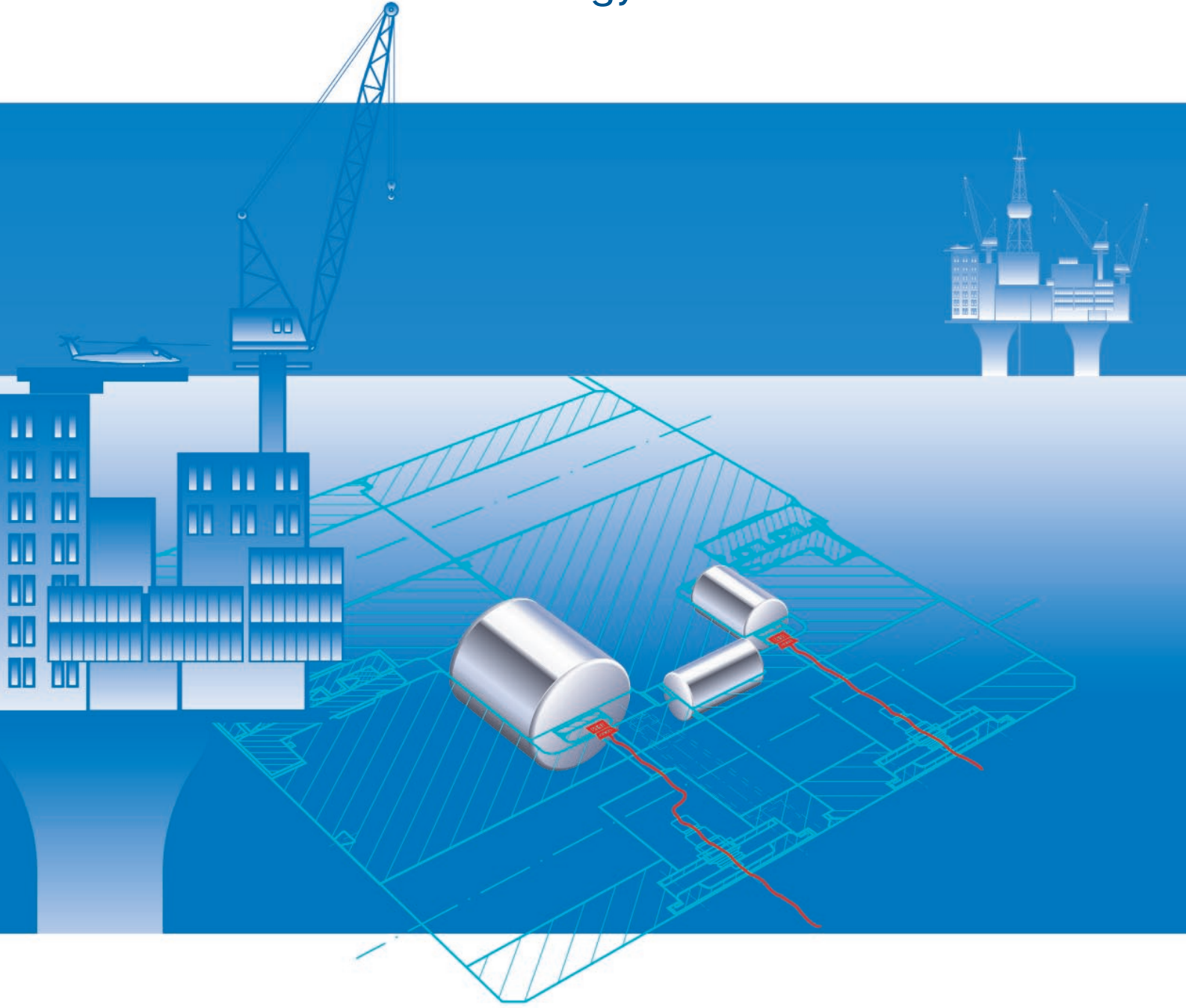


Rothe Erde Bearings and Rothe Erde Rings. Offshore Technology.



A ThyssenKrupp
Technologies
company

Rothe Erde



ThyssenKrupp

Rothe Erde bearings – pivotal in offshore technology.

The romantic picture of illuminated offshore platforms against the backdrop of twilight must not make us forget that this environment places the most exacting requirements on man and material. Stormy weather, blistering heat or freezing cold, man and material must deliver ultimate performance however unforgiving the conditions they have to operate in may be.

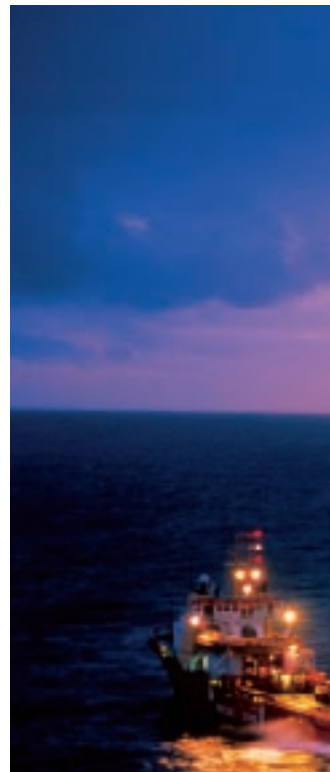
It goes without saying that absolute operating reliability at all times is the prerequisite for any offshore system.

