

Coating Technical File in Accordance with the IMO Performance Standard for Protective Coatings

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ABSTRACT

The coating technical file (CTF) contains documentation relevant to the selection, specification, installation, and inspection of coatings applied to a ship's seawater ballast tanks and double-skin spaces. It also contains documentation of in-service maintenance and repair of coating system(s). These requirements originate in the International Maritime Organization (IMO)'s⁽¹⁾ "Performance Standard for Protective Coatings for Dedicated Seawater Ballast Tanks in All Types of Ships and Double-Side Skin Spaces of Bulk Carriers" (PSPC),¹ Paragraph 3.4, Coating Technical File (CTF).

KEYWORDS

Marine, Ballast, IMO, MEPC 59/2/16, BWTS, Coating, Ships, Technical File, CTF, MSC.215(82), PSPC, TG 402, STG 44.

⁽¹⁾ International Maritime Organization (IMO), 4 Albert Embankment, London SE1 7SR, United Kingdom.

Foreword

The coating technical file (CTF) contains documentation relevant to the selection, specification, installation, and inspection of coatings applied to a ship's seawater ballast tanks and double-skin spaces. It also contains documentation of in-service maintenance and repair of coating system(s). These requirements originate in the International Maritime Organization (IMO)'s⁽¹⁾ "Performance Standard for Protective Coatings for Dedicated Seawater Ballast Tanks in All Types of Ships and Double-Side Skin Spaces of Bulk Carriers" (PSPC),¹ Paragraph 3.4, Coating Technical File (CTF).

This standard is intended for use by parties responsible for the construction of ships in compliance with IMO Resolution MSC.215(82).²

The benefits of the extensive documentation process requirements are twofold. The first is to ensure the coating system(s) is properly installed; the documentation serves as a quality control (QC)/quality assurance (QA) process. The second is to provide important historical data on the new-build's coating system(s) installation for future reference and provide a documentation system for ongoing maintenance and repair of coating system(s). The coating system(s) historical information is best collected and presented with an efficient information access system during the lifetime of the ship.

This standard was prepared by NACE Task Group 402, "PSPC Coating Technical File Standard Practice," which is administered by Specific Technology Group (STG) 44, "Marine Corrosion: Ships and Structures." It is cosponsored by STG 02, "Coatings and Linings, Protective—Atmospheric," STG 03, "Coatings and Linings, Protective—Immersion and Buried Service," and STG 04, "Coatings and Linings, Protective—Surface Preparation." This standard is published by NACE under the auspices of STG 44.

In NACE standards, the terms **shall**, **must**, **should**, and **may** are used in accordance with the definitions of these terms in the NACE Publications Style Manual. The terms **shall** and **must** are used to state a requirement, and are considered mandatory. The term **should** is used to state something good and is recommended, but is not considered mandatory. The term **may** is used to state something considered optional.

⁽¹⁾ International Maritime Organization (IMO), 4 Albert Embankment, London SE1 7SR, United Kingdom.

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1. General	4
2. Definitions	5
3. Coating Technical File Formats.....	5
References.....	12

FIGURES

Figure 1: Coating Technical File Requirements	7
Figure 2: Work and Inspection Records Comparison	10
Figure 3: Work and Inspection Records.....	11
Figure 4: In-Service Maintenance Coating Technical File Requirements.....	12

