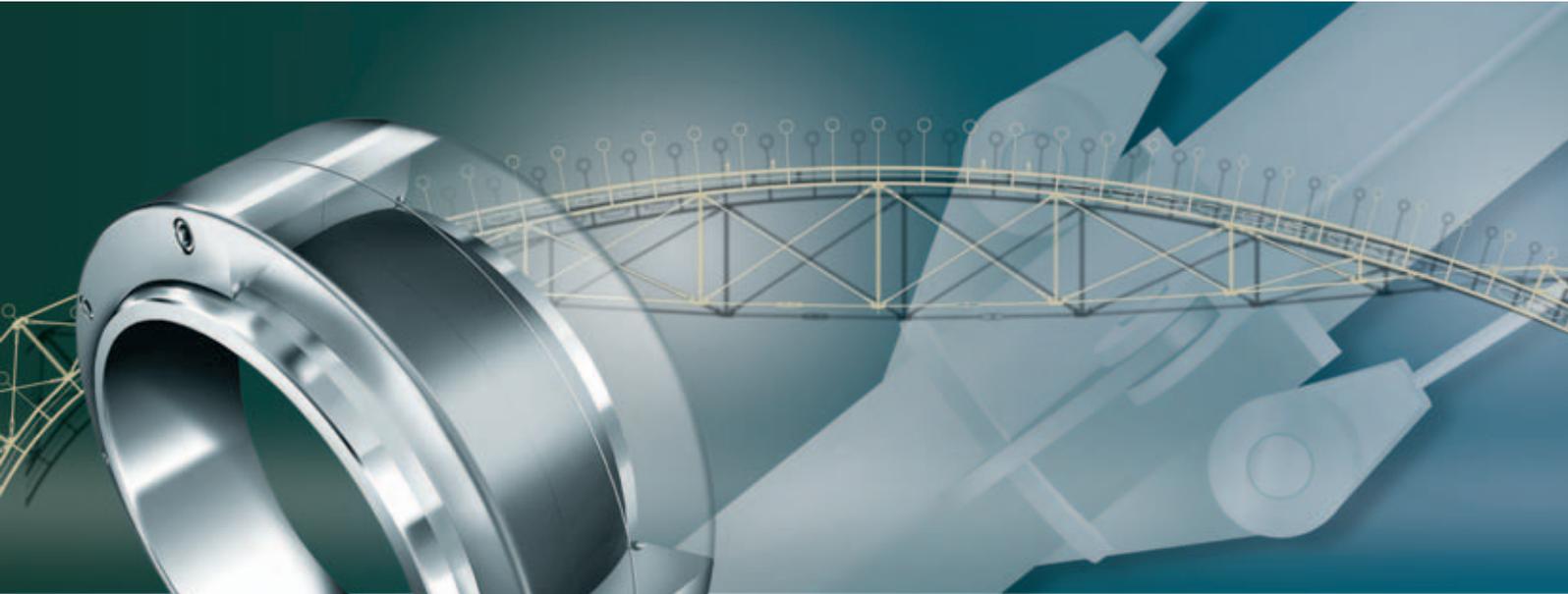




**FAG**



# **Bearing Supports in Buildings and Structures**

**Our Expertise – Your Benefit**

**SCHAEFFLER GROUP**  
INDUSTRIAL



Due to the continuing technical development of our products, the right to make changes is reserved.

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# P r e f a c e



Radial spherical plain bearings



Thrust spherical plain bearings



Bushings



Rod ends

Bearing supports in buildings and structures are sensitive interfaces – for both water and land. They must support weights totaling several tons, withstand extreme heat and biting cold and are exposed to sandstorms and aggressive salt water. And sometimes they must even be earthquake-proof.

INA and FAG have creative bearing designs for applications in this industry. ELGES spherical plain bearings are one example. This proven brand stands for more than 50 years of experience and the consolidated know-how of the entire Schaeffler Group.

High load ratings, operational safety, long life – even in the harshest environmental conditions – are all product benefits that make ELGES spherical plain bearings particularly suitable for these applications.

Our comprehensive product range includes:

- Spherical plain bearings
- Bushings (cylindrical)
- Rod ends
- Combination bearings

“Maintenance free” is the key word, and the brand name is ELGOLIDE®. Take the time to read about what’s behind this name, and see for yourself that there are many application opportunities for INA bearings in buildings and other structures.

Maybe this wide variety will serve as inspiration for you to arrive at a completely new idea for your supporting structure. If so, we should think about it together.

Just ask us!

## Do you really want to lubricate bascule bridges?

Of course not, but they must work properly, because there's hardly any time for maintenance work when a major traffic route such as the harbor bridge in Barcelona has to open several times a day to let ship traffic through. This means extremely heavy work for the bearing positions in the movable bridge segments. Each bridge section has a length of 70 meters and a weight of 2 000 tons.

