



GUIDANCE NOTES ON

MAINTENANCE AND REPAIR OF PROTECTIVE COATINGS

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Foreword

A protective coating is the most efficient way to preserve steel structural strength. However, coatings will deteriorate over time during service. In order to maximize service life with reduced life-cycle cost, it is critical to maintain and repair the coating at an early stage, before accelerated corrosion due to coating deterioration occurs. It is a regulatory requirement for ships to comply with the IMO Performance Standards of Protective Coatings (IMO PSPC) for the goal, as a minimum, of 15 years of useful coating life in “GOOD” condition. These Guidance Notes provide guidelines of coating maintenance and restoration of ballast tanks and cargo oil tanks in order to reach the PSPC goal as a minimum.

IMO Performance Standards of Protective Coatings (IMO resolutions MSC.215(82) and MSC.288(87), hereinafter referred to as “IMO PSPC”) set out coating standards for new construction of seawater ballast tanks and crude oil tanks. The coatings applied in accordance with those PSPC standards are expected to have a target useful coating life of 15 years, over which time the coating system is intended to remain in “GOOD” condition. However, the actual useful life will vary, depending on numerous variables including actual conditions encountered in service.

The existing ABS *Guidance Notes on the Application and Inspection of Marine Coating Systems* published in January 2017 were developed to help the shipyard’s implementation of adopted IMO PSPCs for dedicated seawater ballast tanks and crude oil tanks during new constructions. These newly developed ABS *Guidance Notes on Maintenance and Repair of Protective Coatings* cover recommendations on maintenance and repairs of the PSPC coatings in service, which help the ABS Surveyors, the shipyards, and ship operators assess the coating in-service maintenance and repairs. ABS Nautical Systems has been integrated with ship’s Hull Manager to assist ship operators to assess and monitor the in-service coating conditions to meet the requirement of the ABS **HIMP** Notation issued. This guidance is in line with Hull Manager of ABS Nautical Systems.

The purpose of these Guidance Notes is to assist Surveyors, shipowners, ship managers, shipyards, flag Administrations, and other interested parties in maintaining the PSPC-related certification for compliance with PSPCs in relation to coating condition assessment, maintenance, and repair of protective coatings of seawater ballast tanks and crude oil cargo tanks.

These Guidance Notes become effective on the first day of the month of publication.

Users are advised to check periodically on the ABS website www.eagle.org to verify that this version of these Guidance Notes is the most current.

We welcome your feedback. Comments or suggestions can be sent electronically by email to rsd@eagle.org.

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SECTION 1 General

1 Background

Two coating performance standards for protective coatings (PSPC) have been mandated from SOLAS regulations II-1/3-2 & 3.11 for dedicated seawater ballast tanks (IMO resolution MSC.215(82)) and cargo oil tanks of crude oil tankers (IMO resolution MSC.288(87)). Those IMO resolutions set PSPCs as new construction requirements of ships. The coatings applied in accordance with those PSPC standards have a target useful coating life of 15 years, over which time the coating system is intended to remain in “GOOD” condition. However, the actual useful life will vary, depending on the ability of the coating system to reach its target useful life of 15 years, which depends on numerous variables including the type of coating system selected, the design of the structures, coating application, coating in-service maintenance, and actual conditions encountered in service. All these aspects contribute to the performance of the coating system.

A protective coating is the most efficient way to protect steels and preserve structural strength. However, the coating can deteriorate over time during service. In order to maximize service life with reduced life-cycle cost, it is critical to maintain and repair the coating at an early stage, before accelerated corrosion due to coating deterioration occurs. It is also important for the coatings to comply with the IMO Performance Standards of Protective Coatings (IMO PSPC) for the goal, as a minimum, of 15 years of useful coating life in “GOOD” condition. These Guidance Notes provide guidelines of coating maintenance and restoration of ballast tanks and cargo oil tanks in order to reach the PSPC goal.

