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GUIDELINES ON PROCEDURES FOR IN-SERVICE MAINTENANCE AND REPAIR OF COATING SYSTEMS FOR CARGO OIL TANKS OF CRUDE OIL TANKERS

1 The Committee, at its eighty-ninth session (11 to 20 May 2011), having recognized the need for guidelines for maintenance and repair of protective coatings for cargo oil tanks of crude oil tankers, taking into account the amendments to SOLAS regulation II-1/3-11 and the performance standard for protective coatings for cargo oil tanks of crude oil tankers, adopted by resolutions MSC.291(87) and MSC.288(87), respectively, considered a proposal by the Sub-Committee on Ship Design and Equipment, at its fifty-fifth session, and approved Guidelines on procedures for in-service maintenance and repair of coating systems for cargo oil tanks of crude oil tankers, set out in the annex.

2 Member Governments are urged to bring the annexed Guidelines to the attention of shipowners, ship builders and other parties concerned for consideration during survey, assessment and repair of protective coatings in cargo oil tanks of crude oil tankers.

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ANNEX

GUIDELINES FOR MAINTENANCE AND REPAIR OF PROTECTIVE COATINGS FOR CARGO OIL TANKS OF CRUDE OIL TANKERS

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1 GENERAL

1.1 The purpose of these Guidelines is to assist surveyors, shipowners, ship managers, shipyards, flag Administrations and other interested parties in relation to monitoring, assessment, maintenance and repair of protective coatings in crude oil cargo tanks.

1.2 The ability of the coating system to reach its target useful life depends on the type of coating system, surface preparation, the design of the structures, paint application and coating inspection and maintenance. All these aspects contribute to the good performance of the coating system. These Guidelines focus on maintenance and repair procedures for crude oil cargo tank coatings.

1.3 Maintenance and repair of the protective coating system should be included in the ship's overall maintenance and repair scheme and shall be recorded in the Coating Technical File (CTF) as per resolution MSC.288(87). The effectiveness of the protective coating system should be monitored during the life of a ship by the Administration or an organization recognized by the Administration.

2 APPLICATION AND DEFINITIONS

2.1 These Guidelines apply to ships as specified in SOLAS regulation II-1/3-11 and focus on maintenance and repair procedures for coatings in cargo tanks of all crude oil tankers, hereinafter referred to as "crude oil cargo tanks" or "cargo tanks that are intended to carry crude oil". They only cover the maintenance and repair of coatings. Corrosion prevention systems other than coating are not covered by these Guidelines.

2.2 For the purpose of these Guidelines, the following definitions apply:

.1 *Maintenance* means minor coating restoration work regularly performed by a ship's crew using normal shipboard means and tools to maintain "GOOD" or "FAIR" coating conditions. Maintenance delays or slows down the coating deterioration and effects short term steel protection.

.2 *Repair* means coating restoration work of a longer term nature, usually performed during ship's dry-docking or scheduled repair period (ship idle) to restore the "FAIR" or "POOR" coating condition to "GOOD" condition. This will usually require specialized preparation, manpower and equipment such as blasting equipment, operators and dehumidifiers together with good surface preparation procedures.

2.3 These Guidelines have been developed using the best information currently available and taking into consideration that maintenance may take place when the ship is at sea, while repair usually takes place in dry dock or during scheduled repair periods (afloat at yard).

3 SURVEY RECOMMENDATIONS

3.1 Cargo tank entry

In order to undertake a survey, entry into cargo oil tanks is required. Crude oil cargo tanks must be considered an "enclosed space" and therefore all the recommendations contained in ISGOTT (International Safety Guide for Oil Tankers and Terminals)[1] regarding enclosed space entry and gas freeing should be strictly followed. For gas freeing and venting, reference is made to ISGOTT

[1] Refer to section on entry into enclosed spaces of the current version.

for procedures and equipment for this purpose. Due attention should also be paid to the Recommendations for entering enclosed spaces aboard ships (resolution A.864(20), as amended).

3.2 Survey application

3.2.1 The coating system in cargo tanks should be examined in connection with:

.1 intermediate surveys for all crude oil tankers of 5,000 tonnes deadweight or above exceeding ten years of age;

.2 renewal surveys for all crude oil tankers of 5,000 tonnes deadweight or above; and

.3 incidents during service of the ship indicate damage to the coating of cargo oil tanks or areas coated.

