

wind...

igus® solutions for the wind energy

energy

plastics for longer life®...igus

... www.igus.eu/windpower

Reduce cost ...

Less wind resistance with igus®.

Guaranteed durability ... tested for more than 10 million double strokes.

Wind is your strength, motion plastics® ours. igus® offers a wide selection of solutions for wind power generation as well as in production equipment, transport and installation, which will help you to improve your technology and reduce costs.

The advantages of igus® motion plastics® products for the wind power industry

- Lubrication and maintenance free
- Low weight
- Weather resistant
- Tested and certified
- Cost effective
- For all movement types (torsion, rotary movement, etc.)

We also offer:

- Tested products
- Guaranteed reliability
- Installation services and project engineering services
- Quick delivery from stock worldwide
- Online services, configurators, 3D-CAD files, etc.

With more than 100,000 igus products from stock, every customer can find the right solution. Injection moulding and mass production guarantee a cost effective solution for all motion plastics® applications, from rugged energy supply systems and flexible cables to lubrication and maintenance free plain bearings.

Our online tools also enable you to reduce process costs. igus® delivers from stock in 24-48 hours! Also, see our industry website:

 www.igus.eu/windpower

With this brochure I would like to offer you a glimpse of the igus® motion plastics® options for the wind power generation industry. Countless other products, tips, ideas and references can be found on our website, or if you wish, I will be glad to advise you in person.



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... improve technology ...

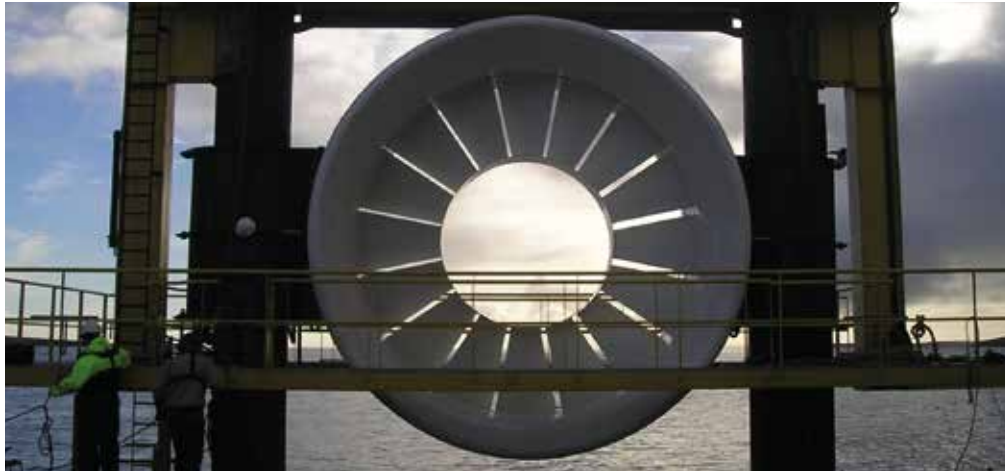


This telescopic three-axle semi-trailer truck is extendable from 20 to 62 metres. Here it can be seen transporting 55 m long rotor blades across Denmark. igus® E4.1 e-chains® are used so that the electric, brake and hydraulic cables can move safely inside the structure. The energy chains® are exposed to very strong push-pull forces especially when the vehicle is extended.

... with motion plastics® from igus®

Applications ...

igus® plastic energy chains® and highly flexible chainflex® cables



This tidal turbine is supplied with energy using igus® E4 e-chains® and chainflex® motor and signal cables



380° surface adjustment thanks to igus® e-chain®



The alternative to cable reel - igus® e-spool in an extendable mast turbine system



igus® has the right solution for all movement types

... in the energy sector

Plastic plain and linear bearings



Guiding without maintenance ...



... with igus® dry-tech® bearing technology



Ship crane for setting up offshore wind farms. igus® e-chains® and chainflex® cables supply power for the rotary movement of the crane.

igus® products in ...

