

igus® the-chain ... moving energy made easy  
...e-chainsystems®...e-chain®...readychain®...chainflex®-cables



# e-chainsystems® for port equipment...





**igus® the-chain ... moving energy made easy**

**More than 4,100 employees worldwide**



# igus® - Headquarter, Cologne Germany

- 36 igus® subsidiaries worldwide (and more to come)
- More than 44 certified igus® distributors around the world





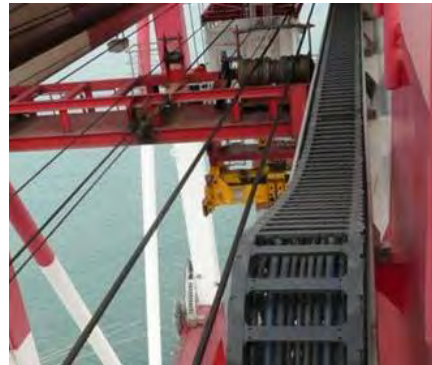
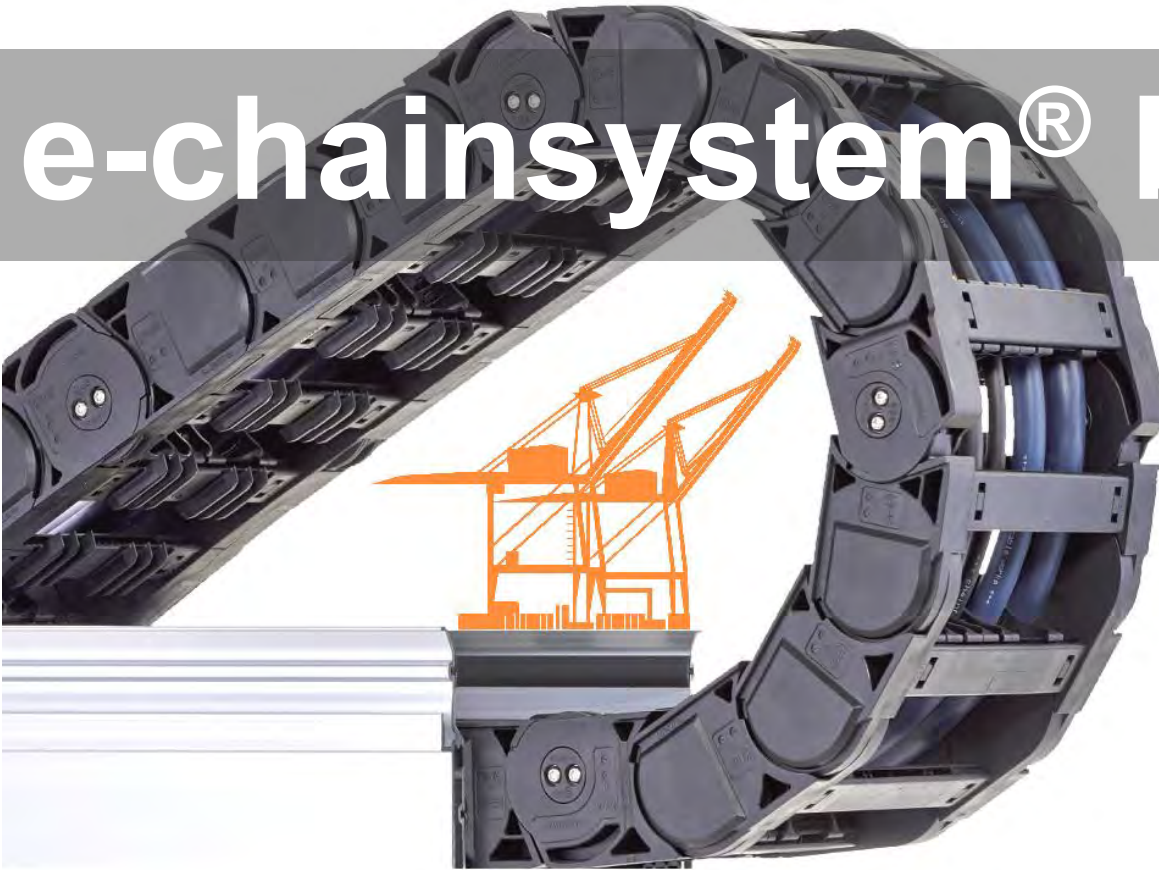
## Worldwide:

- ▶ **More than 9.674\* RTG's / RMG's / ASC's**
- ▶ **More than 2087\* STS**
- ▶ **More than 25.000\* Spreader applications**
- ▶ **More than 70.000\* Indoor-, Gantry-, Bulkhandling-, Shipyard- and Special-cranes**

\* Aug. 2021



# e-chainsystem® benefits





▶ Space saving design

▶ No cable loop station & no loop station

additional steel structure for

e-chainsystem®



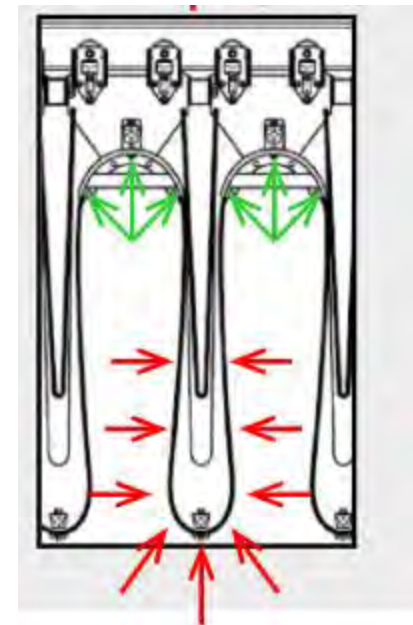
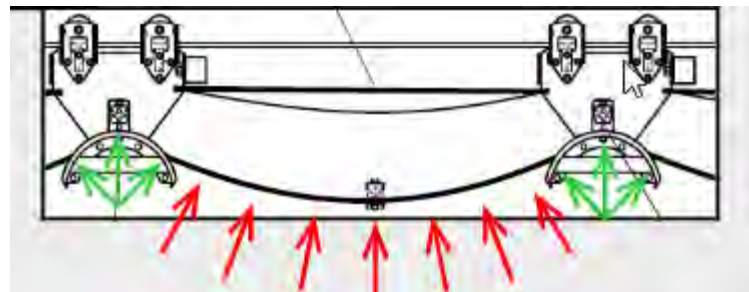
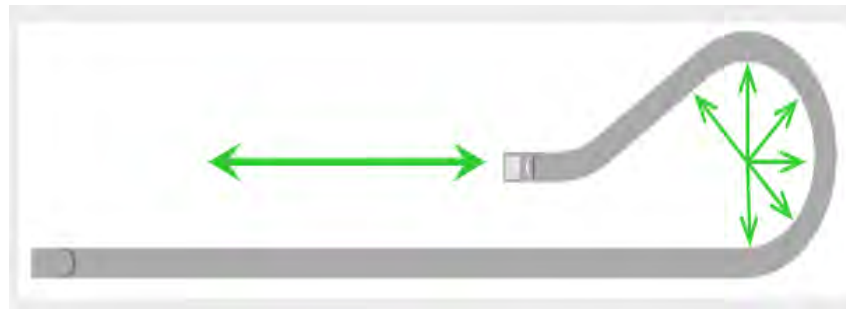
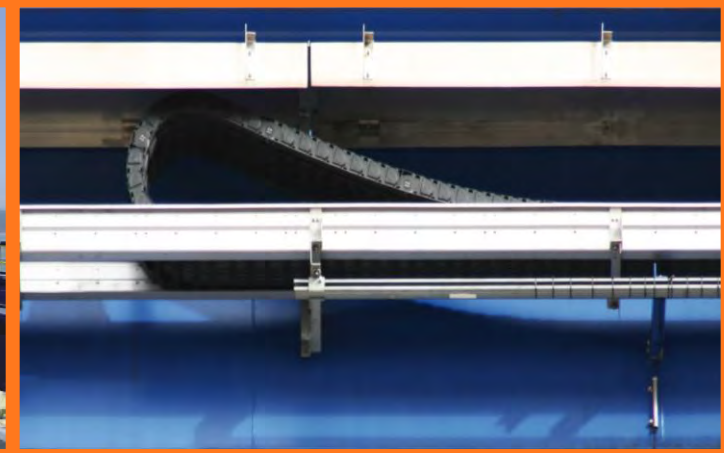
Push-pull force absorbed by e-chain solution. So, no mechanical stress on the cables, thus, extended lifetime of the cables.

No swinging under windy heavy environmental conditions.

