

Subject :

Corrosion prevention of seawater ballast
tanks of oil tankers and bulk carriers

NKTECHNICAL INFORMATION

No. : 272

Date : 16 July 1998

To Shipowners and shipbuilders concerned

Dear Sir(s)

The scheme of corrosion prevention for the seawater ballast tanks of oil tankers and bulk carriers the keels of which are laid on or after 1 July 1998 is to comply with the guidelines set forth in IMO Resolution A. 798(19) in accordance with the requirements of 1996 amendments to SOLAS 74, Reg. II-1/3-2, and is to be submitted to this Society for approval. Paragraph 1.2 of the guidelines states that "The guidelines are not intended to replace the technical aspects of any specific coating system, to be covered by the product and job specification, which are at the discretion and under the responsibility of shipowners, manufacturers and shipyards." Therefore, when approving corrosion prevention scheme, the Society does not intend to examine the technical aspects of coating systems, but it confirms whether or not the corrosion prevention scheme includes the items listed in the attachment ③.

Accordingly, the corrosion prevention scheme for sea water ballast tanks of applicable vessels should contain the documentation listed in the attachment ③ for approval.

If you have any questions, please do not hesitate to contact the Hull Department at the Head Office of ClassNK at the following phone or fax number: Tel: + 81-3-5226-2017, Fax : + 81-3-5226-2029.

Attachment

1. SOLAS Reg/II-1 (1996 amendment)
2. Guidelines: IMO Resolution A.798(19)
3. Items to be stated in the scheme of corrosion prevention

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ANNEX

AMENDMENTS TO THE INTERNATIONAL CONVENTION
FOR THE SAFETY OF LIFE AT SEA, 1974

CHAPTER II-1

CONSTRUCTION - SUBDIVISION AND STABILITY, MACHINERY
AND ELECTRICAL INSTALLATIONS

- 1 The existing title of chapter II-1 is replaced by the following:

"Construction - Structure, subdivision and STABILITY, MACHINERY AND ELECTRICAL installations"
- 2 The following new part A-1 is inserted between part A and part B:

"PART A-1

STRUCTURE OF SHIPS

Regulation 3-1

Structural, mechanical and electrical requirements for ships

In addition to the requirements contained elsewhere in the present regulations, ships shall be designed, constructed and maintained in compliance with the structural, mechanical and electrical requirements of a classification society which is recognized by the Administration in accordance with the provisions of regulation XI/1, or with applicable national standards of the Administration which provide an equivalent level of safety.

Regulation 3-2

Corrosion prevention of seawater ballast tanks

- 1 This regulation applies to oil tankers and bulk carriers constructed on or after 1 July 1998.
- 2 All dedicated seawater ballast tanks shall have an efficient corrosion prevention system, such as hard protective coatings or equivalent. The coatings should preferably be of a light colour. The scheme for the selection, application and maintenance of the system shall be approved by the Administration, based on the guidelines adopted by the Organization*. Where appropriate, sacrificial anodes shall also be used."

* Refer to the Guidelines for the selection, application and maintenance of corrosion prevention systems of dedicated seawater ballast tanks, adopted by the Organization by resolution A.798(19).

Resolution A.798(19)
adopted on 23 November 1995
(Agenda item 10)

**GUIDELINES FOR THE SELECTION, APPLICATION
AND MAINTENANCE OF CORROSION PREVENTION SYSTEMS
OF DEDICATED SEAWATER BALLAST TANKS**

THE ASSEMBLY,

RECALLING Article 15(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations and guidelines concerning maritime safety,

RECALLING ALSO resolution A.713(17) concerning safety of ships carrying solid bulk cargoes, by which it specified interim measures to be taken to improve the safety of ships carrying solid bulk cargoes,

RECALLING FURTHER resolution A.744(18) on guidelines on the enhanced programme of inspections during surveys of bulk carriers and oil tankers, by which it specified detailed inspection requirements to improve the safety and marine pollution prevention of bulk carriers and oil tankers, and, *inter alia*, stipulated interdependence of the condition of coating and survey requirements,

RECOGNIZING the importance of correctly applied and maintained corrosion prevention systems in dedicated seawater ballast tanks of bulk carriers and oil tankers, which are more susceptible to corrosion, in improving the safety of the ship,