Safe ... corrosion resistant ... long life ... space saving

... wind power stations

... maintenance free ... weather resistant ... light ... cost-effective

1



Azimuth and rotor blade adjustment

Rotary motion with "RBR" (Reverse Bend Radius). Complete system with sensor cable for position detection.

www.igus.eu/RBR

2

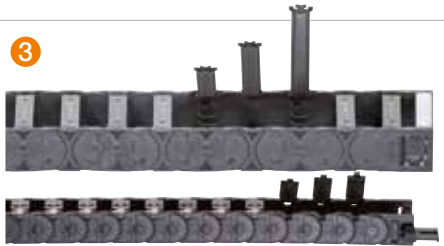


For linear, circular and torsional motions

chainflex® - tested for millions of torsion cycles and double strokes.

www.igus.eu/chainflex

3



Cable protection in the tower

e-chains® - 90,000 cable friendly versions from stock.

www.igus.eu/e-chains



4



Rotor blade adjustment or brake

igidur® polymer plain bearings – maintenance free, dry operation, corrosion resistant

www.igus.eu/igidur

5



Rotor hub

3D e-chain® triflex® R – safe torsion up to $\pm 10^\circ$ per chain link.

www.igus.eu/triflex



Sliding doors and linear mechanisms

drylin® linear guides. Lubrication- and corrosion-free, large modular construction kit

www.igus.eu/drylin

Avoid lubrication ...

igus® **dry-tech®** bearing technology works entirely without lubrication when using iglidur® plastic plain bearings

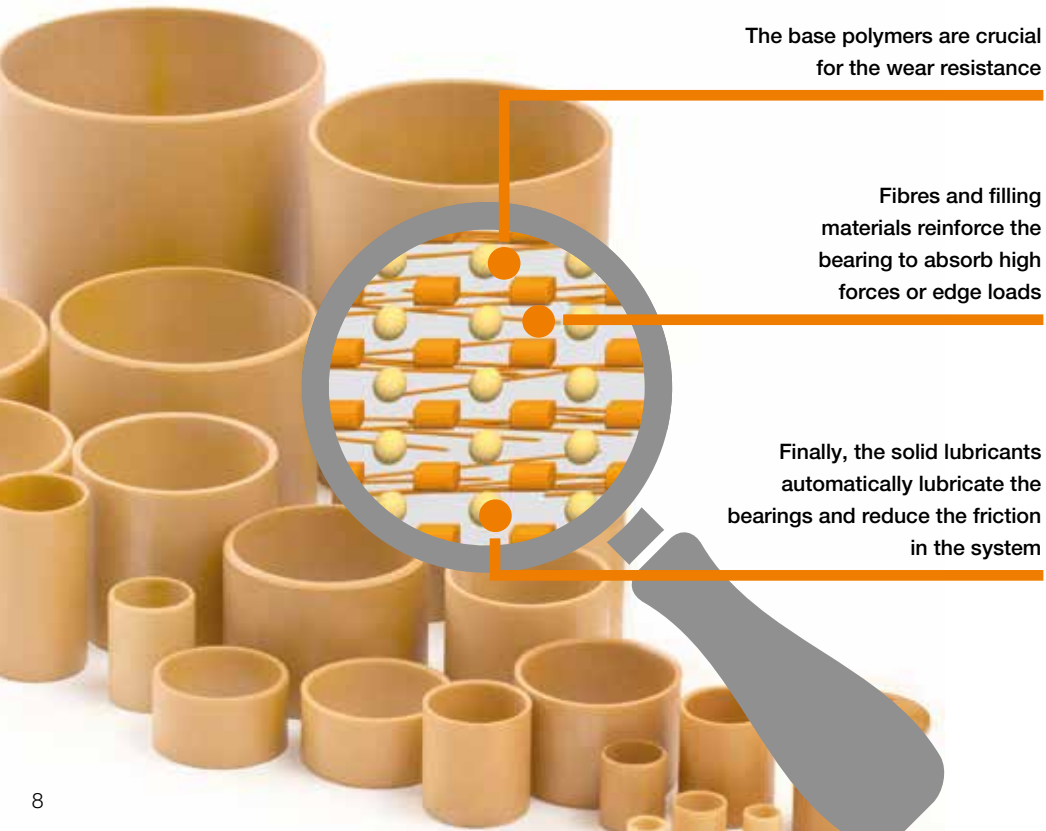
Lubricant and maintenance free plain bearings made from high-performance plastics – iglidur®.