Minimize the downtime, no required for continuous scheduled regular maintenance. System is stabilized, no swinging.

No need for bearings, bolts, tension elements maintained monthly.

Recommend only visual inspection twice a year



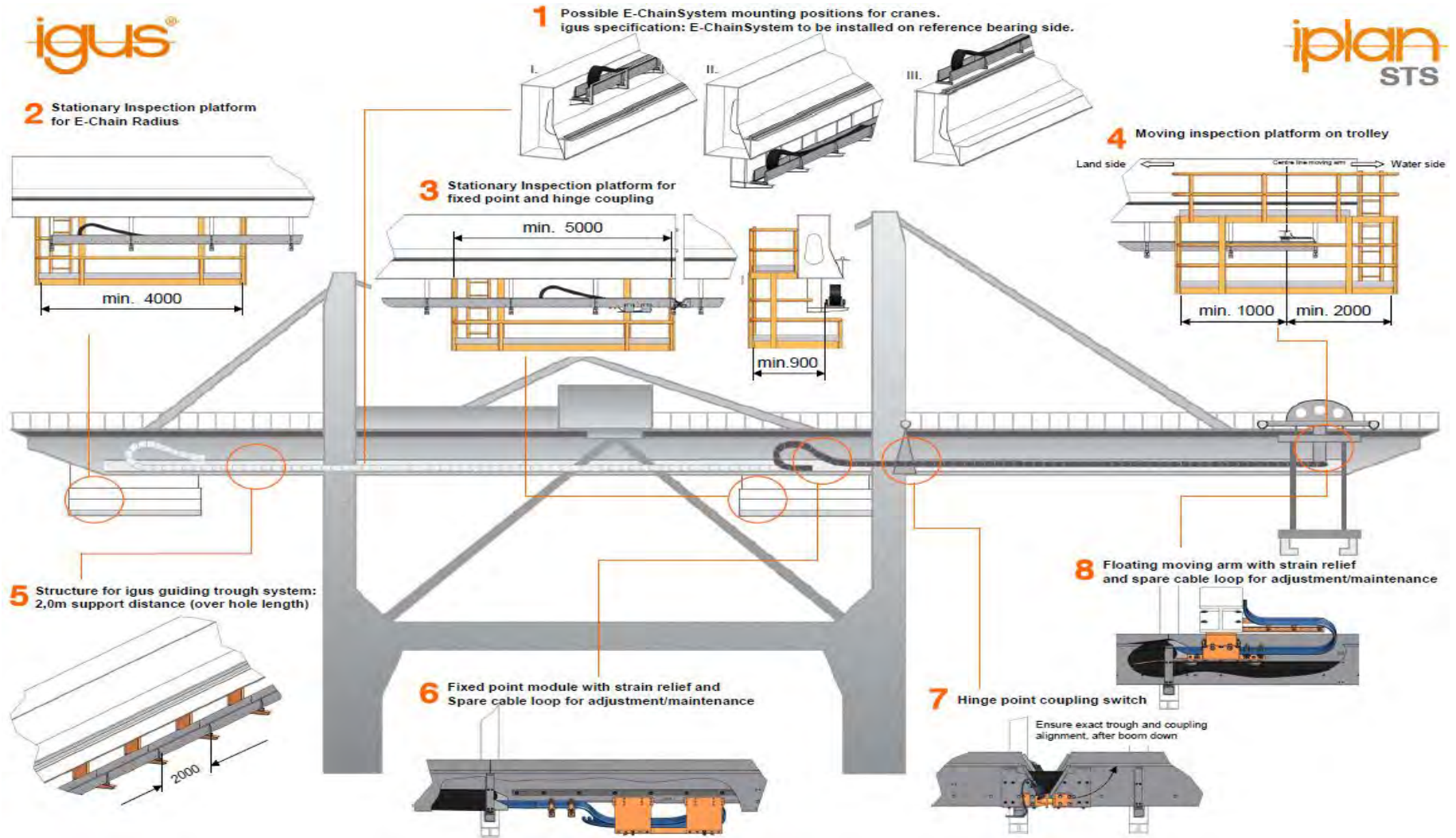


- ▶ No additional drives or control system necessary to move the chain system
- ▶ Synchronous run of trolley and e-chainsystem®
- ▶ All kind of media (power, data, fiber optics, hydraulics, pneumatics, ...) can be conveyed in one system
- ▶ Quick and easy installation of additional cables and hoses
- ▶ igus® field service (inspection, installation, supervisor service)



**inspection, installation & supervisor service**

- ▶ Low maintenance extravagance – less downtime of the crane
- ▶ Wind and weather resistant system