RECOGNIZING FURTHER that the Maritime Safety Committee, at its sixty-third session, approved draft amendments to the International Convention for the Safety of Life at Sea (SOLAS), 1974, by adding a new regulation II-1/14-1 requiring corrosion prevention systems to be fitted in dedicated seawater ballast tanks of new bulk carriers and oil tankers, referring to the guidelines developed by the Organization, for inclusion in the set of amendments proposed to enter into force in 1998,

HAVING CONSIDERED the recommendation made by the Maritime Safety Committee at its sixty-third session,

1. ADOPTS the Guidelines for the Selection, Application and Maintenance of Corrosion Prevention Systems of Dedicated Seawater Ballast Tanks set out in the annex to the present resolution;
2. INVITES Governments to apply the Guidelines to new bulk carriers and oil tankers as soon as possible, without awaiting the entry into force of the relevant amendments to the 1974 SOLAS Convention.

Annex

GUIDELINES FOR THE SELECTION, APPLICATION AND MAINTENANCE OF CORROSION PREVENTION SYSTEMS OF DEDICATED SEAWATER BALLAST TANKS

1 GENERAL

- 1.1 The purpose of these guidelines is to recommend general criteria for the selection, application and maintenance of corrosion prevention systems of dedicated seawater ballast tanks. They apply to new oil tankers and bulk carriers.
- 1.2 The guidelines are not intended to replace the technical aspects of any specific coating system, to be covered by the product and job specifications, which are at the discretion and under the responsibility of shipowners, manufacturers and shipyards.
- 1.3 The owner should select and maintain a system which will ensure an adequate level of corrosion prevention of the seawater ballast tanks.
- 1.4 Coating manufacturers should give evidence of the quality of the product and its ability to satisfy the owner's requirements.
- 1.5 The shipyard and/or its subcontractors should provide clear evidence of their experience in coating application. The coating standard, job specification, inspection, maintenance and repair criteria should be agreed by the shipyard and/or its subcontractors, owner and manufacturer, in consultation with the Administration or an organization recognized by the Administration, before the ship's construction.

2 DEFINITIONS

- 2.1 *Anode* is an electrode through which direct current enters an electrolyte.
- 2.2 *Ballast tank* is a tank which is used for water ballast and includes segregated ballast tanks, ballast double bottom spaces and peak tanks.
- 2.3 *Cathodic protection* is a way of protecting a steel surface from corrosion by installing sacrificial anodes, in contact with the steel in the electrochemical seawater corrosion cell.
- 2.4 *Dewpoint* is the temperature at which air is saturated with moisture.
- 2.5 *DFT* is the nominal dry film thickness.
- 2.6 *Hard coating* is a coating which chemically converts during its curing process, normally used for new constructions or non-convertible air drying coating which may be used for maintenance purposes. Hard coating can be either inorganic or organic.
- 2.7 *LEL* is the lower explosive limit.
- 2.8 *Light colour* is a colour of coating easily distinguishable from rust.
- 2.9 *Primer coat* is the first coating applied in the shipyard (to differentiate it from shop-primer).
- 2.10 *Shop-primer* means prefabrication thin primer coating applied to steel plates, often in automatic plants.
- 2.11 *Solvent* means a volatile liquid capable of completely dissolving a given binder.

2.12 *Thinner* means 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 to spraying consistency.

2.13 TLV means threshold limit value.

3 COATING

3.1 General

3.1.1 The lifetime of a coating applied to a new construction may be influenced by several aspects which include coating selection, application, and maintenance scheme.

3.1.2 Use of a hard coating is the most common practice in present technology. The effectiveness of a hard coating can be achieved only if the manufacturer's technical product data sheet and job specifications are carefully followed.

3.1.3 Multi-coat treatments with coating layers of contrasting colours are recommended. The last layer of coat should preferably be of a light colour in order to facilitate in-service inspections.

3.1.4 Coating performance can be improved by adopting measures at the design stage such as reducing scallops, using rolled profiles, and ensuring that the structural configuration permits easy access with tools and facilitates cleaning, drainage and drying of tanks.

3.1.5 Where coating is supplemented by cathodic protection, the coating must be compatible with the cathodic protection system.

3.2 Coating selection

3.2.1 The selection of a coating should be considered by the parties involved with respect to the service conditions and planned maintenance.

3.2.2 The following aspects, *inter alia*, should be considered:

- .1 location of tank relative to heated surfaces;
- .2 frequency of ballasting/deballasting operations;
- .3 required surface condition;
- .4 required surface cleanliness and dryness; and
- .5 supplementary cathodic protection, if any.