Section 1: General

- 1.1** This standard describes a “best practices” approach to satisfying the CTF requirements of the IMO PSPC for seawater ballast tanks and double-side skin spaces. The guidelines provided are for use with implementation of hard-copy data collection systems as well as flat file electronic and relational database systems.
- 1.1.1** Best practices can also be defined as the most efficient (least amount of effort) and effective (best results) way of accomplishing a task, based on repeatable procedures that have proved themselves over time for large numbers of people. A given best practice is only applicable to a particular condition or circumstance and may have to be modified or adapted for similar circumstances. In addition, a “best” practice can evolve to become better as improvements are discovered.
- 1.2** The primary goal of this standard is to provide an efficient and accurate methodology for the collection, management, and presentation of the data required by the PSPC and to facilitate the ongoing corrosion management of seawater ballast tanks and double-side skin spaces to reach the intended 15-year service life of installed coating systems.
- 1.2.1** The preconstruction phase documents, including selection of the coating system, inspection procedures, coating process, coating inspector qualification, and repair procedures for the coating during construction (areas that may become damaged during construction efforts or nonconforming installed coatings), establish an engineered path for the installation of the coatings on seawater ballast tanks or double-side skin spaces. This first step ends with the tripartite agreement, which shall be agreed on and signed by the shipyard or builder, coating manufacturer, and ship owner.
- 1.2.2** The second step is to ensure that the coatings are installed as specified. This shall be accomplished through extensive inspection and verification that the coating system is installed as specified in the tripartite agreement. This portion of the process could potentially generate thousands of sheets of documentation in support of the work effort and subsequent inspections. The requirements as noted in PSPC Paragraphs 3.4.2.3 and 3.4.2.5 overlap significantly in the data point collection. This duplication of effort can be identified as a quality control (QC)/quality assurance (QA) set of processes.
- 1.3** The CTF supplied to the ship should be in a standardized language format; English is currently the language used for the balance of IMO documentation. Therefore, the logical decision is to deliver the CTF to be kept shipboard in English. However, to remain practicable during the execution of the work, the majority of work and inspection records pertaining to the installation of the cited coatings should be collected in the native language. The required reports shall be translated into English for inclusion in the CTF.
- 1.4** Whereas completely electronic data acquisition and management systems have the ability to collect, manage, and present all the project data and require minimal space to store, this technology solution may not be employed by all shipyards, or effectively utilized by ships’ personnel. Therefore, this standard addresses methods from hard-copy, hand-written forms through relational database-type systems.
- 1.5** The amount of data gathered during the application of ballast tank coatings when a ship is constructed as required by the IMO PSPC is significant. The requirements as noted in PSPC Paragraphs 3.4.2.3 and 3.4.2.5 overlap significantly in the data point collection. This standard strives to prioritize the value of the collected data for process verification during construction and management and presentation of said data for effective engineering use during the lifetime of the ship.
- 1.5.1** The familiarity and accuracy of data collection is significant with regard to performance of inspections. The goal of this process is to ensure the coatings are properly installed with appropriate documentation. A practical solution is to require the CTF deliverable to be summary sheets of the coating work and inspection results by tank/space identifier. The summary sheets provide the pertinent information and note traceability to the original documents, which are not necessarily a physical part of the onboard CTF.
- 1.5.2** Some data are useful on board and serve to validate compliance, and some are collected specific data points and measured values that are not useful to the ship or to validating organizations. Hence, the data are separated into two parts: data included in the CTF and available on board for validation, and data that are boxed up as drawings and stored (possibly off the ship) and presented only when and if needed.

Section 2: Definitions

Ballast tanks: Tanks as defined in IMO Resolution A.798(19)³—Guidelines for the selection, application, and maintenance of corrosion prevention systems of dedicated seawater ballast tanks, and IMO Resolution A.744(18)⁴—Guidelines on the enhanced program of inspections during surveys of bulk carriers and oil tankers.

Coating technical file: A file composed of the specification of the coating system applied to the spaces arranged in a ship, record of the shipyard and ship owner’s coating work, detailed criteria for coating selection, job specifications, inspection, maintenance, and repair. The PSPC requires the CTF to remain on board the ship throughout its service life.

Dew point: The temperature at which air is saturated with moisture.

Flat file database: A plain text or mixed text and digital file that usually contains one record per line or “physical” record. For use with the CTF implementation, the electronic files are organized by directory and subdirectory. There are no structural relationships between the records.

Nominal dry film thickness (NDFT): Dry film thickness (DFT) is the thickness of a dried film, coating, or membrane. A 90/10 practice means that 90% of all thickness measurements shall be greater than, or equal to, NDFT and none of the remaining 10% of measurements shall be below 0.9 x NDFT.

Portable document format (PDF) file: A file format created in 1993 for document exchange. PDF is used for representing two-dimensional documents in a manner independent of the application software, hardware, and operating system. The system is now an open standard published by the International Organization for Standardization (ISO)⁽²⁾ as ISO 32000-1.⁵

Preconstruction primer: The prefabrication primer coating applied to steel plates, often in automatic plants. May also be referred to as the shop primer applied to steel plates.

Primer: A coating material intended to be applied as the first coat on an uncoated surface. The coating is specifically formulated to adhere to and protect the surface as well as to produce a suitable surface for subsequent coats. (Also referred to as prime coat.)

PSPC: The Performance Standard for Protective Coatings—IMO Resolution MSC.215(82).

Relational database: A database that matches data by using common characteristics found within the data set. The resulting groups of data are organized and are systematic. The software used to do this grouping is called a relational database management system. The term “relational database” often refers to this type of software. The software may be a type used to create the database or commercially available software specific to the industry and need.

Shop primer: The prefabrication primer coating applied to steel plates, often in automatic plants. May also be referred to as the preconstruction primer applied to steel plates.

