RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

Part C Hull Construction and Equipment

Rules for the Survey and Construction of Steel Ships
Part C 2013 AMENDMENT NO.2
Guidance for the Survey and Construction of Steel Ships
Part C 2013 AMENDMENT NO.2

Rule No.80 / NoticeNo.69 27th December 2013
Resolved by Technical Committee on 29th July 2013
Approved by Board of Directors on 24th September 2013

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RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

RULES

Part C Hull Construction and Equipment

2013 AMENDMENT NO.2

Rule No.80 27th December 2013

Resolved by Technical Committee on 29th July 2013

Approved by Board of Directors on 24th September 2013

Rule No.80 27th December 2013
AMENDMENT TO THE RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

"Rules for the survey and construction of steel ships" has been partly amended as follows:

Part C HULL CONSTRUCTION AND EQUIPMENT

Chapter 1 GENERAL

1.1 General

1.1.7 Materials

Sub-paragraph -2(1) has been amended as follows.

2 Where high tensile steel specified in **Chapter 3, Part K of the Rules** is used, the construction and scantlings of the ship are to comply with the following requirements in **(1)** to **(3)**:

(1) The section modulus of the transverse section of the hull is not to be less than the value obtained by multiplying the following coefficient with the value specified in **Chapter 15**. However, where special consideration is given to the type of high tensile steel used, this value may be different, subject to the approval of the Society, from the following coefficients. Moreover, the extent of high tensile steel use is to be at the discretion of the Society.

0.78: where high tensile steels *KA*32, *KD*32, *KE*32 or *KF*32 are used
0.72: where high tensile steels *KA*36, *KD*36, *KE*36 or *KF*36 are used
0.68: where high tensile steels *KA*40, *KD*40, *KE*40 or *KF*40 are used.
0.62: where high tensile steel *KE*47 is used (However, only applies to ships subject to **Chapter 32**).

((2) and (3) are omitted)

1.1.17 Workmanship

Sub-paragraph -7 has been added as follows.

7 Jigs used for welding and construction work are to be appropriately treated (i.e., removed, smoothened out, etc.) upon completion of concerned work in order to avoid any adverse effects on strength.

Chapter 32 CONTAINER CARRIERS

32.2 Longitudinal Strength

Paragraph 32.2.3 has been added as follows.

32.2.3 Fatigue Strength

For bottom longitudinals, side longitudinals, hatch corners, hatch side coamings, and areas of stress concentrations such as bench corners in forward holds, sufficient consideration is to be given for fatigue strength.

32.3 Double Bottom Construction

32.3.1 General

Sub-paragraph -5 has been deleted.

~~**5** For bottom longitudinals, sufficient consideration is to be given for fatigue strength.~~

32.4 Double Side Construction

32.4.1 General

Sub-paragraph -12 has been deleted.

~~**12** For side longitudinals, sufficient consideration is to be given for fatigue strength.~~

32.6 Deck Construction

Paragraph 32.6.4 has been added as follows.

32.6.4 Structural Details

1 Free edges including hatch corners of hatch side coamings are not to have any defects such as notches that may adversely affect fatigue strength. Appropriate edge treatment, including the treatment of corner edges, is to be carried out so that edges have sufficient fatigue strength. Details of the edge treatment used are generally to be clearly mentioned in relevant drawings.

2 In cases where equipment such as hatch cover pads and container pads is fitted, the ends of such equipment are to be tapered so that extreme differences in rigidity do not occur between the equipment and the hull structure. Measures such as increasing the thickness of plating at the attachment location are also to be adopted appropriately. Equipment materials and welding procedures are to be considered. If deemed necessary by the Society, a fatigue strength assessment

of the relevant part is to be carried out.

3 Hatch side coaming ends, including fillet-welded parts to strength decks, are to be designed so as to have sufficient fatigue strength. For this reason, fatigue strength assessment, including detailed finite element analysis, are generally to be carried out. Fillet welds for hatch side coaming ends and strength decks are generally to be full penetration welds within a certain range. In addition, boxing welds at the ends are to be smoothened out using a grinder or other means.

4 For members in way of drain holes and other holes installed in hatch side coamings, special consideration is to be given to fatigue strength.

Section 32.10 has been added as follows.

32.10 Special Requirements for Container Carriers applying Extremely Thick Steel Plates

32.10.1 General

This section gives measures for identification and prevention of brittle fractures in container carriers to which extremely thick steel plates are applied for longitudinal structural members. These include measures to prevent brittle crack initiation and to arrest brittle crack propagation in case brittle crack initiates.

32.10.2 Application

1 This section applied to which any of *KA*36, *KD*36 ,*KE*36, *KA*40, *KD*40, *KE*40 and *KE*47 steel plates having thickness of over 50*mm* and not greater than 100*mm*.

2 Notwithstanding the requirement given in **-1** above, when as-built thickness of the hatch side coaming (includes top plates and longitudinal stiffeners) is not greater than 50*mm*, this section may not be necessarily applied regardless of the thickness and grade of steel of the strength deck.

3 The structural members of container carriers applying extremely thick steel plates are to comply with the requirements in **32.1** to **32.9** in addition to the requirements in **32.10**.

32.10.3 Measures for prevention of brittle fracture

Measures for prevention of brittle fracture applying to extremely thick steel plates are to be utilized the combination shown in **Table C32.7** according to the thickness and grade of steel of the hatch side coaming.

Table C32.7 Application of measures for prevention of brittle fractures

Hatch side coaming		Non-destructive inspection during ship construction specified in **1.4.2-1(3), Part M of the Rules**	Brittle crack arrest design specified in **32.10.4**
Grade of steel	Thickness(*mm*)		
*KA*36 *KD*36 *KE*36	$50 < t \leq 100$	X	N.A.
*KA*40 *KD*40 *KE*40	$50 < t \leq 85$		
	$85 < t \leq 100$	X	X(1)
*KE*47 (where electro-gas welding is applied at block-to-block butt joints)	$50 < t \leq 100$	X	X
*KE*47 (where welding procedures other than electro-gas welding are applied at block-to-block butt joints)	$50 < t \leq 100$	X	X(1)

(SYMBOL)
X : To be applied
N.A.: Need not to be applied
(1) : Other measures deemed by the Society to be equivalent in effectiveness to brittle crack arrest designs may be accepted.

32.10.4 Brittle crack arrest design

1 Brittle crack arrest design is to be utilized to prevent large scale fractures of the hull girder by arresting propagation of the brittle crack at a proper position, even in case where brittle crack initiation occurs within the cargo hold region.

2 Following **(1)** and **(2)** are to be considered as the points of brittle crack initiation.

(1) Block-to-block butt joints both of hatch side coaming and strength deck; and

(2) Any welds other than **(1)** above.

3 Following **(1)** to **(3)** are to be considered as the cases of brittle crack propagation.

(1) Cases where the brittle crack initiates from block-to-block butt joint and runs straight along the butt joint;

(2) Cases where the brittle crack initiates from block-to-block butt joint and deviate away from butt joint and runs into base metal; and

(3) Cases where the brittle crack initiates from any welds other than **(1)** and **(2)** above and runs into base metal.

4 With the consideration of the requirements in **-3** above, measures specified in the following **(1)** to **(3)** are to be applied as brittle crack arrest design;

(1) Brittle crack arrest steel is to be provided for strength deck.

(2) Brittle crack arrest steel is to be provided for hatch side coaming; however, such steel is not necessary to be provided in the attached top plate and longitudinal stiffeners.

(3) Appropriate measures is to be provided at a point of block-to-block butt joint between hatch side coaming and strength deck in order to arrest brittle crack propagation running straight along the butt joint.

5 Notwithstanding the provisions in **-4** above, where the equivalency is verified through technical data and/or brittle fracture tests, etc., brittle crack arrest design other than those specified in **-4** above may be accepted by the Society.

6 Brittle crack arrest steel specified in **-4(1)** and **(2)** above is to be a steel which have brittle crack arrest properties for *A*600 or equivalent as specified in **3.12, Part K of the Rules**. Where the

steel plate having thickness of over 80*mm* is provided as brittle crack arrest steel, brittle crack arrest properties of such steel are to be at the discretion of the Society.

EFFECTIVE DATE AND APPLICATION

1. The effective date of the amendments is 1 January 2014.

2. Notwithstanding the amendments to the Rules, the current requirements may apply to ships for which the date of contract for construction* is before the effective date.

* "contract for construction" is defined in the latest version of IACS Procedural Requirement (PR) No.29.

IACS PR No.29 (Rev.0, July 2009)

1. The date of "contract for construction" of a vessel is the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. This date and the construction numbers (i.e. hull numbers) of all the vessels included in the contract are to be declared to the classification society by the party applying for the assignment of class to a newbuilding.

2. The date of "contract for construction" of a series of vessels, including specified optional vessels for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective owner and the shipbuilder.

For the purpose of this Procedural Requirement, vessels built under a single contract for construction are considered a "series of vessels" if they are built to the same approved plans for classification purposes. However, vessels within a series may have design alterations from the original design provided:

(1) such alterations do not affect matters related to classification, or

(2) If the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the shipbuilder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval.

The optional vessels will be considered part of the same series of vessels if the option is exercised not later than 1 year after the contract to build the series was signed.

3. If a contract for construction is later amended to include additional vessels or additional options, the date of "contract for construction" for such vessels is the date on which the amendment to the contract, is signed between the prospective owner and the shipbuilder. The amendment to the contract is to be considered as a "new contract" to which **1.** and **2.** above apply.

4. If a contract for construction is amended to change the ship type, the date of "contract for construction" of this modified vessel, or vessels, is the date on which revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder.

Note:
This Procedural Requirement applies from 1 July 2009.

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE

Part C Hull Construction and Equipment

2013 AMENDMENT NO.2

Notice No.69 27th December 2013

Resolved by Technical Committee on 29th July 2013

Notice No.69 27th December 2013
AMENDMENT TO THE GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

"Guidance for the survey and construction of steel ships" has been partly amended as follows:

Part C HULL CONSTRUCTION AND EQUIPMENT

Amendment 2-1

C1 GENERAL

C1.1 General

Paragraph C1.1.17 has been added as follows.