No lubrication or maintenance required, while cutting costs and increasing service life, everything from stock and delivered promptly – that is the central idea of all igus® products. iglidur® plastics have been extensively tested with respect to wear and friction values including other relevant material properties. iglidur® polymer plain bearings from igus® signifies the step from the plastic bearing to the tested and therefore predictable machine component.

- Lubrication free
- Lightweight
- Maintenance free
- High static loads
- Corrosion free
- Vibration dampening
- Sea water resistant
- Metric and imperial dimensions
- Special dimension and designs

 www.igus.eu/iglidur

Structure of iglidur® plastic plain bearings



Reduce maintenance effort ...

Eliminating lubrication means: "install and forget" with drylin® linear technology

Lubrication free linear technology – drylin®

drylin® is a product range of lubricant-free linear plain bearings based on the principle of sliding instead of rolling. Tribologically optimised iglidur® high performance polymers are used as sliding surfaces. drylin® linear systems travel in dry-running mode and are maintenance free. Linear guides on rails or round shafts are available. drylin®-drive technology can supply ready-to-connect systems with lead screw drives or toothed belt drives, with or without motor. The focus is on, besides the freedom from maintenance and lubrication, the ruggedness and resistance to influences such as dirt, water, chemicals, heat or impacts.

- Resistant to dirt due to dry operation
- Resistant to impacts and vibrations
- High static load capacity
- Suited for short-stroke applications
- Low weight
- Vibration dampening
- Sea water resistant
- Quiet operation
- Metric and imperial dimensions
- Special designs according to customer needs
- Available from stock

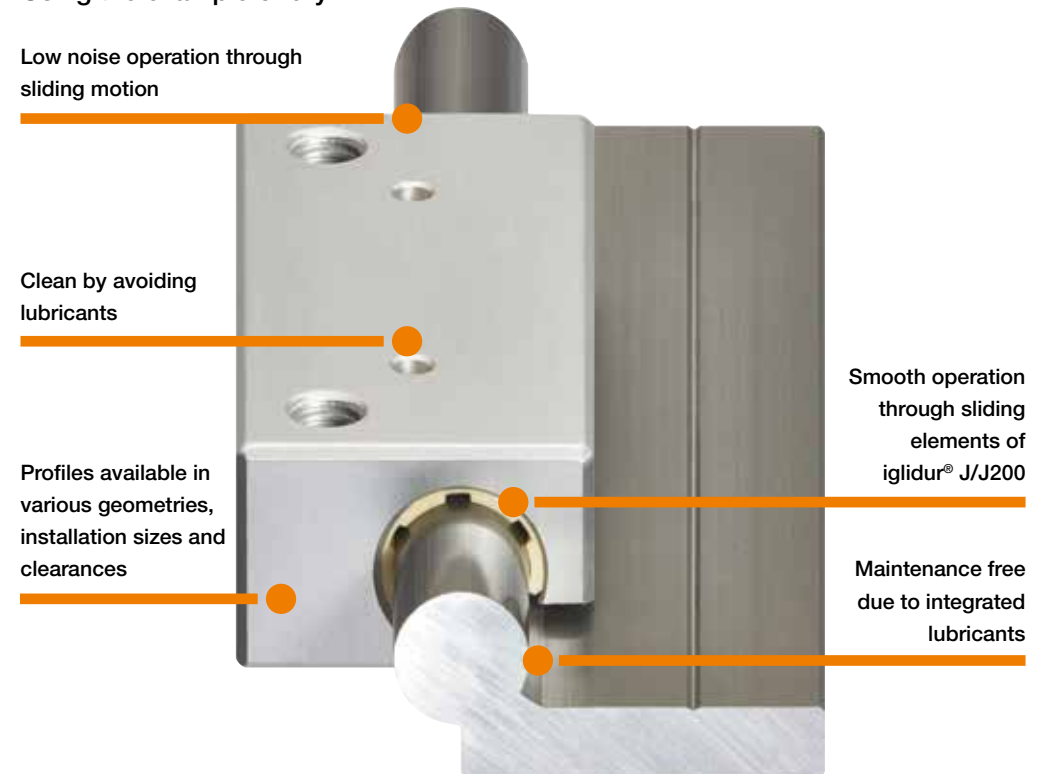
 www.igus.eu/drylin

Using the example of drylin® W

Low noise operation through sliding motion

Clean by avoiding lubricants

Profiles available in various geometries, installation sizes and clearances



Reduce weight ...

