MasterProtect 9000
Highly Durable Coating System for Offshore Foundations
“We have investigated the offshore coating market and concluded that in terms of properties, economics and ease of application, MasterProtect 9000 is the best offshore coating system available. MasterProtect 9000 is the optimum protection for our offshore foundation Hexabase structure.”

Dr.-Ing. Siear Qaimi, ThyssenKrupp Steel Europe AG, Emilio Reales, MOG GmbH, Germany
MasterProtect 9000: Highly Durable Polyurethane Coating System for Offshore Structures

**MasterProtect 9000** is the first coating system for offshore structures which ensures a 25-year protection. A high-build PU membrane forms the basis of **MasterProtect 9000**, which provides the properties for an excellent durability in offshore environments.

The flexibility of the membrane ensures long term integrity even after years of exposure to marine environment, weathering, vibrations and thermal expansion cycles. The high chemical and mechanical resistance of **MasterProtect 9000** provides the necessary protection against offshore attacks of seawater, waves, abrasion, and impacts, especially encountered in the splash and submerged zones. The result is a continuous protection against steel corrosion.

The fields of application for **MasterProtect 9000** are situated in the two most critical areas of offshore foundations: i.e.
- Splash zone
- Submerged foundation

Due to the novel chemical concept of the high-build polyurethane membrane, and highly hydrophobic nature of the system, **MasterProtect 9000** fulfills the requirements for all offshore and marine structures, e.g.:
- Wind turbine foundations and transformer platforms
- Oil and gas structures
- Jetties

The use of **MasterProtect 9000** reduces time and costs during application. The complete system can be applied in only one day, allowing a highly efficient application and manufacturing phase. During the service life of the offshore structures of typically 25 years, maintenance costs are under control while fewer galvanic anodes provide the ultimate required level of protection. **MasterProtect 9000** applied to the entire structure will further allow to design for lower corrosion allowance and thus thinner steel structures.
MasterProtect 9000 – For the Two Most Critical Areas

Coating systems according to NORSOK M-501

Protection systems for offshore structures are classified into different application categories which each require specific characteristics.

System 1: Carbon steel with operating temperatures below 120°C
- structural steel
- exteriors of equipment, vessels, piping, wind turbine towers, …

1 System 7A: Carbon and stainless steel in the splash zone

2 System 7B: Submerged carbon and stainless steel at temperatures ≤ 50°C
MasterProtect 9000 Systems

1. Splash zone
   NORSOK M-501
   System 7A

   **Primer MasterProtect P 9637**
   - Zinc-rich for anodic protection
   - Excellent bonding
   - 2C-EP zinc-rich primer
   - Drying time 20-30 min (RT), fast curing even at low temperatures
   - High degree of corrosion protection by providing additional galvanic action

   **Membrane MasterProtect M 9000**
   - Flexible and crack bridging
   - High mechanical and chemical resistance
   - Highly hydrophobic
   - Sprayed PUR elastomer, tack-free after 30 sec. solvent free
   - Very high permanent resistance to salt water
   - Exceptional low temperature elasticity
   - Noise-dampening effect coming from the elastic and high-build nature

   **Top coat MasterProtect TC 9681**
   - UV-stable
   - Abrasion resistant
   - 2C-Polyaspartic Top Coat
   - RAL 1023 (high-vis color)
   - High wear resistance
   - Smooth surface reducing marine growth
   - Fast drying (< 60 min)

2. Submerged zone
   NORSOK M-501
   System 7B

   **Top coat MasterProtect TC 9681**
   thickness: 60 to 80 µm

   **Membrane MasterProtect M 9000**
   thickness: 1.2 to 3.0 mm

   **Primer MasterProtect P 9637**
   thickness: 25 to 40 µm

MasterProtect P 9637 is the first layer of the system, and offers an active anodic protection against corrosion of the structure. The application using airless spray equipment is fast and easy. The subsequent layer of MasterProtect M 9000 can be applied after just 30 minutes at 20°C. MasterProtect M 9000 is the second layer of the system and the heart of it. The unique properties of the high-build PU membrane resists thermal expansion of the steel structure, salts, impact etc., and ensures a 25-year durability of the system. MasterProtect M 9000 is spray applied with special hot-spray equipment and can be re-coated after 30 minutes at 20°C. MasterProtect TC 9681 provides the high-vis color of the offshore structure and further protects the membrane against UV light and ingress. Various colors are available to meet local standards and regulations. The application is fast and easy with airless spray equipment. The product dries in just 60 minutes at 20°C, for a quick handling of the structures and exposure to the elements.
Validation of MasterProtect 9000

Master Builders Solutions by BASF

Master Builders Solutions by BASF helps the wind industry to be more successful by better understanding the needs of our partners and reducing the risks involved in the construction and exploration of modern wind farms.

