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Corrosion Protection for Offshore Wind Structures

Part 2: Requirements for Corrosion Protection Systems

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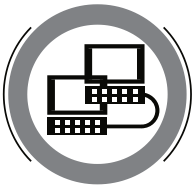

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Part 2 – Corrosion protection systems

Contents

1 General

Part 2* of the standard “Corrosion Protection for Offshore Wind Structures” describes the requirements for coating and duplex systems for initial corrosion protection.

2 Corrosion protection systems

For offshore structures, only coating and duplex systems that meet the requirements of Table 1, Table 2 and Table 4 may be used as corrosion protection. Test reports from an accredited testing institute (see below) are required as evidence (proof of suitability).

The tests are defined in sections 3 and 5 and are divided into

- tests on the coating material (section 3) and
- tests before and after exposure (section 5).

If the use of a thermal spray coating is intended, the requirements set out in Part 1, section 7 apply.

Note:

For atmospheric external areas in zones 2 and 3, it must be ensured that the corrosion protection system to be tested is sufficiently resistant to UV radiation for the intended use. Epoxy resin coatings as top coats should be avoided in all cases, as there is also insufficient surface adhesion without mechanical preparation for subsequent repairs, for example (intermediate adhesion problem).

2.1 Testing institutes

The corrosion protection systems are to be tested by a testing institute which issues a test report to the manufacturer after a successful test. The testing institute must demonstrate with the test report at the latest that it is

- an accredited test laboratory to ISO/IEC 17025 in this field

or

- a corrosion protection laboratory of an ordinary member company of vgbe.

**) In case of doubt, the German version is the reference version.*

2.2 Production of the specimen panels

All specimen panels required for the tests, made of unalloyed structural steel in accordance with EN 10020, must be produced by one of the testing laboratories listed in section 2.1. Alternatively, the manufacturer of the corrosion protection system can produce the specimen panels in the presence of the testing institute or under the supervision of an independent coating inspector certified in accordance with

- DIN CERTCO Level C,
- FROSIO Level III,
- NACE Level 3,
- NACE Level 2 in combination with at least 5 years' professional experience

or comparable evidence.

The test panels are to be prepared by blasting with a surface roughness grade of Sa 2½ with a maximum roughness grade of B (ISO 8501-1). An average roughness grade of "medium (G)" according to ISO 8503-1 is required for the blasted surface. Only angular abrasive (grit) should be used for this.

All specimen panels must be produced uniformly, i.e. at the same time with an identical layer system and application method. For the laboratory test, the panels that are subjected to stress in a climatic chamber must also be coated on the reverse side with the coating system to be tested. Alternatively, a corrosion protection system with a higher resistance to corrosion should be used for the reverse side.

The application conditions, the coating structure and the batches used must be documented; see the appendix.

The test panels are to be conditioned for at least seven days in a standard climate (23 ± 2°C / 50 ± 5 % relative humidity), with free air circulation and without direct exposure to sunlight. Subsequently, exposure and testing should begin as soon as possible.

If the technical data sheet of the corrosion protection system to be tested specifies other requirements, such as degree of roughness, application conditions or conditioning, these must be observed and documented.

2.3 Film thicknesses of the coating system on the test panels

When manufacturing the test panels, the minimum requirements for the number of coats and the nominal film thickness for the individual zones in table 1 must be observed. Table 2 also contains requirements for steel substrates with metallisation.

Table 1: Minimum number of coats (MNOC) and nominal dry film thicknesses of a coating on the blasted steel substrate of test panels in relation to the zone

Zone	Corrosive stress areas	MNOC	NDFT [µm]
1	– Soil, external and internal – Underwater zone (UWZ), external and internal	1	≥ 800
		2	≥ 600
2	– Splash zone (SZ), external – Tidal zone (TZ), external and internal	2	≥ 600
3	Atmosphere, external	3	≥ 360
4a	Atmosphere, internal (not air-conditioned)	2	≥ 300
4b	Atmosphere, internal (air-conditioned)	2	≥ 240

Table 2: Minimum number of coats (MNOC) and nominal dry film thicknesses of a coating on a steel substrate with metallisation on the test panels

Zone	Corrosive stress areas	MNOC [without sealer]	NDFT [µm]
3	Atmosphere, external	2	≥ 240
4a	Atmosphere, internal (not air-conditioned)	2	≥ 200
4b	Atmosphere, internal (air-conditioned)	2	≥ 160

The film thicknesses are defined as nominal dry film thickness (NDFT).