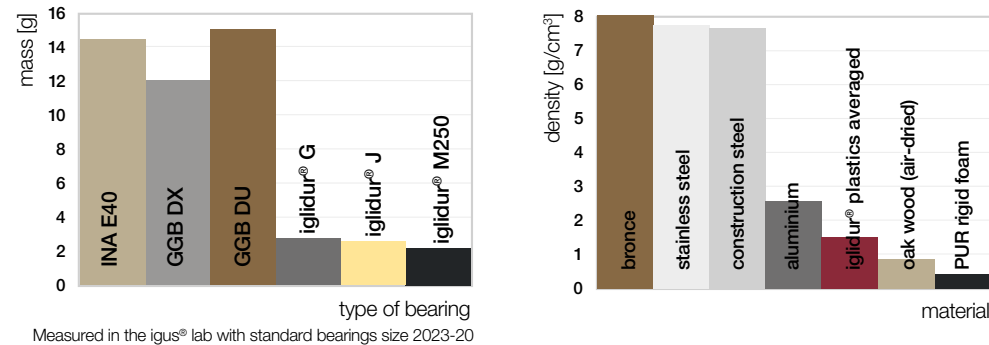
iglidur® plastic plain bearings are up to 7 times lighter than comparable metallic bearings

Lightweight construction with iglidur® plastic plain bearings

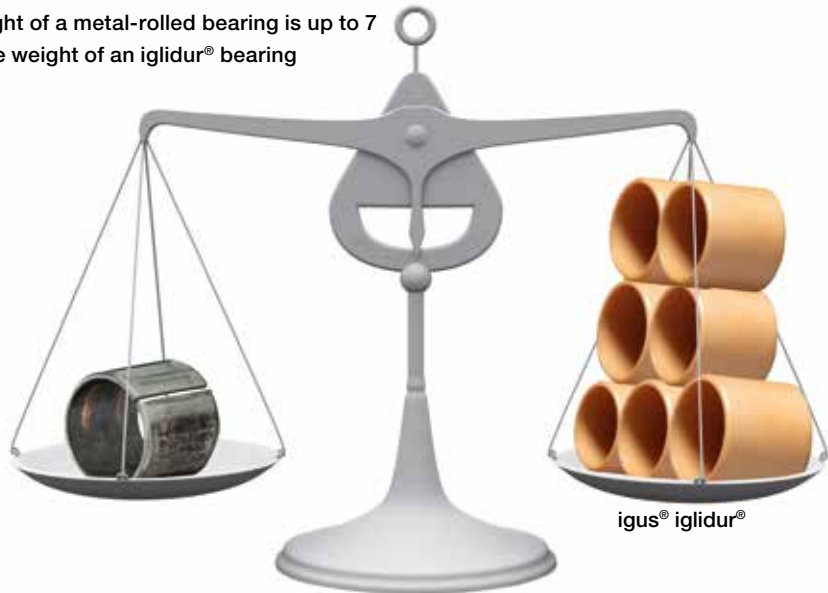
The requirements for wind power stations are rising constantly. Thus larger rotor blades are increasingly used to raise the nominal power of the wind turbines. At the same time the plants and the individual components should be lighter and cheaper. Major weight reductions can be achieved by replacing metal bearings with iglidur® bearings. Metal bearings can be replaced by iglidur® plastic plain bearings 1 to 1 in most cases.

 www.igus.eu/iglidur

Metallic rolled bearings compared to iglidur®



The weight of a metal-rolled bearing is up to 7 times the weight of an iglidur® bearing



Weather-resistance

Underwater, in direct sunlight
high temperatures or extreme cold

UV resistance, cold- and heat-tested

Bearings, e-chains® and chainflex® cables can be exposed to constant weathering in outdoor applications. The UV-resistance is an important measure that states whether a material is affected by UV radiation. The effects can range from slight color variations to brittleness. Almost all igus® products are suitable for outdoor use. We verify this by tests in the igus® climatic chamber at -40°C or in UV-long-term test. Successful applications demonstrate this.

 www.igus.eu/test



iglidur® bearing in long-term UV test



Cold tests in climatic test cabinets as low as -40°C



igus® products in solar systems

All movement types ...

