igus solutions for the shipbuilding and offshore industry



igus[®] solutions ...



Frank Schlögel

Head of Engineering Projects, Phone: +49 2203 9649 166 Email: fschloegel@igus.de

Resistant to sea water, tough, light, lubricant- and maintenance-free; igus® plastic solutions for the maritime industry.

Tried and tested in numerous applications on the high seas: energy chain systems® and plain bearings from igus® withstand the toughest environments. They provide reliable energy supply and allow highly dynamic movements with a long service life in wind turbines, oil rigs and the ship building industry. We test all products in the largest test laboratory in the industry under real world conditions.

In this way we can guarantee the reliability of our products and implement tailored solutions for energy chain systems® and plain bearings in a wide variety of customer applications. Travels for e-chains® of up to 800 metres, cable fillweights of 600 kg/m or high edge loads of up to 250 MPa with plain bearings. More than 200,000 customers per year rely on motion plastics® solutions from igus®.

From the port area to the high seas, we offer igus® products for the offshore industry:

e-chains®:

- Maintenance-free, resistant to sea water and oil
- Fill weights of up to 600 kg/m
- Strong, yet lighter than steel
- Corrosion-resistant
- Conductive ESD options

chainflex® cables:

- Certified cables, e.g. according to Germanischer Lloyd
- Flexible down to -40°C, UV-resistant
- Resistant to oils according to MUD NEK606
- Specifically designed for highly dynamic movements in energy chains[®]

iglidur® bearings:

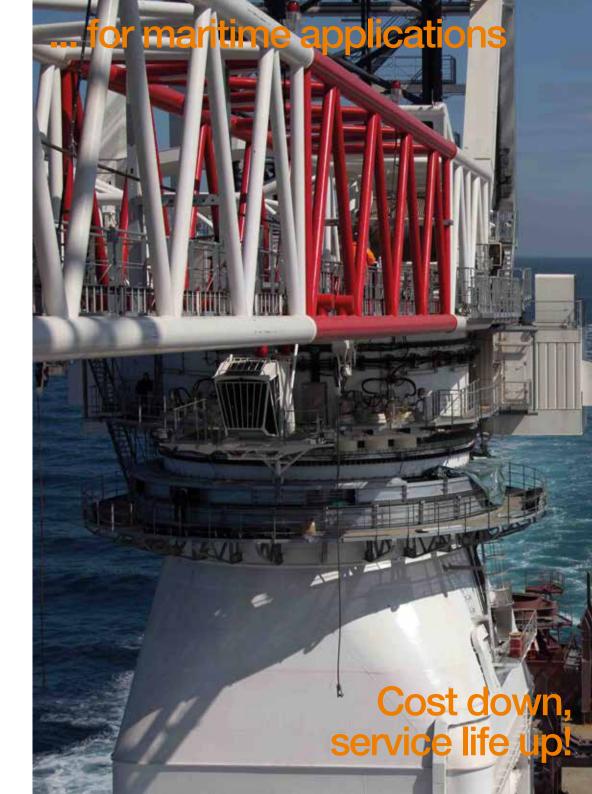
- Dry-running and lubrication-free
- High edge loads and surface pressure up to 250 MPa
- Resistant to dirt

With our 30 online tools you can also save design costs. igus® delivers in 24 to 48 hours from stock! Visit our industry website

www.igus.eu/maritime

I look forward to speaking with you.

Frank Schlögel



Prevent downtime in shipyards ...





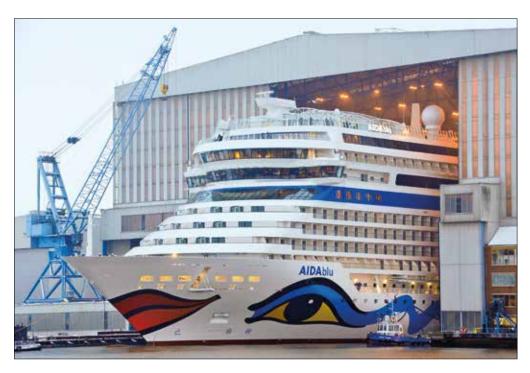




Meyer Werft Papenburg

Eight gantry cranes connected in series travel a total length of 180 m. Both the longitudinal and transverse travels are reliably supplied by igus® e-chains® from the E4/4 range. The compact design of the e-chain® and guide trough allows the system to integrate seemlessly into the beam seemlessly leaving no cable loops hanging in the crane beam area or field of view.

... with igus e-chainsystems





Reliable in offshore applications



Jack up rig, China

Transverse travel

Travel: 6,4 m

Fill weight: 37,7 kg/m

Speed max.: 0,3 m/s

e-chain®: 800.40.600.0

Longitudinal travel

 Travel:
 19,2 m

 Fill weight:
 74,5 kg/m

 Speed max.:
 0,3 m/s

e-chain[®]: 600.25/178/178/25.600.0

... Rig skidding



Working since 1993

e-chain[®]: 50.20/20/20.400.0

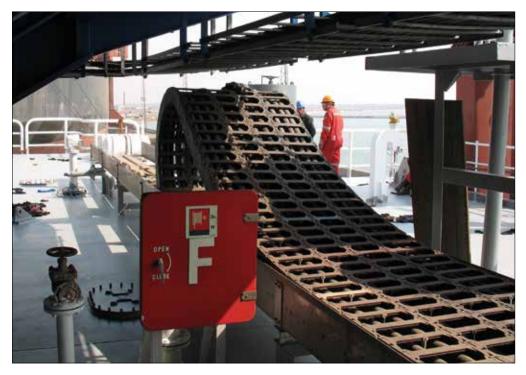
Fill weight: 39 kg/m Travel: 42 m



Claymore drilling rig, North Sea

e-chain®: 5050.18/18/18.450.0

Fill weight: 36.5 kg/m Travel: 29.7 m



... for long travels



Rig skidding concept with e-chain® E4.350 for large diameter hoses and cables. Smaller cables, can guided with e-chains® Series E4.168 and E4.112.



AMORAS - long travel reference in the Port of Antwerp

Travel: 137 m Speed max.: 1,5 m/s Acceleration: 1 m/s²

e-chain[®]: E4.350R.500.1000.0

chainflex®: CF300
Total fill weight: 100 kg/m

... and high loads









Jack-up rig, Caspian Sea

Year Built: 2000

Nested e-chains®: 600.45/45.350.0

600.45/45.500.0

Fill weight: 267 kg/m Travel: 21,5 m



Largest polymer e-chain



Flexlay vessel: Seven Waves

The vertical tiltable lay tower works with the biggest polymer e-chain® in the world.

e-chain[®]: E4.350.800.1000.0

Fill weight: 120 kg/m

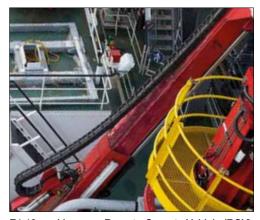


Seven Waves Pipelayer equipped with igus® e-chainsystems®.

... Pipelay vessel



Long travel skidding application with E4.56.



E4.42 working on a Remote Operate Vehicle (ROV).



e-chainsystem® 4040 on a vertical tensioner.