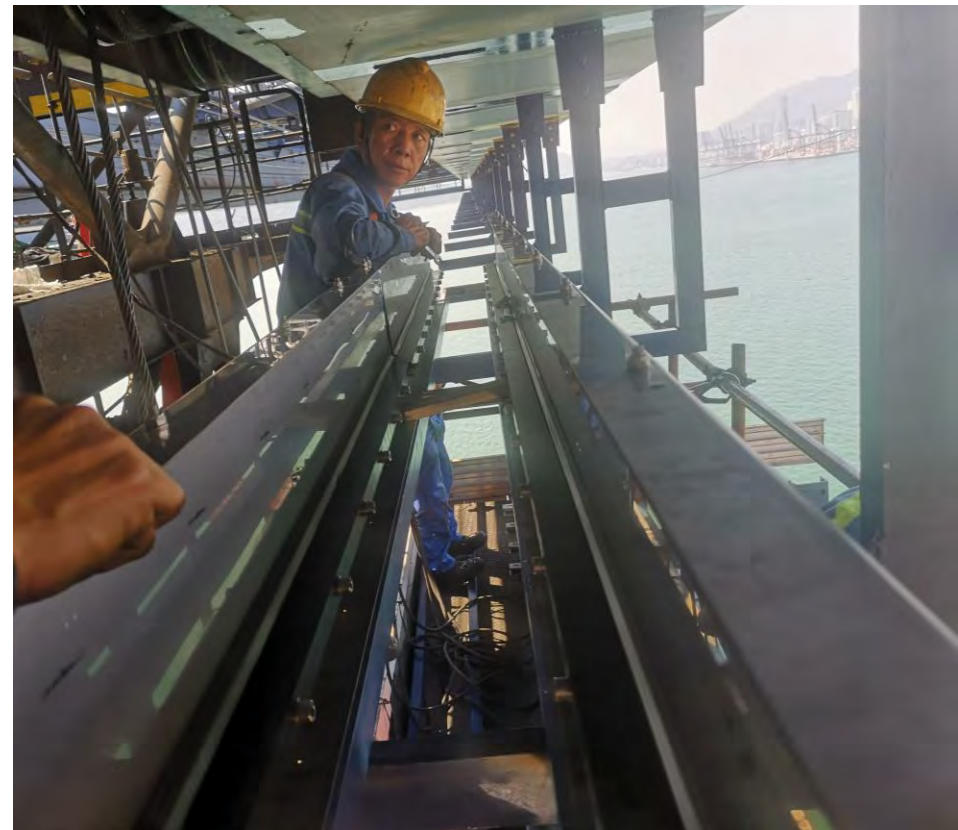


# ... Retrofit STS crane ...

**Before: Festoon System**



**After: igus® e-chain®**



# ... Retrofit RTG crane ...

**Before: Cable Tender System**



**After: igus® e-chain®**





# ... Retrofit RMG crane ...

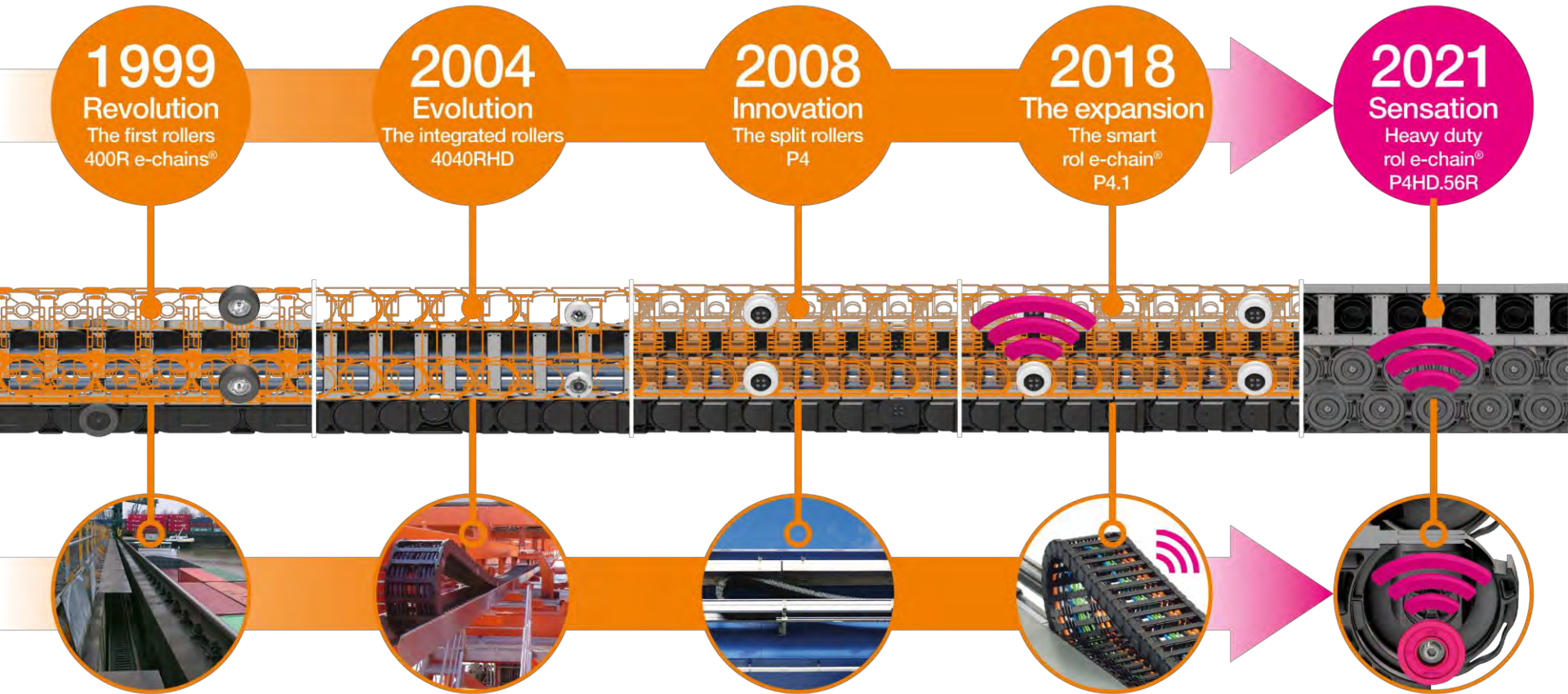
**Before: Festoon System**



**After: igus® e-chain®**



# igus® rol e-chain®





## Technical details

### ▶ Speed up to 600 m/min

The fastest crane with igus® e-chain® is running at 300m/min

### ▶ Acceleration up to 10 m/s<sup>2</sup>

### ▶ Travel length > 900 m

The longest crane application running with igus® e-chain® is 500 m long  
(12 STS, Port of Singapore, 2002-2017)

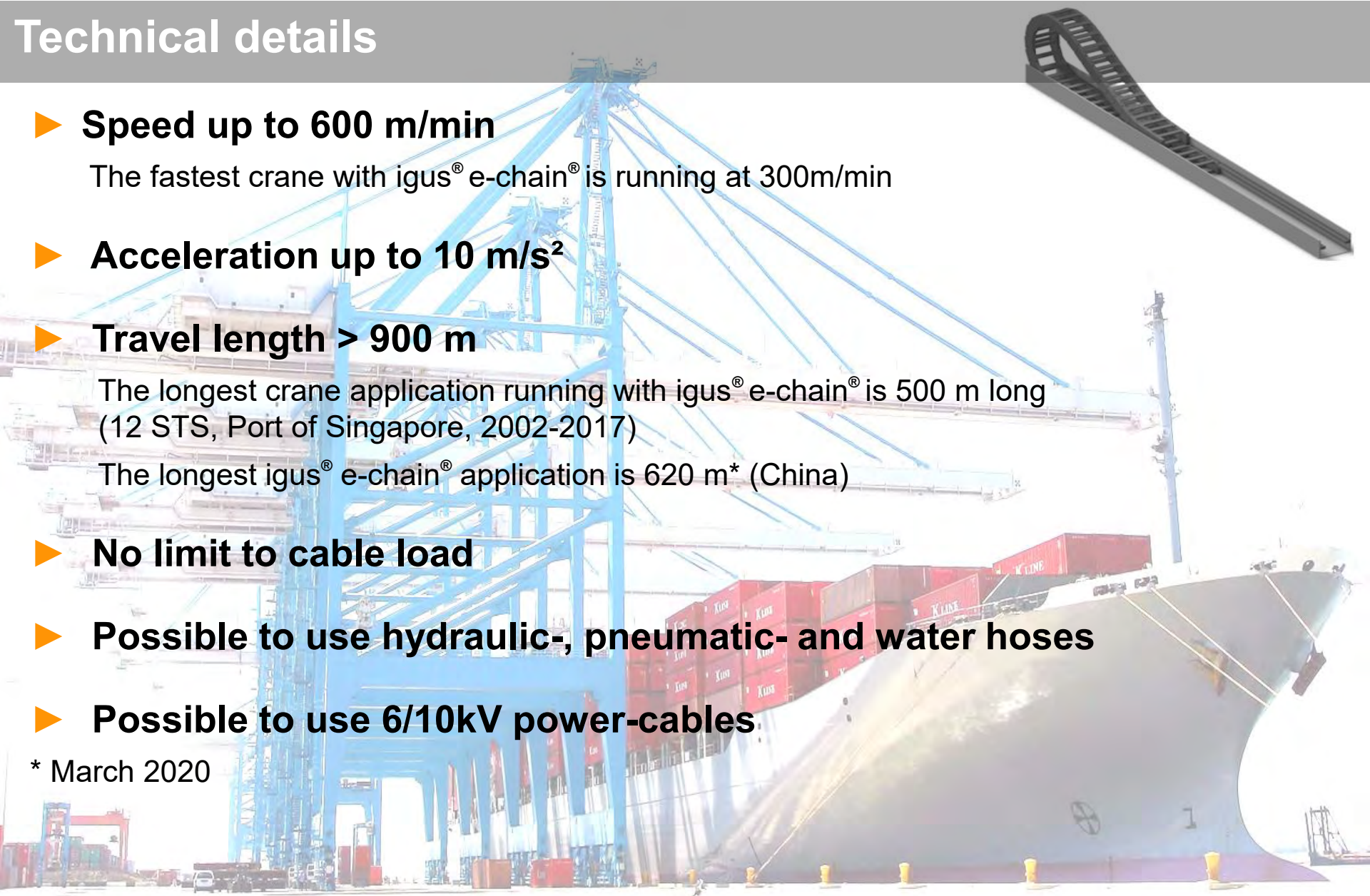
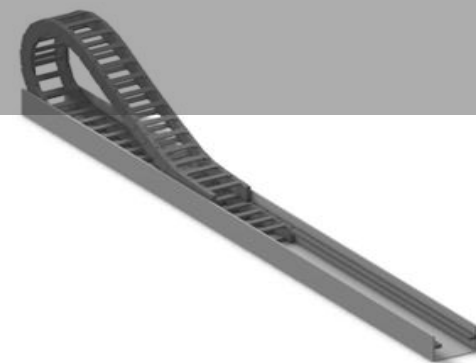
The longest igus® e-chain® application is 620 m\* (China)

### ▶ No limit to cable load

### ▶ Possible to use hydraulic-, pneumatic- and water hoses

### ▶ Possible to use 6/10kV power-cables

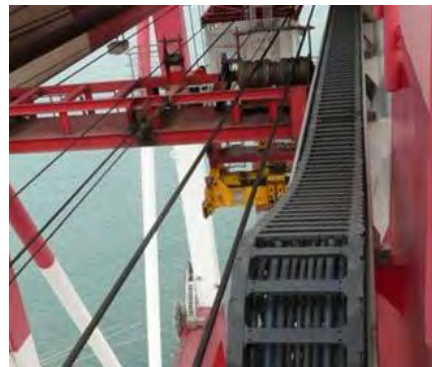
\* March 2020



igus® the-chain ... moving energy made easy  
...e-chainsystems®...e-chain®...readychain®...chainflex®-cables



