

**RESOLUTION MSC.244(83)**  
**(adopted on 5 October 2007)**

**ADOPTION OF PERFORMANCE STANDARD FOR PROTECTIVE COATINGS  
FOR VOID SPACES ON BULK CARRIERS AND OIL TANKERS**

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

HAVING ADOPTED, by resolution MSC.215(82), the Performance standard for protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers and, by resolution MSC.216(82), amended SOLAS regulation II-1/3-2 to make the performance standard mandatory;

RECOGNIZING the need to also develop a performance standard for protective coatings for void spaces on bulk carriers and oil tankers,

HAVING CONSIDERED, at its eighty-third session, the proposed Performance standard for protective coatings for void spaces on bulk carriers and oil tankers,

1. ADOPTS the Performance standard for protective coatings for void spaces on bulk carriers and oil tankers, the text of which is set out in the Annex to the present resolution;
2. INVITES Member Governments to utilize the Performance standard when applying protective coatings to void spaces on bulk carriers and oil tankers.

## ANNEX

### PERFORMANCE STANDARD FOR PROTECTIVE COATINGS FOR VOID SPACES ON BULK CARRIERS AND OIL TANKERS

#### 1 PURPOSE

This Standard provides technical requirements for protective coatings for void spaces constructed of steel in bulk carriers and oil tankers.

#### 2 DEFINITIONS

For the purpose of this Standard, the following definitions apply:

2.1 *Dew point* is the temperature at which air is saturated with moisture.

2.2 *DFT* is dry film thickness.

2.3 *Dust* is loose particle matter present on a surface prepared for painting, arising from blast-cleaning or other surface preparation processes, or resulting from the action of the environment.

2.4 *Edge grinding* is the treatment of edge before secondary surface preparation.

2.5 “*GOOD*” *condition* is the condition with minor spot rusting as defined in the Guidelines on the enhanced programme of inspections during surveys of bulk carriers and oil tankers (resolution A.744(18)).

2.6 *Hard coating* is a coating that chemically converts during its curing process or a non-convertible air drying coating which may be used for maintenance purposes. It can be either inorganic or organic.

2.7 *NDFT* is the nominal dry film thickness. 90/10 practice means that 90% of all thickness measurements should be greater than or equal to NDFT and none of the remaining 10% measurements should be below 0.9 x NDFT.

2.8 *Primer coat* is the first coat of the coating system applied in the shipyard after shop primer application.

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

2.10 *Stripe coating* is painting of edges, welds, hard to reach areas, etc., to ensure good paint adhesion and proper paint thickness in critical areas.

2.11 *Target useful life* is the target value, in years, of the durability for which the coating system is designed.

2.12 *Technical Data Sheet* is paint manufacturers' Product Data Sheet which contains detailed technical instruction and information relevant to the coating and its application.

2.13 *Totally enclosed space* is a space which has no means of access and no ventilation.

2.14 *Void space* is an enclosed space below the bulkhead deck, within and forward of, the cargo area of oil tankers or the cargo length area of bulk carriers, excluding:

- .1 a dedicated seawater ballast tank;
- .2 a space for the carriage of cargo;
- .3 a space for the storage of any substance (e.g., oil fuel, fresh water, provisions);
- .4 a space for the installation of any machinery (e.g., cargo pump, ballast pump, bow thruster);
- .5 any space in normal use by personnel; and
- .6 a double-side skin space of bulk carriers of 150 m in length and upwards which shall comply with the Performance standard for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers adopted by resolution MSC.215(82).

For the purpose of this regulation, "cargo area" and "cargo length area" are as defined in resolution A.744(18).

### **3 GENERAL PRINCIPLES**

3.1 The ability of the coating system to reach its target useful life depends on the type of coating system, steel preparation, application and coating inspection and maintenance. All these aspects contribute to the good performance of the coating system.

3.2 Inspection of surface preparation and coating processes should be agreed upon between the shipowner, the shipyard and the coating manufacturer and presented to the Administration for review. Clear evidence of these inspections should be reported and be included in the Coating Technical File (CTF) (see paragraph 3.4).