11

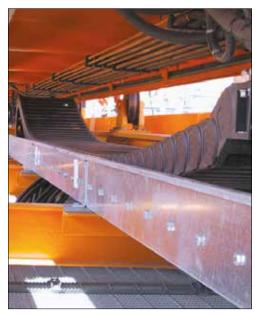
Robust and seawater-resistant ... Pipe handling



Gantry Crane with e-chain® 5050C.26.250.0



Vertical pipe handling systems with opposing e-chains® E4.80.23.300.0



Catwalk machine with e-chain® 5050C.25.200.0



NOV Starracker with Series 600



Starracker with e-chain® 600.20/25/25.500.0

13



Anchor handling tugs





Anchor Handling Tug supply Vessel.

The A-Frame structure of this vessel makes it possible to use the 5050C.47.400/400.0. e-chain®.

The special design with a "reversed bend radius" allows safe operation in any position on the vessel.

The system was installed and commissioned in 2008.



Deepwater construction vessel (DCV)









Vessel: Aegir

The heavy-duty crane has a maximum rotation angle of 560°. igus® e-chains® guide the cable package for the main hoist and the slewing system.

The lay tower is equipped with two parallel E4.350 e-chains®.

Series E4.1 is used for the tensioners.

Wind farm construction vessel ...



The Innovation is a heavy-duty jack-up vessel for installing and maintaining offshore wind farms. The igus® multi-rotation module is the main power supply for the crane which operates around the leg. The 2 layer design allows a rotation angle of 900°.

INNOVATION: Wind farm installation vessel

Operation area: North Sea
Rotation angle: 900°

e-chains®: E4.56.60.200/6000.0

E4.56.60.300/6000.0

chainflex® cables: CF300, CF34, CF10 CFPE,

CFLG, CFBUS

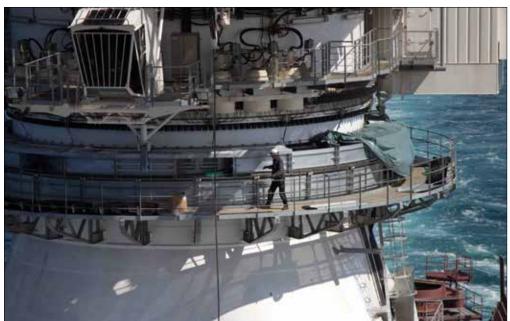
igus® has designed a customized rotary trough system for the Innovation and Vidar. Both systems were developed by the igus project team in cologne before they were assembled Crist shipyard in Gdynia, Poland.





... with 900° multi-rotation modules





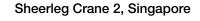
Heavy Lifting ...



Sheerleg Crane 1, Singapore

e-chain®: 5050.15/17/15.300.0

Fill weight: 34,6 kg/m
Travel: 54 m
Speed: 1,0 m/s
Acceleration max.: 1,0 m/s²
Installation/commissioning: 2001







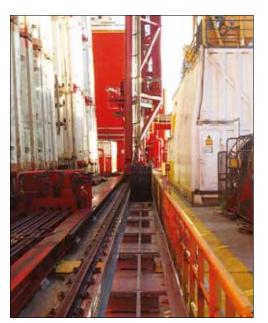
e-chain®: 5050RHD.18/18/18.300.S10.0.E

Fill weight: 45 kg/m
Travel: 74,4 m
Speed: 1,2 m/s
Acceleration max: 1,0 m/s²
Installation/commissioning: 2014

... with heavy duty rol e-chains®





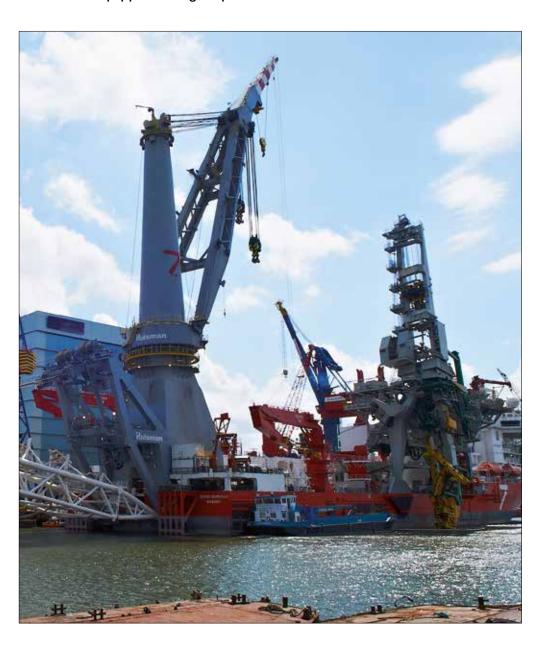




Heavy duty ...

... heavy lift vessel

Due to the igus® rotational module in this heavy-duty crane, it can rotate by 540°. Other areas equipped with igus® products on such vessels are:





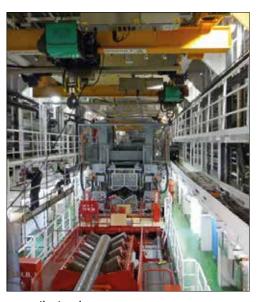
... on welding equipment.



... on pipe handling equipment.



... on handling systems.



... on the tensioner.

Reliable energy supply ...





Power supply for rotary crane

Rotation angle: 470° Speed: 1.82 m/s²

e-chain®: 4040C.40/40.300/3792.0 chainflex® cable: CF27, CF11, CF14,

CF Coax, CFLG

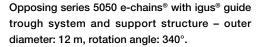
Split guide trough system

Total weight of the e-chain® and cables: 3.5 t



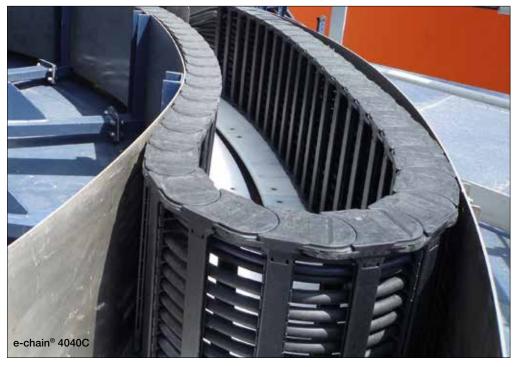
... for heavy-duty cranes







Rotary system with "floating islands" for safe operation on rough seas – rotation angle 540°



Motion compensation platform









Self-stabilizing "Ampelmann" platform

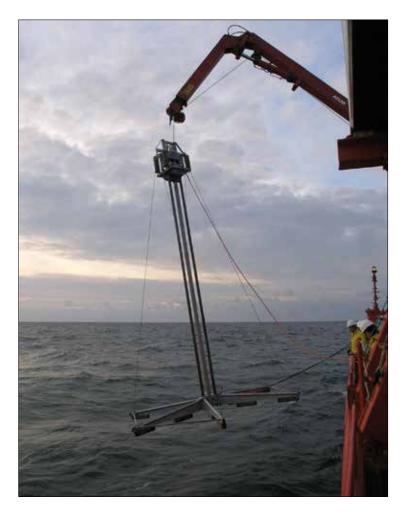
The "Ampelmann" platform automatically compensates all wave movements, so that oil platforms can be worked on safely using a ship as a base. In order to do this the platform is supported by several hydraulic cylinders. The energy supply is guaranteed by igus® triflex® R energy chains®.

e-chains[®]: E4.56.17.200.0

chainflex® cables: CF78.UL.15.25, CF78.UL.15.25,

CFBUS.045, CFPE.100.01

Deep sea drilling rig





Deep sea drilling rig

The Vibrocorer VKG-6 drill, is used in water depths of up to 200 metres, controlled offshore from a ship. igus® chainflex® servo cables from the CF27.D series with two shielded control pairs are used for the energy supply and to control the drilling head, as well as for data transmission to display the drilling depth.