The individual and total film thicknesses are to be measured in accordance with ISO 19840. In the case of electronic measurement, the adjustment (calibration) is to be performed on a smooth surface only.

The following applies to the minimum measured film thickness:

- Film thickness at least 80 % of nominal dry film thickness

The following applies to the maximum measured film thickness (in accordance with ISO 12944-6):

- Nominal dry film thickness ≤ 60 µm: max. 150 % of NDFT
- Nominal dry film thickness > 60 µm: max. 125 % of NDFT

These requirements apply to the individual and total film thicknesses.

2.4 Artificial damage to the specimen panels

For tests 5.3, 5.5 and 5.6, the specimen plates (Figure 1) are to be prepared with a milled scribe. The scribe must be carried out down to the unalloyed steel so that the coating in the scribe is completely removed.

Requirements for the scribe:

- Width 2 mm,
- Length 50 mm and
- Located at least 25 mm from the edges.

The scribe is to be aligned vertically in the testing equipment.

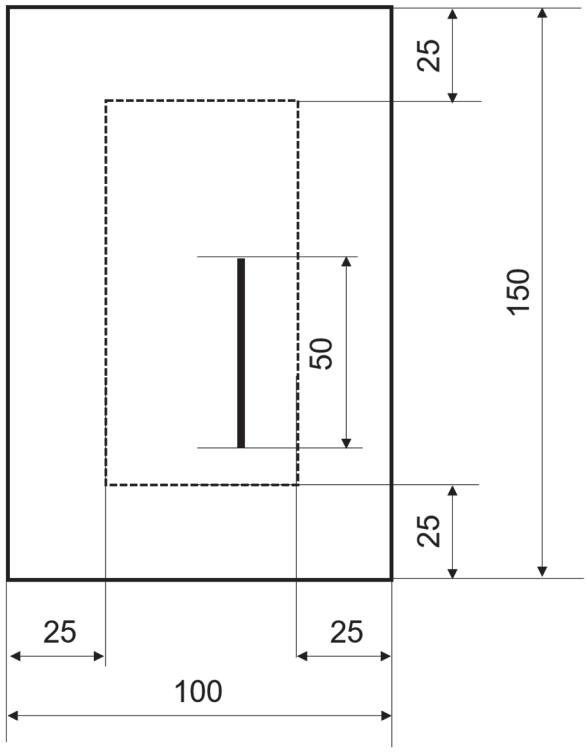

Fig. 1: Example of a test panel with vertical scribe (2 mm wide). The vertical scribe can be freely positioned in the area outlined by dashes. Dimensions in millimetres.

3 Tests on the coating material

The tests on the wet samples of the individual coating materials must be identified during the tests by the testing institutes named in section 2.1 and the parameters submitted by the coating material manufacturer (specified values including tolerance ranges) must be checked for conformity.

The validity period of the coating material test is 10 years.

The parameters listed in table 3 must be tested and the tolerance ranges must be complied with.

Table 3: Parameters and tolerance ranges

Parameter	Tolerance range
Viscosity (e.g. to Brookfield)	See manufacturer's data
Density	±0.05 g/cm^3
Pigment and filler content	±2.5 %
Binder content	±2.5 %
Solvent content (volatiles)	±2.5 %
Pot life	See manufacturer's data

The viscosity and density are to be determined from the individual components or from the mixture according to the manufacturer's specifications:

- The viscosity can be determined, for example, using the flow cup method to ISO 2431 or the rotational viscometer method to ISO 2884.
- The density can be determined for example using the pycnometer method to ISO 2811-1.

The following procedure is employed to examine the quantitative composition of the individual components of the coating material:

– The pigment or filler content is determined by weighing, after separation from the resin, by means of centrifuging and drying in the open air.

– The percentage of volatile components (solvent content) of coating systems is determined after initial weighing (after mixing), cured 24 h at room temperature and 50 % humidity, and subsequently the loss on drying is determined according to DIN EN ISO 3251 (weight of sample approx. 2 g, 105 °C, 2 h)

– The binder content is determined indirectly by subtraction.

For two-component coating systems, the working time (pot life) of the mixture is to be checked at room temperature (23 ±2 °C and 50 ±5 % relative humidity). The solvent content must also be determined from the mixture.

