

GUIDANCE NOTES
GD-2025



INTERNATIONAL SHIP CLASSIFICATION

Guidelines for Thickness Measurement of Hull

(Ver. 6.6)



Effective on 2025-04-01

Preface

Hull thickness measurement is a significant part of ship survey. According to the relevant provisions of the Rules for Classification of Sea-going Steel Ships (hereinafter referred to as current Rules) of International Ship Classification (hereinafter referred to as ISC), surveyors carry out analysis on thickness results to evaluate the compliance of hull local and longitudinal strength with the requirements of strength standards provided in ISC Rules. Hull thickness measurements provide important basis for the inspection of hull structure integrity, for determination and extent of hull structure repair and renewal, as well as effective support for ship maintenance. Since the accuracy of thickness measurement data is vital to ship's structural strength and safe navigation, hull thickness measurement must be taken seriously to make sure that the results are capable of revealing a ship's actual situation in an objective, actual and complete way.

For the template of ISC thickness measurement report, refer to the relevant requirements provided in Appendix 6 and 13 to Chapter 5, PART ONE of current ISC Rules. The thickness measurement companies recognized by ISC shall uniformly use ISC "Hull Structure Thickness Measurement Management System" (METE TM SYSTEM) to compile reports.

Based on the current ISC Rules, relevant IACS URs, IACS PR 19 Procedural Requirement for Thickness Measurements and IACS Recommendation No. 77 Guidelines for the Surveyor on how to Control the Thickness Measurement Process, the Guidelines are developed to provide unified procedures and requirements for implementation of thickness measurement for ship's close-up surveys and thickness measurements performed by ISC surveyors, thickness measurement companies recognized by ISC, ship owners and the other related parties so as to facilitate mutual cooperation. The specific version numbers of the above-mentioned reference documents are as follows:

- ✧ ISC Rules for Classification of Sea-going Steel Ships 2024
- ✧ URZ 7 (Rev.29 Corr.1)
- ✧ URZ 7.1 (Rev.15 Corr.1)
- ✧ URZ 7.2 (Rev.8)
- ✧ URZ 10.1 (Rev.25)
- ✧ URZ 10.2 (Rev.37)
- ✧ URZ 10.3 (Rev.21)
- ✧ URZ 10.4 (Rev.18)
- ✧ URZ 10.5 (Rev.20)
- ✧ PR19 (Rev.1)
- ✧ IACS REC.77 (Rev.4)

When some provisions of the Guidelines are inconsistent or contradictory with those provided in the latest edition of current ISC Rules, IACS URs, IACS PR 19 and IACS Recommendation No. 77, the latter is to prevail.

For the thickness measurement requirements for Condition Assessment Procedure (CAP) for Existing Ships, refer to the relevant provisions of ISC Guidelines for Condition Assessment Procedure (CAP) for Existing Ships.

Where the diagrams of 3D models related to close-up surveys and thickness measurements of ship types covered in the Guidelines are inconsistent with the corresponding text description, the latter

is to prevail.

For any comments or revision suggestions from the user during the implementation of the Guidelines, please send them to the email address of the International Service Development Department of ISC Headquarters: enquiry@isclass.com.

Explanation for Revision

The Guidelines for Thickness Measurement of Hull (Ver.6.5) have been partly revised and developed according to current ISC Rules and the relevant requirements of IMO, IACS URs, PRs, RECs, etc. by referring to relevant provisions and in conjunction with issued found related to thickness measurement during survey management.

Main changes of contents for this revision include:

1. According to the revised "Guidelines for Management of Approval of Suppliers and Personnel Qualification", the requirement for using RIT to conduct thickness measurement has been added.
2. Based on the feedback from REC.77, surveyors and thickness measurement companies, partial modifications have been made to the thickness measurement work process.
3. The local corrosion criteria for weathertight hatch covers in cargo holds (except for bulk carrier, ore carrier and combination carriers) whose construction contracts were signed after July 1, 2012 have been supplemented.
4. The edge corrosion and groove corrosion criteria for non-CSR ships have been supplemented.
5. According to the 2023 amendment circular of the rules, the schematic diagrams of the thickness measurement requirements for double-hull oil tankers are listed independently.
6. The requirements for internal inspections and thickness measurements in the double-side void spaces adjacent to cargo holds for bulk carriers with an age of over 20 years and a length of 150 meters and above have been added.
7. According to the rules, the descriptions and illustrations of the thickness measurement points for CSR bulk carriers and oil tankers have been supplemented (referring to the rules).

Contents

Chapter One	General	- 1 -
Chapter Two	Working Procedures of Thickness Measurements	- 12 -
Chapter Three	Renewal Criteria for Hull Structure.....	- 19 -
Chapter Four	Requirements for Thickness Measurements of Hull of All Ships	- 27 -
Chapter Five	Requirements for Thickness Measurements of Hull of General Dry Cargo Ships	- 36 -
Chapter Six	Requirements for Thickness Measurements of Hull of Oil Tankers (including Combination Ships of Ore/Oil Ships), Double Hull Oil Tankers	- 45 -
Chapter Seven	Requirements for Thickness Measurement of Hull of Bulk Carriers and Double-skin Bulk Carriers	- 62 -
Chapter Eight	Requirements for Thickness Measurement of Hull of Chemical Tankers	- 90 -
Chapter Nine	Minimum Requirements for Thickness Measurements at Hull Special Surveys of Liquefied Gas Carriers	- 92 -
Chapter Ten	Selection of the Thickness Measurement Locations	- 93 -
Annex 1	IACS PR19&IACS REC.77	- 113 -
Annex 2	Surveyor's Glossary	- 118 -

Chapter One General

I. General provisions

1 In principle, the services and reports or certifications provided by thickness measurement companies who offer services to ISC Classed Ships and for ships subject to surveys implemented by ISC under authorization will not be accepted by ISC until such companies are approved in accordance with the relevant provisions of current ISC Rules.

2 In special circumstances, ISC may accept the service provided by a thickness measurement company recognized by other IACS member societies or a company recognized by ISC but not having been certificated.

3 ISC will not accept a thickness measurement carried out without the onboard survey by the surveyor.

4 A thickness measurement company is to implement the work in strict compliance with ISC Rules and the extent determined by the site surveyors.

5 A thickness measurement company is to accept any form of monitoring performed by the site surveyors to ISC and is obliged to provide necessary conditions for such monitoring.

6 If the thickness company provides service beyond the extent limited within the approval certificate, the data concerning the service in question submitted by the company will not be approved by ISC.

7 A thickness measurement company has the exclusive duty and obligation to ensure the authenticity and accuracy of the thickness measurement data. When obvious frauds are found in the service of a thickness measurement company and in the case of avoidance from or rejection of monitoring from the site surveyors, ISC will not approve the thickness measurement data provided by the company and even suspend or withdraw its qualification for thickness measurement. ISC reserves the right of withdrawing thickness measurement approval certificate and of notifying other Classification Society.

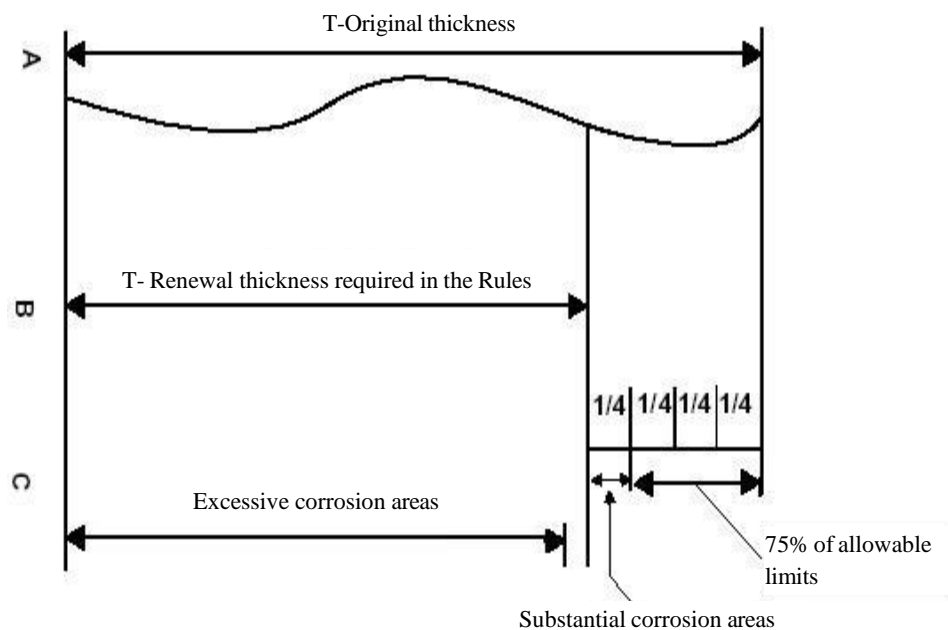
8 When survey is carried out step by step, thickness measurement, in principle, is to be implemented one by one according to individual space and at the same time, sufficient consideration is to be given to the possibility of performing thickness measurement at next survey. In conjunction with docking survey, the overall survey, close-up survey and thickness measurements for all the structures below the lightest ballast waterline are to be completed in dock.

9 The Guidelines apply to thickness measurement of hull of CSA-classed ships engaged in international voyages and all CSA-class ships with the ESP additional notation. For thickness measurement of hull of other CSA-classed ships, it is to be implemented in accordance with current ISC provisions.

10 The thickness measurement of conventional ships, general dry cargo ships, chemical tankers and liquefied gas carriers can be carried out by using Remote Inspection Technology (RIT). The suppliers that conduct thickness measurement using RIT should be recognized by ISC. The recognition shall be carried out in accordance with the requirements of Chapter 16 "Suppliers Engaged in Survey Using Remote Inspection Techniques (RIT) as An Alternative Means for Close-up Survey of the Structure of Ships and Mobile Offshore Units" of the "Guidelines for Management of Approval of Suppliers and Personnel Qualification". For bulk carriers and oil tankers, the use of RIT for thickness measurement should be approved by the Administration.

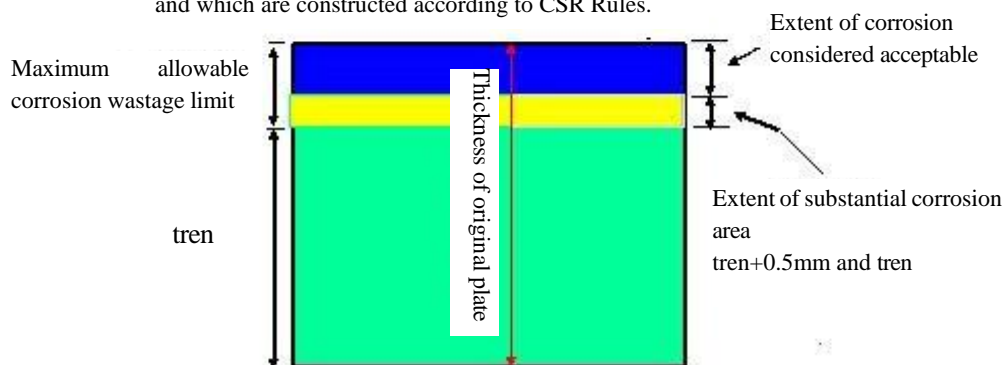
II. Definitions

- 1 A ballast tank: is a tank that is being used primarily for salt water ballast.
- 1.1 A Combined Cargo/Ballast Tank: is a tank which is used for the carriage of cargo or ballast water as a routine part of the vessel's operation and will be treated as a ballast tank. Cargo tanks in which water ballast might be carried only in exceptional cases per MARPOL Annex I/18.3 are to be treated as cargo tanks.
- 1.2 A Ballast Tank of Bulk Carrier: is a tank which is used solely for salt water ballast, or, where applicable, a space which is used for both cargo and salt water ballast will be treated as a ballast tank when substantial corrosion has been found in that space.
- 1.3 A Ballast Tank of Double Skin Bulk Carrier: is a tank which is used solely for salt water ballast, or, where applicable, a space which is used for both cargo and salt water ballast will be treated as a ballast tank when substantial corrosion has been found in that space. A double side tank is to be considered as a separate tank even if it is in connection to either the topside tank or the hopper side tank.
- 2 A transverse section: includes all longitudinal members such as plating, longitudinals and girders at the deck, side, bottom, inner bottom, and longitudinal bulkhead (where applicable, hopper side plating and bottom plating of top wing tanks). For transversely framed vessels, a transverse section includes adjacent frames and their end connections in way of transverse sections.
- 3 Spaces: are independent compartments including holds, tanks, cofferdams and void spaces bounding cargo holds, decks and the outer hull.
- 4 Representative spaces: are those which are expected to reflect the conditions of other spaces of similar type and service and with similar corrosion protection systems. When selecting representative spaces, account is to be taken of the service and repair history on board and identifiable critical and/or suspect areas.
- 5 Critical structural areas: are 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.
- 6 Suspect areas: are locations showing substantial corrosion and/or are considered by the surveyor to be prone to rapid wastage.
- 7 Extensive corrosion: is an extent of corrosion consisting of hard and/or loose scale, including pitting, over 70% or more of the area under consideration, accompanied by evidence of thickness diminution.
- 8 Substantial corrosion: is an extent of corrosion such that assessment of corrosion pattern indicates a wastage in excess of 75% of allowable margins, but within acceptable limits. For CSR ships, substantial corrosion is an extent of corrosion that assessment of corrosion pattern indicates a wastage between $t_{ren}+0.5$ mm and t_{ren} . The substantial corrosion of non-CSR ships and that of CSR ships are shown in the following Sketch Maps 1.1 and 1.2 respectively.



Sketch Map 1.1

Substantial corrosion—Common Structural Rules (CSR)
 Applicable to oil tankers and bulk carriers whose construction contracts are signed on or after 1 April 2006 and which are constructed according to CSR Rules.



Sketch Map 1.2

- 9 CSR ships: ships complying with the provisions of Common Structural Rules.
- 10 A prompt and thorough repair: is a permanent repair completed at the time of survey to the satisfaction of the surveyor, therein removing the need for the imposition of any associated condition of classification.
- 11 Wind and water strakes: are the two (2) strakes located in the vicinity of the load waterline. Due to vessel's trim, the strakes may vary over the length of the vessel.
- 12 An overall survey^①: is a survey intended to report on the overall condition of the hull

① Please pay attention to the examples of overall survey given in paragraph 2.2, part I. Thickness measurement procedures of Chapter Two of the Guidelines.

structure and determine the extent of additional close-up surveys.

13 A close-up survey: is a survey where the details of structural components are within the close visual inspection range of the surveyor, i.e. normally within reach of hand.

14 Special consideration or specially considered (in connection with close-up surveys and thickness measurements) means sufficient close-up inspection and thickness measurements are to be taken to confirm the actual average condition of the structure under the coating. Special consideration is to be approved by the surveyor and the content is to be indicated in the survey reports. In case the full-hard protective coating is in “good” condition, it needs to be clarified the scope of close-up survey and thickness measurement may be reduced with the agreement of the surveyor, but this survey requirement is not to be completely exempted.

15 Cargo length area is that part of the ship which includes all cargo holds and adjacent areas including fuel tanks, cofferdams, ballast tanks and void spaces.

16 Excessive corrosion is an extent of corrosion that exceeds the Allowable Corrosion in accordance with IACS RECOMMENDATION No. 77.

17 General corrosion appears as non-protective, friable rust of a uniform nature on uncoated surfaces. Rust scale continually breaks off, exposing fresh metal to corrosive attack. Visual judgment of thickness loss is difficult until serious wastage has occurred.

18 Renewal thickness (t_{ren}): is the minimum allowable thickness, in mm, below which renewal of structural members is to be carried out.

19 Pitting corrosion (known as “pit corrosion”): is defined as scattered corrosion spots/areas with local material reductions which are greater than the general corrosion in the surrounding area. Pitting intensity is shown in Figure 5.1.5.1(18), Section 1, Chapter 5, PART ONE of current ISC Rules.

20 Grooving corrosion: is typically local material loss adjacent to weld joints along abutting stiffeners and at stiffener or plate butts or seams. An example of groove corrosion is shown in Figure 5.1.5.1(20), Section 1, Chapter 5, PART ONE of current ISC Rules.

21 Edge corrosion: is defined as local corrosion at the free edges of plates, stiffeners, primary support members and around openings. An example of edge corrosion is shown in Figure 5.1.5.1(19), Section 1, Chapter 5, PART ONE of current ISC Rules.

22 Ships subject to ESP Surveys: are ships of bulk carriers, oil tankers (double hull), ore carriers, combination ships (ore/oil carriers, ore/bulk/oil carriers), self-unloading bulk carriers and chemical tankers having ESP notations.

23 Coating condition:

23.1 GOOD condition is a term used to describe only minor spot rusting.

23.2 FAIR condition is a term used to describe local breakdown at edges of stiffeners and weld connections and/or light rusting over 20% or more of areas under consideration, but less than as defined for POOR condition.

23.3 POOR condition is a term used to describe general breakdown of coating over 20% or more or hard scale at 10% or more of areas under consideration.

23.4 The coating assessment standards are elaborated in detail as follows:

	GOOD ③	FAIR	POOR
Breakdown of coating or area rusted ①	< 3%	3 ~ 20%	> 20%
Area of hard rust scale①	—	< 10%	≥10%
Local breakdown of coating or rust on edges or weld lines②	< 20%	20 ~ 50%	> 50%

- ①—% is the percentage of the area under consideration or of the "critical structural area";
- ②—% is the percentage of edges or weld lines in the area under consideration or of the "critical structural area";
- ③—spot rusting, i.e. rusting in spot without visible failure of coating.

For the area under consideration, please refer to MSC.1/Circ.1330/Rev.1 “Guidelines for Coating Maintenance & Repairs”

Critical structural areas are 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.



Coating Condition Sketch: GOOD



Coating Condition Sketch: GOOD



Coating condition changing from GOOD to FAIR but still remaining in GOOD



Coating Condition Sketch: FAIR



Coating Condition Sketch: FAIR



Coating condition changing from FAIR to POOR but still remaining in FAIR



Coating Condition Sketch: POOR



Coating Condition Sketch: POOR

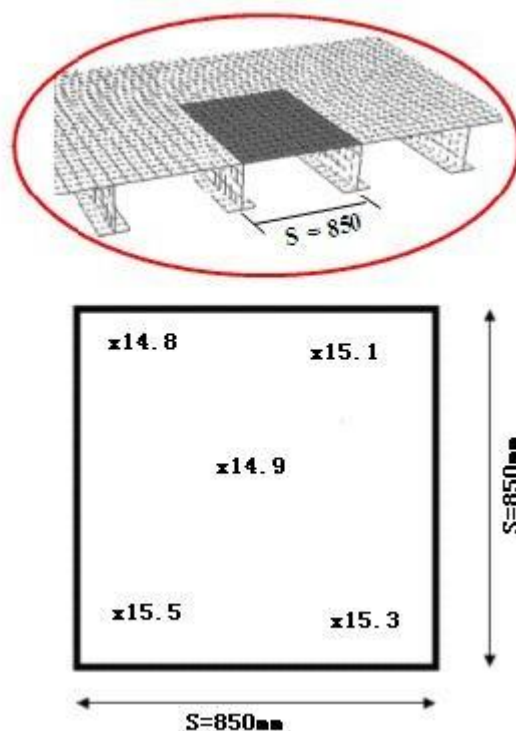


Coating condition changing from FAIR to POOR and already remaining in POOR

24 Cargo area (oil tankers) is that part of the ship that contains cargo tanks, slop tanks and cargo/ballast pump-rooms adjacent to cargo tanks, void spaces ,cofferdams, ballast tanks and also deck areas throughout the entire length and breadth of the part of the ship over the above mentioned spaces.

25 Single Point Measurement: means obtaining an average from multi-point measurements for the purpose of determining the thickness of the structural member.

Thickness measurement value on the thickness measurement report is to represent the condition of the measured area, normally recorded in the report in terms of single measurement value. If the single point thickness measurement value is not able to reflect the condition of the measured area, an average value is to be calculated by selecting more than one point for thickness measurement. The average value is to be applied to reflect the condition of measured area and is to be recorded in the thickness measurement report. Refer to the following Sketch Map 1.3:



Sketch Map 1.3

For example, for any panel structure, if framings are spaced 850 mm, the same space (850 mm) is to be taken in the direction of ship width or length, where several points to be measured are selected within the measured area (normally five points may be selected), therein, the value recorded in the thickness measurement report is an average of multi point measurements, i.e. $(14.8+15.1+14.9+15.5+15.3)/5=15.12$ mm.

For the reason of various structural arrangement patterns and corrosion conditions, it is hard to quantificationally determine how many thickness measurements may work out an average that is able to reflect or represent the condition of the measured area which is determined normally according to the structural arrangement patterns and corrosion conditions of the measured area appropriately.

Chapter Two Working Procedures of Thickness Measurements

I. General

This Chapter on working procedures of thickness measurements is developed in accordance with the relevant requirements of Section 1, Chapter 5, PART ONE of current ISC Rules as well as IACS PR19 (Procedural Requirement for Thickness Measurements) and IACS RECOMMENDATION No. 77 (Guidelines for the Surveyor on how to Control the Thickness Measurement Process). For specific provisions of IACS PR19 and IACS RECOMMENDATION No. 77, refer to Annex 1 of the Guidelines.

II. Procedures for thickness measurement

Upon receipt of application, the thickness measurement company is to learn requirements concerning the said thickness measurement from the site surveyor of ISC or customers according to working procedures of thickness measurements and to designate adequate qualified personnel to take charge of the implementation and monitoring of the thickness measurement according to various ship types, quantity and conditions of thickness measurement. According to the document "Technical Requirements for Ship Maintenance and Inspection Service Institutions" issued by the China Maritime Safety Administration, when carrying out thickness measurement work within the territory of the People's Republic of China, the thickness measurement company should assign at least one quality inspector (supervisor) and one operator. The site surveyor is responsible for confirming the qualification of the thickness measurement company and thickness measurement personnel.

The required thickness measurements, if not carried out by ISC surveyor, a necessary scope are to be witnessed by an attending surveyor of ISC, who is to record the monitoring process in the surveyor's progress report in order to ensure the accuracy of thickness measurement results.

1 Survey planning meeting

When thickness measurement (It should be noted that the thickness measurement of the component in the area where the close-up inspection is required should be carried out simultaneously with the close-up inspection) is required during intermediate and special surveys implemented according to rules (including each part during the step-by-step implementation), the thickness measurement company is to contact ISC surveyors implementing surveys timely, and a survey planning meeting is to be held between the site surveyor(s), the owner's representative in attendance, the master of the ship (an appropriately qualified representative appointed by the master or Company) and the thickness measurement company representative so as to ensure the safe and efficient conduct of the survey work to be carried out. The following contents are to be definitely addressed in the meeting:

- 1.1 schedule of the vessel (i.e. the voyage, docking and undocking manoeuvres, periods alongside, cargo and ballast operation plans, etc.);
- 1.2 provisions and arrangements for thickness measurements (i.e. personal safety, access, cleaning, de-scaling, illumination, ventilation,);
- 1.3 extent of the thickness measurements (i.e. initial extent of the thickness measurements determined in accordance with ISC Rules and previous substantial corrosion areas);

- 1.4 plans related to thickness measurements kept onboard ship and the previous thickness measurement report is available. ;
- 1.5 allowable corrosion criteria;
- 1.6 extent of close-up survey and thickness measurement considering the coating condition and suspect areas/areas of substantial corrosion;
- 1.7 execution of thickness measurements;
- 1.8 taking representative readings in general and where uneven corrosion/pitting is found;
- 1.9 additional thickness measurement procedures for areas of substantial corrosion;
- 1.10 communication methods between the surveyors, the owner's representative and the thickness measurement personnel;
 - 1.10.1 the thickness measurement personnel is to periodically report the thickness measurements to the surveyor;
 - 1.10.2 the thickness measurement personnel is to inform the surveyor promptly when any of the following situation is found:
 - (1) excessive and/or extensive corrosion or substantial corrosion or pitting/grooving of any significance;
 - (2) structural defects like buckling, fractures and deformed structures;
 - (3) detached and/or holed structure
 - (4) corrosion of welds.
- 1.11 the thickness measurement company is to provide the thickness measurement instrument intended to be used and also the relevant information records about thickness measurement personnel;

If the thickness measurements of step-by-step survey are completed at different stages and/or conducted by different companies, separate survey planning meeting is to be held prior to each thickness measurement. Any thickness measurement carried out before the survey planning meeting will not be admitted by ISC.

After the survey planning meeting, a meeting minutes is to be completed and signed and confirmed by the site surveyor, the owner's representative, the master of the ship (an appropriately qualified representative appointed by the master or Company) and the thickness measurement company representative. For any extending, reduction or exemption of thickness measurement, an additional survey planning meeting record is to be completed. The templates of minutes and additional records of survey planning meeting are provided by site surveyors of ISC.

2 Surveyor monitoring for thickness measurement on site

- 2.1 Prior to thickness measurement, the surveyor is to:
 - 2.1.1 examine the certificate of thickness measurement company approved or accepted by ISC and personnel qualification certificates(UT Level Certification Certificate), and confirm the validity;
 - 2.1.2 confirm the thickness measurement personnel are acquainted with the extent of thickness measurement and relevant requirements and their skills and techniques are satisfactory;
 - 2.1.3 examine the types of the instruments to confirm that the concerned instruments have been calibrated by national legal or metrological authorized metrological technical institutions in accordance with the approved National/International Standards and their accuracy meets the requirements. The instruments should have appropriate qualification labels or calibration certification documents;

2.1.4 verify that the accuracy of the instruments meet the requirements;

2.1.5 ensure that the thickness measurement operator will be using oscilloscope or multi-pulse echo technique instruments. Single pulse echo instruments may be used on uncoated surfaces, which have been properly cleaned.

2.2 The surveyor is to decide final extent and location of thickness measurements after overall survey of representative spaces onboard. In case the owner prefers to commence the thickness measurements prior to the overall survey then the surveyor is to advise that the scope and location of the planned thickness measurement will be confirmed during the overall survey. Based on results of overall survey, the surveyor may require that additional thickness measurements have to be taken.

During the overall survey of representative spaces on board carried out by the site surveyor, if the survey results cannot be used as the sufficient basis for judging the structural condition of such spaces, additional close-up survey and thickness measurement must be carried out in accordance with the results of overall survey. Overall survey is a survey intended to report on the overall condition of the hull structure and determine the extent of additional close-up surveys, the purpose of which is to identify substantial corrosion of structure, major deformation, cracks or other structural defects, in order to confirm the effectiveness and integrity of hull structures. For example, when the surveyor decides to carry out the close-up survey and related thickness measurements on one side of the transverse bulkhead in cargo hold; the side is to be chosen based on the outcome of the overall survey of both sides. In the event of doubt, the Surveyor may also require (possibly partial) close-up survey and thickness measurement (where necessary) on the other side.

When conducting the overall survey specified in Chapter 5, PART ONE of current ISC Rules and the Guidelines, attention is to be given to the above example explaining the relationship between overall survey and close-up survey and thickness measurement, in order to facilitate correct understanding and implementation during survey.

2.3 The surveyor is to direct the gauging operation by selecting locations such that readings taken represent, on average, the condition of the structure for that area.

The type of hull structural corrosion is mainly divided into general corrosion and local corrosion, while the latter is generally further divided into pitting corrosion, edge corrosion and grooving corrosion. Generally speaking, the value of a single thickness measurement point cannot reflect the corrosion extent and an average value is to be calculated by selecting more than one point for thickness measurement (i.e. single point measurement) in order to reflect the average corrosion condition of measured area. If the measurement value is close to substantial corrosion or corrosion criteria, the surveyor is to carry out close-up survey and increase the number of thickness measurement points for the area selected for thickness measurement, in order to evaluate the average corrosion condition of structural members in the surrounding area and confirm the structural integrity.

2.4 Thickness measurements mainly to evaluate the extent of corrosion, which may affect the hull girder strength, should be carried out in a systematic manner of all longitudinal structural members that are required to be gauged by the Society's relevant rules.

2.5 Where thickness measurements indicate substantial corrosion or excessive diminution the surveyor is to direct locations for additional thickness measurements in order to delineate areas of substantial corrosion and to identify structural members for repairs / renewals.

2.6 Thickness measurements of structures in areas where close-up surveys are required are to be carried out simultaneously with close-up surveys so as to have the thickness measurement monitored by the surveyor while to make the surveyor's close-up survey more effectively.

2.7 For specific requirements for monitoring during thickness measurement process carried out by the surveyor, details are given in provisions for hull thickness measurement in ISC Instructions to Surveyors.

2.8 During thickness measurement for the ship, the thickness measurement company is to compare the ship's previous thickness measurement report with the data of this time. If large deviation is found from the comparison, the thickness measurement company is to timely inform the surveyor who will check the condition and report to ISC Headquarters as necessary. ISC Headquarters will review the site comments and inform the opinions to survey unit.

2.9 For areas in tanks where hard protective coatings are found to be in a GOOD condition, the extent of thickness measurement may be specially considered by the surveyor.

3 Review and verification by the surveyor

3.1 The surveyor is to carry out the review after the completion of thickness measurement to ensure that the position and extent of the concerned thickness measurement meet the requirements.

3.2 In some cases, when IACS Unified Requirements allow special considerations, the extent of thickness measurement may be appropriately reduced provided such special considerations of the surveyor are to be recorded in the additional record of survey planning meeting.

3.3 If only part of the thickness measurement is carried out, the remaining or completed items of thickness measurement are to be addressed in detail in survey report issued by the surveyor and an internal memo is to be given so as to make the subsequent surveyor clearly acquainted with the extent of thickness measurement remained to be implemented.

3.4 The surveyor is to confirm that appropriate format of thickness measurement report has been used.

3.5 Upon completion of the thickness measurements onboard, the surveyor is to verify and keep a copy of the preliminary thickness measurement report signed by the operator.

3.6 Upon review that the final gauging report is consistent with the preliminary report, the Surveyor is to countersign the cover page of the final report. The Surveyor is to keep the preliminary report, as a minimum, until the review of the final report is completed.

4 The thickness measurement personnel gets appropriate instrument and equipment, prepares corresponding plans and information, and carries out the thickness measurement according to working procedures of thickness measurements.

4.1 The receiving of instrument is to be appropriately recorded (e.g.: date of receiving, model of equipment, receiver, etc.). To select instrument according to ship condition and calibrate it to the satisfaction, ensure the sufficient power supply and couplant complying with the requirements.

4.2 The accuracy of instrument is to comply with the following standards or to meet the provisions of instrument instruction manual.

thickness of plating < 10 mm accuracy \pm 0.1 mm

thickness of plating \geq 10 mm accuracy \pm 0.2 mm

4.3 Other auxiliary equipment such as explosion relief torch and descaling hammer is provided in place.

4.4 Prepare recording chart drafted with sketches according to the planned extent of thickness measurement and relevant drawings. Thickness measurement personnel is to take the priority to

use a miniature copy of the related ship drawing as the recording chart, e.g. shell expansion plan, primary structure plan, transverse section plan and transverse bulkhead plan, etc. For the structural members to be thickness measured inconvenient to be recorded by relevant ship drawings such as frames of cargo holds, transverse web of ballast tanks, the thickness measurement personnel is allowed to draw thickness sketches by themselves provided that the sketches are to provide the ship's names, the names and positions of structural members, original thickness and relative positions of the structural members, etc. All of the information is subject to adequate verification and approval of the site surveyor.

5 The thickness measurement company is to include Checklist of Corresponding Records in the procedural documentations for the purpose of recording all the participants involved in the service process, adopted instruments, extent of measurement, access, measurement results, etc. to facilitate the monitoring by ISC.

III. Safety protection of thickness measurement on site

- 1 From the beginning to the end of thickness measurement, the personnel must be provided with and wear all the necessary safety outfits.
- 2 During the work, the thickness measurement personnel is to constantly notice the safety of working environment, including ascending, high tossing, entry of restricted areas, etc.
- 3 If thickness measurement personnel have doubt about safety, they are to stop the operation immediately and resume the work until hazardous factors are eliminated.
- 4 For guidelines about safe operation, refer to relevant requirements in current ISC Guidelines for Clients for Safety of Survey.

IV. Thickness measurement on site

- 1 The thickness measurement personnel is to check whether the dimensions and arrangements of structural members are consistent with drawings. Identification is to be made for any incompliance and sketch is to be drawn based on practical situation. Record the data of thickness measurement on the sketch or table and notify the surveyor promptly. The identification for structural members is requested to be clear and in detail.
- 2 When there are coverings, accumulated water, dirt, residual oil and widespread hard rust scale in the thickness measurement area that may affect the thickness measurement results, it should be cleaned before thickness measurement.
- 3 If the coating condition is good, a thickness measurement instrument featured by Multi-pulse echo technique is to be used to reduce as far as practical damage to coating. If the coating condition is poor, appropriate descaling measures are to be taken.
- 4 During thickness measurement, when finding that the actual thickness of measured structural members are in excess of the original thickness indicated in the drawing or the extent of corrosion is in excess of stipulated standards or the thickness measurement results reveals substantial corrosion, the thickness measurement personnel is to further verify the accuracy of the data, to determine the extent of substantial corrosion areas and make records in sketch drawings and also to inform the surveyor who is undertaking the work. The thickness measurement personnel should also promptly notify the responsible surveyor upon discovering other circumstances mentioned in Paragraph 1.10.2 of this chapter.

5 The thickness measurement personnel is to identify the measured positions located in suspect areas or other areas deemed necessary by the surveyor with easily identifiable marks if requested by the surveyor so as to trace the thickness measurement results.

6 The thickness measurement personnel is to submit the preliminary thickness measurement reports signed by him/her to the surveyor and ship owner on the same day or next day. The surveyor is to review, sign and confirm each page of the preliminary thickness measurement reports. Where the surveyor has any doubt as to the accuracy of thickness measurement result, or such result approaches or reaches substantial corrosion or approaches corrosion criteria, the ship owner is to be notified promptly to extend the thickness measurement to determine the final average condition of structures of the suspect area so as to take appropriate measures for the ship.

V. Preparation, audit and print of thickness measurement reports

1 Before preparing thickness measurement reports, the thickness measurement personnel is to sort out all the preliminary thickness measurement reports signed by the surveyor on each page, including drawings, to fill in data of thickness measurement report (including original data, thickness measurement data) so as to form a complete preliminary thickness measurement records.

2 After being reviewed by the designated personnel (supervisors), the thickness measurement report shall be prepared based on the preliminary thickness measurement records. Under normal circumstances, the thickness measurement report shall be prepared in the format specified in Appendix 13 "Recommended Procedures for Thickness Measurement" of Chapter 5 in Part 1 of the current regulations of the ISC, and the "Hull Structure Thickness Measurement Management System" (METE-TM SYSTEM) developed by ISC shall be adopted. .

3 In principle, the thickness measurement company is to submit the final report (electronic version) to the surveyor for audit before the completion of ship survey by the site surveyor, however, with the consent of the site surveyor, the report may be submitted within five working days after the completion date of survey. Upon re-examination that the final thickness measurement report is consistent with the preliminary one, the surveyor only signs on the basic information page, which is affixed with the certificate business stamp of survey unit for confirmation.

Under normal circumstances, the thickness measurement company submits the thickness measurement report signed and sealed by the thickness measuring company in PDF format and the database tmc file of the "Hull Structure Thickness Measurement Management System" through the ISC customer service system. The responsible surveyor will electronically sign and stamp the thickness measurement report in PDF format after satisfactorily verified the thickness measurement report. The thickness measuring company may also provide a paper thickness measuring report. In this case, the thickness measuring report in PDF format signed by the surveyor and/or the database tmc file of the "Hull Structure Thickness Management System" should also be provided..

4 The thickness measurement company is to pass the final thickness measurement report signed by the surveyor to the ship owner for retention.

5 The thickness measurement company is to keep a copy of the thickness measurement report and the preliminary thickness measurement report signed by the surveyor on each page and record/additional record of survey planning meeting.

Note: In application of the electronic format provided by ISC, appropriate modification of formula is to be made according to different corrosion and wastage standards so as to avoid the errors.

VI. Final thickness measurement report

1 The thickness measurement report is to follow the principles of Appendix 13 Recommended Procedures for Thickness Measurement, Chapter 5, PART ONE of current ISC Rules, attached with the copies of thickness measurement company approval certificate, thickness measurement personnel qualification certificate and thickness measurement equipment qualification certificate. However, when using a paper thickness report, the thickness measuring company shall submit at least four final thickness measuring reports (i.e., one for each of the ship, the ship company, the survey unit and the thickness measuring company) to the surveyor for verification.

2 The diagrams contained in the thickness measurement report are to be consistent with the ship's drawings. The measured positions are to be numbered to have the codes in the diagram corresponding to those in the report so as to facilitate identification on real ship.

3 The additional measurement points for substantial corrosion areas are to be separately listed in the thickness measurement report. Draw the thickness measurement plans according to the plans onboard ship as accurately as possible, particularly marking the measurement points and the extent of substantial corrosion area. The longitudinal and transverse positions of the substantial corrosion areas are to be indicated in the drawing. In the thickness measurement report, each thickness measurement point (i.e. the points marked with "S" in the thickness measurement report) of the substantial corrosion area appearing in the normal extent of thickness measurement is to be attached with additional measurement data corresponding to such area in the thickness measurement report, unless such area has been renewed. In the final thickness measurement report, measurement points of substantial corrosion are marked with "S", and structural members whose corrosion exceeds standards and which have been renewed are marked with "R" (e.g., where EXCEL thickness measurement report template is used) or "N" (e.g., where ISC "Hull Structure Thickness Measurement Management System" is used).

4 For structural members which are renewed because corrosion has exceeded standards or due to other reason (e.g. structural members in substantial corrosion area), "R" or "N" and thickness value of renewed structural member are to be indicated in the thickness measurement report, which is to also indicate the position and area of the renewed structural members in the form of diagram. Also the report is to indicate the substantial corrosion area in the form of additional diagram in the thickness measurement report; for cutting and renewal of structural members for the reasons other than corrosion, diagrams for identification may not be requested in thickness measurement report.

Chapter Three Renewal Criteria for Hull Structure

I. Criteria for longitudinal strength

1 Refer to relevant provisions in paragraph 1, Appendix 1, Chapter 5, PART ONE of current ISC Rules.

II. Criteria for local strength

1 Refer to relevant provisions in paragraph 2, Appendix 1, Chapter 5, PART ONE of current ISC Rules.

For ships with 2 ship type notations, the standards of corrosion and wastage of hull structural members are to be controlled in accordance with high corrosion standards.

2 Considering no specific and clear corrosion limit is defined in the current ISC Rules for interior members of peak ballast tanks, in order to unify standards and avoid the application of different standards for corrosion limit due to understanding discrepancy, the Guidelines offer the clarifications of the corrosion standard for above-mentioned structural members. See Table 3.1 for more details.

Standards of corrosion and wastage of additional structural members

Table 3.1

Structural member	Minimum renewed thickness	
	$L \geq 90$ m	$L < 90$ m
Structural members in fore peak ballast tanks and aft peak ballast tanks	75%	70%

3 Regulations on the net thickness/corrosion allowance of bulk carriers contracted for construction on or after 1 July 1998 during in-service survey. In accordance with relevant provisions of Sections 9 and 11, Chapter 8, PART TWO of current ISC Rules, If the as-built drawings do not indicate the net thickness values, the net thickness values of cargo hold corrugated transverse watertight bulkheads, cargo hold hatch covers and hatch coamings are to be determined by the as-built thickness minus the corrosion addition of corresponding structural members respectively, which is shown as below:

3.1 URS18: this requirement is applicable to bulk carriers of 150 m in length and above (excluding double skin bulk carriers not required by URS18.1) contracted for construction on or after 1 July 1998, which is with single deck, topside tanks and hopper tanks, intending to carry solid bulk cargoes having a density of 1.0 t/m³, or above, with vertical corrugated transverse watertight bulkheads. The net thickness value of corrugated watertight transverse bulkhead plating and structural members which are applicable to this requirement can be calculated by as-built thickness minus corresponding corrosion addition, and the corrosion addition is taken as 3.5 mm. When the actually gauged thickness of the watertight corrugated bulkhead is less than $t_{net}+0.5$ mm, the renewal measure are to be taken and the renewal thickness is taken as as-built thickness; when the actually gauged thickness of the watertight corrugate bulkhead is within the range between $t_{net}+0.5$ mm and $t_{net}+1.0$ mm, the corrugated bulkhead can be coated according to the requirements

of coating manufacturer or annually gauged as an alternative to renewal.

3.2 URS21: this requirement applies to all bulk carriers, ore carriers and combination carriers, and are for all cargo hatch covers and hatch forward and side coamings on expose decks in position 1 as defined in International Convention on Load Lines, 1966.

For bulk carriers contracted for construction on or after 1 July 1998, the net thickness value of hatch cover plating is to satisfy IACS URS21.

For bulk carriers contracted for construction on or after 1 July 1998 and before 1 January 2004, the renewal thickness of cargo hold hatch coaming is still controlled in accordance with 75% (for $L \geq 90$ m) or 70% (for $L < 90$ m).

For bulk carriers, ore carriers and combination carriers contracted for construction on or after 1 January 2004, the evaluation criteria for strength of structural members of hatch coamings is to satisfy IACS URS21.6.2 (Note: the requirement for evaluation criteria for net thickness of structural members of hatch coamings on applicable bulk carriers, ore carriers and combination carriers was firstly introduced in IACS URS21(Rev.3)).

The net thickness values of hatch covers and coaming stated in this requirement can be calculated by the as-built thickness minus corresponding corrosion addition t_s , specific value t_s is shown as below:

1) Hatch cover

For all structures (plating and secondary stiffeners) of single skin hatch cover, the corrosion addition t_s is to be 2.0 mm.

For double skin hatch cover, the corrosion addition is to be:

- 2.0 mm, for roof and base plate;
- 1.5 mm, for internal structures.

For the plating of double skin hatch cover and for plating and stiffeners of single skin hatch cover, if the actually gauged thickness is less than $t_{net} + 0.5$ mm, the renewal measures are to be taken, the renewal thickness is the as-built thickness; as the actually gauged thickness is within the range between $t_{net} + 0.5$ mm and $t_{net} + 1.0$ mm, the coating applied in accordance with the requirements of coating manufacture or annual gauging could be adopted as an alternative to renewal, the coating is to be maintained under “good” condition as defined in UR Z10.2.1.2.

For the internal structure of double skin hatch covers, thickness gauging is required when plating renewal is to be carried out or when this is deemed necessary, at the discretion of the surveyor, on the basis of the plating corrosion or deformation condition. If the gauged thickness is less than t_{net} value, the internal structure is to be renewed, and the renewal thickness is the as-built thickness.

2) Hatch coaming (only applicable to bulk carriers, ore carriers and combination carriers contracted for construction on or after 1 January 2004)

The corrosion addition of the structure of hatch coaming and coaming stays is to be 1.5 mm.

When the actually gauged thickness is less than $t_{\text{net}}+0.5$ mm, the renewal measures are to be taken, when the actually gauged thickness is within the range between $t_{\text{net}}+0.5$ mm and $t_{\text{net}}+1.0$ mm, the coating applied in accordance with the requirements of coating manufacture or annual gauging could be adopted as an alternative to renewal, the coating is to be maintained under “good” condition as defined in UR Z10.2.1.2.

The above measures are adopted to determine net thickness value and corrosion addition. The corrosion criteria are to be put forward during survey planning meeting (if any). If any objection is raised by the ship owner, the evaluation information related to URS 18 and 21 may be submitted to ISC plan approval center by the ship owner. The net thickness value of relevant structural members is determined upon review by plan approval center. The survey unit will evaluate the condition of thickness measurement during survey based on the evaluation information. The net thickness value table of relevant evaluation information is to be uploaded to SSMIS, in which a memo is given: The implementation for compliance with the requirements of IACS URS18,21 were completed with satisfaction and for more details, refer to survey report No.xxx(Form RA).

4 For the steel weathertight hatch covers of cargo holds on all weather decks of ships (except bulk carriers, ore carriers and combination carriers) that signed construction contracts on or after July 1, 2012 and meet the requirements of Section 20, Chapter 2, Part 2 of the current Steel Rules of ISC, Steel renewal is required where the gauged thickness is less than $t_{\text{net}} + 0.5$ mm for single skin hatch covers, double skin hatch covers, hatch coamings, hatch coaming stiffeners and stiffening members. Coating or annual gauging may be used for substitution of renewal when gauged thickness is between t_{net} and $t_{\text{net}} + 0.5$ mm. For internal structure of double skin hatch covers, thickness gauging is required when hatch cover top or bottom plating renewal is to be carried out or when it is deemed necessary by ISC surveyor, on the basis of the plating corrosion or deformation. In these cases, steel renewal for the internal structures is to be required where the gauged thickness is less than t_{net} . For corrosion addition $t_S = 1.0$ mm, the thickness for steel renewal is t_{net} and coating or annual gauging may be used for substitution of renewal when gauged thickness is between t_{net} and $t_{\text{net}} + 0.5$ mm.

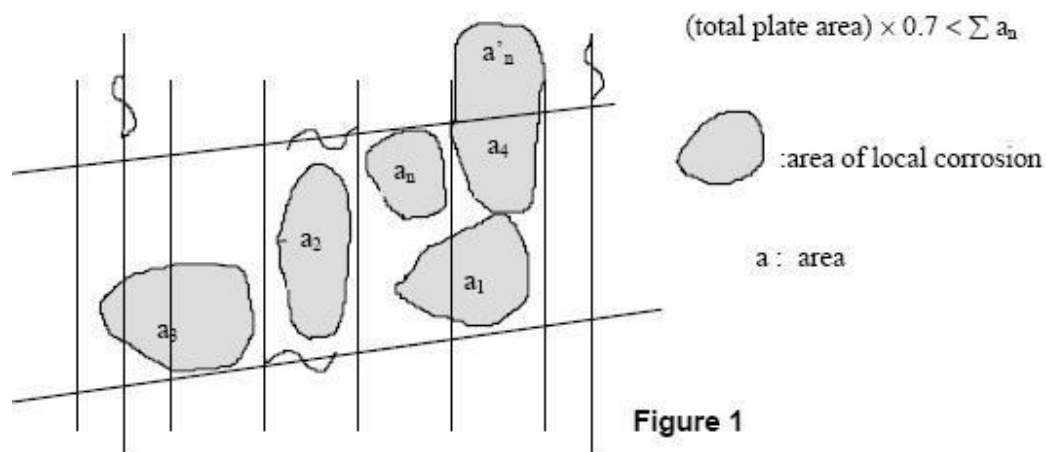
5 At initial classification survey of ships not constructed in accordance with ISC Rules or survey of ships subject to major conversion, the local strength standards for hull structures (i.e. structural corrosion standards) will be provided by ISC Headquarters.