# e-chains® for cranes & port equipment





## E4.1 e-chain® series

Guarantee  
igus e-chain  
**36**  
months  
up to 36 months guarantee



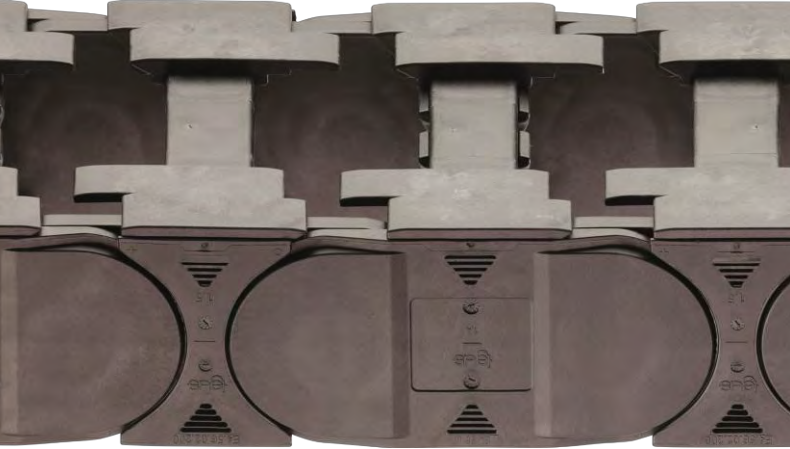
- ▶ Suitable for unsupported & gliding applications
- ▶ Dirt repellant, with smooth, wear-resistant surface
- ▶ High lateral stability



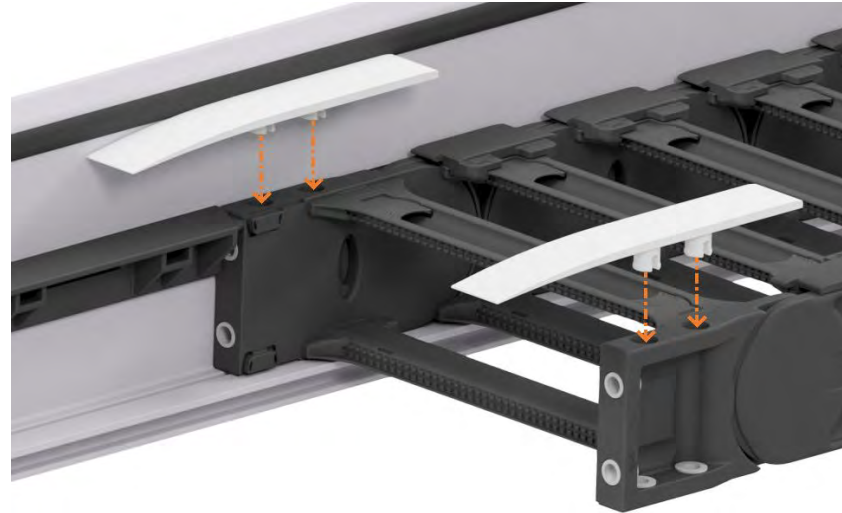
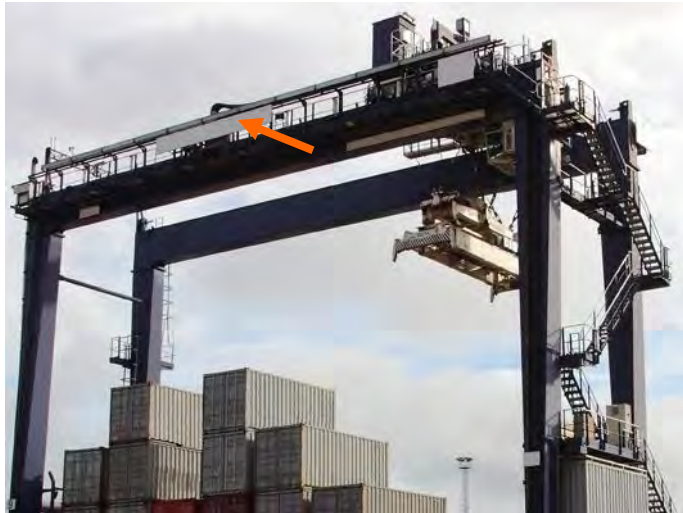
Successfully used on various Reachstacker applications around the world



## Glide shoes for E4.1 e-chain® series



- ▶ Longer e-chain® service life in gliding applications by exchangeable glide shoes
- ▶ Easy to retrofit
- ▶ Especially designed for travel speeds of 1-3 m/s
- ▶ Including fixed end transition unit



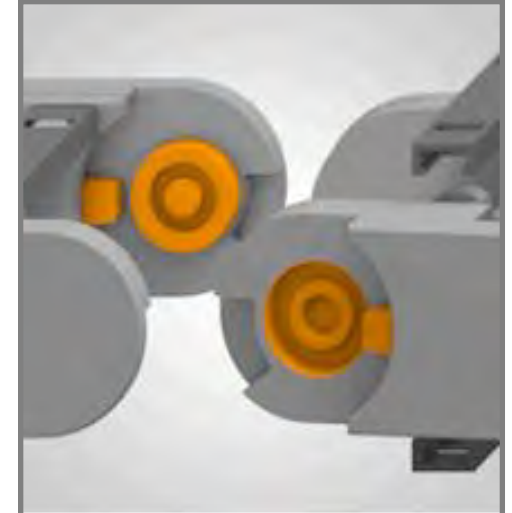
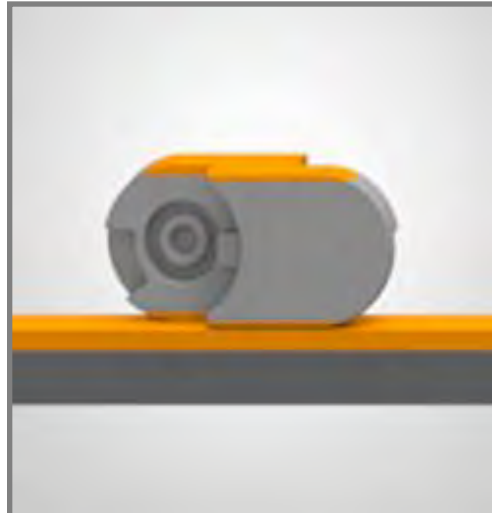
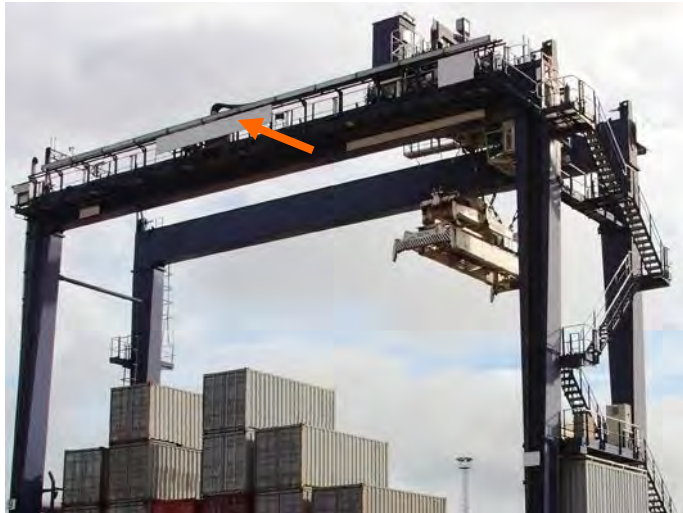


## Heavy Duty e-chain® series – for high additional loads



- ▶ Enlarged gliding surface, less wear
- ▶ Large pin / bore connection surface
- ▶ High tensile stability
- ▶ Robust steel mounting brackets

Successfully used on RTGs around the world



## E4.1R rol-e-chain® series



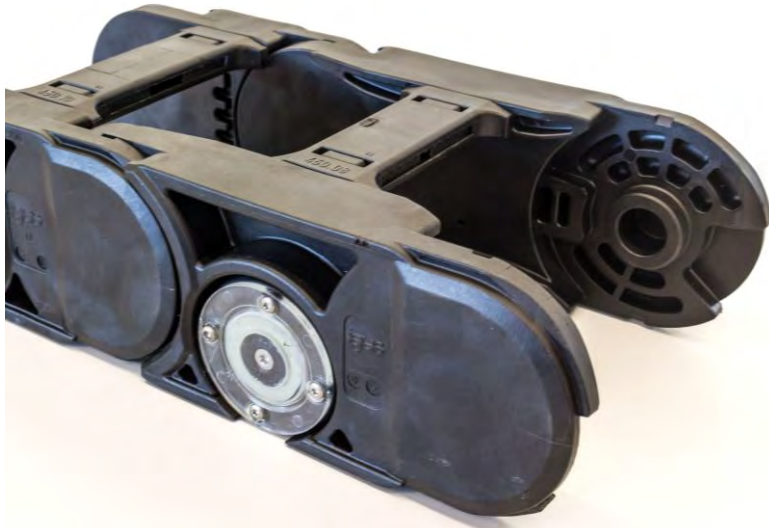
**Over 20 years experience -  
chains with integrated rollers!**

