

Evaluation of Necessity and Usefulness of IMO PSPC

- Performance Standard of Protective Coating

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Abstract

Coating, which works for corrosion control, has been understood as a supplemental manner to maintain the net scantling for the safety of ships. Based on this reasoning, the coating has not necessarily been the item to be surveyed and approved by the Administrations or the Recognized Organizations. However, now IMO has adopted the procedure, in which the enhanced coating system is to be applied to ballast tank generally as a mandatory regulation for the safety of ships. In this connection, here showed the results of consideration about necessity and usefulness of PSPC for the safety of ships.

1 PREFACE

The coating has not been considered as a means of corrosion control for the structural safety of ship, but rather as a supplementary means of corrosion control which may help to maintain the net scantling for the safety of ships. Based on this reasoning, the coating is one of the items used onboard ships that is not approved by the Administrations or the Recognized Organizations (RO).

Type of coating system, steel preparation, application and coating inspection and maintenance contribute to achieve a long useful life of coating system. However, it is a questionable that the enhanced performance standard for coating is a vital component for the safety of ship which to be controlled by IMO under the SOLAS Regulation.

2 COATING IS SAFETY ISSUE?

2.1 History of IMO PSPC

Is the coating safety issue? Answer is in the IMO history of PSPC.

Upon the request from the Industry of ship operators for the development of future standards for coating in Double Side Skin Spaces (DSS) of bulk carriers, Design and Equipment Sub-committee 47th (DE 47) meeting had agreed to develop the IMO performance standards for protective coatings referred to in SOLAS regulation XII/6.4. Main concern was that DSS is very narrow and extremely difficult to access for maintenance, if the DSS of bulk carrier became mandatory requirement in SOLAS. It is the main aim that enhanced coating systems in DSS have to be applied to minimize the maintenance during operation.

Even though, the rules to make DSS mandatory in order to reinforce the safety of Bulk carrier was rejected, the IMO MSC decided during the 78th meeting (May 2004) that enhanced coating should be applied to DSS and dedicated Water ballast tanks of bulk carrier. This means that the coating system came to be a different issue from the structure reinforcement which relates closely

to the safety of ships.

At the 48th meeting of the DE, decision was made that the draft of PSPC should be extensively applied to void space and Water Ballast Tanks (WBT) for all types of vessels including Bulk carriers. And PSPC had been approved and adopted in regular sequence by the MSC at 81st and 82nd sessions.

Aforementioned history is very clear that coating is maintenance free issue which has been commercially handled in marine business. It does not make sense that coating is more efficient for the safety of ship than the double side skin structure, if coating is safety issue.

2.2 In view of Casualty on Ship's Damage

The incidents of ships in operation have been caused by various types of defects and damages which are structural damage, fire/explosion, machinery damage, etc. It is known that the causes are sorted as hull and equipment, propulsion, other machinery and system/electric/instrument, cargo/ballast/bilge system, etc. by items. According to the investigation, it is aware that most incidents are caused from the other means of event rather than the events of corrosion caused by poor coating performance.

Among the various causes, items related structural damage – hull and equipment which have direct influence on ship's durability are recognized as cause of many incidents. Even in this case, structure and hull problems from corrosion caused by painting specification/condition are relatively small.

In this regard, the several materials investigated/reported by DNV, INTERCARGO, OCIMF, INTERTANKO etc. have been examined thoroughly.

In these materials, only a few cases for structural damage are related to corrosion, for instance corrosion in hold due to damage by grab and corrosive cargo (sulfur) or adjacent to heated tank, side frame corrosion from structural damage, transverse bulkhead corrosion due to buckling, etc. However, they are not so serious to have influence on durability of ships, and in particular it has not been reported that corrosion had taken place in water ballast tank.

The facts show that the coating is not the safety issue and is still supplementary means of corrosion control to maintain the net scantling.

3 CRITICAL ITEMS OF PSPC

Even though the effect of coating is insignificant for the safety of ships, PSPC is encouraged to enhance the safety of ships.