3.3 When considering the standard provided in section 4, the following should be taken into account:

- .1 it is essential that specifications, procedures and the various different steps in the coating application process (including, but not limited to, surface preparation) are strictly applied by the shipbuilder in order to prevent premature decay and/or deterioration of the coating system;
- .2 the coating performance can be improved by adopting measures at the ship design stage such as reducing scallops, using rolled profiles, avoiding complex geometric configurations and ensuring that the structural configuration permits easy access for tools and to facilitate cleaning, drainage and drying of the space to be coated; and

- .3 the coating performance standard provided in this resolution is based on the experience of manufacturers, shipyards and ship operators; it is not intended to exclude suitable alternative coating systems, providing a performance at least equivalent to that specified in this Standard is demonstrated. Acceptance criteria for alternative systems are provided in section 8.

### 3.4 Coating Technical File

3.4.1 Specification of the coating system applied to void spaces in bulk carriers and oil tankers, records of the shipyard's and shipowner's coating work, detailed criteria for coating selection, job specifications, inspection, maintenance and repair should be documented in the Coating Technical File (CTF), which should be reviewed by the Administration or an organization recognized by the Administration.

#### 3.4.2 *New construction stage*

The Coating Technical File should contain at least the following items relating to this Standard and should be delivered by the shipyard at the new ship construction stage:

- .1 copy of Statement of Compliance or Type Approval Certificate;
- .2 copy of Technical Data Sheet, including:
  - .1 product name and identification mark and/or number;
  - .2 materials, components and composition of the coating system, colours;
  - .3 minimum and maximum dry film thickness;
  - .4 application methods, tools and/or machines;
  - .5 condition of surface to be coated (de-rusting grade, cleanness, profile, etc.); and
  - .6 environmental limitations (temperature and humidity);
- .3 shipyard work records of coating application, including:
  - .1 applied actual space and area (in square metres) of each void space;
  - .2 applied coating system;
  - .3 time of coating, thickness, number of layers, etc.;
  - .4 ambient condition during coating; and
  - .5 method of surface preparation;
- .4 procedures for inspection and repair of coating system during ship construction;
- .5 coating log issued by the coating inspector, stating that the coating was applied in accordance with the specifications to the satisfaction of the coating supplier representative and specifying deviations from the specifications (example of daily log and non-conformity report, see annex 2);
- .6 shipyard's verified inspection report, including:
  - .1 completion date of inspection;
  - .2 result of inspection;
  - .3 remarks (if given);
  - .4 inspector signature; and
- .7 procedures for in-service maintenance and repair of coating system.

### **3.4.3 Maintenance, repair and partial re-coating**

Maintenance, repair and partial re-coating activities should be recorded in the Coating Technical File in accordance with the relevant section of the guidelines for coating maintenance and repair<sup>1</sup>.

### **3.4.4 Re-coating**

If full re-coating is carried out, the items specified in paragraph 3.4.2 should be recorded in the Coating Technical File.

3.4.5 The Coating Technical File should be kept on board and maintained throughout the life of the ship.

## **3.5 Health and safety**

The shipyard is responsible for the implementation of national regulations to ensure the health and safety of individuals and to minimize the risk of fire and explosion.

## **4 COATING STANDARD**

### **4.1 Performance standard**

This Standard is based on specifications and requirements which intend to provide a target useful coating life of 15 years, which is considered to be the time period, from initial application, over which the coating system is intended to remain in “GOOD” condition. The actual useful life will vary, depending on numerous variables including actual conditions encountered in service.

### **4.2 Standard application**

4.2.1 Protective coatings for the following void spaces should comply with the requirements in this Standard:

- .1 in bulk carriers:
  - .1 double bottom pipe passages / pipe tunnels;
  - .2 small void spaces located behind gusset or shedder plates at the bottom of corrugation bulkheads with the exception of totally enclosed spaces;
  - .3 other small void spaces in cargo spaces, with the exception of totally enclosed spaces;
  - .4 lower transverse stool of transverse bulkheads, with the exception of totally enclosed spaces<sup>2</sup>; and
  - .5 upper transverse stool of transverse bulkheads, with the exception of totally enclosed spaces<sup>2</sup>; and

---

<sup>1</sup> To be developed by the Organization.

<sup>2</sup> Noting, *inter alia*, the mandatory provisions of resolution A.744(18), as amended, regarding the requirement to undertake close-up surveys of the internal structure of upper and lower stools, where fitted.

- .2 in oil tankers:
  - .1 forward cofferdam/cofferdam separating cargo from forepeak;
  - .2 cofferdam in cargo area/cofferdam separating incompatible cargoes;
  - .3 aft cofferdam;
  - .4 duct keel/pipe tunnels;
  - .5 lower bulkhead stools; and
  - .6 upper bulkhead stools.