Explosion protection on FPSO ...









ATEX version of the igus® e-chainsystem®, series E4, harnessed with hydraulic hoses and igus® chainflex® cables. Here shown on a test stand, now in operation on the Dalia FPSO (linear motion of mooring).

igus[®] rol e-chain[®] on a maintenance crane.

e-chain[®]: 2828R.10.200.0.E

Travel: 202 m
Speed max.: 1.5 m/s
Acceleration max.: 1.0 m/s²

ATEX material

The conductive material igumid ESD has offered explosion protection and protection against electrostatic buildup since 2002. This material is in turn based on a material which was developed as early as 1992, modified in 2002 and certified by the PTB as far back as eleven years ago.

- igumid ESD with PTB certificate.
- all standard e-chains® are available in igumid ESD.
- tested and successfully used in explosion-protection areas for many years.
- identification:

 Il 2 GD special ESD e-chain® colour: grey (RAL 7015)

... thanks to ATEX/ESD solutions









E4.350 to be installed on a skidding application on an FPSO. Stainless steel guide trough with hook attachment.

e-chain®: E4.350.450.1100.0.ESD.E44

Fill weight: 108 kg/m Travel: 14.7 m

High loads, corrosion-free ...

Save cost and increase productivity!

Lubrication- and maintenance-free products for the shipbuilding and offshore industry.

The construction of increasingly bigger ships and complex offshore facilities poses high demands on the production processes in any shipyard. igus® products can demonstrate a proven track record of many applications in the world of shipbuilding.

For example, igus® products ensure a reliable energy supply to overhead cranes, welding systems and cutting equipment in shipyards as well as to handling applications on offshore platforms or the rotary movements of heavy-duty cranes. Use igus® products made from high-performance plastics to optimise the service life of your systems while also reducing costs and weight. igus® products are suitable for applications subject to almost any environmental condition: whether hot, cold, humidity or dirt – we can always offer the right solution.

Key benefits:

- Individual problem solutions through the igus® engineering team
- Maintenance- and lubrication-free, predictable service life
- Resistant to heat/cold, corrosion, seawater, chemicals and UV radiation
- Rotation and linear motion are possible
- Easy installation, flexible, reliable and modular



... long service life

Strong, corrosion free, UV and sea water resistant energy supply systems

Polymer e-chains $^{\circ}$ with inner heights of up to 350 mm and fill weights (additional loads) of up to 600 kg/m.

- Corrosion free and UV resistant
- Strong and maintenance free
- Easy to install and long service life



Page **08 | 09**



e-chainsystems®

Cables acc. to "DNV-GL" and mud resistant acc. to NEK 606

The certification of 348 chainflex® cable types with the DNV-GL seal of approval provides further evidence of their high quality for the offshore and cargo ship sectors. With 3,942 certified cable types, we offer more approvals and certificates for e-chain® cables than any other provider. Our chainflex® cables are now also CTP and EAC-certified for the Russian, Belarusian and Kazakh markets! These certificates replace the former GOST certificates.

- Resistant against dirt, mud, oil, sea water and UV
- Highly flexible even at low temperatures (-40°C)
- For the highest demands inside energy chains®

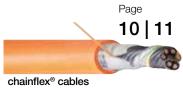
www.igus.eu/chainflex

Dirt resistant and corrosion-free polymer bearings

Dry running polymer bearings and linear bearings for high loads of up to 150 MPa and use in dirty environments.

- Lubrication-free and dirt resistant
- Low wear even with high loads
- Maintenance free and cost effective
- Also available as a stainless-steel version (drylin[®] linear bearings)

www.igus.eu/iglidur







iglidur® drylin® polymer bearings linear technology

chainflex cables ...



A world first: chainflex® cables with DNV-GL certificate

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

A total of 348 chainflex® cables have received DNV-GL certification, making them the world's first cables especially designed for energy chains® on ships and in offshore applications. This new test standard for the certificate has been jointly developed by igus® GmbH and the classification association DNV-GL (Det Norske Veritas and Germanische Lloyd). chainflex® cables certified with this certificate can be used on ships and for offshore applications without special certification or concession.

The increase in automation of maritime applications in recent years has also increased the demand for energy chain systems® in this sector. The expertise offered by igus® GmbH, which has almost 25 years experience of design, manufacture and testing in this area, has been used to help develop a testing procedure for guaranteeing the reliability of chainflex® cables on ships and in offshore applications. In creating this procedure,

the two partners used igus® internal standards as a basis for guaranteeing the service life of the cables in moving applications. Consideration was also given to the standard type approval tests used by DNV-GL, which are based on international tests and standards.

DNV-GL

DNV-GL certificate

Certified according to DNV-GL classification



NEK 606 - MUD resistance

NEK 606 is an norwegian standard for all cables which are in use in offshore applications. Our PUR outer jackets of 14 selected cables according to the requirements of the MUD oil-test of NEK 606.

... with DNV-GL approval

chainflex® cables

The igus chainflex® range has been and continues to be specially developed, manufactured and tested for e-chains® with a guaranteed service life. More than 1,040 types are available from stock.

- DNV-GL approval
- Mud resistant acc. to NEK 606
- For outdoor applications
- Special design to combat cable breakage,
- Perfect for use with e-chains[®]



www.chainflex.eu



In the field





Tested!

In the largest lab of its kind, igus® Cologne

1,750 m² lab ... more than 700 cable tests ... 2 billion test cycles ... reliability through practical experience ...

By conducting over 2 billion test cycles per year in igus®'s own test lab (1,750 m²) we have gained a unique level of knowledge of cables in the area of e-chains®.

For example: cold test

Objective: To determine the maximum service life of igus[®] chainflex[®]

TPE cables at temperatures of -40 °C.

Test setup: An igus[®] CF35 TPE cable was moved in an e-chain[®] in the

igus® climate container at a travel of 7 m and a speed of

1.5 m/s at -40°C.

Results: The test was ended after 3.7 million double strokes. The

cable exhibits little/or no wear and is fully functional.







348 chainflex cables ...

IGUS" CHADIFLEX" CF77.UL.D.

IGUS" CHAINFLEK" CF78.UL

IRUS" CHAINFLEX CFYLL

SSUS" CHASHFLEX" CFIRUR.