It does not come as a surprise then, that Rothe Erde ball and roller bearings enjoy an enviable reputation in the offshore industry for their efficiency and safety.

They perform their duty day after day in cranes, derricks, oil mooring stations, rudder propellers, etc.

The success of Rothe Erde is founded on innovation, products tailored to requirements, vast manufacturing know-how and thorough commitment to quality based on DIN EN ISO 9001.

International supervisory bodies and classification companies regularly verify that our technology meets the particularly stringent requirements applying to drill platforms, oil rigs, explorers, pipe layers, etc.





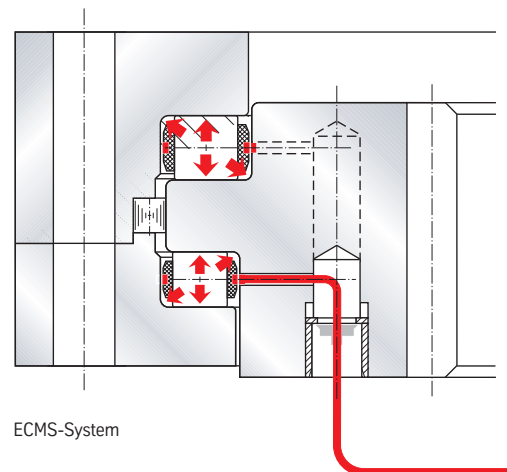
Statoil, Den norske stats oljeselskap a.s, Stavanger, Norway



Rothe Erde bearings in offshore cranes.

Rothe Erde bearings are globally recognised for their outstanding performance in offshore cranes where they must prove their functionality in often very hostile environments.

The concept of structural safety for the intended use of a bearing is crucial, and therefore, rigorously pursued throughout the planning and development stages, including simulated reality tests.



Bearings for use in offshore cranes must meet the rigorous requirements of international classification companies who define the applicable safety factors and calculation bases.



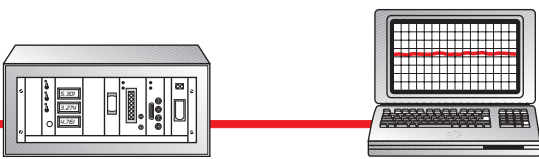
Stålprodukter AS, Molde, Norway



Favelle Favco Cranes Pty Ltd., Sydney, Australia



Kenz Cranes B.V., Zaandam, The Netherlands



These rules cover such issues as bearing design, resistance to cross-section fracture, bolted connections of safety devices, and many more.

The latest crane constructions already use the Rothe Erde ECMS system described in this brochure.

Bearings equipped with the Rothe Erde ECMS system do not need to undergo the otherwise prescribed periodical inspections.

Rothe Erde bearings in offshore oil mooring stations.

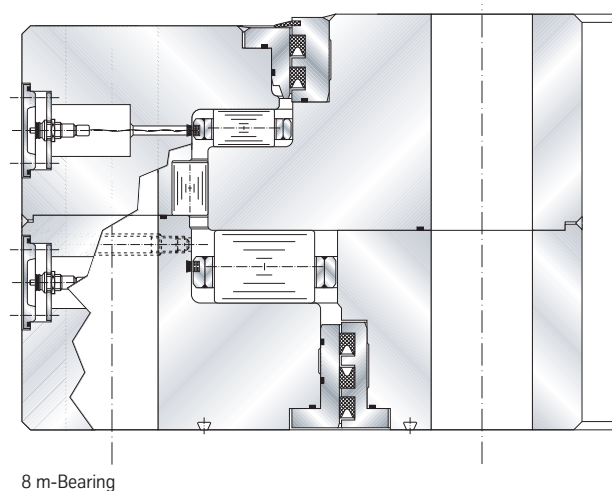


FPSO Northern Endeavour, Single Buoy Moorings Inc., Monaco

Offshore oil mooring applications place particularly heavy demands on bearings with regard to load transmission and sealing systems. Oil buoys and mooring stations are exposed to a multitude of load components which need to be considered.

The swivel-mounted systems must be capable of weathervaning during oil or gas transfer.

The 5 – 8 m diameter bearings used in these types of application can be supplied in monobloc designs.





FPSO II/Petrobras Marlim South Brazil,
Single Buoy Moorings Inc., Monaco



FPSO Uisge Gorm, Bluewater Engineering N.V., Es-
sen, Belgium

From here, the stored crude oil is off-
loaded into tankers while oil or gas ex-
traction continues without interruption.

Monobloc bearing designs can be sup-
plied in diameters up to 8 m, larger dia-
meters require segmental bearings.
One example is the 46-tonne bearing
with a diameter of 10,280 mm for the
“Vidal de Negreiros” FPSO extracting oil
off the coast of Brazil in a water depth
of approx. 330 m.



FPSO Vidal de Negreiros Petrobras “Albacora” Field,
Sofec Inc., Houston, Texas, USA

Segmental bearing

FPSO (Floating Production, Storage and
Offloading) systems are equally more
and more often equipped with large-
diameter antifriction bearings.