Guide energy safely in all directions

igus® e-chains® and e-chainsystems® are suitable for universal applications



- Carry sensitive bus, data and fibre optic cables, as well as other energy forms such as electricity, gas, air and liquids in one system
- Many types of orientation and application
- For high dynamic loads and long service life requirements
- For all environments and climates (from -40°C to +120°C)
- Easy to clean, space saving installation
- Enclosed or open construction types
- Simple modular assembly on site, as well as quick retrofitting of cables

 www.igus.eu/e-chain

Multi-axis movement – triflex® R



- Secure energy supply for undefined movements
- High torsional stability
- Can be arbitrarily shortened and extended
- Large filling space
- Smooth outer contours
- Small bend radius
- Connection uses ball and socket system to absorb high tensile forces
- One-piece link, extremely light

 www.igus.eu/triflexR

... and installation methods

Construction kit with 90,000 options

Rotary movements in small spaces - igus® twisterband

- 7,000° and more rotary movement horizontally and up to 3,000° vertically
- Rotary speeds up to 180°/s
- Compact, modular and lightweight
- Bands can be lengthened and shortened as required
- Minimum installation space, fits very closely around the rotary axis
- Can be reliably used in various installation orientations (horizontal, vertical, overhead)
- Cost effective
- Easily filled
- Ideal in combination with igus® chainflex® cables for rotary motions in very limited installation spaces



 www.igus.eu/twisterband

Very durable in energy chains® – chainflex® cables

The special design of igus® chainflex® cables is the key to a long service life in energy chains.

- Savings due to different quality levels
- Solutions for long and short travels
- Always with 36 months guarantee
- Clear service life data for every series
- Matched to the e-chain®

 www.chainflex.eu

1. High-tensile core element, for durability in the dynamics
2. Optimised stranded wire structure, for the smallest bend radii
3. High-quality core insulation, protection against short circuits



4. Stranding in bundles in short pitch lengths, reliability through rugged construction
5. Gusset filled extruded inner jacket, long service life in long travels
6. Overall shield with optimised braiding angle, excellent EMC protection in the long term
7. Pressure extruded, abrasion resistant outer jacket, protection in cold and abrasive environments

Torsional & circular motion ...

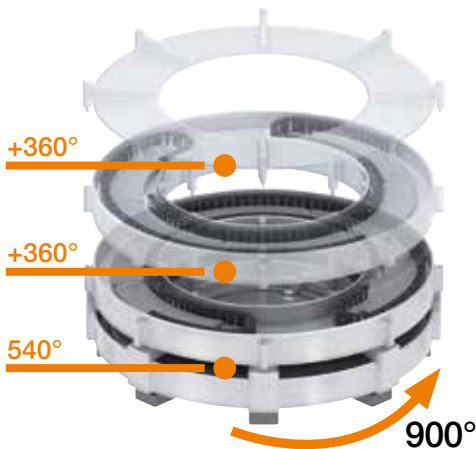
e-chains® and chainflex® cables for ...



triflex® R – multiaxis energy supply system for harsh environments

- Around $\pm 10^\circ$ torsion per chain link
- High tensile strength ball-and-socket joint
- Easy to lengthen or shorten, no steel wire or other parts
- Many dimensions and options

 www.igus.eu/triflexR



RBR – Implement circular movements reliably

- Circular movements can be realised with several solutions from the igus® e-chain® range
- RBR solutions (reverse bend radius) allow high fill weights and rotary movements up to 540°
- Ideal for rotary movements with high fill weights and confined spaces
- e-chains® can be freely assembled
- Peripheral speeds up to 1 m/s

 www.igus.eu/RBR



CFROBOT – twistable cables for energy chains®

- For use in torsion applications of $\pm 90^\circ$ with 1 m cable length
- Available as hybrid/control cables, motor/servo cables, bus/data cables, FOC cables
- Flame retardant
- Shielded or unshielded
- 36 months guarantee

 www.igus.eu/CFROBOT

... tested from stock

... Rotary and torsional movements

The torsion-resistant requirement for cables for energy chains® is not new, but is seldom defined in detail. So how can a statement such as "this cable is torsion-resistant up to $\pm 180^\circ$ " be evaluated? That's why it is all the more important to be able to deliver comparable and conclusive test results.