IGUS" CHAINFLEH" CF240 PUR

INTERNATION OF COMMERCE

IGUS" CHACHFLOY CFBUS

The certification of 348 chainflex® cable types with the Germanischer Lloyd seal of approval provides further evidence of their high quality – including in the offshore and ship sectors.



chainflex® CF77.UL.D - PUR control cable for heavy duty use, oil and coolant-resistant, flame-retardant, notch-resistant. PVC/halogen-free, min, bending radius 6.8-7.5 x cable-Ø ** www.igus.eu/CF77ULD



chainflex® CF78.UL – PUR control cable for heavy duty use, shielded, oil and coolant-resistant, flame-retardant, notch-resistant, PVC/halogen-free, min. bending radius 6.8-7.5 x cable-Ø **www.igus.eu/CF78UL



chainflex® CF9.UL – TPE control cable for extremely heavy duty use, oil and biooil-resistant, PVC/halogen-free, low temperature flexible, min. bending radius 5 x cable-Ø



chainflex® CF10.UL - TPE control cable for extremely heavy duty use, shielded, oil and biooil-resistant, PVC/halo-gen-free, low temperature flexible, min. bending radius 5 x cable-Ø www.igus.eu/CF10UL



chainflex® CF240.PUR – PUR data cable for heavy duty use, overall shielded, oil and coolant-resistant, flame-retardant, PVC/halogen-free, min. bending radius 10-12 x cable-Ø www.igus.eu/CF240PUR



chainflex® CFBUS.PUR - PUR Profibus cable heavy duty use, overall shielded, oil and biooil-resistant, flame-retardant, min. bending radius 10-12.5 x cable-Ø



chainflex® CFBUS - TPE bus cable for extremely heavy-duty use, overall shielded, oil and biooil-resistant, flame-retardant, min. bending radius 10-12.5 x cable-Ø www.igus.eu/CFBUS

... with GL approval



chainflex® CF111.D - PUR system cable for medium heavy duty use, shielded, oil and coolant-resistant, cut-resistant, flame-retardant, min. bending radius 10 x cable-Ø www.igus.eu/CF111D



33

chainflex® CF113.D – PUR measuring system cable for heavy duty use, shielded, oil and coolant-resistant, flame retardant, PVC/halogen-free, min. bending radius 10 x cable-Ø www.igus.eu/CF113D



chainflex® CF27.D - PUR servo cable for heavy duty use, shielded, oil and coolant-resistant, flame-retardant, PVC/halogen-free, min. bending radius 7.5 x cable-Ø www.igus.eu/CF27D



chainflex® CF34.UL.D - TPE motor cable for extremely heavy duty use, oil and biooil-resistant, flame-retardant, UV-resistant, min. bending radius 7.5 x cable-Ø www.igus.eu/CF34ULD



flame-retardant, UV-resistant, min. bending radius 7.5 x cable-Ø www.igus.eu/CF35UL



chainflex® CF34.UL.D - TPE motor cable for extremely heavy duty use, oil and biooil-resistant, flame-retardant, UV-resistant, min. bending radius 7.5 x cable-Ø www.igus.eu/CF300ULD

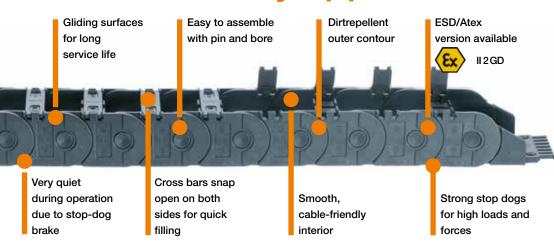


chainflex® CFPE - TPE motor cable for extremely heavy duty use, oil and biooil-resistant, flame-retardant, UV-resistant, min. bending radius 7.5 x cable-Ø www.igus.eu/CFPE



chainflex® CF310.UL - TPE motor cable for extremely heavy duty use, oil and biooil-resistant, flame-retardant, UV-resistant, min. bending radius 7.5 x cable-Ø www.igus.eu/CF310UL

e-chains for any application ...



igus® e-chains® are versatile, available from stock and simple to use.



The versatile one – System E2/000

The E2/000 system symbolises easy and versatile installation combined with ruggedness - high stability combined with lownoise operation, long service life for cables and many mounting options. Mechanical engineers all over the world rely on this range.



The cost-effective and easy-to-fill - easychain®

easychains® are available in two versions. In the "E" version the cable is simply routed from the outside, and in the "Z" version from inside. The shortened installation time is one of the main features of the easychain® e-chains®. Their elastic and rugged material igumid NB offers yet more reasons for application: optimum elasticity, UL94-V2 classification and excellent suitability for clean rooms. Their one-piece design makes the



The small, stable all-rounder chain – System E2.1

Small e-chain® with rugged stop dog system and large bolts for up to 25% longer unsupported length and 100% higher additional loads (compared to identical igus® types). A built-in "brake" minimises impact noise and very smooth contours ensure optimum cable protection. A chain opener (included) saves significant time when opening e-chains®.





easychain® very cost effective.



... and installation methods

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

- Various types of motion
- To carry sensitive bus, data cables and fibre optics cables as well as energy sources such as electricity, gas, air and liquids
- For high dynamic loads and tough service life requirements
- For all environments
- Compact installation
- High acceleration and speeds can be achieved
- Simple modular assembly on site, as well as quick retrofitting of cables



Save time and money by and using e-chains® and e-chainsystems®!

- Innovative products that can be assembled quickly
- Delivered straight from stock reducing your storage costs
- Large range of products find the right solution immediately
- Supply of entire systems, including assembly and turn-key installation
- Swift project planning and consulting with an ever-growing network of local sales engineers in Germany and worldwide





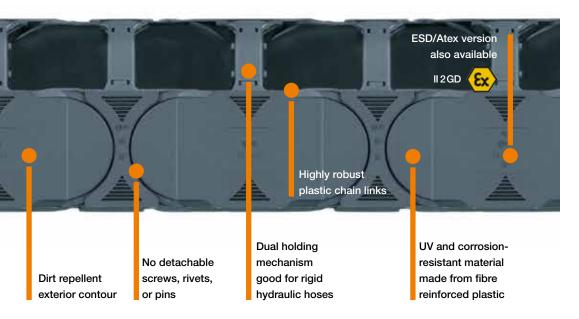








... Robust, low maintenance ...



igus[®] e-chains[®]: robust, modular, corrosion free and easy to install.



The Allrounder – System E4.1

The E4.1 system is the toughest igus® e-chain® range. With the igus® E4.1 system, the service life of your application can be extended and costs lowered.



Heavy duty – System E4/4

igus® "heavy duty" e-chains® are especially developed for the highest demands and harshest environments.



High speed and long travel – System P4

igus® P4 rol e-chains® for long travels of up to 600 m and speeds of up to 10 m/s. By "rolling" instead of "gliding" the drive output can be reduced by up to 57%.



36





... assembly-friendly

e-chains® - designed to guide and protect.

e-chainsystems® - the "umbilical cord" of modern machines. They reduce downtime and increase the service lives of cables and hoses. Plastic energy chains® have been developed, produced and tested by igus® since 1971. e-chainsystems® carry sensitive bus, data and fiber optic cables, as well as energy forms such as electricity, gas, air and hydraulics.

- Up to 350 mm inner height / 200-1000 mm inner width
- Fill weights up to 600 kg/m
- Travel speeds up to 600 m/min.
- Maintenance free no grease or oil needed to lubricate the joints
- Modular design reduces the assembly time
- Highly resistant to wear, corrosion and sea water
- Easy to lengthen and shorten
- Plastic material reduces noise
- Electrically insulating



Tested!

In the largest lab of its kind, igus® Cologne



Vibration test

Objective: To test the service life of an e-chain® subject to strong

vibrations, as the existing became unstable due to screws

coming loose

Test setup: An upright igus® E4 e-chain® was exposed to direct vibration

(comparable to a rock drilling machine).