- ▶ Simple conversion from gliding to rolling chain (within the E4.1 series)
- ▶ Quite chain operation as all links have the same pitch length
- ▶ Very small bending radii possible
- ▶ Ideal for longer travels



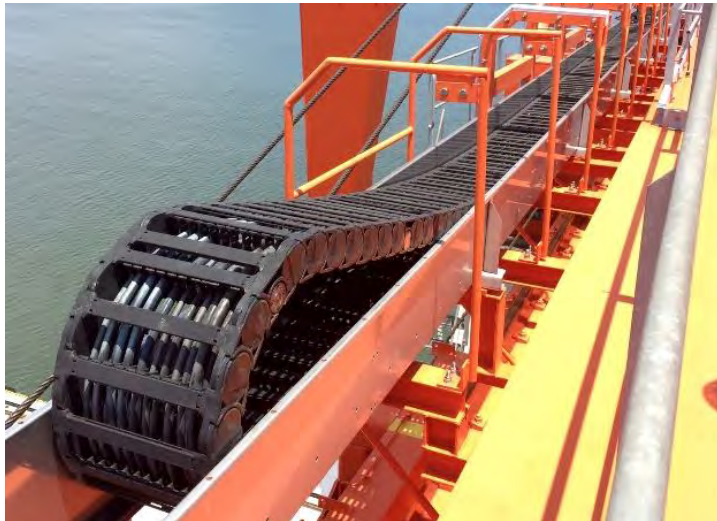


## Heavy Duty rol-e-chain® series – for high additional loads



- ▶ Integrated roller - reduced friction & wear
- ▶ Maintenance free, sealed roller bearing

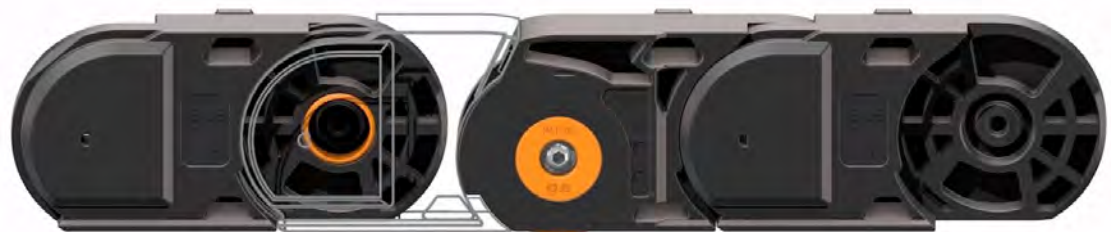
Successfully used in various port applications since 2004!



## P4.1 rol-e-chain® series – for high speeds

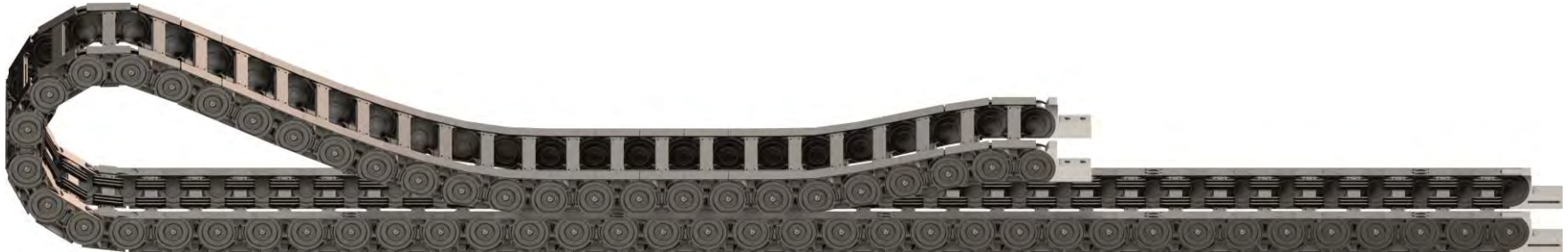


- ▶ Extended service life with integrated tribo-polymer plain bearing
- ▶ Less friction between pin & bore connection
- ▶ High speed (5m/sec & more)
- ▶ Low noise operation (optimized chain link design)
- ▶ Low vibration

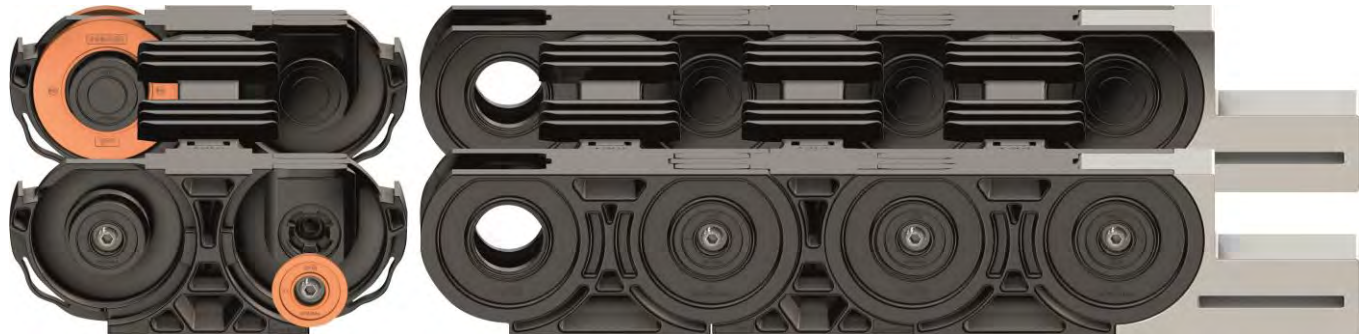




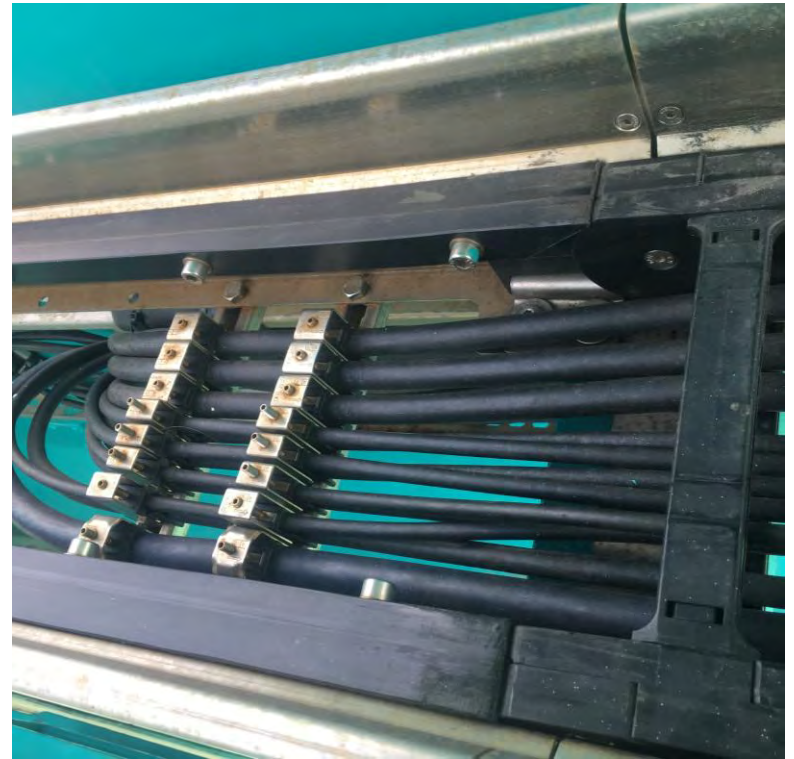
# P4HD heavy duty rol-e-chain® series – for highest speeds



- ▶ Longest service life with tribo-polymer bolts (chain link connection)
- ▶ Increased chain side link stability (fork / shackle joint connection)
- ▶ Wider side links for complete roller support
- ▶ High speed (5m/sec & more)
- ▶ Low noise operation (optimized chain link design & radius brake)
- ▶ Low vibration