Regardless whether it is a double bascule bridge, as in this example, or hydraulic, balance or swing bridge design, the situation definitely calls for high-performance plain bearings with ELGOGLIDE®, because they're maintenance-free.

ELGOGLIDE® bearings are low-friction, high load capacity dry plain bearings that are particularly suitable for oscillating motion. The reason: Dynamic load

ratings are very high in relation to the low bearing weight.

The attribute "high performance", by the way, has not been added to the name without conducting the proper testing. In a test on this bearing, we applied a dynamic load of up to 600 N/mm<sup>2</sup>. This corresponds to 200 % of the dynamic load ratings given in the catalog, which demonstrates that there is a great deal of performance to spare. We can also provide you with the necessary application reliability for your design.



Barcelona. The world's largest double bascule bridge pivots on maintenance-free large spherical plain bearings with bore diameters of 670 mm.



## Why do large spherical plain bearings get the “X-life” seal of approval?

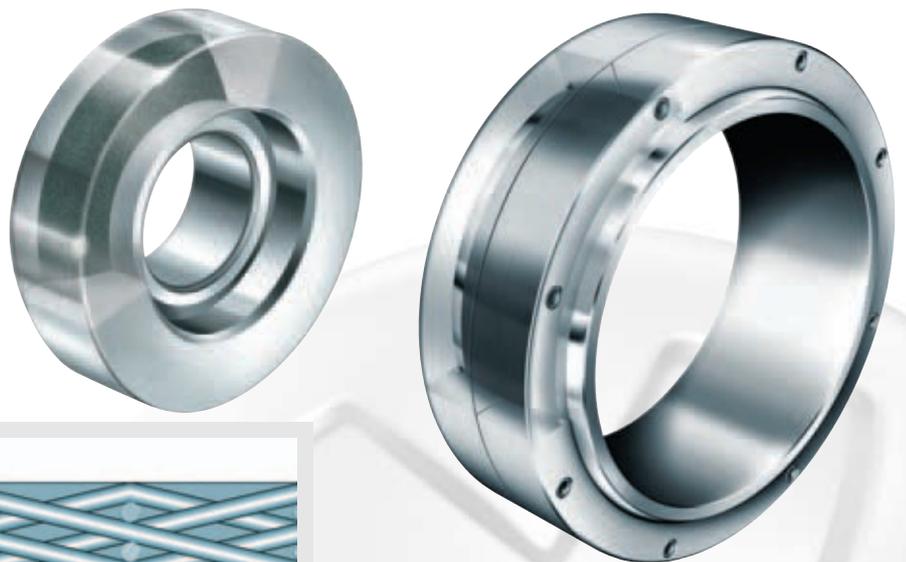
For years now, INA-Schaeffler KG has been the market leader with its ELGES maintenance-free spherical plain bearings. The performance of these bearings has been improved, and they are being sold with a new seal of approval called “X-life”. INA and FAG have started to use this to designate their premium products and services for industrial applications.

The decisive factor for including our spherical plain bearings in this group was the improved ELGOGLIDE® coating: Dynamic and static load ratings have been increased by 50 %, and the potential service life can be up to eight times higher than that offered by our competitors. Since the coating is completely resistant to moisture, these bearings are also suitable for hydraulic steel structures – an industry that is extremely sensitive from an environmental protection point of view.

X-life large spherical plain bearings are available with shaft diameters starting at 320 mm (radial) and 220 mm (thrust).



Buenos Aires. The Puente de la Mujer pedestrian bridge in the old harbor is a master achievement, both architecturally and technically. This is also true for the bearing positions of the pivoting bridge for which a zero-maintenance period of 50 years is required. This is no problem for ELGES large spherical plain bearings and represents premium quality made by INA that deserves the “X-life” seal of approval.

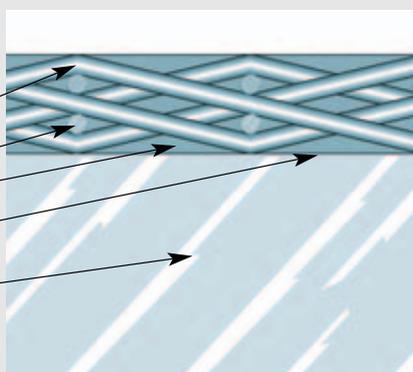


### What is ELGOGLIDE®?

Let's use this simple formula to explain:

- PTFE fabric consisting of Teflon® and support fibers
- + resin matrix
- + adhesion/glue on the steel support body

= ELGOGLIDE®



The result is a balanced combination of high load capacity, excellent wear and friction behavior and excellent dry running characteristics