C1.1.17 Workmanship

In cases where material of high tensile steel *KE*47 is used for the longitudinal structural members of upper decks region, jigs used for welding and construction work mounted directly on to any structural members using *KE*47 are, in principle, to be completely removed.

C25 CEMENTING AND PAINTING

C25.2 Painting

Paragraph C25.2.3 has been amended as follows.

C25.2.3 Corrosion Protection for Cargo Oil Tanks

1 (Omitted)

2 (Omitted)

3 With respect to **25.2.3(1), Part C of the Rules**, IACS Unified Interpretation SC259 as may be amended is to be applied.

~~**3**~~**4** With respect to **25.2.3(2), Part C of the Rules**, the relevant IACS Unified Interpretation is to be applied.

C32 CONTAINER CARRIERS

C32.2 Longitudinal Strength

Paragraph C32.2.2 has been amended as follows.

C32.2.2 Torsional Strength

1 The torsional strength of hull is to comply with the following **(1)** or **(2)**:

(1) The torsional strength of the hull at each sectional position from the collision bulkhead to the watertight bulkhead at the fore end of the machinery space is to be such that the following relationship is satisfied.

$$\sqrt{(0.75\sigma_V)^2 + \sigma_H^2 + \sigma_\omega^2} + \sigma_S \le \frac{1000}{5.72K}$$

Where:

σ_S, σ_V and σ_H : As obtained from the following formula

However warping stress is to be added to σ_S when torsional moment is generated in the ship by unbalanced loading of cargoes.

$$\sigma_S = 1000\frac{|M_S|}{Z_V}$$

$$\sigma_V = 1000\frac{M_W}{Z_V}$$

$$\sigma_H = 1000\frac{M_H}{Z_H}$$

M_S : As specified in **15.2.1-1, Part C** of the Rules

M_W : M_W (+) or M_W (-) as specified in **15.2.1-1, Part C** of the Rules whichever is of the same sign as M_S

M_H : As obtained from the following formula:

$0.45C_1L^2d(C_b + 0.05)C_H$ (kN-m)

C_H : Coefficient, as given in **Table C32.2.2-1**, based on the ratio of L to x, where x is the distance (m) from the aft end of L to the section under consideration

Intermediate values are to be determined by interpolation.

Z_V : Section modulus (cm^3) of strength deck with respect to longitudinal bending of the hull at the position of the section under consideration

Z_H : Section modulus (cm^3) of hatch side with respect to horizontal bending of the hull at the position of the section under consideration

C_1 : As specified in **15.2.1-1, Part C** of the Rules

Table C32.2.2-1 Coefficient C_H

x/L	0.0	0.4	0.7	1.0
C_H	0.0	1.0	1.0	0.0

σ_ω: Warping stress (N/mm^2) due to torsion of the hull calculated according to the following formula for ships of ordinary construction using the dimensions and scantlings at the midship section
Values for other types are to be in accordance with the discretion of the Society.

$$\sigma_\omega = 0.000318 \frac{\omega l_C M_T}{I_\omega + 0.04 l_C^2 J}$$

M_T : As given by the following formula:

$$M_T = 7.0 K_2 C_w^2 B^3 \left(1.75 + 1.5 \frac{e}{D_S} \right) \quad (kN\text{-}m)$$

C_w : Water plane area coefficient

e : As given by the following formula:

$$e = e_1 - \frac{d_0}{2}$$

e_1 : As given by the following formula:

$$e_1 = \frac{(3D_1 - d_1) d_1 t_d + (D_1 - d_1)^2 t_S}{3 d_1 t_d + 2(D_1 - d_1) t_S + B_1 t_b / 3}$$

d_0 : Height of double bottom (m)

d_1 : Breadth of double hull side (m)

D_1 : As given by the following formula:

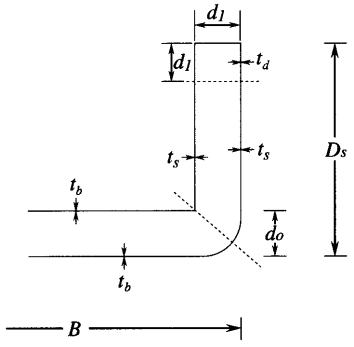
$$D_1 = D_S - \frac{d_0}{2}$$

B_1 : As given by the following formula:

$$B_1 = B - d_1$$

t_d, t_s, t_b : Mean thickness (m) of deck, ship's side, and bottom specified in **Fig. C32.2.2-1**
Mean thickness may be determined including all the longitudinal strength members within this range.

Fig. C32.2.2-1



K_2 : As given by the following formulae:

$$K_2 = \sqrt{1 - \left(\frac{300 - L_1}{300} \right)^2} \quad \text{for ships with } L_1 < 300 \ m$$

1.0 for ships with $L_1 \geq 300\ m$

ω : As given by the following formula:

$$\omega = \frac{B_1}{2}(D_1 - e_1) + \frac{d_1}{2}(D_1 + e_1)$$

l_C : Distance (m) from the collision bulkhead to watertight bulkhead of the fore end of machinery room

I_ω : As given by the following formula:

$$I_\omega = B_1^2 \{d_1 t_d I_d + (D_1 - d_1) t_S I_S + B_1 t_b I_b\}$$

I_d : As given by the following formula:

$$I_d = (D_1 - e_1)\left\{\frac{3}{2}(D_1 - e_1) - d_1\right\} + \frac{d_1^2}{3}$$

I_S : As given by the following formula:

$$I_S = (D_1 - d_1)\left\{\frac{1}{3}(D_1 - d_1) - e_1\right\} + e_1^2$$

I_b : As given by the following formula:

$$I_b = \frac{e_1^2}{6}$$

J : As given by the following formula

However, the mean thicknesses of t'_d, t'_S, t'_b are to be calculated only using the strength deck, side shell, bottom shell, inner bottom and longitudinal bulkhead plating. Other longitudinal strength members are not to be included.

$$J = \frac{2\{Bd_0 + 2(D_S - d_0)d_1\}^2}{3d_1 / t'_d + 2(D_1 - d_1)/t'_S + B_1 / t'_b}$$

K : Coefficient corresponding to the kind of steel

e.g. 1.0 for mild steel, the values specified in **1.1.7-2(1) of the Rules** for high tensile steel

(2) Torsional strength assessments are to be carried out in accordance with the **"Guidelines for Hull Girder Torsional Strength Assessment"** in the **"Guidelines for Container Carrier Structures"**

2 Notwithstanding the requirements of **-1** above, torsional strength assessments specified in **-1(2)** above may be required when deemed necessary by the Society.

Paragraph C32.2.3 has been added as follows.

C32.2.3 Fatigue Strength

1 Fatigue strength assessments for bottom longitudinals and side longitudinals are to be in accordance with the requirements in **1.1.23-4** and **-5, Part C of the Rules.**

2 Fatigue strength assessments for the longitudinal structural members of upper decks, including hatch side coamings and bench corner in foreword hold, are to be as follows:

(1) Hatch side coaming top plate at hatch corner

(a) Hatch side coaming top plates at hatch corners are to have sufficient fatigue strength. The Society may require fatigue strength assessments according to the **"Guidelines for**

Fatigue Strength Assessment" in the **"Guidelines for Container Carrier Structures"** in consideration of the kind of steel used, the size of the ship, and the structural arrangement, etc. Hot-spot stresses at hatch corners (hot-spot mean stress and hot-spot stress fluctuation range) are to be determined using detailed Finite Element Analysis (FEA) using fine mesh elements. Element sizes, details of analysis and so on are to be at the Society's discretion.

(b) Butt welds for hatch side coamings, and fillet welded joints for attaching equipment is to be set at an sufficient distance from hatch corners so that effects of stress concentration are avoided. The Society may require the submission of drawings and data related to arrangement of welded joints.

(2) Welded joints of hatch side coamings

For butt welded joints and fillet welded joints of hatch side coamings (including welds for attaching equipment, etc.), special consideration is to be given to fatigue strength. The Society may require the submission of relevant fatigue strength assessments.

(3) Fatigue strength of locations other than hatch side coamings

(a) The fatigue strength at locations other than hatch side coamings (strength decks, sheer strakes, uppermost strakes of longitudinal bulkheads) are to sufficiently consider in conjunction with increase of hull girder stress (longitudinal bending stress and torsional stress).

(b) The Society may require fatigue assessments according to the **"Guidelines for Fatigue Strength Assessment"** in the **"Guidelines for Container Carrier Structures"** in consideration of the kind of steel used, the size of the ship, and the structural arrangement, etc. If deemed necessary, the Society may require detailed Finite Element Analysis (FEA) be used to calculate hatch corner hot-spot stresses.

(c) The fatigue strength of hatch corner in way of forward holds is to be carefully considered. If deemed necessary by the Society, a fatigue strength assessment of the relevant part may be required.

3 When deemed necessary by the Society, fatigue strength assessments may be required for structural members other than those specified in **-2(1)** to **(3)**.

Section C32.10 has been added as follows.

C32.10 Special Requirements for Container Carriers applying Extremely Thick Steel Plates

C32.10.3 Measures for prevention of brittle fracture

1 "Other measures deemed by the Society to be equivalent in effectiveness to brittle crack arrest designs" in Notes (1) of **Table C32.7, Part C of the Rules** means the non-destructive testing of particularly Time-of-flight diffraction (*TOFD*) technique specified in **1.1.2-3** of **Annex M1.4.2-2 "GUIDANCE FOR NON-DESTRUCTIVE INSPECTIONS ON SURFACE IMPERFECTIONS OF THE WELDED JOINTS OF HULL CONSTRUCTIONS"** is carried out at location specified in **1.2.4** of **Annex M1.4.2-2**.

2 Where the measures specified in **-1** above is applied, it may be considered as equivalent in effectiveness as measures specified **32.10.4-4(2)** and **(3), Part C of the Rules**.

C32.10.4 Brittle crack arrest design

1 "Appropriate measure" in **32.10.4-4(3), Part C of the Rules** means that the block-to-block butt welds of the hatch side coaming are to be shifted from those of the strength deck, this shift is to

be greater than or equal to 300*mm* in principle and welded joints between hatch side coaming and strength deck are to be fillet weld at each side without groove for an appropriate region.

