

vgbe/BAW-Standard

# Corrosion Protection for Offshore Wind Structures

Part 3: Application of Coating Systems

VGBE-S-021-03-2023-05-EN

4<sup>th</sup> Edition 2023

(formerly VGB-S-021-03-2018-04-EN)



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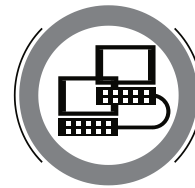
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# vgbe/BAW-Standard

## Corrosion Protection for Offshore Wind Structures

### Part 3: Application of Coating Systems

(4<sup>th</sup> edition, 2023)

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## Part 3 – Application of coating systems

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## 1 General

This Part 31\* of the standard “Corrosion Protection for Offshore Wind Structures” describes the requirements for the application of coating systems to steel. It does not cover the application of metallic coatings to steel. Unless otherwise specified, organic coatings can be applied to metallic coatings in accordance with this standard.

The following points must be agreed between the employer, the contractor and, if applicable, the coating system manufacturer during the award phase:

- The coating system to be used (product and manufacturer)
- The colours that will be used
- The number, size and positions (locations) of control surfaces
- Production of specimen panels for tests during construction
- The nature and scope of support/advice on coating work to be provided by an application engineer/supervisor of the coating system manufacturer

The scope of testing agreed by the principal and contractor must be set down in a test and examination sequence plan (TESP).

During processing of coating systems, the technical data sheets, processing instructions and safety data sheets of the coating system manufacturers must be observed.

### Supervisory personnel

When carrying out corrosion protection work, the contractor may use only supervisory personnel (on-site supervisors, work crew foremen) who are in possession of a

- KOR certificate to ZTV-ING,
- DIN CERTCO Level C,
- FROSIO Level III,
- NACE Level 3,
- NACE Level 2 with evidence of at least 5 years of professional experience

or similar. The on-site supervisor or foreman must be present at the work site at all times during performance of the work.

### Personnel performing coating work

On the basis of ISO 12944-7, the personnel carrying out coating work must be capable of performing the work professionally, safely and reliably.

*\*) If anything is unclear, the German version is the reference version.*

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<sup>1</sup> cf. section on standards

## 2 Surface preparation

The surfaces of components shall be prepared by means of blast cleaning as per ISO 12944-4.

Prior to blast cleaning, all weld residues such as spatter, slag and foreign contaminants such as greases, oils and salts (e.g. chlorides) are to be removed from the surfaces by suitable methods; where appropriate, a corresponding test is to be performed prior to blast cleaning. The surfaces must be dry. It is to be ensured that the blasting abrasive is dry and free of foreign contaminants, so that the required surface quality is achieved before coating.

Temporary coatings are to be fully removed by blast cleaning before the coating system is applied.

All steel parts including the weld seams are prepared by blast cleaning at least with the preparation grade B Sa 2½ to ISO 12944-4 immediately before applying the first coat.

Blasting work is to take place in closed, air-conditioned rooms. If necessary, a suitable housing is to be erected, so as for example to prevent pollution of the surrounding area. This also must be taken into account for any transport work required.

During blast cleaning work the following climatic conditions are to be observed.

Permanent workshop and/or temporary housing in workshop:

- Relative humidity                      ≤ 60 %
- Dewpoint difference                      ≥ 3 K  
*Detection by continuous measurement of the ambient temperature and humidity, and individual measurements of the workpiece temperature every 3 hours.*

The climatic conditions are to be maintained continuously from the start of the blasting work to the end of the application of the first coating layer.

If application at elevated ambient and workpiece temperatures (> 30 °C) is not described in the technical data sheet and cannot be avoided, the further procedure must be agreed with the coating material manufacturer and the customer must be informed. It must be ensured that the air-conditioned air flow is directed in such a way that the entire working area meets the above-mentioned specifications.

The air used for blasting must be dry and free of oil.

The roughness of the prepared, blast-cleaned surface influences the adhesive strength of the coating systems. Therefore, for blast cleaned surfaces a medium roughness grade “medium G” to ISO 8503-1 is required. For this purpose only angular abrasive (grit) is to be used. Should higher requirements for the roughness and the blasting

abrasive to be used be stipulated in the technical data sheet of the coating system, they must be complied with.

After blasting, the surface must be cleaned and protected from further contamination until the coating is applied. If the required roughness is not attained, a further blast cleaning operation, if necessary with adjustment of the blasting abrasive, is to be carried out.

During blasting work, no deformation of or damage to the workpiece may occur. Sealing surfaces and functional surfaces which are not to be coated are to be cleaned and masked or covered prior to blasting.

Where it is not possible to avoid transporting a blast-cleaned component to the place where the coating work will be carried out, the following conditions must be maintained:

- No precipitation
- Humidity < 80 %
- Minimum duration
- Transport is to be documented (ambient conditions and climate curve)

### **3 Inspection of the prepared surface**

As part of its internal controls, the corrosion protection company performing the work shall make the following inspections (3.1 to 3.7).