These Guidance Notes have been developed based on IMO recommendations from MSC.1/Circ.1330, MSC.1/Circ.1399, and the best information currently available. Consideration has been taken that maintenance may take place when the vessel is at sea, while repair usually takes place in dry dock or during scheduled repair periods (afloat at yard).

The *ABS Guidance Notes on the Application and Inspection of Marine Coating Systems* published in January 2017 were developed to help the shipyard’s implementation of adopted IMO PSPCs for dedicated seawater ballast tanks and crude oil tanks during new constructions. These *Guidance Notes on Maintenance and Repair of Protective Coatings* cover recommendations on maintenance and repairs of the PSPC coatings in service.

These Guidance Notes assist in assessing coating conditions, which are reflected in ABS Nautical Systems Hull Manager to aid ship operators to assess and monitor in-service coating conditions of tanks for compliance with the ABS **HIMP** Notation. These Guidance Notes focus on the tank’s coating maintenance and restoration, and provide updated information for ABS Nautical Systems Hull Manager.

3 Scope and Application

These Guidance Notes address maintenance and repair procedures for PSPC coatings of seawater ballast tanks and crude oil cargo tanks. Corrosion prevention systems other than coatings are not covered by these Guidance Notes.

Maintenance and repair of the protective coating system should be included in the vessel’s overall maintenance and repair scheme and should be recorded in the Coating Technical File (CTF) as per IMO resolutions MSC.215(82) and MSC.288(87). The effectiveness of the protective coating system, which may include the use of anodes, should be monitored by the Administration or an organization recognized by the Administration during the life of a vessel.



SECTION 2 Definitions

1 Maintenance

Maintenance means minor coating restoration work regularly performed by a vessel's crew using normal shipboard means and tools to maintain "GOOD" or "FAIR" coating conditions. Maintenance delays or slows down the coating deterioration and effects short-term steel protection.

3 Repair

Repair means coating restoration work of a longer-term nature, usually performed during a vessel's drydocking or scheduled repair period (ship idle) to restore the "FAIR" or "POOR" coating condition to "GOOD" condition. This will usually require specialized shipyard arrangement and preparation, manpower, and equipment such as staging, blasting equipment, operators, and ventilation/dehumidifiers for surface preparation and coating application.

5 Coating Conditions

The condition of the coating is assigned and categorized as "GOOD", "FAIR", or "POOR", based on visual inspection and estimated percentage of areas with coating failures and rusty. Refer to IMO resolution A.744(18) and IACS Recommendation 87 for the coating condition definitions, photographs, and uniform/localized assessment scales. The coating condition definitions from IMO MSC.1/Circ.1330 and IMO MSC.1/Circ.1399 are in line with those from IACS Recommendation No. 87.

- **GOOD:** Spot rusting without visible failures of the coating is be less than 3% of the area under consideration. Rusting at edges or welds is less than 20% of edges or weld lines in the area under consideration.
- **FAIR:** Breakdown of coating or rust penetration is less than 20% of the area under consideration. Hard rust scale is less than 10% of the area under consideration. Rusting at edges or welds is less than 50% of edges or weld lines in the area under consideration.
- **POOR:** Breakdown of coating or rust penetration is equal to or more than 20% or hard rust scale is equal to or more than 10% of the area under consideration or local breakdown concentrated at edges or welds is equal to or more than 50% of edges or weld lines in the area under consideration.

Section 2, Table 1 summarizes the coating conditions. Section 2, Table 2 provides ABS inspection grading criteria of coating conditions for the ABS Hull Inspection and Maintenance Program (HIMP).

TABLE 1
“GOOD”, “FAIR”, and “POOR” Coating Conditions

Considered Area	Coating Condition		
	GOOD	FAIR	POOR
Area under consideration ⁽¹⁾	Spot rusting without visible coating failures is < 3% of the area.	Breakdown of coating or rust penetration is ≥ 3% but < 20% of the area. Hard rust scale is < 10% of the area.	Breakdown of coating or rust penetration is ≥ 20% of the area. Hard rust scale is ≥ 10% of the area.
Edges/welds ⁽²⁾	Rusting in the area is < 20% of edges or weld lines.	Rusting in the area is ≥ 20% but < 50% of edges or weld lines.	Rusting in the area is > 50% of edges or weld lines

Notes:

- 1 % is the percentage calculated on basis of the area under consideration or of the “critical structural area”. Spot rusting is rusting in spots without visible failure of coating.
- 2 % is the percentage calculated on basis of edges or weld lines in the area under consideration or of the “critical structural area”.