2 If detailed documentation (including information such as construction procedure, application and procedure of non-destructive inspections at joints, etc.) which demonstrates the applicability as an alternative measure to **-1** above is submitted to and approved by the Society, the following **(1)** and **(2)** may be applied instead. In such cases, where deemed necessary by the Society, brittle fracture tests may be required to confirm the effectiveness of the alternative measure.

(1) Where crack arrest holes are provided in way of the block-to-block butt welds at the region where hatch side coaming weld meets the deck weld, the fatigue strength of the lower end of the butt weld is to be assessed.

(2) Where arrest insert plates of brittle crack arrest steel or weld metal inserts with high crack arrest toughness properties are provided in way of the block-to-block butt welds at the region where hatch side coaming weld meets the deck weld.

3 In **32.10.4-6, Part C of the Rules**, where steel plate being evaluated using the manner of assessment other than specified in **3.12, Part K of the Rules** is for use as crack arresting steel, documents related to the manner of assessment and the applicability which the measure has equivalent with brittle crack arrest properties for *A*600 are submitted to the Society for approval. In this case, where deemed necessary by the Society, additional test may be required.

Appendix C6 has been added as follows.

Appendix C6 PERFORMANCE STANDARD FOR PROTECTIVE COATINGS FOR CARGO OIL TANKS (Resolution MSC.288(87) and IACS Unified Interpretations SC259)

1 PURPOSE

This Standard provides technical requirements for the minimum standard for protective coatings to be applied in cargo oil tanks during the construction of new crude oil tankers.

2 DEFINITIONS

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

2.1 *Crude oil tanker* is as defined in Annex I of *MARPOL* 73/78.

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

2.3 *DFT* is dry film thickness.

2.4 *Dust* is loose particulate 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.

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

2.6 "*GOOD*" *condition* is the condition with minor spot rusting as defined in resolution *A*.1049(27) (2011 *ESP* Code) for assessing the ballast tank coatings for tankers.

2.7 *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. This can be either inorganic or organic.

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

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

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

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

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

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

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Interpretation

GOOD: Condition with spot rusting on less than 5% of the area under consideration without visible failure of the coating, or no-perforated blistering. Breakdown at edges or welds should be less than 20% of edges or weld lines in the area under consideration.

Coating Technical File: A term used for the collection of documents describing issues related to the coating system and its application from the point in time when the first document is provided and for the entire life of the ship including the inspection agreement and all elements of PSPC-COT **3.4**.

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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, operating environment, 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 shall be agreed upon between the shipowner, the shipyard and the coating manufacturer and presented to the Administration for review. Clear evidence of these inspections shall be reported and included in the Coating Technical File (CTF) (see **3.4**).

****

Interpretation

1. Inspection of surface preparation and coating processes agreement shall be signed by shipyard, shipowner and coating manufacturer and shall be presented by the shipyard to the Administration for review prior to commencement of any coating work on any stage of a new building and as a minimum shall comply with the PSPC-COT.
2. To facilitate the review, the following from the CTF, shall be available:
   a) Coating specification including selection of areas (spaces) to be coated, selection of coating system, surface preparation and coating process.
   b) Statement of Compliance or Type Approval of the coating system.
3. The agreement shall be included in the CTF and shall at least cover:
   a) Inspection process, including scope of inspection, who carries out the inspection, the qualifications of the coating inspector(s) and appointment of one qualified coating inspector (responsible for verifying that the coating is applied in accordance with the PSPC-COT). Where more than one coating inspector will be used then their areas of responsibility shall be identified. (For example, multiple construction sites).
   b) Language to be used for documentation.
4. Any deviations in the procedure relative to the PSPC-COT noted during the review shall be raised with the shipyard, which is responsible for identifying and implementing the corrective actions.
5. Cargo Ship Safety Certificate or Cargo Ship Safety Construction Certificate, as appropriate, shall not be issued until all required corrective actions have been closed to the satisfaction of the Administration.

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3.3 When considering the Standard provided in **section 4**, the following is to 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 document is based on experience from 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 (CTF)

3.4.1 Specification of the cargo oil tank coating system applied, record of the shipyard's and shipowner's coating work, detailed criteria for coating selection, job specifications, inspection, maintenance and repair shall be included in the Coating Technical File required by resolution *MSC*.215(82).

3.4.2 New construction stage

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

.1 copy of Statement of Compliance or Type Approval Certificate;

.2 copy of Technical Data Sheet, including:

.2.1 product name and identification mark and/or number;

.2.2 materials, components and composition of the coating system;

.2.3 minimum and maximum dry film thickness;

.2.4 application methods, tools and/or machines;

.2.5 condition of surface to be coated (de-rusting grade, cleanness, profile, etc.); and

.2.6 environmental limitations (temperature and humidity);

.3 shipyard work records of coating application, including:

.3.1 applied actual areas (*in square metres*) of coating in each cargo oil tank;

.3.2 applied coating system;

.3.3 time of coating, thickness, number of layers, etc.;

.3.4 ambient conditions during coating; and

.3.5 details 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 (see **annex 2**);

.6 shipyard's verified inspection report, including:

.6.1 completion date of inspection;

.6.2 result of inspection;

.6.3 remarks (if given); and

.6.4 inspector signature; and

.7 procedures for in-service maintenance and repair of coating systems*.

* Refer to the "*Guidelines on procedures for in-service maintenance and repair of Coating systems for cargo oil tanks of crude oil tankers*" (*MSC*.1/*Circ*.1399).

3.4.3 In-service maintenance and repair

In-service maintenance and repair activities shall be recorded in the Coating Technical File in accordance with the relevant section of the Guidelines for coating maintenance and repair.

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

****

Interpretation

Procedure for Coating Technical File Review

1 The shipyard is responsible for compiling the Coating Technical File (CTF) either in paper or electronic format, or a combination of the two.

2 The CTF is to contain all the information required by the PSPC-COT **3.4** and the inspection of surface preparation and the coating processes agreement (see PSPC-COT **3.2**).

3 The CTF shall be reviewed for content in accordance with the PSPC-COT **3.4.2**.

4 Any deviations found under **3** shall be raised with the shipyard, which is responsible for identifying and implementing the corrective actions.

5 Cargo Ship Safety Certificate or Cargo Ship Safety Construction Certificate, as appropriate, shall not be issued until all required corrective actions have been closed to the satisfaction of the Administration.

****

3.5 Health and safety

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

****

Interpretation

In order to document compliance with PSPC-COT **3.5**, relevant documentation from the coating manufacturer concerning health and safety aspects such as Material Safety Data Sheet is recommended to be included in the CTF for information.

****

4 COATING STANDARD

4.1 Performance standard

This Standard is based on specifications and requirements 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

Protective coatings for cargo oil tanks applied during the construction of new crude oil tankers shall at least comply with the requirements in this Standard.

4.3 Coating system

An epoxy-based system meeting test and physical properties (**table 1.1.3**) shall be documented, and a Type Approval Certificate or Statement of Compliance shall be provided.

4.4 Area of application

The following areas are the minimum areas that shall be protected according to this Standard:

.1 Deckhead with complete internal structure, including brackets connecting to longitudinal and transverse bulkheads. In tanks with ring frame girder construction the underdeck transverse framing to be coated down to level of the first tripping bracket below the upper faceplate.

.2 Longitudinal and transverse bulkheads to be coated to the uppermost means of access level. The uppermost means of access and its supporting brackets to be fully coated.

.3 On cargo tank bulkheads without an uppermost means of access the coating to extend to 10% of the tanks height at centreline but need not extend more than 3 *m* down from the deck.

.4 Flat inner bottom and all structure to height of 0.3 *m* above inner bottom to be coated.

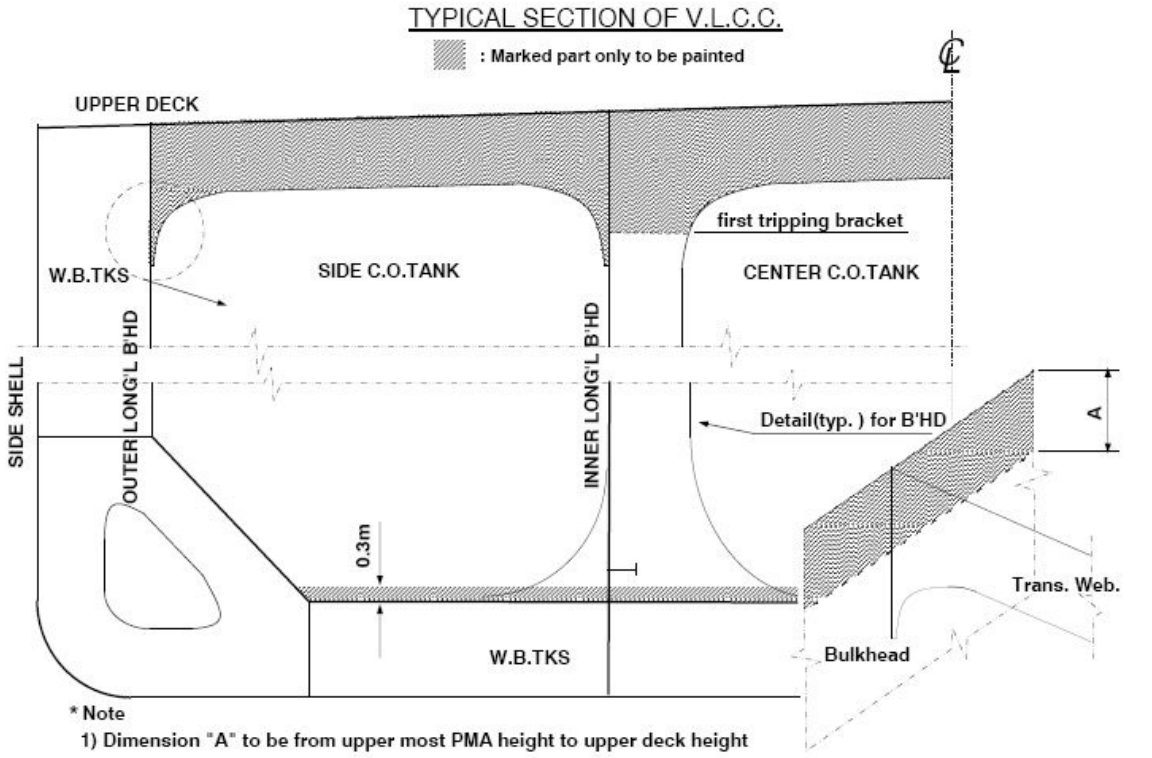

Fig. 1

4.5 Special application

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

4.5.2 It is recommended that this Standard is applied, to the extent practicable, to those portions of means of access provided for inspection within the areas specified in subsection **4.4** that are 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 stiffener depths for walkways, stringers, etc., are to fully comply with this Standard when located within the coated areas.