The crude oil passes through flexible
risers into the turret which is normally
located at the bow of the ship and firm-
ly anchored to the bottom of the sea.
The bearing integrated into the turret
allows the ship to weathervane freely
around the turret axis. FPSOs are pro-
duction and intermediate storage facili-
ties at the same time.

Rothe Erde bearings for special purposes.

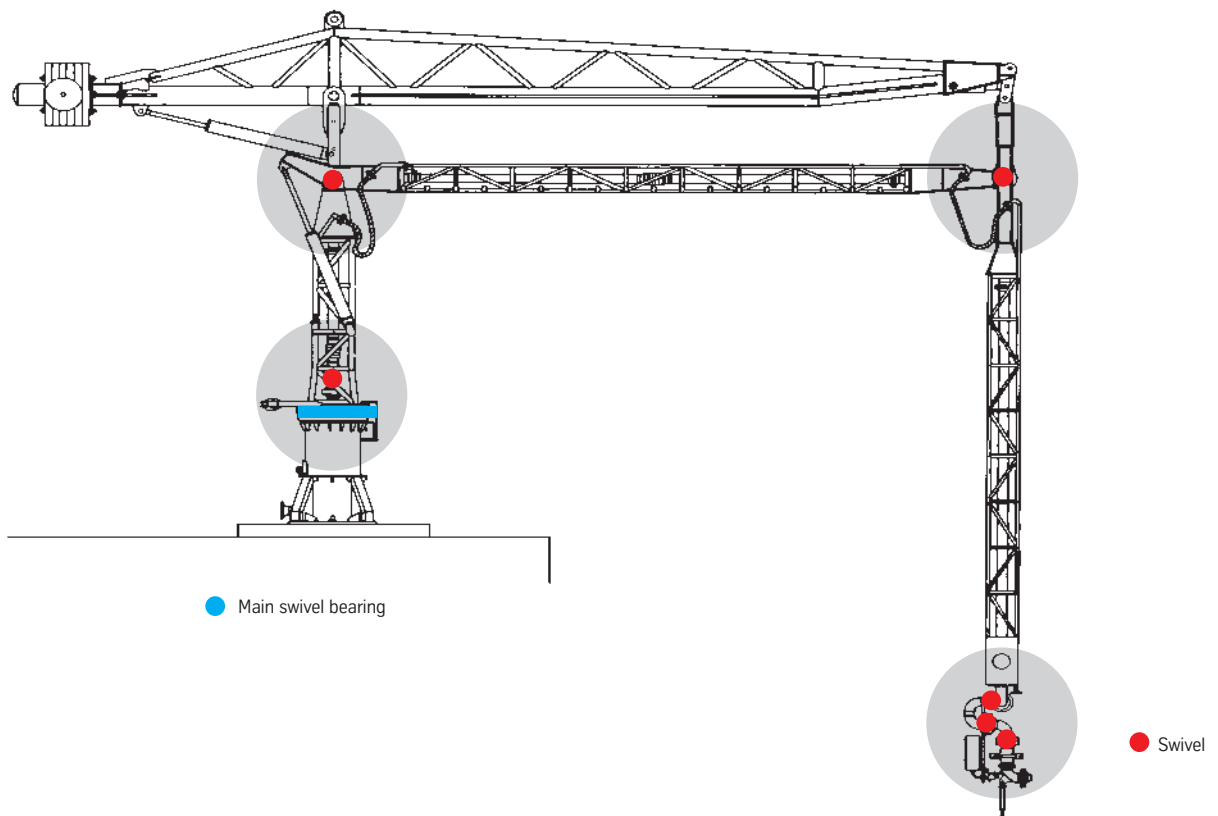
Derricks

Tankers transporting fluids or gas are loaded and unloaded at transfer points by derricks with built-in pipelines which are flange mounted to the tanker and follow its every movement. Rothe Erde has developed swivels tailored for this use, which also seal off the pipelines by their integrated sealing systems thus contributing their share to the protection of the environment.

The low-temperature swivel was developed for liquid-gas transfer stations which are extremely demanding on all structural elements.

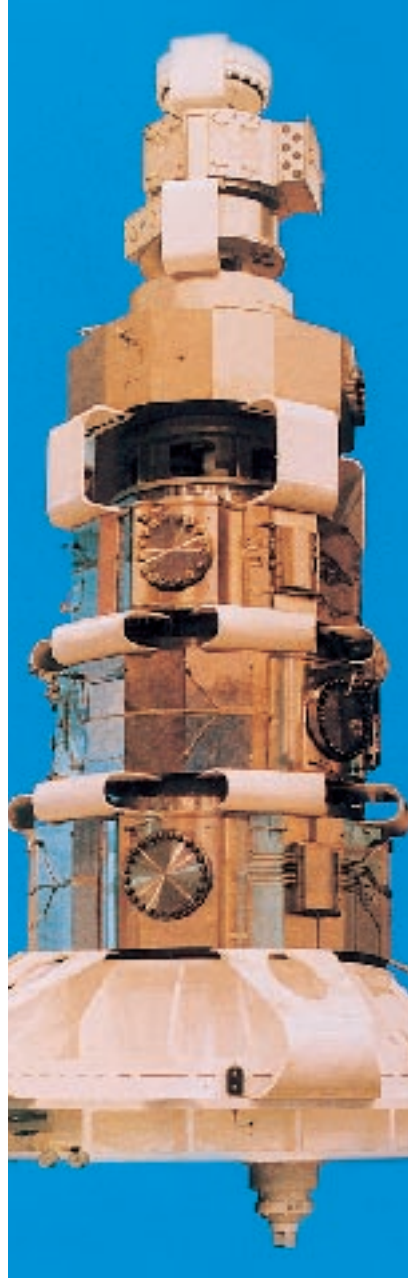
These swivels withstand low temperatures down to -160°C , perform in excess of 1 million swivel operations, and resist a 5 bar internal pressure with absolute reliability. Further proof of Rothe Erde cutting edge technology.

