
**Ships and marine technology — Protective
coatings and inspection method —**

**Part 1:
Dedicated sea water ballast tanks**

*Navires et technologie maritime — Revêtements de protection et
méthode d'inspection —*

Partie 1: Ballasts d'eau de mer dédiée

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 16145-1 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 8, *Ship design*.

ISO 16145 consists of the following parts, under the general title *Ships and marine technology — Protective coatings and inspection method*:

- Part 1: *Dedicated sea water ballast tanks*
- Part 2: *Void spaces of bulk carriers and oil tankers*
- Part 3: *Cargo oil tanks of crude oil tankers*

The following parts are under preparation:

- Part 4: *Automated measuring method for the total amount of water-soluble salts*
- Part 5: *Assessment method for coating damages*

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Introduction

The ISO 16145 series addresses qualified coating and inspection works in accordance with the requirements of IMO PSPC.

Technical Committee ISO/TC 8 *Ships and marine technology*, SC 8, *Ship design* has decided to standardize a coating and inspection method for the IMO PSPC series.

Coating quality itself depends largely on the surface preparation and coating application. Therefore, the right application of surface preparation and coating in accordance with the coating manufacturer's recommendations, including inspections at each step, are of vital importance.

This part of ISO 16145 is intended to serve as a standard for ship owners, shipyards, coating manufacturers, coating inspectors and coating applicators in applying IMO PSPC in the new building stage.

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Ships and marine technology — Protective coatings and inspection method —

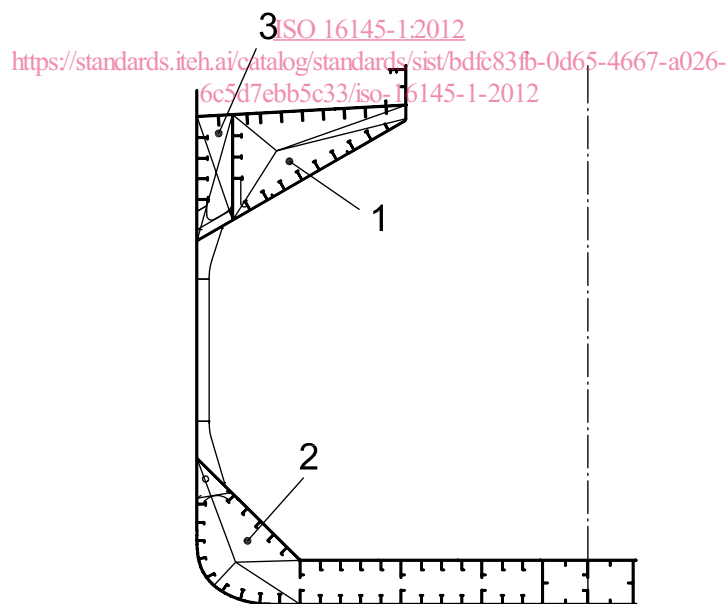
Part 1: Dedicated sea water ballast tanks

1 Scope

This part of ISO 16145 specifies a method of protective coatings and its inspection for dedicated seawater ballast tanks. It is applicable to all types of ships of not less than 500 gross tonnage and double-side skin spaces of bulk carriers of 150 m in length and upwards, which are contracted for new building on or after 1 July 2008; or in the absence of a building contract, the keels of which are laid or which are at a similar stage of construction on or after 1 January 2009; or the delivery of which is on or after 1 July 2012.

This part of ISO 16145 also is applicable to the dedicated seawater ballast tanks of oil tankers of double hull construction of 150 m in length and upwards and double-side skin spaces of bulk carriers of 90 m in length and upwards, which are contracted for new building on or after 8 December 2006.

