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PERFORMANCE STANDARDS FOR PROTECTIVE COATINGS

Draft performance standards for protective coatings

**Submitted by BIMCO, International Association of Classification Societies (IACS),
International Chamber of Shipping (ICS), International Association of Dry Cargo
Shipowners (INTERCARGO), International Association of Independent Tanker Owners
(INTERTANKO)**

SUMMARY

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| <i>Executive summary:</i> | This document provides draft performance standards for protective coatings as requested by the Sub-Committee at its forty-seventh session and by the MSC at its seventy-eighth session. |
| <i>Action to be taken:</i> | Paragraph 9 |
| <i>Related document:</i> | DE 47/WP.12, paragraphs 18.3 and 18.4 |

1 At DE 47, the Sub-Committee, in view of draft SOLAS regulation XII/6.4, requested IACS and the industry to develop draft performance standards for protective coatings in double-side spaces of bulk carriers.

2 Consequently, an IACS-Industry Joint Working Group on Corrosion Prevention (JWG/COR – comprised of representatives of IACS, BIMCO, ICS, INTERCARGO, INTERTANKO, OCIMF, as well as one observer from EMSA) was formed and undertook the development of such draft standards that are attached hereto as annex.

Introduction

3 The attached draft performance standard for coating of ballast spaces and similar spaces is based on the following concepts:

- .1 the “target useful life” of a protective coating system. This is the durability which should be considered when designing the protective coating system;
- .2 performance standard: the target useful life of a protective coating system should be 15 years; and
- .3 basic coating specifications for a protective coating system having a target useful life of 15 years.

Technical background

4 JWG/COR agreed that the most practical performance standard is a 15 years target useful life. This is because:

- .1 such target useful life, while producing a safety level felt adequate, would lead to an average anticipation for re-coating only once in a ship's life;
- .2 a 10 years standard would likely result in more than one re-coat during the ship life (which is a major economical undertaking) as well as provide a lower level of performance; and
- .3 a 20 or 25 years standard, besides not ensuring a "re-coating free" ship life, was considered un-practical to be mandated as a minimum standard in view of the additional requirements needed to achieve the extended useful life.

5 From the technical point of view, the attached draft performance standard is based on resolution A.798(19) "Guidelines for the Selection, Application and Maintenance of Corrosion Prevention Systems of Dedicated Seawater Ballast Tanks" and on the industry recommendations provided by the Tanker Structure Co-operative Forum's (TSCF) "Guidelines for Ballast Tank Coatings Systems and Surface Preparation", in particular the TSCF15 guide for a 15 years system specification.

6 The JWG/COR found TSCF15 to be an excellent basis for the performance standard for the following reasons:

- .1 it is a widely used standard for newly built oil tankers, hence it has a well proven record of experience;
- .2 although it was originally developed for ballast tanks of oil tankers, the JWG/COR found it applicable to ballast tanks and void spaces of double side skin bulk carriers.

7 Relevant aspects of resolution A.798(19) were judged to be a useful addition to the TSCF15 standard. The rationale being that, since a good performance of the coating system depends on proper steel preparation, application and verification, several aspects of resolution A.798(19) are to be considered as an integral part of a coating standard.

Additional views of the JWG/COR

8 It is the view of the JWG/COR that the Sub-Committee may wish to consider in the future, when and if felt appropriate, the following coating related aspects:

- .1 the development of a detailed checklist for the inspections relevant to surface preparation and coating application (see paragraph 3.8.1 of resolution A.798(19));
- .2 IMO's Procedures for the Approval of Active Substances (G9), currently under development, should take into account that these substances/chemicals are compatible with the coating system; and

- .3 that the JWG/COR consider that the attached draft standard has a general validity as far as ballast water spaces are concerned hence its application need not be limited to the double side skin spaces of bulk carriers. Therefore the Sub-Committee may wish to take the annex into account if the matter of coating of ballast tanks in bulk carriers and/or oil tanker will be addressed in the future.

Action requested of the Sub-Committee

- 9 The Sub-Committee is invited to note the above comments and the instructions at annex and take actions as appropriate.

ANNEX

[DRAFT] PERFORMANCE STANDARD FOR PROTECTIVE COATINGS OF THE DOUBLE-SIDE SKIN SPACES OF BULK CARRIERS AND OF BALLAST TANKS**1 DEFINITIONS**