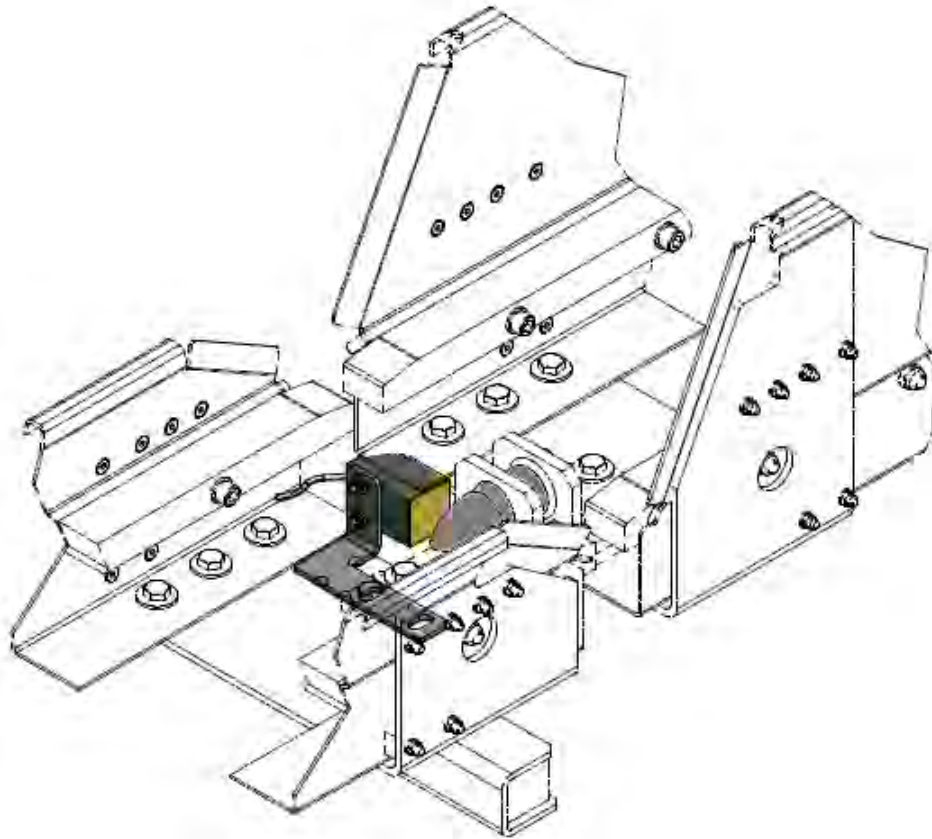
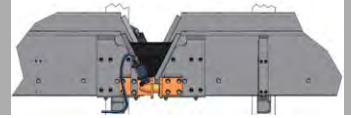
## Strain relief



Clamps for safe cable strain relief at the fixed and moving end side of the chain. All strain relief elements are an igus® own development.



# Hinge clutch



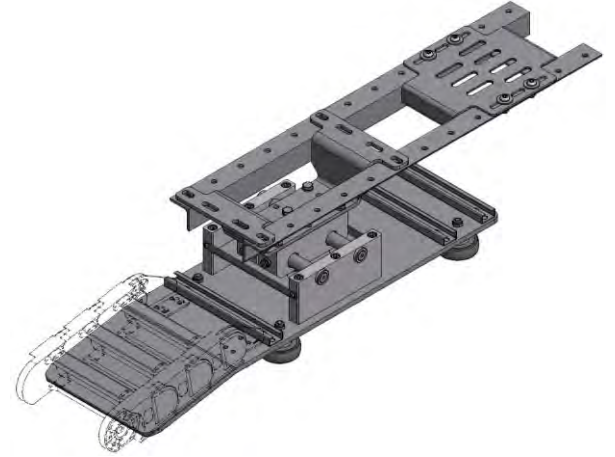
Coupling at the crane hinge point, equipped with guide mandrel to ensure a safe adjustment of the trough system during the lowering of the boom.

## Floating moving arm



igus® floating moving arm for compensation of the lateral mismatch. Floating moving arms are successfully used by igus® on STS / RMG / RTG / ASC cranes and other applications for more than 15 years.

### Heavy Duty version:



### Economic version:





## isense smart plastics - diagnostic tools for predictive maintenance & condition monitoring



- ▶ **EC.P**  
push / pull force monitoring-



- ▶ **EC.PP**  
position monitoring



- ▶ **EC.B**  
e-chain breakage detection



- ▶ **CF.P**  
cable force monitoring





This system measures the displacement forces on the echain several times per second, and compares the information with the calculated specification.

The echain system stops when the force is exceeded.

Emergency shut down or alarming in case of overload is possible with this system.

If the forces are exceeded, the i.Sense EC.P system recognises this, reports it and switches the system off instantly to prevent expensive consequential or total damage

We can also integrate this system with the echain system on your current RTGs, RMGs and STS as well.

Electronic pull-push force monitor with the igus® PPDS system





- ▶ Largest e-chain® cable range from stock – 1,354 different types
- ▶ No minimum order quantity
- ▶ More than 30 years experience in e-chain® cable development
- ▶ 36 months guarantee\*

\* igus® chainflex® cable selection and installation according to igus® specifications

chainflex® cable stock



chainflex® cables in life span test. Millions of cycles guarantee: chainflex® lasts or money back!



## igus® up to 4 years system guarantee



- ▶ Guarantee certificate for igus e-chain & cables
- ▶ Free spare parts for e-chain or cables that fail due to wear & tear
- ▶ Up to 4 years guarantee\*

\* igus® chainflex® cable selection and installation according to igus® specifications

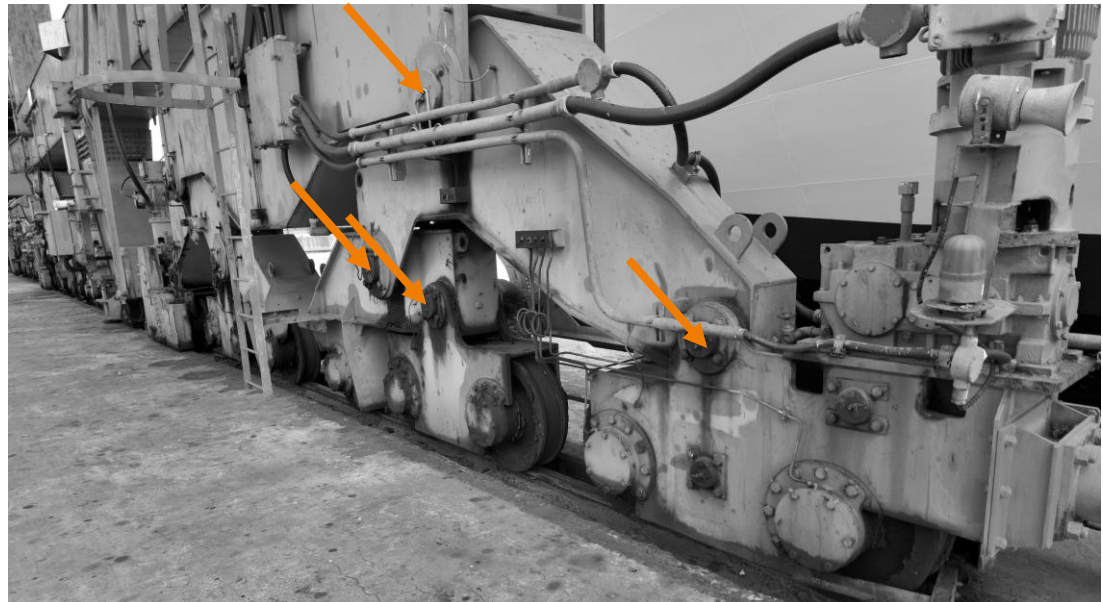
The e-chain service life guarantee is valid for the indicated number of double strokes calculated according to the igus online service life calculator