Result: No damage to the connections on the e-chain® links.

No individual parts were lost.

In the field

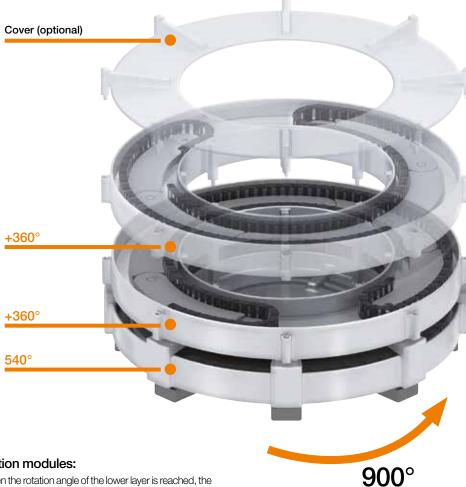








... High stacking ...



Rotation modules:

- When the rotation angle of the lower layer is reached, the next upper module is carried along automatically due to an integrated anchorage system.
- The construction minimizes potential interferences. The Multi Rotation Module system is ideal for rotary applications, heavy loads and for tough environments.
- The e-chain[®] can also guide hoses for air, gas or fluids, as well as bus and fibre optic cables.
- Even for harsh environmental conditions.

... large rotation

Realize circular motions up to 900° and more, even for high loads, using igus® rotation modules

With the rotation module you can implement larger angles of rotation of 900° and more. Thanks to addon modules the angles of rotation can be extended virtually indefinitely. The rotation and add-on modules are ideally suited for rotary motions with high fill weights and limited space

- Several individual systems are stacked on each other and thus are combined to a complete system.
- The maximum rotation of the individual levels can be easily added, thereby enabling rotary motions up to 900 degrees and more
- Compact design enables the application even in limited space
- Extendable as required
- High fill weights possible
- Chains can be freely assembled
- Peripheral speeds up to 1 m/s



In the field







In the largest lab of its kind, igus® Cologne

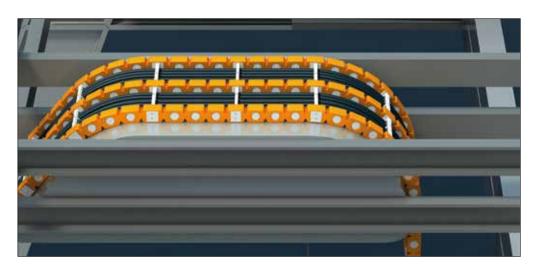


igus® RBR rotation modules tested in the igus® lab.





Supply energy ...



... to sea bed



Supply energy to the sea bed

Heavy duty energy feed to the sea bed. e-chain® for enormously high loads under hanging use up to 200m long. Very flexible and adaptable, so that even large hoses and cables can be reliably guided.

- For very high tensile forces
- Hanging applications up to 200 m length
- Very resistant against dirt, mud and sea water
- Very flexible and adaptable
- For underwater applications







In the large igus® lab in Cologne

Study: Under water energy supply

Offshore wind farms pose particular challenges with regard to cable management. Drilling work has to be carried out under water for the pylons on wind turbines. Heavy duty energy supply systems are necessary to withstand the difficult environmental conditions and the huge tensile forces when freely suspended over long lengths. The specially developed, environmentally-resistant and flexible offshore e-chain® from igus® guides even cables with large diameters safely. The heavy duty



wire holds the weight of the system. Intensive tests in the igus® laboratory have proven the extraordinary load capacity of the offshore chain.

www.igus.eu/offshore-chain

Corrosion-free ... high loads ...

From a wide range of lubrication-free dry-tech® solutions a selection for the offshore industry.

iglidur® bearings are corrosion, maintenance and lubrication-free.

- More than 45 materials available from stock
- Online lifetime calculator and product finder to find the right solution for every application
- Types: bearing with flange or thrust washers
- Dimensions from Ø 3 195 mm

igus® has developed a combination of stainless steel and lubrication-free tribo-polymers especially for the offshore industry.

drylin® SHT

linear tables

- All steel components are entirely corrosion-free
- Use of 1,4571 and 1,4301 stainless steel
- Resistant to sea water and chemicals.
- Ready-to-fit solutions from stock
- iglidur® J bearings for under water use



www.igus.eu/drylin



www.igus.eu/iglidur



iglidur® H370 for underwater use.



ialidur® J low wear.



drvlin® R round linear guidance systems.



drvlin® W linear guidance systems.



ialidur® X ialidur® H for high highly environmentally resistant. temperatures.



ialidur® TX1 high loads, seawater resistant.

... maintenance free

dry-tech®: Improve technology without lubrication

igus® dry-tech® bearings are an alternative to plain and roller bearings with lubrication. igus® develops tribopolymers for dry-running bearings. By avoiding lubrication, dry-tech® polymer technology attains superior service life: from -100°C up to +250°C at continuous exposure – from cleanroom environments to extreme dirt exposure, from vacuums to extreme humidity. dry-tech® bearing technology for:

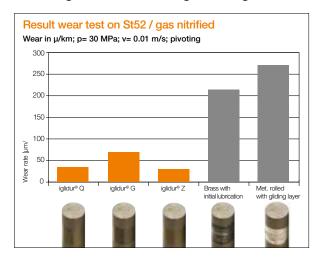
- Lubricant-free applications for a long service life
- Extreme environmental conditions
- Lowest possible friction and wear values in continuous and intermittent



www.igus.eu/drytech

Tested!

In the largest lab of its kind, igus® Cologne



Test: "swivel test"

Result:

Objective: To test the wear of iglidur® plastic plain bearings compared

to metallic plain bearings

Test setup: Swivel test on a shaft with a weight of 1,200 kg.

The figure to the right illustrates the concept

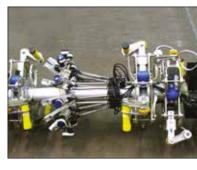
All tested iglidur® materials exhibit significantly lower wear than the metal plain bearings. The shafts of the metal plain bearings exhibit significant wear and are

therefore unsuitable for further use.

In the field



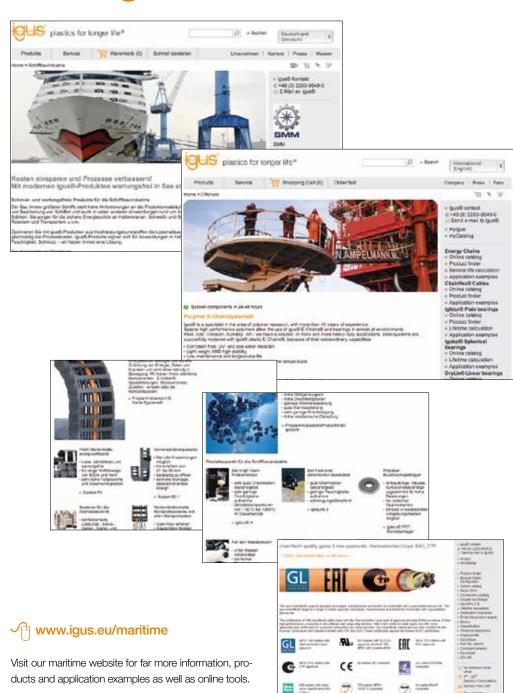


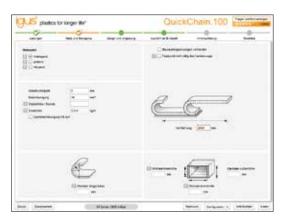






www.igus.eu/maritime



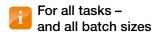


www.igus.eu/quickchain100

Expert for designing and calculating systems for travels of up to 100 m

Simply enter your application's parameters into the e-chain® expert and this will propose a suitable solution.