## Can a train station sway in the wind?

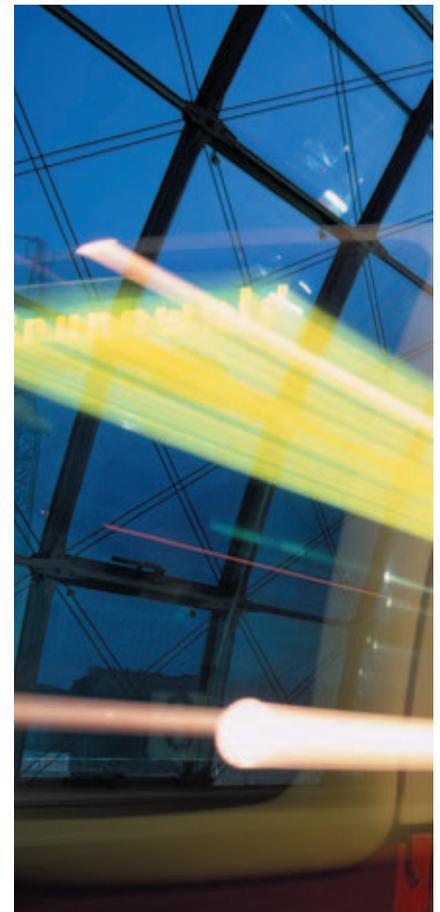


The answer is definitely “Yes”, at least for the gigantic roof architecture that must withstand all kinds of weather. Large spherical plain bearings provide the required length compensation in the steel design. In the Lehrter train station in Berlin, for instance, numerous spherical plain bearings and bolt systems made by ELGES have been installed in the trussed frames. They support the entire glass roof. A similar roof design, which includes ELGES bearings, covers the new connecting train station at the Cologne/Bonn airport.

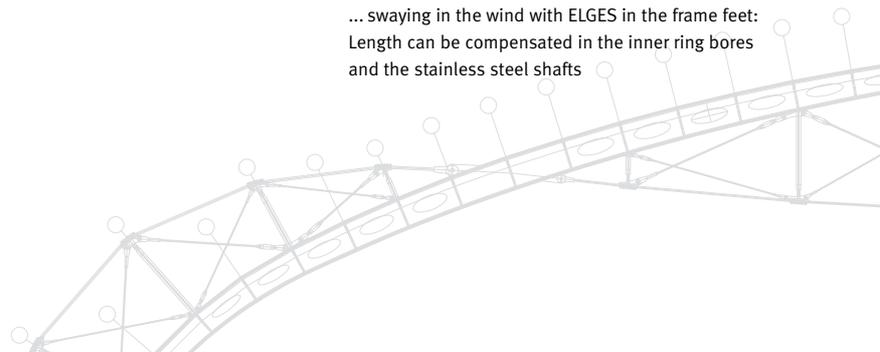
It is not just train stations, though, that “sway” using our traditional brand. From the dvg building in Hanover, Germany to the Hong Kong Bank in Shanghai, our zero-maintenance bearings are used all over the world. The benefits are obvious ... After all, relubricating the bearing positions would be a task only acrobats could perform.

In many applications, the inner ring bores of the bearings are coated with ELGOGLIDE®. In this way, both angular

motions and weather-related axial length changes can be compensated easily over a range of several millimeters. Even moisture, usually the main enemy of bearing supports, does not stand a chance. The fabric coating is connected to the steel support body and is resistant to moisture.



... swaying in the wind with ELGES in the frame feet: Length can be compensated in the inner ring bores and the stainless steel shafts





Lehrter train station in Berlin: The roof structure of Europe's largest train station spans 300 m of platforms and contains numerous ELGES spherical plain bearings and bolt systems (Photograph courtesy of Computersimulation (C) Archimation, Berlin)

We have performed comprehensive testing using in-house test stands to ensure the moisture resistance of the connection between the sliding layer and the support body: The sliding material does

not swell or stick to metal and is resistant to most chemicals. Numerous applications over many years have confirmed this result (see our "References" section at the end of this brochure). The fact

that all components are designed to match each other makes all ELGOGLIDE® coated plain bearings particularly wear resistant. That's why they keep working year after year.

