

ATTACHMENT 2

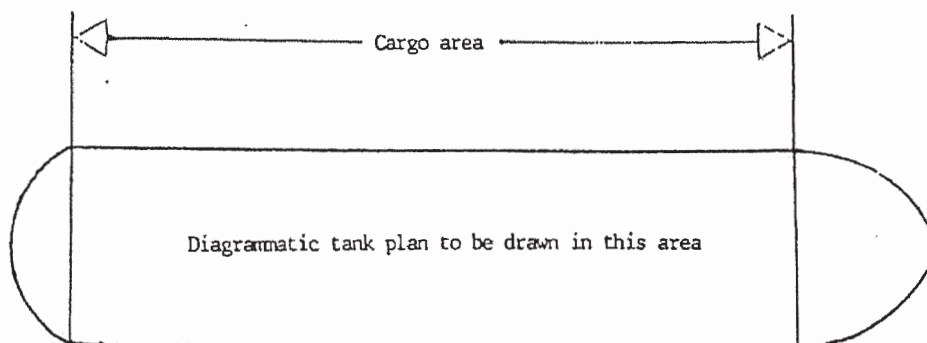
TO THE

INTERNATIONAL CERTIFICATE OF FITNESS FOR THE  
CARRIAGE OF LIQUEFIED GASES IN BULK

TANK PLAN (specimen)

Name of ship: .....

Distinctive number or letters: .....



Date.....  
(as for Certificate)

.....  
(Signature of official issuing the Certificate  
and/or seal or stamp of issuing authority)"

第 45/2015 號行政長官公告

Aviso do Chefe do Executivo n.º 45/2015

中華人民共和國於一九九九年十二月十三日以照會通知聯合國秘書長，經修訂的《1974年國際海上人命安全公約》自一九九九年十二月二十日起適用於澳門特別行政區；

Considerando que a República Popular da China, por nota datada de 13 de Dezembro de 1999, notificou o Secretário-Geral das Nações Unidas sobre a aplicação da Convenção Internacional para a Salvaguarda da Vida Humana no Mar de 1974, tal como emendada, na Região Administrativa Especial de Macau a partir de 20 de Dezembro de 1999;

國際海事組織海上安全委員會於二零一零年五月十四日透過第MSC.288 (87) 號決議通過了《原油油船貨油艙保護塗層性能標準》，該標準自二零一二年一月一日起適用於澳門特別行政區；

Considerando igualmente que, em 14 de Maio de 2010, o Comité de Segurança Marítima da Organização Marítima Internacional, através da resolução MSC.288(87), adoptou a Norma de Desempenho para Revestimentos de Protecção para Tanques de Carga de Hidrocarbonetos de Navios-Tanque de Petróleo Bruto, e que tal Norma é aplicável na Região Administrativa Especial de Macau desde 1 de Janeiro de 2012;

基於此，行政長官根據澳門特別行政區第3/1999號法律第六條第一款的規定，命令公佈包含上指標準的第MSC.288 (87) 號決議的中文及英文文本。

O Chefe do Executivo manda publicar, nos termos do n.º 1 do artigo 6.º da Lei n.º 3/1999 da Região Administrativa Especial de Macau, a resolução MSC. 288(87), que contém a referida Norma, nos seus textos em línguas chinesa e inglesa.

二零一五年五月四日發佈。

Promulgado em 4 de Maio de 2015.

行政長官 崔世安

O Chefe do Executivo, Chui Sai On.

## 第 MSC.288 (87) 號決議

(2010 年 5 月 14 日通過)

### 原油油船貨油艙保護塗層性能標準

海上安全委員會，

憶及《國際海事組織公約》關於本委員會職能的第二十八條第(二)款，

注意到以第 MSC.291 (87) 號決議通過的關於原油油船貨油艙保護塗層的經修正的《1974 年國際海上人命安全公約》(《安全公約》)(下稱“公約”)第 II-1/3-11 條，

還注意到上述第 II-1/3-11 條規定，該條中所述保護塗層須符合《原油油船貨油艙保護塗層性能標準》(下稱“保護塗層性能標準”)的要求，

認識到上述《保護塗層性能標準》無意阻礙作為替代系統的新型或新穎技術的發展，

在其第 87 屆會議上，審議了《保護塗層性能標準》的建議文本，

1. 通過《原油油船貨油艙保護塗層性能標準》，其正文載於本決議附件；
2. 請《公約》各締約國政府注意，該《保護塗層性能標準》將在《公約》第 II-1/3-11 條於 2012 年 1 月 1 日生效之時生效；

3. 注意到，根據《安全公約》第 II-1/3-11.3.1 條的規定，《原油油船貨油艙保護塗層性能標準》的修正案須按照《公約》第 VIII 條關於公約附則除第 I 章外的適用修正程序予以通過、生效和實施；
4. 要求秘書長將本決議和附件中《保護塗層性能標準》文本的核證無誤副本送發所有《公約》締約國政府；
5. 進一步要求秘書長將本決議及其附件的副本送發本組織非《公約》締約國政府的所有會員國；
6. 請各國政府鼓勵發展旨在作為替代系統的新穎技術，並隨時將任何有效結果通知本組織。
7. 決定不斷審議《保護塗層性能標準》並根據應用中獲得的經驗做出必要修正。

## 附 件

## 原油油船貨油艙保護塗層性能標準

## 1 目的

本標準規定了原油油船建造時貨油艙內塗裝的保護塗層最低標準的技術要求。

## 2 定義

下列定義適用於本標準：

- 2.1 原油油船為《73/78 年防污公約》附則 I 中界定的油船。
- 2.2 露點為空氣中濕度飽和時的溫度。
- 2.3 *DFT* 為乾膜厚度。
- 2.4 灰塵為呈現在準備塗漆的表面上、由於噴砂清理或其他表面處理工藝而產生的，或由於環境作用而產生的鬆散顆粒性物質。
- 2.5 邊緣打磨係指二次表面處理前對邊緣的處理。
- 2.6 “良好”狀況係指評估油船壓載艙塗層的第 A.744 (18) 號決議界定的有少量點鏽的狀況。
- 2.7 硬塗層係指在固化過程中發生化學變化的塗層或可用於維護目的的非化學變化、在空氣中乾燥的塗層。它可以是無機的也可以是有機的。

2.8 *NDFT* 為標定乾膜厚度。90/10 原則係指所有測厚點的 90%測量結果須大於或等於標定乾膜厚度，其餘 10%測量結果均須不小於  $0.9 \times$  標定乾膜厚度。

2.9 *底漆*係指車間底漆塗裝後在船廠塗裝的塗層系統的第一道塗層。

2.10 *車間底漆*係指加工前塗在鋼板表面的底漆，通常在自動化車間噴塗（在塗層系統第一道塗層之前）。

2.11 *預塗*係指對關鍵區域邊緣、焊縫、不易噴塗區域等位置的預先塗刷，以保證良好的塗料附着力和恰當的塗層厚度。

2.12 *目標使用壽命*為塗層系統設計壽命的目標值，以年計。

2.13 *技術規格書*為塗料生產商的產品規格書，包含與塗料及其塗裝有關的詳細技術性說明和資料。

### 3. 通則

3.1 塗層系統達到其目標使用壽命的能力取決於塗層系統的類型、鋼材處理、運營環境、塗裝和塗層檢查及維護。所有這些方面對塗層系統的優良性能都有影響。

3.2 船東、船廠和塗料生產商須就表面處理和塗裝過程的檢查達成協議，並提交主管機關審查。須報告這些檢查的明確證據並包括在塗層技術檔案中（CTF）（見第 3.4 段）。

3.3 關於第 4 節所列的標準，應考慮下列因素：

- .1 為了防止塗層系統過早老化和（或）退化，船廠有必要在塗裝作業中嚴格執行塗裝技術規範、程序和各種不同步驟（包括，但不限於表面處理）；

- .2 在船舶設計階段可採取措施以提高塗層的性能，如減少挖孔、採用圓順的外形、避免複雜的幾何結構，保證結構形狀能便於工具進入，方便塗裝部位的清潔、排水和乾燥；和
- .3 本文件規定的塗層性能標準基於製造商、船廠和船舶經營人的經驗；並不意味着排斥其他合適的替代塗層系統，只要證明其性能至少不低於本標準規定的性能。替代塗層系統的接受標準見第 8 節。

### 3.4 塗層技術檔案

3.4.1 所塗裝的貨油艙塗層系統的技術規範、船廠和船東的塗裝工作、塗層選擇的詳細標準、工作說明書、檢查、維護和修補的記錄均須按照第 MSC.215 (82) 號決議的要求包括在塗層技術檔案之中。