4.5.3 It is also recommended that supports for piping, measuring devices, etc., be coated as a minimum in accordance with the non-integral items indicated in paragraph **4.5.2**.

****

Interpretation

Reference is made to the non-mandatory *MSC*/*Circ*.1279 "Guidelines for corrosion protection of permanent means of access arrangements", adopted by *MSC* 84 in May 2008.

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4.6 Basic coating requirements

4.6.1 The requirements for protective coating systems to be applied at ship construction for the cargo oil tanks of crude oil tankers meeting the performance standard specified in paragraph **4.1** are listed in **table 1**.

4.6.2 Coating manufacturers shall provide a specification of the protective coating system to satisfy the requirements of **table 1** and the operating environment.

4.6.3 The Administration shall verify the Technical Data Sheet and Statement of Compliance or Type Approval Certificate for the protective coating system.

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

4.7 The referenced standards listed in this Standard are acceptable to the Organization. Test equipment, test methods, preparation methods and/or test results shall conform to performance standards not inferior to those acceptable to the Organization.

Table 1 Basic coating system requirements for cargo oil tanks of crude oil tankers

	Characteristic	Requirement
1 Design of coating system		
.1	Selection of the coating system	The selection of the coating system shall be considered by the parties involved with respect to the service conditions and planned maintenance. The following aspects, among other things shall be considered: .1 location of space relative to heated surfaces; .2 frequency of cargo operations; .3 required surface conditions; .4 required surface cleanliness and dryness; .5 supplementary cathodic protections, if any (where coating is supplemented by cathodic protection, the coating shall be compatible with the cathodic protection system); .6 permeability of the coating and resistance to inert gas and acids; and .7 appropriate mechanical properties (flexibility, impact resistance). The coating manufacturer shall supply products with documented satisfactory performance records and technical data sheets. The manufacturer shall also be capable of rendering adequate technical assistance. Performance records, technical data sheet and any manufacturer's technical assistance provided shall be recorded in the Coating Technical File. Coatings for application underneath sun-heated decks or on bulkheads forming boundaries of heated spaces shall be able to withstand repeated heating and/or cooling without becoming brittle.
.2	Coating type	Epoxy based systems. Other coating systems with performance according to the test procedure in **annex 1**. A multi-coat system with each coat of contrasting colour is recommended. The top coat shall be of a light colour to facilitate in-service inspection. Consideration should be given to the use of enhanced coatings in way of suction bellmouths and heating coil downcomers. Consideration should be given to the use of supplementary cathodic protection where there may be galvanic issues.
.3	Coating test	Epoxy based systems tested prior to the date of entry into force 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; or which have documented field exposure for 5 years with a final coating condition of not less than “GOOD” may be accepted. For epoxy-based systems approved on or after entry into force of this Standard, testing according to the procedure in **annex 1**, or equivalent, is required.

.4	Job specification	There shall be a minimum of two stripe coats and two spray coats, except that the second stripe coat, by way of welded seams only, may be reduced in scope where it is proven that the NDFT can be met by the coats applied in order to avoid unnecessary over thickness. Any reduction in scope of the second stripe coat shall be fully detailed in the CTF. Stripe coats shall be applied by brush or roller. Roller shall be used for scallops, ratholes, etc., only. Each main coating layer shall be appropriately cured before application of the next coat, in accordance with the coating manufacturer's recommendations. Job specifications shall include the dry-to-recoat times and walk-on time given by the manufacturer. Surface contaminants such as rust, grease, dust, salt, oil, etc., shall be removed prior to painting. The method to be according to the paint manufacturer's recommendations. Abrasive inclusions embedded in the coating shall be removed.
.5	NDFT (nominal total dry film thickness)[1]	NDFT 320μm with 90/10 rule for epoxy based systems; other systems to coating manufacturer's specifications. Maximum total dry film thickness according to manufacturer's detailed specifications. Care shall be taken to avoid increasing the DFT in an exaggerated way. Wet film thickness shall be regularly checked during application. Thinner shall be limited to those types and quantities recommended by the manufacturer.
2 PSP (Primary Surface Preparation)		
.1	Blasting and Profile.[2, 3]	Sa2½; with profiles between 30-75μm Blasting shall not be carried out when: .1 the relative humidity is above 85%; or .2 the surface temperature of steel is less than 3°C above the dew point. Checking of the steel surface cleanliness and roughness profile shall be carried out at the end of the surface preparation and before the application of the primer, and in accordance with the coating manufacturer's recommendations.
.2	Water soluble salt limit equivalent to NaCl[4]	≤ 50 mg/m^2 of sodium chloride.
.3	Shop primer	Zinc containing inhibitor free zinc silicate based or equivalent. Compatibility with main coating system shall be confirmed by the coating manufacturer.
3 Secondary surface preparation		
.1	Steel condition[5]	The steel surface to be coated shall 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 to grade P2. Edges to be treated to a rounded radius of minimum 2 *mm*, or subjected to three pass grinding or at least equivalent process before painting.

.2	Surface treatment[2]	Sa2½ on damaged shop primer and welds. All surfaces to be coated shall be blasted to Sa 2, removing at least 70% of intact shop primer, which has not passed a pre-qualification certified by test procedures in **1.3**. If the complete coating system comprising epoxy-based main coating and shop primer has passed a pre-qualification certified by test procedures in **1.3** intact shop primer may be retained provided the same epoxy-based system is used. Retained shop primer shall be cleaned by sweep blasting, high pressure water washing or equivalent method. If a zinc silicate shop primer has passed the pre-qualification test of **1.3** as part of an epoxy coating system, it may be used in combination with other epoxy coatings certified under **1.3**, provided that the compatibility has been confirmed by the manufacturer by the test with reference to the immersion test of **annex 1** or in accordance with 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)).
.3	Surface treatment after erection	Erection joints St 3 or better or Sa 2½ where practicable. For inner bottom: - Damages up to 20% of the area to be coated to be treated to minimum St 3. - Contiguous damages over 25m^2 or over 20% of the area to be coated, Sa 2½ shall be applied. For underdeck: - Damages up to 3% of area to be coated to be treated to minimum St 3. - Contiguous damages over 25m^2 or over 3% of the area to be coated, Sa 2½ shall be applied. Coating in overlap to be feathered.
.4	Profile requirements[3]	In case of full or partial blasting 30-75μm, otherwise as recommended by the coating manufacturer.
.5	Dust[6]	Dust quantity rating "1" for dust size class "3", "4" or "5". Lower dust size classes to be removed if visible on the surface to be coated without magnification.
.6	Water soluble salts limit equivalent to NaCl after blasting/ grinding[4]	≤ 50 mg/m^2 of sodium chloride.
.7	Contamination	No oil contamination. Paint manufacturer's recommendations should be followed regarding any other contamination between coats.
4 Miscellaneous		
.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 shall be applied under controlled humidity and surface conditions, in accordance with the manufacturer's specifications. In addition, coating shall not be applied when: .1 the relative humidity is above 85%; or .2 the surface temperature is less than 3°C above the dew point; or .3 any other requirements of the paint manufacturer are not being met.
.3	Testing of coating[1]	Destructive testing should be avoided. Sample dry film thickness shall be measured after each coat for quality control purpose and the total dry film thickness shall be confirmed after completion of the 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 shall be re-checked and documented.

[1] Type of gauge and calibration in accordance with SSPC-PA2: 2004. *Paint Application Specification No.2.*

[2] Refer to standard: *ISO* 8501-1: *1988/Suppl: 1994. Preparation of steel substrate before application of paints and related products – Visual assessment of surface cleanliness.*

[3] Refer to 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.*

[4] Conductivity measured in accordance with the following standards:

.1 *ISO* 8502-9: *1998. Preparation of steel substrate before application of paints and related products – Test for the assessment of surface cleanliness*; or

.2 *NACE SP*0508-2010 *Item no*.21134. *Standard practice methods of validating equivalence to ISO* 8502-9 *on measurement of the levels of soluble salts.*

[5] Refer to standard: *ISO* 8501-3: *2001. Preparation of steel substrate before application of paints and related products – Visual assessment of surface cleanliness.*

[6] Refer to standard: *ISO* 8502-3:*1993. Preparation of steel substrate before application of paints and related products – Test for the assessment of surface cleanliness.*

****

Interpretation regarding Table 1

1 Design of coating system

1.3 Coating pre-qualification test

Procedure for Coating System Approval

Type Approval Certificate showing compliance with the PSPC-COT 5 shall be issued if the results of either method A+C or B+C are found satisfactory by the Administration.

The Type Approval Certificate shall indicate the Product and the Shop Primer tested. The certificate shall also indicate other type approved shop primers with which the product may be used which have under gone the cross over test in a laboratory meeting the requirements in Method A, **1.1** of this UI.

The documents required to be submitted are identified in the following sections, in addition for all type approvals the following documentation is required:

Technical Data Sheet showing all the information required by PSPC-COT **3.4.2.2**.

Winter type epoxy is required separate prequalification test including shop primer compatibility test according to PSPC-COT **Annex 1**. Winter and summer type coating are considered different unless Infrared (IR) identification and Specific Gravity (SG) demonstrates that they are the same.

Method A: Laboratory Test

1.1 Coating pre-qualification test shall be carried out by the test laboratory which is recognized by the Administration.

1.2 Results from satisfactory pre-qualification tests (PSPC-COT **Table 1**: **1.3**) of the coating system shall be documented and submitted to the Administration.

1.3.1 Type Approval tests shall be carried out for the epoxy based system with the stated shop primer in accordance with the PSPC-COT **Annex 1**. If the tests are satisfactory, a Type Approval Certificate will be issued to include both the epoxy and the shop primer. The Type Approval Certificate will allow the use of the epoxy either with the named shop primer or on bare prepared steel.

1.3.2 An epoxy based system may be used with shop primers other than the one with which it was originally tested provided that, the other shop primers are approved as part of a system, PSPC-COT **Table 1**: **2.3** and **Table 1**: **3.2**, and have been tested according to the

immersion test of PSPC-COT **Annex 1** or in accordance with Res.*MSC*.215(82), which is known as the "Crossover Test". If the test or tests are satisfactory, a Type Approval Certificate will be issued. In this instance the Type Approval Certificate will include the details of the epoxy and a list of all shop primers with which it has been tested that have passed these requirements. The Type Approval Certificate will allow the use of the epoxy with all the named shop primers or on bare prepared steel.

1.3.3 Alternatively the epoxy can be tested without shop primer on bare prepared steel to the requirements of the PSPC-COT **Annex 1**. If the test or tests are satisfactory, a Type Approval Certificate will be issued. The Type Approval Certificate will just record the epoxy. The certificate will allow the use of the epoxy on bare prepared steel only. If in addition, crossover tests are satisfactorily carried out with shop primers, which are approved as part of a system, the Type Approval Certificate will include the details of shop primers which have satisfactorily passed the crossover test. In this instance the Type Approval Certificate will allow the use of the epoxy based system with all the named shop primers or on bare prepared steel.

1.3.4 The Type Approval Certificate is invalid if the formulation of either the epoxy or the shop primer is changed. It is the responsibility of the coating manufacturer to inform the Administration immediately of any changes to the formulation.

1.3.5 For the coating pre-qualification test, the measured average dry film thickness (DFT) on each prepared test panels shall not exceed a nominal DFT (NDFT) of 320 microns plus 20% unless a paint manufacturer specifies a NDFT greater than 320 microns. In the latter case, the average DFT shall not exceed the specified NDFT plus 20% and the coating system shall be certified to the specified NDFT if the system passes the tests according to **Annex 1** of PSPC-COT. The measured DFT shall meet the "90/10" rule and the maximum DFT shall be below the maximum DFT value specified by the manufacturer.

Method B: 5 years field exposure

1.4 Coating manufacturer's records, which shall at least include the information indicated in **1.4.1**, shall be examined to confirm coating system has 5 years field exposure, and the current product is the same as that being assessed.

1.4.1 Manufacturer's Records

- Original application records
- Original coating specification
- Original technical data sheet
- Current formulation's unique identification (Code or number)
- If the mixing ratio of base and curing agent has changed, a statement from the coating manufacturer confirming that the composition mixed product is the same as the original composition. This shall be accompanied by an explanation of the modifications made.
- Current technical data sheet for the current production site
- SG and IR identification of original product
- SG and IR identification of the current product
- If original SG and IR cannot be provided then a statement from the coating manufacturer confirming the readings for the current product are the same as those of the original.

1.5 Either class survey records from an Administration or a joint (coating manufacturer and Administration) survey of cargo tanks of a selected vessel is to be carried out for the

purpose of verification of compliance with the requirements of **1.4** and **1.9**. The reporting of the coating condition in both cases shall be in accordance with the principles given in **section 4** of *MSC*.1/*Circ*.1399.

1.6 The selected vessel is to have cargo tanks in regular use, of which:

- At least one tank is exposed to minimum temperature of 60 degree C plus or minus 3 degree
- For field exposure the ship should be trading in varied trade routes and carrying substantial varieties of crude oils including highest temperature and lowest pH limits to ensure a realistic sample: for example, three ships on three different trade areas with different varieties of crude cargoes.

1.7 In the case that the selected vessel does not meet the requirements in **1.6** then the limitations on lowest pH and Highest temperature of crude oils carried shall be clearly stated on the type approval certificate.

1.8 In all cases of approval by Method B, the shop primer shall be removed prior to application of the approved epoxy based system coating, unless it can be confirmed that the shop primer applied during construction, is identical in formulation to that applied in the selected vessel used as a basis of the approval.

1.9 All ballast tanks shall be in "GOOD" condition excluding mechanical damages, without touch up or repair in the prior 5 years.

1.9.1 "Good" is defined as: Condition with spot rusting on less than 5% of the area under consideration without visible failure of the coating, or no perforated blistering. Breakdown at edges or welds should be less than 20% of edges or welds in the area under consideration.

1.9.2 Examples of how to report coating conditions with respect to areas under consideration should be as those given in the principles given in **section 4** of *MSC*.1/*Circ*.1399.

1.10 If the applied NDFT is greater than required by the PSPC, the applied NDFT will be the minimum to be applied during construction. This will be reported prominently on the Type Approval Certificate.

1.11 If the results of the inspection are satisfactory, a Type Approval Certificate shall be issued to include both the epoxy based system and the shop primer. The Type Approval Certificate shall allow the use of the epoxy based system either with the named shop primer or on bare prepared steel. The Type Approval Certificate shall reference the inspection report which will also form part of the Coating Technical File.

1.12 The Type Approval Certificate is invalid if the formulation of either the epoxy based system or the shop primer is changed. It is the responsibility of the coating manufacturer to inform the Administration immediately of any changes to the formulation.

Method C: Coating Manufacturer

1.13 The coating/shop primer manufacturer shall meet the requirements set out in **IACS UR Z17** paragraphs **4**, **5**, **6** and **7**, (except for **4.6**) and paragraphs **1.13.1** to **1.13.6** below, which shall be verified by the Administration.

1.13.1 Coating Manufacturers

(a) Extent of Engagement – Production of coating systems in accordance with PSPC-COT and this UI.

(b) These requirements apply to both the main coating manufacturer and the shop primer manufacturer where both coatings form part of the total system.

(c) The coating manufacturer should provide to the Administration the following information;

- A detailed list of the production facilities.
- Names and location of raw material suppliers will be clearly stated.
- A detailed list of the test standards and equipment to be used, (Scope of approval).
- Details of quality control procedures employed.
- Details of any sub-contracting agreements.
- List of quality manuals, test procedures and instructions, records, etc.
- Copy of any relevant certificates with their issue number and/or date e.g. Quality Management System certification.

(d) Inspection and audit of the manufacturer's facilities will be based on the requirements of the PSPC-COT.

(e) With the exception of early 'scale up' from laboratory to full production, adjustment outside the limitations listed in the QC instruction referred to below is not acceptable, unless justified by trials during the coating system's development programme, or subsequent testing. Any such adjustments must be agreed by the formulating technical centre.

(f) If formulation adjustment is envisaged during the production process the maximum allowable limits will be approved by the formulating technical centre and clearly stated in the QC working procedures.

(g) The manufacturer's quality control system will ensure that all current production is the same formulation as that supplied for the Type Approval Certificate. Formulation change is not permissible without testing in accordance with the test procedures in the PSPC-COT and the issue of a Type Approval Certificate by the Administration.

(h) Batch records including all QC test results such as viscosity, specific gravity and airless spray characteristics will be accurately recorded. Details of any additions will also be included.

(i) Whenever possible, raw material supply and lot details for each coating batch will be traceable. Exceptions may be where bulk supply such as solvents and pre-dissolved solid epoxies are stored in tanks, in which case it may only be possible to record the supplier's blend.

(j) Dates, batch numbers and quantities supplied to each coating contract will be clearly recorded.

1.13.2 All raw material supply must be accompanied the supplier's 'Certificate of Conformance'. The certificate will include all requirements listed in the coating manufacturer's QC system.

1.13.3 In the absence of a raw material supplier's certificate of conformance, the coating manufacturer must verify conformance to all requirements listed in the coating manufacturer's QC system.

1.13.4 Drums must be clearly marked with the details as described on the 'Type Approval Certificate'.

1.13.5 Product Technical Data Sheets must comply with all the PSPC-COT requirements. The QC system will ensure that all Product Technical Data Sheets are current.

1.13.6 QC procedures of the originating technical centre will verify that all production units comply with the above stipulations and that all raw material supply is approved by the technical centre.

1.14 In the case that a coating manufacturer wishes to have products which are manufactured in different locations under the same name, then IR identification and SG shall be used to

demonstrate that they are the same coating, or individual approval tests will be required for the paint manufactured in each location.

1.15 The Type Approval Certificate is invalid if the formulation of either the epoxy based system or the shop primer is changed. It is the responsibility of the coating manufacturer to inform class immediately of any changes to the formulation. Failure to inform class of an alteration to the formulation will lead to cancellation of the certificates for that manufacturer's products.

Interpretation regarding 1.4 Job specification and 1.5 NDFT (nominal total dry film thickness)

Wet film thickness shall be regularly checked during application for quality control by the Builder. PSPC-COT does not state who should check WFT, it is accepted for this to be the Builder. Measurement of DFT shall be done as part of the inspection required in PSPC-COT **6**.

Stripe coats should be applied as a coherent film showing good film formation and no visible defects. The application method employed should insure that all areas that require stripe coating are properly coated by brush or roller. A roller may be used for scallops, ratholes etc., but not for edges and welds.

2 PSP (Primary Surface Preparation)

Interpretation regarding 2.2 Water soluble salt limit equivalent to NaCl

The conductivity of soluble salts is measured in accordance with ISO 8502-6 and ISO 8502-9 or equivalent method as validated according to NACE SP0508-2010, and compared with the conductivity of $50 mg/m^2$ NaCl. If the measured conductivity is less than or equal to, then it is acceptable. Minimum readings to be taken are one (1) per plate in the case of manually applied shop primer. In cases where an automatic process for application of shop primer is used, there should be means to demonstrate compliance with PSPC-COT through a Quality Control System, which should include a monthly test.

Interpretation regarding 2.3 Shop primer

Shop primers not containing zinc or not silicate based are considered to be "alternative systems" and therefore equivalency is to be established in accordance with **Section 8** of the PSPC-COT with test acceptance criteria for "alternative systems" given in Section 3.1 (right columns) of **Appendixes 1** and **2** to Annex 1 of PSPC-COT.

Interpretation regarding Procedure for review of Quality Control of Automated Shop Primer plants

1 It is recognised that the inspection requirements of PSPC-COT **6.2** may be difficult to apply to an automated shop primer plant and a Quality Control approach would be a more practical way of enabling compliance with the requirements of PSPC-COT.