#### **3.1 Visual assessment of surface cleanliness**

No contamination may be in evidence on the prepared surface.

#### **3.2 Inspection of design and preparation grades**

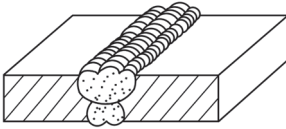
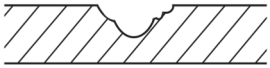
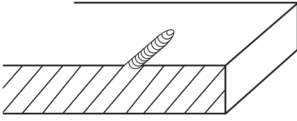
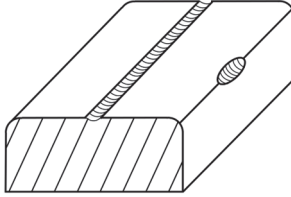
The coating-compatible structural design and the degree of surface preparation must be inspected for compliance with preparation level P3 (ISO 8501-3) in accordance with ISO 12944-3.

According to ISO 8501-3, preparation grade P3 corresponds to very thorough preparation. The surface is free of significant visible irregularities.

Depending on the specific application, the significance of visible irregularities should preferably be agreed between the parties involved.

The following Figure 1 contains explanatory notes that clarify the interpretation of selected requirements of ISO 8501-3:2006-03 within the scope of standard VGBE-S-021.

Figure 1: Explanatory notes that clarify the interpretation of selected requirements of ISO 8501-3:2006-03 within the scope of standard VGBE-S-021

Requirements to ISO 8501-3		
Description	Illustration	Preparation Grade Requirements: Clarification of the interpretation of the requirements
<b>1. Weld seams</b>		
1.2 Weld ripple/profile		P3: Even and smooth weld seam profiles are permissible (under the following conditions without machining). Weld seams with soft transitions and smooth surfaces may have an excess weld metal provided the seam transitions correspond to quality level B to ISO 5817, Table 1, No. 1.12.
<b>3. Surfaces generally</b>		
3.1 Pits and craters		P3: Surface imperfections must be sufficiently open and smooth to enable the required surface preparation (blasting) and specification-compliant coverage with the coating system (DFT).
3.5 Grooves and gouges (formed by mechanical influence)		The requirements of EN 10163 Class A or B (in accordance with structural steel design requirements) must be complied with.
3.6 Indentations and roll marks		If surface repairs by grinding are required, the remaining steel thickness must be checked for compliance with the requirements of EN 10163-2 Class A or B

### 3.3 Inspection of preparation grade

The preparation grade is to be determined in accordance with ISO 12944-4 on the component at site immediately before coating and must be at least Sa 2½. The steel used must correspond to rust grade A or B in the initial state in accordance with ISO 8501-1.

### 3.4 Roughness inspection

The roughness inspection is to be carried out by means of surface profile comparators in accordance with ISO 8503-1 (grit) and performed in accordance with ISO 8503-2.



### 3.5 Inspection of surface cleanliness

The surface cleanliness is to be checked by tape test according to ISO 8502-3. The dust quantity 2 and the particle size class 2 must not be exceeded. If the required degree of cleanliness is not achieved, a further cleaning operation must be carried out.

### 3.6 Inspection for presence of water-soluble contaminants

The blast cleaned surface must be free of water-soluble contaminants.

This is to be demonstrated immediately before coating by the performance to DIN/TR 55684 of a

- wipe test,
- surface extraction with adhesive cell; sampling to ISO 8502-6 (e.g. Bresle method) or
- conductivity measurement by the field methods to identify water-soluble salts to ISO 8502-9.

The limit values set out in DIN/TR 55684 for the relevant corrosivity category and protection duration must not be exceeded. The test location must then be re-blasted. If the stipulated limit values are exceeded, the contamination must be removed using suitable methods.

If the coating material manufacturer requires lower limit values for the coating system than those described in DIN/TR 55684, these must be complied with.

### 3.7 Inspection for presence of oil, grease and wax

The blast cleaned surface must be free of oil, grease and wax. If the presence of such contamination is suspected or the possibility of such contamination exists, a detection method to DIN/TR 55684 is to be employed. If the specified limits are exceeded, the contaminants must be removed by suitable methods.

## 4 Application of the coating

### 4.1 Film thicknesses on the structure

For each zone, minimum requirements for the film thickness of the coating system as set out in Table 1 and Table 2 – NDFT (nominal dry film thickness) – must be complied with. The dry film thickness is measured in accordance with ISO 19840 (80/20 rule). The measurement of the individual and total coating thicknesses is to be carried out as specified in section 5.2.

The maximum permissible film thickness is three times the nominal dry film thickness. If the coating system manufacturer requires lower maximum film thicknesses, these must be complied with. The coating material manufacturer's specifications apply with regard to the maximum film thickness of zinc dust primer coatings.

