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发：本社总部有关处室、本社各分社、办事处、本社验船师、有关船厂、船东

关于下发海安会通函 MSC.1/Circ.1198 对于 SOLAS 第 XII/6.3 条应用关于所有类型船舶专用海水压载舱和双舷侧处所防腐要求和应用所有类型船舶专用海水压载舱和双舷侧处所保护涂层性能标准的通知

1、IMO 海上安全委员会第 81 届会议（MSC 81）批准了新的《所有类型船舶专用海水压载舱和散货船双舷侧处所保护涂层性能标准》（以下简称涂层性能标准），今年 11 月底召开的第 82 届海安会（MSC82）将最终通过该标准。

2、该涂层性能标准将在 SOLAS 第 II-1/3-2 条修正案中引入而成为强制性要求。按照 SOLAS 公约修正案的批准、通过和生效程序，使上述涂层性能标准成为强制性要求的第 II-1/3-2 条修正案也将于 MSC 82 通过，预期将于 2008 年 7 月 1 日生效。

3、MSC 81 注意到 2006 年 7 月 1 日生效的 SOLAS 第 XII/6.3 条修正案要求散货船的双舷侧处所和专用海水压载舱按照 IMO 制定的涂层性能标准进行涂装，因此与涂层性能标准实际能够生效日期出现不衔接的时期。

4、为此，MSC 81 决定 SOLAS 公约缔约国可以在 MSC 81 批准的 SOLAS 第 II-1/3-2 条和第 XII/6.3 条修正案及新的涂层性能标准生效之前对于 2006 年 7 月 1 日或以后建造的悬挂其船旗的 150m 以上的散货船提前应用这一涂层性能标准，并以海安会通函 MSC.1/Circ.1198 将上述 SOLAS 公约修正案和涂层性能标准草案散发供使用。

5、另外，国际船级社协会于 2006 年 4 月 1 日通过的油船和散货船共同规范也要求对 IMO 通过上述修正案之日或以后签订建造合同的适用于共同规范的油船和散货船，其专用海水压载舱和散货船双舷侧处所保护涂层应符合 IMO 制定的涂层性能标

准。

6、鉴于上述，现将海安会通函 MSC.1/Circ.1198（包括附件）中、英文下发，以便各有关方面：

1） 可根据有关船旗国政府要求提前应用涂层性能标准；

2） 对采用 IACS 共同规范的船舶，按照规范要求应用该涂层性能标准。

7、船厂、设计部门、审图部门等有关单位在按上述第 6 条应用该涂层性能标准时，请注意在签订设计/建造合同中明确所采用的上述涂层性能标准（MSC.1/Circ.1198 的附件 2）

【注：本通函在本社网站（www.ccs.org.cn ）上发布，并由本社验船师转发所辖区域内的船厂、船东】

附件：海安会通函 MSC.1/Circ.1198 中、英文

附件：MSC.1/Circ.1198

对 SOLAS 第 XII/6.3 条应用关于所有类型船舶专用海水压载舱和散货船双舷侧处所防腐要求和应用所有类型船舶专用海水压载舱和散货船双舷侧处所保护涂层性能标准

1、海上安全委员会第81届会议（2006年5月10日至19日）承认对于当实施MSC.170(79)通过的 SOLAS 第 XII/6.3 条关于散货船双舷侧处所和专用海水压载舱防腐要求的修正案（将于 2006 年 7 月 1 日生效）和相关的涂层性能标准时可能遇到的问题的关切。

2、委员会为使上述涂层性能标准在经修正的 SOLAS 第 II-1/3-2 条下成为强制性标准，批准了所附的 SOLAS 第 II-1/3-2 条和第 XII/6.3 条修正案（附件 1）和所有类型船舶专用海水压载舱和散货船双舷侧处所保护涂层性能标准（附件 2），并将于 MSC82 通过。这些修正案预期于 2008 年 7 月 1 日生效。

3、委员会在批准修正案草案时，意识到 2006 年 7 月 1 日及以后建造的船长为 150m 及以上的散货船，根据 SOLAS 第 XII/6.3 条要求，仍将要按照 MSC.47(66)通过的 SOLAS 第 II-1/3-2 条涂装，直到前述修正案生效。

4、因此，委员会决定，SOLAS 缔约国政府可以对 2006 年 7 月 1 日或以后建造的悬挂其船旗的船长为 150m 及以上的散货船，提前应用本通函所附的 SOLAS 第 II-1/3-2 条以及所有类型船舶专用海水压载舱和散货船双舷侧处所保护涂层性能标准草案，作为替代 MSC.47(66)通过的 SOLAS 第 II-1/3-2 条的要求。

5、请 SOLAS 缔约国政府，当根据 SOLAS 第 I/8 条和第 I/12 条对货船检验和发证时，以及根据 SOLAS 第 I/19 条进行港口国监督时，对这一决定予以考虑。

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附件 1

SOLAS 公约第 II-1/3-2 条和第 XII/6 条修正案

（草案）

第 II-1/3-2 条 油船和散货船海水压载舱的防腐

1、规则的标题和内容由以下文本替代：

“所有类型船舶专用海水压载舱和散货船双舷侧处所的保护涂层

1 本规则第 2 段适用于不小于 500 总吨的船舶：

.1 该船于 2008 年 7 月 1 日或以后签定建造合同；或
.2 无建造合同，在 2009 年 1 月 1 日或以后安放龙骨或处于类似建造阶段；或
.3 于 2012 年 7 月 1 日或以后交船。

2 所有船上布置的专用海水压载舱和 150m 及以上的散货船的双舷侧处所在建造时应按照《所有类型船舶专用海水压载舱和散货船双舷侧处所保护涂层性能标准》涂装，该标准是海上安全委员会以海安会 MSC.…(82)决议通过的，可由本组织修正，但此种修正应按本公约第 VIII 条关于附则（除第 I 章外）适用的修正程序予以通过、达到生效和生效。

3 1998 年 7 月 1 日或以后建造，但在第 1 段所指日期前签订合同、安放龙骨或交船的油船和散货船上布置的所有专用海水压载舱应符合经海安会 MSC.47(66)决议通过的第 II-1/3-2 条的要求。

4 保护涂层系统的维护应包含在船舶的整体维护体系中。保护涂层系统的有效性应在船舶寿命期间由主管机关或被主管机关认可的组织根据本组织制定的导则*进行验证。

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* 将由本组织制定的导则。

第 XII/6 条 散货船的附加安全措施

2、删除现第 3 段，并将现第 4 段和第 5 段重新编号为第 3 段和第 4 段。

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附件 2

所有类型船舶专用海水压载舱和散货船双舷侧处所保护涂层性能标准
（草案）

1 目的

为实施 MSC.［…(82)］通过的 SOLAS 第 II-1/3-2 条，本标准规定了对第 II-1/3-2 条所述日期或以后签订合同、安放龙骨或交船的不小于 500 总吨的所有类型船舶专用海水压载舱和船长不小于 150m 的散货船双舷侧处所[①]内保护涂层的技术要求。

2 定义

下列定义适用于本标准:

2.1 *压载舱* 为 A.798 (19) 和 A.744(18) 决议所定义的那些压载舱；

2.2 *露点* 为空气被所含潮气饱和时的温度；

2.3 *DFT* 为干膜厚度；

2.4 *灰尘* 为呈现在准备涂漆表面上的松散的颗粒性物质，是由于喷射清理或其他表面处理工艺产生的，或由于环境作用产生的；

2.5 *边缘打磨* 系指二次表面处理前对边缘的处理；

2.6 *"良好"状况* 系指 A.744 (18) 决议定义的有少量点锈的状况；

2.7 *硬涂层* 系指在固化过程中发生化学变化的涂层或非化学变化、在空气中干燥的涂层。硬涂层可用于维护目的，类型可以是无机的也可以是有机的；

2.8 *NDFT* 为名义干膜厚度。90/10 规则意指所有测量点的 90%测量结果应大于或等于 NDFT，余下 10%测量结果均应不小于 0.9×NDFT；

2.9 *底漆* 系指车间底漆涂装后在船厂涂装的涂层系统的第一道涂层；

2.10 *车间底漆* 系指预先涂在钢板表面的底漆，通常在自动化车间喷涂（在涂层系统第一道涂层之前）；

2.11 *预涂* 系指对关键区域边缘、焊缝、不易喷涂区域等位置的预先涂刷，以保证良好的涂料附着力和恰当的涂层厚度；

2.12 *目标使用寿命* 为涂层系统设计寿命的目标值，以年计；

[①]本标准仅适用于钢质的所有类型船舶专用压载水舱和散货船双舷侧处所。

2.13 *技术规格书* 为涂料生产商的产品规格书，包含与涂层及其涂装有关的详细技术性说明和资料。

3 通则

3.1 涂层系统达到其目标使用寿命的能力取决于涂层系统的类型，钢材处理，涂装和涂层检查及维护。所有这些方面对涂层系统的优良性能都有影响。

3.2 表面处理和涂装过程的检查应该由船东，船厂和涂料生产商达成一致，并提交给主管机关或主管机关认可的组织审查。应报告这些检查的明确证据并包括在涂层技术文件中（CTF）（见第 3.4 段）。

3.3 关于第 4 节所列的标准，应考虑下列因素：

.1 为了防止涂层系统过早破坏和/或老化，船厂有必要在涂装作业中严格执行涂装规范、程序、各种不同的步骤（包括，但不限于表面准备）；

.2 在船舶设计阶段可采取措施以提高涂层的性能，如减少挖孔、采用圆顺的外形、避免复杂的几何结构，保证结构形状使工具容易进入，方便涂装部位的清洁、排水和干燥；

.3 本文件规定的涂层性能标准是基于制造商、船厂和船舶作业者的经验；并不意味着排斥其他合适的涂层系统，只要证明该涂层的性能至少不低于本标准规定的性能。替代涂层系统的验收标准见第 8 节。

3.4 涂层技术文件

3.4.1 用于船舶海水压载舱和双舷侧处所的涂层体系规范、船厂和船东的涂装工作记录、涂层系统选择的详细标准、工作规范、检查、维护和修补均应形成文件记入“涂层技术文件”，涂层技术文件应由主管机关或主管机关认可的组织审查。