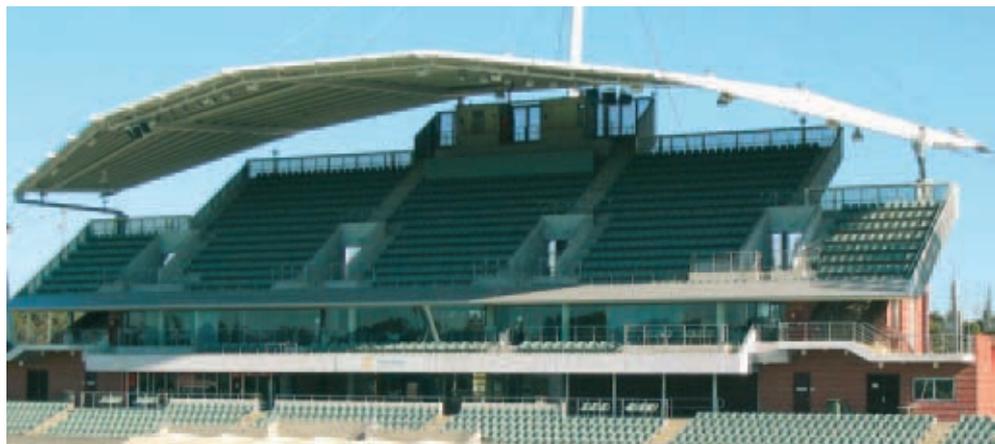


Tested ELGES quality: The bearing systems supplied consist of special-design spherical plain bearings – lined with ELGOGLIDE® – and bolts/shafts

## Can architects be artists?

The State Hockey Centre in Sydney, the Stade de France in Paris or the Gerry Weber Stadium in Halle (Westphalia) ... All over the world, stadiums are appealing planning projects for architects and supporting framework planners. Lightweight roofs are important for these structures. And the optimum design also includes ELGES maintenance-free spherical plain bearings. Roofs are often spanned with ropes whose coupling points must contain moment-free bearing supports on both sides.

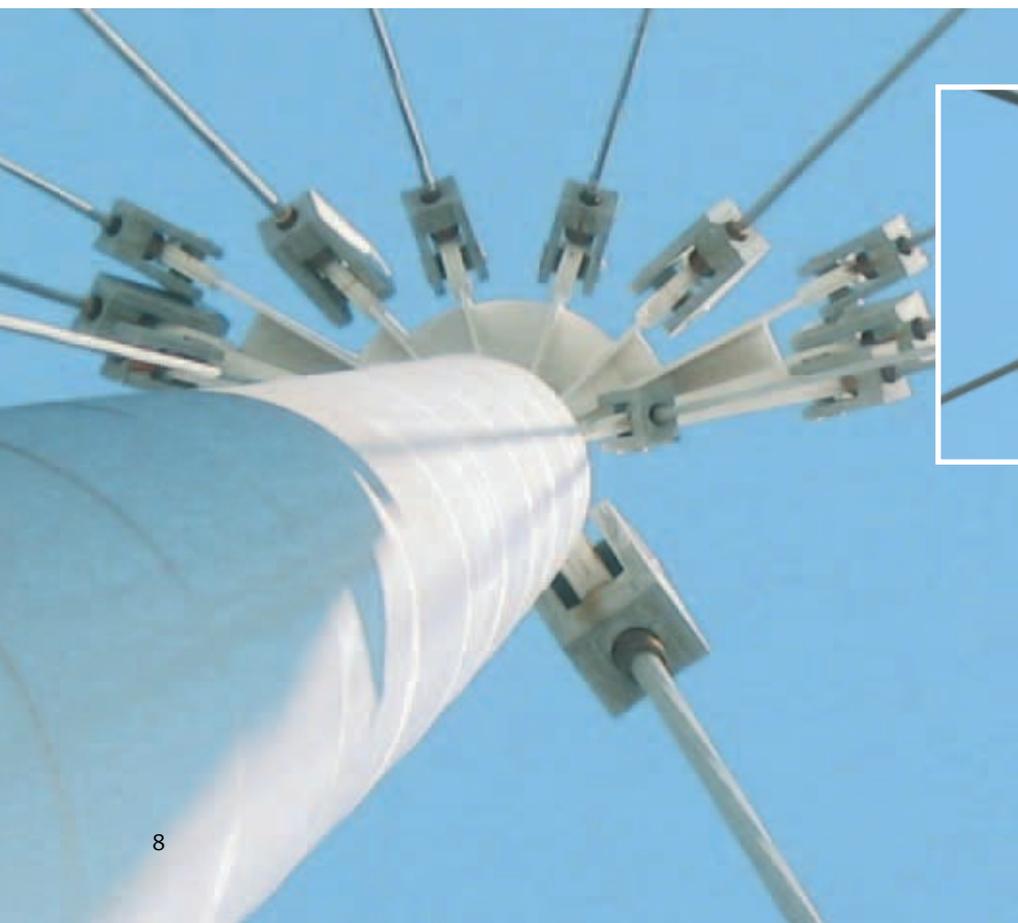
But aesthetics is only one aspect – the climate protection provided by the roof is much more important. After all, neither the athletes nor the fans like getting wet



The State Hockey Centre in Sydney – all of the rope coupling points at the edge of the roof and on the masts have supports incorporating ELGOGLIDE® spherical plain bearings

in the rain. The enormous forces that act on the bearing positions when the roof is opened and closed are no problem for our ELGOGLIDE®-coated spherical plain bear-

ings. They can support contact pressures up to 300 N/mm<sup>2</sup> under dynamic and up to 500 N/mm<sup>2</sup> under static loading conditions.