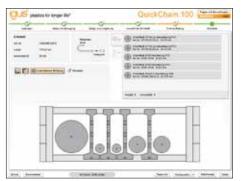
A wide range of other online tools, such as configurators, service life calculators, and product finders, can be found at \(\frac{1}{2} \) www.igus.eu/online



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

www.igus.eu/industries





Research and development



Better products for less - a key element is the industry's largest test lab. 1,750 m² lab, more than 15,000 tests and 2 billion test strokes per year.

The igus[®] lab and field experience

Cutting costs while also guaranteeing maximum process reliability - with intensive research and testing can this be achieved.

The industry's largest test lab conducts more than two billion test cycles per year on a total of 107 test





Tribological tests in the plain bearings laboratory, igus® Cologne.

15,000 tests per year



igus® quality assurance

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



Better for the environment

Because iglidur® does not require lubricants, no contaminants are released into the environment. Even the low weight of iglidur polymer plain bearings make them ecologically valuable.













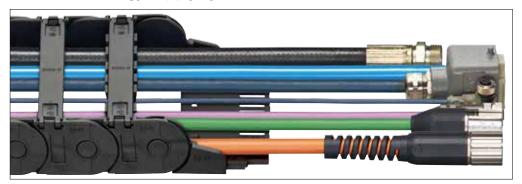
Extensive test database

What is probably the world's largest database was created from more than 15,000 tests.

This database gives us the ablity to select the right product for your specific application.

igus® services

Assembled energy supply systems and cables with connectors



readychain®

Fully assembled systems in 3-10 days, 700 systems per week in 11 readychain® factories worldwide – optimised assembly time and better 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 machine downtime
- System guarantee depending on the application



readycable®

igus® provides more than 2,830 harnessed cables for drive technology pursuant to 20 different manufacturer standards. Professionally produced, 100% tested.

- Servo, motor and signal/encoder cables
- No cutting charges, no surcharges for small quantities and packaging
- Cable length accurate to the centimetre per customer specifications
- Smallest bending radii from 7.5 x d
- Reduce storage costs and increase cashflow
- Ex stock in 24-48 hrs

www.igus.eu/readycable

The igus® assembly service

Ensure error-free installation and avoid downtime and additional costs – with the igus® e-chainsystem® assembly service

- Products and services from a single source with low logistics costs for you
- igus® system guarantee, customised for each application





... from 24 hours

igus® delivery service - quick & reliable



From 24 hrs or same day*

All catalogue parts and individual components for example: one e-chain® link, 6 metre e-chain®, 3 strain reliefs, one iglidur® Q2 plain bearing, one drylin® linear plain bearing

24 - 48 hrs*

Customised systems

for example: 11.46 m e-chain® with interior separation, guide rails, mounting brackets; 2.46 m drylin® profile rail with 2 carriages

3-5 business days

Simple prefabricated systems

for example: simple, harnessed e-chainsystems® with filled cables without connectors, lead screw unit based on specific needs

10 business days

Complex systems and machined components

for example: harnessed e-chainsystem® with cables of all types and connectors, interfaces, protrusions, machined shafts according to drawing, or mechanically shortened plain bearings, or tool-based injection-moulded parts

The indicated delivery time specifies the time until the product ships.



motion plastics®

For 50 years, we have been driven by a single vision – motion plastics[®]: innovations from plastics that move machinery.

Our core technology is tribo-polymers – high-performance plastics,

that we optimise for friction and wear. This technology has made us into the world-wide leader for developing and manufacturing energy supply systems and plain bearings.



^{*} Products leave our facility within the indicated time.

igus® addresses ...

igus® distributors

igus® GmbH Spicher Str. 1a D-51147 Cologne P.O.Box 90 61 23 51147 Cologne Phone + 49 2203 9649-0 Fax +49 2203 9649-222 info@igus.de, www.igus.eu

2 Australia

Treotham Automation Pty. Ltd. 14 Sydenham Road Brookvale NSW 2100 Phone +61 2 9907-1788 Fax +61 2 9907-1778

info@treotham.com.au.

igus® polymer Innovationen GmbH Ort 55

4843 Ampflwang Phone +43 7675 4005-0 Fax +43 7675 3203 igus-austria@igus.at

4 Argentina

Borintech SRL Av. Flcano 4971 C1427CIH Buenos Aires Phone +5411 4556 1000 Fax +5411 4556 1000 igus@borintech.com

5 Belarus

SOOO Hennlich Kharkovskaya Str. 90-8 Minsk, 220015 Phone +375 17 207-1828 Fax +375 17 207-392 info@hennlich.by

igus® B.V.B.A. Kolonel Begaultlaan 75 3012 Wilsele Phone +32 16 314431 Fax +32 16 314439

info@iaus.be

igus® do Brasil Ltda. Avenida Marginal Norte da via Anhanguera 53.780 CEP 13206-245 - SP Phone +55 11 3531-4487 +55 11 3531-4488 vendas@igus.com.br

8 Bulgaria

igus® EOOD Lui Ayer str., fl.4, off. 4 1404 Sofia, Bulgariaí Phone +359 2 850 8409 +359 2 850 8409 itraykov@igus.de

8 Bulgaria

Hennlich OOD, BG 4003 Plovdiv, Bulgaria 147A Brezovsko shose Str. Rota center, fl. 3 Phone +359 32 511 326 Fax +359 32 621 929 office@hennlich.bg

igus® Office Canada 201 Millway Ave UNIT 25 Ontario I 4K 5K8 Phone +1 905 7608448 Fax +1 905 7608688

webmaster@igus.com

10 Chile

Vendortec San Martín # 2097 Maipú – Santiago Phone +56 2 7105825 ventas@vendortec.cl

igus® Shanghai Co., Ltd. No.46 Warehouse. 11 Debao Road, WGQ FTZ, Shanghai 200131, P.R.China Shanghai 200131, P.R.C. Phone +86 21 51303100 Fax +86 21 51303200 master@igus.com.cn

12 Colombia

Colsein Ltda Parque Industrial Gran Edificio / Building 32 Tocancipá, CUN 251017 Phone +57-1-519-0967 Iriano@colsein.com.co

13 Costa Rica

Enesa Equipos Neumaticos S.A. Del Colegio Marista 100 este, 200 sur, 25 este Urbanizacion Ciruelas Alaiuela Costa Rica Phone +506 2440-2393 Fax +506 2440-2393 equiposneumaticos@

igus® d.o.o. Ventilatorska 9 10250 Lucko Zagreb Croatia Cell: +385 913 007 233 ibelavic@igus.de

14 Croatia Hennlich, Industrijska

d.o.o. Stupničkoobreška 17 Stupnički Obrež 10255 Gornji Stupnik Phone +385 1 3874334 Fax +385 1 3874336 hennlich@hennlich.hr