2 As required in PSPC it is the responsibility of the coating inspector to confirm that the quality control procedures are ensuring compliance with PSPC-COT.

3 When reviewing the Quality Control for automated shop primer plants the following procedures should be included.

3.1 Procedures for management of the blasting grit including measurement of salt and contamination.

3.2 Procedures recording the following; steel surface temperature, relative humidity, dewpoint.

3.3 Procedures for controlling or monitoring surface cleanliness, surface profile, oil, grease,

dust and other contamination.

3.4 Procedures for recording/measuring soluble salts.

3.5 Procedures for verifying thickness and curing of the shop primer conforms to the values specified in the Technical Specification.

3 SSP (Secondary Surface Preparation)

Interpretation regarding 3.2 Surface treatment, 3.3 Surface treatment after erection, and 3.4 Profile requirement

Methods such as, but not limited to, UHP Water Jetting may be considered for Secondary Surface Preparation, where it can be demonstrated that the surface conditions specified by PSPC **Table 1**, **Section 3** can be achieved before the application of the main coatings.

Usually, the fillet welding on tank boundary watertight bulkhead is left without coating on block stage (because not yet be leakage tested), in which case it can be categorized as erection joint ("butt") to be power tooled to St 3.

Interpretation regarding 3.6 Water soluble salts limit equivalent to NaCl after blasting/grinding

The conductivity of soluble salts is measured in accordance with ISO 8502-6 and ISO 8502-9 or equivalent method as validated according to NACE SP0508-2010, and compared with the conductivity of 50mg/m^2 NaCl. If the measured conductivity is less then or equal to, then it is acceptable.

All soluble salts have a detrimental effect on coatings to a greater or lesser degree. ISO 8502-9:1998 does not provide the actual concentration of NaCl. The % NaCl in the total soluble salts will vary from site to site. Minimum readings to be taken are one (1) reading per block/section/unit prior to applying.

4 Miscellaneous

4.3 Testing of coating

All DFT measurements shall be measured. Only the final DFT measurements need to be measured and reported for compliance with the PSPC-COT by the qualified coating inspector. The Coating Technical File may contain a summary of the DFT measurements which typically will consist of minimum and maximum DFT measurements, number of measurements taken and percentage above and below required DFT. The final DFT compliance with the 90/10 practice shall be calculated and confirmed, see PSPC-COT **2.8**.

Interpretation regarding footnotes

Only the footnoted standards referred to in PSPC-COT **Table 1** are to be applied, i.e. they are mandatory.

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5 COATING SYSTEM APPROVAL

Results from prequalification tests (**table 1**, **paragraph 1.3**) of the coating system shall be documented, and a Statement of Compliance or Type Approval Certificate shall be issued if found satisfactory by a third party, independent of the coating manufacturer.

****

Interpretation

See Interpretation of PSPC-COT **Table 1: 1** Design of coating system, **1.3** Coating prequalification test.

****

6 COATING INSPECTION REQUIREMENTS

6.1 General

6.1.1 To ensure compliance with this Standard, the following shall 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.

6.1.2 Coating inspectors shall inspect surface preparation and coating application during the coating process by carrying out, as a minimum, those inspection items identified in subsection **6.2** to ensure compliance with this Standard. Emphasis shall 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 shall be non-destructively examined for coating thickness. The inspector shall verify that appropriate collective measures have been carried out.

6.1.3 Results from the inspection shall be recorded by the inspector and shall be included in the CTF (see **annex 2**).

****

Interpretation

Procedure for Assessment of Coating Inspectors' Qualifications

1 Coating inspectors required to carry out inspections in accordance with the PSPC-COT **6** shall be qualified to NACE Coating Inspector Level 2, FROSIO Inspector Level III, or an equivalent qualification. Equivalent qualifications are described in **3** below.

2 However, only coating inspectors with at least 2 years relevant coating inspector experience and qualified to NACE Coating Inspector Level 2 or FROSIO Inspector Level III, or with an equivalent qualification, can write and/or authorise procedures, or decide upon corrective actions to overcome non-compliances.

3 Equivalent Qualification

3.1 Equivalent qualification is the successful completion, as determined by course tutor, of an approved course.

3.1.1 The course tutors shall be qualified with at least 2 years relevant experience and qualified to NACE Coating Inspector Level 2 or FROSIO Inspector Level III, or with an equivalent qualification.

3.1.2 Approved Course: A course that has a syllabus based on the issues associated with the PSPC including the following:

- Health Environment and Safety
- Corrosion
- Materials and design
- International standards referenced in PSPC
- Curing mechanisms
- Role of inspector
- Test instruments

- Inspection Procedures
- Coating specification
- Application Procedures
- Coating Failures
- Pre-job conference
- MSDS and product data sheet review
- Coating technical file
- Surface preparation
- Dehumidification
- Waterjetting
- Coating types and inspection criteria
- Specialized Application Equipment
- Use of inspection procedures for destructive testing and non destructive testing instruments.
- Inspection instruments and test methods
- Coating inspection techniques
- Cathodic protection
- Practical exercises, case studies.

Examples of approved courses may be internal courses run by the coating manufacturers or shipyards etc.

3.1.3 Such a course shall have an acceptable measurement of performance, such as an examination with both theoretical and practical elements. The course and examination shall be approved by the Administration.

3.2 Equivalent qualification arising from practical experience: An individual may be qualified without attending a course where it can be shown that the individual:

- has a minimum of 5-years practical work experience as a coating inspector of ballast tanks and/or cargo tanks during new construction within the last 10 years, and
- has successfully completed the examination given in **3.1.3**.

4 Assistants to coating inspectors

4.1 If the coating inspectors requires assistance from other persons to do the part of the inspections under the coating inspector's supervision, those persons shall be trained to the coating inspector's satisfaction.

4.2 Such training should be recorded and endorsed either by the inspector, the yard's training organization or inspection equipment manufacturer to confirm competence in using the measuring equipment and confirm knowledge of the measurements required by the PSPC-COT.

4.3 Training records shall be available for verification if required.

****

6.2 Inspection items

Construction stage		Inspection items
Primary surface preparation	1	The surface temperature of steel, the relative humidity and the dew point shall be measured and recorded before the blasting process starts and at times of sudden changes in weather.
	2	The surface of steel plates shall be tested for soluble salt checked for oil, grease and other contamination.
	3	The cleanliness of the steel surface shall be monitored in the shop primer application process.
	4	The shop primer material shall 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 to 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 shall be carried out. Any oil, grease or other visible contamination to be removed.
	2	After blasting/grinding/cleaning and prior to coating, a visual inspection of the prepared surface shall be carried out. On completion of blasting and cleaning and prior to the application of the first coat of the system, the steel surface shall 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 shall be monitored and recorded during the coating application and curing.
	4	Inspection to be performed of the steps in the coating application process mentioned in **table 1**.
	5	DFT measurements shall be taken to prove that the coating has been applied to the thickness as specified.
Erection	1	Visual inspection for steel surface condition, surface preparation and verification of conformance to other requirements in **table 1**, and the agreed specification to be performed.
	2	The surface temperature, the relative humidity and the dew point shall be measured and recorded before coating starts and regularly during the coating process.
	3	Inspection to be performed of the steps in the coating application process mentioned in **table 1**.

7 COATING VERIFICATION REQUIREMENTS

The following shall 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.

****

Interpretation

Procedure for Verification of Application of the PSPC-COT

1 The verification requirements of PSPC-COT **7** shall be carried out by the Administration.

1.1 Monitoring implementation of the coating inspection requirements, as called for in PSPC-COT **7.5** means checking, on a sampling basis, that the inspectors are using the correct equipment, techniques and reporting methods as described in the inspection procedures reviewed by the Administration.

2 Any deviations found under **1.1** shall be raised initially with the coating inspector, who is responsible for identifying and implementing the corrective actions.

3 In the event that corrective actions are not acceptable to the Administration or in the event that corrective actions are not closed out then the shipyard shall be informed.

4 Cargo Ship Safety Certificate or Cargo Ship Safety Construction Certificate, as appropriate, shall not be issued until all required corrective actions have been closed out to the satisfaction of the Administration.

****

8 ALTERNATIVE COATING SYSTEMS

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

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 shall be subject to documented evidence that they ensure a corrosion prevention performance at least equivalent to that indicated in this Standard, by either:

.1 testing according to this standard; or

.2 five years' field exposure with documentary evidence of continuous trading with crude oil cargoes.* The coating condition is not less than "GOOD" after five years.

* For field exposure the ship should be trading in varied trade routes and carrying substantial varieties of crude oils to ensure a realistic sample: for example, three ships on three different trade areas with different varieties of crude cargoes.

****

Interpretation

1 The definition of alternative systems

1.1 Normal coating systems, i.e. not alternative systems, are epoxy-based systems applied according to **table 1** of PSPC-COT.

1.2 Alternative systems can be coating systems which are:

- epoxy-based systems, but not applied according to **table 1** of PSPC-COT;
- non epoxy-based systems applied according to **table 1** of PSPC-COT; or
- non epoxy-based systems, but not applied according to **table 1** of PSPC-COT.

2 The requirement of coating system approval for alternative systems

2.1 Type Approval Certificate shall be issued subject to satisfaction of the test procedure given in **Annex 1** to this standard, evaluated according to the acceptance criteria for alternative systems.

3 The inspection of application of alternative systems

3.1 The coatings are to be inspected according to the coating inspection requirement in PSPC-COT.

4 The application of alternative systems

4.1 The necessary conditions for application, especially for difference from conventional epoxy coating system should be specified in the coating technical file as per **section 3.4** of PSPC-COT.

4.2 It is recommended that the work for confirmation of the suitability of application (workability, coating quality, worker's skill and so on) is demonstrated before the project starts.

****

ANNEX 1
TEST PROCEDURES FOR COATING QUALIFICATION FOR CARGO OIL TANKS OF CRUDE OIL TANKERS

1 Scope

This annex provides details of the test procedures for cargo tank coatings for crude oil carriers as referred to in paragraphs **4.6** and **8.3** of this Standard. Both the tank-top and deck-head should be applied with coating systems that have passed the full test protocol as described in this document.