6 Clarification of general corrosion of plating

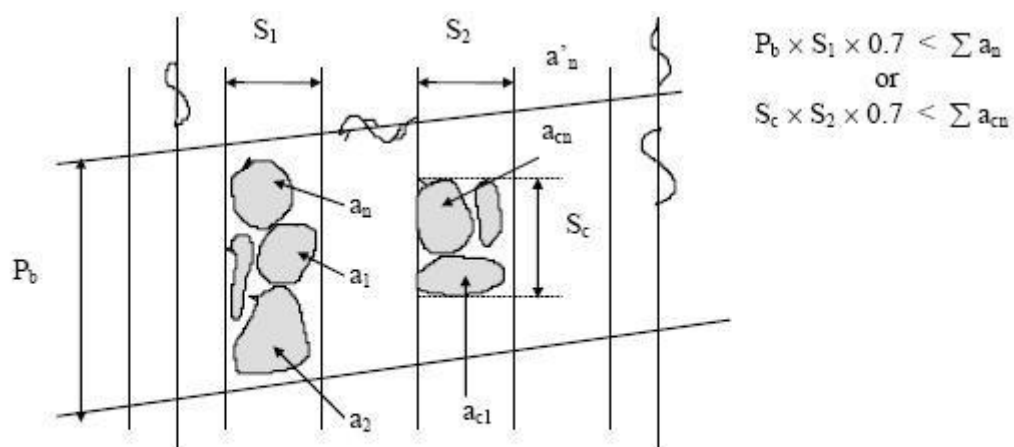
The corrosion conditions of the following structural members are to be regarded as general corrosion:

- 1) corrosion extending and expanding to whole frame;
- 2) corrosion extending and expanding to whole width of the plating (frame, floor and beam);
- 3) the extent of pitting and local corrosion exceeding 70% of the area of the nominating plate.

Refer to the following Figure 1, 2 for detail:



The whole plate is regarded as general corrosion.



Part of plate is regarded as general corrosion.

7 Uneven corrosion(non-CSR ships)

7.1 Pitting corrosion

Technical requirements for pitting corrosion of ships are based on two major ship types, i.e. tanker and bulk carrier, taking into account factors such as structural type, loaded cargo and tank washing. For other ship types, reference may be made to the criteria for bulk carrier based on factors such as structural type and characteristics of pitting corrosion.

7.1.1 Allowable corrosion limit of pitting corrosion of oil tankers

Maximum allowable corrosion limit of pitting corrosion of non-CSR oil tankers

1) Cargo tank structure

The reference area of pitting intensity is a single plate panel area. Pitting intensity diagram is given in Figure 5.1.5.1(18), Section 1, Chapter 5, PART ONE of current ISC Rules.

7.1.1.1 For structural members with general corrosion limit equal to 20%, the general corrosion criteria are to be used with pitting intensity not less than 20% and the minimum acceptable remaining thickness is 70% of as-built thickness with pitting intensity less than 20% and the remaining thickness of any point is not to be less than 6 mm.

7.1.1.2 For structural members with general corrosion limit equal to 25%, the general corrosion criteria are to be used with pitting intensity not less than 20% and the minimum acceptable remaining thickness is 65% of as-built thickness with pitting intensity less than 20% and the remaining thickness of any point is not to be less than 6 mm.

7.1.1.3 Allowable corrosion limit of pitting corrosion of oil tankers using special corrosion standards (other than 20% or 25%)

(1) For structural members with general corrosion limit less than 25%, the general corrosion criteria are to be used with pitting intensity not less than 20% and the minimum acceptable remaining thickness is 70% of as-built thickness with pitting intensity less than 20% and the remaining thickness of any point is not to be less than 6 mm.

(2) For structural members with general corrosion limit not less than 25%, the general corrosion criteria are to be used with pitting intensity not less than 20% and the minimum acceptable remaining thickness is 65% of as-built thickness with pitting intensity less than 20% and the remaining thickness of any point is not to be less than 6 mm.

2) Structures other than the cargo tank

Reference is made to pitting corrosion criteria for cargo tank.

7.1.2 Allowable corrosion limit of pitting corrosion of bulk carriers

Maximum allowable corrosion limit of pitting corrosion of non-CSR bulk carriers

1) Side structures complying with the requirements of URS31

For thickness measurement requirements with regard to side frames and brackets of single side skin bulk carriers complying with the requirements of URS31, refer to relevant provisions of Appendix 6, Chapter 5, PART ONE of the current ISC Rules.

If pitting intensity is higher than 15% in an area (A, B, C, D), then thickness measurements are to be taken to check the extent of the pitting corrosion. The 15% is based upon pitting or grooving on only one side of the web.

In cases pitting intensity is higher than 15%, then an area of 300 mm diameter or more (or, where this is impracticable on the frame flange or the side shell, hopper tank plating or topside tank plating attached to the side frame, an equivalent rectangular area), at the most pitted part, is to be cleaned to bare metal, and the thickness measured in way of the five deepest pits within the cleaned area. The least thickness measured in way of any of these pits is to be taken as the thickness to be recorded. The minimum acceptable remaining thickness in any pit is equal to:

- 75% of the as-built thickness, for pitting in the cargo hold frame brackets webs and flanges;
- 70% of the as-built thickness, for pitting in the side shell, hopper tank and topside tank plating attached to the cargo hold side frame, over a width up to 30 mm from each side of it.

2) Structures other than 1) above

For other structures, reference is made to 1) corrosion criteria for side structures above.

In case of pitting corrosion measurement, separate diagrams of pitting corrosion are to be drawn, indicating the least remaining thickness measured, influenced areas, percentage of pitting corrosion at the influenced areas and average depth of pitting corrosion. The surveyor will determine whether to cut and renew the pitting corrosion area in view of the actual situation.

Pitting corrosion often occurs to the areas:

- Wind and water strakes;
- The bottom plating below the trumpet suction of ballast and cargo tank pipes;
- The inner bottom plating below the washing machine in the cargo oil tank of the crude oil cargo tank.

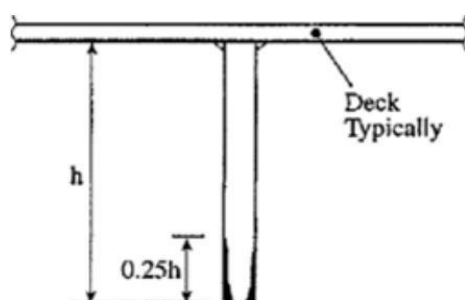
7.2 Edge corrosion

- 1) Fractured edge or flat bar longitudinal:

Height of edge corrosion part is less than 25% of height of web plate of longitudinal;

Edge thickness is not less than $\frac{2}{3}$ $T_{as-built}$;

Average thickness of longitudinal is not less than the uniform corrosion limit.



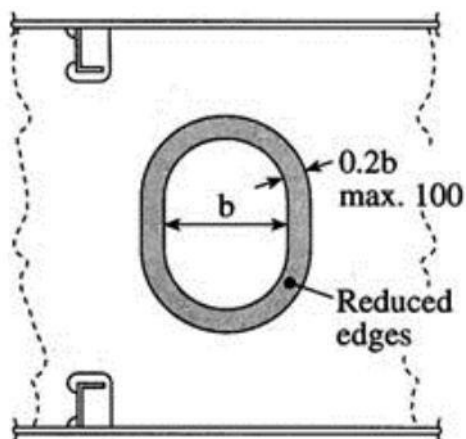
Longitudinal edge corrosion

- 2) Manhole, lightening hole

Limit of edge corrosion of web plate at opening of manhole, lightening hole is:

Edge thickness is not less than $\frac{1}{3}$ $T_{as-built}$, and is uniform; the maximum scope of corroded edge is to not be larger than 20% of the minimum size of opening, and not larger than 100mm.

so long as the biggest increasing of opening size does not exceed 10% of its area, the edge of corrosion area of the opening can be cropped and repaired.



Manhole, lightening edge corrosion

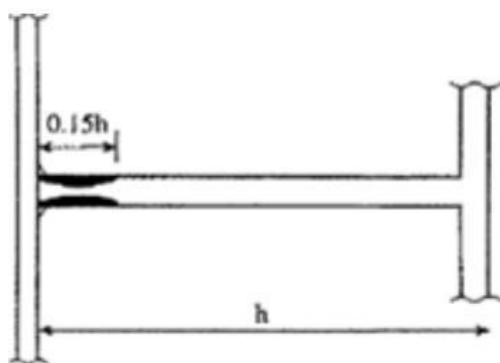
7.3 Grooving corrosion

Grooving corrosion commonly appears at surrounding of weld seam, If meet following conditions:

- (1) Groove and edge are smooth and have no sharp concave-convex;
- (2) Weld seam is complete, and thickness of surplus welding throat is acceptable;

Then:

- 1) Minimum allowable thickness of web and face plate after grooving corrosion is as follows:
If width of groove does not exceed 15% of height of web plate and not exceed 30mm, the minimum allowable thickness in groove area: $t_{min} = 0.75 \cdot T_{as-built}$ but not less than 6.00mm.



Grooving corrosion

- 2) Corroded weld seam on shell plate

Minimum thickness of weld seam or plate: $t_{min} = 0.7 \cdot T_{as-built}$, when the breath of the groove corrosion adjacent to the framing knuckle weld was not more than 30mm.

In case of grooving corrosion measurement, separate diagrams of pitting corrosion are to be drawn, indicating the least remaining thickness measured, influenced areas, percentage of grooving corrosion at the influenced areas and the length of grooving corrosion.

The position of the grooving corrosion was normally located at:

- (1) The location near the knuckle weld between the frame of the cargo hold and the hull plate of the dry cargo ship;
- (2) The location at the heel of the vertical and horizontal bulkhead of the cargo hold the dry cargo ship;
- (3) The location at the heel of the longitudinal in the Wing Ballast Tank.

III. Acceptance criteria for strength of CSR ships

1 General

1.1 For CSR ships, the Acceptance Criteria is according to ISC Common Structural Rules and as specified in 2-4 hereunder.

2 Acceptance criteria for pitting corrosion of CSR ships

2.1 Side structures of bulk carriers

Refer to the provisions of 5.1.17(2)①, Section 1, Chapter 5, PART ONE of current ISC Rules.

2.2 Other structures

Refer to the provisions of 5.1.17(2)②, Section 1, Chapter 5, PART ONE of current ISC Rules.

3 Acceptance criteria for edge corrosion of CSR ships

Refer to the provisions of 5.1.17(3), Section 1, Chapter 5, PART ONE of current ISC Rules.

4 Acceptance criteria for grooving corrosion of CSR ships

Refer to the provisions of 5.1.17(4), Section 1, Chapter 5, PART ONE of current ISC Rules.

Chapter Four Requirements for Thickness Measurements of Hull of All Ships

I. General provisions

This Chapter applies to all ships, and the hull thickness measurements for general dry cargo ships, oil tankers (including double hull oil tankers), bulk carriers (including double skin bulk carriers), chemical tankers and liquefied gas carriers are also to comply with relevant provisions given in Chapters Five, Six, Seven, Eight and Nine respectively.

1 Requirements and position of thickness measurement

1.1 Requirements for thickness measurement at annual and intermediate surveys are mainly based on conditions (e.g. extensive corrosion or suspect area) identified during survey and suspect area or substantial corrosion area determined at previous special and intermediate surveys.

1.2 Requirements for thickness measurement at special survey are based on relevant contents in Chapter 5, PART ONE of current ISC Rules. The extent of thickness measurement is determined in accordance with factors such as ship type, age and size.

1.3 With regard to thickness measurements taken at special survey of ESP ships and intermediate survey of ESP ships of 10 years of age and above, the extent of thickness measurement is determined in accordance with developed enhanced survey programme.

1.4 During on-site survey process, the surveyor may require additional thickness measurements to be taken in case of any doubt as to the structural condition.

1.5 The surveyor is to determine the specific position for thickness measurement of transverse section. For specific requirement, refer to part IV, Chapter Ten of the Guidelines.

2 Revision of minimum requirements for thickness measurement

2.1 For cargo holds and tanks where hard protective coatings are in a GOOD condition, the extent of close-up survey and thickness measurement may be specially considered by the surveyor. For spaces other than cargo holds and tanks where hard protective coatings are in a GOOD condition, the extent of close-up survey may be specially considered by the surveyor. For specific provisions, refer to relevant chapters of the Guidelines.

2.2 For internal structural members where hard protective coatings are in a GOOD condition, the extent of thickness measurement may be specially considered by the surveyor.

2.3 For general dry cargo ships, where the protective coating in spaces is found in a GOOD condition, the extent of close-up surveys according to Table 5.5.4.4(2), Section 5, Chapter 5, PART ONE of the current ISC Rules and the extent of thickness measurements according to Table 5.5.4.5(1), Section 5, Chapter 5, PART ONE of the current ISC Rules may be specially considered.

2.4 For oil tankers, for areas in tanks where hard protective coatings are found to be in a GOOD condition as defined in 5.1.5.1(15), Chapter 5, PART ONE of current ISC Rules, the extent of close-up surveys according to Table 5.6.4.3(2)① or ② and thickness measurement according to Table 5.6.4.4(1)① or ② of Section 6 of Chapter 5 may be specially considered.

2.5 For bulk carriers, for cargo holds where hard protective coatings are found to be in a GOOD condition as confirmed by the surveyor during survey, the extent of close-up survey and thickness measurement may be specially considered. For tanks where hard protective coatings are found to be in a GOOD condition as confirmed by the surveyor during survey, the extent of thickness measurement according to Table 5.7.4.5(1)① and 5.7.4.5(1)② of Section 7 of Chapter 5 of PART ONE of current ISC Rules may be specially considered.

For spaces where hard protective coatings are found to be in a GOOD condition as confirmed by the surveyor during survey, the extent of close-up survey according to Tables 5.7.4.4(1) ② , 5.7.4.4(2)② and 5.7.4.4(2)③ may be specially considered.

Representative thickness measurement to determine both general and local levels of corrosion in the shell frames and their end attachments in all cargo holds and in water ballast tanks (for double skin bulk carriers, in the transverse web frames in all water ballast tanks) is to be carried out. Thickness measurement is also to be carried out to determine the corrosion levels on the transverse bulkhead plating. The extent of thickness measurements may be specially considered provided the Surveyor is satisfied by the close-up survey, that there is no structural diminution, and the hard protective coating where applied remains efficient.

At intermediate surveys of bulk carriers, the extent of thickness measurement in accordance with 5.7.3.2 ③ a(a), Section 7, Chapter 5, PART ONE of current ISC Rules may be specially considered provided the Surveyor is satisfied by the close-up survey that there is no structural diminution and the hard protective coatings are found to be in a GOOD condition.

At intermediate surveys of double skin bulk carriers, the extent of thickness measurement in accordance with 5.7.3.2③b(a), Section 7, Chapter 5, PART ONE of current ISC Rules may be specially considered provided the Surveyor is satisfied by the close-up survey that there is no structural diminution and the hard protective coatings are found to be in a GOOD condition.

2.6 For chemical tankers, the Surveyor may extend the close-up survey as deemed necessary taking into account the maintenance of the tanks under survey, the condition of the corrosion prevention system and also specific cases in accordance with the provisions of 5.8.4.3(3), Section 8, Chapter 5, PART ONE of current ISC Rules. For tanks where hard protective coatings are found in a GOOD condition, the requirements for close-up survey according to Table 5.8.4.3(2) and the requirements for thickness measurements according to Table 5.8.4.4(1), Section 8, Chapter 5, PART ONE of current ISC Rules may be specially considered.

2.7 For liquefied gas carriers, for ballast tanks where hard protective coatings are in a GOOD condition, the extent of close-up survey and thickness measurement may be specially considered. In accordance with the provisions of 5.16.4.4(3), 5.16.4.4(4) and 5.16.4.5(3), Section 16, Chapter 5, PART ONE of current ISC Rules, the close-up survey of tanks may be extended by the surveyor and close-up survey of tanks according to Table 5.16.4.4(2) and thickness measurement according to Table 5.16.4.5(1), Section 16, Chapter 5, PART ONE of current ISC Rules may be specially considered.

2.8 With regard to ships subject to major conversion, for hull structural parts without any conversion, corresponding close-up survey and thickness measurement are to be carried out in accordance with original ship age and ship type after conversion. For main parts which are added or replaced during major conversion, the survey extent and requirements for subsequent in-service survey may be determined based on the date on which conversion of such parts is completed upon application by the ship owner and with consent of ISC Headquarters.

3 Extended thickness measurements of suspect area

3.1 For areas prone to rapid wastage, refer to the contents in part II, Chapter Ten of the Guidelines.

3.2 For suspect areas that are known or found during survey, the surveyor is to define specific requirements for extended thickness measurements and notify the ship owner/management company in a timely manner.

3.3 Substantial corrosion is determined for the following purposes: firstly, when the thickness measurement value reaches the range of substantial corrosion, it shows that the corrosion mode of structural members of such area is close to the critical condition of corrosion criteria but it is still within allowable corrosion range and satisfies local strength requirements. The number of thickness measurement points is to be added in order to determine substantial corrosion area and meanwhile appropriate solutions are to be developed (e.g., the surveyor may ask the ship company to pay attention to subsequent survey requirements for substantial corrosion area, especially thickness measurement and inspection for substantial corrosion area at subsequent annual survey and sometimes it is difficult to arrange such inspection; or only a few substantial corrosion areas are identified at special survey, and the ship company may be asked to consider cutting and renewal in order to avoid adverse effect on ship's subsequent operation). The accuracy of thickness measurement value is of utmost importance; secondly, once the substantial corrosion area is determined, the extended thickness measurements are taken for structures with substantial corrosion in accordance with relevant provisions of Sections 4 to 8 and 16, Chapter 5, PART ONE of current ISC Rules and in conjunction with ship type and structures with substantial corrosion at subsequent class periodical survey, in order to further evaluate whether the structural strength continues to satisfy requirements and take repair measures as necessary.

3.4 Where internal members of tank are confirmed with substantial corrosion, thickness measurements are to be extended to other similar and small structural members, in order to confirm whether other surrounding structural members have entered substantial corrosion. The substantial corrosion not only serves as an important symbol for evaluating the corrosion extent and type of structural members. Once it is confirmed that the substantial corrosion area has been found, additional survey and extend thickness measurements are to be carried out at subsequent periodical survey (annual, intermediate and special surveys), in order to determine the scope of substantial corrosion area.

3.5 CSR ships

3.5.1 For CSR oil tankers, examination is to be carried out to the identified substantial corrosion area and additional thickness measurements are to be taken at annual and intermediate surveys.

3.5.2 For CSR bulk carriers, the annual thickness measurements may be omitted where a protective coating in cargo holds and ballast tanks has been applied in accordance with the coating manufacturer's requirements and is maintained in "GOOD" condition.

3.5.3 For CSR bulk carriers, the identified substantial corrosion areas may be:

3.5.3.1 protected by coating applied in accordance with the coating manufacturer's requirements and examined at annual intervals to confirm the coating in way is still in "GOOD" condition, or alternatively

3.5.3.2 required to be measured at annual intervals.

II. Requirements for thickness measurement at special survey

1 Thickness measurement may be carried out from the commencement of special survey or the thickness measurement report may be regarded as the report of special survey in 15 months before the expiry date of special survey.

2 For the minimum requirements for thickness measurements at special surveys, refer to Table 5.4.4.2(17) ①, Section 4, Chapter 5, PART ONE of current ISC Rules. For the diagram of the extent of thickness measurement, refer to Figure 4.1, part VI of this Chapter.

3 The surveyor may extend the extent of thickness measurement as deemed necessary. If the results of these thickness measurements indicate that substantial corrosion is found, then the extent of thickness measurements is to be increased to determine areas of substantial corrosion. For the additional requirements for thickness measurement of substantial corrosion, refer to Table 5.4.4.2(17)②, Section 4, Chapter 5, PART ONE of current ISC Rules. These extended thickness measurements are to be carried out before the special survey is credited as completed.

4 For the requirements for thickness measurement of deck transverse sections, refer to relevant requirements of part V “List of all typical locations and quantity of thickness measurement”, Chapter Ten of the Guidelines.

5 For the requirements for thickness measurement of internal members of fore peak and aft peak ballast tanks, refer to relevant requirements of part V “List of all typical locations and quantity of thickness measurement”, Chapter Ten of the Guidelines.

6 For ships equipped with the EGC system, the requirements of the “Guidelines For Design And Installation Of Exhaust Gas Cleaning Systems” should be the attention and the thickness measurement should be carried out on the following thickness measuring requirements of pipelines/structures during the special survey:

- 1) The short pipes connecting the side valves of the scrubber water discharge ports to the ship's hull.
- 2) The outer plates of the ship's hull within a range of 4 meters from the scrubber water discharge ports.

III. Requirements for thickness measurements at annual surveys

1 Suspect areas (These requirements are not applicable to cargo tanks of oil tankers (including double hull oil tankers) and chemical tankers)

Refer to the provisions of 5.4.2.2(7), Section 4, Chapter 5, PART ONE of current ISC Rules.

2 Salt water ballast spaces and/or combined cargo/salt water ballast spaces

Refer to the provisions of 5.4.2.2(8), Section 4, Chapter 5, PART ONE of current ISC Rules.

IV. Requirements for thickness measurements at intermediate surveys

In addition to complying with the requirements for thickness measurements at annual survey, where extensive corrosion is found, thickness measurement is to be carried out and renewals made when wastage exceeds allowable margin.

V. The areas requested for attention during thickness measurements for other ships

The surveyors just need to pay attention to the following areas and determine whether to carry out thickness measurement or not for such areas according to survey results.

- 1 Ro-ro ships and ro-ro passenger ships
 - 1) Cement coating damaged position and serious rusting positions of vehicle decks.
 - 2) Vehicle deck near side position.
 - 3) Where the coating of longitudinal members of the deck below vehicle decks and cabins is in Good Condition, optional measurement is to be carried out.

- 4) In case of double bottom of which inner bottom plating is used to carry vehicle or cargoes, the surveyor is to require appropriately increasing the extent of measurement for inner bottom plating.
- 5) If the interior members of void tanks and ballast tanks are in poor condition, the extent of measurement is to be increased as required by the surveyor.
- 6) For special survey, the bow, inner, side shell and stern doors thickness measured, the corrosion criteria of doors are in accordance with corrosion criteria of adjacent structures, if deemed necessary by the surveyor. Thickness measurements are to be carried out on hinging arms, securing, supporting and locking devices, to the extent considered necessary by the Surveyor. The maximum diminution is to be treated according to the normal procedure for primary structures, but is not to be more than 15% of the as-built thickness. Certain designs may be subject to special consideration of ISC.

2 Refrigerated cargo ships

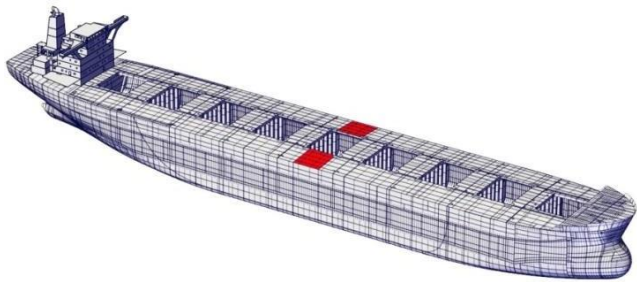
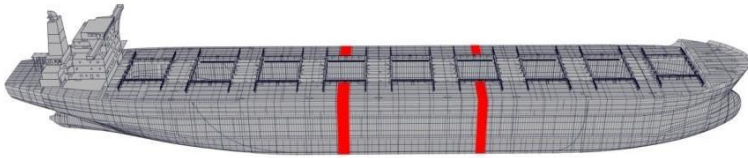
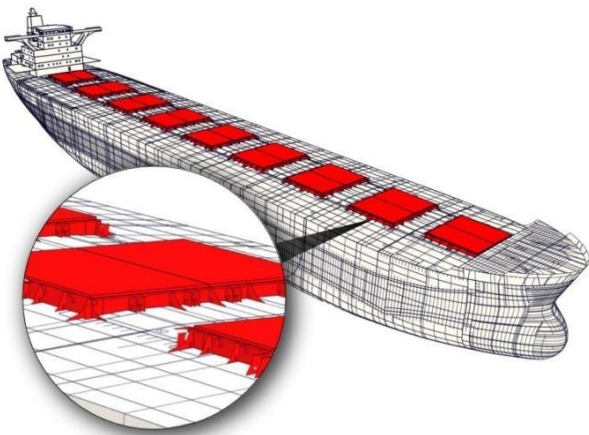
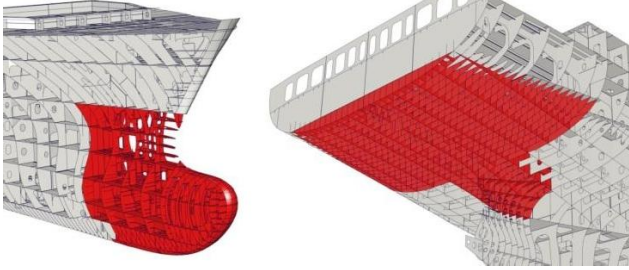
If deck is provided with sheathing of wooden plate, the measurement is to be carried out from upside to down or as required by the surveyor, punching enough holes to enable the probes of thickness measurement instrument to contact the decks.

3 Container carriers

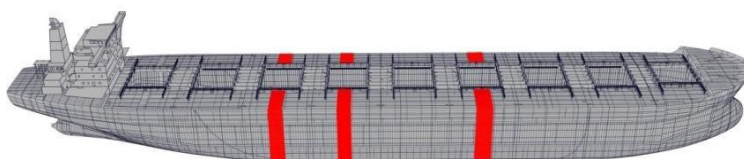
Decks between cargo hold hatchways and inner bottom plating of cargo hold of container carriers with non-weather-tight hatch cover are most likely to be corrosive so that the extent of measurement is to be appropriately extended as required by ISC surveyors.

VI. Section 4, Chapter 5, PART ONE of current ISC Rules (corresponding to IACS UR Z7)
 — **Extent of thickness measurement of all ships**

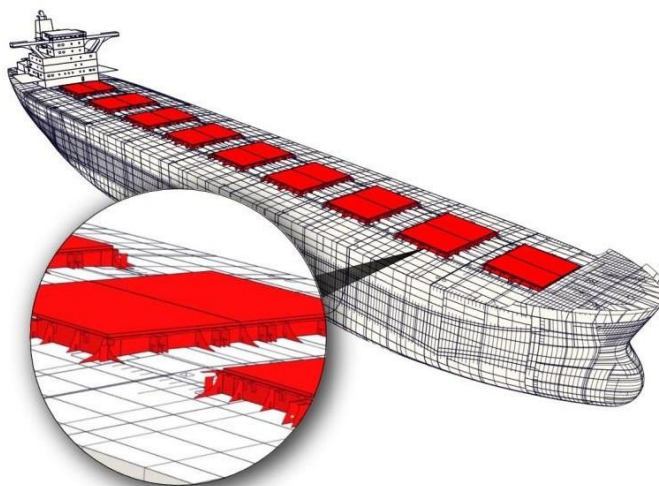
Figure 4.1

Special Survey No.1 (Age ≤ 5)	
1) Suspect areas throughout the ship	
Special Survey No.2 (5 < Age ≤ 10)	
1) Suspect areas throughout the ship	
2) One transverse section of deck plating within the amidships 0.5L (in way of a cargo space, when appropriate)	
	
Special Survey No.3 (10 < Age ≤ 15)	
1) Suspect areas throughout the ship	
2) Two transverse sections within the amidships 0.5L (in way of two different cargo spaces, when appropriate)	
	
3) All cargo hold hatch covers and coamings (plating and stiffeners)	
	
4) Internals in forepeak and afterpeak ballast tanks	
	
Special Survey No.4 and Subsequent (Age > 15)	
1) Suspect areas throughout the ship	

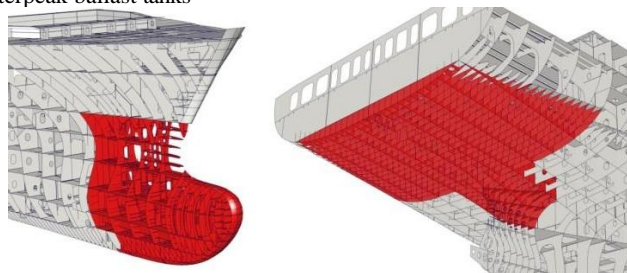
2) A minimum of three transverse sections within the amidships $0.5L$ (in way of a cargo space, when appropriate)



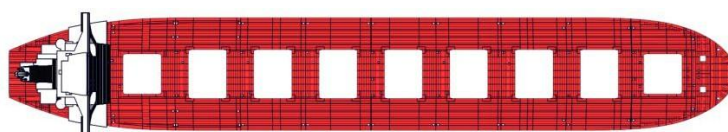
3) All cargo hold hatch covers and coamings (plating and stiffeners)



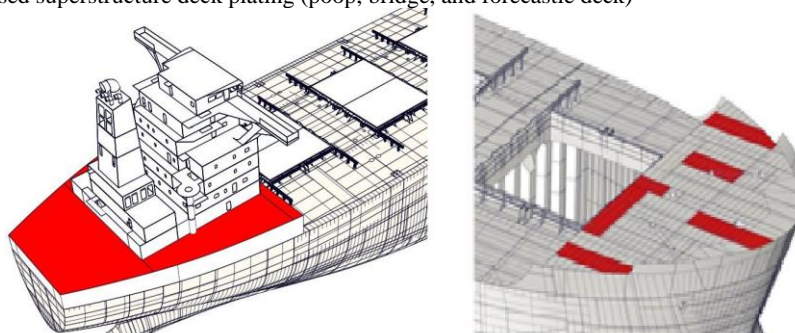
4) Internals in forepeak and afterpeak ballast tanks



5) All exposed main deck plating full length



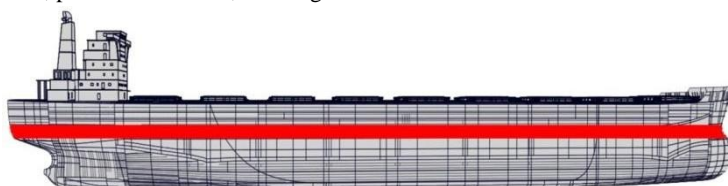
6) Representative exposed superstructure deck plating (poop, bridge, and forecastle deck)



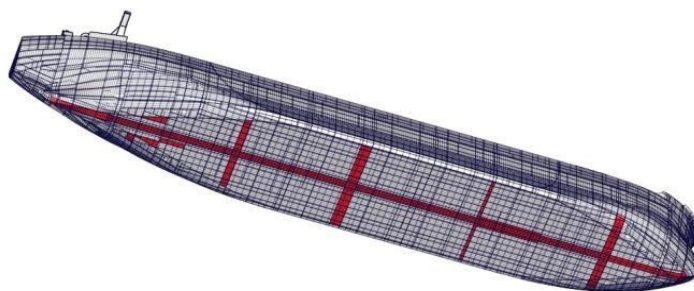
7) Lowest strake and strakes in way of 'tween decks of all transverse bulkheads in cargo spaces together with internals in way



8) All wind and water strakes, port and starboard, full length



9) All keel plates full length. Also, additional bottom plates in way of aftend of tanks, cofferdams, and machinery space



10) Plating of sea chests. Shell plating in way of overboard discharges as considered necessary by the attending Surveyor



VII. Preparation of form of thickness measurement report and relevant supplementary provisions

The current ISC Rules and the IACS Unified Requirements have provided recommended (non-mandatory) thickness measurement report template for thickness measurement of all ships. In order to facilitate the use of such template, the Guidelines provide the following supplementary provisions:

1 For ESP ships, the requirements for report template in Chapters Six, Seven and Eight of the Guidelines are to be followed. Under normal circumstances, the thickness measurement report shall be prepared in accordance with the format in Appendix 13 "Recommended Procedures for Thickness Measurement" of Chapter 5 in Part 1 of the current regulations of ISC, and the "Hull Structure Thickness Measurement Management System" developed by ISC shall be adopted. ;

2 Where the thickness measurement report format recommended in Appendix 13.1A or 13.1B to

Chapter 5, PART ONE of the current ISC Rules is used, in the case of complete transverse bulkhead, including girder systems and their adjacent associates, the thickness measurements are to be filled in TM4-G/TM4-G(NSD) Form; In the case of complete transverse web frame ring in ballast tanks, including their adjacent associates (i.e. associated plating and frames), the thickness measurements are to be filled in TM5-G/TM5-G(NSD) Form.

Chapter Five Requirements for Thickness Measurements of Hull of General Dry Cargo Ships

I. GENERAL

1 The requirements apply to all self-propelled General Dry Cargo Ships of 500gt and above carrying solid cargoes other than:

- (1) bulk carrier;
- (2) dedicated container carriers;
- (3) ro-ro cargo ships;
- (4) refrigerated cargo ships;
- (5) dedicated wood chip carriers;
- (6) dedicated cement carriers;
- (7) livestock carriers;
- (8) deck cargo ships;
- (9) general dry cargo ships of double-side skin construction, with double-side skin extending for the length of the cargo area, and for the height of the cargo hold to the upper deck.

2 For General Dry Cargo Ships with hybrid cargo hold arrangements, e.g. with some cargo holds of single-side skin and others of double-side skin, the requirements of this chapter are to be applied only to structure in way of the single-side skin cargo hold region.

3 The requirements apply to surveys of hull structure and piping systems in way of cargo holds, cofferdams, pipe tunnels, void spaces and fuel oil tanks within the cargo area and all ballast tanks. The survey of the hull structure out of the cargo area (except for ballast tanks) should be in accordance with Chapter Four.

II. Requirements for thickness measurements at special surveys

1 Requirements for special survey of hull and equipment of general dry cargo ships are given in 5.5.4, Section 5, Chapter 5, PART ONE of current ISC Rules. The minimum requirements for thickness measurements at special survey are given in Table 5.5.4.5(1), Section 5, Chapter 5, PART ONE of current ISC Rules.

2 The minimum requirements for close-up surveys at special survey are given in Table 5.5.4.4(2), Section 5, Chapter 5, PART ONE of current ISC Rules. The extent of close-up survey and thickness measurement are shown in Figures 5.1 and 5.2 respectively.

3 The surveyor may extend the close-up survey as deemed necessary taking into account the maintenance of the spaces under survey, the condition of the corrosion prevention system and where spaces have structural arrangements or details which have suffered defects in similar spaces or on similar ships according to available information.

4 For areas in spaces where hard protective coatings are found to be in a GOOD condition, the extent of close-up surveys according to Table 5.5.4.4(2), Section 5, Chapter 5, PART ONE of current ISC Rules may be specially considered.

5 The surveyor may extend the thickness measurements as deemed necessary. Where thickness measurements indicate substantial corrosion, the extent of thickness measurements is to be increased to determine the extent of areas of substantial corrosion. Table 5.4.4.1(17)②, Section 4, Chapter 5, PART ONE of current ISC Rules may be used as guidance for these additional thickness measurements.

6 For areas in spaces where hard protective coatings are found in a GOOD condition, the extent of thickness measurement according to Table 5.5.4.5(1), Section 5, Chapter 5, PART ONE of current ISC Rules may be specially considered.

III. Requirements for thickness measurements at annual surveys

1 Suspect areas

Refer to the provisions of 5.5.2.4, Section 5, Chapter 5, PART ONE of current ISC Rules.

2 Cargo holds

Refer to the provisions of 5.5.2.5, Section 5, Chapter 5, PART ONE of current ISC Rules.

3 Ballast tanks

Refer to the provisions of 5.4.2.2(8), Section 4, Chapter 5, PART ONE of current ISC Rules.

IV. Requirements for thickness measurements at intermediate surveys

1 Refer to the provisions of 5.5.3, Section 5, Chapter 5, PART ONE of current ISC Rules.

V. Preparation of form of thickness measurement report and relevant supplementary provisions

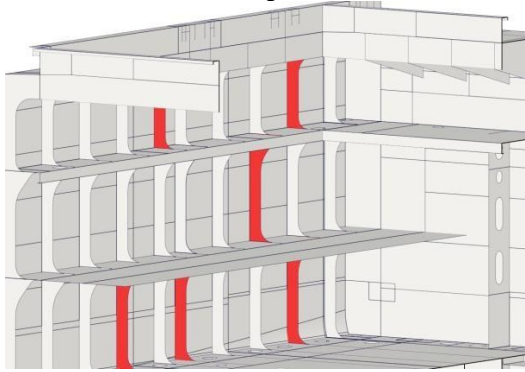
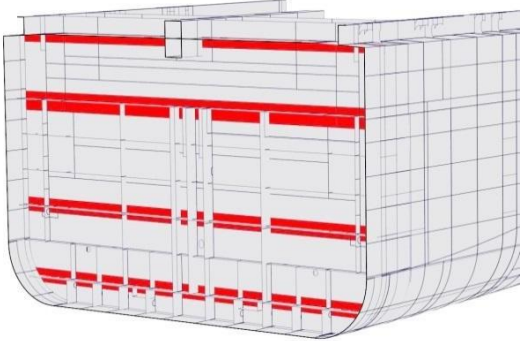
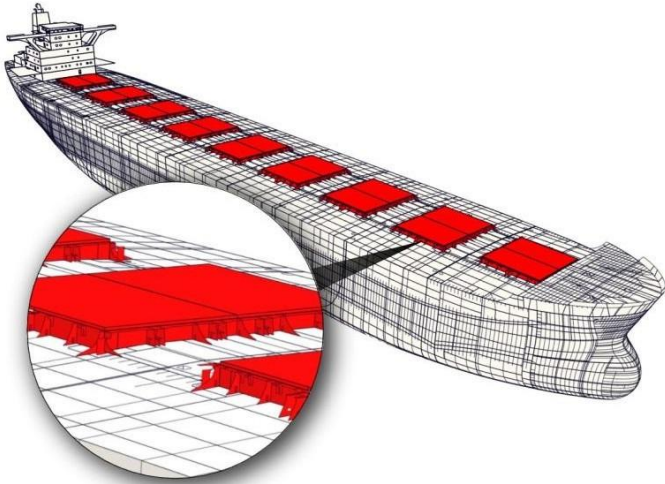
Although the current ISC Rules and IACS Unified Requirements have given provisions on applicable extent of preparation of thickness measurement reports, the Guidelines provide the following supplementary provisions:

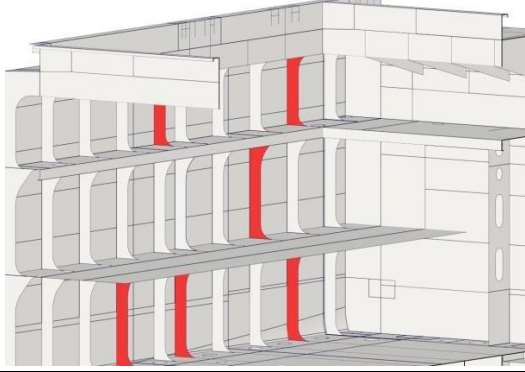

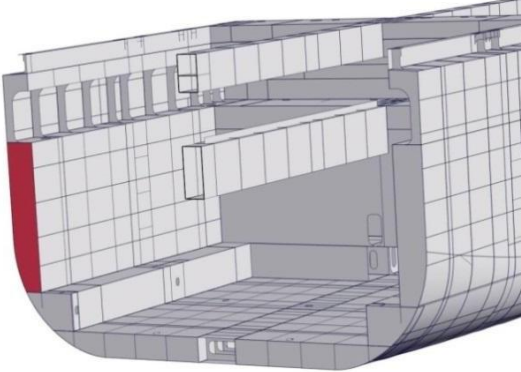
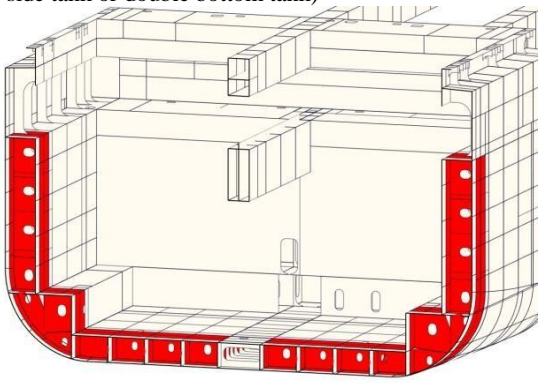
1. Same as the provisions of paragraphs VII/1 and 2 of Chapter Four of the Guidelines.