PSPC will be applied to all type of ship of not less than 500 gross tonnages. This means that most of shipbuilder in the world will implement PSPC as a mandatory regulation. In this reason, it was anticipated that PSPC would bring massive confusion unless carefully evaluated. However, it is disappointing to see careful evaluation had not seemed to be made during development of the PSPC.

3.1 Practicality of PSPC

The coating is a polymer which is sensitive to various environmental conditions since most of the processes are carried out manually, especially in the shipbuilding industry.

It is critical that all shipbuilders should apply the coating according to an unified practice required by PSPC in spite of practice of each shipbuilder have to be different depending on their facility and various environmental conditions such as quality level, skill of the worker, temperature, humidity and etc.

In other words, it means that the coating should be applied, inspected and verified in accordance with the uniform requirements of PSPC irrespective of the capability of worker,

quality level and facility of the each shipbuilder.

In spite of that international mandatory regulation should be minimized as much as possible, current PSPC requires extremely detailed shipbuilder's practice in the application and inspection for the coating system. It is specified in PSPC what kind of tool to be used, how to apply and inspect, which method to be used for application and inspection, and how many measurement to be carried out during inspection.

The inspector should carry out a lot of measurement and visual inspection according to the requirement of PSPC as a minimum, and can request additional inspection for any area considered necessary, but inspector has no authority to reduce the inspection scope. It is natural that most of inspector is familiar with strong and weak point for quality of each shipyard and inspector should concentrate weak area for more enhanced quality inspection.

The excessive inspection may cause schedule delay and increased cost regardless of quality improvement. On the contrary, overall quality of coating may fall behind the expected quality due to excessive inspection.

For example, the major shipyards in Korea apply two main coats on water ballast tank in the indoor facilities where are controlled humidity and temperature for quality of the coating. If the construction schedule is delayed, it is axiomatic that delayed coating work must be carried out in the open air without environmental control unless further invested for the facility. Consequently, overall quality of coating is not better than before.

It is just typical example and there are many other items which are impractical to the shipyard.



Fig1. Indoor facility for surface preparation and coating

3.2 Who will do inspection?

The PSPC specify the qualifications required for the coating inspectors and implies that any inspector, if appropriately qualified - i.e. inspectors of/contracted by Owner, shipyard or paint manufacturer, etc., can conduct the coating inspections. Although the performance standards requires the inspection of surface preparation and coating processes to be agreed upon between the Owner, the shipyard and the coating manufacturer, there will be always arguments between these parties as to who will designate and provide the inspectors. The performance standards, in many areas, entail the judgment of the coating inspector based on his or her visual examination.

Even though all parties assert in the IMO meeting that coating is very much important for the safety of ships, only verification of coating is different with other regulation required by the IMO. There is no responsible party for verification to ensure the implementation of PSPC and inspector – a person takes all responsibility of verification.

It is desirable that the Administration or RO as the responsible body for implementation of

SOLAS requirements should be more directly involved in the coating inspection instead of simply reviewing the inspection reports and monitoring of the implementation of the inspection requirements.

4 EFFECT OF PSPC

It is desirable that the enhanced standard being applied to all type of ships to build a safe and robust ship, however, the deterministic way of adopting standards without proper technical background and demonstrable practical experiences could rather delay a smooth progress of the global maritime industry.

A significant adverse economical impact is envisaged by this PSPC due to the excessive requirements.

Machinery and equipment as called completed unit, which are produced by machining, assembly, and installation process, have the custom to provide periodic maintenance and back-up system for emergency case because it is difficult to maintain the perfect quality level during operation.

In case of paint, it is also very hard to get perfect quality. Especially for the paint work in shipbuilding industry, more enhanced quality control does not always provide simply the quality improvement but provides only disturbing, since such paint work is carried out manually in limited time schedule. To achieve over the reasonable level of quality, it requires huge initial cost without remarkable quality improvement.

As figure2 shows, cost will be rapidly increased to achieve over the coating quality level of blue (solid) line which is practically achievable quality level.

For about 5% levels up for quality, almost 100% of cost increment is expected as shown red (dot) line. Thus, it is impossible for protective coating to be perfect especially in the shipbuilding industry.

It is the reason that 5% of initial coating breakdown is recommended for sacrificial anode design.

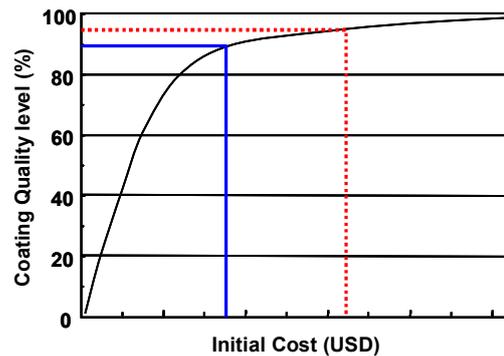


Fig2. Relation between initial cost and coating quality level

As pointed out in section 3 of this paper, one of cost effecting item is the inspection for well organized shipyard in Korea. Inspection scope has been decided by shipbuilder's quality level or customer confidence.

Figure 3 shows relation of inspection and coating quality level. In case of qualified shipyard, inspection cost is negligible as indicated by blue (solid) line. On the other hand, inspection cost of unqualified shipyard is extremely high as indicated by red (dot) line.

However, inspection scope cannot be reduced the depending on the shipyard's quality level from now because PSPC is the SOLAS mandatory regulation.

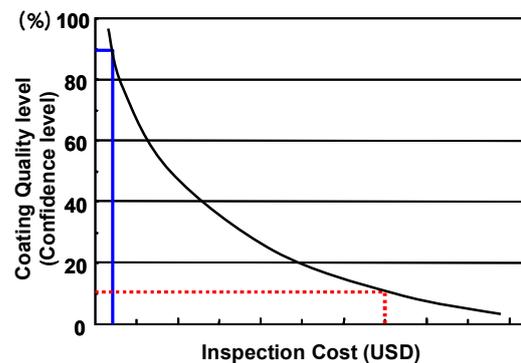


Fig3. Relation between inspection cost and coating quality level

The most typical item effecting inspection cost, is dry film thickness (DFT) measurement notwithstanding most of inspection items required PSPC, are effected to inspection cost.

PSPC requires more 7 times of DFT measurement than currently used in shipyard in the world, however the total required number may differ depending on the interpretation. The DFT measurement will take about 2.5 months for 3 inspectors in case of VLCC.

5 CONCLUSION

One of the objectives behind the PSPC as described in its Sec. 3 is to prevent premature coating breakdown for extending the ship's lifetime, there is a need to find out whether or not the application of quality paint alone would be sufficient to achieve such objective. The extension of coating life will not be ensured even where the high performance of paint is applied under the stringent application standard, unless local corrosion caused by fatigue or structural stress proliferate to overall corrosion is prevented.

It is well known that a fatigue failure is one of the primary causes of the structural failure of tankers and bulk carriers. A various form of dynamic stresses and notch-stress concentration on the structures cause coating failures like crack at the fatigue sensitive areas. These coating failures are deem to be caused by more localized fatigue induced coating breakdown than poor/downgrade of the coating performance.

It should be noted that a premature coating breakdown have occurred at the sensitive areas in a limited number and the fatigue sensitive areas are very limited spaces of all ballast tank areas. It is worth to positively consider harmonizing with alternative measures like cathodic protection system or enhanced corrosion margin for unexpected coating breakdown, which were proved in the experiment and practice to maintain the net scantling for the structural safety of ship.

The benefit of the enhancement of performance standard of coating is far less than expected upgrading the safety of ships and more enhanced quality control does not always provide the quality improvement but provides only disturbing construction schedule and the quality level degrade.

References

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