TABLE 2
Inspection Grading Criteria for the ABS Hull Inspection and Maintenance Program (HIMP)

Regulations	ABS HIMP Program			
Coating Condition	Grading Point	Condition Description	Risk Level	Color Code
Good	0	Excellent coating with negligible indication of coating failure	Very Low	Green
	1	Minor spot rusting	Low	
	2	- Spot rusting without visible coating failure is < 3% of the area under consideration. - Rusting is < 20% of edges or weld lines.	Low – Medium	
Fair	3	- Breakdown of coating or rust penetration is ≥ 3% but < 10% of the area. - Hard rust scale is < 5% of the area. - Rusting in the area is ≥ 20% but < 35% of edges or weld lines.	Medium	Yellow
	4	- Breakdown of coating or rust penetration is ≥ 10% but < 20% of the area. - Hard rust scale is ≥ 5% but < 10% of the area. - Rusting in the area is > 35% but < 50% of edges or weld lines.	Medium – High	
Poor	5	- Breakdown of coating or rust penetration is ≥ 20% but < 30% of the area. - Hard rust scale is ≥ 10% but < 20% of the area. - Rusting in the area is ≥ 50% but < 75% of edges or weld lines.	High	Red
	6	- Breakdown of coating or rust penetration is ≥ 30% of the area. - Hard rust scale is ≥ 20% of the area. - Rusting in the area is ≥ 75% of edges or weld lines.	Very High	

7 Areas under Consideration and Critical Structural Areas

Areas under consideration are areas subdivided into sections small enough to be readily examined and evaluated by the Surveyor. However, the areas subdivided should not be so small as to be structurally insignificant or too numerous to report on practically. The coating condition in each area should be reported using current practice and terminology (frame numbers, longitudinal numbers and/or strakes numbers, etc.). See Section 3 for details.

Critical structural areas, per SOLAS Ch. II-1 Part A-1/Reg. 3-6/4.2, are defined as “locations which have been identified from calculations to require monitoring (might be found in the Coating Technical File (CTF) from new building stage), from the service history of the subject ship or from similar or sister ships (if available) to be sensitive to cracking, buckling or corrosion which would impair the structural integrity of the ship”. See Subsection 3/9 for details.



SECTION 3 Areas under Consideration

1 General

Recognizing that different areas in the tank experience different corrosion and erosion environments and thus different rates of coating breakdown, areas under consideration should be areas subdivided into sections small enough to be readily examined and evaluated by the Surveyor. However, the areas subdivided should not be so small as to be structurally insignificant or too numerous to practically report on. The coating condition in each area should be reported using current practice and terminology (frame numbers, longitudinal numbers and/or strakes numbers, etc.). Each area is then rated “GOOD”, “FAIR”, or “POOR” and the tank rating should not be higher than the rating of its “area under consideration” or its “critical structural areas” having the lowest rating. Examples of coating conditions with respect to areas under consideration of ballast tanks are given in IACS Recommendation 87, appendix I.

Special attention should be given to coatings in “critical structural areas” sensitive to cracking, buckling, corrosion, or erosion. “Critical structural areas”, per SOLAS Ch. II-1 Part A-1/Reg. 3-6/4.2, are defined as “locations which have been identified from calculations to require monitoring or from the service history of the subject ship or from similar or sister ships (if available) to be sensitive to cracking, buckling or corrosion which would impair the structural integrity of the ship”. Each critical structural area is also rated “GOOD”, “FAIR”, or “POOR”.

The specific details of the coated areas in each tank can be found from the CTF.