In harbours where such transfer stations are not available, on-board pipe handling cranes are used which, of course, are also equipped with Rothe Erde bearings.



Multipath Swivel

Another interesting application are the swivel stacks arranged coaxially to the turrets. Here as well, Rothe Erde bearings have been used successfully for decades. These bearings must meet the most rigorous requirements as to oil and gas-tightness.



Multipath swivel, Brown Brothers & Co. Ltd.,
Edinburgh, Great Britain

Steerable Thrusters

Compared to the conventional design of propeller and rudder, steerable thrusters have brought about considerable structural changes in the ship building industry.

They are now predominantly used in dynamically positioned vessels such as drill ships, semisubmersible platforms, supply vessels and others.

In contrast to the former design, the compact steerable thruster may be placed anywhere in the vessel for improved propulsion efficiency.

Steerable thrusters are excellently manoeuvrable in any direction, independent of the ship's speed.

All modern thrusters are equipped with Rothe Erde bearings.



Rudder propeller, Lips Thrusters Drunen B.V.,
Drunen, The Netherlands



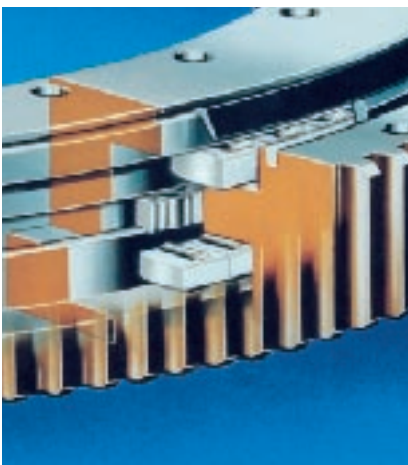
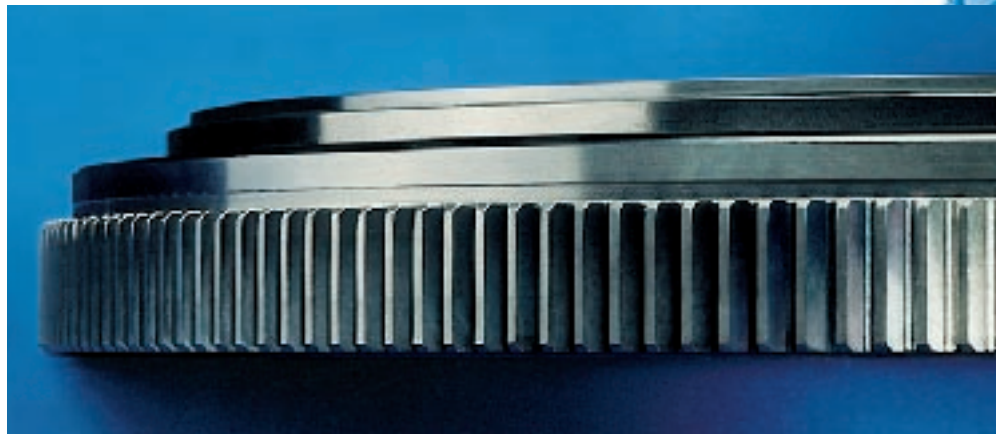
Rudder propeller, Aquamaster-Rauma Ltd., Rauma,
Finland

Rothe Erde bearings – bearing technology tailored to requirements.

The diversity of bearing applications in offshore technology demands continuous innovative input from the design engineer.

Many of the cranes needed in the construction and operation of offshore platforms, drill ships and supply vessels are equipped with Rothe Erde bearings. As are oil buoys and oil platforms.