4.2.2 Protective coatings for the following void spaces should comply with the requirements in the Performance standard for protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers (resolution MSC.215(82)):

- .1 in bulk carriers:
  - .1 double-side skin spaces in ships of less than 150 m in length; and
  - .2 upper and lower side void spaces and double bottoms void spaces in cargo area; and
- .2 in oil tankers:
  - double-side skin (DSS) voids including sides, bottoms/double hull voids spaces protecting cargo oil tanks.

4.2.3 No requirements are contained in this Standard for protective coatings for the following void spaces in bulk carriers and oil tankers:

- .1 totally enclosed spaces located behind gusset or shedder plates at the bottom of corrugation bulkheads and other small totally enclosed spaces in cargo tanks;
- .2 lower transverse stool of transverse bulkheads that are totally enclosed spaces;
- .3 upper transverse stool of transverse bulkheads that are totally enclosed spaces;
- .4 transducer voids; and
- .5 any spaces not specifically mentioned in paragraphs 4.2.1 and 4.2.2.

### 4.3 Special application

4.3.1 This Standard covers protective coating requirements for the ship steel structure. It is noted that other independent items are fitted within the tanks to which coatings are applied to provide protection against corrosion.

4.3.2 It is recommended that this Standard be applied, to the extent possible, to those portions of permanent means of access provided for inspection, not integral to the ship structure, such as rails, independent platforms, ladders, etc. Other equivalent methods of providing corrosion protection for non-integral items may also be used, provided they do not impair the performance of the coatings of the surrounding structure. Access arrangements that are integral to the ship structure, such as increased stiffener depths for walkways, stringers, etc., should fully comply with this Standard.

4.3.3 It is also recommended that supports for piping, measuring devices, etc., be coated in accordance with the provisions for non-integral items indicated in paragraph 4.3.2.

#### **4.4 Basic coating requirements**

4.4.1 The requirements for protective coating systems, which should be applied at ship construction to void spaces in bulk carriers and oil tankers meeting the standard specified in paragraph 4.1, are listed in table 1.

4.4.2 Coating manufacturers should provide a specification of the protective coating system to satisfy the requirements of table 1.

4.4.3 The Administration or an organization recognized by the Administration should verify the Technical Data Sheet and Statement of Compliance or Type Approval Certificate for the protective coating system.

4.4.4 The shipyard should apply the protective coating in accordance with the verified Technical Data Sheet and its own verified application procedures.

**Table 1 - Basic coating system requirements for void spaces in bulk carriers and oil tankers**

	Characteristic	Requirement
<b>1 Design of coating system</b>		
.1	Selection of the coating system	<p>The selection of the coating system should be considered by the parties involved with respect to the service conditions and planned maintenance. The following aspects, among other things should be considered:</p> <ul style="list-style-type: none"> <li>.1 location of space relative to heated surfaces;</li> <li>.2 required surface conditions;</li> <li>.3 required surface cleanliness and dryness;</li> <li>.4 relative humidity;</li> <li>.5 access and maintenance; and</li> <li>.6 mechanical ventilation.</li> </ul> <p>Coating manufacturers should have products with documented satisfactory performance records and technical data sheets. The manufacturers should also be capable of rendering adequate technical assistance. Performance records, Technical Data Sheet and technical assistance (if given) should be recorded in the Coating Technical File.</p> <p>Coatings for application underneath sun-heated decks or on bulkheads forming boundaries of heated spaces should be able to withstand repeated heating and/or cooling without becoming brittle.</p>
.2	Coating type	<p>Epoxy-based systems.</p> <p>Other coating systems with performance according to the test procedure in annex 1.</p> <p>When a multi-coat system is applied, contrasting colour is recommended for each coat.</p> <p>The top coat should be of a light colour in order to facilitate in-service inspection.</p>



	Characteristic	Requirement
.3	Coating pre-qualification test	<p>Epoxy-based systems tested prior to the date of adoption of this standard in a laboratory by a method corresponding to the test procedure in annex 1 or equivalent, which, as a minimum, meets the requirements for rusting and blistering may be accepted;</p> <p>or any coating system which meets the requirements in table 1.1.3 of the Performance standard for protective coating for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers (resolution MSC.215(82)), is accepted and may be applied in accordance with this Standard;</p> <p>or which have documented field exposure for 5 years with a final coating condition of not less than “GOOD” may also be accepted.</p> <p>For other systems, including epoxy-based systems tested after the adoption of this Standard, testing according to the procedure in annex 1 to this Standard should be required.</p>
.4	Job specification	<p>There should be a minimum of one stripe coat and one spray coat. The stripe coat should be applied on thermally cut free edges and small holes only.</p> <p>Surface contaminants such as rust, grease, dust, salt, oil, etc., should be removed prior to painting with proper methods according to the paint manufacturer’s recommendation. Abrasive inclusions embedded in the coating should be removed. Job specifications should include the dry-to-recoat times and walk-on time given by the manufacturer.</p>
.5	NDFT (nominal total dry film thickness) <sup>3</sup>	<p>NDFT 200 µm with a 90/10 rule for epoxy based coatings, other systems to coating manufacturer’s specifications.</p> <p>Maximum total dry film thickness according to manufacturer’s detailed specifications.</p> <p>Care should be taken to avoid increasing the thickness in an exaggerated way. Wet film thickness should be regularly checked during application.</p> <p>Thinner should be limited to those types and quantities recommended by the manufacturer.</p>

<sup>3</sup> Type of gauge and calibration in accordance with SSPC-PA2:2004. Paint Application Specification No.2.

	Characteristic	Requirement
<b>2 PSP (Primary surface preparation)</b>		
.1	Blasting and profile <sup>4,5</sup>	<p>Sa 2½; with profiles between 30-75 µm.</p> <p>Blasting should not be carried out when:</p> <ul style="list-style-type: none"> <li>.1 the relative humidity is above 85%; or</li> <li>.2 the surface temperature of steel is less than 3°C above the dew point.</li> </ul> <p>Checking of the steel surface cleanliness and roughness profile should be carried out at the end of the surface preparation and before the application of the primer, in accordance with the manufacturer's recommendations.</p>
.2	Water soluble salt limit equivalent to NaCl <sup>6</sup>	≤ 50 mg/m <sup>2</sup> of sodium chloride.
.3	Shop primer	<p>Zinc containing inhibitor free zinc silicate based or equivalent.</p> <p>Compatibility with main coating system should be confirmed by the coating manufacturer.</p>
<b>3 SSP (Secondary surface preparation)</b>		
.1	Steel condition	<p>The steel surface should be prepared so that the coating selected can achieve an even distribution at the required NDFT and have an adequate adhesion by removing sharp edges, grinding weld beads and removing weld spatter and any other surface contaminant<sup>7</sup>.</p> <p>Edges to be smooth, subject to one pass grinding or at least equivalent process before painting<sup>8</sup>.</p>

<sup>4</sup> Reference standard: ISO 8501-1:1988/Suppl:1994. Preparation of steel substrate before application of paints and related products – Visual assessment of surface cleanliness.

<sup>5</sup> Reference standard: ISO 8503-1/2:1988. Preparation of steel substrate before application of paints and related products – Surface roughness characteristics of blast-cleaned steel substrates.

<sup>6</sup> Conductivity measured in accordance with ISO 8502-9:1998. Preparation of steel substrate before application of paints and related products – Test for the assessment of surface cleanliness.

<sup>7</sup> Reference standard: ISO 8501-3:2001 (grade P1). Preparation of steel substrate before application of paints and related products – Visual assessment of surface cleanliness.

<sup>8</sup> Reference standard: ISO 8501-3:2001 (grade P2). Preparation of steel substrate before application of paints and related products – Visual assessment of surface cleanliness.

