



Kingsbury Spherical Tilt Pad Fluid Film Bearings

**Designing Reliability & Serviceability
for the Future of Wind Energy**





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A proven bearing concept,

now being advanced to overcome the maintenance challenges of modern wind turbines. Kingsbury brings more than a century of patented experience designing spherical tilt pad fluid film bearings for high performance rotating equipment in power generation, marine, and heavy industrial applications. That same engineering foundation is now being applied to wind turbine main bearings.

Why this matters in the wind industry.

A main bearing failure can halt power production for extended periods and require specialized equipment, logistics planning, and significant downtime to restore operation. The result is lost energy generation, complex maintenance operations, and high replacement costs, particularly for large turbines operating in remote locations.

The Impact of Bearing Failure



Downtime

Lost production compounds quickly when assets are offline.



Access

Service locations and logistics often define the repair window.



Cost

Maintenance duration and complexity directly affect lifecycle cost.

Spherical tilt pad fluid film bearings

are designed to reduce wear and simplify service in large, high-load machinery. Reliable operation and simplified maintenance are achieved through:

- Oil film that separates sliding surfaces during operation
- Pads that can be replaced uptower in situ
- Maintenance measured in days, not weeks
- High load capacity for large machines
- Controlled lubrication via circulating oil film
- Tilt pad design that accommodates varying load conditions

Over a century of spherical tilt pad bearing technology

More than a century ago, Dr. Albert Kingsbury invented and patented the spherical tilt pad bearing. This invention has proven capable of supporting combination of radial and axial loads simultaneously, making this a highly viable option for wind turbine bearings.



Novel Fluid Film Bearing for Wind Turbine Application

Validating performance under simulated wind turbine conditions through a collaborative testing program.

Testing is currently being carried out in Kingsbury's R&D Laboratory where a spherical bearing is evaluated using integrated sensor technology to capture real-time performance behavior under controlled test conditions.

Key Testing Activity

- Static and dynamic load capacity
- Characteristics of slow speed at bearing face
- Performance using high viscosity oil
- Novel bearing health monitoring methods

Critical Measurements

- Oil film temperature
- Pad face pressure distribution
- Eccentricity
- Film behavior under dynamic load

What comes next?

Current work is shifting from proof of concept, sub-scale testing to realistically-scaled testing with small turbine systems at NLR, with a focus on nacelle designs widely used across the industry. In parallel, novel performance prediction models will be expanded to evaluate full-scale configurations using high quality data generated through testing.

Project Partners

- CATAPULT Offshore Renewable Energy
- GyroMetric Systems
- Leonardo Testing Services
- National Laboratory of the Rockies
- National Offshore Wind Research & Development Consortium
- Tufts University
- UK Research and Innovation
- University of Nevada, Reno

As testing advances toward

validation and deployment, Kingsbury is translating spherical tilt pad bearing technology into wind turbine main bearing solutions ready for real-world application. This work supports confident deployment at turbine scale, informed by performance data generated through targeted testing and validation.

Steps from Testing to Deployment



Validate

Confirm performance through instrumented testing under wind-relevant loading conditions



Scale

Apply validated test results to larger bearing sizes and operating conditions



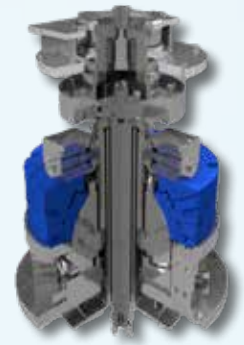
Deploy

Enable confident application in wind turbine main bearing designs

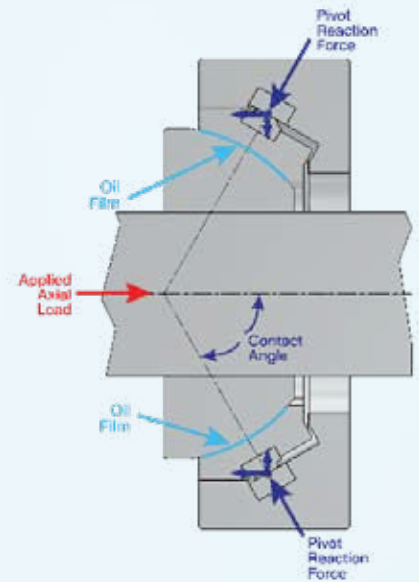


Learn more about spherical tilt pad bearings

Contact Kingsbury to learn more about why spherical tilt pad bearings are a good fit for wind turbines or your other applications.



Cutaway of test rig showing Kingsbury spherical tilt pad bearing in blue



Reaction at tilt pad pivots from applied load



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