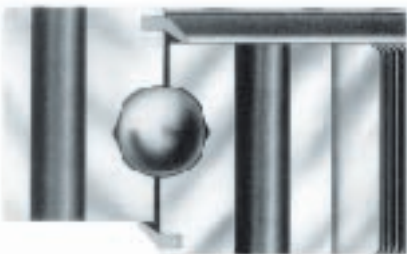
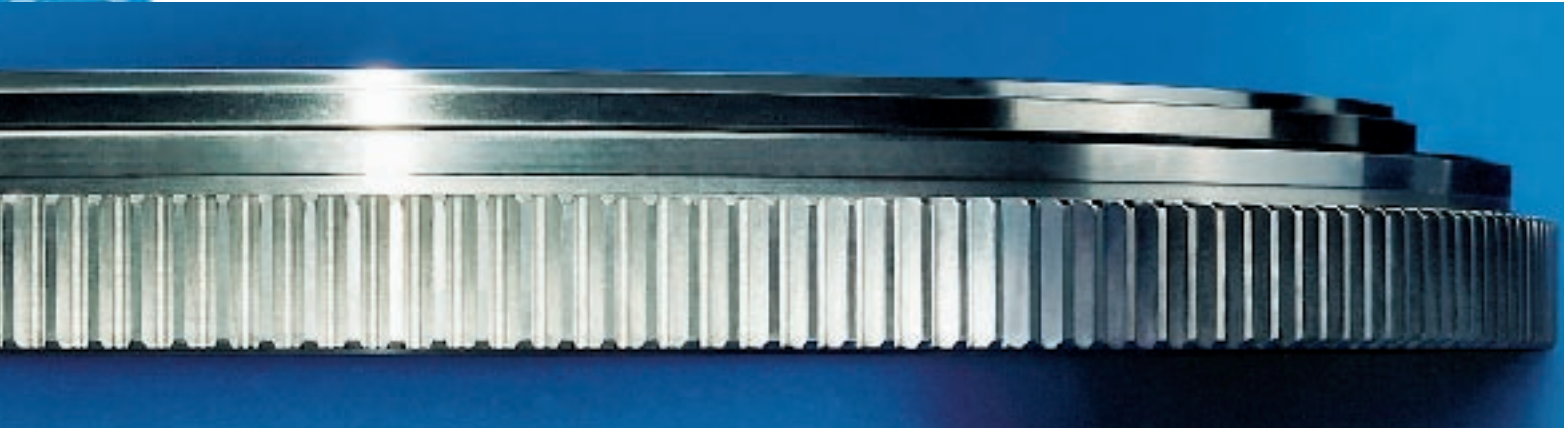
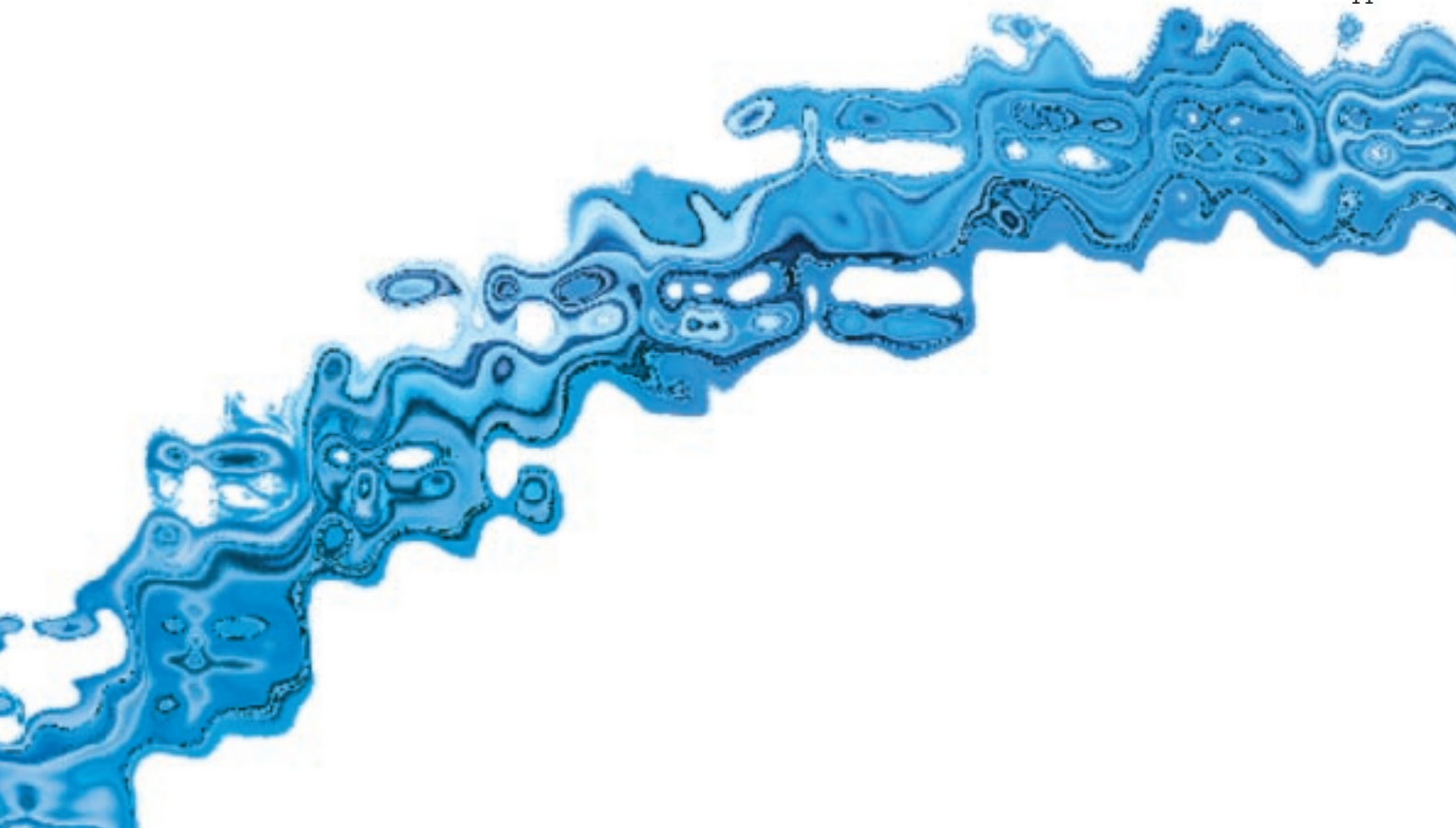
The largest bearings, i.e. with diameters over 10 m, are installed in FPSO systems. Equally important are the complex swivel and rudder propeller bearings.