3.4.2 新造阶段

涂层技术文件至少应包括与本标准相关的下列项目，并在新船建造阶段由船厂提交：

.1 符合证明或型式认可证书的副本；

.2 技术规格书副本，包括：

- 产品名称，识别标记和 / 或编号；
- 涂层系统的材料，成份和组成，涂层颜色；
- 最小和最大干膜厚度；
- 涂装的方式，工具和/或机械；
- 涂装前的表面状况（除锈等级，清洁度、粗糙度等）；和
- 环境限制条件（温度和湿度）；

.3 船厂的涂装作业工作记录，包括：

- 每个舱室涂装的真实空间和面积（平方米计）；
- 涂装的涂层系统；

- 涂装的时间、厚度、道数，等等；
- 涂装时的周围环境条件；和
- 表面处理的方式；

.4 船舶建造期间涂层系统的检查和修补程序；

.5 涂层检查人员签署的涂装日志—声明涂层依照规范涂装，已得到涂料供应商代表的认可，并详细说明与规范的差异（检查日志和不符合报告格式见附录 2）；

.6 船厂核实过的检查报告，包括：
- 检查完成日期；
- 检查结果；
- 备注（如有时）；和
- 检查人员签名

.7 营运期内涂层系统的保养和修补程序。

3.4.3 维护、修补和局部重涂
应按照涂层维护和修补指南*中有关章节要求将维护、修补和局部重涂事项记录在涂层技术文件中。

3.4.4重涂

如果全面重涂，应将第 3.4.2 段规定的条目记录在涂层技术文件中。

3.4.5 涂层技术文件在船舶寿命期内应保存在船上并及时补充有关材料。

3.5 健康和安全
船厂负责执行国家标准，确保劳动者的健康和安全，减少火灾和爆炸的危险。

4 涂层标准

4.1 性能标准

本标准基于这样的规范和要求，即为使涂层达到 15 年的目标使用寿命，这是从最初的涂装开始，涂层系统维持“良好”状态的持续时间。涂层的实际使用寿命是变化的，取决于很多的变化因素，包括在使用中遇到的真实条件。

4.2 标准适用范围

所有类型船舶的专用海水压载舱和船长不小于 150m 散货船的双舷侧处所内的保护涂层应至少符合本标准的要求。

4.3 特别适用

* 将由本组织制定的指南

4.3.1　本标准覆盖了船体钢结构保护涂层的要求。注意到一些其他独立舾装件安装在涂有防腐涂料的舱内。

4.3.2　建议在尽可能地范围内，对永久性检验通道部分，如扶手，独立平台，梯子等非结构整体部分，应用本标准。对非船体结构整体部分的构件，也可以使用其他防腐等效方法，只要这些方法对周围结构的保护涂层性能没有影响。和船体结构成为一体的通道，如作为步道的纵向加强肋、纵梁等，应完全符合本标准。

4.3.3　建议管子、测量装置等支撑件参照第 4.3.2 段所述对非结构整体构件的要求涂装。

4.4 涂层的基本要求

4.4.1　表 1 中列出了所有类型船舶专用海水压载舱和船长不小于 150m 的散货船双舷侧处所保护涂层在建造时的涂装要求，作为满足第 4.1 段所规定的性能标准的要求。

4.4.2　涂料生产商应提供满足表 1 所列要求的保护涂层系统的规范。

4.4.3　主管机关或主管机关认可的组织应核实技术规格书和保护涂层的符合证明或型式认可证书。

4.4.4　船厂应依据核实的技术规格书和工厂自己查证的涂装程序涂装保护涂层。

表 1 – 所有类型船舶的压载舱和船长不小于 150m 的散货船双舷侧处所涂层系统的基本要求

	特性	要求	参考标准
1　涂层系统的设计			
a	涂层系统的选择	涂层系统的选择应由各有关方面结合涂层的使用条件和有计划的保养加以考虑，应考虑其中的下列事项： .1　与受热表面相关舱室的位置; .2　压载和排压载作业的频率; .3　要求的表面条件; .4　要求的表面清洁度和干燥度; .5　辅助阴极保护装置，如果有。（如果涂层有辅助的阴极保护，涂层应与辅助阴极保护系统相兼容）。 涂层生产商应提供成文的、有满意性能记录和技术规格书的产品。 生产商应具有提供适当技术帮助的能力。性能记录、技术规格书和技术帮助 (如有)应在涂层技术文件中记录。 在阳光曝晒甲板下面或在加热舱室周围的舱壁上应用的涂料应具有耐反复加热和／或冷却而不变脆的性能。	

	特性	要求	参考标准
.b	涂层类型	环氧基体系 其他涂层系统的性能要通过附件 1 的试验程序。 建议多道涂层系统，每道涂层的颜色要有对比。 面涂层应为浅色，便于使用期内的检查。	–
.c	涂层合格预试验	环氧基系统在本标准生效日之前，依据附录 1 的试验程序或等效的方法进行实验室试验。如至少满足对锈蚀和鼓泡的要求，则可以接受；或有文件记录经现场暴露试验5年后涂层的最终状况不低于“良好”，也可接受。 所有其他的系统，要求按照附录 1 的试验程序或等效的试验程序进行试验。	–
.d	工作规范	应至少进行两道预涂和两道喷涂。仅在焊缝区能证明涂层可满足 NDFT 要求的范围内，可减少第二道预涂，以避免不必要的涂层过厚。任何减少第二道预涂的范围都应详细地全部记录在 CTF 中。 预涂应采用刷涂或辊涂的方法。辊涂只能用于流水孔、老鼠洞等区域。 应根据涂料生产商的建议，使每一道主涂层在下一道主涂层涂装前适当固化。表面污染物如锈、油脂、灰尘、盐、油等，应该在涂装前根据涂料生产商的建议采用适当的方法去除。应去除埋在涂层中的磨料嵌入物。工作规范应包括涂料商规定的涂层覆涂间隔和可踩踏间隔。	–
.e	NDFT（名义总干膜厚度）	环氧类涂层 NDFT 320μm， 90/10 原则，其他系统根据涂料生产商的规范。 总干膜厚度最大值依据涂料生产商的详细规范。 应小心避免涂膜过厚。涂装中应定期检查湿膜	测厚仪的类型和校准依据 SSPC-PA2

	特性	要求	参考标准
		厚度。 稀释剂应限于使用涂料商推荐的类型和用量。	
.2 第一次表面处理			
.a	喷射处理和粗糙度	Sa 2 ½级，粗糙度介于 30-75 μm。 在下列情况下不应进行喷砂： .1 相对湿度超过 85%；或 .2 钢板的表面温度高于露点温度少于 3°C。 在表面处理结束时，在进行底漆涂装前，应依据涂料商的建议检查钢板表面的清洁度和粗糙度。	ISO 8501-1, ISO 8503-1/3
.b	水溶性盐限制（相当于氯化钠）	≤ 50 mg/m^2 NaCl	电导率测定依据 ISO 8502-9
.c	车间底漆	无缓蚀剂的含锌硅酸锌基涂料或等效的涂料。 车间底漆与主涂层系统的相容性应由涂料生产商确认。	–
.3 二次表面处理			
.a	钢板状况调整	钢板表面应加以处理，以使选择的涂层能够均匀涂布，达到所要求的 NDFT 和有足够的附着力。去除毛边，打磨焊珠，去除焊接飞溅物和任何其他的表面污染物，使之达到 ISO 8501-3 等级 P2。 涂装前边缘或处理成半径至少为 2 mm 的圆角或经过三次打磨，或至少经过等效的处理。	ISO 8501-3
.b	表面处理	被破坏的车间底漆和焊缝处理达到 Sa2½； 如车间底漆按表 1.1.c 所述试验程序未通过涂层合格证明预试验，完整底漆至少要去除 70%，达到 Sa 2。 如果由环氧基的主涂层和车间底漆组成的整	ISO 8501-1

	特性	要求	参考标准
		体涂层系统按表 1.1.c 的试验程序通过了合格证明预试验，则当使用同样的环氧涂层系统时，可保留完整的车间底漆。保留的车间底漆应用扫掠式喷砂、高压水洗或等效的方法清洁。 如果一种硅酸锌车间底漆作为环氧涂层系统的一部分已通过表 1.1.c 的涂层合格预试验，该底漆可和其他的通过表 1.1.c 涂层合格预试验的环氧涂层组合使用，只要该底漆的兼容性得到生产商的确认，并通过附录 1 的附 1 第 1.7 段所述的无浪运动条件下的试验。	
.c	合拢后的表面处理	大接缝 St 3，或更好，或可行时 Sa 2½。小面积破坏区域不大于总面积的 2%时：St3。 相邻接破坏区域的面积超过 25 m^2 或超过舱室总面积 2%, 应采用 Sa2½。 涂层搭接处表面要处理成斜坡状。	ISO 8501-1
.d	粗糙度要求	全面或局部喷砂处理，30-75 μm，其他的处理按照涂料生产商的建议。	ISO 8503-1/3
.e	灰尘	颗粒大小为“3”、”4” or “5”的灰尘分布量 1 级。 更小颗粒的灰尘，如不用放大镜在待涂表面可见时，应去除。	ISO 8502-3
.f	喷砂 /打磨后表面水溶性盐含量（相当于氯化钠）	≤ 50 mg/m^2 NaCl	电导率测定，依据 ISO 8502-9
.g	油污	无油污。	–
.4 其他			
.a	通风	为使涂料适当地固化，必需予以充足的通风。应根据涂料生产商的建议，在整个涂装和涂装完成后的一段时间内保持通风。	–

	特性	要求	参考标准
.b	环境条件	涂装应按照生产商的规范，在控制湿度和表面的条件下进行。此外，下述情况下不应进行涂装： .1 相对湿度超过 85%，或 .2 钢材表面温度高于露点温度小于 3℃。	–
.c	涂层检验	应避免破坏性检验。 为了质量控制，每道涂层干膜厚度都应进行测量。最后一道涂层涂装后应使用适当的测厚计确定总干膜厚度。	ISO 19840 附件 3
.d	修补	任何缺陷区域，如针孔，气泡，露底等，应做标记，并适当修复受影响的区域。所有这类修补应再次检查并以文件记录。	–