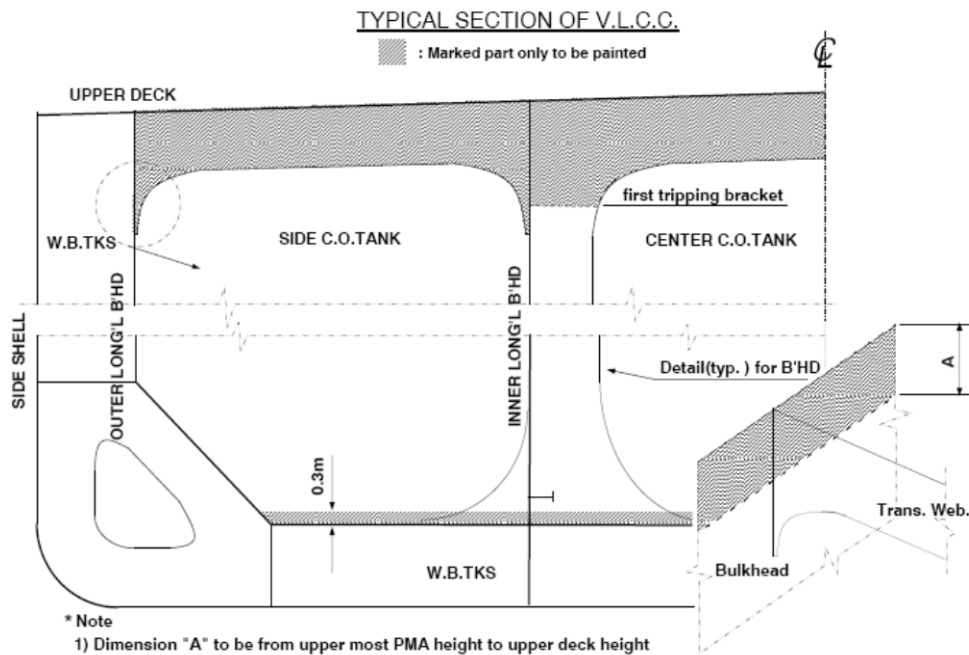
3 Coated Areas of Crude Oil Cargo Tanks in Oil Tankers

3.1 Minimum Areas Coated

The following are the minimum areas to be coated, as defined in IMO Resolution MSC.288(87). See Section 3, Figure 1, below.

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

FIGURE 1
Minimum Coated Areas of Typical VLCC Tanks



3.3 Deck Head with Upper Transverses and Longitudinal Bulkheads

Areas of under deck and bulkhead plating with attached structure in the upper coated areas are considered. One (1) area is for the deck head. One (1) area is for each longitudinal bulkhead upper part with any attached structure and access platforms or stringers. A total of three (3) areas are for the deck head. Transverse bulkhead upper parts are considered in 3/3.7 below.

3.5 Bottom Plating with Lower Transverse and Longitudinal Bulkheads

Areas of the tank bottom and transverse and longitudinal lower bulkheads (including hoppers) with attached structure (if any) in the lower coated areas are considered. A total of one (1) area is for the tank lower parts.

3.7 Transverse Bulkheads (Upper Forward and Aft)

Areas of transverse bulkheads and attached stiffeners and access outittings in upper forward and aft transverse bulkheads are considered. A total of two (2) areas are for upper parts of transverse bulkheads.

3.9 Swash Bulkheads

The upper and lower parts of all swash bulkheads located in cargo tanks, together with any frames, brackets, and access outittings in way are considered. A total of two (2) areas are for swash bulkheads.