Additional tests such as

- fingerprinting by Fourier transform infrared spectroscopy (FTIR) on the liquid and cured coating material,
- determination of the residue on ignition / ash content of the liquid and cured coating material, and
- determination of the functional group content of the liquid coating material

may be agreed by the contracting parties.

Furthermore, the following documents are to be attached to the test reports:

- Safety data sheets
- Technical data sheets
- Additional processing specifications (if any).

4 Evidence of suitability

To verify the suitability of a coating system as permanent corrosion protection in the offshore sector, the tests listed in Table 4 must be carried out and documented with a corresponding test report.

Test reports are valid for 10 years from the date of issue. Existing test reports are valid as long as the current requirements (4th edition) are met.

Table 4: Tests required for the various exposure zones (as set out in Part 1, section 4)

Section	Test	Zone 1	Zone 2	Zone 3	Zone 4a	Zone 4b
		Seabed / UWZ (external / internal)	TZ / SZ (external / internal)	Atmosphere (external)	Atmosphere (internal, not air-conditioned)	Atmosphere (internal, air-conditioned)
5.1	Adhesion	✓	✓	✓	✓	✓
5.2	Impact strength [1]	---	✓	---	---	---
5.3	Immersion (NaCl) [2]	4,200 h	---	---	---	---
5.4	Condensation test	---	1,440 h	1,440 h	720 h	480 h
5.5	Salt spray test	---	2,160 h	2,160 h	1,440 h	720 h
5.6	Cyclic ageing test	---	4,200 h		---	---
5.7	ICCP stability	15 months		---	---	---
5.8	Water vapour diffusion [3]	21 days		---	---	---

[1] The impact strength test for zone 2 internal is optional.

[2] Passing of a salt spray test (2,160 h) is considered an alternative to the immersion test for zone 1; see section 5.5.

[3] The water vapour diffusion test is only carried out on epoxy resin coats. The test is not carried out on other coatings (e.g. epoxy Zn(R) base coat).

Note:

Further tests, such as testing resistance to abrasion or colour fastness, can be agreed as additional tests by the customer and the contractor.

4.1 Dimensions of the test panels

The panels required for the tests described in chapter 5 must have the following dimensions in order to provide a sufficiently large test area for destructive tests after the end of exposure:

- Length: 150 mm
- Width: 100 mm
- Thickness: 3 mm
- Thickness: 4 mm (for impact test only)

The dimensions for the length and width of the specimen panels are minimum dimensions and larger panels may be used if required. The dimensions for the thickness of the specimen panels must be adhered to as specified. Coatings are not included in the dimensions of the test panels.

For the adhesion test, it is recommended to reinforce the back of the specimen panels with a sufficiently thick steel plate prior to the test when using the one-sided method. Bonding is carried out with a suitable adhesive (e.g. two-component epoxy).

A minimum thickness of 4 mm is required for the impact test (section 5.2). It is permissible to underlay a 3 mm thick test panel with a ≥ 1 mm thick steel plate.

4.2 Evaluation at the end of exposure

The relevant visual assessments (ISO 4628) must be carried out immediately after the test procedures have been completed, as described in the following sections.

When duplex systems are used, the metallic layer is part of the corrosion protection system. Therefore, only corrosion products originating from the carbon steel substrate are to be considered for the tests with an assessment of corrosion around the scribe.

For the adhesion tests, 3 test dollies must be used per test panel. The requirement values from the following tables apply to each individual measurement, i.e. each dolly on the test panels to be evaluated must fulfil the requirement. The diameter of the test dollies is to be 20 mm.

Within each test, at least two of three test panels must fulfil all the requirements.

Note:

Measured values may be commercially rounded. For example, in the cyclic ageing test, a measured value of 6.49 mm for corrosion around the scribe is rounded down to 6 mm, thus fulfilling the evaluation criterion. In the pull-off test as a reference test for zone 1, a measured value of 7.50 MPa is rounded up to 8 MPa, which also fulfils the evaluation criterion.

5 Tests before and after exposure

5.1 Adhesion test: determination of pull-off strength

The adhesion test is carried out without a prior exposure phase (reference test) using the pull-off method based on ISO 4624 and evaluated according to Table 5.

The adhesive strength (in MPa), the separation case (adhesion or cohesion break-down), its position (e.g. between the primer/base coat and the first intermediate coat) and the percentage of the respective coating layer or interfaces are determined.

