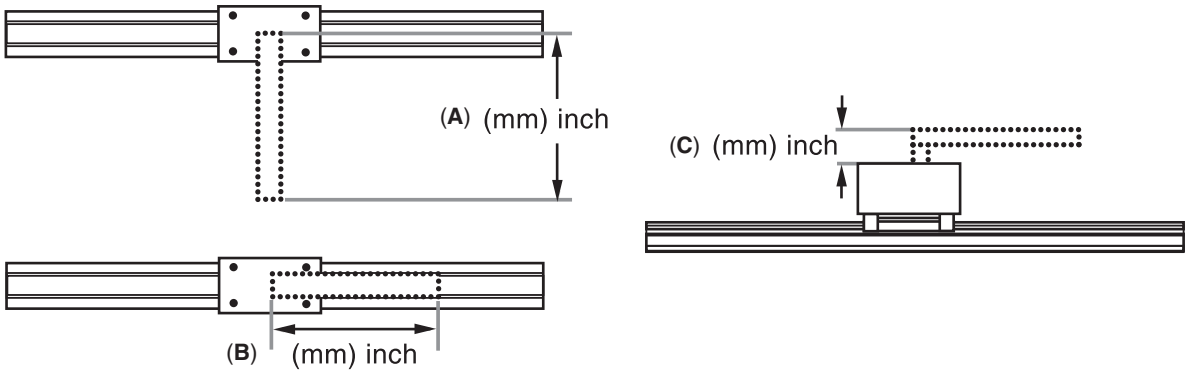
Haydon Kerk™ Linear Rail Systems are designed to be **precision motion devices**. Many variables must be considered before applying a particular rail system in an application. The following is a basic checklist of information needed that will make it easier for the Haydon Kerk engineering team to assist you in choosing the proper linear rail.

Linear Rail Application Checklist

1) ❑ **Maximum Load?** _____ (N or lbs.)

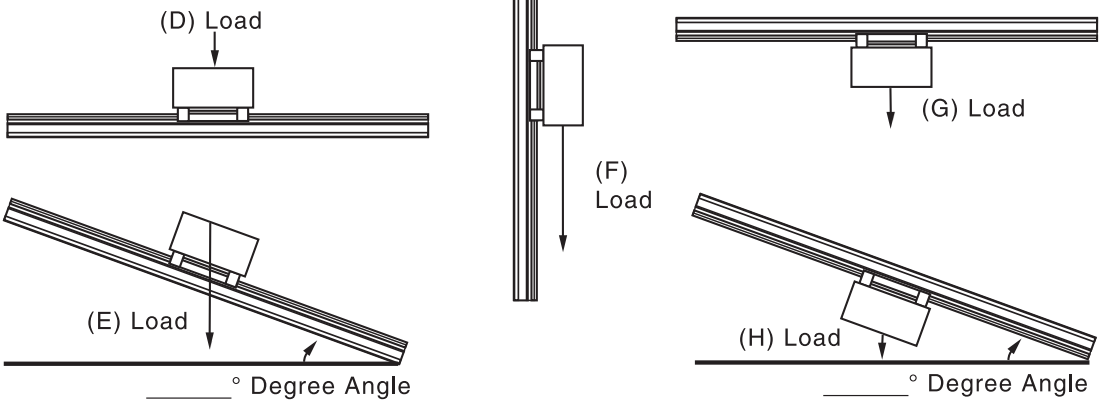
2) ❑ **Load Center of Gravity (cg) Distance and Height** (mm or inches)**?** See illustrations (A) (B) (C) below.
Dimensions (❑ **mm /** ❑ **inch)**:

❑ **(A)** _____ **... OR...** ❑ **(B)** _____ **AND...** ❑ **(C)** _____



3) ❑ **Rail Mount Orientation?** The force needed to move the load is dependent on the orientation of the load relative to the force of gravity. For example, total required force in the horizontal plane (D) is a function of friction and the force needed for load acceleration ($F_f + F_a$). Total force in the vertical plane is a function of friction, load acceleration, and gravity ($F_f + F_a + F_g$).

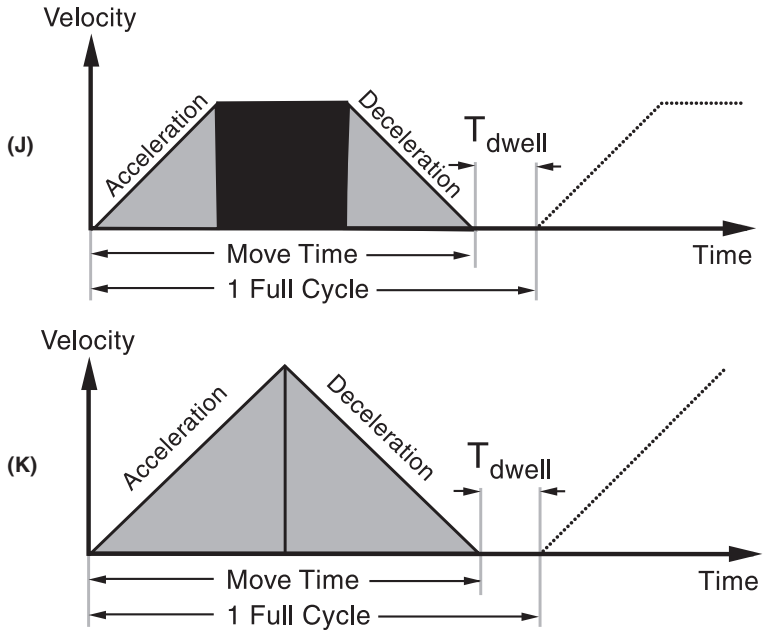
Orientation:
❑ **(D)**
❑ **(E)** _____°
❑ **(F)**
❑ **(G)**
❑ **(H)** _____°



