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GUIDELINES FOR MAINTENANCE AND REPAIR OF PROTECTIVE COATINGS

Development of guidelines for implementation of the Performance Standard for protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers (resolution MSC.215(82))

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SUMMARY

Executive summary: This document advises IMO of the outcome of the Industry JWG/Coatings in their development of Guidelines for implementation of resolution MSC.215(82) – Performance Standard for protective coatings. It also highlights two areas of ambiguity for clarification by IMO.

Action to be taken: Paragraph 9

Related document: Resolution MSC.215(82)

Introduction

1 After the adoption of the Performance Standard for protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers (PSPC) at MSC 82 as resolution MSC.215(82), a number of guidelines for implementation were published within the industry. An industry joint working group (JWG/Coatings) was established in March 2007, chaired by IACS, in order to combine these into an industry guideline. The working group met in the Republic of Korea from 22 to 24 May 2007 and in Genova on 28 August 2007 in order to develop this guideline.

2 Members of this working group included, in addition to the sponsors of this submission, CESS (Committee for Expertise of Shipbuilding Specifics), MARTECMA (Marine Technical Managers Association), KOSHIPA (The Korea Shipbuilder's Association), SAJ (Shipbuilders' Association of Japan), CSNAME (Chinese Society of Naval Architects & Marine Engineers), JSTRA (Japan Ship Technology Research Association) and JPMA (Japanese Paint Manufacturers Association).

For reasons of economy, this document is printed in a limited number. Delegates are kindly asked to bring their copies to meetings and not to request additional copies.

Guidelines for implementation

3 Due to the size and content of the document, the group agreed to work in the following manner. Items which members of the working group felt should be included were then discussed and if a consensus was reached then these were included in the guideline. Anything that was included had to add value to the guidelines and make implementation clearer.

4 The final agreed version of the Guideline is attached as annex to this document.

5 Whilst the Guideline includes all areas on which industry felt clarification or uniform guidance was needed and was in agreement, it was accepted by the JWG that this document is a live document which will need to be updated in light of future experience in the implementation of the PSPC. The Guideline will need to be amended prior to circulation once the two items for clarification (see paragraphs 6 to 8 below) have been resolved.

Items for clarification

6 During the development of the industry guideline it became clear that there were two areas where the wording in the PSPC is ambiguous and upon which industry was clearly divided as to the meaning and intent. On these two items, concerning the soluble salts and the stripe coat method, it was agreed to ask IMO for clarification as to their original intent, and decide the correct interpretation.

Soluble salts

7 The two understandings of the wording regarding measurement of soluble salts (as stated in items 2.2 and 3.6 of table 1 of resolution MSC.215(82)) are:

The conductivity of total soluble salts are measured in accordance with ISO 8502-6 and ISO 8502-9, and compared with the conductivity of 50 mg NaCl. If the measured conductivity is lower then it is acceptable; and

The total soluble salts are measured in accordance with ISO 8502-6 and ISO 8502-9, and then the quantity of NaCl in that sample is calculated using conversion factor based upon experience of the shipyard. This result should be less than 50 mg NaCl.

It should be noted that this matter was discussed at length during DE 49 and was included in the working group report (DE 49/WP.3, paragraph 16), however, there is still no common understanding in the industry on the intent.

Stripe coat method

8 The PSPC states that “Stripe coats shall be applied by brush or roller. Roller to be used for scallops, ratholes, etc., only”.

The two understandings of this are:

Stripe coating can be done using a brush or a roller, in ratholes scallops etc. a roller must be used not a brush; and

Stripe coating can be done by brush or roller, a roller may only be used in ratholes, scallops etc.

Action requested of the Sub-Committee

9 Considering the urgent nature of the above issues for the proper preparation and implementation of the Performance Standard for protective coatings (resolution MSC.215(82)) by the Administrations and the industry in time for entry into force on 1 July 2008, the Sub-Committee is invited to review the above, with the aim of:

- .1 clarification on the original intent and understanding of the measurement of soluble salts and stripe coating method (paragraphs 7 and 8); and
- .2 circulation of the industry guideline for implementation of resolution MSC.215(82) developed by the industry JWG with recommendation of its use by Member States, industries and other concerned parties (paragraph 4 and annex).

ANNEX

GUIDELINE FOR IMPLEMENTATION OF

**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))**

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Preface

The purpose of this Guideline is to provide guidance for implementation of “*Performance Standard for Protective Coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers* (hereinafter referred to as “PSPC”) referred in the amendments to regulations II-1/3-2 and XII/6 of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended adopted by resolution MSC.216(82).

The terms used in this Guideline have the same meaning as those defined in PSPC.

These guidelines are developed based on the current available and approved types of paints and it is recognised that new types of paint maybe developed in the future for which all these requirements may not be appropriate. It is recognised in these guidelines but that any deviation from these requirements will be specific to the paint being approved and form part of the testing and approved process to confirm their compliance with the requirements of resolution MSC.215(82) as amended.