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

Zone	Corrosive stress areas	MNOC	NDFT [ $\mu\text{m}$ ]
1	– Soil, external and internal – Underwater zone (UWZ), external and internal	1	$\geq 800$
		2	$\geq 600$
2	– Splash zone (SZ), external – Tidal zone (TZ), external and internal	2	$\geq 600$
3	Atmosphere, external	3	$\geq 360$
4a	Atmosphere, internal (not air-conditioned)	2	$\geq 300$
4b	Atmosphere, internal (air-conditioned*)	2	$\geq 240$

\* Zone 4b is air-conditioned and has a permanent relative humidity of under 60 %. In addition, suitable measures for transport and the installation period are to be taken for this zone.

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

Zone	Corrosive stress areas	MNOC [without sealer]	NDFT [ $\mu\text{m}$ ]
3	Atmosphere, external	2	$\geq 240$
4a	Atmosphere, internal (not air-conditioned)	2	$\geq 200$
4b	Atmosphere, internal (air-conditioned)	2	$\geq 160$

For transport, storage and processing of the coating systems, the specifications of the coating system manufacturer are to be observed.

The following climatic conditions are to be maintained when applying coatings:

Permanent workshop and/or temporary housing in workshop:

- Ambient temperature  $\geq +10\text{ °C} \leq +30\text{ °C}$
- Workpiece temperature  $\geq +10\text{ °C} \leq +30\text{ °C}$
- Relative humidity  $\leq 60\%$  until end of application of the first coat;  
then  $\leq 80\%$

Deviations may have to be agreed, for example for moisture-curing coatings such as 1K-PUR.

- Dewpoint difference  $\geq 3\text{ K}$

The first coating layer (ISO 12944-1) is to be applied immediately after blasting, cleaning and evaluation of the blasted surface of the component. The complete coating system must be applied without intermediate weathering.

At higher ambient and workpiece temperatures ( $> 30\text{ °C}$ ), the further procedure must be agreed with the coating material manufacturer. The use of additives outside the specifications of the technical data sheets must be agreed with the customer.

Coating work must be carried out in closed, clean and air-conditioned rooms. If necessary, a suitable enclosure must be erected to protect the component from external influences.

For two-component coating systems, always mix the complete original containers (mixing ratio of base component to hardener component). If smaller coating quantities than in the original containers are required for smaller areas, the mixing ratio must be documented using weighing protocols.

As a rule, application to large, smooth surfaces should be by airless spraying. All corners, edges, interstices, screw holes, weld seams, rivets and poorly accessible areas are to be brush painted in advance.

During application of intermediate and top coats, the re-coating intervals specified by the coating material manufacturer are to be observed.

The required climatic conditions must be maintained until the last coat has been completed and cured and degree of drying 6 to ISO 9117-5 has been reached, including any touch-ups, before the component is transported from a permanent workshop or temporary enclosure/workshop. Intermediate weathering of the components to be coated is not permitted. In consultation with the coating material manufacturer, higher curing temperatures may be permitted.

The coating is to be protected from external influences during the curing process. In addition, the drying times specified by the coating manufacturer must be observed with regard to mechanical and chemical stress.

When applying multi-layer coating systems the individual coats must be applied in alternating colours.

In addition, the contractor has to produce test panels prepared together with the components, made of the same steel material as the component, for each specified test area. The following test panels must be produced for each test area in accordance with Table 3.

*Table 3: Test panels for use during construction*

Panel (mm)	Purpose
300 x 300 x 10	Testing of pull-off strength
300 x 300 x 10	Retained sample for customer

## 5 Inspection of the applied coating

As part of its internal controls, the corrosion protection company performing the work shall perform the inspections and tests outlined in sections 5.1 to 5.4.

The individual tests are to be carried out no earlier than after the required curing time in accordance with the coating material manufacturer's instructions.

### 5.1 Visual inspection of surface quality

The visual inspection of the surface condition is to be carried out on the entire coating surface. Each applied coating layer is to be checked. Defects such as runs, overspray, dirt inclusions, non-continuous film or lack of coverage are not permitted and must be professionally removed and/or repaired. In addition, the coating surface must be uniform in colour and gloss.

### 5.2 Measurement of film thickness

The individual and total film thicknesses are to be measured in accordance with ISO 19840. In the case of a coating system with layers of the same product, the intermediate measurement of the same individual coats can be dispensed with.

With electronic measurement, calibration is always to be carried out on a smooth surface.

The film thickness is to be measured evenly over the entire coating surface. The minimum number of measurements is as follows:

- 2 measuring points per 10 m<sup>2</sup>
- On small surfaces ( $\leq 125$  m<sup>2</sup>), at least 25 measuring points.

Areas with insufficient film thicknesses are not permissible and must be properly re-worked.

Unless stipulated otherwise, the specifications of the coating system manufacturer govern the maximum individual coating thickness that may be applied.

### 5.3 Testing for pores and cracks by the high voltage method

The test for pores and cracks by the high voltage method of the fully applied coating must be carried out in stress zones 1 and 2. Pores are not permissible.

The scope of testing is 5% of the coated area of zones 1 and 2 for each project, to be determined individually by the customer. The first component of a series must always be tested.

If a test for pores and cracks by the high voltage method does not meet the requirements, it is recommended that the scope of testing be extended to 15% of the coated area of the project. If a test for pores and cracks by the high voltage method on the increased test scope again fails to meet the requirements, the test scope must be extended to 100 % of the coated area.

If a cathodic protection system is installed, the permeability test for zone 1 can be waived in consultation with the customer.

The test for pores and cracks by the high voltage method on the coating is carried out in accordance with ISO 29601 on the entire coating surface using high voltage after the required curing time. If necessary, the test voltage is to be adjusted in accordance with the coating material manufacturer's specifications.

#### 5.4 Testing of adhesion on specimen panels for use during construction

Testing of adhesive strength in stress zones 1 and 2 is performed according to ISO 16276 Part 1 (Pull-off test) and Part 2 (X-cut) for each test area on a test panel for use during construction; see section 4.

Requirements for pull-off test

- Number of dollies per specimen panel: 5

Minimum requirement:

- $\geq 8 \text{ MPa (N/mm}^2\text{)}$  in zone 1
- $\geq 5 \text{ MPa (N/mm}^2\text{)}$  in zone 2

Requirements for X-cut

Minimum requirement:

- $\leq \text{Level 2.}$

## 6 Tested coating systems

Only tested coating systems which meet the requirements of the vgbe/BAW standard VGBE-S-021-02 (Part 2) may be used.

Only original containers are to be used.

Required container markings:

- Coating system manufacturer
- Coating material
- Colour
- Batch number
- Mixing ratio for multi-component material
- Weight capacity (net)
- Date of manufacture and/or filling
- Storage life

## 7 Control surfaces

If control surfaces are required by the customer as specified and agreed, these must be created in accordance with ISO 12944-7 (possibly differing in number and size) and documented by means of control surface records and marking. A control surface always corresponds to at least one representative component from a coating system area. This applies to all application sites of the main suppliers and their sub-suppliers.

The location of control surfaces must be selected in such a way that they are accessible under operating conditions. The customer must be notified in writing of the creation of control surfaces.

The following parties should participate in the creation of control surfaces in accordance with this standard:

- Contractor
- Processor
- Coating system manufacturer

Participation by the customer is optional.

## 8 Repairs before shipment

Any necessary repairs to a coating system must be carried out before shipment.

The following points must be agreed in advance with all parties involved:

- Surface preparation grade
- Coating system to be used
- Coating structure
- Climatic conditions during surface preparation, application and curing
- Colour

Inspection of corrosion protection prior to shipment is recommended.

## 9 Transport and installation of coated components

Storage, transport and installation of coated steel components are to take place in such a way that damage is avoided. This includes in particular the use of textile belts, wooden chocks with PE sheeting, and the avoidance of abrasive stresses and mechanical impacts.

## 10 Self-monitoring by the contractor

Before commencing corrosion protection work, the contractor must compile a work folder containing at least the following:

- Organizational chart
- Implementation plan
- Location(s) of the work
- Duration of the work
- Processing/applying company
- Specification for the performance of the coating work to ISO 12944-8, Table 3
- Specification for coating systems – New work to ISO 12944-8, Appendix F
- Monitoring and assessment specification to ISO 12944-8, Table 4
- Coating materials and coating systems to be used, stating manufacturers
- Test certificates and approvals
- Technical data sheets



- Directions from the coating system manufacturer
- Safety data sheets
- Inspection and Test Plan (ITP)  
(see Appendices 1 and 2, example records)

Unless otherwise agreed, the work folder must be submitted to the customer for approval at least 4 weeks before the start of the work.

The coating work may only be started after the work folder has been released by the customer.

The released work folder must be available for inspection at any time at the place of work (workshop, site office).

The customer, its appointed inspectors and the coating system manufacturers must be given the opportunity to inspect the corrosion protection work in the respective production facilities after notification to the contractor.

Within the scope of self-monitoring, the contractor is to deploy a certified coating inspector of level C to DIN CERTCO or comparable qualification (e.g. FROSIO Level III, NACE Level 3, etc.) during the corrosion protection work on site.

The coating inspector appointed by the contractor shall be obliged to monitor and document the proper and professional execution of the corrosion protection work on a continuous basis.

This shall include, but not be limited to, the following steps:

- Surface preparation,
- measurement of climate data,
- measurement of film thicknesses (wet and dry film thicknesses), and
- testing for pores and cracks using high voltage (permeability testing).

It is recommended that the contractor ensures that a representative retention sample with batch number is taken.

## 11 Documentation

The contractor is to prepare project-related records for each work step. The records shall be prepared by the contractor during production and handed over to the customer. The customer reserves the right to check the documentation.

Sample records for the documentation of the corrosion protection work can be found in Appendix 2 or the forms from ISO 12944-8, Appendices H and I. The contents of the sample protocols represent the minimum requirement for the documentation. Any additional content must be agreed with the customer on a project-related basis.

On completion of the corrosion protection work, the contractor is to summarize all collected data in an orderly manner in documentation.

This documentation should contain the following:

- Blasting abrasives (product, particle size, etc.)
- Nature and quantity of additives used during construction (e.g. solvents)

## 12 Standards and codes of practice

This standard defines additional requirements supplementing the following series of standards and codes of practice, some of which are cited in this standard:

### Standards:

DIN 16945:1989-03	Testing of resins, hardeners and accelerators, and catalysed resins
ISO 29601:2011-07	Paints and varnishes – Corrosion protection by protective paint systems – Assessment of porosity in a dry film
EN 10204:2005-01	Metallic products – Types of inspection documents
EN 14879-1:2005-12	Organic coating systems and linings for protection of industrial apparatus and plants against corrosion caused by aggressive media – Part 1: Terminology, design and preparation of substrate
ISO 4624:2016-03	Paints and varnishes – Pull-off test for adhesion
ISO 8501-3:2006-03	Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 3: Preparation grades of welds, edges and other areas with surface imperfections
ISO 8502-3:2017-01	Preparation of steel substrates before application of paints and related products – Tests for the assessment of surface cleanliness – Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)
ISO 8502-6:2020-08	Preparation of steel substrates before application of paints and related products – Tests for the assessment of surface cleanliness – Part 6: Extraction of water soluble contaminants for analysis (Bresle method)
ISO 8502-9:2020-08	Preparation of steel substrates before application of paints and related products – Tests for the assessment of surface cleanliness – Part 9: Field method for the conductometric determination of water-soluble salts
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 8503-2:2012-02	Preparation of steel substrates before application of paints and related products – Surface roughness characteristics of blast-cleaned steel substrates – Part 2: Method for the grading of surface profile of abrasive blast-cleaned steel – Comparator procedure
ISO 12944-3: 2018-04	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 3: Design considerations
ISO 12944-4: 2018-04	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 4: Types of surface and surface preparation
ISO 12944-7: 2018-04	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 7: Execution and supervision of paint work
ISO 12944-8: 2018-04	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 8: Development of specifications for new work and maintenance
ISO 16276-1: 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 1: Pull-off testing
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 19840:2012-09	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

Codes of practice (in the current version):

DIN/TR 55684 currently 2021-01	Corrosion protection of steel structures by protective paint systems – Testing of surfaces before application of coating materials for containments that cannot be detected visually
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“Corrosion protection for offshore wind structures”

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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

## 13 Appendices

### Appendix 1: Specification – Corrosion protection for hydraulic steelwork – Example inspection and test plan, Page 1 of 3

This inspection and test plan is an example, showing the minimum requirements. The contractor / coating firm is to compile a project-related inspection and test plan for each operation. The contents and the test steps must be defined and coordinated with the customer in relation to the project.

<b>Company: ABC</b> <b>Corrosion Protection</b>		<b>Inspection and Test Plan</b>					Page 1 of 3
		Customer: <i>XYZ Mechanical Engineers</i>		Wind farm/Site: <i>Energy Village</i>			Rev./Date: <i>0/DD.MM.YYYY</i>
		End-user: <i>Customer</i>		Component/Structure: <i>Foundation XY</i>			
Test no.	Basis of test/Standard: Specification	Description/Test step	Record	Testing by			Remarks / Requirements
				ABC	XYZ	Principal	
1	ZTV-ING – Part 4, Section 3 ISO 12944-7	Qualification certificates for supervisors and staff	Z	X	X	H	
2		Test certificates for coating systems including technical data sheets, processing instructions and safety data sheets	PZ	X	X	H	
3		Climate data measurement during blasting and coating work					
3.1		Ambient temperature (°C) (coating work only)	Pr. 1	X	S	S	≥ 10 °C ≤ 30 °C
3.2		Workpiece temperature (°C) (coating work only)	Pr. 1	X	S	S	≥ 10 °C ≤ 25 °C
3.3		Relative humidity (%)	Pr. 1	X	S	S	≤ 65 % / If coating only takes place after 12 h, then ≤ 40%
3.4		Dewpoint difference (K)	Pr. 1	X	S	S	≥ 5 K
4		Inspection before blasting					
4.1	ISO 8501-3 ISO 12944-3	Inspection for coating-compliant design of the steel surface	Pr. 2	X	S	S	ISO 8501-3: Preparation grade P3
4.2	DIN/TR 55684 ISO 8502-6	Visual inspection of steel surface for contaminants Where appropriate, detection of water-soluble contaminants and/or detection of oil, grease and wax	Pr. 2	X	S	S	
5		Inspection after blasting					
5.1		Visual inspection of steel surface for cleanliness	Pr. 3	X	X	H	
5.2	ISO 8501-3 ISO 12944-3	Inspection for coating-compliant design of the steel surface	Pr. 3	X	X	H	ISO 8501-3: Preparation grade P3
<b>Release of Inspection and Test Plan</b>							
Date		Company	Name			Signature	
DD.MM.YYYY		ABC Corrosion Protection	Mr./Ms. Sample			MMM	
DD.MM.YYYY		XYZ Mechanical Engineers	Mr./Ms. Example			BBB	
DD.MM.YYYY		Customer	Mr./Ms. Unknown			UUU	

