



Tanker Structure Co-operative Forum

Comparison of TSCF and PSPC Ballast Tank Coating Guidance - Owners Experiences and Best Practice

TSCF and PSPC Comparison

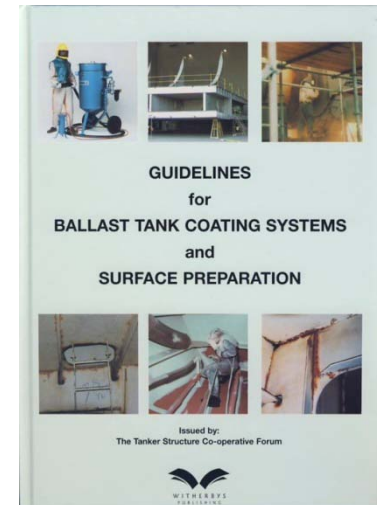
Presentation Agenda

- History of Guidelines
- Working Group Background
- Gap Assessment
- Summary



History of Guidelines

- 2002 - TSCF published a ballast tank coating guidelines document in response to the unsatisfactory performance of many ballast tank corrosion control coating applications on ships built in the previous years.
 - *TSCF provides differing levels of standards for minimum target coating life of 10,15 and 25 years (denoted as TSCF10, TSCF15, TSCF25).*
- 2006 - IMO adopted Resolution MSC 215(82) “Performance Standard for Protective Coatings for Dedicated Seawater Ballast Tanks in all Types of Ships and Double-Side Skin Spaces of Bulk Carriers” (PSPC). This came into force in 2008.
 - *PSPC is intended for a minimum target coating life of 15 years (the equivalent of TSCF15).*



Background – PSPC Working Group

- TSCF Members currently have over 80 PSPC ships in service and another 40 on order or under construction.
- The TSCF working group on ballast tank coatings carried out a comprehensive gap analysis between the existing TSCF and PSPC guidelines to identify differences and assess their impact.
- Members were asked for feedback based on their experiences with PSPC during construction and in service.



Today's Presentation & Future Paper

- This presentation today:
 - Highlights the gaps and differences between the TSCF and PSPC guidelines and their effects on coating performance.
 - Offers recommendations to improve coating performance based on owners' experiences of best practice that provides coating longevity.
- The key points covered by this presentation which will be expanded in a TSCF information paper which is being finalized and will be posted next year.



Block Joints

- Surface treatment of block joints represents the most significant gap between TSCF and PSPC, and the most significant issue for ship owners.
- The PSPC guidelines for surface treatment of block joints fall significantly below the TSCF15 guidelines:
 - *TSCF10 – St3 for block joints*
 - *TSCF15 – Sa2.5 for block joints*
 - *TSCF 25 – Sa2.5 for block joints*
 - *PSPC – St3 for block joints*



St3 power-tooled surface finish

Block Joints

- Power tooling of block joints is inadequate and leads to poor coating adhesion. Owners have experienced many failures of coatings on power-tooled block joints.
- Coating performance tests are carried out on Sa2.5 surfaces, but not St3 surfaces, and so are not optimized for St3 surfaces.
- For best practice, Sa2.5 surface treatment should be applied to all block joints (with vacuum-blasting) or paints should be additionally tested for adhesion on St3 surfaces.



Power-tooled block joint after 5 years service



*Examples of poor coating adhesion on
power-tooled block joints*



Bellmouths

- TSCF guidelines specifies that areas under bell-mouths should have extra protection by reinforced coating or coating of increased thickness.
- PSPC offers no guidance on additional protection under bellmouths and no glass flake paints have been given PSPC approval.
- Lack of extra protection under bellmouths on PSPC tanks leads to faster coating breakdown.
- For best practice, additional protection under bellmouths should be covered by PSPC.



General corrosion



Pitting

Blistering

- TSCF guidelines considers blistering as a serious defect which requires investigation and remedial work.
- PSPC offers no guidance on blistering. This is a serious omission.
- Blistering is indicative of poor paint batch quality or poor surface preparation.
- From owners' experiences, it is best practice that no blisters should be allowed and PSPC should include guidance on blistering.



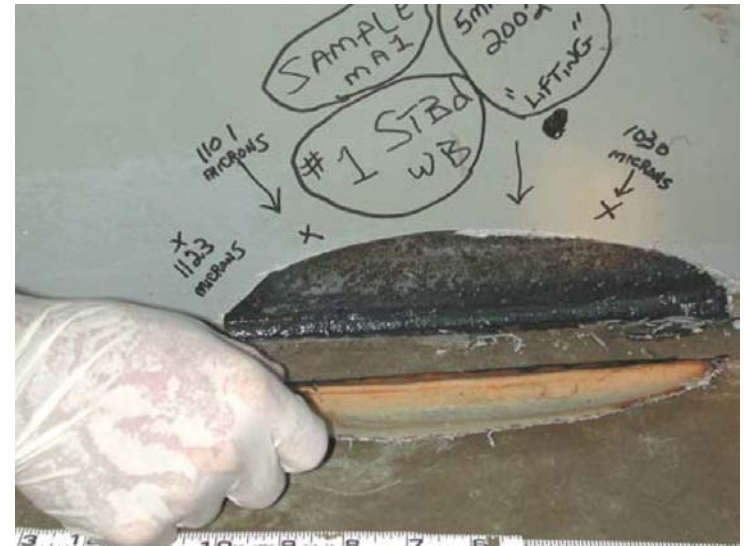


Block Holding Primer

- TSCF guidelines suggest the use of block holding primers is acceptable for TSCF10 and TSCF15 standards, but not for TSCF25.
- PSPC offers no guidance on block holding primers.
- From owners' experiences, quality varies between yards, but block holding primers are more likely to fail when blocks are constructed in other yards and transported to the assembly yard by sea.
- Best practice would be for full painting to be carried out directly after blasting instead of using block holding primers.



Example of poor BHP performance



Coating failure due to BHP not being completely removed prior to coating

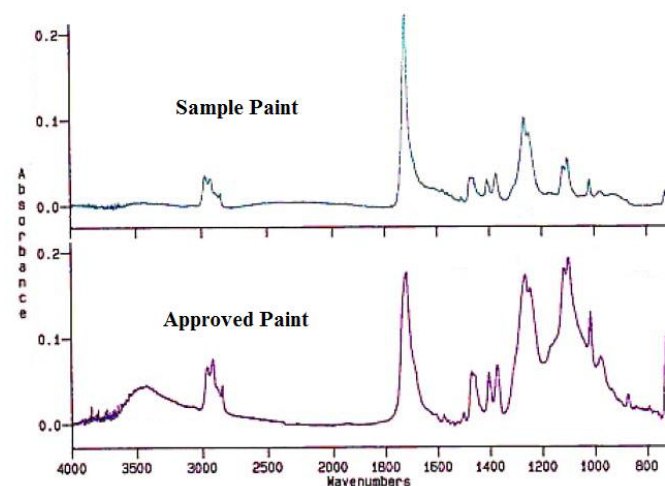
Environmental Conditions

- TSCF states dew point differential to be maintained at all times during the painting process, including during curing.
- PSPC states that dew point shall be maintained during painting, but does not specifically state that it must also be maintained during curing.
- TSCF specifies a maximum Relative Humidity of 60%, PSPC specifies 85%.
- PSPC does not provide clear guidance on painting inside or outside paint cells.
- Owners' preferences for improved coating life are for Relative Humidity to be limited at 60% and for painting and curing to be carried out in a continuously controlled environment.



Environmental Control and Traceability

- Paints can be damaged by poor environmental controls during transport to and storage at the shipyard which can lead to large-scale coating problems.
- Quality Control procedures need to be maintained during transport and storage.
- For best practice, fingerprinting of paints should be mandated:
 - Use infrared spectral analysis to check paint chemistry (density, ash, volume solids and mass content of binder, pigments and non-volatile matter) (e.g. ASTM D7588)
 - Comparison of applied paint with spectrum of tested/approved paint.
 - Ensures quality of applied paint is the same as approved paint.





*Large-scale failure of coatings –
indicative of a lack of environmental
controls during painting/curing or paint
transportation/storage.*

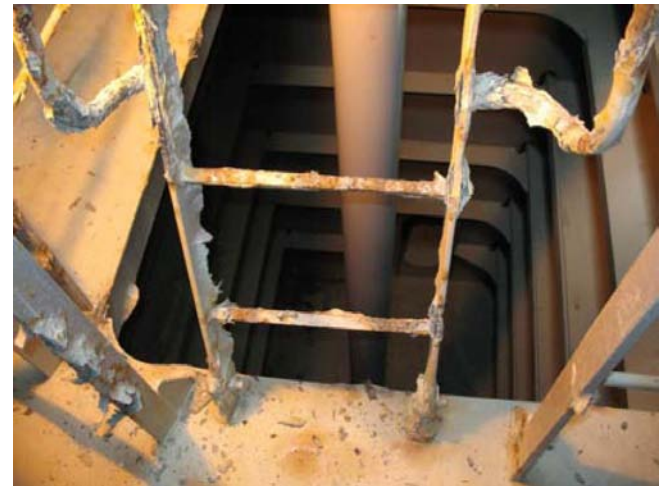


Permanent Means of Access (PMA) and Non-Integral Outfitting Items

- TSCF specifies coating of all outfit/non-integral items should be same standard as the tank, including galvanized or corrosion-resistant alloy items.
- PSCC recommends coating for non-integral PMA items, but does not comment on specialized surfaces (galvanized, CRA, etc.). MSC Circular 1279 should be applied.
- Owners' experience of best practice, from a safety perspective, is not to compromise on coating PMA items and specialized surfaces.

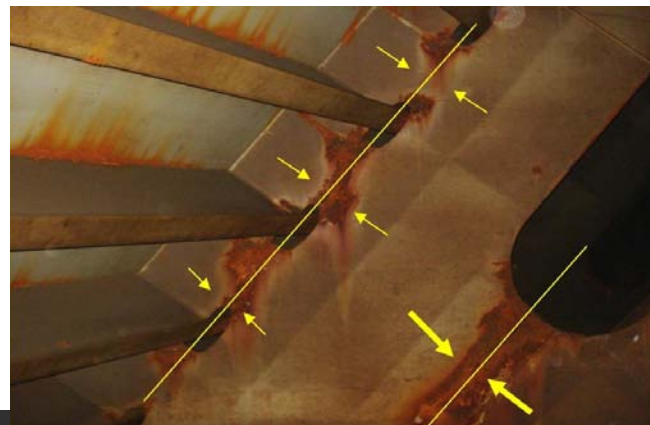


Corrosion on PMA can be life-threatening



PSPC Coating Approval Test Procedures

- Owners' experience is that the test procedures for new PSPC coatings can be improved to add realistic considerations and more representative tests:
 - Paints should be additionally tested on St3 surfaces.
 - Salt levels on paint test panels are very low compared with levels found during construction. Paints should be tested using salt levels at upper levels of acceptability.
 - Testing for low temperature in-service performance should be addressed
 - this is becoming more important as vessels trade further North.
 - Bend testing is not included. This is useful in assessing coating flexibility.



Example of cracking of inflexible coating

Stripe Coating

- Further work is needed to resolve order of coating and method of application.
- Owners' experience of best practice is that the first coat should always be a full coat, followed by a stripe coat. Stripe coat should be a different colour.
- Second stripe coat should be applied to all welded seams unless the Buyer approves otherwise. NDFT needs to be assured in practice.



Example of good stripe coating



Example of inadequate stripe coating leading to breakdown

Stripe Coating Application

- TSCF specifies stripe coating to be carried out by brush only.
- PSPC does not specify how stripe coating is applied.
- Roller application for stripe coating is considered a lesser standard, with higher DFT and less penetration of substrate.
- IACS UI SC223 states - *“Roller to be used for scallops, rat holes, etc., only”*.
- Owners’ experience of best practice is that stripe coating is carried out using brushes for a better finish.



Coating breakdown starting to occur due to inadequate stripe coating on 2 year old PSPC ship



Excessive edge breakdown due to no edge treatment and only one stripe coat





10 year old ship with coating breakdown on access ladders, coaming and longitudinal edges due to insufficient stripe coating and poor treatment of non-integral fittings

Abrasives for Blasting

- TSCF provides some guidance on abrasive characteristics, however it does not advise on particle size.
- PSPC provides no guidance on abrasive characteristics at all. Certification for abrasive quality should be included in PSPC. These are considered significant omissions.
- Owners' experience of best practice is that abrasives are not to be recycled/reused. Re-use reduces the abrasive's ability to produce the required surface profile, leading to areas of lower quality surface finish.



Secondary Surface Preparation

- Sa 2.5 (30-75 μ m) is a compromise surface finish and coating adhesion could be improved with higher profile values.
- The use of hydro-blasting for secondary preparation is not covered by PSPC. This would be a useful addition.



Severe coating breakdown within 2 years of coating in accordance with PSPC.



Paint cracking in 5 year old ship – contributing factors were excessive DFT, short loading cycles and temperature gradient – effective selection of coating system is important.

Painter Qualifications

- Painter qualifications are a notable omission from both PSPC and TSCF guidelines.
- Painting is skilled work and requires training to produce consistent high quality coatings.
- Owners consider that painters should be trained and qualified in the same way that welders are.
- Owners consider that there should be Class involvement to ensure painters are properly trained and qualified.



Who is painting your ship?



Paint Inspector Considerations

- There should be more than one qualified inspector per ship in order to provide sufficient inspection levels.
- Deputy Inspectors also need to be qualified to NACE II or FROSIO III. Locally accepted equivalencies need to be better defined by administrations.
- There is a potential conflict of interest when the coating inspector is contracted by the shipyard.



Summary

- It is said that a ship lives and dies by its ballast tank coatings. Effective coatings should not be compromised.
- TSCF guidelines generally provide more detailed guidance than PSPC and in some places sets higher standards.
- There are several aspects of PSPC guidelines which need to be improved in order to achieve 15 year coating performance in all areas of a ballast tank:
 - Improved surface preparation standards, especially for block joints
 - Coating of non-standard areas (under bellmouths, PMA, etc.)
 - Maintaining proper environmental conditions at all stages
 - Representative test procedures for approving paints
 - Painter and inspector qualifications
- In-service experience of applying current PSPC guidelines needs to feed into future updates of the PSPC guidelines.



Thank you for listening.





10 minute discussion session