#### 3.4.2 新造階段

塗層技術檔案至少須包括與本標準相關的下列項目，並在新船建造階段由船廠提交：

- .1 符合規定證明或型式認可證書的副本；
- .2 技術規格書副本，包括：
  - .2.1 產品名稱，識別標記和（或）編號；
  - .2.2 塗層系統的材料、成分和構成、顏色；
  - .2.3 最小和最大乾膜厚度；
  - .2.4 塗裝的方式、工具和（或）機械；
  - .2.5 塗裝前的表面狀況（除鏽等級、清潔度、粗糙度等）；和

- .2.6 環境限制條件（溫度和濕度）；
- .3 船廠塗裝作業工作記錄，包括：
  - .3.1 各貨油艙實際塗裝面積（以平方米計）；
  - .3.2 塗裝的塗層系統；
  - .3.3 塗裝的時間、厚度、道數，等等；
  - .3.4 塗裝時的環境條件；和
  - .3.5 表面處理的細節；
- .4 船舶建造期間塗層系統的檢查和修補程序；
- .5 塗層檢查員簽發的塗裝日誌－聲明塗層系按照規範塗裝，已得到塗料供應商代表的認可，並詳細說明與規範的差異（見附件 2）；
- .6 船廠經核實的檢查報告，包括：
  - .6.1 檢查完成日期；
  - .6.2 檢查結果；
  - .6.3 備註（如有的話）；和
  - .6.4 檢查員簽名；及
- .7 塗層系統營運中維護和修補程序。

### **3.4.3 營運中的維護、修補和局部重塗**

營運中的維護、修補和局部重塗事項須按照塗層維護和修補導則有關章節的要求記錄在塗層技術檔案中。

3.4.4 在船舶壽命期內，塗層技術檔案須保存在船上並及時補充有關材料。

### 3.5 健康和安全

船廠負責執行國家規定，確保勞動者的健康和 safety，減少失火和爆炸的危險。

## 4 塗層標準

### 4.1 性能標準

本標準基於使塗層達到 15 年目標使用壽命的技術條件和要求，這是從最初的塗裝開始，塗層系統維持“良好”狀態的持續時間。塗層的實際使用壽命將有變化，取決於眾多可變因素，包括在使用中遇到的真實條件。

### 4.2 標準適用範圍

新原油油船建造時塗裝的貨油艙保護塗層須至少符合本標準的要求。

### 4.3 塗層系統

對滿足測試和物理性能（表 1.1.3）的環氧基系統須做出文件記錄，並須提供型式認可證書或符合規定證明。

### 4.4 塗裝區域

作為最低限度，下列區域須按照本標準得到保護：

- .1 艙頂板及全部內部結構，包括與縱向和橫向隔艙壁連接的肘板。在具有環框縱樑構造的艙中，甲板下橫肋須塗裝至上面板之下的第一防撓肘板。



- .2 縱向和橫向隔艙壁塗裝至最高檢驗通道的高度。最高檢驗通道及其支撐架全部塗裝。
- .3 無最高檢驗通道的貨艙隔艙壁塗層延伸至艙中線高度的10%，但從甲板向下延伸無需超過3米。
- .4 內平底和全部構件塗裝至內平底之上0.3米處。



圖一

#### 4.5 特殊應用

4.5.1 本標準涵蓋了貨油艙內鋼結構保護塗層的要求。注意到貨油艙內裝有一些其他獨立構件，須塗裝塗料防止腐蝕。

4.5.2 建議在實際可行的範圍內，對位於第 4.4 段規定的範圍內的檢驗通道的非船體結構整體的部分，如扶手、獨立平臺、梯子等，應用本標準。對非船體結構整體的構件也可以使用其他防腐等效方法，只要這些方法對周圍結構的保護塗層性能沒有影響。作為船體結構整體

的通道佈置，如步道的縱向加強肋、縱樑等，如位於塗裝區域之內，須完全符合本標準。

4.5.3 建議管子、測量裝置等的支撐件，至少按照第 4.5.2 段所述對非結構整體構件的要求塗裝。

#### 4.6 塗層的基本要求

4.6.1 表 1 中列出了滿足第 4.1 段所規定的性能標準的原油油船貨油艙保護塗層在建造時的塗裝要求。

4.6.2 塗料生產商須提供滿足表 1 所列要求和作業環境的保護塗層系統規範。

4.6.3 主管機關須核實保護塗層系統的技術規格書和符合規定證明或型式認可證書。

4.6.4 船廠須依據經核實的技術規格書和工廠自己經核實的塗裝程序塗裝保護塗層。

4.7 本標準中所列參照標準為本組織可接受的標準。測試設備、測試方法、準備方法和（或）測試結果須符合不劣於本組織可接受的性能標準。

表 1—原油油船貨油艙塗層系統基本要求

	特性	要求
<b>1 塗層系統的設計</b>		
.1	塗層系統的選擇	塗層系統的選擇須由各有關方面結合塗層的使用條件和有計劃的保養加以考慮。其中須考慮下列事項： .1 與受熱表面相關的艙室位置； .2 貨物作業的頻率；

	特性	要求
		<p>.3 要求的表面條件；</p> <p>.4 要求的表面清潔度和乾燥度；</p> <p>.5 輔助陰極保護裝置，如有（如果塗層有輔助的陰極保護，塗層須與輔助陰極保護系統相兼容）；</p> <p>.6 塗層滲透性和耐惰性氣體性和耐酸性；及</p> <p>.7 適當的機械特性（塑性、耐衝擊性）。</p> <p>塗層生產商須提供有成文的、令人滿意的性能記錄和技術規格書的產品。生產商須有能力提供適當技術協助。性能記錄、技術規格書，及所提供的技術協助（如有的話）須記錄在塗層技術檔案中。</p> <p>在陽光曝曬甲板下面或在構成加熱艙室限界的艙壁上應用的塗料須能承受反覆加熱和（或）冷卻而不變脆。</p>
.2	塗層類型	<p>環氧基系統。</p> <p>性能符合附件中測試程序的其他塗層系統。</p> <p>建議多道塗層系統，每道塗層的顏色要有對比。</p> <p>表面塗層須為淺色，便於營運中檢查。</p> <p>吸入口和加熱盤管下行管處應考慮使用強化塗層。</p> <p>在有電流問題之處，應考慮使用輔助陰極保護。</p>
.3	塗層測試	<p>在本標準生效日之前，依據與附件 1 中的試驗程序相應或等效的方法進行實驗室試驗的環氧基系統，如至少滿足對鏽蝕和鼓泡的要求，或有實地暴露 5 年後塗層最終狀況不低於“良好”的文件記錄，可以接受。</p> <p>本標準生效之日或之後批准的環氧基系統，要求按照附件 1 中的試驗程序或等效的試驗程序進行試驗。</p>
.4	工作規範	<p>須至少進行兩道預塗和兩道噴塗。在證明塗裝的塗層能夠滿足標定總乾膜厚度要求時，可僅在焊縫區減少第二道預塗的範圍，以避免不必要的塗層過厚。任何第二道預塗範圍的減少須詳細地全部記錄在塗層技術檔案中。</p>

	特性	要求
		<p>預塗須採用刷塗或輥塗的方法。輥塗須僅用於排水孔、老鼠洞等部位。</p> <p>須根據塗料生產商的建議，在每一道主塗層適當固化後再塗裝在下一道主塗層。</p> <p>工作規範須包括塗料商規定的塗層複塗時間間隔和可踩踏時間間隔。</p> <p>表面污染物如鏽、油脂、灰塵、鹽、油等須在塗裝前按照塗料生產商建議的方法去除。須去除嵌入塗層中的磨料夾雜物。</p>
.5	NDFT (名義 總乾膜 厚度)	<p>環氧基塗層系統在 90/10 原則下為 NDFT 320 <math>\mu\text{m}</math>，其他系統依照塗料生產商的規範。</p> <p>最大總乾膜厚度依照塗料生產商的詳細規範。</p> <p>須小心避免塗膜過厚。塗裝中須定期檢查濕膜厚度。</p> <p>稀釋劑須限於使用塗料商推薦的類型和用量。</p>
<b>2 初次表面處理</b>		
.1	噴砂處理和粗糙度	<p>Sa 2½級，粗糙度介於 30-75 <math>\mu\text{m}</math>。</p> <p>在下列情況下不得進行噴砂：</p> <ul style="list-style-type: none"> <li>.1 相對濕度超過 85%；或</li> <li>.2 鋼板的表面溫度不到露點溫度以上 3°C。</li> </ul> <p>在表面處理結束後和進行底漆塗裝前，須依據塗料商的建議檢查鋼板表面的清潔度和粗糙度。</p>
.2	水溶性鹽限值 (相當於氯化鈉)	<p><math>\leq 50 \text{ mg/m}^2</math> 氯化鈉</p>
.3	車間底漆	<p>無緩蝕劑的含鋅硅酸鋅基塗料或等效塗料。</p> <p>車間底漆與主塗層系統的相容性須得到塗料生產商的確認。</p>