Three-row roller bearing slewing ring

Our design engineers are challenged to develop new application-focused bearing solutions meeting requirements like transmission of all forces and moments, excellent tightness, optimum operating temperature, perfect safety and, last but not least, convincing economy.





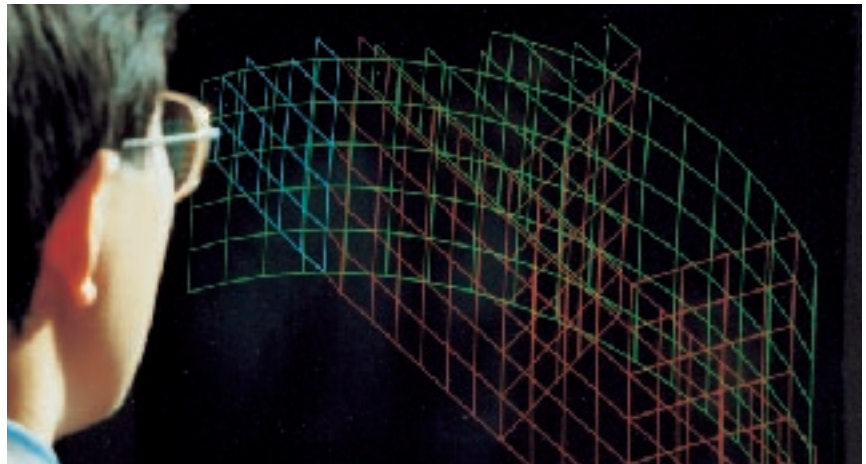
Single-row ball bearing slewing ring
with internal gear

Targeted research and development as well as close cooperation between design engineers, customers and classification companies guarantee future-oriented bearing solutions for the harsh offshore operating environments.

Rothe Erde bearings – design engineering and development.

Offshore technology demands the utmost in performance and structural safety from Rothe Erde bearings.

Finite element analysis has shown to be a reliable method for determining the occurring stresses in new bearing designs as well as for analysing load distributions and load transfer into the mating structures, that are otherwise difficult to assess. Finite element analysis is an equally valuable tool for bearing optimisation.



Application of the finite element method



Axial testing bench

To ensure that Rothe Erde bearings will continue to enjoy their reputation for reliability and economy in extreme situations, our R&D Centre subjects all new bearing designs to relentless and assiduous testing.

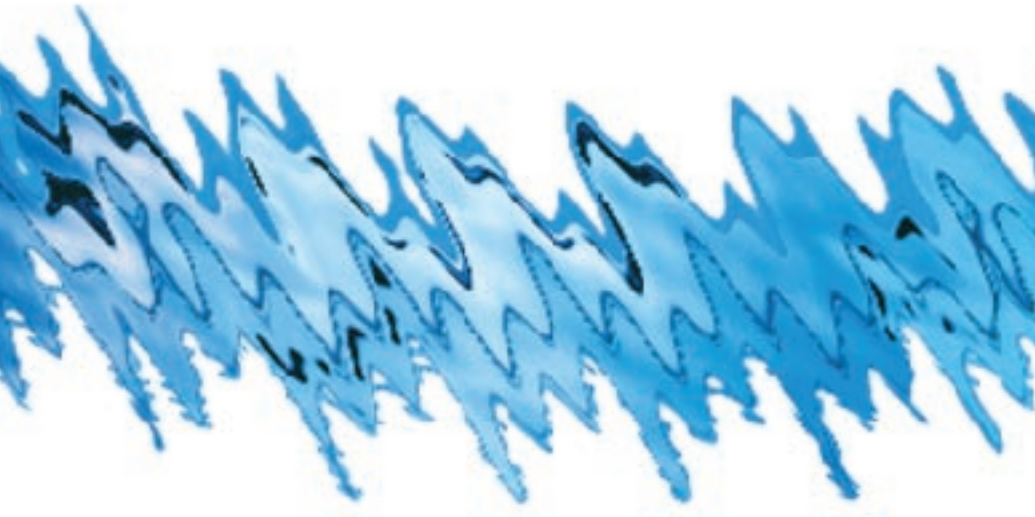
We are known for our pioneering development work and search for advanced, practicable solutions. The latest findings, experience and innovation combine in the creation of new technologies.



Fatigue test geared ring

Segmental bearings of various types, like compact or sandwich bearings. Corrosion-proof bearings with special sealing systems. Lubrication sampling and bearing condition monitoring systems.

The Rothe Erde Eddy Current Condition Monitoring System.



Principle sketch ECMS

The Rothe Erde Eddy Current Condition Monitoring System (ECMS) is a newly developed measuring system to guarantee the operational safety of large-diameter bearings.