Sophisticated solutions that support extremely high loads: Rope coupling points in the roof design



In the "AufSchalke" stadium on a Saturday afternoon during soccer season. ELGES is there when the whistle blows. The mechanical equipment that allows the soccer turf to be rolled out and rolled up contains standard and spherical plain bearings with ELGOGLIDE®-lined bores. They ensure the low-friction operation of the transport rails. The maintenance-free rod ends that are used in the adjustment devices for the movable platforms are also made by ELGES.



The "AufSchalke" stadium in Gelsenkirchen: It takes six hours for the playing field that looks so picturesque in front of the stadium here to travel the 300 m distance into the stadium

INA has a comprehensive product range of zero-maintenance rod ends and rod ends requiring maintenance in various dimensions and shaft diameters of up to

200 mm. The design variants offered are equally numerous: turned or cast, with internal or external threads, right-hand

or left-hand threads ... Special designs are also available at the customer's request.



Spherical plain bearings in the supports under the platform: When raised, they allow the playing field to be moved in and out



## Can safety be fun?



London Eye: Thanks to INA and FAG, people can safely enjoy the stunning view from the world's largest ferris wheel

At the top of the Millenium Wheel, also known as the London Eye, you have the most impressive view of London. Millions of tourists have taken a ride on this ferris wheel and have returned to the ground safely thanks to INA and FAG. The consolidated knowhow and the ideal way in which these two bearing specialists complement each other are evident in this project.

In the hub, the “heart” of the ferris wheel, FAG ensures friction-free rotary motion. Two spherical roller bearings are installed in this position. They each weigh tons and have a diameter of one meter.

INA is responsible for the safe upright position, or more specifically, two special-design ELGES large spherical plain bearings. With outside diameters of 600 mm and a weight of 194 kg each they were indispensable for moving the wheel from its horizontal mounting position across the Thames into a vertical position. During the process, enormous contact pressures of more than 450 N/mm<sup>2</sup> were present.



Safe fun: INA has performed comprehensive testing on the load capacity of ELGOLIDE® coating on its in-house test stands



dvg building, Hanover: The roof hovers above visitors like a huge cobweb



Since then, the bearings have had to compensate micro movements caused by the wind. Thanks to ELGOGLIDE®, the bearings can support extremely high loads and require zero maintenance. This ensures a long service life, even

given the very high contact pressures of 300 N/mm<sup>2</sup> for the radial spherical plain bearings. The spherical plain bearings are adjustable with low moments. This is ideal for connection points where moving capability must be ensured.

ELGES large spherical plain bearings allow a small design envelope and high operational safety. Without them, the London Eye probably would not look as elegant as it does today. Thanks to the extremely long-life components made by INA and FAG, this sophisticated structure has become a major attraction and will continue to be in the future.



Thousand-fold fascination:  
The moment-free link points in the supporting structure design all include the ELGES name

## Are lock gates afraid of next winter?



Land reclamation project in Korea – Saemangum: This dam, completed in 2001, is one of the most interesting applications for ELGES products

A lock gate of course does not have feelings. DIN 19704-1 (hydraulic steel structures) categorizes this structure as a “lock” that compensates the natural water falls of rivers or artificial falls of reservoirs.

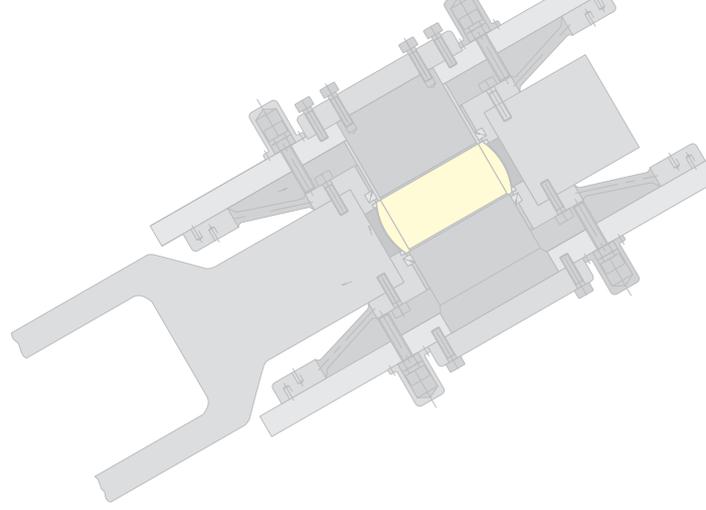
Such locks include segment, inlet and radial flood gates or check gates and represent important applications for INA

spherical plain bearings. Wherever concrete and steel meet there will be foundation settling, manufacturing accuracies will increase, and elastic deformations and changes in length will occur due to temperature changes. Think about the biting cold weather and ice on the numerous lock gate facilities in the Netherlands for instance, such as the Hartel Canal.