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

- a. **abrasive inclusions:** are abrasive particles shot into the surface of the steel;
- b. **ballast spaces:** are spaces that can be used for storing ballast water. They normally include, but are not limited to, ballast tanks as defined in resolution A.798(19) and resolution A.744(18) and tanks which, according to the ship's loading manual, can be used for both cargo and ballast;
- c. **dew point:** is the temperature at which air is saturated with moisture;
- d. **NDFT:** is the nominal dry film thickness;
- e. **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. Can be either inorganic or organic;
- f. **primer coat:** is the first coating applied in the shipyard (to differentiate it from shop-primer);
- g. **shop-primer:** is the prefabricated thin primer coating applied to steel plates, often in automatic plants;
- h. **solvent:** is a volatile liquid capable of completely dissolving a given binder;
- i. **stripe coating:** is an application, normally by brush, of one or more coating layers on locations where it is not easy to achieve the final total dry film coating thickness with the simple spray application;
- l. **target useful life:** is the target value, in years, of the durability for which the coating system is designed. It is noted that the design of a coating system includes criteria for selection of the coating and for its proper application;
- m. **thinner:** is a volatile liquid that does not necessarily dissolve the binder, but which is capable of reducing the viscosity of the binder solution (vehicle), for example in reducing the viscosity of a paint spraying consistency.

2 GENERAL PRINCIPLES

2.1 The ability of the coating system to reach its target useful life depends on the type of coating system, steel preparation, application and regular coating inspection and maintenance. All these aspects contribute to the good performance of the coating system. All are dealt with in this document with the exception of regular coating inspection, which is covered by resolution A.744(18), and maintenance.

2.2 When considering the standard provided in section 3, 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 proper periodic coating inspection and repair of any damage found during the ship life is necessary and is to be carried out by the operator of the vessel on behalf of the owner;
- .3 the coating performance can be improved by adopting measures at the ship design stage such as reducing scallops, using rolled profiles and ensuring that the structural configuration permits easy access with tools and facilitate cleaning, drainage and drying of the space to be coated;
- .4 the coating performance standard provided in this document is based on state of the art experience from manufacturers, shipyards and ship operators; it is not intended to exclude suitable alternative coating procedures providing a performance at least equivalent to that specified in this standard is demonstrated. Acceptance criteria for alternative procedures are provided in section 4.

3 COATING STANDARD

3.1 Performance standard

This standard is based on specifications and requirements which intend to provide a target useful coating life of 15 years, which is considered to be the time period, from initial application, over which the coating system remains in “GOOD” condition according to resolution A.744(18). However, actual useful life will vary depending on numerous variables including actual conditions encountered in service and the frequency and extent of maintenance and repair performed.

3.2 Basic coating requirements

- .1 The basic requirements for a coating system meeting the performance standard specified in paragraph 3.1 are listed in Table 1.
- .2 Coating manufacturers should give clear evidence of the quality of the product and its ability to satisfy the requirements of Table 1 while the shipyard and/or its subcontractors should provide clear evidence of their experience in coating application.
- .3 Detailed criteria for coating selection, job specifications, inspection, maintenance and repair should be agreed by the shipyards and/or its subcontractors, owner and manufacturer in consultation with the Administration or an organization recognized by the Administration, before the ship’s construction. These detailed criteria should be documented in an agreed scheme for the selection, application and maintenance of the coating system.

Table 1 – Basic coating system requirements

	Characteristic	Requirement	Reference standard
.1 Design of coating			
.a	Selection of the coating system	The selection of the coating system should be considered by the parties involved with respect to the service conditions and planned maintenance. The following aspects, <i>inter alia</i>, should be considered: .1 location of space relative to heated surfaces; .2 frequency of ballasting/deballasting operations; .3 required surface conditions; .4 required surface cleanliness and dryness; .5 supplementary cathodic protection, if any (where coating is supplemented by cathodic protection, the coating should be compatible with the cathodic protection system). Coating manufacturers should have products with documented satisfactory performance records and technical data sheets. The manufacturers should also be capable of rendering adequate technical assistance. Coatings for application underneath sun-heated decks or on bulkheads forming boundaries of heated spaces should be able to withstand constant or repeated heating without becoming brittle.	-
.b	Coating type	Epoxy (or other equivalent hard coating) based. Multi-coat treatment with coating layers of contrasting colour are recommended. The top layer of coat should be of a light colour in order to facilitate in-service inspection.	-
.c	Coating pre-qualification test	Certified performance test from laboratory corresponding to classification B1 for hard coating.	TSCF Guidelines for Ballast Tank Coating Systems and Surface Preparation, 2002, Appendix 3, Testing and classification of ballast tank coatings
.d	Number of coats	As a minimum, two full stripe coats followed by two full spray coats. Stripe coats beyond the first coat should be applied by brush or roller. Each coating layers should be adequately cured before application of the next coat, in accordance with coating manufacturer's recommendations. Intermediate coats must not be contaminated with dirt, grease, dust, salt, over spray, etc.. Job specifications should include the dry-to-recoat times given by the manufacturer.	-

