



## Design: Gliding, Long Travel Applications



Gliding application -  
If the upper run of the E-Chain® rests on the lower run, it is a gliding application

Our calculations and analyses are based on the result of ongoing practical tests in our Technical Center and our experience with gliding applications. We test all system components such as cables, hoses, strain relief and other accessories, in addition to the Energy Chains®/Tubes and guide troughs.



Conveyor belt in quarry. Travel distance of 587 ft (179 m), travel speed 220 ft/min. (67 m/min.) and fill weight 5.38 lbs/ft (8 kg/m)

### Long travel applications

For long travels, the upper run of the igus® Energy Chains® nests on the lower run. The upper run glides partially on the lower run and partially at the same height on a glide bar.

We recommend that igus® calculate every gliding application for you. We will always offer the most cost-effective solution, taking the technical requirements and operating safety into consideration. The system solution designed by us is also automatically given an igus® system guarantee.

igus® Energy Chain Systems®

Telephone 1-800-521-2747  
Fax 1-401-438-7270



### Advantages for long travel applications with igus® Energy Chains®

- Travels over 1312 ft (400 m)
- Gliding speeds up to 16.4 ft/s (5 m/s) (more in individual cases)
- Service life of 10 years and more with igus® Energy Chain Systems®

Further advantages of the design are:

- Many different types of cables and hoses can operate side by side in the same system (i.e. electrical, data, fiber optic cables with hydraulic and pneumatic hoses)
- Space-saving installation
- Quiet operation
- High accelerations
- Durable in wind, weather, dirt, and chemicals
- Simple assembly of the modular system on the spot
- Rapid assembly and replacement of cables and hoses

Long travel "off the reel." Up to 328 ft (100 m) travel pre-assembled and ready to install

### Trends in long travel applications

New developments are currently being tested:

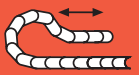
- Travels up to 2,625 ft (800 m). We break through the 1,312 ft (400 m) barrier by means of special components. Please ask us for more specific information.
- Long travel systems "off the reel." Complete made-to-spec Energy Chain Systems® - with cables, connectors, strain relief - are delivered on the reel and "rolled off" into the pre-assembled guide troughs. Travel distances up to 328 ft (100 m) are delivered this way today, with longer travels possible.
- Long travel **without** guide troughs. Our AUTO-GLIDE system consists of self-guiding Energy Chains®. We have recently extended this technology to large Energy Chains® and currently offer travels up to 328 ft (100 m).
- Long travels with very small Energy Chains, for example, the igus "Flizz" offers the guidance of a single bus cable inside a small Energy Chain with high acceleration on long travel applications.

Please consult igus® if one of these new technically and economical-ly advantageous possibilities is of interest to you.



Ship to shore crane, Malaysia. Travel distance of 1447.8 ft (441.3 m) realized with the igus® Rol-E-Chain® Series 5050R

Internet: <http://www.igus.com>  
email: [sales@igus.com](mailto:sales@igus.com)  
QuickSpec: <http://www.igus.com/qs/echain.asp>

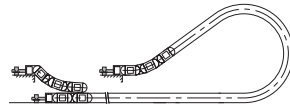


Example of lowered mounting height



Advantages lowered moving end:

- Space saving
- Longer travels possible
- Higher service life due to less wear



The illustrations below to the left show the gliding application principle. For lateral guidance, a guide trough is necessary. If the stationary mounting bracket and the fixed end of the cables and hoses can be placed in the center, the Energy Chain® length is calculated as follows:

*E-Chain® length:*

$$L_k = S/2 + K$$

$S$  = Length of travel

$R$  = Bending radius

$H_{Ri}$  = Trough inner height

$H_F$  = Required clearance height

$K_2$  = Further add-on if the mounting bracket location is set lower (specified by igus®)