The adhesion test is to be performed by one of the following two methods:

- Sandwich method, or
- Single-sided pull-off.

Table 5: Requirements and assessment procedure for determination of pull-off strength

Zones: 1 (Soil/UWZ) **/ 2** TZ/SZ) / **3** (Atmosphere external) / **4a/4b** (Atmosphere internal)	
Requirement	**Value**
Test temperatures	23 ±2 °C and 5 ±2 °C
Number of test panels	6 (3 per test temperature)
Number of test dollies per test panel	3
Diameter of test dolly	20.0 mm
Assessment method	**Assessment criterion**
Adhesion – pull-off test (ISO 4624)	Zone 1: ≥ 8 MPa Zone 2, 3, 4a/4b: ≥ 5 MPa *(depending on fracture pattern)*

5.2 Impact resistance test: determination of resistance to rapid deformation by a falling weight

Testing of impact resistance is based on ISO 6272-1, with assessment to ISO 29601. Impact testing for zone 2 internal is optional.

In order to detect existing pores caused by errors in applying the coating film, the test panels must be tested for impermeability using the high voltage method to ISO 29601 before impact testing. When calculating the test voltage based on the total nominal dry film thickness, electrically conductive coatings (e.g. metallization, zinc dust primers) are not taken into account.

After the impact, cracks and peeling are visually inspected and documented without magnifying glasses and the impermeability of the coating is checked using the high voltage method to ISO 29601, but with a reduced test voltage (Table 6).

The test temperatures stated apply to the surface temperature of the test panels. It is not necessary to carry out the test inside a climatic chamber.

Table 6: Requirements and assessment procedure for determination of impact resistance

Zone 2 (TZ/SZ)	
Requirement	**Value**
Position of impact points	All impact points must be at least 20 mm from the edge of the panel and at least 40 mm from each other.
Test temperatures (temperature of the panels)	23 ±2 °C and 5 ±2 °C
Drop height, drop mass	50 cm, 1 kg, test panel not spring mounted
Number of test panels	6 (3 per test temperature)
Number of measurements	3 per test panel
Test voltage per 100 µm nominal dry film thickness – before impact test – after impact test	 0.5 kV 0.3 kV
Assessment method	**Assessment criterion**
High voltage test	No breakdown (no acoustic or optical detection)

5.3 Immersion test: determination of resistance to liquids – water immersion method

Testing of resistance to liquids is based on ISO 2812-2 (Table 7). Passing a salt spray test as specified for zone 2 is considered an alternative to the immersion test for zone 1.

The test panels must be completely immersed in the medium and placed in the apparatus at a distance of 30 mm from each other. At the end of the exposure, the loose and infiltrated coating is removed with a suitable tool and the corrosion is measured at the scribe. The adhesion test by X-cut is performed after 1 h (wet adhesion) and after 7 days (dry adhesion). The adhesion test by pull-off testing is also carried out after 7 days.

Table 7: Requirements and assessment procedure for determination of resistance to liquids (immersion)

Zone 1 (Soil/UWZ)	
Requirement	**Value**
Test duration	4,200 h
Test temperature	40 ± 2 °C
Immersion medium	5 % NaCl solution
Number of test panels	3
Artificial damage	See section 2.4
Assessment method	**Assessment criterion**
Degree of blistering (ISO 4628-2)	0 (S0)
Degree of rusting (ISO 4628-3)	Ri 0
Degree of cracking (ISO 4628-4)	0
Degree of flaking (ISO 4628-5)	0
Corrosion around the scribe (ISO 4628-8)	≤ 2 mm (from 9 measuring points to ISO 12944-6)
Adhesion – X-cut (ISO 16276-2)	≤ Level 2
Adhesion – pull-off test (ISO 4624)	≥ 5 MPa (per individual measurement, see section 4.2), each independent of fracture pattern

5.4 Condensation test: determination of resistance to humidity – condensation (single-sided exposure)

Testing of resistance to humidity is based on ISO 6270-1.

The adhesion test by X-cut is performed 1 h (wet adhesion) and 7 days (dry adhesion) after the end of exposure. Testing of the adhesion by a pull-off test is also carried out after 7 days.

The test criteria (at the end of exposure) are listed in Table 8.

Table 8: Requirements and assessment procedure for determination of resistance to humidity (condensation)

Zones: 2 (TZ/SZ) **/ 3** (Atmosphere external) **/ 4a/4b** (Atmosphere internal)	
Requirement	**Value**
Test duration	Zone 2 & 3: 1,440 h Zone 4a: 720 h Zone 4b: 480 h
Test temperature	38 ± 2 °C
Number of test panels	3
Assessment method	**Assessment criterion**
Degree of blistering (ISO 4628-2)	0 (S0)
Degree of rusting (ISO 4628-3)	Ri 0
Degree of cracking (ISO 4628-4)	0
Degree of flaking (ISO 4628-5)	0
Adhesion – X-cut (ISO 16276-2)	≤ Level 2
Adhesion – pull-off test (ISO 4624)	≥ 5 MPa (per individual measurement, see section 4.2), each independent of fracture pattern

5.5 Salt spray test: determination of resistance to neutral salt spray

Testing of resistance to neutral salt spray is based on ISO 9227.

The coating is removed with a suitable tool and the corrosion around the scribe is measured on the exposed surface.

The adhesion test by X-cut is performed 1 h (wet adhesion) and 7 days (dry adhesion) after the end of exposure. Testing of the adhesion by a pull-off test is also carried out after 7 days.

The test criteria (at the end of exposure) are listed in Table 9.

Table 9: Requirements and assessment procedure for determination of resistance to neutral salt spray

Zones: 2 (UWZ/TZ/SZ) **/ 3** (Atmosphere external) **/ 4a/4b** (Atmosphere internal)	
Requirement	**Value**
Test duration	Zone 2 & 3: 2,160 h Zone 4a: 1,440 h Zone 4b: 720 h
Test temperature	35 ± 2 °C
Test solution	5% NaCl solution
Number of test panels	3
Artificial damage	See section 2.4
Assessment method	**Assessment criterion**
Degree of blistering (ISO 4628-2)	0 (S0)
Degree of rusting (ISO 4628-3)	Ri 0
Degree of cracking (ISO 4628-4)	0
Degree of flaking (ISO 4628-5)	0
Corrosion around the scribe (ISO 4628-8)	≤ 3 mm (from 9 measuring points to ISO 12944-6)
Adhesion – X-cut (ISO 16276-2)	≤ Level 2
Adhesion – pull-off test (ISO 4624)	≥ 5 MPa (per individual measurement, see section 4.2), each independent of fracture pattern

5.6 Cyclic ageing test

The cyclic ageing test is based on ISO 12944-9.

The coating is removed with a suitable tool and the corrosion around the scribe is measured on the exposed surface.

The test panels are subjected to 25 cycles (4,200 h) in accordance with the following weekly rhythm:

- 72 h alternating every four hours: Dry UVA exposure (λ = 340 nm; 60 ± 3 °C) and condensation (50 ± 3 °C) to ISO 16474-3 method A cycle 1
- 72 h salt spray exposure (35 ± 2 °C) to ISO 9227
- Rinsing with demineralized water
- 24 h dry storage (-20 ± 2 °C).

After exposure, the test panels are to be subjected to 24-hour conditioning at room temperature. The test criteria (at the end of exposure) are listed in Table 10.

The adhesion test by X-cut is performed 1 h (wet adhesion) and 7 days (dry adhesion) after the end of exposure. Testing of the adhesion by a pull-off test is also carried out after 7 days.

Table 10: Requirements and assessment procedure for the cyclic ageing test

Zones: 2 (UWZ/TZ/SZ) **/ 3** (Atmosphere external)	
Requirement	**Value**
Test duration	4,200 h
Number of test panels	3
Artificial damage	See section 2.4
Assessment method	**Assessment criterion**
Degree of blistering (ISO 4628-2)	0 (S0)
Degree of rusting (ISO 4628-3)	Ri 0
Degree of cracking (ISO 4628-4)	0
Degree of flaking (ISO 4628-5)	0
Corrosion around the scribe (ISO 4628-8)	≤ 6 mm (from 9 measuring points to ISO 12944-6)
Adhesion – X-cut (ISO 16276-2)	≤ Level 2
Adhesion – pull-off test (ISO 4624)	≥ 5 MPa (per individual measurement, see section 4.2), each independent of fracture pattern

5.7 ICCP stability test: determination of the resistance to cathodic disbonding

The ICCP stability test is carried out in accordance with the BAW's "Guidelines for the testing of coating systems for the corrosion protection of hydraulic steel structures" (RPB).

The ICCP stability test can be carried out with and without coloured top coats. The test is to be performed with artificial seawater and artificial brackish water.

For connection to the potentiostat, the specimen panels must have a stable electrical connection at the edge that is not affected by corrosion. The solder joints and edges must be sealed with coating material. Immediately before the stress is applied, a defined defect is to be made on the coated surface of each sample plate by blasting or milling down to the steel substrate.

The test solutions of artificial seawater and artificial brackish water are to be aerated by a constant flow of fresh air for the duration of the test. The test solutions are to be prepared according to Table 11. For artificial seawater, a test solution according to DIN 50905-4 or ISO 15711 is to be used.

Table 11: Composition of electrolyte for the test solutions used in the ICCP stability test

Salt used	**Chemical formula**	**Artificial seawater [g/L]**		**Artificial brackish water [g/L]**
		DIN 50905-4 *	ISO 15711	DIN 50905-4 *
Sodium chloride	NaCl	28.0	23.0	5.6
Sodium hydrogen carbonate	$NaHCO_3$	0.2	---	---
Sodium sulphate decahydrate	$Na_2SO_4 \cdot 10\ H_2O$	---	8.9	---
Magnesium chloride hexahydrate	$MgCl_2 \cdot 6\ H_2O$	5.0	9.8	1.0
Magnesium sulphate heptahydrate	$MgSO_4 \cdot 7\ H_2O$	7.0	---	1.4
Calcium chloride	$CaCl_2$	---	1.2	---
Calcium chloride hexahydrate	$CaCl_2 \cdot 6\ H_2O$	2.4	---	0.48
Sodium citrate dihydrate	$C_6H_5Na_3O_7 \cdot 2\ H_2O$	---	---	0.2
Thioacetamide	CH_3CSNH_2	---	---	0.1
pH		7 – 8	---	7,5 ± 0,2

* The solutions are to be prepared as stipulated in DIN 50905-4.

The loose and infiltrated coating is to be removed with a suitable tool and the adhesion measured on the exposed surface starting from the defect (outer circle). The adhesion strength is tested in a pull-off test after 7 days.

The test criteria (at the end of exposure) are listed in Table 12.

Table 12: Requirements and assessment procedure for determination of resistance to cathodic disbonding

Zones: 1 (Soil/UWZ) **/ 2** (UWZ/TZ/SZ)	
Requirement	**Value**
Test duration	15 months
Number of test panels	6 (3 for sea water and 3 for brackish water)
Potential (Ag/AgCl/$KCl_{tot.}$)	-930 ± 5 mV
Circular damage at the centre of the test panel down to the substrate (machine milled)	External circle: D = 30 mm with milling width 1 mm Internal circle: D = 5 mm full area
Assessment method	**Assessment criterion**
Degree of blistering (ISO 4628-2)	0 (S0)
Assessment of disbonding at the fracture	≤ 10 mm
Adhesion – pull-off test (ISO 4624)	≥ 5 MPa (per individual measurement, see section 4.2), each independent of fracture pattern

5.8 Water vapour diffusion test – determination of the water vapour transmission properties on a free coating film

The water vapour diffusion test is performed by the cup method and based on ISO 7783.

The test is only performed on EP coating systems.

The test is used to determine the water vapour diffusion on a single-layer cured free coating film. For this purpose, the coating is applied as a free film. It is recommended to use a dry film thickness of 400 ± 50 µm. Alternatively, the specific NDFT of the applied coating should be tested. The test may be started no earlier than 7 days after curing.

2 out of 3 tests must fulfil the requirements. The test criteria are listed in Table 12.

Table 12: Test requirements for the diffusion test

Zones: 1 (Soil/UWZ) **/ 2** (UWZ/TZ/SZ)	
Requirement	**Value**
Test duration	21 days
Test apparatus	Permeability cup
Test area	≥ 10 cm^2
Demineralized water	2 g for 10 cm^2 (larger areas are to be calculated in relation to the cup volume)
Test location	Drying cabinet
Temperature in the drying cabinet	40 °C
Intermediate inspections	After 7 and after 14 days
Requirements/Characteristics	
Water vapour current density [g/(m^2 × h)]	≤ 0.40

6 Standards and codes of practice

List of standards and regulations in force at the time of publication of this standard:

Standards:

DIN 50905-4: 2018-03	Corrosion of metals – Corrosion testing – Part 4: Performance of chemical corrosion experiments without mechanical stresses in liquids in the laboratory
EN 10020:2000-07	Definition and classification of grades of steel
ISO 2431:2019-06	Paints and varnishes – Determination of flow time by use of flow cups
ISO 2811-1:2023-01	Paints and varnishes – Determination of density – Part 1: Pycnometer method
ISO 2812-2:2018-11	Paints and varnishes – Determination of resistance to liquids – Part 2: Water immersion method
ISO 2884:1999-10	Paints and varnishes – Determination of viscosity using rotational viscometers
ISO 3251:2019-05	Paints, varnishes and plastics – Determination of non-volatile-matter content
ISO 4624:2013-03	Paints and varnishes – Pull-off test for adhesion
ISO 4628-2:2016-01	Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 2: Assessment of degree of blistering
ISO 4628-3:2016-01	Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 3: Assessment of degree of rusting
ISO 4628-4:2016-01	Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 4: Assessment of degree of cracking
ISO 4628-5:2022-11	Paints and varnishes – Evaluation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 5: Assessment of degree of flaking
ISO 4628-8:2012-11	Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of

	intensity of uniform changes in appearance – Part 8: Assessment of degree of delamination and corrosion around a scribe or other artificial defect
ISO 6270-1:2017-11	Paints and varnishes – Determination of resistance to humidity – Part 1: Condensation (single-sided exposure)
ISO 6272-1:2011-08	Paints and varnishes – Rapid-deformation (impact resistance) tests – Part 1: Falling-weight test, large-area indenter
ISO 7783:2018-10	Paints and varnishes – Determination of water-vapour transmission properties – Cup method
ISO 8501-1:2007-05	Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings
ISO 8503-1:2012-02	Preparation of steel substrates before application of paints and related products – Surface roughness characteristics of blast-cleaned steel substrates – Part 1: Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast-cleaned surfaces
ISO 9227:2022-11	Corrosion tests in artificial atmospheres – Salt spray tests
ISO 12944-5: 2019-09	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 5: Protective paint systems
ISO 12944-6: 2018-01	Paints and varnishes – Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 6: Laboratory performance test methods
ISO 12944-9: 2018-01	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 9: Protective paint systems and laboratory performance test methods for offshore and related structures
ISO 15711:2003-05	Paints and varnishes – Determination of resistance to cathodic disbonding of coatings exposed to sea water
ISO 16276-2: 2007-05	Corrosion protection of steel structures by protective paint systems – Assessment of, and acceptance criteria for, the adhesion/cohesion (fracture strength) of a coating – Part 2: Cross-cut testing and X-cut testing

ISO 16474-3: 2021-01	Paints and varnishes – Methods of exposure to laboratory light sources – Part 3: Fluorescent UV lamps
ISO/IEC 17025: 2017-11	General requirements for the competence of testing and calibration laboratories
ISO 19840:2021-09	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Measurement of, and acceptance criteria for, the thickness of dry films on rough surfaces

vgbe/VGB/BAW-Standard VGBE/VGB-S-021 series
“Corrosion protection for offshore wind structures”

Part 1 “General” (VGBE-S-021-01-2023-05-EN), 2023

Part 2 “Requirements for corrosion protection systems” (VGBE-S-021-02-2023-05-EN), 2023

Part 3 “Application of coating systems” (VGBE-S-021-03-2023-05-EN), 2023

Part 4 “Cathodic protection (CCP)” (VGB-S-021-04-2018-07-EN), 2018

Codes of practice (in the current version):

BAW RPB	Guidelines for the testing of coating systems for the corrosion protection of hydraulic steel structures

7 Appendix: Documentation on the production of test panels

Name of the applying company: .....

Substrate (steel grade): .....

Date of application: .....

Production of the test panels is in accordance with section 2.2.

Coat	Product name	Binder type/ Material type	Batch number (paint)	Applica-tion method*	Curing conditions			DFT [µm] (from at least 5 individual measurements)	
					Air temper-ature [°C]	Relative humidity [%]	Curing time [hh:mm]	min. / average / max.	Std. dev.
1									
2									
3									
4									
5									

* AS – Airless PS – Pneumatic Spraying Br. – Brush R – Roller

If it is necessary to add thinners, this must be done in accordance with the coating material manufacturer's specification. This is to be documented

....., ...

Place Date Signature

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