2 Definitions

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

3 Background

It is acknowledged that a crude oil cargo tank on board a ship is exposed to two very different environmental conditions.

3.1 When the cargo tank is loaded there are three distinct vertical zones:

.1 Lowest part, and horizontal parts on stringer decks, etc., exposed to water that can be acidic and sludge that can contain anaerobic bacteria.

.2 Mid part where the oil cargo is in contact with all immersed steel.

.3 Vapour space where the air is saturated with various vapours from the loaded cargo tank such as H_2S, CO_2, SO_2, water vapour and other gases and compounds from the inert gas system.

3.2 When the tank is in a ballast condition:

.1 Lowest part and horizontal parts on stringer decks, etc., exposed to cargo residues and water that can be acidic and sludge that can contain anaerobic bacteria.

.2 Tank space where the air contains various vapours from the crude oil residues such as H_2S, CO_2, SO_2, water vapour and other gases and compounds from the inert gas system.

4 Testing

The tests herein are designed to simulate, as far as practicable, the two main environmental conditions to which the crude oil cargo tank coating will be exposed. The coating shall be validated

by the following tests: the test procedures shall comply with **Appendix 1** (Gas-tight chamber simulating the vapour phase of the loaded tank) and **Appendix 2** (Immersion test simulating the loaded condition of the crude oil tank[1])

[1] Related test method is derived from, but not identical to, standard *ISO* 2812-1:*2007 - Paints and varnishes - Determination of resistance to liquids - Part 1: Immersion in liquids other than water*.

5 Test gas composition

The test gas is based on the composition of the vapour phase in crude oil tanks, except that the hydrocarbon components are not included as these have no detrimental effect on epoxy coatings such as those used in cargo oil tanks.

TEST GAS COMPOSITION

N_2	83 ± 2 %vol.
CO_2	13 ± 2 %vol.
O_2	4 ± 1 %vol.
SO_2	300 ± 20 *ppm*
H_2S	200 ± 20 *ppm*

6 Test liquid

Crude oil is a complex chemical material which is not stable over time when stocked. Crude oils can also vary in composition over time. In addition the use of crude oil has proven to create practical and HSE barriers for the involved testing institutes. To overcome this, a model immersion liquid is used to simulate crude oil. The formulation of this crude oil model system is given below:

.1 start with distillate Marine Fuel, DMA Grade[2] density at 15ºC: maximum 890 kg/m^3, viscosity of maximum 6 mm^2/s at 40ºC;

.2 add naphthenic acid up to an acid number[3] of 2.5 ± 0.1 *mg KOH/g*;

.3 add benzene/ toluene (1:1 ratio) up to a total of 8.0 ± 0.2% *w/w* of the DMA;

.4 add artificial seawater[4] up to a total of 5.0 ± 0.2% *w/w* to the mixture;

.5 add H_2S dissolved in a liquid carrier (in order to get 5 ± 1 *ppm w/w* H_2S in the total test liquid);

.6 thoroughly mix the above constituents immediately prior to use; and

.7 once the mixture is completed, it should be tested to confirm the mixture is compliant with the test mixture concentrations.

Note: To prevent the risk of H_2S release into the test facility, it is recommended to use a stock solution for steps 1 to 4, then fill the test containers and complete the test solution with steps 5 and 6.

[2] Refer to *ISO* 8217:*2005. Petroleum products - Fuels (class F) - Specifications of marine fuels*.

[3] Refer to *ISO* 6618:*1997. Petroleum products and lubricants - Determination of acid or base number - Colour-indicator titration method*.

[4] Refer to *ASTM D*1141 - 98(*2008*) - *Standard Practice for the Preparation of Substitute Ocean Water*.

****

Interpretation

Only the footnoted standards referred to in **Annex 1** are to be applied, i.e. they are mandatory.

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APPENDIX 1 GAS-TIGHT CABINET TEST

1 Test condition

The vapour test shall be carried out in a gas-tight cabinet. The dimensions and design of the air tight gas cabinet are not critical, provided the requirements of subparagraphs **.6** to **.10** below are met. The test gas is designed to simulate the actual crude oil cargo tank environment in ballast condition as well as the vapour conditions of the loaded tank.

.1 The exposure time is 90 days.

.2 Testing shall be carried out using duplicate panels; a third panel shall be prepared and stored at ambient conditions to act as a reference panel during final evaluation of the test panels.

.3 The size of each test panel is 150 *mm* × 100 *mm* × 3 *mm*.

.4 The panels shall be treated according to the Performance standard, **Table 1**, **1.2** and the coating system applied according to **Table 1**, **1.4** and **1.5**.

.5 The zinc silicate shop primer, when used, shall be weathered for at least 2 months and cleaned by low pressure fresh water washing. The exact method of shop primer preparation before being over coated shall be reported, and the judgement issued for that specific system. The reverse side and edges of the test piece shall be coated appropriately, in order not to influence the test results.

.6 Inside the gas-tight cabinet a trough shall be present. This trough shall be filled with 2 ± 0.2 *l* of water. The water in the trough shall be drained and renewed prior to each time the test gas is refreshed.

.7 The vapour spaces inside the gas-tight cabinet are to be filled with a mixture of test gas as per item **5** of the Standard. The cabinet atmosphere shall be maintained over the period of the test. When the gas is outside the scope of the test method, it shall be refreshed. The monitoring frequency and method, and the date and time for refreshing the test gas, shall be in the test report.

.8 The atmosphere in the test cabinet shall at all times be 95 ± 5% relative humidity.

.9 Temperature of the test atmosphere shall be 60 ± 3 °C.

.10 A stand for the test panels shall be made of a suitable inert material to hold the panels vertically spaced at least 20 *mm* between panels. The stand shall be positioned in the cabinet to ensure the lower edge of the panels is at least 200 *mm* above the height of the water and at least 100 *mm* from the walls of the cabinet. If two shelves are in the cabinet, care shall be taken to ensure solution does not drip on to the lower panels.

2 Test results

2.1 Prior to testing, the following measured data of each coating composing the coating system, including the zinc silicate shop primer when used under the coating system, shall be reported:

.1 infrared (*IR*) identification of the base and hardener components of the coating;

.2 specific gravity[1] of the base and hardener components of the paint; and

.3 mean dry film thickness (*DFT*) (by using a template). [2]

2.2 After completion of the test duration, the panels shall be removed from the cabinet and rinsed with warm tap water. The panels shall be dried by blotting with absorbent paper and, then, evaluated for rust and blistering within 24 *h* of the end of the test.

2.3 After testing, the measured data of blisters and rust are to be reported. [3, 4, 5]

[1] Refer to *ISO* 2811-1/4:*1997. Paints and varnishes. Determination of density*.

[2] Six equally distributed measuring points are used on panels size 150 *mm* × 100 *mm*.

[3] *ISO* 4628-1:*2003. Paints and varnishes – Evaluation of degradation of coatings –*

Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 1: General introduction and designation system.

[4] *ISO* 4628-2:*2003. 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*.

[5] *ISO* 4628-3:*2003. 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*.

3 Acceptance criteria

3.1 The test results based on **section 2** shall satisfy the following criteria, the poorest performing of the duplicate test panels shall be used in the report:

Item	Acceptance criteria for epoxy-based systems	Acceptance criteria for alternative systems
Blisters on panel	No blisters	No blisters
Rust on panel	Ri 0 (0%)	Ri 0 (0%)

3.2 When evaluating test panels, blistering or rusting within 5*mm* of the panel edge shall be ignored.

4 Test report

The test report shall include the following information:

.1 coating manufacturers' name and manufacturing site;[6]

.2 dates of test;

.3 product name/identification of each coat and, where applicable, zinc silicate shop primer;

.4 batch numbers of each component of each product;

.5 details of surface preparation of steel panels, before shop primer application, and treatment of the shop primer before over coating where relevant and at a minimum including the following:

.5.1 surface treatment, or treatment of weathered shop primer, and any other important information on treatment influencing the performance; and

.5.2 water soluble salt level measured on the steel prior to application of the shop primer;[7, 8]

.6 details of coating system, including the following:

.6.1 zinc silicate shop primer if relevant, its secondary surface pre-treatment and condition under which applied, weathering period;

.6.2 number of coats, including the shop primer, and thickness of each;

.6.3 mean dry film thickness (*DFT*) prior to testing;[9]

.6.4 thinner if used;[9]

.6.5 humidity;[9]

.6.6 air temperature;[9] and

.6.7 steel temperature;[9]

.7 details of schedule for refreshing the test gas;

.8 test results according to **section 2**; and

.9 results according to **section 3**.

[6] It should be noted that the test is valid irrespective of production site, meaning that no individual testing of product from different production sites is required.

[7] *ISO* 8502-6:*2006. Preparation of steel substrates before application of paints and*

related products – Tests for the assessment of surface cleanliness – Part 6: Extraction of soluble contaminants for analysis – The Bresle method.

[8] *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*.

[9] Both of actual specimen data and manufacturer's requirement/recommendation.

APPENDIX 2 IMMERSION TEST

1 Test condition

The immersion test[1] is developed to simulate the conditions in a crude oil tank in loaded condition.

.1 The exposure time is 180 days.

.2 The test liquid should be made as per **item 6** in the Standard.

.3 The test liquid should be added to a container with an inside flat bottom until a column of the test liquid of height of 400*mm* is reached, resulting in an aqueous phase of 20*mm*. Any other alternative test set-up, using an identical test liquid, which will also result in the immersion of the test panel in 20*mm* of the aqueous phase, is also accepted. This can be achieved by using, for instance, inert marbles.

.4 The temperature of the test liquid should be 60 ± 2°C and should be uniform and maintained constant with recognized methods such as water or oil bath or air circulation oven capable of keeping the immersion liquid within the required temperature range.

.5 Test panels shall be positioned vertically and fully immersed during the test.

.6 Testing shall be carried out using duplicate panels.

.7 Inert spacers which do not cover the test area shall be used to separate test panels.

.8 The size of each test panel is 150*mm* × 100*mm* × 3*mm*.

.9 The panels shall be treated according to the Performance Standard **Table 1**, **1.2** and the coating system applied according to **Table 1**, **1.4** and **1.5**.