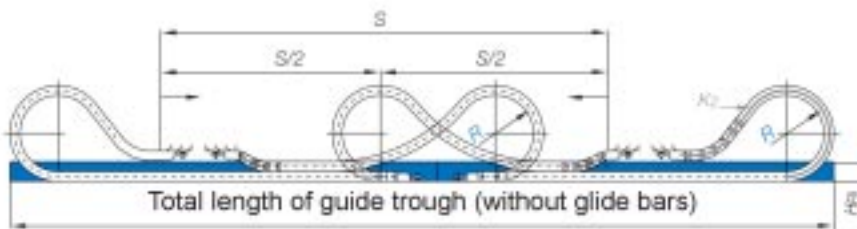
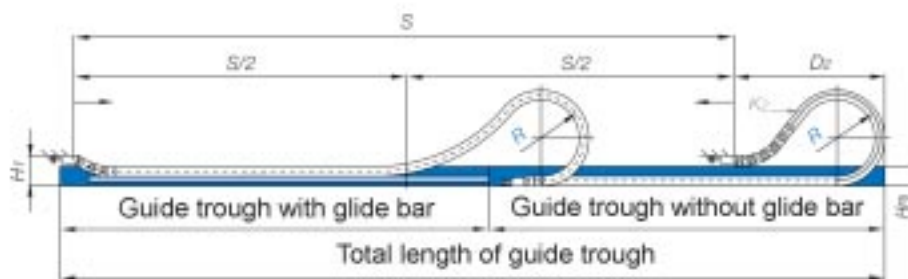
$K = \pi \cdot R + \text{"safety"}$

Add-on for bending radius ( $K$  is taken from the data tables of the individual igus® Series)

$D_2$  = Over length for long travels gliding

● Guide trough

● Glide bar



Mobile camera, live images, Olympic Games in Atlanta  $S = 328$  ft (100 m)  $V = 32.8$  ft (10 m/s) in push-pull operation



Robotics: quiet running, high acceleration; up to 10,000 cycles per day

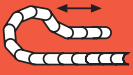
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 Specs/CAD/RFQ: [www.igus.com/echain.asp](http://www.igus.com/echain.asp)  
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Depending on the technical data and the selected Energy Chain®, the mounting point of the moving end of the Energy Chain® must be lowered on some units.

Preferred series for gliding, long travel design

- Rol-E-Chain
- System E4
- E2/000



Guide troughs are used for long travels, travels from 16.4 to 32.8 ft (5 to 10 m) and greater, depending on the chain type. They enable igus<sup>®</sup> Energy Chains<sup>®</sup> and Energy Tubes to deliver smooth, low-friction operation in long-travel situations. Various guide trough systems are available.

► Guide Troughs, Section 9



### Guide troughs

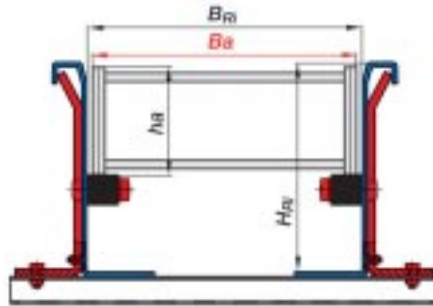
A guide trough is an important element in long travel applications. Diagrams are shown below. The height of the trough must be at least twice the total chain link height. The sides must provide a chamfered opening. The trough inner width is the same as the chain outer width, plus .20" (5 mm). When the upper run cannot glide on the lower run, glide bars must be

installed along the sides of the trough. Igus recommends the use of polymer glide bars. They are optimally matched to the chain material and achieve the lowest values for friction, noise and wear. Guide troughs with and without glide bars can be obtained for almost all igus Energy Chains<sup>®</sup>.

**Important:** When assembling the trough parts, the following points must be given particular attention:

- Properly align all trough parts upon installation
- All screw heads should be flush with the trough
- Smooth leveled transition between the end of the chain and the glide bars
- Solid connection with the glide surface

If the fixed point is in the center of the travel, use half of the guide trough with glide bars...

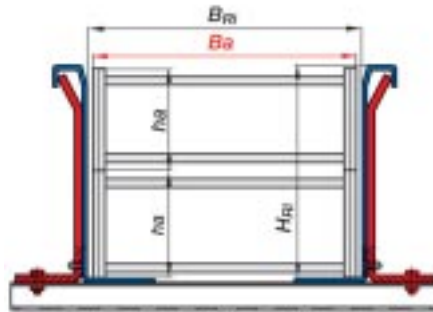


Demonstration: Guide troughs with glide bars. Igus recommends the use of polymer glide bars made of UHMW. They are optimally matched to the E-Chain<sup>®</sup> material and achieve the lowest values for friction, noise and wear.