	Characteristic	Requirement
.2	Surface treatment <sup>4</sup>	<p>For damaged shop primer:</p> <p>Sa 2 or St 3 on damaged shop primer and welds;</p> <p>For intact shop primer:</p> <p>Sa 2 removing at least 70% of intact shop primer, which has not passed a pre-qualification certified by test procedures in table 1.1.3.</p> <p>If the complete coating system comprising epoxy-based main coating and shop primer has passed a pre-qualification certified by test procedures in table 1.1.3 intact shop primer may be retained provided the same epoxy coating system is used. The retained shop primer should be cleaned by sweep blasting, high pressure water washing or other methods in accordance with the manufacturer's recommendation.</p> <p>If a zinc silicate shop primer has passed the pre-qualification test of table 1.1.3 as part of an epoxy coating system, it may be used in combination with other epoxy coatings certified under table 1.1.3, provided that the compatibility has been confirmed by the manufacturer by the test in accordance with paragraph 1.7 of appendix 1 to annex 1 of the Performance standard for protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers, without wave movement.</p>
.3	Surface treatment after erection <sup>4</sup>	<p>St 3 or better or Sa 2 where practicable on butts and damages.</p> <p>Coating in overlap to be feathered.</p>
.4	Profile requirements <sup>5</sup>	In case of full or partial blasting 30-75 µm, otherwise as recommended by the coating manufacturer.
.5	Dust <sup>9</sup>	Dust quantity rating "2" for dust size class "3", "4" and "5".
.6	Water soluble salts limit equivalent to NaCl after blasting/grinding <sup>6</sup>	≤ 100 mg/m <sup>2</sup> of sodium chloride.
.7	Oil contamination	No oil contamination.

<sup>9</sup> Reference standard: ISO 8502-3:1993. Preparation of steel substrate before application of paints and related products – Test for the assessment of surface cleanliness.

	Characteristic	Requirement
<b>4 Miscellaneous</b>		
.1	Ventilation	Adequate ventilation is necessary for the proper drying and curing of coating. Ventilation should be maintained throughout the application process and for a period after application is completed, as recommended by the coating manufacturer.
.2	Environmental conditions	Coating should be applied under controlled humidity and surface conditions, in accordance with the manufacturer's specifications. In addition, coating should not be applied when: <ul style="list-style-type: none"> <li>.1 the relative humidity is above 85%; or</li> <li>.2 the surface temperature is less than 3°C above the dew point.</li> </ul>
.3	Testing of coating <sup>3</sup>	Destructive testing should be avoided.  Dry film thickness should be measured after each coat for quality control purposes and the total dry film thickness should be confirmed after completion of final coat, using appropriate thickness gauges.
.4	Repair	Any defective areas, e.g. pin-holes, bubbles, voids, etc. should be marked up and appropriate repairs effected. All such repairs should be re-checked and documented.

## 5 COATING SYSTEM APPROVAL

Results from prequalification tests (table 1.1.3) of the coating system should be documented, and a Statement of Compliance or Type Approval Certificate should be issued if found satisfactory by a third party, independent of the coating manufacturer.

## 6 COATING INSPECTION REQUIREMENTS

### 6.1 General

6.1.1 To ensure compliance with this Standard, the following should be carried out by qualified coating inspectors certified to NACE Coating Inspector Level 2, FROSIO Inspector level III or equivalent as verified by the Administration<sup>10</sup>.

6.1.2 Coating inspectors should inspect surface preparation and coating application during the coating process by carrying out, as a minimum, those inspection items identified in section 6.2 to ensure compliance with this Standard. Emphasis should be placed on initiation of each stage of surface preparation and coatings application, as improper work is extremely difficult to correct later in the coating progress. Representative structural members should be non-destructively

<sup>10</sup> In accordance with SOLAS regulation I/6, for the purposes of this Standard, the Administration may entrust a recognized organization acting on its behalf to determine compliance with the provisions of this Standard.

examined for coating thickness. The inspector should verify that appropriate collective measures have been carried out.

6.1.3 Results from the inspection should be recorded by the inspector and should be included in the CTF (refer to annex 2, Example of Daily Log and Non-conformity Report).

## 6.2 Inspection items

Construction stage		Inspection items
Primary surface preparation	1	The surface temperature of steel, the relative humidity and the dew point should be measured and recorded before the blasting process starts and at times of sudden changes in weather.
	2	The surface of steel plates should be tested for soluble salt checked for oil, grease and other contamination.
	3	The cleanliness of the steel surface should be monitored in the shop primer application process.
	4	The shop primer material should be confirmed to meet the requirements of 2.3 of table 1.
Thickness		If compatibility with the main coating system has been declared, then the thickness and curing of the zinc silicate shop primer should be confirmed to conform to the specified values.
Block assembly	1	After completing construction of the block and before secondary surface preparation starts, a visual inspection for steel surface treatment including edge treatment should be carried out.  Any oil, grease or other visible contamination should be removed.
	2	After blasting/grinding/cleaning and prior to coating, a visual inspection of the prepared surface should be carried out.  On completion of blasting and cleaning and prior to the application of the first coat of the system, the steel surface should be tested for levels of remaining soluble salts in at least one location per block.
	3	The surface temperature, the relative humidity and the dew point should be monitored and recorded during the coating application and curing.
	4	Inspection should be performed of the steps in the coating application process mentioned in table 1.
	5	DFT measurements should be taken to prove that the coating has been applied to the thickness as specified and outlined in annex 3.