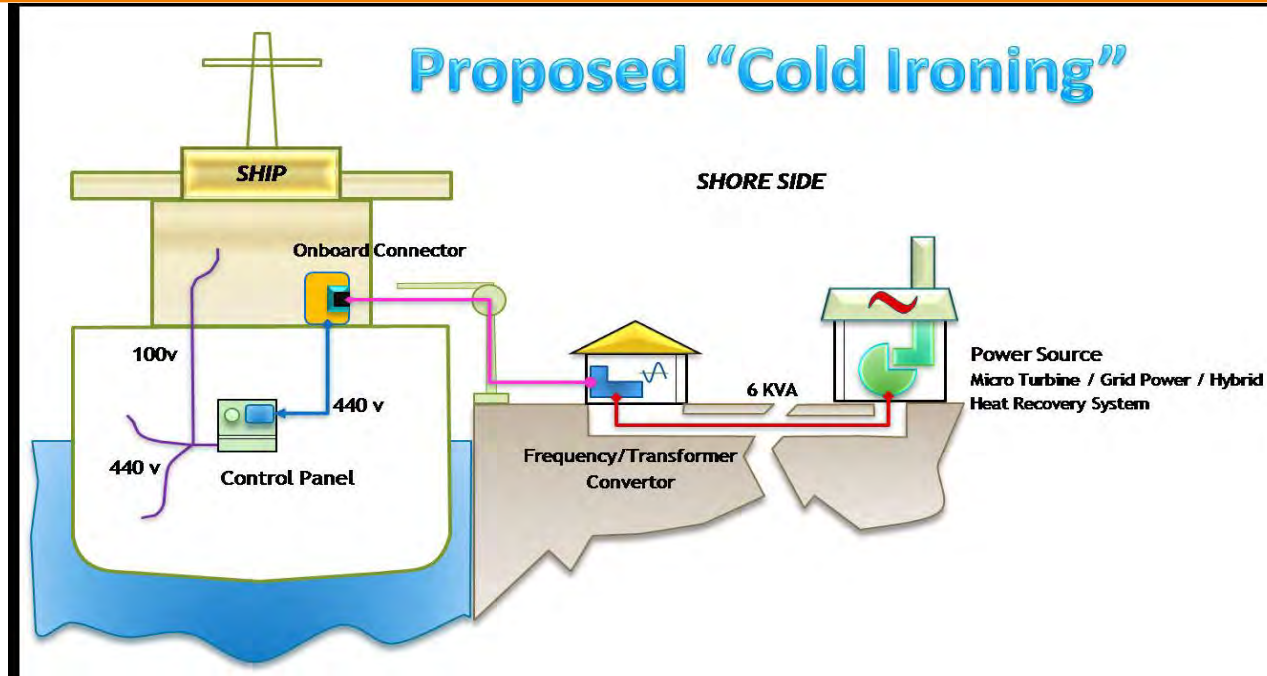


## igutex® TX sleeve bearing



- ▶ Composite bearing with fiberglass fabric
- ▶ Wear-resistant & dimensionally stable
- ▶ Good liquid media resistant
- ▶ Up to 200 MPa static & 140 MPa dynamic
- ▶ Lubrication & maintenance free





Shore power / Cold iron saves consumption of fuel that would otherwise be used to power vessels while in port, and eliminates the air pollution associated with consumption of that fuel. Use of shore power facilitates maintenance of the ship's engines and generators, and reduces noise.

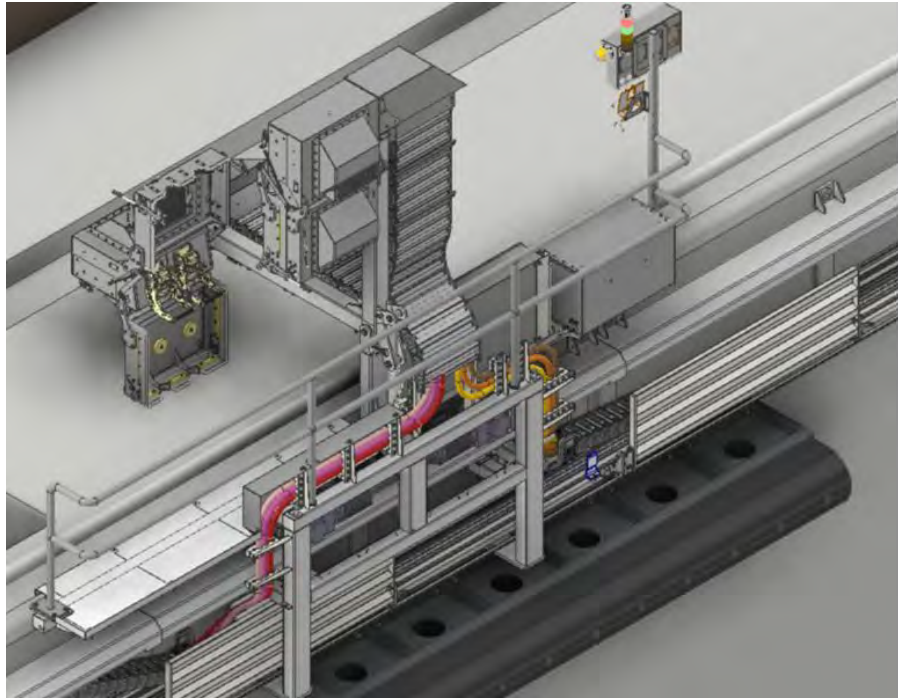
Shutting down main engines while in [port](#) continues as a majority practice.

[Auxiliary diesel generators](#) that power cargo handling equipment and other ship's services while in port are the primary source of air emissions from ships in ports today, because the auxiliaries run on [heavy fuel oil](#) or bunkers.

Cold ironing mitigates harmful emissions from [diesel engines](#) by connecting a ship's load to a more [environmentally friendly](#), shore-based source of electrical power.