... and the other half of the guide trough without glide bars

$$H_{Ri} \geq 2 \times h_a$$

$$B_{Ri} \geq B_a + 5$$



Demonstration: Guide troughs without glide bars - upper run glides on the lower run.

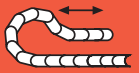
$B_a$	= E-Chain <sup>®</sup> outer width
$h_a$	= E-Chain <sup>®</sup> outer height
$H_{Ri}$	= Inner trough height
$B_{Ri}$	= Inner trough width
	= guide trough
	= assembly elements
	= glide bars

### Glide friction values for igus Energy Chains<sup>®</sup> made of igumid G and various glide bars:

igumid G	igus <sup>®</sup> Polymer Glide Bar	Galvanized Sheet Steel	Anodized Aluminum	Stainless Steel
Friction value	0.19	0.45	0.54	0.48
dynamic				

Source: igus<sup>®</sup> Laboratory

# Design: Gliding, Long Travel Applications



## Travel speeds and accelerations

Travel speeds up to 16.4 ft/s (5 m/s) in continuous operation are possible and in use on current applications. In special cases, even higher speeds are possible. For example, igus® E4/100 and E4/4 Energy Chains® achieve speeds of 72 ft/s (22 m/s) and accelerations of 2572 ft/s<sup>2</sup> (784 m/s<sup>2</sup>) in crash test units. (Only a few thousand cycles per year are required in this situation.) Acceleration plays a large role in the calculation. Differentiations must be made between normal operational acceleration and a sudden jolt of acceleration such as unexpected stops or so-called “E-stops.” Even in these situations, igus® Energy Chains® prove to be very durable.

## Service Life

We offer service life calculations for your application based on our extensive gliding application experience. As developers of polymer plain bearings, we possess vast material behavior knowledge which



Automated storage/retrieval system with System E2 and Chainflex® cables - travels up to 80 m and speed of 14.8 ft/s (4.5 m/s)

we apply to the development of Energy Chains® as well. Units with 656 ft (200 m) travels have been in operation for 8 years with minimum maintenance. Units up to 197 ft (60 m) travels have been in operation for 12 years with almost no maintenance. (Please consult igus® for references and calculations for your project.) The maintenance-free aspects of igus® Energy Chain Systems® over long periods and under rough operating conditions is often the deciding factor in choosing igus.

Our system guarantee provides additional peace of mind.

## Technical environment

Long travel applications using igus Energy Chains® run in water, in dirt, in the tropics, in explosion risk areas (with special design features) and many other conditions. Guide troughs can be supplied in corrosion-free materials. You will find more details in the **Technical Environment** section of this chapter.

## Calculation

Comprehensive tests place us in the position of knowing our products precisely. Important factors in these tests are:

- Push-pull forces under both ambient and extreme temperatures, humidity, dirt, friction values of the polymers, alone and against various glide surfaces, behavior of electrical cables under push-pull conditions, behavior of hydraulic and media hoses under push-pull conditions, service life, and noise generation.

If we cannot in fact calculate your application based on these factors, we will perform a practical test for you in our laboratory. Please consult igus®.



E4 in a pre-cast concrete plant with dust and concrete sediment

## General data, long travels

Travel max	1312 ft (400 m) / 2625 ft (800m)
Travel speed max	16.4 ft/s (5 m/s)
Travel acceleration max	dependent on calculation, can be 164 ft/s <sup>2</sup> (50 m/s <sup>2</sup> ) and more
Fill weight max	dependent on calculation, can be 47 lbs/ft (70 kg/m) and more



Corrosion-free guide troughs are available in the material:

- Normally galvanized
- Stainless steel
- Seawater resistant aluminum

## Special properties - Long travel applications

Energy Chains® that are **nested** can be used in gliding applications. This type of installation is most often used when there is a width restriction. Guide troughs with special wall heights are necessary.

Energy Chains® **running side by side**, or in a “multiband” design can also be used in gliding applications. Higher fill weights often require special guide troughs which can be delivered either from stock or on short notice.

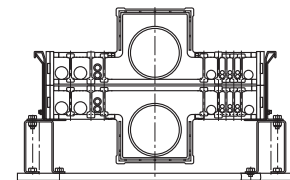
We have also developed standard parts for unconventional solutions involving **large hoses** in gliding applications.



Nested, gliding E-Chains®



“Multiband” E-Chain®



Large hose elements

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