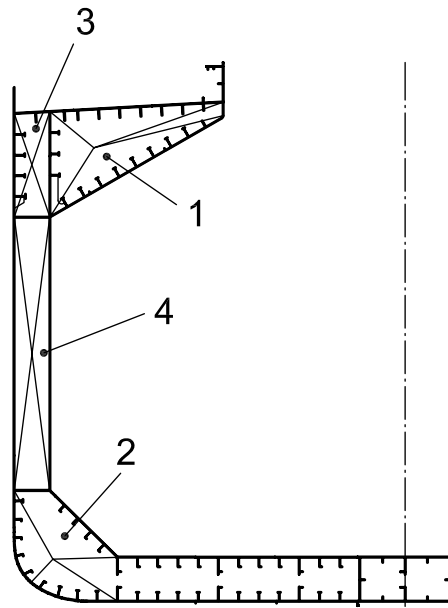
NOTE Double-side skin space is a configuration where each ship side is constructed by the side shell with a longitudinal bulkhead connecting to the double bottom and the deck. Hopper side tanks and top-side tanks may, where fitted, be integral parts of the double-side skin configuration. Therefore, the void spaces or other designated tanks arranged as a part of top-side tank, when provided in the bulk carriers of single-side skin construction, need not be considered as a double-side skin space (see Figures 1 and 2 for details).



Key

- 1 top-side tank
- 2 hopper side tank
- 3 void space or other designated tank (not to be considered as a double-side skin space)

Figure 1 — Midship section of bulk carriers with single-side skin construction



Key

- 1 top-side tank
- 2 hopper side tank
- 3 void space or other designated tank (to be considered as a double-side skin space)
- 4 double-side skin space

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Figure 2 — Midship section of bulk carriers with double-side skin construction

2 Normative references

ISO 16145-1:2012

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The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8501-1:2007, *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 8501-3:2001¹⁾, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 3: Preparation grades of welds, cut edges and other areas with surface imperfections*

ISO 8502-3:1992, *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 8502-9:1998, *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, *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*

ISO 8503-2:2012, *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*

1) Withdrawn International Standard revised by ISO 8501-3:2006.

IACS UI SC223, *For Application of SOLAS Regulation II-1/3-2 Performance Standard for Protective Coatings (PSPC) for Dedicated Seawater Ballast Tanks in All Types of Ships and Double-side Skin Spaces of Bulk Carriers, adopted by Resolution MSC.215 (82)*

IMO Res.MSC.215 (82), *Performance standard for protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces on bulk carriers*

3 Terms and definitions

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

3.1

90/10 rule

rule according to which 90% of all thickness measurements should be greater than or equal to nominal dry film thickness (NDFT) and none of the remaining 10% measurements shall be below 90% of NDFT

3.2

abrasive

metallic or non-metallic particles which are used in blasting work for removing mill scale, rust or foreign substance on the surface to be coated using pressurized air or a high-speed rotating impeller

NOTE A steel shot ball is used mainly in the primary surface preparation and steel grit is used mainly in the secondary surface preparation; however, garnet or non-metallic abrasives may be used in some circumstances.

3.3

coating inspector

qualified person certified to at least NACE Coating Inspector Level 2, FROSIO Inspector Level III, or an equivalent qualification with at least two years' documented relevant coating inspection experience and as agreed by ship owner, shipyard and coating manufacturer as specified in IACS UI SC223, adopted by Resolution MSC.215 (82)

3.4

erection

final assembly of blocks or pre-erected blocks

EXAMPLE On the dry dock or ground building berth.

3.5

line quality controller

line QC

person, other than the coating inspector or assistant to the coating inspector, who carries out the inspection work prior to the official inspection

3.6

measurement of representative dry film thickness (DFT)

measurement of typical dry film thickness (DFT) after each main coating in order to use it as a reference in a follow-up coating by measuring the film thickness of certain representative parts of the compartment

NOTE It is not necessary to keep a record of the representative DFT.

3.7

pre-erection

assembly of blocks in large units corresponding to the crane capacity for erection

3.8

shop primer

prefabrication primer coating applied to steel plates, often in automatic plants (and before the first coat of a coating system)

3.9

stain

light shadows, slight streaks or minor discolorations

4 Symbols and abbreviated terms

4.1 Symbols

C_m	electric conductivity of solution
C_s	electric conductivity of abrasive
K	cell constant