Fulfill the needs in offshore applications

The task of the product developers in BASF’s research laboratories: to develop a coating material that meets the requirements of the offshore industry, especially a system that significantly reduces the time required for the manufacturing and coating process of offshore structures. A hot spray applied coating that resists long lasting exposure to seawater is new and innovative in the offshore industry. The need for such coating system that lasts 25 years under harsh offshore conditions was met with MasterProtect 9000.

The NORSOK M-501 standard specifies the requirements for the selection of coating materials, surface preparation, application methods and test for protective coatings to be applied during the construction and installation of offshore installations and associated equipment.

The standard NORSOK M-501 covers paints, metallic coatings and the spraying of passive fire protection coatings.

The aim of the NORSOK M-501 standard is to obtain a coating system which ensures:
1. Optimal protection of the system with minimal maintenance
2. A maintenance friendly coating system
3. The coating system should be easy to use
4. The standard assesses and documents effects on health, safety and environment.

Fraunhofer IFAM has issued a test report which confirms compliance of the MasterProtect 9000 System for applications in the splash zone as well as for fully immersed applications.
NORSOK M-501 compliance testing was conducted at the Fraunhofer IFAM testing institute. Test specimens were subjected to corrosion protection tests in accordance with the requirements of ISO 20340. Coated steel specimens were tested before and after exposure to cyclic and cathodic disbonding testing.

The cyclic testing consists of an exposure to various subsequent exposure conditions. After such exposure the condition of the coating is validated and compared to the non-exposed specimens.

In the cathodic disbonding test, thick organic coatings are treated under cathodic protection in seawater and their respective time degradation is monitored by EIS measurements (electrochemical impedance spectroscopy).

<table>
<thead>
<tr>
<th>Evaluation before exposure: MasterProtect 9000 Offshore system</th>
<th>Average of 3 specimens</th>
<th>NORSOK M-501 requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIN EN ISO 2808 Film thickness [µm]</td>
<td>1,2 – 2,0 mm</td>
<td>NA</td>
</tr>
<tr>
<td>DIN EN ISO 4624 Adhesion strength [MPa]</td>
<td>7,5 MPa</td>
<td>&gt; 5 MPa</td>
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</tbody>
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<table>
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<tr>
<th>Evaluation after exposure (duration: 4200 hours): MasterProtect Offshore system</th>
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<tbody>
<tr>
<td>DIN EN ISO 4624 Adhesion strength</td>
</tr>
<tr>
<td>Corrosion at the scribe Visual corrosion</td>
</tr>
<tr>
<td>DIN EN ISO 4628-2 Degree of blistering</td>
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<tr>
<td>DIN EN ISO 4628-3 Degree of rusting</td>
</tr>
<tr>
<td>DIN EN ISO 4628-4 Degree of cracking</td>
</tr>
<tr>
<td>DIN EN ISO 4628-5 Degree of flaking</td>
</tr>
<tr>
<td>DIN EN ISO 4628-6 Chalking</td>
</tr>
<tr>
<td>Visual inspection</td>
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<tr>
<td>Disbonding Dalamination at the scribe</td>
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</tbody>
</table>
MasterProtect 9000 Improves Offshore Protection

The corrosion of offshore steel structures is often the result of:
- ca. 50% Cracking of the paint
- ca. 50% Mistakes during application (surface preparation, time window between 2 layers, temperature range, etc.)

The MasterProtect 9000 system overcomes these defaults and ensures the long-term durability of the structure.

Micro cracks often occur with traditional coatings in areas with special shapes and in the vicinity of the welding of two elements, resulting in corrosion. Due to the high elasticity and flexibility of MasterProtect 9000, micro cracking does not occur after application nor after many years in service.

All 3 layers of the MasterProtect 9000 system can be spray applied, and while being fast curing reduce the waiting time between subsequent layers optimizing the overall application time. Furthermore, the fast curing reduces the risk for any problem to occur during the critical curing phase, when the material is weak.
Durability of MasterProtect 9000

These 5 main properties guarantee that the 
MasterProtect 9000 can last 25 years without special maintenance in the harsh offshore environment.

- Elongation $\geq 250\%$
- High-build – 1,2 to 3 mm
- Fast application – 1 day for full system
- Highly hydrophobic
- High shore hardness, high tear strength

15 YEARS
Lifetime of a conventional epoxy system

Sacrificial anode
Corrosion allowance according to classification society is 0.3 mm per year.

Difference between the estimated service time of the offshore structure (25 years) and lifetime of corrosion protection system of 10 years.

The design of the foundation thus needs to consider 3 mm additional steel for corrosion allowance. This results in higher steel thickness and weight as theoretically necessary for the structural integrity.

Maintenance
Higher maintenance and repair costs, typically in the range of 3000 €/m², are to be considered in case of failure.

25 YEARS
Lifetime of MasterProtect 9000 offshore system

Sacrificial anode
Corrosion allowance according to classification society is 0.3 mm per year.

As there is no difference between the estimated service time of the offshore structure (25 years) and lifetime of corrosion protection system there is a strongly reduced need for galvanic anodes.

Corrosion allowance should only be considered for contingency reasons if the structure is completely coated down to the sea bed.

Maintenance
Lower maintenance and repair costs as the risk for failures with the galvanic anodes is significantly reduced.

25% cost saving with MasterProtect 9000 when compared with a traditional design using EP-coatings
MasterProtect 9000: Cost Reduction of Offshore Foundation Contract

Highly Durable Polyurethane Coating System for offshore structures

Benefits during application
- Minimizing manpower – increased number of cycles in serial production.
- Fast reaction and short curing times. All coats can be applied within regular working shift (8h).
- Active zinc primer provides additional galvanic protection.
- Spray applied products for ease of application, and quality of works.
- Primer and top coat meet the EU directive for low VOC content. The Polyurethane membrane is 100% solvent free.
- Layer thicknesses of 500 μm - 3000 μm may be applied in one cycle, due to the fast reaction time of the membrane.
- Foundations can be transferred from the fabrication hall to external storage area shortly after application of the final layer.

Benefits in operation
- Long-term lifetime > 25 years.
- Highly hydrophobic for a continuous long lasting seawater resistance.
- Support of bubble curtains as high-build coating system provides additional noise reduction during offshore pile-driving.
- No embrittlement of MasterProtect 9000, as the coating system remains permanently elastic even at very low temperatures.
- The coating is highly impact and abrasion resistant.
- Up to 80% reduction of the sacrificial anode mass, when structure is coated down to the seabed.
- Considerable weight and cost saving potential of the steel structure. Possible reduction of the corrosion allowance when the structure is fully coated to the seabed.
- The signal yellow top coat is particularly UV-stable and retains its color fidelity.
- Smooth top coat minimizing marine growth
Master Builders Solutions from BASF

Master Builders Solutions

The Master Builders Solutions brand brings all of BASF’s expertise together to create chemical solutions for new construction, maintenance, repair and renovation of structures. Master Builders Solutions is built on the experience gained from more than a century in the construction industry.

The know-how and experience of a global community of BASF construction experts form the core of Master Builders Solutions. We combine the right elements from our portfolio to solve your specific construction challenges. We collaborate across areas of expertise and regions and draw on the experience gained from countless construction projects world-wide. We leverage global BASF technologies, as well as our in-depth knowledge of local building needs, to develop innovations that help make you more successful and drive sustainable construction.

Our comprehensive portfolio

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- Chemical solutions for underground construction
- Waterproofing solutions
- Sealants
- Concrete repair and protection solutions
- Performance grouts
- Performance flooring solutions
Master Builders Solutions from BASF for the Construction Industry

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Complete solutions for air entrained concrete

MasterBrace
Solutions for concrete strengthening

MasterCast
Solutions for the manufactured concrete product industry

MasterCem
Solutions for cement manufacture

MasterEase
Low viscosity for high-performance concrete

MasterEmaco
Solutions for concrete repair

MasterFinish
Solutions for formwork treatment and surface improvement

MasterFlow
Solutions for precision grouting

MasterFiber
Comprehensive solutions for fiber-reinforced concrete

MasterGlenium
Solutions for high-performance concrete

MasterInject
Solutions for concrete injection

MasterKure
Solutions for concrete curing

MasterLife
Solutions for enhanced durability

MasterMatrix
Advanced rheology control for concrete

MasterPel
Solutions for water-tight concrete

MasterPolyheed
Solutions for mid-range concrete

MasterPozzolith
Solutions for water-reduced concrete

MasterProtect
Solutions for concrete protection

MasterRheobuild
Solutions for high-strength concrete

MasterRoc
Solutions for underground construction

MasterSeal
Solutions for waterproofing and sealing

MasterSet
Solutions for setting control

MasterSuna
Solutions for sand and gravel in concrete

MasterSure
Solutions for extraordinary workability retention

MasterTop
Solutions for industrial and commercial floors

Master X-Seed
Advanced accelerator solutions for concrete

Ucrete
Flooring solutions for harsh environments

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ADVANCED CHEMISTRY BY MASTER BUILDERS SOLUTIONS

Let the numbers do the talking: We have portrayed some of our most eco-efficient product solutions for concrete and precast production, construction, civil engineering, and flooring.

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