NSK

EXTRA-CAPACITY ECA SPHERICAL ROLLER BEARINGS

A NEW STANDARD IN HIGH PERFORMANCE FOR WIND TURBINE MAIN SHAFTS

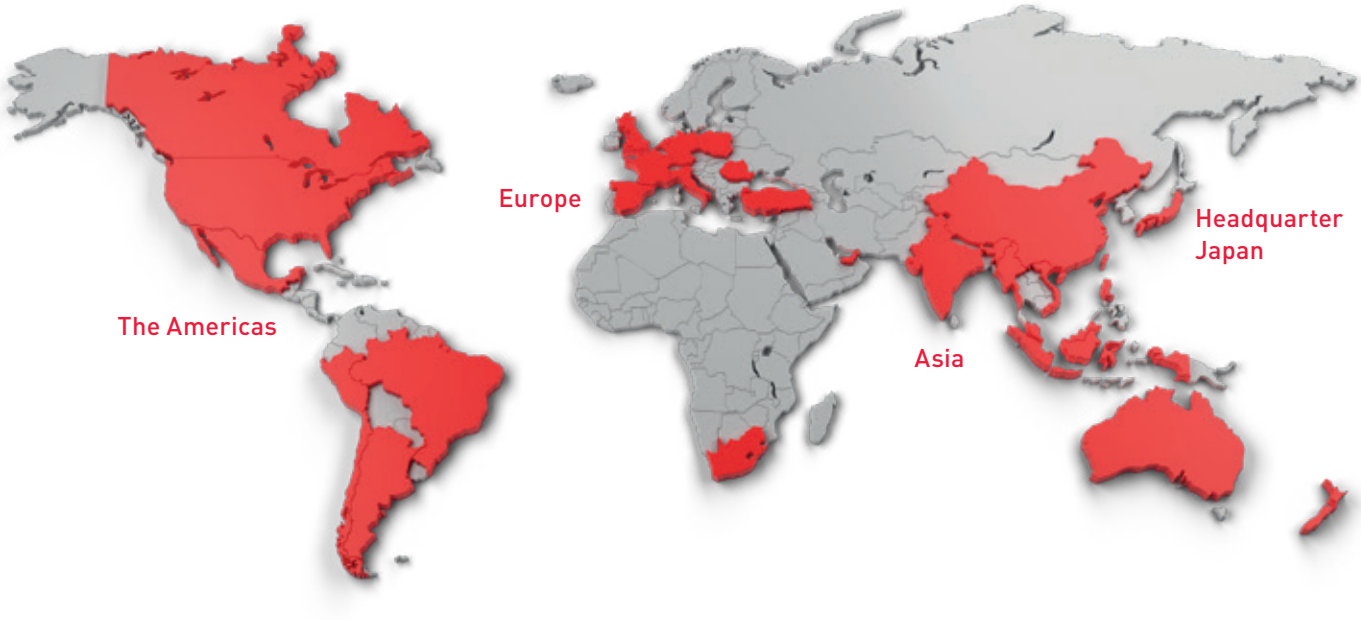


BRANDS OF **NSK EUROPE**

NSK RHP *bearings* PPL

SETTING THE FUTURE IN MOTION

We are among the leading manufacturers for rolling bearings, linear technology components and steering systems worldwide. We can be found on almost every continent – with production facilities, sales offices and technology centres – because our customers appreciate short decision-making channels, prompt deliveries and local service.



The NSK company

NSK commenced operations as the first Japanese manufacturer of rolling bearings back in 1916. Ever since, we have been continuously expanding and improving not only our product portfolio but also our range of services for various industrial sectors. In this context our worlwide research and production facilities are linked together in a global network. Here we concentrate not only on the development of new technologies, but also on the continuous optimisation of quality – at every process stage. Among other things, our research activities include product design, simulation applications using a variety of analytical systems and the development of different steels and lubricants for rolling bearings.

More about NSK under: www.nsk.com/eu-en/

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A NEW STANDARD FOR MAIN SHAFTS:

GUIDE RING-FREE WITH AN OPTIMISED PERFORMANCE ENVELOPE

Bearings for wind turbine main shafts operate under immense and continuous dynamic wind loads while rotating at ultra-low speeds, a fraction at which they have been designed to normally run. The kinematic stresses that must be endured as a result of these conditions present staggering challenges to bearings, in particular to perform with requisite durability for extremely long periods between maintainance intervals.

With our new extra-capacity ECA spherical roller bearings, NSK has redefined high-performance and reliability specifically for wind turbine main shafts with:

- Newly optimised internal design and an advanced roller-guided cage that eliminates the need for a center guide ring
- Higher load capacities derived from a larger complement of larger-sized rollers
- Superior wear resistance achieved with new design measures as well as the optional specification of NSK's long-life Super-TF steel technology



DESIGN FEATURES AND PERFORMANCE CHARACTERISTICS

Boasting newly optimised internal design and advanced cage technology, NSK's new extra-capacity ECA Spherical Roller Bearings deliver unrivalled capacity and reliability to wind turbine main shafts.

