



Lloyd's Register
Marine

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Thickness measurement and close-up survey guidance

Ver. 7.4

February 2017



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For further information, contact your local Lloyd's Register group office.

For all other Thickness Measurement guidance and information about our services go to:
www.lr.org/tm

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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, 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.	<p>The survey is to be extended when Substantial Corrosion is found and include additional Close-up Survey when necessary.</p> <p>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.</p> <p>Areas identified at previous surveys with Substantial Corrosion are to have thickness measurements taken (not applicable to CSR)</p> <p>Areas found with Substantial Corrosion are to be examined at subsequent annual surveys</p>	<p>Memoranda applied by the surveyor separately for each space/hold/tank in order to identify areas with substantial corrosion:</p> <p>"AREAS XXXXXX FOUND WITH SUBSTANTIAL CORROSION - TO BE EXAMINED AND GAUGED AT EACH ANNUAL SURVEY"</p>
CSR	Any	Substantial corrosion is an extent of corrosion such that the assessment of the corrosion pattern indicates a measured thickness between $t_{min} + 0.5mm$ and t_{renew} (t_{renew} = renewal thickness)	<p>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</p> <p>b) required to be examined and gauged at annual intervals</p> <p>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.</p> <p><i>All Non-CSR 'Actions During Survey' are applicable (except otherwise instructed)</i></p>	<p>Memoranda applied by the surveyor for each space/hold/tank in order to identify areas with substantial corrosion:</p> <p>"AREAS XXXXXX FOUND WITH SUBSTANTIAL CORROSION - TO BE EXAMINED AT EACH ANNUAL SURVEY AND TO BE GAUGED IF COATING: NOT APPLIED / FAIR / POOR"</p>
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	<p>Where the gauged thickness is within the range $t_{min} + 0.5 mm$ and $t_{min} + 1.0 mm$, or when measured (gauged) thickness is between: $T_{REN} \leq T_M \leq T_{COR}$</p> <p><i>NOTE: Revised limits of 'Substantial Corrosion' and implementation will be indicated in a 'Table of Diminution' incorporated in the bulkhead approved plan.</i></p>	<p>Coating (applied in accordance with the coating manufacturer's requirements) or annual gauging may be adopted as an alternative to steel renewal.</p>	<p>A suitable Memorandum is to be added for annual examination and gauging.</p> <p>"AREAS XXXXXX FOUND WITH SUBSTANTIAL CORROSION - TO BE EXAMINED AND GAUGED AT EACH ANNUAL SURVEY"</p>
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	<p>When measured (gauged) thickness is between: $T_{REN} \leq T_M \leq T_{COR}$</p>	<p>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.</p> <p>Where gauging readings close to the criteria are found, the number of hold frames to be measured is to be increased.</p> <p>a) Sand blasting, or equivalent, and coating.</p> <p>b) Fitting tripping brackets, when the above condition occurs for any of the side frame zones A, B, C and D.</p> <p>c) Maintaining the coating in "as-new" condition (i.e. without breakdown or rusting) at Special and Intermediate Surveys.</p> <p>Waiving of sandblasting and coating is permitted if:</p> <ul style="list-style-type: none"> - coating is in GOOD condition; AND - tripping brackets are fitted and the coating damaged in way of the tripping bracket welding is repaired. 	<p>Memoranda applied by the surveyor for each space/hold/tank in order to identify areas with substantial corrosion:</p> <p>"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"</p>
IACS UR S18	Evaluation of Scantlings of Corrugated Transverse Watertight Bulkheads in Bulk Carriers Considering Hold Flooding	<p>When the gauged thickness is between Renewal Thickness ($t_{min} + 0.5mm$) and Renewal Thickness + $0.5mm$ ($t_{min} + 1.0mm$)</p>	<p>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.</p>	<p>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:</p> <p>"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"</p>
IACS UR S21 and S21A	Evaluation of Scantlings of Hatch Covers and Hatch Coamings and Closing Arrangements of Cargo Holds of Ships	<p>When the gauged thickness is between Renewal Thickness ($t_{min} + 0.5mm$) and Renewal Thickness + $0.5mm$ ($t_{min} + 1.0mm$)</p>	<p>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.</p>	<p>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:</p> <p>"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"</p>

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.

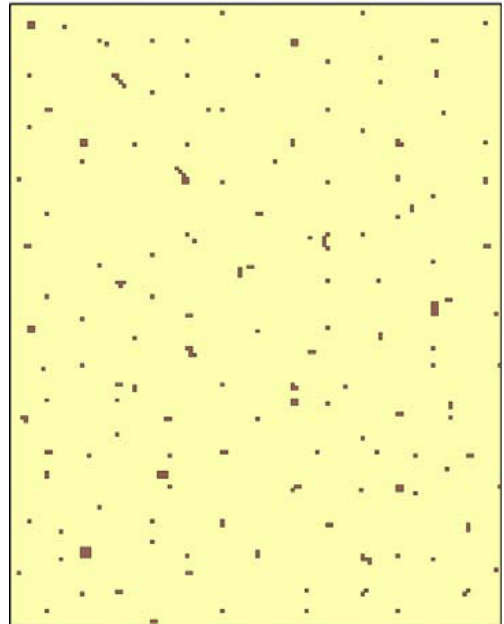
The following tables show examples and definitions of the coating conditions:

Survey Planning

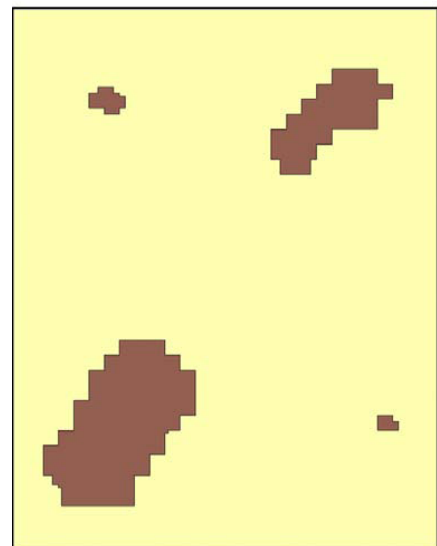
Part 1, Chapter 2

Section 2

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

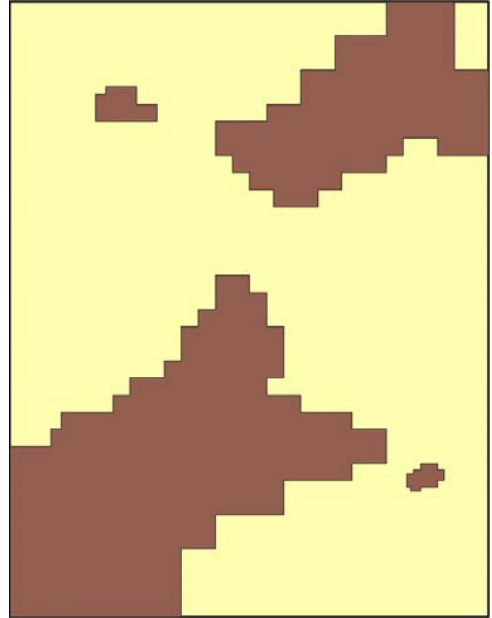
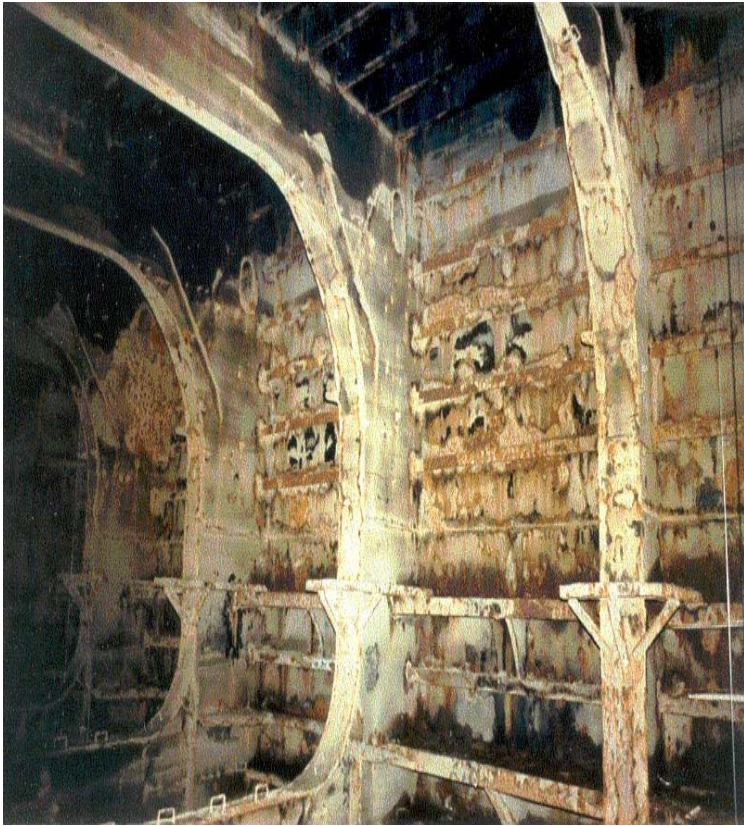


Survey Planning

Part 1, Chapter 2

Section 2

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.

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.

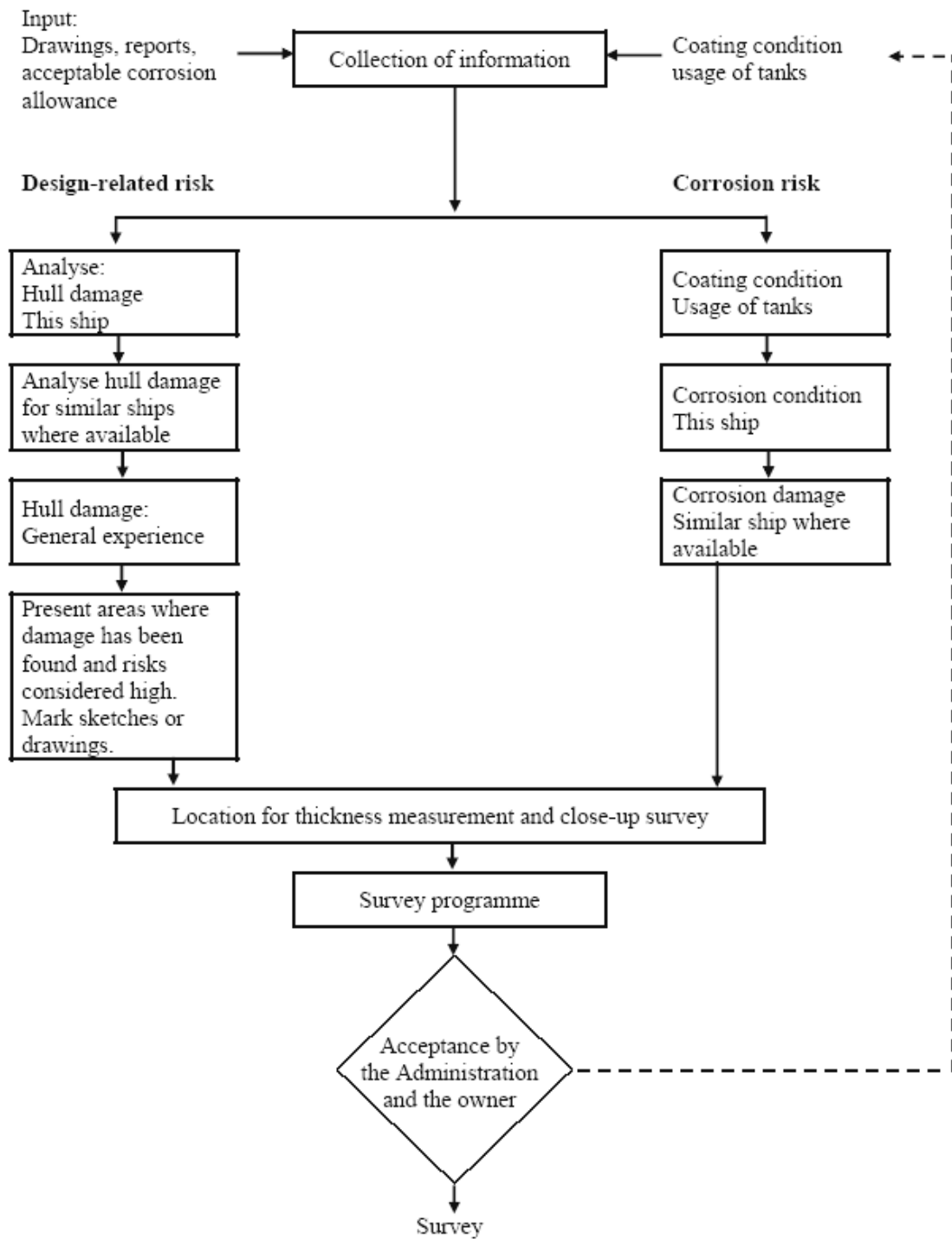


Figure 1 – Technical assessment and the survey planning process

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.

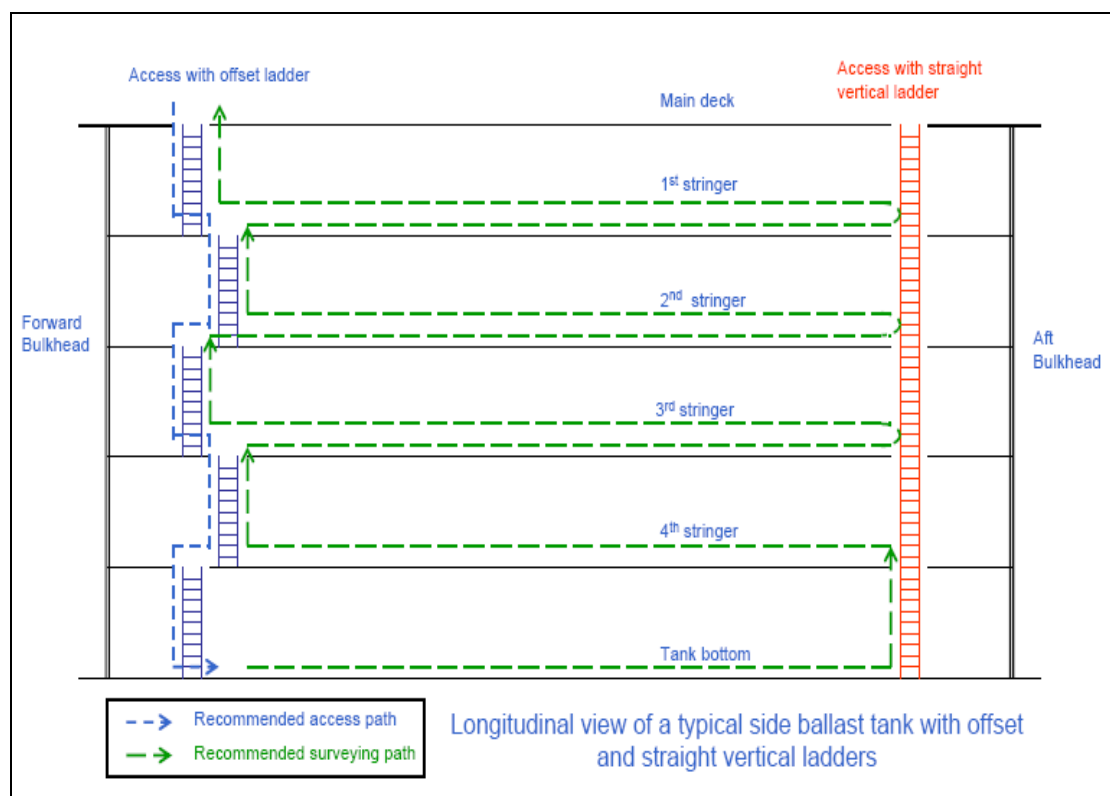


A typical stiffener & end bracket in a W.B.T. after chipping – cleaning may reveal the true thickness reduction it is subjected to

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:

- Permanent stages and passages through the structures.
- Temporary stages and passages through the structures.
- Hydraulic arm vehicles such as conventional cherry pickers, lifts and movable platforms
- Portable ladders.
- Boats and rafts.
- 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.
- (c) Notwithstanding the above requirements, for single skin bulk carriers greater than 10 years old, at Annual Survey the use of a portable ladder fitted with a mechanical device to secure the upper end of the ladder is acceptable for when the Close-up Survey of cargo hold shell frames is required.

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:

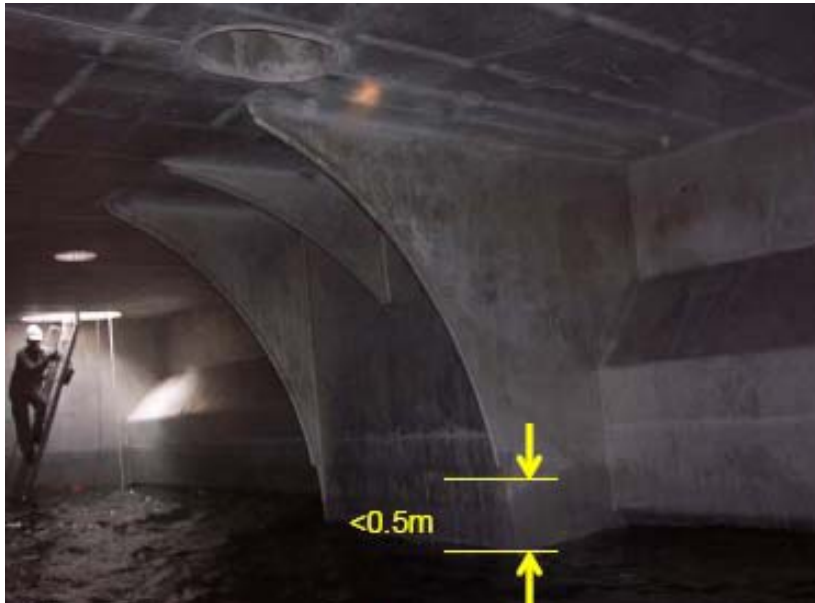
- (a) A communication system is to be arranged between the survey party in the tank and the responsible officer on deck. This system must include the personnel in charge of ballast pump handling if boats or rafts are to be used.
- (b) Surveys of tanks by means of boats or rafts are to be agreed with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

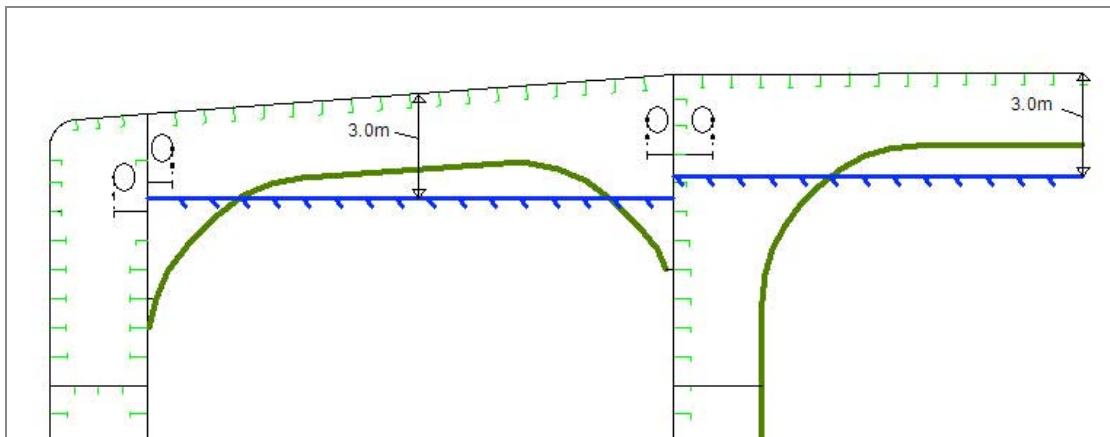


A damaged raft may result in capsizing

- (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.

1.4 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.

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

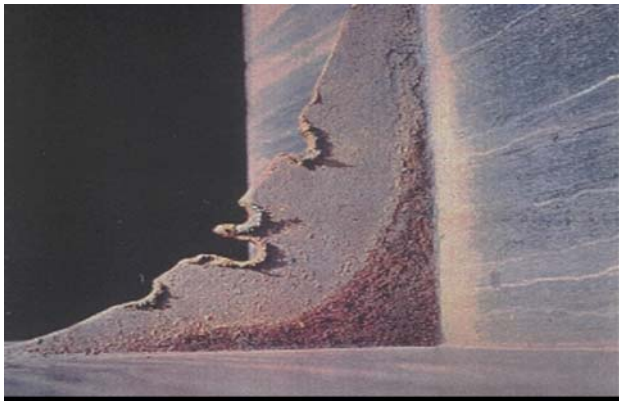
The Surveyor should direct the gauging operation by selecting locations such that the readings taken represent, on average, the general condition of the overall structural area.

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 shearstrake and stringer plate.
- Strengthening in way of cargo hatch corners which may not always be apparent when welded insert plates have been used.



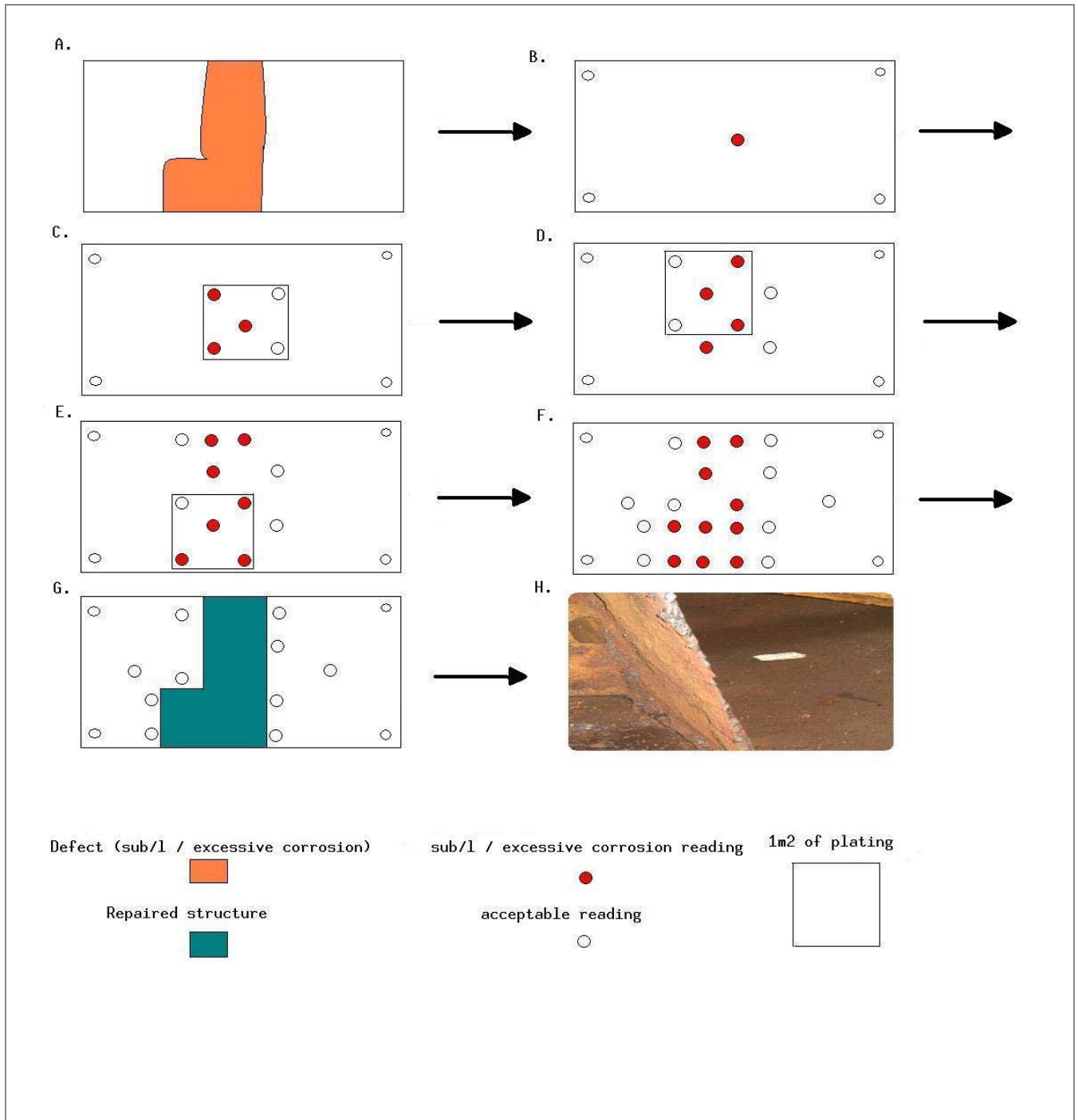
Typical hatch corner defect on a Bulk Carrier

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 a 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 1m² 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%

Acceptance Criteria

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Section 1

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%
<i>*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.)</i>	
<i>*COT: Cargo Oil Tank</i>	
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*

Acceptance Criteria

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Section 2

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%
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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.)*

<i>*COT: Cargo Oil Tank</i>	25%
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Cargo hold hatch cover plating	25%
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Cargo hold hatch cover stiffeners	25%
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Cargo hold hatch coaming plating	25%
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Cargo hold hatch coaming stiffeners	25%
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Acceptance Criteria

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Section 3

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%
<i>*SWDBT: Salt-Water Double Bottom Tanks</i>	
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%

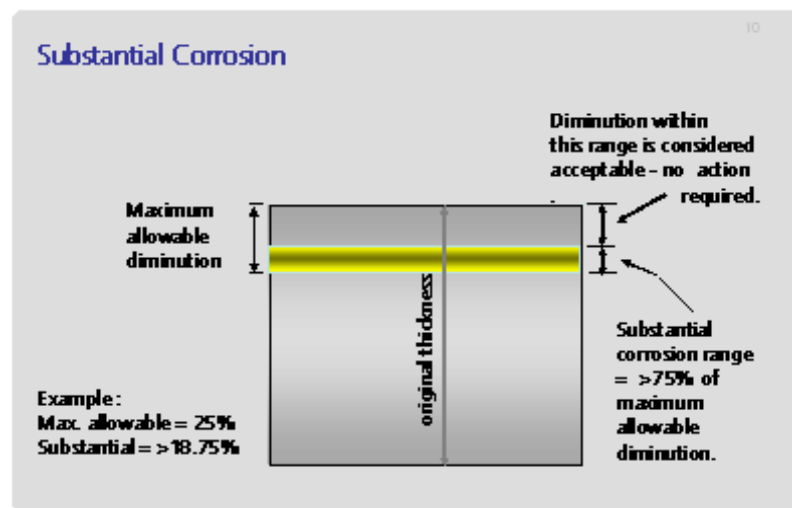
Acceptance Criteria

Part 1, Chapter 5

Section 5

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.

Acceptance Criteria

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Section 6

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_0 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 review 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

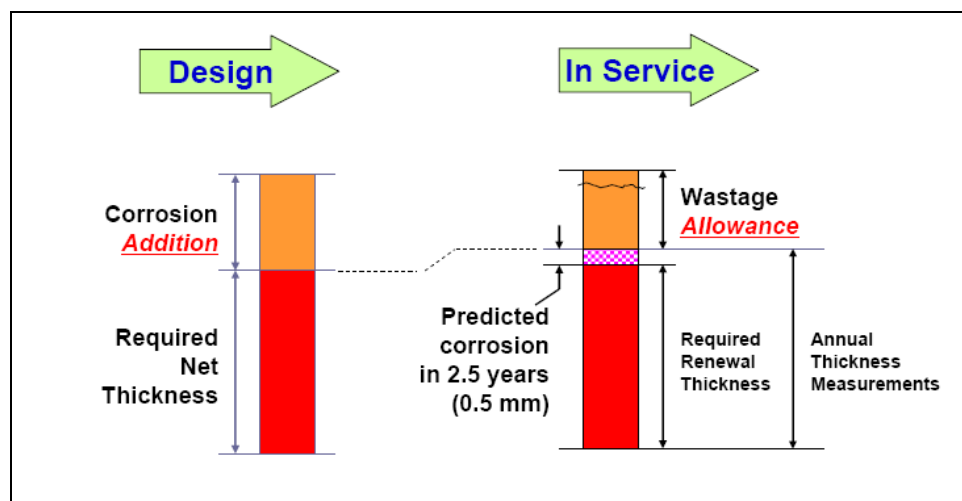
1.5.7.1 Application

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

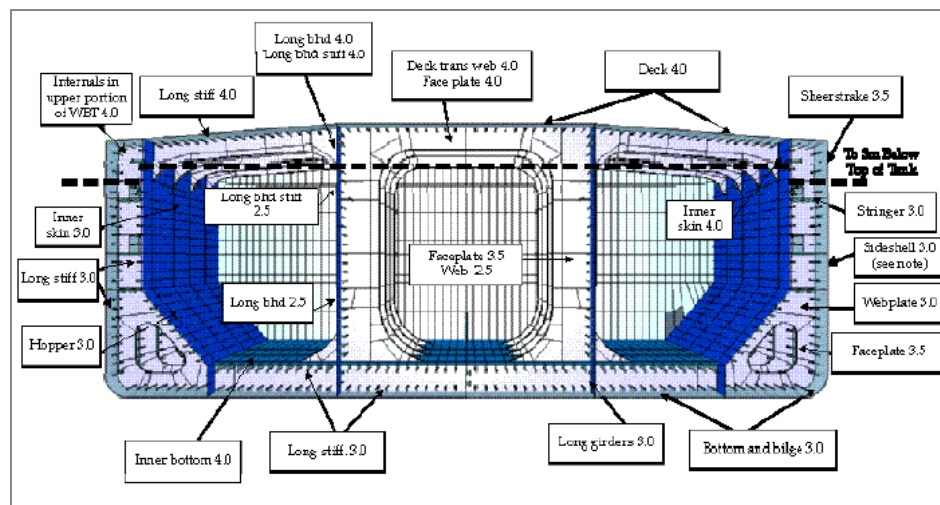
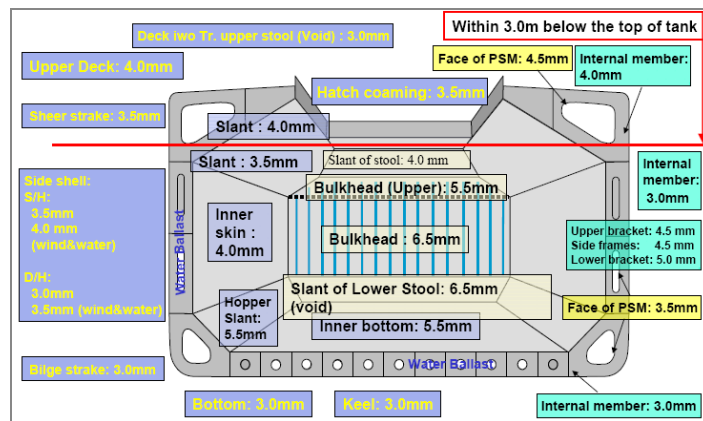


Wastage allowance is comprised of two aspects; local wastage allowance and overall hull girder wastage allowance. Assessment against both local and overall hull girder wastage criteria is required during the operational life of the vessel. Steel renewal is required if either the local or overall hull 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 corrossions of very local aspect.

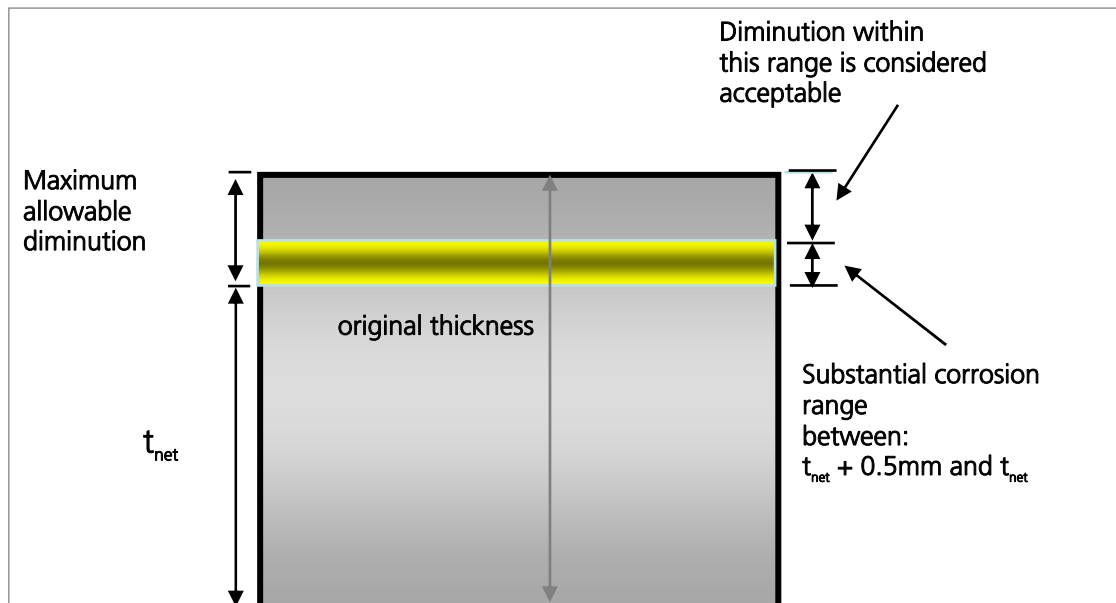
Substantial corrosion: Substantial corrosion is an extent of corrosion such that assessment of the corrosion pattern indicates a gauged (or measured) thickness between $t_{renewal}$ and $t_{renewal} + t_{reserve}$.

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:

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

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: $t_{repair} = t_{as-built} - t_{own}$ (mm)

Where:

$t_{as-built}$: 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

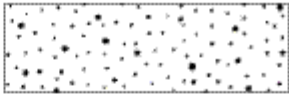
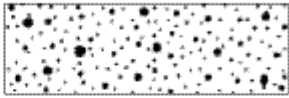
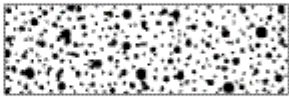
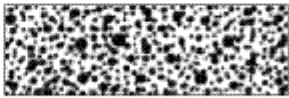
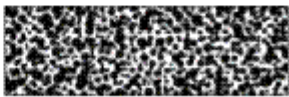
If pitting intensity in an area where coating is required is higher than 15%, thickness measurements are to be performed to check the extent of pitting corrosion. The 15% is based on pitting or grooving on only one side of a plate.

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 $t_{renewal}$.

5% Scattered	
10% Scattered	
20% Scattered	
30% Scattered	
50% Scattered	

CSR Tankers

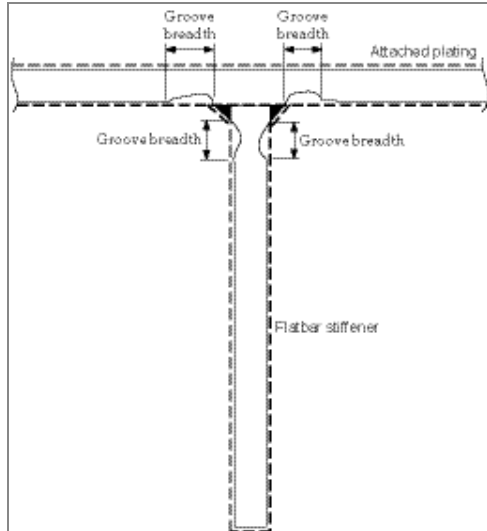
For plates with pitting intensity less than 20%, the measured thickness, t_m , of any individual measurement is to meet the lesser of the following criteria:

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

$$t_m \geq t_{renewal} - 1 \text{ mm}$$

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_m , in the grooved area is to meet the lesser of the following criteria:

$$t_m \geq 0.75 (t_{as-built} - t_{own}) \text{ mm}$$

$$t_m \geq t_{renewal} - 0.5 \text{ mm}$$

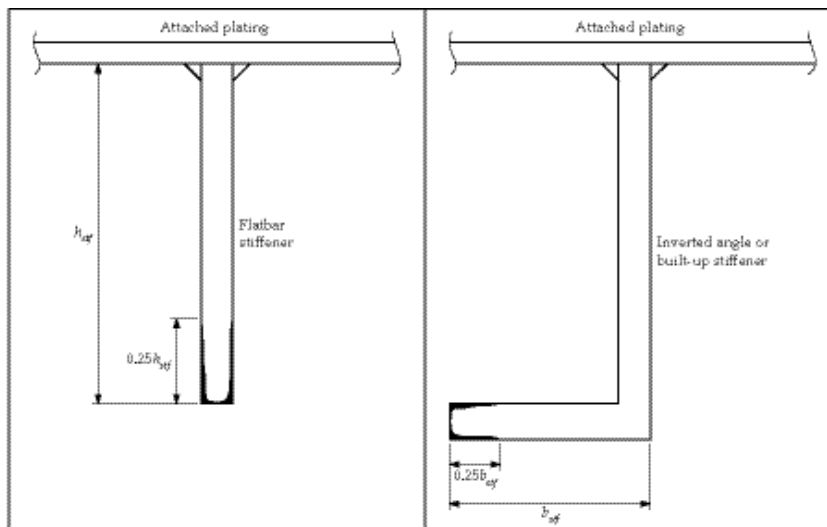
but is not to be less than

$$t_m = 6 \text{ mm}$$

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_c , is to meet the lesser of the following criteria

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

$$t_m \geq t_{renewal} - 1 \text{ mm}$$

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:

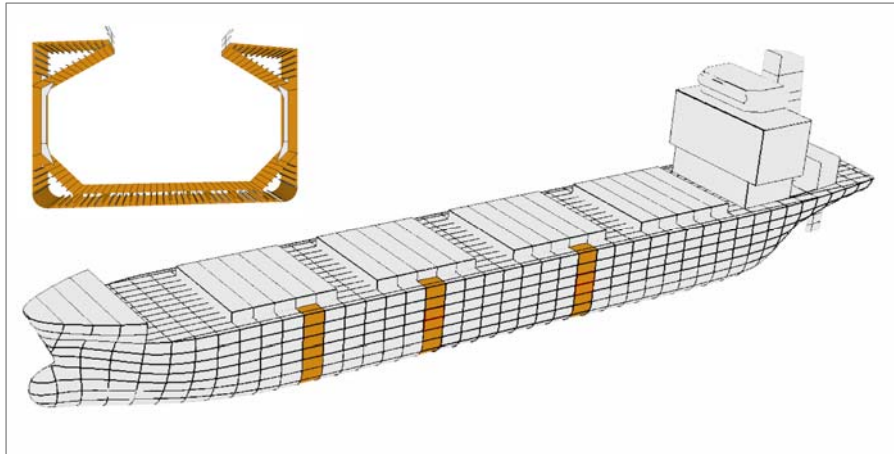
- The current **sectional area** of the neutral axis zone, which is the sum of the measured plating areas of this zone, is not to be less than the sectional area of the neutral axis zone calculated with the gross offered thickness minus 0.5 t_c .

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 0.5 t_c 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).

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 Designated 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.

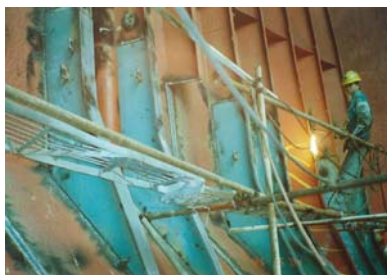
For those ships reference should be made to the Approved Bulkhead Upgrade Plan (included in the ESP Survey File, **ESP SHIPS**), which details the particular diminution criteria for cargo hold transverse bulkheads that have been upgraded in accordance with this notation. Refer and confirm with the Ship's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

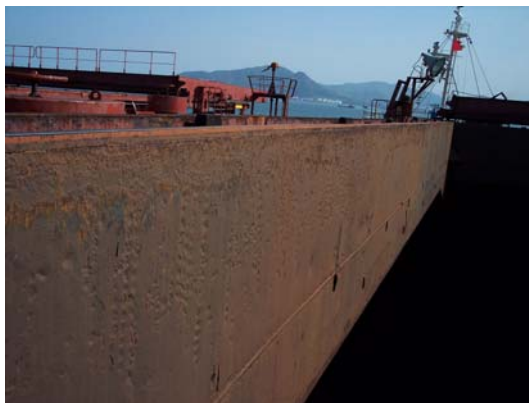
Measurements are to be recorded on Form **TM6 UR S21**.

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, t_s , to t_{net} . The net thicknesses, t_{net} , 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.

General Particulars

SHIP PARTICULARS SURVEY DETAILS TM COMPANY DETAILS **SUPPORTING DOCUMENTS** NOTES AUTHORISATION

Attach Supporting Document(s)

File Name	Document	Delete
UR S19		

Print Preview Save Cancel

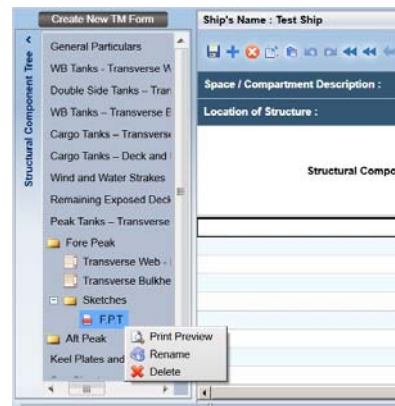
By use of the TM Form, the description of identifiers like the strake or plate position has to correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches in a similar fashion. The **Sketch Reference ID** should include indication of the sketch reference where found necessary (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).

Reporting

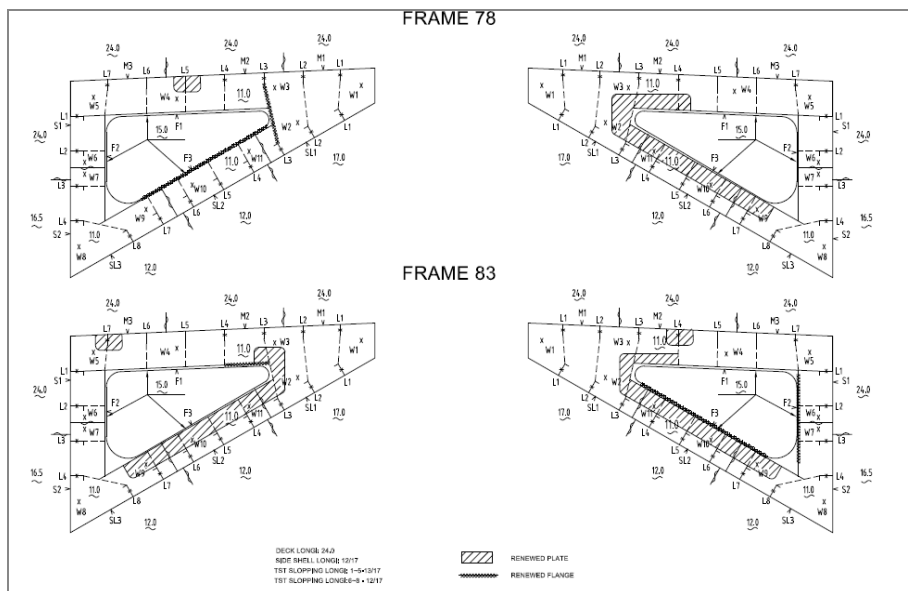
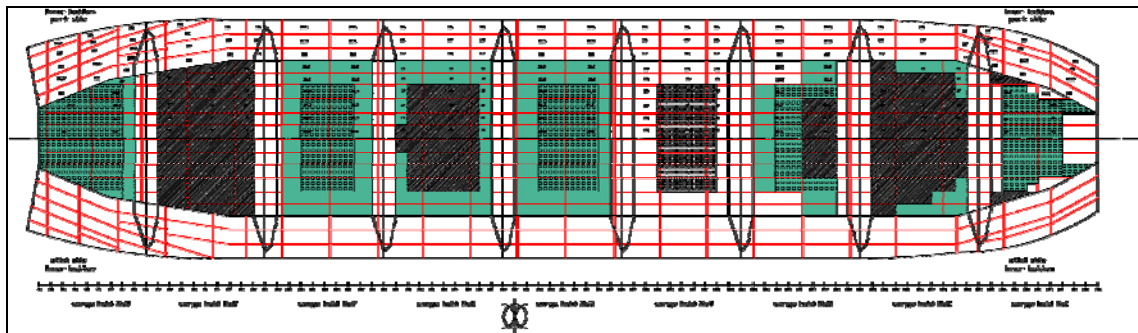
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Sketches can be attached to the appropriate folder in the TM report **Structural Component Tree** by right click and selecting **Attach Sketches**. A folder will be automatically created under the corresponding TM forms where any sketch will be appended 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.



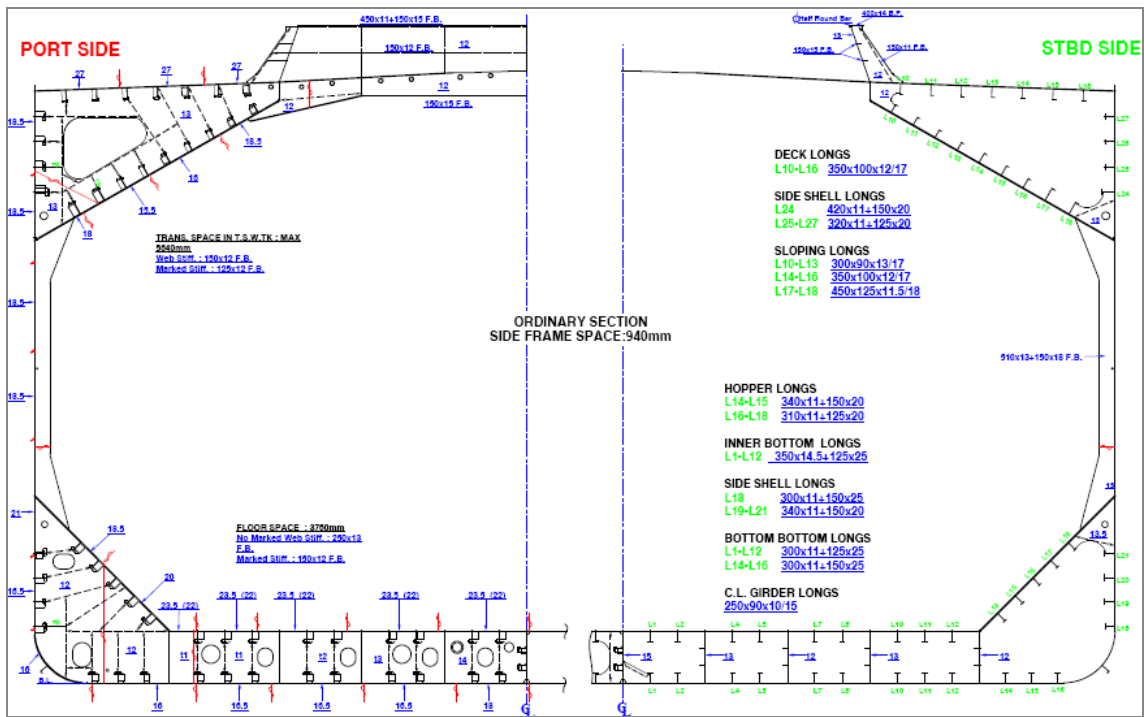
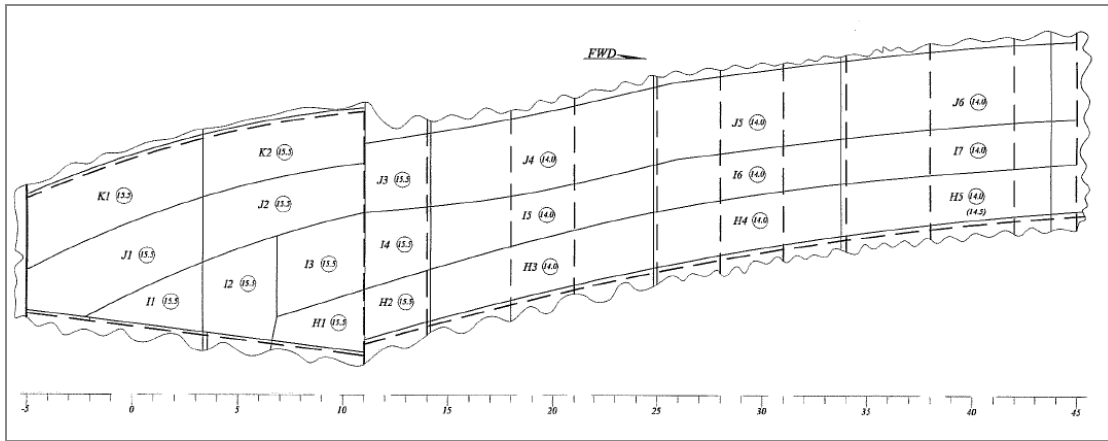
Below as presented are typical sketches with mapping of renewed structural areas where applicable:



Reporting

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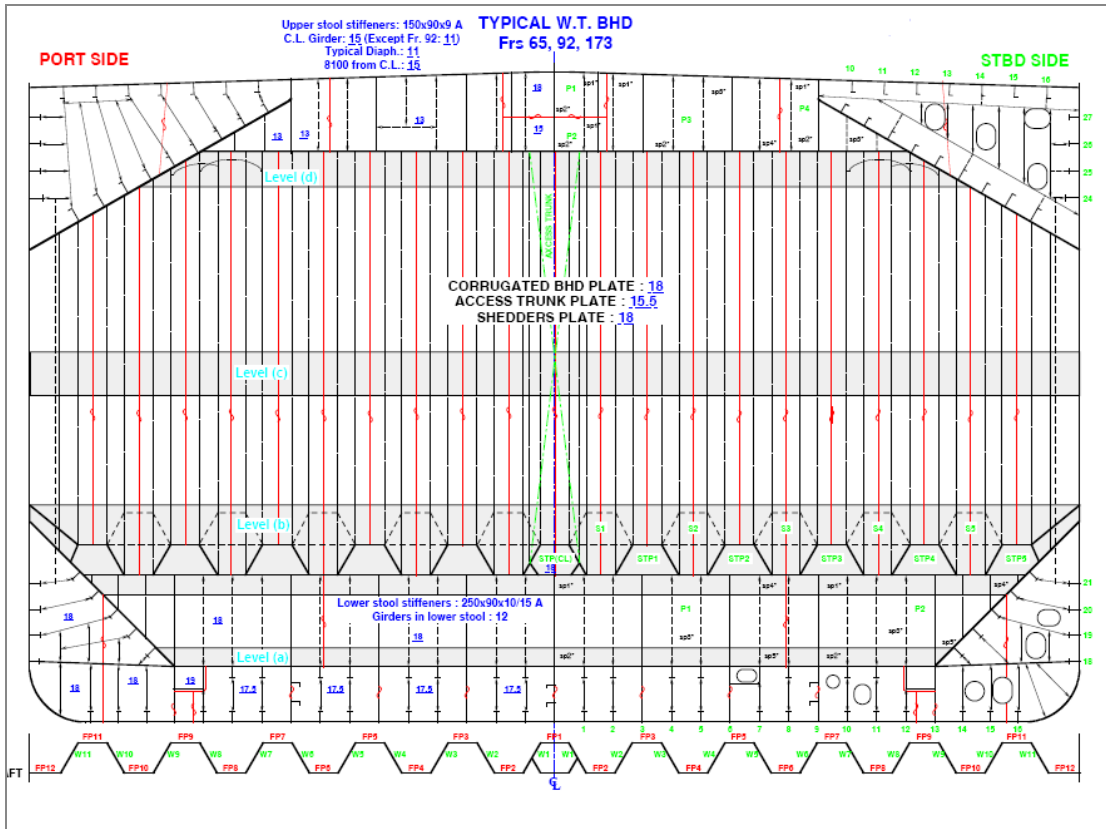
Section 2



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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 Lontitudinal 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.

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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.

Renewals Reports	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	
Renewed As Built	-	Frame No. 100	Bulkhead	S3	Starboard	-	15	14
Renewed other than A:	-	Frame No. 100	Bulkhead	S4	Port	-	15	15
All Renewals	-	Frame No. 100	Bulkhead	S5	Port	-	15	16
Exception Reports	-	Frame No. 100	Bulkhead	S5	Starboard	-	15	15
Missing Measurements:								
Excessive Diminution								
Substantial Corrosion								
Coated or Gauged Ann								
Deficient Transverse S								
Abnormally High Read								

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 - Stakes 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.

Complete (X)
Completion (F)
Part Held (P)

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

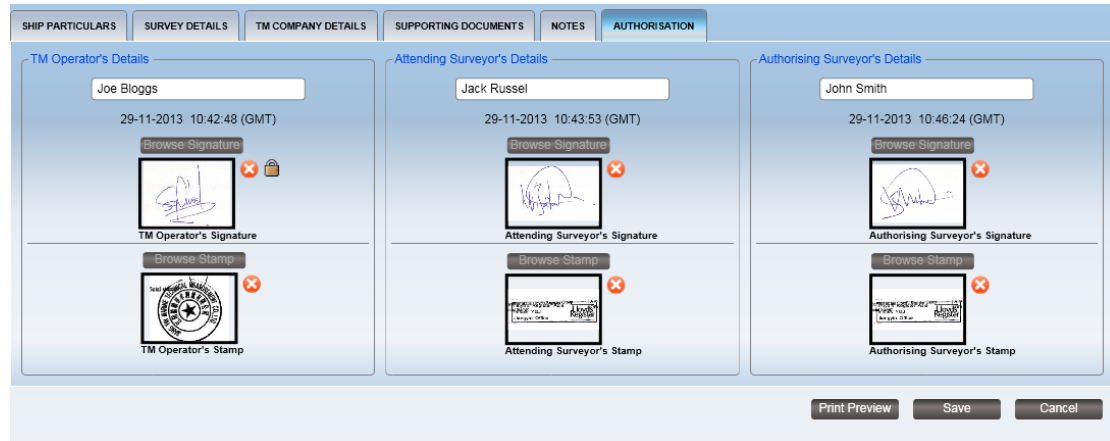
The new TM application has the option for authorised users to attach images of their signature and stamp to the final TM report. It is important to note that the system does not provide a way to control & manipulate the images uploaded to the report. Any image control must be applied outside the application.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

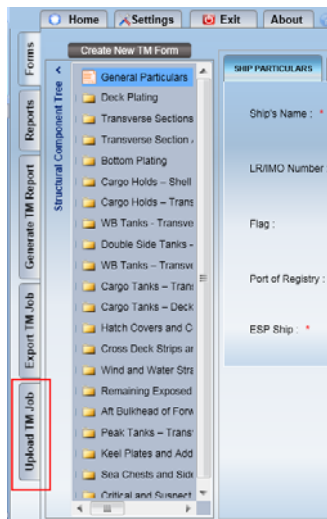
A Special Survey is not to be considered complete if any final TM Report(s) remains outstanding. If final TM Report(s) have not been credited by the Special Survey due date, then a suitable Condition of Class (HULL) is to be raised with a validity of no longer than three months after the due date.

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

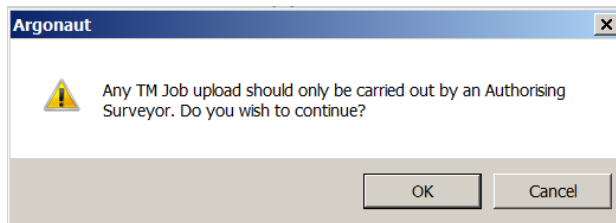
Reporting

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Section 2



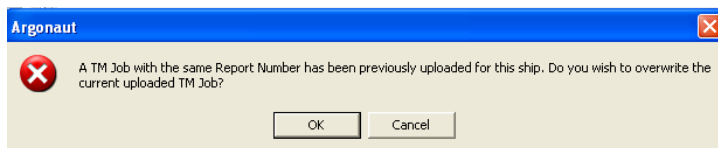
The following warning messages will appear:



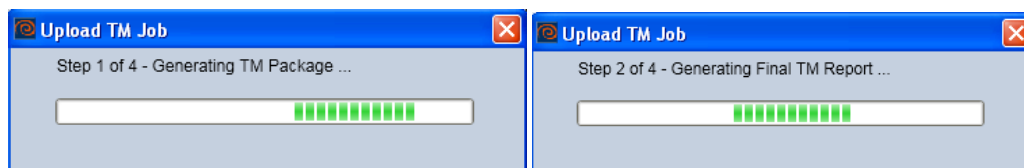
- If the report is not signed at the time of upload:

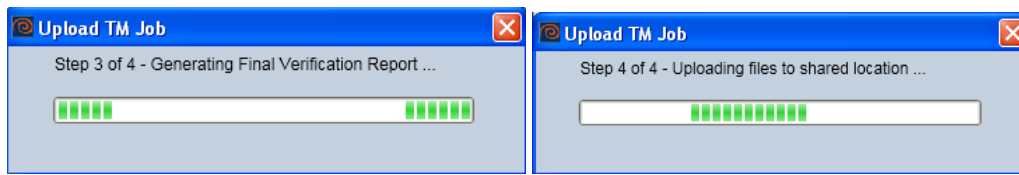


- If a report with same report number has been previously uploaded under the same LR number (Please note that the previous report will be overwritten by the new one).



- 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**:

Report Summary -							Survey -> Reports	
Database	Report Number	Last Visit Date/	Survey Code	Held Status	ESP Report	TM Job	Fee Report	
			AS	X				
			LLA	X				
			SCAH	X				
History	DBI0802056	18-11-2008	MOAH	X	Y	Y	Y	
			CCAH	X				
			MAAH	X				
			SEAH	X				
			RTP	X				
History	MCT0800046	19-09-2008	POLM	X	N	N	Y	
			MSRH	X				
History	DBI0801251	19-03-2008	HULL	X	Y	N	Y	
History	DBI0801077	23-01-2008	POLM	X	N	N	Y	
History	DBI0702137	27-12-2007	POLM	X	N	N	Y	
			CSM	P				
			SS	F				
			DS	X				
			AS	X				
			COCH1	X				
			HRPS	X				
History	DBI0701812	12-10-2007	SAFM	X	Y	Y	Y	
			PLRH	X				
			SCRH	X				
			MORH	X				
			CCRH	X				

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).

TM Job -
- TM Report

TM Report
 Verification Report
 TM Package (ZIP)

Download PDF

Ship Name: **PEARL**

LR No.:

Date of Build: **30-Sep-1982**

Flag: **MALTA**

ESP Vessel: **Yes**

Ship Type: **Tanker**

Gross Tons: **8750**

Deadweight: **13845**

Report Number: **DBI0701812**

First Visit: **19-Sep-2007**

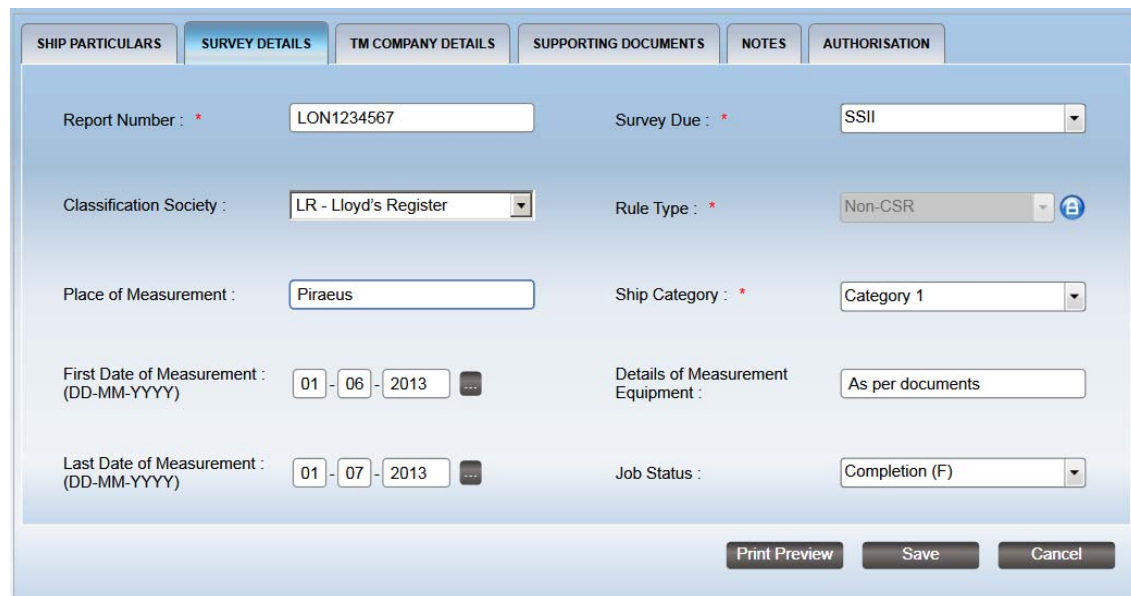
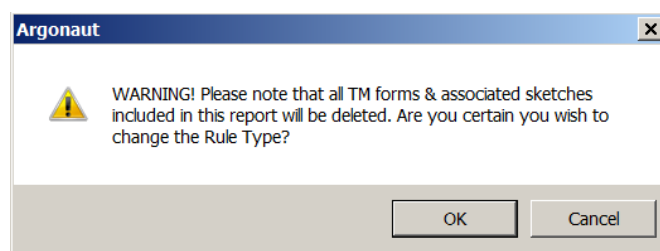
Last Visit: **12-Oct-2007**

No. of Visits: **8**

1.7.4 Thickness Measurement Reporting: TM Forms

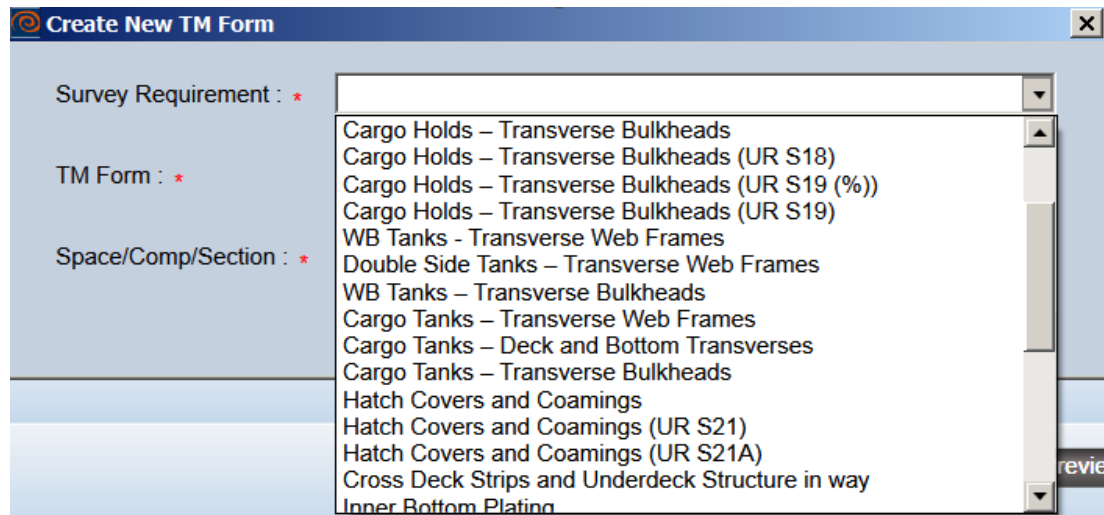
Thickness measurements are to be reported on the report form TM1 to TM8 as appropriate. There are two sets of forms, one for CSR ships and one for non-CSR ships. The LR TM reporting system will be able to provide the appropriate set of forms to the user, after user selects the **Rule Type** under the **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) : 

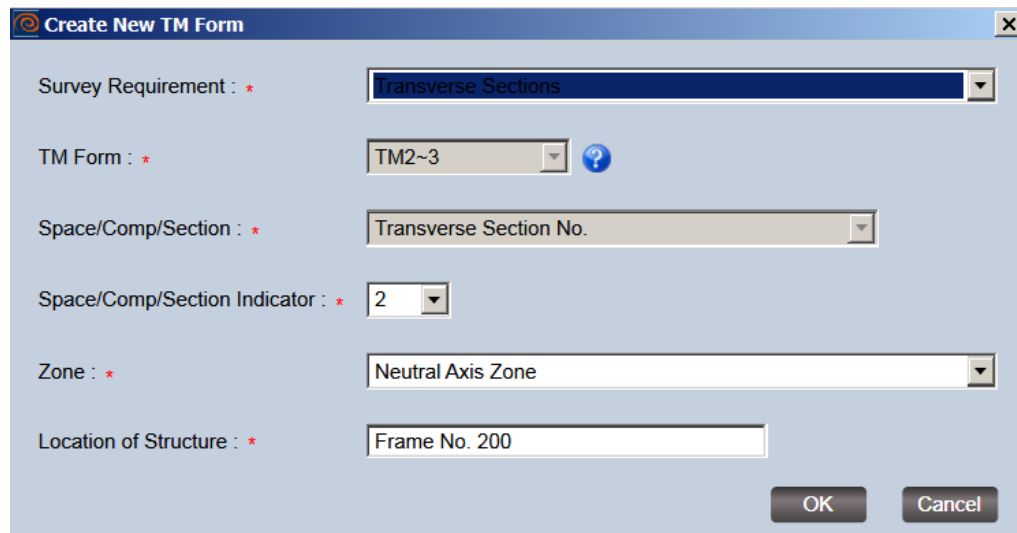



By selecting **Create New TM Form** a survey requirement drop down menu will provide various options to the user. By selecting the appropriate survey requirement any corresponding TM forms will be provided as an option. After selecting the TM form, further drop down menus will provide various options 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.

Create New TM Form



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.



Reporting

Part 1, Chapter 7

Section 2

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 <u>fully</u> 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.

Reporting

Part 1, Chapter 7

Section 2

CSR TM Forms

<u>TM1 CSR</u>	is to be used for reporting the thickness measurement of deck plating, bottom shell plating and side shell plating within the cargo length area.
<u>TM2~3 CSR</u>	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.
<u>TM4 CSR</u>	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.
<u>TM5 CSR</u>	is to be used for reporting the thickness measurement of W.T. transverse bulkheads where appropriate.
<u>TM6 CSR</u>	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.
<u>TM7 CSR</u>	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 <u>fully</u> reported onto an additional TM form e.g. TM6.
<u>TM8 CSR</u>	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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Marine

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Thickness measurement and close-up survey guidance

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

FEBRUARY 2017 Ver.7.4



Part 2 – Special Survey Requirements

Chapter	1	Thickness Measurement Requirements	(2.1)
Section	1	Other Ship types – General	(2.1.1)
	2	General Dry Cargo ships	(2.1.2)
Chapter	2	Close-Up Survey Requirements	(2.2)
Section	1	General Dry Cargo ships	(2.2.1)
Chapter	3	Substantial Corrosion	(2.3)
Section	1	Additional Requirements in way of Structure Identified with Substantial Corrosion	(2.3.1)

2.1 Thickness Measurement Requirements

Table 2.1.1 Minimum requirements for thickness measurement– General

Requirements based on Pt 1, Ch 3,5 TABLE 3.5.3 of the <i>Rules and Regulations for the Classification of Ships</i>		
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 8.	(1) Within 0,5L amidships; 2 transverse sections in way of two different cargo spaces . See Notes 2, 4(a), 5 and 7.	(1) Within 0,5L amidships; a minimum of 3 transverse sections in way of cargo spaces. See Notes 2, 4(b) and 7.
Special Survey II (Ships 10 years old)	(2) All cargo hold hatch covers and coamings (plating and stiffeners). See Note 9.	(2) All cargo hold hatch covers and coamings (plating and stiffeners). See Note 9.
(1) Within 0,5L amidships; 1 transverse section of deck plating in way of a cargo space. See Note 2 and 7.	(3) All transverse webs with associated plating and longitudinals, and the transverse bulkhead complete in the fore peak tank and aft peak tank . See Note 6.	(3) All exposed main deck plating over full length of ship.
(2) Suspect areas, as required by the Surveyor. See Note 8.	(4) Suspect areas, as required by the Surveyor. See Note 8.	(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) All transverse webs with associated plating and longitudinals, and the transverse bulkhead complete in the fore peak tank and aft peak 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.
<p>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.</p> <p>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.</p>		

Note 3. Where the protective coating is in GOOD condition, then the extent of thickness measurements 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.	(1) Within 0,5L amidships; 2 transverse sections in way of two different cargo spaces. See Notes 2 and 4(a).	(1) Within the cargo length area:
Special Survey II (Ships 10 years old)	(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 .	(i) A minimum of three transverse sections within the amidships 0,5L. See Notes 2 & 4(b).
(1) Within 0,5L amidships; 1 transverse section of deck plating in way of a cargo space. See Note 2.	(3) Within the cargo length area; each deck plate outside line of cargo hatch openings. See Note 6.	(ii) Each deck plate outside the line of cargo hatch openings. See Note 6.
(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.	(4) All wind and water strakes within the cargo length area.	(iii) Each bottom plate, including lower turn of bilge
(3) Suspect areas, as required by the Surveyor. See Note 3.	(5) Selected wind and water strakes outside the cargo length area.	(iv) Duct keel or pipe tunnel plating and internals.
	(6)	(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 .
	(7) Suspect areas, as required by the Surveyor. See Note 3.	(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 of sea 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 <i>Rules and Regulations for the Classification of Ships</i>			
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)
<p>(1) Selected shell frames in one forward and one aft cargo hold and associated 'tween deck spaces.</p> <p>(2) One selected cargo hold transverse bulkhead.</p> <p>(3) All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2.</p>	<p>(1) Selected shell frames in all cargo holds and 'tween deck spaces.</p> <p>(2) One transverse bulkhead in each cargo hold, including stiffening system.</p> <p>(3) Forward and aft transverse bulkhead in one side ballast tank, including stiffening system.</p> <p>(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).</p> <p>(5) All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2.</p> <p>(6) Selected areas of all deck plating and underdeck structure inside the line of hatch openings between cargo hold hatches.</p> <p>(7) Selected areas of inner bottom plating.</p>	<p>(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.</p> <p>(2) All cargo hold transverse bulkheads, including stiffening system.</p> <p>(3) All transverse bulkheads in ballast tanks, including stiffening system.</p> <p>(4) All transverse webs with associated plating and framing in each water ballast tank.</p> <p>(5) All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2.</p> <p>(6) All deck plating and underdeck structure and inside the line of hatch openings between cargo hold hatches.</p> <p>(7) All areas of inner bottom plating.</p>	<p>(1) All shell frames in all cargo holds and 'tween deck spaces, including their upper and lower end attachments and adjacent shell plating.</p> <p>(2) All cargo hold transverse bulkheads, including stiffening system.</p> <p>(3) All transverse bulkheads in ballast tanks, including stiffening system.</p> <p>(4) All transverse webs with associated plating and framing in each water ballast tank.</p> <p>(5) All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2.</p> <p>(6) All deck plating and underdeck structure inside the line of hatch openings between cargo hold hatches.</p> <p>(7) All areas of inner bottom plating.</p>
<p>Note 1. Close-up survey of cargo hold transverse bulkheads to be carried out at the following areas:</p> <p>(a) Immediately above the inner bottom and immediately above the 'tween decks, as applicable.</p> <p>(b) Mid-height of the bulkhead for the holds without 'tween decks.</p> <p>(c) Immediately below the main deck plating and 'tween deck plating.</p> <p>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.</p>			

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 <i>Rules and Regulations for the Classification of Ships</i>		
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

FEBRUARY 2017 Ver.7.4

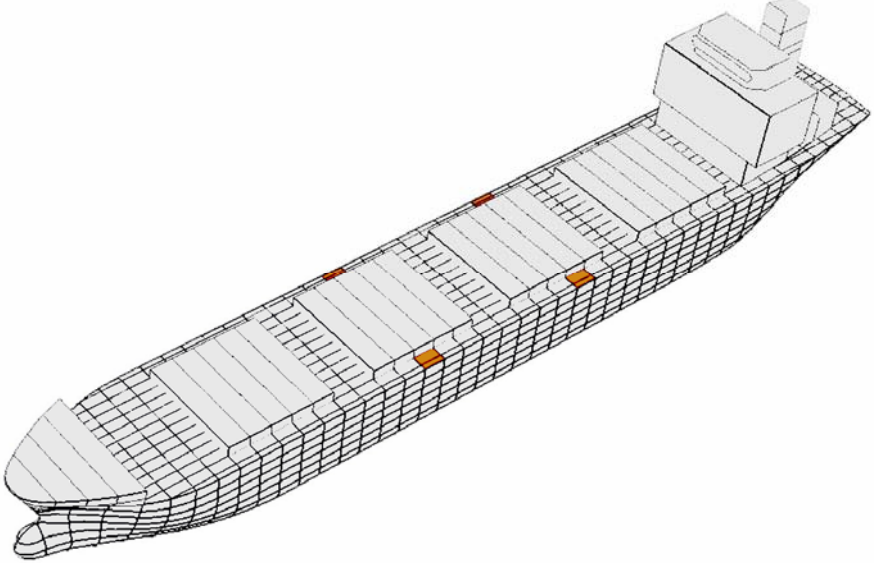


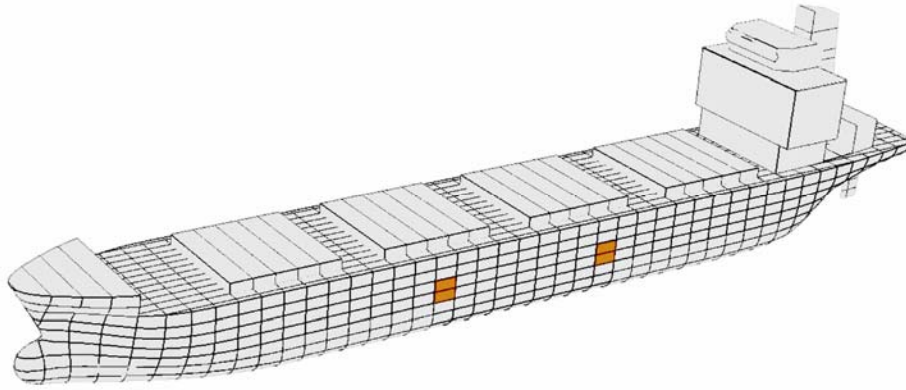
Part 3 – Special Survey Requirements

Chapter	1	Thickness Measurement Requirements	(3.1)
Section	1	Single and Double Skin Bulk Carriers	(3.1.1)
Chapter	2	Close-Up Survey Requirements	(3.2)
Section	1	Single Skin Bulk Carriers	(3.2.1)
	2	Double Skin Bulk Carriers	(3.2.2)
	3	Ore Carriers	(3.2.3)
Chapter	3	Substantial Corrosion	(3.3)
Section	1	Single Skin Bulk Carriers – Shell Plating and Stiffening with Substantial Corrosion	(3.3.1)
	2	Single Skin Bulk Carriers – Double Bottom and Hopper Structure with Substantial Corrosion	(3.3.2)
	3	Single and Double Skin Bulk Carriers – Transverse Bulkheads in Cargo Holds with Substantial Corrosion	(3.3.3)
	4	Single and Double Skin Bulk Carriers – Deck Structure including Cross Strips, Main Cargo Hatchways, Hatch Covers, Coamings and Topside Tanks with Substantial Corrosion	(3.3.4)
	5	Double Skin Bulk Carriers – Bottom, Inner Bottom and Hopper Structure with Substantial Corrosion	(3.3.5)
	6	Double Skin Bulk Carriers – Double Side Space Structure, (including Wing Void spaces of Ore Carriers) with Substantial Corrosion	(3.3.6)

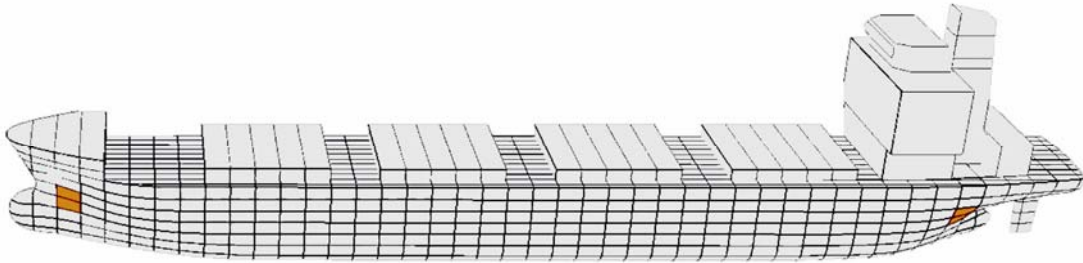
3.1 Thickness Measurement Requirements

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 <i>Rules and Regulations for the Classification of Ships</i>
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.



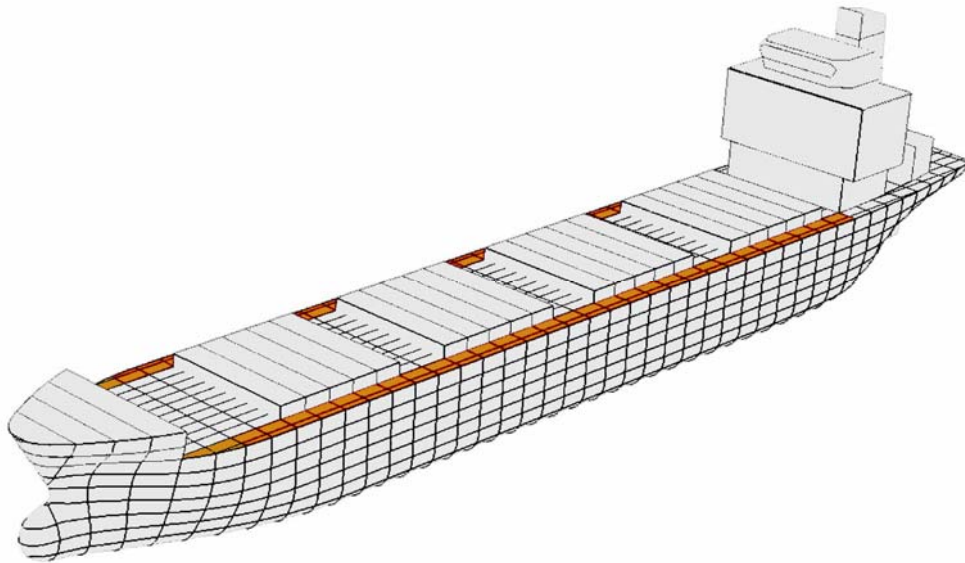
(3) Wind and water strakes in way of the transverse sections considered in (1).



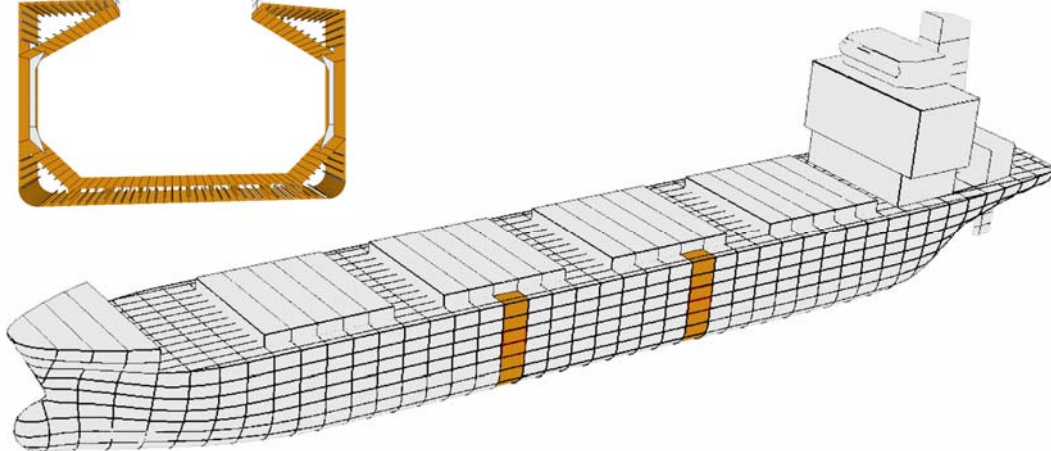
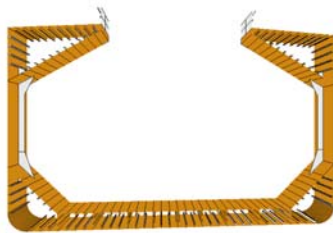
(4) Selected wind and water strakes outside the cargo length area.

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

SPECIAL SURVEY III (Ships 15 Years Old)

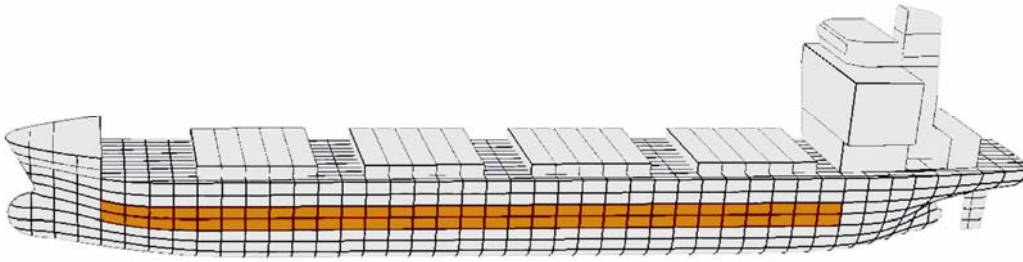


- (1) Within the cargo length area:
 (a) Each deck plate outside line of cargo hatch openings

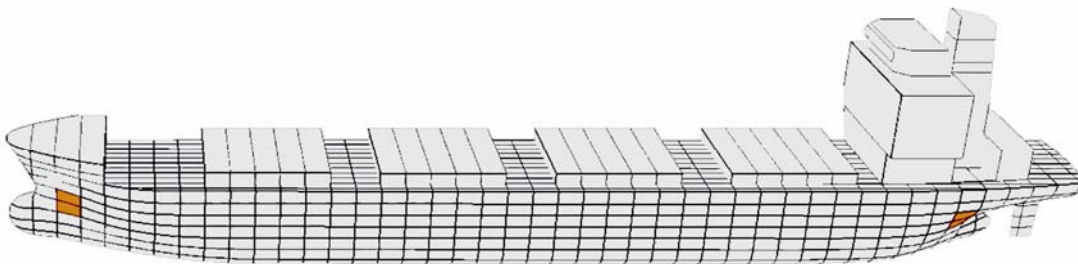


- (1) Within the cargo length area:
 (b) 2 transverse sections, outside line of cargo hatch openings. (A minimum of 1 of the above transverse sections is to be within $0.5L$ amidships). See Notes 2 and 6.

(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.

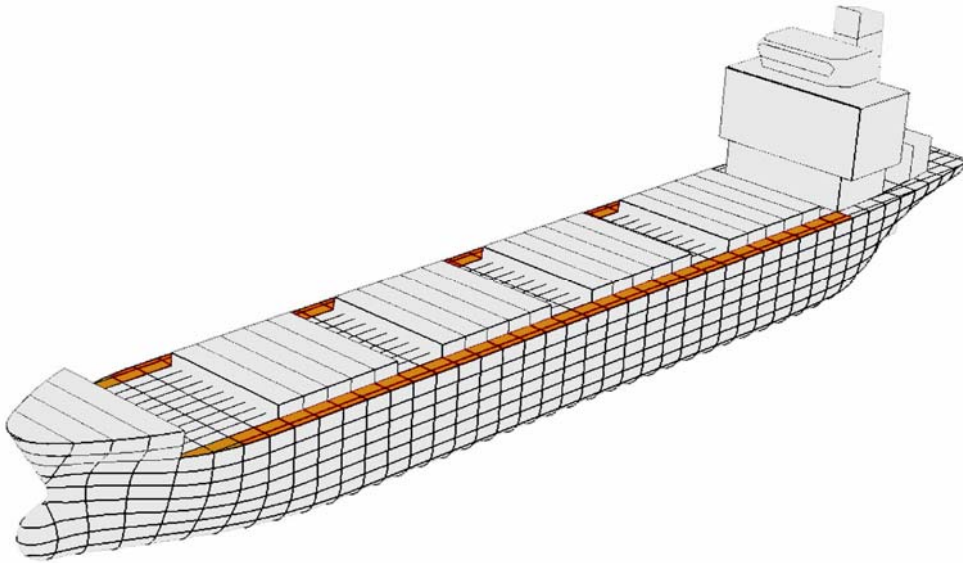
Thickness Measurement

Part 3, Chapter 1

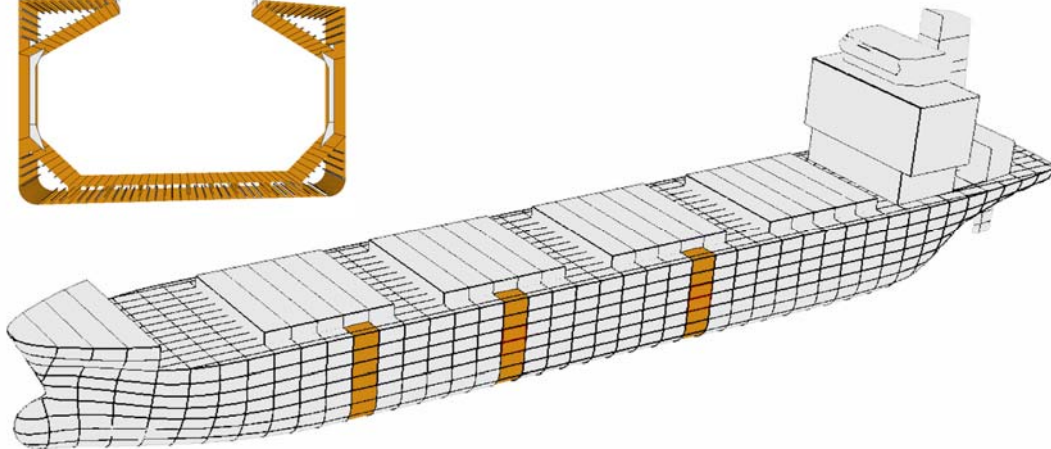
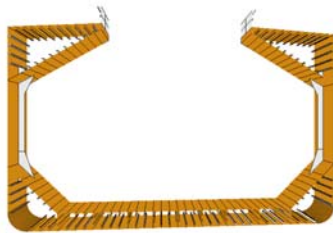
Single And Double Skin Bulk Carriers

Section 1

SPECIAL SURVEY IV (Ships 20 Years Old)



- (1) Within the cargo length area:
 - (a) each deck plate outside line of cargo hatch openings.



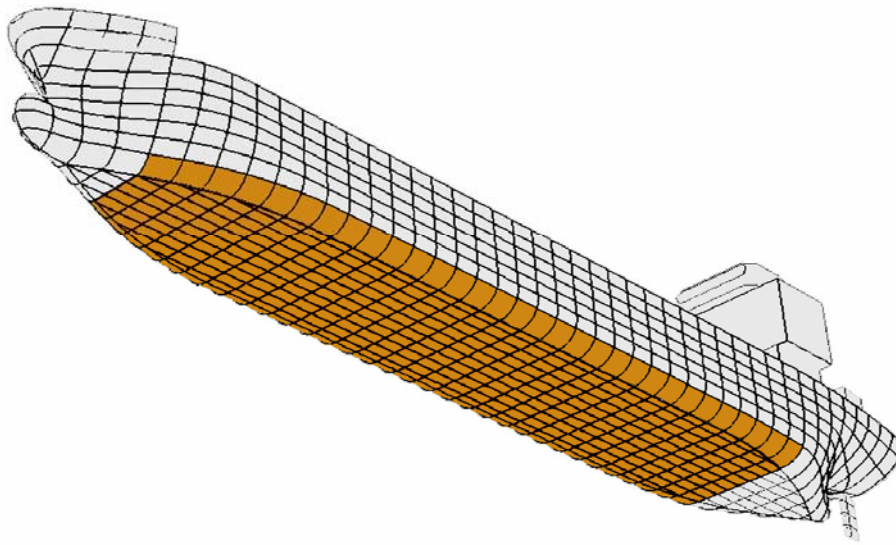
- (1) Within the cargo area:
 - (b) 3 transverse sections, outside line of cargo hatch openings. (A minimum of 2 of the above transverse sections is to be within 0,5L amidships.) See Notes 2 and 6.

Thickness Measurement

Part 3, Chapter 1

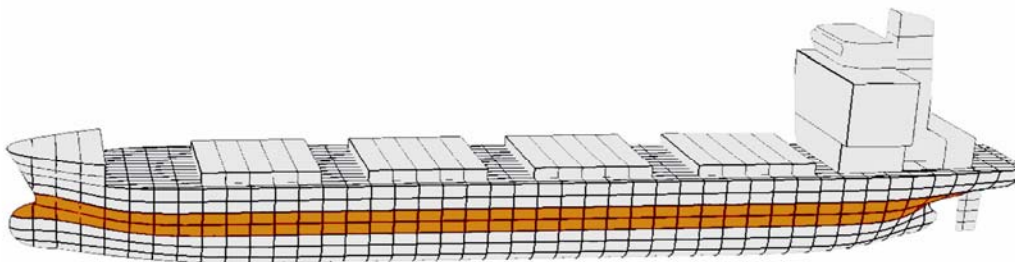
Single And Double Skin Bulk Carriers

Section 1



(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.



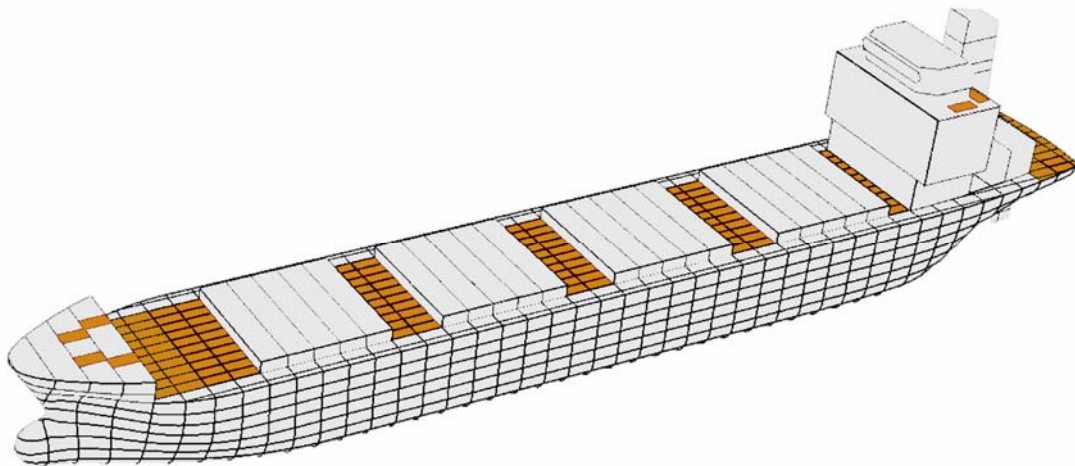
(3) All wind and water strakes over the full length of the ship, port and starboard. (Wind and Water Strake: the strakes of a ship's side shell plating between the ballast and the deepest load waterline).

Thickness Measurement

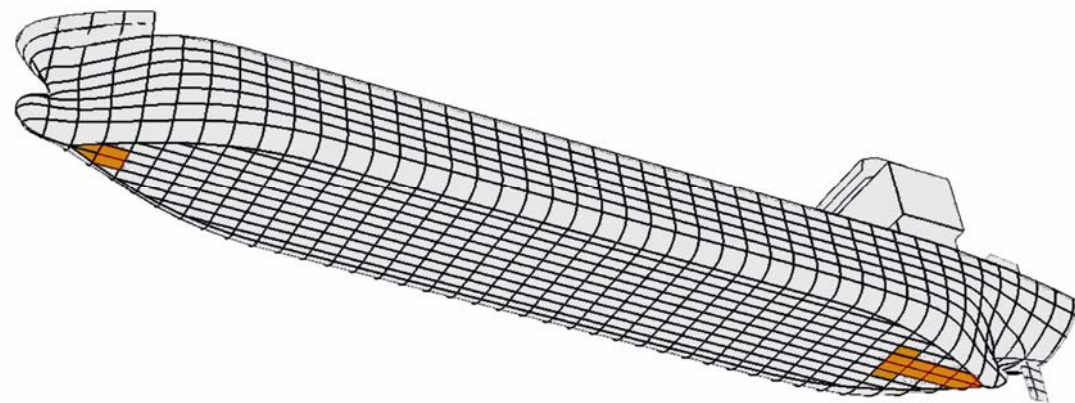
Part 3, Chapter 1

Single And Double Skin Bulk Carriers

Section 1



(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.

Thickness Measurement

Part 3, Chapter 1

Single And Double Skin Bulk Carriers

Section 1

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.

Close-up Survey

Part 3, Chapter 2

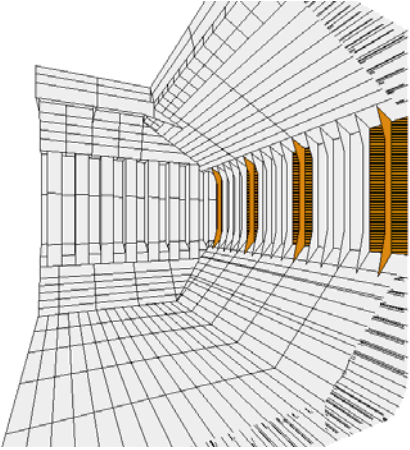
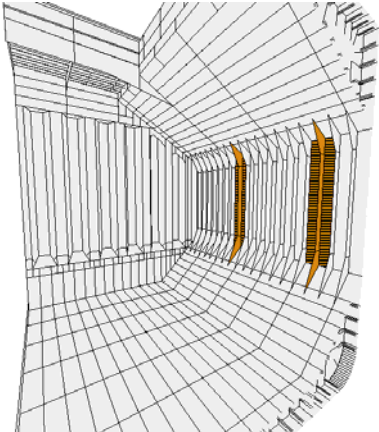
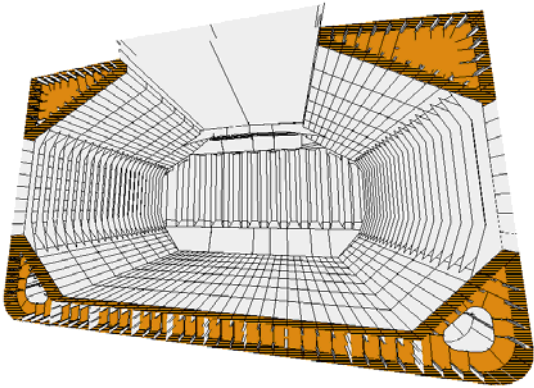
Single Skin Bulk Carriers – SS1

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*

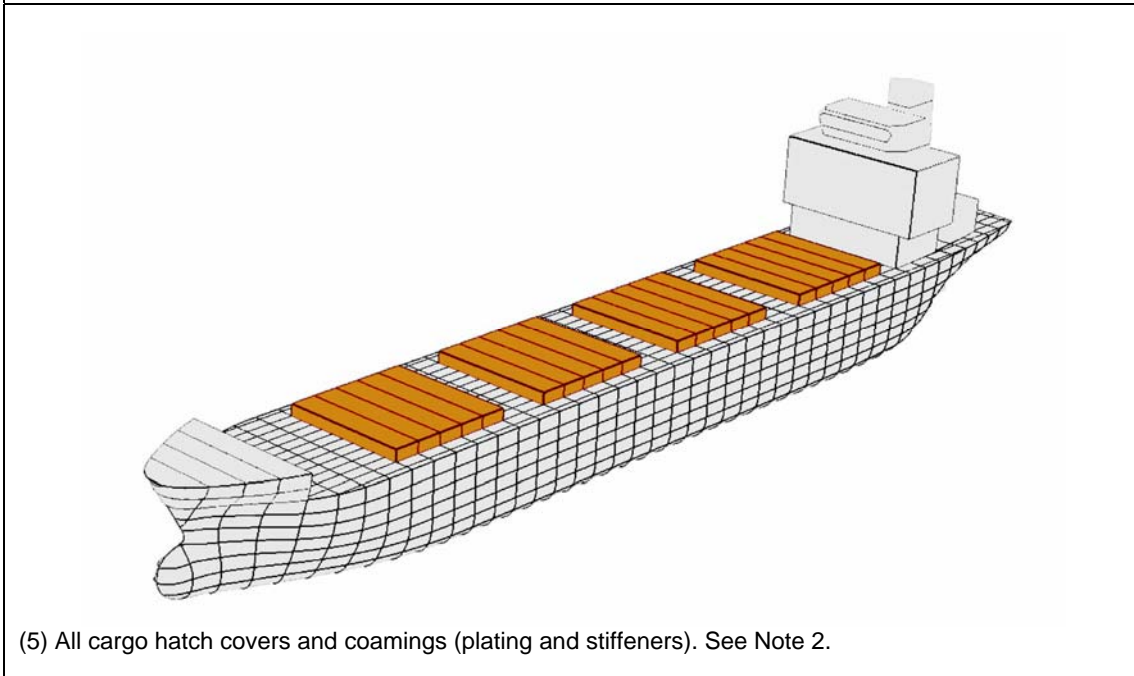
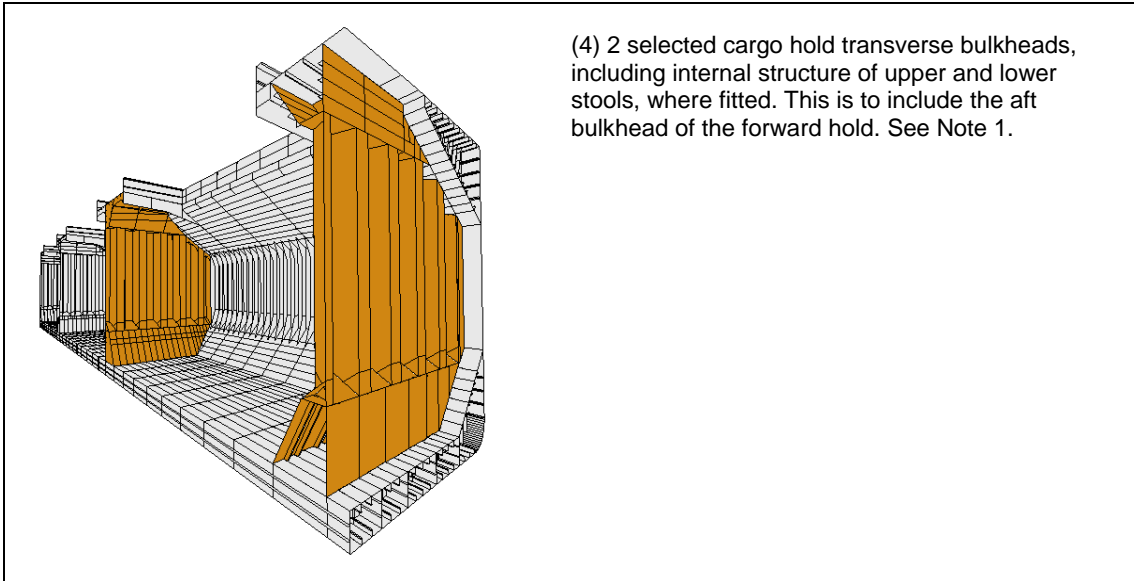
SPECIAL SURVEY I (Ships 5 Years Old)	
	<p>(1) 25% of shell frames and their end attachments in the forward cargo hold at representative positions.</p>
	<p>(2) Selected shell frames and their end attachments in remaining cargo holds.</p>
	<p>(3) 1 transverse web with associated plating and longitudinals in 2 representative water ballast tanks of each type (i.e. topside, peak, double bottom and hopper side tank).</p>

Close-up Survey

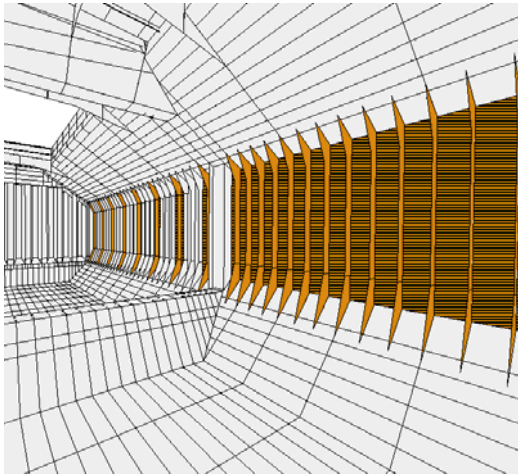
Part 3, Chapter 2

Single Skin Bulk Carriers – SS1

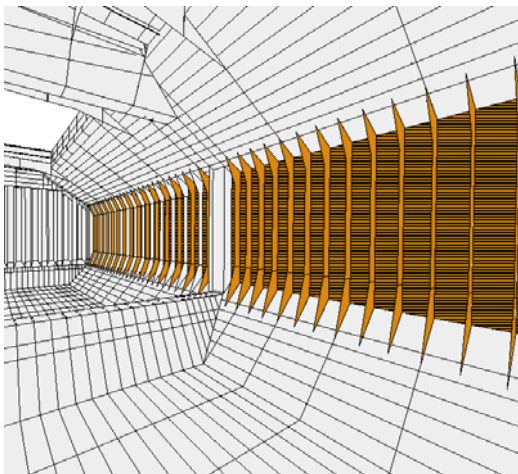
Section 1



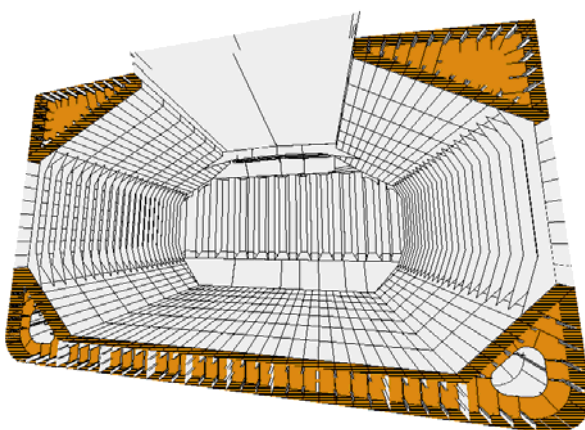
SPECIAL SURVEY II (Ships 10 Years Old)



(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.



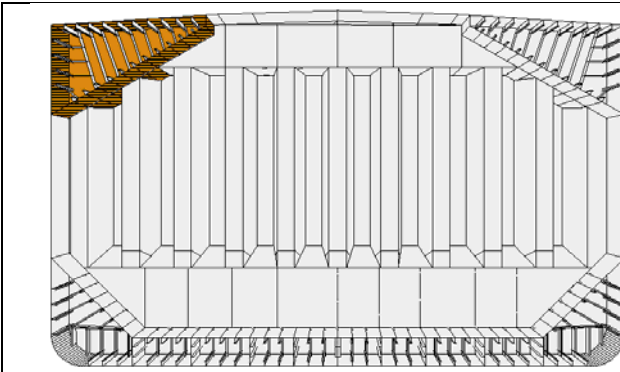
(2) 1 transverse web with associated plating and longitudinals in each water ballast tank

Close-up Survey

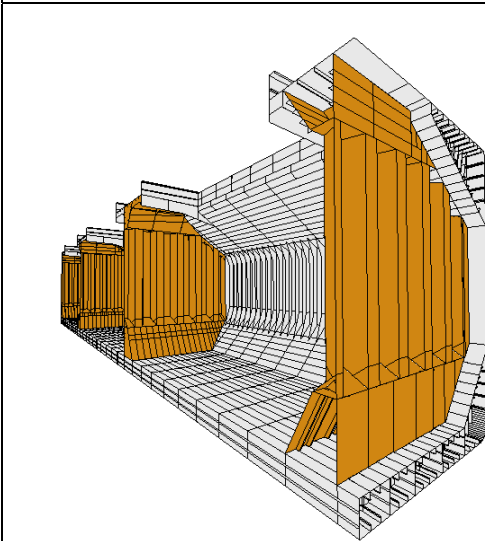
Part 3, Chapter 2

Single Skin Bulk Carriers – SS2

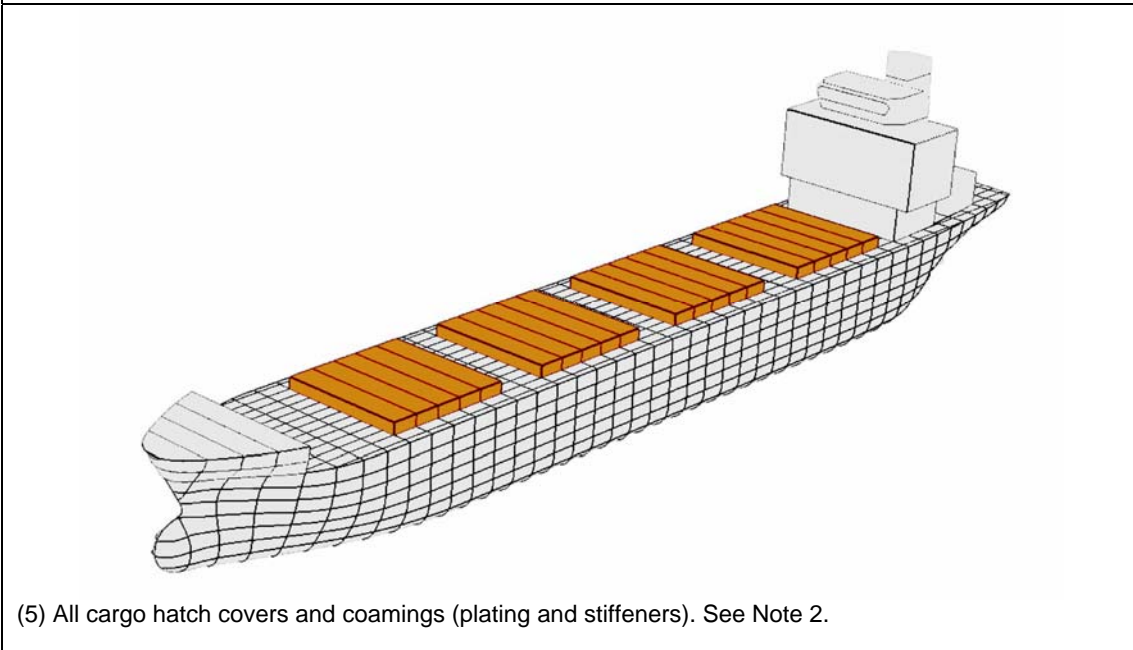
Section 1



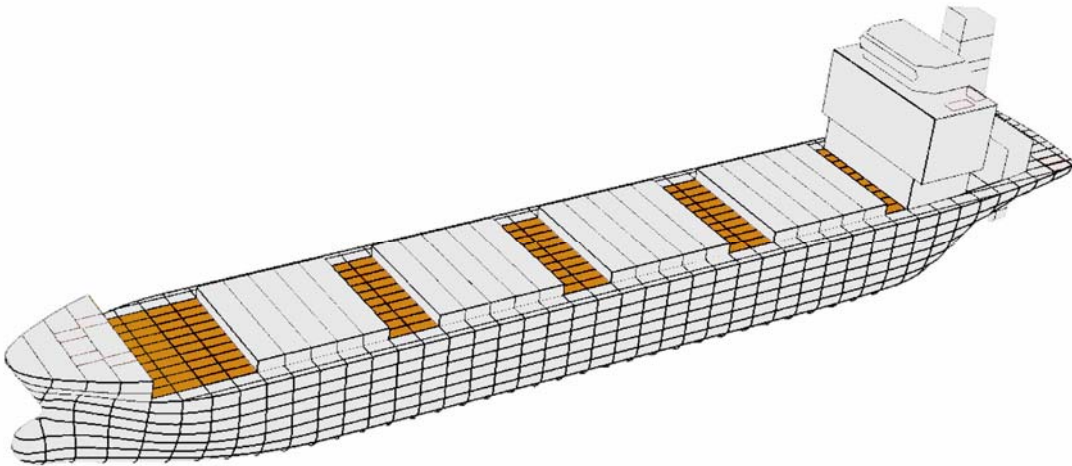
(3) Forward and aft transverse bulkhead in 1 side ballast tank, including stiffening system



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

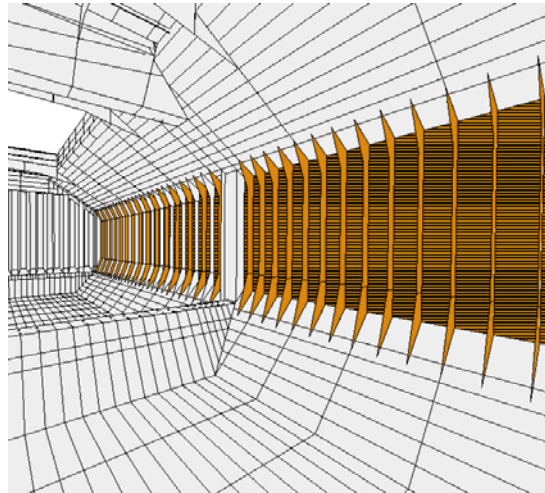


(5) All cargo hatch covers and coamings (plating and stiffeners). See Note 2.

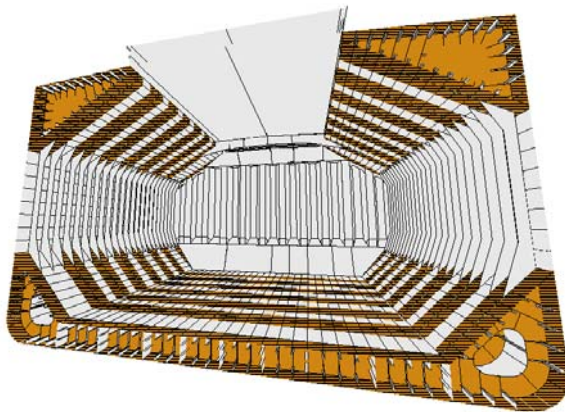


(6) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches

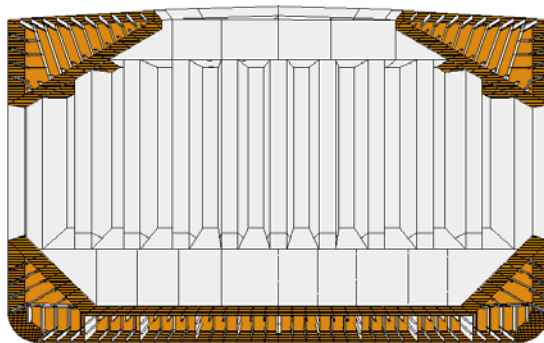
SPECIAL SURVEY III (Ships 15 Years Old)



(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.



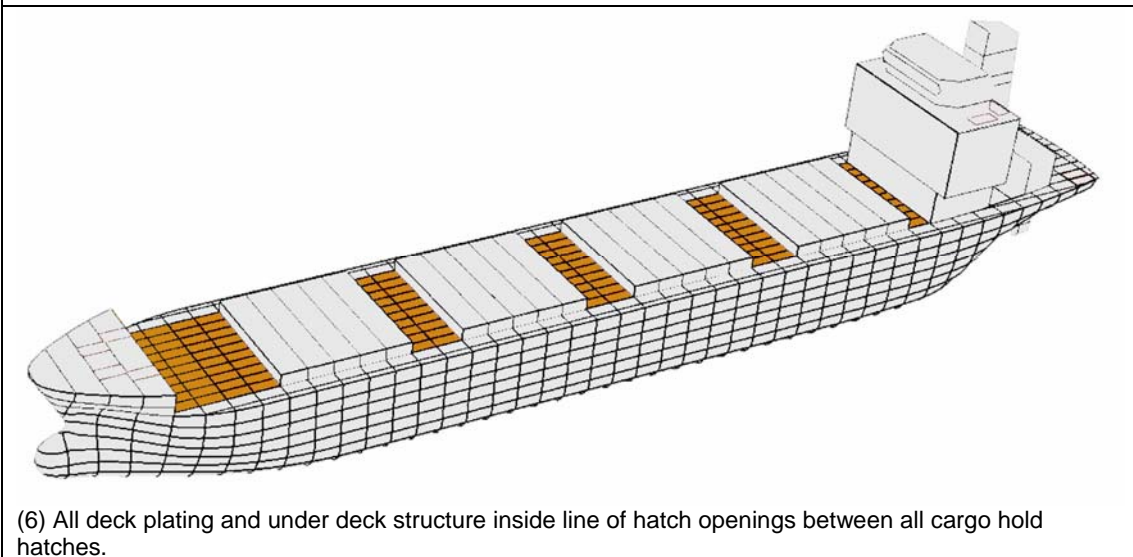
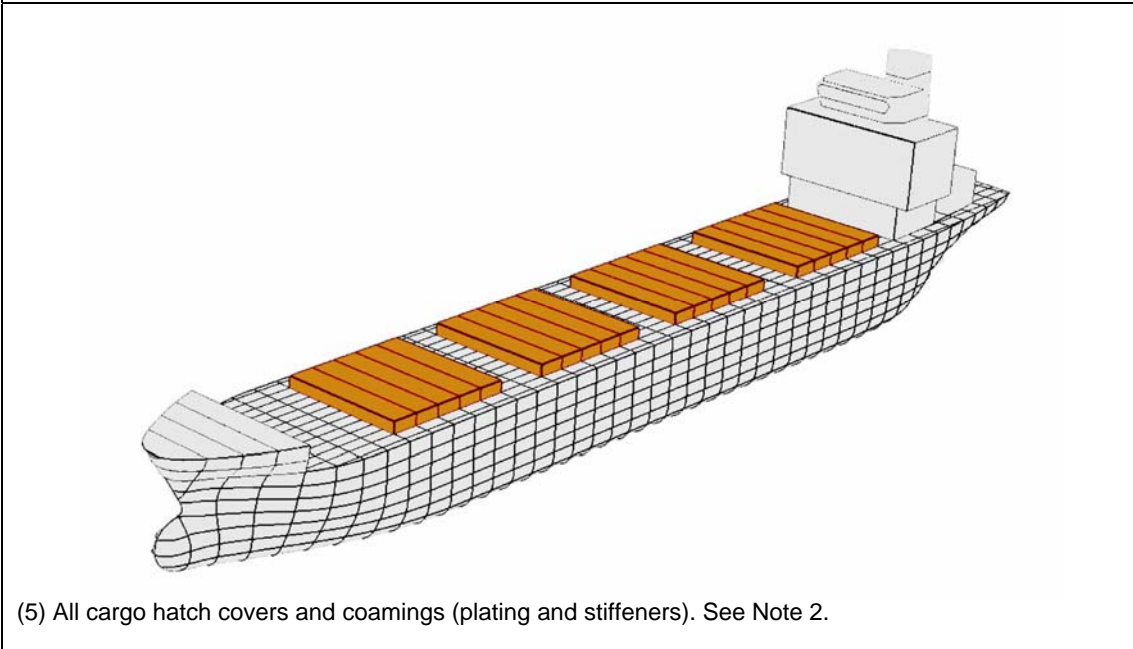
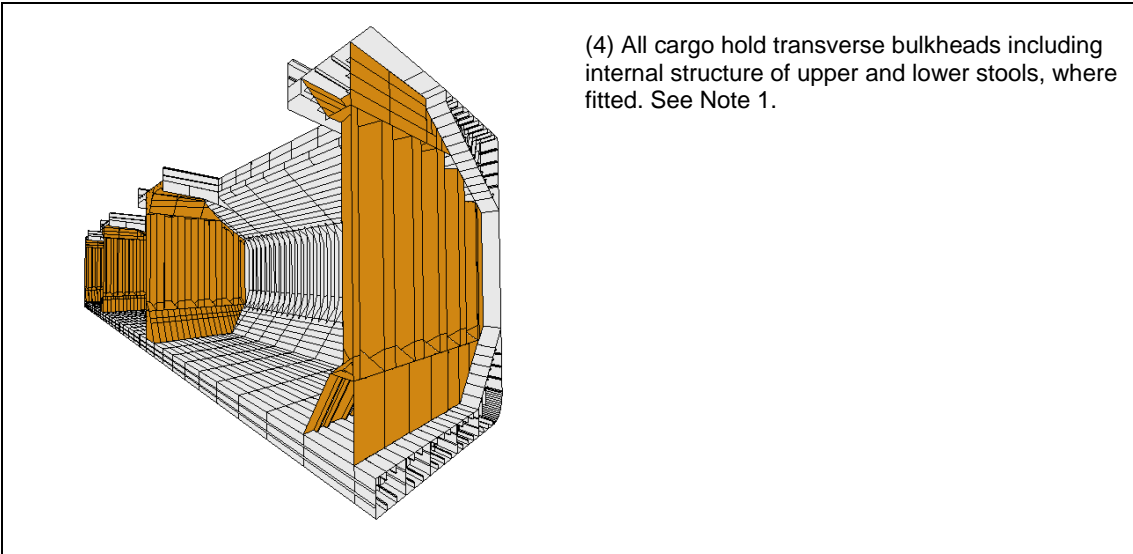
(3) All transverse bulkheads in ballast tanks, including stiffening system.

Close-up Survey

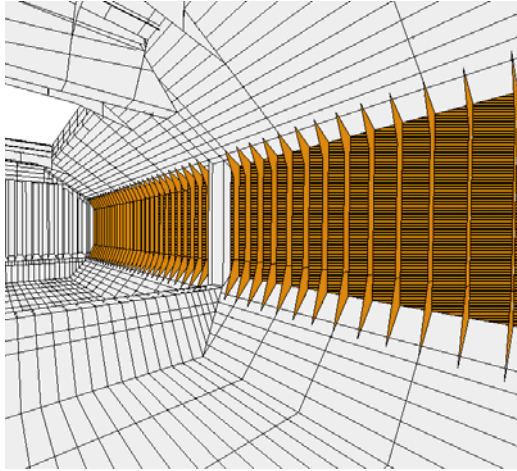
Part 3, Chapter 2

Single Skin Bulk Carriers – SS3

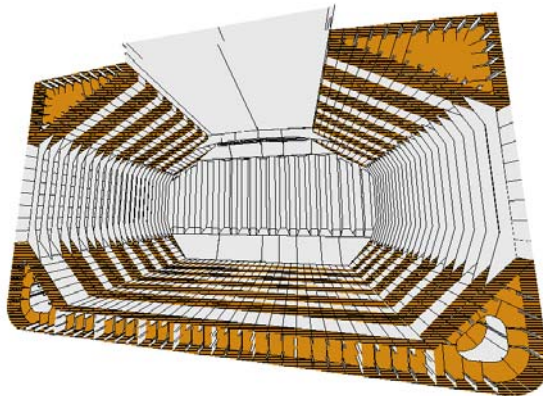
Section 1



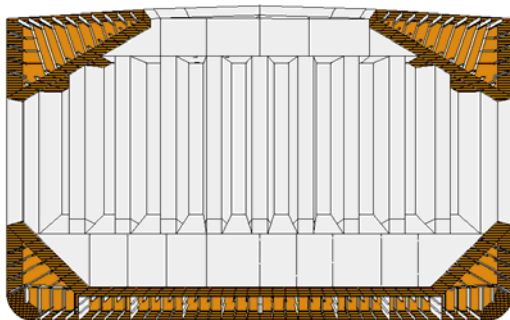
SPECIAL SURVEY IV (Ships 20 Years Old)



(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.



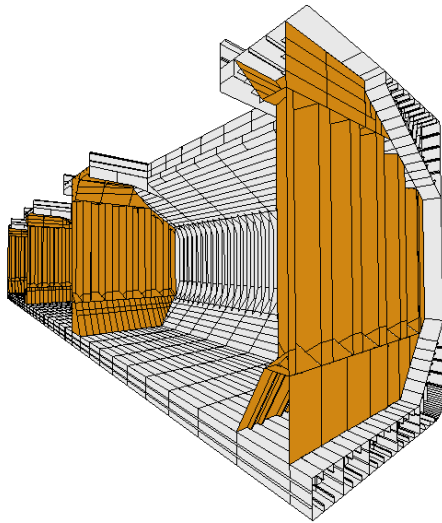
(3) All transverse bulkheads in ballast tanks, including stiffening system

Close-up Survey

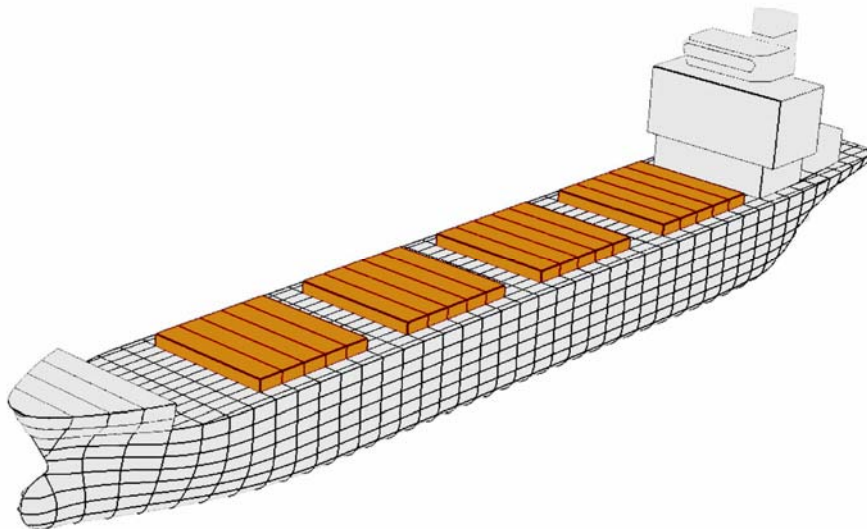
Part 3, Chapter 2

Single Skin Bulk Carriers – SS4

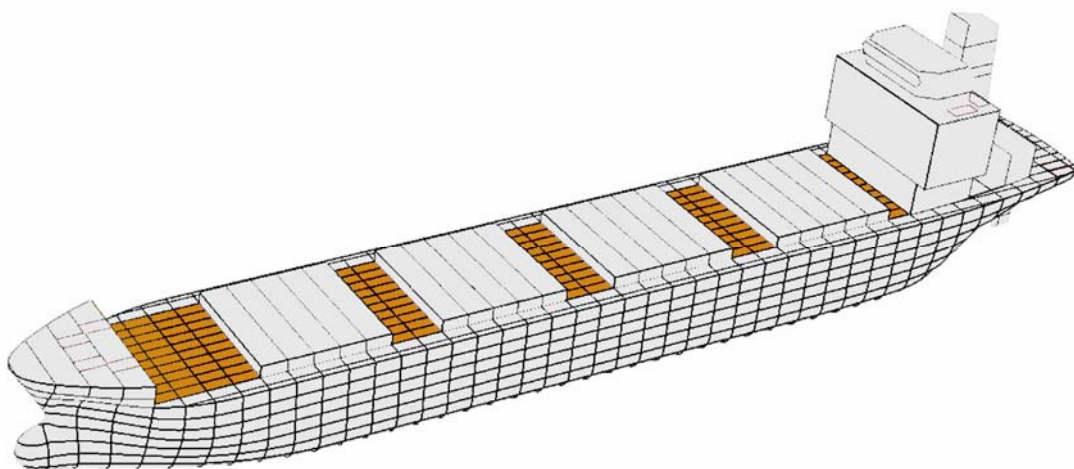
Section 1



(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

Close-up Survey

Part 3, Chapter 2

Single Skin Bulk Carriers – SS4

Section 1

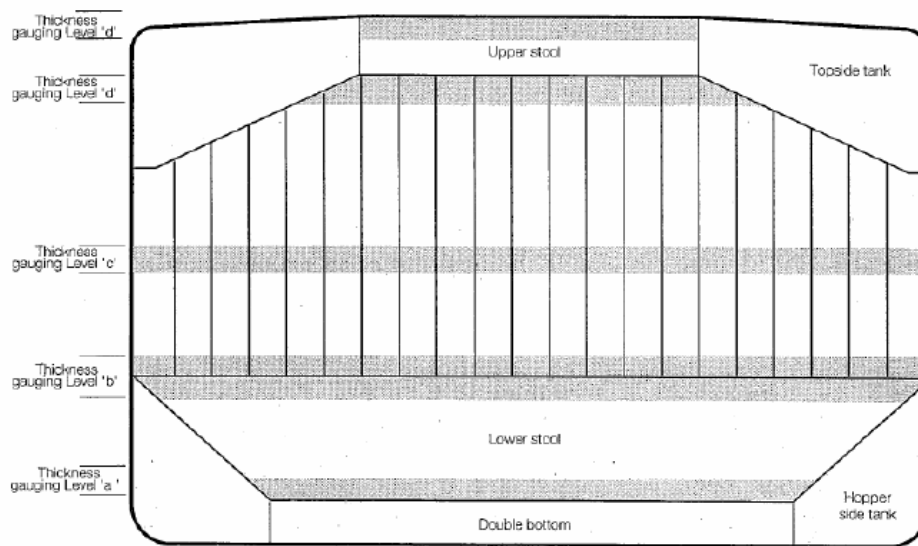
Note 1. Close-up Survey of transverse bulkheads to be carried out at four levels:

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.

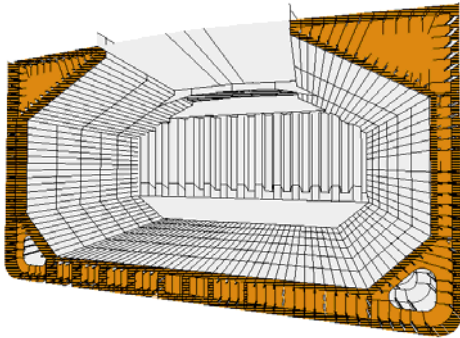


Note 2. Subject to cargo hold hatch covers of approved design (which structurally have no access to the internals), close-up survey/thickness measurement shall be done of accessible parts of hatch covers structures.

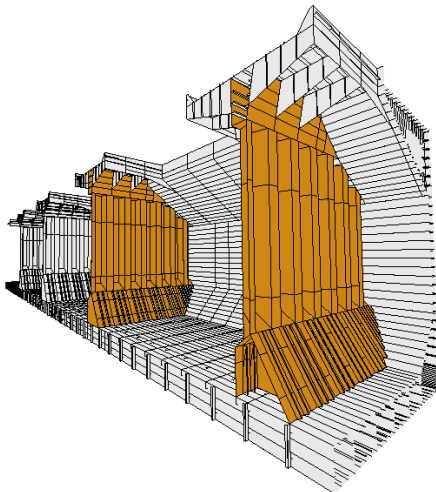
Table 3.2.2 Minimum requirements for Close-up Survey - Double Skin Bulk Carriers

Requirements based on Pt 1, Ch 3,6 TABLE 3.6.2 of the *Rules and Regulations for the Classification of Ships*

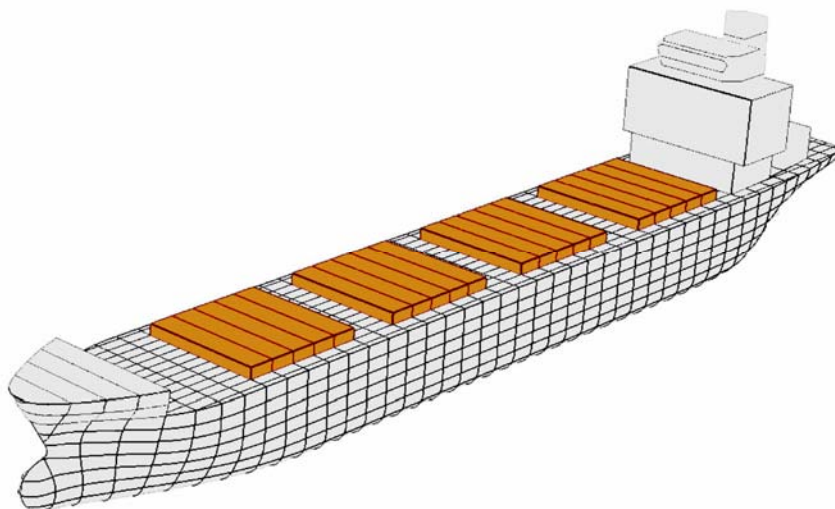
SPECIAL SURVEY I (Ships 5 Years Old)



(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.

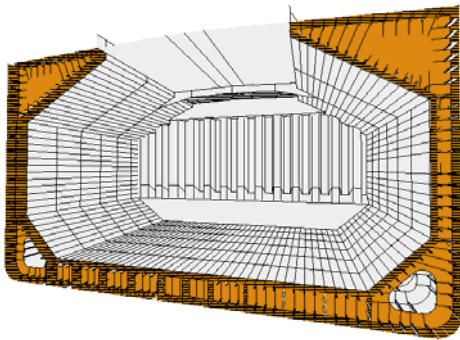


(2) 2 Selected cargo hold transverse bulkheads including internal structure of upper and lower stools, where fitted. See Note 1.

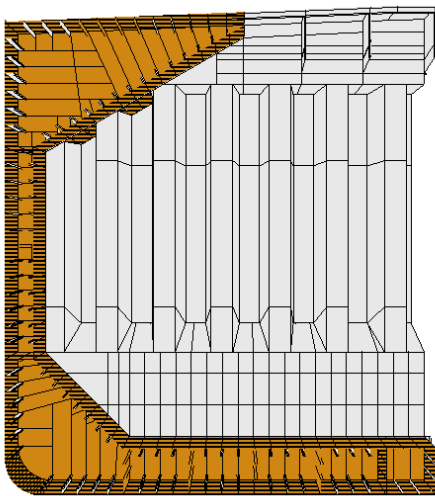


(3) All cargo hatch covers and coamings (plating and stiffeners). See Note 2.

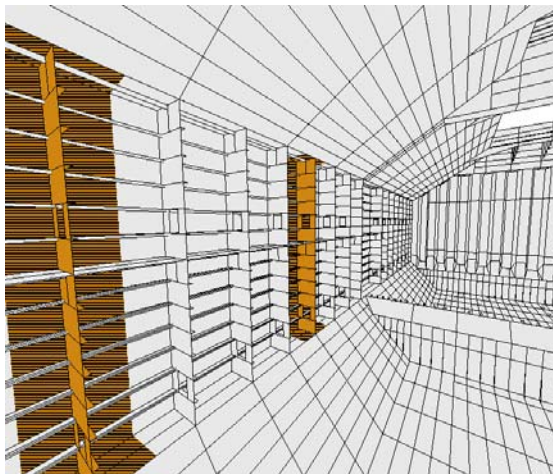
SPECIAL SURVEY II (Ships 10 Years Old)



(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.



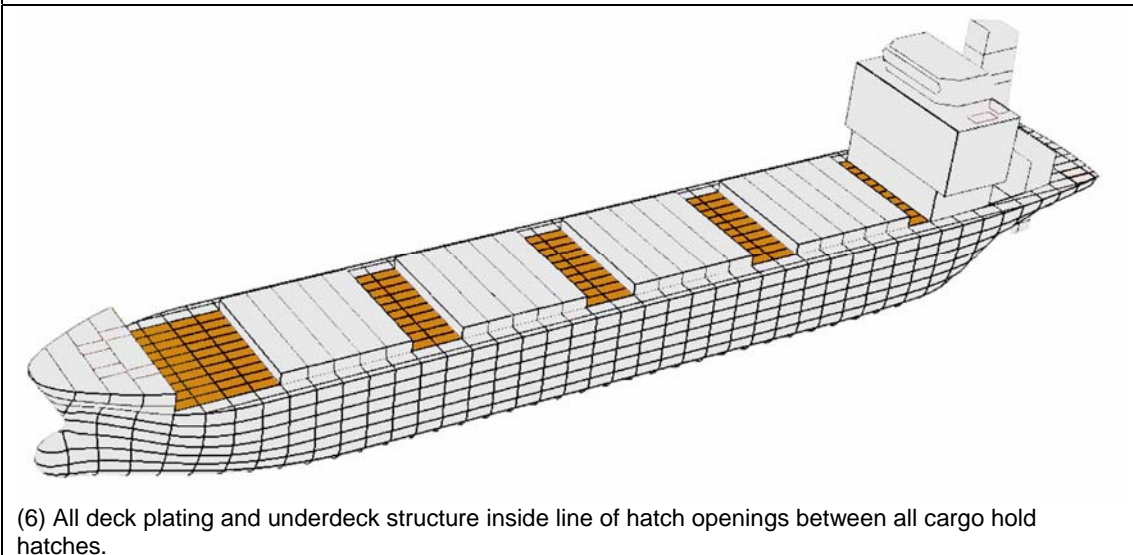
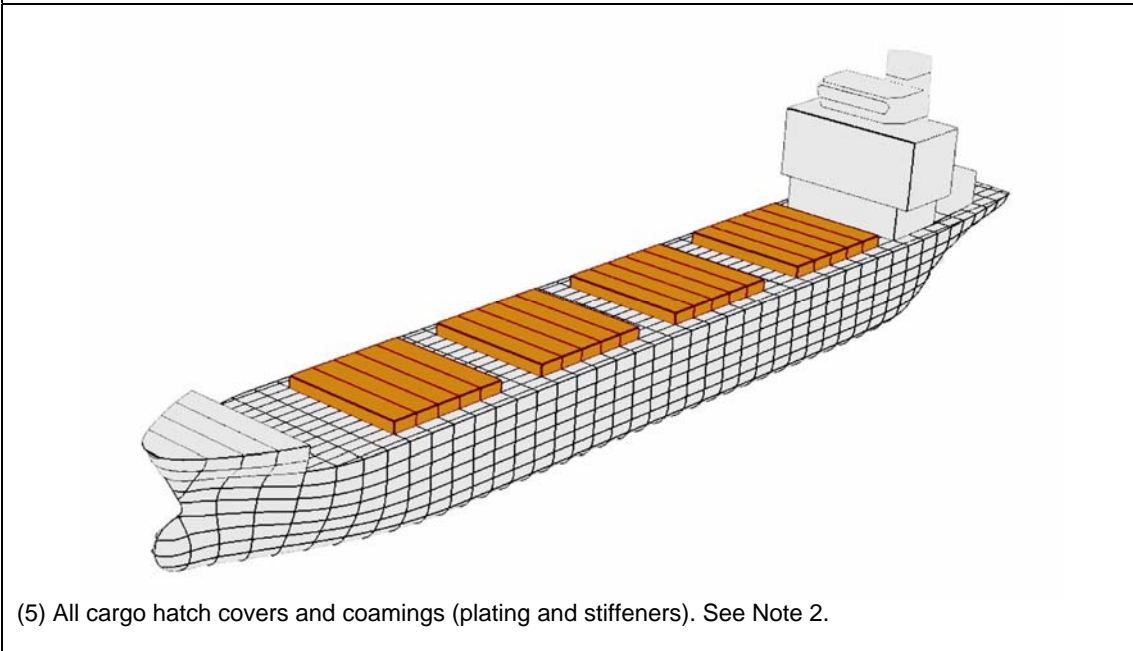
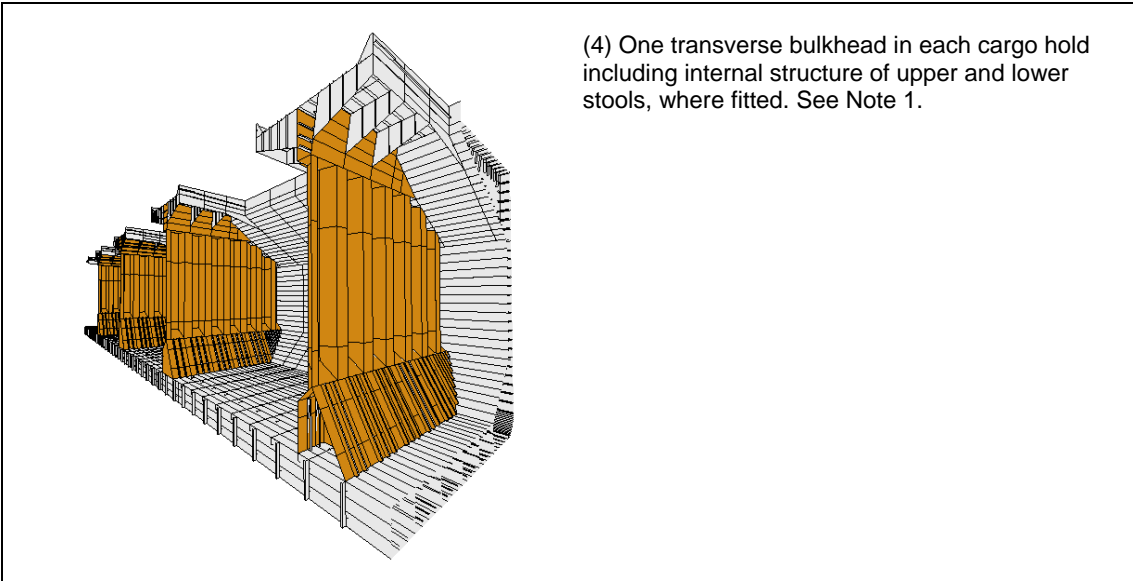
(3) 25% of ordinary transverse frames for transverse framing system or 25% of longitudinal for longitudinal framing system on side shell and inner side plating at forward, middle and aft parts, in the foremost double side tanks.

Close-up Survey

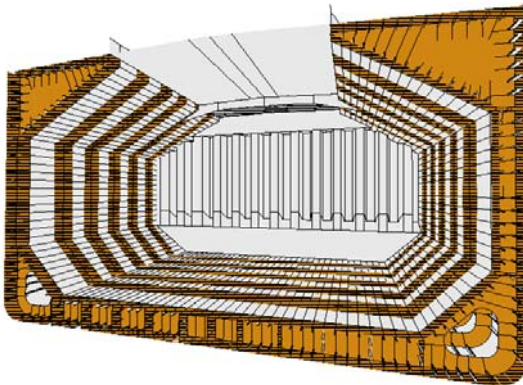
Part 3, Chapter 2

Double Skin Bulk Carriers – SS2

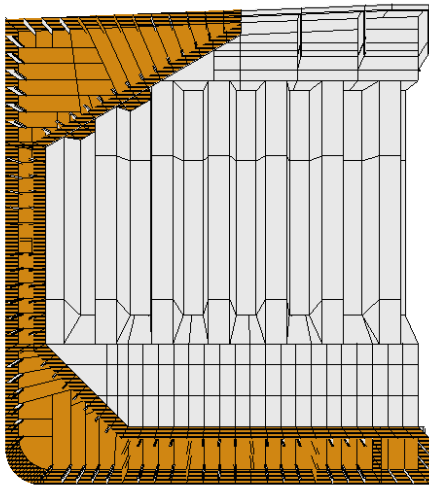
Section 2



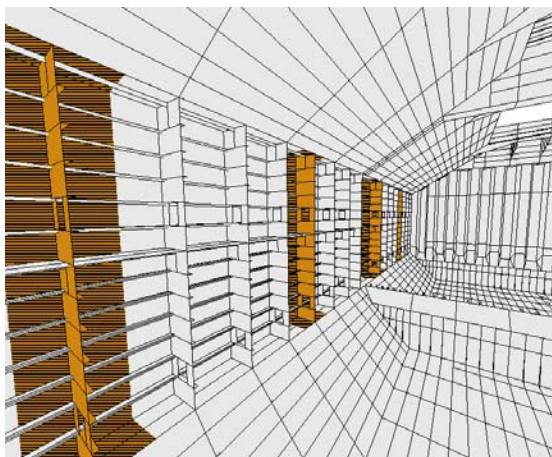
SPECIAL SURVEY III (Ships 15 Years Old)



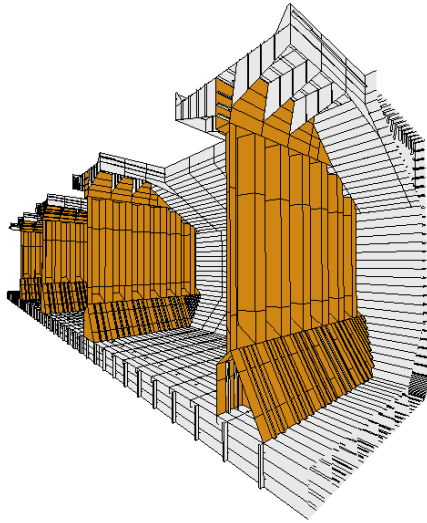
(1) All transverse webs with associated plating and longitudinals in each water ballast tank.



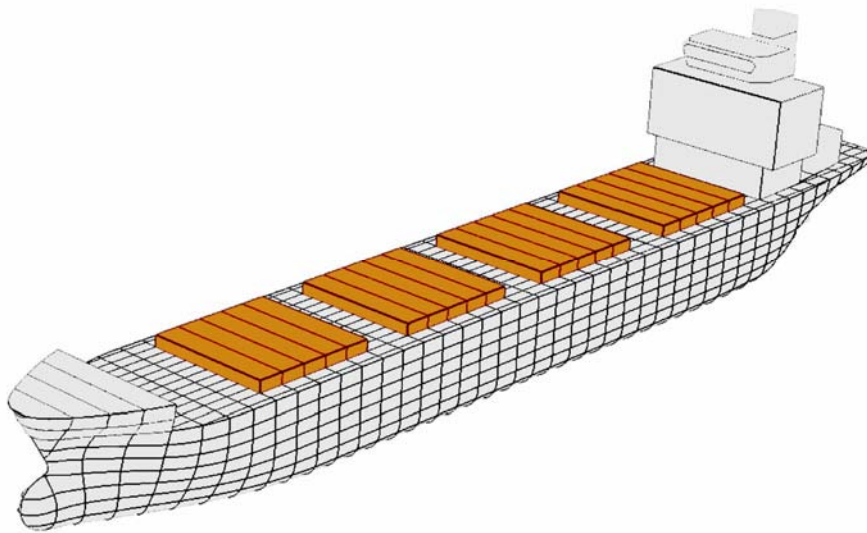
(2) All transverse bulkheads in the ballast tanks, including stiffening system.



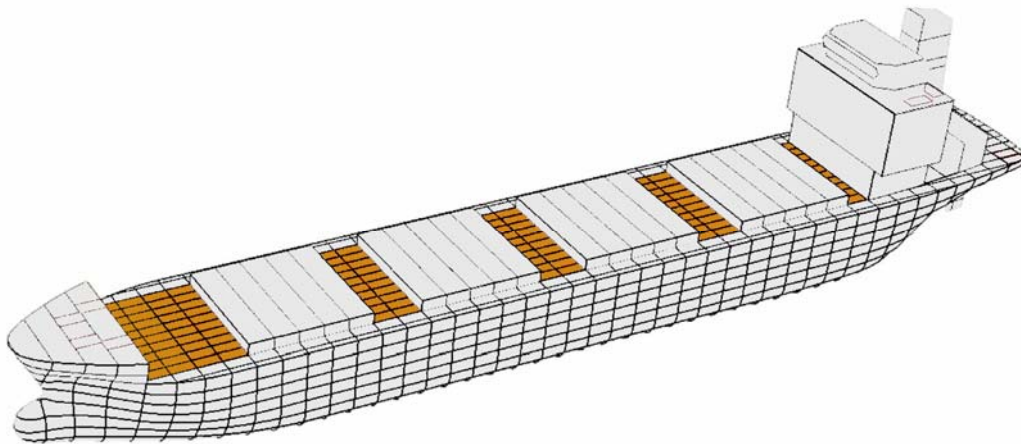
(3) 25% of ordinary transverse frames for transverse framing system or 25% of longitudinal for longitudinal framing system on side shell and inner side plating at forward, middle and aft parts, in all double side tanks.



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

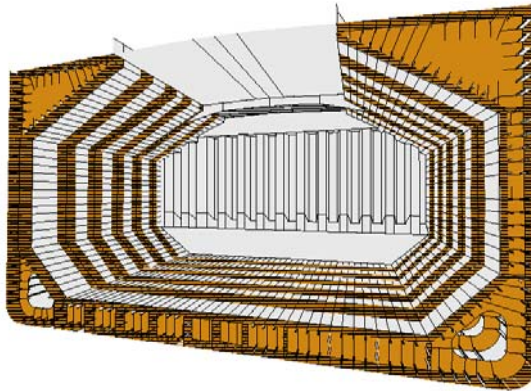


(5) All cargo hatch covers and coamings (plating and stiffeners). See Note 2.

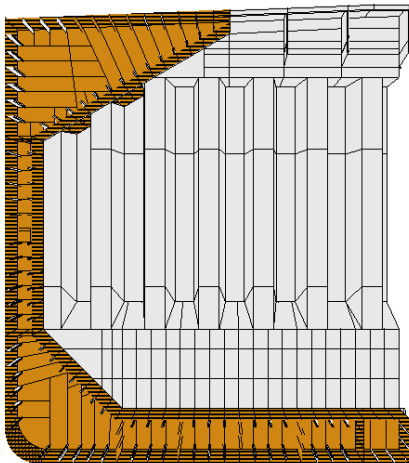


(6) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches.

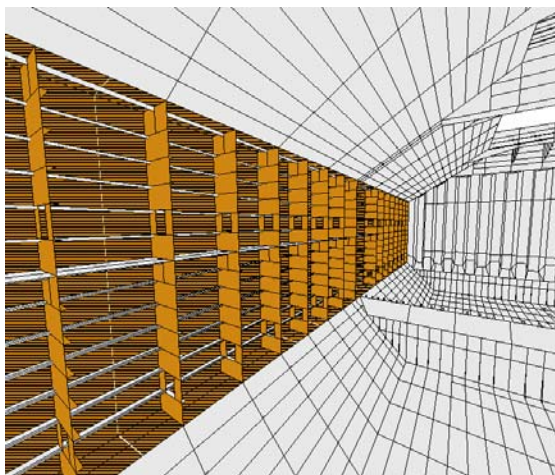
SPECIAL SURVEY IV (Ships 20 Years Old)



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



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



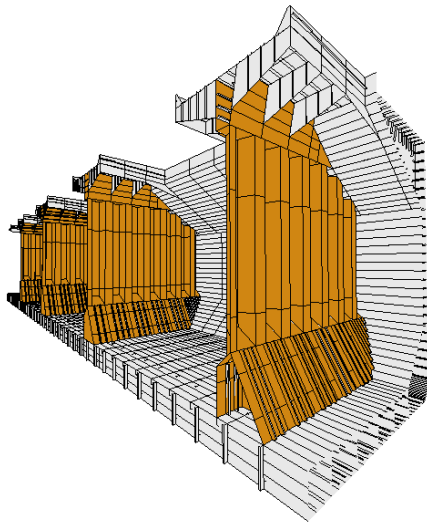
(3) All ordinary transverse frames for transverse framing system or 25% of longitudinal for longitudinal framing system on side shell and inner side plating at forward, middle and aft parts, in all double side tanks.

Close-up Survey

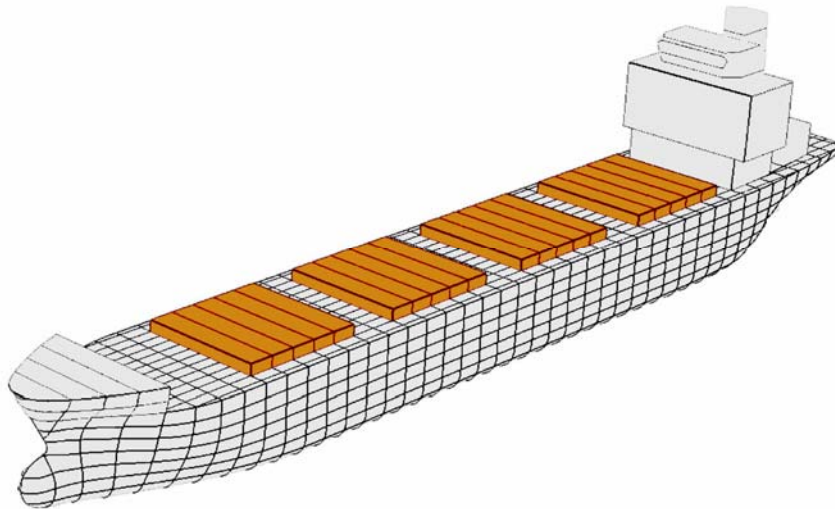
Part 3, Chapter 2

Double Skin Bulk Carriers – SS4

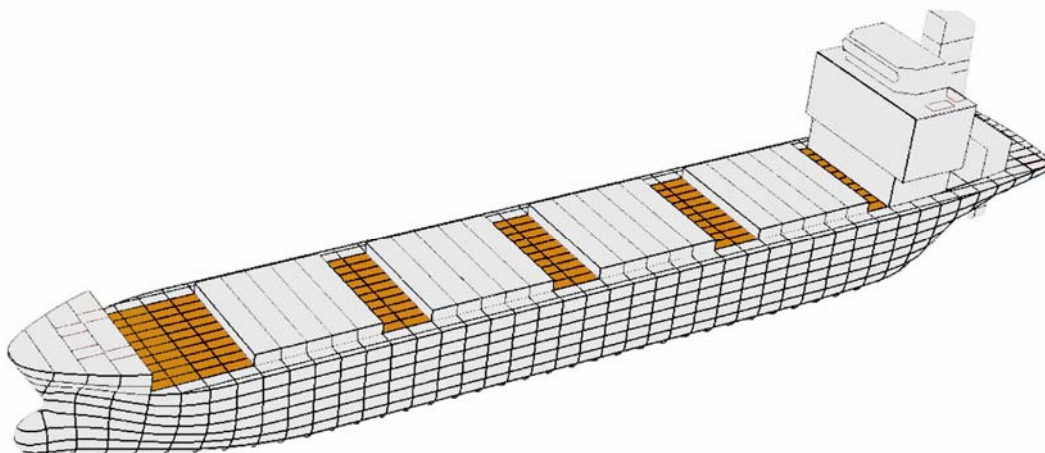
Section 2



(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.

Close-up Survey

Part 3, Chapter 2

Double Skin Bulk Carriers – SS4

Section 2

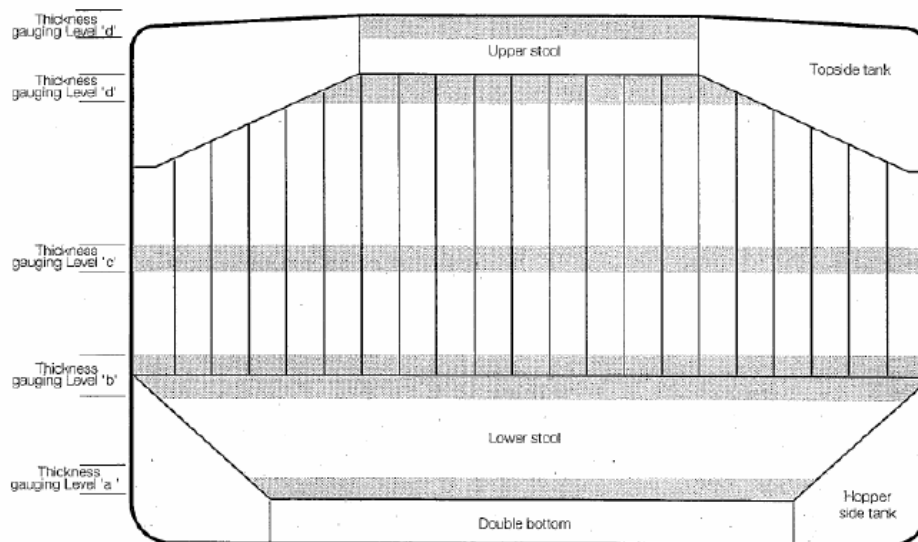
Note 1 Close-up Survey of transverse bulkheads to be carried out at four levels:

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.

Close-up Survey

Part 3, Chapter 2

Ore Carriers

Section 3

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)
<p>(1) 1 web frame ring complete including adjacent structural members in a water ballast wing tank.</p> <p>(2) 1 transverse bulkhead lower part including girder system and adjacent structural members in a ballast tank.</p> <p>(3) 2 selected cargo hold transverse bulkheads, including internal structure of upper and lower stools where fitted, See Note 1.</p> <p>(4) All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2.</p>	<p>(1) All web frame rings complete including adjacent structural members in a water ballast wing tank.</p> <p>(2) 1 deck transverse including adjacent structural members in each remaining water ballast tank.</p> <p>(3) Forward and aft transverse bulkheads including girder system and adjacent structural members in a ballast wing tank.</p> <p>(4) 1 transverse bulkhead lower part including girder system and adjacent structural members in each remaining ballast tank.</p> <p>(5) 1 transverse bulkhead in each cargo hold, including internal structure of upper and lower stools where fitted, See Note 1.</p> <p>(6) All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2.</p> <p>(7) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches.</p>	<p>(1) All web frame rings complete including adjacent structural members in each water ballast tank.</p> <p>(2) All transverse bulkheads including girder system and adjacent structural members in each ballast tank.</p> <p>(3) 1 web frame ring complete including adjacent structural members in each wing void space.</p> <p>(4) Additional web frame rings including adjacent structural members in void spaces as deemed necessary by the Surveyor.</p> <p>(5) All cargo hold transverse bulkheads, including internal structure of upper and lower stools where fitted, See Note 1.</p> <p>(6) All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2.</p> <p>(7) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches.</p>	<p>(1) All web frame rings complete including adjacent structural members in each water ballast tank.</p> <p>(2) All transverse bulkheads including girder system and adjacent structural members in each ballast tank.</p> <p>(3) 1 web frame ring complete including adjacent structural members in each wing void space.</p> <p>(4) Additional web frame rings including adjacent structural members in void spaces as deemed necessary by the Surveyor.</p> <p>(5) All cargo hold transverse bulkheads, including internal structure of upper and lower stools where fitted, See Note 1.</p> <p>(6) All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2.</p> <p>(7) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches.</p>

Close-up Survey

Part 3, Chapter 2

Ore Carriers

Section 3

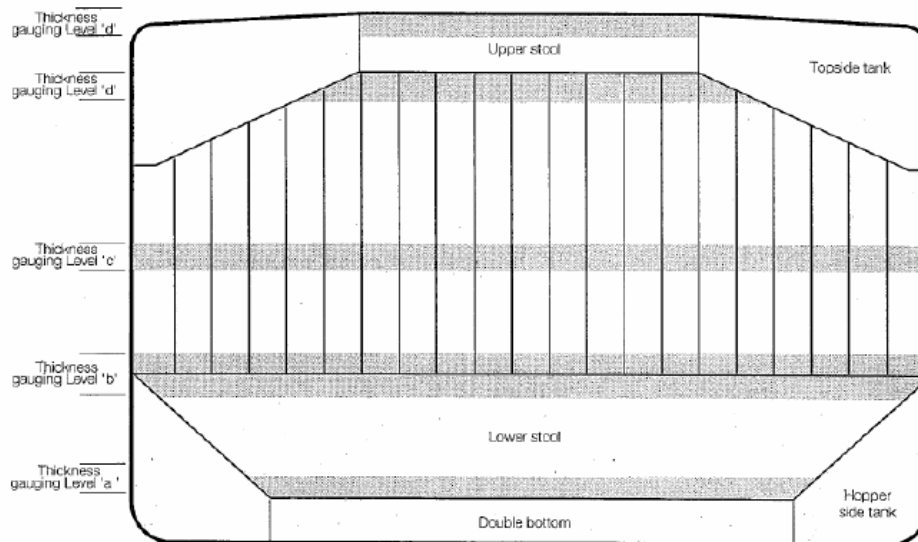
Note 1. Close-up Survey of transverse bulkheads to be carried out at four levels:

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.

Substantial Corrosion

Part 3, Chapter 3

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 <i>Rules and Regulations for the Classification of Ships</i>		
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 <i>Rules and Regulations for the Classification of Ships</i>		
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 (b) upper 2/3 of tank	(a) 5 point pattern over 1 m ² of plating (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

Substantial Corrosion

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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 <i>Rules and Regulations for the Classification of Ships</i>		
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 Toppers Tanks with Substantial Corrosion.

Requirements based on Pt 1, Ch 3,6 TABLE 3.6.8 of the <i>Rules and Regulations for the Classification of Ships</i>		
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

Substantial Corrosion

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(5) Topside salt-water ballast tanks	(a) Watertight transverse bulkheads	(i) 5 point pattern over 1 m ² of plating (ii) 5 point pattern over 1 m ² of plating (iii) 5 point pattern over 1 m length
	(i) lower 1/3 of bulkhead (ii) upper 2/3 of bulkhead (iii) stiffeners	
	(b) Swash transverse bulkheads	(i) 5 point pattern over 1 m ² of plating (ii) 5 point pattern over 1 m ² of plating (iii) 5 point pattern over 1 m length
	(i) lower 1/3 of bulkhead (ii) upper 2/3 of bulkhead (iii) stiffeners	
(6) Main deck plating	(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	
(7) Main deck longitudinals	(d) suspect longitudinals and adjacent plates	5 point pattern both web and flange over 1 m length
(8) Web frames/transverses	Suspect plates and 4 immediately adjacent plates	5 point pattern over 1 m ² of plating
(6) Main deck plating	Minimum of 3 longitudinals where plating measured	5 point pattern on both web and flange over 1 m length
(7) Main deck longitudinals	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 (b) Measurements around and under all suction bell mouths	5 point pattern for each panel between longitudinals and floors
(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

Substantial Corrosion

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(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 (b) upper 2/3 of bulkhead (c) stiffeners (minimum of 3)	(a) 5 point pattern over 1 m ² of plating (b) 5 point pattern over 2 m ² of plating (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 <i>Rules and Regulations for the Classification of Ships</i>		
Structural member	Extent of measurement	Pattern of measurement
(1) Side shell and inner plating: (i) Upper strake and strakes in way of horizontal girders (ii) All other strakes	(i) Plating between each pair of transverse frames/longitudinals in a minimum of 3 bays along the tank (ii) Plating between every third pair of longitudinals in same 3 bays	(i) Single measurement (ii) Single measurement
(2) Side shell and inner side transverse frames/longitudinals on: (i) Upper strake (ii) All other strakes	(i) Each transverse frame/longitudinal in same 3 bays (ii) Every third transverse frame/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) 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) 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 approx. 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 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

FEBRUARY 2017 Ver.7.4



Part 4 – Special Survey Requirements

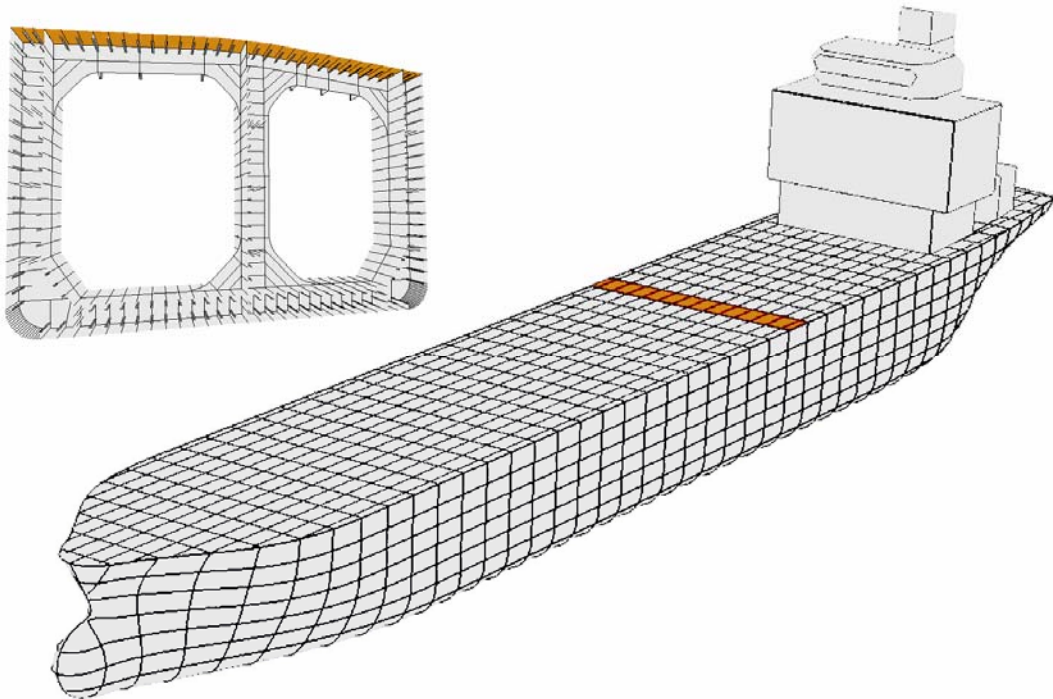
Chapter	1	Thickness Measurement Requirements	(4.1)
Section	1	Single And Double Hull	(4.1.1)
Chapter	2	Close-Up Survey Requirements	(4.2)
Section	1	Double Hull Oil Tankers	(4.2.1)
	2	Single Hull Oil Tankers	(4.2.2)
	3	Ore/Oil Ships	(4.2.3)
	4	Ore/Bulk/Oil Ships	(4.2.4)
Chapter	3	Substantial Corrosion	(4.3)
Section	1	Bottom Structure With Substantial Corrosion	(4.3.1)
	2	Deck Structure With Substantial Corrosion	(4.3.2)
	3	Shell And Longitudinal Bulkheads With Substantial Corrosion	(4.3.3)
	4	Transverse Bulkheads And Swash Bulkheads With Substantial Corrosion	(4.3.4)
	5	Double Hull Oil Tankers – Bottom, Inner Bottom And Hopper Structure With Substantial Corrosion	(4.3.5)
	6	Double Hull Oil Tankers – Deck Structure With Substantial Corrosion	(4.3.6)
	7	Double Hull Oil Tankers – Wing Ballast Tank Structure With Substantial Corrosion	(4.3.6)
	8	Double Hull Oil Tankers – Longitudinal Bulkhead Structure In Cargo Tanks With Substantial Corrosion	(4.3.8)
	9	Double Hull Oil Tankers – Transverse Watertight And Swash Bulkhead Structure In Cargo Tanks With Substantial Corrosion	(4.3.9)

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)

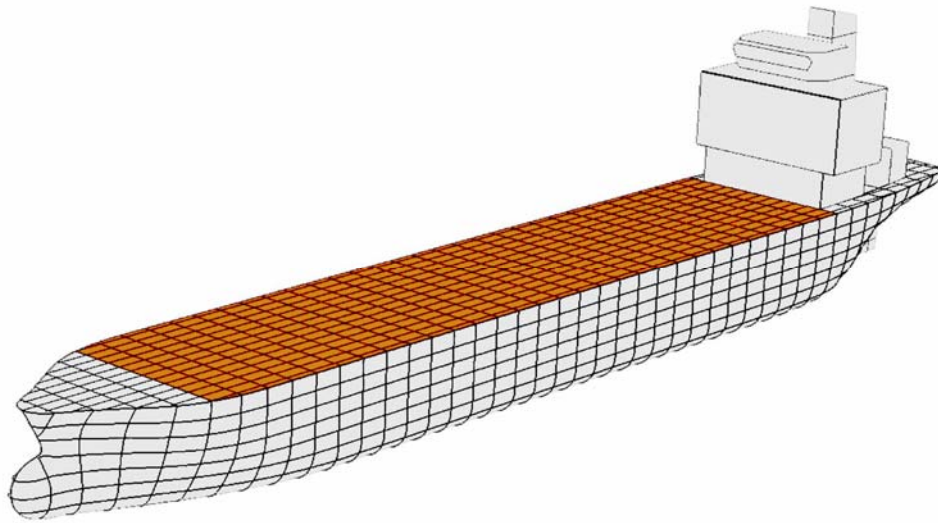


(1) 1 section of deck plating for the full beam of the ship within 0,5L amidships in way of a ballast tank, if any, or a cargo tank used primarily for water ballast.

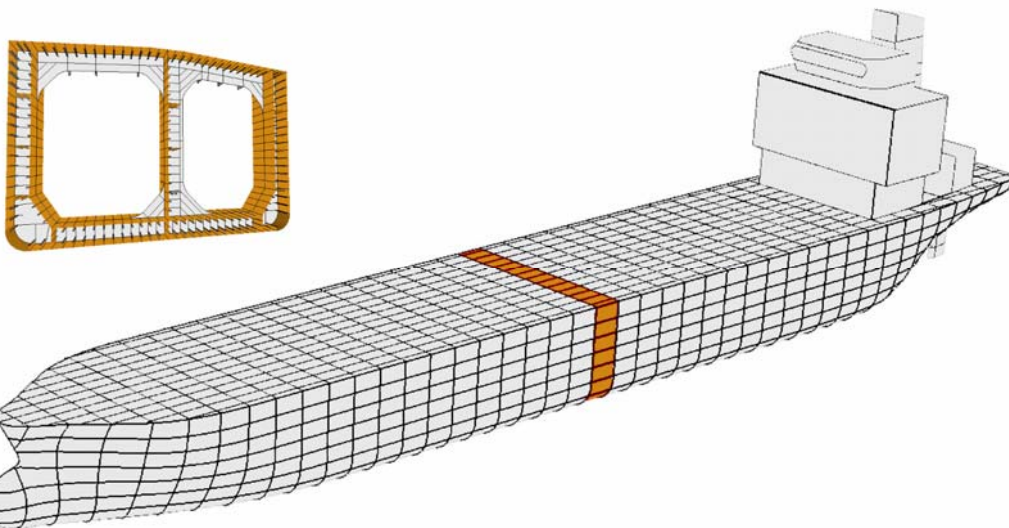
(2) Measurement for general assessment and recording of corrosion pattern, of those structural members subject to Close-up Survey in accordance with Pt 1, Ch 3, [Table 3.7.2 Minimum requirements for Close-up Survey – Single Hull oil tankers](#), [Table 3.7.3 Minimum requirement for Close-up Survey – 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) Suspect areas, as required by the Surveyor. See Note 7.

SPECIAL SURVEY II (Ships 10 Years Old)

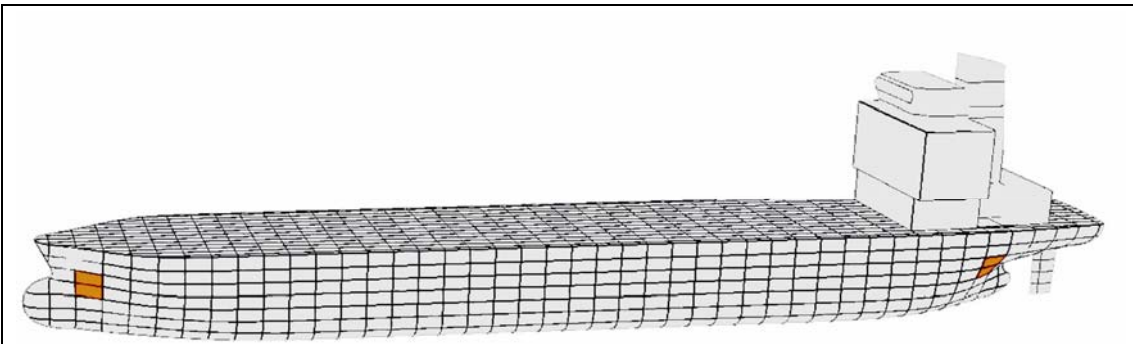


- (1) Within Cargo Area:
 (a) Each deck plate.



- (1) Within Cargo Area:
 (b) 1 Transverse Section, see Notes 2, 3 and 6.

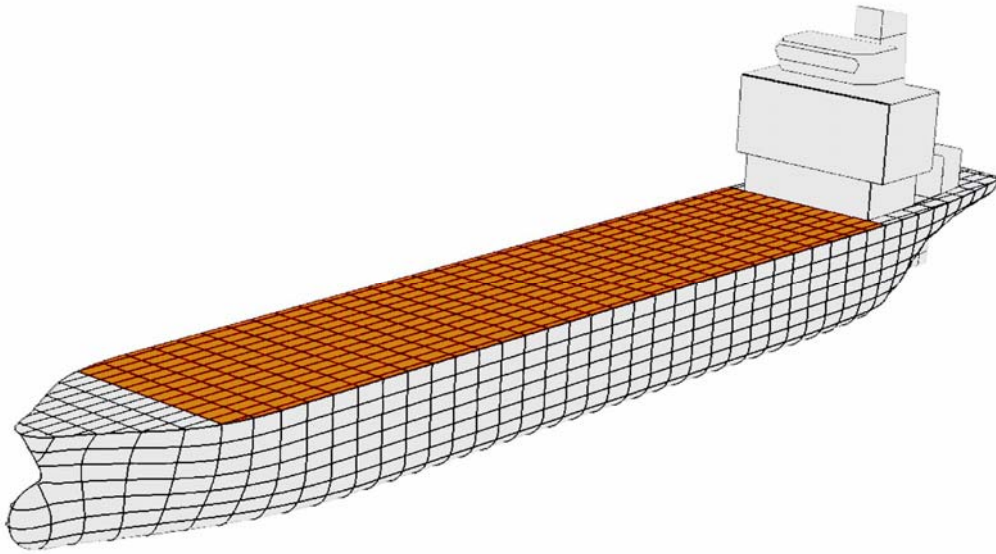
(2) Measurement for general assessment and recording of corrosion pattern, of those structural members subject to Close-up Survey in accordance with Pt 1, Ch 3, [Table 3.7.2 Minimum requirements for Close-up Survey – Single Hull oil tankers](#), [Table 3.7.3 Minimum requirement for Close-up Survey – 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.



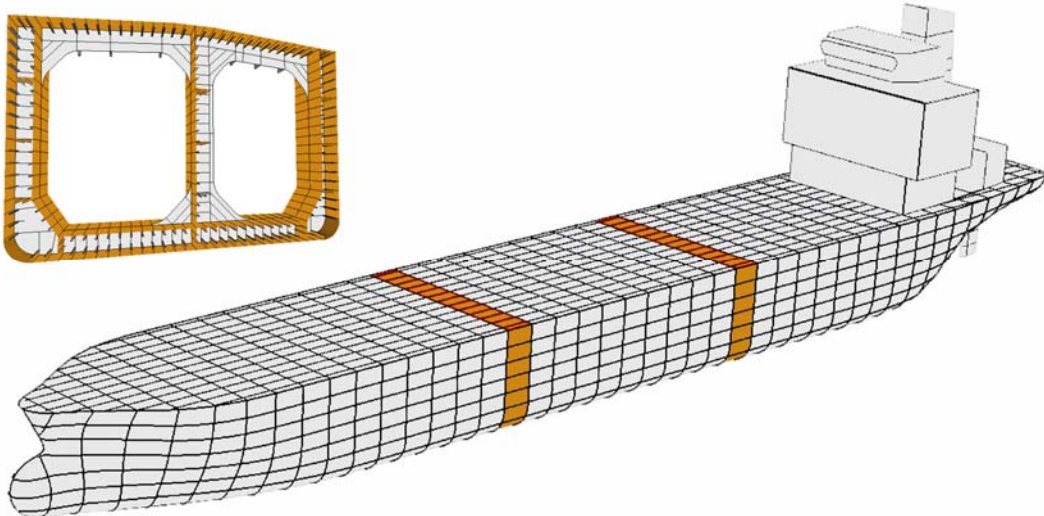
(3) Selected wind and water strakes outside the cargo area. (Wind and Water Strake: The strakes of a ship's side shell plating between the ballast and the deepest load waterline).

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

SPECIAL SURVEY III (Ships 15 Years Old)

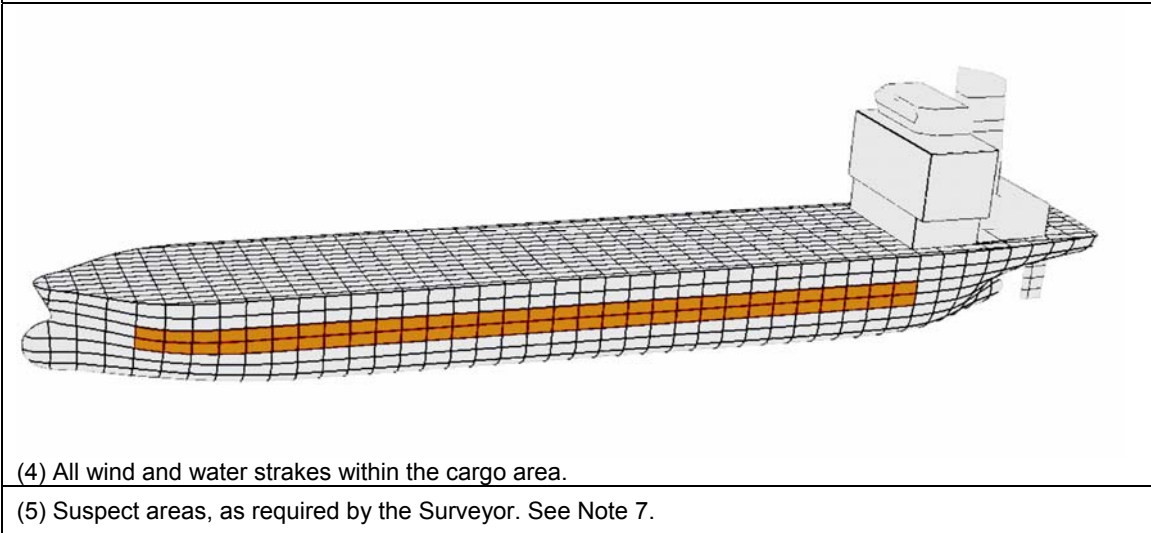
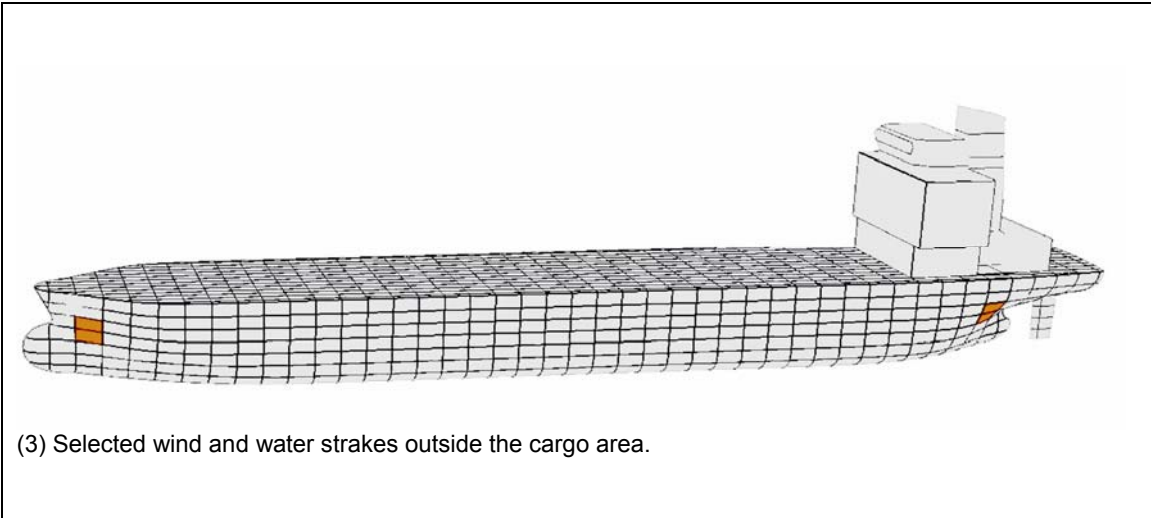


- (1) Within Cargo Area:
 - (a) Each deck plate.

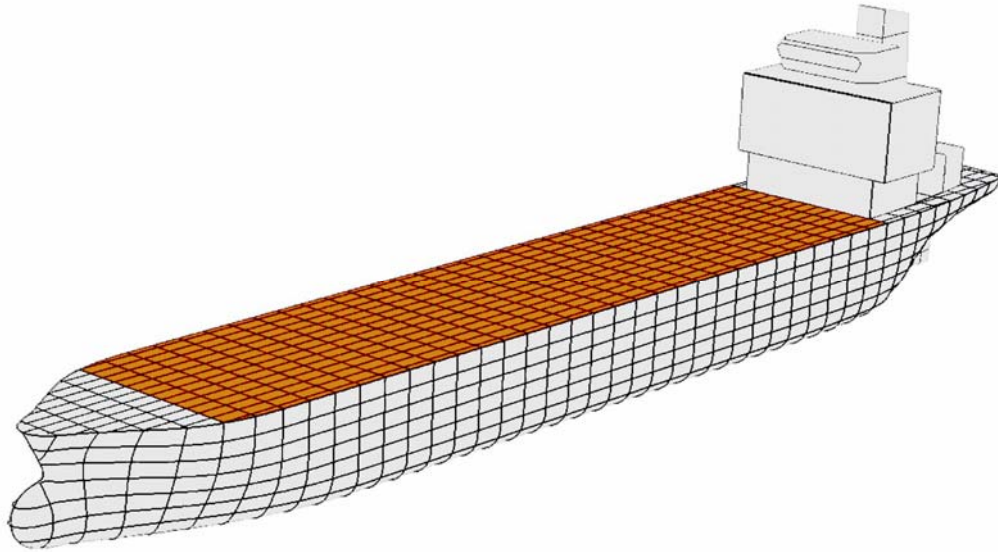


- (1) Within Cargo Area:
 - (b) 2 Transverse Sections, See Notes 2, 3, 5 and 6.

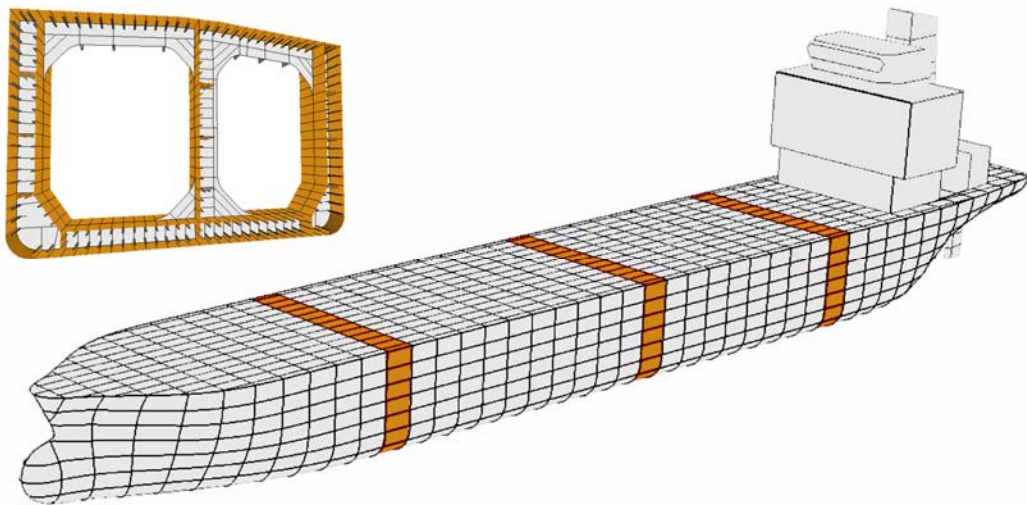
(2) Measurement for general assessment and recording of corrosion pattern, of those structural members subject to Close-up Survey in accordance with Pt 1, Ch 3, [Table 3.7.2 Minimum requirements for Close-up Survey – Single Hull oil tankers](#), [Table 3.7.3 Minimum requirement for Close-up Survey – 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.



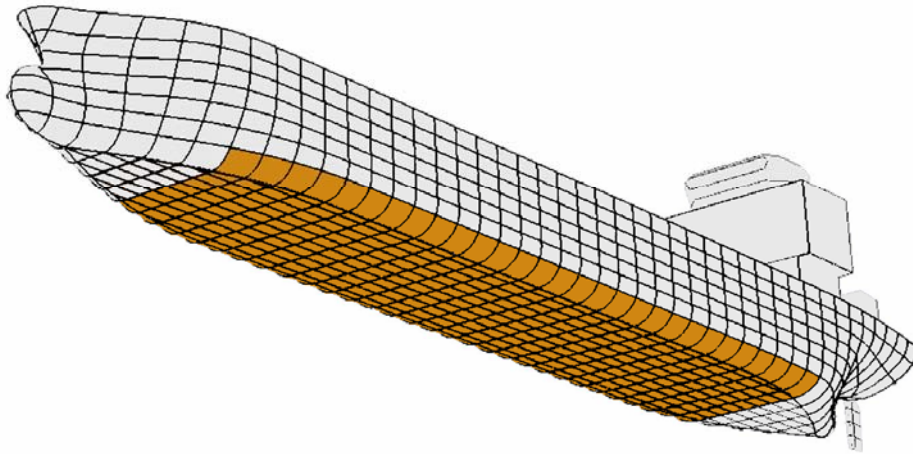
SPECIAL SURVEY IV (Ships 20 Years Old)



- (1) Within Cargo Area:
 - (a) each deck plate.

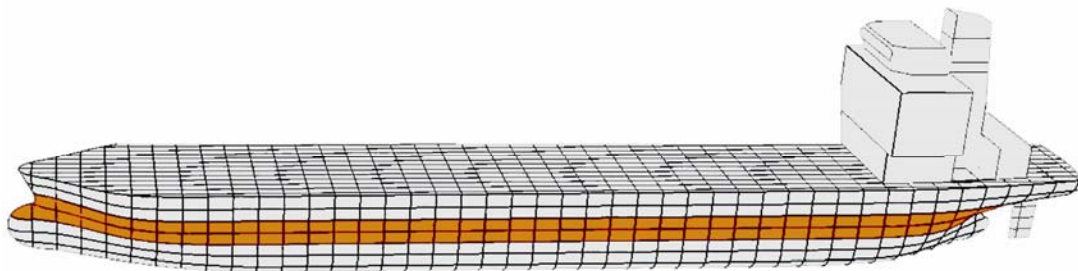


- (1) Within Cargo Area:
 - (b) 3 Transverse Sections, See Notes 2, 3, 5 and 6.

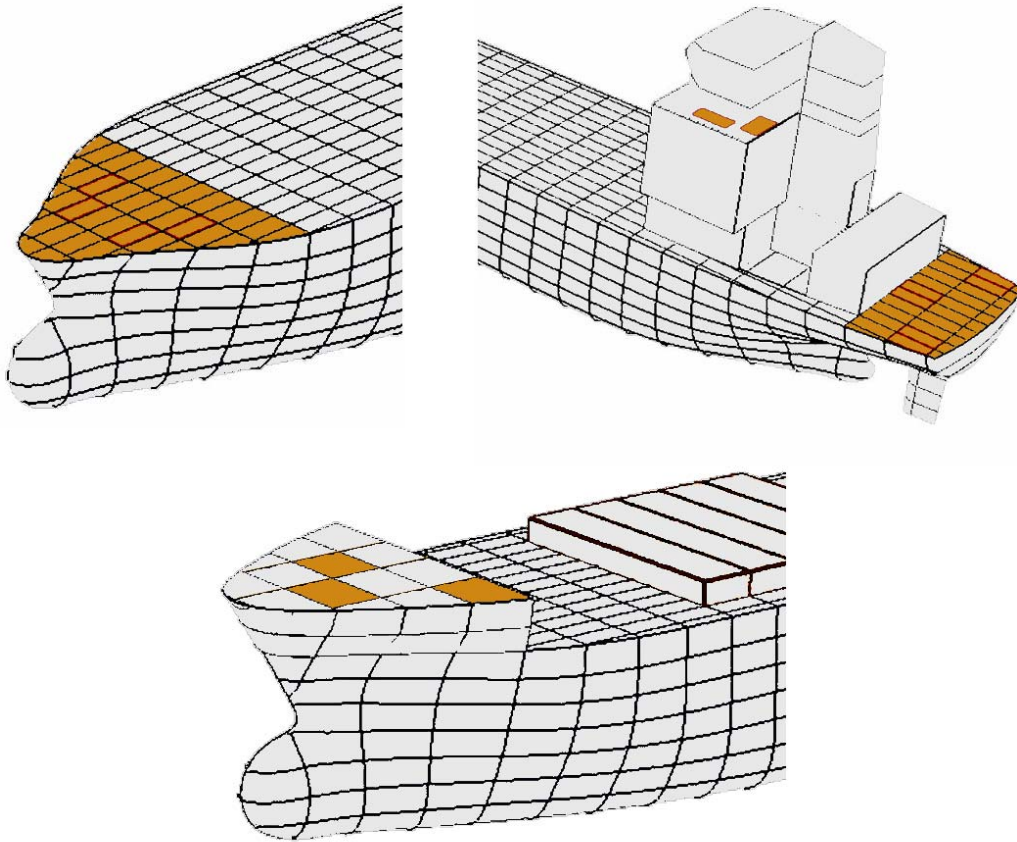


- (1) Within cargo area:
(c) Each Bottom Plate.

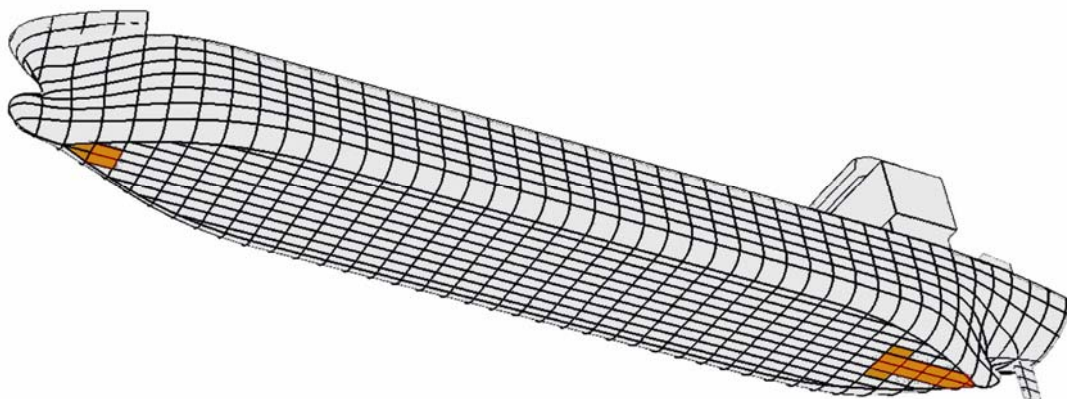
(2) Measurement for general assessment and recording of corrosion pattern, of those structural members subject to Close-up Survey in accordance with Pt 1, Ch 3, [Table 3.7.2 Minimum requirements for Close-up Survey – Single Hull oil tankers](#), [Table 3.7.3 Minimum requirement for Close-up Survey – 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.



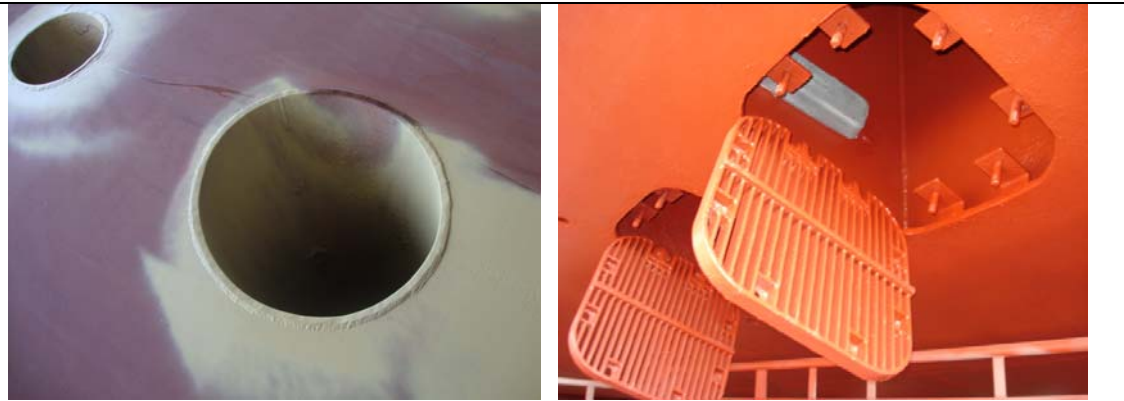
- (3) All wind and water strakes over the full length of the ship, port and starboard



(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 0,5L 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 0,5L 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.

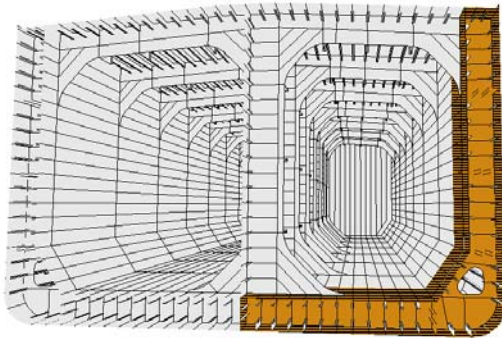
Note 7. Suspect areas are locations showing substantial corrosion and/or are considered by the Surveyor to be prone to rapid wastage.

4.2 Close-Up Survey Requirements

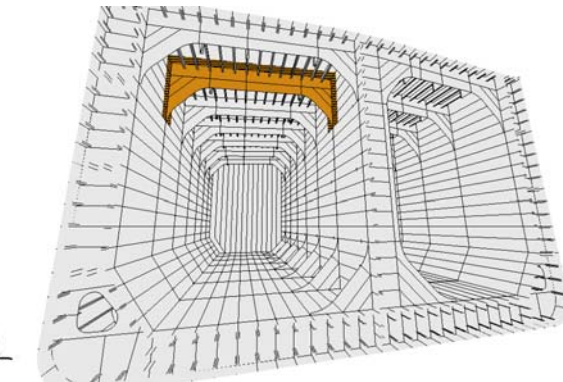
4.2.1 Minimum requirements for Close-up Survey - Double Hull Oil Tankers

Requirements based on Pt 1, Ch 3,7 TABLE 3.7.3 of the *Rules and Regulations for the Classification of Ships*

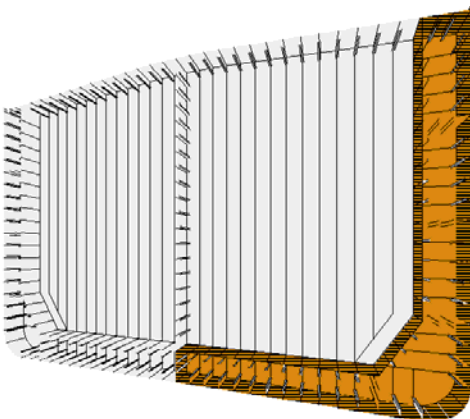
SPECIAL SURVEY I (Ships 5 Years Old)



(1) One web frame ring in a complete ballast tank. See Notes 1 and 3.



(2) One deck transverse in a cargo tank . See Note 4.



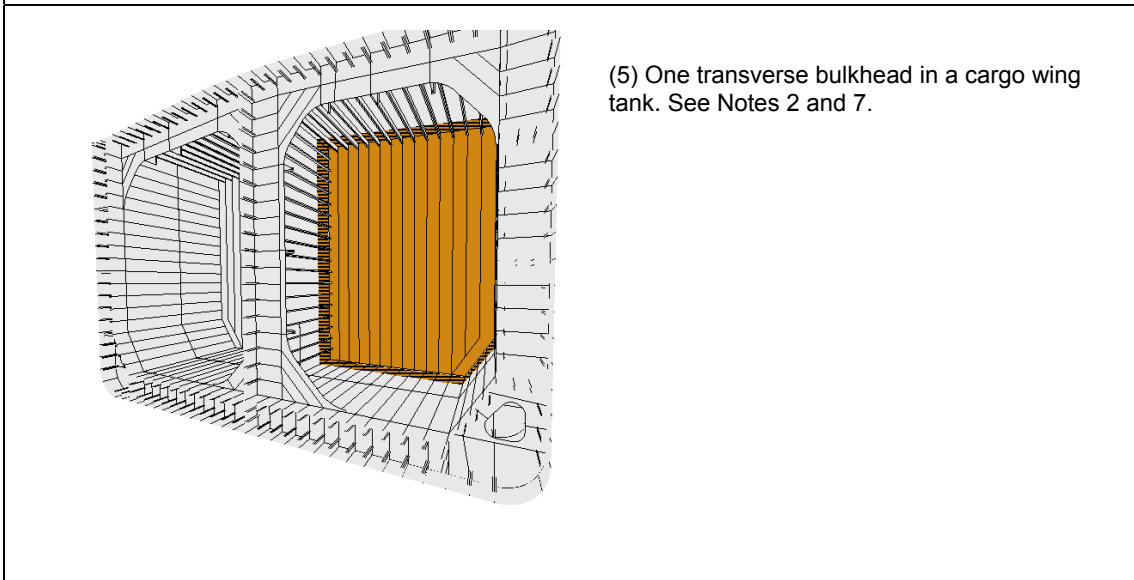
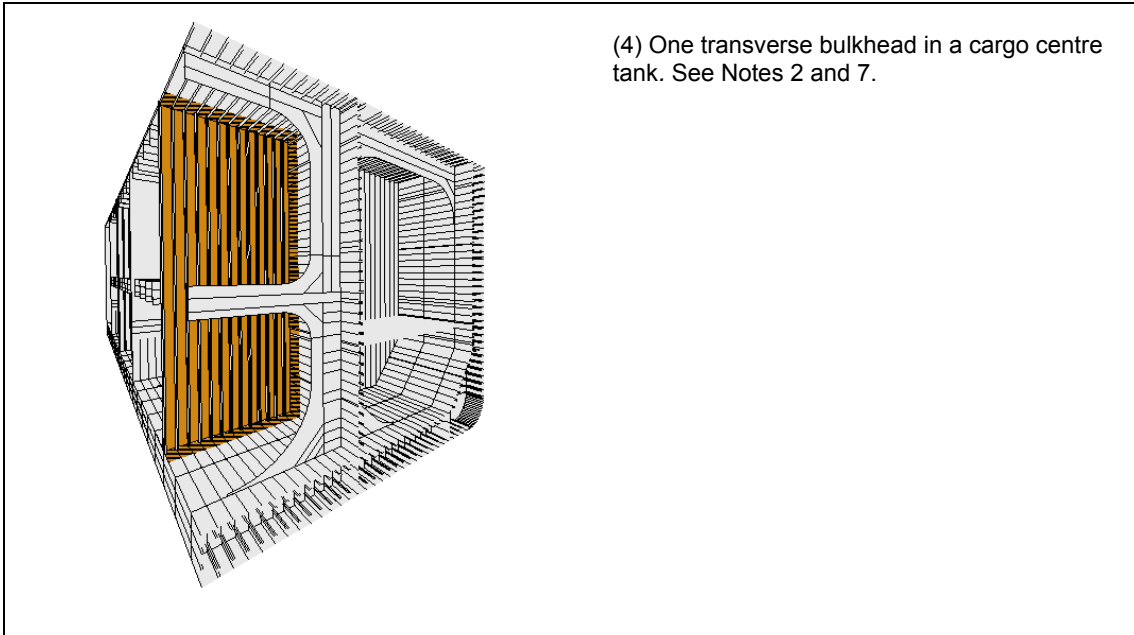
(3) One transverse bulkhead in a complete ballast tank . See Notes 1 and 6.

Close-up Survey

Part 4, Chapter 2

Double Hull Oil Tankers – SS1

Section 1



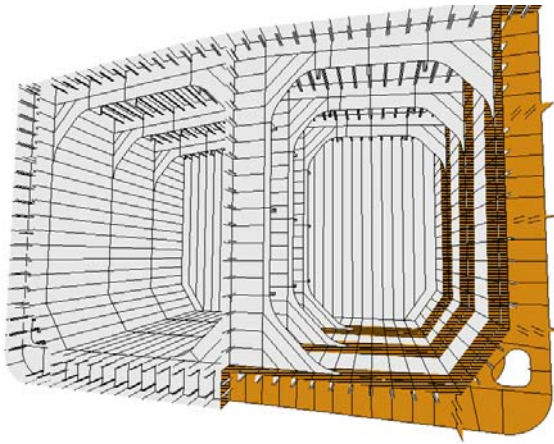
Close-up Survey

Part 4, Chapter 2

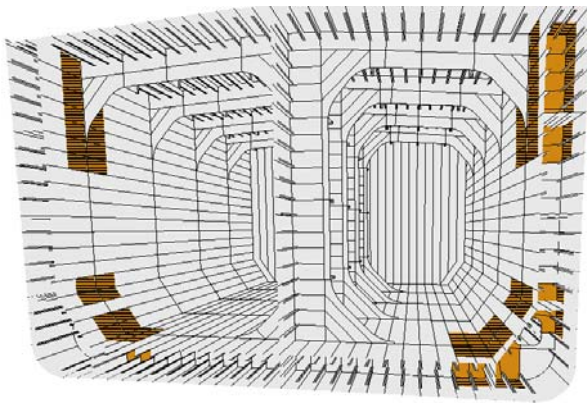
Double Hull Oil Tankers – SS2

Section 1

SPECIAL SURVEY II (Ships 10 Years Old)

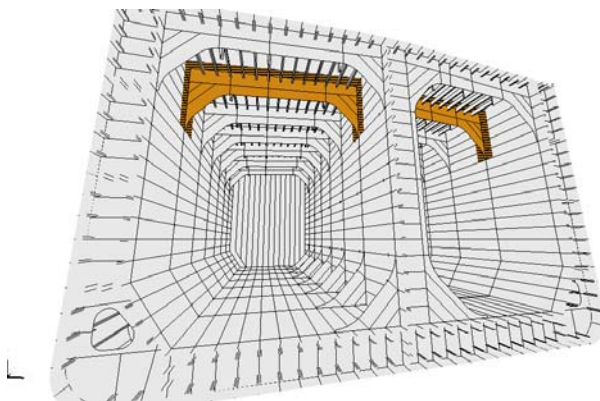


(1) All web frame rings in a complete ballast tank. See Notes 1 and 3.



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

5 m



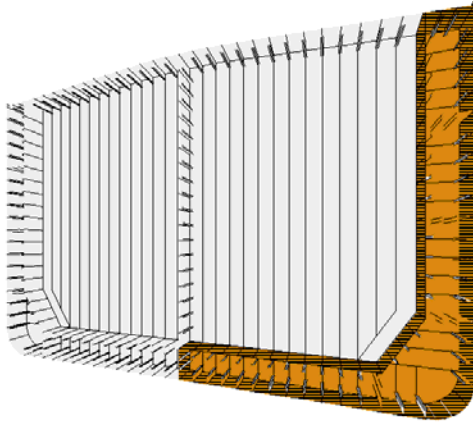
(3) One deck transverse in two cargo tanks. See Note 4.

Close-up Survey

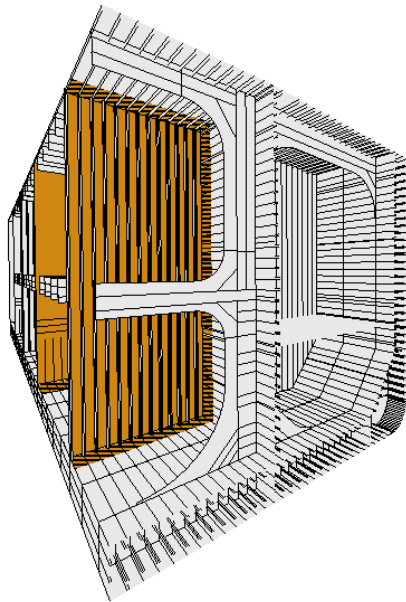
Part 4, Chapter 2

Double Hull Oil Tankers – SS2

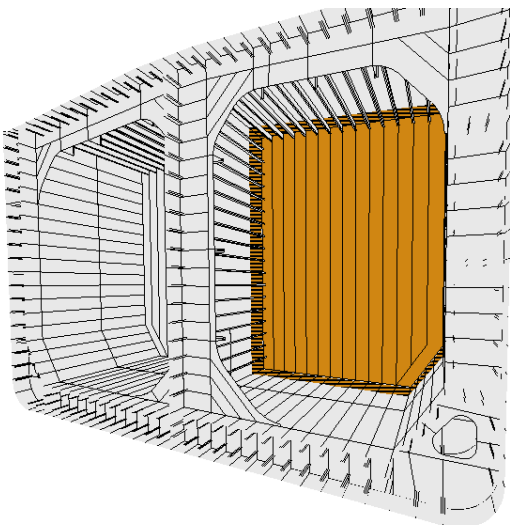
Section 1



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

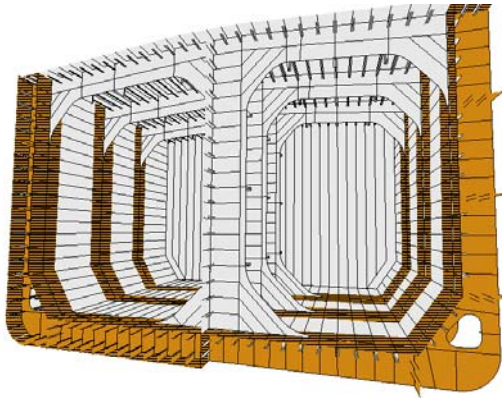


(5) One transverse bulkhead in two cargo centre tanks. See Notes 2 and 7.

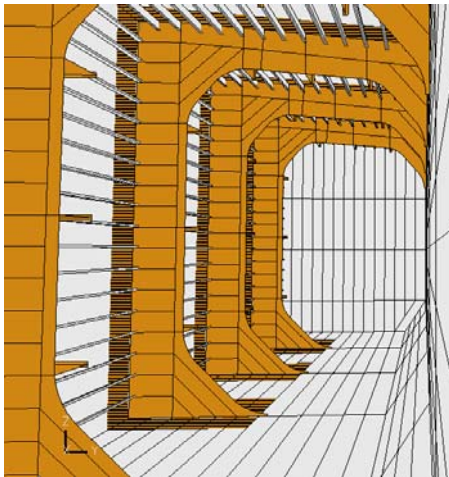


(6) One transverse bulkhead in a cargo wing tank. See Notes 2 and 7.

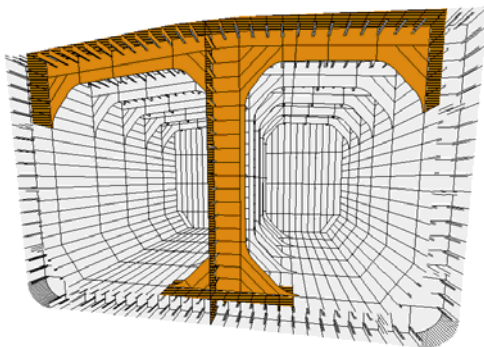
SPECIAL SURVEY III (Ships 15 Years Old)



(1) All web frame rings in all ballast tanks. See Note 3.



(2) All web frame rings in a cargo tank. See Note 9.



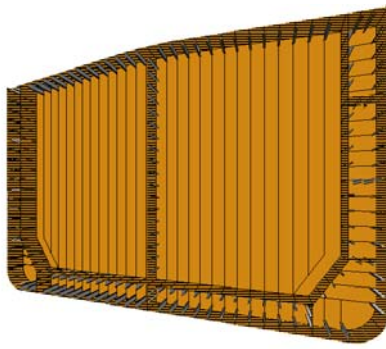
(3) One web frame ring in each remaining cargo tank. See Note 9.

Close-up Survey

Part 4, Chapter 2

Double Hull Oil Tankers – SS3

Section 1



(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.

Close-up Survey

Part 4, Chapter 2

Double Hull Oil Tankers – SS4

Section 1

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

<p>Note 1. Complete ballast tank means double bottom tank, double side tank and double deck tank, as applicable, even if these are separate.</p> <p>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.</p> <p>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.</p> <p>Note 4. Deck transverse including adjacent deck structural members (or external structure on deck in way of the tank, where applicable).</p> <p>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.</p>	<p>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.</p> <p>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.</p> <p>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.</p> <p>Note 9. Web frame ring in cargo tank includes deck transverse, longitudinal bulkhead vertical girder and cross ties, where fitted, and adjacent structural members.</p> <p>Note 10. Additional complete transverse web frame ring.</p>
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Close-up Survey

Part 4, Chapter 2

Ore / Oil Ships

Section 2

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 <i>Rules and Regulations for the Classification of Ships</i>			
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)
<p>(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.</p> <p>(2) One deck transverse – in a cargo oil tank. See Note 2.</p> <p>(3) One transverse bulkhead. See Notes 4 and 8:</p> <p>(a) in a ballast tank.</p> <p>(b) in a cargo oil wing tank.</p> <p>(c) in a cargo oil centre tank.</p>	<p>(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.</p> <p>(2) One deck transverse. See Note 2:</p> <p>(a) in each of the remaining ballast tanks, if any</p> <p>(b) in a cargo oil wing tank</p> <p>(c) in 2 cargo oil centre tanks</p> <p>(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.</p> <p>(4) One transverse bulkhead. See Note 4 and 8:</p> <p>(a) in each remaining ballast tank.</p> <p>(b) in a cargo oil wing tank.</p> <p>(c) in 2 cargo oil centre tanks.</p>	<p>(1) All web frame rings, see Note 1:</p> <p>(a) in all ballast tanks</p> <p>(b) in a cargo oil wing tank</p> <p>(2) A minimum of 30% of all web frame rings in each remaining cargo oil wing tank. See Notes 1 and 7.</p> <p>(3) All transverse bulkheads – in all cargo and ballast tanks, see Note 3.</p> <p>(4) A minimum of 30% of deck and bottom transverses in each cargo centre tank. See Notes 5 and 7.</p> <p>(5) As considered necessary by Surveyor. See Note 6.</p>	<p>(1) As Special Survey III.</p> <p>(2) Additional transverses if deemed necessary by the Surveyor.</p>
<p>Note 1. Complete transverse web frame ring including adjacent structural members.</p> <p>Note 2. Deck transverse including adjacent deck structural members.</p> <p>Note 3. Transverse bulkhead complete, including girder system and adjacent members, and adjacent longitudinal bulkhead structure.</p> <p>Note 4. Transverse bulkhead lower part including girder system and adjacent structural members.</p>		<p>Note 5. Deck and bottom transverse including adjacent structural members.</p> <p>Note 6. Additional complete transverse web frame ring.</p> <p>Note 7. The 30% is to be rounded up to the next whole number of structural items.</p> <p>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.</p>	

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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 <i>Rules and Regulations for the Classification of Ships</i>			
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)
<p>(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.</p> <p>(2) One deck transverse – in a cargo tank. See Note 2.</p> <p>(3) One transverse bulkhead. See Notes 4 and 8:</p> <p>(a) in a ballast tank</p> <p>(b) in a cargo oil wing tank</p> <p>(c) in a cargo oil centre tank.</p>	<p>(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.</p> <p>(2) One deck transverse. See Notes 2 and 8:</p> <p>(a) in each of the remaining ballast tanks, if any.</p> <p>(b) in a cargo oil wing tank.</p> <p>(c) in 2 cargo oil centre tanks.</p> <p>(3) Both transverse bulkheads – in a wing ballast tank, if any, or a cargo wing tank used primarily for water ballast. See Note 3.</p> <p>(4) One transverse bulkhead. See Note 4 and 8:</p> <p>(a) in each remaining ballast tank, if any.</p> <p>(b) in a cargo oil wing tank.</p> <p>(c) in 2 cargo oil centre tanks.</p> <p>(5) Selected cargo hold hatch covers and coamings (plating and stiffeners). See Note 9.</p> <p>(6) Selected areas of deck plating inside line of hatch openings between cargo hold hatches.</p>	<p>(1) All web frame rings. See Note 1</p> <p>(a) in all ballast tanks.</p> <p>(b) in a cargo oil wing tank.</p> <p>(2) A minimum of 30% of all web frame rings in each remaining cargo oil wing tank. See Notes 1 and 7.</p> <p>(3) All transverse bulkheads– in all cargo and ballast tanks. See Note 3.</p> <p>(4) A minimum of 30% of deck and bottom transverses in each cargo oil centre tank. See Notes 5 and 7.</p> <p>(5) As considered necessary by the Surveyor. See Note 6.</p> <p>(6) All cargo hold hatch covers and coamings (plating and stiffeners)</p> <p>(7) All deck plating inside line of hatch coamings between cargo hold hatches</p>	<p>(1) As Special Survey III.</p> <p>(2) Additional transverse areas if deemed necessary by the Surveyor.</p>
<p>Note 1. Complete transverse web frame ring including adjacent structural members.</p> <p>Note 2. Deck transverse including adjacent deck structural members.</p> <p>Note 3. Transverse bulkhead complete, including girder system and adjacent members, and adjacent longitudinal bulkhead structure.</p>			

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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 <i>Rules and Regulations for the Classification of Ships</i>			
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)
<p>(1) 25% of shell frames and their end attachments in the forward cargo hold at representative positions.</p> <p>(2) Selected frames and their end attachments in remaining cargo holds.</p> <p>(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).</p> <p>(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.</p>	<p>(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.</p> <p>(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.</p> <p>(2) 1 transverse web with associated plating and longitudinals in each water ballast tank.</p> <p>(3) Forward and aft transverse bulkhead in 1 side ballast tank, including stiffening system.</p> <p>(4) All cargo hold transverse bulkheads including internal structure of upper and lower stools where fitted. See Note 1.</p> <p>(5) All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2.</p> <p>(6) All deck plating and underdeck structure inside line of hatch openings between all cargo hold hatches.</p>	<p>(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.</p> <p>(2) All transverse webs with associated plating and longitudinals in each water ballast tank.</p> <p>(3) All transverse bulkheads in ballast tanks, including stiffening system.</p> <p>(4) All cargo hold transverse bulkheads including internal structure of upper and lower stools, where fitted. See Note 1.</p> <p>(5) All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2.</p> <p>(6) All deck plating and underdeck structure inside line of hatch openings between cargo hold hatches.</p>	<p>(1) All shell frames in all cargo holds including their end attachments and adjacent shell plating.</p> <p>(2) All transverse webs with associated plating and longitudinals in each water ballast tank.</p> <p>(3) All transverse bulkheads in ballast tanks, including stiffening system.</p> <p>(4) All cargo hold transverse bulkheads including internal structure of upper and lower stools, where fitted. See Note 1.</p> <p>(5) All cargo hold hatch covers and coamings (plating and stiffeners). See Note 2.</p> <p>(6) All deck plating and underdeck structure inside line of hatch openings between cargo hold hatches.</p>
<p>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</p>			

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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 <i>Rules and Regulations for the Classification of Ships</i>		
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 <i>Rules and Regulations for the Classification of Ships</i>		
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

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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 <i>Rules and Regulations for the Classification of Ships</i>		
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 <i>Rules and Regulations for the Classification of Ships</i>		
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

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(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 <i>Rules and Regulations for the Classification of Ships</i>		
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

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

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(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 <i>Rules and Regulations for the Classification of Ships</i>		
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

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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

FEBRUARY 2017 Ver.7.4



Part 5 – Special Survey Requirements

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	4	Single and double hull chemical tankers – transverse watertight bulkheads and swash bulkheads with substantial corrosion	(5.3.4)

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 <i>Rules and Regulations for the Classification of Ships</i>		
Special Survey I (Ships 5 years old)	Special Survey III (Ships 15 years old)	Special Survey IV (Ships 20 years old and over)
<p>(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).</p> <p>(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) Suspect areas, as required by the Surveyor. See Note 6.</p>	<p>(1) Within the cargo area:</p> <p>(a) Each deck plate.</p> <p>(b) 2 transverse sections. See Notes 2, 3 and 5.</p> <p>(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.</p> <p>(3) Selected wind and water strakes outside the cargo area.</p> <p>(4) All wind and water strakes within the cargo area.</p> <p>(5) .</p> <p>Suspect areas, as required by the Surveyor. See Note 6.</p>	<p>(1) Within the cargo area:</p> <p>(a) Each deck plate.</p> <p>(b) 3 transverse sections. See Notes 2, 3 and 5.</p> <p>(c) Each bottom plate.</p> <p>(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.</p> <p>(3) All wind and water strakes over the full length of the ship, port and starboard.</p> <p>(4) Remaining exposed main deck plating not considered in item (1) and representative exposed superstructure deck plating (i.e. poop, bridge and forecastle deck).</p> <p>(5) All keel plates outside the cargo tank length. Also additional bottom plates in way of cofferdams, machinery space and aft end of tanks.</p> <p>(6) Plating of seachests. Also side shell plating in way of overboard discharges, as considered necessary by the Surveyor.</p> <p>(7) Suspect areas, as required by the Surveyor. See Note 6.</p>
<p>Special Survey II (Ships 10 years old)</p> <p>(1) Within the cargo area:</p> <p>(a) Each deck plate.</p> <p>(b) 1 transverse section. See Notes 2, 3 and 5.</p> <p>(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.</p> <p>(3) Selected wind and water strakes outside the cargo area.</p> <p>(4) Suspect areas, as required by the Surveyor. See Note 6.</p>		
<p>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.</p> <p>Note 2. Transverse sections should be chosen where the largest reductions are likely to occur, or as revealed by deck plating measurements.</p>		

Note 3. Where two or three transverse sections are required to be measured, at least one is to include a ballast tank within $0,5L$ 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 <i>Rules and Regulations for the Classification of Ships</i>			
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. See Note 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 <i>Rules and Regulations for the Classification of Ships</i>			
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 <i>Rules and Regulations for the Classification of Ships</i>		
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

Substantial Corrosion

Part 5, Chapter 3

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 <i>Rules and Regulations for the Classification of Ships</i>		
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

Substantial Corrosion

Part 5, Chapter 3

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 <i>Rules and Regulations for the Classification of Ships</i>		
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

FEBRUARY 2017 Ver.7.4



Part 6 – Special Survey Requirements

Chapter 1		Thickness Measurement Requirements	(6.1)
Section	1	Ships For Liquefied Gases	(6.1.1)
Chapter 2		Close-Up Survey Requirements	(6.2)
Section	1	Ships For Liquefied Gases	(6.2.1)
Chapter 3		Substantial Corrosion	(6.3)
Section	1	Ships For Liquefied Gases – Structural Areas with substantial corrosion	(6.3.1)

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 <i>Rules and Regulations for the Classification of Ships</i>		
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)
<p>(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.</p> <p>(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.</p> <p>(3) Suspect areas, as required by the Surveyor. See Note 5.</p>	<p>(1) Within the cargo area:</p> <p>(a) Each deck plate.</p> <p>(b) 2 transverse sections. See Note 2, 3 and 4.</p> <p>(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.</p> <p>(3) Selected wind and water strakes outside the cargo area.</p> <p>(4) All wind and water strakes within the cargo area.</p>	<p>(1) Within the cargo area:</p> <p>(a) Each deck plate.</p> <p>(b) 3 transverse sections. See Note 2, 3 and 4.</p> <p>(c) Each bottom plate.</p> <p>(d) Duct Keel plating and internals.</p> <p>(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.</p>
Special Survey II (Ships 10 years old)	<p>(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.</p> <p>(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.</p> <p>(7) Suspect areas, as required by the Surveyor. See Note 5.</p>	<p>(3) All wind and water strakes over the full length of the ship, port and starboard.</p> <p>(4) Remaining exposed main deck plating not considered in item (1) and representative exposed superstructure deck plating (i.e. poop, bridge and forecandle deck).</p> <p>(5) All keel plates outside the cargo tank length. Also additional bottom plates in way of cofferdams, machinery space and aft end of tanks.</p> <p>(6) Plating of seachests. Also side shell plating in way of overboard discharges, as considered necessary by the Surveyor.</p> <p>(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.</p>
<p>(1) Within the cargo area:</p> <p>(a) Each deck plate.</p> <p>(b) 1 transverse section. See Note 2, 3 and 4.</p> <p>(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.</p> <p>(3) Selected wind and water strakes outside the cargo area.</p> <p>(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.</p> <p>(5) For those ships designated to carry light oils in the independent cargo tanks,</p>		

<p>thickness measurement of the independent cargo tank structure is to be carried out as considered necessary by the Surveyor.</p> <p>(6) Suspect areas, as required by the Surveyor. See Note 5</p>		<p>(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.</p> <p>(9) Suspect areas, as required by the Surveyor. See Note 5.</p>
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<p>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.</p> <p>Note 2. Transverse sections should be chosen where the largest reductions are likely to occur, or as revealed by deck plating measurements.</p> <p>Note 3. Where transverse sections are required to be measured, at least one is to include a ballast tank within 0,5L amidships.</p> <p>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.</p> <p>Note 5. Suspect areas are locations showing substantial corrosion and/or are considered by the Surveyor to be prone.</p>

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 <i>Rules and Regulations for the Classification of Ships</i>			
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)
<p>(1) One web frame in:</p> <p>(a) a topside ballast tank</p> <p>(b) a hopper side ballast tank</p> <p>(c) a double hull side ballast tank</p> <p>See Notes 1, 2, 5 and 6.</p> <p>(2) One transverse bulkhead in a ballast tank. See Notes 1, 3, 4, 5 and 6.</p>	<p>(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.</p> <p>(2) One web frame in each remaining ballast tank. See Notes 1, 2, 5 and 6.</p> <p>(3) One transverse bulkhead in each ballast tank. See Notes 1, 3, 5 and 6.</p>	<p>(1) All web frames in all ballast tanks. See Notes 1, 2, 5 and 6.</p> <p>(2) All transverse bulkheads in all ballast tanks. See Notes 1, 3, 5 and 6.</p>	<p>(1) All web frames in all ballast tanks. See Notes 1, 2, 5 and 6.</p> <p>(2) All transverse bulkheads in all ballast tanks. See Notes 1, 3, 5 and 6.</p>
<p>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.</p> <p>Note 2. Complete transverse web frame ring including adjacent structural members.</p> <p>Note 3. Transverse bulkhead complete, including girder system and adjacent structural members and adjacent longitudinal bulkhead structure.</p> <p>Note 4. Transverse bulkhead lower part including girder system and adjacent structural members.</p> <p>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.</p> <p>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.</p>			

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 <i>Rules and Regulations for the Classification of Ships</i>		
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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Part 7, Annual and intermediate survey requirements

All ships

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PART 7 – Annual And Intermediate Survey Requirements

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Section	6 All Remaining Ships	(7.2.6)

7.1 Annual Survey Requirements

Table 7.1.1 General Dry Cargo Ships

Ships up to 10 years of age	Ships over 10 years of age	Ships over 15 years of age
See Notes 1 and 2	Overall survey of one forward and one after cargo hold and their associated 'tween deck spaces See Notes 1, 2 and 3.	(1) Overall survey of all cargo holds and 'tween deck spaces (2) Close-up Survey of at least 25% of shell frames, including their end attachments and adjacent shell plating in a forward lower cargo hold and one other selected lower cargo hold. Close-up Survey is to include the lower one third length of the shell frames See Notes 1, 2, 3, 4 and 5
<p>NOTES</p> <ol style="list-style-type: none"> 1. Cargo hatch covers, coamings and stiffeners are to be subjected to a close-up examination. 2. Close-up Survey and thickness measurement of structure identified at the previous Special Survey or Intermediate Survey as having substantial corrosion. 3. Where considered necessary by the Surveyor, thickness measurement is to be carried out. Where the results of thickness measurement indicate substantial corrosion, the extent of thickness measurement should be in accordance with the Rules for Ships, Pt 1, Ch 3, Table 3.5.6. The survey will not be considered complete until these additional thickness measurements have been carried out. 4. Where the survey reveals the need for remedial measures, then the survey is to be extended to include the Close-up Survey of all shell frames and adjacent shell plating in those cargo holds and associated 'tween deck spaces, as well as a Close-up Survey of sufficient extent of all remaining cargo holds and 'tween deck spaces. 5. Where the protective coatings in cargo holds are found in GOOD condition, as defined in the Rules for Ships, Pt 1, Ch 3,1.5, the extent of Close-up Survey may be specially considered. 		

Table 7.1.2 Dry Bulk Carriers

Ships less than 10 years old	Ships between 10 and 15 years old	Ships greater than 15 years old
<p>(1) Overall survey of the forward cargo hold and an aft cargo hold on single skin ships</p> <p>(2) Close-up examination of steel hatch covers coamings and stiffeners</p>	<p>(1) Overall survey of</p> <p>(i) all cargo holds on single skin ships</p> <p>(ii) two selected cargo holds on double skin ships</p> <p>(2) Close-up Survey of at least 25% of the cargo hold side shell frames, their lower end attachments and adjacent shell plating in the forward cargo hold on single skin ships</p> <p>(3) Close-up examination of steel cargo hatch covers coamings and stiffeners</p>	<p>(1) Overall survey of all cargo holds</p> <p>(2) Close-up Survey of at least 25% of the cargo hold side shell frames, their lower end attachments and adjacent shell plating in the forward cargo hold and one other selected cargo hold on single skin ships</p> <p>(3) Close-up examination of steel cargo hatch covers coamings and stiffeners</p>
<p>See Notes 1 and 6</p>	<p>See Notes 1, 2, 3, 4 and 5</p>	<p>See Notes 1, 2, 3, 4 and 5</p>
<p>NOTES</p> <p>The requirements in this Table apply to both single skin and double skin ships, unless stated otherwise.</p> <p>1. Close-up Survey and thickness measurement of structure identified at the previous surveys as having substantial corrosion in accordance with the Rules for Ships, Pt 1, Ch 3, Tables 3.6.4 to 3.6.9.</p> <p>2. Close-up Survey is required within the area of the lower one third of the length of the cargo hold side shell frames.</p> <p>3. Where the Survey reveals the need for remedial measures, the Survey is to be extended to include a Close-up Survey of all of the cargo hold side shell frames and adjacent shell plating of that cargo hold, as well as a Close-up Survey of sufficient extent of all remaining cargo holds.</p> <p>4. When considered necessary by the Surveyor, thickness measurement is to be carried out. Where the results of thickness measurement indicate substantial corrosion, the extent of thickness measurement should be in accordance with the Rules for Ships, Pt 1, Ch 3, Tables 3.6.4 to 3.6.9 as applicable. The survey will not be considered complete until these additional thickness measurements have been carried out.</p> <p>5. Where protective coatings are found in good condition, as defined in the Rules for Ships, Pt 1, Ch 3, 1.5, the extent of the Close-up Survey and thickness measurement may be specially considered. Prior to any coating or recoating of cargo holds, scantlings are to be confirmed by thickness measurement with the Surveyor in attendance.</p> <p>6. Where overall survey reveals the need for remedial measures, then the survey is to be extended to include all cargo holds.</p>		

Annual Survey Requirements

Part 7, Chapter 1

Section 3 and Section 4

Table 7.1.3 Oil tankers, Ore/Oil Ships, Ore/Bulk/Oil Ships and Chemical Tankers

Single and Double Hull Oil Tankers and Chemical Tankers
<p>(1) Close-up Survey and thickness measurement of structure identified at the previous Special Survey or Intermediate Survey as having substantial corrosion.</p> <p>(2) For ballast tanks, in areas where substantial corrosion, as defined in the Rules for Ships, Pt 1, Ch 3,1.5, has been noted then additional measurements are to be carried out in accordance with the Rules for Ships, Pt 1, Ch 3, Tables 3.7.7 to 3.7.15 and Tables 3.8.3 to 3.8.6, as applicable. The survey will not be considered complete until these additional thickness measurements have been carried out.</p> <p>(3) Examination of details as per Rules for Ships Pt 1, Ch 3, 2.2.30 (a) to (q) for Oil Tankers (including o/b/o and ore/oil ships) and 2.2.31 (a) to (u) for Chemical Tankers.</p>

Table 7.1.4 All Remaining Ships

Close-up Survey and thickness measurement of structure identified as having substantial corrosion.
<p>NOTE</p> <p>For liquefied gas ships <i>see also</i> the Rules for Ships, Pt. 1, Ch 3,9</p>

Intermediate Survey Requirements Part 7, Chapter 2

Section 1

7.1 Intermediate Survey Requirements

Table 7.2.1 General Dry Cargo Ships

Ships between 5 and 10 years old	Ships between 10 and 15 years old	Ships greater than 15 years old
<p>(1) Overall Survey of representative salt-water ballast tanks, as selected by the Surveyor</p> <p>(2) Overall Survey of one forward and one after cargo hold and their associated 'tween deck spaces</p> <p>See Note 1 and 6</p>	<p>(1) An overall Survey of all cargo holds and 'tween deck spaces</p> <p>(2) Where considered necessary by the Surveyor, thickness measurement is to be carried out</p> <p>See Notes 1, 2, 3 and 4</p>	<p>A survey to the same extent as the previous special Survey (applicable only to surveys of the hull structure and piping systems in way of the cargo holds cofferdams, pipe tunnels and void spaces within the cargo area and all salt-water ballast tanks)</p> <p>See Notes 1, 2, 4 and 5</p>
<p>NOTES</p> <p>1. Close-up Survey and thickness measurement of structure identified in the previous Special Survey as having substantial corrosion.</p> <p>2. Where the results of thickness measurement indicate substantial corrosion, the extent of thickness measurement should be in accordance with the Rules for Ships Pt 1, Ch 3, Table 3.5.6. The survey will not be considered complete until these additional thickness measurements have been carried out.</p> <p>3. If such examinations reveal no visible structural defects then the examination may be limited to a verification that the protective coating remains in GOOD or FAIR condition as defined by the Rules for Ships Pt 1, Ch 3,1.5</p> <p>4. For all salt-water ballast tanks where a hard protective coating is found to be in POOR condition, as defined by the Rules for Ships Pt 1, Ch 3,1.5, and it has not been repaired and where a soft coating has been applied from the time of construction the following requirements are applicable: (a) For salt-water ballast tanks, other than independent double bottom tanks, maintenance of class will be subject to the spaces in question being examined and gauged as necessary at Annual Surveys. (b) For independent salt-water double bottom tanks, maintenance of class may, at the discretion of the Surveyor, be subject to the spaces in question being examined and gauged as necessary at Annual Surveys.</p> <p>5. Tank testing, Survey of automatic air pipe heads and internal examination of oil fuel, lubricating oil and fresh water tanks are to be carried out if deemed necessary by the Surveyor.</p> <p>6. Where a hard protective coating is found to be in POOR condition, as defined in the Rules for Ships, Pt 1, Ch 3,1.5, where a soft or semi-hard coating has been applied, where a protective coating was not applied from the time of construction, or other defects are found, the survey is to be extended to other ballast tanks of the same type.</p>		

Intermediate Survey Requirements Part 7, Chapter 2

Table 7.2.2 Dry Bulk Carriers

Ships between 5 and 10 years old	Ships between 10 and 15 years old	Ships greater than 15 years old
<p>(1) Overall Survey of all cargo holds</p> <p>(2) Close-up Survey to establish the condition of at least 25% of the cargo hold side shell frames including their upper and lower end attachments, adjacent shell plating and the transverse bulkheads in the forward cargo hold and one other selected cargo hold on single skin ships</p> <p>(3) Overall Survey of representative salt-water ballast tanks, as selected by the Surveyors. For double skin dry bulk cargo ships (bulk carriers), the selected tanks are to include the fore peak tank, aft peak tank and a number of other tanks</p>	<p>A survey to the same extent as the previous Special Survey (applicable only to ESP surveys, see the Rules for Ships, Pt 1, Ch 3.6.1.2)</p>	<p>A survey to the same extent as the previous Special Survey (applicable only to ESP surveys, see the Rules for Ships, Pt 1, Ch 3.6.1.2)</p>
<p>See Notes 1, 3, 4 and 6</p>	<p>See Notes, 2, 3, 4 and 5</p>	<p>See Notes 3, 4 and 5</p>
<p>NOTES</p> <p>The requirements in this Table apply to both single skin and double skin ships, unless stated otherwise.</p> <p>1. For single skin ships, where considered necessary by the Surveyor as a result of the Overall and Close-up Survey, the Survey is to be extended to include a Close-up Survey of all of the side shell frames and adjacent shell plating of that cargo hold, as well as a Close-up Survey of sufficient extent of all remaining cargo holds.</p> <p>2. For double skin ships, where considered necessary by the Surveyor as a result of the Overall Survey, the Survey is to be extended to include a Close-up Survey of all those areas of structure in cargo holds selected by the Surveyor.</p> <p>3. Thickness measurement is to be carried out of sufficient extent to determine the level of corrosion of those areas subject to Close-up Survey and structure identified at the previous Special Survey as having substantial corrosion. Where the results of thickness measurement indicate substantial corrosion, the extent of thickness measurement should be in accordance with the Rules for Ships, Pt 1, Ch 3,6, Tables 3.6.4, 3.6.5, 3.6.6, 3.6.7, 3.6.8 and 3.6.9 as applicable. The survey will not be considered complete until these additional thickness measurements have been carried out.</p> <p>4. For ships between 5 and 10 years old where hard protective coatings in cargo holds are found to be in good condition, as defined in the Rules for Ships, Pt 1, Ch 3,1.5, the extent of Close-up Survey and thickness measurement may be specially considered. Prior to any coating or re-coating of cargo holds, scantlings are to be confirmed by thickness measurement with the Surveyor in attendance.</p> <p>5. For ore carriers, in addition to the requirements above, the examination of salt-water ballast tanks is to include the following:</p> <ul style="list-style-type: none"> (i) All web frame rings in one ballast wing tank. (ii) One deck transverse in each remaining wing tank. (iii) Both transverse bulkheads in one ballast wing tank. (iv) One transverse bulkhead in each remaining ballast wing tank. <p>6. Where a hard protective coating is found to be in POOR condition, as defined in the Rules for Ships, Pt 1, Ch 3,1.5, where a soft or semi-hard coating has been applied, where a protective coating was not applied from the time of construction, or other defects are found, the survey is to be extended to other ballast tanks of the same type</p>		

Intermediate Survey Requirements Part 7, Chapter 2

7.2.3 Oil Tankers, Ore / Oil Ships, Ore / Bulk / Oil Ships

Ships between 5 and 10 years old	Ships greater than 10 years old
<p>(1) Single Hull:</p> <p>An examination of all salt-water ballast tanks is to be carried out. Where considered necessary by the Surveyor, thickness measurement and testing are to be carried out to ensure the structural integrity remains effective</p> <p>See Notes 2 and 3</p> <p>(2) Double Hull:</p> <p>Overall Survey of representative salt-water ballast tanks, as selected by the Surveyor</p> <p>See Notes 1, 2 and 3</p>	<p>1) A survey to the same extent as the previous Special Survey (refer to requirements in the Rules for Ships, Pt 1, Ch 3.7)</p> <p>See Notes 1, 2 and 3</p> <p>2) Pressure testing of cargo and ballast tanks and the requirements for the longitudinal strength evaluation are to be carried out if deemed necessary by the attending Surveyor</p> <p>See Notes 1, 2 and 3.</p>
<p>NOTES</p> <p>1. If the survey reveals no visible defects, the examination may be limited to a verification that the hard protective coating remains in GOOD condition.</p> <p>2. Close-up Survey and thickness measurement of structure identified at the previous Special Survey as having substantial corrosion. (Also refer to Pt 1, Ch 3,7, Tables 3.7.6 to 3.7.9 of the Rules for Ships.)</p> <p>3. Salt-water ballast tanks are to be examined and gauged as necessary at Annual Surveys where:</p> <ul style="list-style-type: none"> (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, or (d) The hard protective coating is found to be in less than GOOD condition, as defined in the Rules for Ships Pt 1, Ch 3,1.5, and the hard protective coating is not repaired to the satisfaction of the Surveyor. 	

Intermediate Survey Requirements Part 7, Chapter 2

Section 4

Table 7.2.4 Chemical Tankers

Ships between 5 and 10 years old	Ships greater than 10 years old
<p>Overall Survey of representative salt-water ballast tanks, as selected by the Surveyor</p> <p>See Notes 1,2 and 3</p>	<p>Close-up Survey of:</p> <p>(1) A survey to the same extent as the previous Special Survey (applicable only to ESP surveys, see the Rules for Ships, Pt 1, Ch 3.8.1.2)</p> <p>(2) Pressure testing of cargo and ballast tanks is to be carried out if deemed necessary by the attending Surveyor</p> <p>See Notes 1 and 2</p>
<p>NOTES</p> <p>1. If the survey reveals no visible defects, the examination may be limited to a verification that the hard protective coating remains in GOOD condition.</p> <p>2. Close-up Survey and thickness measurement of structure identified at the previous Special Survey as having substantial corrosion.</p> <p>3. Salt-water ballast tanks are to be examined and gauged as necessary at Annual Surveys where:</p> <ul style="list-style-type: none"> (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, or (d) The hard protective coating is found to be in less than GOOD condition, as defined in 1.5, and the hard protective coating is not repaired to the satisfaction of the Surveyor. 	

Intermediate Survey Requirements Part 7, Chapter 2

Table 7.2.5 Ships For Liquefied Gases – Intermediate Surveys

Ships over 5 and up to 10 years old	Ships between 10 and 15 years old	Ships greater than 15 years old
<p>(1) Overall survey of representative ballast tanks, See Notes 1, 7 and 8</p>	<p>(1) Close-up Survey of all web frames and both transverse bulkheads in a representative ballast tank See Notes 1, 2, 3, 4, 5 and 6. (2) Close-up Survey of the upper part of one web frame in one other representative ballast tank See Notes 1, 2, 3, 4, 5 and 6. (3) Close-up Survey of one transverse bulkhead in one other representative ballast tank See Notes 1, 3, 4, 5 and 6 (4) Overall survey of all ballast tanks See Notes 1 to 7</p>	<p>(1) Close-up Survey of all web frames and both transverse bulkheads in two representative ballast tanks See Notes 1, 2, 3, 4, 5 and 6. (2) Overall survey of all ballast tanks See Notes 1 to 7</p>
<p>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 including adjacent structural members. Note 3. Transverse bulkhead complete, including girder system and adjacent structural members and adjacent longitudinal bulkhead structure. Note 4. For areas in cargo tanks and salt-water ballast tanks subject to Close-up Survey, the Close-up Survey may be specially considered but not dispensed with in its entirety, provided the Surveyor is satisfied with the Close-up Survey that there is no structural diminution and the overall tank protective coating remains in GOOD condition. Note 5. 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. Note 6. 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.</p>		

Intermediate Survey Requirements Part 7, Chapter 2

Section 6

Table 7.2.6 All Remaining Ships

Ships between 5 and 10 years old	Ships between 10 and 15 years old	Ships greater than 15 years old
Overall Survey of representative salt-water ballast tanks, as selected by the Surveyor	Overall survey of all salt-water ballast tanks	(1) Overall survey of all salt-water ballast tanks (2) Overall survey of selected cargo holds
See Notes 1, 2, 3 and 4	See Notes 1, 2 and 3	See Notes 1, 2 and 3
<p>NOTES</p> <p>1. Close-up Survey and thickness measurement of structure identified in the previous Special Survey as having substantial corrosion.</p> <p>2. For all salt-water ballast tanks where a hard protective coating is found to be in POOR condition, as defined by the Rules for Ships Pt 1, Ch 3,1.5, and it has not been repaired; where a soft or semi-hard coating has been applied from the time of construction, the following requirements are applicable: (a) For salt-water ballast tanks, other than independent double bottom tanks, maintenance of class will be subject to the spaces in question being examined and gauged as necessary at Annual Surveys. (b) For independent salt-water double bottom tanks, maintenance of class may, at the discretion of the Surveyor, be subject to the spaces in question being examined and gauged as necessary at Annual Surveys.</p> <p>3. If such examinations reveal no visible structural defects then the examination may be limited to a verification that the protective coating remains in GOOD or FAIR condition, as defined by the Rules for Ships Pt 1, Ch 3.1.5.</p> <p>4. Where a hard protective coating is found to be in POOR condition as defined in the Rules for Ships, Pt 1, Ch 3.1.5, where a soft or semi-hard coating has been applied, where a protective coating was not applied from the time of construction or other defects are found, the survey is to be extended to other ballast tanks of the same type.</p>		



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Thickness measurement and close-up survey guidance

Part 8, Assessment of protective coatings in ballast tanks
All ships

FEBRUARY 2017 Ver.7.4



PART 8 – Assessment Of Protective Coatings In Ballast Tanks

Chapter 1	Introduction	(8.1)
Chapter 2	Coating Conditions (Good, Fair, Poor)	(8.2)
Chapter 3	Areas Under Consideration	(8.3)
Section	1 General	(8.3.1)
Section	2 Ballast tanks in oil tankers	(8.3.2)
Section	3 Ballast tanks in ships other than oil tankers	(8.3.3)
Chapter 4	In-Service Ballast Tank Condition Monitoring	(8.4)

Introduction

Part 8, Chapter 1

8.1 Introduction

This guidance is to assist surveyors, shipowners, shipyards, flag Administrations and other interested parties involved in the survey and assessment of protective coatings in ballast tanks.

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

Maintenance and repair of the protective coating system should be included in the ship's overall maintenance and repair scheme.

These Guidelines apply to all LR classed ships and focus on assessment of coatings in dedicated seawater ballast tanks of all types of ships and double-side skin spaces of bulk carriers, hereinafter referred to as "ballast tanks". Corrosion prevention systems other than coating are not covered.

The methodology for coating assessment as detailed subsequently should be used for inspection of all ballast tanks on all ships.

8.2 Coating Conditions (Good, Fair, Poor)

The condition of the coating in ballast tanks is assigned and categorised as “GOOD”, “FAIR” or “POOR” based on visual inspection and estimated percentage of areas with coating failure and rusty surfaces.

The definitions of coating conditions “GOOD”, “FAIR” and “POOR” are as follows:

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% or more of areas under consideration, but less than as defined for POOR condition.

POOR: Condition with general breakdown of coating over 20% or more of areas or hard scale at 10% or more of areas under consideration.

These Guidelines clarify the above definitions in order to achieve a unified assessment of coating conditions as follows, see also the table below:

GOOD: Condition with spot rusting on less than 3% of the area under consideration without visible failure of the coating. Rusting at edges or welds, should be on less than 20% of edges or weld lines in the area under consideration.

FAIR: Condition with breakdown of coating or rust penetration on less than 20% of the area under consideration. Hard rust scale should be less than 10% of the area under consideration. Rusting at edges or welds should be on less than 50% of edges or weld lines in the area under consideration.

POOR: Condition with breakdown of coating or rust penetration on more than 20% or hard rust scale on more than 10% of the area under consideration or local breakdown concentrated at edges or welds on more than 50% of edges or weld lines in the area under consideration.

	GOOD ⁽³⁾	FAIR	POOR
Breakdown of coating or area rusted ⁽¹⁾	< 3%	3 - 20%	> 20%
Area of hard rust scale ⁽¹⁾	–	< 10%	≥ 10%
Local breakdown of coating or rust on edges or weld lines ⁽²⁾	< 20%	20 - 50%	> 50%

Notes:	
1	% is the percentage calculated on basis of the area under consideration or of the “critical structural area”
2	% is the percentage calculated on basis of edges or weld lines in the area under consideration or of the “critical structural area”
3	spot rusting, i.e. rusting in spot without visible failure of coating

8.3 Areas Under Consideration

8.3.1 General

Recognising that different areas in the tank experience different coating breakdown and corrosion patterns, the intent of this section is to subdivide the planar boundaries of the tank for evaluation of coating into areas small enough to be readily examined and evaluated by the surveyor. However, the areas subdivided should not be so small as to be structurally insignificant or too numerous to practically report on. Coating condition in each area should be noted using current practice and terminology (frame numbers, longitudinal numbers and/or strakes numbers, etc.). Each area is then rated **“GOOD”, “FAIR” or “POOR”** and **the tank rating should not be higher than the rating of its “area under consideration” having the lowest rating.**

Special attention should be given to coating in critical structural areas which are defined as “locations which have been identified from calculations to require monitoring as indicated in the Coating Technical File (CTF) from new building stage or from the service history of the subject ship or from similar or sister ships (if available) to be sensitive to cracking, buckling or corrosion which would impair the structural integrity of the ship”. Each critical structural area is rated **“GOOD”, “FAIR” or “POOR”**, applying the table above and **the rating of each “area under consideration” should then not be higher than the rating of its critical structural area (if present) having the lowest rating.**

The “area under consideration” with the worst coating condition should determine the frequency of surveys. Hence, **it is not intended to “average” the coating condition for all “areas under consideration” within a tank**, to determine an “average” coating condition for the entire tank.

8.3.2 Ballast tanks in oil tankers

Definitions of “areas under consideration” for ballast tanks in oil tankers are as follows (also illustrated for a wing ballast tank, a fore peak ballast and aft peak tank in **Figures 1, 2 and 3** below, respectively).

Single-hull tanker – wing ballast tanks

- *Deck and bottom*

Areas of deck and bottom plating with attached structure (one area to consider for deck and one area to consider for bottom).

- *Side shell and longitudinal bulkheads*

Areas of side shell and longitudinal bulkheads with attached structure, in lower, middle and upper third (three areas to consider for side shell and three areas to consider for longitudinal bulkhead).

- *Transverse bulkheads (forward and aft)*

Areas of transverse bulkhead and attached stiffeners, in lower, middle and upper third (three areas to consider for forward transverse bulkhead and three areas to consider for aft transverse bulkhead).

Double-hull tanker – Double bottom ballast tanks

Areas of tank boundaries and attached structure, in lower and upper half of tank (two areas to consider).

Double-hull tanker – Double bottom side tanks

- *Deck and bottom*

Areas of deck and bottom plating with attached structure (one area to consider for deck and one area to consider for bottom).

- *Side shell and longitudinal bulkheads*

Areas Under Consideration

Part 8, Chapter 3

Areas of side shell and longitudinal bulkheads with attached structure, in lower, middle and upper third (three areas to consider for side shell and three areas to consider for longitudinal bulkhead).

- *Transverse bulkheads (forward and aft)*

Areas of transverse bulkhead and attached stiffeners, in lower, middle and upper third (three areas to consider for forward transverse bulkhead and three areas to consider for aft transverse bulkhead).

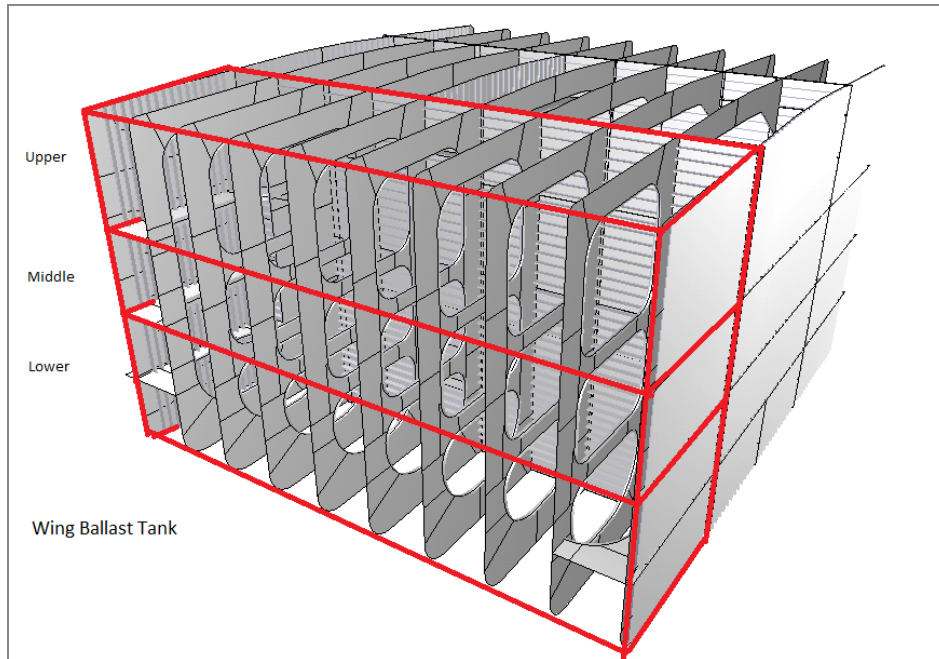


Figure 1 "Areas under consideration" indicated for a wing ballast tank, from one side, i.e. deck, side shell, longitudinal bulkhead and transverse bulkheads

Single-hull and Double-hull tanker – Fore peak tanks

Areas of tank boundaries and attached structure, in upper, middle and lower third of tank (three areas to consider).

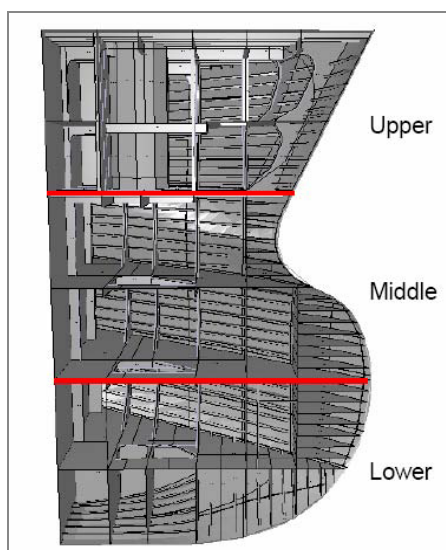


Figure 2 "Areas under consideration" indicated for a fore peak ballast tank

Single-hull and Double-hull tanker – After peak tanks

Areas of tank boundaries and attached structure, in lower and upper half of tank (two areas to consider).

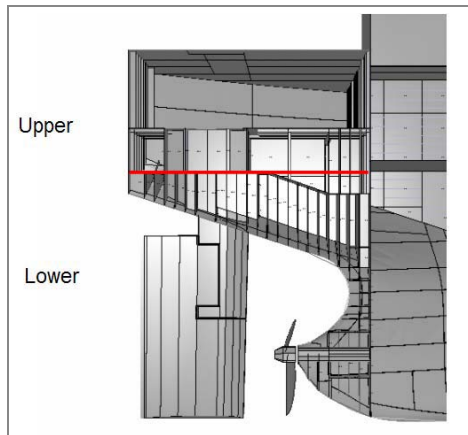


Figure 3 “Areas under consideration” indicated for an aft peak tank

8.3.3 Ballast tanks in ships other than oil tankers

Definitions of “areas under consideration” for ballast tanks and double-side skin spaces in ships other than oil tankers, which are based on representative tank configuration, are as follows (also illustrated for topside tanks, hopper tanks, double bottom tanks, side tanks, fore peak tanks and after peak tanks in **Figures 4 to 9** below, respectively):

Topside tanks

- *Deck, vertical strake and bottom.*

Areas of deck, vertical strake and bottom plating with attached structure (one area to consider for deck and vertical strake with attached structure and one area to consider for bottom).

- *Side shell*

Side shell with attached structure, in lower and upper or in lower, middle and upper depending on the vertical height (two areas to consider for side shell, but if the vertical height is more than 15 m, three areas to consider).

- *Transverse bulkheads (forward and aft)*

Areas of transverse bulkhead and attached stiffeners, in lower and upper or in lower, middle and upper depending on the vertical height (two areas to consider for forward transverse bulkhead and aft transverse bulkhead, but if the vertical height is more than 15 m, three areas to consider).

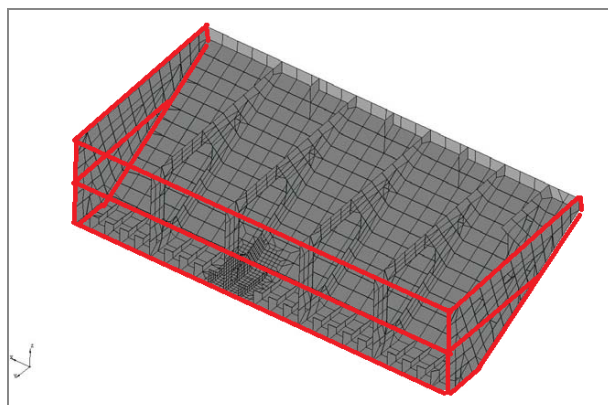


Figure 4 “Areas under consideration” indicated for a topside tank

Hopper tanks

- *Hopper, side girder and bottom*

Areas of hopper, side girder and bottom plating with attached structure (one area to consider for bottom and side girder with attached structure and one area to consider for hopper).

- *Side shell*

Side shell, including bilge plating, with attached structure, in lower and upper or in lower, middle and upper depending on the vertical height (two areas to consider for side shell, but if the vertical height is more than 15 m, three areas to consider).

- *Transverse bulkheads (forward and aft)*

Areas of transverse bulkhead and attached stiffeners, in lower and upper or in lower, middle and upper depending on the vertical height (two areas to consider for forward transverse bulkhead and aft transverse bulkhead, but if the vertical height is more than 15 m, three areas to consider).

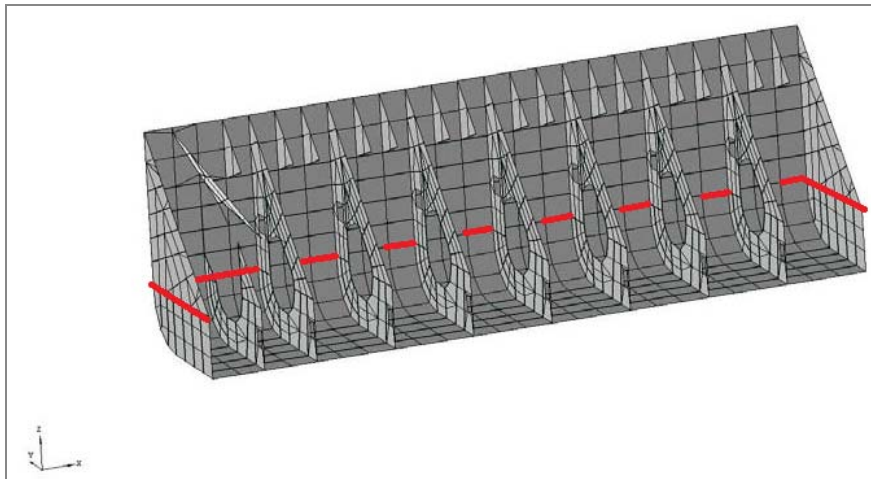


Figure 5 "Areas under consideration" indicated for a hopper tank

Double bottom tanks

Areas of tank boundaries and attached structure, in lower and upper half of tank (two areas to consider).

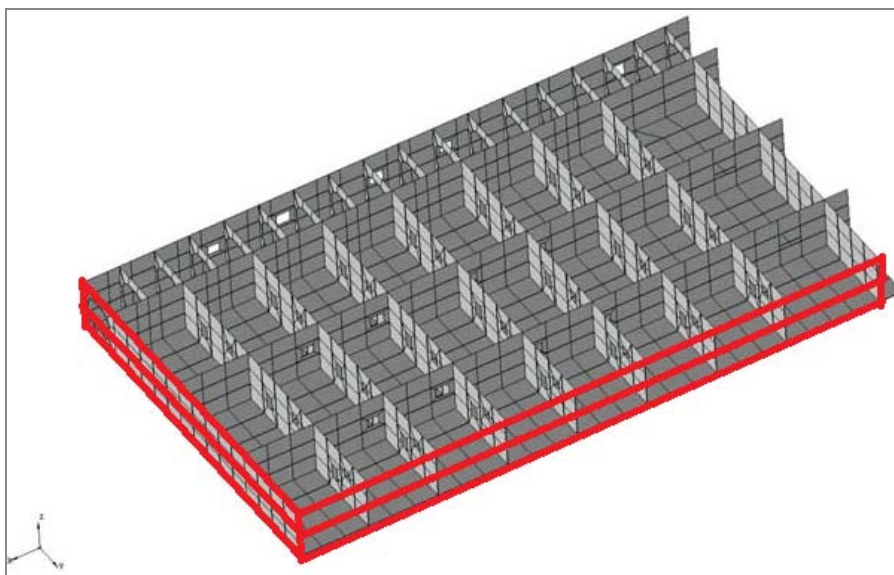


Figure 6 "Areas under consideration" indicated for a double bottom tank

Side tanks

- *Deck and bottom*

Areas of deck and bottom plating with attached structure (one area to consider for deck and one area to consider for bottom).

- *Side shell and longitudinal bulkheads*

Side shell and longitudinal bulkheads with attached structure, in lower and upper or in lower, middle and upper depending on the vertical height (two areas to consider for side shell, but if the vertical height is more than 15 m, three areas to consider).

- *Transverse bulkheads (forward and aft)*

Areas of transverse bulkhead and attached stiffeners, in lower and upper or in lower, middle and upper depending on the vertical height (two areas to consider for forward transverse bulkhead and aft transverse bulkhead, but if the vertical height is more than 15 m, three areas to consider).

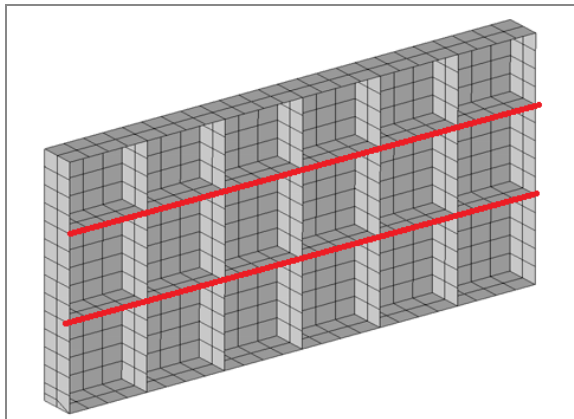


Figure 7 "Areas under consideration" indicated for a side tank

Fore peak tanks

Areas of tank boundaries and attached structure in upper and lower or upper, middle and lower depending on the vertical height (two areas to consider for fore peak tanks, but if the vertical height is more than 15 m, three areas to consider).

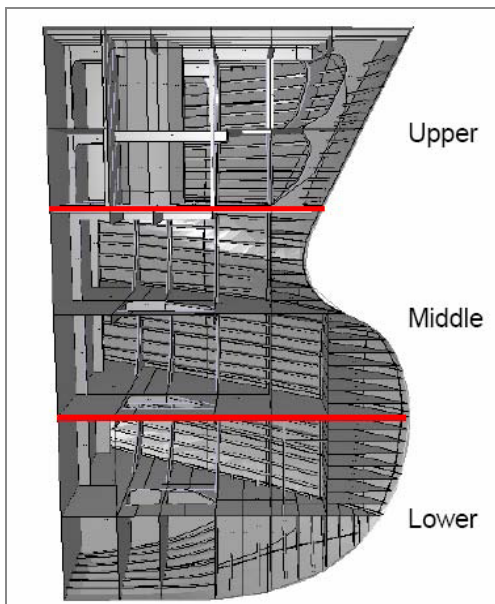


Figure 8 "Areas under consideration" indicated for a fore peak ballast tank

After peak tanks

Areas of tank boundaries and attached structure in upper and lower (two areas to consider).

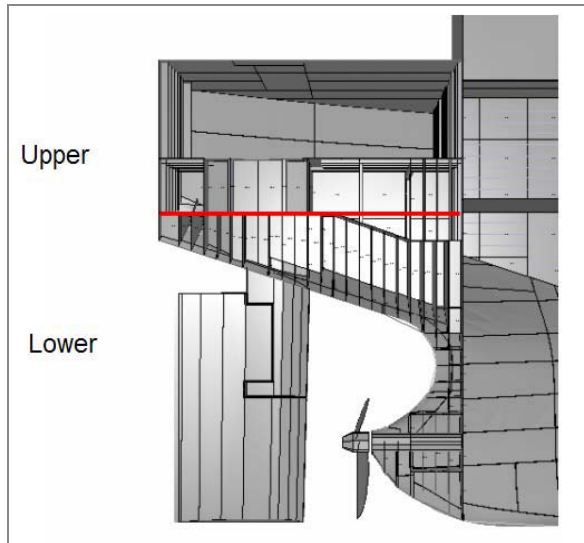


Figure 9 "Areas under consideration" indicated for an aft peak tank

Notes:

1. Each area includes plating and attached structural members.
2. A tank configuration which is a combination of two or more tank configurations may be dealt with separately in accordance with its unit shape or tank configuration, e.g., a combined hopper and double bottom tank or a combined topside, side and double bottom tank.
3. For fore peak tank or after peak tank, which consists of a ballast tank and a void space, they should be separately considered. Void spaces are not considered under these guidelines.

If the vertical height of a ballast tank other than a double bottom tank, fore peak tank or after peak tank is more than 15 m, it should be divided into three areas under consideration as shown in the table below.

Maximum vertical height (h) of tank	Areas under consideration (vertical)
$h \leq 15$ m	Two areas (lower/upper)
$h > 15$ m	Three areas (lower/middle/upper)

When deciding the boundary between lower/(middle)/upper parts for areas under consideration of the vertical surface, other than dividing the vertical surface equally by the number of areas decided according to the table above, the conspicuous structural member(s) such as stringers and/or horizontal girders on bulkheads or side shell may be the boundary.

8.4 In-Service Ballast Tank Condition Monitoring

It is recommended that all ballast tanks, especially for ships over six years of age, are inspected at least annually by the crew.

Standardized reports should be used with the following information, where applicable:

1. ship's name;
2. tank number/designation;
3. inspection date;
4. inspection by whom;
5. year coated;
6. coating name/type;
7. last repaired;
8. surface area;
9. coating condition (GOOD, FAIR or POOR);
10. Pitting corrosion – Yes/No;
11. amount of rust scale (in m² or % of areas under consideration);
12. access arrangement condition;
13. sounding pipe condition;
14. vent pipe condition;
15. ballast pipes condition;
16. structural damage, mechanical damage, location and extent; and
17. other comments.

The coating condition rating is used to give an objective report of the condition so that the urgency of the repairs can be established and the most cost effective solution found. The suitable rating system for this purpose is GOOD/FAIR/POOR as specified in Section 8.2.



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Thickness measurement and close-up survey guidance

Appendix

February 2017 Ver.7.4



Appendix

- Appendix 1 Opening Meeting Form**

- Appendix 2 Thickness Measurement Report Forms**

- Appendix 3 Guidance On Thickness Measurement For The Evaluation
Of Longitudinal Strength Of Hull Girders For All Ships (Including Oil
Tankers Greater Than 130m In Length)**

- Appendix 4 Guidance On Thickness Measurement Of Cargo Hold Shell
Frames On Single Skin Bulk Carriers Contracted For Construction Prior
To 1 July 1998**

- Appendix 5 Approval Of Thickness Measurement Companies**

- Appendix 6 Guidance Notes For Evaluation Of Scantlings
Of Corrugated Transverse Watertight Bulkheads In Bulk Carriers
Contracted For Construction On Or After 1 July 1998**

- Appendix 7 Guidance Notes For Evaluation Of Scantlings
Of Hatch Covers & Hatch Coamings Of Cargo Holds Of Bulk Carriers
Contracted For Construction On Or After 1 July 1998 & Bulk Carriers,
Ore Carriers And Combination Carriers Contracted For Construction On
Or After 1 January 2004.**

- Appendix 8 Guidelines For The Gauging / Renewal / Reinforcement Of The
Vertically Corrugated Transverse Watertight Bulkhead Between Holds
Nos. 1 And 2 In Accordance To UR S19**

- Appendix 9 CAP TM Jobs Argonaut User Guide**

- Appendix 10 Residual Deck Buckling in Argonaut**

Appendix 1

Report no:

Page of



OPENING MEETING - Agenda

IMO Number	Vessel Name	Ship Type	Location/Yard	Date	Survey Type	Due Date
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For all ships, prior to the commencement of any part of the Special or Intermediate Surveys and for any type of survey where thickness measurements are to be taken, a survey planning meeting is to be held between the attending Surveyor(s), the Owner's representative, the TM firm's representative & the Master of the ship, where involved.

REVIEW OF ESP/CAS APPROVED SURVEY PLANNING DOCUMENT (as applicable)

COMMENTS:

NOTE:

Please be guided by Lloyd's Register Rules and Regulations for the Classification of Ships, Chapter 3, Section 1.6 Preparation for survey and means of access for information on Survey Planning Documents for Special & Intermediate Surveys of ESP ships.

SCOPE OF SURVEY

Review Part 1 Ch 3 of the LR Rules and Regulations for the Classification of Ships and Periodical Survey Regulations for each applicable ship type.

1. Close-up Survey Requirements as applicable.
2. Thickness Measurement Requirements.
3. Critical Areas as required by the Surveyors.
4. Areas subject to Close-ups and Thickness Measurements, including areas previously identified with substantial corrosion, as applicable.
5. Areas subject to Close-up and Thickness Measurement, in spaces as previously identified with POOR/FAIR tank coatings from ship Memoranda, as applicable.
6. Requirements for the extend of Thickness Measurements, for any new areas as identified, with substantial corrosion, localised pitting, grooving & edge corrosion.

COMMENTS:

SAFETY

NOTES:

The finding of asbestos in use during surveys will result in immediate cancellation of surveys, and will only result in continuation of surveys after adequate and acceptable measures have been taken to satisfaction of Lloyd's Register.

All safety requirements and means of access to structure must be in alignment to Part 1 Ch 3 Section 1.6 of the Rules and Regulations for the Classification of Ships & the Periodical Survey Regulations.

All tanks and spaces will be adequately cleaned for survey. Where blasting or chipping is planned, such areas will be inspected before & after the activity.

Does Company have a Health & Safety System / Policy?

Are Procedures provided for Confined Tank Entry and have they been reviewed by all parties?

- a. Communications in place (i.e. at tank entrance, inside tank)
- b. Permits/Certificates: safe entry/hot work/gas free, frequency
- c. Ventilation (fit for purpose blowers, blowers in good condition, time versus space to be ventilated)
- d. Emergency evacuation provisions (i.e. stretcher, SCBA, medivac)
- e. Illumination (safe and efficient and fit for size of space)

Appendix 1

SAFETY (Continued)

Are procedures provided for Working at Height and have they been reviewed by all parties? (scaffolding, harness use, scaff tag system, use of ladders/mobile work platform)

If close up surveys by rafting is requested, are suitable, robust rafts available? (rough duty, multi chamber design, no of back-up rafts)

Means of Access for Close-ups and Thickness Measurements:

COMMENTS:

Safety Provisions for close-ups & Thickness Measurements (cleaning, illumination, ventilation, means of comm/s, gas freeing, safety equipment):

COMMENTS:

THICKNESS MEASUREMENT

Availability of ship plans, prepared TM Sketches, URS 19/31 assessment tables & TM CALC model File (as applicable) (Y/N) :

COMMENTS:

Availability of permissible diminution levels for ship type as applicable:

COMMENTS:

Communications & Thickness Measurement monitoring by LR Surveyors:

1. Measurements done during Close-up Survey
2. Reporting of Thickness Measurements on regular intervals (e.g. end of each day as agreed on signed ship sketches/drafts)
3. Draft TM Report at end of Survey
4. Prompt notification to the Surveyor in case of findings as:
 - Excessive/Substantial corrosion
 - Pitting/Grooving of any significance
 - Doubler plates and patched structure
 - Detached/deformed/fractured structure & buckling
 - Cracks & corrosion on welds

COMMENTS:

Ultrasonic Equipment used (Type / model & confirmation of Calibration Testing):

Appendix 1

- This form is in compliance with IACS PR 19 -

TM Company & TM Operator(s) approved (Y / N) and expiry date of approval certificate:

ATTENDEES		
Company	Representative	Role



LR Surveyor

LR Surveyor

Appendix 2

APPENDIX 2 THICKNESS MEASUREMENT REPORT 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.

Non CSR TM Forms

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.
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 <u>fully</u> reported onto an additional TM form e.g. TM6.

Appendix 2

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.
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 <u>fully</u> 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.

Appendix 2

THICKNESS MEASUREMENT –REPORT FORMS – GENERAL PARTICULARS FORM



Thickness Measurement Report

Ship's Name: A SHIP

LR/IMO Number: 1234567

TM Report Number: LON1234567

General Particulars

Ship Particulars	
Flag :	Port of Registry :
ESP Ship : Yes	Ship Type : Double Hull Oil Tanker
Length Overall (m) :	Gross Tonnage :
Deadweight (t) :	Date of Build :

Survey Details	
Classification Society : LR - Lloyd's Register	Place of Measurement :
First Date of Measurement :	Last Date of Measurement :
Survey Due : SSI	Rule Type : CSR
Ship Category :	Details of Measurement Equipment :
Job Status :	

TM Company Details	
Name of Company Performing Thickness Measurement :	
Thickness Measurement Company certified by :	Certificate Number :
Certificate Valid From :	Certificate Valid To :
Qualification of Operators :	

Authorisation		
TM Operator's Details	Attending Surveyor's Details	Authorising Surveyor's Details
Name:	Name:	Name:
Signature:	Signature:	Signature:
	Surveyor to Lloyd's Register EMBA "A subsidiary of Lloyd's Register Group Limited"	Surveyor to Lloyd's Register EMBA "A subsidiary of Lloyd's Register Group Limited"
Stamp:	Stamp:	Stamp:

Notes

Lloyd's Register Group Limited, its affiliates and subsidiaries and their respective officers, employees or agents are, individually and collectively, referred to in this clause as 'Lloyd's Register'. Lloyd's Register assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Lloyd's Register entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract.

Appendix 2

NON CSR THICKNESS MEASUREMENT – REPORT FORMS – TM1

TM1 – Deck, Shell & Bottom Plating

Space / Compartment Description :		Main Deck Plating													Comments	
Strake Position :		Strake S														
Plate Position	Sketch Reference ID	As Built Thickness (mm)	Max Allowable Diminution (%)	Renewal Thickness (mm)	Port Reading											
					Gauged Thickness (mm)	Forward		Thickness As Renewed (mm)	Gauged Thickness (mm)	Aft		Thickness As Renewed (mm)	Mean Diminution (%)			
(mm)	(mm)	(%)	(mm)	(mm)		(%)	(mm)									
10th Fwd																
9th Fwd																
8th Fwd																
7th Fwd																
6th Fwd																
5th Fwd																
4th Fwd																
3rd Fwd																
2nd Fwd																
1st Fwd																
Amidships																
1st Aft																
2nd Aft																
3rd Aft																
4th Aft																
5th Aft																
6th Aft																
7th Aft																
8th Aft																
9th Aft																
10th Aft																

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

Name of TM Operator : Operator's Name Surname

Name of LR Attending Surveyor : Surveyor's Name Surname

NOTES:

1. This Form is to be used for recording the thickness measurement for the below primary structural members:

- ✓ All strength deck plating within the cargo area.
- ✓ All keel, bottom, shell and bilge plating within the cargo area.
- ✓ All wind and water strakes within the cargo area.

2. Access **Create New TM Form** and select the appropriate **Survey Requirement** from the drop down list. The **TM Form** drop down list will then display the TM forms associated to selected survey requirements.

Create New TM Form

2.1 Form TM1 or TM6 will then become available to the user. The **Space/Comp/Section** will be automatically selected after user selects the TM Form.

Please note that TM6 has been associated with most survey requirements to provide the option for localised corrosion reporting. The system permits a unique combination of **Survey Requirement, TM Form** and **Space/Comp/Section**. In case the user reports both available TM Forms, There will be 2 TM Forms under the same Survey Requirement folder, titled the same, in the **Structural Component Tree**. Therefore, users should use a different **Location of Structure** in case they require generating both TM forms under the same **Survey Requirement** and **Space/Comp/Section**.

Appendix 2

Create New TM Form

Survey Requirement : * Deck Plating

TM Form : *
 TM1
 TM6

Space/Comp/Section : *

OK Cancel

Create New TM Form

Survey Requirement : * Deck Plating

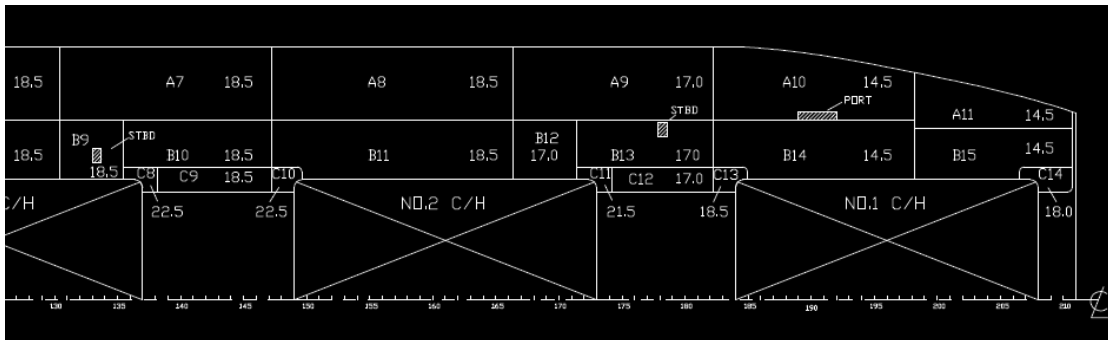
TM Form : * TM1

Space/Comp/Section : * Main Deck Plating

Location of Structure : * Strake S

OK Cancel

2.2 Please enter the **Location of Structure** on the available free-text box. For TM1 the strake position must be selected. The appropriate strake is to be symbolised with an identifier that corresponds to the plans aboard and the associated sketches attached to these TM forms.



3. The description of the plate position has to correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches. The **Sketch Reference ID** has to include two (2) elements: An indication of the sketch reference (1), where found necessary, as well as the plate reference (2).

Appendix 2

Ship's Name : Test Ship		LR/IMO Number : 8000111			Report Number : LON1234567							
TM1 - Deck, Shell & Bottom Plating												
Space / Compartment Description :		Main Deck Plating										
Strake Position :		Strake S										
Sketch Reference ID	As Built Thickness (mm)	Max Allowable Diminution (%)	Renewal Thickness (mm)	Port Reading								
				Forward			Aft			Mean Diminution (%)		
				Gauged Thickness (mm)	Diminution (mm) (%)		Thickness As Renewed (mm)	Gauged Thickness (mm)	Diminution (mm) (%)		Thickness As Renewed (mm)	
E	13.5	25.00	10.1	12.9	0.6	4.44	14	13.1	0.4	2.96		3.70
E	14.5	25.00	10.9	11.6	2.9	20.00		10.7	3.8	26.21		23.10
E	19.5	25.00	14.6					18.8	0.7	3.59		
E	23	25.00	17.3	20.6	2.4	10.43		18.8	4.2	18.26		14.35
E	23.5	25.00	17.6	21.8	1.7	7.23		18.1	5.4	22.98		15.11
E	24	25.00	18									

4. For oil tankers, all deck plating strakes are to be recorded; for ships with hatch openings, only the deck plating strakes outside the line of openings are to be recorded on this form.

5. Measurements are to be taken on the forward and aft areas of all plates and where plates cross ballast/cargo tank boundaries, separate measurements for the areas of plating in way of each type of tank are to be recorded.

6. The single measurements recorded on the TM Form are to represent the average of multiple measurements on a particular plate.

7. The TM Forms will highlight with colours any applicable exceptions for:

- ✓ Missing Reading
- ✓ Abnormally High Readings
- ✓ Substantial Corrosion (or)
- ✓ To be Coated or Gauged Annually
- ✓ Excessive Diminution
- ✓ Renewed As-Built
- ✓ Renewed other than As-Built

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

8. Comments at the end of the form are to be used for additional reporting of close up survey area findings on each particular structural item like pitting, grooving, edge corrosion, necking effect, detached structure. This will provide a more accurate description of the findings that explain any repairs carried out. It should be noted that comments for close up survey findings on plates that have not been marked as repaired, will be considered as outstanding defects on close out of the survey. The comments recorded to this column should accurately reflect the final condition of the ship, after any repairs renewals and alterations have taken place to the reported structural items.

9. The final TM report including this TM Form must represent the final condition of the ship structure after any repairs, renewals and alterations.

Appendix 2

2. Access **Create New TM Form** and select the appropriate **Survey Requirement** from the drop down list. The **TM Form** drop down list will then display the TM forms associated to selected survey requirements.



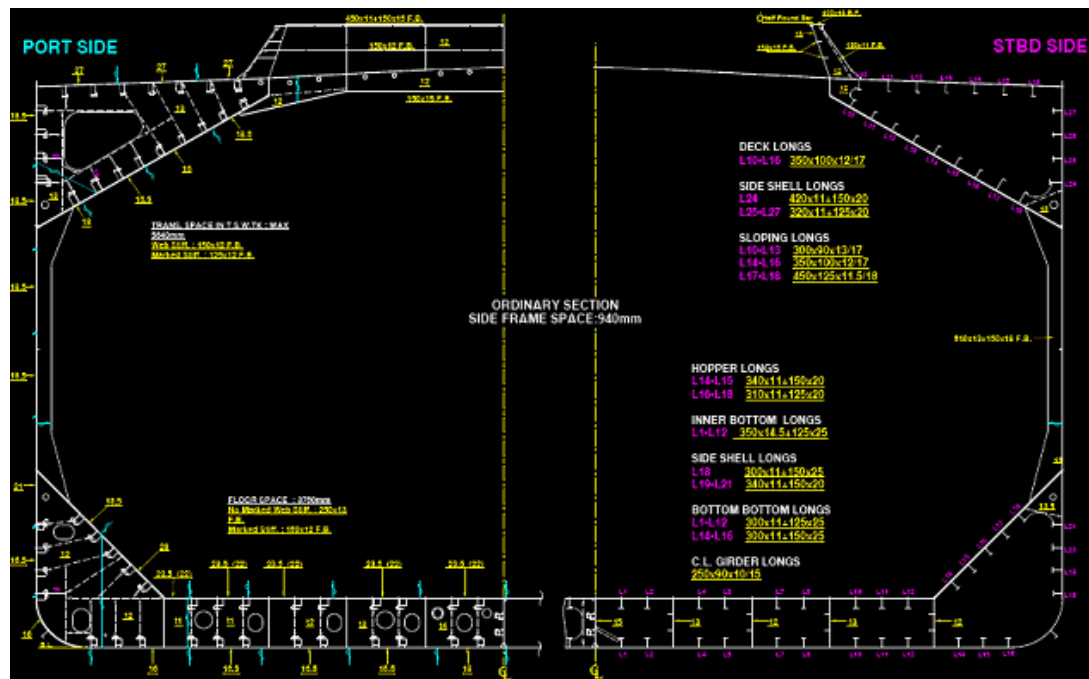
2.1 Form TM2~3 will then become available to the user. The Space/Comp/Section will be automatically selected.

2.2 Please fill in the **Space/Comp/Section Indicator** with the designated number of the transverse section being reported on this form.

2.3 Please select the **Zone** for the transverse section that is being reported. The drop down menu will provide the **Deck Zone**, the **Bottom Zone** or the **Neutral Axis Zone** for the user to select. Please review the *TM & Close up Survey Guide* for further information on which structural items are to be reported on each zone, for each particular ship type.

2.4 Please enter the **Location of Structure** in the available free-text box. For TM2~3 this should be the Frame number of the Transverse Section to be assessed. The Frame number should correspond to the plans onboard & -the associated sketches attached to these TM forms unless a typical midship section is attached in reference to all transverse sections in the report.

Appendix 2



3. On form TM2-3, the description of the **Structural Component** should correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches. The **Sketch Reference ID** has to include two (2) elements. Indication of the sketch reference (1) where found necessary, as well as the plate reference (2).

Transverse Section :		No. 1											
Zone :		Deck Zone											
Frame No. :		Frame No. 120											
Tank / Compartment / Space	Structural Component	Sketch Reference ID	As Built Thickness (mm)	Max Allowable Diminution (%)	Renewal Thickness (mm)	Plate / Profile Width / Height (mm)	Port Reading						
							Gauged Thickness (mm)	Diminution (mm)	Diminution (%)	Thickness As Renewed (mm)			
D.B.T.2	L1	Tr1	12	25.00	9	100	8.9	3.1	25.83				
D.B.T.2	L2	Tr1	10	25.00	7.5	150	9.0	0	0.00				
D.B.T.2	L3	Tr1	12	25.00	9	100	9.5	2.5	20.83	12			
D.B.T.2	L4	Tr1	10	25.00	7.5	150	6.7	3.3	33.00	10			
D.B.T.2	L5	Tr1	12	25.00	9	100	10.3	1.7	14.17				
D.B.T.2	L6	Tr1	10	25.00	7.5	150	9.1	0.9	9.00				
D.B.T.2	L7	Tr1	12	25.00	9	100	9.5	2.5	20.83				
D.B.T.2	L8	Tr1	10	25.00	7.5	150	10	0	0.00				
D.B.T.2	L9	Tr1	12	25.00	9	100	11.8	0.2	1.67				
D.B.T.2	L10	Tr1	10	25.00	7.5	150							

3.1 Enter the **Tank/Compartment/Space** associated with the plating / profile, for each structural item. This will normally be the **Tank/Compartment/Space** in which the measurement was obtained.

3.2 Select a **Plate/Profile Width/Height** for each structural item. This is the measurement that, when multiplied by the thickness of the plate or profile, will give the area for that plate or profile. The system will then calculate automatically the sectional area (**A**) for each plate for the as-built thickness and the gauged thickness on each row as per the following calculations on typical section examples illustrated below:

Appendix 2

Total Zone Sectional Area	
$A_{total} = A_{total-plat} + A_{total-long}$	
$A_{total-pl} = A_{pl1} + A_{pl2} + A_{pl3} + \dots = (t_{pl} \times H_{pl})_1 + (t_{pl} \times H_{pl})_2 + (t_{pl} \times H_{pl})_3 + \dots$	
$A_{total-long} = A_{long1} + A_{long2} + A_{long3} + \dots = (t \times H)_{long1} + (t \times H)_{long2} + (t \times H)_{long3} + \dots$	
$A_{long-typical} = (A_{web} + A_{flange})_{long-typical}$	
L-Section Longitudinal	
$A_{web-long} = (t_w \times W_w)_{long} = [t_w \times (W_w - t_f)]_{long}$	
$A_{flange-long} = (t_f \times H_f)_{long}$	
T-Section Longitudinal	
$A_{web-long} = (t_w \times W_w)_{long}$	
$A_{flange-long} = (t_f \times H_f)_{long}$	
Bulb Section Longitudinal	
$A_{web-long} = (t_w \times W_w)_{long}$	
$A_{flange-long}$: is not required to be assessed due to the difficulty of obtaining a thickness reading on the bulb section	
W : Plate or Long/l Width	H : Plate or Long/l Height
A : Transverse sectional area as indicated	t : Rule or Gauged thickness reading

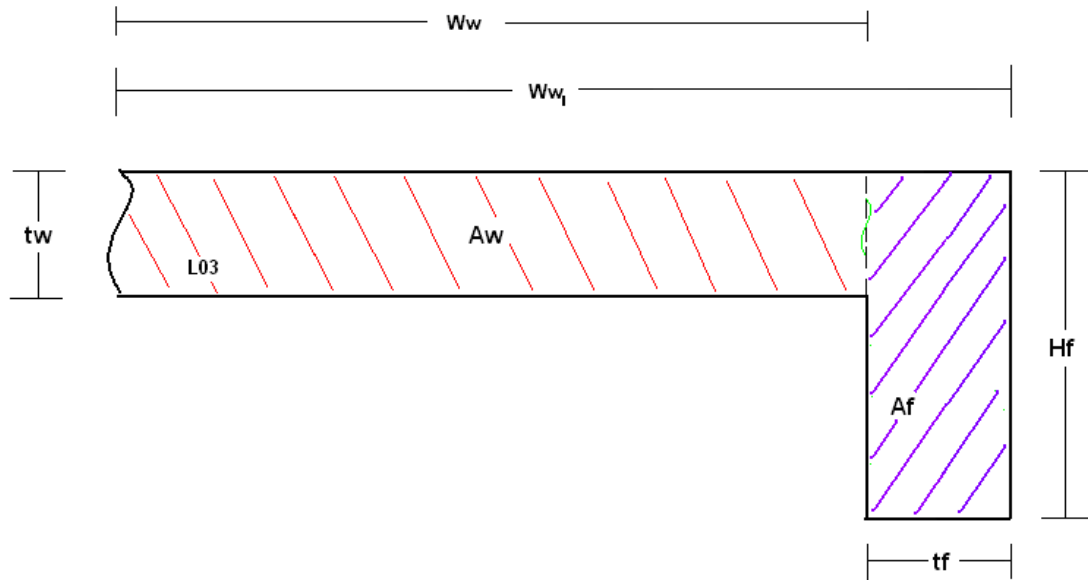
a. Plating



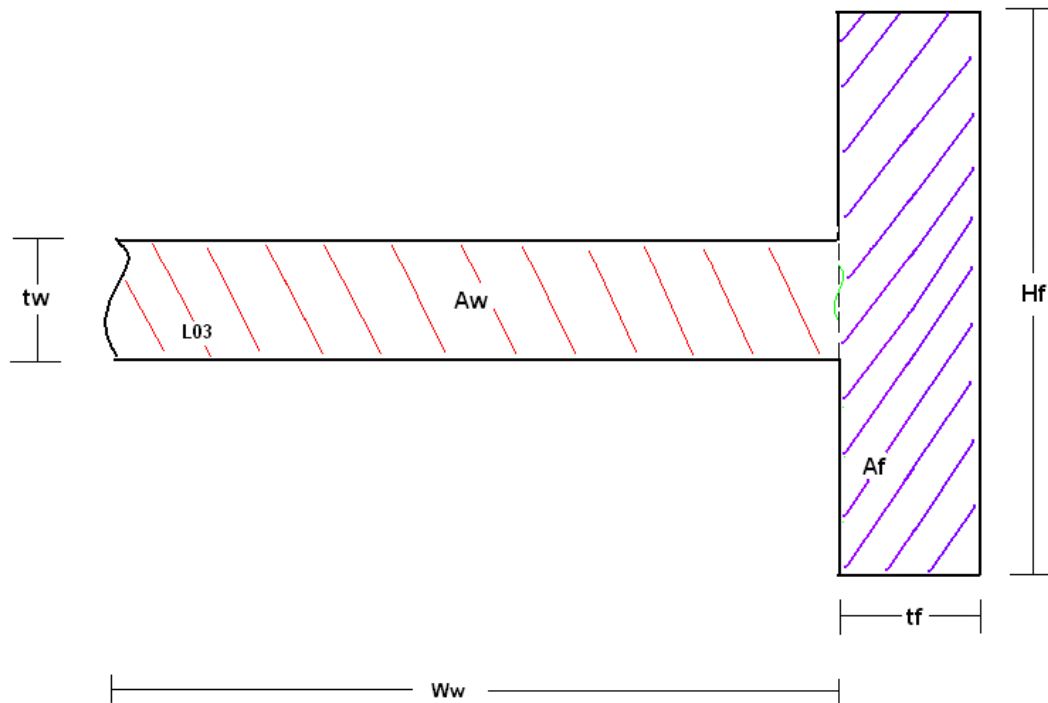
Appendix 2

b. Longitudinals

L-Section



T-Section



Appendix 2

3.3 The sum of the area calculations for the **Rule** design thickness and the **Actual** gauged thickness for each zone of a reported transverse section are presented on form TM8. This form will be generated automatically every time a TM2~3 form has been created for a transverse section.

Ship's Name : Test Ship		LR/IMO Number : 8000111		Report Number : LON1234567	
TM8 - Transverse Sections - Longitudinal Strength Assessment					
Transverse Section :			No. 1		
Frame No. :			Frame No. 100		
Area Assessment of Hull Girder Strength					
Zone	Actual (cm ²)	Rule (cm ²)	Reduction (%)	Acceptance Criteria (%)	
Deck Zone	297.9	189	-57.59	10	
Neutral Axis Zone				15	
Bottom Zone	158.9	189	15.93	10	
● Non-Acceptable					

3.4 Note that the calculations on the TM8 form will update each time a user updates the TM2~3 form. Where the user updates a **Gauged Thickness** on TM2~3 form with a **Thickness As-Renewed**, the calculation for the **Actual** transverse sectional area will be updated using the repaired thickness instead of the gauged thickness.

4. The TM2~3 Form will highlight with colours any applicable exceptions for:

- ✓ Missing Reading
- ✓ Abnormally High Readings
- ✓ Substantial Corrosion (or)
- ✓ To be Coated or Gauged Annually
- ✓ Excessive Diminution
- ✓ Renewed As-Built
- ✓ Renewed other than As-Built

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

5. The TM8 form will highlight any non-acceptable transverse sectional area assessment.

6. Comments at the end of the form are to be used for additional reporting of close up survey area findings on each particular structural item, for example pitting, grooving, edge corrosion, necking effect, and detached structure. This column will provide a more accurate description of the findings that explain any repairs carried out. It should be noted that comments for close up survey findings on plates that have not been marked as repaired, will be considered as outstanding defects on close out of the survey. The comments recorded to this column should accurately reflect the *final condition of the ship*, after any repairs, renewals and alterations have taken place to the reported structural items.

7. The final TM report including this TM Form must represent the final condition of the ship structure after any repairs, renewals and alterations.

Appendix 2

NON CSR THICKNESS MEASUREMENT – REPORT FORMS – TM4

TM4 – Transverse Structural Members & Attached Longitudinal Structure

Space / Compartment Description :		Wing Tank No. 2												
Location of Structure :		Frame No. 100												
Structural Component	Sketch Reference ID	As Built Thickness (mm)	Max Allowable Diminution (%)	Renewal Thickness (mm)	Port Reading			Starboard Reading			Comments			
					Gauged Thickness (mm)	Diminution		Thickness As Renewed (mm)	Gauged Thickness (mm)	Diminution		Thickness As Renewed (mm)		
						(mm)	(%)			(mm)			(%)	

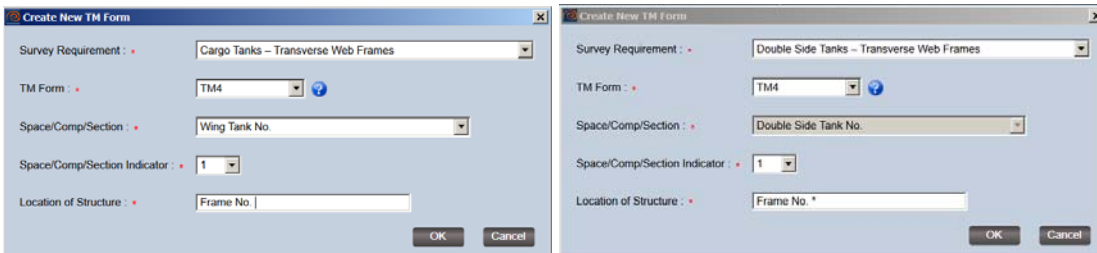
● Excessive Diminution
 ● Substantial Corrosion
 ● Renewed As Built
 ● Renewed other than As Built
 ● Missing Reading
 ● Abnormally High Reading
 Name of TM Operator : Operator's Name Surname Name of LR Attending Surveyor : Surveyor's Name Surname

NOTES:

1. This Form is to be used for recording 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.
2. Access **Create New TM Form** and select the appropriate **Survey Requirement** from the drop down list. The **TM Form** drop down list will display the TM forms associated to selected survey requirements.



2.1 Form TM4 will then become available to the user. The **Space/Comp/Section** will be automatically updated to provide a list of space/compartments like the Wing Tank or the Double Side Tank example below. The user should now select the more suitable descriptor from the drop down list.

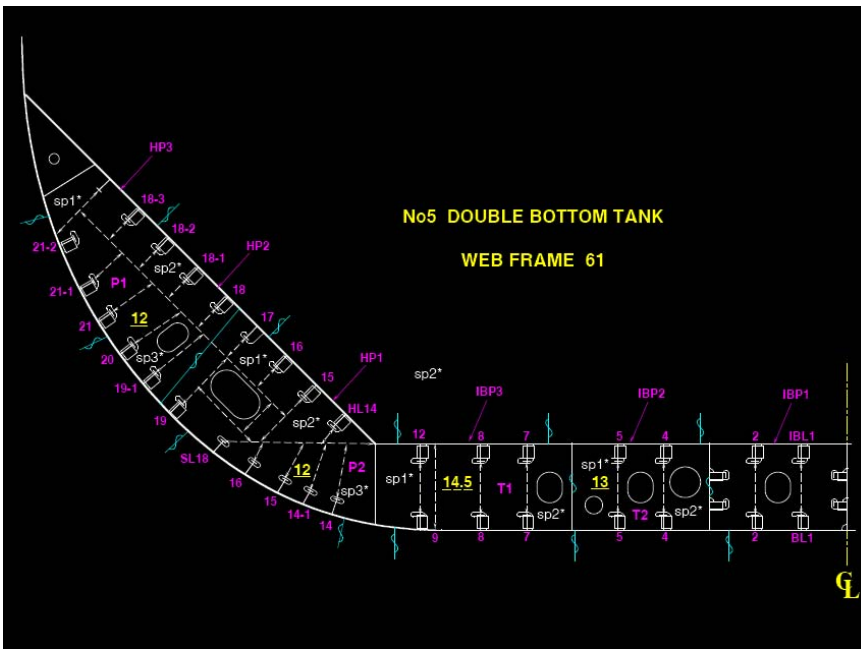


Appendix 2

Please note that TM6 has been associated with most survey requirements to provide the option for localised corrosion reporting. The system permits a unique combination of **Survey Requirement, TM Form** and **Space/Comp/Section**. In case the user reports both available TM Forms, There will be 2 TM Forms under the same Survey Requirement folder, titled the same, in the **Structural Component Tree**. Therefore, users should use a different descriptor for **Location of Structure** in case they require generating both TM forms under the same **Survey Requirement** and **Space/Comp/Section**.

2.2 Select the **Space/Comp/Section Indicator** with the indicating number of the compartment or space including the survey areas being reported to this form.

2.3 Please enter the **Location of Structure** on the available free-text box. For TM4 the particular frame station of the transverse structural member must be entered. The appropriate Frame number is to be symbolised with an identifier that corresponds to the plans aboard and the associated sketches attached to these TM forms.



3. By use of the TM Form, the description of the **Structural Component** has to correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches. The **Sketch Reference ID** has to include two (2) elements. Indication of the sketch reference (1) where found necessary, as well as the plate reference (2).

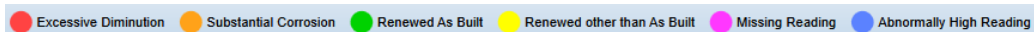
Ship's Name : Test Ship		LR/IMO Number : 8000111		Report Number : LON1234567						
TM4 - Transverse Structural Members & Attached Longitudinal Structure										
Space / Compartment Description :		Wing Tank No. 2								
Location of Structure :		Frame No. 100								
Sketch Reference ID	As Built Thickness (mm)	Max Allowable Diminution (%)	Renewal Thickness (mm)	Port Reading			Starboard Reading			
				Gauged Thickness (mm)	Diminution		Gauged Thickness (mm)	Diminution		Thickne As Renewe (mm)
					(mm)	(%)		(mm)	(%)	
S1	15	25.00	11.3	13.5	1.5	10.00	13.6	1.4	9.33	
S2	15	25.00	11.3	11.5	3.5	23.33	12.1	2.9	19.33	
S3	15	25.00	11.3	12.5	2.5	16.67	13.2	1.8	12.00	14
S4	15	25.00	11.3	12.1	2.9	19.33	10.5	4.5	30.00	
S5	15	25.00	11.3	10.5	4.5	30.00	12	3	20.00	15

Appendix 2

4. The single measurements recorded are to represent the average of multiple measurements.

5. The TM4 Form will highlight with colours any applicable exceptions for:

- ✓ Missing Reading
- ✓ Abnormally High Readings
- ✓ Substantial Corrosion (or)
- ✓ To be Coated or Gauged Annually
- ✓ Excessive Diminution
- ✓ Renewed As-Built
- ✓ Renewed other than As-Built



6. Comments at the end of the form are to be used for additional reporting of close up survey area findings on each particular structural item like pitting, grooving, edge corrosion, necking effect, and detached structure. This column will provide a more accurate description of the findings that explain any repairs carried out. It should be noted that comments for close up survey findings on plates that have not been marked as repaired, will be considered as outstanding defects on close out of the survey. The comments recorded to this column should accurately reflect the final condition of the ship, after any repairs, renewals and alterations have taken place to the reported structural items.

7. The final TM report including this TM Form must represent the final condition of the ship structure after any repairs, renewals and alterations.

Appendix 2

NON CSR THICKNESS MEASUREMENT – REPORT FORMS – TM5

TM5 - W.T. & O.T. Transverse Bulkheads

Space / Compartment Description :		Wing Tank No. 3											
Location of Structure :		Frame No. 100											
Type of Bulkhead :		Plain Transverse Bulkhead											
Structural Component (Plating / Stiffener)	Sketch Reference ID	As Built Thickness (mm)	Max Allowable Diminution (%)	Renewal Thickness (mm)	Port Reading			Starboard Reading			Comments		
					Gauged Thickness (mm)	Diminution (mm) (%)		Thickness As Renewed (mm)	Gauged Thickness (mm)	Diminution (mm) (%)		Thickness As Renewed (mm)	

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

Name of TM Operator : Operator's Name Surname

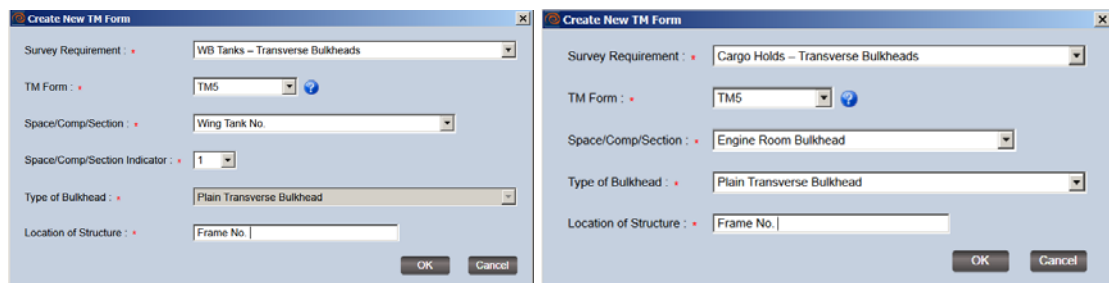
Name of LR Attending Surveyor : Surveyor's Name Surname

NOTES:

1. This Form is to be used for recording the thickness measurement of all W.T. transverse bulkheads where appropriate.
2. Access **Create New TM Form** and select the appropriate **Survey Requirement** from the drop down list. The **TM Form** drop down list will display the TM forms associated to selected survey requirements.



2.1 Form TM5 will then become available to the user. The **Space/Comp/Section** will be automatically updated to provide a list of possible space/compartments like the Wing Tank or the Engine Room Bulkhead examples below. The user should now select the more suitable descriptor from the drop down list.



Please note that TM6 has been associated with most survey requirements to provide the option for localised corrosion reporting. The system permits a unique combination of **Survey Requirement**, **TM Form** and **Space/Comp/Section**. In case the user reports both available TM Forms, there will be 2 TM Forms under the same Survey Requirement folder, titled the same, in the **Structural Component Tree**. Therefore, users should

Appendix 2

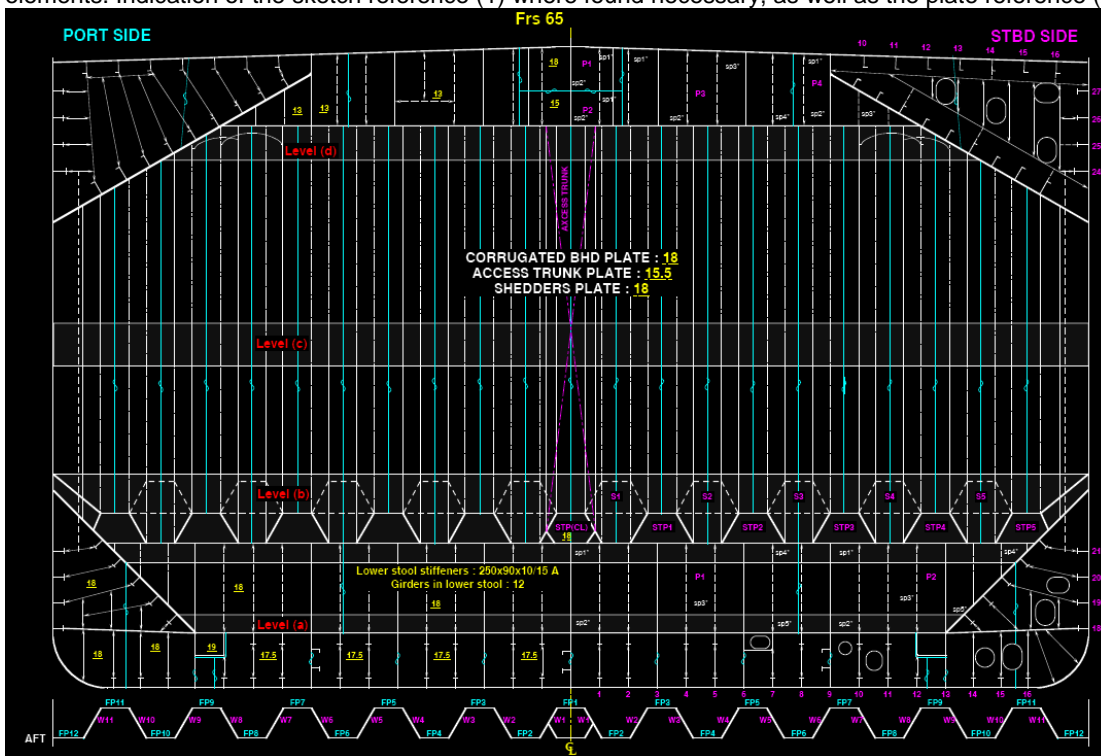
use a different descriptor for **Location of Structure** in case they require generating both TM forms under the same **Survey Requirement** and **Space/Comp/Section**.

2.2 Select the **Space/Comp/Section Indicator** that best describes the boundary of two ship space/compartments that the Bulkhead separates. Free text selection of **Space/Comp/Section** as well as the **Space/Comp/Section Indicator** is also available to the user.

2.3 Select the **Type of Bulkhead** that best describes the structural design of the bulkhead.

2.4 Please enter the **Location of Structure** on the available free-text box. For TM5 the particular Frame station of the transverse Bulkhead is required to be entered. The appropriate Frame number is to be symbolised with an identifier that corresponds to the plans aboard and the associated sketches attached to these TM forms.

3. By use of the TM Form, the description of the **Structural Component** has to correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches. The **Sketch Reference ID** has to include two (2) elements. Indication of the sketch reference (1) where found necessary, as well as the plate reference (2).



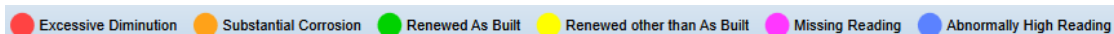
Ship's Name : Pak		LRIMO Number : 9186209		Report Number : ATW1231231							
TM5 - W.T. & O.T. Transverse Bulkheads											
Space / Compartment Description :		Wing Tank No. 1									
Location of Structure :		Frame No. 123									
Type of Bulkhead :		Plain Transverse Bulkhead									
Structural Component (Plating / Stiffener)	Sketch Reference ID	As Built Thickness (mm)	Max Allowable Diminution (%)	Renewal Thickness (mm)	Port Reading			Starboard Reading			Comments
					Gauged Thickness (mm)	Diminution (mm)	Thickness As Renewed (mm)	Gauged Thickness (mm)	Diminution (mm)	Thickness As Renewed (mm)	
Corrugated Plating	1	16	15.00	13.6	14.6	1.4	8.75	14.9	1.1	6.88	
	2	16	15.00	13.6	15.5	0.5	3.13	15	1	6.25	
	3	16	15.00	13.6	15.7	0.3	1.88	15.3	0.7	4.37	
	4	16	15.00	13.6	15.7	0.3	1.88	13.5	2.5	13.63	Pitting Stbd
	5	16	15.00	13.6	15.1	0.9	5.62	12.1	3.9	14.36	Pitting Stbd
	6	16	15.00	13.6	14.7	1.3	8.13	15.5	0.5	3.13	
	7	16	15.00	13.6	14.3	1.7	10.63				
	8	16	15.00	13.6	12.1	3.9	24.36	16.6	0	0.00	
	9	18	15.00	15.3	15.5	2.5	13.69	14	4	22.92	Pitting Stbd
	10	18	15.00	15.3	17.1	0.9	5.00	15.9	2.1	11.67	Pitting Stbd

Appendix 2

4. The single measurements recorded are to represent the average of multiple measurements.

5. The TM5 Form will highlight with colours any applicable exceptions for:

- ✓ Missing Reading
- ✓ Abnormally High Readings
- ✓ Substantial Corrosion (or)
- ✓ To be Coated or Gauged Annually
- ✓ Excessive Diminution
- ✓ Renewed As-Built
- ✓ Renewed other than As-Built



6. Comments at the end of the form are to be used for additional reporting of close up survey area findings on each particular structural item like pitting, grooving, edge corrosion, necking effect, and detached structure. This column will provide a more accurate description of the findings that explain any repairs carried out. It should be noted that comments for close up survey findings on plates that have not been marked as repaired, will be considered as outstanding defects on close out of the survey. The comments recorded to this column should accurately reflect the final condition of the ship, after any repairs, renewals and alterations have taken place to the reported structural items.

7. The final TM report including this TM Form must represent the final condition of the ship structure after any repairs, renewals and alterations.

Appendix 2

NON CSR THICKNESS MEASUREMENT – REPORT FORMS – TM5 UR S18

TM5 UR S18 - Cargo Hold W.T. Corrugated Transverse Bulkheads

Space / Compartment Description :				Bulkhead Between Cargo Hold Nos. 1/2					
Location of Structure :				Frame No. 120					
Type of Bulkhead :				Corrugated Transverse Bulkhead					
Structural Component	Sketch Reference ID	As Built Thickness (mm)	Net Thickness (mm)	Renewal Thickness (mm)	Port Reading		Starboard Reading		Comments
					Gauged Thickness (mm)	Thickness As Renewed (mm)	Gauged Thickness (mm)	Thickness As Renewed (mm)	

● Excessive Diminution ● To Be Coated or Gauged Annually ● Renewed As Built ● Renewed other than As Built ● Missing Reading ● Abnormally High Reading

Name of TM Operator : Operator's Name Surname

Name of LR Attending Surveyor : Surveyor's Name Surname

NOTES:

1. This Form is to be used for recording the thickness measurement of corrugated cargo hold transverse bulkheads, that have been assessed in accordance with UR S18 (ship assigned ESN notation – Enhanced Survivability Notation) and for which controlling thickness limits of tren and tsub/l (excessive diminution/substantial corrosion) are calculated with corrosion addition (ts) taken equal to 3.5mm.

2. Access **Create New TM Form** and select the appropriate **Survey Requirement** from the drop down list. The **TM Form** drop down list will display the TM forms associated to selected survey requirements.

[Create New TM Form](#)

2.1 Form TM5 UR S18 will then become available to the user. The **Space/Comp/Section** will be automatically updated to provide a list of possible space/compartments.

Appendix 2

Please note that TM6 has been associated with most survey requirements to provide the option for localised corrosion reporting. The system permits a unique combination of **Survey Requirement**, **TM Form** and **Space/Comp/Section**. In case the user reports both available TM Forms, there will be 2 TM Forms under the same Survey Requirement folder, titled the same, in the **Structural Component Tree**. Therefore, users should use a different descriptor for **Location of Structure** in case they require generating both TM forms under the same **Survey Requirement** and **Space/Comp/Section**.

2.2 Please select the **Space/Comp/Section Indicator** that best describes the boundary of two ship space/compartments that the Bulkhead is dividing. Free text selection of **Space/Comp/Section** as well as the **Space/Comp/Section Indicator** is also available to the user.

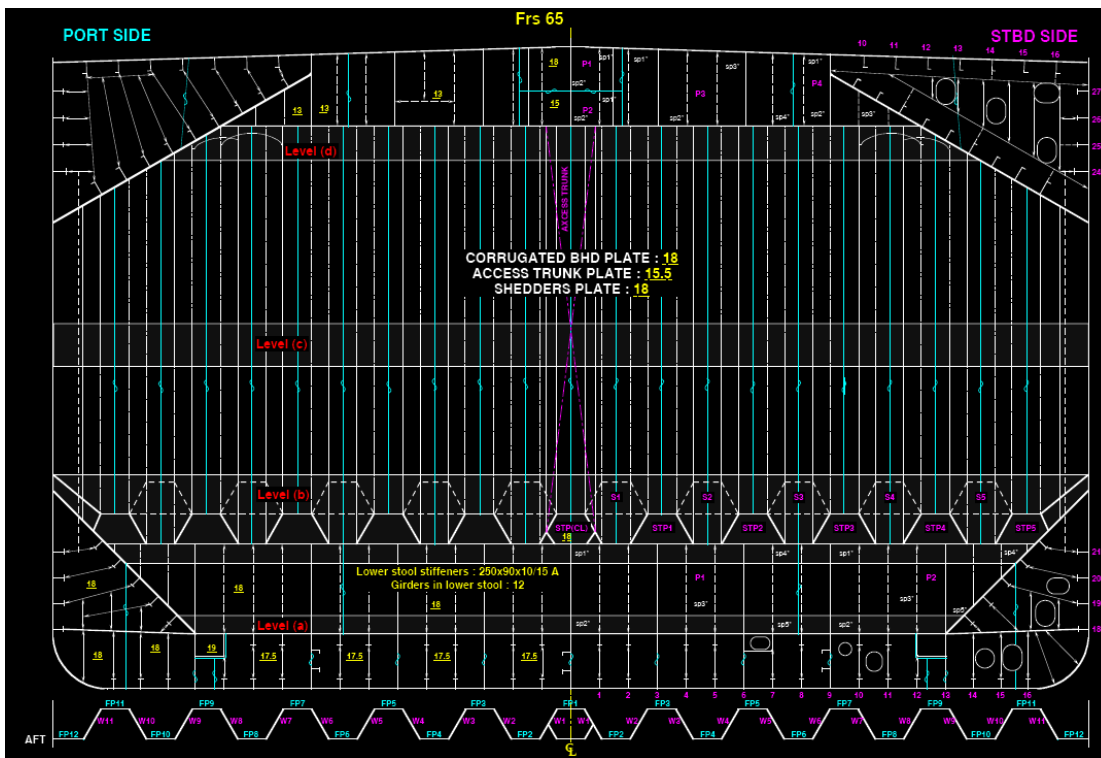
2.2 Select the **Space/Comp/Section Indicator** that best describes the boundary of two ship compartments that the Bulkhead separates. Free text selection of **Space/Comp/Section** as well as the **Space/Comp/Section Indicator** is also available to the user.

2.3 The **Type of Bulkhead** is set by default to: **Corrugated Transverse Bulkhead**.

2.4 Please enter the **Location of Structure** on the available free-text box. For TM5 UR S18 the particular Frame station of the transverse Bulkhead is required to be entered. The appropriate Frame number is to be symbolised with an identifier that corresponds to the plans aboard and the associated sketches attached to these TM forms.

3. By use of the TM Form, the description of the **Structural Component** has to correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches. The **Sketch Reference ID** has to include two (2) elements. Indication of the sketch reference (1) where found necessary, as well as the plate reference (2).

Appendix 2



Ship's Name : Non-CSR SHIP		LR/IMO Number : 9186209		Report Number : ATW1212121					
TM5 UR S18 - Cargo Hold W.T. Corrugated Transverse Bulkheads									
Space / Compartment Description :		Bulkhead Between Cargo Hold Nos. 1/2							
Location of Structure :		Frame No. 123							
Type of Bulkhead :		Corrugated Transverse Bulkhead							
Structural Component	Sketch Reference ID	As Built Thickness (mm)	Net Thickness (mm)	Renewal Thickness (mm)	Port Reading		Starboard Reading		Comments
					Gauged Thickness (mm)	Thickness As Renewed (mm)	Gauged Thickness (mm)	Thickness As Renewed (mm)	
Corrugated Pating									
1		16	12.5	13	13.1	16	15.5		
2		16	12.5	13	13.8		13.3		
3		16	12.5	13	13.7		16		
4		16	12.5	13	15.5		13.1	16	
5		16	12.5	13	16.8		15.5		
6		14	10.5	11	13.5	16	13.8		
7		14	10.5	11	13.3		13.9		
8		14	10.5	11	14		13.5		
9		14	10.5	11	13.9		13.9		

4. The net thickness can be calculated as: **t_{net} = Original Thickness – Corrosion Addition**

5.0 If the gauged thickness is within range of renewal thickness (t_{net} + 0.5mm) to renewal thickness + 0.5mm (t_{net} + 1.0mm), a coating should be applied (in accordance with the coating manufacturer's requirements) and maintained in 'GOOD' condition or annual examination and gauging may be adopted as an alternative to steel renewal (substantial corrosion).

5.1 Example Net and Renewal Thicknesses for given Corrugated Transverse Bulkhead Rule Thickness:

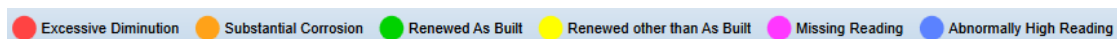
Corrugated Bulkhead Rule Design Thickness	Corrosion addition	Net Thickness	Renewal Thickness	Sub/ Corrosion
t _{or}	t _s	t _{net}	t _{ren}	t _{sub/}
22.0mm	3.5mm	18.5mm	19.0mm	19.5mm
20.0mm	3.5mm	16.5mm	17.0mm	17.5mm
18.0mm	3.5mm	14.5mm	15.0mm	15.5mm
16.0mm	3.5mm	12.5mm	13.0mm	13.5mm

Appendix 2

6. The single measurements recorded are to represent the average of multiple measurements.

7. The TM5 Form will highlight with colours any applicable exceptions for:

- ✓ Missing Reading
- ✓ Abnormally High Readings
- ✓ Substantial Corrosion (or)
- ✓ To be Coated or Gauged Annually
- ✓ Excessive Diminution
- ✓ Renewed As-Built
- ✓ Renewed other than As-Built



8. Comments at the end of the form are to be used for additional reporting of close up survey area findings on each particular structural item like pitting, grooving, edge corrosion, necking effect, and detached structure. This column will provide a more accurate description of the findings that explain any repairs carried out. It should be noted that comments for close up survey findings on plates that have not been marked as repaired, will be considered as outstanding defects on close out of the survey. The comments recorded to this column should accurately reflect the final condition of the ship, after any repairs, renewals and alterations have taken place to the reported structural items.

9. The final TM report including this TM Form must represent the final condition of the ship structure after any repairs, renewals and alterations.

Appendix 2

NON CSR THICKNESS MEASUREMENT – REPORT FORMS – TM5 UR S19

TM5 UR S19 – Cargo Hold W.T. Corrugated Transverse Bulkheads (Table Based)

Space / Compartment Description :		Bulkhead Between Cargo Hold Nos. 1/2										
Location of Structure :		Frame No. 120										
Type of Bulkhead :		Corrugated Transverse Bulkhead										
Structural Component (Plating / Stiffener)	Sketch Reference ID	As Built Thickness (mm)	Substantial Corrosion (T-COAT) (mm)	Excessive Diminution (T-REN) (mm)	Port Reading			Starboard Reading			Comments	
					Gauged Thickness (mm)	Diminution (mm)	Thickness As Renewed (mm)	Gauged Thickness (mm)	Diminution (mm)	Thickness As Renewed (mm)		

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

Name of TM Operator : Operator's Name Surname

Name of LR Attending Surveyor : Surveyor's Name Surname

NOTES:

- This Form is to be used for recording the thickness measurement of all W.T. transverse bulkheads required to be assessed in accordance to Unified Requirement Strength 19 and ship has been assigned the notation ESN-HOLD 1 or ESN-ALL HOLDS (Enhanced Survivability Notation). The Approved Bulkhead Upgrade Plan indicates thicknesses for gauging purposes with table values provided for substantial (*T-Coat*) and renewal corrosion (*T-Ren*). Where a bulkhead Part (Middle or Lower Part) requires Classification Rules diminution criteria to be applied in accordance to the Approved Bulkhead Upgrade Plan, the Form TM 5 UR S19% is to be used instead.
- Access **Create New TM Form** and select the appropriate **Survey Requirement** from the drop down list. The **TM Form** drop down list will display the TM forms associated to selected survey requirements.

Create New TM Form

2.1 Form TM5 UR S19 will then become available to the user. The **Space/Comp/Section** will be automatically updated to provide a list of possible space/compartments.

Appendix 2

Please note that TM6 has been associated with most survey requirements to provide the option for localised corrosion reporting. The system permits a unique combination of **Survey Requirement**, **TM Form** and **Space/Comp/Section**. In case the user reports both available TM Forms, there will be 2 TM Forms under the same Survey Requirement folder, titled the same, in the **Structural Component Tree**. Therefore, users should use a different descriptor for **Location of Structure** in case they require generating both TM forms under the same **Survey Requirement** and **Space/Comp/Section**.

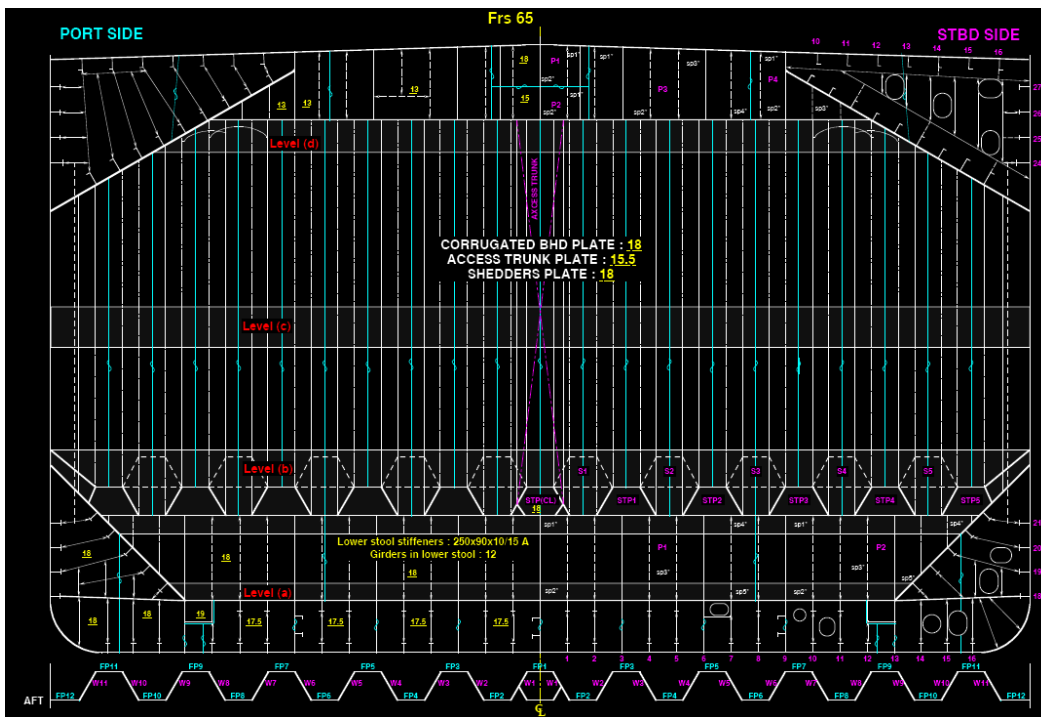
2.2 Select the **Space/Comp/Section Indicator** that best describes the boundary of two ship space/compartments that the Bulkhead separates. Free text selection of **Space/Comp/Section** as well as the **Space/Comp/Section Indicator** is also available to the user.

2.3 The **Type of Bulkhead** is set by default to: **Corrugated Transverse Bulkhead**.

2.4 Please enter the **Location of Structure** on the available free-text box. For TM5 UR S19 the particular Frame station of the transverse Bulkhead is required to be entered. The appropriate Frame number is to be symbolised with an identifier that corresponds to the plans aboard and the associated sketches attached to these TM forms.

3. By use of the TM Form, the description of the **Structural Component** has to correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches. The **Sketch Reference ID** has to include two (2) elements. Indication of the sketch reference (1) where found necessary, as well as the plate reference (2).

Appendix 2



Ship's Name : Non- CSR SHIP LR/IMO Number : 9186209 Report Number : ATW1231231

TM5 UR S19 - Cargo Hold W.T. Corrugated Transverse Bulkheads (Table Based)

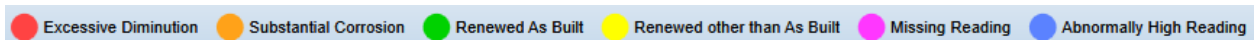
Space / Compartment Description :	Bulkhead Between Cargo Hold Nos. 1/2
Location of Structure :	Frame No. 123
Type of Bulkhead :	Corrugated Transverse Bulkhead

Structural Component (Plating / Stiffener)	Sketch Reference ID	As Built Thickness (mm)	Substantial Corrosion (T-COAT) (mm)	Excessive Diminution (T-REN) (mm)	Port Reading			Gauged Thickness (mm)
					Gauged Thickness (mm)	Diminution (mm)	Thickness As Renewed (mm)	
Strake "A"								
1	sa22	17	9	5	89	0	17	
2	sa74	4	8	6	5	0	15	
3	sa22	17	6	4			17	
4	da22	15	15	9	10	5	15	
5	dr56	15	7	2			17	
6								

4. The single measurements recorded are to represent the average of multiple measurements.

5. The TM5 Form will highlight with colours any applicable exceptions for:

- ✓ Missing Reading
- ✓ Abnormally High Readings
- ✓ Substantial Corrosion (or)
- ✓ To be Coated or Gauged Annually
- ✓ Excessive Diminution
- ✓ Renewed As-Built
- ✓ Renewed other than As-Built



Appendix 2

6. Comments at the end of the form are to be used for additional reporting of close up survey area findings on each particular structural item like pitting, grooving, edge corrosion, necking effect, and detached structure. This column will provide a more accurate description of the findings that explain any repairs carried out. It should be noted that comments for close up survey findings on plates that have not been marked as repaired, will be considered as outstanding defects on close out of the survey. The comments recorded to this column should accurately reflect the final condition of the ship, after any repairs, renewals and alterations have taken place to the reported structural items.

7. The final TM report including this TM Form must represent the final condition of the ship structure after any repairs, renewals and alterations.

Appendix 2

NON CSR THICKNESS MEASUREMENT – REPORT FORMS – TM5 UR S19%

TM5 UR S19(%) - Cargo Hold W.T. Corrugated Transverse Bulkheads (Percentage Based)

Space / Compartment Description :		Bulkhead Between Cargo Hold Nos. 1/2												
Location of Structure :		Frame No. 120												
Type of Bulkhead :		Corrugated Transverse Bulkhead												
Structural Component (Plating / Stiffener)	Sketch Reference ID	As Built Thickness (mm)	Max Allowable Diminution (%)	Renewal Thickness (mm)	Port Reading			Starboard Reading			Comments			
					Gauged Thickness (mm)	Diminution (mm)	(%)	Thickness As Renewed (mm)	Gauged Thickness (mm)	Diminution (mm)		(%)	Thickness As Renewed (mm)	

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

Name of TM Operator : Operator's Name Surname

Name of LR Attending Surveyor : Surveyor's Name Surname

NOTES:

1. This Form is to be used for recording the thickness measurement of all W.T. transverse bulkheads required to be assessed in accordance to Unified Requirement Strength 19 and ship has been assigned the notation ESN-HOLD 1 or ESN-ALL HOLDS (Enhanced Survivability Notation). When the Approved Bulkhead Upgrade Plan indicates the applicability of Classification Rules diminution criteria on any Part of the Corrugated Transverse Bulkhead, this form is to be used instead of TM5 UR S19(the Approved Bulkhead Upgrade Plan indicates thicknesses for gauging purposes with table values provided for substantial (T-Coat) and renewal corrosion (T-Ren)).

2. Access **Create New TM Form** and select the appropriate **Survey Requirement** from the drop down list. The **TM Form** drop down list will display the TM forms associated to selected survey requirements.



2.1 Form TM5 UR S19% will then become available to the user. The **Space/Comp/Section** will be automatically updated to provide a list of possible space/compartments.

Appendix 2

Please note that TM6 has been associated with most survey requirements to provide the option for localised corrosion reporting. The system permits a unique combination of **Survey Requirement**, **TM Form** and **Space/Comp/Section**. In case the user reports both available TM Forms, there will be 2 TM Forms under the same Survey Requirement folder, titled the same, in the **Structural Component Tree**. Therefore, users should use a different descriptor for **Location of Structure** in case they require generating both TM forms under the same **Survey Requirement** and **Space/Comp/Section**.

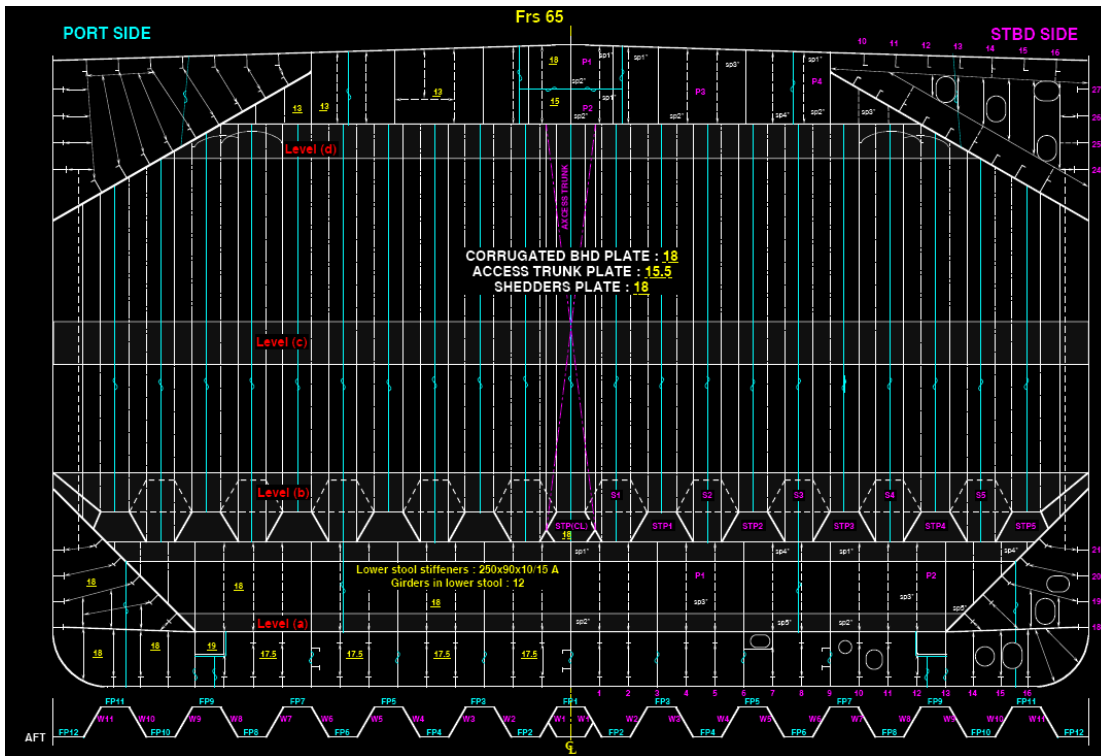
2.2 Select the **Space/Comp/Section Indicator** that best describes the boundary of two ship space/compartments that the Bulkhead separates. Free text selection of **Space/Comp/Section** as well as the **Space/Comp/Section Indicator** is also available to the user.

2.3 Please select the **Type of Bulkhead** that best describes the structural design of the bulkhead.

2.4 Please enter the **Location of Structure** on the available free-text box. For TM5 the particular Frame station of the transverse Bulkhead is required to be entered. The appropriate Frame number is to be symbolised with an identifier that corresponds to the plans aboard and the associated sketches attached to these TM forms.

3. By use of the TM Form, the description of the **Structural Component** has to correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches. The **Sketch Reference ID** has to include two (2) elements. Indication of the sketch reference (1) where found necessary, as well as the plate reference (2).

Appendix 2



Ship's Name : Non- CSR SHIP LR/IMO Number : 9186209 Report Number : ATW1231231

TM5 UR S19(%) - Cargo Hold W.T. Corrugated Transverse Bulkheads (Percentage Based)

Space / Compartment Description : Bulkhead Between Cargo Hold Nos. 1/2

Location of Structure : Frame No. 123

Type of Bulkhead : Corrugated Transverse Bulkhead

Structural Component (Plating / Stiffener)	Sketch Reference ID	As Built Thickness (mm)	Max Allowable Diminution (%)	Renewal Thickness (mm)	Port Reading			Starboard		
					Gauged Thickness (mm)	Diminution (mm)	(%)	Thickness As Renewed (mm)	Gauged Thickness (mm)	Dim (mm)
					(mm)	(mm)	(%)	(mm)	(mm)	(mm)
Corrugated Plating	1	16	20.00	12.8	15.5	0.5	3.13			
	2	15	20.00	12	14.3	0.7	4.67			
	3	15	20.00	12	12.3	2.7	18.00	15		
	4	17	20.00	13.6	16.4	0.6	3.53			
	5	15	20.00	12	14.1	0.9	6.00	14		
	6	18	20.00	14.4	17.8	0.2	1.11			
	7	16	20.00	12.8	15.9	0.1	0.63			
	8	16	20.00	12.8	15.7	0.3	1.88			
	9	14	20.00	11.2						
	10	17	20.00	13.6	13.4	3.6	21.18			

4. The single measurements recorded are to represent the average of multiple measurements.

5. The TM5 Form will highlight with colours any applicable exceptions for:

- ✓ Missing Reading
- ✓ Abnormally High Readings
- ✓ Substantial Corrosion (or)
- ✓ To be Coated or Gauged Annually
- ✓ Excessive Diminution
- ✓ Renewed As-Built
- ✓ Renewed other than As-Built

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

Appendix 2

6. Comments at the end of the form are to be used for additional reporting of close up survey area findings on each particular structural item like pitting, grooving, edge corrosion, necking effect, and detached structure. This column will provide a more accurate description of the findings that explain any repairs carried out. It should be noted that comments for close up survey findings on plates that have not been marked as repaired, will be considered as outstanding defects on close out of the survey. The comments recorded to this column should accurately reflect the final condition of the ship, after any repairs, renewals and alterations have taken place to the reported structural items.

7. The final TM report including this TM Form must represent the final condition of the ship structure after any repairs, renewals and alterations.

Appendix 2

NON CSR THICKNESS MEASUREMENT – REPORT FORMS – TM6

TM6 - Miscellaneous Structural Members

Space / Compartment Description :				Deck Plating inside line of hatch openings									Comments
Location of Structure :				A									
Structural Component	Sketch Reference ID	As Built Thickness (mm)	Max Allowable Diminution (%)	Renewed Thickness (mm)	Port Reading			Thickness As Renewed (mm)	Starboard Reading				
					Gauged Thickness (mm)	Diminution (mm) (%)			Gauged Thickness (mm)	Diminution (mm) (%)		Thickness As Renewed (mm)	

● Excessive Diminution
 ● Substantial Corrosion
 ● Renewed As Built
 ● Renewed other than As Built
 ● Missing Reading
 ● Abnormally High Reading
 Name of TM Operator : Operator's Name Surname
 Name of LR Attending Surveyor : Surveyor's Name Surname

NOTES:

1. This Form is to be used for recording the thickness measurement of miscellaneous structural members, such as:

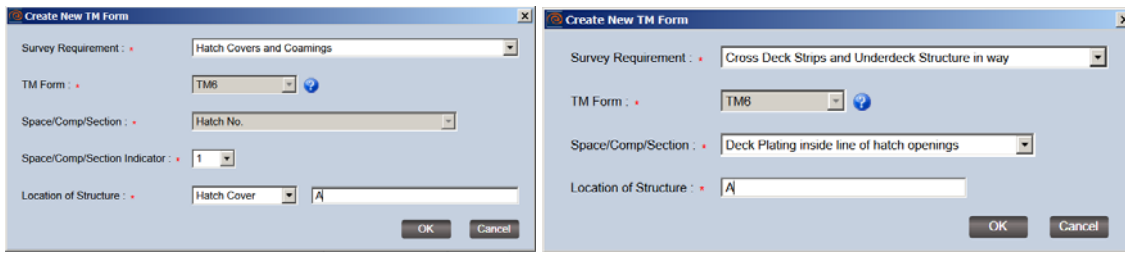
- ✓ Hatch covers
- ✓ Hatch coamings
- ✓ Cross deck strips and underdeck structure in way
- ✓ Deck, shell and bottom plating outside the cargo length area
- ✓ Sea chests and shell plating in way of overboard discharges
- ✓ Keel Plates and Additional Bottom Plates
- ✓ Duct Keel/Pipe Tunnel
- ✓ Remaining Exposed Deck/Superstructure Plating
- ✓ Inner bottom plating
- ✓ Localised corrosion in any area of the structure
- ✓ In addition, this form is to be used for reporting of any critical areas as defined by the surveyor. This form may also be used for reporting of any additional survey areas outside the normal scope of survey that would require to be thickness measured.

2. Access **Create New TM Form** and select the appropriate **Survey Requirement** from the drop down list. The **TM Form** drop down list will display the TM forms associated to selected survey requirements.

Create New TM Form

2.1 Form TM6 will then become available to the user. The **Space/Comp/Section** will be automatically updated to free-text or to provide a list of space/compartments. The user should now select the more suitable descriptor either by manual input or via a drop-down menu.

Appendix 2

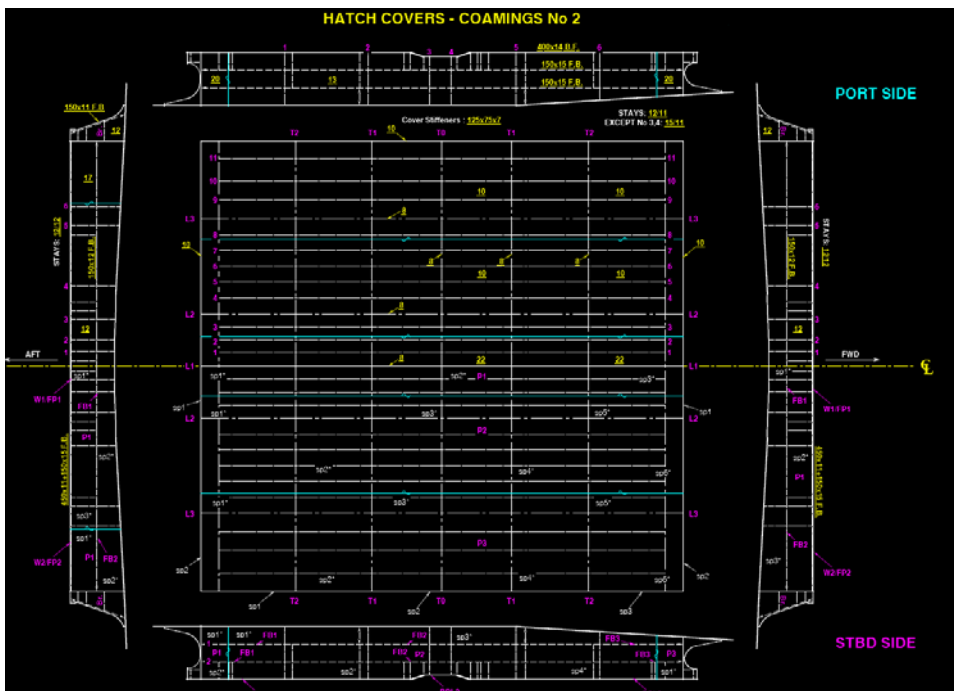


Please note that TM6 has been associated with most survey requirements to provide the option for localised corrosion reporting. The system permits a unique combination of **Survey Requirement**, **TM Form** and **Space/Comp/Section**. In case the user reports both available TM Forms, there will be 2 TM Forms under the same Survey Requirement folder, titled the same, in the **Structural Component Tree**. Therefore, users should use a different descriptor for **Location of Structure** in case they require generating both TM forms under the same **Survey Requirement** and **Space/Comp/Section**.

2.2 If necessary, please select the **Space/Comp/Section Indicator** with the indicating number of the compartment or space including the survey areas being reported to this form.

2.3 Please enter the **Location of Structure** on the available free-text box. The appropriate location is to be symbolised with an identifier that corresponds to the plans aboard and the associated sketches attached to these TM forms.

3. By use of the TM Form, the description of the **Structural Component** has to correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches. The **Sketch Reference ID** has to include two (2) elements. Indication of the sketch reference (1) where found necessary, as well as the plate reference (2).



Appendix 2

Ship's Name : Test Ship		LR/IMO Number : 8000111				Report Number : LON1234567					
Space / Compartment Description :		TM6 - Miscellaneous Structural Members									
Location of Structure :		A									
Sketch Reference ID	As Built Thickness (mm)	Max Allowable Diminution (%)	Renewal Thickness (mm)	Port Reading					Starboard Reading		
				Gauged Thickness (mm)	Diminution		Thickness As Renewed (mm)	Gauged Thickness (mm)	Diminution		
					(mm)	(%)			(mm)	(mm)	(%)
A	12	30.00	8.4	8.9	3.1	25.83	13	10.1	1.9	15.8	
B	12	30.00	8.4	8.7	3.3	27.50	12	11.1	0.9	7.5	
C	10	30.00	7	9.6	0.4	4.00		8.5	1.5	15.0	
D	10	30.00	7	8.1	1.9	19.00		8.1	1.9	19.0	
E	9	30.00	6.3	7.9	1.1	12.22					
F	9	30.00	6.3	8.5	0.5	5.56					

4. The single measurements recorded are to represent the average of multiple measurements.

5. The TM6 Form will highlight with colours any applicable exceptions for:

- ✓ Missing Reading
- ✓ Abnormally High Readings
- ✓ Substantial Corrosion (or)
- ✓ To be Coated or Gauged Annually
- ✓ Excessive Diminution
- ✓ Renewed As-Built
- ✓ Renewed other than As-Built

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

6. Comments at the end of the form are to be used for additional reporting of close up survey area findings on each particular structural item like pitting, grooving, edge corrosion, necking effect, and detached structure. This column will provide a more accurate description of the findings that explain any repairs carried out. It should be noted that comments for close up survey findings on plates that have not been marked as repaired, will be considered as outstanding defects on close out of the survey. The comments recorded to this column should accurately reflect the final condition of the ship, after any repairs, renewals and alterations have taken place to the reported structural items.

7. The final TM report including this TM Form must represent the final condition of the ship structure after any repairs, renewals and alterations.

Appendix 2

NON CSR THICKNESS MEASUREMENT – REPORT FORMS – TM6 UR S21

TM6 UR S21 – Hatch Covers & Coamings

Hatch No :		1							
Type of Structure :		Single Skin Open Type (Plating and Stiffeners)							
Corrosion Addition (mm) :		2							
Location of Structure :		Hatch Coaming B							
Structural Component	Sketch Reference ID	As Built Thickness (mm)	Net Thickness (mm)	Renewal Thickness (mm)	Port Reading		Starboard Reading		Comments
					Gauged Thickness (mm)	Thickness As Renewed (mm)	Gauged Thickness (mm)	Thickness As Renewed (mm)	

● Excessive Diminution
 ● To Be Coated or Gauged Annually
 ● Renewed As Built
 ● Renewed other than As Built
 ● Missing Reading
 ● Abnormally High Reading

Name of TM Operator : Operator's Name Surname

Name of LR Attending Surveyor : Surveyor's Name Surname

NOTES:

1. This Form is to be used for recording the thickness measurement for the evaluation of Scantlings of Hatch Covers of Bulk Carrier cargo holds assessed in accordance with UR S21 for which controlling thickness limits of excessive diminution (tren) and substantial corrosion thickness (tsub/l) are calculated with corrosion addition and renewal thickness according to the following table:

Hatch Cover Type	Corrosion Addition (ts)	Steel Renewal (tren)	Steel Renewal Coefficient
Single Skin Open Type (Plating and Stiffeners)	2.0mm	<t _{net} + 0.5mm	0.5mm
Double Skin Type (Plated in/Pontoon) top and bottom plating	2.0mm	<t _{net} + 0.5mm	0.5mm
Double Skin Type (Plated in/Pontoon) internal structure	1.5mm	<t _{net}	0mm
Any Type Hatch Coaming and Coaming Stays	1.5mm	<t _{net} + 0.5mm	0.5mm

2. Access **Create New TM Form** and select the appropriate **Survey Requirement** from the drop down list. The **TM Form** drop down list will display the TM forms associated to selected survey requirements.

Create New TM Form

2.1 Form TM6 UR S21 will then become available to the user. The **Space/Comp/Section** will be automatically updated to provide the appropriate space/compartment. The selection for this field will default to **Hatch No.**

Appendix 2

Create New TM Form

Survey Requirement : * Hatch Covers and Coamings (UR S21)

TM Form : * TM6 UR S21 ?

Space/Comp/Section : * Hatch No.

Space/Comp/Section Indicator : * 1

Type of Structure : * Single Skin Open Type (Plating and Stiffeners)

Location of Structure : * Hatch Coaming B

OK Cancel

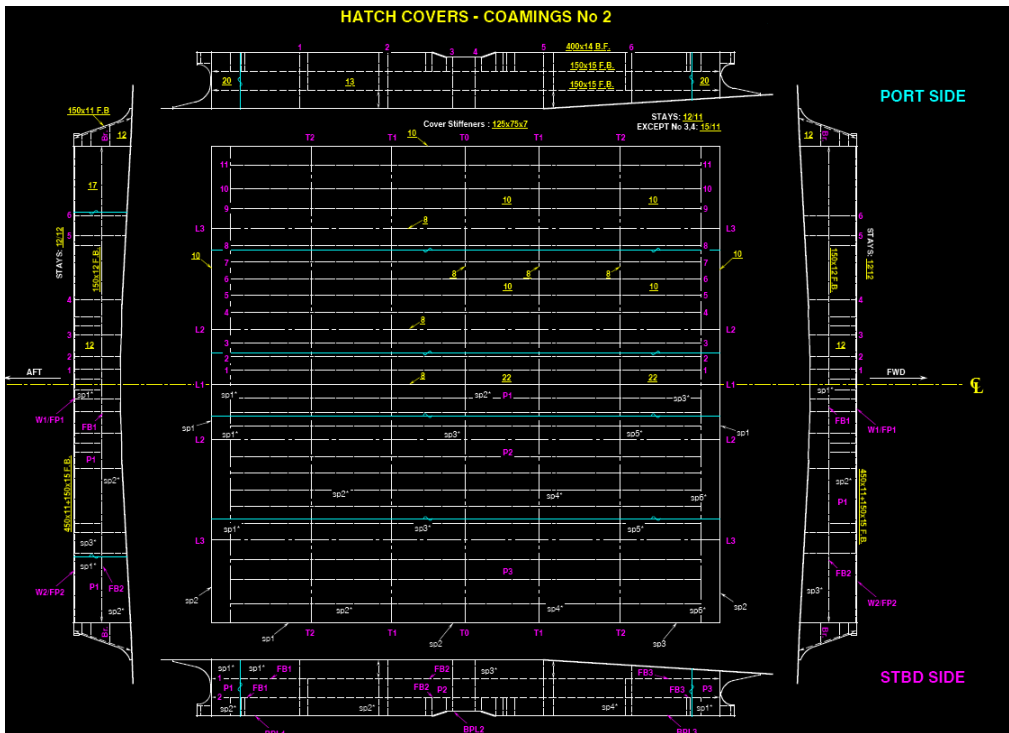
2.2 Select the **Space/Comp/Section Indicator** with the indicating number of the compartment or space including the survey areas being reported to this form.

2.3 Also select the **Type of Structure** from the drop down. The selection will result in the appropriate Corrosion Addition and Steel Renewal to be applied to the TM Form calculations.

2.4 Please enter the **Location of Structure** from the available drop-down. There is also an additional free text field for any additional location information. The appropriate location is to be symbolised with an identifier that corresponds to the plans aboard and the associated sketches attached to these TM forms.

3. By use of the TM Form, the description of the **Structural Component** has to correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches. The **Sketch Reference ID** has to include two (2) elements. Indication of the sketch reference (1) where found necessary, as well as the plate reference (2).

Appendix 2



Ship's Name : Non- CSR SHIP		LR/IMO Number : 9186209		Report Number : ATW1231231				
TM6 UR S21 - Hatch Covers & Coamings								
Hatch No. :	1							
Type of Structure :	Single Skin Open Type (Plating and Stiffeners)							
Corrosion Addition (mm) :	2							
Location of Structure :	Hatch Coaming B							
Structural Component	Sketch Reference ID	As Built Thickness (t _{gross}) (mm)	Net Thickness (t _{net}) (mm)	Renewal Thickness (mm)	Port Reading		Starboard Reading	
					Gauged Thickness (t _{gauged}) (mm)	Thickness As Renewed (mm)	Gauged Thickness (t _{gauged}) (mm)	Thickness As Renewed (mm)
Top Plating	Sketch H1							
	A	14	12	12.5	13.5		13.9	
	B	14	12	12.5	13.6		13.2	
	C	14	12	12.5	13.1		13	15
	D	14	12	12.5	13.8		13.4	16
Side Plating	E	12	10	10.5	13.2		13.6	
	F	16	14	14.5	13.9	16	15.4	
	G	16	14	14.5	14.9	16	15.7	
Fwd Plating	H	16	14	14.5	15.5		15.2	
	I	16	14	14.5	15.5			

4. The net thickness can be calculated as follows:

$$\text{Net Thickness}(t_{net}) = \text{As Built Thickness } (t_{gross}) - \text{Corrosion Addition } (t_s).$$

4.1 The Maximum Allowable Diminution occurs when the steel thickness has diminished to a point that is a function of t_{net} in accordance to table in 1.

5. If the gauged thickness is within range of renewal thickness ($t_{net} + 0.5\text{mm}$) to renewal thickness + 0.5mm ($t_{net} + 1.0\text{mm}$), a coating should be applied (in accordance with the coating manufacturer's requirements) and maintained in 'GOOD' condition or annual examination and gauging may be adopted as an alternative to steel renewal (substantial corrosion).

6. Example:

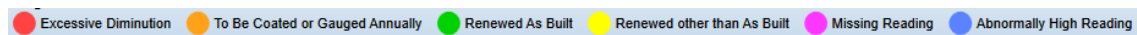
Appendix 2

Type of structure	Rule Thickness t_{or}	Corrosion addition t_s	Net Thickness t_{net}	Renewal Thickness t_{ren}	Sub/I Corrosion $t_{sub/I}$
Pontoon type hatch cover top plating	12.0mm	2.0mm	10.0mm	10.5mm	11.0mm
Pontoon type hatch cover side plating	14.0mm	2.0mm	12.0mm	12.5mm	13.0mm
Pontoon type hatch cover internals	12.0mm	1.5mm	10.5mm	10.5mm	N.A.
Hatch Coaming plating	13.0mm	1.5mm	11.5mm	12.0mm	12.5mm

7. The single measurements recorded are to represent the average of multiple measurements.

8. The Form will highlight with colours any applicable exceptions for:

- ✓ Missing Reading
- ✓ Abnormally High Readings
- ✓ Substantial Corrosion (or)
- ✓ To be Coated or Gauged Annually
- ✓ Excessive Diminution
- ✓ Renewed As-Built
- ✓ Renewed other than As-Built



9. Comments at the end of the form are to be used for additional reporting of close up survey area findings on each particular structural item like pitting, grooving, edge corrosion, necking effect, and detached structure. This column will provide a more accurate description of the findings that explain any repairs carried out. It should be noted that comments for close up survey findings on plates that have not been marked as repaired, will be considered as outstanding defects on close out of the survey. The comments recorded to this column should accurately reflect the final condition of the ship, after any repairs, renewals and alterations have taken place to the reported structural items.

10. The final TM report including this TM Form must represent the final condition of the ship structure after any repairs, renewals and alterations.

Appendix 2

NON CSR THICKNESS MEASUREMENT – REPORT FORMS – TM6 UR S21A

TM6 UR S21A – Hatch Covers & Coamings

Hatch No :		1			Ship Type :		Double Hull Oil Tanker		
Type of Structure :		*							
Corrosion Addition (mm) :		2							
Location of Structure :		Hatch Cover *							
Structural Component	Sketch Reference ID	As Built Thickness (mm)	Net Thickness (mm)	Renewal Thickness (mm)	Port Reading		Starboard Reading		Comments
					Gauged Thickness (mm)	Thickness As Renewed (mm)	Gauged Thickness (mm)	Thickness As Renewed (mm)	

● Excessive Diminution ● To Be Coated or Gauged Annually ● Renewed As Built ● Renewed other than As Built ● Missing Reading ● Abnormally High Reading

Name of TM Operator : Operator's Name Surname

Name of LR Attending Surveyor : Surveyor's Name Surname

NOTES:

1. This Form is to be used for recording the thickness measurement for the evaluation of Scantlings of Hatch Covers of all ships contracted for construction on or after 1 July 2012, except Bulk Carriers, Ore Carriers and Combination Carriers. Steel cargo hatch covers and coamings on exposed decks on these ships are assessed in accordance with UR S21A, except hatch coamings on Container Ships, Car Carriers, Paper Carriers and Passenger Ships, and any other ship in which the Hatch Coamings are part of the longitudinal Hull Structure (in these cases the hatch coamings are to be reported conventionally in Form TM6). Controlling thickness limits of excessive diminution (tren) and substantial corrosion thickness (tsub/l) are calculated with corrosion addition and renewal thickness in accordance to the following table:

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Ship Type	Hatch Cover Type	Corrosion Addition(mm)	Steel Renewal
Container ships, car carriers, paper carriers and passenger vessels	Any type - All structure	1.0	$<t_{net} + 0.5 \text{ mm}$
	Hatch coamings plating & stays (part of the longitudinal hull structure)	Apply percentage based diminution criteria in accordance to conventional LR Rules	
All other ship types (except Bulk Carriers, Ore Carriers and Combination Carriers, see UR S21)	Single Skin type - Plating	2.0	$<t_{net} + 0.5 \text{ mm}$
	Double Skin type - top and bottom plating	1.5	$<t_{net} + 0.5 \text{ mm}$
	Internal structure of double skin hatch covers and closed box girders*	1.0	$<t_{net}$
	Hatch coamings plating & stays (not part of the longitudinal hull structure)	1.5	$<t_{net} + 0.5 \text{ mm}$
	Hatch coamings plating & stays (part of the longitudinal hull structure)	Apply percentage based diminution criteria in accordance to conventional LR Rules	

* For the internal structure of double skin hatch covers, thickness gauging is required when hatch cover top or bottom plating renewal is to be carried out or when this is deemed necessary, at the discretion of the individual class society's surveyor, on the basis of the plating corrosion or deformation condition.

FOR ALL STRUCTURE: If the gauged thickness is diminished to within Renewal Thickness + 0.5 mm, a Memorandum should be imposed either for the structure to be examined and gauged annually, or a coating should be applied (in accordance with the coating manufacturer's requirements) and maintained in 'GOOD' condition

2. Please **Create New TM Form** and select the appropriate **Survey Requirement** from the drop down list. The **TM Form** list will be updated accordingly with TM forms associated with the survey requirement.



2.1 Form TM6 UR S21A will then become available to the user. The **Space/Comp/Section** will be automatically updated to provide the appropriate space/compartment. The selection for this field will default to **Hatch No.**.

2.2 Select the **Space/Comp/Section Indicator** with the indicating number of the compartment or space including the survey areas being reported to this form.

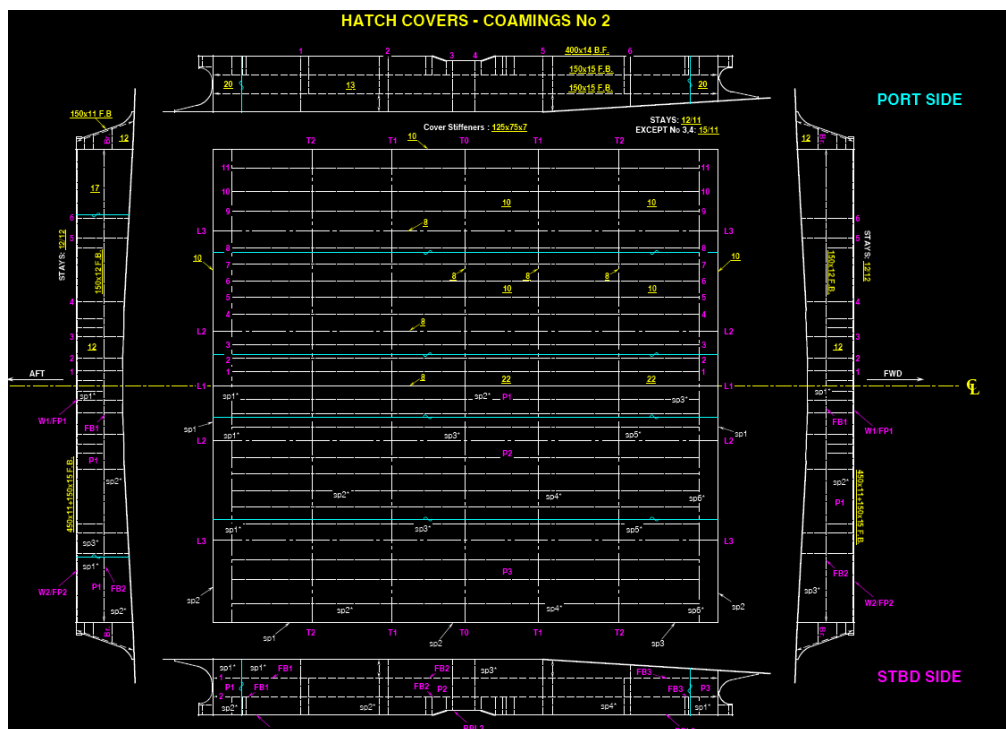
2.3 Kindly complete the free text field for the **Type of Structure** in accordance to descriptions of the above table in **1.** that suits the structural design of the Hatch Cover type under consideration.

2.4 Please enter the designated **Corrosion Addition** for the selected Hatch Cover type depending to the ship type selected in accordance to table in **1.** above.

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2.5 Please enter the **Location of Structure** from the available drop-down. There is also an additional free text field for any additional location information required. The appropriate location is to be symbolised with an identifier that corresponds to the plans aboard and the associated sketches attached to these TM forms.

3. By use of the TM Form, the description of the **Structural Component** has to correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches. The **Sketch Reference ID** has to include two (2) elements. Indication of the sketch reference (1) where found necessary, as well as the plate reference (2).



Ship's Name : Non-CSR SHIP		LR/IMO Number : 9186209		Report Number : ATW1231231				
TM6 UR S21A - Hatch Covers & Coamings								
Hatch No. :	1	Ship Type :	Other					
Type of Structure :	Hatch Coaming							
Corrosion Addition (mm) :	1.5							
Location of Structure :	Hatch Cover Plating Btwn Fr167-Fr179							
Structural Component	Sketch Reference ID	As Built Thickness (t _{gross}) (mm)	Net Thickness (t _{net}) (mm)	Renewal Thickness (mm)	Port Reading (Gauged) (mm)	Thickness As Renewed (mm)	Starboard Reading (Gauged) (mm)	Thickness As Renewed (mm)
Side Plating	D	14	12.5	13	13.3	14	13.5	
	D1	14	12.5	13	13.7		14	
	D2	14	12.5	13	13.9		14	
	E1	14	12.5	13	14	13	14	
	E2	14	12.5	13	14		14	
	F1	14	12.5	13	10		14	
	F2	14	12.5	13	13.8		10	
	G1	14	12.5	13	13		13.3	
	G2	14	12.5	13	13.9		14	

4. The net thickness can be calculated as follows:

$$\text{Net Thickness}(t_{net}) = \text{As Built Thickness}(t_{gross}) - \text{Corrosion Addition}(t_s).$$

5. The Maximum Allowable Diminution occurs when the steel thickness has diminished to a point that is a function of t_{net} in accordance to table in 1.. User must select the appropriate Renewal Thickness and enter to the TM Form.

6. If the gauged thickness is within range of renewal thickness ($t_{net} + 0.5\text{mm}$) to renewal thickness + 0.5mm ($t_{net} + 1.0\text{mm}$), a coating should be applied (in accordance with the coating manufacturer's requirements) and

Appendix 2

maintained in 'GOOD' condition or annual examination and gauging may be adopted as an alternative to steel renewal (substantial corrosion).

7. The single measurements recorded are to represent the average of multiple measurements.

8. The Form will highlight with colours any applicable exceptions for:

- ✓ Missing Reading
- ✓ Abnormally High Readings
- ✓ Substantial Corrosion (or)
- ✓ To be Coated or Gauged Annually
- ✓ Excessive Diminution
- ✓ Renewed As-Built
- ✓ Renewed other than As-Built

● Excessive Diminution ● To Be Coated or Gauged Annually ● Renewed As Built ● Renewed other than As Built ● Missing Reading ● Abnormally High Reading

9. Comments at the end of the form are to be used for additional reporting of close up survey area findings on each particular structural item like pitting, grooving, edge corrosion, necking effect, and detached structure. This column will provide a more accurate description of the findings that explain any repairs carried out. It should be noted that comments for close up survey findings on plates that have not been marked as repaired, will be considered as outstanding defects on close out of the survey. The comments recorded to this column should accurately reflect the final condition of the ship, after any repairs, renewals and alterations have taken place to the reported structural items.

10. The final TM report including this TM Form must represent the final condition of the ship structure after any repairs, renewals and alterations.

Appendix 2

NON CSR THICKNESS MEASUREMENT – REPORT FORMS – TM7

TM7 – Cargo Hold Transverse Web Frames & Attached Structure

Location of Structure :		Cargo Hold No. A											Comments	
Structural Component / Frame No.	Zone / Part	As Built Thickness (mm)	Max Allowable Diminution (%)	Renewal Thickness (mm)	Port Reading				Starboard Reading					
					Gauged Thickness (mm)	Diminution		Thickness As Renewed (mm)	Gauged Thickness (mm)	Diminution		Thickness As Renewed (mm)		
						(mm)	(%)			(mm)	(%)			

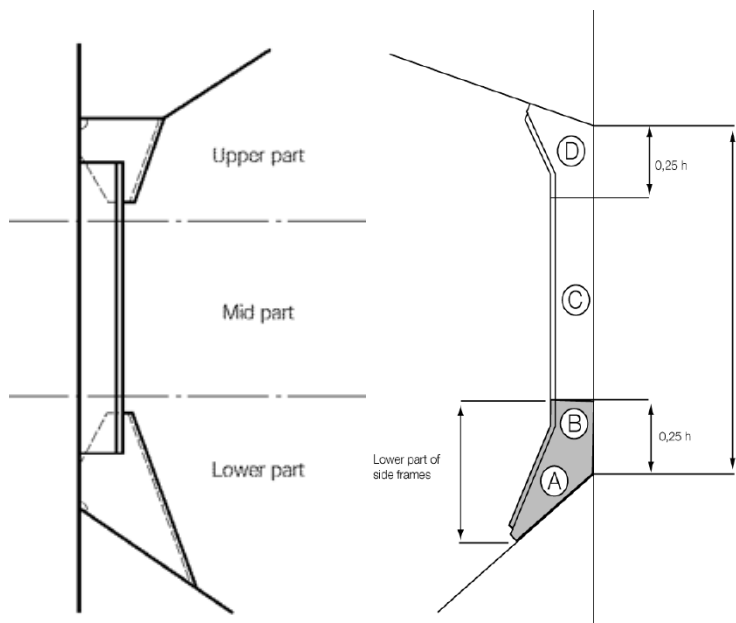
● Excessive Diminution
 ● Substantial Corrosion
 ● Renewed As Built
 ● Renewed other than As Built
 ● Missing Reading
 ● Abnormally High Reading

Name of TM Operator : Operator's Name Surname Name of LR Attending Surveyor : Surveyor's Name Surname

NOTES:

1. This Form is to be used for reporting the thickness measurement of cargo hold/tank transverse frames (web/flange plating) for transversely framed ships where percentage diminutions are applied for the Upper, Mid and Lower part in consideration (in accordance to the image below). For single skin bulk carriers that side shell frames are to be assessed in accordance to UR S31, Form TM 7 UR S31 is to be used instead for the frame web plating in A, B, C, D zones as defined in the figure below. For these ships' side shell frame flange area, this TM form is to be used instead and the flange plating should be assessed individually for the Upper, Mid and Lower part of the frame. The form may also be used for reporting of any attached structure to the cargo hold/tank transverse frames required to be assessed.

Appendix 2



2. Access **Create New TM Form** and select the appropriate **Survey Requirement** from the drop down list. The **TM Form** drop down list will display the TM forms associated to selected survey requirements.



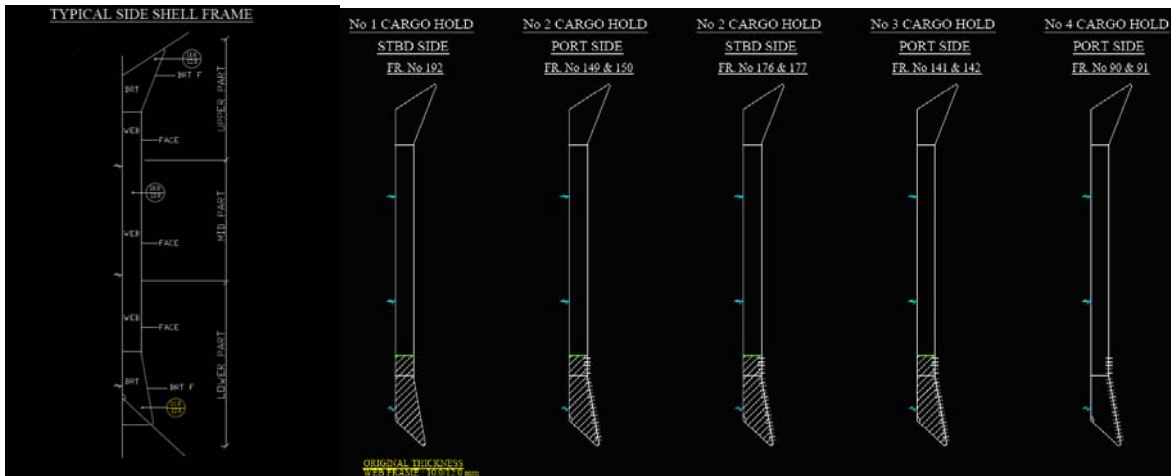
2.1 Form TM7 will then become available to the user. The **Space/Comp/Section** will be automatically updated to provide a list of available space/compartments. For Form TM 7 the default selection will be set to **Cargo Holds**.

Please note that TM6 has been associated with most survey requirements to provide the option for localised corrosion reporting. The system permits a unique combination of **Survey Requirement**, **TM Form** and **Space/Comp/Section**. In case the user reports both available TM Forms, there will be 2 TM Forms under the same Survey Requirement folder, titled the same, in the **Structural Component Tree**. Therefore, users should use a different descriptor for **Location of Structure** in case they require generating both TM forms under the same **Survey Requirement** and **Space/Comp/Section**.

2.2 Please enter the **Location of Structure** on the available free-text box for the compartment the reported cargo hold/tank transverse frames are located within. The appropriate location is to be symbolised with an identifier that corresponds to the plans aboard and the associated sketches attached to these TM forms.

Appendix 2

3. By use of the TM Form, the description of the **Structural Component/Frame No** has to correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches. The **Sketch Reference ID** has to include two (2) elements. Indication of the sketch reference (1) where found necessary, as well as the plate reference (2).



Ship's Name : Non- CSR SHIP LR/IMO Number : 9186209 Report Number : ATW1231231

TM7 - Cargo Hold Transverse Web Frames & Attached Structure

Location of Structure : Cargo Hold No. A

Structural Component / Frame No.	Zone / Part	As Built Thickness (mm)	Max Allowable Diminution (%)	Renewal Thickness (mm)	Port Reading			Gauged Thickness (mm)	
					Gauged Thickness (mm)	Diminution			Thickness As Renewed (mm)
						(mm)	(mm)		
Fr120	A	16	25.00	12	13.7	2.3	14.38		
	B	16	25.00	12	14.9	1.1	6.88	15	
	C	16	25.00	12	10	6	37.50		
Fr124	A	16	25.00	12	14.2	1.8	11.25		
	B	16	25.00	12	15.4	0.6	3.75		
	C	16	25.00	12	13	3	18.75	16	
Fr128	A	16	25.00	12	14	2	12.50		
	B	16	25.00	12	14.1	1.9	11.88		
	C	16	25.00	12	15.8	0.2	1.25		

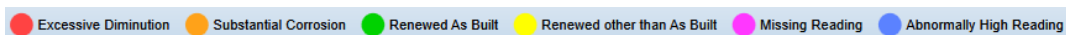
4. Use the **Structural Component/Frame No** column to record the actual Frame Number of the side shell frame web or flange plating reported and the **Zone / Part** column for describing the Upper, Mid or Lower zone).

5. It is recommended to also attach a typical sketch for showing the web frame upper, mid and lower zone/part.

6. The single measurements recorded are to represent the average of multiple measurements.

7. The TM7 Form will highlight with colours any applicable exceptions for:

- ✓ Missing Reading
- ✓ Abnormally High Readings
- ✓ Substantial Corrosion (or)
- ✓ To be Coated or Gauged Annually
- ✓ Excessive Diminution
- ✓ Renewed As-Built
- ✓ Renewed other than As-Built



Appendix 2

8. Comments at the end of the form are to be used for additional reporting of close up survey area findings on each particular structural item like pitting, grooving, edge corrosion, necking effect, and detached structure. This column will provide a more accurate description of the findings that explain any repairs carried out. It should be noted that comments for close up survey findings on plates that have not been marked as repaired, will be considered as outstanding defects on close out of the survey. The comments recorded to this column should accurately reflect the final condition of the ship, after any repairs, renewals and alterations have taken place to the reported structural items.

9. The final TM report including this TM Form must represent the final condition of the ship structure after any repairs, renewals and alterations.

Appendix 2

NON CSR THICKNESS MEASUREMENT – REPORT FORMS – TM7 UR S31

TM7 UR S31 - Cargo Hold Transverse Web Frames

Location of Structure :		Cargo Hold No. 1										
Structural Component / Frame No.	Zone / Part	As Built Thickness T-AB (mm)	T-COAT (mm)	Renewed Thickness T-REN (mm)	Port Reading			Starboard Reading			Comments	
					Gauged Thickness T-M (mm)	Diminution (mm)	Thickness As Renewed (mm)	Gauged Thickness T-M (mm)	Diminution (mm)	Thickness As Renewed (mm)		

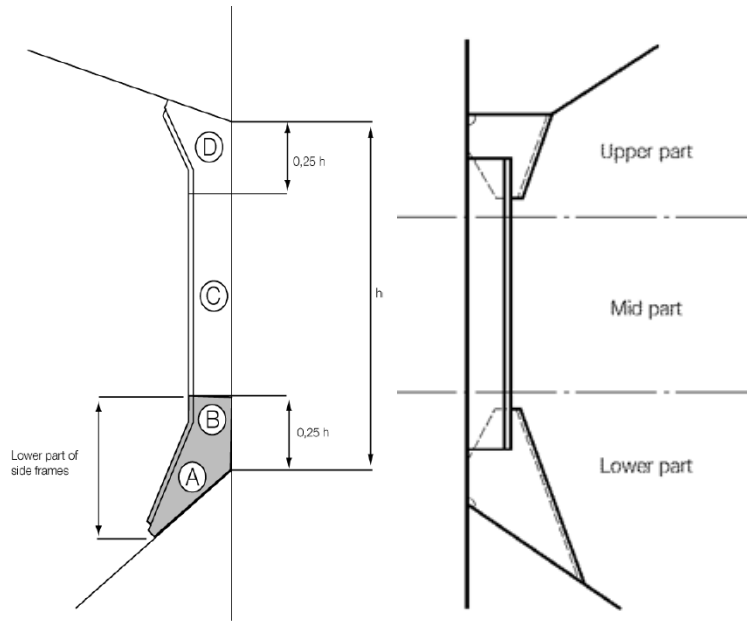
● Excessive Diminution
 ● To Be Coated or Gauged Annually
 ● Renewed As Built
 ● Renewed other than As Built
 ● Missing Reading
 ● Abnormally High Reading

Name of TM Operator : Operator's Name Surname
 Name of LR Attending Surveyor : Surveyor's Name Surname

NOTES:

1. This Form is to be used for reporting the thickness measurement of the web plating of cargo hold/tank transverse frames of single skin bulk carriers, where side shell frames are to be assessed in accordance to Unified Requirement Strength 31 and the tables provided with the Preliminary Assessment for Cargo Hold Transverse Framing in Accordance to UR S31. This Form is to be used for the frame web plating at zones A, B, C and D as defined in the figure below. For these ships' side shell frame flange, TM7 form is to be used instead and the face plate should be assessed separately for the Upper, Mid and Lower part of the frame.

Appendix 2



2. Please **Create New TM Form** and select the appropriate **Survey Requirement** from the drop down list. The **TM Form** list will be updated accordingly with TM forms associated with the survey requirement.

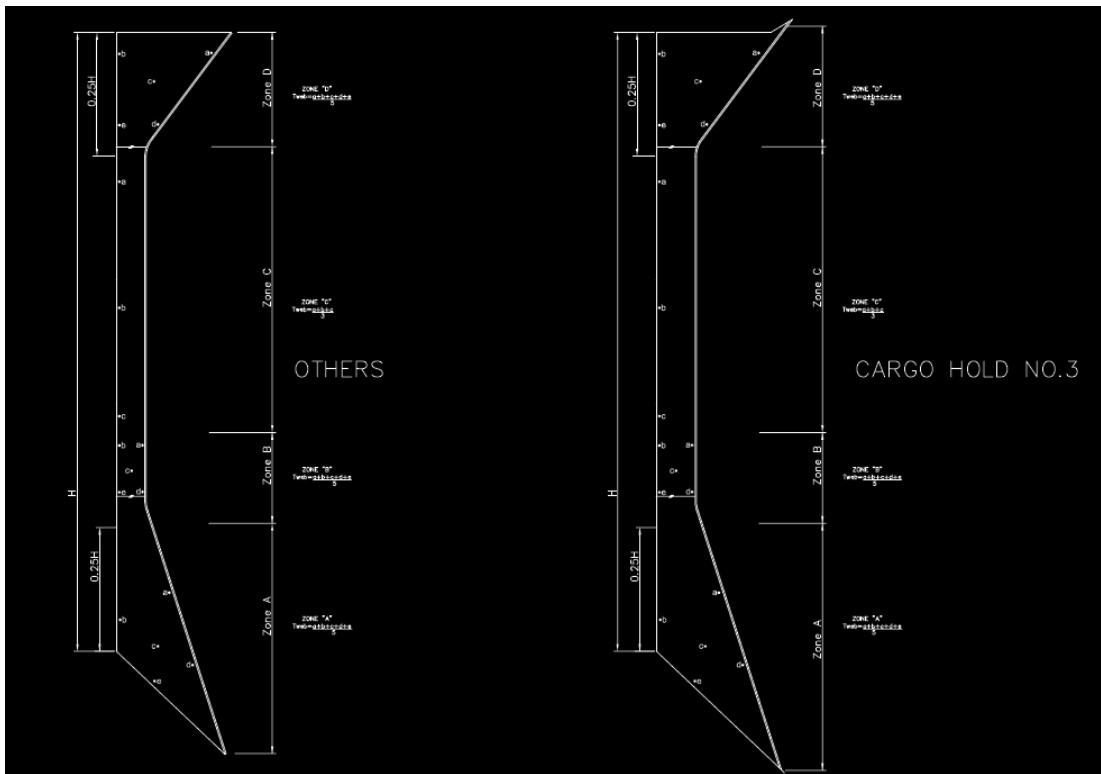


2.1 Form TM7 UR S31 will then become available to the user. The **Space/Comp/Section** will be automatically updated to provide a list of available space/compartments. For Form TM 7 the default selection will be set to **Cargo Holds**.

2.2 Please enter the **Location of Structure** on the available free-text box for the compartment the reported cargo hold/tank transverse frames are located. The appropriate location is to be symbolised with an identifier that corresponds to the plans aboard and the associated sketches attached to these TM forms.

3. By use of the TM Form, the description of the **Structural Component/Frame No** has to correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches. The **Sketch Reference ID** has to include two (2) elements. Indication of the sketch reference (1) where found necessary, as well as the plate reference (2).

Appendix 2



Ship's Name : Non- CSR SHIP		LR/IMO Number : 9186209			Report Number : ATW1231231				
TM7 UR S31 - Cargo Hold Transverse Web Frames									
Location of Structure :		Cargo Hold No. 1							
Structural Component / Frame No.	Zone / Part	As Built Thickness T-AB (mm)	T-COAT (mm)	Renewal Thickness T-REN (mm)	Port Reading			Starboard Reading	
					Gauged Thickness T-M (mm)	Diminution (mm)	Thickness As Renewed (mm)	Gauged Thickness T-M (mm)	Diminution (mm)
Fr120 -Web	A	14.5	12	11.5	11.9	2.6	15		
	B	14.5	12	11.5	12.1	2.4			
	C	14.5	12	11.5	12.9	1.6	12		
	D	14.5	12	11.5	12.8	1.7			
Fr.125 -Web	A	14.5	12	11.5	13.6	0.9			
	B	14.5	12	11.5	13.2	1.3	14.5		
	C	14.5	12	11.5	10	4.5			
Fr.130 -Web	D	14.5	12	11.5	13	1.5			
	A	14.5	12	11.5	12	2.5			
	B	14.5	12	11.5	14	0.5			

4. Please use the **Structural Component/Frame No** column to record the actual Frame Number of the side shell frame web and the **Zone / Part** column for describing zone A, B, C or D.

5. It is recommended to also attach a sketch for showing zones on a typical side shell web frame.

6. Kindly refer to the "Preliminary Assessment of Cargo Holds Transverse Framing in Accordance with UR S31" for the values of **T_{Coat}** and **T_{ren}** to be used for each transverse web frame.

7. The single measurements recorded are to represent the average of multiple measurements.

8. The TM7 UR S31 Form will highlight with colours any applicable exceptions for:

- ✓ Missing Reading
- ✓ Abnormally High Readings
- ✓ Substantial Corrosion (or)

Appendix 2

- ✓ To be Coated or Gauged Annually
- ✓ Excessive Diminution
- ✓ Renewed As-Built
- ✓ Renewed other than As-Built

● Excessive Diminution ● To Be Coated or Gauged Annually ● Renewed As Built ● Renewed other than As Built ● Missing Reading ● Abnormally High Reading

9. Comments at the end of the form are to be used for additional reporting of close up survey area findings on each particular structural item like pitting, grooving, edge corrosion, necking effect, and detached structure. This column will provide a more accurate description of the findings that explain any repairs carried out. It should be noted that comments for close up survey findings on plates that have not been marked as repaired, will be considered as outstanding defects on close out of the survey. The comments recorded to this column should accurately reflect the final condition of the ship, after any repairs, renewals and alterations have taken place to the reported structural items.

10. The final TM report including this TM Form must represent the final condition of the ship structure after any repairs, renewals and alterations.

Appendix 2

NON CSR THICKNESS MEASUREMENT – REPORT FORMS – TM8

TM8 - Transverse Sections - Longitudinal Strength Assessment

Transverse Section :		No. 1		
Frame No. :		Frame No. 100		
Area Assessment of Hull Girder Strength				
Zone	Actual (cm ²)	Rule (cm ²)	Reduction (%)	Acceptance Criteria (%)
Deck Zone				10
Neutral Axis Zone				15
Bottom Zone				10

● Non-Acceptable

NOTES:

*See Non CSR TM2-3 Form notes.

Appendix 2

CSR THICKNESS MEASUREMENT – REPORT FORMS – TM1

TM1 – Deck / Shell / Bottom Plating

Space / Compartment Description :		Main Deck Plating											
Strake Position :		Strake 1											
Plate Position	Sketch Reference ID	As Built Thickness (mm)	Voluntary Thickness Addition (mm)	Renewal Thickness (mm)	Port Reading						Mean Remaining Corrosion Addition (mm)	Comments	
					Forward			Aft					
					Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)	Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)			
10th Fwd													
9th Fwd													
8th Fwd													
7th Fwd													
6th Fwd													
5th Fwd													
4th Fwd													
3rd Fwd													
2nd Fwd													
1st Fwd													
Ambiships													
1st Aft													
2nd Aft													
3rd Aft													
4th Aft													
5th Aft													
6th Aft													
7th Aft													
8th Aft													
9th Aft													
10th Aft													

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

Name of TM Operator : Name Surname

Name of LR Attending Surveyor :

NOTES:

1. This Form is to be used for recording the thickness measurement for the below primary structural members:

- ✓ All strength deck plating within the cargo area.
- ✓ All keel, bottom shell and bilge plating within the cargo area.
- ✓ All wind and water strakes within the cargo area.

2. Access **Create New TM Form** and select the appropriate **Survey Requirement** from the drop down list. The **TM Form** drop down list will display the TM forms associated to selected survey requirements.

[Create New TM Form](#)

2.1 Form TM1 CSR will then become available to the user. The **Space/Comp/Section** will be automatically selected.

Please note that TM6 has been associated with most survey requirements to provide the option for localised corrosion reporting. The system permits a unique combination of **Survey Requirement, TM Form** and **Space/Comp/Section**. In case the user reports both available TM Forms, There will be 2 TM Forms under the same Survey Requirement folder, titled the same, in the **Structural Component Tree**. Therefore, users should use a different descriptor for **Location of Structure** in case they require generating both TM forms under the same **Survey Requirement** and **Space/Comp/Section**.

Appendix 2

Create New TM Form

Survey Requirement : * Deck Plating

TM Form : *
 TM1 CSR
 TM6 CSR

Space/Comp/Section : *

OK Cancel

Create New TM Form

Survey Requirement : * Deck Plating

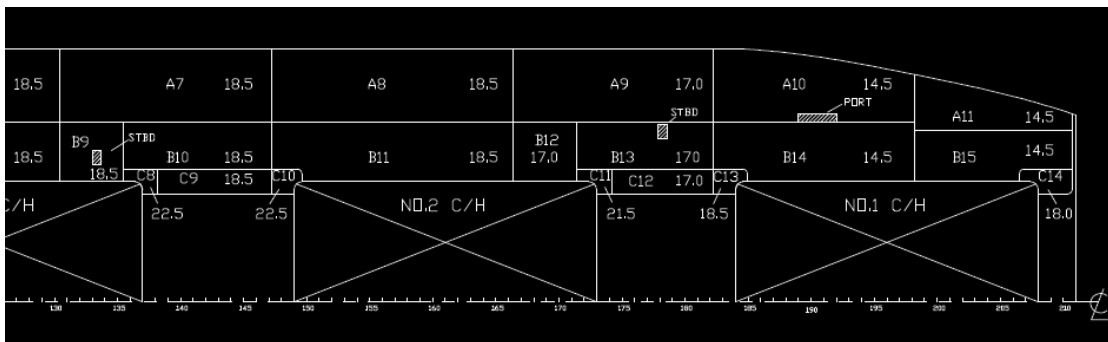
TM Form : * TM1 CSR

Space/Comp/Section : * Main Deck Plating

Location of Structure : * Strake *

OK Cancel

2.2 Please enter the **Location of Structure** on the available free-text box. For TM1 the strake position must be selected. The appropriate strake is to be symbolised with an identifier that corresponds to the plans aboard and the associated sketches attached to these TM forms.



3. The description of the plate position has to correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches. The **Sketch Reference ID** has to include two (2) elements; an indication of the sketch reference (1) where found necessary, as well as the plate reference (2).

Appendix 2

Ship's Name : CSR Ship		LR/IMO Number : 1234567			Report Number : LON1311301		
Space / Compartment Description :		Main Deck Plating					
Strake Position :		Strake *					
Plate Position	Sketch Reference ID	As Built Thickness (mm)	Voluntary Thickness Addition (mm)	Renewal Thickness (mm)	Forward		
					Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)
Fwd	A1	15	0	12	12.3	0.3	
Fwd	B1	15	0	12	13.2	1.2	
Fwd	C1	15	0	12	15	3	
Fwd	D1	15	0	12	50	38	
Fwd	E1	15	0	12	11.5	-0.5	15
Fwd	F1	15	0	12	11.8	-0.2	15
Fwd	G1	15	0	12	12.5	0.5	15.5
Fwd	H1	15	0	12	12.8	0.8	
Fwd	I1	15	0	12			
Fwd	J1	15	0	12			
ships	K1	15	0	12			

4. For oil tankers, all deck plating strakes are to be recorded; for ships with hatch openings, only the deck plating strakes outside the line of openings are to be recorded on this form.

5. Measurements are to be taken on the forward and aft areas of all plates and where plates cross ballast/cargo tank boundaries and separate measurements for the areas of plating in way of each type of tank are to be recorded.

6. The single measurements recorded are to represent the average of multiple measurements.

7. The TM Forms will highlight with colours any applicable exceptions for:

- ✓ Missing Reading
- ✓ Abnormally High Readings
- ✓ Substantial Corrosion (or)
- ✓ To be Coated or Gauged Annually
- ✓ Excessive Diminution
- ✓ Renewed As-Built
- ✓ Renewed other than As-Built

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

8. Comments at the end of the form are to be used for additional reporting of close up survey area findings on each particular structural item like pitting, grooving, edge corrosion, necking effect, and detached structure. This will provide a more accurate description of the findings that explain any repairs carried out. It should be noted that comments for close up survey findings on plates that have not been marked as repaired, will be considered as outstanding defects on close out of the survey. The comments recorded to this column should accurately reflect the final condition of the ship, after any repairs renewals and alterations have taken place to the reported structural items.

9. The final TM report including this TM Form must represent the final condition of the ship structure after any repairs, renewals and alterations.

Appendix 2

CSR THICKNESS MEASUREMENT – REPORT FORMS – TM2-3

TM2~3 - Transverse Sections - Deck, Shell, Bottom Plating & Longitudinal Members

Transverse Section :	No. 2													
Zone :	Deck Zone													
Frame No. :	Frame No. 120													
Tank / Compartment / Space	Structural Component	Sketch Reference ID	As Built Thickness (mm)	Voluntary Thickness Addition (mm)	Renewal Thickness (mm)	Plots / Patches / Width / Height (mm)	Port Reading			Starboard Reading			Comments	
							Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)	Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)		

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

Name of TM Operator : _____ Name Surname Name of LR Attending Surveyor : _____

PURPOSE:

- The purpose of the TM2~3 form is to collect thickness measurements of structure in Transverse Sections, where required.
- The purpose of the TM8 form is to assess the measurements for Global (Longitudinal Strength) purposes. This is carried out by means of an Area Assessment, assessing the total area of structure remaining, and comparing it with Rule Requirements.

For the purpose of this Area Assessment, the Transverse Section is divided into 3 zones, the Deck Zone, the Neutral Axis Zone and the Bottom Zone. Each Zone’s remaining structural area is assessed separately.

The diminution limits for the area assessment of the zones are 10% for Deck Zone and Bottom Zone, and the gross offered thickness minus 0.5 *t_c* for the Neutral Axis Zone. Where the areas are diminished in excess of these, remedial action must be taken for those zones affected.

NOTES:

1. This Form is to be used for recording the thickness measurement for all continuous longitudinal structural members that contribute to the ship’s global strength at one, two or three transverse sections:

- ✓ Strength deck plating
- ✓ Keel, bottom shell plating and bilge plating
- ✓ Side shell plating
- ✓ Longitudinal bulkhead plating
- ✓ Topsides tank Sloping plating
- ✓ Internal or external longitudinal stiffeners and girders in tanks, holds and void spaces
- ✓ Inner bottom & hopper plating
- ✓ Wing tank stringer plating
- ✓ Continuous hatch coaming plating and longitudinals

Appendix 2

2. Access **Create New TM Form** and select the appropriate **Survey Requirement** from the drop down list. The **TM Form** drop down list will display the TM forms associated to selected survey requirements.

Create New TM Form

2.1 Form TM2~3 will then become available to the user. The **Space/Comp/Section** will be automatically selected.

Create New TM Form

Survey Requirement : * Transverse Sections

TM Form : * TM2~3 CSR ?

Space/Comp/Section : * Transverse Section No.

Space/Comp/Section Indicator : * 1

Zone : * Deck Zone

Location of Structure : * Frame No. *

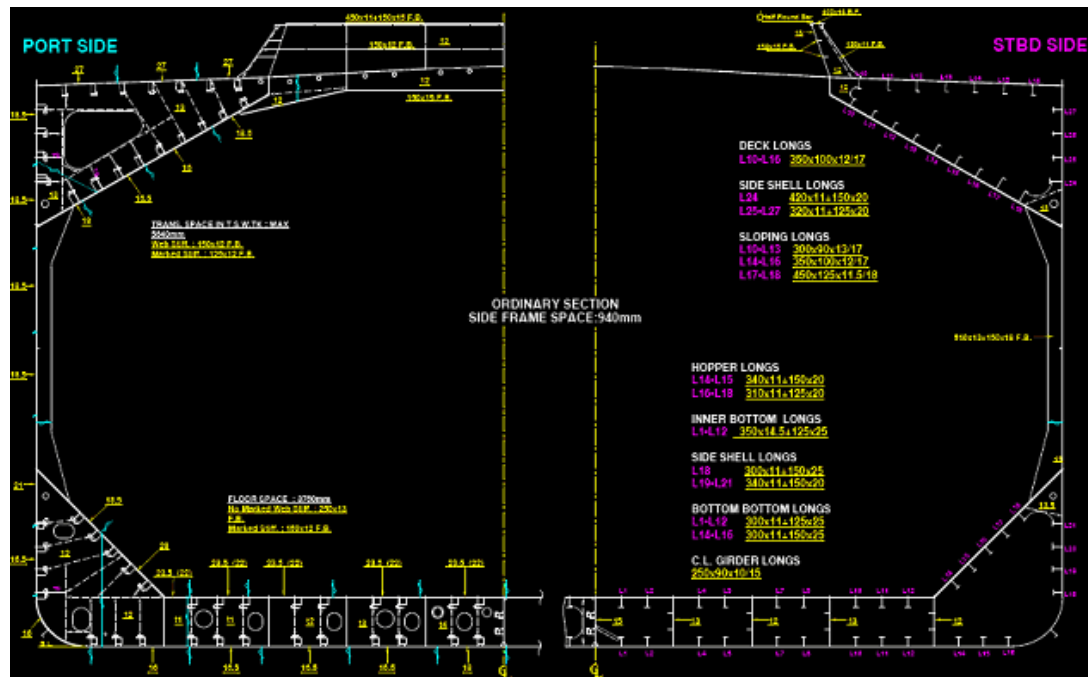
OK Cancel

2.2 Please fill in the **Space/Comp/Section Indicator** with the designated number of the transverse section being reported on this form.

2.3 Select the **Zone** for the transverse section that is being reported. The drop down menu will provide the **Deck Zone**, the **Bottom Zone** or the **Neutral Axis Zone** for the user to select. Please review the TM & close up Survey Guide booklet for further information on which structural items are to be reported on each zone, for each particular ship type.

2.4 Enter the **Location of Structure** in the available free-text box. For TM2~3 this should be the Frame number of the Transverse Section to be assessed. The Frame number should correspond to the plans onboard & associated sketches attached to these TM forms.

Appendix 2



3. On form TM2~3, the description of the **Structural Component** should correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches. The **Sketch Reference ID** has to include two (2) elements. Indication of the sketch reference (1) where found necessary, as well as the plate reference (2).

Ship's Name : CSR Ship		LR/IMO Number : 1234567		Report Number : LON1311301						
TM2~3 - Transverse Sections - Deck, Shell, Bottom Plating & Longitudinal Members										
Transverse Section :		No. 1								
Zone :		Deck Zone								
Frame No. :		Frame No. 100								
Sketch Reference ID	As Built Thickness (mm)	Voluntary Thickness Addition (mm)	Renewal Thickness (mm)	Plate / Profile Width / Height (mm)	Port Reading			Starboard Reading		
					Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)	Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)
A1	20	2	17	2000	17.9	0.9		17.5	0.5	
A2	20	2	17	2000	17.7	0.7		17.6	0.6	
A3	20	2	17	2000	17.2	0.2		17.7	0.7	
A4	20	2	17	2000	18.1	1.1		16.1	-0.9	21
A5	20	2	17	2000	15.1	-1.9	20	17	0	
A6	20	2	17	2000	18.5	1.5		68	51	
A7	20	2	17	2000	17.2	0.2		17.9	0.9	
A8	20	2	17	2000	49	32		17.8	0.8	
A9	20	2	17	2000						
A10	20	2	17	2000						

3.1 Enter the **Tank/Compartment/Space** associated with the plating / profile, for each structural item. This will normally be the **Tank/Compartment/Space** in which the measurement was obtained.

3.2 Select a **Plate/Profile Width/Height** for each structural item. This is the measurement that, when multiplied by the thickness of the plate or profile, will give the area for that plate or profile. The system will then calculate automatically the sectional area (**A**) for each plate for the as-built thickness and the gauged thickness on each row as per the following calculations on typical section examples illustrated below:

Appendix 2

Total Zone Sectional Area	
$A_{total} = A_{total-plat} + A_{total-long}$	
$A_{total-pl} = A_{pl1} + A_{pl2} + A_{pl3} + \dots = (t_{pl} \times H_{pl})_1 + (t_{pl} \times H_{pl})_2 + (t_{pl} \times H_{pl})_3 + \dots$	
$A_{total-long} = A_{long1} + A_{long2} + A_{long3} + \dots = (t \times H)_{long1} + (t \times H)_{long2} + (t \times H)_{long3} + \dots$	
$A_{long-typical} = (A_{web} + A_{flange})_{long-typical}$	
L-Section Longitudinal	
$A_{web-long} = (t_w \times W_w)_{long} = [t_w \times (W_{w1} - t_f)]_{long}$	
$A_{flange-long} = (t_f \times H_f)_{long}$	
T-Section Longitudinal	
$A_{web-long} = (t_w \times W_w)_{long}$	
$A_{flange-long} = (t_f \times H_f)_{long}$	
Bulb Section Longitudinal	
$A_{web-long} = (t_w \times W_w)_{long}$	
$A_{flange-long}$: is not required to be assessed due to the difficulty of obtaining a thickness reading on the bulb section	
W: Plate or Long/I Width	H: Plate or Long/I Height
A: Transverse sectional area as indicated	t: Rule or Gauged thickness reading

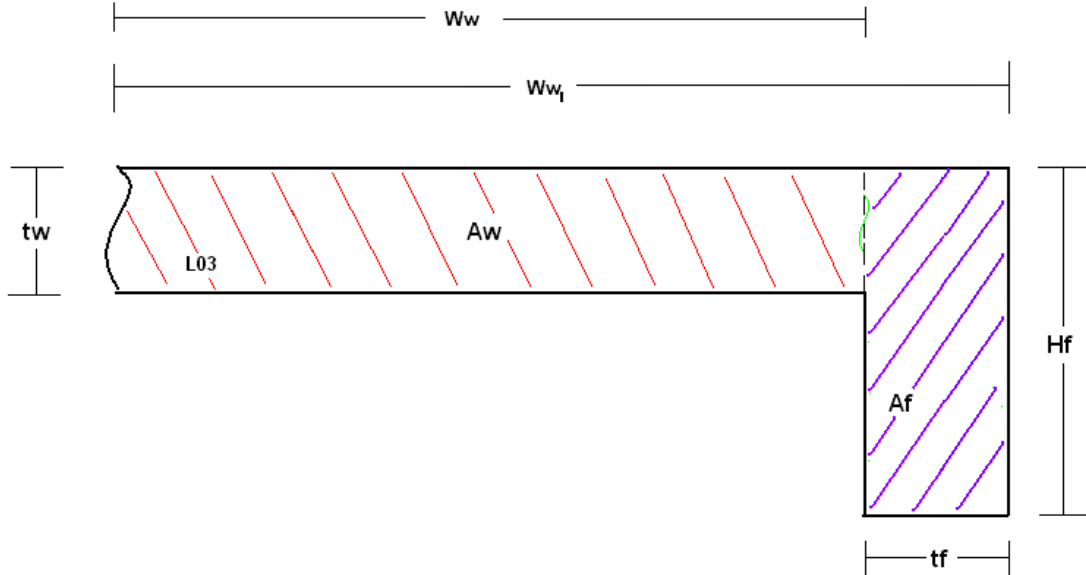
a. Plating



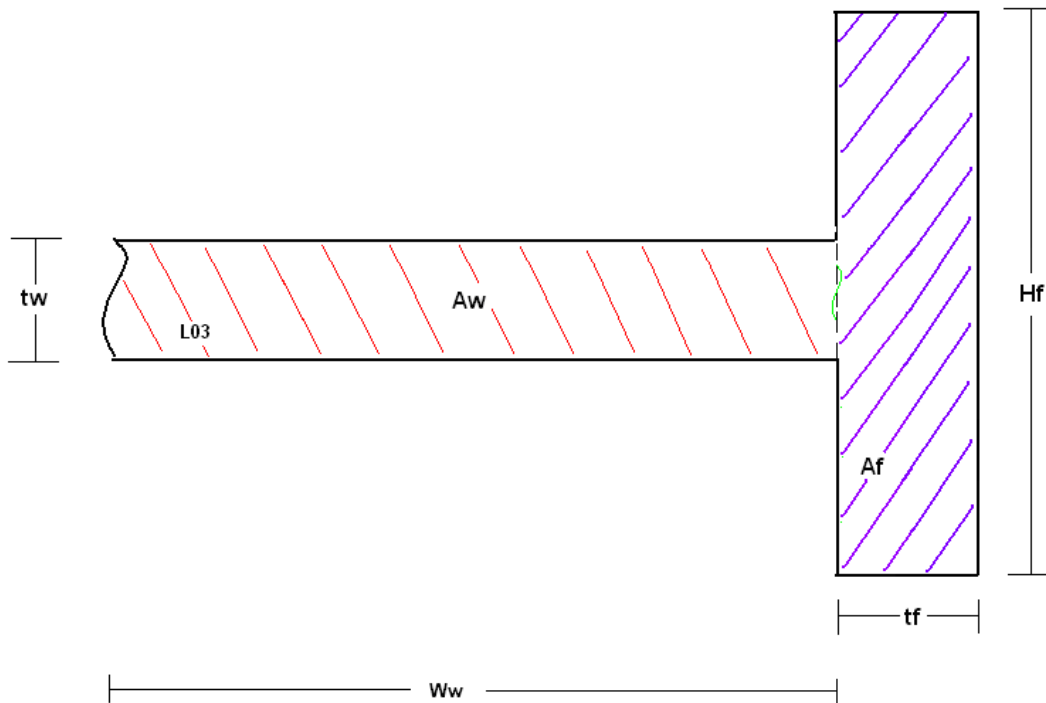
Appendix 2

b. Longitudinals

L-Section



T-Section



3.3 The sum of the area calculations for the **Rule** design thickness and the **Actual** gauged thickness for each zone of a reported transverse section are presented on form TM8. This form will be generated automatically every time a TM2~3 form has been created for a transverse section.

Appendix 2

Ship's Name : CSR Ship		LR/IMO Number : 1234567		Report Number : LON1311301	
TM8 - Transverse Sections - Longitudinal Strength Assessment					
Transverse Section :			No. 1		
Frame No. :			Frame No. 100		
Area Assessment of Hull Girder Strength					
Zone	Actual (cm²)	Rule (cm²)	Reduction (%)	Acceptance Criteria (%)	
Deck Zone	7402	5760	-28.51	10	
Bottom Zone	5680	6480	12.35	10	
Zone	Actual (cm²)	Zone Area (t _{ren}) with 50% of Mean Corrosion Addition (cm²)	Acceptance (Yes/No)	Acceptance Criteria	
Neutral Axis Zone				Actual ≥ Zone Area (t _{ren}) with 50% of Mean Corrosion Addition	

● Non-Acceptable

3.4 Note that the calculations on the TM8 form will update each time a user updates the TM2~3 form. Where the user updates a **Gauged Thickness** on TM2~3 form with a **Thickness As-Renewed**, the calculation for the **Actual** transverse sectional area will be updated using the repaired thickness instead of the gauged thickness.

3.5 CSR ships require a separate calculation for the evaluation of the **Neutral Axis Zone**.

Acceptance Criteria:

- Yes , if **Actual Zone Area ≥ Zone Area (t_{ren}) with 50% of mean corrosion addition**
- No , if **Actual Zone Area < Zone Area (t_{ren}) with 50% of mean corrosion addition**

Zone Area (t_{ren}) with 50% of mean corrosion addition =

$$(L \times (((t_a - t_v - t_{Ren}) / 2) + t_{Ren}))_{Port_row1} + (L \times (((t_a - t_v - t_{Ren}) / 2) + t_{Ren}))_{Stbd_row1} + (L \times (((t_a - t_v - t_{Ren}) / 2) + t_{Ren}))_{Port_row2} + (L \times (((t_a - t_v - t_{Ren}) / 2) + t_{Ren}))_{Stbd_row2} + \dots + (L \times (((t_a - t_v - t_{Ren}) / 2) + t_{Ren}))_{Port_row\ n} + (L \times (((t_a - t_v - t_{Ren}) / 2) + t_{Ren}))_{Stbd_row\ n}$$

4. The single measurements recorded for each element, i.e. plate or profile, are to represent the average of multiple measurements.

5. The TM2~3 Form will highlight with colours any applicable exceptions for:

- ✓ Missing Reading
- ✓ Abnormally High Readings
- ✓ Substantial Corrosion (or)
- ✓ To be Coated or Gauged Annually
- ✓ Excessive Diminution
- ✓ Renewed As-Built
- ✓ Renewed other than As-Built

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

6. The TM8 form will highlight any non-acceptable transverse sectional area assessment.

7. Comments at the end of the form are to be used for additional reporting of close up survey area findings on each particular structural item, for example pitting, grooving, edge corrosion, necking effect, and detached structure. This column will provide a more accurate description of the findings that explain any repairs carried out. It should be noted that comments for close up survey findings on plates that have not been marked as repaired, will be considered as outstanding defects on close out of the survey.

Appendix 2

The comments recorded to this column should accurately reflect the *final condition of the ship*, after any repairs, renewals and alterations have taken place to the reported structural items.

8. The final TM report including this TM Form must represent the final condition of the ship structure after any repairs, renewals and alterations.

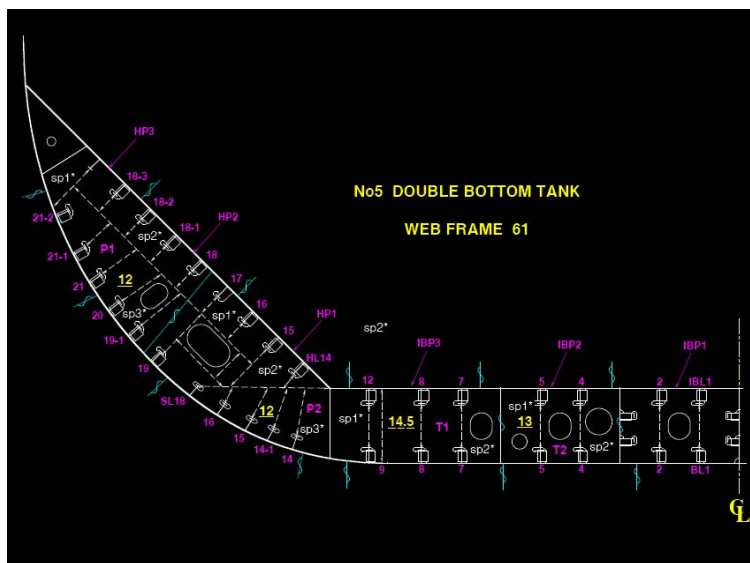
Appendix 2

Therefore, users should use a different descriptor for **Location of Structure** in case they require generating both TM forms under the same **Survey Requirement** and **Space/Comp/Section**.

2.2 Select the **Space/Comp/Section Indicator** with the indicating number of the compartment or space including the survey areas being reported to this form.

2.3 Please enter the **Location of Structure** on the available free-text box. For TM4 the particular frame station of the transverse structural member must be entered. The appropriate Frame number is to be symbolised with an identifier that corresponds to the plans aboard and the associated sketches attached to these TM forms.

3. The description of the **Structural Component** has to correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches. The **Sketch Reference ID** has to include two (2) elements. Indication of the sketch reference (1) where found necessary, as well as the plate reference (2).



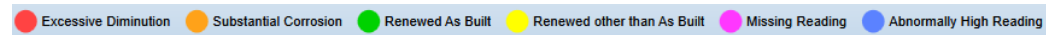
Ship's Name : CSR Ship		LR/IMO Number : 1234567		Report Number : LON1311301					
TM4 - Transverse Structural Members & Attached Longitudinal Structure									
Space / Compartment Description :		Double Side Tank No. 1							
Location of Structure :		Frame No. 100							
Sketch Reference ID	As Built Thickness (mm)	Voluntary Thickness Addition (mm)	Renewal Thickness (mm)	Port Reading			Starboard Reading		
				Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)	Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)
A	12	0	10	11.5	1.5		11.5	1.5	
B	14	0	12	12.5	0.5		12.5	0.5	
C	16	0	14	13.5	-0.5	16	13.5	-0.5	
D	12	0	10	11.5	1.5		11.5	1.5	
E	14	0	12	12.5	0.5		12.5	0.5	
F	16	0	14	13.5	-0.5	17	13.5	-0.5	
G	12	0	10	50	40				
A	14	0	12						
B	16	0	14						

4. The single measurements recorded are to represent the average of multiple measurements.

Appendix 2

5. The TM4Form will highlight with colours any applicable exceptions for:

- ✓ Missing Reading
- ✓ Abnormally High Readings
- ✓ Substantial Corrosion (or)
- ✓ To be Coated or Gauged Annually
- ✓ Excessive Diminution
- ✓ Renewed As-Built
- ✓ Renewed other than As-Built



6. Comments at the end of the form are to be used for additional reporting of close up survey area findings on each particular structural item like pitting, grooving, edge corrosion, necking effect, and detached structure. This column will provide a more accurate description of the findings that explain any repairs carried out. It should be noted that comments for close up survey findings on plates that have not been marked as repaired, will be considered as outstanding defects on close out of the survey. The comments recorded to this column should accurately reflect the final condition of the ship, after any repairs, renewals and alterations have taken place to the reported structural items.

7. The final TM report including this TM Form must represent the final condition of the ship structure after any repairs, renewals and alterations.

Appendix 2

CSR THICKNESS MEASUREMENT – REPORT FORMS – TM5

TM5 - Transverse Bulkheads

Space / Compartment Description :		Transverse Bulkhead between Cargo Hold Nos. 1/2									
Location of Structure :		Frame No. 155									
Type of Bulkhead :		Plain Transverse Bulkhead									
Structural Component (Plating / Stiffener)	Sketch Reference ID	As Built Thickness (mm)	Voluntary Thickness Addition (mm)	Renewal Thickness (mm)	Port Reading			Starboard Reading			Comments
					Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)	Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)	

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

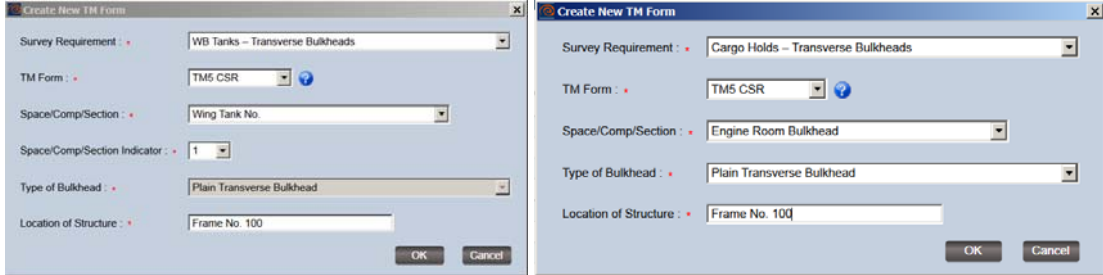
NOTES:

1. This Form is to be used for recording the thickness measurement of all W.T. transverse bulkheads where appropriate.

2. Access **Create New TM Form** and select the appropriate **Survey Requirement** from the drop down list. The **TM Form** drop down list will display the TM forms associated to selected survey requirements.



2.1 Form TM5 CSR will then become available to the user. The **Space/Comp/Section** will be automatically updated to provide a list of possible space/compartments like the Wing Tank or the Engine Room Bulkhead examples below. The user should now select the more suitable descriptor from the drop down list.



Please note that TM6 has been associated with most survey requirements to provide the option for localised corrosion reporting. The system permits a unique combination of **Survey Requirement**, **TM Form** and **Space/Comp/Section**. In case the user reports both available TM Forms, there will be 2 TM Forms under the same Survey Requirement folder, titled the same, in the **Structural Component Tree**. Therefore, users should use a different descriptor for **Location of Structure** in case they require generating both TM forms under the same **Survey Requirement** and **Space/Comp/Section**.

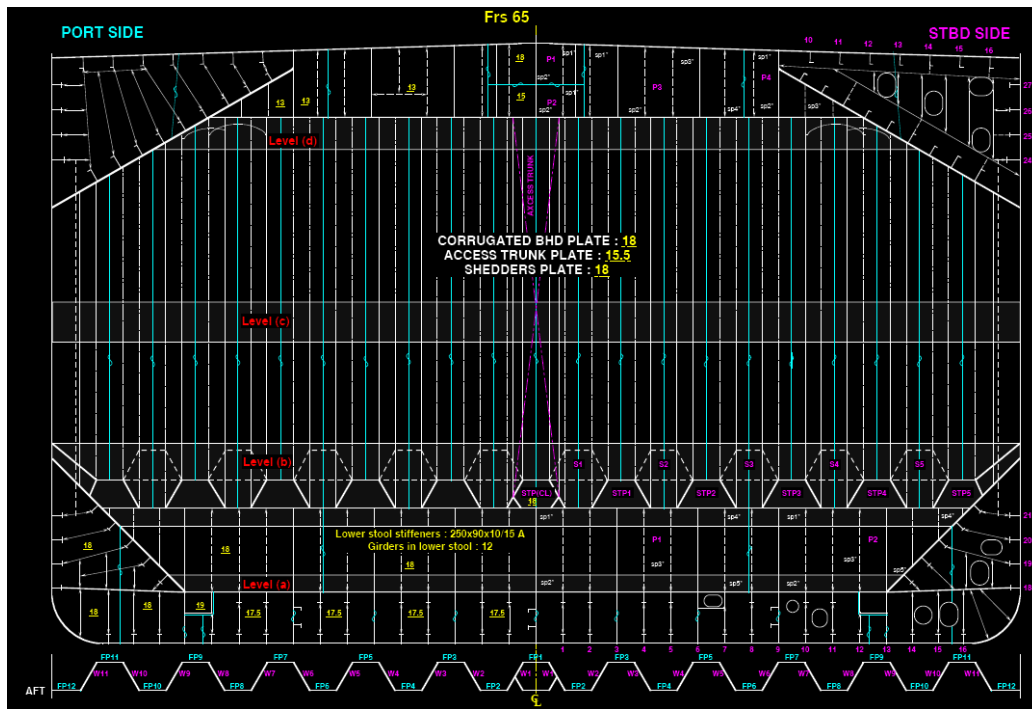
2.2 Select the **Space/Comp/Section Indicator** that best describes the boundary of two ship space/compartments that the Bulkhead separates. Free text selection of **Space/Comp/Section** as well as the **Space/Comp/Section Indicator** is also available to the user.

Appendix 2

2.3 Select the **Type of Bulkhead** that best describes the structural design of the bulkhead.

2.4 Please enter the **Location of Structure** on the available free-text box. For TM5 the particular Frame station of the transverse Bulkhead is required to be entered. The appropriate Frame number is to be symbolised with an identifier that corresponds to the plans aboard and the associated sketches attached to these TM forms.

3. By use of the TM Form, the description of the **Structural Component** has to correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches. The **Sketch Reference ID** has to include two (2) elements. Indication of the sketch reference (1) where found necessary, as well as the plate reference (2).



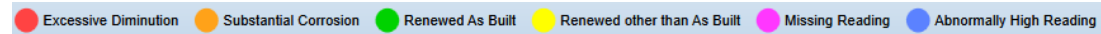
Ship's Name : CSR Ship			LR/IMO Number : 1234567			Report Number : LON1311301				
TM5 - Transverse Bulkheads										
Space / Compartment Description :		Engine Room Bulkhead								
Location of Structure :		Frame No. 60								
Type of Bulkhead :		Plain Transverse Bulkhead								
Plating / Stiffener)	Sketch Reference ID	As Built Thickness (mm)	Voluntary Thickness Addition (mm)	Renewal Thickness (mm)	Port Reading			Starboard Reading		
					Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)	Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)
	1	17	2	14.5	7.9	-6.6	17	15.5	1	
	2	17	2	14.5	7.8	-6.7	17	16.5	2	
	3	17	2	14.5	15.1	0.6		13.5	-1	10
	4	17	2	14.5	15.4	0.9		12.5	-2	10
	5	17	2	14.5	14.5	0		14.5	0	
	6	17	2	14.5	14.6	0.1		14.6	0.1	
	7	17	2	14.5	15.9	1.4		15.9	1.4	
	8	17	2	14.5	16.5	2		50	35.5	
	9	17	2	14.5						

Appendix 2

4. The single measurements recorded are to represent the average of multiple measurements.

5. The TM5 Form will highlight with colours any applicable exceptions for:

- ✓ Missing Reading
- ✓ Abnormally High Readings
- ✓ Substantial Corrosion (or)
- ✓ To be Coated or Gauged Annually
- ✓ Excessive Diminution
- ✓ Renewed As-Built
- ✓ Renewed other than As-Built



6. Comments at the end of the form are to be used for additional reporting of close up survey area findings on each particular structural item like pitting, grooving, edge corrosion, necking effect, and detached structure. This column will provide a more accurate description of the findings that explain any repairs carried out. It should be noted that comments for close up survey findings on plates that have not been marked as repaired, will be considered as outstanding defects on close out of the survey. The comments recorded to this column should accurately reflect the final condition of the ship, after any repairs, renewals and alterations have taken place to the reported structural items.

7. The final TM report including this TM Form must represent the final condition of the ship structure after any repairs, renewals and alterations.

Appendix 2

CSR THICKNESS MEASUREMENT – REPORT FORMS – TM6

TM6 - Miscellaneous Structural Members

Space / Compartment Description :		1										
Location of Structure :		2										
Structural Component	Sketch Reference ID	As Built Thickness (mm)	Voluntary Thickness Addition (mm)	Renewal Thickness (mm)	Port Reading			Starboard Reading			Comments	
					Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)	Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)		

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

Name of TM Operator : Name Surname

Name of LR Attending Surveyor :

NOTES:

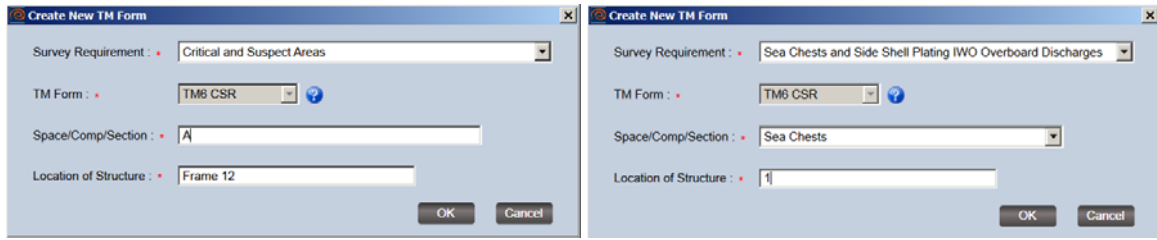
1. This Form is to be used for recording the thickness measurement of miscellaneous structural members, such as:
- ✓ Hatch covers
 - ✓ Hatch coamings
 - ✓ Cross deck strips and underdeck structure in way
 - ✓ Deck, shell and bottom plating outside the cargo length area
 - ✓ Sea chests and shell plating in way of overboard discharges
 - ✓ Keel Plates and Additional Bottom Plates
 - ✓ Duct Keel/Pipe Tunnel
 - ✓ Remaining Exposed Deck/Superstructure Plating
 - ✓ Inner bottom plating
 - ✓ Localised corrosion in any area of the ship structure
 - ✓ In addition, this form is to be used for reporting of any critical areas as defined by the surveyor. This form may also be used for reporting of any additional survey areas outside the normal scope of survey that would require to be thickness measured.

2. Access **Create New TM Form** and select the appropriate **Survey Requirement** from the drop down list. The **TM Form** drop down list will display the TM forms associated to selected survey requirements.

Create New TM Form

2.1 Form TM6 CSR will then become available to the user. The **Space/Comp/Section** will be automatically updated to free-text or to provide a list of space/compartments. The user should now select the more suitable descriptor either by manual input or via a drop-down menu.

Appendix 2

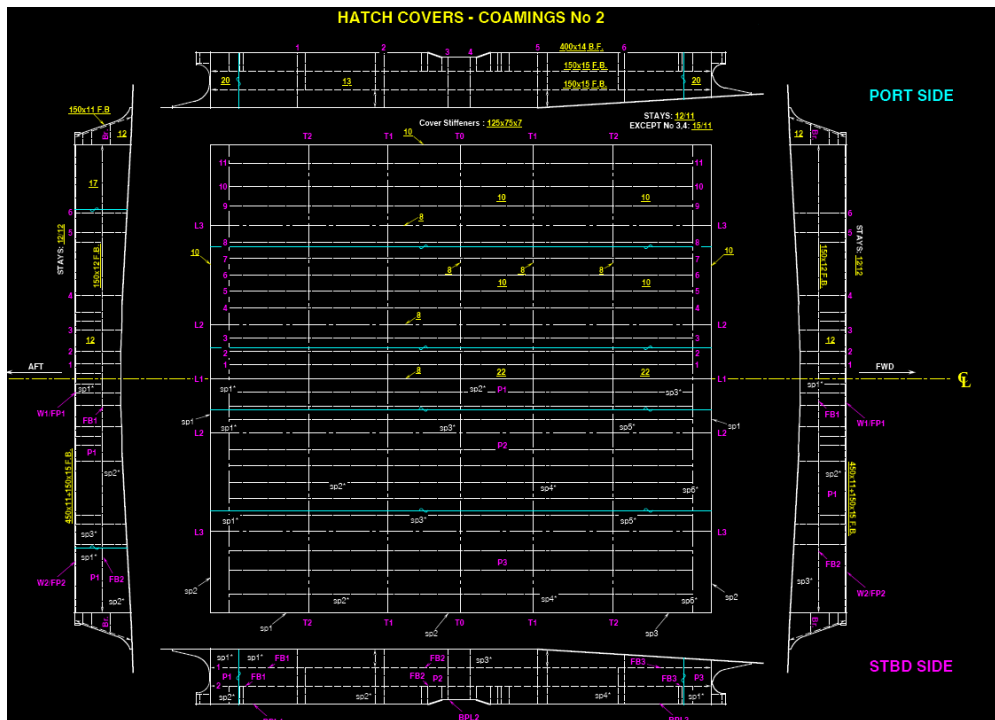


Please note that TM6 has been associated with most survey requirements to provide the option for localised corrosion reporting. The system permits a unique combination of **Survey Requirement**, **TM Form** and **Space/Comp/Section**. In case the user reports both available TM Forms, there will be 2 TM Forms under the same Survey Requirement folder, titled the same, in the **Structural Component Tree**. Therefore, users should use a different descriptor for **Location of Structure** in case they require generating both TM forms under the same **Survey Requirement** and **Space/Comp/Section**.

2.2 If required so, select the **Space/Comp/Section Indicator** with the indicating number of the compartment or space including the survey areas being reported to this form.

2.3 Please enter the **Location of Structure** on the available free-text box. The appropriate location is to be symbolised with an identifier that corresponds to the plans aboard and the associated sketches attached to these TM forms.

3. By use of the TM Form, the description of the **Structural Component** has to correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches. The **Sketch Reference ID** has to include two (2) elements. Indication of the sketch reference (1) where found necessary, as well as the plate reference (2).



Appendix 2

Ship's Name : CSR Ship										
LR/IMO Number : 1234567										
Report Number : LON1311301										
TM6 - Miscellaneous Structural Members										
Space / Compartment Description :		Sea Chests								
Location of Structure :		1								
Sketch Reference ID	As Built Thickness (mm)	Voluntary Thickness Addition (mm)	Renewal Thickness (mm)	Port Reading			Starboard Reading			
				Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)	Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)	
A	10	1	7.5	8.9	1.4		7.1	-0.4	11	
B	10	1	7.5	7.7	0.2		8.9	1.4		
C	10	1	7.5	7.1	-0.4	10	7.7	0.2		
D	10	1	7.5							

4. The single measurements recorded are to represent the average of multiple measurements.

5. The TM6 Form will highlight with colours any applicable exceptions for:

- ✓ Missing Reading
- ✓ Abnormally High Readings
- ✓ Substantial Corrosion (or)
- ✓ To be Coated or Gauged Annually
- ✓ Excessive Diminution
- ✓ Renewed As-Built
- ✓ Renewed other than As-Built

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

6. Comments at the end of the form are to be used for additional reporting of close up survey area findings on each particular structural item like pitting, grooving, edge corrosion, necking effect, and detached structure. This column will provide a more accurate description of the findings that explain any repairs carried out. It should be noted that comments for close up survey findings on plates that have not been marked as repaired, will be considered as outstanding defects on close out of the survey. The comments recorded to this column should accurately reflect the final condition of the ship, after any repairs, renewals and alterations have taken place to the reported structural items.

7. The final TM report including this TM Form must represent the final condition of the ship structure after any repairs, renewals and alterations.

Appendix 2

CSR THICKNESS MEASUREMENT – REPORT FORMS – TM7

TM7 - Cargo Hold Transverse Frames

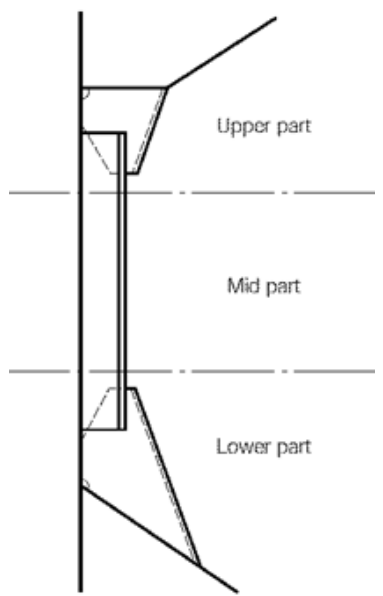
Location of Structure :		Cargo Hold No. 2									Comments
Structural Component / Frame No.	Zone / Part	As Built Thickness (mm)	Voluntary Thickness Addition (mm)	Renewal Thickness (mm)	Port Reading			Starboard Reading			
					Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)	Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)	

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

Name of TM Operator : Name Surname
 Name of LR Attending Surveyor :

NOTES:

1. This Form is to be used for reporting the thickness measurement of cargo hold/tank transverse frames for the Upper, Mid and Lower part of the web and flange plating in consideration (in accordance to the image below). The form may also be used for reporting of any attached structure to the cargo hold/tank transverse frames required to be assessed.



2. Access **Create New TM Form** and select the appropriate **Survey Requirement** from the drop down list. The **TM Form** drop down list will display the TM forms associated to selected survey requirements.

[Create New TM Form](#)

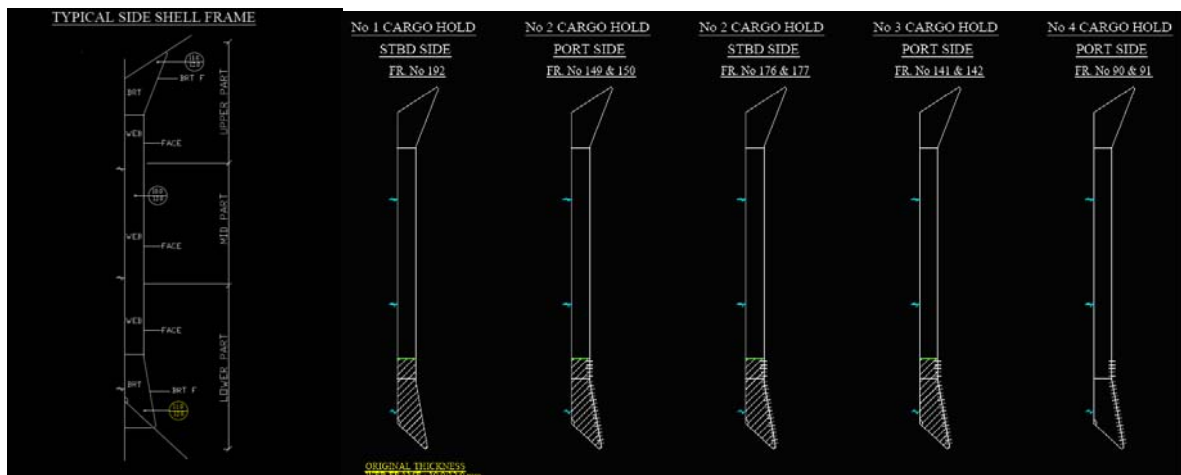
Appendix 2

2.1 Form TM7 CSR will then become available to the user. The **Space/Comp/Section** will be automatically updated to provide a list of available space/compartments. The user should now select the more suitable descriptor via a drop-down menu.

Please note that TM6 has been associated with most survey requirements to provide the option for localised corrosion reporting. The system permits a unique combination of **Survey Requirement**, **TM Form** and **Space/Comp/Section**. In case the user reports both available TM Forms, there will be 2 TM Forms under the same Survey Requirement folder, titled the same, in the **Structural Component Tree**. Therefore, users should use a different descriptor for **Location of Structure** in case they require generating both TM forms under the same **Survey Requirement** and **Space/Comp/Section**.

2.2 Enter the **Location of Structure** on the available free-text box for the compartment the reported cargo hold/tank transverse frames are located within. The appropriate location is to be symbolised with an identifier that corresponds to the plans aboard and the associated sketches attached to these TM forms.

3. By use of the TM Form, the description of the **Structural Component** has to correspond to a **Sketch Reference ID** that is to be clearly indicated on the sketches. The **Sketch Reference ID** has to include two (2) elements. Indication of the sketch reference (1) where found necessary, as well as the plate reference (2).



Appendix 2

Ship's Name : CSR Ship			LR/IMO Number : 1234567			Report Number : LON1311301				
Location of Structure :			Cargo Hold No. 1							
nt / Frame No.	Zone / Part	As Built Thickness (mm)	Voluntary Thickness Addition (mm)	Renewal Thickness (mm)	Port Reading			Starboard Reading		
					Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)	Gauged Thickness (mm)	Remaining Corrosion Addition (mm)	Thickness As Renewed (mm)
	F1	10	2	8	30	22		5.9	-2.1	11
	F2	10	2	8	8.1	0.1		9.9	1.9	
	F3	10	2	8	8.5	0.5		8.5	0.5	
	F4	10	2	8	9.5	1.5		8.7	0.7	
	F5	10	2	8	9.4	1.4		9.5	1.5	
	F6	10	2	8	5.5	-2.5	10	9.9	1.9	
	F7	10	2	8						

4. Please use the **Structural Component/Frame No** column to record the actual Frame Number of the side shell frame reported and the **Zone / Part** column for describing the Upper, Mid or Lower part - web or flange plating.

5. It is recommended to also attach a typical sketch for showing the web frame upper, mid and lower part as per above sketch example.

6. The single measurements recorded are to represent the average of multiple measurements.

7. The TM7 Form will highlight with colours any applicable exceptions for:

- ✓ Missing Reading
- ✓ Abnormally High Readings
- ✓ Substantial Corrosion (or)
- ✓ To be Coated or Gauged Annually
- ✓ Excessive Diminution
- ✓ Renewed As-Built
- ✓ Renewed other than As-Built

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

8. Comments at the end of the form are to be used for additional reporting of close up survey area findings on each particular structural item like pitting, grooving, edge corrosion, necking effect, and detached structure. This column will provide a more accurate description of the findings that explain any repairs carried out. It should be noted that comments for close up survey findings on plates that have not been marked as repaired, will be considered as outstanding defects on close out of the survey. The comments recorded to this column should accurately reflect the final condition of the ship, after any repairs, renewals and alterations have taken place to the reported structural items.

9. The final TM report including this TM Form must represent the final condition of the ship structure after any repairs, renewals and alterations.

Appendix 2

CSR THICKNESS MEASUREMENT – REPORT FORMS – TM8

TM8 - Transverse Sections - Longitudinal Strength Assessment

Transverse Section :		No. 1		
Frame No. :		Frame No. 100		
Area Assessment of Hull Girder Strength				
Zone	Actual (cm ²)	Rule (cm ²)	Reduction (%)	Acceptance Criteria (%)
Deck Zone	7402	5760	-28.51	10
Bottom Zone	5980	6480	12.35	10
Zone	Actual (cm ²)	Zone Area (I _{eq}) with 50% of Mean Corrosion Addition (cm ²)	Acceptance (Yes/No)	Acceptance Criteria
Neutral Axis Zone				Actual ≥ Zone Area (I _{eq}) with 50% of Mean Corrosion Addition

● Non-Acceptable

NOTES:

*See CSR TM2-3 Form Notes.

Appendix 3

APPENDIX 3

GUIDANCE ON THICKNESS MEASUREMENT FOR TRANSVERSE SECTIONS AND THE EVALUATION OF LONGITUDINAL STRENGTH OF HULL GIRDERS FOR ALL SHIPS (INCLUDING OIL TANKERS GREATER THAN 130m IN LENGTH)

APPLICABILITY

These requirements are applicable to all ship types including **CSR** and **non-CSR** ships.

These requirements are effective immediately.

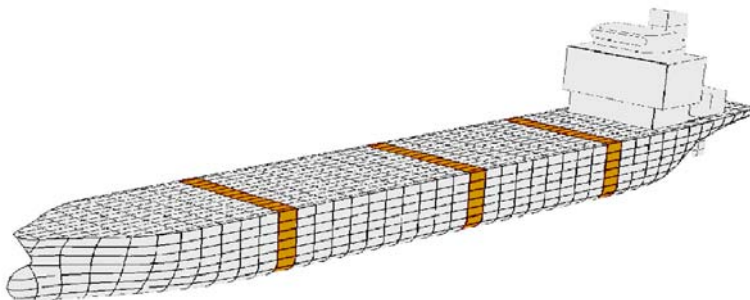
The following guidance covers the requirements for Transverse Sections during close up survey & thickness measurements (LR rules for Ships Pt. 1 Ch.3) for all ships. Also covered are the additional requirements for oil tankers (including chemical, ore/oil and ore/bulk/oil ships) of 130 m in length and upwards (as defined by the International Convention on Load Lines in force), where the ship's longitudinal strength is to be evaluated at three Transverse sections, 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 accordance with IMO Resolution A.1049(27), International Code On The Enhanced Programme Of Inspections During Surveys Of Bulk Carriers And Oil Tankers, 2011 (2011 ESP CODE).

Theory of Transverse Sectional Thickness Measurement

At certain surveys on certain ship types, it is a requirement that Transverse Sections are measured. These measurements are to ensure that the global strength of the hull girder remains satisfactory, from a longitudinal strength perspective.

The global strength is initially assessed as an area of remaining longitudinal material, for comparison with an original rule area of longitudinal material. Should the acceptance criteria be met there is no requirement for further action at the survey.

Definition of a Transverse Section



For Thickness Measurement purposes, a Transverse Section is defined as all continuous longitudinal structural material in a given Transverse Section of a ship.

Extent of Longitudinal Strength Evaluation and selection of Transverse Sections

Longitudinal strength is to be evaluated at Transverse Sections within 0.4L amidships for the extent of the hull girder length that contains tanks therein, and within 0.5L amidships for adjacent tanks which may extend beyond 0.4L amidships (where 'tanks' means ballast tanks and cargo tanks). It is recommended that these Transverse Sections should be about 0.2L forward of amidships, amidships and 0.2L aft of amidships.

Appendix 3

Sampling method of thickness measurement

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.

The Transverse Sections are to 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 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).

It is required to enter a thickness reading for every span of plating (where a span is the plating between two longitudinal members). Where plating is found in good condition with no evidence of corrosion/wastage, a reduction in the number of readings from the above may be considered. However, at least two points should be measured for each deck plate and shell plate required to be measured for the selected Transverse Sections. These measurements can then be used for all the readings covered by these plates.

Every continuous longitudinal member (including deck and bottom girders) should be measured on the web and flange (except for bulb sections). For bulb sections, thickness readings for the web only need to be recorded. A comment should be made on the TM Form highlighting the presence of bulb sections. As a general rule, the thickness of each structural component should be determined by averaging all the measurements taken on each component.

Zones

For the purposes of assessment, each Transverse Section is divided into 3 zones as follows:-

- **Deck Zone**
- **Neutral Axis Zone**
- **Bottom Zone**

Contents of the Deck Zone

The deck zone includes all the following items contributing to the hull girder strength:

- For **Bulk Carriers, Ore Carriers** (and other ESP ships of similar structural configuration): all the following items contributing to the hull girder strength above the horizontal strake of the topside tank or above the level corresponding to 0.9D above the base line if there is no topside tank:
 - ✓ strength deck plating
 - ✓ deck stringer
 - ✓ sheer strake
 - ✓ side shell plating
 - ✓ top side tank sloped plating, including horizontal and vertical strakes
 - ✓ longitudinal stiffeners connected to the above mentioned plating.

Note: the strakes crossed by the 0.9D level line are included in the deck zone area.

- For **Oil Tankers** (including **Chemical Tankers, Oil/Bulk/Ore** and **Ore/Oil Ships**):
 - ✓ strength deck plating
 - ✓ deck longitudinals
- For **all other ship types**: continuous longitudinal elements above the level corresponding to 0.9D (where D = Depth of ship) above the base line.

Contents of the Bottom Zone

The bottom zone includes the following items contributing to the hull girder strength:

- For **Bulk Carriers, Ore Carriers** (and other ESP ships of similar structural configuration): elements up to the upper level of the hopper sloping plating or up to and including the inner bottom plating if there is no hopper tank:

Appendix 3

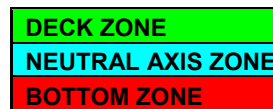
- ✓ Keel plate
 - ✓ Bottom plating
 - ✓ Bilge plating
 - ✓ Bottom girders
 - ✓ Inner bottom plating
 - ✓ Hopper tank sloping plating, and horizontal plating, if any
 - ✓ Side shell plating
 - ✓ Longitudinal stiffeners and girders connected to the above mentioned plating.
- For **Oil Tankers** (including **Chemical Tankers**, **Oil/Bulk/Ore** and **Ore/Oil Ships**):
 - ✓ Keel plate
 - ✓ Bottom plating
 - ✓ Bottom longitudinals and double bottom girders in way.
 - For **all other ship types**: elements below the level corresponding to 0.1D (where D = Depth of ship) above the base line.

Contents of the Neutral Axis Zone

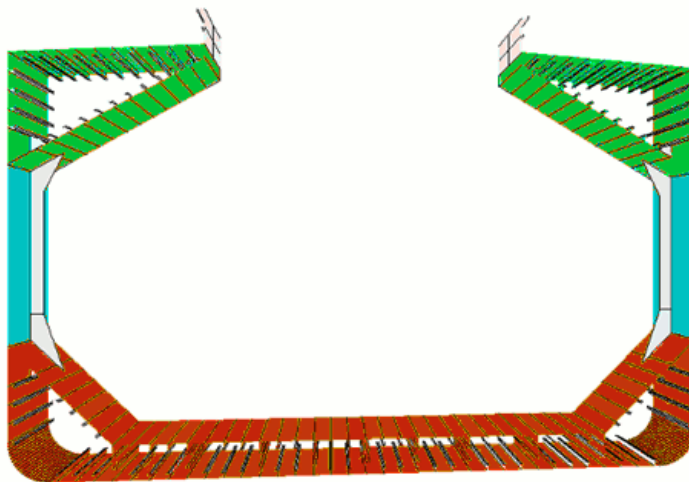
The neutral axis zone for **all ship types** includes longitudinal material between the deck zone and the bottom zone, for example:

- ✓ Side shell plating
- ✓ Inner hull plating (longitudinal bulkheads and attached longitudinals (if any))
- ✓ Inner bottom plating and attached longitudinals (for **Tankers** only)

Typical diagrams below for **Bulk Carrier** and **Oil Tanker** configurations display pictorially the elements contributing to each zone of a Transverse Section.

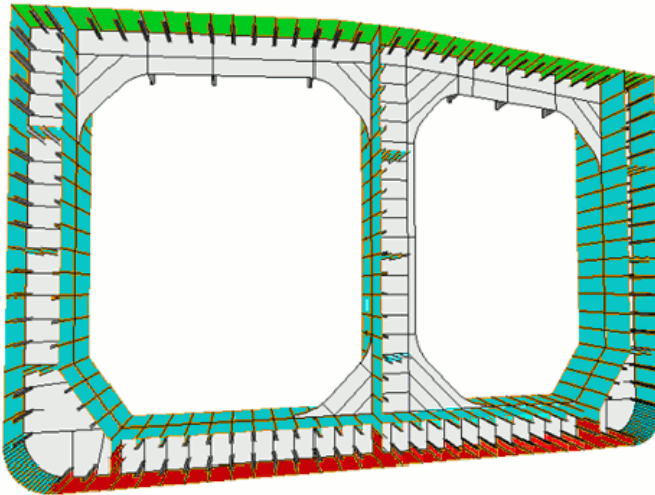


a. Bulk Carrier



Appendix 3

b. Oil Tanker



Reporting Principles

LR's Argonaut TM software provides the functionality to assess Transverse Sections longitudinal strength by calculating Transverse Sectional Areas for the Actual and the Rule Thickness. The revised TM8 form holds the ability to calculate the percentage reduction of the hull girder strength from the original Rule design thickness. The latest TM8 form is required to be completed for all ships at periodical surveys where it is required to evaluate Transverse Sections.

The measurements are input for the Deck Zone, Bottom Zone and the Neutral Axis Zone, on Form TM2-3. Once measurements are recorded for a given zone of a Transverse Section, a Form TM8 evaluation of the cross-sectional area of each zone may be generated including the as-built (Rule) and actual (Gauged) Transverse Sectional area.

It should be noted that on Form TM2-3 it is required to input plate and stiffener widths/depths and thicknesses in order that each member's remaining area may be assessed as part of the total area calculation for the cross-section of each zone.

In case bulb bar stiffeners are identified in the structure under consideration, due to the increased difficulty to obtain a gauged reading on the bulb section, thickness readings and dimensions for the web only need to be recorded.

Should a zone fail to meet the acceptance criteria below, the result will be highlighted on the Form TM8 and will form an exception on the TM Exception Report. See the relevant section below on failure to meet acceptance criteria resulting in a deficient Transverse Section.

Longitudinal strength assessment should be completed as soon as possible during the survey for the appropriate corrective action to be taken. A deficient Transverse Section result should immediately be brought to the attention of the attending surveyor during regular onboard meetings, who will decide in cooperation with the owners, on the remedial actions to be taken, in accordance with the below instructions.

It is to be noted that the thicknesses to be input to TM2-3 form are to be the Rule Thicknesses only, to account for reduced 'as-built' scantlings for ships with 'CC' notation (Corrosion Control notation).

Appendix 3

Acceptance Criteria

The hull girder strength criteria are given as detailed below:

- a) **CSR and non CSR Deck and Bottom Zones:**
The measured sectional areas of the Deck Zone and of the Bottom Zone which are the sum of the measured item areas of the considered zones are not to be less than 90% of the sectional area of the corresponding zones determined with the gross offered thicknesses (original Rule sectional area).
- b) **Non CSR Neutral axis Zone:**
The measured 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 85% of the sectional area of the corresponding zone determined with the gross offered thicknesses (original Rule sectional area).
- c) **CSR 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.

(Gauged Thickness) x (Plate/Profile Width/Height) >	(Plate/Profile Width/Height) x (((As-Built Thickness) – (Owners Voluntary Addition) – (Renewal Thickness)) / 2) + (Renewal Thickness)
--	---

Gauged Thickness	t_g
Plate/Profile Width/Height	L
As-Built Thickness	t_a
Owners Voluntary Addition	t_v
Renewal Thickness	t_{Ren}

- Therefore the criterion is:-

$$(t_g \times L)_{Item 1} + (t_g \times L)_{Item 2} + \dots + (t_g \times L)_{Item n} > (L \times (((t_a - t_v - t_{Ren}) / 2) + t_{Ren}))_{Item 1} + (L \times (((t_a - t_v - t_{Ren}) / 2) + t_{Ren}))_{Item 2} + \dots + (L \times (((t_a - t_v - t_{Ren}) / 2) + t_{Ren}))_{Item n}$$

If these criteria are not satisfied the Section is to be considered as Deficient and remedial actions are to be taken. Note that LR's Argonaut TM software will perform all necessary calculations and highlight a deficient zone of a transverse sectional area assessment.

Deficient Transverse Sectional Area - Zone

Where one or more Transverse Sections are found to be deficient in respect of the longitudinal strength requirements in any of the assessed zones, the number of Transverse Sections should be increased in order that each tank within the 0.5L amidships region has been sampled. The measurements for the additional Transverse Sections are to be input into Form TM2-3 in order that each of the new zones is assessed. Tank spaces that are partially within, but extend beyond, the 0.5L region, should be included in this assessment. The following are further instructions on actions necessary for a deficient Transverse Section to be resolved during the course of a survey.

Renew or reinforce structural areas under any of the Transverse Sections found deficient:

- For **Deck, Bottom or Neutral Axis Zone**

Additional thickness measurements should also be performed on one Transverse Section forward and one aft of each repaired area to the extent necessary to ensure that the areas bordering the repaired section also comply with the requirements. This is necessary only where substantial repairs/renewals have been carried out and the transverse sectional area/section modulus will increase appreciably after repairs. Where isolated repairs are carried out (due to localised corrosion/wastage), evaluation of additional sections forward and aft of the repairs is not considered necessary.

NOTE: For the purposes of the assessment, the Rule thickness is to be used for 'As built' values, in order to take account of the ships built with **(CC)** notation.

Appendix 3

Effective Repair Methods

The extent of renewal or reinforcement carried out when any zone of a Transverse Section is found deficient should be in compliance with IACS URZ7, Z7.1, Z7.2, Z10.1, Z10.2, Z10.3, Z10.4 or Z10.5 and in accordance with IACS Recommendation 47 and the following procedures as applicable:

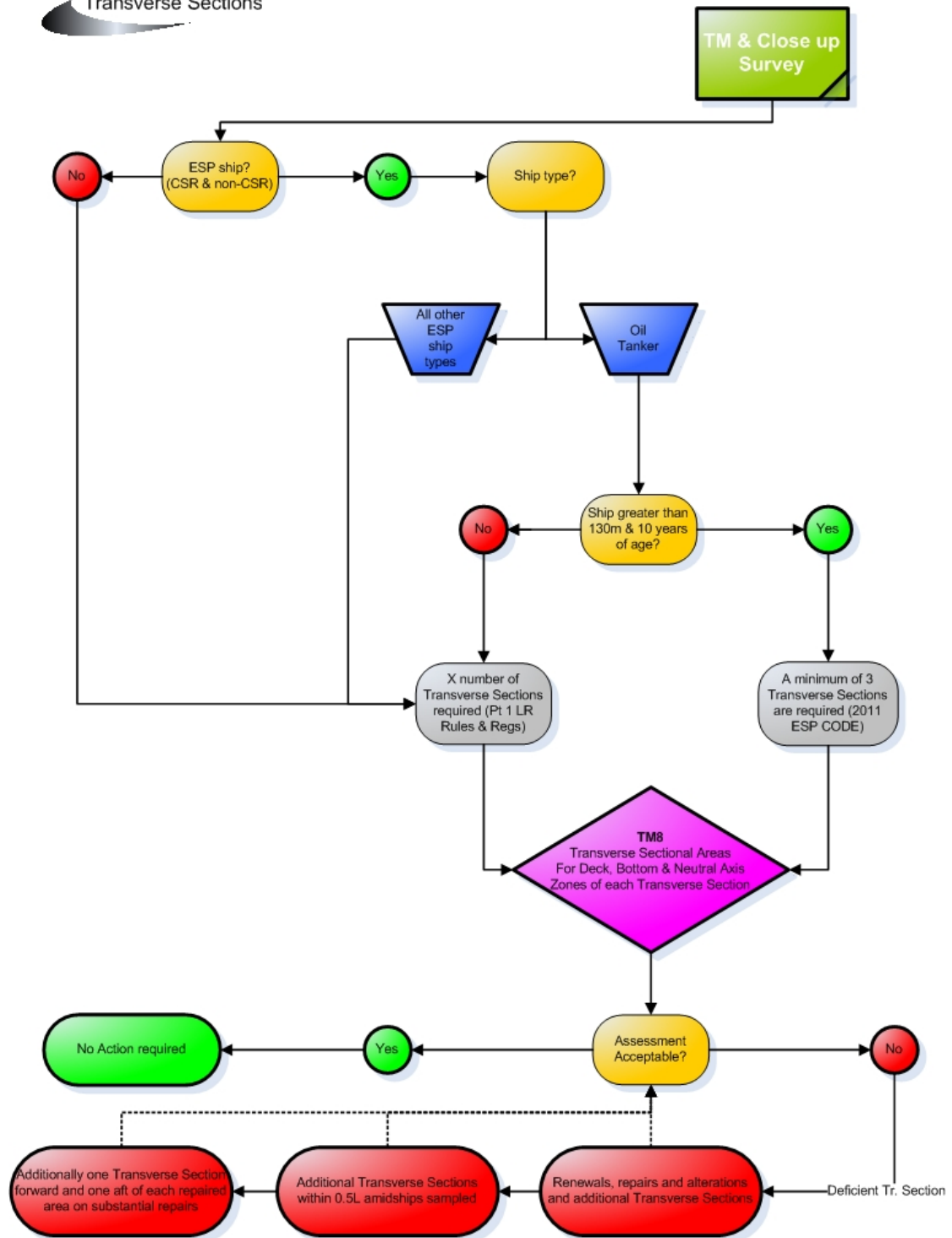
The minimum continuous length of a renewed or reinforced structural member should be not less than twice the spacing of the primary members in way. In addition, the thickness diminution in way of the butt joint of each joining member forward and aft of the replaced member (plates, stiffeners, girder webs and flanges, etc.) should not be within the substantial corrosion range. Where differences in thickness at the butt joint exceed 15% of the lower thickness, a transition taper should be provided. Alternative repair methods involving the fitting of doubling straps or structural modification should be subject to special consideration. In considering the fitting of doubling straps, the following conditions should be considered:

- The local Design Support Office should be consulted
- To restore and/or increase longitudinal strength
- The thickness diminution of the deck or bottom plating to be reinforced should not be within the substantial corrosion range
- The alignment and arrangement, including the termination of the straps, should be in accordance with a standard recognized by the Classification Society;
- The straps should be continuous over the entire 0.5L amidships length
- Continuous fillet welding and full penetration welds are used at butt welding between doubling straps and, depending on the width of the strap, slot welds may be necessary. Care is to be taken in way of any root run, and doubling strap butts should be efficiently separated from the primary structure below. The welding procedures applied should be acceptable to the Classification Society.

The existing structure adjacent to replacement areas and in conjunction with the fitted straps, etc. should be capable of withstanding the applied loads, taking into account the buckling resistance and the condition of welds between the longitudinal members and hull envelope plating.

Appendix 3

Flowchart Transverse Sections



Appendix 4

APPENDIX 4 GUIDANCE ON THICKNESS MEASUREMENT OF CARGO HOLD SHELL FRAMES ON SINGLE SKIN BULK CARRIERS CONTRACTED FOR CONSTRUCTION PRIOR TO 1 JULY 1998 SUBJECT TO UR S31

General

These guidelines apply to the cargo hold shell frames and end brackets on single skin bulk carriers contracted for construction prior to 1 July 1998. Thickness measurement is necessary to determine the general condition of the structure and to define the extent of possible steel renewals or other repairs for the webs and flanges of shell frames and their end brackets for verification of compliance with the *Provisional Rules for Existing Ships* Ch 2,6, which also provides the procedures relating to the re-assessment including renewal criteria for cargo hold shell frames.

Zones of Side Shell Frames and Brackets

For the purpose of steel renewal, sand blasting and coating, four zones A, B, C and D are defined, as shown in Figure 1. Zones A and B are considered to be the most critical zones.

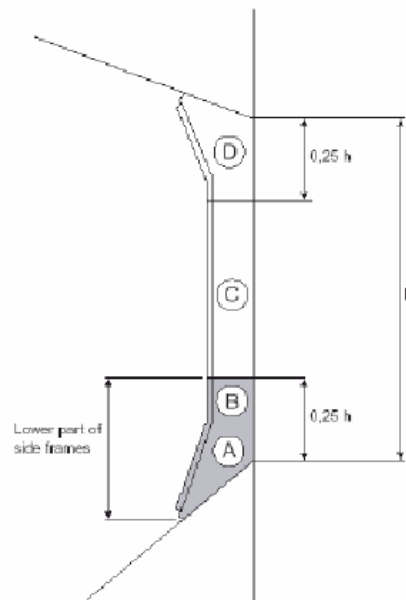


Figure 1 – Zones of side shell frames and brackets

Method of Measurement

The number of side frames to be measured is equivalent to the number of side frames subject to Close-up survey at the time of the Special Survey or Intermediate Survey. Representative measurements are to be taken for each zone as specified above and reported on form TM7 UR S31.

The extent of thickness measurement may be specially considered by the Surveyor, provided the structural members indicate no thickness diminution with respect to the Rule thickness and the coating is found in "as new" condition (i.e., without breakdown or rusting).

Where measurement readings are found to be close to the criteria, the number of shell frames to be measured is to be increased.

If renewal or repairs in accordance with the Provisional Rules for Existing Ships are to be applied on individual frames in a hold, then the extent of thickness measurement is to be increased to include all shell frames in that cargo hold.

Structural sections used in the construction of shell frames include those with face plates (T sections), flanged plates or bulb plates. The use of face plates and flanged sections is considered similar for measurement purposes. If a bulb plate has been used, then the web of the bulb plate is to be measured in the normal manner and the sectional modulus is to be specially considered if required.

Appendix 4

Measurement Pattern for Zones A, B and D

Web plating

The measurement pattern for Zones A, B and D is to be a 5 point pattern (see Figure 2). The 5 point pattern is to be over the depth of the web and the same area vertically. The measurement report is to reflect the average reading.

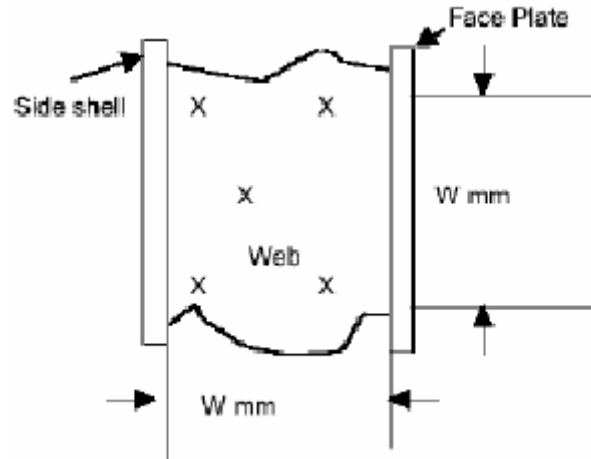


Figure 2 – Typical 5 point pattern on the web plate

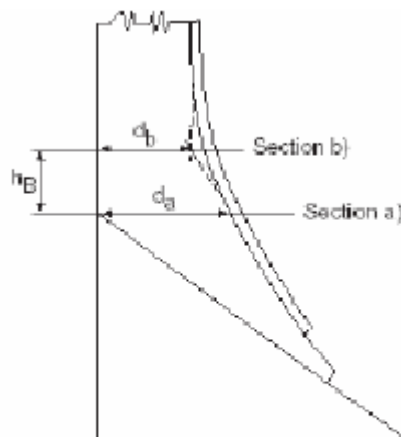
Measurements for Zone C

Web plating

Depending upon the condition of the web in way of Zone C, the web may be measured by taking 3 readings over the length of Zone C and averaging them. The average reading is to be compared with the allowable thickness. If the web plating has general corrosion then this pattern should be expanded to a 5 point pattern as noted above.

Measurements for section (a) and (b) (flanges and side shell plating)

Measurements are to be taken at sections (a) and (b) to calculate the actual section modulus (see Figure 3). At least 2 readings on the flange/face plate are to be taken in way of each section. At least 1 reading of the attached shell plating is to be taken on each side of the frame (i.e. fore and aft) in way of section (a) and section (b).



d_a = lower bracket web depth

d_b = frame web depth

h_B = lower bracket length

Figure 3 – Sections (a) and (b)

Appendix 4

Pitting and grooving

Pits can grow in a variety of shapes, some of which would need to be ground before assessment. Pitting corrosion may be found under coating blisters, which must be removed before inspection. To measure the remaining thickness of pits or grooving the normal ultrasonic transducer (generally 10 mm diameter) will not suffice. A miniature transducer (3 to 5 mm diameter) must be used. Alternatively the measurement firm must use a pit gauge to measure the depth of the pits and grooving and calculate the remaining thickness.

Assessment based upon Area

This is the method specified in the Provisional Rules for Existing Ships and is based upon the intensity determined from Figure 4 below.

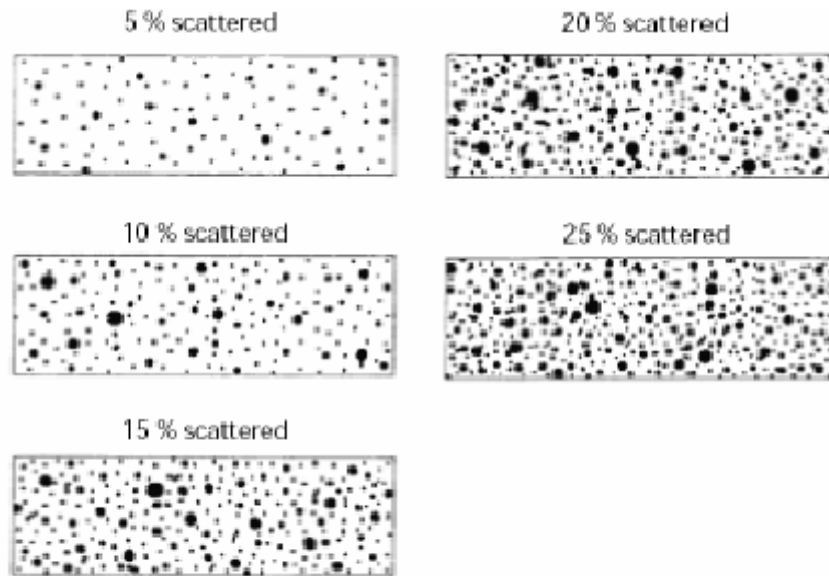


Figure 4 – Pitting intensity diagrams (from 5% to 25% intensity)

Where the pitting intensity is greater than 15 per cent in an area, then thickness measurements are to be taken to determine the extent of the pitting corrosion. The 15 per cent is based upon pitting or grooving on only one side of the web.

In cases where pitting is evident as defined above (exceeding 15 per cent) then an area of 300 mm diameter or more, at the most pitted part of the frame, is to be cleaned to bare metal, and the thickness measured in way of the five deepest pits within the cleaned area. The least thickness measured in way of any of these pits is to be taken as the thickness to be recorded. The minimum acceptable remaining thickness in any pit or groove is equal to:

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

Appendix 5

Approval for Thickness Measurement of Hull Structure

Revision 7, September 2014

1 General Information

- 1.1 It is a requirement of the Lloyd's Register Rules and Regulations for the Classification of Ships, Part 1, Chapter 3, Section 5, that firms supplying services on behalf of ship owners for thickness measurement of structural material of ships be approved in accordance with this procedure. This document describes the requirements of Lloyd's Register for such approval and incorporate the criteria for approval identified by IACS (Unified Requirement Z17).
- 1.2 For the guidance of surveyors, ship owners and other interested parties LR document entitled Thickness Measurement and Close-Up Survey Guidance has been developed to complement the Regulations, providing in tabular form and diagrammatically the special survey requirements for thickness measurement and close-up survey.
- 1.3 Lloyd's Register Thickness Measurement software has been developed to provide a uniform reporting format for the results of thickness measurement surveys. The software is available to service suppliers approved by LR and should be used for all thickness measurement work carried out under LR survey. Reporting should be in compliance to latest: TM & Close up Survey Guide, Pt 1, 1.7 Reporting.
- 1.4 The work of firms approved in accordance with this procedure will be subject to surveillance checking by the surveyor. In particular, thickness measurements taken during Enhanced Survey Procedure at Special Survey III and beyond are to be made with the surveyor substantially in attendance.
- 1.5 The scope of this approval for Thickness measurement firms approved by LR **covers all vessels except:** non-ESP ships less than 500 gross tonnage, and all fishing vessels
- 1.6 . The documents must be submitted in English language.

Appendix 5

2 Related standards and Rules

Lloyd's Register Rules for the Classification of Ships, Part 1, Chapter 3, Section 5 - (Latest addition)

Lloyd's Register - Thickness Measurement and Close-Up Survey Guidance Revision – (Latest edition)

IACS Unified Requirements Z17 – Procedural Requirements for Service Suppliers – (Latest edition)

SNT – TC-1A – Recommended Practice - Personnel qualification and Certification in Non - Destructive Testing.

ISO 9712: - Non-destructive testing - Qualification and certification of personnel.

IACS Procedure Requirement PR 23 – Procedure for Reporting Information on the Approval of Thickness Measurement Firms – (Latest edition)

Appendix 5

3 Procedure for Approval

3.1 General Procedure

3.1.2 Application for approval on Form 2584, Request for Approval.

3.1.3 The documents referred in section 4 are to be prepared and submitted.

3.1.4 An audit of the firm will be undertaken as section 4 and results reported.

3.1.5 Review of documents and audit results by MNDE department, United Kingdom

3.1.6 Issue of certification by MNDE department, United Kingdom

3.1.7 Updating of LR thickness measurement service supplier database.

3.2 Requirements for approval

3.2.1 Suppliers that demonstrate the experience and capability necessary to carry out a thickness survey will be considered for approval if they comply with the following:

3.2.2 Training of Personnel

A documented training programme for thickness measurement personnel should be in place. Where it is not possible to perform this internally, a programme of external training may be accepted.

3.2.3 Personnel at operator and supervisor grades are to be qualified in accordance with a recognised national or international industrial standard such as SNT-TC-1A, ISO 9712, or equivalent. Operators are to be certified to a minimum of level I, supervisors to a minimum of level II.

3.2.4 Operators should have had a minimum of one year tutored training on board ship and have enough knowledge of ship structures to be able to select a representative position for each measurement.

3.2.5 Supervisors should have had a minimum of two years' experience as operator/technician/inspector involved with the thickness measurement of ship structural material.

3.2.6 Supervision

The supplier shall provide supervision for all services supplied. For a supplier consisting of one person, that person shall meet the requirements of a supervisor.

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3.2.7 Training Programmes

There is to be a structured training programme in place which should address the principles and techniques of ultrasonic testing, with the emphasis on thickness measurement, together with a basic instruction in hull structures and likely areas of corrosion.

The training programme should cover the selection and identification of test locations (which will be subject to the agreement of the Owners representative and the classification surveyor) based on LR document 'Thickness Measurement and Close-Up Guidance'. The training should also include knowledge of ship structures, and nomenclature of appropriate structures.

Practical training and examinations should cover calibration of ultrasonic equipment and should include thickness measurement on samples which include the following conditions;

- (a) Corrosion on both accessible and remote surfaces
- (b) Protective coatings of various types on the accessible surface.

The training programme should also include the use of and reporting requirements in the latest version of LR Thickness Measurement software package available from LR Classification (free of charge).

3.2.8 Personnel Records

A list of qualified personnel including details of formal education, training and experience must be maintained up to date and be available for scrutiny by the attending surveyor.

Supervisors and operators are to carry ID cards (with photographs) showing NDE qualifications and authorisation to work on thickness measurement surveys and shall include a photograph of sufficient size and detail as to identify the operator. The names of all authorised supervisors and operators will (additionally) be listed on the LR issued TM certificate.

3.2.9 Equipment

Suppliers must possess equipment that is capable of giving accurate readings of material thickness.

Where measurements are to be taken through protective coatings the equipment must be capable of using the multiple echo technique in order that coatings are discounted from the displayed readings.

'A scan' flaw detectors, multiple echo direct reading gauges or a

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combination of both may be used for this purpose.

Equipment must be maintained and calibrated regularly in accordance with a documented procedure and the status of calibration is to be displayed on each piece of equipment.

The range of materials, thicknesses, surface conditions and protective coatings upon which the equipment can be used must be stated, together with the tolerances on accuracy of measurement that can be expected.

Instructions for the safe and effective operation of the equipment must be available to all operators.

3.2.10 Quality Assurance System

Suppliers are required to have a documented system which covers at least the following items:

- (a) survey preparation (equipment required, surface preparation, preservation of protective coatings, checklists, etc.)
- (b) maintenance, calibration and operation of equipment
- (c) Safety requirements
- (d) code of conduct to be observed by employees
- (e) training programmes for personnel
- (f) the method and degree of supervision and verification to be applied, including sub contractors if applicable
- (g) survey recording and reporting
- (h) periodic review of work process procedures, complaints, corrective actions, and issuance, maintenance and control of documents
- (i) quality management of subsidiaries and branches

The documented system should be approved and endorsed by the company personnel

A documented Quality Assurance system complying with the ISO 9000 standard or equivalent and including the above items, would be considered acceptable.

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3.2.11 Reports

The recommended method of reporting is that specified in the latest Thickness Measurement and Close-up Survey Guide, with the support of the latest Thickness Measurement software supplied by LR Classification. Any other proposed reporting methods may be accepted, subject to special consideration by LR.

The reports should include the current version of General Particulars Form 6059, countersigned by the attending and authorising surveyors, showing: name and type of ship; location and date(s) of measurement; the equipment used (including serial numbers); names of personnel and their qualifications, and all Data sheets.

Data sheets within reports are to identify the following:

- (i) locations of measurement
- (ii) original thicknesses
- (iii) measured thicknesses
- (iv) percentage diminution
- (v) maximum permissible diminutions

Any sketches and drawings used in the preparation of the report must be included as an integral part of the report.

Thickness measurement supervisors are to liaise with surveyors to ensure that the reporting format is acceptable, and to confirm that the original thickness and measured thickness are correctly reported.

Reports are to be signed by the supervisor/lead operator of the thickness measurement firm. Printed names can be accepted on data sheets.

A copy of the firm's certificate of approval should be attached to the report.

4 Approval Submission

4.1 The following documents should be prepared and submitted for review

- (i) description of the suppliers organisation identifying management structure and any branch offices, subsidiary companies or subcontractors

- (ii) summary of extent of experience listing any major surveys completed in the previous three years with details of dates, ship type and

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identity, type of survey and approximate numbers thickness readings reported

(iii) evidence of approval/acceptance by other bodies if any

(iv) list of personnel to be involved in thickness measurement showing job titles (supervisor / operator), training, extent of experience and copies of qualification certificates

(v) type and scope of ultrasonic equipment used, and copies of calibration certificates

(vi) operators guide for equipment

(vii) Thickness measurement procedure

(viii) representative sample of a recent thickness survey report including the General Particulars sheet.

(ix) record of customer complaints (where appropriate) and corrective actions agreed with client.

(x) quality manual and/or documented procedures covering requirements as detailed in section 3.2.10.

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4.2 Audit

- 4.2.1** An audit will be made by the local LR office against the Audit Checklist, Form 2585, to confirm that the supplier is duly organised and managed in accordance with the documents submitted. A separate audit may be required for each branch or office of the supplier for which approval is requested, according to the same requirements as for the main office.
- 4.2.2** The capability of the firm is to be confirmed by practical demonstration. This may be established by an onboard survey (or onboard demonstration), or from other relevant non -classification survey work, consisting of measurement through coatings, and on corroded (or simulated corroded) samples. The auditing surveyor is to witness the practical demonstration.

Note – the practical demonstration may also take place in the NDE laboratory, provided the above requirements are met.

4.3 Review

A review of the required documents referenced in 4.1 will be undertaken by MNDE specialist. Queries arising from the review by MNDE Department will be referred back to the local LR office, for clarification with the firm. The suitability of the firm for approval will be determined by reference to the criteria given herein and the details entered on the Audit Checklist form 2585. Endorsement of the checklist will signify that the firm satisfies the requirement for approval

4.4 Certification

- 4.4.1** When a supplier has been deemed to satisfy LR requirements, a certificate of approval will be issued. The firm's name will be entered into the LR database for list of Approved Service Suppliers.
- 4.4.2** The certificate of approval will contain the following information as a minimum:
- (i) Name of firm and registered address, together with address of any branch or sub-office(s).
 - (ii) Scope of approval.
 - (iii) Certificate number, date of issue and date of expiry (for each office, where applicable).
 - (iv) Names of approved supervisor(s) and operator(s).

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- 4.4.3** Approval will be valid for a three-year period from the date of issue, subject to the supplier maintaining the system in accordance with LR requirements. Where any significant alteration to the certified system, including change of personnel is made, such alteration is to be immediately advised to Lloyd's Register.
- 4.4.4** Upon receipt of an application for amendment of a certificate, the supplier is to forward a request to MNDE (via local CFO), who will advise should any reviews or audits be required.
- 4.5** **Withdrawal of Certificate**
- 4.5.1** LR reserves the right to cancel or suspend a certificate and inform the IACS members accordingly if:
- (i) measurements have been improperly carried out or the results of measurements improperly reported
 - (ii) significant alterations to the approved Quality System have been made without notification to LR or are such as to render the original approval invalid
 - (iii) where corrective actions have not been taken to rectify previously reported deficiencies in the approved system of the supplier
 - (iv) where deliberate distortion or omissions of facts are found
 - (v) if the supplier no longer wishes to remain on the list of approved service suppliers.
- 4.5.2** If LR considers that a certificate of approval should be withdrawn or cancelled, the supplier will be informed in writing and be given the opportunity to take appropriate corrective action, or give notice of appeal.
- 4.5.3** If a certificate is withdrawn, suspended or has expired, the firm's name will be removed from the LR service supplier database's.
- 4.5.4** A supplier whose approval has been cancelled may apply for re-approval provided that the firm demonstrate that they have made the necessary changes to satisfy LR requirements.

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- 4.5.5** Where LR are notified by another society that approval has been cancelled, LR may suspend its approval until the others society's cancelled approval is restored, or until LR are satisfied to continue with approval. During the suspension period, the supplier must not carry out any thickness surveys on LR Classed vessels.
- 4.6** Renewal of Approval
- 4.6.1** Applications for renewal of the period of validity should be received at least three months prior to the date of expiry.
- 4.6.2** Suppliers wishing to renew their approval should submit to the local office the following documents:
- (i) Request for Approval Form 2584,
 - (ii) a list of current personnel, identifying qualifications, extent of experience and job title of each individual.
 - (iii) a copy of the current procedure for thickness measurement used by the supplier
 - (iv) a sample of a recent report of a thickness survey (also to include the General Particulars form). The sample should be sufficient to demonstrate compliance with the requirements of Lloyd's Register for the reporting of thickness surveys.
 - (v) A list of all ultrasonic measuring equipment intended to be used in the survey, including copies of relevant calibration certificates
 - (vi) Brief details of current training programmes (both UT and ship's structure)
- 4.6.3** On receipt of the Request for Approval form arrangements will be made by the local LR office to carry out an audit of the supplier against the Audit Checklist, Form 2585.
- 4.6.4** The document package and the completed checklist showing the recommendations of the local office is to be forwarded to MNDE Department UK - for review in accordance with 4.3
- 4.6.4** Upon satisfactory renewal, the firm will be approved for another three year period. A certificate will be issued (4.4) with a new expiry date and the firm's

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entry in the approved lists, updated accordingly.

4.6.5 Where a firm has not performed any thickness surveys for LR in the last three years, the following should apply:

- (i) Practical demonstrations on corroded and coated samples

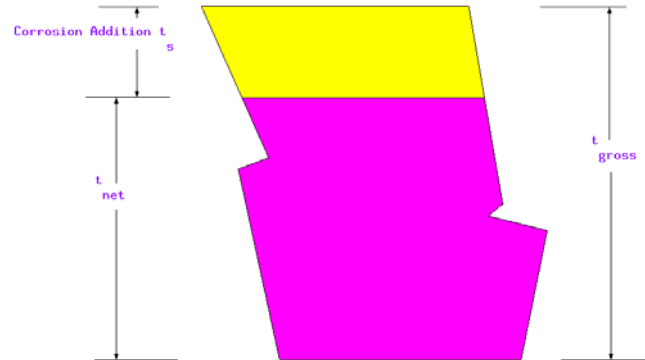
- (ii) Review of latest LR requirements and reporting software

- (iii) Substantial attendance of the surveyor during next thickness measurement survey.

- (iv) Review of thickness measurement reports, performed for other classification societies, if applicable.

Appendix 6

APPENDIX 6 GUIDANCE NOTES FOR EVALUATION OF SCANTLINGS OF CORRUGATED TRANSVERSE WATERTIGHT BULKHEADS IN BULK CARRIERS CONTRACTED FOR CONSTRUCTION ON OR AFTER 1 JULY 1998



Ship Type Applicability

UR S18 Bulk carriers contracted for construction on or after 1 July 1998, of 150 m in length and above, with single deck, topside tanks and hopper tanks, and of single side or double side skin construction, intending to carry solid bulk cargoes having a density of 1.0 t/m³, or above, with vertically corrugated transverse watertight bulkheads, not including **CSR** ships.

Structural Applicability

All corrugated transverse watertight bulkheads.

Theory

The Original Thickness (**tgross**) includes a Corrosion Addition (t_s) and a remaining net thickness (**tnet**), such that (**tgross**) = (**tnet**) + (t_s)

The Maximum Allowable Diminution occurs when the steel thickness has diminished to a point that is a function of **tnet**

Corrosion Additions (t_s) mm

The Corrosion Addition in all cases **$t_s = 3.5$ mm**

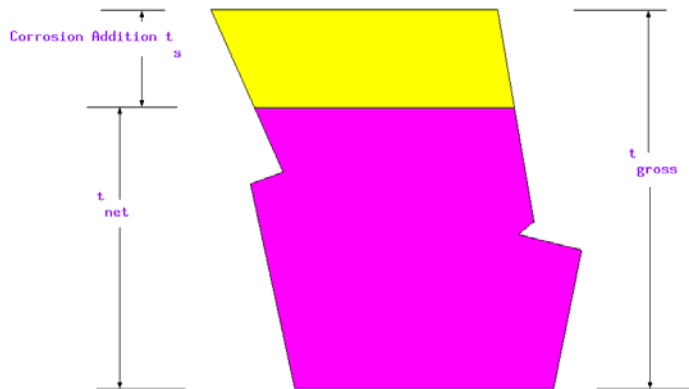
Steel Renewals

For Corrugated transverse watertight bulkheads:-

- Renewal is required if gauged thickness is less than **tnet + 0.5 mm** (i.e. when thickness is diminished by 3.0 mm)
- If the gauged thickness is within range of **Renewal Thickness (tnet + 0.5mm)** and **Renewal Thickness + 0.5 mm (tnet + 1.0 mm)**, a Memorandum should be imposed either for the structure to be examined and gauged annually, or a coating should be applied (in accordance with the coating manufacturer's requirements) and maintained in 'GOOD' condition as an alternative to steel renewal.

Appendix 7

APPENDIX 7 GUIDANCE NOTES FOR EVALUATION OF SCANTLINGS OF HATCH COVERS & HATCH COAMINGS OF CARGO HOLDS OF BULK CARRIERS CONTRACTED FOR CONSTRUCTION ON OR AFTER 1 JULY 1998 & BULK CARRIERS, ORE CARRIERS AND COMBINATION CARRIERS CONTRACTED FOR CONSTRUCTION ON OR AFTER 1 JANUARY 2004. ALSO ALL REMAINING SHIPS CONTRACTED FOR CONSTRUCTION ON OR AFTER 1 JULY 2012.



Ship Type Applicability

UR S21 Bulk Carriers contracted for construction on or after 1 July 1998; Bulk Carriers, Ore Carriers and Combination Carriers contracted for construction on or after 1 January 2004, not including CSR ships.

UR S21A All remaining ships contracted for construction on or after 1 July 2012, except Bulk Carriers, Ore Carriers and Combination Carriers.

Structural Applicability

UR S21 Steel cargo hatch covers and coamings on exposed decks

UR S21A Steel cargo hatch covers and coamings on exposed decks, except hatch coamings on Container Ships, Car Carriers, Paper Carriers and Passenger Ships, and any other ship in which the Hatch Coamings are part of the longitudinal Hull Structure (in these cases the hatch coamings are to be reported in the conventional manner)

Theory

The Original Thickness (**t_{gross}**) includes a Corrosion Addition (**t_s**) and a remaining net thickness (**t_{net}**), such that (**t_{gross}**) = (**t_{net}**) + (**t_s**)

The Maximum Allowable Diminution occurs when the steel thickness has diminished to a point that is a function of **t_{net}**

Corrosion Additions (t_s) mm

UR S21 Single Skin (open type) hatch covers (plating and stiffeners) - 2.0 mm
 Double Skin (plated in) hatch covers (top & bottom plating) – 2.0 mm
 Double Skin (plated in) hatch covers (internal structure)* – 1.5 mm
 Hatch Coamings and coaming stays – 1.5mm

Appendix 7

UR S21A Weather deck hatches of container ships, car carriers, paper carriers and passenger vessels :-
Hatch Covers – 1.0 mm
Hatch Coamings – Not applicable, to be reported conventionally

UR S21A
(cont) Weather deck hatches of all other ship types covered by UR S21A :-
Hatch Covers (General) – 2.0 mm
Weather exposed plating and bottom plating of double skin hatch covers – 1.5 mm
Internal structure of double skin hatch covers and closed box girders* – 1.0 mm
Hatch coamings not part of the longitudinal hull structure – 1.5 mm
Hatch coamings part of the longitudinal hull structure - Not applicable, to be reported conventionally
Coaming stays and stiffeners – 1.5 mm

* For the internal structure of double skin hatch covers, thickness gauging is required when hatch cover top or bottom plating renewal is to be carried out or when this is deemed necessary, at the discretion of the individual class society's surveyor, on the basis of the plating corrosion or deformation condition.

Steel Renewals

UR S21

For single skin hatch covers and the plating of double skin hatch covers:-
Renewal is required if gauged thickness is less than **t_{net} + 0.5 mm**

For internal structure of double skin hatch covers:-
Renewal is required if gauged thickness is less than **t_{net}**

For hatch coamings and coaming stays:-
Renewal is required if gauged thickness is less than **t_{net} + 0.5 mm**

For all structure (*with the exception of double skin hatch cover internal structure) :-
If the gauged thickness is within range of **Renewal Thickness (t_{net} + 0.5mm)** and **Renewal Thickness + 0.5 mm (t_{net} + 1.0 mm)**, a Memorandum should be imposed either for the structure to be examined and gauged annually, or a coating should be applied (in accordance with the coating manufacturer's requirements) and maintained in 'GOOD' condition as an alternative to steel renewal.

UR S21A

For single skin hatch covers and the plating of double skin hatch covers:-
Renewal is required if gauged thickness is less than **t_{net} + 0.5 mm**

For internal structure of double skin hatch covers:-
Renewal is required if gauged thickness is less than **t_{net}**

For hatch coamings and coaming stays (not part of longitudinal structure):-
Renewal is required if gauged thickness is less than **t_{net} + 0.5 mm**

For corrosion addition **t_s = 1.0 mm**
Renewal is required if gauged thickness is less than **t_{net}**

For all structure (*with the exception of double skin hatch cover internal structure):-
If the gauged thickness is within **Renewal Thickness (t_{net} + 0.5mm)** and **Renewal Thickness + 0.5 mm (t_{net} + 1.0 mm)**, a Memorandum should be imposed either for the structure to be examined and gauged annually, or a coating should be applied (in accordance with the coating manufacturer's requirements) and maintained in 'GOOD' condition as an alternative to steel renewal.

Appendix 8

APPENDIX 8

GUIDELINES FOR THE GAUGING / RENEWAL / REINFORCEMENT OF THE VERTICALLY CORRUGATED TRANSVERSE WATERTIGHT BULKHEAD BETWEEN HOLDS NOS. 1 AND 2 IN ACCORDANCE TO UR S19

The need for renewal or reinforcement of the vertically corrugated transverse watertight bulkhead between cargo holds Nos. 1 and 2 will be determined by the classification society on a case by case basis using the criteria given in UR S19 in association with the most recent gaugings and findings from survey.

In addition to class requirements, the UR S19 assessment of the transverse corrugated bulkhead will take into account the following:-

(a) Scantlings of individual vertical corrugations will be assessed for reinforcement/renewal based on thickness measurements obtained in accordance with Annex III to UR Z10.2 at their lower end, at mid-depth and in way of plate thickness changes in the lower 70%. These considerations will take into account the provision of gussets and shedder plates and the benefits they offer.

(b) Taking into account the scantlings and arrangements for each case, permissible levels of diminution will be determined and appropriate measures taken

Gauging is necessary to determine the general condition of the structure and to define the extent of possible repairs and/or reinforcements of the vertically corrugated transverse watertight bulkhead for verification of the compliance with UR S19.

Taking into account the buckling model applied in UR S19 in the evaluation of strength of the bulkhead, it is essential to determine the thickness diminution at the critical levels shown in Figures 1 and 2.

The gauging is to be carried out at the levels as described below. To adequately assess the scantlings of each individual vertical corrugation, each corrugation flange, web, shedder plate and gusset plate within each of the levels given below are to be gauged.

Level (a) Ships without lower stool (see Figure 1):

Locations:

- The mid-breadth of the corrugation flanges at approximately 200 mm above the line of shedder plates;
- The middle of gusset plates between corrugation flanges, where fitted;
- The middle of the shedder plates;
- The mid-breadth of the corrugation webs at approximately 200 mm above the line of shedder plates.

Level (b) Ships with lower stool (see Figure 2):

Locations:

- The mid-breadth of the corrugation flanges at approximately 200 mm above the line of shedder plates;
- The middle of gusset plates between corrugation flanges, where fitted;
- The middle of the shedder plates;
- The mid-breadth of the corrugation webs at approximately 200 mm above the line of shedder plates.

Level (c) Ships with or without lower stool (see Figures 1 and 2):

Locations:

- The mid-breadth of the corrugation flanges and webs at about the mid-height of the corrugation.
- Where the thickness changes within the horizontal levels, the thinner plate is to be gauged. Steel renewal and/or reinforcement is to comply with UR S19.

Appendix 8

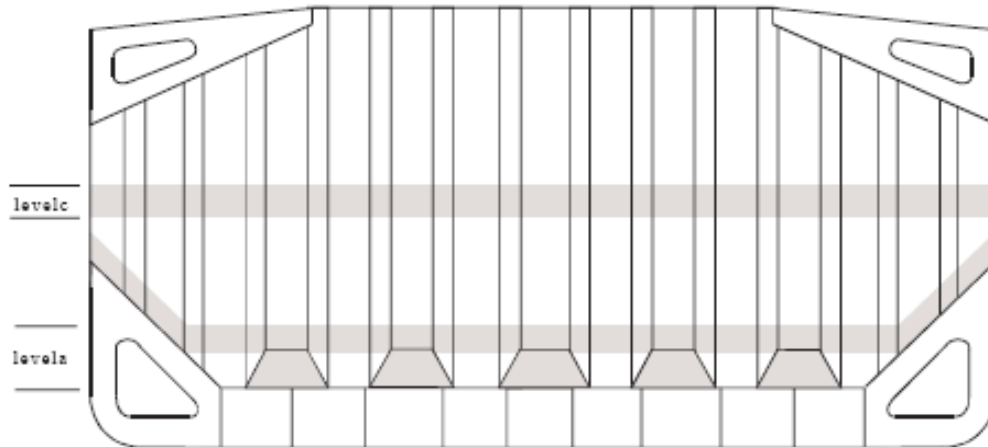


Figure 1

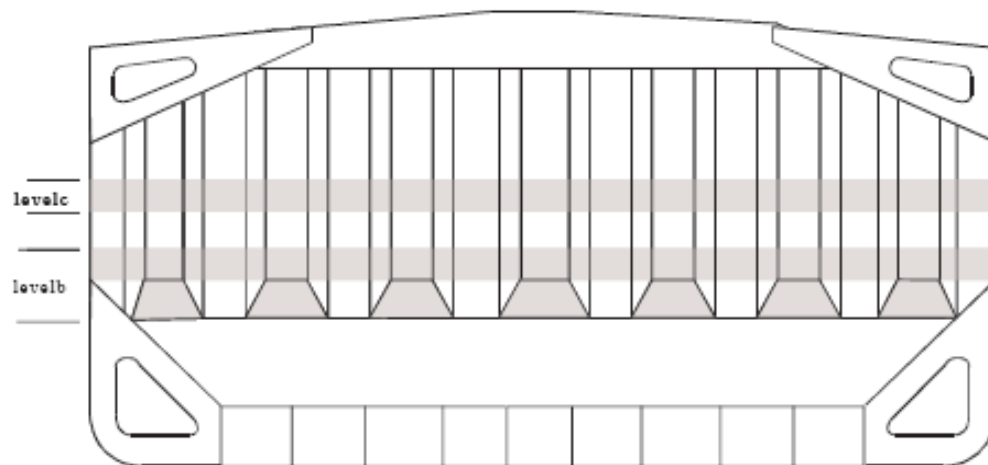


Figure 2

For the corrugated watertight bulkhead between Hold Nos. 1 and 2, the actual gauged thickness of the bulkhead is to be compared with the 'net' thickness, determined from the UR S19 evaluation, and an appropriate level of renewal or reinforcement is applied.

Where the gauged thickness of the bulkhead plating is below the renewal limit, of $t_{net} + 0.5\text{mm}$ (where t_{net} is the minimum determined from shear area, shear buckling or local panel collapse pressure considerations), the scheme of bulkhead upgrading may incorporate partial renewal of the bulkhead. On renewal of bulkhead plating, a minimum thickness of $t_{net} + 2.5\text{mm}$ is incorporated with an increased thickness typically being adopted to satisfy bending capacity considerations without reinforcement. Figure 3 shows a scheme of bulkhead upgrading combining partial renewal of the lower part of bulkhead span and doubling strip reinforcement of the middle part of bulkhead span. When the scheme of bulkhead upgrading incorporates partial renewal of the bulkhead plating, consideration will need to be given to ensuring that sufficient parts of the bulkhead remain in situ during cropping and renewing works to ensure that adequate support is provided to the cross deck strip and hatch coaming structure. On fitting of the new bulkhead parts, special attention may need to be given to the fit-up and alignment of the new and existing bulkhead parts to ensure good alignment of the corrugations.

Appendix 8

Where renewal is required, the extent of renewal is to be shown clearly in plans. The vertical distance of each renewal zone is to be determined by considering S19 and in general is to be not less than 15% of the vertical distance between the upper and lower end of the corrugation - measured at the ship's centreline.

Where the reinforcement is accepted by adding strips, the length of the reinforcing strips is to be sufficient to allow it to extend over the whole depth of the diminished plating. In general, the width and thickness of strips should be sufficient to comply with the S19 requirements. The material of the strips is to be the same as that of the corrugation plating. The strips are to be attached to the existing bulkhead plating by continuous fillet welds. The strips are to be suitably tapered or connected at ends in accordance with Class Society practice. (See Figure 4)

Where reinforcing strips are connected to the inner bottom or lower stool shelf plates, one side full penetration welding is to be used. When reinforcing strips are fitted to the corrugation flange and are connected to the lower stool shelf plate, they are normally to be aligned with strips of the same scantlings welded to the stool side plating and having a minimum length equal to the breadth of the corrugation flange (See Figure 4).

The application of protective coatings, or annual gauging, is required where the actual thickness of the bulkhead plating is determined, on thickness gauging, to be within 0.5 mm of the UR S19 renewal thickness of $t_{net} + 0.5$ mm. In addition, IACS members have recently adopted amendments to the Survey Regulations which provide for a reduced scope of bulkhead close up survey, and gauging, if protective coatings are applied and remain efficient at periodical surveys. Application of protective coatings is, therefore, recommended in association with any bulkhead upgrading work carried out.

In addition to the lower 70% of the corrugated bulkhead plating, the remaining parts of the corrugated transverse watertight bulkhead (Level D) and the plating of lower (Level A, B) and upper stools (Level D) when fitted will have to be assessed by applicable permissible levels of diminution to be applied in accordance to Classification periodical survey Rules at the remaining levels in accordance to Figure 5.

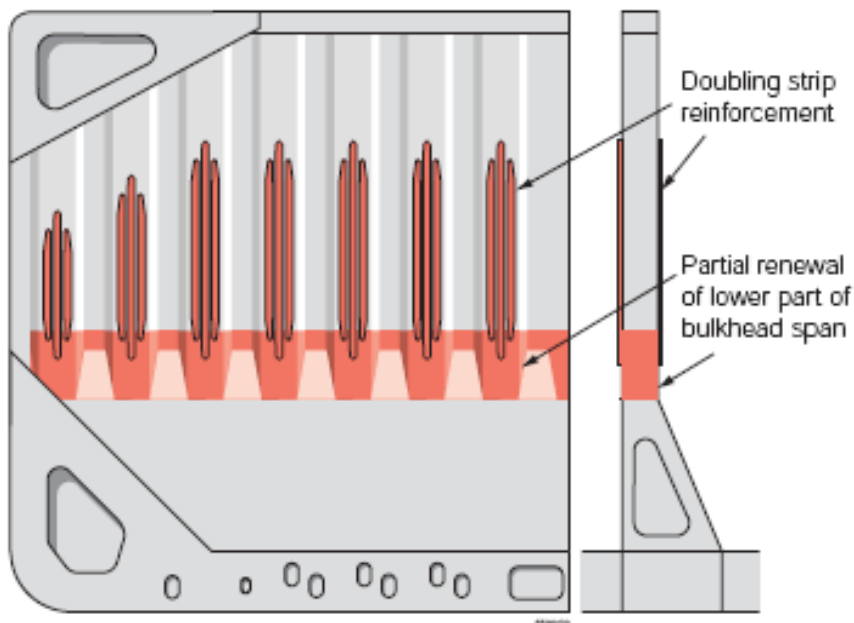
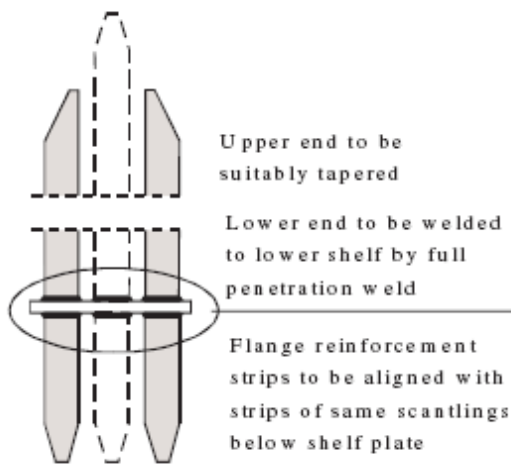
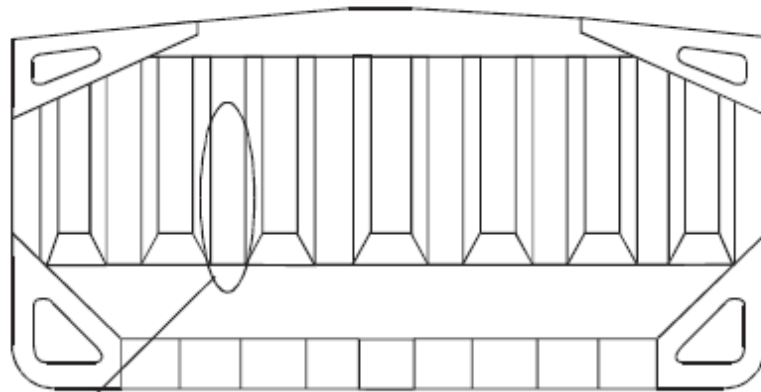
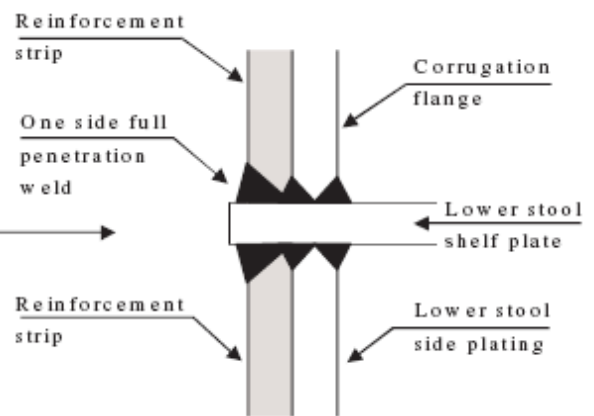


Figure 3

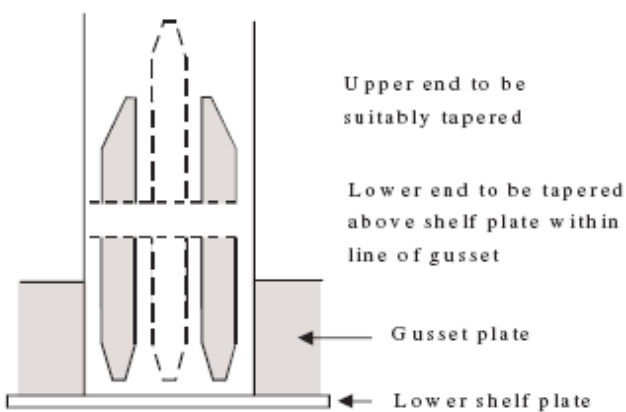
Appendix 8



Reinforcement strips with shedder plate



Weld of reinforcement strip to shelf plate



Reinforcement strips with shedder and gusset plates

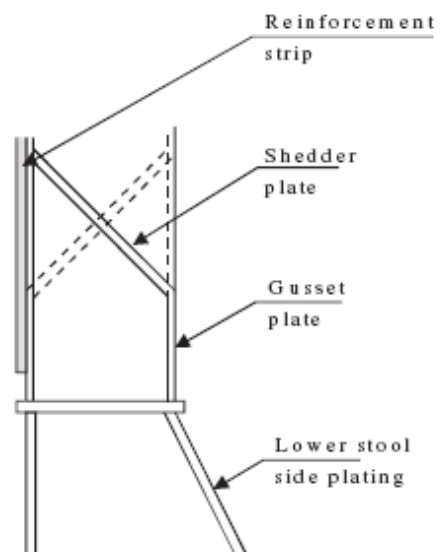
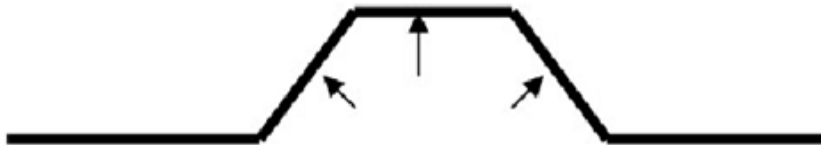
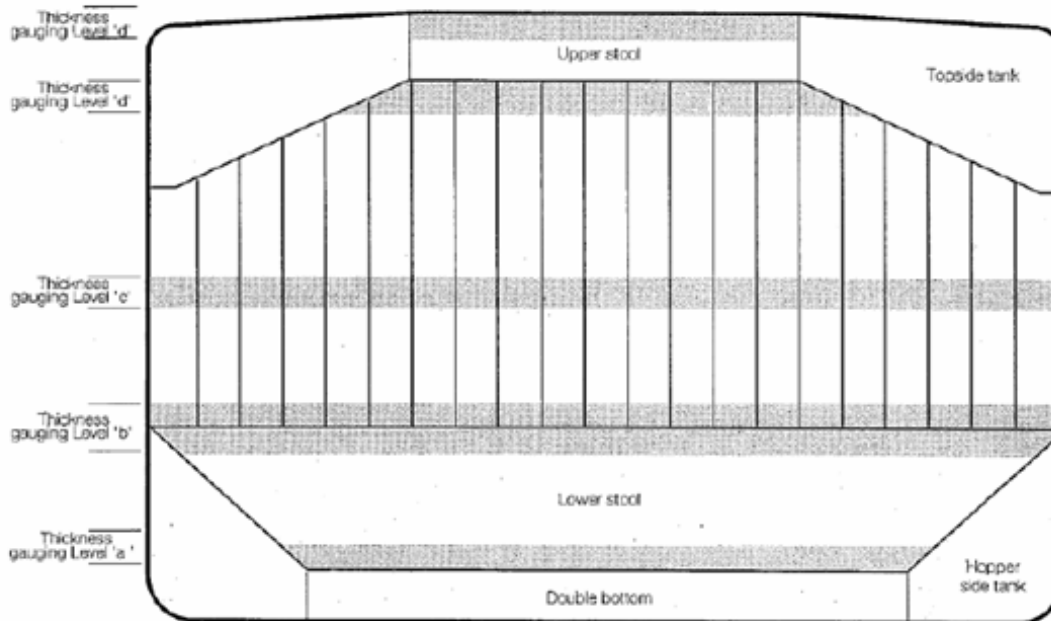


Figure 4

Appendix 8



In addition special attention should also be given to the following areas:

- Bulkhead plating adjacent to the shell plating.
- Bulkhead trunks which form part of the venting, filling and discharging arrangements between the topside tanks and the hopper side tanks.
- Bulkhead plating weld connections to the lower stool or upper stool shelf plates.
- Weld connections to hopper side and topside tanks.
- Any areas where signs of wastage or corrosion are evident.

Figure 5

Appendix 9

CAP TM Jobs Argonaut User Guide

Data Compatibility

Argonaut v2.1 can read TM Jobs from the previous version, it is backwards compatible. However, TM Jobs created in v2.1 cannot be open in v1.0.15; errors will occur. If you need to import a v2.1 job into v1.0.15, please contact us.

Argonaut's Modes

To be possible to distinguish between Class and CAP mode, Argonaut has a new mode.

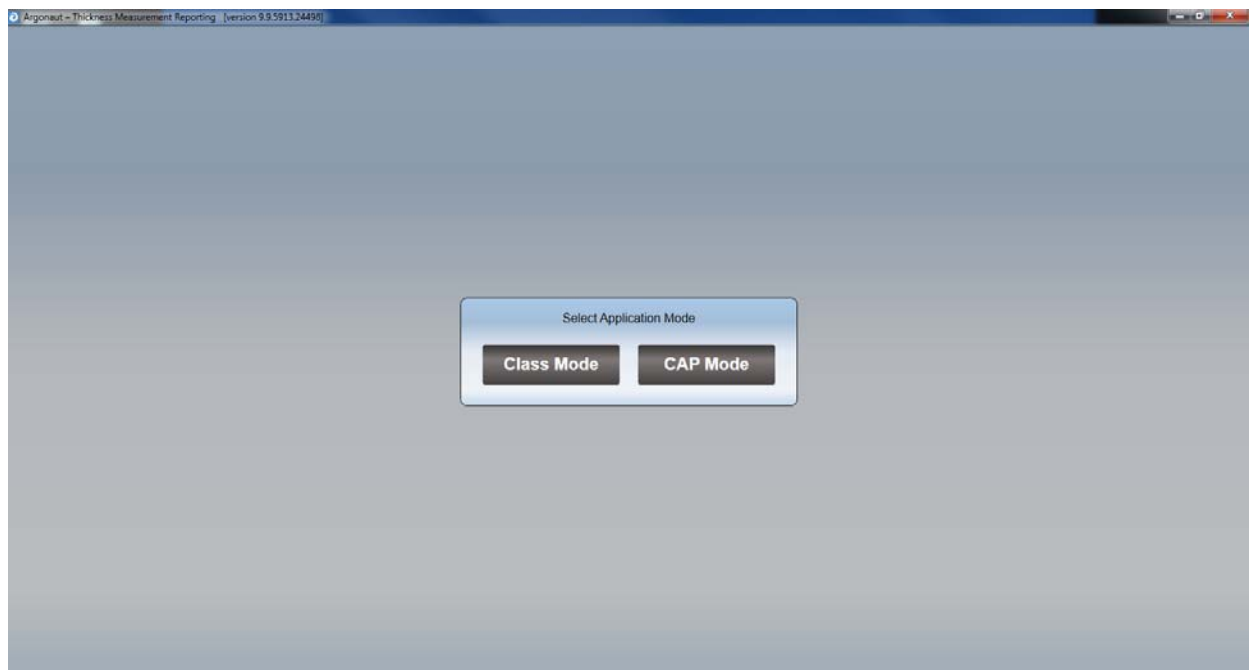
This section covers the following topics:

- Working in Class Mode.
- Working in CAP Mode.
- Changing Argonaut Mode.

Working in Class Mode

The Class Mode works just like Argonaut v1.0.15 did. However there is an initial screen where you select the mode you wish to work. After the application has started:

1. Click the **Class Mode** button.

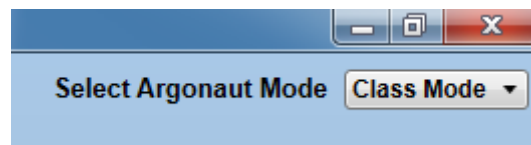


Appendix 9

- Argonaut takes you to the **Class Home** screen where you see listed all of the Class TM jobs you are working on. The list of Class TM jobs includes still in progress and completed TM jobs.

I.R./IMO Number	TM Report Number	Ship's Name	Job Status	Last Date of Measurement	TM Operator's Report Approval Date	Surveyor's Final Report Authorisation Date	Remove
Search here	Search here	Search here	Search here	Search here	Search here	Search here	
7433610	RIO1500125	BRAZTRANS 1	Completion (F)	10 Apr 2015			
8000111	DBI0701812	UAT Test	Completion (F)	03 Dec 2014	24 Aug 2016	24 Aug 2016	
8808068	QD01405289	LAIYU STEEL HARMONIOUS	Complete (X)	31 Jul 2014			
9191668	ROT1500380	DUTCH EMERALD	Complete (X)	17 Jul 2015	28 Jul 2015	14 Aug 2015	
9229968	ZSN1600157	AMORE MID II	Complete (X)	05 Aug 2016	18 Aug 2016		
9534875	QD01505322	OCEAN VENUS	Complete (X)	11 Sep 2015			

Note: You can tell in which mode you are working by looking on the top right hand corner of the screen.

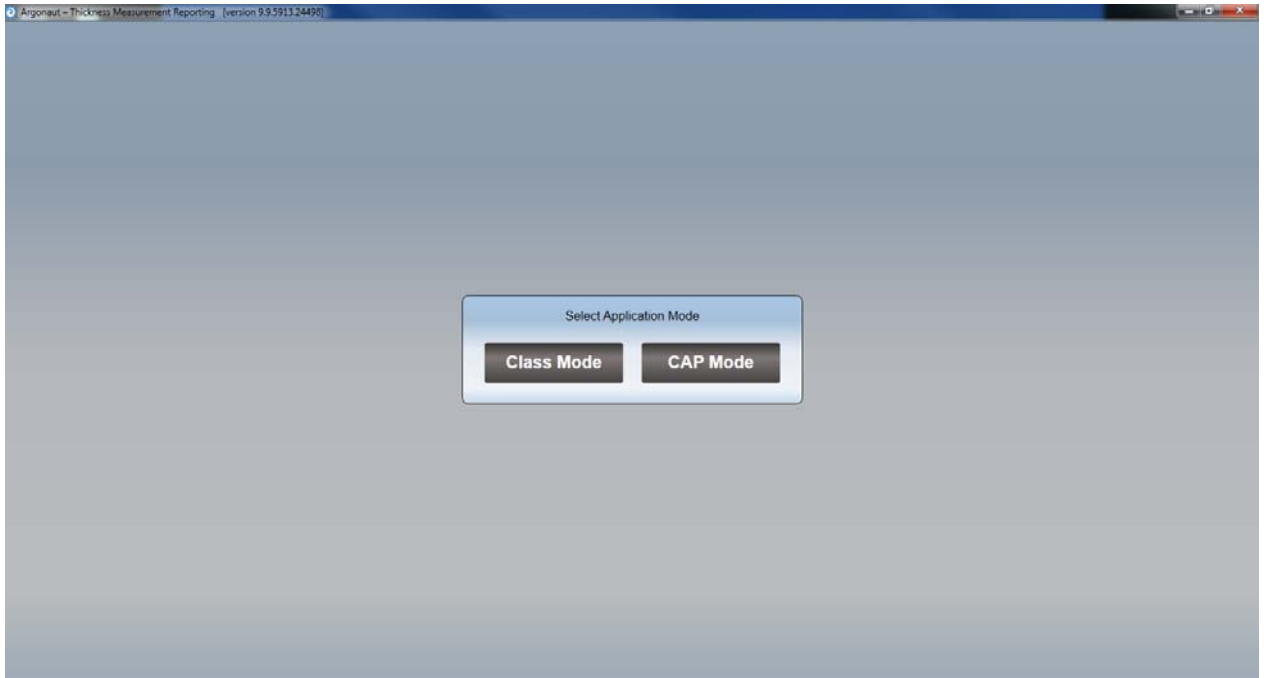


Working in CAP Mode

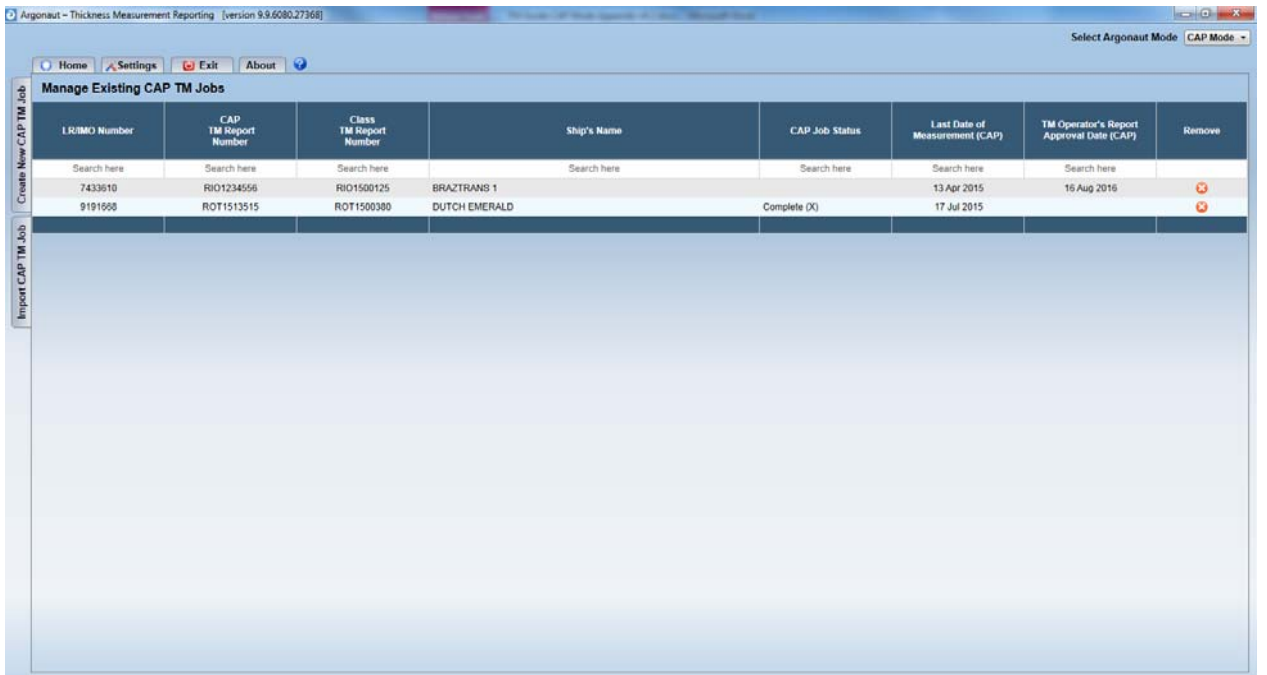
The CAP Mode is completely new in Argonaut v2.1. There is an initial screen where you select the mode you wish to work. After the application has started:

- Click the **CAP Mode** button.

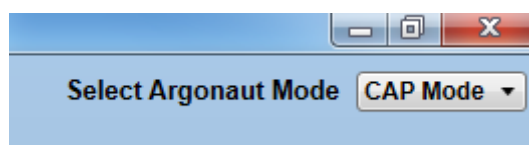
Appendix 9



- Argonaut takes you to the **CAP Home** screen where you see listed all of the CAP TM jobs you are working on. The list of CAP TM jobs includes still in progress and completed jobs.



Note: You can tell in which mode you are working by looking on the top right hand corner of the screen.



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Changing Argonaut Mode

It is possible to change the Mode at any stage in a TM Job. If you change mode, any changes made to the TM job will be automatically saved. If mandatory fields are not populated and you try changing mode, Argonaut will display an warning message, and you will not be able to change mode until the data is saved.

CAP TM Jobs

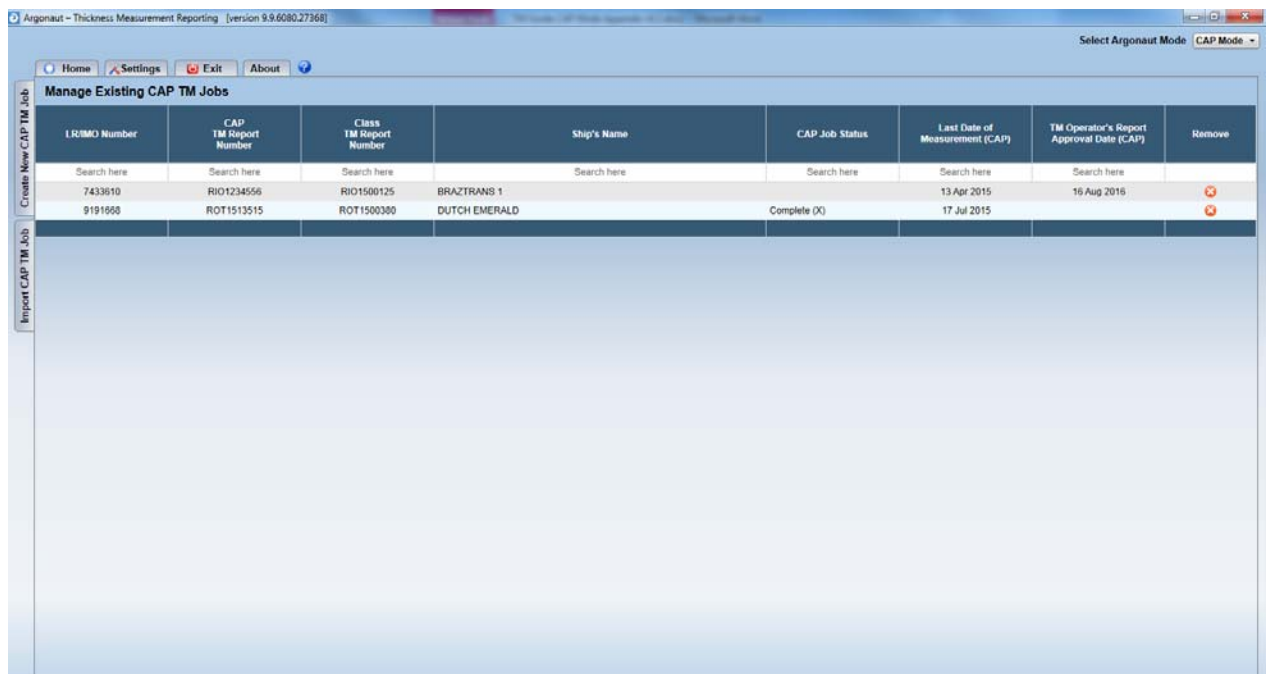
It is now possible to create CAP TM jobs; these can be CAP only jobs or Class TM jobs extended to CAP. This section covers the following topics:

- Creating a New CAP TM job.
- Extending a Class TM job to CAP.

Creating a New CAP TM Job

A new CAP TM job is created when a CAP survey is carried out independently of a Class survey. If a survey is carried out in conjunction with a Class survey, then refer to the *Extending a Class TM Job to CAP* section, in this user guide. As a TM Operator you may need to create a new CAP TM job.

1. Make sure you are in CAP Mode; see top right corner.
2. Click the **Create New CAP TM Job** tab.



Note: A new CAP TM job is created and the *General Particulars > Ship Particulars* tab appears.

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The screenshot shows the 'General Particulars' section of the Argonaut software. The 'SHIP PARTICULARS' tab is active. The form contains the following fields:

- Ship's Name: [Text Input]
- Ship Type: [Dropdown Menu]
- LR/MO Number: [Text Input]
- Rule Length [m]: [Text Input]
- Flag: [Text Input]
- Gross Tons: [Text Input]
- Port of Registry: [Text Input]
- Deadweight (t): [Text Input]
- Date of Build (DD-MM-YYYY): [Date Picker]

Buttons at the bottom right include 'Print Preview', 'Save', and 'Cancel'.

3. Populate all mandatory fields as required; otherwise you will not be able to save the job.

Note: The ESP Ship field is not required for CAP only jobs, therefore is not visible.

4. Populate all other fields as required.
5. Click the **Survey Details** tab.

The screenshot shows the 'Survey Details' section of the Argonaut software. The 'SURVEY DETAILS' tab is active. The form contains the following fields:

- CAP Report Number: [Text Input]
- Survey Due: [Dropdown Menu (CAP)]
- Classification Society: [Dropdown Menu (LR - Lloyd's Register)]
- Rule Type: [Dropdown Menu (Non-CSR)]
- Place of Measurement: [Text Input]
- Ship Category: [Dropdown Menu]
- First Date of Measurement (CAP) (DD-MM-YYYY): [Date Picker]
- Details of Measurement Equipment: [Text Input]
- Last Date of Measurement (CAP) (DD-MM-YYYY): [Date Picker]
- CAP Job Status: [Dropdown Menu]

Buttons at the bottom right include 'Print Preview', 'Save', and 'Cancel'.

6. Populate all mandatory fields as required; otherwise you will not be able to save.

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Note: The Survey Due field is auto-populated with “CAP” and the Rule Type field is auto-populated with “Non-CSR”; these fields cannot be edited.

7. Populate all other fields as required.

Note: You will need to return to this tab to populate the **CAP Job Status** field when finalising the job.

8. Click the **TM Company Details** tab.

9. Populate fields as required. These are the same fields as in Class Mode.

10. Click the **Supporting Documents** tab.

11. Populate fields as required. These are the same fields as in Class Mode.

12. Click the **Supporting Documents** tab.

13. Populate fields as required. These are the same fields as in Class Mode.

14. Click the **Authorisation** tab.

15. Populate this section when you have finished adding the readings in the forms and completed the Verification Report.

Extending a Class TM Job to CAP

As a TM operator you may need to extend a Class TM job to CAP that you have completed. By extending a Class TM job to CAP, you will be preserving all of the

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Class data and additionally, you will be able to add CAP specific data in the General Particulars and the TM Forms.

In a Class Extended to CAP TM job, all of the Class fields are locked. Notwithstanding, the forms will only be locked if the Class TM job is locked in the Class Mode.

Note: For more information about CAP TM data in the forms, see respective TM Forms User Guides.

Argonaut is capable of distinguishing between Class TM readings and CAP TM readings and keeps them in their respective TM jobs. All Class TM readings, which were created in Class Mode, comprise the Class TM job. Additionally, these Class readings will also be part of the extended to CAP TM job and will be displayed in CAP mode. None of the CAP readings will be visible in the Class mode.



Changes to the Class readings in a Class TM job will be reflected in the respective extended to CAP TM job.

In an extended to CAP TM job, all CAP readings will only be displayed and stored in CAP Mode. Additionally, in an extended to CAP TM job, all CAP rows of readings will have the item description text highlighted in bold; this will make it easier for you to distinguish which rows belong to which mode.



The following Best Practices must be adhered to before extending a Class TM Job to CAP:

- The Class TM job is completed and signed by the TM Operator.
- The two corresponding TM jobs (Class & CAP TM jobs) must be submitted together to the attending surveyor.



Restrictions on extending Class TM Jobs to CAP:

It is only possible to extend a Class TM Job to CAP if:

- The Class TM Operator signature and stamp has been completed,

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and

- It is a Non-CSR Job.

1. Make sure you are in *Class Mode*; see top right corner.
2. Click the **Extend Class TM Job to CAP** tab. Argonaut displays all Class TM jobs that can be extended to CAP. If a Class job is not displayed here, it is because it does not comply with the full criteria; see *Restrictions on extending a Class TM Job to CAP: section above*.

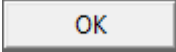
LR/IMO Number	Class TM Report Number	Ship's Name	Job Status	Last Date of Measurement	TM Operator's Report Approval Date	Surveyor's Final Report Authorization Date
Search here	Search here	Search here	Search here	Search here	Search here	Search here
7433610	RIO1500125	BRAZTRANS 1	Complete (X)	10 Apr 2015	09 Mar 2016	06 May 2016
9191668	ROT1500380	DUTCH EMERALD	Complete (X)	17 Jul 2015	28 Jul 2015	14 Aug 2015

3. Double click on a listed Class TM job. Argonaut will navigate to the selected Class TM job General Particulars' and ask for confirmation.

Note: You can see the ship particulars behind the confirmation dialog box.

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The screenshot shows the Argonaut software interface. The main window is titled 'Argonaut - Thickness Measurement Reporting [version 9.9.6080.27368]'. The interface includes a menu bar with 'Home', 'Settings', 'Exit', and 'About'. A sidebar on the left contains navigation options like 'Forms', 'Reports', and 'Generate Class TM Report'. The main area is divided into tabs: 'SHIP PARTICULARS', 'SURVEY DETAILS', 'TM COMPANY DETAILS', 'SUPPORTING DOCUMENTS', 'NOTES', and 'AUTHORISATION'. The 'SHIP PARTICULARS' tab is active, showing fields for 'Ship's Name' (BRAZTRANS 1), 'Ship Type' (Single Skin Bulk Carrier), 'LR/IMO Number' (7433610), 'Rule Length [m]' (193.83), 'Flag' (BRAZIL), 'Port of Registry' (Rio de Janeiro), 'ESP Ship' (Yes), and 'Date of Build' (05-05-1980). A modal dialog box is overlaid on the form, asking 'Extend this Class TM Job to CAP?' with 'OK' and 'Cancel' buttons.

4. Click the  button to confirm.
- Or
5. Click the Cancel button to return to the Extend Class TM Job to CAP home screen.
6. Click the **Survey Details** tab.
7. Populate the **CAP Report Number: ***. The CAP report number must be different from the Class Report number, but it follows the same format (3 letters + 7 numbers). All Class fields are read only.



Additional Information about CAP TM Jobs:

When working in CAP mode the following principles apply:

- The Class Global Lock does not apply to the CAP mode; however it applies to the Class mode. Refer to the Editing Forms and Sketches in Extended TM Jobs section below.
- Readings created in Class mode are also displayed in CAP mode, but readings created in CAP mode are not displayed in Class mode. Refer to the Editing Forms and Sketches in Extended TM Jobs section below.
- It is not possible to edit Class data in CAP mode. Refer to the Editing Forms and Sketches in Extended TM Jobs section below.

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- It is possible to add CAP rows of readings in CAP mode to a Class Form. Refer to the Editing Forms and Sketches in Extended TM Jobs section below.
- After extending a Class TM Job to CAP, when adding additional rows of measurements, the CAP text is displayed in bold.
- The TM8 only uses rows of readings that are created in the Class mode; it is not possible to create a TM2~3 for a job extended to CAP. In an extended to CAP TM Job, TM2~3 readings must be added in the Class Mode.
- For CAP only TM jobs, the Form TM2~3 can be created and readings added.
- In CAP mode, it is expected that the TM Operator's Authorisation section is populated.
- The Legal Entities are applied to the LR Stamps and Signatures equally in the Class and the CAP mode.

Editing Forms and Sketches in Extended TM Jobs

With the ability to extend a Class TM job to CAP the user interface has been modified. With Extended jobs the **Survey Requirement > Location > Form** combination is now shown in **black text**, when it belongs to the working mode, and it is shown in **white text**, if it belongs to the other mode.

In the examples below a set of forms and sketches were created in for the same TM job, the different modes, and then are shown in the two modes for clarification.

Note: *As with the previous version, it is not possible to have two forms with exactly the same **Survey Requirement > Location > Form** combination.*

Class Mode – Viewing CAP Forms

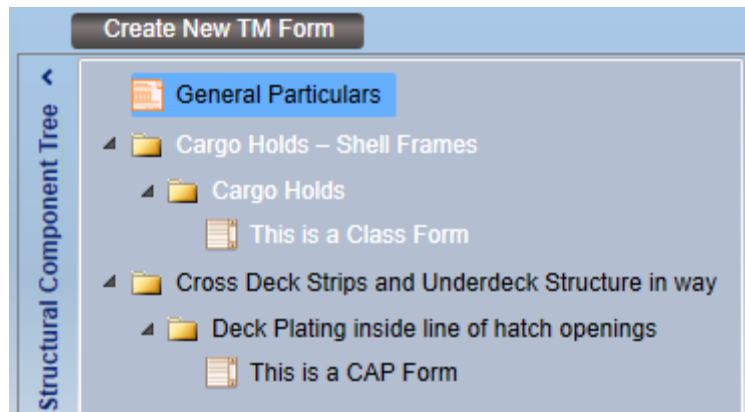
In the example below, the same forms are viewed in the Class mode. In black text are the Class forms.

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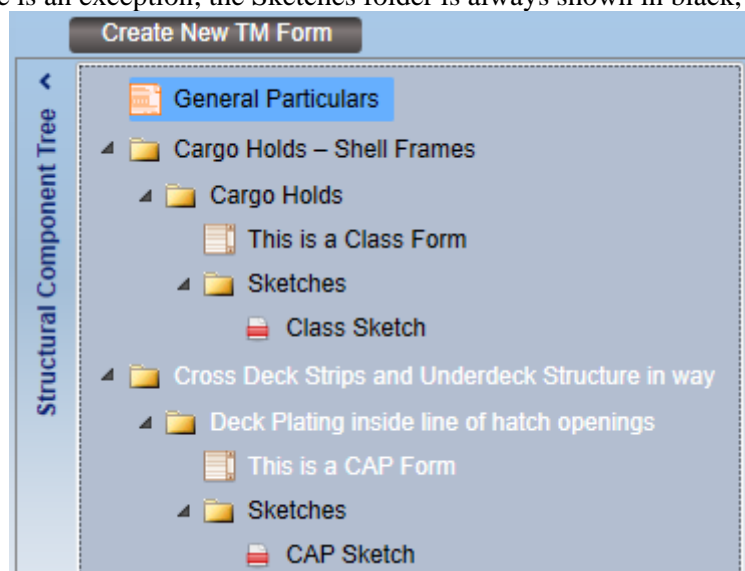
CAP Mode – Viewing Class Forms

In the example below, the user is working in CAP mode and displayed in white are the Class forms.



Sketches are Always in Black

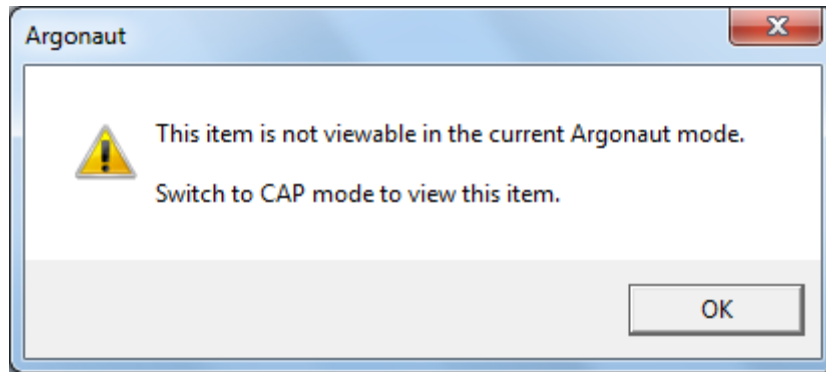
However, there is an exception; the Sketches folder is always shown in black, in both modes.



Class Mode - Editing Class Forms (white) and Sketches

- In Class Mode, CAP Forms and Sketches cannot be edited; the following message appears.

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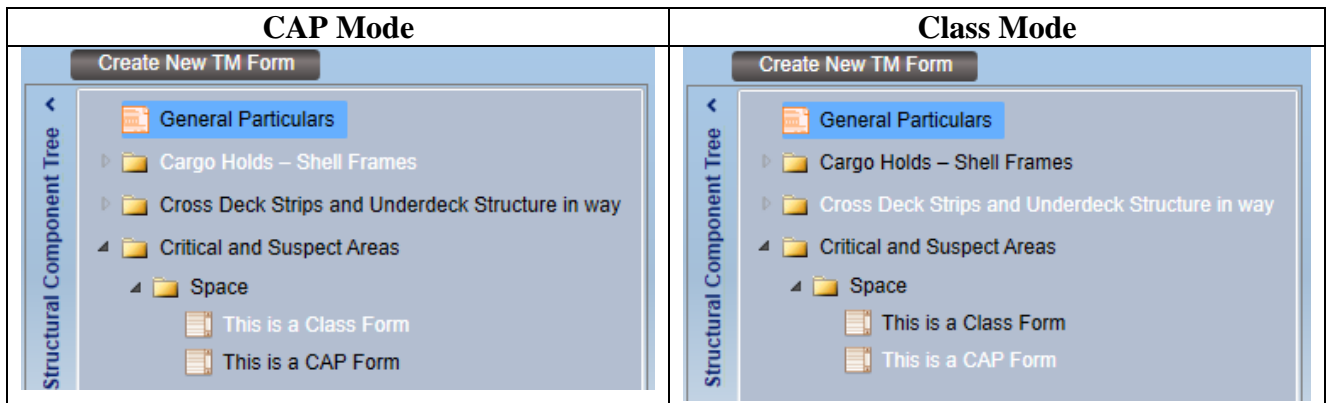
Note: The CAP forms will be excluded when the TM Report is generated.

CAP Mode - Editing Class Forms (white) and Sketches

- In CAP mode, it is possible to add readings to an existing form with class readings.
- In CAP mode, it is not possible to edit existing Class readings, in a Class form.
- In CAP mode, it is not possible to edit the Form descriptors if the Class TM Job is locked.

Mix of Class and CAP Forms

If a **Survey Requirement > Location > Folder** has forms from both modes, the different items will be displayed in a mix of black and white text. See example below:



Exporting and Importing CAP TM Jobs

It is also possible to export and import CAP TM jobs. Argonaut exports CAP TM jobs as “.CAP” files. These files by default do not have any sketches attached; however this option can be changed when exporting.



When exporting a CAP TM job that was extended, the export file will include the Class TM job and the CAP TM job data.

Appendix 9

This section covers the following topics:

- Exporting a CAP TM Job.
- Importing a CAP TM Job.

Exporting a CAP TM Job

As a TM Operator or as a SIAS Officer you may need to export a CAP TM job (New CAP or extended to CAP) for distribution. This process is similar to the Export Class in Class Mode, except the output is a “.CAP” file. This file type is also encrypted.

When exporting in CAP mode, there are two options:

- A full export, similar to Class export, and
- A “slim” export; this option does not include the Sketches, Supporting Documents, Cover Pages, Signatures and Stamps. This is the defaulted export setting in CAP mode.

1. Open a CAP TM job.

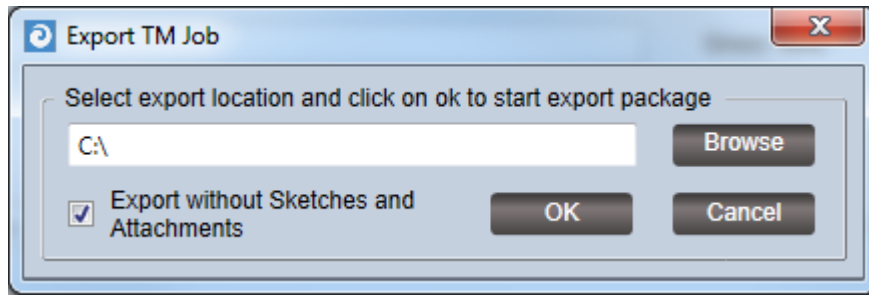
The screenshot shows the 'Argonaut - Thickness Measurement Reporting' software interface. The window title is 'Argonaut - Thickness Measurement Reporting [version 9.9.6080.27368]'. The interface displays a 'Create New TM Form' dialog box with several tabs: 'SHIP PARTICULARS', 'SURVEY DETAILS', 'TM COMPANY DETAILS', 'SUPPORTING DOCUMENTS', 'NOTES', and 'AUTHORIZATION'. The 'SHIP PARTICULARS' tab is active, showing a form with the following fields:

Ship's Name :	BRAZTRANS 1	Ship Type :	Single Slim Bulk Carrier
LR/IMO Number :	7433610	Rule Length (m) :	193.83
Flag :	BRAZIL	Gross Tons :	22,011
Port of Registry :	Rio de Janeiro	Deadweight (t) :	38,186
ESP Ship :	Yes	Date of Build (DD-MM-YYYY) :	05-05-1980

Buttons for 'Print Preview', 'Save', and 'Cancel' are located at the bottom right of the form.

2. Click the **Export CAP TM Job** tab. An **Export TM Job** dialog box appears.

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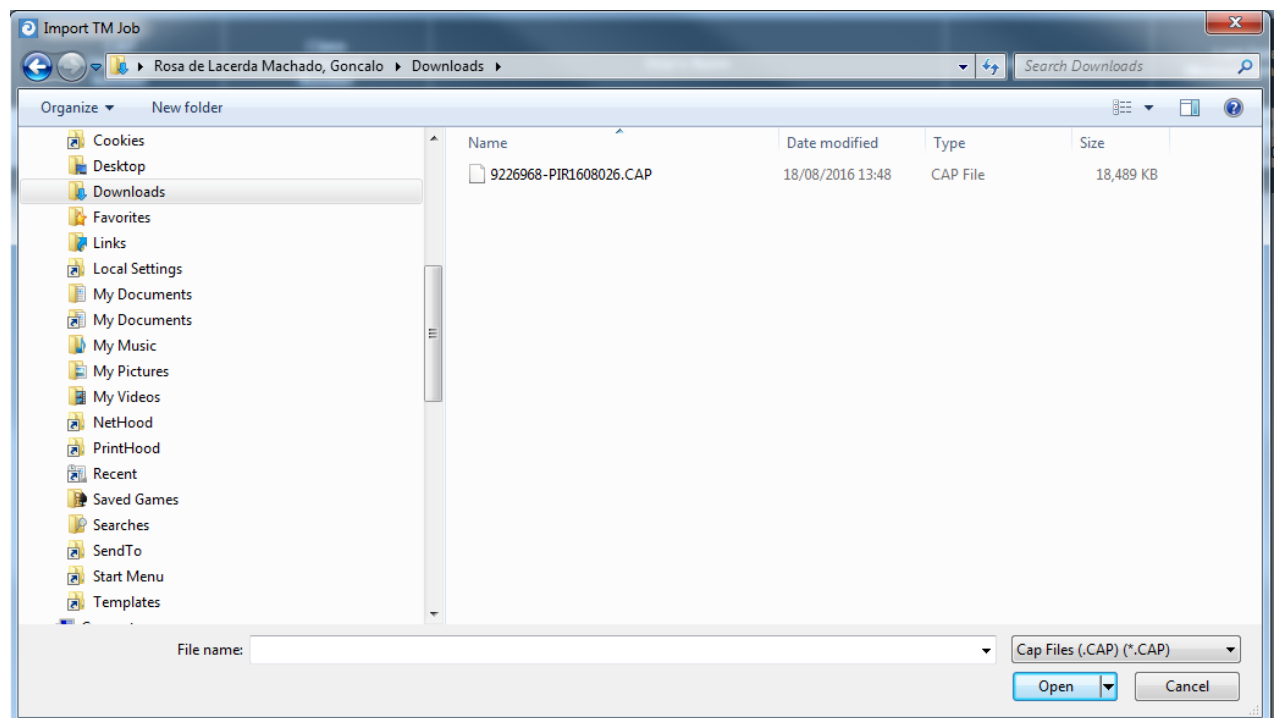


3. Click the **Browse** button and select a location. Make sure you have read and write access to the output folder.
4. Remove the “*Export without Sketches and Attachments*”, if you wish to have a full export. Confirm with SIAS if a full export is required.
5. Click the **OK** button.


Importing a CAP TM Job

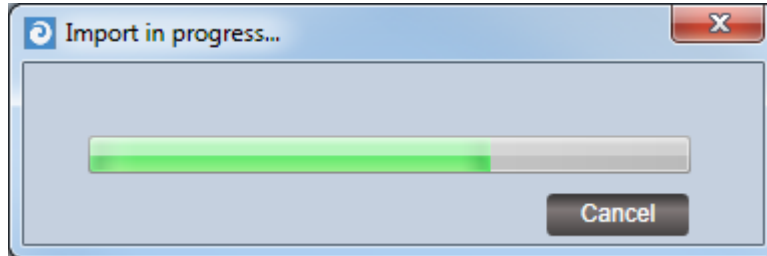
As a SIAS Officer you may need to import a CAP TM job provided to you by a TM Operator/LR Surveyor. Argonaut in CAP mode, only exports and imports **.CAP** files. Argonaut, in Class Mode, only exports and imports **.ZIP** files.

1. Click the **Import CAP TM Job** tab.
2. An **Import TM Job** dialog box appears. Only CAP files can be imported.

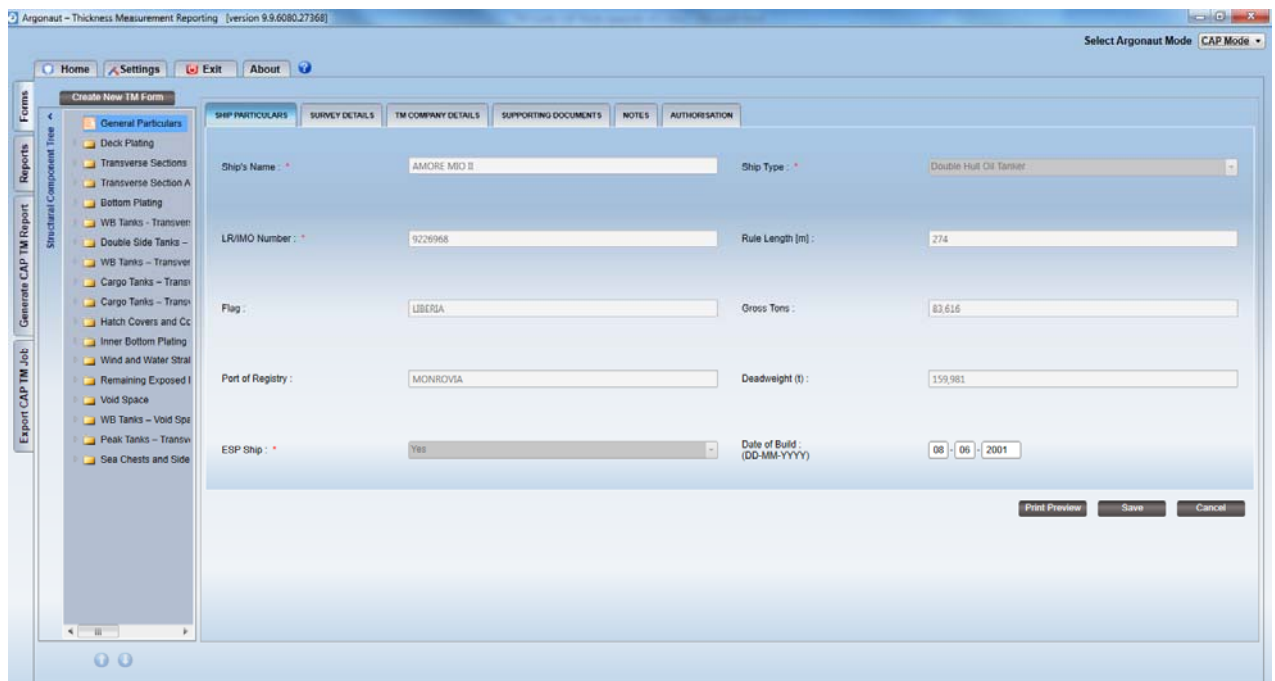


Appendix 9

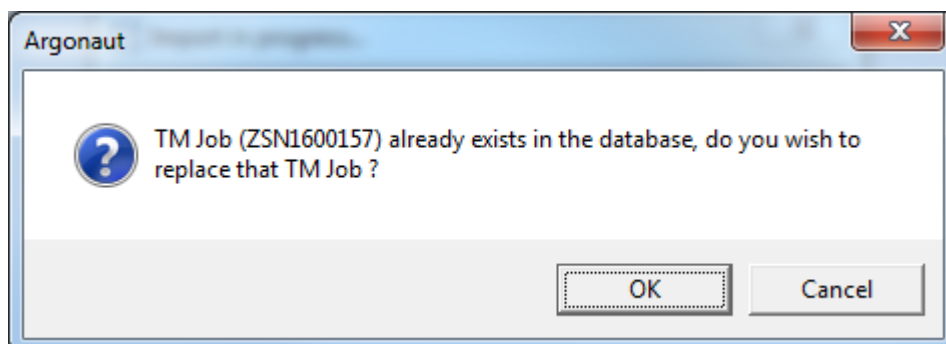
3. Select a **.CAP** file to import. Only one file can be imported at any one time.
4. Click the  button to confirm. A dialog box with a progress bar appears.



5. The imported CAP TM job file is displayed.



6. If the CAP TM job already exists in Argonaut, by clicking the OK button, the original CAP TM job will be overwritten.



7. Alternatively click the Cancel button to stop the import process.



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Deleting TM Jobs

This section covers the following topics:


- Deleting a Class TM job.
- Deleting a Class TM job Extended to CAP.
- Deleting a CAP TM job.

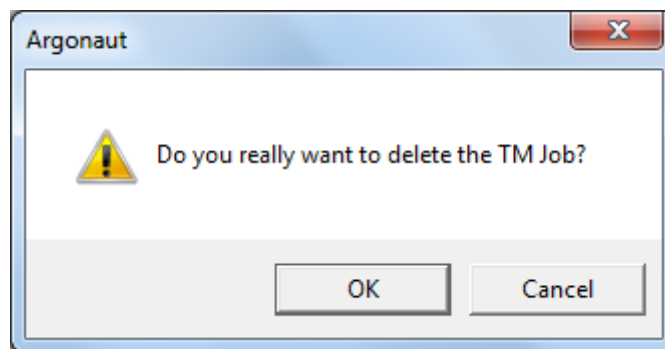
What do the Symbols mean?

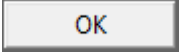
-  In Class mode and CAP mode, the TM Job can be deleted.
-  Found in Class Mode only. The CAP TM job must be deleted first.

Deleting a Class TM Job

The deleting process is straight forward for a Class TM job in Class Mode. For deleting a Class TM job that has been extended to CAP, please see respective section below.

1. Click the  button to the right of the Class TM job you wish to delete. A dialog box appears requesting confirmation.



2. Click the  button. The Class TM job is deleted. This step cannot be undone.


Deleting a Class TM Job Extended to CAP

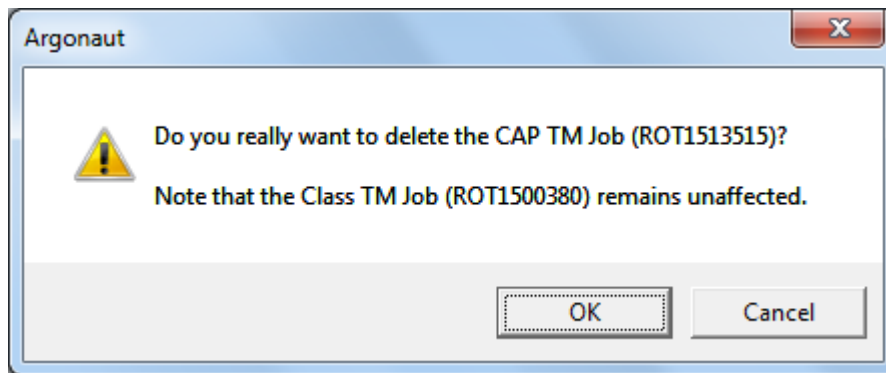
When a Class TM job has been extended to CAP the class data is shared between the two TM Jobs, however Argonaut is capable of keeping both TM jobs separate.

Appendix 9

To delete a Class TM job that has been extended to CAP, firstly it is necessary to delete the CAP TM job in CAP Mode, and then delete the Class TM job in Class Mode.

1. Navigate to the **CAP Home** screen.

2. Click the  button to the right of the CAP TM job you wish to delete. A dialog box appears requesting confirmation.



3. Click the  button.

4. Navigate to the **Class Home** screen.

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Select Argonaut Mode **Class Mode**


Home Settings Exit About

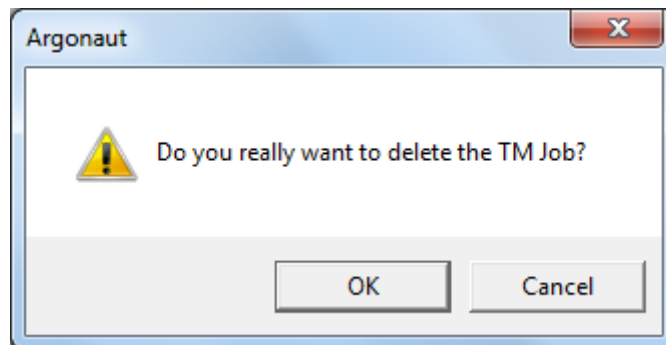
Manage Existing Class TM Jobs

LR/IMO Number	TM Report Number	Ship's Name	Job Status	Last Date of Measurement	TM Operator's Report Approval Date	Surveyor's Final Report Authorisation Date	Remove
Search here	Search here	Search here	Search here	Search here	Search here	Search here	
7433610	RIO1500125	BRAZTRANS 1	Completion (F)	10 Apr 2015			
8000111	DBI0701812	UAT Test	Completion (F)	03 Dec 2014	24 Aug 2016	24 Aug 2016	
8808068	QDO1405289	LAIWU STEEL HARMONIOUS	Complete (X)	31 Jul 2014			
9191668	ROT1500380	DUTCH EMERALD	Complete (X)	17 Jul 2015	28 Jul 2015	14 Aug 2015	
9226968	ZSN1600157	AMORE MIO II		05 Aug 2016	18 Aug 2016		
9534975	QDO1505322	OCEAN VENUS	Complete (X)	11 Sep 2015			

Vertical sidebar options: Create New Class TM Job, Import Class TM Job, Extend Class TM Job to CAP


Appendix 9

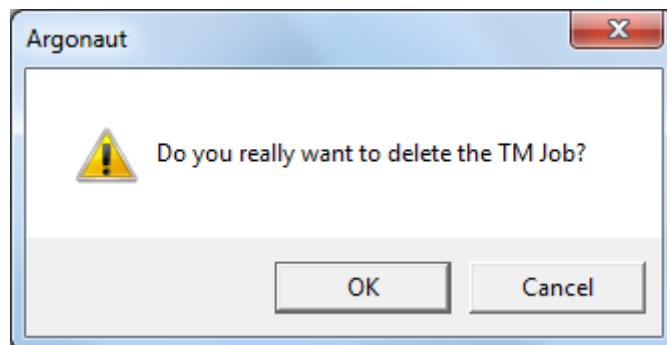
5. Click the  button to the right of the Class TM job you wish to delete. A dialog box appears requesting confirmation.



Deleting a CAP TM Job

The deleting process is straight forward for a CAP TM job in CAP Mode.

1. Click the  button to the right of the CAP TM Job you wish to delete. A dialog box appears requesting confirmation.



2. Click the  button. The Class TM job is deleted.

Previewing General Particulars

This section covers the following topics:

- Previewing General Particulars in a Class TM job.
- Previewing General Particulars in a CAP TM job.
- Previewing General Particulars in Extended to CAP TM job.

Preview General Particulars in a Class TM Job

There are no changes to the PDF generated in Class mode. Refer to the respective section of the TM Guide.

Appendix 9




Previewing General Particulars in a CAP only TM Job

As a TM Operator or a SIAS Officer you may wish to print a CAP TM job General Particulars. For a full preview, the **Ship Particulars**, **Survey Details**, **TM Company Details** and **Authorisation** tabs need to be completed. The **Notes** and **Supporting Documents** tabs are optional.

The General Particulars PDF in a CAP only TM job is very similar to the existing Class TM job PDF. It has only one page and it shows the same sections, but with the CAP specific fields.

1. Click the  button.

Appendix 9

	<h2>Thickness Measurement Report</h2>	
Ship's Name: Gonzl's Vessel	LR/IMO Number: 9037654	CAP TM Report Number: LIS7777777
<h3>General Particulars</h3>		
Ship Particulars		
Flag : LK	Port of Registry : Poole	
ESP Ship : CAP	Ship Type : Tug	
Length Overall (m) : 96,999	Gross Tons : 3,500	
Deadweight (t) : 2,500	Date of Build : 11 June 1999	
Survey Details		
Classification Society : LR - Lloyd's Register	Place of Measurement : Lisbon	
First Date of Measurement (CAP) : 04 April 2015	Last Date of Measurement (CAP) : 08 April 2015	
Survey Due : CAP Survey Requirement	Rule Type : Non-CSR	
Ship Category : Category 3	Details of Measurement Equipment : Top2000	
CAP Job Status : Part Held (P)		
TM Company Details		
Name of Company Performing Thickness Measurement : The TM Company		
Thickness Measurement Company certified by : LR	Certificate Number : LR-97654	
Certificate Valid From : 01 January 2012	Certificate Valid To : 31 December 2017	
CAP Authorisation		
CAP TM Operator's Details		
Name: The TM Dude		
Signature:		
		
Stamp:		
		
CAP Notes		
<p>Class and CAP reports are often created in multiple ports resulting in multiple files. The current solution forces SIAS Officers to manually merge multiple datasets in MS-Excel, this solution is time consuming. As part of the new solution to be deployed in 2016 it is planned to be able to import and merge two or more TM Jobs. However it is necessary to understand what issues need to be address for the import and merge procedure to be successful.</p> <p>Class and CAP reports are often created in multiple ports res</p>		
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Appendix 9

Previewing General Particulars in Extended to CAP TM Job

As a TM Operator or a SIAS Officer you may wish to print a CAP TM job General Particulars. For a full preview, the **Ship Particulars**, **Survey Details**, **TM Company Details** and **Authorisation** tabs need to be completed. The **Notes** and **Supporting Documents** tabs are optional.

The General Particulars PDF in a Class Extended to CAP TM job has several changes. The PDF includes all of the Class and CAP specific fields and thus it is two pages long.

1. Click the  button.

LR		Thickness Measurement Report	
Ship's Name: DUTCH EMERALD		LR/IMO Number: 9191668	
		TM Report Number: ROT1500380 CAP TM Report Number: ROT1513515	
General Particulars			
Ship Particulars			
Flag	: Netherlands	Port of Registry	: Dordrecht
ESP Ship	: Yes	Ship Type	: Double Hull Oil and Chemical Tanker
Rule Length [m]	: 118,000	Gross Tons	: 4,670
Deadweight (t)	: 6,470	Date of Build	: 27 July 2000
Survey Details			
Classification Society	: LR - Lloyd's Register	Place of Measurement	: Damen Shiprepair Rotterdam Pemis
First Date of Measurement (CAP)	: 09 July 2015	Last Date of Measurement (CAP)	: 17 July 2015
Survey Due	: SSIII / CAP	Rule Type	: Non-CSR
Ship Category	: Category 1	Details of Measurement Equipment	: Sonatest Sitiescan D20+, Sonatest CD 5-10S
CAP Job Status	: Complete (X)		
TM Company Details			
Name of Company Performing Thickness Measurement	: Materiaal Metingen Testgroep B.V.		
Thickness Measurement Company certified by	: Lloyd's Register	Certificate Number	: MNDE/2015/6611
Certificate Valid From	: 02 April 2015	Certificate Valid To	: 04 April 2018
Notes			

Print Preview page 1 of 2.

Appendix 9



Ship's Name: My Vessel

Thickness Measurement Report

LR/IMO Number: 9876543

TM Report Number: LIS9999999
CAP TM Report Number: LIS8888888

General Particulars continued ...

Authorisation

TM Operator's Details	Attending Surveyor's Details	Authorising Surveyor's Details
Name: The TM Dude	Name: LR Attending Dude	Name: LR Autho Dude
Signature: 	Signature: 	Signature: 
Stamp: 	Stamp: 	Stamp: 

CAP Authorisation

CAP TM Operator's Details
Name: The TM Dude
Signature: 
Stamp: 

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Appendix 10

Appendix – Residual Deck Buckling in Argonaut

Introduction

In Argonaut v2.2 it is possible to do Residual Deck Buckling calculations over the main deck plating. This is done using Deck Buckling TM1 Form (TM1RDB). For this purpose, Argonaut's Deck Plating TM1 Form was augmented.

Deck Buckling TM1 Form can be created from scratch or by converting a Deck Plating TM1 Form with data. However, it is not possible to convert a Deck Buckling TM1 Form into a Deck Plating TM1 Form; the conversion is only one-directional.

The new Deck Buckling TM1 Form has been extended to include two more columns: Location and Steel Grade. Additionally, when the form is created it is required to specify the Longitudinal Stiffener Spacing; this value is constant and needs to be defined for each form.

Generating Residual Deck Buckling Forms

This section covers the following topics:

- Creating a Residual Deck Buckling Form.
- Converting a Deck Plating form into a Residual Deck Buckling Form.

Creating a Residual Deck Buckling Form

To create a Residual Deck Buckling form, follow the steps below:

3. Click the **Create New TM Form** button. The *Create New TM Form* dialog box appears.
4. Select **Deck Plating** in the *Survey Requirement* field.

The image shows a dialog box titled "Create New TM Form". It contains three dropdown menus: "Survey Requirement" (set to "Deck Plating"), "TM Form" (empty with a question mark icon), and "Space/Comp/Section" (empty). At the bottom right, there are "OK" and "Cancel" buttons.

5. Select **TM1RDB** in the *TM Form* field.
6. Type the required value in the *Location of Structure* field.
7. Type a value between **550-1200** in the *Longitudinal Stiffener*.

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Survey Requirement : * Deck Plating

TM Form : * TM1RDB

Space/Comp/Section : * Main Deck Plating

Location of Structure : * Strake S

Longitudinal Stiffener Spacing (mm) : * 1000

OK Cancel

8. Click the **OK** button. The form is created.

Ship's Name : RDB User Guide LR/IMO No : 9876543 TM Report No : LIS1111111

TM1 Residual Deck Buckling

Space / Compartment Description : Main Deck Plating

Strake Position : Strake S

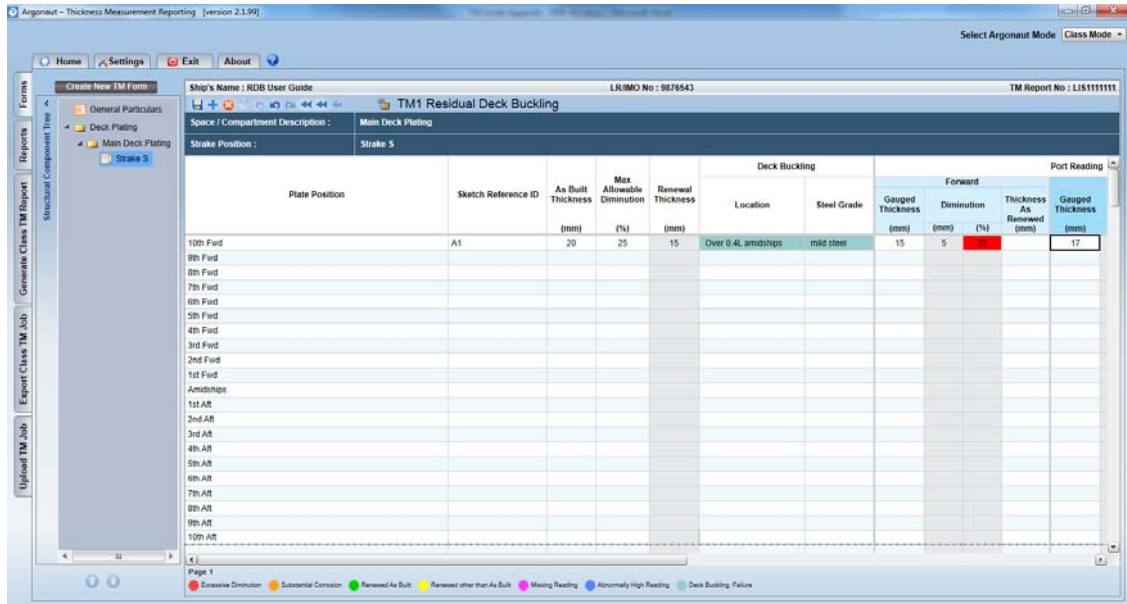
Plate Position	Sketch Reference ID	As Built Thickness (mm)	Max Allowable Diminution (%)	Renewal Thickness (mm)	Deck Buckling		Forward		Port Reading	
					Location	Steel Grade	Gauged Thickness (mm)	Diminution (mm) (%)	Thickness As Renewed (mm)	Gauged Thickness (mm)
10th Fwd										
9th Fwd										
8th Fwd										
7th Fwd										
6th Fwd										
5th Fwd										
4th Fwd										
3rd Fwd										
2nd Fwd										
1st Fwd										
Amidships										
1st Aft										
2nd Aft										
3rd Aft										
4th Aft										
5th Aft										
6th Aft										
7th Aft										
8th Aft										
9th Aft										
10th Aft										

Page 1

Excessive Diminution Substantial Corrosion Renewed As Built Renewed other than As Built Missing Reading Anomaly High Reading Deck Buckling Failure

9. Type the required value in the *Sketch Reference ID*, *As Built Thickness (mm)* and *Max Allowable Diminution (%)* fields.
10. Select a value from the drop-down menu in the **Location** field.
11. Select a value from the drop-down menu in the **Steel Grade** field.
12. Type the required value in the **Gauged Thickness (mm)** field.
13. Type the required value in the **Thickness As Renewed (mm)** field, if necessary.

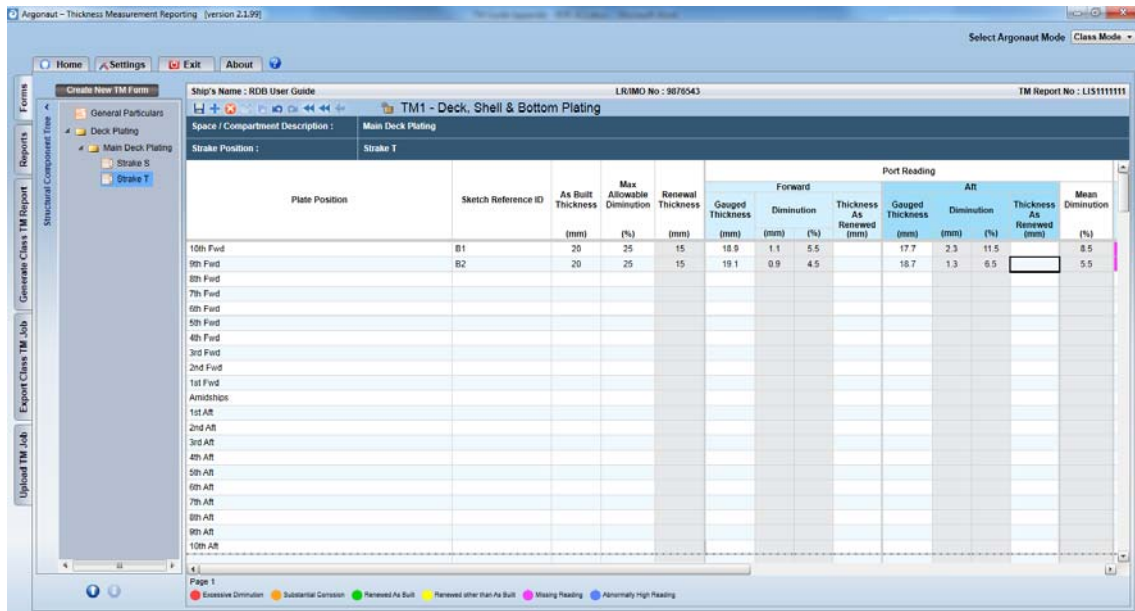
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14. Repeat steps 7 to 11 as required.

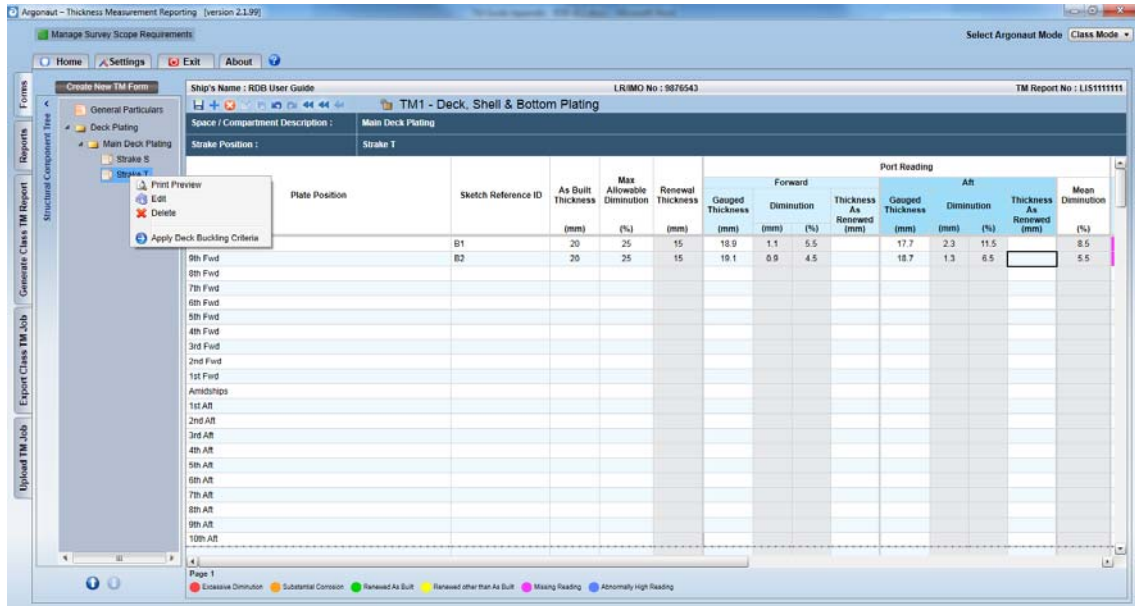
Converting a Deck Plating from into a Residual Deck Buckling Form

If you already have a Deck Plating TM1 form with readings, it is possible to convert it into a Residual Deck Buckling form. The steps below assume that a Deck Plating TM1 form already exists and has readings.

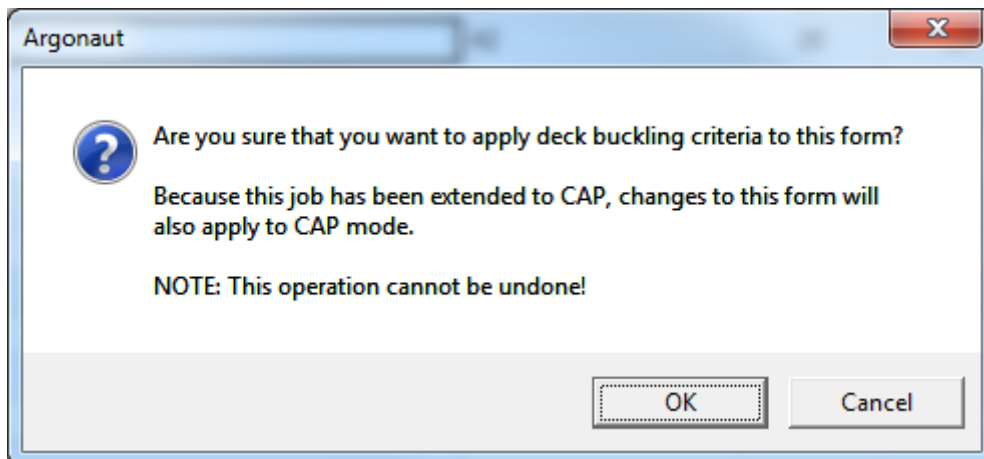


1. Right-click the over the Deck Plating TM1 form to be converted. The *Apply Deck Buckling Criteria* option appears.

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2. Select **Apply Deck Buckling Criteria** from the menu. The following warning is displayed.



3. Click the **OK** button. The following dialog box appears.

Appendix 10

Edit TM Form

Survey Requirement : * Deck Plating

TM Form : * TM1RDB

Space/Comp/Section : * Main Deck Plating

Location of Structure : * Strake T

Longitudinal Stiffener Spacing (mm) : *

OK Cancel

4. Type a value between **550-1200** in the *Longitudinal Stiffener*.

5. Click the **OK** button. The form has been converted.

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Ship's Name : RDB User Guide LRIMO No : 9876543 TM Report No : LIS1111111

Space / Compartment Description : Main Deck Plating

Strake Position : Strake T

Plate Position	Sketch Reference ID	As Built Thickness (mm)	Max Allowable Diminution (%)	Renewal Thickness (mm)	Deck Buckling		Forward			Port Reading
					Location	Steel Grade	Gauged Thickness (mm)	Diminution (mm)	Thickness As Renewed (%)	Gauged Thickness (mm)
10th Fwd	B1	20	25	15			18.9	1.1	5.5	17.7
9th Fwd	B2	20	25	15			19.1	0.9	4.5	18.7
8th Fwd										
7th Fwd										
6th Fwd										
5th Fwd										
4th Fwd										
3rd Fwd										
2nd Fwd										
1st Fwd										
Armships										
1st Aft										
2nd Aft										
3rd Aft										
4th Aft										
5th Aft										
6th Aft										
7th Aft										
8th Aft										
9th Aft										
10th Aft										

Page 1

Excessive Diminution Substantial Corrosion Renewed As Built Renewed other than As Built Missing Reading Abnormally High Reading Deck Buckling Failure

Reviewing Residual Deck Buckling Results

Once the data is typed into the Residual Deck Buckling form Argonaut highlights the rows where the calculations have failed; calculations are highlighted for every row individually.

Argonaut uses an average gauged thickness calculation to make the deck buckling assessment, the cells that are empty will be discarded by the calculation. If a **Thickness as Renewed** has been entered this value will override the corresponding value of the **Gauged Thickness** cell.

Appendix 10

To review the calculations simply hover the mouse pointer over the **Location** field or the **Steel Grade** fields. The screenshot below illustrates an example of a failure.

Plate Position	Sketch Reference ID	As Built Thickness (mm)	Max Allowable Diminution (%)	Renewal Thickness (mm)	Deck Buckling		Forward		Port Reading	
					Location	Steel Grade	Gauged Thickness (mm)	Diminution (mm) (%)	Thickness As Renewed (mm)	Gauged Thickness (mm)
10th Fwd	A1	20	25	15	Over 0.4L amidships	mild steel	15	5	17	17
9th Fwd					Deck Buckling Failure S = 1000 / J = 56.7 I1 (as built thickness - 1.5) = 10.5 I2 (S / J) = 17.64 Average Thickness across 2 readings = 15.00 average thickness = 12					
8th Fwd										
7th Fwd										
6th Fwd										
5th Fwd										
4th Fwd										
3rd Fwd										
2nd Fwd										
1st Fwd										
Amidships										
1st Aft										
2nd Aft										
3rd Aft										
4th Aft										
5th Aft										
6th Aft										
7th Aft										
8th Aft										
9th Aft										
10th Aft										

Assessment

The Deck Buckling Calculations are based on the number of readings available per row. When a set of readings has failed the **Location** and **Steel Grade** fields are highlighted in Deck Buckling: Failure. Argonaut also provides a tooltip with the details of the calculation. To see the tooltip with the calculations simply move the mouse pointer over the **Location** and **Steel Grade** fields.

The tooltip will display a message indicating Deck Buckling Pass or Failure. The tooltip displays:

- The value for S and J according to the Location and Steel Grade values in the particular row.
- The two calculations required as per the corresponding section of the Part 1 of this guidance booklet (Pt1, 1.5.6), as T1 and T2.
- The Average Thickness value must be greater than the smallest of the two values (T1 and T2).

Deck Buckling Failure

The screenshot below shows an example of a tooltip when a calculation as failed.

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Location	Steel Grade	Forward			
		Gauged Thickness (mm)	Diminution		Thickness As Renewed (mm)
			(mm)	(%)	
Over 0.4L amidships	HT32	20	0	0	
<div style="border: 1px solid gray; padding: 5px; background-color: #e0e0e0;"> <p>Deck Buckling Failure</p> <p>$S = 950 / J = 52.1$</p> <p>t_1 (as built thickness - 1.5) = 18.5</p> <p>t_2 (S / J) = 18.23</p> <p>Average Thickness across 3 readings = 16.00</p> <p>Average Thickness < t_2.</p> </div>					

Deck Buckling Passed

The screenshot below shows an example of a tool-tip when a calculation as passed.

Location	Steel Grade	Forward			
		Gauged Thickness (mm)	Diminution		Thickness As Renewed (mm)
			(mm)	(%)	
Over 0.4L amidships	mild steel	20	0	0	
<div style="border: 1px solid gray; padding: 5px; background-color: #e0e0e0;"> <p>Deck Buckling Passed</p> <p>$S = 950 / J = 56.7$</p> <p>t_1 (as built thickness - 1.5) = 18.5</p> <p>t_2 (S / J) = 16.75</p> <p>Average Thickness across 4 readings = 20.00</p> <p>Average Thickness > t_2.</p> </div>					



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www.lr.org/tm

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