Technical data sheet: The paint manufacturer’s product data sheet, which contains detailed technical instructions and information relevant to the coating and its application.

Section 3: Coating Technical File Formats

3.1 The information required by the CTF shall be collected, maintained, and presented using one of the following methods:

3.1.1 CTF Data System Type I—Any bound hard-copy system composed of preprinted data collection forms and/or hard-copy original data collection sheets, including the minimum data collection points as required in this standard.

3.1.2 CTF Data System Type II—Any electronic directory system maintaining the documents, recording minimum collection points as required in this standard in an organized series of directories and subdirectories. The documents shall be included in the directories in PDF format for consistency. The PDF files may originate from electronic originals of various software systems and scanned hard-copy documents. A non-relational database.

3.1.3 CTF Data System Type III—Any relational database system that integrates the minimum required data collection points into a structured relationship, supporting queries into the database for retrieval or analysis of specific data.

⁽²⁾ International Organization for Standardization (ISO), 1 ch. de la Voie-Creuse, Case postale 56, CH-1211, Geneva 20, Switzerland.

3.1.4 CTF Data System Type IV—Any other system that can meet the required CTF components of data collection, management, and presentation as outlined in this standard.

3.2 CTF Language of Delivery

3.2.1 The CTF shall be provided in English as the standard language. A shipyard's native language documents are acceptable as provided within this standard.

3.2.2 Further provision shall be made for inclusion of translated procedural documents for a ship's personnel during operation of the vessel and performance of in-service maintenance of the installed coatings.

3.3 CTF Structure

To provide consistency of presentation, the CTF shall be organized into the four sections identified in Paragraphs 3.3.1 through 3.3.4. The sections group information based on their collection and use within the management of the coatings' installation and maintenance.

Note that for a Type 1 system the section is a dedicated file folder, a tabbed section of a three-ring binder, or similar device. For a Type 2 system, the sections are electronic directories. For a Type 3 system, the section is a standard report based on the queried information parameters or a unique menu function of the software system.

3.3.1 Section 1: General description of the ship and relevant owner, shipyard, coatings manufacturer, and inspector information including the following minimum information:

- (a) Ship name and construction contact information;
- (b) Ship owner and contact information;
- (c) Shipyard of construction and contact information;
- (d) List of qualified inspectors and verified copies of their certifications;
- (e) A copy of the tripartite agreement; and
- (f) Seawater ballast tank coatings manufacturer and contact information.

3.3.2 Section 2: Coating materials and procedures including those assembled during the planning phase prior to the installation of seawater ballast tank coatings. Section 2 shall include the following:

- (a) The Type Approval Certificate (or Certificate of Compliance) (PSPC Requirement 3.4.2.1);
- (b) The coating manufacturer's product technical data sheet (TDS) (PSPC Requirement 3.4.2.2);
- (c) The inspection procedure to be used during construction and the installation of seawater ballast tank coatings (PSPC Requirement 3.4.2.4);
- (d) List of spaces for inspection;
- (e) The repair procedure to be used during construction and the installation of seawater ballast tank coatings when repairs are necessary because of mechanical damage or nonconforming installed coatings (PSPC Requirement 3.4.2.4); and
- (f) The repair procedure to be used during in-service repairs to the coating system (PSPC Requirement 3.4.2.7—MSC.1/Circ.1330⁶).

3.3.3 Section 3: Work and inspection records provide the historical record of the installation of the coatings to seawater ballast tanks detailing surface preparation, application, and testing/inspection of those systems. Section 3 shall include the following minimum information:

- (a) Work record QC summary for each seawater ballast tank and/or double-side skin space with a unique identifier (PSPC Requirement 3.4.2.3);
- (b) Inspection record QA summary for each seawater ballast tank and/or double-side skin space with a unique identifier (PSPC Requirement 3.4.2.5); and
- (c) Shipyard-verified inspection report summarizing all seawater ballast tanks and/or double-side skin spaces for compliance with the project specification with the inspector's signature (PSPC Requirement 3.4.2.6).

3.3.4 Section 4: In-service maintenance and recoating provides a system for the collection of coating maintenance and recoating applications throughout the ship's life. This section shall maintain the following data:

- (a) In-service inspection reports and recommended actions to enable the planning and remedy of coating defects and nonperformance that arise during service after delivery from the shipyard.
- (b) Work records and inspection reports of in-service maintenance including partial recoating of the tank or space.
- (c) Complete Section 3 documentation for recoating of tanks and spaces after entry into service requires the same level of documentation as new construction coatings installation, to include the following:
 - (1) Work record QC summary for each seawater ballast tank and/or double-side skin space with a unique identifier;

- (2) Inspection record QA summary for each seawater ballast tank and/or double-side skin space with a unique identifier; and
- (3) Shipyard-verified inspection report summarizing all seawater ballast tanks and/or double-side skin spaces for compliance with the project specification with the inspector'(s) signature.

