



DPC: 24/30480946 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 18796-2

Oil and gas industries including lower carbon energy – Internal coating of carbon steel process vessels —

Part 2: Guideline for selection of coating systems

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 67 *Oil and gas industries including lower carbon energy*.

A list of all parts in the ISO 18796 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The provision of well-established and robust coating material selection guidelines offers a means of satisfying long-term materials performance that meet the minimum requirements for a broad range of end users in the petroleum, petrochemical and natural gas industries. An additional benefit can be to enable coating manufacturers to develop, manufacture and provide coatings that meet these requirements. Oil and gas production projects benefit from a structured evaluation of coatings performance for the different process fluids being handled **within** process vessels.

The main objective of this document is to provide general requirements with guidelines for the selection of coatings for the internal surfaces of process vessels, with due consideration to the transported fluids and the impact of the external environment. Particular attention is paid to key parameters such as operating temperature, pressure, and presence of abrasion, amongst others. It is the end user's responsibility to provide a project document with respect to implementation of the requirements and guidelines of this document, and to specify the design conditions for coating selection. In addition to the end user, the organization responsible for the facility or for the process equipment design, or for both, is regarded as responsible for coating selection.

This document is developed to provide responsible parties with a structured process to carry out evaluation of proposed coatings in a consistent manner as a part of the engineering work, based upon a design basis for a particular installation / equipment item. Further this document is intended for use by oil companies and engineering contractors. Users of this document are advised that further or differing requirements might be needed for individual applications.

This document is not intended to inhibit a vendor from offering, or the **purchaser** from accepting, alternative coating solutions for individual applications. This can be particularly applicable where there is innovative or developing technology. Where an alternative is proposed, the specification issuer is expected to identify any deviations from this document and provide details.

[Annexes A, B, C, D, E](#) and [F](#) of this document are informative only.

Oil and gas industries including lower carbon energy – Internal coating of carbon steel process vessels —

Part 2: Guideline for selection of coating systems

1 Scope

This document specifies the selection criteria and minimum requirements for selecting coatings for pressurized service within process vessels. This is given for the following:

- key factors influencing coating selection,
- generic composition of test liquids which can be used as references when evaluating supporting testing evidence for coatings,
- principal test methods to be used as evidence of performance when selecting suitable coatings,
- ensuring that supporting evidence used in evaluating coatings is relevant to the potential end use.

This document refers to types of coatings that are generally available, with properties that are known and documented. It also allows other materials to be evaluated and qualified for use. This document is to be used for process vessels coated at the new construction phase. It is intended to be used only where the coating is applied directly to the substrate.

This document does not cover requirements related to metallic coatings nor weld overlay materials.

2 Normative references

The following documents are referred to in the text in such a way that some or all their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1514, *Paints, and varnishes — Standard panels for testing*

ISO 1519, *Paints and varnishes — Bend test (cylindrical mandrel)*

ISO 2811-3, *Paints and varnishes — Determination of density — Part 3: Oscillation method*

ISO 3270, *Paints and varnishes and their raw materials — Temperatures and humidities for conditioning and testing*

ISO 4624, *Paints and varnishes — Pull-off test for adhesion*

ISO 4628-2, *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, *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, *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 7783, *Determination of water-vapour transmission properties — Cup method*

ISO 7784-2, *Paints and varnishes — Determination of resistance to abrasion — Part 2: Method with abrasive rubber wheels and rotating test specimen*

ISO 6272-1, *Paints and varnishes — Rapid-deformation (impact resistance) tests — Part 1: Falling-weight test, large-area indenter*

ISO 8503-1, *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 11357, *Plastics – Differential Scanning Calorimetry – Part 2 Determination of glass transition temperature and glass transition step height*

ISO 12944-9, *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 15184, *Determination of film hardness by pencil test*

ISO 15663-2, *Petroleum, and natural gas industries — Life-cycle costing — Part 2: Guidance on application of methodology and calculation methods*

ISO 17025, *General requirements for the competence of testing and calibration laboratories*

ISO 18796-1, *Petroleum, petrochemicals and natural gas industries — Internal coating and lining of carbon steel process vessels — Part 1: Technical requirements*

ISO 19840, *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*

ISO 29601, *Paints and varnishes — Corrosion protection by protective paint systems — Assessment of porosity in a dry film*

NACE TM0185-SG:2006, *Evaluation of internal plastic coatings for corrosion control of tubular goods by Autoclave testing*

ASTM D2485, *Standard test methods for evaluating coatings for high temperature service.*

ASTM D2583, *Standard test method for indentation hardness of rigid plastics by means of a Barcol impressor.*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses: -

- ISO online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

abrasion resistance

coating wear resistance property

3.2

abrasive blast cleaning

surface preparation method that uses an abrasive propelled by air pressure, centrifugal force, or water pressure to clean and usually to profile a surface.