5 涂层系统认可

涂层系统合格预试验（表 1.1.c）的结果应以文件记录。如结果令人满意，应由独立于涂料生产商的第三方签发一份符合证明或型式认可证书。

6 涂层检查要求

6.1 通则

6.1.1 为保证符合本标准，下列事项应由具有 NACE II 级、FROSIO 红级资格或主管机关或主管机关认可的组织承认的同等资格的涂层检查人员完成。

6.1.2 涂装检查人员应检查整个涂装过程的表面处理和涂装施工，作为最低要求，应至少进行第 6.2 节中的检查项目，保证符合本标准。检查重点应放在表面处理和涂装施工各阶段的起始，因为不恰当的工作在以后的涂装过程中很难纠正。应采用非破坏性的方法检查代表性结构件的涂层厚度。检查人员应证实所进行的全部测量过程是恰当的。

6.1.3 应由检查人员记录检查的结果，并应放入 CTF 中（参考附录 2 - 检查日志和不合报告的样本）。

6.2 检查项目

建造阶段		检查项目
表面预处理	a	在喷砂开始前和天气发生突变时，应测量钢板表面温度、相对湿度和露点，并记录。
	b	应测量钢板表面的可溶性盐分，检查油、油脂和其他污染物。
	c	车间底漆涂装过程中应监控钢板表面的清洁度。
	d	应确认车间底漆的材料满足表 1 中 .2.c 的要求。
厚度		如声明硅酸锌车间底漆与主涂层体系相兼容，则应确认车间底漆厚度和固化情况与规定值一致。
分段组装	a	分段建造完成后，二次表面处理开始前，应目视检查钢板表面处理，包括检查边缘的处理。 去除任何的油、油脂或其他可见的污染物。
	b	喷砂/打磨/清洁后，在涂装前应目视检查处理好的表面。 完成喷射、清洁，系统第一道涂层涂装前，应检查钢板表面残留可溶性盐水平，每个分段至少取一点。
	c	在涂层涂装和固化阶段，应监控钢板表面温度、相对湿度和露点，并记录。
	d	应按表 1 中的涂装过程步骤进行检查。
	e	应按附录 3 的规定和列出的要求进行 DFT 测量，验证涂层达到了规定的厚度。
合拢	a	目视检查钢板表面状况，表面处理情况，验证表 1 中其他要求是否达到，达成一致的规范是否得到执行。
	b	涂装前和涂装中应定期测量钢板表面温度、相对湿度和露点，并做记录。
	c	应按表 1 中的涂装过程步骤进行检查。

7 验证要求

在审核执行本性能标准船舶的涂层技术文件之前，应由主管机关或主管机关认可的组织进行下列各项工作：

.1 核查技术规格书和符合证明或型式认可证书符合本涂层性能标准；

.2 核查代表性包装桶上的涂料标识与技术规格书和符合证明或型式认可证书标识的涂料一致；

.3 按第6.1.1段的资质标准核查检查员的资质；

.4 核查检查员关于表面处理和涂层的涂装报告，表明符合涂料商的技术规格书和符合证明或型式认可证书一致；和

.5 监督涂层检查要求的执行。

8 替代系统

8.1 所有根据本标准表 1 涂装的非环氧基涂层系统都定义为替代系统。

8.2 本性能标准是基于公认的和常用的涂层系统。这并不意味着排斥其他证明具有等效性能的可供选择的系统，如非环氧基的体系。

8.3 接受其他涂层系统将需要有材料证明其耐腐蚀性能至少与本标准要求相当。

8.4 文件证明材料应至少包括涂层系统相当于符合第 4 节涂层标准的令人满意的性能，目标使用寿命为 15 年，或者经实际场地暴露试验 5 年后涂层状况不低于“良好”或者通过实验室试验。实验室的试验应按照本标准附录 1 规定的试验程序进行。

附录 1

所有类型船舶压载舱和散货船双舷侧处所用涂层合格性试验程序

1 范围

本程序提供了本标准第 5 和 8.3 段所涉及的试验程序的详细步骤。

2 定义

涂层规范 系指涂层系统的规范，包括涂层系统类型、钢板处理、表面处理、表面清洁度、环境条件、涂装程序、验收标准和检查。

3 试验

涂层规范应该通过下列试验加以验证。试验程序应遵守本附录的附 1（模拟压载舱状况试验）和附 2（冷凝舱试验）：

.1 附 1 和附 2 适用于专用海水压载舱的保护涂层。

.2 附 2 适用于船长 150m 及以上散货船的双舷侧处所（非专用海水压载舱）的保护涂层。

附 1　　模拟压载舱状况试验

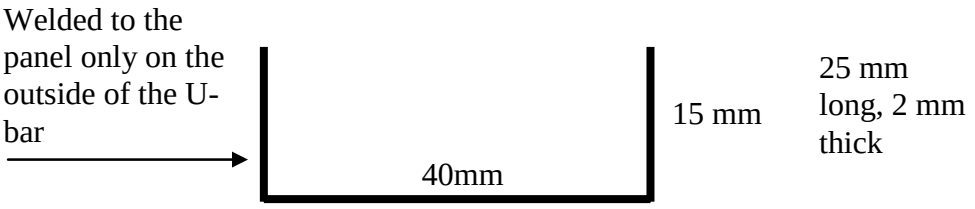
1　试验条件

模拟压载舱状况的试验应满足下列各项条件：

.1　试验期为 180 天。

.2　5 块试验样板。

.3　每块样板尺寸 200mm × 400mm × 3mm。其中的两块样板（样板 3# 和 4#）在背面焊 U 型条，U 型条距一条短边 120mm，距长边各 80mm。



样板应按照性能标准的表 1 的 2 和 3 处理，涂层系统的涂装按照表 1.1.d 和 1.1.e.条进行。车间底漆露天老化至少 2 月并用低压水清洗或其他温和的方法清洁。不用扫掠式喷射或高压水清洗，或其他去除底漆的方法。老化方法和程度应考虑底漆是目标寿命 15 年的系统的基础。为了鼓励创新，替代的处理方法、涂层系统和干膜厚度经明确说明后可以采用（图左侧文字说明：仅在 U 型条外侧焊接）。

.4　试验样板的背面应适当涂装，避免对试验结果产生影响。

.5　模拟压载舱的真实状况，一个试验循环为二个星期装载天然或人工海水，一个星期空载。海水温度保持在大约 35℃。

.6　样板 1：模拟上甲板的状况，50℃加热 12 小时，20℃冷却 12 小时。试验样板周期性的用天然或人工海水泼溅，模拟船前后颠簸和摇摆的运动。泼溅间隔为 3 秒或更短，板上有划破涂层至底材的、有一定长度的横向划线。

.7　样板 2: 固定锌牺牲阳极以评估阴极保护效果。试验样板上距离阳极 100mm 处开有直径 8mm 的圆形人工漏涂孔，以评估阴极保护的效果。试验样板循环浸泡在天然或人工海水中。

.8　样板 3：背面冷却，形成一个温度梯度，以模拟一个压载翼舱的冷却舱壁；天然或人工海水泼溅，模拟船前后颠簸和摇摆的运动。温度梯度大约为 20℃，泼溅间隔为 3 秒或更短。板上有划破涂层至底材的、有一定长度的横向划线。

.9　样板 4：天然或人工海水循环泼溅，模拟船前后颠簸和摇摆的运动，泼溅间隔为 3 秒或更短，板上有划破涂层至底材的、有一定长度的横向划

线。

.10 样板 5：浸泡于 70℃的天然或人工海水中 180 天，模拟双层底受热的燃料舱和压载水舱之间的边界钢板。

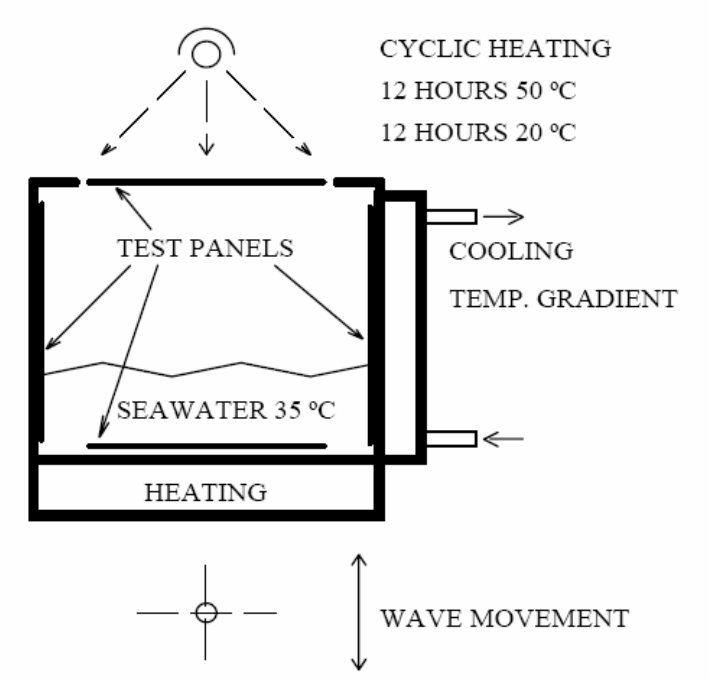


图 1 压载舱涂层试验的波浪舱

2 试验结果

2.1 试验前，应报告涂层系统的下列测量数据:

.1 该涂料的基料和固化剂组分的红外鉴定

.2 该涂料的基料和固化剂组分的比重，依据 ISO 2811-74;

.3 针孔数量，低电压探测器电压 90V 条件;

2.2 试验后，应报告下列测量数据:

.1 起泡和锈蚀，依据 ISO 4628/2 和 ISO 4628/3；

.2 干膜厚度(DFT)（比较样块法）（附录 3）；

.3 附着力，依据 ISO 4624；

.4 柔韧性仅作为一种参考数据，依据 ASTM D4145，根据样板的厚度调整（ 3mm 板，300 μm 涂层，150 mm 圆柱 有 2% 延伸）；

.5 阴极保护单位重量损失/电流需要/人工漏涂处的剥离；

.6 划痕附近的腐蚀蔓延。测量沿划痕两边的腐蚀蔓延，并测得每块样板的

最大膜下腐蚀深度，三个最大值的平均值作为验收值。

3 验收标准

3.1 第 2 节的试验结果应满足下列标准：

项目	依据本标准表 1 涂装的环氧基体系的验收标准	替代系统的验收标准
样板起泡	没有	没有
样板锈蚀	0 级 (0%)	0 级 (0%)
针孔数量	0	0
附着力	> 3.5 MPa 基材和涂层间或涂层之间的剥离面积在 60%或以上。	> 5.0 MPa 基材和涂层间或涂层之间的剥离面积在 60%或以上
内聚力	>3.0 MPa 涂层之间的粘结面积破坏在 40%或以上	>5.0 MPa 涂层之间的粘结面积破坏在 40%或以上
从重量损失计算的阴极保护需要电流	< 5mA/m^2	< 5mA/m^2
阴极保护；人工漏涂处的剥离	< 8mm	< 5mm
划痕附近的腐蚀蔓延	< 8mm	< 5 mm
U 型条	涂层若在角上或焊缝处有缺陷，开裂或剥离都将判定体系不合格。	涂层若在角上或焊缝处有缺陷，开裂或剥离都将判定体系不合格。