Definitions

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

- 2.1 *Ballast tanks* are those as defined in the guidelines for the selection, application and maintenance of corrosion preventions systems of dedicated seawater ballast tanks (resolution A.798(19)) and the Guidelines on the enhanced programme of inspections during surveys of bulk carriers and oil tankers (resolution A.744(18), as amended)
- 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 particle matter present on a surface prepared for painting, arising from blast cleaning or other surface preparation processes, or resulting from the action of the environment.
- 2.5 *Edge grinding* is the treatment of edge before secondary surface preparation.
- 2.6 “*GOOD*” *condition* is the condition with minor spot rusting as defined in resolution A.744(18).
- 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. 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 x 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 paint manufacturers’ Product Data Sheet which contains detailed technical instruction and information relevant to the coating and its application.

Application (SOLAS vs IACS)

The Performance Standard for Protective Coating (PSPC), made mandatory by SOLAS II-1, A-1, Reg. 3-2, was adopted by the IMO Maritime Safety Committee (MSC 82) in Istanbul, 8 December 2006.

For SOLAS the dates of entry into force are:

For ships of not less than 500 gross tonnage:

1. for which the building contract is placed on or after 1 July 2008, or
2. in the absence of a building contract, the keels of which are laid or which are at a similar stage of construction on or after 1 January 2009, or
3. the delivery of which is on or after 1 July 2012.

The coating application (including steel surface preparation etc) shall be in conjunction with:

Coating system approval:

Statement of compliance or Type Approval issued by a third party

Coating inspection:

To be carried out by qualified coating inspectors certified to NACE Coating Inspection level 2 or FROSIO Inspector level III or equivalent, during coating process, to ensure compliance with the Standard. Inspection results to be included in the Coating Technical File.

Verification:

To be carried out by the Administration or recognized organization, consisting of:

- a. reviewing the Coating Technical File
- b. checking the Technical Data Sheet and Coating system approval
- c. checking the coating identification on representative containers
- d. checking that the coating inspectors are qualified and check their reports
- e. monitor implementation of the coating inspection requirements.

For IACS the dates of entry into force are:

For ships covered by the IACS Common Structural Rules (CSR), PSPC applies

Ballast tanks of Double hull oil tankers with $L \geq 150$ m and
Ballast tanks of bulk carriers with $L \geq 90$ m,
Double skin void spaces bulk carriers $L \geq 150$ m

the standard was applied by IACS after adoption by MSC 82 on 8 December 2006, as decided by the IACS Council.

For uniform handling of CSR until 1 July 2008, IACS has adopted a Procedural Requirement (PR No. 34) covering guidelines and procedures for:

- Type Approval of coatings
- Assessment of coating inspectors' qualifications
- Administrations' engagement in inspection procedure agreement
- Verification of application of the PSPC
- Review of Coating Technical File.

General Principle for Inspection

The objective of the coating inspection is to ensure that the required minimum level and quality of protective coatings by PSPC is adequately applied.

It is recognized that in practice it is almost impossible to obtain a perfect coating that has no small imperfections, even with the best execution of this standard. Such perfect coating may only be possible under laboratory conditions. With this in mind inspectors should have a common understanding of what is the acceptable minimum level of quality of protective coatings intended by the application of this standard.

For example, the check points for DFT measurements for the judgment of 90/10 rule are clearly indicated in annex 3 of PSPC, but this cannot guarantee that 90/10 rule is perfectly achieved for the entire surface. The common understanding is that such a sampling method is enough for making the judgment, and if the sample measurements do not satisfy the criteria, additional spot checks should be taken for any area considered necessary by the coating inspector.

Unless expressly provided otherwise in PSPC (for example annex III) and this Guideline, inspection by sampling and statistical method should be adopted to the extent necessary for making practical judgment. This means that the extent of inspection could vary, depending on the quality control of shipyards, to ensure that the required minimum level and quality is achieved.

Qualifications

Coating Inspectors

PSPC Requirements

(1) *Basic requirements*

<p>3 GENERAL PRINCIPLES</p> <p>3.2 <i>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. The Administration may, if it so requires, participate in the agreement process. Clear evidence of these inspections shall be reported and be included in the Coating Technical File (CTF) (see paragraph 3.4).</i></p>
<p>6 COATING INSPECTION REQUIREMENTS</p> <p>6.1 General</p> <p>6.1.1 <i>To ensure compliance with this Standard, the following shall be carried out by the qualified coating inspectors certified to NACE Coating Inspector Level 2, FROSIO Inspector Level III or equivalent as verified by the Administration.</i></p> <p>6.1.2 <i>Coating inspectors shall inspect surface preparation and coating application during the coating process by carrying out, as a minimum, those inspection items identified in section 6.2 to ensure compliance with this Standard. Emphasis 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.</i></p> <p>6.1.3 <i>Results from the inspection shall be recorded by the inspector and shall be included in the CTF (refer to annex 2, Example of Daily Log and Non-conformity Report).</i></p>
<p>7 VERIFICATION REQUIREMENTS</p> <p><i>The following shall be carried out by the Administration prior to reviewing the Coating Technical File for the ship subject to this Performance Standard:</i></p> <p>.1 <i>check that the Technical Data Sheet and Statement of Compliance or Type Approval Certificate comply with this Standard;</i></p> <p>.2 <i>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;</i></p> <p>.3 <i>check that the inspector is qualified in accordance with the qualification standards in paragraph 6.1.1</i></p> <p>.4 <i>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</i></p> <p>.5 <i>monitor implementation of the coating inspection requirements.</i></p>

Guidance

-1 The choice of coating inspectors should be part of the inspection agreement. Any of the parties involved in the inspection agreement have the right to request for replacement of the inspector who is deemed unsuitable or unsatisfactory. If the parties to the agreement consider that such a request is justified, the inspector shall be replaced as soon as convenient.

-2 If the coating inspectors require additional test, measurement and inspection above the requirement of this section, the inspector has to have clear reason but he has the right to require additional measurement.

-3 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 to the coating inspector's satisfaction.

Coatings

Coating Systems

PSPC Requirements

(1) *Basic requirements*

Table 1—Basic coating system requirements for dedicated seawater ballast tanks of all type of ships and double-side skin spaces of bulk carriers of 150 m and upwards		
	Characteristic/Reference standard	Requirement
1 Design of coating system		
.1	Selection of the coating system	<p>The selection of the coating system should be considered by the parties involved with respect to the service conditions and planned maintenance. The following aspects, among other things should be considered:</p> <ul style="list-style-type: none"> .1 location of space relative to heated surfaces; .2 frequency of ballasting and deballasting 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 should be compatible with the cathodic protection system). <p>Coating manufacturers shall have products with documented satisfactory performance records and technical data sheets. The manufacturers should also be capable of rendering adequate technical assistance. Performance records, technical data sheet and technical assistance (if given) shall be recorded in the Coating Technical File.</p> <p>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.</p>
.2	Coating type	<p>Epoxy based systems.</p> <p>Other coating systems with performance according to the test procedure in annex 1.</p> <p>A multi-coat system with each coat of contrasting colour is recommended.</p> <p>The top coat shall be of a light colour in order to facilitate in-service inspection.</p>
.3	Coating pre-qualification test	<p>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.</p> <p>For all other systems, testing according to the procedure in annex 1, or equivalent, is required.</p>
.4	Job Specification	<p>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.</p> <p>Stripe coats shall be applied by brush or roller. Roller to be used for scallops, ratholes, etc., only</p> <p>Each main coating layer shall be appropriately cured before application of the next coat, in accordance with coating manufacturer's recommendations.</p> <p>Surface contaminants such as rust, grease, dust, salt, oil, etc. shall be removed prior to painting with proper method according to the paint manufacturer's recommendation. Abrasive inclusions embedded in the coating shall be removed. Job specifications shall include the dry-to-recoat times and walk-on time given by the manufacturer.</p>

.5	NDFT (nominal total dry film thickness)	<p>NDFT 320 µm with 90/10 rule for epoxy based coatings, other systems to coating manufacturer's specifications.</p> <p>Maximum total dry film thickness according to manufacturer's detailed specifications.</p> <p>Care shall be taken to avoid increasing the thickness in an exaggerated way. Wet film thickness shall be regularly checked during application.</p> <p>Thinner shall be limited to those types and quantities recommended by the manufacturer.</p>
3 Secondary surface preparation		
.2	Surface treatment ^f	<p>Sa 2½ on damaged shop primer and welds.</p> <p>Sa 2 removing at least 70% of intact shop primer, which has not passed a pre-qualification certified by test procedures in 1.3.</p> <p>If the complete coating system comprising epoxy based main coating and shop primer has passed a pre-qualification certified by test procedures in 1.3, intact shop primer may be retained provided the same epoxy coating system is used. The retained shop primer shall be cleaned by sweep blasting, high pressure water washing or equivalent method.</p> <p>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 in accordance with paragraph 1.7 of appendix 1 to annex 1 without wave movement.</p>
<p>4 Reference standard: ISO 8501-1:1988/Suppl: 1994. Preparation of steel substrate before application of paints and related products – Visual assessment of surface cleanliness</p>		

4.4 Basic coating requirements

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

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.

7 VERIFICATION REQUIREMENTS

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

- .1 check that the Technical Data Sheet and Statement of Compliance or Type Approval Certificate comply with this 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.

Guidance

- 1 It is anticipated that the specification of the protective coating system required by 4.4.2 may require supplementary information to that provided in the technical data sheet. Full information to fulfil the requirement of 4.4.2 shall be provided by the coating manufacturer
- 2 Light colour in these guidelines means a colour that reflects light to an extent that a simple flash light (hand torch) will make inspection easy and fast. Normally light grey, buff, off-white, swimming pool blue/green, etc. are easily distinguishable from rust.
- 3 Welded seams mean both butt and fillet welds.
- 4 To dispense the second stripe coat in scope, the DFT measurement adjacent to the welds, not further than 15mm from the welds, is acceptable. Statistical sampling measurement similar to annex 3 for flat surface is acceptable for the verification of NDFT.
- 5 Stripe coats must be applied as a coherent film showing good film formation and no visible defects such as pores or un-wet areas.
- 6 The application method employed must ensure that all areas which require stripe coating are properly stripe coated by alternative application methods which include brush or roller.

-7 Wet film thickness of each coating is typically checked by the painter for reference to achieve objectives of dry film thickness.

-8 It is recommended that steel rust grade A or B plates to be used by way of the ballast tank areas to ensure the stipulated profiles of 30 – 75 are reliably obtained and the profile gauging may be reduced accordingly when these plates are used. Where steel plate rust grade C is used then the extent of inspection should be increased focusing on profile gauging as well as salt contamination accordingly to ensure the standard is complied with.

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Note that the incoming plate before blasting should be relatively clean. Oil, grease and excessive salt contamination on the incoming plates should be removed first to the extent possible before blasting (since blasting will push these contaminants into the steel pores and profile).

-9 It is recognised that when blasting abrasive is recycled it may become contaminated with other matter including water soluble salts. Blasting abrasive is typically controlled through a Quality Control system, however this potential source of salt contamination may need to be taken into account should an increase in salt contamination be encountered.

-10 It is recognised that in some cases the steel plates may arrive at the yard already shop primed from the steel plant or paint subcontractors. In such cases full blasting to Sa 2.5 for shop primed surface shall be carried out in addition to the requirements of the standard for secondary surface preparation, unless all requirements of the standard for primary surface preparation have been complied with, including the inspection requirements of section 6.2, cleanliness/ compatibility/ maximum thickness requirements along with all proper documentation of such tests and inspections by the coating inspector.

Primary Surface Preparation (PSP)

Blasting

PSPC Requirements

(1) Basic requirements

Table 1 – Basic coating system requirements for dedicated seawater ballast tanks of all type of ships and double-side skin spaces of bulk carriers of 150 m and upwards		
	Characteristic/Reference standard	Requirement
2 PSP (Primary Surface Preparation)		
.1	Blasting and profile ^{4,5}	<p>Sa 2½; with profiles between 30-75 µm.</p> <p>Blasting shall not be carried out when:</p> <p>.1 the relative humidity is above 85%; or</p> <p>.2 the surface temperature of steel is less than 3°C above the dew point.</p> <p>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, in accordance with the manufacturer's recommendations.</p>
.2	Water soluble salt limit equivalent to NaCl ⁶	≤ 50 mg/m ² of sodium chloride.
<p>4 Reference standard: ISO 8501-1:1988/Suppl: 1994. Preparation of steel substrate before application of paints and related products – Visual assessment of surface cleanliness.</p> <p>5 Reference standard: ISO 8503-1/2:1988. Preparation of steel substrate before application of paints and related products – Surface roughness characteristics of blast-cleaned steel substrates.</p> <p>6 Conductivity measured in accordance with ISO 8502-9:1998. Preparation of steel substrate before application of paints and related products – Visual assessment of surface cleanliness – Test for the assessment of surface cleanliness</p>		

(2) Inspection requirements for the coating inspector

6 COATING INSPECTION REQUIREMENTS
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.

Guidance

-1 Where blasting is carried out in a blasting chamber the 85% humidity limit refers to the humidity inside the chamber not the outside humidity.

-2 Where:-

(1) Primary surface preparation is carried out at a facility where environmental condition and quality level do not change substantially, and;

(2) Primary surface preparation and shop primer are carried out by automation, and;

(3) Shop primer is applied immediately after blasting.

The primary surface preparation inspection requirements of 6.2 may be satisfied by periodic spot checks and this procedure is to be documented in 3.2.

Records

The results of inspection related to this section are to be recorded by the coating inspector. (See Form PSP as an example of the type of record form that could be used.)

Shop Primer Application

PSPC Requirements

(1) Basic requirements

Table 1 – Basic coating system requirements for dedicated seawater ballast tanks of all type of ships and double-side skin spaces of bulk carriers of 150 m and upwards

	Characteristic/Reference standard	Requirement
2 PSP (Primary Surface Preparation)		
.3	Shop primer	Zinc containing inhibitor free zinc silicate based or equivalent. Compatibility with main coating system shall be confirmed by the coating manufacturer.

(2) Inspection requirements for the coating inspector

6 COATING INSPECTION REQUIREMENTS		
6.2 Inspection items		
Construction stage		Inspection items
Primary surface preparation	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.

Guidance

-1 The coating manufacturer will confirm the compatibility of the shop primer in way of the PSPC test given in Table 1 3.2, paragraph 4, and perform any additional tests or data investigation which the coating manufacturer finds necessary for confirmation that the inclusion of the shop primer will provide at least equivalent performance for the coating system, indicated in 4.1 in the standard.

Records

The results of inspection related to this section are to be recorded by the coating inspector. (See Form PSP as an example of the type of record form that could be used.)

Assembly

Steel Surface Preparation

PSPC Requirements

(1) *Basic requirements*

Table 1 –Basic coating system requirements for dedicated seawater ballast tanks of all type of ships and double-side skin spaces of bulk carriers of 150 m and upwards

	Characteristic/Reference standard	Requirement
3 Secondary surface preparation		
.1	Steel condition ⁷	The steel surface 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. Edges to be treated to a rounded radius of minimum 2mm, or subjected to three pass grinding or at least equivalent process before painting.
⁷ Reference standard: ISO 8501-3:2001 (grade P2). Preparation of steel substrate before application of paints and related products – Visual assessment of surface cleanliness – Visual assessment of surface cleanliness.		

(2) *Inspection requirements for the coating inspector*

6 COATING INSPECTION REQUIREMENTS		
6.2 Inspection items		
Construction stage		Inspection items
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.
	4	Inspection to be performed of the steps in the coating application process mentioned in table 1.

Guidance

-1 “Equivalent process” means a process that produces an edge profile geometrically equivalent to, or better than that usually obtained by three pass grinding which results in an effective coating performance.

Record

The results of inspection related to this section are to be recorded by the coating inspector. (See Form SSP as an example of the type of record form that could be used.)

Secondary Surface Preparation (SSP)

PSPC Requirements

(1) Basic requirements

Table 1 – Basic coating system requirements for dedicated seawater ballast tanks of all type of ships and double-side skin spaces of bulk carriers of 150 m and upwards		
	Characteristic/Reference standard	Requirement
3 Secondary surface preparation		
.1	Steel Condition	The steel surface 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. 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 ⁴	Sa 2½ on damaged shop primer and welds. 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 coating system is used. The 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 in accordance with paragraph 1.7 of appendix 1 to annex 1 without wave movement.
.3	Surface treatment after erection ⁴	Butts St 3 or better or Sa 2½ where practicable. Small damages up to 2% of total area: St 3. Contiguous damages over 25 m ² or over 2% of the total area of the tank, Sa 2½ should be applied. Coating in overlap to be feathered.
.4	Profile requirements ⁵	In case of full or partial blasting 30-75 µm, otherwise as recommended by the coating manufacturer.
.5	Dust ⁸	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 ⁶	≤ 50 mg/m ² of sodium chloride.
.7	Oil contamination	No oil contamination.
<p>4 Reference standard: ISO 8501-1:1988/Suppl: 1994. Preparation of steel substrate before application of paints and related products – Visual assessment of surface cleanliness.</p> <p>5 Reference standard: ISO 8503-1/2:1988. Preparation of steel substrate before application of paints and related products – Surface roughness characteristics of blast-cleaned steel substrates.</p> <p>8 Reference standard: ISO 8502-3:1993. Preparation of steel substrate before application of paints and related products – Test for the assessment of surface cleanliness.</p> <p>6 Conductivity measured in accordance with ISO 8502-9:1998. Preparation of steel substrate before application of paints and related products – Visual assessment of surface cleanliness – Test for the assessment of surface cleanliness</p>		

(2) Inspection requirements for the coating inspector

6 COATING INSPECTION REQUIREMENTS		
6.2 Inspection items		
Construction stage		Inspection items
Block assembly	1	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.
	4	Inspection to be performed of the steps in the coating application process mentioned in table 1.

Guidance

- 1 “Equivalent process” means a process that produces an edge profile geometrically equivalent to, or better than that usually obtained by three pass grinding which results in an effective coating performance
- 2 Sa 2¹/₂ treatment is required to “Damaged shop primer” in the areas where the condition of the shop primer in the opinion of the coating inspector or coating manufacturer of main coating system, will result in a reduced performance of the main coating system. (Example areas of burn damage or corrosion)
- 3 St 3 may be accepted in case of surface treatment to rectify small insufficiently treated areas after blasting.
- 4 Contamination on retained shop primer shall be removed. It is not always appropriate to remove all types of contamination on the shop primer by sweep blasting or high pressure washing; this may include small areas of localized contamination. In which case contamination should be removed by an appropriate method recommended by the coating manufacturer.
- 5 The requirements for complete coating systems existing prior to date of entry into force that are qualified under 3.2 of Table 1 include those verified by satisfactory field exposure of at least 5 years.
- 6 Referring to .3 (surface treatment after erection) ‘butts’ refers to the erection joints. Damages mean, areas where the damage reaches steel surface; these require surface treatment of St 3 or Sa 2.5. Defects within the coating layers not reaching the steel surface are to be touched up to the specified DFT after appropriate treatment of coating surface. Defects are not to be counted towards the 2% or 25m2 assessment.
- 7 Lower dust size classes less than “3” are invisible on the steel surface unless they are accumulated in large quantity. Visible accumulated dust shall be removed to the extent of invisible level.
- 8 Cleaning of oil contamination is to be carried out always according to the coating manufacturer recommendation.
- 9 Representative dry film thickness shall be measured after each coat except for final coat for reference as guidance for subsequent work, and the total dry film thickness after completion of final coat shall be confirmed in accordance with annex 3.
- 10 Where any defective areas were found at inspection, all such repairs shall be checked after rectification and recorded in non-conformity report by the coating inspector
- 11 For the assessment of damaged areas of coatings reference to *ISO 4628-3:2003* Paints and varnishes Evaluation of degradation of coating Designation of quantity and size of defects, and of intensity of uniform changes in appearance Part 3 Assessment of degree of rusting may be found to be helpful.
- 12 3.3 of Table 1 of PSPC, the “coating in overlap” is to be treated according to the coating manufacturer’s recommendation. Compatibility between main coatings is to be confirmed by the coating manufacturer, where a main coating certified under 1.3 of Table 1 inevitably contacts or overlaps with another type of certified main coating, e.g. partial re-coating of damaged part and coating nearby butts, where different seasonal type of coatings have to be applied due to the change in environmental condition

Records

The results of inspection related to this section are to be recorded by the coating inspector. (See Form SSP as an example of the type of record form that could be used.)

Coating

PSPC Requirements

(1) *Basic requirements*

Table 1 – Basic coating system requirements for dedicated seawater ballast tanks of all type of ships and double-side skin spaces of bulk carriers of 150 m and upwards		
	Characteristic/Reference standard	Requirement
1 Design of coating system		
.4	Job specification	<p>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.</p> <p>Stripe coats shall be applied by brush or roller. Roller to be used for scallops, ratholes, etc. only.</p> <p>Each main coating layer shall be appropriately cured before application of the next coat, in accordance with coating manufacturer's recommendations. Surface contaminants such as rust, grease, dust, salt, oil, etc. shall be removed prior to painting with proper method according to the paint manufacturer's recommendation. Abrasive inclusions embedded in the coating shall be removed. Job specifications shall include the dry-to-recoat times and walk-on time given by the manufacturer.</p>
.5	NDFT (nominal total dry film thickness) ³	<p>NDFT 320µm with 90/10 rule for epoxy based coatings, other systems to coating manufacturer's specifications.</p> <p>Maximum total dry film thickness according to manufacturer's detailed specifications.</p> <p>Care shall be taken to avoid increasing the thickness in an exaggerated way. Wet film thickness shall be regularly checked during application.</p> <p>Thinner shall be limited to those types and quantities recommended by the manufacturer.</p>
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: <ul style="list-style-type: none"> .1 the relative humidity is above 85%; or .2 the surface temperature is less than 3°C above the dew point.
.3	Testing of coating ³	<p>Destructive testing should be avoided.</p> <p>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 final coat, using appropriate thickness gauges (see annex 3).</p>
.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.
3 Type of gauge and calibration in accordance with SSPC-PA2: 2004. Paint Application Specification No.2.		

(2) *Inspection requirements for the coating inspector*

6 COATING INSPECTION REQUIREMENTS		
6.2 Inspection items		
Construction stage		Inspection items
Block assembly	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 and outlined in annex 3.
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.

Guidance

Where:-

- (1) Primary surface preparation is carried out at a facility where environmental condition and quality level do not change substantially, and;
- (2) Primary surface preparation and shop primer are carried out by automation, and;
- (3) Shop primer is applied immediately after blasting.

The primary surface preparation inspection requirements of 6.2 may be satisfied by periodic spot checks and this procedure is to be documented in 3.2.

Records

The results of inspection related to this section are to be recorded by the coating inspector. (See Form CA and Form DFT as an example of the type of record form that could be used.)

Others

Verification

PSPC Requirements

(1) Basic requirements

3 GENERAL PRINCIPLES

- 3.1 *The ability of the coating system to reach its target useful life depends on the type of coating system, steel preparation, application and coating inspection and maintenance. All these aspects contribute to the good performance of the coating system.*
- 3.2 *Inspection of surface preparation and coating processes shall be agreed upon between the shipowner, the shipyard and the coating manufacturer and presented to the Administration for review. The Administration may, if it so requires, participate in the agreement process. Clear evidence of these inspections shall be reported and be included in the Coating Technical File (CTF) (see paragraph 3.4).*

.4 Coating Technical File

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:*
 - *product name and identification mark and/or number;*
 - *materials, components and composition of the coating system, colours;*
 - *minimum and maximum dry film thickness;*
 - *application methods, tools and/or machines;*
 - *condition of surface to be coated (de-rusting grade, cleanliness, profile, etc.); and*
 - *environmental limitations (temperature and humidity);*
- .3 *shipyard work records of coating application, including:*
 - *applied actual space and area (in square metres) of each compartment;*
 - *applied coating system;*
 - *time of coating, thickness, number of layers, etc.;*
 - *ambient condition during coating; and*
 - *method of surface preparation;*
- .4 *procedures for inspection and repair of coating system during ship construction;*
- .5 *coating log issued by the coating inspector – stating that the coating was applied in accordance with the specifications to the satisfaction of the coating supplier representative and specifying deviations from the specifications (example of daily log and non-conformity report, see annex 2);*
- .6 *shipyard's verified inspection report, including:*
 - *completion date of inspection;*
 - *result of inspection;*
 - *remarks (if given); and*
 - *inspector signature; and*
- .7 *procedures for in-service maintenance and repair of coating system².*

2 Guidelines to be developed by the Organization.

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.

7 VERIFICATION REQUIREMENTS

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

- .1 check that the Technical Data Sheet and Statement of Compliance or Type Approval Certificate comply with this 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 monitors implementation of the coating inspection requirements.

Guidance

-1 Each Coating manufacturer (main and or shop primer) should submit the following documents to the shipyard.

- (1) Copy of Statement of Compliance or Type Approval Certificate (3.4.2.1)
- (2) Copy of Technical Data Sheet (3.4.2.2)
- (3) Procedures for repair of coating system during ship construction (3.4.2.4)

-2 See the following forms for the documents to be included the "Coating Technical File" specified in 3.4.2 of PSPC. These forms are just examples and different forms may be accepted by the Administration.

- (1) Form PSP (3.4.2.3 and 3.4.2.5)
- (2) Form SSP (3.4.2.3 and 3.4.2.5)
- (3) Form CA (3.4.2.3 and 3.4.2.5)
- (4) Form DFT (3.4.2.3 and 3.4.2.5)

-3 It is important that the Coating Technical File (CTF) contains a detailed and accurate report of the whole coating process. It should be recognized that the list under 3.4.2 is a minimum recommended list of items to be included.

-4 Procedure for in-service maintenance and repair shall be included in CTF after guideline is developed.

Inspection

PSPC Requirements

Table 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 and 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 shall 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 shall 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 and outlined in annex 3.
Erection	1	Visual inspection for steel surface condition, surface preparation and verification of conformance to other

		<i>requirements in table 1, and the agreed specification shall be performed.</i>
	2	<i>The surface temperature, the relative humidity and the dew point shall be measured and recorded before coating starts and regularly during the coating process.</i>
	3	<i>Inspection shall be performed of the steps in the coating application process mentioned in table 1.</i>

Guidance

- 1 Visible accumulated dust shall be removed to the extent of invisible level.
- 2 After surface preparation and cleaning, visual inspection to check dust on the steel surface shall be carried out.
- 3 If there is no dispute among all parties to the inspection and it is agreed by those parties that it is unnecessary, then the tape test for dust may be dispensed with.
- 4 If there is no such agreement, then at least one measurement per block shall be carried out to confirm dust quantity level according to the ISO 8502-3.
- 5 In case of quantity level over “1”, corrective action to be taken to the satisfaction of coating inspector.
- 6 Confirmation that the measured DFT meets the requirements of PSPC shall be made for each tank or unit smaller than a tank, e.g., part/area of a section. At least the following items shall be recorded.
 - (1) Date and signature of the coating inspector
 - (2) Name of the tank (Name of part/area of the section, if smaller unit than the whole tank)
 - (3) Coating specification (NDFT, max. and min. thickness etc.)
 - (4) Number of measurements, minimum, maximum, average DFT readings.
- 7 Inspection for confirming suitable conditions for the erection joint prior to coating may be limited to visual inspection at the coating inspector’s discretion

Annex 3 Dry Film Thickness Measurements

PSPC Requirements

- 1 The following verification check points of DFT are to be taken:
 - .1 one gauge reading per 5 m² of flat surface areas;
 - .2 one gauge reading at 2 to 3 m intervals and as close as possible to tank boundaries, but not further than 15 mm from edges of tank boundaries;
 - .3 longitudinal and transverse stiffener members:

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

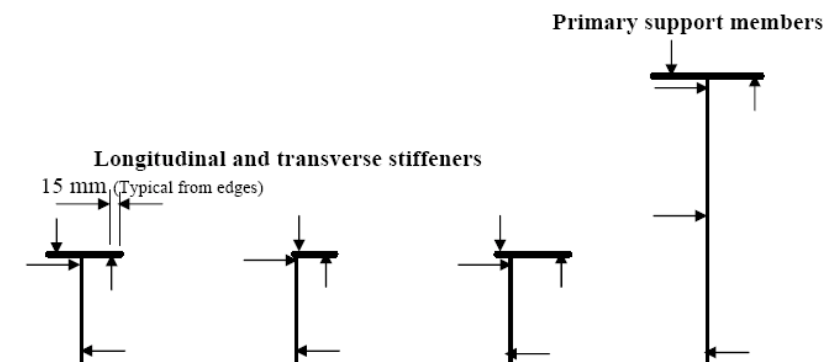


Figure 3

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

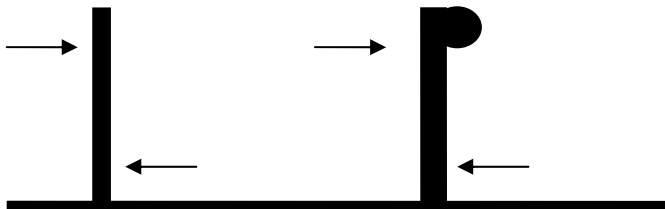
- .4 3 gauge readings for each set of primary support members and 2 gauge readings

- For each set of other members as indicated by the arrows in the diagram;*
- .5 *For primary support members (girders and transverses) one set of gauge readings
For 2 to 3 m run as shown in figure 3 above but not less than three sets;*
 - .6 *Around openings one gauge reading from each side of the opening;*
 - .7 *five gauge readings per square meter (m²) but not less than three gauge readings
Taken at complex areas (i.e., large brackets of primary support members); and*
 - .8 *additional spot checks are to be taken to verify coating thickness for any area considered necessary by the coating inspector.*

Guidance

- 1 The arrows in Figure 3 do not indicate the number of readings but indicate critical areas and should refer to both sides.
- 2 'Tank Boundaries' means the extreme longitudinal, transverse, and vertical corner welds of the tank boundary plates, and gauge readings shall be taken adjacent to the welds, not further than 15mm from the welds.
- 3 Longitudinal girders and transverse webs in double skin structure which do not have a free edge, except for openings, shall be measured as flat surface areas i.e. one gauge reading per 5m² and at least one reading per girder or transverse web.
- 4 Locations of individual gauge readings (refer to -5 and -6 below) shall be selected among those indicated by the arrows, but all critical areas should be evenly selected for total number of gauge readings.
- 5 For primary members, 1 set consisting of 3 gauge readings is required at every 2 to 3m of the member but not less than three (3) sets in any run between cross directional primary support members.
- 6 For longitudinal and transverse stiffeners (secondary members), 1 set consisting of 2 gauge readings, is required every 2 to 3m of the member but not less than 2 sets in any run between primary support members.

For Flat Bar and Bulb Flat Stiffeners



Note: The arrows in Figure above do not indicate the number of readings but indicate critical areas and should refer to both sides.

- 7 For flat and bulbous bar stiffeners (see diagram) which are not covered by Figure 3, 1 gauge reading is required every 2 to 3m of the member but not less than 2 readings in any run between primary support members.
- 8 openings are defined as having a diameter equal to or greater than 400mm.

Example Reporting Forms

Form PSP

COATING LOG (PRIMARY SURFACE PREPARATION)

Sheet No.

NAME/NO. OF SHIP	
PLATE NUMBERS	
INSPECTION DATE	

ENVIRONMENT

	BEFORE	WEATHER CHANGES				REMARKS:
MEASURED TIME						
DRY TEMP. (°C)						
RELATIVE HUMIDITY (%)						
DEW POINT (%)						
SURFACE TEMP. (°C)						

SURFACE PREPARATION

SURFACE PROFILES		REMARKS:
WATER SOLUBLE SALTS (mg/m ² of NaCl)		

SHOP PRIMER

MANUFACTURER		REMARKS:
PRODUCT NAME		
IDENTIFICATION MARK/NUMBER		
MANUFACTURER'S RECOMMENDED DFT		
MEASURED DFT.		
CURING		

COATING INSPECTOR'S NAME:
SIGNATURE:

Form SSP

COATING LOG (SECONDARY SURFACE PREPARATION)

Sheet No.

NAME/NO. OF SHIP	
PART OF STRUCTURE (BLOCK /TANK No., etc.)	
CONSTRUCTION STAGE	BLOCK ASSEMBLY / ERECTION

Steel condition Confirm

Type of Defect	Repair Method	Repair Confirm / Date

SURFACE TREATMENT

INSPECTION DATE		REMARKS
METHOD, GRADE		

COATING INSPECTOR'S NAME:

SIGNATURE:

Form CA

COATING LOG (COATING APPLICATION)

Sheet No.

	FIRST COAT		SECOND COAT	
	BEFORE	AFTER	BEFORE	AFTER
INSPECTION DATE				
ENVIRONMENT DRY TEMP. (°C) RELATIVE HUMIDITY (%) DEW POINT (%) SURFACE TEMP. ((C)				
WATER SOLUBLE SALTS (mg/m2 of NaCl)		X	X	X
DUST		X	X	X
OIL CONTAMINATION		X		X
ABRASIVE INCLUSION	X	X		
STRIPE COATS				
MANUFACTURER				
PRODUCT NAME OF COATING				
PRODUCT IDENTIFICATION MARK/ NUMBER				
REMARKS:				
COATING INSPECTOR'S NAME:				
SIGNATURE:				

Form DFT

COATING LOG (DRY FILM THICKNESS MEASUREMENT)

Sheet No.

NAME/NO. OF SHIP	
PART OF STRUCTURE (BLOCK /TANK No., etc.)	
CONSTRUCTION STAGE	BLOCK ASSEMBLY / ERECTION

DRY FILM THICKNESS MEASUREMENT

DRY FILM THICKNESS (µm)	NUMBER OF POINTS	RATIO
320 -		
288 - 320		
0 - 288		
TOTAL		100%

MAXIMUM THICKNESS (µm)	
MINIMUM THICKNESS (µm)	

REMARKS:

Final Coating Condition Confirm

Type of Defect	Repair Method	Repair Confirm / Date

COATING INSPECTOR'S NAME:

SIGNATURE: