LINEAR MOTION

DryLin® T Linear Bearings

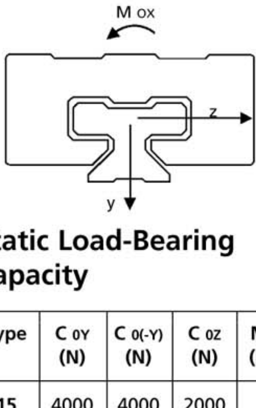
With High Performance Polymers

Introduction

DryLin® T slide guide rails were developed for applications in the automation and handling industries. Rather than extreme precision the development objective was a robust linear guide system for reliable use in the widest range of different environments. DryLin® T guide rails are shock resistant and have an extremely low weight design.
DryLin® T slide guide rails are exceptionally quiet in operation because there are no moving parts or metallic rollers.

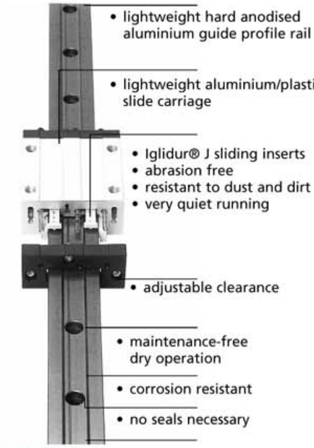
Special Characteristics

- No lubrication necessary
- Adjustable clearance
- Replaceable sliding inserts
- Quiet operation
- Resistant to dust, dirt and moisture
- Corrosion resistant
- High static load rating in all directions
- Low weight
- Shock and vibration resistant
- Excellent wear resistance



Static Load-Bearing Capacity

Type	C_{0Y} (N)	$C_{0(-Y)}$ (N)	C_{0Z} (N)	M_{0X} (Nm)
15	4000	4000	2000	32
20	7400	7400	3700	85
25	10000	10000	5000	125
30	14000	14000	7000	200



Design

DryLin® T slide guide rails consist of carriages mounted on the rail.

1. The rail, together with the basic body of the wagon, is made of aluminium Al Mg Si 0.5. The rail is hard anodised and the aluminium body of the slide is clear anodised.
2. The guide bearing consists of six opposing pairs of slide inserts made of Iglidur J.
3. One side of each of the three guide bearings can be infinitely adjusted in height.
4. All steel parts are galvanised.
5. The end covers are made of plastic.

Dimensions

The mounting directions of the DryLin® T slide guide rails are interchangeable with the usual recirculating ball guides. The DryLin® T slide rail guides offer further advantages compared to other linear guides:

- Very high accelerations possible
- Extreme speeds can be attained quickly
- Minimum effort for assembly
- Replaceable slide inserts
- Maintenance free
- Corrosion resistant

TECHNICAL

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Calculation

For the exact calculation of the DryLin® T linear guide system it is essential to find out whether the position of the forces is within the allowed limits and if the sliding element where the highest forces occur is not overloaded. The calculation of the possible driving force and the maximum speed allowed is important. The position of the guiding system leads to different formulas for calculation. Factors concerning shocks and acceleration forces are not included in the calculation, therefore the distance between maximum load and allowable load has to be observed.

This analysis cannot provide information regarding the wear or lifetime of the system.

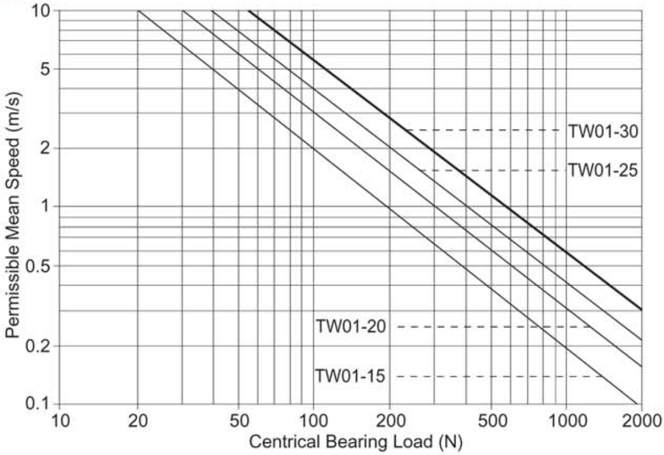
Procedure

Preparation
Step 1: change the position of the system.
Step 2: control of the distances between the forces and comparison with the maximum distances allowed.

Calculation
Step 3: calculation of the necessary driving force.
Step 4: calculation of the maximum load on the bearings in y- and z- direction.

Result
Step 5: control of the maximum load on the bearings, the sliding element where the biggest load occurs (step 4).
Step 6: Establishing the maximum speed allowed for the calculated loads of step 4.

Evaluation



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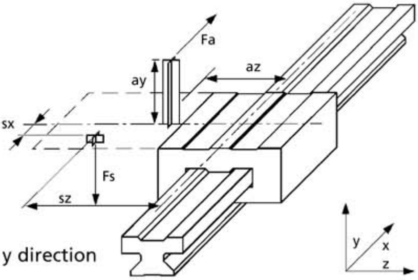
One Rail and One Carriage

Step 2: maximum allowable distances between the acting forces

Part No.	S_x (mm)	S_y, a_y (mm)	S_z, a_z (mm)
TW01-15	14	44	55
TW01-20	17	52	67
TW01-25	20	59	78
TW01-30	24	72	93

Horizontal Mounting



Step 3: calculate required driving force

$$F_a = \frac{F_s\,\mu\,L_x\,(Z_M+2S_z)}{Z_M\,(L_x-2a_z\mu)}$$

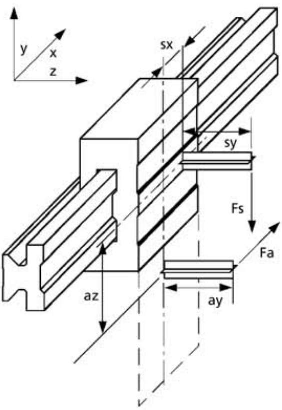
Step 4: maximum bearing load in y direction

$$F_{y\,max} = F_s\left[\frac{S_x}{L_m} + \frac{S_z}{Z_M} + 0.5 + \frac{\mu\,(a_y+Y_O)\,(Z_M+2S_z)}{Z_M\,(L_x-2a_z\mu)}\right]$$

maximum bearing load in z direction

$$F_{z\,max} = \frac{2F_s\,\mu\,a_z\,(Z_M+2S_z)}{Z_M\,(L_x-2a_z\mu)}$$

Vertical Mounting



Step 3: calculate required driving force

$$F_a = \frac{F_s\,\mu\,L_x\,(Z_M+2S_y)}{Z_M\,[L_x-2\mu\,(a_y+Y_O)]}$$

Step 4: maximum bearing load in y direction

$$F_{y\,max} = \left[\frac{F_s}{Z_M}S_y + Y_O + \frac{\mu\,(a_y+Y_O)\,(Z_M+2S_y)}{L_x-2\mu\,(a_y+Y_O)}\right]$$

maximum bearing load in z direction

$$F_{z\,max} = F_S\left[1 + \frac{2S_x}{L_x} + \frac{\mu\,(a_y+Y_O)\,(Z_M+2S_y)}{Z_M\,[L_x-2\mu\,(a_y+Y_O)]}\right]$$

DryLin® T Linear Bearings

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One Rail and Two Carriages

Step 2: maximum allowable distances between the acting forces

Part No.	S_y, a_y (mm)	S_z, a_z (mm)
TW01-15	2Wx - 11.5mm	2Wx
TW01-20	2Wx - 15.0mm	2Wx
TW01-25	2Wx - 19.0mm	2Wx
TW01-30	2Wx - 21.5mm	2Wx