Water pressure and the weight of the lock act as a single-direction load on spherical plain bearings. It is next to impossible for a lubricating film to be formed in the load zone, especially after extended downtimes. In spite of this, it must be possible to move the lock gates at low sliding speeds even under extreme conditions.



Gigantic: The flood gates in the Saemangum dam have a height of 15 meters and a width of 30 meters



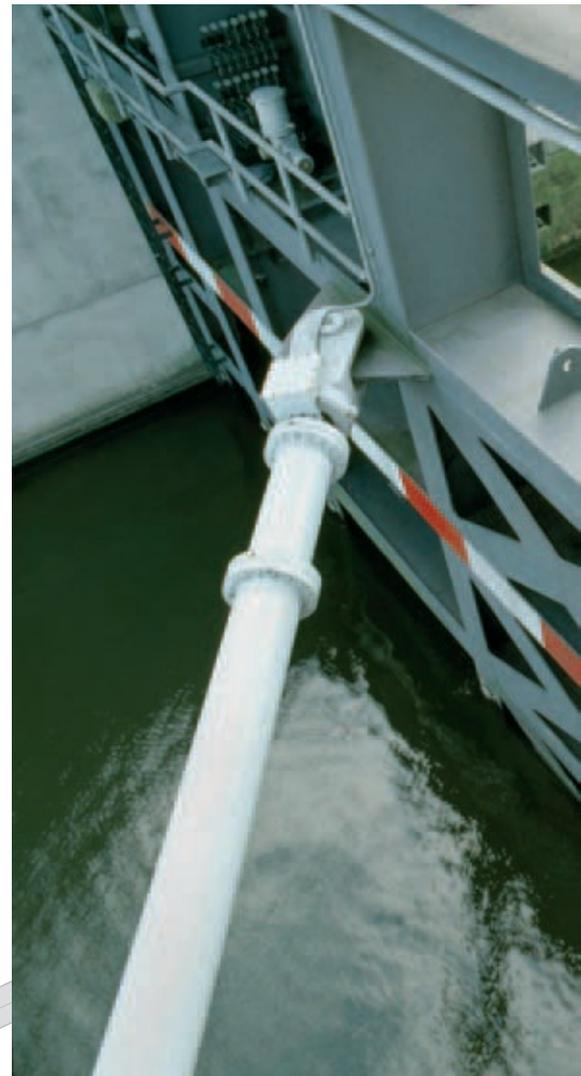
Our ELGOGLIDE®-based maintenance-free ELGES spherical plain bearings are exactly what you need for applications like these. Thanks to the sliding layer, they provide a low-friction and moment-free transfer of loads.

Designs incorporating extreme compressive loads are part of the daily routine in the construction of hydraulic steel structures. For our customers we would recommend the following contact pressures as a design reference for the respective operating conditions:

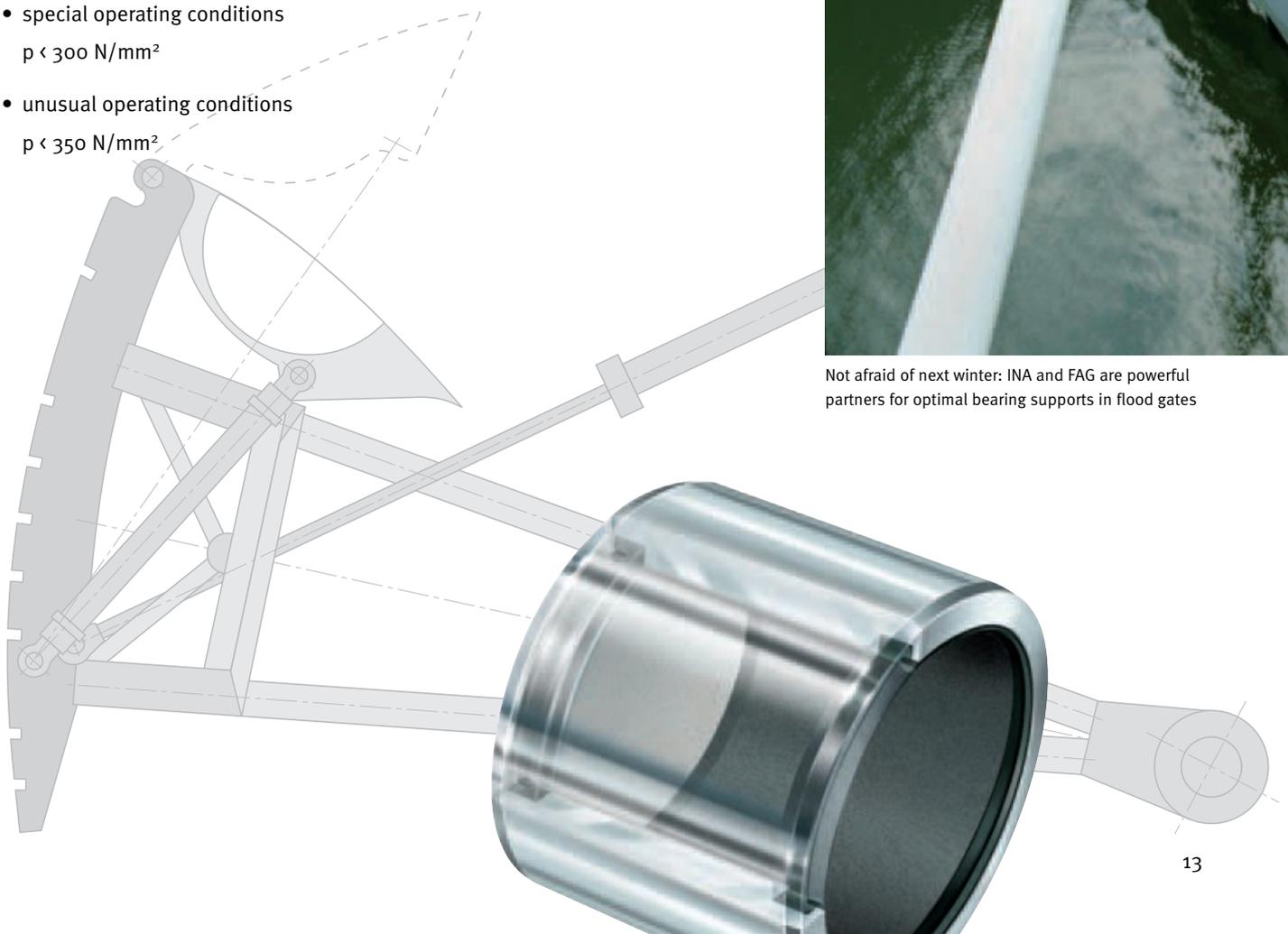
- normal operating conditions  
 $p < 250 \text{ N/mm}^2$
- special operating conditions  
 $p < 300 \text{ N/mm}^2$
- unusual operating conditions  
 $p < 350 \text{ N/mm}^2$

These recommendations were put into practice for the “Caruachi” dam project on the Orinoco river in Venezuela. Nine lock gates, 15 meters wide and 22 meters high, will serve to hold back the river, thus applying load to our spherical plain bearings, series GE 600 DW-2RS2.

High pressure on the bearing positions, moisture and heavy temperature fluctuations are daily occurrences in hydraulic steel structures and present in applications all over the world. That’s where ELGES spherical plain bearings come in, because they are built to withstand extreme conditions, even if Venezuela does not experience harsh winters.



Not afraid of next winter: INA and FAG are powerful partners for optimal bearing supports in flood gates