.10 The zinc silicate shop primer, when used, shall be weathered for at least 2 months and cleaned by low pressure fresh water washing. The exact method of shop primer preparation before being over coated shall be reported, and the judgement issued for that specific system. The reverse side, and edges, of the test piece shall be coated appropriately, in order not to influence the test results.

.11 After the full immersion test period is completed the panels shall be removed from the test liquid and wiped with dry clean cloth before evaluation of the panels.

.12 Evaluation of the test panels shall be done within 24 *h* after completion of the test.

[1] Related test method is derived from, but not identical to, standard *ISO* 2812-1:*2007 - Paints and varnishes - Determination of resistance to liquids - Part 1: Immersion in liquids other than water*.

2 Test results

2.1 Prior to testing, the following measured data of each coating composing the coating system, including the zinc silicate shop primer when used under the coating system, shall be reported:

.1 infrared (*IR*) identification of the base and hardener components of the coating;
.2 specific gravity of the base and hardener components of the paint;[2] and
.3 mean dry film thickness (*DFT*) (by using a template).[3]

2.2 After testing, the following measured data shall be reported: blisters and rust.[4, 5, 6]

[2] Refer to *ISO* 2811-1/4:*1997. Paints and varnishes. Determination of density*.

[3] Six equally distributed measuring points are used on panels size 150*mm* × 100*mm*.

[4] *ISO* 4628-1:*2003. Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 1: General introduction and designation system*.

[5] *ISO* 4628-2:*2003. 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*.

[6] *ISO* 4628-3:*2003. 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*.

3 Acceptance criteria

3.1 The test results based on **section 2** shall satisfy the following criteria, the poorest performing of the duplicate test panels shall be used in the report:

Item	Acceptance criteria for epoxy-based systems	Acceptance criteria for alternative systems
Blisters on panel	No blisters	No blisters
Rust on panel	Ri 0 (0%)	Ri 0 (0%)

3.2 When evaluating test panels, blistering or rusting within 5*mm* of the panel edge should be ignored.

4 Test report

The test report shall include the following information:

.1 coating manufacturers' name and manufacturing site;[7]
.2 dates of test;
.3 product name/identification of each coat and, where applicable, zinc silicate shop primer;
.4 batch numbers of each component of each product;
.5 details of surface preparation of steel panels, before shop primer application, and treatment of the shop primer before over coating where relevant and at a minimum including the following:
  .5.1 surface treatment, or treatment of weathered shop primer, and any other important information on treatment influencing the performance; and
  .5.2 water soluble salt level measured on the steel prior to application of the shop primer;[8, 9]
.6 details of coating system, including the following:
  .6.1 zinc silicate shop primer if relevant, its secondary surface pre-treatment and condition under which applied, weathering period;
  .6.2 number of coats, including the shop primer, and thickness of each;
  .6.3 mean dry film thickness (*DFT*) prior to testing;[10]
  .6.4 thinner if used;[10]
  .6.5 humidity;[10]
  .6.6 air temperature;[10] and
  .6.7 steel temperature;[10]

.7 details of schedule for refreshing the test gas;
.8 test results according to **section 2**; and
.9 results according to **section 3**.

[7] It should be noted that the test is valid irrespective of production site, meaning that no individual testing of product from different production sites is required.

[8] *ISO* 8502-6:*2006. Preparation of steel substrates before application of paints and related products – Tests for the assessment of surface cleanliness – Part 6: Extraction of soluble contaminants for analysis – The Bresle method*.

[9] *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*.

[10] Both of actual specimen data and manufacturer's requirement/recommendation.

APPENDIX 3 PRECAUTIONS REGARDING THE USE OF DANGEROUS MATERIALS

1 The test methods involve the use of materials that may be hazardous to health as follows:
.1 Sulphur Dioxide: Corrosive when wet, toxic if inhaled, causes burns, and is an irritant to the eyes and respiratory system.
.2 Hydrogen Sulphide: Highly flammable (Flash point of -82°C), can form an explosive mixture with air, corrosive when wet, causes burns, has to be kept away from sources of ignition, irritant and asphyxiant, LTEL 5*ppm*, STEL 10*ppm*, higher concentrations can be fatal and have no odour. Repeated exposure to low concentrations can result in the sense of smell for the gas being diminished.
.3 Benzene: Highly flammable (Flash point of -11°C), can form an explosive mixture with air, toxic, carcinogenic, acute health risk.
.4 Toluene: Highly flammable (Flash point of 4°C), can form an explosive mixture with air, irritant, acute health risk, reprotoxin.

2 Special test apparatus and precautions may be required depending on the regulations in force in the country where the tests are carried out.

3 Although some countries have no specific requirements preventing either of the tests being carried out, it shall anyhow be required that:
.1 a risk assessment of the working conditions is carried out;
.2 during the test period, the system shall be enclosed; and
.3 the environment shall be controlled, particularly at the start and end of the tests, suitable air exhaust shall be available and personal protective equipment shall be worn.

ANNEX 2 EXAMPLE OF DAILY LOG AND NON-CONFORMITY REPORT

DAILY LOG **Sheet No:**

Ship:	**Tank/Hold No:**	**Database:**
Part of structure:		
SURFACE PREPARATION		
Method:	**Area (m^2):**	
Abrasive:	**Grain size:**	
Surface temperature:	**Air temperature:**	
Relative humidity (max):	**Dew point:**	
Standard achieved:		
Rounding of edges:		
Comments:		
Job No.:	**Date:**	**Signature:**
COATING APPLICATION:		
Method:		

Coat No.	System	Batch No.	Date	Air temp.	Surf temp.	RH%	Dew point	DFT* Meas.	Specified

* Measured minimum and maximum DFT. DFT readings to be attached to daily log.

Comments:		
Job No:	**Date:**	**Signature:**

NON-CONFORMITY REPORT **Sheet No:**

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

EFFECTIVE DATE AND APPLICATION (Amendment 2-1)

1. The effective date of the amendments is 1 January 2014.

2. Notwithstanding the amendments to the Guidance, the current requirements may apply to ships for which the date of contract for construction* is before the effective date.

* "contract for construction" is defined in the latest version of IACS Procedural Requirement (PR) No.29.

IACS PR No.29 (Rev.0, July 2009)

1. The date of "contract for construction" of a vessel is the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. This date and the construction numbers (i.e. hull numbers) of all the vessels included in the contract are to be declared to the classification society by the party applying for the assignment of class to a newbuilding.

2. The date of "contract for construction" of a series of vessels, including specified optional vessels for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective owner and the shipbuilder.

For the purpose of this Procedural Requirement, vessels built under a single contract for construction are considered a "series of vessels" if they are built to the same approved plans for classification purposes. However, vessels within a series may have design alterations from the original design provided:

(1) such alterations do not affect matters related to classification, or

(2) If the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the shipbuilder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval.

The optional vessels will be considered part of the same series of vessels if the option is exercised not later than 1 year after the contract to build the series was signed.

3. If a contract for construction is later amended to include additional vessels or additional options, the date of "contract for construction" for such vessels is the date on which the amendment to the contract, is signed between the prospective owner and the shipbuilder. The amendment to the contract is to be considered as a "new contract" to which **1.** and **2.** above apply.

4. If a contract for construction is amended to change the ship type, the date of "contract for construction" of this modified vessel, or vessels, is the date on which revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder.

Note:
This Procedural Requirement applies from 1 July 2009.

Amendment 2-2

Appendix C3 SAMPLE OF SHIP STRUCTURAL ACCESS MANUAL

Part I Manual for Safe Access

2 Scope of Access Manual

2.1 General

Paragraph 2.1.1 has been amended as follows.

2.1.1 Permanent means of access provided for the ship do not give access to all areas required to be surveyed and measured. It is necessary that all areas outside of reach (*i.e.*, normally beyond hand's reach) of the permanent means of access can be accessed by alternative means in combination with the permanent means of access, including those specified by resolution ~~*A*.744(18), as amended~~ *A*.1049(27) (2011 *ESP* code). Critical structural areas, if necessary, also can be accessed by appropriate means of access.

2.3 Relevant Rules and Regulations

Sub-paragraph (c) has been amended as follows.

Reference is to be made to the following publications:

(a) *SOLAS* regulation II-1/3-6 adopted by resolution *MSC*.134(76), as amended
(b) Technical Provisions adopted by resolution *MSC*.133(76), as amended
(c) ~~Guidelines~~ International Code on the Enhanced Programme of Inspection During Surveys of Bulk Carriers and Oil Tankers adopted by resolution ~~*A*.744(18), as amended~~ *A*.1049(27) (2011 *ESP* code)
(d) *IACS* Unified Requirements Z10.1, Z10.2, Z10.4 and Z10.5, as appropriate
(e) *IACS* Unified Interpretation SC191, as amended
(f) The relevant Class Rules for Vessels of the concerned Classification Society
(g) *IACS* Recommendation No.39 "Safe Use of Rafts or Boats for Survey"
(h) *IACS* Recommendation No.78 "Safe Use of Portable Ladders for Close-Up Surveys"
(i) *IACS* Recommendation No.91 "Guidelines for Approval/Acceptance of Alternative Means of Access"

Appendix C4 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) and IACS Unified Interpretations SC223)

2 DEFINITIONS

Paragraph 2.1 has been amended as follows.

2.1 *Ballast tanks* are those as defined in the Guidelines for the selection, application and maintenance of corrosion prevention systems of dedicated seawater ballast tanks (resolution *A*.798(19)) and the ~~Guidelines~~ International Code on the enhanced programme of inspections ~~f~~during surveys of bulk carriers and oil tankers (resolution~~s~~ ~~*A*.744(18), as amended~~ *A*.1049(27) (2011 *ESP* code)).

Paragraph 2.6 has been amended as follows.

2.6 "*GOOD*" *condition* is the condition with minor spot rusting as defined in resolution ~~*A*.744(18)~~ *A*.1049(27) (2011 *ESP* code).

EFFECTIVE DATE AND APPLICATION (Amendment 2-2)

1. The effective date of the amendments is 1 January 2014.

2. Notwithstanding the amendments to the Guidance, the current requirements may apply to the surveys for which the application is submitted to the Society before the effective date.