## igus Mobile Shore Power Outlet (iMSPO) 400m travel



## igus e-chain Reel with Mobile Socket 150m travel



### All systems provide the following:

**Compliance:** IEC 80005-1, Annex D 6.6kV, 7.5MVA

**Performance:** 100% connection rate

**Implementation:** Less construction requirements

**Usability:** 2 people, minimal cable handling

**Safety:** Arc flash tested and approved ABB high voltage lab

**CAPEX:** Smaller footprint, 1 time investment

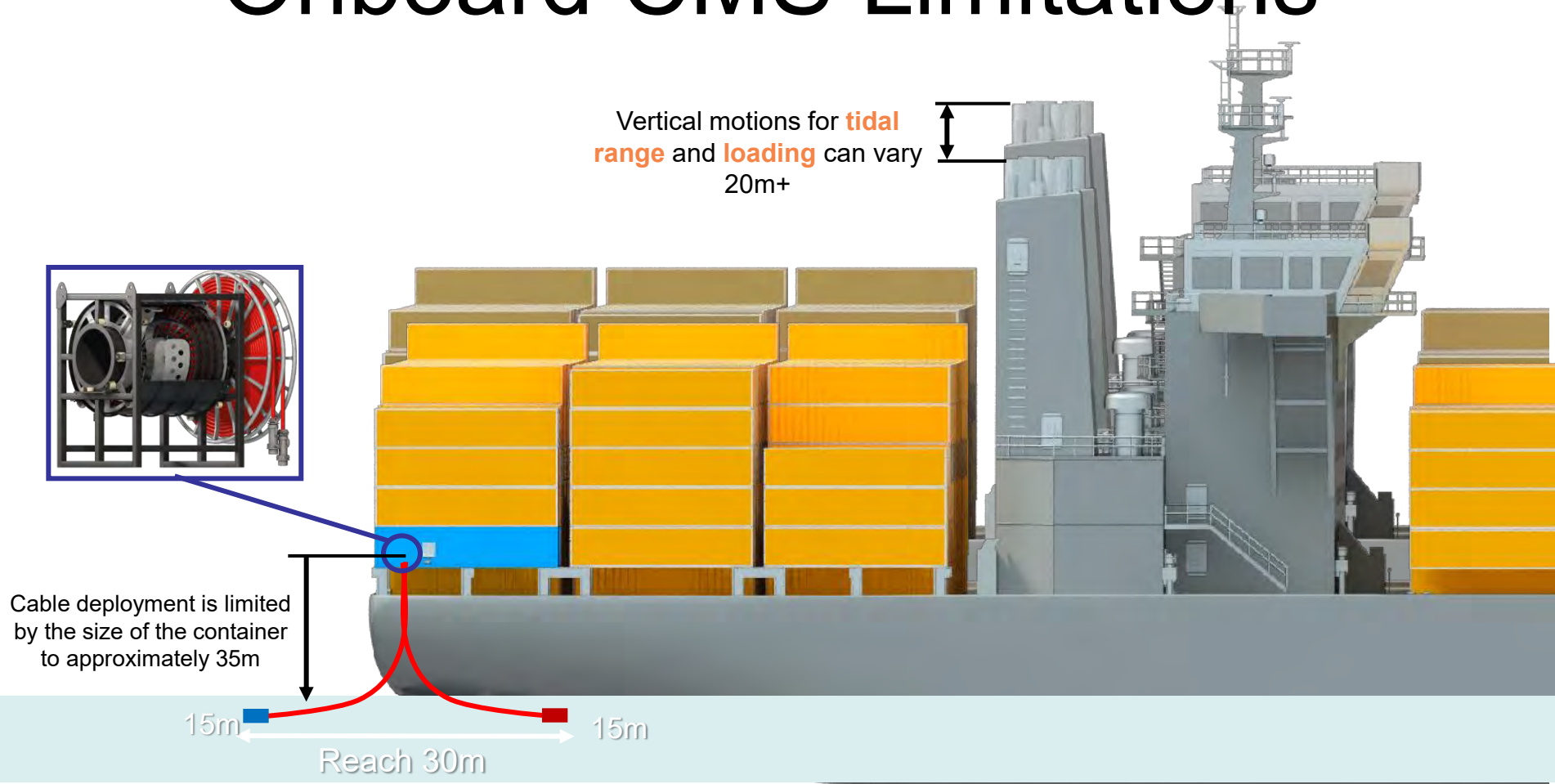
**OPEX:** Less equipment to maintain

**Durability:** Tested, 20+ years with maintenance

**Warranty:** extended warranty and service program 10 years

**Certification:** DNVGL, EU Machine Directive

# Onboard CMS Limitations



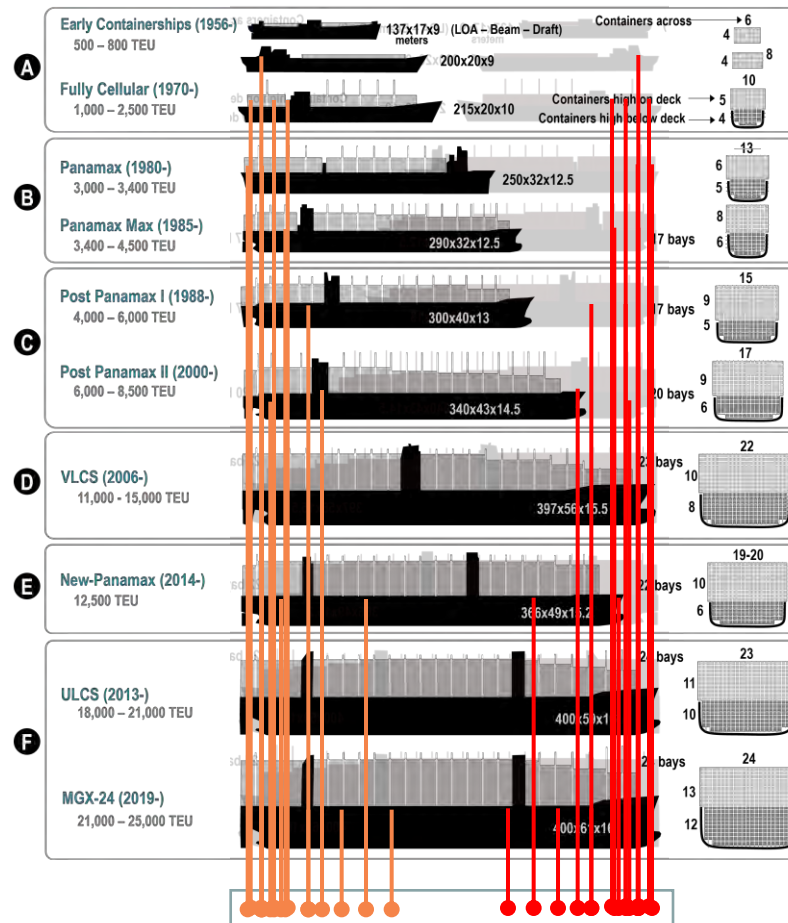


# Onboard CMS Locations

Different vessels size create different positions for the onboard Cable Management System (CMS) as well as optimal berthing position for operations

The ability to berth both port and starboard creates even more uncertainty

CMS location can be close to the stern (AMP container) or closer to the bridge



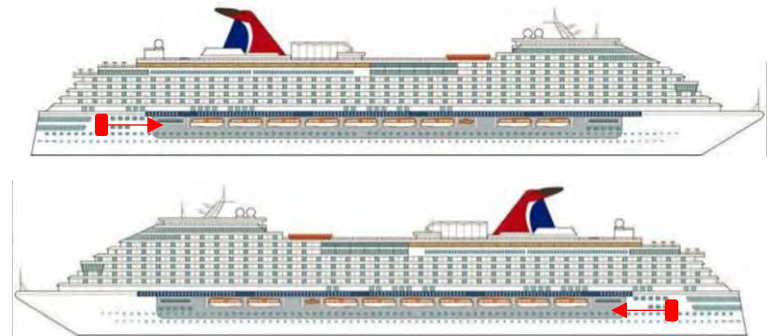
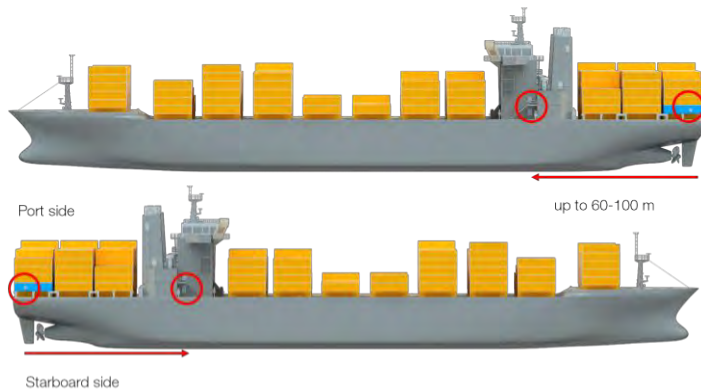
Starboard berthing

Port berthing (mirrored)

# Berthing Arrangement Impact on Connection Point



Multiple ships and flexible berthing arrangements, LOA, port/starboard, mooring lines...



Changing positions of onboard cable management systems and shore power hatches...



# iMSPO solves the “Connection Dilemma”

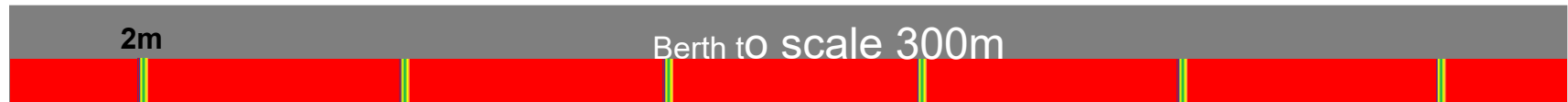
Theoretical coverage

6 vaults every 50m = 120m total coverage = max. 40%



Actual coverage

6 vaults every 50m = 12m total coverage = max. 4%



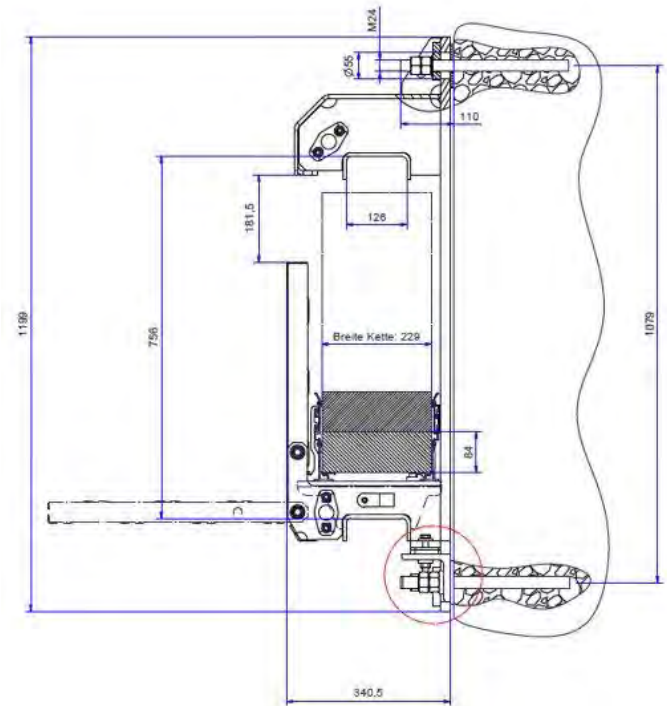
Best solution

1 iMSPO system = 300m total coverage = 100%



# Technical Specification

- Designed according to IEC 80005-1, Annex D – 6.6kV, 7.5MVA
- Meets EU Machinery Directive 2006/42/EC
- Corrosion protection system according to C5-M
- IP66/67 rating for electrical components
- Push Pull Detection Systems (PPDS)
- Signaling for system status
- Travel length up to 400m





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igus® - crane references

igus®



SIEMENS



NIKMNOELL  
SPECIAL CRANES



UBE / UBE MACHINERY CORPORATION, LTD.



MORRIS  
MATERIAL HANDLING



LIEBHERR



KW  
Kranwerke AG



DHHI DALIAN HUARUI HEAVY  
INDUSTRY GROUP CO., LTD.



ING. VOITH + TRAUN  
AUSTRIA



IHI  
Realize your dreams



KONECRANES®  
Lifting Businesses™