## What else can we show you to convince you?

Year completed	Project	Country	INA type
<b>Buildings and stadiums</b>			
1977	Centre Pompidou, Paris	FRA	GE 160 DO, GE 240 DO
1984	Lloyds-Bank, London	GBR	GE 120 AW, GE 180 UK-2RS
1985	Hongkong and Shanghai Bank, Hongkong	CHN	GE 320 UK-2RS, GE 340 UK-2RS, GE 360 UK-2RS, GE 380 UK-2RS (all special design)
1989	Skydome, Toronto	CAN	GE 160 DO, GE 280 DO, GE 200 SX
1991	Gerry Weber Stadium, Halle/Westphalia	DEU	GE 70 UK-2RS, GE 100 UK-2RS
1998	Stade de France, Paris	FRA	GE 60 UK-2RS, GE 100 UK-2RS
1999	dvg Building, Hanover	DEU	GE 60 UK-2RS
2000	State Hockey Centre, Sydney	AUS	GE 120 UK-2RS
2001	“AufSchalke” Stadium, Gelsenkirchen	DEU	GE 140 UK-2RS, GE 240 UK-2RS, GE 300 UK-2RS-W7
2002	Lehrter Train Station, Berlin	DEU	GE 220 FW-2RS, special design
2003	Airport at Cologne/Bonn Airport	DEU	GE 80 UK-2RS, special design
2004	Wembley-Stadium	GBR	GE 300 AW in, special design
<b>Bridges</b>			
1973	Blokzijl Bridge	NLD	GE 60 UK-2RS, GE 100 UK-2RS and GE 110 UK-2RS
1974	Bennebroek Bridge	NLD	GE 140 UK-2RS, GE 200 UK-2RS
1976	Wehr Bridge	DEU	GE 460 DW
1977	Jachmann Bridge Wilhelmshaven	DEU	GE 120 UK-2RS, GE 500 DW
1981	Rode Haan Bridge	NLD	GE 100 SW
1981	Blokkzijl Bridge	NLD	GE 100 UK-2RS
1982, 1983	Ophaal Bridge, Amsterdam	NLD	GE 140 UK-2RS
1984	Blauw Verlaat Bridge	NLD	GE 340 DW
1987	Vroomshoop Bridge	NLD	GE 200 UK-2RS
1990	Jan Berghaus Bridge, Leer	DEU	GE 480 DW-2RS2
1992	Rügen Dam Stralsund – Railroad Bridge	DEU	GE 160 UK-2RS, GE 200 UK-2RS and GE 320 DW
1996	Este Bridge York	DEU	GE 320 DW, GE 380 DW
1997	Purmerend Bridge	NLD	GE 180 UK-2RS, GE 300 UK-2RS, GE 320 DW, GE 340 DW and GIHN-K 160 DO-2RS
1998	First bascule bridge	DEU	GE 260 UK-2RS, GE 320 DW, GE 440 DW
1999	Rügen Dam Stralsund – Bridge	DEU	GE 160 UK-2RS, GE 220 UK-2RS GE 300 UK-2RS
1999	Tarragona Bridge		ESP GE 600 DW-RS2-W8
1999	Barcelona Harbor Bridge	ESP	GE 260 UK-2RS, GE 280 UK-2RS and GE 670 DW-RS2-W8
2001	Puente de la Mujera, Buenos Aires	ARG	GE 360 AW ,GE 950 DW-W7-W10 and GE 1000 DW-W7-W10
2002	Schlei Bridge, Kappeln	DEU	GE 200 UK-2RS, GE 360 DW-2RS2

Year completed	Project	Country	INA type
<b>Bridges (continued)</b>			
2003	Flevo Bridge, Kampen	NLD	GE 240 UK-2RS
2004	Harilaos Trikoupis, Patras (Rion-Antirion Bridge) Golf of Corinth (cable-stayed bridge)	GRC	GE 360 DW-2RS2-W8
<b>Hydraulic steel structures</b>			
1970	Aracena	ESP	GE 220 UK-2RS
1971	Wijk	NLD	GE 160 UK-2RS
1972	Kreekrak	NLD	GE 120 UK-2RS
1974	Mediano	ESP	GE 160 UK-2RS, GE 300 UK-2RS
1975	Houtribsluizen	NLD	GE 160 UK-2RS
1977	Elbe-Trave Canal	DEU	GE 100 UK-2RS
1978	Abwinden-Asten	AUT	16-748, 16-749, GE 160 UK-2RS, 16-771 and 16-772
1978	Hunte Sperwerk	DEU	GE 160 UK-2RS, GE 180 UK-2RS
1978	Altenwörth	AUT	GE 60 UK-2RS-V508, GE 80 UK-2RS and GE 120 UK-2RS
1980	Albert Canal	BEL	GE 80 UK-2RS-V508 and GE 100 UK-2RS
1982	Greifenstein	AUT	16-949, GE 400 DW, 16-948
1987	Lock Gate at Vlissingen	NLD	GE 220 UK-2RS, GE 300 UK-2RS and GE 320 DW
1992	Aquamilpa	MEX	GE 460 DW
1994	Huites	MEX	GE 670 DW
1995	Cunovo	SVK	GE 280 UK-2RS
1996	Zilina	SVK	GE 100 UK-2RS, GE 160 UK-2RS and GE 440 DW-2RS2
1996	Hartel Canal	NLD	GE 180 AW, GE 320 DW
1997	Balambano	IND	GE 120 UK-2RS, GE 320 DW
1998	Lambach	AUT	GE 90 UK-2RS, GE 140 UK-2RS GE 160 UK-2RS, GE 300 UK-2RS and ZGB 180x205x105
1999	Caruachi	VEN	GE 220 UK-2RS-W1, GE 600 DW-2RS2
2001	Saemangum – first construction phase	KOR	GE 240 UK-2RS, GE 280 UK-2RS and GE 600 DW-2RS2, special design
2002	Xiao Lang Di	CHN	GE 440 DW
2003	Yong Quin	CHN	GE 300 UK-2RS
2003	ShuiBuYa	CHN	GE 1000 DW-2RS2
2003	NiErji	CHN	GE 500 DW-2RS2
2003	Saemangum – second construction phase	KOR	GE 240 UK-2RS, GE 280 UK-2RS and GE 600 DW-2RS2, special design
2004	Sessan Dam	VNM	ZGB 460x510x230-2RS



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