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

Part 2:

**Void spaces of bulk carriers and oil tankers**

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

*Partie 2: Espaces vides de vraquiers et de réservoirs d'huile*

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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 16145-2 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 2: Void spaces of bulk carriers and oil tankers

### 1 Scope

This part of ISO 16145 specifies a method of protective coatings and its inspection of void spaces of bulk carriers and oil tankers which are contracted and agreed to apply PSPC/VOID [IMO Res.MSC.244 (83)] for new building on or after 5 October 2007.

### 2 Normative references

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 8501-3:2001<sup>1)</sup>, *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*

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.244 (83), *Performance standard for protective coatings for void spaces on bulk carriers and oil tankers*

1) Withdrawn International Standard revised by ISO 8501-3:2006.

### 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

#### 3.10

##### **totally enclosed space**

space which has no means of access and no ventilation



## 4 Symbols and abbreviated terms

### 4.1 Symbols

$C_m$	electric conductivity of solutions
$C_s$	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
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

## 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 6.3.3 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 6.3.3 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 6.4 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 6.5 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 6.4 and 6.5 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 6.4 and 6.5 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 Areas considered

**6.1.1** Void spaces located in the enclosed area below the bulkhead deck, within and forward of, the cargo area of oil tankers, the cargo length area of bulk carriers shall be coated in accordance with this part of ISO 16145, with the following areas excluded:

- a) dedicated seawater ballast tank;
- b) space for carriage of cargo;
- c) space for the storage of any substance (e.g. oil fuel, fresh water, provisions);
- d) space for the installation of any machinery (e.g. cargo pump, ballast pump, bow thrusters);
- e) any space in normal use by personnel;
- f) double-side skin space of bulk carriers of 150 m in length and upwards.

NOTE 1 Refer to ISO 16145-1 for dedicated seawater ballast tank and double-side skin spaces of a bulk carrier of more than 150 m length.

NOTE 2 The cargo area is that part of the ship that contains cargo holds, cargo tanks, slop tanks and cargo pump-rooms including pump-rooms, cofferdams, ballast and void spaces adjacent to cargo tanks and also deck areas throughout the entire length and breadth of the part of the ship over the above-mentioned spaces.

NOTE 3 The cargo length area is that part of the ship which includes all cargo holds and adjacent areas including fuel tanks, cofferdams, ballast tanks and void spaces.

**6.1.2** The following void spaces shall be coated in accordance with this part of ISO 16145.

#### **6.1.2.1 In a bulk carrier**

- a) Double bottom pipe passages/pipe tunnels;
- b) small void spaces located behind gusset or shedder plates at the bottom of corrugation bulkheads with the exception of totally enclosed spaces;
- c) other small void spaces in cargo space, with the exception of totally enclosed spaces;
- d) lower transverse stool of transverse bulkhead, with the exception of totally enclosed spaces;
- e) upper transverse stool of transverse bulkhead, with the exception of totally enclosed spaces.

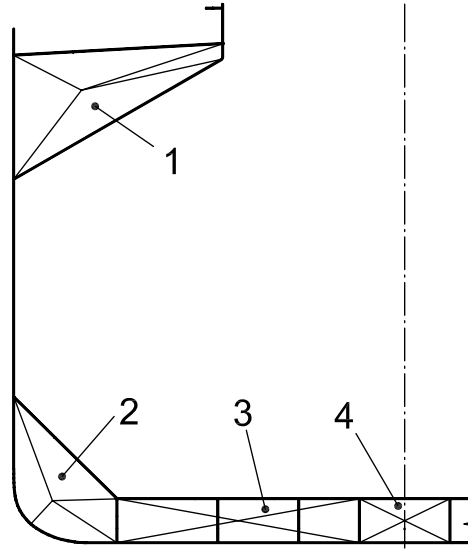
#### **6.1.2.2 In an oil tanker**

- a) Forward cofferdam/cofferdam separating cargo from forepeak;
- b) cofferdam in cargo area/cofferdam separating incompatible cargoes;
- c) aft cofferdam;
- d) duct keel/pipe tunnels;
- e) lower bulkhead stools;
- f) upper bulkhead stools.

**6.1.3** The following void spaces shall be coated in accordance with ISO 16145-1.

#### **6.1.3.1 In a bulk carrier**

- a) Double-side skin spaces in ships of less than 150 m in length;
- b) upper and lower side void spaces and double bottom void spaces of the cargo area (see Figure 1 for details).



**Key**

- 1 upper void area
- 2 lower void area
- 3 double bottom void
- 4 duct keel

**Figure 1 — Midship section of bulk carriers**  
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**6.1.3.2 In a tanker**

- a) Double-side skin spaces to protect cargo tank

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**6.1.4** This part of ISO 16145 does not apply to the following void spaces:

- a) totally enclosed spaces located behind gusset or shedder plates at the bottom of corrugation bulkheads and other small totally enclosed spaces in cargo tanks;
- b) lower transverse stool of transverse bulkheads that are totally enclosed spaces;
- c) upper transverse stool of transverse bulkheads that are totally enclosed spaces;
- d) transducer voids;
- e) other areas not mentioned in 6.1.2 and 6.1.3

**6.2 Surface preparation**

**6.2.1 Applicable standard**

**6.2.1.1 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.

### 6.2.1.2 Comparison with other standards

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	—

### 6.2.1.3 Inspection of surface preparation

The prepared surface shall be inspected as follows. <https://standards.iteh.ai/catalog/standards/sist/913f9528-964d-487d-bf47-878154ac1211/iso-16145-2-2012>

- 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.

### 6.2.2 Reference to the secondary surface preparation

**6.2.2.1** 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.

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