4.2 Abbreviated terms

CTF	coating technical file
DFT	dry film thickness
FROSIO	Faglig Råd for Opplæring og Sertifisering av Inspektører innen Overflatebehandling (The Norwegian Professional Council for Education and Certification of Inspectors for Surface Treatment)
IACS	International Association of Classification Societies Ltd
IMO	International Maritime Organization
JSRA-SPSS	The Shipbuilding Research Association of Japan - Standard for the preparation of steel surface prior to painting
JSTRA-SPSS for PSPC	Japan Ship Technology Research Association - Standard for the preparation of steel substrate for PSPC (SPSS for PSPC)
NACE	NACE International https://standards.iteh.ai/catalog/standards/sist/bdfc83fb-0d65-4667-a026-6e5d7ebb5c33/iso-16145-1-2012
NDFT	nominal dry film thickness
PSPC	performance standard for protective coatings
QA	quality assurance
QC	quality control
SOC	statement of compliance
SSPC	The Society for Protective Coatings (former Steel Structure Painting Council, USA)
TAC	type approval certificate
WFT	wet film thickness
WBT	water ballast tank

5 General procedures for coating work

The typical hull construction process for coating is listed in Table 1 below.

Table 1 — Typical coating and inspection steps for hull structure

Step	Item	Description
1	Storage of steel	Storage area for plates and profiles.
2	Primary surface preparation (pre-treatment) and shop priming	Remove mill scale, rust, and other contaminants and apply shop primer. Details are given in 6.2.
3	Inspection for primary surface preparation and shop priming	Carry out a self-inspection in accordance with the QA system. The QA system contains a regular check and record of surface cleanliness, surface profile, DFT measurement, salt measurement, etc.
4	Steel cutting	Cut steel for assembly.
5	Sub-assembly	Primary assembly step on a small or medium scale. Carry out the work including edge preparation in accordance with ISO 8501-3:2001 (P2 grade). Details are given in 6.2.3 for edge preparation.
6	Block assembly or unit and panel assembly	A step of assembling the members assembled in a small or medium scale into block unit. Carry out the work including edge preparation in accordance with ISO 8501-3:2001 (P2 grade). Details are given in 6.2.3 for edge preparation.
7	Pre-outfitting	Install outfits such as pipes and supports prior to block coating.
8	Secondary surface preparation (block stage)	Details are given in 6.3 for the secondary surface preparation for completed block.
9	Inspection for secondary surface preparation (block stage)	Inspection by a coating inspector (or an assistant to the coating inspector under direct supervision of the coating inspector).
10	Block coating	Details are given in 6.4 for the step of coating on the block where surface preparation and inspection are completed.
11	Inspection for block coating	Inspection by a coating inspector (or an assistant to the coating inspector under direct supervision of the coating inspector).
12	Pre-erection	Assemble blocks in large units corresponding to the crane capacity for erection.
13	Secondary surface preparation and coating for pre-erection joint	Details are given in 6.3 and 6.4 for surface preparation and coating work of the welding joint of pre-erection.
14	Inspection for pre-erection joint	Inspection by a coating inspector (or an assistant to the coating inspector under direct supervision of the coating inspector).
15	Erection	Final assembly step of blocks or pre-erected blocks on the dry dock or ground building berth.
16	Secondary surface preparation and coating for erection joint	Details are given in 6.3 and 6.4 for the step of secondary surface preparation and coating work on erection joint.
17	Inspection erection joint	Inspection by a coating inspector (or an assistant to the coating inspector under direct supervision of the coating inspector).
18	Completion	Completion and final coating touch up and repair.

Steps 12 to 14 may be omitted depending on the size of blocks and the conditions of each shipyard.

6 Standard for coating work

6.1 Surface preparation

6.1.1 Applicable standard

6.1.1.1 Grade of surface cleanliness

For further details including picture, see ISO 8501-1:2007 and ISO 8501-1:1988/Suppl:1994.

a) Sa 2 (thorough blast cleaning)

When viewed without magnification, the surface shall be free from visible oil, grease and dirt, and most of the mill scale, rust, paint coatings and foreign matter. Any remaining contamination shall be attached solidly.

b) Sa 2½ (very thorough blast cleaning)

When viewed without magnification, the surface shall be free from visible oil, grease and dirt, as well as mill scale, rust, paint coatings and foreign matter. Any remaining traces of contamination shall show only as slight stains in the form of spots or stripes.

c) St 2 (thorough hand and power tool cleaning)

When viewed without magnification, the surface shall be free from visible oil, grease and dirt, as well as poorly adhering mill scale, rust, paint coatings and foreign matter.

d) St 3 (very thorough hand and power tool cleaning)

As for St 2, the surface shall be treated much more thoroughly to give a metallic shine arising from the metallic substrate.