	特性	要求
<b>3 二次表面處理</b>		
.1	鋼板狀況	<p>鋼板表面須通過去除毛邊，打磨焊道，去除焊接飛濺物和其他的表面污染物加以處理，達到 P2 級，以使所選擇的塗層能夠均勻塗布，達到所要求的標定總乾膜厚度（NDFT）並有足夠的附着力。</p> <p>塗裝前邊緣須處理成半徑至少為 2mm 的圓角，或經過三次打磨，或至少經過等效處理。</p>
.2	表面處理	<p>被破壞的車間底漆和焊縫處達到 Sa 2½；</p> <p>全部待塗裝表面噴砂清潔達到 Sa 2。如車間底漆按第 1.3 項所述試驗程序未通過預合格證實測試，至少要去除 70% 的完好底漆。</p> <p>如果由環氧基的主塗層和車間底漆組成的整體塗層系統按第 1.3 項的試驗程序通過了預合格證實測試，則當使用同樣的環氧塗層系統時，可保留完好的車間底漆。保留的車間底漆須用掃掠式噴砂、高壓水洗或等效方法清潔。</p> <p>如果一種硅酸鋅車間底漆作為環氧塗層系統的一部分已通過第 1.3 項的塗層預合格試驗，該底漆可和其他的通過第 1.3 項塗層預合格試驗的環氧塗層組合使用，只要該底漆的兼容性得到生產商通過參照附件 1 浸沒實驗或按照所有類型船舶專用海水壓載艙和散貨船雙舷側處所保護塗層性能標準（第 MSC.215（82）號決議）進行測試而做出的確認。</p>
.3	合攏後的表面處理	<p>大接縫為 St 3 或更佳，或可行時，為 Sa 2½。</p> <p>內底：</p> <ul style="list-style-type: none"> <li>— 破壞區域不大於須塗裝面積 20% 時，至少為 St 3。</li> <li>— 相連破壞區域面積超過 25 m<sup>2</sup> 或超過須塗裝面積 20% 時，須為 Sa 2½。</li> </ul>

	特性	要求
		<p>甲板下：</p> <ul style="list-style-type: none"> <li>— 破壞區域不大於塗裝面積 3%時，至少為 St 3。</li> <li>— 相連破壞區域面積超過 25 m<sup>2</sup> 或超過須塗裝面積 3%時，須為 Sa 2½。</li> </ul> <p>塗層搭接處表面要處理成斜坡狀。</p>
.4	粗 糙 度 要求	全面或局部噴砂處理，30-75 μm，其他處理依照塗料生產商的建議。
.5	灰塵	<p>顆粒大小為“3”、“4”或“5”級的灰塵分佈量為 1 等。</p> <p>去除待塗表面上不用放大鏡可見的更低顆粒級別的灰塵。</p>
.6	噴砂 / 打 磨 後 水 溶 性 鹽 限 值 ( 相 當 於 氯 化 鈉 )	≤ 50 mg/m <sup>2</sup> 氯化鈉
.7	沾污	<p>無油污。</p> <p>對於各道塗層之間的其他沾污物，應遵循塗料生產商的建議。</p>
<b>4 其他</b>		
.1	通風	為使塗料適當地乾燥和固化，需予以充足的通風。應根據塗料生產商的建議，在整個塗裝過程中和塗裝完成後的一段時間內保持通風。
.2	環 境 條 件	<p>須按照生產商的規範，在對濕度和表面條件的控制下進行塗裝。此外，下述情況下不得進行塗裝：</p> <ul style="list-style-type: none"> <li>.1 相對濕度超過 85%，或</li> <li>.2 鋼材表面溫度不到露點溫度以上 3°C；或</li> <li>.3 未達到塗料生產商的任何其他要求。</li> </ul>

	特性	要求
.3	塗層檢驗	須避免破壞性檢驗。 為了質量控制，每道塗層乾膜厚度都要進行測量。最後一道塗層塗裝後須使用適當的測厚計確定總乾膜厚度。
.4	修補	任何缺陷區域，如針孔，氣泡，露底等，須標出並適當修補。對所有這類修補須再次檢查並做文件記錄。

## 5 塗層系統認可

塗層系統預合格測試（表 1，第 1.3 項）的結果須做文件記錄。如結果令人滿意，須由獨立於塗料生產商的第三方簽發一份符合規定證明或型式認可證書。

## 6 塗層檢查要求

### 6.1 通則

6.1.1 為保證符合本標準，下列事項須由具有 NACE 檢查員 2 級、FROSIO 檢查員 III 級資格或主管機關承認的同等資格的塗層檢查員完成。

6.1.2 塗層檢查員須在塗裝過程中檢查表面處理和塗裝施工，作為最低要求，應至少進行第 6.2 節中的檢查項目，保證符合本標準。檢查重點須放在表面處理和塗裝施工各階段的起始，因為不恰當的工作在以後的塗裝過程中很難糾正。須採用非破壞性的方法檢查代表性結構件的塗層厚度。檢查員須證實業已完成適當集體措施。

6.1.3 檢查結果須由檢查員予以記錄，並須納入塗層技術檔案（CTF）中（見附件 2）。

## 6.2 檢查項目

建造階段	檢查項目	
初次表面處理	1	在噴砂開始前和天氣發生突變時，須測量並記錄鋼材表面溫度、相對濕度和露點。
	2	須測量鋼板表面的可溶性鹽分並檢查油、油脂和其他污染物。
	3	車間底漆塗裝過程中須監控鋼板表面的清潔度。
	4	須確認車間底漆的材料滿足表 1 第 2.3 項的要求。業經生產商證實。
厚度	如證明硅酸鋅車間底漆與主塗層體系相兼容，則應確認車間底漆的厚度和固化與規定值相符。	
分段組裝	1	分段建造完成後，二次表面處理開始前，須目視檢查鋼材表面處理，包括檢查邊緣處理。去除任何油、油脂或其他可見污染物。
	2	噴砂/打磨/清潔後，在塗裝前須目視檢查處理好的表面。 完成噴砂、清潔後，系統第一道塗層塗裝前，須檢查鋼材表面殘留可溶性鹽水平，每個分段至少取一點。
	3	在塗層塗裝和固化階段，須監測並記錄鋼材板表面溫度、相對濕度和露點。
	4	須對表 1 中所述塗裝過程步驟進行檢查。
	5	須進行乾膜厚度（DFT）測量，驗證塗層達到了規定的厚度。
合攏	1	目視檢查鋼材表面狀況，表面處理情況，驗證表 1 中其他要求是否達到，商定的規範是否得到執行。
	2	塗裝前和塗裝過程中定期測量並記錄鋼材表面溫度、相對濕度和露點。
	3	須對表 1 中所述塗裝過程步驟進行檢查。



## 7 塗層驗證要求

對於執行本性能標準的船舶，在審核其塗層技術檔案之前，主管機關須完成下列各項：

- .1 核查技術規格書和符合規定證明或型式認可證書與本標準相符；
- .2 核查代表性包裝桶上的塗料標識與技術規格書和符合規定證明或型式認可證書中標出的塗料一致；
- .3 按第 6.1.1 段的資質標準核查檢查員的資質；
- .4 核查檢查員關於表面處理和塗層塗裝報告，表明與塗料商的技術規格書和符合規定證明或型式認可證書相符；和
- .5 監督塗層檢查要求的執行。

## 8 替代塗層系統

8.1 所有根據本標準表 1 塗裝的非環氧基塗層系統均定義為替代系統。

8.2 本標準基於公認的和常用的塗層系統。這並不意味着排斥其他經證明具有等效性能的替代系統，如非環氧基的系統。

8.3 接受替代系統須有文件證據，通過：

- .1 按照本標準測試；或
- .2 五年的實地暴露並有連續運輸原油貨物的文件證據。五年後的塗層最終狀況不低於“良好”；

證明其防腐蝕性能至少與本標準要求相當。

## 附件 1

### 原油油船貨油艙保護塗層合格測試程序

#### 1 範圍

本程序提供了本標準第 4.6 和 8.3 段所指原油油船貨油艙保護塗層測試程序的詳細步驟。艙內底和艙頂板均須塗裝已完全通過本文件所述測試程序的塗層系統。

#### 2 定義

塗層規範係指塗層系統的規範，包括塗層系統類型、鋼材處理、表面處理、表面清潔度、環境條件、塗裝程序、檢查和接受標準。

#### 3 背景

3.1 船上的原油貨艙暴露於兩種完全不同的環境狀況，這是公認的。

3.2 當貨艙裝載時，有三個截然不同的豎區：

- .1 最低處和縱通甲板的水平部分等等，暴露於可能屬酸性的水，及可含有厭氧細菌的淤泥。
- .2 中部，貨油接觸到所有浸沒中的鋼材。
- .3 蒸氣空間，空氣中飽和有載貨貨艙的各種蒸氣，如  $H_2S$ 、 $CO_2$ 、 $SO_2$ ，水氣和來自惰性氣體系統的其他氣體和複合物。