3.3

ambient temperature

external temperature range in degrees Celsius in which process vessel needs to operate and maintain characteristics within recommended limits.

3.4

applicator

contractor or subcontractor having the technical capability, knowledge, equipment, qualified personnel that is approved by the purchaser for the coating processes as required by this document.

3.5

cathodic protection

electrochemical protection by decreasing the electrode potential to a level at which the corrosion rate of the metal is significantly reduced.

3.6

chemical resistance

resistance of a material to change in mass, changes in dimensions or changes in other properties after immersion in chemicals.

3.7

coat

one layer of a protective coating applied to the surface in a single application to form an evenly distributed film when dry.

3.8

fluid composition

identity and content of each component that constitutes a gas or liquid mixture.

3.9

corrosion allowance

extra wall thickness added during design to compensate for any reduction in wall thickness by corrosion (internal/external) during the design operational life.

3.10

curing

chemical process of developing the intended properties of a polymerised product in the coating, generally due to a reaction of two or more chemicals (e.g., resin and curative)

3.11

design pressure

the minimum or maximum pressure, inclusive of operating pressure, surge pressure including shut-in pressure, vacuum conditions, and static pressure head.

3.12

nominal dry film thickness (abbreviated to ndft)

dry film thickness specified for each coat or for the whole coating system.

3.13

explosive (rapid) decompression

rapid pressure-drop in a high-pressure gas-containing system which disrupts the equilibrium between external gas pressure and the concentration of gas dissolved inside any polymer, with the result that excess gas tries to escape from the solution at points throughout the material, causing expansion.

3.14

exposure period

duration between the initial attainment to the termination of the specified exposure conditions

3.15

flowrate

actual volume of flow per unit of time

3.16

glass transition temperature (T_g)

temperature where a polymer substrate changes from a rigid glassy material to a soft (not melted) material, usually measured in terms of the stiffness, or modulus.

3.17

holiday

discontinuity in a coating or contamination in the coating film that materially lowers the performance of the coating.

Note 1 to entry: Examples of discontinuity in coatings are pinholes, craters, voids, cracks, thin spots and inclusion of foreign material.

3.18

immersion test

test in which the fluid covers the entire sample for the duration of the test (or partially covers the sample where a gaseous phase is also present)

3.19

impact resistance

energy which a coating can withstand without damage under defined testing conditions.

3.20

lifetime

period during which a coated / lined item of equipment exists and functions.

3.21

lining

internal coating

Note 1 to entry: The term coating is also used for the purposes of this document.

Note 2 to entry: Internal coating can be applied to the internal surfaces of a process vessel to serve as a barrier to corrosion.

3.22

maximum dry film thickness (abbreviated to mdft)

maximum permissible dry film thickness of a layer of coating or coating system in its fully cured condition

3.23

maximum metal design temperature

highest metal temperature at which pressure containing elements can be subjected to design pressure.

3.24

maximum operating pressure

the maximum operating pressure to which the coating will be subjected during normal operation of the process vessel, including start-up or shutdown.

3.25

maximum operating temperature

the maximum operating temperature to which the coating will be subjected during normal operation of the process vessel, including start-up and shut down.

3.26

minimum metal design temperature

lowest metal temperature at which pressure containing elements can be subjected to design pressure.

3.27

minimum operating pressure

the minimum operating pressure to which the coating will be subjected during normal operation of the process vessel, including start-up, shutdown, or emergency decompression.

3.28

minimum operating temperature

the minimum operating temperature to which the coating will be subjected during normal operation of the process vessel.

3.29

process vessel

housing and its direct attachments up to the coupling point connecting it to other equipment, design and built to contain fluids under pressure.

3.30

purchaser

legal entity which is purchasing the installed coating system

3.31

solids content

proportion of solids contained in the liquid either as a contaminant or as a deliberate useful burden or suspension.

Note 1 to entry: Solids content is expressed as a mass percentage or as the fraction of solids volume to total volume, i.e., the volume fraction.

3.32

steam cleaning

removal of surface contaminants by the action of steam or steam jets

3.33

substrate

surface to which the coating material is applied or is to be applied.

3.34

surface profile

micro-roughness of a surface generally expressed as the average height of the major peaks relative to the major valleys.

3.35

thermo-osmosis

the passage of a fluid through a membrane against the hydrostatic pressure, due to a temperature gradient

3.36

vendor

supplier of coatings

3.37

wall thickness

measured wall thickness around the circumference of the process vessel rounded up to the nearest 0,1 mm.

4 Symbols and abbreviated terms

4.1 Symbols

μ micrometre

4.2 Abbreviated terms

ASTM	American Society for Testing and Materials
CADS	Coating application data sheet
IMO	International Maritime Organisation
MDFT	Maximum dry film thickness
mm	Millimetre