

Weidmuller – Your Partner in Industrial Connectivity

As experienced experts we support our customers and partners around the world with products, solutions and services in the industrial environment of power, signal and data. We are at home in their industries and markets and know the technological challenges of tomorrow. We are therefore continuously developing innovative, sustainable and useful solutions for their individual needs. Together we set standards in Industrial Connectivity.

Weidmuller, Inc

821 Southlake Blvd.

Richmond, Virginia 23236

Telephone: (800) 849-9343

Fax: (804) 379-2593

Email: customerservice@weidmuller.com

Website: www.weidmuller.com

Contact Scott Sattler at

scott.sattler@weidmueller.com

for more information and site visit.

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Case Study

Twin Cap System

Insurance Against Blade Liberation from Blade Bearing Failure



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Failures in blade bearings occur as early as 2 to 3 years after the turbine starts to operate. Cracking of outer rings is one of the most common issues in the field and this failure has been seen on many turbine types.

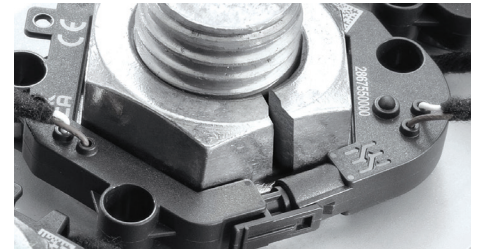


When undetected, blade bearing failure can result in blade liberation.

As a result, many turbine models continue to be at risk and require proactive monitoring that typically involves climbing the turbine and a manual inspection, which is a very costly task. This is where Weidmuller's newly developed Twin Cap for M30 Bolt nuts (modifiable to accommodate all sizes) can offer reduced blade risks for site operators. Wind sites with any type of turbine can retrofit the Twin Cap on high risk assets to help reduce maintenance costs, avoid downtime, and offer a chance to avert catastrophic blade failure.

Why Condition Monitoring System for Blade Bearings (CMBB)?

The Condition Monitoring System for Blade Bearings has been developed to detect nuts that are in the process of breaking. In these turbines, a broken nut is typically the result of a crack in the outer ring of the blade bearing. Without condition monitoring, the progression of the bearing crack and associated fastener failures will severely degrade the pitch system and eventually lead to blade loss.



Twin Cap System from Weidmuller - Early Detection Warning System

A wide variety of wind turbines are at risk for experiencing blade bearing cracks. Weidmuller has developed a sensor system that can be easily implemented on existing blades to monitor and manage risk of the fastening system to the blade bearing.

Called Twin Cap, this innovative system uses sensors over the nuts located on the outer ring of the blade bearing and connects them in a serial topology (daisy chain). If a blade bearing crack spreads from the bearing surface into the nut causing it to crack with a minimum expansion of 2mm, the system detects the broken nut, and can alert the pitch system to initiate a controlled and safe shut down.

Key Parts of the Twin Cap System

The Twin Cap system is designed to detect and signal fastener failure, which if left undetected can result in blade liberation.

Crack detection is independent of the sensor orientation.

The alarm is also visual in nature: Twin Caps are equipped with LEDs to light up at the point where the signal has been interrupted. The sensor LED will light up indicating the specific nut that is broken.



LED indicator clearly indicates the broken nut.

Sensors

- Detects nut breakages
- Utilizes a daisy chain for minimized wiring
- Easy installation and removal

Evaluation Box

- Located in the blade root
- Integrated into the pitch system
- Enables automatic shutdown

The Business Case for Blade Bearing Monitoring

If avoiding blade liberation was not reason enough to install CMBB, a Twin Cap system also reduces the need for physical inspections. TÜV has certified Twin Cap and acknowledged the same inspection service interval extension as with the original CMBB – from 3 months to 6 months, significantly reducing service and maintenance costs.

Avoiding Blade Loss:

The liberation of a blade can generate losses in excess of \$500K. In some cases, blade loss results in complete destruction of the wind turbine with an impact of \$1.5 million or more. These are compelling reasons to proactively install a monitoring system.

Potential Savings: \$1.5 million +

Maintenance Costs:

Currently blade inspection occurs every 3 months at a cost of \$5,000/3 month or \$20,000/year.

With Twin Cap, an operator can push the inspection interval to 6 months, cutting inspection costs in half, leading to a \$10,000/year savings.

Potential Savings: \$10,000/year +

Twin Cap can be adapted to any turbine model, from any OEM.

Twin Cap System – Easy to Install, Backward Compatible

Installing a Twin Cap system is fast and easy. The sensors are placed on the nuts of the outer ring of the blade bearing and secured in place with integral rare earth magnets. The small evaluation box is easily mounted in the blade root.

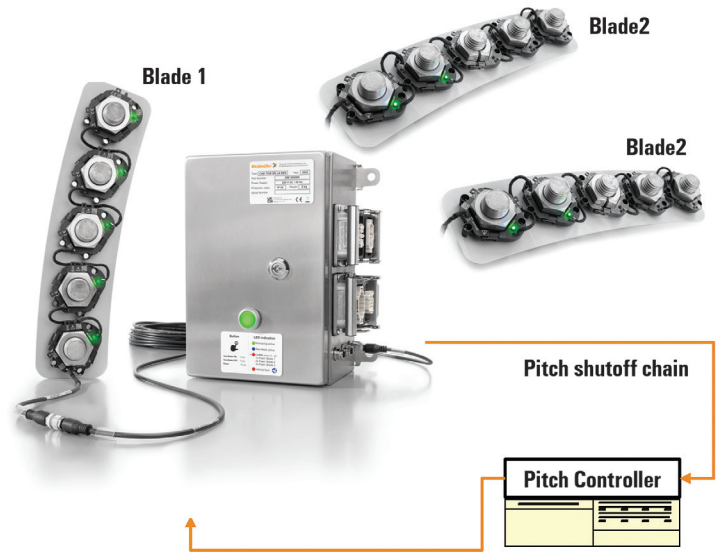
Additionally, Twin Cap sensors are backward compatible with existing/older CMBB boxes, allowing for quick and cost-effective upgrades.

When using the existing box that is already in the turbine:

✓ connection cables must be exchanged with those that are included in the Twin Cap sensor kit.

Twin Cap System Benefits:

- Reduced maintenance and inspection costs
- Reliable avoidance of blade losses
- Quick and easy installation
- Retrofittable
- On-site training for pilot installation
- More than 3,000 twin cap systems installed
- Maintenance free



The Evaluation Box interfaces with the Pitch System to communicate nut breakage and initiate a controlled shutdown request.



Twin Cap simply slides over the nut and is secured in place by strong rare earth magnets.