Horizontal Mounting

Step 3: calculate required driving force

$$F_a = \frac{F_s\, \mu\, W_x\, (Z_M + 2S_z)}{Z_M\, (W_x - 2a_z\mu)}$$

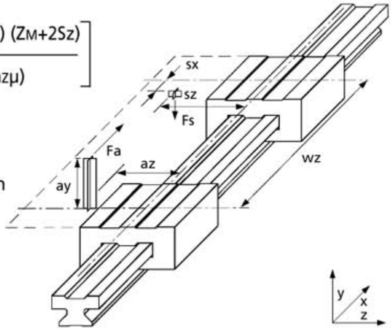
Step 4: maximum bearing load in y direction

$$F_{y\,max} = \frac{F_s}{2}\left[\frac{S_{xk}}{W_x} + \frac{S_z}{Z_M} + \frac{2\mu\,(a_y + Y_O)\,(Z_M + 2S_z)}{Z_M\,(W_x - 2a_z\mu)}\right]$$

$S_{xk} = W_x - S_x$ (if $S_x < 0.5W_x$)
$S_{xk} = S_x$ (if $W_x > S_x > 0.5W_x$)

maximum bearing load in z direction

$$F_{z\,max} = \frac{F_s\, \mu\, a_z\, (Z_M + 2S_z)}{Z_M\, (W_x - 2a_z\mu)}$$



Vertical Mounting

Step 3: calculate required driving force

$$F_a = \frac{F_s\, \mu\, W_x\, [Z_M + 2(S_y + Y_o)]}{Z_M\, [W_x - 2\mu\,(a_y + Y_o)]}$$

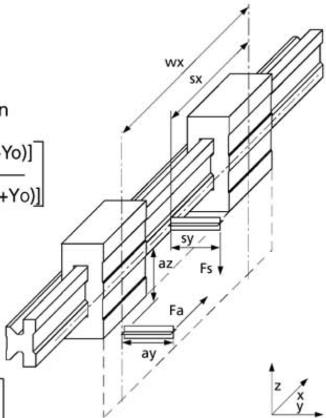
Step 4: maximum bearing load in y direction

$$F_{y\,max} = F_s\left[1 - \frac{S_{xk}}{W_x} + \frac{S_y + Y_o}{2Z_m} + \frac{\mu\, a_z\, [Z_M + 2(S_y + Y_o)]}{Z_m\, [W_x - 2\mu\,(a_y + Y_o)]}\right]$$

$S_{xk} = W_x - S_x$ (if $S_x < 0.5W_x$)
$S_{xk} = S_x$ (if $W_x > S_x > 0.5W_x$)

maximum bearing load in z direction

$$F_{z\,max} = \frac{F_S}{2}\left[\frac{S_y}{Z_M} + \frac{\mu\,(a_y + Y_O)\,[Z_M + 2(S_y + Y_O)]}{Z_M\,[W_x - 2\mu\,(a_y + Y_O)]}\right]$$



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Two Rails and Two Carriages

Step 2: maximum allowable distances between the acting forces

Part Number	S_y, a_y (mm)	S_z, a_z (mm)
TW01-15	2Wx - 11.5mm	2Wx
TW01-20	2Wx - 15.0mm	2Wx
TW01-25	2Wx - 19.0mm	2Wx
TW01-30	2Wx - 21.5mm	2Wx

Horizontal Mounting

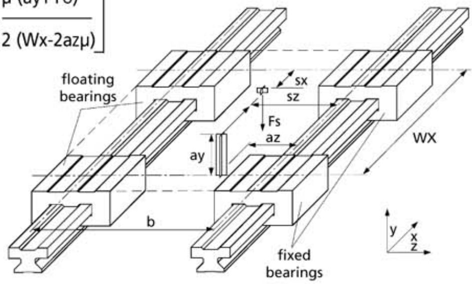
Step 3: calculate required driving force

$$Fa = \frac{Fs\ \mu\ Wx}{Z_M\ (Wx-2az\mu)}$$

Step 4: maximum bearing load in y direction

$$Fy\ max = \frac{Fs}{2}\left[\frac{Sxk}{Wx} + \frac{Szk}{b} + \frac{\mu\ (ay+Y_O)}{2\ (Wx-2az\mu)}\right]$$