	Characteristic	Requirement	Reference standard
.e	NDFT (nominal total dry film thickness)	Minimum 300 µm for epoxy based coatings, other systems to coating manufacturer's specifications. Maximum according to manufacturer's detailed specifications. Care should be taken to avoid increasing the thickness in an exaggerated way. Excessive thickness could lead to dangerous consequences, such as solvent and thinner retention, film cracks, gas pockets, etc.. Wet coating thickness should be checked during application. Thinner should be limited to those types and quantities recommended by the manufacturer.	-
.2 PSP (Primary Surface Preparation)			
.a	Steel surface	The steel surface should be prepared so that the coating selected can achieve an even distribution at the required NDFT and have an adequate adhesion by removing sharp edges, grinding weld beads and removing weld spatter and any other surface contaminant.	-
.b	Blasting and profile	SA 2 ½; 30-75 µm Blasting should 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 or; .3 there is any possibility that the surface of the steel is wet, or there are traces of moisture, or condensation occurs before the primer coat is applied. Checking of the steel surface cleanliness and roughness profile should be carried out at the end of the surface preparation and before the application of the primer, in accordance with the manufacturer's specifications.	ISO 8501, ISO 8503-1/3
.c	Soluble salt limit	≤ 30 mg/m ²	ISO 8502-9
.d	Pre-construction primer	zinc containing, silicate based	-
.3 SSP (Secondary surface preparation)			
.a	Steel condition	Preparation grade P2 Three pass edge grinding of sharp edges	ISO 8501-3
.b	Pre washing (fresh water)	Required	SSPC SP1
.c	Water soluble salts limit before SSP	≤ 30 mg/m ²	ISO 8502-9
.d	Surface treatment	Sa 2 ½ on damaged pre-construction primer and welds; Sa 2 on intact pre-construction primer, removing 70% of primer	ISO 8501
.e	Surface treatment after erection	Butts Sa 2 ½; small damages (<3% of total area) ST3	ISO 8501
.f	Profile requirements	As coating requirements	ISO 8503-1/3
.g	Dust	"1"	ISO 8502-3

	Characteristic	Requirement	Reference standard
.h	Water soluble salts after blasting/grinding	$\leq 30 \text{ mg/m}^2$	ISO 8502-9
.i	Abrasive inclusions	None (as viewed without magnification)	-
.4 Miscellaneous			
.a	Ventilation	Adequate ventilation is necessary for the proper 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.	-
.b	Environmental conditions	Coating should be applied under controlled humidity and surface conditions, in accordance with the manufacturer's specifications.	-
.c	Testing of coating	Destructive testing should be avoided. Dry film thickness tests should be carried out after each coat, not just at the end of the coating application, using appropriate thickness gauges.	-
.d	Inspection	Inspections relevant to surface preparation and coating application should be agreed upon between the shipowner and the shipyard under the manufacturer's advice. Clear evidence of all the above mentioned inspections should be reported in an agreed format. Such reports should be at the disposal of the interested parties, including the Administration or an organization recognized by the Administration. The activities that should be verified, <i>inter alia</i>, are: .1 working conditions, e.g. illumination, access, staging, etc.; .2 environmental conditions, e.g. temperature and humidity; .3 removal of sharp edges; .4 blast cleaning/mechanical cleaning; .5 cleaning up after blast cleaning; .6 shielding of painted surfaces from blasting operations; .7 curing times for individual coats in relation to temperature and humidity; .8 thickness measurement of each coat; .9 use and quantity of specified thinner; .10 continuity of coatings; .11 storing of coating materials and abrasives; .12 cleaning of coated surfaces before application of next coat; .13 handling/storing/transport of coated objects; and .14 coating repair when damaged.	

	Characteristic	Requirement	Reference standard
.e	Acceptance criteria	Following conditions should cause rejection: .1 excessive sags and runs; isolated sags and runs defined as 1 per each 100 m maximum are acceptable; .2 pin-holes: none allowed; .3 air bubbles or air bubble craters: none allowed; .4 low dry film thickness (DFT): none permissible; .5 excessive DFT: none permissible with the exception of acceptable sags and runs; .6 blistering: none acceptable; .7 lifting or peeling: none permissible; .8 insufficient dehumidification, heating and/or ventilation; .9 poor cleaning, presence of inclusions or invisible contamination in excess of the specifications.	-
.f	Repair	Any defective areas, e.g. pin-holes, bubbles, voids, etc. should be marked up and appropriate repairs effected. All such repairs should be re-checked and documented.	-
.g	Health and safety	Precautions should be taken to reduce health risks, fire and/or explosion risk and other safety risks, in accordance with the regulations of the Administration.	-

4 ALTERNATIVE PROCEDURES

4.1 The performance standard indicated in this document is based on a recognized and commonly used coating system. It is not meant to exclude other, alternative, systems.

4.2 Acceptance of alternative systems will be subject to documented evidence that they ensure a corrosion prevention performance at least equivalent to that indicated in this document, this documented evidence is to be to the satisfaction of the Administration.

4.3 As a minimum, the documented evidence shall consist of satisfactory performance corresponding to a target useful life of 15 years in either actual field exposure (ballast spaces) or laboratory testing.