3.2.2 The condition of the coating in crude oil cargo tanks should be assigned and categorized as GOOD, FAIR or POOR based on visual inspection and estimated percentage of areas with coating failure and rusty surfaces (see table 1) and recorded[2]. In the case of widespread blistering[3] which has not been perforated a further evaluation of blistering percent and coating efficiency could be carried out by in order to decide categorization of coating[2].

4 COATING ASSESSMENT METHODS

4.1 "GOOD", "FAIR", "POOR"

4.1.1 The condition of the coating in crude oil cargo tanks is assigned and categorized as "GOOD", "FAIR" or "POOR", based on visual inspection and estimated percentage of areas with coating failure and rusty or blistered surfaces.

4.1.2 The definitions of coating conditions "GOOD", "FAIR" and "POOR" in the Guidelines on the enhanced programme of inspections during surveys of oil tankers (resolution A.744(18)) are as follows:

GOOD: Condition with only minor spot rusting.

FAIR: Condition with local breakdown of coating at edges of stiffeners and weld connections or light rusting over 20% or more of areas under consideration, but less than as defined for POOR condition.

POOR: Condition with general breakdown of coating over 20% or more of areas or hard scale at 10% or more of areas under consideration.

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2 Refer to appendix 10 to IACS Recommendation 87 – Guidelines for Coating Maintenance and Repairs for Ballast Tanks and Combined Cargo/Ballast Tanks on Oil Tankers, revision 1, 2006 – published by Witherby.

3 Blisters are a symptom of coating deterioration and should be noted when observed although the affected area does not require immediate repair. ISO 4628-2, 2003 describes how to assess blisters and rust, etc. IACS Recommendation 47, paragraph 4.3.2 may also provide guidelines for assessing areas.

4.1.3 These Guidelines clarify the above definitions in order to achieve unified assessment of cargo tank coating conditions as follows, see also table 1 below:

GOOD: Condition with spot breakdown on less than 5% of the area under consideration without visible failure of the coating, or non perforated blistering. Breakdown at edges or welds should be less than 20% of edges or weld lines in the area under consideration.

FAIR: Condition with breakdown of coating or penetration on less than 20% of the area under consideration. Total paint failure should be less than 10% of the area under consideration. Breakdown at edges or welds should be less than 50% of edges or weld lines in the area under consideration.

POOR: Condition with breakdown of coating or penetration on more than 20% or on total paint failure more than 10% of the area under consideration or local breakdown concentrated at edges or welds on more than 50% of edges or weld lines in the area under consideration.

Table 1 – "GOOD", "FAIR" and "POOR" coating conditions

	GOOD [3]	**FAIR**	**POOR**
Breakdown of coating (spot breakdown) [1][3]	< 5%	5 – 20%	> 20%
Area of complete breakdown [1]	-	< 10%	≥ 10%
Local breakdown of coating on edges or weld lines [2]	< 20%	20 – 50%	> 50%

Notes:
1 % is the percentage calculated on basis of the area under consideration or of the "critical structural area".
2 % is the percentage calculated on basis of edges or weld lines in the area under consideration or of the "critical structural area".
3 Spot breakdown, i.e. rusting in spots without visible failure of coating.

4.2 Areas under consideration

4.2.1 General

4.2.1.1 Recognizing that different areas in the tank experience different coating breakdown and corrosion patterns or erosion, the intent of this section is to subdivide the planar boundaries of the tank for evaluation of coating into areas small enough to be readily examined and evaluated by the surveyor. However, the areas subdivided should not be so small as to be structurally insignificant or too numerous to practically report on. Coating condition in each area should be reported using current practice and terminology (frame numbers, longitudinal numbers and/or strakes numbers, etc.). Each area is then rated "GOOD", "FAIR" or "POOR" and the tank rating should not be higher than the rating of its "area under consideration" having the lowest rating[4].

[4] Examples of how to report coating conditions with respect to areas under consideration are given in appendix 10 of IACS Recommendation 87 – published by Witherby.

