



Product Data Guide



BESTTM Robotics Competition



800-521-2747
www.igus.com
yes@igus.com

All products listed are donated to all BESTTM teams courtesy of igus[®] Inc.

How To Use igus® Products On Your BEST™ Robot

Hello BEST™ Robotics teams! Enclosed are a number of igus® products to help with the design of your robot. However, if you are unsure about how to use igus® products, read on for product information, and some insightful tips and suggestions!

Engineers use igus® cable carriers, plastic plain bearings, spherical bearings, and linear bearings in a variety of industrial applications. These include, but are not limited to robotics, packaging, medical, machine tools, cranes, and storage and retrieval units. Join the many real-world engineers using igus® products!

If you have additional questions, please contact the **yes** Program team at yes@igus.com.

In this kit, you will find:

e-chain® cable carriers

e-chains® are all-plastic cable carriers designed to guide and protect cables in moving applications. Although the cables on your BEST™ robot won't be moving, e-chains® are perfect for preventing cables from snagging or getting caught on opponents' robots.

▶ **Looking for product specifications? See page 4.**

iglide® G300 plastic plain bearings

iglide® G300 bearings are robust and great in a variety of applications. They are lightweight, making them a perfect option for your robotic application.

▶ **Looking for product specifications? See page 5.**

drylin® N linear guide systems

drylin® N low-profile linear guides are an oil-free alternative to bulky, messy ball bearings. drylin® N has excellent wear resistance and a small mounting height and width, which is perfect when dealing with space constraints on your robot. Use drylin® N to enable any linear movement your robot has to perform.

▶ **Looking for product specifications? See page 6.**

igubal® rod ends, flange bearings and pillow blocks

igubal® spherical bearings are maintenance-free and weigh only a fifth of traditional metallic rod end bearings. These are an extremely popular product among BEST™ robotics teams, as these bearings also compensate for misalignment errors.

▶ **Looking for product specifications? See pages 7 and 8.**

drylin® aluminum shafting

drylin® aluminum shafting is lightweight and highly wear-resistant. It also has a lower coefficient of friction and delivers three times the life of steel when running against the proper bearing material. drylin® shafting is the perfect partner for the spherical bearings also included in your kit.

▶ **Looking for product specifications? See page 9.**

Good luck in this year's competition!

Don't forget to visit www.igus.com to:

- ▶ **Watch product and application videos**
- ▶ **Download free 3D CAD files**
- ▶ **Download brochures and technical articles**
- ▶ **Download catalog pages and product specifications**

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energy chain[®] cable carrier

Series E2-15 micro data sheet

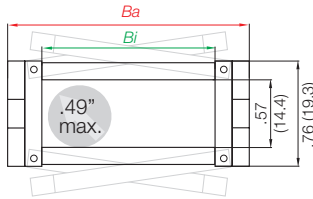
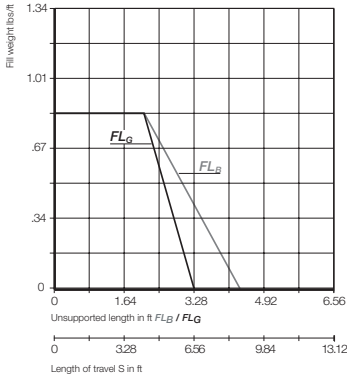
Part Number: E2-15-20-028-0

Quantity: 1 meter



When to use:

- When lightweight construction is required
- When minimal height and width dimensions are required
- When cost is a factor

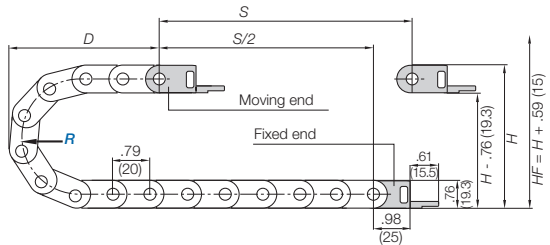


Product Range:

Inner Widths (Bi) inches (mm): .79 (20)
 Bending Radii (R) inches (mm): 1.10 (028)
 Pitch: .79 (20 mm/link) = 15.24 links/ft (50 links/m)

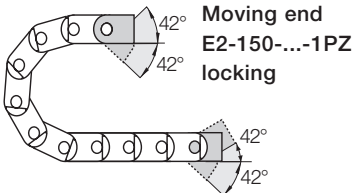
Installation Dimensions

R	1.10 (028)
H	2.95 (75)
D	2.68 (68)
K	5.12 (130)



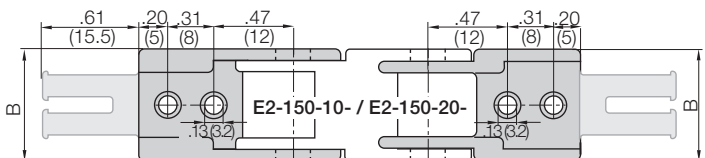
The required clearance height: $H_c = H + .59$ in. (15 mm) (with .20 lbs/ft (0.3 kg/m) fill weight). Please consult igus[®] if space is particularly restricted.

