

RODOLID®

Screw protection caps for
on- and offshore wind turbines



Introduction



RADOLID® Thiel GmbH is a globally active company that has specialised in the production and marketing of screw protection caps made from plastic for over 50 years. Our products protect screw connections from corrosion and dirt in the automotive, wind power, steel and mechanical engineering and construction industries.

Our products have been used on wind turbines for 30 years, initially onshore and, as the industry has increasingly expanded, also offshore. In the supply chain, we supply to some of the largest systems manufacturers such as GE and

Siemens Gamesa, as well as a variety of different companies from the servicing and maintenance, installation and setup, components and spare parts management sectors.

Corrosion on wind turbine screw connections

On offshore turbines especially, resilient protection against corrosion is of fundamental importance for ensuring the construction's operational safety. The constantly high levels of moisture and salt content in both the air and sea water create the ideal conditions for an electrochemical corrosion reaction. Added to this are the strains on the components from UV radiation, abrasive waves and wind. In order to protect the elements of a screw connection from these strains, they are usually given a metal coating immediately after the manufacturing process. The rigours of transport and assembly, however, mean these components can experience mechanical damage, preventing all-round corrosion protection on the screw connection from being guaranteed. We therefore recommend a RADOLID® screw protection cap in combination with our EP7010 corrosion protection grease, for corrosiveness category C5-M.

Turbines that are onshore are generally exposed to less aggressive environmental conditions than those at sea. Nevertheless, rainfall can for example cause corrosion reactions, especially on foundation screws. In this case, we recommend the use of a RADOLID® screw protection cap for categories C2 and C3. In addition to the protection cap's corrosion protection function, it is used in particular onshore as a means of preventing injury, making the unwarranted loosening of the connection more difficult.



Corrosion protection effect and features



The RADOLID® screw protection cap reduces the contact between the corrosive medium and the screw connection as much as possible, ensuring that corrosion reactions are kept to an absolute minimum. The protection cap achieves its sealing effect thanks to the system described below, patented by RADOLID®, consisting of a sealing lip, circular groove and round cross-section.

The external circumferential **sealing lip** on the cap adapts to the surface characteristics of the contact surface and seals the system off as extensively as possible to the outside.

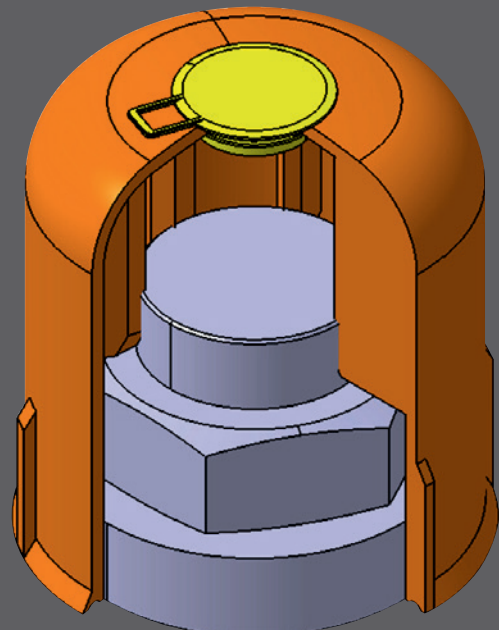
The internal circumferential **chamfer** forms a protective chamber. With this, if there is any slight fluid ingress, the fluid can collect, preventing it from penetrating the interior of the cap.

The **round cross-section** inhibits any possible crevice corrosion. If a protective cap with an internal hex is used, the outer surfaces of the nut form a gap area with the abutting interior surfaces of the cap. If the width of this gap is smaller than the critical gap width, then crevice corrosion occurs. Thanks to its round cross-section, the RADOLID® cap will not fail to reach the critical gap width.

Quick and easy installation

RADOLID® screw protection caps are clamped using the interior clamping edge to the nut or screw head (SW type) or screwed using the interior lugs onto the thread projection (BM type). Special types that combine both types of connection are also available, as are types for round nuts (e.g. IHF Stretch System). Our technical sales team will be happy to assist you with advice regarding your specific application requirements.

For **assembly**, SW-type clamping caps can be applied by hand or using a rubber mallet to the nut or the screw cap. The use of only branded raw material means that there is no risk of damage to or even bursting of the cap. BM-type screw caps can be simply screwed onto the thread. For the use of assembly tools, there are either tightening lugs or a hexagon on the outside of the cap. We would be happy to provide appropriate assembly instructions for the various cap types.



