Lloyd's Register
Marine

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Thickness measurement and close-up survey guidance

Part 1, Thickness measurement process

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Part 1 – Thickness Measurement Process

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1.1 Introduction

At Periodical Survey it is a requirement to carry out overall examination and Thickness Measurement of hull structures. Additionally for oil tankers (including ore/oil ships and ore/bulk/oil ships), chemical tankers, dry bulk cargo ships, ships for liquefied gases and general dry cargo ships it is a requirement to carry out Close-up Surveys.

Lloyd's Register's (LR's) Rules and Regulations for the Classification of Ships (Part 1 Regulations) details, amongst other things, the periodical Survey requirements for existing ships. Planning and preparation for Survey, Thickness Measurement and Close-up Survey are important aspects of the survey process, detailed within this document.

The requirements for Thickness Measurement and Close-up Survey of ships at Special Survey are indicated in the Regulations, Part 1, Chapter 3, Sections 5, 6, 7, 8 and 9; the extent of these Surveys being dependent on ship type and ship age. The requirements for Thickness Measurement of Inland Waterways Ships, Special Service Craft and Naval Ships can be found in separate Rules and Regulations.

As guidance to Surveyors, Owners and other interested parties, this document has been developed to complement the Regulations, providing in tabular form and diagrammatically the requirements for Thickness Measurement and Close-up Survey as follows:

- Part 1 – Thickness Measurement Process
- Part 2 – Special Survey Requirements: General Dry Cargo Ships
- Part 3 – Special Survey Requirements: Bulk Carriers
- Part 4 – Special Survey Requirements: Oil Tankers, Ore/Oil Ships, Ore/Bulk/Oil Ships
- Part 5 – Special Survey Requirements: Chemical Tankers
- Part 6 – Special Survey Requirements: Ships For Liquefied Gases
- Part 7 – Annual and Intermediate Survey Requirements

It is recommended that readers use Part 1 and then the appropriate of Parts 2 to 7 as per ship type of interest, as guidance to conducting Thickness Measurements and Close-up Surveys prior to attendance on board. This document is available for all users to download on our website: www.lr.org/tm

1.2 Survey Planning

1.2.1 Opening Meeting

For all ships: prior to the commencement of any part of the Special or Intermediate Survey (including voyage surveys), a meeting is to be held between the attending Surveyor(s), the Owner's representative, the Thickness Measurement (TM) Company operator representative and the Master of the ship or an appropriately qualified representative appointed by the Master or Owner, so as to ensure the safe and efficient conduct of the survey. During the opening meeting a clear method of communication between the Surveyor, Owner and TM Company operator is to be established to ensure that all parties are regularly and promptly notified of findings, including excessive and/or extensive corrosion or pitting/grooving of any significance, structural defects like buckling, fractures and deformed structures, detached and/or holed structure and corrosion of welds. It is an IACS requirement that this information must be recorded. Lloyd's Register (LR) Form 6012 (2010/06) entitled 'Opening Meeting – Agenda' is to be completed by the Surveyor during the opening meeting to satisfy the requirements of the above. Form 6012 (2010/06) is available in Appendix 1.

On ships where the notation **ESP** is assigned, the survey planning meeting should address the following items (which are recommended to be addressed for all ship types where applicable) for the purpose of ascertaining that all the arrangements envisaged in the Survey Programme are in place, allowing for the safe and efficient conduct of the survey to be carried out.:

- The schedule of the ship (i.e. voyage, docking and undocking manoeuvres, periods alongside, cargo and ballast operations, etc.)
- Provisions and arrangements for thickness measurements, (i.e. access, cleaning/de-scaling, illumination, ventilation, personal safety), *see* Chapter 3
- Extent of the thickness measurements
- CSR or non CSR Rule compliance & permissible diminution levels(if applicable), *see* Chapter 5
- Availability of approved plans onboard and to TM Company
- Extent of Close-up Survey and thickness measurement considering the coating condition and suspect areas/areas of substantial corrosion
- Execution of thickness measurements
- Taking representative readings in general and where uneven corrosion/pitting is found.
- Mapping of areas of substantial corrosion
- Communication methods between attending Surveyor(s), the TM Company Operator(s) and Owner's representative(s) concerning findings
- Method of communication concerning confirmation of repairs for defected areas prior to survey completion

Proper preparation and close co-operation between the attending Surveyor(s) and the Owner's representative on board prior to and during the survey are an essential part of the safe and efficient conduct of the survey. On board safety meetings are to be held regularly.

1.2.2 Additional Requirements

The following conditions, as reflected from Ship's Memoranda, will require additional Thickness Measurements at periodical surveys unless otherwise instructed.

1.2.2.1 Substantial Corrosion

In general and where considered necessary, structure that is identified with substantial corrosion will require Close-up Survey and Thickness Measurement at Annual and subsequent Surveys with representative readings taken to identify the extend of corrosion.

For CSR vessels coating applied in accordance with the coating manufacturer's requirements or annual gauging may be adopted as an alternative to the steel renewal. The coating is to be maintained in good condition and annual examination is required by the surveyor.

For those ships where **ESP** class notation is applicable, details of substantial corrosion is also recorded in the Executive Summary.

A matrix that summarises substantial corrosion and how to treat it can be found below:

SUBSTANTIAL CORROSION MATRIX

Rules	Survey Area	Definition	Actions During Survey	Actions During Reporting
Conventional (Non-CSR)	Any	Substantial Corrosion is an extent of corrosion such that assessment of the corrosion pattern indicates a wastage in excess of 75% of allowable margins, but within acceptable limits.	The survey is to be extended when Substantial Corrosion is found and include additional Close-up Survey when necessary. The extent of thickness measurements is to be increased in accordance with TM Guide. These extended thickness measurements are to be carried out before the survey is credited as completed. Areas identified at previous surveys with Substantial Corrosion are to have thickness measurements taken(*not applicable to CSR*) Areas found with Substantial Corrosion are to be examined at subsequent annual surveys	Memoranda applied by the surveyor separately for each space/hold/tank in order to identify areas with substantial corrosion: "AREAS XXXXXX FOUND WITH SUBSTANTIAL CORROSION - TO BE EXAMINED AND GAUGED AT EACH ANNUAL SURVEY"
CSR	Any	Substantial corrosion is an extent of corrosion such that the assessment of the corrosion pattern indicates a measured thickness between t_{REN} + 0.5mm and t_{REN} + 1mm. (t_{REN} = renewal thickness)	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 examined and gauged at annual intervals The annual thickness gauging may be omitted where a protective coating has been applied in accordance with the coating manufacturer's requirements and is maintained in good condition. *All Non-CSR 'Actions During Survey' are applicable(except otherwhise instructed)*	Memoranda applied by the surveyor for each space/hold/tank in order to identify areas with substantial corrosion: "AREAS XXXXXX FOUND WITH SUBSTANTIAL CORROSION - TO BE EXAMINED AT EACH ANNUAL SURVEY AND TO BE GAUGED IF COATING: NOT APPLIED / FAIR / POOR"
IACS UR S19	Evaluation of Scantlings of the Transverse Watertight Corrugated Bulkhead between Cargo Holds Nos. 1 and 2, with Cargo Hold No. 1 Flooded, for Existing Bulk Carriers not constructed in compliance with IACS Unified Requirement S18	Where the gauged thickness is within the range t_{net} + 0,5 mm and t_{net} + 1,0 mm, or when measured(gauged) thickness is between: $T_{REN} \leq T_M \leq T_{COAT}$ NOTE: *Revised limits of 'Substantial Corrosion' and implementation will be indicated in a 'Table of Diminution' incorporated in the bulkhead approved plan.*	Coating (applied in accordance with the coating manufacturer's requirements) or annual gauging may be adopted as an alternative to steel renewal.	A suitable Memorandum is to be added for annual examination and gauging. "AREAS XXXXXX FOUND WITH SUBSTANTIAL CORROSION - TO BE EXAMINED AND GAUGED AT EACH ANNUAL SURVEY"
IACS UR S31	Renewal Criteria for Side Shell Frames and Brackets in Single Side Skin Bulk Carriers and Single Side Skin OBO Carriers not Built in accordance with UR S12 Rev.1 or subsequent revisions	When measured (gauged) thickness is between: $T_{REN} \leq T_M \leq T_{COAT}$	If renewal or other measures according to S31 are to be applied on individual frames in a hold, then all frames in that hold are to be gauged. Where gauging readings close to the criteria are found, the number of hold frames to be measured is to be increased. a) Sand blasting, or equivalent, and coating. b) Fitting tripping brackets, when the above condition occurs for any of the side frame zones A, B, C and D. c) Maintaining the coating in "as-new" condition (i.e. without breakdown or rusting) at Special and Intermediate Surveys. Waiving of sandblasting and coating is permitted if: - coating is in GOOD condition; AND - tripping brackets are fitted and the coating damaged in way of the tripping bracket welding is repaired.	Memoranda applied by the surveyor for each space/hold/tank in order to identify areas with substantial corrosion: "FOR CONTINUOUS COMPLIANCE WITH THE REQUIREMENTS OF UR S31, AREAS XXXXXX TO BE EXAMINED AT EACH ANNUAL SURVEY AND TO BE GAUGED IF COATING: NOT APPLIED / FAIR / POOR"
IACS UR S18	Evaluation of Scantlings of Corrugated Transverse Watertight Bulkheads in Bulk Carriers Considering Hold Flooding	When the gauged thickness is between Renewal Thickness (t_{net} + 0.5mm) and Renewal Thickness + 0.5mm (t_{net} + 1.0mm)	Coating (applied in accordance with the coating manufacturer's requirements) or gauging at each Annual Survey may be adopted as an alternative to steel renewal. Coating is to be maintained in GOOD condition.	A suitable Memoranda is to be added for the structural area in question, whether it has been re-coated or is subject to annual gauging: "FOR CONTINUOUS COMPLIANCE WITH THE REQUIREMENTS OF UR S18, AREAS XXXXXX TO BE EXAMINED AT EACH ANNUAL SURVEY AND TO BE GAUGED IF COATING: NOT APPLIED / FAIR / POOR"
IACS UR S21 and S21A	Evaluation of Scantlings of Hatch Covers and Hatch Coamings and Closing Arrangements of Cargo Holds of Ships	When the gauged thickness is between Renewal Thickness (t_{net} + 0.5mm) and Renewal Thickness + 0.5mm (t_{net} + 1.0mm)	Coating (applied in accordance with the coating manufacturer's requirements) or gauging at each Annual Survey may be adopted as an alternative to steel renewal. Coating is to be maintained in GOOD condition.	A suitable Memoranda is to be added for the structural area in question, whether it has been re-coated or is subject to annual gauging: "FOR CONTINUOUS COMPLIANCE WITH THE REQUIREMENTS OF UR S21/21A, AREAS XXXXXX TO BE EXAMINED AT EACH ANNUAL SURVEY AND TO BE GAUGED IF COATING: NOT APPLIED / FAIR / POOR"

1.2.2.2 Tank Coatings

For all ships, with the exception of oil tankers and chemical tankers, salt-water ballast tanks, other than independent double bottom ballast tanks, where a hard protective coating is found in POOR condition and is not renewed, where soft coating has been applied, or where a hard protective coating was not applied from the time of construction, the tanks in question are to be examined at Annual Survey. Representative thickness measurement readings are required to be taken to assess the condition of the structure. The extent of the readings is to be decided by the attending Surveyor.

For independent double bottom ballast tanks, where a hard protective coating is found in POOR condition and is not renewed, where soft coating has been applied, or where a hard protective coating was not applied from time of construction, the tanks in question are to be examined and gauged at Annual Survey at the discretion of the Surveyor. Representative readings are required to be taken to assess the condition of the structure. The extent of the readings is to be decided by the attending Surveyor.

For oil tankers and chemical tankers, tanks used for water ballast, where a hard protective coating is found in less than GOOD condition and is not restored, where soft coating has been applied, where a hard protective coating was not applied from time of construction, where substantial corrosion has been identified. Representative thickness measurement readings are required to be taken to assess the condition of the structure. The extent of the readings is to be decided by the attending Surveyor.

Close-up Survey and thickness measurement may be specially considered and reduced (but not waived) at the discretion of the Surveyor where an efficient protective coating (epoxy or equivalent) is found in GOOD condition.

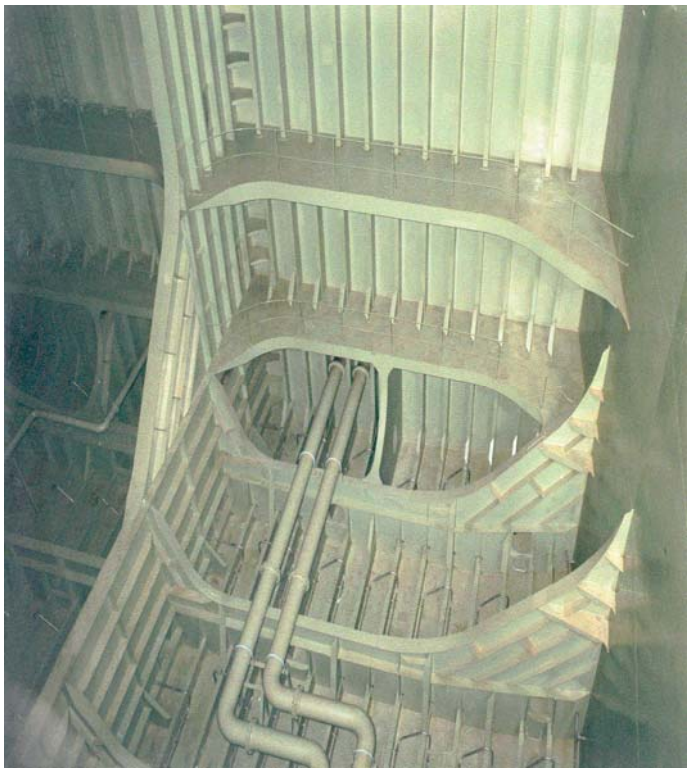
The Surveyor may extend the Close-up Survey as deemed necessary taking into account the condition of the tanks under survey and also the following:

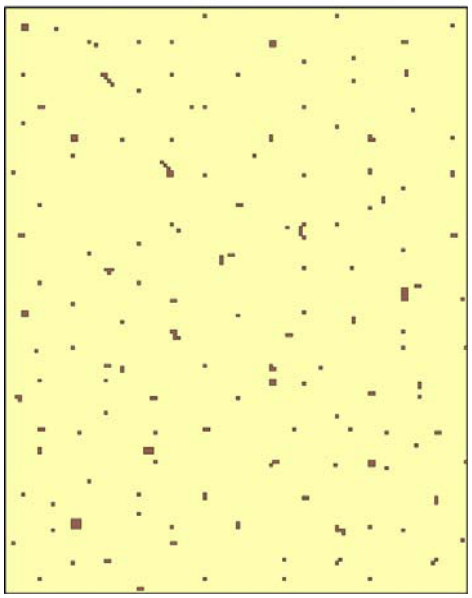
- Structural arrangements or details which have suffered defects in similar tanks or on similar ships
- Structures approved with reduced scantlings due to an approved corrosion control system
- Close-up Survey of Sandwich Plate Systems (SPS) should be done in the same way as for normal structure.

Guidance on the assessment of coatings in ballast tanks can be found in Part 8 of this document.

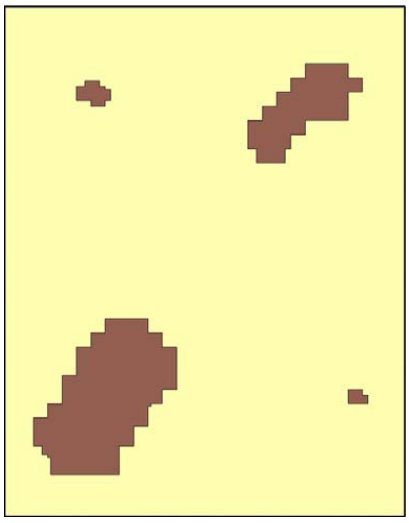
The following tables show examples and definitions of the coating conditions:

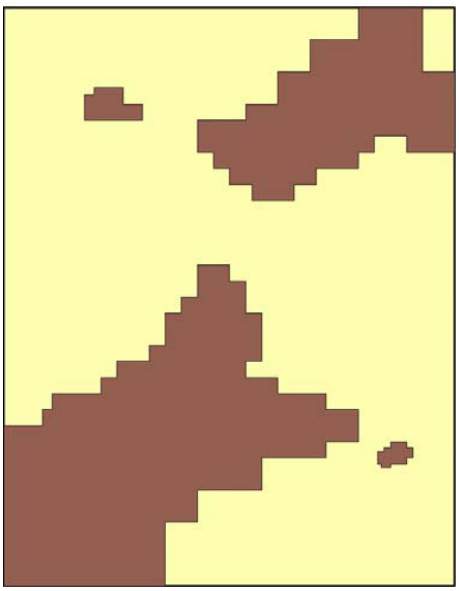
GOOD - Condition with only minor spot rusting





FAIR - Condition with local breakdown of coating at edges of stiffeners and weld connections and/or light rusting over 20 per cent or more of areas under consideration, but less than as defined for poor



POOR - Condition with general breakdown of coating over 20 per cent or more of areas of hard scale at 10 per cent or more of areas under consideration	
	

1.2.3 ESP Ships: Planning and Survey Programme

For Special Surveys, and Intermediate Survey for ships over 10 years of age, of those ships assigned ESP notation (i.e. Oil Tankers, Chemical Tankers, Ore/Oil Ships, Ore/Bulk/Oil Ships, Ore Carriers and Bulk Carriers), Owners are to submit a Survey Planning Questionnaire and Survey Programme prior to the commencement of the survey. The Survey Programme is to include the Owner's proposals for Close-up Survey and Thickness Measurement and is to be approved by the relevant LR Devolved Classification Executive, (DCE).

The Survey Planning Questionnaire is to include information on access provisions for Close-up Surveys and Thickness Measurements; cargo history; the results of inspections carried out by the Owner; a list of reports of Port State Control Inspection containing hull structural deficiencies (if any); a list of Safety Management System non-conformities related to hull maintenance and details of the thickness measurement company (if any).

The Survey Programme is to be submitted prior to the commencement of any part of the survey. This is to be in a written format and submitted to LR at least six months in advance of the survey. The Survey Programme at Intermediate Survey may consist of the Survey Programme agreed for the previous Special Survey supplemented by the Executive Hull Summary of that Special Survey and later relevant survey reports. The survey will not commence until a Survey Programme has been agreed. The Survey Programme is to take into account any amendments to the survey requirements implemented after the previous Special Survey.

Further information on the Survey Planning Questionnaire and Survey Programme can be found in the ESP guidance booklets that have been prepared by LR and are available on our website at www.lr.org/esp.

It should be noted that the work of approved firms will be subject to surveillance checking by the surveyor. In particular, thickness measurements are to be made with the surveyor substantially in attendance. In case the owner prefers to commence the thickness measurements prior to the overall survey then the attending 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.

Recommendations:
It is recommended that thickness measurements are completed over the course of a single survey by one TM Service Supplier and as early as practicable during the survey period. This is considered to be an integral part of survey planning and will provide sufficient time for the Owner and LR to evaluate fully the results of thickness measurements and effect appropriate corrective actions.

It is recommended that Owners provide a preliminary set of ship's plans to the TM Company at the same time as submitting the Survey Programme for approval. In turn TM Companies are advised to prepare the full set of TM sketches prior to attendance on board to conduct the Opening Meeting. These preparations will allow for the prompt delivery of all required documentation and reports upon completion of survey.

1.2.4 Guidelines for technical assessment in conjunction with planning for enhanced surveys

The purpose of the technical assessments described in these guidelines is to assist in identifying critical structural areas, nominating suspect areas and in focusing attention on structural elements or areas of structural elements which may be particularly susceptible to, or evidence a history of, wastage or damage. This information may be useful in nominating locations, areas' holds and tanks for thickness measurement, close-up survey and tank testing and may be used in conjunction with the planning of enhanced surveys of ESP vessels.

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.

However, these guidelines may not be used to reduce the requirements pertaining to thickness measurement, close-up survey and tank testing contained in this book which, in all cases, should be complied with as a minimum.

As with other aspects of survey planning, the technical assessments described in these guidelines should be worked out by the owner or operator in co-operation with Lloyd's Register well in advance of the commencement of the renewal survey, i.e., prior to commencing the survey and normally at least 12 to 15 months before the survey's completion due date.

Considerations
Technical assessments, which may include quantitative or qualitative evaluation of relative risks of possible deterioration, of the following aspects of a particular ship may be used as a basis for the nomination of holds, tanks and areas for survey:

1. Design features such as stress levels on various structural elements, design details and extent of use of high-tensile steel.

2. Former history with respect to corrosion, cracking, buckling, indents and repairs for the particular ship as well as similar vessels, where available.

3. Information with respect to types of cargo carried, use of different holds/tanks for cargo/ballast, protection of holds and tanks and condition of coating, if any.

Technical Assessment
There are three basic types of possible failure, which may be the subject of technical assessment in connection with planning of surveys; corrosion, cracks and buckling. Contact damages are not normally covered by the survey planning since indents are usually noted in memoranda and assumed to be dealt with as a normal routine by surveyors.

Technical assessments performed in conjunction with the survey planning process should, in principle, be as shown schematically in Figure 1 below. The approach is basically an evaluation of the risk in the following aspects based on the knowledge and experience related to:

1. Design
2. Corrosion.

1. The design should be considered with respect to structural details, which may be susceptible to buckling or cracking as a result of vibration, high stress levels or fatigue.

2. Corrosion is related to the ageing process, and is closely connected with the quality of corrosion prevention systems fitted at new building, and subsequent maintenance during the service life. Corrosion may also lead to cracking and/or buckling.

Design
Damage experience related to the ship in question and sister and/or similar ships, where available, is the main source of information to be used in the process of planning. In addition, a selection of structural details from the design drawings is to be included.

Typical damage experience to be considered will consist of:

1. Number, extent, location and frequency of cracks; and
2. Location of buckles.

This information may be found in the survey reports and/or the Owner's files, including the results of the Owner's own inspections. The defects should be analysed, noted and marked on sketches. In addition, general experience should be utilised as well as the various diagrammatic representations with critical areas on each ship type as provided with the Survey Planning Questionnaire & Survey Programme template.

The review of the main structural drawings, in addition to using the above-mentioned figures, should include checking for typical design details where cracking has been experienced. Also the factors contributing to damage should be carefully considered.

The use of high-tensile steel (HTS) is an important factor. Details showing good service experience where ordinary mild steel has been used may be more susceptible to damage when HTS, and its higher associated stresses, are utilised. There is extensive and, in general, good experience, with the use of HTS for longitudinal material in deck and bottom structures. Experience in other locations, where the dynamic stresses may be higher, is less favourable, e.g., side structures.

In this respect, stress calculations of typical and important components and details, in accordance with relevant methods, may prove useful and should be considered. The selected areas of the structure identified during this process should be recorded and marked on the structural drawings to be included in the Survey Programme.

Corrosion
In order to evaluate relative corrosion risks, the following information should generally be considered:

1. Usage of tanks, holds and spaces;
2. Condition of coatings;
3. Cleaning procedures;
4. Previous corrosion damage;
5. Ballast use and time for cargo holds;
6. Risk of corrosion in cargo holds and ballast tanks; and
7. Location of ballast tanks adjacent to heated fuel oil tanks.

The evaluation of corrosion risks should be based on the relevant information on the anticipated condition of the ship, as derived from the information collected in order to prepare the Survey Programme, and the age of the ship. The various holds, tanks and spaces should be listed with the corrosion risks nominated accordingly.

Locations for Close-up Survey and thickness measurement:
On the basis of the table of corrosion risks and the evaluation of design experience, the locations for initial close-up survey and thickness measurement (areas and sections) may be nominated. The sections subject to thickness measurement should normally be nominated in tanks, holds and spaces where corrosion risk is judged to be the highest. The nomination of tanks, holds and spaces for close-up survey should initially be based on highest corrosion risk, and should always include ballast tanks. The principle for the selection should be that the extent is increased by age or where information is insufficient or unreliable. However, these guidelines for selection of the survey areas may not be used to reduce the requirements pertaining to thickness measurement, close-up survey and tank testing contained in this book which, in all cases, should be complied with as a minimum.

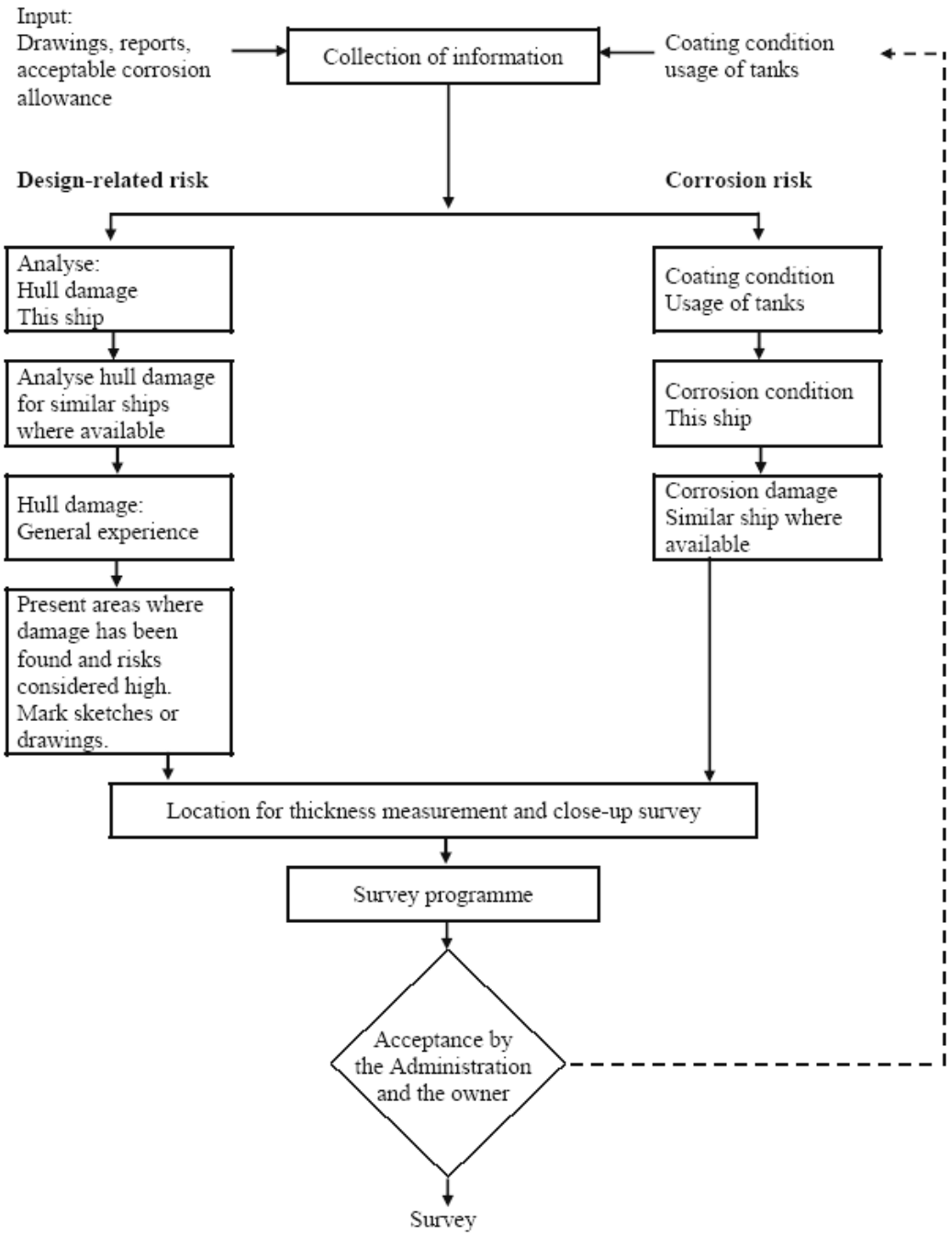


Figure 1 – Technical assessment and the survey planning process

1.3 Preparation Of Spaces

1.3.1 Tank Cleaning

In preparation for survey all spaces are to be cleaned, including removal of all loose accumulated corrosion scale. Spaces are to be sufficiently clean and free from water, scale, dirt, oil residues etc. to reveal corrosion, deformation, fractures, damages or other structural deterioration as well as the condition of the protective coating. However, those areas of structure whose renewal has already been decided by the Owner need only be cleaned and de-scaled to the extent necessary to determine the limits of renewed areas (IACS UNIFIED REQUIREMENTS Z7 Ch 5.1.3).

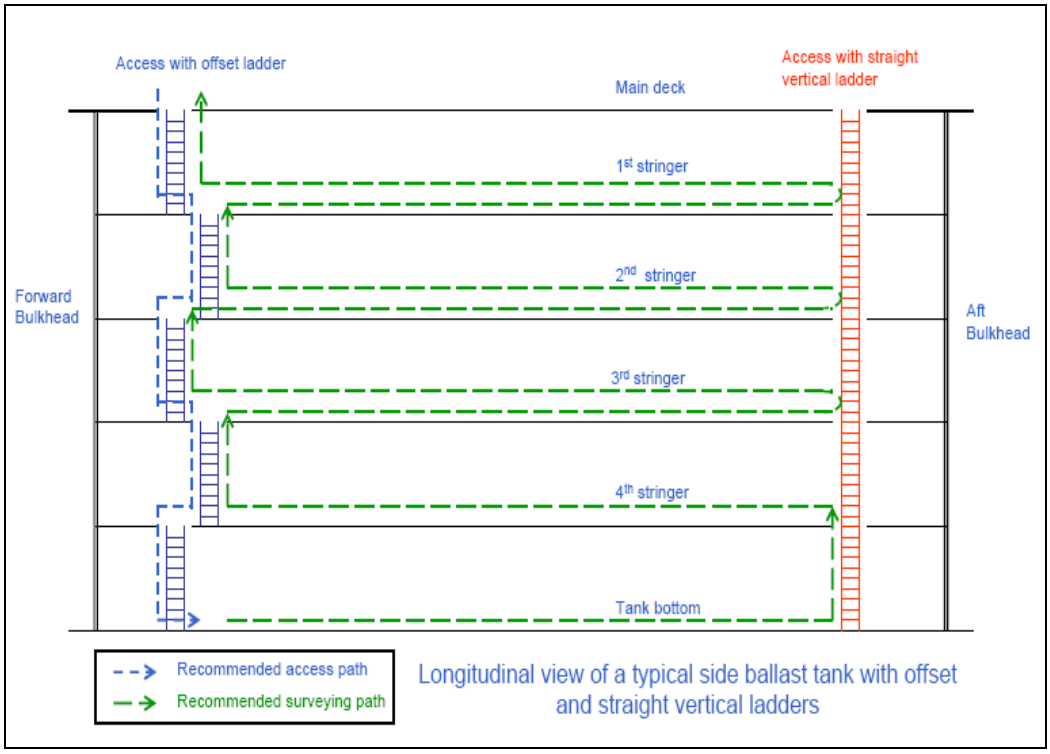
Thickness reductions, cracks & other defects can be easily identified after cleaning & removal of all loose accumulated corrosion scale

The removal of scale may be extremely difficult. The removal of scale by hammering may cause sheet scale to fall, and in cargo holds this may result in residues of cargo falling from above. When using a chipping or scaling hammer, care should be taken to protect eyes, and where possible safety glasses should be worn. If the structure is heavily scaled then it may be necessary to request de-scaling before conducting a satisfactory visual examination. Scaling may affect the thickness measurements and provide an additional difficulty to perform them. Special considerations should be taken to de-scale the spaces subject to close-ups and thickness measurements.

A typical stiffener & end bracket in a W.B.T. after chipping – cleaning may reveal the true thickness reduction it is subjected to

1.3.2 Means of Access for Close-up Survey and Thickness Measurements

Close-up Surveys are to be carried out by Surveyors accompanied by Owners' representatives. The thickness measurements required in association with Close-up Surveys should be carried out simultaneously with the Close-up Surveys, in order to facilitate a meaningful survey. Route planning should be considered prior to entry to confined space to ensure safe conduct of the survey.



Example of safe route planning to survey of a confined space

Close-up Survey is defined in the Regulations as 'a survey where the structural components are within the close visual inspection range of the Surveyor, i.e. normally within reach of hand'. One or more of the following means of access, to the Surveyor's satisfaction, is to be provided:

a) Permanent stages and passages through the structures.
b) Temporary stages and passages through the structures.
c) Hydraulic arm vehicles such as conventional cherry pickers, lifts and movable platforms
d) Portable ladders.
e) Boats and rafts.
f) Other equivalent means.

Sufficient illumination is to be provided to reveal corrosion, deformation, fractures, damages or other structural deterioration.

Lighting can reveal the full extent of defects, corrosion or deformations in a confined space

Portable ladders may be used, at the discretion of the Surveyor, for survey of the hull structure of single skin bulk carriers, except for the Close-up Survey of cargo hold shell frames, in the following cases.

Unacceptable means of access to side shell frames of single skin bulk carriers via unsecured ladder

For Close-up Surveys of the cargo hold shell frames of single skin bulk carriers with deadweight less than 100,000 tonnes, one or more of the following means of access is to be provided:

(a) Permanent staging and passages through structures.
(b) Temporary staging and passages through structures.
(c) Portable ladder restricted to not more than 5 m in length may be accepted for surveys of the lower section of a shell frame including bracket.
(d) Hydraulic arm vehicles such as conventional cherry pickers, lifts and movable platforms.
(e) Boats or rafts, provided the structural capacity of the hold is sufficient to withstand static loads at all levels of water.
(f) Other equivalent means.

Typical Cherry Picker configuration and a surveyor performing close up survey on side shell plating

For Close-up Surveys of the cargo hold shell frames of single skin bulk carriers with deadweight equal to or greater than 100,000 tonnes, the use of portable ladders is not accepted and one or more of the following means of access is to be provided:

(a) At Annual Surveys, Intermediate Surveys held before the ship is 10 years old and Special Survey I:
  (i) Permanent staging and passages through structures.
  (ii) Temporary staging and passages through structures.
  (iii) Hydraulic arm vehicles such as conventional cherry pickers, lifts and movable platforms.
  (iv) Boats or rafts, provided the structural capacity of the hold is sufficient to withstand static loads at all levels of water.
  (v) Other equivalent means.

(b) At Special Survey II and all subsequent Intermediate and Special Surveys:
  (i) Either permanent or temporary staging and passage through structures for Close-up Survey of at least the upper part of hold frames.
  (ii) Hydraulic arm vehicles such as conventional cherry pickers for surveys of lower and middle part of shell frames as alternative to staging.
  (iii) Lifts and movable platforms.
  (iv) Boats or rafts, provided the structural capacity of the hold is sufficient to withstand static loads at all levels of water.
  (v) Other equivalent means.

Notwithstanding the above requirements, the following apply:.

(i) At Annual Survey, for access to perform the close-up survey of the lower region of cargo hold shell frames, the use of a portable ladder fitted with a mechanical device to secure the upper end of the ladder is acceptable.
(ii) The use of hydraulic arm vehicles such as conventional cherry pickers may be accepted by the attending surveyor for the close-up survey of the upper part of side shell frames or other structures in all cases where the maximum working height is not more than 17 m.

For surveys of the hull structure/s conducted by use of an RIT, one or more of the following means for access, acceptable to the Surveyor, is to be provided:

a. Unmanned robot arm.
b. Remote Operated Vehicles (ROV).
c. Unmanned Aerial Vehicles / Drones.,
d. Other means acceptable to LR.

Survey at sea or anchorage may be undertaken when the Surveyor is fully satisfied with the necessary assistance from the personnel on board and provided the foregoing preparations for survey have been met where applicable. In addition, the following conditions and limitations are to be applied:

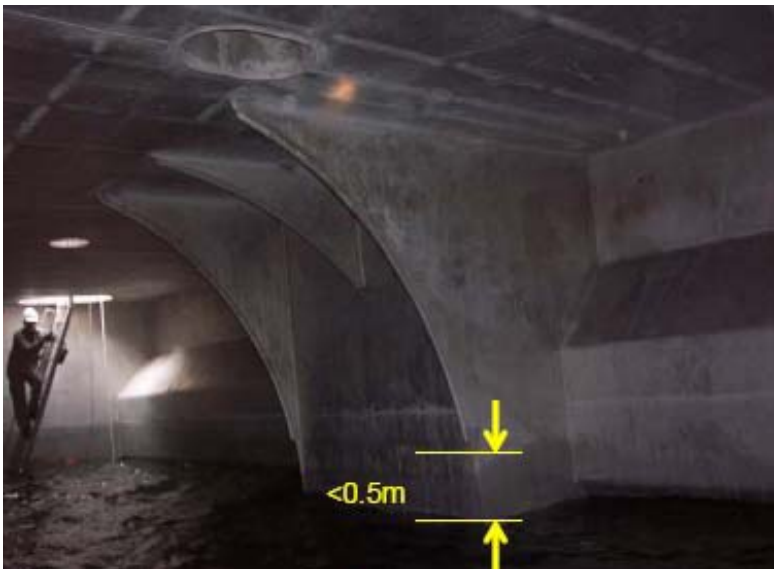
(a) A communication system is to be arranged between the survey party in the tank and the responsible officer on deck. This system must include the personnel in charge of ballast pump handling if boats or rafts are to be used.

(b) Surveys of tanks by means of boats or rafts are to be agreed with the attending Surveyor, who is to take into account the safety arrangements provided, including weather forecasting and ship response under foreseeable sea conditions and provided the expected rise of water within the tank does not exceed 0.25 m. Where it has been agreed to use boats or rafts when carrying out Close-up Survey, the following conditions are to be observed:
   (i) Only rough duty, inflatable rafts or boats, having satisfactory residual buoyancy and stability even if one chamber is ruptured, are to be used.
   (ii) The boat or raft is to be tethered to the access ladder and an additional person is to be stationed down the access ladder with a clear view of the boat or raft.
   (iii) Appropriate life-jackets are to be available for all participants.
   (iv) The surface of water in the tank is to be calm and the water level stationary. On no account is the level of the water to be rising while the boat or raft is in use.
   (v) The tank or space must contain clean ballast water only. Even a thin sheen of oil on the water is not acceptable.
   (vi) At no time is the water level to be allowed to be within 1 m of the deepest under deck web face flat so that the survey team is not isolated from a direct escape route to the tank hatch. Filling to levels above the deck transverses is only to be contemplated if a deck access manhole is fitted and open in the bay being examined, so that an escape route for the survey party is available at all times. Other effective means of escape to the deck may be considered.
   (vii) If the tanks (or spaces) are connected by a common venting system, or Inert Gas system, the tank in which the boat or raft is to be used is to be isolated to prevent a transfer of gas from other tanks (or spaces).

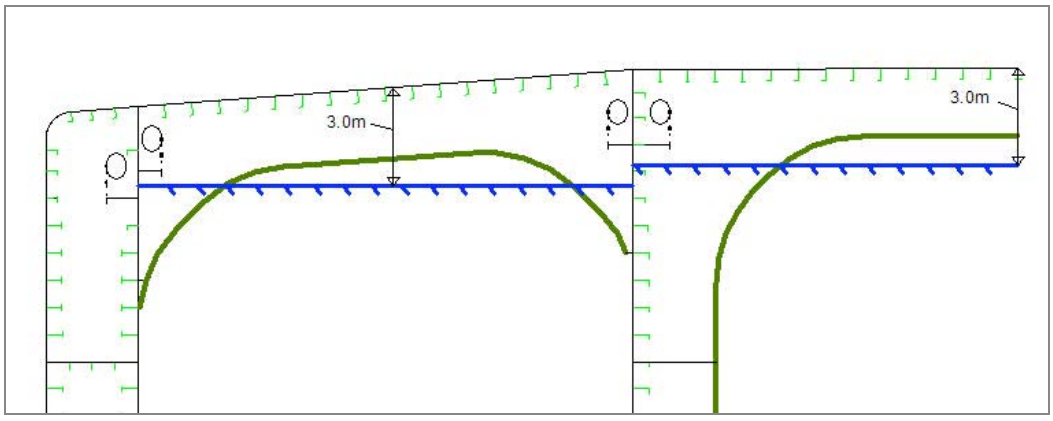
A damaged raft may result in capsize

(c) Rafts or boats may be permitted for the survey of the under deck areas of tanks or spaces, if the depth of the under deck web plating is 1,5 m or less. If the depth of the under deck web plating is greater than 1,5 m, then rafts or boats may be permitted only when the coating of the under deck structure is in GOOD condition and there is no evidence of wastage or if a permanent means of access is provided in each bay to allow safe entry and exit. A permanent means of access is considered to mean:
   (i) Access direct from the deck via a vertical ladder and a small platform fitted approximately 2 m below the deck in each bay or,

(ii) Access to deck from a longitudinal permanent platform having ladders to the deck at each end of the tank. The platform shall be arranged over the full length of the tank and level with, or above, the maximum water level needed for rafting of the under deck structure. For this purpose, the ullage corresponding to the maximum water level is to be assumed not more than 3 m from the deck plate measured at the midspan of deck transverses and at the mid point of the tank's length. If neither of the above conditions is met, then staging or another equivalent means is to be provided for the survey of the under deck areas.



Maximum Water fluctuation for tank rafting



IACS REC 39 limits the maximum ullage level to conduct under deck survey to 3 m

(d) Where soft or semi-hard coatings have been applied, safe access is to be provided for the Surveyor to verify the effectiveness of the coating and to carry out an assessment of the conditions of internal structures which may include spot removal of the coating. When safe access cannot be provided, the soft or semi-hard coating is to be removed.

(e) A multi-gas alarm, breathing apparatus, lifeline, riding belts with rope and hook and whistles together with instructions and guidelines on their use are to be made available during the survey. For oil tankers and chemical tankers, an explosimeter is to be provided.

Note: For further information on confined space entry guide and safe practices, please visit the IACS website on http://www.iacs.org.uk/ and refer to IACS **REC 72.**

1.3.3 Remote Inspection Technique (RIT)

A **Remote Inspection Technique (RIT)** is a means of survey that enables examination of ship structure without the need for direct physical access of the Surveyor.

Consideration may be given by LR to allow the use of RIT as a means to carry out a close-up survey. Surveys conducted using an RIT are to be completed to the satisfaction of the attending Surveyor. The following requirements are applicable:

a. The RIT is to provide the information normally obtained by a Surveyor when using traditional means of access to perform the survey.

b. Surveys performed with the use of an RIT are to be carried out in accordance with the requirements given in IACS Recommendation 42 'Guidelines for Use of Remote Inspection Techniques for surveys'. These considerations are to be included in the proposals for use of an RIT which are to be submitted in advance of the survey so that satisfactory arrangements can be agreed with LR.

c. The equipment and procedure for observing and reporting the survey using an RIT are to be discussed and agreed prior to the survey using an RIT,

d. Time is to be allowed to set-up, calibrate and test all equipment beforehand.

e. When using an RIT as a means to carry out a close-up survey, if not carried out by LR itself, it is to be conducted by a firm approved as a service supplier and is to be witnessed by the attending Surveyor.

f. The structure to be examined using an RIT is to be sufficiently clean and visibility is to be sufficient to allow a meaningful examination. LR is to be satisfied with the methods of orientation on the structure.

g. The Surveyor is to be satisfied with the method of data presentation including pictorial representation, and a good two-way communication between the Surveyor and the RIT operator is to be provided.

h. When a RIT is used as a means to carry out a close-up survey, means of access for the corresponding thickness measurements are to be provided unless the RIT is also able to carry out the required thickness measurements.

i. If the RIT reveals damage or deterioration that requires attention, the Surveyor may require a further close-up survey to be undertaken without the use of an RIT.

1.4 Thickness Measurement And Close-Up Survey

1.4.1 General

1.4.1.1 Thickness Measurement Approval Process

Thickness measurements are normally to be taken by means of ultrasonic test equipment and are to be carried out by an approved service supplier in accordance with Lloyd's Register's Approval Processes for Thickness Measurement of Hull Structures. The procedure can be found on Appendix 5 of this document. LR will not accept thickness measurements undertaken by non LR approved Service Suppliers. Approval of both the TM Company and attending Operators is to be verified on board by the attending Surveyor.

- For non-**ESP** ships less than 500 gross tons and all fishing vessels, the designated Surveyor, who has received training and been qualified by LR, may perform thickness measurements.

Note: For additional approval procedures on Remote Inspection Techniques as a means for the Close Up Survey of hull structure, refer to the additional LR publication "Procedure for approval of Service Suppliers", Par. 2.21: "Requirements for Service Suppliers Engaged in Surveys using Remote Inspection Techniques (RIT) as an Alternative Means for Close-up Survey of the Structure of Ships and Mobile Offshore Units" and Appendix 11 of this Guide.

1.4.1.2 Survey Execution

Thickness measurements may be witnessed by a single Surveyor. The Surveyor is required to be on board while the thickness measurements are taken to the extent necessary to control the process. The thickness measurement report, or summary of the report, is to be submitted to the Surveyor prior to completion of the survey for verification that all requirements have been met. Where this is not complied with, the matter is to be immediately referred to the London office for instruction and before any interim certificate is issued. Upon completion of thickness measurements on board, the Surveyor should verify and keep a copy of the preliminary thickness measurement report signed by the TM Company operator. When thickness measurements are carried out over several stages the Surveyor should verify and keep a copy of the preliminary thickness measurement report, signed by the TM Company operator, after each stage i.e. whenever Surveyors are provided with a draft/preliminary copy of a thickness measurement report. They are to be retained in the local office survey file.

The extent of thickness measurements in salt-water ballast tanks and cargo oil tanks and for areas subject to Close-up Surveys may be specially considered, where the protective coating is identified as being in 'Good' condition by the attending Surveyor. In such cases, the extent of representative thickness measurements taken, for those areas subject to Close-up Survey, is to be agreed with the attending Surveyor.

Where thickness measurements indicate substantial corrosion, excessive diminution or structural defects, the TM Companies are to advise the attending Surveyor and Owners promptly to allow the extent of measurement to be given special consideration and facilitate the prompt implementation of repairs/renewals.

Prior to commencing the thickness measurements, the Surveyor is to:

- Check ultrasonic equipment and calibration according to the appropriate standard and properly labelled;
- Witness calibration appropriate to size and type of material;
- Be satisfied with the TM Company operator's skill and competence;
- Ensure that the TM Company operator(s) is using instruments with pulsed echo technique (either with oscilloscope or digital instrument using multiple echo). Single echo instruments may only be used on uncoated surfaces which have been properly cleaned.

Typical calibration tests

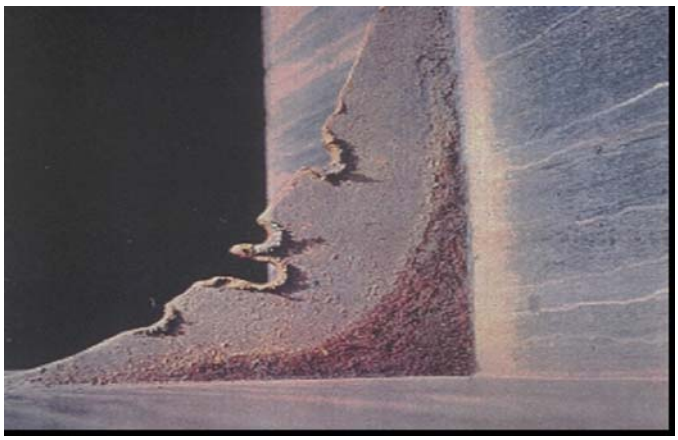
The Surveyor should direct the gauging operation by selecting locations such that the readings taken represent, on average, the general condition of the overall structural area.

Mandatory thickness measurement requirements are to be carried out in entirety and witnessed accordingly. It should be ensured that all longitudinal members in way of transverse sections, if any, are recorded to facilitate an accurate area assessment calculation.

Thickness measurements for the structural areas subject to Close-up Survey are to be carried out simultaneously with the Close-up Surveys in order to facilitate a meaningful survey.

In selecting the position of transverse sections for measurement, a careful overall assessment is to be made utilising shell expansion and deck plans in order to avoid local reinforcements, doublers or any other obstructions, both on deck and at the shell. Transverse sections are to be chosen where the largest reductions in thickness are suspected to occur or are revealed from deck plating measurement. Transverse sections should be well clear of:

- The ends of superstructure where local increases have usually been made to the sheerstrake and stringer plate.
- Strengthening in way of cargo hatch corners which may not always be apparent when welded insert plates have been used.

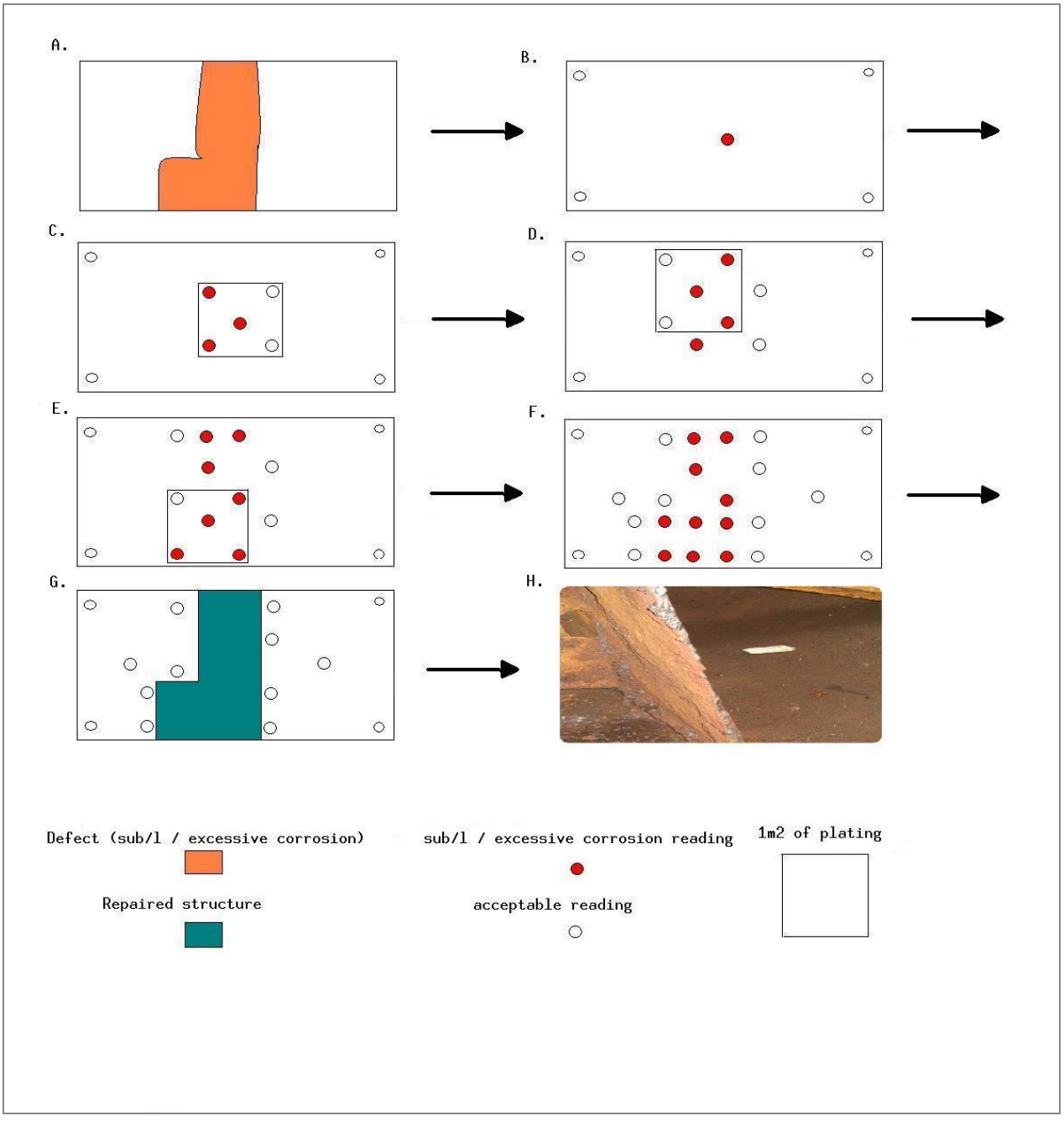


Typical hatch corner defect on a Bulk Carrier

When Surveyors require additional thickness measurements in any portion of the structure where signs of wastage are evident or where wastage is normally found, it is essential that the measurements are sufficient to assess the general condition of the plating and the full extent of wastage.

Bell-mouths in W.B.T. are considered critical locations for local wastage in all types of vessels

The extent of measurements must be sufficient to provide a mean thickness for the part of the plate or profile being measured. The below is an diagrammatic example of the extent of measurements necessary to identify a substantial/excessive corrosion area on plating:



A. Plating shown prior to thickness being measured displaying the defected area
B. Representative readings are taken on the structure identifying a locally corroded area
C. 5 point pattern is applied over $1m^2$ of plating to identify extent of defected area
D. / E. Expanding 5 point pattern further to verify extent of defected area
F. Additional measurements confirm defected area on structure
G. / H. Renewal area is marked and replaced according to original Rule thickness

Recommended methods of verification of Thickness Measurements by the Surveyor:
During the course of the survey it is required that TM Operators submit draft sketches of appropriate quality & clear indications of findings after prompt notification, to the Surveyor for the following:

- Excessive/Substantial corrosion
- Pitting/Grooving of any significance
- Doubler plates and patched structure
- Detached/deformed/fractured structure & buckling
- Cracks & corrosion on welds

Draft sketches **must** be signed by the TM Operator prior to submission to the Surveyor.
The Surveyor will use the submitted draft sketches mapping findings verified during Close-up Surveys to select additional spot measurements over the identified locations of defected structure.

A recommended method to identify easily defected areas during thickness measurements is by recording of the measurements over the structure itself, as such will provide the exact spot locations for the surveyor's attention.

The picture below exhibits this method of verification.

1.5 Permissible Diminution For Non CSR Ships

Tables 1.5.1 to 1.5.4 detail permissible levels of diminution on different non CSR built ship types. These Tables should be read in conjunction with Tables 1.5.5 and 1.5.6 which detail permissible diminution for generic structural members.

Ship categories for purposes of Thickness Measurement evaluation are defined as follows:

Category 1: Non CSR Oil tankers, chemical tankers, dry bulk cargo ships, combination carriers and liquefied gas ships having a length *L* equal to or greater than 90 metres.

Category 2: All remaining ship types not included in Category 1 and having a length *L* equal to or greater than 90 metres.

Category 3: All ship types having a length *L* less than 90 metres.

Repairs will be required when the percentage diminutions given in Tables I and II are exceeded.

The maximum diminutions given take account of additional average corrosion for a further five year period.

Substantial corrosion is wastage of individual plates and stiffeners in excess of 75% of the permissible diminution. Where individual plates or stiffeners show substantial corrosion then the additional thickness measurement requirements in accordance with the Rules and Regulations for the Classification of Ships Part 1, Chapter 3, Section 5 - Table 3.5.6, Section 6 - Tables 3.6.3 to 3.6.6, Section 7 - Tables 3.7.7 to 3.7.15 and Section 8 - Tables 3.8.3 to 3.8.6 to be carried out, as applicable. The survey will not be considered complete until these additional thickness measurements have been carried out.

1.5.1 Permissible Diminution Levels for Category 1 non-CSR Oil Tankers, Chemical Tankers and Liquefied Gas Carriers

Hull Envelope

Strength deck plating	20%
Side shell plating	20%
Bottom shell plating	20%
Forecastle deck plating	25%
Poop deck plating	25%
Superstructure deck plating	25%

General – Internal Structure

Transverse bulkhead plating	25%
Transverse bulkhead stiffeners	25%
Transverse bulkhead horizontal stringer plating and face plates	25%
Longitudinal bulkhead plating	20%
Longitudinal bulkhead longitudinals	25%
Strength deck longitudinals	25%
Side shell longitudinals	25%
Bottom shell longitudinals	25%
Inner bottom plating	20%
Inner bottom longitudinals	25%
Horizontal girder (fabricated)	20%
Horizontal girder face plate	25%
Horizontal girder rolled section	25%

Deck girder plating (fabricated)	20%
Deck girder face plates	25%
Deck girder (rolled section)	25%
Bottom girder plating (fabricated)	20%
Bottom girder face plates	25%
Bottom girder (rolled section)	25%
SWBT* & COT web frame plating	20%
SWBT* & COT web frame face plates	20%
SWBT* & COT web frame stiffeners	25%
SWBT* & COT web frame secondary structure	25%

**SWBT includes any tanks (including peak tanks, wing tanks, centre tanks, double bottom tanks, side tanks and deep tanks) designated for the use of salt water ballast.)*

**COT: Cargo Oil Tank*

Centre tank deck transverse plating	20%
Centre tank deck transverse face plate	20%
Centre tank deck transverse stiffeners	25%
Centre tank deck transverse secondary structure	25%
Centre tank bottom transverse plating	20%
Centre tank bottom transverse face plates	20%
Centre tank bottom transverse stiffeners	25%
Centre tank bottom transverse secondary structure	25%
Peak tank longitudinal bulkhead plating and stiffeners	25%
Peak tank stringer plating	25%
Plating of seachests	25%
Shell plating in way of overboard discharges	20%

1.5.2 Permissible Diminution Levels for Category 3 Oil Tankers, Chemical Tankers and Liquefied Gas Ships

Hull Envelope

Strength deck plating	30%
Side shell plating	30%
Bottom shell plating	30%
Forecastle deck plating	30%
Poop deck plating	30%
Superstructure deck plating	30%

General – Internal Structure

Transverse bulkhead plain plating	30%
Transverse bulkhead corrugated plating	25%
Transverse bulkhead stiffeners	25%
Transverse bulkhead horizontal stringer plating	30%
Transverse bulkhead horizontal stringer face plates	25%
Longitudinal bulkhead plating	30%
Longitudinal bulkhead longitudinals	25%
Strength deck longitudinals	25%
Side shell longitudinals	25%
Bottom shell longitudinals	25%
Inner bottom plating	30%
Inner bottom longitudinals	25%
Horizontal girder (fabricated)	30%
Horizontal girder face plates	25%
Horizontal girder (rolled sections)	25%
Deck girder plating (fabricated)	30%
Deck girder face plates	25%
Deck girder (rolled section)	25%
Bottom girder plating (fabricated)	30%
Bottom girder plating (rolled section)	25%
Bottom girder face plates	25%
SWBT* & COT web frame plating	25%
SWBT* & COT web frame face plates	25%
SWBT* & COT web frame stiffeners	25%
SWBT* & COT web frame secondary structure	30%

**SWBT includes any tanks (including peak tanks, wing tanks, centre tanks, double bottom tanks, side tanks and deep tanks) designated for the use of salt water ballast.)*

**COT: Cargo Oil Tank*

Centre tank deck transverse plating	25%
Centre tank deck transverse face plate	25%
Centre tank deck transverse stiffeners	25%
Centre tank deck transverse secondary structure	30%
Centre tank bottom transverse plating	25%
Centre tank bottom transverse face plates	25%
Centre tank bottom transverse stiffeners	25%
Centre tank bottom transverse secondary structure	30%
Peak tank longitudinal bulkhead plating	30%
Peak tank longitudinal bulkhead stiffeners	25%
Peak tank stringer plating	30%
Plating of seachests	30%
Shell plating in way of overboard discharges	30%

1.5.3 Permissible Diminution Levels for Category 1 non-CSR Bulk Carriers, Ore/Oil Ships and Ore/Bulk/Oil Ships

Hull Envelope

Strength deck plating	20%
Deck plating inside line of hatch openings	25%
Side shell plating	20%
Bottom shell plating	20%
Forecastle deck plating	25%
Poop deck plating	25%
Superstructure deck plating	25%

General – Internal Structure

Cargo hold/tank transverse bulkhead plain plating	25%
Cargo hold/tank transverse bulkhead stiffeners	25%
Longitudinal bulkhead plating	20%
Longitudinal bulkhead longitudinals	25%
Strength deck longitudinals	25%
Side shell longitudinals	25%
Bottom shell longitudinals	25%
Inner bottom plating	20%
Inner bottom longitudinals	25%
Hopper sloping plating	20%
Hopper sloping longitudinals	25%
Topside sloping plating	20%
Topside sloping longitudinals	25%
Cargo hold shell frames and end brackets	20%
SWBT & COT web frame plating	20%
SWBT & COT web frame face plates	20%
SWBT & COT transverse bulkhead plating	25%
SWBT & COT transverse bulkhead stiffeners	25%
SWBT or COT web frame secondary structure	25%
**SWBT includes any tanks (including peak tanks, wing tanks, centre tanks, double bottom tanks, side tanks and deep tanks) designated for the use of salt-water ballast.)*	
**COT: Cargo Oil Tank*	25%
Cargo hold hatch cover plating	25%
Cargo hold hatch cover stiffeners	25%
Cargo hold hatch coaming plating	25%
Cargo hold hatch coaming stiffeners	25%

Deck girder plating (fabricated)	20%
Deck girder face plates	25%
Deck girder (rolled section)	25%
Bottom girder plating (fabricated)	20%
Bottom girder face plates	25%
Bottom girder (rolled section)	25%
Peak tank longitudinal bulkhead plating and stiffeners	25%
Peak tank stringer plating	25%
Plating of seachests	25%
Shell plating in way of overboard discharges	20%

Additional criteria applicable only to Bulk Carrier Cargo Holds

Corrugated plating of transverse bulkheads within holds designed to be fully filled with SWB (deep tank)	25%
Corrugated plating of transverse bulkheads within holds designed to be partially filled with SWB	15%
Corrugated plating of aft transverse bulkhead of the forward hold	15%
Corrugated plating of remaining transverse bulkhead	20%
Inner bottom plating**	25%
Hopper sloping plating**	25%

*** Applicable where ship length (L) is greater than 150 metres and the notation Strengthened for Heavy Cargoes is assigned.*

1.5.4 Permissible Diminution Levels for General Dry Cargo Ships and All Other Category 2 & 3 Type Ships

Hull Envelope

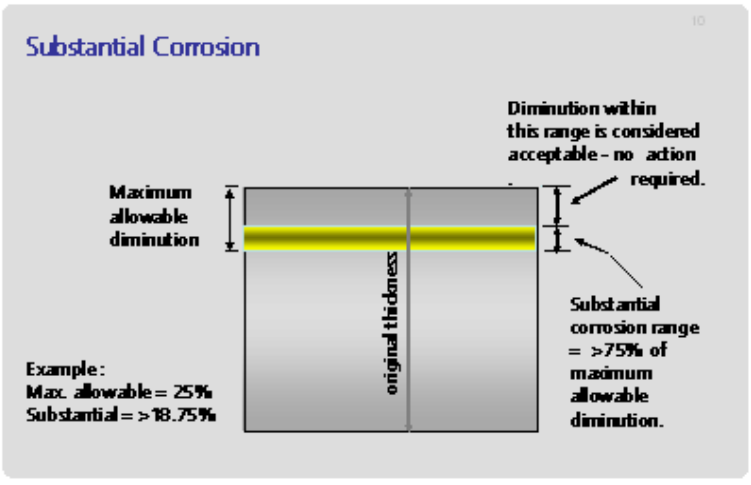
Strength deck plating	30%
Side shell plating	30%
Bottom shell plating	30%
Deck plating inside line of openings, where fitted	30%
Forecastle deck plating	30%
Poop deck plating	30%
Superstructure deck plating	30%

Miscellaneous & Internal Structure

Strength deck longitudinals	25%
Side shell longitudinals	25%
Bottom shell longitudinals	25%
Transverse bulkhead plain plating	30%
Transverse bulkhead corrugated plating	25%
Transverse bulkhead stiffeners	25%
Longitudinal bulkhead plating	30%
Longitudinal bulkhead stiffeners	25%
Inner bottom plating	30%
Inner bottom longitudinals	25%
Hopper sloping plating	30%
Hopper sloping longitudinals	25%
Topside sloping plating	30%
Topside sloping longitudinals	25%
SWBT frames or diaphragms	25%
Cargo hold shell frames and end brackets	25%
Cargo hold hatch cover plating	30%
Cargo hold hatch cover stiffeners	25%
Cargo hold hatch coaming plating	30%
Cargo hold hatch coaming stiffeners	25%
SWDBT Floors	25%
**SWDBT: Salt-Water Double Bottom Tanks*	
Web frame plating	25%
Web frame face plates	25%
Web frame secondary structure	30%
Other miscellaneous plating	30%
Other miscellaneous longitudinals or stiffeners	25%
Plating of seachests	30%
Shell plating in way of overboard discharges	30%

1.5.5 Maximum Permissible Diminution of Individual Plates and Stiffeners for non-CSR Ships

Structural item	Category 1 ships *See* Note 5	Category 2 & 3 ships *See* Note 5	TM Report Form
Hull envelope: individual plates, shell and deck plating recorded along the strake (deck, bottom, side, wind and water)	20% *See* Note 2	30%	TM 1 *See* Note 3
Hull envelope: transverse section, plates recorded by frame number and strake position (deck and sheer/bottom and side)	20%	30%	TM 2~3
Longitudinal structural members (including deck and shell longitudinal stiffeners, longitudinal bulkhead plating and stiffeners, inner bottom plating and stiffeners, hopper sloping plating and stiffeners. (*See* Note 4.2 for additional bulk carrier diminution criteria)	Plating 20% Stiffeners 25%	Plating 30% Stiffeners 25%	TM 2~3 *See* Note 3
Transverse structural members in C.O. and W.B. tanks (including web frame plating and face plates)	20%	25%	TM 4
W.T. and O.T. transverse bulkheads including deep tank bulkheads (*See* Note 4.1 for additional bulk carrier diminution criteria)	Plating 25% Stiffeners and corrugated bulkhead plating 25%	Plating 30% Stiffeners and corrugated bulkhead plating 25%	TM 5, TM 5 UR S18, TM 5 UR S19, TM 5 UR S19% See Note 4.1 (f), (g)
Miscellaneous structural members (including deck plating inside the line of cargo hatch openings)	Plating 25% Stiffeners 25%	Plating 30% Stiffeners 25%	TM 6, TM 6UR S21, TM 6UR S21A *See* Note 3 , 7
Cargo hold transverse frames and end brackets (*See* Note 4 for additional bulk carrier diminution criteria)	20%	25%	TM 7



NOTES

1. For ships with **(cc)** notation, Surveyors are to compare the measurements with the original Rule thickness and not the reduced, as built, scantlings which were approved in association with the (**cc**) notation.

2. For oil tankers of Category 1 the strength deck residual buckling thickness requirement is to be complied with in accordance with Lloyd's Register requirements as advised by the attending Surveyor.

3. Where extensive additional measurements are taken for continuous longitudinal plating these may be reported on Form TM6 as applicable.

4. Additional **Bulk Carrier** diminution criteria:

4.1 Cargo hold transverse bulkheads

(a) Corrugated parts within cargo holds designed to be fully filled with salt-water ballast (deep tank) – 25%.

(b) Corrugated parts within cargo holds designed to be partially filled with salt-water ballast – 15%.

(c) Corrugated parts of the aft transverse bulkhead of the forward cargo hold – 15%, *see* (f), (g) below.

(d) Corrugated parts of the remaining transverse bulkheads in cargo holds – 20%.

(e) All plain transverse bulkhead plating (including stool plating) – 25%.

(f) For the aft transverse bulkhead of the forward cargo hold on bulk carriers which have been assessed and/or upgraded in order to comply with requirements for the notation **ESN-HOLD 1** & **ESN-ALL HOLDS** (UR S19), refer to the *Approved Bulkhead Upgrade Plan* for diminution criteria.

These measurements are to be recorded on Form TM5 UR S19. In case the Approved Bulkhead Upgrade Plan indicates that it is required to apply Classification Rules, then TM5 UR S19% should be used instead.

(g) For the bulkheads of cargo holds on bulk carriers which are contracted for construction on or after 1 July 1998, of 150m in length and above and of single skin (have been assessed in order to comply with requirements of the notation **ESN**) and double skin construction, intended to carry solid bulk cargoes having density of 1.0t/m^3, or above, with vertically corrugated transverse bulkheads (UR S18), measurements are to be recorded on Form TM5 UR S18.

4.2 Cargo hold inner bottom and hopper sloping plating

(a) Where the notation *Strengthened For Heavy Cargoes* is assigned and length *L* is greater than 150 metres then the maximum diminution applicable is 25%. For all other bulk carriers refer to longitudinal structural members above.

4.3 Cargo hold transverse frames (shell frames)

For single skin bulk carriers contracted for construction prior to 1 July 1998 undergoing a re-assessment of their cargo hold shell frames in accordance with the *Provisional Rules for Existing Ships* (UR S31), measurements are to be compared against the minimum thickness values shown in the evaluation records. These measurements are to be recorded on TM7UR S31. For all other bulk carriers refer to 'Cargo hold transverse frames and end brackets' above.

5. For thickness measurement evaluation purposes, ship categories are defined as follows:

Category 1: Non CSR Oil tankers, chemical tankers, dry bulk cargo ships, combination carriers and liquefied gas ships having a length *L* equal to or greater than 90 metres.

Category 2: All remaining ship types not included in Category 1 and having a length *L* equal to or greater than 90 metres.

Category 3: All ship types having a length *L* less than 90 metres.

(***L* is the Rule length defined in Part 3, Chapter 1.6.1 of the Rules for Ships.**)

6. The maximum diminutions are for the average thickness measured over the plate area or over the length between supports.

7. Bulk Carriers which are contracted for construction on or after 1 July 1998 (not including **CSR** ships), are required to comply with the evaluation of scantlings of hatch covers of cargo holds (UR S21). In addition to the above, Bulk Carriers, Ore Carriers and Combination Carriers contracted for construction on or after 1 January 2004 are required to comply with the evaluation of scantlings of hatch coamings of cargo holds in accordance to UR S21.6.2.

Measurements are to be recorded on Form TM6 UR S21.

8. All ships except bulk carriers, ore carriers and combination carriers contracted for construction on or after 1 July 2012 and required to comply with the evaluation of scantlings of hatch covers and coamings on exposed decks (UR S21A). In specific, requirements should be applied in accordance to UR S21A.7.1. Measurements are to be recorded on Form TM6 UR S21A.

1.5.6 Upper Deck Plating t_r and J_r Values for Residual Buckling Thickness Calculations

Longitudinal stiffener spacing s (mm)	LOCATION									
	OVER 0,4L amidships			AT 0,25L from amidships			AT 0,35L from amidships			AT 0,075L from ends
	STEEL GRADE									
	MILD steel	HT32	HT36	MILD steel	HT32	HT36	MILD steel	HT32	HT36	ALL grades
	J_r									
	56,7	52,1	51,3	65,2	61,6	61,0	82,2	80,7	80,4	95,0
550	9,7	10,6	10,7	8,4	8,9	9,0	6,7	6,8	6,8	5,6
575	10,1	11,0	11,2	8,8	9,3	9,4	7,0	7,1	7,2	6,1
600	10,6	11,5	11,7	9,2	9,7	9,8	7,3	7,4	7,5	6,3
625	11,0	12,0	12,2	9,6	10,1	10,2	7,6	7,7	7,8	6,6
650	11,5	12,5	12,7	10,0	10,6	10,7	7,9	8,1	8,1	6,8
675	11,9	13,0	13,2	10,4	11,0	11,1	8,2	8,4	8,4	7,1
700	12,3	13,4	13,6	10,7	11,4	11,5	8,5	8,7	8,7	7,4
725	12,8	13,9	14,1	11,1	11,8	11,9	8,8	9,0	9,0	7,6
750	13,2	14,4	14,6	11,5	12,2	12,3	9,1	9,3	9,3	7,9
775	13,7	14,9	15,1	11,9	12,6	12,7	9,4	9,6	9,6	8,2
800	14,1	15,4	15,6	12,3	13,0	13,1	9,7	9,9	10,0	8,4
825	14,6	15,8	16,1	12,7	13,4	13,5	10,0	10,2	10,3	8,7
850	15,0	16,3	16,6	13,0	13,8	13,9	10,3	10,5	10,6	8,9
875	15,4	16,8	17,1	13,4	14,2	14,3	10,6	10,8	10,9	9,2
900	15,9	17,3	17,5	13,8	14,6	14,8	10,9	11,2	11,2	9,5
925	16,3	17,8	18,0	14,2	15,0	15,2	11,3	11,5	11,5	9,7
950	16,8	18,2	18,5	14,6	15,4	15,6	11,6	11,8	11,8	10,0
975	17,2	18,7	19,0	15,0	15,8	16,0	11,9	12,1	12,1	10,3
1000	17,6	19,2	19,5	15,3	16,2	16,4	12,2	12,4	12,4	10,5
1025	18,1	19,7	20,0	15,7	16,6	16,8	12,5	12,7	12,7	10,8
1050	18,5	20,2	20,5	16,1	17,0	17,2	12,8	13,0	13,1	11,1
1075	19,0	20,6	21,0	16,5	17,5	17,6	13,1	13,3	13,4	11,3

1100	19,4	21,1	21,4	16,9	17,9	18,0	13,4	13,6	13,7	11,6
1125	19,8	21,6	21,9	17,3	18,3	18,4	13,7	13,9	14,0	11,8
1150	20,3	22,1	22,4	17,6	18,7	18,9	14,0	14,3	14,3	12,1
1175	20,7	22,6	22,9	18,0	19,1	19,3	14,3	14,6	14,6	12,4
1200	21,2	23,0	23,4	18,4	19,5	19,7	14,6	14,9	14,9	12,6

NOTE

The Table gives values of J_r and residual thickness, t_r, for the equation below at specific locations and longitudinal stiffener spacings. When necessary intermediate values may be obtained by linear interpolation.

The residual buckling thickness, t_r, is to be not less than the smaller of the following two equations, where t_o is the original thickness, s the spacing of deck longitudinals, in mm and J_r a factor dependent on location and steel type.

$$(1).\ t_r = (t_0 - 1{,}5)\ \text{mm}$$

$$(2).\ t_r = \frac{S}{J_r}\ \text{mm}$$

Where:

J_r = 56,7 over 0,4L amidships (mild steel)
= 52,1 over 0,4L amidships (Higher tensile steel Grade 32)
= 51,3 over 0,4L amidships (Higher tensile steel Grade 36)
= 95,0 at 0,075L from ends

Intermediate values are to be obtained by linear interpolation.

For ships built with excess hull girder section modulus the diminution will be specially considered.

Please refer to Appendix 10 of this document for how to assess and report Residual Deck Buckling thickness calculations on Deck with Argonaut software TM1 RDB form.

1.5.7 Common Structural Rules (CSR) Thickness Measurement Acceptance Criteria

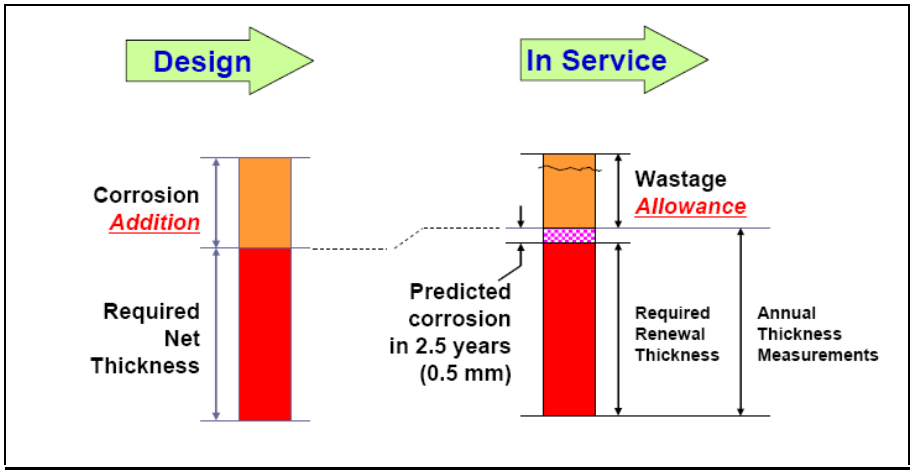
1.5.7.1 Application

These Rules apply to ESP bulk carriers and tankers classed with the Society and contracted for construction on or after 1 April 2006. The "contracted for construction" means the date on which the contract to build the ship is signed between the prospective owner and the shipbuilder.

- CSR Rules apply to the hull structures of single side skin and double side skin bulk carriers with unrestricted worldwide navigation, having length *L* of 90 m or above.
- CSR Rules also apply to double hull oil tankers of 150m length, *L*, and above.

Ships fully complying with the CSR Rules will be assigned the notation **CSR**.

1.5.7.2 Wastage allowance concept

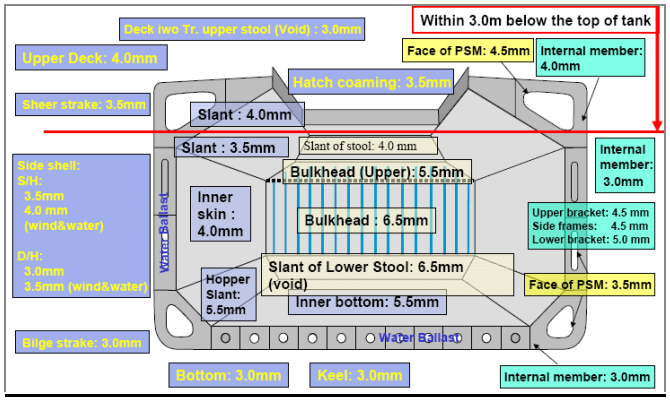


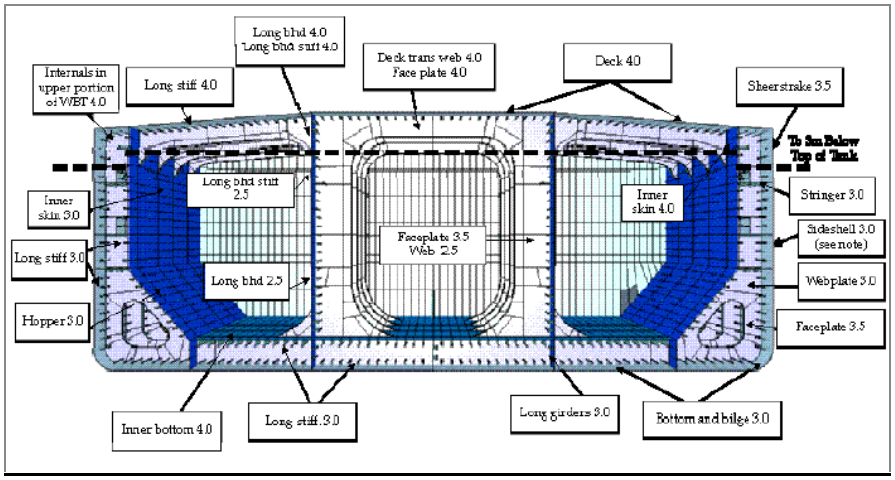
Wastage allowance is comprised of two aspects; local wastage allowance and overall hull girder wastage allowance. Assessment against both local and overall hull girder wastage criteria is required during the operational life of the vessel. Steel renewal is required if either the local or overall hull girder wastage allowance is exceeded. The new building requirements within these Rules incorporate corrosion additions and consider all relevant loads and failure modes (e.g. yielding, buckling, and fatigue). No further assessment of the scantlings against the requirements within these Rules is required during the operational life of the ship provided that the thickness of any structural member remains greater than the renewal thickness specified by these Rules.

The thickness measurements required by CSR consist of:

- systematic thickness measurements in order to assess the global and local strength of the ship
- thickness measurements as indicated in the program of close-up survey
- measurements of elements considered as suspect areas
- additional measurements on areas determined as affected by substantial corrosion.

As follows typical examples of corrosion allowances on a midship section of a CSR bulk carrier and a CSR tanker:





1.5.7.3 Documentation requirements

The plans to be supplied onboard the ship, are to include both the as-built and renewal thickness. Any owner's extra thickness is also to be clearly indicated on the drawings.

The "as-built" Midship Section plan provided by the builder and carried on board the ship is to include a table showing the minimum allowable hull girder sectional properties for the mid-tank transverse section in all cargo tanks.

1.5.7.4 Definitions

Local corrosion: Local corrosion is pitting corrosion, grooving, edge corrosion, necking effect or other corrosions of very local aspect.

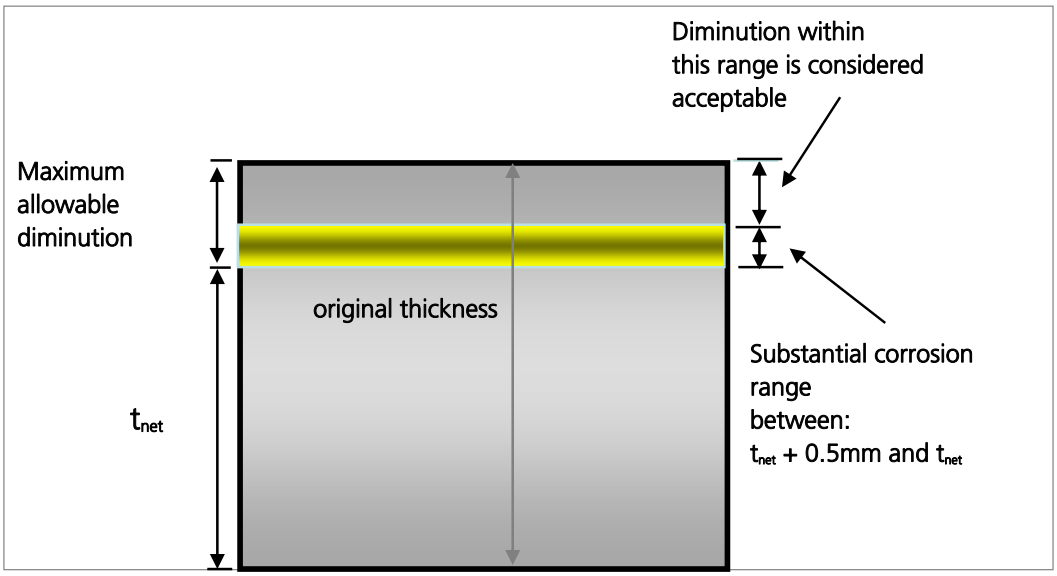
Substantial corrosion: Substantial corrosion is an extent of corrosion such that assessment of the corrosion pattern indicates a gauged (or measured) thickness between $t_{renewal}$ and $t_{renewal} + t_{reserve}$.

Net scantling thickness: Net thickness throughout the ship's life.

Corrosion allowance additional thickness: Corrosion addition on each side of the structural member considers the contents of the compartment to which it is exposed

Reserve additional thickness: 0.5 mm, wastage allowance in reserve for corrosion occurring in the two and half years between Intermediate and Special surveys

Voluntary additional thickness: Owner/builder additional wastage allowance.



1.5.7.5 Local strength criteria - Renewal thickness for general corrosion
General corrosion is defined as areas where general uniform reduction of material thickness is found over an extensive area.

For each structural item, steel renewal is required when the gauged thickness t_{gauged} is less than the renewal thickness, as specified in the following formula:

$$t_{gauged} < t_{renewal},$$

Where the gauged thickness t_{gauged} is such as:

$$t_{renewal} < t_{gauged} < t_{renewal} + t_{reserve}$$

Coating applied in accordance with the coating manufacturer's requirements or annual gauging may be adopted as an alternative to the steel renewal. The coating is to be maintained in good condition and annual examination is required by the surveyor. .

The minimum allowable hull girder sectional properties in the corroded condition are calculated using the same corrosion thickness reductions that are used during the newbuilding stage, thus linking the newbuilding and ship in operation criteria. Therefore the calculation of the minimum allowable hull girder sectional properties is to be based on a member thickness, *t*, given by:

$$t = t_{as\text{-}built} - 0.5\, t_{corr} - t_{own}$$

Areas which need to be renewed based on specific renewal criteria are, in general, to be repaired with inserted material which is to have the same or greater grade/strength as the original and to have a thickness, t_{repair}, not less than the Rule design thickness or: $t_{repair} = t_{as\text{-}built} - t_{own}$ (mm)

Where:
$t_{as\text{-}built}$: as built thickness, in mm
t_{own} : owner/builder specified additional wastage allowance, if applicable, in mm
t_{corr} : corrosion addition in mm

1.5.7.6 Local strength criteria - Renewal thickness for local corrosion

Pitting

Pitting corrosion is defined as scattered corrosion spots/areas with local material reductions which are greater than the general corrosion in the surrounding area.

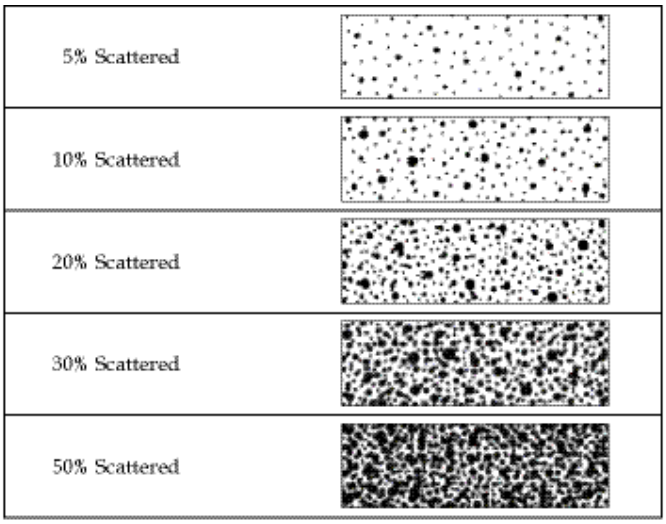
CSR Bulk Carriers
If pitting intensity in an area where coating is required is higher than 15%, thickness measurements are to be performed to check the extent of pitting corrosion. The 15% is based on pitting or grooving on only one side of a plate.

In cases where pitting is exceeding 15%, as defined above, an area of 300 mm or more, at the most pitted part of the plate, is to be cleaned to bare metal and the thickness is to be 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 remaining thickness in pits, grooves or other local areas, is to be greater than:

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

without being greater than $t_{renewal}$.



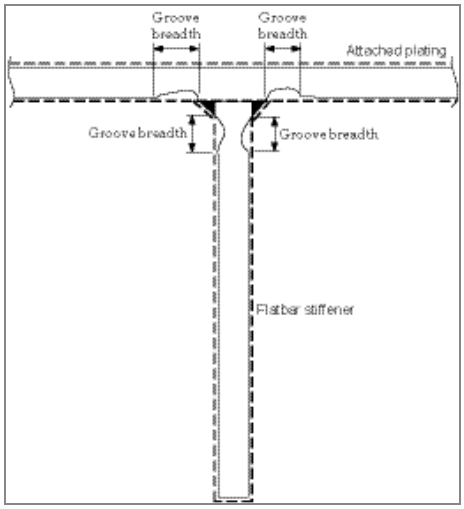
CSR Tankers

For plates with pitting intensity less than 20%,the measured thickness, t_{tm}, of any individual measurement is to meet the lesser of the following criteria:

$$t_m \geq 0.7\ (t_{as\text{-}built} - t_{own})\ \text{mm}$$
$$t_m \geq t_{renewal} - 1\ \text{mm}$$

Grooving Corrosion

Groove 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 on the below figure.



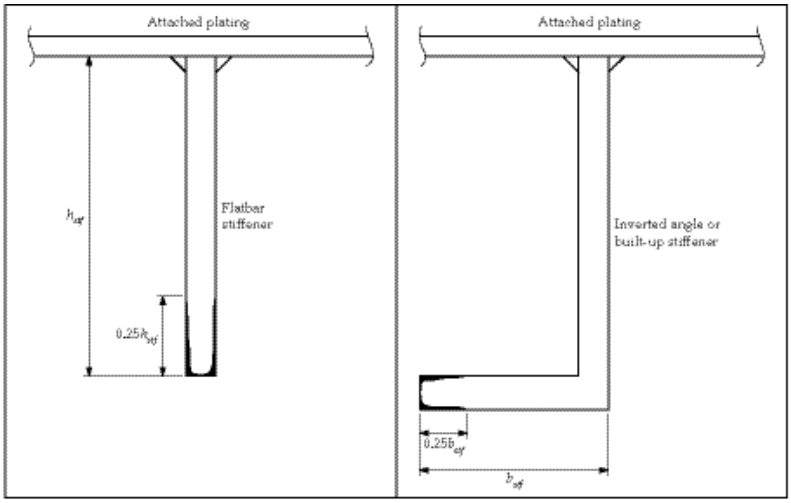
CSR Tankers
Where the groove breadth is a maximum of 15% of the web height, but not more than 30mm, the measured thickness, t_{tm}, in the grooved area is to meet the lesser of the following criteria:

$t_m \geq 0.75\ (t_{as\text{-}built} - t_{own})$ **mm**
$t_m \geq t_{renewal} - 0.5$ **mm**
but is not to be less than
$t_m = 6$ **mm**

Members with areas of grooving greater than those above are to be assessed based on the criteria for general corrosion, using the average measured thickness across the plating/stiffener.

Edge Corrosion

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 below:



CSR Tankers
Provided that the overall corroded height of the edge corrosion of the flange, or web in the case of flat bar stiffeners, is less than 25% of the stiffener flange breadth or web height, as applicable, the measured thickness, t_{tm}, is to meet the lesser of the following criteria

$t_m \geq 0.7\ (t_{as\text{-}built} - t_{own})$ mm
$t_m \geq t_{renewal} - 1$ mm

The average measured thickness across the breadth or height of the stiffener is not to be less than the renewal thickness for general corrosion allowance.

Plate edges at openings for manholes, lightening holes etc. may be below the minimum thickness provided that:

(a). the maximum extent of the reduced plate thickness, below the minimum, from the opening edge is not more than 20% of the smallest dimension of the opening and does not exceed 100mm

(b). rough or uneven edges may be cropped-back provided that the maximum dimension of the opening is not increased by more than 10%.

1.5.7.7 Global Strength Criteria – Renewal Thickness for Global Corrosion
The ship's longitudinal strength is to be evaluated by using the thickness of structural members measured renewed and reinforced, as appropriate, during intermediate & special surveys, for ships over 5 years of age.

Renewal thickness

The global strength criteria are defined by the assessment of the bottom zone, deck zone and neutral axis zone, as detailed below.

a) Bottom Zone And Deck Zone:

- The current hull girder **section modulus** determined by the thickness measurements is not to be less than 90% of the section modulus calculated by the gross offered thicknesses.

  Alternatively,

- The current sectional areas of the bottom zone and of the deck zone which are the sum of the measured items area of the considered zones, are not to be less than 90% of the **sectional area** of the corresponding zones determined by the gross offered thicknesses.

b) Neutral Axis Zone:

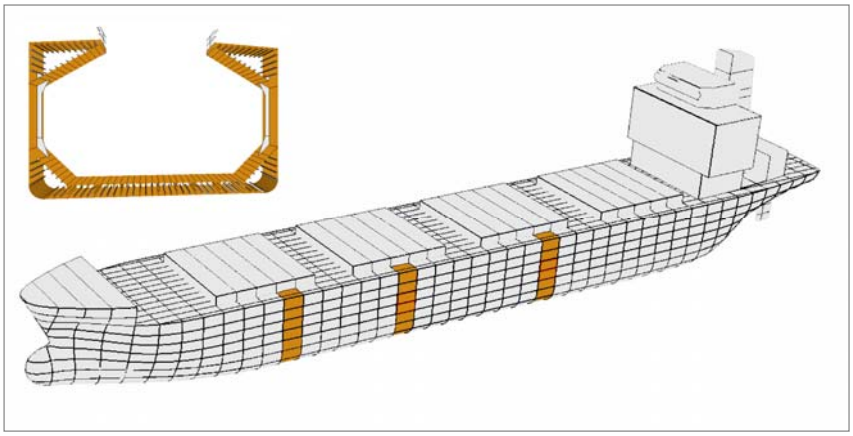
- The current **sectional area** of the neutral axis zone, which is the sum of the measured plating areas of this zone, is not to be less than the sectional area of the neutral axis zone calculated with the gross offered thickness minus 0.5 tc.

If the actual wastage of all items, of a given transverse section, which contribute to the hull girder strength is less than 10% for the deck and bottom zones and 0.5tc for the neutral axis zone, the global strength criteria of this transverse section is automatically satisfied and its checking is no more required.

Please refer for further guidance and definitions of structural areas for each zone, to Chapter 1.6, Additional Assessments and Appendix 3 of this document.

1.6 Additional Assessments

1.6.1 CSR & non CSR Oil Tankers – Evaluation of Longitudinal Strength



In addition to the existing Rule requirements for Thickness Measurement, for oil tankers (including chemical, ore/oil and ore/bulk/oil ships) of 130 m in length and upwards (as defined by the International Convention on Load Lines in force), the ship's longitudinal strength is to be evaluated by using the thickness of structural members measured, renewed and reinforced as appropriate, during the Special Surveys carried out after the ship reaches 10 years of age, i.e., normally SS III and subsequent Special Surveys. (At Intermediate Surveys after the ship reaches 10 years of age if deemed necessary by the Surveyor). In most cases this requirement would be applicable from SS(III) onwards, with some exceptions, e.g. those ships that were commissioned and taken into service after the date of build and are therefore assigned their SS date later than the date of build. As such ships would be more than 10 years of age at the time of the SS(II), they would therefore be required to carry out the evaluation at SS(II).

At least **three** transverse sections are to be gauged for all ships to which these requirements are applicable. The selected transverse sections should be the same sections chosen to satisfy TM requirements. In most cases no additional thickness gauging should be necessary for the transverse sections under consideration.

The selected transverse sections are to be within 0,5L amidships. It is recommended that the sections be located about 0,2L forward of amidships, amidships and 0,2L aft of amidships.

The details for the transverse sections (i.e. transverse sections with the 'as built' thickness values) at the locations recommended in the above should be entered into the TM application where transverse sectional area assessment can be calculated for the deck, bottom and additionally for the neutral axis zone. Care should be taken to ensure that only the appropriate transverse section details are used in the evaluation.

Transverse sections should be chosen such that Thickness Measurements can be taken for as many different tanks in a corrosive environment as possible (e.g. selected transverse sections are to include ballast tanks sharing a common plane boundary with cargo tanks (fitted with heating coils) and other ballast tanks, or cargo tanks permitted to be filled with sea water sharing a common plane boundary with other ballast tanks or cargo tanks).

Section 1

When selecting transverse sections, consideration is to be given to selecting those locations where the largest thickness reductions are suspected to occur and/or are revealed from deck and bottom plating measurements. The selected locations should, as far as possible, be clear of areas that have been locally renewed or reinforced.

Note 1: For the purpose of this section, the term 'as built' is equal to the 'Rule scantlings' thickness values in order to take into consideration the reduced scantlings on ships built with **(CC)** notation.

For more detailed guidance refer to Appendix 3 of this document.

1.6.2 Non-CSR Oil Tankers – Upper Deck Plating Residual Buckling

For non-CSR oil tankers built to Lloyd's Register Class – Upper deck plating allowable diminution/residual buckling:

- For oil tankers having a length *L* of 90 m or greater **starting from SSII** onwards, the thickness requirement of upper deck plating is to be not less than that required by table 1.5.5 or 1.5.6 of the residual buckling thickness nor the criteria applied by the classification on individual plates. In some instances the residual buckling thickness may be the limiting factor for upper deck plating renewals.
- When the actual thickness measurements of individual plates are found to satisfy the residual buckling thickness requirements this is to be indicated accordingly in the narrative of the classification report.
- When the actual thickness measurements of individual plates are found to be less than that required for compliance with the residual buckling thickness requirements, and the diminution does not exceed 20 per cent, then extensive thickness measurements are to be taken on a panel basis to determine accurately the actual mean thickness of individual panels. In this context a panel is deck plating bounded by adjacent deck transverses and two deck longitudinal stiffeners. Where three or more transversely adjacent panels are affected the matter should be referred to the Classification Group in London. Where, after extensive measurement, the individual panels of deck plating are found to be deficient then the deck plating may be repaired by reinforcement

Non-CSR oil tankers not built to Lloyd's Register Class – Upper deck plating allowable diminution (alternative procedure):

- Alternatively, where an oil tanker having a length of 90 m or greater is transferred from an IACS member class society and the losing society supplies Tables for the residual buckling thickness calculations giving original thickness and allowable diminution, the ship is to be Surveyed against those standards (**starting from SSII onwards**). The diminution table for the residual buckling thickness calculations is to be added to the ship's Survey file and a note to this effect raised as a memorandum item.
- A check is to be made that deck and bottom longitudinal material cross sectional areas have not reduced by more than 10 per cent based on availability of previous thickness measurement surveys.
- Where a 10 per cent area reduction is exceeded the case is to be referred to the designated Designed Support Office for review.

1.6.3 Non-CSR Bulk Carriers (IACS UR S18, S19, S21, S21A, S31)

1.6.3.1 UR S19 – Evaluation of Scantlings of the Transverse Watertight Corrugated Bulkhead between Cargo Holds Nos. 1 and 2, with Cargo Hold No. 1 Flooded, for Existing Bulk Carriers (not Built in accordance to UR S18)

For Bulk Carriers assigned the (**ESN-Hold 1**) or (**ESN-All Holds**) notations, i.e. bulk carriers of length *L,* greater than or equal to 150 metres where:

- The foremost hold is bounded by the side shell only, and therefore they were **contracted for construction prior to 1 July 1998** and have not been constructed in compliance with Pt 4, Ch 7,10 of Notice No.2 to the 1996 *Rules and Regulations for the Classification of Ships* (hereinafter referred to as the Rules for Ships), or subsequent editions.
- The foremost hold is a 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 Pt 4, Ch 7,10 of Notice No.2 to the 1998 Rules for Ships, or subsequent editions.

For those ships reference should be made to the Approved Bulkhead Upgrade Plan (included in the ESP Survey File, **ESP SHIPS**), which details the particular diminution criteria for cargo hold transverse bulkheads that have been upgraded in accordance with this notation. Refer and confirm with the Ship's EBX Memo.

Images depicting a failed transverse bulkhead and a typical corrugated bulkhead reinforcement following a URS 19 assessment

Note: Some Bulk Carriers have cargo holds designed to be partially filled with salt-water ballast. In order to identify whether a Bulk Carrier has this facility, it is necessary to check the Capacity Plan and/or the Trim and Stability booklet to identify which holds are designated for partial filling purposes. It is important to identify the holds designed for partial filling as this affects the maximum allowable corrosion diminution that can be applied to the cargo hold corrugated bulkheads (*see* Chapter 5). Once the partial filling holds have been identified a hull memorandum shall indicate these holds for guidance at future surveys.

1.6.3.2 UR S31 – Renewal Criteria for Side Shell Frames and Brackets in Single Side Skin Bulk Carriers and Single Side Skin OBO Carriers (not Built in accordance with UR S12)

The above bulk carriers and single skin ore carriers and single skin ore/oil carriers are to undergo a re-assessment of their cargo hold shell frames in accordance with the *Provisional Rules for Existing Ships*. The number of shell frames to be measured is equivalent to the number of shell frames subject to Close-up Survey, with representative measurements to be taken at specific areas for each frame. For more detailed guidance, refer to Appendix 4 and guidance on assessment of

cargo hold shell frames. Refer and confirm with the Ship's SSZ Memo.

Above – replacements of zone A & B (integral bracket) and below – replacements of zone A & B (separate bracket)

Above and to the left – Typical defect, wastage of cargo hold side shell frames of single skin bulk carriers

With the application of IACS UR S31 it became a requirement, where found necessary, for these ships to be modified by reinforcing the side shell structure. On some ships these modifications required sloped tripping brackets to be fitted between the side shell frames and this limits the access for subsequent surveys in this location. Surveyors must ensure the access for Close-up survey in way of the underside of any tripping brackets will permit the area to be examined safely and effectively. Any deficiencies not detected during surveys due to inadequate Close-up examination of the underside of the brackets **can lead to catastrophic failure of the shell plating and associated framing**. Where access from a cherry picker is deemed unsafe or inadequate other suitable means of access require to be arranged. e.g. staging.

Above – structural reinforcement using Tripping Brackets

1.6.3.3 UR S18 - Evaluation of Scantlings of Corrugated Transverse Watertight Bulkheads in Bulk Carriers Considering Hold Flooding (not Built under CSR)
For the bulkheads of cargo hold on bulk carriers:

- Contracted for construction **on or after 1 July 1998**, of 150m in length and above and of single skin (assigned notation **ESN**) or double skin construction, intended to carry solid bulk cargoes having density of 1.0t/m^3, or above, with vertically corrugated transverse bulkheads, measurements for thickness gauging purposes are to be recorded on Form **TM5 UR S18**.

The required thickness is obtained by adding the corrosion addition ts, to the net thickness tnet. The net thickness tnet is the thickness obtained by applying the strength criteria given in UR S18.

Refer and confirm compliance to UR S18 with the appropriate Ship's memoranda. This UR does **not** apply to **CSR** Bulk Carriers.

For more detailed guidance, refer to Appendix 6 and guidance on evaluation of scantlings of corrugated transverse watertight bulkheads in Bulk Carriers contracted for construction on or after 1 July 1998.

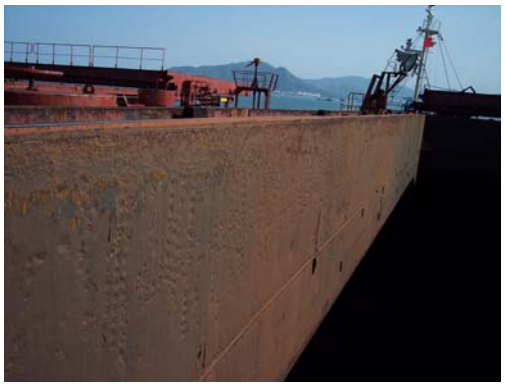
1.6.3.4 UR S21 - Evaluation of Scantlings of Hatch Covers and Hatch Coamings of Cargo Holds of Bulk Carriers, Ore Carriers and Combination Carriers
Bulk Carriers contracted for construction **on or after 1 July 1998** (not including **CSR** ships), are required to comply with the evaluation of scantlings of hatch covers of cargo holds (UR S21). In addition to hatch cover requirements, Bulk Carriers, Ore Carriers and Combination Carriers contracted for construction on or after 1 January 2004 are required to comply with the evaluation of scantlings of hatch coamings of cargo holds in accordance to UR S21.6.2.

Measurements are to be recorded on Form **TM6 UR S21**.

1.6.3.5 UR S21A – Evaluation of Scantlings of Hatch Covers and Hatch Coamings and Closing Arrangements of Cargo Holds of Ships
All ships except bulk carriers, ore carriers and combination carriers contracted for construction **on or after 1 July 2012** and required to comply with the evaluation of scantlings of hatch covers and coamings on exposed decks (UR S21A). In specific, requirements should be applied in accordance to UR S21A.7.1.

Measurements are to be recorded on Form **TM6UR S21A**.

In concern of UR S21 and UR S21A, the required gross thicknesses are obtained by adding the corrosion addition, ts, to tnet. The net thicknesses, tnet, are the member thicknesses necessary to obtain the minimum net scantlings required by these UR's. Refer and confirm with the appropriate Ship's memoranda. For more detailed guidance, kindly refer to Appendix 6 and guidance on evaluation of scantlings for Hatch Covers and Hatch Coamings of the above ships.



Typical wastage – hatch coaming plating

Catastrophic failure – collapsed hatch cover

1.6.4 Sandwich Plate Systems (SPS)

For Sandwich Plate System (SPS) Construction, thickness measurements are required from the top and bottom plate of the SPS panels where the maximum permissible diminution is 20 per cent of minimum Rule thickness.

Note: minimum Rule thickness will have been added as a SRL memorandum.

For more detailed guidance refer to *Provisional Rules for the application of Sandwich Panel Construction to Ship Structure.*

1.6.5 Chemical Tankers – Ships over 10 years old

At the Special Survey selected steel cargo pipes outside cargo tanks and ballast pipes passing through cargo tanks are to be:

- Thickness measured at random or selected pipe lengths to be opened for internal inspection.
- Pressure tested to the maximum working pressure.

Note: Special attention is to be given to cargo/slop discharge piping through ballast tanks and void spaces.

The following may be used for general guidance for levels of diminution requiring renewal of pipes:

- Cargo piping for chemical carriers is required to have a minimum design pressure of 10 bar and suitable corrosion allowance. In addition for carbon steel, the minimum pipe wall thickness is to be in accordance with the general minimum pipe wall thickness in Part 5, Ch12, Table 12.2.4 of the Rules for Ships.

Carbon steel pipes: Cargo pipes operating at less than 10 bar:

- Where general pipe thickness or isolated pockets have a diminution of more than 30 per cent of the original nominal thickness they must be assessed by Engineering Design Appraisal.
- Where general pipe thickness or isolated pockets have a diminution of more than 50 per cent of the original nominal thickness then the pipe should be replaced.

Stainless steel: Cargo pipes operating at less than 10 bar:

- Where general pipe thickness or isolated pockets have a diminution of more than 20 per cent of the original nominal thickness they must be assessed by Engineering Design Appraisal.
- Where general pipe thickness or isolated pockets have a diminution of more than 30 per cent of the original nominal thickness then the pipe should be replaced.

High pressure piping:

- High pressure piping systems generally need to be individually assessed by Engineering Design Appraisal.

1.7 Reporting

1.7.1 Thickness Measurement Reporting: Supporting Software

The results of thickness measurement are to be recorded on the relevant thickness measurement report forms, examples of which are given in Appendix 2. The measurements recorded are to be the average of multiple readings providing a general indication of the condition of the structure. The completed thickness measurement report is to be made up using the forms TM1 to TM8. An LR Thickness Measurement General Particulars (GP) form, Form 6059 (2012.08), is to be included in all thickness measurement reports. The GP form is to be signed and stamped by the TM Company Operator, the attending Surveyor and the authorising Surveyor. The report number refers to the LR control number, to be provided by the attending Surveyor at the opening meeting.

A preliminary TM report in the form of draft sketches with mapping of areas of any findings and repairs, is required to be submitted in advance of the final TM report and **must** be signed by the TM Operator prior of submission to the Surveyor.

The measured thicknesses are to be compared with the original scantlings, or re-assessed scantlings where applicable, and the diminution calculated. It is essential that the original scantlings are included in the report. Surveyors and TM Company operators are to confirm from the documentation on board that the correct scantlings are included in the report. Where the ship has been assigned a **corrosion control** notation, the Rule thicknesses are to be used, and not the corrosion control scantlings. Where this information is not available on board then the required information should be sought from Lloyd's Register Classification Group in London.

The final TM report is to reflect the condition of the ship after any renewals or repairs, and therefore may require annotating by the TM Company and/or Surveyor. Sketches are to reflect the final condition of the ship, indicating areas of substantial corrosion, excessive diminution and renewed structure.

There are occasions that a Special Survey has been commenced and part held, the full scope of thickness measurement has been completed and areas with substantial / excessive corrosion have been identified.

In these instances a TM report is to be issued, reflecting the full scope of TM survey and any substantially / excessively corroded structural areas. Conditions of Class and Memoranda are to be added to deal with the wastage, as appropriate.

Once repairs have been carried out, a TM report is required to be submitted to report the renewal of structure identified in the previously prepared TM report as being excessively corroded, and thus requiring renewal. All areas of excessive corrosion are to have been renewed for completion of Special Survey. Areas of substantial corrosion may also have been renewed, however if not, it is to be ensured suitable memoranda have been, or are now imposed, requiring the structure with substantial corrosion to be examined and gauged at Annual Surveys.

The report number of this new TM report is to be the Control Number of the survey under which the renewals have now been carried out. This new TM report is to be prepared and endorsed by a TM company; it is suggested the TM company that prepared the original TM report carries this out or alternatively a second TM company could be used. Attendance by the TM company at the repair port is recommended, although may not be necessary should no further measurements be required by the attending Surveyor.

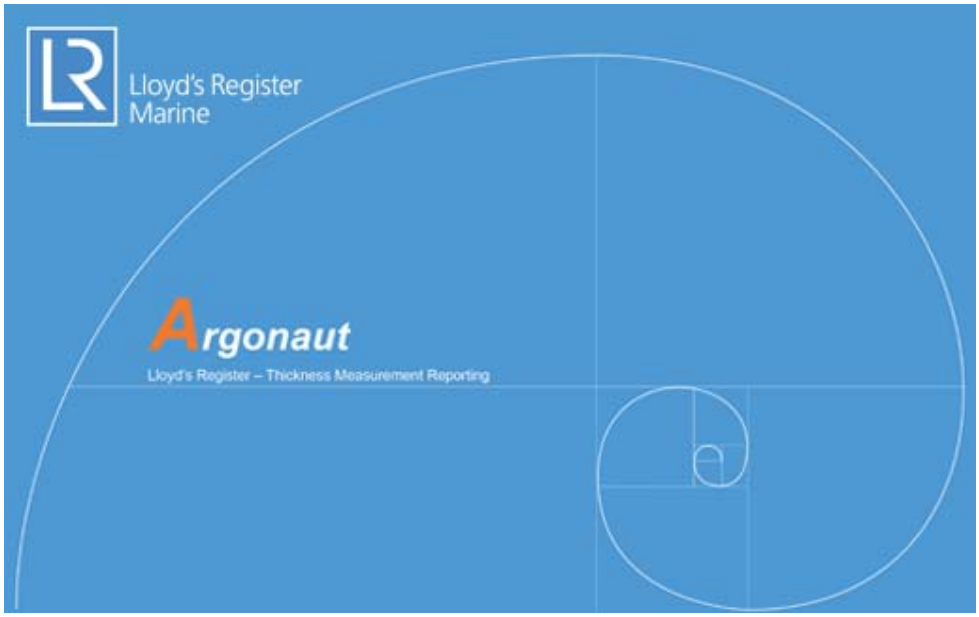
Thickness measurement reports are to be compiled using LR TM Software. It is, however, acceptable for a TM Company to use their own software in case it is justified that the LR software cannot be used. Any software used has to conform to the prescribed IACS Forms format.

The LR TM reporting software has been fully replaced to accommodate Common Structural Rules(CSR) requirements as well as non-CSR thickness measurement requirements and longitudinal strength requirements for specific ship types. Argonaut software is now available for download from the LR website.

It is important to note that the selection of applicable **Rule Type** (CSR, non-CSR) is unique to each TM report and the appropriate forms to become available at each ship with Argonaut. Further

instructions for the appropriate use of TM forms for CSR and non-CSR ships can be found under Chapter 1.7.4. By using the new LR TM reporting software, users will be able to select and lock the Rules(**Local Lock** function) applicable to the ship and the appropriate TM forms will become available for the particular job.

CSR forms are distinctly different utilising a wastage allowance concept instead of a percentage based corrosion allowance. Both types of forms cannot be present in the same TM report. Therefore in case the user requires to amend the **Rule Type**, all the created forms will be deleted from the TM job, if any.



The new TM reporting system has number of improvements and advantages in order to make the manual and time consuming task of thickness measurement reporting as fast, easy & accurate as possible:

TM Forms – TM Reporting

- CSR thickness measurement requirements are incorporated under one system
- UR S18, UR S21 & UR S21A TM Forms have been incorporated under one system.
- Longitudinal strength for oil tanker (above 130m and 10 years of age – TMCalc) requirements as well as CSR requirements on global strength have been incorporated under one system.
- Improved new TM8 Form, resulting in accurate transverse sectional area calculations for all ship types enhancing the process of transverse section assessment and meets compliance to longitudinal strength requirements regardless of the ship type.
- TM reports have been enhanced so can be generated on a standard format in PDF, easily accessed to be reviewed by ship-owners and authorised third parties via Class Direct, providing transparency to the ship's structural results as well as speeding up the process of report submission. The new TM report format and submission processes will provide benefits to the issue of ESP documentation post completion of a special survey on ESP ships.
- Incorporated functionality of attaching supporting documents, cover page and sketches to the electronic TM report that may be viewed within the system, generating a concise and complete thickness measurement report available on demand.

- The final TM report can be generated by the system including cover page, supporting documents, forms & sketches on PDF format. The final TM report can be then uploaded electronically to be accessed on Class Direct. Clients and surveyors will be able to access historical TM reports on-the-fly.

Scope of Survey

- For each particular survey type and ship type, the survey scope report can be produced in PDF format. This report is to be produced during the opening meeting and should be discussed with the TM Operators and owners. Locations for close ups and thickness measurements may be selected and captured on this report. The Survey Scope Report will include all the close up survey and thickness measurement requirements for the ship type and age in accordance to the LR Rules For Ships, Pt 1.

- Often surveys are taking place in many ports and by different surveyors undertaking separate parts of the full scope of a survey. By capturing each TM Jobs' individual survey status and credit each survey requirement separately, we will be better supporting part held surveys. Next attending surveyors would be able to download the previous TM report from Class Direct and review the verification report and survey requirement status. Outstanding survey items would be highlighted supporting transparently the remaining scope to complete a survey and any outstanding close up areas and thickness measurement items.

Renewals

- During ship renewals reporting, TM forms retain the gauged reading as well as the repaired thickness. The items will be colour coded to easily view the results as well as highlight repaired thicknesses not in accordance to the as-built thickness.

- Comments are permitted to be entered on each particular structural item in the TM Forms, to be used to display local corrosion & close up survey area findings(cracks, deformations, buckling, grooving, pitting, necking, edge corrosion, detached structure etc.). Such way, renewals due to local corrosion and close up survey area findings can be explained sufficiently on the TM forms.

- The Renewals Report can be produced on PDF and would highlight all repaired areas ''as built'' and ''other than as built'' thicknesses on renewed plates and stiffeners. These can then be sorted by survey requirement applicable to the survey, or by tank/compartment/space.

Review and verification of TMs

- The forms provide the functionality of colour-highlight a variety of exceptions, making review of the reports a routine process for the surveyor.

- Exceptions can be highlighted in the TM forms as well as the Exception Reports to show the following:

  - ✓ Missed thickness readings
  - ✓ Abnormally high thickness readings
  - ✓ Substantial corrosion readings
  - ✓ Excessive diminution readings

- ✓ Deficient transverse sectional area assessment
- ✓ Readings resulting to items 'coated or gauged annually'

User will be able to navigate from each particular exception of the report to the actual exception location in the TM forms. He will be able to update the exception and return back to the Exception report during report review and verification, improving the time consuming – manual TM report review process into an much easier, routine task.

- The verification report can be generated on PDF format which can be used by the surveyor during the report authorisation. It may also be used as checklist to credit each survey requirement from the given scope of survey as complete(X), part held(P), or on completion(F). Completing the verification report will permit the surveyor to credit the TM Job accordingly and in summary provide the job status of each TM job.

- Often surveys are taking place in many ports and by different surveyors undertaking separate tasks to complete the full scope of a survey. By capturing the TM Job Status of each part held survey, attending surveyors at the next port as well as owners, would be able to download the previous TM report from Class Direct, review the Verification Report where the survey requirement status would be summarised. Outstanding (part held / not seen), Complete or Specially Considered survey items would be listed. The functionality of integrating the detailed scope of each part held survey will help to avoid any duplications in assessment of survey areas during the course of a thickness measurement survey, making the process much more transparent to the stakeholders.

- Avoiding unnecessary repairs since the system will display the exact locations of deficient items during local or global corrosion assessment. Also a summary of all renewals with the actual and renewed thickness and any comments can assist to capture more specifically the reason for a repair which could also be sorted by compartment/space.

- Sorting Repairs per compartment/space may be helpful to ship-owners as the data may be used to calculate the total steel renewals for each compartment. Steel renewals are an important factor of ship dry-docking costs and the provision of Renewal Reports is a step towards the calculation of the total steel renewed in each ship compartment if it is supplemented by the dimensions of the renewed steel plates/profiles.

1.7.2 Thickness Measurement Reporting: Sketches

It is a requirement for all areas under close up survey and thickness measurement to be represented with sketches for which corresponding plates and profiles exist under the appropriate TM forms.

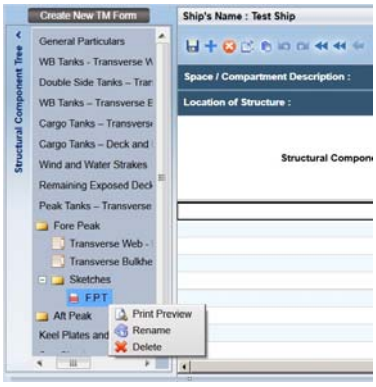
Sketches are to be produced by the TM Company by using any available CAD tools, for all survey areas inspected along with as-built thicknesses, owner's voluntary addition (if any) and renewal thickness or percentage diminution allowance, for these to be reviewed in association with the TM forms. These sketches must resemble the final condition of the vessel after any repairs, renewals and alterations on completion of survey.

TM Companies are recommended to have the full set of survey area sketches prepared during the planning stage of the survey, liaising with the Owners where necessary. The Surveyor will use the sketches as an aid to confirm that all survey requirements have been met.

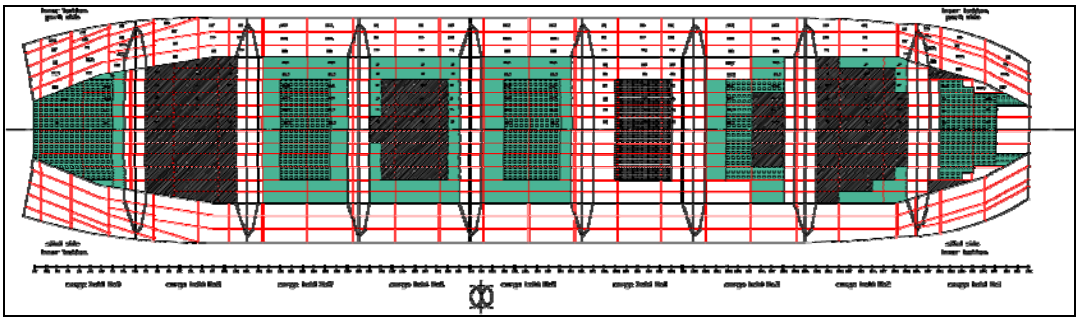
It is recommended that a General Arrangement or Capacity Plan as well as any Unified Requirements assessment tables (UR S19, S31 for bulk carriers) are included under the TM job's Supporting Documents section, with any submitted TM Report to support the authorising Surveyor in the review and authorisation process.

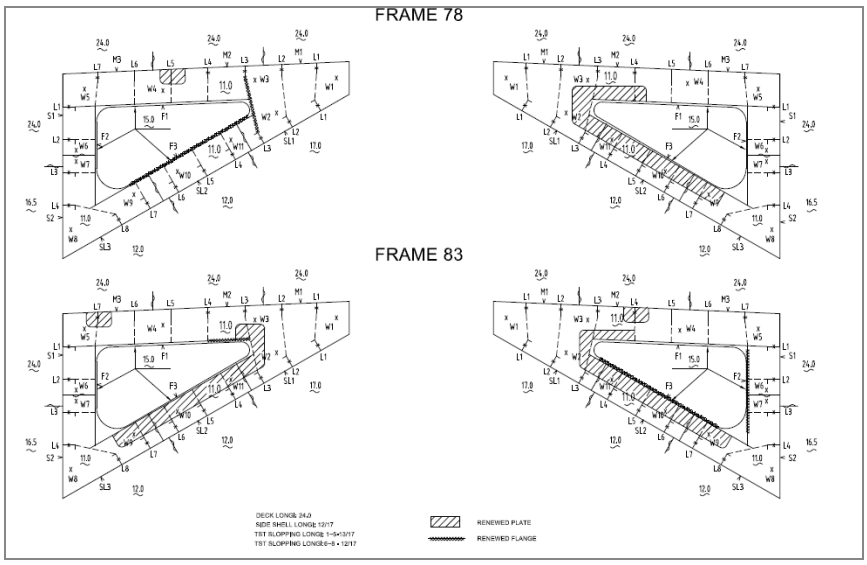
By use of the TM Form, the description of identifiers like the strake or plate position has to correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches in a similar fashion. The **Sketch Reference ID** should include indication of the sketch reference where found necessary (e.g. on transverse members where there will be a number of similar sketches within the same report) as well as the plate reference / gauging point reference (in case this is additionally requested by the surveyors).

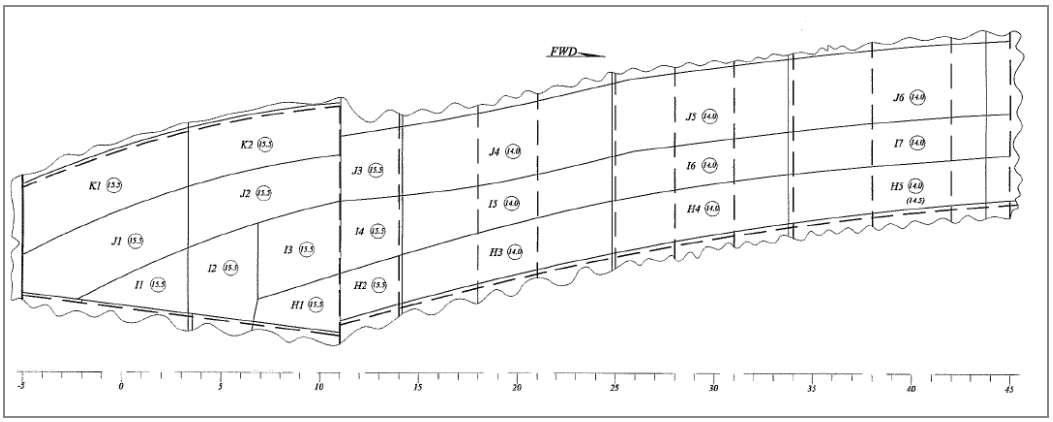
Sketches can be attached to the appropriate folder in the TM report **Structural Component Tree** by right click and selecting **Attach Sketches.** A folder will be automatically created under the corresponding TM forms where any sketch will be appended titled as the name of the file. PDF type of files are permitted to be attached. Each sketch can be renamed by right click and **Rename** in case this is required.

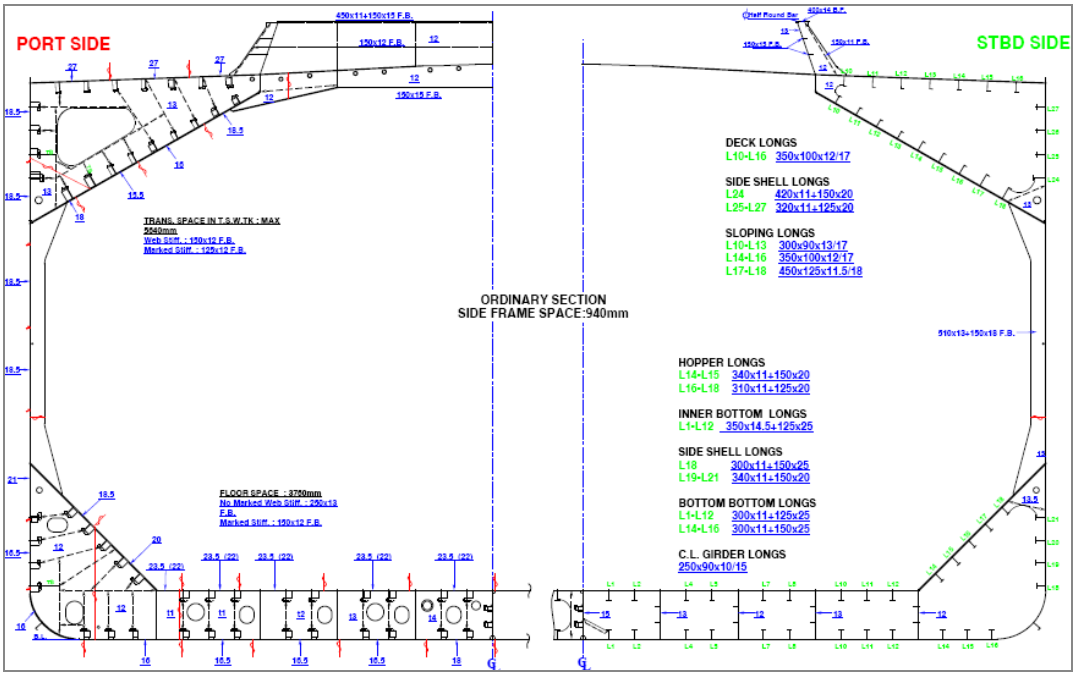


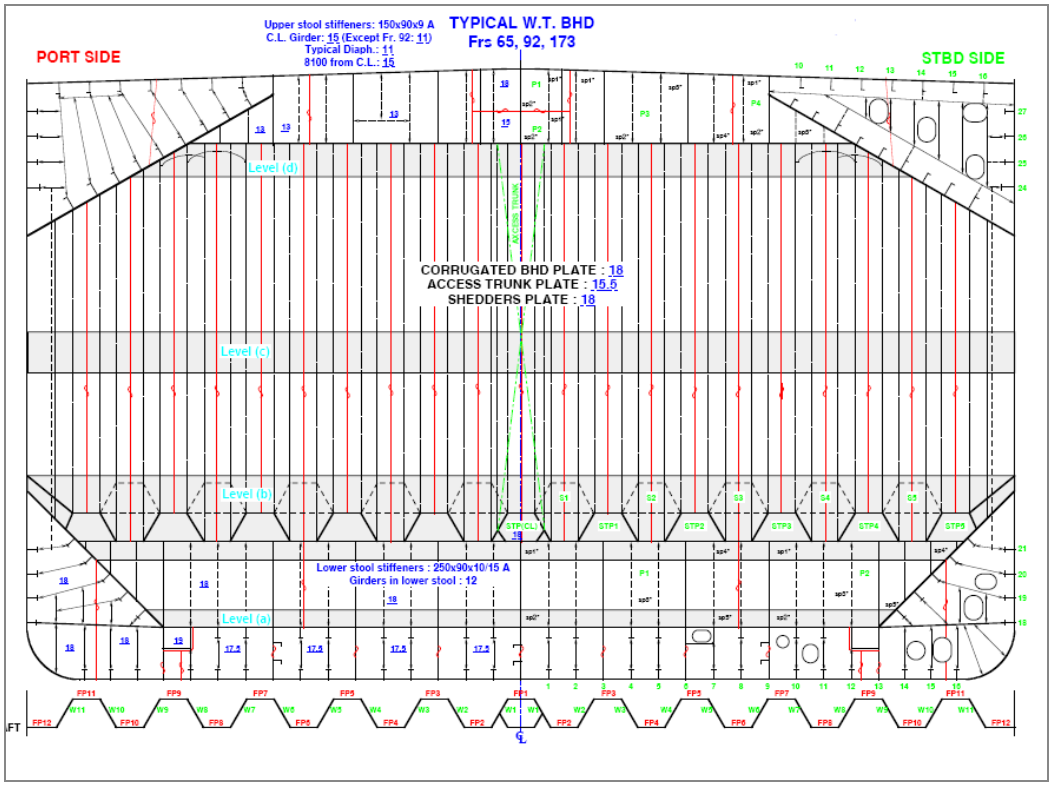
Below as presented are typical sketches with mapping of renewed structural areas where applicable:








PORT SIDE
STBD SIDE
DECK LONGS
L10-L16 350x100x12/17
SIDE SHELL LONGS
L24 420x11+150x20
L25-L27 320x11+125x20
SLOPING LONGS
L10-L13 300x90x13/17
L14-L16 350x100x12/17
L17-L18 450x125x11.5/18
ORDINARY SECTION
SIDE FRAME SPACE:940mm
HOPPER LONGS
L14-L15 340x11+150x20
L16-L18 310x11+125x20
INNER BOTTOM LONGS
L1-L12 350x14.5+125x25
SIDE SHELL LONGS
L18 300x11+150x25
L19-L21 340x11+150x20
BOTTOM BOTTOM LONGS
L1-L12 300x11+125x25
L14-L16 300x11+150x25
C.L. GIRDER LONGS
250x90x10/15
TRANS. SPACE IN T.S.W.TK : MAX
540mm
Web Stiff. : 150x12 F.B.
Marked Stiff. : 125x12 F.B.
FLOOR SPACE : 3750mm
No Marked Web Stiff. : 250x12 F.B.
Marked Stiff. : 150x12 F.B.


TYPICAL W.T. BHD
Frs 65, 92, 173
PORT SIDE
STBD SIDE
Upper stool stiffeners: 150x90x9 A
C.L. Girder: 15 (Except Fr. 92: 11)
Typical Diaph.: 11
8100 from C.L.: 15
Level (d)
Level (c)
Level (b)
Level (a)
CORRUGATED BHD PLATE : 18
ACCESS TRUNK PLATE : 15.5
SHEDDERS PLATE : 18
Lower stool stiffeners : 250x90x10/15 A
Girders in lower stool : 12

1.7.3 Thickness Measurement Reporting: Scope, Verification, Authorisation and Report Submission

Scope

A Survey Scope report can be generated in advance or during the opening meeting of every survey, that captures the requirements for the survey to be completed in accordance to LR Rules for Ships Pt1. The surveyor may select specific structural locations for close up survey and thickness measurements going to take place(e.g. Transverse section frame numbers) during the Opening Meeting. On ESP Ships the selection of survey areas, would have taken place earlier, during the approval of the survey programme by Classification Services. In case the ship is not ESP, the proposed locations for the survey areas to be assessed may be selected and documented on the Survey Scope report. This report can be exported to PDF so it may be printed to be shared with other members of the meeting are referenced throughout the survey at periodical communication intervals. Surveyors are required to complete the Survey Locations for close up survey and thickness measurements at the Opening Meeting. In case these change during the course of the survey, the Survey Scope report may be amended to capture the actual locations of structural survey areas.

Ship Type :	Double Hull Oil Tanker
Rule Type :	Non-CSR
Survey Due :	SSII

Survey Requirements (Requirements for Thickness Measurement & Thickness Measurement in association with Close Up survey)	Survey locations (Proposed Locations for close up survey & Thickness Measurements)
Each **DECK PLATE** within the cargo area	Deck Plating - Strakes A,B,C
One **TRANSVERSE SECTION** within the cargo tank area - **Note:** **(1)** Transverse Sectional area is to be assessed for Londitudinal Strength purposes **(2)** Where the result of the Deck, Neutral Axis or Bottom Zone assessments is found to be greater than 75% of the allowable limit, then additional transverse sections are required to be measured forward and aft of 0.5L amidships **(3)** For oil tankers (including ore/oil and ore/bulk/oil ships) with length equal to or more than 130 m and over 10 years of age, the longitudinal strength is to be evaluated. In such cases, a minimum of three transverse sections are to be measured within 0.5L amidships **(4)** Transverse sections should be chosen where the largest reductions are likely to occur, or as revealed by deck/bottom plating measurement **(5)** See Transverse Section Guidance Notes in Help and TM Guidance Booklet for further information	Tr Section No.1 - Fr. 100 - 101 Tr Section No.2 - Fr. 120 - 121
Selected **WIND AND WATER STRAKES** outside the cargo length area	Strake F - G

Verification

Report verification has never been easier with a number of tools for the user to select and assist his review. All users are authorised to use the tools available in the system to support this process. For further information please review the system User Guide which contains instructions on different areas of the system.

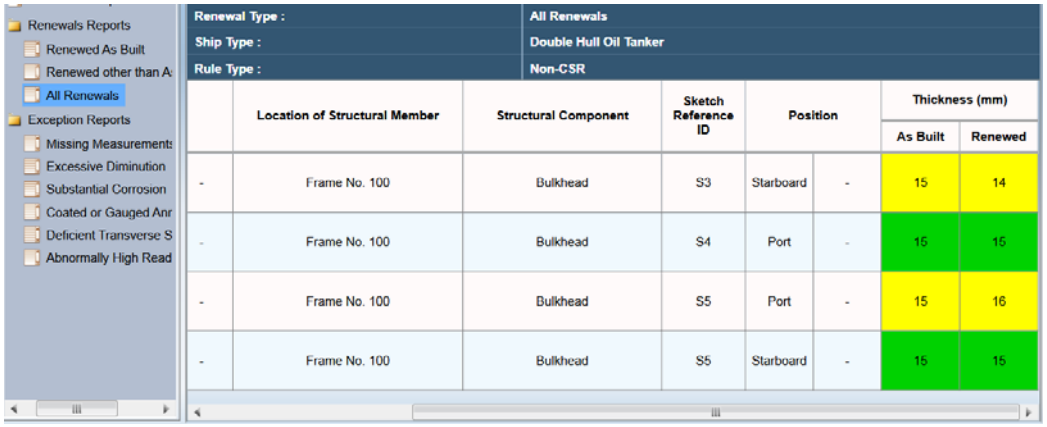
Exceptions can be highlighted on the TM forms with colour coding system. The Exception Reports can be generated on PDF, searching the report to locate the following potential issues:

- Missed thickness readings
- Abnormally high thickness readings
- Substantial corrosion readings
- Excessive diminution readings
- Deficient transverse section
- Readings resulting to items ‘coated or gauged annually’.

Excessive Diminution | Substantial Corrosion | Renewed As Built | Renewed other than As Built | Missing Reading | Abnormally High Reading

Exception Type :			Excessive Diminution				
Rule Type :			Non-CSR				
Survey Requirement	Space / Compartment / Section		Location of Structural Member	Structural Component	Sketch Reference ID	Position	Dimin (%
WB Tanks - Transverse Web Frames	Wing Tank No. 2	-	Frame No. 100	Bulkhead	S3	Port -	30.
WB Tanks - Transverse Web Frames	Wing Tank No. 2	-	Frame No. 100	Bulkhead	S4	Starboard -	29.

Renewal Reports for thicknesses other than as-built as well as same with the as-built thickness, can be generated on PDF as well as to be sorted by ship's space/compartment. It is possible for the user to navigate directly to the specific cell that the renewal or exception is located from the Renewals or Exceptions Report, in order to review and possibly update the reading. The user may navigate back to the Exceptions or Renewals Report, where the report will get automatically updated with any change.



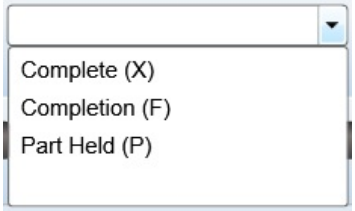
Renewal Type :		All Renewals					
Ship Type :		Double Hull Oil Tanker					
Rule Type :		Non-CSR					
	Location of Structural Member	Structural Component	Sketch Reference ID	Position		Thickness (mm)	
						As Built	Renewed
-	Frame No. 100	Bulkhead	S3	Starboard	-	15	14
-	Frame No. 100	Bulkhead	S4	Port	-	15	15
-	Frame No. 100	Bulkhead	S5	Port	-	15	16
-	Frame No. 100	Bulkhead	S5	Starboard	-	15	15

The Verification Report is a tool to be used by surveyors and it is required to be completed by the authorising surveyor prior to signing the TM final report. Each requirement from the full scope of survey as reflected on the Survey Scope report is required to be credited by the surveyor to sign off the TM job.

Verification Report	
Ship Type :	Double Hull Oil Tanker
Rule Type :	Non-CSR
Survey Due :	SSII

Survey Requirements (Requirements for Thickness Measurement & Thickness Measurement in association with Close Up survey)	Survey locations (Proposed Locations for close up survey & Thickness Measurements)	Requirement Status	
Each **DECK PLATE** within the cargo area	Deck Plating - Strakes A,B,C	Complete	
One **TRANSVERSE SECTION** within the cargo tank area - **Note:** **(1)** Transverse Sectional area is to be assessed for Londitudinal Strength purposes **(2)** Where the result of the Deck, Neutral Axis or Bottom Zone assessments is found to be greater than 75% of the allowable limit, then additional transverse sections are required to be measured forward and aft of 0.5L amidships **(3)** For oil tankers (including ore/oil and ore/bulk/oil ships) with length equal to or more than 130 m and over 10 years of age, the longitudinal strength is to be evaluated. In such cases, a minimum of three transverse sections are to be measured within 0.5L amidships **(4)** Transverse sections should be chosen where the largest reductions are likely to occur, or as revealed by deck/bottom plating measurement **(5)** See Transverse Section Guidance Notes in Help and TM Guidance Booklet for further information	Tr Section No.1 - Fr. 100 - 101 Tr Section No.2 - Fr. 120 - 121	Part-Held	

Crediting of all survey requirements would permit the surveyor to credit the final ***Job Status*** under the **Survey Details** of the **General Particulars** form to display the level of completion of the survey in one report or under multiple reports (P or F). This is required to be completed prior to final submission of the TM report.



Available Credits for Survey Requirements – Verification Report

- **Complete** – The requirement is completed in entirety and reported in the current TM report
- **Completed** – The requirement has previously been part held and was not completed in all respects. It is completed in entirety in the current TM report.
- **Previously Completed** – The requirement had been completed in entirety during a previous survey and reported with a previous TM Report – no need to report in the current TM report
- **Part Held** – Part of the requirement has been completed and reported under the current TM report, the remainder of the requirement is now outstanding
- **Specially Considered** – It is permissible to specially consider the extend of thickness measurements and the LR Rules and conditions have been met in full
- **Outstanding** – The full requirement has not been commenced or completed and reported by any previous TM report nor by the current TM report
- **Not Applicable** - *This option is available only to the **Note for Annual Surveys.**

Available Credits for TM Job Status – General Particulars

- **Part Held (P)** – The scope of survey reported is incomplete as there are outstanding survey requirements to be satisfied
- **Complete (X)** – The scope of survey has been completed and reported in entirety with the current TM report
- **Completion (F)** – Part of the scope of survey had been previously completed and reported and remaining scope completed in entirety with the current TM report.

* An integral part of the Verification report has been to include the following Note which is applicable to every Survey Scope report – Verification report. This item is required to be credited in order to complete the Verification report and cannot be left blank. It refers to areas previously marked with a ship memo to be examined and gauged during the current Annual survey.

- In case this item is required/has been satisfied, surveyors are to mark as **Complete** in the Verification Report and add suitable comments.
- In case this item is not required and there are no areas required to be examined and gauged at Annual survey intervals surveyors should mark as **Not Applicable**.

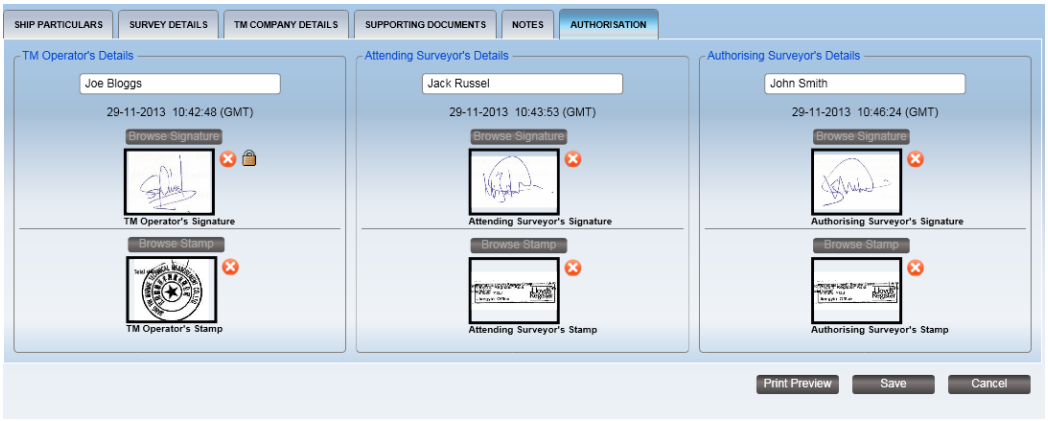
Note AS (Annual Surveys): Salt Water Ballast Tanks are to be examined and **gauged (Thickness Measured)** at Annual Surveys where: a) A hard protective coating has not been applied from the time of construction, or b) A soft or semi-hard coating has been applied, or c) Substantial corrosion is found within the tank internals, or d) The hard protective coating applied is found to be less than **GOOD** condition (for Oil Tankers, Chemical Tankers & Ore/Oil, Ore/Bulk/Oil Ships) or in **POOR** condition (for all other ships types) as defined in LR's Rules Pt 1, Ch 3 Section 1.5. The extent of additional thickness measurements should be in accordance with the LR's Rules Pt 1, Ch 3.

Authorisation
The new TM application has the option for authorised users to attach images of their signature and stamp to the final TM report. It is important to note that the system does not provide a way to control & manipulate the images uploaded to the report. Any image control must be applied outside the application. It is recommended to process and finalise the images of stamp & signature of each user prior to signing a TM report within the TM application.

The user may repeat the step an many times found necessary by deleting and uploading again an image for his signature and stamp (approval). Once these are attached to the report, the system will acknowledge that the report has been approved by the party signing it. After the TM Operator approves the report by attaching both his signature and stamp, the system will apply the **Global Lock** function, in which the TM report will become locked; a safety feature so that any amendments will be prevented from taking place to the approved document. In case users wish to remove the **Global Lock,** both signature and stamp of all the signees must be removed from the TM report in order.

Please note refer to section *3.2. Extending a Class TM Job to CAP*, in the Appendix 9.

Global Lock symbol (Top left of each TM Form and GP Form Authorisation tab):



Export TM Job – Report Submission
The new LR TM application provides the option to export a TM Job package to a consolidated WINZIP format, where it may be passed to the surveyors for review and authorisation. The final TM report produced by the system will include all associated sketches, supporting documents and even a cover page attached by the TM Company.

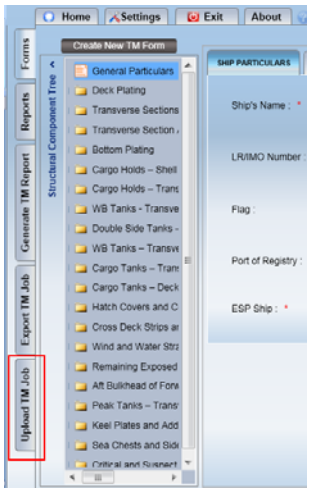
Please note, in CAP Mode, TM Jobs are exported as ".CAP" files.

The system has also the option to generate a final TM report on PDF format. However TM reports must be exported via the **Export TM Job** function and submitted to LR on WINZIP format for the surveyor to be able to view the TM Job with the software in order to sign and authorise the report.

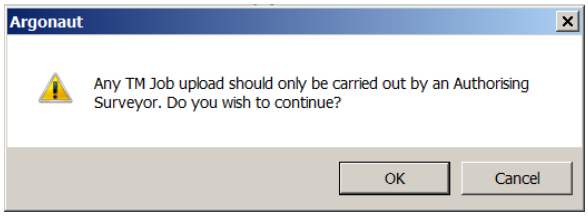
TM Reports are to be submitted within 10 working days from the last onboard visit date. Late submission of thickness measurement reports may delay the issue of statutory and classification certificates and required ESP documentation.

A Special Survey is not to be considered complete if any final TM Report(s) remains outstanding. If final TM Report(s) have not been credited by the Special Survey due date, then a suitable Condition of Class (HULL) is to be raised with a validity of no longer than three months after the due date.

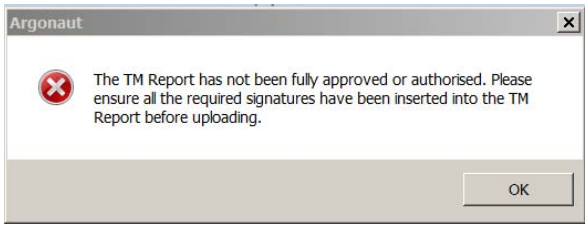
In order to upload a report the Authorising Surveyor is to use the **Upload TM Job** tab.



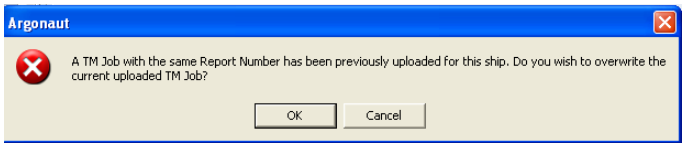
The following warning messages will appear:



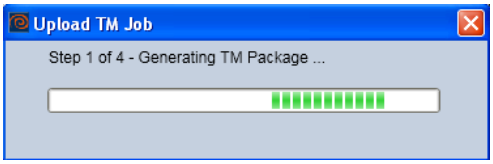
- If the report is not signed at the time of upload:

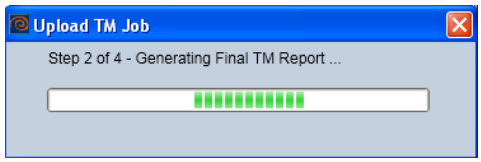


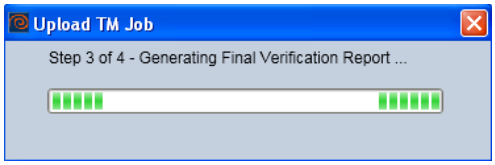
- If a report with same report number has been previously uploaded under the same LR number (Please note that the previous report will be overwritten by the new one).

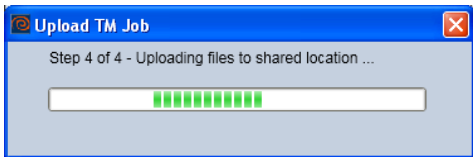


- The following four steps will appear to the authorising surveyor's screen.





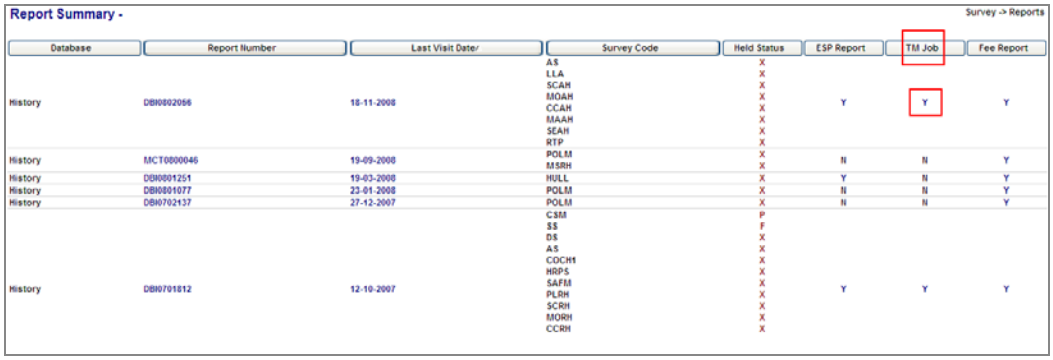




- Finally the following message will confirm the upload to the surveyor:

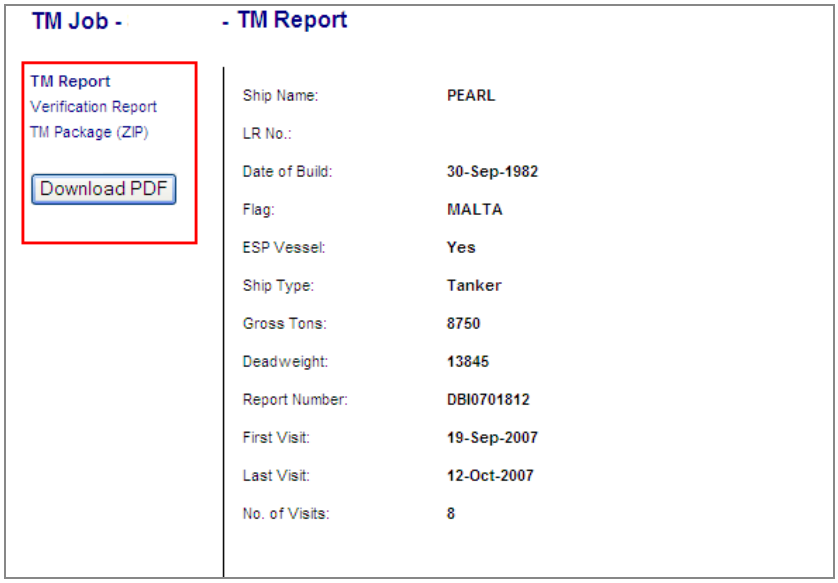
Please note, the Upload functionality is only applicable in Class Mode, it is not applicable in CAP Mode.

Under the Report Summary on Class Direct the **TM Job** tab will display **Y,** for Yes. Please click on **Y**:



The following three options are now available to the Class Direct user:

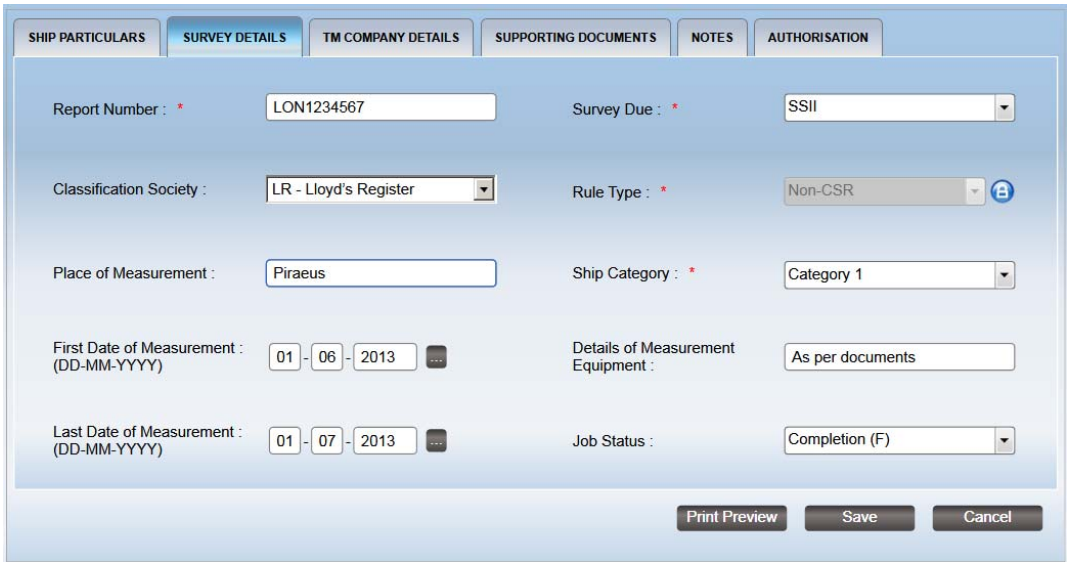
- Download the TM Report in PDF format
- Download the Verification Report for this TM Report in PDF format
- Download the full TM Package in WinZip format (open with Argonaut).

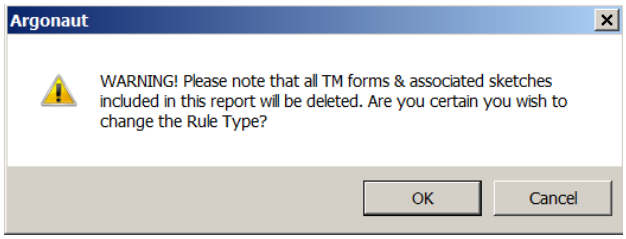


1.7.4 Thickness Measurement Reporting: TM Forms

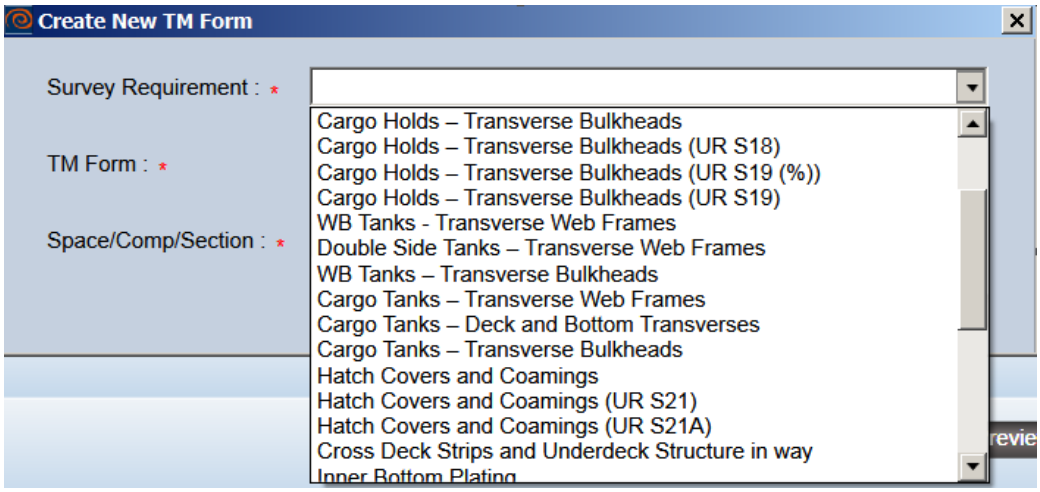
Thickness measurements are to be reported on the report form TM1 to TM8 as appropriate. There are two sets of forms, one for CSR ships and one for non-CSR ships. The LR TM reporting system will be able to provide the appropriate set of forms to the user, after user selects the **Rule Type** under the **Survey Details** of the particular job, in the General Particulars Form. Please note that the **Local Lock** function will become enabled after selecting the **Rule Type**. This function can be manually unlocked to permit changing the Rules applicable, however it may result in loss of all the TM forms with associated data and sketches, if the user changes the **Rule Type** during the TM reporting process. Therefore it is important for the Rule Type to be accurately selected early when setting up the TM Job.

Local Lock Symbol (GP Form **Survey Details** Tab) : 

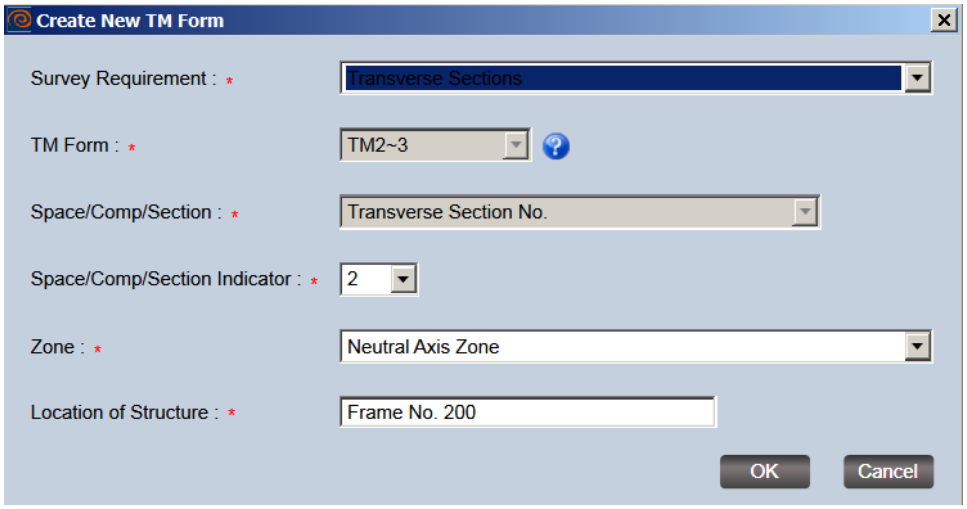




By selecting **Create New TM Form** a survey requirement drop down menu will provide various options to the user. By selecting the appropriate survey requirement any corresponding TM forms will be provided as an option. After selecting the TM form, further drop down menus' will provide various options that correspond to the selected TM form, including the Space / Compartment / Section that the elements are contained within or are part of. Finally the Location of Structure will have to be entered by the user.



Users should note that when generating a **TM2-3** Form, the corresponding **TM8** Form with transverse sectional area calculations for that section will be auto generated by the system. **TM8** will be auto calculated by input of data to **TM2-3** for a particular Zone, and the TM form will refresh every time it is opened on screen, with the corresponding calculations of transverse sectional areas.



Non CSR TM Forms

Please refer to Appendix of this document, for further instructions on each TM form.

TM1	is to be used for reporting the thickness measurement of deck plating, bottom shell plating and side shell plating within the cargo length area.
TM2~3	is to be used for reporting the thickness measurement of the transverse section longitudinal plating, girders and longitudinal frames and stiffeners under the deck, bottom or neutral axis zones. This form is replacing IACS recommended TM2a, TM2b & TM3 forms.
TM4	is to be used for reporting the thickness measurement of transverse structural members and all attached structure in water ballast tanks, deep tanks, cargo tanks and void spaces. This excludes reporting of W.T. transverse bulkheads of any type in any location.
TM5	is to be used for reporting the thickness measurement of W.T. transverse bulkheads where appropriate. This excludes reporting of bulk carrier W.T. transverse bulkheads subject to assessment derived by Unified Requirements Strength 18 and 19 (UR S18, UR S19).
TM5 UR S18	is to be used for reporting the thickness measurement of bulk carrier W.T. transverse bulkheads subject to assessment in accordance with Unified Requirements Strength 18 (UR S18).

TM5 UR S19%	is to be used for reporting the thickness measurement of bulk carrier W.T. transverse bulkheads subject to assessment in accordance with Unified Requirements Strength 19 (UR S19).This form is to be used in case the approved bulkhead upgrade plan does not provide any additional thickness measurement requirements, but requires applicability of Class Rules (diminution criteria) in order to assess the bulkhead during periodical surveys.
TM5 UR S19	is to be used for reporting the thickness measurement of bulk carrier W.T. transverse bulkheads subject to assessment in accordance with Unified Requirements Strength 19 (UR S19) and the approved bulkhead upgrade plan, with additional thickness measurement requirements to conventional Class Rules(diminution criteria).
TM6	is to be used for reporting the thickness measurement of miscellaneous structural members. Also this form is to be used for reporting of any critical areas or any additional survey areas outside the normal scope of survey that would require to be thickness measured. This form is also to be used for reporting of the deck, shell and bottom plating outside the cargo length area.
TM6 UR S21	is to be used for reporting of Scantlings of Hatch Covers / Coamings of Bulk Carrier cargo holds assessed in accordance with Unified Requirements Strength 21 (UR S21).
TM6 UR S21A	is to be used for reporting of Scantlings of Hatch Covers / Coamings of cargo holds for all ships except Bulk Carriers, Ore Carriers and Combination Carriers, assessed in accordance with Unified Requirements Strength 21A (UR S21A).
TM7	is to be used for reporting the thickness measurement of cargo hold/tank transverse frames where appropriate. The form may also be used for reporting of any attached structure to the cargo hold/tank transverse frames, unless it has been fully reported onto an additional TM form e.g. TM6.
TM7 UR S31	is to be used for reporting the thickness measurement of cargo hold/tank transverse frames of bulk carriers assessed in accordance with Unified Requirements Strength 31 (UR S31).
TM8	is to be used for reporting the transverse sectional area of the hull girder strength for deck, bottom and neutral axis zone. This form is automatically generated in the LR software and cannot be generated by the user individually. This form will get updated by data reported onto TM2~3 form, for each zone under consideration.

CSR TM Forms

TM1 CSR	is to be used for reporting the thickness measurement of deck plating, bottom shell plating and side shell plating within the cargo length area.
TM2~3 CSR	is to be used for reporting the thickness measurement of the transverse section longitudinal plating, girders and longitudinal frames and stiffeners falling under the deck, bottom or neutral axis zones. This form is replacing IACS recommended TM2a, TM2b & TM3 forms.
TM4 CSR	is to be used for reporting the thickness measurement of transverse structural members and all attached structure in water ballast tanks, cargo tanks and void spaces. This excludes reporting of W.T. transverse bulkheads of any type in any location.
TM5 CSR	is to be used for reporting the thickness measurement of W.T. transverse bulkheads where appropriate.
TM6 CSR	is to be used for reporting the thickness measurement of miscellaneous structural members. Also this form is to be used for reporting of any critical areas or any additional survey areas outside the normal scope of survey that would require to be thickness measured. This form is also to be used for reporting of the deck, shell and bottom plating outside the cargo length area.
TM7 CSR	is to be used for reporting the thickness measurement of cargo hold/tank transverse

	frames where appropriate. The form may also be used for reporting of any attached structure to the cargo hold/tank transverse frames required to be assessed, unless it has been fully reported onto an additional TM form e.g. TM6.
TM8 CSR	is to be used for reporting the transverse sectional area of the hull girder strength for deck, bottom and neutral axis zone. This form is automatically generated in the LR software and cannot be generated by the user. This form will get updated by reference data reported onto TM2~3 forms, for each zone of the assessed transverse section.

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Thickness measurement and close-up survey guidance

Part 2, Special survey requirements
Other ship types & general dry cargo ships

January 2023 Ver.7.6

Part 2 – Special Survey Requirements

2.1 Thickness Measurement Requirements

Table 2.1.1 Minimum requirements for thickness measurement– General

<table>
<tr><th colspan="3">Requirements based on Pt 1, Ch 3,5 TABLE 3.5.3 of the Rules and Regulations for the Classification of Ships</th></tr>
<tr><th>Special Survey I
(Ships 5 years old)</th><th>Special Survey III
(Ships 15 years old)</th><th>Special Survey IV and subsequent
(Ships 20 years old and over)</th></tr>
<tr><td>(1) Suspect areas, as required by the Surveyor. See Note 8.

Special Survey II
(Ships 10 years old)

(1) Within 0,5L amidships;

1 transverse section of deck plating in way of a cargo space. See Note 2 and 7.

(2) Suspect areas, as required by the Surveyor. See Note 8.</td><td>(1) Within 0,5L amidships;

2 transverse sections in way of two different cargo spaces . See Notes 2, 4(a), 5 and 7.

(2) All cargo hold hatch covers and coamings (plating and stiffeners). See Note 9.

(3) All transverse webs with associated plating and longitudinals, and the transverse bulkhead complete in the fore peak ballast tank and aft peak ballast tank . See Note 6.

(4) Suspect areas, as required by the Surveyor. See Note 8.</td><td>(1) Within 0,5L amidships;

a minimum of 3 transverse sections in way of cargo spaces. See Notes 2, 4(b) and 7.

(2) All cargo hold hatch covers and coamings (plating and stiffeners). See Note 9.

(3) All exposed main deck plating over full length of ship.

(4) All wind and water strakes over the full length of the ship, port and starboard.

(5) Representative exposed superstructure deck plating (i.e. poop, bridge and forecastle deck).

(6) Lowest strake and strakes in way of ‘tween deck of all transverse bulkheads in cargo spaces together with internals in way . See Notes 6 and 7.

(7) Internals and the transverse bulkhead complete in the fore peak ballast tank and aft peak ballast tank. See Note 6.

(8) All keel plates over the full length of the ship. Also additional bottom plates in way of cofferdams, machinery space and aft end of tanks.

(9) Plating of sea chests. Also side shell plating in way of overboard discharges, as considered necessary by the Surveyor.

(10) Suspect areas, as required by the Surveyor. See Note 8.</td></tr>
<tr><td colspan="3">Note 1. Thickness measurement locations are to be selected to provide the best representative sampling of areas likely to be most exposed to corrosion, considering cargo and ballast history and arrangement, and condition of protective coatings.

Note 2. A transverse section is to include all longitudinal members such as plating, longitudinals and girders at the deck, sides, bottom, inner bottom, hopper side and longitudinal bulkheads, where fitted. For transversely framed vessels, a transverse section includes adjacent frames and their end connections in way of transverse sections.

Note 3. Where the protective coating is in GOOD condition, then the extent of thickness measurements</td></tr>
</table>

of internals may be specially considered at the discretion of the Surveyor.

Note 4. For ships having length *L* less than 100 m:

(a) the number of transverse sections required at Special Survey III may be reduced to one;

(b) the number of transverse sections required at Special Survey IV and subsequent surveys may be reduced to two.

Note 5. For ships having length L more than 100m, at Special Survey III, thickness measurement of exposed deck plating within 0.5L amidships may be required.

Note 6.Transverse bulkhead complete including stiffening system.

Note 7. For vessels without defined cargo spaces, thickness measurements are to be taken at the appropriate, most onerous locations selected to provide the best representative sampling of areas likely to be exposed to corrosion the most.

Note 8. Suspect Areas are locations showing substantial corrosion and/or are considered by the Surveyor to be prone to rapid wastage.

Note 9. Subject to cargo hold hatch covers of approved design which structurally have no access to the internals close-up survey/thickness measurement shall be done of accessible parts of hatch cover structures.

Table 2.1.2 Minimum requirements for Thickness measurement - General Dry Cargo ships

Requirements based on Pt 1, Ch 3,5 **TABLE 3.5.5** of the *Rules and Regulations for the Classification of Ships*		
Special Survey I **(Ships 5 years old)**	**Special Survey III** **(Ships 15 years old)**	**Special Survey IV and subsequent** **(Ships 20 years old and over)**
(1) Suspect areas, as required by the Surveyor. See Note 3. **Special Survey II (Ships 10 years old)** *(1)* Within 0,5*L* amidships; 1 transverse section of deck plating in way of a cargo space. See Note 2. *(2)* Measurements for the general assessment and recording of corrosion pattern of those structural members subject to Close-up Survey in accordance with Table 3.5.4, Minimum requirements for Close-up Survey – General dry cargo ships. *(3)* Suspect areas, as required by the Surveyor. See Note 3.	*(1)* Within 0,5*L* amidships; 2 transverse sections in way of two different cargo spaces. *See* Notes 2 and 4(a). *(2)* Measurements for the general assessment and recording of corrosion pattern of those structural members subject to Close-up Survey in accordance with Table 3.5.4, Minimum requirements for Close-up Survey – General dry cargo ships . *(3)* Within the cargo length area; each deck plate outside line of cargo hatch openings. See Note 6. *(4)* All wind and water strakes within the cargo length area. *(5)* Selected wind and water strakes outside the cargo length area. *(6)* *(7)* Suspect areas, as required by the Surveyor. See Note 3.	*(1)* Within the cargo length area: (i) A minimum of three transverse sections within the amidships 0,5L.See Notes 2 & 4(b). (ii) Each deck plate outside the line of cargo hatch openings. See Note 6. (iii) Each bottom plate, including lower turn of bilge (iv) Duct keel or pipe tunnel plating and internals. *(2)* Measurements for the general assessment and recording of corrosion pattern of those structural members subject to Close-up Survey in accordance with Table 3.5.4, Minimum requirements for Close-up Survey – General dry cargo ships . *(3)* All wind and water strakes over the full length of the ship, port and starboard. (4) Remaining exposed main deck plates not considered in item (3) and representative exposed superstructure deck plating (i.e. poop, bridge and forecastle deck). (5) Lowest strake and strakes in way of 'tween deck of all transverse bulkheads in cargo spaces together with internals in way. (6) All keel plates over the full length of the ship. Also additional bottom plates in way of cofferdams, machinery spaces and aft end of tanks. (7) Plating ofsea chests. Also side shell plating in way of overboard discharges, as considered necessary by the Surveyor. (8) Suspect areas, as required by the

		Surveyor. See Note 3.

Note 1. Thickness measurement locations are to be selected to provide the best representative sampling of areas likely to be most exposed to corrosion, considering cargo and ballast history and arrangement, and condition of protective coatings.

Note 2. A transverse section is to include all longitudinal members such as plating, longitudinals and girders at deck, sides, bottom, inner bottom and hopper side plating, longitudinal bulkheads and bottom plating in top wing tanks, where fitted. For transversely framed vessels, a transverse section includes adjacent frames and their end connections in way of transverse sections.

Note 3. Suspect areas are locations showing substantial corrosion and/or are considered by the Surveyor to be prone to rapid wastage.

Note 4. For ships having length *L* less than 100 m:

(a) the number of transverse sections required at Special Survey III may be reduced to one.

(b) the number of transverse sections required at Special Survey IV and subsequent surveys may be reduced to two.

Note 5. For areas in spaces (Cargo Holds and Water Ballast Tanks) where coatings are found to be in GOOD condition, as defined in Pt 1, Ch 3, 1.5 Definitions, 15.20, the extent of thickness measurement may be specially considered, but not dispensed with in its entirety.

Note 6. Deck plating outside line of cargo hatch openings is deck plating between the ship sides and hatch coamings in the transverse section concerned.

2.2 Close-Up Survey Requirements

Table 2.2.1 Minimum requirements for Close-up survey - General Dry Cargo

Requirements based on Pt 1, Ch 3,5 **TABLE 3.5.4** of the *Rules and Regulations for the Classification of Ships*			
Special Survey I (Ships 5 years old)	**Special Survey II (Ships 10 years old)**	**Special Survey III (Ships 15 years old)**	**Special Survey IV and subsequent (Ships 20 years old and over)**
(1) Selected shell frames in one forward and one aft cargo hold and associated 'tween deck spaces. *(2)* One selected cargo hold transverse bulkhead. *(3)* All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2.	*(1)* Selected shell frames in all cargo holds and 'tween deck spaces. *(2)* One transverse bulkhead in each cargo hold, including stiffening system. *(3)* Forward and aft transverse bulkhead in one side ballast tank, including stiffening system. *(4)* One transverse web with associated plating and framing in two representative water ballast tanks of each type (i.e. topside, hopper side, side tank, peak tank or double bottom tank). *(5)* All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2. *(6)* Selected areas of all deck plating and underdeck structure inside the line of hatch openings between cargo hold hatches. *(7)* Selected areas of inner bottom plating.	*(1)* All shell frames in the forward lower cargo hold and 25% of shell frames in each remaining cargo hold and 'tween deck spaces, including their upper and lower end attachments and adjacent shell plating. *(2)* All cargo hold transverse bulkheads, including stiffening system. *(3)* All transverse bulkheads in ballast tanks, including stiffening system. *(4)* All transverse webs with associated plating and framing in each water ballast tank. *(5)* All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2. *(6)* All deck plating and underdeck structure and inside the line of hatch openings between cargo hold hatches. *(7)* All areas of inner bottom plating.	*(1)* All shell frames in all cargo holds and 'tween deck spaces, including their upper and lower end attachments and adjacent shell plating. *(2)* All cargo hold transverse bulkheads, including stiffening system. *(3)* All transverse bulkheads in ballast tanks, including stiffening system. *(4)* All transverse webs with associated plating and framing in each water ballast tank. *(5)* All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2. *(6)* All deck plating and underdeck structure inside the line of hatch openings between cargo hold hatches. *(7)* All areas of inner bottom plating.
Note 1. Close-up survey of cargo hold transverse bulkheads to be carried out at the following areas: (a) Immediately above the inner bottom and immediately above the 'tween decks, as applicable. (b) Mid-height of the bulkhead for the holds without 'tween decks. (c) Immediately below the main deck plating and 'tween deck plating. **Note** 2. Subject to cargo hold hatch covers of approved design which structurally have no access to the internals, close-up survey/thickness measurement shall be done of accessible parts of hatch covers structures.			

2.3 Substantial Corrosion

Table 2.3.1 Additional Requirements in way of Structure Identified with Substantial Corrosion.

Requirements based on Pt 1, Ch 3,5 **TABLE 3.5.6** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurement
Plating	Suspect areas and adjacent plates	5 point pattern over $1m^2$
Stiffeners	Suspect areas	3 measurements each in line across web and flange

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Thickness measurement and close-up survey guidance

Part 3, Special survey requirements
Bulk carriers

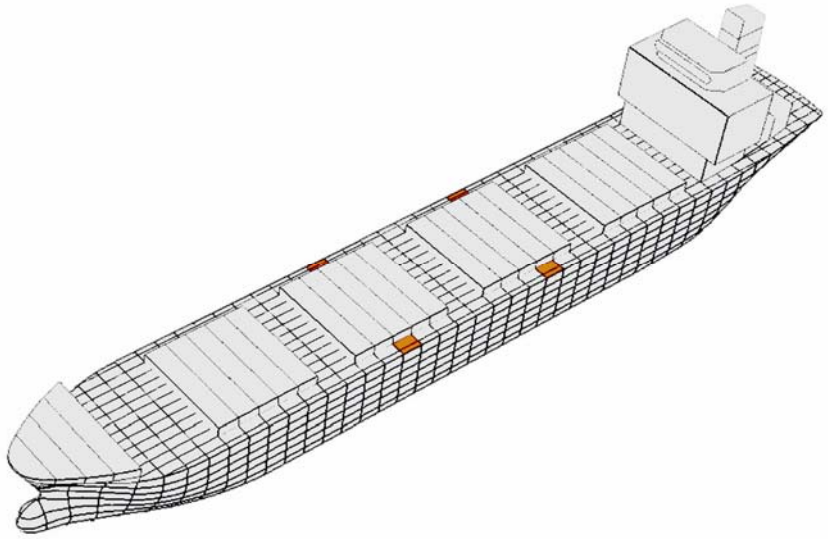
January 2023 Ver.7.6

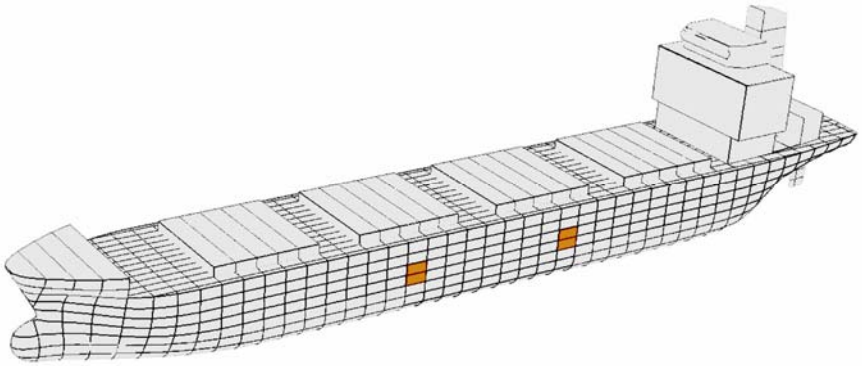
Contents Part 3

Part 3 – Special Survey Requirements

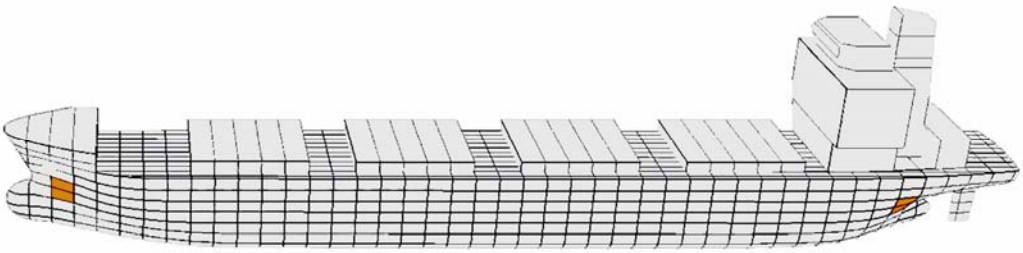
3.1 Thickness Measurement Requirements

Table 3.1.1 Minimum requirements for thickness measurement - Single skin and Double Skin Bulk Carriers (Including Ore Carriers)

Requirements based on Pt 1, Ch 3,6 **TABLE 3.6.4** of the *Rules and Regulations for the Classification of Ships*
SPECIAL SURVEY I (Ships 5 Years Old)
(1) Suspect areas, as required by the Surveyor. See Note 5.
SPECIAL SURVEY II (Ships 10 Years Old)
 (1) Within Cargo Length Area: (a) two transverse sections of deck plating outside line of cargo hatch openings. See Note 7.
(2) Measurement for general assessment and recording of corrosion pattern, of those structural members subject to Close-up Survey in accordance with Table 3.6.1 Minimum requirements for Close-up Survey - Single skin bulk carriers, Table 3.6.2 Minimum requirements for Close-up Survey - Double skin bulk carriers (excluding ore carriers) or Table 3.6.3 Minimum requirements for Close-up Survey - Ore carriers. See Notes 3 and 4.

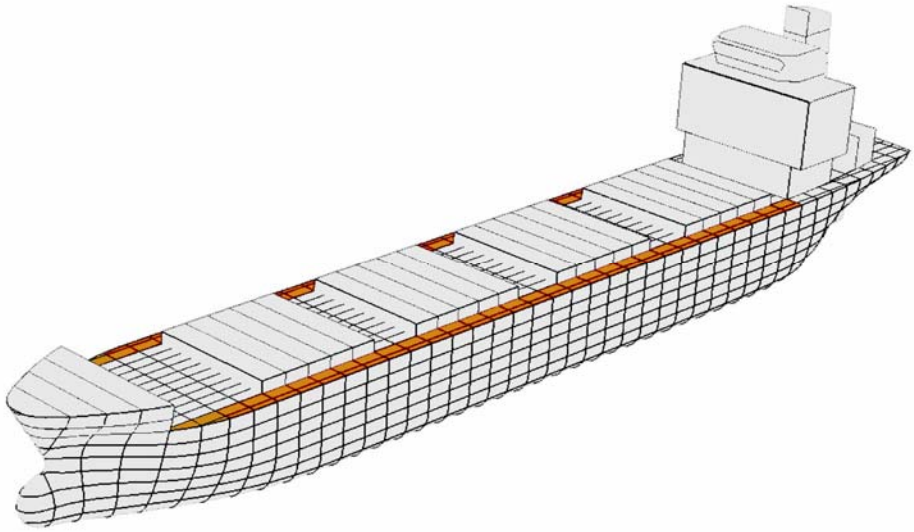
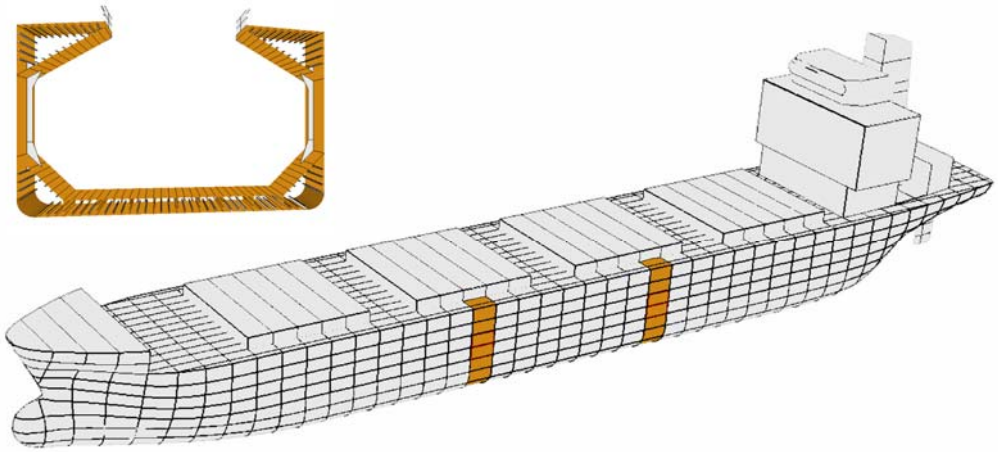


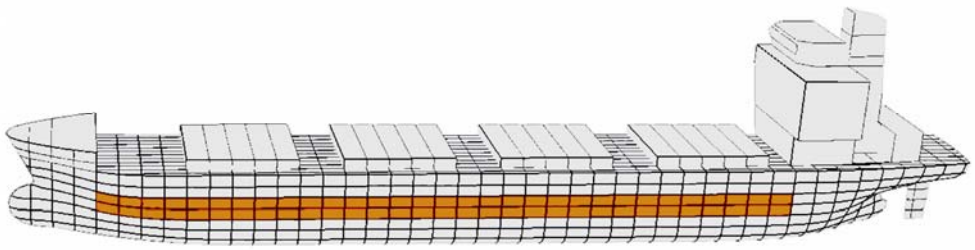
(3) Wind and water strakes in way of the transverse sections considered in (1).



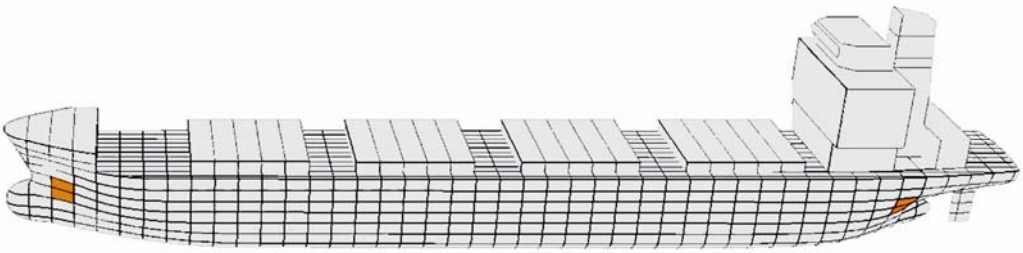
(4) Selected wind and water strakes outside the cargo length area.

(5) Suspect areas, as required by the Surveyor. See Note 5.

SPECIAL SURVEY III (Ships 15 Years Old)
 (1) Within the cargo length area: (a) Each deck plate outside line of cargo hatch openings
 (1) Within the cargo length area: (b) 2 transverse sections, outside line of cargo hatch openings. (A minimum of 1 of the above transverse sections is to be within 0.5*L* amidships). See Notes 2 and 6.
(2) Measurement for general assessment and recording of corrosion pattern, of those structural members subject to Close-up Survey in accordance with Table 3.6.1 Minimum requirements for Close-up Survey - Single skin bulk carriers, Table 3.6.2 Minimum requirements for Close-up Survey - Double skin bulk carriers (excluding ore carriers) or Table 3.6.3 Minimum requirements for Close-up Survey - Ore carriers. See Notes 3 and 4.

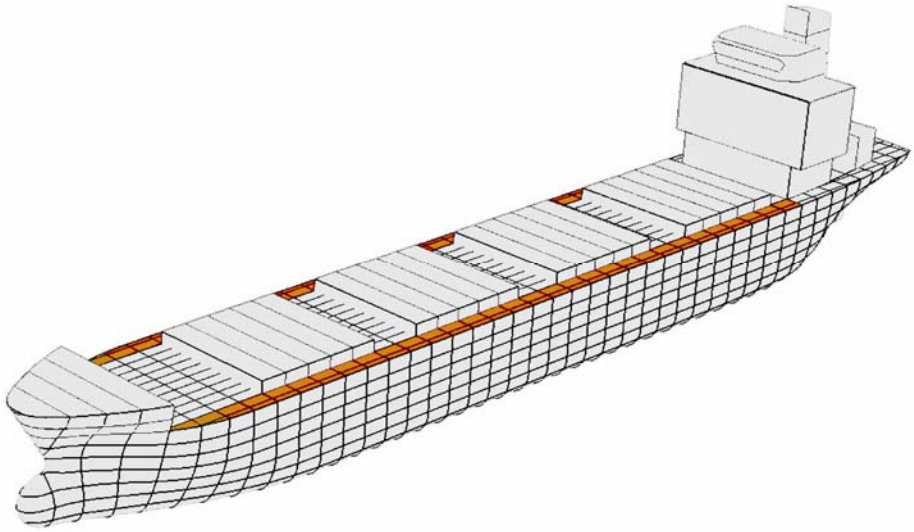
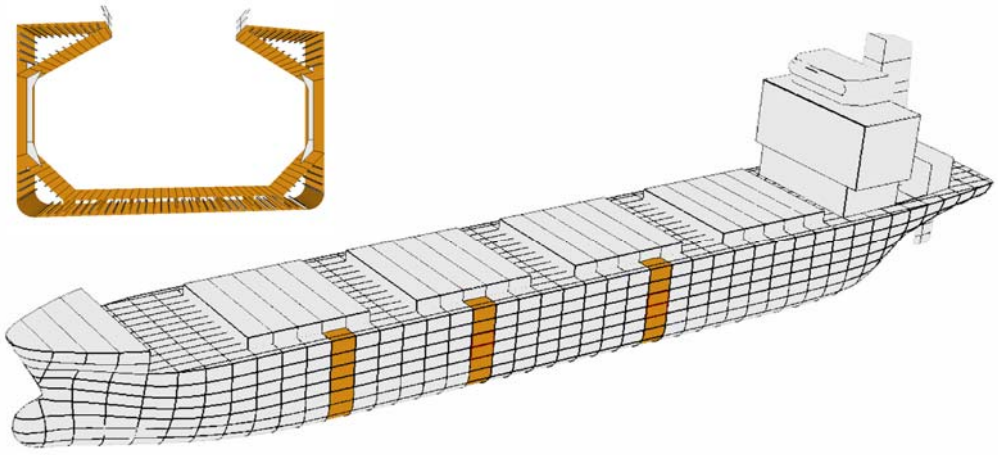


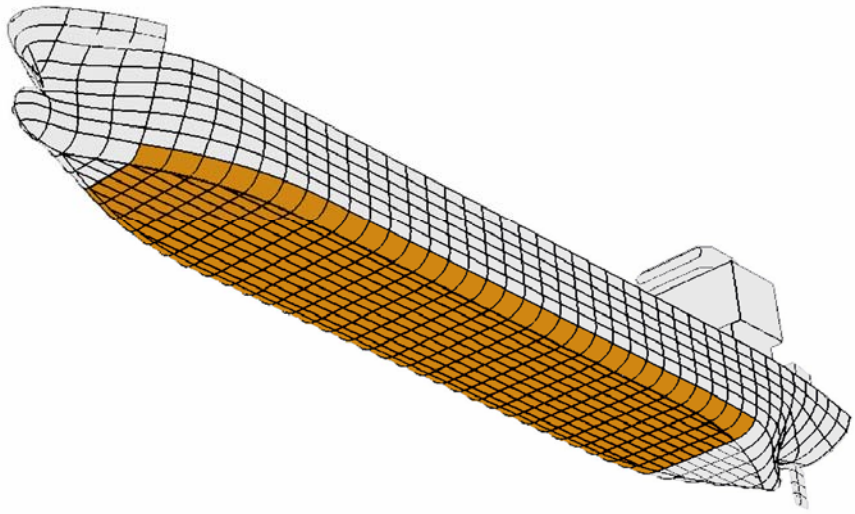
(3) All wind and water strakes within the cargo length area



(4) Selected wind and water strakes outside the cargo length area

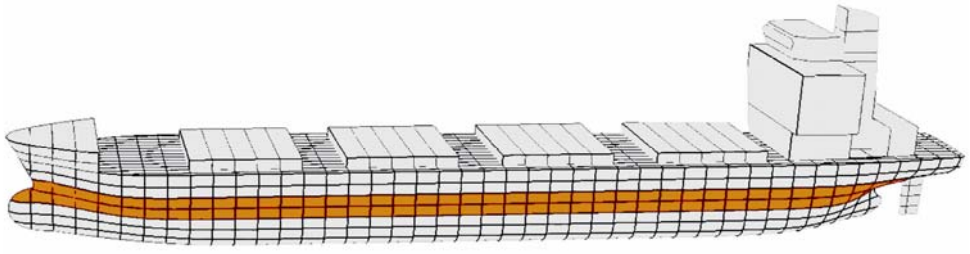
(5) Suspect areas, as required by the Surveyor. See Note 5.

SPECIAL SURVEY IV (Ships 20 Years Old)
 (1) Within the cargo length area: (a) each deck plate outside line of cargo hatch openings.
 (1) Within the cargo area: (b) 3 transverse sections, outside line of cargo hatch openings. (A minimum of 2 of the above transverse sections is to be within 0,5L amidships.) See Notes 2 and 6.

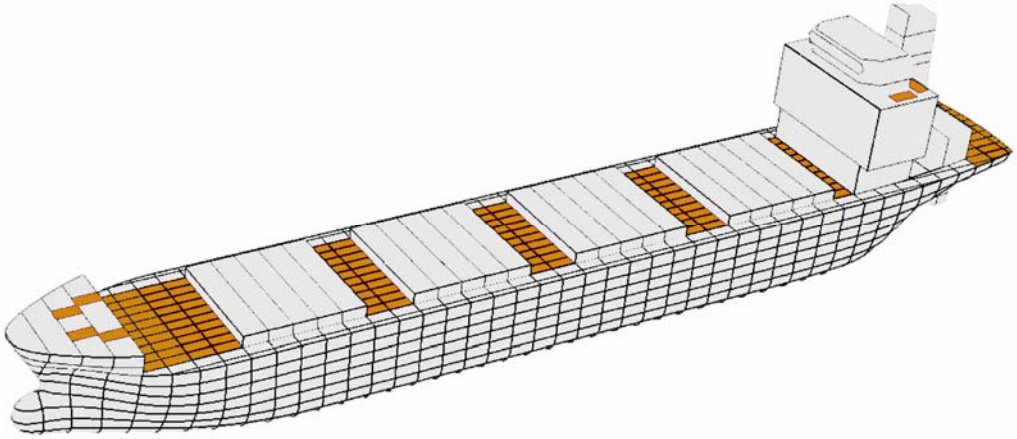


(1) Within the cargo length area:
(c) each bottom plate.

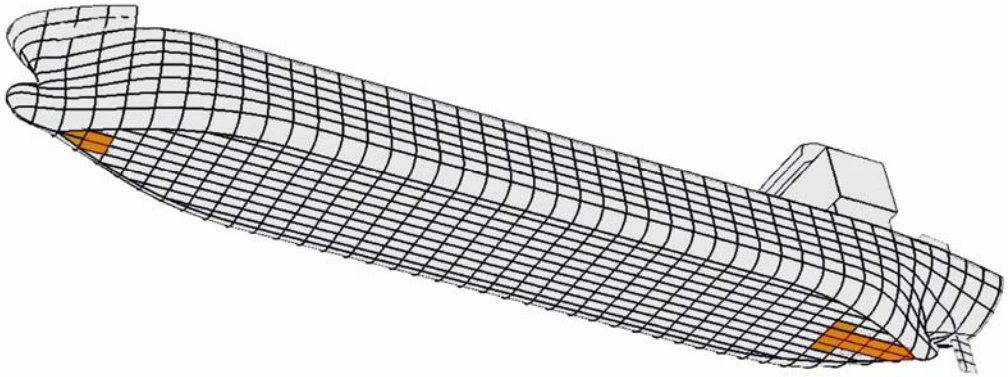
(2) Measurement for general assessment and recording of corrosion pattern, of those structural members subject to Close-up Survey in accordance with Table 3.6.1 Minimum requirements for Close-up Survey - Single skin bulk carriers, Table 3.6.2 Minimum requirements for Close-up Survey - Double skin bulk carriers (excluding ore carriers) or Table 3.6.3 Minimum requirements for Close-up Survey - Ore carriers. See Notes 3 and 4.



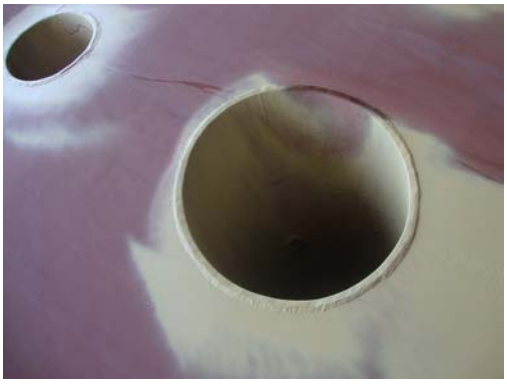
(3) All wind and water strakes over the full length of the ship, port and starboard. (Wind and Water Strake: the strakes of a ship's side shell plating between the ballast and the deepest load waterline).



(4) Remaining exposed main deck plates not considered in item (1) and representative exposed superstructure deck plating (i.e. poop, bridge and forecastle deck).



(5) All keel plates outside the cargo length area. Also additional bottom plates in way of cofferdams. Machinery space and aft end of tanks.



(6) Plating of sea chests. Also side shell plating in way of overboard discharges, as considered necessary by the Surveyor.

(7) Suspect areas, as required by the Surveyor. See Note 5.

Note The requirements in this table apply to both single skin and double skin ships unless stated otherwise.

Note 1. For areas in spaces (cargo holds and water ballast tanks) where coatings are found to be in GOOD condition, as defined in Pt 1, Ch 3, 1.5 Definitions, the extent of thickness measurement may be specially considered, but not dispensed with in its entirety.

Note 2. Transverse sections should be chosen where the largest scantling diminution is likely to occur, or as revealed by deck or bottom plating measurement.

Note 3. For ships assigned the notations **ESN-Hold 1 and ESN All Holds**, the corrugated part of the aft transverse bulkhead of the forward cargo hold is to be subject to thickness measurement. This is to include each vertical corrugation at its lower and middle level including shedder plates and gusset plates, where applicable.

Note 4. Single skin bulk carriers contracted for construction prior to 1 July 1998 are to undergo a re-assessment of their cargo hold shell frames in accordance with the *Provisional Rules for Existing Ships*. The number of shell frames to be measured is equivalent to the number of shell frames subject to Close-up Survey (*see* Pt 1, Ch 3, Table 3.6.1 Minimum requirements for Close-up Survey – Single skin bulk carriers), with representative measurements to be taken at specific areas for each frame.

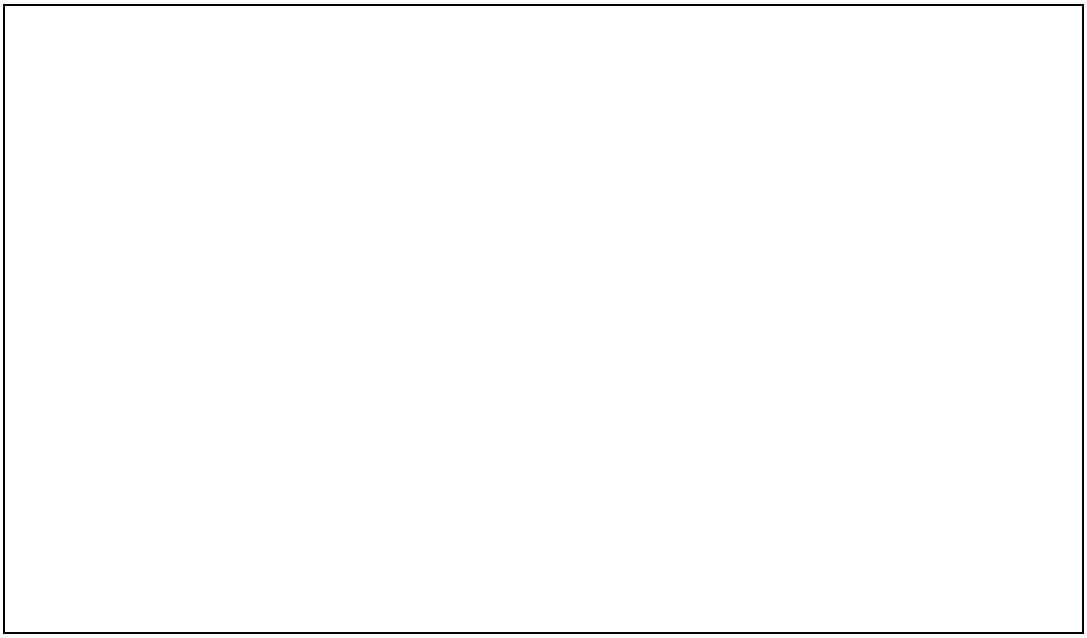
Note 5. Suspect Areas are locations showing substantial corrosion and/or are considered by the surveyor to be prone to rapid wastage.

Note 6. A transverse section includes all continuous longitudinal members such as plating, longitudinals and girders at the deck, sides, bottom, inner bottom, hopper sides, longitudinal bulkheads, inner sides, top wing inner sides and bottom of top wing tanks. For transversely framed vessels, a transverse section includes adjacent frames and their end connections in way of transverse sections.

Note 7. Deck Plating outside line of cargo hatch openings is deck plating between the ship sides and hatch coamings in the transverse section concerned.

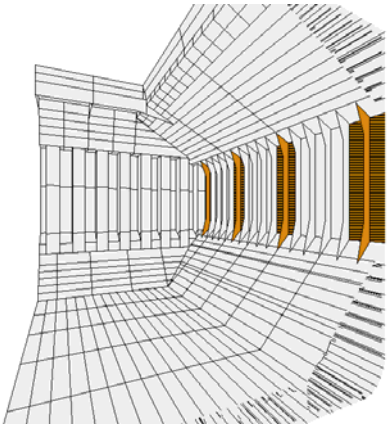
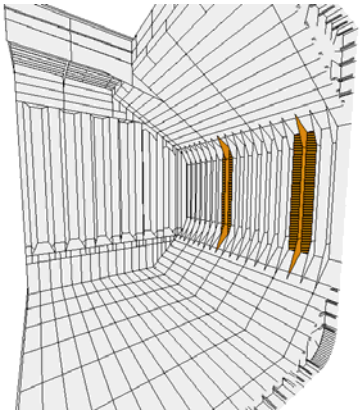
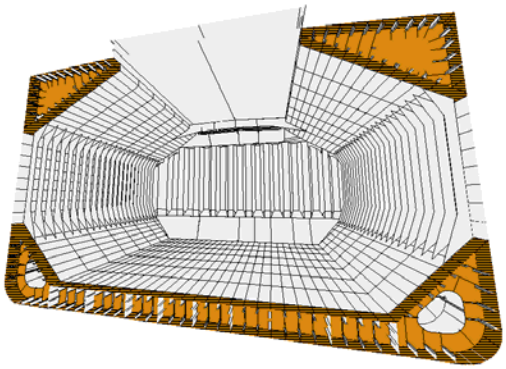
Thickness Measurement Part 3, Chapter 1

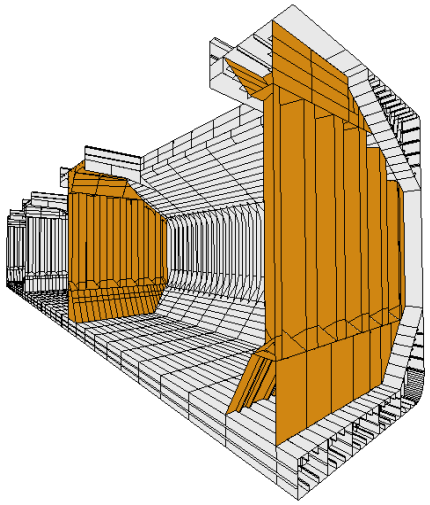
Single And Double Skin Bulk Carriers *Section 1*



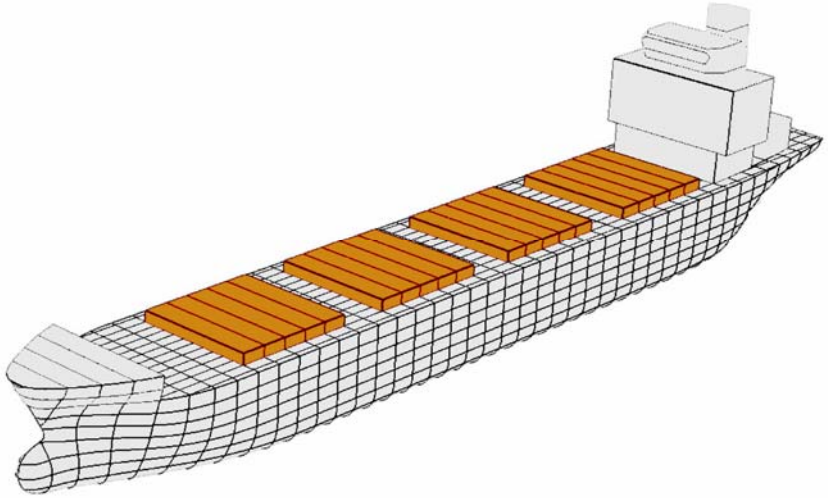
3.2 Close-Up Survey Requirements

Table 3.2.1 Minimum requirements for Close-up Survey - Single Skin Bulk Carriers

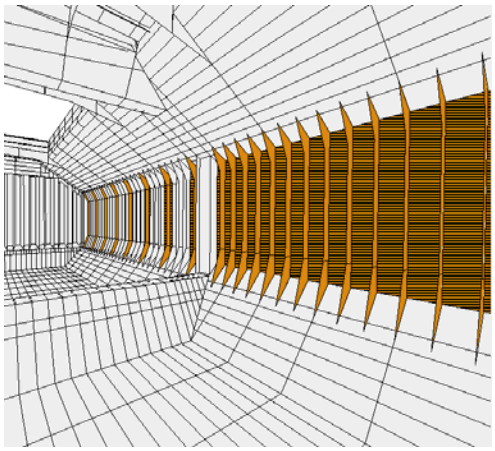
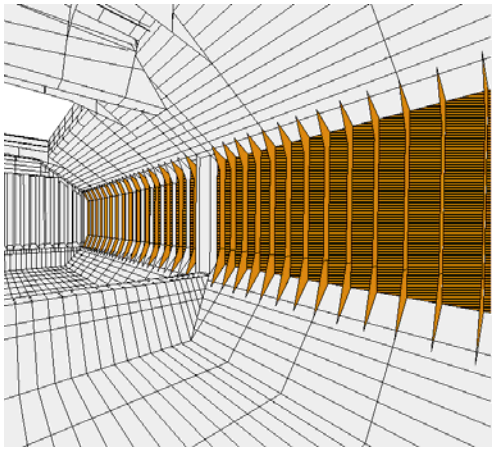
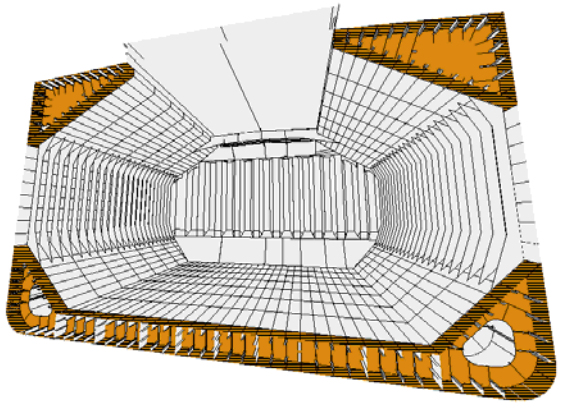
Requirements based on Pt 1, Ch 3,6 **TABLE 3.6.1** of the *Rules and Regulations for the Classification of Ships*
SPECIAL SURVEY I (Ships 5 Years Old)
 (1) 25% of shell frames and their end attachments in the forward cargo hold at representative positions.
 (2) Selected shell frames and their end attachments in remaining cargo holds.
 (3) 1 transverse web with associated plating and longitudinals in 2 representative water ballast tanks of each type (i.e. topside, peak, double bottom and hopper side tank).

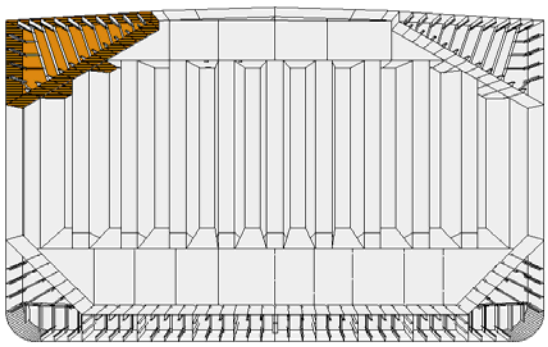


(4) 2 selected cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted. This is to include the aft bulkhead of the forward hold. See Note 1.

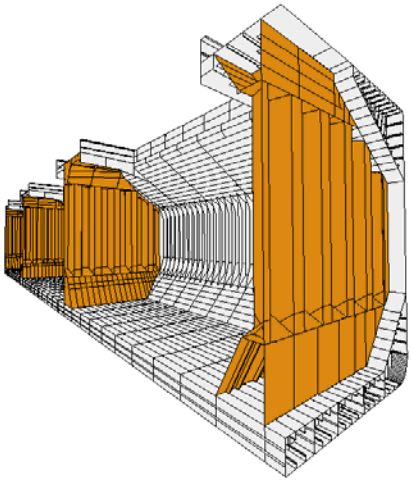


(5) All cargo hatch covers and coamings (plating and stiffeners). See Note 2.

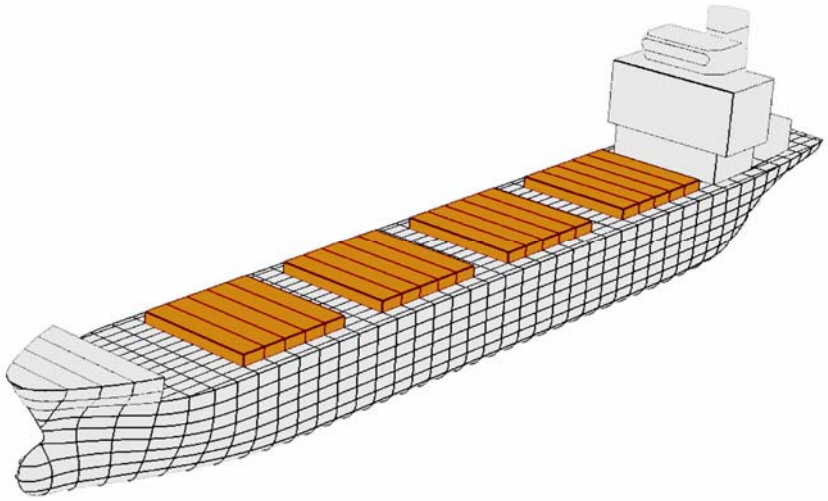
SPECIAL SURVEY II (Ships 10 Years Old)	
	(1) a – For bulk carriers with a deadweight less than 100,000 tonnes, all shell frames in the forward cargo hold and 25% of frames in each of the remaining cargo holds, including their upper and lower end attachments and adjacent shell plating.
	(1) b – For bulk carriers with a deadweight equal to or greater than 100,000 tonnes, all shell frames in the forward cargo hold and 50 % of frames in each remaining cargo hold, including their upper and lower end attachments and adjacent shell plating.
	(2) 1 transverse web with associated plating and longitudinals in each water ballast tank



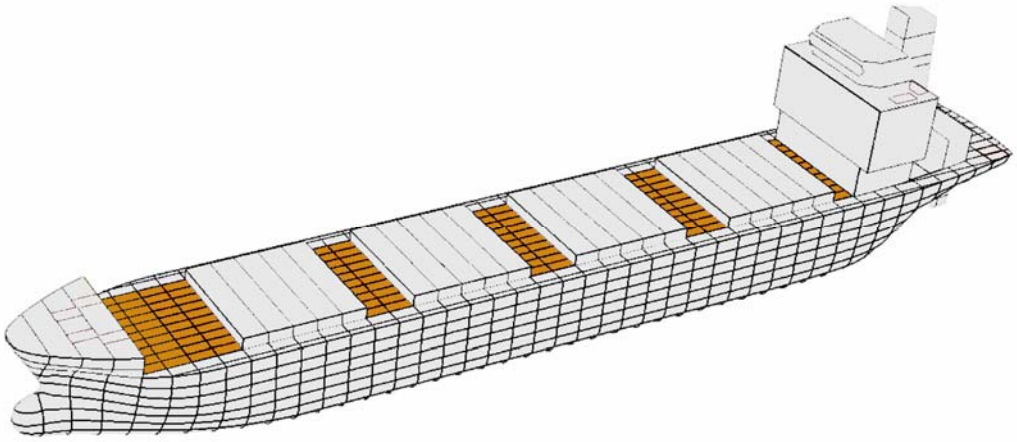
(3) Forward and aft transverse bulkhead in 1 side ballast tank, including stiffening system



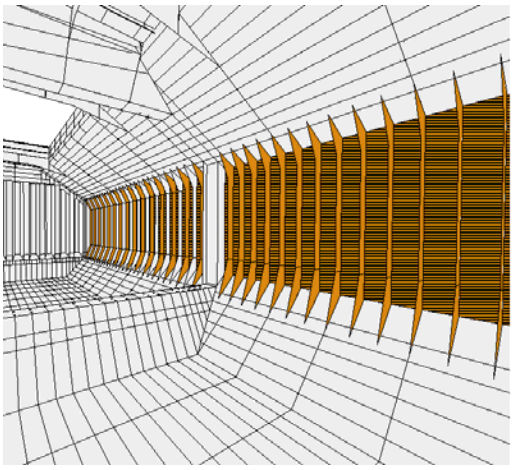
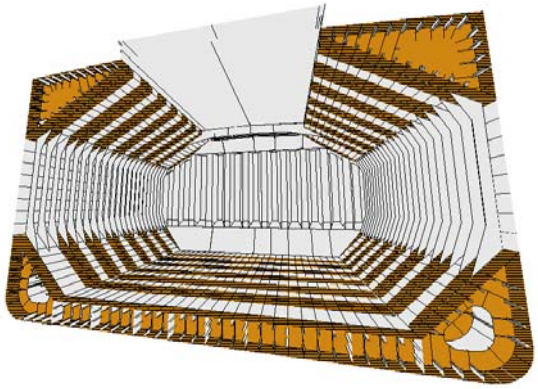
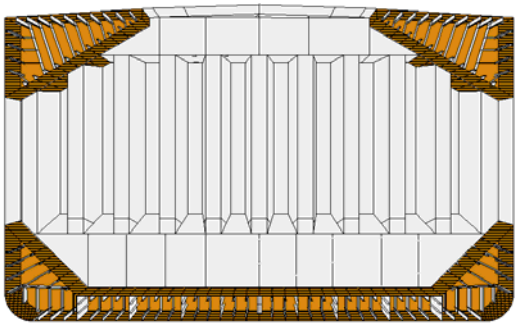
(4) All cargo hold transverse bulkheads including internal structure of upper and lower stools, where fitted. See Note 1.

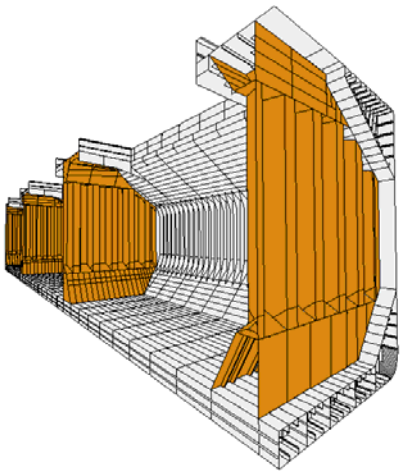


(5) All cargo hatch covers and coamings (plating and stiffeners). See Note 2.

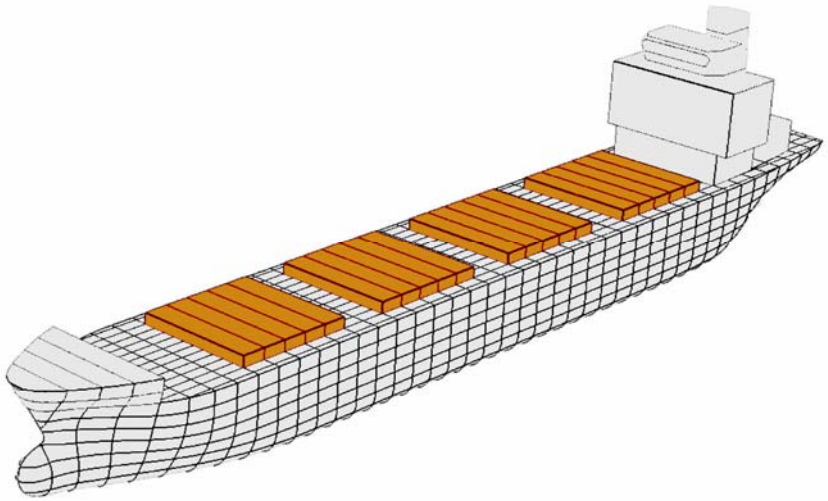


(6) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches

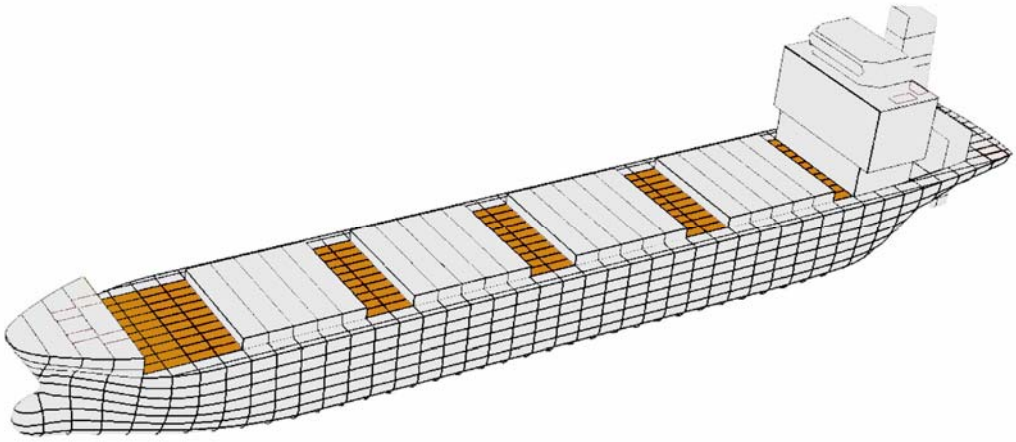
SPECIAL SURVEY III (Ships 15 Years Old)	
	(1) All shell frames in the forward and one other selected cargo hold and 50% of frames in each of the remaining cargo holds, including their upper and lower end attachments and adjacent shell plating.
	(2) All transverse webs with associated plating and longitudinals in each water ballast tank.
	(3) All transverse bulkheads in ballast tanks, including stiffening system.



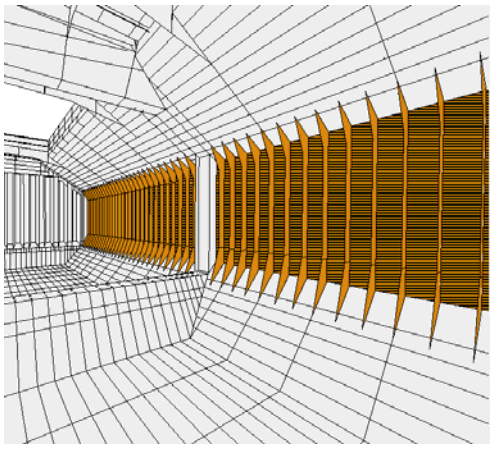
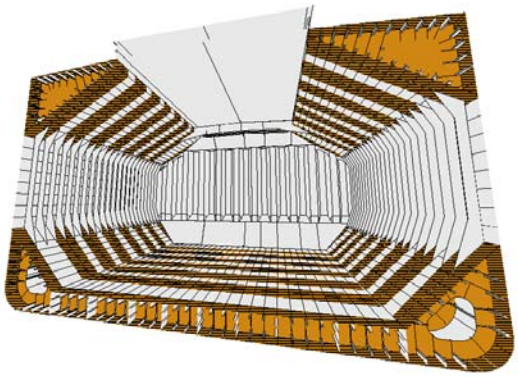
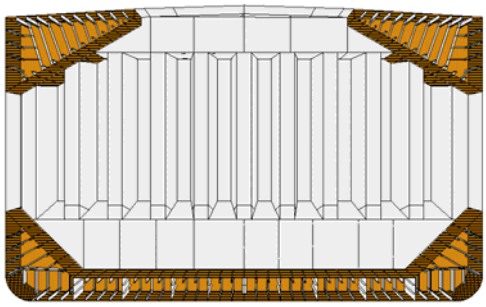
(4) All cargo hold transverse bulkheads including internal structure of upper and lower stools, where fitted. See Note 1.

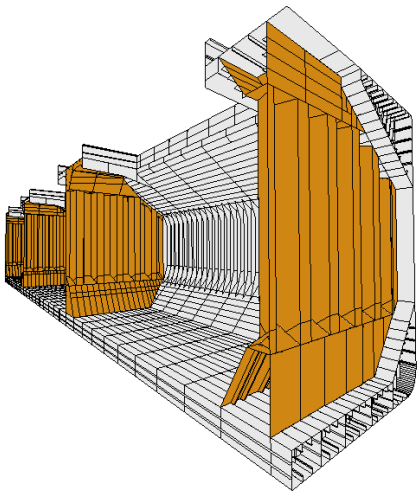


(5) All cargo hatch covers and coamings (plating and stiffeners). See Note 2.

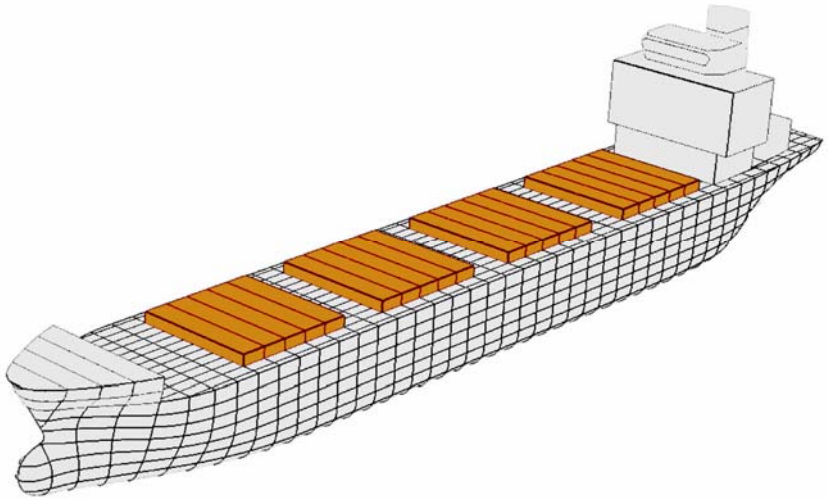


(6) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches.

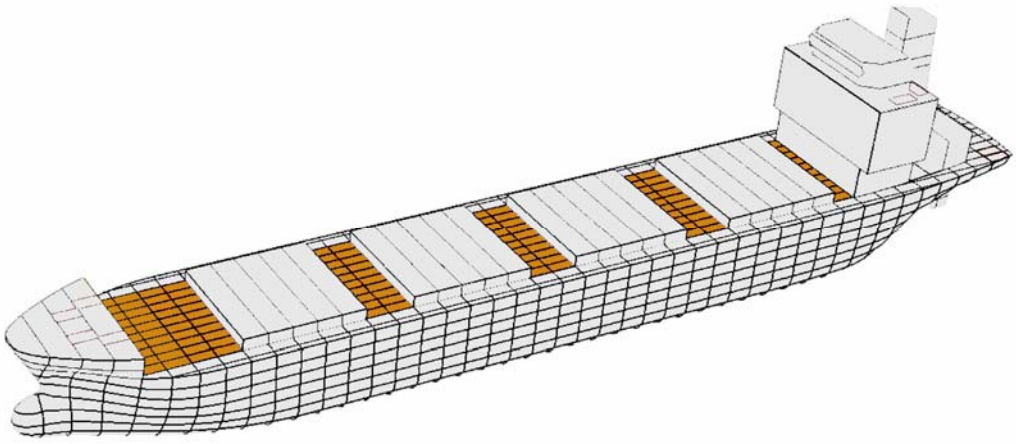
SPECIAL SURVEY IV (Ships 20 Years Old)	
	(1) All shell frames in all cargo holds, including their end attachments and adjacent shell plating.
	(2) All transverse webs with associated plating and longitudinals in each water ballast tank.
	(3) All transverse bulkheads in ballast tanks, including stiffening system



(4) All cargo hold transverse bulkheads including internal structure of upper and lower stools, where fitted. See Note 1.



(5) All cargo hatch covers and coamings (plating and stiffeners). See Note 2.



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

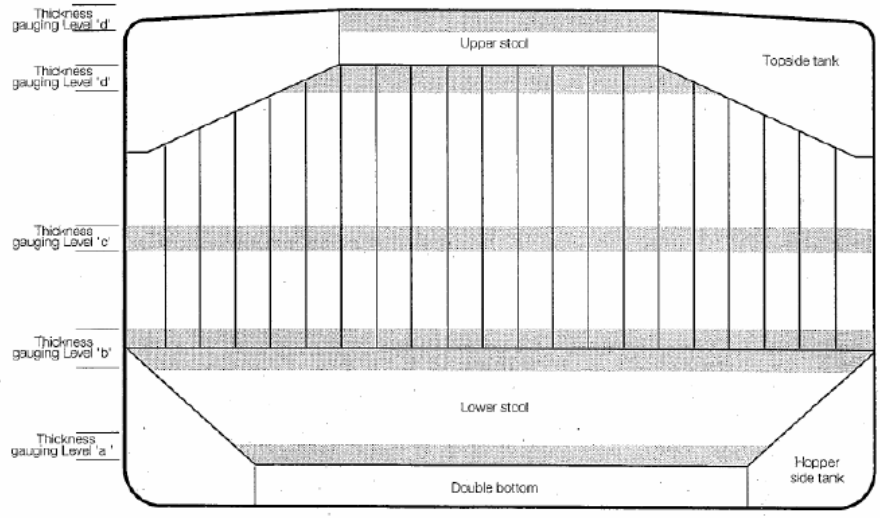
Note 1. Close-up Survey of transverse bulkheads to be carried out at four levels:

Level (a) Immediately above the inner bottom and immediately above the line of gussets (if fitted) and shedders for ships without lower stool.

Level (b) Immediately above and below the lower stool shelf plate (for those ships fitted with lower stools), and immediately above the line of the shedder plates.

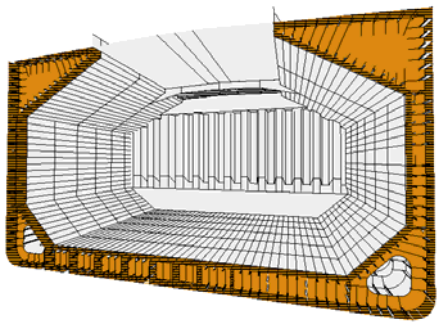
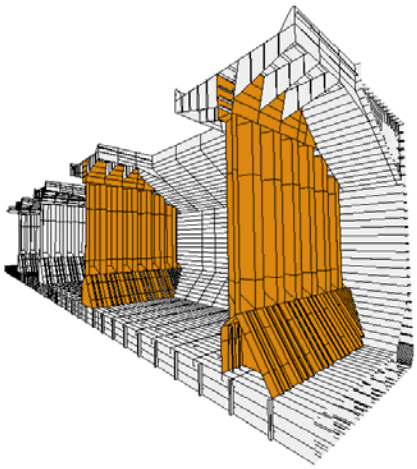
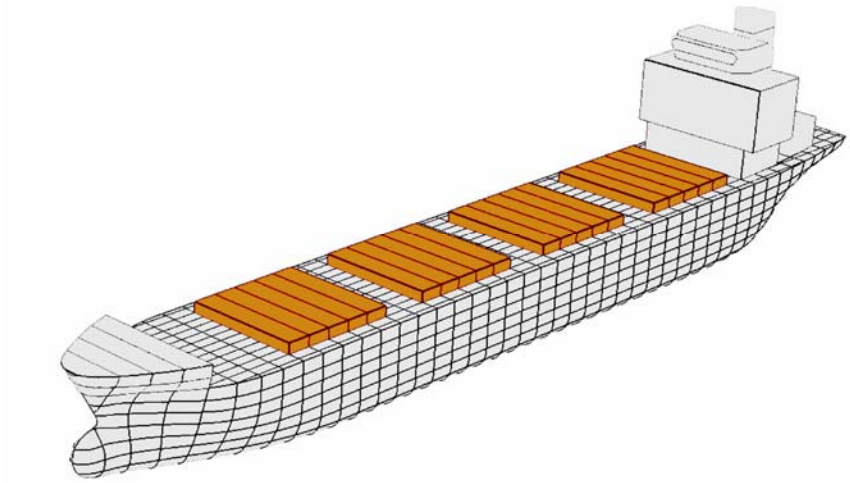
Level (c) About mid-height of the bulkhead.

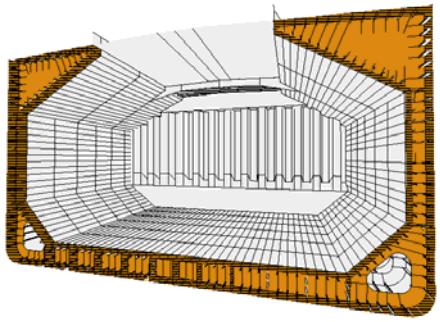
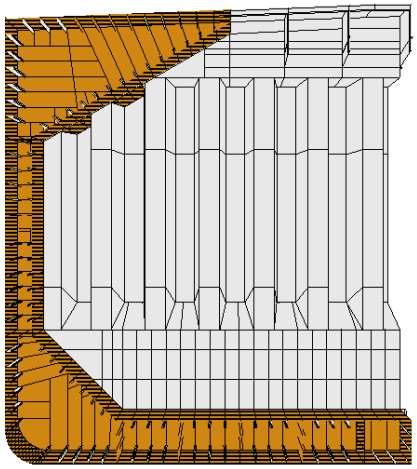
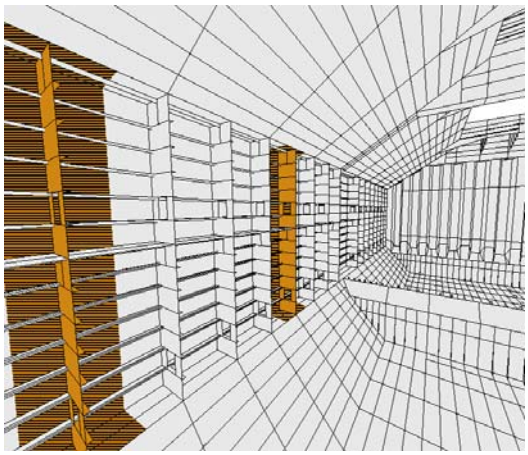
Level (d) Immediately below the upper deck plating and immediately adjacent to the upper wing tank and immediately below the upper stool shelf plate for those ships fitted with upper stools, or immediately below the topside tanks.

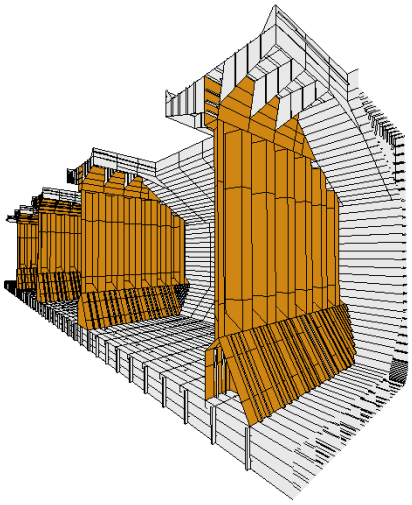


Note 2. Subject to cargo hold hatch covers of approved design (which structurally have no access to the internals), close-up survey/thickness measurement shall be done of accessible parts of hatch covers structures.

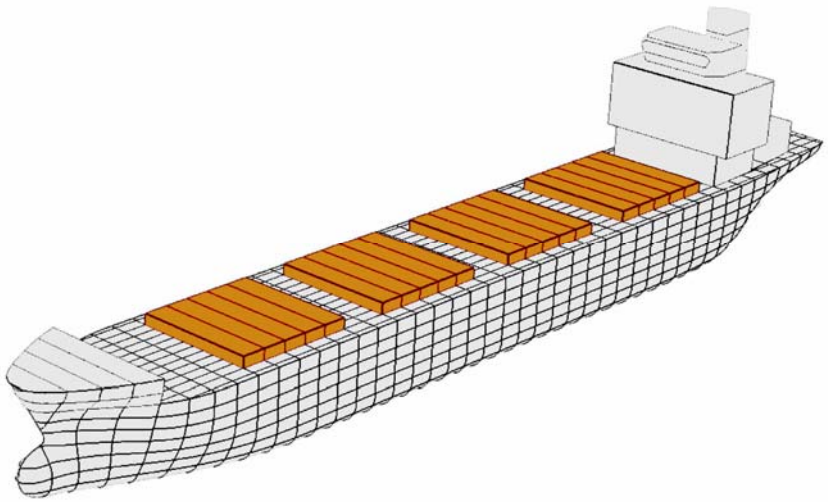
Table 3.2.2 Minimum requirements for Close-up Survey - Double Skin Bulk Carriers

Requirements based on Pt 1, Ch 3,6 **TABLE 3.6.2** of the *Rules and Regulations for the Classification of Ships*
SPECIAL SURVEY I (Ships 5 Years Old)
 (1) 1 transverse web with associated plating and longitudinals in 2 representative water ballast tanks of each type. This is to include the foremost topside and double side ; peak tanks and double bottom tanks.
 (2) 2 Selected cargo hold transverse bulkheads including internal structure of upper and lower stools, where fitted. See Note 1.
 (3) All cargo hatch covers and coamings (plating and stiffeners). See Note 2.

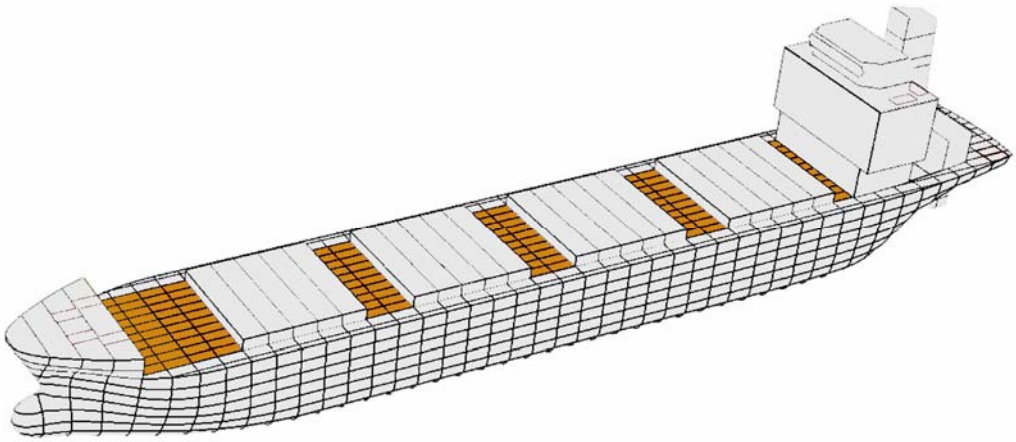
SPECIAL SURVEY II (Ships 10 Years Old)	
	(1) 1 transverse web with associated plating and longitudinals in each water ballast tank.
	(2) Forward and aft transverse bulkheads, including stiffening system, in 1 complete double side ballast tank on one side of the ship(i.e. port or starboard), *see* Note 3.
	(3) 25% of ordinary transverse frames for transverse framing system or 25% of longitudinal for longitudinal framing system on side shell and inner side plating at forward, middle and aft parts, in the foremost double side tanks.



(4) One transverse bulkhead in each cargo hold including internal structure of upper and lower stools, where fitted. See Note 1.

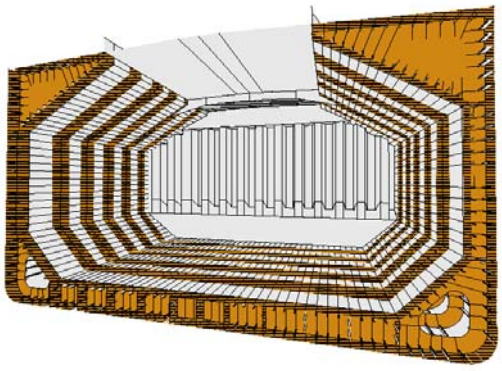


(5) All cargo hatch covers and coamings (plating and stiffeners). See Note 2.

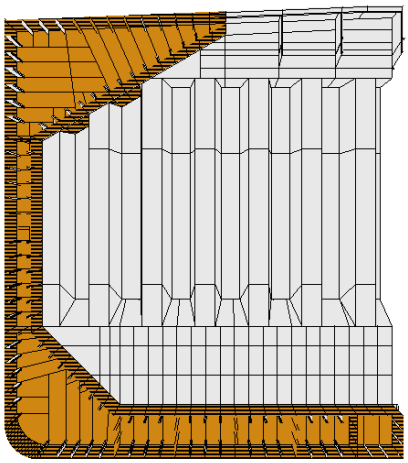


(6) All deck plating and underdeck structure inside line of hatch openings between all cargo hold hatches.

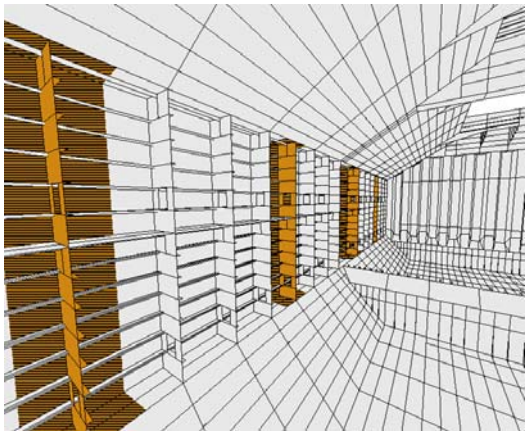
SPECIAL SURVEY III (Ships 15 Years Old)



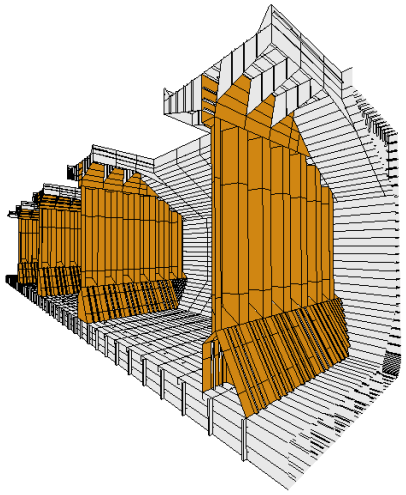
(1) All transverse webs with associated plating and longitudinals in each water ballast tank.



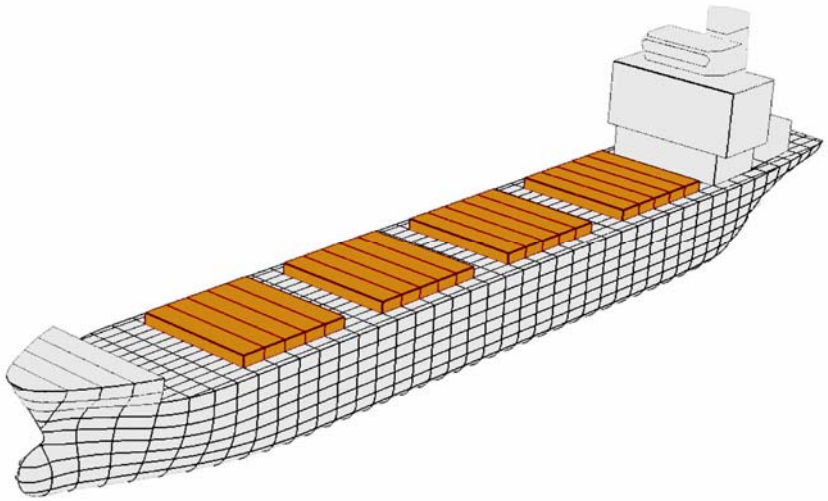
(2) All transverse bulkheads in the ballast tanks, including stiffening system.



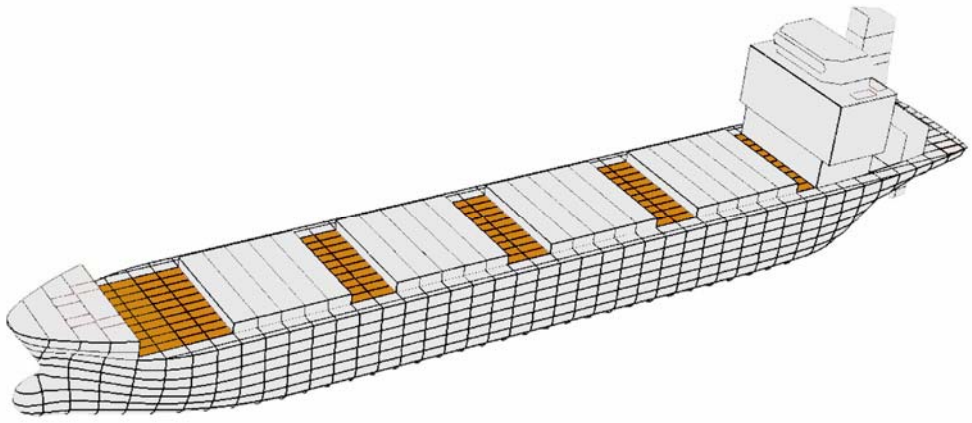
(3) 25% of ordinary transverse frames for transverse framing system or 25% of longitudinal for longitudinal framing system on side shell and inner side plating at forward, middle and aft parts, in all double side tanks.



(4) All cargo hold transverse bulkheads including internal astructure of upper and lower stools, where fitted. See Note 1.



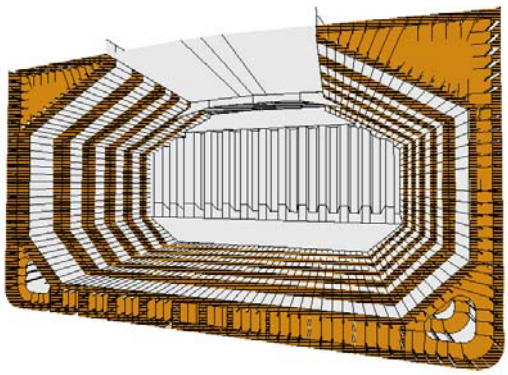
(5) All cargo hatch covers and coamings (plating and stiffeners). See Note 2.



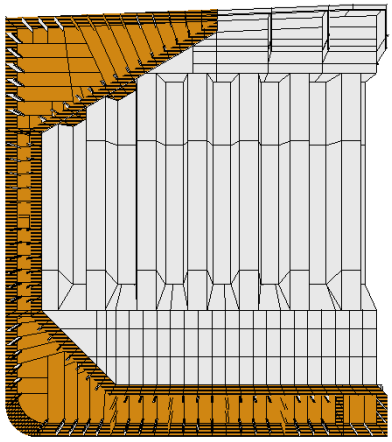
(6) All deck plating and under deck structure inside line of hatch openings between all cargo hold

hatches.

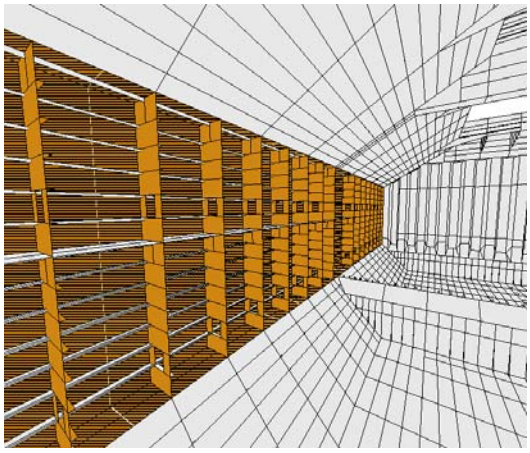
SPECIAL SURVEY IV (Ships 20 Years Old)



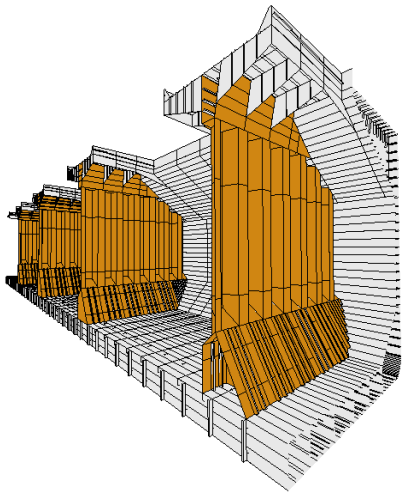
(1) All transverse webs with associated plating and longitudinals in each water ballast tank.



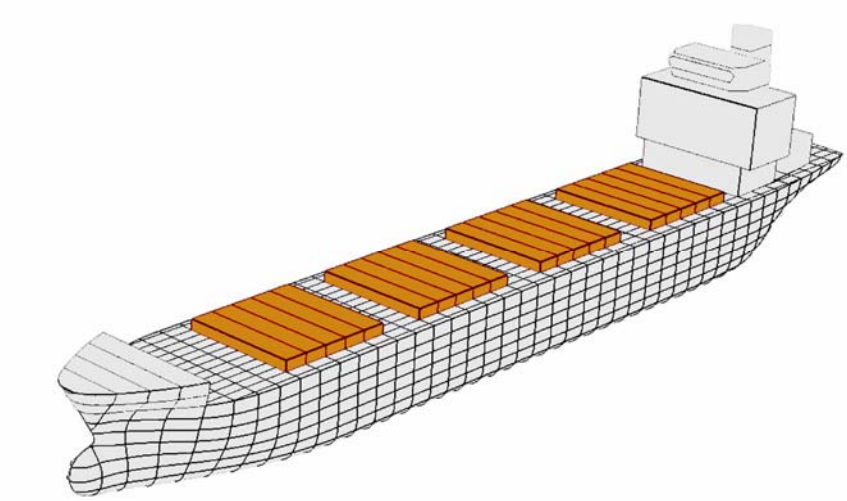
(2) All transverse bulkheads in ballast tanks, including stiffening system.



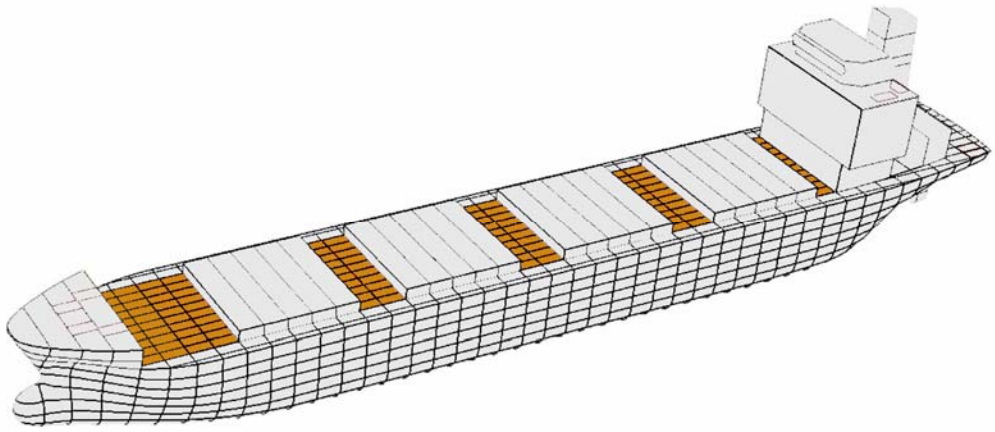
(3) All ordinary transverse frames for transverse framing system or 25% of longitudinal for longitudinal framing system on side shell and inner side plating at forward, middle and aft parts, in all double side tanks.



(4) All cargo hold transverse bulkheads including internal structure of upper and lower stools, where fitted. See Note 1.



(5) All cargo hatch covers and coamings (plating and stiffeners). See Note 2.



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

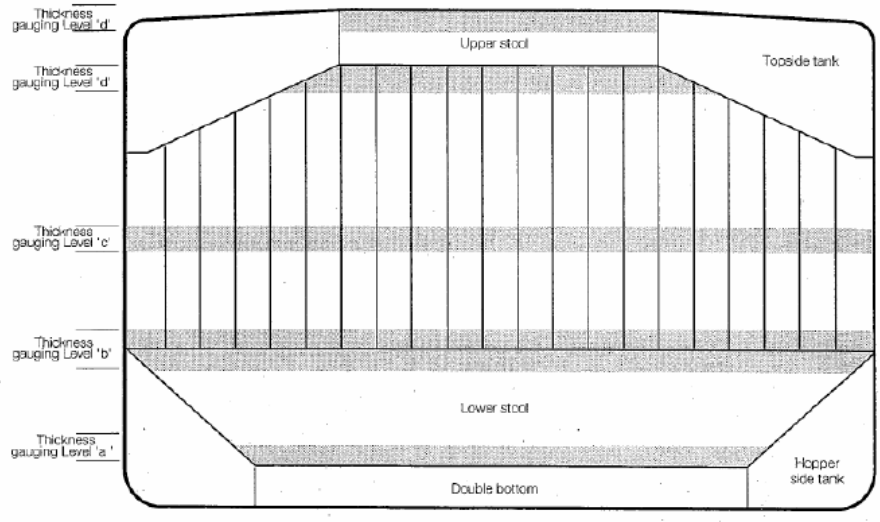
Note 1 Close-up Survey of transverse bulkheads to be carried out at four levels:

Level (a) Immediately above the inner bottom and immediately above the line of gussets (if fitted) and shedders for ships without lower stool.

Level (b) Immediately above and below the lower stool shelf plate (for those ships fitted with lower stools), and immediately above the line of the shedder plates.

Level (c) About mid-height of the bulkhead.

Level (d) Immediately below the upper deck plating and immediately adjacent to the upper wing tank and immediately below the upper stool shelf plate for those ships fitted with upper stools, or immediately below the topside tanks.



Note 2. Subject to cargo hold hatch covers of approved design (which structurally have no access to the internals), close-up survey/thickness measurement shall be done of accessible parts of hatch covers structures.
Note 3. Complete ballast tank means topside tank, hopper tank, double bottom tank and double side tank, even if these are separate.

Table 3.2.3 Minimum requirements for Close-up Survey - Ore Carriers

Requirements based on Pt 1, Ch 3,6 **TABLE 3.6.3** of the *Rules and Regulations for the Classification of Ships*			
Special Survey I (Ships 5 years old)	**Special Survey II (Ships 10 years old)**	**Special Survey III (Ships 15 years old)**	**Special Survey IV (Ships 20 years old and over)**
(1) 1 web frame ring complete including adjacent structural members in a water ballast wing tank. *(2)* 1 transverse bulkhead lower part including girder system and adjacent structural members in a ballast tank. *(3)* 2 selected cargo hold transverse bulkheads, including internal structure of upper and lower stools where fitted, See Note 1. *(4)* All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2.	*(1)* All web frame rings complete including adjacent structural members in a water ballast wing tank. *(2)* 1 deck transverse including adjacent structural members in each remaining water ballast tank. (3) Forward and aft transverse bulkheads including girder system and adjacent structural members in a ballast wing tank. *(4)* 1 transverse bulkhead lower part including girder system and adjacent structural members in each remaining ballast tank. *(5)* 1 transverse bulkhead in each cargo hold, including internal structure of upper and lower stools where fitted, See Note 1. *(6)* All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2. *(7)* All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches.	*(1)* All web frame rings complete including adjacent structural members in each water ballast tank. *(2)* All transverse bulkheads including girder system and adjacent structural members in each ballast tank. *(3)* 1 web frame ring complete including adjacent structural members in each wing void space. *(4)* Additional web frame rings including adjacent structural members in void spaces as deemed necessary by the Surveyor. *(5)* All cargo hold transverse bulkheads, including internal structure of upper and lower stools where fitted, See Note 1. *(6)* All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2. *(7)* All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches.	*(1)* All web frame rings complete including adjacent structural members in each water ballast tank. *(2)* All transverse bulkheads including girder system and adjacent structural members in each ballast tank. *(3)* 1 web frame ring complete including adjacent structural members in each wing void space. *(4)* Additional web frame rings including adjacent structural members in void spaces as deemed necessary by the Surveyor. *(5)* All cargo hold transverse bulkheads, including internal structure of upper and lower stools where fitted, See Note 1. *(6)* All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2. *(7)* All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches.

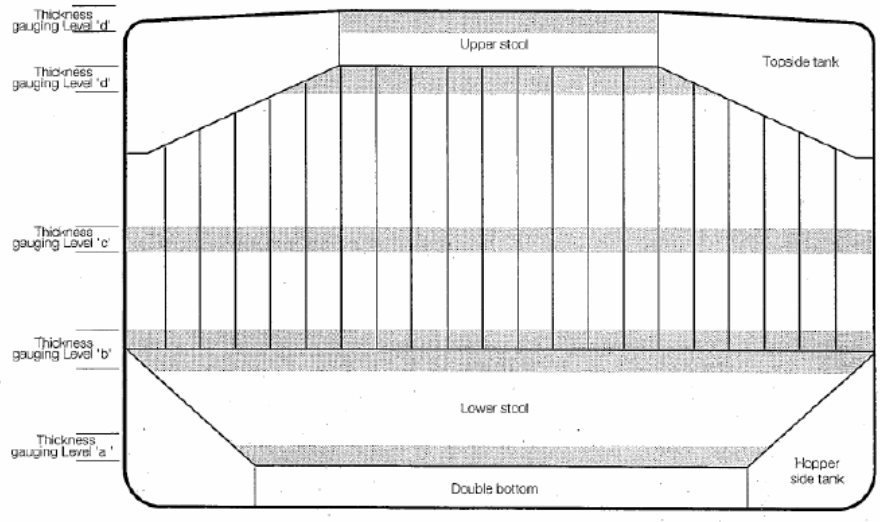
Note 1.Close-up Survey of transverse bulkheads to be carried out at four levels:

Level (a) Immediately above the inner bottom and immediately above the line of gussets (if fitted) and shedders for ships without lower stool.

Level (b) Immediately above and below the lower stool shelf plate (for those ships fitted with lower stools), and immediately above the line of the shedder plates.

Level (c) About mid-height of the bulkhead.

Level (d) Immediately below the upper deck plating and immediately adjacent to the upper wing tank and immediately below the upper stool shelf plate for those ships fitted with upper stools, or immediately below the topside tanks.



Note 2. Subject to cargo hold hatch covers of approved design (which structurally have no access to the internals), close-up survey/thickness measurement shall be done of accessible parts of hatch covers structures.

3.3 Substantial Corrosion

Table 3.3.1 Single Skin Bulk Carriers – Shell Plating and Stiffening with Substantial Corrosion

Requirements based on Pt 1, Ch 3,6 **TABLE 3.6.5** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurement
(1) Bottom and side shell plating	Suspect plate, plus four adjacent plates	5 point pattern for each panel between longitudinals
(2) Bottom/side shell longitudinals	Minimum of three longitudinals in way of suspect areas	3 measurements in line across web and 3 measurements on flange
(3) Side shell frames	Suspect frame and each adjacent	At each end and mid-span: *(a)* 5 point pattern on both web and flange *(b)* 5 point pattern within 25 mm of welded attachment to both shell and hopper sloping plate

Table 3.3.2 Single Sink Bulk Carriers – Double Bottom and Hopper Structure with Substantial Corrosion.

Requirements based on Pt 1, Ch 3,6 **TABLE 3.6.6** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurement
(1) Inner bottom plating	Suspect plate plus all immediately adjacent plates	5 point pattern for each panel between longitudinals over 1 m length
(2) Inner bottom longitudinals	Three longitudinals in way of plates measured	3 measurements in line across web and 3 measurements on flange
(3) Transverse floors and longitudinal girders	Suspect plates	5 point pattern over approximately 1 m^2 of plating
(4) Watertight floors and girders	*(a)* lower 1/3 of tank	*(a)* 5 point pattern over 1 m^2 of plating
	(b) upper 2/3 of tank	*(b)* 5 point pattern alternate plates over 1 m^2 of plating
(5) Transverse web frames	Suspect plate	5 point pattern over 1 m^2 of plating

Table 3.3.3 Single and Double Skin Bulk Carriers – Transverse Bulkheads in Cargo Holds with Substantial Corrosion

Requirements based on Pt 1, Ch 3,6 **TABLE 3.6.7** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurement
(1) Lower stool	*(a)* Transverse band within 25 mm of welded connection to inner bottom	*(a)* 5 point pattern between stiffeners over 1 m length
	(b) Transverse band within 25 mm of welded connection to shelf plate	*(b)* as above
(2) Transverse bulkhead	*(a)* Transverse band immediately above lower stool shelf plate	*(a)* 5 point pattern over 1 m length
	(b) Transverse band at approximately mid-height	*(b)* 5 point pattern over 1 m^2 of plating
	(c) Transverse band at part of bulkhead adjacent to upper deck or below upper stool shelf plate (for those ships fitted with upper stools)	*(c)* 5 point pattern over 1 m^2 of plating

Table 3.3.4 Single and Double Skin Bulk Carriers – Deck Structure including Cross Strips, Main Cargo Hatchways, Hatch Covers Coamings and Topside Tanks with Substantial Corrosion.

Requirements based on Pt 1, Ch 3,6 **TABLE 3.6.8** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurement
(1) Cross-deck strip plating	Suspect cross-deck strip plating	5 point pattern between under deck stiffeners over 1 m length
(2) Under deck stiffeners	*(a)* Transverse members	*(a)* 5 point pattern at each end and mid-span
	(b) Longitudinal member	*(b)* 5 point pattern on both web and flange
(3) Hatch covers	*(a)* Each side and end plate, 3 locations	*(a)* 5 point pattern at each location
	(b) Top plate, 3 longitudinal bands - 2 on outboard strakes and 1 on centreline strake	*(b)* 5 point measurement at each band
(4) Hatch coamings	Each side and end of coaming, one upper and one lower band	5 point measurement at each band

(5) Topside salt-water ballast tanks	*(a)* Watertight transverse bulkheads	*(i)* 5 point pattern over 1 m^2 of plating
	(i) lower 1/3 of bulkhead	*(ii)* 5 point pattern over 1 m^2 of plating
	(ii) upper 2/3 of bulkhead	*(iii)* 5 point pattern over 1 m length
	(iii) stiffeners	
	(b) Swash transverse bulkheads	*(i)* 5 point pattern over 1 m^2 of plating
	(i) lower 1/3 of bulkhead	*(ii)* 5 point pattern over 1 m^2 of plating
	(ii) upper 2/3 of bulkhead	*(iii)* 5 point pattern over 1 m length
	(iii) stiffeners	
	(c) 3 representative bays of the topside sloping plate	*(i)* 5 point pattern over 1 m^2 of plating
		(ii) 5 point pattern over 1 m^2 of plating
	(i) lower 1/3 of tank	
	(ii) upper 2/3 of tank	
	(d) suspect longitudinals and adjacent plates	5 point pattern both web and flange over 1 m length
(6) Main deck plating	Suspect plates and 4 immediately adjacent plates	5 point pattern over 1 m^2 of plating
(7) Main deck longitudinals	Minimum of 3 longitudinals where plating measured	5 point pattern on both web and flange over 1 m length
(8) Web frames/transverses	Suspect plates	5 point pattern over 1 m^2 of plating

Table 3.3.5 Double Skin Bulk Carriers – Bottom, Inner Bottom and Hopper Structure with Substantial Corrosion

Requirements based on Pt 1, Ch 3,6 **TABLE 3.6.9** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurement
(1) Bottom, inner bottom and hopper structure plating	*(a)* Minimum of 3 bays across double bottom tank, including aft bay	5 point pattern for each panel between longitudinals and floors
	(b) Measurements around and under all suction bell mouths	
(2) Bottom, inner bottom and hopper structure longitudinals	Minimum of 3 longitudinals in each bay where bottom plating measured	3 measurements in line across flange and 3 measurements on the vertical web
(3) Bottom girders, including watertight girders	At fore and aft watertight floors and in centre of tanks	Vertical line of single measurements on girder plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements

(4) Bottom floors, including watertight floors	3 floors in the bays where bottom plating measured, with measurements at both ends and middle	5 point pattern over 2 m^2 area
(5) Hopper structure web frame ring	3 floors in bays where bottom plating measured	5 point pattern over 1 m^2 of plating and single measurements on flange
(6) Hopper structure transverse watertight bulkhead or swash bulkhead	*(a)* lower 1/3 of bulkhead	*(a)* 5 point pattern over 1 m^2 of plating
	(b) upper 2/3 of bulkhead	*(b)* 5 point pattern over 2 m^2 of plating
	(c) stiffeners (minimum of 3)	*(c)* For web, 5 point pattern over span (2 measurements across web at each end and 1 at centre of span). For flange, single measurements at each end and centre of span
(7) Panel stiffening	Where applicable	Single measurements

Table 3.3.6 Double Skin Bulk Carriers – Double Side Space Structure (Including Wing Void spaces of Ore Carriers) with Substantial Corrosion.

Requirements based on Pt 1, Ch 3,6 **TABLE 3.6.10** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurement
(1) Side shell and inner plating:	*(i)* Plating between each pair of transverse frames/longitudinals in a minimum of 3 bays along the tank	*(i)* Single measurement
(i) Upper strake and strakes in way of horizontal girders		*(ii)* Single measurement
(ii) All other strakes	*(ii)* Plating between every third pair of longitudinals in same 3 bays	
(2) Side shell and inner side transverse frames/longitudinals on:	*(i)* Each transverse frame/longitudinal in same 3 bays	*(i)* 3 measurements across web and 1 measurement on flange
(i) Upper strake	*(ii)* Every third transverse frame/ longitudinal in same 3 bays	*(ii)* 3 measurements across web and 1 measurement on flange
(ii) All other strakes		
(3) Transverse frames/longitudinals - brackets	Minimum of 3 at top, middle and bottom of tank in same 3 bays	5 point pattern over area of bracket
(4) Vertical web and transverse bulkheads:	*(i)* Minimum of 2 webs and both transverse bulkheads	*(i)* 5 point pattern over approx. 2 m^2 area
(i) Strakes in way of horizontal girders	*(ii)* Minimum of 2 webs and both transverse bulkheads	*(ii)* 2 measurements between each pair of vertical stiffeners
(ii) Other strakes		
(5) Horizontal girders	Plating on each girder in a minimum of 3 bays	2 measurements between each pair of longitudinal girder stiffeners
(6) Panel stiffening	Where applicable	Single measurements

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Thickness measurement and close-up survey guidance

Part 4, Special survey requirements
Oil Tankers, Ore/Oil Ships, Ore/Bulk/Oil Ships

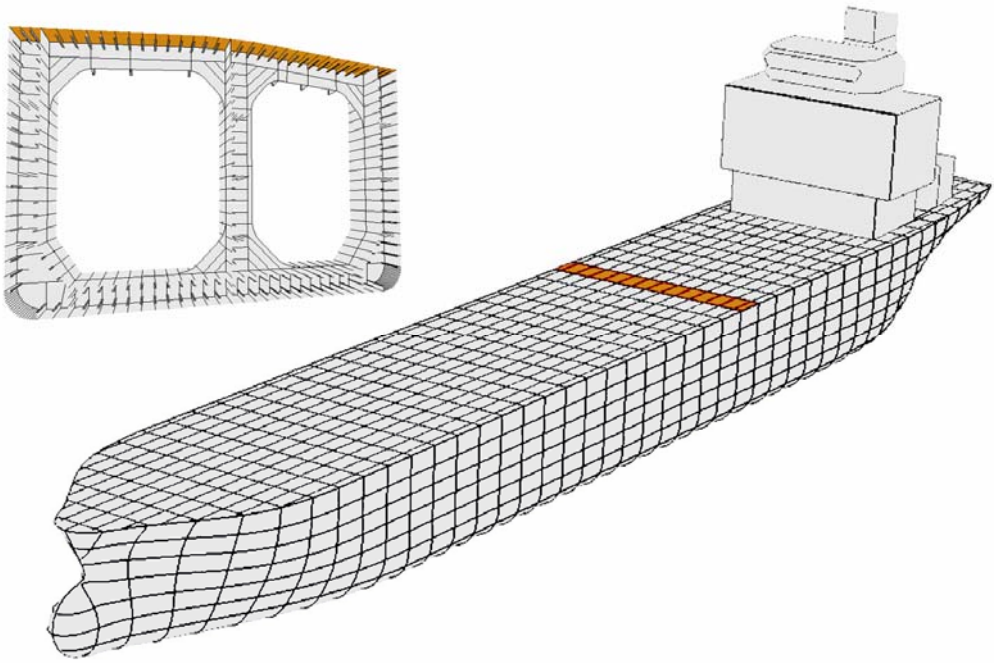
January 2023 Ver.7.6

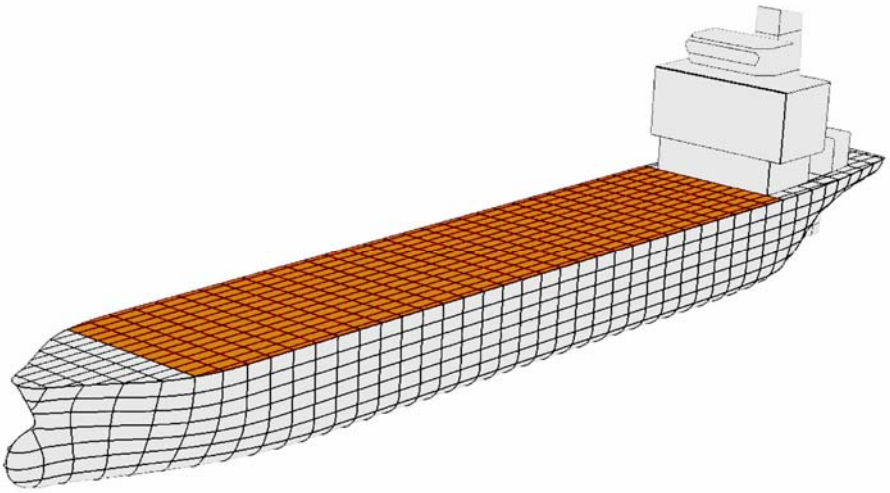
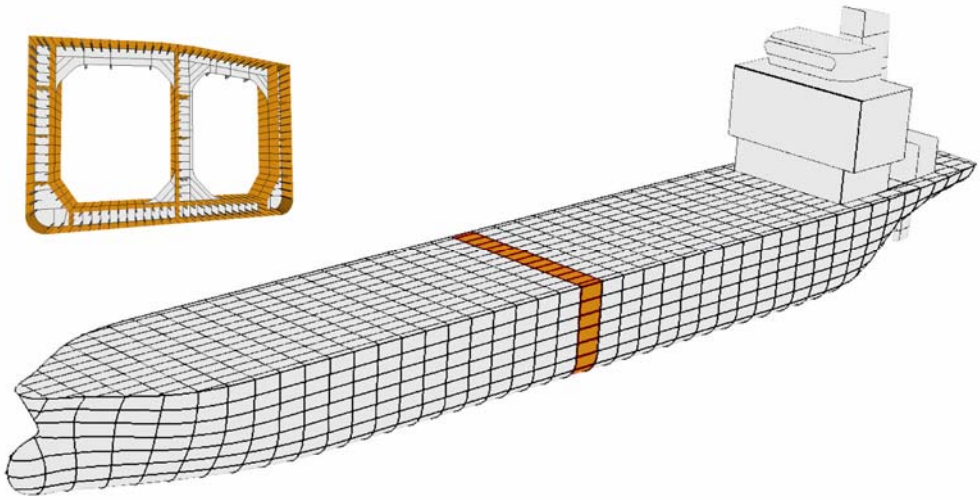
Contents Part 4

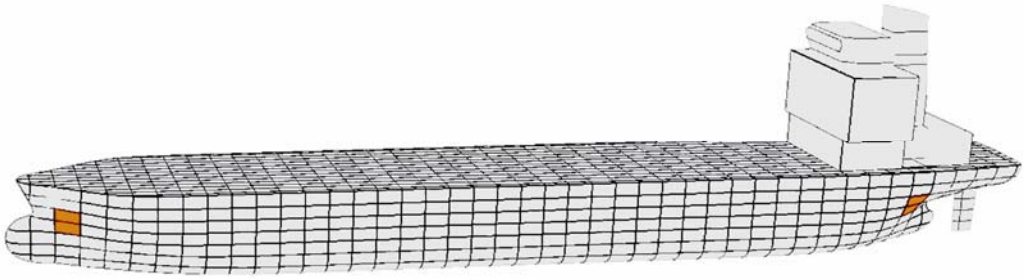
Part 4 – Special Survey Requirements

4.1 Thickness Measurement Requirements

Table 4.1.1 Minimum requirements for thickness measurement - Single Hull and Double Hull oil tankers, ore/oil ships and ore/ bulk/ oil ships

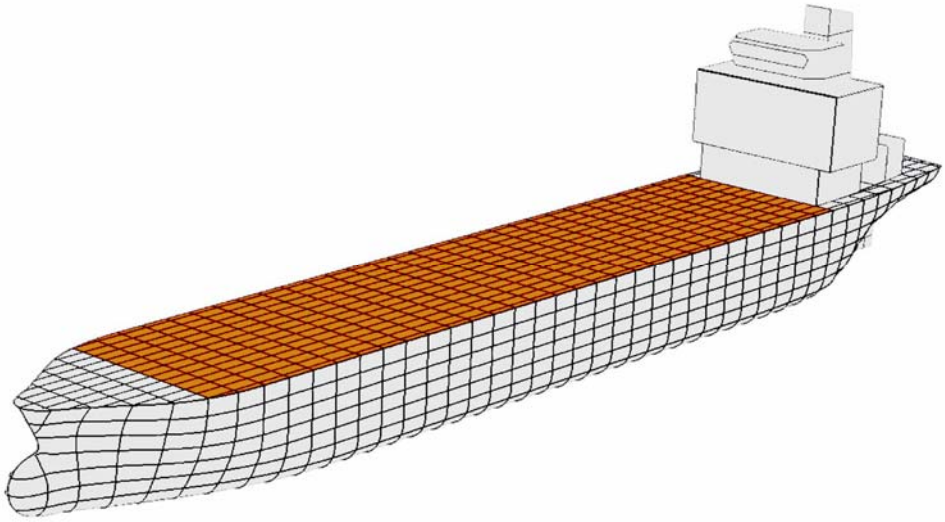
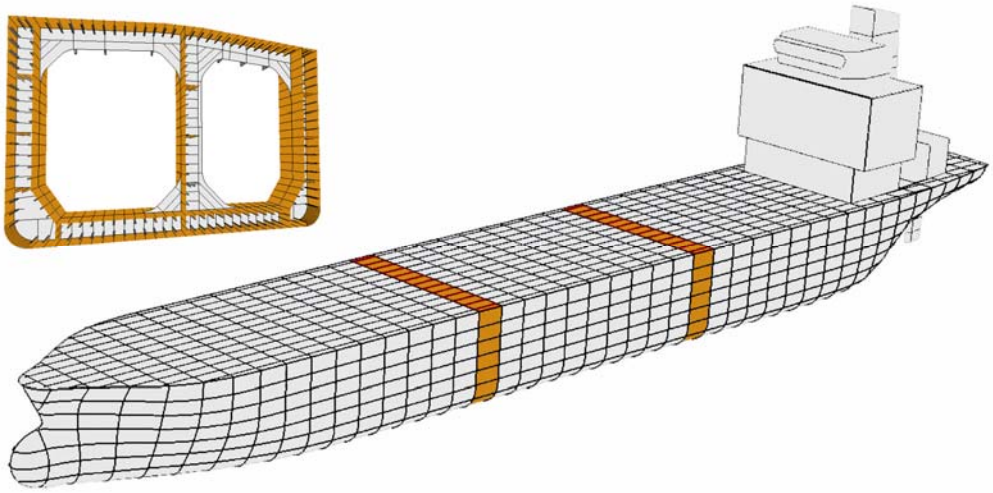
Requirements based on Pt 1, Ch 3,7 **TABLE 3.7.6** of the *Rules and Regulations for the Classification of Ships*
SPECIAL SURVEY I (Ships 5 Years Old)
 (1) 1 section of deck plating for the full beam of the ship within 0,5L amidships in way of a ballast tank, if any, or a cargo tank used primarily for water ballast. *See* Note 8
(2) Measurement for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with, Table 3.7.2 Minimum requirements for Close-up Survey – Single Hull oil tankers, Table 3.7.3 Minimum requirement for Close-up Survey – Double Hull oil tankers, Table 3.7.4 Minimum requirements for Close-up Survey – Ore/ Oil ships or Table 3.7.5 Minimum requirements for Close-up Survey – Ore/ Bulk/ Oil ships. See Notes 4 and 8.
(3) Suspect areas, as required by the Surveyor. See Note 7.

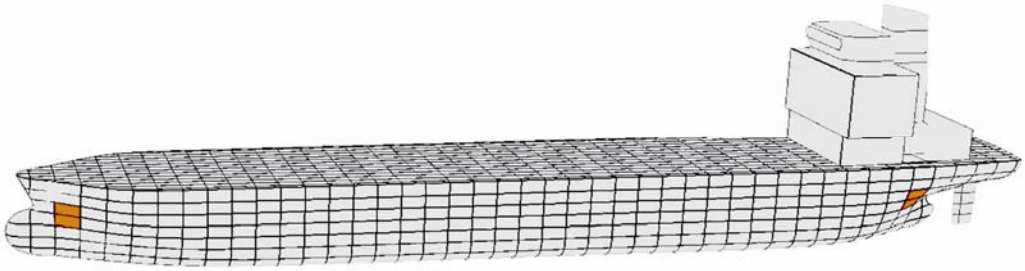
SPECIAL SURVEY II (Ships 10 Years Old)
 (1) Within Cargo Area: (a) Each deck plate.
 (1) Within Cargo Area: (b) 1 Transverse Section, *see* Notes 2, 3 and 6.
(2) Measurement for general assessment and recording of corrosion pattern, of those structural members subject to Close-up Survey in accordance with Pt 1, Ch 3, Table 3.7.2 Minimum requirements for Close-up Survey – Single Hull oil tankers, Table 3.7.3 Minimum requirement for Close-up Survey – Double Hull oil tankers, Table 3.7.4 Minimum requirements for Close-up Survey – Ore/ Oil ships or Table 3.7.5 Minimum requirements for Close-up Survey – Ore/ Bulk/ Oil ships. See Note 4.



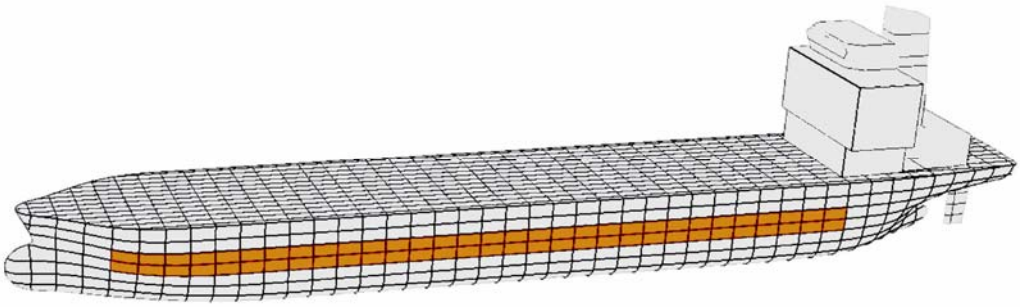
(3) Selected wind and water strakes outside the cargo area. (Wind and Water Strake: The strakes of a ship's side shell plating between the ballast and the deepest load waterline).

(4) Suspect areas, as required by the Surveyor. See Note 7.

SPECIAL SURVEY III (Ships 15 Years Old)
 (1) Within Cargo Area: (a) Each deck plate.
 (1) Within Cargo Area: (b) 2 Transverse Sections, *See* Notes 2, 3, 5 and 6.
(2) Measurement for general assessment and recording of corrosion pattern, of those structural members subject to Close-up Survey in accordance with Pt 1, Ch 3, Table 3.7.2 Minimum requirements for Close-up Survey – Single Hull oil tankers, Table 3.7.3 Minimum requirement for Close-up Survey – Double Hull oil tankers, Table 3.7.4 Minimum requirements for Close-up Survey – Ore/ Oil ships or Table 3.7.5 Minimum requirements for Close-up Survey – Ore/ Bulk/ Oil ships. See Note 4.

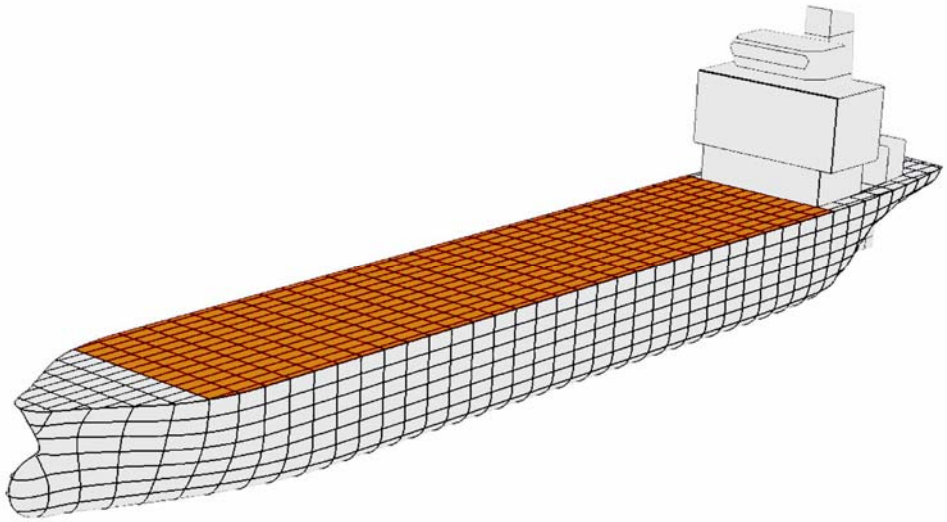
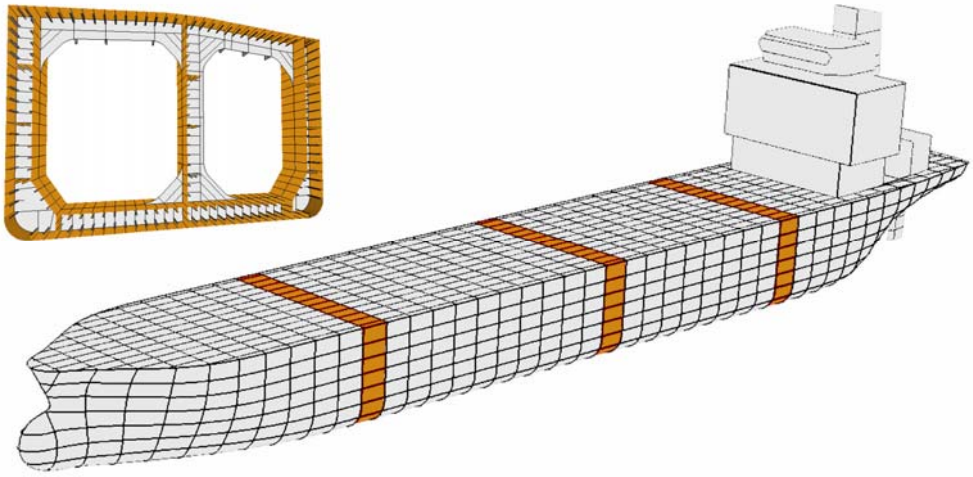


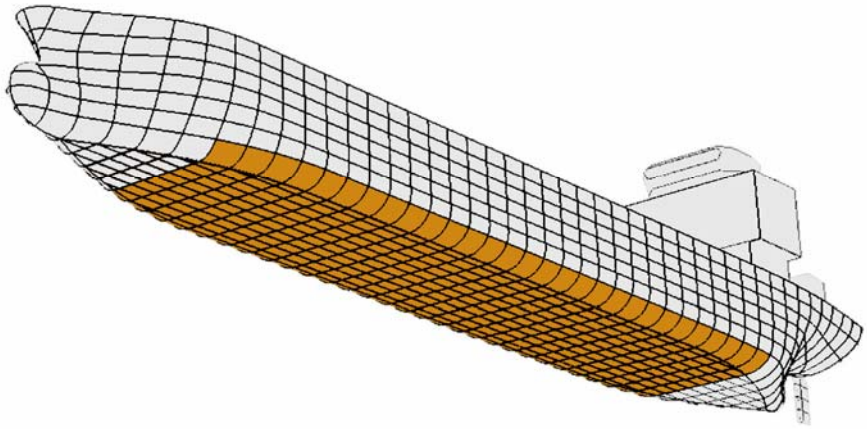
(3) Selected wind and water strakes outside the cargo area.



(4) All wind and water strakes within the cargo area.

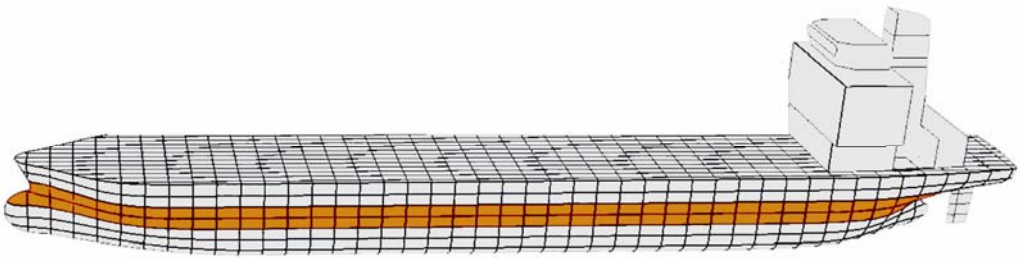
(5) Suspect areas, as required by the Surveyor. See Note 7.

SPECIAL SURVEY IV (Ships 20 Years Old)
 (1) Within Cargo Area: (a) each deck plate.
 (1) Within Cargo Area: (b) 3 Transverse Sections, *See* Notes 2, 3, 5 and 6.

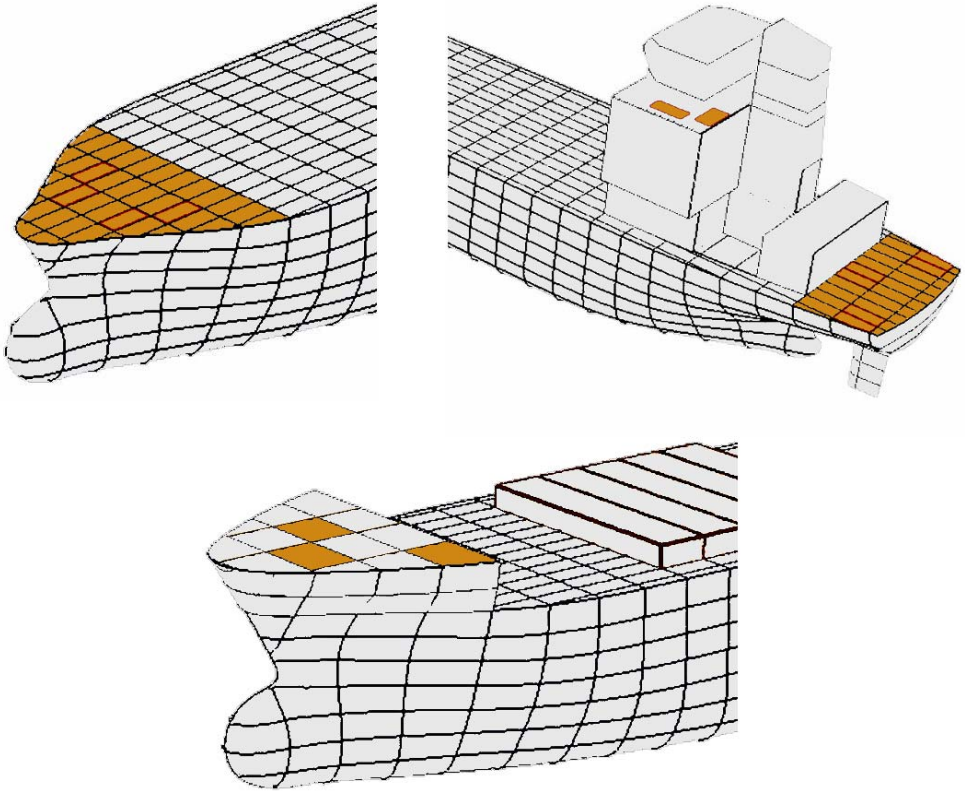


(1) Within cargo area:
(c) Each Bottom Plate.

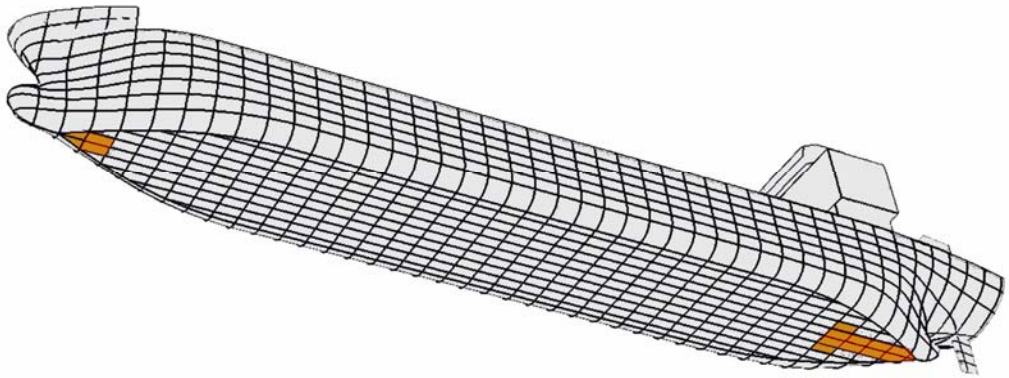
(2) Measurement for general assessment and recording of corrosion pattern, of those structural members subject to Close-up Survey in accordance with Pt 1, Ch 3, Table 3.7.2 Minimum requirements for Close-up Survey – Single Hull oil tankers, Table 3.7.3 Minimum requirement for Close-up Survey – Double Hull oil tankers, Table 3.7.4 Minimum requirements for Close-up Survey – Ore/ Oil ships or Table 3.7.5 Minimum requirements for Close-up Survey – Ore/ Bulk/ Oil ships. See Note 4.



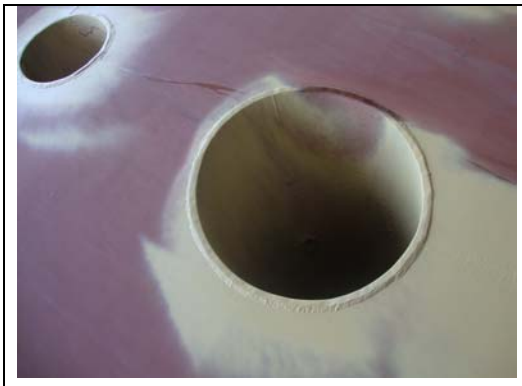
(3) All wind and water strakes over the full length of the ship, port and starboard



(4) Remaining exposed main deck plating not considered in item (1) and representative exposed superstructure deck plating (i.e. poop, bridge and forecastle deck).



(5) All keel plates outside the cargo length area. Also additional bottom plates in way of cofferdams. Machinery space and aft end of tanks.



(6) Plating of sea chests. Also side shell plating in way of overboard discharges, as considered necessary by the Surveyor.

(7) Suspect areas, as required by the Surveyor. See Note 7.

Note 1. For areas in tanks where coatings are found to be in GOOD condition, as defined in Pt 1, Ch 3, 1.5, the extent of thickness measurements may be specially considered, but not dispensed with in its entirety.

Note 2. Transverse sections should be chosen where the largest reductions are likely to occur, or as revealed by deck plating measurements.

Note 3. Where two or three transverse sections are required to be measured, at least one is to include a ballast tank within 0,5*L* amidships.

Note 4. All cargo hold hatch covers and coamings, where fitted, are to be measured on ore/oil and ore/bulk/oil ships.

Note 5. For oil tankers (including ore/oil and ore/bulk/oil ships), with length ≥ 130 m and over 10 years of age, the longitudinal strength is to be evaluated. In such cases, a minimum of three transverse sections are to be measured within 0,5*L* amidships.

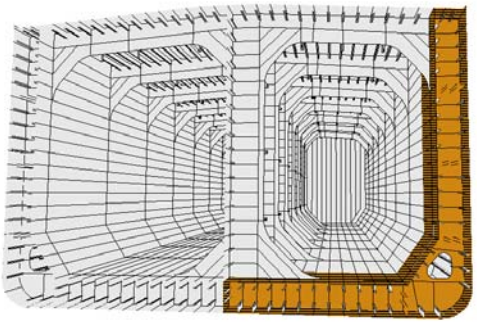
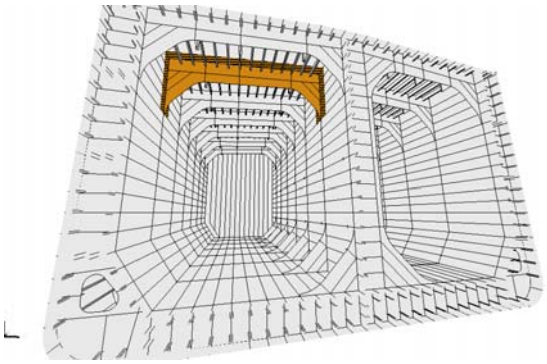
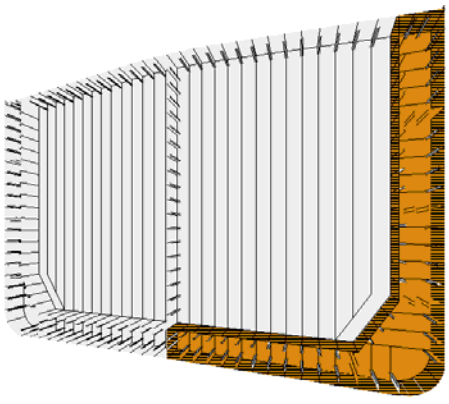
Note 6. A transverse section includes all longitudinal members such as plating, longitudinals and girders at the deck, sides, bottom, inner bottom and longitudinal bulkheads. For transversely framed vessels, a transverse section includes adjacent frames and their end connections in way of transverse sections.

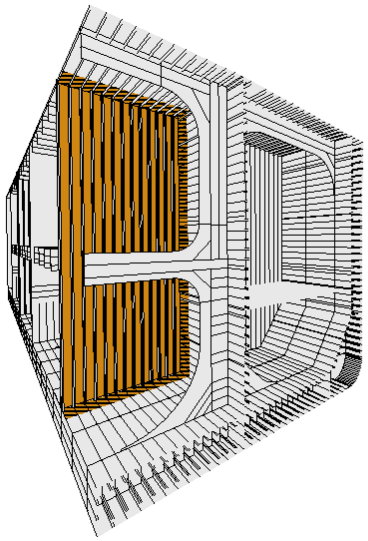
Note 7. Suspect areas are locations showing substantial corrosion and/or are considered by the Surveyor to be prone to rapid wastage.

Note 8. Not applicable for double hull oil tankers.

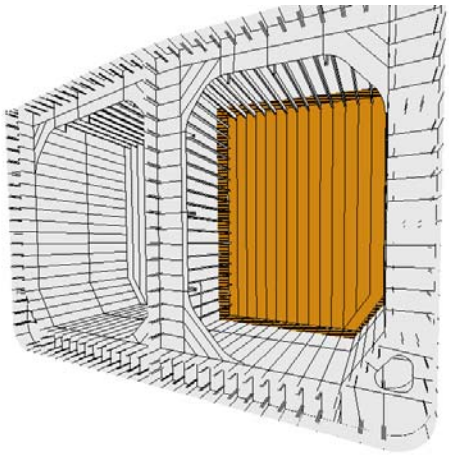
4.2 Close-Up Survey Requirements

4.2.1 Minimum requirements for Close-up Survey - Double Hull Oil Tankers

Requirements based on Pt 1, Ch 3,7 **TABLE 3.7.3** of the *Rules and Regulations for the Classification of Ships*	
SPECIAL SURVEY I (Ships 5 Years Old)	
	(1) One web frame ring in a ballast tank. *See* Notes 1 and 3.
	(2) One deck transverse in a cargo tank . See Note 4.
	(3) One transverse bulkhead in a ballast tank . See Notes 1 and 6.

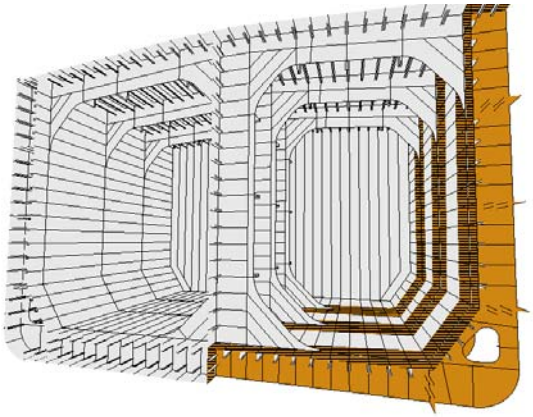


(4) One transverse bulkhead in a cargo centre tank. See Notes 2 and 7.

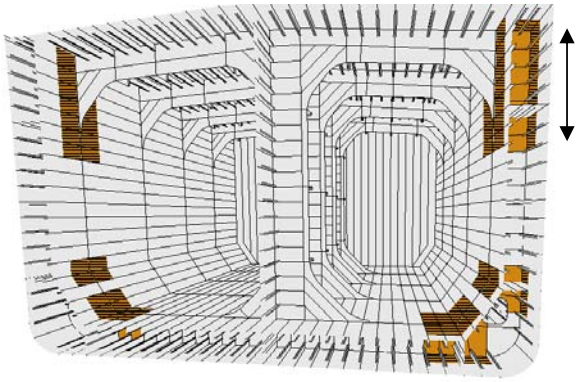


(5) One transverse bulkhead in a cargo wing tank. See Notes 2 and 7.

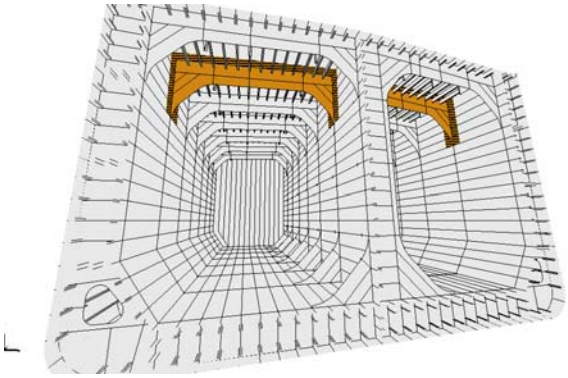
SPECIAL SURVEY II (Ships 10 Years Old)



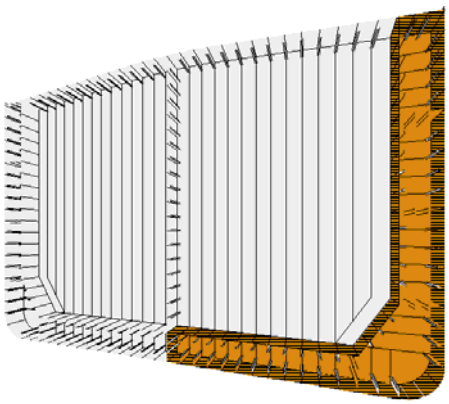
(1) All web frame rings in a complete ballast tank. See Notes 1 and 3.



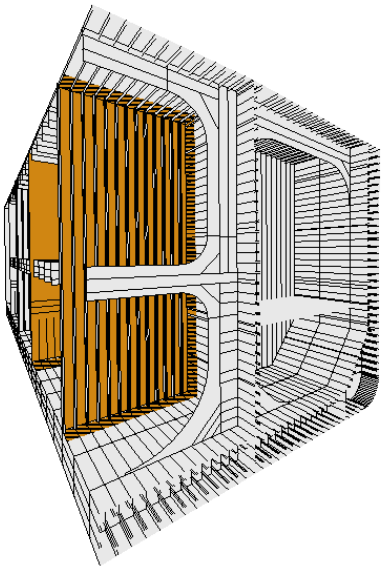
(2) The knuckle area and the upper part (approx. 5 m) of one web frame ring in each remaining ballast tank. *See* Note 8.



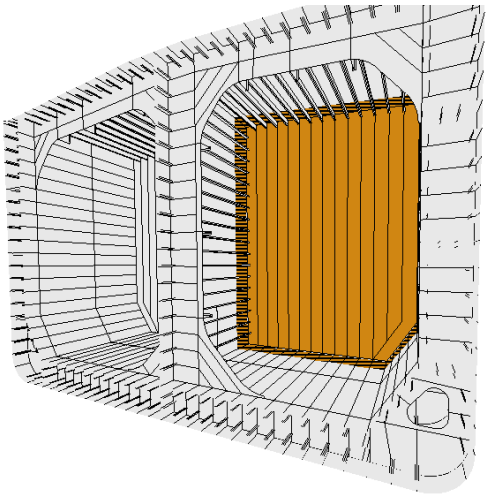
(3) One deck transverse in two cargo tanks. *See* Note 4.



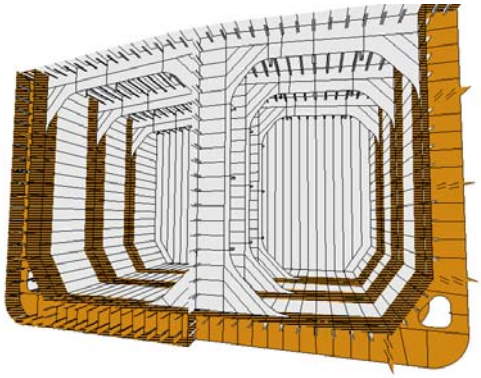
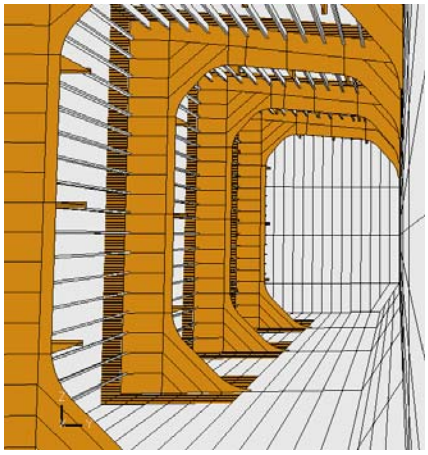
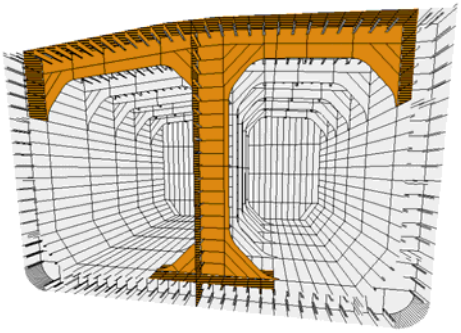
(4) One transverse bulkhead in each ballast tank. See Notes 1 and 6.

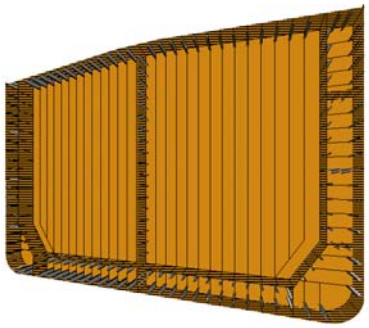


(5) One transverse bulkhead in two cargo centre tanks. *See* Notes 2 and 7.



(6) One transverse bulkhead in a cargo wing tank. See Notes 2 and 7.

SPECIAL SURVEY III (Ships 15 Years Old)	
	(1) All web frame rings in all ballast tanks. *See* Note 3.
	(2) All web frame rings in a cargo tank. *See* Note 9.
	(3) One web frame ring in each remaining cargo tank. See Note 9.



(4) All transverse bulkheads – in all cargo and ballast tanks. *See* Notes 5 and 6.

(5) As considered necessary by the Surveyor. See Note 10.

SPECIAL SURVEY IV (Ships 20 Years Old)
(1) As Special Survey III. (2) Additional transverse areas if deemed necessary by the Surveyor. See Note 10.

Note 1. Apart from the fore and aft peak tanks, the term "ballast tank" has the following meaning:

(a) all ballast compartments (hopper tank, side tank and double deck tank, if separate from double bottom tank) located on one side, i.e. port or starboard, additionally double bottom tank on port plus starboard, when the longitudinal central girder is not watertight and, therefore, the double bottom tank is a unique compartment from port to starboard or

(b) all ballast compartments (double bottom tank, hopper tank, side tank and double deck tank) located on one side, i.e. port or starboard, when the longitudinal central girder is watertight and, therefore, the port double bottom tank is separate from the starboard double bottom tank

Note 2. Where there are no centre tanks, the transverse bulkheads in wing tanks are to be subject to Close-up Survey. Where there are no wing tanks, the transverse bulkheads in centre tanks are to be subjected to Close-up Survey.

Note 3. Web frame ring in a ballast tank includes the vertical web in side tank, hopper web in hopper tank, floor in double bottom tank and deck transverse in a double deck tank and adjacent structural members. In peak tanks a web frame means a complete transverse web frame, including adjacent structural members.

Note 4. Deck transverse including adjacent deck structural members (or external structure on deck in way of the tank, where applicable).

Note 5. Transverse bulkhead complete in cargo tanks, including girder system, adjacent structural members (including longitudinal bulkheads) and internal structure of lower and upper stools, where fitted.

Note 6. Transverse bulkhead complete in ballast tanks, including girder system and adjacent structural members including longitudinal bulkheads, girders in double bottom tanks, inner bottom plating, hopper side, connecting brackets.

Note 7. Transverse bulkhead lower part in cargo tanks, including girder system, adjacent structural members (including longitudinal bulkheads) and internal structure of lower stool, where fitted.

Note 8. The knuckle area and the upper part (approximately 5 m), including adjacent structural members. Knuckle area is the area of the web frame around the connections of the sloping hopper plating to the inner hull bulkhead and the inner bottom plating, up to 2 m from the corners both on the bulkhead and the double bottom.

Note 9. Web frame ring in cargo tank includes deck transverse, longitudinal bulkhead vertical girder and cross ties, where fitted, and adjacent structural members.

Note 10. Additional complete transverse web frame ring.

Table 4.2.2 Minimum requirements for Close-up Survey - Single Hull Oil Tankers

Requirements based on Pt 1, Ch 3,7 **TABLE 3.7.2** of the *Rules and Regulations for the Classification of Ships*			
Special Survey I (Ships 5 years old)	**Special Survey II (Ships 10 years old)**	**Special Survey III (Ships 15 years old)**	**Special Survey IV (Ships 20 years old and over)**
(1) One web frame ring – in a ballast wing tank, if any, or a cargo oil wing tank used primarily for water ballast. See Note 1. *(2)* One deck transverse – in a cargo oil tank. See Note 2. *(3)* One transverse bulkhead. See Notes 4 and 8: *(a)* in a ballast tank. *(b)* in a cargo oil wing tank. *(c)* in a cargo oil centre tank.	*(1)* All web frame rings – in a ballast wing tank, if any, or a cargo oil wing tank used primarily for water ballast. See Note 1. *(2)* One deck transverse. See Note 2: *(a)* in each of the remaining ballast tanks, if any *(b)* in a cargo oil wing tank *(c)* in 2 cargo oil centre tanks *(3)* Both transverse bulkheads – in a wing ballast tank, if any, or a cargo oil wing tank used primarily for water ballast. See Note 3. *(4)* One transverse bulkhead. See Note 4 and 8: *(a)* in each remaining ballast tank. *(b)* in a cargo oil wing tank. *(c)* in 2 cargo oil centre tanks.	*(1)* All web frame rings, *see* Note 1: *(a)* in all ballast tanks *(b)* in a cargo oil wing tank *(2)* A minimum of 30% of all web frame rings in each remaining cargo oil wing tank. See Notes 1 and 7. *(3)* All transverse bulkheads – in all cargo and ballast tanks, *see* Note 3. *(4)* A minimum of 30% of deck and bottom transverses in each cargo centre tank. See Notes 5 and 7. *(5)* As considered necessary by Surveyor. See Note 6.	*(1)* As Special Survey III. *(2)* Additional transverses if deemed necessary by the Surveyor.
Note 1. Complete transverse web frame ring including adjacent structural members. **Note** 2. Deck transverse including adjacent deck structural members. **Note** 3. Transverse bulkhead complete, including girder system and adjacent members, and adjacent longitudinal bulkhead structure. **Note** 4. Transverse bulkhead lower part including girder system and adjacent structural members.		**Note** 5. Deck and bottom transverse including adjacent structural members. **Note** 6. Additional complete transverse web frame ring. **Note** 7. The 30% is to be rounded up to the next whole number of structural items. **Note** 8. Where there are no centre tanks, the transverse bulkheads in wing tanks are to be subject to Close-up Survey. Where there are no wing tanks, the transverse bulkheads in centre tanks are to be subject to Close-up Survey.	

Table 4.2.3 Minimum requirements for Close-up Survey - Ore/Oil Ships

Requirements based on Pt 1, Ch 3,7 **TABLE 3.7.4** of the *Rules and Regulations for the Classification of Ships*			
Special Survey I (Ships 5 years old)	**Special Survey II (Ships 10 years old)**	**Special Survey III (Ships 15 years old)**	**Special Survey IV (Ships 20 years old and over)**
(1) One web frame ring – in a wing ballast tank, if any, or a cargo oil wing tank used primarily for water ballast. See Note 1. *(2)* One deck transverse – in a cargo tank. See Note 2. *(3)* One transverse bulkhead. See Notes 4 and 8: *(a)* in a ballast tank *(b)* in a cargo oil wing tank *(c)* in a cargo oil centre tank.	*(1)* All web frame rings – in a wing ballast tank, if any, or a cargo oil wing tank used primarily for water ballast. See Note 1. *(2)* One deck transverse. See Notes 2 and 8: *(a)* in each of the remaining ballast tanks, if any. *(b)* in a cargo oil wing tank. *(c)* in 2 cargo oil centre tanks. *(3)* Both transverse bulkheads – in a wing ballast tank, if any, or a cargo wing tank used primarily for water ballast. See Note 3. *(4)* One transverse bulkhead. See Note 4 and 8: *(a)* in each remaining ballast tank, if any. *(b)* in a cargo oil wing tank. *(c)* in 2 cargo oil centre tanks. *(5)* Selected cargo hold hatch covers and coamings (plating and stiffeners). See Note 9. *(6)* Selected areas of deck plating inside line of hatch openings between cargo hold hatches.	*(1)* All web frame rings. See Note 1 *(a)* in all ballast tanks. *(b)* in a cargo oil wing tank. *(2)* A minimum of 30% of all web frame rings in each remaining cargo oil wing tank. See Notes 1 and 7. *(3)* All transverse bulkheads– in all cargo and ballast tanks. See Note 3. (4) A minimum of 30% of deck and bottom transverses in each cargo oil centre tank. See Notes 5 and 7. (5) As considered necessary by the Surveyor. See Note 6. *(6)* All cargo hold hatch covers and coamings (plating and stiffeners) *(7)* All deck plating inside line of hatch coamings between cargo hold hatches	*(1)* As Special Survey III. *(2)* Additional transverse areas if deemed necessary by the Surveyor.

Note 1. Complete transverse web frame ring including adjacent structural members.

Note 2. Deck transverse including adjacent deck structural members.

Note 3. Transverse bulkhead complete, including girder system and adjacent members, and adjacent longitudinal bulkhead structure.

Note 4. Transverse bulkhead lower part including girder system and adjacent structural members.

Note 5. Deck and bottom transverse including adjacent structural members.

Note 6. Additional complete transverse web frame ring.

Note 7. The 30% is to be rounded up to the next whole number of structural items.

Note 8. Where there are no centre tanks, the transverse bulkheads in wing tanks are to be subject to Close-up Survey. Where there are no wing tanks, the transverse bulkheads in the centre tanks are to be subject to Close-up Survey.

Note 9. Subject to cargo hold hatch covers of approved design which structurally have no access to the internals, close-up survey/thickness measurement shall be done of accessible parts of hatch covers structures.

Table 4.2.4 Minimum requirements for Close-up Survey - Ore/Bulk/Oil Ships

Requirements based on Pt 1, Ch 3,7 **TABLE 3.7.5** of the *Rules and Regulations for the Classification of Ships*			
Special Survey I (Ships 5 years old)	**Special Survey II (Ships 10 years old)**	**Special Survey III (Ships 15 years old)**	**Special Survey IV (Ships 20 years old and over)**
(1) 25% of shell frames and their end attachments in the forward cargo hold at representative positions. *(2)* Selected frames and their end attachments in remaining cargo holds. *(3)* 1 transverse web with associated plating and longitudinals in 2 representative water ballast tanks of each type (i.e. topside, peak, double bottom hopper side tank). *(4)* 2 selected cargo hold transverse bulkheads including internal structure of upper and lower stools where fitted. This is to include the aft bulkhead in the forward cargo hold. See Note 1.	(1a) For OBOs with a deadweight less than 100,000 tonnes, all shell frames in the forward cargo hold and 25% of frames in each of the remaining cargo holds, including their upper and lower end attachments and adjacent shell plating. (1b) For OBOs with a deadweight equal to or greater than 100,000 tonnes, all shell frames in the forward cargo hold and 50% of frames in each of the remaining cargo holds, including their upper and lower end attachments and adjacent shell plating. *(2)* 1 transverse web with associated plating and longitudinals in each water ballast tank. *(3)* Forward and aft transverse bulkhead in 1 side ballast tank, including stiffening system. *(4)* All cargo hold transverse bulkheads including internal structure of upper and lower stools where fitted. See Note 1. *(5)* All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2. *(6)* All deck plating and underdeck structure inside line of hatch openings between all cargo hold hatches.	*(1)* All shell frames in the forward and one other selected cargo hold and 50% of frames in each of the remaining cargo holds, including their upper and lower end attachments and adjacent shell plating. *(2)* All transverse webs with associated plating and longitudinals in each water ballast tank. *(3)* All transverse bulkheads in ballast tanks, including stiffening system. *(4)* All cargo hold transverse bulkheads including internal structure of upper and lower stools, where fitted. See Note 1. *(5)* All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2. *(6)* All deck plating and underdeck structure inside line of hatch openings between cargo hold hatches.	*(1)* All shell frames in all cargo holds including their end attachments and adjacent shell plating. *(2)* All transverse webs with associated plating and longitudinals in each water ballast tank. *(3)* All transverse bulkheads in ballast tanks, including stiffening system. *(4)* All cargo hold transverse bulkheads including internal structure of upper and lower stools, where fitted. See Note 1. *(5)* All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2. *(6)* All deck plating and underdeck structure inside line of hatch openings between cargo hold hatches.
Note 1. Close-up Survey of cargo hold transverse bulkheads to be carried out at four levels: Level (a) Immediately above the inner bottom and immediately above the line of gussets (if fitted) and shedders for ships without lower stool.			

Level (b) Immediately above and below the lower stool shelf plate (for those ships fitted with lower stools), and immediately above the line of the shedder plates.
Level (c) About mid-height of the bulkhead.
Level (d) Immediately below the upper deck plating and immediately adjacent to the upper wing tank and immediately below the upper stool shelf plate for those ships fitted with upper stools, or immediately below the topside tanks.
Note 2. Subject to cargo hold hatch covers of approved design which structurally have no access to the internals, close-up survey/thickness measurement shall be done of accessible parts of hatch covers structures.

4.3 Substantial Corrosion

Table 4.3.1 Bottom Structure With Substantial Corrosion

Requirements based on Pt 1, Ch 3,7 **TABLE 3.7.7** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurement
(1) Bottom plating	Minimum of 3 bays across tank, including aft bay Measurement around and under all suction strums	5 point pattern for each panel between longitudinals and webs
(2) Bottom longitudinals	Minimum of 3 longitudinals in each bay where bottom plating measured	3 measurements in line across flange and 3 measurements on vertical web
(3) Bottom girders and brackets	At fore and aft transverse bulkhead, bracket toes and in centre of tanks	Vertical line of single measurements on web plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements. 2 measurements across face flat. 5 point pattern on girder/bulkhead brackets
(4) Bottom transverse webs	3 webs in bays where bottom plating measured, with measurements at middle and both ends	5 point pattern over 2 m^2 area. Single measurement on face flat
(5) Panel stiffening	Where applicable	Single measurement

Table 4.3.2 Deck Structure with Substantial Corrosion

Requirements based on Pt 1, Ch 3,7 **TABLE 3.7.8** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurement
(1) Deck plating	2 bands across tank	Minimum of 3 measurements per plate per band
(2) Deck longitudinals	Minimum of 3 longitudinals in each of 2 bays	3 measurements in line vertically on webs and 2 measurements on flange (if fitted)
(3) Deck girders and brackets	At fore and aft transverse bulkhead, bracket toes and in centre of tanks	Vertical line of single measurements on web plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements. 2 measurements across face flat. 5 point pattern on girder/bulkhead brackets
(4) Deck transverse webs	Minimum of 2 webs with measurement at both ends and middle of span	5 point pattern over 2 m^2 area. Single measurement on face flat
(5) Panel stiffening	Where applicable	Single measurement

Table 4.3.3 Shell and Longitudinal Bulkheads with Substantial Corrosion

Requirements based on Pt 1, Ch 3,7 **TABLE 3.7.9** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurement
(1) Deckhead and bottom strakes and strakes in way of stringer platforms	Plating between each pair of longitudinals in a minimum of 3 bays	Single measurement
(2) All other strakes	Plating between every 3rd pair of longitudinals in same 3 bays	Single measurement
(3) Longitudinals – deckhead and bottom strakes	Each longitudinal in same 3 bays	3 measurements across web and 1 measurement on flange
(4) Longitudinals – all others	Every third longitudinal in same 3 bays	3 measurements across web and 1 measurement on flange
(5) Longitudinals – bracket	Minimum of 3 at top, middle and bottom of tank in same 3 bays	5 point pattern over area of bracket
(6) Web frames and cross ties	3 webs with minimum of 3 locations on each web, including in way of cross tie connections	5 point pattern over 2 m^2 area, plus single measurements on web frame and cross tie face flats

Table 4.3.4 Transverse bulkheads and swash bulkheads with Substantial Corrosion

Requirements based on Pt 1, Ch 3,7 **TABLE 3.7.10** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurement
(1) Deckhead and bottom strakes in way of stringer platforms	Plating between pair of stiffeners at 3 locations: approx. 1/4, 1/2 and 3/4 width of tank	5 point pattern between stiffeners over 1 m length
(2) All other strakes	Plating between pair of stiffeners at middle location	Single measurement
(3) Strakes in corrugated bulkheads	Plating for each change of scantling at centre of panel and at flange or fabricated connection	5 point pattern over 1 m^2 of plating
(4) Stiffeners	Minimum of 3 typical stiffeners	For web, 5 point pattern over span between bracket connections (2 measurements across web at each bracket connection and one at centre of span). For flange, single measurement at each bracket toe and at centre of span
(5) Brackets	Minimum of 3 at top, middle and bottom of tank	5 point pattern over area of bracket

(6) Deep webs and girders	Measurements at toe of bracket and at centre of span	For web, 5 point pattern over 1 m^2 area. 3 measurements across face flat
(7) Stringer platforms	All stringers with measurements at middle and both ends	5 point pattern over 1 m^2 area plus single measurement near bracket toes and on face flats

Table 4.3.5 Double Hull Oil Tankers – Bottom, Inner Bottom and Hopper Structure with Substantial Corrosion

Requirements based on Pt 1, Ch 3,7 **TABLE 3.7.11** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurement
(1) Bottom, inner bottom and hopper plating	Minimum of 3 bays across double bottom tank, including aft bay. Measurement around and under all suction strums	5 point pattern for each panel between longitudinals and floors
(2) Bottom, inner bottom and hopper longitudinals	Minimum of 3 longitudinals in each bay where bottom plating measured	3 measurements in line across flange and 3 measurements on vertical web
(3) Bottom girders, including watertight girders	At the fore and aft watertight floors and in centre of tanks	Vertical line of single measurements on girder plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements
(4) Bottom floors, including watertight floors	3 floors in bays where bottom plating measured, with measurements at both ends and middle	5 point pattern over 2 m^2 area
(5) Hopper web frame ring	3 floors in bays where bottom plating measured	5 point pattern over 1 m^2 of plating. Single measurement on flange
(6) Hopper transverse watertight bulkhead or swash bulkhead	*(i)* Lower $\frac{1}{3}$ of bulkhead *(ii)* Upper $\frac{2}{3}$ of bulkhead *(iii)* Stiffeners (minimum of 3)	*(i)* 5 point pattern over 1 m^2 of plating *(ii)* 5 point pattern over 2 m^2 of plating *(iii)* For web, 5 point pattern over span (2 measurements across web at each end and 1 at centre of span). For flange, single measurement at each end and centre of span
(7) Panel stiffening	Where applicable	Single measurement

Table 4.3.6 Double Hull Oil Tankers – Deck Structure with Substantial Corrosion

Requirements based on Pt 1, Ch 3,7 **TABLE 3.7.12** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurement
(1) Deck plating	2 transverse bands across tank	Minimum of 3 measurements per plate per band
(2) Deck longitudinals	Every 3rd longitudinal in each of 2 bands with a minimum of 1 longitudinal	3 measurements in line vertically on webs and 2 measurements on flange (if fitted)
(3) Deck girders and brackets (usually in cargo tanks only)	At the fore and aft transverse bulkhead, bracket toes and in centre of tanks	Vertical line of single measurements on web plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements. 2 measurements across flange. 5 point pattern on girder/bulkhead brackets
(4) Deck transverse webs	Minimum of 2 webs, with measurements at both ends and middle of span	5 point pattern over 1 m^2area. Single measurement on the flange
(5) Vertical web and transverse bulkhead in wing ballast tank (two metres from deck)	Minimum of 2 webs, and both transverse bulkheads	5 point pattern over 1 m^2 area
(6) Panel stiffening	Where applicable	Single measurement

Table 4.3.7 Double Hull Oil Tankers-Wing Ballast Tank Structure with Substantial Corrosion

Requirements based on Pt 1, Ch 3,7 **TABLE 3.7.13** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurement
(1) Side shell and longitudinal bulkhead plating: *(i)* Upper strake and strakes in way of horizontal girders *(ii)* All other strakes	*(i)* Plating between each pair of longitudinals in a minimum of 3 bays (along the tank) *(ii)* Plating between every 3rd pair of longitudinals on same 3 bays	*(i)* Single measurement *(ii)* Single measurement
(2) Side shell and longitudinal bulkhead longitudinals on: *(i)* Upper strake *(ii)* All other strakes	*(i)* Each longitudinal in same 3 bays *(ii)* Every 3rd longitudinal in same 3 bays	*(i)* 3 measurements across web and 1 measurement on flange *(ii)* 3 measurements across web and 1 measurement on flange
(3) Longitudinals – brackets	Minimum of 3 at top, middle and bottom of tank in same 3 bays	5 point pattern over area of bracket

(4) Vertical web and transverse bulkheads (excluding deckhead area): *(i)* Strakes in way of horizontal girders *(ii)* Other strakes	*(i)* Minimum of 2 webs and both transverse bulkheads *(ii)* Minimum of 2 webs and both transverse bulkheads	*(i)* 5 point pattern over approximately 2 m^2 area *(ii)* 2 measurements between each pair of vertical stiffeners
(5) Horizontal girders	Plating on each girder in a minimum of 3 bays	2 measurements between each pair of longitudinal girder stiffeners
(6) Panel stiffening	Where applicable	Single measurement

Table 4.3.8 Double Hull Oil Tankers – Longitudinal Bulkhead Structure in Cargo Tanks with Substantial Corrosion

Requirements based on Pt 1, Ch 3,7 **TABLE 3.7.14** of the *Rules and Regulations for the Classification of Ships*

Structural member	Extent of measurement	Pattern of measurement
(1) Deckhead and bottom strakes, and strakes in way of horizontal stringers on transverse bulkheads	Plating between each pair of longitudinals in a minimum of 3 bays	Single measurement
(2) All other strakes	Plating between every 3rd pair of longitudinals in same 3 bays	Single measurement
(3) Longitudinals on deckhead and bottom strakes	Each longitudinal in same 3 bays	3 measurements across web and 1 measurement on flange
(4) All other longitudinals	Every 3rd longitudinal in same 3 bays	3 measurements across web and 1 measurement on flange
(5) Longitudinals – brackets	Minimum of 3 at top, middle and bottom of tank in same 3 bays	5 point pattern over area of bracket
(6) Web frames and cross ties	3 webs with minimum of 3 locations on each web, including in way of cross tie connections	5 point pattern over approximately 2 m^2 area of webs, plus single measurements on flanges of web frames and cross ties
(7) Lower end brackets (opposite side of web frame)	Minimum of 3 brackets	5 point pattern over approximately 2 m^2 area of brackets, plus single measurements on bracket flanges

4.3.9 Double Hull Oil Tankers – Transverse Watertight and Swash Bulkhead Structure in Cargo Tanks with Substantial Corrosion

Requirements based on Pt 1, Ch 3,7 **TABLE 3.7.15** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurements
(1) Upper and lower stool, where fitted	Transverse band within 25 mm of welded connection to inner bottom/deck plating. Transverse band within 25 mm of welded connection to shelf plate	5 point pattern between stiffeners over 1 m length
(2) Deckhead and bottom strakes, and strakes in way of horizontal stringers	Plating between pair of stiffeners at 3 locations; approximately ¼, ½ and ¾ width of tank	5 point pattern between stiffeners over 1 m length
(3) All other strakes	Plating between pair of stiffeners at middle location	Single measurement
(4) Strakes in corrugated bulkheads	Plating for each change of scantling at centre of panel and at flange of fabricated connection	5 point pattern over approximately 1 m^2 of plating
(5) Stiffeners	Minimum of 3 typical stiffeners	For web, 5 point pattern over span between bracket connections (2 measurements across web at each bracket connection and 1 at centre of span). For flange, single measurement at bracket toe and at centre of span
(6) Brackets	Minimum of 3 at top, middle and bottom of tank	5 point pattern over area of bracket
(7) Horizontal stringers	All stringers with measurements at both ends and middle	5 point pattern over 1 m^2 area, plus single measurement near bracket toes and on flanges

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Thickness measurement and close-up survey guidance

Part 5, Special survey requirements
Chemical tankers

January 2023 Ver.7.6

Contents

Part 5 – Special Survey Requirements

5.1 Thickness Measurement Requirements

Table 5.1.1 Minimum requirements for thickness measurement - Single and Double Hull Chemical Tankers

Requirements based on Pt 1, Ch 3,8 **TABLE 3.8.4** of the *Rules and Regulations for the Classification of Ships*		
Special Survey I (Ships 5 years old)	**Special Survey III (Ships 15 years old)**	**Special Survey IV (Ships 20 years old and over)**
Table 3.8.Table 3.8.3*(1)* Suspect areas, as required by the Surveyor. See Note 6.	*(1)* Within the cargo area: *(a)* Each deck plate. *(b)* 2 transverse sections. See Notes 2, 3 and 5. *(2)* Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with Pt 1, Ch 3, Table 3.8.2 Minimum requirements for Close-up Survey – Single hull chemical tankers and Table 3.8.3 Minimum requirements for Close-up Survey – Double hull chemical tankers. See Note 4. *(3)* Selected wind and water strakes outside the cargo area. *(4)* All wind and water strakes within the cargo area. *(5)* . Suspect areas, as required by the Surveyor. See Note 6.	*(1)* Within the cargo area: *(a)* Each deck plate. *(b)* 3 transverse sections. See Notes 2, 3 and 5. *(c)* Each bottom plate. *(2)* Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with Pt 1, Ch 3, Table 3.8.2 Minimum requirements for Close-up Survey – Single hull chemical tankers and Table 3.8.3 Minimum requirements for Close-up Survey – Double hull chemical tankers. See Note 4. *(3)* All wind and water strakes over the full length of the ship, port and starboard. *(4)* Remaining exposed main deck plating not considered in item (1) and representative exposed superstructure deck plating (i.e. poop, bridge and forecastle deck). *(5)* All keel plates outside the cargo tank length. Also additional bottom plates in way of cofferdams, machinery space and aft end of tanks. *(6)* Plating of seachests. Also side shell plating in way of overboard discharges, as considered necessary by the Surveyor. *(7)* Suspect areas, as required by the Surveyor. See Note 6.
Special Survey II (Ships 10 years old) *(1)* Within the cargo area: *(a)* Each deck plate. *(b)* 1 transverse section. See Notes 2, 3 and 5. *(2)* Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with Pt 1, Ch 3, Table 3.8.2 Minimum requirements for Close-up Survey – Single hull oil tanker and Table 3.8.3 Minimum requirements for Close-up Survey – Double hull chemical tankers. See Note 4. *(3)* Selected wind and water strakes outside the cargo area. *(4)* Suspect areas, as required by the Surveyor. See Note 6.		
Note 1. For areas in tanks where coatings are found to be in GOOD condition, as defined in Part 1, Ch 3, 1.5 Definitions, the extent of thickness measurements may be specially considered, but not dispensed with in its entirety. **Note** 2. Transverse sections should be chosen where the largest reductions are likely to occur, or as revealed by deck plating measurements. **Note** 3. Where two or three transverse sections are required to be measured, at least one is to include a ballast tank		

within 0,5*L* amidships.
Note 4. Transverse bulkhead complete including stiffening system.
Note 5. A transverse section includes all continuous longitudinal members such as plating, longitudinals and girders at the deck, sides, bottom, inner bottom and longitudinal bulkheads. For transversely framed vessels, a transverse section includes adjacent frames and their end connections in way of transverse sections.
Note 6. Suspect areas are locations showing substantial corrosion and/or are considered by the Surveyor to be prone to rapid wastage.

5.2 Close-Up Survey Requirements

Table 5.2.1 Minimum requirements for Close-up Survey - Single Hull Chemical Tankers

Requirements based on Pt 1, Ch 3,8 **TABLE 3.8.2** of the *Rules and Regulations for the Classification of Ships*

Special Survey I (Ships 5 years old)	Special Survey II (Ships 10 years old)	Special Survey III (Ships 15 years old)	Special Survey IV (Ships 20 years old and over)
(1) One web frame ring in a ballast wing tank. See Notes 1 and 6.	(1) All web frame rings in a ballast wing tank or double bottom ballast tank. See Notes 1 and 6.	(1) All web frame rings in all ballast tanks. See Notes 1 and 6.	(1) As Special Survey III.
(2) One deck transverse in a cargo tank or on deck. See Note 2.	(2) One deck transverse in each remaining ballast tank or on deck. See Note 2.	(2) All web frame rings in a cargo wing tank. See Notes 1 and 6.	(2) Additional transverse areas if deemed necessary by the Surveyor.
(3) One transverse bulkhead in a ballast tank. See Note 3.	(3) One deck transverse in a cargo wing tank or on deck. See Note 2.	(3) One web frame ring in each remaining cargo tank. See Note 6.	
(4) One transverse bulkhead in a cargo wing tank. See Notes 3 and 5.	(4) One deck transverse in two cargo centre tanks or on deck. See Note 2.	(4) All transverse bulkheads – in all cargo and ballast tanks. See Note 4.	
(5) One transverse bulkhead in a cargo centre tank. See Notes 3 and 5.	(5) Both transverse bulkheads in a ballast wing tank. See Note 4.		
	(6) One transverse bulkhead in remaining ballast tank. SeeNote 3.		
	(7) One transverse bulkhead in a cargo wing tank. See Notes 3 and 5.		
	(8) One transverse bulkhead in two cargo centre tanks. See Notes 3 and 5.		

Note 1. Ballast double hull tank means double bottom tank, double side tank or double deck tank, as applicable, even if these tanks are separate.
Note 2. Deck transverse including adjacent deck structural members (or external structure on deck in way of the tank).
Note 3. Transverse bulkhead lower part including girder system and adjacent structural members.
Note 4. Transverse bulkhead complete, including girder system and adjacent members, and adjacent longitudinal bulkhead structure.
Note 5. Where there are no centre tanks, the transverse bulkheads in wing tanks are to be subject to Close-up Survey. Where there are no wing tanks, the transverse bulkheads in centre tanks are to be subject to Close-up Survey.

Note *6.* Complete transverse web frame ring including adjacent structural members.

Table 5.2.2 Minimum requirements for Close-up Survey - Double Hull Chemical Tankers

Requirements based on Pt 1, Ch 3,8 **TABLE 3.8.3** of the *Rules and Regulations for the Classification of Ships*

Special Survey I (Ships 5 years old)	Special Survey II (Ships 10 years old)	Special Survey III (Ships 15 years old)	Special Survey IV (Ships 20 years old and over)
(1) One web frame ring in a ballast double hull tank. See Notes 1 and 9.	(1) All web frame rings in a ballast double hull tank. See Notes 1 and 9.	(1) All web frame rings in all ballast tanks. See Note 1.	(1) As Special Survey III.
(2) One deck transverse in a cargo tank or on deck. See Note 2.	(2) The knuckle area and the upper part (approx. 3 m) of one web frame ring in each remaining ballast tank. See Note 6.	(2) All web frame rings in a cargo wing tank. See Note 7.	(2) Additional transverse areas if deemed necessary by the Surveyor.
(3) One transverse bulkhead in a ballast tank. See Note 5.	(3) One deck transverse in two cargo tanks. See Note 2.	(3) One web frame ring in each remaining cargo tank. See Note 7.	
(4) One transverse bulkhead in a cargo wing tank. See Notes 3 and 8.	(4) One transverse bulkhead in each ballast tank. See Note 5.	(4) All transverse bulkheads – in all cargo and ballast tanks. See Notes 4 and 5.	
(5) One transverse bulkhead in a cargo centre tank. See Notes 3 and 8.	(5) One transverse bulkhead in a cargo wing tank. See Note 3.		
	(6) One transverse bulkhead in two cargo centre tanks. See Notes 3 and 8.		

Note 1. Web frame ring in a ballast tank includes the vertical web in side tank, hopper web in hopper tank, floor in double bottom tank and deck transverse in a double deck tank (where fitted) and adjacent structural members. In peak tanks, a web frame means a complete transverse web frame ring, including adjacent structural members.
Note 2. Deck transverse including adjacent deck structural members (or external structure on deck in way of the tank). Where applicable.
Note 3. Transverse bulkhead lower part in cargo tanks, including girder system and adjacent structural members (including longitudinal bulkheads) and internal structure of lower stool, where fitted.
Note 4. Transverse bulkhead complete in cargo tanks, including girder system, adjacent structural members (including longitudinal bulkheads) and internal structure of lower and upper stools, where fitted.
Note 5. Transverse bulkhead complete in ballast tanks, including girder system and adjacent structural members (including longitudinal bulkheads) and internal structure of lower and upper stool, where fitted.
Note 6. The knuckle area and the upper part (approximately 3 m), including adjacent structural members. Knuckle area is the area of the web frame around the connections of the sloping hopper plating to the inner hull bulkhead and the inner bottom plating, up to 2 m from the corners both on the bulkhead and the double bottom.
Note 7. Web frame ring in a cargo tank includes deck transverse, longitudinal bulkhead vertical girder structural elements and cross ties, where fitted, and adjacent structural members.
Note 8. Where there are no centre tanks, the transverse bulkheads in wing tanks are to be subject to Close-up Survey. Where there are no wing tanks, the transverse bulkheads in centre tanks are to be subject to Close-up Survey.

Note 9. Ballast double hull tank includes double bottom tank, double side tank and double deck tank even though these tanks may be separate.

5.3 Substantial Corrosion

Table 5.3.1 Single and double hull chemical tankers – Bottom, inner bottom and hopper structure with substantial corrosion

Requirements based on Pt 1, Ch 3,8 **TABLE 3.8.5** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurement
(1) Bottom, inner bottom and hopper plating	Minimum of 3 bays across double bottom tank, including aft bay. Measurement around and under all suction strums	5 point pattern for each panel between longitudinals and floors
(2) Bottom, inner bottom and hopper longitudinals	Minimum of 3 longitudinals in each bay where bottom plating measured	3 measurements in line across flange and 3 measurements on vertical web
(3) Bottom girders, including watertight girders	At the fore and aft watertight floors and in centre of tanks	Vertical line of single measurements on girder plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements. 2 measurements across face flat (if fitted)
(4) Bottom floors, including watertight floors	3 floors in bays where bottom plating measured, with measurements at both ends and middle	5 point pattern over 2 m^2 area
(5) Hopper web frame ring	3 floors in bays where bottom plating measured	5 point pattern over 1 m^2 of plating. Single measurement on flange
(6) Hopper transverse watertight bulkhead or swash bulkhead	(i) Lower 1/3 of bulkhead	(i) 5 point pattern over 1 m^2 of plating
	(ii) Upper 1/3 of bulkhead	(ii) 5 point pattern over 2 m^2 of plating
	(iii) Stiffeners (minimum of 3)	(iii) For web, 5 point pattern over span (2 measurements across web at each end and 1 at centre of span). For flange, single measurement at each end and centre of span
(7) Panel stiffening	Where applicable	Single measurement

Table 5.3.2 Single and double hull chemical tankers – Deck structure with substantial corrosion

Structural member	Extent of measurement	Pattern of measurement
(1)Deck plating	2 transverse bands across tank	Minimum of 3 measurements per plate per band
(2) Deck longitudinals	Every 3rd longitudinal in each of 2 bands with a minimum of 1 longitudinal	3 measurements in line vertically on webs and 2 measurements on flange (if fitted)
(3) Deck girders and brackets	At the fore and aft transverse bulkhead, bracket toes and in centre of tanks	Vertical line of single measurements on web plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements. 2 measurements across flange. 5 point pattern on girder/bulkhead brackets
(4) Deck transverse webs	Minimum of 2 webs, with measurements at both ends and middle of span	5 point pattern over 1 m^2 area. Single measurement on the flange
(5) Vertical web and transverse bulkhead in wing ballast tank (2 m from deck) – for double hull chemical tankers	Minimum of 2 webs, and both transverse bulkheads	5 point pattern over 1 m^2 area
(6) Panel stiffening	Where applicable	Single measurement

Table 5.3.3 Single and double hull chemical tankers – Side shell and longitudinal bulkheads with substantial corrosion

Requirements based on Pt 1, Ch 3,8 **TABLE 3.8.7** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurement
(1) Side shell and longitudinal bulkhead plating:		
(i) Top and bottom strakes, and strakes in way of horizontal girders	(i) Plating between each pair of longitudinals in a minimum of 3 bays (along the tank)	(i) Single measurement
(ii) All other strakes	(ii) Plating between every 3rd pair of longitudinals on same 3 bays	(ii) Single measurement
(2) Side shell and longitudinal bulkhead longitudinals on:		
(i) Top and bottom strakes	(i) Each longitudinal in same 3 bays	(i) 3 measurements across web and 1 measurement on flange
(ii) All other strakes	(ii) Every 3rd longitudinal in same 3 bays	(ii) 3 measurements across web and 1 measurement on flange
(3) Longitudinals – brackets	Minimum of 3 at top, middle and bottom of tank in same 3 bays	5 point pattern over area of bracket
(4) Vertical web and transverse bulkheads of double side tanks (excluding deckhead area):		
(i) Strakes in way of horizontal girders	(i) Minimum of 2 webs and both transverse bulkheads	(i) 5 point pattern over approximately 2 m^2 area
(ii) Other strakes	(ii) Minimum of 2 webs and both transverse bulkheads	(ii) 2 measurements between each pair of vertical stiffeners
(5) Web frames and cross ties for other tanks than double side tanks	3 webs with minimum of 3 locations on each web, including in way of cross tie connections and lower end bracket	5 point pattern over approximately 2 m^2 area of webs, plus single measurements on flanges of web frame and cross ties
(6) Horizontal girders	Plating on each girder in a minimum of 3 bays	2 measurements between each pair of longitudinal girder stiffeners
(7) Panel stiffening	Where applicable	Single measurement

Table 5.3.4 Single and double hull chemical tankers – Transverse watertight bulkheads and swash bulkheads with substantial corrosion

Requirements based on Pt 1, Ch 3,8 **TABLE 3.8.8** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurement
(1) Upper and lower stool, where fitted	Transverse band within 25 mm of welded connection to inner bottom/deck plating. Transverse band within 25 mm of welded connection to shelf plate	5 point pattern between stiffeners over 1 m length
(2) Top and bottom strakes, and strakes in way of horizontal stringers	Plating between pair of stiffeners at 3 locations; approximately 1/4, 1/2 and 3/4 width of tank	5 point pattern between stiffeners over 1 m length
(3) All other strakes	Plating between pair of stiffeners at middle location	Single measurement
(4) Strakes in corrugated bulkheads	Plating for each change of scantling at centre of panel and at flange of fabricated connection	5 point pattern over approximately 1 m^2 of plating
(5) Stiffeners	Minimum of 3 typical stiffeners	For web, 5 point pattern over span between bracket connections (2 measurements across web at each bracket connection and 1 at centre of span). For flange, single measurement at bracket toe and at centre of span
(6) Brackets	Minimum of 3 at top, middle and bottom of tank	5 point pattern over area of bracket
(7) Horizontal stringers	All stringers with measurements at both ends and middle	5 point pattern over 1 m^2 area, plus single measurement near bracket toes and on flanges
(8) Deep webs and girders	Measurements at toe of bracket and centre of span	For webs, 5 point pattern over 1 m^2 area. 3 measurements across face flat

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Thickness measurement and close-up survey guidance

Part 6, Special survey requirements
Ships for liquefied gases

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Contents Part 6

Part 6 – Special Survey Requirements

6.1 Thickness Measurement Requirements

Table 6.1.1 Minimum requirements for thickness measurement - Ships For Liquefied Gases

Requirements based on Pt 1, Ch 3,9 **TABLE 3.9.3** of the *Rules and Regulations for the Classification of Ships*

Special Survey I (Ships 5 years old)	Special Survey III (Ships 15 years old)	Special Survey IV and subsequent (Ships 20 years old and over)
(1) 1 section of deck plating for the full beam of the ship within 0,5*L* amidships in way of a ballast tank, if any. *(2)* Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with Pt 1, Ch 3, Table 3.9.2 Minimum requirements for Close-up Survey – Ships for liquefied gases. *(3)* Suspect areas, as required by the Surveyor. See Note 5.	*(1)* Within the cargo area: *(a)* Each deck plate. *(b)* 2 transverse sections. See Note 2, 3 and 4. *(2)* Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with Pt 1, Ch 3, Table 3.9.2 Minimum requirements for Close-up Survey – Ships for liquefied gases. *(3)* Selected wind and water strakes outside the cargo area. *(4)* All wind and water strakes within the cargo area. *(5)* Where considered necessary by the Surveyor, the inner bottom plating and adjacent tank supports are to be subject to thickness measurement for general assessment and recording of the corrosion pattern. *(6)* For those ships designated to carry light oils in the independent cargo tanks, thickness measurement of the independent cargo tank structure is to be carried out as considered necessary by the Surveyor. (7) Suspect areas, as required by the Surveyor. See Note 5.	*(1)* Within the cargo area: *(a)* Each deck plate. *(b)* 3 transverse sections. See Note 2, 3 and 4. *(c)* Each bottom plate. *(d)* Duct Keel plating and internals. *(2)* Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with Pt 1, Ch 3, Table 3.9.2 Minimum requirements for Close-up Survey – Ships for liquefied gases. *(3)* All wind and water strakes over the full length of the ship, port and starboard. *(4)* Remaining exposed main deck plating not considered in item (1) and representative exposed superstructure deck plating (i.e. poop, bridge and forecastle deck). *(5)* All keel plates outside the cargo tank length. Also additional bottom plates in way of cofferdams, machinery space and aft end of tanks. *(6)* Plating of seachests. Also side shell plating in way of overboard discharges, as considered necessary by the Surveyor. (7) Where considered necessary by the Surveyor, the inner bottom plating and adjacent tank supports are to be subject to thickness measurement for general assessment and recording of the corrosion pattern.
Special Survey II (Ships 10 years old) *(1)* Within the cargo area: *(a)* Each deck plate. *(b)* 1 transverse section. See Note 2, 3 and 4. *(2)* Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with Pt 1, Ch 3, Table 3.9.2 Minimum requirements for Close-up Survey – Ships for liquefied gases. *(3)* Selected wind and water strakes outside the cargo area. *(4)* Where considered necessary by the Surveyor, the inner bottom plating and adjacent tank supports are to be subject to thickness measurement for general assessment and recording of the corrosion pattern. (5) For those ships designated to carry light oils in the		

independent cargo tanks, thickness measurement of the independent cargo tank structure is to be carried out as considered necessary by the Surveyor. (6) Suspect areas, as required by the Surveyor. See Note 5		*(8)* For those ships designated to carry light oils in the independent cargo tanks, thickness measurement of the independent cargo tank structure is to be carried out as considered necessary by the Surveyor. (9) Suspect areas, as required by the Surveyor. See Note 5.

Note 1. For areas in tanks where coatings are found to be in GOOD condition, as defined in Part 1, Ch 3, 1.5 Definitions, the extent of thickness measurements may be specially considered, but not dispensed with its entirety.

Note 2. Transverse sections should be chosen where the largest reductions are likely to occur, or as revealed by deck plating measurements.

Note 3. Where transverse sections are required to be measured, at least one is to include a ballast tank within 0,5*L* amidships.

Note 4. A transverse section includes all continuous longitudinal members such as plating, longitudinals and girders at the deck, sides, bottom, inner bottom and longitudinal bulkheads. For transversely framed vessels, a transverse section includes adjacent frames and their end connections in way of transverse sections.

Note 5. Suspect areas are locations showing substantial corrosion and/or are considered by the Surveyor to be prone.

6.2 Close-Up Survey Requirements

Table 6.2.1 Minimum requirements for Close-up Survey - Ships For Liquefied Gases

Requirements based on Pt 1, Ch 3,9 **TABLE 3.9.2** of the *Rules and Regulations for the Classification of Ships*			
Special Survey I (Ships 5 years old)	**Special Survey II (Ships 10 years old)**	**Special Survey III (Ships 15 years old)**	**Special Survey IV (Ships 20 years old and over)**
(1) One web frame in: *(a)* a topside ballast tank *(b)* a hopper side ballast tank *(c)* a double hull side ballast tank See Notes 1, 2, 5 and 6. *(2)* One transverse bulkhead in a ballast tank. See Notes 1, 3, 4, 5 and 6.	*(1)* All web frames in either a topside ballast tank or a double hull side ballast tank. If such tanks are not fitted, another ballast tank is to be selected. See Notes 1, 2, 5 and 6. *(2)* One web frame in each remaining ballast tank. See Notes 1, 2, 5 and 6. *(3)* One transverse bulkhead in each ballast tank. See Notes 1, 3, 5 and 6.	*(1)* All web frames in all ballast tanks. See Notes 1, 2, 5 and 6. *(2)* All transverse bulkheads in all ballast tanks. See Notes 1, 3, 5 and 6.	*(1)* All web frames in all ballast tanks. See Notes 1, 2, 5 and 6. *(2)* All transverse bulkheads in all ballast tanks. See Notes 1, 3, 5 and 6.
Note 1. Ballast tanks include topside, double hull side, double bottom, hopper side, or any combined arrangement of the aforementioned, and peak tanks where fitted. **Note** 2. Complete transverse web frame ring including adjacent structural members. **Note** 3. Transverse bulkhead complete, including girder system and adjacent structural members and adjacent longitudinal bulkhead structure. **Note** 4. Transverse bulkhead lower part including girder system and adjacent structural members. **Note** 5. For ships having independent cargo tanks of Type C, with a midship section similar to that of a general cargo ship, the extent of Close-up Survey may be specially considered. **Note** 6. The Surveyor may extend the Close-up Survey, if deemed necessary, taking into account the maintenance of the tanks under survey, the condition of the corrosion prevention system, the structural arrangements or details which have suffered defects in similar spaces or on similar ships and tanks having structures approved with reduced scantlings.			

6.3 Substantial Corrosion

Table 6.3.1 Ships For Liquefied Gases – Structural Areas With Substantial Corrosion

Requirements based on Pt 1, Ch 3,9 **TABLE 3.9.4** of the *Rules and Regulations for the Classification of Ships*		
Structural member	Extent of measurement	Pattern of measurement
Plating	Suspect area and adjacent plates	5 point pattern over 1 m^2 of plating
Stiffeners	Suspect area.	3 measurements each in line across web and flange

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