Mounting Brackets

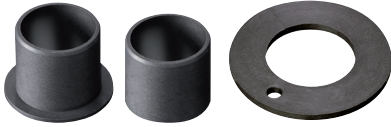


Chain Type	Part No. Full set	Dimension A		Dimensions B	
		in.	(mm)	in.	(mm)
-20	E2-150-20-12PZ	—	—	1.09	(27.8)

Fixed end
E2-150-....-2PZ
locking



iglide® G300 plain bearing



iglide® G300 bearing data sheet

Part Number: GFI-0405-06

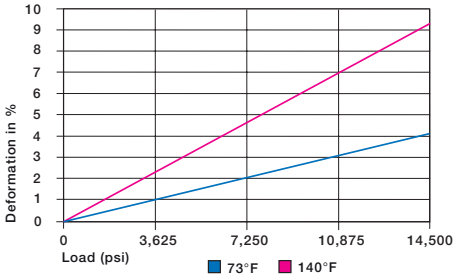
Quantity: 6 pcs

When to use:

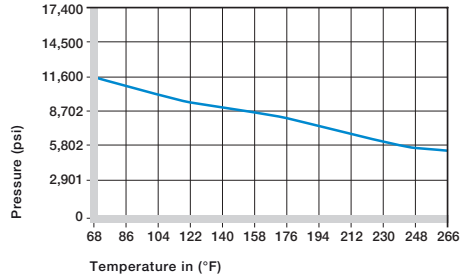
- When you need an economical all-around performance bearing
- For above average loads
- For low to average running speeds
- When the bearing needs to run on different shaft materials
- For oscillating and rotating movements

Special Characteristics:

- Low coefficient of friction
- Vibration dampening
- Excellent chemical resistance



Deformation under load and temperature



Recommended maximum permissible static surface pressure of iglide® G300 as a result of the temperature

Material Data

General Properties	Unit	iglide® G300	Testing Method
Density	g/cm ³	1.46	
Color		dark gray	
Max. moisture absorption at 73°F / 50% r.h.	% weight	0.7	DIN 53495
Max. moisture absorption	% weight	4.0	
Coefficient of friction, dynamic against steel	μ	0.08 - 0.15	
p x v-value, max. (dry)	psi x fpm	12,000	
Mechanical Properties			
Modulus of elasticity	psi	1,131,000	DIN 53457
Tensile strength at 68°F	psi	30,460	DIN 53452
Compressive strength	psi	11,310	
Max. static surface pressure (68°F)	psi	11,600	
Shore D-hardness		81	DIN 53505
Physical and Thermal Properties			
Max. long-term application temperature	°F	266	
Max. short-term application temperature	°F	428	
Min. application temperature	°F	-40	
Thermal conductivity	(W/m x K)	0.24	ASTM C 177
Coefficient of thermal expansion (at 73°F)	(K ⁻¹ x 10 ⁻⁵)	9	DIN 53752
Electrical Properties			
Specific volume resistance	Ωcm	> 10 ¹³	DIN IEC 93
Surface resistance	Ω	> 10 ¹¹	DIN 53482

drylin® N linear guide system



drylin® N data sheet

Part Number: NK01-27-2-450

18 in. (450 mm)

Quantity: 2 assemblies

When to use:

- For linear motion
- To save space
- For high speeds and accelerations



Application pictured uses the larger size of the drylin® N product line

Special Characteristics of drylin® N:

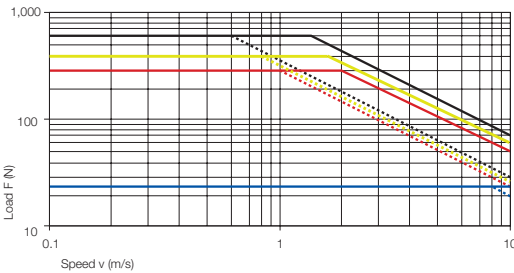
- Maintenance-free and self-lubricating
- High resistance to dirt
- Corrosion resistant
- Lightweight due to aluminum/plastic combination
- Very high speed and acceleration possible
- Replaceable plastic sliding elements made of iglide® J

Data

- Rail weight 0.2 lbs/ft (290 g/m)
- Carriage weight .38 oz (10.8 g)
- Maximum rail length 12 ft (3,658 mm)
- Standard bore scheme symmetrical C5=C6
- Maximum speed 49 ft/s

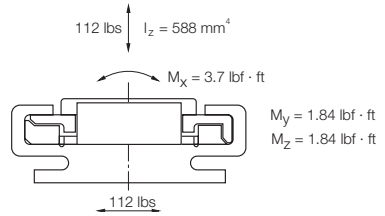
Fv Diagram:

Maximum permissible dynamic loads of drylin® N

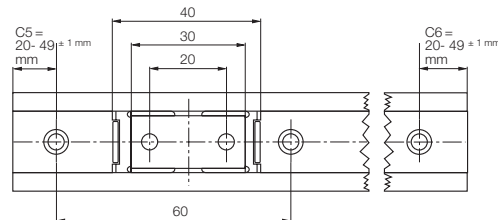
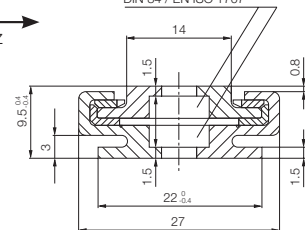


- dotted line: Size 17 z-direction
- dotted line: Size 27 z-direction
- dotted line: Size 40 z-direction
- dotted line: Size 80 z-direction
- Size 17 z-direction
- Size 27 z-direction
- Size 40 z-direction
- Size 80 z-direction

Load Data



for Machine "Low Head" Screws M4
DIN 7984 / DIN 6912
DIN 84 / EN ISO 1707



igubal® rod end bearing



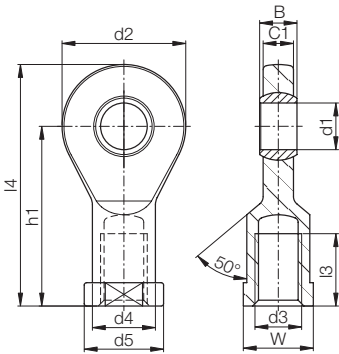
igubal® rod end data sheet

Part Number: EBRI-04

Quantity: 6

When to use (both rod end and flange types):

- For rotational, oscillating and linear motions
- To compensate for misalignment and edge loads
- To reduce the weight of your robot — weighs only one fifth of traditional metallic rod end bearings



Dimensions (inch)

Part No.	Part No.	d1	d2	d3	d4	d5	C1
Right thread	Left thread	[E10]					
EBRI-04	EBLI-04	0.2500	0.827	1/4-28	0.4331	0.5118	0.1732

Part No.	Part No.	B	h1	l3	l4	W	Max. pivot angle
Right thread	Left thread						
EBRI-04	EBLI-04	0.2500	1.1811	0.4724	1.5945	0.43	25°

Load Data

Part No.	Part No.	Max. static Tensile Strength		Max. Radial Load	
		Short term	Long term	Short term	Long term
Right thread	Left thread	[lbs]	[lbs]	[lbs]	[lbs]
EBRI-04	EBLI-04	337	168	45	22

Part No.	Part No.	Min. Thread Depth	Max. Torque Strength	Max. Torque Strength	Weight
			Outer thread	through ball	
Right thread	Left thread	(inch)	(ft•lbs)	(ft•lbs)	[g]
EBRI-04	EBLI-04	.315	3.68	1.8	3.8

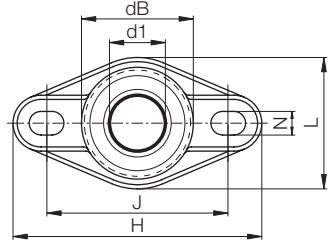
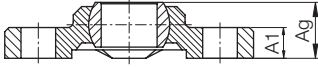
igubal® Flange Bearing



igubal® flange bearing data sheet

Part Number: EFOI-04

Quantity: 6



Load Data and Dimensions (inch)

Part No.	d1 [E10]	dB	H	L	J Hole pitch	A1 Height of housing	Ag Total height	N Bore diameter d x 1
EFOI-04	0.2500	0.551	1.331	0.630	0.945	0.177	0.342	0.126 x 0.197

Part No.	Maximum static axial load		Maximum static radial load		Maximum static torque holes [ft lbs]	Maximum pivot angle	Weight [g]
	Short term [lbs]	Long term [lbs]	Short term [lbs]	Long term [ft lbs]			
EFOI-04	56	28	180	90	0.96	27°	2.0

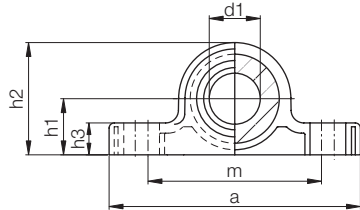
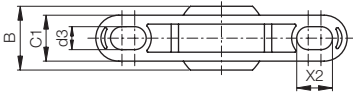
igubal® Pillow Block Bearing



igubal® pillow block bearing data sheet

Part Number: KSTI-04

Quantity: 6



Dimensions (inch)

Part No.	d1 [E10]	B	C1	h1	h2	m	a	h3	d2	X2	Max. pivot angle
KSTI-04	.2500	.375	.250	.390	.705	1.25	1.75	.205	.137	.250	25°

Load Data

Part No.	Max. static tensile strength		Max. axial static compressive strength [lbs]	Max. torque for longitudinal holes [ft lbs]	Weight [g]
	Short term [lbs]	Long term [lbs]			
KSTI-04	135	67	68	0.4	2.8

drylin® Aluminum Shafting



drylin® Shafting data sheet

Part Number: AWI-04 18 in. (450 mm)

Quantity: 2

When to use:

- In conjunction with igus® plain, clip and spherical bearings
- To reduce the weight of your robot

Properties

Material:	6061-T6	Layer Thickness:	> .0016"
Tolerance:	+0/-0.001"	Surface Hardness:	450-550 HV approx. (60 RC)
Straightness:	.001"/ft	Roughness:	RMS = 4-20
Hardness:	75 HB	Spec. Electr. Resistance:	4×10^{11} Ohm mm ² /m
Surface:	hard-anodized mil-A-8625 Type III Class I < .002"	Chemical Resistance:	2 < pH < 9

Part No.	Design	Diameter	Max. Length	Weight (lbs/ft)
AWI-04-18	Solid	.2500	72	.057



Facts At A Glance

igus® is committed to manufacturing plastic components which enhance the performance and prolong the life of automated machinery, as well as meeting the needs of all of its customers, both professional and student alike.

Plastics for longer life®

1964: igus® founded in Cologne, Germany

1985: US headquarters established in East Providence, R.I.

High-performance plastic bearings have emerged as a viable, cost-effective alternative to metal plain bearings. Engineers are realizing that advanced synthetic compounds provide more design opportunities than traditional materials. For more than 50 years, igus® has been developing bearing materials based on modern plastics, which have predictable tribologic, or low-friction, properties: fiber for reinforcement and strength, a solid lubricant and a base material.

Due to their plastic composition, all igus® bearings are self-lubricating and maintenance-free. The plastic-based construction also eliminates corrosion, delivers better vibration dampening than metal bearings, handles edge loading better than metal-backed bearings, has high shock absorption, and emits low noise.

igus® plastics are also used throughout the e-chain® product line. By using only plastic, these cable carriers are lightweight, yet provide the same protection as steel or plastic/steel combination cable carriers.

Today igus® offers over 40 high-performance plastic material blends. All have been developed through years of detailed research and rigorous testing. This commitment to quality has propelled the company to the forefront of the motion-control industry.

igus® develops an array of machinery components in addition to the products enclosed in your BEST™ kit (see data sheets included in this brochure for details on those products), including:

- **chainflex® motion cables** - specifically designed for use in e-chain systems®, which can withstand the stress of tight bending radii and deliver longer life.
- **readychain®** - pre-assembled cable carrier systems complete with cables, connectors and accessories, which are custom-designed to the customers' specifications to deliver a ready-to-install, fully harnessed, out-of-the-box solution.
- **iglide® plastic bearings** - a cost-effective, self-lubricating and maintenance-free alternative to bronze bearings. Over 40 material blends ensure a bearing is available to withstand almost any condition, from severe temperatures, to contamination, to underwater applications.

The yes (Young Engineers Support) Program

igus®, the leading developer of cable carriers, plastic bearings and linear bearings and slide tables, offers free products through its **yes** (Young Engineers Support) Program, which is designed to foster the mechanical design ideas of students who have a passion for engineering.

Through the **yes** Program, igus®:

- offers free product donations to students, engineers, teachers and professors for use in various design competitions, school projects and engineering curriculum;
- offers in-class seminars about igus®, its products and the various ways students can take advantage of the **yes** Program;
- educates students and engineers alike on the merits and benefits of plastic components;
- supports the visions of various engineering competitions by donating products, technical support and other resources;
- revitalizes students' interest in engineering;
- aids in making the unique design ideas of students and engineers a reality;
- encourages students to implement igus® products into their projects in unique, interesting ways, and;
- reaches students all over the world.

yes Facts

- The **yes** Program is open to students of all ages and grade levels, as well as teams and engineers competing in robotic or other competitions.
- Through the **yes** Program igus® is a product sponsor of BEST™ Robotics and has various products included in more than 1,100 consumable parts kits.
- The **yes** Program sponsors additional competitions such as FIRST® Robotics, Botball®, the Rube Goldberg™ contest, NASA's Lunabotics Mining Competition and the SAE® Collegiate Design Series.
- Students have the opportunity to have their accomplishments featured on the **yes** website by submitting information about their application, including pictures and descriptions of how they used igus® products in their designs.

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