Salt spray tests according to DIN 9227 after 1.000 h



Given the roughness of the contact surface, the entry of fluid into the protection cap can in some cases be unavoidable, especially with offshore applications. This does not render the protection cap ineffective, however. Exposure tests in collaboration with the Fraunhofer IWES, salt spray tests and our many years of experience have shown that **significantly less corrosion** occurs on a screw connection with a RADOLID® protection cap than on an unprotected connection, even if moisture does enter the cap. You can see the results of a salt spray mist test below:

To allow fluid to escape again, especially in cases of inverted installations, we offer protection caps featuring **drill holes**. We position these at the lowest point of the cap so that liquid is able to flow out, but not in. Where a screw connection with sensors is used (e.g. PMTS Intelligent Fastener®), we equip the protection cap with a **removable**

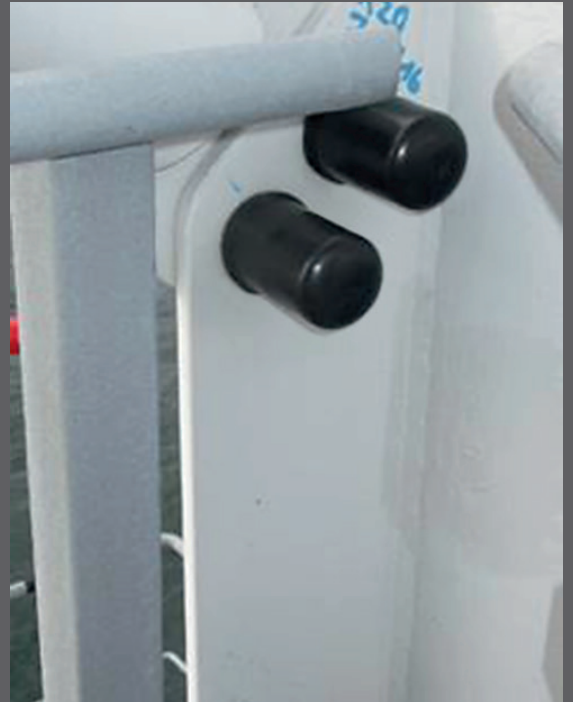
plug, so that the sensor can be accessed without having to dismantle the cap. After measurement, the plug is placed back in the corresponding drill hole by hand. Our technical sales team would be happy to advise you on this too.

We would be delighted to share the results and reports from the tests mentioned above with you upon request.