DESIGN FEATURES

- Next-generation, roller-guided machined brass cage eliminates the need for a center guide ring, reducing sliding friction and wear
- Optimised internal design packs in more rollers of larger size for a significant increase in load capacity and bearing fatigue life
- Controlled raceway surface finish improves lubrication characteristics and augments wear resistance
- High-temperature dimensional stability up to 200°C
- Optional long-life Super-TF steel for high resistance to wear and flaking damage under severe kinematic stresses
- Optional DLC roller surface treatment option for high roller toughness and endurance



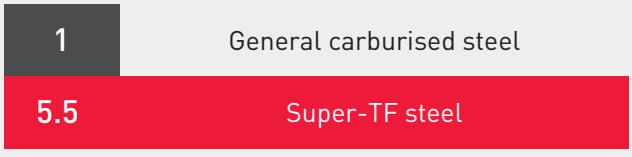
LONG-LIFE SUPER-TF STEEL OPTION

During their operating life, wind turbine main shaft bearings must endure immense radial and axial loads while operating at ultra-low speeds. Effective lubrication of rolling contact surfaces is compromised, initiating inordinate stress, wear and potential bearing failure.

NSK's Super-TF (STF) series spherical roller bearings are engineered for outstanding durability in these environments, delivering exponentially longer life when compared to conventional carburised bearings (Figure 1).

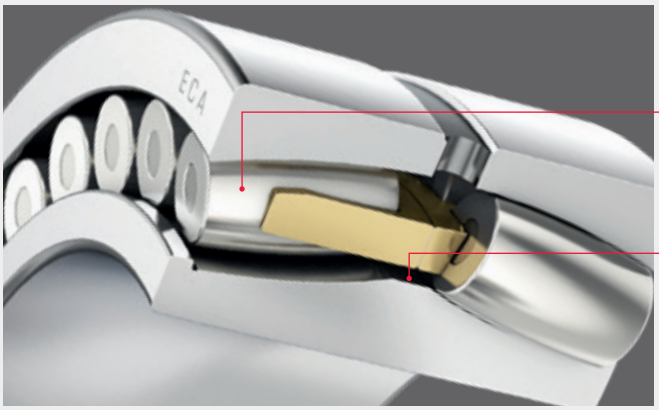
For main shaft applications this translates to achieving total cost and performance expectations without unexpected downtime and maintenance incidents.

Fig. 1: Life test result under boundary lubrication



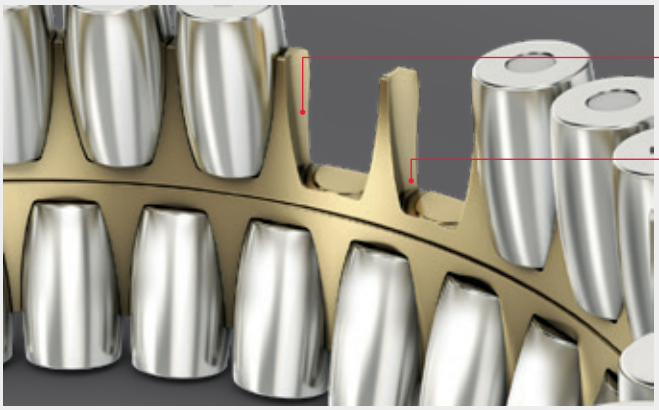
* ball-rod rolling contact fatigue test

DESIGN OPTIMISATIONS / ADVANCEMENTS



Significantly higher load capacity with increased size and quantity of rollers packed into each roller row

Optimised cage geometry eliminates the need for a center guide ring and reduces sliding friction and wear



Controlled roller motion with precision "roller hugging" cage pocket contour

Reduced cage stress with a design that balances form fitting shape with uncompromised cage bar strength in maximum stress zones

Fig. 2: Super-TF long-life material technology

Material composition	Special heat treatment	Retained austenite
Containing appropriate chrome and molybdenum additives for high material hardness	Optimised dispersion of fine carbide and carbonitride particles to achieve high compressive stress	Alleviating stress concentration on rolling contact surfaces

DESIGNATION SYSTEM

EXTRA-CAPACITY ECA SPHERICAL ROLLER BEARINGS FOR MAIN SHAFT

Special Material	Bore Ref. Number		Internal Design		Surface Treatment		Lubrication Features		Surface Finish	
STF	240	/750	E	CA	g5	S4WC	M	E4	CGXXX	U22B	U303
Dimension Series		Extra Capacity		Carburisation		Cage Type		Internal Clearance		Process Control	

DESIGNATION		ATTRIBUTE
Special material designation	blank	standard bearing steel
	STF	long-life Super-TF™ steel
Dimensional series	230	wide series 240 most commonly used in main shaft applications
	240	
Bore reference number		reference number up to 96: multiply x 5 500 mm and greater are expressed as /500 = 500 mm, etc.
Extra capacity	E	optimised cage and rollers
Internal design	CA	high capacity internal design
Carburisation	g5	complete bearing
Surface treatment	blank	standard rollers
	S4WC	diamond-like protective coating applied to roller contact surfaces
Cage type	M	two-piece machined brass cage

DESIGNATION		ATTRIBUTE
Lubrication features	E4	lubrication groove and holes in the outer ring
Internal clearance	CGXXX	custom radial clearance, in microns
Surface finish specification	U22B	advanced raceway surface finish to promote reduced wear
Process control specification	U303	special process control for all NSK wind turbine bearings



ACCUMULATED EXPERTISE

For main shaft, gearbox and generator applications alike, NSK deploys our accumulated expertise in collaboration with turbine builders and operators to achieve:

- optimum engagement with our global technology network and design solutions
- intensive project management, comprehensive engineering support
- advanced design and material technologies for high-capacity, long-life performance
- innovative solutions to negate unique phenomena such as white etching cracks (WEC) and electrical erosion
- undeterred equipment performance with condition monitoring
- control measures and processes - the NSK Wind Standard

With NSK as a development partner, our customers can embark on a critical path to realising a high level of performance, predictable reliability and total cost-efficiency in renewable energy generation.



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