3.2 试验的环氧基系统在本标准生效前应满足上表中的鼓泡和锈蚀标准。

3.3 试验的环氧基系统按本标准表 1 涂装时应满足上表对环氧基体系的标准。

3.4 不一定是环氧基的替代系统和 / 或不一定按本标准表 1 涂装的替代系统应满足上表对替代系统的要求。

4 试验报告

试验报告应包括下列内容：

.1 生产商名称；

.2 试验日期；

.3 产品名称/标识，包括涂料和底漆；

.4 批号；

.5 钢板表面处理的数据，包括下列数据：

- 表面处理方式；
- 水溶性盐含量；
- 灰尘，和
- 磨料嵌入物；

.6 涂层体系涂装的数据，包括下列数据：

- 车间底漆；
- 涂层道数；
- 涂装间隔*；
- 试验前的干膜厚度*；
- 稀释剂*；
- 湿度*；
- 气温*，和
- 钢板温度；

*包括实际样板数据和制造商要求/建议的数据

.7 按第 2 节试验的试验结果，和

.8 按第 3 节判断的结果。

附 2

冷凝舱试验

1 试验条件

冷凝舱试验依据 ISO 6270 进行。

.1 暴露时间为 180 天。

.2 两块试板。

.3 试板的大小尺寸为 150mm × 150mm × 3mm。试板的处理应按性能标准表 1 的 .2 和 .3 条，涂层系统的涂装按照表 1 的 .1.d 和 .e.条，车间底漆至少露天老化 2 月并用低压水清洗或其他温和的方法清洁。不用扫掠式喷射或高压水清洁，或其他的底漆去除方法。应考虑曝晒方法和曝晒程度，因为底漆是目标寿命 15 年体系的基础。为了鼓励创新，替代的处理方法、涂层系统和干膜厚度清楚详细说明后可以采用。

.4 试板的反面应适当涂装，避免对试验结果产生影响。

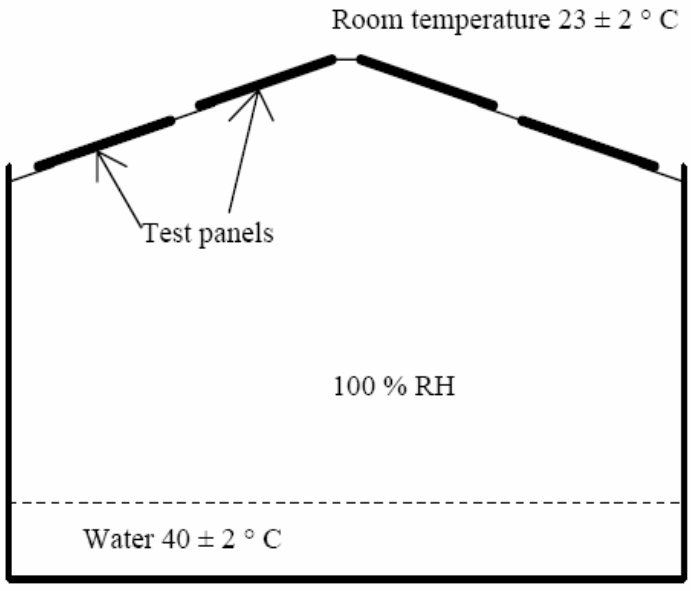


图 2 冷凝舱试验

2 试验结果

依据附 1 的第 2 节（2.2.5 和 2.2.6 除外）。

3 验收标准

3.1 基于第 2 节试验的结果应满足下列标准：

项目	依据本标准表 1 涂装的环氧基系统的验收标准	替代系统的验收标准
样板起泡	没有	没有
样板锈蚀	0 级 (0%)	0 级 (0%)
针孔数量	0	0
附着力	> 3.5 MPa 底材和涂层间或涂层之间的剥离面积在 60%或以上	> 5.0 MPa 底材和涂层间或涂层之间的剥离面积在 60%或以上
内聚力	>3.0 MPa 涂层之间的粘结面积破坏在 40%或以上	>5.0 MPa 涂层之间的粘结面积破坏在 40%或以上

3.2 试验的环氧基系统在本标准生效前应满足上表对鼓泡和锈蚀的标准。

3.3 试验的环氧基系统当按本标准表 1 涂装时应满足上表对环氧基系统的标准。

3.4 所有的替代系统不一定是环氧基和 / 或不一定按本标准表 1 涂装的应满足上表所示的对替代系统的要求。

4 试验报告

依照附 1 第 4 节。

附录 2　检查日志和不符合报告（样本）

DAILY LOG **Sheet No:**

Vessel:	**Tank/Hold No:**	**Database:**
Part of structure:		
SURFACE PREPARATION		
Methode:	**Area (m^2):**	
Abrasive:	**Grain size:**	
Surface temp:	**Air temp.:**	
Rel. humidity (max):	**Dew point:**	
Standard achieved:		
Rounding of edges:		
Comments:		
Job No:	**Date:**	**Signature:**
COATING APPLICATION		
Methode:		

Coat No	System	Batch No	Date	Air temp.	Surf. temp.	RH%	Dew Point	DFT* Meas.*	Speci-fied

*** Mesured min. and max. DFT. WFT and DFT readings to be attached to daily log.**

Comments:		
Job No:	**Date:**	**Signature:**

Non-conformity report **Sheet No:**

Vessel:	**Tank/Hold No:**	**Database:**
Part of structure:		
CORRECTIVE DESCRIPTION OF THE INSPECTION FINDINGS		
Description of Findings:		
Reference document (daily log):		
Action taken:		
Job No:	**Date:**	**Signature:**

附录 3　　干膜厚度测量

DFT 验证检查点的选取方式：

.1　平板区域每 5 m^2 测量一个数据

.2　2～3 米间隔测量一个数据，尽可能地靠近压载舱边界，但距压载舱边界的边缘不少于 15mm

.3　纵向和横向加强梁：

一组测量点如下所示进行取点，每 2～3 米测量一组数据，在主支撑梁间不得少于 2 组；

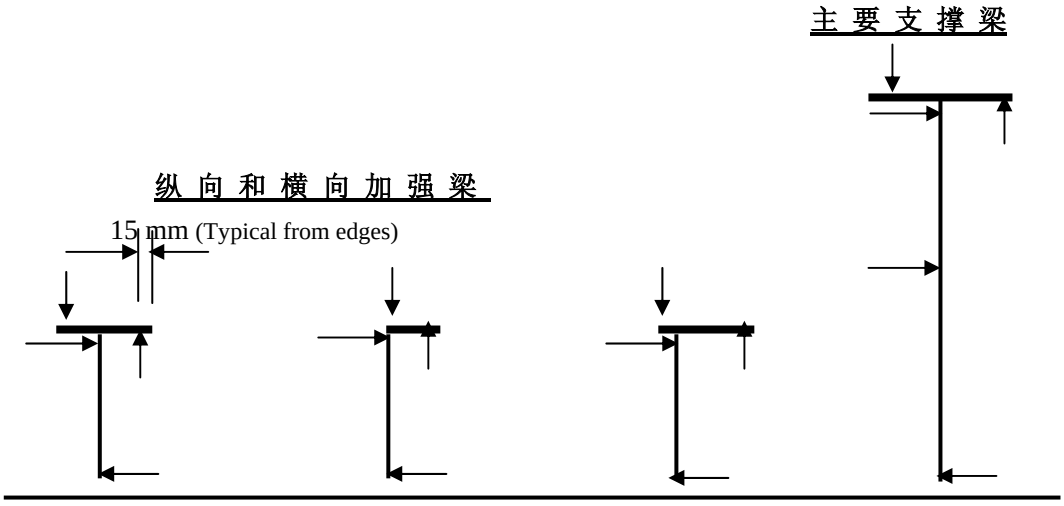


图 3

注：图示箭头指示关键区域，应理解为指示两侧。

.4　每组主支撑梁测三个数据，其他的每组结构如图中箭头所示测二个数据；

.5　主支撑梁（纵梁和横梁）每 2～3 米如图 3 所示进行一组数据的测量，但不得少于 3 组；

.6　开放点周围每一边测一个数据；

7　每平米测五个数据，但复杂区域测量不得少于三个数据（如主支撑梁大支架）；

.8　涂层检查员对认为必要的任何区域可额外取点以验证涂层厚度。

附录 4

参考标准

* Standards refers to PSPC standard

Standard No.	Description
ASTM D4145 : 1983	Standard Test Method for Coating Flexibility of Prepainted Sheet
SSPC-PA2 : 2004	PAINT APPLICATION SPECIFICATION NO.2
ISO 8501-1 : 1988/Suppl : 1994	Preparation of steel substrate before application of paints and related products - Visual assessment of surface cleanliness
ISO 8501-3 : 2001	Preparation of steel substrate before application of paints and related products - Visual assessment of surface cleanliness
ISO 8502-3 : 1993	Preparation of steel substrate before application of paints and related products - Tests for the assessment of surface cleanliness
ISO 8502-9 : 1998	Preparation of steel substrate before application of paints and related products - Tests for the assessment of surface cleanliness
ISO 8503-1 : 1988	Preparation of steel substrate before application of paints and related products - Surface roughness characteristics of blast-cleaned steel substrates
ISO 8503-3 : 1988	Preparation of steel substrate before application of paints and related products - Surface roughness characteristics of blast-cleaned steel substrates
ISO 2811-4 : 1997	Paints and varnishes - Determination of density
ISO 4624 : 2002	Paints and varnishes - Pull-off test for adhesion
ISO 4628-2 : 2003	Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance- Part 2
ISO 4628-3 : 2003	Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of common types of defect - Part 3 : Designation of degree of rusting
ISO 6270-2 : 2005	Paints and varnishes - Determination of resistance to humidity - Part 2 : Procedure for exposing test specimens in condensation water atmospheres
ISO 19840 : 2004	Paints and varnishes – Corrosion protection of steel structures by protective paint systems - Measurement of, and acceptance criteria for, the thickness of dry films on rough surfaces