3.3 當貨艙空載時：

- .1 最低處和縱通甲板的水平部分等等，暴露於貨物殘餘和可能屬酸性的水，及可含有厭氧細菌的淤泥。

- .2 在艙的空間，空氣中含有來自原油殘餘的各種蒸氣，如 H<sub>2</sub>S、CO<sub>2</sub>、SO<sub>2</sub>，水氣和來自惰性氣體系統的其他氣體和複合物。

#### 4 試驗

此實驗設計為，儘實際可行地模擬原有貨艙塗層將接觸的兩種主要環境狀況。塗層須通過下列試驗加以驗證：試驗程序須符合附錄 1（氣密室模擬裝載貨艙的蒸氣相）和附錄 2（浸沒試驗模擬原油艙的裝載狀態）：

#### 5 試驗氣體的構成

試驗氣體基於原油艙蒸氣相的構成，但不包含碳氫成分，因為這些成分對用於貨油倉中的環氧塗層不具有害影響。

##### 試驗氣體的構成

N <sub>2</sub>	乾氣體積的百分之 83±百分之 2
CO <sub>2</sub>	乾氣體積的百分之 13±百分之 2
O <sub>2</sub>	乾氣體積的百分之 4±百分之 1
SO <sub>2</sub>	百萬分之 300±百萬分之 20
H <sub>2</sub> S	百萬分之 200±百萬分之 20

#### 6 試驗液體

原油是一種複雜的化學物質，儲存時，隨着時間的流逝而不穩定。原油成分也會隨着時間的流逝而變化。另外，使用原油已證明對有關試驗機構造成實際和 HSE 障礙。為克服此問題，使用浸沒液體模型模擬原油。此原油模型系統的配方如下：

1. 首先是蒸餾船用燃料，DMA 級 15°C 時最大密度為 890kg/m<sup>3</sup>，40°C 時黏度最大為 6mm<sup>2</sup>/s；
2. 加入環烷酸至酸值為 2.5±0.1mg KOH/g；
3. 加入苯/甲苯（比率 1：1）至 DMA 總量的 8.0±0.2% w/w；
4. 加入人造海水至混合物總量的 5.0±0.2% w/w；
5. 加入溶於液體載體的 H<sub>2</sub>S（以便達到試驗液體總量的百萬分之 5±百萬分之 1w/w 的 H<sub>2</sub>S）；
6. 臨使用前，對以上成分作充分混合；及
7. 混合一旦完成，應加以測試，確認該混合物符合試驗液體濃度

註：為防止 H<sub>2</sub>S 釋放到試驗設施之中，建議使用第 1 至 4 步驟的溶液儲備，之後注入試驗容器再按照第 5 和 6 步驟完成試驗溶液。

## 附錄 1

### 氣密櫃試驗

#### 1 試驗條件

蒸氣試驗須在氣密櫃中進行。氣密櫃的尺寸和設計並非關鍵，只要滿足下列.6 至.10 項的要求即可。試驗氣體設計為模擬空載狀態下貨油艙的實際環境以及裝載狀態下的蒸氣環境。

- .1 試驗期為 90 天。
- .2 使用兩塊相同樣板進行試驗；另製備第三塊樣板存放於環境狀態下，在對試驗樣板作最後評定時用作參照板。
- .3 每塊樣板尺寸為 150mm×100mm×3mm。
- .4 試板按本性能標準表 1，第 1.2 項處理，塗層系統的塗裝按表 1，第 1.4 和 1.5 項進行。
- .5 如使用了硅酸鋅車間底漆，須風化至少 2 個月並用低壓淡水清洗乾淨。須報告塗裝塗層前車間底漆的具體製備方法，並對該具體系統作出評判。試驗樣板的背面和邊緣須適當塗裝，以避免影響試驗結果。
- .6 氣密櫃中須有水槽一具，其中注入  $2\pm 0.2$  升的水。該槽中的水須在每次重新進行試驗之前排空並換新。
- .7 氣密櫃的蒸氣空間須注入符合標準第 5 項的試驗氣體。氣密櫃中的氣體環境須在試驗期間加以保持。當氣體不在試驗方

法範圍內時，須加以更新。監測的頻率和方法，及更新試驗氣體의日期和時間須記入試驗報告。

- .8 試驗櫃中的空氣應隨時保持  $95\pm 5\%$  的相對濕度。
- .9 試驗空氣的溫度須為  $60\pm 3^{\circ}\text{C}$ 。
- .10 樣板支架須使用適宜的惰性材料製作，將樣板垂直夾持，樣板之間의間距至少為 20mm。該支架在試驗櫃中的位置須使樣板的下緣距水面的高度至少為 200mm，距試驗艙壁至少 100mm。如試驗櫃中有兩層，須小心保證溶液不致滴落到下層樣板上。

## 2 試驗結果

2.1 試驗前，須報告構成塗層系統的各道塗層包括硅酸鋅車間底漆（如在塗層系統下使用）的下列測量數據：

- .1 該塗料的基料和固化劑組分的紅外鑑定；
- .2 該塗料的基料和固化劑組分的比重；和
- .3 乾膜厚度平均值（使用模板）。

2.2 完成試驗期限後，須從試驗櫃中取出樣板並用熱水漂洗。用吸水紙吸乾樣板並在試驗結束後 24 小時之內對鏽蝕和起泡進行評定。

2.3 須報告下列測量數據：起泡和鏽蝕。

## 3 接受衡準

3.1 第 2 節的試驗結果須滿足下列衡準；在報告中，須使用兩塊相同樣板中性能最差者：

項目	環氧基系統的接受衡準	替代系統的接受衡準
樣板起泡	無	無
樣板鏽蝕	Ri 0 級 (0%)	Ri 0 級 (0%)

3.2 鑑定樣板時，位於邊緣 5mm 之內的起泡或鏽蝕須忽略不計。

#### 4 試驗報告

試驗報告須包括下列內容：

- .1 塗料生產商名稱和生產地點；
- .2 試驗日期；
- .3 塗料和，如適用，硅酸鋅車間底漆的產品名稱／標識；
- .4 各產品各個組分的批號；
- .5 塗裝車間底漆前，鋼板表面處理的細節，和相關時，加塗塗層前對車間底漆的處理並至少包括：
  - .5.1 表面處理，或風化車間底漆的處理及任何影響性能的有關處理的重要信息；
  - .5.2 塗裝車間底漆前測量的鋼材表面水溶性鹽含量；
- .6 塗層系統細節，包括：
  - .6.1 硅酸鋅車間底漆（如相關的話），其二次表面處理和塗裝條件、風化期；
  - .6.2 塗層道數，包括車間底漆，及各層的厚度；
  - .6.3 試驗前的平均乾膜厚度；
  - .6.4 稀釋劑，如使用；

- .6.5 濕度；
- .6.6 氣溫；和
- .6.7 鋼板溫度；
- .7 試驗氣體更新安排表細節；
- .8 按第 2 節試驗的試驗結果；和
- .9 按第 3 節判定的結果。



## 附錄 2

## 浸沒試驗

## 1 試驗條件

浸沒試驗為模擬裝載條件下原油艙的狀態而制定。

- .1 暴露時間為 180 天。
- .2 試驗液體應按照本標準第 6 項製備。
- .3 試驗液體應注入一個具有內平底的容器，至試驗液體柱的高度達到 400mm，生成 20mm 的水相。任何其他使用同樣試驗液體並亦導致試驗樣板浸入 20mm 水相的試驗安排，亦可接受。這可通過使用例如惰性大理石實現。
- .4 試驗液體的溫度應為  $60\pm 2^{\circ}\text{C}$  並應均勻及使用經認可的方法保持恆溫，例如水浴或油浴池或能夠將浸沒液保持在要求溫度範圍內的循環空氣恆溫箱。
- .5 試驗樣板須垂直放置，並在試驗期間全部浸沒。
- .6 須使用兩塊同樣的樣板進行試驗。
- .7 須使用不遮擋試驗區域的惰性隔離物分離樣板。
- .8 每個樣板的尺寸為 150mm × 100mm × 3mm。
- .9 樣板須按照本性能標準表 1 第 1.2 項加以處理，並按照表 1 第 1.4 和 1.5 項塗裝塗層系統。

- .10 如使用了硅酸鋅車間底漆，須風化至少 2 個月並用低壓淡水清洗乾淨。須報告塗裝塗層前車間底漆的具體製備方法，並對該具體系統作出判定。試驗樣板的背面和邊緣須適當塗裝，以避免影響試驗結果。
- .11 在全浸沒試驗期完成之後，須從試驗液體中取出樣板並用乾布擦乾，之後對樣板進行鑑定。
- .12 樣板鑑定須在試驗完成後 24 小時之內進行。