3.2.3 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.

3.2.4 For products without satisfactory performance records, coating selection should be supported by appropriate data on tests carried out in accordance with recognized standards in order to verify their suitability to the service conditions (e.g. immersion, accelerated hot salt spray and adhesion tests).

3.2.5 Coatings for application underneath sun-heated decks or on bulkheads forming boundaries of heated cargo spaces should be able to withstand constant or repeated heating without becoming brittle.

3.2.6 Due regard should be given to the possible poor edge covering properties of hard coatings with a high solid content.

3.3 Surface preparation

3.3.1 Surface preparation by appropriate methods should be in accordance with the coating manufacturer's specifications and recommendations. The actual sequence of surface preparation and coating application depends on the standard selected.

3.3.2 The steel surface should be prepared so that the coating selected can achieve an even distribution at the required dry film thickness and have an adequate adhesion by removing sharp edges, grinding weld beads, and removing weld spatter and any other surface contaminants.

3.3.3 Cleaning to near white metal or equivalent may be carried out either on incoming materials (plates and profiles), immediately before the shop-primer application, or after completion of tanks before the application of the primer coating.

3.3.4 If blast cleaning techniques are to be employed after completion of tanks, the conditions under which blast cleaning is carried out should preclude condensation. In this respect, it is not recommended to carry out blasting when:

- .1 the relative humidity is above 85%; or
- .2 the surface temperature of steel is less than 3°C above the dewpoint; 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.

3.3.5 Blasting abrasives and dust should be completely removed by means of vacuum cleaning, compressed air and brushes after blasting operations have finished. The abrasive used for blasting should be dry and free from dirt, oil, grease or chlorides, and suitable for producing the standard of cleanliness and profile specified by the manufacturer.

3.4 Checking of surface preparation

Checks on 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 coat, in accordance with the manufacturer's specifications.

3.5 Coating application

3.5.1 The application of a coating should be a well-planned activity, integrated in the shipyard's construction plans, and carried out under controlled conditions in order to avoid conflicts with other yard operations.

3.5.2 Coatings, including the primer and intermediate coats, should be applied on surfaces prepared and checked according to the provisions of 3.3 and 3.4.

3.5.3 Coatings should be applied by spraying under controlled humidity and surface temperature conditions, in accordance with manufacturer's recommendations. Additional stripe coats, if required by the job specifications, should be applied by brush or roller to welds, edges and areas not easily accessible.

3.5.4 Areas where the shop-primer is damaged in any way may be touched up in accordance with the manufacturer's specifications.

3.5.5 Each coating layer should have the maximum/minimum thicknesses in accordance with the coating specification. An 80/20 practice may be adopted, which means that 80% of all thickness measurements should be greater than or equal to the nominal DFT, and none of the remaining 20% is below 80% of the DFT.

3.5.6 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.

3.5.7 Each coating layer should be adequately cured before application of the next coat, in accordance with the coating manufacturer's recommendations. Intermediate coats must not be contaminated with dirt, grease, dust, salt, overspray, etc. Job specifications should include the dry-to-re-coat times given by the manufacturer.

3.5.8 Thinners should be limited to those types and quantities recommended by the manufacturer.

3.6 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.

3.7 Testing of coating

3.7.1 Destructive tests should be avoided.

3.7.2 Dry film thickness tests should be carried out after each coat, not just at the end of the coating application, by using appropriate thickness gauges.

3.8 Inspection

3.8.1 Inspections relevant to surface preparation and coating application should be agreed upon between the shipowner and 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 all the interested parties, including the Administration or an organization recognized by the Administration.

3.8.2 The activities that should be overseen, *inter alia*, are:

- .1 working conditions, e.g. illumination, access, staging, etc.;
- .2 environmental conditions, e.g. temperature and moisture;
- .3 removing of sharp edges;
- .4 blast cleaning/mechanical cleaning;
- .5 cleaning up after blast cleaning;
- .6 shielding of painted surfaces from blasting operations;
- .7 coating application equipment;
- .8 curing times for individual coats in relation to temperature and humidity;
- .9 thickness of each coat;
- .10 use and quantity of specified thinner;
- .11 continuity of coatings;
- .12 storing of coating materials and abrasives;
- .13 cleaning of coated surfaces before application of next coat;
- .14 handling/storing/transport of coated objects; and
- .15 coating repairs, when damaged.