4.2.1.2 Special attention should be given to coating in critical structural areas which are defined[5] as "locations which have been identified from calculations to require monitoring as indicated in the CTF from new building stage or from the service history of the subject ship or from similar or sister ships (if available) to be sensitive to cracking, buckling corrosion or erosion which would impair the structural integrity of the ship". Each critical structural area is rated "GOOD", "FAIR" or "POOR", applying table 1 and the rating of each "area under consideration" should then not be higher than the rating of its critical structural area (if present) having the lowest rating.

4.2.1.3 The ship specific guidelines should include, as an appendix, the actual details of the coated areas in each tank together with other details as specified in paragraph 7.2.2 of these Guidelines.

4.2.2 Coated areas of crude oil cargo tanks in oil tankers

4.2.2.1 Deck head with upper transverses and longitudinal bulkheads

Areas of under deck and bulkhead plating with attached structure (one area to consider for deck head and one area to consider for each bulkhead upper part with any structure and access platforms or stringers).

4.2.2.2 Bottom plating with transverse and longitudinal lower bulkheads

Areas of tank bottom, side and longitudinal bulkheads (hoppers) with attached structure (if any), in the lower coated areas.

4.2.2.3 Swash bulkheads

The upper and lower parts of all swash bulkheads located in cargo tanks together with any frames, brackets, and access outfittings in way.

4.2.2.4 Stringers

Stringers located outside the prescribed upper and lower coating areas are not required to be coated. However, in the case that shipowners have voluntarily coated the upper surfaces of such stringers then these coated surfaces should be included in reports solely for shipowner's benefit and choice of any action.

4.2.2.5 Transverse bulkheads (forward and aft)

Areas of transverse bulkheads and attached stiffeners and access outfittings in upper forward and aft transverse bulkheads.

4.3 In-service condition monitoring

In cases where tank entry is made and coating condition monitoring is carried out and a report provided, it should be in a format as set out in the appendix.

[5] Refer to appendix 5 of IACS Recommendation 87 – published by Witherby.

5 COATING MAINTENANCE

5.1 Process considerations when coating maintenance may be performed

5.1.1 The following considerations should be taken into account when coating maintenance is undertaken:

.1 safety, including tank entry requirements;

.2 tank surface cleaning;

.3 salt contamination;

.4 rust scale;

.5 pitting corrosion;

.6 temperature;

.7 condensation;

.8 ventilation; and

.9 compatibility of coating systems.

5.1.2 **Safety**. Refer to the Recommendations for entering enclosed spaces aboard ships (resolution A.864(20)), as amended, and ISGOTT[6]. It is an absolute requirement that all of the ship's safety and tank entry procedures and policies are adhered to. All risks for the entry into tanks should be taken into account. In addition, it is strongly recommended that all travel coating squad members are trained in safe usage of all the equipment and tools to be used for the project on board, before being sent to the ship.

5.1.3 **Tank and surface cleaning**. Inadequate tank and surface cleaning, may leave a few microns of oil film thickness on the surface which will seriously affect any coating attachment and will shorten the effective life of the maintenance undertaken – see paragraph 6.1.3.

5.1.4 **Salt contamination** will cause accelerated deterioration of the maintenance coating if not removed prior to coating application. A recommended procedure to reduce salt contamination is to remove corrosion products including rust and black scale before washing the steel surface with fresh water. This should be the starting point in any surface preparation process in cargo tanks on board ships.

5.1.5 **Rust scale** that is not removed prior to coating application will cause early failure. Loose top-scale is easy to remove, however the inner (black) hard scale is much more adherent. When over-coated it will soon detach between the steel and the scale and come off, typically with the coating adhering very well to the outside of it. If the hard scale is not removed, the service life expectancy of the treatment is maximum 1 to 2 years regardless of the coating used.

[6] Refer to section on entry into enclosed spaces of the current version.

5.1.6 **Pitting corrosion** is a common problem in unprotected areas of cargo tanks that have been exposed to crude oil for some time. If it has been accepted that the pits need not be welded up, in order to prevent further accelerated damage, a coating should be applied. Soluble salts will be present within the pits and it is essential that these are removed otherwise corrosion will soon start inside over-coated pits, affecting the service life. As salt contamination is concentrated in pits the use of ISO 8502-6 and ISO 8502-9 may result in misleading results. Various methods of salt removal from pits have been proposed for long term repair, however, for shipboard maintenance purpose, high pressure fresh water washing is recommended.