3.11 Stringers

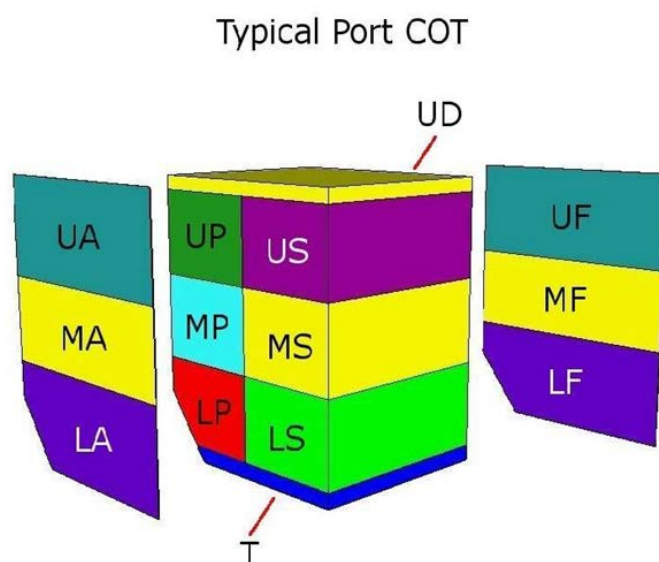
Stringers located outside the prescribed upper and lower coating areas (see Section 3, Figure 1) are not required to be coated. However, in the case that shipowners have voluntarily coated the upper surfaces of such stringers, these coated surfaces should be included in reports solely for the shipowner's benefit and choice of any action.

5 Coated Areas of Ballast Tanks in Oil Tankers

5.1 Typical Zones

The compartment is typically split into 14 zones. See Section 3, Figure 2.

FIGURE 2
Typical Zones for a Tank



Zone 1: Under deck (UD)	Zone 8: Upper aft (UA)
Zone 2: Bottom (T)	Zone 9: Lower port (LP)
Zone 3: Lower forward (LF)	Zone 10: Lower starboard (LS)
Zone 4: Lower aft (LA)	Zone 11: Middle port (MP)
Zone 5: Middle forward (MF)	Zone 12: Middle starboard (MS)
Zone 6: Middle aft (MA)	Zone 13: Upper port (UP)
Zone 7: Upper forward (UF)	Zone 14: Upper starboard (US)

5.3 Single Hull Tanker – Wing Ballast Tanks

5.3.1 Deck and Bottom

Areas of deck and bottom plating with attached structure are considered. One (1) area is for the deck and one (1) area is for the bottom. A total of two (2) areas are considered here. See Areas 1 and 2 illustrated in Section 3, Figure 3.