Linear Rail Application Checklist *(Continued)*

4) ❑ **Stroke Length to Move Load?** _____ (mm or inches)
Overall rail size will be a function of stroke length needed to move the load, the rail frame size (load capability), the motor size, and whether or not an integrated stepper motor programmable drive system is added.

5) ❑ **Move Profile?**
A **trapezoidal** move profile divided into 3 equal segments (J) is a common move profile and easy to work with. Another common move profile is a **triangular** profile divided into 2 equal segments (K).



If using a **trapezoidal** (J) or **triangular** (K) move profile, the following is needed…

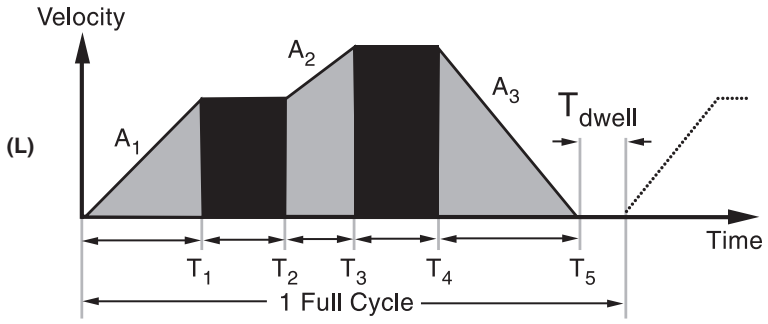
a) ❑ Point to point move distance _____ (mm or inches)
b) ❑ Move time _____ (seconds) including time of acceleration and deceleration
c) ❑ Dwell time between moves _____ (seconds)

The trapezoidal move profile (J) is a good starting point in helping to size a system for prototype work.

A **complex** move profile (L) requires more information.

a) ❑ Time (in seconds) including: $T_1, T_2, T_3, T_4, T_5 \ldots T_n$ and T_{dwell}
b) ❑ Acceleration / Deceleration (mm/sec.^{2} or inches/sec.^{2}) including: $A_1, A_2, A_3 \ldots A_n$

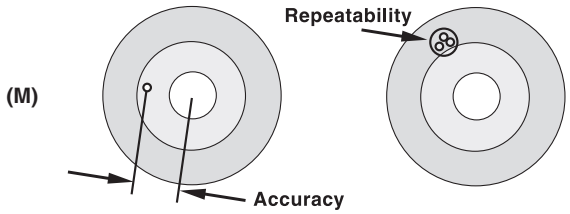
For more information call Haydon Kerk Motion Solutions Engineering at 203 756 7441.



Linear Rail Application Checklist *(Continued)*

6) ❑ **Position Accuracy Required?** _____ (mm or inches)
Accuracy is defined as the difference between the theoretical position and actual position capability of the system. Due to manufacturing tolerances in components, actual travel will be slightly different than theoretical "commanded" position. See figure (M) below.

7) ❑ **Position Repeatability Required?** _____ (mm or inches)
Repeatability is defined as the range of positions attained when the rail is commanded to approach the same position multiple times under identical conditions. See figure (M) below.



8) ❑ **Positioning Resolution Required?** _____ (mm/step or inches/step)
Positioning resolution is the smallest move command that the system can generate. The resolution is a function of many factors including the drive electronics, lead screw pitch, and encoder (if required). The terms "resolution" and "accuracy" should never be used interchangeably.

9) ❑ **Closed-Loop Position Correction Required?** ❑ YES ❑ NO
In stepper motor-based linear rail systems, position correction is typically accomplished using a rotary incremental encoder (either optical or magnetic).

10) ❑ **Life Requirement?** (select the most important application parameter)
a) ❑ Total mm or inches _____
... or ... b) ❑ Number of Full Strokes _____
... or ... c) ❑ Number of Cycles _____

11) ❑ **Operating Temperature Range** _____ (°C or °F)
a) ❑ Will the system operate in an environment in which the worst case temperature is above room temperature?
b) ❑ Will the system be mounted in an enclosure with other equipment generating heat?

12) ❑ **Controller / Drive Information?**
a) ❑ Haydon Kerk IDEA™ Drive (with Size 17 Stepper Motors only)
b) ❑ Customer Supplied Drive... Type? ❑ Chopper Drive ❑ L / R Drive
Model / Style of Drive: _____

13) ❑ **Power Supply Voltage?** _____ (VDC)

14)* ❑ **Step Resolution?** a) ❑ Full Step b) ❑ Half-Step c) ❑ Micro-Step

15)* ❑ **Drive Current?** _____ (A_{rms} / Phase) and _____ (A_{peak} / Phase)

16)* ❑ **Current Boost Capability?** _____ (%)

** If the Haydon Kerk IDEA™ Drive is used disregard items 14, 15, and 16.*