



# Anti-Backlash Lead Screw Assembly

The TLS Series anti-backlash assembly offers an effective linear actuator for design operations requiring precise positional accuracy and repeatability, with minimum cost.

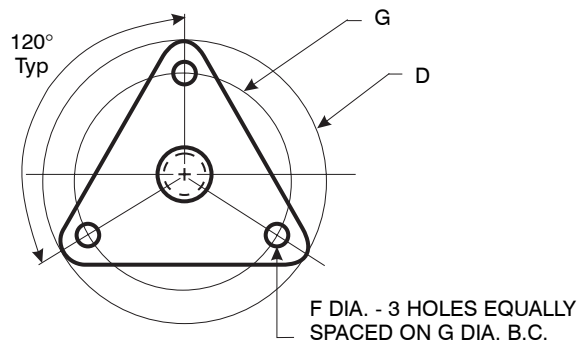
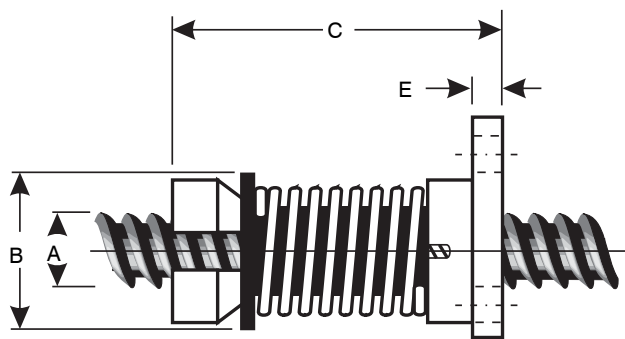
The standard TLS unit utilizes a patented self-lubricating polyacetal nut radially preloaded on a 303 stainless steel screw.

The TLS assembly, through its unique transfer of loads, offers exceptional torque consistency and repeatability when traversing in either direction. The inherent dampening qualities of the TLS design make it ideally suited for vertical applications requiring noise or vibration control.

TLS STANDARD MOUNTING DIMENSIONS, IN. (MM)

SERIES	NOMINAL SCREW DIA. A		NUT DIA. B		NUT LENGTH. C		FLANGE DIA. D		FLANGE WIDTH E		MOUNTING HOLES F		BOLT CIRCLE DIA. G	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)
TLS 6000	3/8	(9.53)	.70	(17.78)	1.9	(48.26)	1.50	(38.10)	.18	(4.57)	.200	(5.08)	1.125	(28.58)

Other mountings available. Please contact **Tusk** for information.



**HIGH ACCURACY:** 50 micro-inch (.0013mm) repeatability. Lead accuracy to 0.0001 in./in. (mm/mm).

**LONG LIFE:** To 350 million inches (880 million cm) of travel.

**LOW MAINTENANCE:** Self lubricating and wear compensating nuts and optional TFE coating on screws eliminate the need for repetitive lubrication or adjustment.

**SMOOTH, QUIET OPERATION:** No recirculating ball noise or metal on metal contact.

## TLS SERIES ASSEMBLIES

SCREW DIA. (NOMINAL)	INCH LEAD	METRIC LEAD	LEFT HAND AVAILABLE	PART NO.	DRAG TORQUE	DESIGN LOAD	EFFICIENCY %	ROOT DIA. IN. (MM)
3/8" (9.53mm)	0.100	2.0	✓	TLS 6010	2-5 oz. - in. (.014 - .035NM)	10 lbs. (5 kg)	53	.266 (6.76)
	0.200	5.0		TLS 6020			69	.266 (6.76)
	0.500	12.0		TLS 6050			81	.265 (6.73)
	1.000			TLS 6100			84	.254 (6.45)
				TLS 6M02			47	.266 (6.76)
				TLS 6M05			69	.266 (6.76)
				TLS6M12			82	.287 (7.29)

Additional diameters and leads available on special order.

### DESIGN AND ENGINEERING DATA

#### Screw Accuracy

Lead accuracy for standard screws is .0006 in./in. (mm/mm). Lead accuracies are available up to .0001 in./in. (mm/mm).

Assemblies have an extremely high repeatability of 50 micro-inches (.0013mm).

#### End Machining

Tusk can custom machine screws to your requirements (quote to your drawings) or as cut-to-length screws for your own machining.

### MECHANICAL PROPERTIES

SCREW/NUT SERIES	STATIC FRICTIONAL DRAG TORQUE OZ.-IN (NM)	SCREW INERTIA OZ.-IN.-SEC. <sup>2</sup> /IN.	ANTI-BACKLASH LIFE*	ANTI-BACKLASH LIFE W/TFE COATING
TLS 6000	2-5(.01-.03)	1.5 X 10 <sup>-5</sup>	40-60 Million Inches (100-150 million cm)	150-200 Million Inches (380-500 million cm)

Conservative numbers for most applications.

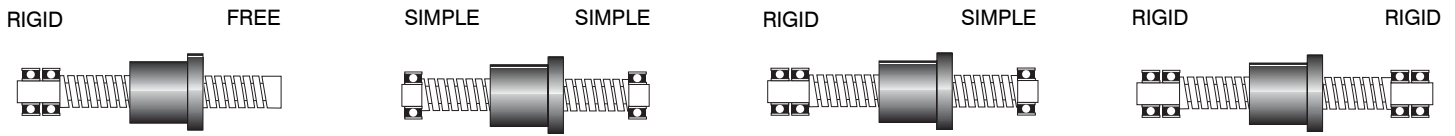
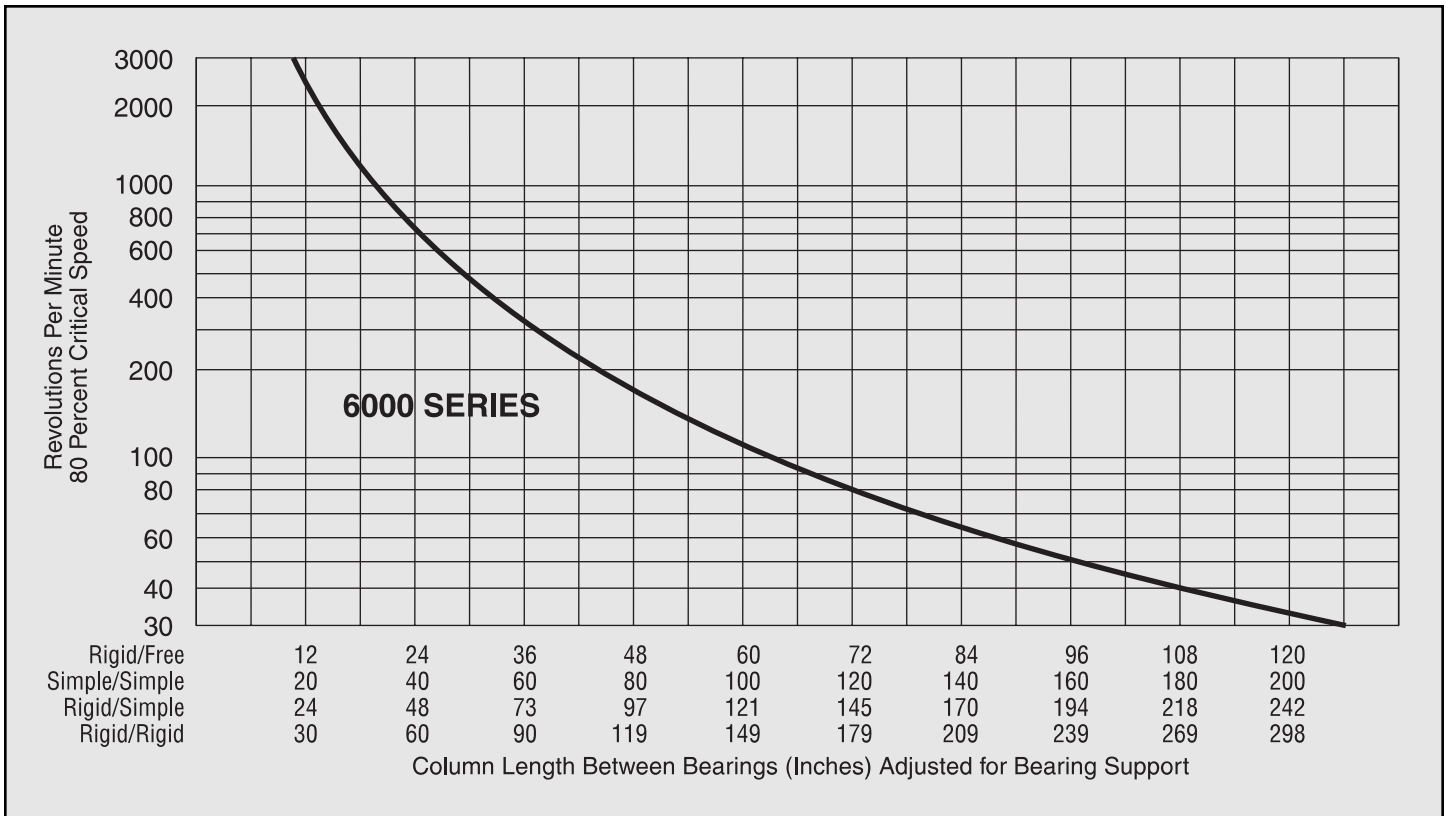
### PHYSICAL PROPERTIES

LEAD SCREW		NUTS			ASSEMBLY	
MATERIAL	SURFACE FINISH	MATERIAL	TENSILE STRENGTH	COEFFICIENT OF EXPANSION	STANDARD OPERATING TEMP. RANGE	COEFFICIENT OF FRICTION NUT TO SCREW
303 Stainless Steel (options available)	Better than 16 Micro Inch	Polyacetal with Lubricating Additive	9,700 psi	6.0 X 10 <sup>-5</sup> in./in./°F	32-200°F** (0-93°C)	Static = .08 .08* Dynamic = .15 .09* *with TFE Coating

\* Life will vary with loading, operating environment, and duty cycle. The longer screw leads generally provide longer life.

\*\* Please call **TUSK** for optional temperature range materials.

## CRITICAL SPEED



**LEAST SUPPORT**

**GREATEST SUPPORT**

Lengths can be specified up to 12 ft. (3.6m) from stock, or up to 10 ft. (2.4m) with TFE coating.

To minimize critical speed problems: use a longer lead, choose a larger diameter or increase bearing mount support.

### LEAD

Advancement per revolution.

$$\text{Lead} = \text{Pitch} \times \text{Number of Starts}$$

### TRAVERSE SPEED

The polyacetal nut materials we use provide long wear-life over a wide variety of conditions. However, very high loads and/or speeds will accelerate nut wear. We recommend the following linear traversing speeds for optimum life\*:

### PITCH

Crest-to-crest distance or one divided by threads per inch. (On a multiple start thread, the pitch equals the lead divided by the number of starts.)

### CRITICAL SPEED

This is the rotational speed at which a screw will experience vibration or other dynamic problems. See CRITICAL SPEED CHART to determine if application parameters result in speed approaching critical.

Lead	Traverse Speed
1/10" - 1/2"	4 in./sec.
1/2" - 1"	10 in./sec.
1" - 2 1/2"	30 in./sec.
2.5 - 12mm	100mm/sec.
12 - 25mm	250mm/sec.
25 - 60mm	760mm/sec.

\*Continuous duty operation. Higher speeds acceptable for short durations.

## MAXIMUM LOAD

Although Tusk Anti-Backlash Assemblies are capable of withstanding relatively high loads without catastrophic failure, these units have been designed to operate under the loading shown in the size charts.

## EFFICIENCY

Efficiency of lead screw varies highly with lead angle (see size listings). For example, the efficiency is low when the lead angle is either very small or very large.

## TORQUE

The required motor torque to drive a lead screw assembly is the sum of three components: The inertial torque, static frictional torque, and torque to move load. It must be noted that this is the torque necessary to drive the lead screw assembly alone.

Additional torque associated with driving frictional bearings and motor shafts, moving components, and drag due to general assembly misalignment must also be considered.

### Inertia Torque:

$$T = I\alpha \quad \text{Where } I = \text{screw inertia}$$
$$\alpha = \text{angular acceleration}$$

### Static Frictional Torque

Tusk Anti-Backlash Assemblies are typically supplied with static frictional torque of 1 to 7 oz./in. The magnitude of the frictional torque is dependent on the standard factory settings or settings specified by the customer. Generally, the higher the preset force, the better the Anti-Backlash characteristics.

### Torque-To-Move Load:

The torque to move a certain load is a function of the lead and the efficiency of the lead screw assembly:

$$\text{TORQUE} = \frac{\text{Load} \times \text{Lead}}{2 \pi \times \text{Efficiency}}$$

## BACK DRIVING

Sometimes referred to as reversibility, this is the ability of a screw to be turned by a thrust load applied to the nut. Generally, when the screw lead is less than 1/3 the diameter, back driving will not occur. For higher leads where back driving is likely, the torque required for holding a load is:

$$T_b = \frac{\text{Load} \times \text{Lead} \times \text{Efficiency}}{2 \pi}$$

## SCREW STRAIGHTNESS

Screw straightness is indicated by Total Indicator Runout (TIR). The standard straightness for lead screws is .003"/ft. Tusk can provide tighter specifications on customer request.