Sxk=Wx - Sx (if Sx <0.5Wx)
Sxk=Sx (if Wx >Sx >0.5Wx)
Szk=b-Sz (if Sz <0.5b)
Szk=Sz (if b >Sz >0.5b)



maximum bearing load in z direction

$$Fz\ max = \frac{Fs\ \mu\ az}{Wx-2az\mu}$$

Vertical Mounting

Step 3: calculate required driving force

$$Fa = \frac{Fs\ \mu\ Wx\ [b+2(Sy+Yo)]}{b\ [Wx-2\mu\ (ay+Yo)]}$$

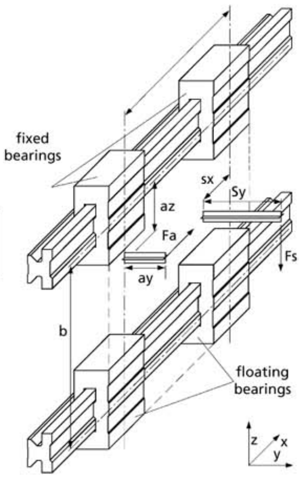
Step 4: maximum bearing load in y direction

$$Fy\ max = \frac{Fs}{4}\left[\frac{(Sy+Yo)}{b} + \frac{\mu\ (ay+Y0)[b+2(Sy+Yo)]}{b\ [Wx-2\mu\ (ay+Y_O)]}\right]$$

maximum bearing load in z direction

$$Fz\ max = Fs\left[\frac{Sxk}{Wx} + \frac{\mu\ az[b+2)\ (Sy+Yo)]}{b\ [Wx-2\mu\ (ay+Y_O)]}\right]$$

Sxk=Wx - Sx (if Sx <0.5Wx)
Sxk=Sx (if Wx >Sx >0.5Wx)



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Step 5: maximum permissible load   Constant factors to allow calculation

Part No.	Fy max, Fz max (N)	Lx (mm)	ZM (mm)	Yo (mm)
TW01-15	2000	29	16	11.5
TW01-20	3700	35	23	15.0
TW01-25	5000	41	25	19.0
TW01-30	7000	49	29	21.5

μ=0.2 dynamic application μ = 0 static application

Fa	:	driving force
Fs	:	applied mass force
Fy, Fz	:	bearing load in y or z direction
Sx, Sy, Sz	:	distance of mass force in xy or z direction
ay, az	:	distance of driving force in xy or z direction
Wx	:	distance of carriages on a rail
Lx	:	constant from table
ZM	:	constant from table
Yo	:	constant from table
b	:	distance of guide rails
μ	:	coefficient of friction

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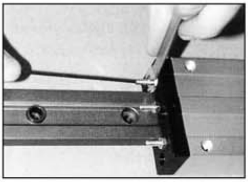
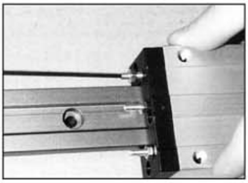
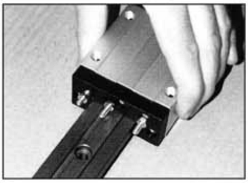
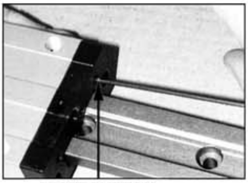
Setting the Clearance









RESET BUTTON

DryLin® T are delivered ready for mounting. The setting of the bearing clearance is carried out at the factory.

The pre-adjustment is carried out on the basis of the displacement force per slide.

If you have special requirements please indicate in your order whether particularly limited or extended bearing play is to be preset.

If required the bearing play of the DryLin® T slides can be readjusted. This should always take place without any additional load:

1. First loosen the lock nuts.
2. The guide play for the 3 bearing points can then be readjusted with an Allen key. In doing so please check the effectiveness via the sliding forces.
3. After you have adjusted all 3 bearing levels the play on the guide inserts should be checked once again.
4. There is a danger that the excessive reduction of the clearance seizes the slide elements and that the play cannot be re-set simply by loosening the Allen screws. The sliding elements are then loosened again by pressing the **reset button** on the opposite side. Please use a 3mm pin for models 25 and 30 and a 2.5mm pin for the models 15 and 20 to press strongly against the readjusting spring. You must already have loosened the respective hexagon socket screws.