3.3.4.1 Note that the maintenance and repair guidelines based on MSC.1/Circ. 1330 distinguish between maintenance and repair:

- (a) *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 affects short-term steel protection.
- (b) *Repair* means coating restoration work of a longer-term nature, usually performed during a ship's dry-docking or scheduled repair period (ship idle) to restore the "FAIR" or "POOR" coating condition to "GOOD" condition. This usually requires specialized manpower and equipment such as blasting equipment, operators, and dehumidifiers.

3.4 CTF Requirements

3.4.1 Section 1: General Description Requirements (see Figure 1)

The CTF shall contain the following information on the ship and relevant owner, shipyard, coatings manufacturer, and inspector including the following minimum:

- (a) Ship name and construction contact information;
- (b) Ship owner and contact information;
- (c) Shipyard of construction and contact information;
- (d) Seawater ballast tank coatings manufacturer and contact information; and
- (e) Name of qualified and agreed-on inspector.

3.4.2 Section 2: Coating Materials and Procedures Requirements

As required by Paragraphs 3.4.2.1, 3.4.2.2, 3.4.2.4, and 3.4.2.7 of the IMO PSPC, the following documents shall be included in the CTF:

3.4.2.1 Type Approval Certificate

A copy of seawater ballast tank coatings "System Statement of Compliance" or "Type Approval Certificate" for coating systems applied to the ship's seawater ballast tanks. The Type Approval Certificate or Certificate of Compliance shall be provided by the coatings manufacturer to the shipyard for inclusion in the CTF. If included as an electronic document PDF file the Type Approval shall be saved as a "secure" document.

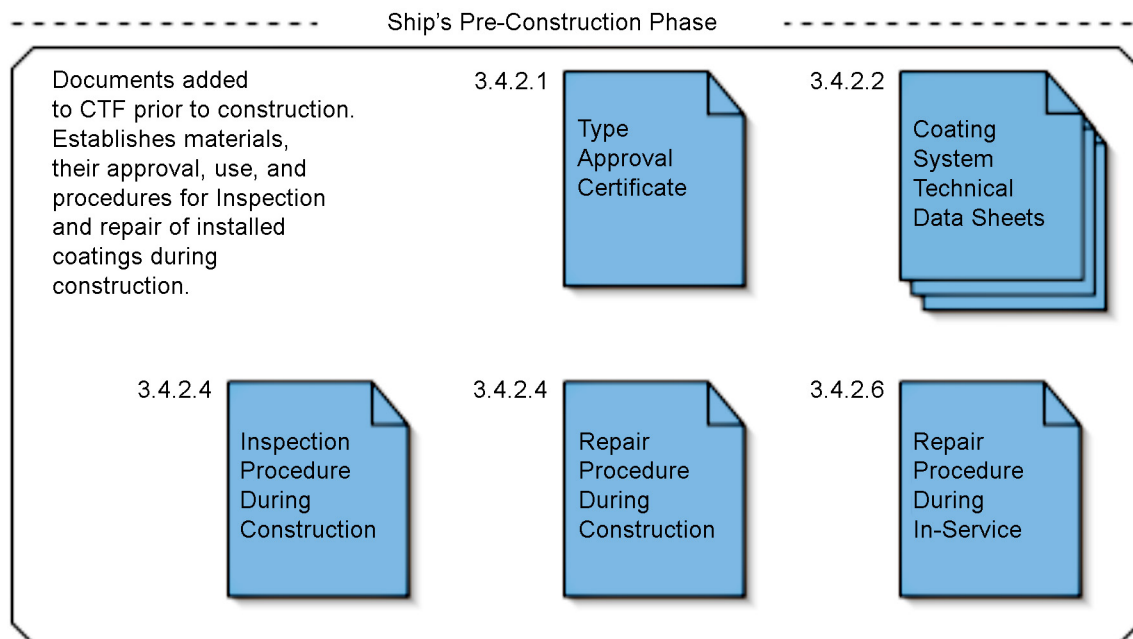


Figure 1: Coating Technical File Requirements. Note: Numbers refer to paragraph numbers in the IMO PSPC.

3.4.2.2 Coating Product Technical Data Sheet(s)

Copies of all coating product TDSs comprising the coating system(s) as applied to the ship's seawater ballast tanks. A cover document shall provide the coating system description and schedule of installation including the color of coatings to be applied for the approved system, noting the relevant TDS for each coating in the system, identified with product name and identification mark and/or number.

The TDS shall be the coatings manufacturer's published document pertinent to the specified coating material at the time of product installation. The TDS shall be provided by the coatings manufacturer to the shipyard and shall include the following information at a minimum:

- (1) Product name and identification;
- (2) Environmental conditions required during surface preparation including any limitations;
- (3) Coating application methods and equipment requirements;
- (4) Environmental conditions required during coating application including any limitations;
- (5) Environmental conditions required during the curing process of the applied coating including any limitations; and
- (6) Relevant recoating (minimum and maximum) intervals and coating curing time based on temperature.

If the TDS is included as an electronic document PDF file type, the TDS shall be saved as a "secure" document for inclusion in the CTF.

3.4.2.3 Inspection Procedures

A copy of the project inspection procedure(s) developed to ensure compliance with the specification for the installation of coatings for seawater ballast tanks. The procedure shall satisfy the requirements of IMO PSPC Paragraphs 3.4.2.3, 3.4.2.5, and 3.4.2.6.

3.4.2.4 Coating Repair Procedures for Damage and Repair During Construction

Repair procedures to ensure the correct repair of damage to coatings for seawater ballast tanks during construction. The repair procedure shall be provided by the coatings manufacturer and/or coating system specifier and approved by the coating system manufacturer.

3.4.2.5 Coating Repair Procedure(s) for In-Service Maintenance, Repair, and Partial Recoating

Repair procedures to ensure the correct repair of damage to coatings for seawater ballast tanks after delivery and when the coating is in service. The repair procedure shall be provided by the coatings manufacturer and/or coating system specifier and approved by the coating system manufacturer. Note the distinction between maintenance and repair previously addressed.

3.4.3 Section 3: Work and Inspection Records

The shipyard shall maintain detailed work records of all aspects of the application of coatings to the ship's seawater ballast tanks. The inspector(s) shall maintain a coatings log/inspection record identifying each tank/space's compliance with the project specifications. The inspector(s) shall note any deviations from the specification relevant to the identified tank/space.

The following minimum information shall be collected during the respective coatings installation operation by the shipyard and/or coating inspector(s):

3.4.3.1 Primary Surface Preparation and Primer Application Operations

- Plate and shape identification
- Soluble salts levels testing and documentation of conformance
- Ambient environmental conditions
 - Relative humidity
 - Air temperature
 - Dew point
- Surface temperature
- Method of surface preparation

- Abrasive media type and size
- Time and date of surface preparation
- Achieved level of surface cleanliness
- Applied coating system identifying specific coating and unique batch number
- Time and date of coating application
- Dry film thickness of installed coatings
 - Compliance with 90/10 rule
 - Summary statistical data
- Cure of coatings verified

The “plates and shapes” prepared during primary surface preparation and intended for use in the construction of seawater ballast tank areas and intended to receive additional coatings as part of an approved seawater ballast tank coating system requires prequalified primers to be applied with inspection requirements as set forth by the IMO PSPC.

These plates and shapes must be tracked with unique identifiers relevant to their inclusion in the seawater ballast tank construction unless all plates and shapes for the ship construction are required to meet the criteria set forth in the IMO PSPC for the primary surface preparation and prequalified primer. If the preapproved preconstruction primer is used for all steel to be used in the ship’s construction, then tracking of individual plates and shapes destined for ballast tanks is not required.

Only process-approved summary sheets for the information shall be included in the CTF copy kept shipboard. The raw data collected should be boxed up as drawings and kept, preferably at a storage site maintained by the owner, to be presented only on request.

3.4.3.2 Secondary Surface Preparation and Coating Application

- Space identification
- Soluble salts levels testing and documentation of conformance
- Ambient environmental conditions
 - Relative humidity
 - Air temperature
 - Dew point
- Surface temperature
- Method of surface preparation
- Time and date of surface preparation
- Area prepared (in square meters)
- Achieved level of surface cleanliness
- Applied coating system
- Time and date of coating application
- Dry film thickness of installed coatings, number of layers (coats) applied
 - Compliance with 90/10 rule
 - Summary statistical data (TBD)
- Variance from stripe-coating requirements
- Cure of coatings verified

The data requirements identified in the IMO PSPC Paragraph 3.4.2.3 encompass coating inspection data that, when compiled and integrated with IMO PSPC 3.4.2.5 inspection log data, provide the relevant data for verification of the coating installation compliance with the project specification (Figure 2).

These data in both handwritten hard copy and/or electronic format represent the most significant quantity of data collected during construction for management and presentation. These data may be provided as part of the CTF as an appendix to the file proper in either electronic or hard copy.

It may not be efficient or accurate to collect the required data in a language other than the shipyard’s native language of operation; therefore, the standard required CTF English language is not required for IMO PSPC Paragraphs 3.4.2.3 and 3.4.2.5 data collection.

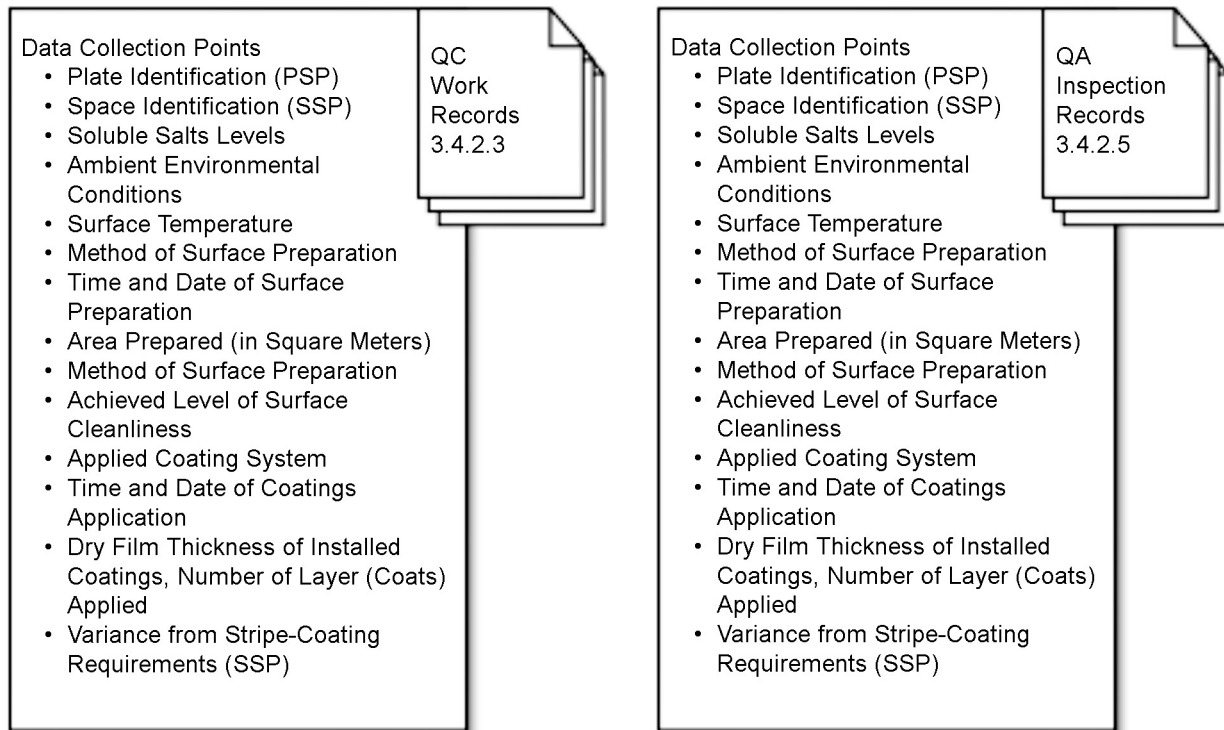


Figure 2: Work and Inspection Records Comparison. *Note: Numbers refer to paragraph numbers in the IMO PSPC.*

To facilitate use of the collected data, the inspector shall supervise the compilation of all required and relevant work records for each tank/space and summarize the data with reference and traceability to the original work records and/or inspection logs into the following summaries for inclusion in the CTF and presented in the standard required English language:

- (1) Quality control work records summary by tank/space; and
- (2) Quality assurance inspection log and reports summary by tank/space
 - Conformance report deviation log
 - Inspection report log
 - Nonconformance summary report of status and log of all reports and remediation
 - Project conformance report.

All summary reports for inclusion in the CTF shall be identified by ship name and tank/space identification system. The summary reports shall become part of the CTF and shall be presented in English as the balance of documents in the CTF.

The summary reports for presentation, verification, approval, and signature shall be compiled by tank/space to provide verification and inspector signature and acceptance in accordance with the requirements of IMO PSPC 3.4.2.6 shipyard-verified inspection report (Figure 3).

3.4.4 Section 4: In-Service Maintenance and Recoating—MSC.1/Circ. 1330

During the in-service life of the ship, coating maintenance, repair, and potentially complete replacement of systems may be needed as indicated by periodic in-service condition inspections.

Typically, records kept while normal maintenance is undertaken on board are limited, because no certified inspectors or classification society surveyors are sailing with the ship. Those records identified as required in the maintenance and repair guidelines being developed by the organization for maintenance and repair shall be included. The reporting requirement for repair is quite extensive. The same CTF data inclusion and raw data storage principles as apply to new construction shall be used for reporting repairs.

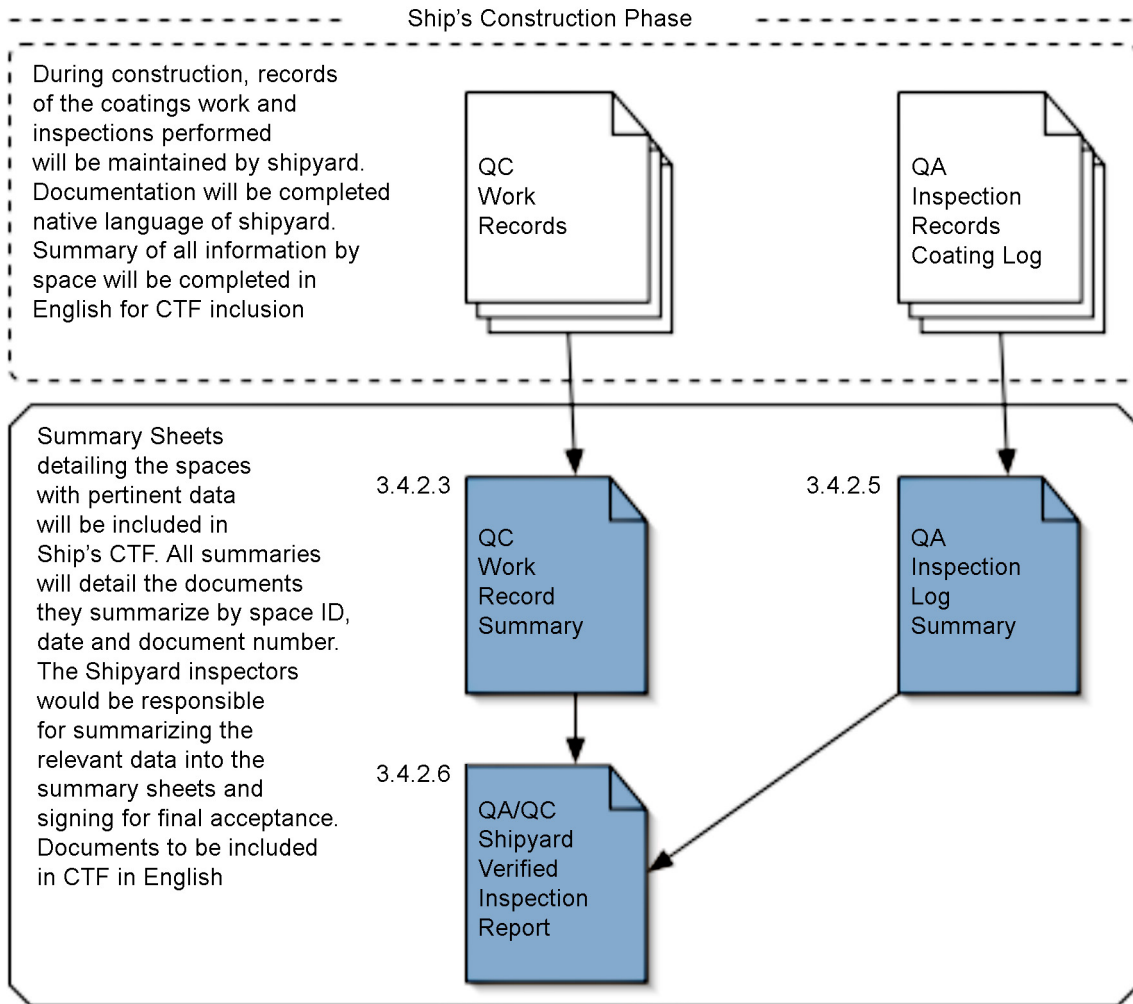


Figure 3: Work and Inspection Records. Note: Numbers refer to paragraph numbers in the IMO PSPC.

Documents that shall be included in Section 4 of the ship's CTF include (Figure 4):

- (a) In-service condition assessment and recommended action reports (surveys);
 - i. Survey reports should contain the following minimum information:
 - ii. Ship's name;
 - iii. Tank number;
 - iv. Inspection date;
 - v. Inspection by whom;
 - vi. Year coated;
 - vii. Coating name/type;
 - viii. Last repaired;
 - ix. Surface area;
 - x. Coating condition (GOOD, FAIR, or POOR);
 - xi. Pitting corrosion: Yes/No;
 - xii. Amount of rust scale (in m² or % of areas under consideration);
 - xiii. Access arrangement condition;
 - xiv. Sounding pipe condition;
 - xv. Vent pipe condition;
 - xvi. Ballast pipes condition;
 - xvii. Structural damage, mechanical damage, location and extent; and
 - xviii. Other comments.
- (b) Records of all maintenance;
- (c) Work and inspection of repair and partial recoating; and
- (d) Section 3 documentation requirements for all recoating and/or replacement coatings.

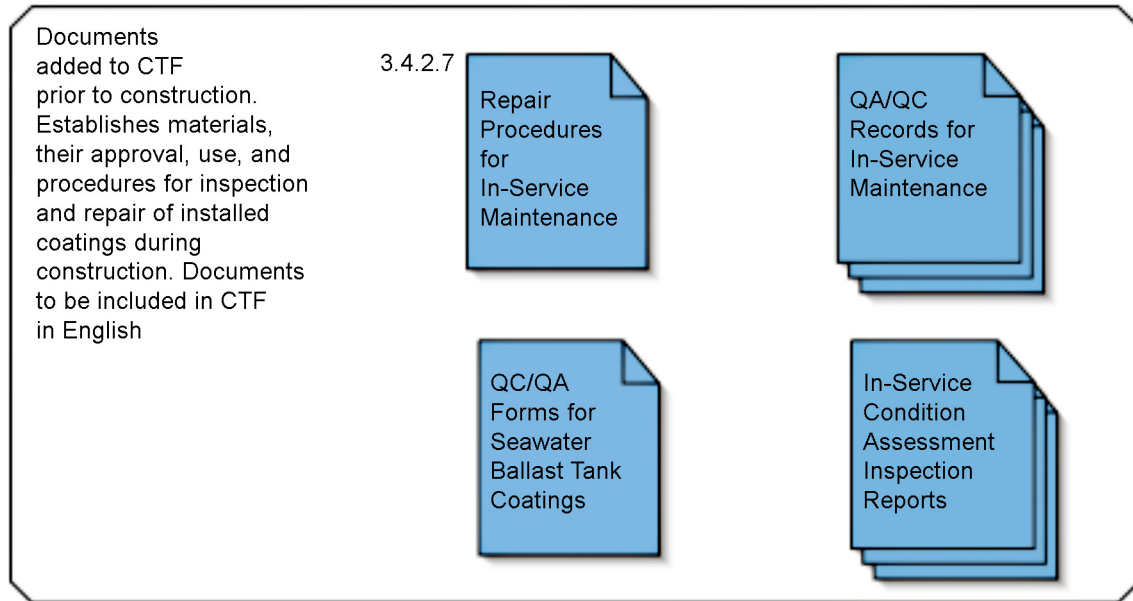


Figure 4: In-Service Maintenance Coating Technical File Requirements.

Note: Numbers refer to paragraph numbers in the IMO PSPC.

If repair is required, the requirements as noted in Paragraph 3.4.3 shall be required in their entirety and those documents shall be entered into the ship's CTF.

3.5 Approval Signature Requirements

Signatures for all CTF documents shall be as agreed in the tripartite agreement and may be scanned or digital signatures.

References

1. "Performance Standard for Protective Coatings for Dedicated Seawater Ballast Tanks in All Types of Ships and Double-Side Skin Spaces of Bulk Carriers" (London, UK: IMO, 2006).
2. Resolution MSC.215(82) to IMO Maritime Safety Committee (MSC) Subcommittee on Ship Design and Equipment (DE) (London, UK: IMO, December 8, 2006).
3. MSC Resolution A.798(19), Amendment to Resolution A.744(19), "Guidelines on the enhanced programme of inspections during surveys of bulk carriers and oil tankers" (London, UK: IMO, 1996).
4. MSC Resolution A.744(18), "Guidelines on the enhanced programme of inspections during surveys of bulk carriers and oil tankers" (London, UK: IMO, 1993).
5. ISO 32000-1 (latest revision), "Portable document format—Document management—Part 1: PDF 1.7 (Geneva, Switzerland: ISO).
6. Resolution MSC.1/Circ.1330, "Guidelines for Maintenance and Repair of Protective Coatings" (London, UK: IMO, 2009).

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