Construction stage		Inspection items
Erection	1	Visual inspection for steel surface condition, surface preparation and verification of conformance to other requirements in table 1, and the agreed specification should be performed.
	2	The surface temperature, the relative humidity and the dew point should be measured and recorded before coating starts and regularly during the coating process.
	3	Inspection should be performed of the steps in the coating application process mentioned in table 1.

## 7 VERIFICATION REQUIREMENTS

The following should be carried out by the Administration prior to reviewing the Coating Technical File for the ship subject to this Standard:

- .1 check that the Technical Data Sheet and Statement of Compliance or Type Approval Certificate comply with the Standard;
- .2 check that the coating identification on representative containers is consistent with the coating identified in the Technical Data Sheet and Statement of Compliance or Type Approval Certificate;
- .3 check that the inspector is qualified in accordance with the qualification standards in paragraph 6.1.1;
- .4 check that the inspector's reports of surface preparation and the coating's application indicate compliance with the manufacturer's Technical Data Sheet and Statement of Compliance or Type Approval Certificate; and
- .5 monitor implementation of the coating inspection requirements.

## 8 ALTERNATIVE SYSTEMS

8.1 All systems that are not an epoxy-based system applied according to table 1 of this Standard are defined as alternative systems.

8.2 This Standard is based on recognized and commonly used coating systems. It is not meant to exclude other, alternative, systems with proven equivalent performance, for example non epoxy-based systems.

8.3 Acceptance of alternative systems should be subject to documented evidence that they ensure a corrosion prevention performance at least equivalent to that indicated in this Standard.

8.4 As a minimum, the documented evidence should consist of satisfactory performance corresponding to that of a coating system which conforms to the Standard as described in section 4, a target useful life of 15 years in either actual field exposure for five years with final coating condition not less than "GOOD" or laboratory testing. Laboratory tests should be conducted in accordance with the test procedure given in annex 1 of this Standard.

## ANNEX 1

**TEST PROCEDURE FOR COATING QUALIFICATION FOR VOID SPACES  
OF BULK CARRIERS AND OIL TANKERS****1 Scope**

This procedure provides details of the test procedure referred to in section 4, table 1, items .1.2 and .1.3 and paragraph 8.3 of this Standard.

**2 Definition**

*Coating specification* means the specification of coating systems which includes the type of coating system, steel preparation, surface preparation, surface cleanliness, environmental conditions, application procedure, acceptance criteria and inspection.

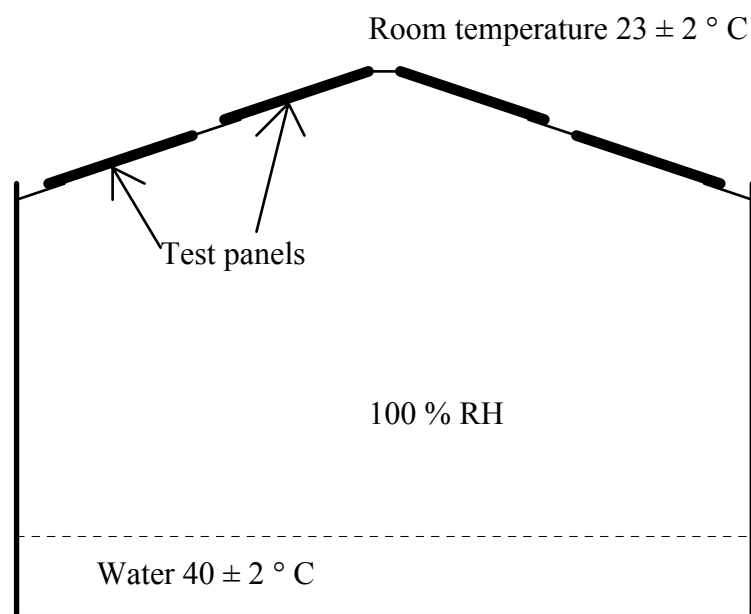
**3 Test**

Coating specification should be verified by a condensation chamber test in accordance with the procedures specified in this section.

**3.1 Test condition**

Condensation chamber tests should be conducted in accordance with ISO 6270.

- .1 The exposure time should be 30 days.
- .2 There should be 3 test panels.
- .3 The size of each test panel should be 150 mm x 150 mm x 3 mm. All of the panels should be treated according to the Performance standard, tables 1, 2 and 3, and coating system applied according to table 1.1.4 and 1.1.5. At the primer stage, two of the panels should be weathered for at least 2 months and cleaned by low pressure washing or other mild method. Blast sweep or high pressure washing, or other primer removal methods should not be used. The third plate should have the primer removed to St 3 before the top coat is applied. Weathering method and extent should take into consideration that the primer should be the foundation for a 15 year target life system. To facilitate innovation, alternative preparation, coating systems and dry film thicknesses may be used when clearly defined.
- .4 The reverse side of the test piece should be painted appropriately, in order not to affect the test results.



**Figure 1: Condensation chamber**

### 3.2 Test results

3.2.1 Prior to the testing, the following measured data of the coating system should be reported:

- .1 infrared (IR) identification of the base and hardener components of the coating;
- .2 specific gravity<sup>11</sup>, of the base and hardener components of the paint; and
- .3 number of pinholes, low voltage detector at 90 V.

3.2.2 After the testing, the following measured data should be reported:

- .1 blisters and rust<sup>12</sup>;
- .2 dry film thickness (DFT) (use of a template);
- .3 adhesion value<sup>13</sup>; and
- .4 flexibility<sup>14</sup> modified according to panel thickness (3 mm steel, 300  $\mu\text{m}$  coating, 150 mm cylindrical mandrel gives 2% elongation) for information only.

<sup>11</sup> According to ISO 2811-74.

<sup>12</sup> According to ISO 4628/2 and ISO 4628/3.

<sup>13</sup> According to ISO 4624.

<sup>14</sup> According to ASTM D4145.



### 3.3 Acceptance criteria

3.3.1 The test results based on section 2 should satisfy the following criteria:

Item	Acceptance criteria for epoxy-based systems applied according to table 1 of this standard	Acceptance criteria for alternative systems
Blisters on panel	No blisters	No blisters
Rust on panel	Ri 0 (0%)	Ri 0 (0%)
Number of pinholes	0	0
Adhesive failure	> 3.5 MPa  Adhesive failure between substrate and coating or between coats for 60% or more of the areas	> 5 MPa  Adhesive failure between substrate and coating or between coats for 60% or more of the areas
Cohesive failure	> 3 MPa  Cohesive failure in coating for 40% or more of the area	> 5 MPa  Cohesive failure in coating for 40% or more of the area

3.3.2 Epoxy-based systems tested prior to the date of adoption of this Standard should satisfy only the criteria for blistering and rust in the table above.

3.3.3 Epoxy-based systems tested when applied according to table 1 of this Standard should satisfy the criteria for epoxy-based systems as indicated in the table above.

3.3.4 Alternative systems not necessarily epoxy-based and/or not necessarily applied according to table 1 of this Standard should satisfy the criteria for alternative systems as indicated in the table above.

### 3.4 Test report

The test report should include the following information:

- .1 name of the manufacturer;
- .2 date of tests;
- .3 product name/identification of both paint and primer;
- .4 batch number;

- .5 data of surface preparation on steel panels, including the following:
  - .1 surface treatment;
  - .2 water soluble salts limit;
  - .3 dust; and
  - .4 abrasive inclusions;
- .6 application data of coating system, including the following:
  - .1 shop primed;
  - .2 number of coats;
  - .3 recoat interval<sup>15</sup>;
  - .4 dry film thickness (DFT) prior to testing<sup>15</sup>;
  - .5 thinner<sup>15</sup>;
  - .6 humidity<sup>15</sup>;
  - .7 air temperature<sup>15</sup>; and
  - .8 steel temperature;
- .7 test results according to section 2; and
- .8 judgment according to section 3.

---

<sup>15</sup> Both of actual specimen data and manufacturer's requirement/recommendation.