<b>Company: ABC</b> <b>Corrosion Protection</b>		<b>Inspection and Test Plan</b>					Page 2 of 3
		Customer: <i>XYZ Mechanical Engineers</i>		Wind farm/Site: <i>Energy Village</i>			Rev./Date: <i>0/DD.MM.YYYY</i>
		End-user: <i>Customer</i>		Component/Structure: <i>Foundation XY</i>			
Test no.	Basis of test/Standard: Specification	Description/Test step	Record	Testing by			Remarks / Requirements
				ABC	XYZ	Principal	
5.3	ISO 12944-4	Inspection of the preparation grade	Pr. 3	X	X	H	B Sa 2½/B Sa 3
5.4	ISO 8503-1	Roughness testing	Pr. 3	X	X	H	"medium (G)" Grit
5.5	DIN/TR 55684 ISO 8502-3	Inspection of surface cleanliness Pressure-sensitive tape test – dust quantity	Pr. 3	X	X	H	ISO 8502-3: Max. dust quantity 2 and particle size class 2
5.6	DIN/TR 55684 ISO 8502-6	Testing for water-soluble contaminants Bresle test or wipe test	Pr. 3	X	X	H	Max. surface concentration: 50 mg/m² anions (or 5 µg/cm²)
5.7	DIN/TR 55684	Inspection for oil, grease and wax if appropriate	Pr. 3	X	X	H	
6		Inspection during coating					
6.1		Documentation of coating work: Coating systems including batch no., number of coats and reworking times, etc.	Pr. 4	X	S	S	
7		Inspection after coating					
7.1		Visual inspection	Pr. 5	X	X	H	
7.2	ISO 19840	Measurement of film thickness Minimum: 2 measuring points/ 10 m² For surfaces (≤ 125m² at least 25 measuring points)	Pr. 5	X	X	H	
7.3	ISO 29601	Testing for pores and cracks using high voltage (permeability test) Test voltage specified by coating system manufacturer → No specification: 0.5 kV/100 µm film thickness	Pr. 5	X	X	H	
<b>Release of Inspection and Test Plan</b>							
Date		Company	Name			Signature	
DD.MM.YYYY		ABC Corrosion Protection	Mr./Ms. Sample			MMM	
DD.MM.YYYY		XYZ Mechanical Engineers	Mr./Ms. Example			BBB	
DD.MM.YYYY		Customer	Mr./Ms. Unknown			UUU	

Company: <b>ABC Corrosion Protection</b>		<b>Inspection and Test Plan</b>					Page 2 of 3
		Customer: <i>XYZ Mechanical Engineers</i>		Wind farm/Site: <i>Energy Village</i>			Rev./Date: <i>0/DD.MM.YYYY</i>
		End-user: <i>Customer</i>		Component/Structure: <i>Foundation XY</i>			
Test no.	Basis of test/Standard: Specification	Description/Test step	Record	Testing by			Remarks / Requirements
				ABC	XYZ	Principal	
8		Testing of test panels for use during construction 2/test area (1x test panel – 1x retained sample for principal)					Dimensions of test panel: 300 x 300 x 10 mm
8.1		Visual inspection	Pr. 6	X	X	H	
8.2	ISO 19840	Measurement of film thickness – 25 measuring points	Pr. 6	X	X	H	
8.3	ISO 29601	Testing for pores and cracks using high voltage (permeability test) Test voltage specified by coating system manufacturer → No specification: 0.5 kV/100 µm film thickness	Pr. 6	X	X	H	
8.4	ISO 4624	Testing of adhesive strength (5 dollies/test panel) including fracture pattern	Pr. 6	X	X	H	
Z = Certificate      X = Test PZ = Test certificate      S = Random check (report to customer) Pr. 1 – Pr. 7 = Test records      H = Hold point (report to customer – further steps only possible after release)							
<b>Release of Inspection and Test Plan</b>							
Date		Company	Name			Signature	
DD.MM.YYYY		ABC Corrosion Protection	Mr./Ms. Sample			MMM	
DD.MM.YYYY		XYZ Mechanical Engineers	Mr./Ms. Example			BBB	
DD.MM.YYYY		Customer	Mr./Ms. Unknown			UUU	



## Appendix 2: Example records

These example test records show the minimum requirements. The contractor / coating firm is to compile a project-related test record for each operation. The contents and structure must be defined and coordinated with the customer in relation to the project.