In order to meet this requirement, the "torsion test bench" was developed according to the igus® standard. Here various cable types are twisted to a specified angle with a cable length of 1 meter. The torsion angle can be freely selected and is fixed according to the requirement on the specimen, but the test standard is $\pm 180^\circ$.

After a prescribed number of double strokes or a negative electrical or mechanical test result, the respective test specimen is dissected, and the type and position of any damage can be determined exactly.

 www.igus.eu/test3105

 **Tested!**

In the largest lab of its kind, igus® Cologne

Test number: 3105

chainflex® cable type:

CFROBOT5.501 robot fibre optic cable

Test parameter: Torsion test $\pm 180^\circ$

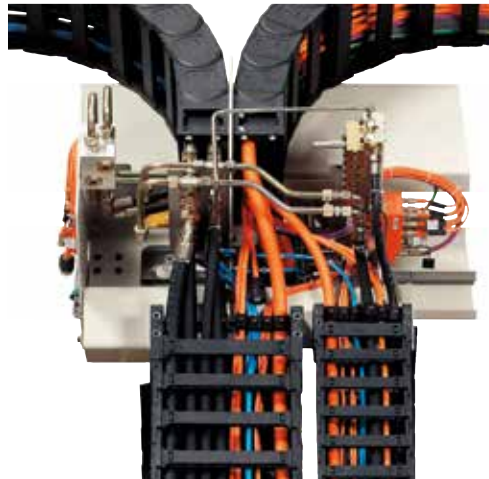
Lifetime: 27,542,214 cycles



chainflex® lasts - proven in test No. 3105 of more than 600 parallel tests conducted by the 1,750 m² test lab, the largest of its kind for flexible cables

As assembled system ...

readychain®: chain - cable - guarantee ... delivered in 3-10 days



Assembled igus® readychain® systems: individual or serial production

readychain® – fully harnessed systems in 3-10 days

1,000 systems produced per week in 12 readychain® factories around the world – assembly time optimised to increase your cash-flow

- Eliminate storage costs for cables, e-chains® and connectors
- Cut turnaround times by half
- Flexibility when orders vary
- Reduce the number of suppliers and orders by 75%
- Minimise your machine downtimes
- System guarantee - depending on application

www.readychain.eu

readychain® assembly rack

80% savings during prototyping. Assembly transport rack for ready-to-install energy supply systems.



... delivered ready to install

readycable®: harnessed drive cables ... in 24 - 48h



readycable® – in 24-48h or today

igus® provides more than 3,200 harnessed cables for drives according to 22 different manufacturer standards. Professionally produced, 100% tested.

- Servo, power and signal/encoder cables
- No cutting charges, no surcharges for small quantities and packaging

- Cable length accurate to the centimetre as per customer specifications
- Smallest bend radii from 7.5 x d
- Reduce storage costs and increase cashflow

www.readycable.eu

Overmoulded cable available for use in energy chains

- Various sizes: M8, M12, M23, M40, USB 3.0 etc.
- Size M23 + M40 with SpeedTec quick-lock
- Angled versions
- According to UL/CSA standard
- Individual customer logo possible
- ESD material for ATEX-areas
- Tamper-proof
- Tight according to IP66/67 already before the molding process
- 360° shielded
- Space and weight saving



Increase service life ...

We are confident enough to give a guarantee because...



Quality assurance: permanent batch testing to ensure the quality level

... we conduct more than 2.0 billion test strokes and 1.4 billion electrical measurements per year.

Our customers often need to give a guarantee for their systems to the end user. They do this to guarantee safety and reliability of their systems. End users want an overall guarantee, but this poses a commercial risk for system manufacturers. With our guarantee we now offer security to system manufacturers as our customers. This guarantee is different from a standard guarantee. In Germany, quality and durability guarantees are used.

Many customers want a binding statement about the durability of the product they use. We understand this, and offer this through our chainflex® guarantee program.

Predictable reliability

Durability and lifetime statements are what our customers require. For over 20 years, we have been conducting test in what is now the largest test laboratory for cables and energy chains. Due to extensive testing we can now make reliable and clear statements in order to make durability and service life of our cables predictable for every user.

... guaranteed reliability

Save money with reliability and innovation ...

3 years igus® guarantee for every chainflex® cable. 100% tested at the igus® lab.

Guarantee statements reduce risk plant engineering. With our unique igus® guarantee for ALL chainflex® cables, we are providing predictable security for 36 months, or up to 10 million double strokes (5 million double strokes for very cost effective chainflex® M cables).



Guarantee igus® chainflex®

36

month guarantee



Reduce cost ...

Reduce costs with products perfectly tailored to your application

For years the igus® motto has been "plastics for longer life®". By this we mean the production of innovative plastic products which reduce maintenance work, achieve technical improvements, at the same time as reducing costs and increasing service life, everything delivered immediately from stock.

UP TO
40%

Save up to 40%!
Metallic bushings can be replaced by iglidur® plain bearings in almost all application areas.



UP TO
25%

Save up to 25%!
By replacing your recirculating ball bearing guide with a drylin® linear guide system



UP TO
50%

Save up to 50%!
For longer service life with polymer spherical bearings



UP TO
57%

Save up to 57%!
With chainflex® M cables you can save costs up to 57% depending on the requirement of the application and get a guarantee for 36 months.



Increase cash-flow!

With assembled e-chainsystems®, you can raise your cash flow fast – with system guarantee!



Save

in the purchase price, because you can now buy smaller e-chains® with the same stability or individually harmonised products for your applications.



Approved and certified

chainflex® fibre optic cable especially for offshore use with DNV/GL approval

New test standard for dynamic cables in moving applications guarantees reliability in maritime equipment.

In order that cables for moving applications can be used on ships and in offshore applications without complex and costly special approvals, igus® and the Germanischer Lloyd classification society have jointly developed a new test standard, and now a total of 328 chainflex® cables from igus® have been awarded with a type approval for continuously moving cables in e-chains®. These are the world's first* cables specifically made for applications in energy chains, which have received this certificate.

- Offshore industry
- For extremely heavy duty applications with 5-7.5 x d
- Maximum EMC protection, with high transmission qualities in terms of glass-specific requirements
- Almost unlimited resistance to oil
- Indoor and outdoor applications
- Unsupported travel distances and up to 100 m for gliding applications (horizontal + vertical)

 www.igus.eu/chainflex



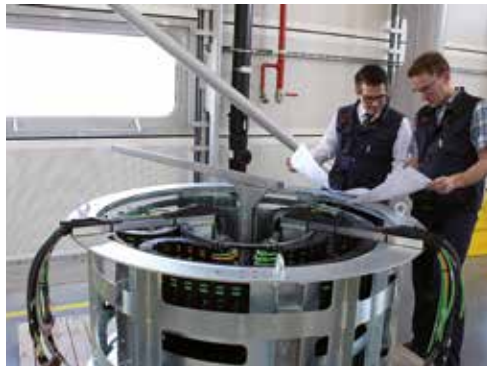
igus® engineering

Engineering projects & custom solutions. We take the difficulty out of the most complex energy supply systems!

Reduce your engineering costs for planning energy supply systems. We provide tailored custom solutions for even the most difficult applications.

We use igus® e-chains®, flexible chainflex® cables and standardised modules that are quickly adapted to your application to give your energy supply solution or to convert an existing plant. Our project engineers will prepare an initial draft design free of charge, and will coordinate the interfaces with you. We therefore plan your application from initial draft through to assembly and on-site commissioning. Our engineering and supervisor network is available to support you anywhere - worldwide!

 www.igus.eu/projects



Functional tests



Customer-specific test setups



Prototype tests



Customer-specific supply

igus® installation service

Save time and money on maintenance and installation of your energy chain systems®

Design, harnessing, delivery up to complete assembly of energy chains® with all components.

Machines must work reliably and without problems. This requires reliable energy chain systems and cables, which guarantee a long service life and a quick service, by which machine downtimes can be avoided or reduced in case of emergency.

 www.igus.eu/installationservice

Our service:

- Predictable fixed cost for the assembly, maintenance or inspection of energy supply systems on your system
- Fast and accurate installation and maintenance of all components by qualified specialists
- Minimal down time
- Products and services (energy chains®, cables, strain relief, guide troughs, etc.) from a single source – less logistics costs for you
- igus® system guarantee



New installations



Upgrades / Replacement



Maintenance



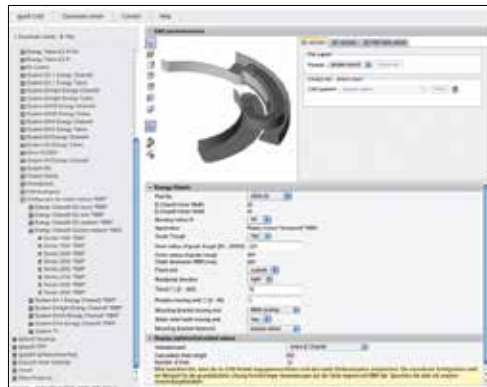
Repairs

igus® services ...



Visit our industry web pages for more information, products, application examples and useful online-tools.

www.igus.eu/windpower



Quickly find and configure products and calculate service life - all online.

Using our online product finders you can find the right igus® product and get a service life prediction.

www.igus.eu/online

For any task - in any quantity

Different industries need different solutions. Whether in mechanical engineering, automotive-manufacturing or in the robot industry – igus® offers customised support for specialised applications. igus® already has many years of experience and specialised resources for many industries

www.igus.eu/industry

... quick and reliable



The igus® delivery service

Over 97% availability of all catalogue parts – no need for you to stock

- Over 100,000 products from stock
- No minimum order value
- No surcharges for small quantities
- No costs for cutting cables
- No packaging costs

www.igus.eu/24



Modern injection moulding technology

The igus® GmbH quality policy is based on the objective of identifying and meeting customer needs, and of always being a professional partner and reliable supplier. igus® has always been committed to producing products of the best possible quality and consistently developing innovative solutions.



The igus® lab

The industry's largest test lab (1,750m²) conducts more than two billion test cycles per year on a total of 107 test rigs.

- Extensive test databases
- Customised tests on request

www.igus.eu/test

igus® motion plastics®

One vision has been driving us for 50 years – motion plastics®: moving parts made of plastic that cost less and last longer. Our core technology consists of tribo-polymers – high-performance plastics, which we have optimised for friction and wear. This technology has made us into a worldwide leader for developing and manufacturing energy supply systems and plain bearings.

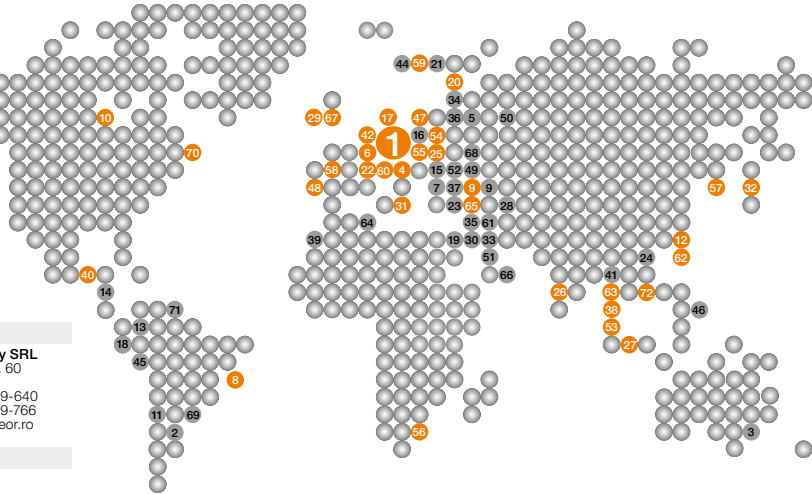


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