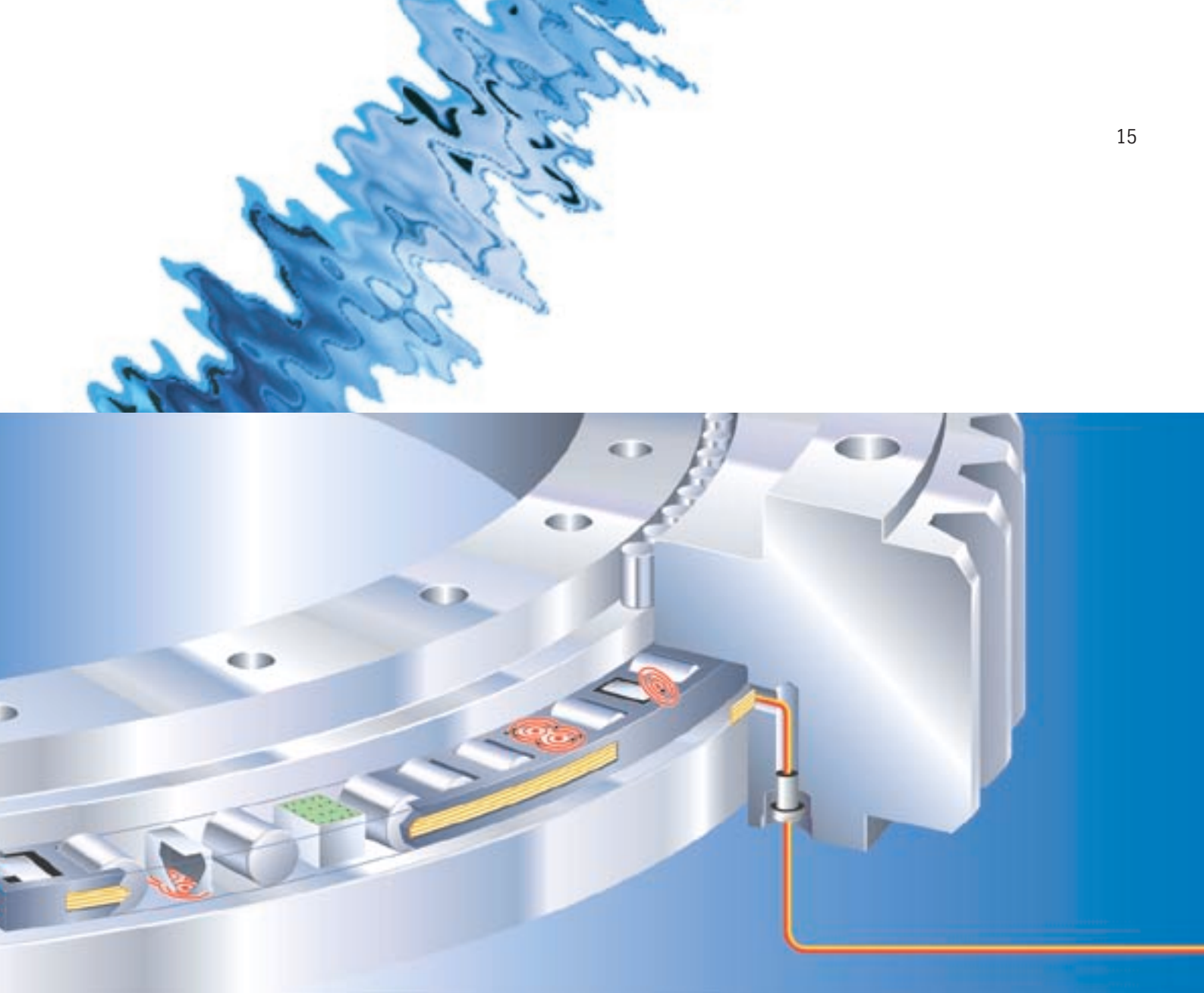
The ECMS system is integrated into the bearing and reliably monitors the condition of the bearing without requiring any time-consuming and cost-intensive intervention.



ECMS test set-up



ECMS evaluation



The monitoring system is contact-free and uses an eddy current sensor emitting a high-frequency magnetic field and inducing eddy currents into the surfaces of the raceways and radii. Damage and pittings in the raceways will affect this magnetic field, and the resulting change in voltage is telemetrically transmitted to a data recorder. A computer then evaluates the measured data and determines the position and size of the defect, if any.

The Rothe Erde Eddy Current Condition Monitoring System has been tested and approved by renowned classification companies.

Retrofitting existing bearings with the monitoring system is no problem, as its installation leaves the installed dimensions and the dimensions of the bearing itself intact.

Quality management.

Rothe Erde bearings meet the highest technical requirements. This applies in particular to offshore technology with its manifold applications.

The Rothe Erde quality system is approved by all national and international classification and acceptance companies and complies with DIN EN ISO 9001.

Our quality planning begins with our first contact with the customer. We determine whether the customer's requirements or concepts can be safely transformed into a viable product. Following clear definition of the requirements the quality features are defined in cooperation with the responsible departments and laid down in drawings, work plans, test specifications, etc., including packaging and customer service.



Spectral analysis of rolling elements



Routine test for rolling elements



Three-coordinate measuring machine



Computer-assisted quality check of a gear

Internal audits guarantee production quality and the functional safety of our quality system. The audit results combined with the quality data stored in the EDP systems permit effective quality control.