References

Alpha Ventus

SW-type clamping caps on platform connections

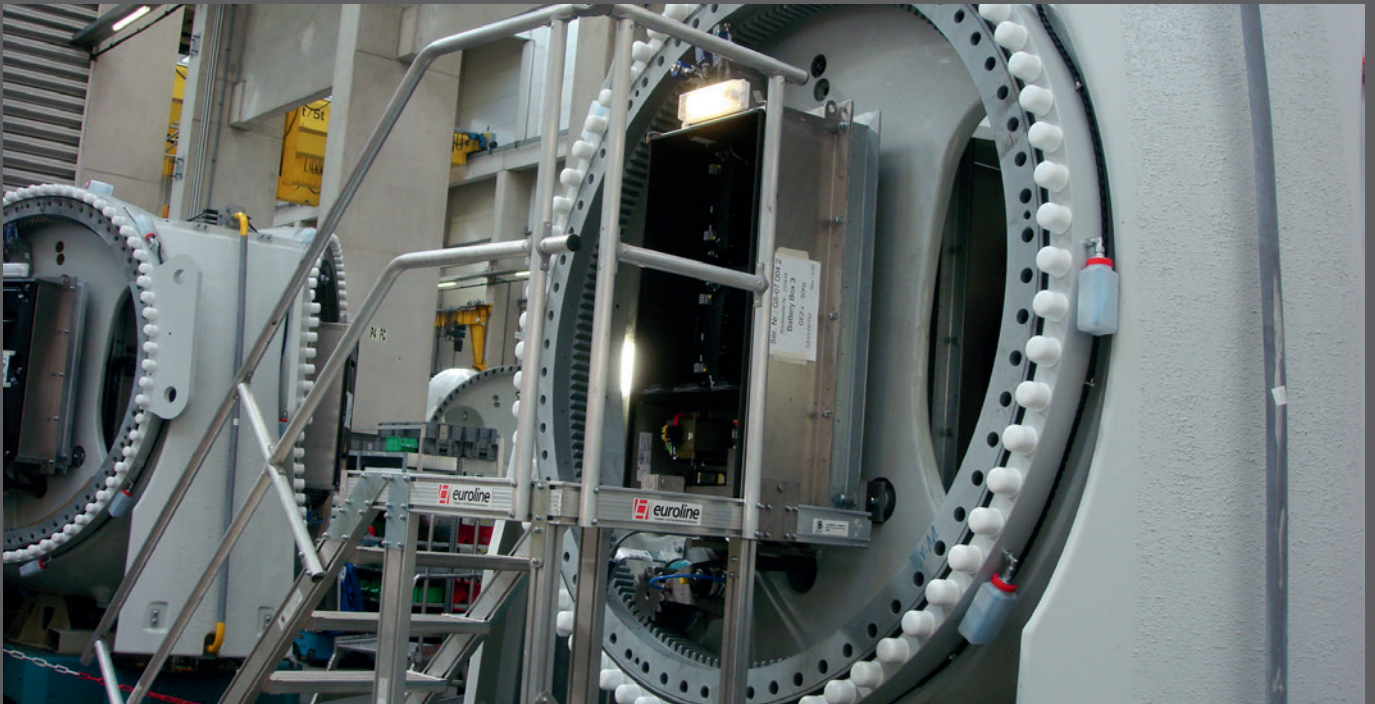


Onshore foundations

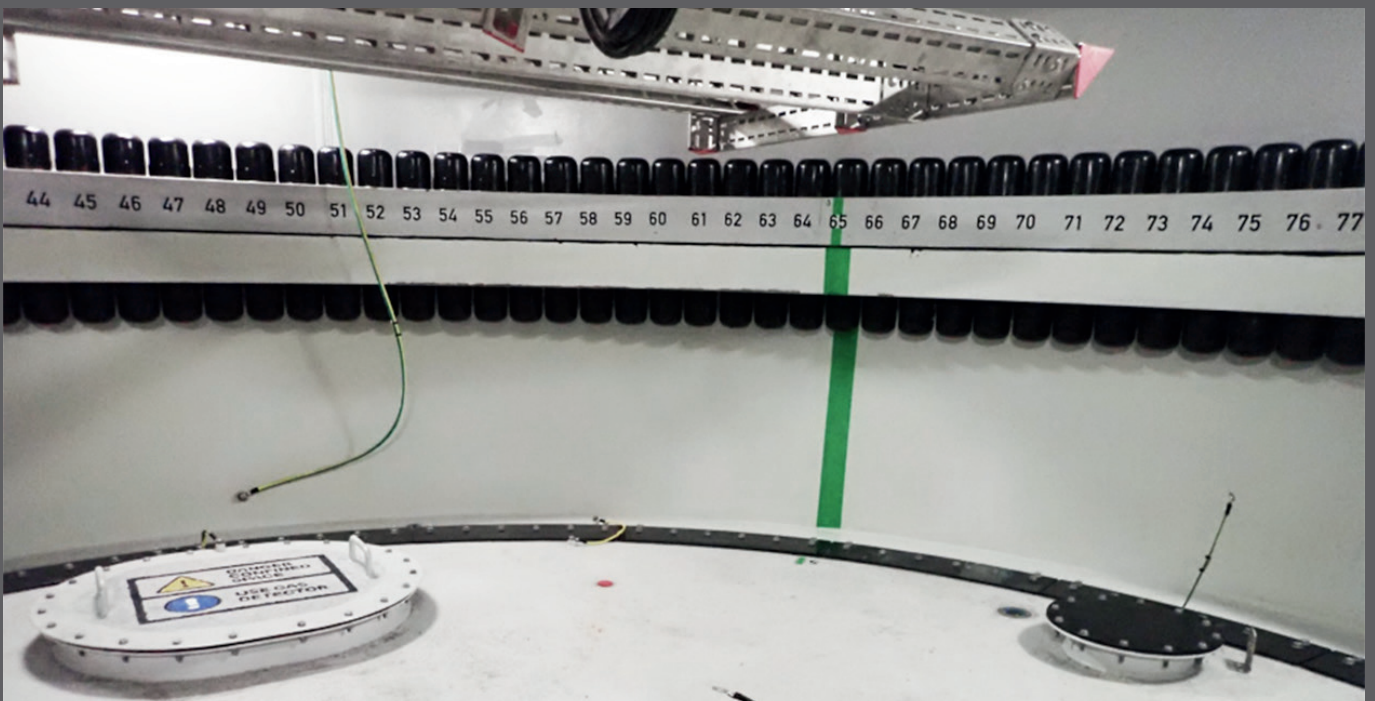
SW-type clamping caps on tower flange connections



1.5 Megawatt Turbines
Protection Caps type SW on hub connections



Deutsche Bucht
BM-type screw caps on tower flange connections with sensors (IHF connecting elements)



RADOLID® Thiel GmbH

Langenstück 2
58579 Schalksmühle
Germany

Phone +49 (0) 23 51/ 97 94 94

Fax +49 (0) 23 51/ 97 94 90

info@radolid.de

Contact

Mr Fabian Henkes
Bachelor of Engineering (B.Eng.)
Technical Consulting & Sales / Key Account Manager

Phone +49 (0) 23 51/ 97 94 95

fhenkes@radolid.de

www.radolid.de