5.1.7 **Temperature** is a critical parameter to consider. When trading in cold water, the risk of condensation is increased and the curing of two-component paints such as epoxy paints is retarded. Plan, if possible, the maintenance operation for periods, or locations, of warmer water. Otherwise lowering ballast water in side and double-bottom tanks to avoid contact with the back side of plating to be treated is recommended.

5.1.8 **Condensation** is always a risk on board ships. It is advisable that the crew have a good understanding about relative humidity and its relation to substrate temperature and dew point. A coating applied over a surface that is at or below the dew point, or that will be at or below the dew point while the coating is still curing, will not perform. Ideally the temperature should be at least 3°C above the dew point.

5.1.9 **Ventilation** is a vital factor for safety and quality of the coating application and must be carried out continuously during surface preparation, paint application, drying and curing. Ventilation arrangements must provide maximum efficiency, e.g., by arranging the ventilation so it extracts from the lowest and furthest corners to ensure the fast and efficient removal of solvents. The use of solvent free coating systems eliminates solvent release from the paint, but ventilation is still required during surface preparation and curing.

5.1.10 **Compatibility of coating systems** is of utmost importance for a good end result. To ensure compatibility of coating systems, using the same coating system as was originally employed is recommended. If this is not possible, the coating manufacturer recommendations should be followed. When applying touch up, the intact coat next to the damaged area should be feathered for good adhesion.

5.2 Principles for maintenance

Maintenance process:

.1 tank washing and oil film/mud removal and venting;

.2 fresh water rinsing;

.3 drying; and

.4 surface preparation, de-scaling/degreasing.

5.3 Recommended maintenance

Table 2 describes the recommended maintenance to maintain "GOOD" or "FAIR" coating conditions.

Table 2 – Recommended maintenance

Purpose	Preparation[7]	Coating system	Dry Film Thickness (DFT)
Maintenance of affected area • GOOD to GOOD • FAIR to FAIR	• Removal of cargo residues, mud, oil, grease, etc., by suitable tank cleaning • Drying • St 3[8] or equivalent according to manufacturer's recommendation • Check ambient conditions	• Epoxy-based system • The same coating system as was originally employed or according to manufacturer's recommendation	• According to manufacturer's recommendation

6 COATING REPAIRS

6.1 Process considerations when coating repairs may be performed

6.1.1 The following considerations should be taken into account when coating repairs are undertaken:

.1 safety, including tank entry requirements;

.2 tank cleaning;

.3 staging;

.4 salt contamination;

.5 rust scale;

.6 pitting corrosion;

.7 temperature;

.8 condensation;

.9 ventilation;

.10 dehumidification;

[7] Repair of pitted areas within the limits imposed by the Classification Society may require special treatments such as application of fillers before application of epoxy coatings.

[8] 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.

.11 compatibility of coating systems; and

.12 stripe coating/design/surface area.

6.1.2 **Safety**. Refer to the Recommendations for entering enclosed spaces aboard ships (resolution A.864(20)), as amended, and ISGOTT[9]. It is an absolute requirement that all of the ship's safety and tank entry procedures and policies are adhered to. When a ship is out of service, in a ship yard repair, local regulations apply regarding safety. The ship yard is responsible for their implementation.

6.1.3 **Tank cleaning**. Successful tank cleaning requires longer termed planning ahead, even for previous voyages to ensure concentrated Crude Oil Washing (COW) is carried out at the port(s) of discharge for the relevant cargo tanks. Especial attention should be given to tanks and areas to be cleaned and treated.

6.1.4 Subsequent to COW of the relevant tanks, water washing, that may include the use of suitable tank cleaning detergent, and the use of fresh water, will be required. If deadweight and draft limitations of preceding voyage allow collecting substantial quantities of fresh water from rivers or other sources, this will make for a much more successful water washing as it will limit the salt contamination of tank surfaces and facilitate hand washing during surface preparations. The aim of the tank cleaning is to provide surfaces without oil residues on areas to be repaired.

6.1.5 The shipowner's office must be contacted to confirm availability and reserve capacity for oily tank washings disposal ashore at subsequent ports. Similar good communication and co-operation will also be required even for programmed coating repairs.

6.1.6 Special care must be taken during the use of solvents and detergents which are essential to ensure oil free surfaces for good adhesion of future coats. Due consideration should be paid to the disposal of these solvents and detergents from the view points of protection and environment. The gases released to the tank atmosphere by these solvents are explosive and toxic or poisonous and should be removed as fast as possible from the tank atmosphere. Thus venting and gas freeing equipment and procedures as recommended in ISGOTT should be established.

6.1.7 When possible, control of the relative humidity during actual application of coating would increase the longevity of the coating and its adherence to the structure. Dehumidification is usually only an option during repairs alongside at an organized repair facility.

6.1.8 **Staging** must be arranged to allow good access to all surfaces. Staging must be arranged according to prevailing safety regulations. Staging poles and working platforms should be placed in a distance from the surface to provide suitable work space for all subsequent operations, special care should be taken secure access to corrugated bulkheads.

6.1.9 **Salt contamination** will cause accelerated deterioration of the coating if not removed prior to coating application. A recommended procedure to reduce salt contamination is to remove loose rust scale followed by thorough fresh water rinsing, preferably at elevated temperatures and high pressure. Test the salt content after washing and before coating using standard ISO 8502-9 or other equivalent method[10] and rewash if necessary. Observe, that salt contamination is concentrated in pits on pitted surfaces and the use of ISO 8502-6 and ISO 8502-9 may result in misleading results. This should be the starting point in any surface

[9] Refer to section on entry into enclosed spaces of the current version.

[10] Refer to MSC.1/Circ.1381 on Modifications to footnotes in the coating performance standards adopted by resolutions MSC.215(82) and MSC.288(87).

preparation process in cargo oil tanks on board ships after having thoroughly removed any oil contamination. In case of major repair or full recoating, any deviation should be agreed between the parties concerned and noted in the CTF.

6.1.10 **Rust scale** that is not removed prior to coating application will cause early failure. Loose top-scale is easy to remove, however the inner (black) hard scale is much more adherent. When over-coated it will soon detach between the steel and the scale and come off, typically with the coating adhering very well to the outside of it. If the hard scale cannot be removed, the service life expectancy of the treatment is 1 to 2 years regardless of the coating used.

6.1.11 **Pitting corrosion** is a major problem on board ships on area that have been exposed to seawater for some time. If it has been accepted that the pits need not be welded up in order to prevent further accelerated damage, a coating should be applied. Soluble salts will be present within the pits and it is essential that these are removed otherwise corrosion will soon start inside over-coated pits, affecting the service life. Various methods of salt removal from pits have been proposed. For example, water jetting followed by blast cleaning or possibly exposure to high humidity and repeated water jetting. Whichever method is chosen, any residues from the washing processes should be removed otherwise the soluble salt will precipitate out of the water on drying.

6.1.12 **Temperature** is a critical parameter to consider. When repairs are carried out in a shipyard, proper surface temperature control can more readily be achieved in the areas requiring coating.

6.1.13 **Condensation** is always a risk. It is an absolute necessity that the contractors have a good understanding about relative humidity and its relation to substrate temperature and dew point.

6.1.14 Applying coating on the surface that is at or below the dew point, or that will be at or below the dew point while the coating is wet, will not perform. Ideally the temperature should be at least 3°C above the dew point.

6.1.15 **Ventilation** is a vital factor for safety and quality of the coating application and must be carried out continuously during surface preparation, paint application, drying and curing. Ventilation arrangements must provide maximum efficiency, e.g., by arranging the ventilation so it extracts from the lowest and furthest corners to ensure the fast and efficient removal of solvents. The use of solvent free coating systems eliminates solvent release from the paint, but ventilation is still required during surface preparation and curing.

6.1.16 **Dehumidification** of the tank or space to be coated effectively prevents rerusting of the steel after surface preparation and allows paint application on a dry steel substrate. This will not only ensure that the paint is applied under proper conditions, but it will also reduce delays and thus improves productivity. There are two different types of dehumidification, i.e. desiccant and refrigeration. Both work well, the desiccant type being ideal in moderate and cold climates, and the refrigeration type in warmer climates. Dehumidification to 40% to 50% relative humidity is recommended.

6.1.17 **Compatibility of coating systems** is of utmost importance for a good end result. Unless the original coating system is totally removed, a coating system compatible to the original system should be used in accordance with the paint manufacturer recommendations. The coating system requires a Statement of Compliance or Type Approval Certificate according to the Performance standard for protective coatings for cargo oil tanks of crude oil tankers (resolution MSC.288(87)).

6.1.18 **Stripe coating/design/surface areas** should be differentiated with respect to coating application as degree of access varies. Edges, corners, weld seams and other areas that are difficult to coat need special treatment. "Stripe coating" is used to produce a satisfactory coating and to obtain specified Dry Film Thickness (DFT) on such areas. Stripe coats should be applied as a coherent film showing good film formation and no visible defects, such as pores or de-wetted areas. The application method employed should ensure that all areas which cannot be adequately coated by spray application are properly stripe coated.

6.1.19 It is recommended to apply a stripe coat before or after each main coat. This should be done using a colour that contrasts with each main coat, as this makes it easier to see that the stripe coat is satisfactory.

6.2 Principles for repairs

6.2.1 Repair process:

.1 tank cleaning, ventilation/gas-freeing and mucking-out;

.2 de-scaling;

.3 degreasing and oil film removal;

.4 fresh water rinsing;

.5 drying; and

.6 surface preparation (surface preparation method chosen depends on the amount of failure and the service life intended – see relevant tables 3.1 to 3.3 below).

6.2.2 It is essential that, if a contractor is providing the service, he can prove that all personnel are fully qualified to carry out the required work. It is also necessary that, whilst on board, the team is fully conversant with appropriate ship operation, safety and evacuation requirements.

6.2.3 It should be realized that more control over the coating process can be achieved in dock and, hence, the overall cost effectiveness of repair must establish whether the required service life will be achievable.

6.3 Recommended repair

6.3.1 Tables 3.1, 3.2 and 3.3 describe the recommended short, medium and long-term repairs.

6.3.2 Coating repair should be inspected by qualified inspectors certified to NACE Coating Inspector Level 2, FROSIO Inspector Level III or equivalent as verified by the Administration.

Table 3.1 – Recommended SHORT term repair

Purpose	Preparation[1]	Coating System		Dry film thickness (DFT)
Repair of affected area • POOR to GOOD • FAIR to GOOD	• Removal of mud, cargo residues, grease, etc., thorough tank cleaning • Drying • St 3 to Sa 2[11] surface preparation • Intact coating next to damage area should be feathered • Total soluble salts, calculated as sodium chloride, according to manufacturer's recommendation but not more than 80 mg/m^2 • Particular focus on pitted steel • Climatic control	(Not recommended for tankers of less than 18 years of age)	• Coating system approved according to resolution MSC.288(87) • The same coating system as was originally employed, or a coating system compatible with the original system, or equivalent according to manufacturer's recommendation. (Care must be taken to confirm that the coating used will have the necessary adhesion to such a surface for the target coating life)	• 250 µm DFT[12] • Minimum two spray coats with two stripe coats

Note: For partial or small spot area repairs it is well understood that these recommendations might not be possible but suitable preparation for the paint system being used should be according to paint manufacturer's recommendations.

[11] Refer to ISO 8501-1, 1998, Suppl.: 1994.

[12] Coating used approved at 320µm DFT, according to resolution MSC.288(87), is satisfactory for short-term at 250µm DFT.

Table 3.2 – Recommended MEDIUM term repair

Purpose	Preparation[1]	Coating System		Dry film thickness (DFT)
Repair of affected area • POOR to GOOD • FAIR to GOOD	• Removal of mud, cargo residues, grease, etc., thorough tank cleaning • Drying • Minimum Sa 2 to 2½[13] surface preparation • Re-cleaning with detergent • Intact coating next to damage area should be feathered • Total soluble salts, calculated as sodium chloride, according to manufacturer's recommendation but not more than 80 mg/m^2 • Particular focus on pitted steel • Climatic and temperature control	(Not recommended for tankers of less than 10 to 12 years of age)	• Coating system approved according to resolution MSC.288(87) • The same coating system as was originally employed, or a coating system compatible with the original system, or equivalent according to manufacturer's recommendation. (Care must be taken to confirm that the coating used will have the necessary adhesion to such a surface for the target coating life)	• 280 µm DFT[14] • Minimum two spray coats with two stripe coats

Note: For partial or small spot area repairs it is well understood that these recommendations might not be possible but suitable preparation for the paint system being used should be according to paint manufacturer's recommendations.

[13] Refer to ISO 8501-1, 1998, Suppl.: 1994.

[14] Coating used approved at 320µm DFT, according to resolution MSC.288(87), is satisfactory for medium-term at 280µm DFT.

Table 3.3 – Recommended LONG term repair

Purpose	Preparation[1]	Coating System		Dry film thickness (DFT)
Repair of affected area • POOR to GOOD • FAIR to GOOD	• Removal of mud, cargo residues, grease, etc., thorough tank cleaning • Drying • Minimum Sa 2½[13] surface preparation • Re-cleaning with detergent • Intact coating next to damage area should be feathered • Total soluble salts, calculated as sodium chloride, according to manufacturer's recommendation but not more than 50 mg/m^2 • Particular focus on pitted steel • Continuous climatic and plating surface temperature control (for condensation as well as application and curing temperature limitations of the paint system)	(Required for tankers of less than 5 to 7 years of age)	• Coating system approved according to resolution MSC.288(87) • The same coating system as was originally employed, or a coating system compatible with the original system, or equivalent according to manufacturer's recommendation.	• 320 µm DFT • Minimum two spray coats with two stripe coats

Note: For partial or small spot area repairs it is well understood that these recommendations might not be possible but suitable preparation for the paint system being used should be according to paint manufacturer's recommendations.

7 COATING TECHNICAL FILE (CTF)

7.1 Maintenance and repair activities should be recorded in the CTF in accordance with the relevant section of these Guidelines[15] and should be carried out in accordance with the procedures and recommendations provided in the CTF.

7.2 For maintenance, the following should be reported in the CTF:

.1 copy of Technical Data Sheet, including:

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

.1.2 materials, components and composition of the coating system, colours;

.1.3 minimum and maximum dry film thickness;

.1.4 application methods, tools and/or machines;

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

.1.6 environmental limitations (temperature and humidity); and

.2 ship maintenance records of coating application, including:

.2.1 applied actual space and area (in square metres) of each compartment;

.2.2 ambient condition during coating; and

.2.3 method of surface preparation.

7.3 For repairs, the CTF should contain at least the following:

.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, colours;

.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);

[15] Resolution MSC.288(87), paragraph 3.4.3.

.3 shipyard work records of coating application, including:

.3.1 applied actual space and area (in square metres) of each compartment;

.3.2 applied coating system;

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

.3.4 ambient condition during coating; and

.3.5 method and standard of surface preparation;

.4 coating log issued by the coating inspector, stating that the coating was applied in accordance with the specifications to the satisfaction of the coating supplier representative and specifying deviations from the specifications (example of daily log and non-conformity report (see annex 2 to resolution MSC.288(87));

.5 shipyard's verified inspection report, including:

.5.1 completion date of inspection;

.5.2 result of inspection;

.5.3 remarks (if given); and

.5.4 inspector signature; and

.6 procedures for in-service maintenance and repair of coating system, if different than original coating system.

8 REFERENCES

IACS Recommendation 87 – Guidelines for Coating Maintenance and Repairs for Ballast Tanks and Combined Cargo/Ballast Tanks on Oil Tankers, revision 1, 2006.

ISGOTT (International Safety Guide for Oil Tankers and Terminals), 5th edition 2006.

Resolution A.864(20) – Recommendations for Entering Enclosed Spaces Aboard Ships, as amended.

Note: The above references are for information purposes only.

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APPENDIX

STANDARDIZED REPORT INFORMATION

1 Ship's identity, including name and IMO number

2 Tank number

3 Inspection date

4 Name of inspector and inspecting body

5 Year last coated, either delivery date or latest repair

6 Coating name/type, manufacturer and product identification used

7 Last repaired

8 Surface area, designation and size

9 Coating condition (GOOD, FAIR or POOR)

10 Pitting corrosion – Yes/No

11 Blistering – Yes/No, blisters perforated – Yes/No

12 Amount of breakdown (in m^2 or % of areas under consideration)

13 Sounding pipe condition

14 Vent pipe and purge pipe condition

15 Pipes condition

16 Bellmouth condition and erosion underneath

17 Conditions of coatings of Permanent Means of Access (PMA)

18 Other comments (for example structural damage, mechanical damage, location and extent)