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TECHNICAL

The Sliding Inserts

The Iglidur J material with hard anodised aluminium achieved the best results by far in our tests.

Comprehensive investigations showed that for the relevant loads of linear guides the slide bearings made of Iglidur J are the most suitable.

They offer the greatest wear resistance and at the same time guarantee very favourable abrasion values.

Compared to slide partners made of hardened steel it even proved possible to further improve the abrasion resistance by a factor of 3 using gliding partners made of hard anodised aluminium.

Special Characteristics of Iglidur J

- very low abrasion values during dry operation
- excellent wear resistance
- maintenance-free operation
- vibration damping
- very low moisture absorption

Operating Temperatures

Iglidur J slide bearings can be used under temperatures of -40° to a maximum of +90°C. The excellent heat conduction of the aluminium rail means that it is only necessary to take note of the generated friction heat during very high speeds for prolonged periods of time.

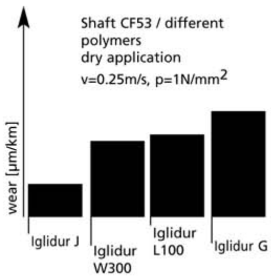
Chemical Resistance

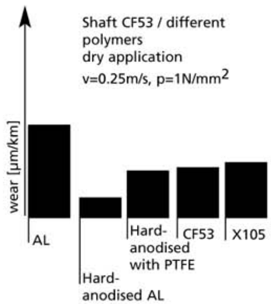
Iglidur J is resistant to weak acids, diluted alkalis, as well as fuels and all types of lubricants.

The very low moisture absorption allows them to be used in wet or moist environments.

The resistance to alkalis allows them to be used in applications in which plants or parts of them have to be frequently cleaned.

Medium	Resistance
Alcohols	resistant
Chlorinated hydrocarbons	resistant
Ester	not resistant
Fats, oils	resistant
Ketone	resistant to an extent
Fuels	resistant
Weak acids	resistant to an extent
Strong acids	not resistant
Weak lyes	resistant
Strong lyes	resistant
Water	resistant





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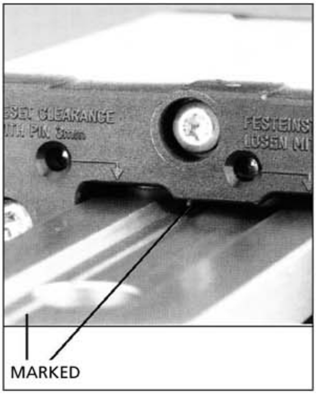
Fitting Instructions



The DryLin® T slide guide rail always requires a small clearance between the slide and rail.

The connecting surface which is screwed to the slide must be very flat, otherwise there is a danger that the slide will be subjected to tension.

When two parallel rails are used one slide must be fitted as a fixed bearing and one slide must be fitted as a floating bearing. When you order we will therefore ask you to describe the fitting situation, preferably on the special order form.

DryLin® T slide rail guides are supplied in assembled and pre-set conditions.

If necessary the slides can be removed for better mounting of the rails.

Please note that the side with endcover which has the part number on the bottom right-hand edge must be first pushed onto the rail.

The setting of the bearing clearance is also to adjust the slide exactly to match the slide rail. Both the rails and the plastic cover of the slide are **marked** to avoid accidently turning the slide around when mounting.

TECHNICAL DATA

Slide Rail	Material	Aluminium, extruded
	Construction material	Al Mg Si 0.5
	Coating	Hard anodised, 50µm
	Hardness	500 HV
Slide Wagon	Basic body	Aluminium, extruded profile
	Construction material	Al Mg Si 0.5
	Coating	Anodised, E6/EV1
	Slide inserts	Maintenance-free sliding bearing material Iglidur J
	Screws	Galvanised steel
	Springs	Galvanised steel
	Cover	Plastic
Maximum Sliding Speed		10 m/s
Temperature Range		-40°C to +90°C