Regular staff training keeps us alert to the ever increasing requirements and raises quality awareness throughout our company.

Rothe Erde rings – versatility and profile.

Rothe Erde rings are important structural and connection elements in offshore technology, e.g. as flanges, reinforcing and retaining rings for pipelines. Or as housings for ball and safety valves, and as profiled rings in turbines and generators.

Seamless rolled steel or non-ferrous metal rings, or complex circumferentially symmetrical components, what they all



Machine rings



Valve body

have in common is superior quality and efficient production at the highest quality level.

Advantageous material usage to minimise machining allowances and inter-linked CAD and DNC systems to optimise ring dimensions allow us to offer convincing and economical solutions even for out-of-the-ordinary problems.



Finish-machined and drilled flange rings



Machine rings

Head Office

Rothe Erde GmbH

Tremoniastrasse 5-11
D-44137 Dortmund
Phone: +49 (2 31) 186-0
Fax: +49 (2 31) 186-25 00
E-mail: rotheerde@tkt-re.thyssenkrupp.com
Internet: www.rotheerde.com

Offices in Germany

Berlin

Rothe Erde GmbH
Geschäftsstelle Berlin
Wittestrasse 30 J
D-13509 Berlin
Phone: +49 (30) 89 79 14-18
Fax: +49 (30) 89 79 14-33
E-mail: rotheerde.gsberlin@
tkt-re.thyssenkrupp.com

North

Rothe Erde GmbH
Geschäftsstelle Nord
Am Pferdemarkt 31
D-30853 Langenhagen
Phone: +49 (5 11) 7 25 35 69-0
Fax: +49 (5 11) 7 25 35 69-9
E-mail: rotheerde.gsnord@
tkt-re.thyssenkrupp.com

South

Rothe Erde GmbH
Geschäftsstelle Süd
Am Ostkai 15
D-70327 Stuttgart
Phone: +49 (7 11) 3 27 79 19-0
Fax: +49 (7 11) 3 27 79 19-9
E-mail: rotheerde.gssued@
tkt-re.thyssenkrupp.com

Subsidiaries

Brazil

Robrasa
Rolamentos Especiais
Rothe Erde Ltda.
Rua Lidia Blank, No. 48
BRA-CEP 09913-010, Diadema,
São Paulo
Phone: +55 (11) 40 57 48 77
Fax: +55 (11) 40 55 38 92
E-mail: robrasa@ibm.net
Internet: www.robrasa.ind.br

Great Britain

Roballo Engineering Co. Ltd.
Mill Hill
North West Industrial Estate
GB-Peterlee,
Co. Durham SR8 2HR
Phone: +44 (1 91) 5 18 56 00
Fax: +44 (1 91) 5 86 90 96
E-mail: info@roballo.co.uk
Internet: www.roballo.co.uk

Japan

Nippon Roballo Co., Ltd.
Atagoyama-Bengoshi Bldg. 6-7
Atago 1-Chome
J-Minato-ku/Tokyo
Phone: +81 (3) 34 34 43 41
Fax: +81 (3) 34 34 43 40
E-mail: info@roballo.co.jp
Internet: www.roballo.co.jp

China

Xuzhou Rothe Erde Slewing
Bearing Co., Ltd.
Wanzhai, Northern Suburb,
VRC-Xuzhou 221007, Jiangsu
Phone: +86 (5 16) 7 76 71 70
Fax: +86 (5 16) 7 76 90 00
E-mail: xuzhou_rothe_erde@
xreb.com
Internet: www.xreb.com

India

Rothe Erde GmbH
Liaison Office India
6 E, "Gee Gee Emerald"
151, Village Road
Nungambakkam
IND-Chennai 600 034
Phone: +91 (44) 8 23 63 14
Fax: +91 (44) 8 23 56 55
E-mail: re_india@vsnl.net
Internet: www.rotheerdeindia.com

Spain

Roteisa
Rothe Erde Ibérica S.A.
Carretera Castellón, km. 7
Polígono Industrial „La Cartuja“
E-50720 La Cartuja Baja
(Zaragoza)
Phone: +34 (9 76) 50 04 80
Fax: +34 (9 76) 50 01 54
E-mail: roteisa@roteisa.es
Internet: www.roteisa.es

France

Roballo France S.à r.l.
30, Boulevard Bellerive
F-92566 Rueil Malmaison CEDEX
Phone: +33 (1) 41 39 00 90
Fax: +33 (1) 41 39 00 99
E-mail: roballofra@wanadoo.fr

Italy

Rothe Erde-Metallurgica Rossi
S.p.A.
Viale Kennedy, 56
I-25010 Visano (Brescia)
Phone: +39 (0 30) 95 20-1
Fax: +39 (0 30) 95 20-3 00
E-mail: mri@rotheerde.it
Internet: www.rotheerde.it

USA

Rotek Incorporated
1400 South Chillicothe Rd.
P.O. Box 312
USA-Aurora, Ohio 44202
Phone: +1 (3 30) 5 62 40 00
Fax: +1 (3 30) 5 62 46 20
E-mail: sales@rotek-inc.com
Internet: www.rotek-inc.com



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