<b>Company:</b> <b>ABC</b> <b>Corrosion</b> <b>Protection</b>	<b>Measurement of Climate Data</b>			
	Customer: <i>XYZ Mechanical Engineers</i>		<b>Record Pr. 1</b>	
	End-user: <i>Customer</i>			
	Wind farm/Site: <i>Sea</i>		Page 1 of 1	
	Component/Structure: <i>Foundation XY</i>			
Test area: <i>Component 123</i>				
Date/Time/ Tester	Ambient temperature. (AT) – [°C] (coating only)	Workpiece temperature (WT) – [°C] (coating only)	Relative humidity (RH) – [%]	Dewpoint difference (ΔT) – [K]
Remarks: Additional Attachment XX if necessary → Continuous measurement				
Date	Company	Name	Signature	
DD.MM.YYYY	ABC Corrosion Protection	Mr./Ms. Sample	MMM	
DD.MM.YYYY	XYZ Mechanical Engineers	Mr./Ms. Example	BBB	

Company: <b>ABC</b> <b>Corrosion Protection</b>	Inspection before Blasting – Acceptance of Steel	
	Customer: <i>XYZ Mechanical Engineers</i>	Record Pr. 2
	End-user: <i>Customer</i>	
	Wind farm/Site: <i>Sea</i>	Page 1 of 1
	Component/Structure: <i>Foundation XY</i>	

Test area: <i>Component 123</i>
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1 – Visual inspection of steel surface for contaminants	
Results:	
<i>Example: Surface seriously fouled with old coating</i>	
2 – Inspection for coating-compliant design of the steel surface (ISO 8501-3, ISO 12944-3)	
Requirements of ISO 8501-3:	Fulfilled: YES / NO
Requirements of ISO 12944-3:	Fulfilled: YES / NO
Defects (photo documentation where appropriate):	
<i>Example: Edges are sharp, weld spatter</i>	
3 – Where appropriate, detection of water-soluble contaminants (DIN/TR 55684, ISO 8502-6)	
Performed: YES / NO	
Results:	
4 – Where appropriate, detection of oil, grease and wax (DIN/TR 55684)	
Performed: YES / NO	
Results:	
Remarks:	

Release for blasting: YES / NO
--------------------------------

Date	Company	Name	Signature
<i>DD.MM.YYYY</i>	<i>ABC Corrosion Protection</i>	<i>Mr./Ms. Sample</i>	<i>MMM</i>
<i>DD.MM.YYYY</i>	<i>XYZ Mechanical Engineers</i>	<i>Mr./Ms. Example</i>	<i>BBB</i>

<b>Company:</b> <b>ABC</b> <b>Corrosion Protection</b>	<b>Inspection after Blasting – Acceptance of Blasting</b>	
	Customer: <i>XYZ Mechanical Engineers</i>	<b>Record Pr. 3</b>
	End-user: <i>Customer</i>	
	Wind farm/Site: <i>Sea</i>	Page 1 of 1
	Component/Structure: <i>Foundation XY</i>	

Test area: <i>Component 123</i>
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1 – Blasting abrasive used	
Product details:	
2 – Visual inspection of steel surface for cleanliness	
Results:	
2 – Inspection for coating-compliant design of the steel surface (ISO 8501-3, ISO 12944-3)	
Requirements of ISO 8501-3:	Fulfilled: YES / NO
Requirements of ISO 12944-3:	Fulfilled: YES / NO
Defects (photo documentation where appropriate):	
4 – Inspection of the preparation grade (ISO 12944-4)	
B Sa 2½/B Sa 3	Results:
5 – Roughness testing (ISO 8503-1)	
Measuring instrument used: <i>Surface profile comparator 123, Measurement Co. – Serial No. 456</i>	
Requirement: "Medium (G)" (Grit)	Results:
6 – Inspection of surface cleanliness – Pressure-sensitive tape test – dust quantity (DIN/TR 55684, ISO 8502-3)	
Requirements (ISO 8502-3): Max. dust quantity 2 and particle size class 2	
Results: Attachment XX where necessary	
7 – Testing for water-soluble contaminants (DIN/TR 55684, ISO 8502-6)	
Wipe test (DIN/TR 55684)	YES / NO
Bresle test (ISO 8502-6)	YES / NO
Requirement: Surface concentration: 50 mg/m <sup>2</sup> anions (or 5 µg/cm <sup>2</sup> )	
Results: Attachment XX where necessary	
7 – ggf. von Inspection for oil, grease and wax if appropriate (DIN/TR 55684)	
Performed: YES / NO	
Results: Attachment XX where necessary	
Remarks:	

<b>Release for coating: YES / NO</b>
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Date/Time	Company	Name	Signature
<i>DD.MM.YYYY/ hh:mm</i>	<i>ABC Corrosion Protection</i>	<i>Mr./Ms. Sample</i>	<i>MMM</i>
<i>DD.MM.YYYY/ hh:mm</i>	<i>XYZ Mechanical Engineers</i>	<i>Mr./Ms. Example</i>	<i>BBB</i>

Company: <b>ABC</b> <b>Corrosion Protection</b>	Inspection during Coating – Application	
	Customer: <i>XYZ Mechanical Engineers</i>	Record Pr. 4
	End-user: <i>Customer</i>	
	Wind farm/Site: <i>Sea</i>	Page 1 of 1
	Component/Structure: <i>Foundation XY</i>	

Test area: <i>Component 123</i>
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1 <sup>st</sup> coat (possibly primer coat)			
Coating system:		Manufacturer:	
Container size – Base component (A) / Hardener component (B):			
Colour:		Application method:	
Batch no. of base component (A):		Storage life:	
Batch no. of hardener component (B):		Storage life:	
Temperature (°C) of base component (A):		Temperature (°C) of hardener component (B):	
Nature and quantity of additives used:			
Date/Time (Start):		Date/Time (Finish):	
Wet film thickness (µm):		Dry film thickness if required (µm):	
2 <sup>nd</sup> coat			
Coating system:		Manufacturer:	
Container size – Base component (A) / Hardener component (B):			
Colour:		Application method:	
Batch no. of base component (A):		Storage life:	
Batch no. of hardener component (B):		Storage life:	
Temperature (°C) Of base component (A):		Temperature (°C) of hardener component (B):	
Nature and quantity of additives used:			
Date/Time (Start):		Date/Time (Finish):	
Wet film thickness (µm):		Dry film thickness if required (µm):	
3 <sup>rd</sup> coat			
Coating system:		Manufacturer:	
Container size – Base component (A) / Hardener component (B):			
Colour:		Application method:	
Batch no. of base component (A):		Storage life:	
Batch no. of hardener component (B):		Storage life:	
Temperature (°C) Of base component (A):		Temperature (°C) of hardener component (B):	
Nature and quantity of additives used:			
Date/Time (Start):		Date/Time (Finish):	
Wet film thickness (µm):		Dry film thickness (µm):	
Remarks: For larger components with several batches of coating materials → Mixing record			

Date	Company	Name	Signature
DD.MM.YYYY	ABC Corrosion Protection	Mr./Ms. Sample	MMM
DD.MM.YYYY	XYZ Mechanical Engineers	Mr./Ms. Example	BBB

<b>Company:</b> <b>ABC</b> <b>Corrosion Protection</b>	Inspection of the Applied Coating	
	Customer: <i>XYZ Mechanical Engineers</i>	Record Pr. 5
	End-user: <i>Customer</i>	
	Wind farm/Site: <i>Sea</i>	Page 1 of 1
	Component/Structure: <i>Foundation XY</i>	

Test area: *Component 123*

Coating:

1 – Visual inspection
Results:
<i>Example: Runs, orange peel, faults, inclusions</i>
2 – Measurement of film thickness [µm] (ISO 19840) – Specified: XX µm
Measuring instrument used: <i>Film thickness tester 123, Measurement Co. – Serial No. 456</i>
Number of measurements:
Minimum value:
Maximum value:
Mean value:
Attachment XX where necessary
3 – Testing for pores and cracks using high voltage (ISO 29601) – Test voltage: XX kV
Measuring instrument used: <i>Porosity tester 123, Measurement Co. – Serial No. 456</i>
Results:
Remarks: Where necessary, photo documentation and drawings, including surface area data

Date	Company	Name	Signature
DD.MM.YYYY	ABC Corrosion Protection	Mr./Ms. Sample	MMM
DD.MM.YYYY	XYZ Mechanical Engineers	Mr./Ms. Example	BBB

<b>Company:</b> <b>ABC</b> <b>Corrosion Protection</b>	<b>Testing of Specimen Panels for Use during Construction,</b>	
	Customer: <i>XYZ Mechanical Engineers</i>	<b>Record Pr. 6</b>
	End-user: <i>Customer</i>	
	Wind farm/Site: <i>Sea</i>	Page 1 of 1
	Component/Structure: <i>Foundation XY</i>	

Specimen panel from test area: *Component 123*

Coating:

1 – Visual inspection

Results:

2 – Measurement of film thickness [µm] (ISO 19840) – 25 measuring points, – Specified, : XX µm

Measuring instrument used: *Film thickness tester 123, Measurement Co. – Serial No. 456*

Minimum value:

Maximum value:

Mean value:

3 – Testing for pores and cracks using high voltage (ISO 29601) – Test voltage: XX kV

Measuring instrument used: *Porosity tester 123, Measurement Co. – Serial No. 456*

Results:

4 – Testing of adhesive strength (ISO 4624) – Specified: XX N/mm<sup>2</sup>

Measuring instrument used: *Force 123, Measurement Co. – Serial No. 456*

Indenter	Adhesive strength [N/mm <sup>2</sup> ]	Fracture pattern
1		
2		
3		
4		
5		
Mean value of adhesive strength [N/mm <sup>2</sup> ]:		
Remarks Where necessary, photo documentation of failure patterns		

Date	Company	Name	Signature
DD.MM.YYYY	ABC Corrosion Protection	Mr./Ms. Sample	MMM
DD.MM.YYYY	XYZ Mechanical Engineers	Mr./Ms. Example	BBB

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