ANNEX 2

EXAMPLE OF DAILY LOG AND NON-CONFORMITY REPORT

DAILY LOG

Sheet No:

<b>Ship:</b>		<b>Void No:</b>		<b>Database:</b>					
<b>Part of structure:</b>									
<b>SURFACE PREPARATION</b>									
<b>Method:</b>					<b>Area (m<sup>2</sup>):</b>				
<b>Abrasive:</b>					<b>Grain size:</b>				
<b>Surface temperature:</b>					<b>Air temperature:</b>				
<b>Relative humidity (max):</b>					<b>Dew point:</b>				
<b>Standard achieved:</b>									
<b>Rounding of edges:</b>									
<b>Comments:</b>									
<b>Job No.:</b>		<b>Date:</b>			<b>Signature:</b>				
<b>COATING APPLICATION:</b>									
<b>Method:</b>									
<b>Coat No.</b>	<b>System</b>	<b>Batch No.</b>	<b>Date</b>	<b>Air temp.</b>	<b>Surf temp.</b>	<b>RH%</b>	<b>Dew point</b>	<b>DFT* Meas.*</b>	<b>Specified</b>
* Measured minimum and maximum DFT. DFT readings to be attached to daily log									
<b>Comments:</b>									
<b>Job No:</b>		<b>Date:</b>			<b>Signature:</b>				

**NON-CONFORMITY REPORT****Sheet No:**

<b>Ship:</b>	<b>Void No:</b>	<b>Database:</b>
<b>Part of structure:</b>		
<b>DESCRIPTION OF THE INSPECTION FINDINGS TO BE CORRECTED</b>		
<b>Description of findings:</b>		
<b>Reference document (daily log):</b>		
<b>Action taken:</b>		
<b>Job No.:</b>	<b>Date:</b>	<b>Signature:</b>

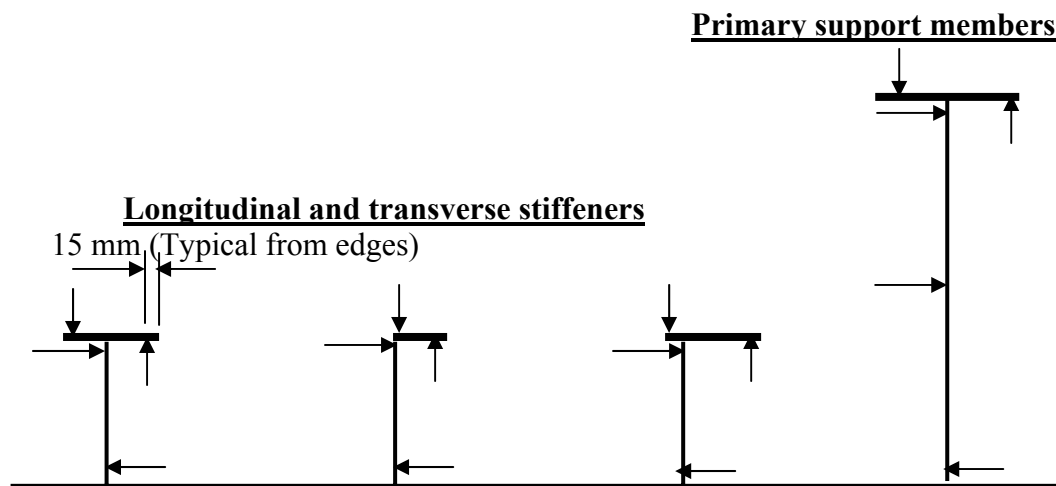
ANNEX 3

**DRY FILM THICKNESS MEASUREMENTS**

The following verification check points of DFT should be taken:

- .1 one gauge reading per 5 m<sup>2</sup> of flat surface areas;
- .2 one gauge reading at 2 to 3 m intervals and as close as possible to tank boundaries, but not further than 15 mm from edges of tank boundaries;
- .3 longitudinal and transverse stiffener members:

One set of gauge readings as shown below, taken at 2 to 3 m run and not less than two sets between primary support members;



**Figure 2**

**Note:** Arrows of diagram indicate critical areas and should be understood to mean indication for both sides.

- .4 three gauge readings for each set of primary support members and two gauge readings for each set of other members as indicated by the arrows in the diagram;
- .5 for primary support members (girders and transverses) one set of gauge readings for 2 to 3 m run as shown in figure 3 above but not less than three sets;
- .6 around openings one gauge reading from each side of the opening;
- .7 five gauge readings per square metre (m<sup>2</sup>) but not less than three gauge readings taken at complex areas (i.e. large brackets of primary support members); and
- .8 additional spot checks should be taken to verify coating thickness for any area considered necessary by the coating inspector.