## 2 試驗結果

2.1 試驗前，須報告構成塗層系統的各道塗層包括硅酸鋅車間底漆（如在塗層系統下使用）的下列測量數據：

- .1 該塗料的基料和固化劑組分的紅外鑑定；
- .2 該塗料的基料和固化劑組分的比重；和
- .3 乾膜厚度平均值（使用模板）。

2.2 試驗後，須報告下列測量數據：起泡和鏽蝕。

## 3 接受衡準

3.1 第 2 節的試驗結果須滿足下列衡準；在報告中，須使用兩塊相同樣板中性能最差者：

項目	環氧基系統的接受衡準	替代系統的接受衡準
樣板起泡	無	無
樣板鏽蝕	Ri 0 級（0%）	Ri 0 級（0%）

3.2 鑑定樣板時，位於邊緣 5mm 之內的起泡或鏽蝕須忽略不計。

#### 4 試驗報告

試驗報告須包括下列內容：

- .1 塗料生產商名稱和生產地點；
- .2 試驗日期；
- .3 各層塗料和，如適用，硅酸鋅車間底漆的產品名稱/標識；
- .4 各產品各個組分的批號；
- .5 塗裝車間底漆前鋼板表面處理的細節，和相關時，加塗塗層前對車間底漆的處理並至少包括：
  - .5.1 表面處理，或車間底漆的風化處理及任何影響性能的有關處理的重要信息；
  - .5.2 塗裝車間底漆前測量的鋼材表面水溶性鹽含量；
- .6 塗層系統細節，包括：
  - .6.1 硅酸鋅車間底漆（如相關的話），其二次表面處理和塗裝條件、風化期；
  - .6.2 塗層道數，包括車間底漆，及各層的厚度；
  - .6.3 試驗前的平均乾膜厚度；
  - .6.4 稀釋劑，如使用；
  - .6.5 濕度；
  - .6.6 氣溫；
  - .6.7 鋼板溫度。

.7 按第 2 節試驗的試驗結果；和

.8 按第 3 節判定的結果。

## 附錄 3

## 使用危險物質注意事項

- 1 試驗方法涉及到使用下列會有害健康的物質：
  - .1 二氧化硫：受潮時具腐蝕性，吸入有毒，引致灼傷並對眼睛和呼吸道有刺激性。
  - .2 硫化氫：極易燃（閃點-82°C），可與空氣形成爆炸性混合物，受潮時具腐蝕性，引致灼傷，須遠離火源，有刺激性並會引起窒息，長期接觸限值 5 ppm，短期接觸限值 10 ppm，更高濃度會致死並且無味。重複暴露於低濃度之中會導致對該氣體的嗅覺降低。
  - .3 苯：極易燃（閃點-11°C），可與空氣形成爆炸性混合物，有毒，致癌物，極具健康風險。
  - .4 甲苯：極易燃（閃點 4°C），可與空氣形成爆炸性混合物，有刺激性，極具健康風險，生殖毒素。
- 2 依據進行試驗的國家中的規定，可能需要專試驗儀器和防範措施。
- 3 雖然一些國家沒有防止進行任一試驗的具體要求，但仍須要求：
  - .1 進行工作條件風險評估；
  - .2 試驗期間，對系統需加以封閉；及
  - .3 對環境進行控制，特別是在試驗啟動和結束時，須有適當排氣，並須穿着個人防護器具。

## 附件 2

## 檢查日誌和不符合規定報告樣本

檢查日誌

編頁號：

船名：		艙/櫃編號：		數據庫：					
結構部位：									
表面處理									
處理方法：						面積 (m <sup>2</sup> )			
磨料：						顆粒度：			
表面溫度：						大氣溫度：			
相對濕度 (最大值)：						露點：			
達到的標準：									
邊緣圓度：									
檢查意見：									
工號：			日期：			簽名：			
塗裝：									
方法：									
塗料號	系統	批號	日期	氣溫	表面溫度	相對濕度	露點	乾膜厚度*	規定值
								測量	
*測得的最小和最大乾膜厚度，乾膜厚度的讀數應附在檢查日誌後。									
檢查意見：									
工號：			日期：			簽名：			

不符合規定報告

編頁號：

船名：	艙/櫃編號：	數據庫：
結構部位：		
對檢查發現應糾正問題的描述		
對所發現情況的描述：		
參照文件（日誌）：		
所採取的行動：		
工號：	日期：	簽名：

**RESOLUTION MSC.288(87)**  
**(adopted on 14 May 2010)**

**PERFORMANCE STANDARD FOR PROTECTIVE COATINGS  
FOR CARGO OIL TANKS OF CRUDE OIL TANKERS**

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

NOTING regulation II-1/3-11 of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended (hereinafter referred to as "the Convention") adopted by resolution MSC.291(87), concerning protective coatings for cargo oil tanks of crude oil tankers,

NOTING ALSO that the aforementioned regulation II-1/3-11 provides that the protective coatings referred to therein shall comply with the requirements of the Performance standard for protective coatings for cargo oil tanks of crude oil tankers (hereinafter referred to as "the Performance standard for protective coatings"),

RECOGNIZING that the Performance standard for protective coatings referred to above is not intended to inhibit the development of new or novel technologies which provide for alternative systems,

HAVING CONSIDERED, at its eighty-seventh session, the text of the proposed Performance standard for protective coatings,

1. ADOPTS the Performance standard for protective coatings for cargo oil tanks of crude oil tankers, the text of which is set out in the Annex to the present resolution;
2. INVITES Contracting Governments to the Convention to note that the Performance standard for protective coatings will take effect on 1 January 2012 upon entry into force of SOLAS regulation II-1/3-11;
3. NOTES that, under the provisions of SOLAS regulation II-1/3-11.3.1, amendments to the Performance standard for protective coatings shall be adopted, brought into force and take effect in accordance with the provisions of article VIII of that Convention concerning the amendment procedure applicable to the Annex to the Convention other than chapter I;
4. REQUESTS the Secretary-General to transmit certified copies of this resolution and the text of the Performance standard for protective coatings contained in the Annex to all Contracting Governments to the Convention;
5. FURTHER REQUESTS the Secretary-General to transmit copies of this resolution and the Annex to all Members of the Organization which are not Contracting Governments to the Convention;
6. INVITES Governments to encourage the development of novel technologies aimed at providing for alternative systems and to keep the Organization advised of any positive results;
7. RESOLVES to keep the Performance standard for protective coatings under review and amend them as necessary, in light of experience gained in its application.



## ANNEX

PERFORMANCE STANDARD FOR PROTECTIVE COATINGS  
FOR CARGO OIL TANKS OF CRUDE OIL TANKERS

## 1 PURPOSE

This Standard provides technical requirements for the minimum standard for protective coatings to be applied in cargo oil tanks during the construction of new crude oil tankers.

## 2 DEFINITIONS

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

- 2.1 *Crude oil tanker* is as defined in Annex I of MARPOL 73/78.
- 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 particulate 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 the edge before secondary surface preparation.
- 2.6 "*GOOD*" *condition* is the condition with minor spot rusting as defined in resolution A.744(18) for assessing the ballast tank coatings for tankers.
- 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. This 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).
- 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 the paint manufacturer's 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, operating environment, 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 for review. Clear evidence of these inspections shall be reported and included in the Coating Technical File (CTF) (see subsection 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 instrument is based on the experience of 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 Specifications of the cargo oil tank coating system applied, records of the shipyard's and shipowner's coating work, detailed criteria for coating selection, job specifications, inspection, maintenance and repair shall be included in the Coating Technical File required by resolution MSC.215(82).

##### 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:
  - .2.1 product name and identification mark and/or number;
  - .2.2 materials, components and composition of the coating system, colours;
  - .2.3 minimum and maximum dry film thickness;

- .2.4 application methods, tools and/or machines;
- .2.5 condition of surface to be coated (de-rusting grade, cleanness, profile, etc.); and
- .2.6 environmental limitations (temperature and humidity);
- .3 shipyard work records of coating application, including:
  - .3.1 applied actual areas (in square metres) of coating in each cargo oil tank;
  - .3.2 applied coating system;
  - .3.3 time of coating, thickness, number of layers, etc.;
  - .3.4 ambient conditions during coating; and
  - .3.5 details 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 (see annex 2);
- .6 shipyard's verified inspection report, including:
  - .6.1 completion date of inspection;
  - .6.2 result of inspection;
  - .6.3 remarks (if given); and
  - .6.4 inspector signature; and
- .7 procedures for in-service maintenance and repair of coating systems.

#### 3.4.3 ***In-service maintenance and repair***

In-service maintenance and repair activities shall be recorded in the Coating Technical File in accordance with the relevant section of the Guidelines for coating maintenance and repair.

3.4.4 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 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 cargo oil tanks applied during the construction of new crude oil tankers shall at least comply with the requirements in this Standard.

### **4.3 Coating system**

An epoxy-based system meeting test and physical properties (table 1.1.3) shall be documented, and a Type Approval Certificate or Statement of Compliance shall be provided.