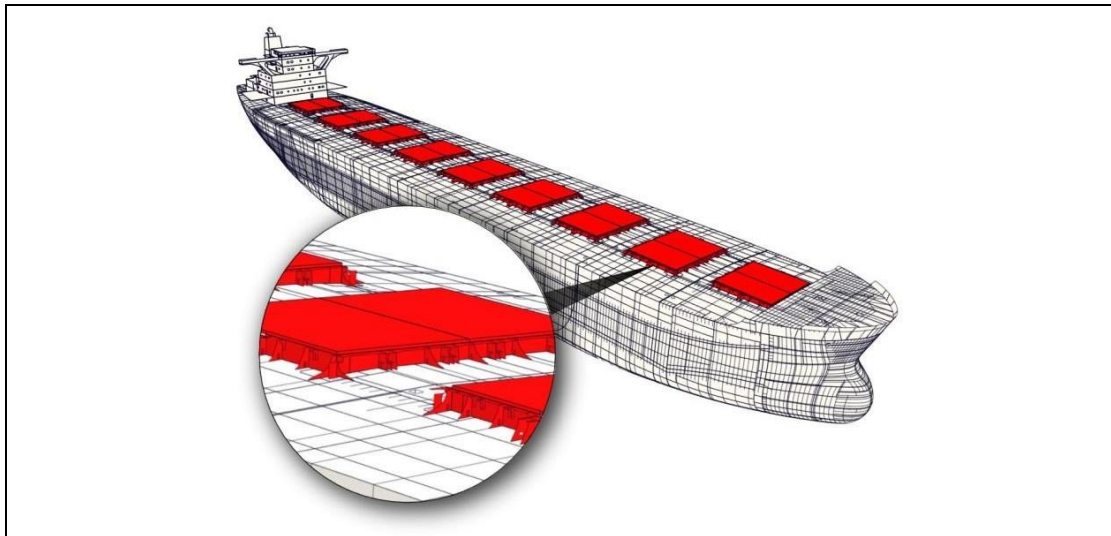
VI. Section 5, Chapter 5, PART ONE of current ISC Rules (corresponding to IACS UR Z7.1)

— 5.1 Extent of close-up surveys at hull surveys of general dry cargo ships

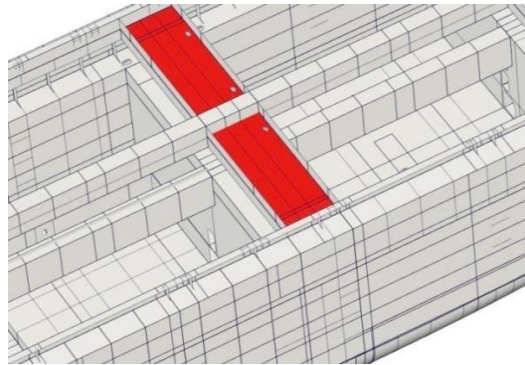
Figure 5.1

Special Survey No.1 (Age ≤ 5)	
(A) Selected shell frames in one forward and one aft cargo hold and associated 'tween-deck spaces	
(B) One selected cargo hold transverse bulkhead	
(D) All cargo hold hatch covers and coamings (plating and stiffeners)	
Special Survey No.2 (5 < Age ≤ 10)	
(A) Selected shell frames in all cargo holds and 'tween-deck spaces	

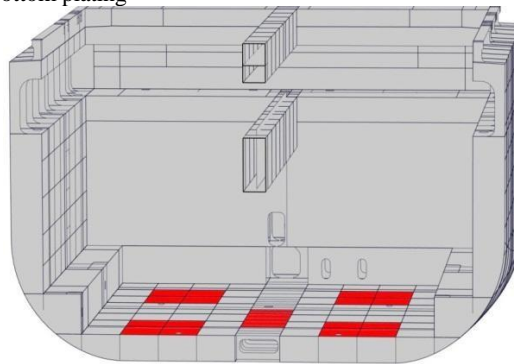

<p>(B) One transverse bulkhead in each cargo hold</p> 
<p>(B) Forward and aft transverse bulkhead in one side ballast tank, including stiffening system</p> 
<p>(C) One transverse web with associated plating and framing in two representative water ballast tanks of each type (i.e. topside, hopper side, side tank or double bottom tank)</p> 
<p>(D) All cargo hold hatch covers and coamings (plating and stiffeners)</p>



(E) Selected areas of all deck plating and underdeck structure inside line of hatch openings between cargo hold hatches

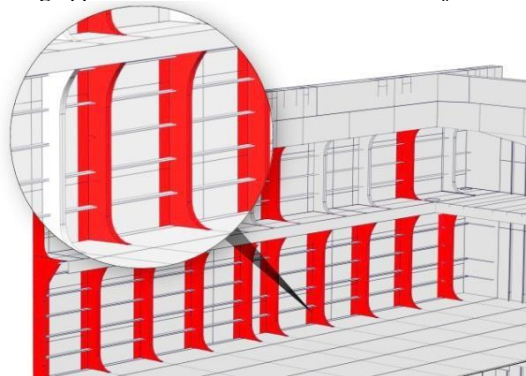


(F) Selected areas of inner bottom plating

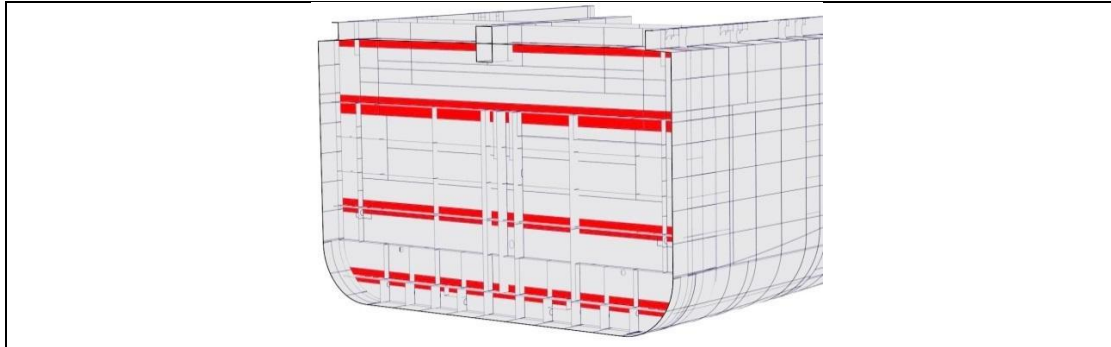


Special Survey No.3 (10 < Age < 15)

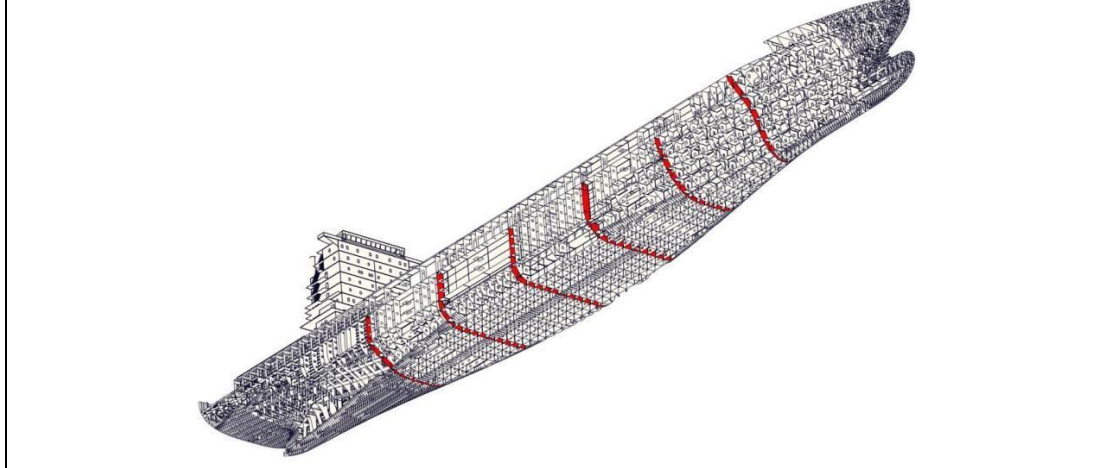
(A) All shell frames in the forward lower cargo hold and 25% frames in each of the remaining cargo holds and 'tween-deck spaces including upper and lower end attachments and adjacent shell plating



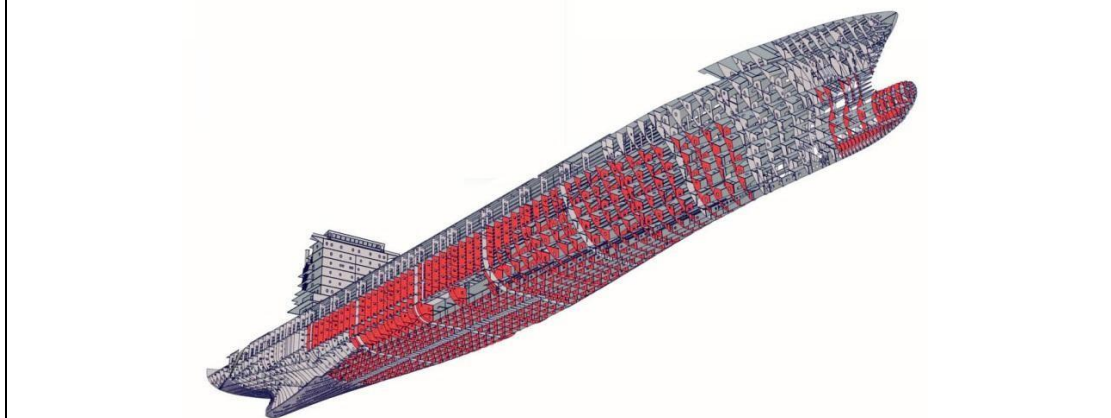
(B) All cargo hold transverse bulkheads



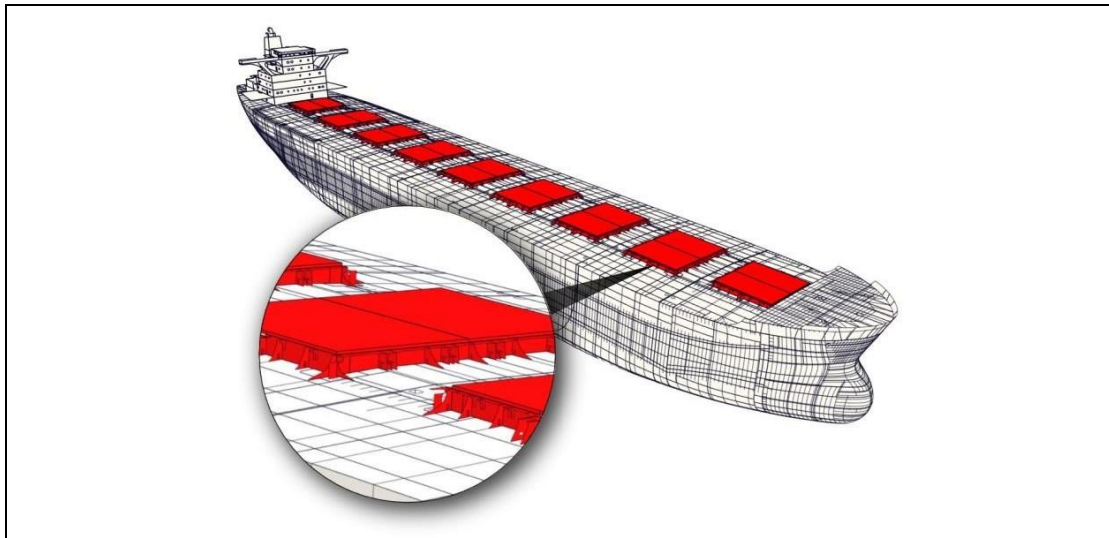
(B) All transverse bulkheads in ballast tanks, including stiffening system



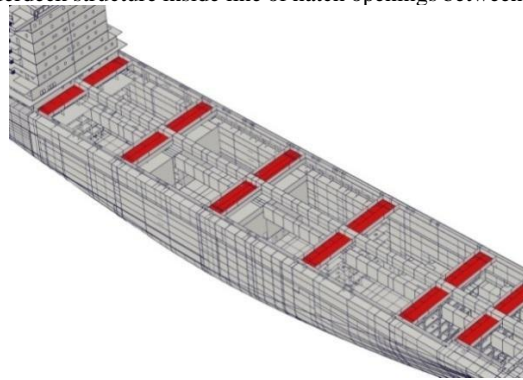
(C) All transverse webs with associated plating and framing in each water ballast tank



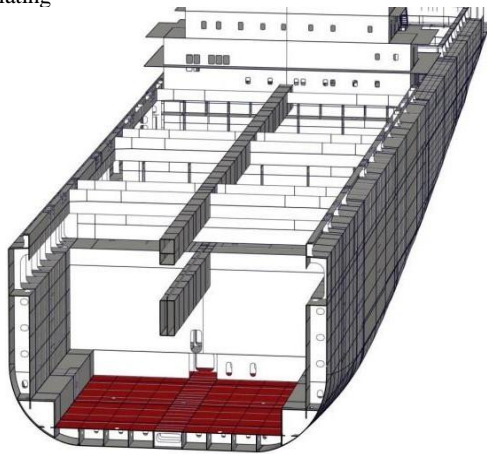
(D) All cargo hold hatch covers and coamings (plating and stiffeners)



(E) All deck plating and underdeck structure inside line of hatch openings between cargo hold hatches



(F) All areas of inner bottom plating



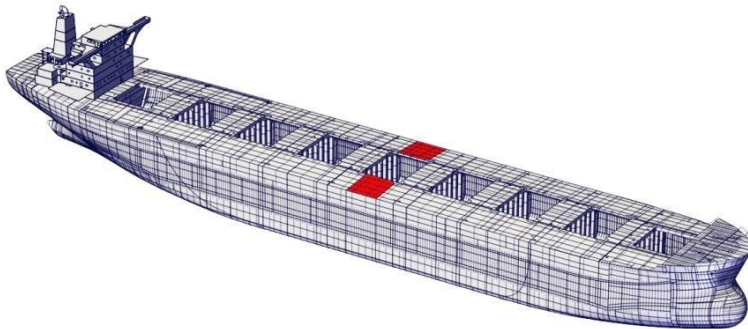
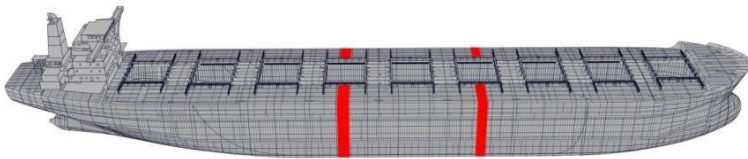
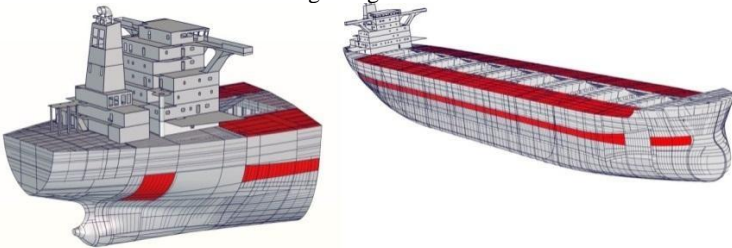
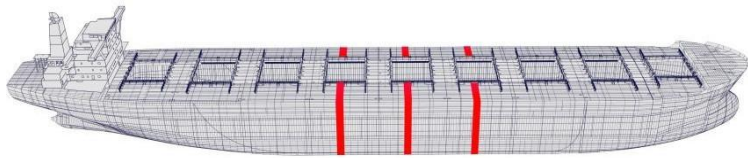
Special Survey No.4 and Subsequent (Age > 15)

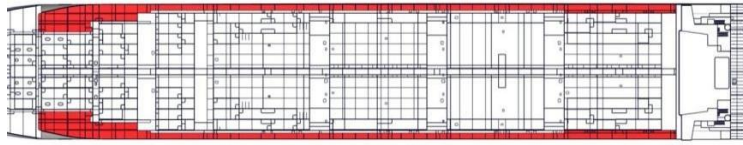
(A) All shell frames in all cargo holds and 'tween-deck spaces including upper and lower end attachments and adjacent shell plating

Areas (B) – (F) as for Special Survey No.3

5.2 Extent of hull thickness measurements of general dry cargo ships

Figure 5.2

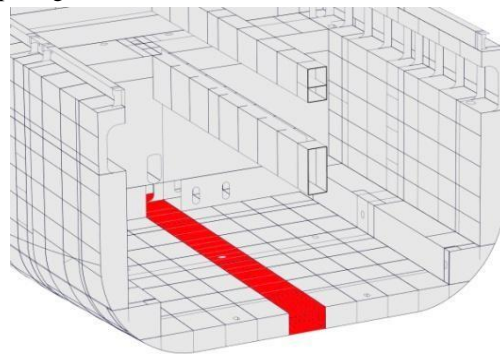
Special Survey No.1 (Age ≤ 5)
1) Suspect areas throughout the ship
Special Survey No.2 (5 < Age ≤ 10)
1) Suspect areas throughout the ship
2) One transverse section of deck plating in way of a cargo space within the amidships 0.5L

3) Measurement for general assessment and recording of corrosion pattern of those structural members subject to close-up survey (refer to figures in close-up survey)
Special Survey No.3 (10 < Age ≤ 15)
1) Suspect areas throughout the ship
2) Two transverse sections within the amidships 0.5L in way of two different cargo spaces

3) Measurement for general assessment and recording of corrosion pattern of those structural members subject to close-up survey (refer to figures in close-up survey)
4) Within the cargo length, each deck plate outside line of cargo hatch openings
5) All wind and water strakes within the cargo length area
6) Selected wind and water strakes outside the cargo length area

Special Survey No.4 and Subsequent (Age > 15)
1) Suspect areas throughout the ship
2) Within the cargo length:
a) A minimum of three transverse sections within the amidships 0.5L

2) Within the cargo length:
b) Each deck plate outside line of cargo hatch openings



- 2) Within the cargo length:
- c) Each bottom plate, including lower turn of bilge

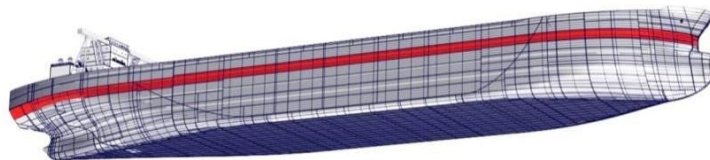


- 2) Within the cargo length:
- d) Duct keel or pipe tunnel plating and internals



- 3) Measurement for general assessment and recording of corrosion pattern of those structural members subject to close-up survey (refer to figures in close-up survey)

- 4) All wind and water strakes full length



Chapter Six Requirements for Thickness Measurements of Hull of Oil Tankers (including Combination Ships of Ore/Oil Ships), Double Hull Oil Tankers

I. GENERAL

1 The requirements apply to surveys of hull structure and piping systems in way of cargo tanks, pump rooms, cofferdams, pipe tunnels, void spaces within the cargo area and all ballast tanks. The survey of the hull structure out of the cargo area (except for ballast tanks) should be in accordance with Chapter Four..

II. Requirements for thickness measurements at special surveys

Requirements for special survey of hull and equipment of oil tankers are given in 5.6.4, Section 6, Chapter 5, PART ONE of current ISC Rules. The minimum requirements for thickness measurements at special surveys of oil tankers (including Combination Ships of Ore/Oil Ships) are given in Table 5.6.4.4(1) ①a, Section 6, Chapter 5, PART ONE of current ISC Rules. The minimum requirements for thickness measurements at special surveys of Double Hull Oil Tankers are given in Table 5.6.4.4(1)①b, Section 6, Chapter 5, PART ONE of current ISC Rules. The minimum requirements for thickness measurements at special surveys of oil tankers (including double hull oil tankers), ore/oil combination ships, etc., not having the notation ESP are given in Table 5.6.4.4(1)②, Section 6, Chapter 5, PART ONE of current ISC Rules.

1 The minimum requirements for close-up surveys at special survey are given as follows:

- 1) The minimum requirements for close-up survey of single hull oil tankers, ore/oil combination ships are given in Table 5.6.4.3(2)①, Section 6, Chapter 5, PART ONE of current ISC Rules. The extent of close-up survey and thickness measurement are shown in Figures 6.1 and 6.2 respectively;
- 2) The minimum requirements for close-up survey of double hull oil tankers are given in Table 5.6.4.3(2) ②, Section 6, Chapter 5, PART ONE of current ISC Rules. The extent of close-up survey and thickness measurement are shown in Figures 6.3 and 6.4 respectively.

2 The surveyor may extend the close-up survey as deemed necessary taking into account the maintenance of the spaces under survey, the condition of the corrosion prevention system and also in the following cases:

- 1) In particular, tanks having structural arrangements or details which have suffered defects in similar tanks or on similar ships according to available information.
- 2) In tanks which have structures approved with reduced scantlings due to an approved corrosion control systems.

3 For areas in tanks where hard protective coatings are found to be in a GOOD condition, the extent of close-up surveys according to Tables 5.6.4.3(2)① and 5.6.4.3(2)②, Section 6, Chapter 5, PART ONE of current ISC Rules may be specially considered.

4 The surveyor may further extend the thickness measurements as deemed necessary.

5 For areas in tanks where hard protective coatings are found to be in a GOOD condition, the requirements of thickness measurements according to Table 6.1 may be specially considered.

6 In cases where two or three sections are to be measured, at least one is to include a Ballast Tank within 0.5L amidships.

In case of oil tankers of 130 m in length and upwards and more than 10 years of age, for the evaluation of the ship's longitudinal strength, the sampling method of thickness measurements is given in Annex 3, Appendix 2, Chapter 5, PART ONE of current ISC Rules.

In case of CSR oil tankers of 130 m in length and upwards (as defined in the International Convention on Load Lines in force), Annex 3, Appendix 2, Chapter 5, PART ONE of current ISC Rules may be used as an alternative method to evaluation of longitudinal strength of CSR oil tankers at special survey after the ship reaches 10 years of age.

7 The survey unit is to communicate timely with the Headquarters with regard to the requirements for close-up surveys and thickness measurements of ore/bulk/oil combination ships so as to determine the additional requirements for close-up surveys and thickness measurements of such types of ships.

8 Although ISC Rules and IACS Unified Requirements have not given definite requirements for thickness measurements at close-up surveys of cargo tank inner bottom plating of oil tankers (including double hull oil tankers and CSR oil tankers), surveyors are to pay attention to the surveys of cargo tank inner bottom plating of oil tankers (including double hull oil tankers) and ore/oil combination ships. The

surveyors may request to carry out additional thickness measurements for cargo tank inner bottom plating when the survey reveals the existence of suspect areas or extensive corrosion.

9 Number and locations of measurements

1) Application

The item only applies to CSR oil tankers. For non CSR ships, the requirements provided in Chapter 10 of the Guidelines are to be satisfied.

2) Number of measurements

Considering the extent of thickness measurements according to the different structural elements of the ship and surveys (special, intermediate and annual), the locations of the points to be measured are given for the most important items of the structure.

3) Locations of measurements

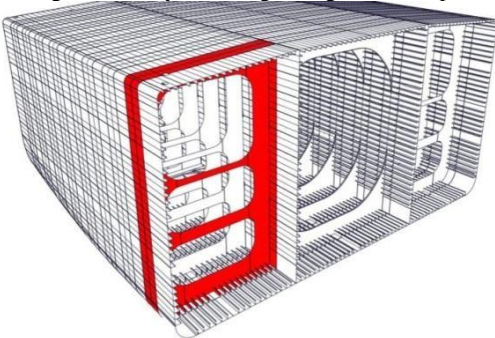
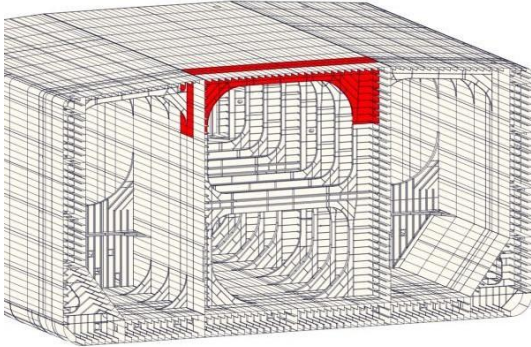
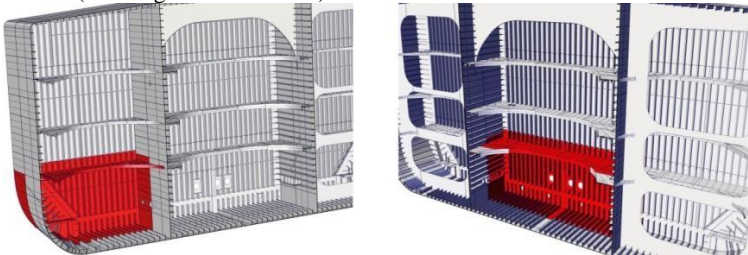
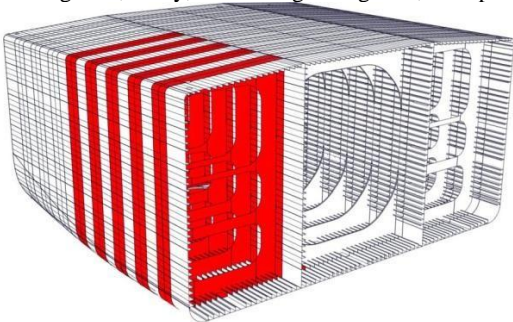
Both systematic thickness measurements related to the calculation of global hull girder strength and specific measurements connected to close-up surveys of CSR oil tankers are given in Chapter 5, PART ONE of current ISC Rules. The interpretations of rules requirements for location and number of measurements of CSR oil tankers are given in Table 5.1.9.3(3)c, Section 1, Chapter 5, PART ONE of current ISC Rules.

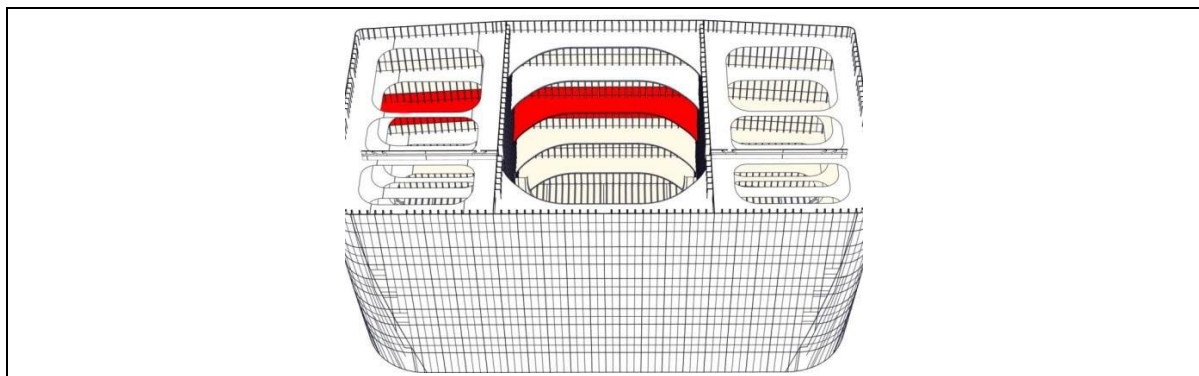
10 Requirements for special surveys of CSR oil tankers are given in Section 6, Chapter 5, PART ONE of current ISC Rules.

III. Section 6, Chapter 5, PART ONE of current ISC Rules (corresponding to IACS UR Z10.1&10.4) — oil tankers

1.1 Extent of close-up surveys of Oil Tankers, Ore/Oil Ships, etc.

Figure 6.1

Special Survey No.1 (Age ≤ 5)	
(A) One web frame ring (in a ballast wing tank, if any, or a cargo wing tank used primarily for water ballast)	
(B) One deck transverse (in a cargo oil tank)	
(D) One transverse bulkhead (in a ballast tank) (D) One transverse bulkhead (in a cargo oil tank) (D) One transverse bulkhead (in a cargo oil centre tank)	
Special Survey No.2 (5 < Age ≤ 10)	
(A) All web frame rings (in a ballast wing tank, if any, or in a cargo wing tank, used primarily for water ballast)	
(B) One deck transverse (in each of the remaining ballast tanks, if any) (B) One deck transverse (in a cargo wing tank) (B) One deck transverse (in two cargo centre tanks)	

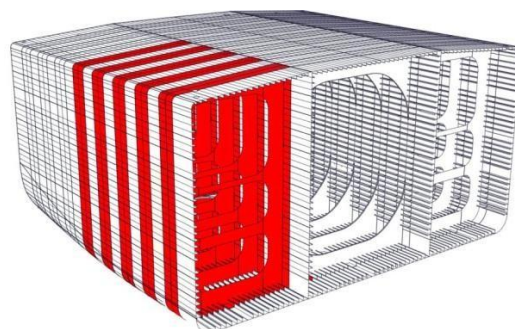


- (C) Both transverse bulkheads (in a wing ballast tank, if any, or a cargo wing tank used primarily for water ballast)
- (D) One transverse bulkhead (in each remaining ballast tank)
- (D) One transverse bulkhead (in a cargo oil wing tank)
- (D) One transverse bulkhead (in two cargo centre tanks)

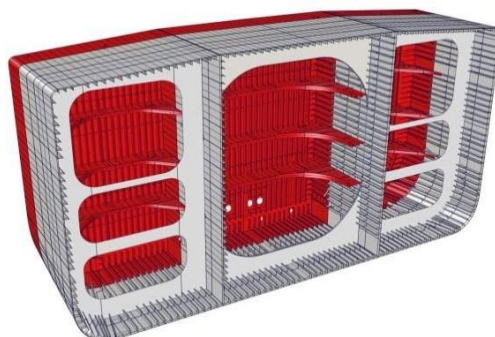


Special Survey No.3 (10 < Age ≤ 15)

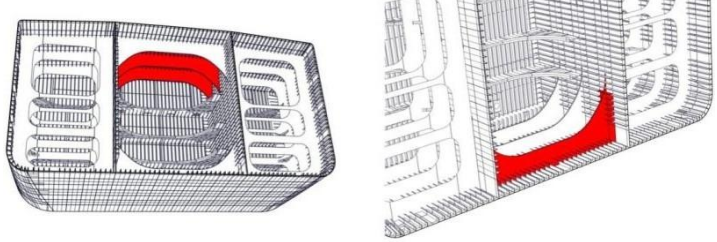
- (A) All web frame rings (in all ballast tanks)
- (A) All web frame rings (in a cargo wing tank)
- (A) A minimum of 30% (to be rounded up to the next whole integer) of all complete transverse web frame rings in each remaining cargo wing tank



- (C) All transverse bulkheads (in all cargo and ballast tanks)

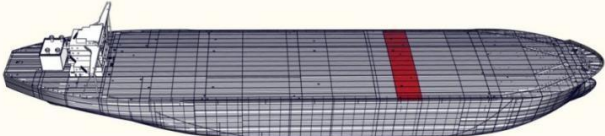
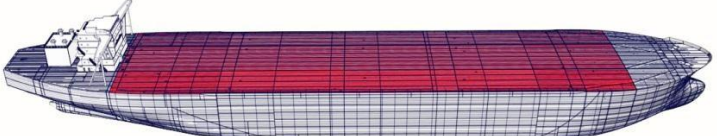
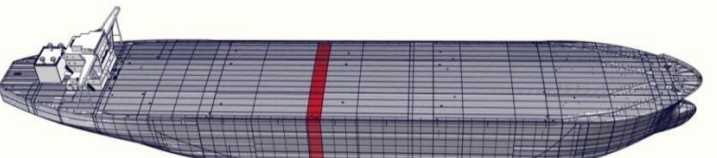
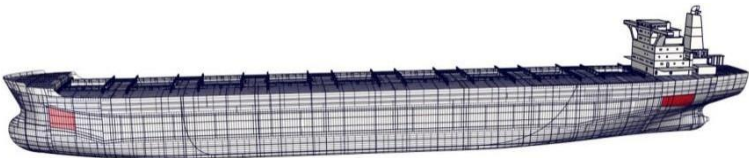


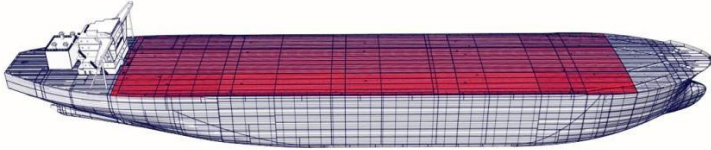
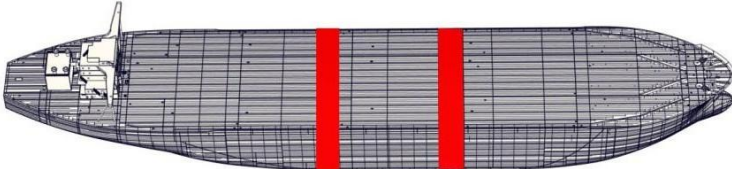

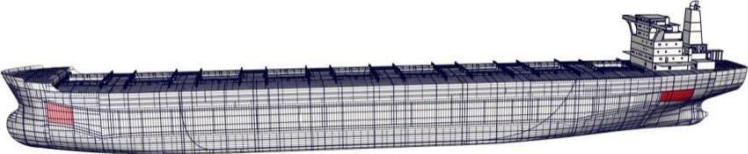
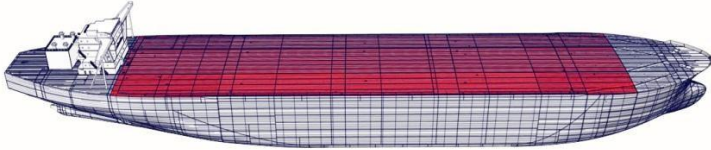
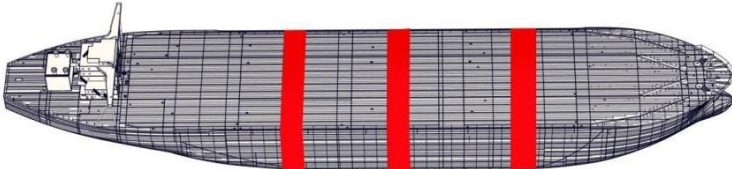

- (E) A minimum of 30% (to be rounded up to the next whole integer) of deck and bottom transverses including adjacent structural members in each cargo centre tank


(F) As considered necessary by the Surveyor
Special Survey No.4 and Subsequent (Age > 15)
As special survey No.3; additional transverses included as deemed necessary by ISC

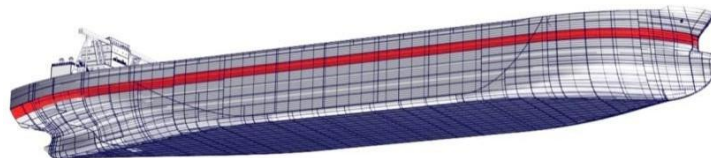
2.2 Extent of thickness measurements of Oil Tankers, Ore/Oil Ships, etc.

Figure 6.2

Special Survey No.1 (Age ≤ 5)
1) One section of deck plating for the full beam of the ship within the cargo area (in way of a ballast tank, if any, or a cargo tank used primarily for water ballast).

2) Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey
3) Suspect areas
Special Survey No.2 (5 < Age ≤ 10)
1) Within the cargo area:
a) Each deck plate

1) Within the cargo area:
b) One transverse section

2) Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey
3) Suspect areas
4) Selected wind and water strakes outside the cargo area

Special Survey No.3 (10 < Age ≤ 15)
1) Within the cargo area:
a) Each deck plate

	
<p>1) Within the cargo area: b) Two transverse sections</p> 	
<p>1) Within the cargo area: c) All wind and water strakes</p> 	
<p>2) Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey</p>	
<p>3) Suspect areas</p>	
<p>4) Selected wind and water strakes outside the cargo area</p> 	
<p>Special Survey No.4 and Subsequent (Age > 15)</p>	
<p>1) Within the cargo area: a) Each deck plate</p> 	
<p>1) Within the cargo area: b) Three transverse sections</p> 	
<p>1) Within the cargo area: c) Each bottom plate</p> 	

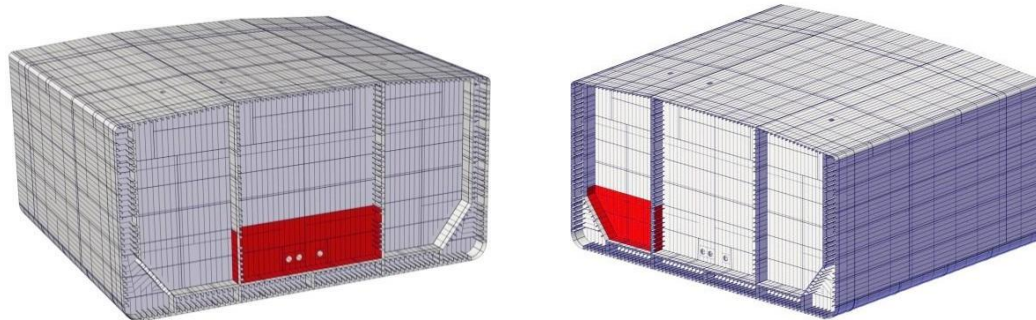
- 2) Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey
- 3) Suspect areas
- 4) All wind and water strakes, full length



2.3 Extent of close-up surveys of double hull oil tankers

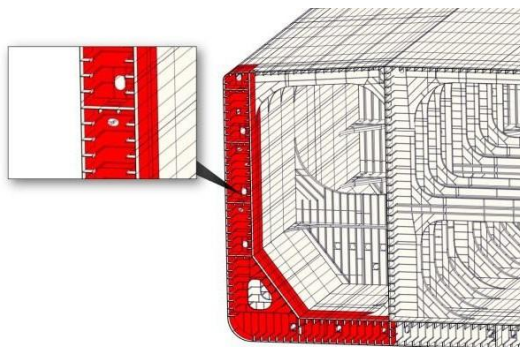
Figure 6.3

Special Survey No.1 (Age ≤ 5)	
One web frame, in a ballast tank	
One deck transverse, in a cargo oil tank	
One transverse bulkhead, in a complete ballast tank	
One transverse bulkhead, in a cargo oil centre tank One transverse bulkhead, in a cargo oil wing tank	

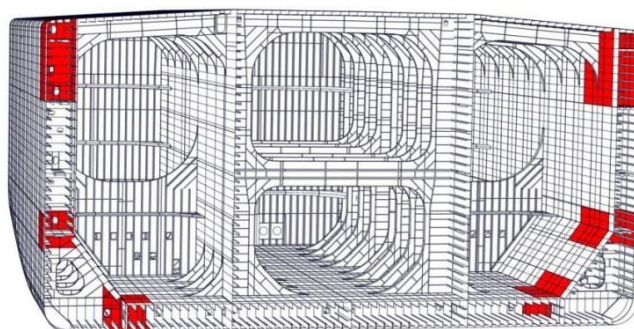


Special Survey No.2 ($5 < \text{Age} \leq 10$)

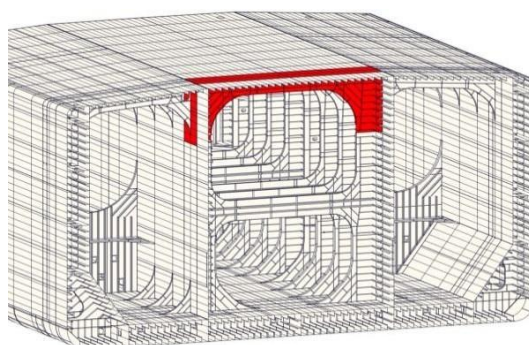
All web frames, in a ballast tank



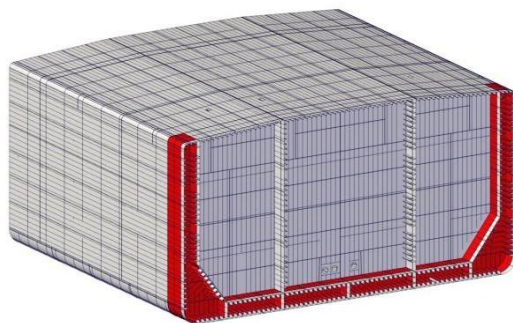
The knuckle area and the upper part (5 m approximately) of one web frame in each remaining ballast tank



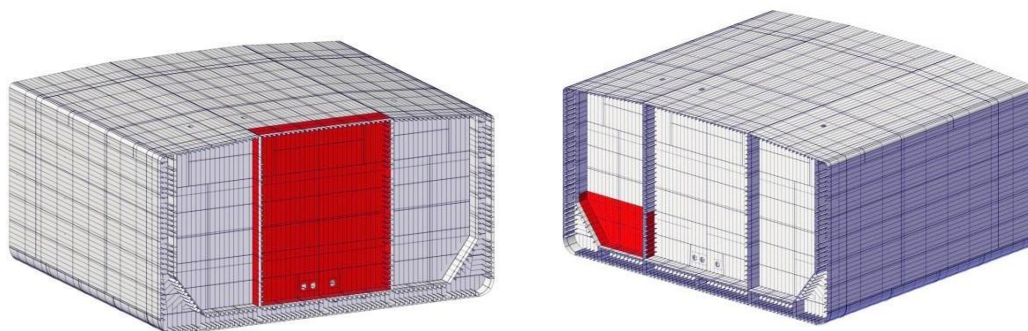
One deck transverse, in two cargo oil tanks



One transverse bulkhead, in each ballast tank

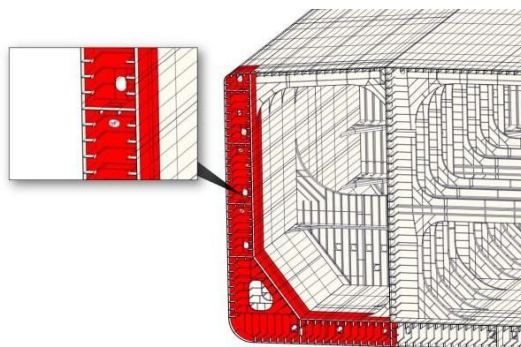


One transverse bulkhead, in two cargo oil centre tanks
 One transverse bulkhead, in a cargo oil wing tank

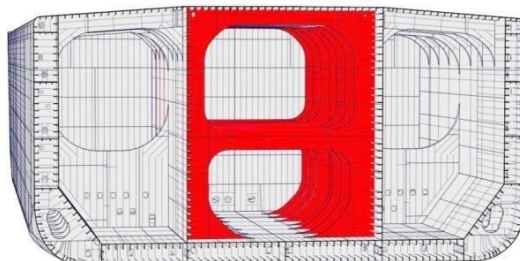


Special Survey No.3 (10 < Age ≤ 15)

All web frames, in all ballast tanks



All web frames, including deck transverse and cross ties, if fitted, in a cargo oil tank / One web frame, including deck transverse and cross ties, if fitted, in each remaining cargo oil tank



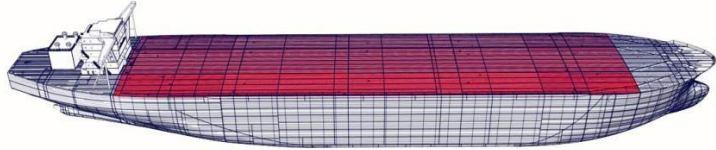
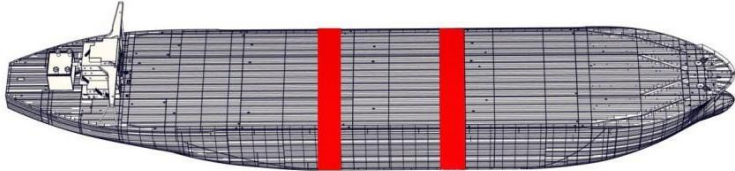
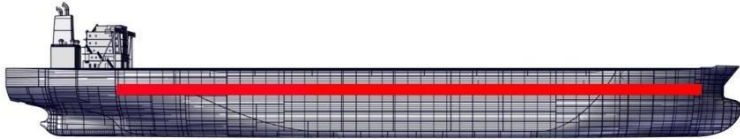
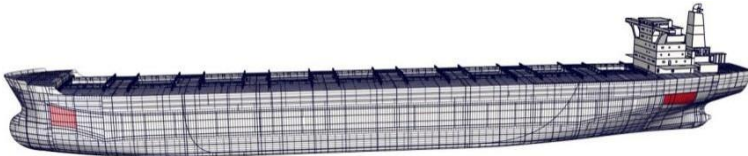
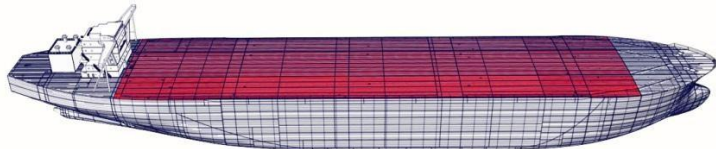
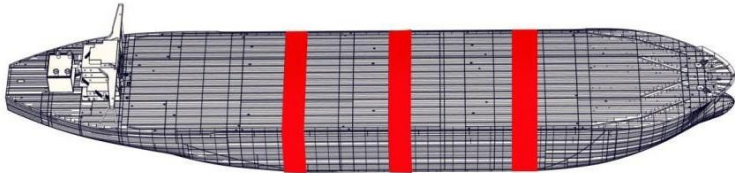
All transverse bulkheads, in all cargo oil and ballast tanks

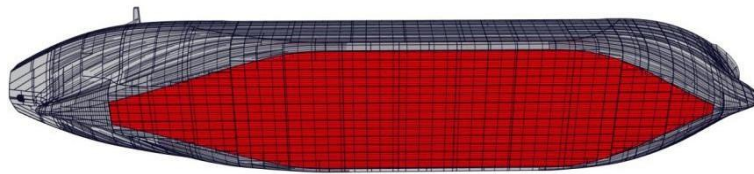
<p>Special Survey No.4 and Subsequent (Age > 15)</p>
<p>As special survey No.3. Additional transverse areas as deemed necessary by ISC</p>

2.4 Extent of thickness measurements of double hull oil tankers

Figure 6.4

<p>Special Survey No.1 (Age ≤ 5)</p>
<p>1) Suspect areas</p>
<p>Special Survey No.2 (5 < Age ≤ 10)</p>
<p>1) Within the cargo area: a) Each deck plate</p>
<p>1) Within the cargo area: b) One transverse section</p>
<p>2) Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey</p>
<p>3) Suspect areas</p>
<p>4) Selected wind and water strakes outside the cargo area</p>
<p>Special Survey No.3 (10 < Age ≤ 15)</p>
<p>1) Within the cargo area: a) Each deck plate</p>

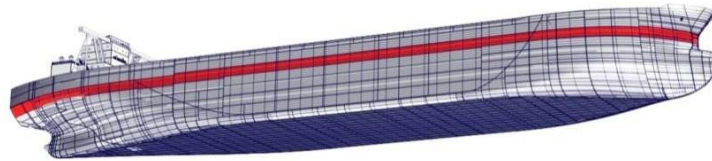

<p>1) Within the cargo area: b) Two transverse sections</p> 
<p>1) Within the cargo area: c) All wind and water strakes</p> 
<p>2) Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey</p>
<p>3) Suspect areas</p>
<p>4) Selected wind and water strakes outside the cargo area</p> 
<p>Special Survey No.4 and Subsequent (Age > 15)</p>
<p>1) Within the cargo area: a) Each deck plate</p> 
<p>1) Within the cargo area: b) Three transverse sections</p> 
<p>1) Within the cargo area: c) Each bottom plate</p>



2) Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey

3) Suspect areas

4) All wind and water strakes, full length



IV. Requirements for thickness measurements of substantial corrosion areas

1 For oil tankers, ore/oil combination ships, the provisions for thickness measurements of areas with substantial corrosion are given in Tables 5.6.4.4(2) ①a~d, Section 6, Chapter 5, PART ONE of current ISC Rules.

2 For double hull oil tankers, the provisions for thickness measurements of areas with substantial corrosion are given in Tables 5.6.4.4(2)②a ~ e, Section 6, Chapter 5, PART ONE of current ISC Rules.

3 For oil tankers not having the notation ESP, the extended thickness measurements of areas with substantial corrosion are carried out in accordance with Table 5.4.4.2(17)②, Section 4, Chapter 5, PART ONE of current ISC Rules.

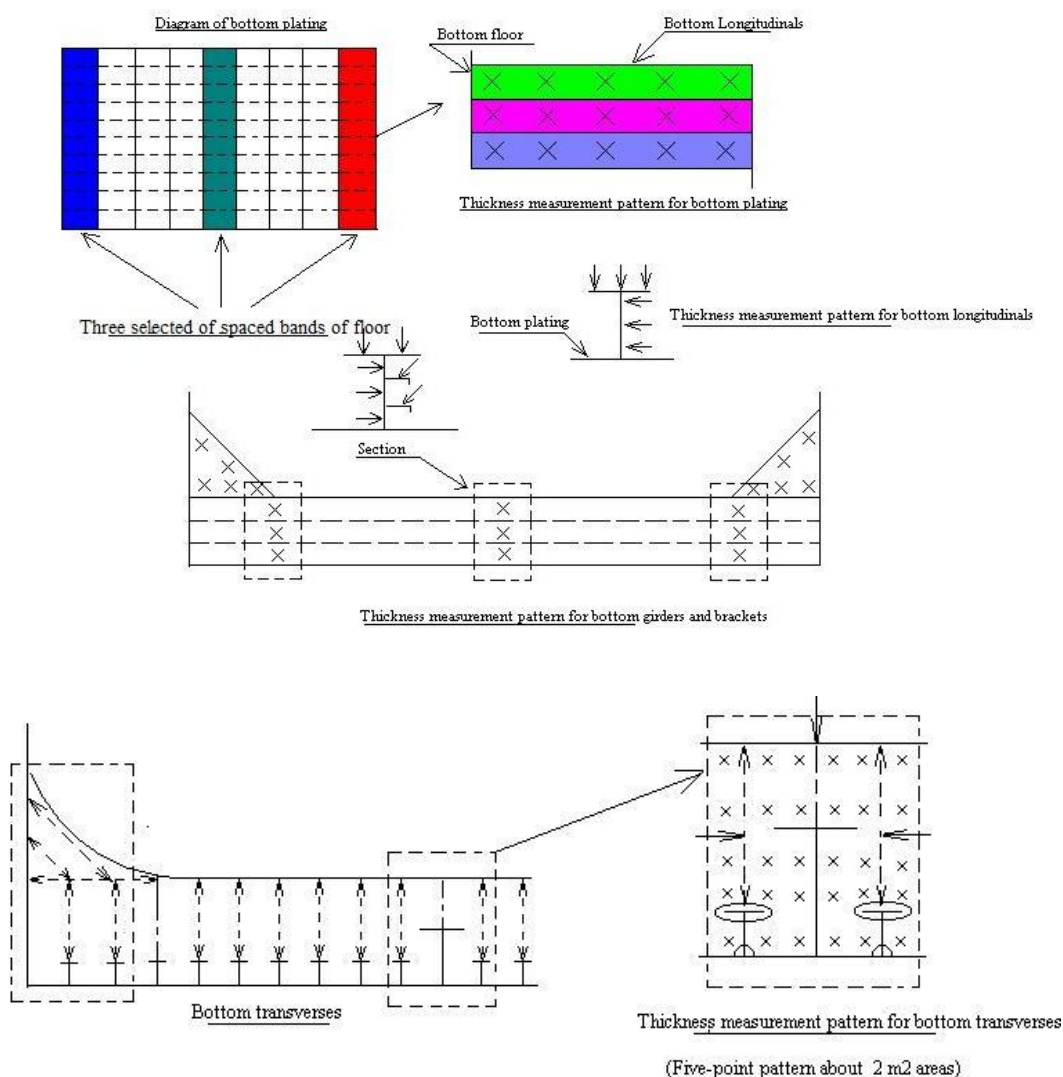
4 Evaluation of local corrosion of CSR oil tankers

Refer to the provisions of 5.1.17, Chapter 5, PART ONE of current ISC Rules.

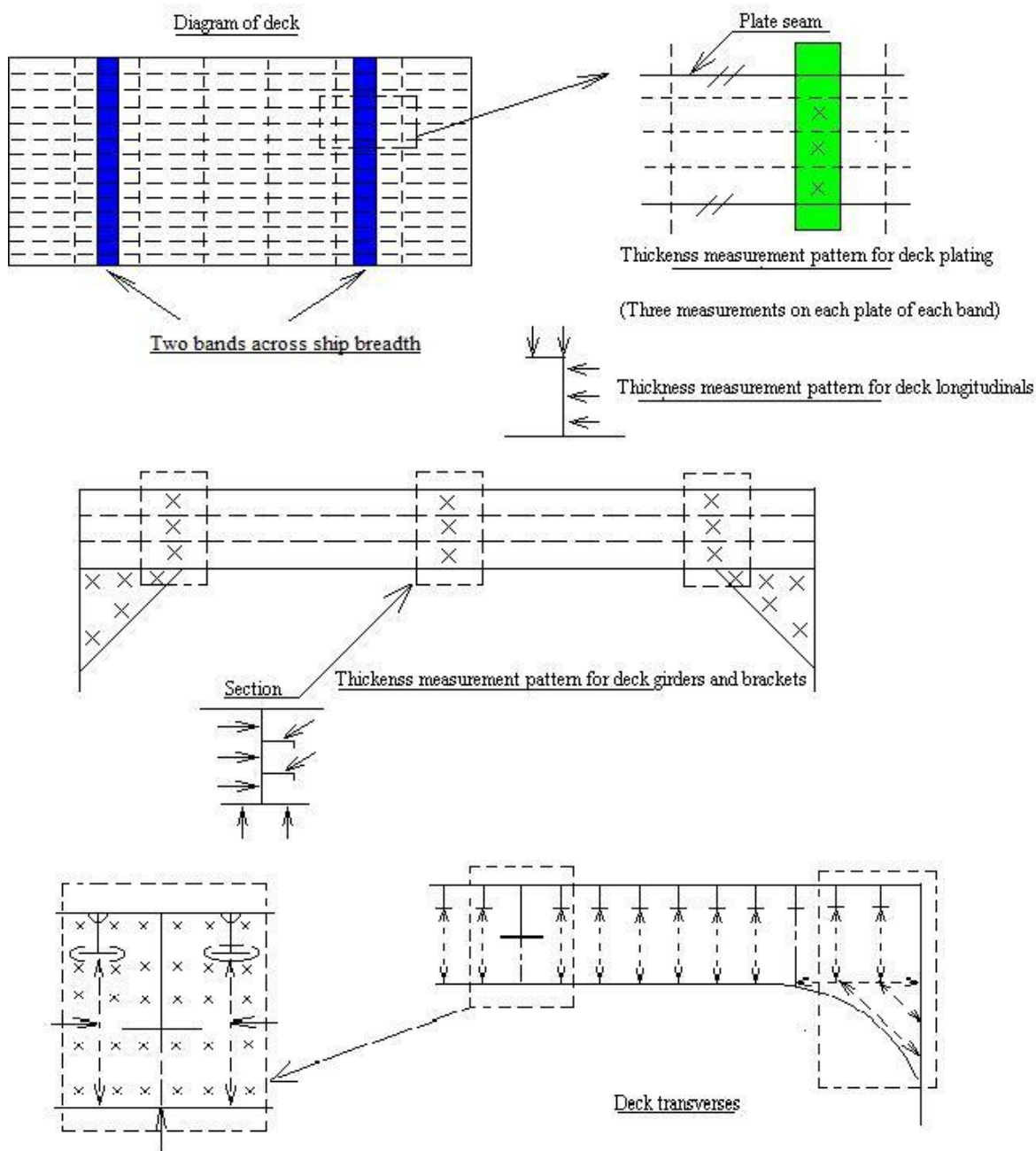
For CSR oil tankers, the identified substantial corrosion areas are required to be examined and additional thickness measurements are to be carried out at annual and intermediate surveys.

V. Diagrams of thickness measurements of areas with substantial corrosion

a) Plans of bottom plating structures



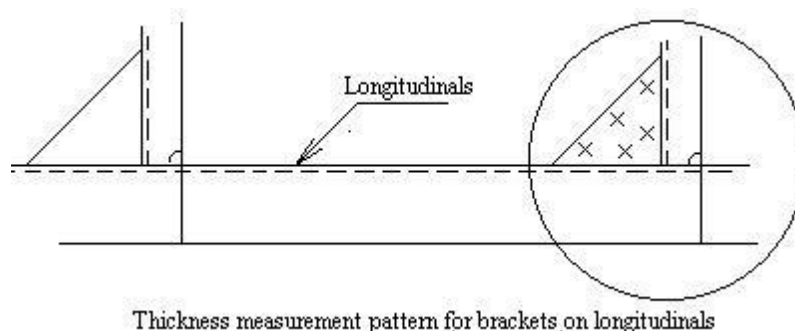
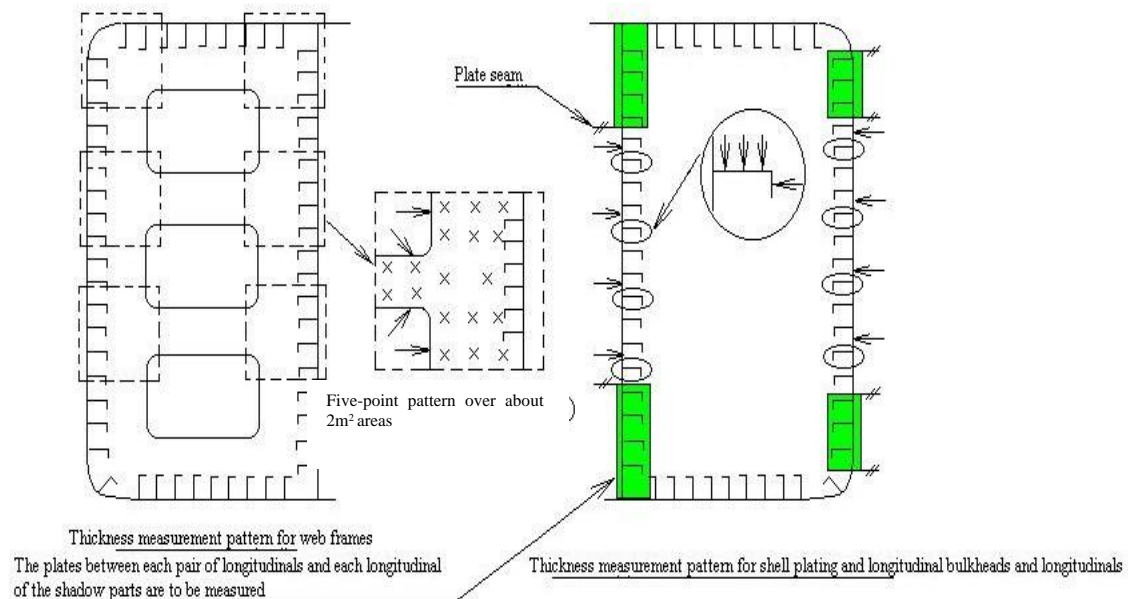
b) Plans of deck structures



Thickness measurement pattern for deck transversees

(Five-point pattern over about 2 m² areas)

c) Shell plating and longitudinal bulkheads



d) Plans of transverse bulkheads

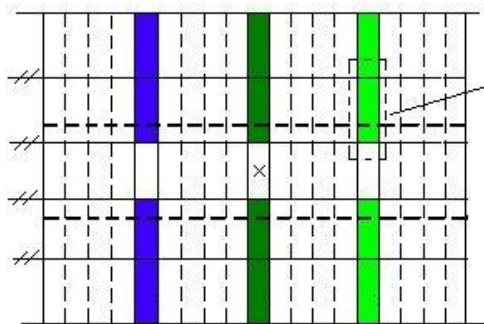
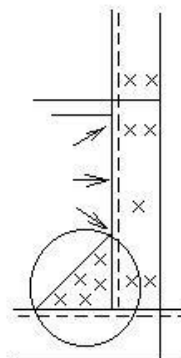
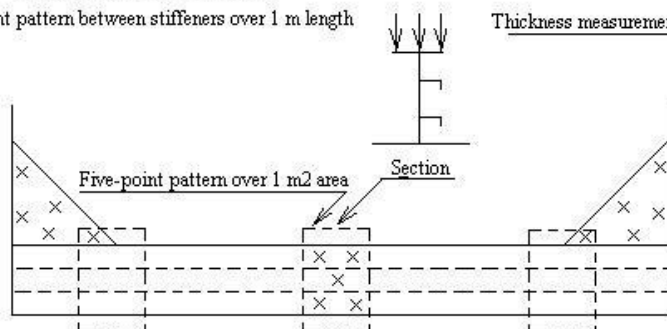


Diagram of transverse bulkheads

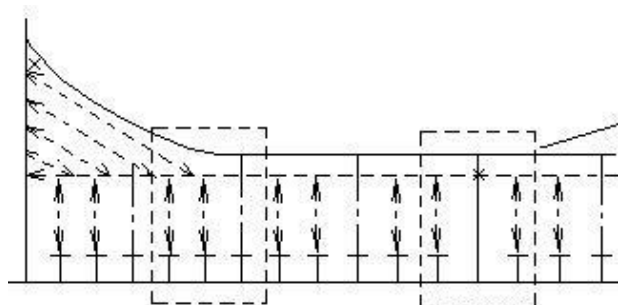
(Five-point pattern between stiffeners over 1 m length



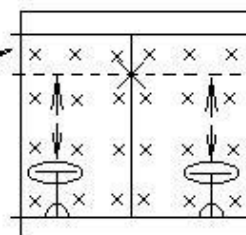
Thickness measurement pattern of stiffeners and brackets



Thickness measurement pattern of deep webs, transverses and brackets



Thickness measurement pattern of stringer platform



(Five point pattern over 1 m2 area)

VI. Application of format of thickness measurement report

1 Relevant provisions for the formats of thickness measurement report and typical transverse section diagrams for single hull oil tankers, ore/oil ships and etc. are given in 13.1, Appendix 13, Chapter 5, PART ONE of current ISC Rules.

2 Relevant provisions for the formats of thickness measurement report and typical transverse section diagrams for double hull oil tankers are given in 13.3A, Appendix 13, Chapter 5, PART ONE of current ISC Rules.

3 Relevant provisions for the formats of thickness measurement report and typical transverse section diagrams for CSR oil tankers are given in 13.3B, Appendix 13, Chapter 5, PART ONE of current ISC Rules.

VII. Requirements for thickness measurements at annual surveys

1 Ballast tanks

Refer to 5.6.2.6, Section 6, Chapter 5, PART ONE of current ISC Rules.

VIII. Requirements for thickness measurements at intermediate surveys

1 Refer to 5.6.3.1, 5.6.3.2, 5.6.3.3 and 5.6.3.4, Section 6, Chapter 5, PART ONE of current ISC Rules.

IX. Preparation of form of thickness measurement report and relevant supplementary provisions

Although the current ISC Rules and IACS Unified Requirements have given provisions on applicable extent of preparation of thickness measurement reports, the Guidelines provide the following supplementary provisions:

1 In the case of complete transverse bulkhead, including girder systems and their adjacent associates, the thickness measurements are to be filled in TM5-T Form or TM5-DHT Form;

2 In the case of complete transverse web frame ring in ballast tanks, including adjacent structural associates, the thickness measurements of the transverse frames are to be filled in TM4-T Form or TM4-DHT Form, while the thickness measurements of the adjacent associates of transverse frames (i.e. associated plating and frames) are to be filled in TM4-T Form or TM4-DHT Form.

Chapter Seven Requirements for Thickness Measurement of Hull of Bulk Carriers and Double-skin Bulk Carriers

I. GENERAL

1 The Requirements apply to surveys of hull structure and piping systems in way of the cargo holds, cofferdams, pipe tunnels, void spaces, fuel oil tanks within the cargo length area and all ballast tanks. The survey of the hull structure out of the cargo area (except for ballast tanks) should be in accordance with Chapter Four.

II. Requirements for thickness measurement at special survey

1 Requirements for special survey of hull and equipment of bulk carriers are given in 5.7.4, Section 7, Chapter 5, PART ONE of current ISC Rules and attention is to be given to the provisions of 5.7.4.1(2), (4) and (5), 5.7.4.2, 5.7.4.3 and 5.7.4.4. The minimum requirements for thickness measurement of single side skin bulk carriers and double skin bulk carriers (as defined in 5.1.5.3(2), Section 1, Chapter 5, PART ONE of current ISC Rules) at special survey are given in Tables 5.7.4.5(1)① and 5.7.4.5(1)②, Section 7, Chapter 5, PART ONE of current ISC Rules.

The minimum requirements for thickness measurements at special hull survey of bulk carriers not having the notation ESP (including double skin bulk carriers) are given in Table 5.7.4.5(1)③, Section 7, Chapter 5, PART ONE of current ISC Rules.

For bulk carriers with hybrid cargo hold arrangements, e.g. with some cargo holds of single side skin and others of double side skin, the requirements for single side skin bulk carriers are to apply to cargo holds of single side skin and the requirements for double side skin bulk carriers are to apply to cargo holds of double side skin and associated wing spaces.

The extent of close-up surveys of single side skin bulk carriers and double skin bulk carriers is shown in Figures 7.1 and 7.3 respectively. The extent of thickness measurements of bulk carriers is shown in Figure 7.2.

2 The minimum requirements for close-up survey at special hull survey of single side skin bulk carriers and double skin bulk carriers are given in Tables 5.7.4.4(1) ② and 5.7.4.4(2) ②, Section 7, Chapter 5, PART ONE of current ISC Rules respectively.

3 The minimum requirements for close-up survey at special hull survey of ore carriers are given in Table 5.7.4.4(2)③, Section 7, Chapter 5, PART ONE of current ISC Rules respectively.

4 The surveyor may extend the close-up survey as deemed necessary taking into account the maintenance of the spaces under survey, the condition of the corrosion prevention system and where spaces have structural arrangements or details which have suffered defects in similar spaces or on similar ships according to available information.

5 For spaces whose protective coating is kept in "GOOD" condition, extent of close-up survey specified in Tables 5.7.4.4(1)②, 5.7.4.4(2)② and 5.7.4.4(2)③ may be specially considered.

6 Extent of thickness measurement

Refer to the provisions of 5.7.4.5, Section 7, Chapter 5, PART ONE of current ISC Rules.

7 For bulk carriers satisfying the requirements of 2.4, Appendix 1, Chapter 5, PART ONE of current ISC Rules, unless in the following conditions, for bulk carriers of 150 m in length and upwards, contracted for construction on or after 1 July 1998 and carrying solid bulk cargoes having a density of 1.0 t/m³ and above, steel renewal is required where the gauged thickness of watertight corrugated bulkheads is less than ($t_{\text{net}} + 0.5$ mm) and coating (applied in accordance with the coating manufacturer's requirements) or annual gauging may be adopted as an alternative to steel renewal (structural members deemed as entering the substantial corrosion area) where the gauged thickness is within the range ($t_{\text{net}} + 0.5$) mm and ($t_{\text{net}} + 1.0$) mm, with t_{net} being net thickness and obtained in accordance with Section 9, Chapter 8 of PART TWO of current ISC Rules. Calculation of net thickness values is to be done with attention to provisions of paragraph 3, Part II of Chapter Three of the Guidelines.

(1) double skin bulk carriers the keels of which were laid or which were at a similar stage of construction before 1 July 1999;

(2) double skin bulk carriers the keels of which were laid or which were at a similar stage of construction before 1 January 2000, with distance between inner and outer skins being not less than 760 mm;

(3) double skin bulk carriers the keels of which were laid or which were at a similar stage of construction

before 1 January 2000, with distance between inner and outer skins being not less than 1,000 mm.

8 For bulk carriers satisfying the requirements of 2.5, Appendix 1, Chapter 5, PART ONE of current ISC Rules, i.e. bulk carriers contracted for construction on or after 1 July 1998 and complying with Section 11, Chapter 8, PART TWO of current ISC Rules, steel renewal is required where the gauged thickness of hatch covers is less than $(t_{\text{net}} + 0.5)$ mm. Where the gauged thickness is within the range between $(t_{\text{net}} + 0.5)$ mm and $(t_{\text{net}} + 1.0)$ mm, coating (applied in accordance with the coating manufacturer's requirements) or annual gauging may be adopted as an alternative to steel renewal (structural members deemed as entering the substantial corrosion area). For internal members of pontoon hatch covers, steel renewal is required where the gauged thickness is less than t_{net} or the surveyor deems it necessary based on the corrosion or deformation. The t_{net} is net thickness and to be obtained in accordance with Section 11, Chapter 8 of PART TWO of current ISC Rules.

For bulk carriers, ore carriers and combination carriers^① contracted for construction on or after 1 January 2004 and complying with Section 11, Chapter 8, PART TWO of current ISC Rules, steel renewal is required where the gauged thickness is less than $t_{\text{net}} + 0.5$ mm for single skin hatch cover and pontoon hatch cover platings, hatching coamings and coaming stays. Where the gauged thickness is within the range $t_{\text{net}} + 0.5$ mm and $t_{\text{net}} + 1.0$ mm, coating (applied in accordance with the coating manufacturer's requirements) or annual gauging may be adopted as an alternative to steel renewal. For internal members of pontoon hatch covers, thickness measurement is required when ISC Surveyor deems it necessary based on the corrosion or deformation. Where the gauged thickness is less than t_{net} , the internal structure is to be renewed.

9 For bulk carriers satisfying the requirements of 2.7, Appendix 1, Chapter 5, PART ONE of current ISC Rules, i.e. for the following bulk carriers of 150 m in length and upwards and carrying solid bulk cargoes having a density of 1.79 t/m³ and above, steel renewal is required where the gauged thickness of transverse watertight corrugated bulkheads between cargo holds nos. 1 and 2 is less than $(t_{\text{net}} + 0.5)$ mm and coating (applied in accordance with the coating manufacturer's requirements) or annual gauging may be adopted as an alternative to steel renewal (structural members deemed as entering the substantial corrosion area) where the gauged thickness is within the range between $(t_{\text{net}} + 0.5)$ mm and $(t_{\text{net}} + 1.0)$ mm, with t_{net} being calculated in accordance with IACS UR S19:

(1) Bulk carriers contracted for construction before 1 July 1998 and not complying with IACS UR S18 and 20;

(2) Bulk carriers the keels of which were laid or which were at a similar stage of construction before 1 July 1999 and not complying with IACS UR S18 and 20.

10 For bulk carriers satisfying the requirements of 2.8, Appendix 1, Chapter 5, PART ONE of current ISC Rules, i.e. for bulk carriers which were not built in accordance with Section 3, Chapter 8 of PART TWO of current ISC Rules, steel renewal is required where the gauged thickness of side shell frames of cargo holds is less than t_{REN} mm. Where the gauged thickness is within the range between (t_{REN}) mm and (t_{COAT}) mm, structural members are deemed as entering the substantial corrosion area and sand blasting, coating and reinforcements are to be done and the coating is to be maintained in "as-new" or an equivalent condition (i.e. without breakdown or rusting) at special and intermediate surveys. The t_{REN} and t_{COAT} above are to be calculated in accordance with IACS UR S31.

For bulk carriers constructed according to Section 3, Chapter 8 of Part TWO of current ISC Rules, control of wastage limit of side shell frames is to meet requirements of paragraph 3, Part II of Chapter Three of the Guidelines.

11 Although no clear requirements have been provided for close-up survey and thickness measurement of inner bottom plating of cargo hold of bulk carriers in current ISC Rules and IACS unified requirement, the surveyor is to pay attention to the inspection of the inner bottom plating of cargo hold of bulk carrier. If the surveyor finds suspect area or severe corrosions during the survey, he is to require the additional thickness measurement of the inner bottom plating of cargo hold of bulk carriers.

12 Number and locations of measurements of CSR bulk carriers

(1) Application

The item only applies to CSR bulk carriers. For non CSR bulk carriers, the requirements for number and

① Bulk carriers, ore carriers and combination carriers are defined in Appendix 2, Chapter 2 of PART ONE of current ISC Rules.

locations of measurements are to comply with applicable provisions given in Chapter 5, PART ONE of current ISC Rules depending on ship's age and structural elements concerned.

(2) Number of measurements

Considering the extent of thickness measurements according to the different structural elements of the ship and surveys (special, intermediate and annual), the locations of the points to be measured are given for the most important items of the structure.

(3) Locations of measurements

In order to facilitate the understanding of interpretation on requirements for number and locations of measurements of CSR bulk carriers (including single side skin and double skin), refer to Tables 5.1.9.3(3)a and b and relevant figures in Section 1, Chapter 5, PART ONE of current ISC Rules.

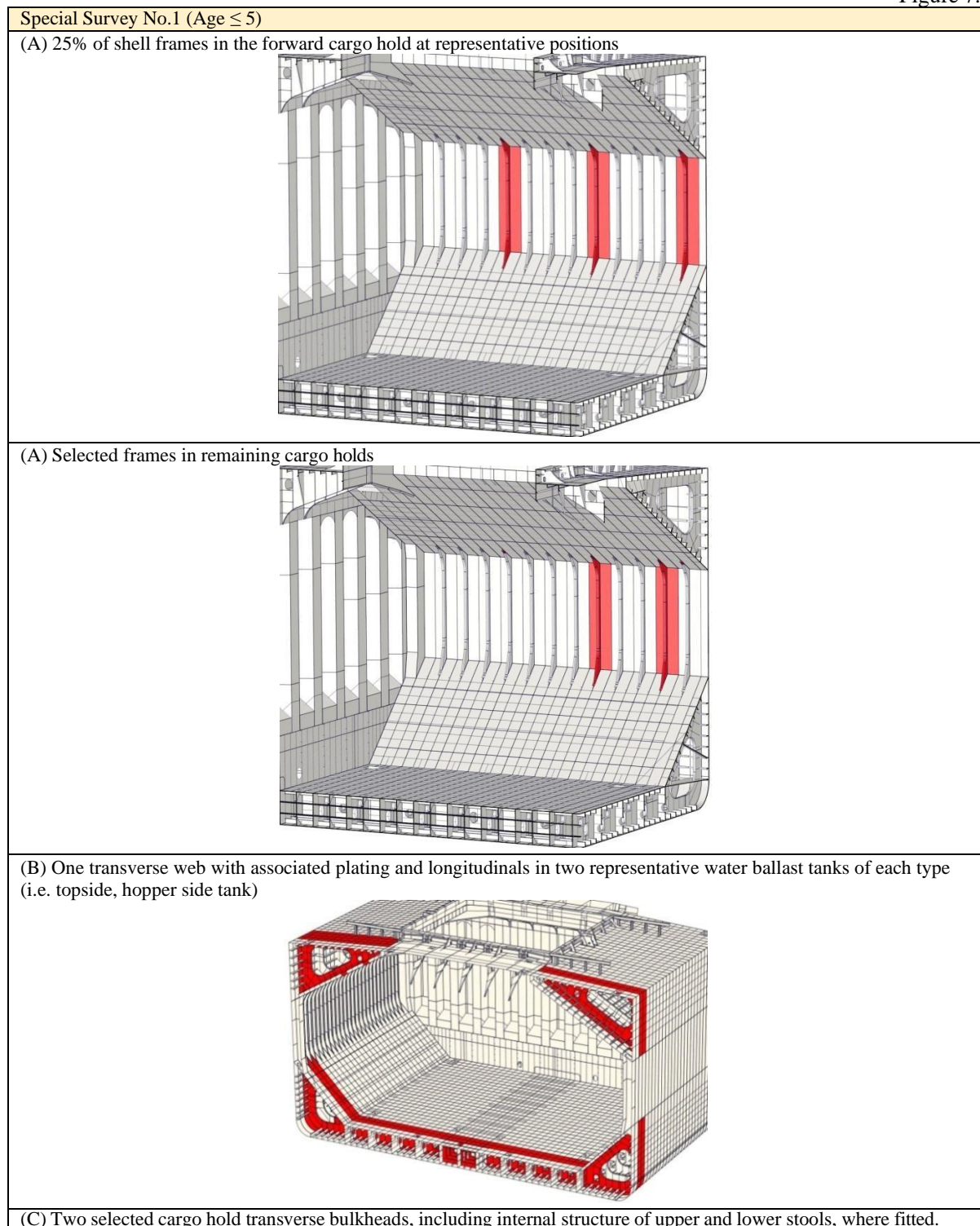
13 Special survey requirements for CSR bulk carriers are given in Section 7, Chapter 5, PART ONE of current ISC Rules.

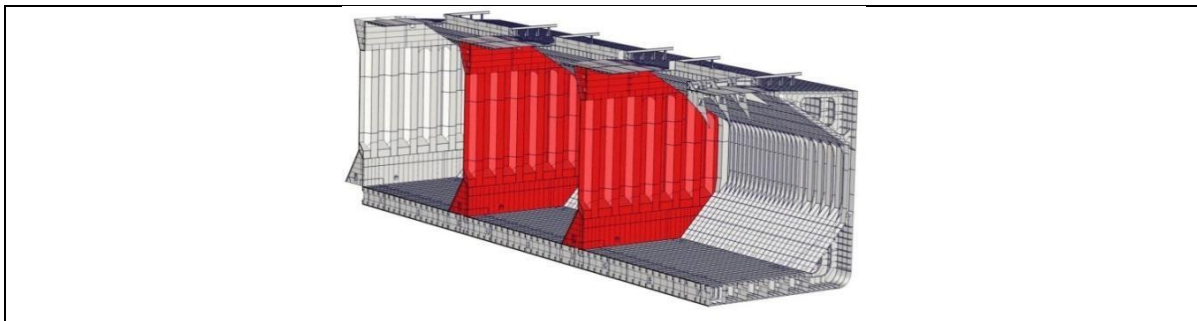
14 For the double side void space adjacent to cargo holds of bulk carriers with an age of over 20 years and a length of 150 meters and above, during special surveys and intermediate surveys, if it is found that the hard protective coating is in a "poor" condition and has not been renewed, or soft coatings or semi-hard coatings are used in such areas, or hard protective coatings were not used during construction, annual inspections shall be carried out for the said void space. During the above-mentioned annual inspections, intermediate surveys and special surveys, thickness measurements shall be conducted when the surveyor deems it necessary or when there is general corrosion.

III. Section 7, Chapter 5, PART ONE of current ISC Rules (corresponding to IACS UR Z10.2&10.5)
— single side skin bulk carriers and double skin bulk carriers

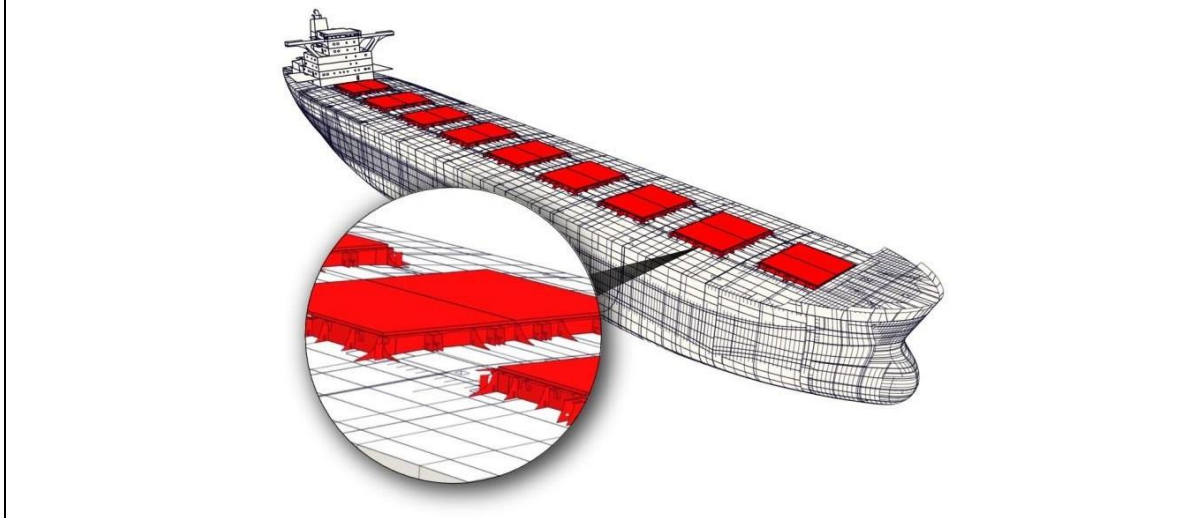
1. Extent of close-up surveys of single side skin bulk carriers

Figure 7.1



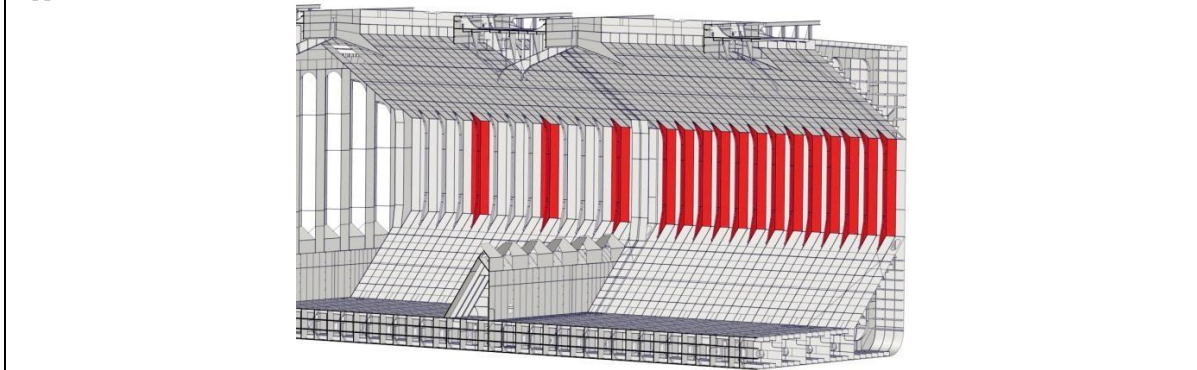


(D) All cargo hold hatch covers and coamings (plating and stiffeners)



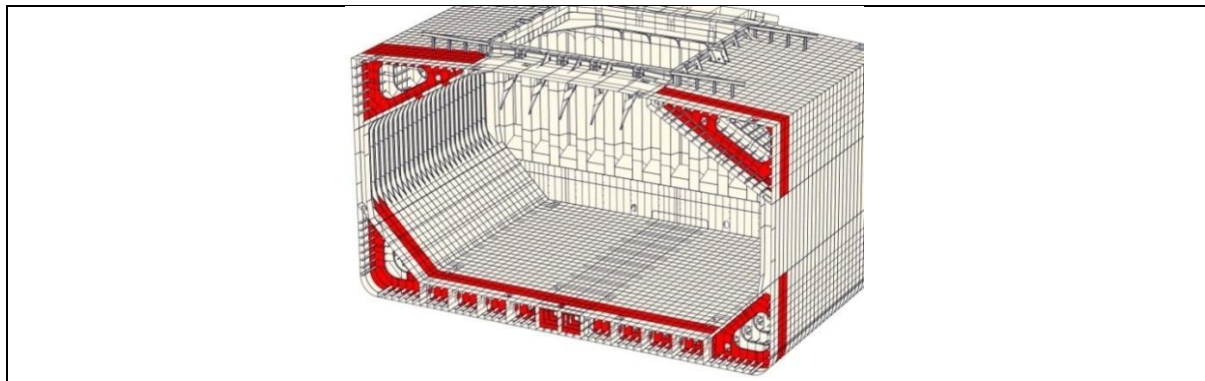
Special Survey No.2 ($5 < \text{Age} \leq 10$)

(A) All shell frames in the forward cargo hold and 25% of shell frames in each of the remaining cargo holds, including upper and lower end attachments and adjacent shell plating

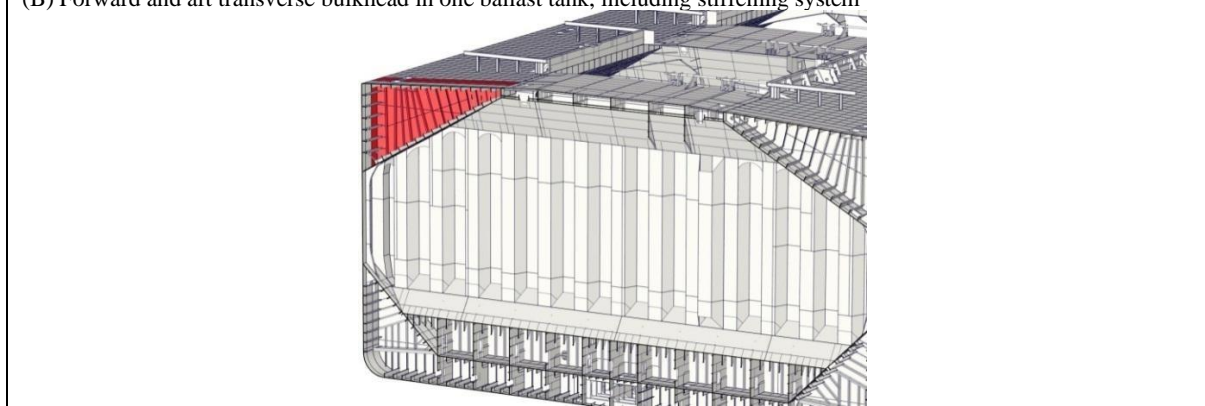


(A) For bulk carriers of 100,000 DWT and above, all shell frames in the forward cargo hold and 50% of shell frames in each of the remaining cargo holds, including upper and lower end attachments and adjacent shell plating

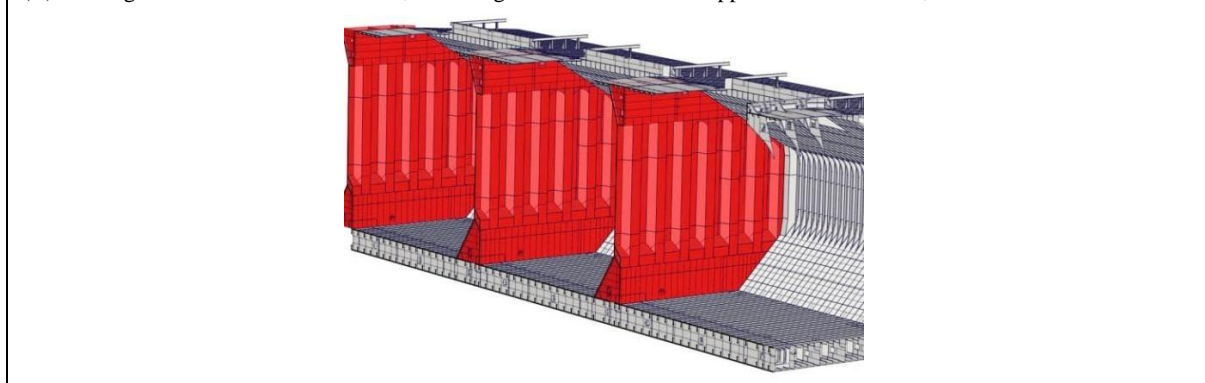
(B) One transverse web with associated plating and longitudinals in each water ballast tank



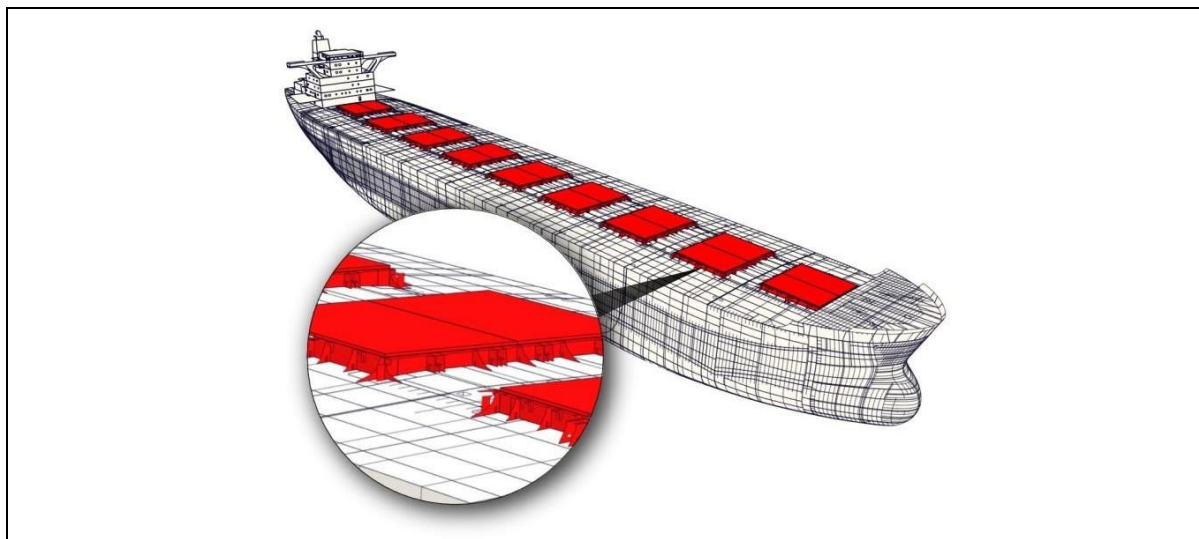
(B) Forward and aft transverse bulkhead in one ballast tank, including stiffening system



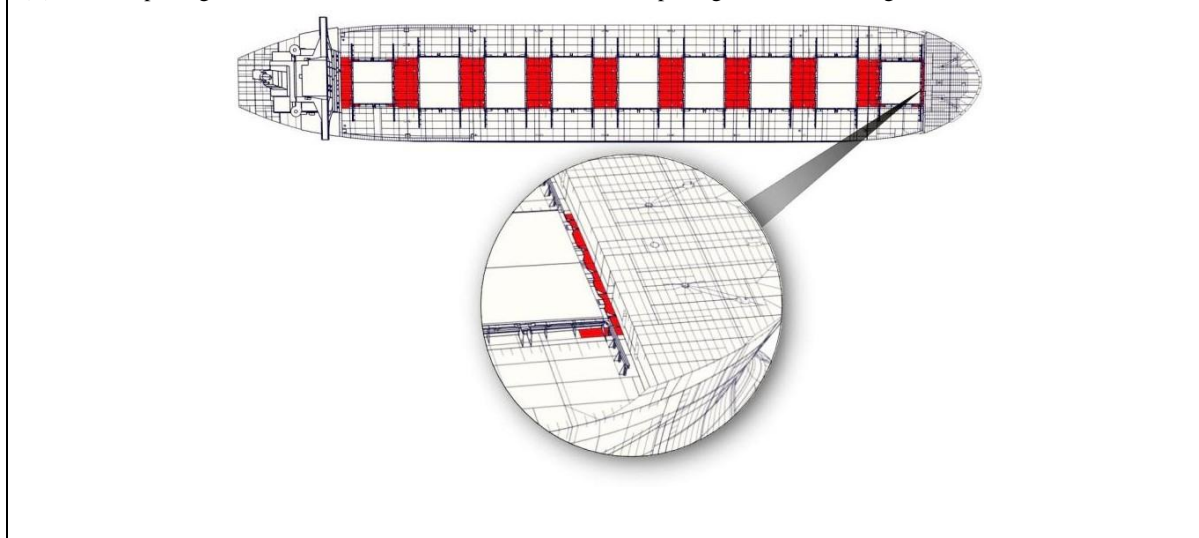
(C) All cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted



(D) All cargo hold hatch covers and coamings (plating and stiffeners)

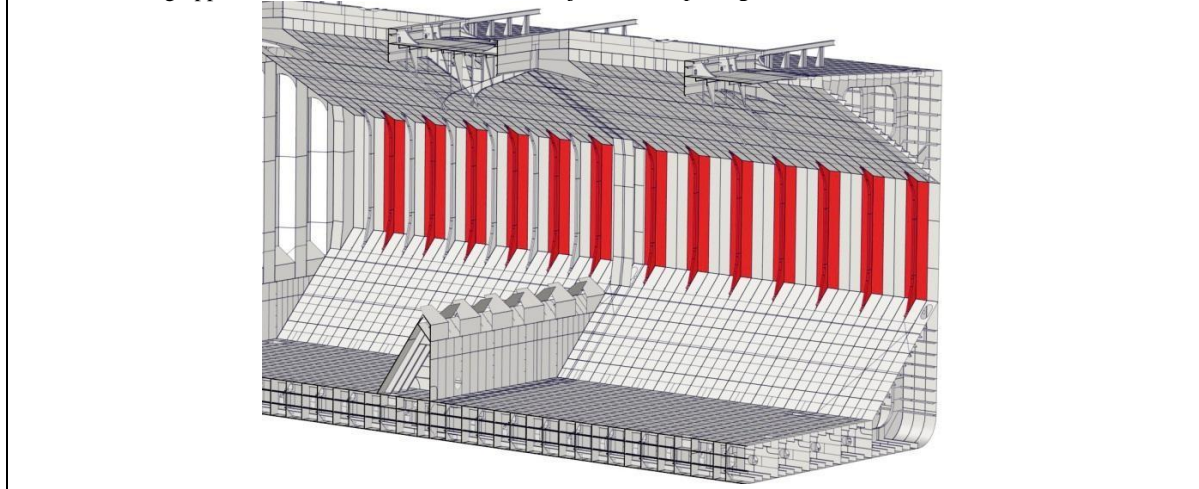


(E) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches

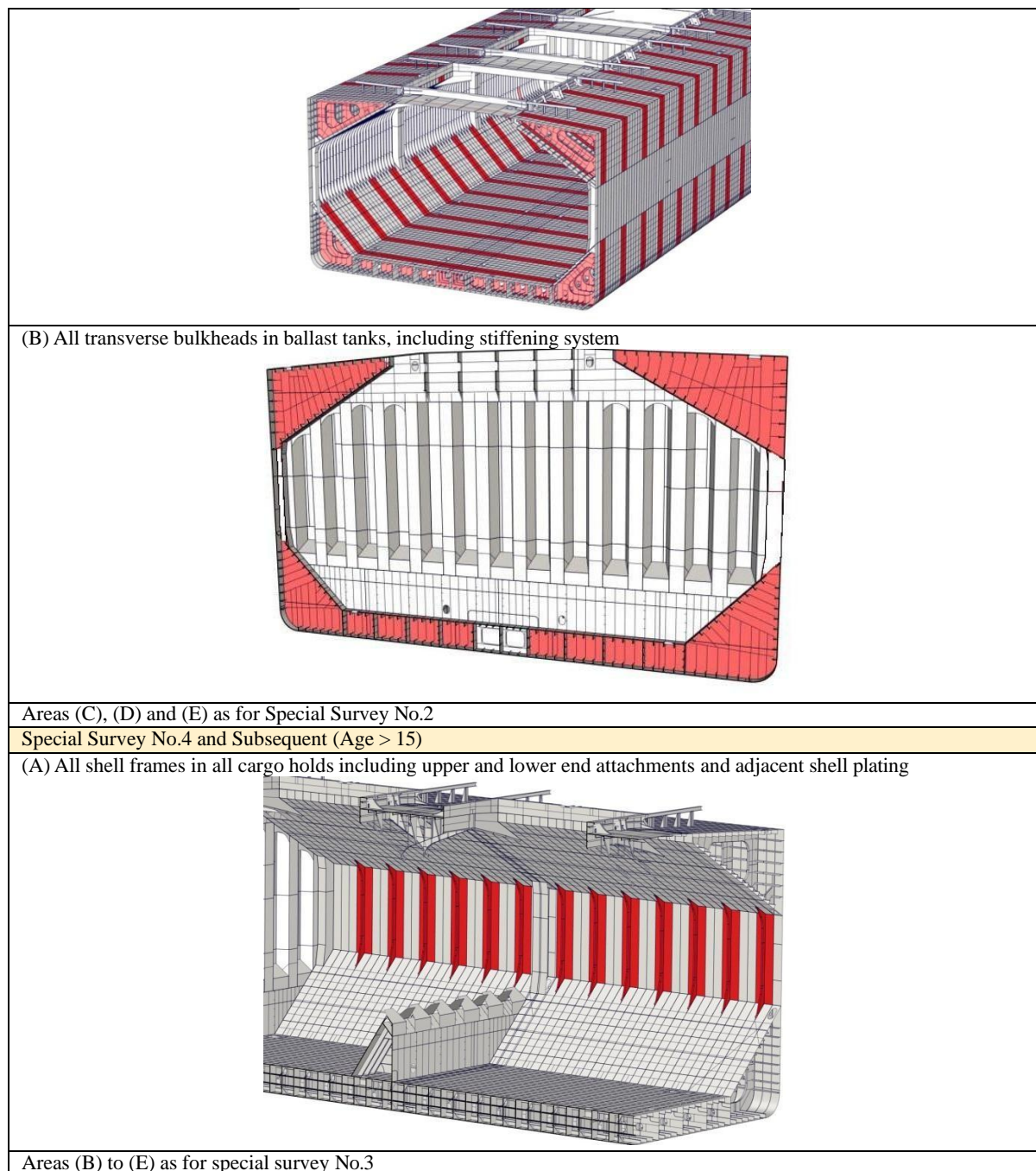


Special Survey No.3 (10 < Age ≤ 15)

(A) All shell frames in the forward and one other selected cargo hold and 50% of frames in each of the remaining cargo holds, including upper and lower end attachments and adjacent shell plating



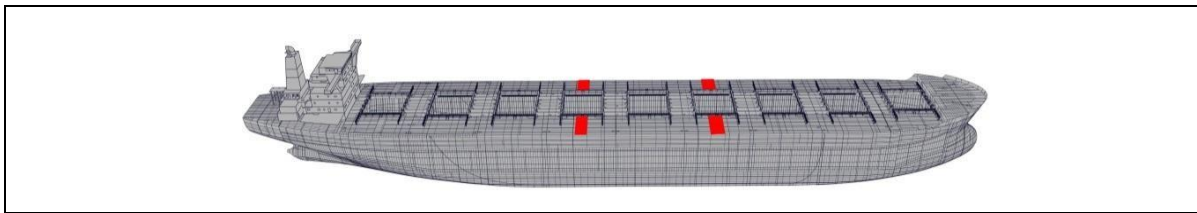
(B) All transverse webs with associated plating and longitudinals in each water ballast tank



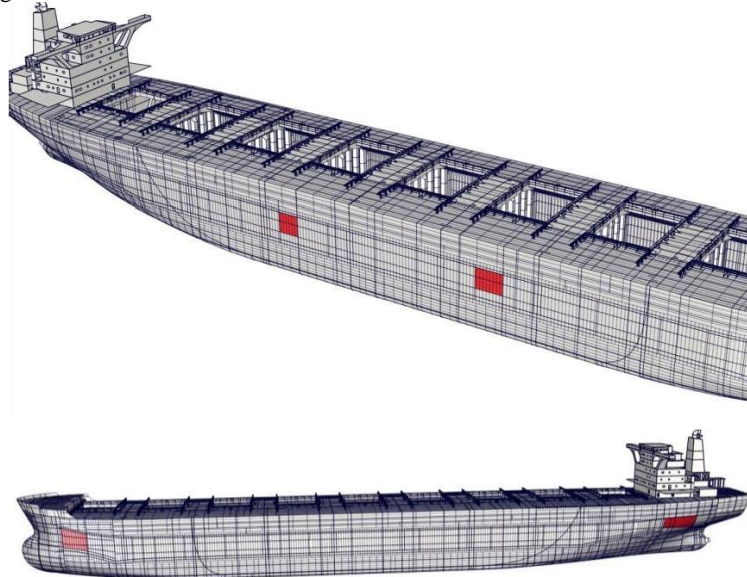
2. Extent of thickness measurements of bulk carriers (including double side skin bulk carriers and ore carriers)

Figure 7.2

Special Survey No.1 (Age ≤ 5)
1) Suspect areas
Special Survey No.2 (5 < Age ≤ 10)
1) Suspect areas
2) Within the cargo length: Two transverse section of deck plating outside line of cargo openings



3) Wind and water strakes in way of the two transverse sections considered above and Selected wind and water strakes outside the cargo length area.



4) Measurement, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey

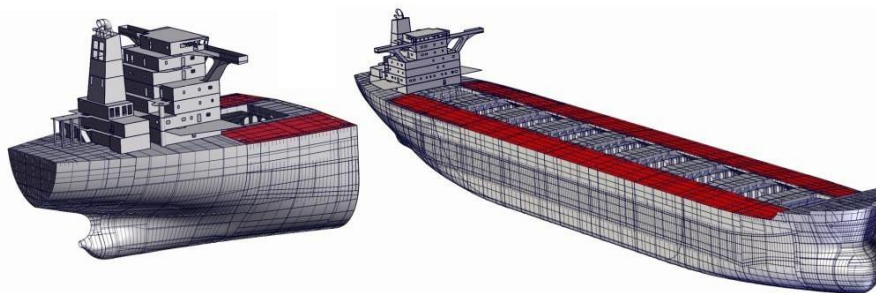
5) Additional thickness measurements of side shell frames and brackets (URS31), where applicable

Special Survey No.3 (10 < Age ≤ 15)

1) Suspect areas

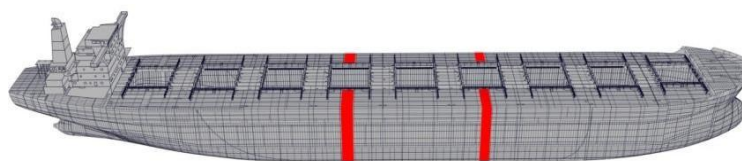
2) Within the cargo length:

a) Each deck plate outside line of cargo hatch openings



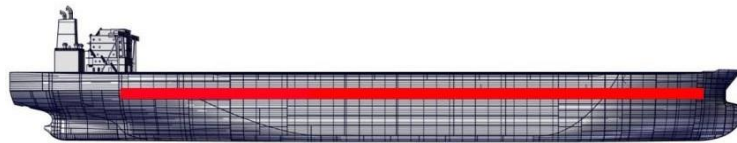

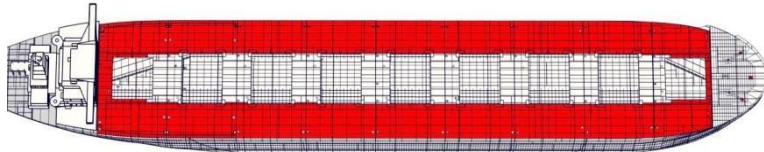
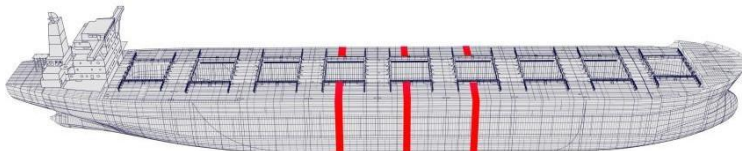

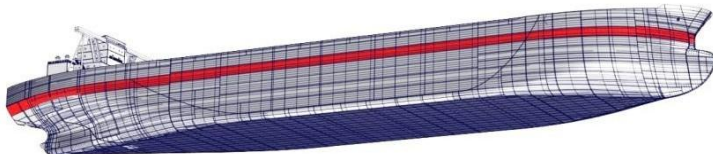
2) Within the cargo length:

b) Two transverse sections, one in the amidship area, outside line of cargo hatch opening



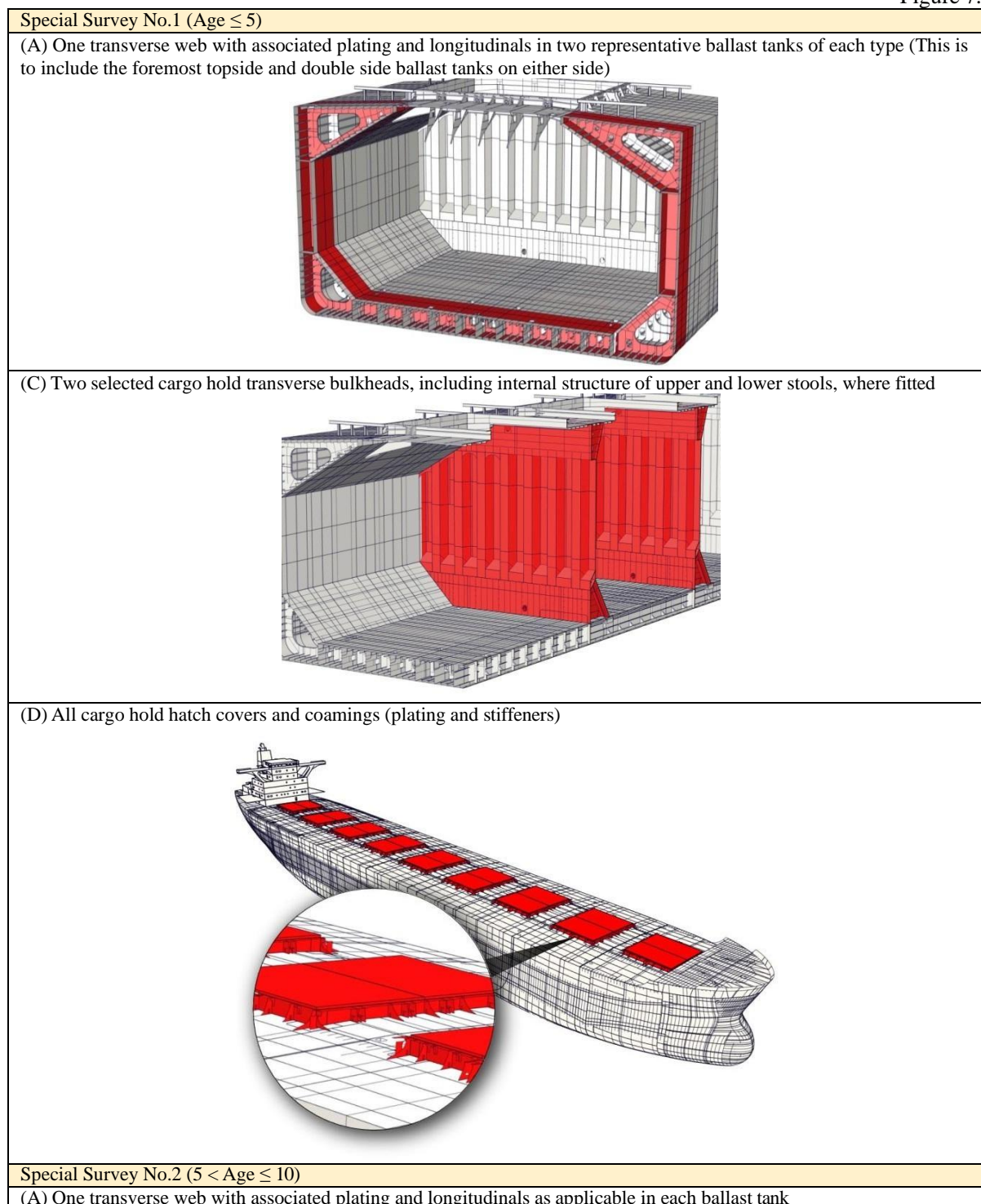
2) Within the cargo length:

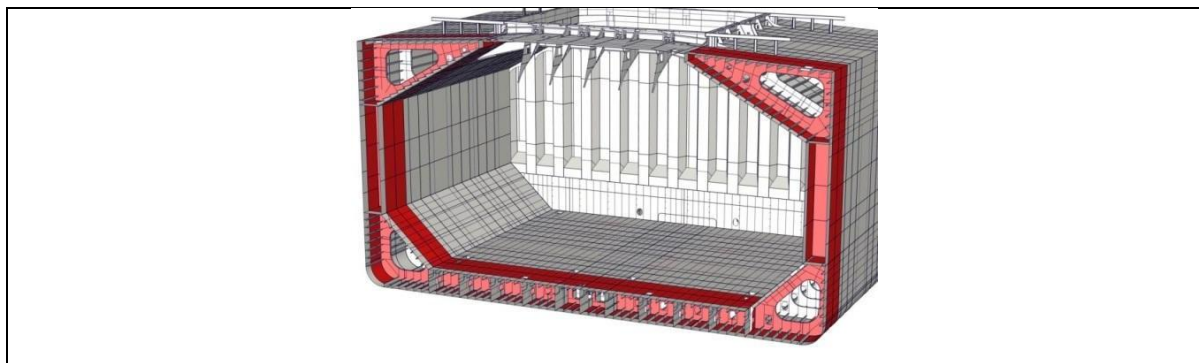
c) All wind and water strakes


<p>3) Selected wind and water strakes outside the cargo length area</p> 
<p>4) Measurement, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey</p>
<p>5) Additional thickness measurements of vertically corrugated transverse watertight bulkhead between cargo holds Nos.1 and 2(URS19), where applicable</p>
<p>6) Additional thickness measurements of side shell frames and brackets (URS31), where applicable</p>
<p>Special Survey No.4 and Subsequent (Age > 15)</p>
<p>1) Suspect areas</p>
<p>2) Within the cargo length:</p> <p>a) Each deck plate outside line of cargo hatch openings</p> 
<p>2) Within the cargo length:</p> <p>b) Three transverse sections, one in the amidship area, outside line of cargo hatch opening</p> 
<p>2) Within the cargo length:</p> <p>c) Each bottom plate</p> 
<p>3) All wind and water strakes, full length</p> 
<p>Points 4, 5 and 6 as for special survey No.3</p>

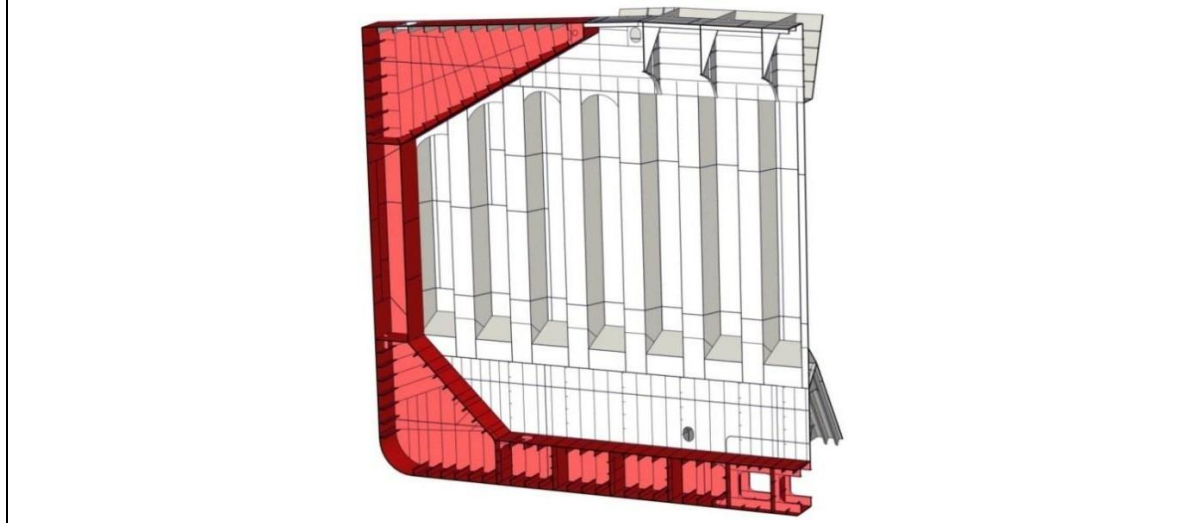
3. Extent of close-up surveys of double side skin bulk carriers (The requirements for close-up survey at special hull survey of ore carriers are given in Table 5.7.4.4(2) ③, Section 7, Chapter 5, PART ONE of current ISC Rules respectively.)

Figure 7.3

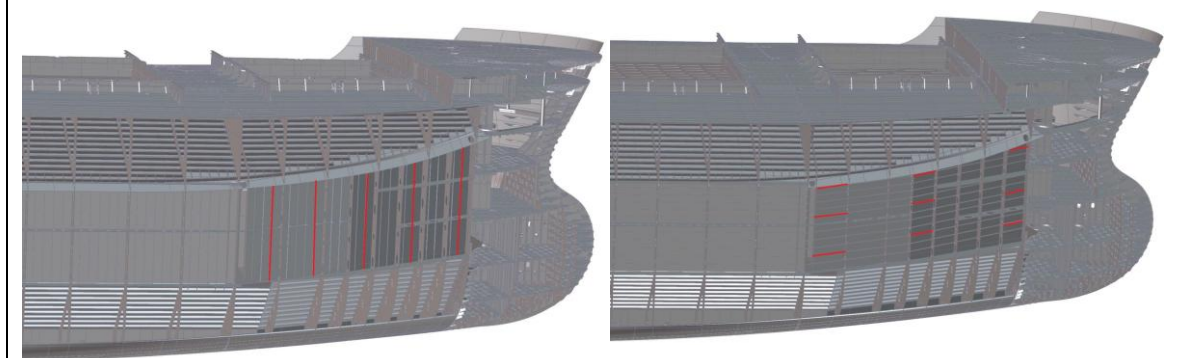




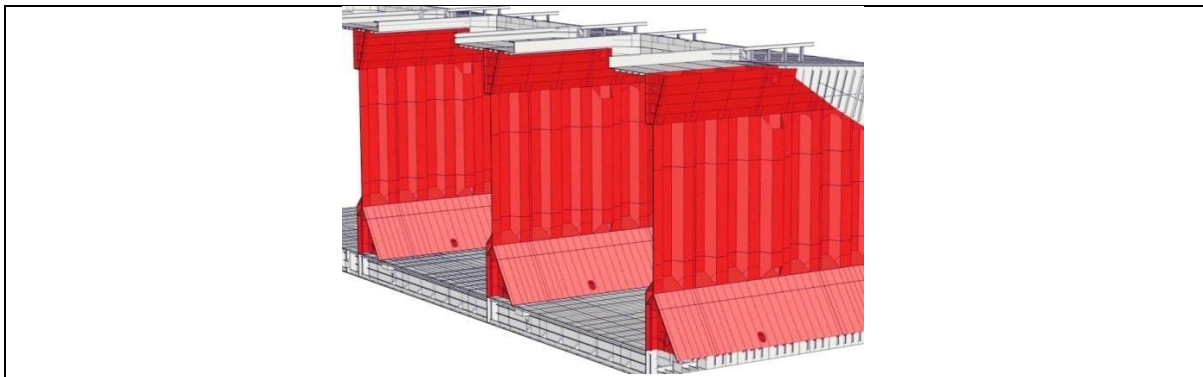
(A) Forward and aft transverse bulkheads including stiffening system in a transverse section including topside, hopper side and double side ballast tanks on one side of the ship (i.e. port or starboard)



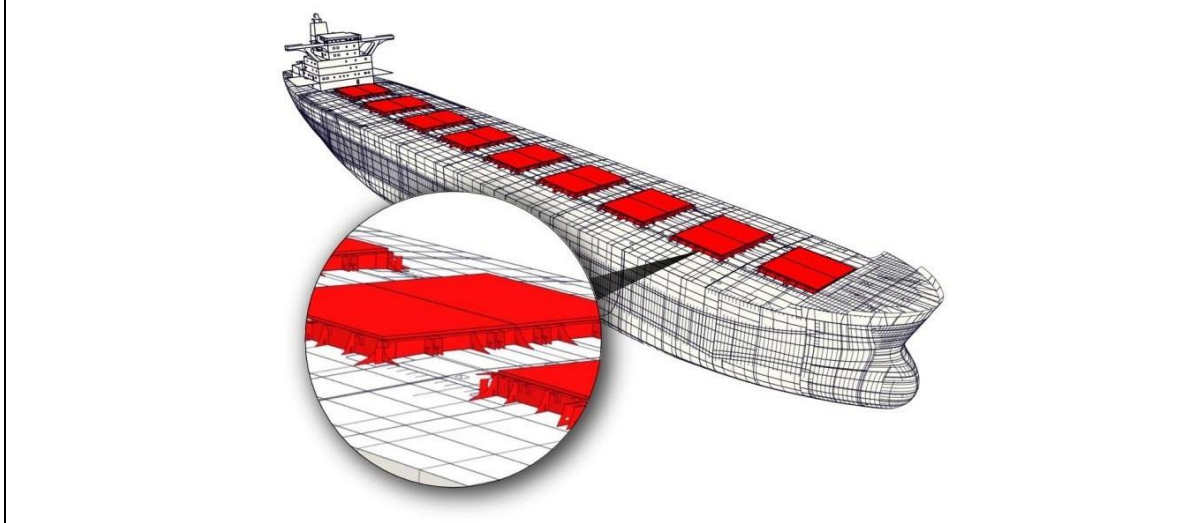
(B) In the foremost double side tanks
 25% of ordinary transverse frames for transverse framing system, or
 25% of longitudinals for longitudinal framing system on side shell and inner side plating at forward, middle and aft parts



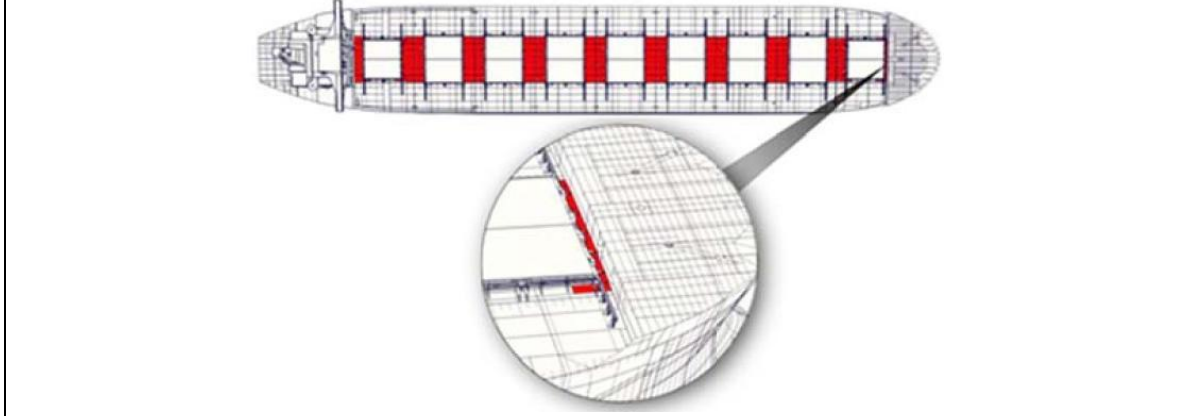
(C) One transverse bulkhead in each cargo hold, including internal structure of upper and lower stools, where fitted



(D) All cargo hold hatch covers and coamings (plating and stiffeners)

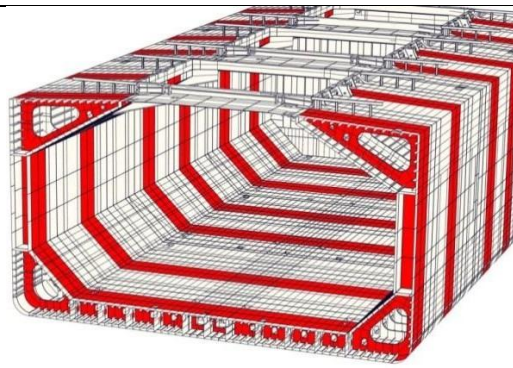


(E) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches

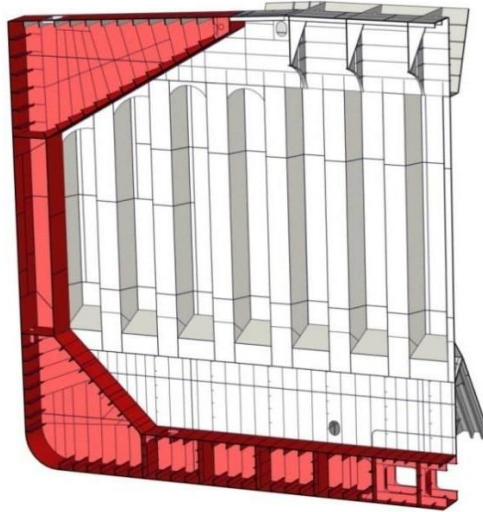


Special Survey No.3 (10 < Age ≤ 15)

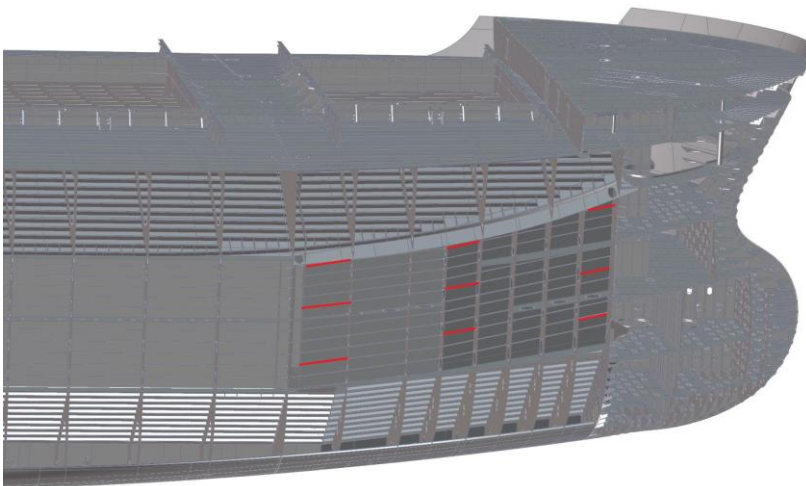
(A) All transverse webs with associated plating and longitudinals as applicable in each water ballast tank

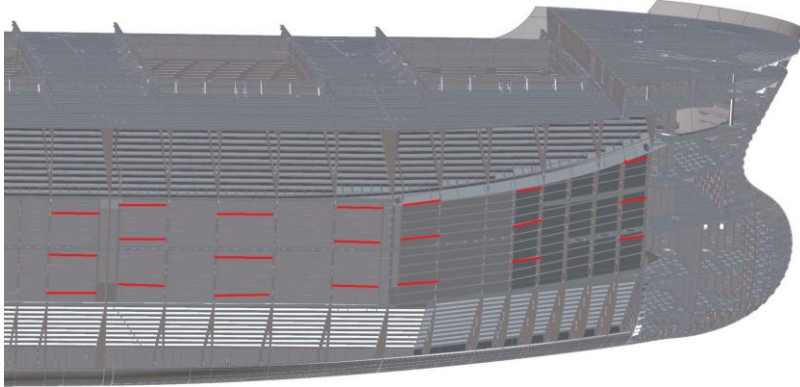


(A) All transverse bulkheads including stiffening system in each water ballast tank

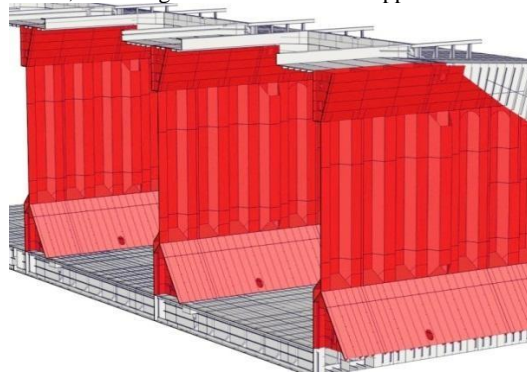


(C) In all double side tanks
 25% of ordinary transverse frames for transverse framing system or
 25% of longitudinals for longitudinal framing system on side shell and inner side plating at forward, middle and aft parts

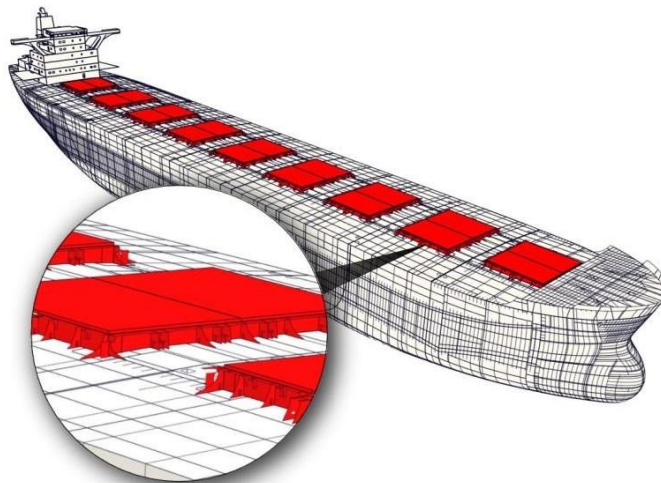




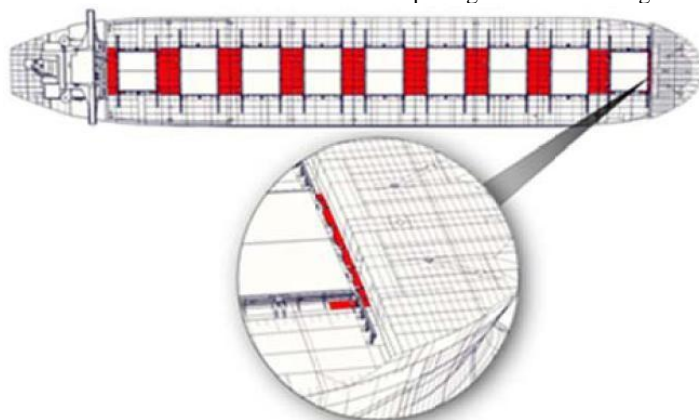
(C) All cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted



(D) All cargo hold hatch covers and coamings (plating and stiffeners)

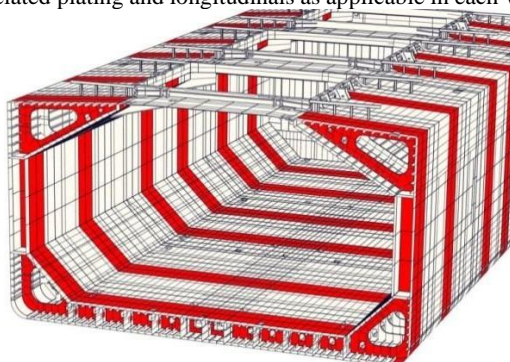


(E) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches

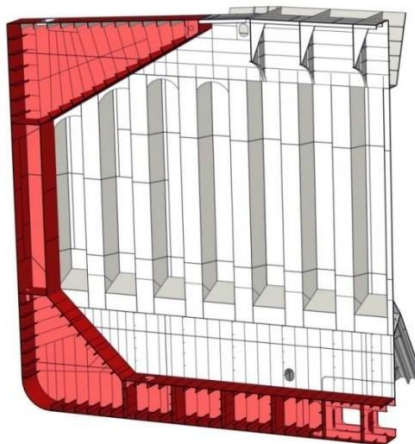


Special Survey No.4 and Subsequent (Age > 15)

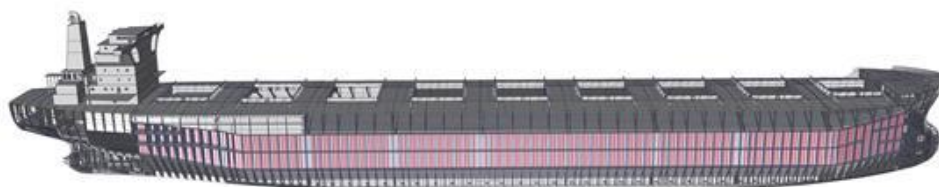
(A) All transverse webs with associated plating and longitudinals as applicable in each water ballast tank



(A) All transverse bulkheads including stiffening system in each water ballast tank



(B) All ordinary transverse frames for transverse framing system or all of longitudinals for longitudinal framing system on side shell and inner side plating at forward, middle and aft parts, in all double side tanks



Areas (C) to (E) as for special survey No.3

IV. Requirements for thickness measuring scantlings of the transverse watertight vertical corrugated bulkhead between cargo holds NOs. 1 and 2 of bulk carriers

1 Applicability of IACS URS19:

Applicable to existing bulk carriers of 150 m in length and above, in the foremost hold, intending to carry solid bulk cargoes having a density of 1,78 t/m³, or above, with single deck, topside tanks and hopper tanks, fitted with vertically corrugated transverse watertight bulkheads between cargo holds No. 1 and 2, and:

- ① Single-side skin bulk carriers which were contracted for construction prior to 1 July 1998, and have not been constructed in compliance with IACS Unified Requirement S18; or
- ② Bulk carriers of double side skin construction of less than 760 mm breadth measured perpendicular to the side shell in ships, the keels of which were laid, or which were at a similar stage of construction, before 1 July 1999 and have not been constructed in compliance with IACS Unified Requirement S18 (Rev. 2, Sept. 2000).

2 Requirement for thickness measurement

Refer to the provisions of Appendix 3, Chapter 5, PART ONE of current ISC Rules.

3 Steel renewal and/or reinforcement is to be in compliance with the requirements in UR S19.

IACS UR S19 requires that for the above applicable vessels, when No.1 cargo hold is flooded, calculate the bending moment and shearing force of the corrugated transverse bulkhead between No.1 and No.2 cargo holds according to the specified loading model and compare against the specified strength standards, to verify if the transverse bulkhead structure is compliant. URS19 assessment results are to be reviewed and approved by ISC Plan Approval Center or by other IACS members. The assessment calculations (for corrugated transverse bulkhead, calculate the bending strength, shearing strength (including shearing bending) and local strength), will get the minimum net thickness t_{net} , b (bending net thickness), $t_{net, s}$ (shearing net thickness) and $t_{net, l}$ (local net thickness), and take the biggest value of the three as t_{net} . The site surveyor is to, in the subsequent intermediate or special survey, verify if it is still complying with the t_{net} requirements listed out in the assessment report or the bulkhead needs to be renewed, strengthened or adopt other equivalent measures by gauge the remaining thickness (t_{gthk}) of corrugated bulkhead between No.1 and No.2 cargo holds. The details are as follows:

Where $t_{gthk} < t_{net} + 0.5$ mm, the bulkhead is to be renewed or strengthened.

Where $t_{net} + 0.5$ mm $\leq t_{gthk} \leq t_{net} + 1.0$ mm, it may be applied with the coating which is in compliance with the relevant requirements of coating manufacturer or measured the thickness every year for the corrugated transverse bulkhead as a monitoring method.

Where $t_{net} + 1.0$ mm $< t_{gthk}$, bulkhead may not be renewed or strengthened.

In the subsequent intermediate or special survey, the site surveyor is to compare the remaining thickness of corrugated bulkhead between No.1 and No.2 cargo holds to see if it is still compliant with the t_{net} listed in the evaluation report, and pay attention to the following:

- (a) For other areas of the bulkhead (e.g. the upper area), they are to be controlled by routine strength criteria (i.e. percentage). If the corrosion is larger than or equal to 20%, it is to be renewed. For webs and wing plates in the mid part and root area of the bulkhead, the renewal criteria for corrosion is to be in accordance with (b) and (c);
- (b) The minimum thickness for renewal is $t_{net} + 2.5$ mm, and no less than the original plate thickness;
- (c) Where $t_{gthk} > t_{net, l} + 0.5$ mm, $t_{gthk} > t_{net, s} + 0.5$ mm and $t_{gthk} < t_{net, b} + 0.5$ mm, the doubling plates may be used instead of renewal. In case (c) is not satisfied, the bulkhead plating is to be renewed.

V. Compliance with requirements for thickness measurement of side shell frames and brackets in single-side skin bulk carriers as specified in IACS URS31

1 Applicability of IACS UR S31

- a. It is applicable to side shell frames and brackets in single-side skin bulk carriers not built in

accordance with IACS URS12 Rev.1 or subsequent revisions;

- b. It is applicable to side shell frames and brackets in single-side skin OBO carriers defined in Appendix 2 of Chapter 2, PART ONE of ISC Rules.

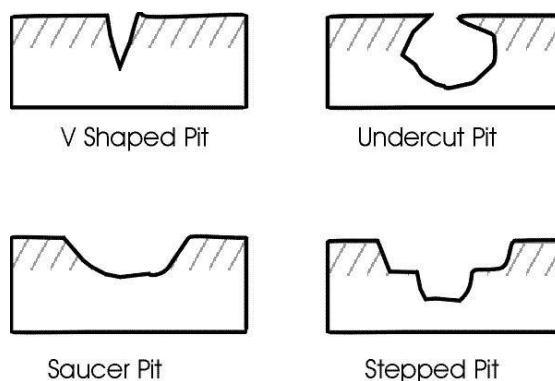
2 Requirements for thickness measurement

Refer to the provisions of Appendix 6, Chapter 5, PART ONE of current ISC Rules.

2.1 Pitting and grooving

2.1.1 Pitting

- ① Pits can grow in a variety of shapes (v-shaped, undercut, saucer and stepped are mostly frequently seen) some of which would need to be ground before assessment. For whatever shapes, pitting weakens the strength of hull structure, especially the long and narrow pitting that may evolve into crack defects. Broad and shallow pitting may weaken the cutting performance. Frequent pitting shapes:



- ② Pitting corrosion may be found under coating blisters, which must be removed before inspection.
- ③ To measure the remaining thickness of pits or grooving, the normal ultrasonic transducer (generally 10 mm diameter) will not suffice. A miniature transducer (3 to 5 mm diameter) must be used. Alternatively the gauging firm must use a pit gauge to measure the depth of the pits and grooving and calculate the remaining thickness.

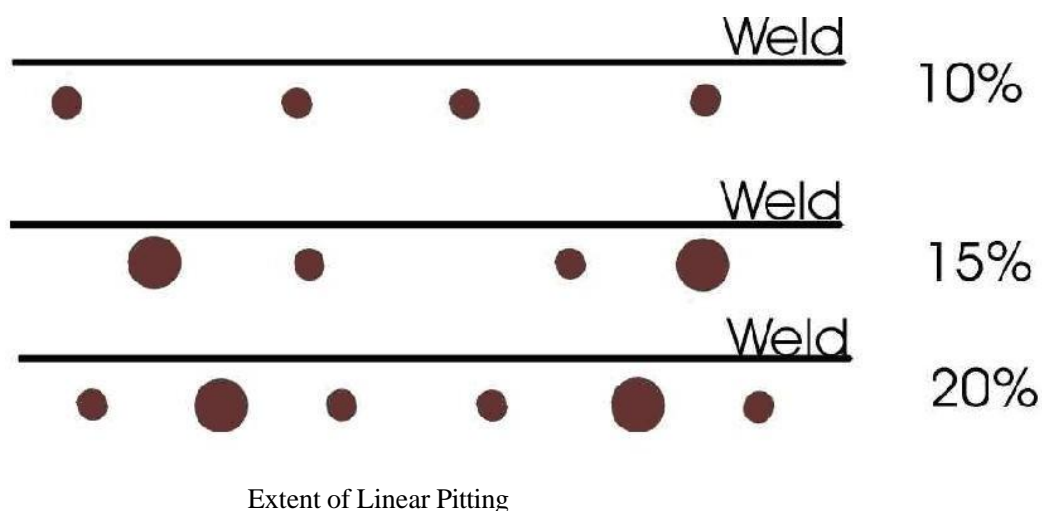
For verification of compliance with UR S31, refer to the provisions of Appendix 6, Chapter 5, PART ONE of current ISC Rules.

If pitting intensity is higher than 15% in an area, then thickness measurements are to be taken to check the extent of the pitting corrosion. Pitting density is to be assessed on each side of the zone A,, B, C or D (if applicable):

- a. Web plating or panel of the shell frame of cargo hold;
- b. End brackets (including web and panel) of the shell frames of cargo hold;
- c. The side shell, hopper tank plating or topside tank plating attached to the side frame, an area of over a width up to 30 mm from each side of it.;

15% pitting density is based on the pitting or grooving only on one side of the web.

For assessment of pitting and grooving, the surveyor is to make the judgement by his experience and also make quantitative assessment of the corrosion in assessed zones with the following figures:



With the above assessment methodology, the surveyor is to select an area of 300 mm diameter at the most pitted part, and remedial measures are to be taken if the total length of pitting is over 45 mm and pitting intensity over 15%.

15% pitting intensity is based on the pitting or grooving on one side of the web, and if the other side is also found with pitting or grooving, and the corrosion intensity on both sides exceed 15%, thickness measurement is to be considered.

2.1.2 Grooving

Shell frames of cargo holds or end connections that are not coated, if found scattered corrossions, and the thickness of corroded areas, as compared with the framework area, is closer to the side plate, refer to Diagram a, b and c.

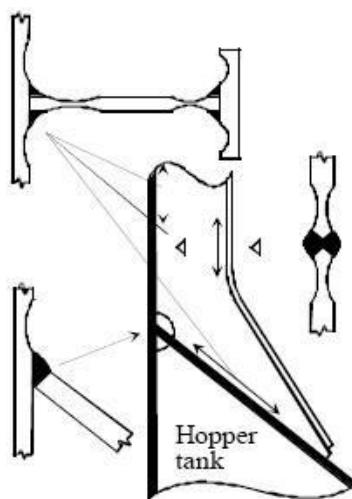


Diagram a

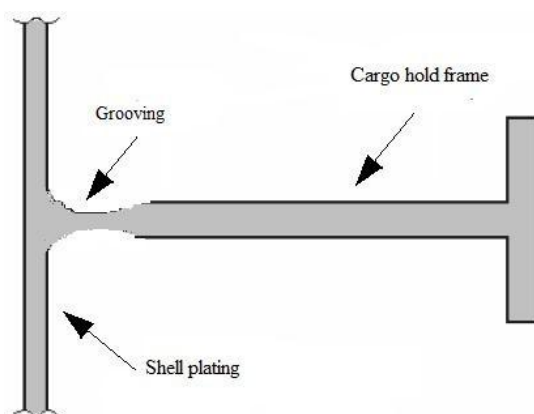


Diagram b

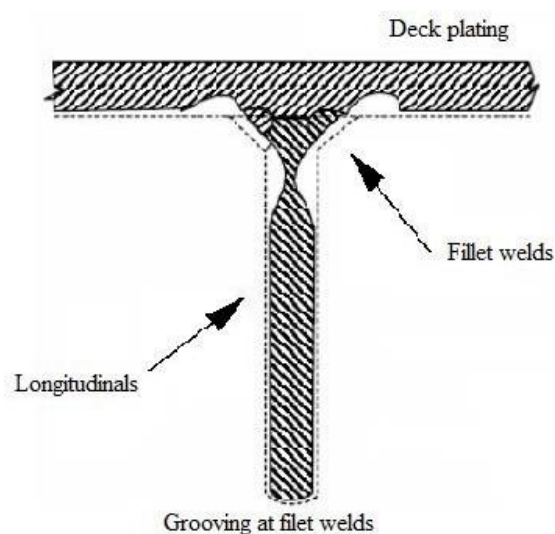
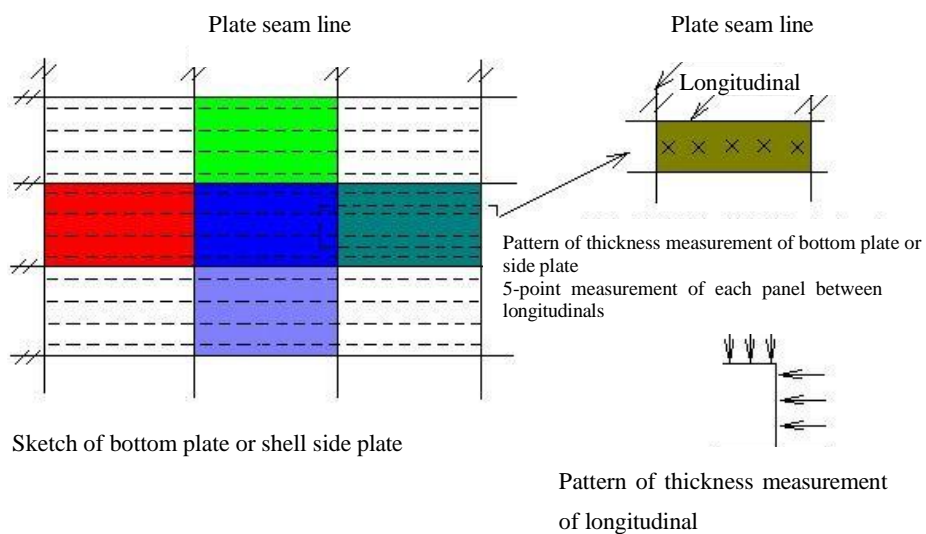


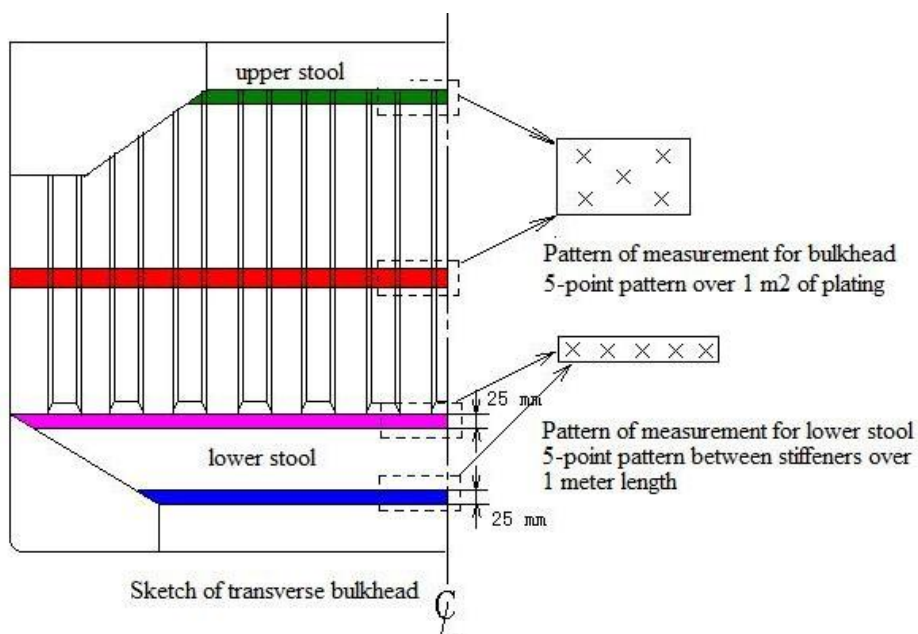
Diagram c

VI. Requirements for the extent of thickness measurement in substantial corrosion areas

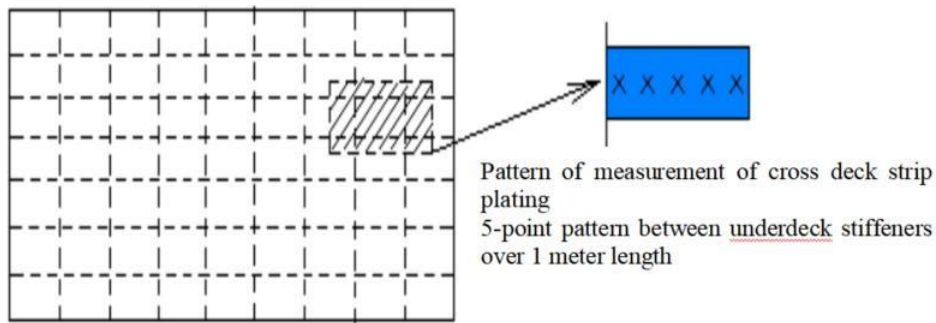
- 1 Requirements for thickness measurement in substantial corrosion areas of single side skin bulk carriers and double skin bulk carriers are given in Tables 5.7.4.5(2)① a ~ e and 5.7.4.5(2)②a ~ d, Section 7, Chapter 5, PART ONE of current ISC Rules respectively.
- 2 For bulk carriers (including double skin bulk carriers) not having the notation ESP, the extended thickness measurement in substantial corrosion areas is to be carried out in accordance with the relevant provisions of Table 5.4.4.2(17)②.
- 3 For CSR ships, the identified substantial corrosion areas may be:
 - a) protected by coating applied in accordance with the coating manufacturer's requirements and examined at annual intervals to confirm the coating in way is still in "GOOD" condition, or alternatively
 - b) required to be measured at annual intervals.
- 4 Diagrams of thickness measurement in substantial corrosion areas
 - 4.1 Shell plating



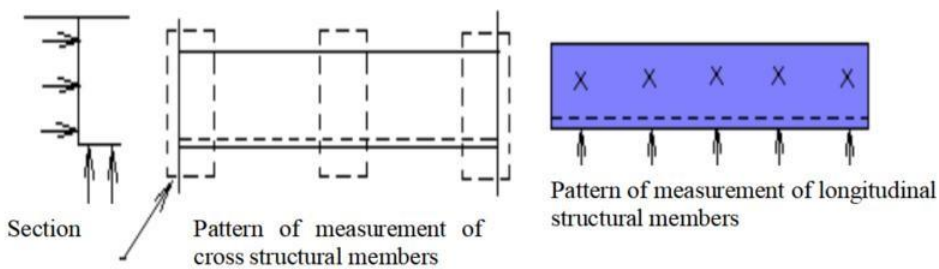
4.2 Transverse bulkhead within the cargo hold



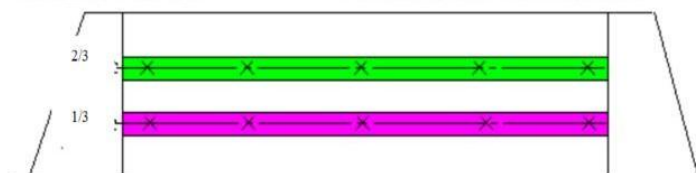
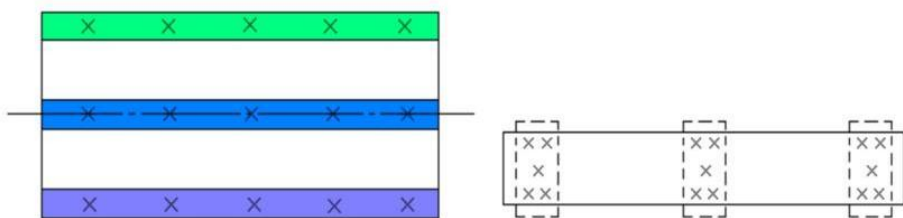
4.3 Cross deck strip plating



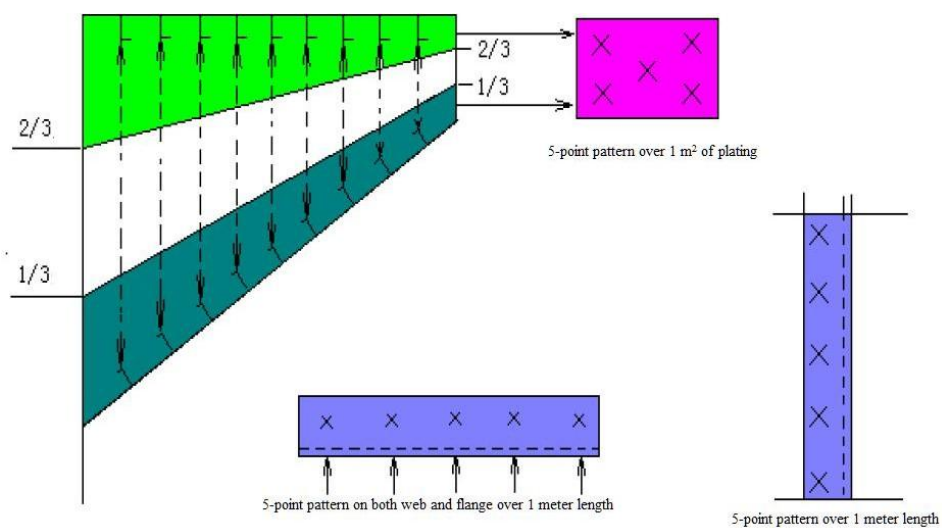
Sketch of cross deck strip plating



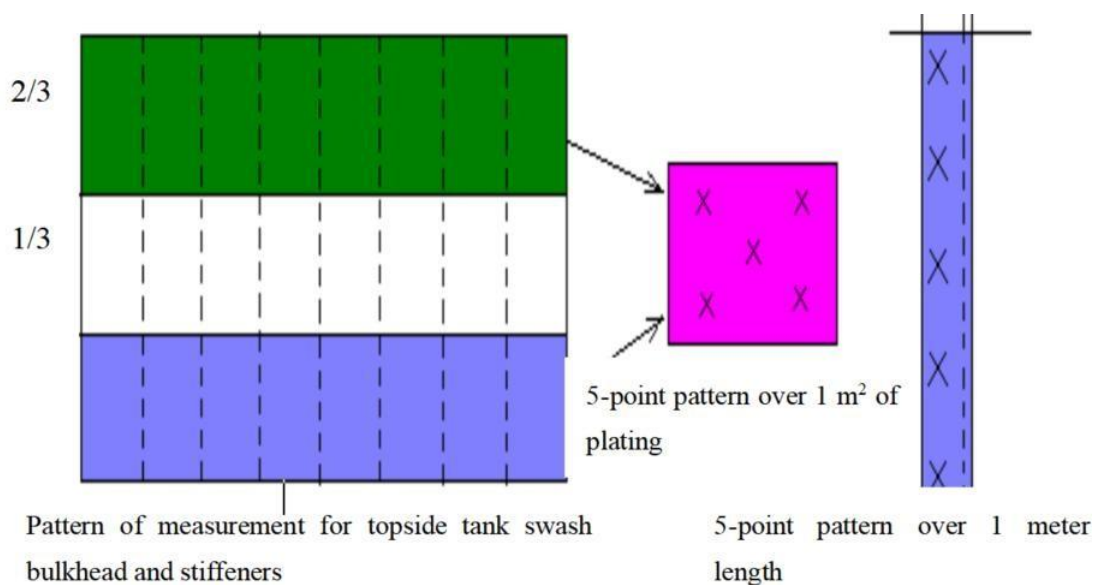
4.4 Hatch cover and coaming



4.5 Topside tank structure

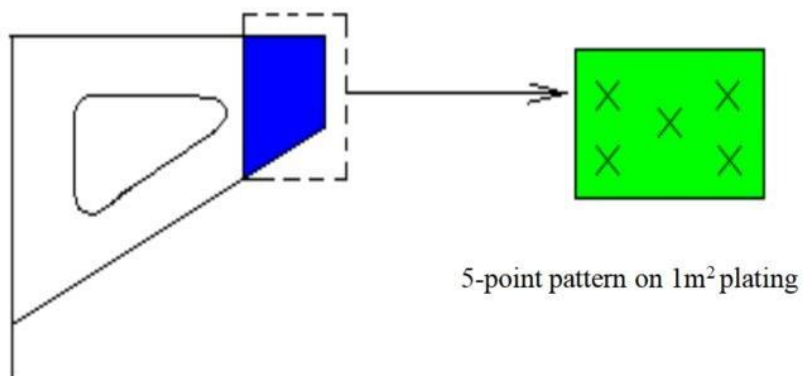
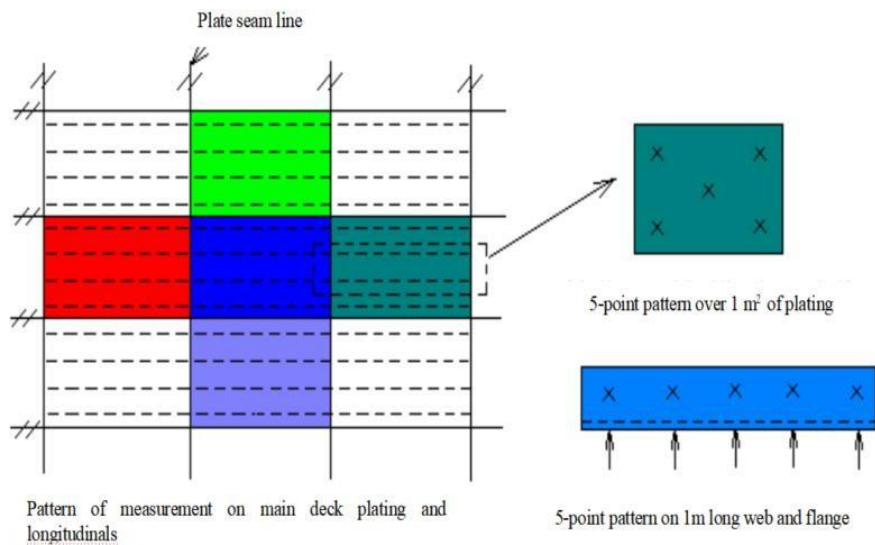


Pattern of measurement for topside tank watertight bulkhead and stiffeners and longitudinals



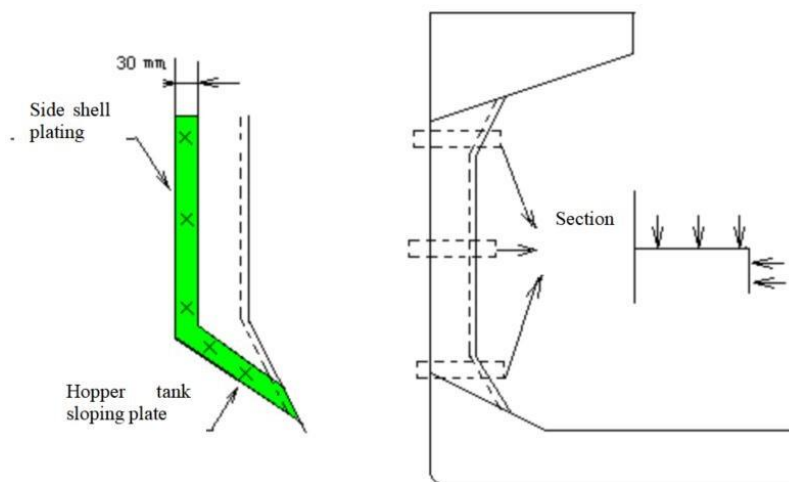
Pattern of measurement for topside tank swash bulkhead and stiffeners

4.6 Main deck and topside tank web frames

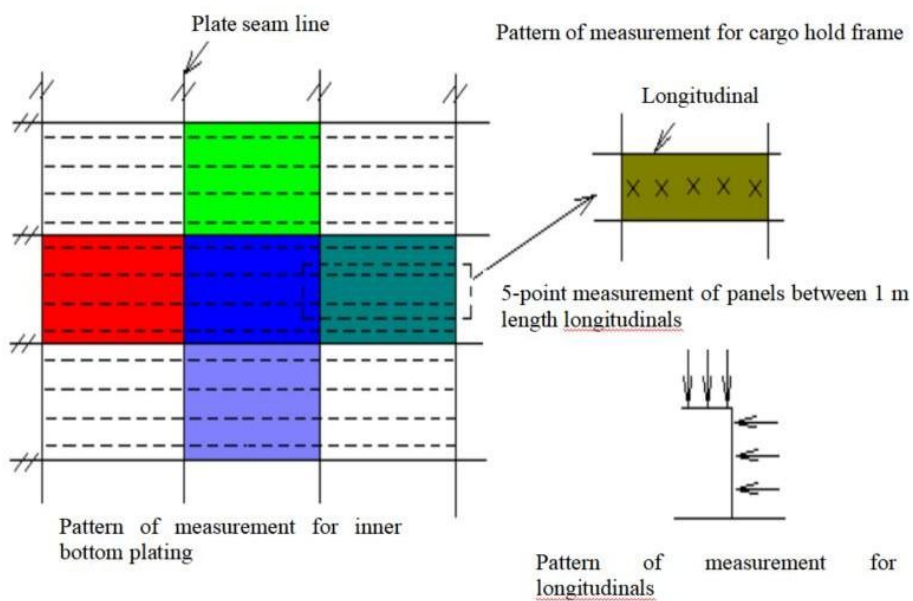


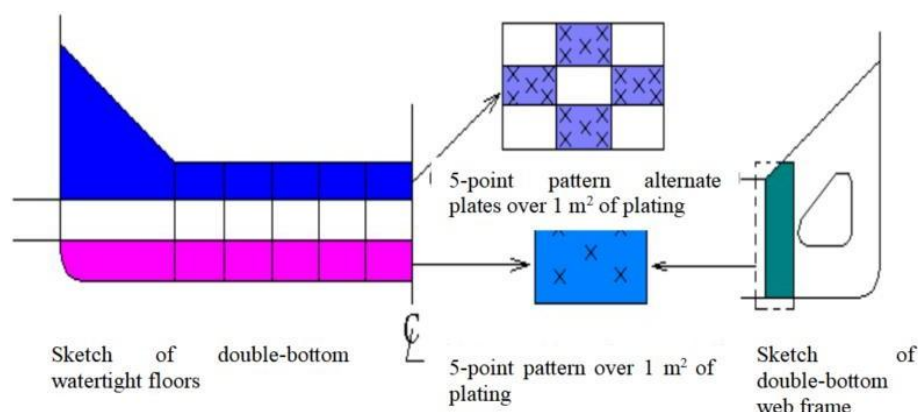
Pattern of measurement for topside tank web frames

4.7 Frame in cargo hold



4.8 Double-bottom and Hopper tank sloping plate structure





VII. Application of format of thickness measurement report

- 1 Relevant provisions for the formats of thickness measurement report and typical transverse section diagrams for single side skin bulk carriers are given in 13.2A, Appendix 13, Chapter 5, PART ONE of current ISC Rules.
- 2 Relevant provisions for the formats of thickness measurement report and typical transverse section diagrams for double skin bulk carriers are given in 13.4A, Appendix 13, Chapter 5, PART ONE of current ISC Rules.
- 3 Relevant provisions for the formats of thickness measurement report and typical transverse section diagrams for CSR bulk carriers and double skin bulk carriers are given in 13.2B and 13.4B, Appendix 13, Chapter 5, PART ONE of current ISC Rules.

VIII. Requirements for thickness measurement at annual survey

- 1 Ballast Tank
Refer to 5.7.2.5, Section 7, Chapter 5, PART ONE of current ISC Rules.
- 2 Cargo hold
Refer to 5.7.2.4, Section 7, Chapter 5, PART ONE of current ISC Rules.
- 3 In the case of bulk carriers of 150 m in length and upwards of single side skin construction, carrying solid bulk cargoes having a density of 1.780 kg/m^3 and above, contracted for construction before 1 July 1999 and constructed with an insufficient number of transverse watertight bulkheads to enable them to withstand flooding of the foremost cargo hold in all loading conditions, the requirements for thickness measurements at annual survey in accordance with SOLAS regulation XII/9.1 are given in 5.7.2.7(3) and (4), Section 7, Chapter 5, PART ONE of current ISC Rules.

IX. Requirements for thickness measurement at intermediate survey

- 1 Refer to 5.7.3.1, Section 7, Chapter 5, PART ONE of current ISC Rules.
- 2 Bulk carriers of 5 to 10 years of age
 - 2.1 Inspection of ballast tank
Refer to 5.7.3.2①, Section 7, Chapter 5, PART ONE of current ISC Rules.
 - 2.2 Inspection of cargo hold
Refer to 5.7.3.2②, Section 7, Chapter 5, PART ONE of current ISC Rules.
 - 2.3 Extent of thickness measurement
Refer to 5.7.3.2③, Section 7, Chapter 5, PART ONE of current ISC Rules.
- 3 Vessels of 10 years of age and above
The requirements of the intermediate survey are to be to the same extent to the previous special survey. Refer to the provisions of 5.7.3.3 and 5.7.3.4, Section 7, Chapter 5, PART ONE of current ISC Rules.

X. Thickness measurement report and supplementary regulations

In spite of the requirements of ISC Rules and IACS Unified Requirements on the format of thickness measurement report and applicability, the Guidelines provide the following supplementary requirements:

1 Cargo hold transverse bulkhead, stiffeners and girders, including the internal structure of upper and lower stools (if fitted), fill in the measurement value in TM5-BC or TM5-DSBC.

2 For complete transverse web frame rings including adjacent structural members, fill in the thickness measurement value of transverse frame in TM4-BC or TM4-DSBC. For the transverse web frame's structural members (adjacent plating and members), fill in the thickness measurement value in TM4-BC or TM4-DSBC.

3 For bulk carriers complying with URS19, gauge the vertical corrugated watertight bulkhead between No.1 and No.2 cargo holds. The thickness values of lower part of bulkhead and central part measured is to be filled in TM5 (a)-BC S19. The newly compiled format is to be filled in as follows:

3.1 URS19 assessment results are to be reviewed and approved by ISC Plan Approval Center or by other IACS members. The assessment calculations (for corrugated transverse bulkhead, calculate the bending strength, shearing strength (including shearing bending) and local strength), will get the minimum net thickness $t_{net, b}$ (bending net thickness), $t_{net, s}$ (shearing net thickness) and $t_{net, l}$ (local net thickness), and take the biggest value of the three as t_{net} . The site surveyor is to, in the follow-up intermediate or special survey, verify if it is still complying with the t_{net} requirements listed out in the assessment report or the bulkhead needs to be renewed, strengthened or adopt other equivalent measures by gauge the remaining thickness (t_{gthk}) of corrugated bulkhead between No.1 and No.2 cargo holds. When $t_{gthk} < t_{net} + 0.5\text{mm}$ (corresponding to the items in Max. Alwb.Dim), the bulkhead is to be renewed or strengthened; when $t_{net} + 0.5\text{mm} \leq t_{gthk} \leq t_{net} + 1.0\text{mm}$, which is equivalent to substantial corrosion areas specified in regular strength standards (corresponding to $t_{net} + 0.5\text{mm}$ and $t_{net} + 1.0\text{mm}$, providing two end numerical values for substantial corrosion areas). Each year, it may be taken as the way to monitor the coating on the bulkhead concerned as required by the manufacturer or the thickness measurement.

3.2 For bulk carriers complying with URS19, gauge the vertical corrugated watertight bulkhead between No.1 and No.2 cargo holds. The thickness measurement value of lower part of the bulkhead concerned (web frame, panel, shedder plates and gusset plates) and central part (web frame and panel of each corrugation) is to be filled in TM5 (a) –BC S19.

3.3 For bulk carriers complying with URS19, gauge the vertical corrugated watertight bulkhead between No.1 and No.2 cargo holds. In addition, gauge the upper part of bulkhead concerned, including the inner structure of upper and lower stools (if fitted), and fill in the value in TM5-BC. Selection of measured points is based on Figure 8, Chapter X of the Guidelines.

3.4 When TMS (a)-BC S19 is applied, specify the Location of Structure. When gauge the web frame of lower part, fill in Low Web, etc.

4 For bulk carriers complying with URS31, the thickness measurement value of web frames of the cargo hold is to be filled in TM7-BC S31. The thickness measurement values of side plating and thickness measurement values of the side frames in area A, B, C and D are to be filled in TM7-BC. Note that the limit for corrosion and abrasion of side plating, topside tank and bottom side tank is 20%. The limit for corrosion and abrasion of shell frames of cargo holds is 25%.

For ships constructed according to Section 3, Chapter 8 of PART TWO of current ISC Rules, gauging result values of hold frames (web and flange), end attachments and adjacent shell plating is to be filled in TM7-BC.

5 Considering the bulk carriers applicable to URS31 have gauged the web plating of cargo holds in area A, B, C and D, it is unnecessary to follow the previous requirements on the thickness measurement of web plating of cargo holds in area A, B, C and D, and fill in the thickness measurement values in TM7-BC. However for single-side skin bulk carriers not applicable to URS31, gauge the upper, middle and lower part of frames of cargo holds and fill in the thickness measurement values in TM7-BC.

6 Where the original thickness of DU (upper bracket) in area D for separated frames as specified URS 31 is different from the original thickness of DL (lower bracket), (refer to Diagram 15 of Chapter X of the Guidelines), if the Plan Approval Center provides two assessment values for different original thicknesses, make three measurements at DU and two at DL and according to different standards, make strength assessment of the URS31 D area. If the Plan Approval Center provides only one assessment value for URS31 Area D (generally referring to the scope of DU), select proper points for thickness measurement in

DU Area (at least three points), and then make the strength assessment of URS31 in area D.

Chapter Eight Requirements for Thickness Measurement of Hull of Chemical Tankers

I. GENERAL

1 The requirements apply to surveys of hull structure and piping systems in way of cargo tanks, pump rooms, cofferdams, pipe tunnels, void spaces within the cargo area and all ballast tanks. The survey of the hull structure out of the cargo area (except for ballast tanks) and the independent tanks on deck should be in accordance with Chapter Four.

II. Requirements for thickness measurements at special surveys

1 Requirements for special survey of hull and equipment of chemical tankers are given in 5.8.4, Section 8, Chapter 5, PART ONE of current ISC Rules. The minimum requirements for thickness measurements at special surveys of single skin and double skin chemical tankers are given in Table 5.8.4.4(1)a, Section 8, Chapter 5, PART ONE of current ISC Rules. The minimum requirements for thickness measurements at special surveys of chemical tankers not having the notation ESP are given in Table 5.8.4.4(1)b, Section 8, Chapter 5, PART ONE of current ISC Rules.

2 Thickness measurement of stainless steel hull structure and piping may be waived, except for clad steel plating.

3 Extent of overall and close-up surveys

Refer to the requirements of 5.8.4.3(1) and (2), Section 8, Chapter 5, PART ONE of current ISC Rules.

4 The Surveyor may extend the close-up survey as deemed necessary taking into account the maintenance of the tanks under survey, the condition of the corrosion prevention system and also the cases as specified in 5.8.4.3(3)① and ②, Section 8, Chapter 5, PART ONE of current ISC Rules. Specific requirements are given in 5.8.4.3(3), Section 8, Chapter 5, PART ONE of current ISC Rules.

5 For areas in tanks where hard protective coatings are found to be in a GOOD condition, the requirements for close-up survey in Tables 5.8.4.3(2)① and 5.8.4.3(2)②, Section 8, Chapter 5, PART ONE of current ISC Rules may be specially considered.

6 Extent of thickness measurement

Refer to the requirements of 5.8.4.4, Section 8, Chapter 5, PART ONE of current ISC Rules.

III. Requirements for extent of thickness measurement of substantial corrosion area

The requirements for thickness measurement in substantial corrosion area of chemical tankers are given in Table 5.8.4.4(2)a to d, Section 8, Chapter 5, PART ONE of current ISC Rules. For ships not having the notation ESP, provisions for extended measurements for areas with substantial corrosion are given in Table 5.4.4.2(17)②, Section 4, Chapter 5, PART ONE of current ISC Rules. These extended thickness measurements are to be carried out before the survey is credited as completed. Suspect areas identified at previous special surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

IV. Application of format of thickness measurement report

Relevant provisions for the formats of thickness measurement report and typical transverse section diagrams for chemical tankers can be referred to 13.1 and 13.3A of Appendix 13, Chapter 5, PART ONE of current ISC Rules.

V. Requirements for thickness measurement at annual surveys

1 Ballast tanks

Refer to 5.8.2.5, Section 8, Chapter 5, PART ONE of current ISC Rules.

VI. Requirements for thickness measurement at intermediate surveys

1 Refer to the provisions of 5.8.3, Section 8, Chapter 5, PART ONE of current ISC Rules.

VII. Thickness measurement report and supplementary regulations

In spite of the requirements of ISC Rules and IACS Unified Requirements on the format of thickness measurement report and applicability, the Guidelines provide the following supplementary requirements:

- 1 For complete transverse bulkheads, including the longitudinal girder system and adjacent structural members, the thickness values measured are to be filled in TM5-T or TM5-DHT.
- 2 For complete transverse web frame rings including adjacent structural members, fill in the thickness measurement value of transverse frame in TM4-T or TM4-DHT. For the transverse web frame's structural members (adjacent plating and members), fill in the thickness measurement value in TM4-T or TM4-DHT.

Chapter Nine Minimum Requirements for Thickness Measurements at Hull Special Surveys of Liquefied Gas Carriers

I. GENERAL

1 The requirements apply to surveys of hull structure in way of pump rooms, compressor rooms, cofferdams, pipe tunnels, void spaces and fuel oil tanks within the cargo area and all ballast tanks. The survey of the hull structure out of the cargo area (except for ballast tanks) and the independent tanks on deck should be in accordance with Chapter Four.

II. Requirements for thickness measurements at special surveys

1 Requirements for special survey of hull and equipment of liquefied gas carriers are given in 5.16.4, Section 16, Chapter 5, PART ONE of current ISC Rules. The minimum requirements for thickness measurements at special surveys are given in Table 5.16.4.5(1), Section 16, Chapter 5, PART ONE of current ISC Rules.

2 The Surveyor may extend the thickness measurements as deemed necessary. When thickness measurements indicate substantial corrosion, the extent of thickness measurements is to be increased to determine the extent of areas of substantial corrosion. The additional measurement extent and patterns are to be in accordance with Table 5.4.4.2(17)②, Section 4, Chapter 5, PART ONE of current ISC Rules.

3 For areas in tanks where protective coatings are found to be in a GOOD condition, the extent of thickness measurement according to Table 5.16.4.5(1) may be specially considered.

4 Transverse sections are to be chosen where the largest reductions are suspected to occur or are revealed from deck plating measurements. Meanwhile attention is to be given to the provisions of part IV, Chapter Ten of the Guidelines.

III. Extent of close-up surveys

1 An overall survey of all tanks and spaces, excluding fuel oil, lube oil and fresh water tanks (see Table 5.4.4.2(2), Section 4, Chapter 5, PART ONE of current ISC Rules) is to be carried out at each special survey.

2 The minimum requirements for close-up surveys at special survey are given in Table 5.16.4.4(2), Section 16, Chapter 5, PART ONE of current ISC Rules.

3 The Surveyor may extend the close-up survey as deemed necessary taking into account the maintenance of the tanks under survey, the condition of the corrosion prevention system and where:

3.1 in particular, tanks have structural arrangements or details which have suffered defects in similar spaces or on similar ships according to available information;

3.2 tanks have structures approved with reduced scantlings due to an approved corrosion control system.

4 For areas in tanks where hard protective coatings are found to be in a GOOD condition, the extent of close-up surveys according to Table 5.16.4.4(2) may be specially considered.

IV. Additional requirements of substantial corrosions:

The additional extent of thickness measurement for substantial corrosion area is to be carried out according to the provisions in Table 5.4.4.2(17)②, Section 4, Chapter 5, PART ONE of current ISC Rules .

V. Requirements for thickness measurement at annual surveys

Refer to 5.16.2.5 and 5.16.2.6, Section 16, Chapter 5, PART ONE of current ISC Rules.

VI. Requirements for thickness measurement at intermediate surveys

Refer to 5.16.3, Section 16, Chapter 5, PART ONE of current ISC Rules.

VII. Thickness measurement report and supplementary regulations

Refer to paragraphs VII/1 and 2 of Chapter Four of the Guidelines.

Chapter Ten Selection of the Thickness Measurement Locations

I. General

This part is to be combined with the surveys; and is to introduce the selection of the thickness measurement locations of operators, and the locations requiring close attention; and is for the reference of the thickness measurement personnel.

II. Locations easy to be corroded (but not limited to the below items)

- 1 Deck plating inside line of hatch openings between cargo hold hatches.
- 2 Deck plating and underdeck structure at upper deck hatch corner.
- 3 Deck plating under steam pipelines, oil pipelines of oil tankers
- 4 Plating in areas adjacent to and under ballast tanks and mouth of suction pipes of double bottom.
- 5 Fore areas on main deck close to bow.
- 6 Forecastle and poop decks.
- 7 The bulkheads as common boundary between ballast tank and cargo or fuel tanks with any means of heating.
- 8 Hatch cover (esp. pontoon hatch covers, i.e. non-enclosed type), hatch coamings and the reinforced structural members.
- 9 Side shell plating between the ballast and deepest load waterlines.
- 10 Lower part of end bulkheads of forecastle, poop and deckhouse.
- 11 Tank top, bilge well.
- 12 Hull structural members around the sea pump within the space.
- 13 Plating of sea chests.
- 14 Shaft tunnel, pipe tunnel, duct keel.
- 15 Chain locker.

III. Principle of location selection

- 1 The most serious corrosion location is to be measured, as appropriate, to reflect the actual status of the plating.
- 2 Where the strake is shared by different types of tanks, such strake is to be deemed as multiple strakes and is to be measured in the different tanks separately.
- 3 The selection of locations in local corrosion areas is to be with the consent of the site surveyor. Please refer to the details in Chapter Three.

IV. The selection of the transverse sections

- 1 Transverse sections are to include as many as tanks of various corrosion types, such as ballast tanks, tanks with any means of heating, combined cargo/ballast tanks, etc. The selection of the transverse sections is to follow the below principles:
 - 1.1 Where the transverse sections are selected, shell expansion and structural plan of deck are to be used for a thorough evaluation to avoid the locations in local strengthening on deck, shell plating, double plating and the attached underwater structures.
 - 1.2 Transverse sections are to be selected where the largest reductions are suspected to occur or revealed from deck plating measurements. Areas which have been renewed or reinforced are to be avoided.
 - 1.3 The selection of transverse sections is to avoid the locations with local strengthening in deck stringer plate or sheer strakes at ends of superstructures;
 - 1.4 The selection of transverse sections is to avoid the locations with local strengthening at hatch corners of cargo hatch openings.
- 2 Additional measurements where the longitudinal strength is deficient for an oil tanker
Refer to relevant provisions of Annex 3, Appendix 2, Chapter 5, PART ONE of current ISC Rules.

V. List of all typical locations and quantity of thickness measurement

Thickness measurement	Specification on measurements	Figures
Selected deck plating, inner bottom plating, bottom plating	Select one plating out of every three, at least two measurements on each plating.	
Selected wind and water strakes	Select one strake out of every three, at least two measurements on each strake.	
All deck plating, inner bottom plating, wind and water strakes and bottom plating, etc.	At least two measurements on each plating/strake.	
Transverse section	All longitudinal members such as plating, longitudinals and girders at the deck, side, bottom, inner bottom, and longitudinal bulkhead (where applicable, hopper side plating and bottom plating of top wing tanks) (specific thickness measurement points are shown in the figures). For transversely framed vessels, a transverse section includes adjacent frames and their end connections in way of transverse sections.	Figure 1: General dry cargo ship Figure 2: Bulk carrier Figure 3: Oil tanker
Transverse section of deck	Including deck plating, deck longitudinals and girders, other longitudinal members, etc.	
All hatch covers and coamings	<ol style="list-style-type: none"> Three sections (in way of $L/4$, $L/2$ and $3L/4$) are to be measured in each direction along cover length (L), each section include: <ul style="list-style-type: none"> ● Single measurement on each top and side plating; ● Two measurements on each adjacent beam and stiffener; ● Single measurement on hatch coaming and the coaming flange. Two measurements on fore and aft end plating on each hatch cover; two measurements on fore and aft coaming and the coaming flange. Brackets at all coamings, where the surveyor is satisfied, one measurement on every three rings, two on each webs, single measurement on face flat. Where the webs on the coaming of a ship required close-up survey, webs are to be measured at each interval. 	Figure 4: Hatch covers and coamings (apply to all ships with hatch covers and coamings). Note: For special hatch cover (thickness of the cover is not even or for large size covers), the requirements for additional thickness measurement is to be proposed by the site surveyor according to the situation on site
Internals of fore and aft peak ballast tanks	<ol style="list-style-type: none"> All transverse webs with associated plating and longitudinals in peak ballast tanks. For primary internals other than 1. above (e.g. each level of platform plating, swash bulkheads, side girders, central girders, deck girders, chain lockers and bulkheads), the location of structural members for thickness measurement and quantity of thickness measurement points are selectively determined by the surveyor in conjunction with the situation on site. 	
Bulkheads of ships other than bulk carrier, oil tanker, chemical tank (transverse and longitudinal bulkheads)	Measurement in accordance with the figure when deemed necessary by surveyor.	Figure 5
Selective measurement on internals of general dry cargo ships	Measurement in accordance with the figure when deemed necessary by surveyor.	Figure 6

Thickness measurement	Specification on measurements	Figures
Thickness measurement in close-up surveys on oil tankers, ore/oil ships, chemical tankers		
Complete web frame ring including adjacent structure members (oil tankers, ore/oil ships)	Adjacent structure members refer to plating and stiffeners of deck, bottom, inner bottom, side and longitudinal bulkheads near web frames. (the specific locations are shown in the figure) Suggesting to add measurements on transverse framing webs in way of 30 mm near deck/shell plating, and 30 mm near the associated deck/shell plating to detect the grooving corrosion as early as possible.	Figure 10
Transverse sections, including adjacent structure members (chemical tankers)	Adjacent structure members refer to deck, bottom, inner bottom, plating and stiffeners of side and longitudinal bulkheads near strength frames. (The specific locations are shown in the figure)	Figure 10
Deck transverse including adjacent deck structural members	Refers to the upper part of strength frames, including adjacent structural members; for chemical tankers, deck transverse may be on the deck (outside of tanks). (The specific locations are shown in the figure)	Figure 10
Complete transverse bulkhead including girder system and adjacent structural members	Complete refers to the whole transverse bulkhead, including girders, stiffeners and other members. (The specific locations are shown in the figure) Suggesting to add the measurement on bulkheads in way of 30 mm near deck/shell plating, and 30 mm near the associated deck/shell plating to detect the grooving corrosion as early as possible.	Figure 11
The lower part of transverse bulkheads including girder system and adjacent structural members	The lower part refers to 1/4 height of moulded depth or 2 m above the lowest strake, whichever is greater, including girders, stiffeners and other members.	Figure 11
Deck and bottom transverse webs including adjacent structural members	The measurement location refers to the complete framing.	Figure 10
All plating and internals (chemical tankers)	Refers to the whole inner plating and members, including members on the deck outside the tanks. Two measurements on each plating; measurements on the strength framing refers to the abovementioned measurements on complete transverse webs; single measurement pattern on longitudinal of every two frame webs and face flats.	
For the descriptions and illustrations of the measurement points of CSR double-hull oil tankers, please refer to Table 5.1.9.3(3)c and Figures 5.1.9.3(3)m - p in Section 1 of Chapter 5 of Part 1 of the current regulations for details.		
Thickness measurement in close-up surveys on bulk carrier and ore carrier		
Cargo hold transverse frames	The specific locations refer to Figure 7.	Figure 7
Watertight bulkheads in topside tank, hopper tank and double bottom tank	The specific locations refer to Figure 9. Suggesting to add measurements on bulkheads in way of 30 mm near deck/shell plating, and 30 mm near the associated deck/shell plating to detect the grooving corrosion as early as possible.	Figure 9

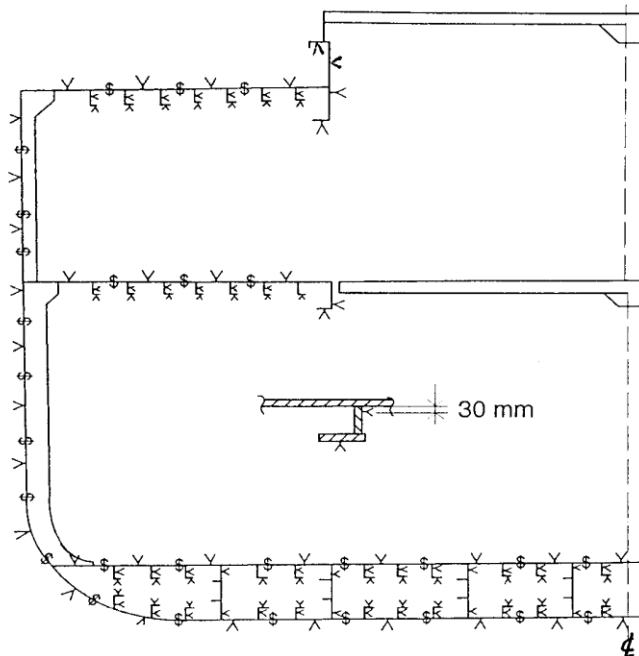
Thickness measurement	Specification on measurements	Figures
Transverse webs or watertight bulkheads inside the ballast tank	The specific locations refer to Figure 7. Suggesting to add measurements on transverse framing webs in way of 30 mm near deck/shell plating, and 30 mm near the associated deck/shell plating to detect the grooving corrosion as early as possible.	Figure 7
Cargo hold transverse bulkhead plating, stiffeners and girders.	For “two selected transverse bulkhead”, one is to select the bulkhead between No.1 and No.2 holds, another is to select the other bulkhead. Close-up survey of transverse bulkheads are to be carried out at the following levels: 1. above the inner bottom , the line of gussets (if fitted) and shedders for ships without lower stool; 2. above the face plate of the lower stool and the shedder plates; 3. About mid-height of the bulkhead; 4. below the upper deck plating and plate adjacent to the upper wing tank, or below the bottom plates of the upper stool and the topside tanks. (The measurements on bulkheads are shown in Figure 8.)	Figure 8 (corrugated bulkhead plating other than that between No.1 and No.2 holds)
Additional thickness measurement requirements on the corrugated transverse bulkheads between No.1 and No.2 cargo holds of bulk carriers in compliance with UR S19 and S23.		
The horizontal lines defined below are to be measured. The scantlings of each separate vertical corrugation, corrugation flange, web, shedder plate and gusset plate within each horizontal line given below are to be measured.		
Horizontal line <i>a</i> without bottom stool	<ol style="list-style-type: none"> 1. Half of the width of the corrugation flange approx. 200 mm above shedder plate line. 2. Center of gusset plate between corrugation flanges, if fitted; 3. Center of shedder plate; 4. Half of the center of the corrugation web approx. 200 mm above shedder plate line. 	Figure 12, 13A, 13B
Horizontal line <i>b</i> with bottom stool	<ol style="list-style-type: none"> 1. Half of the width of the corrugation flange approx. 200 mm above shedder plate line; 2. Center of gusset plate between corrugation flanges, if fitted; 3. Center of shedder plate; 4. Half of the center of the corrugation web approx. 200 mm above shedder plate line. 	Figure 13, 13A, 13B
Horizontal line <i>c</i> with or without bottom stool	Half of the width of the corrugation web and corrugation flange approx. in way of half height of corrugation.	Figure 12, 13, 13A, 13B
The requirements on gauging of side shell frames and brackets in single side skin bulk carriers required to comply with UR S31:		
The thickness measurements on zones A, B, C and D of side shell frames and brackets, to confirm the the extent of renewal and other patterns for the implementation of URS 31. The division of side shell frames refers to Figure 14. If bulb plate has been used, the web of the bulb plate is to be gauged; and the sectional modulus has to be specially considered if required.		
Zone A, B & D	5-point gauging pattern for zones A, B & D within the range of depth and height of the web in the corresponding area. The gauging report is to reflect the average reading.	Figure 15
Zone C	Depending upon the condition of the web in way	Figure 15

Thickness measurement	Specification on measurements	Figures
	of zone C, the web may be measured by taking three readings over the length of zone C and averaging them. The average reading is to be compared with the allowable thickness. If the web plating has general corrosion, then this pattern is to be expanded to a five-point pattern as noted above.	
Gaugings for sections a) and b) (flanges and side shell plating) Where the lower bracket length or depth does not meet the requirements of Rules	At least 2 readings on the flange/faceplate are to be taken in way of each section. At least one reading of the attached shell plating is to be taken on each side of the frame (i.e. fore and aft) in way of sections a) and b).	Figure 16
For the descriptions and illustrations of the measurement points of CSR bulk carriers, please refer to Table 5.1.9.3(3)a and Figures 5.1.9.3(3)a - f in Section 1 of Chapter 5 of Part 1 of the current regulations for details. For the descriptions and illustrations of the measurement points of CSR double-skin bulk carriers, please refer to Table 5.1.9.3(3)b and Figures 5.1.9.3(3)g - l in Section 1 of Chapter 5 of Part 1 of the current regulations for details.		

Some schematic diagrams of the thickness measurement positions for ships are supplemented as follows:

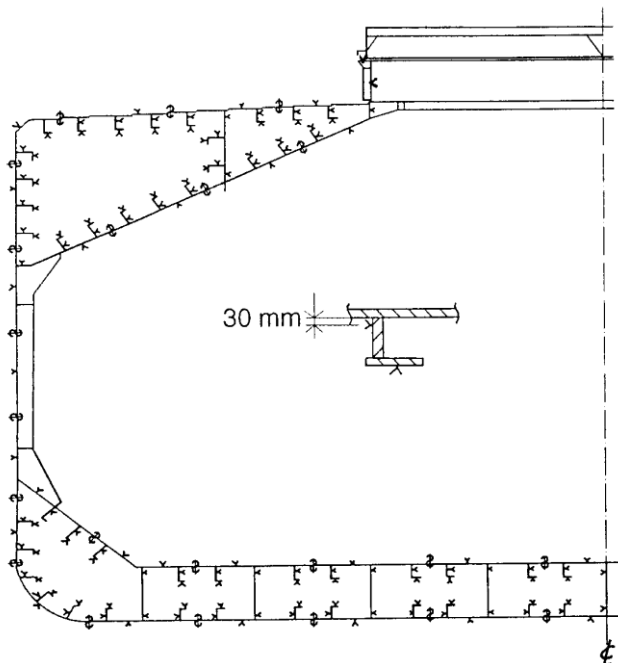
- a) For liquefied gas carriers, the specific thickness measurement positions can be found in Example Diagram 17.
- b) For oil tankers, the specific thickness measurement positions can be found in Example Diagram 18.
- c) For double-hull oil tankers, the specific thickness measurement positions can be found in Example Diagram 19.
- d) For ore carriers, the specific thickness measurement positions can be found in Example Diagram 20.

Figure 1 : Transverse section of a general cargo ship



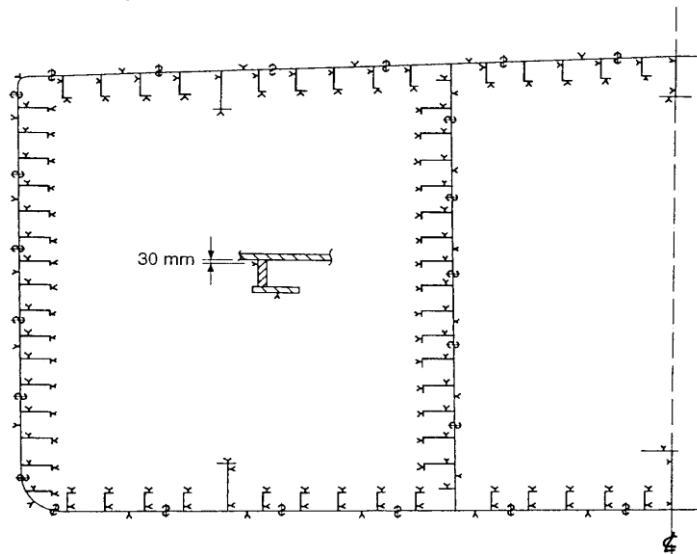
Measurements are to be taken on both port and starboard sides of the selected transverse section

Figure 2 : Transverse section of a bulk carrier



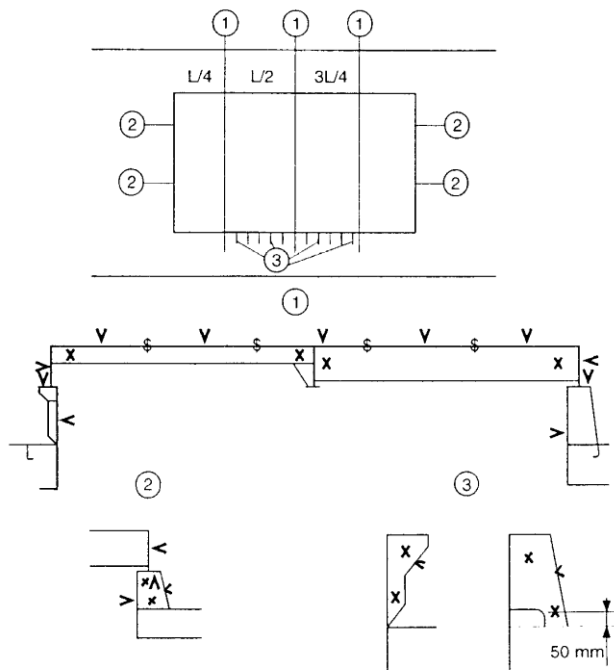
Measurements are to be taken on both port and starboard sides of the selected transverse section

Figure 3 : Transverse section of an oil tanker



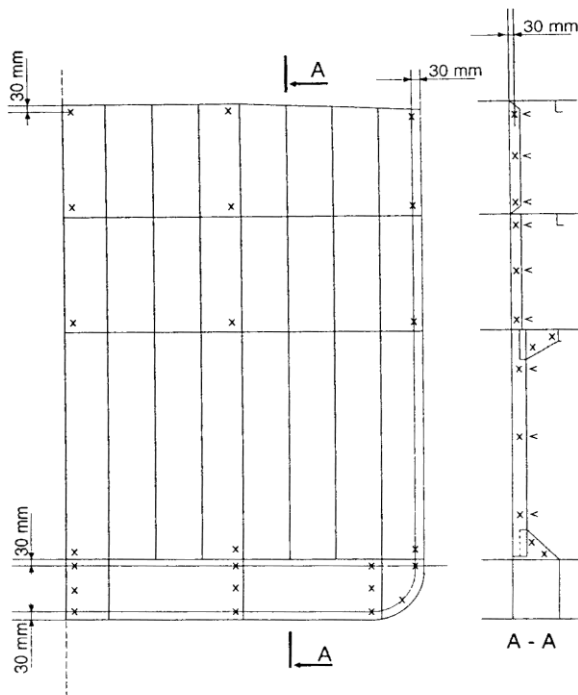
Measurements are to be taken on both port and starboard sides of the selected transverse section

Figure 4 : Locations of measurements on hatch covers and coamings (valid for all ships fitted with hatch covers and coamings)



- (1) Three sections at $L/4$, $L/2$, $3L/4$ of hatch cover length, including:
 - one measurement of each hatch cover plate and skirt plate
 - measurements of adjacent beams and stiffeners
 - one measurement of coaming plates and coaming flange, each side
- (2) Measurements of both ends of hatch cover skirt plate, coaming plate and coaming flange
- (3) One measurement of one out of three hatch coaming brackets and bars, on both sides and both ends

Figure 5 : Locations of measurements on bulkheads of general cargo ships



Cargo hold bulkhead/watertight floor plating to be measured as per main view
 One stiffener out of three to be measured as per view A - A

Figure 6 : Locations of measurements on selected internal structural elements of general cargo ships

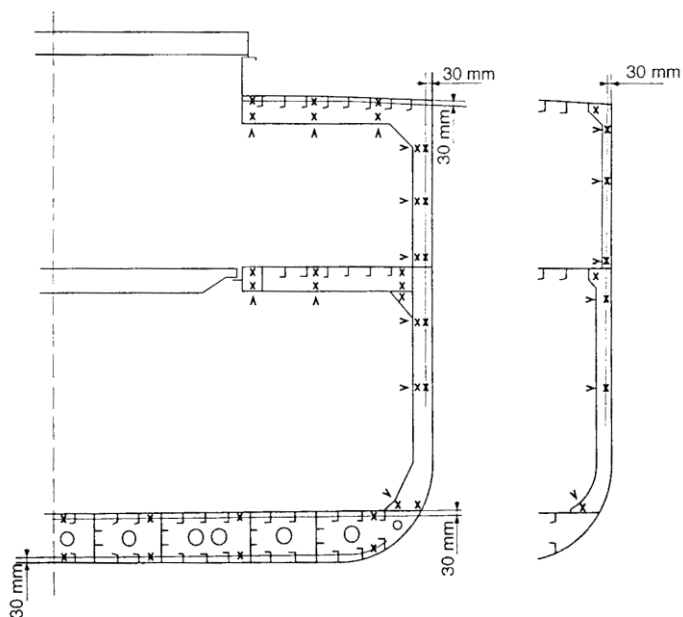
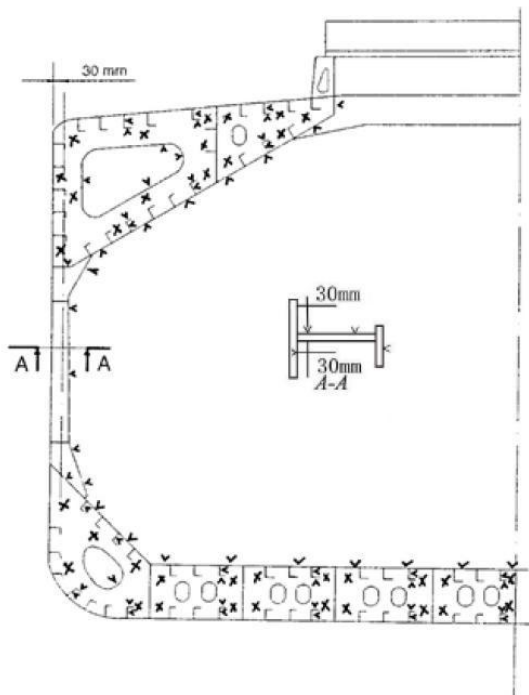


Figure 7 : Locations of measurements on structural members in cargo holds and ballast tanks of bulk carriers



Cargo frames
(face plate and web plate)

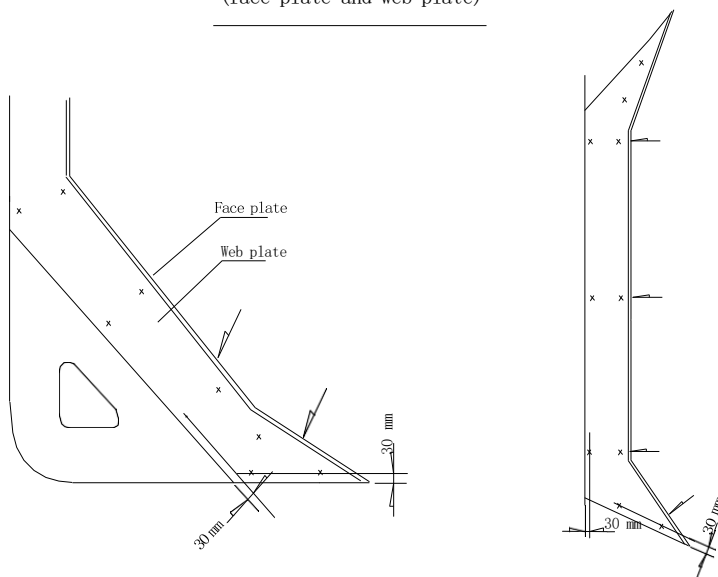
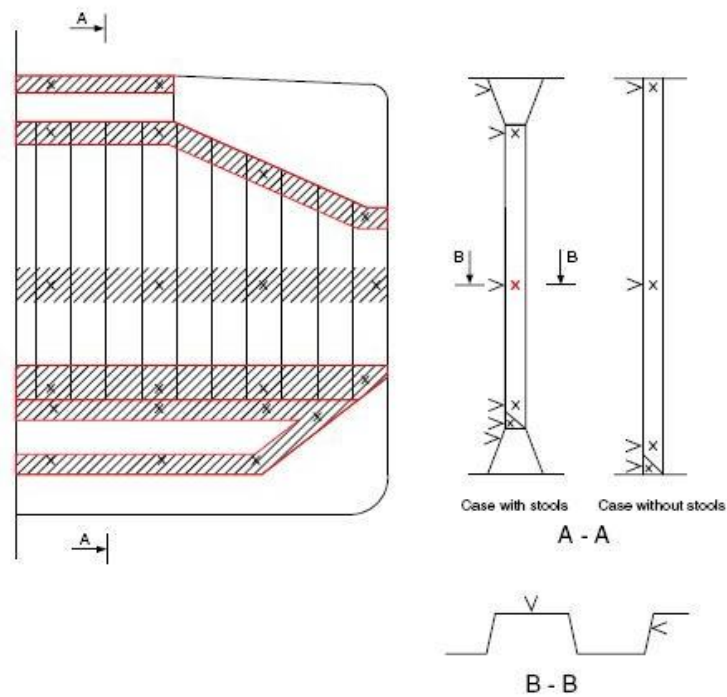
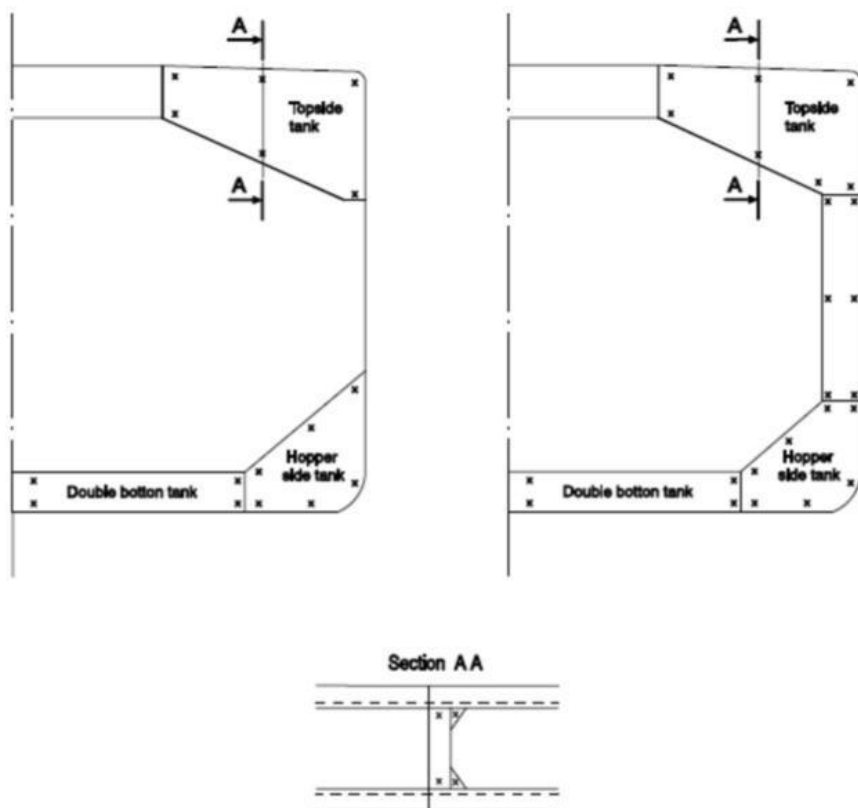


Figure 8 : Locations of measurements on cargo hold transverse bulkheads of bulk carriers



Measurements to be taken in each shaded area as per views A - A and B - B

Figure 9: Location of measurements on transverse bulkheads of topside, hopper and double bottom tanks of bulk carriers



Note: Measurements are to be taken in each shaded area as shown in A-A

Figure 10 : Locations of measurements on web frame rings and longitudinal elements of oil tankers

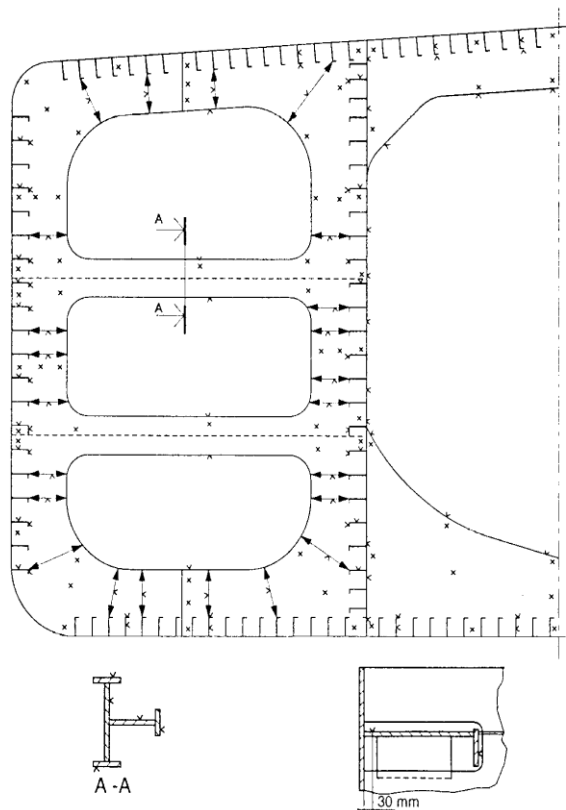


Figure 11 : Locations of measurements on transverse bulkheads of oil tankers

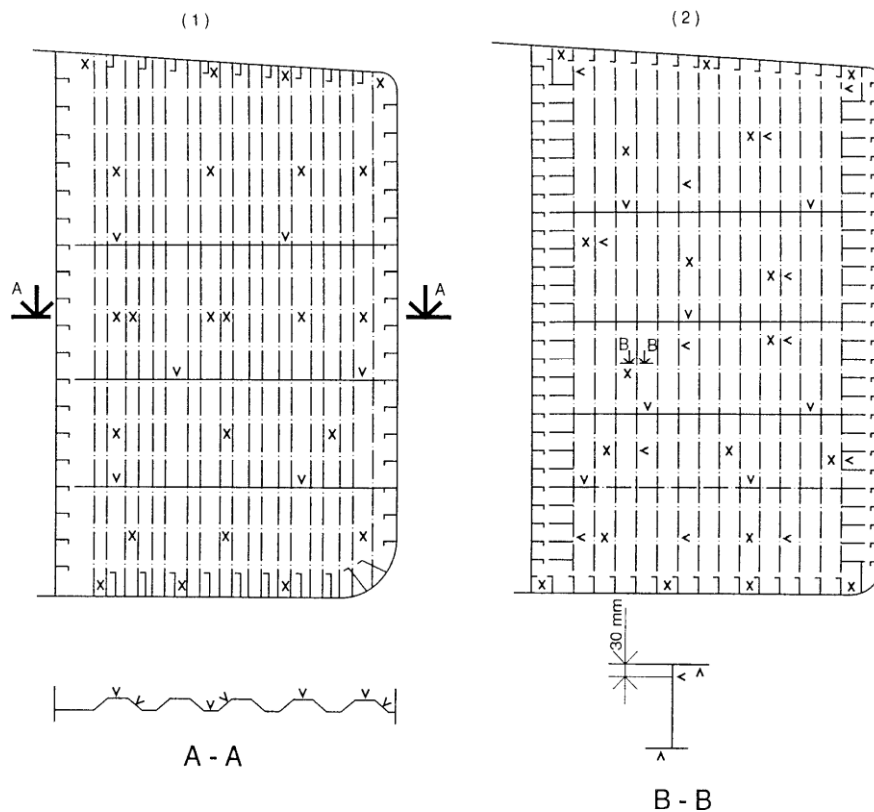


Figure 12: Locations of additional measurements plan of the corrugated Bulkhead without lower stool between No.1&2 cargo hold

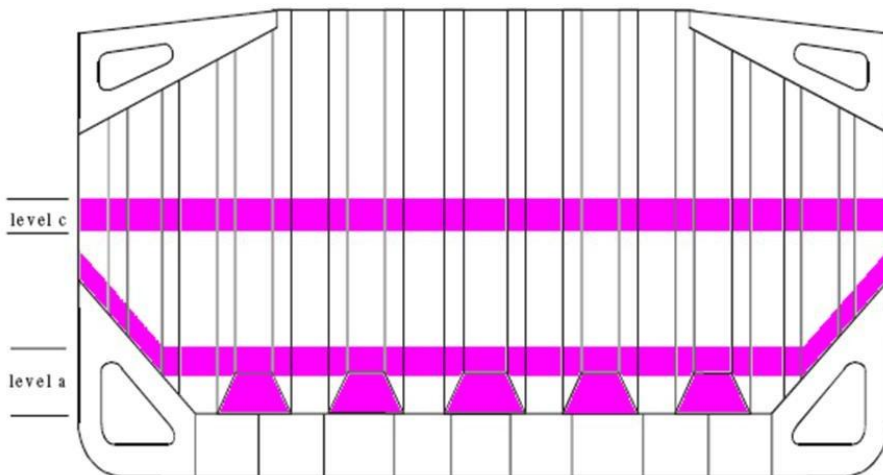


Figure 13: Locations of additional measurements plan of the corrugated Bulkhead with lower stool between No.1&2 cargo hold

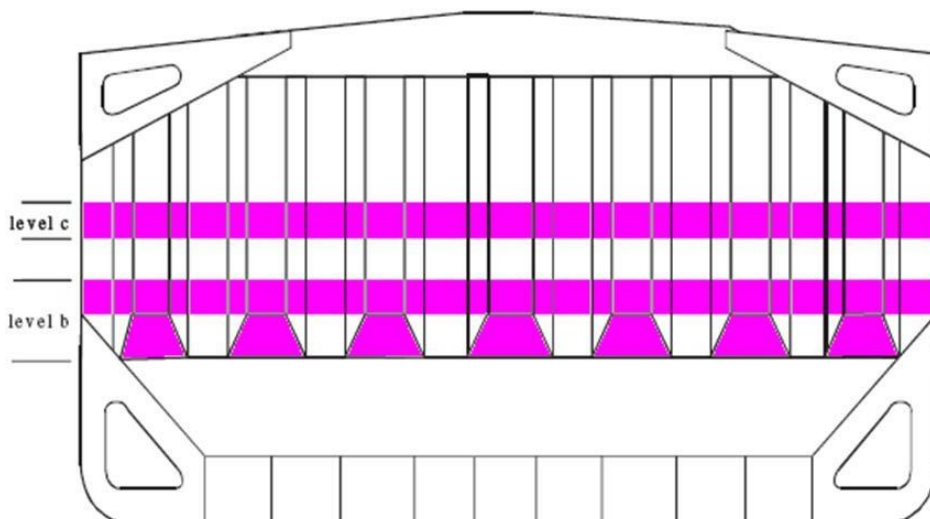


Figure 13A: Locations of additional measurements plan of the corrugated Bulkhead with lower stool between No.1&2 cargo hold

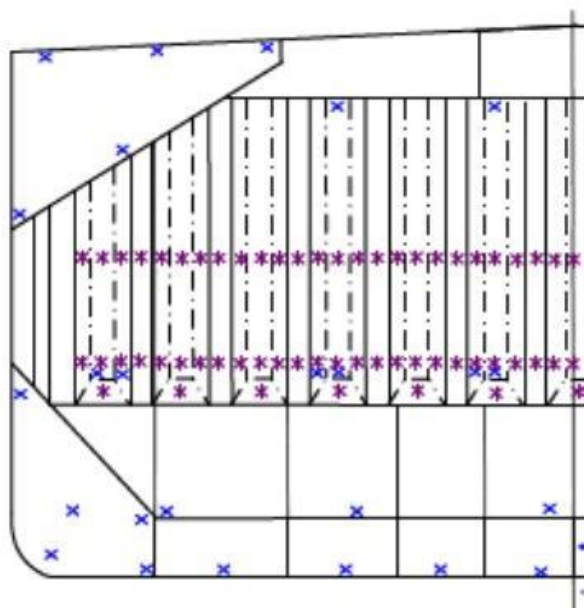


Figure 13B: Locations of additional measurements plan of the corrugated Bulkhead covered doublers between No.1&2 cargo hold

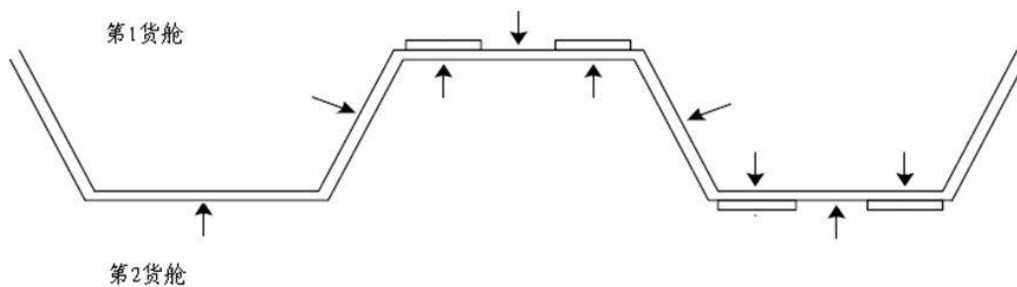


Figure 14: The division of side shell frames and bracket (A,B,C,D)

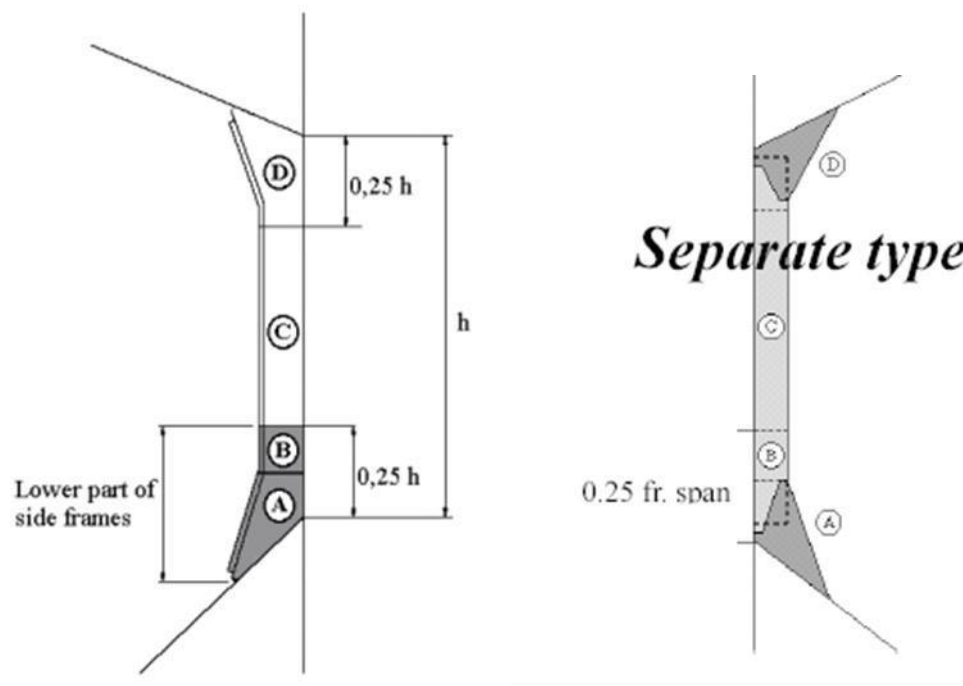
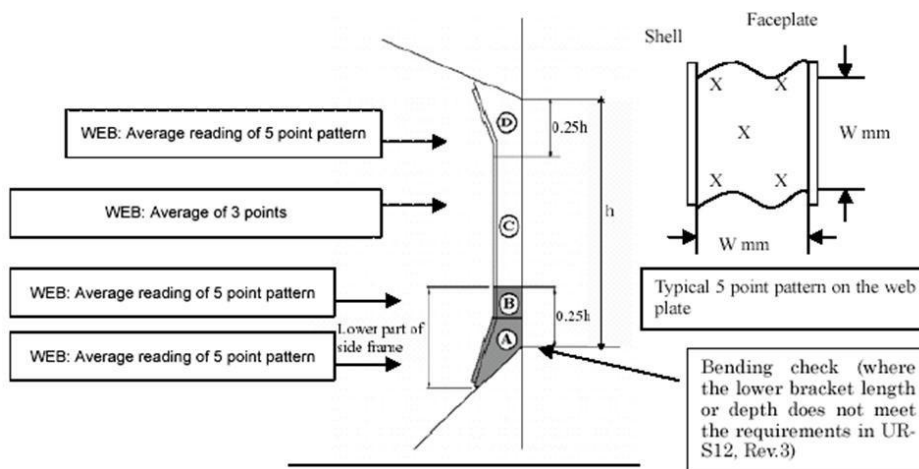
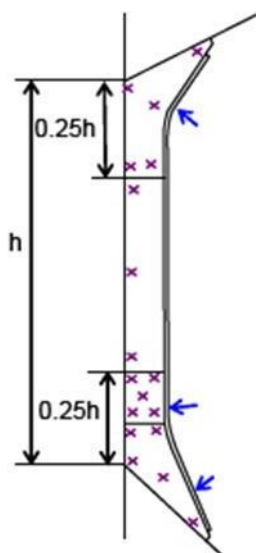


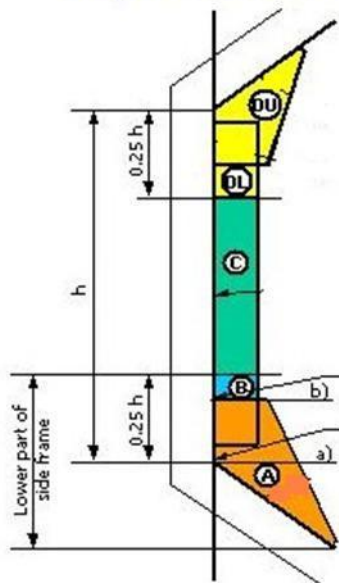
Figure 15: The selection of the measurement points in the corresponding area



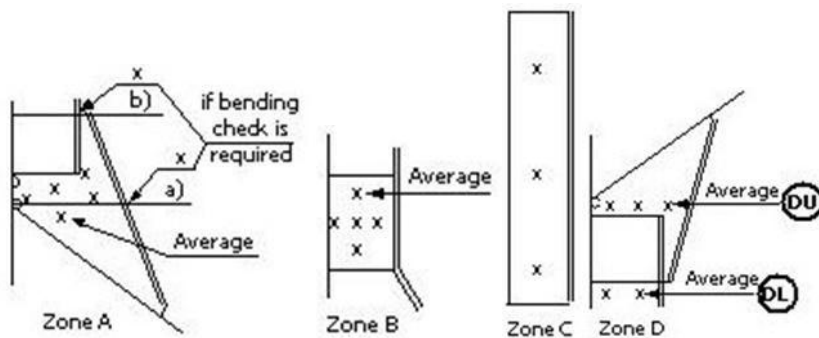
Integral Frame



Separate Frame



Section I.W.O Hold Frame



Locations of measurement points of cargo frame (URS31 assessment)

Figure 16: Section a) and b)

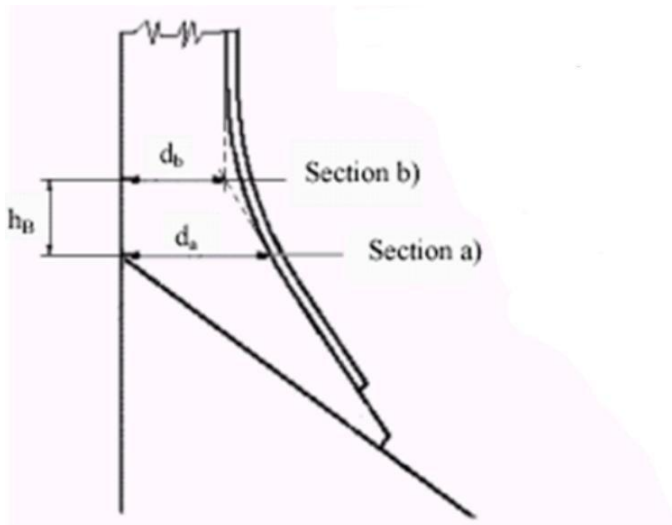


Figure 17: The selection of the measurement points for liquefied gas carriers

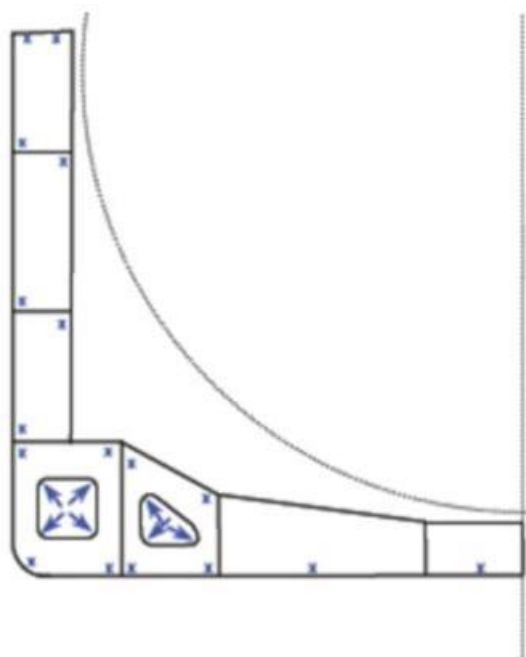
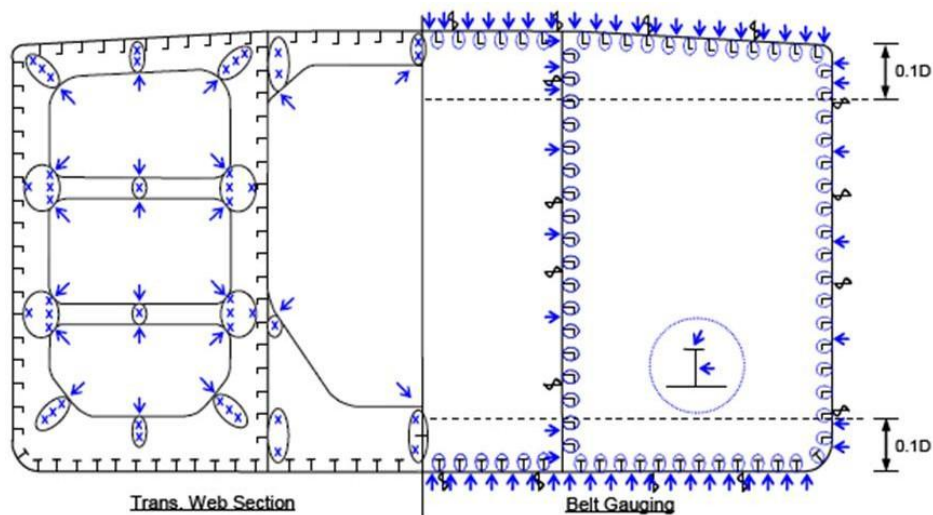


Figure 18: Location of the measurements for oil tankers



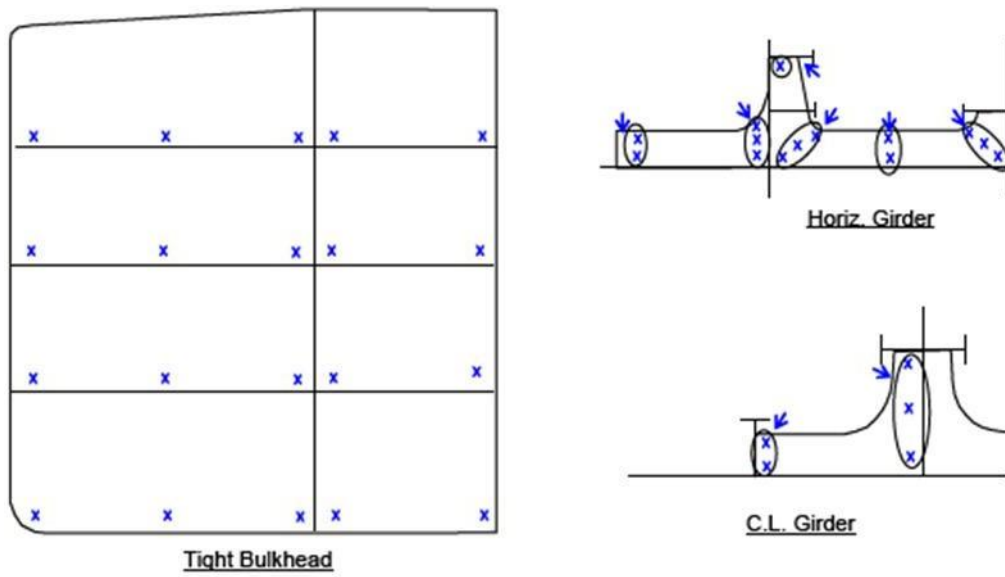


Figure 19: Location of the measurements for double-hull oil tankers

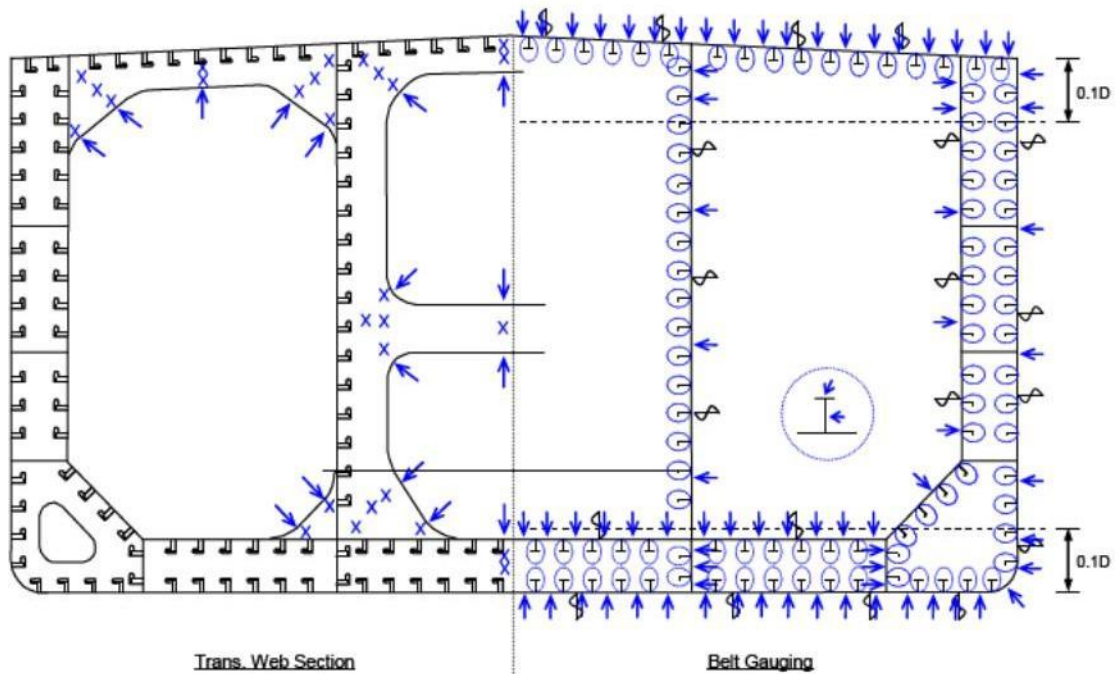
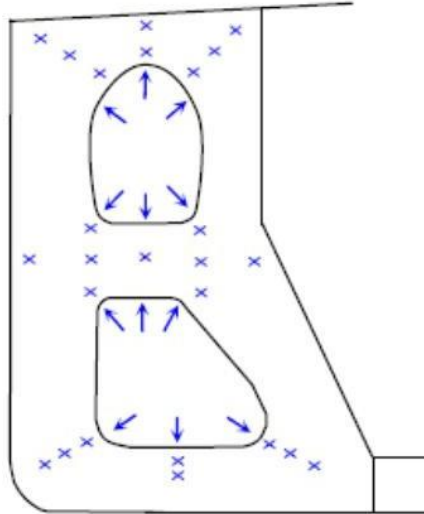


Figure 20: Location of the measurements for ore carriers



Annex 1: IACS PR19&IACS REC.77

Procedural Requirement for Thickness Measurements

No.19

(Rev.0
July 2009)

(Rev.1
July 2017)

1. Thickness Measurements required in the context of hull structural classification surveys, if not carried out by the Society itself shall be witnessed by a surveyor. The attendance of the surveyor shall be recorded.
2. This requires the surveyor to be on board, while the gaugings are taken, to the extent necessary to control the process (see Footnote).

2.1 Survey meeting

Prior to commencement of the Intermediate or Special survey, as required by UR Z7, UR Z7.1, UR Z7.2, UR Z10s or UR Z15, a meeting is to be held between the attending surveyor(s), the master of the ship or mobile offshore unit or an appropriately qualified representative appointed by the master or Company, the owner's representative(s) in attendance and the thickness measurement firm's representative(s) so as to ensure the safe and efficient execution of the surveys and thickness measurements to be carried out onboard.

Communication with the thickness measurement operator(s) and owner's representative(s) is to be agreed during the meeting, with respect to the following:

- reporting of thickness measurements on regular basis to the attending surveyor
- prompt notification to the surveyor in case of following findings:
 - excessive and/or extensive corrosion or pitting/grooving of any significance
 - structural defects like buckling, fractures and deformed structures
 - detached and/or holed structure
 - corrosion of welds.

When thickness measurements are taken in association with Intermediate or Special Survey, a documented record indicating where and when the meeting took place and who attended (the name of the surveyor(s), the master of the ship or mobile offshore unit or an appropriately qualified representative appointed by the master or Company, the owner's representative(s) and the representative(s) of the thickness measurement firm(s)) is to be maintained.

Footnote:

It is confirmed that this also applies to thickness measurements taken during voyages.

Notes:

1. This Procedural Requirement applies from 1 July 2009.
2. Refer to IACS Recommendation No.77 "Guidelines for the Surveyor on how to Control the Thickness Measurement Process".
3. The changes introduced in Rev.1 of this Procedural Requirement are to be uniformly implemented from 1 January 2018.

2.2 Monitoring of the thickness measurement process onboard

The surveyor is to decide final extent and location of thickness measurements after overall survey of representative spaces onboard.

In case the owner prefers to commence the thickness measurements prior to the overall survey then the surveyor is to advise that the planned extent and locations of thickness measurements are subject to confirmation during the overall survey. Based on findings, the surveyor may require that additional thickness measurements have to be taken.

The surveyor is to direct the gauging operation by selecting locations such that readings taken represent, on average, the condition of the structure for that area.

Thickness measurements taken mainly to evaluate the extent of corrosion, which may affect the hull girder strength, are to be carried out in a systematic manner of all longitudinal structural members that are required to be gauged by the relevant UR(s).

Where thickness measurements indicate substantial corrosion or wastage in excess of allowable diminution, the surveyor is to direct locations for additional thickness measurements in order to delineate areas of substantial corrosion and to identify structural members for repairs/renewals.

Thickness measurements of structures in areas where close-up surveys are required shall be carried out simultaneously with close-up surveys.

2.3 Review and verification

Upon completion of the thickness measurements, the surveyor is to confirm that no further gaugings are needed, or specify additional gaugings.

If, where special consideration is allowed by the UR(s), the extent of thickness measurements is reduced, the surveyor's special consideration is to be reported.

In case thickness measurements are partly carried out, the extent of remaining thickness measurements is to be reported for the use of the next surveyor.

Guidelines for the Surveyor on how to Control the Thickness Measurement Process

No.77

(Mar 2002)
(Rev.1
July 2004)
(Rev.2
Apr 2006)
(Rev.3
Oct 2016)
(Rev.4
Oct 2017)

IACS Procedural Requirement PR 19 stipulates that:

"1. Thickness measurements required in the context of hull structural classification surveys, if not carried out by the Society itself shall be witnessed by a surveyor. The attendance of the surveyor shall be recorded.

2. This requires the surveyor to be on board, while the gaugings are taken, to the extent necessary to control the process [See Note 1].

2.1 Survey meeting

Prior to commencement of the Intermediate or Special survey, as required by UR Z7, UR Z7.1, UR Z7.2, UR Z10s or UR Z15, a meeting is to be held between the attending surveyor(s), the master of the ship or mobile offshore unit or an appropriately qualified representative appointed by the master or Company, the owner's representative(s) in attendance and the thickness measurement firm's representative(s) so as to ensure the safe and efficient execution of the surveys and thickness measurements to be carried out onboard."

It is recommended that thickness measurements should be carried out in a single operation, by one thickness measurement firm. If, however, thickness measurements are carried out in several operations during the allowable period for the survey and/or by different thickness measurement firms, separate survey meetings should be held at each time.

Items that should be addressed and agreed in this meeting are among others:

- 1.1 schedule for thickness measurements;
- 1.2 provisions for thickness measurements (personal safety, means of access, cleaning and de-scaling as appropriate, illumination, ventilation);
- 1.3 planned scope of survey:
 - mandatory extent of thickness measurements (according to classification rules)
 - areas subject to close-up surveys and thickness measurements including areas previously identified with substantial corrosion, if applicable.
- 1.4 availability onboard of drawings with original scantlings;
- 1.5 allowable thickness diminution;
- 1.6 taking representative readings in general and where uneven corrosion / pitting is found;
- 1.7 procedure for additional readings of areas with substantial corrosion, if applicable (according to classification rules);
- 1.8 communication between surveyor(s), thickness measurement operator(s) and owner's representative(s):
 - reporting of thickness measurements on regular basis;

- prompt notification of the surveyor in case of findings;
- excessive ^[See Note 2] and/or extensive ^[See Note 3] corrosion or pitting / grooving of any significance;
- structural defects like buckling, fractures and deformed structures;
- detached and/or holed structure;
- corrosion of welds;

1.9 the thickness measurement firm should provide information related to:

- equipment to be used;
- personnel records of operators scheduled for thickness measurements onboard.

1.10 documented record of the survey meeting.

2. MONITORING OF THE THICKNESS MEASUREMENT PROCESS ONBOARD

The surveyor should decide final extent and location of thickness measurements after overall survey of representative spaces onboard. In case the owner prefers to commence the thickness measurements prior to the overall survey then the surveyor shall advise that the planned extent and locations of thickness measurements are subject to confirmation during the overall survey. Based on findings, the surveyor may require that additional thickness measurements have to be taken.

2.1 Prior to commencing the thickness measurements, the surveyor should:

- check type of equipment and verify that equipment is calibrated according to recognized national / international standards and properly labelled;
- witness calibration appropriate for size and type of material;
- be satisfied with operator's skills and competence;
- ensure that the thickness measurement operator will be using instruments using pulsed echo technique (either with oscilloscope or digital instruments using multiple echo). Single echo instruments may be used on uncoated surfaces, which have been properly cleaned.

2.2 The surveyor should direct the gauging operation by selecting locations such that readings taken represent, on average, the condition of the structure for that area.

2.3 Thickness measurements mainly to evaluate the extent of corrosion, which may affect the hull girder strength, should be carried out in a systematic manner of all longitudinal structural members. The surveyor should be in attendance during this process.

2.4 Thickness measurements of structures in areas where close-up surveys are required shall be carried out simultaneously with the close-up surveys in order to facilitate a meaningful survey.

2.5 The surveyor may specially consider the extent of thickness measurements of structures within spaces where the protective coating is found to be in GOOD condition.

2.6 Where thickness measurements indicate substantial corrosion or excessive diminution the surveyor should direct locations for additional thickness measurements in order to delineate areas of substantial corrosion and to identify structural members for repairs / renewals.

3. REVIEW AND VERIFICATION

3.1 Upon completion of the thickness measurements, the surveyor should confirm that no further gaugings are needed, or specify additional gaugings.

3.2 If extent of thickness measurements have been reduced, the surveyor's special consideration should be reported.

3.3 In case thickness measurements are partly carried out, the extent of remaining thickness measurements should be reported for the use of the next surveyor.

3.4 Surveyor should confirm that the proper thickness measurement reporting forms were used if the ship is under the ESP programme.

3.5 Upon completion of the thickness measurements onboard, the surveyor should verify and keep a copy of the preliminary thickness measurement report signed by the operator.

3.6 Upon review that the final gauging report is consistent with the preliminary report, the Surveyor is to countersign the cover page of the final report. The Surveyor should keep the preliminary report, as a minimum, until the review is completed.

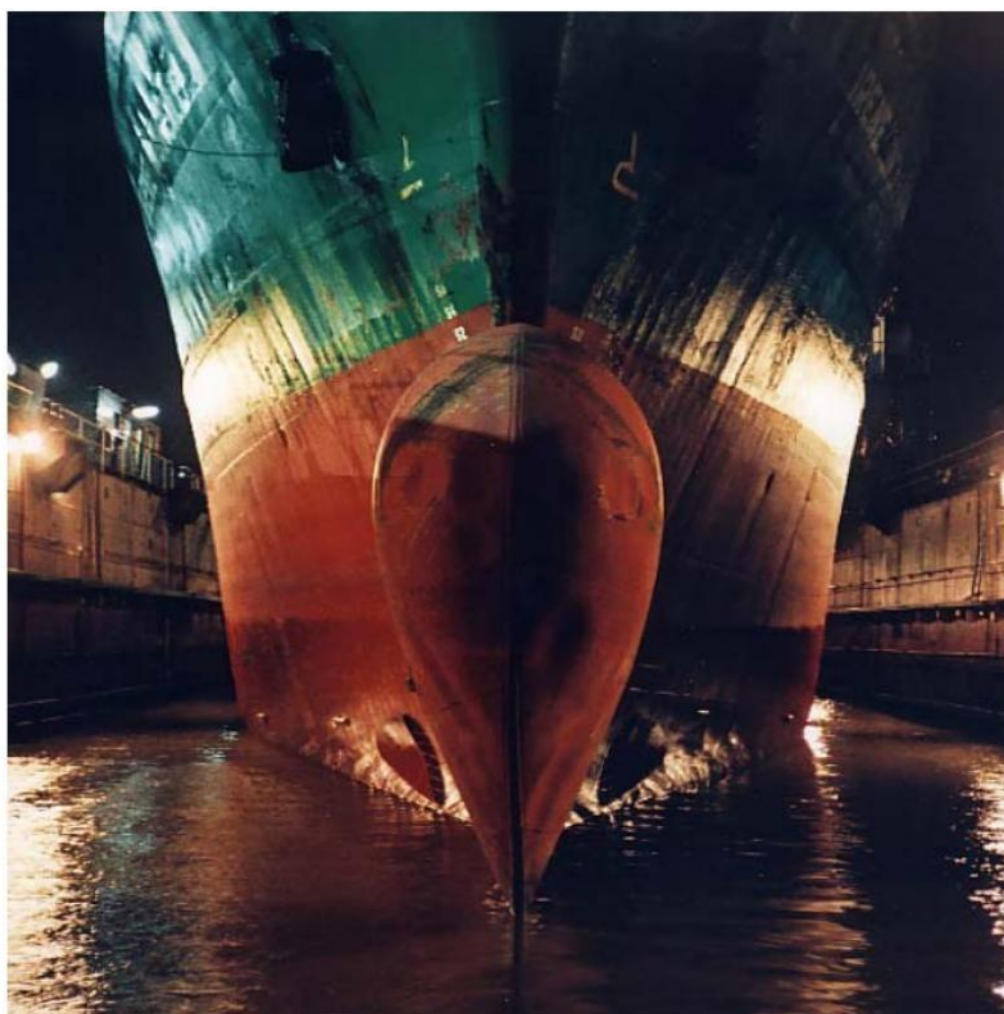
Note:

- 1) It is confirmed that this also applies to thickness measurements taken during voyages.
- 2) Excessive corrosion is an extent of corrosion that exceeds the allowable limit.
- 3) Extensive corrosion is an extent of corrosion consisting of hard and/or loose scale, including pitting, over 70% or more of the area under consideration, accompanied by evidence of thickness diminution.

Annex 2: Surveyor's Glossary



INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES



Surveyor's Glossary

Hull Terms & Hull Survey Terms

© IACS – the International Association of Classification Societies and International Association of Classification Societies Limited 2018

All rights reserved.

Except as permitted under current English legislation no part of this work may be photocopied, stored in a retrieval system, published, performed in public, adapted, broadcast, transmitted, recorded or reproduced in any form or by any means, without prior permission of the copyright owner.

Where IACS has granted written permission for any part of this publication to be quoted such quotation must include acknowledgement to IACS.

Enquiries should be addressed to:

The Secretary General,
International Association of Classification Societies Ltd,
36 Broadway, London, SW1H 0BH

Telephone: +(44)(0) 20 7976 0660
Telefax: +(44)(0) 20 7808 1100
Internet: permsec@iacs.org.uk

ACKNOWLEDGEMENT

IACS acknowledges the contributions made by a variety of marine industry sources in the preparation of this text and specifically acknowledges the kind contribution of the International Bulk Journal for the provision of a photograph for the front cover of this edition.

DISCLAIMER

The IACS members, their affiliates and subsidiaries and their respective officers, employees or agents (on behalf of whom this disclaimer is given) are, individually and collectively, referred to in this disclaimer as the "IACS Members". The IACS Members assume no responsibility and shall not be liable whether in contract or in tort (including negligence) or otherwise to any person for any liability, or any direct, indirect or consequential loss, damage or expense caused by or arising from the use and/or availability of the information expressly or impliedly given in this document, howsoever provided, including for any inaccuracy or omission in it. For the avoidance of any doubt, this document and the material contained in it are provided as information only and not as advice to be relied upon by any person. Any dispute concerning the provision of this document or the information contained in it is subject to the exclusive jurisdiction of the English courts and will be governed by English law.

Surveyor's Glossary

Hull Terms & Hull Survey Terms

No.
82
(July 2003)
(Rev.1
Oct 2018)

1. Introduction

This Surveyor's Glossary of Hull Terms is intended as a guide to improve the standardization of survey reporting. It is recommended that the listed terms for hull structural elements are used throughout report narratives.

The Glossary also includes definitions of common hull survey terms that are applicable for surveys of hull structures and reporting.

All parties involved in the review of classification survey reports should have this Glossary available to assist with correct interpretation of the report narratives.

2. Hull Terms

2.1 General

Accommodation Ladder is a portable set of steps on a ship's side for people boarding from small boats or from a pier.

Aft Peak Bulkhead is a term applied to the first main transverse watertight bulkhead forward of the stern. An aft peak tank is any tank in the narrow part of the stern aft of this last watertight bulkhead.

Bay is the area between adjacent transverse frames or transverse bulkheads.

Bilge Keel is a piece of plate set perpendicular to a ship's shell along her bilges for about one third her length to reduce rolling.

Bilge Strake is the strake at the turn of bilge extending outward to a point where the side rises vertically.

Breast Hook is a triangular plate bracket joining port and starboard side structural members at the stem.

Bulkhead Deck is the uppermost continuous deck to which transverse watertight bulkheads and shell are carried.

Bulkhead Structure is the transverse or longitudinal bulkhead plating with stiffeners and girders.

Bulwark is the vertical plating immediately above the upper edge of the ship's side surrounding the exposed deck(s).

Cargo Area or **Cargo Length Area** is that part of the ship that contains cargo holds and cargo / slop tanks and adjacent areas including ballast tanks, fuel tanks, cofferdams, void spaces and also including deck areas throughout the entire length and breadth of the part of the ship over the mentioned spaces.

Cargo Hold Bulkhead is a boundary bulkhead separating cargo holds.

Cargo Port is a door or port in a ship's side for the loading or discharge of cargo or stores. Also called side port.

Carlings are supports usually of flat plate, welded in a fore and aft direction between transverse deck beams to prevent distortion of the plating.

Casing is the covering or bulkhead around or about any space for protection.

Ceilings is wood sheathing or planking fitted on various parts of the ship such as tank tops, ship's sides and bulkheads to protect the ship's structure from damage and also used to protect the cargo from damage.

Coaming is the vertical boundary structure of a hatch or skylight.

Cofferdams are spaces between two bulkheads or decks primarily designed as a safeguard against leakage of oil from one compartment to another.

Collision Bulkhead is the foremost main transverse watertight bulkhead.

Companion Way is a weathertight entrance leading from a ship's deck to spaces below.

Confined Space is a space identified by one of the following characteristics: limited openings for entry and exit, unfavorable natural ventilation or not designed for continuous worker occupancy.

Cross Deck is the area between cargo hatches.

Cross Ties are used to support the longitudinal bulkheads of oil tankers against hydrostatic and hydrodynamic loads.

Dead Covers are plates of bronze or steel working on a hinge serving to protect the glass port light in heavy weather. Also called dead light.

Deck House is a structure on the freeboard or superstructure deck not extending from side to side of the ship.

Deck Structure is the deck plating with stiffeners, girders and supporting pillars.

Deep Tank is a tank extending from the bottom or inner bottom up to or higher than the lowest deck.

Discharges are any piping leading through the ship's sides for conveying bilge water, circulating water, drains etc. Also called Overboard Discharge.

Double Bottom Structure is the shell plating with stiffeners below the top of the inner bottom and other elements below and including the inner bottom plating.

Duct Keel is a keel built of plates in box form extending the length of the cargo hold. It is used to house ballast and other piping leading forward which otherwise would have to run through the cargo holds.

Enclosed Superstructure is the superstructure with bulkheads forward and/or aft fitted with weather-tight doors and closing appliances.

Equipment Number is used by classification societies mainly to determine the size and number of anchors and chain cables for a new ship.

Floor is a bottom transverse member.

Flush Deck Ship is a ship that has no superstructure on the freeboard deck.

Forecastle is a short superstructure situated at the bow.

Forepeak is the area of the ship forward of the collision bulkhead.

Freeboard Deck is normally the uppermost complete deck exposed to weather and sea, which has permanent means of closing all exposed openings.

Freeing Port is an opening in the bulwarks to allow water shipped on deck to run freely overboard.

Gangway is the raised walkway between superstructure such as between forecastle and bridge or between bridge and poop.

Girder is a collective term for primary supporting structural members.

Gunwale is the upper edge of the ship's sides.

Gusset is a triangular plate, usually fitted to distribute forces at a strength connection between two structural members.

Hatch Coaming is the vertical plating built around the hatchways to prevent water from entering the hold; and to serve as a framework for the hatch covers.

Hatch Covers are wooden or steel covers fitted over a hatchway to prevent the ingress of water into the ship's hold and may also be the supporting structure for deck cargo.

Hatch Ways are openings, generally rectangular, in a ship's deck affording access into the compartment below. Also called hatches.

Hopper Side Tanks are tanks used for ballast or for stability when carrying certain cargoes in bulk carriers. Also referred to as topside wing ballast tanks and bottom hopper tanks.

Independent Tank is a self-supporting tank.

Keel is the main structural member or backbone of a ship running longitudinal along centerline of bottom. Usually a flat plate stiffened by a vertical plate on its centerline inside the shell.

Margin Plate is the outboard strake of the inner bottom and when turned down at the bilge the margin plate (or girder) forms the outer boundary of the double bottom.

Midship Section is the cross section through the ship, midway between the forward and after perpendiculars.

Pipe Tunnel is the void space running in the midships fore and aft lines between the inner bottom and shell plating forming a protective space for bilge, ballast and other lines extending from the engine room to the holds.

Poop is the space below an enclosed superstructure at the extreme aft end of a ship.

Poop Deck is the first deck above the shelter deck at aft end of a ship.

Port Light is another term for side light or side scuttle.

Reduced Scantlings are scantlings that are allowed to be reduced because approved corrosion control arrangements have been applied.

Representative Spaces is those which are expected to reflect the condition of other spaces of similar type and service and with similar corrosion prevention systems.

Scupper is any opening for carrying off water from a deck, either directly or through piping.

Scuttle is a small opening in a deck or elsewhere, usually fitted with a cover or lid or a door for access to a compartment.

Shedder Plates are slanted plates fitted in dry cargo holds to prevent undesired pockets of cargo. The term is also commonly applied to slanted plates that are fitted to improve the structural stability of corrugated bulkheads and framing members.

Sheer Strake is the top strake of a ship's side shell plating.

Single Bottom Structure is the shell plating with stiffeners and girders below the upper turn of bilge.

Skylight. A deck opening fitted with or without glass port light and serving as a ventilator for engine room, quarters, etc.

Spaces are separate compartments including holds and tanks.

Stay is a term for bulwarks and hatch coaming brackets.

Stem is the piece of bar or plating at which a ship's outside plating terminates at her forward end.

Stem Frame is the heavy strength member in single or triple screw ships, combining the rudder post.

Stiffener is a collective term for secondary supporting structural members.

Stool is a structure supporting cargo hold and tank bulkheads.

Strake is a course, or row, of shell, deck, bulkhead, or other plating.

Strength Deck is normally the uppermost continuous deck. After special consideration of its effectiveness, another deck may be defined as strength deck.

Stringer Plate is the outside strake of deck plating.

Superstructure is a decked structure on the freeboard deck extending for at least 92% of the breadth of the ship.

Suspect Areas are locations showing substantial corrosion and/or which are considered by the Surveyor to be prone to rapid wastage.

Tank Bulkhead is a boundary bulkhead in a tank for liquid cargo, ballast or bunkers.

Topside Wing Ballast tanks are ballast tanks in bulk carriers that normally stretch along the length of the ship's side and occupy the upper corners of the cargo hold.

Tween Decks is an abbreviation of between decks, placed between the upper deck and the tank top in the cargo holds.

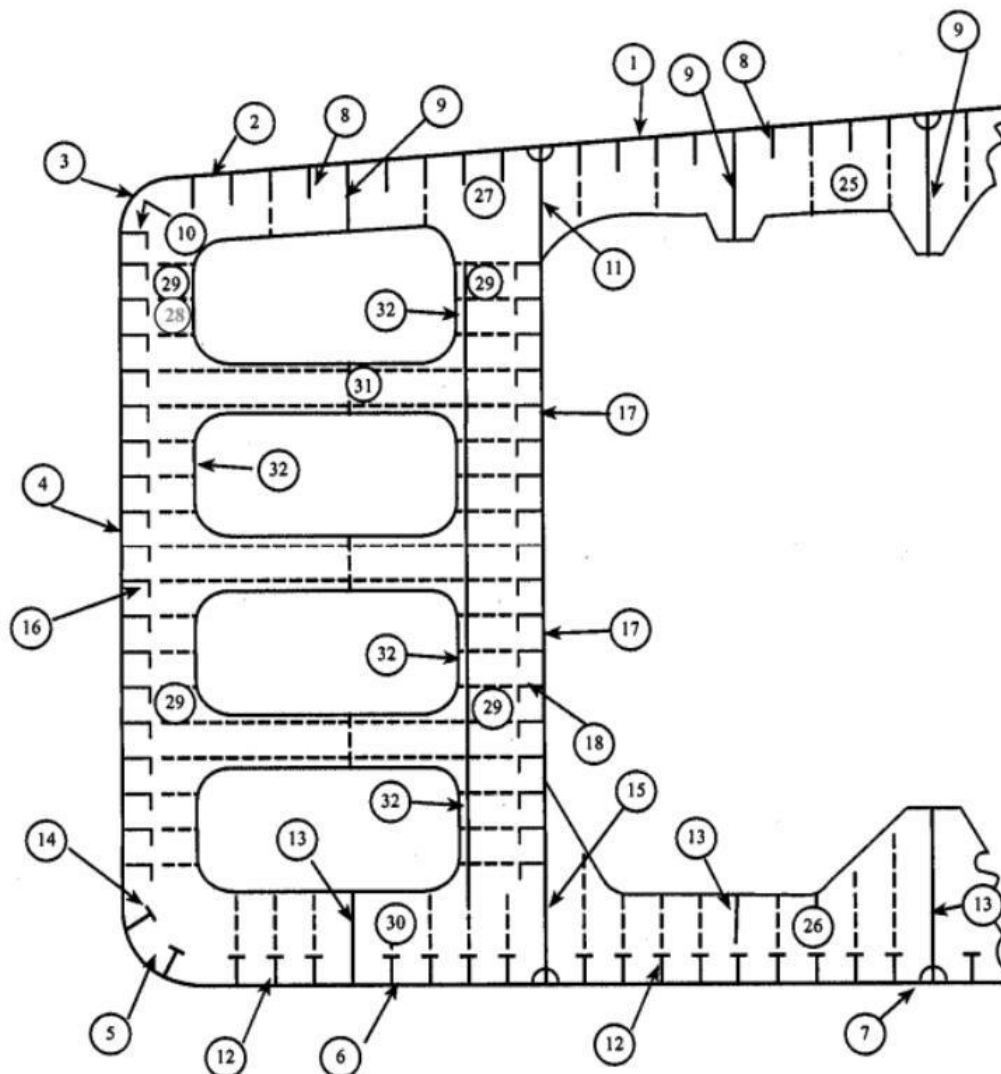
Void is an enclosed empty space in a ship.

Wash Bulkhead is a perforated or partial bulkhead in a tank.

Watertight Bulkhead is a collective term for transverse bulkheads required for subdivision of the hull into watertight compartments.

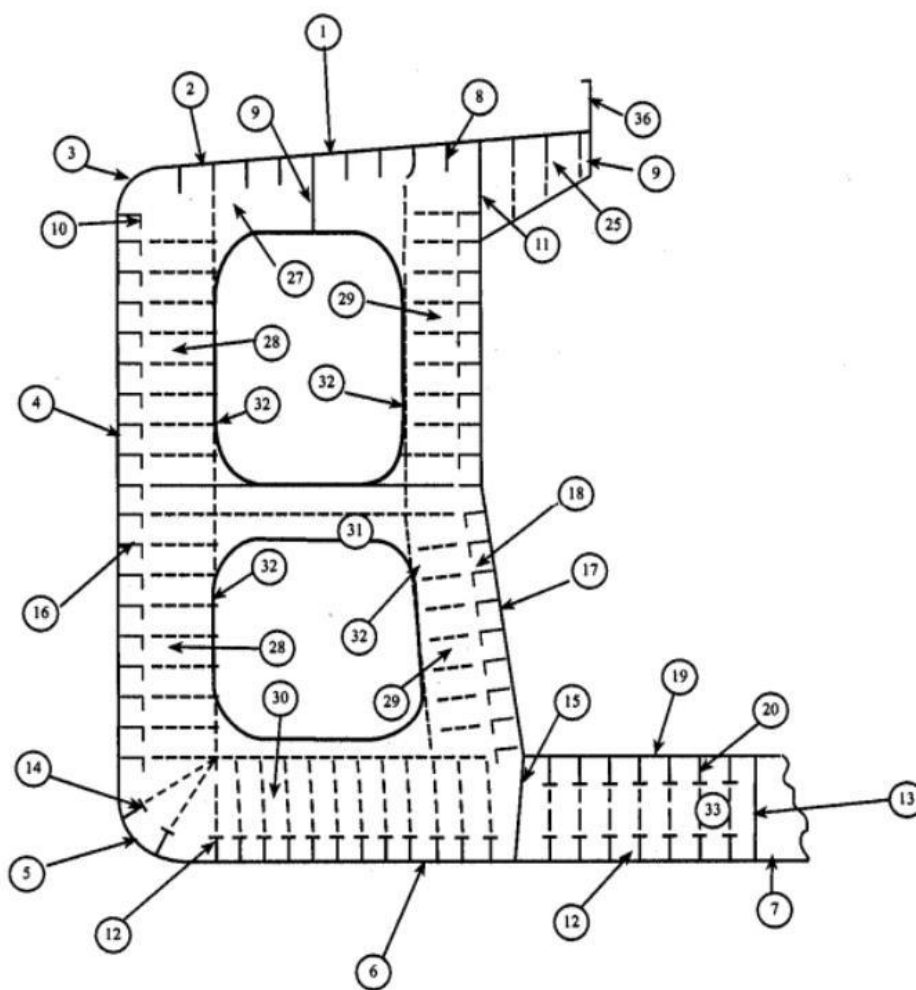
Wind and Water Strakes are the strakes of a ship's side shell plating between the ballast and deepest load waterline.

2.2 Nomenclature for typical hull structures



1	Strength deck plating	14	Bilge longitudinals
2	Stringer plate	15	Longitudinal bulkhead lower strake
3	Sheer strake	16	Side shell longitudinals
4	Side shell plating	17	Longitudinal bulkhead plating
5	Bilge plating	18	Longitudinal bulkhead longitudinals
6	Bottom shell plating	25	Deck transverse centre tank
7	Keel plate	26	Bottom transverse centre tank
8	Deck longitudinals	27	Deck transverse wing tank
9	Deck girders	28	Side shell vertical web
10	Sheer strake longitudinal	29	Longitudinal bulkhead vertical web
11	Longitudinal bulkhead top strake	30	Bottom transverse wing tank
12	Bottom longitudinals	31	Cross ties
13	Bottom girders	32	Transverse web face plate

Figure 1: Single Hull Tanker – Typical Transverse Section



1	Strength deck plating	16	Side shell longitudinals
2	Stringer plate	17	Longitudinal bulkhead plating
3	Sheer strake	18	Longitudinal bulkhead longitudinals
4	Side shell plating	19	Inner bottom plating
5	Bilge plating	20	Inner bottom longitudinals
6	Bottom shell plating	25	Deck transverse centre tank
7	Keel plate	26	Bottom transverse centre tank
8	Deck longitudinals	27	Deck transverse wing tank
9	Deck girders	28	Side shell vertical web
10	Sheer strake longitudinal	29	Longitudinal bulkhead vertical web
11	Longitudinal bulkhead top strake	30	Bottom transverse wing tank
12	Bottom longitudinals	31	Cross ties
13	Bottom girders	32	Transverse web face plate
14	Bilge longitudinals	33	Double bottom floor
15	Longitudinal bulkhead lower strake	36	Hatch coamings

Figure 2: Single Hull Oil / Ore Carrier – Typical Transverse Section

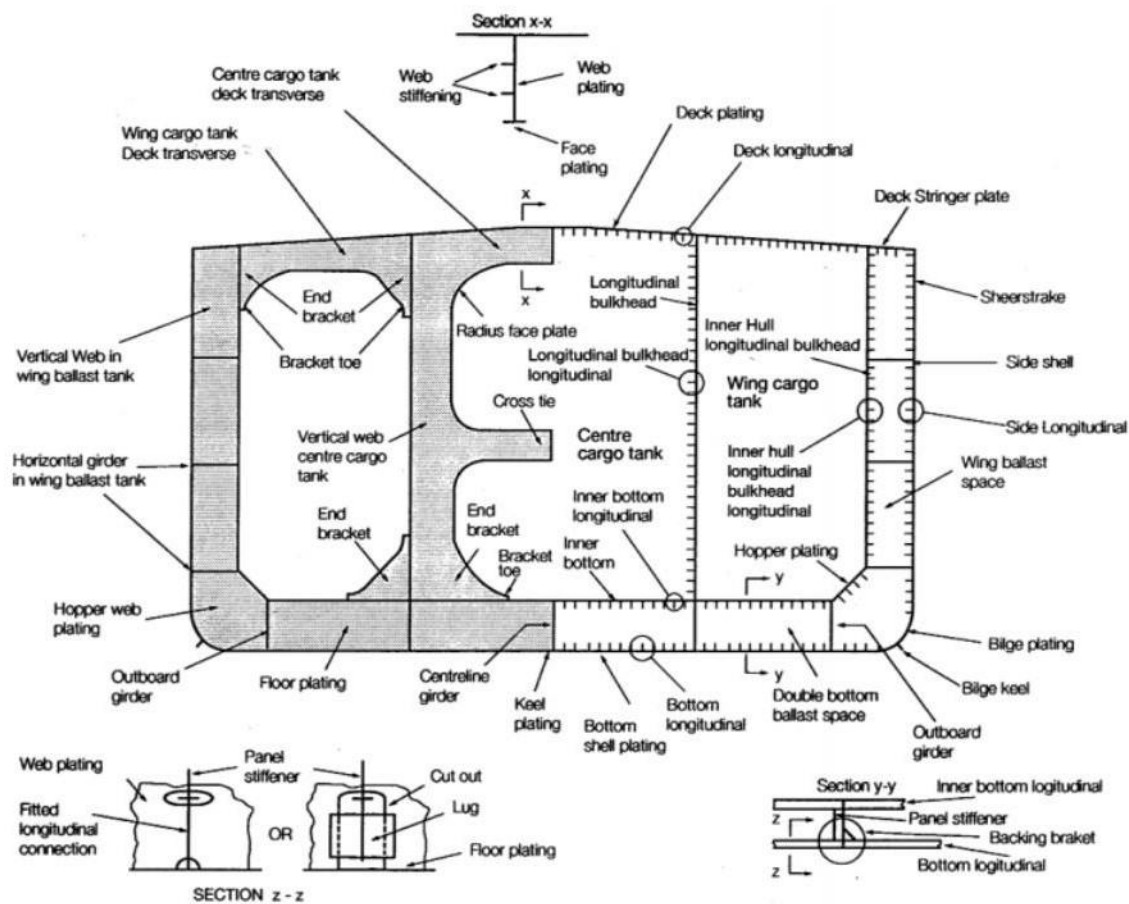


Figure 3: Double Hull Tanker – Typical Transverse Section

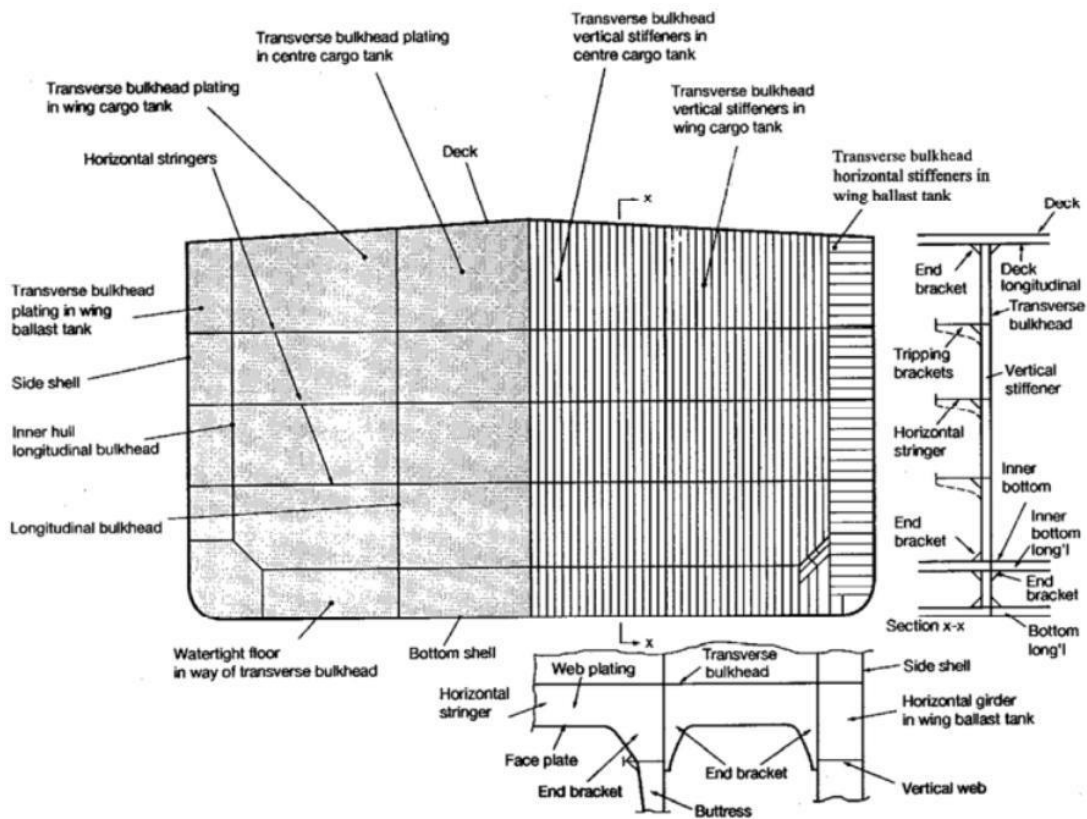


Figure 4: Double Hull Tanker – Typical Transverse Bulkhead

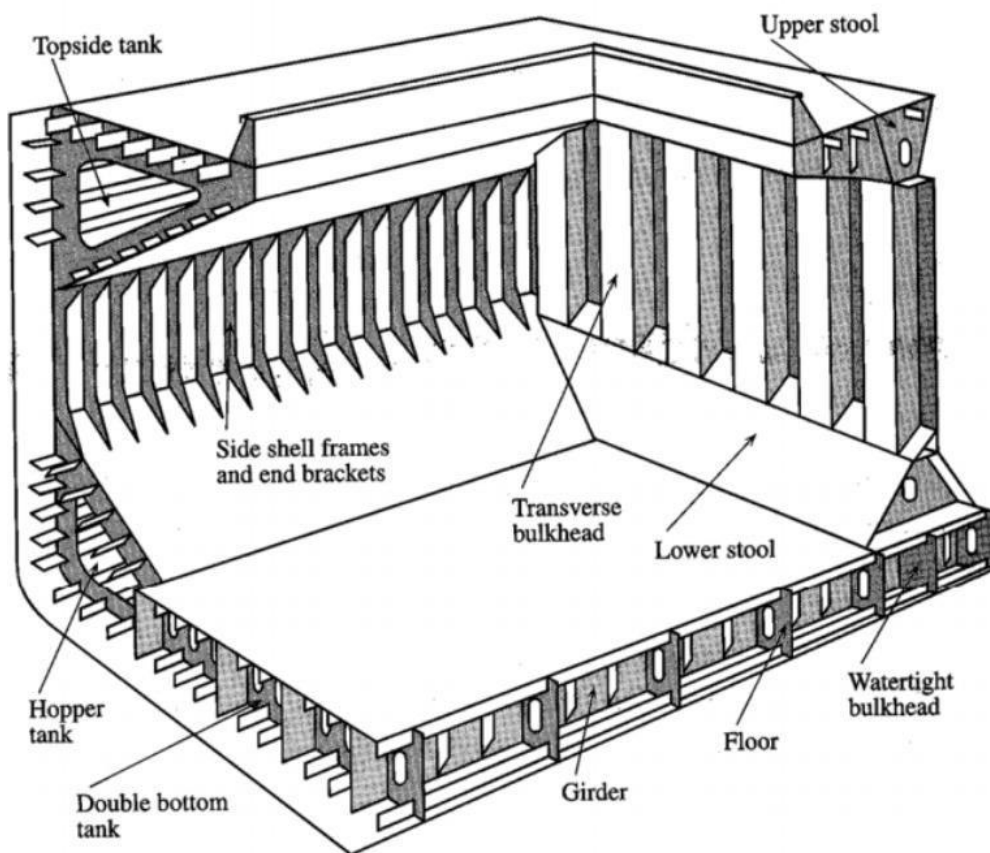


Figure 5: Single Skin Bulk Carrier – Typical Cargo Hold Structural Configuration

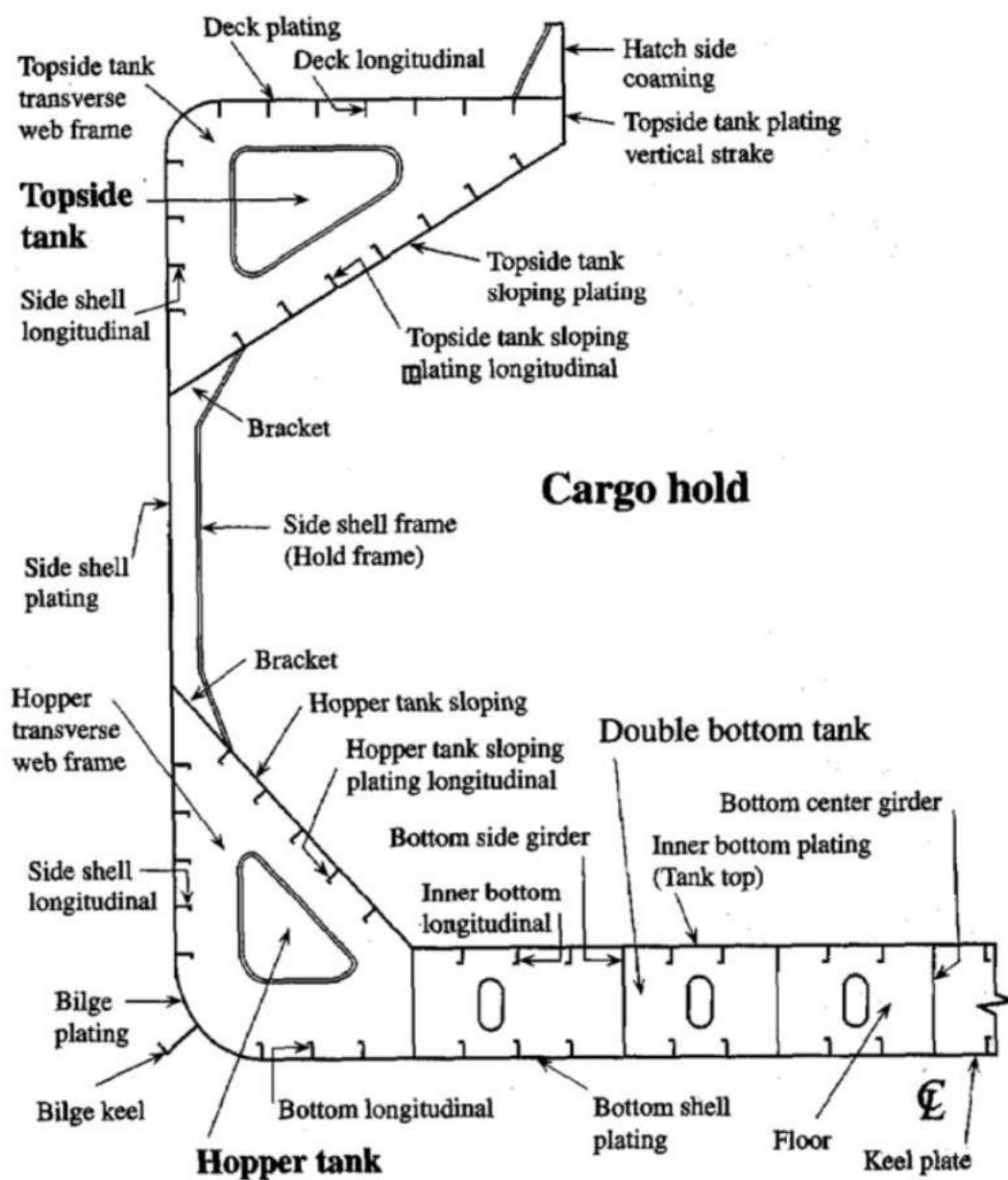


Figure 6: Single Skin Bulk Carrier – Typical Transverse Section

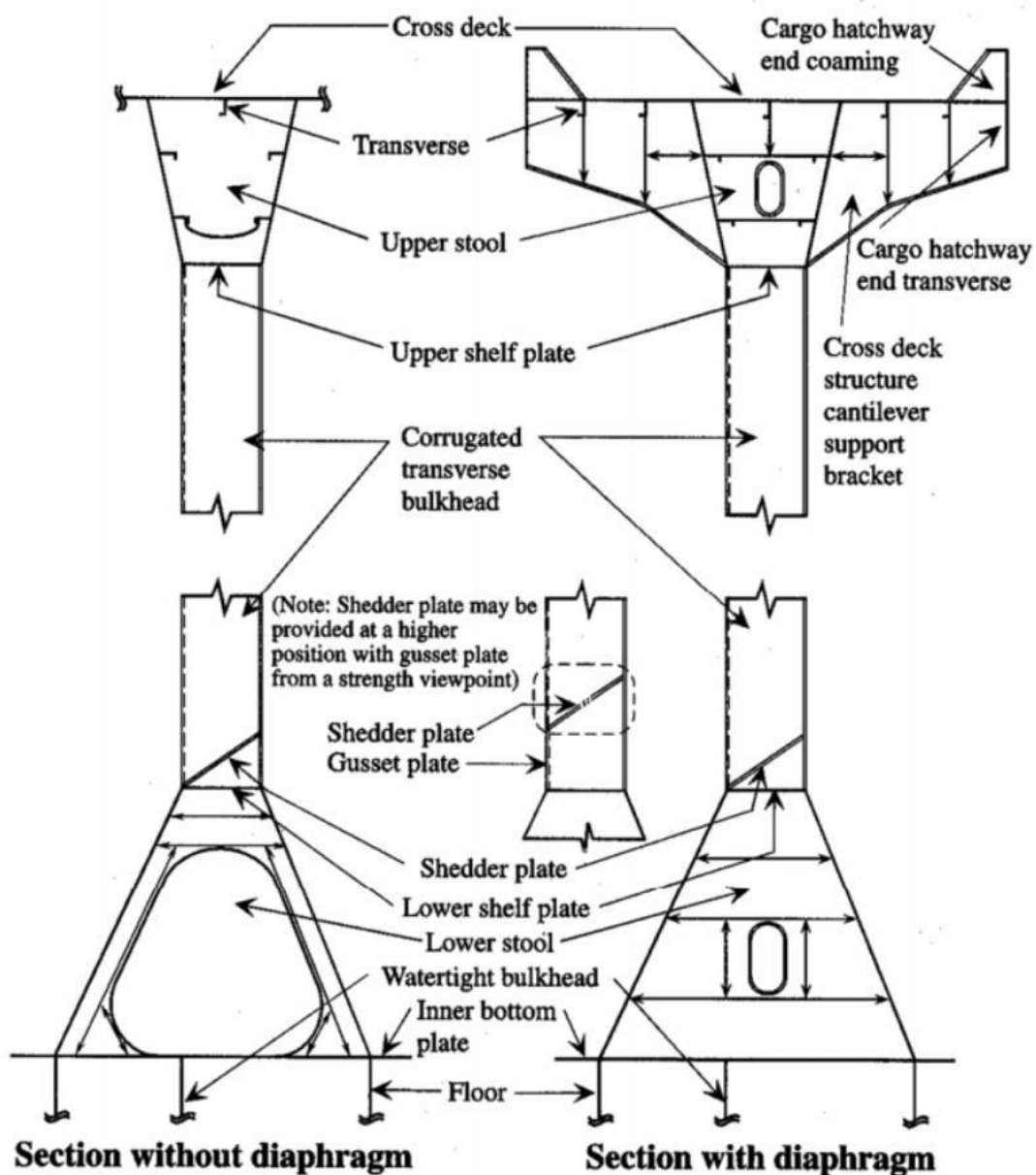


Figure 7: Bulk Carrier – Typical Transverse Watertight Bulkhead

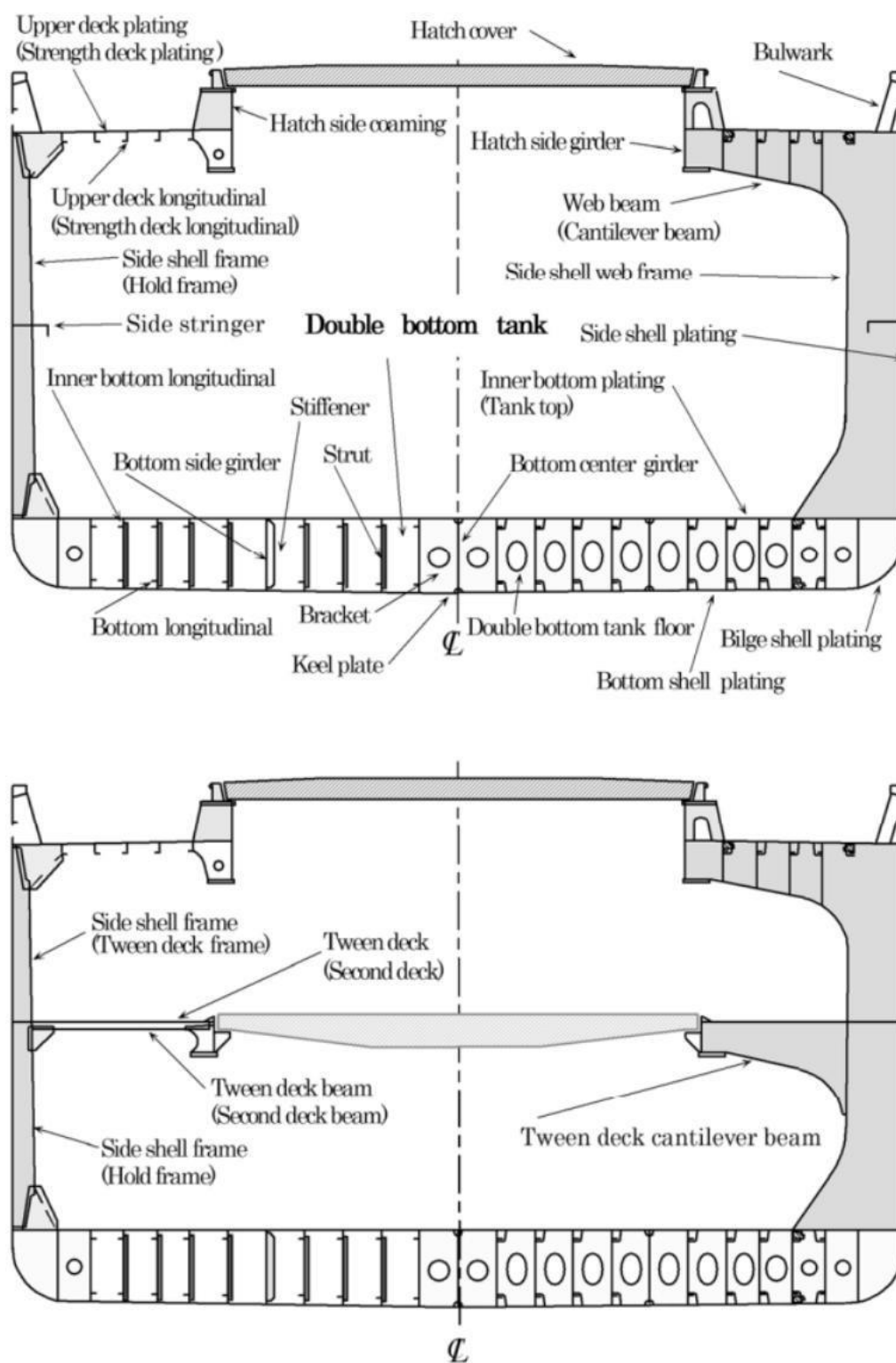


Figure 8: General Dry Cargo Ship – Typical Transverse Section

3. Hull Survey Terms

Abrasion is the removal of material by mechanical, i.e. rubbing or frictional, means.

Active Corrosion means gradual chemical or electrochemical attack on a metal producing loose scale, by atmosphere, moisture or other agents.

Allowable Corrosion or **Wastage Limit** is the acceptable thickness diminution of structural elements.

Anode is the positively charged metal surface and the corroding part of an electrochemical corrosion cell at which the oxidation or loss of electrons occurs. Sacrificial anode or impressed current anode.

Antifouling is paint for use on underwater areas on hulls. Antifouling contains agents who prevent the adhesion and growth of organisms on the hull.

Bacterial Corrosion or **Microbially Influenced Corrosion (MIC)** is corrosion which is induced or accelerated by the presence of micro organisms.

Blasting or **Shot-Blasting** is the cleaning of a metal surface by a stream of abrasive particles.

Blister - a raised area, often dome shaped, resulting from loss of adhesion between a coating or deposit and the substrate.

Brittle Fracture is the separation of a solid accompanied by little or no macroscopic plastic deformation. Typically, brittle fracture occurs by rapid crack propagation with less expenditure of energy than for ductile fracture. Brittle tensile fractures have a bright, granular appearance and exhibit little or no necking.

Buckling: a bulge bend or other wavy condition of the structure caused by in plane compressive stresses and /or shear stresses.

Butt Joint is a joint between two structural members lying in the same plane. Typically a butt joint is used to describe the welded connection between two plates in the transverse direction.

Cathode is the negatively charged metal surface and the non-corroding or protected part of an electrochemical corrosion cell.

Cathodic Protection is the partial or complete protection of a metal from corrosion by making it a cathode, using either a galvanic or an impressed current to bring a metal to a potential where it is thermodynamically stable.

Cavitation Damage is degradation of metal surfaces, characterized by pitting, in which the pit profile is irregular, occurring when very turbulent fluids are in contact with the metal surface, and associated with the formation and collapse of cavities in the liquid at the solid – liquid interface.

Close-up Survey is a survey where the details of structural members are within the close visual inspection range of the surveyor, i.e. normally within the reach of hand.

Coating Evaluation Criteria is normally an assessment of the extent of damage registered in terms of coating breakdown area and/or rust scales in % of area under consideration, normally the complete tank, with additional information on coating

damage to edges and weld connection. Typical coating failures may be given as additional information.

Coating, often synonymous with **Painting**, i.e. a protective film of thickness usually about 0,2 - 0,5 mm, applied to prevent corrosion mainly via a three main mechanisms; the barrier effect, the cathodic effect or by inhibition / passivation.

Collision Damage is damage caused by physical impact between two or more ships used for navigation.

Condition Assessment Programme (CAP) is a voluntary system, which gives a detailed assessment of a tanker's actual condition at the time of inspection and is available to both charter-parties and owners.

Condition Survey is a survey normally of limited scope and time and intended to identify any anticipated structural or corrosion related deficiencies and give an overall visual impression of the structural integrity.

Contact Damage is damage caused when the ship strikes something other than another ship. (see also '**Grounding**').

Corrosion Fatigue is the process in which a metal fractures prematurely in a trans-crystalline manner under conditions of simultaneous corrosion and repeated cyclic loading of lower stress levels or fewer cycles than would be in the absence of a corrosive environment

Corrosion is the chemical or electrochemical reaction between a material, usually a metal and its environment that produces a deterioration of material and its properties, usually an oxide is formed.

Corrosion Prevention System is considered a full hard coating; alternatively a full hard coating supplemented by cathodic protection.

Crack is a fracture type discontinuity without complete separation characterized by a sharp tip and high ratio of length and width to opening displacement.

Crevice Corrosion is localized corrosion of a metal surface at, or immediately adjacent to, an area that is shielded from full exposure to the environment because of close proximity between the metal and surface of another material. It is usually associated with small volumes of stagnant water; within lapped joints, under heads of fastenings, under gaskets and packings, under marine organisms and porous deposits.

Critical Structural Areas are locations which have been identified from calculations to require monitoring or from the service history of the subject ship or from similar ships to be sensitive to cracking, buckling or corrosion which would impair the structural integrity of the ship.

Cumulative Damage is an aggregation of damage due to various physical causes, specifically applied to fatigue under various stress ranges and frequencies.

Damage Survey is a survey requested as a result of hull damage or other defects.

Deformation is a change in the form of a structure due to stress, thermal change, change in moisture, or other causes.

Delamination is peeling from undercoat or substrate.

Deposit Attack is an attack under, or around, the edge of a local deposit formed on a metal surface in the presence of an electrolyte.

Ductile Fracture is the separation of a solid accompanied by gross plastic deformation.

Edge Corrosion is local corrosion at the free edges of stiffeners, brackets, flanges, manholes etc.

Elasticity means the structural member's capability of sustaining stress without permanent deformation, i.e. to recover its original size and shape after the stress has been removed.

Electrochemical Corrosion is corrosion associated with the passage of an electric current. If the current is produced by the system itself it is called Galvanic Corrosion and if it results from an impressed current it is called Electrolytic Corrosion.

Erosion Corrosion is a combined action involving corrosion and erosion in the presence of a moving corrosive fluid, leading to the accelerated loss of material. Erosion corrosion is characterized by grooves, gullies, waves, valleys etc., usually with directional pattern and with bright surfaces free from corrosion products.

Erosion Damage is the physical removal of material from a surface by mechanical means such as e.g. flowing liquid and it may be accelerated by corrosion.

Excessive Corrosion is an extent of corrosion that exceeds the Allowable Corrosion.

Extensive Corrosion is an extent of corrosion consisting of hard and/or loose scale, including pitting, over 70% or more of the area under consideration, accompanied by evidence of thickness diminution.

FAIR condition is a term used to describe the condition of a hard coating; with local breakdown at edges of stiffeners and weld connections and/or light rusting over 20% or more of areas under consideration, but less than as defined for POOR condition.

Fair is to smooth or fair up a ship's lines and eliminating irregularities.

Fatigue is the phenomenon leading to fracture under repeated or fluctuating stresses having a maximum value significantly less than the ultimate tensile strength of the material.

Fracture is the propagation of a crack through the thickness of a material.
(see '**Brittle**' and '**Ductile**' Fractures)

Galvanic Corrosion is electrochemical accelerated corrosion of a metal because of an electrical contact with a more noble metal or nonmetallic conductor in a corrosive electrolyte.

Galvanizing is the deposition of zinc on to the surface of steel to provide corrosion protection by both protecting the steel from contact with the environment and giving sacrificial protection.

General Corrosion or **Overall Corrosion** appears as non-protective, friable rust of a uniform nature on uncoated surfaces. Rust scale continually breaks off, exposing fresh metal to corrosive attack. Visual judgment of thickness loss is difficult until serious

wastage has occurred.

GOOD condition is a term used to describe condition of hard coating; with only minor spot rusting.

Grooving Corrosion is local corrosion normally adjacent to welding joints along abutting stiffeners and at stiffener or plate butts or seams.

Grounding is contact of the ship's bottom with the sea floor.

Hard Coating is a coating which chemically converts during its curing process, normally used for new construction, or non-convertible air drying coating which may be used for maintenance purposes. Hard coating can be either organic or inorganic and covers typical marine coatings such as those based on epoxy, coal tar epoxy, polyurethane, chlorinated rubber, vinyl, zinc epoxy, zinc silicate.

Hose Testing is carried out to demonstrate the tightness of structures not subject to structural (hydrostatic) or leak testing and to other components that contribute to the watertight or weathertight integrity of the hull.

Hydropneumatic Testing is a combination of hydrostatic and air testing.

Indent is deformation of structural members caused by out of-plane loads like bottom slamming and bow impact forces, contact with other objects etc.

Inhibitors are substances used to prevent or retard a chemical or electrochemical reaction, often used to render corrosion products less soluble and thereby tending to stifle electrochemical corrosion processes.

Insignificant Corrosion or **Minor Corrosion** is an extent of corrosion with minor spot rusting and such that an assessment of the corrosion pattern indicates wastage generally not exceeding of 30% of the allowable corrosion limits.

Lamination is an excessively large, laminar, non-metallic inclusion, producing a defect appearing in sheets or strips as segregation or in layers.

Lap Joint is a joint between two structural members that overlap each other.

Leak Testing is an air or other medium test carried out to demonstrate the tightness of the structure.

Local Corrosion is by name local in nature, often appearing at areas with local breakdown of coating or at areas with stress concentrations.

Loose Scale is sheets of rust falling off if the surveyor hits the structure with his test hammer. Loose scale can best be removed by hand or power tool cleaning or a combination of these.

Mill Scale is thick oxide film formed on wrought-metal products which have been hot-rolled or forged and allowed to cool in air, the term is principally applied to steel on which the oxide is essentially magnetic black oxide.

Necking Effect is a term describing local corrosion at junction of plating and stiffeners due to flexure effects caused by reverse, cyclic loading with loss of coating or shedding of scale exposing fresh steel to further corrosion. The corrosion rate may be rather high and accelerates with thinning of the material.

On-hire/Off-hire Survey is surveys carried out to state the ship's condition prior to or after her chartering. The main purpose is to record deficiencies or damages.

Overall Survey is survey intended to report on the overall condition of the hull structure and determine the extent of additional close-up surveys.

Paint can be described as a liquid material capable of being applied or spread over a solid surface on which it subsequently dries or hardens to form a continuous adherent, obliterating film.

Paint Cracking is deep cracks in paint that expose substrate.

Periodical Survey is a collective term of classification surveys carried out after the delivery a ship and at prescribed time intervals, i.e. annual, intermediate and renewal/special surveys.

Pinholing is tiny, deep holes exposing substrate.

Pinpoint Rusting is local rusting at pinholes or holidays.

Pitguard Anode is a sacrificial anode placed just above tank bottom in order to mitigate the general and pitting corrosion process.

Pitting Corrosion is local, random scattered corrosion mainly on horizontal surfaces and at structural details where water is trapped, particularly at bottom of tanks. For coated areas the attack produces deep and small diameter pits which may lead to perforation. Pitting of uncoated areas in tanks, as it progresses, forms shallow but very wide scabby patches (e.g. 300 mm in diameter) and the appearance resembles condition of general corrosion.

Plasticity is the property of a material that allows it to be extensively repeatedly deformed without rupture when acted upon by a force sufficient to cause deformation and that allows it to retain its deformed shape after the applied force has been removed.

POOR condition is a term used to describe condition of hard coating; with general breakdown of coating over 20% or more or hard scale at 10% or more of areas under consideration.

Prompt and Thorough Repair is permanent repair completed at the time of the survey to the satisfaction of the surveyor, therein removing the need for imposition of any associated condition of class.

Rust is a visible corrosion product consisting of hydrated oxides of iron and is formed on steel surfaces exposed to moist atmospheric conditions.

Sags are excess flow of paint, also called runs or curtains.

Scale is surface oxidation, consisting of partially adherent layers of corrosion products, left on metals by heating or casting in air or in other oxidizing atmospheres and is the product of the corrosion process of steel with a porous surface layer or flakes, in volume greater than the metal from which it was formed.

Scantlings are the dimensions of a ship's structural members as girders, stiffeners and plates.

Seam is a joint between two structural members lying in the same plane. Typically a seam is used to describe the welded connection of two plates in the longitudinal direction.

Semi-hard Coating is a coating that dries or converts in such a way that it stays flexible although hard enough to touch and walk upon.

Shop primer is a rust preventing paint for temporary protection of steel immediately after blasting for protection of the material surface from corrosion during construction and until the final paint system is applied.

Soft Coating is a coating that remains soft so that it wears off at low mechanical impact or when touched; often based on oils (vegetable or petroleum) or lanolin (sheep wool grease). Application of soft coating does generally not allow relaxation of the extent of periodical hull survey requirements of ballast tanks.

Statutory Survey is a collective term of surveys required to meet International Convention requirements such as Load Line, SOLAS and MARPOL.

Strain is any forced change in the dimensions of a structural member.

Stress Concentration or **Stress Raiser** is a term used of any notch, crack, hole, corner, groove, attachment or other interruption to smooth flow of stress and strain in structures introduces a concentration of stress.

Stress Corrosion is the preferential attack of areas under tensile stress in a corrosive environment, where such an environment alone would not have caused corrosion. Tensile stresses may be residual stresses from welding or cold-working or applied working stresses.

Stripe Coating is used to produce a coating with sufficient film thickness on edges, corners, weld seams and other areas that are difficult to coat using airless spray.

Structural Testing or **Tank Testing** is a hydrostatic test carried out to demonstrate the structural adequacy of design and tightness of tank boundaries.

Substantial Corrosion is an extent of corrosion such that assessment of corrosion pattern indicates wastage in excess of 75% of allowable corrosion, but within allowable corrosion limits.

Survey is a collective term for examination, testing and evaluation of results and decision making.

Suspect Areas are locations showing substantial corrosion and/or are considered to be prone to rapid wastage.

Transverse Section includes, for thickness measurement purposes, all longitudinal members such as plating, longitudinals and girders at the deck, side, bottom, inner bottom and longitudinal bulkheads. For transversely framed ships, a transverse section includes adjacent frames and their end connections in way of transverse section. Also called **Girthbelt**.

Watertight means capable of preventing the passage of water through the structure under a head of water for which the surrounding structure is designed.

Wear is the deterioration of a surface due to relative motion between it and another.

Weathertight means that in any sea condition water will not penetrate into the ship.

Weld Metal Corrosion is a preferential corrosion of the weld deposit due to an electrolytic action between the weld metal and base metal.