3.8.3 Any defective areas, e.g. pinholes, bubbles, voids, etc., should be marked up and appropriate repairs effected. All such repairs should be rechecked for any uncoated areas.

3.9 Safety precautions

3.9.1 Most paints contain flammable solvents, and some contain materials which can harm the skin or damage the health if swallowed or inhaled. Precautions should be taken to reduce health risks and fire and explosion risks, in accordance with the appropriate safety regulations, to ensure that safe working conditions are achieved.

3.9.2 Health risks may include:

- .1 gases or vapours, i.e. solvent evaporation during the drying period, or formed during the heating of the painted object, which may exceed the permissible exposure limits;
- .2 liquids in the paint, i.e. solvents or binders, which may be toxic if swallowed or inhaled as spray droplets, or if in contact with the skin;
- .3 fumes, powders or dust formed during heating painted objects (e.g. flame-cutting or welding painted steel), or present in powder formed during sanding operations, or in the spray mist.

3.9.3 Precautions should be taken to reduce health risks, fire and explosion risks and other safety risks, in accordance with the regulations of the Administration.

4 CATHODIC PROTECTION

4.1 Cathodic protection by means of sacrificial anodes may be used in combination with the coating to prevent or reduce pitting corrosion starting from local defects in the coating.

4.2 The anodes should be designed in terms of size, weight and distribution to give an adequate life commensurate with the service period. The anode distribution, type, weight and dimensions should be shown in relevant documents and be available for maintenance purposes.

4.3 Once their number and size has been determined, the anodes should be distributed evenly over all the structure with some emphasis on horizontal surfaces likely to retain water. In particular, they should be installed close to the bottom plates of tanks which are seldom completely dry.

4.4 Cathodic protection is without effect when the tank is empty, and it requires some time (a day or more) to become effective after the tank has been filled.

4.5 The following aspects should be considered:

- .1 size and shape of tanks and areas to be protected;
- .2 extent and location of coated and uncoated surfaces;
- .3 frequency of ballasting/deballasting operations, including the percentage of time the tank is filled and level of filling; and
- .4 the resistivity of water, its temperature, etc.

4.6 The anode renewal should be carried out well before the old anodes are fully consumed. The renewal periods should be based on in-service experience.

5 ALTERNATIVE METHODS

Alternative corrosion prevention systems may be used, provided they give the same levels of corrosion prevention accomplished by means of hard coatings.

6 MAINTENANCE

6.1 Maintenance of the corrosion prevention system should be included in the overall ship's maintenance scheme. The effectiveness of the corrosion prevention system should be verified during the ship's life by the Administration or an organization recognized by the Administration, in accordance with the Guidelines on the Enhanced Programme of Inspections During Surveys of Bulk Carriers and Oil Tankers (resolution A.744(18)).

6.2 The most efficient way to preserve the corrosion prevention system is to repair any defects found during the in-service inspections (e.g. spot rusting, local breakdown at edges of stiffeners, etc.). Re-coating of all the defective surfaces should be carried out in accordance with the manufacturer's specifications.

6.3 A type of hard coating compatible with the one used for construction should be applied. This compatibility should be checked by the owner and the manufacturer involved in re-coating operations.

6.4 If the required conditions for the application of the original coating are not achievable, a coating more tolerant of a lower quality of surface treatment, humidity and temperature conditions may be considered, provided that it is applied and maintained in accordance with the manufacturer's specifications.

6.5 When coating is supplemented with cathodic protection, the maintenance scheme should include the replacement of the sacrificial anodes and the inspection of coating around the anode supports.

VOID

Items to be stated in the scheme of corrosion prevention

1. Owner's, coating manufacturer's and shipyard's explicit agreement to the scheme for coating selection, application and maintenance.
2. List of seawater ballast tanks identifying the coating system for each tank, including coating color and whether coating system is a hard coating.
3. Detail of anode, if used.
4. Manufacturer's technical product data for each product.
5. Manufacturer's evidence of product quality and ability to meet owners requirements.
6. Evidence of shipyard's and/or its subcontractor's experience in coating application.
7. Surface preparation procedures, including inspection points and methods.
8. Application procedures and standards, including inspection points and methods.
9. Format for inspection reports on surface preparation and coating application.
10. Manufacturer's safety data sheets for each product.