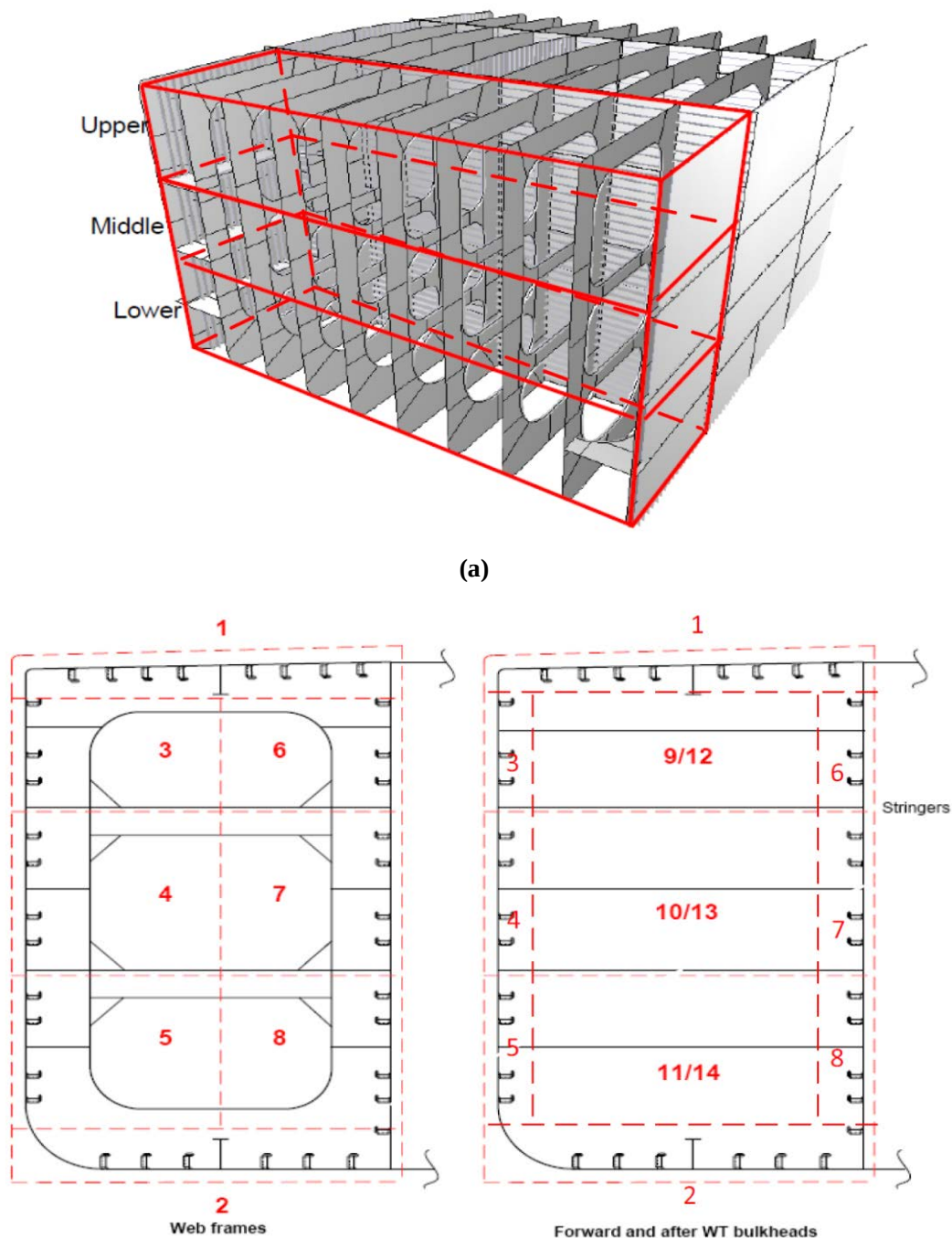
5.3.2 Side Shell and Longitudinal Bulkheads

Areas of side shell and longitudinal bulkhead plating and attached structure, in the lower, middle, and upper third are considered. Web frames are divided in half as attached structure of the longitudinal bulkhead and side shell. Three (3) areas are for the side shell and three (3) areas are for the longitudinal bulkhead. A total of six (6) areas are considered here. See Areas 3 through 8 illustrated in Section 3, Figure 3.

5.3.3 Transverse Bulkheads (Forward and Aft)

Areas of transverse bulkhead plating and attached stiffeners, in the lower, middle, and upper third are considered. Three (3) areas are for the forward transverse bulkhead and three (3) areas are for the aft transverse bulkhead. A total six (6) areas are considered here. See Areas 9 through 14 illustrated in Section 3, Figure 3.

FIGURE 3
Areas under Consideration for a Wing Ballast Tanks of a Single Hull Tanker



- | | | | |
|-------|--|----------|--|
| 1 | Main deck plating and attached structure | 9,10,11 | Forward Transverse Bulkhead upper, middle, and lower parts |
| 2 | Bottom plating in way of bilge and attached structure | 12,13,14 | Aft Transverse Bulkhead upper, middle, and lower parts |
| 3,4,5 | Upper, middle, and lower parts of shell plating and attached structure | | |
| 6,7,8 | Upper, middle, and lower parts of longitudinal bulkhead and attached structure | | |

(b)

5.5 Double Hull Tanker – Double Bottom Ballast Tank

Areas of tank boundaries and attached structure in the lower and upper half of the tank are considered. A total of two (2) areas are for each double bottom ballast tank. See Areas 15 and 16 illustrated in Section 3, Figure 4.

5.7 Double Hull tanker – Double Hull Side Ballast Tank

5.7.1 Deck and Bottom

Areas of deck and bottom plating with attached structure are considered. One (1) area is for the deck and one (1) area is for the bottom. A total of two (2) areas are considered here. See Areas 1 and 2 illustrated in Section 3, Figure 4.

