The 1st PSPC Experience

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Objectives

PSPC :
Performance standard for protective coatings for dedicated seawater ballast tanks in all type of ships and double-side skin spaces of bulk carrier

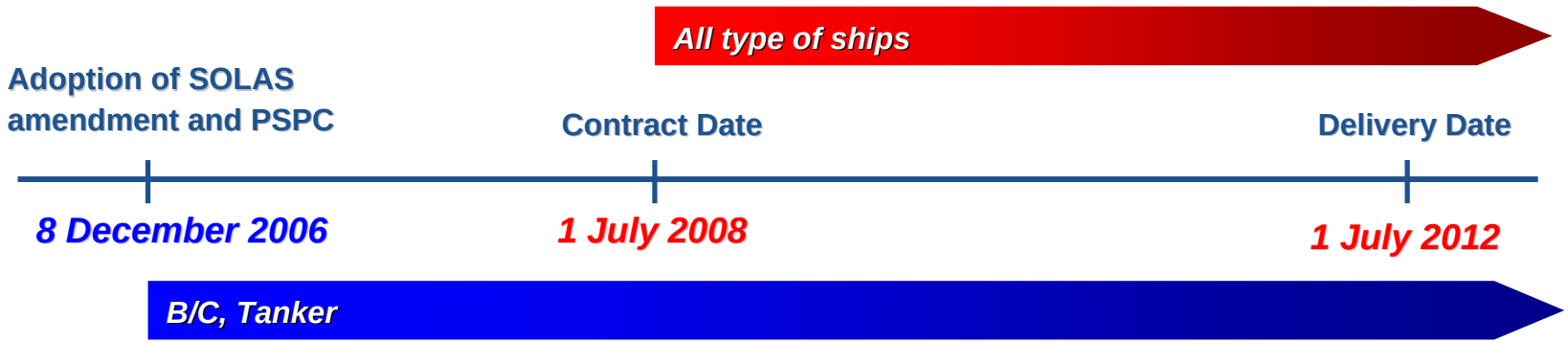
The objectives of this presentation are to share the experience and lessons learned collected from actual application of PSPC and to raise issues for future improvement and amendment of PSPC.

Effective Date of PSPC

PSPC Application according to SOLAS amendment - IMO Resolution MSC.216(82)

Apply to ships of not less than 500 gross tonnage:

* For which the building contract is placed on or after 1 July 2008 or
* the delivery of which is on or after 1 July 2012



IACS CSR Requirement – Tanker, B/C

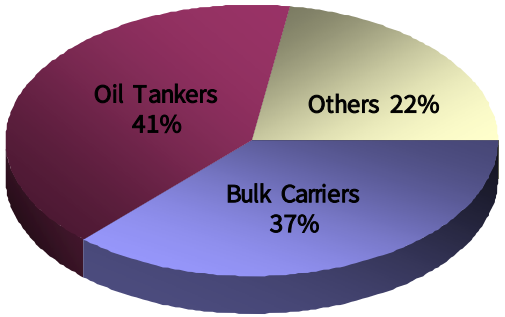
- PSPC shall be applied to ships contracted on or after the adoption date (8 December 2006)

PSPC at DSME

- From early 2007, oil tankers and bulk carriers were contracted with PSPC due to CSR requirement and other type of vessel were contracted with PSPC by owner's request.

- Up to now, more than 70 vessels have been contracted with PSPC.

- The first PSPC application started from January 2008 on a CSR applied bulk carrier.
  Block stage coating works have been completed however, tank final inspections are not finished yet.
  The vessel will be delivered at the end of this year.



Specification

- Painting works for WB tanks shall be carried out in accordance with the IMO performance standard for protective coatings (PSPC) under IACS CSR.
- Water soluble salt test for WB tanks and peak tanks shall be carried out in presence of the paint manufacturer's inspector with the following procedures:

  At block stage : To be carried out at least one point per block.

  At hull stage : To be carried out at least one point per each ballast tank.

  Salt limit : The salt limit shall be set at max. 50 mg/m2 of sodium chloride in accordance with the ISO 8502-9.
- All hull structural members with rust grade A or B in accordance with the ISO 8501-1.
- Surface Preparation
  Primary: Sa 2.5
  Secondary: Sa 2.5 (Block stage) + St 3 (Hull Stage)
- Tar free epoxy, 2 coats, 320microns.

Application of PSPC

- Previous Conditions
- Improved Practice
- Selection of Coating System
- Pre-Job Meeting
- CTF

Previous Conditions

Primary Surface Preparation

- Steel grade: A or B
- Salt : 10 ~ 30mg/m2
- Other contaminations: Acceptable
- Profile : 50~70 microns
- Blasting grade : Sa 2.5
- Weather control : Indoor shop
- Shopprimer type: Inorganic zinc silicate

Condition in a subcontractor ‘s shop

Steel : Occasionally C or D plates

Salt : 30~270mg/m2 (Before blasting)
20~80mg/m2 (After blasting)

Other contaminations; Oil, mill scale and rust are found.

Blasting grade : Partly less than Sa 2.5

Owner’s Concern on Primary S/P






Previous Conditions

Secondary Surface Preparation

- Steel works and Edge condition: Generally acceptable.
  Small holes and corners were weak points.
  Differences between yard standard and ISO 8501-3 P2.
- Salt : 40 ~ 80mg/m2 (Before blasting)
  up to 2000mg/m2 (Before blasting, sea transported)
  10 ~ 50 mg/m2 (After blasting)
- Other contaminations (Oil, mill scale etc.) : Acceptable
- Profile : 80~95 microns
- Weather control : Indoor blasting cell
- Dust : Various Conditions according to blocks and compartments

Condition in a subcontractor ‘s shop

Salt : 130 ~ 300mg/m2 (Before blasting)
40 ~ 140 mg/m2 (After blasting)

Other contaminations; Oil, mill scale and rust are found.
Profile: 20 ~ 130 microns
Blasting grade : Partly less than Sa 2.5

Previous Conditions

Painting Works and Others

- General Painting Conditions : Acceptable
- DFT Control :
  Different criteria for each contract e.g., 85/15, 90/10, 95/5 etc.
  Generally acceptable on plates.
  Corners and hole were weak points (Low/Excessive DFT).
  Sprayers are not familiar with 320 microns spec. (300 or 350 was generally applied)
  Max. DFT : According to paint maker's recommendation.
- Ventilation & Environmental conditions : RH < 85%, less than 3℃ above the dew point
- Stripe coating : Two coats by brush or roller

Previous Conditions

Inspection Practice

- Dust : Visual inspection
- Salt : Random test by paint maker's inspector (by maker's standard)
- DFT Check : As per Contract specification. (5 spot measurement in 10m2 or 20m2 etc.)
- Certificate : Some inspectors are certified by FROSIO. However, there are many non-certified inspectors

Improved Practice

Primary Surface Preparation

- Quality Control in regular basis
  DFT: Daily Check, Profile: Weekly Check, Dust/Salt: Monthly Check
  Conductivity check for abrasive
- QA in Sub-contractor's shop:
  Use of A or B grade steel plate
  Optimum setting of facility
  Monitoring of salt and proper washing
  Abrasive size and conductivity control

Secondary Surface Preparation

- Special attention on small holes and corners. (edge, cleanliness etc)
- ISO 8501-3 P2 grade for steel works
- Monitoring of salt and proper washing (especially for sea transported blocks)
- Abrasive size maintenance for proper profile
- Thorough vacuum cleaning

Improved Practice

Painting Works and Others

- More strict DFT control : 90/10 rule, Max. DFT control
- Check of WFT during spray
- Skilled sprayers
- Limited use of Brush/Roller for stripe coating

Inspection Practice

- FROSIO Level III Certified Coating Inspector
- Dust, Soluble Salt checks to be done in regular basis
- DFT Checks to be done in accordance with Annex 3
- Inspection result to be recorded in the agreed inspection forms

Selection of Coating System

Table 1. 3.2. - Sa 2 removing at least 70% of intact shop primer, which has not passed a prequalification certified by test procedures in 1.3.

Coating system comprising epoxy-based main coating and shopprimer shall be passed a pre-qualification test.

The retained shop primer shall be cleaned by sweep blasting, high-pressure water washing or equivalent method.

Schedule for Type Approval:
WBT Coatings with the yard shopprimer

Maker	Schedule
"S"	2008. Jan.
"J"	2008.Aug.
"I"	2008. Sep.
"K"	2008. Nov.
"H"	2009. Jul.
"C"	2008. Aug.
"N"	2009. Mar.

Pre-Job Meeting

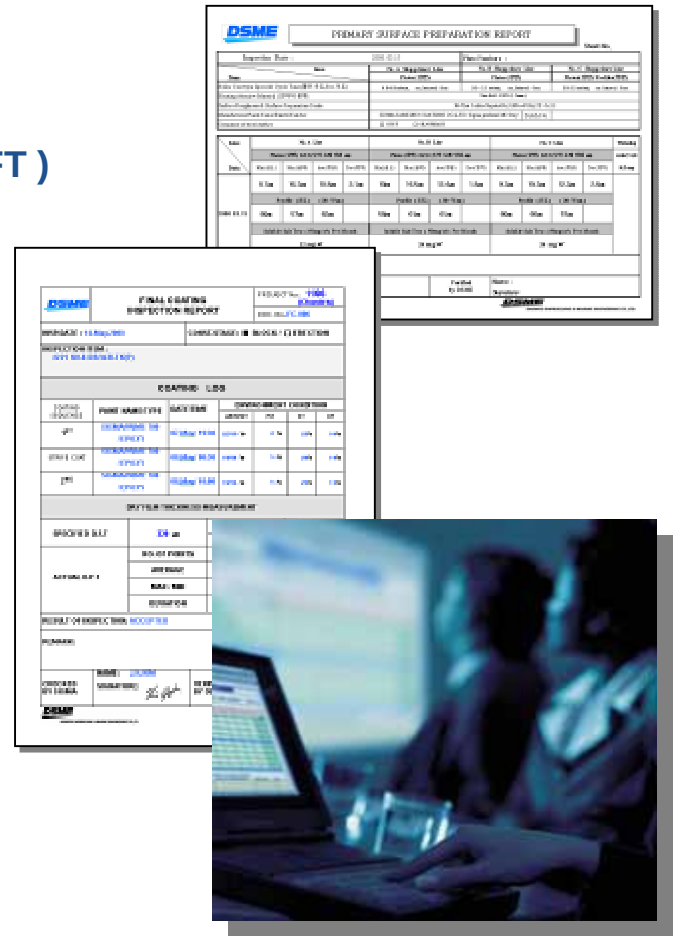
3.2 Inspection of surface preparation and coating processes shall be agreed upon between the shipowner, the shipyard and the coating manufacturer and presented to the Administration for review.

- **PSPC does not cover all issues related with painting works and inspection for water ballast tank coating.**
- **There are many issues to be agreed before actual application of PSPC such as painting work procedure, Inspection scope & attendance, Test Procedure, Form of report, HSE procedure, Repair procedure etc.**

Pre-Job Meeting among the Owner, Yard, Paint Maker and Classification Society has been held before starting the Painting Works.

Meeting Agenda

- Various Test Procedure (Soluble salt, Dust, Profile, DFT)
- Inspection Report (Shoppriming, Secondary Surface Preparation, Block painting, Final painting)
- Inspection Flow Chart
- Paint Working Procedure for Block, P.E & Hull stage
- Safety & Health
- Maintenance Manual
- Data Sheet & Type Approval Report
- Etc.



CTF

3.4.1 Specification of the coating system applied to the dedicated seawater ballast tanks and double-side skin spaces, record of the shipyard's and shipowner's coating work, detailed criteria for coating selection, job specifications, inspection, maintenance and repair shall be documented in the Coating Technical File (CTF), and the Coating Technical File shall be reviewed by the Administration.

- CTF (Coating Technical File) will be delivered by the shipyard after review of Classification Society.
- CTF shall be compiled by Coating Inspector.
- Work records of coating application shall be fully included in CTF.
- Technical data, specification etc. will be prepared by paint manufacturer and yard's painting engineering department.

Lessons Learned

- Coating practice of shipyard and subcontractor shall be checked and improved before application of PSPC.
- Special care shell be taken regarding surface preparation requirements such as grade of cleanliness, profile, salt and dust contamination etc.
- Intensive pre-job meeting among the involved parties is a concrete base of successful application of PSPC.
- Number of certified coating inspector is one of the important factors due to increased work volume.
- Coating inspector shall have good knowledge on PSPC itself and the yard practice, facility and process also.
- PSPC itself has some issues to be improved and amended in the future.

Issues for Future Amendment

Limitation of Tools (e.g., Brush/Roller)

The target of the PSPC is on the performance of coating, not on the tools.

'Stripe coats must be applied as a coherent film showing good film formation and no visible defects such as pores or un-wet areas.' - Industry Guideline

IACS UI SC233

Stripe coats should be applied as a coherent film showing good film formation and no visible defects. The application method employed should insure that all areas that require stripe coating are properly coated by brush or roller. A roller may be used for scallops, ratholes etc., but not for edges and welds.

Issues for Future Amendment

Profile Range and its reference standard
Profile between 30-75 mic. vs Reference standard ISO 8503-1/2 :1998

- There is no reason that profile over 75mic. is not as good as 75mic.
- 30~75 mic. of profile can not be measured by ISO 8503-1/2.

- Upper limit of profile shall be amended to a generally acceptable value e.g., 100mic.
- Profile range shall be amended to meet the referenced ISO standard e.g., Fine (G) ~ Medium (G) or Segment 1~3

a) Comparators for steel, blast-cleaned with grit abrasives

Segment	Nominal reading [1] µm	Tolerance µm
1	25	3
2	60	10
3	100	15
4	150	20

b) Comparators for steel, blast-cleaned with shot abrasives

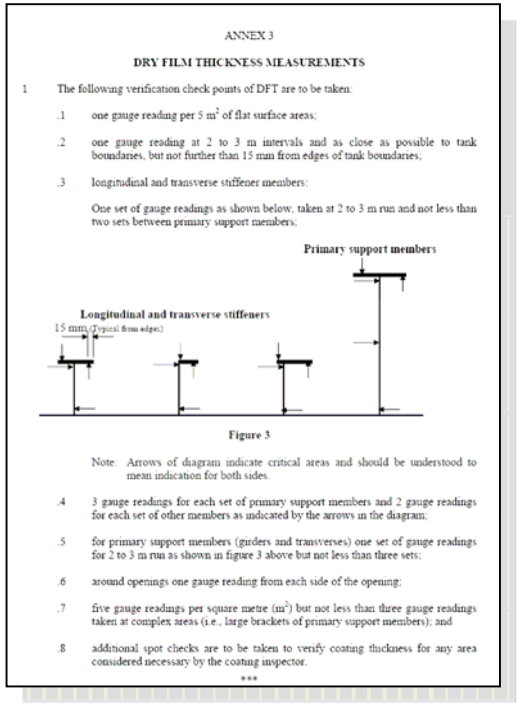
Segment	Nominal reading [1] µm	Tolerance µm
1	25	3
2	40	5
3	70	10
4	100	15

Issues for Future Amendment

ANNEX 3

- Even compared with general inspection practice of an advanced shipyard, Annex 3 is far more labor intensive.
- This increase of labor does not add up any remarkable quality improvement but considerable cost.

Check point requirement shall be simplified to a practical level and more extensive inspection requirement shall be left on specific shipbuilding contract.



ANNEX 3

DRY FILM THICKNESS MEASUREMENTS

1 The following verification check points of DFT are to be taken:

.1 one gauge reading per 5 m^2 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;

Primary support members

Longitudinal and transverse stiffeners

15 mm (Typical from edge)

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 metre (m^2) 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.

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Issues for Future Amendment

Soluble Salt

- Each paint manufacturer has their own criteria based on their experience and knowledge.
- 50mg/㎡ NaCl is not the minimum requirement
- Even fresh water is contaminated by chloride or other ions in some regions.

Soluble Salt limit shall be in accordance with the paint manufacturer's recommendation.

Typical recommendation on Salt Level by Paint Manufacturers

	A	B	C	D	E	F
Immersion Service	50	111	100	80	50	130
PC, FWT Coating	50	111	50	50	50	100
Non-immersion Service	100	315	100	80	100	164

*Converted to ISO8502-6/9, Unit: mg/㎡ NaCl

- End of Document -

Thank You !