

Prospect on IMO's Performance Standards for Protective Coatings (PSPC) Regulation for Ship's Water Ballast Tanks

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In 2006, as a means to minimize early corrosion failure of ships, thus to enhance marine safety, International Maritime Organization (IMO), proposed a mandatory regulation for Performance Standards for the Protective Coatings (PSPC) for ballast tanks of newly built ships to satisfy 15 years of target useful life. In this regulation, several unprecedented strict rules are adopted as minimum, mandatory requirements for protective coatings of ship's water ballast tanks, and all type of ships sailing international sea are subjected to this regulation which is to be effective as early as June of 2008. The PSPC addresses many technical issues in the areas of surface pretreatment (primary and secondary), coating materials, coating application procedure and inspection as well as necessary documentation. The PSPC rules are new and unproven concepts, which calls for rigorous incorporation of reality-based evidences currently available, since there are no practical experiences in terms of the validity of the PSPC rules. There has been much controversy surrounding these regulations and considerable effort has been made by both shipyards and ship owners alike to achieve a performance standard for ballast tank coatings, which is acceptable to all. In this paper, the background and overview of the PSPC rules are given, and several issues in the PSPC are reviewed as a base to achieve robustness of the proposed PSPC, which will serve as a means to minimize early corrosion and to ensure 15 year target useful life of ships.

Keywords : ship, water ballast tanks, protective coating, IMO regulation

1. Introduction

With the introduction of double hulled tankers, the area of ballast tank to be coated has increased considerably. The capital invested in such vessels has also increased accordingly, with the tendency for the initial purchaser to retain the vessel for much of its useful service life. For successful application of high-performance protective coatings, each shipyard has established its own practice and inspection to assure a quality work for hull structures and outfittings. However, certain factors, for example: reduced scantlings, higher operating temperatures in certain areas of the tank, greater vessel steel flexibility and new types of steel all combine to potentially restrict ballast coating lifetime. With major repair or refurbishment of ballast tank coatings likely to be prohibitively expensive, the importance of "getting it right" at new shipbuilding cannot be overstated. Measures for building more "robust" ships to last longer and retaining their structural strength for its life time, thus, has been fiercely debated among

owners, classification societies and shipbuilders. In this regard, for the first time in the history, IMO's 81st session of the Maritime Safety Committee (MSC 81) has finalized and approved amendments to the SOLAS regulations II-1/3-2 and XII/6.3 that mandate a "Performance Standard for Protective Coatings (PSPC) for Dedicated Seawater Ballast Tanks in All Types of Ships and Double-Side Skin Spaces of Bulk Carriers".

The PSPC are set to achieve 15 years of coating life and are expected to raise the safety level of ships, and it is quite possible to build a ship for design life over 20 years, as it has been done for most of offshore structures. The striking difference is, however, the coating specification for the latter is quite different and far more costly than that of the former. Moreover, it is a common knowledge that the "15 years of target useful life" of a ship, as specified in the PSPC, is heavily dependent upon the operation and subsequent maintenance level of the ship. Since there are no practical experiences in terms of the validity of the PSPC rules, it is necessary to incorporate previous experiences and scientific evidences currently available into the PSPC. In this paper, therefore,

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the background and overview of the PSPC rules are given, and then the prospect from shipbuilders are given as an effort for further development for reasonable and practical coating standards as a worldwide, minimum mandatory requirement for all types of ships.

2. Adoption of IMO's performance standards for protective coatings (PSPC)

As a measure to increase the long term protection of ship from the corrosion induced failure, following 2 years of heavy discussions among shipyards and owners, a final draft of mandatory Performance Standards for Protective Coatings (PSPC) of ballast tanks of all types of ships were introduced during the IMO's Design and Equipment Sub-committee's 49th session (DE 49) on February 2006. Later in the same year, the 81st session of the IMO's Maritime Safety Committee (MSC 81) has finalized and approved amendments to the SOLAS regulations II-1/3-2 and XII/6.3 that mandate a "Performance Standard for Protective Coatings (PSPC) for Dedicated Seawater Ballast Tanks in All Types of Ships and Double-Side Skin Spaces of Bulk Carriers".

According to the IMO procedures, the approved texts will be adopted by MSC 82 in December 2006. The end result is a Mandatory Standard that is likely to come into force as soon as December 2006. All parties would have wished for a faster phase-in of the standard but, taking into account that it will apply to ballast tanks of all ship types, the IMO agreed to provide a more flexible phase-in period. The proposed time line for implementation is summarized as follow:

- Feb. 2006: Working group meeting finalized final draft at DE 49, IMO
- May 2006: Final details agreed at MSC 81, IMO
- July 2006: SOLAS XII/6.3 comes into force (July 1st)
- Dec. 2006: Draft MSC Resolution to be adopted at MSC 82, IMO
- Jan. 2007: IACS introduce requirements for all new building contracts after Jan. 1st, 2007
- July 2008: From July 1st application for all ships of over 500 gross tonnage and double sided skin spaces arranged in bulk carriers of length 150 m and upward
- Jan. 2009: From Jan. 1st 2009, PSPC will be applied to keels laid on or after this date
- July 2012: Applicable to all vessels delivered after the July 1st 2012

Additionally, the International Association of Classification Societies (IACS) has announced a plan to move up the introduction date for ships contracted after January 2007, which is 18 months earlier than the deadline pre-

viously agreed by the IMO. Most of shipyards strongly opposed to this new proposal, arguing that IACS should not deviate from the IMO-agreed implementation date, since most of shipyards need proper period to upgrade facilities to meet the new rules. The IACS, however, insists that most of new building shipyards would have no trouble to follow the PSPC rules, since the new PSPC rules are pretty close to the current coating practice of new building shipyards.

3. Key requirements of performance standards for protective coatings (PSPC)

Summary of requirements for the coating system and application, including surface preparation, as being finalized and reported at MSC 81 are as follow;¹⁾

3.1 Coating system requirement

- Coating Type: Multi-coat, epoxy based systems, and other coating systems satisfying the performance test requirement specified in the Annex 1 of the PSPC.
- Coating Pre-qualification Test: Epoxy based systems previously tested in a laboratory by the Annex 1 test procedure or equivalent. For all other systems, testing according to the procedure in Annex 1, or equivalent, is required.
- Job Specification: A minimum of two stripe coats and two spray coats (the second stripe coat of welded seams may be reduced). Stripe coats shall be applied by brush or roller (for scallops, ratholes, etc. only). Surface contaminants (rust, grease, dust, salt, etc.) shall be removed prior to painting following the paint manufacturer's recommendation. Abrasive inclusions embedded in the coating shall be removed.
- NDFT (Nominal Total Dry Film Thickness): 320 μm with 90/10 rule for epoxy based coatings, and maximum total D.F.T. following manufacturer's specifications. D.F.T. shall be measured after each coat for quality control purpose, confirm the total D.F.T. after final coat.
- Alternate Coating Systems: Acceptance of alternative systems other than an epoxy based system will be subject to documented evidence for a corrosion prevention performance. The documented evidence shall consist of either actual field exposure for 5 years with final coating condition not less than "GOOD" or laboratory testing conducted following the Annex 1 test procedure.

3.2 Primary surface preparation

- Blasting & Profile: Sa 2½, with profile in the range

of 30-75 μm

- Water Soluble Salt Limit (equivalent to NaCl): $\leq 50 \text{ mg/m}^2$ (NaCl) through conductivity measured following ISO 8502-9
- Shop Primer: Zinc containing inhibitor free zinc silicate based or equivalent. Compatibility with main coating system shall be confirmed by the coating manufacturer.

3.3 Secondary surface preparation

- Steel Condition: The steel surface should be prepared by removing sharp edges, grinding weld beads and removing weld spatter following ISO 8501-3 grade P2. Edges to be treated to a rounded radius of minimum 2 mm, or subjected to three pass grinding or at least equivalent
- Surface Treatment: 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 test. For pre-qualified coating system (epoxy + shop primer), intact shop primer may be retained, which shall be cleaned by sweep blasting, high pressure water washing or equivalent.
- Surface Treatment after Erection: 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.
- Profile Requirements: 30-75 μm for full/partial blasting,
- Dust: Dust quantity rating "1" for dust size class "3", "4" or "5" (ISO 8502-3). Lower dust size classes, "1" and "2", to be removed if visible on the surface to be coated without magnification.
- Water Soluble Salt Limit (equivalent to NaCl): To be measured after blasting/grinding, $\leq 50 \text{ mg/m}^2$ (NaCl) through conductivity measured following ISO 8502-9

3.4 Inspection requirement

- Inspection shall be done by the qualified coating inspectors certified to NACE Level II, FROSIO level Red or equivalent as verified by the Administration or the RO.
- Coating inspectors shall inspect surface preparation and coating application during the coating process to ensure compliance with PSPC.
- Results from the inspection shall be recorded by the inspector and shall be included in the Coating Technical File (CTF, such as Daily Log, Non-conformity Report).

4. Review of issues in the PSPC

A close reading of the standard indicates that there might be some considerable challenges to be faced by all parties.

4.1 Coating system approval

As described in the above section, there are two tests: one for (new) epoxy coatings and for shop primers (retained as a part of the coating system). Alternative coating systems other than the currently employed are set to be tested in a more stringent manner due to lack of actual service history as well as being deviated from the specific rules of the PSPC. However, one of the concerns to be clarified is to determine the certifying body of the coating system since the PSPC rules mandate that a Type Approval certificate may be issued by a third party other than Administration or Registered Organization (RO).

4.2 Coating inspection requirements

The PSPC rules specify the qualifications required for the coating inspectors is such that any inspector, if possess appropriate qualification, i.e. inspectors from/contracted with ship owner or shipyard or paint manufacturer, etc. can conduct the coating inspections regardless of their organization. Although the PSPC rules require that inspection of surface preparation and coating processes be agreed upon between the ship owner, the shipyard and the coating manufacturer, there will be always arguments among these parties about who will designate and provide the inspectors. Therefore, to ensure proper implementation of coating inspections, the more direct involvement of RO is expected in order to provide independence of coating inspection from interested parties, as well as to cover issues such as, liability, training and certification, etc.

4.3 Implication to shipbuilding industries

During the initial stage for PSPC developments, the shipbuilders' opinion has been not fully incorporated in debates among owners, class and national administrations at the IMO, thus, some of the initial assumptions for the PSPC rules are not mutually consented by most of shipbuilders. One of the acute debates during IMO's DE 49 and MSC 81 was the validity of TSCF guidelines (Tanker Structure Co-operative Forum Guidelines for ballast tank coating systems and surface preparation) on which the PSPC firmly put its foundation. It was heavily contested during the debates that there were no practical experiences in terms of the validity of TSCF guidelines since TSCF 15 year coating guidelines (the highest standards so far proposed, and have pretty much the same con-

tent of the PSPC) yet to be implemented in coating application of water ballast tanks in new shipbuilding.²⁾ The shipbuilders did not oppose the adoption of a performance standard for protective coatings for all ships. However, at same time, they did not believe that the most stringent coating standards, such as TSCF coating guidelines, should be equally and compulsorily applied to all type of ships regardless of their size without considering the adverse impact on the global maritime industry.

Most of shipbuilders viewed the TSCF guidelines were too stringent to be applied as a standard requirement to most types of ships. Apart from the argument over a clear ground for the need of such stringent requirements for coating of all types and sizes of ships, it's necessary to consider the economical impact and the practical difficulties of proper implementation of the coating standards when such stringent requirements are applied to all ships. Because the shipbuilding work have been done so far in a flexible manner in accordance with the shipyard's quality system and the owner's option and inspection, and it would be forced to undergo changes. Such changes might include replacement or changing of automated equipment and processes of the existing shipyard facilities.

It was also argued from the shipbuilders that some of technical issues in the PSPC should be determined based on scientific evidences rather than on yet to be verified TSCF guidelines. Moreover, some shipbuilders regarded the PSPC rules as being quite inflexible in terms of adopting various technical measures to achieve specific aims of the coating standards, which would make difficult to adapt to rapid technical innovations in the field of coating materials, surface preparation techniques as well as measurement equipment for inspection.³⁾

The shipbuilding industries have expressed deep concern that hasty implementation without full preparations by the shipyards might cause unexpected delay of production process and poor treatment. The economic impacts on construction costs have not been fully discussed during the PSPC development, while practical concern of the shipbuilders have not been properly deliberated. To meet the PCPC rules, the construction periods would also be increased, and most of shipyards have to newly invest in facilities and personnel, such as the expansion or new construction of blasting shops. It has been opinioned that the effect of new, mandatory PSPC rules will be a reduction of the total number of vessels a yard can produce annually, which would eventually have an effect on the price of ships. Japanese shipbuilders have already pre-estimated that man hours for paint work would increase by 50%~100% and the construction period would increase by 10-20 days upon immediate application of the PSPC rules

without proper preparation stages. Moreover, production at yards where capacity is fully utilized would decrease by 20% annually. Vessel prices would increase by 2%~10%, or about US\$ 1~5 Mil.⁴⁾

5. What to do next for implementation of the PSPC

For full implementation of the finalized PSPC, it is still necessary to critically review its validity in terms of their practicality and technical feasibility, considering variety of field conditions and various types of ships. Many parties have already suggested the necessity of revise the PSPC with reality based standard to enhance marine safety. In the meantime, the followings are expected to be done by each parties before full implementation of the PSPC rules.⁵⁾

5.1 Coating manufacturers;

- Obtain type approval by any of the methods acceptable for either epoxy or alternate coatings
- Demonstrate compatibility of coating systems with shop primer
- Develop an accelerate test method to prove the coating's 15 years of target life, if possible.
- Develop the Maintenance & Repair requirements to meet the coating's 15 years of target life.
- Prepare material to insert into ship's Coating Technical File
- Update Data sheet information to bring into line with IMO requirements

5.2 Ship owners

- Develop system to record maintenance work in Coating Technical File
- Agree procedures for inspection during new build
- Re-write standard paint schemes in line with requirements.

5.3 New building shipyards

- Shipyard work records to be retrievable and placed in Coating Technical File.
- Approved inspection procedures to be implemented
- Inspection records to be verified
- Re-write standard yard practices to be in line with new requirements.
- Ensure all processes meet the requirements for surface preparation and coating application.
- Define new QM procedures for new testing requirements
- Define procedures for repair work during new build

period.

- Ensure personnel are suitably qualified
- Identify cost and time impact of adopting new requirements.
- Ensure adequate investment in facilities to meet requirements

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