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6.1.1.2 Comparison with other standards

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Comparison of the grade of surface preparation with other standards is shown in Table 2.

Table 2 — Comparison of the grade of surface preparation with other standards

ISO 8501-1:2007	SIS 05 59 00	SSPC-Vis 1/Vis 3	NACE
Sa 2	Sa 2	SSPC-SP 6	NACE No. 3
Sa 2½	Sa 2½	SSPC-SP 10	NACE No. 2
St 2	St 2	SSPC-SP 2	—
St 3	St 3	SSPC-SP 3	—

6.1.1.3 Inspection of surface preparation

The prepared surface shall be inspected as follows.

- a) Examine the condition of steel surface visually immediately before coating application and compare to the surface preparation photographs in ISO 8501-1:2007.
- b) A rational decision shall be made after considering the following fully:
 - 1) The object to be coated is much larger and has a more complex shape than the photographs in ISO 8501-1:2007.
 - 2) Stains are allowed up to 5 % for Sa 2½ and up to 30 % for Sa 2.

- 3) The surface to be inspected may be different than the pictures in ISO 8501-1:2007 because the final prepared surface colour is dependent on lighting, type and size of blast material and initial steel surface grade.

6.1.2 Reference to the secondary surface preparation

6.1.2.1 Internationally recognized standards such as ISO 8501-1:2007, SSPC-Vis 1 or SSPC-Vis 3 shall be used for the inspection of surface preparation. The JSRA/JSTRA standard may be used for inspection of secondary surface preparation.

NOTE The JSRA/JSTRA standard may be referred to for information that is not contained in the standard for secondary surface preparation of ISO 8501-1:2007.

6.1.2.2 Table 3 shall be used as a reference for comparison of ISO international standards and JSRA/JSTRA standards.

Table 3 — Comparison between ISO international standards and JSRA/JSTRA standards

Method of preparation	ISO 8501-1:2007	JSRA-SPSS	JSTRA standard (SPSS for PSPC)
Blast cleaning	B Sa 1, C Sa 1	(IH, IA, IF, ID, IR) Ss	—
	B Sa 2	(IH, IA, IF, ID, IR) Sd1	—
	B Sa 2½	(IH, IA, IF, ID, IR) Sd2	Sa 2½, Rec
	B Sa 3	(IH, IA, IF, ID, IR) Sd3	—
Hand tool or power tool cleaning	—	(IH, IA, IF, ID, IR) Pt1	—
	B St 2, C St 2	(IH, IA, IF, ID, IR) Pt2	—
	B St 3, C St 3	(IH, IA, IF, ID, IR) Pt3	St 3, Rec

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6.2 Primary surface preparation and shop priming

6.2.1 Primary surface preparation

6.2.1.1 The steel plates and profiles of the hull to be coated shall be blasted to the grade of Sa 2½ with the surface roughness of between 30 µm and 75 µm [Medium (G) or Medium (S)]. The measurement (and decision) of surface roughness shall be done in accordance with ISO 8503-1:2012 and ISO 8503-2:2012.

6.2.1.2 In the event that the relative humidity in the blasting chamber (cell) is higher than 85 % or the temperature of steel surface is lower than 3 °C over the dew point, blasting work shall not be carried out.

6.2.1.3 After surface preparation, the cleanliness of the steel surface and surface roughness shall be inspected prior to applying shop primer in accordance with the recommendations of the coating manufacturer.

6.2.1.4 The requirements for the inspection of primary surface preparation shall be a periodic spot check at least once per month normally, in the event that the following conditions are met and such a procedure is documented:

- a) Primary surface preparation is carried out in the facility in which the environment and quality level are not substantially changed.

NOTE Substantially changed means an environment change under the level mentioned in 6.2.1.2.

- b) Primary surface preparation and coating work are done automatically.
- c) Shop primer is coated immediately after the surface preparation.
- d) Steel surface condition is unchanged.