15 Czech Republic HENNLICH s.r.o.

Českolipská 9 412 01 Litoměřice Phone e-chains® +420 416 711332 Phone Plain bearings +420 416 711339 +420 416 7119 99 lin-tech@hennlich.cz

16 Denmark

iaus® ApS Postboks 243 8800 Viborg Phone +45 86 603373 Fax +45 86 603273 info@iaus.dk

16 Denmark - e-chains®

Solar A/S Industrievej Vest 43 6600 Vejen Phone +45 76 961200 +45 75 36 47 59 solar@solar.dk

17 Equador

Ecuainsetec El Zurriago E9-32 y el Vengador Quito Phone +593 2 2253757 +593 2 2461833 infouio@ecuainsetec.com.ec

18 Egypt

Fedicom Trading Mohamed Fayed Sami & Co. 12 Fl Mahaad Fl Swissri St Flat 10 – 2nd Floor-Zamalek Cairo - A.R of Egypt Phone +202 27362537 Fax +202 27363196 mohamed.faved@fedicom.com

18 Egypt

IEE International Company for Electrical Engineering 2nd floor, 25 Orabi St Down Town Cairo Phone +202 25767370 Fax +202 25767375 kamel@iee-egypt.com

iaus® OÜ Lõõtsa 4A Tallinn 11415 Phone +372 667 5600 Fax +372 667 5601 i estonia e@igus.de

20 Finland

SKS Mekaniikka Ov Martinkvläntie 50 01720 Vantaa Phone +358 20 7646522 Fax +358 20 7646824 mekaniikka@sks fi

20 Finland - chainflex®

SKS Automaatio Ov Martinkyläntie 50 01720 Vantaa Phone +358 20 7646748 automaatio@sks.fi

igus® SARL 9, avenue des Pépinières Parc Médicis 94260 Fresnes Phone +33 1 49840404 Fax +33 1 49840394 info@igus.fr

22 Greece -

Chrismotor s.a. 71. Sp. Patsi str. 118 55 Athens Phone +30 210 34 25574 Fax +30 210 3425595

info@chrismotor.gr

22 Greece -

Plain bearings J. & E. Papadopoulos S.A. 12 Polidefkous str Piraeus, 185 40 Phone +30 210 4113133 +30 210 4116781 sales@papadopoulos-sa.com

23 Hong Kong

Sky Top Enterprises Ltd. Room 1707, Block C; Wah Tat Ind Centre; Wah Sing Street; Kwai Chung; Hong Kong Phone +852 22434278 Fax +852 22434279 skytop@ctimail.com

igus® Hungária Kft. Inari Park u.10. 1044 Budanest Phone +36 1 3066486 Fax +36 1 4310374 info@iaus.hu

24 Hungary Tech-Con Kft.

Véső utca 9-11 1133 Budapest Phone +36 1 4124161 Fax +36 1 412 4171 tech-con@tech-con.hu

igus® (India) Pvt. Ltd. 36/1, Sy No. 17/3 Furo School Boad Dodda Nekkundi Industrial Area, - 2nd Stage Mahadevanura Post Bangalore 560048 Phone +91-80-45127800 Fax +91-80-45127802 info@igus.in

PT igus® Indonesia German Centre Suite 6040-6050 Jalan Kapten Subijanto Di. RSD City Tangerang 15321 Phone +62 21 537 61 83 / 84 info@igus.co.id

27 Iran

Tameen Ehtiajat Fani Tehran (TAF CO.) 62, Iranshar Ave., Unit 5 15816 Tehran, Iran Phone +98-21-8831 78 51,2 Fax +98-21-8882 02 68

info@taf-co.com

igus® Ireland Caswell Rd Northampton NN4 7PW Phone +44-1604 677240 Fax +44-1604 677242 sales@igus.ie

29 Israel

Conlog LTD P.O. Box 3265 17 Hamefalssim Str Industrial Zone Kiryat Arie Petach-Tikva 49130 Phone +972 3 9269595 +972 3 9233367 conloa@conloa.co.il

igus® S.r.l. Via delle Rovedine, 4 23899 Robbiate (LC) Phone +39 0395906.1 +39 0395906.222 igusitalia@igus.it

igus® k.k. Arcacentral 15F, 1-2-1 Kinshi, Sumida-ku Tokyo JAPAN Zip 130-0013 Phone +81 358 192030 Fax +81 358 192055 info@igus.co.jp

32 Jordania

Al Hezam Adtech Abu Alanda Street ,Building No. 1 Amman Phone +962 64 170100 Fax: +962 64 169993 info iod@adtech-trading.com

33 Latvia INPAP Katrinas Str 16 Phone +371 7509404 +371 7509403 office@inpap.lv

34 Lebanon

Mecanix Shops Gebran Safi Charles Helou Phone +961 1 486701 Fax mecanix@dm.net.lb

35 Lithuania Hitech UAB

Terminalo g. 3 54469 Biruliskiu k. Kauno raj. Phone +371 67509404 +371 67509403 info@hitech.lt

36 Macedonia, Albania, Kosovo

Hennlich DOOFI Boris Kidric 88 zip: 1200, Tetovo MK Phone +389 44614411 Moh +389 76 200 770 dritan gamili@hennlich mk

igus® Malaysia Sdn Bhd No. 19-1, Jalan PJU 1/3F Sunway Mas Commercial 47301 Petaling Jaya Selangor D.F. Phone +603 7880 5475 Fax +603 7880 5479

info@igus.my 38 Marocco

5. Rue Amir Abdelkader

20300 Casablanca Phone +212 522 633769 Fax +212 522 618351 souria.vu@premium.net.ma

igus® México S. de R.L. de C.V. Boulevad Aeropuerto Miguel Alemán 160 Int. 135 Col. Corredor Industrial Toluca Lerma Lerma Estado de México C.P. 52004 Phone +52 728284 3185 Fax +52 728284 3187 fmarquez@igus.com

igus® B.V. Sterrenbergweg 9 3769 BS Soesterberg Phone +31 346 353932 +31 346 353849 igus.nl@igus.de

40 - Netherlands Plain bearings

Elcee Holland BV Kamerlingh Onnesweg 28 NL-3316 GL Dordrecht Phone +31 78 6544777 Fax +31 78 6544733 info@elcee.nl

41 New Zealand

Automation Equipment Ltd. 26 Tawn Place PO Box 5656 Hamilton Phone +64 7 8490281 Fax +64 7 8492422 sales@autoequip.co.nz

42 Norway

ASI Automatikk AS Ingv. Ludvigsensgate 23 3007 Drammen Phone +47 9006 1100 info@asiflex no

43 Peru

Profaco S.A.C. Calle Bolivar 388/of. 203 Miraflores Lima 18 – Perú Phone +51 1 2414370 Fax +51 1 2428608 ventas@profaco.com

44 Philippines

Silicon Exponents Corp. Suite 6A, 8414 Dr. A. Santos Ave., Sucat, 1700 Paranague Metro Manila Phone +63 2 8250126 Fax +63 2 8250141 info philippines@igus.com.sg

iaus® Sp. z o.o. . Nakielska 3 01-106 Warszawa Phone +48 22 8635770 Fax +48-22 8636169 info@iaus.pl

47 Romania

TechCon Industry SRL Calea Crangasi nr. 60 060346 Bucuresti Phone +40 21 2219-640 Fax +40 21 2219-766 automatizari@meteor.ro

47 Romania

Hennlich SRL Str. Patria, Nr17 310106 Arad Phone +40 257 211119 +40 257 211021 igus@hennlich.ro

000 iaus® 1-st Lesnie Polvany str. 263/1 Gazoprovod Sosenskoe 142704 Moscow info@iaus.ru

48 Russia

000 Hennlich Ozernaja 16 building 1, office 4 170008 Tver Phone +7 4822630-180 Fax +7 4822630-180

hennlich@hennlich.ru

48 Russia 000 Barti Ul.Kustodiewa 19 194352 St.-Petersburg Phone +7-812-972-4914 +7-812-973-8849 +7-812-448-3828

bartix.info@gmail.com

48 Russia 000 Eka-Service Kompani 1-aja Dubrowskaja, 2A, k. 35 109044 Moscow Phone +7 495 6326623 Fax +7 495 6771778 zakaz@ekaservice.ru

49 Saudi Arabia

Khalaf Bin Hesham Street Box 9998 31423 Dammarr Phone +966 38740033 Fax +966 38470077 marketing@afi.com.sa

50 Serbia + Montenegro

Hennlich doo Beograd Radomira Markovica 1/3 11222 Beograd / Srbija Phone: +381 11 63 098 17 Fax: +381 11 63 098 20 Mob.: +381 65 58 81 551 office@hennlich.rs

igus® Singapore Pte Ltd 15 Shaw Road, #03-02 Singapore 367953 Phone +65 6487-1411 +65-6487-1511 info@igus.com.sg

igus® Slovakia s.r.o. Fatranská 3 949 01 Nitra Slovakia Mobile: +421 949 459 409 mkretter@igus.de

52 Slovakia

Hennlich s.r.o. Miletičova 16 SK-821 08 Bratislava Phone +421 2 50202504 Fax +421 2 50202520 technik@hennlich.sk

igus® d.o.o. Tržaška c. 134 1000 Ljubljana Slovenija Mobile: +386 (0)30 601 610 ksobak@igus.de 53 Slovenia

Hennlich, d.o.o. Industriiska tehnika Podpart 33 SI-4244 Podnart Phone +386 4 53206-10 Fax +386 4 53206-20 info@hennlich.si

igus® Pty. Ltd. Unit 29 Midline Business Park Cnr Le Roux & Richards Drive Midrand 1682 Phone +27 11312-1848 Fax +27 11312-1594 sales.sa@igus.de

igus® Korea Co. Ltd. 613-14 Namchondong, Namdonggu Incheon City, 405-300 Phone +82 32 82129-11 Fax +82 32 82129-13 info@igus.kr

igus® S.L. C/ Llohatona 6 Polígono Noi del Sucre 08840 Viladecans - BCN Phone +34 936 473950 igus.es@igus.es

igus® ab Knut Påls väg 8 256 69 Helsingborg Phone +46 42 329270 +46 42 211585 info@igusab.se

57 Sweden - e-chains®

OEM Automatic AB Box 1011 Dalagatan 4 573 28 Tranås Phone +46 75 2424100 Fax +46 75 2424159 info@aut.oem.se

57 Sweden -Plain bearings

Colly Components AB 164 94 Kista Phone +46 8 7030100 Fax +46.8 7039841 info@me.colly.se

igus® Schweiz GmbH 4622 Egerkingen Phone +41 62 3889797 Fax +41 62 3889799 info@igus.ch

59 Syria

ETTA Systems Al-Hamra St. Shalan Building 12850 Damascus Phone +96 311 332 5519 Fax: +96 311 334 2639 info@ettasystems.com

igus® Taiwan Company Ltd. 5F. No. 35, 24th Road Taichung Industrial Park Taichung 40850 Phone +886 4 2358-1000 Fax +886 4 2358-1100 info@igus.com.tw

igus® Thailand Co., Ltd 10 Floor Unit C1 Thanapoom Tower 1550 New Petchaburi Road Makkasan Ratthawi Bangkok 10400 Thailand Phone/Fax +66 (0)2 652 7325 info@iaus.co.th

61 Thailand

Autoflexible Advanced Engineering Co., Ltd. 111 Soi. Sukhumvit 62/1 Sukhumvit Rd, Bangjak, Phakanong, Bangkok 10260 Phone +66 2 3112111

62 Tunesia

00

BOUDRANT 53, Avenue de Carthage 1000 Tunis – Tunisia Phone +216 71340244 Fax +216 71348910 info@boudrant.com.tn

63 Turkey

HIDREL Hidrolik Elemanlar Sanayi ve Ticaret A.S. Percemli Sk. No. 7 Tünel Mevkii 34420 Karaköy / Istanbul Phone +90 212 2494881 +90 212 2920850

info@hidrel.com.tr 64 United Arab Emirates

Unigroup (FZE) 1st floor Rasana Building M602 Shariah Intern Airnort Freezone Shariah - LIAF Phone +971 6 5578386 +971 6 5578387

automation@unigroup ae 64 United Arab Emirates Power & Technology Trading

Co. L.L.C P.O. Box 33372 SH.I Shariah - UAE Phone +971 6 5421300 Fax +971 6 5423700 sales@powertech.ae

igus® Caswell Rd Northampton NN4 7PW Phone +44 1604 677240 Fax +44 1604 677242 sales@igus.co.uk

66 Ukraine

Cominpro Ltd. Romena Rollana 12, Office 220 61058 Kharkov Phone +38 0577174914 Fax +38 0577174914 cominpro@amail.com

66 Ukraine

Hennlich Ukraine LLC (HQ) Kramatorska Street 15 84100 Slovyansk City, Donetsky Region Phone +38 06262 33540 hennlich@hennlich.com.ua

67 Uruguay

Larrique Rulemanes SA Galicia 1204 Montevideo-Uruguay Phone +598 29021773 Fax +598-29084824 larrique@larrique.com.uv

igus[®] inc. 50 N. Broadway P.O. Box 14349 East Providence, RI 02914 Phone +1 401 4382200 Fax +1 401 4387270

webmaster@igus.com

69 Venezuela Neumatica Rotonda C.A. Prolong Av. Michelena C.C. Atlas Locales B-10

Valencia, Edo. Carabobo Phone +58 241 832.64.64 +58 241 832.32.50 +58 241 838.88.19 +58 241 832.62.83 ventas@neumaticar.com

igus® Singapore Pte Ltd The Representative Office in HCMC Centec Tower Unit 028, 4th Floor 72-74 Nguyen Thi Minh Khai Street, District 3, Ho Chi Minh City, Vietnam

Phone +84 8 6299 9197

Fax +84 8 6299 9196

info@igus.vn

... world-wide

51

/9001:2008 /16949:2009

igus[®] is certified for energy chains, cables, and harnessing, as well as plastic plain bearings in acc. with ISO 9001:2008 and ISO/TS 16949:2009.



Spicher Str. 1a 51147 Cologne Germany Phone +49 2203 9649-0 Fax +49 2203 9649-222 info@igus.de www.igus.eu

© 2014 igus GmbH

igus° GmbH

Published by igus® GmbH, Germany MAT0073017.20 Issue 10/2014 Technical changes made without notice