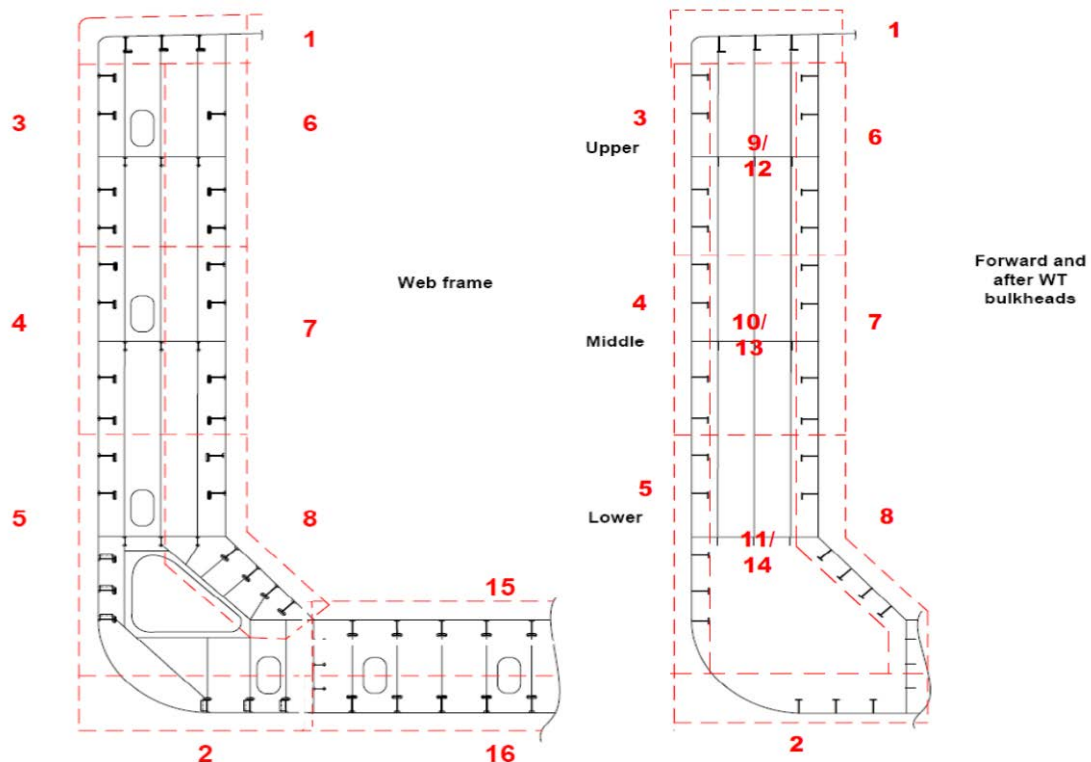
5.7.2 Side Shell and Longitudinal Bulkheads

Areas of side shell and longitudinal bulkhead plating with attached structure, in the lower, middle, and upper third are considered. Web frames are divided in half as attached structure of the longitudinal bulkheads and side shell. Three (3) areas are for the side shell and three (3) areas are for the longitudinal bulkhead. See Areas 3 through 8 illustrated in Section 3, Figure 4.

5.7.3 Transverse Bulkheads (Forward and Aft)

Areas of transverse bulkhead plating and attached stiffeners, in the lower, middle, and upper third are considered. Three (3) areas are for the forward transverse bulkhead and three (3) areas are for the aft transverse bulkhead. See Areas 9 through 14 illustrated in Section 3, Figure 4.

FIGURE 4
Areas under Consideration for Ballast Tanks of a Double Hull Tanker



- 1 Main deck plating and attached structures
- 2 Bottom plating in way of bilge and attached structures
- 3,4,5 Upper, middle, and lower shell plating and attached structures
- 6,7,8 Upper, middle, and lower longitudinal bulkhead and attached structures

- 9,10,11 Forward Transverse Bulkhead upper, middle and lower parts
- 12,13,14 Aft Transverse Bulkhead upper, middle and lower parts
- 15, 16 Upper and lower half parts of double bottom ballast tank