### **4.4 Area of application**

The following areas are the minimum areas that shall be protected according to this Standard:

- .1 Deckhead with complete internal structure, including brackets connecting to longitudinal and transverse bulkheads. In tanks with ring frame girder construction the underdeck transverse framing to be coated down to level of the first tripping bracket below the upper faceplate.
- .2 Longitudinal and transverse bulkheads to be coated to the uppermost means of access level. The uppermost means of access and its supporting brackets to be fully coated.
- .3 On cargo tank bulkheads without an uppermost means of access the coating to extend to 10% of the tanks height at centreline but need not extend more than 3 m down from the deck.
- .4 Flat inner bottom and all structure to height of 0.3 m above inner bottom to be coated.

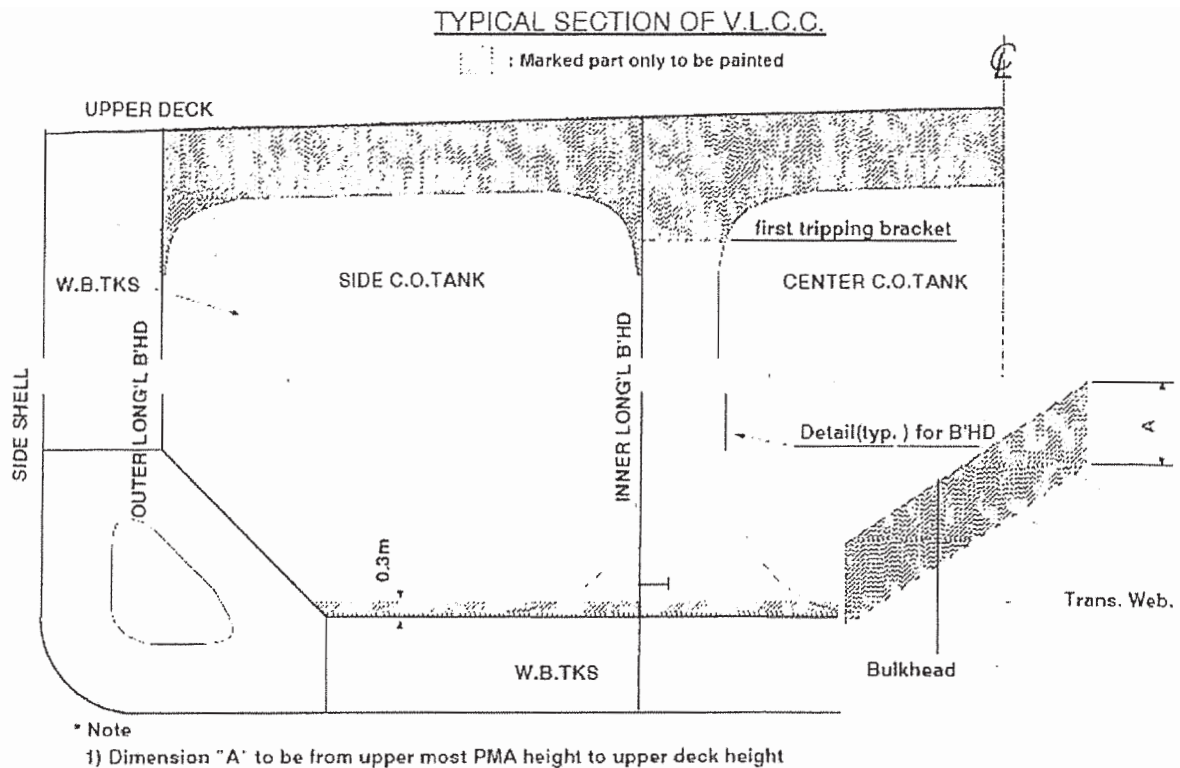


Figure 1

#### 4.5 Special application

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

4.5.2 It is recommended that this Standard is applied, to the extent practicable, to those portions of means of access provided for inspection within the areas specified in paragraph 4.4 that are not integral to the ship structure, such as rails, independent platforms, ladders, etc. Other equivalent methods of providing corrosion protection for 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 stiffener depths for walkways, stringers, etc., are to fully comply with this Standard when located within the coated areas.

4.5.3 It is also recommended that supports for piping, measuring devices, etc., be coated as a minimum in accordance with the non-integral items indicated in paragraph 4.5.2.

#### 4.6 Basic coating requirements

4.6.1 The requirements for protective coating systems to be applied at ship construction for the cargo oil tanks of crude oil tankers meeting the performance standard specified in paragraph 4.1 are listed in table 1.

4.6.2 Coating manufacturers shall provide a specification of the protective coating system to satisfy the requirements of table 1 and the operating environment.

4.6.3 The Administration shall verify the Technical Data Sheet and Statement of Compliance or Type Approval Certificate for the protective coating system.

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

4.7 The referenced standards listed in this Standard are acceptable to the Organization. Test equipment, test methods, preparation methods and/or test results shall conform to performance standards not inferior to those acceptable to the Organization.

Table 1 – Basic coating system requirements for cargo oil tanks of crude oil tankers

	Characteristic	Requirement
1	<b>Design of coating system</b>	
.1	Selection of the coating system	<p>The selection of the coating system shall be considered by the parties involved with respect to the service conditions and planned maintenance. The following aspects, among other things shall be considered:</p> <ul style="list-style-type: none"> <li>.1 location of space relative to heated surfaces;</li> <li>.2 frequency of cargo operations;</li> <li>.3 required surface conditions;</li> <li>.4 required surface cleanliness and dryness;</li> <li>.5 supplementary cathodic protections, if any (where coating is supplemented by cathodic protection, the coating shall be compatible with the cathodic protection system);</li> <li>.6 permeability of the coating and resistance to inert gas and acids; and</li> <li>.7 appropriate mechanical properties (flexibility, impact resistance).</li> </ul> <p>The coating manufacturer shall supply products with documented satisfactory performance records and technical data sheets. The manufacturer shall also be capable of rendering adequate technical assistance. Performance records, technical data sheet and any manufacturer's technical assistance provided shall be recorded in the Coating Technical File.</p> <p>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.</p>
.2	Coating type	<p>Epoxy-based systems.</p> <p>Other coating systems with performance according to the test procedure in the annex.</p> <p>A multi-coat system with each coat of a contrasting colour is recommended.</p> <p>The top coat shall be of a light colour to facilitate in-service inspection.</p> <p>Consideration should be given to the use of enhanced coatings in way of suction bellmouths and heating coil downcomers.</p> <p>Consideration should be given to the use of supplementary cathodic protection where there may be galvanic issues.</p>

	Characteristic	Requirement
.3	Coating test	<p>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.</p> <p>For epoxy-based systems approved on or after entry into force of this Standard, testing according to the procedure in annex 1, or equivalent, is required.</p>
.4	Job specification	<p>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.</p> <p>Stripe coat shall be applied by brush or roller. Roller shall be used for scallops, ratholes, etc., only.</p> <p>Each main coating layer shall be appropriately cured before application of the next coat, in accordance with the coating manufacturer's recommendations.</p> <p>Job specifications shall include the dry-to-recoat times and walk-on time given by the manufacturer.</p> <p>Surface contaminants such as rust, grease, dust, salt, oil, etc., shall be removed prior to painting. The method to be according to the paint manufacturer's recommendations. Abrasive inclusions embedded in the coating shall be removed.</p>
.5	NDFT (nominal total dry film thickness)	<p>NDFT 320 <math>\mu\text{m}</math> with 90/10 rule for epoxy-based systems; other systems to the coating manufacturer's specifications.</p> <p>Maximum total dry film thickness according to the manufacturer's detailed specifications.</p> <p>Care shall be taken to avoid increasing the DFT in an exaggerated way. Wet film thickness shall be regularly checked during application.</p> <p>Thinners shall be limited to those types and quantities recommended by the manufacturer.</p>
<b>2</b>	<b>Primary surface preparation</b>	



	Characteristic	Requirement
.1	Blasting and profile	<p>Sa 2½; with profiles between 30-75 µm.</p> <p>Blasting shall not be carried out when:</p> <ul style="list-style-type: none"> <li>.1 the relative humidity is above 85%; or</li> <li>.2 the surface temperature of steel is less than 3°C above the dew point.</li> </ul> <p>Checking of the steel surface cleanliness and roughness profile shall be carried out at the end of the surface preparation and before the application of the primer, and in accordance with the coating manufacturer's recommendations.</p>
.2	Water soluble salt limit equivalent to NaCl	≤ 50 mg/m <sup>2</sup> of sodium chloride.
.3	Shop primer	<p>Zinc containing inhibitor free zinc silicate based or equivalent.</p> <p>Compatibility with main coating system shall be confirmed by the coating manufacturer.</p>
<b>3 Secondary surface preparation</b>		
.1	Steel condition	<p>The steel surface to be coated shall 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 to grade P2.</p> <p>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.</p>
.2	Surface treatment	<p>Sa 2½ on damaged shop primer and welds.</p> <p>All surfaces to be coated shall be blasted to Sa 2, removing at least 70% of intact shop primer, which has not passed a pre-qualification certified by test procedures in table 1.3.</p> <p>If the complete coating system comprising epoxy-based main coating and shop primer has passed a pre-qualification certified by test procedures in table 1.3 intact shop primer may be retained provided the same epoxy-based system is used. Retained shop primer shall be cleaned by sweep blasting, high pressure water washing or equivalent method.</p> <p>If a zinc silicate shop primer has passed the pre-qualification test of table 1.3 as part of an epoxy coating system, it may be used in combination with other epoxy coatings certified under table 1.3, provided that the compatibility has been confirmed by the manufacturer by the test with reference to the immersion test of annex 1 or 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 (resolution MSC.215(82)).</p>

	Characteristic	Requirement
.3	Surface treatment after erection	<p>Erection joints St 3 or better or Sa 2½ where practicable.</p> <p><i>For inner bottom:</i></p> <ul style="list-style-type: none"> <li>- Damages up to 20% of the area to be coated to be treated to minimum St 3.</li> <li>- Contiguous damages over 25 m<sup>2</sup> or over 20% of the area to be coated, Sa 2½ shall be applied.</li> </ul> <p><i>For underdeck:</i></p> <ul style="list-style-type: none"> <li>- Damages up to 3% of area to be coated to be treated to minimum St 3.</li> <li>- Contiguous damages over 25 m<sup>2</sup> or over 3% of the area to be coated, Sa 2½ shall be applied.</li> </ul> <p>Coating in overlap to be feathered.</p>
.4	Profile requirements	In case of full or partial blasting 30-75 µm, otherwise as recommended by the coating manufacturer.
.5	Dust	<p>Dust quantity rating "1" for dust size class "3", "4" or "5".</p> <p>Lower dust size classes to be removed if visible on the surface to be coated without magnification.</p>
.6	Water soluble salts limit equivalent to NaCl after blasting/ grinding	≤ 50 mg/m <sup>2</sup> of sodium chloride.
.7	Contamination	<p>No oil contamination.</p> <p>Paint manufacturer's recommendations should be followed regarding any other contamination between coats.</p>
<b>4</b>	<b>Miscellaneous</b>	
.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
.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; or .3 any other requirements of the paint manufacturer are not being met.
.3	Testing of coating <sup>1</sup>	Destructive testing should be avoided.  Sample dry film thickness shall be measured after each coat for quality control purposes and the total dry film thickness shall be confirmed after completion of the final coat, using appropriate thickness gauges.
.4	Repair	Any defective areas, e.g., pinholes, bubbles, voids, etc., shall 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, paragraph 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 qualified coating inspectors certified to NACE Coating Inspector Level 2, FROSIO Inspector Level III or equivalent as verified by the Administration.

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 subsection 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 (see annex 2).

### 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. Verified by manufacturer.
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.

Construction stage	Inspection items
	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.
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 COATING VERIFICATION REQUIREMENTS

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

- .1 check that the Technical Data Sheet and Statement of Compliance or Type Approval Certificate comply with the 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 COATING SYSTEMS

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

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 shall be subject to documented evidence that they ensure a corrosion prevention performance at least equivalent to that indicated in this Standard, by either:

- .1 testing according to this standard; or
- .2 five years' field exposure with documentary evidence of continuous trading with crude oil cargoes. The coating condition shall not be less than "GOOD" after five years.

## ANNEX 1

**TEST PROCEDURES FOR COATING QUALIFICATION FOR CARGO OIL TANKS OF  
CRUDE OIL TANKERS****1 Scope**

This annex provides details of the test procedures for cargo tank coatings of crude oil carriers as referred to in paragraphs 4.6 and 8.3 of this Standard. Both the tank-top and deck-head should be applied with coating systems that have passed the full test protocol as described in this standard.

**2 Definitions**

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

**3 Background**

3.1 It is acknowledged that a crude oil cargo tank on board a ship is exposed to two very different environmental conditions.

3.2 When the cargo tank is loaded there are three distinct vertical zones:

- .1 Lowest part, and horizontal parts on stringer decks, etc., exposed to water that can be acidic and sludge that can contain anaerobic bacteria.
- .2 Mid part where the oil cargo is in contact with all immersed steel.
- .3 Vapour space where the air is saturated with various vapours from the loaded cargo tank such as H<sub>2</sub>S, CO<sub>2</sub>, SO<sub>2</sub>, water vapour and other gases and compounds from the inert gas system.

3.3 When the tank is in a ballast condition:

- .1 Lowest part and horizontal parts on stringer decks, etc., exposed to cargo residues and water that can be acidic and sludge that can contain anaerobic bacteria.
- .2 Tank space where the air contains various vapours from the crude oil residues such as H<sub>2</sub>S, CO<sub>2</sub>, SO<sub>2</sub>, water vapour and other gases and compounds from the inert gas system.

**4 Testing**

The tests herein are designed to simulate, as far as practicable, the two main environmental conditions to which the crude oil cargo tank coating will be exposed. The coating shall be validated by the following tests: the test procedures shall comply with Appendix 1 (Gas-tight chamber simulating the vapour phase of the loaded tank) and Appendix 2 (Immersion test simulating the loaded condition of the crude oil tank).

## 5 Test gas composition

The test gas is based on the composition of the vapour phase in crude oil tanks, except that the hydrocarbon components are not included as these have no detrimental effect on epoxy coatings such as those used in cargo oil tanks.

### TEST GAS COMPOSITION

N <sub>2</sub>	83 ± 2 per cent by volume of dry gas
CO <sub>2</sub>	13 ± 2 per cent by volume of dry gas
O <sub>2</sub>	4 ± 1 per cent by volume of dry gas
SO <sub>2</sub>	300 ± 20 ppm
H <sub>2</sub> S	200 ± 20 ppm

## 6 Test liquid

Crude oil is a complex chemical material which is not stable over time when stocked. Crude oils can also vary in composition over time. In addition, the use of crude oil has proven to create practical and HSE barriers for the involved testing institutes. To overcome this, a model immersion liquid is used to simulate crude oil. The formulation of this crude oil model system is given below:

- .1 start with distillate Marine Fuel, DMA Grade density at 15°C: maximum 890 kg/m<sup>3</sup>, viscosity of maximum 6 mm<sup>2</sup>/s at 40°C;
- .2 add naphthenic acid up to an acid number of 2.5 ± 0.1 mg KOH/g;
- .3 add benzene/ toluene (1:1 ratio) up to a total of 8.0 ± 0.2% w/w of the DMA;
- .4 add artificial seawater up to a total of 5.0 ± 0.2% w/w to the mixture;
- .5 add H<sub>2</sub>S dissolved in a liquid carrier (in order to get 5 ± 1 ppm w/w H<sub>2</sub>S in the total test liquid);
- .6 thoroughly mix the above constituents immediately prior to use; and
- .7 once the mixture is completed, it should be tested to confirm the mixture is compliant with the test mixture concentrations.

*Note: To prevent the risk of H<sub>2</sub>S release into the test facility, it is recommended to use a stock solution for steps 1 to 4, then fill the test containers and complete the test solution with steps 5 and 6.*



## APPENDIX 1

## GAS-TIGHT CABINET TEST

**1 Test condition**

The vapour test shall be carried out in a gas-tight cabinet. The dimensions and design of the air tight gas cabinet are not critical, provided the requirements of subparagraphs .6 to .10 below are met. The test gas is designed to simulate the actual crude oil cargo tank environment in ballast condition as well as the vapour conditions of the loaded tank.

- .1 The exposure time is 90 days.
- .2 Testing shall be carried out using duplicate panels; a third panel shall be prepared and stored at ambient conditions to act as a reference panel during final evaluation of the test panels.
- .3 The size of each test panel is 150 mm x 100 mm x 3 mm.
- .4 The panels shall be treated according to the Performance standard table 1, 1.2, and the coating system applied according to table 1, 1.4 and 1.5.
- .5 The zinc silicate shop primer, when used, shall be weathered for at least 2 months and cleaned by low pressure fresh water washing. The exact method of shop primer preparation before being over coated shall be reported, and the judgement issued for that specific system. The reverse side and edges of the test piece shall be coated appropriately, in order not to influence the test results.
- .6 Inside the gas-tight cabinet a trough shall be present. This trough shall be filled with  $2 \pm 0.2$  l of water. The water in the trough shall be drained and renewed prior to each time the test gas is refreshed.
- .7 The vapour spaces inside the gas-tight cabinet shall be filled with a mixture of test gas as per item 5 of the Standard. The cabinet atmosphere shall be maintained over the period of the test. When the gas is outside the scope of the test method, it shall be refreshed. The monitoring frequency and method, and the date and time for refreshing the test gas, shall be in the test report.
- .8 The atmosphere in the test cabinet shall at all times be  $95 \pm 5\%$  relative humidity.
- .9 The temperature of the test atmosphere shall be  $60 \pm 3^\circ\text{C}$ .
- .10 A stand for the test panels shall be made of a suitable inert material to hold the panels vertically spaced at least 20 mm between panels. The stand shall be positioned in the cabinet to ensure the lower edge of the panels is at least 200 mm above the height of the water and at least 100 mm from the walls of the cabinet. If two shelves are in the cabinet, care shall be taken to ensure solution does not drip on to the lower panels.