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Ref. T4/3.01

MSC.1/Circ.1198
2 June 2006

APPLICATION OF SOLAS REGULATION XII/6.3 ON CORROSION PREVENTION OF DEDICATED SEAWATER BALLAST TANKS IN ALL TYPES OF SHIPS AND DOUBLE-SIDE SKIN SPACES OF BULK CARRIERS AND APPLICATION OF THE PERFORMANCE STANDARD FOR PROTECTIVE COATINGS FOR DEDICATED SEAWATER BALLAST TANKS IN ALL TYPES OF SHIPS AND DOUBLE-SIDE SKIN SPACES OF BULK CARRIERS

1 The Maritime Safety Committee, at its eighty-first session (10 to 19 May 2006), acknowledged concerns expressed with regard to problems which might be encountered when implementing the requirements of SOLAS regulation XII/6.3 regarding corrosion prevention of double-side skin spaces and dedicated seawater ballast tanks of bulk carriers, adopted by resolution MSC.170(79), which will enter into force on 1 July 2006, and of the associated Performance standard for protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers.

2 The Committee, in order to make the aforementioned Performance standard for protective coatings mandatory under the revised SOLAS regulation II-1/3-2, approved the draft amendments to SOLAS regulations II-1/3-2 and XII/6, set out in annex 1, and the Performance standard for protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers, set out in annex 2, with a view to subsequent adoption at MSC 82. These amendments are expected to enter into force on 1 July 2008.

3 In approving the draft amendments, the Committee recognized that bulk carriers of 150 m in length and upwards constructed on or after 1 July 2006 will still be required by SOLAS regulation XII/6.3 to be coated in accordance with the requirements of regulation II-1/3-2, as adopted by resolution MSC.47(66), until the entry into force of the aforementioned amendments.

4 The Committee, therefore, resolved that SOLAS Contracting Governments may apply in advance the annexed draft SOLAS regulation II-1/3-2 together with the Performance standard for protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers to bulk carriers of 150 m and above flying their flag constructed on or after 1 July 2006 in lieu of SOLAS regulation II-1/3-2 as adopted by resolution MSC.47(66).

5 SOLAS Contracting Governments are invited to take account of this decision when surveying and certifying bulk carriers under SOLAS regulations I/8 and I/12 and when exercising port State control under SOLAS regulation I/19.

***

ANNEX 1

DRAFT AMENDMENTS TO SOLAS REGULATIONS II-1/3-2 AND XII/6.3 AND APPENDIX

CHAPTER II-1
CONSTRUCTION – STRUCTURE, SUBDIVISION AND STABILITY, MACHINERY AND ELECTRICAL INSTALLATIONS

PART A-1
STRUCTURE OF SHIPS

Regulation 3-2 – Corrosion prevention of seawater ballast tanks in oil tankers and bulk carriers

1 The existing heading and text of the regulation are replaced by the following:

"**Protective coatings of dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers**

1 Paragraph 2 of this regulation shall apply to ships of not less than 500 gross tonnage:

.1 for which the building contract is placed on or after 1 July 2008, or

.2 in the absence of a building contract, the keels of which are laid or which are at a similar stage of construction on or after 1 January 2009, or

.3 the delivery of which is on or after 1 July 2012.

2 All dedicated seawater ballast tanks arranged in ships and double-side skin spaces arranged in bulk carriers of 150 m in length and upwards shall be coated during construction in accordance with the Performance standard for protective coatings for dedicated seawater ballast tanks in all types of ships and double-side skin spaces of bulk carriers, adopted by the Maritime Safety Committee by resolution MSC.(...), as may be amended by the Organization, provided that such amendments are adopted, brought into force and take effect in accordance with the provisions of article VIII of the present Convention concerning the amendment procedures applicable to the Annex other than chapter I.

3 All dedicated seawater ballast tanks arranged in oil tankers and bulk carriers constructed on or after 1 July 1998 but which are contracted, the keels of which are laid, or which are delivered before the dates referred to in paragraph 1 shall comply with the requirements of regulation II-1/3-2 adopted by resolution MSC.47(66).

4 Maintenance of the protective coating system shall be included in the overall ship's maintenance scheme. The effectiveness of the protective coating system shall be verified during the life of a ship by the Administration or an organization recognized by the Administration, based on the guidelines developed by the Organization[*]."

[*] Refer to the guidelines to be developed by the organization.

CHAPTER XII

ADDITIONAL SAFETY MEASURES FOR BULK CARRIERS

Regulation 6 – Structural and other requirements for bulk carriers

2 The existing paragraph 3 is deleted and existing paragraphs 4 and 5 are renumbered as paragraphs 3 and 4.

***

ANNEX 2

DRAFT PERFORMANCE STANDARD FOR PROTECTIVE COATINGS FOR DEDICATED SEAWATER BALLAST TANKS IN ALL TYPES OF SHIPS AND DOUBLE-SIDE SKIN SPACES OF BULK CARRIERS

1 PURPOSE

This Standard provides technical requirements for protective coatings in dedicated seawater ballast tanks of all type of ships of not less than 500 gross tonnage and double-side skin spaces arranged in bulk carriers of 150 m in length and upward* for which the building contract is placed, the keels of which are laid or which are delivered on or after the dates referred to in SOLAS regulation II-1/3-2 as adopted by resolution MSC.[...](82).

2 DEFINITIONS

For the purpose of this Standard, the following definitions apply:

2.1 *Ballast tanks* are those as defined in resolutions A.798(19) and A.744(18).

2.2 *Dew point* is the temperature at which air is saturated with moisture.

2.3 *DFT* is dry film thickness.

2.4 *Dust* is loose particle matter present on a surface prepared for painting, arising from blast-cleaning or other surface preparation processes, or resulting from the action of the environment.

2.5 *Edge grinding* is the treatment of edge before secondary surface preparation.

2.6 "*GOOD*" *condition* is the condition with minor spot rusting as defined in resolution A.744(18).

2.7 *Hard coating* is a coating that chemically converts during its curing process or a non-convertible air drying coating which may be used for maintenance purposes. Can be either inorganic or organic.

2.8 *NDFT* is the nominal dry film thickness. 90/10 practice means that 90% of all thickness measurements shall be greater than or equal to NDFT and none of the remaining 10% measurements shall be below 0.9 x NDFT.

2.9 *Primer coat* is the first coat of the coating system applied in the shipyard after shop primer application.

2.10 *Shop-primer* is the prefabrication primer coating applied to steel plates, often in automatic plants (and before the first coat of a coating system).

* This Standard applies only to dedicated seawater ballast tanks in all types of ships and double-side skin spaces in bulk carriers which are constructed of steel.

2.11 *Stripe coating* is painting of edges, welds, hard to reach areas, etc., to ensure good paint adhesion and proper paint thickness in critical areas.

2.12 *Target useful life* is the target value, in years, of the durability for which the coating system is designed.

2.13 *Technical Data Sheet* is paint manufacturers' Product Data Sheet which contains detailed technical instruction and information relevant to the coating and its application.

3 GENERAL PRINCIPLES

3.1 The ability of the coating system to reach its target useful life depends on the type of coating system, steel preparation, application and coating inspection and maintenance. All these aspects contribute to the good performance of the coating system.

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 or its recognized organization for review. Clear evidence of these inspections shall be reported and be included in the Coating Technical File (CTF) (see paragraph 3.4).

3.3 When considering the Standard provided in section 4, the following is to be taken into account:

.1 it is essential that specifications, procedures and the various different steps in the coating application process (including, but not limited to, surface preparation) are strictly applied by the shipbuilder in order to prevent premature decay and/or deterioration of the coating system;

.2 the coating performance can be improved by adopting measures at the ship design stage such as reducing scallops, using rolled profiles, avoiding complex geometric configurations and ensuring that the structural configuration permits easy access for tools and to facilitate cleaning, drainage and drying of the space to be coated; and

.3 the coating performance standard provided in this document is based on experience from manufacturers, shipyards and ship operators; it is not intended to exclude suitable alternative coating systems, providing a performance at least equivalent to that specified in this Standard is demonstrated. Acceptance criteria for alternative systems are provided in section 8.

3.4 Coating Technical File

3.4.1 Specification of the coating system applied to the 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 or an organization recognized by the Administration.

* Guidelines to be developed by the Organization.

3.4.2 New construction stage

The Coating Technical File shall contain at least the following items relating to this Standard and shall be delivered by the shipyard at new ship construction stage:

.1 copy of Statement of Compliance or Type Approval Certificate;

.2 copy of Technical Data Sheet, including:

- product name and identification mark and/or number;
- materials, components and composition of the coating system, colours;
- minimum and maximum dry film thickness;
- application methods, tools and/or machines;
- condition of surface to be coated (de-rusting grade, cleanness, profile, etc.); and
- environmental limitations (temperature and humidity);

.3 shipyard work records of coating application, including:

- applied actual space and area (in square metres) of each compartment;
- applied coating system;
- time of coating, thickness, number of layers, etc.;
- ambient condition during coating; and
- method of surface preparation;

.4 procedures for inspection and repair of coating system during ship construction;

.5 coating log issued by the coating inspector – stating that the coating was applied in accordance with the specifications to the satisfaction of the coating supplier representative and specifying deviations from the specifications (example of daily log and non-conformity report, see annex 2);

.6 shipyard's verified inspection report, including:

- completion date of inspection;
- result of inspection;
- remarks (if given); and
- inspector signature; and

.7 procedures for in-service maintenance and repair of coating system*.

3.4.3 Maintenance, repair and partial re-coating

Maintenance, repair and partial re-coating activities shall be recorded in the Coating Technical File in accordance with the relevant section of the Guidelines for coating maintenance and repair*.

* Guidelines to be developed by the Organization.

3.4.4 Re-coating

If full re-coating is carried out, the items specified in paragraph 3.4.2 shall be recorded in the Coating Technical File.

3.4.5 The Coating Technical File shall be kept on board and maintained throughout the life of the ship.

3.5 Health and safety

The shipyard is responsible for implementation of national regulations to ensure the health and safety of individuals and to minimize the risk of fire and explosion.

4 COATING STANDARD

4.1 Performance standard

This Standard is based on specifications and requirements which intend to provide a target useful coating life of 15 years, which is considered to be the time period, from initial application, over which the coating system is intended to remain in "GOOD" condition. The actual useful life will vary, depending on numerous variables including actual conditions encountered in service.

4.2 Standard application

Protective coatings for dedicated seawater ballast tanks of all ship types and double-side skin spaces arranged in bulk carriers of 150 m in length and upward shall at least comply with the requirements in this Standard.

4.3 Special application

4.3.1 This Standard covers protective coating requirements for the ship steel structure. It is noted that other independent items are fitted within the tanks to which coatings are applied to provide protection against corrosion.

4.3.2 It is recommended that this Standard is applied, to the extent possible, to those portions of permanent means of access provided for inspection not integral to the ship structure, such as rails, independent platforms, ladders, etc. Other equivalent methods of providing corrosion protection for the non-integral items may also be used, provided they do not impair the performance of the coatings of the surrounding structure. Access arrangements that are integral to the ship structure, such as increased stiffener depths for walkways, stringers, etc. are to fully comply with this Standard.

4.3.3 It is also recommended that supports for piping, measuring devices, etc., be coated in accordance with the non-integral items indicated in paragraph 4.3.2.

4.4 Basic coating requirements

4.4.1 The requirements for protective coating systems to be applied at ship construction for dedicated seawater ballast tanks of all ship types and double-side skin spaces arranged in bulk carriers of 150 m in length and upward meeting the performance standard specified in paragraph 4.1 are listed in table 1.

4.4.2 Coating manufacturers shall provide a specification of the protective coating system to satisfy the requirements of table 1.

4.4.3 The Administration or an organization recognized by the Administration shall verify the Technical Data Sheet and Statement of Compliance or Type Approval Certificate for the protective coating system.

4.4.4 The shipyard shall apply the protective coating in accordance with the verified Technical Data Sheet and its own verified application procedures.

Table 1 – Basic coating system requirements for ballast tanks of all type of ships and double-side skin spaces of bulk carriers of 150 m and upwards

	Characteristic	Requirement	Reference standard
1	**Design of coating system**		
.1	Selection of the coating system	The selection of the coating system should be considered by the parties involved with respect to the service conditions and planned maintenance. The following aspects, among other things should be considered: .1 location of space relative to heated surfaces; .2 frequency of ballasting and deballasting operations; .3 required surface conditions; .4 required surface cleanliness and dryness; .5 supplementary cathodic protections, if any (where coating is supplemented by cathodic protection, the coating should be compatible with the cathodic protection system). Coating manufacturers shall have products with documented satisfactory performance records and technical data sheets. The manufacturers should also be capable of rendering adequate technical assistance. Performance records, technical data sheet and technical assistance (if given) shall be recorded in the Coating Technical File. Coatings for application underneath sun-heated decks or on bulkheads forming boundaries of heated spaces shall be able to withstand repeated heating and/or cooling without becoming brittle.	-

	Characteristic	Requirement	Reference standard
.2	Coating type	Epoxy based systems. Other coating systems with performance according to the test procedure in annex 1. A multi-coat system with each coat of contrasting colour is recommended. The top coat shall be of a light colour in order to facilitate in-service inspection.	–
.3	Coating pre-qualification test	Epoxy based systems tested prior to the date of entry into force of this Standard in a laboratory by a method corresponding to the test procedure in annex 1 or equivalent, which as a minimum meets the requirements for rusting and blistering; or which have documented field exposure for 5 years with a final coating condition of not less than "GOOD" may be accepted. For all other systems, testing according to the procedure in annex 1, or equivalent, is required.	– –
.4	Job specification	There shall be a minimum of two stripe coats and two spray coats, except that the second stripe coat, by way of welded seams only, may be reduced in scope where it is proven that the NDFT can be met by the coats applied in order to avoid unnecessary over thickness. Any reduction in scope of the second stripe coat shall be fully detailed in the CTF. Stripe coats shall be applied by brush or roller. Roller to be used for scallops, ratholes, etc. only. Each main coating layer shall be appropriately cured before application of the next coat, in accordance with coating manufacturer's recommendations. Surface contaminants such as rust, grease, dust, salt, oil, etc. shall be removed prior to painting with proper method according to the paint manufacturer's recommendation. Abrasive inclusions embedded in the coating shall be removed. Job specifications shall include the dry-to-recoat times and walk-on time given by the manufacturer.	–

	Characteristic	Requirement	Reference standard
.5	NDFT (nominal total dry film thickness)	NDFT 320 µm with 90/10 rule for epoxy based coatings, other systems to coating manufacturer's specifications. Maximum total dry film thickness according to manufacturer's detailed specifications. Care shall be taken to avoid increasing the thickness in an exaggerated way. Wet film thickness shall be regularly checked during application. Thinner shall be limited to those types and quantities recommended by the manufacturer.	Type of gauge and calibration in accordance with SSPC-PA2
2	**PSP (Primary surface preparation)**		
.1	Blasting and profile	Sa 2½; with profiles between 30-75 µm. Blasting should not be carried out when: .1 the relative humidity is above 85%; or .2 the surface temperature of steel is less than 3°C above the dew point. Checking of the steel surface cleanliness and roughness profile should be carried out at the end of the surface preparation and before the application of the primer, in accordance with the manufacturer's recommendations.	ISO 8501-1, ISO 8503-1/3
.2	Water soluble salt limit equivalent to NaCl	≤ 50 mg/m^2 of sodium chloride.	Conductivity measured in accordance with ISO 8502-9
.3	Shop primer	Zinc containing inhibitor free zinc silicate based or equivalent. Compatibility with main coating system shall be confirmed by the coating manufacturer.	–
3	**Secondary surface preparation**		
.1	Steel condition	The steel surface should be prepared so that the coating selected can achieve an even distribution at the required NDFT and have an adequate adhesion by removing sharp edges, grinding weld beads and removing weld spatter and any other surface contaminant in accordance with 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 process before painting.	ISO 8501-3

	Characteristic	Requirement	Reference standard
.2	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 certified by test procedures in .1.c. If the complete coating system comprising epoxy based main coating and shop primer has passed a pre-qualification certified by test procedures in .1.c, intact shop primer may be retained provided the same epoxy coating system is used. The retained shop primer shall be cleaned by sweep blasting, high pressure water washing or equivalent method. If a zinc silicate shop primer has passed the pre-qualification test of .1.c as part of an epoxy coating system, it may be used in combination with other epoxy coatings certified under .1.c, provided that the compatibility has been confirmed by the manufacturer by the test in accordance with paragraph 1.7 of appendix 1 to annex 1 without wave movement.	ISO 8501-1
.3	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. Coating in overlap to be feathered.	ISO 8501-1
.4	Profile requirements	In case of full or partial blasting 30-75 µm, otherwise as recommended by the coating manufacturer.	ISO 8503-1/3
.5	Dust	Dust quantity rating "1" for dust size class "3", "4" or "5". Lower dust size classes to be removed if visible on the surface to be coated without magnification.	ISO 8502-3
.6	Water soluble salts limit equivalent to NaCl after blasting/ grinding	≤ 50 mg/m^2 of sodium chloride.	Conductivity measured in accordance with ISO 8502-9
.7	Oil contamination	No oil contamination.	–
4 Miscellaneous			
.1	Ventilation	Adequate ventilation is necessary for the proper drying and curing of coating. Ventilation should be maintained throughout the application process and for a period after application is completed, as recommended by the coating manufacturer.	–

	Characteristic	Requirement	Reference standard
.2	Environmental conditions	Coating shall be applied under controlled humidity and surface conditions, in accordance with the manufacturer's specifications. In addition, coating shall not be applied when: .1 the relative humidity is above 85%; or .2 the surface temperature is less than 3°C above the dew point.	–
.3	Testing of coating	Destructive testing should be avoided. Dry film thickness shall be measured after each coat for quality control purpose and the total dry film thickness shall be confirmed after completion of final coat, using appropriate thickness gauges.	ISO 19840 Annex 3
.4	Repair	Any defective areas, e.g. pin-holes, bubbles, voids, etc. should be marked up and appropriate repairs effected. All such repairs shall be re-checked and documented.	–

5 COATING SYSTEM APPROVAL

Results from prequalification tests (table 1, 1.3) of the coating system shall be documented, and a Statement of Compliance or Type Approval Certificate shall be issued if found satisfactory by a third party, independent of the coating manufacturer.

6 COATING INSPECTION REQUIREMENTS

6.1 General

6.1.1 To ensure compliance with this Standard, the following shall be carried out by the qualified coating inspectors certified to NACE Level II, FROSIO level Red or equivalent as verified by the Administration or the recognized organization.

6.1.2 Coating inspectors shall inspect surface preparation and coating application during the coating process by carrying out, as a minimum, those inspection items identified in section 6.2 to ensure compliance with this Standard. Emphasis shall be placed on initiation of each stage of surface preparation and coatings application as improper work is extremely difficult to correct later in the coating progress. Representative structural members shall be non-destructively examined for coating thickness. The inspector shall verify that appropriate collective measures have been carried out.

6.1.3 Results from the inspection shall be recorded by the inspector and shall be included in the CTF (refer to annex 2, Example of Daily Log and Non-conformity Report).

6.2 Inspection items

Construction stage		Inspection items
Primary surface preparation	1	The surface temperature of steel, the relative humidity and the dew point shall be measured and recorded before the blasting process starts and at times of sudden changes in weather.
	2	The surface of steel plates shall be tested for soluble salt checked for oil, grease and other contamination.
	3	The cleanliness of the steel surface shall be monitored in the shop primer application process.
	4	The shop primer material shall be confirmed to meet the requirements of 2.3 of table 1.
Thickness		If compatibility with the main coating system has been declared, then the thickness and curing of the zinc silicate shop primer to be confirmed to conform to the specified values.
Block assembly	1	After completing construction of the block and before secondary surface preparation starts, a visual inspection for steel surface treatment including edge treatment shall be carried out. Any oil, grease or other visible contamination to be removed.
	2	After blasting/grinding/cleaning and prior to coating, a visual inspection of the prepared surface shall be carried out. On completion of blasting and cleaning and prior to the application of the first coat of the system, the steel surface shall be tested for levels of remaining soluble salts in at least one location per block.
	3	The surface temperature, the relative humidity and the dew point shall be monitored and recorded during the coating application and curing.
	4	Inspection to be performed of the steps in the coating application process mentioned in table 1.
	5	DFT measurements shall be taken to prove that the coating has been applied to the thickness as specified and outlined in annex 3.
Erection	1	Visual inspection for steel surface condition, surface preparation and verification of conformance to other requirements in Table 1, and the agreed specification to be performed.
	2	The surface temperature, the relative humidity and the dew point shall be measured and recorded before coating starts and regularly during the coating process.
	3	Inspection to be performed of the steps in the coating application process mentioned in table 1.

7 VERIFICATION REQUIREMENTS

The following shall be carried out by the Administration or recognized organization prior to reviewing the Coating Technical File for the ship subject to this Performance Standard:

.1 check that the Technical Data Sheet and Statement of Compliance or Type Approval Certificate comply with this Standard;

.2 check that the coating identification on representative containers is consistent with the coating identified in the Technical Data Sheet and Statement of Compliance or Type Approval Certificate;

.3 check that the inspector is qualified in accordance with the qualification standards in paragraph 6.1.1;

.4 check that the inspector's reports of surface preparation and the coating's application indicate compliance with the manufacturer's Technical Data Sheet and Statement of Compliance or Type Approval Certificate; and

.5 monitor implementation of the coating inspection requirements.

8 ALTERNATIVE SYSTEMS

8.1 All systems that are not an epoxy based system applied according to Table 1 of this Standard are defined as an alternative system.

8.2 This Standard is based on recognized and commonly used coating systems. It is not meant to exclude other, alternative, systems with proven equivalent performance, for example non epoxy based systems.

8.3 Acceptance of alternative systems will be subject to documented evidence that they ensure a corrosion prevention performance at least equivalent to that indicated in this Standard.

8.4 As a minimum, the documented evidence shall consist of satisfactory performance corresponding to that of a coating system which conforms to the Coating Standard described in section 4, a target useful life of 15 years in either actual field exposure for 5 years with final coating condition not less than "GOOD" or laboratory testing. Laboratory test shall be conducted in accordance with the test procedure given in annex 1 of this Standard.

* * *

ANNEX 1

TEST PROCEDURES FOR COATING QUALIFICATION FOR BALLAST TANK OF ALL TYPES OF SHIPS AND DOUBLE-SIDE SKIN SPACES OF BULK CARRIERS COATING

1 Scope

These Procedures provide details of the test procedure referred to in paragraphs 5 and 8.3 of this Standard.

2 Definitions

Coating specification means the specification of coating systems which includes the type of coating system, steel preparation, surface preparation, surface cleanliness, environmental conditions, application procedure, acceptance criteria and inspection.

3 Testing

Coating specification shall be verified by the following tests. The test procedures shall comply with appendix 1 (Test on simulated ballast tank conditions) and appendix 2 (Condensation chamber tests) to this annex as follows:

.1 For protective coatings for dedicated seawater ballast tanks, appendix 1 and appendix 2 shall apply.

.2 For protective coatings for double-side spaces of bulk carriers of 150 m in length and upwards other than dedicated seawater ballast tanks, appendix 2 shall apply.

APPENDIX 1

TEST ON SIMULATED BALLAST TANK CONDITIONS

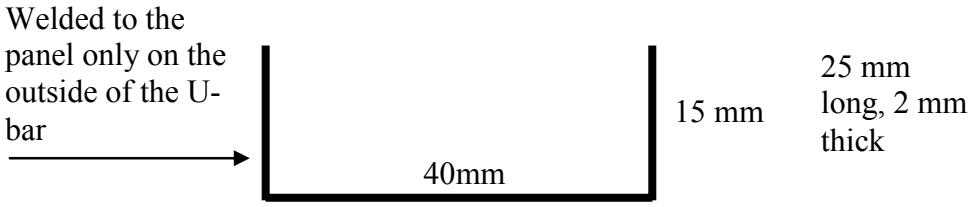
1 Test condition

Test on simulated ballast tank conditions shall satisfy each of the following conditions:

.1 The test shall be carried out for 180 days.

.2 There are to be 5 test panels.

.3 The size of each test panel is 200 mm x 400 mm x 3 mm. Two of the panels (Panel 3 and 4 below) have a U-bar welded on. The U-bar is welded to the panel in a 120 mm distance from one of the short sides and 80 mm from each of the long sides.



The panels are to be treated according to this Standard, table 1; 1, 2 and 3, and coating system applied according to table 1, 1.4 and 1.5. Shop primer to be weathered for at least 2 months and cleaned by low pressure washing or other mild method. Blast sweep or high pressure washing, or other primer removal methods not to be used. Weathering method and extent shall take into consideration that the primer is to be the foundation for a 15 year target life system. To facilitate innovation, alternative preparation, coating systems and dry film thicknesses may be used when clearly defined.

.4 The reverse side of the test piece shall be painted appropriately, in order not to affect the test results.

.5 As simulating the condition of actual ballast tank, the test cycle runs for two weeks with natural or artificial seawater and one week empty. The temperature of the seawater is to be kept at about 35°C.

.6 Test Panel 1: This panel is to be heated for 12 hours at 50°C and cooled for 12 hours at 20°C in order to simulate upper deck condition. The test panel is cyclically splashed with natural or artificial seawater in order to simulate a ship's pitching and rolling motion. The interval of splashing is 3 seconds or faster. The panel has a scribe line down to bare steel across width.

.7 Test Panel 2 has a fixed sacrificial zinc anode in order to evaluate the effect of cathodic protection. A circular 8 mm artificial holiday down to bare steel is introduced on the test panel 100 mm from the anode in order to evaluate the effect of the cathodic protection. The test panel is cyclically immersed with natural or artificial seawater.

.8 Test Panel 3: to be cooled on the reverse side, in order to give a temperature gradient in order to simulate a cooled bulkhead in a ballast wing tank, and splashed with natural or artificial seawater in order to simulate a ship's pitching and rolling motion. The gradient of temperature is approximately 20°C, and the interval of splashing is 3 seconds or faster. The panel has a scribe line down to bare steel across width.

.9 Test Panel 4 is to be cyclically splashed with natural or artificial seawater in order to simulate a ship's pitching and rolling motion. The interval of splashing is 3 seconds or faster. The panel has a scribe line down to bare steel across width.

.10 Test Panel 5 is to be exposed to dry heat for 180 days at 70°C to simulate boundary plating between heated bunker tank and ballast tank in double bottom.

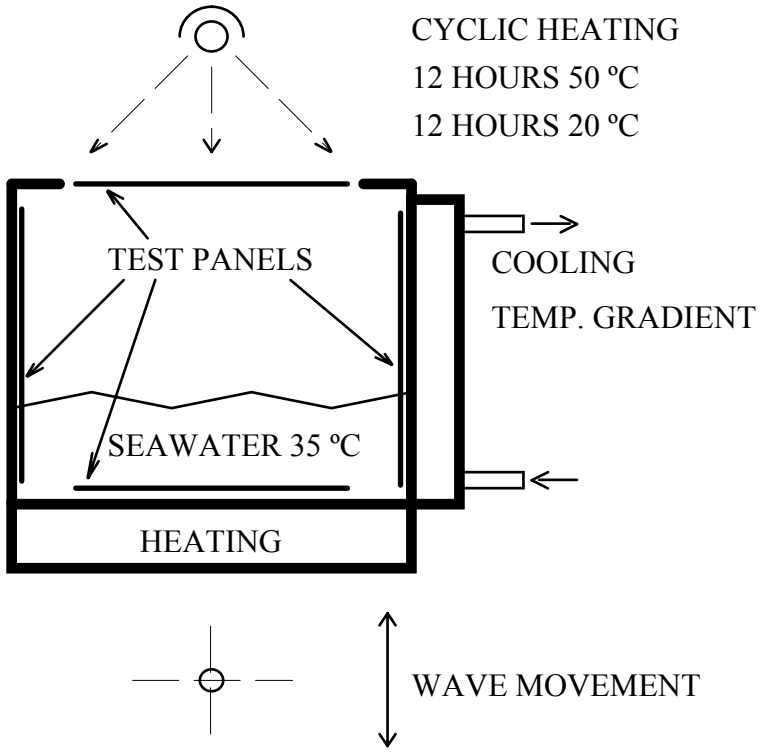


Figure 1
Wave tank for testing of ballast tank coatings

2 Test results

2.1 Prior to the testing, the following measured data of the coating system shall be reported:

.1 infrared (IR) identification of the base and hardener components of the coating;

.2 specific gravity, according to ISO 2811-74, of the base and hardener components of the paint; and

.3 number of pinholes, low voltage detector at 90 Volt.

2.2 After the testing, the following measured data shall be reported:

.1 blisters and rust according to ISO 4628/2 and ISO 4628/3;

.2 dry film thickness (DFT) (use of a template) (see annex 3);

.3 adhesion value according to ISO 4624;

.4 flexibility according to ASTM D4145, modified according to panel thickness (3 mm steel, 300 μm coating, 150 mm cylindrical mandrel gives 2% elongation) for information only;

.5 cathodic protection weight loss/current demand/disbondment from artificial holiday;

.6 undercutting from scribe. The undercutting along both sides of the scribe is measured and the maximum undercutting determined on each panel. The average of the three maximum records is used for the acceptance.

3 Acceptance criteria

3.1 The test results based on section 2 shall satisfy the following criteria:

Item	Acceptance criteria for epoxy based systems applied according to Table 1 of this Standard	Acceptance criteria for alternative systems
Blisters on panel	No blisters	No blisters
Rust on panel	Ri 0 (0%)	Ri 0 (0%)
Number of pinholes	0	0
Adhesive failure	> 3.5 MPa Adhesive failure between substrate and coating or between coats for 60% or more of the areas.	> 5 MPa Adhesive failure between substrate and coating or between coats for 60% or more of the areas.
Cohesive failure	≥ 3.0 MPa Cohesive failure in coating for 40% or more of the area.	> 5 MPa Cohesive failure in coating for 40% or more of the area.
Cathodic protection current demand calculated from weight loss	< 5 mA/m^2	< 5 mA/m^2
Cathodic protection; disbondment from artificial holiday	< 8 mm	< 5 mm
Undercutting from scribe	< 8 mm	< 5 mm
U-beam	Any defects, cracking or detachment at the angle or weld will lead to system being failed.	Any defects, cracking or detachment at the angle or weld will lead to system being failed.

3.2 Epoxy based systems tested prior to the date of entry into force of this Standard shall satisfy only the criteria for blistering and rust in the table above.

3.3 Epoxy based systems tested when applied according to table 1 of this Standard shall satisfy the criteria for epoxy based systems as indicated in the table above.

3.4 Alternative systems not necessarily epoxy based and/or not necessarily applied according to table 1 of this Standard shall satisfy the criteria for alternative systems as indicated in the table above.

4 Test report

The test report shall include the following information:

.1 name of the manufacturer;

.2 date of tests;

.3 product name/identification of both paint and primer;

.4 batch number;

.5 data of surface preparation on steel panels, including the following:

- surface treatment;
- water soluble salts limit;
- dust; and
- abrasive inclusions;

.6 application data of coating system, including the following:

- shop primed;
- number of coats;
- recoat interval*;
- dry film thickness (DFT) prior to testing*;
- thinner*;
- humidity*;
- air temperature*; and
- steel temperature;

* Both of actual specimen data and manufacturer's requirement/recommendation.

.7 test results according to section 2; and

.8 judgment according to section 3.

* * *

APPENDIX 2

CONDENSATION CHAMBER TEST

1 Test condition

Condensation chamber test shall be conducted in accordance with ISO 6270.

.1 The exposure time is 180 days.

.2 There are to be 2 test panels.

.3 The size of each test panel is 150 mm x 150 mm x 3 mm. The panels are to be treated according to this Standard, table 1; 1, 2 and 3, and coating system applied according to table 1, 1.4 and 1.5. Shop primer to be weathered for at least 2 months and cleaned by low pressure washing or other mild method. Blast sweep or high pressure washing, or other primer removal methods not to be used. Weathering method and extent shall take into consideration that the primer is to be the foundation for a 15 year target life system. To facilitate innovation, alternative preparation, coating systems and dry film thicknesses may be used when clearly defined.

.4 The reverse side of the test piece shall be painted appropriately, in order not to affect the test results.

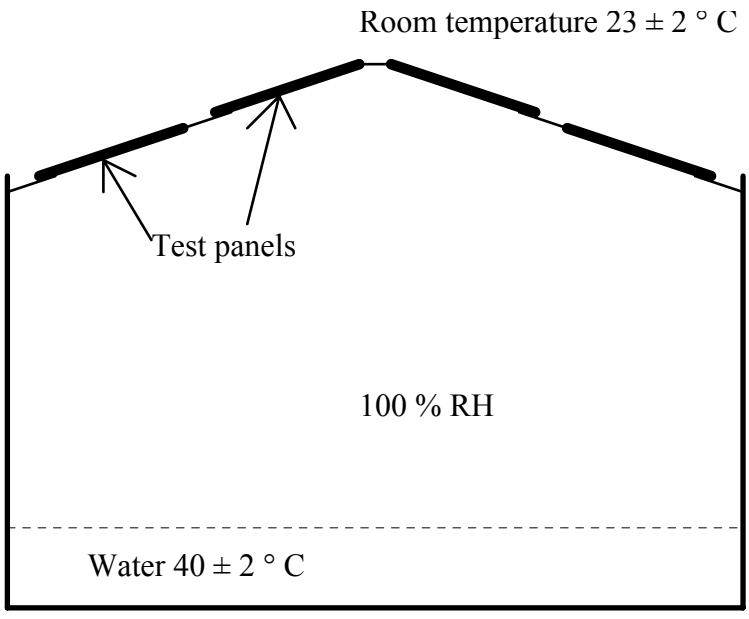


Figure 2
Condensation chamber

2 Test results

According to section 2 (except for paragraphs 2.2.5 and 2.2.6) of Appendix 1.

3 Acceptance criteria

3.1 The test results based on section 2 shall satisfy the following criteria:

Item	Acceptance criteria for epoxy based systems applied according to table 1 of this standard	Acceptance criteria for alternative systems
Blisters on panel	No blisters	No blisters
Rust on panel	Ri 0 (0%)	Ri 0 (0%)
Number of pinholes	0	0
Adhesive failure	> 3.5 MPa Adhesive failure between substrate and coating or between coats for 60% or more of the areas.	> 5 MPa Adhesive failure between substrate and coating or between coats for 60% or more of the areas.
Cohesive failure	> 3.0 MPa Cohesive failure in coating for 40% or more of the area.	> 5 MPa Cohesive failure in coating for 40% or more of the area.

3.2 Epoxy based systems tested prior to the date of entry into force of this Standard shall satisfy only the criteria for blistering and rust in the table above.

3.3 Epoxy based systems tested when applied according to table 1 of this Standard shall satisfy the criteria for epoxy based systems as indicated in the table above.

3.4 Alternative systems not necessarily epoxy based and/or not necessarily applied according to Table 1 of this Standard shall satisfy the criteria for alternative systems as indicated in the table above.

4 Test report

According to section 4 of Appendix 1.

* * *

ANNEX 2

EXAMPLE OF DAILY LOG AND NON-CONFORMITY REPORT

DAILY LOG **Sheet No:**

Vessel:	**Tank/Hold No:**	**Database:**
Part of structure:		

SURFACE PREPARATION

Methode:	**Area (m^2):**
Abrasive:	**Grain size:**
Surface temp:	**Air temp.:**
Rel. humidity (max):	**Dew point:**
Standard achieved:	
Rounding of edges:	

Comments:

Job No:	**Date:**	**Signature:**

COATING APPLICATION

Methode:

Coat No	System	Batch No	Date	Air temp.	Surf. temp.	RH%	Dew Point	DFT* Meas. *	Speci-fied

*** Mesured min. and max. DFT. WFT and DFT readings to be attached to daily log.**

Comments:

Job No:	**Date:**	**Signature:**

Non-conformity report **Sheet No:**

Vessel:	**Tank/Hold No:**	**Database:**
Part of structure:		
CORRECTIVE DESCRIPTION OF THE INSPECTION FINDINGS		
Description of Findings:		
Reference document (daily log):		
Action taken:		
Job No:	**Date:**	**Signature:**

***

ANNEX 3

DRY FILM THICKNESS MEASUREMENTS

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;

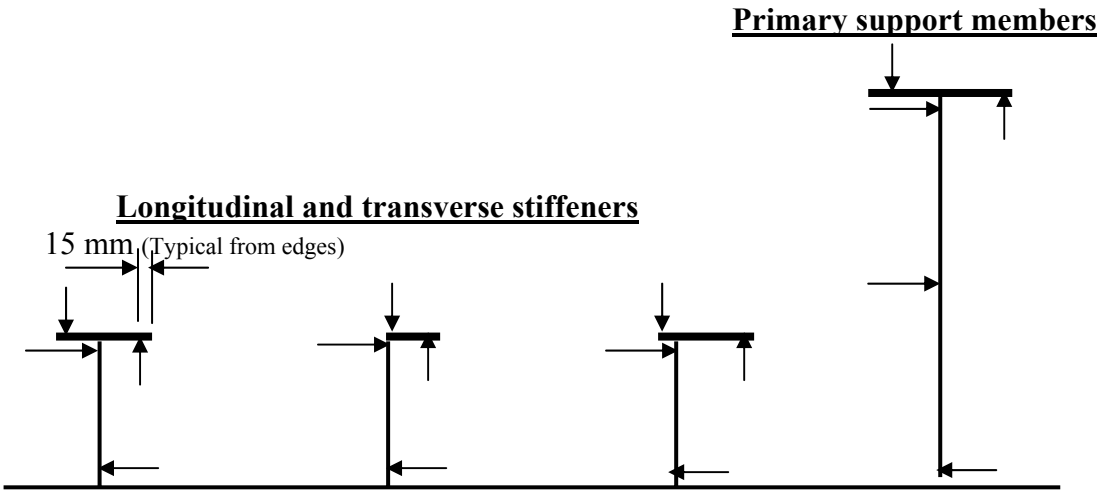


Figure 3

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 to be taken to verify coating thickness for any area considered necessary by the coating inspector.

***

ANNEX 4

STANDARDS REFERENCE TO THE PERFORMANCE STANDARDS ON PROTECTIVE COATINGS

* Standards refers to PSPC standard

Standard No.	Description
ASTM D4145 : 1983	Standard Test Method for Coating Flexibility of Prepainted Sheet
SSPC-PA2 : 2004	PAINT APPLICATION SPECIFICATION NO.2
ISO 8501-1 : 1988/Suppl : 1994	Preparation of steel substrate before application of paints and related products - Visual assessment of surface cleanliness
ISO 8501-3 : 2001	Preparation of steel substrate before application of paints and related products - Visual assessment of surface cleanliness
ISO 8502-3 : 1993	Preparation of steel substrate before application of paints and related products - Tests for the assessment of surface cleanliness
ISO 8502-9 : 1998	Preparation of steel substrate before application of paints and related products - Tests for the assessment of surface cleanliness
ISO 8503-1 : 1988	Preparation of steel substrate before application of paints and related products - Surface roughness characteristics of blast-cleaned steel substrates
ISO 8503-3 : 1988	Preparation of steel substrate before application of paints and related products - Surface roughness characteristics of blast-cleaned steel substrates
ISO 2811-4 : 1997	Paints and varnishes - Determination of density
ISO 4624 : 2002	Paints and varnishes - Pull-off test for adhesion
ISO 4628-2 : 2003	Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance- Part 2
ISO 4628-3 : 2003	Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of common types of defect - Part 3 : Designation of degree of rusting
ISO 6270-2 : 2005	Paints and varnishes - Determination of resistance to humidity - Part 2 : Procedure for exposing test specimens in condensation water atmospheres
ISO 19840 : 2004	Paints and varnishes – Corrosion protection of steel structures by protective paint systems - Measurement of, and acceptance criteria for, the thickness of dry films on rough surfaces