

Surface preparation and protective coating

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Foreword

The NORSOK standards are developed by the Norwegian petroleum industry to ensure adequate safety, value adding and cost effectiveness for petroleum industry developments and operations. Furthermore, NORSOK standards are as far as possible intended to replace oil company specifications and serve as references in the authorities' regulations.

The NORSOK standards are normally based on recognised international standards, adding the provisions deemed necessary to fill the broad needs of the Norwegian petroleum industry. Where relevant, NORSOK standards will be used to provide the Norwegian industry input to the international standardisation process. Subject to development and publication of international standards, the relevant NORSOK standard will be withdrawn.

The NORSOK standards are developed according to the consensus principle generally applicable standards work and according to established procedures defined in NORSOK A-001.

The NORSOK standards are prepared and published with support by The Norwegian Oil Industry Association (OLF) and Federation of Norwegian Manufacturing Industries (TBL).

NORSOK standards are administered and published by Standards Norway.

Annex A is normative, whilst Annex B is for information only.

Introduction

The main changes included in this revision are that

- ISO 20340 has been adopted as pre-qualification test standard for coating systems;
- fire testing of aged spray-on passive fire protection has been introduced;
- minimum requirements with respect to coating products, number of coats and coating thickness have been introduced also for coating systems that shall be pre-qualified;
- DNV classification testing has been accepted as an alternative qualification method for ballast water tank coatings (coating system no. 3B).

Other changes and modifications are also made. All main changes are highlighted with revision marks.

1 Scope

This NORSOK standard gives the requirements for the selection of coating materials, surface preparation, application procedures and inspection for protective coatings to be applied during the construction and installation of offshore installations and associated facilities.

This NORSOK standard cover both paints, metallic coatings and application of spray-on passive fire protective coatings.

The aim of this NORSOK standard is to obtain a coating system, which ensures

- optimal protection of the installation with a minimum need for maintenance;
- that the coating system is maintenance friendly;
- that the coating system is application friendly;
- that health, safety and environmental impacts are evaluated and documented.

This NORSOK standard is not applicable to pipelines and pipeline risers.

2 Normative and informative references

The following standards include provisions and guidelines which, through reference in this text, constitute provisions and guidelines of this NORSOK standard. Latest issue of the references shall be used unless otherwise agreed. Other recognized standards may be used provided it can be shown that they meet or exceed the requirements and guidelines of the standards referenced below.

2.1 Normative references

ASTM D4752	Standard Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub.
DIN 8566-2	Zusätze für das termische Spritzen; Massivdrähte zum Lichtbogenspritzen; Technische Lieferbedingungen.
DNV Classification Note 33.1	Corrosion prevention of tanks and holds.
ISO 1461	Metallic coatings - Hot-dip galvanised coating on fabricated ferrous products - Requirements.
ISO 2814	Paints and varnishes - Comparison of contrast ratio (hiding power) of paint of the same type and colour.
ISO 4624	Paints and varnishes - Pull-off test for adhesion.
ISO 4628-6	Paints and varnishes - Evaluation of degradation of paint coatings - Designation of intensity, quantity and size of common types of defect – Part 6: Rating of degree of chalking by tape method.
ISO 8501-1	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. Informative supplement to part 1: Representative photographic examples of the change of appearance imparted to steel when blast-cleaned with different abrasives (ISO 8501-1:1988/Suppl: 1994).
ISO 8502-3	Preparation of steel substrates before application of paints and related products - Test for the assessment of surface cleanliness – Part 3: Assessment of dust on steel surfaces prepared for painting (pressure sensitive tape method).
ISO 8502-6	Preparation of steel substrates before application of paints and related products - Test for the assessment of surface cleanliness – Part 6: Extraction of soluble contaminants for analysis - The Bresle method.
ISO 8502-9	Preparation of steel substrates before application of paints and related products - Test for the assessment of surface cleanliness – Part 9: Field method for the conductometric determination of water-soluble salts.
ISO 8503	Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast cleaned substrates.
ISO 8504-2	Preparation of steel substrates before application of paints and related products - Surface preparation methods – Part 2: Abrasive blast cleaning.

ISO 12944-5	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 5: Protective paint systems.	
ISO 19840	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Measurement of, and acceptance criteria for, the thickness of dry film on rough surfaces.	
ISO 20340	Paints and varnishes – Performance requirements for protective paint systems for offshore and related structures.	
NACE RP0188	Discontinuity (holiday) testing of protective coatings.	
NORSOK M-001	Material selection.	
NORSOK S-002	Working environment.	
NS 476	Paints and coatings - Approval and certification of surface treatment inspectors.	
SFS 8145	Anticorrosive painting, surface preparation methods of blast cleaned and shop primer coated steel substrates and preparation grades for respective treatments.	
SSPC/SSPM Volume 2	Systems and Specifications, Fourth Edition.	

2.2 Informative references

DIN 32521 Acceptance test and quality control for thermal spraying equipment.

3 Terms, definitions and abbreviations

For the purposes of this NORSOK standard, the following terms, definitions and abbreviations apply.

3.1 Terms and definitions

3.1.1

can

verbal form used for statements of possibility and capability, whether material, physical or casual

3.1.2

feathered

gradual taper in thickness from a coated surface to an uncoated surface

3.1.3

holiday

discontinuity in a coating, which exhibits electrical conductivity, when exposed to a specific voltage

3.1.4

may

verbal form used to indicate a course of action permissible within the limits of the standard

3.1.5

shall

verbal form used to indicate requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted, unless accepted by all involved parties

3.1.6

should

verbal form used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required

3.1.7

shop primer

thin protective coating normally applied for protection during transport and storage

3.1.8

stripe coat

supplementary coat applied to ensure adequate protection of critical areas like edges, welds etc.

3.2 Abbreviations

CPS	coating procedure specification
CPT	coating procedure test
CSDS	coating system data sheet
MDFT	minimum dry film thickness
NACE	National Association of Corrosion Engineers
NDFT	nominal dry film thickness
OAR	occupational air requirements
RAL	colour definitions issued by RAL (Deutsches Institut für Gütesicherung und Kennzeichnung e.V.)
SSPC	Steel Structures Painting Council
SSPM	Steel Structures Painting Manual
QC	quality control
VOC	volatile organic components

4 General requirements

4.1 General

Selection of coating systems and application procedures shall be made with due consideration to conditions during fabrication, installation and service of the installation.

Specific qualification requirements for products, personnel and companies are given in Clause 10.

4.2 Planning

All activities shall be fully incorporated in the fabrication plan.

Details of management, inspectors, operators, facilities, equipment and qualified procedures shall be established and documented before commencing work.

Steel surfaces shall be blast cleaned and coated (i.e. metal sprayed or coated with primer and the succeeding coat of the applicable coating system) prior to installation.

4.3 Equipment protection and clean up

All equipment and structures shall be fully protected from mechanical damages, ingress of abrasives and dust from blast cleaning. Sags, droplets and paint over-spray (inclusive dry-spray) shall be avoided. Adjacent areas not to be painted or already finished shall be protected. On completion of the work in any area, all masking materials, spent abrasives, equipment etc. shall be removed.

4.4 Ambient conditions

No final blast cleaning or coating application shall be done if the relative humidity is more than 85 % and when the steel temperature is less than 3 °C above the dew point. Coating shall only be applied or cured at ambient and steel temperatures above 0 °C.

The coating manufacturer shall specify the maximum and minimum application and curing temperature and other relevant limitations regarding application and curing conditions for each product in any coating system.

4.5 Coating materials

The selected coating materials shall be suitable for the intended use and shall be selected after an evaluation of all relevant aspects such as

- corrosion protective properties;
- requirements to health, safety and environment;
- properties related to application conditions, equipment and personnel;
- experience with the coating materials and coating system;
- availability and economics of coating materials.

All coating materials and solvents shall be protected from ignition sources and shall remain within storage temperatures and storage conditions recommended by the coating manufacturer.

All coating materials and solvents shall be stored in the original container bearing the manufacturer's label and instructions. Each product shall have a batch number showing year and month of manufacture and giving full traceability of production. Shelf life shall be included in the technical data sheet.

Applicable coating systems are tabulated in Annex A.

Coating system no. 1, 3B, 4, 5 and 7 shall be pre-qualified in accordance with Clause 10.

For those coating systems which are subject to pre-qualification, the specified coating systems are examples, and alternative coating systems may be used if the requirements of this NORSOK standard are fulfilled. However, for coating system no. 1 and 7, the number of coats and the coating film thicknesses given in Annex A are minimum requirements which shall apply for coating systems subject to pre-qualification testing.

Topcoat colours should be in accordance with Annex B. Light colours shall be used in ballast and fresh water tanks.

4.6 Steel materials

Steel subject to surface preparation on site shall as a minimum requirement be in accordance with rust-grade B according to ISO 8501-1. Shop primers shall be regarded as temporary corrosion protection and shall be removed prior to the application of the coating systems herein unless the requirements in 4.7 are fulfilled.

4.7 Shop primer

If a shop primer is considered left on the surface to form an integrated part of the final coating system, it shall be applied in accordance with the following requirements:

Blast cleaning shall comply with ISO 8501-1 Sa 2½ and the surface shall remain at Sa 2½ until application of the primer. The primer shall consist of 1 coat zinc ethyl silicate primer with 15 µm thickness. Measured on a plane polished steel or glass test plate, the dry film thickness shall be maximum 25 µm.

Use of shop primer as an integrated part of the final coating system, can only be considered for coating system no. 1, 3B, 4, 5, 7 and 8. For coating system no. 1, 3B, 4, 5 and 7, the pre-qualification requirements in 10.1 shall apply.

Areas with intact shop primer shall be sweep blasted to minimum lightly in accordance with SFS 8145, table 1, prior to application of the final coating system. All other areas shall be treated in accordance with the requirements for bare steel.

4.8 Unpainted surfaces

The following items shall not be coated unless otherwise specified:

- aluminium, titanium, uninsulated stainless steel, insulated stainless steel heating/ventilation/air-conditioning ducts, chrome plated, nickel plated, copper, brass, lead, plastic or similar;
- jacketing materials on insulated surfaces.

If stainless steel is connected to carbon steel, the stainless steel part shall be coated 50 mm beyond the weld zone onto the stainless steel. For piping and pressure vessels, the coating for the stainless steel part shall not contain metallic zinc.

4.9 Handling and shipping of coated items

Coated items shall be carefully handled to avoid damage to coated surfaces. No handling shall be performed before the coating system is cured to an acceptable level. Packing, handling and storage facilities shall be of non-metallic type.