## 2 Test results

2.1 Prior to testing, the following measured data of each coating composing the coating system, including the zinc silicate shop primer when used under the coating system, shall be reported:

- .1 infrared (IR) identification of the base and hardener components of the coating;
- .2 specific gravity of the base and hardener components of the paint; and
- .3 mean dry film thickness (DFT) (by using a template).

2.2 After completion of the test, the panels shall be removed from the cabinet and rinsed with warm tap water. The panels shall be dried by blotting with absorbent paper and then evaluated for rust and blistering within 24 h of the end of the test.

2.3 After testing, the following measured data shall be reported: blisters and rust.

## 3 Acceptance criteria

3.1 The test results based on section 2 shall satisfy the following criteria, the poorest performing of the duplicate test panels shall be used in the report:

Item	Acceptance criteria for epoxy-based systems	Acceptance criteria for alternative systems
Blisters on panel	No blisters	No blisters
Rust on panel	Ri 0 (0%)	Ri 0 (0%)

3.2 When evaluating test panels, blistering or rusting within 5 mm of the panel edge shall be ignored.

## 4 Test report

The test report shall include the following information:

- .1 coating manufacturers' name and manufacturing site;
- .2 dates of test;
- .3 product name/identification of each coat and, where applicable, zinc silicate shop primer;
- .4 batch numbers of each component of each product;
- .5 details of surface preparation of steel panels, before shop primer application, and treatment of the shop primer before over coating where relevant and at a minimum including the following:
  - .5.1 surface treatment, or treatment of weathered shop primer, and any other important information on treatment influencing the performance; and

- .5.2 water soluble salt level measured on the steel prior to application of the shop primer;
- .6 details of coating system, including the following:
  - .6.1 zinc silicate shop primer if relevant, its secondary surface pre-treatment and condition under which applied, weathering period;
  - .6.2 number of coats, including the shop primer, and thickness of each;
  - .6.3 mean dry film thickness (DFT) prior to testing;
  - .6.4 thinner if used;
  - .6.5 humidity;
  - .6.6 air temperature; and
  - .6.7 steel temperature;
- .7 details of schedule for refreshing the test gas;
- .8 test results according to section 2; and
- .9 results according to section 3.

## APPENDIX 2

## IMMERSION TEST

## 1 Test condition

The immersion test has been developed to simulate the conditions in a crude oil tank in loaded condition.

- .1 The exposure time is 180 days.
- .2 The test liquid shall comply with section 6 of annex 1 of the Standard.
- .3 The test liquid shall be added to a container with an inside flat bottom until a column of the test liquid of height of 400 mm is reached, resulting in an aqueous phase of 20 mm. Any other alternative test set-up, using an identical test liquid, which will also result in the immersion of the test panel in 20 mm of the aqueous phase, is also accepted. This can be achieved by using, for instance, inert marbles.
- .4 The temperature of the test liquid should be  $60 \pm 2^{\circ}\text{C}$  and should be uniform and maintained constant with recognized methods such as water or oil bath or air circulation oven capable of keeping the immersion liquid within the required temperature range.
- .5 Test panels shall be positioned vertically and fully immersed during the test.
- .6 Testing shall be carried out using duplicate panels.
- .7 Inert spacers which do not cover the test area shall be used to separate test panels.
- .8 The size of each test panel is 150 mm x 100 mm x 3 mm.
- .9 The panels shall be treated according to table 1, 1.2, and the coating system applied according to table 1, 1.4 and 1.5.
- .10 The zinc silicate shop primer, when used, shall be weathered for at least 2 months and cleaned by low pressure fresh water washing. The exact method of shop primer preparation before being over coated shall be reported, and the judgement issued for that specific system. The reverse side, and edges, of the test piece shall be coated appropriately, in order not to influence the test results.
- .11 After the full immersion test period is completed the panels shall be removed from the test liquid and wiped with dry clean cloth before evaluation of the panels.
- .12 Evaluation of the test panels shall be done within 24 h after completion of the test.

## 2 Test results

2.1 Prior to testing, the following measured data of each coating composing the coating system, including the zinc silicate shop primer when used under the coating system, shall be reported:

- .1 infrared (IR) identification of the base and hardener components of the coating;
- .2 specific gravity of the base and hardener components of the paint; and
- .3 mean dry film thickness (DFT) (by using a template).

2.2 After testing, the following measured data shall be reported: blisters and rust.

## 3 Acceptance criteria

3.1 The test results based on section 2 shall satisfy the following criteria, the poorest performing of the duplicate test panels shall be used in the report:

Item	Acceptance criteria for epoxy-based systems	Acceptance criteria for alternative systems
Blisters on panel	No blisters	No blisters
Rust on panel	Ri 0 (0%)	Ri 0 (0%)

3.2 When evaluating test panels, blistering or rusting within 5 mm of the panel edge should be ignored.

## 4 Test report

The test report shall include the following information:

- .1 coating manufacturers' name and manufacturing site;
- .2 dates of test;
- .3 product name/identification of each coat and, where applicable, zinc silicate shop primer;
- .4 batch numbers of each component of each product;
- .5 details of surface preparation of steel panels, before shop primer application, and treatment of the shop primer before over coating where relevant and at a minimum including the following:
  - .5.1 surface treatment, or treatment of weathered shop primer, and any other important information on treatment influencing the performance; and
  - .5.2 water soluble salt level measured on the steel prior to application of the shop primer;

- .6 details of coating system, including the following:
  - .6.1 zinc silicate shop primer if relevant, its secondary surface pre-treatment and condition under which applied, weathering period;
  - .6.2 number of coats, including the shop primer, and thickness of each;
  - .6.3 mean dry film thickness (DFT) prior to testing;
  - .6.4 thinner if used;
  - .6.5 humidity ;
  - .6.6 air temperature; and
  - .6.7 steel temperature;
- .7 test results according to section 2; and
- .8 results according to section 3.

## APPENDIX 3

## PRECAUTIONS REGARDING THE USE OF DANGEROUS MATERIALS

1 The test methods involve the use of materials that may be hazardous to health as follows:

- .1 Sulphur Dioxide: Corrosive when wet, toxic if inhaled, causes burns, and is an irritant to the eyes and respiratory system.
- .2 Hydrogen Sulphide: Highly flammable (Flash point of  $-82^{\circ}\text{C}$ ), can form an explosive mixture with air, corrosive when wet, causes burns, has to be kept away from sources of ignition, irritant and asphyxiant, LTEL 5 ppm, STEL 10 ppm, higher concentrations can be fatal and have no odour. Repeated exposure to low concentrations can result in the sense of smell for the gas being diminished.
- .3 Benzene: Highly flammable (Flash point of  $-11^{\circ}\text{C}$ ), can form an explosive mixture with air, toxic, carcinogenic, acute health risk.
- .4 Toluene: Highly flammable (Flash point of  $4^{\circ}\text{C}$ ), can form an explosive mixture with air, irritant, acute health risk, reprotoxin.

2 Special test apparatus and precautions may be required depending on the regulations in force in the country where the tests are carried out.

3 Although some countries have no specific requirements preventing either of the tests being carried out, it shall still be required that:

- .1 a risk assessment of the working conditions is carried out;
- .2 during the test period, the system shall be enclosed; and
- .3 the environment shall be controlled, particularly at the start and end of the tests, suitable air exhaust shall be available and personal protective equipment shall be worn.

## ANNEX 2

## EXAMPLE OF DAILY LOG AND NON-CONFORMITY REPORT

DAILY LOG

Sheet No:

Ship:		Tank/Hold No:		Database:					
Part of structure:									
SURFACE PREPARATION									
Method:					Area (m <sup>2</sup> ):				
Abrasive:					Grain size:				
Surface temperature:					Air temperature:				
Relative humidity (max):					Dew point:				
Standard achieved:									
Rounding of edges:									
Comments:									
Job No.:			Date:			Signature:			
COATING APPLICATION:									
Method:									
Coat No.	System	Batch No.	Date	Air temp.	Surf temp.	RH%	Dew point	DFT* Meas.	Specified
* Measured minimum and maximum DFT. DFT readings to be attached to daily log.									
Comments:									
Job No:			Date:			Signature:			



## NON-CONFORMITY REPORT

Sheet No:

Ship:	Tank/Hold No:	Database:
Part of structure:		
DESCRIPTION OF THE INSPECTION FINDINGS TO BE CORRECTED		
Description of findings:		
Reference document (daily log):		
Action taken:		
Job No.:	Date:	Signature: